MARION COUNTY BOARD OF COMMISSIONERS

OREGON

"Delivering Excellence Everyday"

Wednesday, October 7, 2026
Board Session 9:00 a.m.

Senator Hearing Room
555 Court Street NE, Salem

PUBLIC COMMENT

PROCLAMATIONS

BOARD OF COMMISSIONERS

1. Consider approval of a proclamation designating October 18-24, 2026, as National Hands & Words Are Not For Hurting® Week in Marion County. –Ann Kelly, Hermina Kann, and Ariana Jahanshir, Hands & Words Are Not For Hurting Project; Denyc Boles, Salem Health; and Jodi Loper, retired, Boys & Girls Club of Salem, Marion, and Polk Counties.

DISTRICT ATTORNEY'S OFFICE

2. Consider approval of a proclamation designating the month of October 2026 as Domestic Violence Awareness Month in Marion County. –Brendan Murphy, Pami Guerra, and Ashley Carson, Center for Hope and Safety.

CONSENT

FINANCE

3. Approve an order directing the Marion County Sheriff to publish a notice of sale and sell certain county land as referenced in "Exhibit A" at a public auction as provided in Oregon Revised Statutes (ORS) 275.110.

HEALTH AND HUMAN SERVICES

4. Approve the Contract for Services with Bridgeway Community Health in the not-to-exceed amount of $200,000 to provide residential Substance Use Disorder (SUD) treatment and/or detoxification withdrawal management services to individuals who are not eligible for the Oregon Health Plan (OHP), or who otherwise do not have a health benefit that covers SUD treatment services, with a contract ending term date of one year from the date of signature.

5. Approve the Contract for Services with LocumTenens.com, LLC in the not-to-exceed amount of $2,500,000 to provide temporary medical personnel to support the operational and staffing needs of all divisions within the Marion County Health and Human Services Department retroactive to October 1, 2026, through September 30, 2029.

INFORMATION TECHNOLOGY

6. Approve the Purchase Order (PO) with CVE Technologies Group, Inc. in the amount of $808,567.76 for the purchase of data center equipment to support software systems at a Marion County Public Works Building with a PO ending term date of June 30, 2027.

PUBLIC WORKS

7. Approve Amendment #1 to the Contract for Construction with North Santiam Paving Company to add $334,208.15 for six construction change orders for a new contract total of $4,019,725.55 for the asphalt concrete resurfacing of various Marion County roads with no change to the contract's ending term date of September 4, 2027.

8. Approve Amendment #3 to the incoming funds Supplemental Project Agreement with the Oregon Department of Transportation (ODOT) to add $606,717 of which an estimated $544,407.16 will utilize federal funding and an estimated $62,309.84 will utilize county funding for a new agreement total of $1,866,417 for the Connecticut Avenue: Macleay Road to Rickey Street Improvements Project with no change to the contract's ending term date of March 15, 2030.

9. Approve Amendment #3 to the Purchase Order (PO) with Potters Industries LLC to add $135,000 for a new PO total of $1,185,000 for the purchase of reflective glass beads for striping county roads with no change to the PO's ending term date of July 9, 2027.

9.5 Approve the Contract for Services with Legacy Wireless Services, Inc., dba Legacy Wireless Services in the amount of $254,187 to provide tower climbing, antenna installation, inspection, and maintenance services for a network of 15 radio communication tower sites located in Marion, Polk, and Clackamas Counties for the Marion County Radio Project that will be utilized by first responders, with a contract ending term date of March 1, 2027.
Revised 10/7/2026: Motion made and approved to add this item to the Consent Agenda.

SHERIFF'S OFFICE

10. Approve Amendment #1 to the Contract for Services with O'Neill S. Solanky DDS, LLC to add $100,345.04 due to an unanticipated increase in Adults in Custody (AICs) at the Marion County Jail needing dental work, for a new not-to-exceed contract total of $428,825 with no change to the contract's ending term date of June 30, 2027.

ACTION

PUBLIC WORKS

11. Consider approval of Amendment #3 to the incoming funds Supplemental Project Agreement with the Oregon Department of Transportation (ODOT) to add $1,585,561.26 for a new agreement total of $5,069,027 of which an estimated $3,875,429.42 will utilize federal funding, an estimated $30,000 will utilize state funding, and an estimated $1,163,597.58 will utilize county funding for the Center Street: Lancaster Drive to 45th Place NE Improvements Project with no change to the contract's ending term date of June 13, 2029. –Ryan Crowther

PUBLIC HEARINGS
Starting no earlier than 9:00 a.m.

None.

Members of the public may submit written testimony by email to PublicHearings@co.marion.or.us For agenda items where in-person testimony is allowed, the public may sign up to provide testimony by telephone by emailing PublicHearings@co.marion.or.us at least 24 hours before the meeting. The email must specify the meeting date/time and agenda topic for which testimony is being submitted. For telephone testimony requests, the email must also include your name and the phone number that staff should use to call you at the appropriate time.

If you require interpreter assistance, an assistive listening device, large print material or other accommodations, call 503-588-5212 at least 48 hours in advance of the meeting. TTY 503-588-5168 Si necesita servicios de interprete, equipo auditivo, material copiado en letra grande, o culaquier otra acomodacion, por favor llame al 503-588-5212 por lo menos 48 horas con anticipacion a la reunion. TTY 503-588-5168 Marion County is on the Internet at: www.co.marion.or.us

MARION COUNTY BOARD OF COMMISSIONERS

Board Session Agenda Review Form

Meeting date: October 7, 2026

Department: Board of Commissioners

Title: 29th Annual Hands & Words Are Not For Hurting Week proclamation

Management Update/Work Session Date: August 18, 2026 **Audio/Visual aids** ☐

Time Required: 10 minutes **Contact:** Brenda **Phone:** (503) 589-3236

Requested Action:

Consider approving a proclamation designating the week of October 18-24, 2026, as Hands & Words Are Not For Hurting Week in Marion County.

Issue, Description & Background:

The Hands & Words Are Not For Hurting Project began in 1997 in an effort to educate children and adults about abuse and violence in our homes, our classrooms, and our communities. The project has expanded since it's inception in 1997, to all 50 United States and to 11 foreign countries. The powerful Hands & Words Are Not For Hurting Pledge reminds every community member to not use violence, but rather to show respect and equality to not only ourselves but also others.

Financial Impacts:

None.

Impacts to Department & External Agencies:

None.

List of attachments:

Proclamation

Presenter:

Ann Kelly, and Ariana Jahanshir, Hands & Words Are Not For Hurting Project;

Department Head Signature:

BEFORE THE BOARD OF COMMISSIONERS
FOR MARION COUNTY, OREGON

In the matter of proclaiming October 18-24, 2026, as National Hands & Words Are Not For Hurting Week in Marion County.

PROCLAMATION

WHEREAS, a community without abuse, violence, and suicide is a dream we all share; and

WHEREAS, any form of mistreatment of another is abuse and all people have the moral and legal right to live free of abuse and violence; and

WHEREAS, each of us must come to understand that it is within our personal power to choose not to use abuse and violence to resolve conflict; and

WHEREAS, we recognize that respect for ourselves and others is key to developing healthy relationships at every age and in all circumstances; and

WHEREAS, the principle of non-violent resolution of conflict must be taught to our children and practiced within each of our families; and

WHEREAS, verbal and emotional abuse can be just as damaging as physical violence to a person's self-worth, creating scars that are carried for the rest of his/her life; and

WHEREAS, verbal abuse such as name calling, insulting, and belittling frequently escalates into simple force like pushing, grabbing or slapping, and the worst scenario is the escalation to rage, serious violence, and even murder; and

WHEREAS, self-harm and suicide must be acknowledged as a serious public health crisis as the number of victims continues to escalate in children, teens, and adults; and

WHEREAS, we the Commissioners of Marion County, together with communities around the country and overseas, recognize that the Hands & Words Are Not For Hurting Project's Purple Hands Pledge® is an effective tool in abuse, violence, and suicide prevention education; and

NOW THEREFORE, we the Marion County Board of Commissioners, do hereby proclaim the week of October 18 through 24, 2026, to be the 29th annual **HANDS & WORDS ARE NOT FOR HURTING WEEK** in Marion County, and encourage all citizens of Marion County to join hands and hearts to unite as a family and a community to pledge, both privately and publicly, that

"I Will Not Use My Hands Or My Words For Hurting Myself Or Others"®

Marion County
OREGON

Dated this 7th day of October 2026.
MARION COUNTY BOARD OF COMMISSIONERS

Chairperson _____

Commissioner _____

Commissioner _____

MARION COUNTY BOARD OF COMMISSIONERS

Board Session Agenda Review Form

Meeting date: October 7, 2026

Department: District Attorney

Title: Domestic Violence Awareness Month Proclamation

Management Update/Work Session Date: September 29, 2026 **Audio/Visual aids** ☐

Time Required: 10 minutes **Contact:** Zugey Luna **Phone:** 503-588-7983

Requested Action: Read and sign proclamation declaring October 2026 as Domestic Violence month.

Issue, Description & Background: Presentation on DV and community's response to DV. Request Commissioner's declare October 2026 as Domestic Violence Awareness month by reading and signing the proclamation.

Financial Impacts: N/A

Impacts to Department & External Agencies: N/A

List of attachments: Proclamation

Presenter: Pami Guerra, Brendan Murphy, Ashley Carson

Department Head Signature:

BEFORE THE BOARD OF COMMISSIONERS
FOR MARION COUNTY, OREGON

In the matter of proclaiming October 2026 as Domestic Violence Awareness Month in Marion County.

PROCLAMATION

WHEREAS, the impact of domestic violence extends beyond individuals, reaching into families and communities; and

WHEREAS, in the last year Marion County has experienced at least three domestic violence homicide crimes; and

WHEREAS, the Marion County District Attorney's office received over 1,171 law enforcement reports of domestic violence, and filed over 800 domestic violence cases; and

WHEREAS, the Marion County Courts received 1,138 requests for protective orders; and

WHEREAS, the Center for Hope & Safety supported over 4,100 survivors and their children, received over 11,700 calls to the crisis hotline, and provided 13,872 nights of emergency shelter; and

WHEREAS, the Marion County Victim Assistance Division provided services to over 1,668 victims of domestic violence, walking alongside them and giving them a voice in the criminal justice process; and

WHEREAS, we know, as individuals, we can make a difference by speaking up and reaching out to help victims and survivors; and

NOW, THEREFORE, we the Marion County Board of Commissioners do hereby proclaim October 2026 as

DOMESTIC VIOLENCE AWARENESS MONTH

and resolve to honor those who have died and acknowledge those who have survived by supporting meaningful services that create safety and hope for survivors in our community.

Dated this 7th day of October 2026.

Marion County
OREGON

MARION COUNTY BOARD OF COMMISSIONERS

Chairperson _____

Commissioner _____

Commissioner _____

MARION COUNTY BOARD OF COMMISSIONERS

Board Session Agenda Review Form

Meeting date: 10/7/2026

Department: Finance

Title: November Property Auction List, Overview and Board Order

Management Update/Work Session Date: 9/22/2026 **Audio/Visual aids** ☐

Time Required: 5 min **Contact:** John Carlson **Phone:** 503-373-4364

Requested Action:

The Finance Department requests that the Board of Commissioners approve this list of tax-foreclosed properties for public auction and sign the Board Order authorizing the sale.

Issue, Description & Background:

The following three tax accounts 523910, 537081 & 598896 foreclosed due to nonpayment of property taxes. The Finance Department suggests selling these tax accounts in accordance with Oregon Revised Statutes (ORS) Chapters 275 & 312 as applicable.
523910: (5193 CENTER ST NE SALEM OR 97317) - Deeded to Marion County 1/23/2024, RMV: $418,280-Opening bid: $36,000 - Payment: cash, cashier check, money order or certified check.
537081 (2020 TALBOT RD SE JEFFERSON OR) - Deeded to Marion County 1/4/2022, RMV: $407,330-Opening bid: $38,000 - Payment: cash, cashier check, money order or certified check.
598896 (306 THISTLEDOWN LN GATES OR 97346) - Deeded to Marion County 1/23/2024, RMV:$220,900-Opening bid: $19,000-Payment: cash, cashier check, money order/certified check.

Financial Impacts:

The sale of these tax accounts would return the property to the tax roll and mitigate liability associated with retaining these properties.

Impacts to Department & External Agencies:

NA

List of attachments:

Property overview slides, Board Order and Exhibit A (Public Notice).

Presenter:

John Carlson

Department Head Signature:

Jill D White

Account ID: 523910

Map Tax Lot: 072W29AB00700

Real Market Value: $418,280

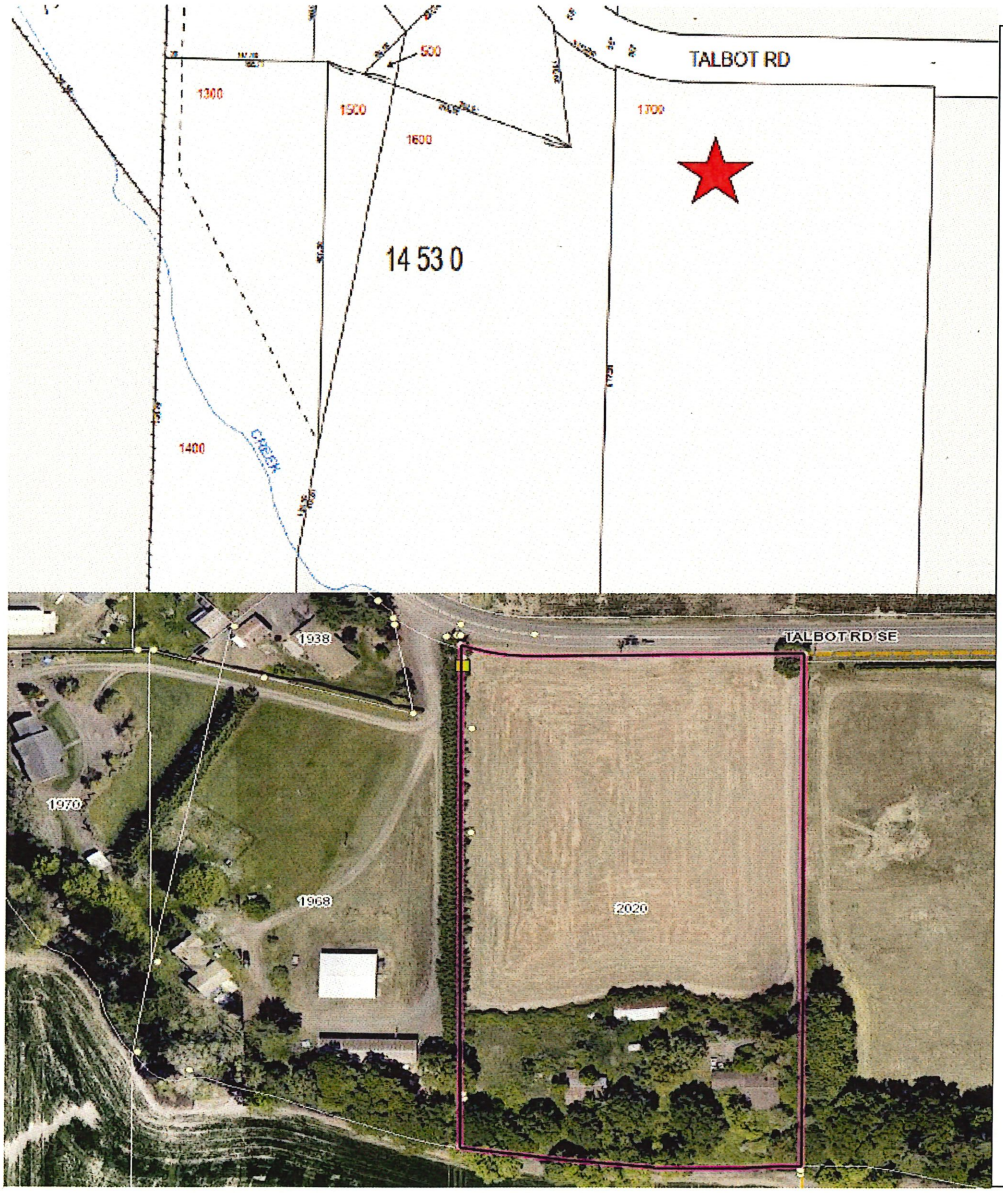
Opening Bid: $36,000

Zoning Code: AR

Acres: 0.22

Situs Address:
5193 CENTER ST NE
SALEM OR 97317

Additional Information:
2021 tax foreclosure list - 21CV34140
Clerk record 2024-002463



Account ID: **103W02BD01700**

Map Tax Lot: **537081**

Real Market Value: $407,330

Opening Bid: $38,000

Zoning Code: EFU

Acres: 6.85

Location:
2020 Talbot Rd. SE
Jefferson, OR 97352

Additional Information:
2019 tax foreclosure list - 19CV37726
Clerk record Reel 4581 Page 319

Account ID: 598896

Map Tax Lot: 093E26C001700

Real Market Value: $220,900

Opening Bid: $19,000

Zoning Code: R

Acres: 2.27

Situs Address:
306 THISTLEDOWN LN
GATES OR 97346

Additional Information:
2021 tax foreclosure list - 21CV34140
Clerk record 2024-002463

BEFORE THE BOARD OF COMMISSIONERS
FOR MARION COUNTY, OREGON

In the Matter of Directing the	)
Sheriff to sell Certain County	)
Land at Public Auction as	)
Provided in ORS 275.110.	)

ORDER No._____

This matter came before the Marion County Board of Commissioners at its regularly scheduled public meeting on October 7, 2026, to direct the Sheriff to sell tax foreclosed and surplus real property at public auction.

WHEREAS, the Marion County Board of Commissioners deems it to be in the best interest of the county to sell tax foreclosed and surplus real property in accordance with Oregon Revised Statutes 275.110 and chapter 312 as applicable; now, therefore

IT IS HEREBY ORDERED that the Sheriff shall sell at public auction the properties listed on Exhibit A of this order. Exhibit A sets forth the minimum price for each property and any additional information deemed pertinent regarding the sale.

IT IS FURTHER ORDERED that the Sheriff shall publish a notice of sale of such property in a newspaper of general circulation, printed and published in the county where the land is situated, once each week for four consecutive weeks prior to the sale, pursuant to ORS 275.120 and chapter 312 as applicable.

DATED at Salem, Oregon, this 7th day of October 2026

MARION COUNTY BOARD OF COMMISSIONERS

_____
Colm Willis, Chair

_____
Kevin Cameron, Vice Chair

_____
Danielle Bethell, Commissioner

Original – Clerk
cc: Finance – Foreclosed Property Coordinator

Exhibit A
Foreclosed Property Auction List
November 17, 2026

On November 17, 2026 at 10:00 am in the Senator Hearing Room located at 555 Court St NE, Salem, OR Marion County will sell at public auction the following described real property pursuant to an Order of the Board of Commissioners for Marion County, made and entered on October 7, 2026. Potential bidders are encouraged to conduct their own due diligence prior to the auction. All real property is sold AS IS and without warranty as to title, zoning suitability for any purpose, environmental condition, wetland designation, easements, or any other condition and will be conveyed by quitclaim deed. Payment in full is required at the time of sale. Payment shall be by cash, cashier check, money order or certified check. You may find additional information on the Property Auction website at https://www.co.marion.or.us/FIN/Pages/propertyinfo.aspx or by calling (503) 373-4364. Due to potential occupancy requirements, registered bidders may be given priority in the Senator Hearing Room.

Account ID #	Map Tax Lot #	Acreage	Situs Address	Real Market Value / Opening Minimum Bid
523910	072W29AB00700	0.22 Acres	5193 CENTER ST NE SALEM OR 97317	RMV: $418,280 Opening minimum bid: $36,000
537081	103W02BD01700	6.85 Acres	2020 TALBOT RD SE JEFFERSON OR 97352	RMV: $407,330 Opening minimum bid : $38,000
598896	093E26C001700	2.27 Acres	306 THISTLEDOWN LN GATES OR 97346	RMV: $220,900 Opening minimum bid : $19,000

MARION COUNTY BOARD OF COMMISSIONERS

Board Session Agenda Review Form

Meeting date: 10/7/26

Department: Health & Human Services

Title: Residential Substance Use Disorder (SUD) Treatment and/or Detoxification Services

Management Update/Work Session Date: 9/22/26 **Audio/Visual aids** ☐

Time Required: 10 **Contact:** Kristina Ballow **Phone:** 503-588-5409

Requested Action:

Approve the provision of Residential Substance Use Disorder (SUD) Treatment and/or Detoxification/Withdrawal Management Services to individuals who are not eligible for the Oregon Health Plan (OHP) or who otherwise do not have a health benefit that covers SUD treatment services, subject to applicable funding, regulatory, and organizational requirements.

Issue, Description & Background:

Provide Residential Substance Use Disorder (SUD) Treatment and/or Detoxification/Withdrawal Management Services to individuals who are not eligible for Oregon Health Plan (OHP) or who otherwise do not have a benefit that covers SUD treatment services.

Financial Impacts:

Health and Human Services anticipates no financial impact to other departments.

Impacts to Department & External Agencies:

NA

List of attachments:

Original

Presenter:

Carol Heard

Department Head Signature:

Troy Gregg
Troy Gregg (Sep 11, 2026 16:46:01 PDT)

Contract Review Sheet

Contract for Services **HE-7223-26**

Title: **Residential Substance Use Disorder (SUD) Treatment and/or Detoxification Services**

Contractor's Name: **Bridgeway Community Health**

Department: **Health and Human Services** Contact: **Kristina Ballow**

Analyst: **Sandra Fixsen** Phone #: **(503) 588-5409**

Term - Date From: **upon signatures** Expires: **December 31, 2027**

Original Contract Amount: **$ 200,000.00** Previous Amendments Amount: **$ -**

Current Amendment: **$ -** New Contract Total: **$ 200,000.00** Amd% **0%**

Outgoing Funds ☐ Federal Funds ☐ Reinstatement ☐ Retroactive ☐ Amendment greater than 25%

Source Selection Method: **20-0260 Request for Proposal** RFP# **HE1785-26**

Description of Services or Grant Award

Provide Residential Substance Use Disorder (SUD) Treatment and/or Detoxification/Withdrawal Management Services to individuals who are not eligible for Oregon Health Plan (OHP) or who otherwise do not have a benefit that covers SUD treatment services.

Desired BOC Session Date:	**10/7/2026**	Contract should be in DocuSign by:	**9/16/2026**
Agenda Planning Date	**9/24/2026**	Printed packets due in Finance:	**9/22/2026**
Management Update	**9/22/2026**	BOC upload / Board Session email:	**9/23/2026**

BOC Session Presenter(s) **Carol Heard** Code: **Y**

REQUIRED APPROVALS

Sandra L. Fixsen	09/11/2026	Kristina Ballow (Sep 9, 2026 11:55:40 PDT)	09/09/2026
Finance - Contracts	Date	Contract Specialist	Date
Jennifer Rogers (Sep 14, 2026 10:38:47 PDT)	09/14/2026	Jan Fritz (Sep 14, 2026 10:53:23 PDT)	09/14/2026
Legal Counsel	Date	Chief Administrative Officer	Date

MARION COUNTY
CONTRACT FOR SERVICES
HE-7223-26

This Contract is between Marion County (a political subdivision of the State of Oregon) hereinafter called County, and Bridgeway Community Health, a corporation hereinafter called Contractor.

RECITALS

WHEREAS County issued Request for Proposal HE1785-26 for Residential Substance Use Disorder (SUD) Treatment and/or Detoxification Services on May 12, 2026.

WHEREAS Bridgeway Community Health submitted a proposal in response to HE1785-26 on June 4, 2026, which was determined to be responsive.

WHEREAS County evaluated and scored all proposals received and issued a Notice of Intent of Award to Bridgeway Community Health on June 26, 2026.

WHEREAS County wishes to engage Contractor to provide the services set forth in Exhibit A.

Contractor agrees to perform, and County agrees to pay for, the services and deliverables described in Exhibit A (the "Work").

1. TERM

This Contract is effective on the date it has been signed by all parties and all required County approvals have been obtained. This Contract expires one year from the date of signature. The parties may extend the term of this Contract for additional periods, up to a maximum term of 3 years, provided that the total Contract term does not extend beyond 12/31/2030**.**

2. DOCUMENTS / ORDER OF PRECEDENCE

This Contract consists of the following documents, each of which is attached and incorporated herein by reference:

A. This Contract less exhibits

B. Exhibit A – Statement of Work

C. Addendum #1 – Health Insurance Portability and Accountability Act

3. CONSIDERATION

A. The maximum, not-to-exceed compensation payable to Contractor under this Contract, which includes any allowable expenses, is **$200,000.00**. County will not pay Contractor any amount in excess of the not-to-exceed compensation of this Contract for completing the Work and will not pay for Work performed before the date this Contract becomes effective or after the termination of this Contract. If the maximum compensation is increased by amendment of this Contract, the amendment must be fully effective before Contractor performs Work subject to the amendment.

B. Interim payments to Contractor shall be made in accordance with the payment schedule and requirements in Exhibit A.

In accordance with 2 CFR 200.331, Contractor has been designated:
☐ Subrecipient
☐ Contractor/Vendor

☒ Not applicable – (there are no federal funds tied to the contract)

4. COMPLIANCE WITH STATUTES AND RULES

A. County and Contractor agree to comply with the provisions of this Contract, its exhibits and attachments and all applicable federal, state, and local statutes and rules.
Unless otherwise specified, responsibility for all taxes, assessment, and any other charges imposed by law upon employers shall be the sole responsibility of Contractor. Failure of Contractor or County to comply with the provisions of this Contract and all applicable federal, state, and local statutes and rules shall be cause for termination of this Contract as specified in sections concerning recovery of funds and termination.

County's performance under this Contract is conditioned upon Contractor's compliance with the obligations intended for contractors under ORS 279B.220, 279B.225 (if applicable to this Contract), 279B.230, 279B.235 (if applicable to this Contract) and ORS 652, which are incorporated by reference herein.

B. Contractor must, throughout the duration of this Contract and any extensions, comply with all tax laws of this state and all applicable tax laws of any political subdivision of this state. For the purposes of this Section, "tax laws" includes all the provisions described in subsection 29. C. (i) through (iv) of this Contract.
Any violation of subsection B of this section shall constitute a material breach of this Contract. Further, any violation of Contractor's warranty, in subsection 29.C of this Contract, that Contractor has complied with the tax laws of this state and the applicable tax laws of any political subdivision of this state also shall constitute a material breach of this Contract. Any violation shall entitle County to terminate this Contract, to pursue and recover any and all damages that arise from the breach and the termination of this Contract, and to pursue any or all of the remedies available under this Contract, at law, or in equity, including but not limited to:

i. Termination of this Contract, in whole or in part;

ii. Exercise of the right of setoff, and withholding of amounts otherwise due and owing to Contractor, in an amount equal to State's setoff right, without penalty; and

iii. Initiation of an action or proceeding for damages, specific performance, declaratory or injunctive relief. County shall be entitled to recover any and all damages suffered as the result of Contractor's breach of this Contract, including but not limited to direct, indirect, incidental and consequential damages, costs of cure, and costs incurred in securing replacement Services.

C. These remedies are cumulative to the extent the remedies are not inconsistent, and County may pursue any remedy or remedies singly, collectively, successively, or in any order whatsoever.

5. CIVIL RIGHTS, REHABILITATION ACT, AMERICANS WITH DISABILITIES ACT AND TITLE VI OF THE CIVIL RIGHTS ACT

Contractor agrees to comply with the Civil Rights Act of 1964, and 1991, Americans with Disabilities Act of 1990, and Section 504 of the Rehabilitation Act of 1973, and Title VI as implemented by 45 CFR 80 and 84 which states in part, No qualified person shall on the basis of disability, race, color, or national origin be excluded from participation in, be denied the benefits of, or otherwise be subjected to discrimination under any program or activity which received or benefits from federal financial assistance.

6. TIME IS OF THE ESSENCE

Contractor agrees that time is of the essence in the performance of this Contract.

7. FORCE MAJEURE

Neither County nor Contractor shall be responsible for any failure to perform or for any delay in the performance of any obligation under this Contract caused by fire, riot, acts of God, terrorism, war, or any other cause which is beyond the breaching party's reasonable control. Contractor shall, however, make all reasonable efforts to remove or eliminate the cause of Contractor's delay or breach and shall, upon the cessation of the cause, continue performing under this Contract. County may terminate this Contract upon written notice to Contractor after reasonably determining that the delay or breach will likely prevent successful performance of this Contract.

8. FUNDING MODIFICATION

A. County may reduce or terminate this Contract when state or federal funds are reduced or eliminated by providing written notice to the respective parties.

B. In the event the Board of Commissioners of County reduces, changes, eliminates, or otherwise modifies the funding for any of the services identified, Contractor agrees to abide by any such decision including termination of service.

9. RECOVERY OF FUNDS

Expenditures of Contractor may be charged to this Contract only if they (1) are in payment of services performed under this Contract, (2) conform to applicable state and federal regulations and statutes, and (3) are in payment of an obligation incurred during the Contract period.

Any County funds spent for purposes not authorized by this Contract and payments by County in excess of authorized expenditures shall be deducted from future payments or refunded to County no later than thirty (30) days after notice of unauthorized expenditure or notice of excess payment.

Contractor shall be responsible to repay for prior contract period excess payments and un-recovered advanced payments provided by County. Repayment of prior period obligations shall be made to County in a manner agreed on.

10. ACCESS TO RECORDS

A. Contractor shall permit authorized representatives of County, State of Oregon, or the applicable audit agencies of the U.S. Government to review the records of Contractor as they relate to the Contract services in order to satisfy audit or program evaluation purposes deemed necessary by County and permitted by law.

B. Contractor agrees to establish and maintain financial records, which indicate the number of hours of work provided, and other appropriate records pertinent to this Contract shall be retained for a minimum of three (3) years after the end of the Contract period. If there are unresolved audit questions at the end of the three-year period, the records must be maintained until the questions are resolved.

11. REPORTING REQUIREMENTS

Contractor shall provide County with periodic reports at the frequency and with the information prescribed by County. Further, at any time, County has the right to demand adequate assurances that the services provided by Contractor shall be in accordance with the Contract. Such assurances provided by Contractor shall be supported by documentation in Contractor's possession from third parties.

12. CONFIDENTIALITY OF RECORDS

A. Contractor shall not use, release, or disclose any information concerning any employee, client, applicant or person doing business with County for any purpose not directly connected with the administration of County's or Contractor's responsibilities under this Contract except upon written consent of County, and if applicable, the employee, client, applicant or person.

B. Contractor shall ensure that its agents, employees, officers, and subcontractors with access to County and Contractor records understand and comply with this confidential provision.

C. If Contractor receives or transmits protected health information, Contractor shall enter into a Business Associate Agreement with County, which shall become part of this Contract, if attached hereto.

D. Client records shall be kept confidential in accordance with ORS 179.505, OAR 309-014-0036(3), 45 CFR 205.50 and 42 CFR Part 2 as applicable.

13. INDEMNIFICATION AND INSURANCE

A. Contractor shall defend, save, indemnify, and hold harmless County, its officers, agents, and employees from and against all claims, suits, actions, losses, damages, liabilities, costs, and expenses of any nature whatsoever, including attorney fees, resulting from, arising out of, or relating to the activities of Contractor or its officers, employees, subcontractors, or agents under this Contract. Contractor shall have control of the defense and settlement of any claim that is subject to this section. However, neither Contractor nor any attorney engaged by Contractor shall defend the claim in the name of either County or any department of County, nor purport to act as legal representative of either County or any of its departments, without first receiving from County Legal Counsel authority to act as legal counsel for County, nor shall Contractor settle any claim on behalf of County without the approval of County Legal Counsel. County may, at its election and expense, assume its own defense and settlement.

B. Contractor shall obtain the insurance required under section 24 prior to performing under this Contract and shall maintain the required insurance throughout the duration of this Contract and all warranty periods.

C. County, pursuant to applicable provisions of ORS 30.260 to 30.300, maintains a self-insurance program that provides property damage and personal injury coverage.

14. EARLY TERMINATION

This Contract may be terminated as follows:

A. County and Contractor, by mutual written agreement, may terminate this Contract at any time.

B. County in its sole discretion may terminate this Contract for any reason on 30 days written notice to Contractor.

C. Either County or Contractor may terminate this Contract in the event of a breach of the Contract by the other. Prior to such termination the party seeking termination shall give to the other party written notice of the breach and intent to terminate. If the party committing the breach has not entirely cured the breach within 15 days of the date of the notice, then the party giving the notice may terminate the Contract at any time thereafter by giving a written notice of termination.

D. Notwithstanding section 14C, County may terminate this Contract immediately by written notice to Contractor upon denial, suspension, revocation, or non-renewal of any license, permit or certificate that Contractor must hold to provide services under this Contract.

15. PAYMENT ON EARLY TERMINATION

Upon termination pursuant to section 14, payment shall be made as follows:

A. If terminated under 14A or 14B for the convenience of County, County shall pay Contractor for Work performed prior to the termination date if such Work was performed in accordance with the Contract. County shall not be liable for direct, indirect, or consequential damages. Termination shall not result in a waiver of any other claim County may have against Contractor.

B. If terminated under 14C by Contractor due to a breach by County, then County shall pay Contractor for Work performed prior to the termination date if such Work was performed in accordance with the Contract.

C. If terminated under 14C or 14D by County due to a breach by Contractor, then County shall pay Contractor for Work performed prior to the termination date provided such Work was performed in accordance with the Contract less any setoff to which County is entitled.

16. INDEPENDENT CONTRACTOR

A. Contractor is a separate and independently established business, retains sole and absolute discretion over the manner and means of carrying out Contractor's activities and responsibilities for the purpose of implementing the provisions of this Contract, and maintains the appropriate license/certifications, if required under Oregon Law. This Contract shall not be construed as creating an agency, partnership, joint venture, employment relationship or any other relationship between the parties other than that of independent parties. The Contractor is acting as an "independent contractor" and is not an employee of County and accepts full responsibility for taxes or other obligations associated with payment for services under this Contract. As an "independent contractor", Contractor will not receive any benefits normally accruing to County employees unless required by applicable law. Furthermore, Contractor is free to contract with other parties for the duration of the Contract.

B. SUBCONTRACTING/NONASSIGNMENT. No portion of the Contract may be contracted or assigned to any other individual, firm or entity without the express and prior approval of County.

17. GOVERNING LAW AND VENUE

This Contract shall be governed by the laws of the State of Oregon. Any action commenced in connection with this Contract shall be in the Circuit Court of Marion County. All rights and remedies of County shall be cumulative and may be exercised successively or concurrently. The foregoing is without limitation to or waiver of any other rights or remedies of County according to law.

18. OWNERSHIP AND USE OF DOCUMENTS

All documents, or other material submitted to County by Contractor shall become the sole and exclusive property of County. All material prepared by Contractor under this Contract may be subject to Oregon's Public Records Laws.

19. NO THIRD-PARTY BENEFICIARIES

A. County and Contractor are the only parties to this Contract and are the only parties entitled to enforce its terms.

B. Nothing in this Contract gives or provides any benefit or right, whether directly, indirectly, or otherwise, to third persons unless such third persons are individually identified by name in this Contract and expressly described as intended beneficiaries of this Contract.

20. SUCCESSORS IN INTEREST

The provisions of this Contract shall be binding upon and inure to the benefit of the parties and their successors and approved assigns.

21. MERGER CLAUSE

This Contract and the attached exhibits constitute the entire agreement between the parties.

A. All understandings and agreements between the parties and representations by either party concerning this Contract are contained in this Contract.

B. No waiver, consent, modification or change in the terms of this Contract shall bind either party unless in writing signed by both parties.

C. Any written waiver, consent, modification, or change shall be effective only in the specific instance and for the specific purpose given.

22. WAIVER

The failure of any Party to enforce any provision of this Contract shall not constitute a waiver by that Party or any other provision. Waiver of any default under this Contract by any Party shall not be deemed to be a waiver of any subsequent default or a modification of the provisions of this Contract.

23. REMEDIES

In the event of breach of this Contract, the Parties shall have the following remedies:

A. If terminated under 14C by County due to a breach by Contractor, County may complete the Work either itself, by agreement with another contractor, or by a combination thereof. If the cost of

completing the Work exceeds the remaining unpaid balance of the total compensation provided under this Contract, then Contractor shall pay to County the amount of the reasonable excess.

B. In addition to the remedies in sections 14 and 15 for a breach by Contractor, County also shall be entitled to any other equitable and legal remedies that are available.

C. If County breaches this Contract, Contractor's remedy shall be limited to termination of the Contract and receipt of Contract payments to which Contractor is entitled.

24. INSURANCE

A. REQUIRED INSURANCE. Contractor shall obtain at Contractor's expense the insurance specified in this section prior to performing under this Contract and shall maintain it in full force and at its own expense throughout the duration of this Contract and all warranty periods. Contractor shall obtain the following insurance from insurance companies or entities that are authorized to transact the business of insurance and issue coverage in Oregon and that are acceptable to County:

i. WORKERS COMPENSATION. All employers, including Contractor, that employ subject workers, as defined in ORS 656.027, shall comply with ORS 656.017 and shall provide workers' compensation insurance coverage for those workers, unless they meet the requirement for an exemption under ORS 656.126(2). Contractor shall require and ensure that each of its subcontractors complies with these requirements.

ii. PROFESSIONAL LIABILITY. Covering any damages caused by an error, omission or any negligent acts related to the services to be provided under this Contract. Contractor shall provide proof of insurance of not less than the following amounts as determined by County:

☒ **Required by County** ☐ **Not required by County.**
☒ $1,000,000 Per occurrence limit for any single claimant; and
☒ $2,000,000 Per occurrence limit for multiple claimants
☐ Exclusion Approved by Risk Manager

iii. CYBER LIABILITY. Covering network security, breach of data, and coverage for regulatory fines and fees imposed against County due to failures in products and services provided under this Contract. Cyber Liability coverage must include errors, omissions, negligent acts, denial of service, media liability (including software copyright), dishonesty, fraudulent or criminal acts by a person or persons whether identified or not, intellectual property infringement, computer system attacks, unauthorized access and use of computer system, regulatory actions, and contractual liability.

☐ **Required by County** ☒ **Not required by County.**
☐ $2,000,000 Per occurrence limit for any single claimant; and
☐ $5,000,000 Per occurrence limit for multiple claimants
☐ Exclusion Approved by Information Technology Director and Risk Manager

iv. COMMERCIAL GENERAL LIABILITY. Covering bodily injury, death, and property damage in a form and with coverages that are satisfactory to County. This insurance shall include personal injury liability, products and completed operations. Coverage shall be written on an occurrence

basis. Contractor shall provide proof of insurance of not less than the following amounts as determined by County:

☒ **Required by County** ☐ **Not required by County.**

Minimum Limits:
☒ $1,000,000 Per occurrence limit for any single claimant; and
☒ $2,000,000 Per occurrence limit for multiple claimants
☐ Exclusion Approved by Risk Manager
☐ $500,000 Per occurrence limit for any single claimant
☐ $1,000,000 Per occurrence limit for multiple claimant

v. AUTOMOBILE LIABILITY INSURANCE. Covering all owned, non-owned, or hired vehicles. This coverage may be written in combination with the Commercial General Liability Insurance (with separate limits for "Commercial General Liability" and "Automobile Liability"). Contractor shall provide proof of insurance of not less than the following amounts as determined by County:

☐ **Required by County** ☒ **Not required by County.**

Minimum Limits:
☐ Oregon Financial Responsibility Law, ORS 806.060 ($25,000 property damage/$50,000 bodily injury $5,000 personal injury).
☐ $500,000 Per occurrence limit for any single claimant; and
☐ $1,000,000 Per occurrence limit for multiple claimants
☐ Exclusion Approved by Risk Manager

B. ADDITIONAL INSURED. The Commercial General Liability insurance required under this Contract shall include Marion County, its officers, employees, and agents as Additional Insureds but only with respect to Contractor's activities to be performed under this Contract. Coverage shall be primary and non-contributory with any other insurance and self-insurance.

C. NOTICE OF CANCELLATION OR CHANGE. There shall be no cancellation, material change, potential exhaustion of aggregate limits or non-renewal of insurance coverage(s) without 30 days written notice from this Contractor or its insurer(s) to County. Any failure to comply with the reporting provisions of this clause shall constitute a material breach of Contract and shall be grounds for immediate termination of this Contract by County.

D. CERTIFICATE(S) OF INSURANCE. Contractor shall provide to County Certificate(s) of Insurance for all required insurance before delivering any Goods and performing any Services required under this Contract. The Certificate(s) must specify all entities and individuals who are endorsed on the policy as Additional Insured (or Loss Payees). Contractor shall pay for all deductibles, self-insured retention, and self-insurance, if any.

25. NOTICE

Except as otherwise expressly provided in this Contract, any communications between the parties hereto or notices to be given hereunder shall be given in writing, to Contractor or County at the address or email set forth below or to such other addresses or emails as either party may hereafter indicate in writing. Delivery may be by personal delivery, or mailing the same, postage prepaid.

A. Any communication or notice by personal delivery shall be deemed delivered when actually given to the designated person or representative.

B. Any communication or notice mailed shall be deemed delivered five (5) days after mailing. Any notice under this Contract shall be mailed by first class postage delivered to:

To Contractor:
Bridgeway Community Health
ctexidormaldonado@bridgewaych.org
250 Church St SE Suite 202 P.O. Box 17818
Salem, OR, 97305

To County
Contracts and Procurement Manager
PO_Contracts@co.marion.or.us
555 Court Street NE, Suite 4247
P.O. Box 14500
Salem, Oregon 97309

26. SURVIVAL

All rights and obligations shall cease upon termination or expiration of this Contract, except for the rights and obligations set forth in sections 3, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26 and 27.

27. SEVERABILITY

If any term or provision of this Contract is declared illegal or in conflict with any law by a court of competent jurisdiction, the validity of the remaining terms and provisions that shall not be affected and the rights and obligations of the parties shall be construed and enforced as if the Contract did not contain the particular term or provision held to be invalid.

28. AMENDMENTS

This Contract may be amended if mutually agreed to by both parties.

A. Anticipated Amendments
This Contract is anticipated to be amended for the following reasons:

i. To extend the Contract term and increase the maximum not-to-exceed amount to cover those extension term.

ii. To adjust the unit pricing or other rate(s) of compensation, set forth in Exhibit A.

B. Unanticipated Amendments
All other amendments for purposes not listed as Anticipated Amendments will be deemed Unanticipated Amendments.

29. CONTRACTOR'S REPRESENTATIONS AND WARRANTIES

Contractor represents and warrants to County that:

A. Contractor has the power and authority to enter into and perform this Contract.

B. This Contract, when executed and delivered, is a valid and binding obligation of Contractor, enforceable in accordance with its terms.

C. Contractor (to the best of Contractor's knowledge, after due inquiry), for a period of no fewer than six calendar years preceding the effective date of this Contract, faithfully has complied with:

i. All tax laws of this state, including but not limited to ORS 305.620 and ORS chapters 316, 317, and 318;

ii. Any tax provisions imposed by a political subdivision of this state that applied to Contractor, to Contractor's property, operations, receipts, or income, or to Contractor's performance of or compensation for any work performed by Contractor;

iii. Any tax provisions imposed by a political subdivision of this state that applied to Contractor, or to goods, services, or property, whether tangible or intangible, provided by Contractor; and

iv. Any rules, regulations, charter provisions, or ordinances that implemented or enforced any of the foregoing tax laws or provisions.

D. Any Goods granted to County under this Contract, and Contractor's Services rendered in the performance of Contractor's obligations under this Contract, shall be provided to County free and clear of any and all restrictions on or conditions of use, transfer, modification, or assignment, and shall be free and clear of any and all liens, claims, mortgages, security interests, liabilities, charges, and encumbrances of any kind.

30. CERTIFICATIONS AND SIGNATURE. THIS CONTRACT MUST BE SIGNED BY AN AUTHORIZED REPRESENTATIVE OF CONTRACTOR

The undersigned certifies under penalty of perjury both individually and on behalf of Contractor is a duly authorized representative of Contractor, has been authorized by Contractor to make all representations, attestations, and certifications contained in this Contract and to execute this Contract on behalf of Contractor.

MARION COUNTY SIGNATURES
BOARD OF COMMISSIONERS:

_____

Chair Date

_____

Commissioner Date

_____

Commissioner Date

Authorized Signature: Troy Gregg (Sep 11, 2026 16:46:01 PDT) 09/11/2026

Department Director or designee Date

Authorized Signature: Jan Fritz (Sep 14, 2026 10:53:23 PDT) 09/14/2026

Chief Administrative Officer Date

Reviewed by Signature: Jennifer Rogers (Sep 14, 2026 10:38:47 PDT) 09/14/2026

Marion County Legal Counsel Date

Reviewed by Signature: Sandra L. Fisher 09/11/2026

Marion County Contracts & Procurement Date

BRIDGEWAY COMMUNITY HEALTH SIGNATURE

Authorized Signature: _____

Date

Title: _____

EXHIBIT A
STATEMENT OF WORK

1. STATEMENT OF SERVICES

Contractor shall perform Services as described below.

A. GENERAL INFORMATION.

Contractor is responsible for daily operations, staffing oversight, quality assurance, regulatory compliance, performance monitoring and continuous quality improvement activities. Services are designed to meet each individual's unique strengths, needs, goals, and stage of recovery. Care is delivered using evidence-based and harm-reduction-informed practices that support recovery, resilience, independence, safety, and overall wellness.

B. REQUIRED SERVICES, DELIVERABLES AND DELIVERY SCHEDULE.

i. Contractor shall provide Medically Managed Withdrawal and/or Residential Substance Use Disorder (SUD) Treatment services to uninsured adults referred by Marion County Health and Human Services (MCHHS), the Marion County Law Enforcement Assisted Diversion (LEAD) Program, or other Marion County-designated behavioral health programs, who meet the applicable eligibility and clinical criteria for such services.

a. Target populations include individuals with a Substance Use Disorder (SUD) and may include individuals who meet one or more of the following criteria:

(1) Co-occurring mental health conditions;

(2) Experiencing homelessness or housing instability;

(3) Criminal justice involved individuals;

(4) Pregnant or post-partum individuals;

b. Contractor will consistently communicate the following:

(1) Bed availability for each service;

(2) Acknowledgement of referrals within one (1) business day, or sooner for detox;

(3) Provide admission, engagement and discharge status of each referral;

(4) Provide written rational for any denial

ii. Contractor shall provide application and enrollment assistance to uninsured individuals who are eligible for the Oregon Health Plan (OHP).

a. Contractor will screen each referral for OHP eligibility.

b. Provide or facilitate on-site OHP enrollment support.

c. Contractor will bill Medicaid/OHP before County funds are utilized.

(1) County funds may only be utilized when no other payer source is available.

(2) Contractor must document uninsured or Medicaid-pending status.

iii. Contractor shall provide monthly reporting of the following;

a. Referrals received by ATS, LEAD other county sources

b. Admissions, discharges and lengths of stay for ATS, LEAD or other county referrals

c. County-funded bed utilization

d. Medicaid/OHP enrollment outcomes

e. Insurance billing activity

2. COMPENSATION

The total amount available for payment to Contractor under Exhibit A, section 2.A and for authorized reimbursement to Contractor under Exhibit A, section 2B is not to exceed **$200,000.00.**

A. METHOD OF PAYMENT FOR SERVICES: Fixed Price for all Daily services: County shall pay Contractor $1474.00 per day for Medically Managed Withdrawal Services. County shall pay Contractor $500.00 per day for Residential Substance Use Disorder (SUD) Services.

B. BASIS OF PAYMENT FOR SERVICES. Individual payments for completes Services. County shall pay Contractor payments upon County's approval of Contractor's invoice submitted to County for completed Services, but only after County has determined that Contractor has completed Services. County may also keep credit card on file with Contractor to pay for services.

C. GENERAL PAYMENT PROVISIONS. Notwithstanding any other payment provision of this Contract, failure of Contractor to submit required reports when due, or failure to perform or document the performance of contracted services, may result in withholding of payments under this Contract. Such withholding of payment for cause shall begin thirty (30) days after written notice is given by County to Contractor, and shall continue until Contractor submits required reports, performs required services or establishes, to County's satisfaction, that such failure arose out of causes beyond the control, and without the fault or negligence of Contractor.

D. INVOICES. Contractor shall comply with the following:

i. Invoices must be submitted within 45 days of completion of services.

ii. Contractor shall include in each invoice:

a. Individual's full name and date of birth on the invoice

b. Specific dates of service e.g. MM/DD/YYYY

c. Type and length of stay.

iii. Invoices submitted after 12 months of services may not be paid.

Contractor shall send all invoices to County's Contract Administrator at the address specified below or to any other address as County may indicate in writing to Contractor.

Marion County
Attn: Health and Human Services
Email: HealthAP@co.marion.or.us
3160 Center St NE
Salem, OR 97301

MARION COUNTY BOARD OF COMMISSIONERS

Board Session Agenda Review Form

Meeting date: 10/7/26

Department: Health & Human Services

Title: LocumTenens.com, LLC

Management Update/Work Session Date: 9/22/26 **Audio/Visual aids** ☐

Time Required: 10 **Contact:** Kristina Ballow **Phone:** 503-588-5409

Requested Action:

Approve authorization for MCHHS to utilize Locum Tenens, LLC for temporary staffing services, including qualified psychiatrists, Psychiatric Mental Health Nurse Practitioners (PMHNPs), and other medical professionals, as needed to support the operational and staffing needs of all divisions within the Health & Human Services Department.

Issue, Description & Background:

Upon request by MCHHS, Locum Tenens, LLC shall provide temporary staffing services consisting of qualified medical professionals, including but not limited to psychiatrists and Psychiatric Mental Health Nurse Practitioners (PMHNPs), to support the operational and staffing needs of all divisions within the Health & Human Services Department.

Financial Impacts:

$2,500,000.00 for the temporary procurement of medical and other qualified staff over a 3-year period. No financial impact to other departments.

Impacts to Department & External Agencies:

NA

List of attachments: Original

Presenter: Carol Heard/Troy Gregg

Department Head Signature:

Troy Gregg (Sep 10, 2026 20:55:11 PDT)

Contract Review Sheet

Contract for Services **HE-7274-26**

Title: **Medical Temporary Personnel**

Contractor's Name: **LocumTenens.com, LLC**

Department: **Health and Human Services** Contact: **Kristina Ballow**

Analyst: **Sandra Fixsen** Phone #: **(503) 588-5409**

Term - Date From: **October 1, 2026** Expires: **September 30, 2029**

Original Contract Amount: **$ 2,500,000.00** Previous Amendments Amount: **$ -**

Current Amendment: **$ -** New Contract Total: **$ 2,500,000.00** Amd% **0%**

Outgoing Funds ☐ Federal Funds ☐ Reinstatement ☑ Retroactive ☐ Amendment greater than 25%

Source Selection Method: **50-0160 Health Provider Contracts**

Description of Services or Grant Award

Upon request by MCHHS, Locum Tenens, LLC shall provide temporary staffing services consisting of qualified medical professionals, including but not limited to psychiatrists and Psychiatric Mental Health Nurse Practitioners (PMHNPs), to support the operational and staffing needs of all divisions within the Health & Human Services Department.

Desired BOC Session Date:	**10/7/2026**	Contract should be in DocuSign by:	**9/16/2026**
Agenda Planning Date	**9/24/2026**	Printed packets due in Finance:	**9/22/2026**
Management Update	**9/22/2026**	BOC upload / Board Session email:	**9/23/2026**

BOC Session Presenter(s) **Carol Heard/Troy Gregg** Code: **Y**

REQUIRED APPROVALS

Sandra L. Fixsen	09/10/2026	Kristina Ballow (Sep 9, 2026 13:23:40 PDT)	09/09/2026
Finance - Contracts	Date	Contract Specialist	Date
Jennifer Rogers (Sep 15, 2026 09:34:17 PDT)	09/15/2026	Jan Fritz (Sep 15, 2026 18:25:05 PDT)	09/15/2026
Legal Counsel	Date	Chief Administrative Officer	Date

REQUEST FOR AUTHORIZATION OF CONTRACT
HE-7274-26

Date: 8/24/26
To: Chief Administrative Officer
Cc: Contract File
From: Kristina Ballow

I. Subject: Retroactive

The Marion County Health and Human Services Department is requesting approval of a retroactive contract as described in Section 10-0580 of the Marion County Public Contracting Rules. The contract is with LocumTenens.com, LLC for Medical Temporary Personnel with a value of $2,500,000.00 and will be effective retroactive to 10/1/2026 upon approval.

A. BACKGROUND

Marion County Health and Human Services (MCHHS) currently contracts with LocumTenens.com, LLC to provide temporary medical personnel needed to support ongoing behavioral health services. The existing contract expires September 30, 2026, and does not provide sufficient authority to continue services beyond that date. The requested retroactive effective date is intended to provide continuity between the expiration of the existing contract and final execution of the new contract. Upon approval, the new contract will be effective October 1, 2026, with a not-to-exceed amount of $2,500,000.00.

B. As required in Section 10-0580(2)(a), Department staff will provide an explanation of why the contract was not submitted before performance began:

Marion County Health and Human Services anticipates that the current contract will expire before the new agreement is fully executed. Continued access to the medical providers supplied through LocumTenens.com, LLC is necessary to maintain adequate medical coverage and continuity of patient care. Approval of a retroactive effective date will allow these services to continue during the contracting transition and ensure payment for services provided prior to final execution of the new contract.

C. As required in Section 10-0580(2)(b), Department staff will provide a description of the steps being taken to prevent similar occurrences in the future:

MCHHS will continue to closely monitor contract expiration dates and initiate future contracting processes with sufficient lead time to accommodate solicitation, contract development, review, and approval requirements. Program staff will coordinate with Contracts and Fiscal staff throughout the process to identify and address potential delays as early as possible to minimize the need for future retroactive contracting requests.

Submitted by:

Kristina Ballow (Sep 9, 2026 13:23:40 PDT)

Kristina Ballow
Health and Human Services

Reviewed by:

Contracts & Procurement

Acknowledged by:

Troy Gregg (Sep 10, 2026 20:55:11 PDT)

Department Head

Acknowledged by:

Jan Fritz
Jan Fritz (Sep 15, 2026 18:25:05 PDT)

Jan Fritz, CAO

MARION COUNTY
CONTRACT FOR SERVICES
HE-7274-26

This Contract is between Marion County (a political subdivision of the State of Oregon) hereinafter called County, and LocumTenens.com, LLC, a corporation, hereinafter called Contractor.

RECITALS

WHEREAS, this Contract is established pursuant to MCPCR 50.0160 and is a direct award.

WHEREAS, County wishes to engage Contractor to provide the services set forth in Exhibit A.

Contractor agrees to perform, and County agrees to pay for, the services and deliverables described in Exhibit A (the "Work").

1. TERM

This Contract is effective retroactively to **October 1, 2026**. This Contract expires on **September 30, 2029**, with the option to extend until **September 30, 2031**.

2. DOCUMENTS / ORDER OF PRECEDENCE

This Contract consists of the following documents, each of which is attached and incorporated herein by reference:

A. This Contract less exhibits

B. Exhibit A – Statement of Work

3. CONSIDERATION

A. The maximum, not-to-exceed compensation payable to Contractor under this Contract, which includes any allowable expenses, is **$2,500,000.00**. County will not pay Contractor any amount in excess of the not-to-exceed compensation of this Contract for completing the Work and will not pay for Work performed before the date this Contract becomes effective or after the termination of this Contract. If the maximum compensation is increased by amendment of this Contract, the amendment must be fully effective before Contractor performs Work subject to the amendment.

B. Interim payments to Contractor shall be made in accordance with the payment schedule and requirements in Exhibit A.

C. If specified below, county's payments to Contractor under this Contract will be paid in whole or in part with federal funds. If so specified, by signing this agreement, Contractor certifies neither it nor its employees, contractors, subcontractors or subgrantees who will perform the Project activities are currently employed by an agency or department of the federal government. If applicable, Contractor shall comply with Appendix II to Title 2, Part 200 of the Code of Federal Regulations.

In accordance with 2 CFR 200.331, Contractor has been designated:
☐ Subrecipient
☐ Contractor/Vendor
☒ Not applicable – (there are no federal funds tied to the contract)

4. COMPLIANCE WITH STATUTES AND RULES

A. County and Contractor agree to comply with the provisions of this Contract, its exhibits and attachments and all applicable federal, state, and local statutes and rules.
Unless otherwise specified, responsibility for all taxes, assessment, and any other charges imposed by law upon employers shall be the sole responsibility of Contractor. Failure of Contractor or County to comply with the provisions of this Contract and all applicable federal, state, and local statutes and rules shall be cause for termination of this Contract as specified in sections concerning recovery of funds and termination.

County's performance under this Contract is conditioned upon Contractor's compliance with the obligations intended for contractors under ORS 279B.220, 279B.225 (if applicable to this Contract), 279B.230, 279B.235 (if applicable to this Contract) and ORS 652, which are incorporated by reference herein.

B. Contractor must, throughout the duration of this Contract and any extensions, comply with all tax laws of this state and all applicable tax laws of any political subdivision of this state. For the purposes of this Section, "tax laws" includes all the provisions described in subsection 29. C. (i) through (iv) of this Contract.
Any violation of subsection B of this section shall constitute a material breach of this Contract. Further, any violation of Contractor's warranty, in subsection 29.C of this Contract, that Contractor has complied with the tax laws of this state and the applicable tax laws of any political subdivision of this state also shall constitute a material breach of this Contract. Any violation shall entitle County to terminate this Contract, to pursue and recover any and all damages that arise from the breach and the termination of this Contract, and to pursue any or all of the remedies available under this Contract, at law, or in equity, including but not limited to:

i. Termination of this Contract, in whole or in part;

ii. Exercise of the right of setoff, and withholding of amounts otherwise due and owing to Contractor, in an amount equal to State's setoff right, without penalty; and

iii. Initiation of an action or proceeding for damages, specific performance, declaratory or injunctive relief. County shall be entitled to recover any and all damages suffered as the result of Contractor's breach of this Contract, including but not limited to direct, indirect, incidental and consequential damages, costs of cure, and costs incurred in securing replacement Services.

C. These remedies are cumulative to the extent the remedies are not inconsistent, and County may pursue any remedy or remedies singly, collectively, successively, or in any order whatsoever.

5. CIVIL RIGHTS, REHABILITATION ACT, AMERICANS WITH DISABILITIES ACT AND TITLE VI OF THE CIVIL RIGHTS ACT

Contractor agrees to comply with the Civil Rights Act of 1964, and 1991, Americans with Disabilities Act of 1990, and Section 504 of the Rehabilitation Act of 1973, and Title VI as implemented by 45 CFR 80 and 84 which states in part, No qualified person shall on the basis of disability, race, color, or national origin be excluded from participation in, be denied the benefits of, or otherwise be subjected to discrimination under any program or activity which received or benefits from federal financial assistance.

6. TIME IS OF THE ESSENCE

Contractor agrees that time is of the essence in the performance of this Contract.

7. FORCE MAJEURE

Neither County nor Contractor shall be responsible for any failure to perform or for any delay in the performance of any obligation under this Contract caused by fire, riot, acts of God, terrorism, war, or any other cause which is beyond the breaching party's reasonable control. Contractor shall, however, make all reasonable efforts to remove or eliminate the cause of Contractor's delay or breach and shall, upon the cessation of the cause, continue performing under this Contract. County may terminate this Contract upon written notice to Contractor after reasonably determining that the delay or breach will likely prevent successful performance of this Contract.

8. FUNDING MODIFICATION

A. County may reduce or terminate this Contract when state or federal funds are reduced or eliminated by providing written notice to the respective parties.

B. In the event the Board of Commissioners of County reduces, changes, eliminates, or otherwise modifies the funding for any of the services identified, Contractor agrees to abide by any such decision including termination of service.

9. RECOVERY OF FUNDS

Expenditures of Contractor may be charged to this Contract only if they (1) are in payment of services performed under this Contract, (2) conform to applicable state and federal regulations and statutes, and (3) are in payment of an obligation incurred during the Contract period.

Any County funds spent for purposes not authorized by this Contract and payments by County in excess of authorized expenditures shall be deducted from future payments or refunded to County no later than thirty (30) days after notice of unauthorized expenditure or notice of excess payment.

Contractor shall be responsible to repay for prior contract period excess payments and un-recovered advanced payments provided by County. Repayment of prior period obligations shall be made to County in a manner agreed on.

10. ACCESS TO RECORDS

A. Contractor shall permit authorized representatives of County, State of Oregon, or the applicable audit agencies of the U.S. Government to review the records of Contractor as they relate to the Contract services in order to satisfy audit or program evaluation purposes deemed necessary by County and permitted by law.

B. Contractor agrees to establish and maintain financial records, which indicate the number of hours of work provided, and other appropriate records pertinent to this Contract shall be retained for a minimum of three (3) years after the end of the Contract period. If there are unresolved audit questions at the end of the three-year period, the records must be maintained until the questions are resolved.

11. REPORTING REQUIREMENTS

Contractor shall provide County with periodic reports at the frequency and with the information prescribed by County. Further, at any time, County has the right to demand adequate assurances that the services provided by Contractor shall be in accordance with the Contract. Such assurances provided by Contractor shall be supported by documentation in Contractor's possession from third parties.

12. CONFIDENTIALITY OF RECORDS

A. Contractor shall not use, release, or disclose any information concerning any employee, client, applicant or person doing business with County for any purpose not directly connected with the administration of County's or Contractor's responsibilities under this Contract except upon written consent of County, and if applicable, the employee, client, applicant or person.

B. Contractor shall ensure that its agents, employees, officers, and subcontractors with access to County and Contractor records understand and comply with this confidential provision.

C. If Contractor receives or transmits protected health information, Contractor shall enter into a Business Associate Agreement with County, which shall become part of this Contract, if attached hereto.

D. Client records shall be kept confidential in accordance with ORS 179.505, OAR 309-014-0036(3), 45 CFR 205.50 and 42 CFR Part 2 as applicable.

13. INDEMNIFICATION AND INSURANCE

A. Contractor shall defend, save, indemnify, and hold harmless County, its officers, agents, and employees from and against all claims, suits, actions, losses, damages, liabilities, costs, and expenses of any nature whatsoever, including attorney fees, resulting from, arising out of, or relating to the activities of Contractor or its officers, employees, subcontractors, or agents under this Contract. Contractor shall have control of the defense and settlement of any claim that is subject to this section. However, neither Contractor nor any attorney engaged by Contractor shall defend the claim in the name of either County or any department of County, nor purport to act as legal representative of either County or any of its departments, without first receiving from County Legal Counsel authority to act as legal counsel for County, nor shall Contractor settle any claim on behalf of County without the approval of County Legal Counsel. County may, at its election and expense, assume its own defense and settlement.

B. Contractor shall obtain the insurance required under section 24 prior to performing under this Contract and shall maintain the required insurance throughout the duration of this Contract and all warranty periods.

C. County, pursuant to applicable provisions of ORS 30.260 to 30.300, maintains a self-insurance program that provides property damage and personal injury coverage.

14. EARLY TERMINATION

This Contract may be terminated as follows:

A. County and Contractor, by mutual written agreement, may terminate this Contract at any time.

B. County in its sole discretion may terminate this Contract for any reason on 30 days written notice to Contractor.

C. Either County or Contractor may terminate this Contract in the event of a breach of the Contract by the other. Prior to such termination the party seeking termination shall give to the other party written notice of the breach and intent to terminate. If the party committing the breach has not entirely cured the breach within 15 days of the date of the notice, then the party giving the notice may terminate the Contract at any time thereafter by giving a written notice of termination.

D. Notwithstanding section 14C, County may terminate this Contract immediately by written notice to Contractor upon denial, suspension, revocation, or non-renewal of any license, permit or certificate that Contractor must hold to provide services under this Contract.

15. PAYMENT ON EARLY TERMINATION

Upon termination pursuant to section 14, payment shall be made as follows:

A. If terminated under 14A or 14B for the convenience of County, County shall pay Contractor for Work performed prior to the termination date if such Work was performed in accordance with the Contract. County shall not be liable for direct, indirect, or consequential damages. Termination shall not result in a waiver of any other claim County may have against Contractor.

B. If terminated under 14C by Contractor due to a breach by County, then County shall pay Contractor for Work performed prior to the termination date if such Work was performed in accordance with the Contract.

C. If terminated under 14C or 14D by County due to a breach by Contractor, then County shall pay Contractor for Work performed prior to the termination date provided such Work was performed in accordance with the Contract less any setoff to which County is entitled.

16. INDEPENDENT CONTRACTOR

A. Contractor is a separate and independently established business, retains sole and absolute discretion over the manner and means of carrying out Contractor's activities and responsibilities for the purpose of implementing the provisions of this Contract, and maintains the appropriate license/certifications, if required under Oregon Law. This Contract shall not be construed as creating an agency, partnership, joint venture, employment relationship or any other relationship between the parties other than that of independent parties. The Contractor is acting as an "independent contractor" and is not an employee of County and accepts full responsibility for taxes or other obligations associated with payment for services under this Contract. As an "independent contractor", Contractor will not receive any benefits normally accruing to County employees unless required by applicable law. Furthermore, Contractor is free to contract with other parties for the duration of the Contract.

B. SUBCONTRACTING/NONASSIGNMENT. No portion of the Contract may be contracted or assigned to any other individual, firm or entity without the express and prior approval of County.

17. GOVERNING LAW AND VENUE

This Contract shall be governed by the laws of the State of Oregon. Any action commenced in connection with this Contract shall be in the Circuit Court of Marion County. All rights and remedies of County shall be cumulative and may be exercised successively or concurrently. The foregoing is without limitation to or waiver of any other rights or remedies of County according to law.

18. OWNERSHIP AND USE OF DOCUMENTS

All documents, or other material submitted to County by Contractor shall become the sole and exclusive property of County. All material prepared by Contractor under this Contract may be subject to Oregon's Public Records Laws.

19. NO THIRD-PARTY BENEFICIARIES

A. County and Contractor are the only parties to this Contract and are the only parties entitled to enforce its terms.

B. Nothing in this Contract gives or provides any benefit or right, whether directly, indirectly, or otherwise, to third persons unless such third persons are individually identified by name in this Contract and expressly described as intended beneficiaries of this Contract.

20. SUCCESSORS IN INTEREST

The provisions of this Contract shall be binding upon and inure to the benefit of the parties and their successors and approved assigns.

21. MERGER CLAUSE

This Contract and the attached exhibits constitute the entire agreement between the parties.

A. All understandings and agreements between the parties and representations by either party concerning this Contract are contained in this Contract.

B. No waiver, consent, modification or change in the terms of this Contract shall bind either party unless in writing signed by both parties.

C. Any written waiver, consent, modification, or change shall be effective only in the specific instance and for the specific purpose given.

22. WAIVER

The failure of any Party to enforce any provision of this Contract shall not constitute a waiver by that Party or any other provision. Waiver of any default under this Contract by any Party shall not be deemed to be a waiver of any subsequent default or a modification of the provisions of this Contract.

23. REMEDIES

In the event of breach of this Contract, the Parties shall have the following remedies:

A. If terminated under 14C by County due to a breach by Contractor, County may complete the Work either itself, by agreement with another contractor, or by a combination thereof. If the cost of

completing the Work exceeds the remaining unpaid balance of the total compensation provided under this Contract, then Contractor shall pay to County the amount of the reasonable excess.

B. In addition to the remedies in sections 14 and 15 for a breach by Contractor, County also shall be entitled to any other equitable and legal remedies that are available.

C. If County breaches this Contract, Contractor's remedy shall be limited to termination of the Contract and receipt of Contract payments to which Contractor is entitled.

24. INSURANCE

A. REQUIRED INSURANCE. Contractor shall obtain at Contractor's expense the insurance specified in this section prior to performing under this Contract and shall maintain it in full force and at its own expense throughout the duration of this Contract and all warranty periods. Contractor shall obtain the following insurance from insurance companies or entities that are authorized to transact the business of insurance and issue coverage in Oregon and that are acceptable to County:

i. WORKERS COMPENSATION. All employers, including Contractor, that employ subject workers, as defined in ORS 656.027, shall comply with ORS 656.017 and shall provide workers' compensation insurance coverage for those workers, unless they meet the requirement for an exemption under ORS 656.126(2). Contractor shall require and ensure that each of its subcontractors complies with these requirements.

ii. PROFESSIONAL LIABILITY. Covering any damages caused by an error, omission or any negligent acts related to the services to be provided under this Contract. Contractor shall provide proof of insurance of not less than the following amounts as determined by County:

☒ **Required by County** ☐ **Not required by County.**
☒ $1,000,000 Per occurrence limit for any single claimant; and
☒ $2,000,000 Per occurrence limit for multiple claimants
☐ Exclusion Approved by Risk Manager

iii. CYBER LIABILITY. Covering network security, breach of data, and coverage for regulatory fines and fees imposed against County due to failures in products and services provided under this Contract. Cyber Liability coverage must include errors, omissions, negligent acts, denial of service, media liability (including software copyright), dishonesty, fraudulent or criminal acts by a person or persons whether identified or not, intellectual property infringement, computer system attacks, unauthorized access and use of computer system, regulatory actions, and contractual liability.

☐ **Required by County** ☒ **Not required by County.**
☐ $2,000,000 Per occurrence limit for any single claimant; and
☐ $5,000,000 Per occurrence limit for multiple claimants
☐ Exclusion Approved by Information Technology Director and Risk Manager

iv. COMMERCIAL GENERAL LIABILITY. Covering bodily injury, death, and property damage in a form and with coverages that are satisfactory to County. This insurance shall include personal injury liability, products and completed operations. Coverage shall be written on an occurrence

basis. Contractor shall provide proof of insurance of not less than the following amounts as determined by County:

☒ **Required by County** ☐ **Not required by County.**

Minimum Limits:
☒ $1,000,000 Per occurrence limit for any single claimant; and
☒ $2,000,000 Per occurrence limit for multiple claimants
☐ Exclusion Approved by Risk Manager
☐ $500,000 Per occurrence limit for any single claimant
☐ $1,000,000 Per occurrence limit for multiple claimant

v. AUTOMOBILE LIABILITY INSURANCE. Covering all owned, non-owned, or hired vehicles. This coverage may be written in combination with the Commercial General Liability Insurance (with separate limits for "Commercial General Liability" and "Automobile Liability"). Contractor shall provide proof of insurance of not less than the following amounts as determined by County:

☒ **Required by County** ☐ **Not required by County.**

Minimum Limits:
☒ Oregon Financial Responsibility Law, ORS 806.060 ($25,000 property damage/$50,000 bodily injury $5,000 personal injury).
☐ $500,000 Per occurrence limit for any single claimant; and
☐ $1,000,000 Per occurrence limit for multiple claimants
☐ Exclusion Approved by Risk Manager

B. ADDITIONAL INSURED. The Commercial General Liability insurance required under this Contract shall include Marion County, its officers, employees, and agents as Additional Insureds but only with respect to Contractor's activities to be performed under this Contract. Coverage shall be primary and non-contributory with any other insurance and self-insurance.

C. NOTICE OF CANCELLATION OR CHANGE. There shall be no cancellation, material change, potential exhaustion of aggregate limits or non-renewal of insurance coverage(s) without 30 days written notice from this Contractor or its insurer(s) to County. Any failure to comply with the reporting provisions of this clause shall constitute a material breach of Contract and shall be grounds for immediate termination of this Contract by County.

D. CERTIFICATE(S) OF INSURANCE. Contractor shall provide to County Certificate(s) of Insurance for all required insurance before delivering any Goods and performing any Services required under this Contract. The Certificate(s) must specify all entities and individuals who are endorsed on the policy as Additional Insured (or Loss Payees). Contractor shall pay for all deductibles, self-insured retention, and self-insurance, if any.

25. NOTICE

Except as otherwise expressly provided in this Contract, any communications between the parties hereto or notices to be given hereunder shall be given in writing, to Contractor or County at the address or email set forth below or to such other addresses or emails as either party may hereafter indicate in writing. Delivery may be by personal delivery, or mailing the same, postage prepaid.

A. Any communication or notice by personal delivery shall be deemed delivered when actually given to the designated person or representative.

B. Any communication or notice mailed shall be deemed delivered five (5) days after mailing. Any notice under this Contract shall be mailed by first class postage delivered to:

To Contractor:
LocumTenens.com, LLC
pgiammatteo@locumtenens.com
2655 Northwinds Pkwy
Alpharetta, GA, 30009

To County
Contracts and Procurement Manager
PO_Contracts@co.marion.or.us
555 Court Street NE, Suite 4247
P.O. Box 14500
Salem, Oregon 97309

26. SURVIVAL

All rights and obligations shall cease upon termination or expiration of this Contract, except for the rights and obligations set forth in sections 3, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26 and 27.

27. SEVERABILITY

If any term or provision of this Contract is declared illegal or in conflict with any law by a court of competent jurisdiction, the validity of the remaining terms and provisions that shall not be affected and the rights and obligations of the parties shall be construed and enforced as if the Contract did not contain the particular term or provision held to be invalid.

28. AMENDMENTS

This Contract may be amended if mutually agreed to by both parties.

A. Anticipated Amendments
This Contract is anticipated to be amended for the following reasons:

i. To extend the Contract term and increase the maximum not-to-exceed amount to cover those extension term.

ii. To adjust the unit pricing or other rate(s) of compensation, set forth in Exhibit A.

B. Unanticipated Amendments
All other amendments for purposes not listed as Anticipated Amendments will be deemed Unanticipated Amendments.

29. CONTRACTOR'S REPRESENTATIONS AND WARRANTIES

Contractor represents and warrants to County that:

A. Contractor has the power and authority to enter into and perform this Contract.

B. This Contract, when executed and delivered, is a valid and binding obligation of Contractor, enforceable in accordance with its terms.

C. Contractor (to the best of Contractor's knowledge, after due inquiry), for a period of no fewer than six calendar years preceding the effective date of this Contract, faithfully has complied with:

i. All tax laws of this state, including but not limited to ORS 305.620 and ORS chapters 316, 317, and 318;

ii. Any tax provisions imposed by a political subdivision of this state that applied to Contractor, to Contractor's property, operations, receipts, or income, or to Contractor's performance of or compensation for any work performed by Contractor;

iii. Any tax provisions imposed by a political subdivision of this state that applied to Contractor, or to goods, services, or property, whether tangible or intangible, provided by Contractor; and

iv. Any rules, regulations, charter provisions, or ordinances that implemented or enforced any of the foregoing tax laws or provisions.

D. Any Services delivered to County under this Contract, and Contractor's Services rendered in the performance of Contractor's obligations under this Contract, shall be provided to County free and clear of any and all restrictions on or conditions of use, transfer, modification, or assignment, and shall be free and clear of any and all liens, claims, mortgages, security interests, liabilities, charges, and encumbrances of any kind.

30. CERTIFICATIONS AND SIGNATURE. THIS CONTRACT MUST BE SIGNED BY AN AUTHORIZED REPRESENTATIVE OF CONTRACTOR

The undersigned certifies under penalty of perjury both individually and on behalf of Contractor is a duly authorized representative of Contractor, has been authorized by Contractor to make all representations, attestations, and certifications contained in this Contract and to execute this Contract on behalf of Contractor.

MARION COUNTY SIGNATURES
BOARD OF COMMISSIONERS:

_____

Chair Date

_____

Commissioner Date

_____

Commissioner Date

Authorized Signature: Troy Gregg (Sep 10, 2026 20:55:11 PDT) 09/10/2026

Department Director or designee Date

Authorized Signature: Jan Fritz Jan Fritz (Sep 15, 2026 18:25:05 PDT) 09/15/2026

Chief Administrative Officer Date

Reviewed by Signature: Jennifer Rogers Jennifer Rogers (Sep 15, 2026 09:34:17 PDT) 09/15/2026

Marion County Legal Counsel Date

Reviewed by Signature: Sandra L. Fisher 09/10/2026

Marion County Contracts & Procurement Date

LOCUMTENENS.COM, LLC SIGNATURE

Authorized Signature: _____

Date

Title: _____

EXHIBIT A
STATEMENT OF WORK

1. STATEMENT OF SERVICES

Contractor shall perform Services as described below.

A. GENERAL INFORMATION.

Upon County's request, Contractor shall provide qualified temporary psychiatrists, nurse practitioners, and other non-medical personnel candidates for the County's selection. The selected individuals shall fulfill temporary positions from medical staff for Marion County Health & Human Services in the Behavioral Health Programs.

B. REQUIRED SERVICES, DELIVERABLES AND DELIVERY SCHEDULE.

i. **Temporary psychiatrists and/or nurse practitioners** shall provide skilled medical assessments and supervision of individuals who use therapeutic medications as part of a treatment plan.

ii. Review and approve the assessment and services and supports identified in the treatment plan for each individual receiving mental health services.

iii. Assess the physical, emotional, and development status of individuals and their families.

iv. Provide positive intervention to maintain, restore or improve health of the individual or their family, using principles of trauma-informed care and recovery.

v. Evaluate the results of treatment intervention based on feedback elicited from the consumer and/or family members, treatment team members, behavioral observations, or other providers.

vi. Contribute to revisions of patient/client treatment plan on the basis of patient/client responses and/or new information regarding appropriate management of specific psychiatric issues.

vii. Prescribe and dispense medication according to all rules governed by licensure Drug Enforcement Administration (DEA) and/or as supported by professional guidelines, professional publication or as meets the standard of care in the community.

viii. Provide consultation and education to staff and other service providers, including primary care, in the areas of medication management and mental health intervention: provide general health education to consumers, staff and the community,

ix. Coordinate with other health care team members to monitor individual(s) and adjust treatment plan as needed.

x. Collaborate with nurses and physician in the development and continual re-evaluation of standing orders, including appropriate medications.

xi. Provide documentation that meets Medicare, Medicaid, and other contracted insurance requirements in paper or electronic health record according to County policies and procedures.

xii. Prepare and file as necessary all paperwork, service notes and other required documentation within five (5) business days of the service provision.

xiii. County and Locum Tenens, LLC shall agree to providers work schedule. Provider shall contact LocumTenens.com and County with requested schedule changes no later than thirty (30) days before the change takes effect. Outside of illness or unexpected emergency, time off will be scheduled 30 days in advance.

xiv. Non-Medical providers, Qualified Mental Health Practitioners, shall provide Mental Health Assessments (MHA) and annual MHA reviews of individuals seeking behavioral health services.

xv. Develop a multidisciplinary treatment plan, based on the needs of the individual.

xvi. xvi. Collaborate with staff and other service providers, including primary care, in the areas of medication management and mental health intervention:

xvii. Contribute to revisions of client treatment plan on the basis of client responses and/or new information regarding appropriate management of specific psychiatric issues.

xviii. Evaluate the results of treatment intervention based on feedback elicited from the consumer and/or family members, treatment team members, behavioral observations, or other providers.

xix. Evaluate the results of treatment intervention based on feedback elicited from the consumer and/or family members, treatment team members, behavioral observations, or other providers.

C. Non-Solicitation; Conversion Fees

For a period of 18 months following the date on which any psychiatrists, nurse practitioners, and other non-medical personnel candidates: (i) interviewed with Authorized Purchaser for purposes of Authorized Purchaser qualifying a candidate or applicant for a role or position or (ii) last worked a shift under this Agreement, or a subsequent Assignment through this Agreement, Authorized Purchaser agrees that it will take no steps to solicit, recruit, hire, or employ as its own employees, or as a contractor, those psychiatrists, nurse practitioners, and other non-medical personnel candidates provided or introduced by Contractor during the term of this Agreement. Authorized Purchaser understands and agrees that Contractor is not an employment agency and that psychiatrists, nurse practitioners, and other non-medical personnel candidates are assigned to the Authorized Purchaser to render temporary service(s) and are not assigned to become employed by the Authorized Purchaser.

Authorized Purchaser further acknowledges and agrees that there is a substantial investment in business related costs incurred by Contractor in sourcing psychiatrists, nurse practitioners, and other non-medical personnel candidates. In the event that Authorized Purchaser, or any Authorized Purchaser affiliate, subsidiary, department, division, Work Site, or any other agent of Authorized Purchaser or agent acting on behalf of Authorized Purchaser solicits, hires, or employ any psychiatrists, nurse practitioners, and other non-medical personnel candidates, Authorized Purchaser will be in material breach of this Agreement.

Notwithstanding the foregoing, Authorized Purchaser may hire or contract with any psychiatrists, nurse practitioners, and other non-medical personnel candidates sourced by Contractor once each psychiatrist, nurse practitioners, and other non-medical personnel candidates has completed a minimum number of hours of work for Authorized Purchaser through Contractor, according to the Conversion Table below:

Aggregate Hours Worked by Locum Tenens, LLC Personnel for Authorized Purchaser in an 18-Month Period	**Conversion Fee**
Prior to completing 500 hours	25% of annualized starting salary
Between completion of 500 and 1000 hours	20% of annualized starting salary
Between completion of 1000 and 2000 hours	15% of annualized starting salary
After completion of 2000 hours	10% of annualized starting salary

D. SPECIAL REQUIREMENTS. Contractor shall be solely responsible for and shall have control over the means, methods, techniques, sequences, and procedures of providing temporary staffing, subject to the plans and specifications under this Contract and shall be solely responsible for the errors and omissions of its employees, subcontractors, and agents.

Contractor has the skill and knowledge possessed by well-informed members of its industry, trade or profession and Contractor will apply that skill and knowledge with care and diligence and perform Services in a timely, professional, and workmanlike manner in accordance with standards applicable to Contractor's industry, trade or profession.

2. COMPENSATION

The total amount available for payment to Contractor under Exhibit A, section 2.A and for authorized reimbursement to Contractor under Exhibit A, section 2.C is **$2,500,000.00**.

A. METHOD OF PAYMENT FOR SERVICES: County shall pay Contractor $2,500,000.00 for completing all Services and delivering all Goods required under this Contract.

B. BASIS OF PAYMENT FOR SERVICES. County shall pay Contractor monthly progress payments upon County's approval of Contractor's invoice submitted to County for completed Services and delivered Goods, but only after County has determined that Contractor has completed, and County has accepted the completed Services and County has accepted the completed Services.

C. EXPENSE REIMBURSEMENT. County will reimburse Contractor for the following expenses incurred only when the expenses are essential to the discharge of, and within the course and scope of, Contractor's obligations under this Contract, and have been pre-approved by the County during the County's interview/selection process of the selected temporary personnel on a case-by-case basis. Contractor shall include as separate line items on Contractor's invoice approved expense reimbursement for each temporary personnel by name and shall submit supporting documentation of each invoiced expense.

D. GENERAL PAYMENT PROVISIONS. Notwithstanding any other payment provision of this Contract, failure of Contractor to submit required reports when due, or failure to perform or document the performance of contracted services, may result in withholding of payments under this Contract. Such withholding of payment for cause shall begin thirty (30) days after written notice is given by County to Contractor, and shall continue until Contractor submits required reports, performs required services or establishes, to County's satisfaction, that such failure arose out of causes beyond the control, and without the fault or negligence of Contractor.

E. INVOICES. Contractor shall send all invoices to County's Contract Administrator at the address specified below or to any other address as County may indicate in writing to Contractor.

Marion County
Attn: Health and Human Services, HealthAP@co.marion.or.us
3160 Center St NE
Salem, OR 97301

Contract Review Sheet

Purchase Order **IT-7351-26**

Title: **Request Approval of CPO# 951209 for purchase of Data Center Equipment**

Contractor's Name: **CVE Technologies Group Inc**

Department: **Information Technology Department** Contact: **Kalynn Smith**

Analyst: **Sandra Fixsen** Phone #: **503-584-7796**

Term - Date From: **upon all signatures** Expires: **June 30, 2027**

Original Contract Amount: **$ 808,567.76** Previous Amendments Amount: **$ -**

Current Amendment: **$ -** New Contract Total: **$ 808,567.76** Amd% **0%**

☐ Outgoing Funds ☐ Federal Funds ☐ Reinstatement ☐ Retroactive ☐ Amendment greater than 25%

Source Selection Method: **10-0400 Cooperative** Cooperative# **NASPO 1605**

Description of Services or Grant Award

Marion County's primary data center in Public Works Building 1 lacks redundant power and cooling, creating significant risks for mission-critical operations. This project will relocate the County's core IT infrastructure to the State of Oregon's Tier 3 data center, which provides fully redundant power, cooling, and connectivity. Moving to this facility will ensure 99.99% uptime for County systems, strengthen disaster recovery capabilities, and enhance physical security. The project also establishes a secondary Internet connection to improve network resilience. This redundancy supports critical systems including ERP and other SaaS applications—addressing a gap identified by Plante Moran during the County's initial IT assessment. Relocating to a Tier 3 environment provides enterprise-grade reliability without the cost of constructing a new County-owned data center.

Approval of CPO# 951209 will authorize the purchase of required hardware; Firewall Devices, Edge Switches, and Network Switches required to complete this migration.

Desired BOC Session Date:	**10/14/2026**	Contract should be in DocuSign by:	**9/23/2026**
Agenda Planning Date	**10/1/2026**	Printed packets due in Finance:	**9/29/2026**
Management Update	**9/29/2026**	BOC upload / Board Session email:	**9/30/2026**

BOC Session Presenter(s) **Steve Brooks & Gary Christofferson** Code: **Y**

REQUIRED APPROVALS

	09/28/2026	Kalynn Smith	09/28/2026
Finance - Contracts	Date	Contract Specialist	Date
	09/29/2026	Jan Fritz Jan Fritz (Sep 29, 2026 17:26:22 PDT)	09/29/2026
Legal Counsel	Date	Chief Administrative Officer	Date

MARION COUNTY BOARD OF COMMISSIONERS

Board Session Agenda Review Form

Meeting date: 10/7/2026

Department: Public Works

Title: 2026 Resurfacing Program - North Santiam Paving, Contract Amendment 1

Management Update/Work Session Date: 9/8/26 **Audio/Visual aids** ☐

Time Required: 5 min **Contact:** Jill Ogden **Phone:** 3152

Requested Action:

Approve Amendment No. 1 to Contract No. PW-7092-26 with North Santiam Paving Co. for Asphalt Concrete Resurfacing of Various County Roads, increasing the contract amount by $334,208.15, from $3,685,517.40 to $4,019,725.55.

Issue, Description & Background:

Contract No. PW-7092-26 with North Santiam Paving Co. for Asphalt Concrete Resurfacing of Various County Roads in the amount of $3,685,517.40 was approved by the Board on May 6, 2026.

This amendment to the contract includes construction change orders one through six adding $334,208.15 to the existing contract for a new contract total of $4,019,725.55 (9.07% over the original contract amount).

Financial Impacts:

This is a budgeted expense in the current fiscal year in the 130 Roads Fund.

Impacts to Department & External Agencies:

None

List of attachments: Amendment 1, PW-7092-26

Presenter: Ryan Crowther

Department Head Signature: BNicholas

Digitally signed by BNicholas
Date: 2026.09.04 15:08:34 -07'00'

Contract Review Sheet

Public Improvement Agreements **PW-7092-26 - Am1**

Title: **Asphalt Concrete Resurfacing of Various Marion County Roads**

Contractor's Name: **North Santiam Paving Co.**

Department: **Public Works Department** Contact: **Traci Clarke**

Analyst: **Kathleen George** Phone #: **503-365-3100**

Term - Date From: **Execution** Expires: **September 4, 2027**

Original Contract Amount: **$ 3,685,517.40** Previous Amendments Amount: **$ -**

Current Amendment: **$ 334,208.15** New Contract Total: **$ 4,019,725.55** Amd% **9%**

Outgoing Funds ☐ Federal Funds ☐ Reinstatement ☐ Retroactive ☐ Amendment greater than 25%

Source Selection Method: **40-0200 Invitation to Bid - Public Improvement** ITB# **PW1778-26**

Description of Services or Grant Award

Construction of asphalt concrete resurfacing of various Marion County roads
Amendment 1 - increases contract by $334,208.15 from 3,85,517.00 to $4,019,725.55 to incorporate change orders 1, 2, 3, 4, 5 and 6:
CCO #1 - ($10,554.77) - Scope changes either increasing or decreasing original design intent.
CCO #2 - $194,925.73 - June Asphalt Escalation
CCO #3 - $65,764.55 - Quantity Overruns
CCO #4 - $34,688.70 - July Asphalt Escalation
CCO #5 - $15,154.44 - Additional July Asphalt Escalation
CCO #6- $34,229.50 - Guardrail Utility Conflict

Desired BOC Session Date: **10/7/2026** Contract should be in DocuSign by: **9/16/2026**

Agenda Planning Date **9/24/2026** Printed packets due in Finance: **9/22/2026**

Management Update **9/22/2026** BOC upload / Board Session email: **9/23/2026**

BOC Session Presenter(s) **Ryan Crowther** Code: **Y**

REQUIRED APPROVALS

	09/18/2026	Traci Clarke	09/18/2026
Finance - Contracts	Date	Contract Specialist	Date
	09/18/2026	Jan Fritz Jan Fritz (Sep 18, 2026 16:34:58 PDT)	09/18/2026
Legal Counsel	Date	Chief Administrative Officer	Date

AMENDMENT 1 to PW-7092-26
the CONTRACT FOR CONSTRUCTION
between
MARION COUNTY and NORTH SANTIAM PAVING CO.

This is Amendment 1 to the Contract for Services (as amended from time to time, the "Contract"), dated May 11, 2026 between Marion County, a political subdivision of the State of Oregon, hereinafter called County, and North Santiam Paving Co., hereafter called Contractor.

The Contract is hereby amended as follows (new language is indicated by underlining and deleted language is indicated by ~~strikethrough~~): Change order 2026-101-CC01, change order 2026-101-CC02, change order 2026-101-CC03, change order 2026-101-CC04, change order 2026-101-CC05 and change order 2026-101-CC06 attached to this Amendment, are hereby incorporated.

Page 1, Paragraph 2, 1st sentence: "Contractor, in consideration of the sum of ~~$3,685,517.40~~ $4,019,725.55 to be paid to the Contractor by the County…"

Except as expressly amended above, all other terms and conditions of the original Contract and any previously executed amendments are still in full force and effect. Contractor certifies that the representations, warranties and certifications contained in the original Contract are true and correct as of the effective date of this Amendment and with the same effect as though made at the time of this Amendment.

MARION COUNTY SIGNATURES
BOARD OF COMMISSIONERS:

_____
Chair Date

_____
Commissioner Date

_____
Commissioner Date

Authorized Signature: Brian Nicholas 09/18/2026
Brian Nicholas (Sep 18, 2026 19:15:02 EDT)
Department Director or designee Date

Authorized Signature: Jan Fritz 09/18/2026
Jan Fritz (Sep 18, 2026 16:34:58 PDT)
Chief Administrative Officer Date

Reviewed by Signature: 09/18/2026
Marion County Legal Counsel Date

Reviewed by Signature: 09/18/2026
Marion County Contracts & Procurement Date

NORTH SANTIAM PAVING CO. SIGNATURE

Authorized Signature: _____
Date

Title: _____

CHANGE ORDER
MARION COUNTY DEPARTMENT OF PUBLIC WORKS

CAPITAL PROJECTS 5155 Silverton Road NE, Salem, OR 97305

Applies to modifications and changes in nature of work, claims for additional compensation, or price reductions

CONTRACT NAME: RESURFACING 2026

CONTRACT NO: 2026-101

CHANGE ORDER NO: 1
PW-7092-26

CONTRACTOR NAME: North Santiam Paving Co.
ADDRESS:
41203 Kingston-Lyons Drive Southeast
Stayton OR 97383
U.S.A.
BILLING ADDRESS:
PO Box 516
Stayton OR 97383

Reason for Change Order: Quantity and Price Adjustments

The purpose of this change order is to:
1. Of the 47 anticipated mailbox supports, only 4 customers wanted this work done resulting in reducing the quantity and adjusting the unit cost for small quantity.
2. Quantity adjustments for over-runs to date to increase spending authority.

Contract Document Revisions (Plans/Specs):

1. Mailbox item quantity and price adjustments

On Project 1 Howell Prairie Rd SE remove items:

1070-0101 Multiple Mailboxes supports 2 EA and

1070-0102 Mailbox Concrete Collars 2 EA and

1070-0650 Mailbox, Locking, With Numbers 3 EA and

Replace item 1070-0100 Single Mailbox Supports 21 EA @ $500 with 1070-0100 Single Mailbox Supports 1 EA @ $864, as agreed.

On Project 2 State St SE remove items:

1070-0101 Multiple Mailboxes supports 1 EA and

1070-0102 Mailbox Concrete Collars 1 EA and

1070-0650 Mailbox, Locking, With Numbers 1 EA and

Replace item 1070-0100 Single Mailbox Supports 20 EA @ $500 with 1070-0100 Single Mailbox Supports 1 ea @ $864, as agreed.

On Project 3 Deschutes Rd / 93rd Ave / Emundson Dr / Waldo Hills Dr remove items:

1070-0600 Mailbox With Numbers 1 EA and

1070-0650 Mailbox, Locking, With Numbers 1 EA and

Replace item 1070-0100 Single Mailbox Supports 6 EA @ $500 with 1070-0100 Single Mailbox Supports 2 ea @ $864, as agreed.

CHANGE ORDER
MARION COUNTY DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECTS 5155 Silverton Road NE, Salem, OR 97305

Applies to modifications and changes in nature of work, claims for additional compensation, or price reductions

2. Quantity overruns

On Project 2 State St SE add the following quantities:

0490-0100 Adjusting Boxes add 6 EA for a new total of 19.

0490-0102 Adjusting Catch Basins add 3 EA for a new total of 5.

0620-0120 Cold Plane Pavement Removal, 2 inches deep add 449.5 SY for a new total of 1,561.5.

0744-0255 Level 2, 1/2" Dense, PG 64-22, ACP add 108086 TN for a new total of 7,608.86.

0749-0100 Extra for Asphalt Approaches add 3 EA for a new total of 6.

Project Number	Pay Item #	Item Description	Est Quan.	Unit	Agreed Price/Unit	Amount	Reason Code
2026-101-2	0490-0100	ADJUSTING BOXES	6	EACH	$200.00	$1,200.00	25
2026-101-2	0490-0102	ADJUSTING CATCH BASINS	3	EACH	$600.00	$1,800.00	25
2026-101-2	0620-0120	COLD PLANE PAVEMENT REMOVAL, 2 INCHES DEEP	449.5	SQYD	$3.65	$1,640.68	25
2026-101-2	0744-0255	LEVEL 2, 1/2" DENSE, PG 64-22, ACP	108.86	TN (Ton)	$77.15	$8,398.55	25
2026-101-2	0749-0100	EXTRA FOR ASPHALT APPROACHES	3	EACH	$600.00	$1,800.00	25
2026-101-1	1070-0100	SINGLE MAILBOX SUPPORTS	1	EA (Each)	$864.00	$864.00	25
2026-101-2	1070-0100	SINGLE MAILBOX SUPPORTS	1	EA (Each)	$864.00	$864.00	25
2026-101-3	1070-0100	SINGLE MAILBOX SUPPORTS	2	EA (Each)	$864.00	$1,728.00	25
2026-101-1	1070-0100	SINGLE MAILBOX SUPPORTS	-21	EACH	$500.00	($10,500.00)	25
2026-101-2	1070-0100	SINGLE MAILBOX SUPPORTS	-20	EACH	$500.00	($10,000.00)	25

CHANGE ORDER
MARION COUNTY DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECTS 5155 Silverton Road NE, Salem, OR 97305

Applies to modifications and changes in nature of work, claims for additional compensation, or price reductions

2026-101-3	1070-0100	SINGLE MAILBOX SUPPORTS	-6	EACH	$500.00	($3,000.00)	25
2026-101-2	1070-0101	MULTIPLE MAILBOX SUPPORTS	-1	EACH	$1,000.00	($1,000.00)	25
2026-101-1	1070-0101	MULTIPLE MAILBOX SUPPORTS	-2	EACH	$1,000.00	($2,000.00)	25
2026-101-1	1070-0102	MAILBOX CONCRETE COLLARS	-2	EACH	$400.00	($800.00)	25
2026-101-2	1070-0102	MAILBOX CONCRETE COLLARS	-1	EACH	$400.00	($400.00)	25
2026-101-3	1070-0600	MAILBOX WITH NUMBERS	-1	EA (Each)	$150.00	($150.00)	25
2026-101-2	1070-0650	MAILBOX, LOCKING, WITH NUMBERS	-1	EA (Each)	$200.00	($200.00)	25
2026-101-1	1070-0650	MAILBOX, LOCKING, WITH NUMBERS	-3	EA (Each)	$200.00	($600.00)	25
2026-101-3	1070-0650	MAILBOX, LOCKING, WITH NUMBERS	-1	EA (Each)	$200.00	($200.00)	25

CHANGE ORDER
MARION COUNTY DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECTS 5155 Silverton Road NE, Salem, OR 97305

Applies to modifications and changes in nature of work, claims for additional compensation, or price reductions

Estimated Net Cost Effect of the Agreement on the Contract: ($10,554.77)

Reason Codes

25	Scope changes either increasing or decreasing original design intent.

Specifications and provisions - The work to be done under this agreement is to be performed, measured, and paid for in accordance with the terms for the above contract except as modified as follows:

This shall be payment in full for all labor, equipment and material used to complete the work as specified. No time is added as a result of these changes.

Please indicate your agreement by signing, dating and returning the original to the construction manager. Work shall not begin until you are notified that this agreement has either been approved or that work may commence under advance approval. Your signature further indicates that payments in accordance with this agreement constitute full and complete compensation for all costs, both direct and indirect, arising out of the described alterations, extra work or claims for additionall compensation covered by this agreement, and releases and discharges the county from all such costs except as provided herein.

See Attached

Date: 07/07/2026

Contractor Signature

After contractor has signed the price agreement, the construction manager submits the original to the Director of Public Works. Upon approval by the Director Public Works, the contract is sent a copy of the approved price agreement.

For Office Use Only

Brandon Stoyles

Marion County Project Manager
Date: 07/07/2026

Max Hepburn

Marion County Capital Projects Manager
Date: 07/08/2026

Lani Radtke

Date: 07/09/2026

CHANGE ORDER
MARION COUNTY DEPARTMENT OF PUBLIC WORKS

CAPITAL PROJECTS 5155 Silverton Road NE, Salem, OR 97305

Applies to modifications and changes in nature of work, claims for additional compensation, or price reductions

CONTRACT NAME: RESURFACING 2026

CONTRACT NO: 2026-101

CHANGE ORDER NO: 2
PW-7092-26

CONTRACTOR NAME: North Santiam Paving Co.
ADDRESS:
41203 Kingston-Lyons Drive Southeast
Stayton OR 97383

BILLING ADDRESS:
PO Box 516
Stayton OR 97383

Reason for Change Order: June Asphalt Escalation

Escalation due for 30,333.2 Tons laid in June.

Contract Document Revisions (Plans/Specs):

Project Number	Pay Item #	Item Description	Est Quan.	Unit	Agreed Price/Unit	Amount	Reason Code
2026-101-1	0001-0801	ACP MATERIAL PRICE ADJUSTMENT	140766.16	AA (As Authorized)	$1.00	$140,766.16	24
2026-101-2	0001-0801	ACP MATERIAL PRICE ADJUSTMENT	54159.57	AA (As Authorized)	$1.00	$54,159.57	24

Estimated Net Cost Effect of the Agreement on the Contract: $194,925.73

Reason Codes

24	New requirements became available after the Contract was awarded

Specifications and provisions - The work to be done under this agreement is to be performed, measured, and paid for in accordance with the terms for the above contract except as modified as follows:

This shall be payment in full for all labor, equipment and material used to complete the work as specified.

CHANGE ORDER
MARION COUNTY DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECTS 5155 Silverton Road NE, Salem, OR 97305

Applies to modifications and changes in nature of work, claims for additional compensation, or price reductions

Please indicate your agreement by signing, dating and returning the original to the construction manager. Work shall not begin until you are notified that this agreement has either been approved or that work may commence under advance approval. Your signature further indicates that payments in accordance with this agreement constitute full and complete compensation for all costs, both direct and indirect, arising out of the described alterations, extra work or claims for additionall compensation covered by this agreement, and releases and discharges the county from all such costs except as provided herein.

Unilateral

Date: 07/08/2026

Contractor Signature

After contractor has signed the price agreement, the construction manager submits the original to the Director of Public Works. Upon approval by the Director Public Works, the contract is sent a copy of the approved price agreement.

For Office Use Only

Brandon Stoyles

Marion County Project Manager
Date: 07/08/2026

Max Hepburn

Marion County Program Manager
Date: 07/08/2026

Lani Radtke

Date: 07/09/2026

Marion County Engineer

CHANGE ORDER
MARION COUNTY DEPARTMENT OF PUBLIC WORKS

CAPITAL PROJECTS 5155 Silverton Road NE, Salem, OR 97305

Applies to modifications and changes in nature of work, claims for additional compensation, or price reductions

CONTRACT NAME: RESURFACING 2026

CONTRACT NO: 2026-101

CHANGE ORDER NO: 3
PW-7092-26

CONTRACTOR NAME: North Santiam Paving Co.
ADDRESS:
41203 Kingston-Lyons Drive Southeast
Stayton OR 97383

BILLING ADDRESS:
PO Box 516
Stayton OR 97383

Reason for Change Order: Quantity Overruns

The reason for this change order is to account for quantity overruns.
Asphalt and aggregate overruns were due to fluctuations in slope, rutting, and wear.
Cold plane overrun was due to an estimating error.

Contract Document Revisions (Plans/Specs):

On Project 1 Howell Prairie Rd SE add the following quantities:

0620-0110 Cold Plane Pavement Removal, Butt Joints add 1,746.1 SY for a new total of 3,996.1 SY.

0641-0130 Aggregate Shoulders add 930.44 Tn for a new total of 8430.44 TN.

0749-0100 Extra for Asphalt Approaches add 8 EA for a new total of 17 EA.

On Project 3 Deschutes Rd / 93rd Av / Edmundson Dr / Waldo Hills Dr add the following quantities:

0641-0130 Aggregate Shoulders add 372.54 Tn for a new total of 3103.54 TN.

0744-0205 Level 2, 3/8" Dense, PG 64-22, ACP add 64.95 TN for a new total of 4,964.95 TN.

Project Number	Pay Item #	Item Description	Est Quan.	Unit	Agreed Price/Unit	Amount	Reason Code
2026-101-1	0620-0110	COLD PLANE PAVEMENT REMOVAL, BUTT JOINTS	1746.1	SY (Square Yard)	$6.50	$11,349.65	23
2026-101-1	0641-0130	AGGREGATE SHOULDERS	930.44	TON	$32.00	$29,774.08	21
2026-101-3	0641-0130	AGGREGATE SHOULDERS	372.54	TON	$31.00	$11,548.74	21
2026-101-3	0744-0205	LEVEL 2, 3/8" DENSE, PG 64-22, ACP	64.95	TN (Ton)	$78.40	$5,092.08	21

CHANGE ORDER
MARION COUNTY DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECTS 5155 Silverton Road NE, Salem, OR 97305

Applies to modifications and changes in nature of work, claims for additional compensation, or price reductions

2026-101-1	0749-0100	EXTRA FOR ASPHALT APPROACHES	8	EACH	$1,000.00	$8,000.00	21

Estimated Net Cost Effect of the Agreement on the Contract: $65,764.55

Reason Codes

21	Changes performed to meet or improve original quality and intent of project.
23	Error in Plans, Specifications, and Design

Specifications and provisions - The work to be done under this agreement is to be performed, measured, and paid for in accordance with the terms for the above contract except as modified as follows:

This shall be payment in full for all labor, equipment and material used to complete the work as specified.

Please indicate your agreement by signing, dating and returning the original to the construction manager. Work shall not begin until you are notified that this agreement has either been approved or that work may commence under advance approval. Your signature further indicates that payments in accordance with this agreement constitute full and complete compensation for all costs, both direct and indirect, arising out of the described alterations, extra work or claims for additionall compensation covered by this agreement, and releases and discharges the county from all such costs except as provided herein.

Unilateral

Date: 07/29/26

Contractor Signature

After contractor has signed the price agreement, the construction manager submits the original to the Director of Public Works. Upon approval by the Director Public Works, the contract is sent a copy of the approved price agreement.

For Office Use Only

Brandon Stoyles

Marion County Project Manager
Date: 07/30/26

Ryan Crowther

Marion County Capital Projects Manager
Date: 07/30/26

Lani Radtke

Date: 07/30/26

Marion County Engineer

CHANGE ORDER
MARION COUNTY DEPARTMENT OF PUBLIC WORKS

CAPITAL PROJECTS 5155 Silverton Road NE, Salem, OR 97305

Applies to modifications and changes in nature of work, claims for additional compensation, or price reductions

CONTRACT NAME: RESURFACING 2026
CONTRACT NO: 2026-101

CHANGE ORDER NO: 4
PW-7092-26

CONTRACTOR NAME: North Santiam Paving Co.
ADDRESS:
41203 Kingston-Lyons Drive Southeast

Stayton OR 97383
U.S.A.
BILLING ADDRESS:
PO Box 516
Stayton OR 97383

Reason for Change Order: July Asphalt Escalation

Escalation due for 5,315.43 Tons laid in July.

Contract Document Revisions (Plans/Specs):

Project Number	Pay Item #	Item Description	Est Quan.	Unit	Agreed Price/Unit	Amount	Reason Code
2026-101-1	0001-0801	ACP MATERIAL PRICE ADJUSTMENT	1	AA (As Authorized)	$2,252.18	$2,252.18	24
2026-101-3	0001-0801	ACP MATERIAL PRICE ADJUSTMENT	1	AA (As Authorized)	$32,436.52	$32,436.52	24

Estimated Net Cost Effect of the Agreement on the Contract: $34,688.70

Reason Codes

24	New requirements became available after the Contract was awarded

Specifications and provisions - The work to be done under this agreement is to be performed, measured, and paid for in accordance with the terms for the above contract except as modified as follows:

This shall be payment in full for all labor, equipment and material used to complete the work as specified.

CHANGE ORDER
MARION COUNTY DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECTS 5155 Silverton Road NE, Salem, OR 97305

Applies to modifications and changes in nature of work, claims for additional compensation, or price reductions

Please indicate your agreement by signing, dating and returning the original to the construction manager. Work shall not begin until you are notified that this agreement has either been approved or that work may commence under advance approval. Your signature further indicates that payments in accordance with this agreement constitute full and complete compensation for all costs, both direct and indirect, arising out of the described alterations, extra work or claims for additionall compensation covered by this agreement, and releases and discharges the county from all such costs except as provided herein.

Unilateral

Date: 08/04/2026

Contractor Signature

After contractor has signed the price agreement, the construction manager submits the original to the Director of Public Works. Upon approval by the Director Public Works, the contract is sent a copy of the approved price agreement.

For Office Use Only

Brandon Stoyles

Marion County Project Manager
Date: 08/04/2026

Ryan Crowther

Marion County Capital Projects Manager
Date: 08/04/2026

Lani Radtke

Date: 08/04/2026

Marion County Engineer

CHANGE ORDER
MARION COUNTY DEPARTMENT OF PUBLIC WORKS

CAPITAL PROJECTS 5155 Silverton Road NE, Salem, OR 97305

Applies to modifications and changes in nature of work, claims for additional compensation, or price reductions

CONTRACT NAME: RESURFACING 2026

CONTRACT NO: 2026-101

CHANGE ORDER NO: 5
PW-7092-26

CONTRACTOR NAME: North Santiam Paving Co.
ADDRESS:
41203 Kingston-Lyons Drive Southeast
Stayton OR 97383
U.S.A.
BILLING ADDRESS:
PO Box 516
Stayton OR 97383

Reason for Change Order: Additional July Asphalt Escalation

Escalation due to 2,319.64 Tons laid in July for project #3.

Contract Document Revisions (Plans/Specs):

Project Number	Pay Item #	Item Description	Est Quan.	Unit	Agreed Price/Unit	Amount	Reason Code
2026-101-3	0001-0801	ACP MATERIAL PRICE ADJUSTMENT	1	AA (As Authorized)	$15,154.44	$15,154.44	24

Estimated Net Cost Effect of the Agreement on the Contract: $15,154.44

Reason Codes

24	New requirements became available after the Contract was awarded

Specifications and provisions - The work to be done under this agreement is to be performed, measured, and paid for in accordance with the terms for the above contract except as modified as follows:

This shall be payment in full for all labor, equipment and material used to complete the work as specified.

CHANGE ORDER
MARION COUNTY DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECTS 5155 Silverton Road NE, Salem, OR 97305

Applies to modifications and changes in nature of work, claims for additional compensation, or price reductions

Please indicate your agreement by signing, dating and returning the original to the construction manager. Work shall not begin until you are notified that this agreement has either been approved or that work may commence under advance approval. Your signature further indicates that payments in accordance with this agreement constitute full and complete compensation for all costs, both direct and indirect, arising out of the described alterations, extra work or claims for additionall compensation covered by this agreement, and releases and discharges the county from all such costs except as provided herein.

Unilateral

Date: 08/20/2026

Contractor Signature

After contractor has signed the price agreement, the construction manager submits the original to the Director of Public Works. Upon approval by the Director Public Works, the contract is sent a copy of the approved price agreement.

For Office Use Only

Brandon Stoyles

Marion County Project Manager
Date: 08/20/2026

Max Hepburn

Marion County Capital Projects Manager
Date: 08/20/2026

Lani Radtke

Date: 08/24/2026

Marion County Engineer

CHANGE ORDER
MARION COUNTY DEPARTMENT OF PUBLIC WORKS

CAPITAL PROJECTS 5155 Silverton Road NE, Salem, OR 97305

Applies to modifications and changes in nature of work, claims for additional compensation, or price reductions

CONTRACT NAME: RESURFACING 2026

CONTRACT NO: 2026-101

CHANGE ORDER NO: 6
PW-7092-26

CONTRACTOR NAME: North Santiam Paving Co.
ADDRESS:
41203 Kingston-Lyons Drive Southeast
Stayton OR 97383

BILLING ADDRESS:
PO Box 516
Stayton OR 97383

Reason for Change Order: Guardrail Utility Conflict

The purpose of this change order is to add the bid item "Extra For Hand Dug Holes" due to utility conflicts at the agreed upon price of $402.70 per hole, not to exceed 85 holes, and to extend contract time.

1. Project 1 (Howell Prairie) add item: 0810-0145000E (EACH) EXTRA FOR HAND DUG GUARDRAIL POST HOLES

2. Project 2 (State St) add item: 0810-0145000E (EACH) EXTRA FOR HAND DUG GUARDRAIL POST HOLES

Contract Document Revisions (Plans/Specs):

In the introduction under 1.5 Time for Completion of Work and 00180.50(h):

Replace the first bullet with "The Contractor shall complete all work to be done under the Contract for project #2 (State St) not later than September 25th, 2026"

Replace the second bullet with "The Contractor shall complete all work to be done under the Contract for all remaining projects not later than September 4th, 2026, except for all guardrail work on Project 1 (Howell Prairie), must be completed by September 25th, 2026".

Project Number	Pay Item #	Item Description	Est Quan.	Unit	Agreed Price/Unit	Amount	Reason Code
2026-101-1	0180-0050	CONTRACT TIME CHANGE	1	LS (Lump Sum)	$0.00	$0.00	32
2026-101-2	0180-0050	CONTRACT TIME CHANGE	1	LS (Lump Sum)	$0.00	$0.00	32
2026-101-1	0810-0145	EXTRA FOR HAND DUG GUARDRAIL POST HOLES	70	EACH	$402.70	$28,189.00	26
2026-101-2	0810-0145	EXTRA FOR HAND DUG GUARDRAIL POST HOLES	15	EACH	$402.70	$6,040.50	26

CHANGE ORDER
MARION COUNTY DEPARTMENT OF PUBLIC WORKS
CAPITAL PROJECTS 5155 Silverton Road NE, Salem, OR 97305

Applies to modifications and changes in nature of work, claims for additional compensation, or price reductions

Estimated Net Cost Effect of the Agreement on the Contract: $34,229.50

Reason Codes

26	Changed conditions
32	Delays or conflicts caused by utilities.

Specifications and provisions - The work to be done under this agreement is to be performed, measured, and paid for in accordance with the terms for the above contract except as modified as follows:

This shall be payment in full for all labor, equipment and material used to complete the work as specified.

Please indicate your agreement by signing, dating and returning the original to the construction manager. Work shall not begin until you are notified that this agreement has either been approved or that work may commence under advance approval. Your signature further indicates that payments in accordance with this agreement constitute full and complete compensation for all costs, both direct and indirect, arising out of the described alterations, extra work or claims for additionall compensation covered by this agreement, and releases and discharges the county from all such costs except as provided herein.

See Attached

Date: 08/25/2026

Contractor Signature

After contractor has signed the price agreement, the construction manager submits the original to the Director of Public Works. Upon approval by the Director Public Works, the contract is sent a copy of the approved price agreement.

For Office Use Only

Brandon Stoyles

Marion County Project Manager
Date: 08/25/2026

Ryan Crowther

Marion County Capital Projects Manager
Date: 08/25/2026

Lani Radtke

Date: 08/25/2026

Marion County Engineer

MARION COUNTY BOARD OF COMMISSIONERS

Board Session Agenda Review Form

Meeting date: 10/7/2026

Department: Public Works

Title: Connecticut Ave: Macleay Rd to Rickey St, Amendment 3 to Project Agreement No. 34018

Management Update/Work Session Date: 9/1/2026 **Audio/Visual aids** ☐

Time Required: 10 Min **Contact:** Jill Ogden **Phone:** 3152

Requested Action:

Approve and sign Amendment #3 to Supplemental Project Agreement #34018 between ODOT and Marion County for the Connecticut Avenue: Macleay Road to Rickey Street Improvement Project, increasing project funding by $606,717.

Issue, Description & Background:

This project will improve Connecticut Avenue from Macleay Road SE to Rickey Street SE. The roadway improvements include widening the pavement to the west, adding additional length to bicycle lanes, and constructing sidewalks along the west side of Connecticut Avenue.

Amendment No. 3 to Supplemental Project Agreement No. 34018 increases the total project funding from $1,279,700 to $1,886,417. The additional $606,717 will go to fund the construction phase of the project and is comprised $544,407.16 (89.73%) and $62,309.84 (10.27%) County Road Fund matching funds.

Financial Impacts:

This amendment adds $544,407.16 in Federal funds and $62,309.84 in County match for a new project total of $1,886,417. This is a budgeted project in the current fiscal year.

Impacts to Department & External Agencies:

There is no financial impact to other County Departments.

List of attachments: Amendment 3 to Supplemental Project Agreement #34018

Presenter: Ryan Crowther

Department Head Signature: BNicholas

Digitally signed by BNicholas
Date: 2026.08.27 14:55:31 -07'00'

Contract Review Sheet

Intergovernmental Agreement **PW-3285-20 - Am3**

Title: **ODOT for Supplemental Project No. 34018: Connecticut Avenue: Macleay Road to Rickey Street MC**

Contractor's Name: **Oregon Department of Transportation**

Department: **Public Works Department** Contact: **Traci Clarke**

Analyst: **Kathleen George** Phone #: **503-365-3100**

Term - Date From: **Execution** Expires: **March 15, 2030**

Original Contract Amount: **$ 171,384.00** Previous Amendments Amount: **$ 1,279,700.00**

Current Amendment: **$ 606,717.00** New Contract Total: **$ 1,886,417.00** Amd% **1001%**

Incoming Funds ☑ Federal Funds ☐ Reinstatement ☐ Retroactive ☑ Amendment greater than 25%

Source Selection Method: **50-0010 General Exemptions (IGAs and QRFs)**

Description of Services or Grant Award

Marion County has received additional federal grant funds under the Urban Surface Transportation Block Grant Program (STBG-U) to provide for the design and construction of pedestrian and bicycle improvements on the west side of Connecticut Avenue SE, from Macleay Road SE on the north, to Rickey Street SE on the South. The project involves the completion of urban bicycle and ADA compliant pedestrian facilities along this segment of Connecticut Avenue SE.
Amendment No. 01 increases the federal funding for the project from $171,384 to $1,008,564.80.
Amendment No. 02: The total project cost is estimated at $1,279,700, of which $1,148,274.81 is being paid with federal funds and the remaining match of $131,425.19 is being provided by Marion County through a combination of staff time donation and cash match. Amendment No. 02 increases the total project funding by $155,700, which includes $137,709.61 from Marion County's annual STBG allocation balance plus County matching funds of $15,990.39.
Amendment No. 03 to Supplemental Project Agreement No. 34018 increases the total project funding from $1,279,700 to $1,886,417. The additional $606,717 will go to fund the construction phase of the project and is comprised $544,407.16 (89.73%) and $62,309.84 (10.27%) County Road Fund matching funds.

Assistance Listing No. 20.205 ODOT 34018

Desired BOC Session Date:	**10/7/2026**	Contract should be in DocuSign by:	**9/16/2026**
Agenda Planning Date	**9/24/2026**	Printed packets due in Finance:	**9/22/2026**
Management Update	**9/22/2026**	BOC upload / Board Session email:	**9/23/2026**

BOC Session Presenter(s) **Ryan Crowther** Code: **Y**

REQUIRED APPROVALS

	09/18/2026	Traci Clarke	09/18/2026
Finance - Contracts	Date	Contract Specialist	Date
	09/18/2026	Jan Fritz Jan Fritz (Sep 18, 2026 13:02:29 PDT)	09/18/2026
Legal Counsel	Date	Chief Administrative Officer	Date

AMENDMENT NUMBER 03
LOCAL AGENCY CERTIFICATION AGREEMENT
Supplemental Project Agreement No. 34018
Connecticut Avenue: Macleay Road to Rickey Street
Marion County

This is Amendment No. 03 to the Agreement between the **State of Oregon**, acting by and through its Department of Transportation, hereinafter referred to as "State" or "ODOT," and MARION COUNTY, acting by and through its elected officials, hereinafter referred to as "Agency," entered into on March 16, 2020, Amendment 1 entered into on October 4, 2022, and Amendment Number 2 entered into on March 1, 2023.

It has now been determined by State and Agency that the Agreement referenced above shall be amended to updated language, increase funding, revise Exhibit B and update State Contact.

1. **Effective Date.** This Amendment shall become effective on the date it is fully executed and approved as required by applicable law.

2. **Amendment to Agreement.**

   a. **Revised Exhibit B shall be deleted in its entirety and replaced with the attached Revised Exhibit B-1. All references to "Revised Exhibit B" shall hereinafter be referred to as "Revised Exhibit B-1." The requirement to comply with the terms and conditions of Revised Exhibit B-1 shall be effective upon execution of this Amendment.**

   b. **TERMS OF AGREEMENT, Paragraph 3, Page 2, which reads:**

      3.The total Project cost is estimated at $1,279,700.00, which is subject to change. Federal funds for this Project shall be limited to $1,148,274.81. Agency shall be responsible for all remaining costs, including any non-participating costs, all costs in excess of the federal or state funds, and the 10.27 percent match for all eligible costs. Any unused federal or state funds obligated to this Project will not be paid out by State and will not be available for use by Agency for this Agreement or any other projects. "Total Project Cost" means the cost to complete the entire Project, and includes any federal funds, state funds, local matching funds, and any other funds. Agency will report the final Total Project Cost at the end of the Project, to the ODOT Regional Local Agency Liaison.

      Shall be deleted in its entirety and replaced with the following:

      3.The total Project cost is estimated at $1,886,417.00, which is subject to change. Federal funds for this Project shall be limited to $1,692,681.42. Agency shall be responsible for all remaining costs, including any non-participating costs, all costs

in excess of the federal or state funds, and the 10.27 percent match for all eligible costs. Any unused federal or state funds obligated to this Project will not be paid out by State and will not be available for use by Agency for this Agreement or any other projects. "Total Project Cost" means the cost to complete the entire Project, and includes any federal funds, state funds, local matching funds, and any other funds. Agency will report the final Total Project Cost at the end of the Project, to the ODOT Regional Local Agency Liaison.

c. <u>TERMS OF AGREEMENT, Paragraph 19, Page 5, which reads:</u>

19. By signing this Agreement, Agency agrees to comply with the provisions of the Federal Funding Accountability and Transparency Act (FFATA) and is subject to the following award terms: http://edocket.access.gpo.gov/2010/pdf/2010-22705.pdf and http://edocket.access.gpo.gov/2010/pdf/2010-22706.pdf.
If, in the preceding fiscal year, Agency received more than 80 percent (80%) of its gross revenues from the federal government, those federal funds exceed $25,000,000 annually, and the public does not have access to information about the compensation of executives through reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 or section 6104 of the Internal Revenue Code of 1986, Agency shall report the total compensation and names of its top five executives to State. Agency shall report said information to State within 14 calendar days of execution of this Agreement and annually thereafter, utilizing the FFATA form attached hereto and marked as "Exhibit B."

Shall be deleted in its entirety and replaced with the following:

19. Agency agrees to provide to ODOT the subaward reporting information required to comply with the Federal Funding Accountability and Transparency Act of 2006 (Pub. L. 109–282), as amended by section 6202 of Public Law 110–252 ("Federal Transparency Act") in accordance with "Revised Exhibit B – Federal Transparency Act Subaward Reporting," attached hereto and by this reference made a part hereof. See **CFR Appendix A to Part 170, Title 2**.

a. Agency's Unique Entity Identifier is: FUAKHMJE2437

b. Agency is not required to report executive compensation information per Federal Transparency Act in accordance with Revised Exhibit B-1.

d. TERMS OF AGREEMENT, Paragraph 34, Page 10, which reads:

34. State's Regional Local Agency Liaison for this Agreement is Andrew Blair, Transportation Project Manager, ODOT Region 2, Area 3, 455 Airport Road SE, Building B, Salem, Oregon 97301; phone: (503) 986-2681; email: andrew.blair@odot.state.or.us, or assigned designee upon individual's absence. State shall notify the other Party in writing of any contact information changes during the term of this Agreement.

Shall be deleted in its entirety and replaced with the following:

34. State's Regional Local Agency Liaison for this Agreement is Valerie Greenway, Senior Transportation Project Manager, , 455 Airport Road SE, Building B, Salem, Oregon 97301; phone: (971) 304-502192; email: Valerie.GREENWAY@odot.oregon.gov, or assigned designee upon individual's absence. State shall notify the other Party in writing of any contact information changes during the term of this Agreement.

3. **Counterparts.** This Amendment may be executed in two or more counterparts (by facsimile or otherwise) each of which is an original and all of which when taken together are deemed one agreement binding on all Parties, notwithstanding that all Parties are not signatories to the same counterpart.

4. **Original Agreement.** Except as expressly amended above, all other terms and conditions of the original Agreement are still in full force and effect. Agency certifies that the representations, warranties and certifications in the original Agreement are true and correct as of the effective date of this Amendment and with the same effect as though made at the time of this Amendment.

5. **Electronic Signatures.** The Parties agree that signatures showing on PDF documents, including but not limited to PDF copies of the Agreement and amendments, submitted or exchanged via email are "Electronic Signatures" under ORS Chapter 84 and bind the signing Party and are intended to be and can be relied upon by the Parties. State reserves the right at any time to require the submission of the hard copy originals of any documents.

THE PARTIES, by execution of this Agreement, hereby acknowledge that their signing representatives have read this Agreement, understand it, and agree to be bound by its terms and conditions.

This Project is in the 2024-2027 Statewide Transportation Improvement Program (STIP), (Key #21304) that was adopted by the Oregon Transportation Commission on July 13, 2023 (or subsequently by amendment to the STIP).

Signature Page Follows

Marion County, by and through its elected officials

By _____
Commissioner

By _____
Commissioner

By _____
Commissioner

Date _____

APPROVAL RECOMMENDED

By Brian Nicholas 09/18/2026
Brian Nicholas (Sep 18, 2026 11:22:38 PDT)
Director of Public Works Date

By Jan Fritz 09/18/2026
Jan Fritz (Sep 18, 2026 13:02:29 PDT)
Chief Administrative Officer Date

APPROVED AS TO FORM

By 09/18/2026
Marion County Contracts Date

By 09/18/2026
Marion County Legal Counsel Date

Agency Contact:
Ryan Crowther, P.E., Capital Project Manager
Marion County Public Works
5155 Silverton Road NE
Salem, OR 97305
(503) 365-3112
rcrowther@co.marion.or.us

STATE OF OREGON, by and through its Department of Transportation

By _____
Region 2 Manager

Date _____

APPROVAL RECOMMENDED

By _____
Certification Program Manager
Date _____

By _____
State Traffic Engineer
Date _____

APPROVED AS TO LEGAL SUFFICIENCY

By _____
Assistant Attorney General

Date _____

State Contact:
Valerie Greenway
Senior Transportation Project Manager
455 Airport Road SE, Bldg. B
Salem, OR 97301
(971) 304-5021
Valerie.GREENWAY@odot.oregon.gov

Revised Exhibit B-1
Federal Transparency Act Subaward Reporting

Agency agrees to comply with the following provisions in this Exhibit B-1. For purposes of this Exhibit B-1, references to "your organization" mean "Agency" and references to "project agreement" mean "Supplemental Project Agreement."

A. Background: To fulfill its obligations under the Federal Funding Accountability and Transparency Act of 2006 (Pub. L. 109–282), as amended by section 6202 of Public Law 110–252 ("Federal Transparency Act"), the Oregon Department of Transportation (ODOT) must report subawards (also known as subrecipient awards) and, when applicable, information about a subrecipient's highly compensated executives to the Federal Funding Accountability and Transparency Act Subaward Reporting System (FSRS). Federal Transparency Act reporting is required for each subaward that equals or exceeds thirty thousand dollars ($30,000) in federal funds.

The Federal Transparency Act requires information on federal awards (federal financial assistance and expenditures) be made publicly available on a single, searchable website: https://www.usaspending.gov/. More information about the Federal Transparency Act is available at https://edocket.access.gpo.gov/2010/pdf/2010-22705.pdf, CFR Appendix A to Part 170, Title 2, and the FSRS website https://www.fsrs.gov/.

B. Unique Entity Identifier: Prior to execution of the project agreement, your organization shall provide to ODOT the federal Unique Entity Identifier (UEI) applicable to the project so that ODOT may include the UEI in its reports to FSRS. Effective April 4, 2022, the UEI is the primary means of identifying entities registered for federal awards in the System for Award Management (SAM) at https://www.sam.gov. If your entity is already registered in SAM, it has been assigned a UEI. The Federal Service Desk has posted instructions for finding the UEI in SAM.

C. Executive compensation: Prior to execution of the project agreement, your organization shall determine and provide to ODOT information on whether your organization's executive compensation information must be reported under the Federal Transparency Act, based on the following criteria:

1. In your organization's previous fiscal year, did your organization receive eighty percent (80%) or more of its annual gross revenues from federal procurement contracts (and subcontracts) and federal financial assistance subject to the Federal Transparency Act, as defined in 2 CFR 170.320 (and subawards), and twenty five million dollars ($25,000,000) or more in federal procurement contracts (and subcontracts) and federal financial assistance subject to the Federal Transparency Act, as defined in 2 CFR 170.320 (and subawards)? (Include parent organization, all branches, and all affiliates worldwide in determining annual gross revenues.)

    - If "yes," proceed to question 2.

- If "no," reporting executive compensation to ODOT will not be required.

2. Does the public have access to information about the compensation of the senior executives in your organization (including parent organization, all branches, and all affiliates worldwide) through periodic reports filed under section 13(a) or 15(d) of the Securities and Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986? (To determine if the public has access to the compensation information, see the U.S. Security and Exchange Commission total compensation filings at https://www.sec.gov/answers/execomp.htm.)

   - If "yes," reporting executive compensation to ODOT will not be required.
   - If "no," within fourteen (14) calendar days of execution of this Amendment and annually thereafter, your organization shall report the names and total compensation for each of your organization's five most highly compensated executives for the preceding completed fiscal year by completing the following online form:

     Federal Transparency Subaward Report:
     https://forms.office.com/g/WNVpUFmdki.

(Total compensation means the cash and noncash dollar value earned by the executive during your organization's preceding fiscal year. For more information on the compensation information required see 17 CFR 229.402(c)(2).)

D. Subrecipient information to be provided to ODOT: By signing the project agreement with ODOT, your organization certifies it has reviewed and confirmed that the following subrecipient information included in the project agreement is true and accurate at the time of execution:

- Your organization's UEI.
- Whether your organization is required to report executive compensation to comply with the Federal Transparency Act.

E. Technical assistance: If you have any questions about this exhibit, email the ODOT Federal Funding Manager at: ODOTFederalFunding@odot.oregon.gov.

MARION COUNTY BOARD OF COMMISSIONERS

Board Session Agenda Review Form

Meeting date: 9/30/26

Department: Public Works

Title: Purchase of Glass Beads for Striping of County Roads

Management Update/Work Session Date: 9/15/26 **Audio/Visual aids** ☐

Time Required: 5 mins **Contact:** Scott Wilson **Phone:** ext. 3129

Requested Action:

Approve Amendment No. 3 to Purchase Order 882868 (PW-5618-23) with Potters Industries, LLC, for the supply of reflective beads used by the Public Works Department for pavement marking operations, increasing the PO amount by $135,000, from $1,050,000 to $1,185,000.

Issue, Description & Background:

Public Works maintains over 3,150 lineal miles of centerline and shoulder line stripes throughout Marion County and other local jurisdictions. Pavement striping requires the application of reflective beads to enhance nighttime visibility and to satisfy pavement marking reflectivity standards. This is a multi-year purchase order. Amendment No. 3 increases the PO amount to accommodate planned purchases through fiscal year 2026/27.

Financial Impacts:

This is a budgeted expense in the current fiscal year.

Impacts to Department & External Agencies:

None

List of attachments:

Amendment No. 3 to PO #882868

Presenter:

Scott Wilson

Department Head Signature:

BNicholas

Digitally signed by BNicholas
Date: 2026.08.27 15:06:38 -07'00'

Contract Review Sheet

PW-5618-23 -Am 3

Title: **SPA Purchase of Glass Beads for Striping of County Roads**

Contractor's Name: **Potters Industries LLC**

Department: **Public Works Department** Contact: **Jeniffer Scales**

Analyst: **Kathleen George** Phone #: **(503) 588-5036**

Term - Date From: **July 11, 2019** Expires: **July 9, 2027**

Original Contract Amount: **$ 525,000.00** Previous Amendments Amount: **$ 525,000.00**

Current Amendment: **$ 135,000.00** New Contract Total: **$ 1,185,000.00** Amd% **126%**

Outgoing Funds ☐ Federal Funds ☐ Reinstatement ☐ Retroactive ☑ Amendment greater than 25%

Source Selection Method: **10-0400 Cooperative** Cooperative#

Description of Services or Grant Award

State of Oregon Price Agreement (SPA) #9265 for purchase of glass beads for striping County roads. PW maintains over 3,150 lineal miles of centerline and shoulder line stripes throughout Marion County and other local jurisdictions. The striping requires the application of reflective marking beads to enhance nighttime visibility for the stripes for increased safety. For FY21/22 through FY22/23, the initial Purchase Order (PO) was $525,000. The actual amount spent for beads through FY22/23 was $490,500.

Amendment 1 reflects the SPA extension through July 10, 2025 and doubles the PO value in order to purchase materials through FY24/25 for a new total of $1,050,000.

Amendment 2 - The State of Oregon Price Agreement (SPA) #9265 has been extended through July 10, 2027, allowing continued purchases under the agreement.

Amendment 3 increases the Purchase Order by $135,000, from $1,050,000 to a new total of $1,185,000. The additional funds will be used to purchase reflective glass beads required for roadway striping.

Desired BOC Session Date: **9/30/2026** Contract should be in DocuSign by: **9/9/2026**

Agenda Planning Date **9/17/2026** Printed packets due in Finance: **9/15/2026**

Management Update **9/15/2026** BOC upload / Board Session email: **9/16/2026**

BOC Session Presenter(s) **Scott Wilson** Code: **Y**

REQUIRED APPROVALS

Finance - Contracts Date Contract Specialist Date

Legal Counsel Date Chief Administrative Officer Date

MARION COUNTY
FINANCE DEPARTMENT

PO Box 14500
555 Court St NE #4247
Salem, OR 97309-5036

Purchase Order		
Purchase Order No	Revision	Page
882868		1

Ship To:
MARION COUNTY PUBLIC WORKS
5155 SILVERTON RD NE
SALEM OR 97305

POTTERS INDUSTRIES LLC
PO BOX 90414
CHICAGO, IL 60696-0414

Bill To:
MARION COUNTY PUBLIC WORKS
5155 SILVERTON RD NE
SALEM OR 97305

Customer Acct No	Supplier No	Order Date / Buyer	Revised Date / Buyer
2377	507761	J SCALES	J SCALES
Payment Terms		Ship Via	F.O.B
IMMEDIATE		BEST METHOD	DESTINATION
Freight Terms		Request Or Deliver To	Confirm To / Telephone
PREPAID		ERIC STEWART	( )

Line #	Description	Delivery Date	Quantity	Unit	Unit Price	Total
1	REFLECTIVE MARKING BEADS FOR STRIPING COUNTY ROADS.		1			$525,000
	AMENDMENT #1 EXTENDS CONTRACT THROUGH 7/10/25 AND ADDS FUNDS.		1			$525,000
	AMENDMENT #2 EXTENDS CONTRACT THROUGH 7/10/27.		1			0.00
	AMENDMENT #3 TO ADD FUNDS.		1			$135,000
	THIS PURCHASE IS PLACED AGAINST STATE PRICE AGREEMENT#9265 7/11/19 - 7/09/27.					
					Total	$1,185,000

INSTRUCTIONS TO VENDOR

1. Please direct any questions concerning this purchase order to invoiced department.
2. Purchase Order Number must appear on all invoices, packages and shipping documents relating to this order.
3. Separate invoices must be submitted for each Purchase Order.
4. Do not overship or substitute.
5. If you cannot supply the items requested, please notify issuing authority at once.

Note : Please notify department contact (above) for all inquiries regarding this Purchase Order

Authorized By:_____

MARION COUNTY PURCHASING
NOT VALID Unless Signed By Purchasing

MARION COUNTY TERMS AND CONDITIONS

1. INSPECTIONS: County may inspect and test the Goods and related Services (collectively, Goods). County may reject non-conforming Goods and require Contractor to correct them without charge or deliver them at a reduced price, as negotiated. If Contractor does not cure any defects within a reasonable time, County may reject the Goods and cancel the PO in whole or in part. This paragraph does not affect or limit County's rights, including its rights under the Uniform Commercial Code, ORS chapter 72 (UCC).

2. DELIVERY: Deliveries will be F.O.B destination. Contractor shall pay all transportation and handling charges. Contractor is responsible and liable for loss or damage until final inspection and acceptance of the Goods. Contractor remains liable for latent defects, fraud, and warranties.

3. PAYMENT: County shall pay Contractor within 30 days from (i) the date the Goods are delivered and accepted or (ii) the date the invoice is received, whichever is later

4. COUNTY PAYMENT OF CONTRACTOR CLAIMS: If Contractor does not pay promptly any claim that is due for Goods or Services furnished to the Contractor by any subcontractor in connection with this PO, the County may pay such claim and charge that payment against any payment due to the Contractor under this PO. The County's payment of a claim does not relieve the Contractor or its surety, if any, from their obligations for any unpaid claims.

5. WARRANTIES: Contractor agrees to perform its services with that highest standard of care, skill and diligence normally provided by a professional individual in the performance of similar services. Contractor represents and warrants that the Goods are new, current, and fully warranted by the manufacturer. Delivered Goods will comply with specifications and be free from defects in labor, material and manufacture. All UCC implied and expressed warranties are incorporated in this PO. Contractor shall transfer all warranties to the County.

6. TERMINATION OF PO: The PO may be terminated under the following conditions: a. By written mutual agreement of both parties. Termination under this provision may be immediate. b. Upon fifteen (15) calendar days written notice by either Party to the other of intent to terminate. c. The County may terminate all or part of this PO for the following reasons: (1) If the consultant fails to provide services, or fails to meet the performance standards as specified in this PO (or subsequent modifications of this PO), within the time specified herein or any extension thereof. Termination under this provision may be immediate; (2) If the consultant fails to start services on the date specified by Marion County in this PO or subsequent modifications to this contract. Termination under this provision may be immediate. (3) Failure of the consultant or Marion County to comply with the provisions of this PO and all applicable federal, state, and local laws and rules may be cause for termination of this contract. Such termination shall be without prejudice to any obligations or liabilities of either party accrued prior to such termination. If this PO is terminated by either party, for reasons other than breach of contract, the County agrees to pay to the consultant all costs and expenses associated with services satisfactorily provided to the effective date of termination.

7. INDEMNIFICATION. The Contractor shall save harmless, indemnify, and defend the County for any and all claims, damages, losses and expenses including but not limited to reasonable attorney's fees arising out of or resulting from Contractor's performance of or failure to perform the obligations of this PO to the extent same are caused by the negligence or misconduct of Contractor or its employees or agents.

8. GOVERNING LAW, VENUE: This PO shall be governed by the laws of the State of Oregon. Any action commenced in connection with this PO shall be in the Circuit Court of Marion County. All rights and remedies of the County shall be cumulative and may be exercised successively or concurrently. The foregoing is without limitation to or waiver of any other rights or remedies of the County according to law.

9. FORCE MAJEURE: Neither party is responsible for delay or default caused by an event beyond its reasonable control. County may terminate this PO without liability to Contractor upon written notice after determining the delay or default reasonably prevents performance of this PO.

10. SUBCONTRACTING/NONASSIGNMENT. No portion of the PO may be contracted or assigned to any other individual, firm or entity without the express and prior approval of the County.

11. MAINTENANCE, RETENTION, AND CONFIDENTIALITY OF RECORD. The Contractor agrees to establish and maintain records and statistics as follows: Financial records, which indicate the number of hours of service provided under this contract and other appropriate records pertinent to this contract shall be retained for a minimum of three (3) years after the end of the contract period. If there are unresolved audit questions at the end of the three-year period, the records must be maintained until the questions are resolved. To the extent applicable, client records shall be kept confidential in accordance with ORS 179.505, OAR 309-11-020, 45 CFR 205.50 and 42 CFR Part 2.

12. COMPLIANCE WITH APPLICABLE LAWS: The Contractor shall comply with all applicable Federal, State and local laws, rules and regulations. All provisions of ORS 279B (Public Contracts and Purchasing) are incorporated herein to the extent applicable to POs.

13. WORKERS' COMPENSATION: Contractor shall comply with ORS 656.017 and provide the required workers' compensation coverage, unless exempt under ORS 656.126(2). Contractor shall ensure that its Subcontractors, if any, comply with these requirements.

14. SAFETY AND HEALTH REQUIREMENTS: Contractor represents and warrants that the Goods comply with all federal and Oregon safety and health requirements.

15. MATERIAL SAFETY DATA SHEET: Contractor shall provide County with a Material Safety Data Sheet for any Goods which may release, or otherwise result in exposure to, a hazardous chemical under normal conditions of use (OAR 437- 002-0360 and 29 CFR 1910.1020). Contractor shall label, tag or mark such Goods.

16. AMENDMENTS: All amendments to this PO must be in writing, signed by County.

17. SEVERABILITY: If a court of competent jurisdiction declares any provision of this PO to be invalid, the other provisions and the rights and obligations of the parties remain in effect.

18. WAIVER: Failure of either party to enforce any provision of this PO is not a waiver or relinquishment of that party's rights to such performance in the future or to enforce any other provisions.

19. TAX CERTIFICATION: Contractor hereby certifies under penalty of perjury: (a) the number shown on this form is the correct Federal Employer Identification Number; (b) it is not subject to backup withholding because (i) it is exempt from backup withholding, (ii) it has not been notified by the IRS that it is subject to backup withholding as a result of a failure to report all interest or dividends, or (iii) the IRS has notified Contractor that it is no longer subject to backup withholding; and (c) it is not in violation of any Oregon tax laws.

SIGNATURE PAGE FOR
CPO#882868 GLASS BEADS FOR STRIPING OF COUNTY ROADS - PW-5618-23
between
MARION COUNTY and POTTERS INDUSTRIES LLC

MARION COUNTY SIGNATURES
BOARD OF COMMISSIONERS:

_____
Chair Date

_____
Commissioner Date

_____
Commissioner Date

Authorized Signature: _____
Department Director or designee Date

Authorized Signature: _____
Chief Administrative Officer Date

Reviewed by Signature: _____
Marion County Legal Counsel Date

Reviewed by Signature: _____
Marion County Contracts & Procurement Date

MARION COUNTY BOARD OF COMMISSIONERS

Board Session Agenda Review Form

Meeting date: 10/14/2026

Department: Public Works

Title: Contract No. PW-7319-26 - Tower Climbing and Antenna Installation Services

Management Update/Work Session Date: 9/29/2026 **Audio/Visual aids** ☐

Time Required: 5 min **Contact:** Brian Nicholas **Phone:** x7944

Requested Action:

Approve Contract for Services PW-7319-26 with Legacy Wireless Services, Inc. in the amount of $254,187.00 for tower climbing, antenna installation, inspection, and maintenance services for a network of fifteen (15) radio communication tower sites located in Marion, Polk and Clackamas Counties.

Issue, Description & Background:

Marion County is in the process of constructing the Marion County Radio Project, a new P25-compliant public safety radio communications system for use by first responder agencies and other public service agencies within Marion County.

This contract provides tower climbing, antenna installation, inspection, and maintenance services for a network of fifteen (15) tower sites. This effort supports an ongoing public safety communications infrastructure upgrade.

Financial Impacts:

This is a budgeted expense in the current fiscal year under CIP 22-308.

Impacts to Department & External Agencies:

The Marion County Sheriff's Office and first responder agencies throughout Marion County will benefit from a stable, unified radio system meeting current public safety radio standards.

List of attachments: Contract for Services No. PW-7319-26

Presenter: Brian Nicholas

Department Head Signature: BNicholas

Digitally signed by BNicholas
Date: 2026.09.21 16:39:29 -07'00'

Contract Review Sheet

Contract for Services **PW-7319-26**

Title: **Tower Climbing and Antenna Installation Services**

Contractor's Name: **Legacy Wireless Services, Inc.**

Department: **Public Works Department** Contact: **Alicia Jones**

Analyst: **Kathleen George** Phone #: **-4388**

Term - Date From: **Execution** Expires: **March 1, 2027**

Original Contract Amount: **$ 254,187.00** Previous Amendments Amount: **$ -**

Current Amendment: **$ -** New Contract Total: **$ 254,187.00** Amd% **0%**

Outgoing Funds ☐ Federal Funds ☐ Reinstatement ☐ Retroactive ☐ Amendment greater than 25%

Source Selection Method: **20-0260 Request for Proposal** RFP# **PW1709-26**

Description of Services or Grant Award

Marion County is in the process of constructing the Marion County Radio Project, a new P25-compliant public safety radio communications system for use by first responder agencies and other public service agencies within Marion County.

This contract provides tower climbing, antenna installation, inspection, and maintenance services for a network of fifteen (15) tower sites. This effort supports an ongoing public safety communications infrastructure upgrade.

Desired BOC Session Date:	**10/14/2026**	Contract should be in DocuSign by:	**9/16/2026**
Agenda Planning Date	**9/24/2026**	Printed packets due in Finance:	**9/22/2026**
Management Update	**9/22/2026**	BOC upload / Board Session email:	**9/23/2026**

BOC Session Presenter(s) **Brian Nicholas** Code: **Y**

REQUIRED APPROVALS

	09/22/2026		09/22/2026
Finance - Contracts	Date	Contract Specialist	Date
	09/22/2026	Jan Fritz Jan Fritz (Sep 23, 2026 09:08:07 PDT)	09/23/2026
Legal Counsel	Date	Chief Administrative Officer	Date

MARION COUNTY
CONTRACT FOR SERVICES
PW-7319-26

This Contract is between Marion County (a political subdivision of the State of Oregon) hereinafter called County, and Legacy Wireless Services, Inc. dba Legacy Wireless Services, an Oregon Limited Liability Company hereinafter called Contractor.

RECITALS

WHEREAS, County issued Request for Proposal PW1709-02 for Tower Climbing and Antenna Installation Services on August 19, 2026.

WHEREAS, Legacy Wireless Services, Inc. submitted a proposal in response to PW1709-26 on September 9, 2026, which was determined to be responsive.

WHEREAS, County evaluated and scored all proposals received and issued a Notice of Intent of Award to Legacy Wireless Services, Inc. on September 11, 2026.

WHEREAS, County wishes to engage Contractor to provide the services set forth in Exhibit A.

Contractor agrees to perform, and County agrees to pay for, the services and deliverables described in Exhibit A (the "Work").

1. TERM

This Contract is effective on the date it has been signed by all parties and all required County approvals have been obtained. This Contract expires on **March 01, 2027.** The parties may extend the term of this Contract provided that the total Contract term does not extend beyond **March 01, 2028.**

2. DOCUMENTS / ORDER OF PRECEDENCE

This Contract consists of the following documents, each of which is attached and incorporated herein by reference:

A. This Contract less exhibits

B. Exhibit A – STATEMENT OF WORK

C. Exhibit B – TOWER APPURTENANCE LIST BY SITE

D. Exhibit C – TOWER WORK REQUIREMENTS

E. Exhibit D – SPECIFICATIONS SHEETS

F. Exhibit E – APPENDIX II TO PART 200

G. Supplementals 1 through 12 – RF Sub-System and Site Design Documents

3. CONSIDERATION

A. The maximum, not-to-exceed compensation payable to Contractor under this Contract, which includes any allowable expenses, is **$254,187.00**. County will not pay Contractor any amount in excess of the not-to-exceed compensation of this Contract for completing the Work and will not pay

for Work performed before the date this Contract becomes effective or after the termination of this Contract. If the maximum compensation is increased by amendment of this Contract, the amendment must be fully effective before Contractor performs Work subject to the amendment.

B. Interim payments to Contractor shall be made in accordance with the payment schedule and requirements in Exhibit A.

C. If specified below, county's payments to Contractor under this Contract will be paid in whole or in part with federal funds. If so specified, by signing this agreement, Contractor certifies neither it nor its employees, contractors, subcontractors or subgrantees who will perform the Project activities are currently employed by an agency or department of the federal government. If applicable, Contractor shall comply with Exhibit E - Appendix II to Part 200 of the Code of Federal Regulations.

In accordance with 2 CFR 200.331, Contractor has been designated:
☐ Subrecipient
☐ Contractor/Vendor
☒ Not applicable – (there are no federal funds tied to the contract)

4. COMPLIANCE WITH STATUTES AND RULES

A. County and Contractor agree to comply with the provisions of this Contract, its exhibits and attachments and all applicable federal, state, and local statutes and rules.
Unless otherwise specified, responsibility for all taxes, assessment, and any other charges imposed by law upon employers shall be the sole responsibility of Contractor. Failure of Contractor or County to comply with the provisions of this Contract and all applicable federal, state, and local statutes and rules shall be cause for termination of this Contract as specified in sections concerning recovery of funds and termination.

County's performance under this Contract is conditioned upon Contractor's compliance with the obligations intended for contractors under ORS 279B.220, 279B.225 (if applicable to this Contract), 279B.230, 279B.235 (if applicable to this Contract) and ORS 652, which are incorporated by reference herein.

B. Contractor must, throughout the duration of this Contract and any extensions, comply with all tax laws of this state and all applicable tax laws of any political subdivision of this state. For the purposes of this Section, "tax laws" includes all the provisions described in subsection 29. C. (i) through (iv) of this Contract.

Any violation of subsection B of this section shall constitute a material breach of this Contract. Further, any violation of Contractor's warranty, in subsection 29.C of this Contract, that Contractor has complied with the tax laws of this state and the applicable tax laws of any political subdivision of this state also shall constitute a material breach of this Contract. Any violation shall entitle County to terminate this Contract, to pursue and recover any and all damages that arise from the breach and the termination of this Contract, and to pursue any or all of the remedies available under this Contract, at law, or in equity, including but not limited to:

i. Termination of this Contract, in whole or in part;

ii. Exercise of the right of setoff, and withholding of amounts otherwise due and owing to Contractor, in an amount equal to State's setoff right, without penalty; and

iii. Initiation of an action or proceeding for damages, specific performance, declaratory or injunctive relief. County shall be entitled to recover any and all damages suffered as the result of Contractor's breach of this Contract, including but not limited to direct, indirect, incidental and consequential damages, costs of cure, and costs incurred in securing replacement Services or a replacement contractor.

C. These remedies are cumulative to the extent the remedies are not inconsistent, and County may pursue any remedy or remedies singly, collectively, successively, or in any order whatsoever.

5. CIVIL RIGHTS, REHABILITATION ACT, AMERICANS WITH DISABILITIES ACT AND TITLE VI OF THE CIVIL RIGHTS ACT

Contractor agrees to comply with the Civil Rights Act of 1964, and 1991, Americans with Disabilities Act of 1990, and Section 504 of the Rehabilitation Act of 1973, and Title VI as implemented by 45 CFR 80 and 84 which states in part, No qualified person shall on the basis of disability, race, color, or national origin be excluded from participation in, be denied the benefits of, or otherwise be subjected to discrimination under any program or activity which received or benefits from federal financial assistance.

6. TIME IS OF THE ESSENCE

Contractor agrees that time is of the essence in the performance of this Contract.

7. FORCE MAJEURE

Neither County nor Contractor shall be responsible for any failure to perform or for any delay in the performance of any obligation under this Contract caused by fire, riot, acts of God, terrorism, war, or any other cause which is beyond the breaching party's reasonable control. Contractor shall, however, make all reasonable efforts to remove or eliminate the cause of Contractor's delay or breach and shall, upon the cessation of the cause, continue performing under this Contract. County may terminate this Contract upon written notice to Contractor after reasonably determining that the delay or breach will likely prevent successful performance of this Contract.

8. FUNDING MODIFICATION

A. County may reduce or terminate this Contract when state or federal funds are reduced or eliminated by providing written notice to the respective parties.

B. In the event the Board of Commissioners of County reduces, changes, eliminates, or otherwise modifies the funding for any of the services identified, Contractor agrees to abide by any such decision including termination of service.

9. RECOVERY OF FUNDS

Expenditures of Contractor may be charged to this Contract only if they (1) are in payment of services performed under this Contract, (2) conform to applicable state and federal regulations and statutes, and (3) are in payment of an obligation incurred during the Contract period.

Any County funds spent for purposes not authorized by this Contract and payments by County in excess of authorized expenditures shall be deducted from future payments or refunded to County no later than thirty (30) days after notice of unauthorized expenditure or notice of excess payment.

Contractor shall be responsible to repay for prior contract period excess payments and un-recovered advanced payments provided by County. Repayment of prior period obligations shall be made to County in a manner agreed on.

10. ACCESS TO RECORDS

A. Contractor shall permit authorized representatives of County, State of Oregon, or the applicable audit agencies of the U.S. Government to review the records of Contractor as they relate to the Contract services in order to satisfy audit or program evaluation purposes deemed necessary by County and permitted by law.

B. Contractor agrees to establish and maintain financial records, which indicate the number of hours of work provided, and other appropriate records pertinent to this Contract shall be retained for a minimum of three (3) years after the end of the Contract period. If there are unresolved audit questions at the end of the three-year period, the records must be maintained until the questions are resolved.

11. REPORTING REQUIREMENTS

Contractor shall provide County with periodic reports at the frequency and with the information prescribed by County. Further, at any time, County has the right to demand adequate assurances that the services provided by Contractor shall be in accordance with the Contract. Such assurances provided by Contractor shall be supported by documentation in Contractor's possession from third parties.

12. CONFIDENTIALITY OF RECORDS

A. Contractor shall not use, release, or disclose any information concerning any employee, client, applicant or person doing business with County for any purpose not directly connected with the administration of County's or Contractor's responsibilities under this Contract except upon written consent of County, and if applicable, the employee, client, applicant or person.

B. Contractor shall ensure that its agents, employees, officers, and subcontractors with access to County and Contractor records understand and comply with this confidential provision.

C. If Contractor receives or transmits protected health information, Contractor shall enter into a Business Associate Agreement with County, which shall become part of this Contract, if attached hereto.

D. Client records shall be kept confidential in accordance with ORS 179.505, OAR 309-014-0036(3), 45 CFR 205.50 and 42 CFR Part 2 as applicable.

13. INDEMNIFICATION AND INSURANCE

A. Contractor shall defend, save, indemnify, and hold harmless County, its officers, agents, and employees from and against all claims, suits, actions, losses, damages, liabilities, costs, and expenses of any nature whatsoever, including attorney fees, resulting from, arising out of, or relating to the activities of Contractor or its officers, employees, subcontractors, or agents under this Contract.

Contractor shall have control of the defense and settlement of any claim that is subject to this section. However, neither Contractor nor any attorney engaged by Contractor shall defend the claim in the name of either County or any department of County, nor purport to act as legal representative of either County or any of its departments, without first receiving from County Legal Counsel authority to act as legal counsel for County, nor shall Contractor settle any claim on behalf of County without the approval of County Legal Counsel. County may, at its election and expense, assume its own defense and settlement.

B. Contractor shall obtain the insurance required under section 24 prior to performing under this Contract and shall maintain the required insurance throughout the duration of this Contract and all warranty periods.

C. County, pursuant to applicable provisions of ORS 30.260 to 30.300, maintains a self-insurance program that provides property damage and personal injury coverage.

14. EARLY TERMINATION

This Contract may be terminated as follows:

A. County and Contractor, by mutual written agreement, may terminate this Contract at any time.

B. County in its sole discretion may terminate this Contract for any reason on 30 days written notice to Contractor.

C. Either County or Contractor may terminate this Contract in the event of a breach of the Contract by the other. Prior to such termination the party seeking termination shall give to the other party written notice of the breach and intent to terminate. If the party committing the breach has not entirely cured the breach within 15 days of the date of the notice, then the party giving the notice may terminate the Contract at any time thereafter by giving a written notice of termination.

D. Notwithstanding section 14C, County may terminate this Contract immediately by written notice to Contractor upon denial, suspension, revocation, or non-renewal of any license, permit or certificate that Contractor must hold to provide services under this Contract.

15. PAYMENT ON EARLY TERMINATION

Upon termination pursuant to section 14, payment shall be made as follows:

A. If terminated under 14A or 14B for the convenience of County, County shall pay Contractor for Work performed prior to the termination date if such Work was performed in accordance with the Contract. County shall not be liable for direct, indirect, or consequential damages. Termination shall not result in a waiver of any other claim County may have against Contractor.

B. If terminated under 14C by Contractor due to a breach by County, then County shall pay Contractor for Work performed prior to the termination date if such Work was performed in accordance with the Contract.

C. If terminated under 14C or 14D by County due to a breach by Contractor, then County shall pay Contractor for Work performed prior to the termination date provided such Work was performed in accordance with the Contract less any setoff to which County is entitled.

