



City of Staunton, Augusta County, City of Waynesboro, Virginia

RFP K00421 SAW Regional P25 Radio System



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1 General Instructions

1.1 Purpose

The City of Staunton, the municipal government of Staunton, Virginia, invites written proposals from qualified proposers to provide a new regional P25 Phase 2 (TDMA) UHF simulcast, trunked radio system to serve the City of Staunton, Augusta County, and the City of Waynesboro (SAW). The purpose of this Request for Proposal (RFP) is to provide PROPOSERS with a common, uniform set of instructions to guide them through the development of their proposals. In addition, this RFP will function as a standard from which to evaluate the PROPOSER'S products and services as they compare to other proposers and as they pertain to the needs of the City of Staunton, Augusta County, and the City of Waynesboro as defined in this document.

1.2 Project Overview

The City of Staunton, Augusta County, and the City of Waynesboro (SAW) seek to replace their legacy UHF analog conventional radio systems with a new regional P25 radio system. SAW requires a single contractor to provide a modern trunked radio system infrastructure, a connectivity network, dispatch consoles, and subscriber radios necessary to support the radio system.

The SAW region is located in western Virginia. The independent Cities of Staunton and Waynesboro are located within Augusta County, VA. The three localities consist of approximately 1,002 square miles of land area. The total population of the SAW region is an estimated 122,130 people. The existing SAW radio systems serve a combined 1700+ public safety and public service personnel. The current radio systems and consoles are at end-of-life and no longer provide sufficient coverage or capacity to meet SAW's needs.

The new SAW communications system will be a UHF P25 Phase 2 (TDMA) Trunked Radio System for all public safety and public service radio users in the SAW region. The successful PROPOSER shall design and install fixed infrastructure equipment that must be maintainable for at least 15 years after Final System Acceptance.

1.3 Definitions

Fiscal Agent: The City of Staunton, Virginia

Procurement Officer:

Chad M. Horvat, Finance Business Manager

City of Staunton

116 W. Beverley Street

Staunton, VA 24402-0058

540.332.3819

PROPOSER: Any firm that submits a proposal in response to this RFP.

CONTRACTOR: The successful PROPOSER with whom a contract is executed pursuant to this RFP.

Project Team: Representatives (typically project managers, lead engineers and significant assigned project members) of SAW, SAW Representatives, and CONTRACTORS, responsible for management and implementation of the project and communication with other parties on the Project Team.

Days:

- “Calendar Days” means any day appearing on the calendar, whether a working day, weekend day, national holiday, state holiday or other day.
- “Days” mean Calendar Days, unless specifically listed.
- “Business Days” means Calendar Days excluding Saturdays, Sundays, and national and/or state recognized holidays.

SAW: City of Staunton, Augusta County, City of Waynesboro Regional System

SAW Representative: The firm (CTA Consultants, LLC) assisting SAW in the evaluation of Proposals, and project implementation.

Scope of Work: The general character and range of Services and supplies needed, the work’s purpose and objectives, and an overview of the performance outcomes expected by SAW.

Services: The services to be performed under the Contract.

Terminal Hardware: all subscriber equipment (mobile, portables, pagers, and control stations).

1.4 Procurement Method

The procurement method is competitive negotiation as defined in Section 2.2-4301 of the Code of Virginia (1950) as amended. This RFP indicates, in general terms, the nature of the project and services being sought. Each PROPOSER is to submit a proposal that best suits the requirements of SAW.

The specific requirements for the contents of proposals are contained in the RFP. Proposers are encouraged to provide additional information not specifically identified as a requirement if that additional information enables the proposal to better suit the needs of SAW.

In order to procure the program that best suits the needs of SAW, the competitive negotiation process and evaluation criteria consider factors in addition to cost.

1.5 Procurement Schedule

The schedule for this procurement is found in Table 1-1. Proposals are due by the date and time indicated. Proposals submitted after this deadline will not be accepted. The City of Staunton reserves the right to postpone the date and time for submission of Proposals at any time prior to the Proposal deadline.

Scheduled Event	Date
RFP Release	November 12, 2021
<i>MANDATORY</i> Pre-Proposal Conference & Site Visits	December 2-3, 2021
Deadline for PROPOSER Questions	January 7, 2022
Deadline for Proposal Submission	February 18, 2022; 4:00 PM
Estimated Contract Execution	May 2022
Anticipated Project Completion	Contract Execution + 24 months

Table 1-1 Procurement Schedule

Proposals shall remain valid without changes for a period of six months after submission deadline date.

1.6 RFP Questions, Answers, and Addenda

All questions are required to be submitted in writing by the prospective PROPOSER using Appendix G PROPOSER Questions excel file. All questions or comments must be received by the date indicated in Table 1-1. Questions will be answered as received. All questions regarding this RFP shall be submitted in writing, using Appendix G, to: SAW@CTA-c.com

All responses will be provided in writing and distributed by the City of Staunton to all prospective PROPOSERS via an official Addendum. Verbal questions and responses to questions are not official and cannot be relied upon for your submission. PROPOSERS shall not communicate with any representatives of the SAW agencies or SAW Representative regarding this RFP unless directed by Procurement Officer.

Should changes to the RFP become necessary, all changes will be made via the addendum process and posted to the City's website (www.staunton.va.us/solicitations) and the eVA procurement site. Receipt of all Addenda must be acknowledged in the Transmittal Letter.

Prior to submitting a Proposal, it is the PROPOSER's responsibility to check the City of Staunton website for any addenda associated with this RFP.

1.7 Mandatory Pre-Proposal Conference & Mandatory Site Visits

A mandatory pre-proposal conference for all interested parties will be held for this RFP. A minimum of one (1) representative from each Proposer shall attend the Mandatory Pre-Proposal Conference in person. A minimum of one (1) representative from each Proposer shall attend the Mandatory Site Visits. A four-wheel drive vehicle is recommended to access all sites. Failure to have one (1) representative attend both the Mandatory Pre-Proposal Conference and the Mandatory Site Visits, in person, will result in the City of Staunton rejecting the PROPOSER'S submission. The schedule for these activities follows:

Scheduled Event	Date / Location
Mandatory Pre-Proposal Conference & Site Visits Registration	November 29, 2021
Mandatory Pre-Proposal Conference (In-Person)	December 2, 2021; 9:00 am City Council Chambers Staunton City Hall 116 W Beverley Street Staunton, VA 24401
Pre-Proposal Conference - Virtual	December 2, 2021; 9:00 am Information will be provided upon registration
Mandatory Site Visits	December 2, 2021, 10:30 am - 5:00 pm December 3, 2021, 8:00 am - 5:00 pm

Table 1-2 Mandatory Pre-Proposal Conference and Mandatory Site Visits Schedule

1.8 Instructions for Submitting Proposals

PROPOSERS shall submit sealed Proposals labeled as follows:

City of Staunton
SAW Regional P25 Phase 2 UHF Radio System
RFP No. K00421

PROPOSER's Name

Proposals will be received at the Procurement Officer's address provided in section 1.3.

PROPOSERS submission shall contain the following:

- one (1) Marked/Stamped Original
- four (4) hard copies
- four (4) electronic copies of all documents in Adobe Acrobat Portable Document format (PDF)
- four (4) electronic copies of the Responsibilities Matrix in Microsoft Excel format
- four (4) electronic copies of the Compliance Matrix in Microsoft Excel format

- four (4) electronic copies of Price Pages in Microsoft Excel format

The PROPOSER is hereby notified this procurement may result in multiple contracts, based upon the fiscal/legal requirements of each SAW jurisdiction. The resulting contract(s) may also be negotiated in phases based upon the financial requirements of each SAW jurisdiction.

1.9 Withdrawal of Proposals

PROPOSERS may modify or withdraw their proposal, either personally or by written request, at any time prior to the scheduled time for opening of proposals.

1.10 Proposal Evaluation

Proposals will be evaluated by a team consisting of representatives of SAW and their consultant. Proposals will be evaluated in accordance with the categories of evaluation found in Appendix A.

1.11 Proposal Questions

The evaluation team will generate a list of written questions for each Proposal and will forward the questions to the PROPOSER. Each PROPOSER shall submit written responses to the Procurement Officer within five (5) working days from the receipt of the questions. The written responses will take precedence over the Proposal.

1.12 Competitive Negotiations

The evaluation process shall be based upon the criteria identified in Appendix A of this Request for Proposals. The City of Staunton shall engage in individual discussions with two or more PROPOSERS deemed fully qualified, responsible and suitable on the basis of initial responses and with emphasis on professional competence, to provide the required services. As an option, the evaluation team may request discussions with PROPOSERS, as necessary, to clarify material in the PROPOSERS submission, to help determine those fully qualified and best suited.

1.13 Oral Presentations

The City of Staunton may invite two or more PROPOSERS to make oral presentations. Suitable time will be scheduled for each PROPOSER's presentation. Each PROPOSER should allow adequate time during this period for questions from the SAW Evaluation Team.

During the oral presentation, discussions shall be limited to the system, equipment and software proposed, including future capabilities for expansion of the system. Price shall NOT be discussed during the oral presentation; the primary purpose of the oral presentation is to provide a forum for discussion of what has been proposed and is not a negotiating session.

1.14 Best and Final Offer

Best and Final Offer (BAFO) may be requested by the City of Staunton.

1.15 Intent to Award

The award of a contract shall be determined in the sole discretion of the City of Staunton based upon evaluation of all information as the City of Staunton may request. The City of Staunton reserves the right to waive any informality in proposals submitted in response to this RFP when such waiver is in the best interest of the City of Staunton.

Upon the award or the announcement of the decision to award a contract as a result of this solicitation, the City of Staunton will publicly post such notice for a minimum of ten (10) days or will notify all responsive PROPOSERS.

1.16 Contract Negotiations

The PROPOSER whose Proposal is found to be the most advantageous to the City of Staunton will be offered the opportunity to enter into an Agreement with the City of Staunton. The scope, terms, and conditions of that Agreement shall be in substantial conformance with the terms, conditions, and specifications described in this RFP.

The City of Staunton reserves the right to negotiate contract terms with the successful PROPOSER for equipment/services other than those specifically stated in this RFP in the best interest of the City of Staunton and agreed to by the PROPOSER, in accordance with § 2.2-4318 of the Code of Virginia. Additional work of reasonable scale shall be priced consistent with proposal to allow for additions and future expansions.

Notice of award will be posted on the Staunton City Website at:

<http://www.staunton.va.us/solicitation-results>

1.17 Contract Execution

Upon the successful completion of contract negotiations, the City of Staunton will prepare and submit a final negotiated contract to the awarded PROPOSER at the address provided in the Proposal. The awarded PROPOSER shall execute the contract within 14 days after the receipt of the contract.

1.18 Contract Conditions

The PROPOSER selected shall not:

1. The PROPOSER shall not use his/her position for the actual or apparent purpose of private gain other than payment for services rendered for himself/herself or another person, particularly one with whom he/she has family, business, or financial ties.

2. The PROPOSER shall not convey inside information that has not become part of the body of public information and that would not be available upon request, directly to any person for the purpose of private gain for himself/herself or another person, particularly one with whom he/she has family, business, or financial ties.

1.19 RFP Property of the City of Staunton

This RFP in its entirety is the property of the City of Staunton. The PROPOSER shall not copy or disseminate any portion of these specifications without express written authorization of the City of Staunton except as necessary in the preparation of the Proposal. Any authorized copies of these specifications or portions thereof shall include a similar paragraph prohibiting further copying or dissemination.

1.20 Rights to Submitted Material

All materials submitted by the PROPOSER in response to this RFP shall become the property of the City of Staunton.

1.21 Confidentiality

Proposals will not be opened publicly. Any PROPOSERS who responds to an RFP, upon request shall be afforded the opportunity to inspect proposal records within a reasonable time after the evaluation and negotiation of proposals are complete but prior to award, except in the event the City of Staunton decides not to accept any of the proposals and to resolicit.

If a PROPOSER believes that any portion of its Proposal contains proprietary information exempt from public disclosure, the PROPOSER shall clearly identify such portions in its Proposal by completing and submitting **Appendix E Proprietary/Confidential Information Identification Form**. The City of Staunton will make a determination as to the validity of the non-disclosure claim. Identifying the entire Proposal as trade secret, confidential or otherwise exempt from disclosure is not acceptable.

The City of Staunton shall not be liable for disclosure of any proprietary information that is not clearly identified as such in the Proposal. Refer to RFP Section titled **Public Inspection of Procurement Records** for compliance requirement to Section 2.2-4342 of the Code of Virginia.

1.22 Incurred Costs

Any costs incurred by PROPOSERS in preparing or submitting proposals are the PROPOSER'S sole responsibility; the City of Staunton will not reimburse any PROPOSER for any costs incurred as a result of the preparation of this Request for Proposal.

1.23 Proposal Errors and Irregularities

The City of Staunton reserves the right to waive minor errors or irregularities in any Proposal if it appears that such errors or irregularities were inadvertent. Any such errors or irregularities shall be corrected in the Proposal prior to contract execution.

1.24 Right to Reject

The City of Staunton reserves the right, at any time prior to award of the contract, to reject any and all Proposals, to make no award, and/or to issue a new Request for Proposal, or make modifications, corrections of additions to the information contained herein.

The City of Staunton is not liable to any PROPOSER for any loss or expense caused by or resulting from the rejection or cancellation of a solicitation, Proposal, or award. All timely submitted Proposals will become part of the solicitation file.

PROPOSERS are cautioned this is a Request for Proposal, NOT a request to contract.

1.25 Public Inspection of Procurement Records

Proposals submitted shall be subject to public inspection only in accordance with Section 2.2-4342 of the Code of Virginia, which reads, in essence, as follows:

Public inspection of certain records:

1. Except as provided in this section, all proceedings, records, contracts, and other public records relating to procurement transactions shall be open to the inspection of any citizen, or any interested person, firm or corporation, in accordance with the Virginia Freedom of Information Act.
2. Cost estimates relating to a proposed procurement transaction prepared by or for a public body shall not be open to public inspection.
3. Any competitive negotiation PROPOSER, upon request, shall be afforded the opportunity to inspect proposal records within a reasonable time after the evaluation and negotiations of proposals are completed but prior to award, except in the event that the City of Staunton decides not to accept any of the proposals and to reopen the contract. Otherwise, proposal records shall be open to public inspection only after award of the contract.
4. Any inspection of procurement transaction records under this section shall be subject to reasonable restrictions to ensure the security and integrity of the records.

Trade secrets or proprietary information submitted by a PROPOSER or CONTRACTOR in connection with a procurement transaction shall not be subject to the Virginia Freedom of Information Act; however, the PROPOSER or CONTRACTOR shall (i) invoke the protections of this section prior to or upon submission of the data or other materials, (ii) identify the data or other materials to be protected, and (iii) state the reasons why protection is necessary. PROPOSER may not invoke this protection on the entire proposal – only on those sections or data which are considered trade secrets or proprietary.

1.26 Mandatory Options

Mandatory Options identify goods and/or services that ***shall*** be offered by the PROPOSER, ***if the mandatory option is available*** as part of the PROPOSERS goods and/or services. Detailed technical descriptions and pricing shall be included in the proposal submission, as a mandatory option for purchase by the City of Staunton at their discretion. If a mandatory option is not available, the PROPOSER shall mark N/A for the Mandatory Option section in the Compliance Matrix. ***Costs for these items are not included in the base cost proposal evaluation.*** These mandatory options may be selected for implementation or inclusion with the initial contract, or at any time during the term of the price guarantee for the price quoted in the Proposal. Failure to offer all requested and PROPOSER **available** Mandatory Options may result in City of Staunton rejecting the PROPOSER'S submission.

1.27 CONTRACTOR Understanding

It is understood and agreed that the CONTRACTOR has, by careful examination, satisfied himself as to the nature and locations of the work, the character of equipment and facilities needed preliminary to and during the prosecution of the work, the general and local conditions and all other matters which in any way effect the work under this contract. No verbal agreement or conversation with any officer, agent or employee of the City of Staunton either before or after the execution of this contract, shall affect or modify any of the terms or obligations herein contained.