16. INDEPENDENT CONTRACTOR

A. Contractor is a separate and independently established business, retains sole and absolute discretion over the manner and means of carrying out Contractor's activities and responsibilities for the purpose of implementing the provisions of this Contract, and maintains the appropriate license/certifications, if required under Oregon Law. This Contract shall not be construed as creating an agency, partnership, joint venture, employment relationship or any other relationship between the parties other than that of independent parties. The Contractor is acting as an "independent contractor" and is not an employee of County and accepts full responsibility for taxes or other obligations associated with payment for services under this Contract. As an "independent contractor", Contractor will not receive any benefits normally accruing to County employees unless required by applicable law. Furthermore, Contractor is free to contract with other parties for the duration of the Contract.

B. SUBCONTRACTING/NONASSIGNMENT. No portion of the Contract may be contracted or assigned to any other individual, firm or entity without the express and prior approval of County.

17. GOVERNING LAW AND VENUE

This Contract shall be governed by the laws of the State of Oregon. Any action commenced in connection with this Contract shall be in the Circuit Court of Marion County. All rights and remedies of County shall be cumulative and may be exercised successively or concurrently. The foregoing is without limitation to or waiver of any other rights or remedies of County according to law.

18. OWNERSHIP AND USE OF DOCUMENTS

All documents, or other material submitted to County by Contractor shall become the sole and exclusive property of County. All material prepared by Contractor under this Contract may be subject to Oregon's Public Records Laws.

19. NO THIRD-PARTY BENEFICIARIES

A. County and Contractor are the only parties to this Contract and are the only parties entitled to enforce its terms.

B. Nothing in this Contract gives or provides any benefit or right, whether directly, indirectly, or otherwise, to third persons unless such third persons are individually identified by name in this Contract and expressly described as intended beneficiaries of this Contract.

20. SUCCESSORS IN INTEREST

The provisions of this Contract shall be binding upon and inure to the benefit of the parties and their successors and approved assigns.

21. MERGER CLAUSE

This Contract and the attached exhibits constitute the entire agreement between the parties.

A. All understandings and agreements between the parties and representations by either party concerning this Contract are contained in this Contract.

B. No waiver, consent, modification or change in the terms of this Contract shall bind either party unless in writing signed by both parties.

C. Any written waiver, consent, modification, or change shall be effective only in the specific instance and for the specific purpose given.

22. WAIVER

The failure of any Party to enforce any provision of this Contract shall not constitute a waiver by that Party or any other provision. Waiver of any default under this Contract by any Party shall not be deemed to be a waiver of any subsequent default or a modification of the provisions of this Contract.

23. REMEDIES

In the event of breach of this Contract, the Parties shall have the following remedies:

A. If terminated under 14C by County due to a breach by Contractor, County may complete the Work either itself, by agreement with another contractor, or by a combination thereof. If the cost of completing the Work exceeds the remaining unpaid balance of the total compensation provided under this Contract, then Contractor shall pay to County the amount of the reasonable excess.

B. In addition to the remedies in sections 14 and 15 for a breach by Contractor, County also shall be entitled to any other equitable and legal remedies that are available.

C. If County breaches this Contract, Contractor's remedy shall be limited to termination of the Contract and receipt of Contract payments to which Contractor is entitled.

24. INSURANCE

A. REQUIRED INSURANCE. Contractor shall obtain at Contractor's expense the insurance specified in this section prior to performing under this Contract and shall maintain it in full force and at its own expense throughout the duration of this Contract and all warranty periods. Contractor shall obtain the following insurance from insurance companies or entities that are authorized to transact the business of insurance and issue coverage in Oregon and that are acceptable to County:

i. WORKERS COMPENSATION. All employers, including Contractor, that employ subject workers, as defined in ORS 656.027, shall comply with ORS 656.017 and shall provide workers' compensation insurance coverage for those workers, unless they meet the requirement for an exemption under ORS 656.126(2). Contractor shall require and ensure that each of its subcontractors complies with these requirements.

ii. PROFESSIONAL LIABILITY. Covering any damages caused by an error, omission or any negligent acts related to the services to be provided under this Contract. Contractor shall provide proof of insurance of not less than the following amounts as determined by County:

☐ **Required by County** ☒ **Not required by County.**
☐ $1,000,000 Per occurrence limit for any single claimant; and
☐ $2,000,000 Per occurrence limit for multiple claimants
☐ Exclusion Approved by Risk Manager

iii. CYBER LIABILITY. Covering network security, breach of data, and coverage for regulatory fines and fees imposed against County due to failures in products and services provided under this Contract. Cyber Liability coverage must include errors, omissions, negligent acts, denial of

service, media liability (including software copyright), dishonesty, fraudulent or criminal acts by a person or persons whether identified or not, intellectual property infringement, computer system attacks, unauthorized access and use of computer system, regulatory actions, and contractual liability.

☐ **Required by County** ☒ **Not required by County.**
☐ $2,000,000 Per occurrence limit for any single claimant; and
☐ $5,000,000 Per occurrence limit for multiple claimants
☐ Exclusion Approved by Information Technology Director and Risk Manager

iv. COMMERCIAL GENERAL LIABILITY. Covering bodily injury, death, and property damage in a form and with coverages that are satisfactory to County. This insurance shall include personal injury liability, products and completed operations. Coverage shall be written on an occurrence basis. Contractor shall provide proof of insurance of not less than the following amounts as determined by County:

☒ **Required by County** ☐ **Not required by County.**

Minimum Limits:
☒ $1,000,000 Per occurrence limit for any single claimant; and
☒ $2,000,000 Per occurrence limit for multiple claimants
☐ Exclusion Approved by Risk Manager
☐ $500,000 Per occurrence limit for any single claimant
☐ $1,000,000 Per occurrence limit for multiple claimant

v. AUTOMOBILE LIABILITY INSURANCE. Covering all owned, non-owned, or hired vehicles. This coverage may be written in combination with the Commercial General Liability Insurance (with separate limits for "Commercial General Liability" and "Automobile Liability"). Contractor shall provide proof of insurance of not less than the following amounts as determined by County:

☒ **Required by County** ☐ **Not required by County.**

Minimum Limits:
☒ Oregon Financial Responsibility Law, ORS 806.060 ($25,000 property damage/$50,000 bodily injury $5,000 personal injury).
☒ $500,000 Per occurrence limit for any single claimant; and
☒ $1,000,000 Per occurrence limit for multiple claimants
☐ Exclusion Approved by Risk Manager

B. ADDITIONAL INSURED. The Commercial General Liability insurance required under this Contract shall include Marion County, its officers, employees, and agents as Additional Insureds but only with respect to Contractor's activities to be performed under this Contract. Coverage shall be primary and non-contributory with any other insurance and self-insurance.

C. NOTICE OF CANCELLATION OR CHANGE. There shall be no cancellation, material change, potential exhaustion of aggregate limits or non-renewal of insurance coverage(s) without 30 days written notice from this Contractor or its insurer(s) to County. Any failure to comply with the

reporting provisions of this clause shall constitute a material breach of Contract and shall be grounds for immediate termination of this Contract by County.

D. CERTIFICATE(S) OF INSURANCE. Contractor shall provide to County Certificate(s) of Insurance for all required insurance before delivering any Goods and performing any Services required under this Contract. The Certificate(s) must specify all entities and individuals who are endorsed on the policy as Additional Insured (or Loss Payees). Contractor shall pay for all deductibles, self-insured retention, and self-insurance, if any.

25. NOTICE

Except as otherwise expressly provided in this Contract, any communications between the parties hereto or notices to be given hereunder shall be given in writing, to Contractor or County at the address or email set forth below or to such other addresses or emails as either party may hereafter indicate in writing. Delivery may be by personal delivery, or mailing the same, postage prepaid.

A. Any communication or notice by personal delivery shall be deemed delivered when actually given to the designated person or representative.

B. Any communication or notice mailed shall be deemed delivered five (5) days after mailing. Any notice under this Contract shall be mailed by first class postage delivered to:

To Contractor:
Legacy Wireless Services, Inc.
jkramer@legacy-wireless.com
15580 SE For Mor Court
Clackamas, OR, 97015

To County
Contracts and Procurement Manager
PO_Contracts@co.marion.or.us
555 Court Street NE, Suite 4247
P.O. Box 14500
Salem, Oregon 97309

26. SURVIVAL

All rights and obligations shall cease upon termination or expiration of this Contract, except for the rights and obligations set forth in sections 3, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26 and 27.

27. SEVERABILITY

If any term or provision of this Contract is declared illegal or in conflict with any law by a court of competent jurisdiction, the validity of the remaining terms and provisions that shall not be affected and the rights and obligations of the parties shall be construed and enforced as if the Contract did not contain the particular term or provision held to be invalid.

28. AMENDMENTS

This Contract may be amended if mutually agreed to by both parties.

A. Anticipated Amendments
This Contract is anticipated to be amended for the following reasons:

i. To extend the Contract term and increase the maximum not-to-exceed amount to cover those extension term.

ii. To adjust the unit pricing or other rate(s) of compensation, set forth in Exhibit A.

B. Unanticipated Amendments
All other amendments for purposes not listed as Anticipated Amendments will be deemed Unanticipated Amendments.

29. CONTRACTOR'S REPRESENTATIONS AND WARRANTIES

Contractor represents and warrants to County that:

A. Contractor has the power and authority to enter into and perform this Contract.

B. This Contract, when executed and delivered, is a valid and binding obligation of Contractor, enforceable in accordance with its terms.

C. Contractor (to the best of Contractor's knowledge, after due inquiry), for a period of no fewer than six calendar years preceding the effective date of this Contract, faithfully has complied with:

i. All tax laws of this state, including but not limited to ORS 305.620 and ORS chapters 316, 317, and 318;

ii. Any tax provisions imposed by a political subdivision of this state that applied to Contractor, to Contractor's property, operations, receipts, or income, or to Contractor's performance of or compensation for any work performed by Contractor;

iii. Any tax provisions imposed by a political subdivision of this state that applied to Contractor, or to goods, services, or property, whether tangible or intangible, provided by Contractor; and

iv. Any rules, regulations, charter provisions, or ordinances that implemented or enforced any of the foregoing tax laws or provisions.

D. Any Goods/Items/Equipment/Components/Hardware delivered to County under this Contract, and Contractor's Services rendered in the performance of Contractor's obligations under this Contract, shall be provided to County free and clear of any and all restrictions on or conditions of use, transfer, modification, or assignment, and shall be free and clear of any and all liens, claims, mortgages, security interests, liabilities, charges, and encumbrances of any kind.

30. CERTIFICATIONS AND SIGNATURE. THIS CONTRACT MUST BE SIGNED BY AN AUTHORIZED REPRESENTATIVE OF CONTRACTOR

The undersigned certifies under penalty of perjury both individually and on behalf of Contractor is a duly authorized representative of Contractor, has been authorized by Contractor to make all representations, attestations, and certifications contained in this Contract and to execute this Contract on behalf of Contractor.

MARION COUNTY SIGNATURES
BOARD OF COMMISSIONERS:

_____

Chair Date

_____

Commissioner Date

_____

Commissioner Date

Authorized Signature: Brian Nicholas
Brian Nicholas (Sep 22, 2026 14:21:58 PDT) 09/22/2026
Department Director or designee Date

Authorized Signature: Jan Fritz
Jan Fritz (Sep 23, 2026 09:08:07 PDT) 09/23/2026
Chief Administrative Officer Date

Reviewed by Signature: 09/22/2026
Marion County Legal Counsel Date

Reviewed by Signature: 09/22/2026
Marion County Contracts & Procurement Date

LEGACY WIRELESS SERVICES, INC. SIGNATURE

Authorized Signature: _____
Date

Title: _____

EXHIBIT A
STATEMENT OF WORK

1. STATEMENT OF SERVICES

Contractor shall perform Services as described below.

A. GENERAL INFORMATION.

County requires a qualified and experienced Contractor to provide radio communication tower climbing, antenna installation, inspection, and maintenance services for a network of up to fifteen (15) radio communication tower sites throughout Marion County. Contract services will support the ongoing deployment of Marion County's public safety radio communication system.

i. Phase 1

a. Contractor shall install all tower appurtenances including, but not limited to radio frequency (RF) and microwave (MW) equipment, supplied to Contractor by County's radio system vendor and County. All tower appurtenances are currently stored at the County's Crosby Maintenance Yard located at 17451 Ralph Lane, Woodburn, Oregon 97071. Contractor shall pickup said appurtenances and deliver them to each specific site in accordance with Section A - Project Locations of this Exhibit A.

b. Contractor shall perform the following services:
   (1) Install antennas, transmission lines, mounts, and accessories.
   (2) Custom fabricate mounts or components when required.
   (3) Cable management, including routing, labeling, and securing.
   (4) RF-safe climbing and coordination with live radio systems.
   (5) Install cabinets with locking mechanisms and secure wall mounting, as applicable.
   (6) Provide photo documentation of work performed per site and task.
   (7) Commission and test installed equipment.

c. Refer to **Supplementals 1 through 12 – RF Sub-System and Site Design Documents** and **Exhibit B – Tower Appurtenance List** for detailed tower dimensions, mounting locations, cable pathways, and appurtenance configurations specific to each site.

d. Refer to **Exhibit D – Specifications Sheets** for additional requirements.

e. Contractor must install and mount all appurtenances in adherence to requirements defined in **Exhibit C – Tower Work Requirements**, which includes compliance with structural integrity standards, secure cabinet enclosures, and cable routing practices.

Project Locations – The project includes the following work locations:

Radio Site	Tower Location		Type	New or Existing	Owner
	Lat	Long			
APW	N 44° 46' 52.2"	W 122° 26' 52.1"	Lattice	New	Marion County
Crooked Finger	N 44° 58' 24.5"	W 122° 36' 02.1"	Lattice	New	Marion County
Crosby Road	N 45° 10' 17.3"	W 122° 52' 12.0"	Lattice	Exist	Marion County
Eagle Crest	N 44° 58' 59.0"	W 123° 8' 35.0"	Lattice	Exist	Polk County
Eastview	N 44° 59' 40.8"	W 122° 45' 57.8"	Monopole	Exist	SBA Comms

Halls Ridge	N 44° 43' 09.9"	W 122° 13' 03.0"	Guyed	Exist	American Tower
House Mountain	N 44° 50' 28.4"	W 122° 28'58.9"	Lattice	New	Marion County
Lower Prospect	N 44° 50' 47.6"	W 123° 06' 39.8"	Lattice	New	Marion County
Marion County Public Works	N 44° 58' 30.7"	W 122° 57' 18.8"	Monopole	Exist	Crown Castle
McCully Mountain	N 44° 45' 48.8"	W 122° 37' 56.0"	Lattice	New	Marion County
METCOM 911	N 45° 09' 03.4"	W 122° 50' 36.5"	Monopole	Exist	Woodburn
Parrett Mountain	N 45° 18' 23.2"	W 122° 53' 35.1"	Lattice	Exist	WCCCA
SCC	N 44° 47' 46.2"	W 122° 48' 52.4"	Lattice	Exist	METCOM 911
Wipper	N 44° 46' 58.5"	W 122° 59' 48.3"	Lattice	New	Marion County
WVCC	N 44° 56' 38.4"	W 123° 1' 55.2"	Lattice	Exist	Salem

ii. Phase 2 - Reserved

B. REQUIRED SERVICES, DELIVERABLES AND DELIVERY SCHEDULE.

i. Provide all materials, labor, equipment, tools, supervision, coordination, transportation and incidental materials necessary for the installation of all tower-mounted equipment and appurtenances identified in **Exhibit B** and further described in **Exhibit C**, including but not limited to the services of one or more experienced and certified tower-climbing crew knowledgeable in the proper mounting, alignment and configuration of tower-mounted RF and MW equipment.

ii. Perform all work in accordance with the equipment manufacturer's published installation requirements and applicable provisions of **Exhibit D**. Each piece of installed RF and MW equipment shall be complete, functional, secure and aligned as specified, including but not limited to the installation of all associated wiring, wave guide, equipment grounding, cable clips and miscellaneous consumables incidental to the proper installation of the specified equipment.

iii. Contractor shall provide all hoisting equipment that may be necessary to complete the Services.

iv. Transportation, Delivery and Storage of Materials and Equipment –

a. Contractor, or its authorized representative, shall deliver to each Project site the antennas, microwave dishes, ice shields, electrical cabling, wave guide and related materials and equipment on dates and times mutually agreed upon by County and Contractor.

b. Contractor shall take receipt of the delivered equipment and, thereafter, shall be responsible for the proper field storage of equipment until installation is complete.

c. Contractor shall be responsible for the delivery of the mounting kits, hardware and related appurtenances to each project site and for proper storage until installation is complete.

d. After delivery, Contractor shall be responsible to repair or replace materials and equipment damaged or lost due to theft, vandalism or improper field storage.

e. County shall make all tower appurtenances available for pickup by Contractor at Marion County's Crosby Maintenance Yard located at 17451 Ralph Lane, Woodburn, Oregon. County will provide a forklift and operator to assist with the loading of materials, if necessary.

v. Schedule of Services – Contractor shall complete all Phase 1 Services according to the following schedule:
   a. Contractor shall complete all tower-mounted installations no later than **March 1, 2027**.

C. SPECIAL REQUIREMENTS. Contractor shall be solely responsible for and shall have control over the means, methods, techniques, sequences, and procedures of performing the work, subject to the plans and specifications under this Contract and shall be solely responsible for the errors and omissions of its employees, subcontractors, and agents.
Contractor has the skill and knowledge possessed by well-informed members of its industry, trade or profession and Contractor will apply that skill and knowledge with care and diligence and perform Services in a timely, professional, and workmanlike manner in accordance with standards applicable to Contractor's industry, trade or profession.

2. COMPENSATION

The total amount available for payment to Contractor under Exhibit A, section 2.A and for authorized reimbursement to Contractor under Exhibit A, section 2.C is **$254,187.00.**

A. METHOD OF PAYMENT FOR SERVICES: County shall pay Contractor the following:

i. Materials Pickup and Delivery – **$3,162.00** for material pickup and delivery of all appurtenances.

ii. Tower Climbing Crew - **$3,347.00** per workday. The total number of Tower Climbing Crew workdays shall not exceed 75 workdays.

B. BASIS OF PAYMENT FOR SERVICES. County shall pay Contractor monthly progress payments upon County's approval of Contractor's invoice submitted to County for completed Services, but only after County has determined that Contractor has completed, and County has accepted the completed Services.

C. EXPENSE REIMBURSEMENT. County will not reimburse Contractor for any expenses under this Contract.

D. GENERAL PAYMENT PROVISIONS. Notwithstanding any other payment provision of this Contract, failure of Contractor to submit required reports when due, or failure to perform or document the performance of contracted services, may result in withholding of payments under this Contract. Such withholding of payment for cause shall begin thirty (30) days after written notice is given by County to Contractor, and shall continue until Contractor submits required reports, performs required services or establishes, to County's satisfaction, that such failure arose out of causes beyond the control, and without the fault or negligence of Contractor.

E. INVOICES. Contractor shall send all invoices to County's Contract Administrator at the address specified below or to any other address as County may indicate in writing to Contractor.

Marion County
Attn: Public Works Department, Alicia Jones
5155 Silverton Rd NE
Salem, OR 97305
PWAP@co.marion.or.us

Exhibit B - Tower Appurtenance List by Site (Microwave Dishes)

Site Information									Antenna Information					Radio Information				
	Site Name	Latitude	Longitude	Tower Type	Tower Height (ft)	Ground Elevation (ft)	Path Azimuth	Path Length (mi)	Manufacturer	Model	Diameter (ft)	Tilt	Centerline	Radio Code	Manufacturer	Model	TX Line Model	TX Line Length (ft)
Path	House Mountain	44 50 28.39 N	122 28 58.79 W	Self Supporting	180	3947.5	259.307	16.588	Andrew	VHLP4-11WA	4	-2.3	85	M11BT8-11	Aviat	WTM 4100 ODU	EW90	52
	SCC	44 47 46.19 N	122 48 52.31 W	Self Supporting	90	441.4	79.073	16.588	Andrew	VHLP4-11WA	4	2.2	86	M11BT8-11	Aviat	WTM 4100 ODU	EW90	116
Path	McCully Mountain	44 45 49.05 N	122 37 55.36 W	Self Supporting	180 (New)	1613.9	82.35	9.136	Andrew	VHLP3-11WA	3	1.1	95	M11BT8-11	Aviat	WTM 4100 ODU	EW90	130
	APW	44 46 51.92 N	122 26 52.55 W	Self Supporting	180 (New)	2570.82	262.48	9.136	Andrew	VHLP3-11WA	3	-1.15	65	M11BT8-11	Aviat	WTM 4100 ODU	EW90	100
Path	McCully Mountain	44 45 49.05 N	122 37 55.36 W	Self Supporting	180 (New)	1613.9	274.382	17.983	Andrew	VHLP6-6WB	6	-0.4	80	M11BT8-11	Aviat	WTM 4100 ODU	EW63	115
	Wipper	44 46 58.59 N	122 59 47.93 W	Self Supporting	180 (New)	1068.8	94.125	17.983	Andrew	VHLP6-6WB	6	0.2	80	M11BT8-11	Aviat	WTM 4100 ODU	EW63	115
Path	Wipper	44 46 58.59 N	122 59 47.93 W	Self Supporting	180 (New)	1068.8	332.526	15.582	Andrew	VHLP6-6WB	6	-0.1	135	M11BT8-11	Aviat	WTM 4100 ODU	EW63	170
	Eagle Crest	44 58 59.00 N	123 8 36.00 W	Self Supporting	150	1078.7	152.49	15.582	Andrew	VHLP6-6WB	6	-0.06	90	M11BT8-11	Aviat	WTM 4100 ODU	EW63	140
Path	Crosby	45 10 17.13 N	122 52 12.09 W	Self Supporting	180	183.79	353.13	9.391	Andrew	VHLP3-11WA	3	1.2	107	M11BT8-11	Aviat	WTM 4100 ODU	EW90	147
	Parrett Mountain	45 18 23.15 N	122 53 35.07 W	Monopole	150	1215.35	173.114	9.391	Andrew	VHLP3-11WA	3	-1.3	136	M11BT8-11	Aviat	WTM 4100 ODU	EW90	161
Path	House Mountain	44 50 28.39 N	122 28 58.79 W	Self Supporting	180	3947.5	157.443	4.496	Andrew	VHLP2-18D	2	-3.3	75	M18B16	Aviat	WTM 4100 ODU	EW180-180	85
	APW	44 46 51.92 N	122 26 52.55 W	Self Supporting	180 (New)	2570.82	337.47	4.496	Andrew	VHLP3-18A	3	3.3	60	M18B16	Aviat	WTM 4100 ODU	EWP180-180	95
Path	Halls Ridge	44 43 11.18 N	122 13 3.52 W	Guyed	125	4400.1	290.568	12.097	Andrew	VHLP4-11WA	4	-1.7	90	M11BT8-11	Aviat	WTM 4100 ODU	EW90	120
	APW	44 46 51.92 N	122 26 52.55 W	Self Supporting	180 (New)	2570.82	110.407	12.097	Andrew	VHLP4-11WA	4	1.6	60	M11BT8-11	Aviat	WTM 4100 ODU	EW90	90
Path	Eagle Crest	44 58 59.00 N	123 8 36.00 W	Self Supporting	150	1078.7	116.38	6.088	Andrew	VHLP3-11WA	3	-1.7	105	M11BT8-18	Aviat	WTM 4100 ODU	EW90	150
	WVCC	44 56 38.56 N	123 1 55.08 W	Self Supporting	90	157.93	296.46	6.088	Andrew	VHLP3-11WA	3	1.6	87	M11BT8-18	Aviat	WTM 4100 ODU	EW90	147
Path	Courthouse	44 56 23.47 N	123 2 10.19 W	Non Pen Roof Mount	Roof Mount	154.22	35.42	0.355	Andrew	VHLP2-18D	2	-0.9	99	M18B16	Aviat	WTM 4100 ODU	Cat5 (POE)	115
	WVCC	44 56 38.56 N	123 1 55.08 W	Self Supporting	90	157.93	215.423	0.355	Andrew	VHLP2-18D	2	0.9	65	M18B16	Aviat	WTM 4100 ODU	EWP180-180	172
Path	MCPW (Tech Shop)	44 58 28.29 N	122 57 27.03 W	Self Supporting Rohn	48	189.4	67.791	0.123	Andrew	VHLPX1-23C	1	2.3	35	M23F81	Aviat	WTM 4100 ODU	EW220	45
	MCPW (DISP)	44 58 30.71 N	122 57 18.68 W	Monopole	145	200.8	247.793	0.123	Andrew	VHLPX1-23C	1	-2.3	50	M23F81	Aviat	WTM 4100 ODU	EW220	110
Path	Metcomm	45 9 3.42 N	122 50 36.52 W	Monopole	150	186.2	347.315	11.006	Andrew	VHLP4-11WA	4	1	114	M11BT8-11	Aviat	WTM 4100 ODU	EW90	214
	Parrett Mountain	45 18 23.15 N	122 53 35.07 W	Monopole	150	1215.35	167.28	11.006	Andrew	VHLP4-11WA	4	-1.1	114	M11BT8-11	Aviat	WTM 4100 ODU	EW90	140
Path	Eastview	44 59 40.82 N	122 45 57.57 W	Monopole	140	581	340.67	11.438	Andrew	VHLP4-11WA	4	-0.4	132	M11BT8-11	Aviat	WTM 4100 ODU	EW90	214
	Metcomm	45 9 3.42 N	122 50 36.52 W	Monopole	150	186.2	160.615	11.438	Andrew	VHLP4-11WA	4	0.3	135	M11BT8-11	Aviat	WTM 4100 ODU	EW90	140
Path	Eastview	44 59 40.82 N	122 45 57.57 W	Monopole	140	581	100.166	8.241	Andrew	VHLP3-11WA	3	1.7	127	M11BT8-11	Aviat	WTM 4100 ODU	EW90	167
	Crooked Finger	44 58 24.56 N	122 36 1.84 W	Self Supporting	180 (New)	1883.9	280.283	8.241	Andrew	VHLP3-11WA	3	-1.8	178	M11BT8-11	Aviat	WTM 4100 ODU	EW90	225
Path	MCPW (DISP)	44 58 30.71 N	122 57 18.68 W	Monopole	145	200.8	90.263	17.385	Andrew	VHLP6-6WB	6	1	75	M06215-13	Aviat	WTM 4100 ODU	EW90	167
	Crooked Finger	44 58 24.56 N	122 36 1.84 W	Self Supporting	180 (New)	1883.9	270.514	17.835	Andrew	VHLP6-6WB	6	-1.2	120	M06215-13	Aviat	WTM 4100 ODU	EW90	225
Path	MCPW (DISP)	44 58 30.71 N	122 57 18.68 W	Monopole	145	200.8	220.81	11.716	Andrew	VHLP4-11WA	4	0.7	68	M11BTB-11	Aviat	WTM 4100 ODU	EW90	128
	Lower Prospect	44 50 48.04 N	123 6 39.80 W	Self Supporting	180(New)	1006.1	40.7	11.716	Andrew	VHLP4-11WA	4	-0.9	130	M11BT8-11	Aviat	WTM 4100 ODU	EW90	165
Path	Lower Prospect	44 50 48.04 N	123 6 39.80 W	Self Supporting	180(New)	1006.1	103.356	14.984	Andrew	VHLP6-6WB	6	-0.5	150	M06215-13	Aviat	WTM 4100 ODU	EW90	128
	SCC	44 47 46.19 N	122 48 52.31 W	Self Supporting	90	441.4	283.565	14.984	Andrew	VHLP6-6WB	6	0.4	71	M06215-13	Aviat	WTM 4100 ODU	EW90	165
Path	Crosby	45 10 17.13 N	122 52 12.09 W	Self Supporting	180	183.79	225.888	18.655	Andrew	VHLP6-6WB	6	0.4	141	M06F61	Aviat	WTM 4100 ODU	EW63	181
	Eagle Crest	44 58 59.00 N	123 8 36.00 W	Self Supporting	150	1078.7	45.695	18.655	Andrew	VHLP6-6WB	6	0.6	117	M06F61	Aviat	WTM 4100 ODU	EW63	162

Exhibit B - Tower Appurtenance List by Site (RF Antennas)

Site	Description	Part Number	Length	Leg/Face	Base Height	CL Height	Tip Height	Antenna Azimuth	Mount	Transmission Line	Transmission Line Length
APW	TX Antenna	SE414-SWBPALDF(D00)	4.4	B	162	164	166	45	Site-Pro PSA-6 (6' standoff)	7/8"	200
	RX Antenna	CC807-09	10.3	B	179	184	189	None	Standard	1/2" to TTA	10
	TTA	NPD3633A-TTA	1	B	176	177	177	None	Standard	7/8"	220
Crooked Finger	TX Antenna	SE414-SWBPALDF(D00)	4.4	B	162	164	166	145	Site-Pro PSA-6 (6' standoff)	7/8"	200
	RX Antenna	CC807-09	10.3	B	179	184	189	None	Standard	1/2" to TTA	10
	TTA	NPD3633A-TTA	1	B	176	177	177	None	Standard	7/8"	220
Crosby	TX Antenna	CC807-09	10.3	C	159	164	169	None	Site-Pro PSA-6 (6' standoff)	7/8"	200
	RX Antenna	CC807-09	10.3	C	179	184	189	None	Standard	1/2" to TTA	10
	TTA	NPD3633A-TTA	1	C	176	177	177	None	Standard	7/8"	220
Eagle Crest	TX Antenna	SE414-SWBPALDF(D00)	4.4	B	123	125	127	90	Face Mount w/ Standoff	7/8"	153
	RX Antenna	CC807-09	10.3	C	140	145	150	None	Face Mount w/ Standoff	1/2" to TTA	10
	TTA	NPD3633A-TTA	1	C	137	138	138	None	Standard on Face Mount	7/8"	187
Eastview	TX Antenna	SE414-SWBPALDF(D00)	4.4	SE	103	105	107	165	Site-Pro PSA-6 (6' standoff)	7/8"	133
	RX Antenna	CC807-09	10.3	SE	120	125	130	None	Standard	1/2" to TTA	10
	TTA	NPD3633A-TTA	1	SE	117	118	118	None	Standard	7/8"	147
Halls Ridge	TX Antenna	SE414-SWBPALDF(D00)	4.4	A	59	61	63	90	Site-Pro PSA-6 (6' standoff)	7/8"	100
	RX Antenna	CC807-09	10.3	A	76	81	86	None	Standard	1/2" to TTA	10
	TTA	NPD3633A-TTA	1	A	73	74	74	None	Standard	7/8"	120
House Mountain	TX Antenna	SE414-SWBPALDF(D00)	4.4	B	162	164	166	165	Site-Pro PSA-6 (6' standoff)	7/8"	200
	RX Antenna	CC807-09	10.3	B	179	184	189	None	Standard	1/2" to TTA	10
	TTA	NPD3633A-TTA	1	B	176	177	177	None	Standard	7/8"	240
Lower Prospect	TX Antenna	CC807-09	10.3	B	159	164	169	165	Site-Pro PSA-6 (6' standoff)	7/8"	189
	RX Antenna	CC807-09	10.3	B	179	184	189	None	Standard	1/2" to TTA	10
	TTA	NPD3633A-TTA	1	B	176	177	177	None	Standard	7/8"	206
McCully Mountain	TX Antenna	SE414-SWBPALDF(D00)	4.4	B	162	164	166	105	Site-Pro PSA-6 (6' standoff)	7/8"	200
	RX Antenna	CC807-09	10.3	B	179	184	189	None	Standard	1/2" to TTA	10
	TTA	NPD3633A-TTA	1	B	176	177	177	None	Standard	7/8"	240
Parrett Mountain	TX Antenna	SE412-SWBP4LDF(D00)	1.8	SW	89	90	91	225	Site-Pro PSA-6 (6' standoff)	7/8"	119
	RX Antenna	CC807-09	10.3	SW	105	110	115	None	Standard	1/2" to TTA	10
	TTA	NPD3633A-TTA	1	SW	102	103	103	None	Standard	7/8"	132
Wipper	TX Antenna	SE414-SWBPALDF(D00)	4.4	C	162	164	166	180	Site-Pro PSA-6 (6' standoff)	7/8"	192
	RX Antenna	CC807-09	10.3	C	179	184	189	None	Standard	1/2" to TTA	10
	TTA	NPD3633A-TTA	1	C	176	177	177	None	Standard	7/8"	206

Exhibit C - Tower Work Requirements

150	3.19 ANTENNAS AND MOUNTS	
151	3.19.A.	Communication antennas, regardless installation location, will be erected plumb, level, and square unless specifically noted in the design (e.g., mechanical down tilt antennas). Proposer will supply antenna mounts and all attachment hardware required to install antennas. If fabrication is necessary, antenna mounting hardware will be hot dipped galvanized after fabrication. Antenna mounting hardware will be hot dipped galvanized or stainless-steel material. Heavy wall conduit (already galvanized) may be used when mounting antennas to buildings, wooden poles, or other non-tower structures. Exterior utilization of electrogalvanized or plated material for mounting of antennas is not permissible.
152	3.19.B.	Galvanizing on any antenna support that is heavily scratched, saw cut, drilled, or destroyed in any manner, damaged area will be repaired using cold galvanizing compound.
153	3.19.C.	Antenna mounting hardware must provide a complete contact bond between antenna and mount.
154	3.19.D.	The manufacturer recommended bending radius specifications will not be exceeded. No connectors will fall within, or be obscured by any antenna support pipe or conduit run when making antenna feed line installations inside of support pipes or conduit runs.
156	3.19.E.1.	Where feed line support systems have not been provided, cable ladder or angle mount clamps will be installed to support feedline using cushions or similar mounting approach.
157	3.19.E.2.	Locations where galvanized pipe or electrical conduit are used for mounting antennas, the external feed line runs may be secured by the utilization snap in hangers.
158	3.19.E.3.	Locations where wooden utility poles are used for mounting of antennas, antenna feed line may be secured by using jiffy clips, one hole pipe straps or rigid conduit straps.
159	3.19.E.4.	No ty-wraps of any sort, twisted wire, electrical tape, duct tape, string, or rope.
160	3.19.F.	When installing antenna feed line, antenna feed line will not be attached to any individual antenna feed line already installed. Attachment methods will encompass all antenna feed line runs and antenna feed line support. Attachment intervals will follow requirements within this RFP or manufacturer recommendations.
161	3.19.G.	Use of cable trays or messenger cable for antenna feed line support will be considered on an as needed basis. All antenna feed line runs will be secured to messenger or cable tray by utilization of stainless-steel snap in hangers.
162	3.19.H.	Antenna feed line inside buildings (where cable trays are provided) may be secured by black nylon cable ties. Where cable trays are not provided, the use of jiffy clips, one hole pipe straps, rigid conduit straps, Unistrut and Unistrut clamps, or black nylon cable ties are permitted to secure antenna feed line runs. Utilization of electrogalvanized or plated material inside of buildings is permitted.
163	3.19.I.	Antenna feed lines will have cable identification tags denoting corresponding antennas. Each antenna and transmission line will be identified with colored tape bands and brass tags supplied and installed by Proposer.
164	3.19.J.	Place colored tape bands on antennas, near the ends of each cable and jumper, and on cables on both sides of building entrances, panels, and on both sides of cable inside the building.
165	3.19.K.	Color tape will be 3M 7mil Scotch 35 Vinyl Electrical Color-Coding Tape.
166	3.19.L.	Place 1.5” diameter round blank brass tags (Brady Catalog #23211) near ends of each cable. Each brass tag will be customized to clearly identify each run of cable utilizing ¼” steel stamps for letter and number sets (Brady Catalog #23240 and #23241).
167	3.19.M.	Continuous, ¼-inch-wide, Type 316 stainless-steel strapping (Brady Catalog #42331) and stainless-steel banding heads (Brady Catalog #90910) utilizing a proper banding tool (Brady Catalog #42322) will be used to secure brass tags at connector ends.
168	3.19.N.	Antenna feed line entryways will be sealed. All entryways will be filled to near capacity prior to starting a new opening. Microwave waveguide installations may dictate special consideration. Proposer will provide appropriate cable boots and closures on any new cable entry both interior and exterior building.
169	3.19.O.	Antennas supported by wooden poles, electrical conduit, pipe mounted to building sides, or through roofs will use some type of grounding system. Where possible, this type of support should have an AWG #2 wire running to an adequate grounding system or grounding rod.
170	3.19.P.	Antenna feed lines will require frequency appropriate Bulkhead Coaxial RF Surge Protectors mounted horizontally in line with antenna line entry ports. Proposers are not allowed to install RF surge protectors in free air space and will be securely mounted to a grounding bus bulkhead. Failure to do so will result in Proposer re-installing equipment at Proposers cost.
171	3.19.Q.	Antenna grounds will comply with TIA-607-B or Proposer approved equivalent.
172	3.19.R.	After ground installation, work will be wrapped with overlapping layers of black outdoor electrical tape and protected with Scotchkote or equivalent outdoor coating. A minimum of three layers of protection will be applied.

208	4.5 MATERIALS	
210	4.5.A.1.	Structural-Steel Shapes: ASTM A 36/A 36M or ASTM A 529/A 529M
211	4.5.A.2.	Steel Plate, Bar, or Strip: ASTM A 529/A 529M, ASTM A 570/A 570M, or ASTM A 572/A 572M; 50,000-psi minimum yield strength
212	4.5.A.3.	Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 50, with G60 coating designation; mill phosphatized
213	4.5.A.4.	Metallic-Coated Steel Sheet Pre-painted with Coil Coating: Steel sheet metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A755/A755M and following requirements:
214	4.5.A.5.	Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality
215	4.5.A.6.	Color: To be specified Marion County from manufacturer's samples
216	4.5.A.7.	Non-High-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A; carbon-steel, hex-head bolts; carbon-steel nuts; and flat, unhardened steel washers
217	4.5.A.8.	Finish: Hot-dip zinc coating, ASTM A 153, Class C
218	4.5.A.9.	High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers
219	4.5.A.10.	Finish: Hot-dip zinc coating, ASTM A 153, Class C
220	4.5.A.11.	Anchor Rods, Bolts, Nuts, and Washers
221	4.5.A.12.	Finish: Hot-dip zinc coating, ASTM A 153, Class C
222	4.5.A.13.	Anchor Rods, Bolts, Nuts, and Washers
223	4.5.A.14.	Finish: Hot-dip zinc coating, ASTM A 153, Class C
225	4.5.A.16.	Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer; complying with performance requirements of FS TT-P-664
226	4.5.A.17.	Metallic-Coated Steel Sheet Pre-painted with Coil Coating: Steel sheet metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A755/A755M and the following requirements:
227	4.5.A.18.	Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality
228	4.6 ANTENNA MOUNTS	
229	4.6.A.	Tower antenna mounts will be furnished and installed by Proposer. Marion County and Proposer will agree on antenna mounting hardware, elevation, azimuth, and other technical parameters prior to installation.
230	4.6.B.	Proposers will supply all antenna mounting hardware required to fasten or install antenna(s).
231	4.7 TRANSMISSION LINE SUPPORTS	
232	4.7.A.	Transmission line supports will be furnished and installed by Proposer as needed.
233	4.7.B.	Transmission lines will be installed and supported following cable manufacturer instructions, vertical distance between supports will be limited to between 36 and 42 inches with 36 inches preferred.
234	4.7.C.	Transmission lines will be routed to an in-ground cable trench or an overhead ice- bridge depending on site conditions.
596	6.21 ANTENNA AND TRANSMISSION LINES	
597	6.21.A.	All transmission antenna system components will be rated as low PIM (passive intermodulation) by the manufacturer. Type "N" connectors will not be used. If type "N" connectors are part of the proposed design, the Proposer will justify the use and the County's Project Manager will approve prior to installation. All lines will require PIM testing post installation.
598	6.21.B.	The 700/800 MHz base/repeater antennas furnished as part of the system will be designed to produce uniform signal strength on the ground from the antenna site to the horizon. Heavy null fill is required to assure close in coverage. Polarization will be vertical.
599	6.21.C.	In all cases, antennas will be chosen to provide the best balance for system transmission and reception. Proposer will state the number of antennas required for the proposed system configuration.
601	6.21.D.1.	Antenna gain: As required.
602	6.21.D.2.	Radiation Pattern: As required.
603	6.21.D.3.	Down Tilt Angle: As required.
604	6.21.D.4.	Rated Power Input: 500 watts minimum or more as required by the system design.
605	6.21.D.5.	Wind Rating: 120MPH minimum.

606	6.21.D.6.	VSWR: 1.5 to 1 maximum.
607	6.21.D.7.	Antenna Termination: 7/16DIN connectors will be used. Nickel or chrome plated connectors will not be used due to oxidation issues.
608	6.21.D.8.	Cable Termination: 7/16DIN or 4.3-10 connectors (cable to jumper or equipment) connector will be used. Nickel or chrome plated connectors will not be used due to oxidation issues.
609	6.21.D.9.	Operating Frequency: As designated.
610	6.21.D.10.	Bandwidth: 5MHz minimum.
611	6.21.E.	Antenna will be supplied with mounting brackets, mast, and all other suitable mounting hardware for top or side mounting on a mast or tower. All brackets, mast, clamps, and hardware will be of a suitable galvanized steel material to minimize corrosion and rust. Proposer will state in proposals, the material to be used. Proposer will supply the specific tower mounting structure and tower mounts as required by antenna locations indicated in Proposals. Proposer will supply the hardware to mount to the tower mounts.
613	6.21.F.1.	Transmission Line – Transmit and Receive: CommScope AVA or LDF series, ½”, 7/8”, 1-1/4”, 1-5/8”, or 2-1/4” jacketed foam dielectric, Helix or equivalent.
614	6.21.F.2.	Impedance: 50ohms.
615	6.21.F.3.	Outer Conductor: Solid copper.
616	6.21.F.4.	Grounding Kit: Kits will be furnished and installed to bond transmission lines at both the top and bottom of towers and at the bottom of non-tower (buildings) sites and at intervals not to exceed 75 feet along the transmission line between the top and bottom. Kits will be furnished and installed at all building entry points. Proposer will use preferred manufactures grounding kits and cable water proofing.
617	6.21.F.5.	Hoisting Grip: The grips will be used at maximum 100-foot intervals for raising the transmission line on the structure.
618	6.21.F.6.	Cable Clamps: Microflect/Valmont system of boots and cushions or equivalent will be used to attach the transmission line to the antenna support structure at intervals not to exceed the manufacturer’s published recommendations.
619	6.21.F.7.	Connectors: High-quality connectors required for each transmission line will be designed for use at 700/800 MHz and will be used at all installations. Nickel or chrome plated connectors will not be used. Proposer will use coaxial cable manufacturers connectors where applicable.
620	6.21.F.8.	Lightning Protection: Appropriate PolyPhaser, or approved equivalent, type entrance devices and lightning protectors will be provided at all locations. Lightning arrestors will be configured with Male and Female connectors to allow the removal of a failed lightning arrestor and direct reconnection of the coax cables without the use of a barrel connector. Bulkhead type Polyphasers will be provided with an appropriate grounding bus where applicable.
621	6.21.F.9.	Connectors for equipment end of the transmission line will be field installed with manufacturers stripping, crimping, cutting, and cleaning tools. Use of pocketknives, razor blades, and hand stripping tools is strictly prohibited.
622	6.21.F.10.	All RF connectors will be labeled appropriately using either heat shrink labels or sticker to identify transmission lines. All RF connectors will utilize thermoplastic adhesive heat shrink interior and exterior.
623	6.21.F.11.	All transmission line runs will be calculated for a length of 200 feet for each site, and costs will be proposed on this basis. The exact length of line for each site will be determined and supplied by Seller incidental to the Contract Price.
624	6.21.F.12.	Equipment in-building interconnecting cables may be 1/4” or 1/2” Superflex coaxial cable to interconnect transmitter, combiner, receiver multicoupler, and antenna system transmission lines. However, all equipment in-building interconnecting cables will be either solid jacketed or double-shielded.
625	6.21.F.13.	Proposer will not use LMR 200, 240, 400, etc. in any transmit or receive lines, interior or exterior. This includes, but not limited to; repeater connections to combining equipment, precision time clocks, exterior antennas, TTA’s and all other cables transmitting and/or receiving RF energy.
626	6.21.F.14.	Proposer will be required to fault test cables in rack installations.
627	6.21.F.15.	Proposer will be required to supply line loss figures in transmit and receive lines post installation at point of origin (equipment).
628	6.21.F.16.	Proposer will be required to validate “actual” line loss figures against design engineered loss figures and make system adjustments accordingly. Proposer will be required to document and record any changes made post installation.

943	8.1 INSTALLATION	
944	8.10.A.	Proposer will be responsible for shipping costs, storage, and other transport required for equipment proposed.
945	8.10.B.	Electronic equipment is to be mounted on the ground in environmentally controlled equipment shelter. Standard 19-inch mounting racks within the shelter will be provided by Marion County. Mounting space will be near, but not necessarily adjacent to any current mounting locations of pre-existing microwave equipment. Marion County will provide adjacent mounting space wherever possible.
946	8.10.C.	Electronic equipment, transmission lines, equipment racks, antennas, and tower and building attachments will be grounded in accordance with TIA-607-B or equivalent and local building codes. Electrical work will be performed by Marion County approved licensed electricians and completed by standards adopted by National Electrical Code (NEC).
947	8.10.D.	Antenna feed points, and RF transmission lines are to be dry air pressurized via a vendor provided dehydrator/compressor if applicable. Pressure/humidity faults will be reported to the Network Management System (NMS).
948	8.10.E.	Antennas and tower attachments will be installed in accordance with ANSI/TIA-222G for material, structural, wind, and ice loading in the geographical zone in which tower or other attachment structure is located.
949	8.10.F.	Old antennas, antenna mounts and mounting hardware, waveguides, waveguide tower hangers, and associated other attachments are to be removed from the tower or other structure and staged on pallets on the ground at the tower or other location post acceptance. All antennas, equipment, and attachments will be removed in current operational condition.
950	8.10.G.	Antennas, antenna mounts, hardware, waveguide, waveguide tower hangers, compressed air manifolds, air tubing, and compressors at existing facilities will be replaced with new equipment.
951	8.10.H.	Pressurized lines and waveguides will be tested to manufacturer’s specifications.
952	8.10.I.	Antenna mounts will be of the three (3) points of attachment type with stiff arm or other equally ridged configuration to prevent movement of the antenna from set path azimuth and elevation.
953	8.10.J.	Proposer will include ice mitigation in proposed design with appropriate tower loading specifications.
954	8.10.K.	Proposer will provide a list of their last five projects with references and contact information and insurance experience modification rating (EMR) for preferred installation services provider.
955	8.10.L.	Proposer's subcontractor will have experience with Pacific Northwest tower installations.
956	8.10.M.	Installation related cabling will be neat, organized, and logical fashion.

800MHz Corporate Collinear Antennas

748-870MHz

CC807 Series

These industry leading, full featured corporate collinear arrays allow site operators to combine, with complete integrity, a large number of communications services into a single, low profile antenna solution.

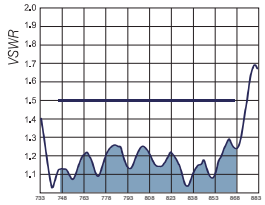
The corporate feed design employed by RFI maintains superior pattern control, allowing gain to be maximised with zero tilt variation over a very broad bandwidth, comparable to that only previously available in exposed dipole array configurations. This is achieved in the preferred form factor of a fully enclosed fibreglass radome, providing a reduction in wind loading, ice loading and tower loading in comparison.

The CC807 series have been designed with an exceptional power rating of 500W across the band as well as a Peak Instantaneous Power (PIP) rating of 25kW to cater for the peak voltage levels present in large multi-carrier combining environments. RFI's refined design processes and proven construction methods achieve a PIM rating of –150dBc, further ensuring performance is maintained for the service life of the antenna.

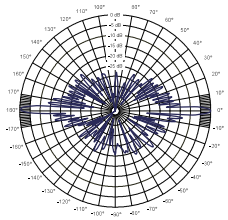
Features:

- 500W Continuous Power rating
- -150dBc Passive Intermodulation (PIM) rating, 100% PIM tested
- 25 kW Peak Instantaneous Power (PIP) rating
- DC grounding on all elements for the ultimate in lightning protection and dissipation of static noise.
- Light weight dipole construction using RFI's patented flexi-PCB architecture, maintains a low centre of gravity reducing tip deflection and sway
- Field invertible (excluding tilt models)
- Preset downtilt variations of 2 and 4 degrees available, see note (1)

Typical VSWR Response (CC807-12)



CC807-12 - E Plane



Electrical Specifications

Model Number	CC807-09-P	CC807-12-P
Nominal Gain *dBd (dBi)*	9.0 (11.1)	11.5 (13.6)
Frequency *MHz*	746-870	
Tuned Bandwidth *MHz*	Full	
VSWR *(Return Loss)*	1.5:1	
Nominal Impedance Ω	50	
Downtilt°	0 Std 2, 4 (1)	
Vertical Beamwidth°	8	4
Horizontal Beamwidth°	Omni +/- 0.5dB	
Input Power W	500	
Passive IM 3rd order (2x20W) *dBc*	-150	
Peak Instantaneous Power *kW*	25	

Mechanical

Model Number		CC807-09-P	CC807-12-P
Construction		Sky blue fibreglass radome	
Radome Diameter mm (inches)		76 (3.0)	
Length mm (inches)		3135 (123.4)	6235 (245.5)
Weight *kg (lbs)*		14 (30.9)	25.5 (56.2)
Termination		Integrated 4.3-10 Female	
Mountaing Area mm (inches)		750 x 90 (30 x 3.5) diameter Ecofilm™ plated aluminium	
Suggested Clamps		3 x UC-114	
Shipping Dimensions *mm (inches)*	H	115 (4.5)	
	W	115 (4.5)	
	L	3335 (131.3)	6435 (253.3)
Shipping Weight *kg (lbs)*		20.0 (44.1)	36.5 (80.5)
Projected area *cm² (ft²)*	No Ice	2597 (2.8)	5559 (6.0)
	With Ice	3192 (3.4)	7037 (7.6)
Lateral Thrust @160km/h *N* (100 mph lbs)		308 (69)	659 (148)
Wind Gust Rating *km/h (mph)*	No Ice	>240 (150)	
Torque @ 160km/h *Nm* (100mph ft-lbs)		413 (305)	1823 (1345)

(1) To order pre-set downtilt versions available, simply add a -T2 or -T4 towards the end of the part number to denote downtilt model required. For eg. CC807-12-T2-P to order CC807-12-P with 2deg of downtilt. Please note: Models with downtilt are NOT field invertible. . Eg. CC807-12-T2-P

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AVA5-50

AVA5-50, HELIAX® Andrew Virtual Air™ Coaxial Cable, corrugated copper, 7/8 in, black PE jacket (Halogen free jacketing non-fire-retardant)

Product Classification

Product Type	Coaxial wireless cable
Product Brand	HELIAX®
Product Series	AVA5-50
Ordering Note	North America alternative part number is AVA5P-50-C (520093702/00) | Not available in the United States or Canada

General Specifications

Product Number	520096102/00 | SZ520096102/00
Flexibility	Standard
Jacket Color	Black
Performance Note	Attenuation values typical, guaranteed within 5%
Specification Sheet Revision Level	B

Dimensions

Diameter Over Dielectric	24.13 mm | 0.95 in
Diameter Over Jacket	27.991 mm | 1.102 in
Inner Conductor OD	9.449 mm | 0.372 in
Outer Conductor OD	25.4 mm | 1 in
Nominal Size	7/8 in

Electrical Specifications

Cable Impedance	50 ohm ±1 ohm
Capacitance	73 pF/m | 22.25 pF/ft
dc Resistance, Inner Conductor	1.435 ohms/km | 0.437 ohms/kft
dc Resistance, Outer Conductor	1.116 ohms/km | 0.34 ohms/kft

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AVA5-50

dc Test Voltage	6000 V
Inductance	0.184 µH/m | 0.056 µH/ft
Insulation Resistance	100000 MOhms-km
Jacket Spark Test Voltage (rms)	8000 V
Operating Frequency Band	1 – 5000 MHz
Peak Power	91 kW
Velocity	91 %

VSWR/Return Loss

Frequency Band	VSWR	Return Loss (dB)
680–800 MHz	1.13	24.3
800–960 MHz	1.13	24.3
1700–2200 MHz	1.13	24.3

Attenuation

Frequency (MHz)	Attenuation (dB/100 m)	Attenuation (dB/100 ft)	Average Power (kW)
1.0	0.113	0.034	74.43
1.5	0.138	0.042	60.73
2.0	0.16	0.049	52.56
10.0	0.359	0.11	23.37
20.0	0.51	0.156	16.46
30.0	0.627	0.191	13.39
50.0	0.814	0.248	10.32
85.0	1.068	0.326	7.86
88.0	1.088	0.332	7.72
100.0	1.162	0.354	7.23
108.0	1.209	0.368	6.95
150.0	1.433	0.437	5.86
174.0	1.548	0.472	5.43
200.0	1.665	0.507	5.05
204.0	1.682	0.513	4.99
300.0	2.059	0.628	4.08
400.0	2.398	0.731	3.5
450.0	2.553	0.778	3.29
460.0	2.583	0.787	3.25

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500.0	2.7	0.823	3.11
512.0	2.735	0.834	3.07
600.0	2.977	0.907	2.82
700.0	3.235	0.986	2.6
800.0	3.478	1.06	2.42
824.0	3.534	1.077	2.38
894.0	3.694	1.126	2.27
960.0	3.841	1.171	2.19
1000.0	3.927	1.197	2.14
1218.0	4.377	1.334	1.92
1250.0	4.44	1.353	1.89
1500.0	4.912	1.497	1.71
1700.0	5.268	1.605	1.59
1794.0	5.429	1.655	1.55
1800.0	5.439	1.658	1.54
2000.0	5.771	1.759	1.46
2100.0	5.933	1.808	1.42
2200.0	6.091	1.856	1.38
2300.0	6.247	1.904	1.34
2500.0	6.55	1.996	1.28
2700.0	6.845	2.086	1.23
3000.0	7.272	2.217	1.15
3400.0	7.819	2.383	1.07
3600.0	8.083	2.464	1.04
3700.0	8.213	2.503	1.02
3800.0	8.342	2.542	1.01
3900.0	8.47	2.581	0.99
4000.0	8.596	2.62	0.98
4100.0	8.722	2.658	0.96
4200.0	8.846	2.696	0.95
4300.0	8.969	2.734	0.94
4400.0	9.092	2.771	0.92
4500.0	9.213	2.808	0.91
4600.0	9.333	2.845	0.9
4700.0	9.453	2.881	0.89

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4800.0	9.572	2.917	0.88
4900.0	9.689	2.953	0.87
5000.0	9.806	2.989	0.86

Material Specifications

Dielectric Material	Foam PE
Jacket Material	PE
Inner Conductor Material	Copper tube
Outer Conductor Material	Corrugated copper

Mechanical Specifications

Minimum Bend Radius, multiple Bends	254 mm | 10 in
Minimum Bend Radius, single Bend	127 mm | 5 in
Number of Bends, minimum	15
Number of Bends, typical	30
Tensile Strength	159 kg | 350.535 lb
Bending Moment	19 N-m | 168.164 in lb
Flat Plate Crush Strength	1.3 kg/mm | 72.797 lb/in

Environmental Specifications

Installation temperature	-40 °C to +60 °C (-40 °F to +140 °F)
Operating Temperature	-55 °C to +85 °C (-67 °F to +185 °F)
Storage Temperature	-70 °C to +85 °C (-94 °F to +185 °F)
Attenuation, Ambient Temperature	68 °F | 20 °C
Average Power, Ambient Temperature	104 °F | 40 °C
Average Power, Inner Conductor Temperature	212 °F | 100 °C

Packaging and Weights

Cable weight	0.45 kg/m | 0.302 lb/ft

Regulatory Compliance/Certifications

Agency	**Classification**
CENELEC	EN 50575 compliant, Declaration of Performance (DoP) available
CHINA-ROHS	Below maximum concentration value
ISO 9001:2015	Designed, manufactured and/or distributed under this quality management system

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AVA5-50

REACH-SVHC	Compliant as per SVHC revision on www.andrew.com/ProductCompliance
ROHS	Compliant
UK-ROHS	Compliant

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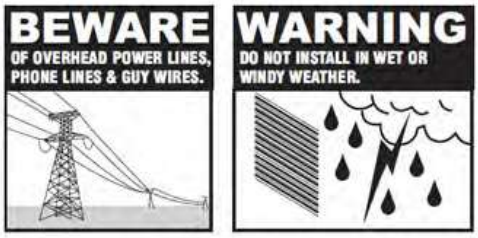
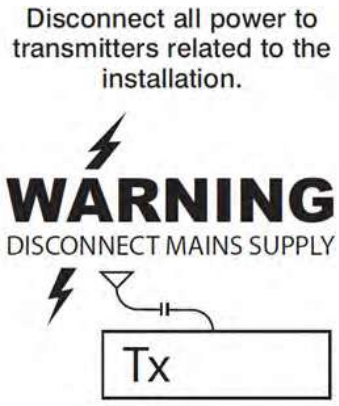
CC and CO Series Antennas Installation Guide

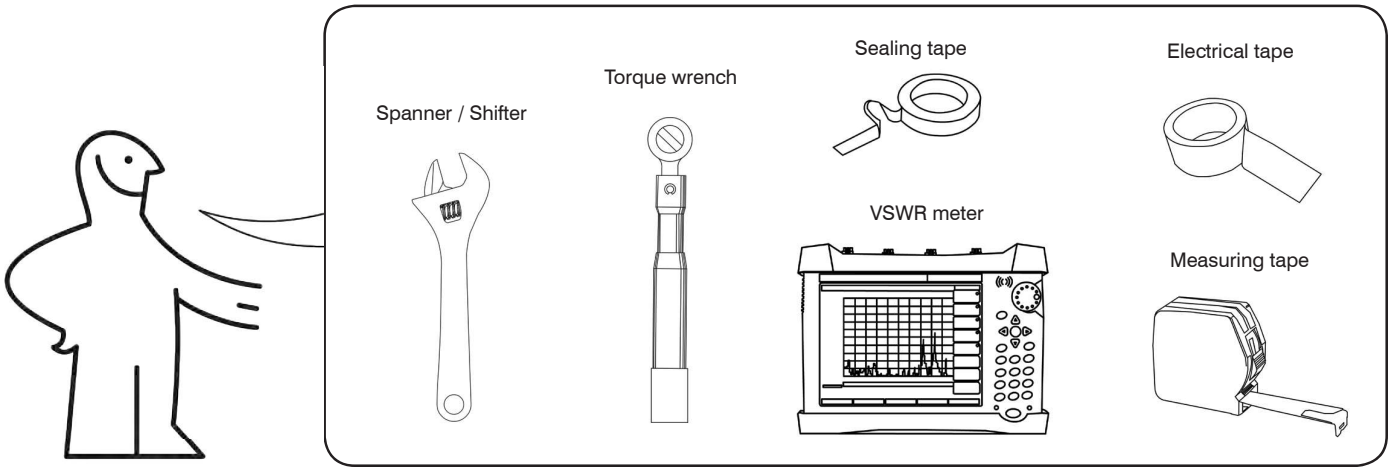
Please Ensure, SAFETY AT ALL TIMES



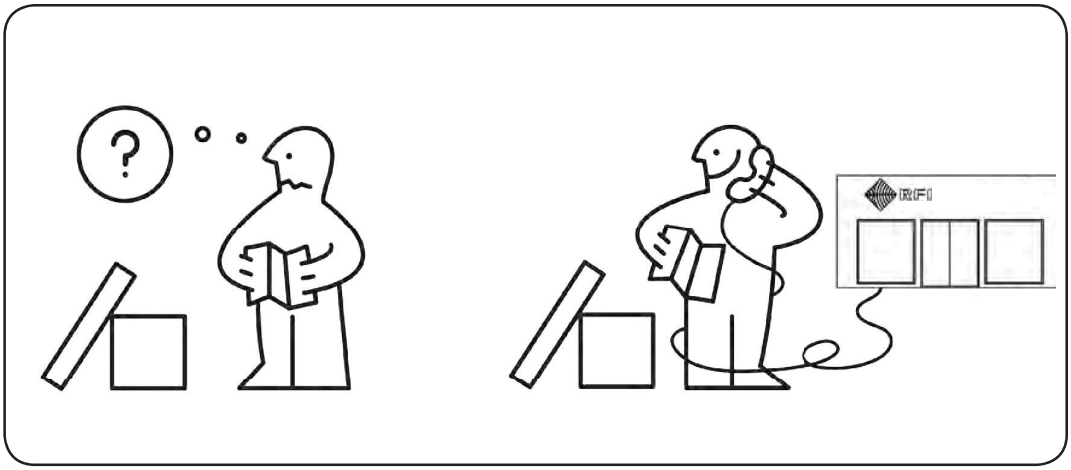
DO NOT INSTALL NEAR POWER LINES, TELEPHONE LINES AND GUY WIRES. THEY ALL LOOK THE SAME SO ASSUME ANY WIRE OR LINE CAN ELECTROCUTE YOU.



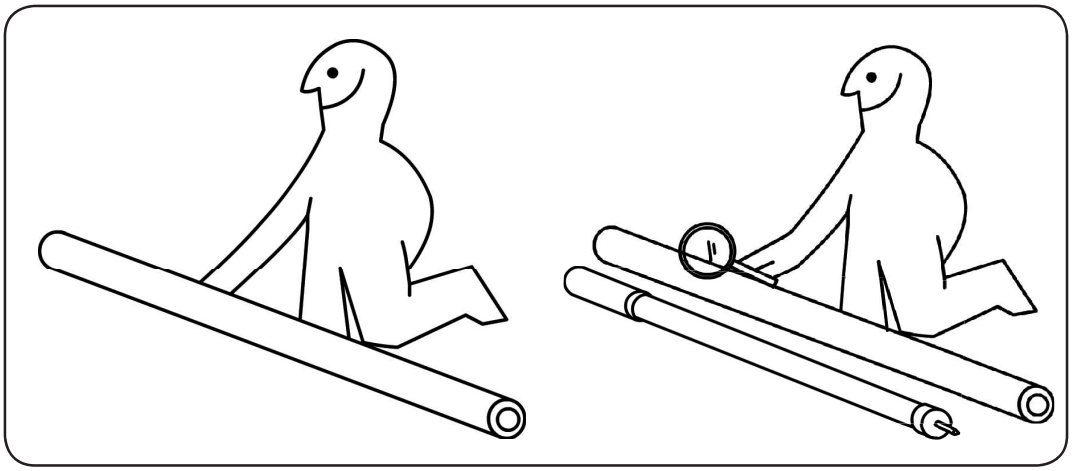
Tools and equipment that may be required:



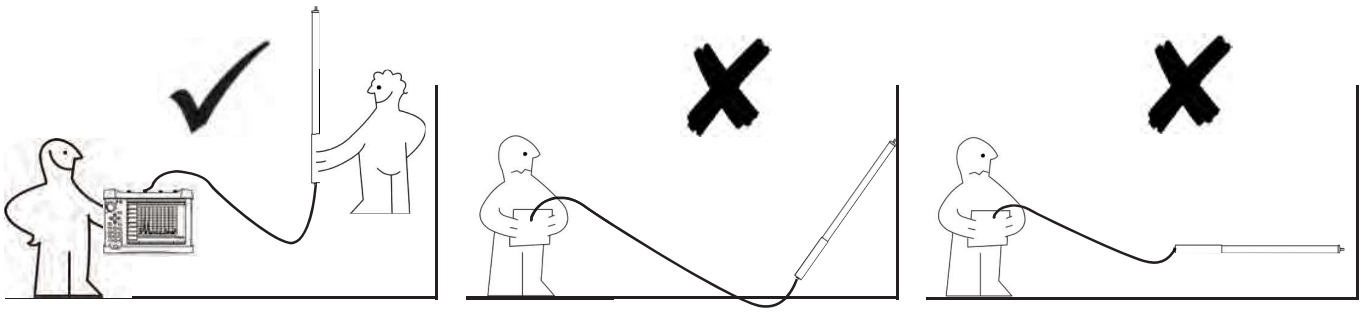
Any **QUESTIONS** contact your RFI representative.



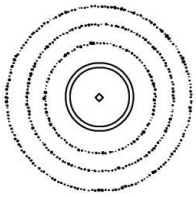
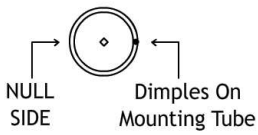
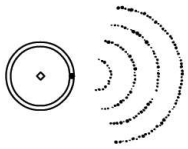
1. Check carton tube and take out antenna for transport damage.



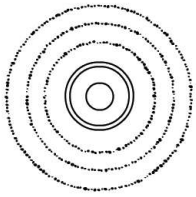
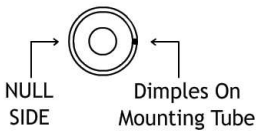
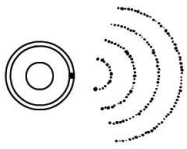
2. **VSWR test antenna prior to installation.**



3. **Install antenna upright (normal mounting) or upside down (inverted mounting)**

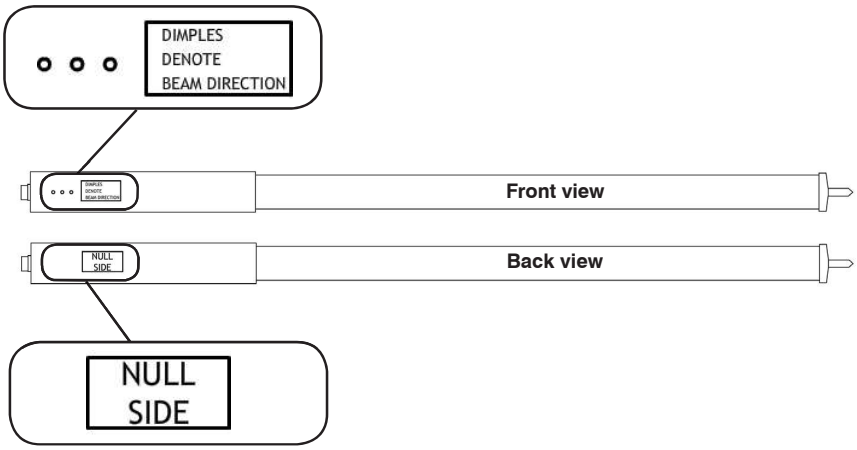
Normal Mounting	Beam Direction
Corporate Collinear (CC Series)	Bird View
	
Corporate Offset (CO Series)	Bird View
	

Normal Mounting

Inverted Mounting	Beam Direction
Corporate Collinear (CC Series)	Bird View
	
Corporate Offset (CO Series)	Bird View
	

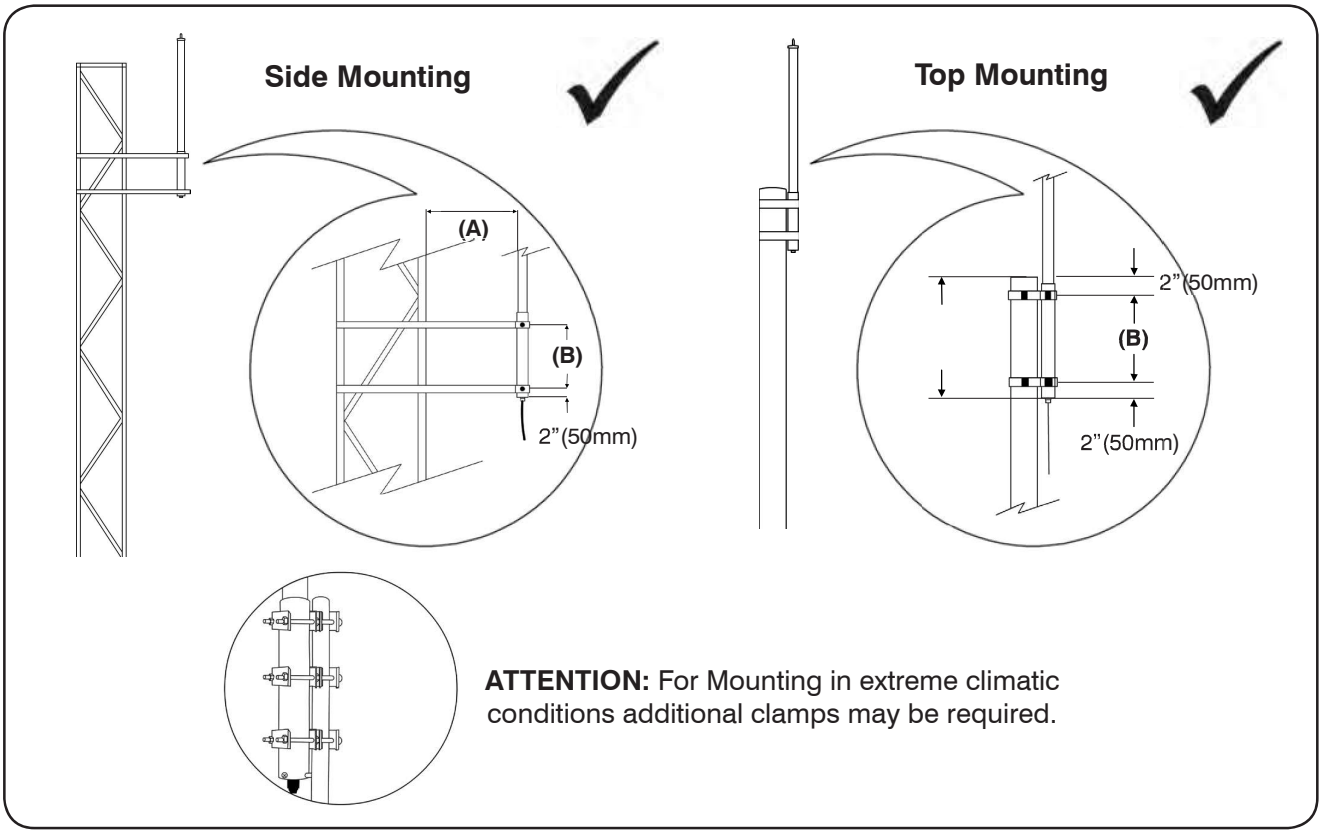
Inverted Mounting

3.1 How to identify CO Series antenna beam direction

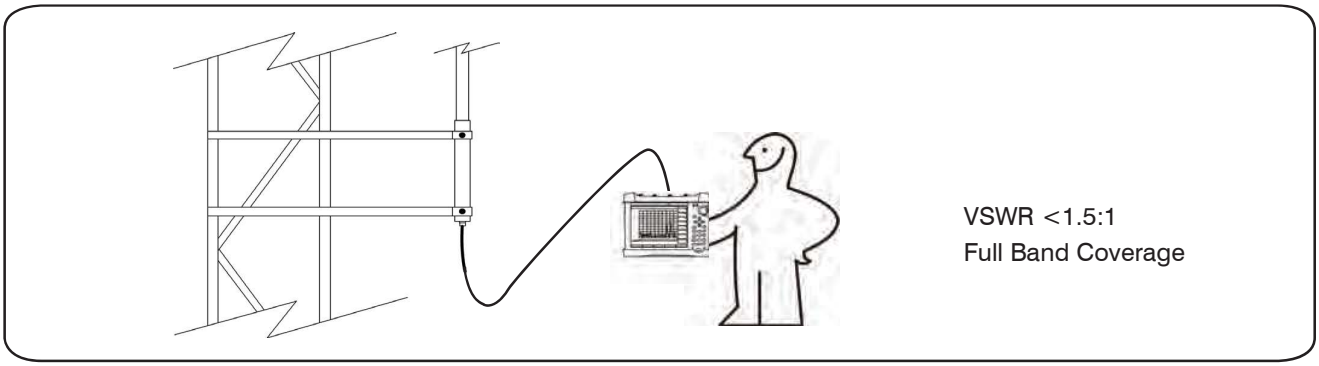


4. **SPACING**. Antenna to **Structure** and **Clamping** dimensions

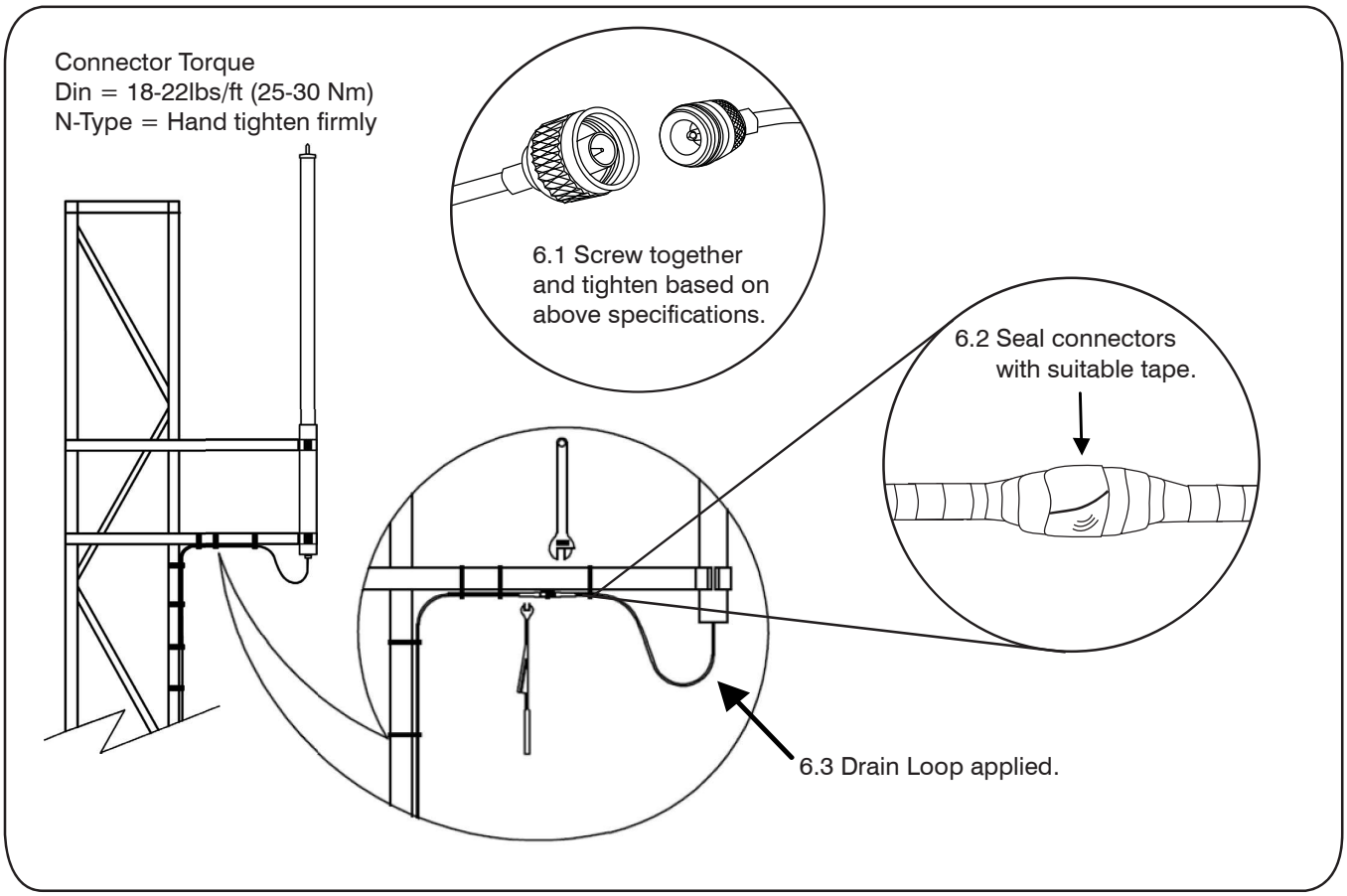
Band	Frequency MHz	Minimum Antennas to Structure spacing (A)		Clamping dimensions (B)	
		Inches	mm	Inches	mm
UHF	380	31.1	790	19.7	500
	400	30	762		
	415	28	712		
	430	27	686		
	445	27	686		
	460	26	660		
	475	25	635		
	490	24	609		
	505	23	584		
	520	23	584		
800 MHz	746 - 870	16	400	19.7	500



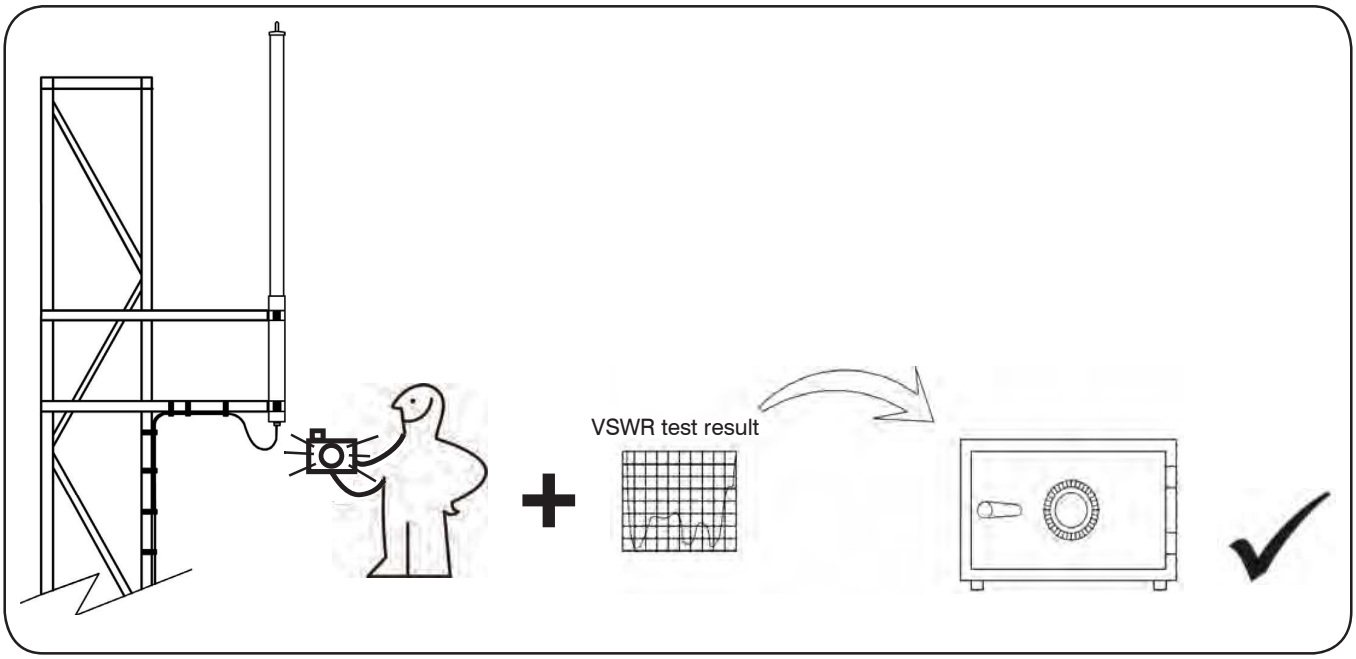
5. VSWR test the antenna **after mounting**.



6. **Torque connector(s) and weatherproof. Drain loop must be applied.**



7. Take installation photos and store with VSWR results with site records.



LDF4-50A

LDF4-50A, HELIAX® Low Density Foam Coaxial Cable, corrugated copper, 1/2 in, black PE jacket Halogen free jacketing non-fire-retardant (General propose cable for outdoor use only)

Product Classification

Product Type	Coaxial wireless cable
Product Brand	HELIAX®
Product Series	LDF4-50A
Ordering Note	ANDREW® standard product (Global)

General Specifications

Product Number	520094002/00 | SZ520094902/00
Flexibility	Standard
Jacket Color	Black
Performance Note	Attenuation values typical, guaranteed within 5%

Dimensions

Diameter Over Dielectric	12.954 mm | 0.51 in
Diameter Over Jacket	15.875 mm | 0.625 in
Inner Conductor OD	4.826 mm | 0.19 in
Outer Conductor OD	13.97 mm | 0.55 in
Nominal Size	1/2 in

Electrical Specifications

Cable Impedance	50 ohm ±1 ohm
Capacitance	75.8 pF/m | 23.104 pF/ft
dc Resistance, Inner Conductor	1.48 ohms/km | 0.451 ohms/kft
dc Resistance, Outer Conductor	2.69 ohms/km | 0.82 ohms/kft
dc Test Voltage	4000 V
Inductance	0.19 µH/m | 0.058 µH/ft
Insulation Resistance	100000 MOhms-km
Jacket Spark Test Voltage (rms)	8000 V

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Revised: August 12, 2025

LDF4-50A

Operating Frequency Band	1 – 8800 MHz
Peak Power	40 kW
Velocity	88 %

Attenuation

Frequency (MHz)	Attenuation (dB/100 m)	Attenuation (dB/100 ft)	Average Power (kW)
1.0	0.211	0.064	36.11
1.5	0.259	0.079	29.46
2.0	0.299	0.091	25.5
10.0	0.672	0.205	11.35
20.0	0.954	0.291	7.99
30.0	1.172	0.357	6.51
50.0	1.521	0.463	5.02
85.0	1.995	0.608	3.82
88.0	2.031	0.619	3.76
100.0	2.169	0.661	3.52
108.0	2.256	0.688	3.38
150.0	2.673	0.815	2.85
174.0	2.887	0.88	2.64
200.0	3.103	0.946	2.46
204.0	3.135	0.956	2.43
300.0	3.835	1.169	1.99
400.0	4.462	1.36	1.71
450.0	4.749	1.447	1.61
460.0	4.804	1.464	1.59
500.0	5.021	1.53	1.52
512.0	5.085	1.55	1.5
600.0	5.533	1.686	1.38
700.0	6.009	1.831	1.27
800.0	6.456	1.968	1.18
824.0	6.56	1.999	1.16
894.0	6.855	2.089	1.11
960.0	7.124	2.171	1.07
1000.0	7.284	2.22	1.05
1218.0	8.11	2.472	0.94

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1250.0	8.226	2.507	0.93
1500.0	9.093	2.771	0.84
1700.0	9.744	2.97	0.78
1794.0	10.039	3.06	0.76
1800.0	10.058	3.066	0.76
2000.0	10.666	3.251	0.72
2100.0	10.961	3.341	0.7
2200.0	11.251	3.429	0.68
2300.0	11.535	3.516	0.66
2500.0	12.09	3.685	0.63
2700.0	12.627	3.849	0.6
3000.0	13.407	4.086	0.57
3400.0	14.401	4.389	0.53
3600.0	14.882	4.536	0.51
3700.0	15.118	4.608	0.5
3800.0	15.353	4.679	0.5
3900.0	15.585	4.75	0.49
4000.0	15.815	4.82	0.48
4100.0	16.042	4.889	0.48
4200.0	16.268	4.958	0.47
4300.0	16.492	5.027	0.46
4400.0	16.714	5.094	0.46
4500.0	16.934	5.161	0.45
4600.0	17.153	5.228	0.44
4700.0	17.37	5.294	0.44
4800.0	17.585	5.36	0.43
4900.0	17.798	5.425	0.43
5000.0	18.01	5.489	0.42
6000.0	20.055	6.113	0.38
8000.0	23.826	7.262	0.32
8800.0	25.244	7.694	0.3

Material Specifications

Dielectric Material	Foam PE
Jacket Material	PE

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LDF4-50A

Inner Conductor Material	Copper-clad aluminum wire
Outer Conductor Material	Corrugated copper

Mechanical Specifications

Minimum Bend Radius, multiple Bends	127 mm | 5 in
Minimum Bend Radius, single Bend	50.8 mm | 2 in
Number of Bends, minimum	15
Number of Bends, typical	50
Tensile Strength	113 kg | 249.122 lb
Bending Moment	3.8 N-m | 33.633 in lb
Flat Plate Crush Strength	2 kg/mm | 111.995 lb/in

Environmental Specifications

Installation temperature	-40 °C to +60 °C (-40 °F to +140 °F)
Operating Temperature	-55 °C to +85 °C (-67 °F to +185 °F)
Storage Temperature	-70 °C to +85 °C (-94 °F to +185 °F)
Attenuation, Ambient Temperature	68 °F | 20 °C
Average Power, Ambient Temperature	104 °F | 40 °C
Average Power, Inner Conductor Temperature	212 °F | 100 °C

Packaging and Weights

Cable weight	0.22 kg/m | 0.148 lb/ft

Regulatory Compliance/Certifications

Agency	Classification
CENELEC	EN 50575 compliant, Declaration of Performance (DoP) available
CHINA-ROHS	Below maximum concentration value
ISO 9001:2015	Designed, manufactured and/or distributed under this quality management system
REACH-SVHC	Compliant as per SVHC revision on www.andrew.com/ProductCompliance
ROHS	Compliant
UK-ROHS	Compliant

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Revised: August 12, 2025

Antennas
700-1000 MHz Antennas
SE412-WBL - PIM Certified Series

SE412-SWBP2LDF(D00) Enclosed dipole, 5 dBd, Bi-directional, Low PIM, 746-960 MHz

- New wide band design covers 746-960 MHz band
- Compact, enclosed antenna with excellent low intermodulation performance
- PIM certified and PIP rated
- 0-6º electrical downtilt available

One wideband antenna for your 700, 800, 900 MHz systems. Sinclair's SE412-WBL series of enclosed dipole arrays offer excellent intermodulation performance covering 746-960 MHz in a single antenna. These highly versatile antennas are particularly well suited to communication systems where a specific coverage pattern is required. These include cellular systems, trunked radio, paging, and data transmission, where predictable and highly reliable performance is a must. Desgined for multi-channel systems, the PIP rated SE412-WBL series features with low intermodulation products, highly rated average power and peak instantaneous power.

This antenna support upright mounting.
Electrical downtilt is available upon request.
Clamps for mechanical downtilt can be ordered separately.

QUESTIONS? VISIT WWW.TALLEYCOM.COM OR CONTACT TALLEY AT 800.949. 7079 OR SALES@TALLEYCOM.COM TODAY.

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Electrical Specifications

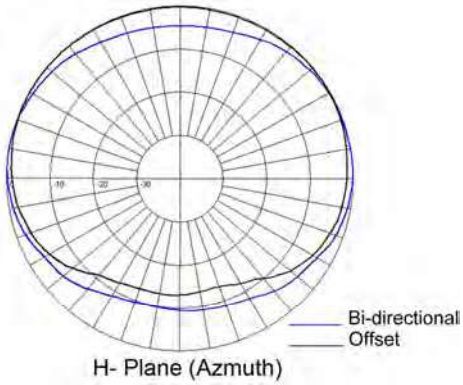
Frequency Range	MHz	746 to 960
Bandwidth	MHz	214
Connector		7/16 DIN-Female
Gain (nominal)	dBd (dBi)	5 (7.1)
Input VSWR (max)		1.5:1
Polarization		vertical
Impedance	Ω	50
Pattern		Bi- directional
Vertical beamwidth (typ)	degrees	34
Average Power Input (max)	W	350
Passive intermod. (2x20W, 3rd ord.)	dBc	-150
Lightning protection		DC ground
PIP(KW, max)		25
Electrical tilt (available)		0-6 degrees

Notes

*1 : Clamps not included in measurement
*2 : Clamps not included in measurement
*3 : Ref. Clamp maximum

Mechanical Specifications

Width	in (mm)	2.9 (74)	*1
Depth	in (mm)	8.5 (216)	*2
Length/ Height	in (mm)	22 (559)	
Base pipe diameter	in (mm)	2.88 (73)	*3
Base pipe mounting length	in (mm)	10.25 (260)	
Radiating element material		prntd circuit bd	
Weight	lbs (kg)	7 (3.18)	
Mounting Hardware (Included)		#130 clamp	
Estimated Shipping Weight	lbs (kg)	15 (6.81)	
Shipping dimensions	in (mm)	16x12x22 (406x305x559)	
Mounting configurations		upright	



Environmental Specifications

Temperature range	°F (°C)	-40 to +140 (-40 to +60)
Wind Loading Area (Flat Plate Equivalent)	ft² (m²)	1.4 (0.13)
Wind Loading Area (1/2" ice)	ft² (m²)	1.6 (0.15)
Rated wind velocity (no ice)	mph (km/h)	195 (314)
Rated wind velocity (1/2" radial ice)	mph (km/h)	170 (274)
Lateral thrust (100 mph No Ice)	lbs (N)	56 (249.1)
Torsional moment (100 mph No Ice)	ft-lbs (Nm)	22 (29.7)

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SE414-SWBPALDF(D00) Enclosed dipole, 8-11.5 dBd, adj. beamwidth, Low PIM, 746-960MHz

- Wide band design covers whole 746-960 MHz band, PIP rated
- Horizontal beamwidth can be adjusted (60º/90º/105º/130º/160º)
- Gain depends on horizontal beamwidth setting (11.5/10/9/8.5/8 dBd)
- 0-10º electrical downtilt available

One wideband antenna for your 700, 800, 900 MHz systems. Sinclair's SE414-WBL series of enclosed dipole arrays offer excellent intermodulation performance covering 746-960 MHz in a single antenna. These highly versatile antennas are particularly well suited to communication systems where a specific coverage pattern is required. These include cellular systems, trunked radio, paging, and data transmission, where predictable and highly reliable performance is a must.

The SE414-WBAL series come with field adjustable reflectors that provide horizontal beamwidths between 60 and 160 degrees. The creative design and construction permits excellent pattern control and greater efficiency.

This antenna shall be mounted in an upright position.
Clamps for mechanical downtilt can be ordered separately.
Electrical downtilt is available upon request.

Antenna may not appear exactly as picture.

www.sinctech.com

Region	United States	Europe, Middle East and Africa	Caribbean and Latin America	Canada and rest of the world
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Electrical Specifications

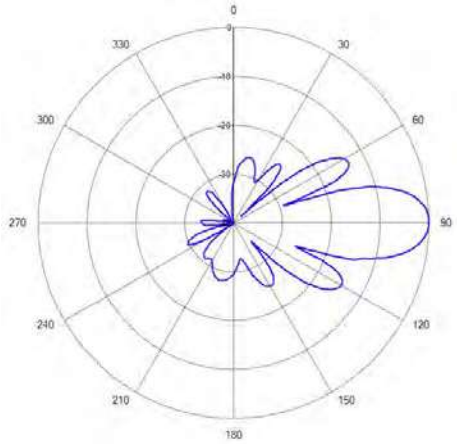
Frequency Range	MHz	746 to 960	
Bandwidth	MHz	214	
Connector		7/16 DIN-Female	
Gain (nominal)	dBd (dBi)	11.5 (13.6)	*1
Input VSWR (max)		1.5:1	
Polarization		vertical	
Impedance	Ω	50	
Pattern		Directional and Adjustable	
Horizontal beamwidth (typ)	degrees	60	*2
Vertical beamwidth (typ)	degrees	20	
Average Power Input (max)	W	500	
Passive intermod. (2x20W, 3rd ord.)	dBc	-150	*3
PIP(KW, max)		25	
Lightning protection		DC ground	
Electrical tilt (available)		0 to 10 degrees	
Front-to-back ratio (min)	dB	20	

Notes

*1 : Dependant on reflector setting 10/9/8.5/8 dBd
*2 : 90/105/130/160
*3 : Measured in the receive band: 2 - 20W carriers
*4 : 90° beamwidth configuration, clamp not included in measurement
*5 : 90° beamwidth configuration, clamp not included in measurement
*6 : Ref. clamp maximum

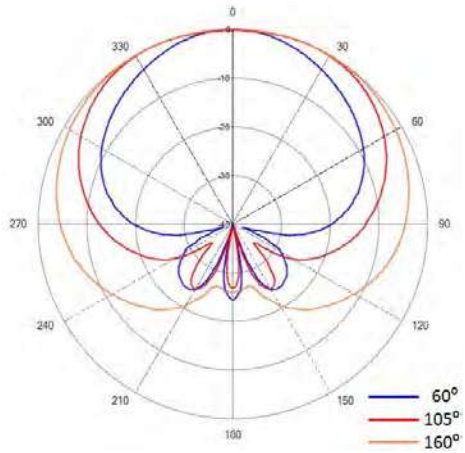
Mechanical Specifications

Width	in (mm)	25 (635)	*4
Depth	in (mm)	8.5 (216)	*5
Length/ Height	in (mm)	53 (1346)	
Base pipe diameter	in (mm)	2.88 (73)	*6
Base pipe mounting length	in (mm)	30.5 (775)	
Radiating element material		prntd circuit bd	
Weight	lbs (kg)	19.5 (8.85)	
Mounting Hardware (Included)		#130 clamp	
Mounting configurations		upright	
Actual shipping weight	lbs (kg)	24.5 (11.12)	
Shipping dimensions	in (mm)	58x14x17 (1473x356x432)	



Environmental Specifications

Temperature range	°F (°C)	-40 to +140 (-40 to +60)
Wind Loading Area (Flat Plate Equivalent)	ft² (m²)	4.8 (0.45)
Wind Loading Area (1/2" ice)	ft² (m²)	5.7 (0.53)
Rated wind velocity (no ice)	mph (km/h)	155 (250)
Rated wind velocity (1/2" radial ice)	mph (km/h)	140 (225)
Lateral Thrust (100 mph No Ice)	lbs (N)	180 (800.6)
Torsional moment (100 mph No Ice)	ft-lbs (Nm)	93 (125.6)



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PRESSURE GAUGES MANIFOLD

Pressure gauges manifold is designed to measure pressure level in pressurized plants. Each pressure gauge measures pressure of only one user and it is equipped with its own independent shut off valve.

It is designed to work with Cibred Sud dehydrators and manifolds. It doesn't need to be powered.

P/N	N°. inlets	Type of inlet fittings	N°. of pressure gauges	N°. of outlets and shut off valves	Type of outlet fittings
K15019	1	8/6 push-on fitting	4	4	8/6 push-on fitting
K15019.002	3	8/6 push-on fitting	3	3	8/6 push-on fitting
K15019.003	2	3/8" push-on fitting	4	4	3/8" push-on fitting
K15019.004	1	8/6 push-on fitting	2	2	8/6 push-on fitting
K15019.005	1	3/8" push-on fitting	4	4	3/8" push-on fitting
K15019.006	1	3/8" push-on fitting	6	6	3/8" push-on fitting
K15019.007	1	3/8" push-on fitting	2	2	3/8" push-on fitting

Pressure range each: 0 – 250 kPa

Operating temperature range: from 0°C to +40°C

Dimensions (LxHxD): 482 x 177 x 100 mm approx

Net weight: 3 kg approx.

Mount type: wall

The equipment illustrated are fully equipped versions. CIBRED SUD reserves the right to modify without notice characteristics and data supplied herein.

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LAB4.50 DEHYDRATOR FOR WAVEGUIDES AND COAXIAL CABLES

key features

- output pressure programmable up to 50 kPa (7 psi)
- flow rate up to 300 l/h
- dew point better than -45 °C
- two pumps and two drying chambers running alternatively
- continuous duty and automatic operation
- drying chambers automatic regeneration
- microprocessor control and monitoring with digital display
- low/high pressure, high humidity, power and system failures alarms
- local and remote alarm signaling
- optional remote control through SNMP protocol and WEB browser or through serial link
- optional digital flowmeter for air flow measurement
- output pressure, hour meter, alarms readout
- low power consumption and low acoustic noise
- wide-range power supply: both 110-240 VAC 50/60 Hz and 48/60 VDC always available
- high reliability and long life
- mounting flexibility: wall, floor, 19” and ETSI N3 racks

description

The LAB4.50 dehydrator provides continuous dry air flow up to 300 l/h with a dew point better than -45°C. Output pressure can be set in the range from 10 kPa to 50 kPa.

The LAB4.50 achieves reduced mechanical wear and noise and therefore a long lifetime by output pressure measurement, microprocessor control and pump speed regulation. Pumps speed control avoids mechanical pressure regulators eliminating undesirable pressure losses and a worse response to plant air flow regulation.

Two drying chambers contain the desiccant and dry airstream by adsorption process. The chambers operate on alternate cycles so while the first chamber dries, the second one regenerates the desiccant by heating and backwashing with a small reverse dry air flow.

This technology reduces overall power consumption.

The following devices are available on the front panel:

- monitoring digital display
- function keyboard to scroll and modify settings
- power on and alarms LED
- on/off outlet valves

Output air pressure, hour meter, active alarm messages, output pressure setting and alarm thresholds are available on the digital display.

The basic version has low pressure, high pressure, high humidity, power and system failures alarms. The alarms are remotely signaled by one SPDT relay.

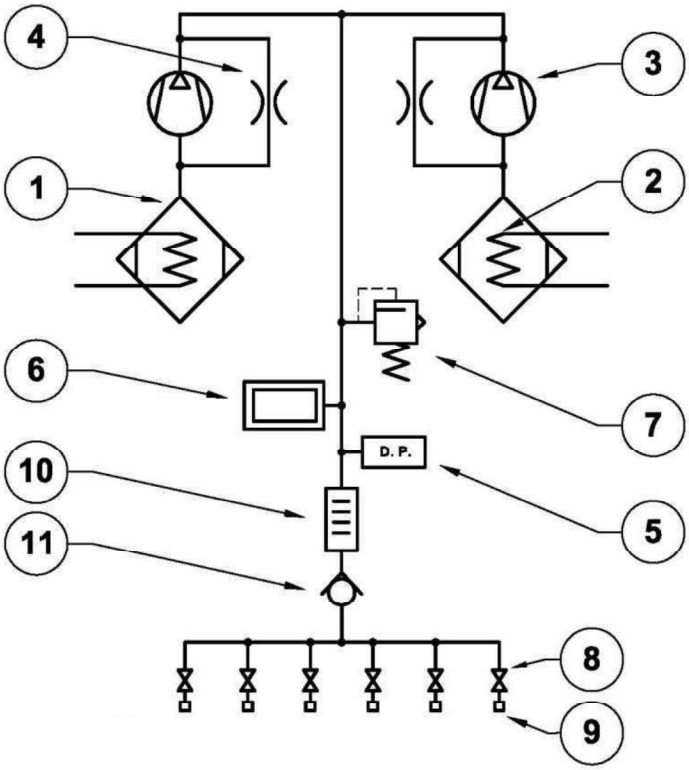
As option are available:

- remote control through SNMP protocol and HTTP WEB browser by an Ethernet interface,
- remote control by a RS485/RS422 or R232 serial link,
- digital flowmeter with data showed on the display

On the rear panel are available the AC and DC power supply connectors, the connector for remote alarm and the optional RJ45 connector for Ethernet interface or D-Sub 9 pins for serial link.

The LAB4.50 always includes wall, floor, 19" and ETSI N3 rack mountings.

pneumatic scheme



1 DRYING CHAMBER

2 HEATER

3 PUMP

4 AIR BACKWASHING HOLE

5 HUMIDITY PROBE

6 DIGITAL PRESSURE GAUGE

7 RELIEF VALVE

8 SHUT OFF VALVE

9 DRY AIR OUTLET

10 FLOW METER (OPTIONAL)

11 ONE-WAY VALVE

performance

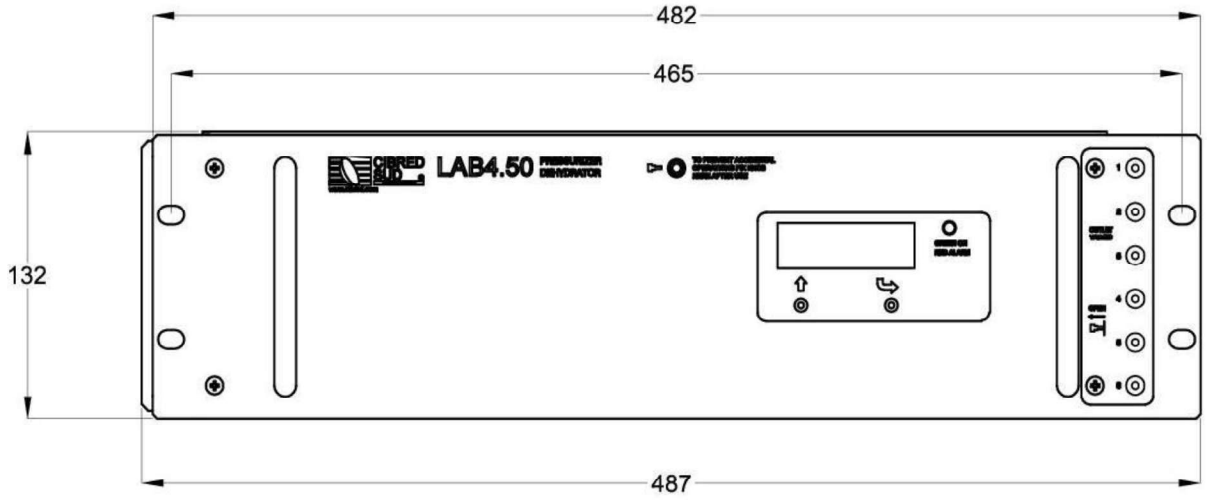
Output pressure	:	factory set at 20 kPa (3 psi) programmable from 10 kPa to 50 kPa (1.5 – 7 psi)
Maximum flow rate	:	300 l/h
Safety valve	:	built in, factory set at 70 kPa (10 psi)
Output air dew point	:	better than -45°C at 80% RH at 20°C
Regeneration	:	automatic by heating
Local alarms	:	low pressure, high pressure, high humidity, power and system failures alarms
Remote alarms	:	all the alarms are remotely signaled by SPDT relay
Optional remote monitoring interface		Web Browser and SNMP, others on request
Optional measures	:	air flow by a digital flowmeter
LED indications	:	power on, alarms
Readouts	:	output pressure, low/high pressure alarm thresholds, hour meter
European Community Directives	:	2014/35/EU “Low Voltage Directive” 2014/30/EU “Electromagnetic Compatibility Directive” 2015/863/UE Environmental compliance (RoHS3)
Safety Normative	:	EN 62368-1
Electromagnetic Compatibility Normative	:	EN 55032; EN 55024

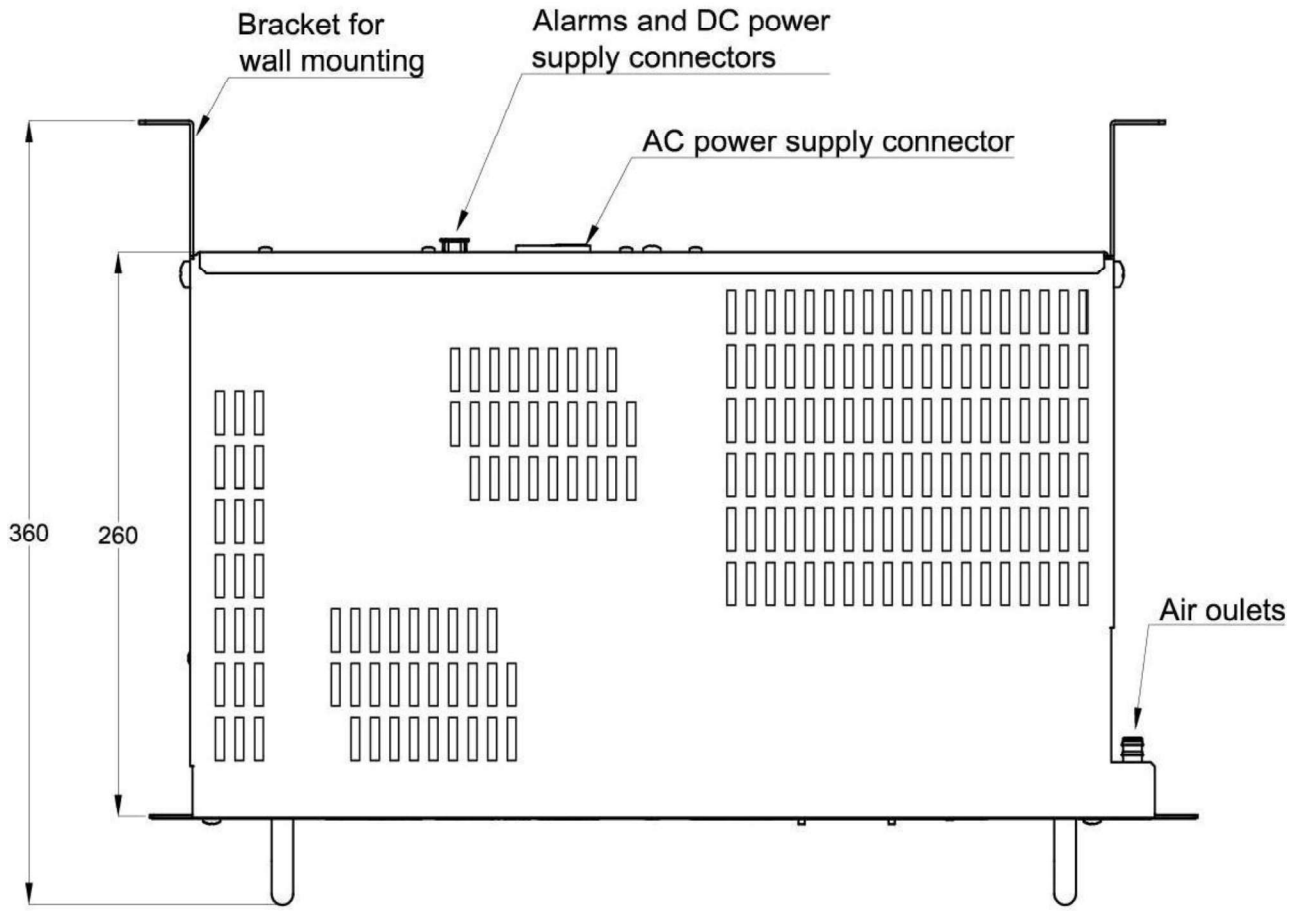
electrical specifications

Power supply	:	both 110-240 VAC 50/60 Hz and 48/60 VDC always available
Power consumption		
Average	:	< AC: 60 VA, DC: 35 W
Max during regeneration phase	:	< AC: 100 VA, DC: 60 W

mechanical and environmental characteristics

Temperature °C (°F)		
Operating	:	-10 to + 50 (+14 to +122)
Storage	:	-30 to + 60 (-22 to +140)
Mountings	:	Wall, floor, 19” and ETSI N3 racks
Acoustic noise	:	≤ 50 dBA at 1 m far and 1,5 m height
Dimensions mm (in)		
Wall and floor mounting	:	width 487 (19.2) height 132 (5.2) depth 360 (14.2)
19” rack mounting	:	height 3U depth 260 (10.2)
ETSI – N3 mounting	:	height 6U depth 260 (10.2)
Weight kg (lb)	:	about 9 (30)
Standard outlets	:	6 outlets, each with ON/OFF valve
Outlets fitting mm (in)	:	9,5 (3/8”) diameter, others on request





The equipment illustrated are fully equipped versions. CIBRED SUD reserves the right to modify without notice characteristics and data supplied herein.

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EW63

EW63, HELIAX® Standard Elliptical Waveguide, 5.925–7.125 GHz, black PE jacket

Product Classification

Product Type	Standard elliptical waveguide
Product Brand	HELIAX®
Product Series	Standard

General Specifications

Jacket Color	Black
Performance Note	Values typical, unless otherwise stated

Dimensions

Diameter Over Jacket (E Plane)	51.1 mm | 2.012 in
Diameter Over Jacket (H Plane)	29.5 mm | 1.161 in
Cable Volume	855 L/km | 9.203 ft³/kft

Electrical Specifications

eTE11 Mode Cutoff	4.001 GHz
Group Delay at Frequency	126 ns/100 ft @ 6.775 GHz | 413 ns/100 m @ 6.775 GHz
Operating Frequency Band	5.925 – 7.125 GHz

VSWR/Return Loss

Frequency Band	VSWR	Return Loss (dB)
5.925–7.125 GHz	1.15	23.13

Attenuation

Frequency (GHz)	Attenuation (dB/100 m)	Attenuation (dB/100 ft)	Average Power (kW)	Group Velocity %
5.925	4.878	1.487	4.45	73.8
6.13	4.738	1.444	4.581	75.8
6.33	4.626	1.41	4.692	77.5
6.53	4.533	1.382	4.788	79

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6.73	4.454	1.358	4.873	80.4
6.93	4.387	1.337	4.948	81.7

Material Specifications

Conductor Material	Corrugated copper
Jacket Material	PE

Mechanical Specifications

Minimum Bend Radius, Multiple Bends (E Plane)	260 mm | 10.236 in
Minimum Bend Radius, Multiple Bends (H Plane)	740 mm | 29.134 in
Minimum Bend Radius, Single Bend (E Plane)	180 mm | 7.087 in
Minimum Bend Radius, Single Bend (H Plane)	510 mm | 20.079 in
Maximum Twist	3.281 °/m | 1 °/ft

Environmental Specifications

Installation temperature	-40 °C to +60 °C (-40 °F to +140 °F)
Operating Temperature	-55 °C to +85 °C (-67 °F to +185 °F)
Storage Temperature	-70 °C to +85 °C (-94 °F to +185 °F)
Attenuation, Ambient Temperature	75 °F | 23.889 °C
Average Power, Ambient Temperature	104 °F | 40 °C
Average Power, Temperature Rise	42 °C | 107.6 °F

Packaging and Weights

Cable weight	0.76 kg/m | 0.511 lb/ft

Regulatory Compliance/Certifications

Agency	**Classification**
CHINA-ROHS	Below maximum concentration value
ISO 9001:2015	Designed, manufactured and/or distributed under this quality management system
REACH-SVHC	Compliant as per SVHC revision on www.andrew.com/ProductCompliance
ROHS	Compliant
UK-ROHS	Compliant

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Revised: March 12, 2025

EW90

EW90, HELIAX® Standard Elliptical Waveguide, 10.2–11.7 GHz, black PE jacket

Product Classification

Product Type	Standard elliptical waveguide
Product Brand	HELIAX®
Product Series	Standard

General Specifications

Jacket Color	Black
Performance Note	Values typical, unless otherwise stated

Dimensions

Diameter Over Jacket (E Plane)	33.5 mm | 1.319 in
Diameter Over Jacket (H Plane)	20.3 mm | 0.799 in
Cable Volume	334 L/km | 3.595 ft³/kft

Electrical Specifications

eTE11 Mode Cutoff	6.5 GHz
Group Delay at Frequency	125 ns/100 ft @ 11.200 GHz | 410 ns/100 m @ 11.200 GHz
Operating Frequency Band	10.2 – 11.7 GHz

VSWR/Return Loss

Frequency Band	VSWR	Return Loss (dB)
10.2–11.7 GHz	1.15	23.13

Attenuation

Frequency (GHz)	Attenuation (dB/100 m)	Attenuation (dB/100 ft)	Average Power (kW)	Group Velocity %
10.2	10.649	3.246	1.509	77.1
10.4	10.503	3.201	1.53	78.1
10.6	10.371	3.161	1.549	79
10.8	10.253	3.125	1.567	79.9

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11.0	10.146	3.093	1.584	80.7
11.2	10.049	3.063	1.599	81.4
11.4	9.961	3.036	1.613	82.2
11.6	9.88	3.012	1.626	82.8

Material Specifications

Conductor Material	Corrugated copper
Jacket Material	PE

Mechanical Specifications

Minimum Bend Radius, Multiple Bends (E Plane)	180 mm | 7.087 in
Minimum Bend Radius, Multiple Bends (H Plane)	480 mm | 18.898 in
Minimum Bend Radius, Single Bend (E Plane)	150 mm | 5.906 in
Minimum Bend Radius, Single Bend (H Plane)	330 mm | 12.992 in
Maximum Twist	6.562 °/m | 2 °/ft

Environmental Specifications

Installation temperature	-40 °C to +60 °C (-40 °F to +140 °F)
Operating Temperature	-55 °C to +85 °C (-67 °F to +185 °F)
Storage Temperature	-70 °C to +85 °C (-94 °F to +185 °F)
Attenuation, Ambient Temperature	75 °F | 23.889 °C
Average Power, Ambient Temperature	104 °F | 40 °C
Average Power, Temperature Rise	42 °C | 107.6 °F

Packaging and Weights

Cable weight	0.48 kg/m | 0.323 lb/ft

Regulatory Compliance/Certifications

Agency	**Classification**
CHINA-ROHS	Below maximum concentration value
ISO 9001:2015	Designed, manufactured and/or distributed under this quality management system
REACH-SVHC	Compliant as per SVHC revision on www.andrew.com/ProductCompliance
ROHS	Compliant
UK-ROHS	Compliant

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EW180

EW180, HELIAX® Standard Elliptical Waveguide, 17.3–19.7 GHz, black PE jacket

Product Classification

Product Type	Standard elliptical waveguide
Product Brand	HELIAX®
Product Series	Standard

General Specifications

Jacket Color	Black
Performance Note	Values typical, unless otherwise stated

Dimensions

Diameter Over Jacket (E Plane)	20.1 mm | 0.791 in
Diameter Over Jacket (H Plane)	12.4 mm | 0.488 in
Cable Volume	111 L/km | 1.195 ft³/kft

Electrical Specifications

eTE11 Mode Cutoff	11.15 GHz
Group Delay at Frequency	127 ns/100 ft @ 18.700 GHz | 416 ns/100 m @ 18.700 GHz
Operating Frequency Band	17.7 – 19.7 GHz

VSWR/Return Loss

Frequency Band	VSWR	Return Loss (dB)
17.7–19.7 GHz	1.15	23.13

Attenuation

Frequency (GHz)	Attenuation (dB/100 m)	Attenuation (dB/100 ft)	Average Power (kW)	Group Velocity %
17.7	20.111	6.13	0.537	77.7
18.1	19.799	6.035	0.546	78.8
18.5	19.523	5.951	0.553	79.8
18.9	19.278	5.876	0.56	80.7

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19.3	19.06	5.81	0.567	81.6
19.7	18.865	5.75	0.573	82.4

Material Specifications

Conductor Material	Corrugated copper
Jacket Material	PE

Mechanical Specifications

Minimum Bend Radius, Multiple Bends (E Plane)	150 mm | 5.906 in
Minimum Bend Radius, Multiple Bends (H Plane)	380 mm | 14.961 in
Minimum Bend Radius, Single Bend (E Plane)	150 mm | 5.906 in
Minimum Bend Radius, Single Bend (H Plane)	380 mm | 14.961 in
Maximum Twist	6.562 °/m | 2 °/ft

Environmental Specifications

Installation temperature	-40 °C to +60 °C (-40 °F to +140 °F)
Operating Temperature	-55 °C to +85 °C (-67 °F to +185 °F)
Storage Temperature	-70 °C to +85 °C (-94 °F to +185 °F)
Attenuation, Ambient Temperature	75 °F | 23.889 °C
Average Power, Ambient Temperature	104 °F | 40 °C
Average Power, Temperature Rise	42 °C | 107.6 °F

Packaging and Weights

Cable weight	0.22 kg/m | 0.148 lb/ft

Regulatory Compliance/Certifications

Agency	Classification
ISO 9001:2015	Designed, manufactured and/or distributed under this quality management system

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EW220

EW220, HELIAX® Standard Elliptical Waveguide, 21.2–23.6 GHz, black PE jacket

Product Classification

Product Type	Standard elliptical waveguide
Product Brand	HELIAX®
Product Series	Standard

General Specifications

Jacket Color	Black
Performance Note	Values typical, unless otherwise stated

Dimensions

Diameter Over Jacket (E Plane)	17.8 mm | 0.701 in
Diameter Over Jacket (H Plane)	11.2 mm | 0.441 in
Cable Volume	74 L/km | 0.797 ft³/kft

Electrical Specifications

eTE11 Mode Cutoff	13.338 GHz
Group Delay at Frequency	127 ns/100 ft @ 22.400 GHz | 415 ns/100 m @ 22.400 GHz
Operating Frequency Band	21.2 – 23.6 GHz

VSWR/Return Loss

Frequency Band	VSWR	Return Loss (dB)
21.2–23.6 GHz	1.15	23.13

Attenuation

Frequency (GHz)	Attenuation (dB/100 m)	Attenuation (dB/100 ft)	Average Power (kW)	Group Velocity %
21.2	28.042	8.547	0.398	77.7
21.6	27.799	8.473	0.401	78.7
22.0	27.577	8.406	0.404	79.5
22.4	27.376	8.344	0.407	80.3

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22.8	27.192	8.288	0.41	81.1
23.2	27.024	8.237	0.413	81.8
23.6	26.87	8.19	0.415	82.5

Material Specifications

Conductor Material	Corrugated copper
Jacket Material	PE

Mechanical Specifications

Minimum Bend Radius, Multiple Bends (E Plane)	120 mm | 4.724 in
Minimum Bend Radius, Multiple Bends (H Plane)	230 mm | 9.055 in
Minimum Bend Radius, Single Bend (E Plane)	120 mm | 4.724 in
Minimum Bend Radius, Single Bend (H Plane)	230 mm | 9.055 in
Maximum Twist	6.562 °/m | 2 °/ft

Environmental Specifications

Installation temperature	-40 °C to +60 °C (-40 °F to +140 °F)
Operating Temperature	-55 °C to +85 °C (-67 °F to +185 °F)
Storage Temperature	-70 °C to +85 °C (-94 °F to +185 °F)
Attenuation, Ambient Temperature	75 °F | 23.889 °C
Average Power, Ambient Temperature	104 °F | 40 °C
Average Power, Temperature Rise	42 °C | 107.6 °F

Packaging and Weights

Cable weight	0.18 kg/m | 0.121 lb/ft

Regulatory Compliance/Certifications

Agency	**Classification**
CHINA-ROHS	Below maximum concentration value
ISO 9001:2015	Designed, manufactured and/or distributed under this quality management system
REACH-SVHC	Compliant as per SVHC revision on www.andrew.com/ProductCompliance
ROHS	Compliant
UK-ROHS	Compliant

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VHLP2-18/D

Base Product

0.6m | 2 ft ValuLine® High Performance Antenna, single polarized, 17.700 – 19.700 GHz

Product Classification

Product Type	Microwave antenna
Product Brand	ValuLine®

General Specifications

Antenna Type	VHLP - ValuLine® High Performance Low Profile Antenna, single-polarized
Polarization	Single
Side Struts, Included	0
Side Struts, Optional	0

Dimensions

Diameter, nominal	0.6 m | 2 ft

Electrical Specifications

Operating Frequency Band	17.700 – 19.700 GHz
Gain, Low Band	38.6 dBi
Gain, Mid Band	39 dBi
Gain, Top Band	39.4 dBi
Boresite Cross Polarization Discrimination (XPD)	30 dB
Front-to-Back Ratio	67 dB
Beamwidth, Horizontal	2.1 °
Beamwidth, Vertical	2.1 °
Return Loss	17.7 dB
VSWR	1.3
Radiation Pattern Envelope Reference (RPE)	7204D
Electrical Compliance	ACMA FX03_18a | Brazil Anatel Class 3 | Canada SRSP 317.8 Part A | ETSI 302 217 Class 3 | US FCC Part 101A

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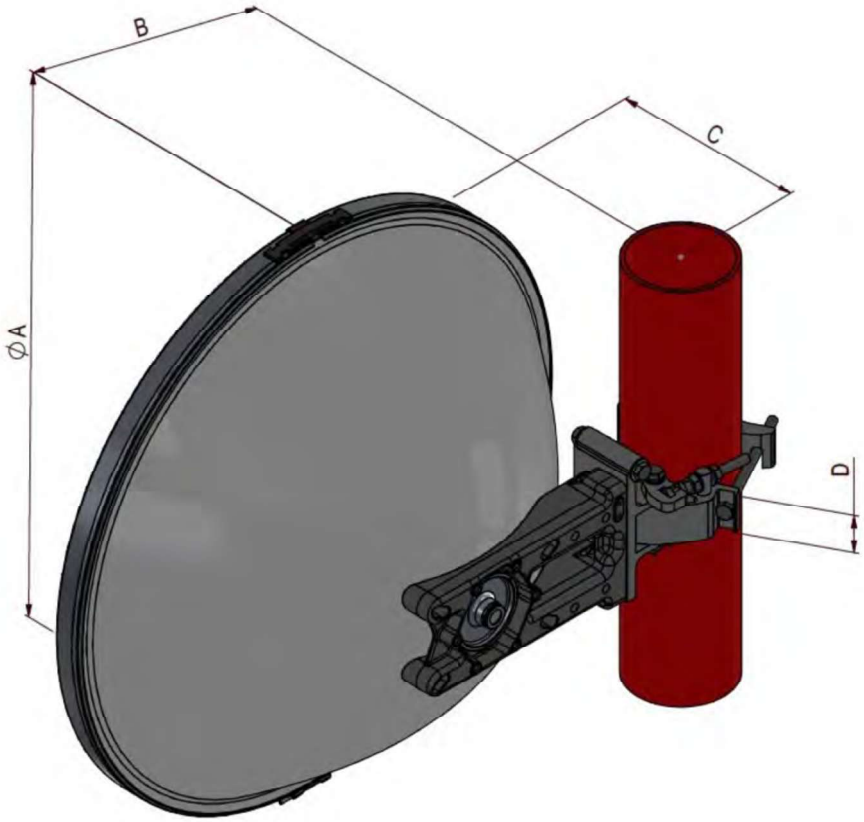
VHLP2-18/D

Mechanical Specifications

Compatible Mounting Pipe Diameter	48 mm–120 mm | 1.9 in–4.7 in
Fine Azimuth Adjustment Range	±15°
Fine Elevation Adjustment Range	±15°
Wind Speed, operational	201 km/h | 124.896 mph
Wind Speed, survival	252 km/h | 156.585 mph

Antenna Dimensions and Mounting Information



Dimensions in Inches (mm)				
Antenna Size, ft (m)	A	B	C	D
2 (0.6)	25.9 (660)	12.2 (310)	8.9 (228)	1.8 (45)

Wind Forces at Wind Velocity Survival Rating

Axial Force (FA)	1400 N | 314.733 lbf

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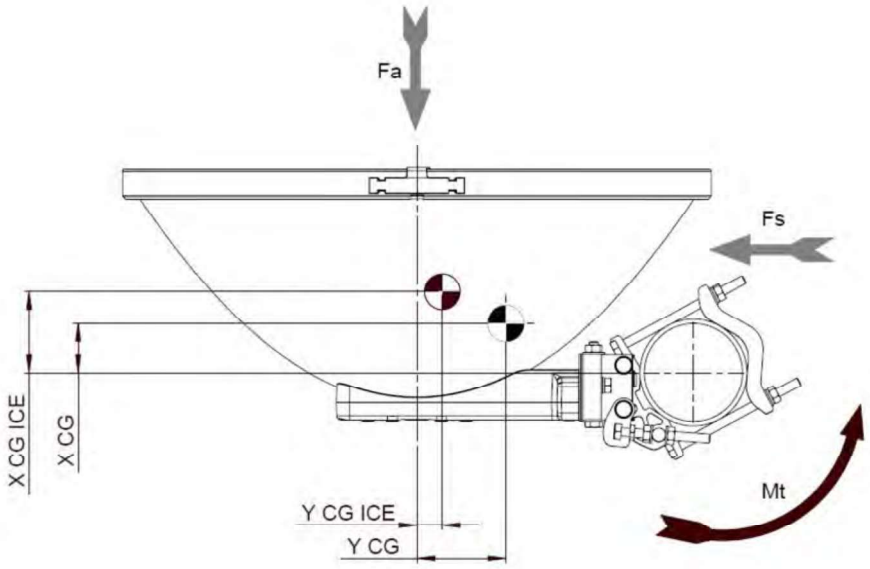
VHLP2-18/D

Angle α for MT Max	-50 °
Side Force (FS)	-350 N | -78.683 lbf
Twisting Moment (MT)	500 N-m | 4,425.373 in lb
Zcg without Ice	55 mm | 2.165 in
Zcg with 1 in (25 mm) Radial Ice	91 mm | 3.583 in
Weight with 1 in (25 mm) Radial Ice	20 kg | 44.092 lb

Wind Forces at Wind Velocity Survival Rating Image



Packaging and Weights

Weight, net	6.7 kg | 14.771 lb

Regulatory Compliance/Certifications

Agency	Classification
ISO 9001:2015	Designed, manufactured and/or distributed under this quality management system

* Footnotes

Operating Frequency Band	Bands correspond with CCIR recommendations or common allocations used throughout the world. Other ranges can be accommodated on special order.
Gain, Mid Band	For a given frequency band, gain is primarily a function of antenna size.

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	The gain of Andrew antennas is determined by either gain by comparison or by computer integration of the measured antenna patterns.
Boresite Cross Polarization Discrimination (XPD)	The difference between the peak of the co-polarized main beam and the maximum cross-polarized signal over an angle twice the 3 dB beamwidth of the co-polarized main beam.
Front-to-Back Ratio	Denotes highest radiation relative to the main beam, at 180° ±40°, across the band. Production antennas do not exceed rated values by more than 2 dB unless stated otherwise.
Return Loss	The figure that indicates the proportion of radio waves incident upon the antenna that are rejected as a ratio of those that are accepted.
VSWR	Maximum; is the guaranteed Peak Voltage-Standing-Wave-Ratio within the operating band.
Radiation Pattern Envelope Reference (RPE)	Radiation patterns define an antenna's ability to discriminate against unwanted signals. Under still dry conditions, production antennas will not have any peak exceeding the current RPE by more than 3dB, maintaining an angular accuracy of +/-1° throughout
Wind Speed, operational	For VHLP(X), SHP(X), HX and USX antennas, the wind speed where the maximum antenna deflection is 0.3 x the 3 dB beam width of the antenna. For other antennas, it is defined as a deflection is equal to or less than 0.1 degrees.
Wind Speed, survival	The maximum wind speed the antenna, including mounts and radomes, where applicable, will withstand without permanent deformation. Realignment may be required. This wind speed is applicable to antenna with the specified amount of radial ice.
Axial Force (FA)	Maximum forces exerted on a supporting structure as a result of wind from the most critical direction for this parameter. The individual maximums specified may not occur simultaneously. All forces are referenced to the mounting pipe.
Side Force (FS)	Maximum side force exerted on the mounting pipe as a result of wind from the most critical direction for this parameter. The individual maximums specified may not occur simultaneously. All forces are referenced to the mounting pipe.
Twisting Moment (MT)	Maximum forces exerted on a supporting structure as a result of wind from the most critical direction for this parameter. The individual maximums specified may not occur simultaneously. All forces are referenced to the mounting pipe.

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VHLP3-11W/A

Base Product

0.9m | 3 ft ValuLine® High Performance Low Profile Antenna, single-polarized, 10.125–11.700 GHz

Product Classification

Product Type	Microwave antenna
Product Brand	ValuLine®

General Specifications

Antenna Type	VHLP - ValuLine® High Performance Low Profile Antenna, single-polarized
Polarization	Single
Side Struts, Included	0
Side Struts, Optional	1 inboard

Dimensions

Diameter, nominal	0.9 m | 3 ft

Electrical Specifications

Operating Frequency Band	10.125 – 11.700 GHz
Gain, Low Band	37.8 dBi
Gain, Mid Band	38.4 dBi
Gain, Top Band	39 dBi
Boresite Cross Polarization Discrimination (XPD)	30 dB
Front-to-Back Ratio	64 dB
Beamwidth, Horizontal	2 °
Beamwidth, Vertical	2 °
Return Loss	17.7 dB
VSWR	1.3
Radiation Pattern Envelope Reference (RPE)	7164A | 7166A
Electrical Compliance	Brazil Anatel Class 2 | Canada SRSP 310.5 | ETSI 302 217 Class 3 | US FCC Part 101A @ 10.55–10.7 GHz | US FCC Part 101A @

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	10.7–11.7 GHz | US FCC Part 101B @ 10.125–11.7 GHz

Mechanical Specifications

Compatible Mounting Pipe Diameter	90 mm–120 mm | 3.5 in–4.7 in
Fine Azimuth Adjustment Range	±15°
Fine Elevation Adjustment Range	±15°
Wind Speed, operational	201 km/h | 124.896 mph
Wind Speed, survival	250 km/h | 155.343 mph

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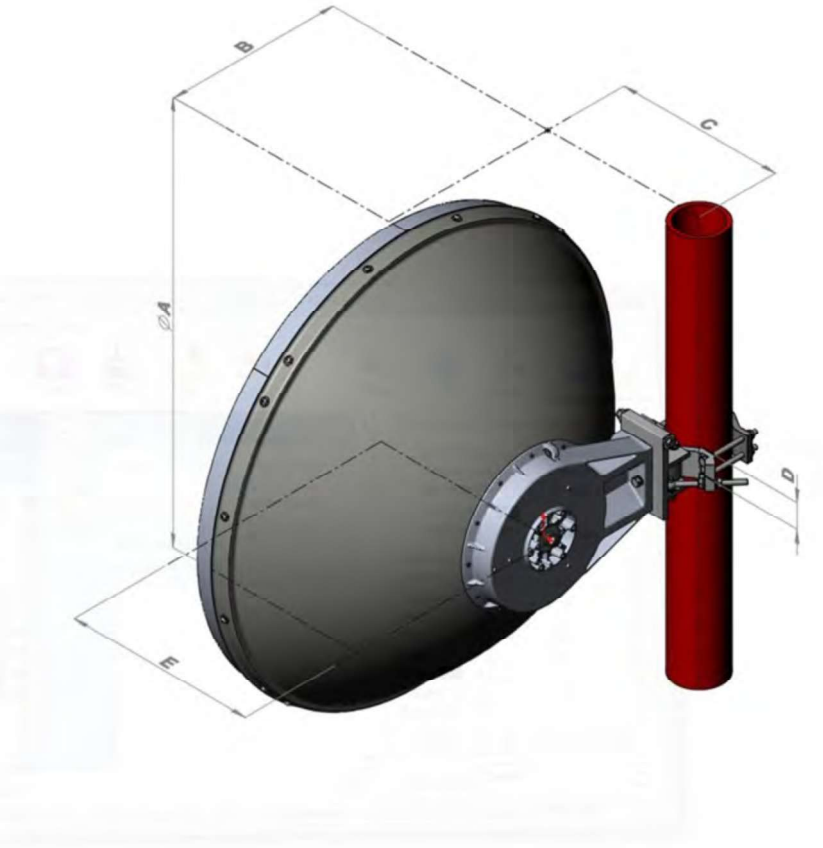
VHLP3-11W/A

Antenna Dimensions and Mounting Information



Dimension in Inches (mm)					
Antenna size, ft (m)	A	B	C	D	E
3 (1.0)	39.3 (999)	16 (407)	15.2 (387)	2.4 (60)	17.2 (437)

Wind Forces at Wind Velocity Survival Rating

Axial Force (FA)	2903 N | 652.621 lbf
Angle α for MT Max	0 °
Side Force (FS)	1439 N | 323.5 lbf
Twisting Moment (MT)	1179 N-m | 10,435.029 in lb
Zcg without Ice	135 mm | 5.315 in
Zcg with 1/2 in (12 mm) Radial Ice	84 mm | 3.307 in
Weight with 1/2 in (12 mm) Radial Ice	46 kg | 101.413 lb

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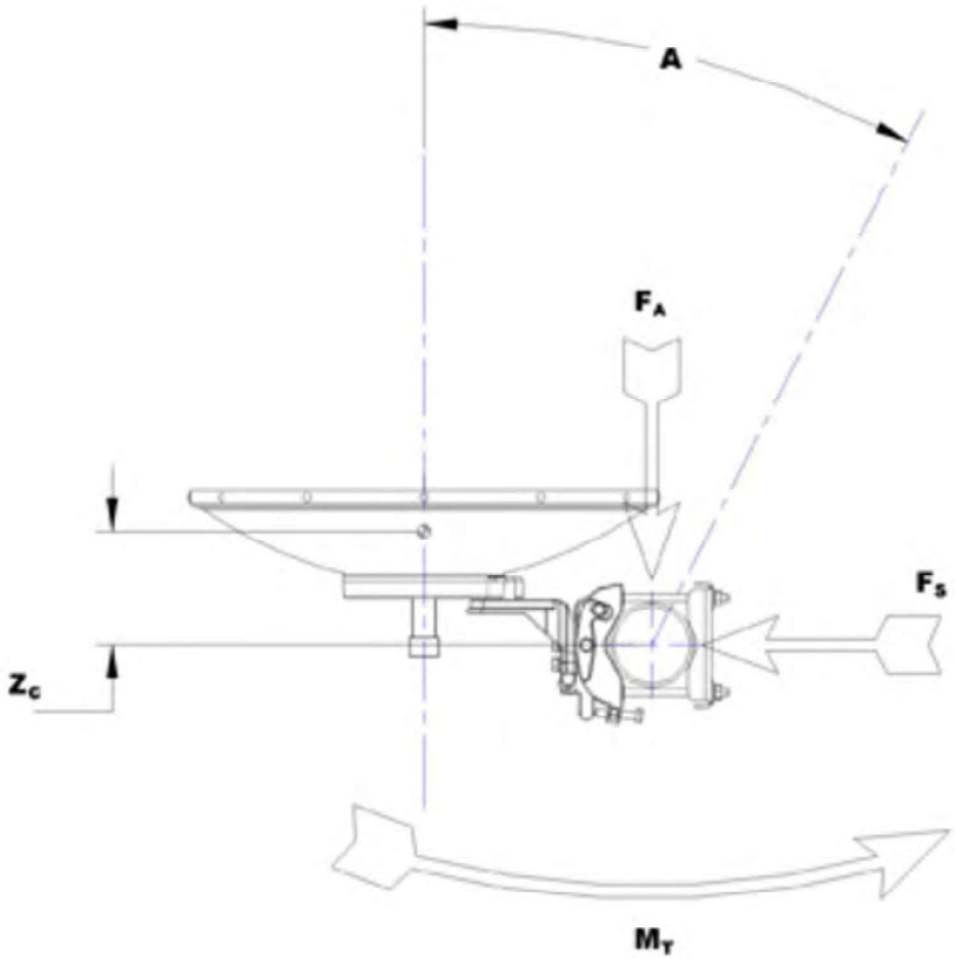
VHLP3-11W/A

Wind Forces at Wind Velocity Survival Rating Image



Packaging and Weights

Weight, net	17 kg | 37.479 lb

Regulatory Compliance/Certifications

Agency	Classification
ISO 9001:2015	Designed, manufactured and/or distributed under this quality management system

* Footnotes

Operating Frequency Band	Bands correspond with CCIR recommendations or common allocations used throughout the world. Other ranges can be accommodated on special order.

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Gain, Mid Band	For a given frequency band, gain is primarily a function of antenna size. The gain of Andrew antennas is determined by either gain by comparison or by computer integration of the measured antenna patterns.
Boresite Cross Polarization Discrimination (XPD)	The difference between the peak of the co-polarized main beam and the maximum cross-polarized signal over an angle twice the 3 dB beamwidth of the co-polarized main beam.
Front-to-Back Ratio	Denotes highest radiation relative to the main beam, at 180° ±40°, across the band. Production antennas do not exceed rated values by more than 2 dB unless stated otherwise.
Return Loss	The figure that indicates the proportion of radio waves incident upon the antenna that are rejected as a ratio of those that are accepted.
VSWR	Maximum; is the guaranteed Peak Voltage-Standing-Wave-Ratio within the operating band.
Radiation Pattern Envelope Reference (RPE)	Radiation patterns define an antenna's ability to discriminate against unwanted signals. Under still dry conditions, production antennas will not have any peak exceeding the current RPE by more than 3dB, maintaining an angular accuracy of +/-1° throughout
Wind Speed, operational	For VHLP(X), SHP(X), HX and USX antennas, the wind speed where the maximum antenna deflection is 0.3 x the 3 dB beam width of the antenna. For other antennas, it is defined as a deflection is equal to or less than 0.1 degrees.
Wind Speed, survival	The maximum wind speed the antenna, including mounts and radomes, where applicable, will withstand without permanent deformation. Realignment may be required. This wind speed is applicable to antenna with the specified amount of radial ice.
Axial Force (FA)	Maximum forces exerted on a supporting structure as a result of wind from the most critical direction for this parameter. The individual maximums specified may not occur simultaneously. All forces are referenced to the mounting pipe.
Side Force (FS)	Maximum side force exerted on the mounting pipe as a result of wind from the most critical direction for this parameter. The individual maximums specified may not occur simultaneously. All forces are referenced to the mounting pipe.
Twisting Moment (MT)	Maximum forces exerted on a supporting structure as a result of wind from the most critical direction for this parameter. The individual maximums specified may not occur simultaneously. All forces are referenced to the mounting pipe.

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VHLP3-18/A

Base Product

0.9m | 3 ft ValuLine® High Performance Low Profile Antenna, single-polarized, 17.700–19.700 GHz

Product Classification

Product Type	Microwave antenna
Product Brand	ValuLine®

General Specifications

Antenna Type	VHLP - ValuLine® High Performance Low Profile Antenna, single-polarized
Polarization	Single
Side Struts, Included	0
Side Struts, Optional	1 inboard

Dimensions

Diameter, nominal	0.9 m | 3 ft

Electrical Specifications

Operating Frequency Band	17.700 – 19.700 GHz
Gain, Low Band	43.1 dBi
Gain, Mid Band	43.5 dBi
Gain, Top Band	43.7 dBi
Boresite Cross Polarization Discrimination (XPD)	30 dB
Front-to-Back Ratio	71 dB
Beamwidth, Horizontal	1.1 °
Beamwidth, Vertical	1.1 °
Return Loss	17.7 dB
VSWR	1.3
Radiation Pattern Envelope Reference (RPE)	7152A
Electrical Compliance	Brazil Anatel Class 2 | Canada SRSP 317.8 Part A | ETSI 302 217 Class 3 | US FCC Part 101A

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VHLP3-18/A

Mechanical Specifications

Compatible Mounting Pipe Diameter	90 mm–120 mm | 3.5 in–4.7 in
Fine Azimuth Adjustment Range	±15°
Fine Elevation Adjustment Range	±15°
Wind Speed, operational	201 km/h | 124.896 mph
Wind Speed, survival	250 km/h | 155.343 mph

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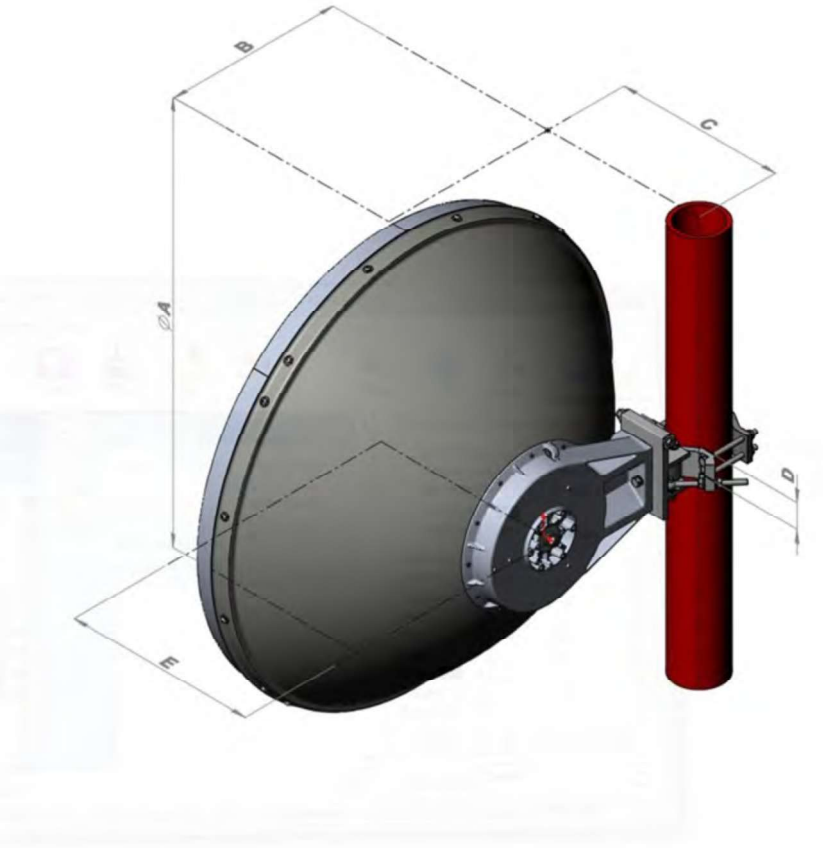
VHLP3-18/A

Antenna Dimensions and Mounting Information



Dimension in Inches (mm)					
Antenna size, ft (m)	A	B	C	D	E
3 (1.0)	39.3 (999)	16 (407)	15.2 (387)	2.4 (60)	17.2 (437)

Wind Forces at Wind Velocity Survival Rating

Axial Force (FA)	2903 N | 652.621 lbf
Angle α for MT Max	0 °
Side Force (FS)	1439 N | 323.5 lbf
Twisting Moment (MT)	1179 N-m | 10,435.029 in lb
Zcg without Ice	135 mm | 5.315 in
Zcg with 1/2 in (12 mm) Radial Ice	84 mm | 3.307 in
Weight with 1/2 in (12 mm) Radial Ice	46 kg | 101.413 lb

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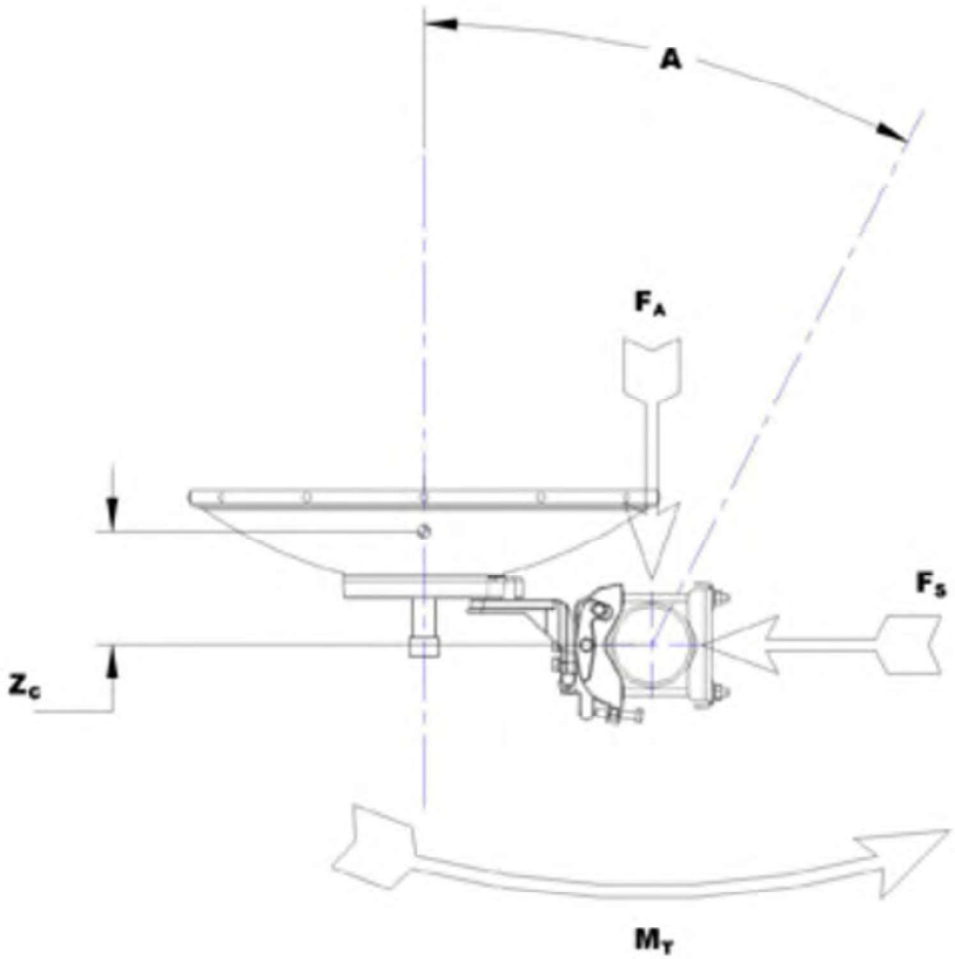
VHLP3-18/A

Wind Forces at Wind Velocity Survival Rating Image



Packaging and Weights

Weight, net	17 kg | 37.479 lb

Regulatory Compliance/Certifications

Agency	Classification
ISO 9001:2015	Designed, manufactured and/or distributed under this quality management system

* Footnotes

Operating Frequency Band	Bands correspond with CCIR recommendations or common allocations used throughout the world. Other ranges can be accommodated on special order.

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Gain, Mid Band	For a given frequency band, gain is primarily a function of antenna size. The gain of Andrew antennas is determined by either gain by comparison or by computer integration of the measured antenna patterns.
Boresite Cross Polarization Discrimination (XPD)	The difference between the peak of the co-polarized main beam and the maximum cross-polarized signal over an angle twice the 3 dB beamwidth of the co-polarized main beam.
Front-to-Back Ratio	Denotes highest radiation relative to the main beam, at 180° ±40°, across the band. Production antennas do not exceed rated values by more than 2 dB unless stated otherwise.
Return Loss	The figure that indicates the proportion of radio waves incident upon the antenna that are rejected as a ratio of those that are accepted.
VSWR	Maximum; is the guaranteed Peak Voltage-Standing-Wave-Ratio within the operating band.
Radiation Pattern Envelope Reference (RPE)	Radiation patterns define an antenna's ability to discriminate against unwanted signals. Under still dry conditions, production antennas will not have any peak exceeding the current RPE by more than 3dB, maintaining an angular accuracy of +/-1° throughout
Wind Speed, operational	For VHLP(X), SHP(X), HX and USX antennas, the wind speed where the maximum antenna deflection is 0.3 x the 3 dB beam width of the antenna. For other antennas, it is defined as a deflection is equal to or less than 0.1 degrees.
Wind Speed, survival	The maximum wind speed the antenna, including mounts and radomes, where applicable, will withstand without permanent deformation. Realignment may be required. This wind speed is applicable to antenna with the specified amount of radial ice.
Axial Force (FA)	Maximum forces exerted on a supporting structure as a result of wind from the most critical direction for this parameter. The individual maximums specified may not occur simultaneously. All forces are referenced to the mounting pipe.
Side Force (FS)	Maximum side force exerted on the mounting pipe as a result of wind from the most critical direction for this parameter. The individual maximums specified may not occur simultaneously. All forces are referenced to the mounting pipe.
Twisting Moment (MT)	Maximum forces exerted on a supporting structure as a result of wind from the most critical direction for this parameter. The individual maximums specified may not occur simultaneously. All forces are referenced to the mounting pipe.

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VHLP4-11W/A

Base Product

1.2 m | 4 ft ValuLine® High Performance Low Profile Antenna, single-polarized, 10.125–11.700 GHz

Product Classification

Product Type	Microwave antenna
Product Brand	ValuLine®

General Specifications

Antenna Type	VHLP - ValuLine® High Performance Low Profile Antenna, single-polarized
Polarization	Single
Side Struts, Included	1 inboard
Side Struts, Optional	1 inboard

Dimensions

Diameter, nominal	1.2 m | 4 ft

Electrical Specifications

Operating Frequency Band	10.125 – 11.700 GHz
Gain, Low Band	40.2 dBi
Gain, Mid Band	40.7 dBi
Gain, Top Band	41 dBi
Boresite Cross Polarization Discrimination (XPD)	30 dB
Front-to-Back Ratio	66 dB
Beamwidth, Horizontal	1.6 °
Beamwidth, Vertical	1.6 °
Return Loss	17.7 dB
VSWR	1.3
Radiation Pattern Envelope Reference (RPE)	7182A
Electrical Compliance	Brazil Anatel Class 2 | Canada SRSP 310.5 | Canada SRSP 310.7 Part A | Canada SRSP 310.7 Part B | ETSI 302 217 Class

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3 | US FCC Part 101A @ 10.55–10.7 GHz | US FCC Part 101A @ 10.7–11.7 GHz | US FCC Part 101B @ 10.125–11.7 GHz

Mechanical Specifications

Compatible Mounting Pipe Diameter	115 mm | 4.5 in
Fine Azimuth Adjustment Range	±15°
Fine Elevation Adjustment Range	±15°
Wind Speed, operational	201 km/h | 124.896 mph
Wind Speed, survival	250 km/h | 155.343 mph

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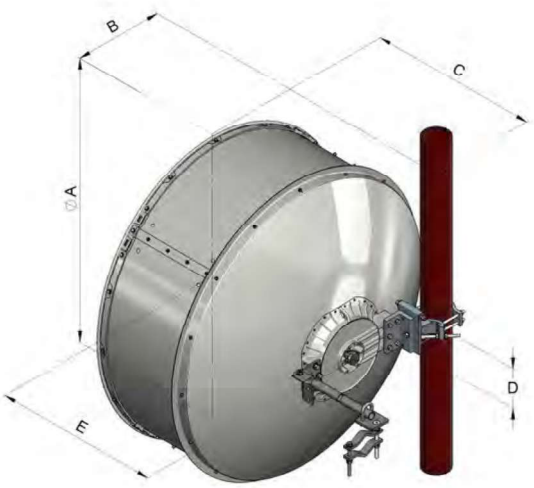
VHLP4-11W/A

Antenna Dimensions and Mounting Information



Dimensions in inches (mm)					
Antenna size, ft (m)	A	B	C	D	E
4 (1.2)	50.8 (1291)	16 (407)	30.2 (767)	7.2 (183)	29.5 (748)

Wind Forces at Wind Velocity Survival Rating

Axial Force (FA)	5326 N | 1,197.333 lbf
Side Force (FS)	2638 N | 593.046 lbf
Twisting Moment (MT)	2162 N-m | 19,135.312 in lb
Force on Inboard Strut Side	2862 N | 643.403 lbf
Zcg without Ice	43 mm | 1.693 in
Zcg with 1/2 in (12 mm) Radial Ice	284 mm | 11.181 in
Weight with 1/2 in (12 mm) Radial Ice	74 kg | 163.142 lb

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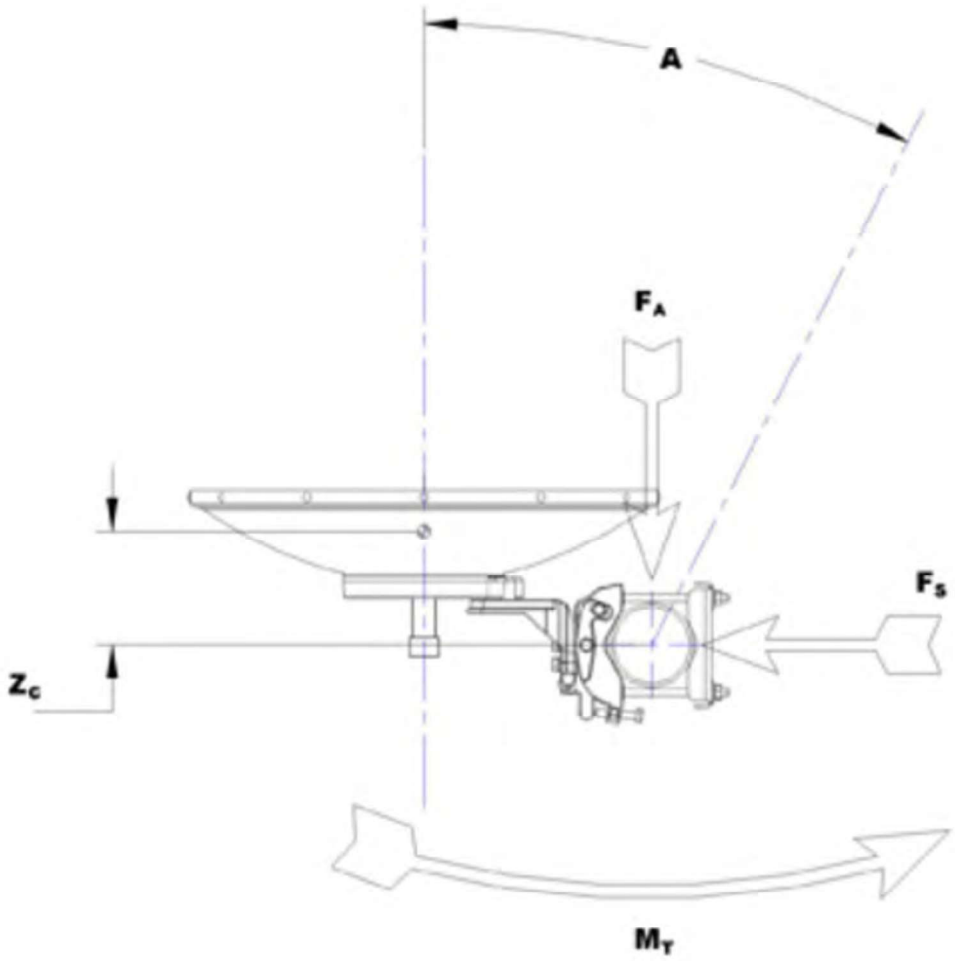
Revised: March 12, 2025

VHLP4-11W/A

Wind Forces at Wind Velocity Survival Rating Image



Packaging and Weights

Weight, net	32 kg | 70.548 lb

Regulatory Compliance/Certifications

Agency	Classification
ISO 9001:2015	Designed, manufactured and/or distributed under this quality management system

* Footnotes

Operating Frequency Band	Bands correspond with CCIR recommendations or common allocations used throughout the world. Other ranges can be accommodated on special order.

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Revised: March 12, 2025

Gain, Mid Band	For a given frequency band, gain is primarily a function of antenna size. The gain of Andrew antennas is determined by either gain by comparison or by computer integration of the measured antenna patterns.
Boresite Cross Polarization Discrimination (XPD)	The difference between the peak of the co-polarized main beam and the maximum cross-polarized signal over an angle twice the 3 dB beamwidth of the co-polarized main beam.
Front-to-Back Ratio	Denotes highest radiation relative to the main beam, at 180° ±40°, across the band. Production antennas do not exceed rated values by more than 2 dB unless stated otherwise.
Return Loss	The figure that indicates the proportion of radio waves incident upon the antenna that are rejected as a ratio of those that are accepted.
VSWR	Maximum; is the guaranteed Peak Voltage-Standing-Wave-Ratio within the operating band.
Radiation Pattern Envelope Reference (RPE)	Radiation patterns define an antenna's ability to discriminate against unwanted signals. Under still dry conditions, production antennas will not have any peak exceeding the current RPE by more than 3dB, maintaining an angular accuracy of +/-1° throughout
Wind Speed, operational	For VHLP(X), SHP(X), HX and USX antennas, the wind speed where the maximum antenna deflection is 0.3 x the 3 dB beam width of the antenna. For other antennas, it is defined as a deflection is equal to or less than 0.1 degrees.
Wind Speed, survival	The maximum wind speed the antenna, including mounts and radomes, where applicable, will withstand without permanent deformation. Realignment may be required. This wind speed is applicable to antenna with the specified amount of radial ice.
Axial Force (FA)	Maximum forces exerted on a supporting structure as a result of wind from the most critical direction for this parameter. The individual maximums specified may not occur simultaneously. All forces are referenced to the mounting pipe.
Side Force (FS)	Maximum side force exerted on the mounting pipe as a result of wind from the most critical direction for this parameter. The individual maximums specified may not occur simultaneously. All forces are referenced to the mounting pipe.
Twisting Moment (MT)	Maximum forces exerted on a supporting structure as a result of wind from the most critical direction for this parameter. The individual maximums specified may not occur simultaneously. All forces are referenced to the mounting pipe.

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Revised: March 12, 2025

VHLP6-6W/B

Base Product

1.8 m | 6 ft ValuLine® High Performance Low Profile Antenna, single-polarized, 5.925–7.125 GHz

Product Classification

Product Type	Microwave antenna
Product Brand	ValuLine®

General Specifications

Antenna Type	VHLP - ValuLine® High Performance Low Profile Antenna, single-polarized
Polarization	Single
Side Struts, Included	1
Side Struts, Optional	1 inboard

Dimensions

Diameter, nominal	1.8 m | 6 ft

Electrical Specifications

Operating Frequency Band	5.925 – 7.125 GHz
Gain, Low Band	38.5 dBi
Gain, Mid Band	39.3 dBi
Gain, Top Band	40.1 dBi
Boresite Cross Polarization Discrimination (XPD)	30 dB
Front-to-Back Ratio	66 dB
Beamwidth, Horizontal	1.8 °
Beamwidth, Vertical	1.8 °
Return Loss	17.7 dB
VSWR	1.3
Radiation Pattern Envelope Reference (RPE)	7138B
Electrical Compliance	Brazil Anatel Class 3 | Canada SRSP 305.9 Part B | Canada SRSP 306.4 Part A | ETSI 302 217 Class 3 | US FCC Part 101A

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Revised: March 12, 2025

VHLP6-6W/B

Electrical Specifications, Band 2

Operating Frequency Band	5.700 – 5.875 GHz
Gain, Mid Band	38.3 dBi
Beamwidth, Horizontal	2.2 °
Beamwidth, Vertical	2.2 °

Mechanical Specifications

Compatible Mounting Pipe Diameter	115 mm–120 mm | 4.5 in–4.7 in
Fine Azimuth Adjustment Range	±15°
Fine Elevation Adjustment Range	±5°
Wind Speed, operational	201 km/h | 124.896 mph
Wind Speed, survival	250 km/h | 155.343 mph

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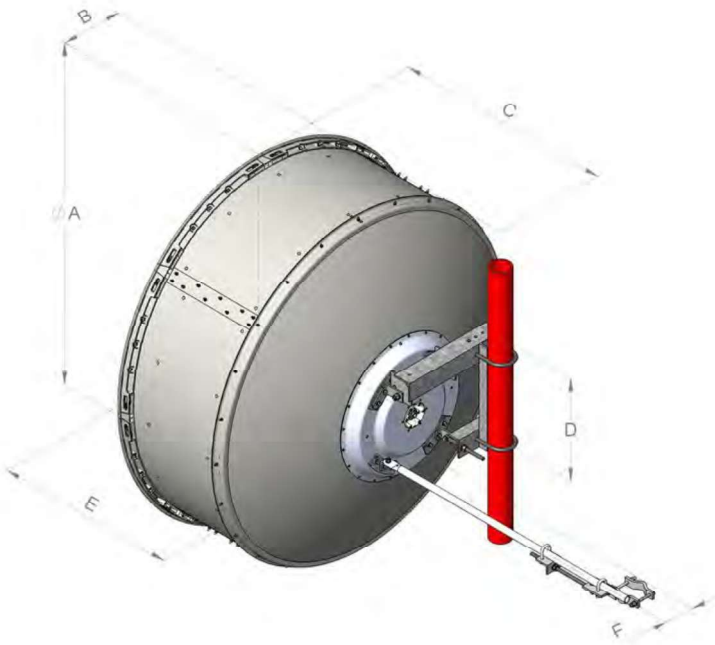
Revised: March 12, 2025

VHLP6-6W/B

Antenna Dimensions and Mounting Information



Dimensions in inches (mm)						
Antenna size, ft (m)	A	B	C	D	E	F
6 (1.8)	74.8 (1899)	13.4 (340)	47.5 (1206)	22.4 (570)	39.4 (1001)	6.9 (174)

Wind Forces at Wind Velocity Survival Rating

Axial Force (FA)	10670 N | 2,398.712 lbf
Angle α for MT Max	-120 °
Side Force (FS)	5286 N | 1,188.34 lbf
Twisting Moment (MT)	4752 N-m | 42,058.742 in lb
Zcg without Ice	363 mm | 14.291 in
Zcg with 1/2 in (12 mm) Radial Ice	543 mm | 21.378 in
Weight with 1/2 in (12 mm) Radial Ice	234 kg | 515.881 lb

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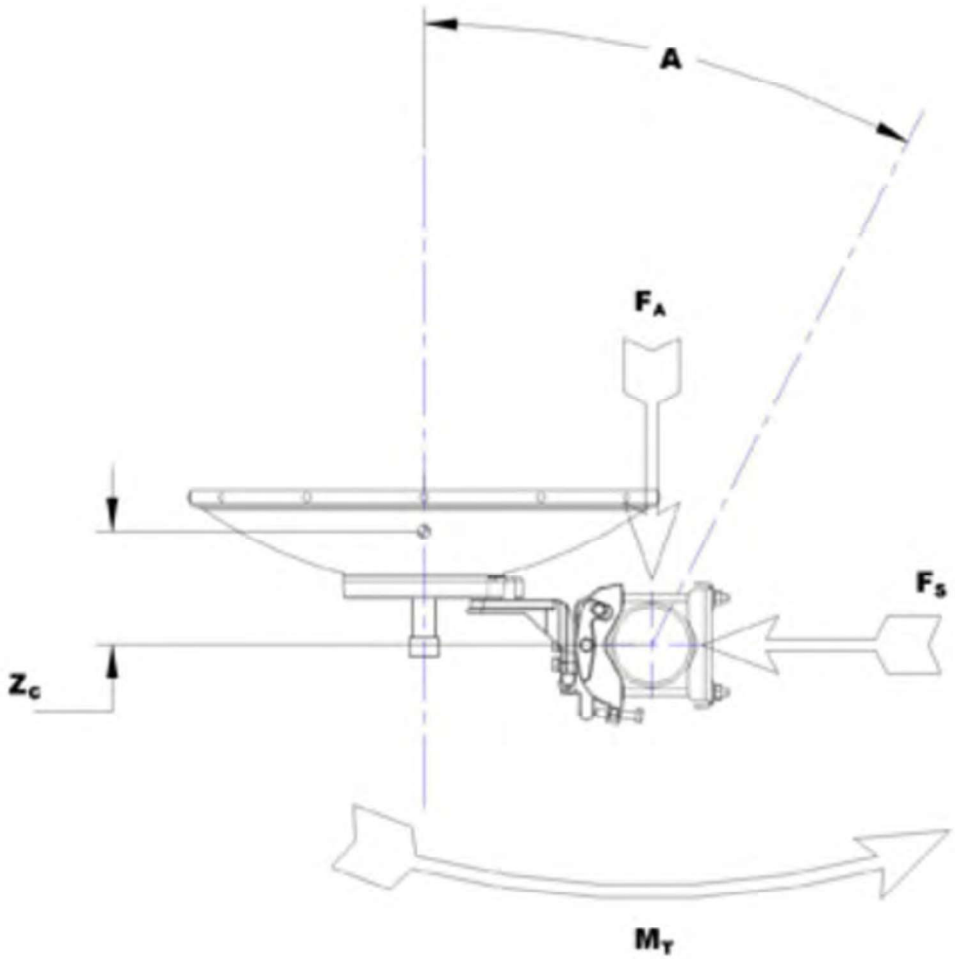
Revised: March 12, 2025

VHLP6-6W/B

Wind Forces at Wind Velocity Survival Rating Image



Packaging and Weights

Weight, net	86 kg | 189.597 lb

Regulatory Compliance/Certifications

Agency	Classification
ISO 9001:2015	Designed, manufactured and/or distributed under this quality management system

* Footnotes

Operating Frequency Band	Bands correspond with CCIR recommendations or common allocations used throughout the world. Other ranges can be accommodated on special order.

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Revised: March 12, 2025

Gain, Mid Band	For a given frequency band, gain is primarily a function of antenna size. The gain of Andrew antennas is determined by either gain by comparison or by computer integration of the measured antenna patterns.
Boresite Cross Polarization Discrimination (XPD)	The difference between the peak of the co-polarized main beam and the maximum cross-polarized signal over an angle twice the 3 dB beamwidth of the co-polarized main beam.
Front-to-Back Ratio	Denotes highest radiation relative to the main beam, at 180° ±40°, across the band. Production antennas do not exceed rated values by more than 2 dB unless stated otherwise.
Return Loss	The figure that indicates the proportion of radio waves incident upon the antenna that are rejected as a ratio of those that are accepted.
VSWR	Maximum; is the guaranteed Peak Voltage-Standing-Wave-Ratio within the operating band.
Radiation Pattern Envelope Reference (RPE)	Radiation patterns define an antenna's ability to discriminate against unwanted signals. Under still dry conditions, production antennas will not have any peak exceeding the current RPE by more than 3dB, maintaining an angular accuracy of +/-1° throughout
Wind Speed, operational	For VHLP(X), SHP(X), HX and USX antennas, the wind speed where the maximum antenna deflection is 0.3 x the 3 dB beam width of the antenna. For other antennas, it is defined as a deflection is equal to or less than 0.1 degrees.
Wind Speed, survival	The maximum wind speed the antenna, including mounts and radomes, where applicable, will withstand without permanent deformation. Realignment may be required. This wind speed is applicable to antenna with the specified amount of radial ice.
Axial Force (FA)	Maximum forces exerted on a supporting structure as a result of wind from the most critical direction for this parameter. The individual maximums specified may not occur simultaneously. All forces are referenced to the mounting pipe.
Side Force (FS)	Maximum side force exerted on the mounting pipe as a result of wind from the most critical direction for this parameter. The individual maximums specified may not occur simultaneously. All forces are referenced to the mounting pipe.
Twisting Moment (MT)	Maximum forces exerted on a supporting structure as a result of wind from the most critical direction for this parameter. The individual maximums specified may not occur simultaneously. All forces are referenced to the mounting pipe.

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Revised: March 12, 2025

VHLPX1-23/C

Base Product

0.3 m | 1 ft ValuLine® High Performance Low Profile Antenna, dual-polarized, 21.200–23.600 GHz

This product will be discontinued on: January 31, 2026

Replaced By:

VHLPX1-23/D	0.3m	1 ft ValuLine® High Performance Antenna, dual polarized, 21.200–23.600 GHz

Product Classification

Product Type	Microwave antenna
Product Brand	ValuLine®

General Specifications

Antenna Type	VHLPX - ValuLine® High Performance Low Profile Antenna, dual-polarized
Polarization	Dual
Side Struts, Included	0
Side Struts, Optional	0

Dimensions

Diameter, nominal	0.3 m	1 ft

Electrical Specifications

Operating Frequency Band	21.200 – 23.600 GHz
Gain, Low Band	35 dBi
Gain, Mid Band	35.6 dBi
Gain, Top Band	36.2 dBi
Boresite Cross Polarization Discrimination (XPD)	30 dB
Front-to-Back Ratio	62 dB
Beamwidth, Horizontal	3 °
Beamwidth, Vertical	3 °

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Revised: August 7, 2025

VHLPX1-23/C

Return Loss	17.7 dB
VSWR	1.3
Radiation Pattern Envelope Reference (RPE)	7015C
Electrical Compliance	Brazil Anatel Class 2 | Canada SRSP 321.8 Part B | ETSI 302 217 Class 3 | US FCC Part 101A

Mechanical Specifications

Compatible Mounting Pipe Diameter	50 mm–120 mm | 2.0 in–4.7 in
Fine Azimuth Adjustment Range	±15°
Fine Elevation Adjustment Range	±15°
Wind Speed, operational	201 km/h | 124.896 mph
Wind Speed, survival	250 km/h | 155.343 mph

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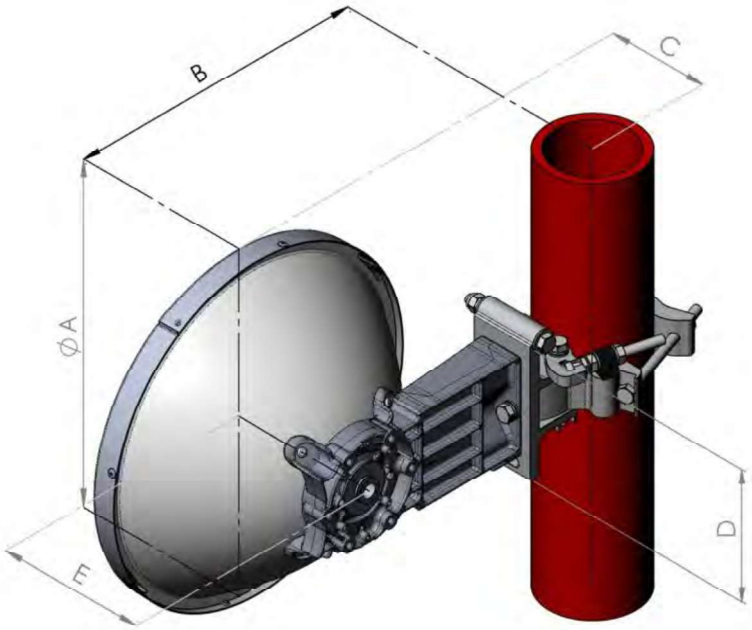
VHLPX1-23/C

Antenna Dimensions and Mounting Information



Dimensions in inches (mm)					
Antenna size, ft (m)	A	B	C	D	E
1 (0.3)	15(382)	12.7(323)	6(151)	6.1(155)	7(177)

Wind Forces at Wind Velocity Survival Rating

Axial Force (FA)	446 N | 100.265 lbf
Side Force (FS)	198 N | 44.512 lbf
Twisting Moment (MT)	144 N-m | 1,274.507 in lb
Zcg without Ice	28 mm | 1.102 in
Zcg with 1/2 in (12 mm) Radial Ice	54 mm | 2.126 in
Weight with 1/2 in (12 mm) Radial Ice	12 kg | 26.455 lb

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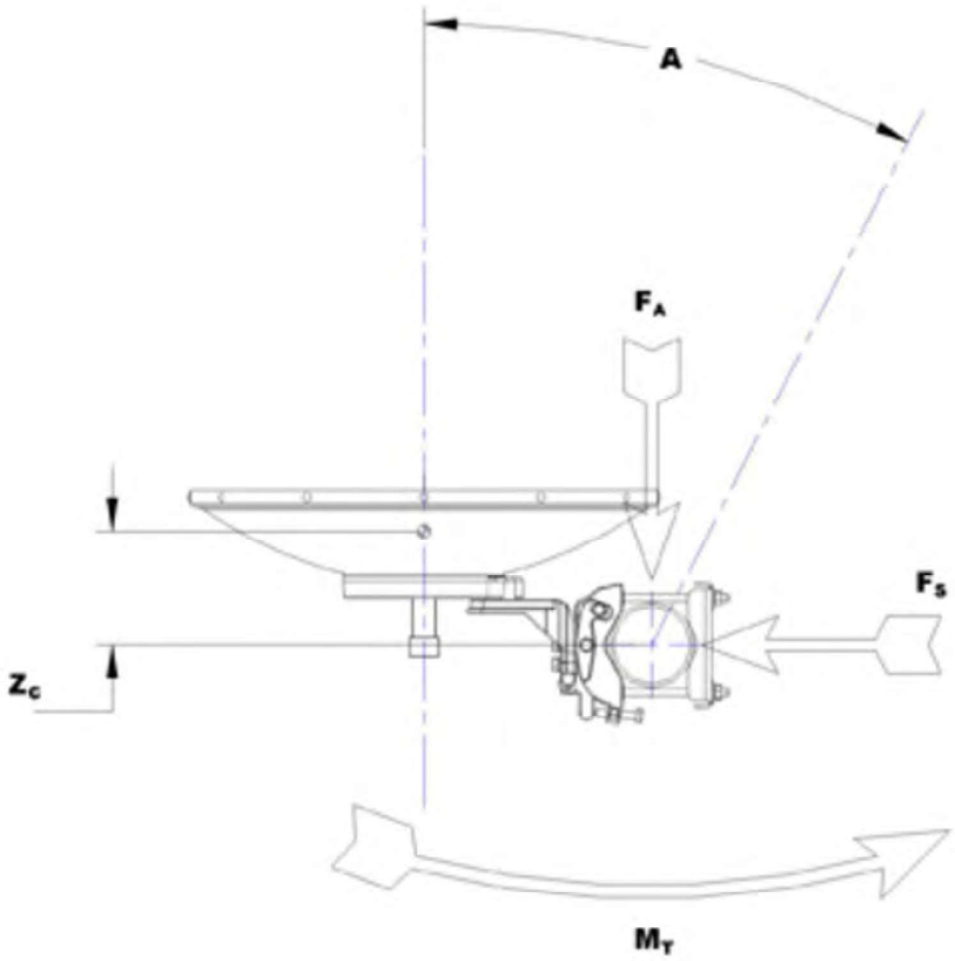
VHLPX1-23/C

Wind Forces at Wind Velocity Survival Rating Image



Packaging and Weights

Weight, net	4.7 kg | 10.362 lb

Regulatory Compliance/Certifications

Agency	Classification
ISO 9001:2015	Designed, manufactured and/or distributed under this quality management system

* Footnotes

Operating Frequency Band	Bands correspond with CCIR recommendations or common allocations used throughout the world. Other ranges can be accommodated on special order.

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Gain, Mid Band	For a given frequency band, gain is primarily a function of antenna size. The gain of Andrew antennas is determined by either gain by comparison or by computer integration of the measured antenna patterns.
Boresite Cross Polarization Discrimination (XPD)	The difference between the peak of the co-polarized main beam and the maximum cross-polarized signal over an angle twice the 3 dB beamwidth of the co-polarized main beam.
Front-to-Back Ratio	Denotes highest radiation relative to the main beam, at 180° ±40°, across the band. Production antennas do not exceed rated values by more than 2 dB unless stated otherwise.
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Wind Speed, operational	For VHLP(X), SHP(X), HX and USX antennas, the wind speed where the maximum antenna deflection is 0.3 x the 3 dB beam width of the antenna. For other antennas, it is defined as a deflection is equal to or less than 0.1 degrees.
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Revised: August 7, 2025

EXHIBIT E
Marion County Requirements for Non-Federal Entity Contracts

Section 1: Appendix II to Part 200 - Contract Provisions for Non-Federal Entity Contracts Under Federal Awards

(A) Contracts for more than the simplified acquisition threshold, which is the inflation adjusted amount determined by the Civilian Agency Acquisition Council and the Defense Acquisition Regulations Council (Councils) as authorized by 41 U.S.C. 1908, must address administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as appropriate.

(B) All contracts in excess of $10,000 must address termination for cause and for convenience by the non-Federal entity including the manner by which it will be affected and the basis for settlement.

(C) Equal Employment Opportunity. Except as otherwise provided under 41 CFR Part 60, all contracts that meet the definition of "federally assisted construction contract" in 41 CFR Part 60-1.3 must include the equal opportunity clause provided under 41 CFR 60-1.4(b), in accordance with Executive Order 11246, "Equal Employment Opportunity" (30 FR 12319, 12935, 3 CFR Part, 1964-1965 Comp., p. 339), as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and implementing regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."

(D) Davis-Bacon Act, as amended (40 U.S.C. 3141-3148). When required by Federal program legislation, all prime construction contracts in excess of $2,000 awarded by non-Federal entities must include a provision for compliance with the Davis-Bacon Act (40 U.S.C. 3141-3144, and 3146-3148) as supplemented by Department of Labor regulations (29 CFR Part 5, "Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction"). In accordance with the statute, contractors must be required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, contractors must be required to pay wages not less than once a week. The non-Federal entity must place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation. The decision to award a contract or subcontract must be conditioned upon the acceptance of the wage determination. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency. The contracts must also include a provision for compliance with the Copeland "Anti-Kickback" Act (40 U.S.C. 3145), as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States"). The Act provides that each contractor or subrecipient must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency.

(E) Contract Work Hours and Safety Standards Act (40 U.S.C. 3701-3708). Where applicable, all contracts awarded by the non-Federal entity in excess of $100,000 that involve the employment of

mechanics or laborers must include a provision for compliance with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 U.S.C. 3702 of the Act, each contractor must be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

(F) Rights to Inventions Made Under a Contract or Agreement. If the Federal award meets the definition of "funding agreement" under 37 CFR § 401.2 (a) and the recipient or subrecipient wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under that "funding agreement," the recipient or subrecipient must comply with the requirements of 37 CFR Part 401, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," and any implementing regulations issued by the awarding agency.

(G) Clean Air Act (42 U.S.C. 7401-7671q.) and the Federal Water Pollution Control Act (33 U.S.C. 1251-1387), as amended. Contracts and subgrants of amounts in excess of $150,000 must contain a provision that requires the non-Federal award to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

(H) Debarment and Suspension (Executive Orders 12549 and 12689). A contract award (see 2 CFR 180.220) must not be made to parties listed on the governmentwide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), "Debarment and Suspension." SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.

(I) Byrd Anti-Lobbying Amendment (31 U.S.C. 1352). Contractors that apply or bid for an award exceeding $100,000 must file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352. Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non-Federal award.

(J) See § 200.323. Procurement of recovered materials.

(K) See § 200.216. Prohibition on certain telecommunications and video surveillance services or equipment.

(L) See § 200.322. Domestic preference for procurements.

[78 FR 78608, Dec. 26, 2013, as amended at 79 FR 75888, Dec. 19, 2014; 85 FR 49577, Aug. 13, 2020]

Section 2: Additional Requirements for Non-Federal Entity Contracts

1. Audit Requirements

- Subrecipients must comply with the federal regulations set forth in 2 CFR §200.5XX Subpart F.
- Subrecipient must comply, and require any subcontractor to comply, with applicable audit requirements and responsibilities set forth in this Agreement and applicable state or federal law as set forth in 2 CFR §200.501(h).
- If Subrecipient expends federal awards in excess of $1,000,000 in a fiscal year, Subrecipient is subject to audit conducted in accordance with the provisions of 2 CFR §200.5XX Subpart F. Copies of all audits must be submitted to the County within 30 days of completion.
- Subrecipient must save, protect and hold harmless the County from the cost of any audits or special investigations performed by the Secretary of State with respect to the funds expended under this Agreement. Subrecipient acknowledges and agrees that any audit costs incurred by Subrecipient as a result of allegations of fraud, waste or abuse are ineligible for reimbursement under this or any other agreement between Subrecipient and the County.

2. System for Award Management - 2 CFR Part 25 - Subrecipient must comply with applicable requirements regarding the System for Award Management (SAM), currently accessible at https://www.sam.gov. This includes applicable requirements regarding registration with SAM, as well as maintaining current information in SAM. Subrecipient must also comply with applicable restrictions on subawards ("subgrants") to first tier subcontractors (first-tier "Subcontractors"), including restrictions on subawards to entities that do not acquire and provide (to the County) the unique entity identifier required for SAM registration.

3. Whistleblower Protection Act - 2 CFR § 200.217 - Subrecipient must comply and ensure the compliance by subcontractors, with 41 U.S.C. 4712, Program for Enhancement of Employee Whistleblower Protection. Subrecipient must inform subcontractors, contractors and employees, in writing, in the predominant language of the workforce, of the employee whistleblower rights and protections under 41 USC 4712.

4. Recordkeeping Requirements - Subrecipient must maintain records and financial documents for five years after all funds have been expended or returned to the County. The County may request transfer of

records of long-term value at the end of such period. Wherever practicable, such records should be collected, transmitted, and stored in open and machine-readable formats.

Subrecipient must agree to provide or make available such records to the County upon request, and to the Government Accountability Office ("GAO"), U.S. Treasury's Office of Inspector General ("OIG"), and their authorized representative in order to conduct audits or other investigations.

6. Civil Rights Compliance - Recipients of Federal financial assistance from the U.S. Treasury are required to meet legal requirements relating to nondiscrimination and nondiscriminatory use of Federal funds. Those requirements include ensuring that entities receiving Federal financial assistance from the U.S. Treasury do not deny benefits or services, or otherwise discriminate on the basis of race, color, national origin (including limited English proficiency), disability, age, or sex (including sexual orientation and gender identity), in accordance with the following authorities: Title VI of the Civil Rights Act of 1964 (Title VI) Public Law 88-352, 42 U.S.C. 2000d-1 et seq., and the Subrecipient's implementing regulations, 31 CFR part 22; Section 504 of the Rehabilitation Act of 1973 (Section 504), Public Law 93-112, as amended by Public Law 93-516, 29 U.S.C. 794; Title IX of the Education Amendments of 1972 (Title IX), 20 U.S.C. 1681 et seq., and the Subrecipient's implementing regulations, 31 CFR part 28; Age Discrimination Act of 1975, Public Law 94-135, 42 U.S.C. 6101 et seq., and the Subrecipient implementing regulations at 31 CFR part 23.

In order to carry out its enforcement responsibilities under Title VI of the Civil Rights Act, U.S. Treasury will collect and review information from non-Tribal recipients to ascertain their compliance with the applicable requirements before and after providing financial assistance. U.S. Treasury's implementing regulations, 31 CFR part 22, and the Department of Justice (DOJ) regulations, Coordination of Non-discrimination in Federally Assisted Programs, 28 CFR part 42, provide for the collection of data and information from recipients (see 28 CFR 42.406). U.S. Treasury may request that recipients submit data for post-award compliance reviews, including information such as a narrative describing their Title VI compliance status. This collection does not apply to Tribal governments.

7. Real Property, Equipment and Other Capital Expenditures - County shall, and shall cause its Subrecipients to, maintain policies and procedures for the management of property and equipment that comply with all requirements of the applicable Uniform Guidance at 2 CFR Part 200, Subpart D, 2 CFR Part 200.310 – 200.316 and 200.439, and specific requirements of the source of funds. These regulations shall apply to all real property, equipment, and other capital expenditures purchased with the federal funding.

Supplemental 1 - APW

PROVISIONAL Design Document

RF Sub-System and Site Designs

Marion County

Region: East Cell

Site: APW

Issue 1.1 ○ 1st May 2026

www.taitradio.com

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PREFACE

Project Details

Project number	
Customer	Marion County
Project description	P25 Phase 2 Simulcast & P25 Phase 1 Conventional Simulcast
Business Development Manager	
Sales Engineer	
Project Engineer	Jared Farrar / Riley Alfaqeeh
Project Manager	Stacey Adams (formerly Matt Jordan)
Lead RF Engineers	Ian Graham

Purpose

The Marion County project is an 11 site P25 simulcast design that uses the US 700MHz band. To control Time Delay Interference (TDI), the simulcast design is split into three cells – North, South, and East. The North cell is comprised of four sites with P25 Phase 2 trunked operation, the South cell is comprised of four sites with P25 Phase 2 trunked operation, and the East cell is comprised of three sites with P25 Phase 1 conventional operation.

The purpose of this report is to document the RF subsystem design for the **APW** site which forms part of the East simulcast cell.

Scope

This document specifies the frequencies to be utilized at the site and summarizes the intermodulation analysis with these frequencies and other high-level in-band carriers as identified from an FCC license search. The required antenna system and associated RF combining equipment will then be described in full.

Publication Record

Author	Ian Graham, Jared Farrar
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Document Status

Issue	Date	Signature	Comment
0.1	8th October 2025	Jared Farrar	Initial draft
1.0	7th November 2025	Jared Farrar	Initial release
1.1	1st May 2026		

Document Approvals

Approvals	Position	Signature	Date
Bladimyr Guzman	TAM Design Authority		

Associated Documents & References

Reference documentation includes:

- Marion County P25 System Design_v1.1.docx
- Marion County P25 Project - Equipment List by Site.xlsx
- Marion County Power_Heat_Load.xlsx

1. GENERAL RF DESIGN APPROACH

The Marion County project is an 11-site P25 simulcast design that uses the US 700MHz band. To control Time Delay Interference (TDI), the simulcast design is split into three cells – North, South, and East.

The North Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- Crooked Finger
- Crosby
- Eastview
- Parrett Mountain

The South Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- Eagle Crest
- Lower Prospect
- McCully Mountain
- Wipper

The East Cell sites operate in P25 Phase 1 conventional mode and are identified as follows:

- **APW**
- House Mountain
- Halls Ridge

Each site within the North and South Cells will have five trunked P25 Phase 2 channels providing eight dynamic talkpaths (one 12.5kHz FDMA control channel plus four 2-slot 12.5kHz TDMA traffic channels) across each respective cell's coverage area. The East Cell will have five conventional P25 Phase 1 12.5kHz FDMA channels providing five fixed talkpaths across the cell.

Each site across all three cells will have separate transmit (Tx) and receive (Rx) antennas, typically with 20ft vertical separation between centers of radiation. The anticipated low site noise floors in the 700MHz band means Tower Top Amplifiers (TTA) can be used to improve receiver sensitivity and talk-in coverage. Along with the 30MHz Tx-Rx frequency separation, these factors lead to a common RF combining subsystem design which is applicable to all Marion County sites. The combining system requirements were captured based on the proposed frequency plan in coordination with ADCOMM Engineering LLC and Tait subsequently worked with the chosen equipment vendor, dBSpectra, on an optimal design. The main consideration was the TTA where it was decided to use dBSpectra's compact design after it was shown all the required receiver filtering could be accommodated. The generic (starting point) site combining system design therefore features the:

- DSCC75M-5BM 5 Channel Ceramic Tx Combiner
- DSCHPMDC1MDC Channelized Power Monitor
- NPD3633A-TTA Tower Top Amplifier
- NPD3363A-PDU Rx Multicoupler PDU

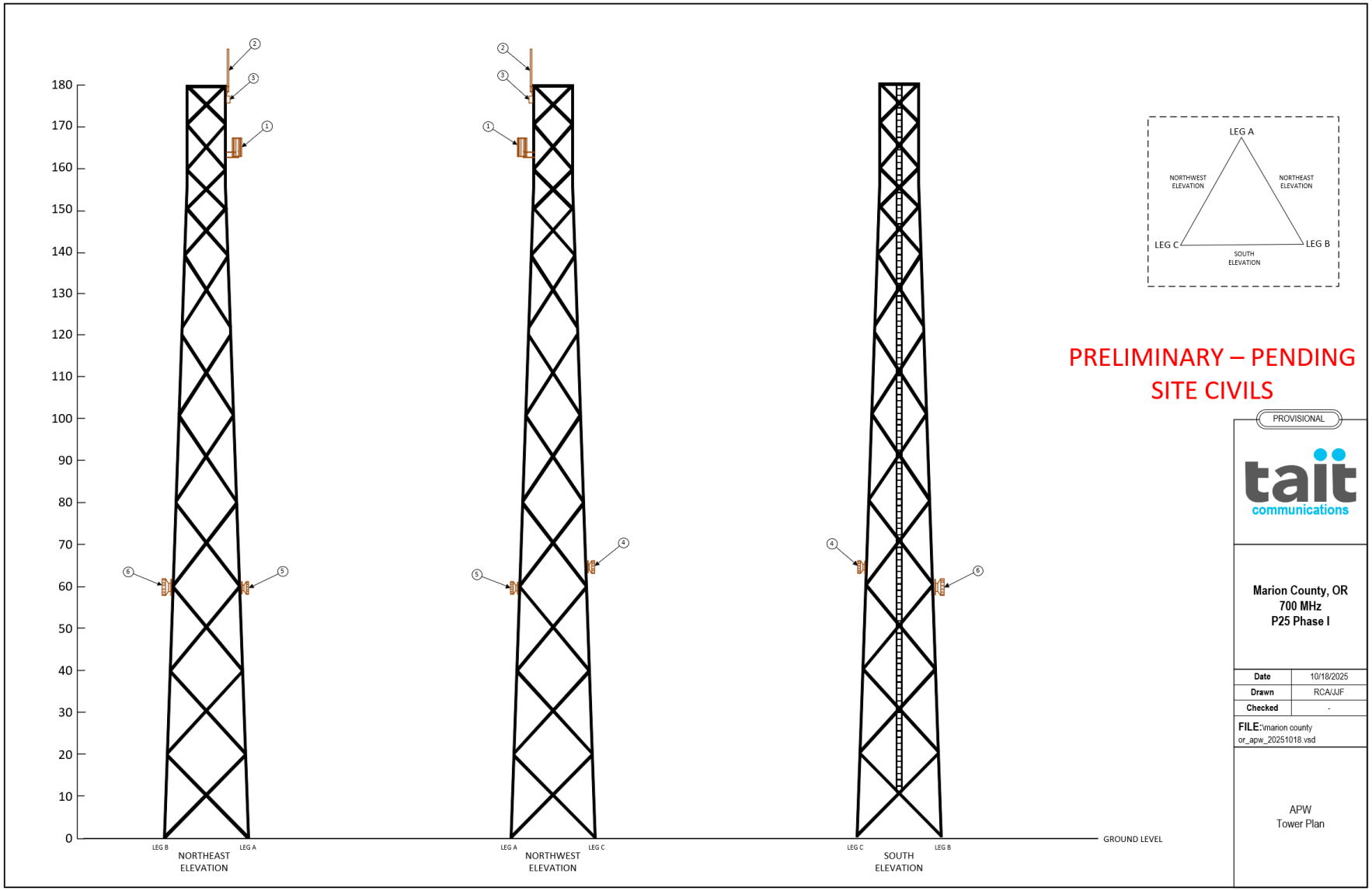
Antennas were chosen on a site-by-site basis to minimize TDI in the simulcast cells while still providing necessary talk-out coverage. The proposed antennas are the:

- Sinclair SE412-SWBPAL
    - 5dBd Low PIM Enclosed Dipole Array
- Sinclair SE414-SWBPAL
    - 8.5 to 11dBd Low PIM Adjustable Beamwidth Enclosed Dipole Array
- RFI CC807-09
    - 9dBd Collinear Omnidirectional

For the APW site, the basic design approach will be:

- Install a new SE414-SWBPALDF(D00) transmit antenna at 162ft AGL on Leg ‘A’ (NE) of the 180ft tower, azimuth 45º, beamwidth 90º.
    - The 5 transmit channels will be connected to the Tx antenna using the dBSpectra DSCC75M-5BM Ceramic Combiner.
- Install a new RFI CC807-09 receive antenna at 179ft AGL on Leg ‘A’ (NE) of the 180ft tower (azimuth n/a).
    - The 5 receive channels will be fed from the Rx antenna via the dBSpectra NPD3633A-TTA Tower Top Amplifier and the NPD3633A-PDU Rx multicoupler/PDU

2. TOWER MAPPING



#	Description	Part Number	Length (ft)	Leg/Face	Status	Base Height (ft)	Centerline Height(ft)	Tip Height (ft)	Antenna Azimuth	Mount Azimuth	Mount	Transmission Line Size/Type
1	P25 TX Antenna	SE414-SWBPALDF(D00)	4.4	A	New	162	164	166	45		Site-Pro PSA-6 (6' standoff)	7/8"
2	P25 RX Antenna	CC807-09	10.3	A	New	179	184	189	-		Standard	1/2" to TTA
3	TTA	NPD3633A-TTA	1.0	A	New	176	177	177	-		Standard	7/8"
4	Microwave - McCully	VHLP3-11W	3.0	C	New	64	65	67	262.48	262.48	Standard w/ tieback	EW90
5	Microwave - House Mtn	VHLP3-18	3.0	A	New	59	60	62	337.47	337.47	Standard w/ tieback	EW90
6	Microwave - Halls Ridge	VHLP4-11W	4.0	B	New	58	60	62	110.52	110.52	Standard w/ tieback	EWP180-180

Figure 1: APW 180ft Tower Mapping and Appurtenances

3. FREQUENCY PLANNING

5 Channels will be deployed at this site.

The East Simulcast cell uses the following frequencies:

Site Name	FCC Channel Number	Tx Frequency (MHz)	Rx Frequency (MHz)
APW	421-422	771.63125	801.63125
	517-518	772.23125	802.23125
	565-566	772.53125	802.53125
	605-606	772.78125	802.78125
	787-788	773.91875	803.91875

Table 1: East Cell Frequency Assignments

4. INCUMBENTS SEARCH

An external high-level carrier (HLC) is defined as a signal that appears at a level of >-40dBm at the receive antenna. These are the signals which have the potential to contribute towards intermodulation that would result in a loss of receiver sensitivity on one or more channels.

Signal and Noise Monitoring of RF activity at the site was not deemed necessary for this project given the wide Tx-Rx frequency separation in the 700MHz band and the anticipated low site noise floors.

To get some idea of potential RF activity at the site, an FCC License Search was carried out to identify any other transmitters operating between 700 and 900MHz located within a 0.6-mile radius of the tower (a typical transmitter emitting 100W ERP at 0.6 miles away would be received at -40dBm assuming free space path loss). These include cellular transmitters (as their wide bandwidth could cause IM energy to spread into the LMR receive band) and are summarized in Table 2 below:

Owner	Call Sign	Frequency (MHz)	Tx ERPd (dBm)	Distance from Marion County Tower (miles)
NONE DISCOVERED				

Table 2: High Level Carriers

5. INTERMODULATION ANALYSIS

An intermodulation (IM) analysis was performed for the potentially significant sources, including both the Marion County channels to be deployed and any HLCs found during the FCC License Search. For antenna configurations using separate transmit and receive antennas Tait best practice is to search for IM products up to 7th order within a defined search window accounting for the fact the bandwidth of IM products spread according to the order and bandwidth of the signals that cause it.

The frequencies included in the IM analysis are listed in Table 3 below.

Transmit Frequencies (MHz)	Receive Frequencies (MHz)
771.63125	801.63125
772.23125	802.23125
772.53125	802.53125
772.78125	802.78125
773.91875	803.91875

Table 3: Frequencies Included in IM Analysis

Table 4 below shows how many IM products are generated on each of the receive frequencies. A direct hit is an IM product that falls exactly at the receive frequency. An indirect hit is one that does not fall exactly at a receive frequency but does fall within the search window.

IM Order	Number of Intermodulation Products at each Receive Frequency									
	801.64375MHz		802.24375MHz		802.54375MHz		802.79375MHz		803.90625MHz	
	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect
3rd	0	0	0	0	0	0	0	0	0	0
5th	0	0	0	0	0	0	0	0	0	0
7th	0	0	0	0	0	0	0	0	0	0

Table 4: Intermodulation Results Summary

6. ANTENNA SYSTEM DESIGN

The Antenna System detailed here and the RF Combining System described later in sections 7, 8, and 10 have been specifically designed to mitigate any interference caused by the listed high level carriers, thereby maximizing the coverage achieved by the Marion County system.

6.1 Antenna Type

The following antennas will be used at APW.

Antenna	Manufacturer	Antenna Model Number	Description	Antenna Length (ft)	Antenna Gain (dBd)
Rx	RFI	CC807-09	Collinear Omni	10	9
Tx	Sinclair	SE414-SWBPALDF(D00)	Enclosed Dipole	4.4	10

Table 5: Antenna Details

800MHz Corporate Collinear Antennas

748-870MHz

CC807 Series

These industry leading, full featured corporate collinear arrays allow site operators to combine, with complete integrity, a large number of communications services into a single, low profile antenna solution.

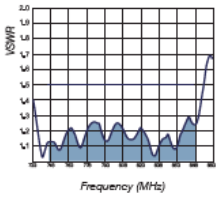
The corporate feed design employed by RFI maintains superior pattern control, allowing gain to be maximised with zero tilt variation over a very broad bandwidth, comparable to that only previously available in exposed dipole array configurations. This is achieved in the preferred form factor of a fully enclosed fibreglass radome, providing a reduction in wind loading, ice loading and tower loading in comparison.

The CC807 series have been designed with an exceptional power rating of 500W across the band as well as a Peak Instantaneous Power (PIP) rating of 25kW to cater for the peak voltage levels present in large multi-carrier combining environments. RFI's refined design processes and proven construction methods achieve a PIM rating of –150dBc, further ensuring performance is maintained for the service life of the antenna.

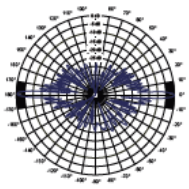
Features:

- 500W Continuous Power rating
- -150dBc Passive Intermodulation (PIM) rating, 100% PIM tested
- 25 kW Peak Instantaneous Power (PIP) rating
- DC grounding on all elements for the ultimate in lightning protection and dissipation of static noise.
- Light weight dipole construction using RFI's patented flexi-PCB architecture, maintains a low centre of gravity reducing tip deflection and sway
- Field invertible (excluding tilt models)
- Preset downtilt variations of 2 and 4 degrees available, see note (1)

Typical VSWR Response (CC807-12)



CC807-12 - E Plane



Electrical Specifications

Model Number	CC807-09-P	CC807-12-P
Nominal Gain *dBd (dBi)*	9.0 (11.1)	11.5 (13.6)
Frequency *MHz*	746-870	
Tuned Bandwidth *MHz*	Full	
VSWR *(Return Loss)*	1.5:1	
Nominal Impedance Ω	50	
Downtilt°	0 Std 2, 4 (1)	
Vertical Beamwidth°	8	4
Horizontal Beamwidth°	Omni +/- 0.5dB	
Input Power W	500	
Passive IM 3rd order (2x20W) *dBc*	-150	
Peak Instantaneous Power *kW*	25	

Mechanical

Model Number		CC807-09-P	CC807-12-P
Construction		Sky blue fibreglass radome	
Radome Diameter mm (inches)		76 (3.0)	
Length mm (inches)		3135 (123.4)	6235 (245.5)
Weight *kg (lbs)*		14 (30.9)	25.5 (56.2)
Termination		Integrated 4.3-10 Female	
Mountaing Area mm (inches)		750 x 90 (30 x 3.5) diameter Ecofilm™ plated aluminium	
Suggested Clamps		3 x UC-114	
Shipping Dimensions *mm (inches)*	H	115 (4.5)	
	W	115 (4.5)	
	L	3335 (131.3)	6435 (253.3)
Shipping Weight *kg (lbs)*		20.0 (44.1)	36.5 (80.5)
Projected area *cm² (ft²)*	No Ice	2597 (2.8)	5559 (6.0)
	With Ice	3192 (3.4)	7037 (7.6)
Lateral Thrust @160km/h *N* (100 mph lbs)		308 (69)	659 (148)
Wind Gust Rating *km/h (mph)*	No Ice	>240 (150)	
Torque @ 160km/h *Nm* (100mph ft-lbs)		413 (305)	1823 (1345)

(1) To order pre-set downtilt versions available, simply add a -T2 or -T4 towards the end of the part number to denote downtilt model required. For eg. CC807-12-T2-P to order CC807-12-P with 2deg of downtilt. Please note: Models with downtilt are NOT field invertible. . Eg. CC807-12-T2-P

P-43021-7

Asia Pacific | EMEA | Americas

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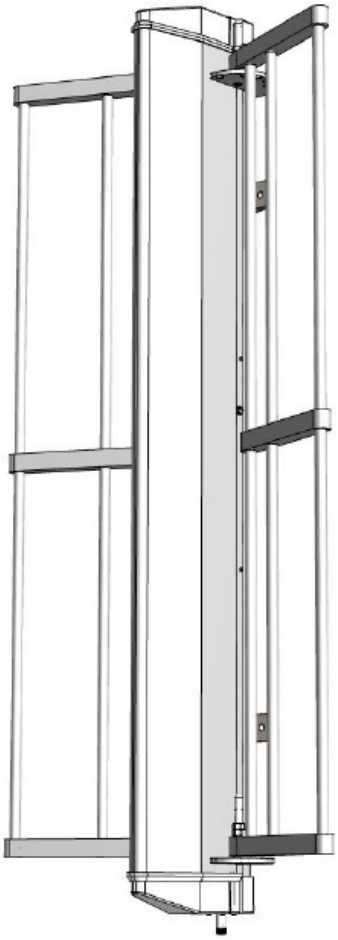
Antennas

700-1000 MHz Antennas

SE414-WBAL - PIM Certified Series

SE414-SWBPAL(YY)(DXX) Enclosed dipole, 8-11.5 dBd, adj. beamwidth, Low PIM, 746-960MHz

- Wide band design covers whole 746-960 MHz band, PIP rated
- Horizontal beamwidth can be adjusted (60º/90º/105º/130º/160º)
- Gain depends on horizontal beamwidth setting (11.5/10/9/8.5/8 dBd)
- PIP rated and low PIM



One wideband antenna for your 700, 800, 900 MHz systems. Sinclair's SE414-WBL series of enclosed dipole arrays offer excellent intermodulation performance covering 746-960 MHz in a single antenna. These highly versatile antennas are particularly well suited to communication systems where a specific coverage pattern is required. These include cellular systems, trunked radio, paging, and data transmission, where predictable and highly reliable performance is a must.

The SE414-WBAL series come with field adjustable reflectors that provide horizontal beamwidths between 60 and 160 degrees. The creative design and construction permits excellent pattern control and greater efficiency.

When ordering, please refer to the chart below for the model number. Different configurations are subject to various list prices. Please contact your Sinclair Sales Representative or Customer Service Representative for more information.

Model Number	Connector	Downtilt	PIM(dBc)	PIP(kW, max)
SE414-SWBPALDF(D00)	7/16 DIN(F)	0º	<-150	25
SE414-SWBPALDF(D01)	7/16 DIN(F)	1º	<-150	25
SE414-SWBPALDF(D02)	7/16 DIN(F)	2º	<-150	25
SE414-SWBPALDF(D03)	7/16 DIN(F)	3º	<-150	25
SE414-SWBPALDF(D04)	7/16 DIN(F)	4º	<-150	25
SE414-SWBPALDF(D05)	7/16 DIN(F)	5º	<-150	25
SE414-SWBPALDF(D06)	7/16 DIN(F)	6º	<-150	25
SE414-SWBPALNF(D00)	N(F)	0º	<-139	N/A
SE414-SWBPALNF(D01)	N(F)	1º	<-139	N/A
SE414-SWBPALNF(D02)	N(F)	2º	<-139	N/A
SE414-SWBPALNF(D03)	N(F)	3º	<-139	N/A
SE414-SWBPALNF(D04)	N(F)	4º	<-139	N/A
SE414-SWBPALNF(D05)	N(F)	5º	<-139	N/A
SE414-SWBPALNF(D06)	N(F)	6º	<-139	N/A

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Antennas
700-1000 MHz Antennas
SE414-WBAL - PIM Certified Series

Electrical Specifications

Frequency Range	MHz	746 to 960	
Bandwidth	MHz	214	
Gain (nominal)	dBd (dBi)	11.5 (13.6)	*1
Input VSWR (max)		1.5:1	
Polarization		vertical	
Impedance	Ω	50	
Pattern		Directional and Adjustable	
Horizontal beamwidth (typ)	degrees	60	*2
Vertical beamwidth (typ)	degrees	20	
Average Input Power (max)	W	500	
Front-to-back ratio (min)	dB	20	
Grounding		All metal parts DC-grounded	

Notes

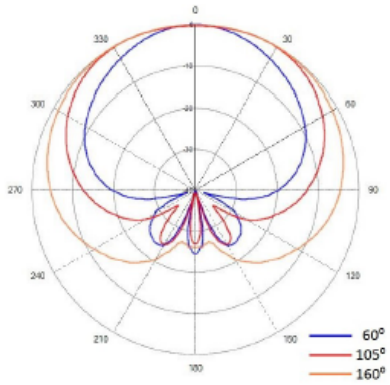
*1 : Dependant on reflector setting 10/9/8.5/8 dBd
*2 : 90/105/130/160
*3 : 90° beamwidth configuration, clamp not included in measurement
*4 : 90° beamwidth configuration, clamp not included in measurement
*5 : Ref. clamp maximum

Mechanical Specifications

Width	in (mm)	25 (635)	*3
Depth	in (mm)	8.5 (216)	*4
Length/ Height	in (mm)	53 (1346)	
Base pipe diameter	in (mm)	2.88 (73)	*5
Base pipe mounting length	in (mm)	30.5 (775)	
Radiating element material		prntd circuit bd	
Weight	lbs (kg)	23 (10.44)	
Mounting Hardware (Included)		#130 clamp	
Mounting configurations		upright	
Actual shipping weight	lbs (kg)	28 (12.71)	
Shipping dimensions	in (mm)	58x14x17 (1473x356x432)	

Environmental Specifications

Temperature range	°F (°C)	-40 to +140 (-40 to +60)
Wind Loading Area (Flat Plate Equivalent)	ft² (m²)	4.8 (0.45)
Wind Loading Area (1/2" ice)	ft² (m²)	5.7 (0.53)
Rated wind velocity (no ice)	mph (km/h)	155 (250)
Rated wind velocity (1/2" radial ice)	mph (km/h)	140 (225)
Lateral Thrust (100 mph No Ice)	lbs (N)	180 (800.6)
Torsional moment (100 mph No Ice)	ft-lbs (Nm)	93 (125.6)



Horizontal

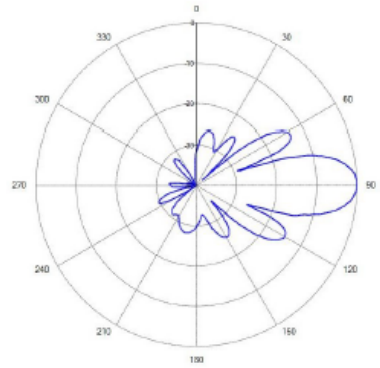

Vertical, 0° downtilt

Figure 2: Antenna Datasheet

6.2 Antenna Mounting Locations

Table 6 below specifies the Marion County antenna mounting location details.

Antenna	Mounting Height (feet AGL)	Antenna Orientation (degrees)	Tower Leg	Standoff Length (feet)	Standoff Orientation (degrees)	Standoff Model
Receive	179	n/a	A (NE)	n/a	n/a	n/a
Transmit	162	45	A (NE)	6	45	Site-Pro PSA-6

Table 6: Antenna Mounting Locations

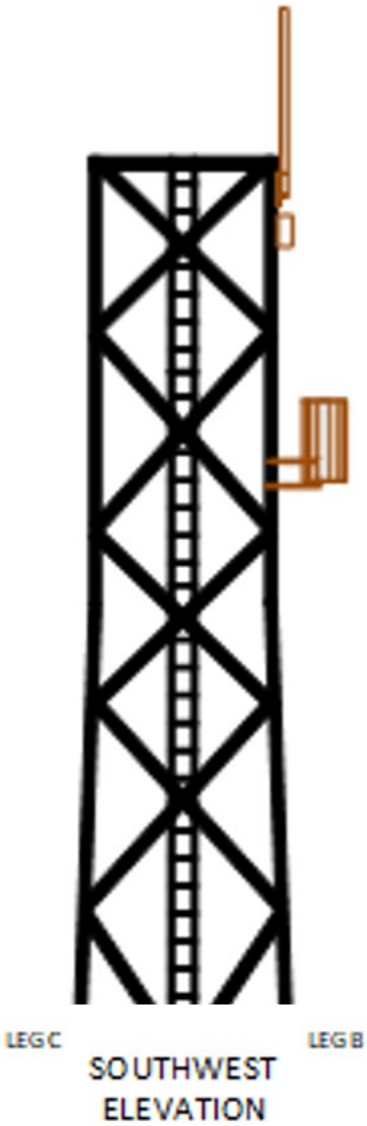
The antenna system design for this site is given in Figure 3.

Marion County Rx Antenna

- System Type: P25 Phase 2 Simulcast
- Antenna Manufacturer: RFI
- Antenna Type no: CC807-09
- Antenna Height AGL at base: 179ft
- Antenna CoR: 184ft
- Antenna Azimuth: n/a
- Tower Leg: B (SE)
- Antenna Function: Rx
- Rx: 801.64375MHz, 802.24375MHz, 802.54375MHz, 802.79375MHz,

Marion County Tx Antenna

- System Type: P25 Phase 2 Simulcast
- Antenna Manufacturer: RFI
- Antenna Type no: SE414-SWBPALDF(D00)
- Antenna Height AGL at base: 162ft
- Antenna CoR: 164ft
- Antenna Azimuth: 145°
- Tower Leg: B (SE)
- Antenna Function: Tx
- Tx: 771.64375MHz, 772.24375MHz, 772.54375MHz, 772.79375MHz, 773.90625MHz



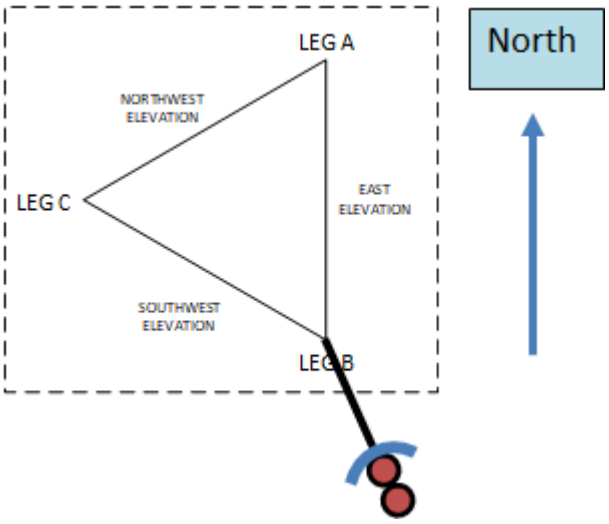


Figure 3: Antenna System Design

6.3 Antenna Isolation

The Transmit and Receive antennas are vertically separated by 20ft and horizontally separated by 6ft which gives an isolation between them of **63.8dB**. A figure of **60dB** will be assumed in subsequent calculations, though, as that is often the limit of what can be practically achieved (e.g., mounting imperfections, mechanical drift due to wind/ice loads or aging hardware).

7. TRANSMITTER COMBINER DESIGN

7.1 RF Connectors

The antenna output of the combiner is fitted with **4.3-10 female** connector to minimize Passive Intermodulation (PIM).

The transmitter input ports of the combiner are fitted with **N Type female** connectors.

7.2 Cavity Filters

Filtering in the Tx Combiner is predominantly bandpass.

A combination of band-pass and band-reject filtering is sometimes to provide extra rejection at specific site Rx frequencies, but band-reject filters are never used alone.

The cavity filters provide the minimum attenuation at the closest receive frequency equal to or greater to the value specified in section 7.9 of this document.

7.3 Isolator

A dual Isolator is included between the output of each transmitter and the Tx Combiner input port.

The isolator load closest to the Tx Combiner input port is rated at a minimum of **100 watts**.

7.4 Maximum RF Power

The Tx combiner supports a maximum of **100 watts** of RF input power per channel.

7.5 Minimum Tx to Tx Frequency Separation

The minimum frequency separation allowed between transmitters sharing the same combiner is **250kHz**.

7.6 Maximum number of Transmitters per combiner

Standard Tait practice is a maximum of four transmitters per Tx combiner. But in this case, the relatively wide Tx-Tx spacing and the fact that self-TxIM does not occur renders the penalty in combining all five transmitters together negligible.

7.7 Maximum Tx Combiner Loss per Channel

The insertion loss shall be minimized to the extent possible while complying with all other specifications.

The Tx Combiner insertion loss per Tx channel (not including associated Tx antenna feeder cable losses) will be around **3.2dB** for the Tx-Tx frequency separation at this site.

7.8 Tx Intermodulation Suppression

Transmitters that cause intermodulation on any site receive frequency must not be connected to the same combiner.

However, there is still a responsibility to keep the site as ‘clean’ as possible for its incumbents. To that end, the levels of intermodulation products generated in the combiner are controlled by a requiring a minimum isolation

between the outputs of combined transmitters of **at least 60dB**. This figure includes the reverse isolation of the isolator and any additional attenuation provided by the cavity filters in neighboring branches.

7.9 Tx Sideband Noise Suppression

In addition to the Tx – Rx antenna isolation, the Tx Combiner provides the suppression required to reduce transmitter sideband noise at the Rx antenna to the level where it causes no more than 1dB of receiver de-sensitization. The transmitter sideband noise suppression required at this site is given in Table 7 below.

Transmit Frequency (MHz)	Offset to Nearest Receive Frequency (MHz)	Sideband Noise Suppression Required at Offset (dB)
771.63125	30.0000	14
772.23125	29.4000	15
772.53125	29.1000	15
772.78125	28.8500	15
773.91875	27.7375	15

Table 7: Transmitter Combiner Sideband Noise Rejection Requirements

8. RECEIVER SUBSYSTEM DESIGN

8.1 RF Connectors

8.1.1 Tower Top Amplifier

The Rx Filter input is fitted with a **4.3-10 female** connector.

The Rx Filter output is fitted with a **4.3-10 female** connector.

8.1.2 Receiver Multicoupler/PDU

The Rx Multicoupler input is fitted with a **4.3-10 female** connector.

The receiver output ports of the Rx Multicoupler are fitted with a **BNC Female** connector.

8.2 Receiver Subsystem Topology

The Receiver Subsystem will utilize a Tower Top Amplifier (TTA, which includes the receiver filtering) to optimize talk-in coverage followed by a multicoupler/PDU system that further amplifies and splits the received signal between the connected receivers.

8.3 Receiver Filtering

The Receiver Filters will pass the 801 to 805MHz part of the 700MHz band used for the Marion County system while fully rejecting associated transmit signals in both the 700MHz and 800MHz Tx bands. This is important because combinations of transmitters in both bands can result in 7th order IM falling within the 700MHz receive band.

8.3.1 Blocking Rejection

Between them, the Receiver Filters must provide enough attenuation so that no more than 1dB of de-sensitization of any of the connected receivers occurs due to receiver blocking. The attenuation required at this site to prevent receiver blocking due to the Marion County transmitters and external interferers found during FCC database search is given in Table 8 below:

	Tx Name	Tx Frequency (MHz)	Minimum Rejection in Rx Filter at Tx Frequency (dB)				
			Rx1 (MHz)	Rx2 (MHz)	Rx3 (MHz)	Rx4 (MHz)	Rx5 (MHz)
			801.63125	801.63125	801.63125	801.63125	801.63125
Transmitters	Tx1	771.63125	20	20	20	20	20
	Tx2	772.23125	20	20	20	20	20
	Tx3	772.53125	20	20	20	20	20
	Tx4	772.78125	20	20	20	20	20
	Tx5	773.91875	20	20	20	20	20

Table 8: Receiver Filter Blocking Rejection Requirements

8.3.2 Receiver Intermodulation Rejection

The Rx Filter must provide enough attenuation so that no more than 1dB of de-sensitization of any of the connected receivers occurs due to intermodulation. At this site, there is no anticipated IM risk. Therefore, the rejection specified above is sufficient.

8.4 Low Noise Amplifiers

Low Noise Amplifiers (LNAs) with appropriate gain and noise figure will be included in the receiver sub system to ensure that the cascade noise figure of the line up from the base of the receive antenna up to and including the base station receiver is equal to or less than 5dB. In the case of APW, this noise figure can be improved to approximately **3.9dB** while still maintaining linearity of the receive system lineup.

The output third order intercept of the LNAs will be ≥ +40dBm to maintain the linearity of the system.

8.5 Variable Attenuator

A Variable Attenuator will be fitted in the Rx Multicoupler/PDU for field optimization of the receiver subsystem gain, noise figure, and IP3. The attenuator has an adjustment range of 0dB to 15dB, in 0.25dB steps. To achieve a noise figure of 3.9dB, the variable attenuator shall be set to **6dB**.

Setting of the attenuator value must be done electronically so as not to require disassembly of the multicoupler equipment.

8.6 Receiver Ports

To allow for future expansion, the Rx Multicoupler will have 8 ports

All unused ports will be terminated in a 50-ohm load.

9. POWER MONITOR

The dBSpectra DSCHPMDC1MDC Power Monitor will be used within the Marion County RF systems. This is placed at the output of the Tx Combiner and allows remote monitoring of channelized transmitted power and antenna VSWR. The major benefit is early warning of antenna system degradation so that repairs can be made before failure occurs.

DSCHPM-Series (VHF, 220, UHF, 700/800/900 MHz)
SMART Channelized Transmit Power Monitor with Front Panel Display Option

dbSpectra
Always a Better Value

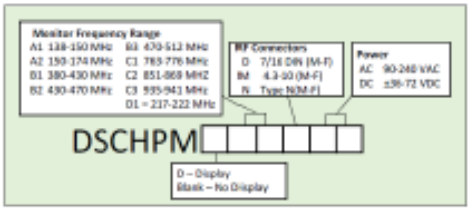
DSCHPM Power Monitor with front panel display option.

Directional coupler for installation on combiner output.

Features and Benefits

- *Per-channel and composite* measurement of forward and reflected RF power with the SMART Channelized RF Power Monitor.
- Calculates and displays combiner insertion loss for each channel.
- All measurements are displayed with 95% accuracy.
- IP network connection and designed-in web server for web browser interface.
- Full remote configuration, monitoring and data logging.
- Optional front panel display with Navigation Keys for monitoring only.
- User-defined alarm thresholds are indicated by alarm relay closure or by SNMP protocol on the network.
- Optional temperature sensors for equipment and ambient temperature measurements and alarms.
- Compact single rack unit mounting with remote RF sensor for flexibility in mounting locations.

Ordering Information

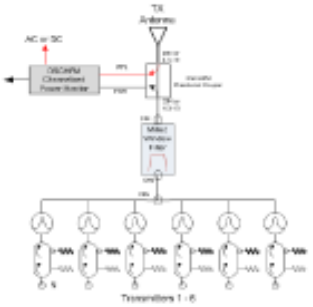


Notes:
1. Factory calibrated using a P25 LSM signal source, may be calibrated in the field for improved accuracy.
2. Contact dbSpectra at tech@dbspectra.com for additional information on optional temperature sensor feature.

Specifications

Electrical Specifications	
Frequency Range, MHz	See Ordering Information
Minimum TX to TX Separation	50 kHz
Maximum Power Input	600 Watts (directional coupler)
System Type	Digital or analog
Insertion Loss	< 0.1 dB
PIM Rating	-150 dBc
Channelized Power Measurements	Forward /reflected power of individual channels: Watts, dBm, VSWR, Return Loss, Combiner Insertion Loss
Power Requirements	AC Model 90-240 VAC 15W, or DC model ±36-72 VDC 15W
IP Interface	IPV4, with TLS security layer, SNMP v2c/v3 alarm protocol
Alarms	Form C contacts or SNMP v2c/v3
User Interface	Web browser or remote SNMP system manager. Front Panel Display (optional) for Monitoring only.
Temperature Range	-30 to +60 °C
Mechanical Specifications	
Mounting Dimensions	1 RU, 1.75 X 19 in. (44 X 483 mm) 7.5 in. (191 mm) deep
Construction / Finish	Aluminum / protective finishes
Directional Coupler Connectors Input Output Coupled Ports	 7/16 DIN, 4.3-10 or N(male) 7/16 DIN, 4.3-10 or N(female) MCX type push-on with two 4 ft RD316 cables supplied.
Power Connector	AC model: IEC 320-C13 inlet & cord DC model: 2 port terminal block
Ethernet Connector	RJ-45
Alarm Closures Connector	3 port pluggable terminal block
Temp. Sensor Connector	24-pin header male pins
Net Weight	4.6 lbs. (2.1 kg)
Shipping weight	6.1 lbs. (2.8 kg)

Typical Application



Specifications are subject to change • www.dbspectra.com • 1590 E Hwy 121, Building A, Suite 100, Lewisville, TX 75056 • P (469)322-0080 •096000-797.A • 01/2024

Figure 4: DSCHPMDC1MDC Channelized Power Monitor

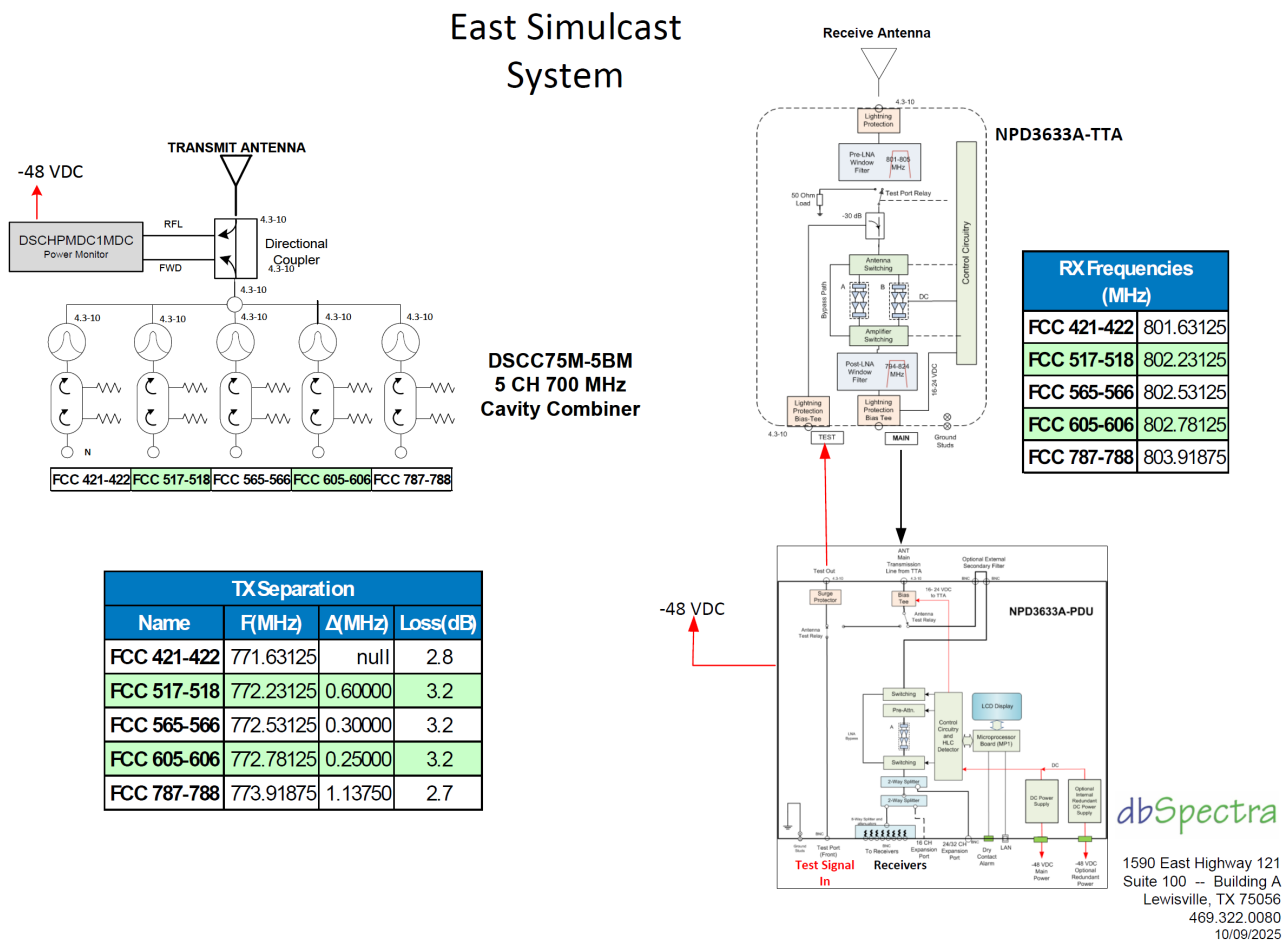
10. RF SUB-SYSTEM DESIGN

Tait have worked with dBSpectra to develop a generic combining system for the Marion County project that meets the performance goals derived in sections 7 and 8 of this report and thereby maximizes the talk in and talk out coverage of the system.

The transmit side of the RF sub-system consists of a 5-channel cavity filter based ceramic combiner to minimize losses and maximize the transmitted power and talk out coverage from the site. The cavity filters meet or exceed the Tx sideband noise filtering requirements given in section 7.9.

The receive side features a compact Tower Top Amplifier (TTA) followed by a Receiver Multicoupler/PDU that allows the receiver sensitivity to be optimized and distributes the signal to the five connected receivers. All the receive filtering is accommodated within the TTA. There are two filters, one before the LNA to preselect the 801 to 805MHz part of the band used by the Marion County system (see Figure 6), and a second after the LNA that fully rejects the Marion County system transmit signals, and the other 700 and 800MHz HLCs identified from the FCC database search (see Figure 7). Together, the filters meet or exceed the receiver blocking and receiver intermodulation filtering requirements given in sections 8.3.1 and 8.3.2. There are two LNAs, one in the TTA and one in the Rx Multicoupler/PDU with gains, noise figures and intercept points optimized so the cascade noise figure and linearity of the receiver line up meet the requirements of section 8.4.

A block diagram of the East Cell combining system design is shown in Figure 5 below:



RX Frequencies (MHz)	
FCC 421-422	801.63125
FCC 517-518	802.23125
FCC 565-566	802.53125
FCC 605-606	802.78125
FCC 787-788	803.91875

TX Separation			
Name	F(MHz)	Δ(MHz)	Loss(dB)
FCC 421-422	771.63125	null	2.8
FCC 517-518	772.23125	0.60000	3.2
FCC 565-566	772.53125	0.30000	3.2
FCC 605-606	772.78125	0.25000	3.2
FCC 787-788	773.91875	1.13750	2.7

Figure 5: SPD3454C-4TR Dual Band RF Combining System

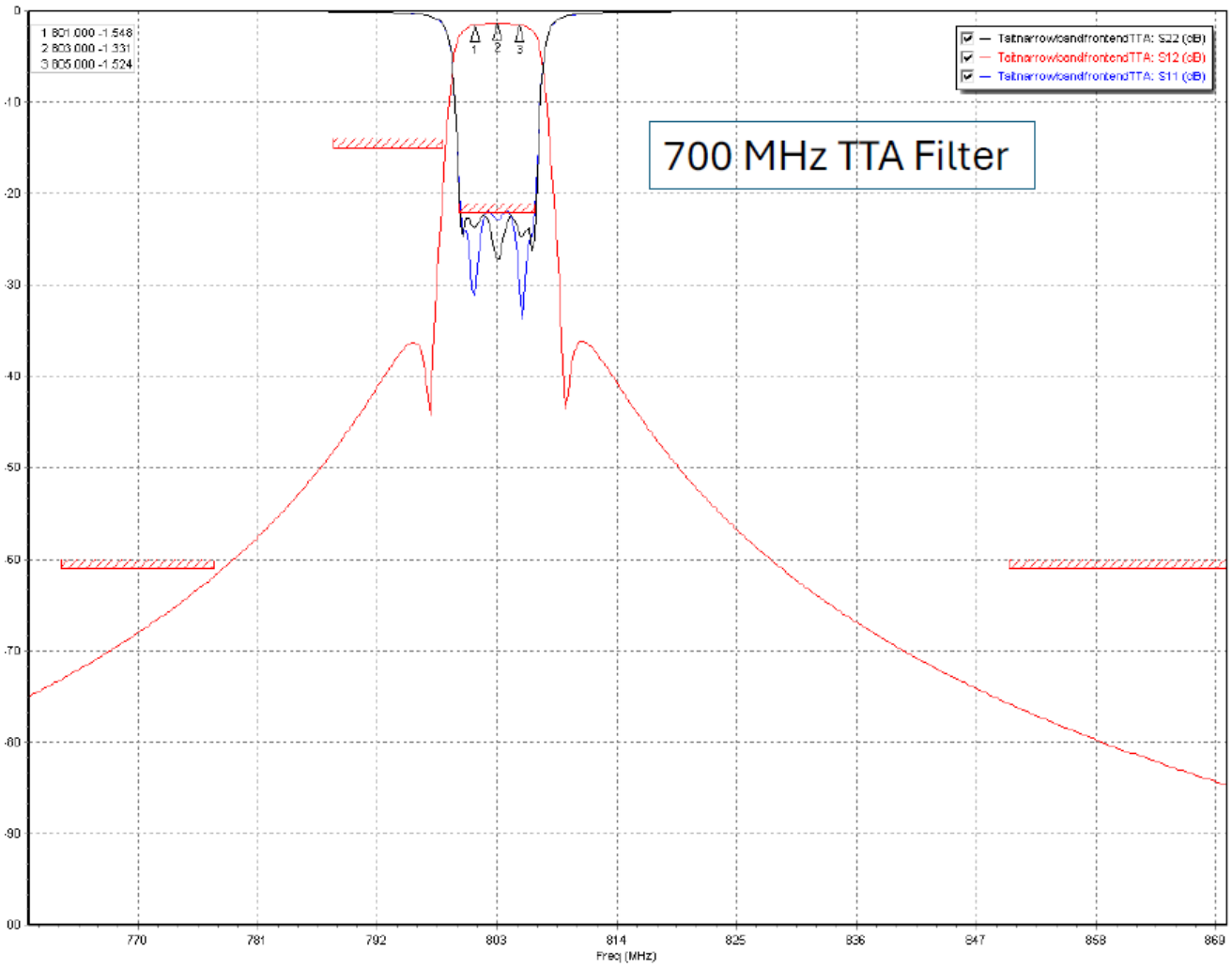


Figure 6: TTA Preselector Filter Plot

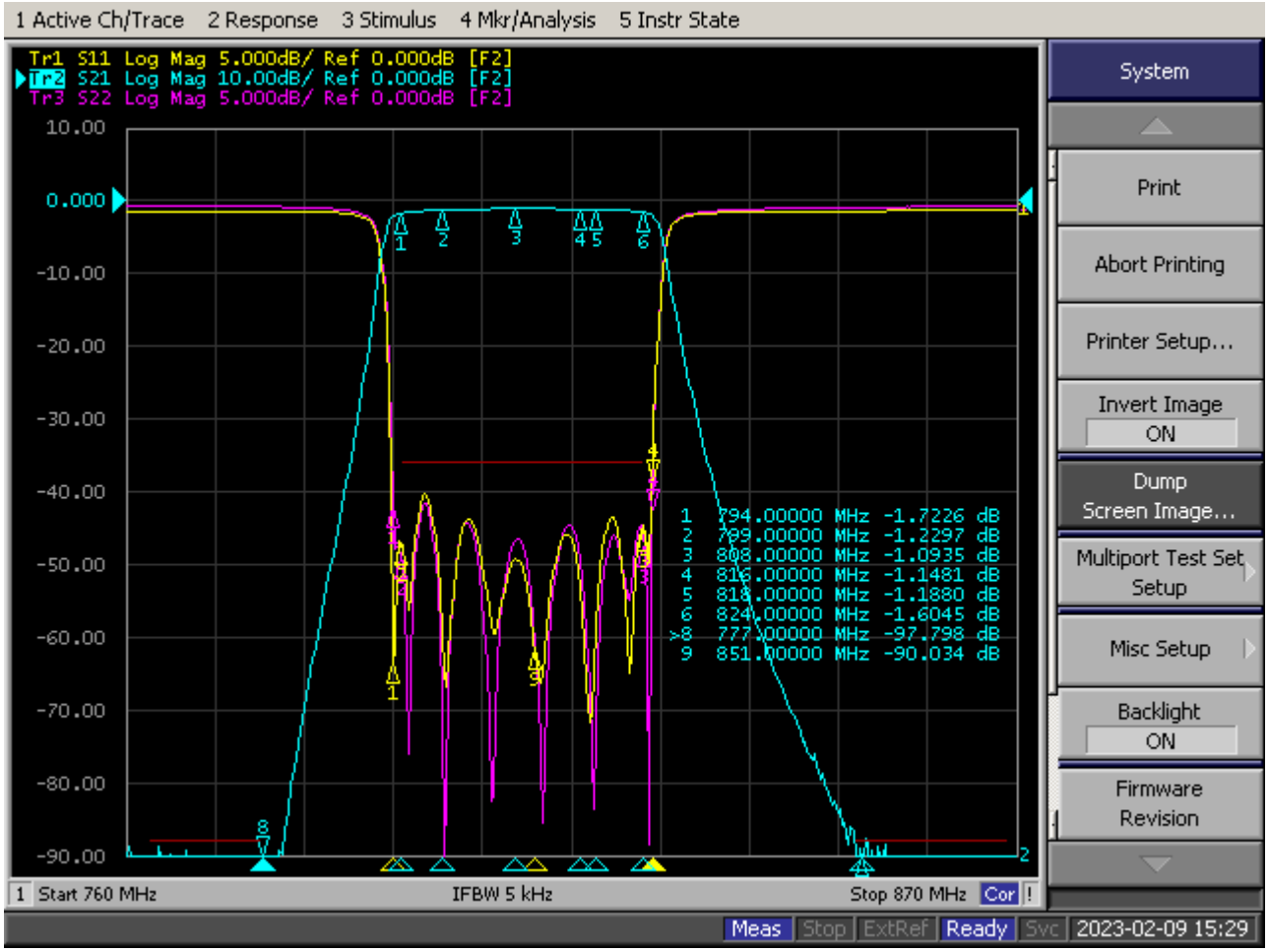


Figure 7: TTA Post LNA Filter Plot

11. MICROWAVE SYSTEM DESIGN

Refer to “Marion County P25 System Design_v1.1.docx” for Microwave System Details.

11.1 Site Specific Design

The APW site supports three Aviat microwave links. Two of these links connect APW to House Mountain and McCully Mountain, forming part of the 13-site core ring and providing the redundant routing expected within the looped topology. The third link extends from APW to Halls Ridge as a spur, engineered as 2+0 to ensure reliable, uninterrupted connectivity from Halls Ridge into the core network.

12. RF SUB-SYSTEM DRAWINGS

The figure below contains the schematic of the RF sub-system to be deployed at this site.

12.1 RF System Schematic

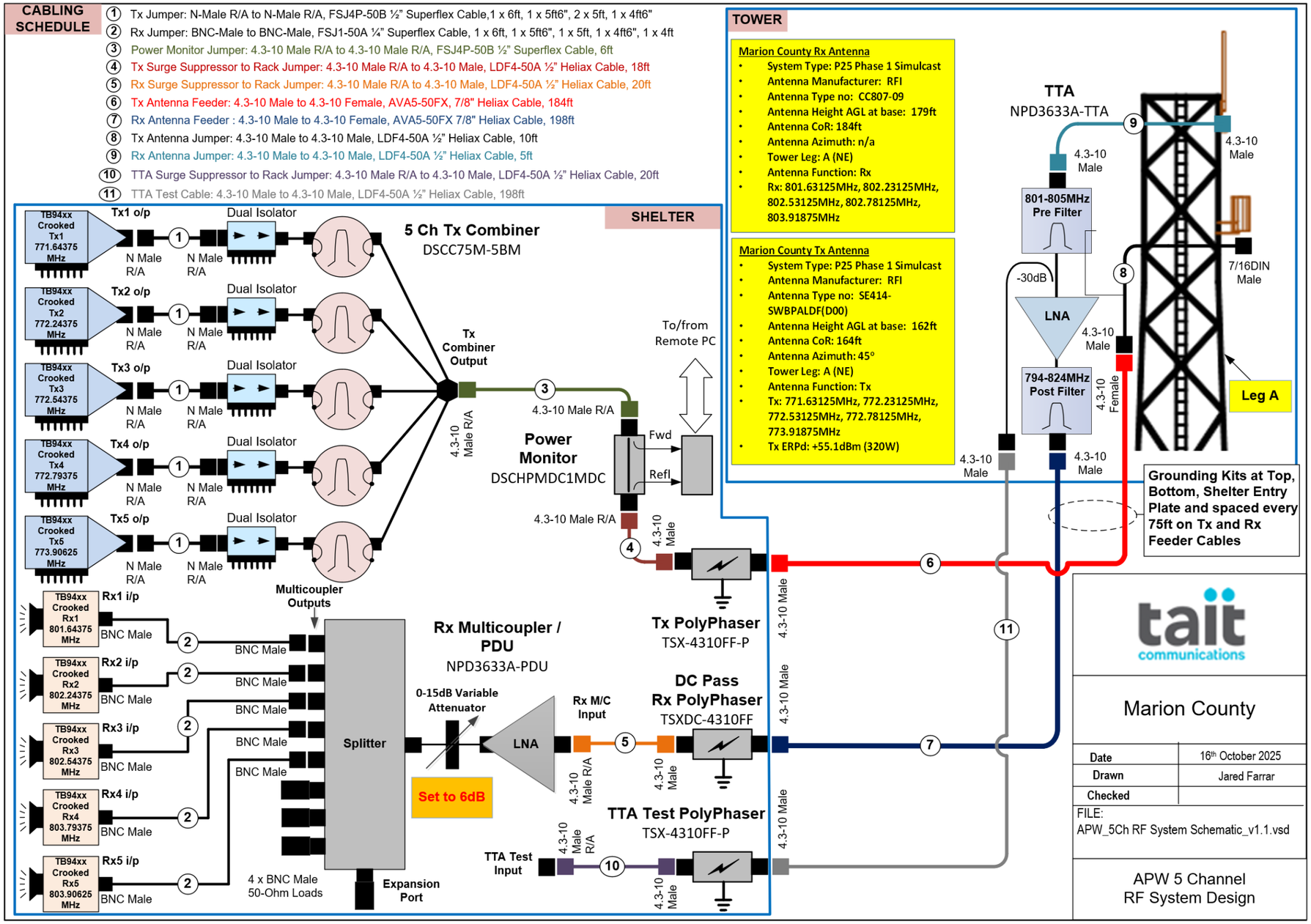
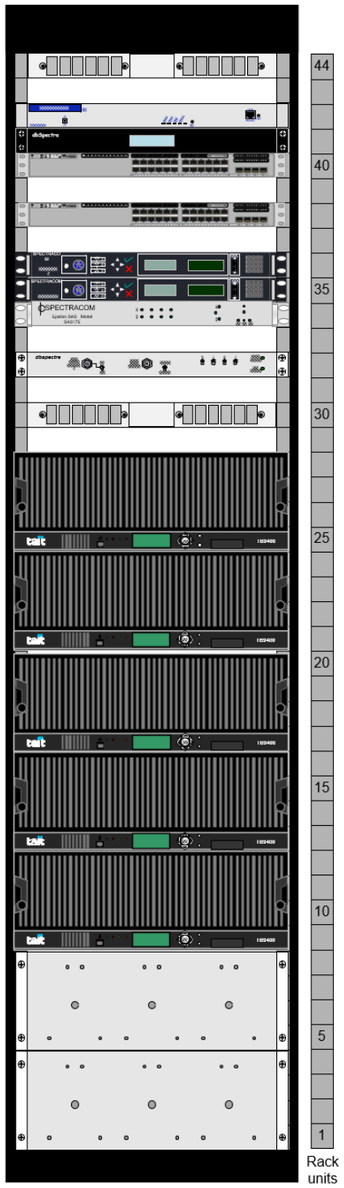


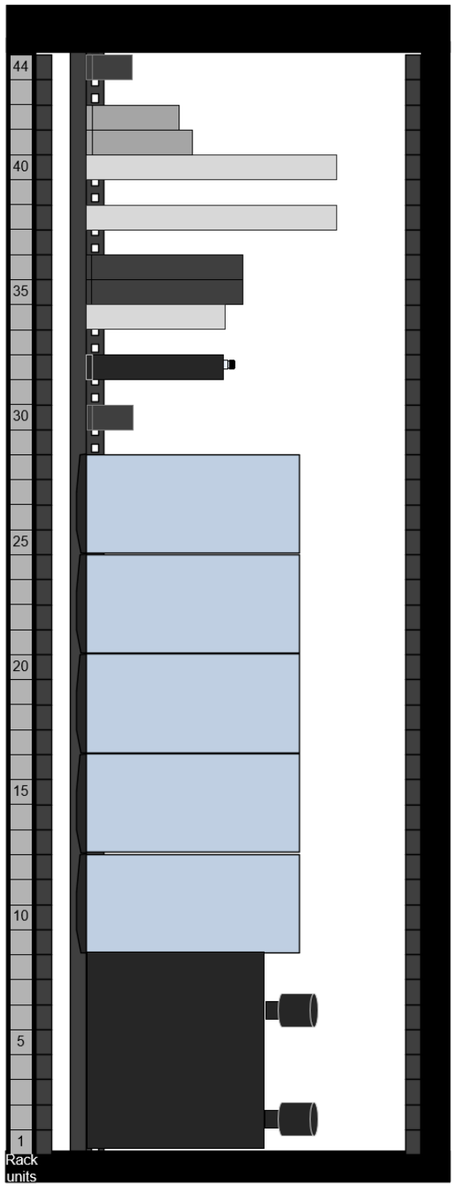
Figure 8: RF System Schematic

12.2 Rack Layout

This section contains the rack layout front & back view, side view and cabling diagram for this site.



Front View



Side View

Rack	RU	Description	Vendor PN	Vendor	Width (in)	Height (in)	Depth (in)
1	44	Breaker Panel	9072101001	9072101001	19	1U	3.25
1	42	Alarm Panel	M16G2 & D-PK-16PAN	M16G2 & D-PK-16PAN	17	1U	6.6
1	40	Switch #1	C9300L-24P-4X-A	C9300L-24P-4X-A	17.5	1U	17.7
1	38	Switch #2	C9300L-24P-4X-A	C9300L-24P-4X-A	17.5	1U	17.7
1	36	Timing Reference	2402-613	2402-613	17.1	1U	15.17
1	35	Timing Reference	2402-613	2402-613	17.1	1U	15.17
1	34	Timing Switch	SAS-17E	SAS-17E	19	1U	13.4
1	30	Breaker Panel	9072101001	9072101001	19	1U	3.25
1	25-28	P25 Conventional Base Station - CH1	TB9435S-100T	TB9435S-100T	19	4U	15.8
1	21-24	P25 Conventional Base Station - CH2	TB9435S-100T	TB9435S-100T	19	4U	15.8
1	17-20	P25 Conventional Base Station - CH3	TB9435S-100T	TB9435S-100T	19	4U	15.8
1	13-16	P25 Conventional Base Station - CH4	TB9435S-100T	TB9435S-100T	19	4U	15.8
1	9-12	P25 Conventional Base Station - CH5	TB9435S-100T	TB9435S-100T	19	4U	15.8
1	1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra	19	8U	12.5

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RF_Site_Simulcast

Figure 9: Marion County 19" Rack Layout – RF Front & Side

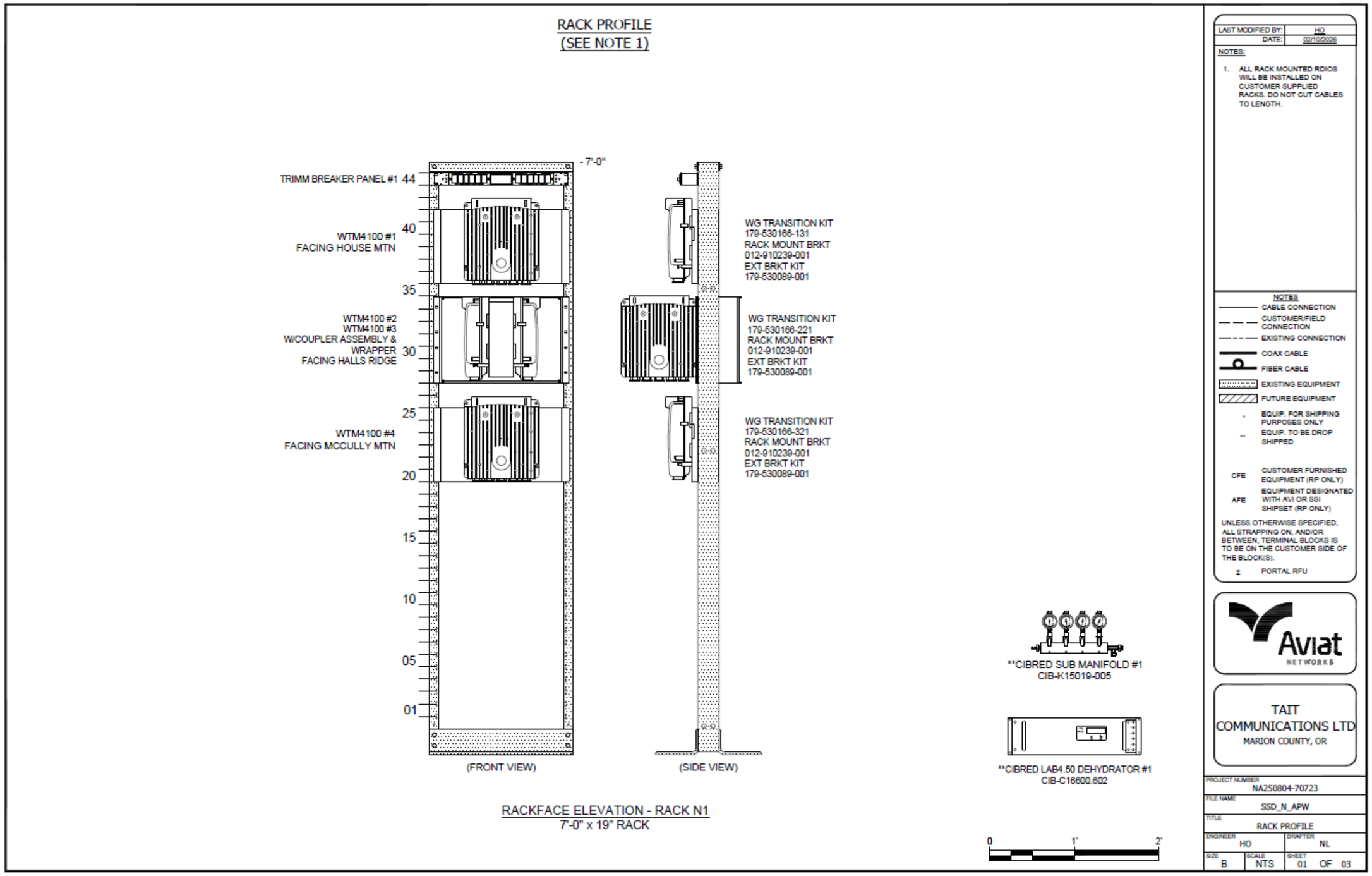
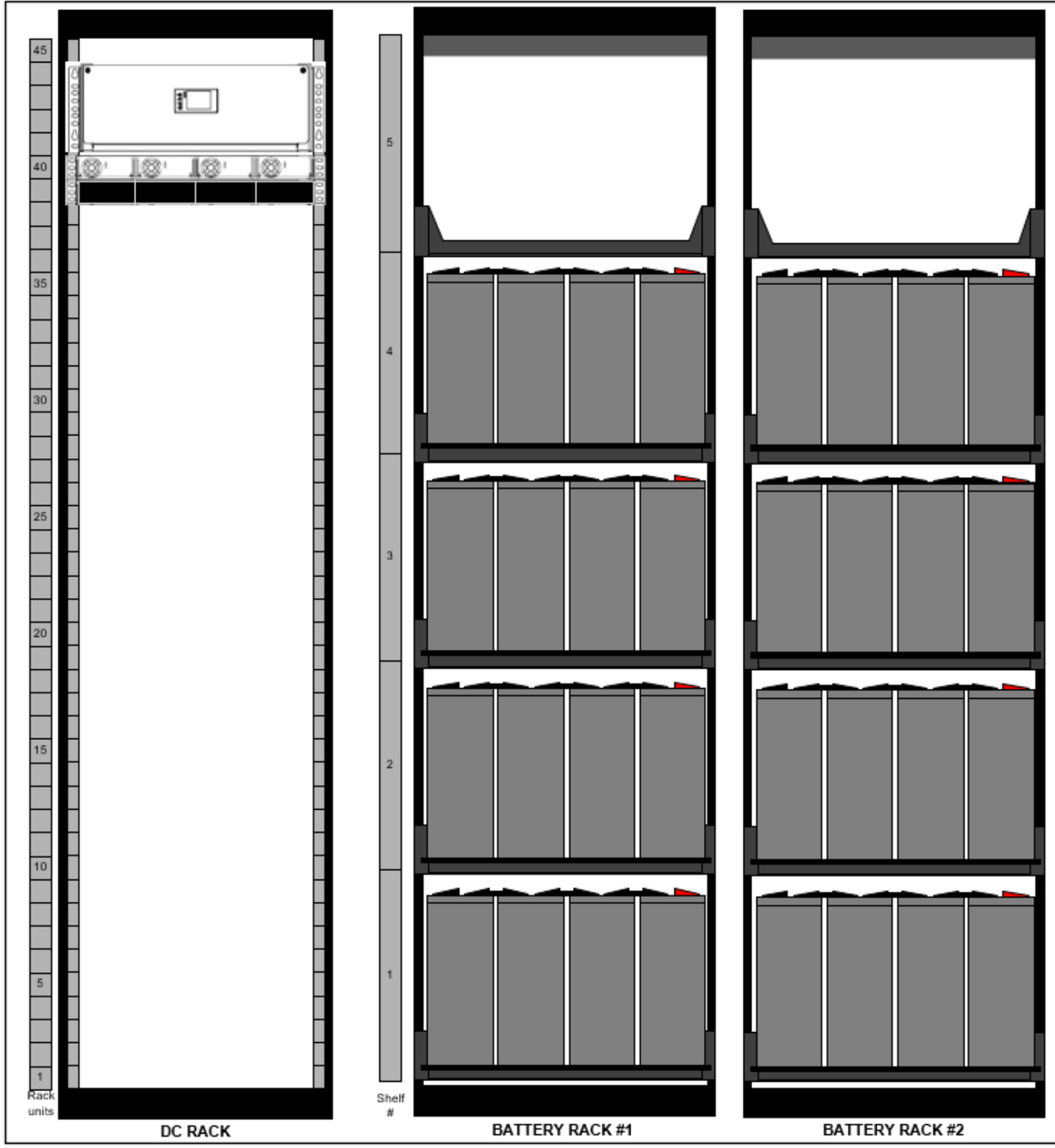


Figure 10: Microwave Rack



Rack	RU	Description	Vendor PN	Vendor
DC Rack	41-44	Unity Power System w/ Flatpack2	UNT20806.00014	Eltek
DC Rack	39-40	4x Flatpack2 HE Rectifier 2000W 48V	241115.105	Eltek
Battery Rack #1	S1	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack #1	S2	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack #1	S3	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack #1	S4	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack #2	S1	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack #2	S2	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack #2	S3	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack #2	S4	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada

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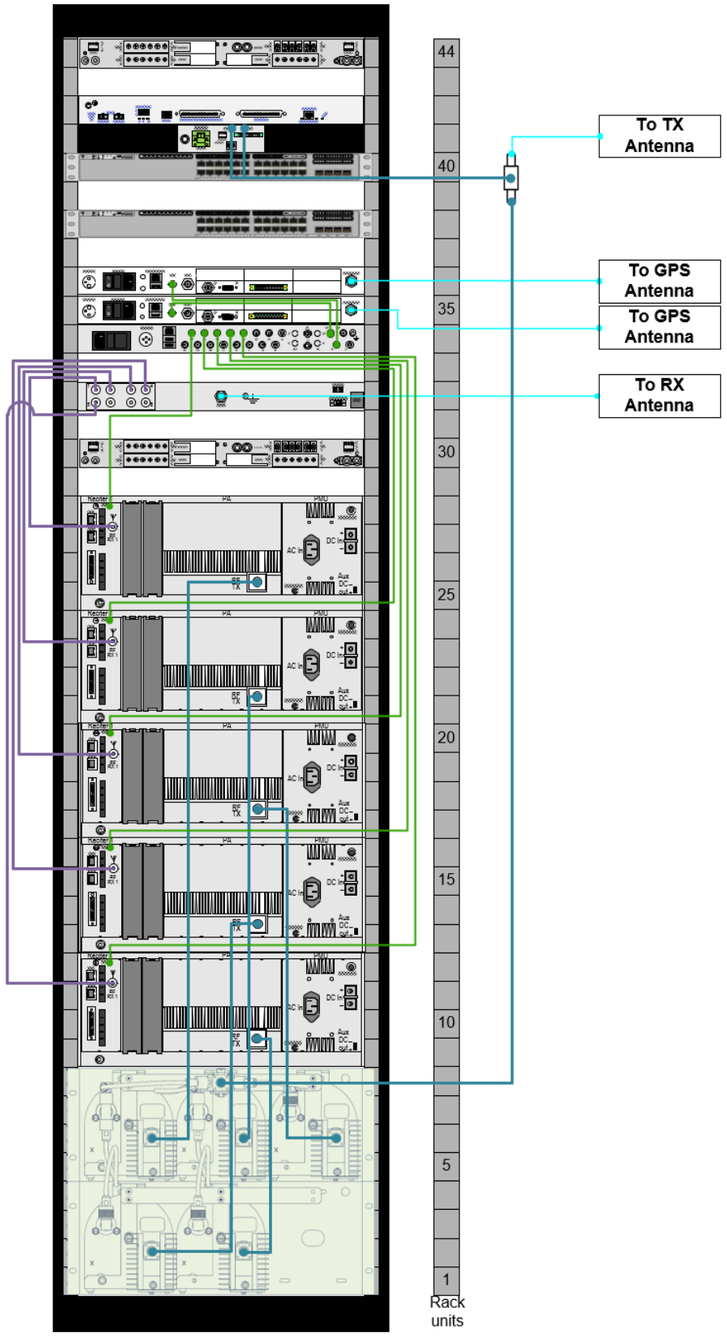
DC Power - East

Figure 11: DC Power & Battery Racks



Rack	RU	Description	Vendor PN	Vendor
1	44	Breaker Panel	9072101001	9072101001
1	42	Alarm Panel	M16G2 & D-PK-16PAN	M16G2 & D-PK-16PAN
1	40	Switch #1	C9300L-24P-4X-A	C9300L-24P-4X-A
1	38	Switch #2	C9300L-24P-4X-A	C9300L-24P-4X-A
1	36	Timing Reference	2402-613	2402-613
1	35	Timing Reference	2402-613	2402-613
1	34	Timing Switch	SAS-17E	SAS-17E
1	30	Breaker Panel	9072101001	9072101001
1	25-28	P25 Conventional Base Station - CH1	TB9435S-100T	TB9435S-100T
1	21-24	P25 Conventional Base Station - CH2	TB9435S-100T	TB9435S-100T
1	17-20	P25 Conventional Base Station - CH3	TB9435S-100T	TB9435S-100T
1	13-16	P25 Conventional Base Station - CH4	TB9435S-100T	TB9435S-100T
1	9-12	P25 Conventional Base Station - CH5	TB9435S-100T	TB9435S-100T
1	1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

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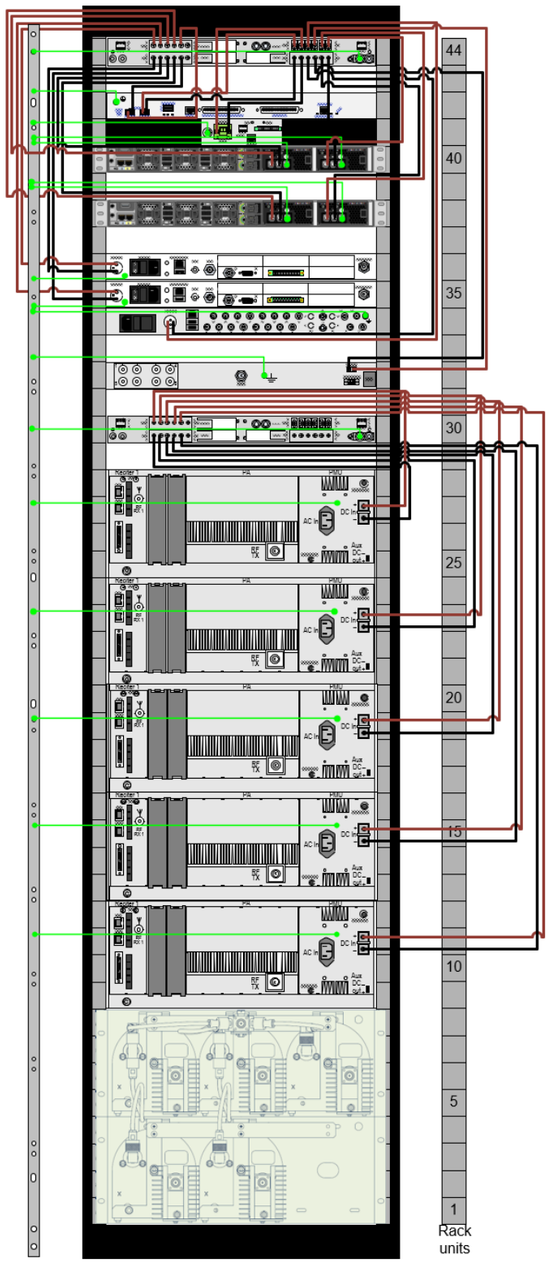
Cabling - RF

Figure 12: Marion County 19" Rack Layout – RF Cabling



Rack	RU	Description	Vendor PN	Vendor
1	44	Breaker Panel	9072101001	9072101001
1	42	Alarm Panel	M16G2 & D-PK-16PAN	M16G2 & D-PK-16PAN
1	40	Switch #1	C9300L-24P-4X-A	C9300L-24P-4X-A
1	38	Switch #2	C9300L-24P-4X-A	C9300L-24P-4X-A
1	36	Timing Reference	2402-613	2402-613
1	35	Timing Reference	2402-613	2402-613
1	34	Timing Switch	SAS-17E	SAS-17E
1	30	Breaker Panel	9072101001	9072101001
1	25-28	P25 Conventional Base Station - CH1	TB9435S-100T	TB9435S-100T
1	21-24	P25 Conventional Base Station - CH2	TB9435S-100T	TB9435S-100T
1	17-20	P25 Conventional Base Station - CH3	TB9435S-100T	TB9435S-100T
1	13-16	P25 Conventional Base Station - CH4	TB9435S-100T	TB9435S-100T
1	9-12	P25 Conventional Base Station - CH5	TB9435S-100T	TB9435S-100T
1	1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

Description A	Connection A	Description B	Connection B
Breaker Panel 1	A1	GPS 1	-48 VDC
Breaker Panel 1	A2	GPS 2	-48 VDC
Breaker Panel 1	A3	Switch 1-A	-48 VDC
Breaker Panel 1	A4	Switch 2-A	-48 VDC
Breaker Panel 1	A5	Alarm Panel A	-48 VDC
Breaker Panel 2	B1	Alarm Panel B	-48 VDC
Breaker Panel 2	B2	Power Monitor	-48 VDC
Breaker Panel 2	B3	Timing Switch	-48 VDC
Breaker Panel 2	B4	Multicoupler	-48 VDC
Breaker Panel 2	B5	Switch 2-B	-48 VDC
Breaker Panel 2	B6	Switch 1-B	-48 VDC

Description A	Connection A	Description B	Connection B
Breaker Panel 2	A1	TB9400 CH1	-48 VDC
Breaker Panel 2	A2	TB9400 CH3	-48 VDC
Breaker Panel 2	A3	TB9400 CH5	-48 VDC
Breaker Panel 2	B1	TB9400 CH2	-48 VDC
Breaker Panel 2	B2	TB9400 CH4	-48 VDC

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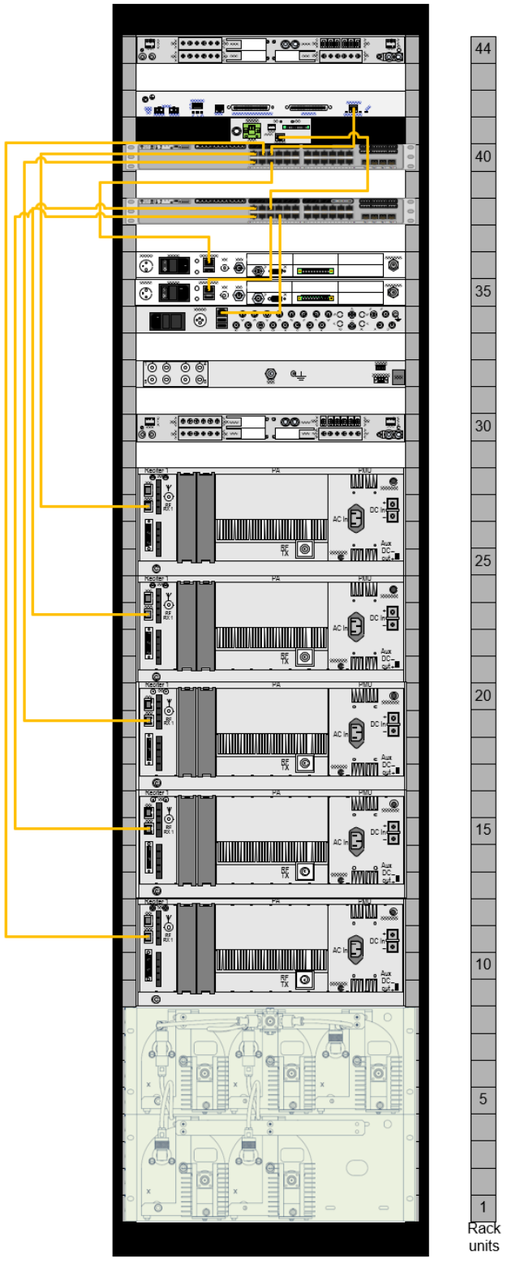
Cabling - Power

Figure 13: Marion County 19" Rack Layout – Power Cabling



Rack	RU	Description	Vendor PN	Vendor
1	44	Breaker Panel	9072101001	9072101001
1	42	Alarm Panel	M16G2 & D-PK-16PAN	M16G2 & D-PK-16PAN
1	40	Switch #1	C9300L-24P-4X-A	C9300L-24P-4X-A
1	38	Switch #2	C9300L-24P-4X-A	C9300L-24P-4X-A
1	36	Timing Reference	2402-613	2402-613
1	35	Timing Reference	2402-613	2402-613
1	34	Timing Switch	SAS-17E	SAS-17E
1	30	Breaker Panel	9072101001	9072101001
1	25-28	P25 Conventional Base Station - CH1	TB9435S-100T	TB9435S-100T
1	21-24	P25 Conventional Base Station - CH2	TB9435S-100T	TB9435S-100T
1	17-20	P25 Conventional Base Station - CH3	TB9435S-100T	TB9435S-100T
1	13-16	P25 Conventional Base Station - CH4	TB9435S-100T	TB9435S-100T
1	9-12	P25 Conventional Base Station - CH5	TB9435S-100T	TB9435S-100T
1	1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

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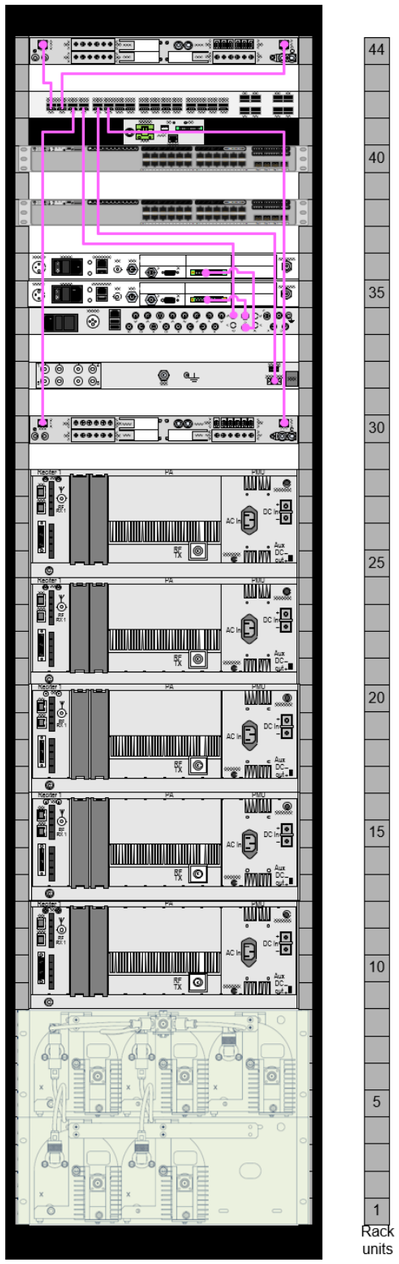
Cabling - Network

Figure 14: Marion County 19" Rack Layout – Network Cabling



Rack	RU	Description	Vendor PN	Vendor
1	44	Breaker Panel	9072101001	9072101001
1	42	Alarm Panel	M16G2 & D-PK-16PAN	M16G2 & D-PK-16PAN
1	40	Switch #1	C9300L-24P-4X-A	C9300L-24P-4X-A
1	38	Switch #2	C9300L-24P-4X-A	C9300L-24P-4X-A
1	36	Timing Reference	2402-613	2402-613
1	35	Timing Reference	2402-613	2402-613
1	34	Timing Switch	SAS-17E	SAS-17E
1	30	Breaker Panel	9072101001	9072101001
1	25-28	P25 Conventional Base Station - CH1	TB9435S-100T	TB9435S-100T
1	21-24	P25 Conventional Base Station - CH2	TB9435S-100T	TB9435S-100T
1	17-20	P25 Conventional Base Station - CH3	TB9435S-100T	TB9435S-100T
1	13-16	P25 Conventional Base Station - CH4	TB9435S-100T	TB9435S-100T
1	9-12	P25 Conventional Base Station - CH5	TB9435S-100T	TB9435S-100T
1	1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

Marion County, OR
700 MHz P25 Phase I

Date	-
Drawn	RCA/JJF
Checked	-

FILE:\ marioncountyor_rackdiagrams_rev1.4.vsdx

TITLE:

Cabling - Alarms

Figure 15: Marion County 19" Rack Layout – Alarm Cabling

13. PARTS AND EQUIPMENT LISTS

Refer to “Marion County P25 Project - Equipment List by Site.xlsx” for site-specific equipment list.

14. RF PERFORMANCE

14.1 Tx Effective Radiated Power

Table below summarizes the transmitter system performance. It shows the required TB9400 transmitter output power setting, the combining losses (including internal cabling), the antenna feeder loss and finally the resulting ERP relative to a dipole (ERPd).

Transmitter Frequency (MHz)	Transmitter Output Power Setting	Combining Losses (dB)	Misc Losses (dB)	Antenna Feeder Losses (dB)	Tx ERPd
771.64375	+49.3dBm (85W)	3.2	0.7	2.42	+53.0dBm (200W)
772.24375	+49.3dBm (85W)	3.2			+53.0dBm (200W)
772.54375	+49.3dBm (85W)	3.2			+53.0dBm (200W)
772.79375	+49.3dBm (85W)	3.2			+53.0dBm (200W)
773.90625	+49.3dBm (85W)	3.2			+53.0dBm (200W)

Table 9: Transmitter Output Power Setting and Effective Radiated Power

14.2 Site Noise

Site Noise in the 700MHz band can be assumed to be negligible.

14.3 Receiver Sensitivity

Table summarizes the receiver system performance. It shows the amount of de-sensitization caused by the elevated site noise floor, the required Rx Multicoupler attenuation setting, and the resulting final Receiver sensitivity that can be achieved.

Receiver Frequency (MHz)	Rx Multicoupler Attenuator Setting (dB)	Rx Sensitivity for DAQ3.4 (dBm)
801.63125	6	-112.8
802.23125		
802.53125		
802.78125		
803.91875		

Table 10: Receiver Sensitivity

15. SITE DESIGN INFORMATION

15.1 Site Plan

The site plan is an overhead view of the overall compound depicting locations of pertinent features.

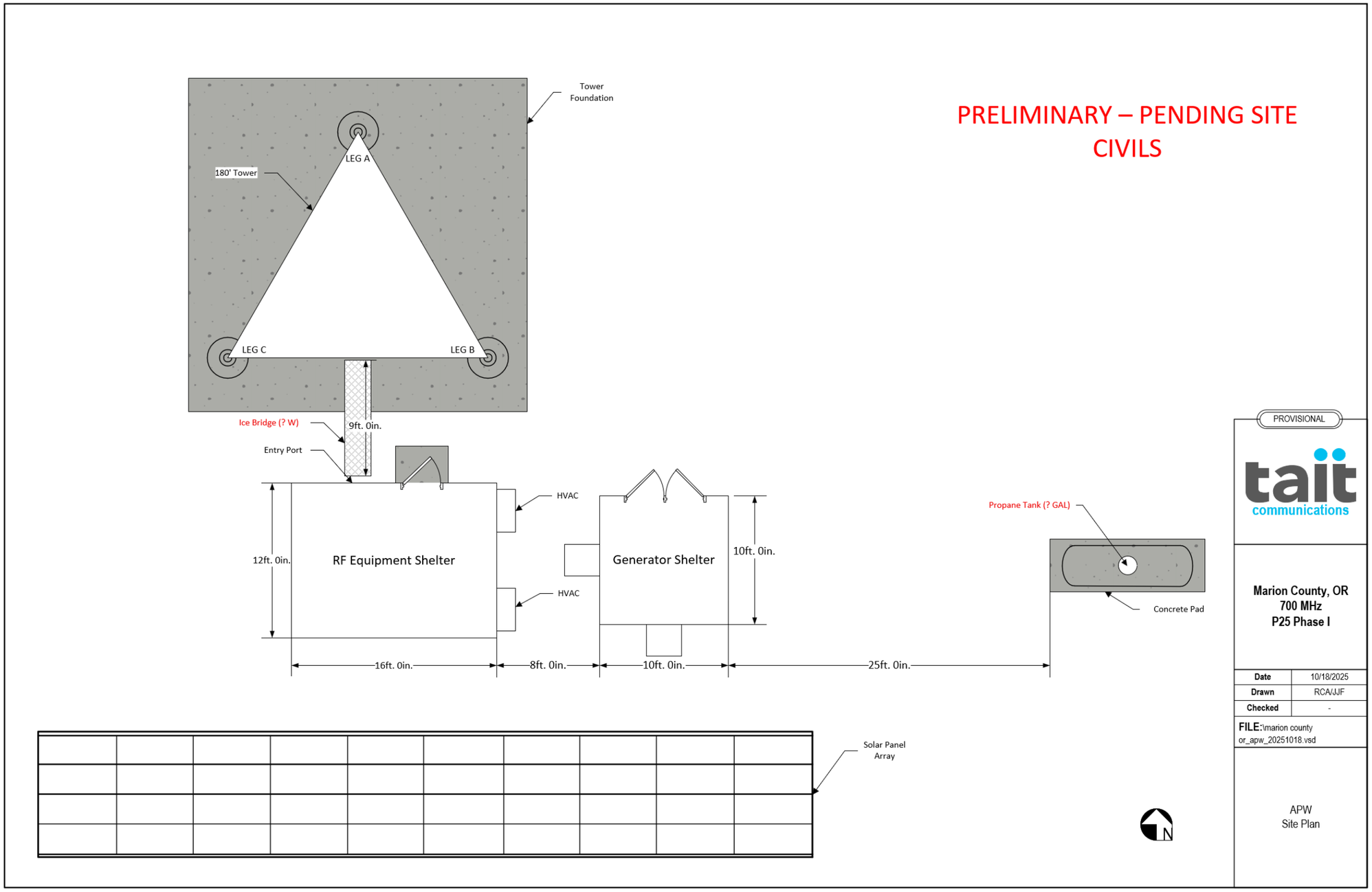


Figure 16: Site Plan

15.2 Floor and Cable Routing Plan

The floor and cable routing plan is an overhead view of the equipment room layout depicting locations of pertinent equipment and including the cable routing plans leading to the tower.

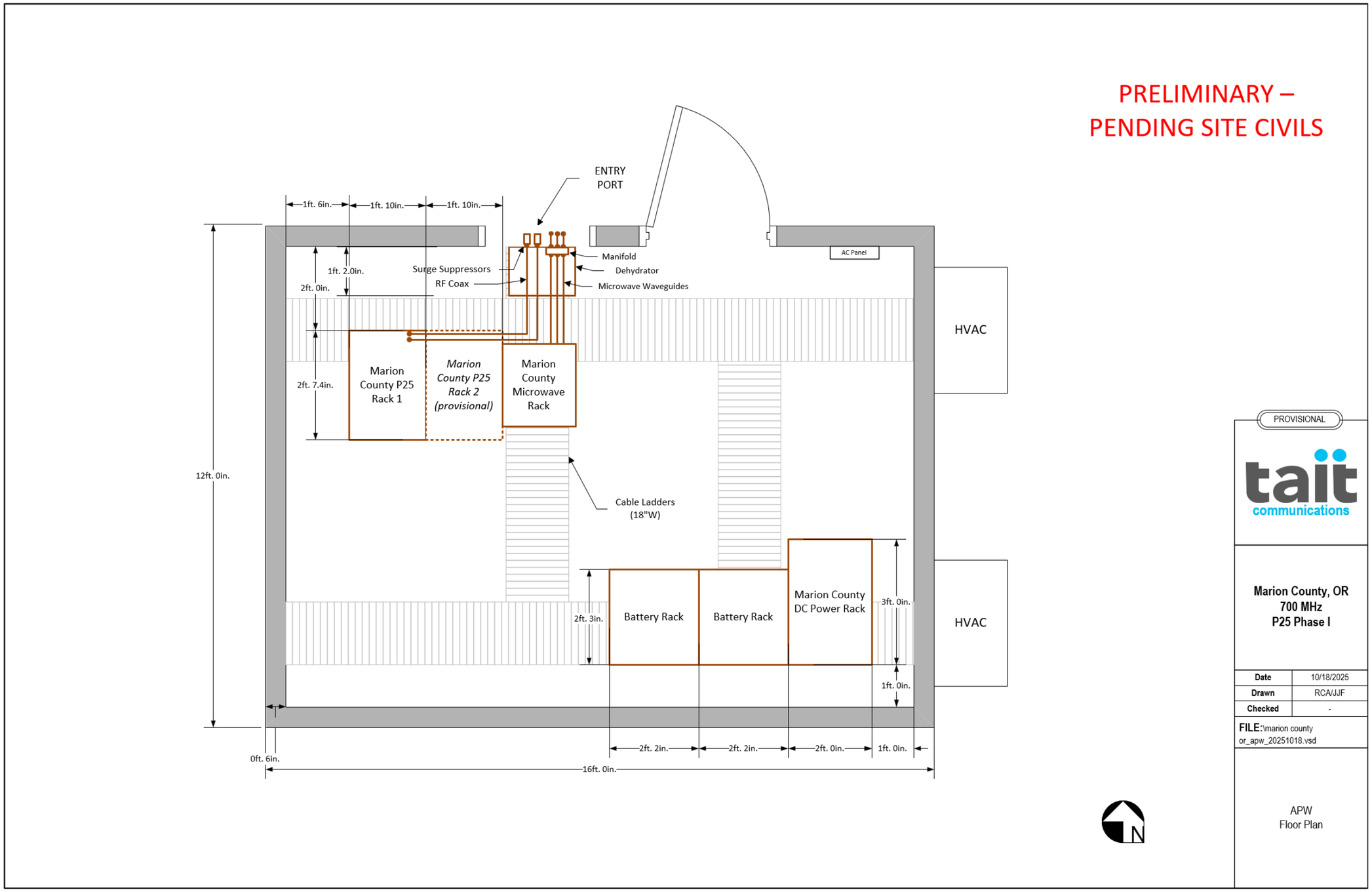


Figure 17: Floor and Cable Routing Plan

15.3 Entry and Exit Ports

The ports where the antenna and TTA cables enter / exit the shelter are shown in the below figure.

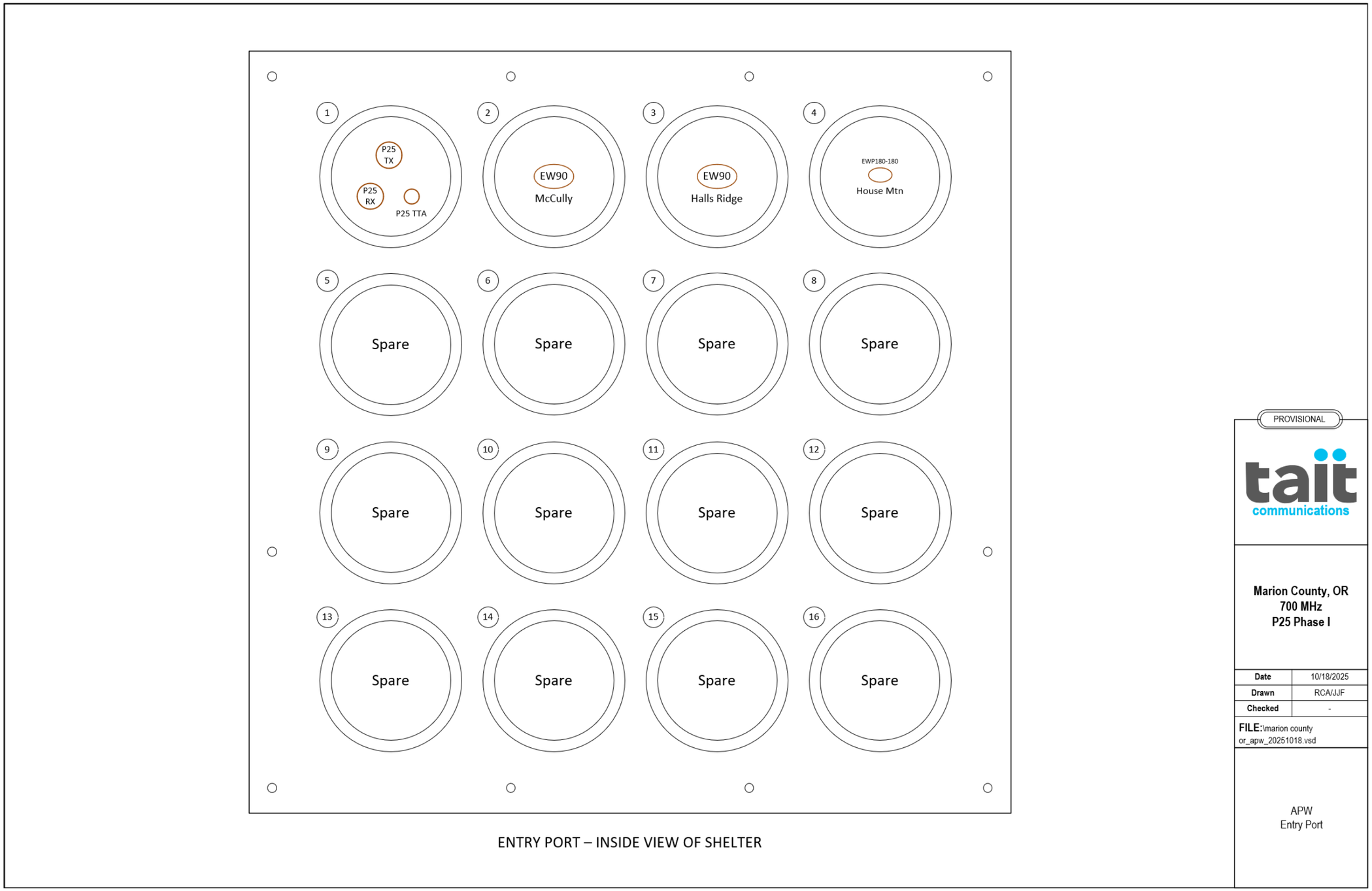


Figure 18: Shelter Cable Entry & Exit Ports

15.3.1 Power & Heat Load Calculations

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Power & Heat Load details.

15.3.2 DC Distribution Fuse Panel

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Fuse Panel details.

Supplemental 2 - Courthouse

PROVISIONAL Design Document

RF Sub-System and Site Designs

Marion County

Site: Courthouse

Issue 1.1 • 1st May 2026

www.taitradio.com

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PREFACE

Project Details

Project number	
Customer	Marion County
Project description	P25 Phase 2 Simulcast & P25 Phase 1 Conventional Simulcast
Business Development Manager	
Sales Engineer	
Project Engineer	Jared Farrar / Riley Alfaqeeh
Project Manager	Stacey Adams
Lead RF Engineers	Ian Graham

Purpose

The Marion County P25 Public Safety Radio System will include a 17-site microwave system to serve as the backhaul network, carrying the P25 radio system's IP traffic between sites (both individual RF sites and logical simulcast sites) and the core RFSS, simulcast site controllers, and dispatch console subsystem. The Microwave system is comprised of a 13-site ring plus 4 spur sites. The primary and backup nodes are located at METCOMM Dispatch and SCC Backup dispatch, respectively.

The purpose of this report is to document the site design for the **Courthouse location**.

Scope

This document provides an overview of site-specific details and requirements for the referenced location.

Publication Record

Author	Tyler Balkan, Jared Farrar
Issue	1.0
Document Status	Initial Release
Date	19th March, 2026

Document Status

Issue	Date	Signature	Comment
1.1	5/1/2026		

Document Approvals

Approvals	Position	Signature	Date
Bladimyr Guzman	TAM Design Authority		

Associated Documents & References

Reference documentation includes:

- Marion County P25 System Design_v1.1.docx
- Marion County P25 Project - Equipment List by Site.xlsx
- Marion County Power_Heat_Load.xlsx

1. GENERAL RF DESIGN APPROACH

The Marion County project is an 11-site P25 simulcast design that uses the US 700MHz band. To control Time Delay Interference (TDI) and due to unique electric utility challenges in the high peaks to the east of the county necessitating the use of generators, the simulcast design is split into three cells – North, South, and East.

The North Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- Crooked Finger
- **Crosby**
- Eastview
- Parrett Mountain

The South Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- Eagle Crest
- Lower Prospect
- McCully Mountain
- Wipper

The East Cell sites operate in P25 Phase 1 conventional mode (to avoid the energy consumption of a control channel with 100% duty cycle) and are identified as follows:

- APW
- House Mountain
- Halls Ridge

Each site within the North and South Cells will have five trunked P25 Phase 2 channels providing eight dynamic talkpaths (one 12.5kHz FDMA control channel plus four 2-slot 12.5kHz TDMA traffic channels) across each respective cell's coverage area. The East Cell will have five conventional P25 Phase 1 12.5kHz FDMA channels providing five fixed talkpaths across the cell.

Each site across all three cells will have separate transmit (Tx) and receive (Rx) antennas, typically with 20ft vertical separation between centers of radiation. The anticipated low site noise floors in the 700MHz band means Tower Top Amplifiers (TTA) can be used to improve receiver sensitivity and talk-in coverage. Along with the 30MHz Tx-Rx frequency separation, these factors lead to a common RF combining subsystem design which is applicable to all Marion County sites. The combining system requirements were captured based on the proposed frequency plan in coordination with ADCOMM Engineering LLC and Tait subsequently worked with the chosen equipment vendor, dBSpectra, on an optimal design. The main

consideration was the TTA where it was decided to use dBSpectra's compact design after it was shown all the required receiver filtering could be accommodated. The generic (starting point) site combining system design therefore features the:

- DSCC75M-5BM 5 Channel Ceramic Tx Combiner
- DSCHPMDC1MDC Channelized Power Monitor
- NPD3633A-TTA Tower Top Amplifier
- NPD3363A-PDU Rx Multicoupler PDU

Antennas were chosen on a site-by-site basis to minimize TDI in the simulcast cells while still providing necessary talk-out coverage. The proposed antennas are the:

- Sinclair SE412-SWBPAL
    - 5dBd Low PIM Enclosed Dipole Array
- Sinclair SE414-SWBPAL
    - 8.5 to 11dBd Low PIM Adjustable Beamwidth Enclosed Dipole Array
- RFI CC807-09
    - 9dBd Collinear Omnidirectional

2. TOWER MAPPING

#	Description	Part Number	Length (ft)	Leg/Face	Status	Base Height (ft)	Centerline Height(ft)	Tip Height (ft)	Antenna Azimuth	Mount Azimuth	Mount	Transmission Line Size/Type
1	Microwave - WVCC	VHLP2-18	2.0	Rooftop	New	98	99	100	35.42	35.42	Standard w/ tieback	CAT5E

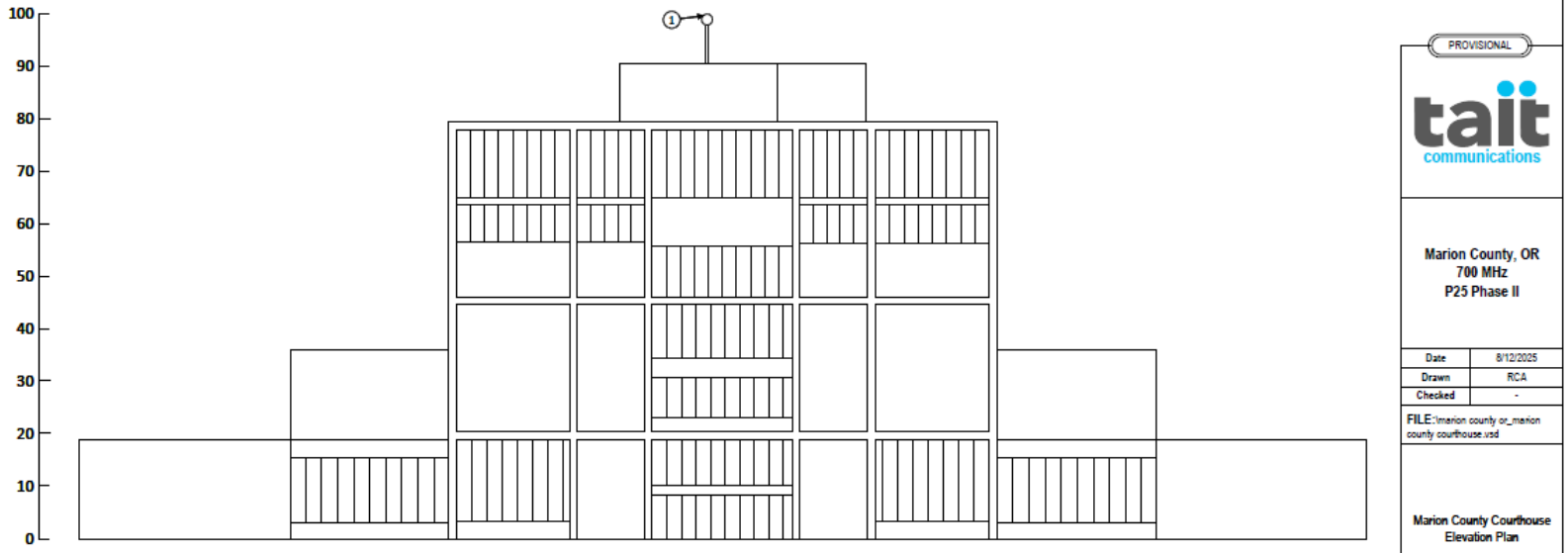


Figure 1: Courthouse Building **Mapping and Appurtenances**

3. FREQUENCY PLANNING

Not applicable. No Tait Base Stations at this location.

4. INCUMBENTS SEARCH

Not Applicable. No Tait Base Stations at this location.

5. INTERMODULATION ANALYSIS

Not Applicable. No Tait Base Stations at this location.

6. ANTENNA SYSTEM DESIGN

Not Applicable. No Tait Base Stations at this location.

7. TRANSMITTER COMBINER DESIGN

Not Applicable. No Tait Base Stations at this location.

8. RECEIVER SUBSYSTEM DESIGN

Not Applicable. No Tait Base Stations at this location.

9. POWER MONITOR

Not Applicable. No Tait Base Stations at this location.

10. RF SUB-SYSTEM DESIGN

Not Applicable. No Tait Base Stations at this location.

11. MICROWAVE SYSTEM DESIGN

Refer to “Marion County P25 System Design_v1.1.docx” for Microwave System Details.

11.1 Site Specific Design

The Courthouse site supports one Aviat microwave link. This link extends from Courthouse to WVCC as a spur, engineered as 2+0 to ensure reliable, uninterrupted connectivity from Courthouse into WVCC. The spur from WVCC to Eagle Crest is engineered as 2+0 to ensure reliable uninterrupted connectivity from Courthouse into the core network.

12. SUB-SYSTEM DRAWINGS

Microwave System Schematic

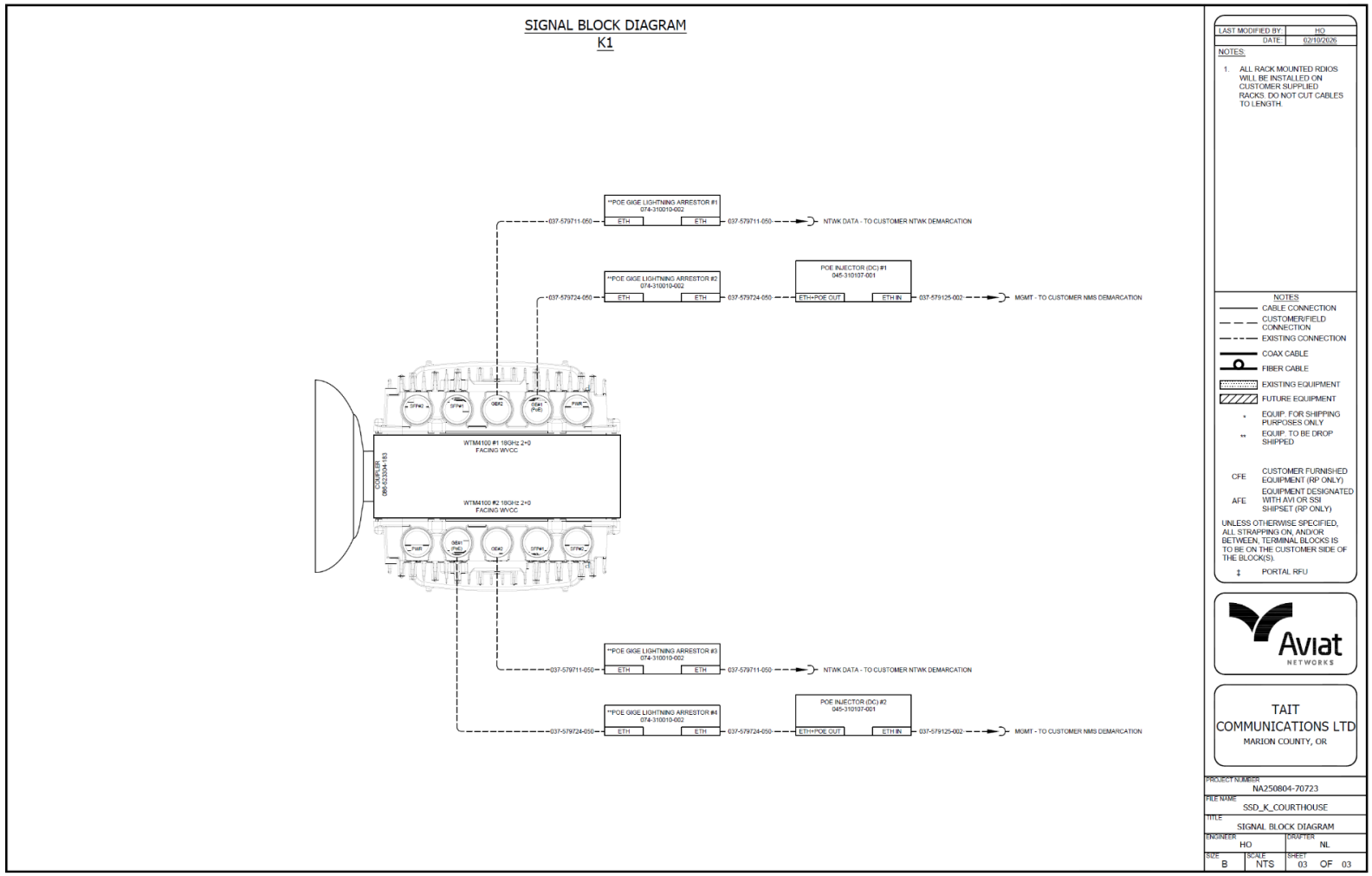


Figure 2: Microwave System Schematic

12.1 Rack Layout

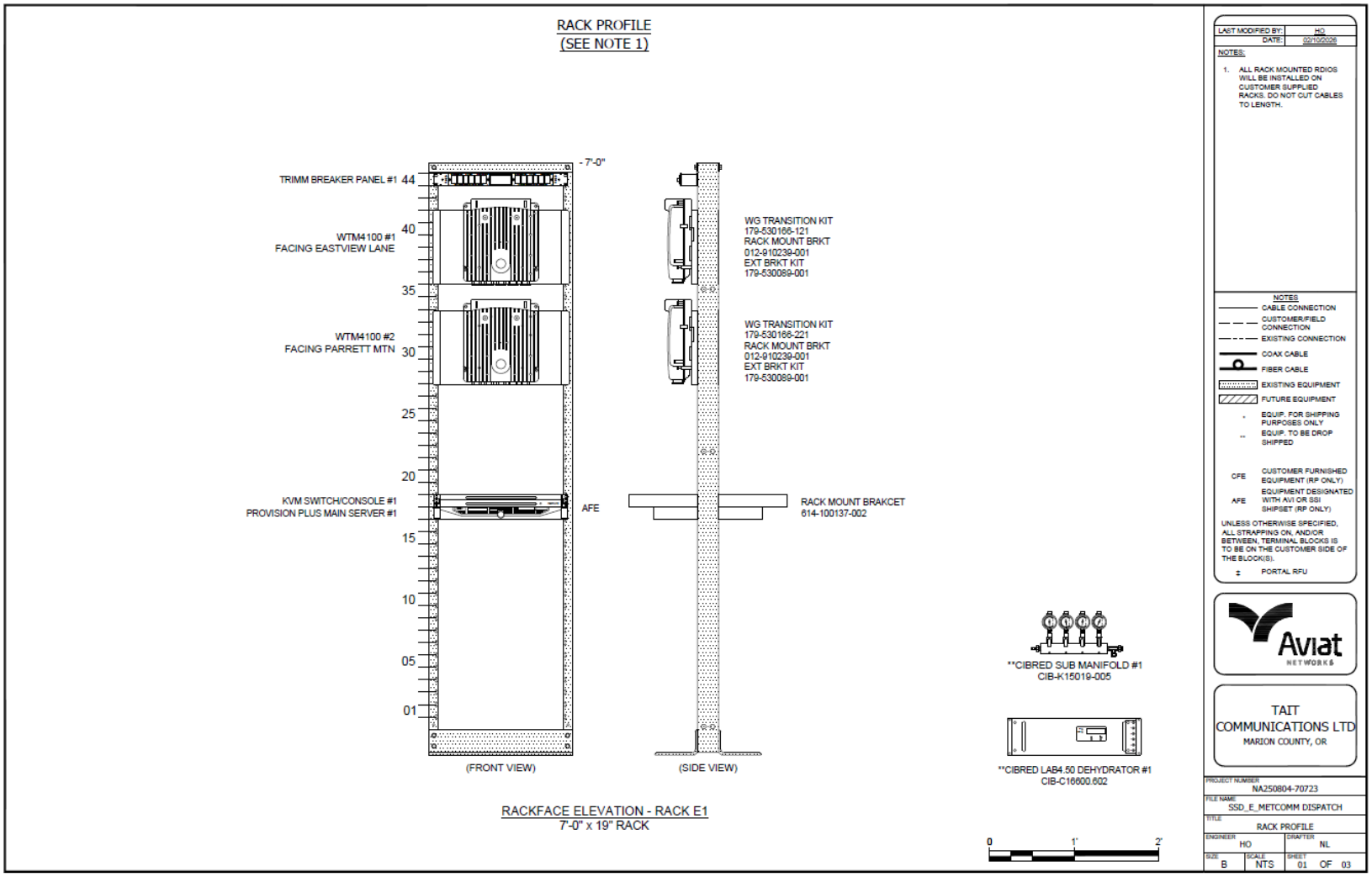
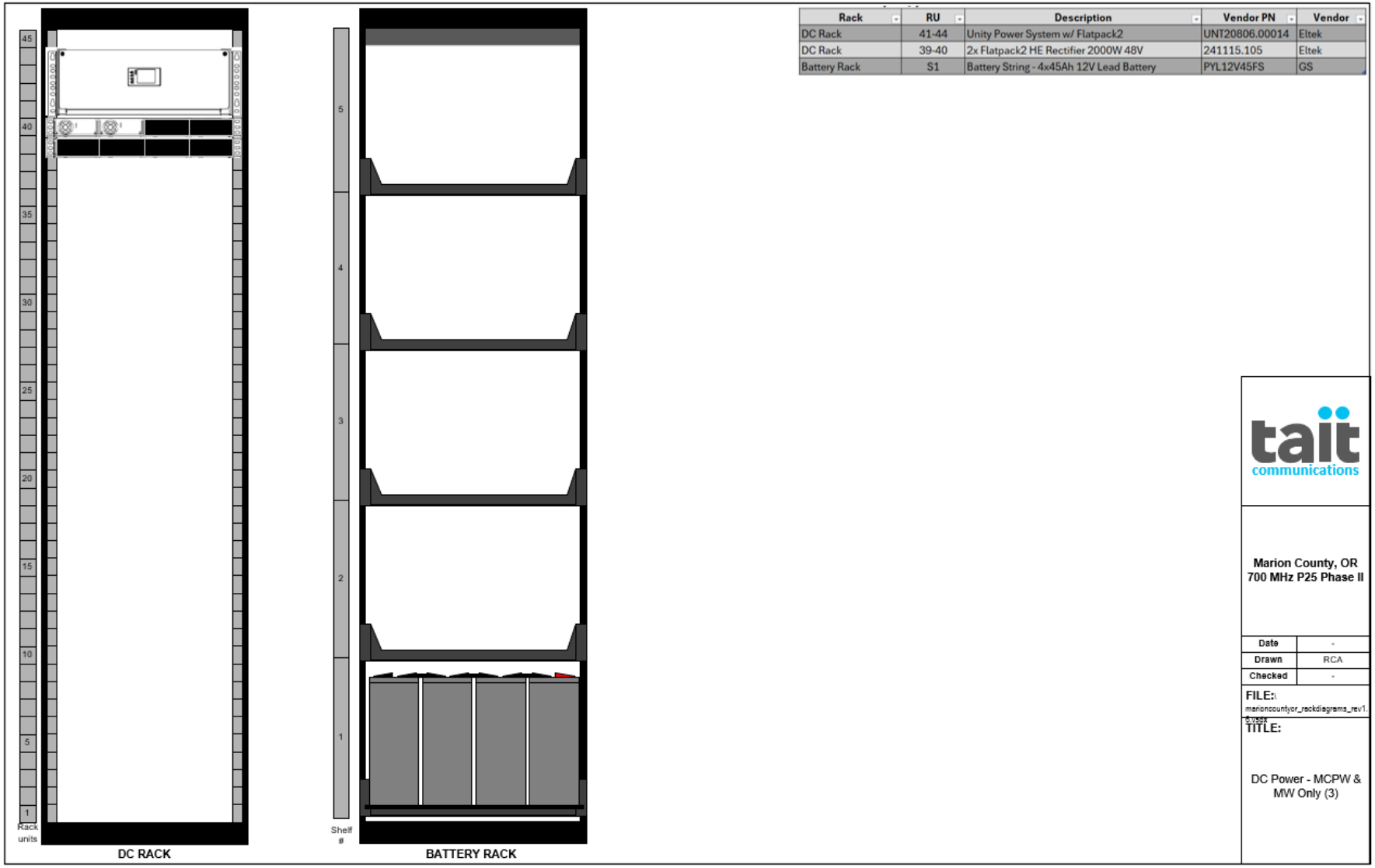


Figure 3 Microwave Rack



Rack	RU	Description	Vendor PN	Vendor
DC Rack	41-44	Unity Power System w/ Flatpack2	UNT20806.00014	Eltek
DC Rack	39-40	2x Flatpack2 HE Rectifier 2000W 48V	241115.105	Eltek
Battery Rack	S1	Battery String - 4x45Ah 12V Lead Battery	PYL12V45FS	GS

Figure 4: DC Power & Battery Racks

13. PARTS AND EQUIPMENT LISTS

Refer to “Marion County P25 Project - Equipment List by Site.xlsx” for site-specific equipment list.

14. RF PERFORMANCE

Not Applicable. No Tait Base Stations at this location.

15. SITE DESIGN INFORMATION

15.1 Site Plan

The site plan is an overhead view of the overall compound depicting locations of pertinent features.

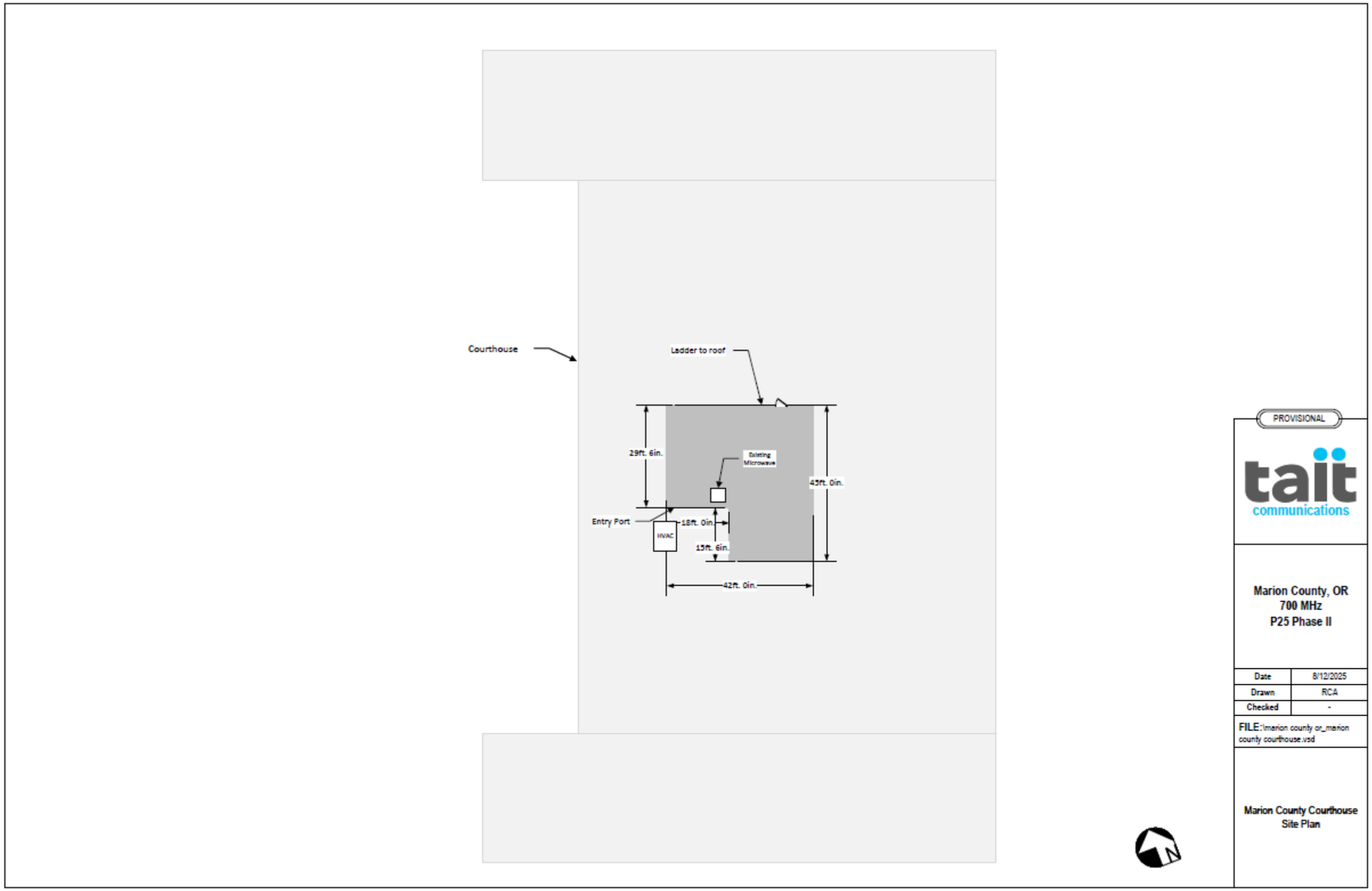


Figure 5: Site Plan

15.2 Floor and Cable Routing Plan

The floor and cable routing plan is an overhead view of the equipment room layout depicting locations of pertinent equipment and including the cable routing plans leading to the tower. For the purposes of this document it shall be treated as provisional.

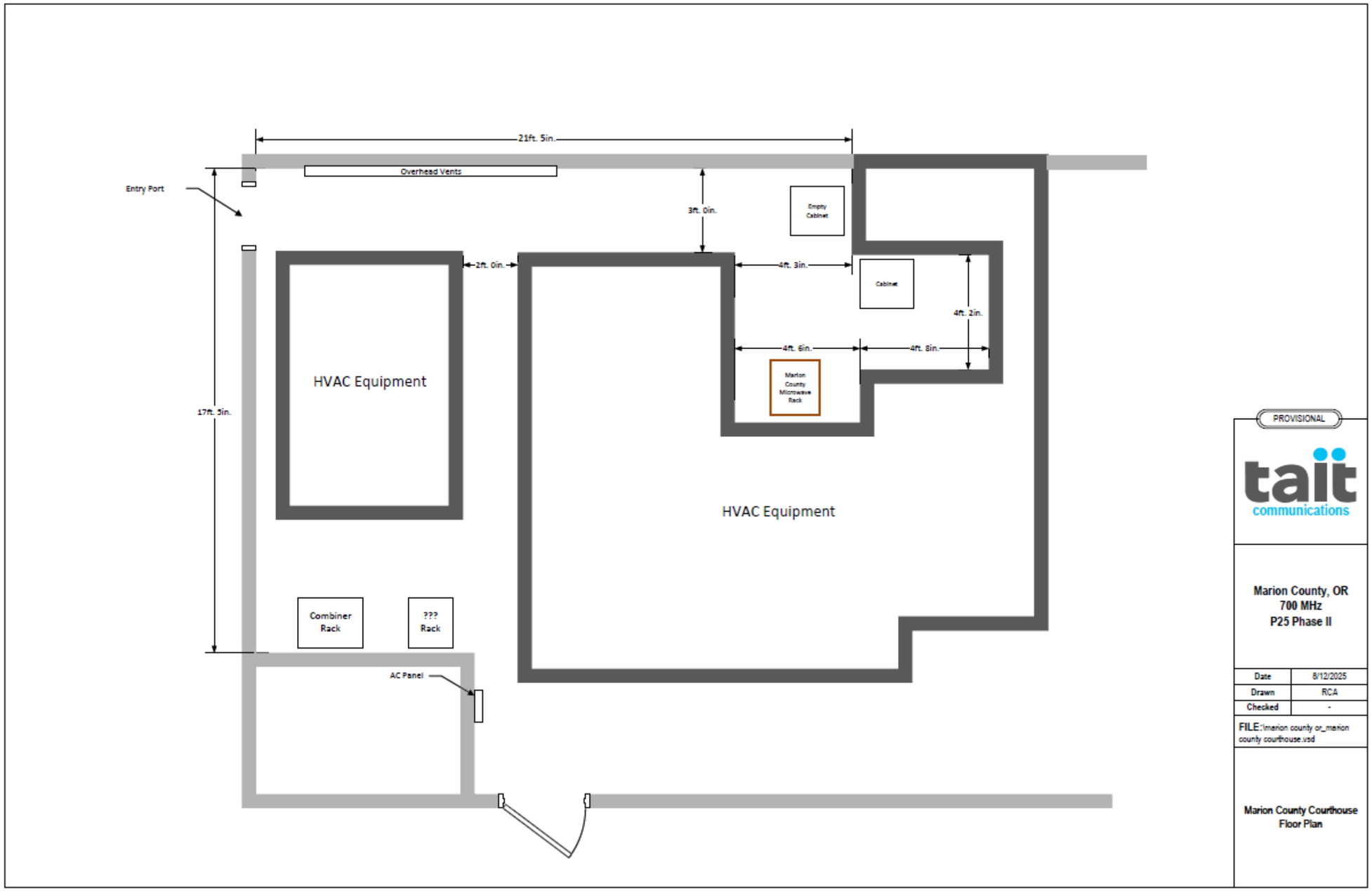


Figure 6: Floor and Cable Routing Plan

15.3 Entry and Exit Ports

The ports where the antenna and TTA cables enter / exit the shelter are shown in the below figure.

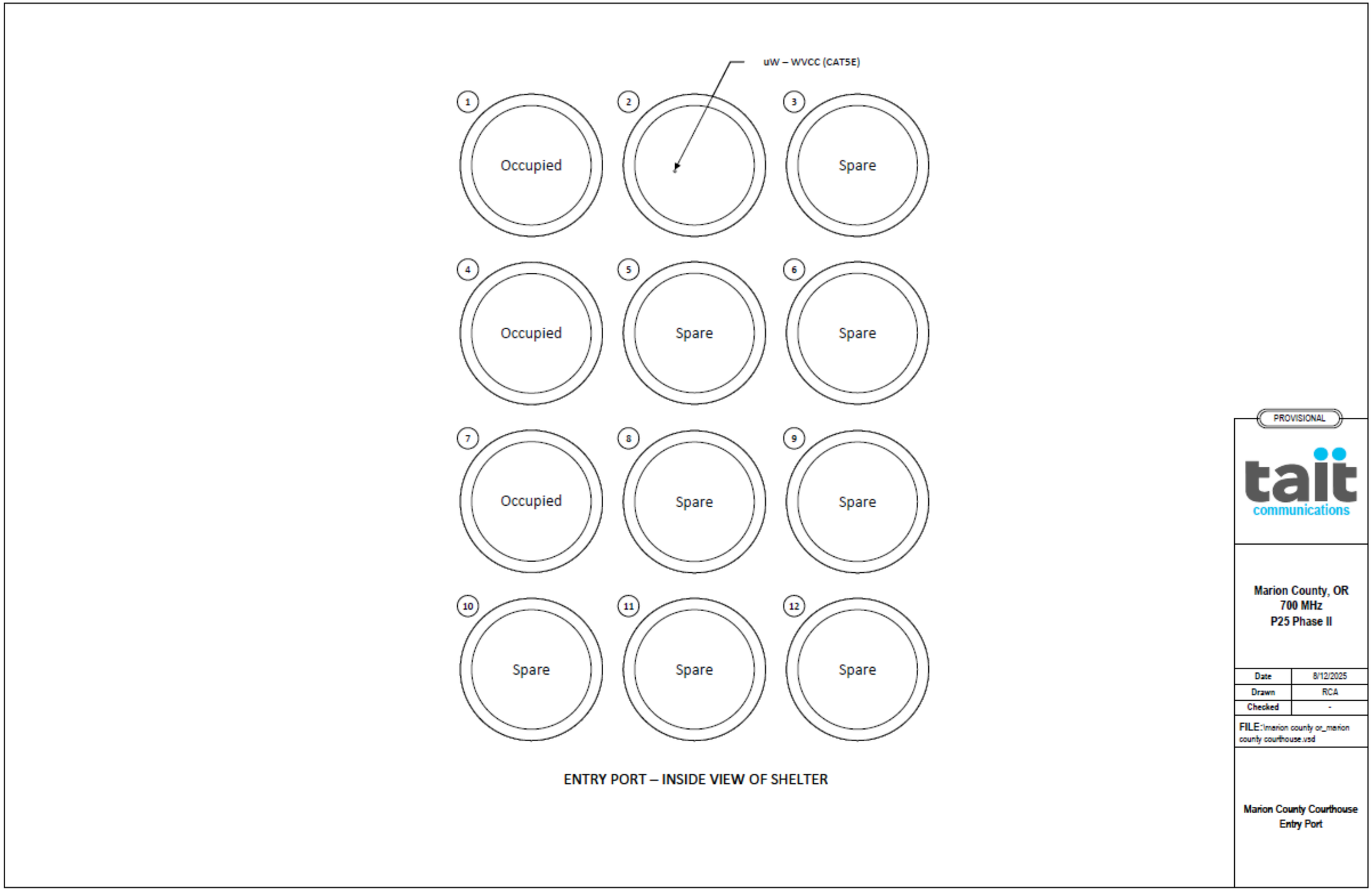


Figure 7: Floor and Cable Routing Plan

15.3.1 Power & Heat Load Calculations

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Power & Heat Load details.