2 Proposal Outline

The PROPOSERS submission shall use the following outline:

Section 1 Table of Contents
Section 2 Transmittal Letter
Section 3 Executive Summary
Section 4 Scope of Work
Section 5 General System Overview
Section 6 Radio System Description
Section 7 Connectivity Network Description
Section 8 Subscriber Equipment Description
Section 9 Physical Facilities Description
Section 10 Qualifications and References
Section 11 Appendix B Compliance Matrix
Section 12 Appendix C Responsibilities Matrix
Section 13 Appendix D Pricing Forms
Section 14 Appendix E Proprietary/Confidential Information Identification Form
Section 15 Appendix F Certification of Interest & Relationships

2.1 Letter of Transmittal & Executive Summary

The introduction and letter of transmittal shall provide the necessary certification from the PROPOSER that the signer is authorized to make this Proposal on behalf of the PROPOSER. The letter shall designate by name not more than two individuals authorized to negotiate and sign the contract with the City of Staunton on behalf of the PROPOSER. The executive summary shall contain a synopsis of the SAW specific scope of the project and the PROPOSER'S general plan for implementation. The Executive Summary may also briefly set forth any particular information the PROPOSER wishes to bring to the City of Staunton's attention; however, the Executive Summary is not intended to contain general corporate information and statistics.

2.2 Scope of Work

These sections shall describe PROPOSER's design, including maps, figures, tables, photographs, etc. The PROPOSER shall describe capabilities, limitations, operational procedures of all proposed equipment (including mandatory options) and shall provide a specifications sheet for each major component of the proposed system.

2.3 Qualifications and References

2.3.1 Project Manager / Project Engineer Resumes and Reference

PROPOSER shall provide a detailed resume for the proposed Project Manager and Project Engineer. Each resume shall contain a minimum of five (5) public safety critical communications system implementations of similar size and complexity and a brief description of the team member's role and responsibility on each project. Each reference shall include a point of contact, email, and phone number, that will provide detailed information as to the performance of the Project Manager and Project Engineer. **Failure to provide this information for both the Project Manager and the Project Engineer may result in disqualification or loss of evaluation points.**

2.3.2 Warranty and Maintenance Service Organization Experience and References

PROPOSER shall provide information on a minimum of five (5) public safety critical communications systems the *proposed warranty and maintenance service organization* has provided services similar in nature and complexity. Each reference shall include a point of contact, email, and phone number, that will provide detailed information as to the performance of the *proposed warranty and maintenance service organization*. **Failure to provide this information may result in disqualification or loss of evaluation points.**

2.4 Compliance Matrix

The PROPOSER shall provide a compliance statement by completing the compliance matrix found in APPENDIX B. This document is included in a Microsoft Excel file named "PROPOSER'S Name for the City of Staunton RFP K00421 Appendix B.xlsx" included with the RFP in soft copy available on the City's website (www.staunton.va.us/solicitations) and the eVA procurement site.

The PROPOSER shall provide this completed excel file as part of the PDF Proposal submission and in its native Microsoft Excel format. **Failure to provide this information in its native Microsoft Excel format may result in disqualification or loss of evaluation points.**

The compliance spreadsheet provides space for a compliance response and explanation for each section of the RFP. There are three valid responses:

Response	Meaning
Comply	Proposal <i>fully</i> complies with all requirements as stated in the numbered section.

Response	Meaning
Comply with Clarification	Proposal complies with the intent of the requirements as stated in the numbered section; however, the means of implementing the requirement necessitates a clarification. * If PROPOSER provides an unsatisfactory explanation of their compliance, the City of Staunton may, at their discretion, consider this an exception.
Exception	Proposal does <i>not</i> comply with requirements of the section. Explain the nature of the exception(s). If you take exception to more than one part of a section, identify the number of exceptions taken and provide explanations for each. Any item not explicitly identified as an exception in the Proposal will be considered compliant.
Not Applicable	This category should <i>only</i> be used if the section does not apply to the PROPOSER'S Proposal or system configuration. <i>Use this response with caution.</i>

2.5 Responsibilities Matrix

The PROPOSER shall provide a responsibilities statement by completing the responsibilities matrix found in APPENDIX C. This document is included in a Microsoft Excel document named "PROPOSER'S Name for the City of Staunton RFP K00421 .xlsx" included with the RFP in soft copy available on the City's website (www.staunton.va.us/solicitations) and the eVA procurement site.

The PROPOSER shall provide this completed excel file as part of the PDF Proposal submission and in its native Microsoft Excel format. **Failure to provide this information in its native Microsoft Excel format may result in disqualification or loss of evaluation points.**

The responsibilities matrix shall contain, at a minimum, the following categories:

- Management
- Detailed Design Review (DDR)
- System Integration
- Site Work
- Tower Work
- Shelter work
- Generators
- System Installation / Optimization
- Acceptance Testing
- Subscriber Equipment
- Training
- Final Acceptance

The PROPOSER may include additional categories and subcategories, as well as additional lines within the subcategories. This document will be used throughout the implementation of the project to enhance organization and efficiency.

2.6 Pricing Forms

The PROPOSER shall complete the Pricing Forms in APPENDIX D. A soft copy of this form is found in a Microsoft Excel file named “PROPOSER’S Name – the City of Staunton RFP K00421 Appendix D.xlsx” included with the RFP in soft copy available on the City’s website www.staunton.va.us/solicitations). The PROPOSER shall provide this completed excel file as part of the PDF Proposal submission and in its native Microsoft Excel format. **Failure to provide this information in its native Microsoft Excel format may result in disqualification or loss of evaluation points.**

Failure to fill in all blanks of the Pricing Forms and to supply all information required may be cause for rejection of the Proposal. Any attempt to modify the structure or formulas in the Pricing Forms may be cause for rejection of the Proposal. If the PROPOSER finds a need to change the Pricing Forms a request must be made in writing, and if the City of Staunton deems it appropriate to make a change, the document will be re-issued via the RFP Addenda process.

Failure to entirely complete Sheet K Mandatory Project Mandatory Options and Sheet L Mandatory Unit Pricing **may result in disqualification or loss of evaluation points.**

If the PROPOSER wishes to provide additional pricing information, the PROPOSER may submit the information on additional sheets and electronic files. In all cases, the hardcopy of the pricing shall be binding.

3 General Terms and Conditions

3.1 Proposed Terms and Conditions

In the case that any supplemental terms and conditions are found to conflict with the terms and conditions as set forth in this Section of the RFP, the terms, and conditions as set forth in this Section of the RFP shall take precedence, unless a term and condition is negotiated and revised in writing.

3.2 Best and Final Offer (BAFO)

At the conclusion of negotiations, the proposer(s) may be asked to submit in writing, a Best and Final Offer (BAFO). After the BAFO is submitted, no further negotiations shall be conducted with the PROPOSER(S). The PROPOSER'S proposal will be rescored to combine and include the information contained in the BAFO. The decision to award will be based on the final evaluation including the BAFO.

3.3 Order of Precedence

The following items shall be incorporated by reference into the Contract. These items shall take precedence in the order in which they are listed:

1. Amendments to Contract Agreement
2. Contract Agreement Signature Page
 - Exhibit A - Compliance Matrix as amended
 - Exhibit B – Payment Milestones & Pricing Pages as amended
 - Exhibit C - Project Schedule as amended
 - Exhibit D - Performance and Payment Bonds
 - Exhibit E - Responsibilities Matrix, as amended
3. Written clarifications and negotiated resolutions
4. RFP addenda
5. RFP
6. Additional Proposer Submitted Contract Exhibits
7. Proposal amendments
8. Proposal

3.4 Anti-Collusion Certification

By their signatures on the submitted Proposal, the PROPOSER and the signatory thereto on behalf of the PROPOSER (the “Signatories”) certify this proposal is made without prior understanding, agreement, or connection with any corporation, firm or person submitting a proposal for the same materials, supplies, equipment, or services and is in all respects fair and without collusion or fraud. The Signatories understand collusive bidding is a violation of the Virginia Governmental Frauds Act and

Federal Law, and can result in fines, prison sentences, and civil damage awards. The Signatories agree to abide by all conditions of this proposal or Contract and certify the Signatories are authorized to sign this bid, proposal, and/or Contract for the proposer and/or Contractor.

3.5 Certification of Interest & Relationships

The extent that either CONTRACTOR or any of CONTRACTOR'S officers, directors, or executive employees, maintains a financial or familial relationship with any person acting for, or employed by, the City of Staunton, Augusta County, or the City of Waynesboro, Contractor shall reveal such relationships. In accordance with this paragraph, CONTRACTOR shall execute the certification attached hereto as, Appendix F, and submit the certification contemporaneously with the executed Contract.

3.6 Anti-Kickbacks Certification

By their signatures on the submitted Proposal, the PROPOSER, and the signatory thereto on behalf of the PROPOSER (the “Signatories”) certify that they have not offered or received any kickback from any other PROPOSER, contractor, supplier, manufacturer, or subcontractor in connection with any response to this RFP or Contract resulting therefrom. A kickback is defined as an inducement for the award of a contract, subcontracts, or order, in the form of any payment, loan, subscription, advance, deposit of money, services or anything, present or promised, unless consideration of substantially equal or greater value is exchanged. Further, no person shall demand or receive any payment, loan, subscription, advance, deposit of money, services, or anything of value in return for an agreement not to compete on a public contract.

3.7 Gifts by PROPOSER or CONTRACTOR

PROPOSER shall not confer on any public employee having official responsibility for a procurement transaction any payment, loan, subscription, advance, deposit of money, services, or anything of more than nominal value, present or promised, unless consideration of substantially equal or greater value is exchanged.

3.8 Audit

The CONTRACTOR hereby agrees to retain all books, records, and other documents relative to the Contract for three (3) years after final payment and all other pending matters related in any way to the Contract are closed.

The City of Staunton, its authorized agents, state auditors, any Federal grantor agency, the Comptroller of the U.S., or any of their duly authorized representatives shall have access to any books, documents, papers, and records of the CONTRACTOR which are directly pertinent to the Contract for the purpose of making audits, examinations, excerpts, or transcriptions.

3.9 Pricing and Payment

The Total Agreement Price for the Hardware, the Software licenses, and the Services shall be paid by the City of Staunton to CONTRACTOR as follows:

3.9.1 Infrastructure Hardware and Services

- i. Five percent (5%) of the Total Agreement Price (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) shall be due upon SAW's approval of the Contract Design Review.
- ii. Ten percent (10%) of the Total Agreement Price (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) shall be due upon the SAW's approval of the Detailed Design Review.
- iii. Twenty percent (20%) of the Total Agreement Price (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) shall be due upon the SAW's approval of Infrastructure Hardware (Radio and Microwave) factory staging as described in the project schedule.
- iv. Ten percent (10%) of the Total Agreement Price (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) shall be due upon tower construction/remediation.
- v. Fifteen percent (15%) of the Total Agreement Price (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) shall be due upon site civil work completion.
- vi. Twenty percent (20%) of the Total Agreement Price (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) shall be due upon completion of installation of Infrastructure Hardware. This payment is contingent upon resolution of all site inspection punch list items.
- vii. Ten percent (10%) of the Total Agreement Price (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) shall be due upon the City of Staunton's approval of Conditional System Acceptance.
- viii. Ten percent (10%) of the Total Agreement Price (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) plus any remaining unpaid portion of the Total Agreement Price for all Hardware, Software and Services to be provided under the terms of this Agreement (excluding the aggregate price of the Terminal Hardware included in the Total Agreement Price) shall be due upon Final Project Acceptance.

3.9.2 Terminal Hardware and Services

- i. Fifty Percent (50%) of the purchase price of Terminal Hardware shall be invoiced upon (F.O.B. destination) of units on a per unit basis upon the City of Staunton's written authorization.

- ii. Fifty Percent (50%) of the purchase price of Terminal Hardware shall be invoiced upon completion of installation and programming of a unit on a per unit basis.

3.9.3 Payment Terms

Any contract awarded as a result of this Request for Proposal shall incorporate the terms and conditions of Article 4 of the Virginia Public Procurement Act with respect to Prompt Payment.

3.9.3.1 To Prime CONTRACTOR

- a. Invoices for items ordered, delivered and accepted shall be submitted by the contractor directly to the payment address shown on the purchase order/contract. All invoices shall show the purchase order number.
- b. Any payment terms requiring payment in less than 30 days will be regarded as requiring payment 30 days after satisfactory invoice or delivery, whichever occurs last. This shall not affect offers of discounts for payment in less than 30 days, however.
- c. All goods or services provided under the contract, which are to be paid for with public funds, shall be billed by the contractor at the contract price, regardless of which public agency is being billed.
- d. The following shall be deemed to be the date of payment: the date of postmark in all cases where payment is made by mail, or the date of offset when offset proceedings have been instituted as authorized under the Virginia Debt Collection Act.
- e. Unreasonable Charges. Under certain emergency procurements and for most time and material purchases, final job costs cannot be accurately determined at the time orders are placed. In such cases, contractors should be put on notice that final payment in full is contingent on a determination of reasonableness with respect to all invoiced charges. Charges which appear to be unreasonable will be researched and challenged, and that portion of the invoice held in abeyance until a settlement can be reached. Upon determining that invoiced charges are not reasonable, the City of Staunton shall promptly notify the contractor, in writing, as to those charges which it considers unreasonable and the basis for the determination. A contractor may not institute legal action unless a settlement cannot be reached within thirty (30) days of notification. The provisions of this section do not relieve the City of Staunton of its prompt payment obligations with respect to those charges which are not in dispute (Code of Virginia, § 2.2-4363).

3.9.3.2 To Subcontractors

A proposer awarded a contract under this solicitation is hereby obligated:

- a. To pay the subcontractor(s) within seven (7) days of the proposer's receipt of payment from the City for the proportionate share of the payment received for work performed by the subcontractor(s) under the contract; or

- b. To notify the agency and the subcontractor(s), in writing, of the proposer's intention to withhold payment and the reason.

3.9.3.3 CONTRACTOR Obligation

The CONTRACTOR is obligated to pay the subcontractor(s) interest at the rate of one percent per month (unless otherwise provided under the terms of the contract) on all amounts owed by the proposer that remain unpaid seven (7) days following receipt of payment from the City of Staunton, except for amounts withheld as stated in (3.9.3.2) above. The date of mailing of any payment by U.S. Mail is deemed to be payment to the addressee. These provisions apply to each sub-tier contractor performing under the primary contract. A proposer's obligation to pay an interest charge to a subcontractor may not be construed to be an obligation of SAW.

3.9.3.4 Billing Terms

The CONTRACTOR may bill monthly, for Items 3.9.1.iv, 3.9.1.v, 3.9.1.vi, 3.9.2.i, and 3.9.2.ii above. All invoices shall provide detailed deliverable items, e.g., submittals, equipment, services, etc., and price and include the required Application and Certificate for Payment. The Application and Certificate for Payment may use AIA Form G702-1992 and G703-1992 Continuation Sheet, or similar. The City of Staunton representative will review and certify for payment before approval by the City of Staunton.

3.10 Price Guarantee/Escalation

The CONTRACTOR shall guarantee all prices quoted in the price proposal forms, as negotiated, for equipment, accessories, and services shall not be increased through the end of the warranty period.

The CONTRACTOR shall guarantee all prices quoted in the price proposal forms, as negotiated, for equipment, accessories, and services shall not increase at a rate higher than the U.S. Consumer Price Index for ten (10) years after the end of the warranty period.

The CONTRACTOR shall provide SAW a complete commercial price listing for all applicable products and parts offered by the CONTRACTOR. The CONTRACTOR shall continue to send this price listing to SAW once every twelve months until asked to discontinue this practice by SAW.

After the price guarantee term expires, additional equipment and services shall be priced in accordance with the price escalation provisions of this RFP. These items, as priced, provide information SAW requires to make decisions concerning design alternatives, expansion and/or enhancements to the operation of the system design under consideration.

3.11 Contract Security

A Performance Bond and a Labor and Material Payment Bond, each in a sum equal to 100% of the negotiated price and duly executed by the CONTRACTOR as principal and by a surety company qualified to do business under the laws of the Commonwealth of Virginia and satisfactory to the City of Staunton, as surety, will be required for the faithful performance of the contract, the payment from labor and materials, and for the guarantee and maintenance of the work. The successful PROPOSER shall furnish the Performance and Labor and Material Payment Bonds within ten (10) business days of the executed contract.

3.12 Legality

Any required SAW permits must be obtained by the CONTRACTOR and will be provided at no cost to SAW. The successful CONTRACTOR must obtain at his/her own expense, the required business license from the City of Staunton, Commissioner of Revenue's Office, the City of Waynesboro and Augusta County prior to beginning work. All equipment and/or installation must meet all applicable local, State, and Federal codes. Pursuant to Code of Virginia §2.2-4311.2 subsection B, a PROPOSER authorized to transact business in the Commonwealth pursuant to Title 13.1 or Title 50 is required to include in its offer or proposal the identification number issued to it by the State Corporation Commission (SCC). Any PROPOSER that is not required to be authorized to transact business in the Commonwealth as a foreign business entity under Title 13.1 or Title 50 or as otherwise required by law is required to include in its offer or proposal a statement describing why the proposer is not required to be so authorized.