15.3.2 DC Distribution Fuse Panel

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Fuse Panel details.

Supplemental 3 - Crooked Finger

PROVISIONAL Design Document

RF Sub-System and Site Designs

Marion County

Region: North Cell

Site: Crooked Finger

Issue 1.1 • 1st May 2026

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PREFACE

Project Details

Project number	
Customer	Marion County
Project description	P25 Phase 2 Simulcast & P25 Phase 1 Conventional Simulcast
Business Development Manager	
Sales Engineer	
Project Engineer	Jared Farrar / Riley Alfaqeeh
Project Manager	Matt Jordan
Lead RF Engineers	Ian Graham

Purpose

The Marion County project is an 11 site P25 simulcast design that uses the US 700MHz band. To control Time Delay Interference (TDI), the simulcast design is split into three cells – North, South, and East. The North cell is comprised of four sites with P25 Phase 2 trunked operation, the South cell is comprised of four sites with P25 Phase 2 trunked operation, and the East cell is comprised of three sites with P25 Phase 1 conventional operation.

The purpose of this report is to document the RF subsystem design for the **Crooked Finger** site which forms part of the North simulcast cell.

Scope

This document specifies the frequencies to be utilized at the site and summarizes the intermodulation analysis with these frequencies and other high-level in-band carriers as identified from an FCC license search. The required antenna system and associated RF combining equipment will then be described in full.

Publication Record

Author	Ian Graham, Jared Farrar
Issue	1.0
Document Status	Initial Release (minor corrections)
Date	15th October 2025

Document Status

Issue	Date	Signature	Comment
0.1	8th May 2025	Ian Graham	Initial draft
1.0	3rd October 2025	Jared Farrar	Updates following simulcast cell reconfiguration and final microwave subsystem design. Improvements to achievable cascaded noise figure and Rx sensitivity. Updates to required Tx sideband noise suppression, Rx filter rejection at Tx frequencies, and antenna isolation figure.
1.0	15th October 2025	Jared Farrar	Edits to language and typo fixes. Updated RF System Schematic (Figure 8) to include 50-ohm terminations on unused multicoupler ports and changed expansion port count from 2 to 1.
1.1	1st May 2026		

Document Approvals

Approvals	Position	Signature	Date
Bladimyr Guzman	TAM Design Authority		

Associated Documents & References

Reference documentation includes:

- Marion County P25 System Design_v1.1.docx
- Marion County P25 Project - Equipment List by Site.xlsx
- Marion County Power_Heat_Load.xlsx

1. GENERAL RF DESIGN APPROACH

The Marion County project is an 11-site P25 simulcast design that uses the US 700MHz band. To control Time Delay Interference (TDI), the simulcast design is split into three cells – North, South, and East.

The North Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- **Crooked Finger**
- Crosby
- Eastview
- Parrett Mountain

The South Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- Eagle Crest
- Lower Prospect
- McCully Mountain
- Wipper

The East Cell sites operate in P25 Phase 1 conventional mode and are identified as follows:

- APW
- House Mountain
- Halls Ridge

Each site within the North and South Cells will have five trunked P25 Phase 2 channels providing eight dynamic talkpaths (one 12.5kHz FDMA control channel plus four 2-slot 12.5kHz TDMA traffic channels) across each respective cell's coverage area. The East Cell will have five conventional P25 Phase 1 12.5kHz FDMA channels providing five fixed talkpaths across the cell.

Each site across all three cells will have separate transmit (Tx) and receive (Rx) antennas, typically with 20ft vertical separation between centers of radiation. The anticipated low site noise floors in the 700MHz band means Tower Top Amplifiers (TTA) can be used to improve receiver sensitivity and talk-in coverage. Along with the 30MHz Tx-Rx frequency separation, these factors lead to a common RF combining subsystem design which is applicable to all Marion County sites. The combining system requirements were captured based on the proposed frequency plan in coordination with ADCOMM Engineering LLC and Tait subsequently worked with the chosen equipment vendor, dBSpectra, on an optimal design. The main consideration was the TTA where it was decided to use dBSpectra's compact design after it was shown all the required receiver filtering could be accommodated. The generic (starting point) site combining system design therefore features the:

- DSCC75M-5BM 5 Channel Ceramic Tx Combiner
- DSCHPMDC1MDC Channelized Power Monitor
- NPD3633A-TTA Tower Top Amplifier
- NPD3363A-PDU Rx Multicoupler PDU

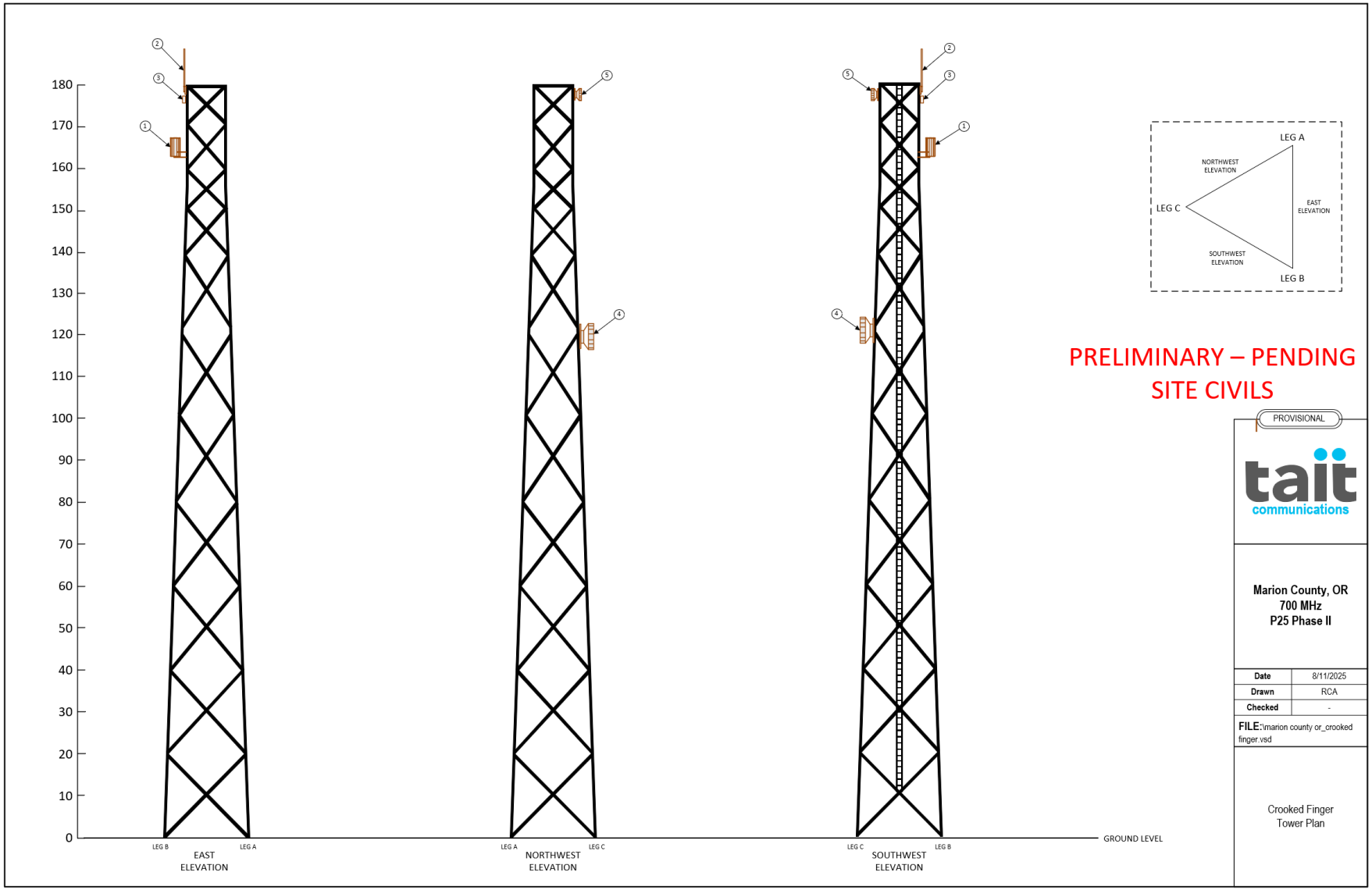
Antennas were chosen on a site-by-site basis to minimize TDI in the simulcast cells while still providing necessary talk-out coverage. The proposed antennas are the:

- Sinclair SE412-SWBPAL
    - 5dBd Low PIM Enclosed Dipole Array
- Sinclair SE414-SWBPAL
    - 8.5 to 11dBd Low PIM Adjustable Beamwidth Enclosed Dipole Array
- RFI CC807-09
    - 9dBd Collinear Omnidirectional

For the Crooked Finger site, the basic design approach will be:

- Install a new SE414-SWBPALDF(D00) transmit antenna at 162ft AGL on Leg 'B' (SE) of the 180ft tower, azimuth 145º, beamwidth 60º.
    - The 5 transmit channels will be connected to the Tx antenna using the dBSpectra DSCC75M-5BM Ceramic Combiner.
- Install a new RFI CC807-09 receive antenna at 179ft AGL on Leg 'B' (SE) of the 180ft tower (azimuth n/a).
    - The 5 receive channels will be fed from the Rx antenna via the dBSpectra NPD3633A-TTA Tower Top Amplifier and the NPD3633A-PDU Rx multicoupler / PDU

2. TOWER MAPPING



#	Description	Part Number	Length (ft)	Leg/Face	Status	Base Height (ft)	Centerline Height(ft)	Tip Height (ft)	Antenna Azimuth	Mount Azimuth	Mount	Transmission Line Size/Type
1	P25 TX Antenna	SE414-SWBPALDF(D00)	4.4	B	New	162	164	166	145		Site-Pro PSA-6 (6' standoff)	7/8"
2	P25 RX Antenna	CC807-09	10.3	B	New	179	184	189	-		Standard	1/2" to TTA
3	TTA	NPD3633A-TTA	1.0	B	New	176	177	177	-		Standard	7/8"
4	Microwave - MCPW	VHLP6-6W	6.0	C	New	117	120	123	270.51	270.51	Standard w/ tieback	EW63
5	Microwave - Eastview Lane	VHLP3-11W	3.0	C	New	177	178	180	280.28	280.28	Standard w/ tieback	EW90

Figure 1: Crooked Finger 180ft Tower Mapping and Appurtenances

3. FREQUENCY PLANNING

5 Channels will be deployed at this site.

The North Simulcast cell uses the following frequencies (pending approval from FCC Region 35).

Site Name	FCC Channel Number	Tx Frequency (MHz)	Rx Frequency (MHz)
Crooked Finger	423-424	771.64375	801.64375
	519-520	772.24375	802.24375
	567-568	772.54375	802.54375
	607-608	772.79375	802.79375
	785-786	773.90625	803.90625

Table 1: North Cell Frequency Assignments

4. INCUMBENTS SEARCH

An external high-level carrier (HLC) is defined as a signal that appears at a level of >-40dBm at the receive antenna. These are the signals which have the potential to contribute towards intermodulation that would result in a loss of receiver sensitivity on one or more channels.

Signal and Noise Monitoring of RF activity at the site was not deemed necessary for this project given the wide Tx-Rx frequency separation in the 700MHz band and the anticipated low site noise floors.

To get some idea of potential RF activity at the site though, an FCC License Search was carried out to identify any other transmitters operating between 700 and 900MHz located within a 0.6-mile radius of the tower (a typical transmitter emitting 100W ERP at 0.6 miles away would be received at -40dBm assuming free space path loss). These include cellular transmitters (as their wide bandwidth could cause IM energy to spread into the LMR receive band) and are summarized in Table 2 below:

Owner	Call Sign	Frequency (MHz)	Tx ERPd (dBm)	Distance from Marion County Tower (miles)
NONE DISCOVERED				

Table 2: High Level Carriers

5. INTERMODULATION ANALYSIS

An intermodulation (IM) analysis was performed for the potentially significant sources, including both the Marion County channels to be deployed and any HLCs found during the FCC License Search. For antenna configurations using separate transmit and receive antennas Tait best practice is to search for IM products up to 7th order within a defined search window accounting for the fact the bandwidth of IM products spread according to the order and bandwidth of the signals that cause it.

The frequencies included in the IM analysis are listed in Table 3 below.

Transmit Frequencies (MHz)	Receive Frequencies (MHz)
771.64375	801.64375
772.24375	802.24375
772.54375	802.54375
772.79375	802.79375
773.90625	803.90625

Table 3: Frequencies Included in IM Analysis

Table 4 below shows how many IM products are generated on each of the receive frequencies. A direct hit is an IM product that falls exactly at the receive frequency. An indirect hit is one that does not fall exactly at a receive frequency but does fall within the search window.

IM Order	Number of Intermodulation Products at each Receive Frequency									
	801.64375MHz		802.24375MHz		802.54375MHz		802.79375MHz		803.90625MHz	
	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect
3rd	0	0	0	0	0	0	0	0	0	0
5th	0	0	0	0	0	0	0	0	0	0
7th	0	0	0	0	0	0	0	0	0	0

Table 4: Intermodulation Results Summary

6. ANTENNA SYSTEM DESIGN

The Antenna System detailed here and the RF Combining System described later in sections 7, 8, and 10 have been specifically designed to mitigate any interference caused by the listed high level carriers, thereby maximizing the coverage achieved by the Marion County system.

6.1 Antenna Type

The following antennas will be used at Crooked Finger.

Antenna	Manufacturer	Antenna Model Number	Description	Antenna Length (ft)	Antenna Gain (dBd)
Rx	RFI	CC807-09	Collinear Omni	10	9
Tx	Sinclair	SE414-SWBPALDF(D00)	Enclosed Dipole	4.4	11.5

Table 5: Antenna Details

800MHz Corporate Collinear Antennas

748-870MHz

CC807 Series

These industry leading, full featured corporate collinear arrays allow site operators to combine, with complete integrity, a large number of communications services into a single, low profile antenna solution.

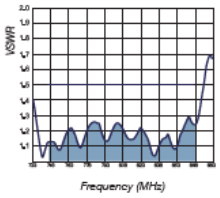
The corporate feed design employed by RFI maintains superior pattern control, allowing gain to be maximised with zero tilt variation over a very broad bandwidth, comparable to that only previously available in exposed dipole array configurations. This is achieved in the preferred form factor of a fully enclosed fibreglass radome, providing a reduction in wind loading, ice loading and tower loading in comparison.

The CC807 series have been designed with an exceptional power rating of 500W across the band as well as a Peak Instantaneous Power (PIP) rating of 25kW to cater for the peak voltage levels present in large multi-carrier combining environments. RFI's refined design processes and proven construction methods achieve a PIM rating of –150dBc, further ensuring performance is maintained for the service life of the antenna.

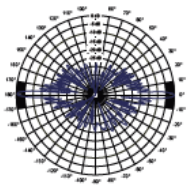
Features:

- 500W Continuous Power rating
- -150dBc Passive Intermodulation (PIM) rating, 100% PIM tested
- 25 kW Peak Instantaneous Power (PIP) rating
- DC grounding on all elements for the ultimate in lightning protection and dissipation of static noise.
- Light weight dipole construction using RFI's patented flexi-PCB architecture, maintains a low centre of gravity reducing tip deflection and sway
- Field invertible (excluding tilt models)
- Preset downtilt variations of 2 and 4 degrees available, see note (1)

Typical VSWR Response (CC807-12)



CC807-12 - E Plane



Electrical Specifications

Model Number	CC807-09-P	CC807-12-P
Nominal Gain *dBd (dBi)*	9.0 (11.1)	11.5 (13.6)
Frequency *MHz*	746-870	
Tuned Bandwidth *MHz*	Full	
VSWR *(Return Loss)*	1.5:1	
Nominal Impedance Ω	50	
Downtilt°	0 Std 2, 4 (1)	
Vertical Beamwidth°	8	4
Horizontal Beamwidth°	Omni +/- 0.5dB	
Input Power W	500	
Passive IM 3rd order (2x20W) *dBc*	-150	
Peak Instantaneous Power *kW*	25	

Mechanical

Model Number		CC807-09-P	CC807-12-P
Construction		Sky blue fibreglass radome	
Radome Diameter mm (inches)		76 (3.0)	
Length mm (inches)		3135 (123.4)	6235 (245.5)
Weight *kg (lbs)*		14 (30.9)	25.5 (56.2)
Termination		Integrated 4.3-10 Female	
Mountaing Area mm (inches)		750 x 90 (30 x 3.5) diameter Ecofilm™ plated aluminium	
Suggested Clamps		3 x UC-114	
Shipping Dimensions *mm (inches)*	H	115 (4.5)	
	W	115 (4.5)	
	L	3335 (131.3)	6435 (253.3)
Shipping Weight *kg (lbs)*		20.0 (44.1)	36.5 (80.5)
Projected area *cm² (ft²)*	No Ice	2597 (2.8)	5559 (6.0)
	With Ice	3192 (3.4)	7037 (7.6)
Lateral Thrust @160km/h *N* (100 mph lbs)		308 (69)	659 (148)
Wind Gust Rating *km/h (mph)*	No Ice	>240 (150)	
Torque @ 160km/h *Nm* (100mph ft-lbs)		413 (305)	1823 (1345)

(1) To order pre-set downtilt versions available, simply add a -T2 or -T4 towards the end of the part number to denote downtilt model required. For eg. CC807-12-T2-P to order CC807-12-P with 2deg of downtilt. Please note: Models with downtilt are NOT field invertible. . Eg. CC807-12-T2-P

P-43021-7

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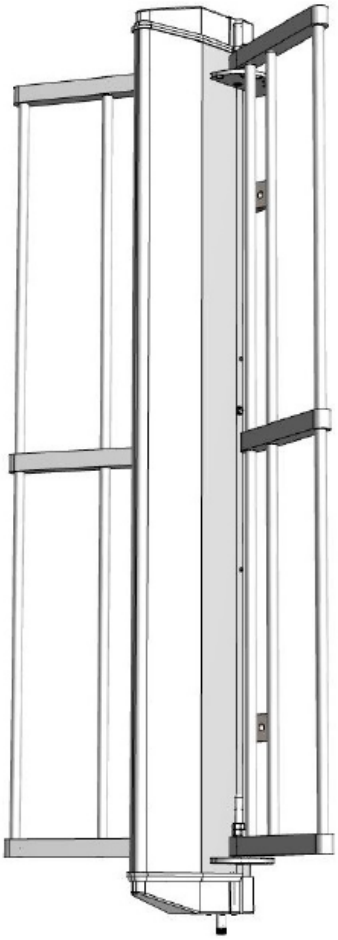
Antennas

700-1000 MHz Antennas

SE414-WBAL - PIM Certified Series

SE414-SWBPAL(YY)(DXX) Enclosed dipole, 8-11.5 dBd, adj. beamwidth, Low PIM, 746-960MHz

- Wide band design covers whole 746-960 MHz band, PIP rated
- Horizontal beamwidth can be adjusted (60º/90º/105º/130º/160º)
- Gain depends on horizontal beamwidth setting (11.5/10/9/8.5/8 dBd)
- PIP rated and low PIM



One wideband antenna for your 700, 800, 900 MHz systems. Sinclair's SE414-WBL series of enclosed dipole arrays offer excellent intermodulation performance covering 746-960 MHz in a single antenna. These highly versatile antennas are particularly well suited to communication systems where a specific coverage pattern is required. These include cellular systems, trunked radio, paging, and data transmission, where predictable and highly reliable performance is a must.

The SE414-WBAL series come with field adjustable reflectors that provide horizontal beamwidths between 60 and 160 degrees. The creative design and construction permits excellent pattern control and greater efficiency.

When ordering, please refer to the chart below for the model number. Different configurations are subject to various list prices. Please contact your Sinclair Sales Representative or Customer Service Representative for more information.

Model Number	Connector	Downtilt	PIM(dBc)	PIP(kW, max)
SE414-SWBPALDF(D00)	7/16 DIN(F)	0º	<-150	25
SE414-SWBPALDF(D01)	7/16 DIN(F)	1º	<-150	25
SE414-SWBPALDF(D02)	7/16 DIN(F)	2º	<-150	25
SE414-SWBPALDF(D03)	7/16 DIN(F)	3º	<-150	25
SE414-SWBPALDF(D04)	7/16 DIN(F)	4º	<-150	25
SE414-SWBPALDF(D05)	7/16 DIN(F)	5º	<-150	25
SE414-SWBPALDF(D06)	7/16 DIN(F)	6º	<-150	25
SE414-SWBPALNF(D00)	N(F)	0º	<-139	N/A
SE414-SWBPALNF(D01)	N(F)	1º	<-139	N/A
SE414-SWBPALNF(D02)	N(F)	2º	<-139	N/A
SE414-SWBPALNF(D03)	N(F)	3º	<-139	N/A
SE414-SWBPALNF(D04)	N(F)	4º	<-139	N/A
SE414-SWBPALNF(D05)	N(F)	5º	<-139	N/A
SE414-SWBPALNF(D06)	N(F)	6º	<-139	N/A

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Antennas
700-1000 MHz Antennas
SE414-WBAL - PIM Certified Series

Electrical Specifications

Frequency Range	MHz	746 to 960	
Bandwidth	MHz	214	
Gain (nominal)	dBd (dBi)	11.5 (13.6)	*1
Input VSWR (max)		1.5:1	
Polarization		vertical	
Impedance	Ω	50	
Pattern		Directional and Adjustable	
Horizontal beamwidth (typ)	degrees	60	*2
Vertical beamwidth (typ)	degrees	20	
Average Input Power (max)	W	500	
Front-to-back ratio (min)	dB	20	
Grounding		All metal parts DC-grounded	

Notes

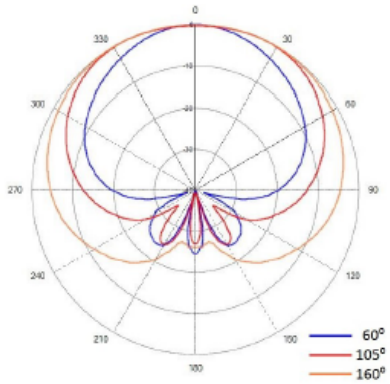
*1 : Dependant on reflector setting 10/9/8.5/8 dBd
*2 : 90/105/130/160
*3 : 90° beamwidth configuration, clamp not included in measurement
*4 : 90° beamwidth configuration, clamp not included in measurement
*5 : Ref. clamp maximum

Mechanical Specifications

Width	in (mm)	25 (635)	*3
Depth	in (mm)	8.5 (216)	*4
Length/ Height	in (mm)	53 (1346)	
Base pipe diameter	in (mm)	2.88 (73)	*5
Base pipe mounting length	in (mm)	30.5 (775)	
Radiating element material		prntd circuit bd	
Weight	lbs (kg)	23 (10.44)	
Mounting Hardware (Included)		#130 clamp	
Mounting configurations		upright	
Actual shipping weight	lbs (kg)	28 (12.71)	
Shipping dimensions	in (mm)	58x14x17 (1473x356x432)	

Environmental Specifications

Temperature range	°F (°C)	-40 to +140 (-40 to +60)
Wind Loading Area (Flat Plate Equivalent)	ft² (m²)	4.8 (0.45)
Wind Loading Area (1/2" ice)	ft² (m²)	5.7 (0.53)
Rated wind velocity (no ice)	mph (km/h)	155 (250)
Rated wind velocity (1/2" radial ice)	mph (km/h)	140 (225)
Lateral Thrust (100 mph No Ice)	lbs (N)	180 (800.6)
Torsional moment (100 mph No Ice)	ft-lbs (Nm)	93 (125.6)



Horizontal

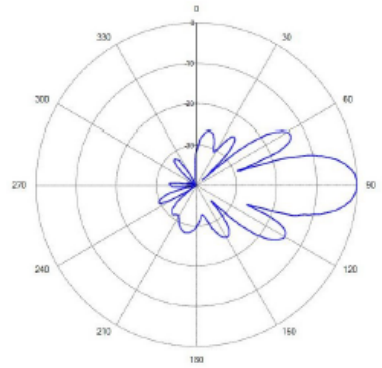

Vertical, 0° downtilt

Figure 2: Antenna Datasheet

6.2 Antenna Mounting Locations

Table 6 below specifies the Marion County antenna mounting location details.

Antenna	Mounting Height (feet AGL)	Antenna Orientation (degrees)	Tower Leg	Standoff Length (feet)	Standoff Orientation (degrees)	Standoff Model
Receive	179	n/a	B (SE)	n/a	n/a	n/a
Transmit	162	145	B (SE)	6	165	Site-Pro PSA-6

Table 6: Antenna Mounting Locations

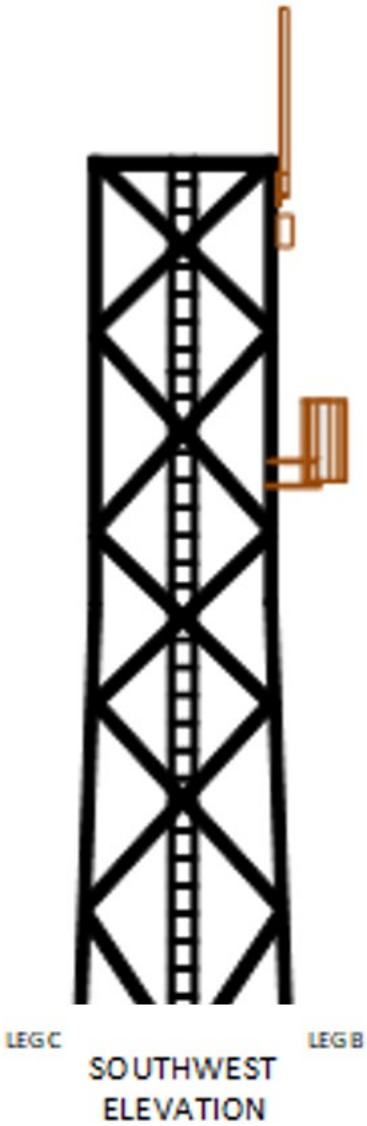
The antenna system design for this site is given in Figure 3.

Marion County Rx Antenna

- System Type: P25 Phase 2 Simulcast
- Antenna Manufacturer: RFI
- Antenna Type no: CC807-09
- Antenna Height AGL at base: 179ft
- Antenna CoR: 184ft
- Antenna Azimuth: n/a
- Tower Leg: B (SE)
- Antenna Function: Rx
- Rx: 801.64375MHz, 802.24375MHz, 802.54375MHz, 802.79375MHz,

Marion County Tx Antenna

- System Type: P25 Phase 2 Simulcast
- Antenna Manufacturer: RFI
- Antenna Type no: SE414-SWBPALDF(D00)
- Antenna Height AGL at base: 162ft
- Antenna CoR: 164ft
- Antenna Azimuth: 145°
- Tower Leg: B (SE)
- Antenna Function: Tx
- Tx: 771.64375MHz, 772.24375MHz, 772.54375MHz, 772.79375MHz, 773.90625MHz



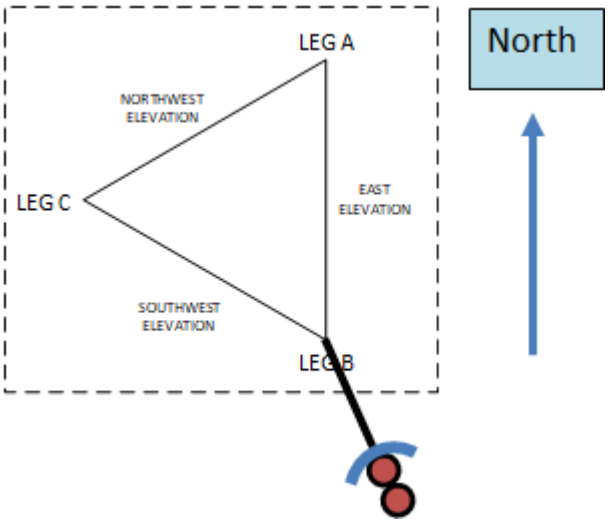


Figure 3: Antenna System Design

6.3 Antenna Isolation

The Transmit and Receive antennas are vertically separated by 20ft and horizontally separated by 6ft which gives an isolation between them of **63.6dB**. A figure of **60dB** will be assumed in subsequent calculations, though, as that is often the limit of what can be practically achieved (e.g., mounting imperfections, mechanical drift due to wind/ice loads or aging hardware).

7. TRANSMITTER COMBINER DESIGN

7.1 RF Connectors

The antenna output of the combiner is fitted with **4.3-10 female** connector to minimize Passive Intermodulation (PIM).

The transmitter input ports of the combiner are fitted with **N Type female** connectors.

7.2 Cavity Filters

Filtering in the Tx Combiner is predominantly bandpass.

A combination of band-pass and band-reject filtering is sometimes to provide extra rejection at specific site Rx frequencies, but band-reject filters are never used alone.

The cavity filters provide the minimum attenuation at the closest receive frequency equal to or greater to the value specified in section 7.9 of this document.

7.3 Isolator

A dual Isolator is included between the output of each transmitter and the Tx Combiner input port.

The isolator load closest to the Tx Combiner input port is rated at a minimum of **100 watts**.

7.4 Maximum RF Power

The Tx combiner supports a maximum of **100 watts** of RF input power per channel.

7.5 Minimum Tx to Tx Frequency Separation

The minimum frequency separation allowed between transmitters sharing the same combiner is **250kHz**.

7.6 Maximum number of Transmitters per combiner

Standard Tait practice is a maximum of four transmitters per Tx combiner. But in this case, the relatively wide Tx-Tx spacing and the fact that self-TxIM does not occur renders the penalty in combining all five transmitters together negligible.

7.7 Maximum Tx Combiner Loss per Channel

The insertion loss shall be minimized to the extent possible while complying with all other specifications.

The Tx Combiner insertion loss per Tx channel (not including associated Tx antenna feeder cable losses) will be around **3.2dB** for the Tx-Tx frequency separation at this site.

7.8 Tx Intermodulation Suppression

Transmitters that cause intermodulation on any site receive frequency must not be connected to the same combiner.

However, there is still a responsibility to keep the site as ‘clean’ as possible for its incumbents. To that end, the levels of intermodulation products generated in the combiner are controlled by a requiring a minimum isolation

between the outputs of combined transmitters of **at least 60dB**. This figure includes the reverse isolation of the isolator and any additional attenuation provided by the cavity filters in neighboring branches.

7.9 Tx Sideband Noise Suppression

In addition to the Tx – Rx antenna isolation, the Tx Combiner provides the suppression required to reduce transmitter sideband noise at the Rx antenna to the level where it causes no more than 1dB of receiver de-sensitization. The transmitter sideband noise suppression required at this site is given in Table 7 below.

Transmit Frequency (MHz)	Offset to Nearest Receive Frequency (MHz)	Sideband Noise Suppression Required at Offset (dB)
771.64375	30.0000	15
772.24375	29.4000	16
772.54375	29.1000	16
772.79375	28.8500	16
773.90625	27.7375	16

Table 7: Transmitter Combiner Sideband Noise Rejection Requirements

8. RECEIVER SUBSYSTEM DESIGN

8.1 RF Connectors

8.1.1 Tower Top Amplifier

The Rx Filter input is fitted with a **4.3-10 female** connector.

The Rx Filter output is fitted with a **4.3-10 female** connector.

8.1.2 Receiver Multicoupler/PDU

The Rx Multicoupler input is fitted with a **4.3-10 female** connector.

The receiver output ports of the Rx Multicoupler are fitted with a **BNC Female** connector.

8.2 Receiver Subsystem Topology

The Receiver Subsystem will utilize a Tower Top Amplifier (TTA, which includes the receiver filtering) to optimize talk-in coverage followed by a multicoupler/PDU system that further amplifies and splits the received signal between the connected receivers.

8.3 Receiver Filtering

The Receiver Filters will pass the 801 to 805MHz part of the 700MHz band used for the Marion County system while fully rejecting associated transmit signals in both the 700MHz and 800MHz Tx bands. This is important because combinations of transmitters in both bands can result in 7th order IM falling within the 700MHz receive band.

8.3.1 Blocking Rejection

Between them, the Receiver Filters must provide enough attenuation so that no more than 1dB of de-sensitization of any of the connected receivers occurs due to receiver blocking. The attenuation required at this site to prevent receiver blocking due to the Marion County transmitters and external interferers found during FCC database search is given in Table 8 below:

	Tx Name	Tx Frequency (MHz)	Minimum Rejection in Rx Filter at Tx Frequency (dB)				
			Rx1 (MHz)	Rx2 (MHz)	Rx3 (MHz)	Rx4 (MHz)	Rx5 (MHz)
			801.64375	802.24375	802.54375	802.79375	803.90625
Transmitters	Tx1	771.64375	21	21	21	21	21
	Tx2	772.24375	21	21	21	21	21
	Tx3	772.54375	21	21	21	21	21
	Tx4	772.79375	21	21	21	21	21
	Tx5	773.90625	21	21	21	21	21

Table 8: Receiver Filter Blocking Rejection Requirements

8.3.2 Receiver Intermodulation Rejection

The Rx Filter must provide enough attenuation so that no more than 1dB of de-sensitization of any of the connected receivers occurs due to intermodulation. At this site, there is no anticipated IM risk. Therefore, the rejection specified above is sufficient.

8.4 Low Noise Amplifiers

Low Noise Amplifiers (LNAs) with appropriate gain and noise figure will be included in the receiver sub system to ensure that the cascade noise figure of the line up from the base of the receive antenna up to and including the base station receiver is equal to or less than 5dB. In the case of Crooked Finger, this noise figure can be improved to approximately **3.9dB** while still maintaining linearity of the receive system lineup.

The output third order intercept of the LNAs will be ≥ +40dBm to maintain the linearity of the system.

8.5 Variable Attenuator

A Variable Attenuator will be fitted in the Rx Multicoupler/PDU for field optimization of the receiver subsystem gain, noise figure, and IP3. The attenuator has an adjustment range of 0dB to 15dB, in 0.25dB steps. To achieve a noise figure of 3.9dB, the variable attenuator shall be set to **6dB**.

Setting of the attenuator value must be done electronically so as not to require disassembly of the multicoupler equipment.

8.6 Receiver Ports

To allow for future expansion, the Rx Multicoupler will have 8 ports

All unused ports will be terminated in a 50-ohm load.

9. POWER MONITOR

The dBSpectra DSCHPMDC1MDC Power Monitor will be used within the Marion County RF systems. This is placed at the output of the Tx Combiner and allows remote monitoring of channelized transmitted power and antenna VSWR. The major benefit is early warning of antenna system degradation so that repairs can be made before failure occurs.

DSCHPM-Series (VHF, 220, UHF, 700/800/900 MHz)
SMART Channelized Transmit Power Monitor with Front Panel Display Option

dbSpectra
Always a Better Value

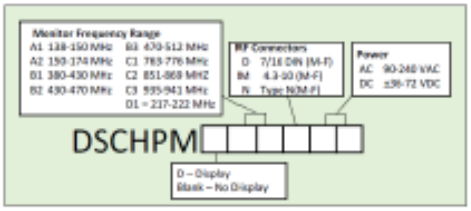
DSCHPM Power Monitor with front panel display option.

Directional coupler for installation on combiner output.

Features and Benefits

- *Per-channel and composite* measurement of forward and reflected RF power with the SMART Channelized RF Power Monitor.
- Calculates and displays combiner insertion loss for each channel.
- All measurements are displayed with 95% accuracy.
- IP network connection and designed-in web server for web browser interface.
- Full remote configuration, monitoring and data logging.
- Optional front panel display with Navigation Keys for monitoring only.
- User-defined alarm thresholds are indicated by alarm relay closure or by SNMP protocol on the network.
- Optional temperature sensors for equipment and ambient temperature measurements and alarms.
- Compact single rack unit mounting with remote RF sensor for flexibility in mounting locations.

Ordering Information

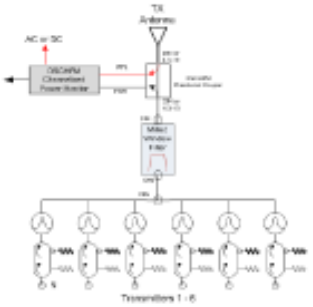


Notes:
1. Factory calibrated using a P25 LSM signal source, may be calibrated in the field for improved accuracy.
2. Contact dbSpectra at tech@dbspectra.com for additional information on optional temperature sensor feature.

Specifications

Electrical Specifications	
Frequency Range, MHz	See Ordering Information
Minimum TX to TX Separation	50 kHz
Maximum Power Input	600 Watts (directional coupler)
System Type	Digital or analog
Insertion Loss	< 0.1 dB
PIM Rating	-150 dBc
Channelized Power Measurements	Forward /reflected power of individual channels: Watts, dBm, VSWR, Return Loss, Combiner Insertion Loss
Power Requirements	AC Model 90-240 VAC 15W, or DC model ±36-72 VDC 15W
IP Interface	IPV4, with TLS security layer, SNMP v2c/v3 alarm protocol
Alarms	Form C contacts or SNMP v2c/v3
User Interface	Web browser or remote SNMP system manager. Front Panel Display (optional) for Monitoring only.
Temperature Range	-30 to +60 °C
Mechanical Specifications	
Mounting Dimensions	1 RU, 1.75 X 19 in. (44 X 483 mm) 7.5 in. (191 mm) deep
Construction / Finish	Aluminum / protective finishes
Directional Coupler Connectors Input Output Coupled Ports	 7/16 DIN, 4.3-10 or N(male) 7/16 DIN, 4.3-10 or N(female) MCX type push-on with two 4 ft RD316 cables supplied.
Power Connector	AC model: IEC 320-C13 inlet & cord DC model: 2 port terminal block
Ethernet Connector	RJ-45
Alarm Closures Connector	3 port pluggable terminal block
Temp. Sensor Connector	24-pin header male pins
Net Weight	4.6 lbs. (2.1 kg)
Shipping weight	6.1 lbs. (2.8 kg)

Typical Application



Specifications are subject to change • www.dbspectra.com • 1590 E Hwy 121, Building A, Suite 100, Lewisville, TX 75056 • P (469)322-0080 •096000-797.A • 01/2024

Figure 4: DSCHPMDC1MDC Channelised Power Monitor

10. RF SUB-SYSTEM DESIGN

Tait have worked with dBSpectra to develop a generic combining system for the Marion County project that meets the performance goals derived in sections 7 and 8 of this report and thereby maximizes the talk in and talk out coverage of the system.

The transmit side of the RF sub-system consists of a 5-channel cavity filter based ceramic combiner to minimize losses and maximize the transmitted power and talk out coverage from the site. The cavity filters meet or exceed the Tx sideband noise filtering requirements given in section 7.9.

The receive side features a compact Tower Top Amplifier (TTA) followed by a Receiver Multicoupler/PDU that allows the receiver sensitivity to be optimized and distributes the signal to the five connected receivers. All the receive filtering is accommodated within the TTA. There are two filters, one before the LNA to preselect the 801 to 805MHz part of the band used by the Marion County system (see Figure 6), and a second after the LNA that fully rejects the Marion County system transmit signals, and the other 700 and 800MHz HLCs identified from the FCC database search (see Figure 7). Together, the filters meet or exceed the receiver blocking and receiver intermodulation filtering requirements given in sections 8.3.1 and 8.3.2. There are two LNAs, one in the TTA and one in the Rx Multicoupler/PDU with gains, noise figures and intercept points optimized so the cascade noise figure and linearity of the receiver line up meet the requirements of section 8.4.

A block diagram of the North Cell combining system design is shown in Figure 5 below:

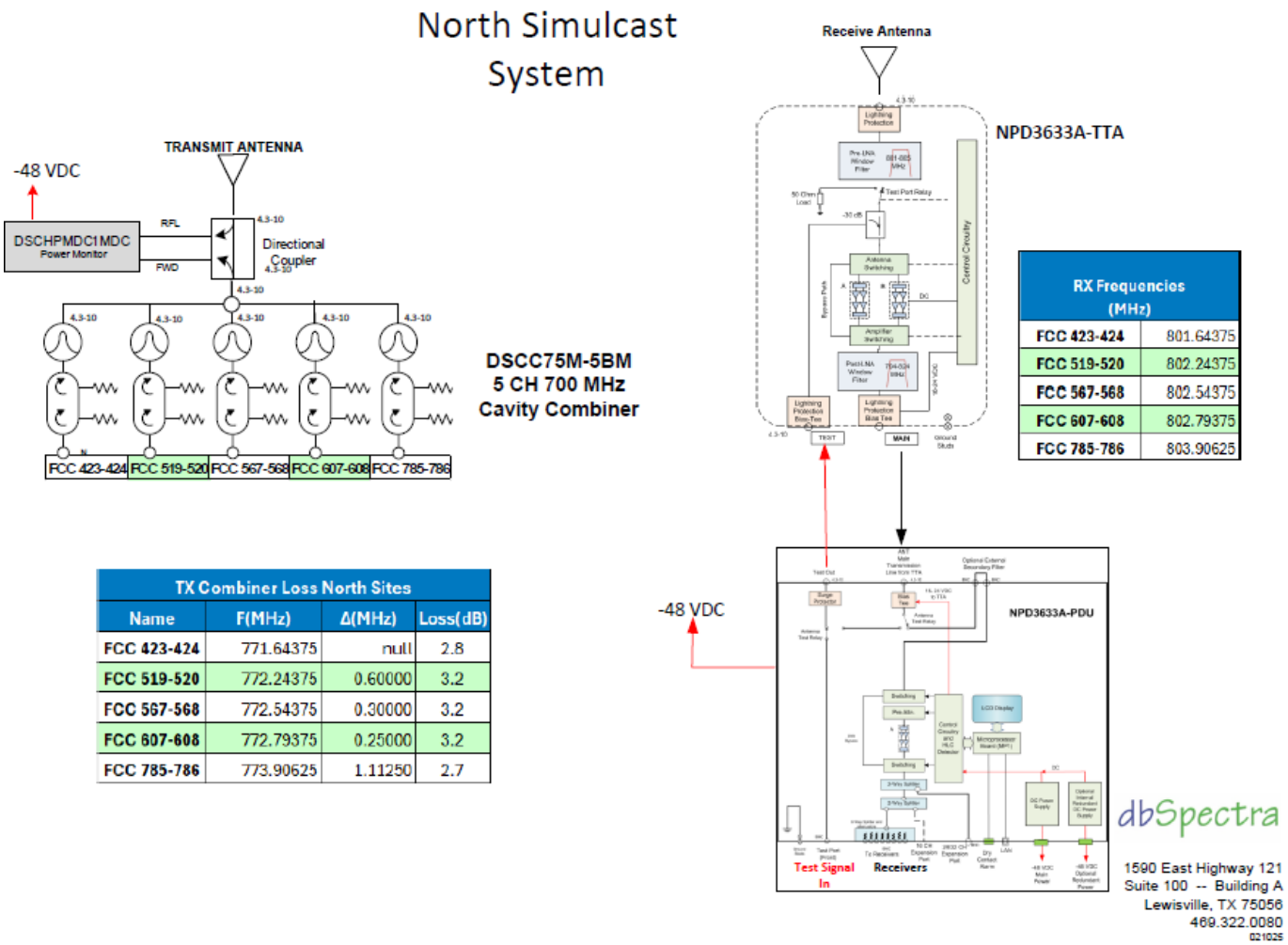


Figure 5: SPD3454C-4TR Dual Band RF Combining System

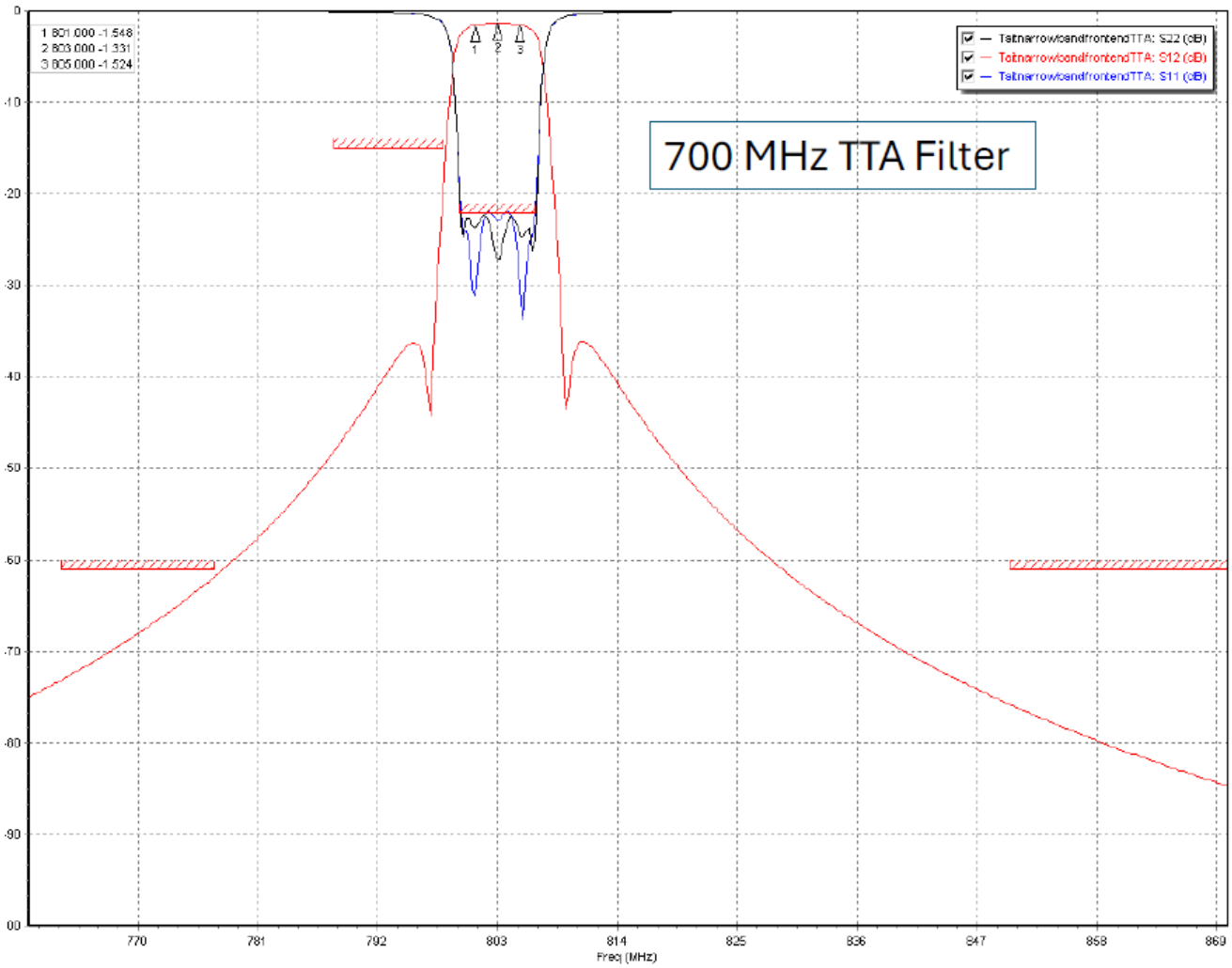


Figure 6: TTA PreSelector Filter Plot

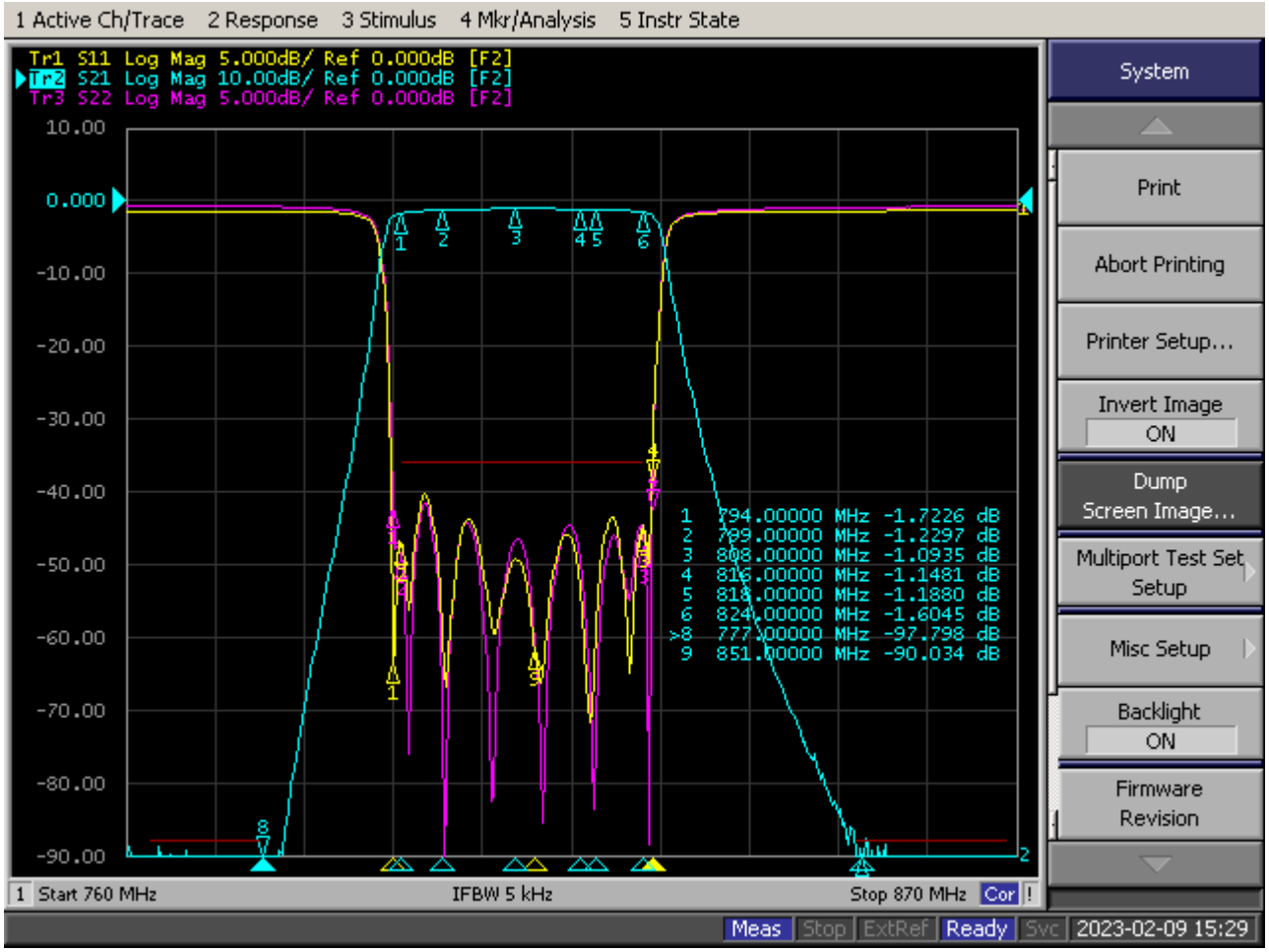


Figure 7: TTA Post LNA Filter Plot

11. MICROWAVE SYSTEM DESIGN

Refer to “Marion County P25 System Design_v1.1.docx” for Microwave System Details.

11.1 Site Specific Design

The Crooked Finger site supports two Aviat microwave links. These links connect Crooked Finger to Eastview Lane and MCPW Dispatch, forming part of the 13-site core ring and providing the redundant routing expected within the looped topology.

12. RF SUB-SYSTEM DRAWINGS

The figure below contains the schematic of the RF sub-system to be deployed at this site.

12.1 RF System Schematic

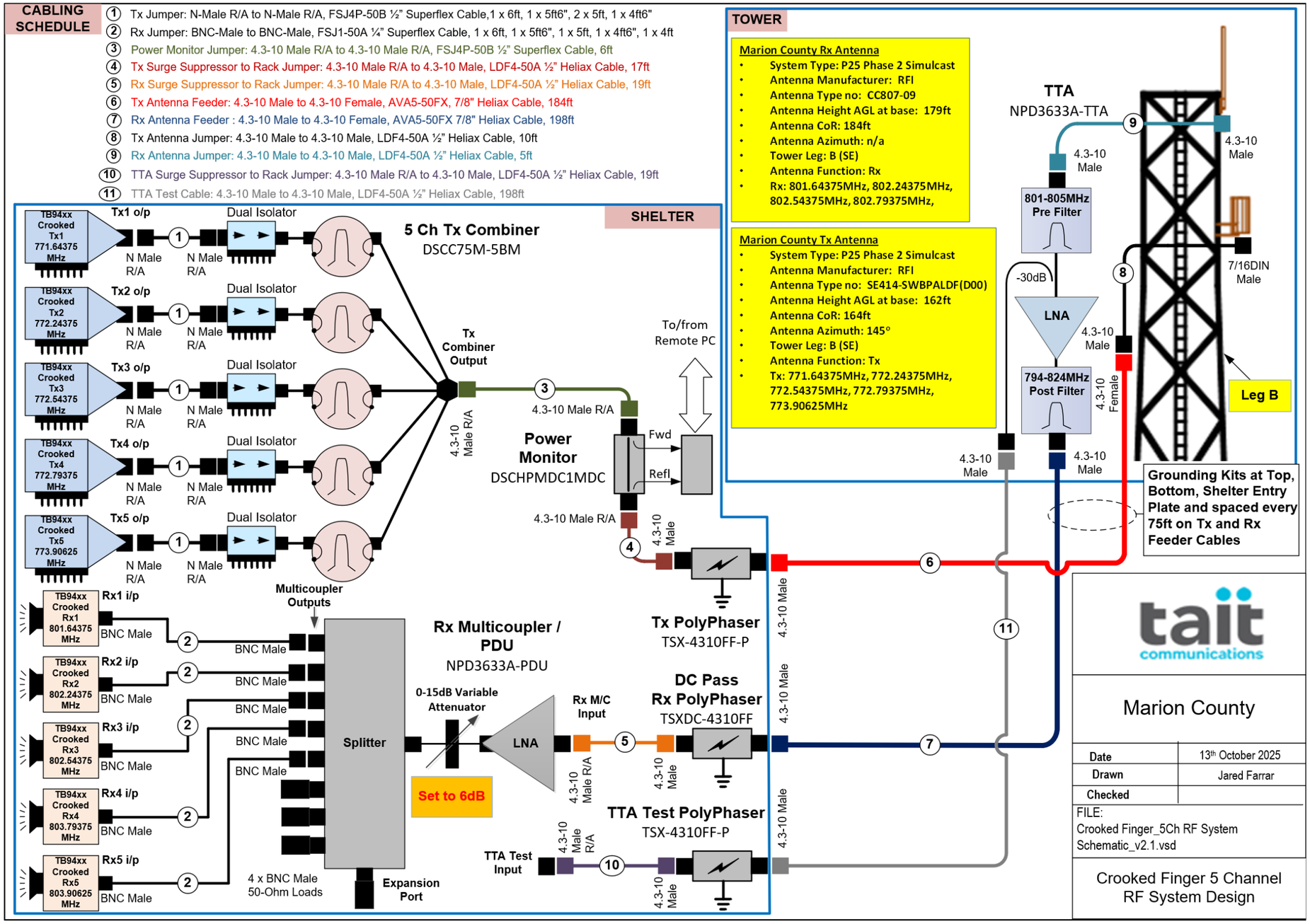
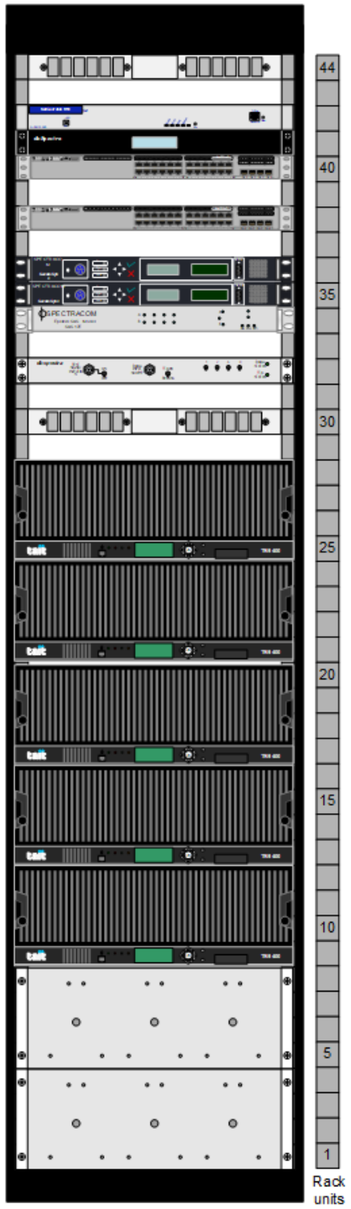


Figure 8: RF System Schematic

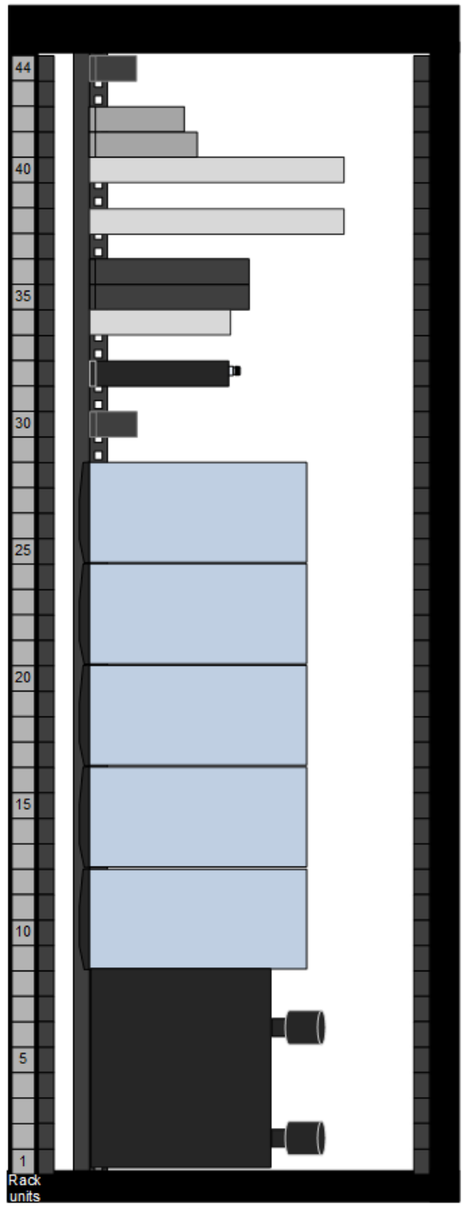
12.2 Rack Layout

This section contains the rack layout front & back view, side view and cabling diagram for this site.

700 MHz P25 Phase II Rackup Diagrams



Front View



Side View

RU	Description	Vendor PN	Vendor	Width (in)	Height (in)	Depth (in)
44	Breaker Panel	9072101001	TRIMM	19	1U	3.25
42	Alarm Panel	M16G2 & D-PK-16PAN	Netguardian	17	1U	6.6
41	Power Monitor	DSCHPMDC	dBSpectra	19	1U	7.5
40	Switch #1	C9300L-24P-4X-A	Cisco	17.5	1U	17.7
38	Switch #2	C9300L-24P-4X-A	Cisco	17.5	1U	17.7
36	Timing Reference	2402-613	Safran	17.1	1U	15.17
35	Timing Reference	2402-613	Safran	17.1	1U	15.17
34	Timing Switch	SAS-17E	Safran	19	1U	13.4
32	Multicoupler	NPD3633A	dBSpectra	19	1U	10.5
30	Breaker Panel	9072101001	TRIMM	19	1U	3.25
25-28	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
21-24	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
17-20	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
13-16	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
9-12	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra	19	8U	12.5

Marion County, OR
700 MHz P25 Phase II

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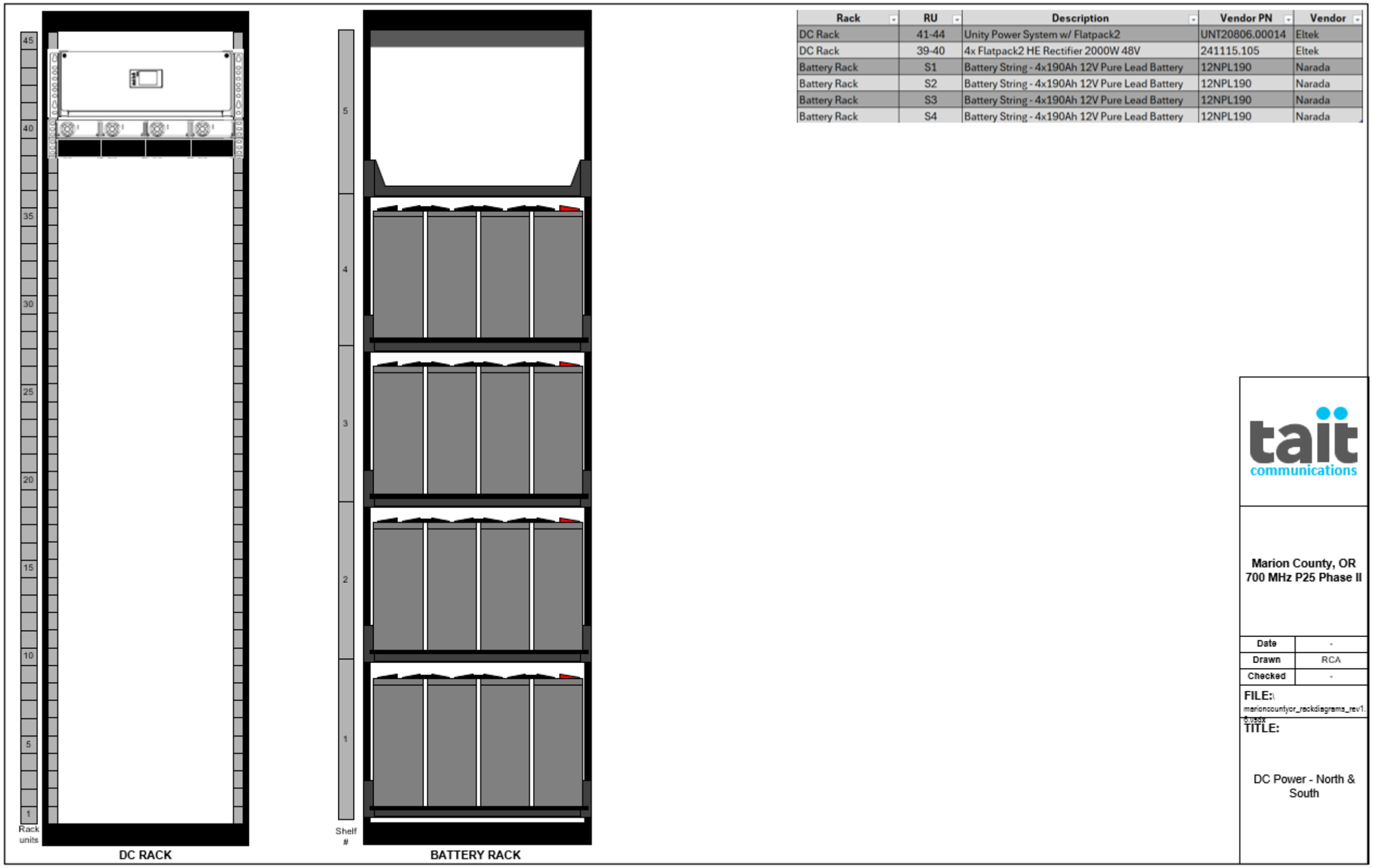
RF_Site_Simulcast

Figure 9: Marion County 19" Rack Layout – RF Front & Side



Rack	RU	Description	Vendor PN	Vendor
DC Rack	41-44	Unity Power System w/ Flatpack2	UNT20806.00014	Eltek
DC Rack	39-40	4x Flatpack2 HE Rectifier 2000W 48V	241115.105	Eltek
Battery Rack	S1	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack	S2	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack	S3	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack	S4	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada

Figure 10: DC Power & Battery Racks

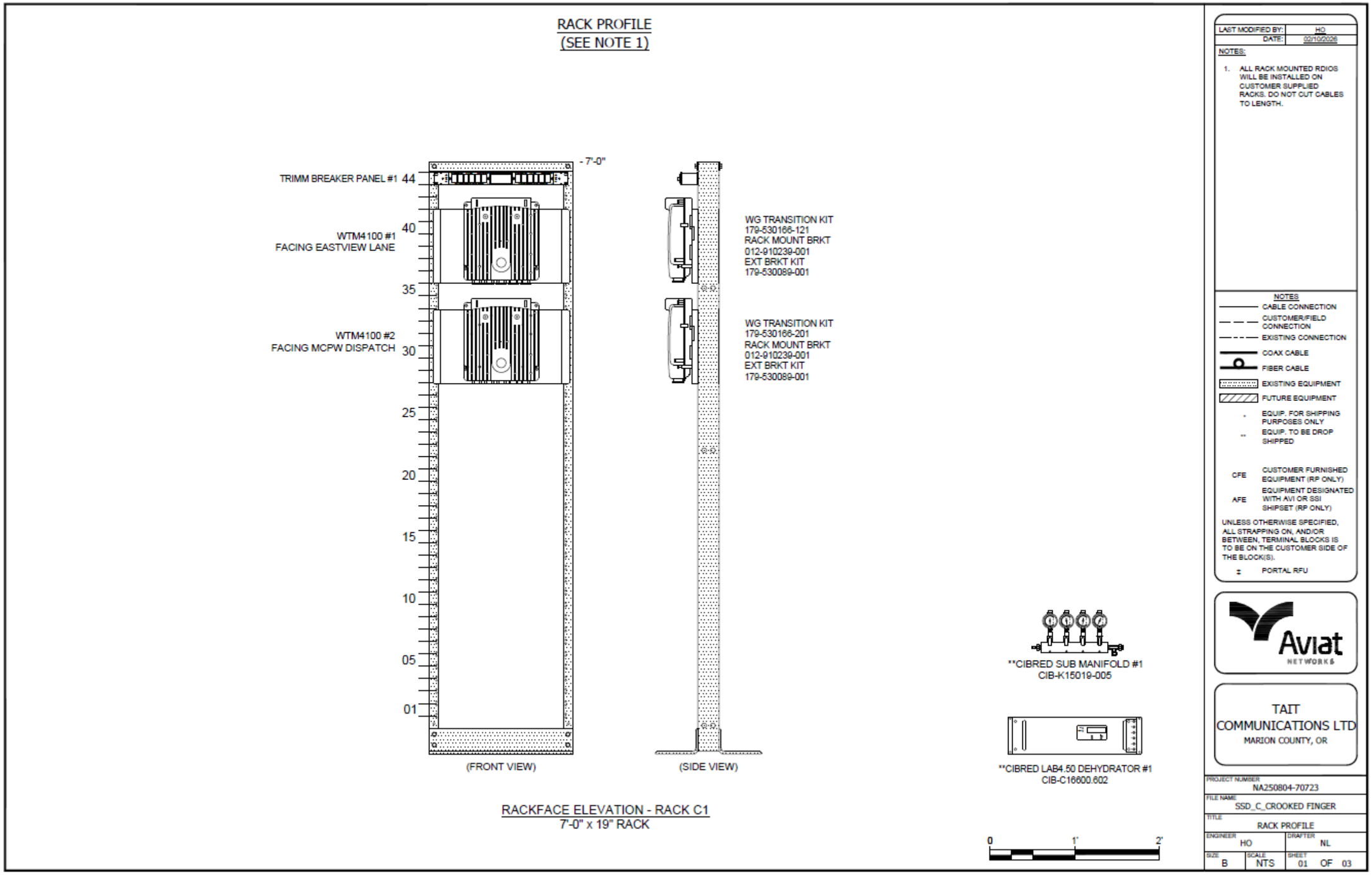
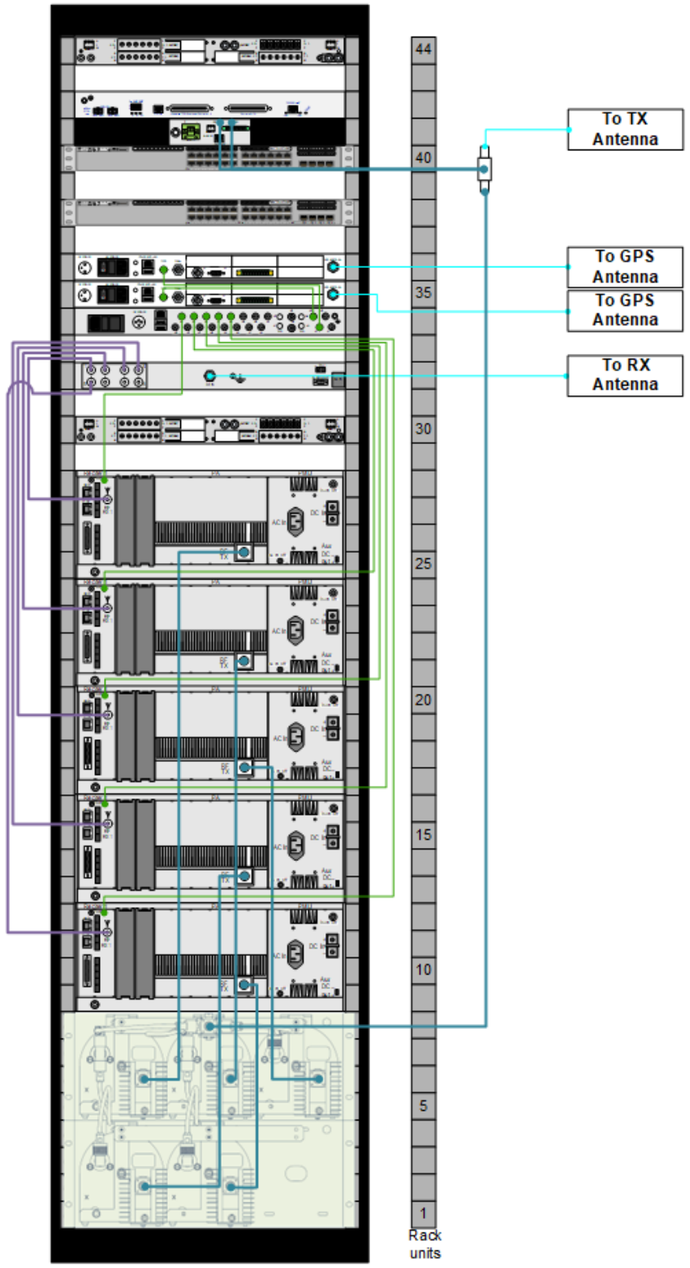


Figure 11 Microwave Rack

700 MHz P25 Phase II
Rackup Diagrams



RU	Description	Vendor PN	Vendor
44	Breaker Panel	9072101001	TRIMM
42	Alarm Panel	M16G2 & D-PK-16PAN	Netguardian
41	Power Monitor	DSCHPMDC	dBSpectra
40	Switch #1	C9300L-24P-4X-A	Cisco
38	Switch #2	C9300L-24P-4X-A	Cisco
36	Timing Reference	2402-613	Safran
35	Timing Reference	2402-613	Safran
34	Timing Switch	SAS-17E	Safran
32	Multicoupler	NPD3633A	dBSpectra
30	Breaker Panel	9072101001	TRIMM
25-28	P25 Trunked Base Station	TB9435S-100T	Tait
21-24	P25 Trunked Base Station	TB9435S-100T	Tait
17-20	P25 Trunked Base Station	TB9435S-100T	Tait
13-16	P25 Trunked Base Station	TB9435S-100T	Tait
9-12	P25 Trunked Base Station	TB9435S-100T	Tait
1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

Marion County, OR
700 MHz P25 Phase II

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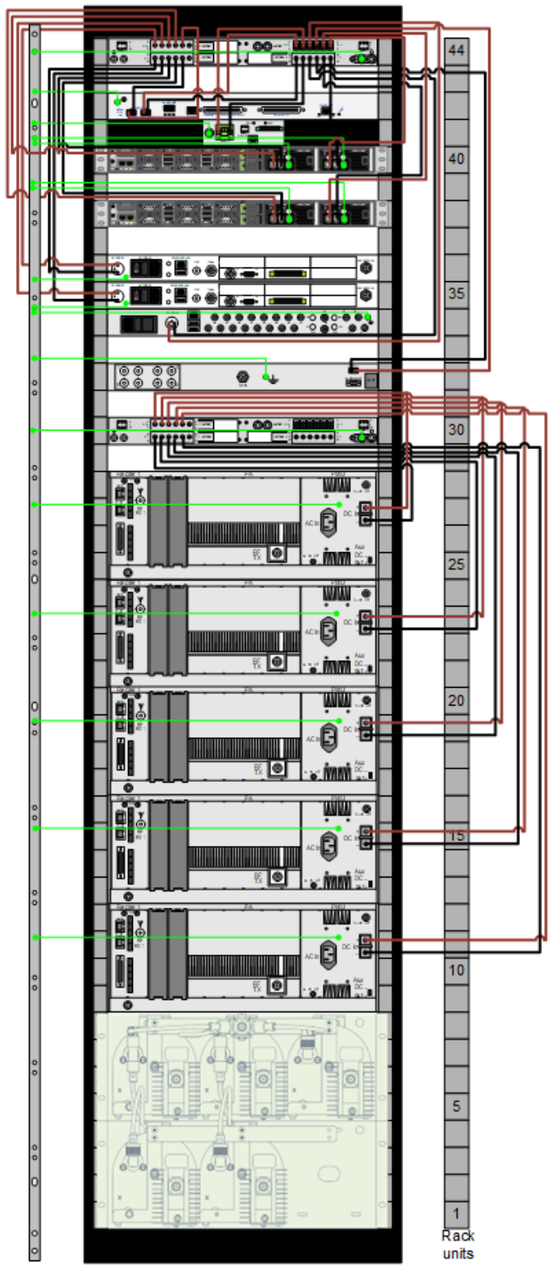
Cabling - RF

Figure 12: Marion County 19" Rack Layout – RF Cabling

700 MHz P25 Phase II
Rackup Diagrams



RU	Description	Vendor PN	Vendor
44	Breaker Panel	9072101001	TRIMM
42	Alarm Panel	M16G2 & D-PK-16PAN	Netguardian
41	Power Monitor	DSCHPMDC	dBSpectra
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34	Timing Switch	SAS-17E	Safran
32	Multicoupler	NPD3633A	dBSpectra
30	Breaker Panel	9072101001	TRIMM
25-28	P25 Trunked Base Station	TB9435S-100T	Tait
21-24	P25 Trunked Base Station	TB9435S-100T	Tait
17-20	P25 Trunked Base Station	TB9435S-100T	Tait
13-16	P25 Trunked Base Station	TB9435S-100T	Tait
9-12	P25 Trunked Base Station	TB9435S-100T	Tait
1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

Description A	Connection A	Description B	Connection B
Breaker Panel 1	A1	GPS 1	-48 VDC
Breaker Panel 1	A2	GPS 2	-48 VDC
Breaker Panel 1	A3	Switch 1-A	-48 VDC
Breaker Panel 1	A4	Switch 2-A	-48 VDC
Breaker Panel 1	A5	Alarm Panel A	-48 VDC
Breaker Panel 2	B1	Alarm Panel B	-48 VDC
Breaker Panel 2	B2	Power Monitor	-48 VDC
Breaker Panel 2	B3	Timing Switch	-48 VDC
Breaker Panel 2	B4	Multicoupler	-48 VDC
Breaker Panel 2	B5	Switch 2-B	-48 VDC
Breaker Panel 2	B6	Switch 1-B	-48 VDC

Marion County, OR
700 MHz P25 Phase II

Date	-
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TITLE:

Cabling - Power

Figure 13: Marion County 19" Rack Layout – Power Cabling

13. PARTS AND EQUIPMENT LISTS

Refer to “Marion County P25 Project - Equipment List by Site.xlsx” for site-specific equipment list.

14. RF PERFORMANCE

14.1 Tx Effective Radiated Power

Table below summarizes the transmitter system performance. It shows the required TB9400 transmitter output power setting, the combining losses (including internal cabling), the antenna feeder loss and finally the resulting ERP relative to a dipole (ERPd).

Transmitter Frequency (MHz)	Transmitter Output Power Setting	Combining Losses (dB)	Misc Losses (dB)	Antenna Feeder Losses (dB)	Tx ERPd
771.64375	+50dBm (100W)	3.2	0.7	2.42	+55.0dBm (320W)
772.24375	+50dBm (100W)	3.2			+55.0dBm (320W)
772.54375	+50dBm (100W)	3.2			+55.0dBm (320W)
772.79375	+50dBm (100W)	3.2			+55.0dBm (320W)
773.90625	+50dBm (100W)	3.2			+55.0dBm (320W)

Table 10: Transmitter Output Power Setting and Effective Radiated Power

14.2 Site Noise

Site Noise in the 700MHz band can be assumed to be negligible.

14.3 Receiver Sensitivity

Table summarizes the receiver system performance. It shows the amount of de-sensitization caused by the elevated site noise floor, the required Rx Multicoupler attenuation setting, and the resulting final Receiver sensitivity that can be achieved.

Receiver Frequency (MHz)	Rx Multicoupler Attenuator Setting (dB)	Rx Sensitivity for DAQ3.4 (dBm)
801.64375	6	-111.2
802.24375		
802.54375		
802.79375		
803.90625		

Table 11: Receiver Sensitivity

15. SITE DESIGN INFORMATION

15.1 Site Plan

The site plan is an overhead view of the overall compound depicting locations of pertinent features.

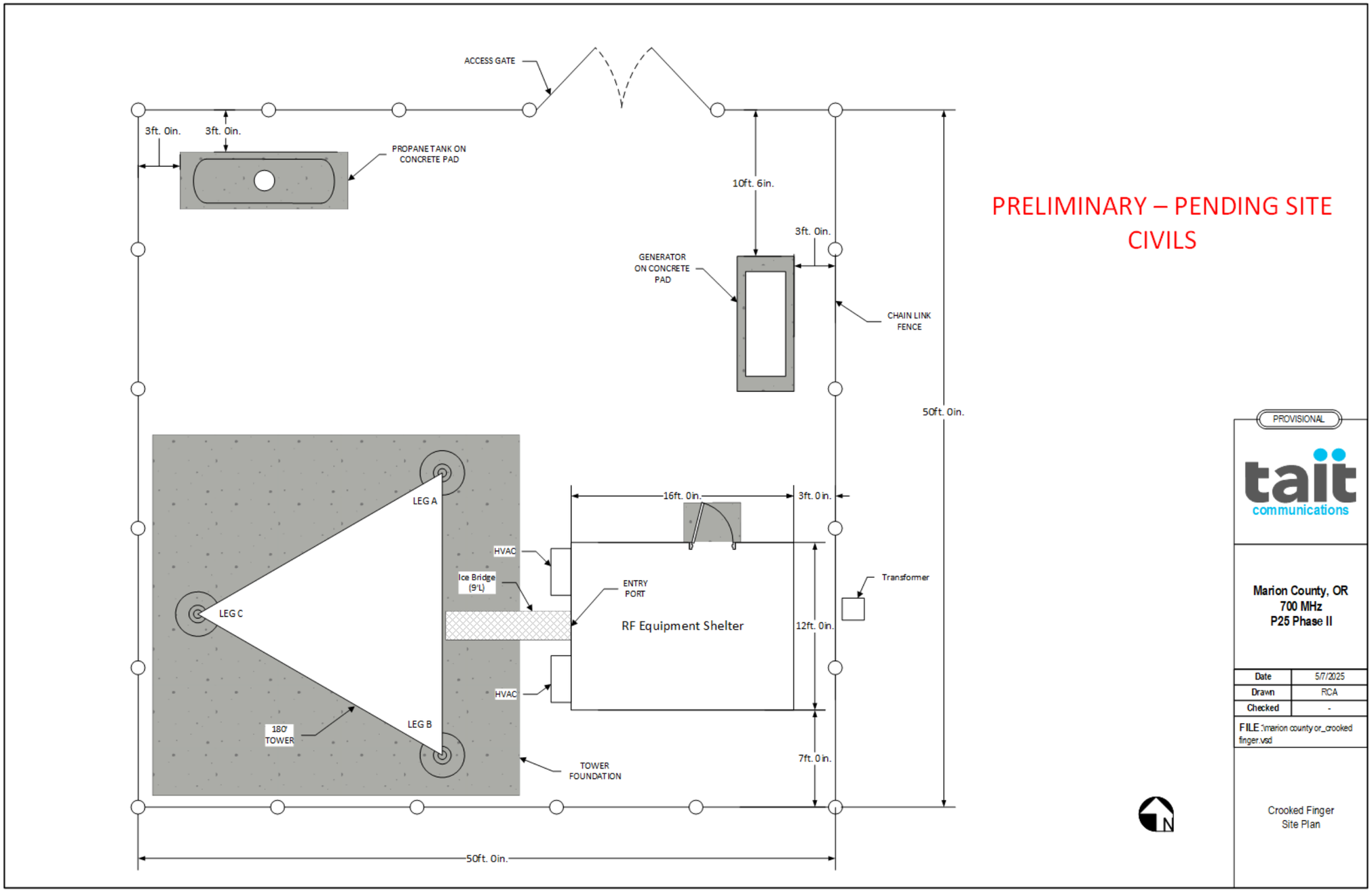

Figure 14: Site Plan

15.2 Floor and Cable Routing Plan

The floor and cable routing plan is an overhead view of the equipment room layout depicting locations of pertinent equipment and including the cable routing plans leading to the tower.

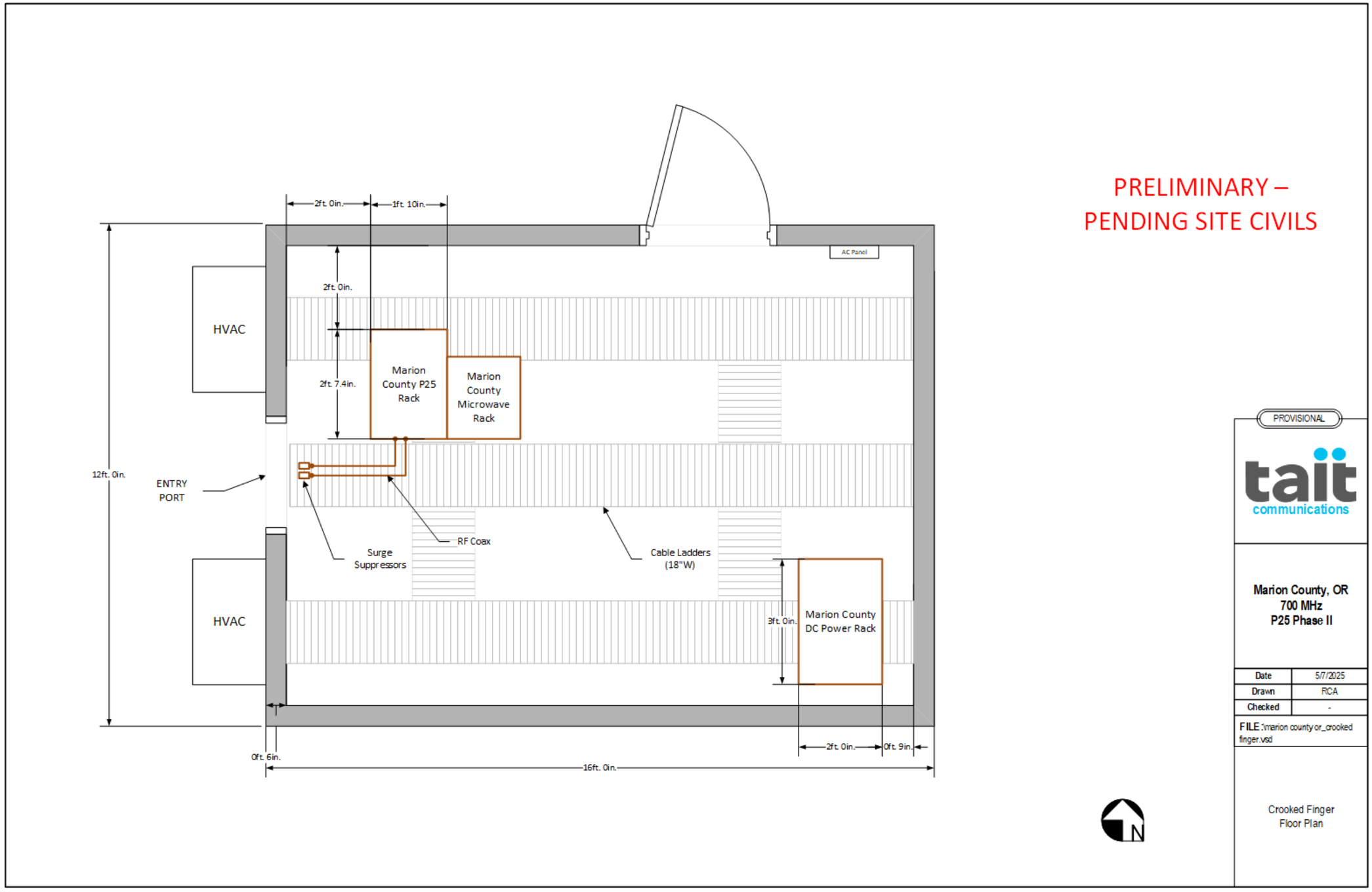

Figure 15: Floor and Cable Routing Plan

15.3 Entry and Exit Ports

The ports where the antenna and TTA cables enter / exit the shelter are shown in the below figure.

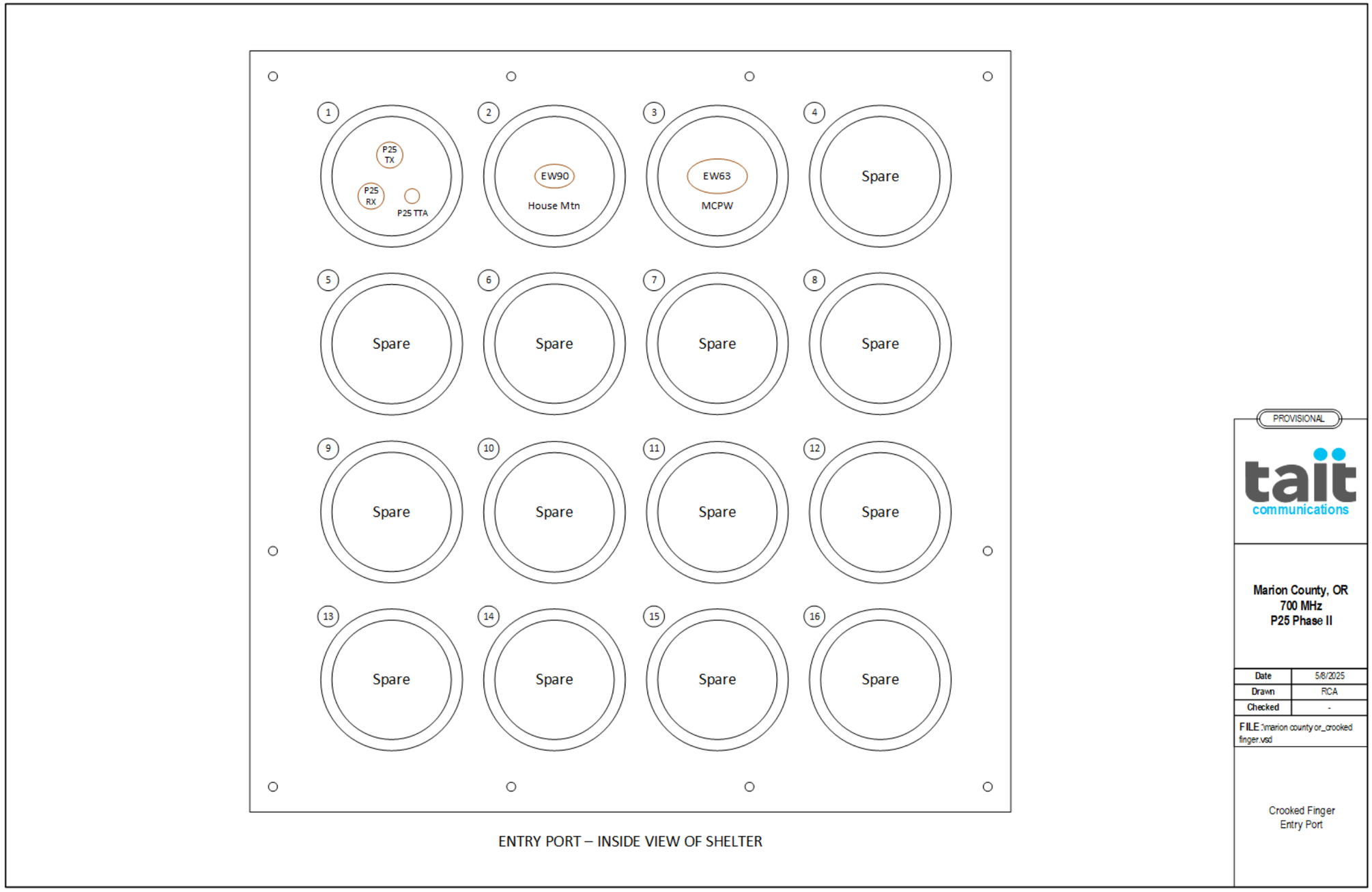

Figure 16: Shelter Cable Entry & Exit Ports

15.3.1 Power & Heat Load Calculations

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Power & Heat Load details.

15.3.2 DC Distribution Fuse Panel

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Fuse Panel details.

Supplemental 4 - Crosby

PROVISIONAL Design Document

RF Sub-System and Site Designs

Marion County

Region: North Cell

Site: Crosby

Issue 1.1 • 1st May 2026

www.taitradio.com

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PREFACE

Project Details

Project number	
Customer	Marion County
Project description	P25 Phase 2 Simulcast & P25 Phase 1 Conventional Simulcast
Business Development Manager	
Sales Engineer	
Project Engineer	Jared Farrar / Riley Alfaqeeh
Project Manager	Matt Jordan
Lead RF Engineers	Ian Graham

Purpose

The Marion County project is an 11 site P25 simulcast design that uses the US 700MHz band. To control Time Delay Interference (TDI), the simulcast design is split into three cells – North, South, and East. The North cell is comprised of four sites with P25 Phase 2 trunked operation, the South cell is comprised of four sites with P25 Phase 2 trunked operation, and the East cell is comprised of three sites with P25 Phase 1 conventional operation.

The purpose of this report is to document the RF subsystem design for the **Crosby** site which forms part of the North simulcast cell.

Scope

This document specifies the frequencies to be utilized at the site and summarizes the intermodulation analysis with these frequencies and other high-level in-band carriers as identified from an FCC license search. The required antenna system and associated RF combining equipment will then be described in full.

Publication Record

Author	Ian Graham, Jared Farrar
Issue	1.0
Document Status	Initial Release (minor corrections)
Date	3rd October 2025

Document Status

Issue	Date	Signature	Comment
0.1	15th April 2025	Ian Graham	Initial draft
1.0	3rd October 2025	Jared Farrar	Updates following simulcast cell reconfiguration and final microwave subsystem design. Improvements to achievable cascaded noise figure and Rx sensitivity. Updates to required Tx sideband noise suppression.
1.0	15th October 2025	Jared Farrar	Edits to language and typo fixes. Added clarification on antenna azimuth in Section 1. Replaced tower mapping & appurtenance chart with updated version (Figure 1). Updated RF System Schematic (Figure 8) to include 50-ohm terminations on unused multicoupler ports and changed expansion port count from 2 to 1.
1.1	1st May 2026		

Document Approvals

Approvals	Position	Signature	Date
Bladimyr Guzman	TAM Design Authority		

Associated Documents & References

Reference documentation includes:

- Marion County P25 System Design_v1.1.docx
- Marion County P25 Project - Equipment List by Site.xlsx
- Marion County Power_Heat_Load.xlsx

1. GENERAL RF DESIGN APPROACH

The Marion County project is an 11-site P25 simulcast design that uses the US 700MHz band. To control Time Delay Interference (TDI) and due to unique electric utility challenges in the high peaks to the east of the county necessitating the use of generators, the simulcast design is split into three cells – North, South, and East.

The North Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- Crooked Finger
- **Crosby**
- Eastview
- Parrett Mountain

The South Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- Eagle Crest
- Lower Prospect
- McCully Mountain
- Wipper

The East Cell sites operate in P25 Phase 1 conventional mode (to avoid the energy consumption of a control channel with 100% duty cycle) and are identified as follows:

- APW
- House Mountain
- Halls Ridge

Each site within the North and South Cells will have five trunked P25 Phase 2 channels providing eight dynamic talkpaths (one 12.5kHz FDMA control channel plus four 2-slot 12.5kHz TDMA traffic channels) across each respective cell's coverage area. The East Cell will have five conventional P25 Phase 1 12.5kHz FDMA channels providing five fixed talkpaths across the cell.

Each site across all three cells will have separate transmit (Tx) and receive (Rx) antennas, typically with 20ft vertical separation between centers of radiation. The anticipated low site noise floors in the 700MHz band means Tower Top Amplifiers (TTA) can be used to improve receiver sensitivity and talk-in coverage. Along with the 30MHz Tx-Rx frequency separation, these factors lead to a common RF combining subsystem design which is applicable to all Marion County sites. The combining system requirements were captured based on the proposed frequency plan in coordination with ADCOMM Engineering LLC and Tait subsequently worked with the chosen equipment vendor, dBSpectra, on an optimal design. The main consideration was the TTA where it was decided to use dBSpectra's compact design after it was shown all the required receiver filtering could be accommodated. The generic (starting point) site combining system design therefore features the:

- DSCC75M-5BM 5 Channel Ceramic Tx Combiner
- DSCHPMDC1MDC Channelized Power Monitor
- NPD3633A-TTA Tower Top Amplifier
- NPD3363A-PDU Rx Multicoupler PDU

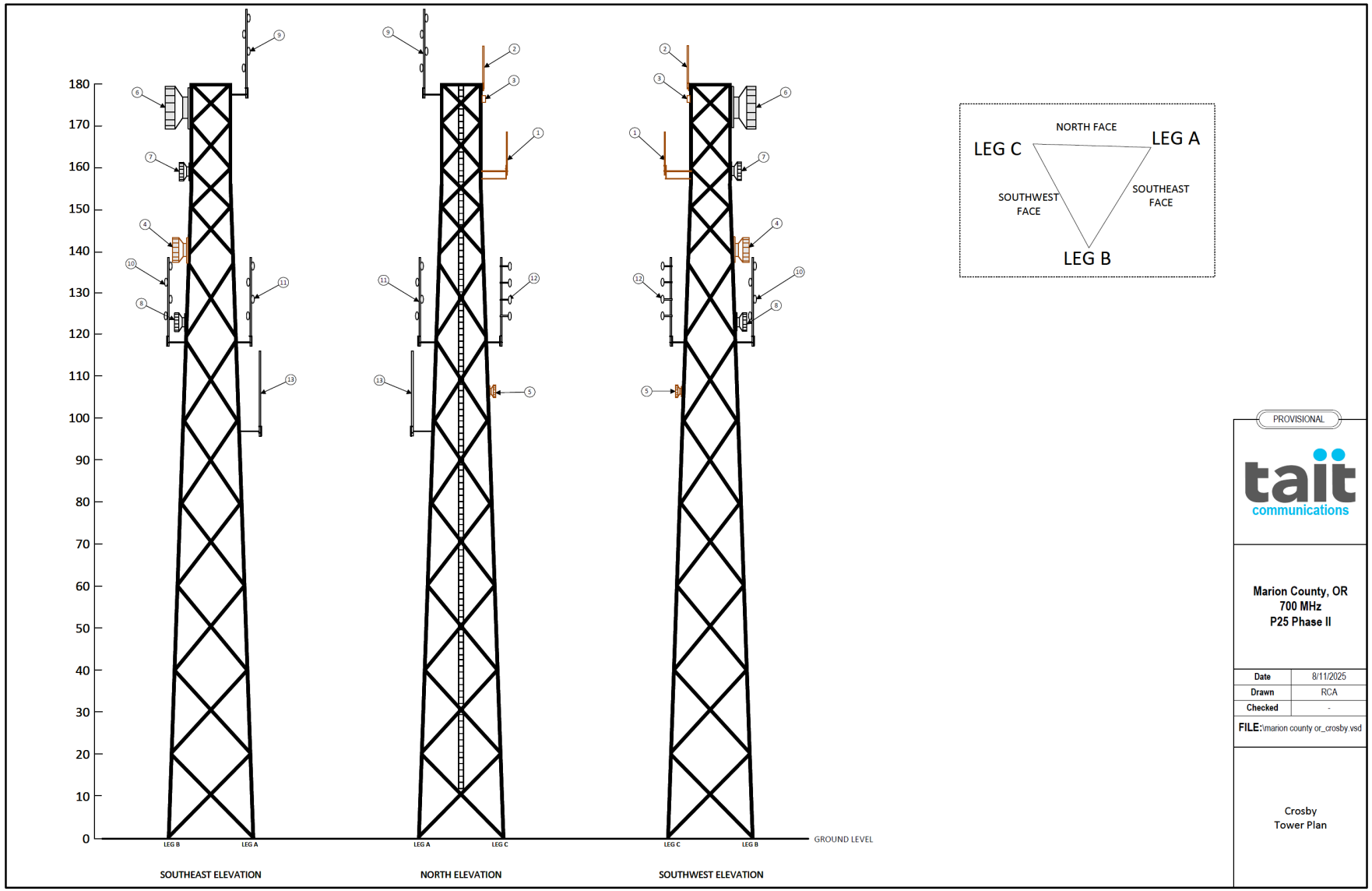
Antennas were chosen on a site-by-site basis to minimize TDI in the simulcast cells while still providing necessary talk-out coverage. The proposed antennas are the:

- Sinclair SE412-SWBPAL
    - 5dBd Low PIM Enclosed Dipole Array
- Sinclair SE414-SWBPAL
    - 8.5 to 11dBd Low PIM Adjustable Beamwidth Enclosed Dipole Array
- RFI CC807-09
    - 9dBd Collinear Omnidirectional

For the Crosby site, the basic design approach will be:

- Install a new RFI CC807-09 transmit antenna at 159ft AGL on Leg 'C' (NW) of the 180ft tower, azimuth approximately 270°.
    - Note that Crosby is unlike the majority of Marion County RF sites in that the selected Tx antenna is a collinear omni model rather than a directional enclosed dipole. Consequently, the decision to place it on Leg C of the tower (pointing WNW) is largely based on available tower space allowing for both Tx and Rx antennas to coexist on the same leg, allowing for maximum Tx-Rx isolation, rather than optimizing placement based on downlink TDI considerations. In this case, the standoff azimuth fully determines the antenna's azimuth.
    - The 5 transmit channels will be connected to the Tx antenna using the dBSpectra DSCC75M-5BM Ceramic Combiner.
- Install a new RFI CC807-09 receive antenna at 179ft AGL on Leg 'C' (NW) of the 180ft tower (azimuth n/a)
    - The 5 receive channels will be fed from the Rx antenna via the dBSpectra NPD3633A-TTA Tower Top Amplifier and the NPD3633A-PDU Rx multicoupler / PDU

2. TOWER MAPPING



#	Description	Part Number	Length (ft)	Leg/Face	Status	Base Height (ft)	Centerline Height(ft)	Tip Height (ft)	Antenna Azimuth	Mount Azimuth	Mount	Transmission Line Size/Type
1	P25 TX Antenna	CC807-09	10.3	C	New	159	164	169	-		Site-Pro PSA-6 (6' standoff)	7/8"
2	P25 RX Antenna	CC807-09	10.3	C	New	179	184	189	-		Standard	1/2" to TTA
3	TTA	NPD3633A-TTA	1.0	C	New	176	177	177	-		Standard	7/8"
4	Microwave - Eagle Crest	VHLP6-6W	6.0	B	New	138	141	144	225.89	225.89	Standard w/ tieback	EW63
5	Microwave - Parrett Mtn	VHLPX3-11W	3.0	C	New	106	107	109	353.13	353.13	Standard w/ tieback	EW90
6	Microwave-1		10	B	Existing	170	175	180			Standard	
7	Microwave-2		4	B	Existing	158	160	162			Standard	
8	Microwave-3		4	B	Existing	121	123	125			Standard	
9	Dipole-1	VHF Dipole	20	A	Existing	178	188	198			Standoff	
10	Dipole-2	VHF Dipole	20	B	Existing	118	128	138			Standoff	
11	Dipole-3	VHF Dipole	20	A	Existing	118	128	138			Standoff	
12	Dipole-4	VHF Dipole	20	C	Existing	118	128	138			Standoff	
13	Omni-1		20	A	Existing	95	105	115			Standoff	

Figure 1: Crosby 180ft Tower Mapping and Appurtenances

3. FREQUENCY PLANNING

5 Channels will be deployed at this site.

The North Simulcast cell uses the following frequencies (pending approval from FCC Region 35).

Site Name	FCC Channel Number	Tx Frequency (MHz)	Rx Frequency (MHz)
Crosby	423-424	771.64375	801.64375
	519-520	772.24375	802.24375
	567-568	772.54375	802.54375
	607-608	772.79375	802.79375
	785-786	773.90625	803.90625

Table 1: North Cell Frequency Assignments

4. INCUMBENTS SEARCH

An external high-level carrier (HLC) is defined as a signal that appears at a level of >-40dBm at the receive antenna. These are the signals which have the potential to contribute towards intermodulation that would result in a loss of receiver sensitivity on one or more channels.

Signal and Noise Monitoring of RF activity at the site was not deemed necessary for this project given the wide Tx-Rx frequency separation in the 700MHz band and the anticipated low site noise floors.

To get some idea of potential RF activity at the site though, an FCC License Search was carried out to identify any other transmitters operating between 700 and 900MHz located within a 0.6-mile radius of the tower (a typical transmitter emitting 100W ERP at 0.6 miles away would be received at -40dBm assuming free space path loss). These include cellular transmitters (as their wide bandwidth could cause IM energy to spread into the LMR receive band) and are summarized in Table 2 below:

Owner	Call Sign	Frequency (MHz)	Tx ERPd (dBm)	Distance from Marion County Tower (miles)
NONE DISCOVERED				

Table 2: High Level Carriers

5. INTERMODULATION ANALYSIS

An intermodulation (IM) analysis was performed for the potentially significant sources, including both the Marion County channels to be deployed and any HLCs found during the FCC License Search. For antenna configurations using separate transmit and receive antennas Tait best practice is to search for IM products up to 7th order within a defined search window accounting for the fact the bandwidth of IM products spread according to the order and bandwidth of the signals that cause it.

The frequencies included in the IM analysis are listed in Table 3 below.

Transmit Frequencies (MHz)	Receive Frequencies (MHz)
771.64375	801.64375
772.24375	802.24375
772.54375	802.54375
772.79375	802.79375
773.90625	803.90625

Table 3: Frequencies Included in IM Analysis

Table 4 below shows how many IM products are generated on each of the receive frequencies. A direct hit is an IM product that falls exactly at the receive frequency. An indirect hit is one that does not fall exactly at a receive frequency but does fall within the search window.

IM Order	Number of Intermodulation Products at each Receive Frequency									
	801.64375MHz		802.24375MHz		802.54375MHz		802.79375MHz		803.90625MHz	
	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect
3rd	0	0	0	0	0	0	0	0	0	0
5th	0	0	0	0	0	0	0	0	0	0
7th	0	0	0	0	0	0	0	0	0	0

Table 4: Intermodulation Results Summary

6. ANTENNA SYSTEM DESIGN

The Antenna System detailed here and the RF Combining System described later in sections 7, 8, and 10 have been specifically designed to mitigate any interference caused by the listed high level carriers, thereby maximizing the coverage achieved by the Marion County system.

6.1 Antenna Type

The following antennas will be used at Crosby.

Antenna	Manufacturer	Antenna Model Number	Description	Antenna Length (ft)	Antenna Gain (dBd)
Rx	RFI	CC807-09	Collinear Omni	10	9
Tx	RFI	CC807-09	Collinear Omni	10	9

Table 5: Antenna Details

800MHz Corporate Collinear Antennas

748-870MHz

CC807 Series

These industry leading, full featured corporate collinear arrays allow site operators to combine, with complete integrity, a large number of communications services into a single, low profile antenna solution.

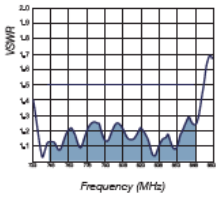
The corporate feed design employed by RFI maintains superior pattern control, allowing gain to be maximised with zero tilt variation over a very broad bandwidth, comparable to that only previously available in exposed dipole array configurations. This is achieved in the preferred form factor of a fully enclosed fibreglass radome, providing a reduction in wind loading, ice loading and tower loading in comparison.

The CC807 series have been designed with an exceptional power rating of 500W across the band as well as a Peak Instantaneous Power (PIP) rating of 25kW to cater for the peak voltage levels present in large multi-carrier combining environments. RFI's refined design processes and proven construction methods achieve a PIM rating of –150dBc, further ensuring performance is maintained for the service life of the antenna.

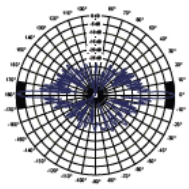
Features:

- 500W Continuous Power rating
- -150dBc Passive Intermodulation (PIM) rating, 100% PIM tested
- 25 kW Peak Instantaneous Power (PIP) rating
- DC grounding on all elements for the ultimate in lightning protection and dissipation of static noise.
- Light weight dipole construction using RFI's patented flexi-PCB architecture, maintains a low centre of gravity reducing tip deflection and sway
- Field invertible (excluding tilt models)
- Preset downtilt variations of 2 and 4 degrees available, see note (1)

Typical VSWR Response (CC807-12)



CC807-12 - E Plane



Electrical Specifications

Model Number	CC807-09-P	CC807-12-P
Nominal Gain *dBd (dBi)*	9.0 (11.1)	11.5 (13.6)
Frequency *MHz*	746-870	
Tuned Bandwidth *MHz*	Full	
VSWR *(Return Loss)*	1.5:1	
Nominal Impedance Ω	50	
Downtilt°	0 Std 2, 4 (1)	
Vertical Beamwidth°	8	4
Horizontal Beamwidth°	Omni +/- 0.5dB	
Input Power W	500	
Passive IM 3rd order (2x20W) *dBc*	-150	
Peak Instantaneous Power *kW*	25	

Mechanical

Model Number		CC807-09-P	CC807-12-P
Construction		Sky blue fibreglass radome	
Radome Diameter mm (inches)		76 (3.0)	
Length mm (inches)		3135 (123.4)	6235 (245.5)
Weight *kg (lbs)*		14 (30.9)	25.5 (56.2)
Termination		Integrated 4.3-10 Female	
Mountaing Area mm (inches)		750 x 90 (30 x 3.5) diameter Ecofilm™ plated aluminium	
Suggested Clamps		3 x UC-114	
Shipping Dimensions *mm (inches)*	H	115 (4.5)	
	W	115 (4.5)	
	L	3335 (131.3)	6435 (253.3)
Shipping Weight *kg (lbs)*		20.0 (44.1)	36.5 (80.5)
Projected area *cm² (ft²)*	No Ice	2597 (2.8)	5559 (6.0)
	With Ice	3192 (3.4)	7037 (7.6)
Lateral Thrust @160km/h *N* (100 mph lbs)		308 (69)	659 (148)
Wind Gust Rating *km/h (mph)*	No Ice	>240 (150)	
Torque @ 160km/h *Nm* (100mph ft-lbs)		413 (305)	1823 (1345)

(1) To order pre-set downtilt versions available, simply add a -T2 or -T4 towards the end of the part number to denote downtilt model required. For eg. CC807-12-T2-P to order CC807-12-P with 2deg of downtilt. Please note: Models with downtilt are NOT field invertible. . Eg. CC807-12-T2-P

P-43021-7 Asia Pacific | EMEA | Americas rfi.com.au

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Figure 2: Antenna Datasheet

6.2 Antenna Mounting Locations

Table 6 below specifies the Marion County antenna mounting location details.

Antenna	Mounting Height (feet AGL)	Antenna Orientation (degrees)	Tower Leg	Standoff Length (feet)	Standoff Orientation (degrees)	Standoff Model
Receive	179	n/a	C (Northwest)	n/a	n/a	n/a
Transmit	159	n/a	C (Northwest)	6	270	Site-Pro PSA-6

Table 6: Antenna Mounting Locations

The antenna system design for this site is given in Figure 3.

Marion County Rx Antenna

- System Type: P25 Phase 2 Simulcast
- Antenna Manufacturer: RFI
- Antenna Type no: CC807-09
- Antenna Height AGL at base: 179ft
- Antenna CoR: 184ft
- Antenna Azimuth: n/a
- Tower Leg: C
- Antenna Function: Rx
- Rx: 801.64375MHz, 802.24375MHz, 802.54375MHz, 802.79375MHz, 803.90625MHz

Marion County Tx Antenna

- System Type: P25 Phase 2 Simulcast
- Antenna Manufacturer: RFI
- Antenna Type no: CC807-09
- Antenna Height AGL at base: 159ft
- Antenna CoR: 164ft
- Antenna Azimuth: 270°
- Tower Leg: C
- Antenna Function: Tx
- Tx: 771.64375MHz, 772.24375MHz, 772.54375MHz, 772.79375MHz, 773.90625MHz
- Tx ERPd: +52.10dBm (162.2W)

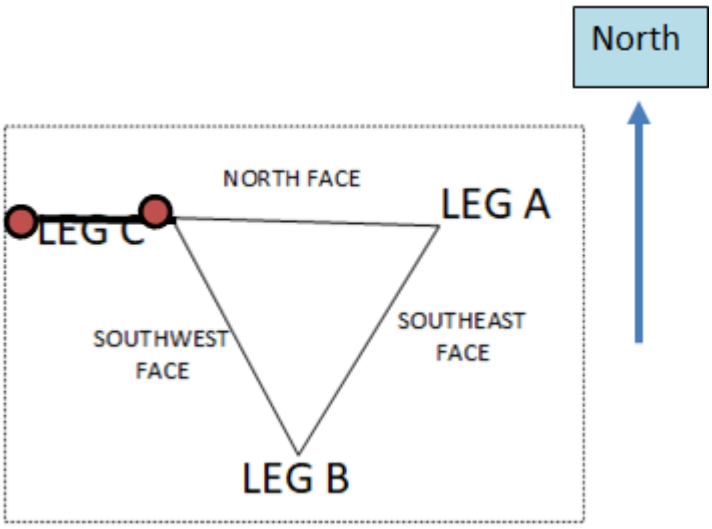


Figure 3: Antenna System Design

6.3 Antenna Isolation

The Transmit and Receive antennas are vertically separated by 20ft and horizontally separated by 6ft which gives an isolation between them of **64dB**. A figure of **60dB** will be assumed in subsequent calculations, though, as that is often the limit of what can be practically achieved (e.g., mounting imperfections, mechanical drift due to wind/ice loads or aging hardware).

7. TRANSMITTER COMBINER DESIGN

7.1 RF Connectors

The antenna output of the combiner is fitted with **4.3-10 female** connector to minimize PIM.

The transmitter input ports of the combiner are fitted with **N Type female** connectors.

7.2 Cavity Filters

Filtering in the Tx Combiner is predominantly bandpass.

A combination of band-pass and band-reject filtering is sometimes to provide extra rejection at specific site Rx frequencies, but band-reject filters are never used alone.

The cavity filters provide the minimum attenuation at the closest receive frequency equal to or greater to the value specified in section 7.9 of this document.

7.3 Isolator

A dual Isolator is included between the output of each transmitter and the Tx Combiner input port.

The isolator load closest to the Tx Combiner input port is rated at a minimum of **100 watts**.

7.4 Maximum RF Power

The Tx combiner supports a maximum of **100 watts** of RF input power per channel.

7.5 Minimum Tx to Tx Frequency Separation

The minimum frequency separation allowed between transmitters sharing the same combiner is **250kHz**.

7.6 Maximum number of Transmitters per combiner

Standard Tait practice is a maximum of four transmitters per Tx combiner. But in this case, the relatively wide Tx-Tx spacing and the fact that self-TxIM does not occur, renders the penalty in combining all five transmitters together negligible.

7.7 Maximum Tx Combiner Loss per Channel

The insertion loss shall be minimized to the extent possible while complying with all other specifications.

The Tx Combiner insertion loss per Tx channel (not including associated Tx antenna feeder cable losses) will be around **3.2dB** for the Tx-Tx frequency separation at this site.

7.8 Tx Intermodulation Suppression

Transmitters that cause intermodulation on any site receive frequency must not be connected to the same combiner.

However, there is still a responsibility to keep the site as ‘clean’ as possible for its incumbents. To that end, the levels of intermodulation products generated in the combiner are controlled by a requiring a minimum isolation

between the outputs of combined transmitters of **at least 60dB**. This figure includes the reverse isolation of the isolator and any additional attenuation provided by the cavity filters in neighboring branches.

7.9 Tx Sideband Noise Suppression

In addition to the Tx – Rx antenna isolation, the Tx Combiner provides the suppression required to reduce transmitter sideband noise at the Rx antenna to the level where it causes no more than 1dB of receiver de-sensitization. The transmitter sideband noise suppression required at this site is given in Table 7 below.

Transmit Frequency (MHz)	Offset to Nearest Receive Frequency (MHz)	Sideband Noise Suppression Required at Offset (dB)
771.64375	30.0000	15
772.24375	29.4000	16
772.54375	29.1000	16
772.79375	28.8500	16
773.90625	27.7375	16

Table 7: Transmitter Combiner Sideband Noise Rejection Requirements

8. RECEIVER SUBSYSTEM DESIGN

8.1 RF Connectors

8.1.1 Tower Top Amplifier

The Rx Filter input is fitted with a **4.3-10 female** connector.

The Rx Filter output is fitted with a **4.3-10 female** connector.

8.1.2 Receiver Multicoupler/PDU

The Rx Multicoupler input is fitted with a **4.3-10 female** connector.

The receiver output ports of the Rx Multicoupler are fitted with a **BNC Female** connector.

8.2 Receiver Subsystem Topology

The Receiver Subsystem will utilize a Tower Top Amplifier (TTA, which includes the receiver filtering) to optimize talk-in coverage followed by a multicoupler/PDU system that further amplifies and splits the received signal between the connected receivers.

8.3 Receiver Filtering

The Receiver Filters will pass the 801 to 805MHz part of the 700MHz band used for the Marion County system while fully rejecting associated transmit signals in both the 700MHz and 800MHz Tx bands. This is important because combinations of transmitters in both bands can result in 7th order IM falling within the 700MHz receive band.

8.3.1 Blocking Rejection

Between them, the Receiver Filters must provide enough attenuation so that no more than 1dB of de-sensitization of any of the connected receivers occurs due to receiver blocking. The attenuation required at this site to prevent receiver blocking due to the Marion County transmitters and external interferers found during FCC database search is given in Table 8 below:

	Tx Name	Tx Frequency (MHz)	Minimum Rejection in Rx Filter at Tx Frequency (dB)				
			Rx1 (MHz)	Rx2 (MHz)	Rx3 (MHz)	Rx4 (MHz)	Rx5 (MHz)
			801.64375	802.24375	802.54375	802.79375	803.90625
Transmitters	Tx1	771.64375	20	20	20	20	20
	Tx2	772.24375	20	20	20	20	20
	Tx3	772.54375	20	20	20	20	20
	Tx4	772.79375	20	20	20	20	20
	Tx5	773.90625	20	20	20	20	20

Table 8: Receiver Filter Blocking Rejection Requirements

8.3.2 Receiver Intermodulation Rejection

The Rx Filter must provide enough attenuation so that no more than 1dB of de-sensitization of any of the connected receivers occurs due to intermodulation. At this site, there is no anticipated IM risk. Therefore, the rejection specified above is sufficient.

8.4 Low Noise Amplifiers

Low Noise Amplifiers (LNAs) with appropriate gain and noise figure will be included in the receiver sub system to ensure that the cascade noise figure of the line up from the base of the receive antenna up to and including the base station receiver is equal to or less than 5dB. In the case of Crosby, this noise figure can be improved to approximately **3.85dB** while still maintaining linearity of the receive system lineup.

The output third order intercept of the LNAs will be >= +40dBm to maintain the linearity of the system.

8.5 Variable Attenuator

A Variable Attenuator will be fitted in the Rx Multicoupler/PDU for field optimization of the receiver subsystem gain, noise figure and IP3. The attenuator has an adjustment range of 0dB to 15dB, in 0.25dB steps. To achieve a noise figure of 3.85dB, the variable attenuator shall be set to **5dB**

Setting of the attenuator value must be done electronically so as not to require disassembly of the multicoupler equipment.

8.6 Receiver Ports

To allow for future expansion, the Rx Multicoupler will have 8 ports

All unused ports will be terminated in a 50-ohm load.

9. POWER MONITOR

The dBSpectra DSCHPMDC1MDC Power Monitor will be used within the Marion County RF systems. This is placed at the output of the Tx Combiner and allows remote monitoring of channelized transmitted power and antenna VSWR. The major benefit is early warning of antenna system degradation so that repairs can be made before failure occurs.

DSCHPM-Series (VHF, 220, UHF, 700/800/900 MHz)
SMART Channelized Transmit Power Monitor with Front Panel Display Option

dbSpectra
Always a Better Value

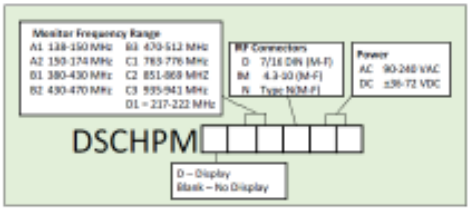
DSCHPM Power Monitor with front panel display option.

Directional coupler for installation on combiner output.

Features and Benefits

- *Per-channel and composite* measurement of forward and reflected RF power with the SMART Channelized RF Power Monitor.
- Calculates and displays combiner insertion loss for each channel.
- All measurements are displayed with 95% accuracy.
- IP network connection and designed-in web server for web browser interface.
- Full remote configuration, monitoring and data logging.
- Optional front panel display with Navigation Keys for monitoring only.
- User-defined alarm thresholds are indicated by alarm relay closure or by SNMP protocol on the network.
- Optional temperature sensors for equipment and ambient temperature measurements and alarms.
- Compact single rack unit mounting with remote RF sensor for flexibility in mounting locations.

Ordering Information

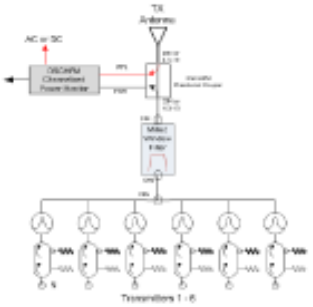


Notes:
1. Factory calibrated using a P25 LSM signal source, may be calibrated in the field for improved accuracy.
2. Contact dbSpectra at tech@dbspectra.com for additional information on optional temperature sensor feature.

Specifications

Electrical Specifications	
Frequency Range, MHz	See Ordering Information
Minimum TX to TX Separation	50 kHz
Maximum Power Input	600 Watts (directional coupler)
System Type	Digital or analog
Insertion Loss	< 0.1 dB
PIM Rating	-150 dBc
Channelized Power Measurements	Forward /reflected power of individual channels: Watts, dBm, VSWR, Return Loss, Combiner Insertion Loss
Power Requirements	AC Model 90-240 VAC 15W, or DC model ±36-72 VDC 15W
IP Interface	IPV4, with TLS security layer, SNMP v2c/v3 alarm protocol
Alarms	Form C contacts or SNMP v2c/v3
User Interface	Web browser or remote SNMP system manager. Front Panel Display (optional) for Monitoring only.
Temperature Range	-30 to +60 °C
Mechanical Specifications	
Mounting Dimensions	1 RU, 1.75 X 19 in. (44 X 483 mm) 7.5 in. (191 mm) deep
Construction / Finish	Aluminum / protective finishes
Directional Coupler Connectors Input Output Coupled Ports	 7/16 DIN, 4.3-10 or N(male) 7/16 DIN, 4.3-10 or N(female) MCX type push-on with two 4 ft RD316 cables supplied.
Power Connector	AC model: IEC 320-C13 inlet & cord DC model: 2 port terminal block
Ethernet Connector	RJ-45
Alarm Closures Connector	3 port pluggable terminal block
Temp. Sensor Connector	24-pin header male pins
Net Weight	4.6 lbs. (2.1 kg)
Shipping weight	6.1 lbs. (2.8 kg)

Typical Application



Specifications are subject to change • www.dbspectra.com • 1590 E Hwy 121, Building A, Suite 100, Lewisville, TX 75056 • P (469)322-0080 •096000-797.A • 01/2024

Figure 4: DSCHPMDC1MDC Channelized Power Monitor

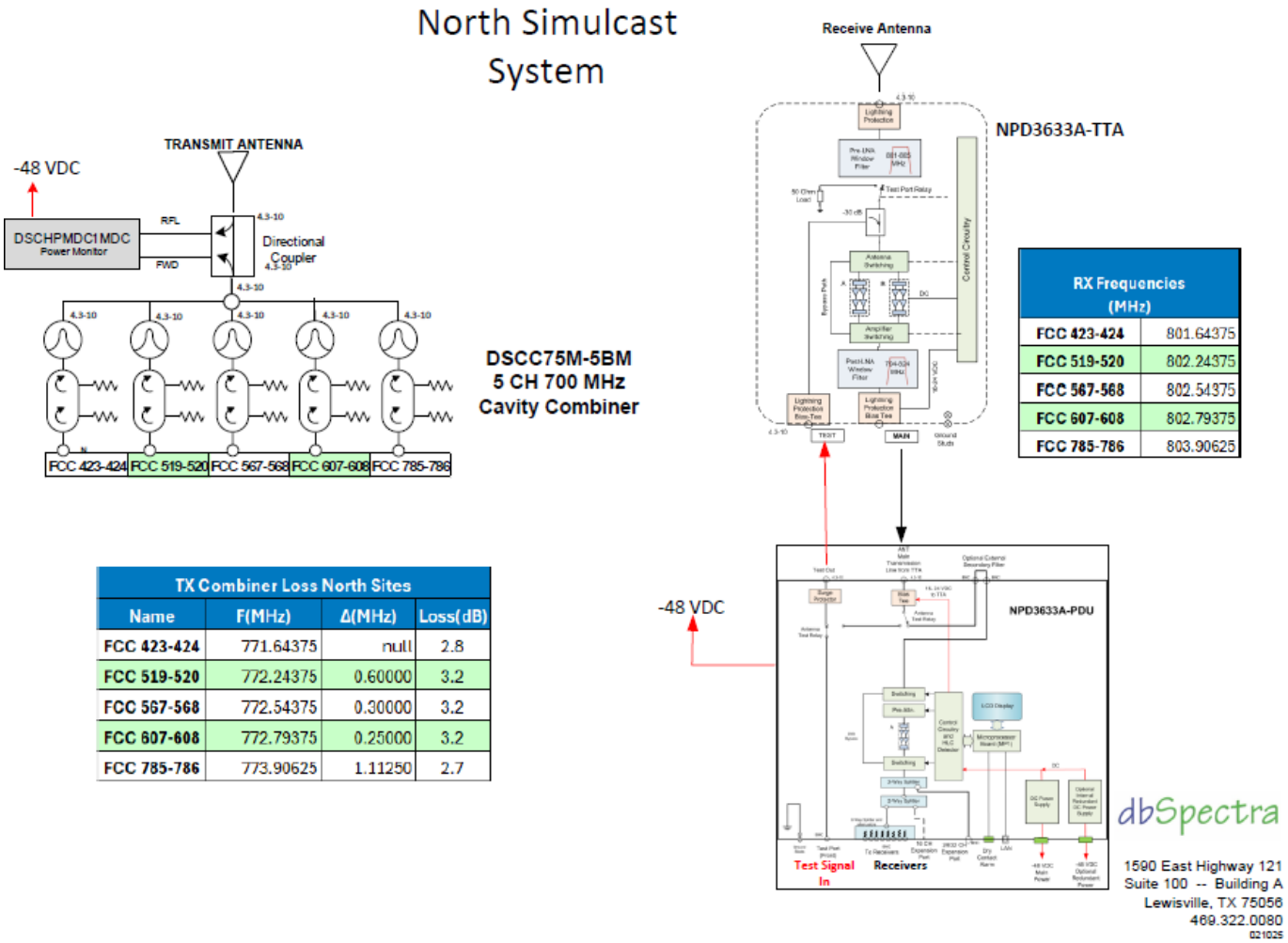
10. RF SUB-SYSTEM DESIGN

Tait have worked with dBSpectra to develop a generic combining system for the Marion County project that meets the performance goals derived in sections 7 and 8 of this report and thereby maximizes the talk in and talk out coverage of the system.

The transmit side of the RF sub-system consists of a 5-channel cavity filter based ceramic combiner to minimize losses and maximize the transmitted power and talk out coverage from the site. The cavity filters meet or exceed the Tx sideband noise filtering requirements given in section 7.9.

The receive side features a compact Tower Top Amplifier (TTA) followed by a Receiver Multicoupler/PDU that allows the receiver sensitivity to be optimized and distributes the signal to the five connected receivers. All the receive filtering is accommodated within the TTA. There are two filters, one before the LNA to preselect the 801 to 805MHz part of the band used by the Marion County system (see Figure 6), and a second after the LNA that fully rejects the Marion County system transmit signals, and the other 700 and 800MHz HLCs identified from the FCC database search (see Figure 7). Together, the filters meet or exceed the receiver blocking and receiver intermodulation filtering requirements given in sections 8.3.1 and 8.3.2. There are two LNAs, one in the TTA and one in the Rx Multicoupler/PDU with gains, noise figures and intercept points optimized so the cascade noise figure and linearity of the receiver line up meet the requirements of section 8.4.

A block diagram of the North Cell combining system design is shown in Figure 5 below:



TX Combiner Loss North Sites			
Name	F(MHz)	Δ(MHz)	Loss(dB)
FCC 423-424	771.64375	null	2.8
FCC 519-520	772.24375	0.60000	3.2
FCC 567-568	772.54375	0.30000	3.2
FCC 607-608	772.79375	0.25000	3.2
FCC 785-786	773.90625	1.11250	2.7

Figure 5: SPD3454C-4TR Dual Band RF Combining System

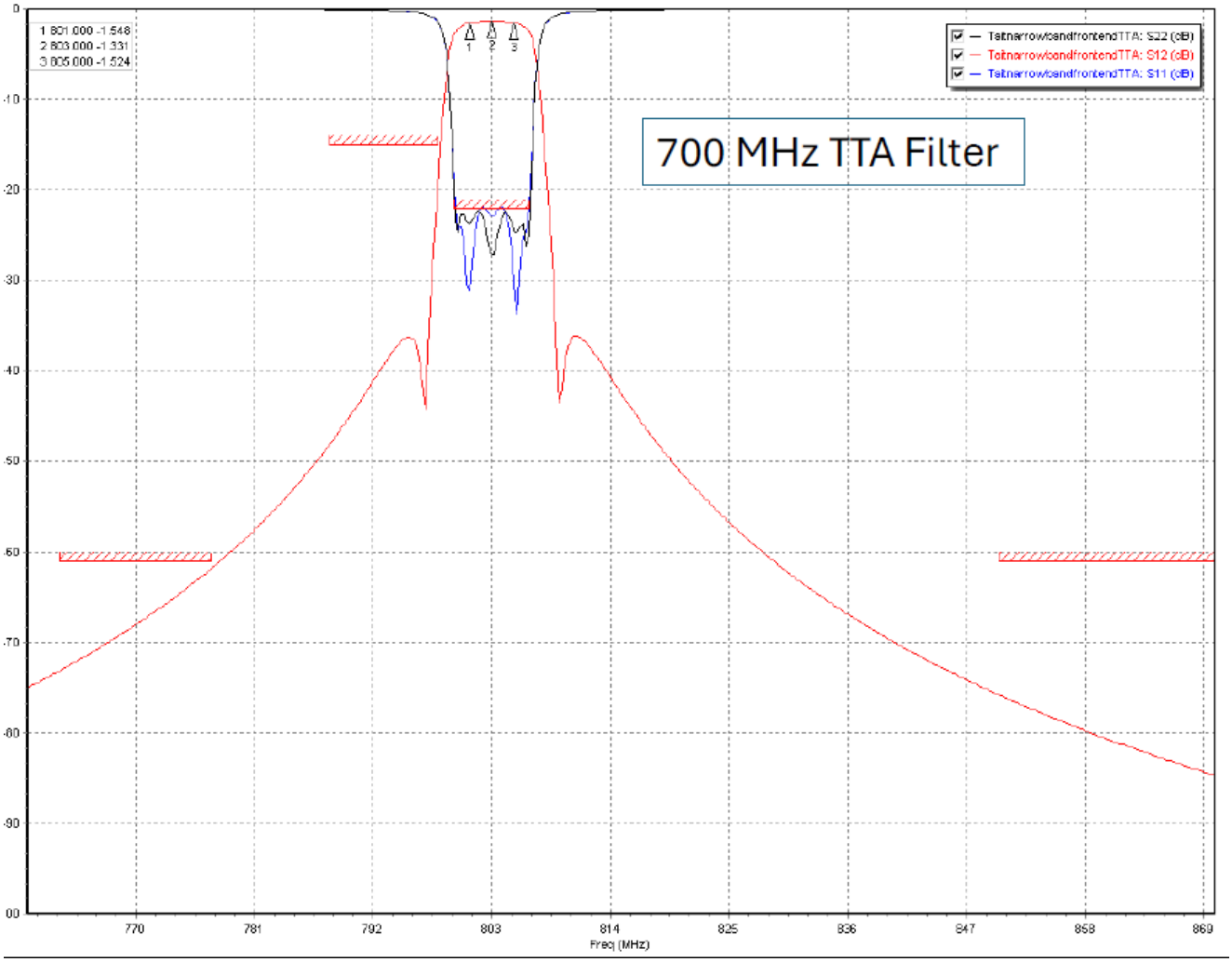


Figure 6: TTA PreSelector Filter Plot

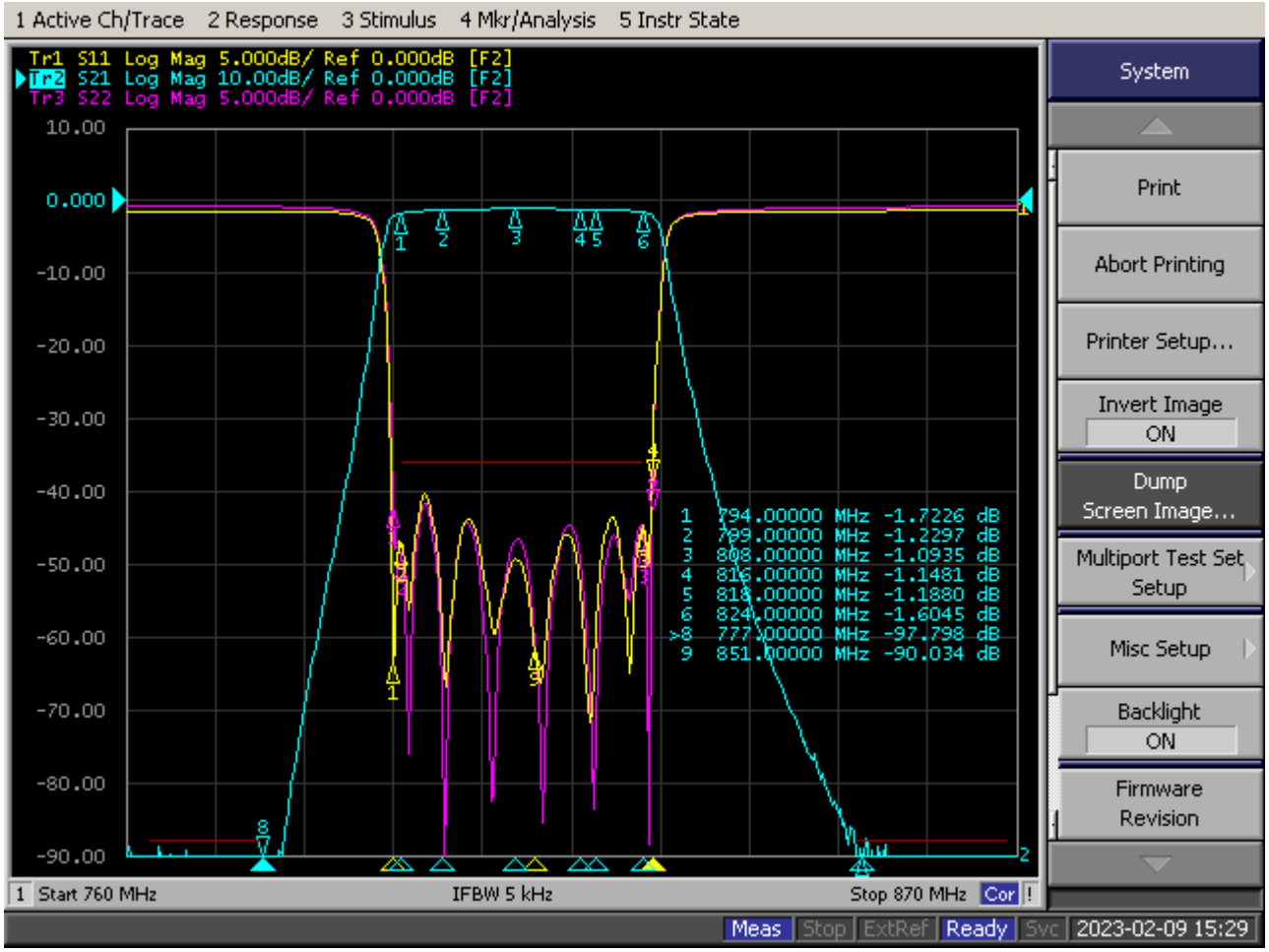


Figure 7: TTA Post LNA Filter Plot

11. MICROWAVE SYSTEM DESIGN

Refer to “Marion County P25 System Design_v1.1.docx” for Microwave System Details.

11.1 Site Specific Design

The Crosby site supports two Aviat microwave links. These links connect Crosby to Eagle Crest and Parrett Mountain, forming part of the 13-site core ring and providing the redundant routing expected within the looped topology.

12. RF SUB-SYSTEM DRAWINGS

The figure below contains the schematic of the RF sub-system to be deployed at this site.

12.1 RF System Schematic

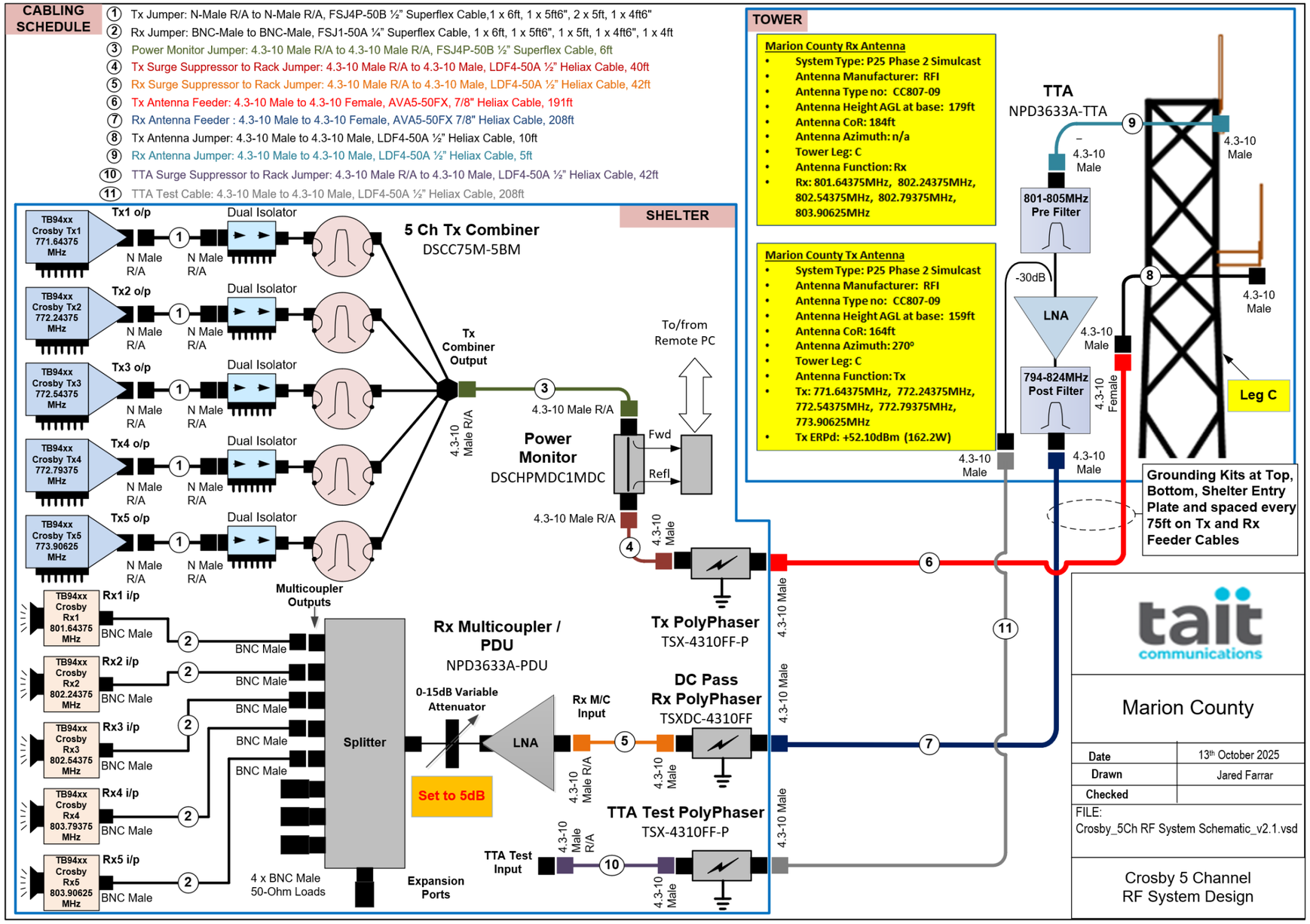
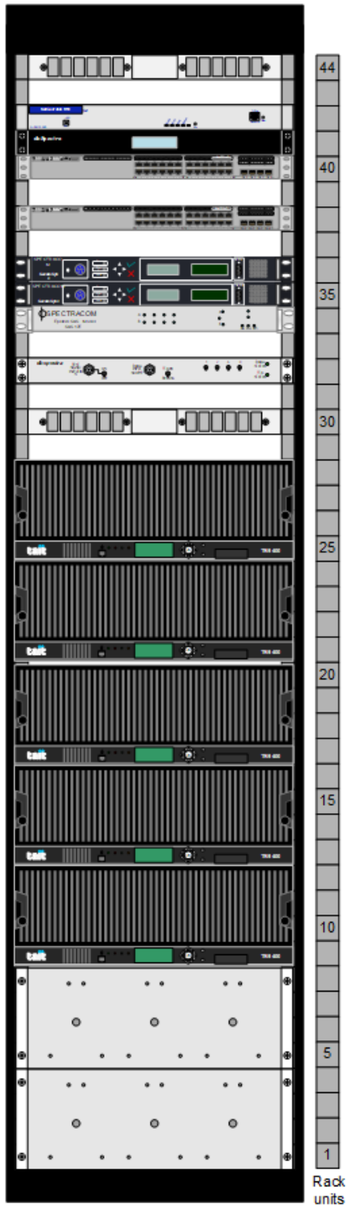


Figure 8: RF System Schematic

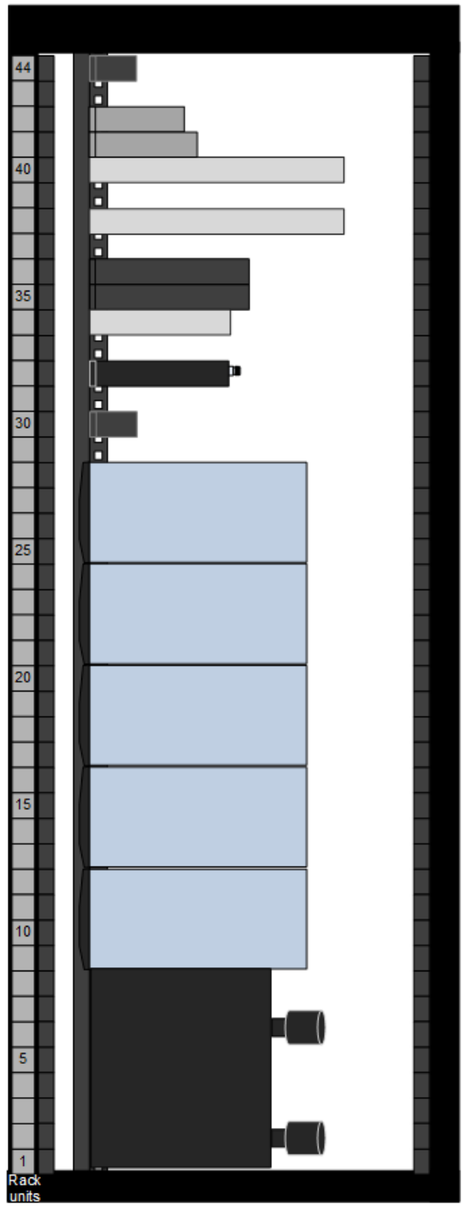
12.2 Rack Layout

This section contains the rack layout front & back view, side view and cabling diagram for this site.

700 MHz P25 Phase II Rackup Diagrams



Front View



Side View

RU	Description	Vendor PN	Vendor	Width (in)	Height (in)	Depth (in)
44	Breaker Panel	9072101001	TRIMM	19	1U	3.25
42	Alarm Panel	M16G2 & D-PK-16PAN	Netguardian	17	1U	6.6
41	Power Monitor	DSCHPMDC	dBSpectra	19	1U	7.5
40	Switch #1	C9300L-24P-4X-A	Cisco	17.5	1U	17.7
38	Switch #2	C9300L-24P-4X-A	Cisco	17.5	1U	17.7
36	Timing Reference	2402-613	Safran	17.1	1U	15.17
35	Timing Reference	2402-613	Safran	17.1	1U	15.17
34	Timing Switch	SAS-17E	Safran	19	1U	13.4
32	Multicoupler	NPD3633A	dBSpectra	19	1U	10.5
30	Breaker Panel	9072101001	TRIMM	19	1U	3.25
25-28	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
21-24	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
17-20	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
13-16	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
9-12	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra	19	8U	12.5

Marion County, OR
700 MHz P25 Phase II

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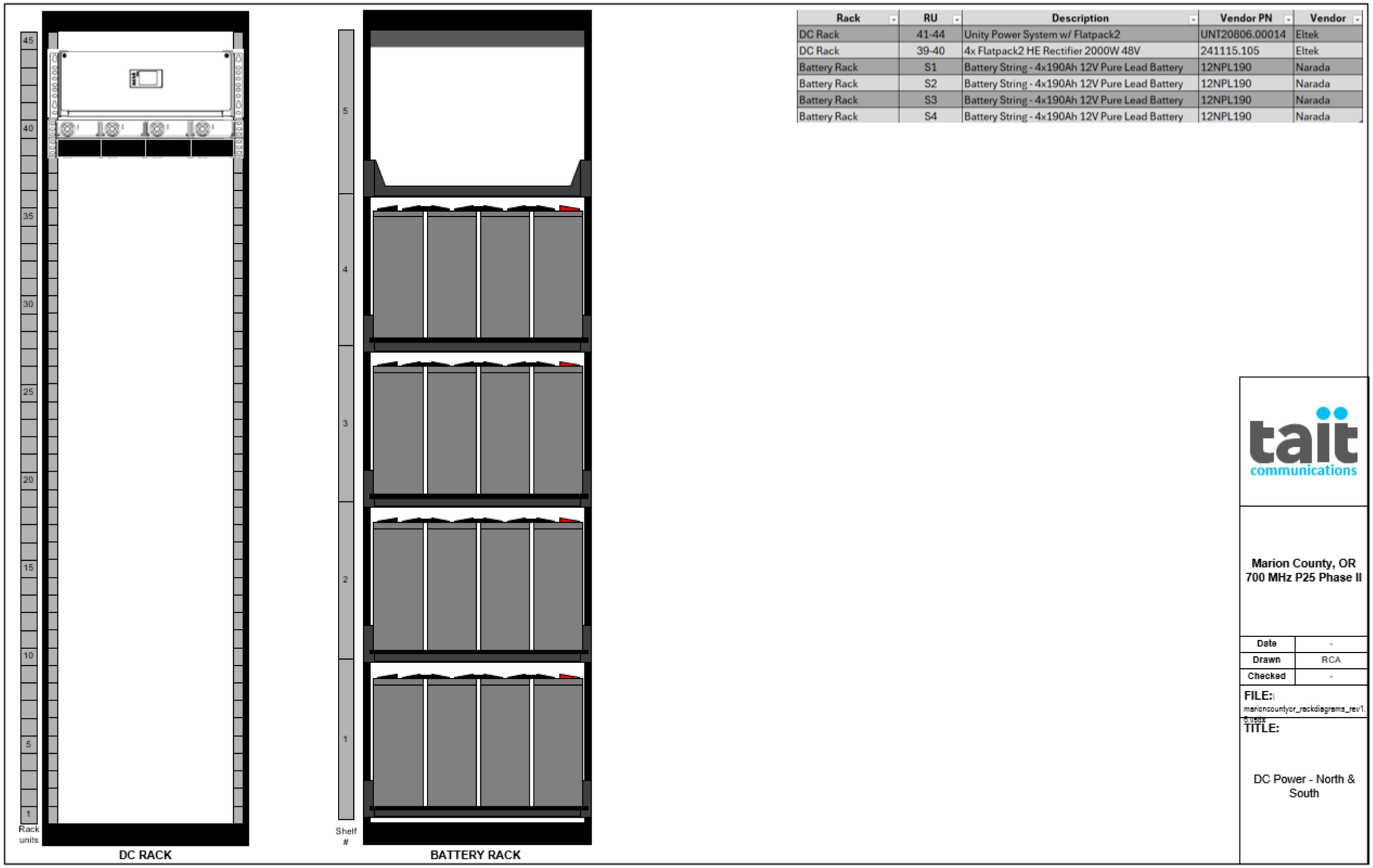
TITLE:

RF_Site_Simulcast

Figure 9: Marion County 19" Rack Layout – RF Front & Side



Rack	RU	Description	Vendor PN	Vendor
DC Rack	41-44	Unity Power System w/ Flatpack2	UNT20806.00014	Eltek
DC Rack	39-40	4x Flatpack2 HE Rectifier 2000W 48V	241115.105	Eltek
Battery Rack	S1	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack	S2	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack	S3	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack	S4	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada

Figure 10: DC Rack

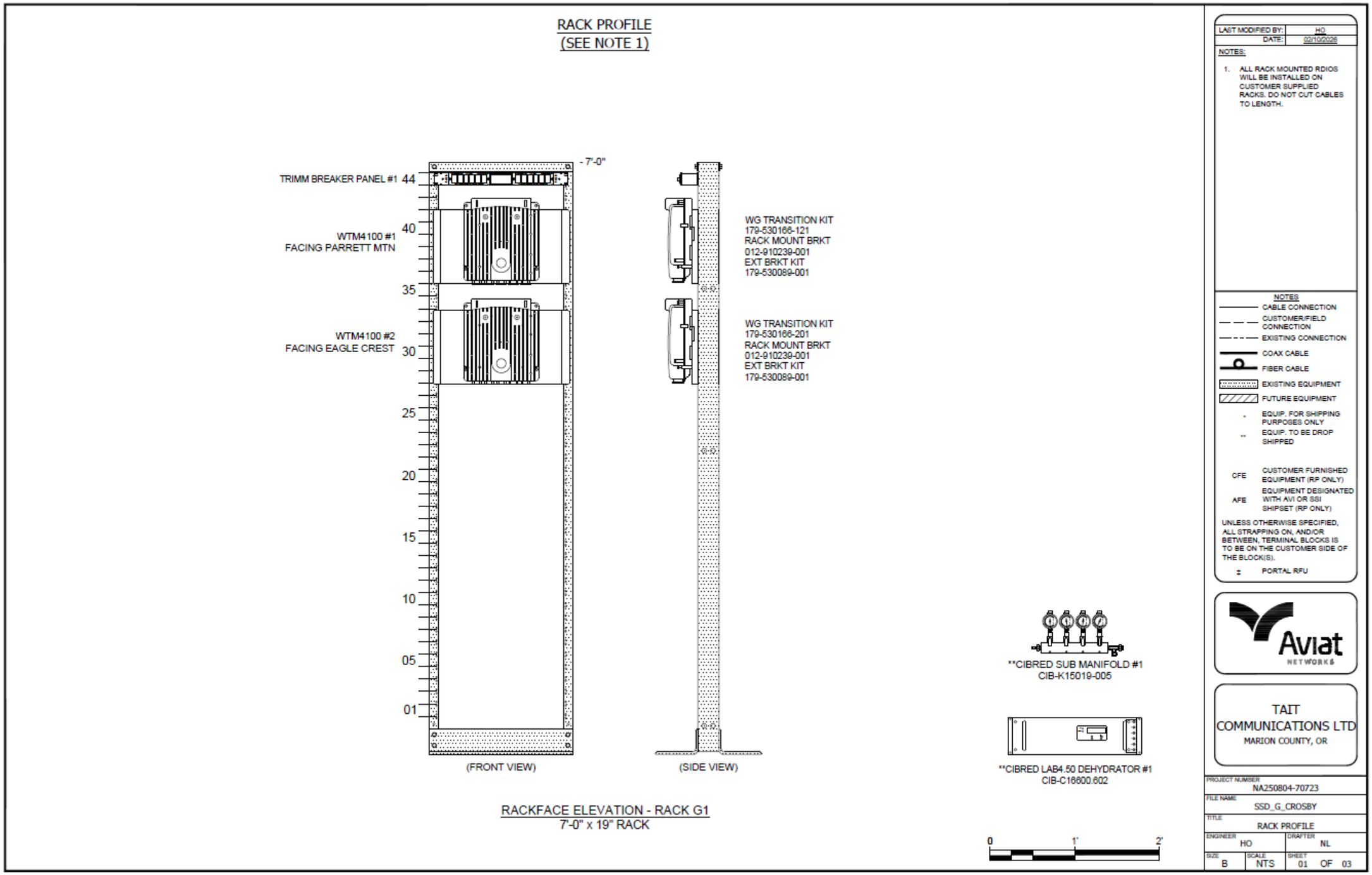
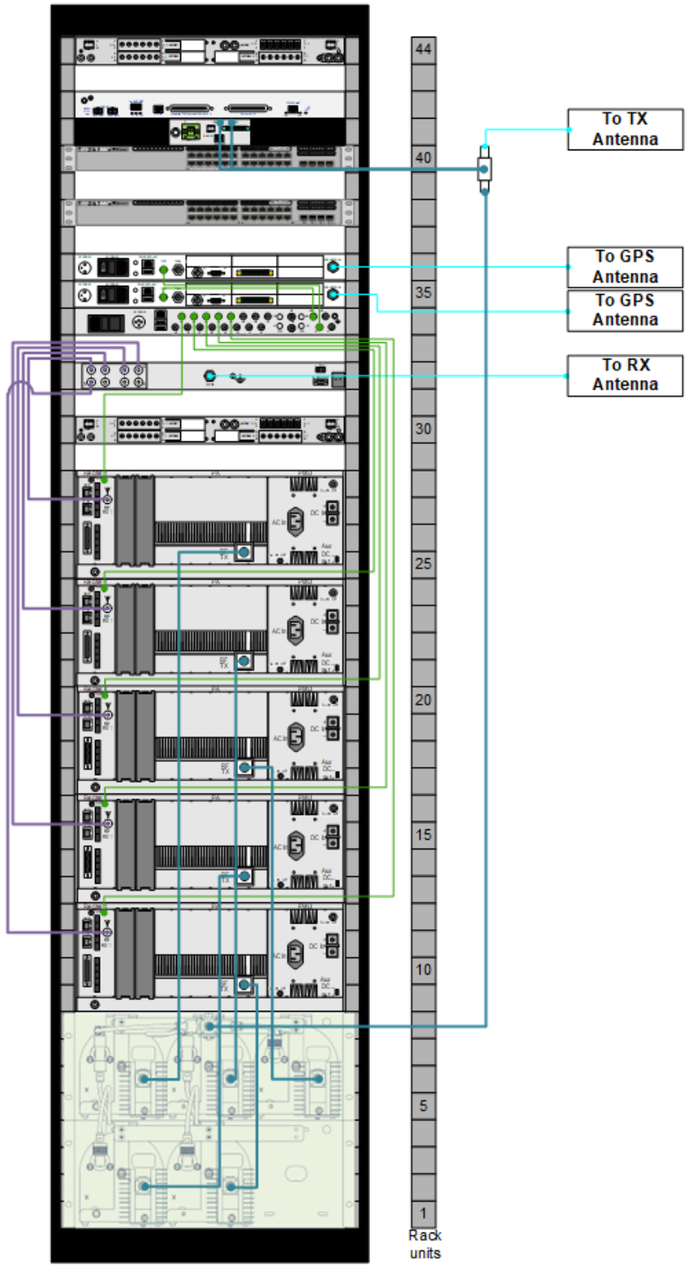


Figure 11 Microwave Rack

700 MHz P25 Phase II
Rackup Diagrams



RU	Description	Vendor PN	Vendor
44	Breaker Panel	9072101001	TRIMM
42	Alarm Panel	M16G2 & D-PK-16PAN	Netguardian
41	Power Monitor	DSCHPMDC	dBSpectra
40	Switch #1	C9300L-24P-4X-A	Cisco
38	Switch #2	C9300L-24P-4X-A	Cisco
36	Timing Reference	2402-613	Safran
35	Timing Reference	2402-613	Safran
34	Timing Switch	SAS-17E	Safran
32	Multicoupler	NPD3633A	dBSpectra
30	Breaker Panel	9072101001	TRIMM
25-28	P25 Trunked Base Station	TB9435S-100T	Tait
21-24	P25 Trunked Base Station	TB9435S-100T	Tait
17-20	P25 Trunked Base Station	TB9435S-100T	Tait
13-16	P25 Trunked Base Station	TB9435S-100T	Tait
9-12	P25 Trunked Base Station	TB9435S-100T	Tait
1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

Marion County, OR
700 MHz P25 Phase II

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Checked	-

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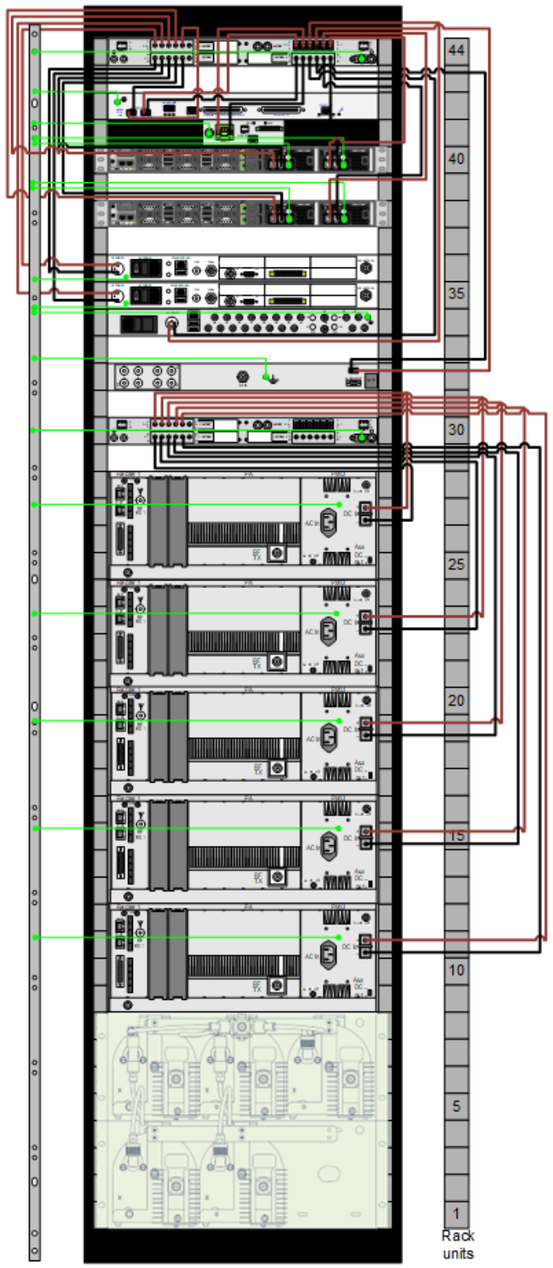
Cabling - RF

Figure 12: Marion County 19" Rack Layout – RF Cabling

700 MHz P25 Phase II
Rackup Diagrams



RU	Description	Vendor PN	Vendor
44	Breaker Panel	9072101001	TRIMM
42	Alarm Panel	M16G2 & D-PK-16PAN	Netguardian
41	Power Monitor	DSCHPMDC	dBSpectra
40	Switch #1	C9300L-24P-4X-A	Cisco
38	Switch #2	C9300L-24P-4X-A	Cisco
36	Timing Reference	2402-613	Safran
35	Timing Reference	2402-613	Safran
34	Timing Switch	SAS-17E	Safran
32	Multicoupler	NPD3633A	dBSpectra
30	Breaker Panel	9072101001	TRIMM
25-28	P25 Trunked Base Station	TB9435S-100T	Tait
21-24	P25 Trunked Base Station	TB9435S-100T	Tait
17-20	P25 Trunked Base Station	TB9435S-100T	Tait
13-16	P25 Trunked Base Station	TB9435S-100T	Tait
9-12	P25 Trunked Base Station	TB9435S-100T	Tait
1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

Description A	Connection A	Description B	Connection B
Breaker Panel 1	A1	GPS 1	-48 VDC
Breaker Panel 1	A2	GPS 2	-48 VDC
Breaker Panel 1	A3	Switch 1-A	-48 VDC
Breaker Panel 1	A4	Switch 2-A	-48 VDC
Breaker Panel 1	A5	Alarm Panel A	-48 VDC
Breaker Panel 2	B1	Alarm Panel B	-48 VDC
Breaker Panel 2	B2	Power Monitor	-48 VDC
Breaker Panel 2	B3	Timing Switch	-48 VDC
Breaker Panel 2	B4	Multicoupler	-48 VDC
Breaker Panel 2	B5	Switch 2-B	-48 VDC
Breaker Panel 2	B6	Switch 1-B	-48 VDC

Marion County, OR
700 MHz P25 Phase II

Date	-
Drawn	RCA
Checked	-

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TITLE:

Cabling - Power

Figure 13: Marion County 19" Rack Layout – Power Cabling

13. PARTS AND EQUIPMENT LISTS

Refer to “Marion County P25 Project - Equipment List by Site.xlsx” for site-specific equipment list.

14. RF PERFORMANCE

14.1 Tx Effective Radiated Power

Table 9 below summarizes the transmitter system performance. It shows the required TB9400 transmitter output power setting, the combining losses (including internal cabling), the antenna feeder loss and finally the resulting ERP relative to a dipole (ERPd).

Transmitter Frequency (MHz)	Transmitter Output Power Setting	Combining Losses (dB)	Misc Losses (dB)	Antenna Feeder Losses (dB)	Tx ERPd
771.64375	+50dBm (100W)	3.2	1.2	2.49	+52.1dBm (162W)
772.24375	+50dBm (100W)	3.2			+52.1dBm (162W)
772.54375	+50dBm (100W)	3.2			+52.1dBm (162W)
772.79375	+50dBm (100W)	3.2			+52.1dBm (162W)
773.90625	+50dBm (100W)	3.2			+52.1dBm (162W)

Table 9: Transmitter Output Power Setting and Effective Radiated Power

14.2 Site Noise

Site Noise in the 700MHz band can be assumed to be negligible.

14.3 Receiver Sensitivity

Table 10 summarizes the receiver system performance. It shows the amount of de-sensitization caused by the elevated site noise floor, the required Rx Multicoupler attenuation setting, and the resulting final Receiver sensitivity that can be achieved.

Receiver Frequency (MHz)	Rx Multicoupler Attenuator Setting (dB)	Rx Sensitivity for DAQ3.4 (dBm)
801.64375	5	-111.2
802.24375		
802.54375		
802.79375		
803.90625		

Table 10: Receiver Sensitivity

15. SITE DESIGN INFORMATION

15.1 Site Plan

The site plan is an overhead view of the overall compound depicting locations of pertinent features.

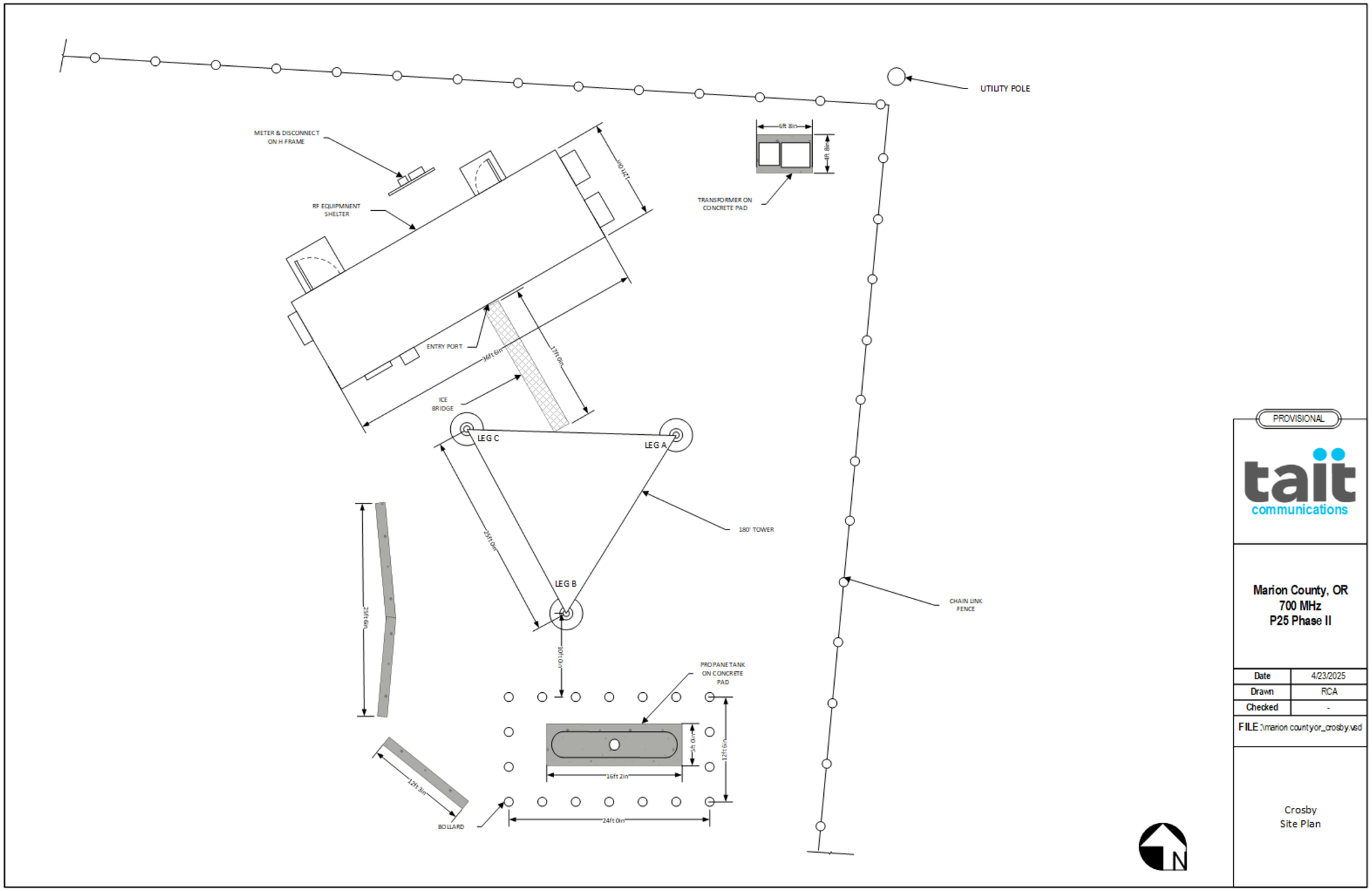

Figure 14: Site Plan

15.2 Floor and Cable Routing Plan

The floor and cable routing plan is an overhead view of the equipment room layout depicting locations of pertinent equipment and including the cable routing plans leading to the tower.

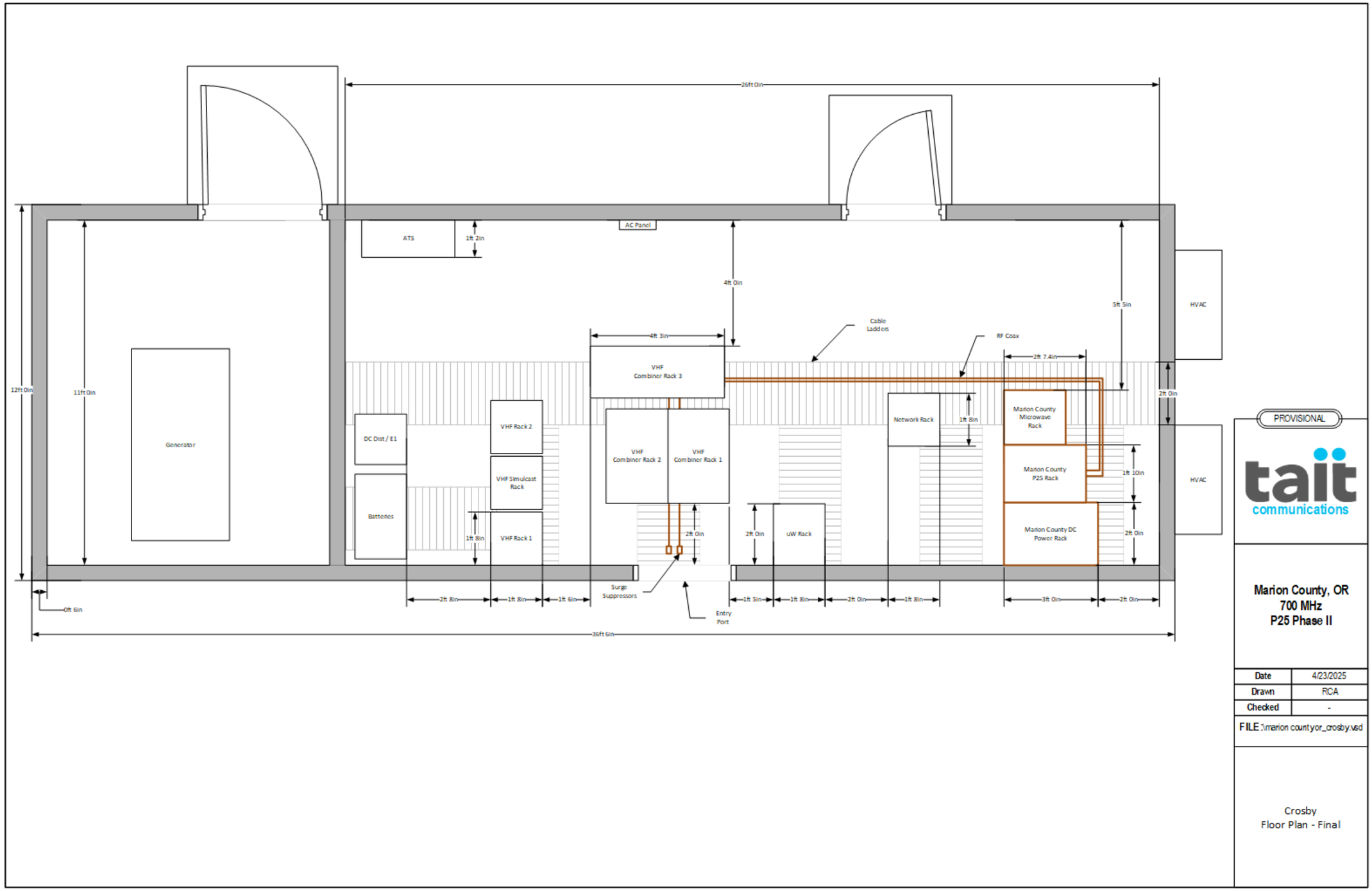

Figure 15: Floor and Cable Routing Plan

15.3 Entry and Exit Ports

The ports where the antenna and TTA cables enter / exit the shelter are shown in the below figure.

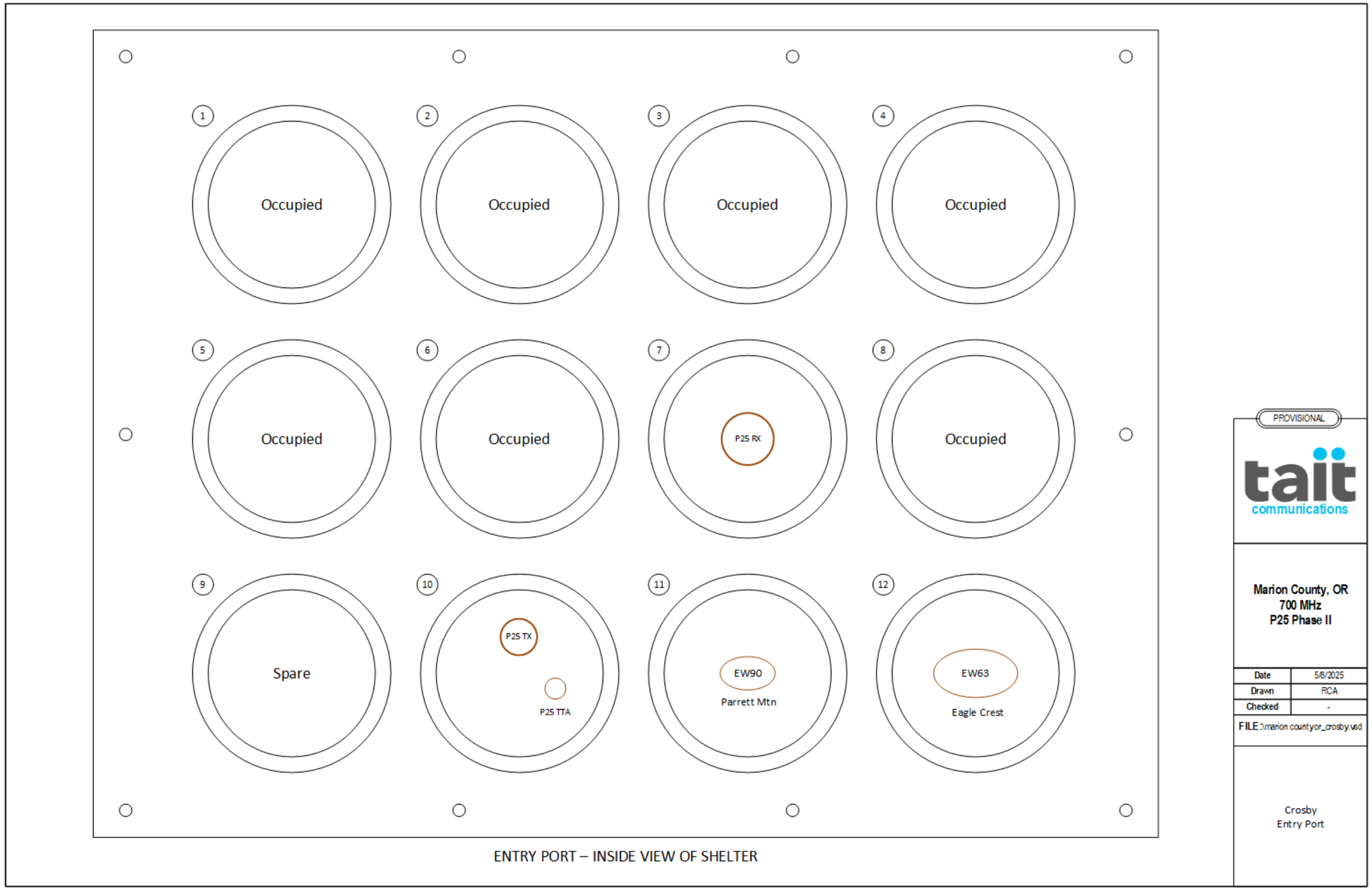

Figure 16: Floor and Cable Routing Plan

15.3.1 Power & Heat Load Calculations

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Power & Heat Load details.

15.3.2 DC Distribution Fuse Panel

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Fuse Panel details.

Supplemental 5 - Eastview

PROVISIONAL Design Document

RF Sub-System and Site Designs

Marion County

Region: North Cell

Site: Eastview

Issue 1.1 • 1st May 2026

www.taitradio.com

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PREFACE

Project Details

Project number	
Customer	Marion County
Project description	P25 Phase 2 Simulcast & P25 Phase 1 Conventional Simulcast
Business Development Manager	
Sales Engineer	
Project Engineer	Jared Farrar / Riley Alfaqeeh
Project Manager	Matt Jordan
Lead RF Engineers	Ian Graham

Purpose

The Marion County project is an 11 site P25 simulcast design that uses the US 700MHz band. To control Time Delay Interference (TDI), the simulcast design is split into three cells – North, South, and East. The North cell is comprised of four sites with P25 Phase 2 trunked operation, the South cell is comprised of four sites with P25 Phase 2 trunked operation, and the East cell is comprised of three sites with P25 Phase 1 conventional operation.

The purpose of this report is to document the RF subsystem design for the **Eastview** site which forms part of the North simulcast cell.

Scope

This document specifies the frequencies to be utilized at the site and summarizes the intermodulation analysis with these frequencies and other high-level in band carriers as identified from an FCC license search. The required antenna system and associated RF combining equipment will then be described in full.

Publication Record

Author	Ian Graham, Jared Farrar
Issue	1.1
Document Status	Initial Release (minor corrections)
Date	15th October 2025

Document Status

Issue	Date	Signature	Comment
0.1	2nd May 2025	Ian Graham	Initial draft
1.0	3rd October 2025	Jared Farrar	Updates following simulcast cell reconfiguration and final microwave subsystem design. Inclusion of IM analysis.
1.1	15th October 2025	Jared Farrar	Edits to language and typo fixes. Replaced tower mapping & appurtenance chart with updated version (Figure 1) to reflect updated microwave heights. Updated RF System Schematic (Figure 8) to include 50-ohm terminations on unused multicoupler ports and changed expansion port count from 2 to 1. Replaced site plan, floor plan, and entry/exit port diagrams with updated versions.

Document Approvals

Approvals	Position	Signature	Date
Bladimyr Guzman	TAM Design Authority		

Associated Documents & References

Reference documentation includes:

- Marion County P25 System Design_v1.1.docx
- Marion County P25 Project - Equipment List by Site.xlsx
- Marion County Power_Heat_Load.xlsx

1. GENERAL RF DESIGN APPROACH

The Marion County project is an 11-site P25 simulcast design that uses the US 700MHz band. To control Time Delay Interference (TDI), the simulcast design is split into three cells – North, South, and East.

The North Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- Crooked Finger
- Crosby
- **Eastview**
- Parrett Mountain

The South Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- Eagle Crest
- Lower Prospect
- McCully Mountain
- Wipper

The East Cell sites operate in P25 Phase 1 conventional mode and are identified as follows:

- APW
- House Mountain
- Halls Ridge

Each site within the North and South Cells will have five trunked P25 Phase 2 channels providing eight dynamic talkpaths (one 12.5kHz FDMA control channel plus four 2-slot 12.5kHz TDMA traffic channels) across each respective cell's coverage area. The East Cell will have five conventional P25 Phase 1 12.5kHz FDMA channels providing five fixed talkpaths across the cell.

Each site across all three cells will have separate transmit (Tx) and receive (Rx) antennas, typically with 20ft vertical separation between centers of radiation. The anticipated low site noise floors in the 700MHz band means Tower Top Amplifiers (TTA) can be used to improve receiver sensitivity and talk-in coverage. Along with the 30MHz Tx-Rx frequency separation, these factors lead to a common RF combining subsystem design which is applicable to all Marion County sites. The combining system requirements were captured based on the proposed frequency plan in coordination with ADCOMM Engineering LLC and Tait subsequently worked with the chosen equipment vendor, dBSpectra, on an optimal design. The main consideration was the TTA where it was decided to use dBSpectra's compact design after it was shown all the required receiver filtering could be accommodated. The generic (starting point) site combining system design therefore features the:

- DSCC75M-5BM 5 Channel Ceramic Tx Combiner
- DSCHPMDC1MDC Channelized Power Monitor
- NPD3633A-TTA Tower Top Amplifier
- NPD3363A-PDU Rx Multicoupler PDU

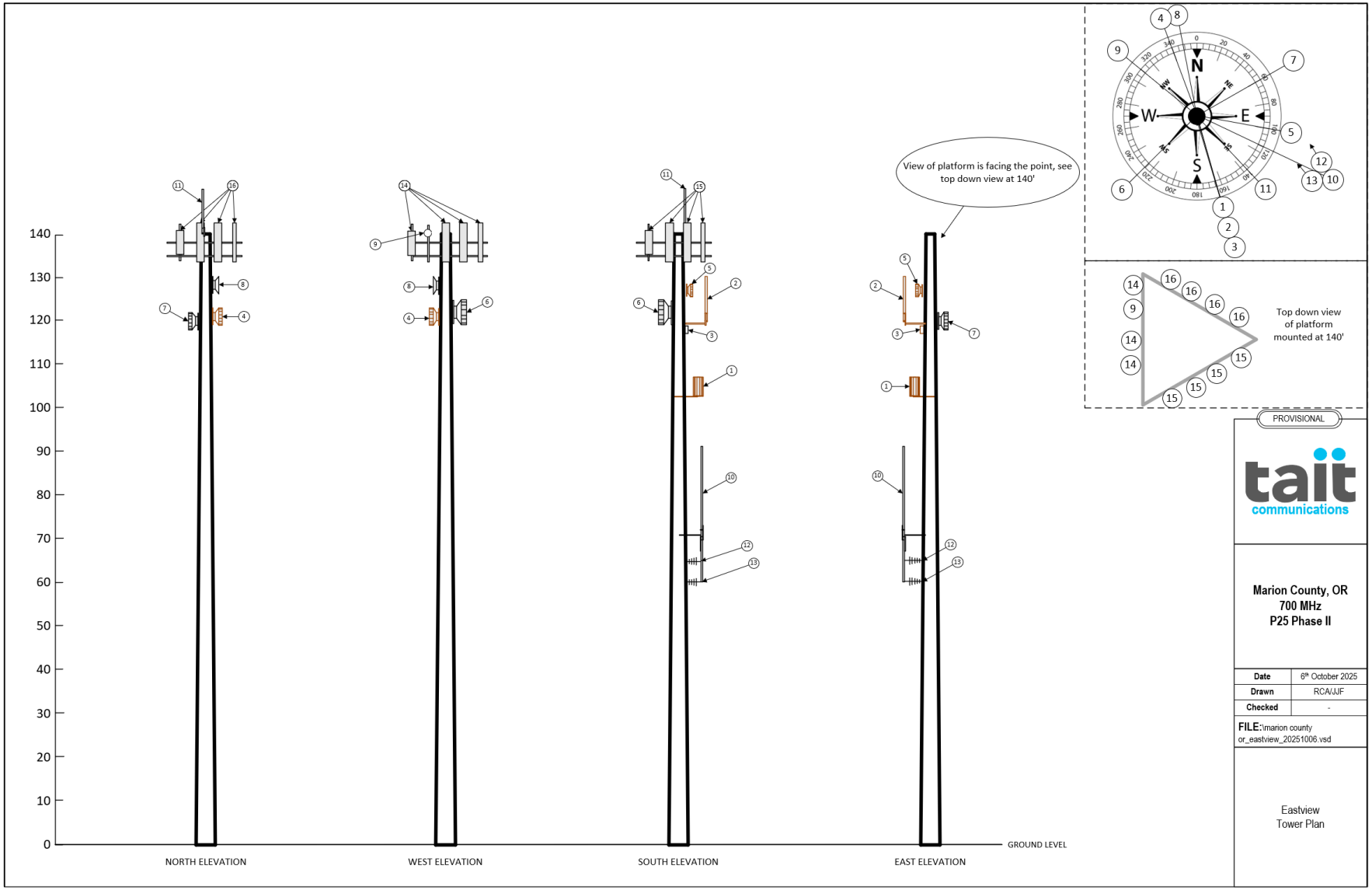
Antennas were chosen on a site-by-site basis to minimize TDI in the simulcast cells while still providing necessary talk-out coverage. The proposed antennas are the:

- Sinclair SE412-SWBPAL
    - 5dBd Low PIM Enclosed Dipole Array
- Sinclair SE414-SWBPAL
    - 8.5 to 11dBd Low PIM Adjustable Beamwidth Enclosed Dipole Array
- RFI CC807-09
    - 9dBd Collinear Omnidirectional

For the Eastview site, the basic design approach will be:

- Install a new SE414-SWBPALDF(D00) transmit antenna on the 140ft monopole at 103ft AGL, azimuth 165º, beamwidth 60º
    - The 5 transmit channels will be connected to the Tx antenna using the dBSpectra DSCC75M-5BM Ceramic Combiner.
- Install a new RFI CC807-09 receive antenna on the 140ft monopole at 120ft AGL, azimuth 165º
    - The 5 receive channels will be fed from the Rx antenna via the dBSpectra NPD3633A-TTA Tower Top Amplifier and the NPD3633A-PDU Rx multicoupler / PDU

2. TOWER MAPPING



#	Description	Part Number	Length (ft)	Leg/Face	Status	Base Height (ft)	Centerline Height(ft)	Tip Height (ft)	Antenna Azimuth	Mount Azimuth	Mount	Transmission Line Size/Type
1	P25 TX Antenna	SE414-SWBPALDF(D00)	4.4	SE	New	103	105	107	165	165	Site-Pro PSA-6 (6' standoff)	7/8"
2	P25 RX Antenna	CC807-09	10.3	SE	New	120	125	130	-	165	Standard	1/2" to TTA
3	TTA	NPD3633A-TTA	1.0	SE	New	117	118	118	-	165	Standard	7/8"
4	Microwave - METCOMM DISP	VHLP4-11W	4.0	NW	New	118	120	122	340.67	340.67	Standard w/ tieback	EW90
5	Microwave - Crooked Finger	VHLP3-11W	3.0	SE	New	126	127	129	100.17	100.17	Standard w/ tieback	EW90
6	Microwave-1			SW	Existing		122		SW	SW	Standard	
7	Microwave-2			NE	Existing		120		NE	NE	Standard	
8	Microwave-3			NW	Existing		128		NW	NW	Standard	
9	Microwave-4			NW	Existing		140		NW	NW	Standard/platform	
10	Omni-1			SE	Existing		80		SE	S	Standoff	
11	Omni-2			SE	Existing		148		SE	SE	Standard	
12	Yagi-1			SE	Existing		65		NW	SE	Standoff	
13	Yagi-2			SE	Existing		61		NW	SE	Standoff	
14	Panel-1	Cell panels (x4)		NW	Existing		138		NW	NW	Platform	
15	Panel-2	Cell panels (x4)		SE	Existing		138		SE	SE	Platform	
16	Panel-3	Cell panels (x4)		NE	Existing		138		NE	NE	Platform	

= estimated value based on survey documentation and photos

Figure 1: Eastview 140ft Tower Mapping and Appurtenances

3. FREQUENCY PLANNING

5 Channels will be deployed at this site.

The North Simulcast cell uses the following frequencies (pending approval from FCC Region 35).

Site Name	FCC Channel Number	Tx Frequency (MHz)	Rx Frequency (MHz)
Eastview	423-424	771.64375	801.64375
	519-520	772.24375	802.24375
	567-568	772.54375	802.54375
	607-608	772.79375	802.79375
	785-786	773.90625	803.90625

Table 1: North Cell Frequency Assignments

4. INCUMBENTS SEARCH

An external high-level carrier (HLC) is defined as a signal that appears at a level of >-40dBm at the receive antenna. These are the signals which have the potential to contribute towards intermodulation that would result in a loss of receiver sensitivity on one or more channels.

Signal and Noise Monitoring of RF activity at the site was not deemed necessary for this project given the wide Tx-Rx frequency separation in the 700MHz band and the anticipated low site noise floors.

To get some idea of potential RF activity at the site though, an FCC License Search was carried out to identify any other transmitters operating between 700 and 900MHz located within a 0.6-mile radius of the tower (a typical transmitter emitting 100W ERP at 0.6 miles away would be received at -40dBm assuming free space path loss). These include cellular transmitters (as their wide bandwidth could cause IM energy to spread into the LMR receive band) and are summarized in Table 2 below.

> ***Disclaimer:*** *During the period spent preparing this RF design document, the United States Government experienced a government shutdown. Consequently, the FCC was affected and the Universal Licensing System (ULS), ordinarily utilized to perform queries on incumbents about a site, was unavailable. Should it become available in a timely manner, details concerning the antennas/transmitters on the license(s) itemized below shall be used to refine the subsequent IM analysis. Absent the finer details, broad assumptions were made concerning the nature of the transmitted signals. In this case, the Tx ERPd was earlier noted during an initial incumbency search. However, the specific azimuths and gains of the cellular panels were not retained.*

Owner	Call Sign	Frequency (MHz)	Tx ERPd (dBm)	Distance from Marion County Tower (miles)
Cellco Partnership (Verizon)	KNKA446	880.02	51.5	0 (collocated)
Cellco Partnership (Verizon)	KNKA446	891.51	51.5	0 (collocated)

Table 2: High Level Carriers

5. INTERMODULATION ANALYSIS

An intermodulation (IM) analysis was performed for the potentially significant sources, including both the Marion County channels to be deployed and any HLCs found during the FCC License Search. For antenna configurations using separate transmit and receive antennas Tait best practice is to search for IM products up to 7th order within a defined search window accounting for the fact the bandwidth of IM products spread according to the order and bandwidth of the signals that cause it.

The frequencies included in the IM analysis are listed in Table 3 below.

Transmit Frequencies (MHz)	Receive Frequencies (MHz)
771.64375	801.64375
772.24375	802.24375
772.54375	802.54375
772.79375	802.79375
773.90625	803.90625
880.02	
891.51	

Table 3: Frequencies Included in IM Analysis

Table 4 below shows how many IM products are generated on each of the receive frequencies. A direct hit is an IM product that falls exactly at the receive frequency. An indirect hit is one that does not fall exactly at a receive frequency but does fall within the search window. Note that for the purposes of this table, the number of direct hits depends on the bandwidth of the LTE signals at 880.02MHz and 891.51MHz. Both are downlink signals within Band 5 (US 850MHz Cellular) which may contain channel bandwidths of 1.4MHz, 3MHz, 5MHz, or 10MHz. A wider signal contributes to a larger IM bandwidth, resulting in a greater number of indirect hits as illustrated here.

IM Order	Number of Intermodulation Products at each Receive Frequency									
	801.64375MHz		802.24375MHz		802.54375MHz		802.79375MHz		803.90625MHz	
	Direct	Indirect (1.4/3/5/10)	Direct	Indirect (1/4/3/5/10)	Direct	Indirect (1.4/3/5/10)	Direct	Indirect (1.4/3/5/10)	Direct	Indirect (1.4/3/5/10)
3rd	0	0	0	0	0	0	0	0	0	0
5th	0	0/2/5/5	0	0/1/5/5	0	0/1/5/5	0	0/1/5/5	0	0/0/5/5
7th	0	1/31/55/55	0	1/24/55/55	0	2/19/54/55	0	2/16/54/55	0	4/10/47/55

Table 4: Intermodulation Results Summary

6. ANTENNA SYSTEM DESIGN

The Antenna System detailed here and the RF Combining System described later in sections 7, 8, and 10 have been specifically designed to mitigate any interference caused by the listed high level carriers, thereby maximizing the coverage achieved by the Marion County system.

6.1 Antenna Type

The following antennas will be used at Eastview.

Antenna	Manufacturer	Antenna Model Number	Description	Antenna Length (ft)	Antenna Gain (dBd)
Rx	RFI	CC807-09	collinear	10	9
Tx	Sinclair	SE414-SWBPALDF(D00)	Enclosed Dipole	4	11.5

Table 5: Antenna Details

800MHz Corporate Collinear Antennas

748-870MHz

CC807 Series

These industry leading, full featured corporate collinear arrays allow site operators to combine, with complete integrity, a large number of communications services into a single, low profile antenna solution.

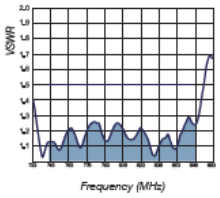
The corporate feed design employed by RFI maintains superior pattern control, allowing gain to be maximised with zero tilt variation over a very broad bandwidth, comparable to that only previously available in exposed dipole array configurations. This is achieved in the preferred form factor of a fully enclosed fibreglass radome, providing a reduction in wind loading, ice loading and tower loading in comparison.

The CC807 series have been designed with an exceptional power rating of 500W across the band as well as a Peak Instantaneous Power (PIP) rating of 25kW to cater for the peak voltage levels present in large multi-carrier combining environments. RFI's refined design processes and proven construction methods achieve a PIM rating of –150dBc, further ensuring performance is maintained for the service life of the antenna.

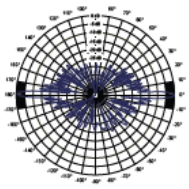
Features:

- 500W Continuous Power rating
- -150dBc Passive Intermodulation (PIM) rating, 100% PIM tested
- 25 kW Peak Instantaneous Power (PIP) rating
- DC grounding on all elements for the ultimate in lightning protection and dissipation of static noise.
- Light weight dipole construction using RFI's patented flexi-PCB architecture, maintains a low centre of gravity reducing tip deflection and sway
- Field invertible (excluding tilt models)
- Preset downtilt variations of 2 and 4 degrees available, see note (1)

Typical VSWR Response (CC807-12)



CC807-12 - E Plane



Electrical Specifications

Model Number	CC807-09-P	CC807-12-P
Nominal Gain *dBd (dBi)*	9.0 (11.1)	11.5 (13.6)
Frequency *MHz*	746-870	
Tuned Bandwidth *MHz*	Full	
VSWR *(Return Loss)*	1.5:1	
Nominal Impedance Ω	50	
Downtilt°	0 Std 2, 4 (1)	
Vertical Beamwidth°	8	4
Horizontal Beamwidth°	Omni +/- 0.5dB	
Input Power W	500	
Passive IM 3rd order (2x20W) *dBc*	-150	
Peak Instantaneous Power *kW*	25	

Mechanical

Model Number		CC807-09-P	CC807-12-P
Construction		Sky blue fibreglass radome	
Radome Diameter mm (inches)		76 (3.0)	
Length mm (inches)		3135 (123.4)	6235 (245.5)
Weight *kg (lbs)*		14 (30.9)	25.5 (56.2)
Termination		Integrated 4.3-10 Female	
Mountaing Area mm (inches)		750 x 90 (30 x 3.5) diameter Ecofilm™ plated aluminium	
Suggested Clamps		3 x UC-114	
Shipping Dimensions *mm (inches)*	H	115 (4.5)	
	W	115 (4.5)	
	L	3335 (131.3)	6435 (253.3)
Shipping Weight *kg (lbs)*		20.0 (44.1)	36.5 (80.5)
Projected area *cm² (ft²)*	No Ice	2597 (2.8)	5559 (6.0)
	With Ice	3192 (3.4)	7037 (7.6)
Lateral Thrust @160km/h *N* (100 mph lbs)		308 (69)	659 (148)
Wind Gust Rating *km/h (mph)*	No Ice	>240 (150)	
Torque @ 160km/h *Nm* (100mph ft-lbs)		413 (305)	1823 (1345)

(1) To order pre-set downtilt versions available, simply add a -T2 or -T4 towards the end of the part number to denote downtilt model required. For eg. CC807-12-T2-P to order CC807-12-P with 2deg of downtilt. Please note: Models with downtilt are NOT field invertible. . Eg. CC807-12-T2-P

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Figure 2: RFI CC807-09 Antenna Datasheet

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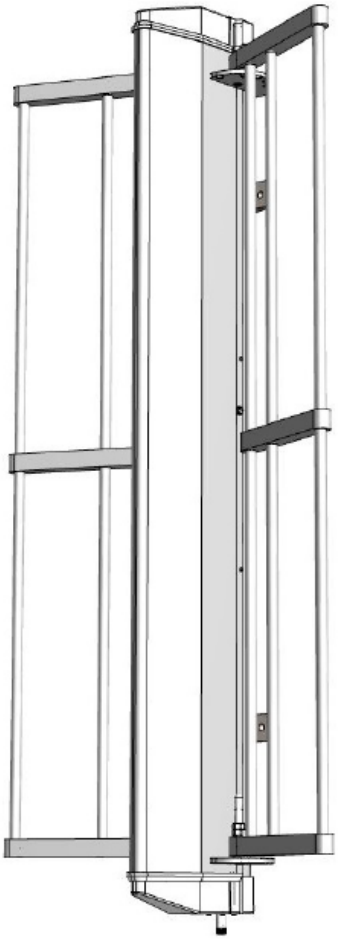
Antennas

700-1000 MHz Antennas

SE414-WBAL - PIM Certified Series

SE414-SWBPAL(YY)(DXX) Enclosed dipole, 8-11.5 dBd, adj. beamwidth, Low PIM, 746-960MHz

- Wide band design covers whole 746-960 MHz band, PIP rated
- Horizontal beamwidth can be adjusted (60º/90º/105º/130º/160º)
- Gain depends on horizontal beamwidth setting (11.5/10/9/8.5/8 dBd)
- PIP rated and low PIM



One wideband antenna for your 700, 800, 900 MHz systems. Sinclair's SE414-WBL series of enclosed dipole arrays offer excellent intermodulation performance covering 746-960 MHz in a single antenna. These highly versatile antennas are particularly well suited to communication systems where a specific coverage pattern is required. These include cellular systems, trunked radio, paging, and data transmission, where predictable and highly reliable performance is a must.

The SE414-WBAL series come with field adjustable reflectors that provide horizontal beamwidths between 60 and 160 degrees. The creative design and construction permits excellent pattern control and greater efficiency.

When ordering, please refer to the chart below for the model number. Different configurations are subject to various list prices. Please contact your Sinclair Sales Representative or Customer Service Representative for more information.

Model Number	Connector	Downtilt	PIM(dBc)	PIP(kW, max)
SE414-SWBPALDF(D00)	7/16 DIN(F)	0º	<-150	25
SE414-SWBPALDF(D01)	7/16 DIN(F)	1º	<-150	25
SE414-SWBPALDF(D02)	7/16 DIN(F)	2º	<-150	25
SE414-SWBPALDF(D03)	7/16 DIN(F)	3º	<-150	25
SE414-SWBPALDF(D04)	7/16 DIN(F)	4º	<-150	25
SE414-SWBPALDF(D05)	7/16 DIN(F)	5º	<-150	25
SE414-SWBPALDF(D06)	7/16 DIN(F)	6º	<-150	25
SE414-SWBPALNF(D00)	N(F)	0º	<-139	N/A
SE414-SWBPALNF(D01)	N(F)	1º	<-139	N/A
SE414-SWBPALNF(D02)	N(F)	2º	<-139	N/A
SE414-SWBPALNF(D03)	N(F)	3º	<-139	N/A
SE414-SWBPALNF(D04)	N(F)	4º	<-139	N/A
SE414-SWBPALNF(D05)	N(F)	5º	<-139	N/A
SE414-SWBPALNF(D06)	N(F)	6º	<-139	N/A

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Antennas
700-1000 MHz Antennas
SE414-WBAL - PIM Certified Series

Electrical Specifications

Frequency Range	MHz	746 to 960	
Bandwidth	MHz	214	
Gain (nominal)	dBd (dBi)	11.5 (13.6)	*1
Input VSWR (max)		1.5:1	
Polarization		vertical	
Impedance	Ω	50	
Pattern		Directional and Adjustable	
Horizontal beamwidth (typ)	degrees	60	*2
Vertical beamwidth (typ)	degrees	20	
Average Input Power (max)	W	500	
Front-to-back ratio (min)	dB	20	
Grounding		All metal parts DC-grounded	

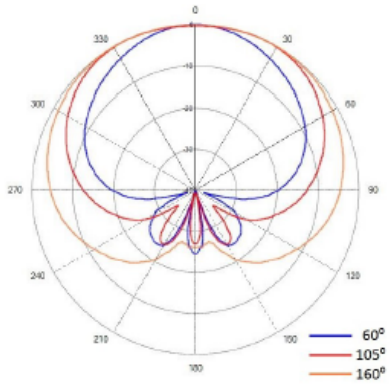
Notes
*1 : Dependant on reflector setting 10/9/8.5/8 dBd
*2 : 90/105/130/160
*3 : 90° beamwidth configuration, clamp not included in measurement
*4 : 90° beamwidth configuration, clamp not included in measurement
*5 : Ref. clamp maximum

Mechanical Specifications

Width	in (mm)	25 (635)	*3
Depth	in (mm)	8.5 (216)	*4
Length/ Height	in (mm)	53 (1346)	
Base pipe diameter	in (mm)	2.88 (73)	*5
Base pipe mounting length	in (mm)	30.5 (775)	
Radiating element material		prntd circuit bd	
Weight	lbs (kg)	23 (10.44)	
Mounting Hardware (Included)		#130 clamp	
Mounting configurations		upright	
Actual shipping weight	lbs (kg)	28 (12.71)	
Shipping dimensions	in (mm)	58x14x17 (1473x356x432)	

Environmental Specifications

Temperature range	°F (°C)	-40 to +140 (-40 to +60)
Wind Loading Area (Flat Plate Equivalent)	ft² (m²)	4.8 (0.45)
Wind Loading Area (1/2" ice)	ft² (m²)	5.7 (0.53)
Rated wind velocity (no ice)	mph (km/h)	155 (250)
Rated wind velocity (1/2" radial ice)	mph (km/h)	140 (225)
Lateral Thrust (100 mph No Ice)	lbs (N)	180 (800.6)
Torsional moment (100 mph No Ice)	ft-lbs (Nm)	93 (125.6)



Horizontal

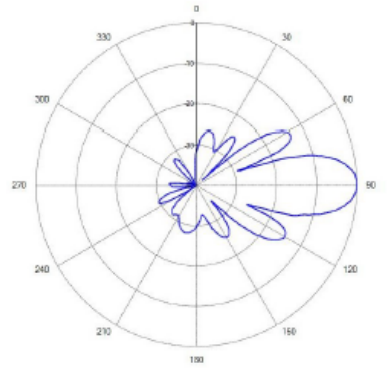

Vertical, 0° downtilt

Figure 3: Sinclair SE414-SWBPALDF(D00) Antenna Datasheet

6.2 Antenna Mounting Locations

Table 6 below specifies the Marion County antenna mounting location details.

Antenna	Mounting Height (feet AGL)	Antenna Orientation (degrees)	Tower Leg	Standoff Length (feet)	Standoff Orientation (degrees)	Standoff Model
Receive	120	n/a	n/a (monopole)	6	165	Site-Pro PSA-6
Transmit	103	165	n/a (monopole)	6	165	Site-Pro PSA-6

Table 6: Antenna Mounting Locations

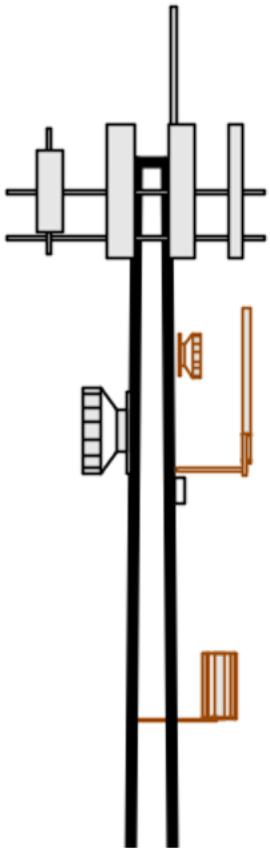
The antenna system design for this site is given in Figure 4.

Marion County Rx Antenna

- System Type: P25 Phase 2 Simulcast
- Antenna Manufacturer: RFI
- Antenna Type no: CC807-09
- Antenna Height AGL at base: 120ft
- Antenna CoR: 125ft
- Antenna Azimuth: 165°
- Tower Leg: n/a
- Antenna Function: Rx
- Rx: 801.64375MHz, 802.24375MHz, 802.54375MHz, 802.79375MHz,

Marion County Tx Antenna

- System Type: P25 Phase 2 Simulcast
- Antenna Manufacturer: RFI
- Antenna Type no: SE414-SWBPALDF(D00)
- Antenna Height AGL at base: 103ft
- Antenna CoR: 105ft
- Antenna Azimuth: 165°
- Tower Leg: n/a
- Antenna Function: Tx
- Tx: 771.64375MHz, 772.24375MHz, 772.54375MHz, 772.79375MHz, 773.90625MHz



SOUTH ELEVATION

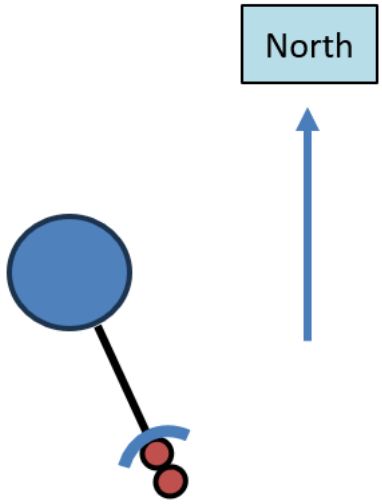


Figure 4: Antenna System Design

6.3 Antenna Isolation

The Transmit and Receive antennas are vertically separated by 20ft which gives an isolation between them of **76dB**. A figure of 60dB will be assumed in subsequent calculations though as that is often the limit of what can be practically achieved.

7. TRANSMITTER COMBINER DESIGN

7.1 RF Connectors

The antenna output of the combiner is fitted with **4.3-10 female** connector to minimize PIM.

The transmitter input ports of the combiner are fitted with **N Type female** connectors.

7.2 Cavity Filters

Filtering in the Tx Combiner is predominantly bandpass.

A combination of band-pass and band-reject filtering is sometimes to provide extra rejection at specific site Rx frequencies, but band-reject filters are never used alone.

The cavity filters provide the minimum attenuation at the closest receive frequency equal to or greater to the value specified in section 7.9 of this document.

7.3 Isolator

A dual Isolator is included between the output of each transmitter and the Tx Combiner input port.

The isolator load closest to the Tx Combiner input port is rated at a minimum of **100 watts**.

7.4 Maximum RF Power

The Tx combiner supports a maximum of **100 watts** of RF input power per channel.

7.5 Minimum Tx to Tx Frequency Separation

The minimum frequency separation allowed between transmitters sharing the same combiner is **250kHz**.

7.6 Maximum number of Transmitters per combiner

Standard Tait practice is a maximum of four transmitters per Tx combiner. But in this case, the relatively wide Tx-Tx spacing and the fact that self-TxIM does not occur renders the penalty in combining all five transmitters together negligible.

7.7 Maximum Tx Combiner Loss per Channel

The insertion loss shall be minimized to the extent possible while complying with all other specifications.

The Tx Combiner insertion loss per Tx channel (not including associated Tx antenna feeder cable losses) will be around **3.2dB** for the Tx-Tx frequency separation at this site.

7.8 Tx Intermodulation Suppression

Transmitters that cause intermodulation on any site receive frequency must not be connected to the same combiner.

However, there is still a responsibility to keep the site as ‘clean’ as possible for its incumbents. To that end, the levels of intermodulation products generated in the combiner are controlled by a requiring a minimum isolation

between the outputs of combined transmitters of **at least 60dB**. This figure includes the reverse isolation of the isolator and any additional attenuation provided by the cavity filters in neighboring branches.

7.9 Tx Sideband Noise Suppression

In addition to the Tx – Rx antenna isolation, the Tx Combiner provides the suppression required to reduce transmitter sideband noise at the Rx antenna to the level where it causes no more than 1dB of receiver de-sensitization. The transmitter sideband noise suppression required at this site is given in Table 7 below.

Transmit Frequency (MHz)	Offset to Nearest Receive Frequency (MHz)	Sideband Noise Suppression Required at Offset (dB)
771.64375	30.0000	15
772.24375	29.4000	16
772.54375	29.1000	16
772.79375	28.8500	16
773.90625	27.7375	16

Table 7: Transmitter Combiner Sideband Noise Rejection Requirements

8. RECEIVER SUBSYSTEM DESIGN

8.1 RF Connectors

8.1.1 Tower Top Amplifier

The Rx Filter input is fitted with a **4.3-10 female** connector.

The Rx Filter output is fitted with a **4.3-10 female** connector.

8.1.2 Receiver Multicoupler / PDU

The Rx Multicoupler input is fitted with a **4.3-10 female** connector.

The receiver output ports of the Rx Multicoupler are fitted with a **BNC Female** connector.

8.2 Receiver Subsystem Topology

The Receiver Subsystem will utilize a Tower Top Amplifier (TTA, which includes the receiver filtering) to optimize talk-in coverage followed by a multicoupler/PDU system that further amplifies and splits the received signal between the connected receivers.

8.3 Receiver Filtering

The Receiver Filters will pass the 801 to 805MHz part of the 700MHz band used for the Marion County system while fully rejecting associated transmit signals in both the 700MHz and 800MHz Tx bands. This is important because combinations of transmitters in both bands can result in 7th order IM falling within the 700MHz receive band.

8.3.1 Blocking Rejection

Between them, the Receiver Filters must provide enough attenuation so that no more than 1dB of de-sensitization of any of the connected receivers occurs due to receiver blocking. The attenuation required at this site to prevent receiver blocking due to the Marion County transmitters and external interferers found during FCC database search is given in Table 8 below:

	Tx Name	Tx Frequency (MHz)	Minimum Rejection in Rx Filter at Tx Frequency (dB)				
			Rx1 (MHz)	Rx2 (MHz)	Rx3 (MHz)	Rx4 (MHz)	Rx5 (MHz)
			801.64375	802.24375	802.54375	802.79375	803.90625
Transmitters	Tx1	771.64375	22	22	22	22	22
	Tx2	772.24375	22	22	22	22	22
	Tx3	772.54375	22	22	22	22	22
	Tx4	772.79375	22	22	22	22	22
	Tx5	773.90625	22	22	22	22	22
	LTE_1	880.02	<89	<89	<89	<89	<89
	LTE_2	891.51	<89	<89	<89	<89	<89

Table 8: Receiver Filter Blocking Rejection Requirements

8.3.2 Receiver Intermodulation Rejection

The Rx Filter must provide enough attenuation so that no more than 1dB of de-sensitization of any of the connected receivers occurs due to intermodulation.

In this case, an absolute worst-case scenario was entertained in which an imaginary external interferer arrives directly at the Marion County Rx antenna with a power level of the licensed ERP of the cellular carrier. When the 5th and 7th order IM products are considered, they all contain either fundamentals of the Marion County Tx channels or at most second harmonics mixed with second or third harmonics of the cellular frequencies. Consequently, a *direct* 5th order IM product in this scenario would lead to a generated IM product power level of -177.7dBm. In this case, the permissible IM product level at the Rx filter is -117.91dBm. Here we are left with a margin of 59.7dB. Similarly, a direct 7th order IM product in this scenario would yield an IM product power level of -228.9dBm and a corresponding margin of 111dB.

In reality, the power spectral density of the cellular signal is very low because of its wide bandwidth despite the high ERP; the amount of energy contained in a 12.5kHz slice of even a direct IM product would be negligible. Furthermore, the Marion County Rx antenna will not hear the cellular signal at the full ERP. Finally, the mechanism of the intermodulation in this case is indirect, i.e., it is a consequence of the bandwidth of the IM product expanding according to a.) the wide bandwidth of the cellular signal, and b.) the order of the IM product (it can be shown that the bandwidth of an IM product is the sum of the products of the harmonics of the constituent frequencies implicated in the IM and the bandwidths of those constituent frequencies).

The attenuation required at this site to prevent receiver intermodulation due to the Marion County transmitters and external interferers found during FCC database search is given in Table 9 below. Note that the dBSpectra TTA provides >110dB of rejection in our transmit band and, in a reciprocal fashion, provides roughly the same figure in the 800MHz transmit band.

	Tx Name	Tx Frequency (MHz)	Minimum Rejection in Rx Filter at Tx Frequency (dB)				
			Rx1 (MHz)	Rx2 (MHz)	Rx3 (MHz)	Rx4 (MHz)	Rx5 (MHz)
			801.64375	802.24375	802.54375	802.79375	803.90625
Transmitters	Tx1	771.64375	22	22	22	22	22
	Tx2	772.24375	22	22	22	22	22
	Tx3	772.54375	22	22	22	22	22
	Tx4	772.79375	22	22	22	22	22
	Tx5	773.90625	22	22	22	22	22
	LTE_1	880.02	<89	<89	<89	<89	<89
	LTE_2	891.51	<89	<89	<89	<89	<89

Table 9: Receiver Filter Intermodulation Rejection Requirements

8.4 Low Noise Amplifiers

Low Noise Amplifiers (LNAs) with appropriate gain and noise figure will be included in the receiver sub system to ensure that the cascade noise figure of the line up from the base of the receive antenna up to and including the base station receiver is equal to or less than 5dB. In the case of Eastview, this figure will be approximately **4.7dB.**

The output third order intercept of the LNAs will be >= +40dBm to maintain the linearity of the system.

8.5 Variable Attenuator

A Variable Attenuator will be fitted in the Rx Multicoupler/PDU for field optimization of the receiver subsystem gain, noise figure and IP3. The attenuator has an adjustment range of 0dB to 15dB, in 0.25dB steps. To achieve a noise figure of 4.7dB, the variable attenuator shall be set to **11dB**.

Setting of the attenuator value must be done electronically so as not to require disassembly of the multicoupler equipment.

8.6 Receiver Ports

To allow for future expansion, the Rx Multicoupler will have 8 ports

All unused ports will be terminated in a 50-ohm load.

9. POWER MONITOR

The dBSpectra DSCHPMDC1MDC Power Monitor will be used within the Marion County RF systems. This is placed at the output of the Tx Combiner and allows remote monitoring of channelized transmitted power and antenna VSWR. The major benefit is early warning of antenna system degradation so that repairs can be made before failure occurs.

DSCHPM-Series (VHF, 220, UHF, 700/800/900 MHz)
SMART Channelized Transmit Power Monitor with Front Panel Display Option

dbSpectra
Always a Better Value

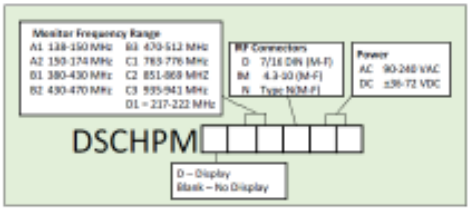
DSCHPM Power Monitor with front panel display option.

Directional coupler for installation on combiner output.

Features and Benefits

- *Per-channel and composite* measurement of forward and reflected RF power with the SMART Channelized RF Power Monitor.
- Calculates and displays combiner insertion loss for each channel.
- All measurements are displayed with 95% accuracy.
- IP network connection and designed-in web server for web browser interface.
- Full remote configuration, monitoring and data logging.
- Optional front panel display with Navigation Keys for monitoring only.
- User-defined alarm thresholds are indicated by alarm relay closure or by SNMP protocol on the network.
- Optional temperature sensors for equipment and ambient temperature measurements and alarms.
- Compact single rack unit mounting with remote RF sensor for flexibility in mounting locations.

Ordering Information

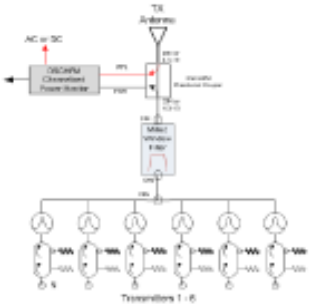


Notes:
1. Factory calibrated using a P25 LSM signal source, may be calibrated in the field for improved accuracy.
2. Contact dbSpectra at tech@dbspectra.com for additional information on optional temperature sensor feature.

Specifications

Electrical Specifications	
Frequency Range, MHz	See Ordering Information
Minimum TX to TX Separation	50 kHz
Maximum Power Input	600 Watts (directional coupler)
System Type	Digital or analog
Insertion Loss	< 0.1 dB
PIM Rating	-150 dBc
Channelized Power Measurements	Forward /reflected power of individual channels: Watts, dBm, VSWR, Return Loss, Combiner Insertion Loss
Power Requirements	AC Model 90-240 VAC 15W, or DC model ±36-72 VDC 15W
IP Interface	IPV4, with TLS security layer, SNMP v2c/v3 alarm protocol
Alarms	Form C contacts or SNMP v2c/v3
User Interface	Web browser or remote SNMP system manager. Front Panel Display (optional) for Monitoring only.
Temperature Range	-30 to +60 °C
Mechanical Specifications	
Mounting Dimensions	1 RU, 1.75 X 19 in. (44 X 483 mm) 7.5 in. (191 mm) deep
Construction / Finish	Aluminum / protective finishes
Directional Coupler Connectors Input Output Coupled Ports	 7/16 DIN, 4.3-10 or N(male) 7/16 DIN, 4.3-10 or N(female) MCX type push-on with two 4 ft RD316 cables supplied.
Power Connector	AC model: IEC 320-C13 inlet & cord DC model: 2 port terminal block
Ethernet Connector	RJ-45
Alarm Closures Connector	3 port pluggable terminal block
Temp. Sensor Connector	24-pin header male pins
Net Weight	4.6 lbs. (2.1 kg)
Shipping weight	6.1 lbs. (2.8 kg)

Typical Application



Specifications are subject to change • www.dbspectra.com • 1590 E Hwy 121, Building A, Suite 100, Lewisville, TX 75056 • P (469)322-0080 •096000-797.A • 01/2024

Figure 5: DSCHPMDC1MDC Channelized Power Monitor

10. RF SUB-SYSTEM DESIGN

Tait have worked with dBSpectra to develop a generic combining system for the Marion County project that meets the performance goals derived in sections 7 and 8 of this report and thereby maximizes the talk in and talk out coverage of the system.

The transmit side of the RF sub-system consists of a 5-channel cavity filter based ceramic combiner to minimize losses and maximize the transmitted power and talk out coverage from the site. The cavity filters meet or exceed the Tx sideband noise filtering requirements given in section 7.9.

The receive side features a compact Tower Top Amplifier (TTA) followed by a Receiver Multicoupler/PDU that allows the receiver sensitivity to be optimized and distributes the signal to the five connected receivers. All the receive filtering is accommodated within the TTA. There are two filters, one before the LNA to preselect the 801 to 805MHz part of the band used by the Marion County system (see Figure 7), and a second after the LNA that fully rejects the Marion County system transmit signals, and the other 700 and 800MHz HLCs identified from the FCC database search (see Figure 8). Together, the filters meet or exceed the receiver blocking and receiver intermodulation filtering requirements given in sections 8.3.1 and 8.3.2. There are two LNAs, one in the TTA and one in the Rx Multicoupler/PDU with gains, noise figures. and intercept points optimized so the cascade noise figure and linearity of the receiver line up meet the requirements of section 8.4.

A block diagram of the North Cell combining system design is shown in Figure 6 below:

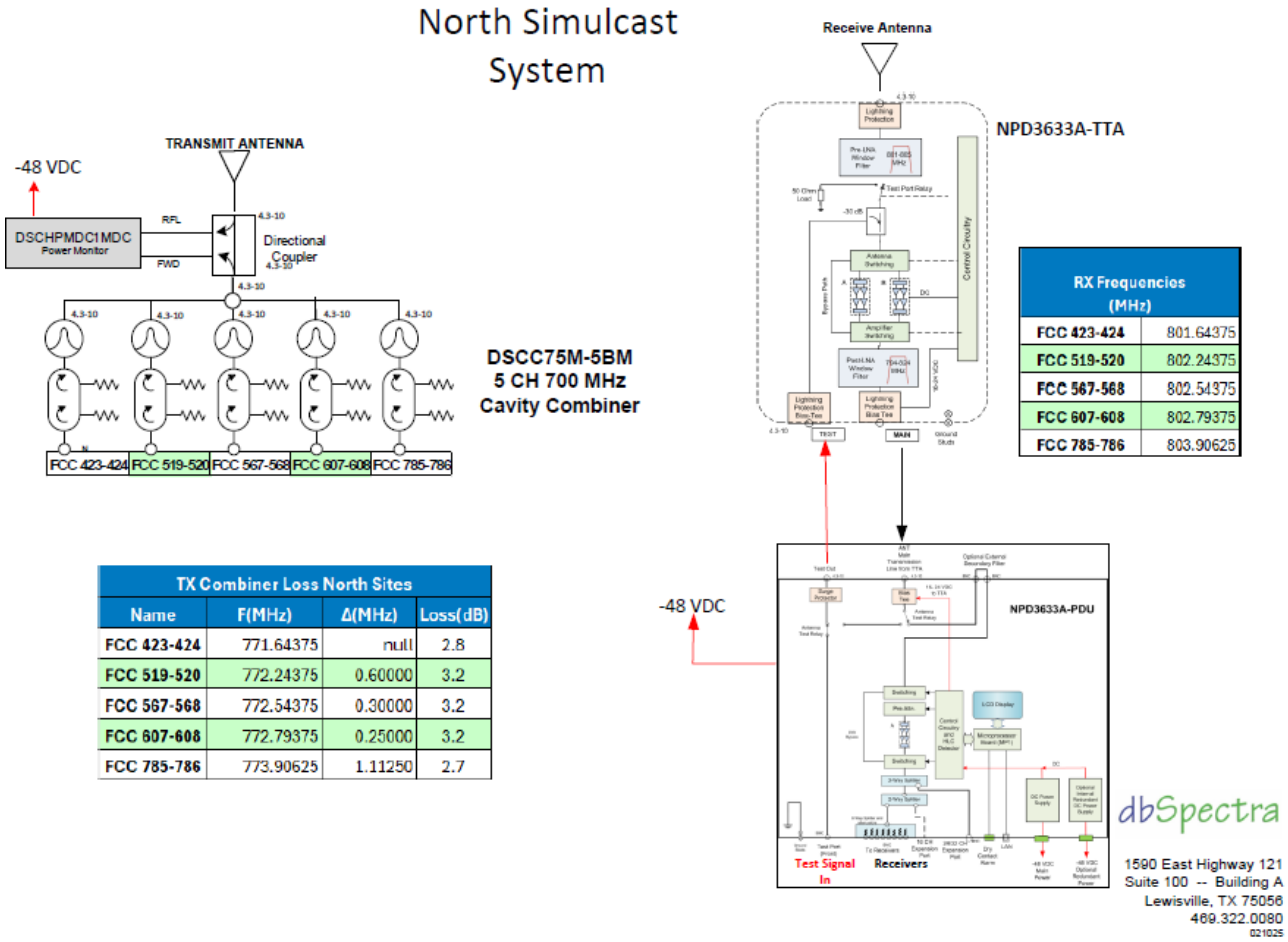


Figure 6: SPD3454C-4TR Dual Band RF Combining System

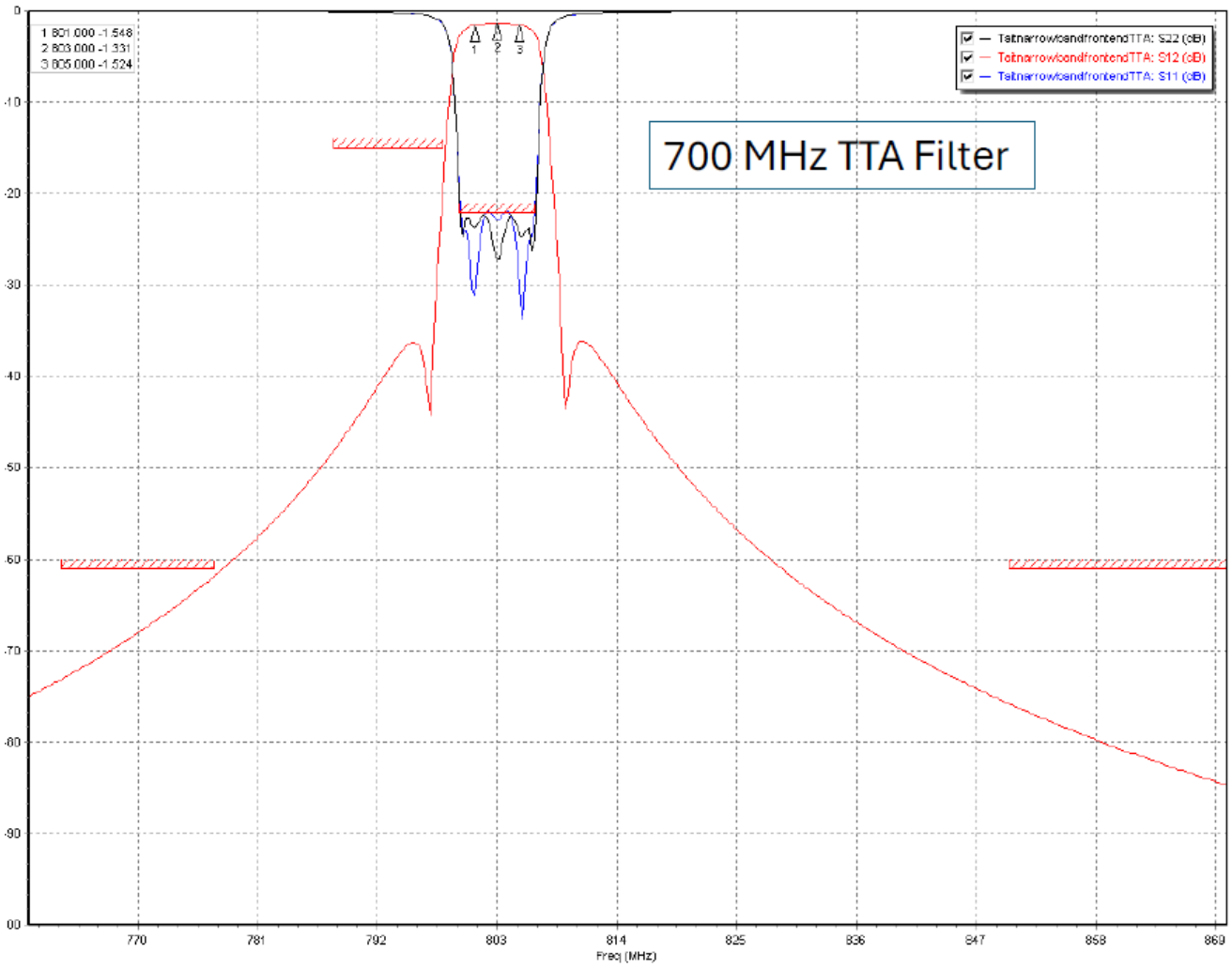


Figure 7: TTA PreSelector Filter Plot

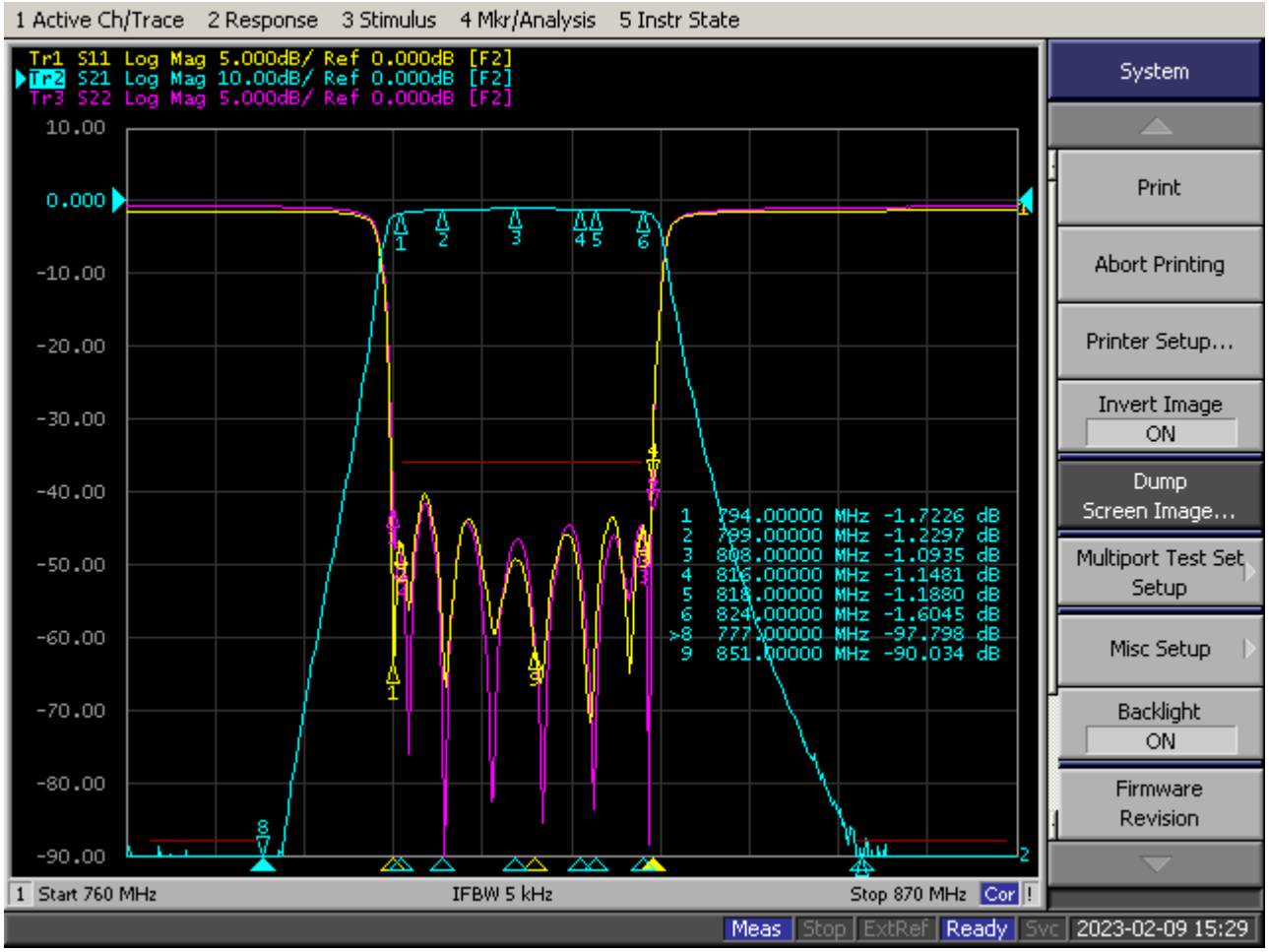


Figure 8: TTA Post LNA Filter Plot

11. MICROWAVE SYSTEM DESIGN

Refer to “Marion County P25 System Design_v1.1.docx” for Microwave System Details.

11.1 Site Specific Design

The Eastview Lane site supports two Aviat microwave links. These links connect Eastview Lane to METCOMM Dispatch and Crooked Finger, forming part of the 13-site core ring and providing the redundant routing expected within the looped topology.

12. RF SUB-SYSTEM DRAWINGS

The figure below contains the schematic of the RF sub-system to be deployed at this site.

12.1 RF System Schematic

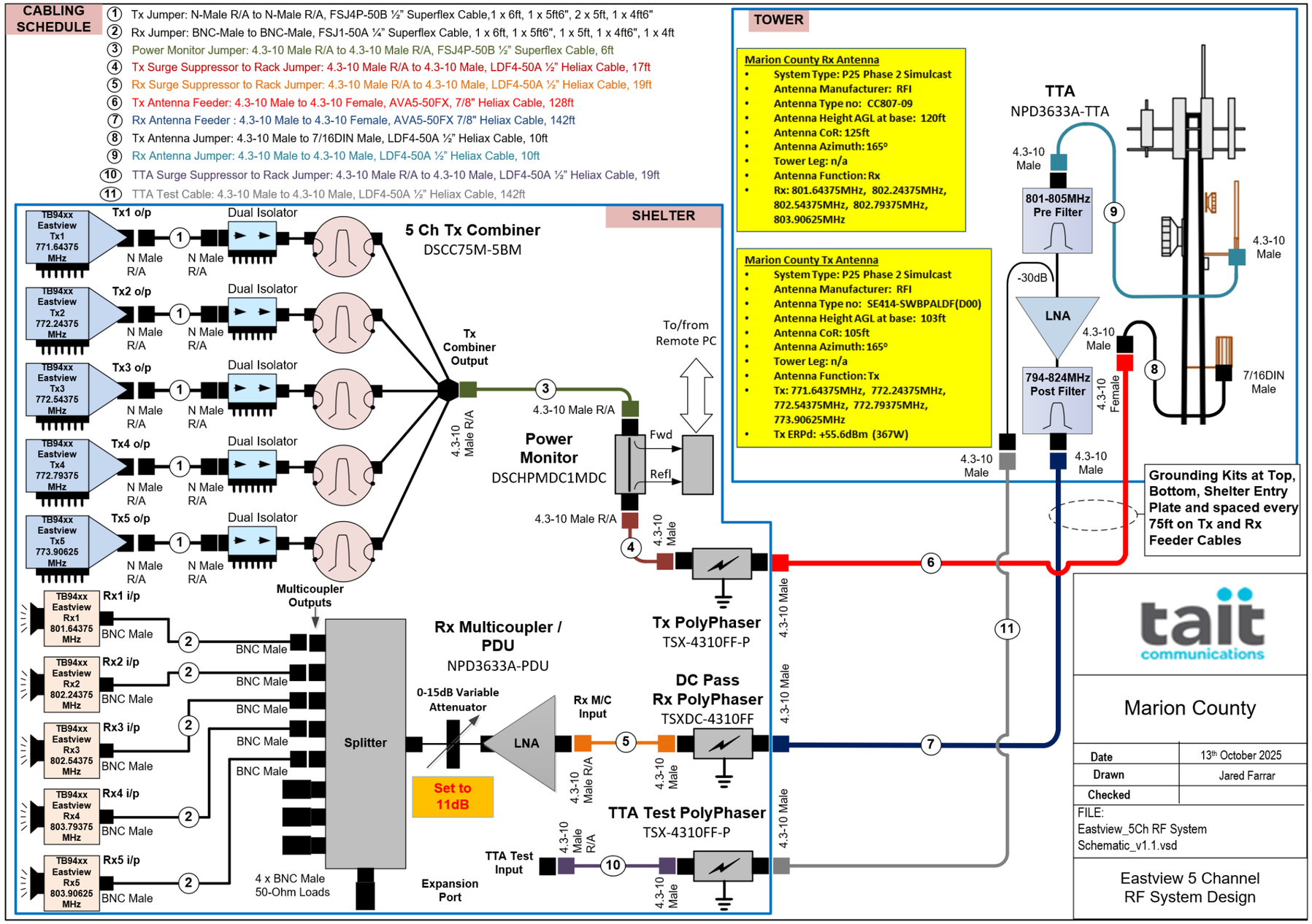
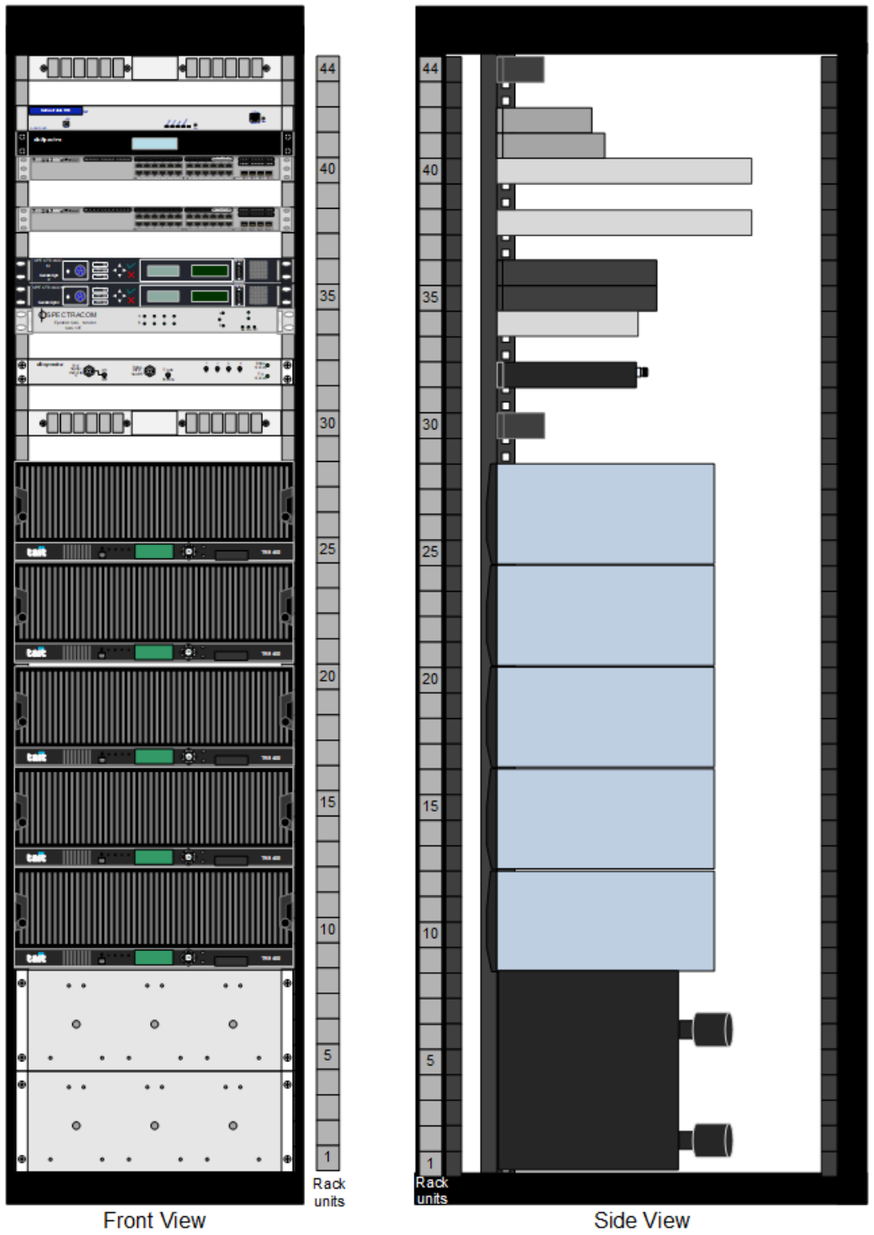


Figure 9: RF System Schematic

12.2 Rack Layout

This section contains the rack layout front & back view, side view and cabling diagram for this site.

700 MHz P25 Phase II Rackup Diagrams



RU	Description	Vendor PN	Vendor	Width (in)	Height (in)	Depth (in)
44	Breaker Panel	9072101001	TRIMM	19	1U	3.25
42	Alarm Panel	M16G2 & D-PK-16PAN	Netguardian	17	1U	6.6
41	Power Monitor	DSCHPMDC	dBSpectra	19	1U	7.5
40	Switch #1	C9300L-24P-4X-A	Cisco	17.5	1U	17.7
38	Switch #2	C9300L-24P-4X-A	Cisco	17.5	1U	17.7
36	Timing Reference	2402-613	Safran	17.1	1U	15.17
35	Timing Reference	2402-613	Safran	17.1	1U	15.17
34	Timing Switch	SAS-17E	Safran	19	1U	13.4
32	Multicoupler	NPD3633A	dBSpectra	19	1U	10.5
30	Breaker Panel	9072101001	TRIMM	19	1U	3.25
25-28	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
21-24	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
17-20	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
13-16	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
9-12	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra	19	8U	12.5

Marion County, OR
700 MHz P25 Phase II

Date	-
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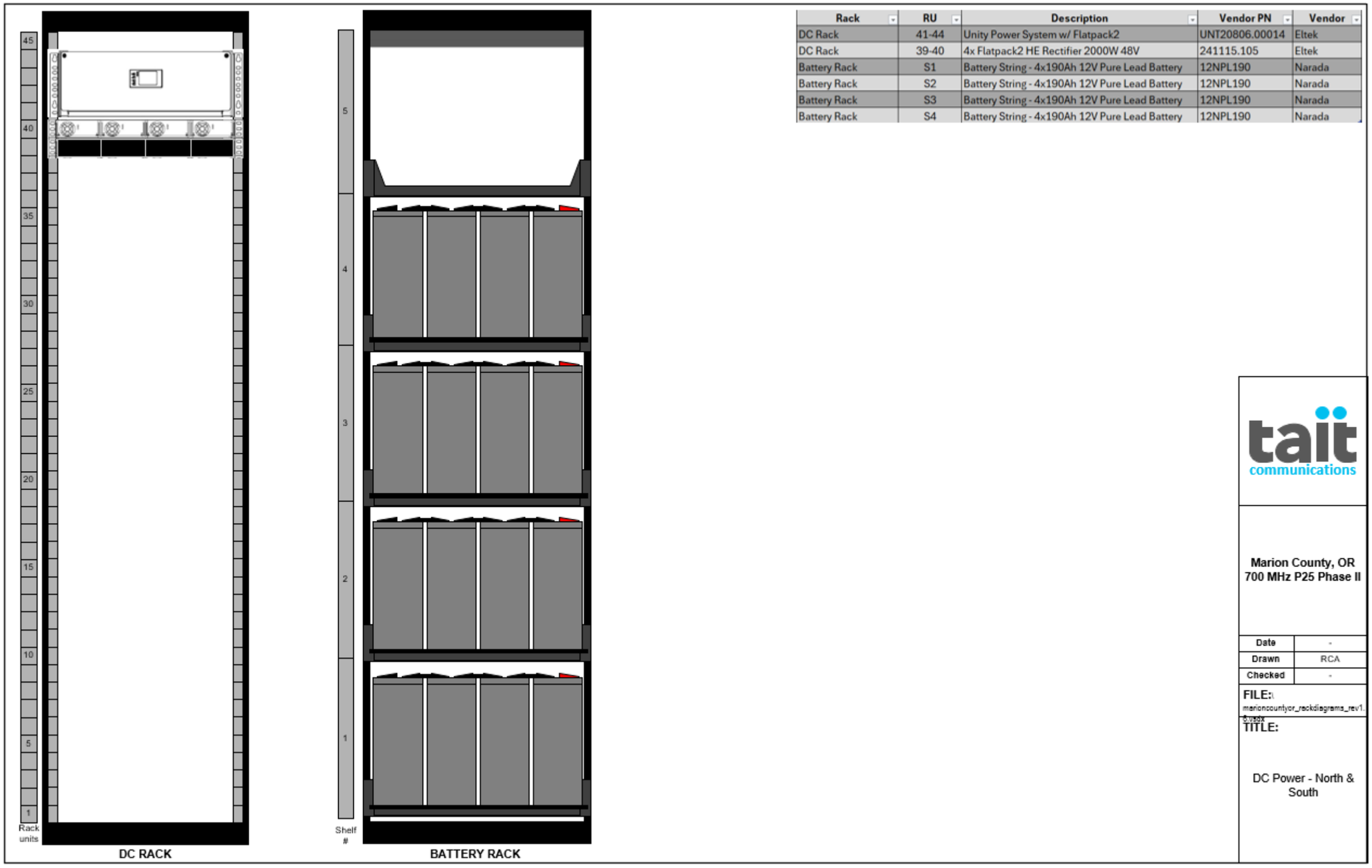
TITLE:

RF_Site_Simulcast

Figure 10: Marion County 19" Rack Layout – RF Front & Side



Rack	RU	Description	Vendor PN	Vendor
DC Rack	41-44	Unity Power System w/ Flatpack2	UNT20806.00014	Eltek
DC Rack	39-40	4x Flatpack2 HE Rectifier 2000W 48V	241115.105	Eltek
Battery Rack	S1	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack	S2	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack	S3	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack	S4	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada

Figure 11: DC Rack

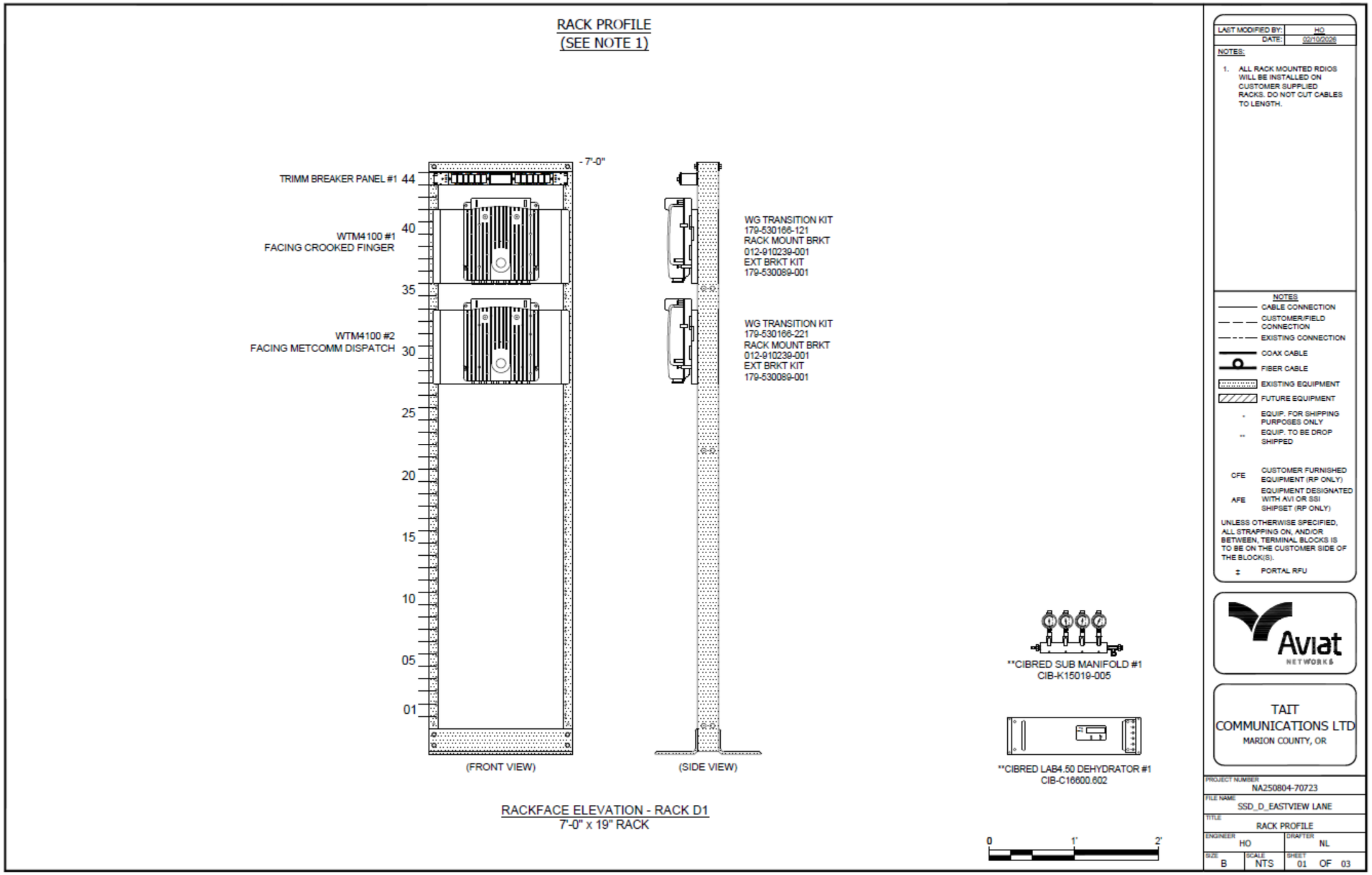
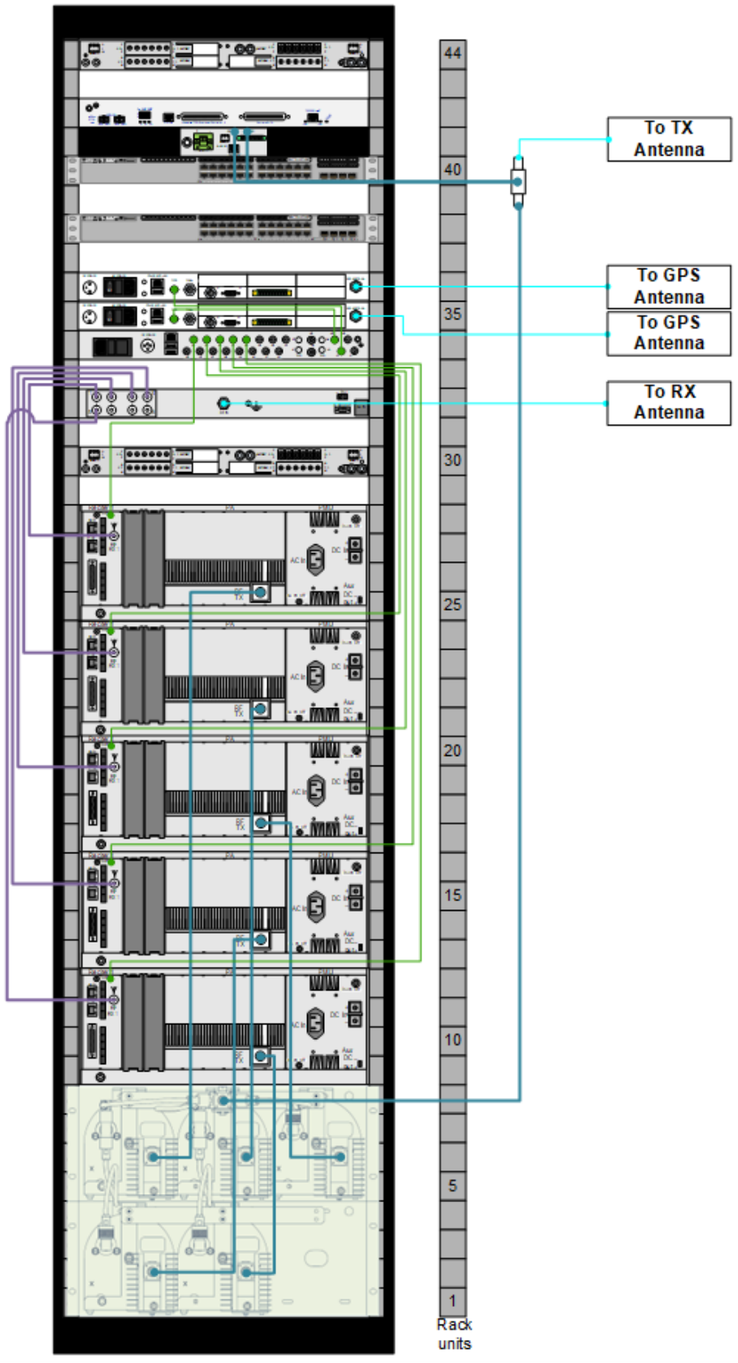


Figure 12 Microwave Rack

700 MHz P25 Phase II
Rackup Diagrams



RU	Description	Vendor PN	Vendor
44	Breaker Panel	9072101001	TRIMM
42	Alarm Panel	M16G2 & D-PK-16PAN	Netguardian
41	Power Monitor	DSCHPMDC	dBSpectra
40	Switch #1	C9300L-24P-4X-A	Cisco
38	Switch #2	C9300L-24P-4X-A	Cisco
36	Timing Reference	2402-613	Safran
35	Timing Reference	2402-613	Safran
34	Timing Switch	SAS-17E	Safran
32	Multicoupler	NPD3633A	dBSpectra
30	Breaker Panel	9072101001	TRIMM
25-28	P25 Trunked Base Station	TB9435S-100T	Tait
21-24	P25 Trunked Base Station	TB9435S-100T	Tait
17-20	P25 Trunked Base Station	TB9435S-100T	Tait
13-16	P25 Trunked Base Station	TB9435S-100T	Tait
9-12	P25 Trunked Base Station	TB9435S-100T	Tait
1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

Marion County, OR
700 MHz P25 Phase II

Date	-
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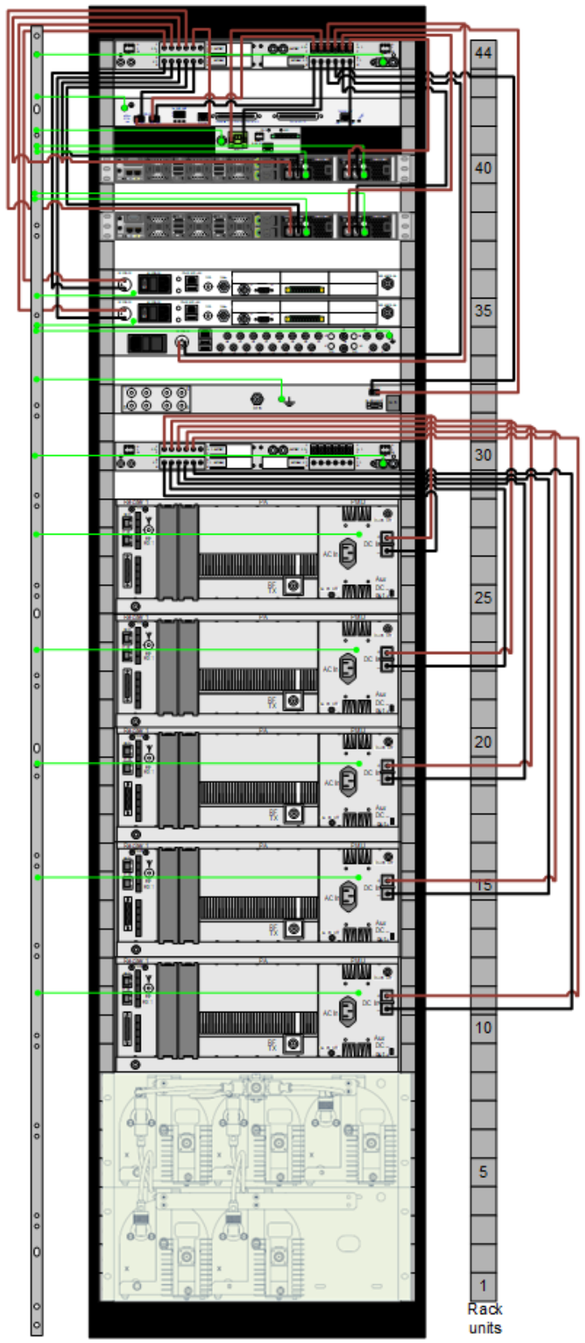
TITLE:

Cabling - RF

Figure 13: Marion County 19" Rack Layout – RF Cabling

700 MHz P25 Phase II
Rackup Diagrams



RU	Description	Vendor PN	Vendor
44	Breaker Panel	9072101001	TRIMM
42	Alarm Panel	M16G2 & D-PK-16PAN	Netguardian
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17-20	P25 Trunked Base Station	TB9435S-100T	Tait
13-16	P25 Trunked Base Station	TB9435S-100T	Tait
9-12	P25 Trunked Base Station	TB9435S-100T	Tait
1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

Description A	Connection A	Description B	Connection B
Breaker Panel 1	A1	GPS 1	-48 VDC
Breaker Panel 1	A2	GPS 2	-48 VDC
Breaker Panel 1	A3	Switch 1-A	-48 VDC
Breaker Panel 1	A4	Switch 2-A	-48 VDC
Breaker Panel 1	A5	Alarm Panel A	-48 VDC
Breaker Panel 2	B1	Alarm Panel B	-48 VDC
Breaker Panel 2	B2	Power Monitor	-48 VDC
Breaker Panel 2	B3	Timing Switch	-48 VDC
Breaker Panel 2	B4	Multicoupler	-48 VDC
Breaker Panel 2	B5	Switch 2-B	-48 VDC
Breaker Panel 2	B6	Switch 1-B	-48 VDC

Marion County, OR
700 MHz P25 Phase II

Date	-
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TITLE:

Cabling - Power

Figure 14: Marion County 19" Rack Layout – Power Cabling

13. PARTS AND EQUIPMENT LISTS

Refer to “Marion County P25 Project - Equipment List by Site.xlsx” for site-specific equipment list.

14. RF PERFORMANCE

14.1 Tx Effective Radiated Power

Table 10 below summarises the transmitter system performance. It shows the required TB9xxx transmitter output power setting, the combining losses (including internal cabling), the antenna feeder loss and finally the resulting ERP relative to a dipole (ERPd).

Transmitter Frequency (MHz)	Transmitter Output Power Setting	Combining Losses (dB)	Misc Losses (dB)	Antenna Feeder Losses (dB)	Tx ERPd
771.64375	+50dBm (100W)	3.2	0.53	1.80	+55.65dBm (367W)
772.24375	+50dBm (100W)	3.2			+55.65dBm (367W)
772.54375	+50dBm (100W)	3.2			+55.65dBm (367W)
772.79375	+50dBm (100W)	3.2			+55.65dBm (367W)
773.90625	+50dBm (100W)	3.2			+55.65dBm (367W)

Table 10: Transmitter Output Power Setting and Effective Radiated Power

14.2 Site Noise

Site Noise in the 700MHz band can be assumed to be negligible.

14.3 Receiver Sensitivity

Table 11 summarises the receiver system performance. It shows the amount of de-sensitisation caused by the elevated site noise floor, the required Rx Multicoupler attenuation setting, and the resulting final Receiver sensitivity that can be achieved.

Receiver Frequency (MHz)	Rx Multicoupler Attenuator Setting (dB)	Rx Sensitivity for DAQ3.4 (dBm)
801.64375	11	-111.2
802.24375		
802.54375		
802.79375		
803.90625		

Table 11: Receiver Sensitivity

15. SITE DESIGN INFORMATION

15.1 Site Plan

The site plan is an overhead view of the overall compound depicting locations of pertinent features.

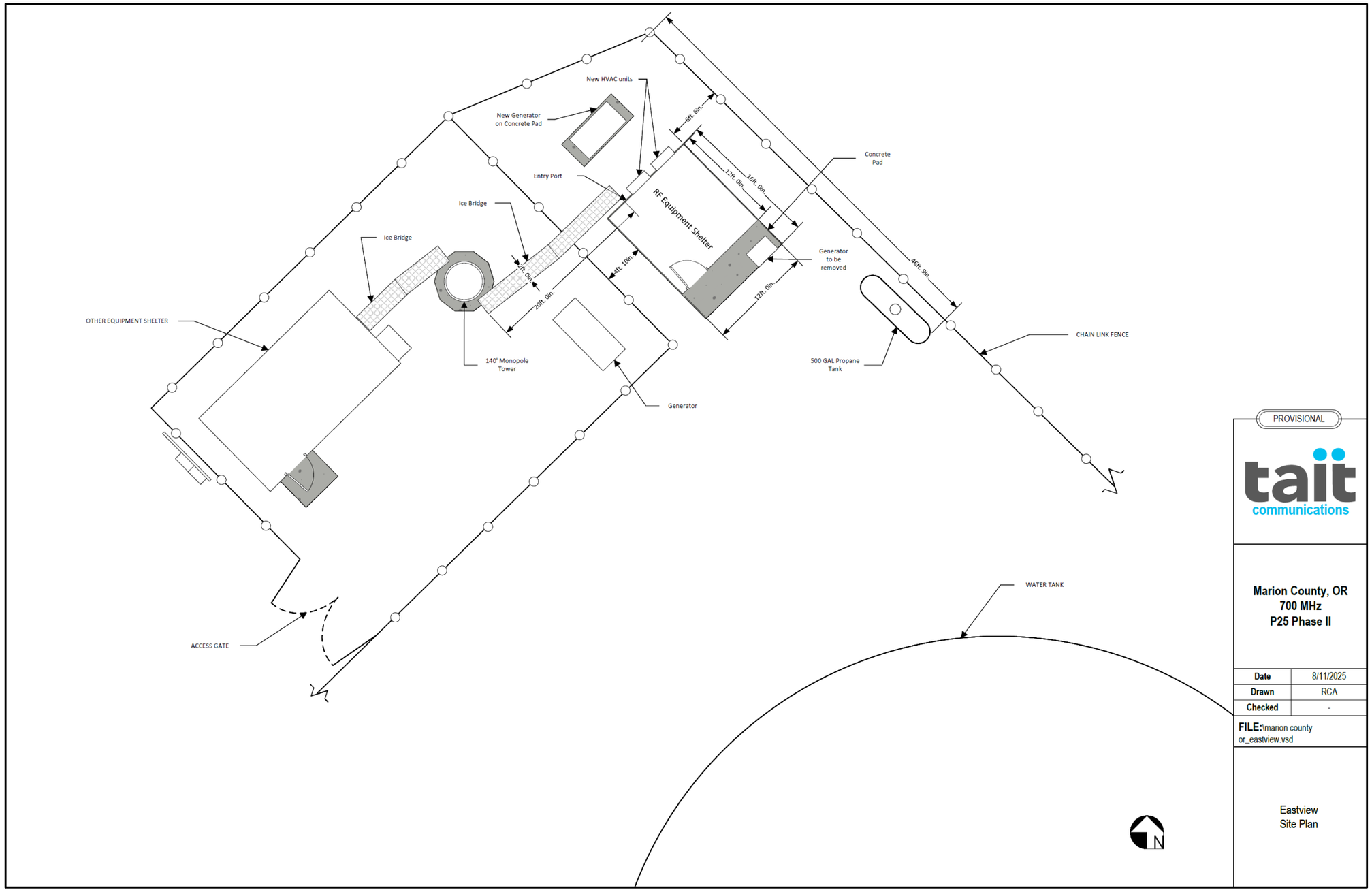

Figure 15: Site Plan

15.2 Floor and Cable Routing Plan

The floor and cable routing plan is an overhead view of the equipment room layout depicting locations of pertinent equipment and including the cable routing plans leading to the tower.

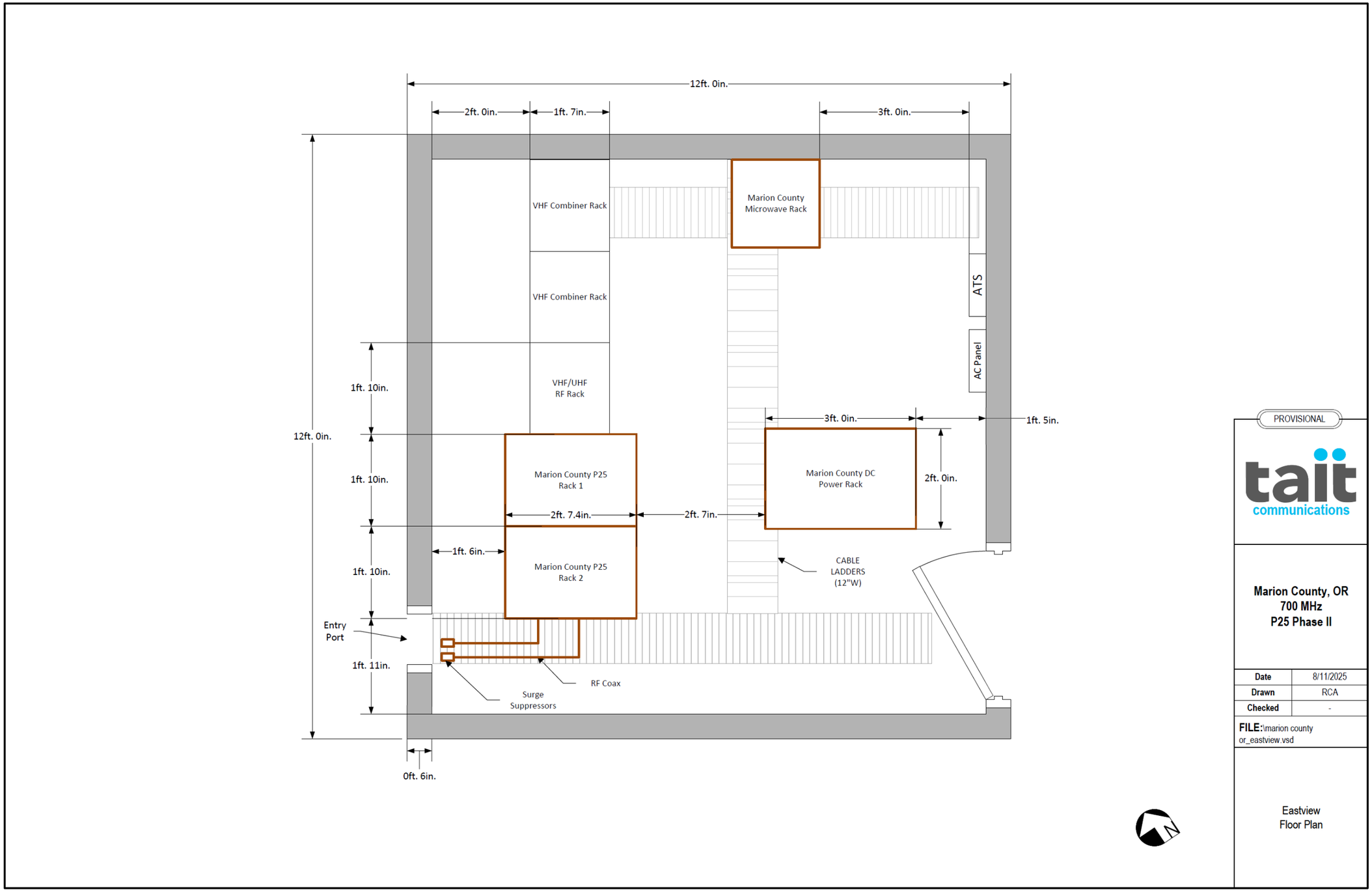

Figure 16: Floor and Cable Routing Plan

15.3 Entry and Exit Ports

The ports where the antenna and TTA cables enter / exit the shelter are shown in the below figure.

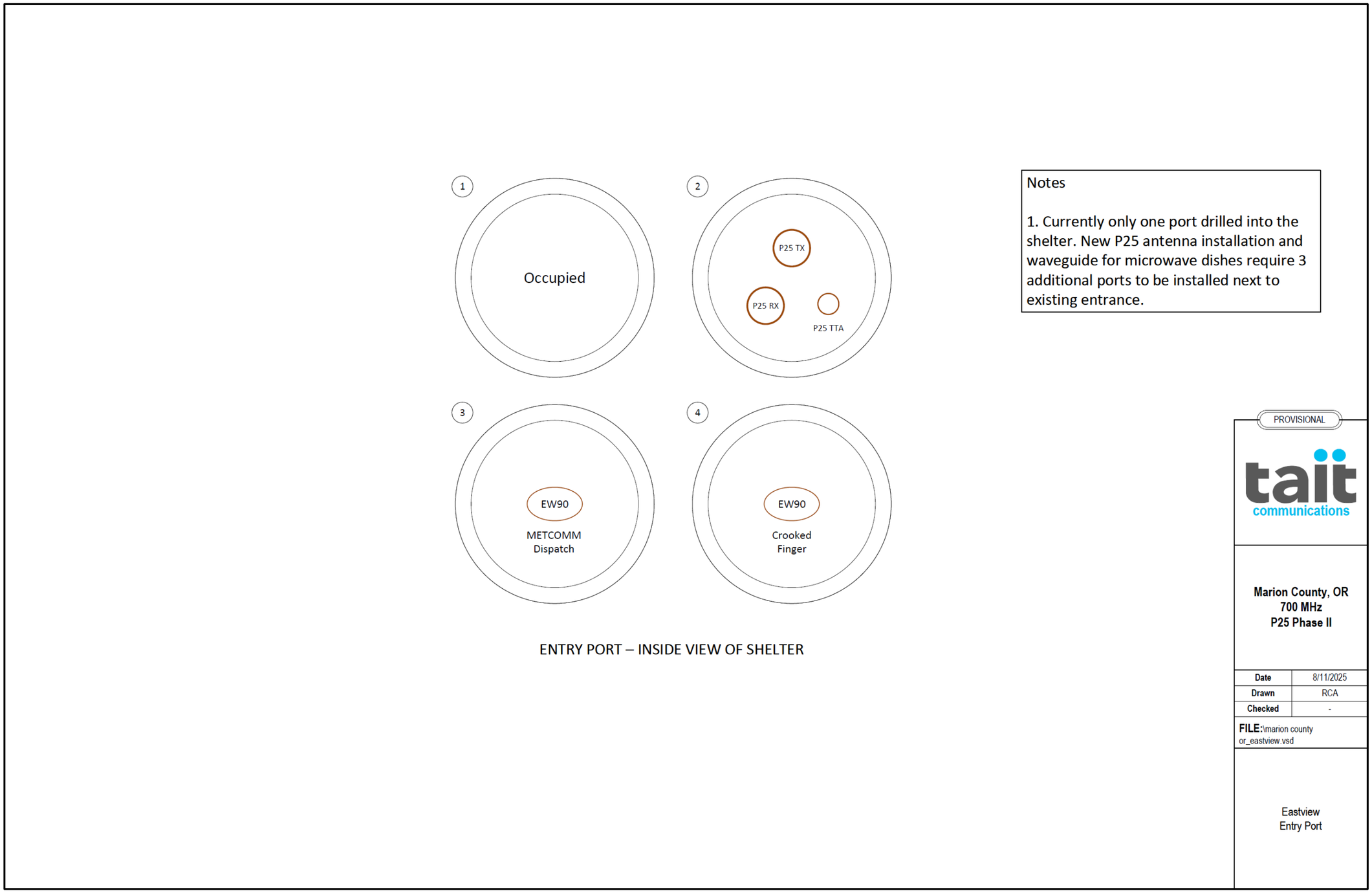

Figure 17: Shelter Cable Entry & Exit Ports

15.3.1 Power & Heat Load Calculations

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Power & Heat Load details.

15.3.2 DC Distribution Fuse Panel

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Fuse Panel details.

Supplemental 6 - Halls Ridge

PROVISIONAL Design Document

RF Sub-System and Site Designs

Marion County

Region: East Cell

Site: Halls Ridge

Issue 1.1 • 1st May 2026

www.taitradio.com

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PREFACE

Project Details

Project number	
Customer	Marion County
Project description	P25 Phase 2 Simulcast & P25 Phase 1 Conventional Simulcast
Business Development Manager	
Sales Engineer	
Project Engineer	Jared Farrar / Riley Alfaqeeh
Project Manager	Stacey Adams (formerly Matt Jordan)
Lead RF Engineers	Ian Graham

Purpose

The Marion County project is an 11 site P25 simulcast design that uses the US 700MHz band. To control Time Delay Interference (TDI), the simulcast design is split into three cells – North, South, and East. The North cell is comprised of four sites with P25 Phase 2 trunked operation, the South cell is comprised of four sites with P25 Phase 2 trunked operation, and the East cell is comprised of three sites with P25 Phase 1 conventional operation.

The purpose of this report is to document the RF subsystem design for the **Halls Ridge** site which forms part of the East simulcast cell.

Scope

This document specifies the frequencies to be utilized at the site and summarizes the intermodulation analysis with these frequencies and other high-level in-band carriers as identified from an FCC license search. The required antenna system and associated RF combining equipment will then be described in full.

Publication Record

Author	Jared Farrar
Issue	1.1
Document Status	Initial Release
Date	12th December 2025

Document Status

Issue	Date	Signature	Comment
0.1	8th October 2025	Jared Farrar	Initial draft
1.0	12th December 2025	Jared Farrar	Initial release
1.1	1st May 2026		

Document Approvals

Approvals	Position	Signature	Date
Bladimyr Guzman	TAM Design Authority		

Associated Documents & References

Reference documentation includes:

- Marion County P25 System Design_v1.1.docx
- Marion County P25 Project - Equipment List by Site.xlsx
- Marion County Power_Heat_Load.xlsx

1. GENERAL RF DESIGN APPROACH

The Marion County project is an 11-site P25 simulcast design that uses the US 700MHz band. To control Time Delay Interference (TDI), the simulcast design is split into three cells – North, South, and East.

The North Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- Crooked Finger
- Crosby
- Eastview
- Parrett Mountain

The South Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- Eagle Crest
- Lower Prospect
- McCully Mountain
- Wipper

The East Cell sites operate in P25 Phase 1 conventional mode and are identified as follows:

- APW
- House Mountain
- **Halls Ridge**

Each site within the North and South Cells will have five trunked P25 Phase 2 channels providing eight dynamic talkpaths (one 12.5kHz FDMA control channel plus four 2-slot 12.5kHz TDMA traffic channels) across each respective cell's coverage area. The East Cell will have five conventional P25 Phase 1 12.5kHz FDMA channels providing five fixed talkpaths across the cell.

Each site across all three cells will have separate transmit (Tx) and receive (Rx) antennas, typically with 20ft vertical separation between centers of radiation. The anticipated low site noise floors in the 700MHz band means Tower Top Amplifiers (TTA) can be used to improve receiver sensitivity and talk-in coverage. Along with the 30MHz Tx-Rx frequency separation, these factors lead to a common RF combining subsystem design which is applicable to all Marion County sites. The combining system requirements were captured based on the proposed frequency plan in coordination with ADCOMM Engineering LLC and Tait subsequently worked with the chosen equipment vendor, dBSpectra, on an optimal design. The main consideration was the TTA where it was decided to use dBSpectra's compact design after it was shown all the required receiver filtering could be accommodated. The generic (starting point) site combining system design therefore features the:

- DSCC75M-5BM 5 Channel Ceramic Tx Combiner
- DSCHPMDC1MDC Channelized Power Monitor
- NPD3633A-TTA Tower Top Amplifier
- NPD3363A-PDU Rx Multicoupler PDU

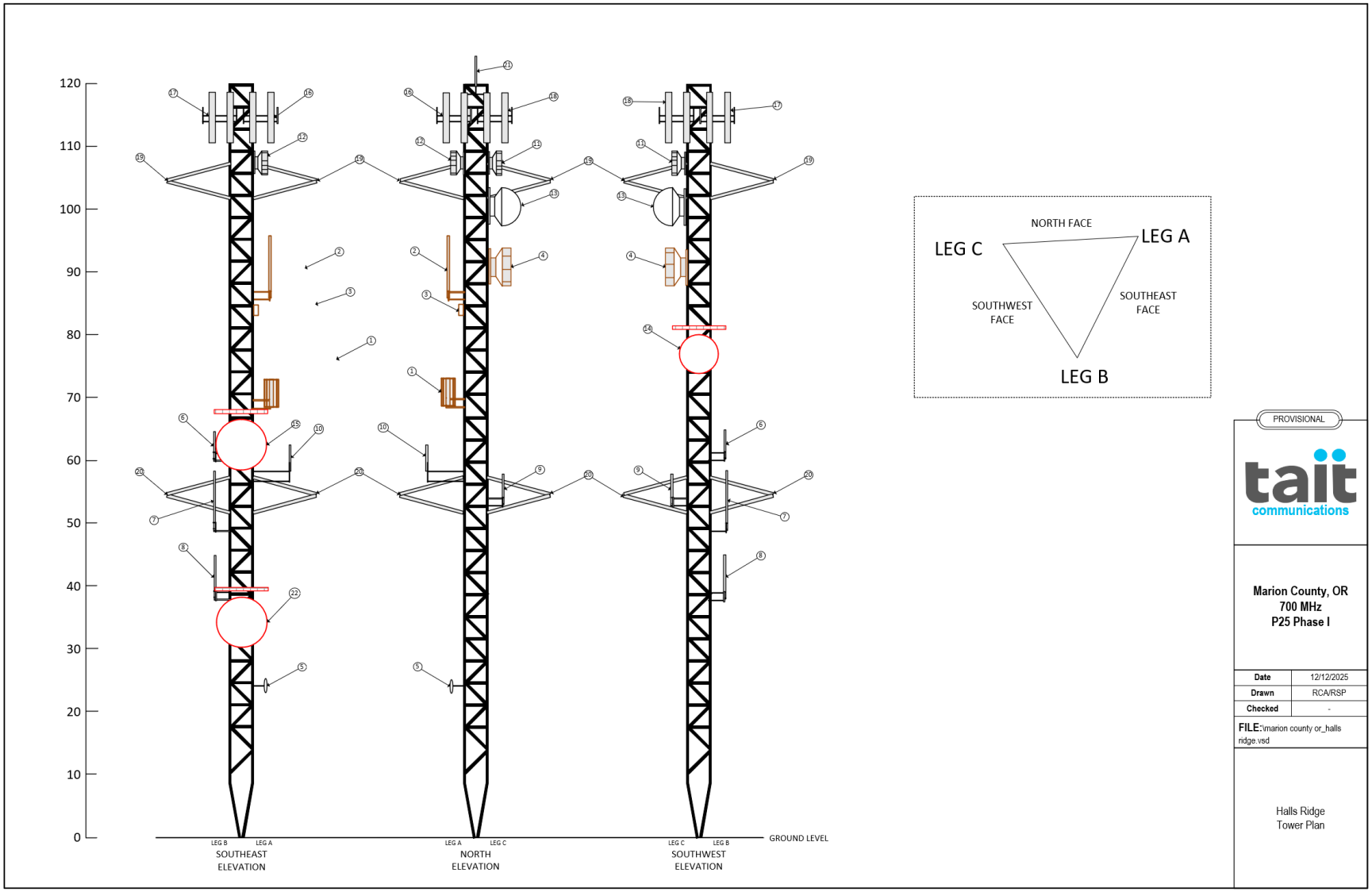
Antennas were chosen on a site-by-site basis to minimize TDI in the simulcast cells while still providing necessary talk-out coverage. The proposed antennas are the:

- Sinclair SE412-SWBPAL
    - 5dBd Low PIM Enclosed Dipole Array
- Sinclair SE414-SWBPAL
    - 8.5 to 11dBd Low PIM Adjustable Beamwidth Enclosed Dipole Array
- RFI CC807-09
    - 9dBd Collinear Omnidirectional

For the Halls Ridge site, the basic design approach will be:

- Install a new SE414-SWBPALDF(D00) transmit antenna at 59ft AGL on Leg ‘A’ (NE) of the 100ft tower, azimuth 90º, beamwidth 90º.
    - The 5 transmit channels will be connected to the Tx antenna using the dBSpectra DSCC75M-5BM Ceramic Combiner.
- Install a new RFI CC807-09 receive antenna at 76ft AGL on Leg ‘A’ (NE) of the 120ft tower, azimuth 90°.
    - The 5 receive channels will be fed from the Rx antenna via the dBSpectra NPD3633A-TTA Tower Top Amplifier and the NPD3633A-PDU Rx multicoupler/PDU

2. TOWER MAPPING



#	Description	Part Number	Length (ft)	Leg/Face	Status	Base Height (ft)	Centerline Height(ft)	Tip Height (ft)	Antenna Azimuth	Mount Azimuth	Mount	Transmission Line Size/Type
1	P25 TX Antenna	SE414-SWBPALDF(D00)	4.4	A	New	59	61	63	90		Site-Pro PSA-6 (6' standoff)	7/8"
2	P25 RX Antenna	CC807-09	10.3	A	New	76	81	86	-		Site-Pro PSA-6 (6' standoff)	1/2" to TTA
3	TTA	NPD3633A-TTA	1.0	A	New	73	74	74	-		Standard	7/8"
4	Microwave - APW	VHLP3-11W	4.0	C	New	88	90	92	290.57	290.57	Standard w/ tieback	EW90
5	Dipole-1	-	1.5	A	Existing	23	24	25			Standoff	
6	Omni-1	DB633 (UHF)	4.7	B	Existing	61	63	65			Standoff	
7	Omni-2	Andrew DB636-C (UHF)	9.5	B	Existing	49	54	59			Standoff	
8	Omni-3	Kathrein Scala OGC6-825N	7	B	Existing	39	42	46			Standoff	
9	Omni-4	Swedcom SPO 9	5	C	Existing	54	56	59			Standoff	
10	Omni-5	SRL-433 (7/8/900 MHz)	5	A	Existing	59	61	64			Standoff	
11	Microwave-1	HPD4-5.2	4	C	Existing	106	108	110			Standard	
12	Microwave-2	HPD4-5.2	4	A	Existing	106	108	110			Standard	
13	Microwave-3	Gabriel SSP6-23 Radome	6	C	Existing	98	101	104			Standard	
14	Microwave-4	HPX6-59-P3A/K w/ice shield	6	Face C-B	To be removed	74	77	80			Standard	
15	Microwave-5	HPX8-59 w/ice shield	8	Face B-A	To be removed	59	63	67			Standard	
16	Panel-1	NHH-85C-R2B panels (x2)	8	A	Existing	111	115	119			Standoff	
17	Panel-2	NHH-85C-R2B panels (x2)	8	B	Existing	111	115	119			Standoff	
18	Panel-3	NHH-85C-R2B panels (x2)	8	C	Existing	111	115	119			Standoff	
19	Guy brackets	-	6	Face B-A, A-C, C-B	Existing	102	105	108			-	
20	Guy brackets	-	6	Face B-A, A-C, C-B	Existing	52	55	58			-	
21	Omni-6	Cyclone 2450-360.15	2	Face A-C	Existing	121	122	123			Standoff	
22	Microwave-6	HPX6-59-P3A/K w/ice shield	6	Face B-A	To be removed	32	35	38			Standard	

= estimated value based on survey documentation and photos

Figure 1: Halls Ridge 120ft Tower Mapping and Appurtenances

3. FREQUENCY PLANNING

5 Channels will be deployed at this site.

The East Simulcast cell uses the following frequencies:

Site Name	FCC Channel Number	Tx Frequency (MHz)	Rx Frequency (MHz)
Halls Ridge	421-422	771.63125	801.63125
	517-518	772.23125	802.23125
	565-566	772.53125	802.53125
	605-606	772.78125	802.78125
	787-788	773.91875	803.91875

Table 1: East Cell Frequency Assignments

4. INCUMBENTS SEARCH

An external high-level carrier (HLC) is defined as a signal that appears at a level of >-40dBm at the receive antenna. These are the signals which have the potential to contribute towards intermodulation that would result in a loss of receiver sensitivity on one or more channels.

Signal and Noise Monitoring of RF activity at the site was not deemed necessary for this project given the wide Tx-Rx frequency separation in the 700MHz band and the anticipated low site noise floors.

To get some idea of potential RF activity at the site, an FCC License Search was carried out to identify any other transmitters operating between 700 and 900MHz located within a 0.6-mile radius of the tower (a typical transmitter emitting 100W ERP at 0.6 miles away would be received at -40dBm assuming free space path loss). These include cellular transmitters (as their wide bandwidth could cause IM energy to spread into the LMR receive band) and are summarized in Table 2 below. *Note that Tx ERPd values for cellular carriers represent the panel sector with the highest licensed maximum ERP.*

Owner	Call Sign	Frequency (MHz)	Tx ERPd (dBm)	Distance from Marion County Tower (miles)
Slater, Alan D	WPBP612	860.5625	52	0
AT&T Mobility Spectrum, LLC	KNKA265	869.04	52.5	0
AT&T Mobility Wireless Operations Holdings Inc.	KNKN461	869.04	52.5	0
New Cingular Wireless PCS, LLC	KNKA754	869.04	52.2	0
New Cingular Wireless PCS, LLC	KNKN231	869.04	52.5	0
AT&T Mobility Spectrum, LLC	KNKA265	879.39	52.5	0
AT&T Mobility Wireless Operations Holdings Inc.	KNKN461	879.39	52.5	0
New Cingular Wireless PCS, LLC	KNKA754	879.39	52.5	0
New Cingular Wireless PCS, LLC	KNKN231	879.39	52.5	0
Cellco Partnership	KNKA446	880.02	54	0
AT&T Mobility Spectrum, LLC	KNKA265	890.01	52.5	0
AT&T Mobility Wireless Operations Holdings Inc.	KNKN461	890.01	52.5	0
New Cingular Wireless PCS, LLC	KNKA754	890.01	52.5	0
New Cingular Wireless PCS, LLC	KNKN231	890.01	52.5	0
Cellco Partnership	KNKA446	891.51	54	0

Table 2: High Level Carriers

5. INTERMODULATION ANALYSIS

An intermodulation (IM) analysis was performed for the potentially significant sources, including both the Marion County channels to be deployed and any HLCs found during the FCC License Search. For antenna configurations using separate transmit and receive antennas Tait best practice is to search for IM products up to 7th order within a defined search window accounting for the fact the bandwidth of IM products spread according to the order and bandwidth of the signals that cause it.

The frequencies included in the IM analysis are listed in Table 3 below.

Transmit Frequencies (MHz)	Receive Frequencies (MHz)
771.63125	801.63125
772.23125	802.23125
772.53125	802.53125
772.78125	802.78125
773.91875	803.91875
860.56250	
869.04000	
879.39000	
880.02000	
890.01000	
891.51000	

Table 3: Frequencies Included in IM Analysis

Table 4 below shows how many IM products are generated on each of the receive frequencies. A direct hit is an IM product that falls exactly at the receive frequency. An indirect hit is one that does not fall exactly at a receive frequency but does fall within the search window. Note that for Halls Ridge a 1.4MHz bandwidth is assumed for the cellular carrier frequencies as this is wide enough on its own to cause a multitude of indirect hits without considering wider cellular channels (e.g., 3, 5, and 10MHz) and would produce the highest power spectral density among all LTE bandwidths. Further, the bandwidth consideration only affects the number of *indirect* hits incurred which are far less consequential than *direct* hits.

IM Order	Number of Intermodulation Products at each Receive Frequency									
	801.64375MHz		802.24375MHz		802.54375MHz		802.79375MHz		803.90625MHz	
	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect
3rd	0	2	1	2	0	1	0	2	0	2
5th	1	57	0	64	1	70	1	75	1	75
7th	3	696	3	759	3	771	0	791	2	834

Table 4: Intermodulation Results Summary

6. ANTENNA SYSTEM DESIGN

The Antenna System detailed here and the RF Combining System described later in sections 7, 8, and 10 have been specifically designed to mitigate any interference caused by the listed high level carriers, thereby maximizing the coverage achieved by the Marion County system.

6.1 Antenna Type

The following antennas will be used at Halls Ridge.

Antenna	Manufacturer	Antenna Model Number	Description	Antenna Length (ft)	Antenna Gain (dBd)
Rx	RFI	CC807-09	Collinear Omni	10	9
Tx	Sinclair	SE414-SWBPALDF(D00)	Enclosed Dipole	4.4	10

Table 5: Antenna Details

800MHz Corporate Collinear Antennas

748-870MHz

CC807 Series

These industry leading, full featured corporate collinear arrays allow site operators to combine, with complete integrity, a large number of communications services into a single, low profile antenna solution.

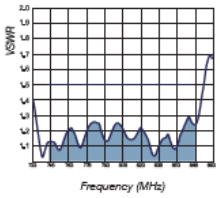
The corporate feed design employed by RFI maintains superior pattern control, allowing gain to be maximised with zero tilt variation over a very broad bandwidth, comparable to that only previously available in exposed dipole array configurations. This is achieved in the preferred form factor of a fully enclosed fibreglass radome, providing a reduction in wind loading, ice loading and tower loading in comparison.

The CC807 series have been designed with an exceptional power rating of 500W across the band as well as a Peak Instantaneous Power (PIP) rating of 25kW to cater for the peak voltage levels present in large multi-carrier combining environments. RFI's refined design processes and proven construction methods achieve a PIM rating of –150dBc, further ensuring performance is maintained for the service life of the antenna.

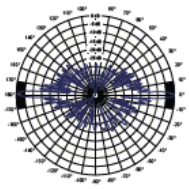
Features:

- 500W Continuous Power rating
- -150dBc Passive Intermodulation (PIM) rating, 100% PIM tested
- 25 kW Peak Instantaneous Power (PIP) rating
- DC grounding on all elements for the ultimate in lightning protection and dissipation of static noise.
- Light weight dipole construction using RFI's patented flexi-PCB architecture, maintains a low centre of gravity reducing tip deflection and sway
- Field invertible (excluding tilt models)
- Preset downtilt variations of 2 and 4 degrees available, see note (1)

Typical VSWR Response (CC807-12)



CC807-12 - E Plane



Electrical Specifications

Model Number	CC807-09-P	CC807-12-P
Nominal Gain *dBd (dBi)*	9.0 (11.1)	11.5 (13.6)
Frequency *MHz*	746-870	
Tuned Bandwidth *MHz*	Full	
VSWR *(Return Loss)*	1.5:1	
Nominal Impedance Ω	50	
Downtilt°	0 Std 2, 4 (1)	
Vertical Beamwidth°	8	4
Horizontal Beamwidth°	Omni +/- 0.5dB	
Input Power W	500	
Passive IM 3rd order (2x20W) *dBc*	-150	
Peak Instantaneous Power *kW*	25	

Mechanical

Model Number		CC807-09-P	CC807-12-P
Construction		Sky blue fibreglass radome	
Radome Diameter mm (inches)		76 (3.0)	
Length mm (inches)		3135 (123.4)	6235 (245.5)
Weight *kg (lbs)*		14 (30.9)	25.5 (56.2)
Termination		Integrated 4.3-10 Female	
Mountaing Area mm (inches)		750 x 90 (30 x 3.5) diameter Ecofilm™ plated aluminium	
Suggested Clamps		3 x UC-114	
Shipping Dimensions *mm (inches)*	H	115 (4.5)	
	W	115 (4.5)	
	L	3335 (131.3)	6435 (253.3)
Shipping Weight *kg (lbs)*		20.0 (44.1)	36.5 (80.5)
Projected area *cm² (ft²)*	No Ice	2597 (2.8)	5559 (6.0)
	With Ice	3192 (3.4)	7037 (7.6)
Lateral Thrust @160km/h *N* (100 mph lbs)		308 (69)	659 (148)
Wind Gust Rating *km/h (mph)*	No Ice	>240 (150)	
Torque @ 160km/h *Nm* (100mph ft-lbs)		413 (305)	1823 (1345)

(1) To order pre-set downtilt versions available, simply add a -T2 or -T4 towards the end of the part number to denote downtilt model required. For eg. CC807-12-T2-P to order CC807-12-P with 2deg of downtilt. Please note: Models with downtilt are NOT field invertible. . Eg. CC807-12-T2-P

P-43021-7

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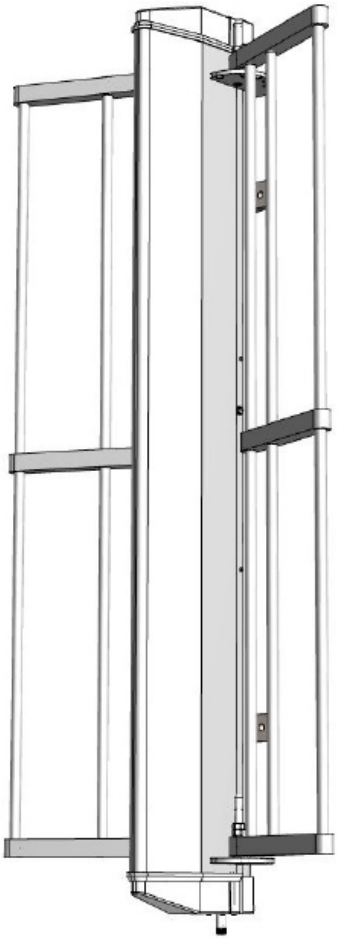
Antennas

700-1000 MHz Antennas

SE414-WBAL - PIM Certified Series

SE414-SWBPAL(YY)(DXX) Enclosed dipole, 8-11.5 dBd, adj. beamwidth, Low PIM, 746-960MHz

- Wide band design covers whole 746-960 MHz band, PIP rated
- Horizontal beamwidth can be adjusted (60º/90º/105º/130º/160º)
- Gain depends on horizontal beamwidth setting (11.5/10/9/8.5/8 dBd)
- PIP rated and low PIM



One wideband antenna for your 700, 800, 900 MHz systems. Sinclair's SE414-WBL series of enclosed dipole arrays offer excellent intermodulation performance covering 746-960 MHz in a single antenna. These highly versatile antennas are particularly well suited to communication systems where a specific coverage pattern is required. These include cellular systems, trunked radio, paging, and data transmission, where predictable and highly reliable performance is a must.

The SE414-WBAL series come with field adjustable reflectors that provide horizontal beamwidths between 60 and 160 degrees. The creative design and construction permits excellent pattern control and greater efficiency.

When ordering, please refer to the chart below for the model number. Different configurations are subject to various list prices. Please contact your Sinclair Sales Representative or Customer Service Representative for more information.

Model Number	Connector	Downtilt	PIM(dBc)	PIP(kW, max)
SE414-SWBPALDF(D00)	7/16 DIN(F)	0º	<-150	25
SE414-SWBPALDF(D01)	7/16 DIN(F)	1º	<-150	25
SE414-SWBPALDF(D02)	7/16 DIN(F)	2º	<-150	25
SE414-SWBPALDF(D03)	7/16 DIN(F)	3º	<-150	25
SE414-SWBPALDF(D04)	7/16 DIN(F)	4º	<-150	25
SE414-SWBPALDF(D05)	7/16 DIN(F)	5º	<-150	25
SE414-SWBPALDF(D06)	7/16 DIN(F)	6º	<-150	25
SE414-SWBPALNF(D00)	N(F)	0º	<-139	N/A
SE414-SWBPALNF(D01)	N(F)	1º	<-139	N/A
SE414-SWBPALNF(D02)	N(F)	2º	<-139	N/A
SE414-SWBPALNF(D03)	N(F)	3º	<-139	N/A
SE414-SWBPALNF(D04)	N(F)	4º	<-139	N/A
SE414-SWBPALNF(D05)	N(F)	5º	<-139	N/A
SE414-SWBPALNF(D06)	N(F)	6º	<-139	N/A

SINCLAIR
Superior then, Superior now.
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Antennas
700-1000 MHz Antennas
SE414-WBAL - PIM Certified Series

Electrical Specifications

Frequency Range	MHz	746 to 960	
Bandwidth	MHz	214	
Gain (nominal)	dBd (dBi)	11.5 (13.6)	*1
Input VSWR (max)		1.5:1	
Polarization		vertical	
Impedance	Ω	50	
Pattern		Directional and Adjustable	
Horizontal beamwidth (typ)	degrees	60	*2
Vertical beamwidth (typ)	degrees	20	
Average Input Power (max)	W	500	
Front-to-back ratio (min)	dB	20	
Grounding		All metal parts DC-grounded	

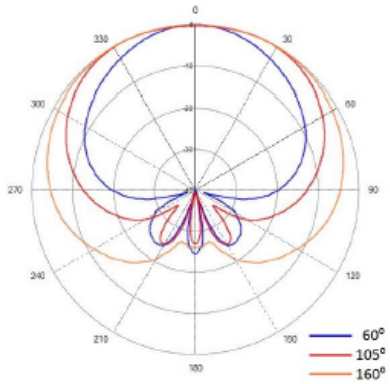
Notes
*1 : Dependant on reflector setting 10/9/8.5/8 dBd
*2 : 90/105/130/160
*3 : 90° beamwidth configuration, clamp not included in measurement
*4 : 90° beamwidth configuration, clamp not included in measurement
*5 : Ref. clamp maximum

Mechanical Specifications

Width	in (mm)	25 (635)	*3
Depth	in (mm)	8.5 (216)	*4
Length/ Height	in (mm)	53 (1346)	
Base pipe diameter	in (mm)	2.88 (73)	*5
Base pipe mounting length	in (mm)	30.5 (775)	
Radiating element material		prntd circuit bd	
Weight	lbs (kg)	23 (10.44)	
Mounting Hardware (Included)		#130 clamp	
Mounting configurations		upright	
Actual shipping weight	lbs (kg)	28 (12.71)	
Shipping dimensions	in (mm)	58x14x17 (1473x356x432)	

Environmental Specifications

Temperature range	°F (°C)	-40 to +140 (-40 to +60)
Wind Loading Area (Flat Plate Equivalent)	ft² (m²)	4.8 (0.45)
Wind Loading Area (1/2" ice)	ft² (m²)	5.7 (0.53)
Rated wind velocity (no ice)	mph (km/h)	155 (250)
Rated wind velocity (1/2" radial ice)	mph (km/h)	140 (225)
Lateral Thrust (100 mph No Ice)	lbs (N)	180 (800.6)
Torsional moment (100 mph No Ice)	ft-lbs (Nm)	93 (125.6)



Horizontal

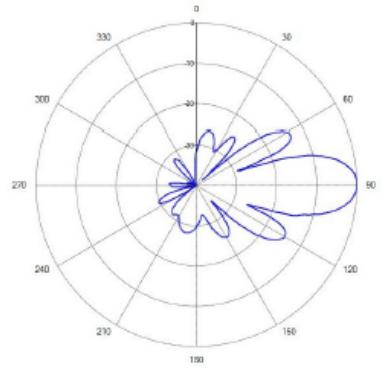

Vertical, 0° downtilt

Figure 2: Antenna Datasheet

6.2 Antenna Mounting Locations

Table 6 below specifies the Marion County antenna mounting location details.

Antenna	Mounting Height (feet AGL)	Antenna Orientation (degrees)	Tower Leg	Standoff Length (feet)	Standoff Orientation (degrees)	Standoff Model
Receive	61	90	A (NE)	6	90	Site-Pro PSA-6
Transmit	81	90	A (NE)	6	90	Site-Pro PSA-6

Table 6: Antenna Mounting Locations

The antenna system design for this site is given in Figure 3.

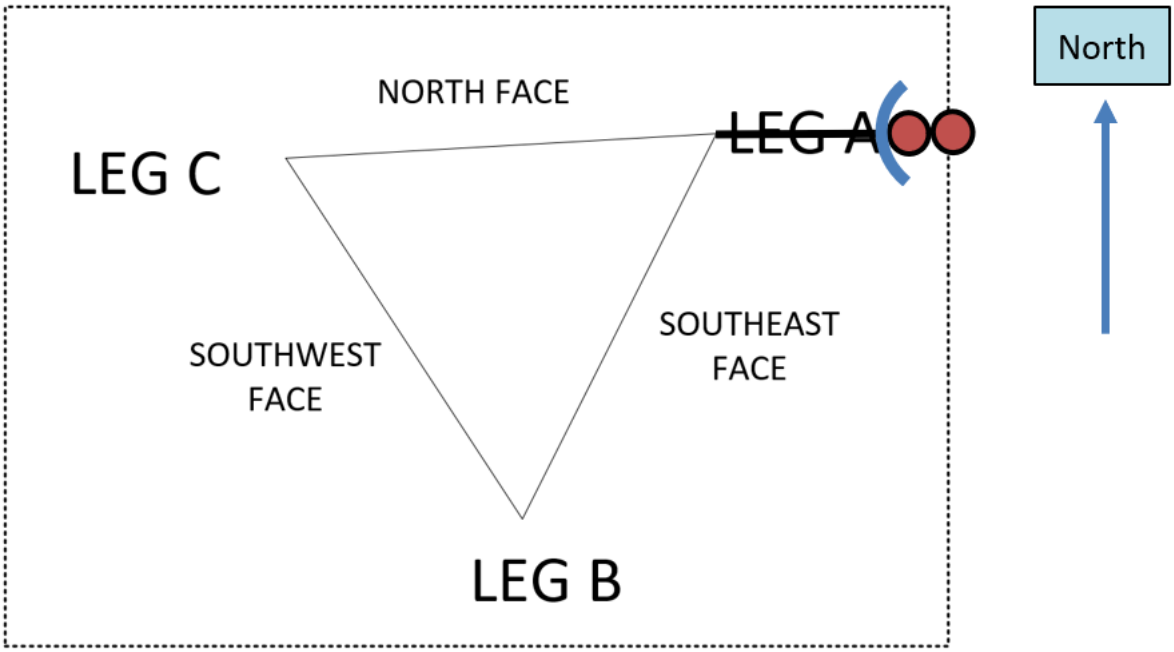


Figure 3: Antenna System Design

6.3 Antenna Isolation

The Transmit and Receive antennas are vertically separated by 20ft (no horizontal component) which gives an isolation between them of **75.8dB**. A figure of **60dB** will be assumed in subsequent calculations, though, as that is often the limit of what can be practically achieved (e.g., mounting imperfections, mechanical drift due to wind/ice loads or aging hardware).

7. TRANSMITTER COMBINER DESIGN

7.1 RF Connectors

The antenna output of the combiner is fitted with **4.3-10 female** connector to minimize Passive Intermodulation (PIM).

The transmitter input ports of the combiner are fitted with **N Type female** connectors.

7.2 Cavity Filters

Filtering in the Tx Combiner is predominantly bandpass.

A combination of band-pass and band-reject filtering is sometimes to provide extra rejection at specific site Rx frequencies, but band-reject filters are never used alone.

The cavity filters provide the minimum attenuation at the closest receive frequency equal to or greater to the value specified in section 7.9 of this document.

7.3 Isolator

A dual Isolator is included between the output of each transmitter and the Tx Combiner input port.

The isolator load closest to the Tx Combiner input port is rated at a minimum of **100 watts**.

7.4 Maximum RF Power

The Tx combiner supports a maximum of **100 watts** of RF input power per channel.

7.5 Minimum Tx to Tx Frequency Separation

The minimum frequency separation allowed between transmitters sharing the same combiner is **250kHz**.

7.6 Maximum number of Transmitters per combiner

Standard Tait practice is a maximum of four transmitters per Tx combiner. But in this case, the relatively wide Tx-Tx spacing and the fact that self-TxIM does not occur renders the penalty in combining all five transmitters together negligible.

7.7 Maximum Tx Combiner Loss per Channel

The insertion loss shall be minimized to the extent possible while complying with all other specifications.

The Tx Combiner insertion loss per Tx channel (not including associated Tx antenna feeder cable losses) will be around **3.2dB** for the Tx-Tx frequency separation at this site.

7.8 Tx Intermodulation Suppression

Transmitters that cause intermodulation on any site receive frequency must not be connected to the same combiner.

However, there is still a responsibility to keep the site as ‘clean’ as possible for its incumbents. To that end, the levels of intermodulation products generated in the combiner are controlled by a requiring a minimum isolation

between the outputs of combined transmitters of **at least 60dB**. This figure includes the reverse isolation of the isolator and any additional attenuation provided by the cavity filters in neighboring branches.

7.9 Tx Sideband Noise Suppression

In addition to the Tx – Rx antenna isolation, the Tx Combiner provides the suppression required to reduce transmitter sideband noise at the Rx antenna to the level where it causes no more than 1dB of receiver de-sensitization. The transmitter sideband noise suppression required at this site is given in Table 7 below.

Transmit Frequency (MHz)	Offset to Nearest Receive Frequency (MHz)	Sideband Noise Suppression Required at Offset (dB)
771.63125	30.0000	13
772.23125	29.4000	14
772.53125	29.1000	14
772.78125	28.8500	14
773.91875	27.7375	14

Table 7: Transmitter Combiner Sideband Noise Rejection Requirements

8. RECEIVER SUBSYSTEM DESIGN

8.1 RF Connectors

8.1.1 Tower Top Amplifier

The Rx Filter input is fitted with a **4.3-10 female** connector.

The Rx Filter output is fitted with a **4.3-10 female** connector.

8.1.2 Receiver Multicoupler/PDU

The Rx Multicoupler input is fitted with a **4.3-10 female** connector.

The receiver output ports of the Rx Multicoupler are fitted with a **BNC Female** connector.

8.2 Receiver Subsystem Topology

The Receiver Subsystem will utilize a Tower Top Amplifier (TTA, which includes the receiver filtering) to optimize talk-in coverage followed by a multicoupler/PDU system that further amplifies and splits the received signal between the connected receivers.

8.3 Receiver Filtering

The Receiver Filters will pass the 801 to 805MHz part of the 700MHz band used for the Marion County system while fully rejecting associated transmit signals in both the 700MHz and 800MHz Tx bands. This is important because combinations of transmitters in both bands can result in 7th order IM falling within the 700MHz receive band.

8.3.1 Blocking Rejection

Between them, the Receiver Filters must provide enough attenuation so that no more than 1dB of de-sensitization of any of the connected receivers occurs due to receiver blocking. The attenuation required at this site to prevent receiver blocking due to the Marion County transmitters and external interferers found during FCC database search is given in Table 8 below:

	Tx Name	Tx Frequency (MHz)	Minimum Rejection in Rx Filter at Tx Frequency (dB)				
			Rx1 (MHz)	Rx2 (MHz)	Rx3 (MHz)	Rx4 (MHz)	Rx5 (MHz)
			801.63125	802.23125	802.53125	802.78125	802.91875
Transmitters	Tx1	771.63125	23	23	23	23	23
	Tx2	772.23125	23	23	23	23	23
	Tx3	772.53125	23	23	23	23	23
	Tx4	772.78125	23	23	23	23	23
	Tx5	773.91875	23	23	23	23	23
	WPBP612	860.5625	32	32	32	32	32
	LTE_1	869.04	32	32	32	32	32
	LTE_2	879.39	32	32	32	32	32
	LTE_3	880.02	34	34	34	34	34
	LTE_4	890.01	32	32	32	32	32
	LTE_5	891.51	34	34	34	34	34

Table 8: Receiver Filter Blocking Rejection Requirements

8.3.2 Receiver Intermodulation Rejection

The Rx Filter must provide enough attenuation so that no more than 1dB of de-sensitization of any of the connected receivers occurs due to intermodulation.

Because it is uncertain whether the offending cellular signals transmit from the panels mounted on the neighboring monopole or are collocated on the 120ft. ATC guyed tower on which the Marion County antennas are to be installed, the scenario of worst isolation between the two is considered.

In the case of the monopole, it is situated approximately 100ft. away from the guyed ATC yielding a Friis Free Space Path Loss (FSPL) of approximately 61dB at the frequencies under consideration. In reality, the isolation is much greater due to the eastward directionality of the highest ERP panels per the FCC licenses. Notwithstanding, 61dB will be the assumed isolation.

In the case of the panels collocated on the ATC tower, there is a 35ft. vertical separation between the panels and the Marion County Rx antenna. This yields an approximate isolation of 88dB.

Given that the former is more pessimistic, 61dB was the isolation considered to obtain worst-case ERPd levels of these signals experienced at the location of the Marion County Rx antenna. In this hypothetical stress test, there is only one 3rd Order IM Mechanism, comprised exclusively of fundamentals, which warrants filter rejection beyond the values determined for receiver blocking alone: (Marion County Tx4) + (890.0100) – (860.5625) resulting in a direct hit on Marion County Rx2.

The attenuation required of the filtering at this site to prevent receiver intermodulation due to the Marion County transmitters and external interferers based on this extreme scenario while also contending with receiver blocking is given in Table 9 below. Note that the dBSpectra TTA provides more than sufficient attenuation to meet both the blocking rejection and intermodulation rejection requirements.

	Tx Name	Tx Frequency (MHz)	Minimum Rejection in Rx Filter at Tx Frequency (dB)				
			Rx1 (MHz)	Rx2 (MHz)	Rx3 (MHz)	Rx4 (MHz)	Rx5 (MHz)
			801.63125	802.23125	802.53125	802.78125	802.91875
Transmitters	Tx1	771.63125	23	23	23	23	23
	Tx2	772.23125	23	23	23	23	23
	Tx3	772.53125	23	23	23	23	23
	Tx4	772.78125	23	23	23	23	23
	Tx5	773.91875	23	23	23	23	23
	WPBP612	860.5625	32	32	32	32	32
	LTE_1	869.04	32	32	32	32	32
	LTE_2	879.39	32	32	32	32	32
	LTE_3	880.02	34	34	34	34	34
	LTE_4	890.01	32	50	32	32	32
	LTE_5	891.51	34	34	34	34	34

Table 9: Receiver Filter Intermodulation Rejection Requirements

8.4 Low Noise Amplifiers

Low Noise Amplifiers (LNAs) with appropriate gain and noise figure will be included in the receiver sub system to ensure that the cascade noise figure of the line up from the base of the receive antenna up to and including the base station receiver is equal to or less than 5dB. In the case of Halls Ridge, this noise figure can be improved to approximately **4.0dB** while maintaining linearity of the receive system lineup.

The output third order intercept of the LNAs will be ≥ +40dBm to maintain the linearity of the system.

8.5 Variable Attenuator

A Variable Attenuator will be fitted in the Rx Multicoupler/PDU for field optimization of the receiver subsystem gain, noise figure, and IP3. The attenuator has an adjustment range of 0dB to 15dB, in 0.25dB steps. To achieve a noise figure of 3.9dB, the variable attenuator shall be set to **8dB**.

Setting of the attenuator value must be done electronically so as not to require disassembly of the multicoupler equipment.

8.6 Receiver Ports

To allow for future expansion, the Rx Multicoupler will have 8 ports

All unused ports will be terminated in a 50-ohm load.

9. POWER MONITOR

The dBSpectra DSCHPMDC1MDC Power Monitor will be used within the Marion County RF systems. This is placed at the output of the Tx Combiner and allows remote monitoring of channelized transmitted power and antenna VSWR. The major benefit is early warning of antenna system degradation so that repairs can be made before failure occurs.

DSCHPM-Series (VHF, 220, UHF, 700/800/900 MHz)
SMART Channelized Transmit Power Monitor with Front Panel Display Option

dbSpectra
Always a Better Value

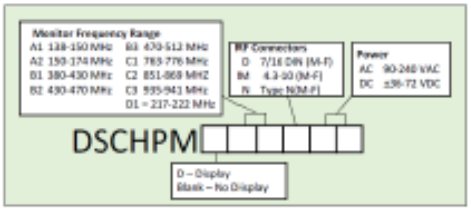
DSCHPM Power Monitor with front panel display option.

Directional coupler for installation on combiner output.

Features and Benefits

- *Per-channel and composite* measurement of forward and reflected RF power with the SMART Channelized RF Power Monitor.
- Calculates and displays combiner insertion loss for each channel.
- All measurements are displayed with 95% accuracy.
- IP network connection and designed-in web server for web browser interface.
- Full remote configuration, monitoring and data logging.
- Optional front panel display with Navigation Keys for monitoring only.
- User-defined alarm thresholds are indicated by alarm relay closure or by SNMP protocol on the network.
- Optional temperature sensors for equipment and ambient temperature measurements and alarms.
- Compact single rack unit mounting with remote RF sensor for flexibility in mounting locations.

Ordering Information



Notes:
1. Factory calibrated using a P25 LSM signal source, may be calibrated in the field for improved accuracy.
2. Contact dbSpectra at tech@dbspectra.com for additional information on optional temperature sensor feature.

Specifications

Electrical Specifications	
Frequency Range, MHz	See Ordering Information
Minimum TX to TX Separation	50 kHz
Maximum Power Input	600 Watts (directional coupler)
System Type	Digital or analog
Insertion Loss	< 0.1 dB
PIM Rating	-150 dBc
Channelized Power Measurements	Forward /reflected power of individual channels: Watts, dBm, VSWR, Return Loss, Combiner Insertion Loss
Power Requirements	AC Model 90-240 VAC 15W, or DC model ±36-72 VDC 15W
IP Interface	IPV4, with TLS security layer, SNMP v2c/v3 alarm protocol
Alarms	Form C contacts or SNMP v2c/v3
User Interface	Web browser or remote SNMP system manager. Front Panel Display (optional) for Monitoring only.
Temperature Range	-30 to +60 °C
Mechanical Specifications	
Mounting Dimensions	1 RU, 1.75 X 19 in. (44 X 483 mm) 7.5 in. (191 mm) deep
Construction / Finish	Aluminum / protective finishes
Directional Coupler Connectors Input Output Coupled Ports	 7/16 DIN, 4.3-10 or N(male) 7/16 DIN, 4.3-10 or N(female) MCX type push-on with two 4 ft RD316 cables supplied.
Power Connector	AC model: IEC 320-C13 inlet & cord DC model: 2 port terminal block
Ethernet Connector	RJ-45
Alarm Closures Connector	3 port pluggable terminal block
Temp. Sensor Connector	24-pin header male pins
Net Weight	4.6 lbs. (2.1 kg)
Shipping weight	6.1 lbs. (2.8 kg)

Typical Application

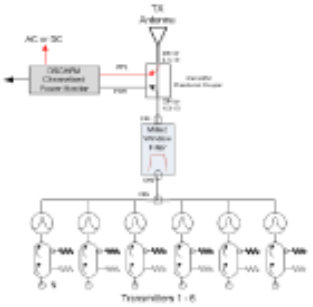


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Figure 4: DSCHPMDC1MDC Channelized Power Monitor

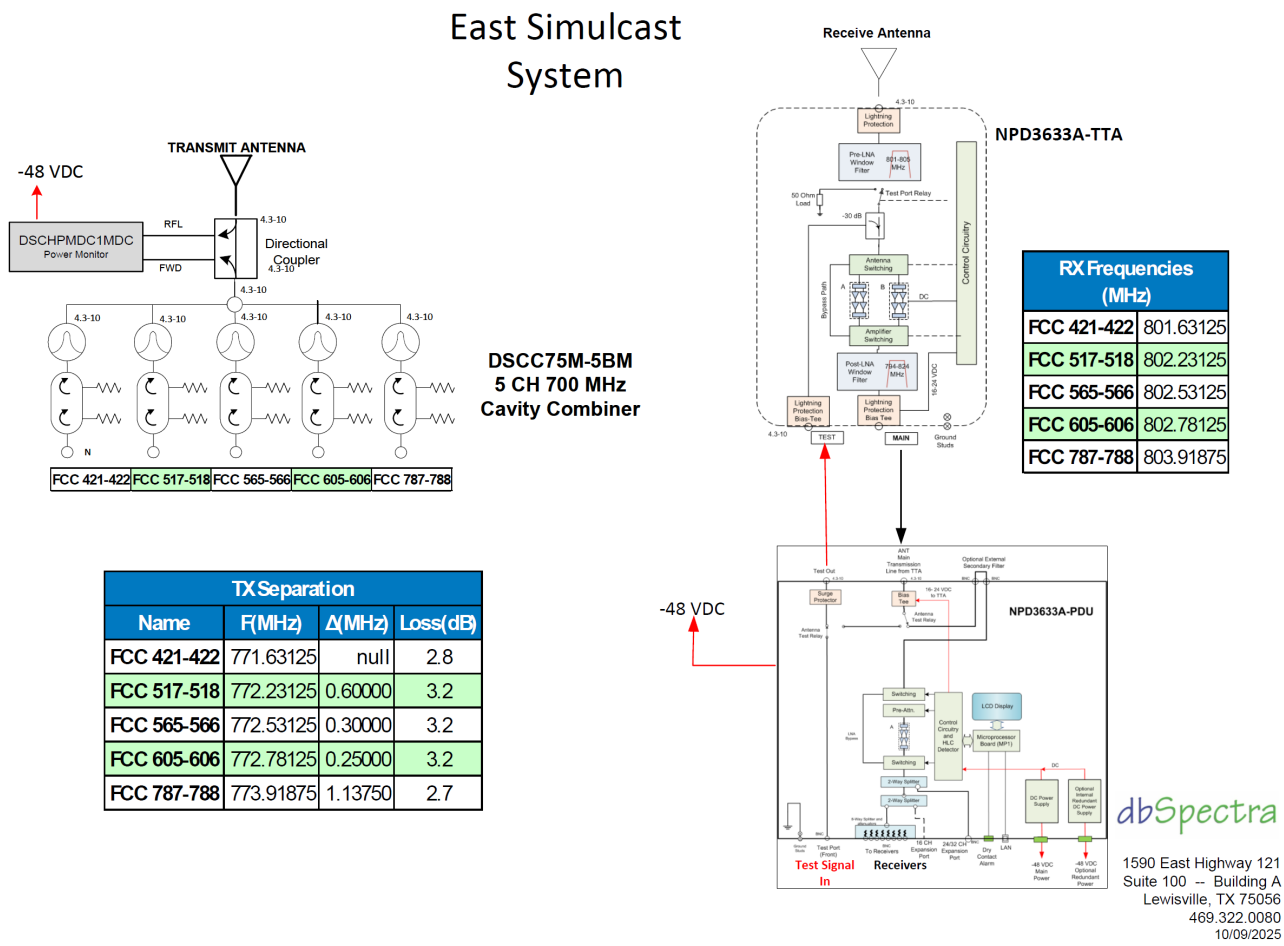
10. RF SUB-SYSTEM DESIGN

Tait have worked with dBSpectra to develop a generic combining system for the Marion County project that meets the performance goals derived in sections 7 and 8 of this report and thereby maximizes the talk in and talk out coverage of the system.