The successful PROPOSER shall comply in every way with the requirements of state and local laws, codes, and ordinances. No claims for additional payment will be approved for changes required to comply with codes, ordinances, and regulations in effect on date of offering, since it is the PROPOSER's responsibility to become familiar with such requirements before submitting a proposal.

3.13 Law and Courts

The CONTRACTOR shall comply with all federal laws, Commonwealth of Virginia laws, and local statutes, ordinances, and regulations in effect as of the Effective Date of this Agreement or hereafter adopted, in performance of scope of work set forth herein. Any litigation with respect thereto shall be filed and maintained solely in the General District Court or the Circuit Court of the City of Staunton, Virginia.

3.14 Contractual Claims

Contractual claims, whether for money or other relief, shall be submitted in writing to the City of Staunton Procurement Officer no later than 60 calendar days after final payment; however, written notice of the CONTRACTOR's intention to file such claim shall have been given at the time of the occurrence or beginning of the work upon which the claim is based. SAW shall issue a decision

regarding such claim, in writing, no later than 60 calendar days subsequent to notification to the City of Staunton.

For good cause and as consideration for executing this contract, the PROPOSER acting herein by and through the person signing this Proposal on behalf of the PROPOSER as duly authorized agent, hereby conveys, sells, assigns, and transfers to SAW all rights, title and interest in and to all causes of action it may now or hereafter acquire under the anti-trust laws of the United States and the Commonwealth of Virginia, relating to the particular goods or services purchased or acquired by SAW through this contract.

3.15 Sales Tax Exemption

The City of Staunton is exempt from Virginia state sales and use taxes. The City of Staunton will furnish the CONTRACTOR a Sales and Use Tax Exemption Certificate prior to the issuance of a notice to proceed. The Proposal shall include all other applicable taxes and fees.

3.16 Liquidated Damages

Delivery is required not later than the mutually agreed upon date for Final Acceptance. It is understood and agreed by the PROPOSER that time is of the essence in the delivery of services, materials, or equipment of the character and quality specified in the RFP document. In the event these specified services, materials, or equipment are not delivered by the date specified there will be deducted, not as a penalty but as liquidated damages, the sum of \$2,500 per day for each and every calendar day of delay beyond the time specified; except that if the delivery be delayed by any act, negligence, or default on the part of SAW, public enemy, war, embargo, fire, or explosion not caused by the negligence or intentional act of the contractor or his supplier(s), or by riot, sabotage, or labor trouble that results from a cause or causes entirely beyond the control or fault of the contractor or his supplier(s), a reasonable extension of time as the procuring public body deems appropriate may be granted. Upon receipt of a written request and justification for any extension from the contractor, the purchasing office may extend the time for performance of the contract or delivery of goods herein specified, at the purchasing office's sole discretion, for good cause shown.

3.17 Indemnity

The CONTRACTOR shall indemnify and hold harmless the City of Staunton, its members of Council, officers, directors, agents and employees against any and all claims, liabilities, losses, damages, demands, payments, suits, actions, recoveries, and judgments of every nature and description brought or recoverable against the City of Staunton, or by reason of any negligent act or omission of the CONTRACTOR, its agent, or its employees, in the execution of the work, or in consequence of any negligence or carelessness in guarding the same, including all liability for, or growing out of any infringement of letter patent or copyright of the United States, in respect to the normal use of the proposed and installed system. The City of Staunton will promptly give the CONTRACTOR notice of

any such claim. This shall include providing the City of Staunton with a defense to any legal action brought against the City of Staunton as a result of CONTRACTOR'S acts or omissions.

The successful PROPOSER shall assume all risk and bear any loss or injury to the property or persons occasioned by neglect or accident during the progress of work until the same shall be completed and accepted. The CONTRACTOR shall also assume all blame or loss by reason of neglect or violation by CONTRACTOR of any state or federal law or municipal rule regulation or order. The CONTRACTOR shall give to the proper authorities all required notices relating to the work and shall be responsible for ensuring all official construction permits and licenses are obtained prior to the beginning of work, and for paying all proper fees. SAW will sign permit requests as required and as submitted by the CONTRACTOR. The CONTRACTOR shall make good, at no additional cost to SAW, any damage that may have occurred to any adjoining building, structure, or utility in consequence of this work. SAW agrees to notify CONTRACTOR in writing as soon as practicable of any claim, demand, or cause of action for which City of Staunton will request indemnification from CONTRACTOR. SAW will provide CONTRACTOR with the necessary information and assistance to defend or settle such claim, demand, or cause of action. The obligations of CONTRACTOR under this paragraph shall survive the expiration of this Agreement.

At no time shall CONTRACTOR permit any mechanics or similar liens to attach to SAW's premises on account of labor or material furnished to proposer or claimed to have been furnished to proposer, in connection with its work hereunder.

3.18 Liability and Litigation

The City shall not indemnify or hold harmless any contractor or other third party. The City does not waive any right or release any party from liability, whether on its own behalf or on behalf of any boards, employees or agents. The City does not waive the right to trial by jury for any cause of action arising from the Contract and shall not submit any Contract claim to binding arbitration or mediation. The City shall not be liable to contractor for any special, punitive or exemplary damages arising from the performance of the contract, including, but not limited to, incidental damages, and lost profit and lost wages, even if such special damages are reasonably foreseeable. Any provision(s) in the Contract contrary to these statements is/are hereby deleted and rendered void.

3.19 Copyrights

The Proposer hired pursuant to this contract is prohibited from copyrighting any papers, interim reports, forms, or other materials resulting from performance under this agreement, without the written permission of the Purchasing Agency. Data and their analysis, forms, and images gathered or developed during fulfillment of this contract may be used by the Proposer in subsequent copyrighted publications, provided the copyrights do not in any way restrict or limit the Purchasing Agency's ownership, use, or distribution of said information, forms, or images.

3.20 Appropriations

Agreements are made subject to the appropriation of funds by the City of Staunton, Augusta County, and the City of Waynesboro and are null and void in the event of non-appropriation by the SAW jurisdictions. Non-appropriation of funds shall not be deemed a cancellation and shall terminate this agreement without recourse and with no liability on the part of SAW.

3.21 Insurance Requirements

3.21.1 Insurance Coverages

During the term of this contract, the CONTRACTOR shall procure and maintain insurance coverages with insurance companies rated by A. M. Best Company as A – VIII or better. The company(ies) shall be authorized to do business under the laws of the Commonwealth of Virginia and be acceptable to the City of Staunton and shall provide the following minimum types of insurance:

- a) Commercial General Liability Insurance – This will cover claims for Bodily Injury, Property Damage, Personal and Advertising Injury, Products and Completed Operations, which may arise from operations under the Contract, whether such operations be performed by the CONTRACTOR or by any Subcontractor or Independent Contractor, or by anyone directly or indirectly employed by any of them. Such insurance shall include coverages "X", "C" and "U" for explosion, collapse of other structures and underground utilities, as well as Contractual Liability Insurance covering the requirements outlined in the General Conditions.

This insurance shall name the City of Staunton, the City Council and its employees as additional insured by endorsement to the Commercial General Liability policy. Such policy shall not have a restriction on the limits of coverage provided to the City of Staunton as an additional insured. The City of Staunton shall be entitled to protection up to the full limits of the CONTRACTOR'S policy regardless of the minimum requirements specified in this contract. If endorsements to the Commercial General Liability insurance policies cannot be made, then separate policies providing such protection shall be purchased by the CONTRACTOR.

The Policy shall have the following minimum limits:

- \$1,000,000 Each Occurrence Limit
- \$1,000,000 General Aggregate Limit
- \$1,000,000 Personal and Advertising Injury Limit
- \$1,000,000 Products and Completed Operations Aggregate Limit
- \$5,000 Medical Expense Limit

This insurance shall include the following provisions and /or endorsements:

The General Aggregate limit shall apply on a "per project" and on a "per location" basis;

- i. Coverage shall apply to all liability arising from all premises and operations conducted by the CONTRACTOR, subcontractors and independent contractors;

- ii. The CONTRACTOR agrees that liability arising from Products and Completed Operations will be covered. Such liability coverage will be maintained for two years after completion of the Work.
 - iii. The CONTRACTOR shall require each of his Subcontractors to procure and maintain Commercial General Liability Insurance of the type specified in this document in the minimum amounts required by the City of Staunton and the CONTRACTOR, during the term of this subcontract.
- b) Worker's compensation and Employer's Liability Insurance -- Worker's Compensation and Employer's Liability Insurance for the Contractor's employees engaged in the Work under this Contract, in accordance with the statutory requirements of the Commonwealth of Virginia. The CONTRACTOR shall require each of his Subcontractors to provide Worker's Compensation and Employer's Liability Insurance for all of the Subcontractor's employees engaged on such subcontracts. If any class of employees engaged on work under the Contract is not protected under the Worker's Compensation statute, the CONTRACTOR shall provide similar protection for these employees in amounts not less than the legal requirements. The amount of Employer's Liability Insurance for the CONTRACTOR and each of his Subcontractors shall be not less than:

- \$100,000 per employee for Bodily Injury.
- \$100,000 per employee for disease
- \$500,000 per policy for disease

The Worker's Compensation and Employer's Liability Insurance policy shall include an "all states" or "other states" endorsement.

- c) Commercial Automobile Liability Insurance -- Commercial Automobile Liability Insurance, including coverage for owned, hired, non-owned and borrowed vehicles used in the work with minimum limits of \$1,000,000 Combined Single Limit per occurrence. This insurance shall name the City of Staunton, the City Council and its employees as additional insureds by endorsement to the Commercial Automobile Liability policy. Such policy shall not have a restriction on the limits of coverage provided to the City of Staunton as an additional insured. The City of Staunton shall be entitled to protection up to the full limits of the CONTRACTOR'S policy regardless of the minimum requirements specified in this contract.
- d) Umbrella or Excess Liability -- Umbrella Liability or Excess Liability Insurance with the following minimum limits of:

- \$5,000,000 Each Occurrence
- \$5,000,000 Annual Aggregate

The following policies shall be scheduled as underlying policies:

- Commercial General Liability
- Commercial Automobile Liability
- Employers Liability

This insurance shall name the City of Staunton, the City Council and its employees as additional insured by endorsement to the Umbrella or Excess Liability policy. Such policy shall not have a restriction on the limits of coverage provided to the City of Staunton as an

additional insured. The City of Staunton shall be entitled to protection up to the full limits of the CONTRACTOR'S policy regardless of the minimum requirements specified in this contract.

- e) Professional Liability -- Errors and Omissions Insurance with the following minimum limits of:
- \$3,000,000 limit per claim and in the Aggregate

3.21.2 Proof of Insurance

Proof of insurance for each type of coverage listed herein shall be provided within 10 Days after issuance of the Award Letter for the Contract, and no Work shall proceed unless all such insurance is in effect. The CONTRACTOR shall not allow any Subcontractor to commence work on his subcontract until all such insurance of the Subcontractor has been so obtained and approved by the CONTRACTOR and found to be in accordance with the requirements set forth herein. The CONTRACTOR certifies by commencement of the Work that his insurance and that of Subcontractors is in effect and meets the requirements set forth herein.

3.21.3 CONTRACTOR Liability

The CONTRACTOR shall purchase and maintain required liability and all other insurance as is appropriate for the Work being performed and furnished. The insurance shall provide protection from claims which may arise out of or result from Contractor's performance and furnishing of the Work and CONTRACTOR'S other obligations under the Contract Documents, whether it is to be performed or furnished by CONTRACTOR, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform or furnish any of the Work, or by anyone for whose acts any of them may be liable:

- a) claims under Worker's Compensation, Employers Liability, disability benefits, and other similar employee benefit acts;
 - b) claims for damages because of bodily injury, occupational sickness or disease, or death of CONTRACTOR'S employees;
 - c) claims for damages because of bodily injury, sickness or disease, or death of any person other than CONTRACTOR'S employees;
 - d) claims for damages insured by personal injury liability coverage which are sustained: (1) by any person as a result of an offense directly or indirectly related to the employment of such person by CONTRACTOR; or (2) by any other person for any other reason;
 - e) claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and
 - f) claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle.
- The insurance required to be purchased and maintained by the CONTRACTOR shall:
 - a) include completed operations insurance;

- b) with respect to any other insurance coverage written on a claims-made basis, remain in effect for at least 2 years after final payment (and CONTRACTOR shall furnish the City of Staunton evidence satisfactory to the City of Staunton of continuation of such insurance at final payment and 1 year thereafter);
- c) contain a cross liability or severability of interest clause or endorsement. Insurance covering the specified additional insured shall be primary insurance, and all other insurance carried by the additional insured shall be excess insurance.
- All of the aforesaid insurance policies must be endorsed to provide that the insurance company shall give 30 days written notice to the City of Staunton if the policies are to be terminated or if any changes are made during the Contract period which will affect in any way the insurance requirements required in this contract. Before starting the Work, the CONTRACTOR shall provide the City of Staunton with a copy of each policy which he and each of his Subcontractors shall carry in accordance herewith, together with receipted bills evidencing proof of premium payment. These policies shall contain endorsements to the policies naming the City of Staunton as an additional insured as required.
- Nothing contained herein shall effect, or shall be deemed to affect, a waiver of the City of Staunton's sovereign immunity under law.

3.22 Safety and OSHA Standards

All parties performing services for the City shall comply with all Occupational Safety and Health Administration (OSHA), State Occupational Health Standards, and any other applicable rules and regulations. All parties shall be held responsible for the training, supervision, and safety of their employees. Any unsafe acts or hazardous conditions that may cause injury or damage to any persons or property within and around the work site areas under this contract shall be remedied per the regulatory agency's guidelines.

3.23 Assignment

Assignment by the successful PROPOSER to any third party of any contract based on this RFP or any monies due shall be absolutely prohibited and will not be recognized by the City of Staunton unless approved by the City of Staunton in writing. Approval will not be unreasonably withheld.

3.24 News Release

The PROPOSER shall at no time make any news or advertising releases pertaining to this RFP for any purpose without the prior written approval of the Purchasing Agent, and then only in coordination with the City of Staunton.

3.25 Cooperative Procurement

This procurement is being conducted on behalf of other public bodies, in accordance with §2.2-4304 (A) of the Code of the Commonwealth of Virginia. If authorized by the PROPOSER, the resultant contract may be extended to any public body in the Commonwealth of Virginia in accordance with contract terms.

3.26 Transportation and Storage

The CONTRACTOR shall make all arrangements for transportation of equipment, in suitable vehicles and by experienced equipment carriers. Supervision of packing, unpacking and placement of equipment shall be furnished by the CONTRACTOR without charge to the City of Staunton, all invoices shall be based accordingly F.O.B destination. The CONTRACTOR shall incur the transportation expenses. The acquisition of the required storage space shall be at the expense of the CONTRACTOR.

3.27 Transfer of Title

The CONTRACTOR shall assume full risk of loss of, or damage to, and operational responsibility, whether or not covered by insurance, until Final System Acceptance by the City of Staunton in writing, excepting loss or damage caused by City of Staunton's negligence. Only at that time will the City of Staunton assume responsibility for and take possession of the system.

Under no circumstances, shall any warranty begin until Final System Acceptance of the system by the City of Staunton in writing. The CONTRACTOR shall ship the Terminal Hardware to the City of Staunton upon written authorization. Partial deliveries shall be permitted. Title and Risk of Loss to Terminal Hardware shall pass upon installation and programming of Terminal Hardware.

3.28 Equipment, Systems, Software, and Licenses

Any additional limitations or constraints on all systems, equipment, software, and licenses provided shall not conflict with the requirements of this RFP. The PROPOSER shall only offer additional systems, equipment, and proprietary and third-party software limitations or constraints that they willing to negotiate with SAW in good faith.

3.29 Non-Discrimination in Employment

By submitting their offers, all proposers certify to City of Staunton that they will conform to the provisions of the Federal Civil Rights Act of 1964, as amended, as well as the Virginia Fair Employment Acts as amended, where applicable, and §2.2-4311 of the Virginia Public Procurement Act as follows:

During the performance of this contract, the CONTRACTOR agrees as follows:

1. The CONTRACTOR will not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin age, disability or other basis prohibited by state law relating to discrimination in employment, except where there is a bona fide occupational qualification reasonably necessary to the normal operation of the CONTRACTOR.
2. The CONTRACTOR agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this non-discrimination clause.
3. The CONTRACTOR, in all solicitations or advertisements for employees placed by or on behalf of the CONTRACTOR, will state that such subcontractor is an equal opportunity employer.
4. Notices, advertisements, and solicitations placed in accordance with federal law, rule or regulation shall be deemed enough for the purpose of meeting the requirements of this section.