The transmit side of the RF sub-system consists of a 5-channel cavity filter based ceramic combiner to minimize losses and maximize the transmitted power and talk out coverage from the site. The cavity filters meet or exceed the Tx sideband noise filtering requirements given in section 7.9.

The receive side features a compact Tower Top Amplifier (TTA) followed by a Receiver Multicoupler/PDU that allows the receiver sensitivity to be optimized and distributes the signal to the five connected receivers. All the receive filtering is accommodated within the TTA. There are two filters, one before the LNA to preselect the 801 to 805MHz part of the band used by the Marion County system (see Figure 6), and a second after the LNA that fully rejects the Marion County system transmit signals, and the other 700 and 800MHz HLCs identified from the FCC database search (see Figure 7). Together, the filters meet or exceed the receiver blocking and receiver intermodulation filtering requirements given in sections 8.3.1 and 8.3.2. There are two LNAs, one in the TTA and one in the Rx Multicoupler/PDU with gains, noise figures and intercept points optimized so the cascade noise figure and linearity of the receiver line up meet the requirements of section 8.4.

A block diagram of the East Cell combining system design is shown in Figure 5 below:



RX Frequencies (MHz)	
FCC 421-422	801.63125
FCC 517-518	802.23125
FCC 565-566	802.53125
FCC 605-606	802.78125
FCC 787-788	803.91875

TX Separation			
Name	F(MHz)	Δ(MHz)	Loss(dB)
FCC 421-422	771.63125	null	2.8
FCC 517-518	772.23125	0.60000	3.2
FCC 565-566	772.53125	0.30000	3.2
FCC 605-606	772.78125	0.25000	3.2
FCC 787-788	773.91875	1.13750	2.7

Figure 5: SPD3454C-4TR Dual Band RF Combining System

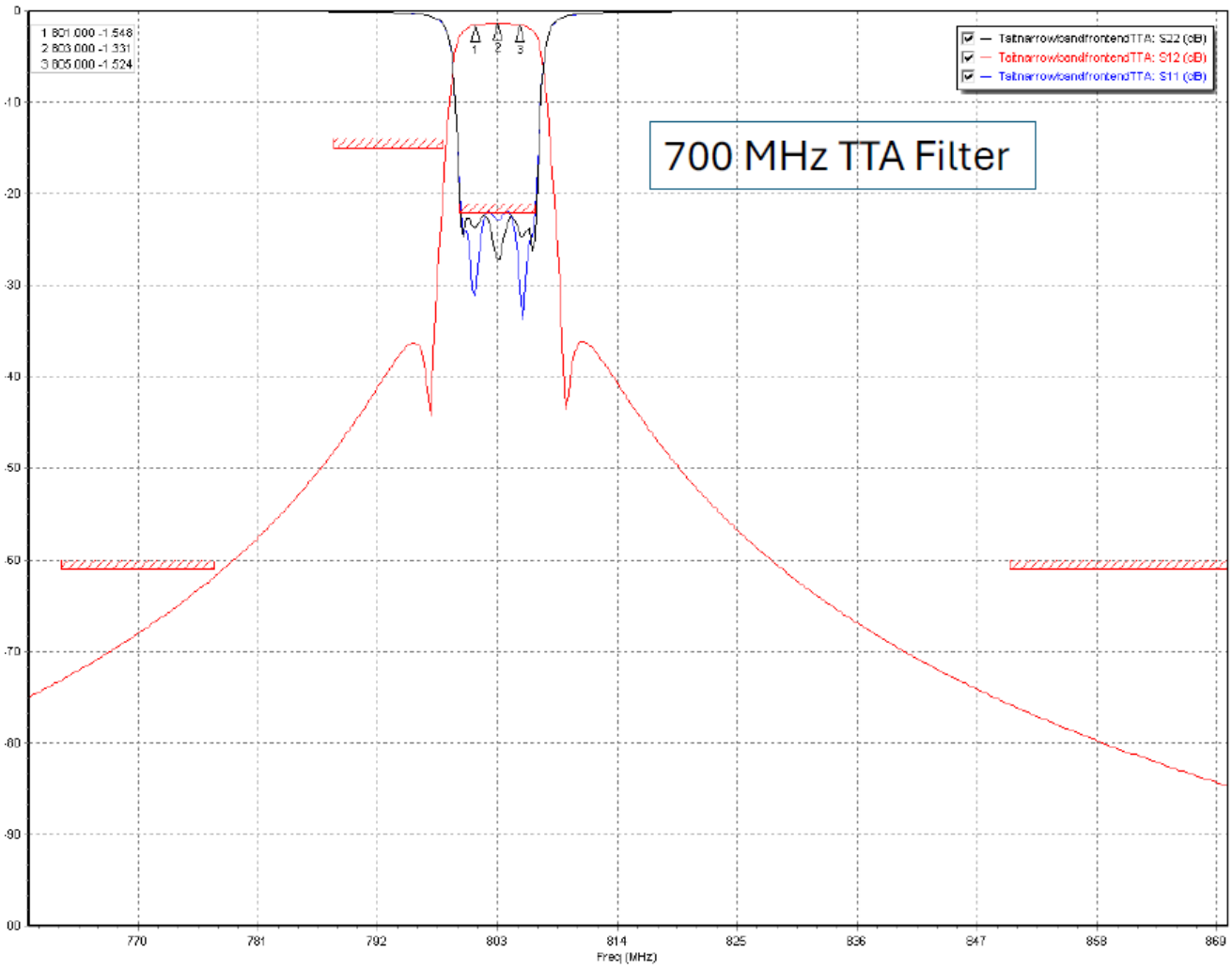


Figure 6: TTA Preselector Filter Plot

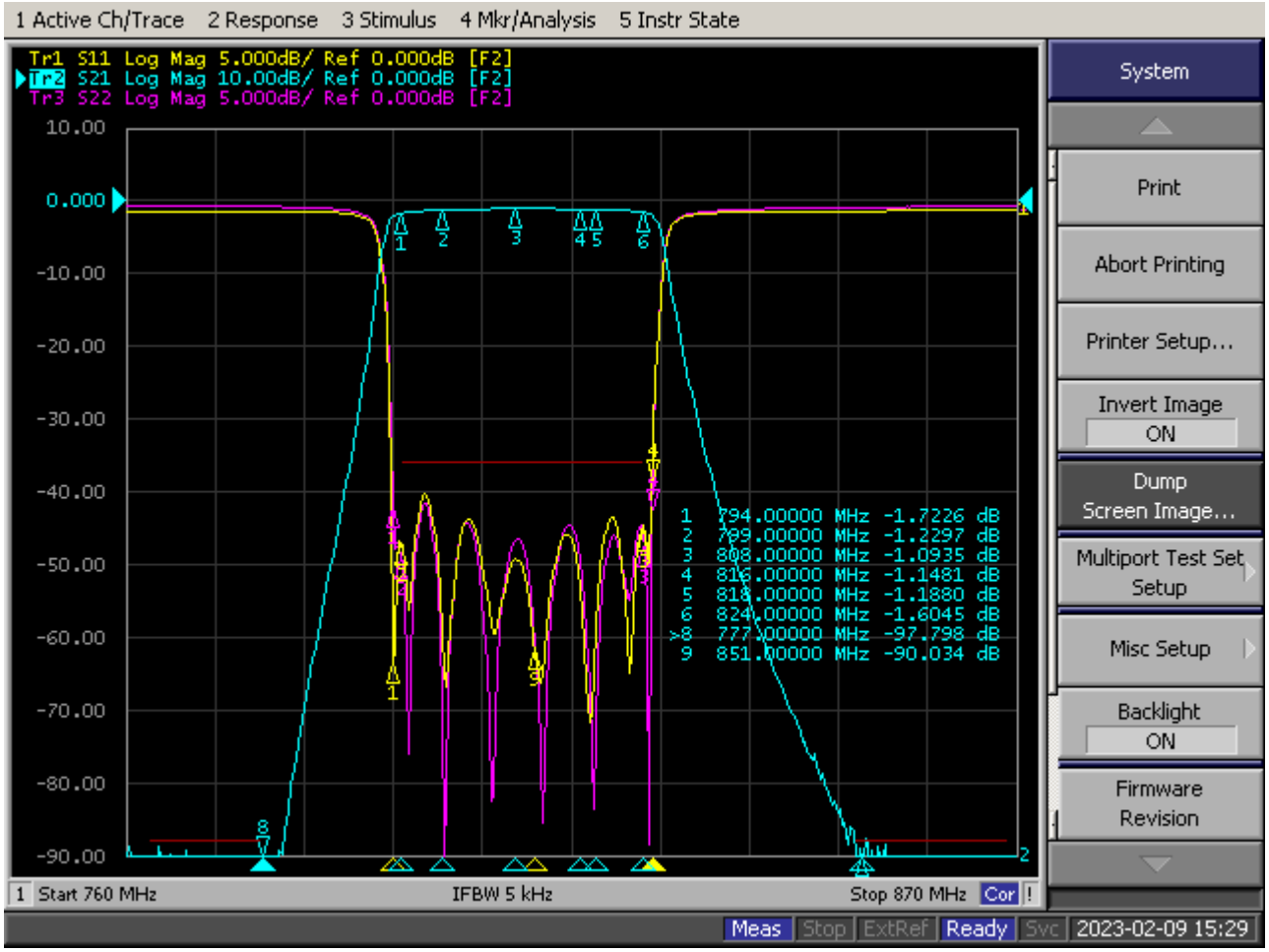


Figure 7: TTA Post LNA Filter Plot

11. MICROWAVE SYSTEM DESIGN

Refer to “Marion County P25 System Design_v1.1.docx” for Microwave System Details.

11.1 Site Specific Design

The Halls Ridge site supports one Aviat microwave link. This link extends from Halls Ridge to APW as a spur, engineered as 2+0 to ensure reliable, uninterrupted connectivity from Halls Ridge into the core network.

12. RF SUB-SYSTEM DRAWINGS

The figure below contains the schematic of the RF sub-system to be deployed at this site.

12.1 RF System Schematic

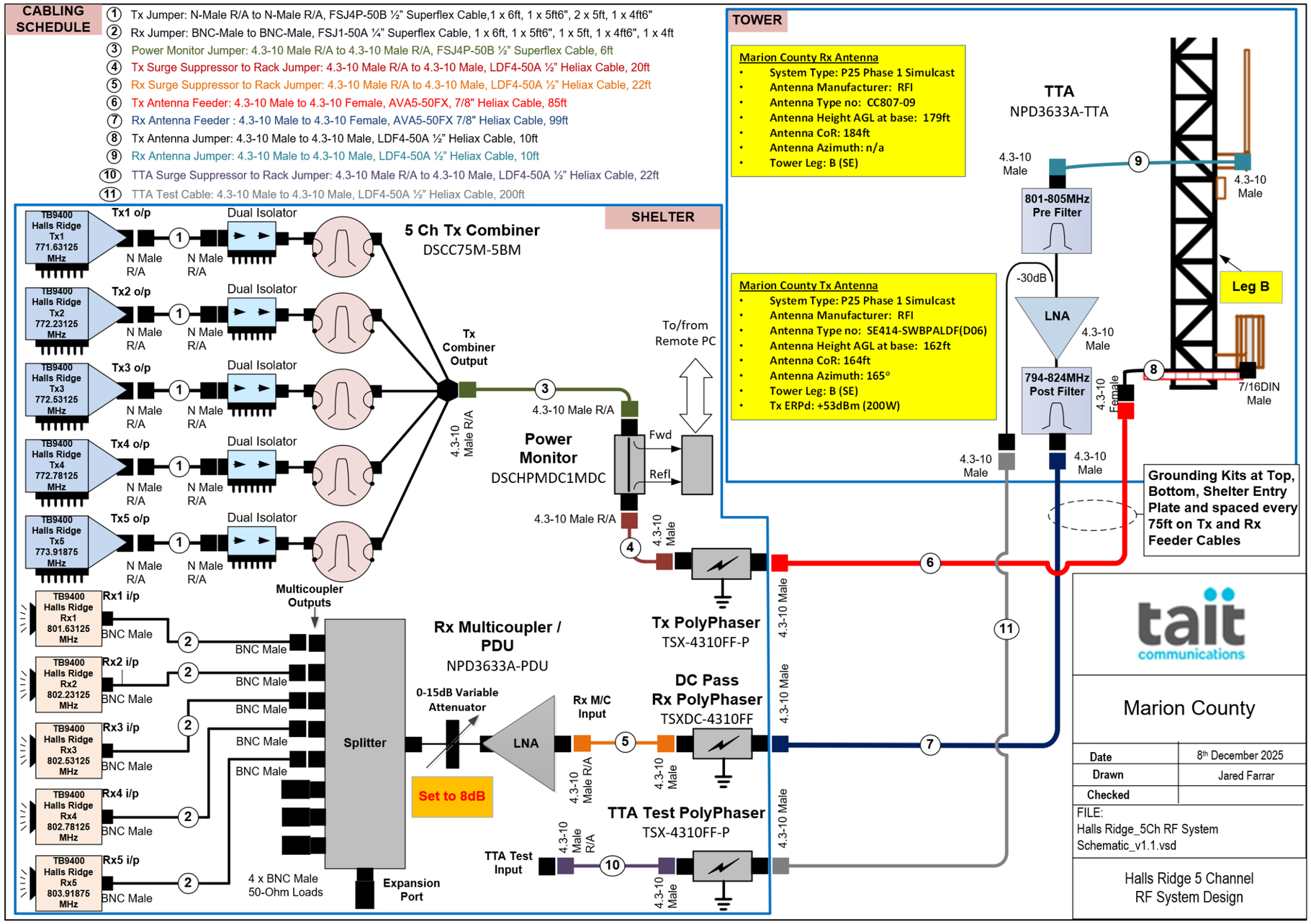
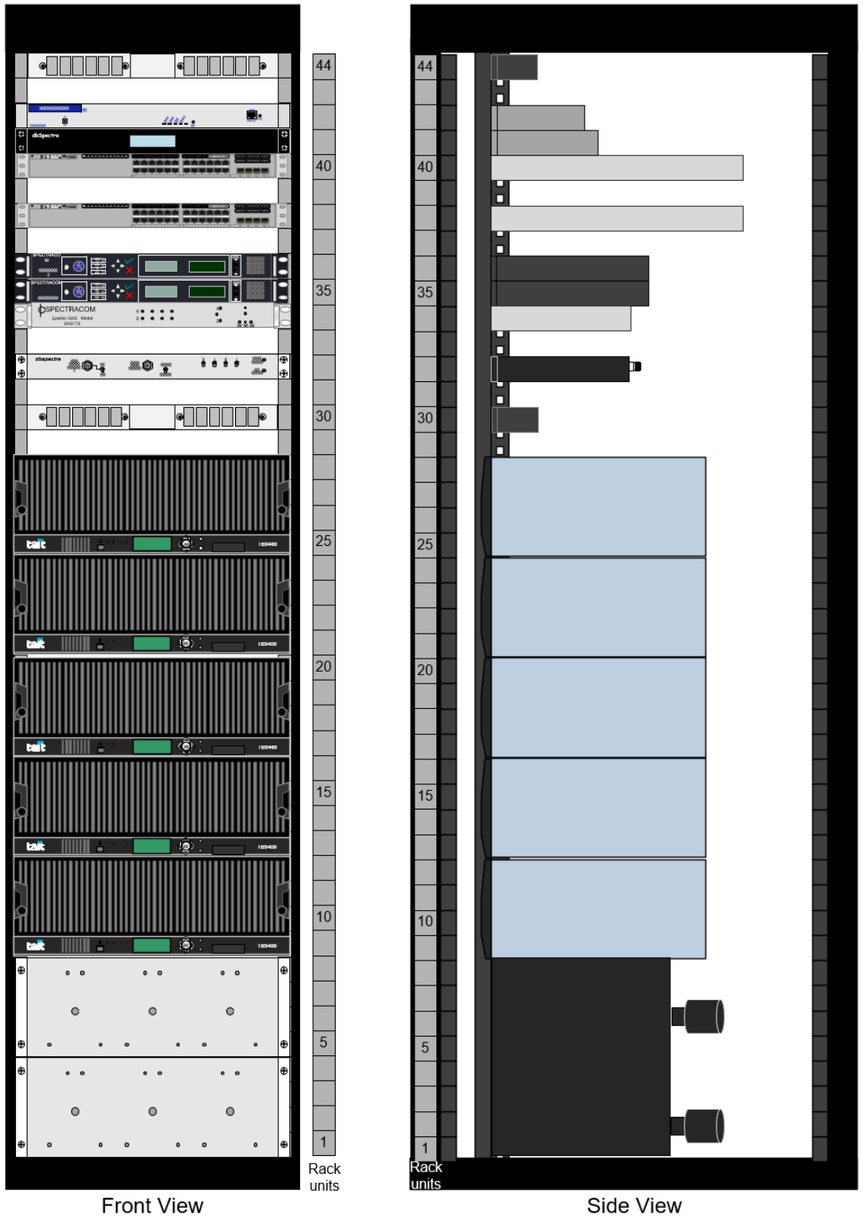


Figure 8: RF System Schematic

12.2 Rack Layout

This section contains the rack layout front & back view, side view and cabling diagram for this site.



Rack	RU	Description	Vendor PN	Vendor	Width (in)	Height (in)	Depth (in)
1	44	Breaker Panel	9072101001	9072101001	19	1U	3.25
1	42	Alarm Panel	M16G2 & D-PK-16PAN	M16G2 & D-PK-16PAN	17	1U	6.6
1	40	Switch #1	C9300L-24P-4X-A	C9300L-24P-4X-A	17.5	1U	17.7
1	38	Switch #2	C9300L-24P-4X-A	C9300L-24P-4X-A	17.5	1U	17.7
1	36	Timing Reference	2402-613	2402-613	17.1	1U	15.17
1	35	Timing Reference	2402-613	2402-613	17.1	1U	15.17
1	34	Timing Switch	SAS-17E	SAS-17E	19	1U	13.4
1	30	Breaker Panel	9072101001	9072101001	19	1U	3.25
1	25-28	P25 Conventional Base Station - CH1	TB9435S-100T	TB9435S-100T	19	4U	15.8
1	21-24	P25 Conventional Base Station - CH2	TB9435S-100T	TB9435S-100T	19	4U	15.8
1	17-20	P25 Conventional Base Station - CH3	TB9435S-100T	TB9435S-100T	19	4U	15.8
1	13-16	P25 Conventional Base Station - CH4	TB9435S-100T	TB9435S-100T	19	4U	15.8
1	9-12	P25 Conventional Base Station - CH5	TB9435S-100T	TB9435S-100T	19	4U	15.8
1	1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra	19	8U	12.5

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RF_Site_Simulcast

Figure 9: Marion County 19" Rack Layout – RF Front & Side

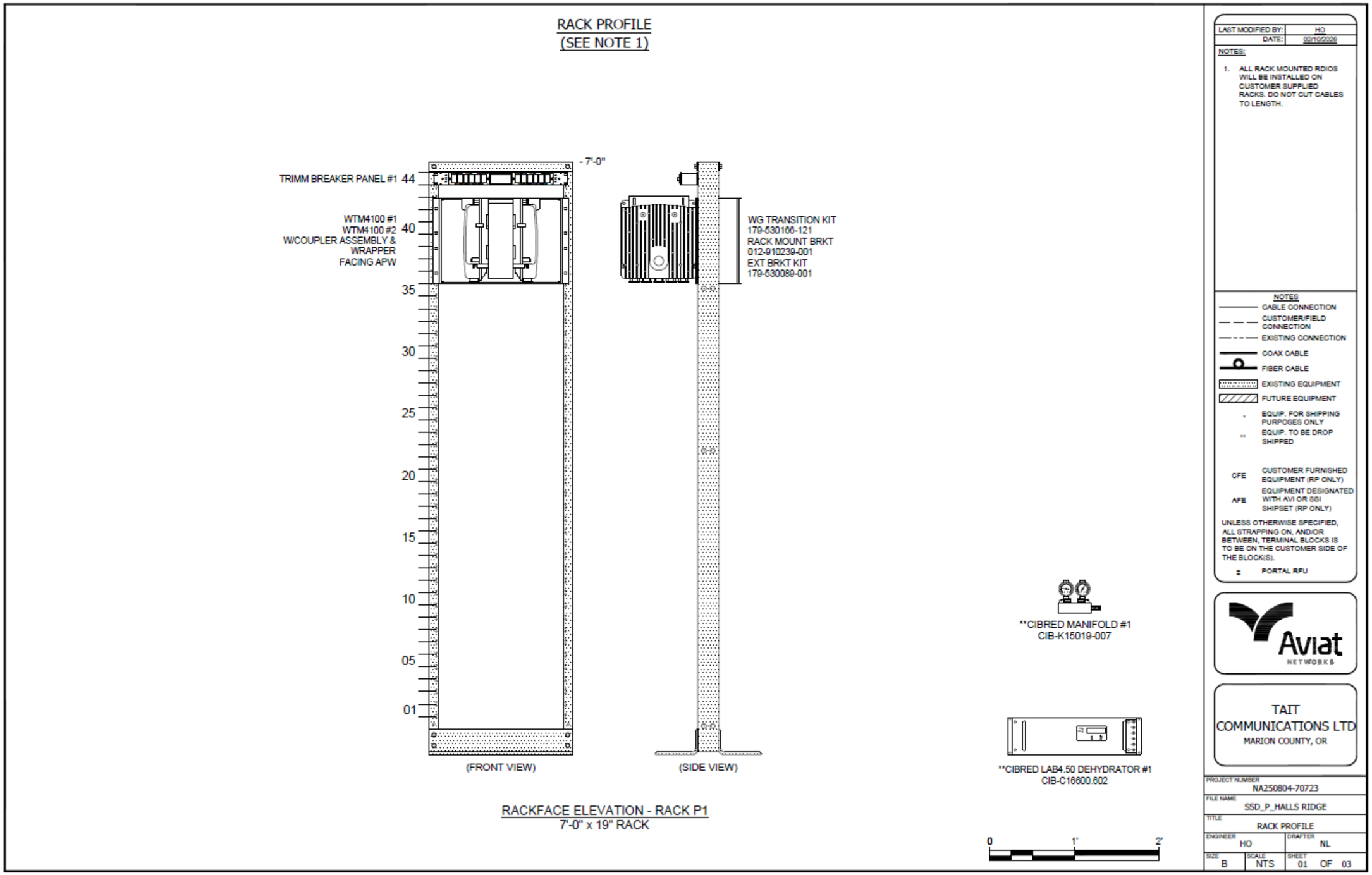
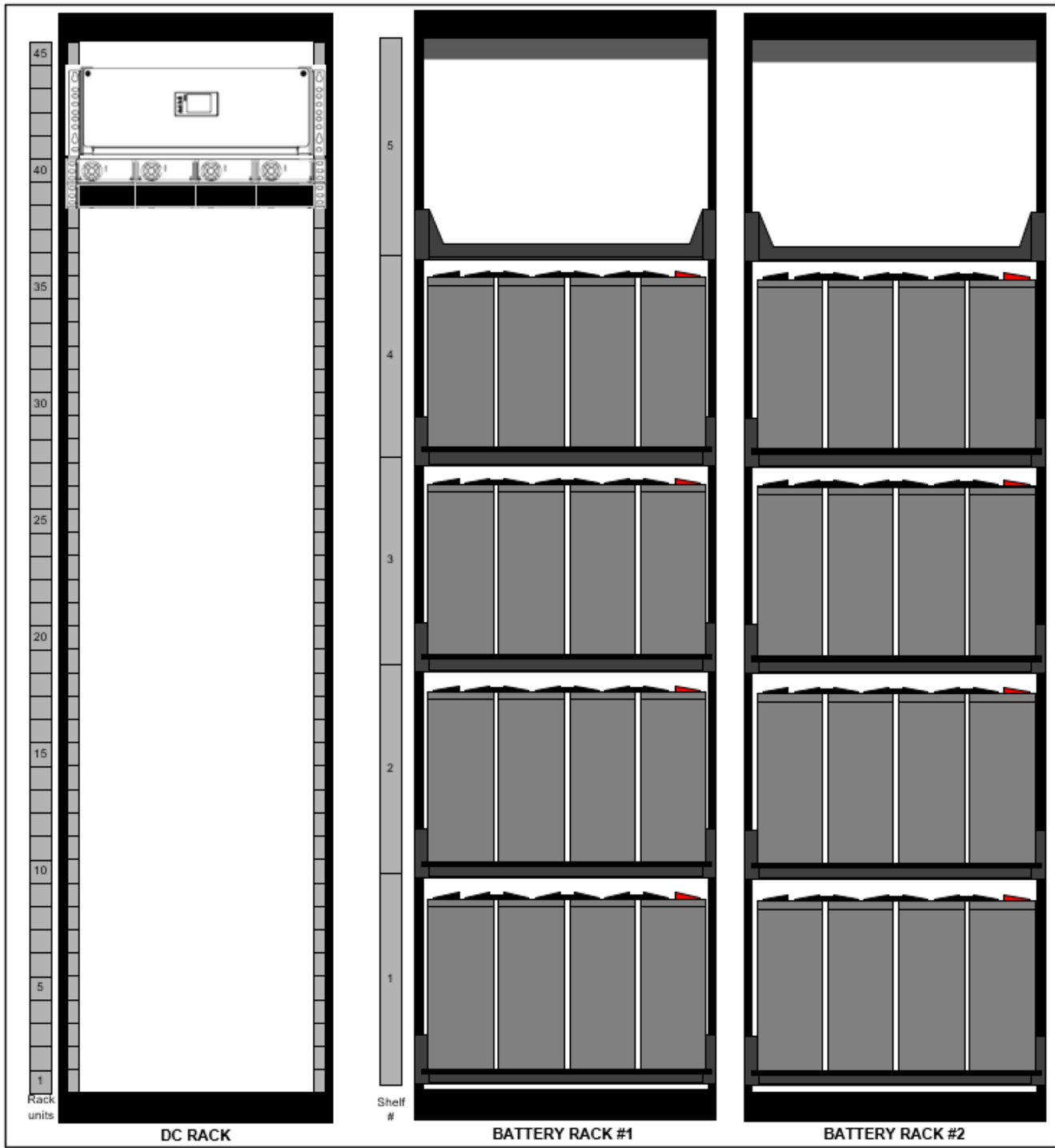


Figure 10: Microwave Rack



Rack	RU	Description	Vendor PN	Vendor
DC Rack	41-44	Unity Power System w/ Flatpack2	UNT20806.00014	Eltek
DC Rack	39-40	4x Flatpack2 HE Rectifier 2000W 48V	241115.105	Eltek
Battery Rack #1	S1	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack #1	S2	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack #1	S3	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack #1	S4	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack #2	S1	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack #2	S2	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack #2	S3	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack #2	S4	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada

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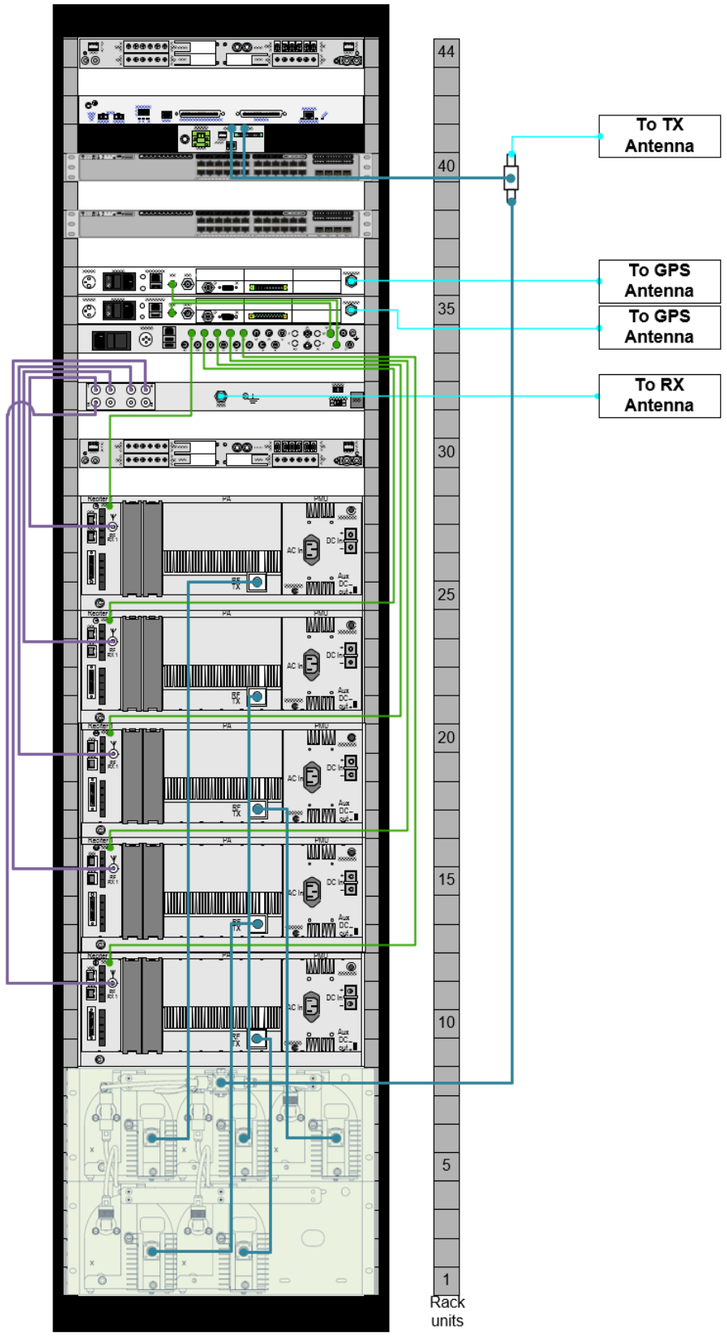
DC Power - East

Figure 11: DC Power & Battery Racks



Rack	RU	Description	Vendor PN	Vendor
1	44	Breaker Panel	9072101001	9072101001
1	42	Alarm Panel	M16G2 & D-PK-16PAN	M16G2 & D-PK-16PAN
1	40	Switch #1	C9300L-24P-4X-A	C9300L-24P-4X-A
1	38	Switch #2	C9300L-24P-4X-A	C9300L-24P-4X-A
1	36	Timing Reference	2402-613	2402-613
1	35	Timing Reference	2402-613	2402-613
1	34	Timing Switch	SAS-17E	SAS-17E
1	30	Breaker Panel	9072101001	9072101001
1	25-28	P25 Conventional Base Station - CH1	TB9435S-100T	TB9435S-100T
1	21-24	P25 Conventional Base Station - CH2	TB9435S-100T	TB9435S-100T
1	17-20	P25 Conventional Base Station - CH3	TB9435S-100T	TB9435S-100T
1	13-16	P25 Conventional Base Station - CH4	TB9435S-100T	TB9435S-100T
1	9-12	P25 Conventional Base Station - CH5	TB9435S-100T	TB9435S-100T
1	1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

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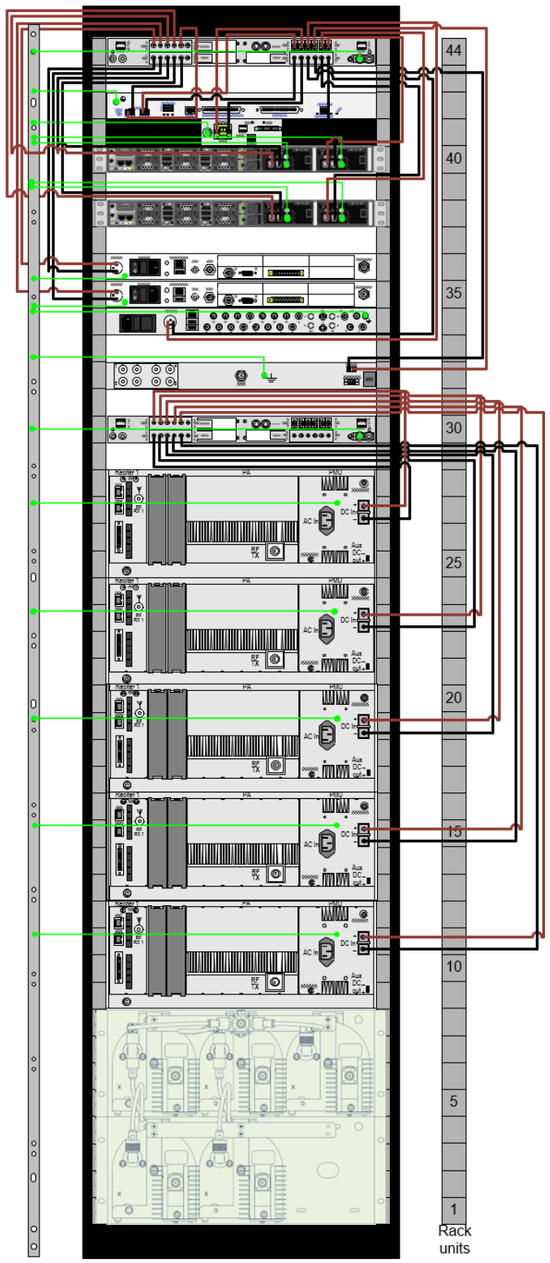
Cabling - RF

Figure 12: Marion County 19" Rack Layout – RF Cabling



Rack	RU	Description	Vendor PN	Vendor
1	44	Breaker Panel	9072101001	9072101001
1	42	Alarm Panel	M16G2 & D-PK-16PAN	M16G2 & D-PK-16PAN
1	40	Switch #1	C9300L-24P-4X-A	C9300L-24P-4X-A
1	38	Switch #2	C9300L-24P-4X-A	C9300L-24P-4X-A
1	36	Timing Reference	2402-613	2402-613
1	35	Timing Reference	2402-613	2402-613
1	34	Timing Switch	SAS-17E	SAS-17E
1	30	Breaker Panel	9072101001	9072101001
1	25-28	P25 Conventional Base Station - CH1	TB9435S-100T	TB9435S-100T
1	21-24	P25 Conventional Base Station - CH2	TB9435S-100T	TB9435S-100T
1	17-20	P25 Conventional Base Station - CH3	TB9435S-100T	TB9435S-100T
1	13-16	P25 Conventional Base Station - CH4	TB9435S-100T	TB9435S-100T
1	9-12	P25 Conventional Base Station - CH5	TB9435S-100T	TB9435S-100T
1	1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

Description A	Connection A	Description B	Connection B
Breaker Panel 1	A1	GPS 1	-48 VDC
Breaker Panel 1	A2	GPS 2	-48 VDC
Breaker Panel 1	A3	Switch 1-A	-48 VDC
Breaker Panel 1	A4	Switch 2-A	-48 VDC
Breaker Panel 1	A5	Alarm Panel A	-48 VDC
Breaker Panel 2	B1	Alarm Panel B	-48 VDC
Breaker Panel 2	B2	Power Monitor	-48 VDC
Breaker Panel 2	B3	Timing Switch	-48 VDC
Breaker Panel 2	B4	Multicoupler	-48 VDC
Breaker Panel 2	B5	Switch 2-B	-48 VDC
Breaker Panel 2	B6	Switch 1-B	-48 VDC

Description A	Connection A	Description B	Connection B
Breaker Panel 2	A1	TB9400 CH1	-48 VDC
Breaker Panel 2	A2	TB9400 CH3	-48 VDC
Breaker Panel 2	A3	TB9400 CH5	-48 VDC
Breaker Panel 2	B1	TB9400 CH2	-48 VDC
Breaker Panel 2	B2	TB9400 CH4	-48 VDC

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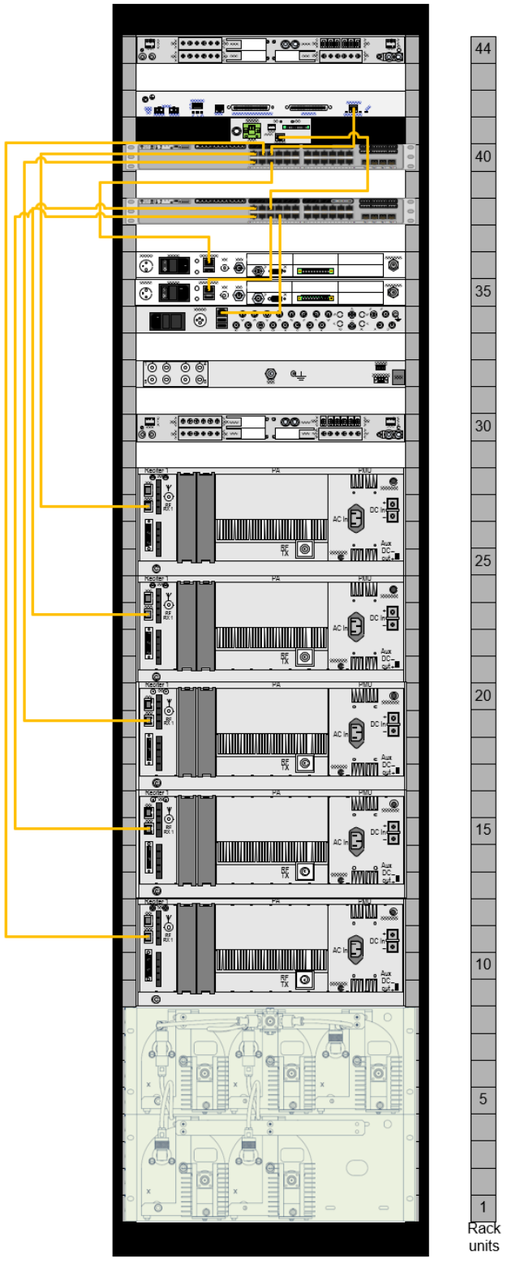
Cabling - Power

Figure 13: Marion County 19" Rack Layout – Power Cabling



Rack	RU	Description	Vendor PN	Vendor
1	44	Breaker Panel	9072101001	9072101001
1	42	Alarm Panel	M16G2 & D-PK-16PAN	M16G2 & D-PK-16PAN
1	40	Switch #1	C9300L-24P-4X-A	C9300L-24P-4X-A
1	38	Switch #2	C9300L-24P-4X-A	C9300L-24P-4X-A
1	36	Timing Reference	2402-613	2402-613
1	35	Timing Reference	2402-613	2402-613
1	34	Timing Switch	SAS-17E	SAS-17E
1	30	Breaker Panel	9072101001	9072101001
1	25-28	P25 Conventional Base Station - CH1	TB9435S-100T	TB9435S-100T
1	21-24	P25 Conventional Base Station - CH2	TB9435S-100T	TB9435S-100T
1	17-20	P25 Conventional Base Station - CH3	TB9435S-100T	TB9435S-100T
1	13-16	P25 Conventional Base Station - CH4	TB9435S-100T	TB9435S-100T
1	9-12	P25 Conventional Base Station - CH5	TB9435S-100T	TB9435S-100T
1	1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

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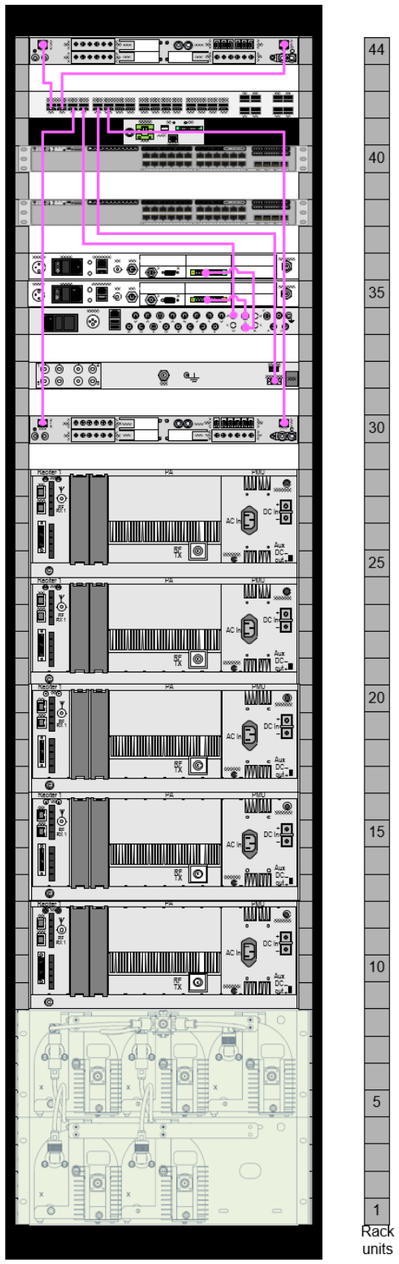
Cabling - Network

Figure 14: Marion County 19" Rack Layout – Network Cabling



Rack	RU	Description	Vendor PN	Vendor
1	44	Breaker Panel	9072101001	9072101001
1	42	Alarm Panel	M16G2 & D-PK-16PAN	M16G2 & D-PK-16PAN
1	40	Switch #1	C9300L-24P-4X-A	C9300L-24P-4X-A
1	38	Switch #2	C9300L-24P-4X-A	C9300L-24P-4X-A
1	36	Timing Reference	2402-613	2402-613
1	35	Timing Reference	2402-613	2402-613
1	34	Timing Switch	SAS-17E	SAS-17E
1	30	Breaker Panel	9072101001	9072101001
1	25-28	P25 Conventional Base Station - CH1	TB9435S-100T	TB9435S-100T
1	21-24	P25 Conventional Base Station - CH2	TB9435S-100T	TB9435S-100T
1	17-20	P25 Conventional Base Station - CH3	TB9435S-100T	TB9435S-100T
1	13-16	P25 Conventional Base Station - CH4	TB9435S-100T	TB9435S-100T
1	9-12	P25 Conventional Base Station - CH5	TB9435S-100T	TB9435S-100T
1	1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

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Cabling - Alarms

Figure 15: Marion County 19" Rack Layout – Alarm Cabling

13. PARTS AND EQUIPMENT LISTS

Refer to “Marion County P25 Project - Equipment List by Site.xlsx” for site-specific equipment list.

14. RF PERFORMANCE

14.1 Tx Effective Radiated Power

Table below summarizes the transmitter system performance. It shows the required TB9400 transmitter output power setting, the combining losses (including internal cabling), the antenna feeder loss and finally the resulting ERP relative to a dipole (ERPd).

Transmitter Frequency (MHz)	Transmitter Output Power Setting	Combining Losses (dB)	Misc Losses (dB)	Antenna Feeder Losses (dB)	Tx ERPd
771.63125	+47.3dBm (55W)	3.2	0.7	1.33	+52.0dBm (158.5W)
772.23125	+47.3dBm (55W)	3.2			+52.0dBm (158.5W)
772.53125	+47.3dBm (55W)	3.2			+52.0dBm (158.5W)
772.78125	+47.3dBm (55W)	3.2			+52.0dBm (158.5W)
773.91875	+47.3dBm (55W)	3.2			+52.0dBm (158.5W)

Table 9: Transmitter Output Power Setting and Effective Radiated Power

14.2 Site Noise

Site Noise in the 700MHz band can be assumed to be negligible.

14.3 Receiver Sensitivity

Table summarizes the receiver system performance. It shows the amount of de-sensitization caused by the elevated site noise floor, the required Rx Multicoupler attenuation setting, and the resulting final Receiver sensitivity that can be achieved.

Receiver Frequency (MHz)	Rx Multicoupler Attenuator Setting (dB)	Rx Sensitivity for DAQ3.4 (dBm)
801.63125	8	-112.8
802.23125		
802.53125		
802.78125		
803.91875		

Table 10: Receiver Sensitivity

15. SITE DESIGN INFORMATION

15.1 Site Plan

The site plan is an overhead view of the overall compound depicting locations of pertinent features.

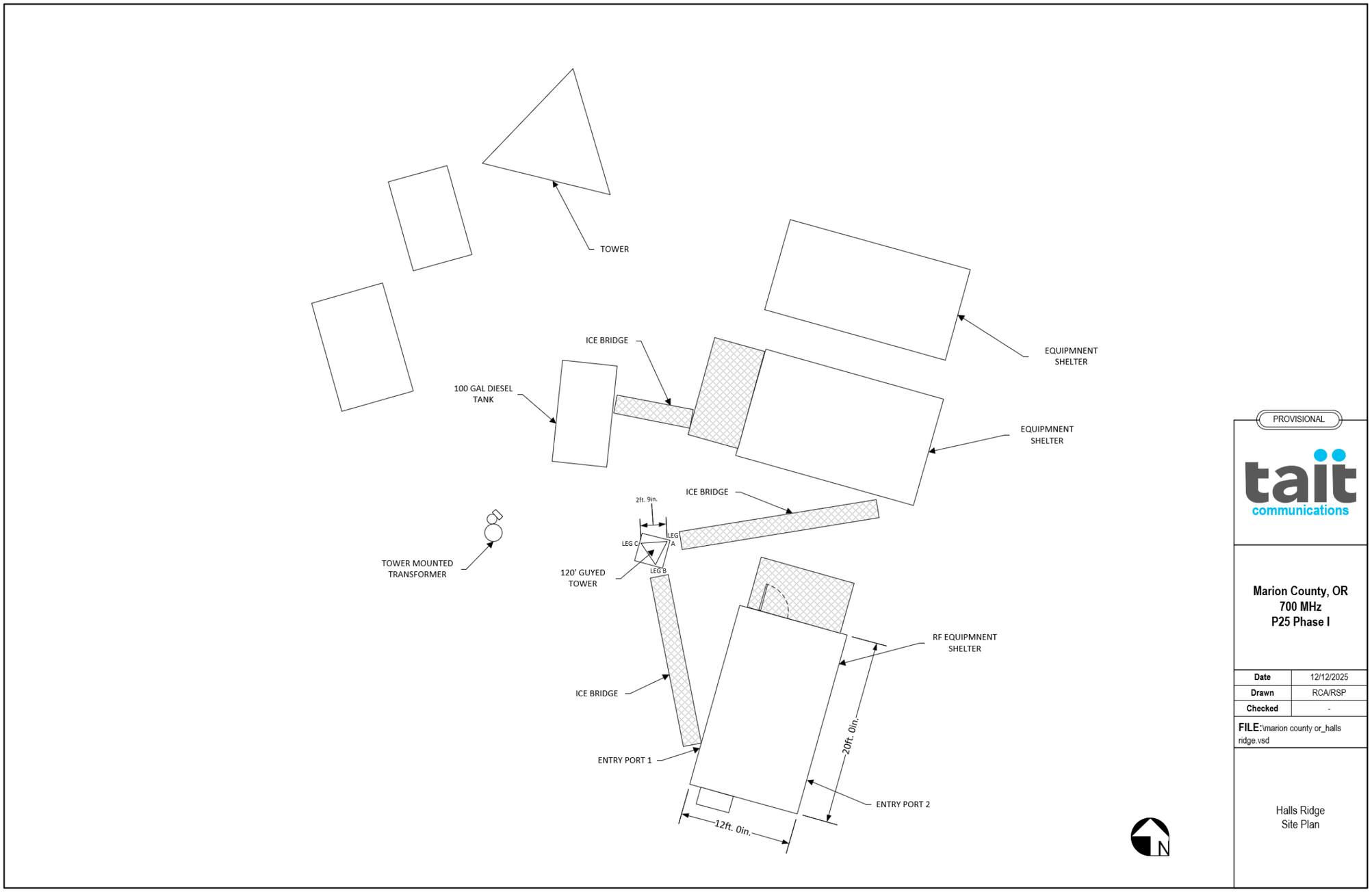

Figure 16: Site Plan

15.2 Floor and Cable Routing Plan

The floor and cable routing plan is an overhead view of the equipment room layout depicting locations of pertinent equipment and including the cable routing plans leading to the tower.

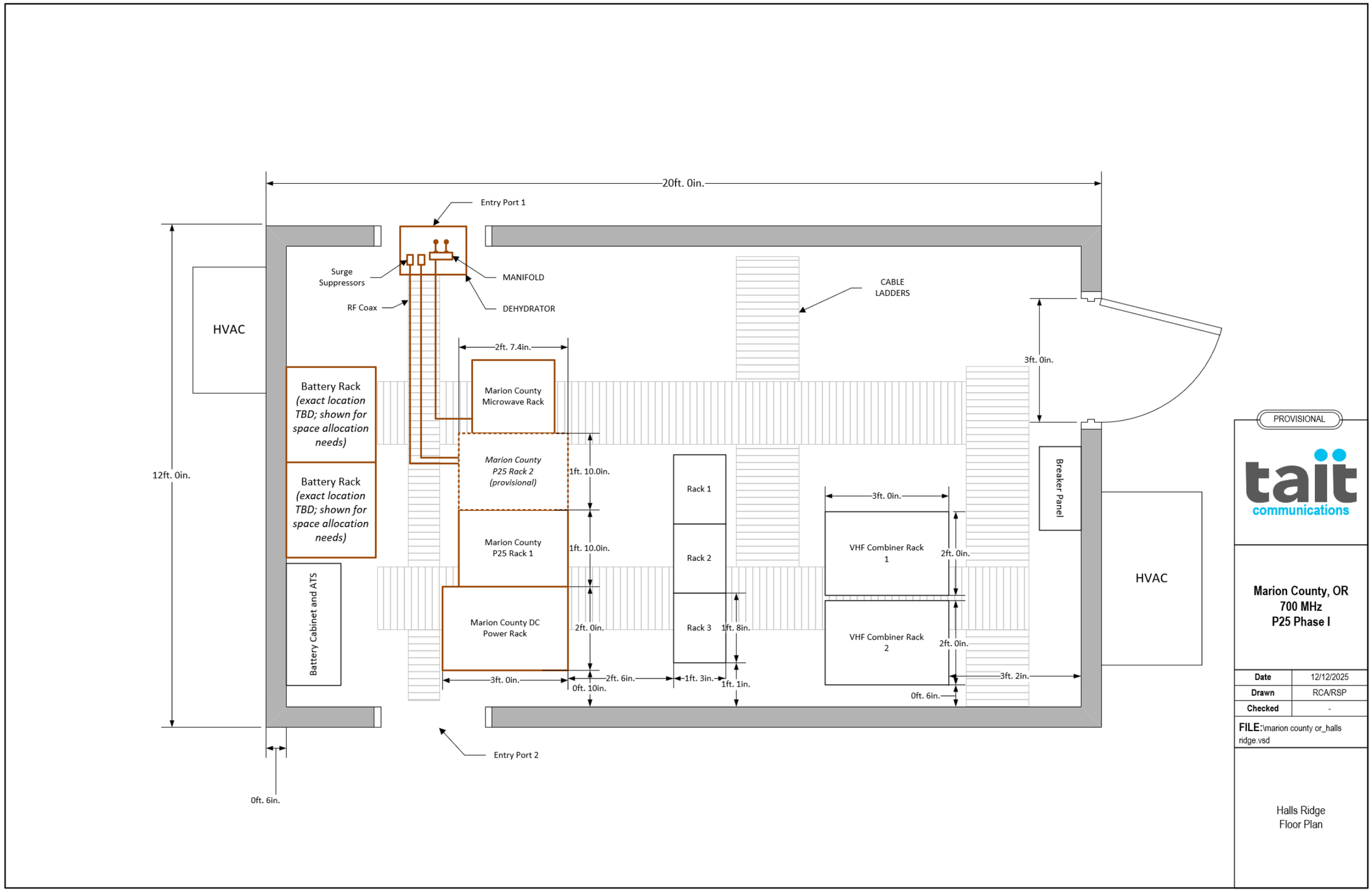

Figure 17: Floor and Cable Routing Plan

15.3 Entry and Exit Ports

The ports where the antenna and TTA cables enter / exit the shelter are shown in the below figure.

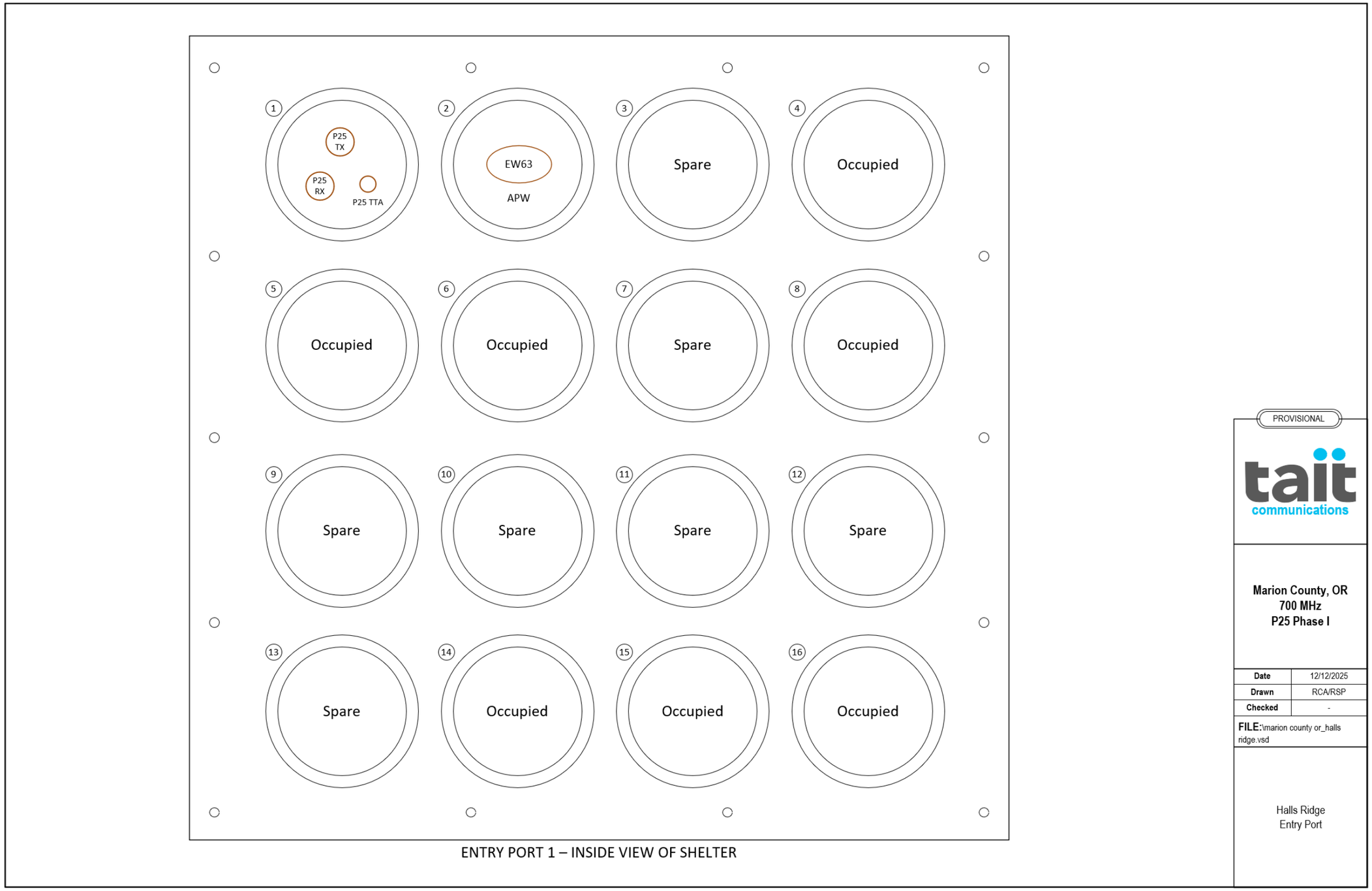

Figure 18: Shelter Cable Entry & Exit Ports

15.3.1 Power & Heat Load Calculations

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Power & Heat Load details.

15.3.2 DC Distribution Fuse Panel

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Fuse Panel details.

Supplemental 7 - House Mountain

tait communications

PROVISIONAL Design Document

RF Sub-System and Site Designs

Marion County

Region: East Cell

Site: House Mountain

Issue 1.1 ○ 1st May 2026

www.taitradio.com

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PREFACE

Project Details

Project number	
Customer	Marion County
Project description	P25 Phase 2 Simulcast & P25 Phase 1 Conventional Simulcast
Business Development Manager	
Sales Engineer	
Project Engineer	Jared Farrar / Riley Alfaqeeh
Project Manager	Stacey Adams (formerly Matt Jordan)
Lead RF Engineers	Ian Graham

Purpose

The Marion County project is an 11 site P25 simulcast design that uses the US 700MHz band. To control Time Delay Interference (TDI), the simulcast design is split into three cells – North, South, and East. The North cell is comprised of four sites with P25 Phase 2 trunked operation, the South cell is comprised of four sites with P25 Phase 2 trunked operation, and the East cell is comprised of three sites with P25 Phase 1 conventional operation.

The purpose of this report is to document the RF subsystem design for the **House Mountain** site which forms part of the East simulcast cell.

Scope

This document specifies the frequencies to be utilized at the site and summarizes the intermodulation analysis with these frequencies and other high-level in-band carriers as identified from an FCC license search. The required antenna system and associated RF combining equipment will then be described in full.

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Approvals	Position	Signature	Date
Bladimyr Guzman	TAM Design Authority		

Associated Documents & References

Reference documentation includes:

- Marion County P25 System Design_v1.1.docx
- Marion County P25 Project - Equipment List by Site.xlsx
- Marion County Power_Heat_Load.xlsx

1. GENERAL RF DESIGN APPROACH

The Marion County project is an 11-site P25 simulcast design that uses the US 700MHz band. To control Time Delay Interference (TDI), the simulcast design is split into three cells – North, South, and East.

The North Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- Crooked Finger
- Crosby
- Eastview
- Parrett Mountain

The South Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- Eagle Crest
- Lower Prospect
- McCully Mountain
- Wipper

The East Cell sites operate in P25 Phase 1 conventional mode and are identified as follows:

- APW
- **House Mountain**
- Halls Ridge

Each site within the North and South Cells will have five trunked P25 Phase 2 channels providing eight dynamic talkpaths (one 12.5kHz FDMA control channel plus four 2-slot 12.5kHz TDMA traffic channels) across each respective cell's coverage area. The East Cell will have five conventional P25 Phase 1 12.5kHz FDMA channels providing five fixed talkpaths across the cell.

Each site across all three cells will have separate transmit (Tx) and receive (Rx) antennas, typically with 20ft vertical separation between centers of radiation. The anticipated low site noise floors in the 700MHz band means Tower Top Amplifiers (TTA) can be used to improve receiver sensitivity and talk-in coverage. Along with the 30MHz Tx-Rx frequency separation, these factors lead to a common RF combining subsystem design which is applicable to all Marion County sites. The combining system requirements were captured based on the proposed frequency plan in coordination with ADCOMM Engineering LLC and Tait subsequently worked with the chosen equipment vendor, dBSpectra, on an optimal design. The main consideration was the TTA where it was decided to use dBSpectra's compact design after it was shown all the required receiver filtering could be accommodated. The generic (starting point) site combining system design therefore features the:

- DSCC75M-5BM 5 Channel Ceramic Tx Combiner
- DSCHPMDC1MDC Channelized Power Monitor
- NPD3633A-TTA Tower Top Amplifier
- NPD3363A-PDU Rx Multicoupler PDU

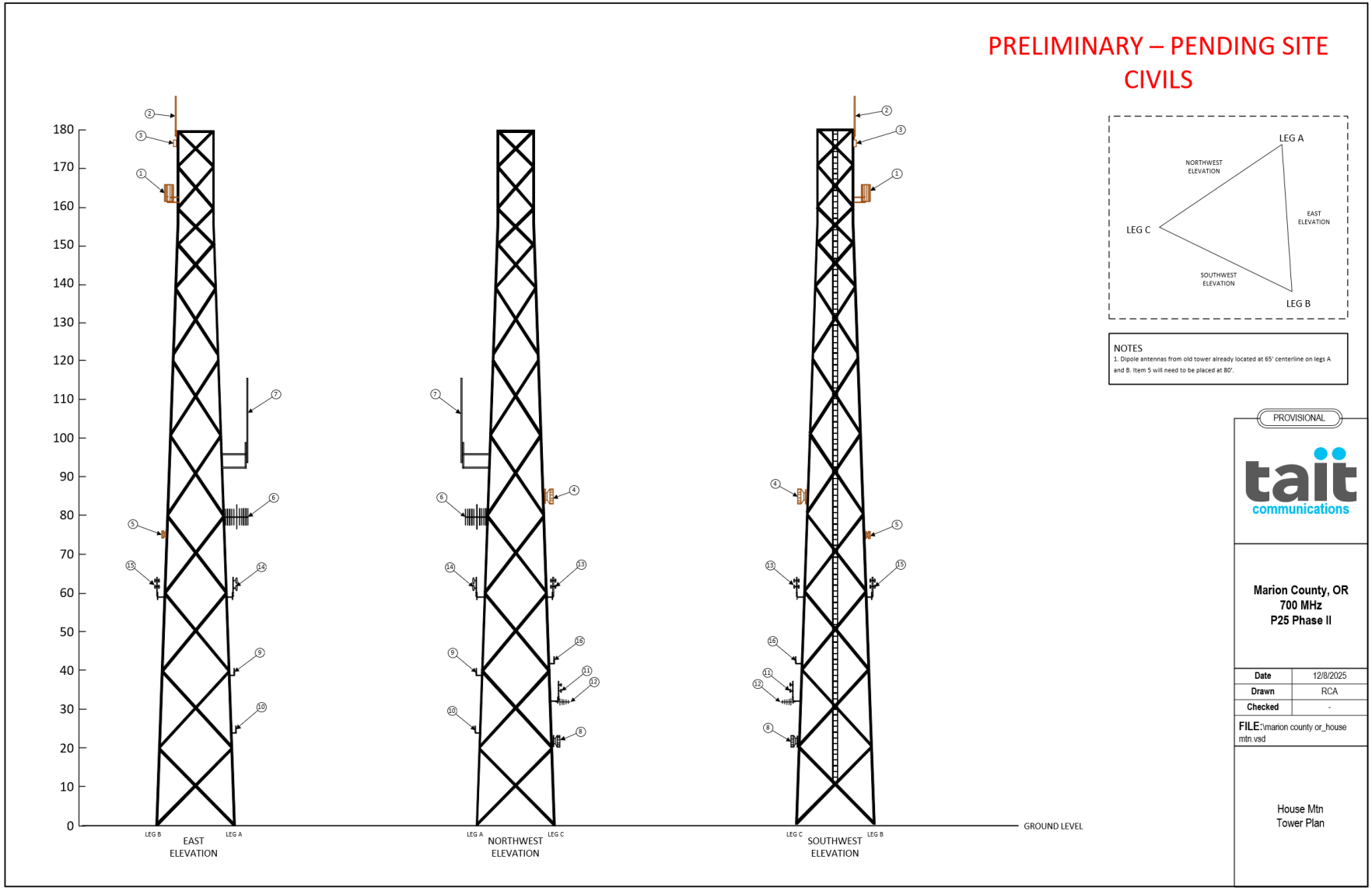
Antennas were chosen on a site-by-site basis to minimize TDI in the simulcast cells while still providing necessary talk-out coverage. The proposed antennas are the:

- Sinclair SE412-SWBPAL
    - 5dBd Low PIM Enclosed Dipole Array
- Sinclair SE414-SWBPAL
    - 8.5 to 11dBd Low PIM Adjustable Beamwidth Enclosed Dipole Array
- RFI CC807-09
    - 9dBd Collinear Omnidirectional

For the House Mountain site, the basic design approach will be:

- Install a new SE414-SWBPALDF(D06) transmit antenna at 162ft AGL on Leg ‘A’ (NE) of the 180ft tower, azimuth 45º, beamwidth 90º.
    - The 5 transmit channels will be connected to the Tx antenna using the dBSpectra DSCC75M-5BM Ceramic Combiner.
    - Note the SE414-SWBPALDF(D06) antenna is a slight deviation from the sites using the (D00) variant of the same model in that it provides 6° of electrical down-tilt.
- Install a new RFI CC807-09 receive antenna at 179ft AGL on Leg ‘A’ (NE) of the 180ft tower (azimuth n/a).
    - The 5 receive channels will be fed from the Rx antenna via the dBSpectra NPD3633A-TTA Tower Top Amplifier and the NPD3633A-PDU Rx multicoupler/PDU

2. TOWER MAPPING



#	Description	Part Number	Length (ft)	Leg/Face	Status	Base Height (ft)	Centerline Height(ft)	Tip Height (ft)	Antenna Azimuth	Mount Azimuth	Mount	Transmission Line Size/Type
1	P25 TX Antenna	SE414-SWBPALDF(D06)	4.4	B	New	162	164	166	165	165	Site-Pro PSA-6 (6' standoff)	7/8"
2	P25 RX Antenna	CC807-09	10.3	B	New	179	184	189	-		Standard	1/2" to TTA
3	TTA	NPD3633A-TTA	1.0	B	New	176	177	177	-		Standard	7/8"
4	Microwave - SCC	VHLP4-11W	4.0	C	New	83	85	87	259.31	259.31	Standard w/ tieback	EW90
5	Microwave - APW	VHLP2-18	2.0	B	New	74	75	76	157.44	157.44	Standard w/ tieback	EWP180-180
6	VHF AS-IP TX Antenna	SV227-SF2SNM	4.0	A	New	78	80	82	90	90	Standard	
7	VHF AS-IP RX Antenna	DS1F06F36U-D	21.9	A	New	94	105	116	-	90	Standoff	
8	Microwave-1	Drum with ice shield	3	C	Existing	21	22	24	~270	~270	Standard	
9	Omni-1		2	A	Existing	39	40	41			Standoff	
10	Omni-2		2	A	Existing	24	25	26			Standoff	
11	Dipole-1	2 element	10	C	Existing	30	35	40			Standoff	
12	Yagi		1	C	Existing	30	30	31			Standoff	
13	Dipole-2	4 element	3	C	Existing	61	62	64			Standoff	
14	Dipole-3	2 element	5	A	Existing	60	62	65			Standoff	
15	Dipole-4	4 element	3	B	Existing	61	62	64			Standoff	
16	Omni-3		2	C	Existing	42	43	44			Standoff	

= estimated value based on survey documentation and photos

Figure 1: House Mountain 180ft Tower Mapping and Appurtenances

3. FREQUENCY PLANNING

5 Channels will be deployed at this site.

The East Simulcast cell uses the following frequencies:

Site Name	FCC Channel Number	Tx Frequency (MHz)	Rx Frequency (MHz)
House Mountain	421-422	771.63125	801.63125
	517-518	772.23125	802.23125
	565-566	772.53125	802.53125
	605-606	772.78125	802.78125
	787-788	773.91875	803.91875

Table 1: East Cell Frequency Assignments

4. INCUMBENTS SEARCH

An external high-level carrier (HLC) is defined as a signal that appears at a level of >-40dBm at the receive antenna. These are the signals which have the potential to contribute towards intermodulation that would result in a loss of receiver sensitivity on one or more channels.

Signal and Noise Monitoring of RF activity at the site was not deemed necessary for this project given the wide Tx-Rx frequency separation in the 700MHz band and the anticipated low site noise floors.

To get some idea of potential RF activity at the site, an FCC License Search was carried out to identify any other transmitters operating between 700 and 900MHz located within a 0.6-mile radius of the tower (a typical transmitter emitting 100W ERP at 0.6 miles away would be received at -40dBm assuming free space path loss). These include cellular transmitters (as their wide bandwidth could cause IM energy to spread into the LMR receive band) and are summarized in Table 2 below:

Owner	Call Sign	Frequency (MHz)	Tx ERPd (dBm)	Distance from Marion County Tower (miles)
NONE DISCOVERED				

Table 2: High Level Carriers

5. INTERMODULATION ANALYSIS

An intermodulation (IM) analysis was performed for the potentially significant sources, including both the Marion County channels to be deployed and any HLCs found during the FCC License Search. For antenna configurations using separate transmit and receive antennas Tait best practice is to search for IM products up to 7th order within a defined search window accounting for the fact the bandwidth of IM products spread according to the order and bandwidth of the signals that cause it.

The frequencies included in the IM analysis are listed in Table 3 below.

Transmit Frequencies (MHz)	Receive Frequencies (MHz)
771.63125	801.63125
772.23125	802.23125
772.53125	802.53125
772.78125	802.78125
773.91875	803.91875

Table 3: Frequencies Included in IM Analysis

Table 4 below shows how many IM products are generated on each of the receive frequencies. A direct hit is an IM product that falls exactly at the receive frequency. An indirect hit is one that does not fall exactly at a receive frequency but does fall within the search window.

IM Order	Number of Intermodulation Products at each Receive Frequency									
	801.64375MHz		802.24375MHz		802.54375MHz		802.79375MHz		803.90625MHz	
	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect
3rd	0	0	0	0	0	0	0	0	0	0
5th	0	0	0	0	0	0	0	0	0	0
7th	0	0	0	0	0	0	0	0	0	0

Table 4: Intermodulation Results Summary

6. ANTENNA SYSTEM DESIGN

The Antenna System detailed here and the RF Combining System described later in sections 7, 8, and 10 have been specifically designed to mitigate any interference caused by the listed high level carriers, thereby maximizing the coverage achieved by the Marion County system.

6.1 Antenna Type

The following antennas will be used at House Mountain.

Antenna	Manufacturer	Antenna Model Number	Description	Antenna Length (ft)	Antenna Gain (dBd)	Down-tilt (degrees)
Rx	RFI	CC807-09	Collinear Omni	10	9	N/A
Tx	Sinclair	SE414-SWBPALDF(D06)	Enclosed Dipole	4.4	11.5	6

Table 5: Antenna Details

800MHz Corporate Collinear Antennas

748-870MHz

CC807 Series

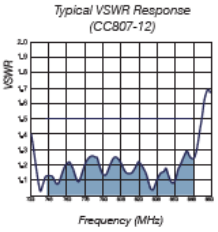
These industry leading, full featured corporate collinear arrays allow site operators to combine, with complete integrity, a large number of communications services into a single, low profile antenna solution.

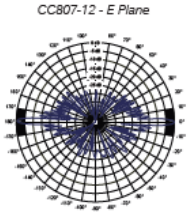
The corporate feed design employed by RFI maintains superior pattern control, allowing gain to be maximised with zero tilt variation over a very broad bandwidth, comparable to that only previously available in exposed dipole array configurations. This is achieved in the preferred form factor of a fully enclosed fibreglass radome, providing a reduction in wind loading, ice loading and tower loading in comparison.

The CC807 series have been designed with an exceptional power rating of 500W across the band as well as a Peak Instantaneous Power (PIP) rating of 25kW to cater for the peak voltage levels present in large multi-carrier combining environments. RFI's refined design processes and proven construction methods achieve a PIM rating of –150dBc, further ensuring performance is maintained for the service life of the antenna.

Features:

- 500W Continuous Power rating
- -150dBc Passive Intermodulation (PIM) rating, 100% PIM tested
- 25 kW Peak Instantaneous Power (PIP) rating
- DC grounding on all elements for the ultimate in lightning protection and dissipation of static noise.
- Light weight dipole construction using RFI's patented flexi-PCB architecture, maintains a low centre of gravity reducing tip deflection and sway
- Field invertible (excluding tilt models)
- Preset downtilt variations of 2 and 4 degrees available, see note (1)





Electrical Specifications

Model Number	CC807-09-P	CC807-12-P
Nominal Gain *dBd (dBi)*	9.0 (11.1)	11.5 (13.6)
Frequency *MHz*	746-870	
Tuned Bandwidth *MHz*	Full	
VSWR *(Return Loss)*	1.5:1	
Nominal Impedance Ω	50	
Downtilt°	0 Std 2, 4 (1)	
Vertical Beamwidth°	8	4
Horizontal Beamwidth°	Omni +/- 0.5dB	
Input Power W	500	
Passive IM 3rd order (2x20W) *dBc*	-150	
Peak Instantaneous Power *kW*	25	

Mechanical

Model Number		CC807-09-P	CC807-12-P
Construction		Sky blue fibreglass radome	
Radome Diameter mm (inches)		76 (3.0)	
Length mm (inches)		3135 (123.4)	6235 (245.5)
Weight *kg (lbs)*		14 (30.9)	25.5 (56.2)
Termination		Integrated 4.3-10 Female	
Mountaing Area mm (inches)		750 x 90 (30 x 3.5) diameter Ecofilm™ plated aluminium	
Suggested Clamps		3 x UC-114	
Shipping Dimensions *mm (inches)*	H	115 (4.5)	
	W	115 (4.5)	
	L	3335 (131.3)	6435 (253.3)
Shipping Weight *kg (lbs)*		20.0 (44.1)	36.5 (80.5)
Projected area *cm² (ft²)*	No Ice	2597 (2.8)	5559 (6.0)
	With Ice	3192 (3.4)	7037 (7.6)
Lateral Thrust @160km/h *N* (100 mph lbs)		308 (69)	659 (148)
Wind Gust Rating *km/h (mph)*	No Ice	>240 (150)	
Torque @ 160km/h *Nm* (100mph ft-lbs)		413 (305)	1823 (1345)

(1) To order pre-set downtilt versions available, simply add a -T2 or -T4 towards the end of the part number to denote downtilt model required. For eg. CC807-12-T2-P to order CC807-12-P with 2deg of downtilt. Please note: Models with downtilt are NOT field invertible. . Eg. CC807-12-T2-P

P-43021-7

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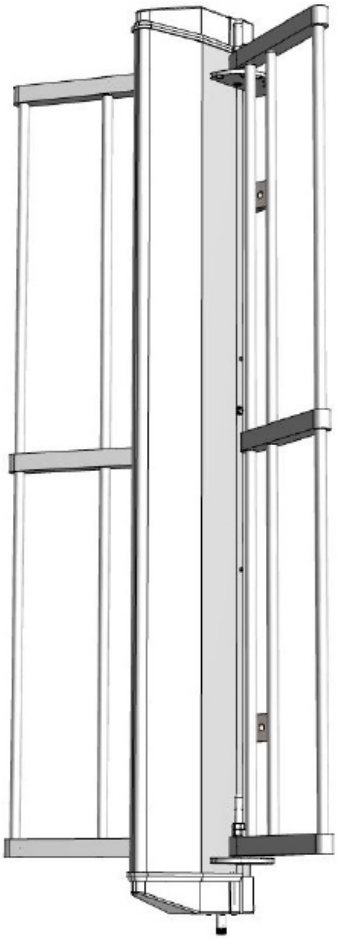
Antennas

700-1000 MHz Antennas

SE414-WBAL - PIM Certified Series

SE414-SWBPAL(YY)(DXX) Enclosed dipole, 8-11.5 dBd, adj. beamwidth, Low PIM, 746-960MHz

- Wide band design covers whole 746-960 MHz band, PIP rated
- Horizontal beamwidth can be adjusted (60º/90º/105º/130º/160º)
- Gain depends on horizontal beamwidth setting (11.5/10/9/8.5/8 dBd)
- PIP rated and low PIM



One wideband antenna for your 700, 800, 900 MHz systems. Sinclair's SE414-WBL series of enclosed dipole arrays offer excellent intermodulation performance covering 746-960 MHz in a single antenna. These highly versatile antennas are particularly well suited to communication systems where a specific coverage pattern is required. These include cellular systems, trunked radio, paging, and data transmission, where predictable and highly reliable performance is a must.

The SE414-WBAL series come with field adjustable reflectors that provide horizontal beamwidths between 60 and 160 degrees. The creative design and construction permits excellent pattern control and greater efficiency.

When ordering, please refer to the chart below for the model number. Different configurations are subject to various list prices. Please contact your Sinclair Sales Representative or Customer Service Representative for more information.

Model Number	Connector	Downtilt	PIM(dBc)	PIP(kW, max)
SE414-SWBPALDF(D00)	7/16 DIN(F)	0º	<-150	25
SE414-SWBPALDF(D01)	7/16 DIN(F)	1º	<-150	25
SE414-SWBPALDF(D02)	7/16 DIN(F)	2º	<-150	25
SE414-SWBPALDF(D03)	7/16 DIN(F)	3º	<-150	25
SE414-SWBPALDF(D04)	7/16 DIN(F)	4º	<-150	25
SE414-SWBPALDF(D05)	7/16 DIN(F)	5º	<-150	25
SE414-SWBPALDF(D06)	7/16 DIN(F)	6º	<-150	25
SE414-SWBPALNF(D00)	N(F)	0º	<-139	N/A
SE414-SWBPALNF(D01)	N(F)	1º	<-139	N/A
SE414-SWBPALNF(D02)	N(F)	2º	<-139	N/A
SE414-SWBPALNF(D03)	N(F)	3º	<-139	N/A
SE414-SWBPALNF(D04)	N(F)	4º	<-139	N/A
SE414-SWBPALNF(D05)	N(F)	5º	<-139	N/A
SE414-SWBPALNF(D06)	N(F)	6º	<-139	N/A

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Antennas
700-1000 MHz Antennas
SE414-WBAL - PIM Certified Series

Electrical Specifications

Frequency Range	MHz	746 to 960	
Bandwidth	MHz	214	
Gain (nominal)	dBd (dBi)	11.5 (13.6)	*1
Input VSWR (max)		1.5:1	
Polarization		vertical	
Impedance	Ω	50	
Pattern		Directional and Adjustable	
Horizontal beamwidth (typ)	degrees	60	*2
Vertical beamwidth (typ)	degrees	20	
Average Input Power (max)	W	500	
Front-to-back ratio (min)	dB	20	
Grounding		All metal parts DC-grounded	

Notes

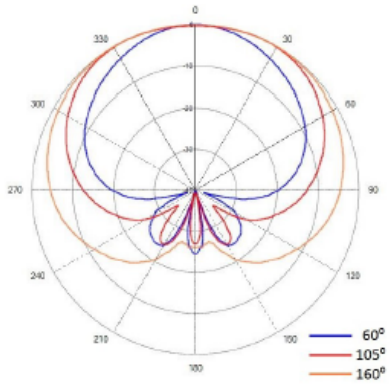
*1 : Dependant on reflector setting 10/9/8.5/8 dBd
*2 : 90/105/130/160
*3 : 90° beamwidth configuration, clamp not included in measurement
*4 : 90° beamwidth configuration, clamp not included in measurement
*5 : Ref. clamp maximum

Mechanical Specifications

Width	in (mm)	25 (635)	*3
Depth	in (mm)	8.5 (216)	*4
Length/ Height	in (mm)	53 (1346)	
Base pipe diameter	in (mm)	2.88 (73)	*5
Base pipe mounting length	in (mm)	30.5 (775)	
Radiating element material		prntd circuit bd	
Weight	lbs (kg)	23 (10.44)	
Mounting Hardware (Included)		#130 clamp	
Mounting configurations		upright	
Actual shipping weight	lbs (kg)	28 (12.71)	
Shipping dimensions	in (mm)	58x14x17 (1473x356x432)	

Environmental Specifications

Temperature range	°F (°C)	-40 to +140 (-40 to +60)
Wind Loading Area (Flat Plate Equivalent)	ft² (m²)	4.8 (0.45)
Wind Loading Area (1/2" ice)	ft² (m²)	5.7 (0.53)
Rated wind velocity (no ice)	mph (km/h)	155 (250)
Rated wind velocity (1/2" radial ice)	mph (km/h)	140 (225)
Lateral Thrust (100 mph No Ice)	lbs (N)	180 (800.6)
Torsional moment (100 mph No Ice)	ft-lbs (Nm)	93 (125.6)



Horizontal

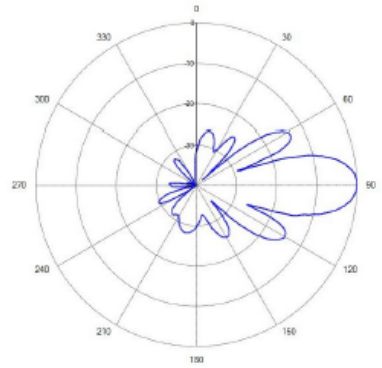

Vertical, 0° downtilt

Figure 2: Antenna Datasheet

6.2 Antenna Mounting Locations

Table 6 below specifies the Marion County antenna mounting location details.

Antenna	Mounting Height (feet AGL)	Antenna Orientation (degrees)	Tower Leg	Standoff Length (feet)	Standoff Orientation (degrees)	Standoff Model
Receive	179	n/a	B (SE)	n/a	n/a	n/a
Transmit	162	165	B (SE)	6	165	Site-Pro PSA-6

Table 6: Antenna Mounting Locations

The antenna system design for this site is given in Figure 3.

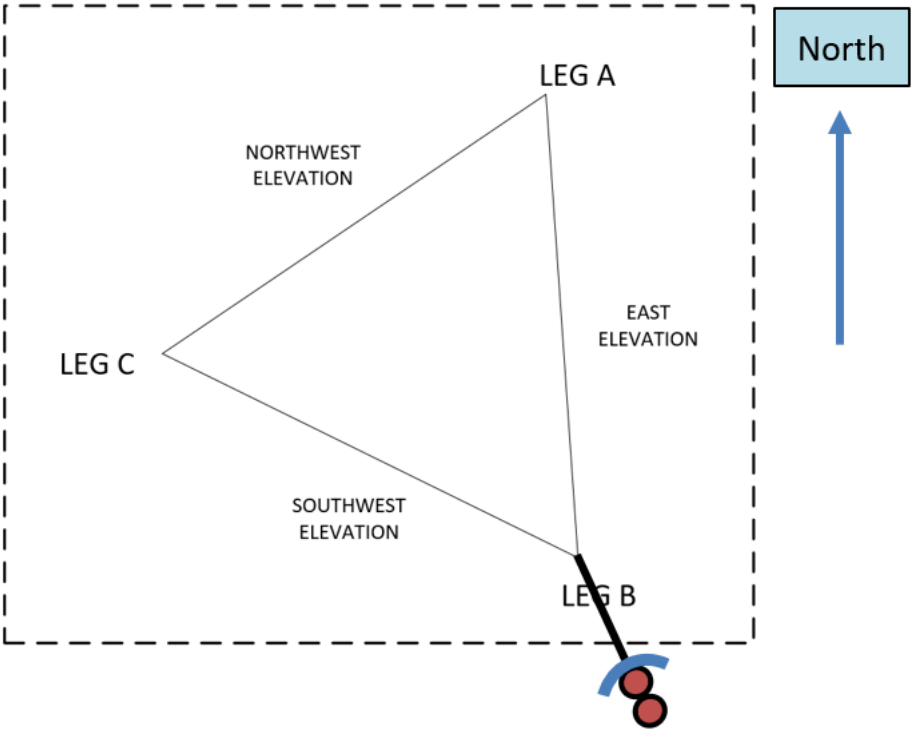


Figure 3: Antenna System Design

6.3 Antenna Isolation

The Transmit and Receive antennas are vertically separated by 20ft and horizontally separated by 6ft which gives an isolation between them of **63.8dB**. A figure of **60dB** will be assumed in subsequent calculations, though, as that is often the limit of what can be practically achieved (e.g., mounting imperfections, mechanical drift due to wind/ice loads or aging hardware). The isolation impacts due to the 6° electrical down-tilt applied to the TX antenna are negligible over the separation distances considered.

7. TRANSMITTER COMBINER DESIGN

7.1 RF Connectors

The antenna output of the combiner is fitted with **4.3-10 female** connector to minimize Passive Intermodulation (PIM).

The transmitter input ports of the combiner are fitted with **N Type female** connectors.

7.2 Cavity Filters

Filtering in the Tx Combiner is predominantly bandpass.

A combination of band-pass and band-reject filtering is sometimes to provide extra rejection at specific site Rx frequencies, but band-reject filters are never used alone.

The cavity filters provide the minimum attenuation at the closest receive frequency equal to or greater to the value specified in section 7.9 of this document.

7.3 Isolator

A dual Isolator is included between the output of each transmitter and the Tx Combiner input port.

The isolator load closest to the Tx Combiner input port is rated at a minimum of **100 watts**.

7.4 Maximum RF Power

The Tx combiner supports a maximum of **100 watts** of RF input power per channel.

7.5 Minimum Tx to Tx Frequency Separation

The minimum frequency separation allowed between transmitters sharing the same combiner is **250kHz**.

7.6 Maximum number of Transmitters per combiner

Standard Tait practice is a maximum of four transmitters per Tx combiner. But in this case, the relatively wide Tx-Tx spacing and the fact that self-TxIM does not occur renders the penalty in combining all five transmitters together negligible.

7.7 Maximum Tx Combiner Loss per Channel

The insertion loss shall be minimized to the extent possible while complying with all other specifications.

The Tx Combiner insertion loss per Tx channel (not including associated Tx antenna feeder cable losses) will be around **3.2dB** for the Tx-Tx frequency separation at this site.

7.8 Tx Intermodulation Suppression

Transmitters that cause intermodulation on any site receive frequency must not be connected to the same combiner.

However, there is still a responsibility to keep the site as ‘clean’ as possible for its incumbents. To that end, the levels of intermodulation products generated in the combiner are controlled by a requiring a minimum isolation

between the outputs of combined transmitters of **at least 60dB**. This figure includes the reverse isolation of the isolator and any additional attenuation provided by the cavity filters in neighboring branches.

7.9 Tx Sideband Noise Suppression

In addition to the Tx – Rx antenna isolation, the Tx Combiner provides the suppression required to reduce transmitter sideband noise at the Rx antenna to the level where it causes no more than 1dB of receiver de-sensitization. The transmitter sideband noise suppression required at this site is given in Table 7 below.

Transmit Frequency (MHz)	Offset to Nearest Receive Frequency (MHz)	Sideband Noise Suppression Required at Offset (dB)
771.63125	30.0000	12
772.23125	29.4000	13
772.53125	29.1000	13
772.78125	28.8500	13
773.91875	27.7375	13

Table 7: Transmitter Combiner Sideband Noise Rejection Requirements

8. RECEIVER SUBSYSTEM DESIGN

8.1 RF Connectors

8.1.1 Tower Top Amplifier

The Rx Filter input is fitted with a **4.3-10 female** connector.

The Rx Filter output is fitted with a **4.3-10 female** connector.

8.1.2 Receiver Multicoupler/PDU

The Rx Multicoupler input is fitted with a **4.3-10 female** connector.

The receiver output ports of the Rx Multicoupler are fitted with a **BNC Female** connector.

8.2 Receiver Subsystem Topology

The Receiver Subsystem will utilize a Tower Top Amplifier (TTA, which includes the receiver filtering) to optimize talk-in coverage followed by a multicoupler/PDU system that further amplifies and splits the received signal between the connected receivers.

8.3 Receiver Filtering

The Receiver Filters will pass the 801 to 805MHz part of the 700MHz band used for the Marion County system while fully rejecting associated transmit signals in both the 700MHz and 800MHz Tx bands. This is important because combinations of transmitters in both bands can result in 7th order IM falling within the 700MHz receive band.

8.3.1 Blocking Rejection

Between them, the Receiver Filters must provide enough attenuation so that no more than 1dB of de-sensitization of any of the connected receivers occurs due to receiver blocking. The attenuation required at this site to prevent receiver blocking due to the Marion County transmitters and external interferers found during FCC database search is given in Table 8 below:

	Tx Name	Tx Frequency (MHz)	Minimum Rejection in Rx Filter at Tx Frequency (dB)				
			Rx1 (MHz)	Rx2 (MHz)	Rx3 (MHz)	Rx4 (MHz)	Rx5 (MHz)
			801.63125	802.23125	802.53125	802.78125	802.91875
Transmitters	Tx1	771.63125	18	18	18	18	18
	Tx2	772.23125	18	18	18	18	18
	Tx3	772.53125	18	18	18	18	18
	Tx4	772.78125	18	18	18	18	18
	Tx5	773.91875	18	18	18	18	18

Table 8: Receiver Filter Blocking Rejection Requirements

8.3.2 Receiver Intermodulation Rejection

The Rx Filter must provide enough attenuation so that no more than 1dB of de-sensitization of any of the connected receivers occurs due to intermodulation. At this site, there is no anticipated IM risk. Therefore, the rejection specified above is sufficient.

8.4 Low Noise Amplifiers

Low Noise Amplifiers (LNAs) with appropriate gain and noise figure will be included in the receiver sub system to ensure that the cascade noise figure of the line up from the base of the receive antenna up to and including the base station receiver is equal to or less than 5dB. In the case of House Mountain, this noise figure can be improved to approximately **3.9dB** while maintaining linearity of the receive system lineup.

The output third order intercept of the LNAs will be ≥ +40dBm to maintain the linearity of the system.

8.5 Variable Attenuator

A Variable Attenuator will be fitted in the Rx Multicoupler/PDU for field optimization of the receiver subsystem gain, noise figure, and IP3. The attenuator has an adjustment range of 0dB to 15dB, in 0.25dB steps. To achieve a noise figure of 3.9dB, the variable attenuator shall be set to **6dB**.

Setting of the attenuator value must be done electronically so as not to require disassembly of the multicoupler equipment.

8.6 Receiver Ports

To allow for future expansion, the Rx Multicoupler will have 8 ports

All unused ports will be terminated in a 50-ohm load.

9. POWER MONITOR

The dBSpectra DSCHPMDC1MDC Power Monitor will be used within the Marion County RF systems. This is placed at the output of the Tx Combiner and allows remote monitoring of channelized transmitted power and antenna VSWR. The major benefit is early warning of antenna system degradation so that repairs can be made before failure occurs.

DSCHPM-Series (VHF, 220, UHF, 700/800/900 MHz)
SMART Channelized Transmit Power Monitor with Front Panel Display Option

dbSpectra
Always a Better Value

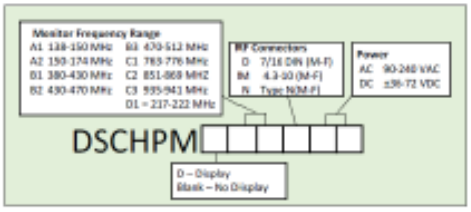
DSCHPM Power Monitor with front panel display option.

Directional coupler for installation on combiner output.

Features and Benefits

- *Per-channel and composite* measurement of forward and reflected RF power with the SMART Channelized RF Power Monitor.
- Calculates and displays combiner insertion loss for each channel.
- All measurements are displayed with 95% accuracy.
- IP network connection and designed-in web server for web browser interface.
- Full remote configuration, monitoring and data logging.
- Optional front panel display with Navigation Keys for monitoring only.
- User-defined alarm thresholds are indicated by alarm relay closure or by SNMP protocol on the network.
- Optional temperature sensors for equipment and ambient temperature measurements and alarms.
- Compact single rack unit mounting with remote RF sensor for flexibility in mounting locations.

Ordering Information

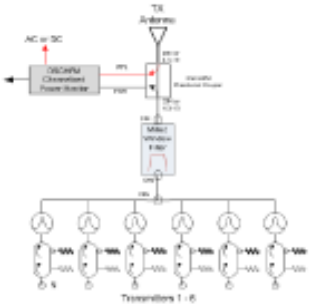


Notes:
1. Factory calibrated using a P25 LSM signal source, may be calibrated in the field for improved accuracy.
2. Contact dbSpectra at tech@dbspectra.com for additional information on optional temperature sensor feature.

Specifications

Electrical Specifications	
Frequency Range, MHz	See Ordering Information
Minimum TX to TX Separation	50 kHz
Maximum Power Input	600 Watts (directional coupler)
System Type	Digital or analog
Insertion Loss	< 0.1 dB
PIM Rating	-150 dBc
Channelized Power Measurements	Forward /reflected power of individual channels: Watts, dBm, VSWR, Return Loss, Combiner Insertion Loss
Power Requirements	AC Model 90-240 VAC 15W, or DC model ±36-72 VDC 15W
IP Interface	IPV4, with TLS security layer, SNMP v2c/v3 alarm protocol
Alarms	Form C contacts or SNMP v2c/v3
User Interface	Web browser or remote SNMP system manager. Front Panel Display (optional) for Monitoring only.
Temperature Range	-30 to +60 °C
Mechanical Specifications	
Mounting Dimensions	1 RU, 1.75 X 19 in. (44 X 483 mm) 7.5 in. (191 mm) deep
Construction / Finish	Aluminum / protective finishes
Directional Coupler Connectors Input Output Coupled Ports	 7/16 DIN, 4.3-10 or N(male) 7/16 DIN, 4.3-10 or N(female) MCX type push-on with two 4 ft RD316 cables supplied.
Power Connector	AC model: IEC 320-C13 inlet & cord DC model: 2 port terminal block
Ethernet Connector	RJ-45
Alarm Closures Connector	3 port pluggable terminal block
Temp. Sensor Connector	24-pin header male pins
Net Weight	4.6 lbs. (2.1 kg)
Shipping weight	6.1 lbs. (2.8 kg)

Typical Application



Specifications are subject to change • www.dbspectra.com • 1590 E Hwy 121, Building A, Suite 100, Lewisville, TX 75056 • P (469)322-0080 •096000-797.A • 01/2024

Figure 4: DSCHPMDC1MDC Channelized Power Monitor

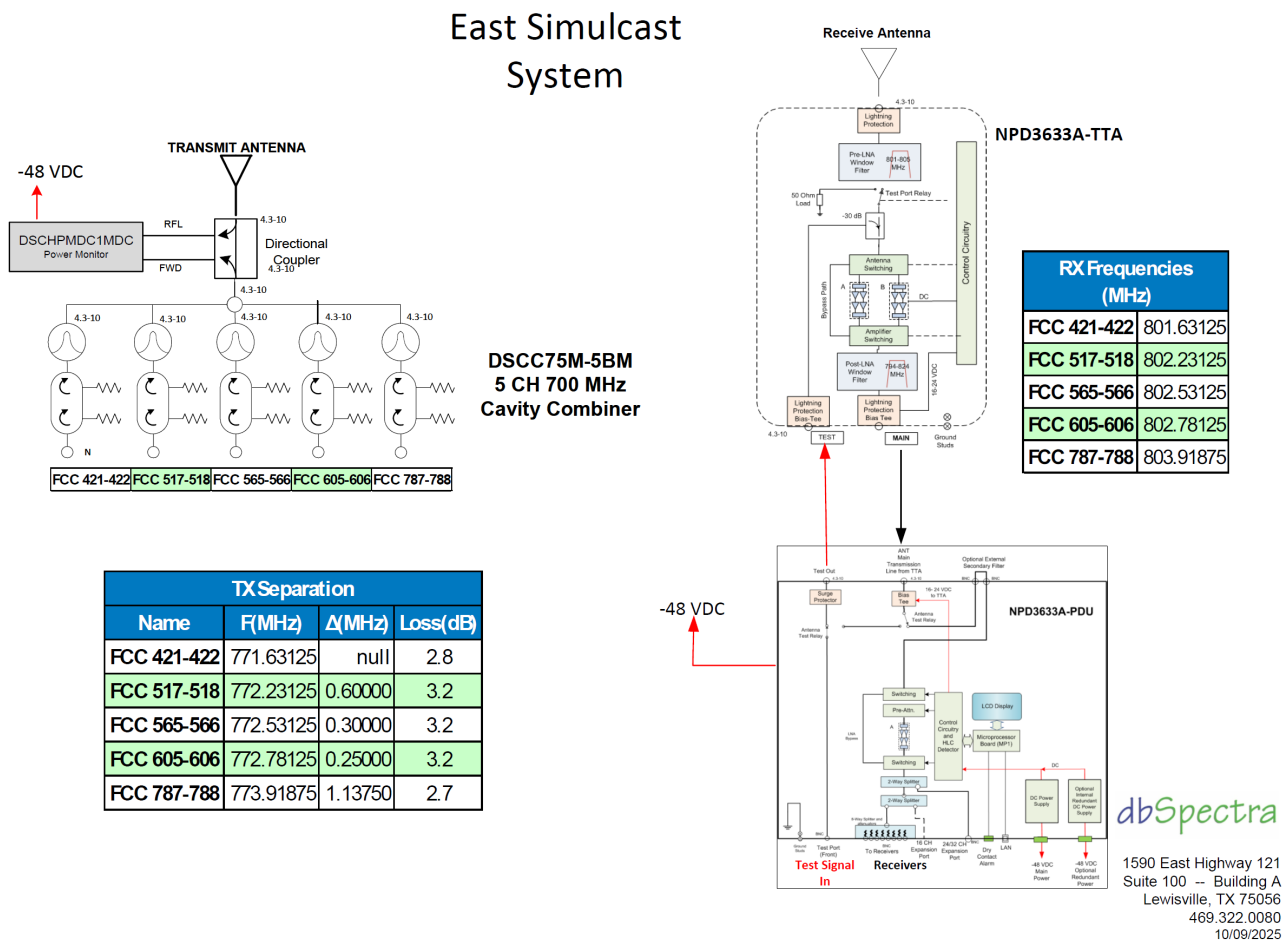
10. RF SUB-SYSTEM DESIGN

Tait have worked with dBSpectra to develop a generic combining system for the Marion County project that meets the performance goals derived in sections 7 and 8 of this report and thereby maximizes the talk in and talk out coverage of the system.

The transmit side of the RF sub-system consists of a 5-channel cavity filter based ceramic combiner to minimize losses and maximize the transmitted power and talk out coverage from the site. The cavity filters meet or exceed the Tx sideband noise filtering requirements given in section 7.9.

The receive side features a compact Tower Top Amplifier (TTA) followed by a Receiver Multicoupler/PDU that allows the receiver sensitivity to be optimized and distributes the signal to the five connected receivers. All the receive filtering is accommodated within the TTA. There are two filters, one before the LNA to preselect the 801 to 805MHz part of the band used by the Marion County system (see Figure 6), and a second after the LNA that fully rejects the Marion County system transmit signals, and the other 700 and 800MHz HLCs identified from the FCC database search (see Figure 7). Together, the filters meet or exceed the receiver blocking and receiver intermodulation filtering requirements given in sections 8.3.1 and 8.3.2. There are two LNAs, one in the TTA and one in the Rx Multicoupler/PDU with gains, noise figures and intercept points optimized so the cascade noise figure and linearity of the receiver line up meet the requirements of section 8.4.

A block diagram of the East Cell combining system design is shown in Figure 5 below:



RX Frequencies (MHz)	
FCC 421-422	801.63125
FCC 517-518	802.23125
FCC 565-566	802.53125
FCC 605-606	802.78125
FCC 787-788	803.91875

TX Separation			
Name	F(MHz)	Δ(MHz)	Loss(dB)
FCC 421-422	771.63125	null	2.8
FCC 517-518	772.23125	0.60000	3.2
FCC 565-566	772.53125	0.30000	3.2
FCC 605-606	772.78125	0.25000	3.2
FCC 787-788	773.91875	1.13750	2.7

Figure 5: SPD3454C-4TR Dual Band RF Combining System

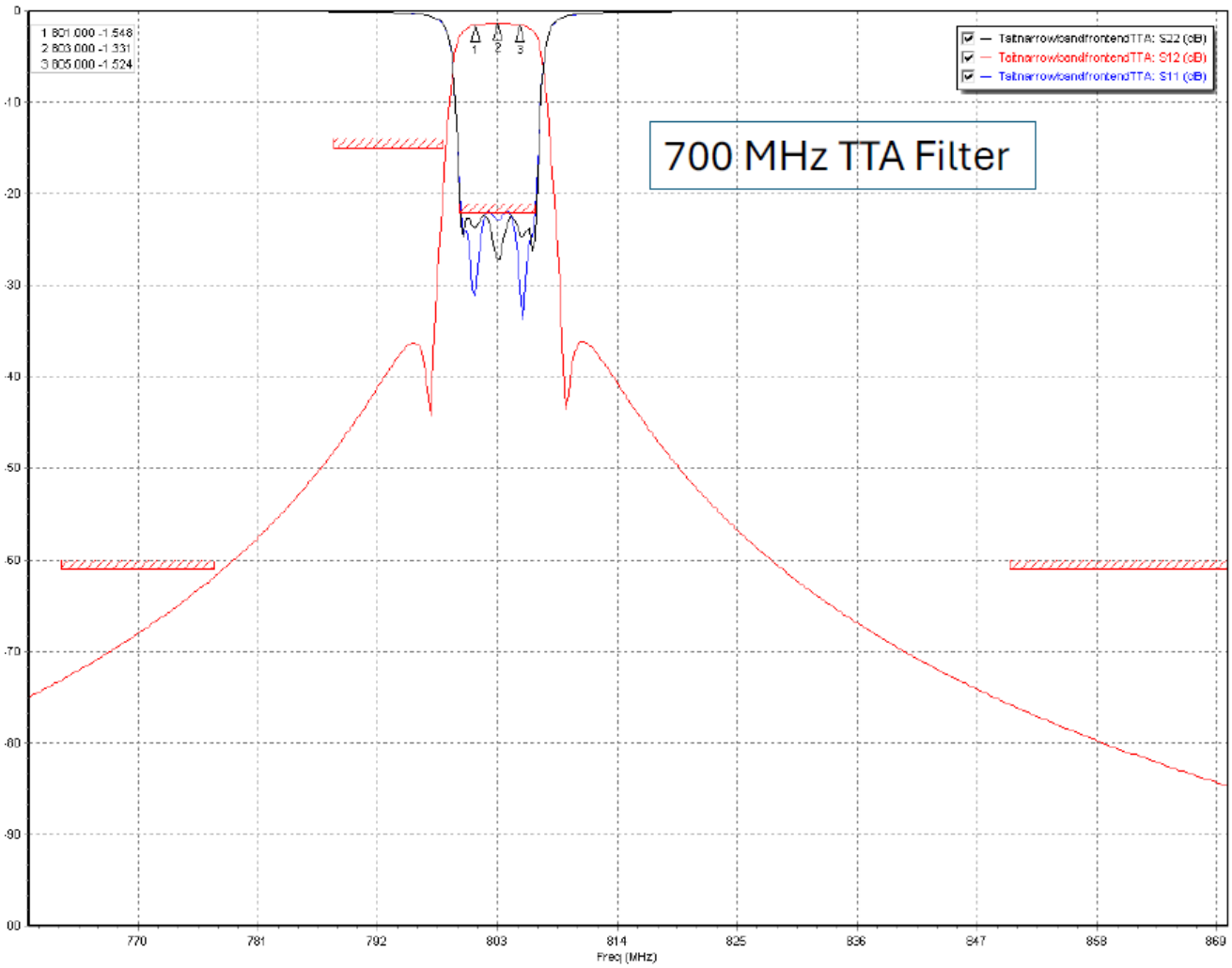


Figure 6: TTA Preselector Filter Plot

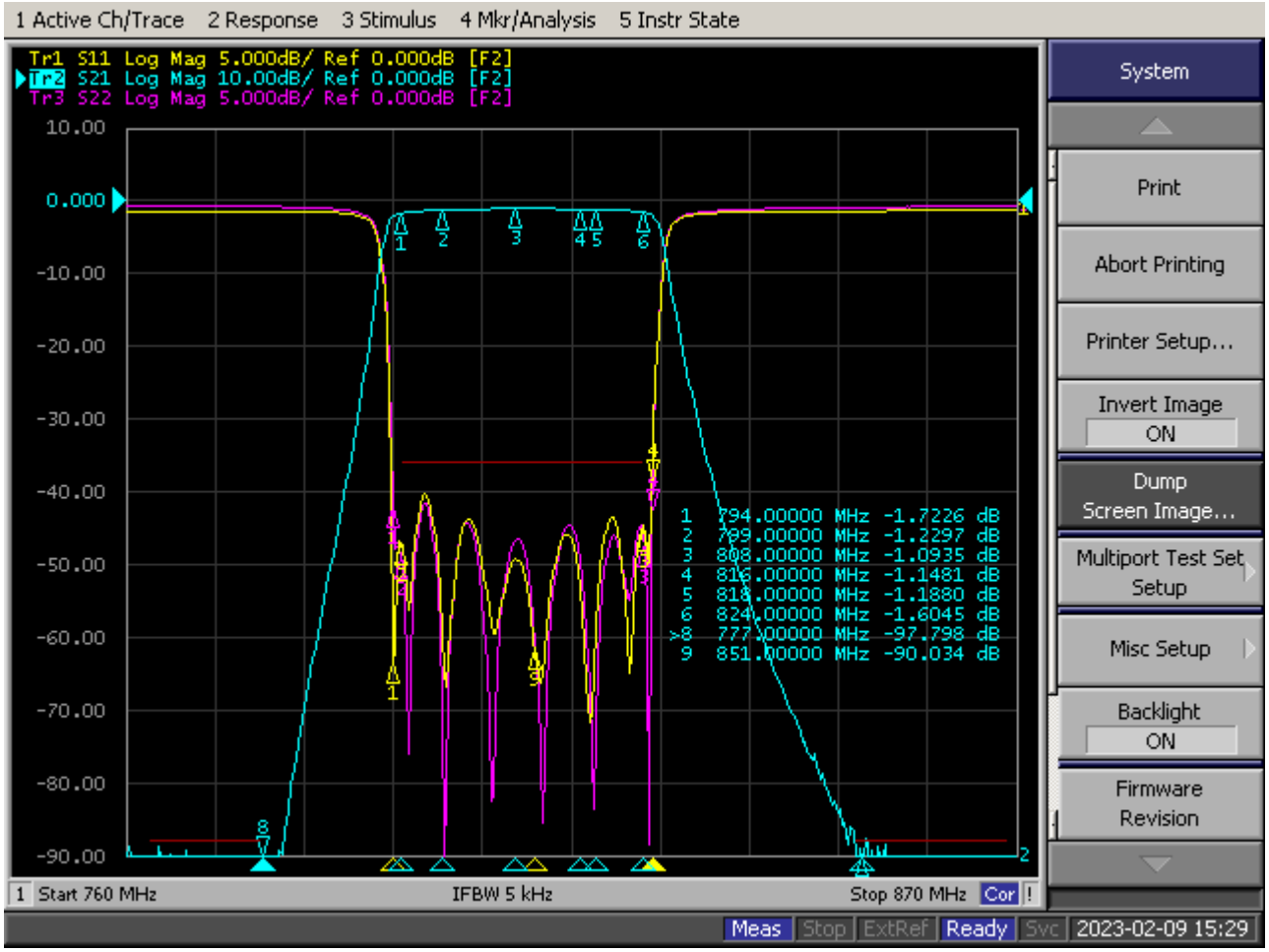


Figure 7: TTA Post LNA Filter Plot

11. MICROWAVE SYSTEM DESIGN

Refer to “Marion County P25 System Design_v1.1.docx” for Microwave System Details.

11.1 Site Specific Design

The House Mountain site supports two Aviat microwave links. These links connect House Mountain to SCC Backup Dispatch and APW, forming part of the 13-site core ring and providing the redundant routing expected within the looped topology.

12. RF SUB-SYSTEM DRAWINGS

The figure below contains the schematic of the RF sub-system to be deployed at this site.

12.1 RF System Schematic

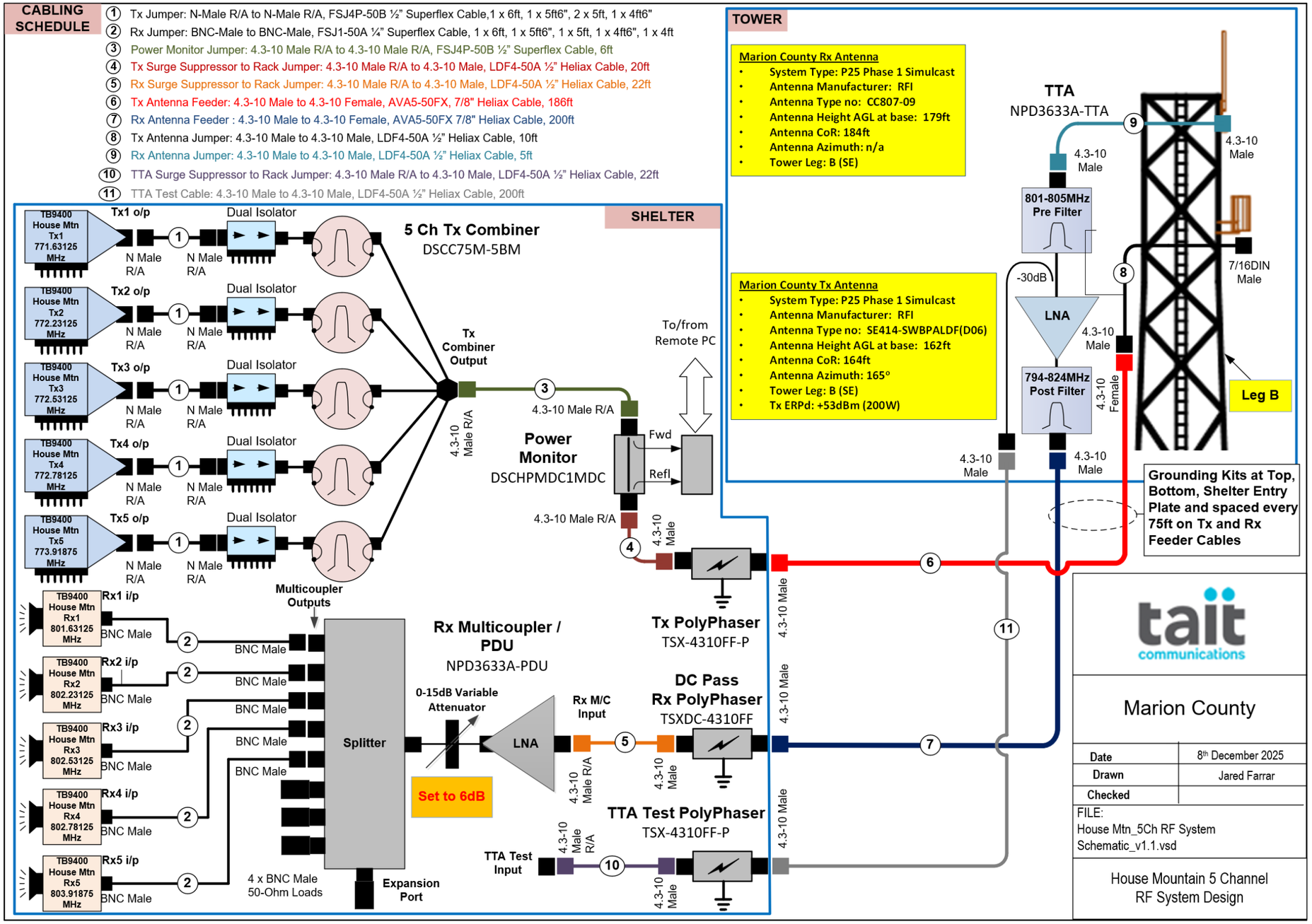


Figure 8: RF System Schematic

12.2 Rack Layout

This section contains the rack layout front & back view, side view and cabling diagram for this site.

Rack	RU	Description	Vendor PN	Vendor	Width (in)	Height (in)	Depth (in)
1	44	Breaker Panel	9072101001	9072101001	19	1U	3.25
1	42	Alarm Panel	M16G2 & D-PK-16PAN	M16G2 & D-PK-16PAN	17	1U	6.6
1	40	Switch #1	C9300L-24P-4X-A	C9300L-24P-4X-A	17.5	1U	17.7
1	38	Switch #2	C9300L-24P-4X-A	C9300L-24P-4X-A	17.5	1U	17.7
1	36	Timing Reference	2402-613	2402-613	17.1	1U	15.17
1	35	Timing Reference	2402-613	2402-613	17.1	1U	15.17
1	34	Timing Switch	SAS-17E	SAS-17E	19	1U	13.4
1	30	Breaker Panel	9072101001	9072101001	19	1U	3.25
1	25-28	P25 Conventional Base Station - CH1	TB9435S-100T	TB9435S-100T	19	4U	15.8
1	21-24	P25 Conventional Base Station - CH2	TB9435S-100T	TB9435S-100T	19	4U	15.8
1	17-20	P25 Conventional Base Station - CH3	TB9435S-100T	TB9435S-100T	19	4U	15.8
1	13-16	P25 Conventional Base Station - CH4	TB9435S-100T	TB9435S-100T	19	4U	15.8
1	9-12	P25 Conventional Base Station - CH5	TB9435S-100T	TB9435S-100T	19	4U	15.8
1	1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra	19	8U	12.5

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RF_Site_Simulcast

Figure 9: Marion County 19" Rack Layout – RF Front & Side

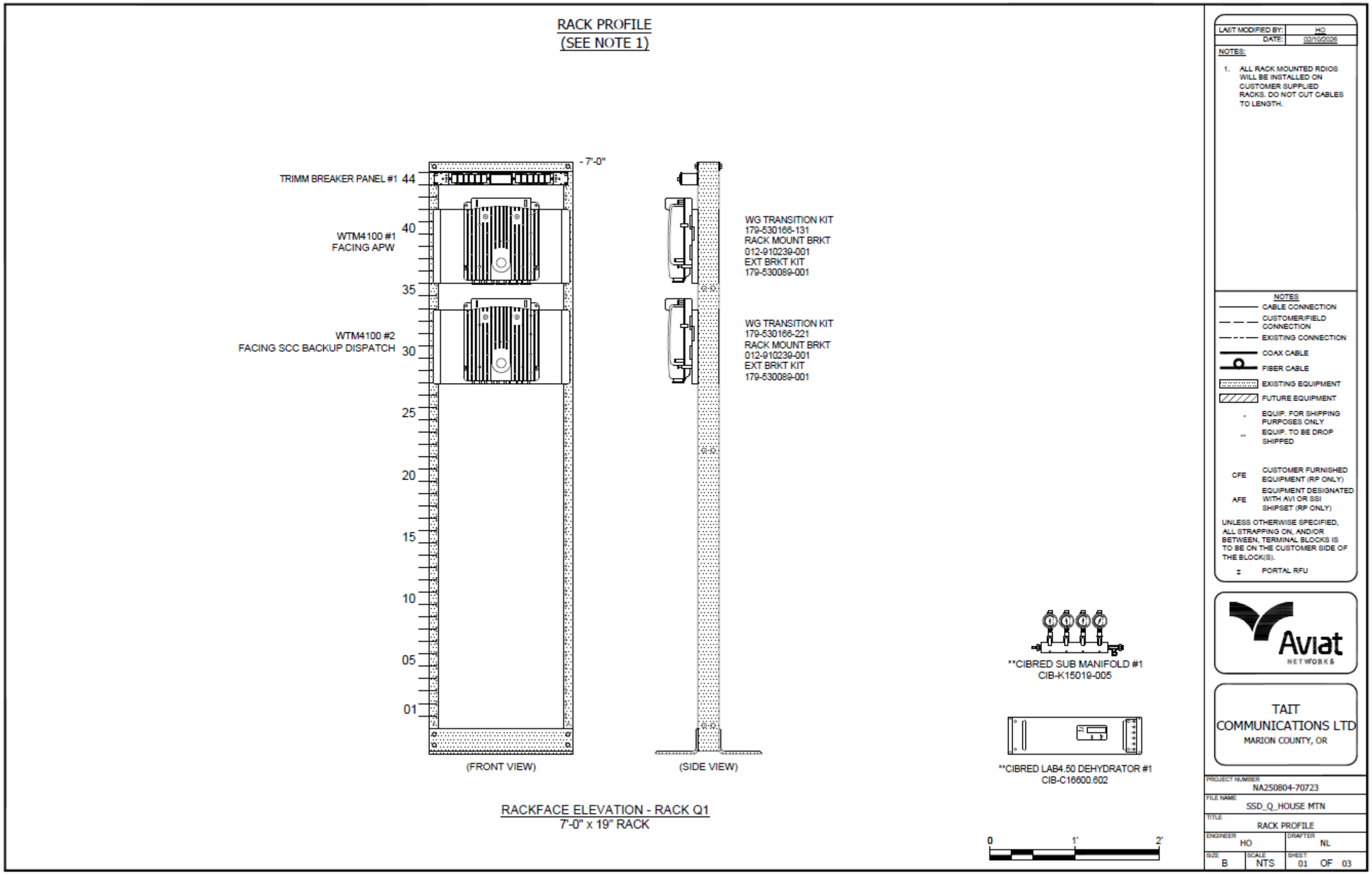
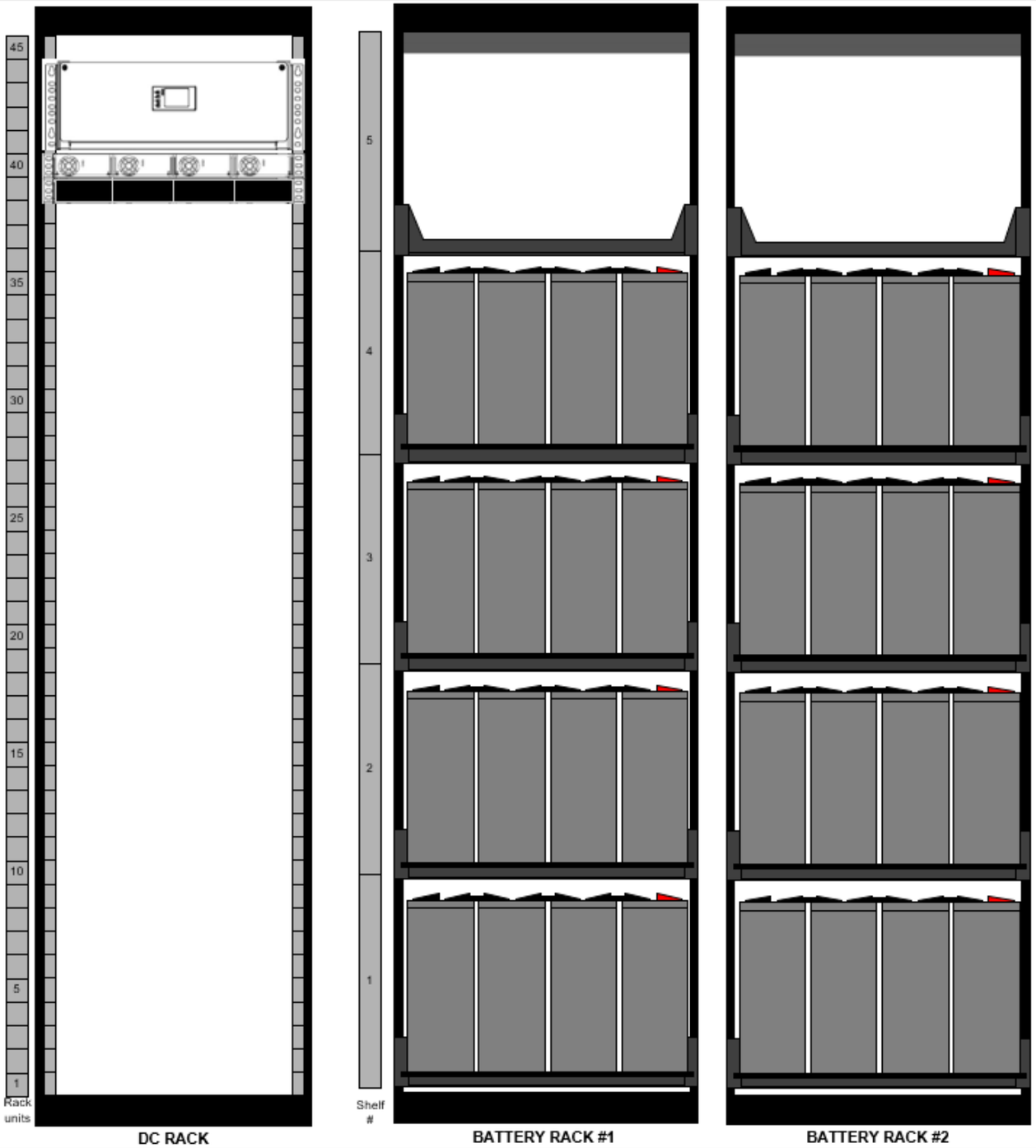


Figure 10: Microwave Rack



Rack	RU	Description	Vendor PN	Vendor
DC Rack	41-44	Unity Power System w/ Flatpack2	UNT20806.00014	Eltek
DC Rack	39-40	4x Flatpack2 HE Rectifier 2000W 48V	241115.105	Eltek
Battery Rack #1	S1	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack #1	S2	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack #1	S3	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack #1	S4	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack #2	S1	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack #2	S2	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack #2	S3	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack #2	S4	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada

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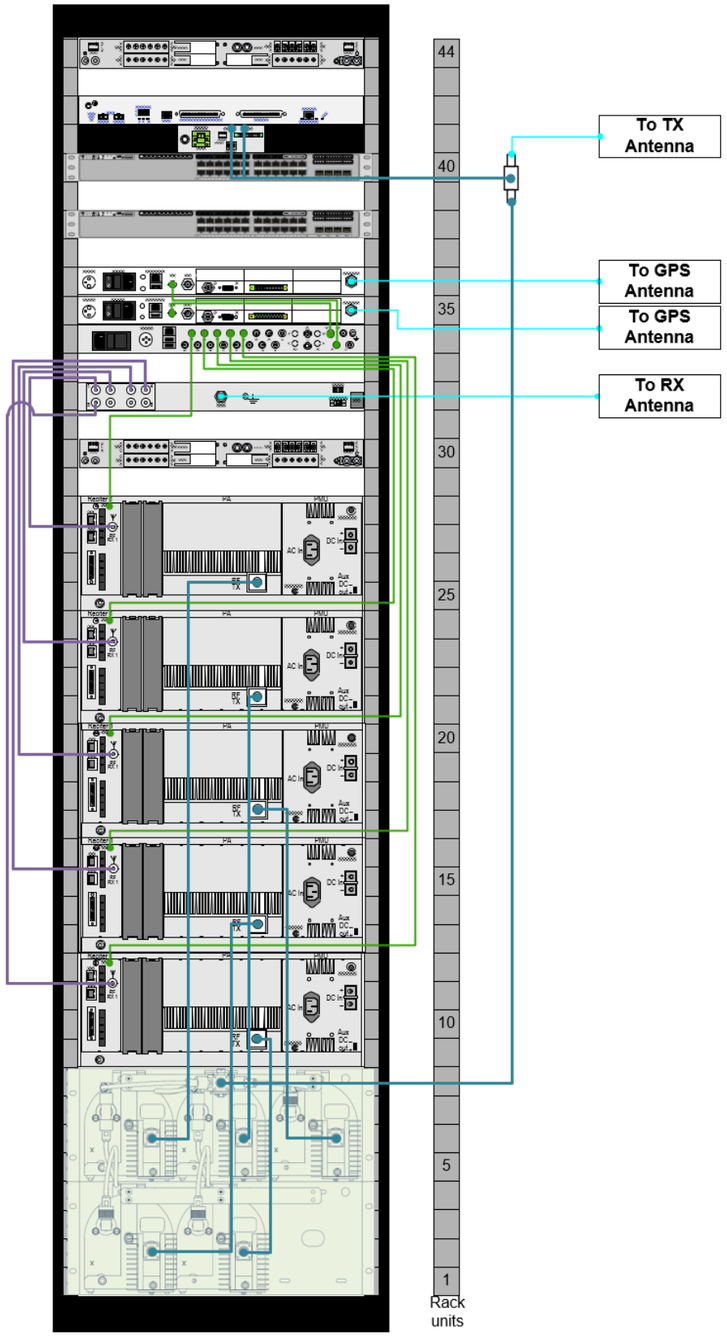
DC Power - East

Figure 11: DC Power & Battery Racks



Rack	RU	Description	Vendor PN	Vendor
1	44	Breaker Panel	9072101001	9072101001
1	42	Alarm Panel	M16G2 & D-PK-16PAN	M16G2 & D-PK-16PAN
1	40	Switch #1	C9300L-24P-4X-A	C9300L-24P-4X-A
1	38	Switch #2	C9300L-24P-4X-A	C9300L-24P-4X-A
1	36	Timing Reference	2402-613	2402-613
1	35	Timing Reference	2402-613	2402-613
1	34	Timing Switch	SAS-17E	SAS-17E
1	30	Breaker Panel	9072101001	9072101001
1	25-28	P25 Conventional Base Station - CH1	TB9435S-100T	TB9435S-100T
1	21-24	P25 Conventional Base Station - CH2	TB9435S-100T	TB9435S-100T
1	17-20	P25 Conventional Base Station - CH3	TB9435S-100T	TB9435S-100T
1	13-16	P25 Conventional Base Station - CH4	TB9435S-100T	TB9435S-100T
1	9-12	P25 Conventional Base Station - CH5	TB9435S-100T	TB9435S-100T
1	1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

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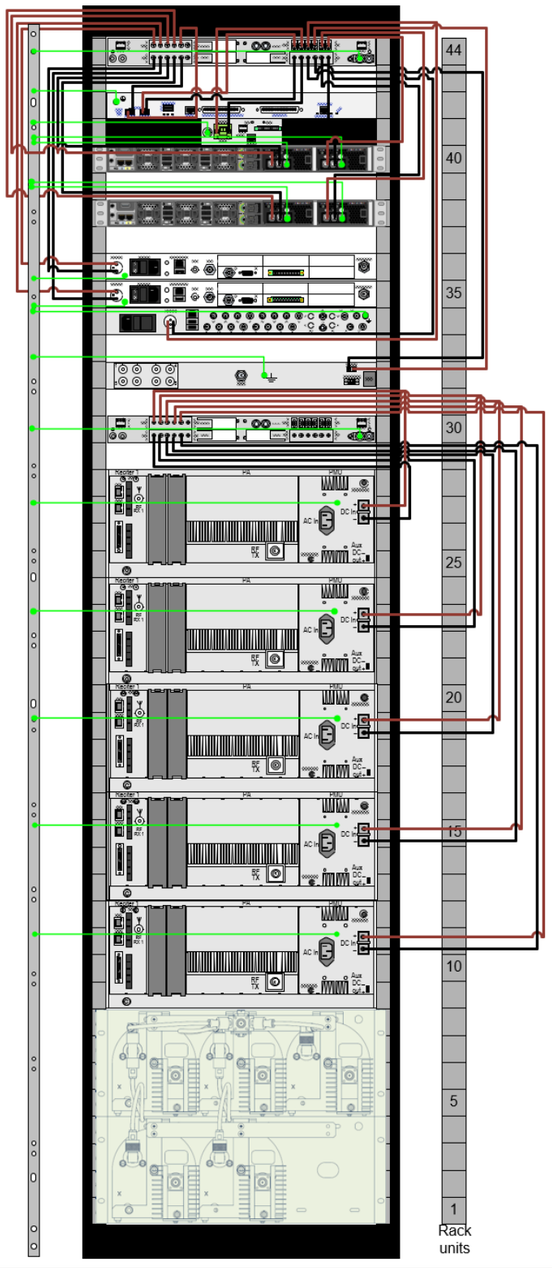
Cabling - RF

Figure 12: Marion County 19" Rack Layout – RF Cabling



Rack	RU	Description	Vendor PN	Vendor
1	44	Breaker Panel	9072101001	9072101001
1	42	Alarm Panel	M16G2 & D-PK-16PAN	M16G2 & D-PK-16PAN
1	40	Switch #1	C9300L-24P-4X-A	C9300L-24P-4X-A
1	38	Switch #2	C9300L-24P-4X-A	C9300L-24P-4X-A
1	36	Timing Reference	2402-613	2402-613
1	35	Timing Reference	2402-613	2402-613
1	34	Timing Switch	SAS-17E	SAS-17E
1	30	Breaker Panel	9072101001	9072101001
1	25-28	P25 Conventional Base Station - CH1	TB9435S-100T	TB9435S-100T
1	21-24	P25 Conventional Base Station - CH2	TB9435S-100T	TB9435S-100T
1	17-20	P25 Conventional Base Station - CH3	TB9435S-100T	TB9435S-100T
1	13-16	P25 Conventional Base Station - CH4	TB9435S-100T	TB9435S-100T
1	9-12	P25 Conventional Base Station - CH5	TB9435S-100T	TB9435S-100T
1	1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

Description A	Connection A	Description B	Connection B
Breaker Panel 1	A1	GPS 1	-48 VDC
Breaker Panel 1	A2	GPS 2	-48 VDC
Breaker Panel 1	A3	Switch 1-A	-48 VDC
Breaker Panel 1	A4	Switch 2-A	-48 VDC
Breaker Panel 1	A5	Alarm Panel A	-48 VDC
Breaker Panel 2	B1	Alarm Panel B	-48 VDC
Breaker Panel 2	B2	Power Monitor	-48 VDC
Breaker Panel 2	B3	Timing Switch	-48 VDC
Breaker Panel 2	B4	Multicoupler	-48 VDC
Breaker Panel 2	B5	Switch 2-B	-48 VDC
Breaker Panel 2	B6	Switch 1-B	-48 VDC

Description A	Connection A	Description B	Connection B
Breaker Panel 2	A1	TB9400 CH1	-48 VDC
Breaker Panel 2	A2	TB9400 CH3	-48 VDC
Breaker Panel 2	A3	TB9400 CH5	-48 VDC
Breaker Panel 2	B1	TB9400 CH2	-48 VDC
Breaker Panel 2	B2	TB9400 CH4	-48 VDC

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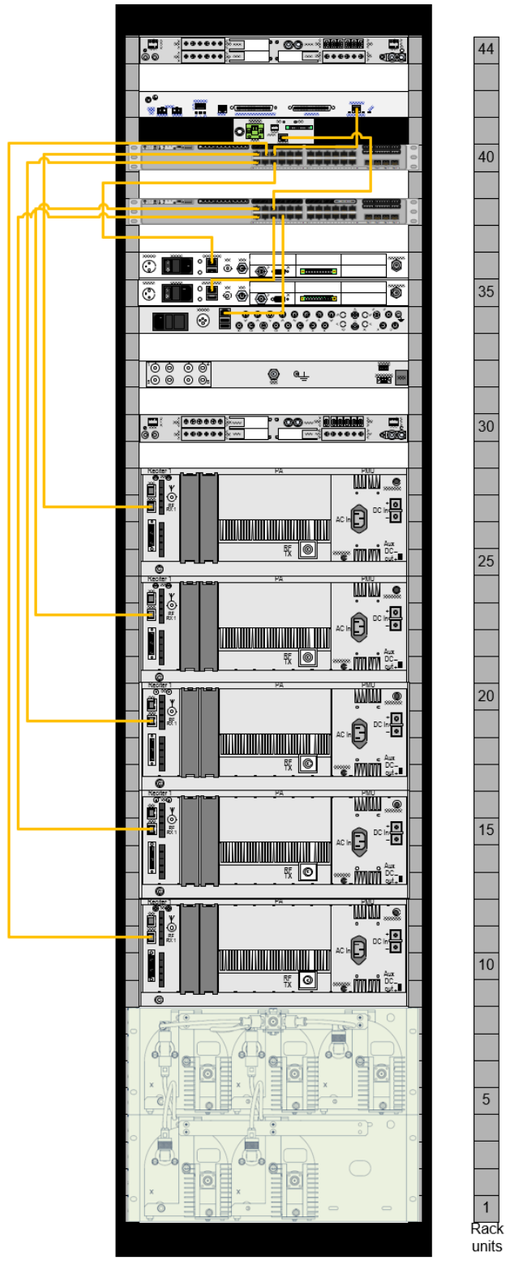
Cabling - Power

Figure 13: Marion County 19" Rack Layout – Power Cabling



Rack	RU	Description	Vendor PN	Vendor
1	44	Breaker Panel	9072101001	9072101001
1	42	Alarm Panel	M16G2 & D-PK-16PAN	M16G2 & D-PK-16PAN
1	40	Switch #1	C9300L-24P-4X-A	C9300L-24P-4X-A
1	38	Switch #2	C9300L-24P-4X-A	C9300L-24P-4X-A
1	36	Timing Reference	2402-613	2402-613
1	35	Timing Reference	2402-613	2402-613
1	34	Timing Switch	SAS-17E	SAS-17E
1	30	Breaker Panel	9072101001	9072101001
1	25-28	P25 Conventional Base Station - CH1	TB9435S-100T	TB9435S-100T
1	21-24	P25 Conventional Base Station - CH2	TB9435S-100T	TB9435S-100T
1	17-20	P25 Conventional Base Station - CH3	TB9435S-100T	TB9435S-100T
1	13-16	P25 Conventional Base Station - CH4	TB9435S-100T	TB9435S-100T
1	9-12	P25 Conventional Base Station - CH5	TB9435S-100T	TB9435S-100T
1	1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

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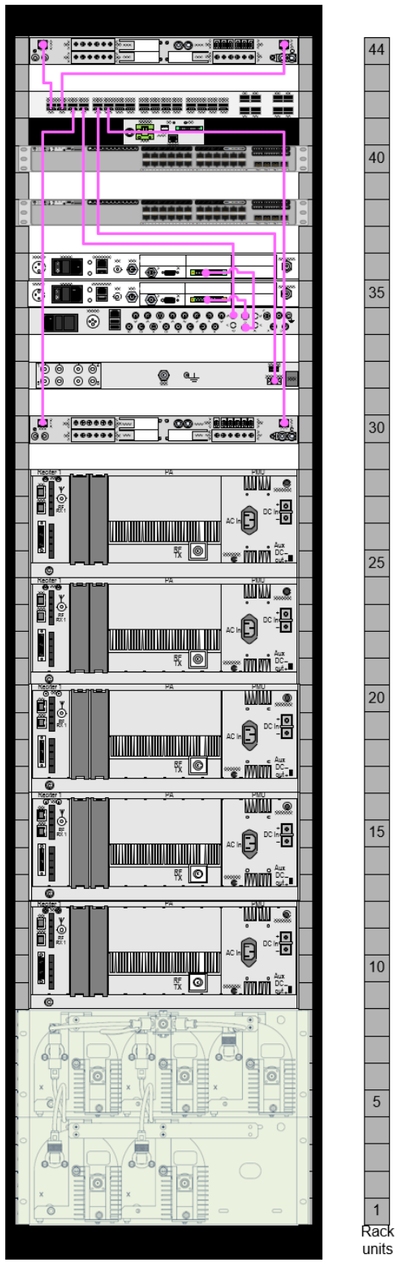
Cabling - Network

Figure 14: Marion County 19" Rack Layout – Network Cabling



Rack	RU	Description	Vendor PN	Vendor
1	44	Breaker Panel	9072101001	9072101001
1	42	Alarm Panel	M16G2 & D-PK-16PAN	M16G2 & D-PK-16PAN
1	40	Switch #1	C9300L-24P-4X-A	C9300L-24P-4X-A
1	38	Switch #2	C9300L-24P-4X-A	C9300L-24P-4X-A
1	36	Timing Reference	2402-613	2402-613
1	35	Timing Reference	2402-613	2402-613
1	34	Timing Switch	SAS-17E	SAS-17E
1	30	Breaker Panel	9072101001	9072101001
1	25-28	P25 Conventional Base Station - CH1	TB9435S-100T	TB9435S-100T
1	21-24	P25 Conventional Base Station - CH2	TB9435S-100T	TB9435S-100T
1	17-20	P25 Conventional Base Station - CH3	TB9435S-100T	TB9435S-100T
1	13-16	P25 Conventional Base Station - CH4	TB9435S-100T	TB9435S-100T
1	9-12	P25 Conventional Base Station - CH5	TB9435S-100T	TB9435S-100T
1	1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

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Cabling - Alarms

Figure 15: Marion County 19" Rack Layout – Alarm Cabling

13. PARTS AND EQUIPMENT LISTS

Refer to “Marion County P25 Project - Equipment List by Site.xlsx” for site-specific equipment list.

14. RF PERFORMANCE

14.1 Tx Effective Radiated Power

Table below summarizes the transmitter system performance. It shows the required TB9400 transmitter output power setting, the combining losses (including internal cabling), the antenna feeder loss and finally the resulting ERP relative to a dipole (ERPd).

Transmitter Frequency (MHz)	Transmitter Output Power Setting	Combining Losses (dB)	Misc Losses (dB)	Antenna Feeder Losses (dB)	Tx ERPd
771.63125	+47.98dBm (63W)	3.2	0.7	2.44	+53.0dBm (200W)
772.23125	+47.98dBm (63W)	3.2			+53.0dBm (200W)
772.53125	+47.98dBm (63W)	3.2			+53.0dBm (200W)
772.78125	+47.98dBm (63W)	3.2			+53.0dBm (200W)
773.91875	+47.98dBm (63W)	3.2			+53.0dBm (200W)

Table 9: Transmitter Output Power Setting and Effective Radiated Power

14.2 Site Noise

Site Noise in the 700MHz band can be assumed to be negligible.

14.3 Receiver Sensitivity

Table summarizes the receiver system performance. It shows the amount of de-sensitization caused by the elevated site noise floor, the required Rx Multicoupler attenuation setting, and the resulting final Receiver sensitivity that can be achieved.

Receiver Frequency (MHz)	Rx Multicoupler Attenuator Setting (dB)	Rx Sensitivity for DAQ3.4 (dBm)
801.63125	6	-112.8
802.23125		
802.53125		
802.78125		
803.91875		

Table 10: Receiver Sensitivity

15. SITE DESIGN INFORMATION

15.1 Site Plan

The site plan is an overhead view of the overall compound depicting locations of pertinent features.

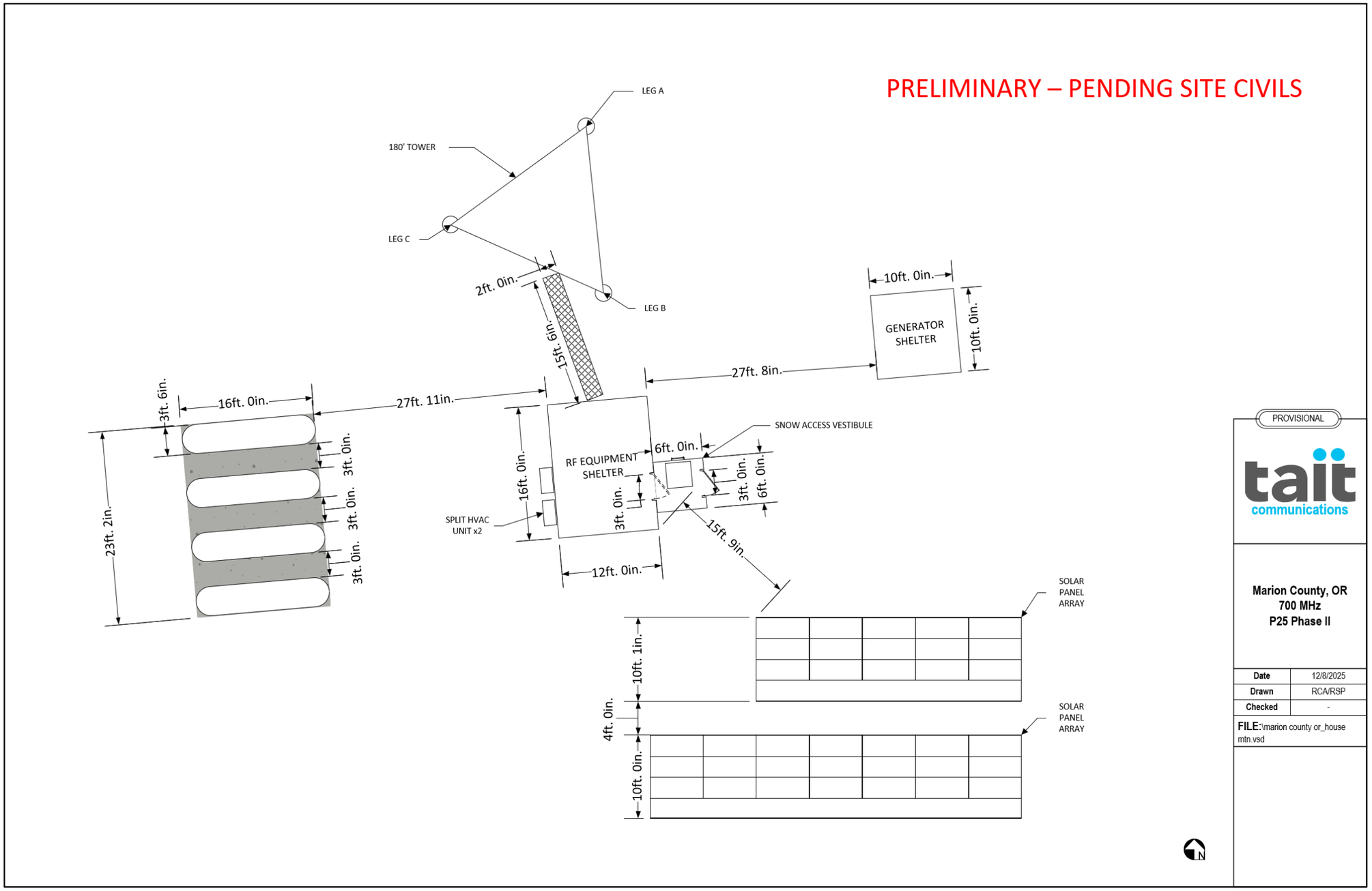

Figure 16: Site Plan

15.2 Floor and Cable Routing Plan

The floor and cable routing plan is an overhead view of the equipment room layout depicting locations of pertinent equipment and including the cable routing plans leading to the tower.

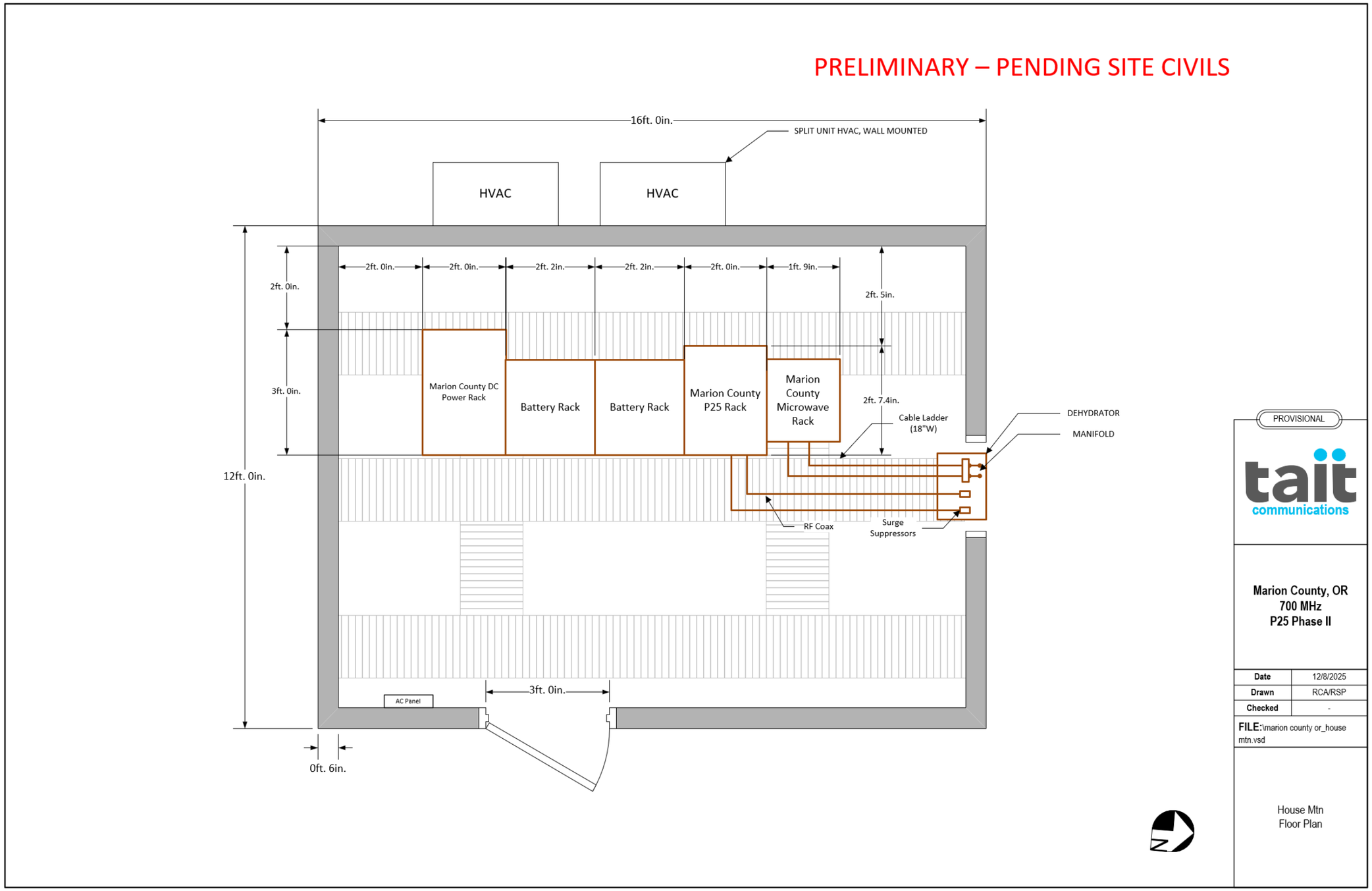

Figure 17: Floor and Cable Routing Plan

15.3 Entry and Exit Ports

The ports where the antenna and TTA cables enter / exit the shelter are shown in the below figure.

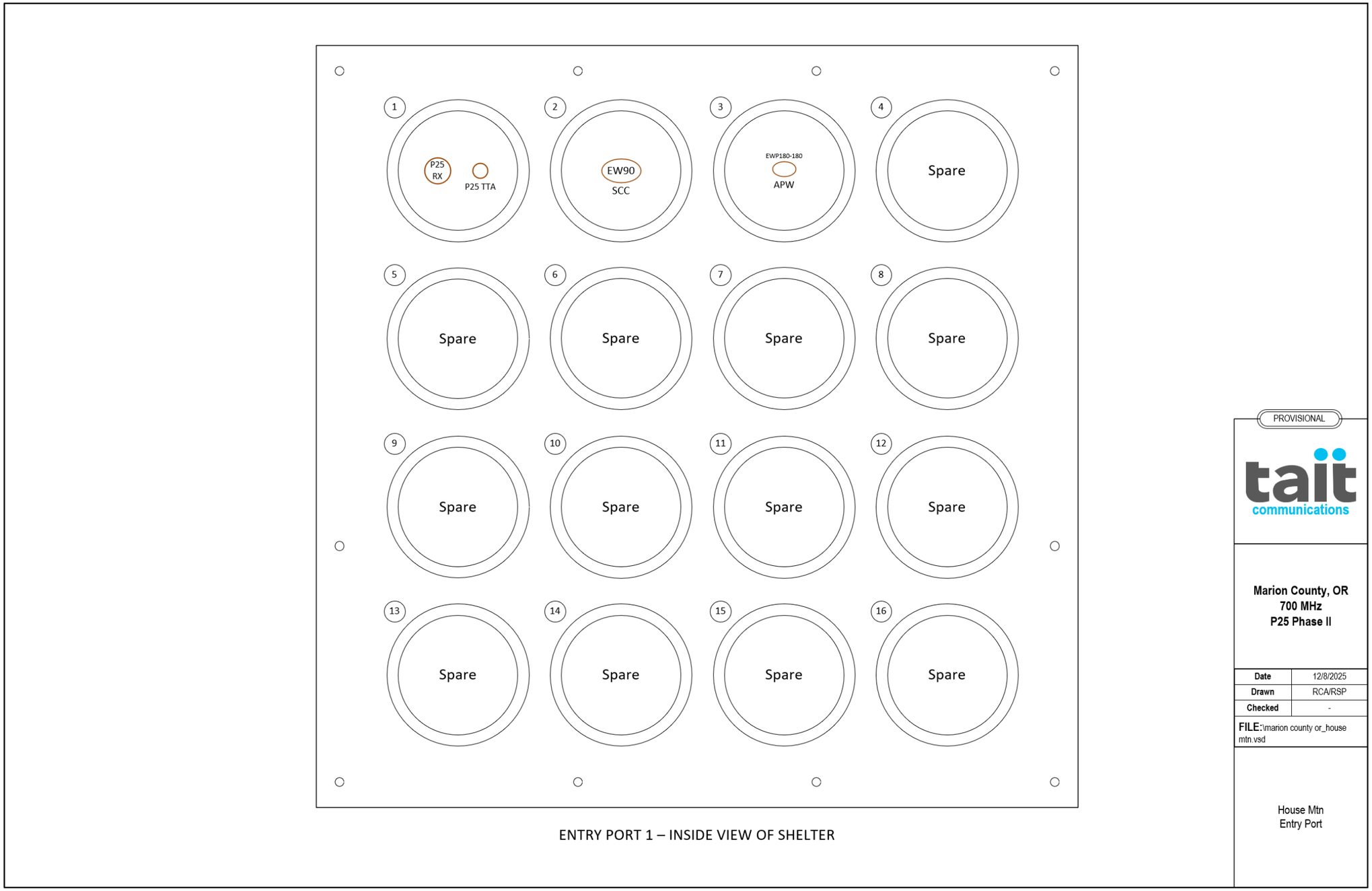

Figure 18: Shelter Cable Entry & Exit Ports

15.3.1 Power & Heat Load Calculations

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Power & Heat Load details.

15.3.2 DC Distribution Fuse Panel

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Fuse Panel details.

Supplemental 8 - Lower Prospect

PROVISIONAL Design Document

RF Sub-System and Site Designs

Marion County

Region: South Cell

Site: Lower Prospect

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www.taitradio.com

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PREFACE

Project Details

Project number	
Customer	Marion County
Project description	P25 Phase 2 Simulcast & P25 Phase 1 Conventional Simulcast
Business Development Manager	
Sales Engineer	
Project Engineer	Jared Farrar / Riley Alfaqeeh
Project Manager	Stacey Adams (formerly Matt Jordan)
Lead RF Engineers	Ian Graham

Purpose

The Marion County project is an 11 site P25 simulcast design that uses the US 700MHz band. To control Time Delay Interference (TDI), the simulcast design is split into three cells – North, South, and East. The North cell is comprised of four sites with P25 Phase 2 trunked operation, the South cell is comprised of four sites with P25 Phase 2 trunked operation, and the East cell is comprised of three sites with P25 Phase 1 conventional operation.

The purpose of this report is to document the RF subsystem design for the **Lower Prospect** site which forms part of the South simulcast cell.

Scope

This document specifies the frequencies to be utilized at the site and summarizes the intermodulation analysis with these frequencies and other high-level in band carriers as identified from an FCC license search. The required antenna system and associated RF combining equipment will then be described in full.

Publication Record

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1.0	18th December 2025	Jared Farrar	Initial Release
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Document Approvals

Approvals	Position	Signature	Date
Bladymir Guzman	TAM Design Authority		

Associated Documents & References

Reference documentation includes:

- Marion County P25 System Design_v1.1.docx
- Marion County P25 Project - Equipment List by Site.xlsx
- Marion County Power_Heat_Load.xlsx

1. GENERAL RF DESIGN APPROACH

The Marion County project is an 11-site P25 simulcast design that uses the US 700MHz band. To control Time Delay Interference (TDI), the simulcast design is split into three cells – North, South, and East.

The North Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- Crooked Finger
- Crosby
- Eastview
- Parrett Mountain

The South Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- Eagle Crest
- **Lower Prospect**
- McCully Mountain
- Wipper

The East Cell sites operate in P25 Phase 1 conventional mode and are identified as follows:

- APW
- House Mountain
- Halls Ridge

Each site within the North and South Cells will have five trunked P25 Phase 2 channels providing eight dynamic talkpaths (one 12.5kHz FDMA control channel plus four 2-slot 12.5kHz TDMA traffic channels) across each respective cell's coverage area. The East Cell will have five conventional P25 Phase 1 12.5kHz FDMA channels providing five fixed talkpaths across the cell.