The CONTRACTOR will include the provisions of the foregoing paragraphs 1, 2, and 3 in every subcontract or purchase order of over \$10,000, so that the provisions will be binding upon each subcontractor or vendor.

3.30 Drug Free Workplace

During the performance of this contract, the CONTRACTOR agrees to conform to the provisions of §2.2-4312 of the Virginia Procurement Act, to (i) provide a drug-free workplace for the contractor's employees; (ii) post in conspicuous places, available to employees and applicants for employment, a statement notifying employees that the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance or marijuana is prohibited in the contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition; (iii) state in all solicitations or advertisements for employees placed by or on behalf of the contractor that the contractor maintains a drug-free workplace; and (iv) include the provisions of the foregoing clauses in every subcontract or purchase order of over \$10,000, so that the provisions will be binding upon each subcontractor or CONTRACTOR. For the purposes of this section, "drug-free workplace" means a site for the performance of work done in connection with a specific contract awarded to a contractor, the employees of whom are prohibited from engaging in the unlawful manufacture, sale, distribution, dispensation, possession or use of any controlled substance or marijuana during the performance of the contract.

3.31 Immigration and Reform Act

During the performance of this contract, CONTRACTOR agrees that they will not, and shall not knowingly employ an unauthorized alien as defined in the federal Immigration Reform and Control Act of 1986. (per §2.2-4311.1)

3.32 Debarment Status

By submitting their proposal, all PROPOSERS certify that they are not currently debarred from submitting bids or proposals on contracts by any public body of the Commonwealth of Virginia, nor are they an agent of any person or entity that is currently debarred from submitting bids or proposals on contracts by any public body of the Commonwealth of Virginia.

3.33 Force Majeure

Neither party will be liable to the other for any failure or delay in rendering performance arising out of causes beyond its reasonable control and without its fault or negligence. Such causes may include, but are not limited to, acts of God or the public enemy, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes and unusually severe weather; but the failure or delay must be beyond reasonable control and without fault or negligence.

If the CONTRACTOR's failure to perform is caused by the default of a subcontractor, and if such default arises out of causes beyond the reasonable control of both the CONTRACTOR and subcontractor, and without the fault or negligence of either of them, the CONTRACTOR shall not be liable for any excess costs for failure to perform, unless the equipment or services to be furnished by the subcontractor were obtainable from other sources in sufficient time to permit the PROPOSER to meet the required delivery schedule. Dates or time of performance will be extended to the extent of delays excused by this section, provided that the party whose performance is affected notifies the other promptly of the existence and nature of such delay.

3.34 Termination for Convenience

The City of Staunton may terminate the Contract at any time for its convenience upon sixty (60) days written notice to the other party. The CONTRACTOR shall be paid for no service rendered or expense incurred after receipt of such notice except such fees and expenses incurred prior to the effective date of termination that are necessary for curtailment of its work under the Contract. In the event of termination, all documents and other materials related in the performance of the Contract shall become the property of the City of Staunton.

3.35 Termination with Cause / Default

If, through any cause, the contractor shall fail to fulfill in a timely and proper manner the obligations agreed to, the City of Staunton shall have the right to terminate the contract by specifying the date of termination in a written notice to the contractor at least thirty (30) days prior to the termination date. Termination shall be without prejudice to any of the City of Staunton's rights or remedies by law. In the event of termination, all documents and other materials related in the performance of the Contract shall become the property of the City of Staunton.

The City of Staunton, at its discretion, may provide the CONTRACTOR not more than thirty (30) days from the date notice is provided in which to cure the default. Upon failure of CONTRACTOR to cure the default, CONTRACTOR may immediately cancel and terminate this Agreement as of the date of notice. Termination shall be without prejudice to any of the City of Staunton rights or remedies by law.

Upon termination, CONTRACTOR shall withdraw its personnel and equipment, cease performance of any further work under the Agreement, and turn over to City of Staunton any work in process for which payment has been or is willing to be made.

In the event of violations of law, safety or health standards and regulations, this Agreement may be immediately cancelled and terminated by City of Staunton. Termination shall be without prejudice to any of the City of Staunton's rights or remedies by law.

3.36 Site Visits

Ignorance of site conditions shall not relieve the CONTRACTOR of any liability or obligations under the contract as agreed to by both parties.

3.37 CONTRACTOR Responsibilities

The CONTRACTOR shall assume total responsibility for delivery, installation, acceptance, and warranty of all hardware, software, and engineering and support services offered in the Proposal, whether the PROPOSER is the manufacturer, producer, author, or supplier of them.

The CONTRACTOR shall be the sole point of contact regarding all contractual matters, including the performance, service, and payment of any and all charges resulting from the lease and installation of the entire system configuration, and all other services performed. Failure to meet these obligations shall result in the cancellation of any contracts.

3.38 System Responsibility

The PROPOSER shall be responsible for verifying the completeness and suitability of all work or equipment proposed for this system. The CONTRACTOR shall provide any additional equipment or labor required to meet these specifications, without claim for additional payment, it being understood that a complete operating system is required.

The CONTRACTOR shall be responsible for designing, furnishing, and installing all required interfaces with existing systems and equipment, along with such interfaces as specified in the system specification, unless such interfaces are specifically excluded or ascribed to others in this specification. The CONTRACTOR shall be obligated to provide a system that meets all guarantees in the Proposal for the price contained therein.

3.39 Property Damage

The CONTRACTOR shall be responsible for any loss or damage to property caused by their operations or personnel. Damages will be settled with the owner of the property by the CONTRACTOR in the company of an agent of the City of Staunton. The CONTRACTOR shall submit a signed damage release for all sites concerned as a condition of Final System Acceptance within the timeframe identified in Table 4-1.

3.40 System Use before Acceptance

The City of Staunton will not use any part of the system for operational use prior to conditional acceptance, other than for training and testing of the system. Conditional acceptance shall be on a system basis only. Once the Acceptance and Coverage Tests have been passed validating all significant functions, features, coverage, and cutover has been successfully completed, the City of Staunton will agree to Conditional Acceptance but will not pay the final milestone until Final Acceptance. Only when the CONTRACTOR has completed all contractual responsibilities and the City of Staunton has approved all punch-list items, submittals, as-built drawings, training, maintenance manuals, etc. will Final System Acceptance be achieved.

It may become necessary however, because of unplanned events, for the City of Staunton to use a part or all the system or a subsystem. Such use shall not constitute conditional acceptance unless it continues for 30 consecutive days. The CONTRACTOR will be entitled to seek relief from any damages for delays which result from such unplanned use of the system or subsystems.

3.41 Change Order

A written Change Order, signed by both the City of Staunton and CONTRACTOR, shall be required for any modification to the Total Agreement Price, Project Schedule, Project Scope, Project Responsibilities, or other Contract terms. Price increases and/or extensions of time shall not be binding upon either Party unless or until evidenced by a fully executed Change Order. If a project change impacts the critical path of the Project Schedule, both parties must agree on a time frame in advance of executing a Change Order. If a project change impacts the Project Scope a Change Order must be executed prior to commencement of the Work.

3.42 Retesting

If the CONTRACTOR notifies the City of Staunton that a site, system, or subsystem is ready for inspection and/or testing at a *mutually agreed* time and place according to a *mutually agreed* test plan; and if the site, system, or subsystem is inspected and/or tested according to the agreed test plan; and if the site, system or subsystem fails the inspection and/or test and requires retesting at a later date; then the CONTRACTOR shall bear the costs due to rescheduling that may accrue to the City of Staunton and City of Staunton Representatives, including travel, lodging and compensation at the City of Staunton's and City of Staunton Representatives' standard rates.

3.43 Contract Provisions for Non-Federal Entity Contracts Under Federal Awards

If funding from a Federal Award is utilized the contract shall contain the following provisions:

3.43.1 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.”

3.43.2 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.

3.43.3 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.

3.43.4 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.

3.43.5 Clean Air Act / Federal Water Pollution Control Act

Clean Air Act (*42 U.S.C. 7401-7675*) and the Federal Water Pollution Control Act (*33 U.S.C. 1251-1388*), 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. 7401-7675*) and the Federal Water Pollution Control Act as amended (*33 U.S.C. 1251-1388*). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

3.43.6 Debarment and Suspension

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.

3.43.7 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.

3.43.8 §200-323 Procurement of recovered materials

A non-Federal entity that is a state agency or agency of a political subdivision of a state and its contractors must comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act. The requirements of Section 6002 include procuring only items designated in guidelines of the Environmental Protection Agency (EPA) at *40 CFR part 247* that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition, where the purchase price of the item exceeds \$10,000 or the value of the quantity acquired during the preceding fiscal year exceeded \$10,000; procuring solid waste management services in a manner that maximizes energy and resource recovery; and establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines.

3.43.9 Domestic Preference

To the extent that a procurement award or transaction for goods or services under this purchase order or other contract is funded with federal funds, the successful proposer or awardee must comply with the federal domestic preference for procurements requirements of the federal regulations prescribed in Section 200.322 of Title 2 of the Code of Federal Regulations (CFR). The successful proposer or awardee certifies that any contracts, as well as any subcontracts, shall include this requirement, which mandates that to the greatest extent practicable there shall be a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products). Definition of the terms “produced in the United States” and “manufactured products” made be found in the CFRS at: [Electronic Code of Federal Regulations \(eCFR\)](#) or successor url. And to the extent not in compliance with such requirements, the successful proposer or awardee shall indemnify, defend and hold harmless the City of Staunton, Augusta County, and the City of Waynesboro to the fullest extent permitted by law.

4 Statement of Work

The statement of work applies to all systems, equipment, facilities, services, and software specified in this RFP.

4.1 Project Management

The CONTRACTOR shall have experience with projects of similar size and scope as the proposed system. Assigned personnel shall have qualifications and experience to perform their tasks for this project. Provide an organizational chart, names and resumes for the project manager, lead engineer and key positions, including significant subcontractors and their personnel.

4.1.1 Project Manager

The CONTRACTOR shall designate a single project manager to supervise and coordinate the CONTRACTOR's work and to act as the primary point of contact for all project-related issues. The CONTRACTOR's project manager shall direct the CONTRACTOR's personnel and subcontractors in the project and assist in resolving project problems.

The CONTRACTOR shall provide the project manager's contact information after SAW issues the notice to proceed (NTP) within the timeframe identified in Table 4-1. The contact information shall include the following:

- Name
- Office phone number
- Cell phone number
- Email address

The CONTRACTOR shall notify SAW and obtain written approval to replace the project manager. Provide the name and resume for proposed replacement project manager. SAW has the right to reject any proposed project manager.

4.1.2 CONTRACTOR's Key Personnel

The CONTRACTOR shall provide each Key Personnel's names, resumes and three project references for review and approval by SAW. The contact information shall include the following:

- Name
- Office phone number
- Cell phone number
- Email address

The CONTRACTOR shall notify SAW to replace key personnel assigned to the project. Provide names and resumes for proposed replacement personnel within the timeframe identified in Table 4-1. SAW has the right to reject proposed key personnel.

4.1.3 Subcontractors

The CONTRACTOR shall notify SAW prior to procuring subcontractor(s) to perform tasks and/or provide equipment on the project within the timeframe identified in Table 4-1. SAW has the right to reject proposed subcontractors.

4.1.4 CONTRACTOR Registration

Firms performing construction work on behalf of the CONTRACTOR shall be licensed with the appropriate authorities. The firms shall be licensed at the time of the submission of the Proposal and must remain licensed through the completion of the work.

The CONTRACTOR and its subcontractors shall have all federal, state, and local licenses necessary to do the work, and shall remain licensed through the completion of the work.

4.1.5 Project Management Plan

4.1.5.1 Project Schedule

The PROPOSER shall provide a preliminary detailed project schedule that reflects all work described in the submitted proposal. The proposed project schedule shall be displayed as a Linked Gantt Chart and include the following information: ID number, Task Name, Task Duration, Start Date, Finish Date, Dependencies, and stacked bar timeline. The project critical path shall be clearly identified on the preliminary project schedule.

The CONTRACTOR shall maintain a Microsoft Project schedule for the design, implementation, and acceptance of the system. The project schedule shall contain all project activities that are the responsibility of the CONTRACTOR, SAW, and SAW Representative to ensure successful design, implementation, and acceptance. The CONTRACTOR shall provide a baseline project schedule within the timeframe identified in Table 4-1.

The CONTRACTOR shall provide an updated project schedule, in PDF and native Microsoft Project each month, as part of the monthly project review meeting.

The project schedule shall display a breakdown of each task, including the following details:

- Planned Start and End dates
- Actual Start and End Dates
- Percentage completed
- Predecessors and Successors
- Responsibility (CONTRACTOR, SAW, and SAW Representative)

- Critical path

The schedule for the implementation of each communications system site shall be broken out separately on the project schedule.

4.1.5.2 Project Review Meetings and Teleconferences

The CONTRACTOR shall conduct monthly project review meetings, or video conferences, beginning with the Project Kickoff Meeting until Final System Acceptance. SAW shall determine when a video conference may replace an in-person meeting.

The CONTRACTOR shall organize and conduct regular video conferences between scheduled review meetings.

The SAW Representative will provide a virtual meeting platform and inform the PROJECT TEAM members of the call-in number, Web URL, and access codes. The CONTRACTOR shall utilize this virtual meeting platform for all PROJECT TEAM meetings.

The CONTRACTOR shall provide an agenda to all invitees at least 48 hours prior to the meeting or video conference. Agenda Items shall include as a minimum:

- Review project status
- Review project Schedule
- Activities for previous period
- Review action items, completed, in progress, to be completed next period
- New issues and action items
- Identified Red Flag items and resolutions
- Plans for the next period
- Date and time of next meeting or teleconference

The CONTRACTOR shall provide minutes to all attendees and PROJECT TEAM members 5 business days after the conclusion the meeting or teleconference.

4.1.5.3 Action Item List

The SAW Representative will develop and maintain an action item list. The action item list shall include the following items:

- Item Number
- Site Name (if a specific site)
- Description of the Item
- Responsible Party
- Priority
- Due Date Assigned

- Date Resolved
- Resolution / Transmittal #

4.1.5.4 Project Status Reports

The CONTRACTOR shall submit monthly project status reports to SAW within ten (10) days after the end of the month for the duration of the project. Monthly status reports shall follow this general outline:

- Activities completed during the previous month
- Activities planned or scheduled the next month
- Updated Project Schedule
- Submittal Schedule: Item Status - Planned & Completed
- Red flag items / Risk Issues
- Transmittal log
- Punch-list items

4.1.5.5 Submittals

The CONTRACTOR shall provide project submittals according to the submittal schedule. A preliminary submittal schedule is found in Table 4-1 (calendar days unless specifically listed business days). Each of the submittal items below shall be included in the Proposer's responsibilities matrix.

The SAW Representative will maintain the submittal schedule to identify project deliverables are submitted timely and are complete. The schedule will include the following for each item:

- RFP or contract reference
- Document description
- Scheduled submittal date
- Actual submittal date
- Approval date
- Notes

RFP Section	Submittal	Scheduled Delivery Date
4.1.1	Project Manager's contact information	within 15 days after NTP
4.1.3	Subcontractor	30 days prior to engaging subcontractor
4.1.5.1	Baseline Project Schedule	30 days after Project Kickoff Meeting
4.2.3	Detailed Design Review (DDR)	within 120 days after NTP
4.2.3	Detailed Design Documentation	15 business days prior to DDR

4.3.13	FCC Licenses Application(s)	within 30 days after path surveys
9.11.12	FAA Notifications	within 60 days after Approved DDR
9.15	Grounding Plan Documentation	within 60 days after Approved DDR
9.10.4	Concrete Testing Results	45 days after collection of concrete samples
4.3.17	Connectivity Network Acceptance Test Plan	at least 90 days prior to the Connectivity Network Staging Test
4.3.16	Radio System Acceptance Test Plan	at least 30 days prior to the Factory staging tests
4.3.15	Fleet Mapping Plan	at least 6 months prior to radio system cutover
4.3.14	Interference Analysis and Mitigation	Within 30 days after Installation of Radio Equipment
4.4.6	Acceptance Test Results	Within 30 days of all Acceptance Testing
5.8.4	Statement of Compliance with Electromagnetic Exposure limits	within 10 days prior to acceptance testing at a site
4.4.2.1	Connectivity Network Acceptance Test Report & Punch List	Within 14 days after completion of connectivity network testing. When reviewed test report and punch list resolved, SAW will approve.
4.4.3.2	Radio System Acceptance Test Report & Punch List	Within 14 days after completion of radio system testing. When reviewed test report and punch list resolved, SAW will approve.
6.3.3.1	Self-Interference Test	At least 21 days prior to acceptance testing, submit test results for each channel at each site
4.7.2	Training Materials	At least 30 days prior to the beginning of class sessions
4.6.4	Subscriber Documentation	at least 7 days prior to subscriber training
4.6.1	Standard Manuals	At least 30 days prior Cutover
4.6.2	Physical Facilities As-Built Documentation	Drafts – at the beginning of the 30-day performance period Finals – within 30 days after cutover
4.6.3	System Maintenance Documentation	at the beginning of the 30-day performance period
3.39	Damage Release Form	10 days prior Final System Acceptance

Table 4-1 Submittal Schedule

4.1.5.6 Transmittals

The CONTRACTOR shall assign a unique transmittal identification number to each submittal listed in Table 4-1 and to other significant project-related documentation, such as important memoranda, requests for approval, reports, and change order requests. The transmittal ID number shall consist of an identifier for the sending party and a consecutive serial number for the transmittal. Each transmittal shall include the following information:

- Transmittal ID number

- Date
- Sender
- Organization
- Recipient(s)
- Subject
- List of documents delivered

The CONTRACTOR shall maintain a log of its transmittals and shall include it with the monthly project status report.

4.1.5.7 Project Documentation

The CONTRACTOR shall provide and maintain all the project documentation, sharing with the PROJECT TEAM from the beginning to System Acceptance and Cutover. At the end of the project, the CONTRACTOR will hand-off to SAW for future maintenance, all project documentation pertinent to the definition and implementation of this project, e.g., submittals, transmittals, schedules, agendas, charts, data, diagrams, drawings, photographs, maps, emails, licenses, manuals, minutes, permits, procedures, reports, spreadsheets, text files, written plans, etc.

Documentation shall be provided in PDF soft copy (and in hard copy at SAW's request) and shall be supplied without copy protection. When appropriate, documentation shall be professionally bound in three-ring binders with section tabs and a table of contents. When submitted for approval or information, documents shall be clearly marked with the name of this project, date, and other tracking information, e.g., contract information, site name and/or drawing/document number. SAW Representative will provide a Web-based "cloud drive" to safely store and share documents, drawings, maps, photos with all members from the PROJECT TEAM. This Web-based "cloud drive" shall be used by the CONTRACTOR to store all project documentation.

4.1.5.8 Risk Management

The CONTRACTOR shall identify and assess potential risks to the Project and notify the PROJECT TEAM by including such risks under the Red Flag item on the Monthly Status Report. If a risk item develops into a problem, it should be placed on the action item list to determine its status, impact, and the responsible party.

4.1.5.9 Change Orders

If a Change Order is required as stated in the RFP Terms and Conditions, the CONTRACTOR shall submit change order requests to SAW's Project Manager. A separate change order for each request shall include:

- Customer name

- Project number and title
- Issue date
- Tracking number
- CONTRACTOR name
- Reason for change
- Description of change
- Cost impact
- Schedule impact
- Operational or performance impact

No changes to the work shall commence until the change order request has been approved by SAW in writing via a Contract Amendment.

4.1.5.10 Punch List

The CONTRACTOR shall establish and maintain a punch list for inspections, staging tests, field tests and acceptance tests. The list will be published monthly to include a sequential punch list item number, site reference, date identified, description of the item, resolution date, and notes. SAW's Project Manager will be responsible to review and approve the resolution of each item.

4.2 Planning and Design

The CONTRACTOR shall design, engineer, furnish, install, configure, test, and warranty the systems, equipment and software required by the technical specifications of this RFP. Supply all equipment, software, and services necessary to provide a complete and operational communications system.

4.2.1 Project Kickoff Meeting

The SAW Representative will initiate a project Kickoff Meeting to be held either in person or virtually within 15 days after Contract Signing. Project Notice to Proceed (NTP) will be provided upon successful conclusion of this meeting.

The process for the following items shall be discussed at the project kickoff meeting:

- Introduce Project Team Members
- Project Communications Process
- Project Review Meetings Process & Schedule
- Action Item Checklist Process
- Project Schedule Process
- Design Review Submittals and Checklist Process
- Punch List Process
- Transmittal Process
- Project Management Report Process

4.2.2 Contract Design Review (CDR)

The CONTRACTOR shall proceed with project plans and design activities after receiving written NTP.

The CONTRACTOR shall conduct the Contract Design Review (CDR) at a location provided by SAW for the PROJECT TEAM within 30 days after NTP. The following items shall be discussed at the CDR meeting:

- Introduce Additional Project Team Members and Subcontractors
- Project Overview
 - Design Plan
 - Sites Information
 - Schedule for site design visits/ surveys (prior to DDR)
 - Baseline Schedule
- Detailed Design Review (DDR) Content / Tentative Date

4.2.3 Detailed Design Review (DDR)

The CONTRACTOR shall conduct the Detailed Design Review (DDR) for the PROJECT TEAM, at a location provided by SAW and within the timeframe identified in Table 4-1. The DDR is expected to be a single event, lasting two (2) days. If the DDR is not completed during the agreed upon scheduled visit, all costs for attending an additional DDR, including those incurred by SAW for its personnel, SAW Representative, and other CONTRACTORS, and any direct expenses (including travel, lodging, meals, etc.), shall be borne by the CONTRACTOR.

The agenda for the DDR shall be as follows:

- Project Schedule
- Technical Design
 - System Configuration
 - System Operations – Features & Functions
 - Coverage Maps
 - Traffic Loading Analysis
 - Frequency plan
 - Alarm System Plan
 - System Control and Management
 - Failure Modes
- Connectivity Network
 - Network Topology Diagrams
 - Path Survey Reports (photographs, figures, profile paths, data sheets, calculations)
 - Fiber optic maps
- Interfaces (between radio system, connectivity network and facilities)
- NRAO Coordination / Power Limitations
FCC Licenses (Radio System and Microwave System)

- Dispatch Centers
- Draft Acceptance Test Plans
 - Radio Staging
 - Microwave/Connectivity Network Staging
 - Radio System (Field test)
 - Microwave/Connectivity Network (Field test)
 - Coverage (Field Drive Test)
- Site Design (Physical Facilities)
 - Site Plans
 - Site Access
 - Fencing
 - Towers
 - Building / Shelter Plans
 - Floor plans and Dimensions
 - Electrical System
 - UPS and / or DC Power System
 - Generator
 - Grounding and Surge Protection
 - HVAC
 - Fire detection / suppression
- Subscribers
- Fleet Mapping
- Training Plans
- Cutover Plans

The CONTRACTOR shall prepare and submit the above referenced detailed design documentation to the PROJECT TEAM in soft copy within the timeframe identified in Table 4-1. The CONTRACTOR shall prepare and submit four (4) hard copies to the PROJECT TEAM at the DDR. Each hardcopy shall be provided in a 3-ring binder. Large scale drawings shall be folded to fit in the 3-ring binder.

The PROJECT TEAM will return comments within ten (10) business days after the DDR. The CONTRACTOR shall make appropriate changes within fifteen (15) business days after receiving the PROJECT TEAM's comments. Once all comments have been resolved to the satisfaction of the PROJECT TEAM, SAW will approve the DDR, or may approve separately each subsystem, site, equipment, and/or functions prior to manufacturing and/or procuring by the CONTRACTOR.

4.3 Implementation

4.3.1 Permits and Licensing

The CONTRACTOR is responsible to obtain the appropriate federal, state, and local zoning, environmental, special use and construction approvals, permits and licenses necessary for the construction of physical facilities. The CONTRACTOR shall pay all fees and costs associated with obtaining all approvals, permits and licenses.

4.3.2 SHPO and NEPA Studies

The CONTRACTOR shall perform State Historic Preservation Office (SHPO) and National Environmental Policy Act (NEPA) studies where required for selected sites.

4.3.3 Coordination with SAW's Operations

The CONTRACTOR shall coordinate all work with SAW's operating and scheduling requirements. It may be required that certain tasks, such as installation, testing and/or cutover, will need to be performed outside SAW's normal working hours.

4.3.4 Infrastructure Equipment Orders

The CONTRACTOR shall submit factory orders and/or purchase material orders for infrastructure equipment only after SAW has approved, in writing, the detailed system design and authorized factory or material orders. SAW accepts no responsibility for infrastructure equipment orders placed prior to approval of the detailed design.

4.3.5 Subscriber Equipment Orders

Except for a nominal quantity for testing purposes, subscriber equipment and accessories shall not be ordered until after the successful completion of factory staging tests and SAW has authorized, in writing, the CONTRACTOR to proceed with subscriber equipment orders. Under no circumstances will SAW accept subscribers placed in storage at the convenience of the CONTRACTOR.

4.3.6 Relocation of Existing Equipment

The CONTRACTOR shall assist SAW to identify existing equipment that must be relocated or removed to accommodate new equipment required by this RFP. The CONTRACTOR shall pay any expenses related to existing equipment relocation or disposition of property. If any, relocation of existing equipment must be approved by SAW prior to relocating.

4.3.7 Equipment, Systems and Software

The CONTRACTOR shall furnish all systems, equipment, and software required by this RFP.

The CONTRACTOR shall provide all proprietary and third-party software necessary for overall system operation, including, but not limited to, all interface protocols, interoperability protocols, backbone and network interconnections, auxiliary equipment, subsystem interfaces and communications links.

4.3.8 Installation

The CONTRACTOR shall install all systems, equipment and software required by this RFP.

The CONTRACTOR shall leave all sites in a neat, presentable condition throughout the project. The CONTRACTOR shall remove all rubbish, temporary structures, and equipment generated or used by the CONTRACTOR after installation and prior to acceptance.

4.3.9 Utilities

4.3.9.1 Temporary Electrical Power

The CONTRACTOR shall pay all installation fees for any temporary electric power and electric bills required for site work until the temporary electric power is discontinued.

4.3.9.2 Permanent Electrical Power

For a new site (“Greenfield”), the CONTRACTOR shall pay all installation fees for electric power and electric bills until system cutover.

4.3.10 Inspect Excavations

The CONTRACTOR shall notify SAW and the PROJECT TEAM of any excavation at a site 15 days prior to completion of the excavation. SAW and the PROJECT TEAM reserves the right to inspect excavations, rock, socket, and reinforcement placement.

4.3.11 Existing AM Radio Station Towers

The CONTRACTOR shall ensure tower construction or alteration shall not disturb the antenna radiation patterns of existing AM broadcast stations.

At the detailed design review, the CONTRACTOR shall provide a report of its initial survey identifying all sites requiring tower construction or alteration that are within 1 mile of existing non-directional AM stations and within 3 mile of directional AM stations.

The CONTRACTOR is responsible for pre-construction analysis, and/or remediation of interference resulting from the construction or alteration.

The CONTRACTOR shall provide documentation for each site, prior to inspection, either guarantee no interference with existing broadcast antenna patterns, or detail the tower detuning required and the test results confirm that detuning corrected the problem.

4.3.12 Generator Maintenance and Service

The CONTRACTOR shall conduct routine maintenance and operational testing of backup/standby generators until System Acceptance. Following installation, backup/standby generators shall be exercised to at least 30 percent of nameplate rating for 60 minutes, at least once per month.

After the successful completion of the 30-day performance test, provide a “preventive maintenance” service contract to SAW for a period of one year starting on the day of Final System Acceptance. The contract shall include all routine preventive maintenance required by the manufacturer, with the exception that weekly and monthly inspections of batteries will be excluded.

4.3.13 MANDATORY OPTION: Frequency Licensing

The CONTRACTOR shall select frequencies, prepare (Regional Planning Committee documentation, if required, and) FCC license application within the timeframe identified in Table 4-1. SAW will sign and submit (Regional Plan documentation,) FCC application and pay coordination and license fees.

The CONTRACTOR shall perform any modification to existing FCC licenses, planning for the new radio system, that will require coordination and preparation of FCC applications, submittals, and documentation.

SAW is inside the NRAO quiet zone, and any new frequency or modify an existing frequency will require NRAO coordination. The CONTRACTOR is required to perform all required NRAO coordination.

4.3.14 Interference Analysis and Mitigation

The CONTRACTOR shall verify that all CONTRACTOR installed equipment is operating within the bounds of SAW’s FCC license, regulations, and published equipment specifications upon completion of system installation.

Prior to installation, the CONTRACTOR shall identify new and existing equipment and analyze collocated RF equipment to discover potential sources of intermodulation, spurious emissions, transmitter noise or receiver desensitization that may affect the new system. The CONTRACTOR shall provide a report on this interference analysis, within the timeframe

identified in Table 4-1 and include a description of recommended steps SAW can take to minimize potential interference.

The CONTRACTOR is responsible for resolving interference, due to existing collocated equipment, at no cost to SAW if all the following criteria are met:

- the interference is reported before final system acceptance
- the collocated equipment was licensed prior to the DDR
- the collocated equipment causing the interference was installed prior to the installation of the CONTRACTOR'S equipment
- the collocated equipment is operating within the bounds of its license, FCC regulations and published equipment specifications

If all prior conditions are not met, the CONTRACTOR shall *cooperate* with SAW to resolve identified interference to or from collocated equipment; and the Contractor and SAW will execute a mutually agreeable change order to remedy the interference.

If the Radio System coverage and performance are subject to degradation or disruption due to anomalous propagation and interference by natural phenomena or other radio Systems ("Outside Interference"), beyond that which the CONTRACTOR should reasonably have anticipated based upon best RF engineering practices and further described in this section, the CONTRACTOR shall not be held responsible for the Outside Interference. In the event of a case of degradation or disruption due to Outside Interference by natural phenomena or an outside party, as described in this paragraph, the CONTRACTOR shall cooperate with SAW to resolve the interference; and the Contractor and SAW will execute a mutually agreeable change order to remedy the interference.

4.3.15 Fleet Mapping

The CONTRACTOR shall assist SAW in developing a fleet map for the radio system, with unique templates for each department or agency. SAW will be responsible for establishing standard operating procedures. The CONTRACTOR shall provide a preliminary fleet map plan to SAW within the timeframe identified in Table 4-1.

4.3.16 Final Radio System Acceptance Test Plan

The CONTRACTOR shall provide the final Radio System Acceptance Test Plan (ATP) to the PROJECT TEAM within the timeframe identified in Table 4-1. The testing shall demonstrate proper operation of system features and functions, including fault management functions. All subsystems and equipment shall be exercised during acceptance testing. Tests that cannot be performed at staging should be labeled in the test plan as "Field Test".

This test plan will be repeated for the Field Radio System Acceptance Test, with the addition of any tests labeled "Field Test".

4.3.17 Final Connectivity Network Field Acceptance Test Plan

The CONTRACTOR shall provide the Final Connectivity Network Field Acceptance Test Plan within the timeframe identified in Table 4-1. The CONTRACTOR shall perform careful testing to ensure that the RF path performance and end-to-end voice/data circuit performance requirements are measured and documented. The end-to-end performance tests shall specifically include BER and packet data tests in normal and protected configurations. Tests that cannot be performed at staging should be labeled in the test plan as “Field Test”.

This test plan will be repeated for the Field Connectivity Network Acceptance Test, with the addition of any tests labeled “Field Test”.

4.3.18 Radio System Staging

The CONTRACTOR shall notify SAW at least thirty (30) days prior to the radio factory staging. The staging tests shall not begin until SAW has approved the final ATP. Staging is expected to be one event, lasting not more than three (3) days. If staging is not completed during the scheduled visit, or due to CONTRACTOR or system failures, the CONTRACTOR shall pay all SAW personnel, including SAW Representatives’ expenses to attend a second Staging event.

SAW’s representatives will inspect the radio system equipment and witness the radio system staging tests. At completion of the radio system tests, the CONTRACTOR shall provide the following:

- Authenticated and dated equipment inspection and test documentation, notes and 3 signatures (or initials) for two SAW’s representatives and the CONTRACTOR for each test procedure and the results
- A punch-list from failed tests and resolution
- When the punch-list is satisfied, SAW will approve the Radio System Staging Test

These staging tests shall become the baseline for tests and measurements performed after field installation, to allow item-by-item comparisons.

4.3.19 Connectivity Network / Microwave Staging

The CONTRACTOR shall notify SAW at least thirty (30) days prior to the factory staging for Connectivity Network/ Microwave. The staging tests shall not begin until SAW approves the final ATP. Staging is expected to be one event, lasting not more than three (3) days. If staging is not completed during the scheduled visit, or due to CONTRACTOR or system failures, the CONTRACTOR shall pay all SAW personnel, including SAW Representatives’ expenses to attend a second Staging event.