Each site across all three cells will have separate transmit (Tx) and receive (Rx) antennas, typically with 20ft vertical separation between centers of radiation. The anticipated low site noise floors in the 700MHz band means Tower Top Amplifiers (TTA) can be used to improve receiver sensitivity and talk-in coverage. Along with the 30MHz Tx-Rx frequency separation, these factors lead to a common RF combining subsystem design which is applicable to all Marion County sites. The combining system requirements were captured based on the proposed frequency plan in coordination with ADCOMM Engineering LLC and Tait subsequently worked with the chosen equipment vendor, dBSpectra, on an optimal design. The main consideration was the TTA where it was decided to use dBSpectra's compact design after it was shown all the required receiver filtering could be accommodated. The generic (starting point) site combining system design therefore features the:

- DSCC75M-5BM 5 Channel Ceramic Tx Combiner
- DSCHPMDC1MDC Channelized Power Monitor
- NPD3633A-TTA Tower Top Amplifier
- NPD3363A-PDU Rx Multicoupler PDU

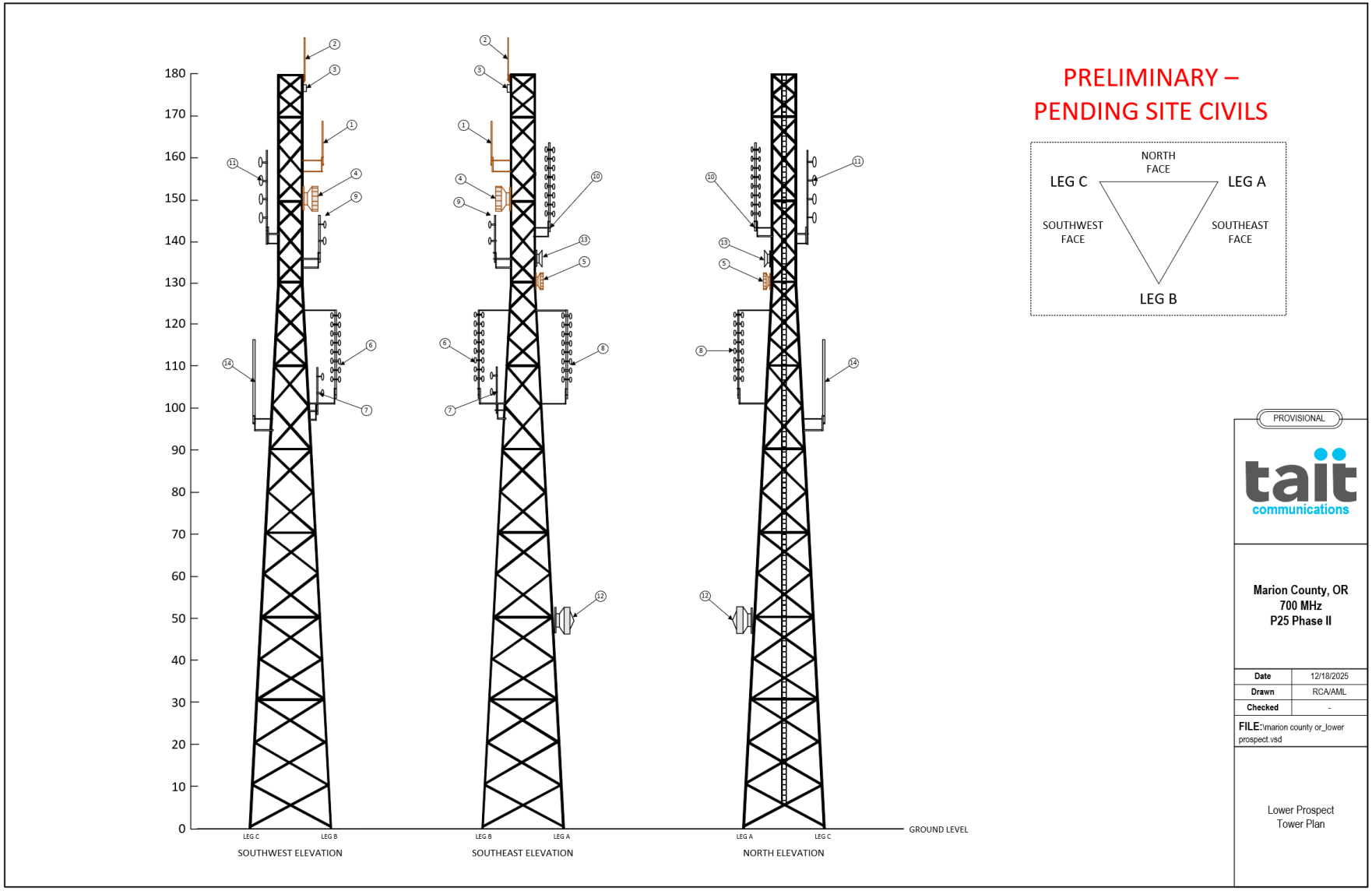
Antennas were chosen on a site-by-site basis to minimize TDI in the simulcast cells while still providing necessary talk-out coverage. The proposed antennas are the:

- Sinclair SE412-SWBPAL
    - 5dBd Low PIM Enclosed Dipole Array
- Sinclair SE414-SWBPAL
    - 8.5 to 11dBd Low PIM Adjustable Beamwidth Enclosed Dipole Array
- RFI CC807-09
    - 9dBd Collinear Omnidirectional

For the Lower Prospect site, the basic design approach will be:

- Install a new RFI transmit antenna on Leg B (S) of the 180ft Tower at 159ft AGL, azimuth ~165°
    - Note that Lower Prospect is unlike the majority of Marion County RF sites in that the selected Tx antenna is a collinear omni model rather than a directional enclosed dipole. Consequently, the decision to place it on Leg C of the tower (pointing WNW) is largely based on available tower space allowing for both Tx and Rx antennas to coexist on the same leg, allowing for maximum Tx-Rx isolation, rather than optimizing placement based on downlink TDI considerations. In this case, the standoff azimuth fully determines the antenna's azimuth.
    - The 5 transmit channels will be connected to the Tx antenna using the dBSpectra DSCC75M-5BM Ceramic Combiner.
- Install a new RFI CC807-09 receive antenna on Leg B (S) of the 180ft Tower at 179ft AGL (azimuth n/a).
    - The 5 receive channels will be fed from the Rx antenna via the dBSpectra NPD3633A-TTA Tower Top Amplifier and the NPD3633A-PDU Rx multicoupler/PDU

2. TOWER MAPPING



Lower Prospect												
#	Description	Part Number	Length (ft)	Leg/Face	Status	Base Height (ft)	Centerline Height(ft)	Tip Height (ft)	Antenna Azimuth	Mount Azimuth	Mount	Transmission Line Size/Type
1	P25 TX Antenna	CC807-09	10.3	B	New	159	164	169	165	165	Site-Pro PSA-6 (6' standoff)	7/8"
2	P25 RX Antenna	CC807-09	10.3	B	New	179	184	189	-	90	Standard	1/2" to TTA
3	TTA	NPD3633A-TTA	1.0	B	New	176	177	177	-	-	Standard	7/8"
4	Microwave - SCC Backup	VHLP6-6W	6.0	B	New	147	150	153	103.36	103.36	Standard w/ tieback	EW63
5	Microwave - MCPW Dispatch	VHLP4-11W	4.0	A	New	128	130	132	40.7	40.7	Standard w/ tieback	EW90
6	Dipole-1	16 element	20	B	Existing	102	112	122			Standoff	
7	Dipole-2	2 element	10	B	Existing	99	104	109			Standoff	
8	Dipole-3	16 element	20	A	Existing	102	112	122			Standoff	
9	Dipole-4	2 element	10	B	Existing	135	140	145			Standoff	
10	Dipole-5	16 element	20	A	Existing	140	150	160			Standoff	
11	VHF AS-IP RX Antenna	4 element	20	C	Existing	125	135	145			Standoff	
12	Microwave-1	RFS	6	A	Existing	47	50	53			Standard	
13	Microwave-2		3	A	Existing	134	135	137			Standard	
14	VHF AS-IP TX Antenna	DB224-E	22.5	C	New	94	105	116	-	-	Standoff	

= estimated value based on survey documentation and photos

= information pending

Figure 1: Lower Prospect 180ft Tower Mapping and Appurtenances

3. FREQUENCY PLANNING

5 Channels will be deployed at this site.

The South Simulcast cell uses the following frequencies.

Site Name	FCC Channel Number	Tx Frequency (MHz)	Rx Frequency (MHz)
Lower Prospect	411-412	771.56875	801.56875
	461-462	771.88125	801.88125
	573-574	772.58125	802.58125
	745-746	773.65625	803.65625
	837-838	774.23125	804.23125

Table 1: South Cell Frequency Assignments

4. INCUMBENTS SEARCH

An external high-level carrier (HLC) is defined as a signal that appears at a level of >-40dBm at the Receive antenna. These are the signals that have the potential to contribute towards intermodulation that would result in a loss of receiver sensitivity on one or more channels.

Signal and Noise Monitoring of RF activity at the site was not deemed necessary for this project given the wide Tx-Rx frequency separation in the 700MHz band and the anticipated low site noise floors.

To get some idea of potential RF activity at the site though, an FCC License Search was carried out to identify any other transmitters operating between 700 and 900MHz located within a 0.6-mile radius of the tower (a 100W transmitter, 0.6 miles away would be received at -40dBm assuming free space path loss). These may include cellular transmitters (as their wide bandwidth could cause IM energy to spread into the LMR receive band) and are summarized in Table 2 below.

Owner	Call Sign	Frequency (MHz)	Tx ERPd (dBm)	Distance from Marion County Tower (miles)
NW Natural	WNZM308	854.9375	N/A (ref. Table 4)	0
NW Natural	WNZM308	855.9375	N/A (ref. Table 4)	0
DD Inc	WPVA699	856.3125	N/A (ref. Table 4)	0
DD Inc	WPVA699	857.3125	N/A (ref. Table 4)	0
DD Inc	WPVA699	858.3125	N/A (ref. Table 4)	0
DD Inc	WPVA699	859.3125	N/A (ref. Table 4)	0
Wireless Connection, LLC	WPVJ257	860.8625	N/A (ref. Table 4)	0.5
Wireless Connection, LLC	WPVJ257	860.8625	N/A (ref. Table 4)	0.5

Table 2: High Level Carriers

5. INTERMODULATION ANALYSIS

An intermodulation (IM) analysis was performed for the potentially significant sources, including both the Marion County channels to be deployed and any HLCs found during the FCC License Search. For antenna configurations using separate transmit and receive antennas Tait best practice is to search for IM products up to 7th order within a defined search window accounting for the fact the bandwidth of IM products spread according to the order and bandwidth of the signals that cause it.

The frequencies included in the IM analysis are listed in Table 3 below.

Transmit Frequencies (MHz)	Receive Frequencies (MHz)
771.56875	801.56875
771.88125	801.88125
772.58125	802.58125
773.65625	803.65625
774.23125	804.23125
854.9375	
855.9375	
856.3125	
857.3125	
858.3125	
859.3125	
860.8625	
860.8625	

Table 3: Frequencies Included in IM Analysis

Table 4 below shows how many IM products are generated on each of the receive frequencies. A direct hit is an IM product that falls exactly at the receive frequency. An indirect hit is one that does not fall exactly at a receive frequency but does fall within the search window.

IM Order	Number of Intermodulation Products at each Receive Frequency									
	801.56875		801.88125		802.58125		803.65625		804.23125	
	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect
3rd	0	0	0	0	0	0	0	0	0	0
5th	0	0	0	0	0	0	0	0	0	0
7th	0	0	0	0	0	0	0	0	0	0

Table 4: Intermodulation Results Summary

6. ANTENNA SYSTEM DESIGN

The Antenna System detailed here and the RF Combining System described later in sections 7, 8, and 10 have been specifically designed to mitigate any interference caused by the listed high level carriers, thereby maximizing the coverage achieved by the Marion County system.

6.1 Antenna Type

The following antennas will be used at Lower Prospect.

Antenna	Manufacturer	Antenna Model Number	Description	Antenna Length (ft)	Antenna Gain (dBd)
Rx	RFI	CC807-09	Collinear	10	9
Tx	RFI	CC807-09	Collinear	10	9

Table 5: Antenna Details

800MHz Corporate Collinear Antennas

748-870MHz

CC807 Series

These industry leading, full featured corporate collinear arrays allow site operators to combine, with complete integrity, a large number of communications services into a single, low profile antenna solution.

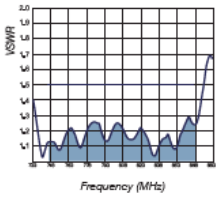
The corporate feed design employed by RFI maintains superior pattern control, allowing gain to be maximised with zero tilt variation over a very broad bandwidth, comparable to that only previously available in exposed dipole array configurations. This is achieved in the preferred form factor of a fully enclosed fibreglass radome, providing a reduction in wind loading, ice loading and tower loading in comparison.

The CC807 series have been designed with an exceptional power rating of 500W across the band as well as a Peak Instantaneous Power (PIP) rating of 25kW to cater for the peak voltage levels present in large multi-carrier combining environments. RFI's refined design processes and proven construction methods achieve a PIM rating of –150dBc, further ensuring performance is maintained for the service life of the antenna.

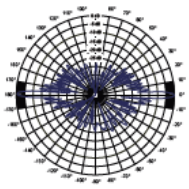
Features:

- 500W Continuous Power rating
- -150dBc Passive Intermodulation (PIM) rating, 100% PIM tested
- 25 kW Peak Instantaneous Power (PIP) rating
- DC grounding on all elements for the ultimate in lightning protection and dissipation of static noise.
- Light weight dipole construction using RFI's patented flexi-PCB architecture, maintains a low centre of gravity reducing tip deflection and sway
- Field invertible (excluding tilt models)
- Preset downtilt variations of 2 and 4 degrees available, see note (1)

Typical VSWR Response (CC807-12)



CC807-12 - E Plane



Electrical Specifications

Model Number	CC807-09-P	CC807-12-P
Nominal Gain *dBd (dBi)*	9.0 (11.1)	11.5 (13.6)
Frequency *MHz*	746-870	
Tuned Bandwidth *MHz*	Full	
VSWR *(Return Loss)*	1.5:1	
Nominal Impedance Ω	50	
Downtilt°	0 Std 2, 4 (1)	
Vertical Beamwidth°	8	4
Horizontal Beamwidth°	Omni +/- 0.5dB	
Input Power W	500	
Passive IM 3rd order (2x20W) *dBc*	-150	
Peak Instantaneous Power *kW*	25	

Mechanical

Model Number		CC807-09-P	CC807-12-P
Construction		Sky blue fibreglass radome	
Radome Diameter mm (inches)		76 (3.0)	
Length mm (inches)		3135 (123.4)	6235 (245.5)
Weight *kg (lbs)*		14 (30.9)	25.5 (56.2)
Termination		Integrated 4.3-10 Female	
Mountaing Area mm (inches)		750 x 90 (30 x 3.5) diameter Ecofilm™ plated aluminium	
Suggested Clamps		3 x UC-114	
Shipping Dimensions *mm (inches)*	H	115 (4.5)	
	W	115 (4.5)	
	L	3335 (131.3)	6435 (253.3)
Shipping Weight *kg (lbs)*		20.0 (44.1)	36.5 (80.5)
Projected area *cm² (ft²)*	No Ice	2597 (2.8)	5559 (6.0)
	With Ice	3192 (3.4)	7037 (7.6)
Lateral Thrust @160km/h *N* (100 mph lbs)		308 (69)	659 (148)
Wind Gust Rating *km/h (mph)*	No Ice	>240 (150)	
Torque @ 160km/h *Nm* (100mph ft-lbs)		413 (305)	1823 (1345)

(1) To order pre-set downtilt versions available, simply add a -T2 or -T4 towards the end of the part number to denote downtilt model required. For eg. CC807-12-T2-P to order CC807-12-P with 2deg of downtilt. Please note: Models with downtilt are NOT field invertible. . Eg. CC807-12-T2-P

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Figure 2: RFI CC807-09 Antenna Datasheet

6.2 Antenna Mounting Locations

Table 6 below specifies the Marion County antenna mounting location details.

Antenna	Mounting Height (feet AGL)	Antenna Orientation (degrees)	Tower Leg	Standoff Length (feet)	Standoff Orientation (degrees)	Standoff Model
Receive	179	n/a	B (S)	n/a	n/a	n/a
Transmit	159	n/a	B (S)	6	165	Site-Pro PSA-6

Table 6: Antenna Mounting Locations

The antenna system design for this site is given in Figure 3.

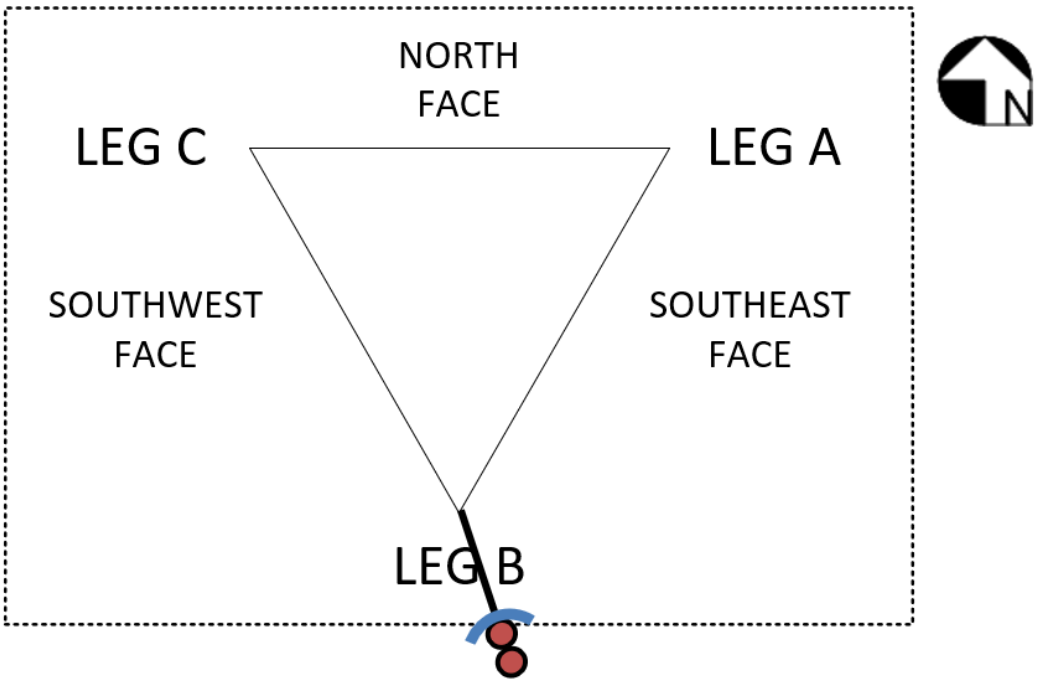


Figure 3: Antenna System Design

6.3 Antenna Isolation

The Transmit and Receive antennas are vertically separated by 20ft and horizontally separated by 6ft which gives an isolation between them of **64dB**. A figure of **60dB** will be assumed in subsequent calculations though as that is often the limit of what can be practically achieved (e.g., mounting imperfections, mechanical drift due to wind/ice loads or aging hardware).

7. TRANSMITTER COMBINER DESIGN

7.1 RF Connectors

The antenna output of the combiner is fitted with **4.3-10 female** connector to minimize Passive Intermodulation (PIM).

The transmitter input ports of the combiner are fitted with **N Type female** connectors.

7.2 Cavity Filters

Filtering in the Tx Combiner is predominantly bandpass.

A combination of band-pass and band-reject filtering is sometimes to provide extra rejection at specific site Rx frequencies, but band-reject filters are never used alone.

The cavity filters provide the minimum attenuation at the closest receive frequency equal to or greater to the value specified in section 7.9 of this document.

7.3 Isolator

A dual Isolator is included between the output of each transmitter and the Tx Combiner input port.

The isolator load closest to the Tx Combiner input port is rated at a minimum of **100 watts**.

7.4 Maximum RF Power

The Tx combiner supports a maximum of **100 watts** of RF input power per channel.

7.5 Minimum Tx to Tx Frequency Separation

The minimum frequency separation allowed between transmitters sharing the same combiner is **250kHz**.

7.6 Maximum number of Transmitters per combiner

Standard Tait practice is a maximum of 4 transmitters per Tx combiner. But in this case, the Tx-Tx spacing and the fact that self-TxIM is unlikely mean the penalty in combining all 5 transmitters together is negligible.

7.7 Maximum Tx Combiner Loss per Channel

The insertion loss shall be minimized to the extent possible while complying with all other specifications.

The Tx Combiner insertion loss per Tx channel (not including associated Tx antenna feeder cable losses) will be around **3.2dB** for the Tx-Tx frequency separation at this site.

7.8 Tx Intermodulation Suppression

Transmitters that cause intermodulation on any site receive frequency must not be connected to the same combiner.

But there is still a responsibility to keep the site as ‘clean’ as possible. So, to control the levels of intermodulation products generated in the combiner, the minimum isolation between the outputs of combined

transmitters shall be at least **60dB**. This figure includes the reverse isolation of the isolator and any additional attenuation provided by the cavity filters in neighboring branches.

7.9 Tx Sideband Noise Suppression

In addition to the Tx – Rx antenna isolation, the Tx Combiner provides the suppression required to reduce transmitter sideband noise at the Rx antenna to the level where it causes no more than 1dB of receiver de-sensitization. The transmitter sideband noise suppression required at this site is given in Table 7 below.

Transmit Frequency (MHz)	Offset to Nearest Receive Frequency (MHz)	Sideband Noise Suppression Required at Offset (dB)
771.56875	30.0000	14
771.88125	29.6875	15
772.58125	28.9875	15
773.65625	27.9125	15
774.23125	27.3375	15

Table 7: Transmitter Combiner Sideband Noise Rejection Requirements

8. RECEIVER SUBSYSTEM DESIGN

8.1 RF Connectors

8.1.1 Tower Top Amplifier

The Rx Filter input is fitted with a **4.3-10 female** connector.

The Rx Filter output is fitted with a **4.3-10 female** connector.

8.1.2 Receiver Multicoupler / PDU

The Rx Multicoupler input is fitted with a **4.3-10 female** connector.

The receiver output ports of the Rx Multicoupler are fitted with a **BNC Female** connector.

8.2 Receiver Subsystem Topology

The Receiver Subsystem will utilize a Tower Top Amplifier (TTA, which includes the receiver filtering) to optimize talk-in coverage followed by a multicoupler / PDU system that further amplifies and splits the received signal between the connected receivers.

8.3 Receiver Filtering

The Receiver Filters will pass the 801 to 805MHz part of the 700MHz band used for the Marion County system while fully rejecting associated transmit signals in both the 700MHz and 800MHz Tx bands. This is important because combinations of transmitters in both bands can result in 7th order IM falling within the 700MHz receive band.

8.3.1 Blocking Rejection

Between them, the Receiver Filters must provide enough attenuation so that no more than 1dB of de-sensitization of any of the connected receivers occurs due to receiver blocking. The attenuation required at this site to prevent receiver blocking due to the Marion County transmitters and external interferers found during FCC database search is given in Table 8 below:

	Tx Name	Tx Frequency (MHz)	Minimum Rejection in Rx Filter at Tx Frequency (dB)				
			Rx1 (MHz)	Rx2 (MHz)	Rx3 (MHz)	Rx4 (MHz)	Rx5 (MHz)
			801.56875	801.88125	802.58125	803.65625	804.23125
Transmitters	Tx1	771.56875	20	20	20	20	20
	Tx2	771.88125	20	20	20	20	20
	Tx3	772.58125	20	20	20	20	20
	Tx4	773.65625	20	20	20	20	20
	Tx5	774.23125	20	20	20	20	20

Table 8: Receiver Filter Blocking Rejection Requirements

8.3.2 Receiver Intermodulation Rejection

The Rx Filter must provide enough attenuation so that no more than 1dB of de-sensitization of any of the connected receivers occurs due to intermodulation.

As no IM products are generated per Table 4, no additional rejection is necessary beyond the blocking rejection figures tabulated in Table 8.

8.4 Low Noise Amplifiers

Low Noise Amplifiers (LNAs) with appropriate gain and noise figure will be included in the receiver sub system to ensure that the cascade noise figure of the line up from the base of the receive antenna up to and including the base station receiver is equal to or less than 5dB. Here we are able to improve this figure down to a cascaded noise figure of **3.91dB**.

The output third order intercept of the LNAs will be >= +40dBm to maintain the linearity of the system.

8.5 Variable Attenuator

A Variable Attenuator will be fitted in the Rx Multicoupler/PDU for field optimization of the receiver subsystem gain, noise figure and IP3. The attenuator has an adjustment range of 0dB to 15dB, in 0.25dB steps.

Setting of the attenuator value must be done electronically so as not to require disassembly of the multicoupler equipment. The variable attenuator shall be set to **6dB** for this site.

8.6 Receiver Ports

To allow for future expansion, the Rx Multicoupler will have 8 ports

All unused ports will be terminated in a 50-ohm load.

9. POWER MONITOR

The dBSpectra DSCHPMDC1MDC Power Monitor will be used within the Marion County RF systems. This is placed at the output of the Tx Combiner and allows remote monitoring of channelized transmitted power and antenna VSWR. The major benefit is early warning of antenna system degradation so that repairs can be made before failure occurs.

DSCHPM-Series (VHF, 220, UHF, 700/800/900 MHz)
SMART Channelized Transmit Power Monitor with Front Panel Display Option

dbSpectra
Always a Better Value

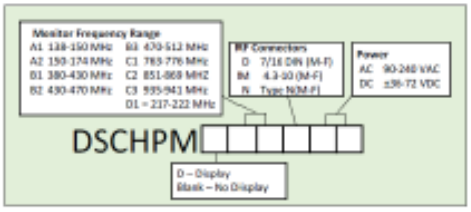
DSCHPM Power Monitor with front panel display option.

Directional coupler for installation on combiner output.

Features and Benefits

- *Per-channel and composite* measurement of forward and reflected RF power with the SMART Channelized RF Power Monitor.
- Calculates and displays combiner insertion loss for each channel.
- All measurements are displayed with 95% accuracy.
- IP network connection and designed-in web server for web browser interface.
- Full remote configuration, monitoring and data logging.
- Optional front panel display with Navigation Keys for monitoring only.
- User-defined alarm thresholds are indicated by alarm relay closure or by SNMP protocol on the network.
- Optional temperature sensors for equipment and ambient temperature measurements and alarms.
- Compact single rack unit mounting with remote RF sensor for flexibility in mounting locations.

Ordering Information

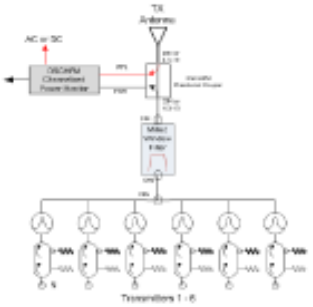


Notes:
1. Factory calibrated using a P25 LSM signal source, may be calibrated in the field for improved accuracy.
2. Contact dbSpectra at tech@dbspectra.com for additional information on optional temperature sensor feature.

Specifications

Electrical Specifications	
Frequency Range, MHz	See Ordering Information
Minimum TX to TX Separation	50 kHz
Maximum Power Input	600 Watts (directional coupler)
System Type	Digital or analog
Insertion Loss	< 0.1 dB
PIM Rating	-150 dBc
Channelized Power Measurements	Forward /reflected power of individual channels: Watts, dBm, VSWR, Return Loss, Combiner Insertion Loss
Power Requirements	AC Model 90-240 VAC 15W, or DC model ±36-72 VDC 15W
IP Interface	IPV4, with TLS security layer, SNMP v2c/v3 alarm protocol
Alarms	Form C contacts or SNMP v2c/v3
User Interface	Web browser or remote SNMP system manager. Front Panel Display (optional) for Monitoring only.
Temperature Range	-30 to +60 °C
Mechanical Specifications	
Mounting Dimensions	1 RU, 1.75 X 19 in. (44 X 483 mm) 7.5 in. (191 mm) deep
Construction / Finish	Aluminum / protective finishes
Directional Coupler Connectors Input Output Coupled Ports	 7/16 DIN, 4.3-10 or N(male) 7/16 DIN, 4.3-10 or N(female) MCX type push-on with two 4 ft RD316 cables supplied.
Power Connector	AC model: IEC 320-C13 inlet & cord DC model: 2 port terminal block
Ethernet Connector	RJ-45
Alarm Closures Connector	3 port pluggable terminal block
Temp. Sensor Connector	24-pin header male pins
Net Weight	4.6 lbs. (2.1 kg)
Shipping weight	6.1 lbs. (2.8 kg)

Typical Application



Specifications are subject to change • www.dbspectra.com • 1590 E Hwy 121, Building A, Suite 100, Lewisville, TX 75056 • P (469)322-0080 •096000-797.A • 01/2024

Figure 4: DSCHPMDC1MDC Channelised Power Monitor

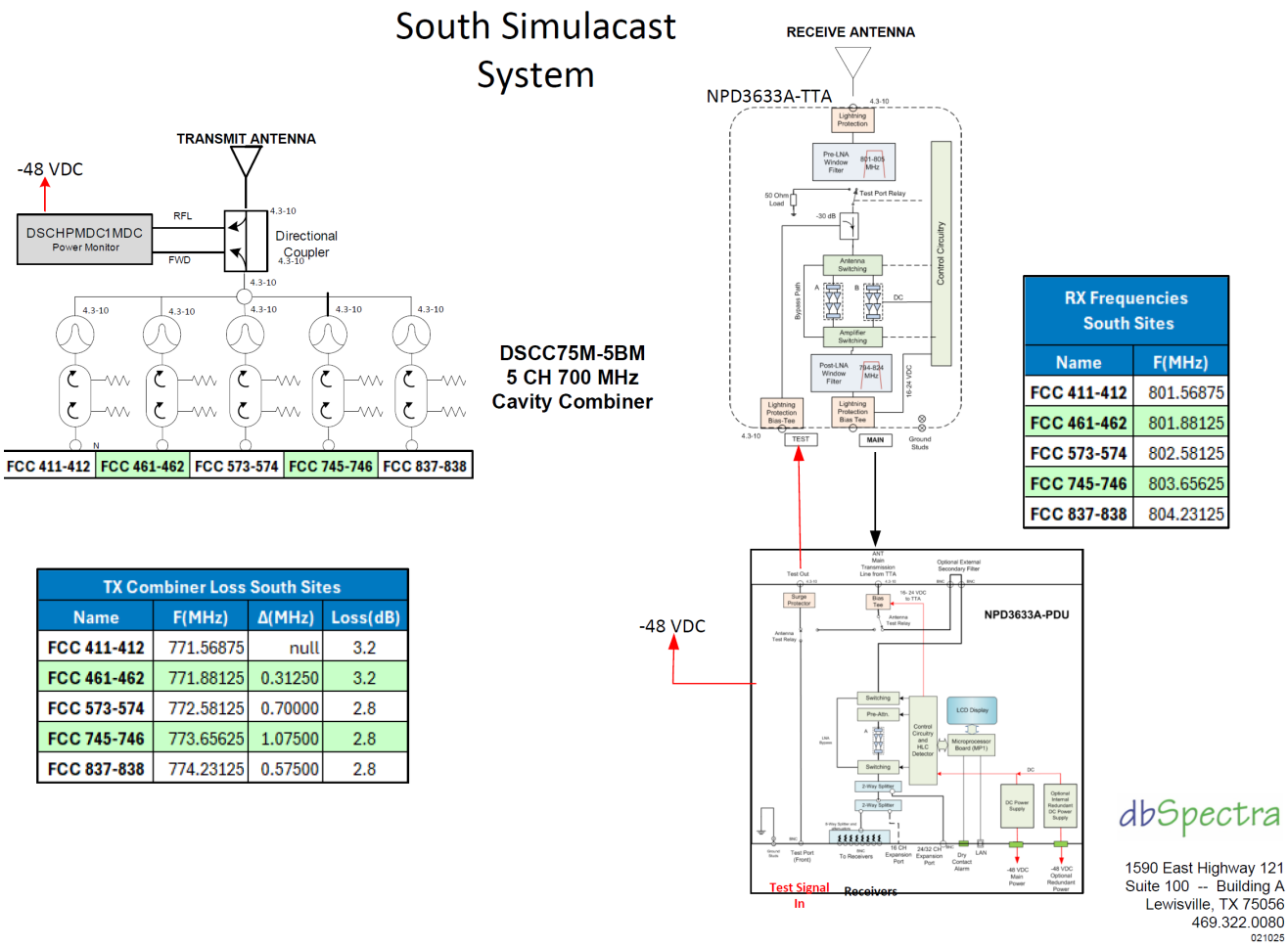
10. RF SUB-SYSTEM DESIGN

Tait have worked with dBSpectra to develop a generic combining system for the Marion County project that meets the performance goals derived in sections 7 and 8 of this report and thereby maximizes the talk in and talk out coverage of the system.

The transmit side of the RF sub-system consists of a 5-channel cavity filter based ceramic combiner to minimize losses and hence maximize the transmitted power and talk out coverage from the site. The cavity filters meet or exceed the Tx sideband noise filtering requirements given in section 7.9.

The receive side features a compact Tower Top Amplifier (TTA) followed by a Receiver Multicoupler/PDU that allows the receiver sensitivity to be optimized and distributes the signal to the five connected receivers. All the receive filtering is accommodated within the TTA. There are two filters, one before the LNA to preselect the 801 to 805MHz part of the band used by the Marion County system (see Figure 6), and a second after the LNA that fully rejects the Marion County system transmit signals, and the other 700 and 800MHz HLCs identified from the FCC database search (see Figure 7). Together, the filters meet or exceed the receiver blocking and receiver intermodulation filtering requirements given in sections 8.3.1 and 8.3.2. There are two LNAs, one in the TTA and one in the Rx Multicoupler/PDU with gains, noise figures and intercept points optimized so the cascade noise figure and linearity of the receiver line up meets the requirements of section 8.4.

A block diagram of the South Cell combining system design is shown in Figure 5 below:



RX Frequencies South Sites	
Name	F(MHz)
FCC 411-412	801.56875
FCC 461-462	801.88125
FCC 573-574	802.58125
FCC 745-746	803.65625
FCC 837-838	804.23125

TX Combiner Loss South Sites			
Name	F(MHz)	Δ(MHz)	Loss(dB)
FCC 411-412	771.56875	null	3.2
FCC 461-462	771.88125	0.31250	3.2
FCC 573-574	772.58125	0.70000	2.8
FCC 745-746	773.65625	1.07500	2.8
FCC 837-838	774.23125	0.57500	2.8

Figure 5: SPD3454C-4TR Dual Band RF Combining System

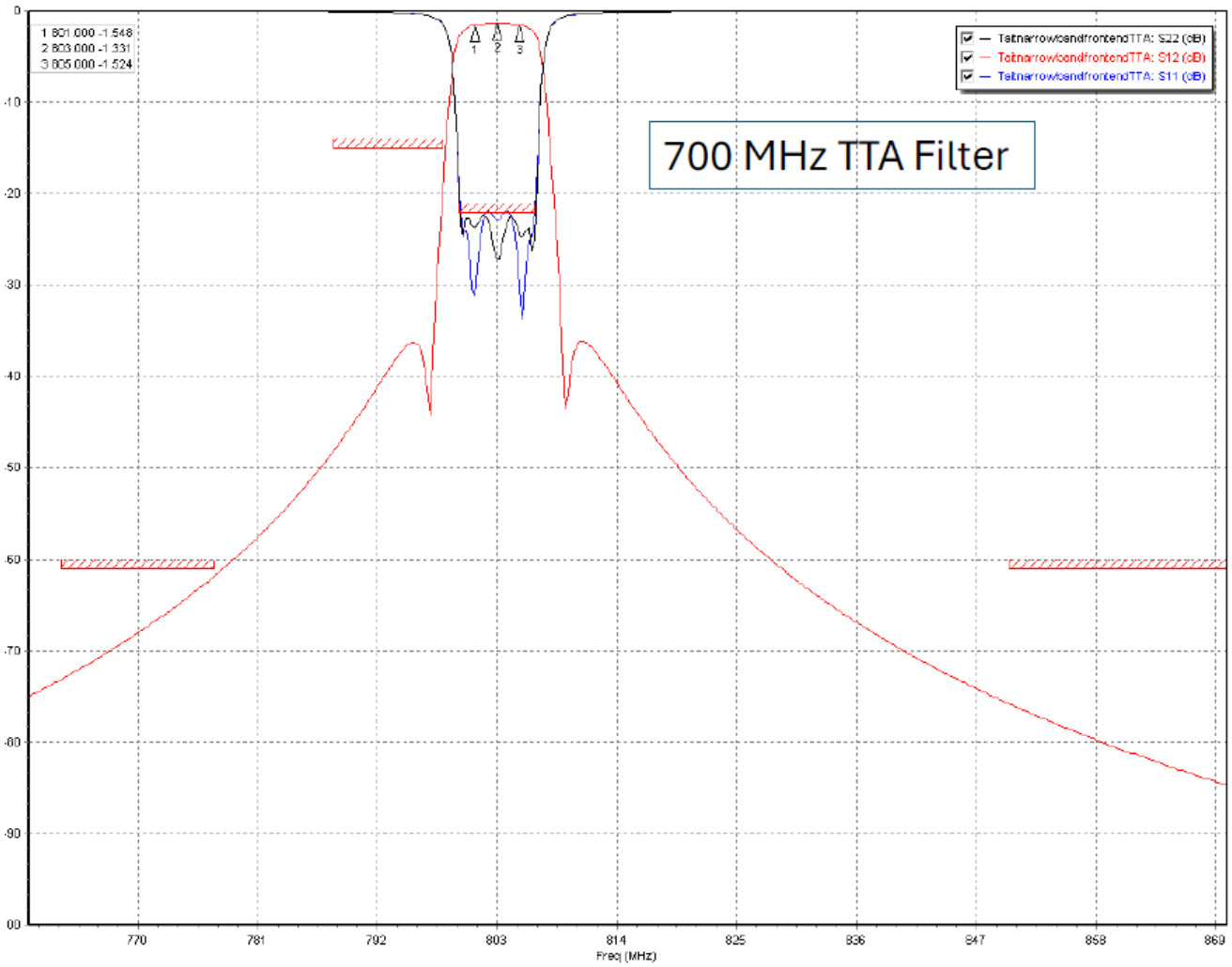


Figure 6: TTA PreSelector Filter Plot

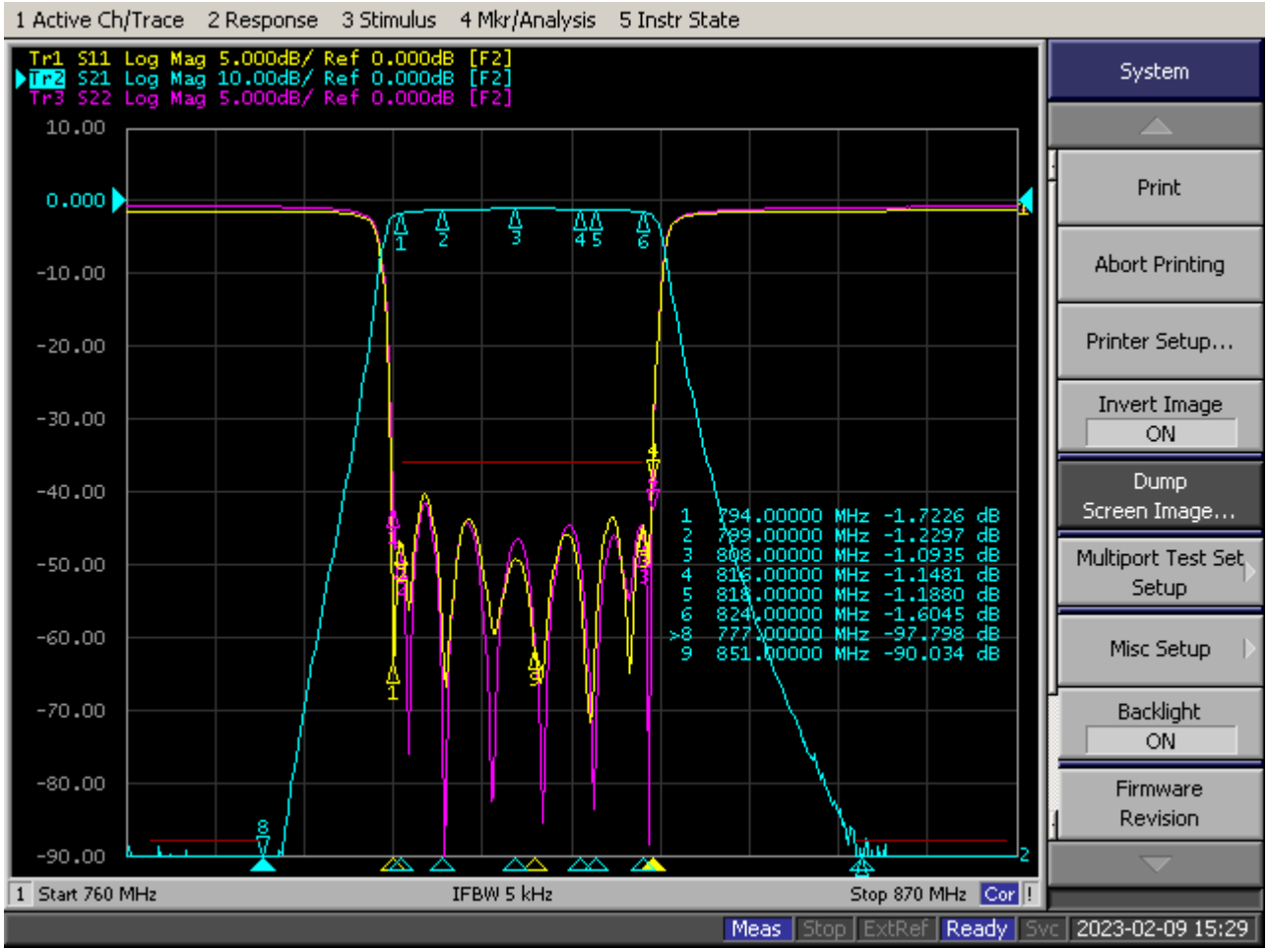


Figure 7: TTA Post LNA Filter Plot

11. MICROWAVE SYSTEM DESIGN

Refer to “Marion County P25 System Design_v1.1.docx” for Microwave System Details.

11.1 Site Specific Design

The Lower Prospect site supports two Aviat microwave links. These links connect Lower Prospect to MCPW Dispatch and SCC Backup Dispatch, forming part of the 13-site core ring and providing the redundant routing expected within the looped topology.

12. RF SUB-SYSTEM DRAWINGS

The figure below contains the schematic of the RF sub-system to be deployed at this site.

12.1 RF System Schematic

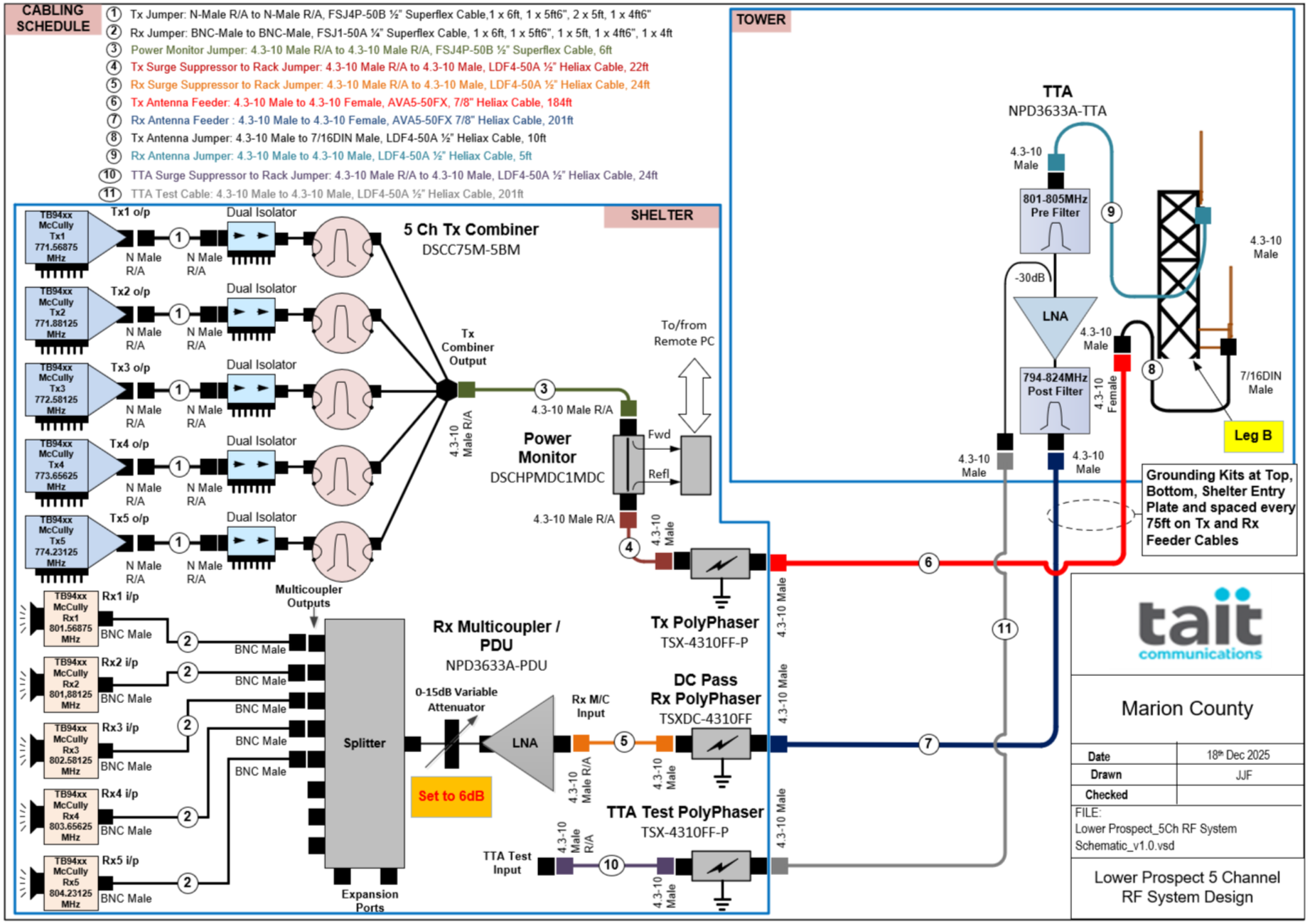
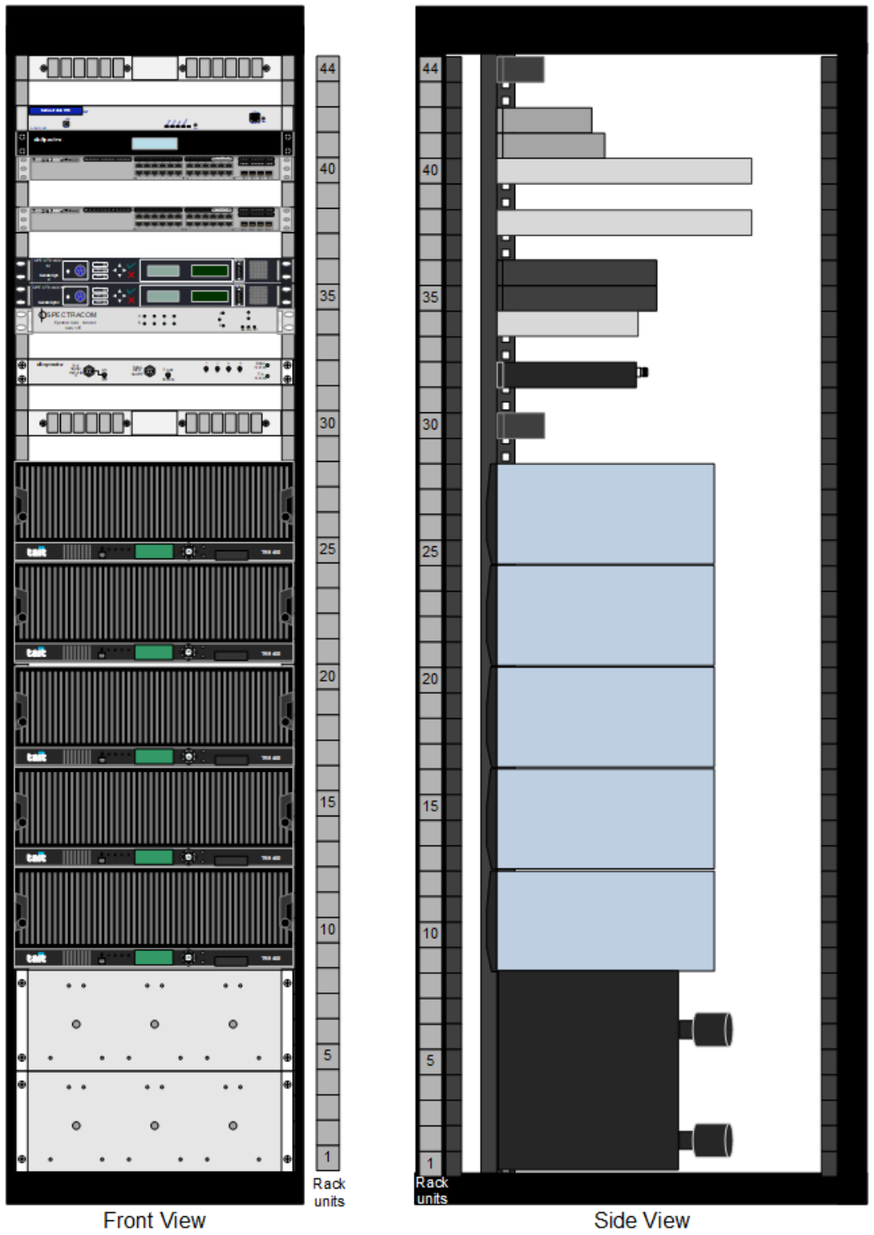


Figure 8: RF System Schematic

12.2 Rack Layout

This section contains the rack layout front & back view, side view and cabling diagram for this site.

700 MHz P25 Phase II Rackup Diagrams



RU	Description	Vendor PN	Vendor	Width (in)	Height (in)	Depth (in)
44	Breaker Panel	9072101001	TRIMM	19	1U	3.25
42	Alarm Panel	M16G2 & D-PK-16PAN	Netguardian	17	1U	6.6
41	Power Monitor	DSCHPMDC	dBSpectra	19	1U	7.5
40	Switch #1	C9300L-24P-4X-A	Cisco	17.5	1U	17.7
38	Switch #2	C9300L-24P-4X-A	Cisco	17.5	1U	17.7
36	Timing Reference	2402-613	Safran	17.1	1U	15.17
35	Timing Reference	2402-613	Safran	17.1	1U	15.17
34	Timing Switch	SAS-17E	Safran	19	1U	13.4
32	Multicoupler	NPD3633A	dBSpectra	19	1U	10.5
30	Breaker Panel	9072101001	TRIMM	19	1U	3.25
25-28	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
21-24	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
17-20	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
13-16	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
9-12	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra	19	8U	12.5

Marion County, OR
700 MHz P25 Phase II

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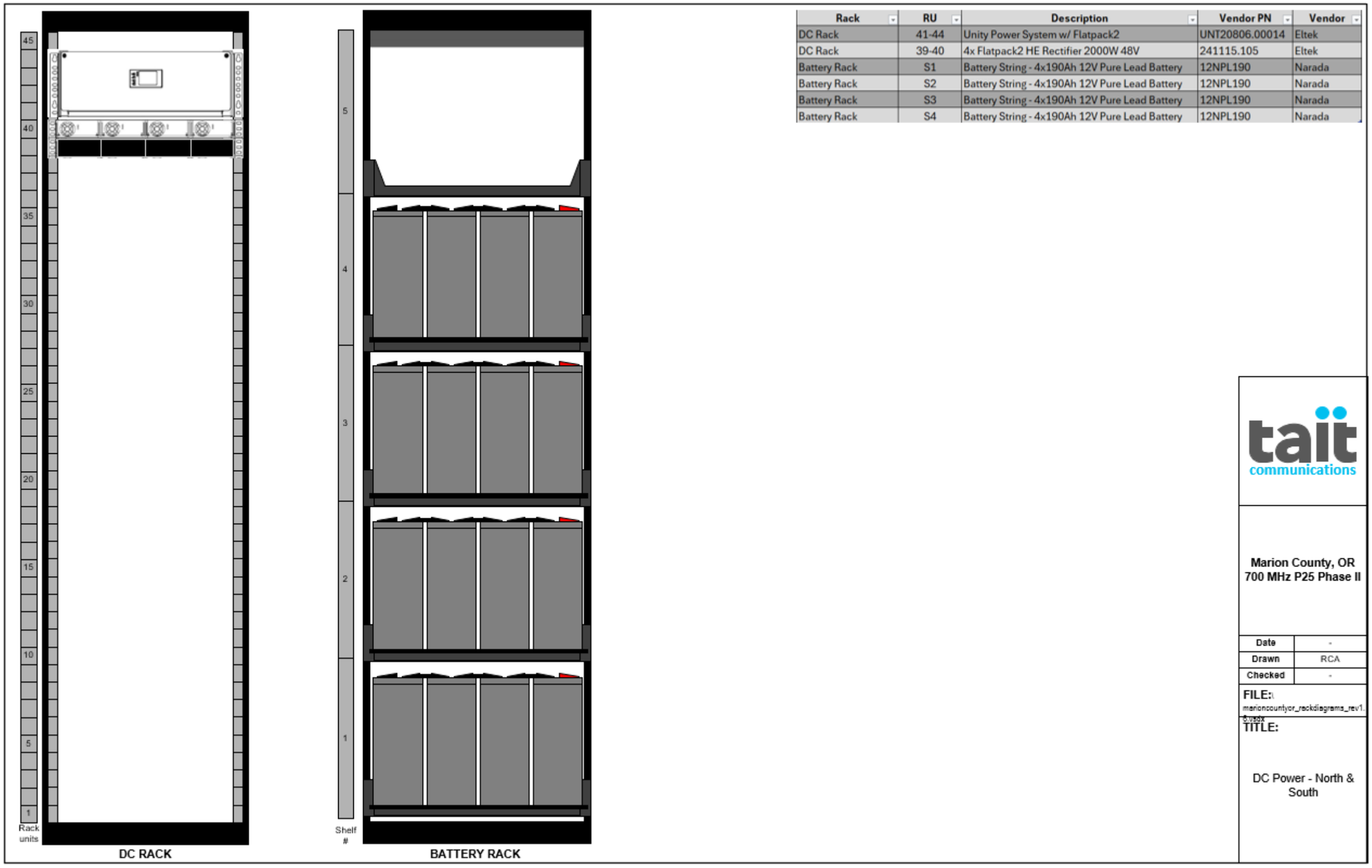
RF_Site_Simulcast

Figure 9: Marion County 19" Rack Layout – RF Front & Side



Rack	RU	Description	Vendor PN	Vendor
DC Rack	41-44	Unity Power System w/ Flatpack2	UNT20806.00014	Eltek
DC Rack	39-40	4x Flatpack2 HE Rectifier 2000W 48V	241115.105	Eltek
Battery Rack	S1	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack	S2	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack	S3	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack	S4	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada

Figure 10: DC Power & Battery Racks

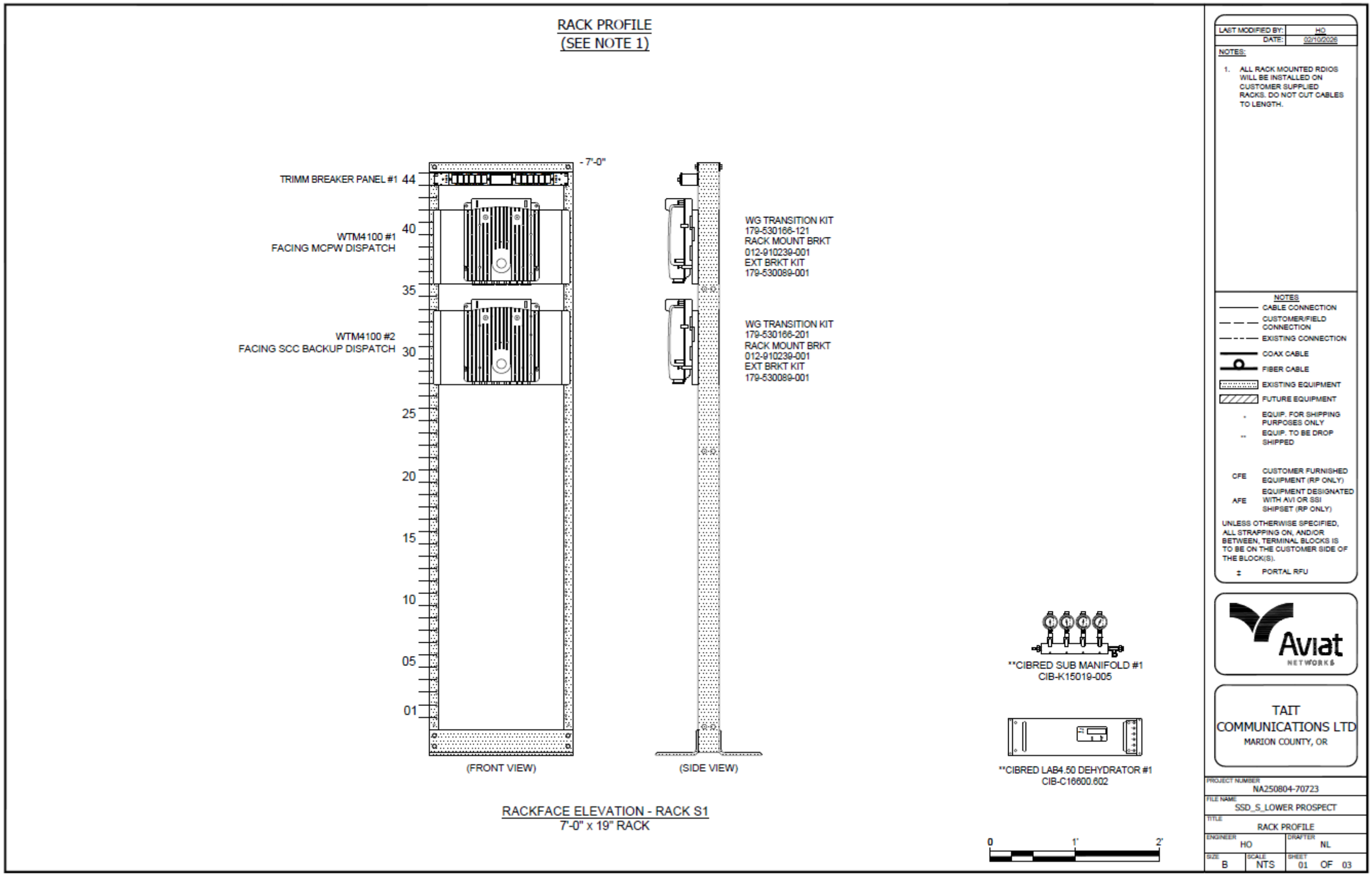
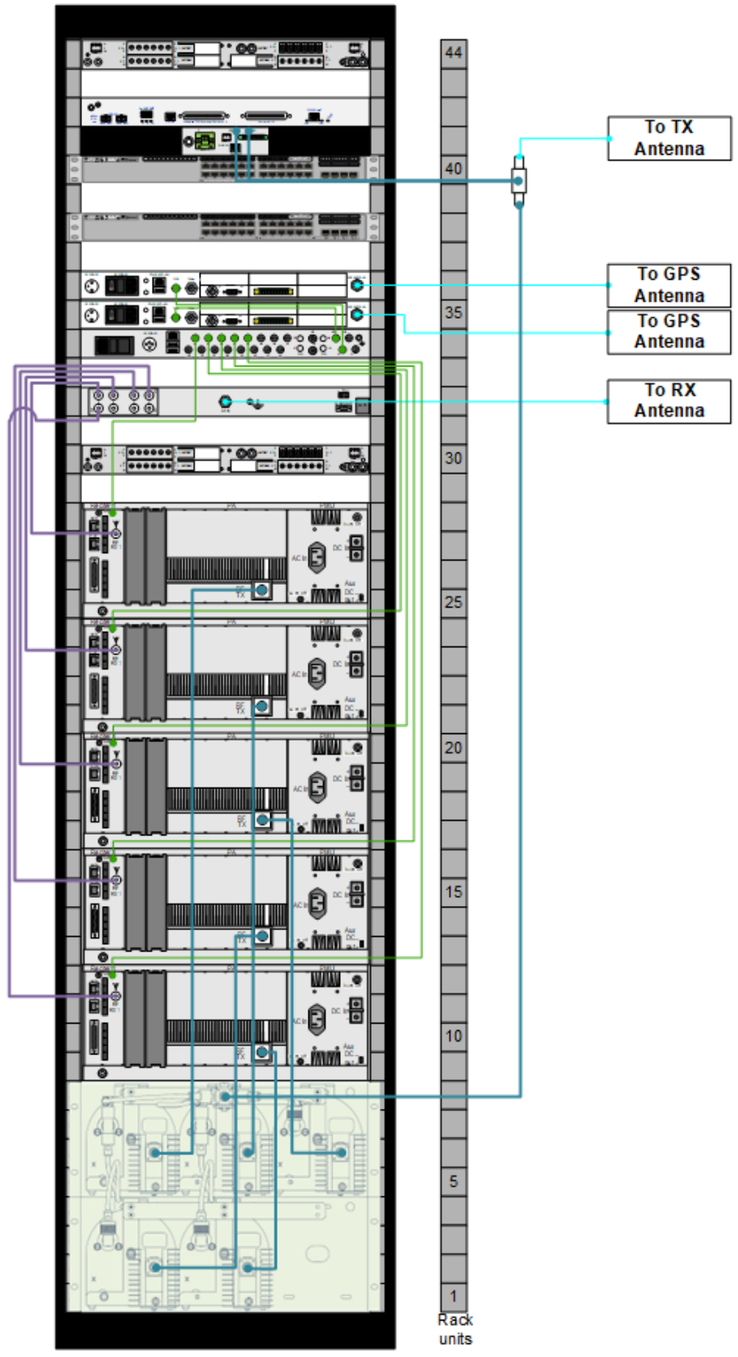


Figure 11: Microwave Rack

700 MHz P25 Phase II
Rackup Diagrams



RU	Description	Vendor PN	Vendor
44	Breaker Panel	9072101001	TRIMM
42	Alarm Panel	M16G2 & D-PK-16PAN	Netguardian
41	Power Monitor	DSCHPMDC	dBSpectra
40	Switch #1	C9300L-24P-4X-A	Cisco
38	Switch #2	C9300L-24P-4X-A	Cisco
36	Timing Reference	2402-613	Safran
35	Timing Reference	2402-613	Safran
34	Timing Switch	SAS-17E	Safran
32	Multicoupler	NPD3633A	dBSpectra
30	Breaker Panel	9072101001	TRIMM
25-28	P25 Trunked Base Station	TB9435S-100T	Tait
21-24	P25 Trunked Base Station	TB9435S-100T	Tait
17-20	P25 Trunked Base Station	TB9435S-100T	Tait
13-16	P25 Trunked Base Station	TB9435S-100T	Tait
9-12	P25 Trunked Base Station	TB9435S-100T	Tait
1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

Marion County, OR
700 MHz P25 Phase II

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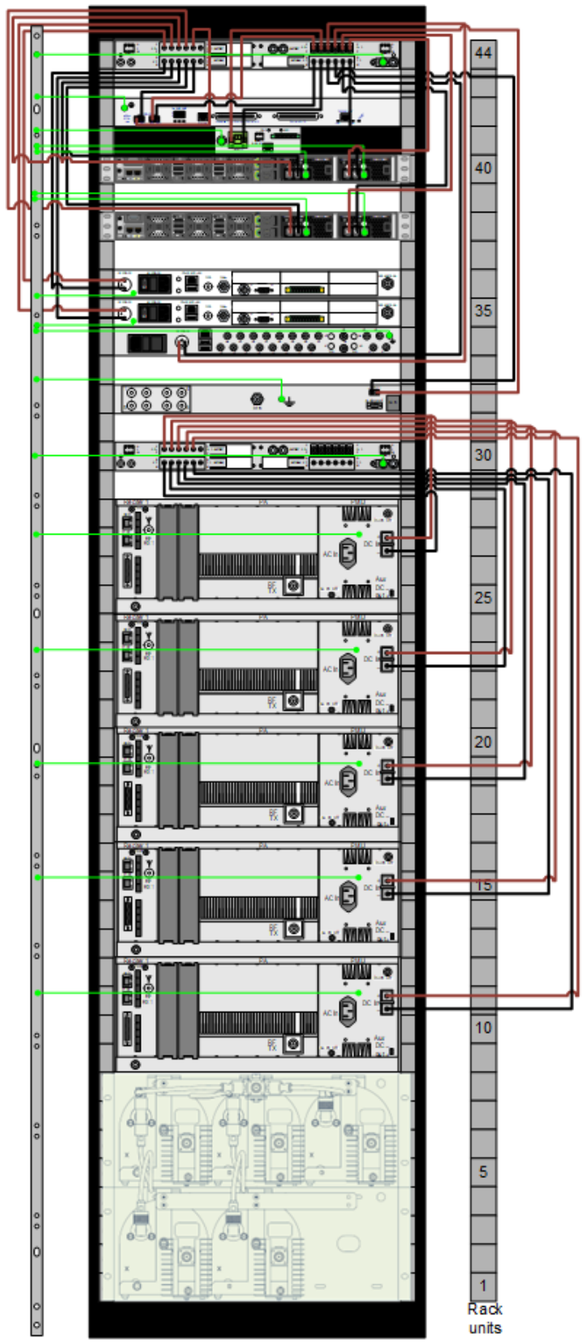
Cabling - RF

Figure 12: Marion County 19" Rack Layout – RF Cabling

700 MHz P25 Phase II
Rackup Diagrams



RU	Description	Vendor PN	Vendor
44	Breaker Panel	9072101001	TRIMM
42	Alarm Panel	M16G2 & D-PK-16PAN	Netguardian
41	Power Monitor	DSCHPMDC	dBSpectra
40	Switch #1	C9300L-24P-4X-A	Cisco
38	Switch #2	C9300L-24P-4X-A	Cisco
36	Timing Reference	2402-613	Safran
35	Timing Reference	2402-613	Safran
34	Timing Switch	SAS-17E	Safran
32	Multicoupler	NPD3633A	dBSpectra
30	Breaker Panel	9072101001	TRIMM
25-28	P25 Trunked Base Station	TB9435S-100T	Tait
21-24	P25 Trunked Base Station	TB9435S-100T	Tait
17-20	P25 Trunked Base Station	TB9435S-100T	Tait
13-16	P25 Trunked Base Station	TB9435S-100T	Tait
9-12	P25 Trunked Base Station	TB9435S-100T	Tait
1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

Description A	Connection A	Description B	Connection B
Breaker Panel 1	A1	GPS 1	-48 VDC
Breaker Panel 1	A2	GPS 2	-48 VDC
Breaker Panel 1	A3	Switch 1-A	-48 VDC
Breaker Panel 1	A4	Switch 2-A	-48 VDC
Breaker Panel 1	A5	Alarm Panel A	-48 VDC
Breaker Panel 2	B1	Alarm Panel B	-48 VDC
Breaker Panel 2	B2	Power Monitor	-48 VDC
Breaker Panel 2	B3	Timing Switch	-48 VDC
Breaker Panel 2	B4	Multicoupler	-48 VDC
Breaker Panel 2	B5	Switch 2-B	-48 VDC
Breaker Panel 2	B6	Switch 1-B	-48 VDC

Marion County, OR
700 MHz P25 Phase II

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TITLE:

Cabling - Power

Figure 13: Marion County 19" Rack Layout – Power Cabling

13. PARTS AND EQUIPMENT LISTS

Refer to “Marion County P25 Project - Equipment List by Site.xlsx” for site-specific equipment list.

14. RF PERFORMANCE

14.1 Tx Effective Radiated Power

Table 9 below summarizes the transmitter system performance. It shows the required TB9xxx transmitter output power setting, the combining losses (including internal cabling), the antenna feeder loss and finally the resulting ERP relative to a dipole (ERPd).

Transmitter Frequency (MHz)	Transmitter Output Power Setting	Combining Losses (dB)	Misc Losses (dB)	Antenna Feeder Losses (dB)	Tx ERPd
771.56875	+49.5dBm (88W)	3.2	0.83	2.42	+52dBm (260W)
771.88125	+49.5dBm (88W)	3.2			+52dBm (260W)
772.58125	+49.5dBm (88W)	3.2			+52dBm (260W)
773.65625	+49.5dBm (88W)	3.2			+52dBm (260W)
774.23125	+49.5dBm (88W)	3.2			+52dBm (260W)

Table 9: Transmitter Output Power Setting and Effective Radiated Power

14.2 Site Noise

Site Noise in the 700MHz band can be assumed to be negligible.

14.3 Receiver Sensitivity

Table 10 summarizes the receiver system performance. It shows the amount of de-sensitization caused by the elevated site noise floor, the required Rx Multicoupler attenuation setting, and the resulting final Receiver sensitivity that can be achieved.

Receiver Frequency (MHz)	Rx Multicoupler Attenuator Setting (dB)	Rx Sensitivity for DAQ3.4 (dBm)
801.56875	6	-111.2
801.88125		
802.58125		
803.65625		
804.23125		

Table 10: Receiver Sensitivity

15. SITE DESIGN INFORMATION

15.1 Site Plan

The site plan is an overhead view of the overall compound depicting locations of pertinent features.

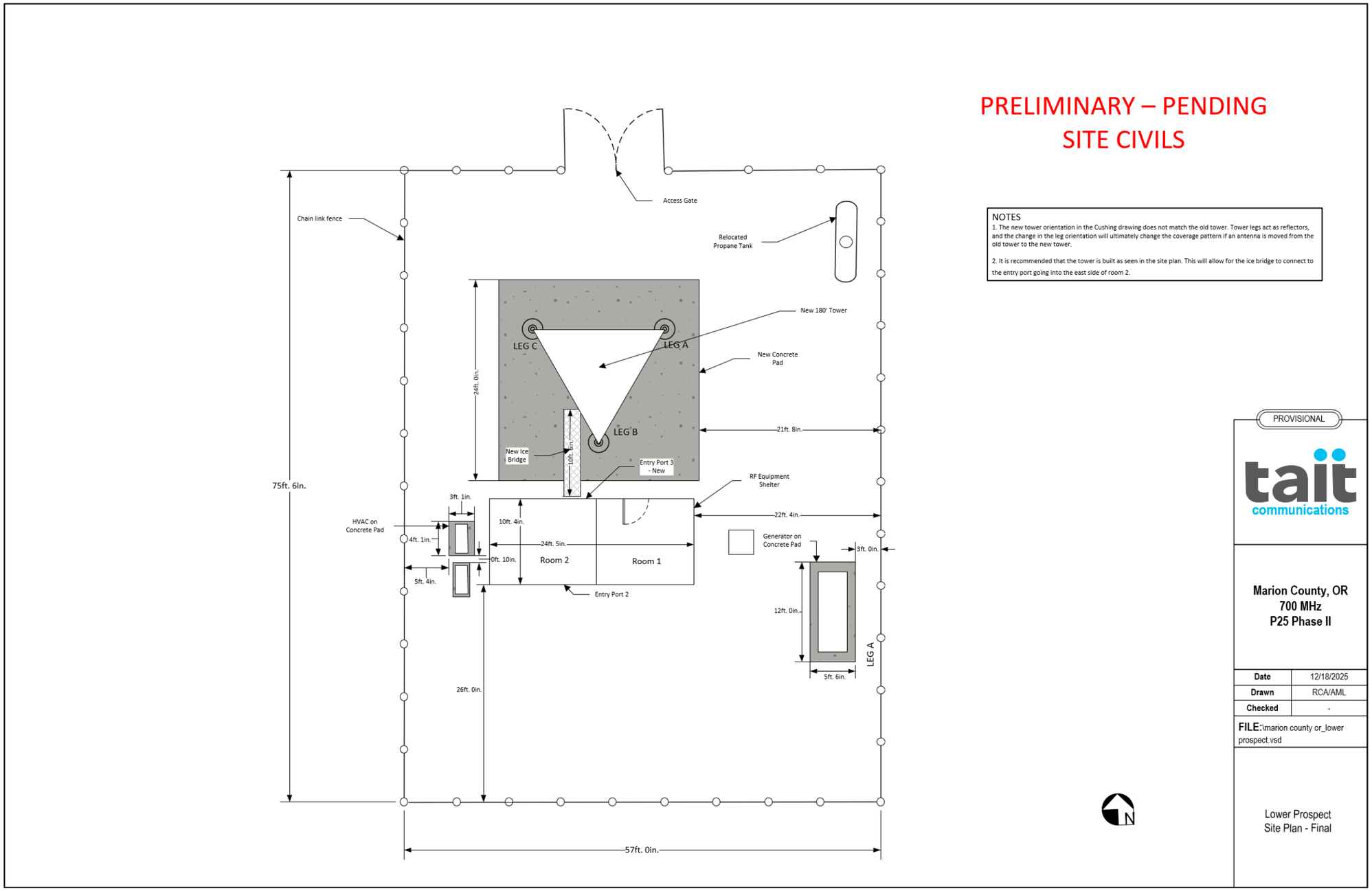

Figure 14: Site Plan

15.2 Floor and Cable Routing Plan

The floor and cable routing plan is an overhead view of the equipment room layout depicting locations of pertinent equipment and including the cable routing plans leading to the tower.

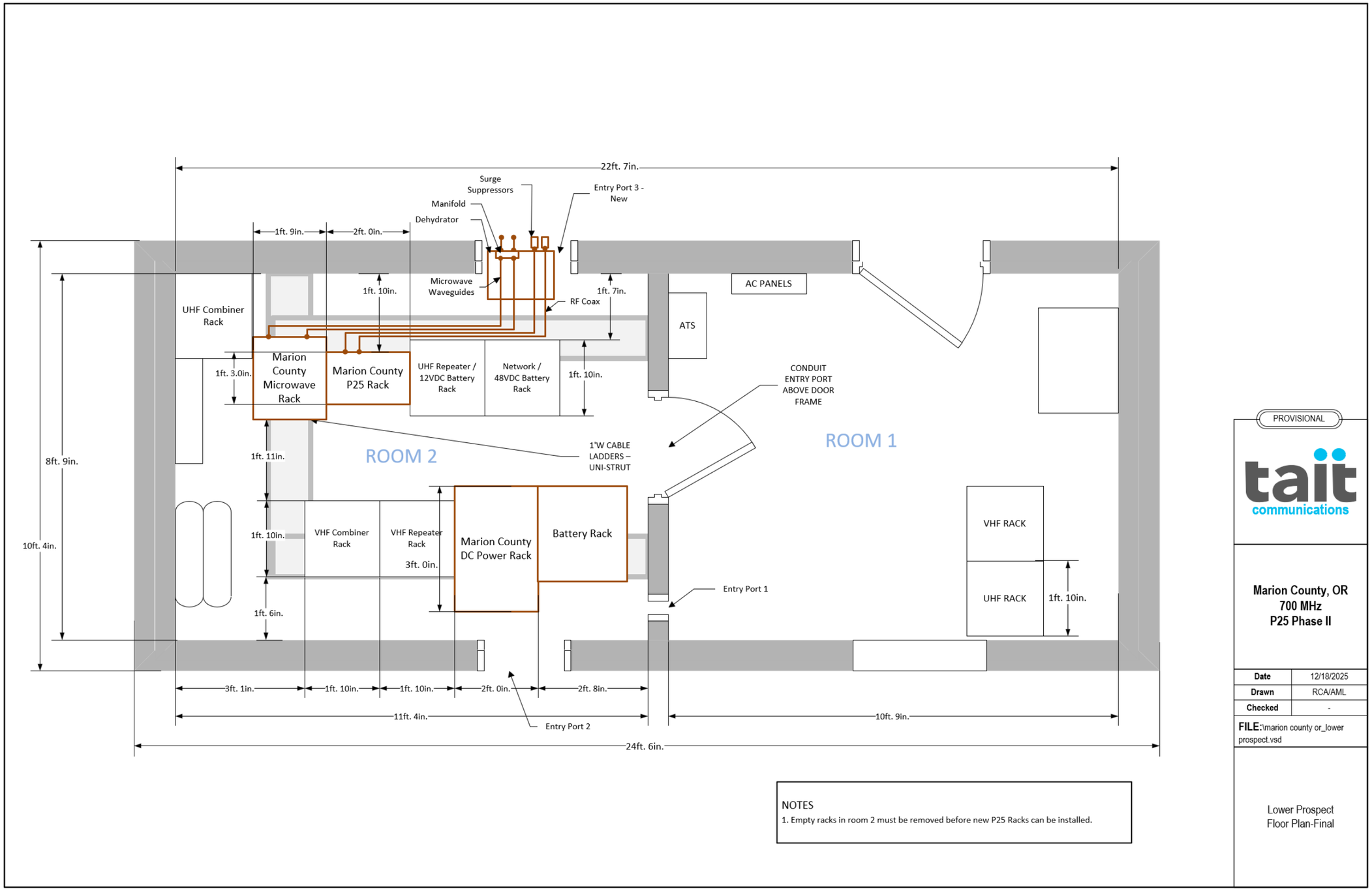

Figure 15: Floor and Cable Routing Plan

15.3 Entry and Exit Ports

The ports where the antenna and TTA cables enter / exit the shelter are shown in the below figure.

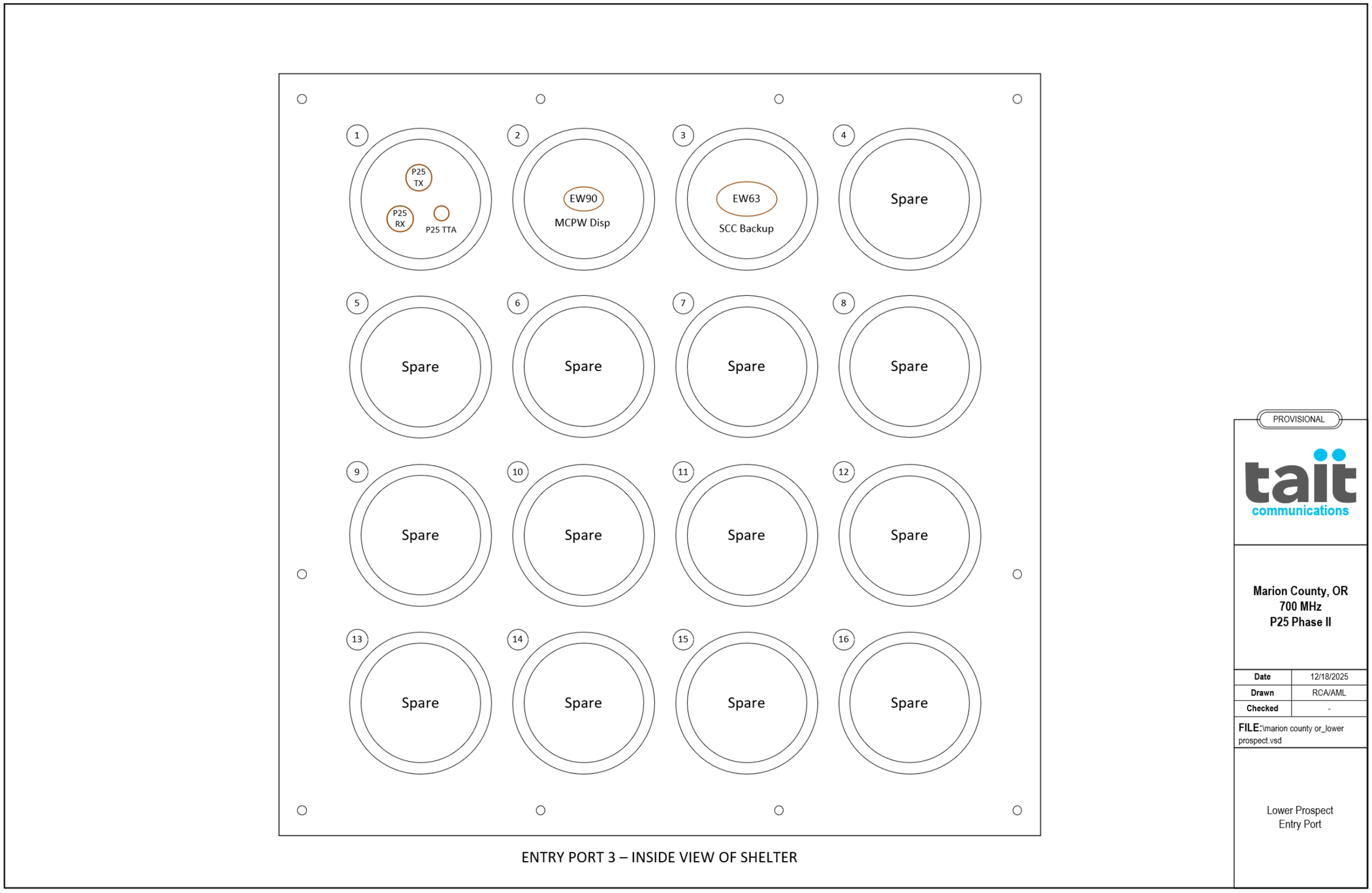

Figure 16: Shelter Cable Entry & Exit Ports

15.3.1 Power & Heat Load Calculations

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Power & Heat Load details.

15.3.2 DC Distribution Fuse Panel

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Fuse Panel details.

Supplemental 9 - McCully Mountain

PROVISIONAL Design Document

RF Sub-System and Site Designs

Marion County

Region: South Cell

Site: McCully Mountain

Issue 1.1 • 1st May 2026

www.taitradio.com

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PREFACE

Project Details

Project number	
Customer	Marion County
Project description	P25 Phase 2 Simulcast & P25 Phase 1 Conventional Simulcast
Business Development Manager	
Sales Engineer	
Project Engineer	Jared Farrar / Riley Alfaqeeh
Project Manager	Stacey Adams (formerly Matt Jordan)
Lead RF Engineers	Ian Graham

Purpose

The Marion County project is an 11 site P25 simulcast design that uses the US 700MHz band. To control Time Delay Interference (TDI), the simulcast design is split into three cells – North, South, and East. The North cell is comprised of four sites with P25 Phase 2 trunked operation, the South cell is comprised of four sites with P25 Phase 2 trunked operation, and the East cell is comprised of three sites with P25 Phase 1 conventional operation.

The purpose of this report is to document the RF subsystem design for the **McCully Mountain** site which forms part of the South simulcast cell.

Scope

This document specifies the frequencies to be utilized at the site and summarizes the intermodulation analysis with these frequencies and other high-level in band carriers as identified from an FCC license search. The required antenna system and associated RF combining equipment will then be described in full.

Publication Record

Author	Ian Graham, Jared Farrar
Issue	1.0
Document Status	Initial Release
Date	12th December 2025

Document Status

Issue	Date	Signature	Comment
0.1	22nd May 2025	Ian Graham	Initial draft
1.0	12th December 2025	Jared Farrar	Initial Release
1.1	1st May 2026		

Document Approvals

Approvals	Position	Signature	Date
Bladymir Guzman	TAM Design Authority		

Associated Documents & References

Reference documentation includes:

- Marion County P25 System Design_v1.1.docx
- Marion County P25 Project - Equipment List by Site.xlsx
- Marion County Power_Heat_Load.xlsx

1. GENERAL RF DESIGN APPROACH

The Marion County project is an 11-site P25 simulcast design that uses the US 700MHz band. To control Time Delay Interference (TDI), the simulcast design is split into three cells – North, South, and East.

The North Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- Crooked Finger
- Crosby
- Eastview
- Parrett Mountain

The South Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- Eagle Crest
- Lower Prospect
- **McCully Mountain**
- Wipper

The East Cell sites operate in P25 Phase 1 conventional mode and are identified as follows:

- APW
- House Mountain
- Halls Ridge

Each site within the North and South Cells will have five trunked P25 Phase 2 channels providing eight dynamic talkpaths (one 12.5kHz FDMA control channel plus four 2-slot 12.5kHz TDMA traffic channels) across each respective cell's coverage area. The East Cell will have five conventional P25 Phase 1 12.5kHz FDMA channels providing five fixed talkpaths across the cell.

Each site across all three cells will have separate transmit (Tx) and receive (Rx) antennas, typically with 20ft vertical separation between centers of radiation. The anticipated low site noise floors in the 700MHz band means Tower Top Amplifiers (TTA) can be used to improve receiver sensitivity and talk-in coverage. Along with the 30MHz Tx-Rx frequency separation, these factors lead to a common RF combining subsystem design which is applicable to all Marion County sites. The combining system requirements were captured based on the proposed frequency plan in coordination with ADCOMM Engineering LLC and Tait subsequently worked with the chosen equipment vendor, dBSpectra, on an optimal design. The main consideration was the TTA where it was decided to use dBSpectra's compact design after it was shown all the required receiver filtering could be accommodated. The generic (starting point) site combining system design therefore features the:

- DSCC75M-5BM 5 Channel Ceramic Tx Combiner
- DSCHPMDC1MDC Channelized Power Monitor
- NPD3633A-TTA Tower Top Amplifier
- NPD3363A-PDU Rx Multicoupler PDU

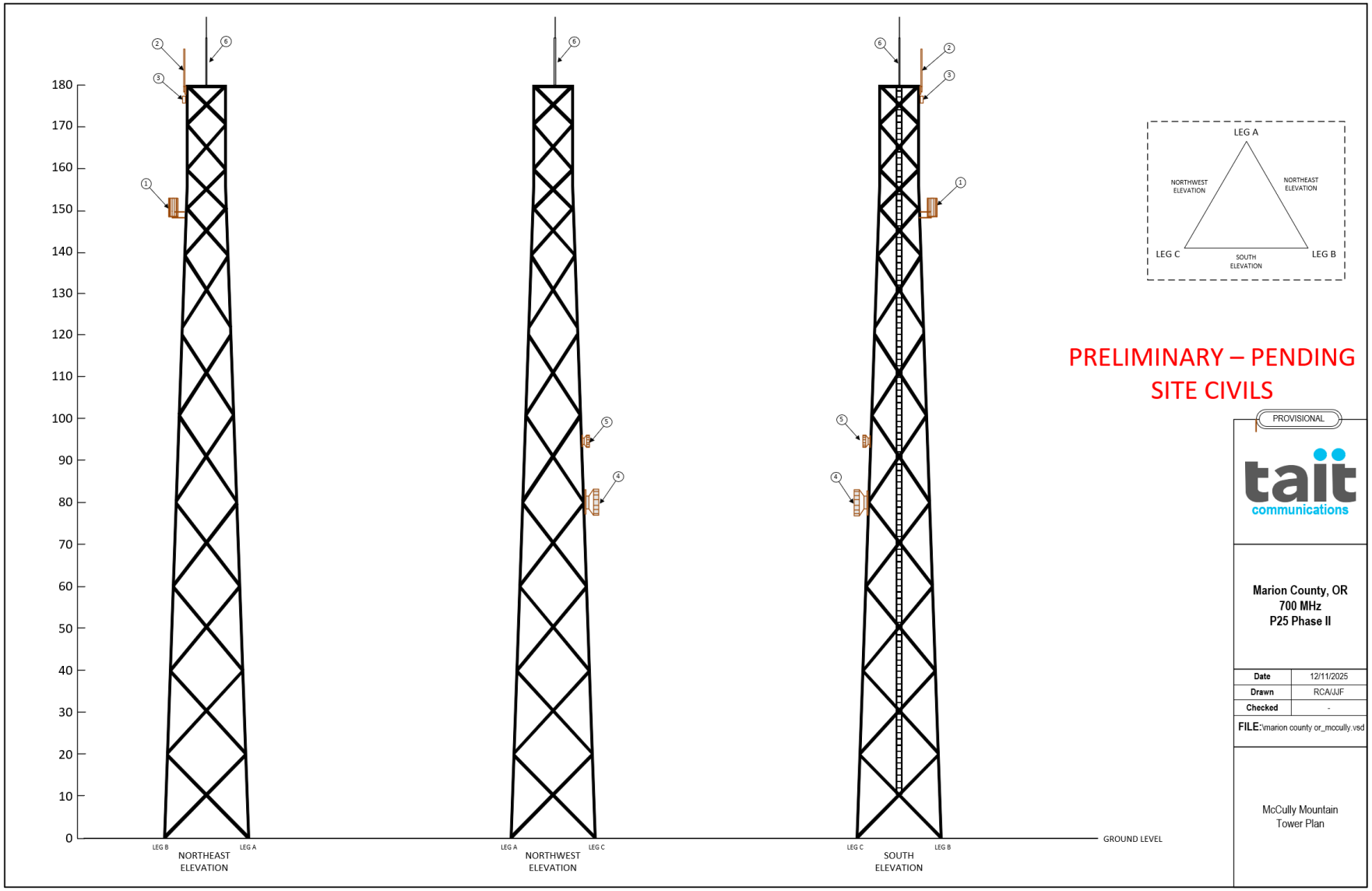
Antennas were chosen on a site-by-site basis to minimize TDI in the simulcast cells while still providing necessary talk-out coverage. The proposed antennas are the:

- Sinclair SE412-SWBPAL
    - 5dBd Low PIM Enclosed Dipole Array
- Sinclair SE414-SWBPAL
    - 8.5 to 11dBd Low PIM Adjustable Beamwidth Enclosed Dipole Array
- RFI CC807-09
    - 9dBd Collinear Omnidirectional

For the McCully Mountain site, the basic design approach will be:

- Install a new SE414-SWBPALDF(D00) transmit antenna on Leg B (SE) of the 180ft Tower at 148ft AGL, azimuth 105º, beamwidth 60º
    - The 5 transmit channels will be connected to the Tx antenna using the dBSpectra DSCC75M-5BM Ceramic Combiner.
- Install a new RFI CC807-09 receive antenna on Leg B (SE) of the 180ft Tower at 179ft AGL (azimuth n/a).
    - The 5 receive channels will be fed from the Rx antenna via the dBSpectra NPD3633A-TTA Tower Top Amplifier and the NPD3633A-PDU Rx multicoupler/PDU

2. TOWER MAPPING



#	Description	Part Number	Length (ft)	Leg/Face	Status	Base Height (ft)	Centerline Height(ft)	Tip Height (ft)	Antenna Azimuth	Mount Azimuth
1	P25 TX Antenna	SE414-SWBPALDF(D00)	4.4	B	New	148	150	152	105	
2	P25 RX Antenna	CC807-09	10.3	B	New	179	184	189	-	
3	TTA	NPD3633A-TTA	1.0	B	New	176	177	177	-	
4	Microwave - Wipper	VHLP6-6W	6.0	C	New	77	80	83	274.38	274.38
5	Microwave - APW	VHLP3-11W	3.0	B	New	94	95	97	82.35	82.35
6	Lightning Rod		20	Center	Existing	180	190	200		

= estimated value based on survey documentation and photos

Figure 1: Eastview 180ft Tower Mapping and Appurtenances

3. FREQUENCY PLANNING

5 Channels will be deployed at this site.

The South Simulcast cell uses the following frequencies.

Site Name	FCC Channel Number	Tx Frequency (MHz)	Rx Frequency (MHz)
McCully Mountain	411-412	771.56875	801.56875
	461-462	771.88125	801.88125
	573-574	772.58125	802.58125
	745-746	773.65625	803.65625
	837-838	774.23125	804.23125

Table 1: South Cell Frequency Assignments

4. INCUMBENTS SEARCH

An external high-level carrier (HLC) is defined as a signal that appears at a level of >-40dBm at the Receive antenna. These are the signals that have the potential to contribute towards intermodulation that would result in a loss of receiver sensitivity on one or more channels.

Signal and Noise Monitoring of RF activity at the site was not deemed necessary for this project given the wide Tx-Rx frequency separation in the 700MHz band and the anticipated low site noise floors.

To get some idea of potential RF activity at the site though, an FCC License Search was carried out to identify any other transmitters operating between 700 and 900MHz located within a 0.6-mile radius of the tower (a 100W transmitter, 0.6 miles away would be received at -40dBm assuming free space path loss). These include cellular transmitters (as their wide bandwidth could cause IM energy to spread into the LMR receive band) and are summarized in Table 2 below. *Note that Tx ERPd values for cellular carriers represent the panel sector with the highest licensed maximum ERP.*

Owner	Call Sign	Frequency (MHz)	Tx ERPd (dBm)	Distance from Marion County Tower (miles)
Cellco Partnership	KNKA446	880.02	58.5	0.1
Cellco Partnership	KNKN413	880.02	58.5	0.1
Cellco Partnership	KNKA446	891.51	58.5	0.1
Cellco Partnership	KNKN413	891.51	58.5	0.1

Table 2: High Level Carriers

5. INTERMODULATION ANALYSIS

An intermodulation (IM) analysis was performed for the potentially significant sources, including both the Marion County channels to be deployed and any HLCs found during the FCC License Search. For antenna configurations using separate transmit and receive antennas Tait best practice is to search for IM products up to 7th order within a defined search window accounting for the fact the bandwidth of IM products spread according to the order and bandwidth of the signals that cause it.

The frequencies included in the IM analysis are listed in Table 3 below.

Transmit Frequencies (MHz)	Receive Frequencies (MHz)
771.56875	801.56875
771.88125	801.88125
772.58125	802.58125
773.65625	803.65625
774.23125	804.23125
880.02	
891.51	

Table 3: Frequencies Included in IM Analysis

Table 4 below shows how many IM products are generated on each of the receive frequencies. A direct hit is an IM product that falls exactly at the receive frequency. An indirect hit is one that does not fall exactly at a receive frequency but does fall within the search window. Note that for the purposes of this table, the number of direct hits depends on the bandwidth of the LTE signals at 880.02MHz and 891.51MHz. Both are downlink signals within Band 5 (US 850MHz Cellular) which may contain channel bandwidths of 1.4MHz, 3MHz, 5MHz, or 10MHz. A wider signal contributes to a larger IM bandwidth, resulting in a greater number of indirect hits as illustrated here.

IM Order	Number of Intermodulation Products at each Receive Frequency									
	801.56875		801.88125		802.58125		803.65625		804.23125	
	Direct	Indirect (1.4/3/5/10)	Direct	Indirect (1.4/3/5/10)	Direct	Indirect (1.4/3/5/10)	Direct	Indirect (1.4/3/5/10)	Direct	Indirect (1.4/3/5/10)
3rd	0	0/0/0/0	0	0/0/0/0	0	0/0/0/0	0	0/0/0/0	0	0/0/0/0
5th	0	0/3/5/5	0	0/2/5/5	0	0/2/5/5	0	0/0/5/5	0	0/0/5/5
7th	0	5/32/55/55	0	4/31/55/55	0	3/23/51/55	0	3/18/45/55	0	4/14/40/55

Table 4: Intermodulation Results Summary

6. ANTENNA SYSTEM DESIGN

The Antenna System detailed here and the RF Combining System described later in sections 7, 8, and 10 have been specifically designed to mitigate any interference caused by the listed high level carriers, thereby maximizing the coverage achieved by the Marion County system.

6.1 Antenna Type

The following antennas will be used at McCully Mountain.

Antenna	Manufacturer	Antenna Model Number	Description	Antenna Length (ft)	Antenna Gain (dBd)
Rx	RFI	CC807-09	collinear	10	9
Tx	Sinclair	SE414-SWBPALDF(D00)	Enclosed Dipole	4	11.5

Table 5: Antenna Details

800MHz Corporate Collinear Antennas

748-870MHz

CC807 Series

These industry leading, full featured corporate collinear arrays allow site operators to combine, with complete integrity, a large number of communications services into a single, low profile antenna solution.

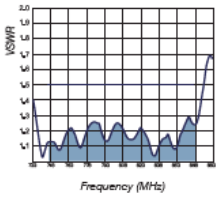
The corporate feed design employed by RFI maintains superior pattern control, allowing gain to be maximised with zero tilt variation over a very broad bandwidth, comparable to that only previously available in exposed dipole array configurations. This is achieved in the preferred form factor of a fully enclosed fibreglass radome, providing a reduction in wind loading, ice loading and tower loading in comparison.

The CC807 series have been designed with an exceptional power rating of 500W across the band as well as a Peak Instantaneous Power (PIP) rating of 25kW to cater for the peak voltage levels present in large multi-carrier combining environments. RFI's refined design processes and proven construction methods achieve a PIM rating of –150dBc, further ensuring performance is maintained for the service life of the antenna.

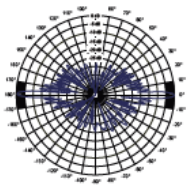
Features:

- 500W Continuous Power rating
- -150dBc Passive Intermodulation (PIM) rating, 100% PIM tested
- 25 kW Peak Instantaneous Power (PIP) rating
- DC grounding on all elements for the ultimate in lightning protection and dissipation of static noise.
- Light weight dipole construction using RFI's patented flexi-PCB architecture, maintains a low centre of gravity reducing tip deflection and sway
- Field invertible (excluding tilt models)
- Preset downtilt variations of 2 and 4 degrees available, see note (1)

Typical VSWR Response (CC807-12)



CC807-12 - E Plane



Electrical Specifications

Model Number	CC807-09-P	CC807-12-P
Nominal Gain *dBd (dBi)*	9.0 (11.1)	11.5 (13.6)
Frequency *MHz*	746-870	
Tuned Bandwidth *MHz*	Full	
VSWR *(Return Loss)*	1.5:1	
Nominal Impedance Ω	50	
Downtilt°	0 Std 2, 4 (1)	
Vertical Beamwidth°	8	4
Horizontal Beamwidth°	Omni +/- 0.5dB	
Input Power W	500	
Passive IM 3rd order (2x20W) *dBc*	-150	
Peak Instantaneous Power *kW*	25	

Mechanical

Model Number		CC807-09-P	CC807-12-P
Construction		Sky blue fibreglass radome	
Radome Diameter mm (inches)		76 (3.0)	
Length mm (inches)		3135 (123.4)	6235 (245.5)
Weight *kg (lbs)*		14 (30.9)	25.5 (56.2)
Termination		Integrated 4.3-10 Female	
Mountaing Area mm (inches)		750 x 90 (30 x 3.5) diameter Ecofilm™ plated aluminium	
Suggested Clamps		3 x UC-114	
Shipping Dimensions *mm (inches)*	H	115 (4.5)	
	W	115 (4.5)	
	L	3335 (131.3)	6435 (253.3)
Shipping Weight *kg (lbs)*		20.0 (44.1)	36.5 (80.5)
Projected area *cm² (ft²)*	No Ice	2597 (2.8)	5559 (6.0)
	With Ice	3192 (3.4)	7037 (7.6)
Lateral Thrust @160km/h *N* (100 mph lbs)		308 (69)	659 (148)
Wind Gust Rating *km/h (mph)*	No Ice	>240 (150)	
Torque @ 160km/h *Nm* (100mph ft-lbs)		413 (305)	1823 (1345)

(1) To order pre-set downtilt versions available, simply add a -T2 or -T4 towards the end of the part number to denote downtilt model required. For eg. CC807-12-T2-P to order CC807-12-P with 2deg of downtilt. Please note: Models with downtilt are NOT field invertible. . Eg. CC807-12-T2-P

P-43021-7 Asia Pacific | EMEA | Americas rfi.com.au

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Figure 2: RFI CC807-09 Antenna Datasheet

Superior then, Superior now.

A Norsat Company

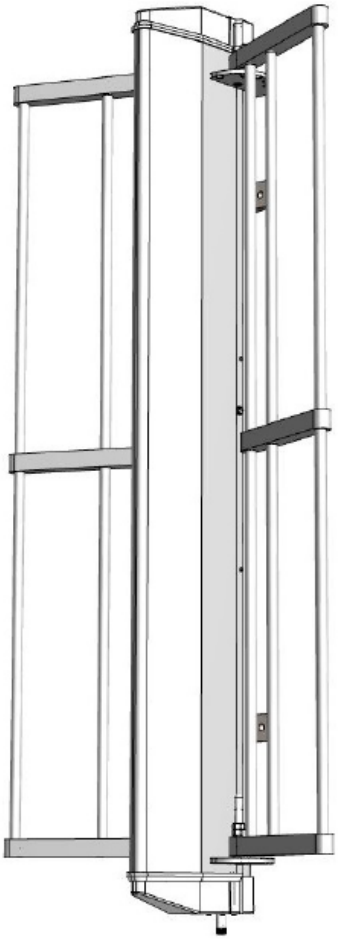
Antennas

700-1000 MHz Antennas

SE414-WBAL - PIM Certified Series

SE414-SWBPAL(YY)(DXX) Enclosed dipole, 8-11.5 dBd, adj. beamwidth, Low PIM, 746-960MHz

- Wide band design covers whole 746-960 MHz band, PIP rated
- Horizontal beamwidth can be adjusted (60º/90º/105º/130º/160º)
- Gain depends on horizontal beamwidth setting (11.5/10/9/8.5/8 dBd)
- PIP rated and low PIM



One wideband antenna for your 700, 800, 900 MHz systems. Sinclair's SE414-WBL series of enclosed dipole arrays offer excellent intermodulation performance covering 746-960 MHz in a single antenna. These highly versatile antennas are particularly well suited to communication systems where a specific coverage pattern is required. These include cellular systems, trunked radio, paging, and data transmission, where predictable and highly reliable performance is a must.

The SE414-WBAL series come with field adjustable reflectors that provide horizontal beamwidths between 60 and 160 degrees. The creative design and construction permits excellent pattern control and greater efficiency.

When ordering, please refer to the chart below for the model number. Different configurations are subject to various list prices. Please contact your Sinclair Sales Representative or Customer Service Representative for more information.

Model Number	Connector	Downtilt	PIM(dBc)	PIP(kW, max)
SE414-SWBPALDF(D00)	7/16 DIN(F)	0º	<-150	25
SE414-SWBPALDF(D01)	7/16 DIN(F)	1º	<-150	25
SE414-SWBPALDF(D02)	7/16 DIN(F)	2º	<-150	25
SE414-SWBPALDF(D03)	7/16 DIN(F)	3º	<-150	25
SE414-SWBPALDF(D04)	7/16 DIN(F)	4º	<-150	25
SE414-SWBPALDF(D05)	7/16 DIN(F)	5º	<-150	25
SE414-SWBPALDF(D06)	7/16 DIN(F)	6º	<-150	25
SE414-SWBPALNF(D00)	N(F)	0º	<-139	N/A
SE414-SWBPALNF(D01)	N(F)	1º	<-139	N/A
SE414-SWBPALNF(D02)	N(F)	2º	<-139	N/A
SE414-SWBPALNF(D03)	N(F)	3º	<-139	N/A
SE414-SWBPALNF(D04)	N(F)	4º	<-139	N/A
SE414-SWBPALNF(D05)	N(F)	5º	<-139	N/A
SE414-SWBPALNF(D06)	N(F)	6º	<-139	N/A

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Antennas
700-1000 MHz Antennas
SE414-WBAL - PIM Certified Series

Electrical Specifications

Frequency Range	MHz	746 to 960	
Bandwidth	MHz	214	
Gain (nominal)	dBd (dBi)	11.5 (13.6)	*1
Input VSWR (max)		1.5:1	
Polarization		vertical	
Impedance	Ω	50	
Pattern		Directional and Adjustable	
Horizontal beamwidth (typ)	degrees	60	*2
Vertical beamwidth (typ)	degrees	20	
Average Input Power (max)	W	500	
Front-to-back ratio (min)	dB	20	
Grounding		All metal parts DC-grounded	

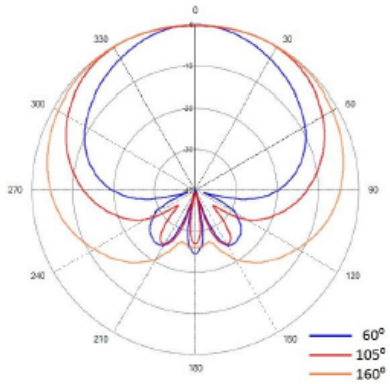
Notes
*1 : Dependant on reflector setting 10/9/8.5/8 dBd
*2 : 90/105/130/160
*3 : 90° beamwidth configuration, clamp not included in measurement
*4 : 90° beamwidth configuration, clamp not included in measurement
*5 : Ref. clamp maximum

Mechanical Specifications

Width	in (mm)	25 (635)	*3
Depth	in (mm)	8.5 (216)	*4
Length/ Height	in (mm)	53 (1346)	
Base pipe diameter	in (mm)	2.88 (73)	*5
Base pipe mounting length	in (mm)	30.5 (775)	
Radiating element material		prntd circuit bd	
Weight	lbs (kg)	23 (10.44)	
Mounting Hardware (Included)		#130 clamp	
Mounting configurations		upright	
Actual shipping weight	lbs (kg)	28 (12.71)	
Shipping dimensions	in (mm)	58x14x17 (1473x356x432)	

Environmental Specifications

Temperature range	°F (°C)	-40 to +140 (-40 to +60)
Wind Loading Area (Flat Plate Equivalent)	ft² (m²)	4.8 (0.45)
Wind Loading Area (1/2" ice)	ft² (m²)	5.7 (0.53)
Rated wind velocity (no ice)	mph (km/h)	155 (250)
Rated wind velocity (1/2" radial ice)	mph (km/h)	140 (225)
Lateral Thrust (100 mph No Ice)	lbs (N)	180 (800.6)
Torsional moment (100 mph No Ice)	ft-lbs (Nm)	93 (125.6)



Horizontal

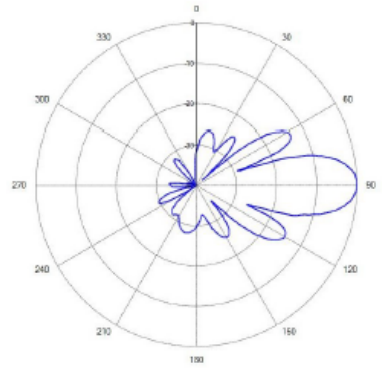

Vertical, 0° downtilt

Figure 3: Sinclair SE414-SWBPALDF(D00) Antenna Datasheet

6.2 Antenna Mounting Locations

Table 6 below specifies the Marion County antenna mounting location details.

Antenna	Mounting Height (feet AGL)	Antenna Orientation (degrees)	Tower Leg	Standoff Length (feet)	Standoff Orientation (degrees)	Standoff Model
Receive	179	n/a	B (SE)	n/a	n/a	n/a
Transmit	148	105	B (SE)	6	105	Site-Pro PSA-6

Table 6: Antenna Mounting Locations

The antenna system design for this site is given in Figure 4.

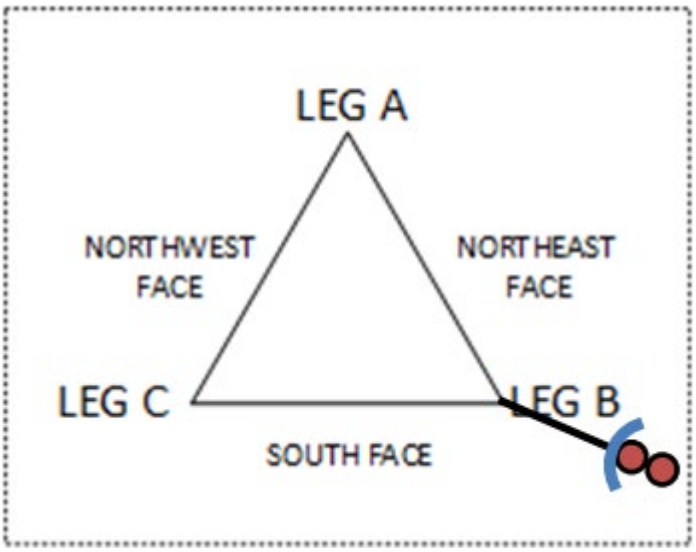


Figure 4: Antenna System Design

6.3 Antenna Isolation

The Transmit and Receive antennas are vertically separated by 34ft and horizontally separated by 6ft which gives an isolation between them of **75.5dB**. A figure of **60dB** will be assumed in subsequent calculations though as that is often the limit of what can be practically achieved (e.g., mounting imperfections, mechanical drift due to wind/ice loads or aging hardware).

7. TRANSMITTER COMBINER DESIGN

7.1 RF Connectors

The antenna output of the combiner is fitted with **4.3-10 female** connector to minimize Passive Intermodulation (PIM).

The transmitter input ports of the combiner are fitted with **N Type female** connectors.

7.2 Cavity Filters

Filtering in the Tx Combiner is predominantly bandpass.

A combination of band-pass and band-reject filtering is sometimes to provide extra rejection at specific site Rx frequencies, but band-reject filters are never used alone.

The cavity filters provide the minimum attenuation at the closest receive frequency equal to or greater to the value specified in section 7.9 of this document.

7.3 Isolator

A dual Isolator is included between the output of each transmitter and the Tx Combiner input port.

The isolator load closest to the Tx Combiner input port is rated at a minimum of **100 watts**.

7.4 Maximum RF Power

The Tx combiner supports a maximum of **100 watts** of RF input power per channel.

7.5 Minimum Tx to Tx Frequency Separation

The minimum frequency separation allowed between transmitters sharing the same combiner is **250kHz**.

7.6 Maximum number of Transmitters per combiner

Standard Tait practice is a maximum of 4 transmitters per Tx combiner. But in this case, the Tx-Tx spacing and the fact that self-TxIM is unlikely mean the penalty in combining all 5 transmitters together is negligible.

7.7 Maximum Tx Combiner Loss per Channel

The insertion loss shall be minimized to the extent possible while complying with all other specifications.

The Tx Combiner insertion loss per Tx channel (not including associated Tx antenna feeder cable losses) will be around **3.2dB** for the Tx-Tx frequency separation at this site.

7.8 Tx Intermodulation Suppression

Transmitters that cause intermodulation on any site receive frequency must not be connected to the same combiner.

But there is still a responsibility to keep the site as ‘clean’ as possible. So, to control the levels of intermodulation products generated in the combiner, the minimum isolation between the outputs of combined

transmitters shall be at least **60dB**. This figure includes the reverse isolation of the isolator and any additional attenuation provided by the cavity filters in neighboring branches.

7.9 Tx Sideband Noise Suppression

In addition to the Tx – Rx antenna isolation, the Tx Combiner provides the suppression required to reduce transmitter sideband noise at the Rx antenna to the level where it causes no more than 1dB of receiver de-sensitization. The transmitter sideband noise suppression required at this site is given in Table 7 below.

Transmit Frequency (MHz)	Offset to Nearest Receive Frequency (MHz)	Sideband Noise Suppression Required at Offset (dB)
771.56875	30.0000	14
771.88125	29.6875	15
772.58125	28.9875	15
773.65625	27.9125	15
774.23125	27.3375	15

Table 7: Transmitter Combiner Sideband Noise Rejection Requirements

8. RECEIVER SUBSYSTEM DESIGN

8.1 RF Connectors

8.1.1 Tower Top Amplifier

The Rx Filter input is fitted with a **4.3-10 female** connector.

The Rx Filter output is fitted with a **4.3-10 female** connector.

8.1.2 Receiver Multicoupler / PDU

The Rx Multicoupler input is fitted with a **4.3-10 female** connector.

The receiver output ports of the Rx Multicoupler are fitted with a **BNC Female** connector.

8.2 Receiver Subsystem Topology

The Receiver Subsystem will utilize a Tower Top Amplifier (TTA, which includes the receiver filtering) to optimize talk-in coverage followed by a multicoupler / PDU system that further amplifies and splits the received signal between the connected receivers.

8.3 Receiver Filtering

The Receiver Filters will pass the 801 to 805MHz part of the 700MHz band used for the Marion County system while fully rejecting associated transmit signals in both the 700MHz and 800MHz Tx bands. This is important because combinations of transmitters in both bands can result in 7th order IM falling within the 700MHz receive band.

8.3.1 Blocking Rejection

Between them, the Receiver Filters must provide enough attenuation so that no more than 1dB of de-sensitization of any of the connected receivers occurs due to receiver blocking. The attenuation required at this site to prevent receiver blocking due to the Marion County transmitters and external interferers found during FCC database search is given in Table 8 below:

	Tx Name	Tx Frequency (MHz)	Minimum Rejection in Rx Filter at Tx Frequency (dB)				
			Rx1 (MHz)	Rx2 (MHz)	Rx3 (MHz)	Rx4 (MHz)	Rx5 (MHz)
			801.56875	801.88125	802.58125	803.65625	804.23125
Transmitters	Tx1	771.56875	20	20	20	20	20
	Tx2	771.88125	20	20	20	20	20
	Tx3	772.58125	20	20	20	20	20
	Tx4	773.65625	20	20	20	20	20
	Tx5	774.23125	20	20	20	20	20
	LTE_1	880.02	20	20	20	20	20
	LTE_2	891.51	20	20	20	20	20

Table 8: Receiver Filter Blocking Rejection Requirements

8.3.2 Receiver Intermodulation Rejection

The Rx Filter must provide enough attenuation so that no more than 1dB of de-sensitization of any of the connected receivers occurs due to intermodulation.

The offending signals in this instance are broadband LTE carriers located approximately 0.1mi away from the proposed McCully Mountain site location. Assuming Friis Free Space Path Loss (FSPL), the air gap provides 75.5dB of attenuation. As such, the LTE signal could not possibly impinge the Marion County Rx antenna at a level no greater than -17dBm, which is the same level as the Marion County Tx signals (taking 60dB of antenna isolation as the practical upper bound).

The permissible IM product level at the filter output to assure no more than 1dB total de-sense across the different modalities (primarily transmitter sideband noise, blocking, and receiver IM) is -119.51dBm. If a worst-case scenario is entertained in which a *direct* 3rd Order hit occurs, the Rx filter lineup would need to accommodate an additional 26dB of rejection headroom beyond the receiver blocking rejection requirements (Table 8) to accommodate the potential de-sense due to receiver IM experienced as a result of such a 3rd Order direct IM product. Even in this example, though, the dBSpectra TTA has more than enough margin to fully reject frequencies contributing to a direct 3rd Order IM product.

The levels of 5th Order and 7th Order IM products at the filter output, even when comprised fully of fundamentals (i.e., no harmonic terms), are buried well below the thermal noise floor. As an example, a 5th Order direct IM product is generated at a level of -165.7dBm after accounting for the receiver blocking rejection budget, which is completely imperceptible to the receiver.

The attenuation required at this site to prevent receiver intermodulation due to the Marion County transmitters and external interferers found during FCC database search is given in Table 9 below:

	Tx Name	Tx Frequency (MHz)	Minimum Rejection in Rx Filter at Tx Frequency (dB)				
			Rx1 (MHz)	Rx2 (MHz)	Rx3 (MHz)	Rx4 (MHz)	Rx5 (MHz)
			801.56875	801.88125	802.58125	803.65625	804.23125
Transmitters	Tx1	771.56875	20	20	20	20	20
	Tx2	771.88125	20	20	20	20	20
	Tx3	772.58125	20	20	20	20	20
	Tx4	773.65625	20	20	20	20	20
	Tx5	774.23125	20	20	20	20	20
	LTE_1	880.02	20	20	20	20	20
	LTE_2	891.51	20	20	20	20	20

Table 9: Receiver Filter Intermodulation Rejection Requirements

8.4 Low Noise Amplifiers

Low Noise Amplifiers (LNAs) with appropriate gain and noise figure will be included in the receiver sub system to ensure that the cascade noise figure of the line up from the base of the receive antenna up to and including the base station receiver is equal to or less than 5dB.

The output third order intercept of the LNAs will be >= +40dBm to maintain the linearity of the system.

8.5 Variable Attenuator

A Variable Attenuator will be fitted in the Rx Multicoupler/PDU for field optimization of the receiver subsystem gain, noise figure and IP3. The attenuator has an adjustment range of 0dB to 15dB, in 0.25dB steps.

Setting of the attenuator value must be done electronically so as not to require disassembly of the multicoupler equipment.

8.6 Receiver Ports

To allow for future expansion, the Rx Multicoupler will have 8 ports

All unused ports will be terminated in a 50-ohm load.

9. POWER MONITOR

The dBSpectra DSCHPMDC1MDC Power Monitor will be used within the Marion County RF systems. This is placed at the output of the Tx Combiner and allows remote monitoring of channelized transmitted power and antenna VSWR. The major benefit is early warning of antenna system degradation so that repairs can be made before failure occurs.

DSCHPM-Series (VHF, 220, UHF, 700/800/900 MHz)
SMART Channelized Transmit Power Monitor with Front Panel Display Option

dbSpectra
Always a Better Value

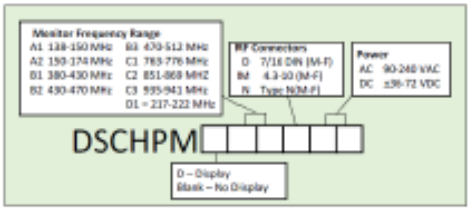
DSCHPM Power Monitor with front panel display option.

Directional coupler for installation on combiner output.

Features and Benefits

- *Per-channel and composite* measurement of forward and reflected RF power with the SMART Channelized RF Power Monitor.
- Calculates and displays combiner insertion loss for each channel.
- All measurements are displayed with 95% accuracy.
- IP network connection and designed-in web server for web browser interface.
- Full remote configuration, monitoring and data logging.
- Optional front panel display with Navigation Keys for monitoring only.
- User-defined alarm thresholds are indicated by alarm relay closure or by SNMP protocol on the network.
- Optional temperature sensors for equipment and ambient temperature measurements and alarms.
- Compact single rack unit mounting with remote RF sensor for flexibility in mounting locations.

Ordering Information

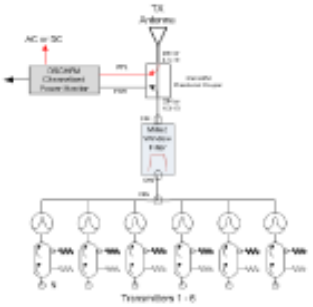


Notes:
1. Factory calibrated using a P25 LSM signal source, may be calibrated in the field for improved accuracy.
2. Contact dbSpectra at tech@dbspectra.com for additional information on optional temperature sensor feature.

Specifications

Electrical Specifications	
Frequency Range, MHz	See Ordering Information
Minimum TX to TX Separation	50 kHz
Maximum Power Input	600 Watts (directional coupler)
System Type	Digital or analog
Insertion Loss	< 0.1 dB
PIM Rating	-150 dBc
Channelized Power Measurements	Forward /reflected power of individual channels: Watts, dBm, VSWR, Return Loss, Combiner Insertion Loss
Power Requirements	AC Model 90-240 VAC 15W, or DC model ±36-72 VDC 15W
IP Interface	IPV4, with TLS security layer, SNMP v2c/v3 alarm protocol
Alarms	Form C contacts or SNMP v2c/v3
User Interface	Web browser or remote SNMP system manager. Front Panel Display (optional) for Monitoring only.
Temperature Range	-30 to +60 °C
Mechanical Specifications	
Mounting Dimensions	1 RU, 1.75 X 19 in. (44 X 483 mm) 7.5 in. (191 mm) deep
Construction / Finish	Aluminum / protective finishes
Directional Coupler Connectors Input Output Coupled Ports	 7/16 DIN, 4.3-10 or N(male) 7/16 DIN, 4.3-10 or N(female) MCX type push-on with two 4 ft RD316 cables supplied.
Power Connector	AC model: IEC 320-C13 inlet & cord DC model: 2 port terminal block
Ethernet Connector	RJ-45
Alarm Closures Connector	3 port pluggable terminal block
Temp. Sensor Connector	24-pin header male pins
Net Weight	4.6 lbs. (2.1 kg)
Shipping weight	6.1 lbs. (2.8 kg)

Typical Application



Specifications are subject to change • www.dbspectra.com • 1590 E Hwy 121, Building A, Suite 100, Lewisville, TX 75056 • P (469)322-0080 •096000-797.A • 01/2024

Figure 5: DSCHPMDC1MDC Channelised Power Monitor

10. RF SUB-SYSTEM DESIGN

Tait have worked with dBSpectra to develop a generic combining system for the Marion County project that meets the performance goals derived in sections 7 and 8 of this report and thereby maximizes the talk in and talk out coverage of the system.

The transmit side of the RF sub-system consists of a 5-channel cavity filter based ceramic combiner to minimize losses and hence maximize the transmitted power and talk out coverage from the site. The cavity filters meet or exceed the Tx sideband noise filtering requirements given in section 7.9.

The receive side features a compact Tower Top Amplifier (TTA) followed by a Receiver Multicoupler/PDU that allows the receiver sensitivity to be optimized and distributes the signal to the five connected receivers. All the receive filtering is accommodated within the TTA. There are two filters, one before the LNA to preselect the 801 to 805MHz part of the band used by the Marion County system (see Figure 7), and a second after the LNA that fully rejects the Marion County system transmit signals, and the other 700 and 800MHz HLCs identified from the FCC database search (see Figure 8). Together, the filters meet or exceed the receiver blocking and receiver intermodulation filtering requirements given in sections 8.3.1 and 8.3.2. There are two LNAs, one in the TTA and one in the Rx Multicouper/PDU with gains, noise figures and intercept points optimized so the cascade noise figure and linearity of the receiver line up meets the requirements of section 8.4.

A block diagram of the North Cell combining system design is shown in Figure 6 below:

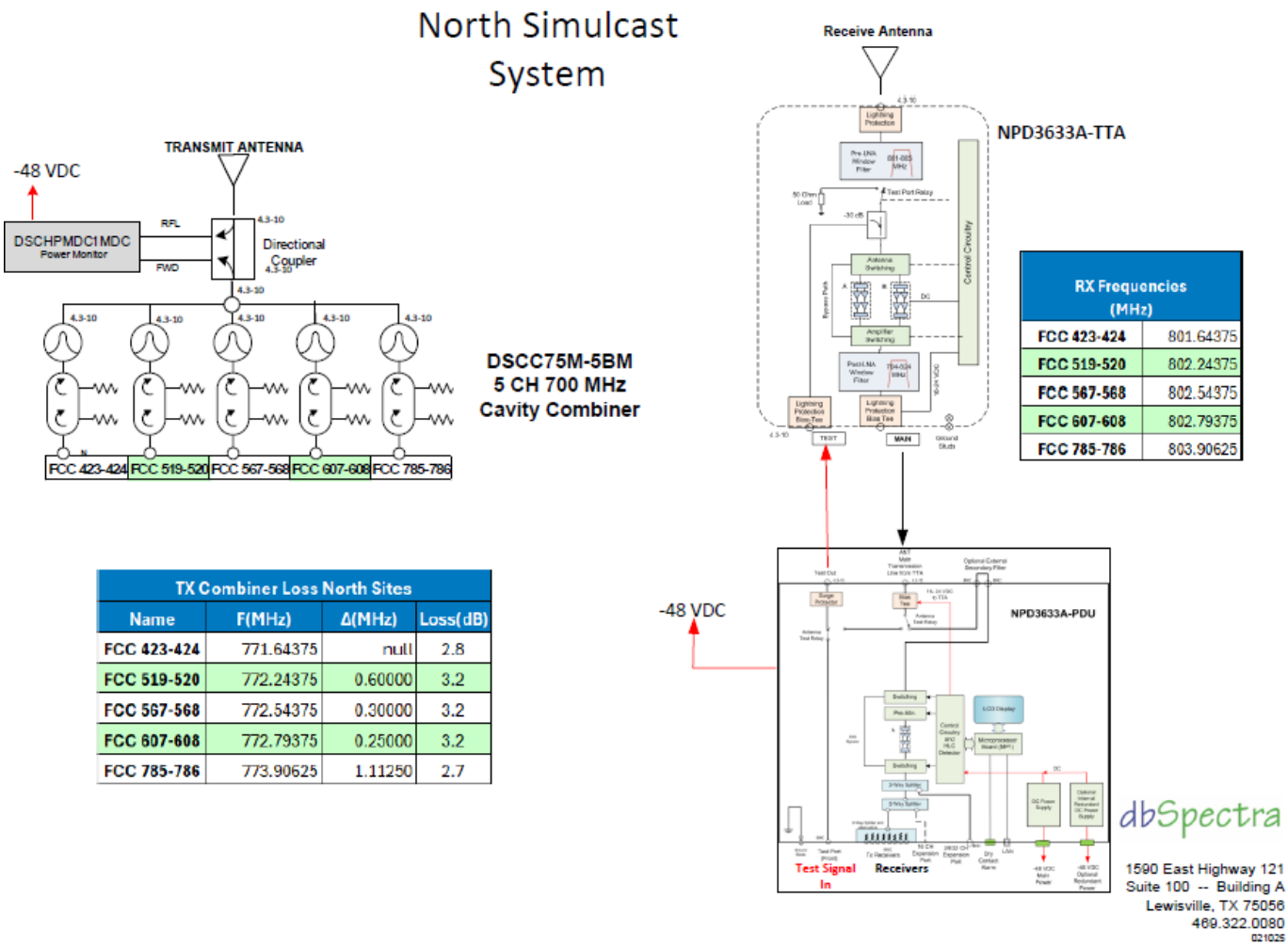


Figure 6: SPD3454C-4TR Dual Band RF Combining System

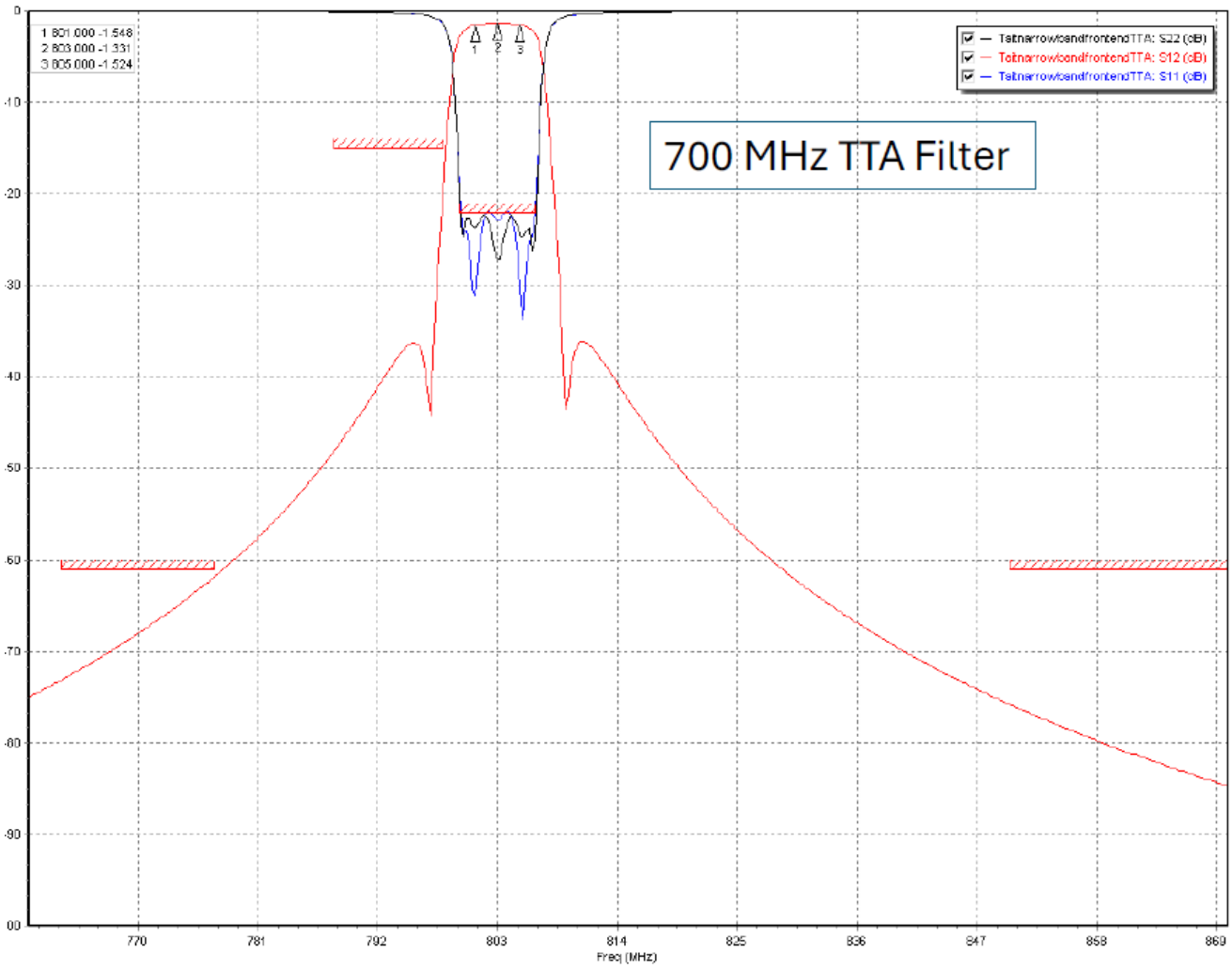


Figure 7: TTA PreSelector Filter Plot

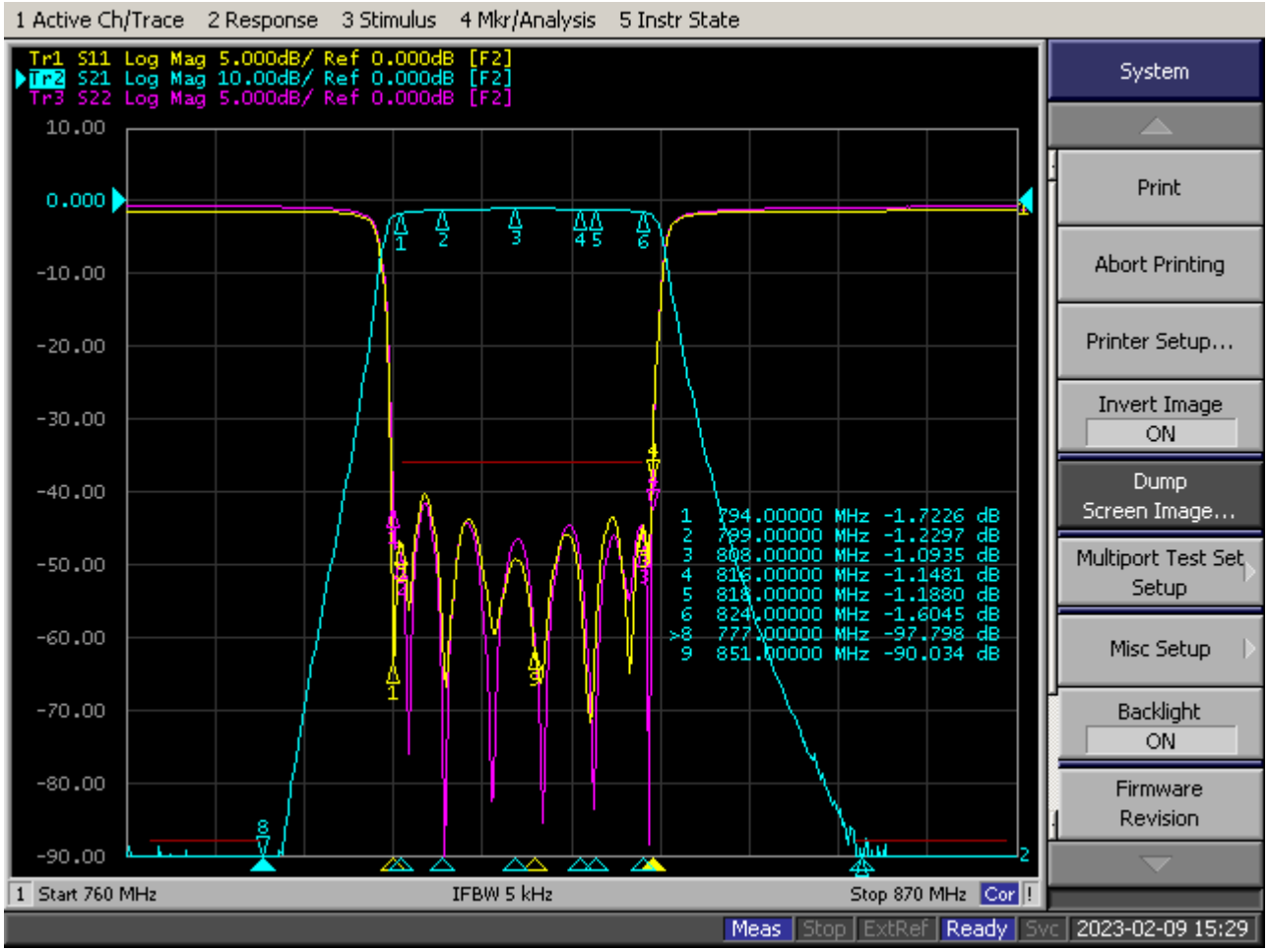


Figure 8: TTA Post LNA Filter Plot

11. MICROWAVE SYSTEM DESIGN

Refer to “Marion County P25 System Design_v1.1.docx” for Microwave System Details.

11.1 Site Specific Design

The McCully Mountain site supports two Aviat microwave links. These links connect McCully Mountain to APW and Wipper, forming part of the 13-site core ring and providing the redundant routing expected within the looped topology.

12. RF SUB-SYSTEM DRAWINGS

The figure below contains the schematic of the RF sub-system to be deployed at this site.

12.1 RF System Schematic

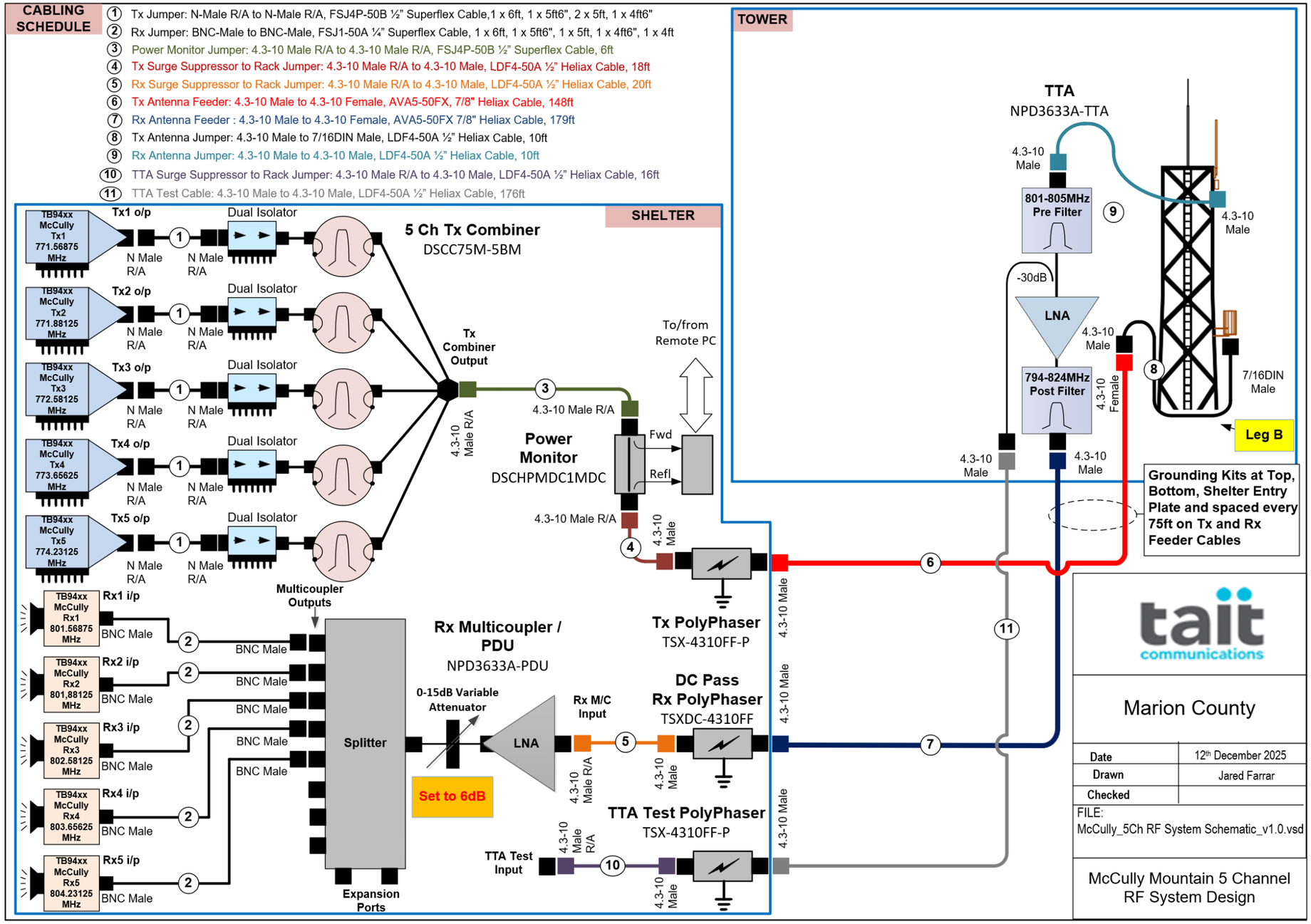
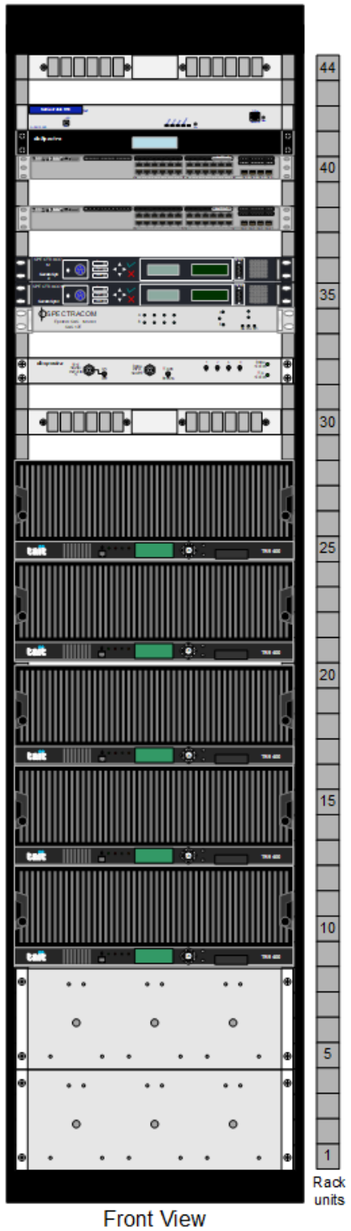


Figure 9: RF System Schematic

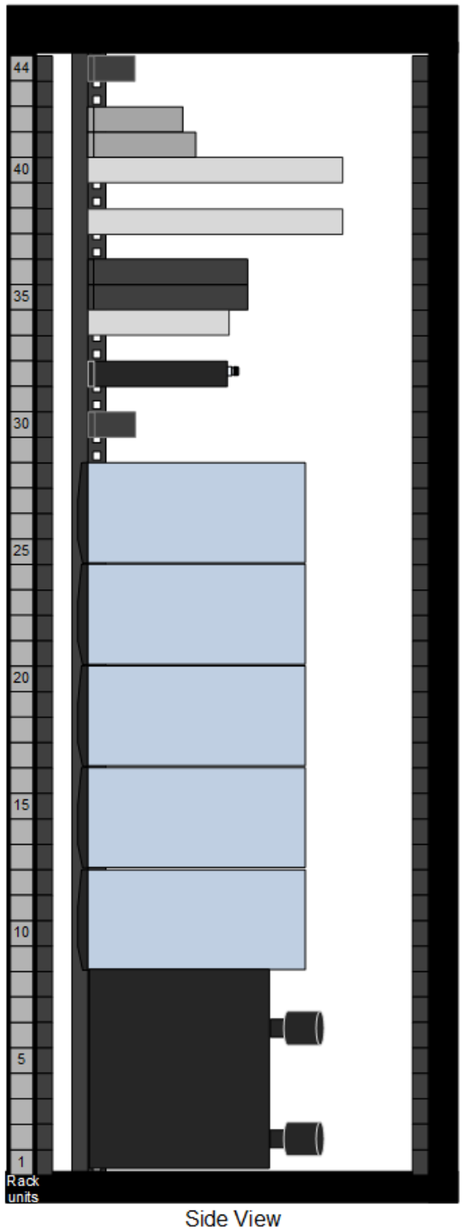
12.2 Rack Layout

This section contains the rack layout front & back view, side view and cabling diagram for this site.

700 MHz P25 Phase II Rackup Diagrams



Front View



Side View

RU	Description	Vendor PN	Vendor	Width (in)	Height (in)	Depth (in)
44	Breaker Panel	9072101001	TRIMM	19	1U	3.25
42	Alarm Panel	M16G2 & D-PK-16PAN	Netguardian	17	1U	6.6
41	Power Monitor	DSCHPMDC	dBSpectra	19	1U	7.5
40	Switch #1	C9300L-24P-4X-A	Cisco	17.5	1U	17.7
38	Switch #2	C9300L-24P-4X-A	Cisco	17.5	1U	17.7
36	Timing Reference	2402-613	Safran	17.1	1U	15.17
35	Timing Reference	2402-613	Safran	17.1	1U	15.17
34	Timing Switch	SAS-17E	Safran	19	1U	13.4
32	Multicoupler	NPD3633A	dBSpectra	19	1U	10.5
30	Breaker Panel	9072101001	TRIMM	19	1U	3.25
25-28	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
21-24	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
17-20	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
13-16	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
9-12	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra	19	8U	12.5

Marion County, OR
700 MHz P25 Phase II

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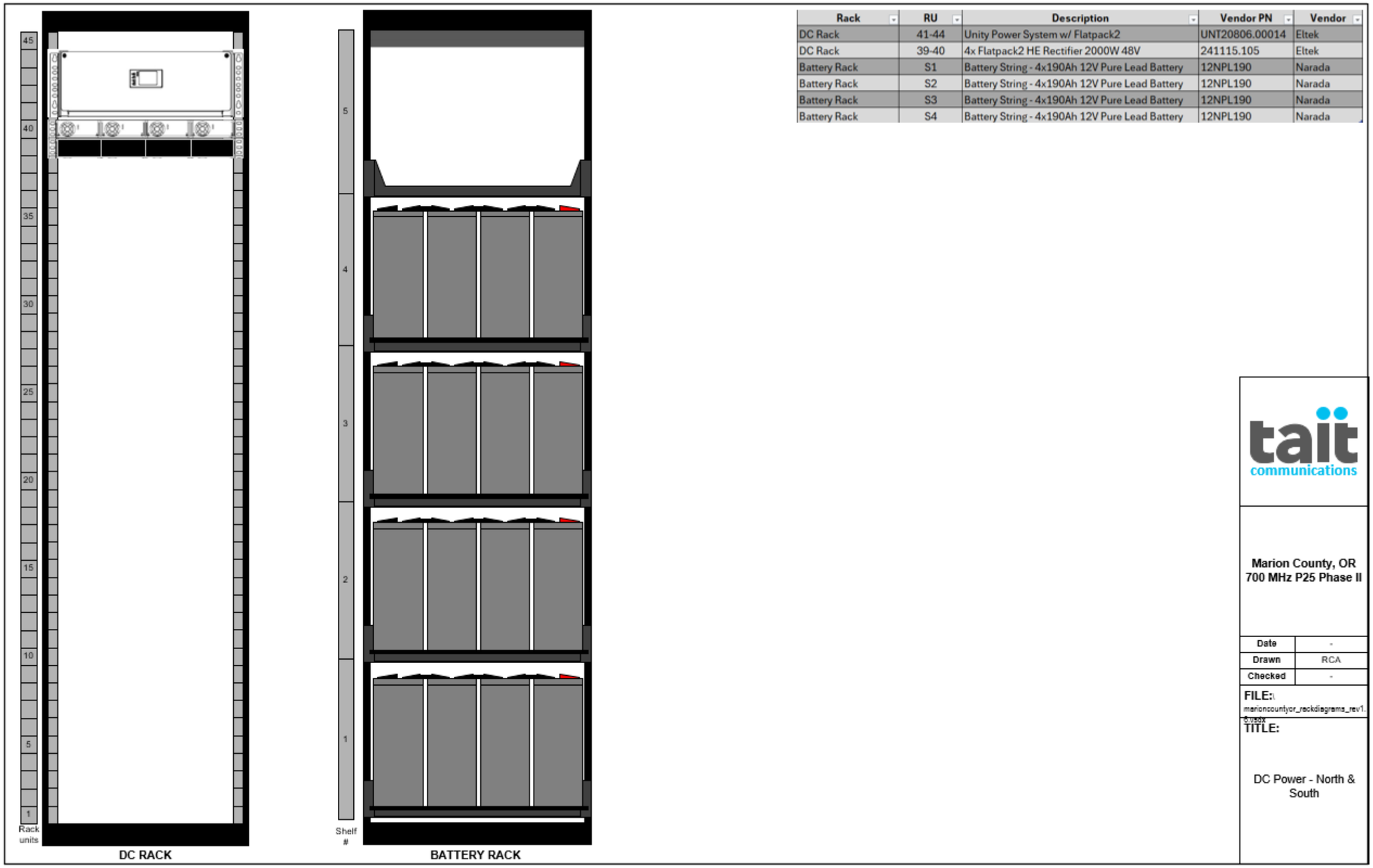
RF_Site_Simulcast

Figure 10: Marion County 19" Rack Layout – RF Front & Side



Rack	RU	Description	Vendor PN	Vendor
DC Rack	41-44	Unity Power System w/ Flatpack2	UNT20806.00014	Eltek
DC Rack	39-40	4x Flatpack2 HE Rectifier 2000W 48V	241115.105	Eltek
Battery Rack	S1	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack	S2	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack	S3	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack	S4	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada

Figure 11: DC Power & Battery Racks

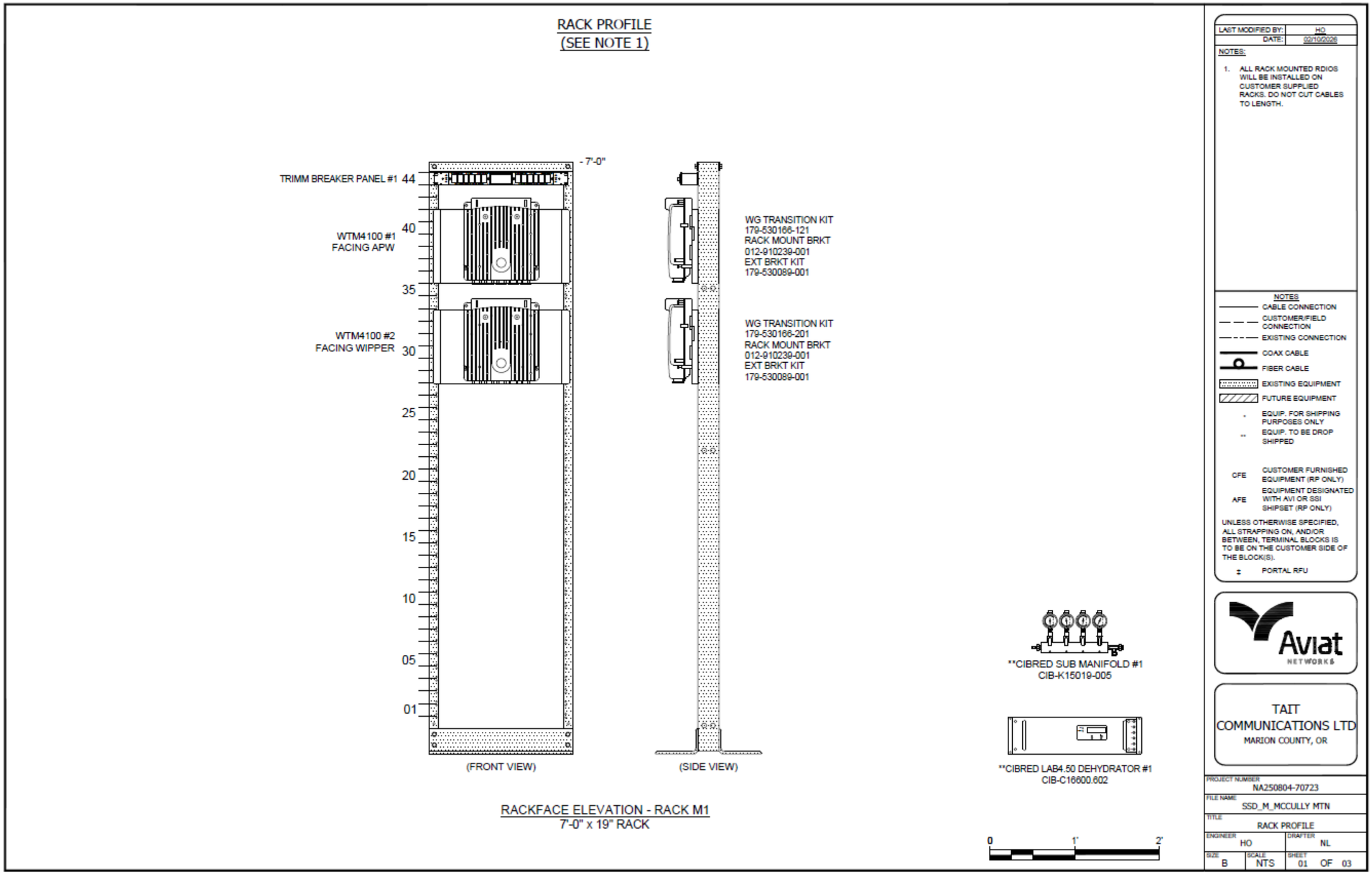
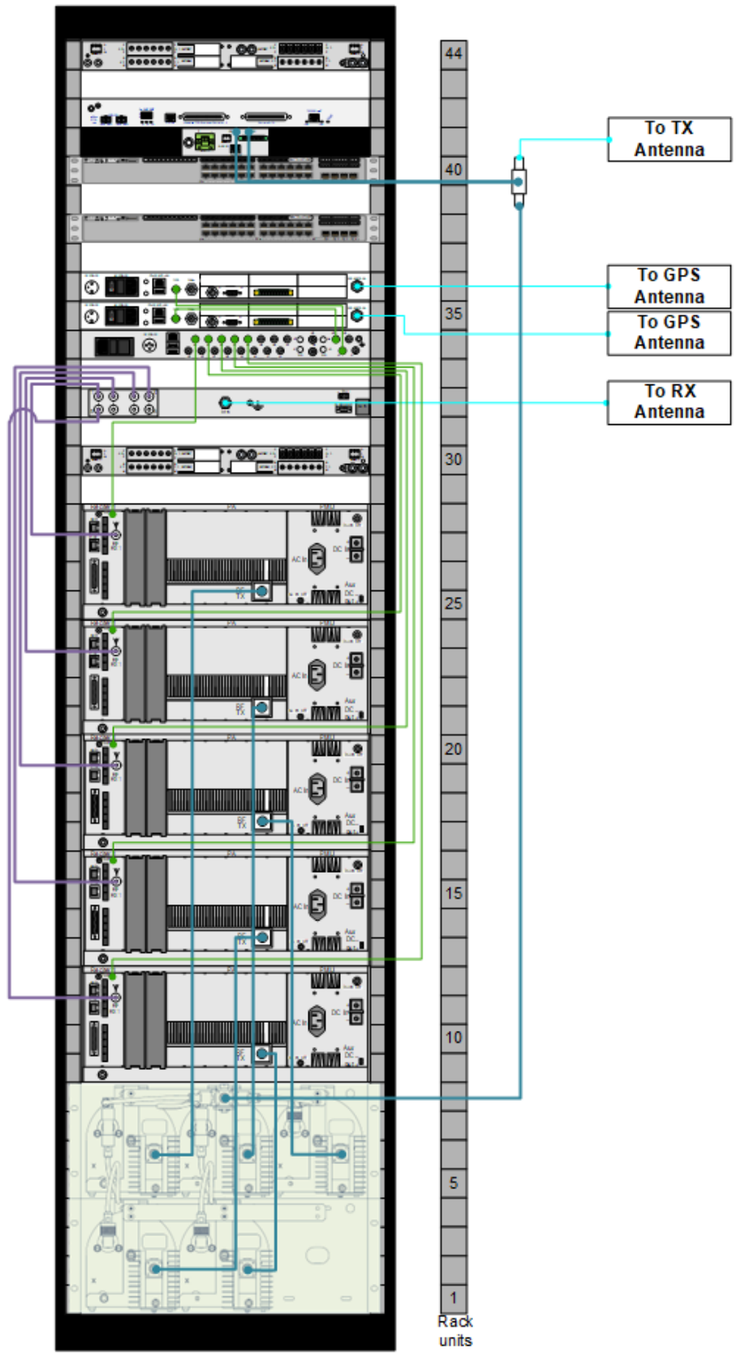


Figure 12: Microwave Rack

700 MHz P25 Phase II
Rackup Diagrams



RU	Description	Vendor PN	Vendor
44	Breaker Panel	9072101001	TRIMM
42	Alarm Panel	M16G2 & D-PK-16PAN	Netguardian
41	Power Monitor	DSCHPMDC	dBSpectra
40	Switch #1	C9300L-24P-4X-A	Cisco
38	Switch #2	C9300L-24P-4X-A	Cisco
36	Timing Reference	2402-613	Safran
35	Timing Reference	2402-613	Safran
34	Timing Switch	SAS-17E	Safran
32	Multicoupler	NPD3633A	dBSpectra
30	Breaker Panel	9072101001	TRIMM
25-28	P25 Trunked Base Station	TB9435S-100T	Tait
21-24	P25 Trunked Base Station	TB9435S-100T	Tait
17-20	P25 Trunked Base Station	TB9435S-100T	Tait
13-16	P25 Trunked Base Station	TB9435S-100T	Tait
9-12	P25 Trunked Base Station	TB9435S-100T	Tait
1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

Marion County, OR
700 MHz P25 Phase II

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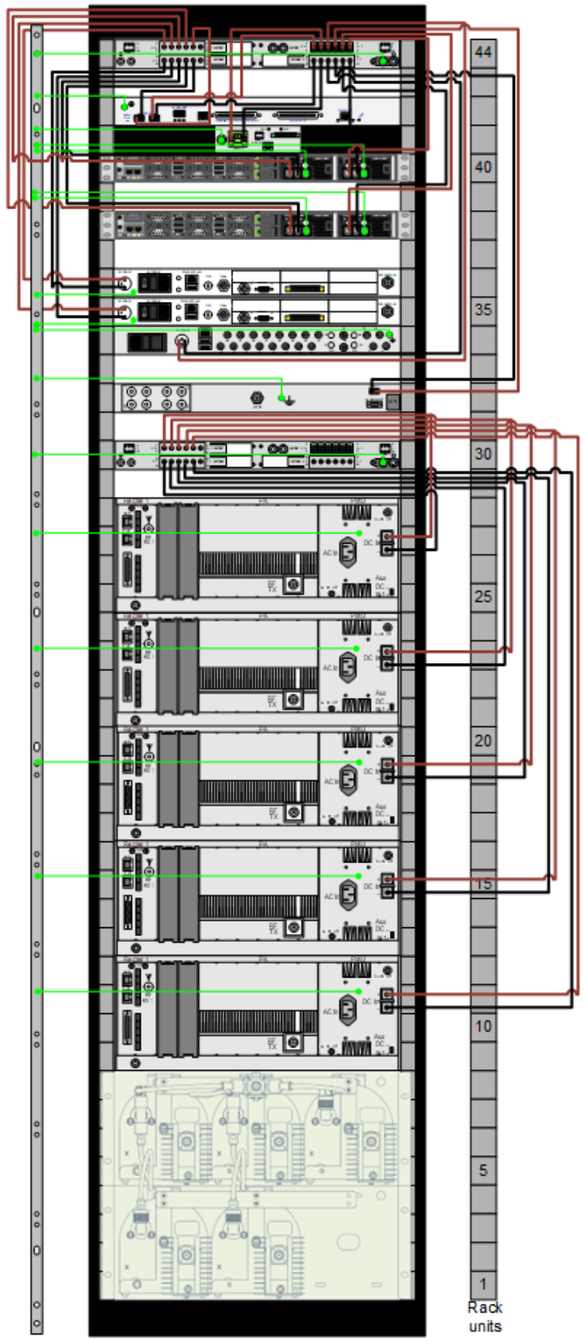
Cabling - RF

Figure 13: Marion County 19" Rack Layout – RF Cabling

700 MHz P25 Phase II
Rackup Diagrams



RU	Description	Vendor PN	Vendor
44	Breaker Panel	9072101001	TRIMM
42	Alarm Panel	M16G2 & D-PK-16PAN	Netguardian
41	Power Monitor	DSCHPMDC	dBSpectra
40	Switch #1	C9300L-24P-4X-A	Cisco
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36	Timing Reference	2402-613	Safran
35	Timing Reference	2402-613	Safran
34	Timing Switch	SAS-17E	Safran
32	Multicoupler	NPD3633A	dBSpectra
30	Breaker Panel	9072101001	TRIMM
25-28	P25 Trunked Base Station	TB9435S-100T	Tait
21-24	P25 Trunked Base Station	TB9435S-100T	Tait
17-20	P25 Trunked Base Station	TB9435S-100T	Tait
13-16	P25 Trunked Base Station	TB9435S-100T	Tait
9-12	P25 Trunked Base Station	TB9435S-100T	Tait
1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

Description A	Connection A	Description B	Connection B
Breaker Panel 1	A1	GPS 1	-48 VDC
Breaker Panel 1	A2	GPS 2	-48 VDC
Breaker Panel 1	A3	Switch 1-A	-48 VDC
Breaker Panel 1	A4	Switch 2-A	-48 VDC
Breaker Panel 1	A5	Alarm Panel A	-48 VDC
Breaker Panel 2	B1	Alarm Panel B	-48 VDC
Breaker Panel 2	B2	Power Monitor	-48 VDC
Breaker Panel 2	B3	Timing Switch	-48 VDC
Breaker Panel 2	B4	Multicoupler	-48 VDC
Breaker Panel 2	B5	Switch 2-B	-48 VDC
Breaker Panel 2	B6	Switch 1-B	-48 VDC

Marion County, OR
700 MHz P25 Phase II

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TITLE:

Cabling - Power

Figure 14: Marion County 19" Rack Layout – Power Cabling

13. PARTS AND EQUIPMENT LISTS

Refer to “Marion County P25 Project - Equipment List by Site.xlsx” for site-specific equipment list.