SAW's representatives will inspect the Connectivity Network/ Microwave equipment and witness the Connectivity Network/ Microwave staging tests. At completion of the Connectivity Network/ Microwave staging tests, the CONTRACTOR shall provide the following:

- Authenticated and dated equipment inspection and test documentation dated, notes and 3 signatures (or initials) for two of SAW's representatives and the CONTRACTOR for each test procedure and the results
- A punch-list from failed tests and resolution
- When the punch-list is satisfied, SAW will approve factory equipment and the staging tests

These staging tests shall become the baseline for tests and measurements performed after field installation, to allow item-by-item comparisons.

4.3.20 Shipment and Storage

Upon successful completion of staging tests, and after notification that sites are ready to install fixed network equipment, SAW will authorize the CONTRACTOR to ship equipment to the radio sites.

4.4 System Acceptance

4.4.1 Inspections

SAW will conduct site inspections during construction and a Final Inspection at each site. Deficiencies identified by inspections will be recorded as punch-list items. If an inspection cannot be completed during the scheduled visit, *due to site incompleteness*, all costs for additional inspections, including those incurred by SAW for its personnel, SAW Representatives and other CONTRACTORS, and any expenses (including time, travel, lodging, meals, etc.), shall be borne by the CONTRACTOR.

4.4.1.1 Facility Inspection and Testing

The CONTRACTOR shall notify the PROJECT TEAM when physical facilities will be complete and ready for inspection at a site prior to installation of infrastructure equipment. All site, building, fence, parking, commercial power, backup power, HVAC, grounding, and tower construction shall be installed in a neat and workman-like fashion in compliance with applicable standards.

The CONTRACTOR shall conduct tests for all facility operations at each site, including testing generator and automatic transfer switch, fire alarm system, HVAC operations, minor and major alarms, etc. SAW's representatives will inspect each site, witness testing operations, and update the project punch-list.

4.4.1.2 Final Inspection of Radio Equipment

The CONTRACTOR shall notify the PROJECT TEAM when radio / connectivity infrastructure

equipment installation and configuration is complete. SAW's representatives will inspect equipment installation and prepare a punch-list of items required.

The CONTRACTOR shall respond to and resolve punch-list items before acceptance testing begins. Exceptions may be waived for punch-list items that do not affect radio system performance. SAW's representatives will record resolution of punch-list items.

4.4.2 Connectivity Network Acceptance Testing

Final acceptance testing shall include the same tests as staging and any additional tests that could not be conducted during staging, such as testing involved in existing or new fiber-optic circuits.

4.4.2.1 Connectivity Network Field Acceptance Testing

Upon completion of installation and final alignment, the CONTRACTOR will perform and record data in accordance with the collection/analysis process agreed to in the ATP for the same type of equipment tests as were made at staging, so long as they are not exclusive staging type tests. Additional tests shall be required for equipment not tested at the factory or staging area, including the following:

- Battery/Charger Equipment
- Antenna System Equipment
- Fiber-optic links
- Microwave path tests
- Microwave system end-to-end verification
- Loopback testing between sites
- Leased connectivity line testing
- Fiber Link End-to-End Verification
- Optical Transport Acceptance Tests

SAW's representatives will inspect the equipment and witness the field acceptance tests. At completion of the connectivity network acceptance tests, the CONTRACTOR shall provide the following:

- Installed equipment inspection and test documentation dated, notes and 3 signatures (or initials) for two of SAW's representatives and the CONTRACTOR for each test procedure and the results.
- A punch-list from failed tests and resolution.
- When the punch-list is satisfied, SAW will approve the connectivity network acceptance tests.

All documentation should be provided to SAW within the timeframe identified in Table 4-1.

4.4.2.2 Connectivity Network Re-Testing

All costs for re-testing, including those incurred by SAW for its personnel, SAW Representatives, and other CONTRACTORS, and any expenses (including time, travel, lodging, meals, etc.), shall be borne by the CONTRACTOR.

4.4.3 Radio System Acceptance Testing

4.4.3.1 Base Station Tests

The CONTRACTOR shall perform base station tests after equipment installation, configuration, and submit test results 21 days prior to acceptance testing. Base station tests shall include:

- Transmitter frequency
- Transmitter deviation or modulation integrity
- Transmitter forward and reflected power
- Combiner forward and reflected power
- Receiver frequency
- Receiver static (unfaded) sensitivity for each channel
- Local operating controls

If the system includes satellite receivers, the Contractor shall perform the receiver tests, and submit results as well.

SAW will randomly select base stations and receivers to witness re-tests and confirm results. If any test fails, a punch-list may require resolution before continuing the Acceptance Tests.

4.4.3.2 Radio System Field Acceptance Testing

The CONTRACTOR shall perform the radio system acceptance test after the ATP has been approved by SAW and after installation with resolved punch-list items. SAW's representatives will inspect the equipment and witness the field acceptance tests. At completion of the radio system acceptance tests, the CONTRACTOR shall provide the following:

- Installed equipment inspection and test documentation dated, notes and 3 signatures (or initials) for two of SAW's representatives and the CONTRACTOR for each test procedure and the results.
- A punch-list from failed tests and resolution.
- When the punch-list is satisfied, SAW will approve the radio system acceptance tests.

All documentation should be provided to SAW within the timeframe identified in Table 4-1.

4.4.3.3 Failure Mode Testing

The CONTRACTOR shall demonstrate failure mode operation of the system during acceptance testing. All equipment and components, both main and standby, shall be exercised during testing.

All standard system functions and failure modes, including continued system operation during major failures, shall be demonstrated. Alarm functions shall also be demonstrated.

4.4.3.4 Simulcast Alignment Testing

After the simulcast system has been properly aligned, the CONTRACTOR shall perform a voice test to verify proper alignment.

The CONTRACTOR shall provide maps of predicted coverage overlap areas. A test drive route shall indicate an adequate sampling within these areas. All sites shall be keyed continuously on a single channel, which is modulated with a common audio signal.

4.4.3.5 Radio System Re-Testing

All costs for radio system acceptance **re-testing**, including those incurred by SAW for its personnel, SAW Representatives, and other CONTRACTORS, and any expenses (including time, travel, lodging, meals, etc.), shall be borne by the CONTRACTOR.

4.4.4 Coverage Acceptance Testing

The CONTRACTOR shall submit the draft Coverage Acceptance Test Plan (CATP) at the DDR documentation, within the timeframe identified in Table 4-1. The PROJECT TEAM will review the CATP, and SAW will approve the CATP at least 60 days prior to beginning coverage acceptance testing.

Coverage testing shall be performed during full foliage between May and mid-October.

The CATP shall use a voice test to determine passing or failing. The CONTRACTOR may measure signal strength and bit error rate (BER), but this data will only be used “for information” and will not affect the Coverage Acceptance Test.

Based on the CONTRACTOR’s input, each service area will be divided into a grid pattern with test tiles and use the TSB-88 Estimate of Proportions analysis to determine the number and size of the test tiles to ensure a statistically valid result for each service area.

Tests will be performed for both talk-in and talk-out directions but talk-in and talk-out paths will record results separately and determine separate statistics.

Tests will be performed while in motion.

In each test tile, a single attempt to access the system will be made by pressing the push-to-talk button (automatic re-tries are allowed). If the test radio does not receive a channel grant tone in that tile, the access test for that location has failed.

Testing will be performed using mobile radios provided by the CONTRACTOR under the Contract. Where the coverage requirement is for portable service area, attenuators and (if necessary) circulators will be used to emulate the portable radios mounted on the hip.

The scoring shall be conducted by a voting “team” consisting of one representative each from SAW, SAW Representatives, and the CONTRACTOR. The three voting representatives will each listen to the message for each test tile. Two out of three votes shall determine whether a test tile is passed or failed.

The “field team” will test the talk-out path requiring three voting representatives (SAW, SAW Representatives, and CONTRACTOR) inside the vehicle, and a fourth person for the driver. The driver is ineligible to vote unless they are the official SAW representative.

The “base team” will test the talk-in path requiring three voting representatives (SAW, SAW Representatives, CONTRACTOR) at the Dispatch Center with an IP Console or a control station.

In order to “Pass” a test tile, you must be able to understand every word of the test message. If a word is lost, or not understandable, the Team will vote “Fail” for that test tile.

The voice test messages must be spoken clearly with good diction, using unique sentences or phrases with 6 to 15 words taking about 3 to 8 seconds.

4.4.4.1 MANDATORY OPTION: Testing Vehicles and Drivers

CONTRACTOR shall provide the vehicles for Coverage Acceptance Testing and a driver for each field testing team.

4.4.4.2 OPTION: Recorded Audio Messages

The CONTRACTOR may record audio messages (talk-out path) for the mobile radio in the vehicle and use a GPS to record location information (e.g., test tile) and time, and retain as part of the permanent file. The CONTRACTOR or SAW may also record audio messages (talk-in path) at the Dispatch Center. If these audio recordings are available, it may be used in any appeal that arises if the system fails to meet the coverage guarantee.

4.4.4.3 Accessible Test Tiles

Test tiles will use publicly accessible roads and will not require 4-wheeled drive vehicles to navigate, where no special permission is required from entities (other than SAW) to enter a tile. The field team will determine if it is safe to enter the tile. All accessible test tiles within the service area will be tested.

4.4.4.4 Inaccessible Test Tiles

Inaccessible test tiles will not be included in the calculations of system coverage performance.

4.4.4.5 Tile Retries

Tiles that fail the initial talk-in or talk-out test may be retried. Re-scoring will be performed with the same procedure. *The CONTRACTOR may retest as many failed tiles as desired; however, no more than a total of 5% of retested tiles in a service area may be added to the final coverage test results.*

4.4.4.6 Retry Location

Test retries will be conducted in the same test tile.

4.4.4.7 Re-Testing

In the event the coverage test fails to meet the coverage guarantees, the CONTRACTOR shall make corrections and require a re-test.

All costs for re-testing, including those incurred by SAW for its personnel, SAW Representatives, and other CONTRACTORS, and any expenses (including time, travel, lodging, meals, etc.), shall be borne by the CONTRACTOR.

4.4.5 MANDATORY OPTION: Critical Building Coverage Testing

SAW does not require a critical building coverage guarantee. SAW does require as a mandatory option, critical building coverage testing for information purposes only.

The CONTRACTOR shall perform coverage testing in each of the critical buildings listed in Table 4-2. Coverage testing will be witnessed by SAW's representatives. If coverage within a building is found unusable, SAW may decide to exercise the mandatory option of installing a distributed antenna system in that building. When the distributed antenna system has been installed, the CONTRACTOR will retest the building witnessed by SAW representatives. Testing shall be performed at locations identified previously to verify that coverage deficiencies have been satisfied. Twenty (20) points, evenly distributed, shall be tested on each floor.

Building Name	Address	City	Zip	# of floors
Augusta Correctional	1821 Estaline Valley Rd	Craigsville	24430	4
Augusta Health	70 Medical Center Dr.	Fishersville	22939	4
Augusta Co Sheriff Office	127 Lee Hwy	Verona	24482	1
Augusta County Govt Center	18 Government Center Lane	Verona	24482	3
Beverly Manor Elem. School	116 Cedar Green Rd	Staunton	24401	1
Buffalo Gap High School	1800 Buffalo Gap Hwy	Swoope	24479	3
Churchville Elem School	37'0 Churchville Ave	Churchville	24421	2
Clymore Elem School	184 Fort Defiance Rd	Fort Defiance	24437	1
Cold Springs Correctional	221 Spitler Cir	Greenville	24440	3
Craigsville Elem School	100 E First St	Craigsville	24430	1
Craigsville Town Hall	18 Hidy St	Craigsville	24430	1
Fishersville Wasterwater Plant	886 Sangers Lane	Staunton	24401	1
Fort Defiance High School	195 Fort Defiance Rd	Fort Defiance	24437	3
GK Stump Elem School	115 Draft Ave	Stuarts Draft	24477	1
Hugh K Cassel	1301 Rockfish Road	Waynesboro	22980	2
Lyndhurst Waterwater Plant	1166 Mount Torrey Rd	Lyndhurst	22952	1
Middle River Wasterwater Plant	848 Laurel Hill Rd	Verona	24482	1
Middle River Regional Jail	350 Technology Dr	Staunton	24401	1
North River Elem School	3395 Scenic Hwy	Mount Solon	22843	2
Riverheads High School	19 Howardsville Rd.	Staunton	24401	2
Riverheads Elem School	239 Don Hanger Cir	Staunton	24401	2
S G Steward Middle School	118 Fort Defiance Rd	Fort Defiance	24437	1
Stuarts Draft Elem School	63 School Blvd	Stuarts Draft	24477	1
Stuarts Draft High School	1028 Augusta Farms Rd	Stuarts Draft	24477	3
Target Distribution	345 Mt Vernon Road	Stuarts Draft	24477	1
Valley Technical Ceter	69 Hornet Rd	Fishersville	22939	1
Wilson Elementary School	127 Woodrow Wilson Ave	Fishersville	22939	1
Wilson Middle School	232 Hornet Rd	Fishersville	22939	1
Wilson High School	189 Hornet Rd	Fishersville	22939	1
AR Ware Elementary School	330 Grubert Ave	Staunton	24401	2
Best Buy	1 Industry Way	Staunton	24401	1
Brookdale Staunton	1900 Hillsmere Ln	Staunton	24401	2
City Hall	116 W. Beverley St	Staunton	24401	4
Envoy of Staunton	512 Houston St	Staunton	24401	4
Fairfield Inn	114 Crossing Way	Staunton	24401	5
Fed Ex	7 Industry Way	Staunton	24401	1
Federated Auto Parts	50 Morris Mill Rd	Staunton	24401	1
FedEx Ground Warehouse	7 Industry Way	Staunton	24401	2
Fisher Auto Parts	512 Greenville Ave	Staunton	24401	2
Food Lion	2411 W. Beverley St	Staunton	24401	1
Frontier Ridge Apartments	20 Frontier Ridge Ct	Staunton	24401	3
Hotel 24 South	24 S. Market St	Staunton	24401	5
Kings Daughter's Nursing	1410 N Augusta St	Staunton	24401	2
Legacy at North Augusta	1410-A N. Augusta St	Staunton	24401	2
Lowe's	1028-D Richmond Rd	Staunton	24401	1
Masonic Temple	13 W. Beverley St	Staunton	24401	5
Pierce Science Center - MBC	201 E Fredrick St	Staunton	24401	4
Red Roof Inn	855 Bells Ln	Staunton	24401	2
Shelburne Middle School	300 Grubert Ave	Staunton	24401	2
St. Pauls United Methodist Church	2000 Shutterlee Mill Rd	Staunton	24401	2
Staunton High School	1301 N. Coalter St	Staunton	24401	4
Super Shoes	1106 Greenville Ave	Staunton	24401	1
Tru Hilton	120 Crossing Way	Staunton	24401	5
Tullidge Dorm - MBC	100 Tullidge Dr	Staunton	24401	3
VSDB	104 VSDB Way	Staunton	24401	4
Walmart	1028-C Richmond Rd	Staunton	24401	1
Thomas Gorsuch Municipal Building	250 S Wayne Ave	Waynesboro	22980	3
Summit Square Retirement Community	501 Oak Ave	Waynesboro	22980	5
Springdale Apartments	300 S Wayne Ave	Waynesboro	22980	5
The Lycra Company	400 Dupont Blvd	Waynesboro	22980	4
Global Berry	1020 Shenandoah Village Dr	Waynesboro	22980	2
Lowe's	801 Lew Dewitt Blvd	Waynesboro	22980	1
Home Depot	31 Windigrove Dr	Waynesboro	22980	1
Walmart	116 Lucy Lane	Waynesboro	22980	1
Target	811 Town Center Dr	Waynesboro	22980	1
Kohls	841 Town Center Dr	Waynesboro	22980	1
Waynesboro High School	1200 W Main St	Waynesboro	22980	4
Kate Collins Middle School	1725 Ivy St	Waynesboro	22980	2
Westwood Hills Elementary School	548 Rosser Ave	Waynesboro	22980	1
Berkely Glenn Elementary School	1020 Jefferson Ave	Waynesboro	22980	1
Wenonah Elementary School	125 N Bayard Ave	Waynesboro	22980	1
William Perry Elementary School	840 King Ave	Waynesboro	22980	1
Waynesboro Public Schools Central Office	301 Pine Ave	Waynesboro	22980	3
Charles Yancey Municipal Building	503 W Main St	Waynesboro	22980	2
Kroger	245 Arch Ave	Waynesboro	22980	1
Martins	437 Tiffany Dr.	Waynesboro	22980	1
Foodlion	990 Hopeman Pkwy	Waynesboro	22980	1
Accordius Healthcare	1221 Rosser Ave	Waynesboro	22980	1
Solutions Way	1 Solutions Way	Waynesboro	22980	3
Amazon Distribution	2712 W Main St	Waynesboro	22980	1
Augusta Health Urgent Care	201 Lew DeWitt Blvd	Waynesboro	22980	1
South River Properties	200 W 12th Street	Waynesboro	22980	2

Table 4-2 Critical Buildings List

4.4.6 Acceptance Test Results

Contractor shall provide a comprehensive report detailing the results of all acceptance testing to SAW within the timeframe identified in Table 4-1.