14. RF PERFORMANCE

14.1 Tx Effective Radiated Power

Table 10 below summarizes the transmitter system performance. It shows the required TB9xxx transmitter output power setting, the combining losses (including internal cabling), the antenna feeder loss and finally the resulting ERP relative to a dipole (ERPd).

Transmitter Frequency (MHz)	Transmitter Output Power Setting	Combining Losses (dB)	Misc Losses (dB)	Antenna Feeder Losses (dB)	Tx ERPd
771.56875	+49.4dBm (87W)	3.2	0.75	2.43	+54.5dBm (462W)
771.88125	+49.4dBm (87W)	3.2			+54.5dBm (462W)
772.58125	+49.4dBm (87W)	3.2			+54.5dBm (462W)
773.65625	+49.4dBm (87W)	3.2			+54.5dBm (462W)
774.23125	+49.4dBm (87W)	3.2			+54.5dBm (462W)

Table 10: Transmitter Output Power Setting and Effective Radiated Power

14.2 Site Noise

Site Noise in the 700MHz band can be assumed to be negligible.

14.3 Receiver Sensitivity

Table 11 summarizes the receiver system performance. It shows the amount of de-sensitization caused by the elevated site noise floor, the required Rx Multicoupler attenuation setting, and the resulting final Receiver sensitivity that can be achieved.

Receiver Frequency (MHz)	Rx Multicoupler Attenuator Setting (dB)	Rx Sensitivity for DAQ3.4 (dBm)
801.56875	6	-111.2
801.88125		
802.58125		
803.65625		
804.23125		

Table 11: Receiver Sensitivity

15. SITE DESIGN INFORMATION

15.1 Site Plan

The site plan is an overhead view of the overall compound depicting locations of pertinent features.

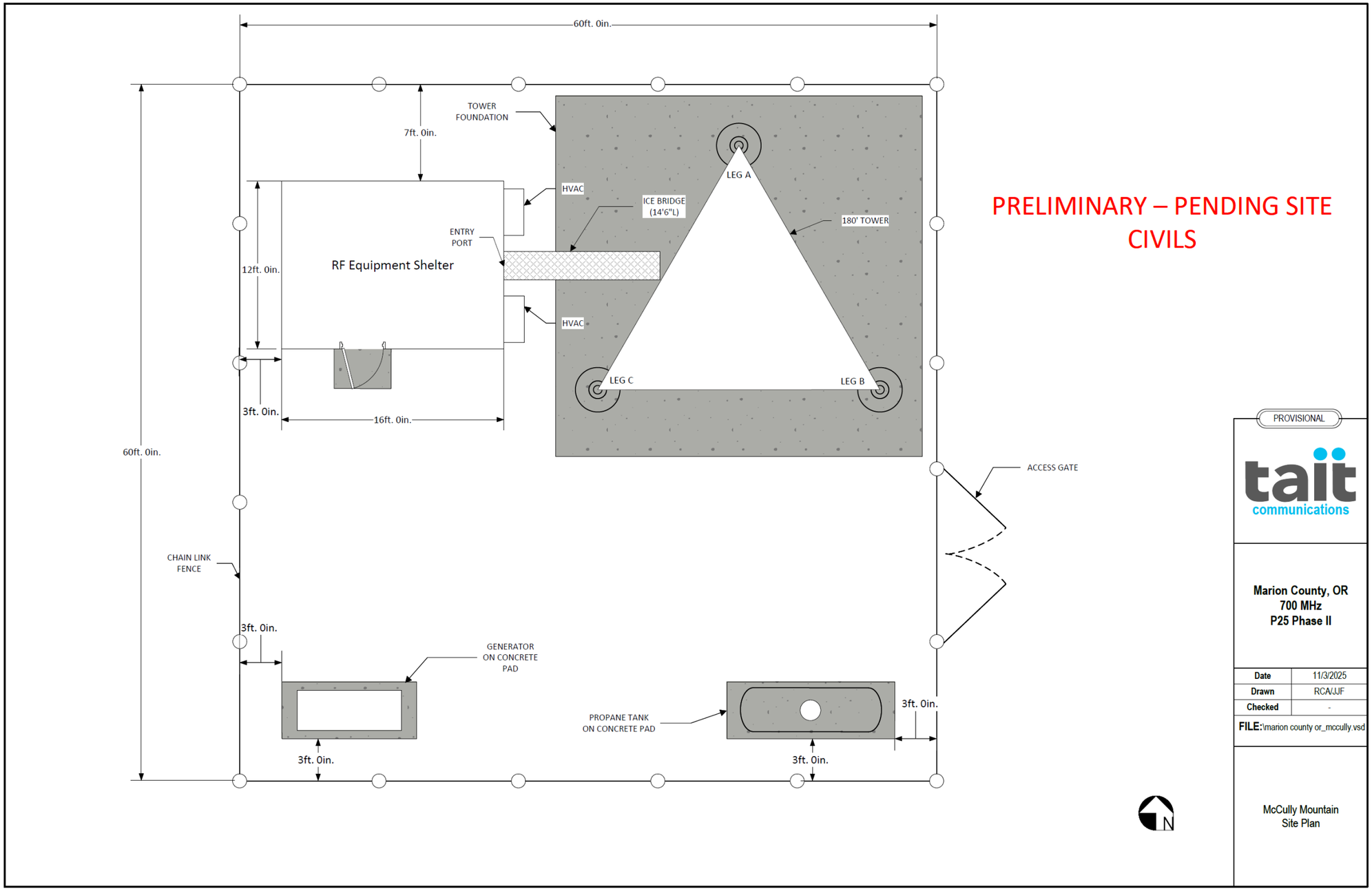

Figure 15: Site Plan

15.2 Floor and Cable Routing Plan

The floor and cable routing plan is an overhead view of the equipment room layout depicting locations of pertinent equipment and including the cable routing plans leading to the tower.

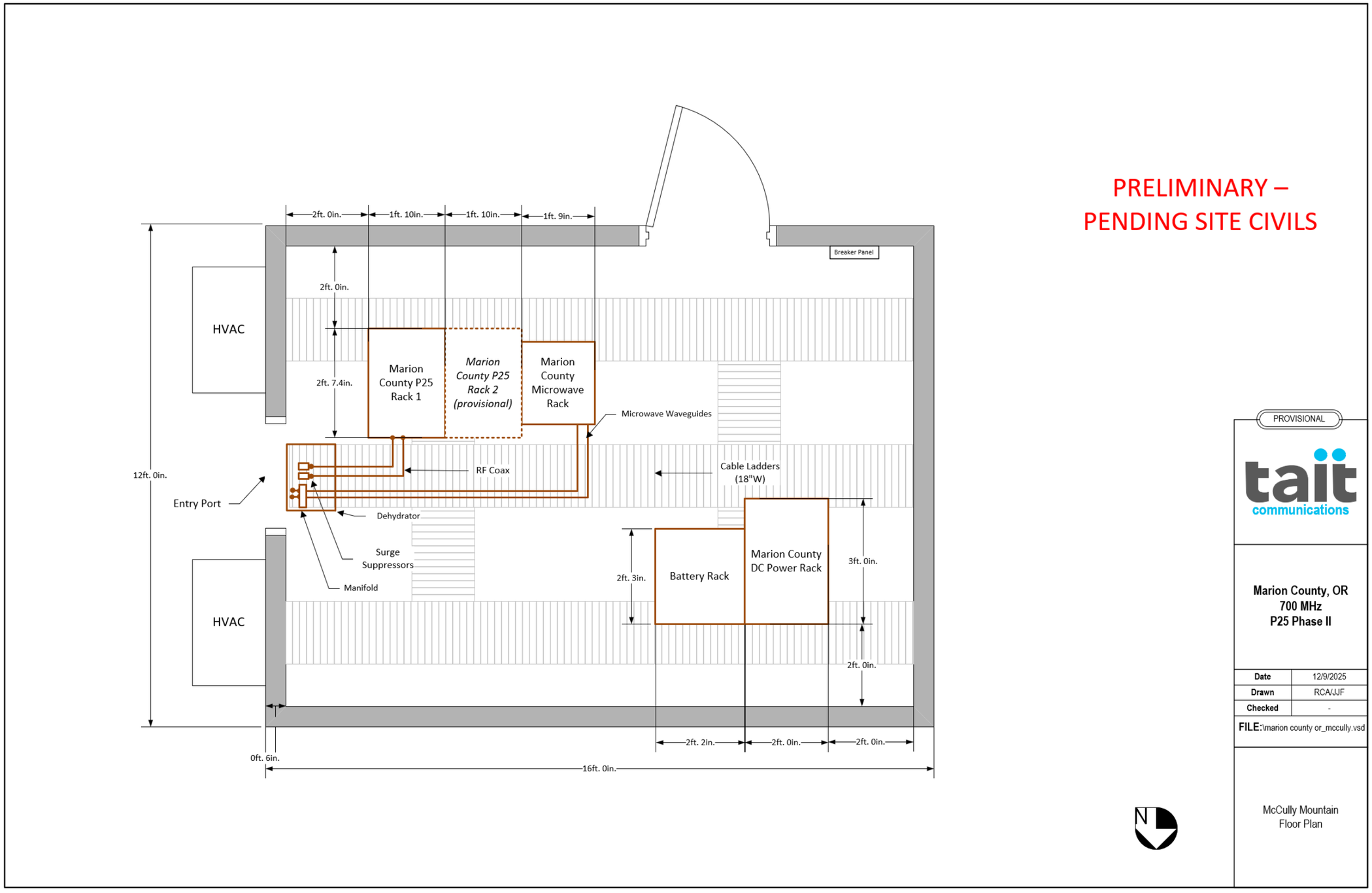

Figure 16: Floor and Cable Routing Plan

15.3 Entry and Exit Ports

The ports where the antenna and TTA cables enter / exit the shelter are shown in the below figure.

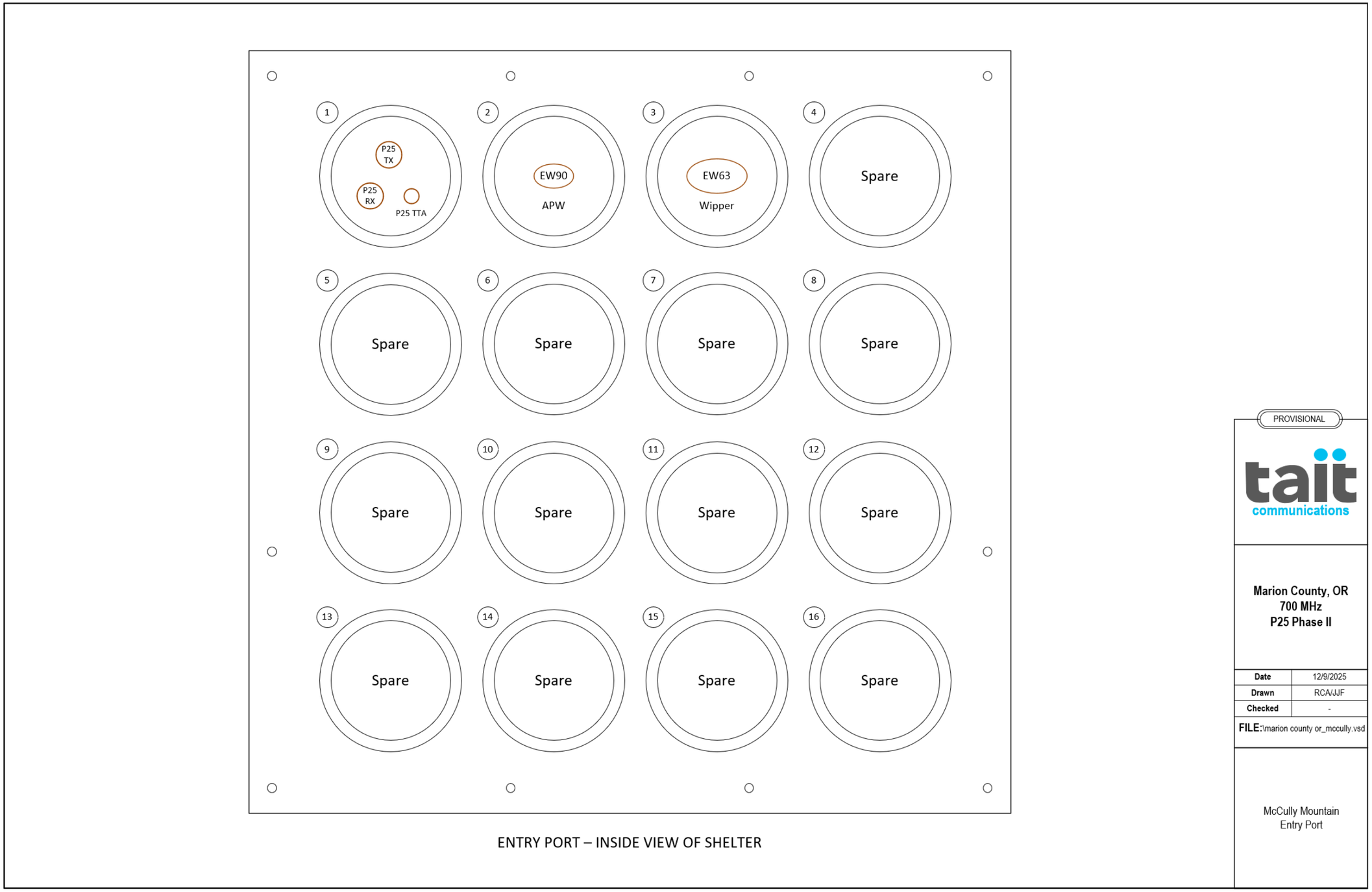

Figure 17: Shelter Cable Entry & Exit Ports

15.3.1 Power & Heat Load Calculations

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Power & Heat Load details.

15.3.2 DC Distribution Fuse Panel

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Fuse Panel details.

PROVISIONAL Design Document

RF Sub-System and Site Designs

Marion County

Site: MCPW Tech Shop

Issue 1.1 • 1st May 2026

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PREFACE

Project Details

Project number	
Customer	Marion County
Project description	P25 Phase 2 Simulcast & P25 Phase 1 Conventional Simulcast
Business Development Manager	
Sales Engineer	
Project Engineer	Jared Farrar / Riley Alfaqeeh
Project Manager	Stacey Adams
Lead RF Engineers	Ian Graham

Purpose

The Marion County project is an 11 site P25 simulcast design that uses the US 700MHz band. To control Time Delay Interference (TDI), the simulcast design is split into three cells – North, South, and East. The North cell is comprised of four sites with P25 Phase 2 trunked operation, the South cell is comprised of four sites with P25 Phase 2 trunked operation, and the East cell is comprised of three sites with P25 Phase 1 conventional operation.

The Marion County Project also consists of a 17 site Aviat Microwave Backhaul system. The Microwave system is comprised of a 13 site ring and 4 spur sites. The primary and backup nodes are located at METCOMM Dispatch and SCC Backup dispatch, respectively.

The purpose of this report is to document the site design for the **MCPW Tech Shop location**.

Scope

This document provides an overview of site-specific details and requirements for the referenced location.

Publication Record

Author	Ian Graham, Jared Farrar
Issue	1.0
Document Status	Initial Release
Date	18th March, 2026

Document Status

Issue	Date	Signature	Comment
1.1	5/1/2026		

Document Approvals

Approvals	Position	Signature	Date
Bladimyr Guzman	TAM Design Authority		

Associated Documents & References

Reference documentation includes:

- Marion County P25 System Design_v1.1.docx
- Marion County P25 Project - Equipment List by Site.xlsx
- Marion County Power_Heat_Load.xlsx

1. GENERAL RF DESIGN APPROACH

The Marion County project is an 11-site P25 simulcast design that uses the US 700MHz band. To control Time Delay Interference (TDI) and due to unique electric utility challenges in the high peaks to the east of the county necessitating the use of generators, the simulcast design is split into three cells – North, South, and East.

The North Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- Crooked Finger
- **Crosby**
- Eastview
- Parrett Mountain

The South Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- Eagle Crest
- Lower Prospect
- McCully Mountain
- Wipper

The East Cell sites operate in P25 Phase 1 conventional mode (to avoid the energy consumption of a control channel with 100% duty cycle) and are identified as follows:

- APW
- House Mountain
- Halls Ridge

Each site within the North and South Cells will have five trunked P25 Phase 2 channels providing eight dynamic talkpaths (one 12.5kHz FDMA control channel plus four 2-slot 12.5kHz TDMA traffic channels) across each respective cell's coverage area. The East Cell will have five conventional P25 Phase 1 12.5kHz FDMA channels providing five fixed talkpaths across the cell.

Each site across all three cells will have separate transmit (Tx) and receive (Rx) antennas, typically with 20ft vertical separation between centers of radiation. The anticipated low site noise floors in the 700MHz band means Tower Top Amplifiers (TTA) can be used to improve receiver sensitivity and talk-in coverage. Along with the 30MHz Tx-Rx frequency separation, these factors lead to a common RF combining subsystem design which is applicable to all Marion County sites. The combining system requirements were captured based on the proposed frequency plan in coordination with ADCOMM Engineering LLC and Tait subsequently worked with the chosen equipment vendor, dBSpectra, on an optimal design. The main consideration was the TTA where it was decided to use dBSpectra's compact design after it was shown all the required receiver filtering could be accommodated. The generic (starting point) site combining system design therefore features the:

- DSCC75M-5BM 5 Channel Ceramic Tx Combiner
- DSCHPMDC1MDC Channelized Power Monitor
- NPD3633A-TTA Tower Top Amplifier
- NPD3363A-PDU Rx Multicoupler PDU

Antennas were chosen on a site-by-site basis to minimize TDI in the simulcast cells while still providing necessary talk-out coverage. The proposed antennas are the:

- Sinclair SE412-SWBPAL
    - 5dBd Low PIM Enclosed Dipole Array
- Sinclair SE414-SWBPAL
    - 8.5 to 11dBd Low PIM Adjustable Beamwidth Enclosed Dipole Array
- RFI CC807-09
    - 9dBd Collinear Omnidirectional

2. TOWER MAPPING

Information not available at time of detailed design. Information will be populated at a later date.

3. FREQUENCY PLANNING

Not applicable. No Tait Base Stations at this location.

4. INCUMBENTS SEARCH

Not Applicable. No Tait Base Stations at this location.

5. INTERMODULATION ANALYSIS

Not Applicable. No Tait Base Stations at this location.

6. ANTENNA SYSTEM DESIGN

Not Applicable. No Tait Base Stations at this location.

7. TRANSMITTER COMBINER DESIGN

Not Applicable. No Tait Base Stations at this location.

8. RECEIVER SUBSYSTEM DESIGN

Not Applicable. No Tait Base Stations at this location.

9. POWER MONITOR

Not Applicable. No Tait Base Stations at this location.

10. RF SUB-SYSTEM DESIGN

Not Applicable. No Tait Base Stations at this location.

11. MICROWAVE SYSTEM DESIGN

Refer to “Marion County P25 System Design_v1.1.docx” for Microwave System Details.

11.1 Site Specific Design

The MCPW Tech Shop site supports one Aviat microwave link. This link extends from MCPW Tech Shop to MCPW Dispatch as a spur, engineered as 2+0 to ensure reliable, uninterrupted connectivity from MCPW Tech Shop into the core network.

12. RF SUB-SYSTEM DRAWINGS

12.1 RF System Schematic

Not Applicable. No Tait Base Stations at this location.

12.2 Rack Layout

This section contains the rack drawings for this site.

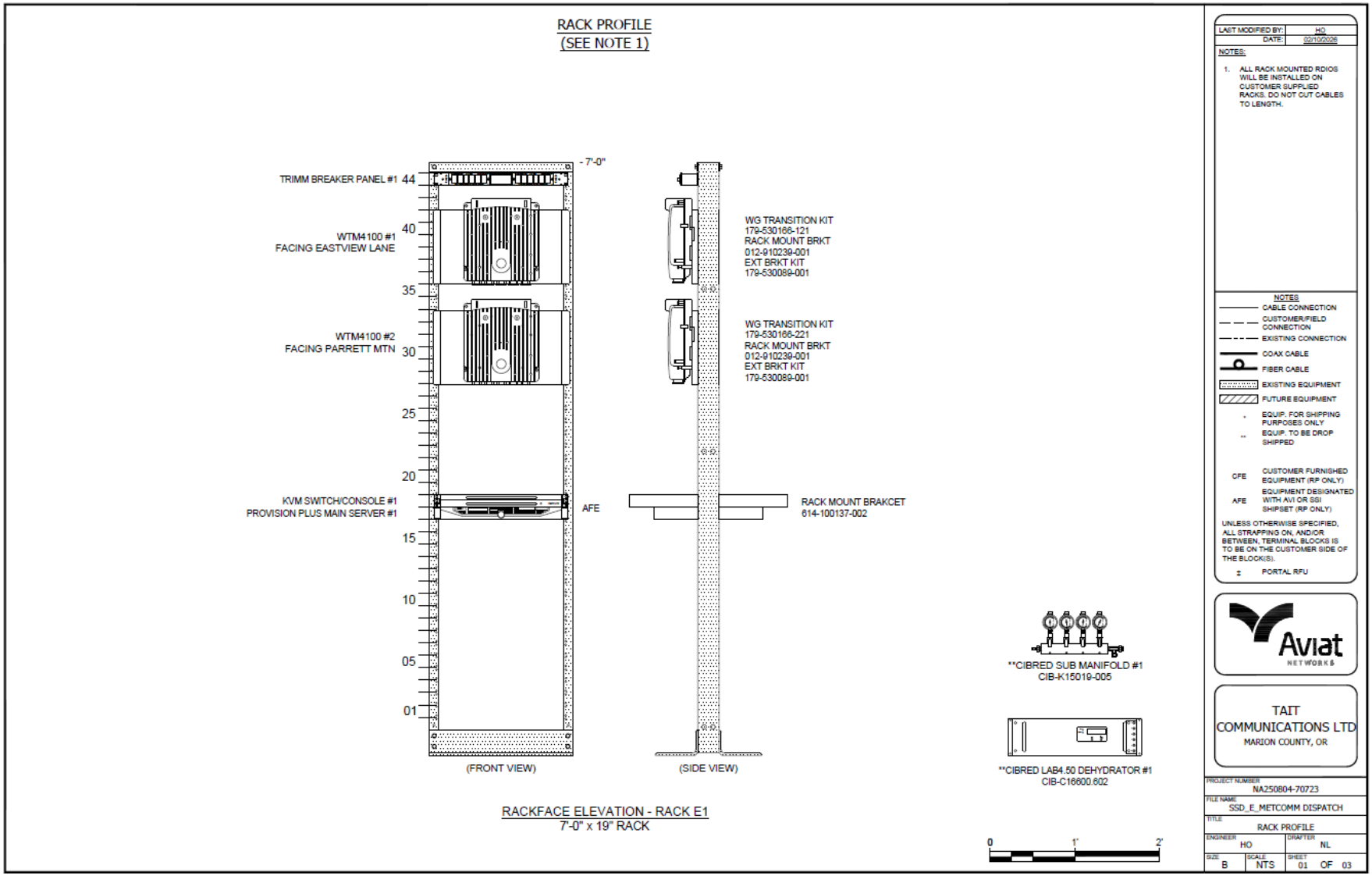
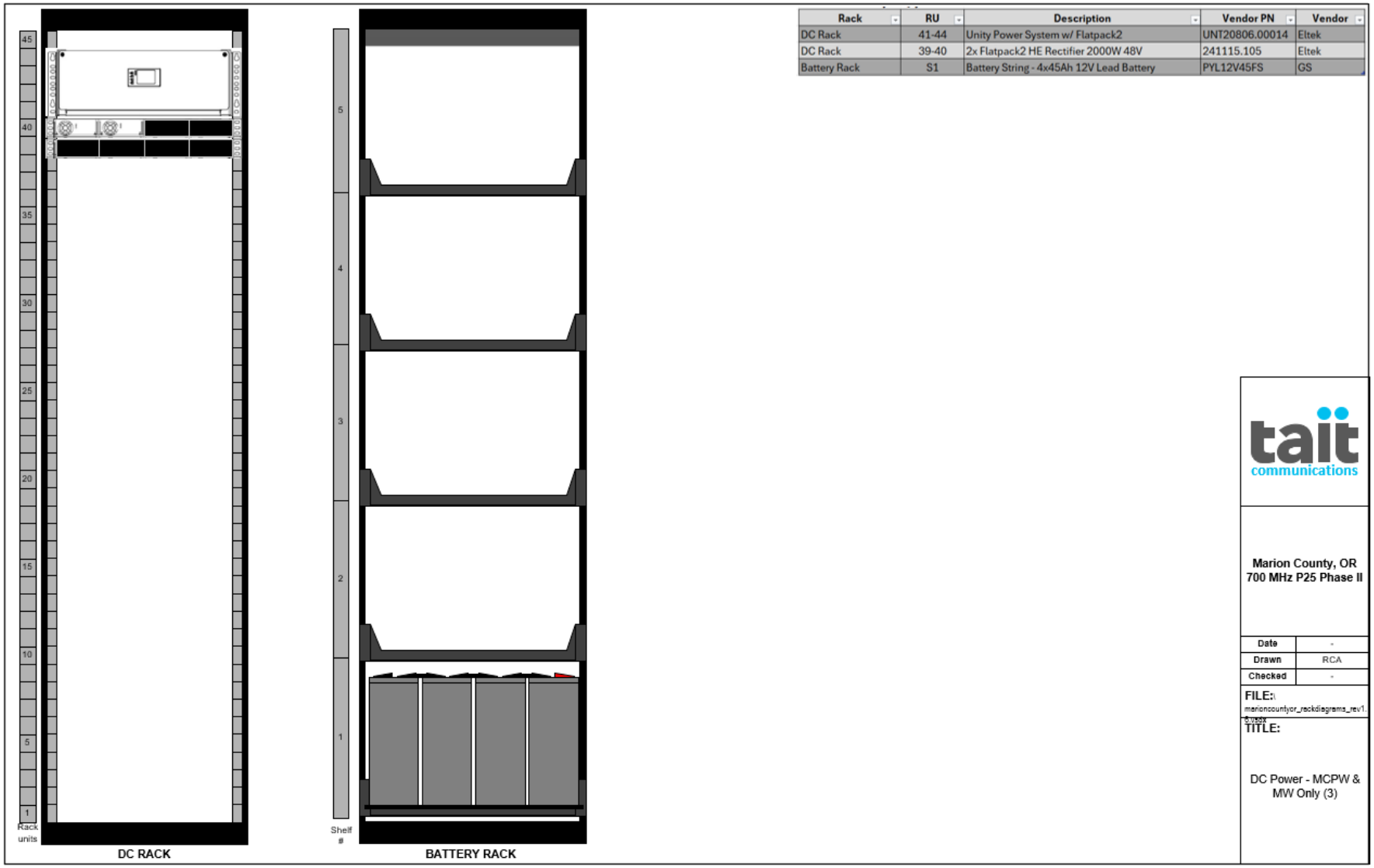


Figure 1 Microwave Rack



Rack	RU	Description	Vendor PN	Vendor
DC Rack	41-44	Unity Power System w/ Flatpack2	UNT20806.00014	Eltek
DC Rack	39-40	2x Flatpack2 HE Rectifier 2000W 48V	241115.105	Eltek
Battery Rack	S1	Battery String - 4x45Ah 12V Lead Battery	PYL12V45FS	GS

Figure 2: DC Power & Battery Racks

13. PARTS AND EQUIPMENT LISTS

Refer to “Marion County P25 Project - Equipment List by Site.xlsx” for site-specific equipment list.

14. RF PERFORMANCE

Not Applicable. No Tait Base Stations at this location.

15. SITE DESIGN INFORMATION

15.1 Site Plan

Information not available at time of detailed design. Information will be populated at a later date.

15.2 Floor and Cable Routing Plan

Information not available at time of detailed design. Information will be populated at a later date.

15.3 Entry and Exit Ports

Information not available at time of detailed design. Information will be populated at a later date.

15.3.1 Power & Heat Load Calculations

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Power & Heat Load details.

15.3.2 DC Distribution Fuse Panel

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Fuse Panel details.

Supplemental 11 - Wipper

PROVISIONAL Design Document

RF Sub-System and Site Designs

Marion County

Region: South Cell

Site: Wipper

Issue 1.1 • 1st May 2026

www.taitradio.com

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PREFACE

Project Details

Project number	
Customer	Marion County
Project description	P25 Phase 2 Simulcast & P25 Phase 1 Conventional Simulcast
Business Development Manager	
Sales Engineer	
Project Engineer	Jared Farrar / Riley Alfaqeeh
Project Manager	Stacey Adams (formerly Matt Jordan)
Lead RF Engineers	Ian Graham

Purpose

The Marion County project is an 11 site P25 simulcast design that uses the US 700MHz band. To control Time Delay Interference (TDI), the simulcast design is split into three cells – North, South, and East. The North cell is comprised of four sites with P25 Phase 2 trunked operation, the South cell is comprised of four sites with P25 Phase 2 trunked operation, and the East cell is comprised of three sites with P25 Phase 1 conventional operation.

The purpose of this report is to document the RF subsystem design for the **Wipper** site which forms part of the South simulcast cell.

Scope

This document specifies the frequencies to be utilized at the site and summarizes the intermodulation analysis with these frequencies and other high-level in band carriers as identified from an FCC license search. The required antenna system and associated RF combining equipment will then be described in full.

Publication Record

Author	Jared Farrar
Issue	1.1
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Date	5th January 2026

Document Status

Issue	Date	Signature	Comment
1.0	5th January 2026	Jared Farrar	Initial Release
1.1	1st May 2026		

Document Approvals

Approvals	Position	Signature	Date
Bladymir Guzman	TAM Design Authority		

Associated Documents & References

Reference documentation includes:

- Marion County P25 System Design_v1.1.docx
- Marion County P25 Project - Equipment List by Site.xlsx
- Marion County Power_Heat_Load.xlsx

1. GENERAL RF DESIGN APPROACH

The Marion County project is an 11-site P25 simulcast design that uses the US 700MHz band. To control Time Delay Interference (TDI), the simulcast design is split into three cells – North, South, and East.

The North Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- Crooked Finger
- Crosby
- Eastview
- Parrett Mountain

The South Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- Eagle Crest
- Lower Prospect
- McCully Mountain
- **Wipper**

The East Cell sites operate in P25 Phase 1 conventional mode and are identified as follows:

- APW
- House Mountain
- Halls Ridge

Each site within the North and South Cells will have five trunked P25 Phase 2 channels providing eight dynamic talkpaths (one 12.5kHz FDMA control channel plus four 2-slot 12.5kHz TDMA traffic channels) across each respective cell's coverage area. The East Cell will have five conventional P25 Phase 1 12.5kHz FDMA channels providing five fixed talkpaths across the cell.

Each site across all three cells will have separate transmit (Tx) and receive (Rx) antennas, typically with 20ft vertical separation between centers of radiation. The anticipated low site noise floors in the 700MHz band means Tower Top Amplifiers (TTA) can be used to improve receiver sensitivity and talk-in coverage. Along with the 30MHz Tx-Rx frequency separation, these factors lead to a common RF combining subsystem design which is applicable to all Marion County sites. The combining system requirements were captured based on the proposed frequency plan in coordination with ADCOMM Engineering LLC and Tait subsequently worked with the chosen equipment vendor, dBSpectra, on an optimal design. The main consideration was the TTA where it was decided to use dBSpectra's compact design after it was shown all the required receiver filtering could be accommodated. The generic (starting point) site combining system design therefore features the:

- DSCC75M-5BM 5 Channel Ceramic Tx Combiner
- DSCHPMDC1MDC Channelized Power Monitor
- NPD3633A-TTA Tower Top Amplifier
- NPD3363A-PDU Rx Multicoupler PDU

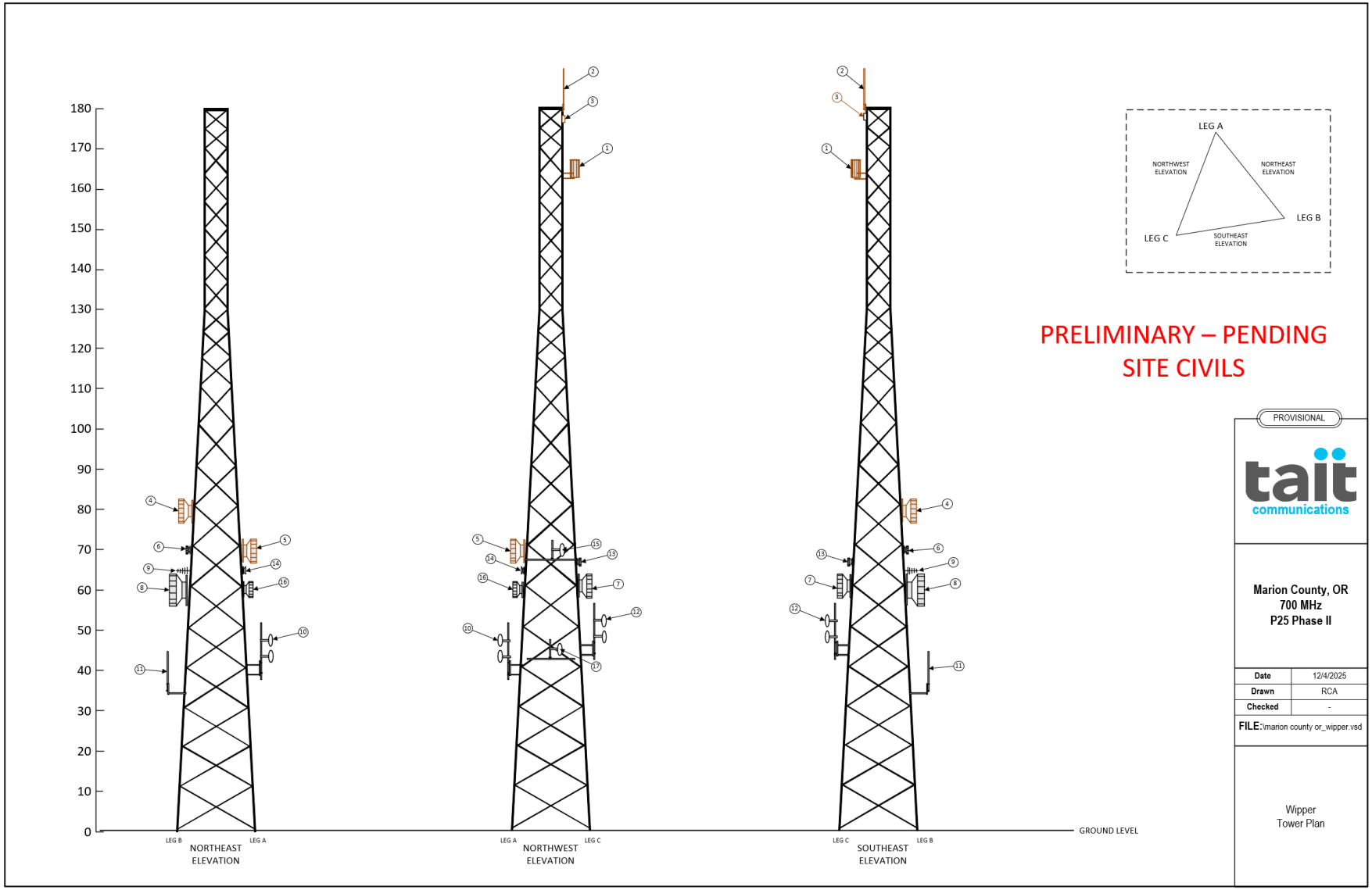
Antennas were chosen on a site-by-site basis to minimize TDI in the simulcast cells while still providing necessary talk-out coverage. The proposed antennas are the:

- Sinclair SE412-SWBPAL
    - 5dBd Low PIM Enclosed Dipole Array
- Sinclair SE414-SWBPAL
    - 8.5 to 11dBd Low PIM Adjustable Beamwidth Enclosed Dipole Array
- RFI CC807-09
    - 9dBd Collinear Omnidirectional

For the Wipper site, the basic design approach will be:

- Install a new Sinclair SE414-SWBPALDF(D00) transmit antenna on Leg C (SW) of the 180ft Tower at 164ft AGL, beamwidth 60°, azimuth 180º
    - The 5 transmit channels will be connected to the Tx antenna using the dBSpectra DSCC75M-5BM Ceramic Combiner.
- Install a new RFI CC807-09 receive antenna on Leg C (SW) of the 180ft Tower at 179ft AGL (azimuth n/a).
    - The 5 receive channels will be fed from the Rx antenna via the dBSpectra NPD3633A-TTA Tower Top Amplifier and the NPD3633A-PDU Rx multicoupler/PDU

2. TOWER MAPPING



Wipper

#	Description	Part Number	Length (ft)	Leg/Face	Status	Base Height (ft)	Centerline Height(ft)	Tip Height (ft)	Antenna Azimuth	Mount Azimuth	Mount	Transmission Line Size/Type
2	P25 RX Antenna	CC807-09	10.3	C	New	179	184	189	-		Standard	1/2" to TTA
3	TTA	NPD3633A-TTA	1.0	C	New	176	177	177	-		Standard	7/8"
1	P25 TX Antenna	SE414-SWBPALDF(D00)	4.4	C	New	162	164	166	180	180	Site-Pro PSA-6 (6' standoff)	7/8"
5	Microwave - Eagle Crest	VHLP6-6W	6.0	A	New	132	135	138	332.58	332.58	Standard w/ tieback	EW63
4	Microwave - McCully	VHLP6-6W	6.0	B	New	77	80	83	94.14	94.14	Standard w/ tieback	EW63
14	Microwave-5		1	A	Existing	70	70	71			Standard	
6	Microwave-1		2	B	Existing	69	70	71			Standard	
15	Dipole-3	1 element	5	Face A-C	Existing	68	70	73			Standoff	
9	Yagi-1		1	B	Existing	67	67	68			Standard	
13	Microwave-4		2	C	Existing	66	67	68			Standard	
7	Microwave-2		6	C	Existing	58	61	64			Standard	
16	Microwave-6		4	A	Existing	58	60	62			Standard	
8	Microwave-3		8	B	Existing	56	60	64			Standard	
12	Dipole-2	2 element	5	C	Existing	48	50	53			Standoff	
10	Dipole-1	2 element	5	A	Existing	43	45	48			Standoff	
17	Dipole-4	1 element	5	Face A-C	Existing	43	45	48			Standoff	
11	Omni-1		10	B	Existing	35	40	45			Standoff	

= estimated value based on survey documentation and photos

Figure 1: Wipper 180ft Tower Mapping and Appurtenances

3. FREQUENCY PLANNING

5 Channels will be deployed at this site.

The South Simulcast cell uses the following frequencies.

Site Name	FCC Channel Number	Tx Frequency (MHz)	Rx Frequency (MHz)
Wipper	411-412	771.56875	801.56875
	461-462	771.88125	801.88125
	573-574	772.58125	802.58125
	745-746	773.65625	803.65625
	837-838	774.23125	804.23125

Table 1: South Cell Frequency Assignments

4. INCUMBENTS SEARCH

An external high-level carrier (HLC) is defined as a signal that appears at a level of >-40dBm at the Receive antenna. These are the signals that have the potential to contribute towards intermodulation that would result in a loss of receiver sensitivity on one or more channels.

Signal and Noise Monitoring of RF activity at the site was not deemed necessary for this project given the wide Tx-Rx frequency separation in the 700MHz band and the anticipated low site noise floors.

To get some idea of potential RF activity at the site, an FCC License Search was carried out to identify any other transmitters operating between 700 and 900MHz located within a 0.6-mile radius of the tower (a 100W transmitter, 0.6 miles away would be received at -40dBm assuming free space path loss). These may include cellular transmitters (as their wide bandwidth could cause IM energy to spread into the LMR receive band) and are summarized in Table 2 below.

Note: It is understood that antennas for ODOT's 700MHz trunked radio system will be collocated on this tower with TX and RX antenna heights of 150ft and 180ft, respectively. The site TX frequencies for the ODOT system are included and highlighted in yellow.

Owner	Call Sign	Frequency (MHz)	Tx ERPd (dBm)	Distance from Marion County Tower (miles)
Cellco Partnership	KNKA446	880.02	46.9	0
Cellco Partnership	KNKA446	891.51	46.9	0
ODOT	TBD	799.43125	TBD	0
ODOT	TBD	799.96875	TBD	0
ODOT	TBD	800.41875	TBD	0
ODOT	TBD	803.29375	TBD	0
ODOT	TBD	803.80625	TBD	0
ODOT	TBD	804.08125	TBD	0
ODOT	TBD	804.53125	TBD	0

Table 2: High Level Carriers

5. INTERMODULATION ANALYSIS

An intermodulation (IM) analysis was performed for the potentially significant sources, including both the Marion County channels to be deployed and any HLCs found during the FCC License Search. For antenna configurations using separate transmit and receive antennas Tait best practice is to search for IM products up to 7th order within a defined search window accounting for the fact the bandwidth of IM products spread according to the order and bandwidth of the signals that cause it.

The frequencies included in the IM analysis are listed in Table 3 below.

Transmit Frequencies (MHz)	Receive Frequencies (MHz)
771.56875	801.56875
771.88125	801.88125
772.58125	802.58125
773.65625	803.65625
774.23125	804.23125
880.02	
891.51	
799.43125	
799.96875	
800.41875	
803.29375	
803.80625	
804.08125	
804.53125	

Table 3: Frequencies Included in IM Analysis

Table 4 below shows how many IM products are generated on each of the receive frequencies. A direct hit is an IM product that falls exactly at the receive frequency. An indirect hit is one that does not fall exactly at a receive frequency but does fall within the search window. Note that for the purposes of this table, the number of direct hits depends on the bandwidth of the LTE signals at 880.02MHz and 891.51MHz. Both are downlink signals within Band 5 (US 850MHz Cellular) which may contain channel bandwidths of 1.4MHz, 3MHz, 5MHz, or 10MHz.

IM Order	Number of Intermodulation Products at each Receive Frequency									
	801.56875		801.88125		802.58125		803.65625		804.23125	
	Direct	Indirect (1.4/3/5/10)	Direct	Indirect (1.4/3/5/10)	Direct	Indirect (1.4/3/5/10)	Direct	Indirect (1.4/3/5/10)	Direct	Indirect (1.4/3/5/10)
3rd	0	0/0/0/0	0	0/0/0/0	0	0/0/0/0	0	0/0/0/0	0	0/0/0/0
5th	0	LARGE	0	LARGE	0	LARGE	0	LARGE	0	LARGE
7th	0	LARGE	1	LARGE	0	LARGE	0	LARGE	0	LARGE

Table 4: Intermodulation Results Summary

6. ANTENNA SYSTEM DESIGN

The Antenna System detailed here and the RF Combining System described later in sections 7, 8, and 10 have been specifically designed to mitigate any interference caused by the listed high level carriers, thereby maximizing the coverage achieved by the Marion County system.

6.1 Antenna Type

The following antennas will be used at Wipper.

Antenna	Manufacturer	Antenna Model Number	Description	Antenna Length (ft)	Antenna Gain (dBd)
Rx	RFI	CC807-09	Collinear	10	9
Tx	Sinclair	SE414-SWBPALDF(D00)	Collinear	4.4	11.5

Table 5: Antenna Details

800MHz Corporate Collinear Antennas

748-870MHz

CC807 Series

These industry leading, full featured corporate collinear arrays allow site operators to combine, with complete integrity, a large number of communications services into a single, low profile antenna solution.

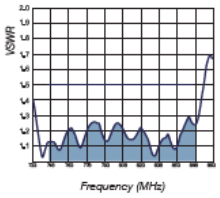
The corporate feed design employed by RFI maintains superior pattern control, allowing gain to be maximised with zero tilt variation over a very broad bandwidth, comparable to that only previously available in exposed dipole array configurations. This is achieved in the preferred form factor of a fully enclosed fibreglass radome, providing a reduction in wind loading, ice loading and tower loading in comparison.

The CC807 series have been designed with an exceptional power rating of 500W across the band as well as a Peak Instantaneous Power (PIP) rating of 25kW to cater for the peak voltage levels present in large multi-carrier combining environments. RFI's refined design processes and proven construction methods achieve a PIM rating of –150dBc, further ensuring performance is maintained for the service life of the antenna.

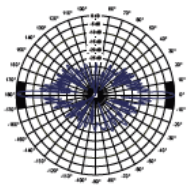
Features:

- 500W Continuous Power rating
- -150dBc Passive Intermodulation (PIM) rating, 100% PIM tested
- 25 kW Peak Instantaneous Power (PIP) rating
- DC grounding on all elements for the ultimate in lightning protection and dissipation of static noise.
- Light weight dipole construction using RFI's patented flexi-PCB architecture, maintains a low centre of gravity reducing tip deflection and sway
- Field invertible (excluding tilt models)
- Preset downtilt variations of 2 and 4 degrees available, see note (1)

Typical VSWR Response (CC807-12)



CC807-12 - E Plane



Electrical Specifications

Model Number	CC807-09-P	CC807-12-P
Nominal Gain *dBd (dBi)*	9.0 (11.1)	11.5 (13.6)
Frequency *MHz*	746-870	
Tuned Bandwidth *MHz*	Full	
VSWR *(Return Loss)*	1.5:1	
Nominal Impedance Ω	50	
Downtilt°	0 Std 2, 4 (1)	
Vertical Beamwidth°	8	4
Horizontal Beamwidth°	Omni +/- 0.5dB	
Input Power W	500	
Passive IM 3rd order (2x20W) *dBc*	-150	
Peak Instantaneous Power *kW*	25	

Mechanical

Model Number		CC807-09-P	CC807-12-P
Construction		Sky blue fibreglass radome	
Radome Diameter mm (inches)		76 (3.0)	
Length mm (inches)		3135 (123.4)	6235 (245.5)
Weight *kg (lbs)*		14 (30.9)	25.5 (56.2)
Termination		Integrated 4.3-10 Female	
Mountaing Area mm (inches)		750 x 90 (30 x 3.5) diameter Ecofilm™ plated aluminium	
Suggested Clamps		3 x UC-114	
Shipping Dimensions *mm (inches)*	H	115 (4.5)	
	W	115 (4.5)	
	L	3335 (131.3)	6435 (253.3)
Shipping Weight *kg (lbs)*		20.0 (44.1)	36.5 (80.5)
Projected area *cm² (ft²)*	No Ice	2597 (2.8)	5559 (6.0)
	With Ice	3192 (3.4)	7037 (7.6)
Lateral Thrust @160km/h *N* (100 mph lbs)		308 (69)	659 (148)
Wind Gust Rating *km/h (mph)*	No Ice	>240 (150)	
Torque @ 160km/h *Nm* (100mph ft-lbs)		413 (305)	1823 (1345)

(1) To order pre-set downtilt versions available, simply add a -T2 or -T4 towards the end of the part number to denote downtilt model required. For eg. CC807-12-T2-P to order CC807-12-P with 2deg of downtilt. Please note: Models with downtilt are NOT field invertible. . Eg. CC807-12-T2-P

P-43021-7

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SINCLAIR

Superior then, Superior now.

A Norsat Company Norsat International Inc.

Antennas

700-1000 MHz Antennas

SE414-WBAL - PIM Certified Series

SE414-SWBPAL(YY)(DXX) Enclosed dipole, 8-11.5 dBd, adj. beamwidth, Low PIM, 746-960MHz

- Wide band design covers whole 746-960 MHz band, PIP rated
- Horizontal beamwidth can be adjusted (60°/90°/105°/130°/160°)
- Gain depends on horizontal beamwidth setting (11.5/10/9/8.5/8 dBd)
- PIP rated and low PIM

One wideband antenna for your 700, 800, 900 MHz systems. Sinclair's SE414-WBL series of enclosed dipole arrays offer excellent intermodulation performance covering 746-960 MHz in a single antenna. These highly versatile antennas are particularly well suited to communication systems where a specific coverage pattern is required. These include cellular systems, trunked radio, paging, and data transmission, where predictable and highly reliable performance is a must.

The SE414-WBAL series come with field adjustable reflectors that provide horizontal beamwidths between 60 and 160 degrees. The creative design and construction permits excellent pattern control and greater efficiency.

When ordering, please refer to the chart below for the model number. Different configurations are subject to various list prices. Please contact your Sinclair Sales Representative or Customer Service Representative for more information.

Model Number	Connector	Downtilt	PIM(dBc)	PIP(kW, max)
SE414-SWBPALDF(D00)	7/16 DIN(F)	0°	<-150	25
SE414-SWBPALDF(D01)	7/16 DIN(F)	1°	<-150	25
SE414-SWBPALDF(D02)	7/16 DIN(F)	2°	<-150	25
SE414-SWBPALDF(D03)	7/16 DIN(F)	3°	<-150	25
SE414-SWBPALDF(D04)	7/16 DIN(F)	4°	<-150	25
SE414-SWBPALDF(D05)	7/16 DIN(F)	5°	<-150	25
SE414-SWBPALDF(D06)	7/16 DIN(F)	6°	<-150	25
SE414-SWBPALNF(D00)	N(F)	0°	<-139	N/A
SE414-SWBPALNF(D01)	N(F)	1°	<-139	N/A
SE414-SWBPALNF(D02)	N(F)	2°	<-139	N/A
SE414-SWBPALNF(D03)	N(F)	3°	<-139	N/A
SE414-SWBPALNF(D04)	N(F)	4°	<-139	N/A
SE414-SWBPALNF(D05)	N(F)	5°	<-139	N/A
SE414-SWBPALNF(D06)	N(F)	6°	<-139	N/A

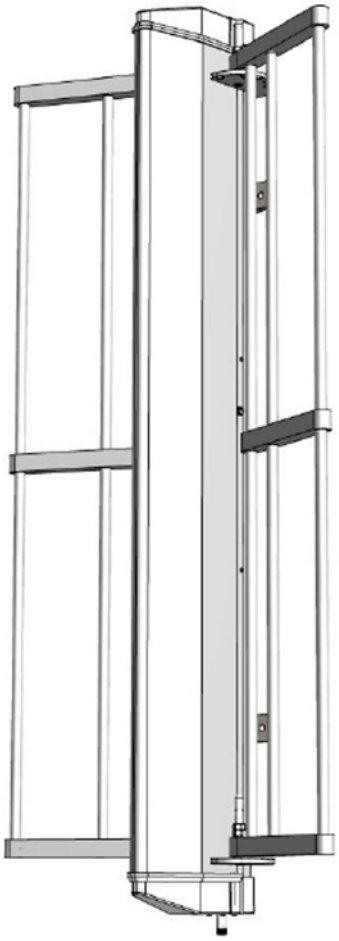


Figure 2: Antenna Datasheets

6.2 Antenna Mounting Locations

Table 6 below specifies the Marion County antenna mounting location details.

Antenna	Mounting Height (feet AGL)	Antenna Orientation (degrees)	Tower Leg	Standoff Length (feet)	Standoff Orientation (degrees)	Standoff Model
Receive	179	n/a	C (SW)	n/a	90	Site-Pro PSA-6
Transmit	162	180	C (SW)	6	90	Site-Pro PSA-6

Table 6: Antenna Mounting Locations

The antenna system design for this site is given in Figure 3.

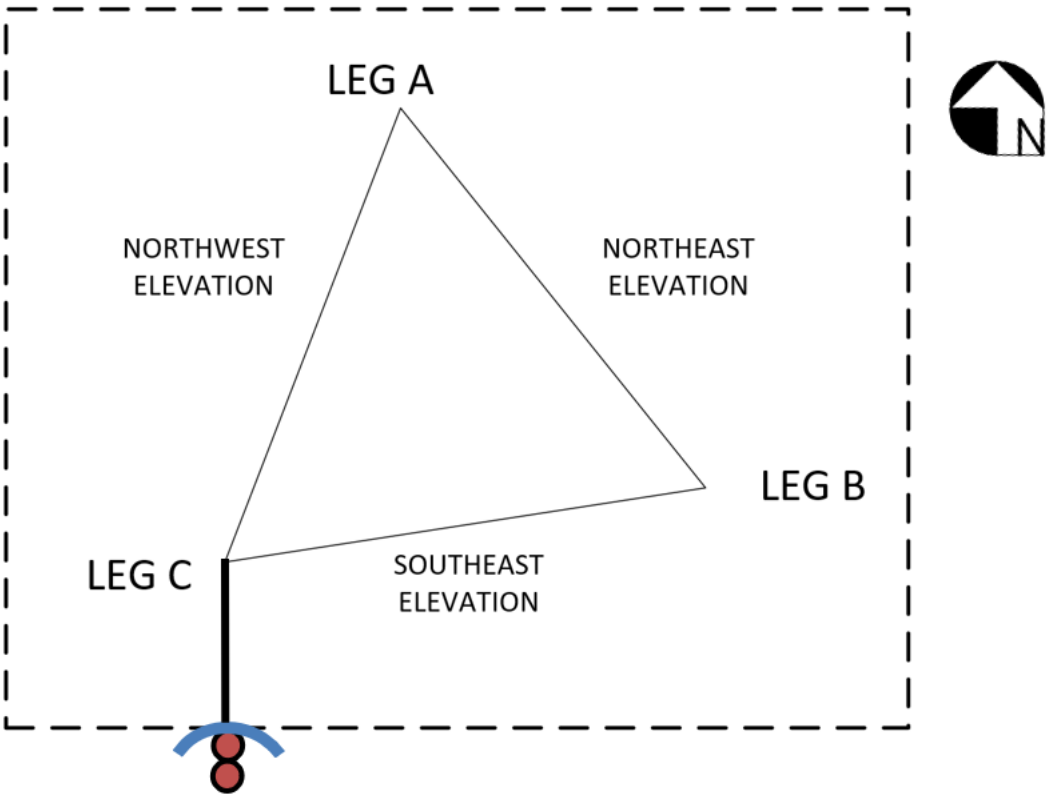


Figure 3: Antenna System Design

6.3 Antenna Isolation

The Transmit and Receive antennas are vertically separated by 20ft and horizontally separated by 6ft which gives an isolation between them of **73dB**. A figure of **60dB** will be assumed in subsequent calculations though as that is often the limit of what can be practically achieved (e.g., mounting imperfections, mechanical drift due to wind/ice loads or aging hardware).

7. TRANSMITTER COMBINER DESIGN

7.1 RF Connectors

The antenna output of the combiner is fitted with **4.3-10 female** connector to minimize Passive Intermodulation (PIM).

The transmitter input ports of the combiner are fitted with **N Type female** connectors.

7.2 Cavity Filters

Filtering in the Tx Combiner is predominantly bandpass.

A combination of band-pass and band-reject filtering is sometimes to provide extra rejection at specific site Rx frequencies, but band-reject filters are never used alone.

The cavity filters provide the minimum attenuation at the closest receive frequency equal to or greater to the value specified in section 7.9 of this document.

7.3 Isolator

A dual Isolator is included between the output of each transmitter and the Tx Combiner input port.

The isolator load closest to the Tx Combiner input port is rated at a minimum of **100 watts**.

7.4 Maximum RF Power

The Tx combiner supports a maximum of **100 watts** of RF input power per channel.

7.5 Minimum Tx to Tx Frequency Separation

The minimum frequency separation allowed between transmitters sharing the same combiner is **250kHz**.

7.6 Maximum number of Transmitters per combiner

Standard Tait practice is a maximum of 4 transmitters per Tx combiner. But in this case, the Tx-Tx spacing and the fact that self-TxIM is unlikely mean the penalty in combining all 5 transmitters together is negligible.

7.7 Maximum Tx Combiner Loss per Channel

The insertion loss shall be minimized to the extent possible while complying with all other specifications.

The Tx Combiner insertion loss per Tx channel (not including associated Tx antenna feeder cable losses) will be around **3.2dB** for the Tx-Tx frequency separation at this site.

7.8 Tx Intermodulation Suppression

Transmitters that cause intermodulation on any site receive frequency must not be connected to the same combiner.

But there is still a responsibility to keep the site as ‘clean’ as possible. So, to control the levels of intermodulation products generated in the combiner, the minimum isolation between the outputs of combined

transmitters shall be at least **60dB**. This figure includes the reverse isolation of the isolator and any additional attenuation provided by the cavity filters in neighboring branches.

7.9 Tx Sideband Noise Suppression

In addition to the Tx – Rx antenna isolation, the Tx Combiner provides the suppression required to reduce transmitter sideband noise at the Rx antenna to the level where it causes no more than 1dB of receiver de-sensitization. The transmitter sideband noise suppression required at this site is given in Table 7 below.

Transmit Frequency (MHz)	Offset to Nearest Receive Frequency (MHz)	Sideband Noise Suppression Required at Offset (dB)
771.56875	30.0000	14
771.88125	29.6875	15
772.58125	28.9875	15
773.65625	27.9125	15
774.23125	27.3375	15

Table 7: Transmitter Combiner Sideband Noise Rejection Requirements

8. RECEIVER SUBSYSTEM DESIGN

8.1 RF Connectors

8.1.1 Tower Top Amplifier

The Rx Filter input is fitted with a **4.3-10 female** connector.

The Rx Filter output is fitted with a **4.3-10 female** connector.

8.1.2 Receiver Multicoupler / PDU

The Rx Multicoupler input is fitted with a **4.3-10 female** connector.

The receiver output ports of the Rx Multicoupler are fitted with a **BNC Female** connector.

8.2 Receiver Subsystem Topology

The Receiver Subsystem will utilize a Tower Top Amplifier (TTA, which includes the receiver filtering) to optimize talk-in coverage followed by a multicoupler / PDU system that further amplifies and splits the received signal between the connected receivers.

8.3 Receiver Filtering

The Receiver Filters will pass the 801 to 805MHz part of the 700MHz band used for the Marion County system while fully rejecting associated transmit signals in both the 700MHz and 800MHz Tx bands. This is important because combinations of transmitters in both bands can result in 7th order IM falling within the 700MHz receive band.

8.3.1 Blocking Rejection

Between them, the Receiver Filters must provide enough attenuation so that no more than 1dB of de-sensitization of any of the connected receivers occurs due to receiver blocking. The attenuation required at this site to prevent receiver blocking due to the Marion County transmitters and external interferers found during FCC database search is given in Table 8 below.

Note: Blocking Rejection Requirements for the ODOT TRS frequencies transmitted at this site will be added once their ERP is determined.

	Tx Name	Tx Frequency (MHz)	Minimum Rejection in Rx Filter at Tx Frequency (dB)				
			Rx1 (MHz)	Rx2 (MHz)	Rx3 (MHz)	Rx4 (MHz)	Rx5 (MHz)
			801.56875	801.88125	802.58125	803.65625	804.23125
Transmitters	Tx1	771.56875	20	20	20	20	20
	Tx2	771.88125	20	20	20	20	20
	Tx3	772.58125	20	20	20	20	20
	Tx4	773.65625	20	20	20	20	20
	Tx5	774.23125	20	20	20	20	20

Table 8: Receiver Filter Blocking Rejection Requirements

8.3.2 Receiver Intermodulation Rejection

The Rx Filter must provide enough attenuation so that no more than 1dB of de-sensitization of any of the connected receivers occurs due to intermodulation.

Note: Receiver Intermodulation Rejection requirements will be added once ERP for the ODOT TRS frequencies is determined.

While there is an abundance of Indirect 5th Order and 7th Order IM hits, these are inconsequential and do not warrant further investigation as their modality relies on the bandwidth growth of the IM products which is dominated by the LTE carrier on the monopole approximately 100ft away from the Wipper tower transmitting in the southern direction with an ERP no greater than 46.9dBm (48.5W) per the FCC license associated with the carrier's callsign and site location. For the indirect hits, the rejection provided by the TTA's filtering (>110dB) will effectively silence the LTE carriers and bury the power levels of any IM products generated via this mechanism below the site's noise floor.

However, the direct IM hit on Marion County's 801.88125MHz receive channel warrants further investigation as the mechanism of the product involves fundamentals of three ODOT frequencies and second harmonics of the LTE signals. Once the ERP for the ODOT TRS at this site is determined, receiver rejection requirements can be determined.

8.4 Low Noise Amplifiers

Low Noise Amplifiers (LNAs) with appropriate gain and noise figure will be included in the receiver sub system to ensure that the cascade noise figure of the line up from the base of the receive antenna up to and including the base station receiver is equal to or less than 5dB. Here we are able to improve this figure down to a cascaded noise figure of **3.97dB**.

The output third order intercept of the LNAs will be >= +40dBm to maintain the linearity of the system.

8.5 Variable Attenuator

A Variable Attenuator will be fitted in the Rx Multicoupler/PDU for field optimization of the receiver subsystem gain, noise figure and IP3. The attenuator has an adjustment range of 0dB to 15dB, in 0.25dB steps.

Setting of the attenuator value must be done electronically so as not to require disassembly of the multicoupler equipment. The variable attenuator shall be set to **6dB** for this site.

8.6 Receiver Ports

To allow for future expansion, the Rx Multicoupler will have 8 ports

All unused ports will be terminated in a 50-ohm load.

9. POWER MONITOR

The dBSpectra DSCHPMDC1MDC Power Monitor will be used within the Marion County RF systems. This is placed at the output of the Tx Combiner and allows remote monitoring of channelized transmitted power and antenna VSWR. The major benefit is early warning of antenna system degradation so that repairs can be made before failure occurs.

DSCHPM-Series (VHF, 220, UHF, 700/800/900 MHz)
SMART Channelized Transmit Power Monitor with Front Panel Display Option

dbSpectra
Always a Better Value

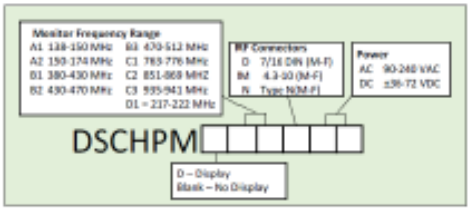
DSCHPM Power Monitor with front panel display option.

Directional coupler for installation on combiner output.

Features and Benefits

- *Per-channel and composite* measurement of forward and reflected RF power with the SMART Channelized RF Power Monitor.
- Calculates and displays combiner insertion loss for each channel.
- All measurements are displayed with 95% accuracy.
- IP network connection and designed-in web server for web browser interface.
- Full remote configuration, monitoring and data logging.
- Optional front panel display with Navigation Keys for monitoring only.
- User-defined alarm thresholds are indicated by alarm relay closure or by SNMP protocol on the network.
- Optional temperature sensors for equipment and ambient temperature measurements and alarms.
- Compact single rack unit mounting with remote RF sensor for flexibility in mounting locations.

Ordering Information

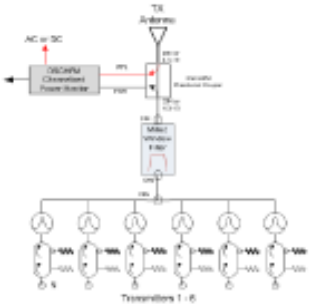


Notes:
1. Factory calibrated using a P25 LSM signal source, may be calibrated in the field for improved accuracy.
2. Contact dbSpectra at tech@dbspectra.com for additional information on optional temperature sensor feature.

Specifications

Electrical Specifications	
Frequency Range, MHz	See Ordering Information
Minimum TX to TX Separation	50 kHz
Maximum Power Input	600 Watts (directional coupler)
System Type	Digital or analog
Insertion Loss	< 0.1 dB
PIM Rating	-150 dBc
Channelized Power Measurements	Forward /reflected power of individual channels: Watts, dBm, VSWR, Return Loss, Combiner Insertion Loss
Power Requirements	AC Model 90-240 VAC 15W, or DC model ±36-72 VDC 15W
IP Interface	IPV4, with TLS security layer, SNMP v2c/v3 alarm protocol
Alarms	Form C contacts or SNMP v2c/v3
User Interface	Web browser or remote SNMP system manager. Front Panel Display (optional) for Monitoring only.
Temperature Range	-30 to +60 °C
Mechanical Specifications	
Mounting Dimensions	1 RU, 1.75 X 19 in. (44 X 483 mm) 7.5 in. (191 mm) deep
Construction / Finish	Aluminum / protective finishes
Directional Coupler Connectors Input Output Coupled Ports	 7/16 DIN, 4.3-10 or N(male) 7/16 DIN, 4.3-10 or N(female) MCX type push-on with two 4 ft RD316 cables supplied.
Power Connector	AC model: IEC 320-C13 inlet & cord DC model: 2 port terminal block
Ethernet Connector	RJ-45
Alarm Closures Connector	3 port pluggable terminal block
Temp. Sensor Connector	24-pin header male pins
Net Weight	4.6 lbs. (2.1 kg)
Shipping weight	6.1 lbs. (2.8 kg)

Typical Application



Specifications are subject to change • www.dbspectra.com • 1590 E Hwy 121, Building A, Suite 100, Lewisville, TX 75056 • P (469)322-0080 •096000-797.A • 01/2024

Figure 4: DSCHPMDC1MDC Channelised Power Monitor

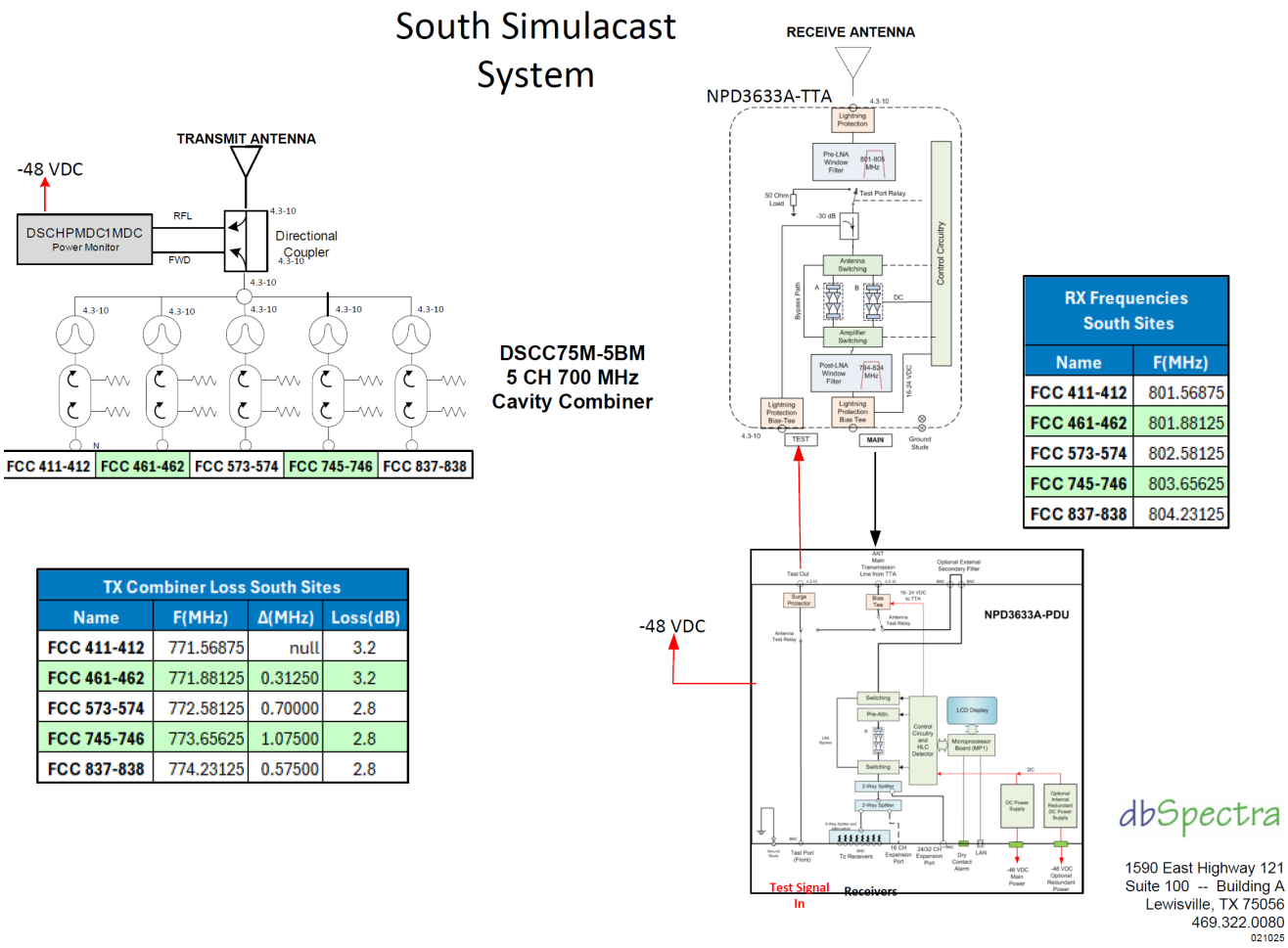
10. RF SUB-SYSTEM DESIGN

Tait have worked with dBSpectra to develop a generic combining system for the Marion County project that meets the performance goals derived in sections 7 and 8 of this report and thereby maximizes the talk in and talk out coverage of the system.

The transmit side of the RF sub-system consists of a 5-channel cavity filter based ceramic combiner to minimize losses and hence maximize the transmitted power and talk out coverage from the site. The cavity filters meet or exceed the Tx sideband noise filtering requirements given in section 7.9.

The receive side features a compact Tower Top Amplifier (TTA) followed by a Receiver Multicoupler/PDU that allows the receiver sensitivity to be optimized and distributes the signal to the five connected receivers. All the receive filtering is accommodated within the TTA. There are two filters, one before the LNA to preselect the 801 to 805MHz part of the band used by the Marion County system (see Figure 6), and a second after the LNA that fully rejects the Marion County system transmit signals, and the other 700 and 800MHz HLCs identified from the FCC database search (see Figure 7). Together, the filters meet or exceed the receiver blocking and receiver intermodulation filtering requirements given in sections 8.3.1 and 8.3.2. There are two LNAs, one in the TTA and one in the Rx Multicoupler/PDU with gains, noise figures and intercept points optimized so the cascade noise figure and linearity of the receiver line up meets the requirements of section 8.4.

A block diagram of the South Cell combining system design is shown in Figure 5 below:



RX Frequencies South Sites	
Name	F(MHz)
FCC 411-412	801.56875
FCC 461-462	801.88125
FCC 573-574	802.58125
FCC 745-746	803.65625
FCC 837-838	804.23125

TX Combiner Loss South Sites			
Name	F(MHz)	Δ(MHz)	Loss(dB)
FCC 411-412	771.56875	null	3.2
FCC 461-462	771.88125	0.31250	3.2
FCC 573-574	772.58125	0.70000	2.8
FCC 745-746	773.65625	1.07500	2.8
FCC 837-838	774.23125	0.57500	2.8

Figure 5: SPD3454C-4TR Dual Band RF Combining System

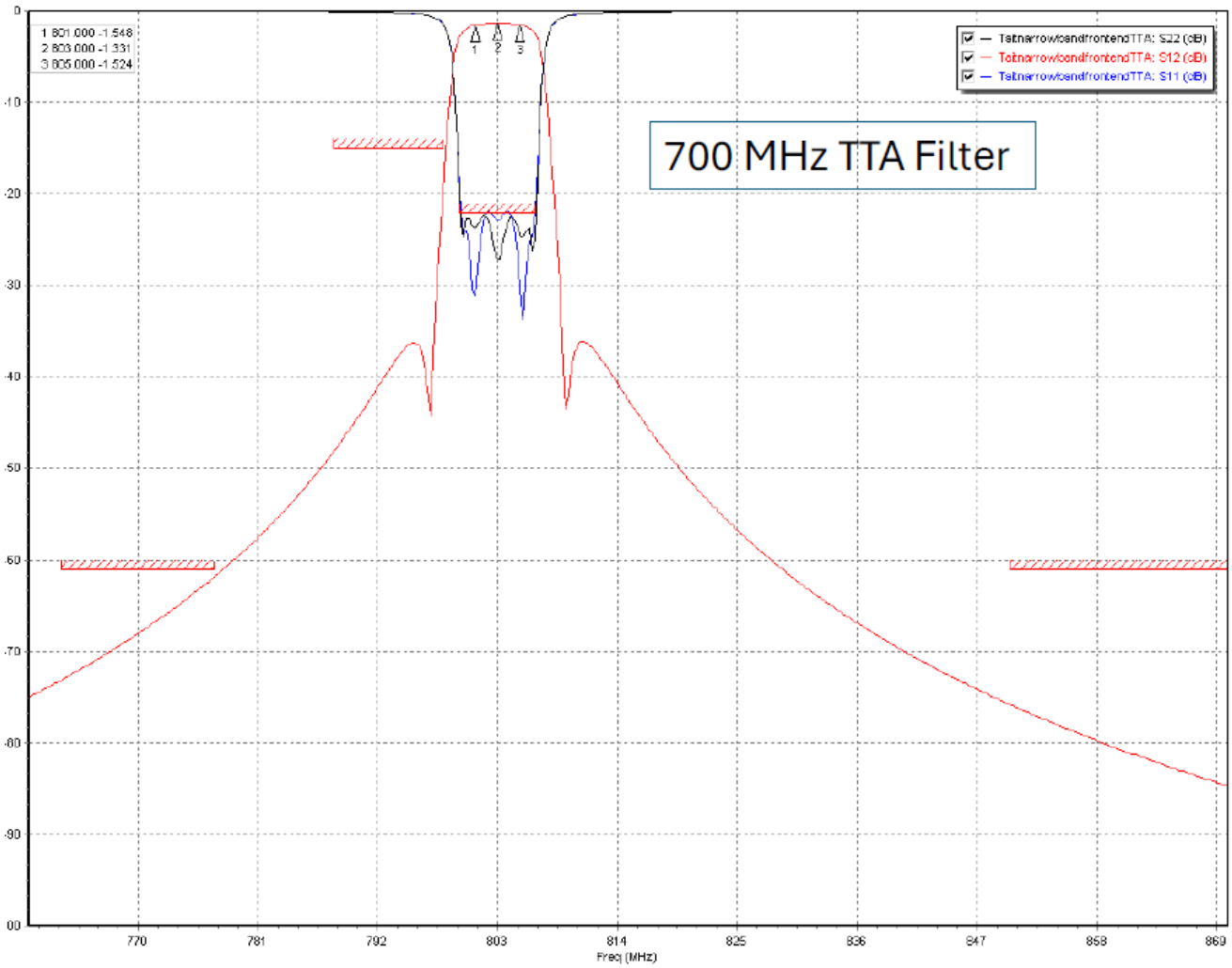


Figure 6: TTA PreSelector Filter Plot

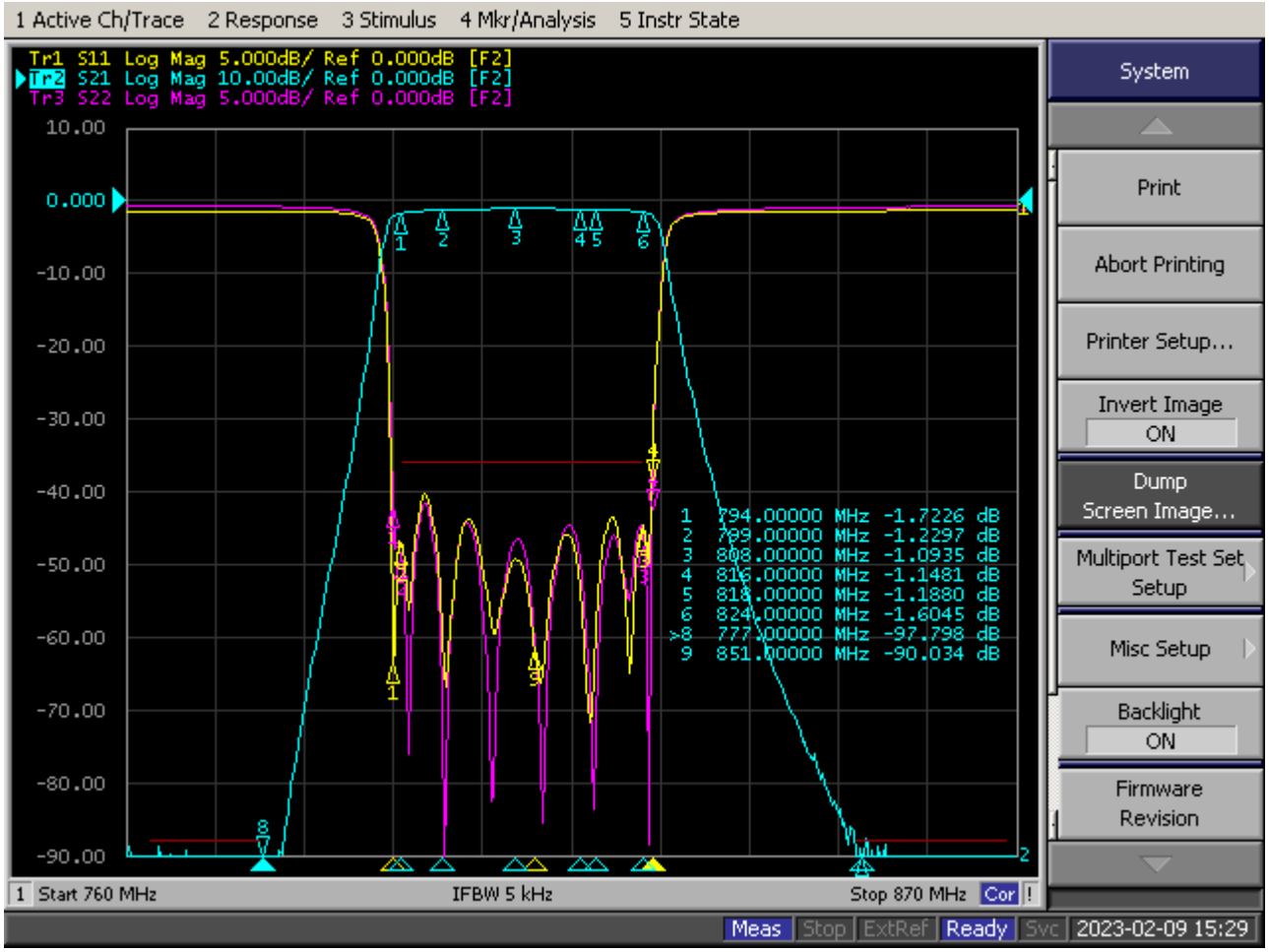


Figure 7: TTA Post LNA Filter Plot

11. MICROWAVE SYSTEM DESIGN

Refer to “Marion County P25 System Design_v1.1.docx” for Microwave System Details.

11.1 Site Specific Design

The Wipper site supports two Aviat microwave links. These links connect Wipper to McCully Mountain and Eagle Crest, forming part of the 13-site core ring and providing the redundant routing expected within the looped topology.

12. RF SUB-SYSTEM DRAWINGS

The figure below contains the schematic of the RF sub-system to be deployed at this site.

12.1 RF System Schematic

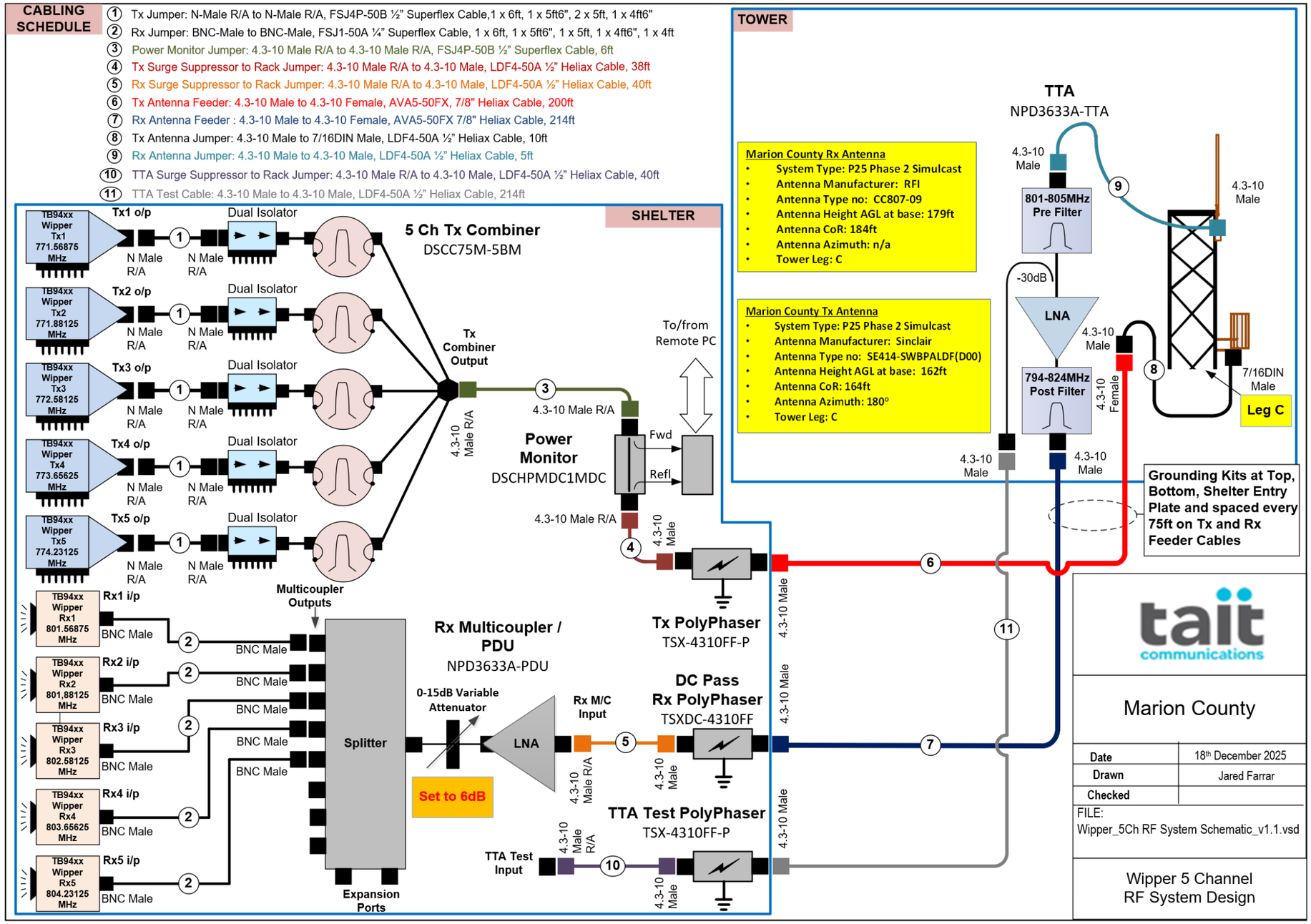
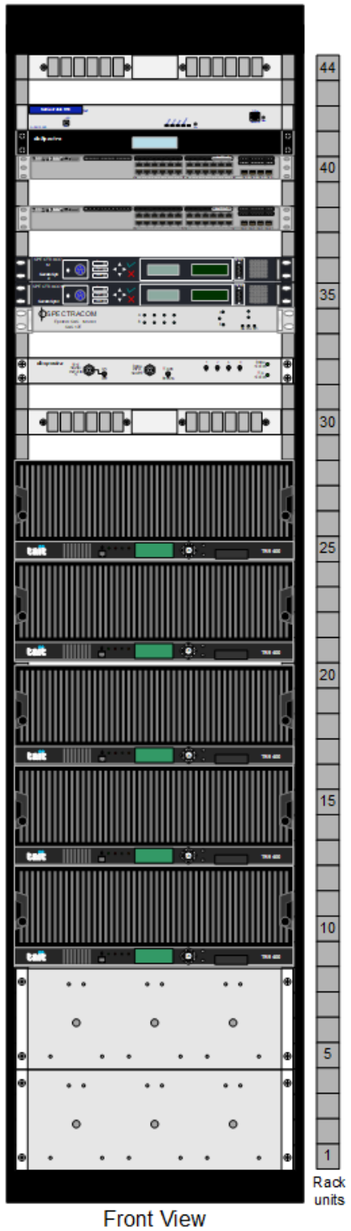


Figure 8: RF System Schematic

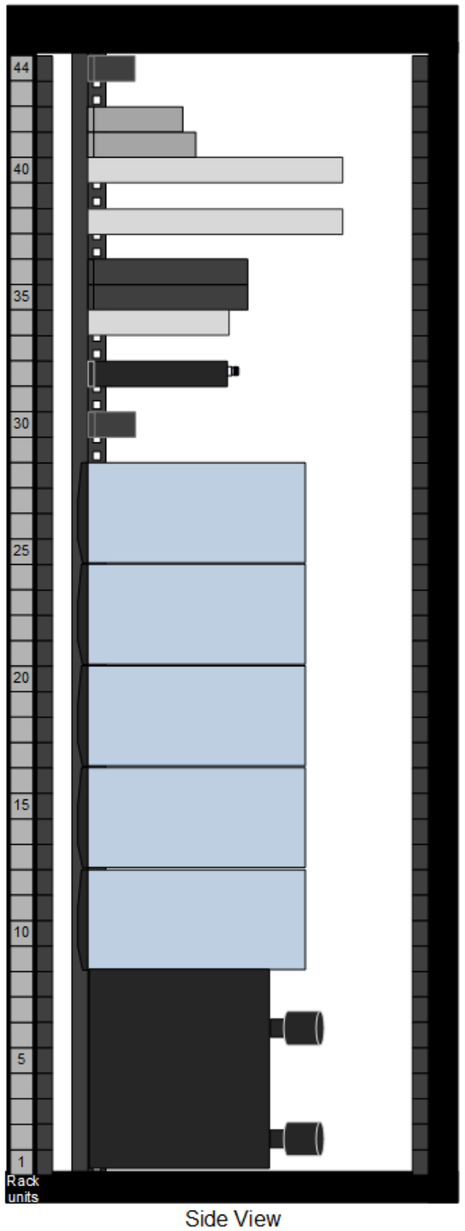
12.2 Rack Layout

This section contains the rack layout front & back view, side view and cabling diagram for this site.

700 MHz P25 Phase II Rackup Diagrams



Front View



Side View

RU	Description	Vendor PN	Vendor	Width (in)	Height (in)	Depth (in)
44	Breaker Panel	9072101001	TRIMM	19	1U	3.25
42	Alarm Panel	M16G2 & D-PK-16PAN	Netguardian	17	1U	6.6
41	Power Monitor	DSCHPMDC	dBSpectra	19	1U	7.5
40	Switch #1	C9300L-24P-4X-A	Cisco	17.5	1U	17.7
38	Switch #2	C9300L-24P-4X-A	Cisco	17.5	1U	17.7
36	Timing Reference	2402-613	Safran	17.1	1U	15.17
35	Timing Reference	2402-613	Safran	17.1	1U	15.17
34	Timing Switch	SAS-17E	Safran	19	1U	13.4
32	Multicoupler	NPD3633A	dBSpectra	19	1U	10.5
30	Breaker Panel	9072101001	TRIMM	19	1U	3.25
25-28	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
21-24	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
17-20	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
13-16	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
9-12	P25 Trunked Base Station	TB9435S-100T	Tait	19	4U	15.8
1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra	19	8U	12.5

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RF_Site_Simulcast

Figure 9: Marion County 19" Rack Layout – RF Front & Side

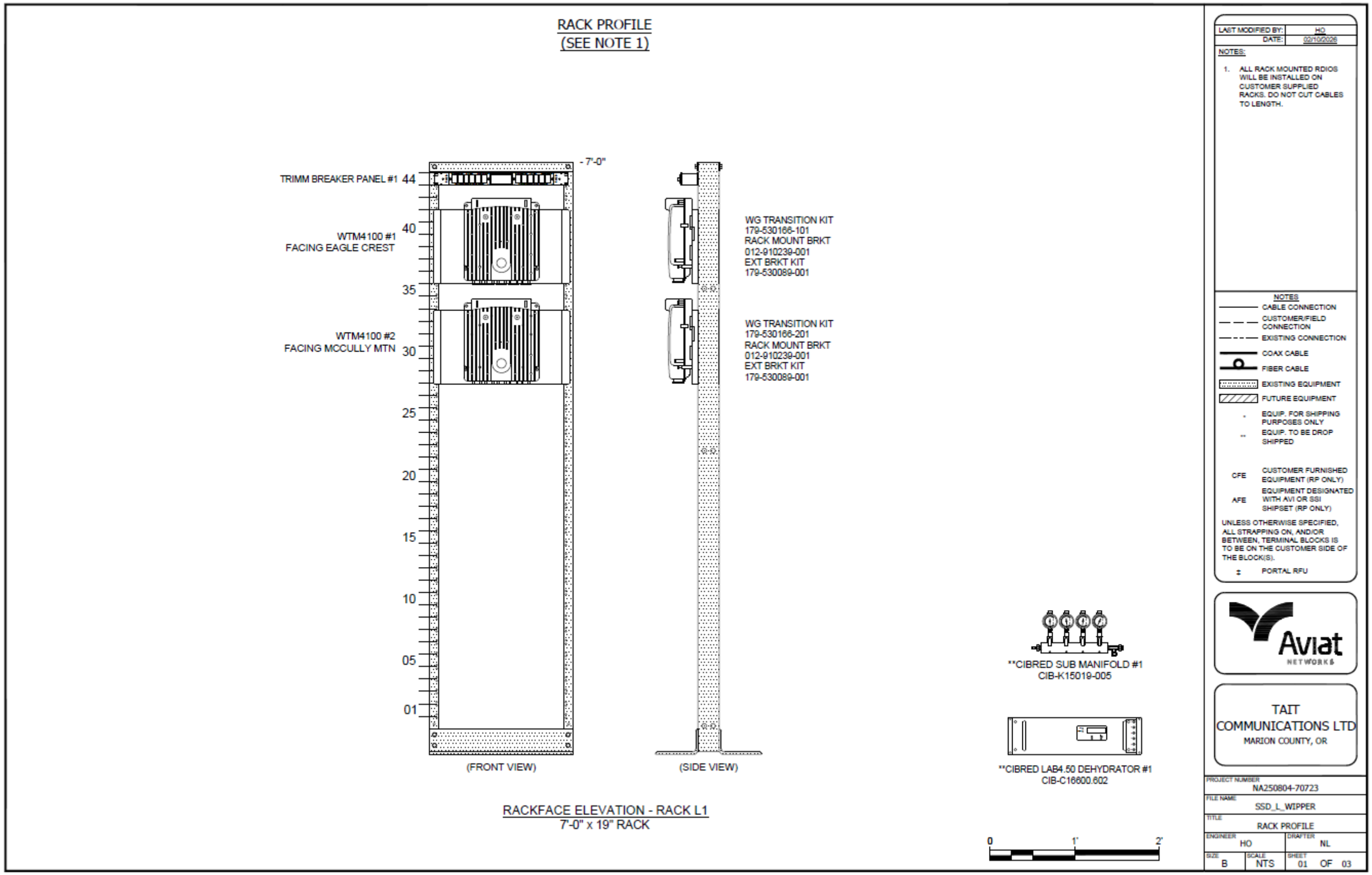
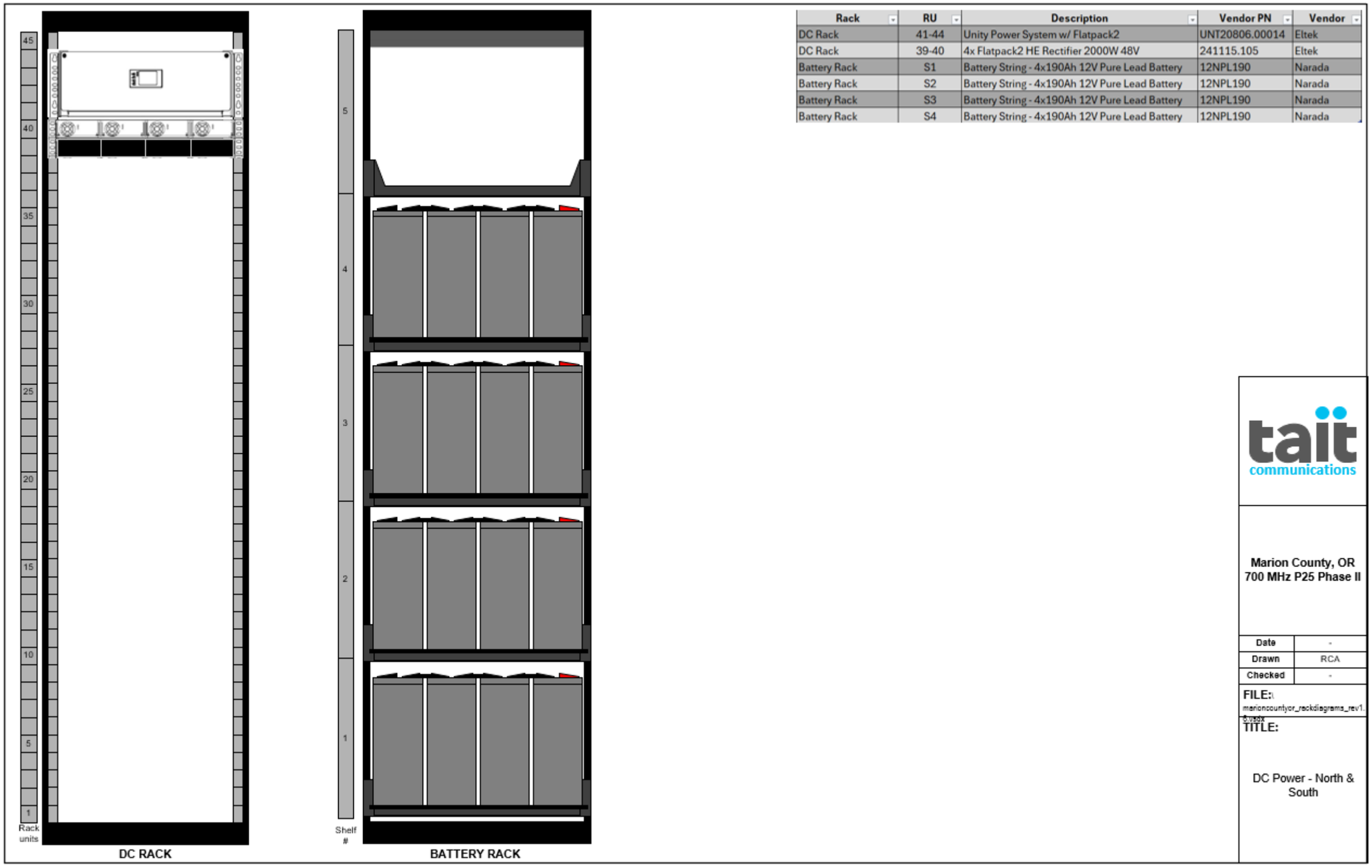


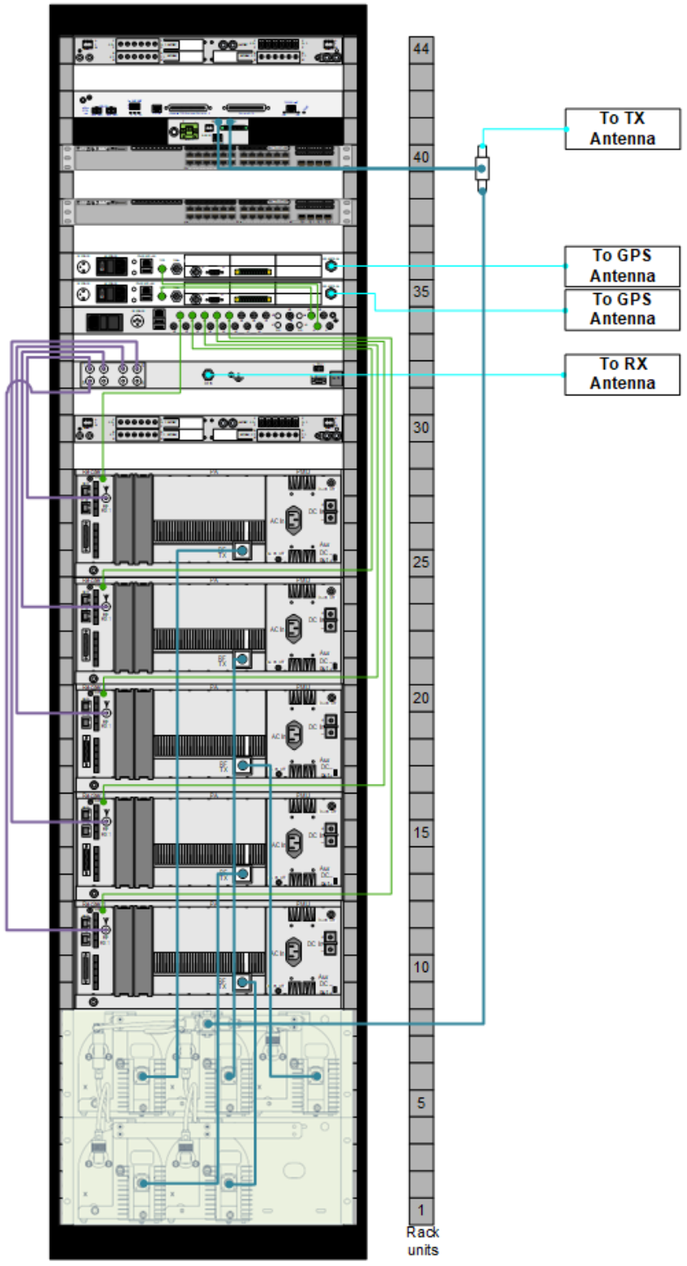
Figure 10: Microwave Rack



Rack	RU	Description	Vendor PN	Vendor
DC Rack	41-44	Unity Power System w/ Flatpack2	UNT20806.00014	Eltek
DC Rack	39-40	4x Flatpack2 HE Rectifier 2000W 48V	241115.105	Eltek
Battery Rack	S1	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack	S2	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack	S3	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada
Battery Rack	S4	Battery String - 4x190Ah 12V Pure Lead Battery	12NPL190	Narada

Figure 11: DC Power & Battery Racks

700 MHz P25 Phase II
Rackup Diagrams



RU	Description	Vendor PN	Vendor
44	Breaker Panel	9072101001	TRIMM
42	Alarm Panel	M16G2 & D-PK-16PAN	Netguardian
41	Power Monitor	DSCHPMDC	dBSpectra
40	Switch #1	C9300L-24P-4X-A	Cisco
38	Switch #2	C9300L-24P-4X-A	Cisco
36	Timing Reference	2402-613	Safran
35	Timing Reference	2402-613	Safran
34	Timing Switch	SAS-17E	Safran
32	Multicoupler	NPD3633A	dBSpectra
30	Breaker Panel	9072101001	TRIMM
25-28	P25 Trunked Base Station	TB9435S-100T	Tait
21-24	P25 Trunked Base Station	TB9435S-100T	Tait
17-20	P25 Trunked Base Station	TB9435S-100T	Tait
13-16	P25 Trunked Base Station	TB9435S-100T	Tait
9-12	P25 Trunked Base Station	TB9435S-100T	Tait
1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

Marion County, OR
700 MHz P25 Phase II

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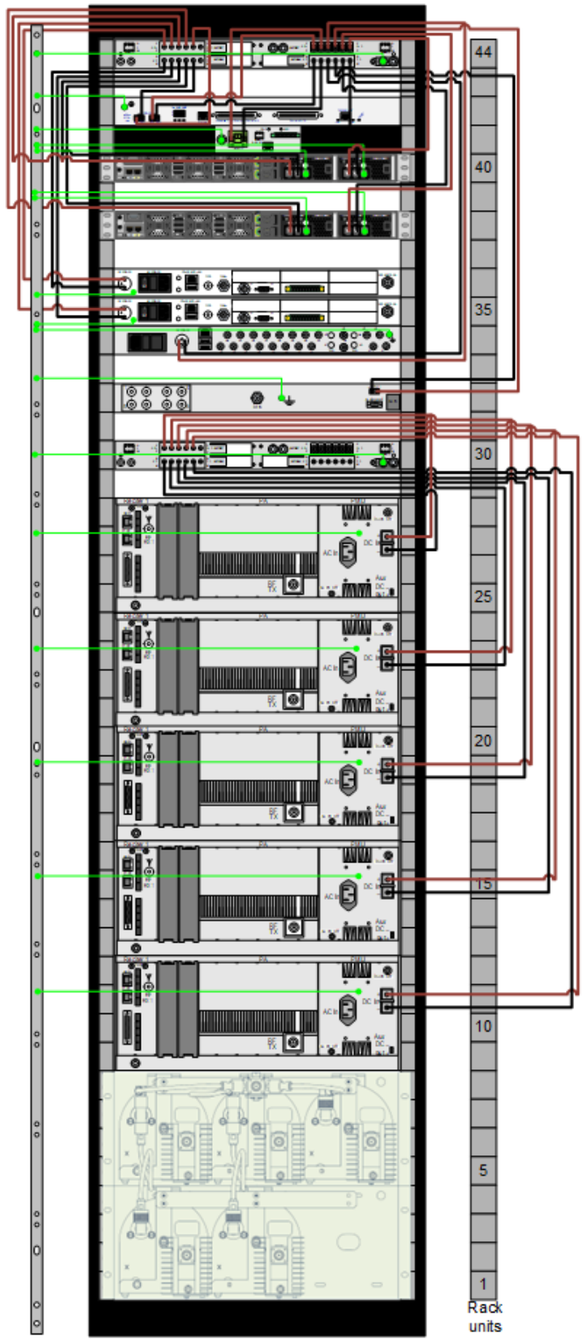
Cabling - RF

Figure 12: Marion County 19" Rack Layout – RF Cabling

700 MHz P25 Phase II
Rackup Diagrams



RU	Description	Vendor PN	Vendor
44	Breaker Panel	9072101001	TRIMM
42	Alarm Panel	M16G2 & D-PK-16PAN	Netguardian
41	Power Monitor	DSCHPMDC	dBSpectra
40	Switch #1	C9300L-24P-4X-A	Cisco
38	Switch #2	C9300L-24P-4X-A	Cisco
36	Timing Reference	2402-613	Safran
35	Timing Reference	2402-613	Safran
34	Timing Switch	SAS-17E	Safran
32	Multicoupler	NPD3633A	dBSpectra
30	Breaker Panel	9072101001	TRIMM
25-28	P25 Trunked Base Station	TB9435S-100T	Tait
21-24	P25 Trunked Base Station	TB9435S-100T	Tait
17-20	P25 Trunked Base Station	TB9435S-100T	Tait
13-16	P25 Trunked Base Station	TB9435S-100T	Tait
9-12	P25 Trunked Base Station	TB9435S-100T	Tait
1-8	5CH Transmit Combiner	DSCC75M-5BM	dBSpectra

Description A	Connection A	Description B	Connection B
Breaker Panel 1	A1	GPS 1	-48 VDC
Breaker Panel 1	A2	GPS 2	-48 VDC
Breaker Panel 1	A3	Switch 1-A	-48 VDC
Breaker Panel 1	A4	Switch 2-A	-48 VDC
Breaker Panel 1	A5	Alarm Panel A	-48 VDC
Breaker Panel 2	B1	Alarm Panel B	-48 VDC
Breaker Panel 2	B2	Power Monitor	-48 VDC
Breaker Panel 2	B3	Timing Switch	-48 VDC
Breaker Panel 2	B4	Multicoupler	-48 VDC
Breaker Panel 2	B5	Switch 2-B	-48 VDC
Breaker Panel 2	B6	Switch 1-B	-48 VDC

Marion County, OR
700 MHz P25 Phase II

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Cabling - Power

Figure 13: Marion County 19" Rack Layout – Power Cabling

13. PARTS AND EQUIPMENT LISTS

Refer to “Marion County P25 Project - Equipment List by Site.xlsx” for site-specific equipment list.

14. RF PERFORMANCE

14.1 Tx Effective Radiated Power

Table 9 below summarizes the transmitter system performance. It shows the required TB9xxx transmitter output power setting, the combining losses (including internal cabling), the antenna feeder loss and finally the resulting ERP relative to a dipole (ERPd).

Transmitter Frequency (MHz)	Transmitter Output Power Setting	Combining Losses (dB)	Misc Losses (dB)	Antenna Feeder Losses (dB)	Tx ERPd
771.56875	+50dBm (100W)	3.2	1.15	2.59	+54.5dBm (282W)
771.88125	+50dBm (100W)	3.2			+54.5dBm (282W)
772.58125	+50dBm (100W)	3.2			+54.5dBm (282W)
773.65625	+50dBm (100W)	3.2			+54.5dBm (282W)
774.23125	+50dBm (100W)	3.2			+54.5dBm (282W)

Table 9: Transmitter Output Power Setting and Effective Radiated Power

14.2 Site Noise

Site Noise in the 700MHz band can be assumed to be negligible.

14.3 Receiver Sensitivity

Table 10 summarizes the receiver system performance. It shows the amount of de-sensitization caused by the elevated site noise floor, the required Rx Multicoupler attenuation setting, and the resulting final Receiver sensitivity that can be achieved.

Receiver Frequency (MHz)	Rx Multicoupler Attenuator Setting (dB)	Rx Sensitivity for DAQ3.4 (dBm)
801.56875	6	-111.1
801.88125		
802.58125		
803.65625		
804.23125		

Table 10: Receiver Sensitivity

15. SITE DESIGN INFORMATION

15.1 Site Plan

The site plan is an overhead view of the overall compound depicting locations of pertinent features.

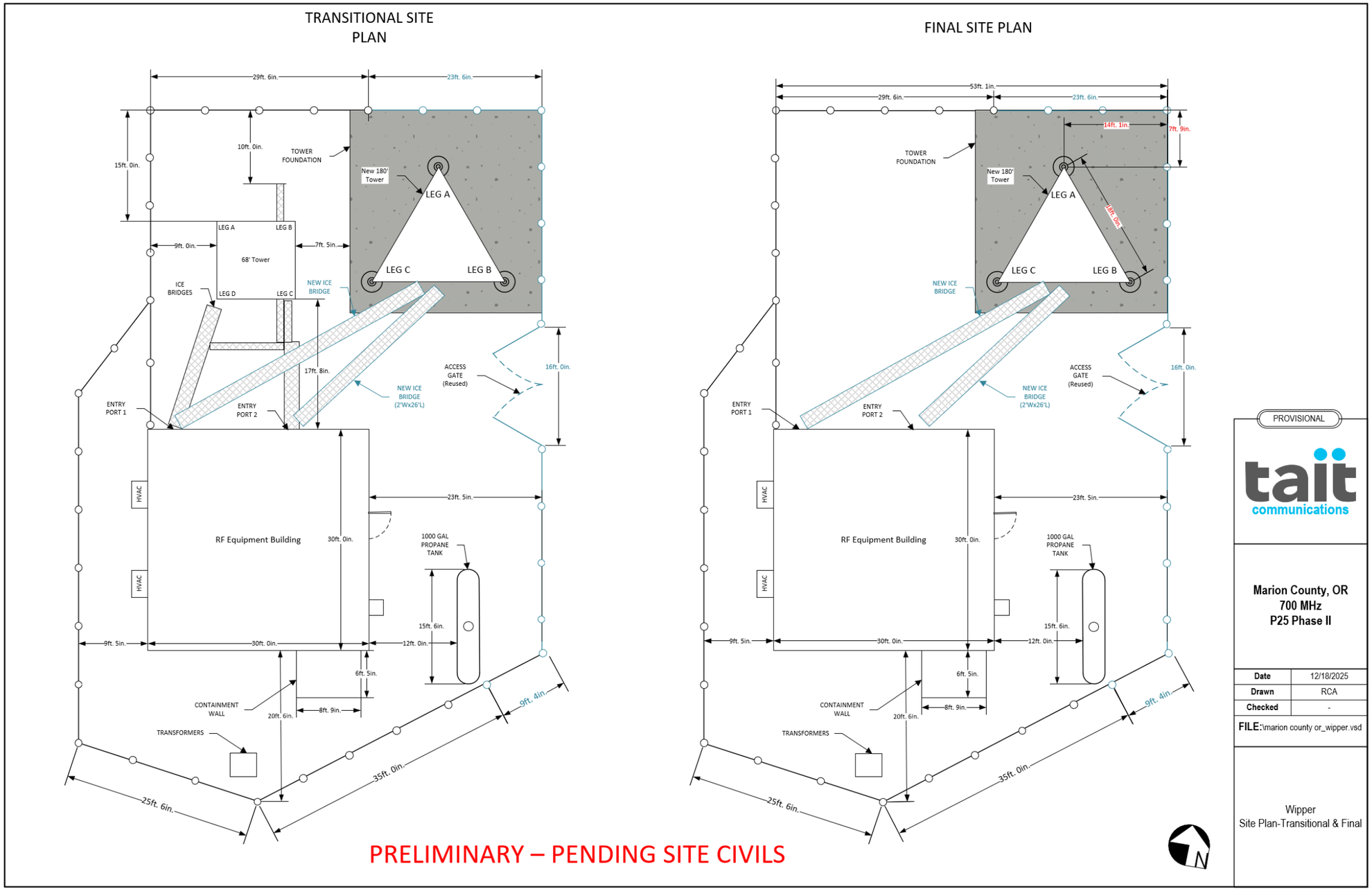

Figure 14: Site Plan

15.2 Floor and Cable Routing Plan

The floor and cable routing plan is an overhead view of the equipment room layout depicting locations of pertinent equipment and including the cable routing plans leading to the tower.

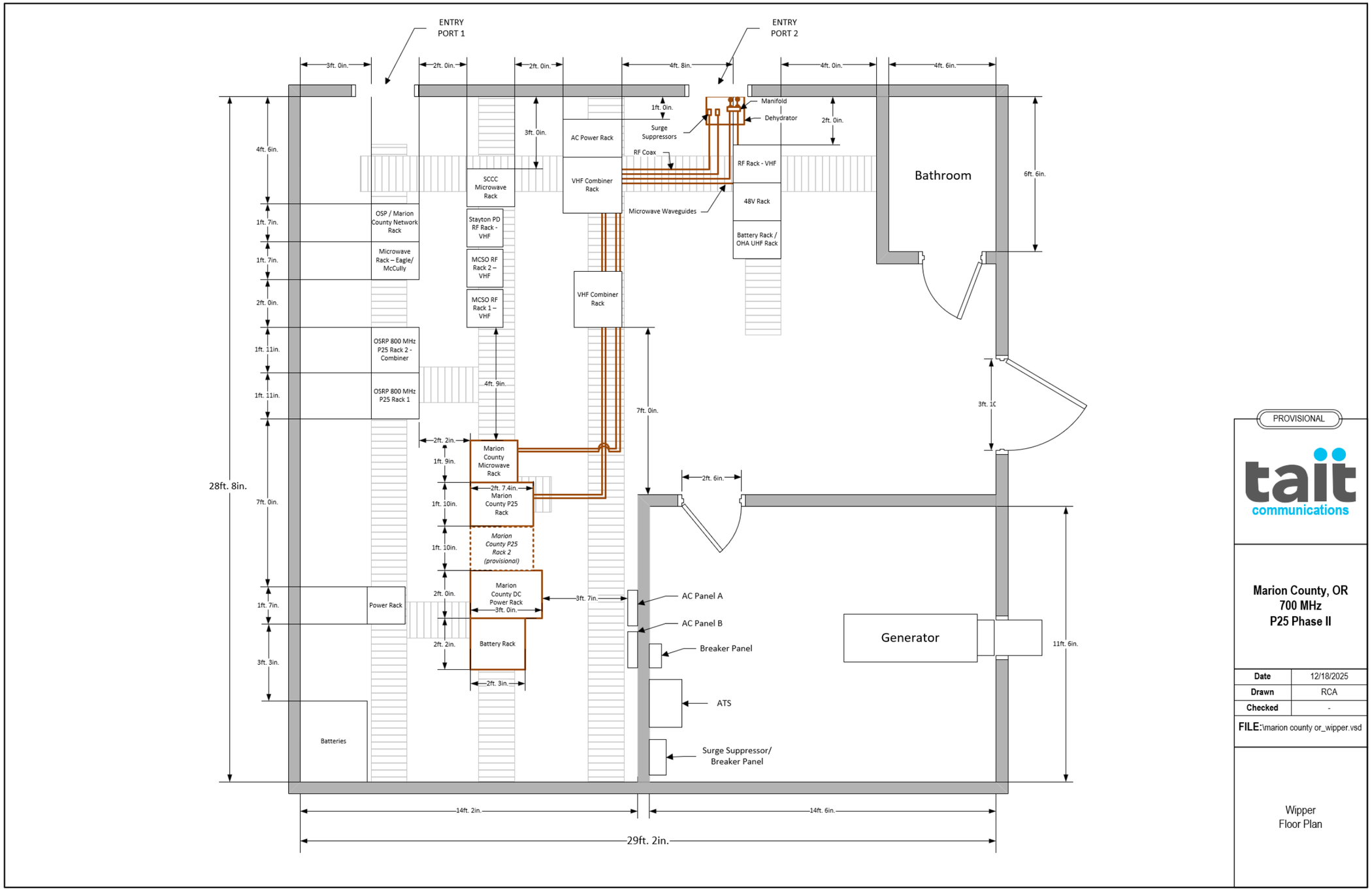

Figure 15: Floor and Cable Routing Plan

15.3 Entry and Exit Ports

The ports where the antenna and TTA cables enter / exit the shelter are shown in the below figure.

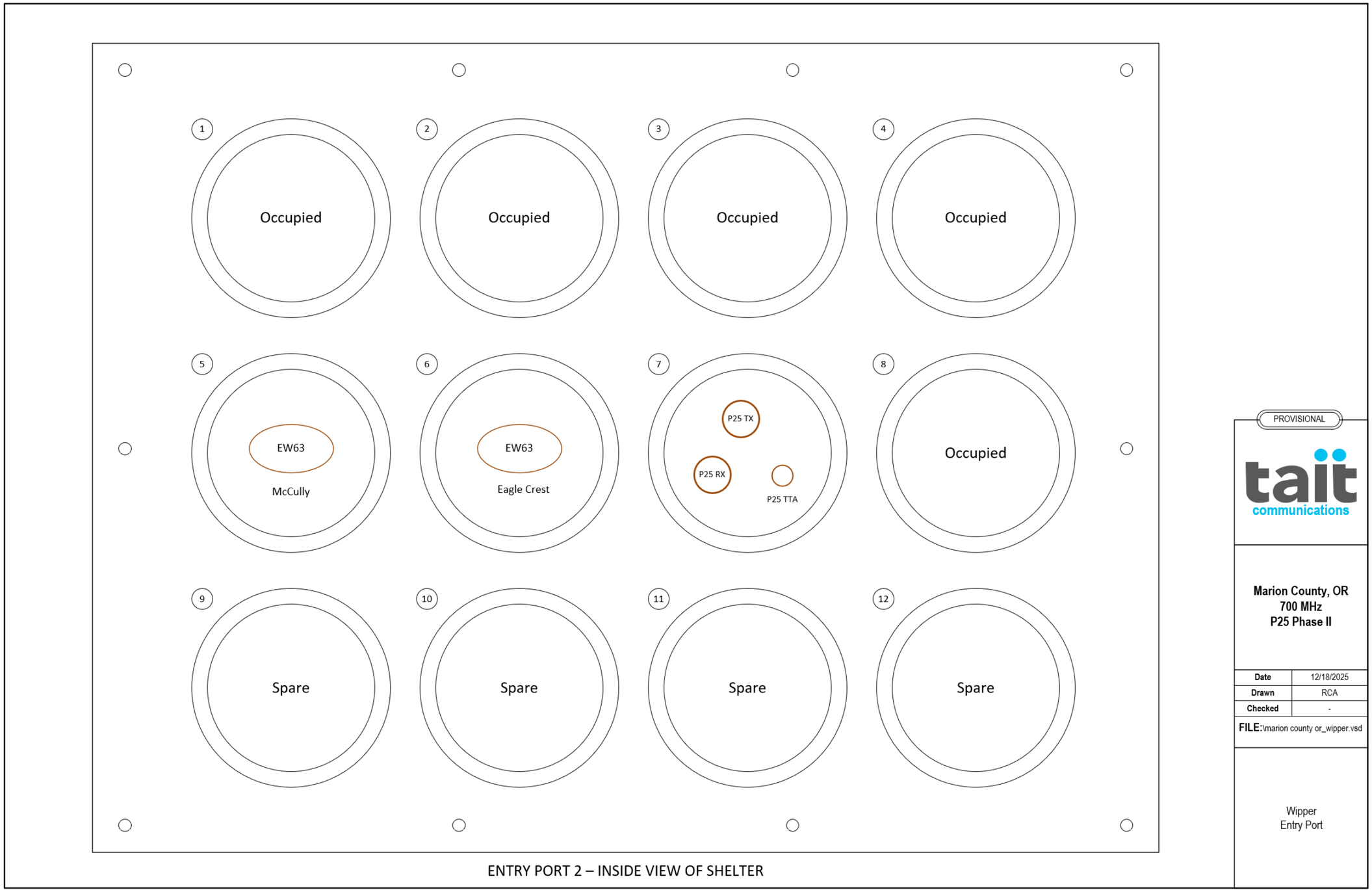

Figure 16: Shelter Cable Entry & Exit Ports

15.3.1 Power & Heat Load Calculations

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Power & Heat Load details.

15.3.2 DC Distribution Fuse Panel

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Fuse Panel details.

Supplemental 12 - WVCC

tait communications

PROVISIONAL Design Document

RF Sub-System and Site Designs

Marion County

Site: WVCC

Issue 1.1 • 1st May 2026

www.taitradio.com

CONTACT INFORMATION

Tait Communications Corporate Head Office

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Houston, Texas 77084,
United States of America

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PREFACE

Project Details

Project number	
Customer	Marion County
Project description	P25 Phase 2 Simulcast & P25 Phase 1 Conventional Simulcast
Business Development Manager	
Sales Engineer	
Project Engineer	Jared Farrar / Riley Alfaqeeh
Project Manager	Stacey Adams
Lead RF Engineers	Ian Graham

Purpose

The Marion County project is an 11 site P25 simulcast design that uses the US 700MHz band. To control Time Delay Interference (TDI), the simulcast design is split into three cells – North, South, and East. The North cell is comprised of four sites with P25 Phase 2 trunked operation, the South cell is comprised of four sites with P25 Phase 2 trunked operation, and the East cell is comprised of three sites with P25 Phase 1 conventional operation.

The Marion County Project also consists of a 17 site Aviat Microwave Backhaul system. The Microwave system is comprised of a 13 site ring and 4 spur sites. The primary and backup nodes are located at METCOMM Dispatch and SCC Backup dispatch, respectively.

The purpose of this report is to document the site design for the **WVCC location**.

Scope

This document provides an overview of site-specific details and requirements for the referenced location.

Publication Record

Author	Ian Graham, Jared Farrar
Issue	1.0
Document Status	Initial Release
Date	18th March, 2026

Document Status

Issue	Date	Signature	Comment
1.1	5/1/2026		

Document Approvals

Approvals	Position	Signature	Date
Bladimyr Guzman	TAM Design Authority		

Associated Documents & References

Reference documentation includes:

- Marion County P25 System Design_v1.1.docx
- Marion County P25 Project - Equipment List by Site.xlsx
- Marion County Power_Heat_Load.xlsx

1. GENERAL RF DESIGN APPROACH

The Marion County project is an 11-site P25 simulcast design that uses the US 700MHz band. To control Time Delay Interference (TDI) and due to unique electric utility challenges in the high peaks to the east of the county necessitating the use of generators, the simulcast design is split into three cells – North, South, and East.

The North Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- Crooked Finger
- **Crosby**
- Eastview
- Parrett Mountain

The South Cell sites operate in P25 Phase 2 trunked mode and are identified as follows:

- Eagle Crest
- Lower Prospect
- McCully Mountain
- Wipper

The East Cell sites operate in P25 Phase 1 conventional mode (to avoid the energy consumption of a control channel with 100% duty cycle) and are identified as follows:

- APW
- House Mountain
- Halls Ridge

Each site within the North and South Cells will have five trunked P25 Phase 2 channels providing eight dynamic talkpaths (one 12.5kHz FDMA control channel plus four 2-slot 12.5kHz TDMA traffic channels) across each respective cell's coverage area. The East Cell will have five conventional P25 Phase 1 12.5kHz FDMA channels providing five fixed talkpaths across the cell.

Each site across all three cells will have separate transmit (Tx) and receive (Rx) antennas, typically with 20ft vertical separation between centers of radiation. The anticipated low site noise floors in the 700MHz band means Tower Top Amplifiers (TTA) can be used to improve receiver sensitivity and talk-in coverage. Along with the 30MHz Tx-Rx frequency separation, these factors lead to a common RF combining subsystem design which is applicable to all Marion County sites. The combining system requirements were captured based on the proposed frequency plan in coordination with ADCOMM Engineering LLC and Tait subsequently worked with the chosen equipment vendor, dBSpectra, on an optimal design. The main consideration was the TTA where it was decided to use dBSpectra's compact design after it was shown all the required receiver filtering could be accommodated. The generic (starting point) site combining system design therefore features the:

- DSCC75M-5BM 5 Channel Ceramic Tx Combiner
- DSCHPMDC1MDC Channelized Power Monitor
- NPD3633A-TTA Tower Top Amplifier
- NPD3363A-PDU Rx Multicoupler PDU

Antennas were chosen on a site-by-site basis to minimize TDI in the simulcast cells while still providing necessary talk-out coverage. The proposed antennas are the:

- Sinclair SE412-SWBPAL
    - 5dBd Low PIM Enclosed Dipole Array
- Sinclair SE414-SWBPAL
    - 8.5 to 11dBd Low PIM Adjustable Beamwidth Enclosed Dipole Array
- RFI CC807-09
    - 9dBd Collinear Omnidirectional

2. TOWER MAPPING

Information not available at time of detailed design. Information will be populated at a later date.

3. FREQUENCY PLANNING

Not applicable. No Tait Base Stations at this location.

4. INCUMBENTS SEARCH

Not Applicable. No Tait Base Stations at this location.

5. INTERMODULATION ANALYSIS

Not Applicable. No Tait Base Stations at this location.

6. ANTENNA SYSTEM DESIGN

Not Applicable. No Tait Base Stations at this location.

7. TRANSMITTER COMBINER DESIGN

Not Applicable. No Tait Base Stations at this location.

8. RECEIVER SUBSYSTEM DESIGN

Not Applicable. No Tait Base Stations at this location.

9. POWER MONITOR

Not Applicable. No Tait Base Stations at this location.

10. RF SUB-SYSTEM DESIGN

Not Applicable. No Tait Base Stations at this location.

11. MICROWAVE SYSTEM DESIGN

Refer to “Marion County P25 System Design_v1.1.docx” for Microwave System Details.

11.1 Site Specific Design

The WVCC site supports two Aviat microwave links. These links extends from WVCC to Eagle Crest and Courthouse as spurs, engineered as 2+0 to ensure reliable, uninterrupted connectivity from WVCC into the core network.

12. RF SUB-SYSTEM DRAWINGS

12.1 RF System Schematic

Not Applicable. No Tait Base Stations at this location.

12.2 Rack Layout

This section contains the rack drawings for this site.

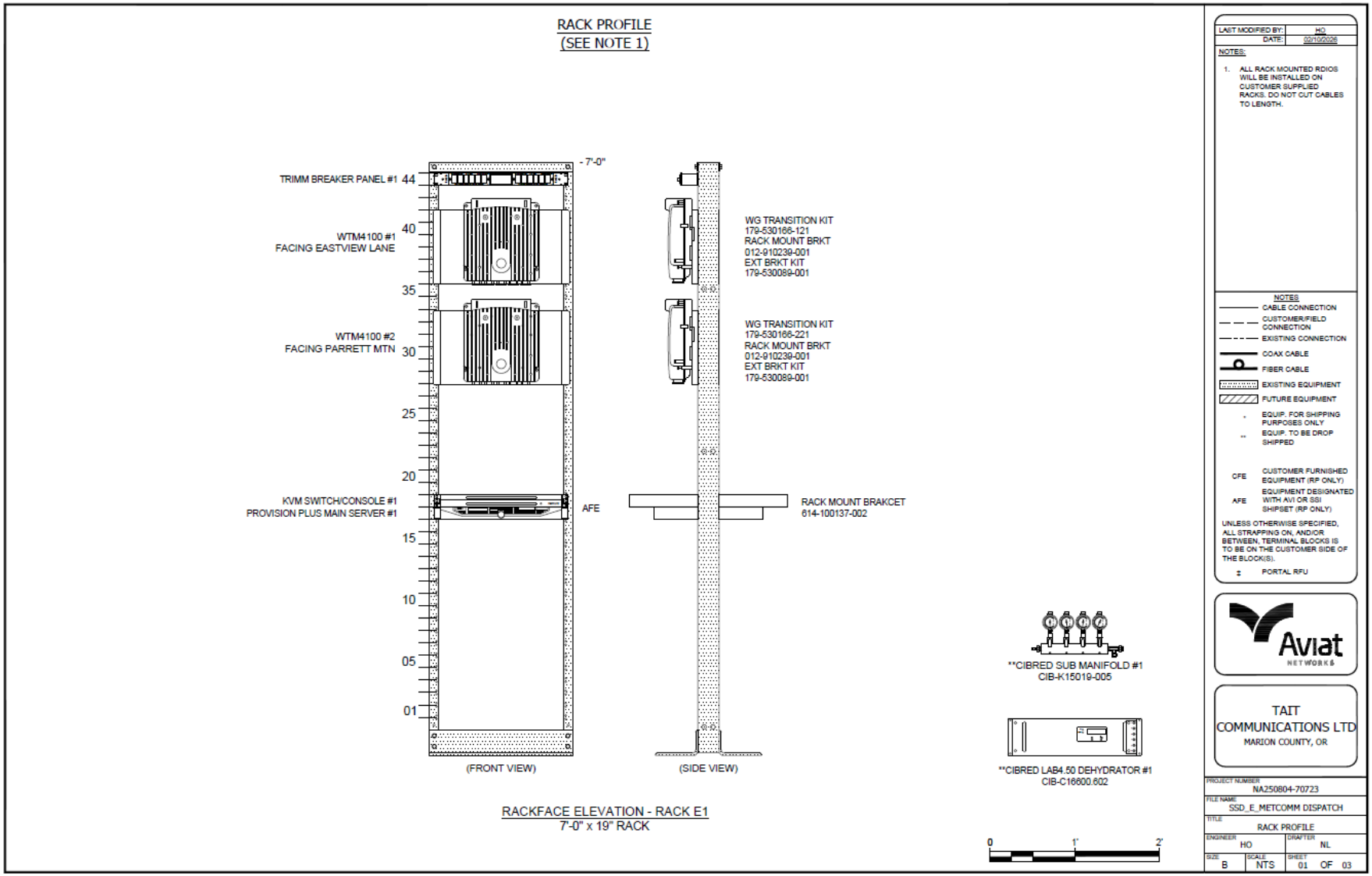
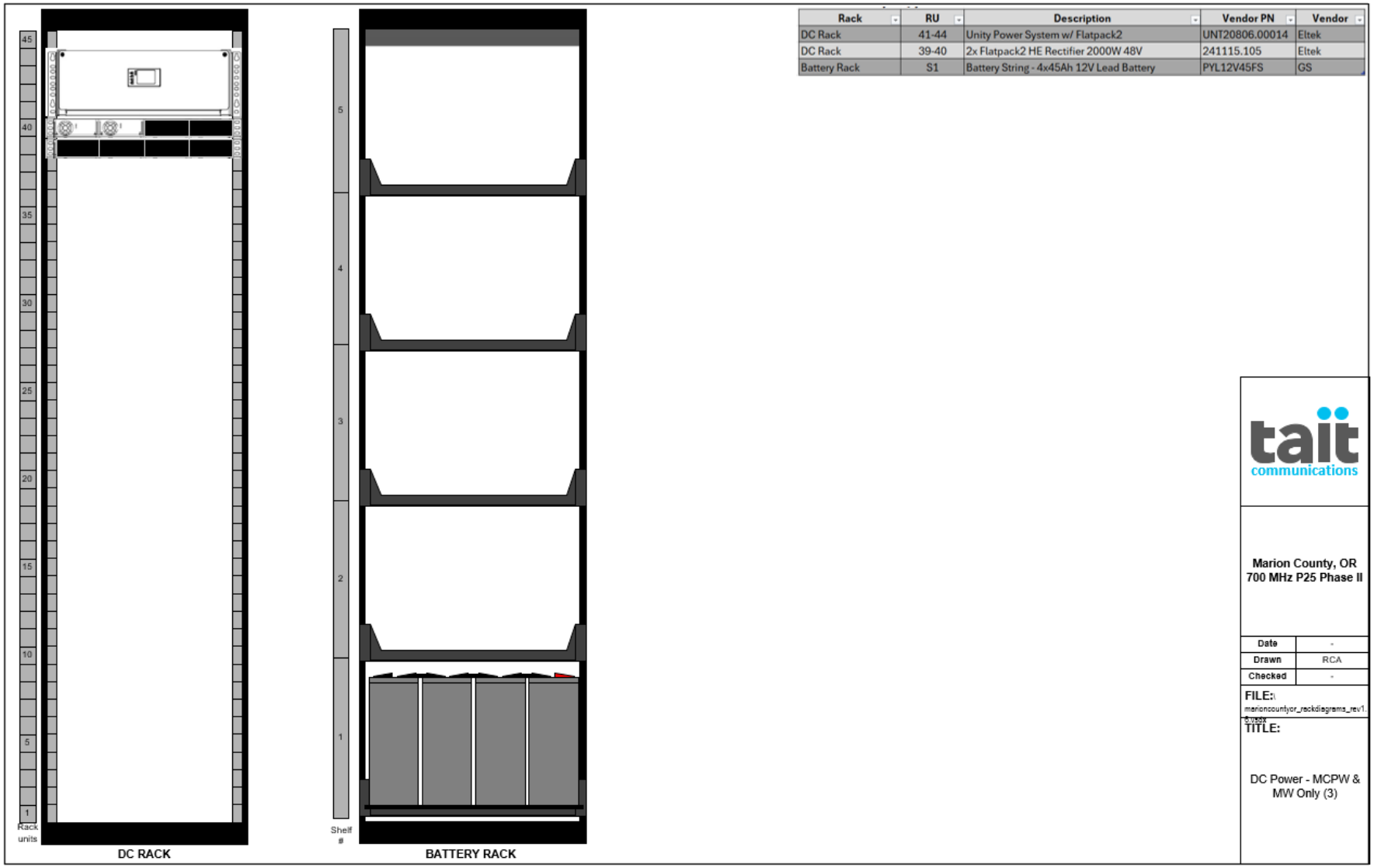


Figure 1 Microwave Rack



Rack	RU	Description	Vendor PN	Vendor
DC Rack	41-44	Unity Power System w/ Flatpack2	UNT20806.00014	Eltek
DC Rack	39-40	2x Flatpack2 HE Rectifier 2000W 48V	241115.105	Eltek
Battery Rack	S1	Battery String - 4x45Ah 12V Lead Battery	PYL12V45FS	GS

Figure 2: DC Power & Battery Racks

13. PARTS AND EQUIPMENT LISTS

Refer to “Marion County P25 Project - Equipment List by Site.xlsx” for site-specific equipment list.

14. RF PERFORMANCE

Not Applicable. No Tait Base Stations at this location.

15. SITE DESIGN INFORMATION

15.1 Site Plan

Information not available at time of detailed design. Information will be populated at a later date.

15.2 Floor and Cable Routing Plan

Information not available at time of detailed design. Information will be populated at a later date.

15.3 Entry and Exit Ports

Information not available at time of detailed design. Information will be populated at a later date.

15.3.1 Power & Heat Load Calculations

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Power & Heat Load details.

15.3.2 DC Distribution Fuse Panel

Refer to “Marion County Power_Heat_Load.xlsx” for Site specific Fuse Panel details.

MARION COUNTY BOARD OF COMMISSIONERS

Board Session Agenda Review Form

Meeting date: Wednesday, October 7, 2026

Department: Sheriff's Office

Title: Amendment #1 to the Contract for Services with Dr. O'Neill Solanky

Management Update/Work Session Date: Tuesday, August 25, 2026 **Audio/Visual aids** ☐

Time Required: 5 minutes **Contact:** Kristy Witherell **Phone:** x4402

Requested Action:

Staff is requesting approval of Amendment #1 to the Contract for Services with Dr. O'Neill Solanky DDS, LLC in the amount of $100,345.04, for a new contract total of $428,825.00, for dental services to the Adults in Custody at the Jail through June 30, 2027.

Issue, Description & Background:

Dr. Solanky has been providing dental services to the adults in custody at the jail for more than 13 years. These dental services include consultation, diagnosis, treatment, and referrals as necessary. The last fiscal year, the Sheriff's Office spent $149,630.00 on dental services, which left only $59,654.96 on the contract. Due to the increased demand of dental services in the jail, staff is requesting to amend the contract for $100,345.04. the new contract total will be $428,825.00 if approved.

Financial Impacts:

Adding $100,345.04 to the contract for a contract total of $428,825.00.

Impacts to Department & External Agencies:

N/A

List of attachments: Amendment #1 and Original Contract

Presenter: Commander Jacob Ramsey

Department Head Signature: Jeremy Landers

Jeremy Landers (Sep 15, 2026 06:17:55 PDT)

Contract Review Sheet

Contract for Services **SO-6066-24 - Am1**

Title: **AIC Dental Services**

Contractor's Name: **O'Neill S. Solanky DDS, LLC**

Department: **Sheriff's Office** Contact: **Kristy Witherell**

Analyst: **Sandra Fixsen** Phone #: **(503) 373-4402**

Term - Date From: **July 1, 2024** Expires: **June 30, 2027**

Original Contract Amount: **$ 328,479.96** Previous Amendments Amount: **$ -**

Current Amendment: **$ 100,345.04** New Contract Total: **$ 428,825.00** Amd% **31%**

Outgoing Funds ☐ Federal Funds ☐ Reinstatement ☐ Retroactive ☑ Amendment greater than 25%

Source Selection Method: **50-0160 Health Provider Contracts**

Description of Services or Grant Award

Amd 1 - Adding $100,345.04 in funding through June 30, 2027 for dental services for the Adults in Custody at the Jail. New contract total will be $428,825.00. The amendment for funding is due to an unanticipated increase in AICs needing dental work.

Original - Dr. Solanky will provide dental services to the adults in custody at the Marion County Jail. These dental services will include consultation, diagnosis, treatment, and referral as necessary. The term of this contract is for three years with options to renew for two additional years.

Desired BOC Session Date:	**10/7/2026**	Contract should be in DocuSign by:	**9/16/2026**
Agenda Planning Date	**9/24/2026**	Printed packets due in Finance:	**9/22/2026**
Management Update	**9/22/2026**	BOC upload / Board Session email:	**9/23/2026**

BOC Session Presenter(s) **Commander Jacob Ramsey** Code: **Y**

REQUIRED APPROVALS

Sandra L. Fixsen	09/14/2026	Kristy Witherell Kristy Witherell (Sep 14, 2026 14:10:02 PDT)	09/14/2026
Finance - Contracts	Date	Contract Specialist	Date
Michelle Teed Michelle Teed (Sep 17, 2026 10:16:44 PDT)	09/17/2026	Jan Fritz Jan Fritz (Sep 17, 2026 12:23:12 PDT)	09/17/2026
Legal Counsel	Date	Chief Administrative Officer	Date

AMENDMENT 1 to SO-6066-24
the CONTRACT FOR SERVICES
between
MARION COUNTY and O'NEILL S. SOLANKY DDS, LLC

This is Amendment 1 to the Contract for Services (as amended from time to time, the "Contract"), dated July 01, 2024 between Marion County, a political subdivision of the State of Oregon, hereinafter called County, and O'Neill S. Solanky DDS, LLC , hereafter called Contractor.

The Contract is hereby amended as follows (new language is indicated by underlining and deleted language is indicated by ~~strikethrough~~):

2. CONSIDERATION.

A. The maximum, not-to-exceed compensation payable to Contractor under this Contract, which includes any allowable expenses, is $428,825.00 ~~$328,479.96~~.

EXHIBIT A
STATEMENT OF WORK

2. COMPENSATION.
The total amount available for payment to Contractor under Exhibit A, section 2.A and for authorized reimbursement to Contractor under Exhibit A, section 2.C is $428,825.00 ~~$328,479.96~~.

A. METHOD OF PAYMENT FOR SERVICES: County shall pay Contractor as per stated rates but not in excess of $428,825.00 ~~$328,479.96~~ for completing all services required under this Contract.

Except as expressly amended above, all other terms and conditions of the original Contract and any previously executed amendments are still in full force and effect. Contractor certifies that the representations, warranties and certifications contained in the original Contract are true and correct as of the effective date of this Amendment and with the same effect as though made at the time of this Amendment.

AMENDMENT 1 to SO-6066-24
the CONTRACT FOR SERVICES
between
MARION COUNTY and O'NEILL S. SOLANKY DDS, LLC

MARION COUNTY SIGNATURES
BOARD OF COMMISSIONERS:

_____
Chair Date

_____
Commissioner Date

_____
Commissioner Date

Authorized Signature: Jeremy Landers (Sep 15, 2026 06:17:55 PDT) 09/15/2026
Department Director or designee Date

Authorized Signature: Jan Fritz (Sep 17, 2026 12:23:12 PDT) 09/17/2026
Chief Administrative Officer Date

Reviewed by Signature: Michelle Teed (Sep 17, 2026 10:16:44 PDT) 09/17/2026
Marion County Legal Counsel Date

Reviewed by Signature: 09/14/2026
Marion County Contracts & Procurement Date

O'NEILL S. SOLANKY DDS, LLC SIGNATURE

Authorized Signature: _____
Date

Title: _____

MARION COUNTY BOARD OF COMMISSIONERS

Board Session Agenda Review Form

Meeting date: 10/7/2026

Department: Public Works

Title: Amendment 3 to SPA No. 33277 for the Center Street: Lancaster Drive to 45th Place NE Project

Management Update/Work Session Date: 9/8/2026 **Audio/Visual aids** ☐

Time Required: 5 min **Contact:** Shane Ottosen **Phone:** 3104

Requested Action:

Approve Amendment No. 3 to Supplemental Project Agreement (SPA) No. 33277 with the Oregon Department of Transportation for the Center Street: Lancaster Drive to 45th Place NE project, increasing total project funding by $1,585,561.26, from $3,483,465.74 to $5,069,027.00.

Issue, Description & Background:

This project will improve Center Street NE from Lancaster Drive NE to 45th Place NE by widening the pavement to the north, reconfiguring the striping to allow for a center left-turn lane and a bicycle lane, and constructing sidewalks along the north side of Center Street. In May 2019, the Board approved SPA No. 33277 and subsequently approved Amendment Nos. 1 and 2. Amendment 3 increases the total estimated Project cost from $3,483,465.74 to $5,069,027.00. The resulting project funds consists of $3,875,429.42 in federal funds, $30,000 in State All Routes Transportation Safety (ARTS) funds, and $1,163,597.58 in County Road Funds.

Financial Impacts:

Federal funds for this Project shall be limited to $3,875,429.42. State funds for the project total $30,000.00. The County is responsible for the remaining $1,163,597.58.

Impacts to Department & External Agencies:

Entering into this agreement does not directly impact any other Marion County departments. The project will benefit the public at large by providing needed roadway facilities in a very busy neighborhood. The project is an approved CIP in the current budget year.

List of attachments: Amendment No. 3, Supplemental Project Agreement 33277

Presenter: Ryan Crowther

Department Head Signature: BNicholas

Digitally signed by BNicholas
Date: 2026.09.04 15:03:41 -07'00'

Contract Review Sheet

Intergovernmental Agreement **PW-2856-19 - Am3**

Title: **ODOT 33277 - Center Street NE Improvements Lancaster Drive to 45th Place NE**

Contractor's Name: **Oregon Department of Transportation**

Department: **Public Works Department** Contact: **Traci Clarke**

Analyst: **Kathleen George** Phone #: **503-365-3100**

Term - Date From: **Execution** Expires: **June 13, 2029**

Original Contract Amount: **$ 2,187,676.00** Previous Amendments Amount: **$ 1,295,789.74**

Current Amendment: **$ 1,585,561.26** New Contract Total: **$ 5,069,027.00** Amd% **132%**

Incoming Funds ☑ Federal Funds ☐ Reinstatement ☐ Retroactive ☑ Amendment greater than 25%

Source Selection Method: **50-0010 General Exemptions (IGAs and QRFs)**

Description of Services or Grant Award

In May of 2019, the Board of Commissioners signed Supplemental Project Agreement No. 33277 with ODOT for a Federal Surface Transportation Program-Urban (STP-U) grant to provide the design and construction of the first-phase of improvements on Center Street NE from Lancaster Drive NE to 45th Place NE. The first phase of roadway improvements include widening the pavement to the north, reconfiguring the striping to allow for a center left-turn lane and a bicycle lane, and constructing sidewalks along the north side of Center Street.

Amendment No. 1 changes the total estimated Project cost from $2,187, 676 to $2,958,366 and increases the total federal funding amount for the Project from $1,663,001 to $2,354,541. Additionally, the Amendment updates language concerning the County's certification status and updates agreement terms related to ADA.

Amendment 2: Amendment No. 2 increases the total estimated Project cost from $2,958,366 to $3,483,465.74. Additional federal funds for this Project includes $270,000.00 provided through the ARTS program (with a 10% match of $30,000 provided by State) and $201,982 from Marion County's allocated STBG funds (witha 10.27% match of $23,117.74 provided by the County). The total funding increase is $525,099.74.

Amendment 3 increases the total estimated Project cost from $3,483,465.74 to $5,069,027.00. Federal funds for this Project shall be limited to $3,875,429.42, which includes $270,000.00 of federal funds provided through the ARTS program. State shall be responsible for the ARTS Program match funding, up to $30,000.00. This amendment adds $1,048,906.21 in federal funds. The County is responsible for the 10.27% match and overmatch totaling $1,163,597.58.

Desired BOC Session Date:	**10/7/2026**	Contract should be in DocuSign by:	**9/16/2026**
Agenda Planning Date	**9/24/2026**	Printed packets due in Finance:	**9/22/2026**
Management Update	**9/22/2026**	BOC upload / Board Session email:	**9/23/2026**

BOC Session Presenter(s) **Ryan Crowther** Code: **Y**

REQUIRED APPROVALS

	09/18/2026	Traci Clarke	09/18/2026
Finance - Contracts	Date	Contract Specialist	Date
	09/18/2026	Jan Fritz Jan Fritz (Sep 18, 2026 16:46:32 PDT)	09/18/2026
Legal Counsel	Date	Chief Administrative Officer	Date

AMENDMENT NUMBER 03
LOCAL AGENCY CERTIFICATION PROGRAM
Supplemental Project Agreement No. 33277
Center Street: Lancaster Drive to 45th Place NE
Marion County

This is Amendment No. 03 to the Agreement between the **State of Oregon**, acting by and through its Department of Transportation, hereinafter referred to as "State" or "ODOT," and MARION COUNTY, acting by and through its elected officials, hereinafter referred to as "Agency," entered into on June 13, 2019, Amendment 1 entered into on September 2, 2022, and Amendment Number 2 entered into on January 31, 2023.

It has now been determined by State and Agency that the Agreement referenced above shall be amended to update language, increase funding, revise Exhibit B and update state contact.

1. **Effective Date.** This Amendment shall become effective on the date it is fully executed and approved as required by applicable law.

2. **Amendment to Agreement.**

   a. **Exhibit B shall be deleted in its entirety and replaced with the attached Revised Exhibit B. All references to "Exhibit B" shall hereinafter be referred to as "Revised Exhibit B." The requirement to comply with the terms and conditions of Revised Exhibit B shall be effective upon execution of this Amendment.**

   b. **TERMS OF AGREEMENT, Paragraph 2, Page 2, which reads:**

   2.The Total Project cost is estimated at $3,483,465.74, ~~$2,958,366.00,~~ which is subject to change. Federal funds for this Project shall be limited to $2,826,523.21~~$2,354,541.37~~, which includes $270,000.00 of federal funds provided through the ARTS program. State shall be responsible for the ARTS Program match funding, up to $30,000.00. Agency shall be responsible for all remaining costs, including any non-participating costs, all costs in excess of the federal or state funds, and the 10.27 percent match for all eligible costs. Any unused federal or state funds obligated to this Project will not be paid out by State, and will not be available for use by Agency for this Agreement or any other projects. "Total Project Cost" means the cost to complete the entire Project, and includes any federal funds, state funds, local matching funds, and any other funds. Agency will report the final cost of each phase of the Project at the completion of each phase, as well as the Total Project Cost at the end of the Project, to the ODOT Regional Local Agency Liaison. Notwithstanding the

foregoing, any of Agency's unused STBG funds obligated to the Preliminary Engineering phase of the Project will be returned to Agency's allocation for use on other phases of this Project or other projects as requested in writing by Agency.

Shall be deleted in its entirety and replaced with the following:

2.The Total Project cost is estimated at $5,069,027.00 which is subject to change. Federal funds for this Project shall be limited to $3,875,429.42, which includes $270,000.00 of federal funds provided through the ARTS program. State shall be responsible for the ARTS Program match funding, up to $30,000.00. Agency shall be responsible for all remaining costs, including any non-participating costs, all costs in excess of the federal or state funds, and the 10.27 percent match for all eligible costs. Any unused federal or state funds obligated to this Project will not be paid out by State, and will not be available for use by Agency for this Agreement or any other projects. "Total Project Cost" means the cost to complete the entire Project, and includes any federal funds, state funds, local matching funds, and any other funds. Agency will report the final cost of each phase of the Project at the completion of each phase, as well as the Total Project Cost at the end of the Project, to the ODOT Regional Local Agency Liaison. Notwithstanding the foregoing, any of Agency's unused STBG funds obligated to the Preliminary Engineering phase of the Project will be returned to Agency's allocation for use on other phases of this Project or other projects as requested in writing by Agency.

c. TERMS OF AGREEMENT, Paragraph 18, Page 4, which reads:

18. By signing this Agreement, Agency agrees to comply with the provisions of the Federal Funding Accountability and Transparency Act (FFATA) and is subject to the following award terms: http://edocket.access.gpo.gov/2010/pdf/2010-22705.pdf and http://edocket.access.gpo.gov/2010/pdf/2010-22706.pdf.
If, in the preceding fiscal year, Agency received more than 80 percent (80%) of its gross revenues from the federal government, those federal funds exceed $25,000,000 annually, and the public does not have access to information about the compensation of executives through reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 or section 6104 of the Internal Revenue Code of 1986, Agency shall report the total compensation and names of its top five executives to State. Agency shall report said information to State within 14 calendar days of execution of this Agreement and annually thereafter, utilizing the FFATA form attached hereto and marked as "Exhibit B."

Shall be deleted in its entirety and replaced with the following:

18. Agency agrees to provide to ODOT the subaward reporting information required to comply with the Federal Funding Accountability and Transparency Act

of 2006 (Pub. L. 109–282), as amended by section 6202 of Public Law 110–252 ("Federal Transparency Act") in accordance with "Revised Exhibit B – Federal Transparency Act Subaward Reporting," attached hereto and by this reference made a part hereof. See **CFR Appendix A to Part 170, Title 2**.

a. Agency's Unique Entity Identifier is: FUAKHMJE2437

b. Agency is not required to report executive compensation information per Federal Transparency Act in accordance with Revised Exhibit B.

d. TERMS OF AGREEMENT, Paragraph 33, Page 9, which reads:

33. State's Regional Local Agency Liaison for this Agreement is Kumar Rethnasamy, Transportation Project Manager, ODOT Region 2, Area 3, 455 Airport Road SE, Building B, Salem, Oregon 97301; phone: (503) 383-6223; email: kumar.rethnasamy@odot.oregon.gov, ~~*Andrew Blair, Transportation Project Manager, ODOT Region 2, Area 3, 455 Airport Road SE, Building B, Salem, Oregon 97301; phone: (503)986-2681; email: Andrew.Blair@odot.oregon.gov,*~~ or assigned designee upon individual's absence. State shall notify the other Party in writing of any contact information changes during the term of this Agreement.

Shall be deleted in its entirety and replaced with the following:

33. State's Regional Local Agency Liaison for this Agreement is Valerie Greenway, Transportation Project Manager, 455 Airport Road SE, Building B, Salem, Oregon 97301; phone: (971) 304-5021; email: Valerie.GREENWAY@odot.oregon.gov, or assigned designee upon individual's absence. State shall notify the other Party in writing of any contact information changes during the term of this Agreement.

3. **Counterparts.** This Amendment may be executed in two or more counterparts (by facsimile or otherwise) each of which is an original and all of which when taken together are deemed one agreement binding on all Parties, notwithstanding that all Parties are not signatories to the same counterpart.

4. **Original Agreement.** Except as expressly amended above, all other terms and conditions of the original Agreement are still in full force and effect. Agency certifies that the representations, warranties and certifications in the original Agreement are true and correct as of the effective date of this Amendment and with the same effect as though made at the time of this Amendment.

5. **Electronic Signatures.** The Parties agree that signatures showing on PDF documents, including but not limited to PDF copies of the Agreement and amendments, submitted or exchanged via email are "Electronic Signatures" under ORS Chapter 84 and bind the signing Party and are intended to be and can be relied upon by the Parties. State reserves the right at any time to require the submission of the hard copy originals of any documents.

State/Agency
Agreement No. 33277

THE PARTIES, by execution of this Agreement, hereby acknowledge that their signing representatives have read this Agreement, understand it, and agree to be bound by its terms and conditions.

This Project is in the 2024-2027 Statewide Transportation Improvement Program (STIP), (Key #21301) that was adopted by the Oregon Transportation Commission on July 13, 2023 (or subsequently by amendment to the STIP).

Marion County, by and through its elected officials

By _____
Commissioner

By _____
Commissioner

By _____
Commissioner

Date _____

APPROVAL RECOMMENDED

By Brian Nicholas (Sep 18, 2026 19:16:19 EDT) 09/18/2026
Director of Public Works Date

By Jan Fritz (Sep 18, 2026 16:46:32 PDT) 09/18/2026
Chief Administrative Officer Date

APPROVED AS TO FORM

By _____ 09/18/2026
Marion County Contracts Date

By _____ 09/18/2026
Marion County Legal Counsel Date

Agency Contact:
Shane Ottosen Jr., P.E.,
Marion County Public Works
5155 Silverton Road NE
Salem, OR 97305
(503) 365-3104
sottosen@co.marion.or.us

STATE OF OREGON, by and through its Department of Transportation

By _____
Region 2 Manager

Date _____

APPROVAL RECOMMENDED

By _____
Certification Program Manager
Date _____

By _____
State Traffic Engineer
Date _____

APPROVED AS TO LEGAL SUFFICIENCY

By _____
Assistant Attorney General

Date _____

State Contact:
Valerie Greenway
Transportation Project Manager
455 Airport Road SE, Bldg. B
Salem, OR 97301
(971) 304-5021
Valerie.GREENWAY@odot.oregon.gov

Revised Exhibit B
Federal Transparency Act Subaward Reporting

Agency agrees to comply with the following provisions in this Exhibit B. For purposes of this Exhibit B, references to "your organization" mean "Agency" and references to "project agreement" mean "Supplemental Project Agreement."

A. Background: To fulfill its obligations under the Federal Funding Accountability and Transparency Act of 2006 (Pub. L. 109–282), as amended by section 6202 of Public Law 110–252 ("Federal Transparency Act"), the Oregon Department of Transportation (ODOT) must report subawards (also known as subrecipient awards) and, when applicable, information about a subrecipient's highly compensated executives to the Federal Funding Accountability and Transparency Act Subaward Reporting System (FSRS). Federal Transparency Act reporting is required for each subaward that equals or exceeds thirty thousand dollars ($30,000) in federal funds.

The Federal Transparency Act requires information on federal awards (federal financial assistance and expenditures) be made publicly available on a single, searchable website: https://www.usaspending.gov/. More information about the Federal Transparency Act is available at https://edocket.access.gpo.gov/2010/pdf/2010-22705.pdf, CFR Appendix A to Part 170, Title 2, and the FSRS website https://www.fsrs.gov/.

B. Unique Entity Identifier: Prior to execution of the project agreement, your organization shall provide to ODOT the federal Unique Entity Identifier (UEI) applicable to the project so that ODOT may include the UEI in its reports to FSRS. Effective April 4, 2022, the UEI is the primary means of identifying entities registered for federal awards in the System for Award Management (SAM) at https://www.sam.gov. If your entity is already registered in SAM, it has been assigned a UEI. The Federal Service Desk has posted instructions for finding the UEI in SAM.

C. Executive compensation: Prior to execution of the project agreement, your organization shall determine and provide to ODOT information on whether your organization's executive compensation information must be reported under the Federal Transparency Act, based on the following criteria:

1. In your organization's previous fiscal year, did your organization receive eighty percent (80%) or more of its annual gross revenues from federal procurement contracts (and subcontracts) and federal financial assistance subject to the Federal Transparency Act, as defined in 2 CFR 170.320 (and subawards), and twenty five million dollars ($25,000,000) or more in federal procurement contracts (and subcontracts) and federal financial assistance subject to the Federal Transparency Act, as defined in 2 CFR 170.320 (and subawards)? (Include parent organization, all branches, and all affiliates worldwide in determining annual gross revenues.)

    - If "yes," proceed to question 2.
    - If "no," reporting executive compensation to ODOT will not be required.

2. Does the public have access to information about the compensation of the senior executives in your organization (including parent organization, all branches, and all affiliates worldwide) through periodic reports filed under section 13(a) or 15(d) of the Securities and Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986? (To determine if the public has access to the compensation information, see the U.S. Security and Exchange Commission total compensation filings at https://www.sec.gov/answers/execomp.htm.)

    - If "yes," reporting executive compensation to ODOT will not be required.
    - If "no," within fourteen (14) calendar days of execution of this Amendment and annually thereafter, your organization shall report the names and total compensation for each of your organization's five most highly compensated executives for the preceding completed fiscal year by completing the following online form:

      Federal Transparency Subaward Report:
      https://forms.office.com/g/WNVpUFmdki.

(Total compensation means the cash and noncash dollar value earned by the executive during your organization's preceding fiscal year. For more information on the compensation information required see 17 CFR 229.402(c)(2).)

D. Subrecipient information to be provided to ODOT: By signing the project agreement with ODOT, your organization certifies it has reviewed and confirmed that the following subrecipient information included in the project agreement is true and accurate at the time of execution:

- Your organization's UEI.
- Whether your organization is required to report executive compensation to comply with the Federal Transparency Act.

E. Technical assistance: If you have any questions about this exhibit, email the ODOT Federal Funding Manager at: ODOTFederalFunding@odot.oregon.gov.