4.4.7 Thirty (30) Day Performance Period

Thirty (30) Day Performance Period will not begin prior to SAW's approval of all acceptance test results.

A successful performance period shall consist of thirty (30) consecutive days of successful uninterrupted operation after the completion of field acceptance testing. During the performance period, the CONTRACTOR shall maintain records of any equipment failures and readjustments made. During this period of "system burn-in", some minor equipment failures should be expected. The performance period shall be considered interrupted if any of the following conditions occur:

- The system experiences a major failure, as defined in the specifications
- The same device fails more than twice during the performance period
- A failure is not responded to within the time specified by the Warranty

If the thirty (30) day performance period is interrupted by any of the above conditions, the CONTRACTOR shall correct the deficiency and begin the thirty (30) day performance period again as day one of the test. SAW **will not** accept thirty (30) cumulative days of performance in lieu of thirty (30) consecutive days of performance for passing this test.

The performance period may be interrupted by mutual written agreement of SAW, SAW Representatives, and the CONTRACTOR if the downtime is due to causes beyond the reasonable control of the CONTRACTOR. Such downtime will be excluded from the thirty (30) day performance period.

Subject to approval of SAW as a written exception, coverage performance testing may be concurrent to the thirty (30) day performance period.

4.4.8 System Cutover

The CONTRACTOR shall prepare a plan for cutting over SAW's operations from the old radio system(s) to the new radio system. The draft cutover plan shall be provided as part of the DDR documentation, within the timeframe identified in Table 4-1. The cutover plan shall address the following items:

- Fixed equipment cutover
- Interfaces with and transfer of control from existing systems and equipment
- Dispatching transitions
- Subscriber equipment installation and/or distribution

- Special sequences
- Scheduled downtime
- Dual operation of old and new systems
- Personnel schedules
- Training
- Fallback plans in case of problems or failures

When the Acceptance Testing, Coverage Testing and the 30-day performance period has been successfully completed, and SAW approves the Cutover Plan, SAW will authorize the day and time to cutover.

Cutover from the existing radio system to the new radio system shall be planned to minimize disruption to SAW's operations.

4.4.9 Conditional System Acceptance

Conditional System Acceptance shall occur upon successful completion of all Acceptance Tests, Coverage Tests, the thirty (30) Day Performance Period, and SAW approval the System Cutover Plan and successful Cutover. Upon Conditional System Acceptance, the CONTRACTOR will promptly memorialize this event by providing a Conditional System Acceptance Certificate. SAW will sign the System Acceptance Certificate within ten (10) business days. Upon successful completion of Conditional System Acceptance, the initiation of the Warranty Period will begin.

4.4.10 Final System Acceptance

SAW will provide "Final System Acceptance" upon successful completion of Conditional System Acceptance, all programmed subscriber units have been issued to all departments, all project punch-list items are resolved and approved, all submittals (including as-built documentation, maintenance & operational manuals, etc.) are delivered and accepted, and all services have been satisfactorily performed. Upon written approval by SAW of Final System Acceptance all remaining monies will be released to the CONTRACTOR, and the project will be closed.

4.5 Subscriber Equipment Programming, Installation, and Issuance

4.5.1 Subscriber Equipment Programming

The CONTRACTOR shall develop templates based on the fleet map in coordination with SAW and program subscriber units.

4.5.2 Mobile Radio Equipment Installation

The CONTRACTOR shall install all new mobile units, vehicular equipment, chargers, and requested accessories. Installation responsibilities shall include removal, as required, of existing equipment after system cutover. SAW has purchased mobile radios within the last several years that may be used in a new P25 system if in good condition. SAW requests all reasonable efforts be made to either reuse the existing mobile radios or provide a contract credit for these units.

4.5.3 Control Station Equipment Installation

The CONTRACTOR shall install all new control station equipment with transmission line, antennas, remotes (if required), and requested accessories. SAW will provide the exact locations for equipment to the CONTRACTOR and coordinate with installation.

4.6 Documentation

4.6.1 Standard Manuals

The CONTRACTOR shall provide operational and maintenance manuals for each model of fixed equipment with shipment within the timeframe identified in Table 4-1. The required quantities are as follows:

Number of Units Purchased	Number of Manuals Required
≤20	Five (5) hard copies Three (3) electronic copy
>20	One (1) additional hard copy for each ten (10) additional units

Manuals shall be complete, self-contained and of the same revision level as the equipment provided.

The CONTRACTOR shall provide to SAW an electronic subscription to the latest equipment manuals and technical service bulletins for a period of five years after system acceptance.

4.6.2 Physical Facilities As-Built Documentation

The CONTRACTOR shall submit three (4) draft hard copies of all facilities as-built documentation to SAW for review and approval within the timeframe identified in Table 4-1.

Physical facilities/site construction as-built drawings include, but are not limited to, the following:

- Site layout drawings
- Floor plans

- Site grounding drawings
- Building elevation detail drawings with foundations
- Building layout drawings
- AC and DC electrical distribution drawings
- Site utility connection details
- Fence installation details
- Foundation details for shelter, towers, and LPG tank
- Site lighting details
- Fire detection/suppression system drawings
- Tower design detail drawings including light controller wiring
- Antenna, combiner, coax line and antenna placement drawings
- Equipment layout drawings
- Equipment/rack elevation profiles
- Console operator position layout drawings
- Equipment shelter plans: providing AC distribution, lighting, grounding, HVAC, and cable ladder details

The CONTRACTOR shall provide the following quantity of final physical facilities as-built documentation within the timeframe identified in Table 4-1:

- One (1) set per system site in hard copy
- Four (4) additional sets in hard copy
- Four (4) sets in soft copy as PDF files

4.6.3 System Maintenance Documentation

The CONTRACTOR shall provide system maintenance documentation to allow a properly trained technician to understand, configure, maintain, troubleshoot, and repair the radio system. System maintenance documentation includes, but is not limited to the following:

- System operational description, including a description of the function of each major system component, circuit types and signal flow between system components
- System interconnection drawings and block diagrams depicting system architecture
- Numbering and labeling of all interconnecting cabling
- Pin-out of all cabling connectors
- Numbering and labeling of all connections to punch blocks
- System interconnection and installation documentation as required for vendor equipment and/or physical facilities
- Complete list of all major fixed equipment by model number and revision code and installed firmware/software with revision (configuration control) numbers
- A chart or list of software and firmware version numbers, programming parameters and jumper configurations as they apply
- Record of any telephone circuits interconnected with the equipment by circuit number and telephone number
- System level setting procedures and a log of level settings for all control circuits

- Measured levels of alignment, including level-setting block diagrams and logs of all level settings necessary for setup, alignment, and maintenance activities
- Standard operations and maintenance manuals for all equipment and systems
- Equipment floor layouts and rack elevations
- Detailed HVAC heat load and electrical load calculations

The CONTRACTOR shall provide SAW with three (4) hardcopy sets of draft system maintenance documentation within the timeframe identified in Table 4-1.

SAW will provide comments, recommendations, and corrections to the system maintenance documentation.

The CONTRACTOR shall address these comments, recommendations, and corrections to the satisfaction of SAW.

The CONTRACTOR shall provide the following quantity of final system maintenance documentation within the timeframe identified in Table 4-1:

- One (1) set per system site in hard copy
- Four (4) additional sets in hard copy
- Four (4) sets in soft copy as PDF files

4.6.4 Subscriber Documentation

The CONTRACTOR shall supply the following with each subscriber unit purchased:

- One (1) standard operator's manual
- One (1) customized quick reference, a small, laminated guide that can be referenced in the field
- One (1) customized quick reference customized for SAW's radio system

In addition, the CONTRACTOR shall supply five (5) copies of each manual or reference documentation in electronic format as within the timeframe in Table 4-1.

During warranty and subsequent maintenance contracts, the CONTRACTOR shall supply addenda as needed to the standard operator's manual and standard quick reference.

4.7 Training

4.7.1 Types of Training

The CONTRACTOR shall provide the types of training specified below:

Type of Training
Radio User
Train-the-Trainer
Console Operators
Radio System Administration & Management
Radio System Maintenance
Microwave Network Maintenance

When multiple training sessions are required, each session should be given during a different week to compensate for scheduling conflicts. Provide the following details on the training offered:

- Course outline
- Recommended class size
- Recommended number of sessions
- Estimated duration
- Class schedule
- Class location

Appendix D provides an estimate of quantities, that may be revised at the discretion of the PROPOSER to successfully train all users, operators, administrators, and maintenance personnel.

4.7.2 Training Materials

The CONTRACTOR shall provide all training materials, manuals, schematics, and other documentation within the timeframe identified in Table 4-1.

Customize radio user and console operator training and training materials, including any quick-reference guides, to SAW's system configuration. Provide draft training materials, within the timeframe identified in Table 4-1, for SAW's review and approval.

SAW will review radio user and console operator training course content and materials and provide comments. When all comments have been addressed, SAW will approve course content and materials prior to beginning class sessions.

4.7.3 Travel and Lodging

SAW prefers on-site training during implementation and limited travel by personnel for training. SAW will be responsible for food, travel and lodging expenses incurred by SAW's personnel, if appropriate, during the training program.

4.7.4 On-the-Job Training

SAW's technicians may work alongside with the CONTRACTOR's personnel during installation, configuration, testing, and warranty during this project.

4.7.5 Training Descriptions

The use of audio and visual aids, as well as actual equipment demonstrations, is required for all courses. SAW will not accept a course consisting primarily of a trainer lecturing trainees.

The CONTRACTOR shall provide professionally produced training manuals to all students. The training manuals shall be furnished to SAW for continuing education purposes. The manuals shall contain clean, legible copies of all written material and visual aids used by the instructor.

4.7.5.1 Radio User Training

- Target audience: Radio users
- Location: On-site using installed equipment
- Schedule: Prior to system cutover
- Duration: One to two hours
- Description:
 - Basic overview of the radio and trunked radio system operation
 - Emphasis on types of mobile and portable equipment provided with SAW's system
 - Includes distribution and review of laminated quick-reference guides to be provided with each subscriber unit

The CONTRACTOR shall provide "User Evaluation Forms" and instruct each student in their use.

4.7.5.2 Radio User Web Based Training

The CONTRACTOR shall provide web based interactive training sessions that incorporate the above-described radio user training. Pricing shall be provided on a per seat basis.

4.7.5.3 Train-the-Trainer

- Target audience: Primarily those who will be responsible for training field personnel, service personnel, dispatchers, and all other radio system users.
- Location: On-site using installed equipment
- Schedule: Prior to system cutover
- Duration: Four to eight hours
- Description:
 - Train-the-trainer for radio users.

- In-depth training on the system configuration, operational modes, and the features and functionality specific to SAW's system.
- Special emphasis on hands familiarization and operation with all types of mobile, portable and control station equipment furnished with the new system.
- Includes distribution and review of laminated quick-reference guides to be provided with each subscriber unit.

The CONTRACTOR shall provide "User Evaluation Forms" and instruct each participant in their use.

4.7.5.4 Console Operator Training

- Target audience: Dispatchers, supervisors, and system managers
- Location: On-site using SAW's operational consoles, with no more than two people on a console
- Schedule: Prior to system cutover
- Duration: Four to eight hours
- Description:
 - Hands-on familiarization with console operation, including all features and functionality of the console or those which SAW is implementing.
 - An overview of SAW's system and a discussion on the operational theory of the system.
 - Hands-on familiarization with the use of the backup control stations furnished with the new system.

The CONTRACTOR shall provide "User Evaluation Forms" and instruct each participant in their use.

4.7.5.5 Radio System Administration and Management Training

- Target audience: Engineers, supervisors and managers involved in radio system administration, management, and control.
- Location: Typically, at the factory
- Schedule: After the detailed design review (DDR) and prior to fleet mapping. This will allow SAW to plan for all the system operations, features, and operations more effectively.
- Duration: As recommended by the CONTRACTOR
- Description:
 - May require multiple courses.
 - At the end of the training, the participants will be able to administer and manage the radio system. The training should include a system overview and theory of operation of the entire radio system.
 - Hands-on training for the system management, support equipment, and support functions of the radio system.

- Database management.
- System programming, including console configuration and subscriber equipment programming.
- System management.

4.7.5.6 Radio System Maintenance Training

- Target audience: Radio System maintenance technicians and supervisors
- Location: Combination of radio system factory training or on-site formal training
- Schedule: During radio system implementation
- Duration: As recommended by the CONTRACTOR
- Description: Training shall be sufficient to enable a competent radio technician to troubleshoot, align, maintain, and program all subscriber and/or fixed network equipment to the board level.

4.7.5.7 Microwave Network Maintenance Training

- Target audience: Microwave Network maintenance technicians and supervisors
- Location: Combination of microwave network factory training or on-site formal training
- Schedule: During microwave network implementation
- Duration: As recommended by the CONTRACTOR (or subcontractor)
- Description: Training shall be sufficient to enable a competent microwave technician to troubleshoot, align, maintain, and program microwave network equipment to the board level.

4.8 Warranty and Maintenance

4.8.1 Warranty

4.8.1.1 Infrastructure Warranty

The CONTRACTOR shall warranty the systems, equipment, software, and services provided under the Contract against failures, errors or defects in operation, materials, and workmanship for a period of at least one (1) year after System Acceptance.

The CONTRACTOR shall warranty all standard physical facilities, e.g., new constructed towers, shelters, generators, HVAC, etc. The CONTRACTOR shall provide a list of physical facilities and equipment that will offer standard warranty beyond one year. (As an example, new towers should include standard five (5) years warranty.)

The CONTRACTOR shall repair, replace, or otherwise correct defective systems, equipment, or software during the warranty period at no cost to SAW.

If a device fails more than twice during the warranty period, the CONTRACTOR shall explain such failures to SAW. If these failures indicate the equipment is prone to continuing failures, the CONTRACTOR shall replace such equipment at no cost to SAW.

4.8.1.2 Subscriber Warranty

The CONTRACTOR shall warranty subscribers for two (2) years after installation/programming and cutover (whichever is later). The CONTRACTOR shall repair, replace, or otherwise correct defective equipment or software during the warranty period at no cost to SAW.

If a subscriber fails more than twice during the warranty period, the CONTRACTOR shall explain such failures to SAW. If these failures indicate the subscriber is prone to continuing failures, the CONTRACTOR shall replace the subscriber at no cost to SAW.

4.8.2 New Equipment Purchases

Equipment purchased after system acceptance shall be covered by its particular warranty period. When new equipment is purchased, the maintenance contract will be amended to include the new equipment on a prorated basis from the date of installation to the expiration of the term of the maintenance contract in place at that time.

4.8.3 System Life-Cycle Support

The CONTRACTOR shall support the system, including the connectivity network, for a period of fifteen (15) years after System Acceptance by offering at *reasonable* cost the following:

- Hardware and software fixes and upgrades for the system
- Professional and timely service and repair
- Immediate availability of parts, materials, and equipment
- Design and engineering counsel
- Any other support as is customary and expected of a service-oriented business

4.8.4 Maintenance Contract – Years 2-15

The CONTRACTOR shall provide maintenance for all systems, equipment and software provided under this contract. Maintenance contracts shall be renewable yearly beginning at the end of system warranty for years 2 through 15.

4.8.5 Maintenance Services

The CONTRACTOR shall provide the following maintenance services during the warranty and subsequent maintenance periods.

4.8.5.1 Hardware Maintenance

4.8.5.1.1 Service Plan

The CONTRACTOR and SAW shall develop a service plan that includes the following:

- Contact names and phone numbers
- Procedures for reporting service problems
- Procedures for reporting problem resolution
- Escalation procedures

4.8.5.1.2 Preventive Maintenance

The CONTRACTOR shall provide regularly scheduled preventive maintenance as recommended by equipment manufacturer(s). Performance of systems, equipment, and subscriber units shall be maintained to original specifications.

Preventive maintenance that may affect normal operation of the system, shall be performed at a time agreeable to SAW and may be outside regular business hours at no additional expense to SAW.

Verification of simulcast alignment shall be performed on a routine basis.

4.8.5.1.3 Subscriber Units

The CONTRACTOR shall pick up defective subscriber units from a central location, be responsible for repairing units, and is responsible for providing any parts necessary for repair. If the unit cannot be repaired, CONTRACTOR will provide a new unit equivalent or better at no additional charge.

4.8.5.1.4 Mandatory OPTION: Maintenance Re-used Equipment

The CONTRACTOR shall provide maintenance for re-used existing equipment planned in the proposed system. Contract shall be renewable on an annual basis. Provide pricing in Appendix D for any maintenance on equipment that may be re-used, including any existing subscriber units planned to receive P25 software upgrades.

4.8.5.2 Emergency Service

Emergency service is reactive maintenance to address any loss of functionality in the radio infrastructure and its supporting equipment.

4.8.5.2.1 Availability

Emergency service shall be available 24 hours a day, seven days a week, including weekends and holidays.

4.8.5.2.2 Response Times

A qualified technician shall respond to requests for emergency service within the following time frames:

Failure Type	Time of Notification	Response Time
Major Failure	Any time	Technician shall respond within two (2) hours. If a problem cannot be resolved remotely, a technician shall respond to the location of failure within four (4) hours
Minor Failure	00:00-12:00	Same business day – overtime if needed
Minor Failure	12:01-24:00	Next business day – start job in the morning

Response times for all minor failures shall be the same during the 30-day performance test period. Response times are measured from the time the failure is reported. No equipment shall be out of service more than 24 hours after failure notification.

The following are considered major failures:

- loss of functionality of any entire site
- failure of the alarm system to report any alarms within its designed alarm reporting cycle
- simultaneous loss of two (2) or more radio channels
- failure of three (3) or more consoles in the system
- loss of simulcast capabilities at any site
- loss of trunking capabilities
- any failure that causes the trunked system to fail or revert to operation as a conventional radio system
- a continual bit error rate (BER) greater than 1E-6 on any link in the radio system's connectivity network
- a continual packet loss on any link in the radio system's connectivity network
- a loss of signal on any microwave hop

A minor failure is any failure not classified as a major failure.

4.8.5.3 Software Maintenance

4.8.5.3.1 Corrective Upgrades

The CONTRACTOR shall provide at no additional cost, corrective upgrades to the radio system and/or subscriber software. The availability and frequency of corrective upgrades shall be at the discretion of the CONTRACTOR.

When upgrades are made available to SAW, the timing to apply these upgrades will be at the sole discretion of SAW. If deemed necessary by SAW, the CONTRACTOR shall perform software upgrades during evenings or weekends at no additional cost to SAW.

This covers only upgrades by the CONTRACTOR or through its designated Original Equipment Manufacturer (OEM) or Software Provider that are:

- remedies for defective software
- remedies for security vulnerabilities
- new releases that are corrective revisions for earlier versions
- no-cost enhancements to earlier releases

The CONTRACTOR shall ensure that software upgrades do not have a negative impact on other components of the system.

4.8.5.3.2 Enhancements

New software releases that contain enhancements (i.e., new features and capabilities) shall be offered for purchase at agreed upon prices.

The CONTRACTOR shall make every effort to separate corrective revisions from enhancements. If it is unable to do so, and new releases are necessary to correct problem(s), then the entire release (including enhancements) shall be provided to SAW at no additional cost.

4.8.5.3.3 MANDATORY OPTION: Software Enhancement Subscription

The CONTRACTOR shall provide, as an add-on to the maintenance contract, a software update subscription service to keep SAW's equipment operating at the latest version of software.

4.8.5.3.4 Backup Media and Manuals

Backup electronic media and revised software manuals shall be provided at the time of any software revisions to SAW at no additional cost.

All system definition parameters and other unique information (data base) used to operate the system or associated subsystems shall be backed up onto removable media on a quarterly basis during the maintenance period by the CONTRACTOR. These media shall be turned over to SAW for safe, off-site storage. Backup functions shall be designed to run in an unattended mode with no requirement to change media during the process.

4.8.5.3.5 MANDATORY OPTION: Remote Monitoring

The CONTRACTOR shall remotely and continuously monitor the system for alarms, failures, or network security threats.

4.8.5.4 Technical Support

The CONTRACTOR shall provide remote, phone-based technical support, available 24 hours a day, 7 days a week, including holidays and weekends. This support shall be available to emergency response personnel, the optional support personnel and SAW's own management and maintenance personnel.

4.8.6 Service Organization

Warranty and maintenance service shall be performed only by properly trained, vendor certified, and authorized maintenance personnel.

The CONTRACTOR or authorized service organization(s) shall maintain comprehensive installation and instruction manuals for all system equipment. These manuals shall be the property of SAW and shall revert to them at such time as SAW assumes the maintenance responsibility for the system.

4.8.7 Service Records

The CONTRACTOR shall document all service performed on the system. For each maintenance service, the documentation shall include the following:

- Time started
- Location
- Name, telephone number and e-mail address of technician providing service
- Service performed
- Parts required to perform service
- Time finished

For each emergency service, the documentation shall include the following:

- Time problem was reported
- Name, telephone number and email address of person reporting problem
- Name, telephone number and email address of technician responding to problem
- Time technician responded to problem
- Description of problem
- Description of problem resolution
- Parts or repairs required to resolve problem
- Time problem was resolved, and resolution was reported to the appropriate SAW contact

Service records shall be available for SAW's inspection upon request. Records shall be maintained by the service organization for the duration of system warranty and any follow-on maintenance contracts and shall revert to SAW upon termination of the warranty or maintenance contract.

4.8.8 Spare Parts

A sufficient supply of spare parts shall be stored at a location to be determined by SAW, to allow immediate restoration of minimal operation of the system on a rolling repair-and-return basis. Other parts shall be available via emergency request and air freighted within twenty-four hours of the equipment failure. The CONTRACTOR may draw upon this spares inventory as necessary during the warranty/maintenance period, replacing equipment as it is used.

At the end of the maintenance contract, the full complement of spares shall be delivered to SAW in a repaired condition.

Further, if during the one-year warranty period, more than 5 percent of repairs are not returned within ten days, the spares inventory counts shall be doubled *for that failed spare* at no additional cost to SAW. These additional spares shall also be delivered to SAW as specified above. The purpose of this requirement is to ensure that adequate quantities of available spares are maintained on the shelf.

4.8.9 MANDATORY OPTION: Full-time Service Personnel

The CONTRACTOR shall provide full-time dedicated service personnel for the operation, administration and maintenance of the systems, equipment and software purchased under this contract. These personnel shall be available during normal business hours throughout the year and shall work at the direction of SAW. Substitutes shall be provided when personnel are absent due to vacation, training, or other reasons. SAW will provide workspace, secure area for storage of spare parts, access to SAW's work order system, landline telephone, laptop computer for programming, desktop workstation for administrative duties, and miscellaneous office supplies for these persons.

4.8.10 MANDATORY OPTION: Network Engineer

The CONTRACTOR shall provide a network engineer, capable of managing, configuring, and programming the systems, equipment and software purchased under this contract. The network engineer shall be responsible for managing other personnel assigned to SAW and shall interface with SAW's personnel.

4.8.10.1 Training

The CONTRACTOR shall be responsible for training necessary personnel to perform duties assigned.

4.8.10.2 Equipment

The CONTRACTOR shall provide work vehicles and equip personnel with tools and equipment necessary to perform duties assigned.

5 General System Requirements

5.1 Scope

The requirements of this section apply to all systems, equipment and software specified in this RFP.

5.2 Deviations from the Specifications

Systems, equipment, and software shall be based upon the latest technology and communications industry standards. The specifications in this RFP are meant to define a level of functionality without being overly restrictive. Deviations from the specifications *may* be allowed *if* they (1) will improve operational capability, maintainability, or technical quality; or (2) diminish the propensity toward obsolescence.

5.3 Brand Names

The use of brand names in this specification is intended to establish minimum performance standards and is not intended to be restrictive. The PROPOSER may propose alternate but equal equipment. Proposals using alternate but equal equipment shall be accompanied by point-by-point specification comparisons demonstrating the proposed equipment indeed equals or exceeds the specified equipment in all areas germane to the operational requirements of the RFP.

Any specification requirements that cannot be readily verified based on provided equipment data sheets, may be treated as exceptions during the evaluation.

5.4 System Reliability

5.4.1 Single-Point Failures

Failure of a single device or component (a single-point failure) within the communications system shall not reduce the ability of the system to provide the required communications under routine operational conditions.

5.4.2 Multi-Point Failures

Simultaneous failures of multiple devices or components within the system (a multi-point failure) may reduce the ability of the system to provide communications under routine operational conditions, but the system shall be designed to degrade gracefully, providing at least minimal communications under these conditions.

5.5 General Equipment Specifications

5.5.1 New Equipment

Equipment shall be the latest version of new, standard equipment. Except as noted elsewhere in the RFP, used or refurbished equipment will not be accepted.

5.5.2 Environmental Specifications

All fixed equipment must meet the following environmental specifications:

Condition	Specifications	
	Indoor	Outdoor
Operational Temperature	+5° to +40° C	-30° to +60° C
Operational Relative Humidity	15 to 90% Non-condensing	0 to 100% Condensing

5.5.3 Equipment Power Requirements

All sites involved in the system have or will have available 120/240 VAC, three-wire, single-phase or 120/208 VAC four-wire, three-phase, 60 Hz electric service. All fixed equipment power supplies, rectifiers or battery chargers must be compatible with the electric service available.

5.5.4 Equipment Grounding

The CONTRACTOR shall ground its equipment to the site ground system in accordance with ANSI J-STD-607-B.

5.5.5 Surge Protection

The CONTRACTOR shall furnish and install surge protective devices (SPDs) on all electrical, communications and control circuits connected to its equipment in accordance with ANSI J-STD-607-B. Where SPDs are or will be provided by others, the CONTRACTOR shall verify the suitability of these SPDs for its equipment. If these SPDs are suitable, the CONTRACTOR is not required to install additional SPDs.

5.5.6 FCC Part 15 Devices

All electrical and electronic equipment must comply with the standards for unintentional and incidental radiators found in 47 CFR 15, "Radio Frequency Devices."

5.5.7 Proprietary Equipment

The system shall be based as much as possible upon commercial off-the-shelf (COTS) servers, workstations, routers and switches, and associated operating system software. SAW desires the ability to replace this equipment with commercially available equipment, in the event of an emergency. Specifications for the identified equipment and software must be provided with the system maintenance documentation.

5.6 Software and Hardware Versions

Versions of software and hardware must be the latest publicly released versions or revisions at completion of system staging.

5.7 Computer and Network Security

Multi-layered security solutions shall be implemented to minimize the risk that a security incident will reduce the ability of the system to provide the required communications under routine operational conditions.

5.7.1 Computer Security

Computers integrated into the system must be configured and equipped to minimize risk to the reliability and availability of the system. The following requirements establish a minimum level of security based upon industry standards. These requirements include configuration, software, and documentation requirements.

5.7.1.1 Anti-Virus Software

All computers running a standard operating system shall be protected with anti-virus software.

5.7.2 Operating System Configuration

All computers running a standard operating system shall be protected with host-based intrusion prevention software (HIPS). The HIPS shall be tuned to protect system applications with minimal interaction with the end user. The HIPS will remain patched and up to date for the duration of the Warranty and any subsequent extended warranty periods.

5.7.3 Network Security

5.7.3.1 Authentication

All network elements (servers, workstations, routers, switches, etc.) that allow access through the network must support username and password authentication. Elements shall support, at a minimum, ten-character complex passwords. Passwords shall expire, at most, every 90 days.

5.7.3.2 Ports and Protocols

The CONTRACTOR shall supply port and protocol information for all devices connecting to the radio system network at the Detailed Design Review (DDR). The information must be of sufficient detail to support the creation of default deny filtering in network and security equipment. The CONTRACTOR shall support troubleshooting and resolution of issues associated with the supplied information.

5.7.3.3 DMZ Support

The CONTRACTOR shall certify any application that resides on a network outside of the communications system network and interfaces with devices in the communications system network will operate correctly through a De-Militarized Zone (DMZ). A DMZ is defined as firewall and intrusion preventive functions in default deny configuration that protects the interface between the radio system network and outside networks.

5.8 Installation

Equipment and physical facilities must be installed in a neat and professional manner, employing the highest standard of workmanship and in compliance with applicable standards. All sites must be left in a neat, presentable condition throughout the installation phase of the project. All rubbish, temporary structures, and equipment generated or used by the CONTRACTOR must be removed after completion of the work, and prior to acceptance.

5.8.1 Calibration of Test Equipment

All measuring and test equipment used for installation and/or acceptance testing must be part of a documented calibration program. Calibration must be traceable to the National Institute of Standards and Technology (NIST). The following equipment must be included in the calibration program:

- oscilloscopes
- service monitors
- spectrum analyzers
- network analyzers
- frequency counters
- signal generators
- multimeters used for quantitative measurements
- watt meters
- time-domain reflectometers
- RF return-loss bridges
- torque wrenches used where torque wrenches are required

5.8.2 Racks and Cabinets

Except for small ancillary equipment (such as dehydrators, coaxial surge suppressors, modems, or punch blocks) and computer equipment for human interface to the radio system (such as consoles and network management system workstations), all fixed communications equipment must be mounted in cabinets or racks.

Cabinets must be suitable for the environment in which they are installed (e.g., NEMA Type 3R or 4X for outdoor installations exposed to rain, sleet, and snow). Shelters or equipment rooms must have appropriate environmental controls (HVAC) for the installed equipment and the environment in which they are installed. Cabinets must be equipped with locking doors or panels.

Racks must meet the requirements of current revision EIA-310.

Racks and cabinets shall be designed and installed to provide easy access to equipment controls and connection points.

5.8.3 Rack and Cabinet Installation

All equipment racks and cabinets must be securely mounted to the floor. If necessary, racks or cabinets must be bolted together or braced from the ceiling to prevent swaying or being dislodged. Racks must be isolated from floors and ceilings using suitable insulators, insulating plates, washers, and sleeves.

Equipment racks and cabinets must be placed to allow a minimum of 36 inches access front and back unless all connection and maintenance points are in the front. Under no conditions shall an equipment rack or cabinet need to be moved for maintenance after installation.

5.8.4 Electromagnetic Exposure

All sites must be designed, protected, and posted to meet the limits for both public and occupational human exposure to radio frequency (RF) electromagnetic fields in accordance with FCC rules and FCC OET Bulletin 65.

Where required by 47 CFR §1.1307(b), the CONTRACTOR shall provide a statement of compliance to SAW with the electromagnetic exposure limits found in 47 CFR §1.1310 for each licensed radio system site within the timeframe identified in Table 4-1.

5.8.5 Labeling

All cables and wiring between equipment must be clearly labeled at both ends indicating source and destination equipment, connector designation and termination points.

5.9 Contractor Commitment

The CONTRACTOR shall maintain and upgrade the operational software and hardware to its most recent revision level for the term of the contract. There shall be no requirement on SAW's part to incorporate any new features. The Contractor shall provide equipment software and hardware patch, upgrade, or release notes.

Any change shall have minimal impact on system operations, or the cost shall be assumed by the CONTRACTOR.

6 Radio System

6.1 New System Description

6.1.1 Trunked Radio System

SAW desires to implement a new P25 Phase 2 (TDMA) UHF simulcast, trunked radio system that meets Project 25 standards. Dispatch consoles shall be installed at three Dispatch Centers. Each proposal shall provide radio coverage, traffic load, and all requirements to meet specifications.

6.1.2 Radio Sites

A list of existing radio sites is provided in Table 9-1 Section 9 Physical Facilities Requirements. The PROPOSER may recommend other sites not listed in the table for inclusion in the system design based on the following criteria:

- Radio coverage
- Connectivity network availability
- Facility availability
- Licensing and permitting
- Physical access
- Availability of electric power
- Cost

6.1.3 Frequency Plan and Traffic Loading Analysis

The CONTRACTOR shall develop and recommend a frequency plan for the radio system based upon a traffic loading analysis and identify the most appropriate frequencies for its system design. SAW requires:

- **Busy Hour Impact** – Must measure the **busiest hour** in a year to use mobiles, portables, desktop radios and consoles
- **Delayed Call Grade of Service Limits < 1%**
- **Maximum Acceptable Call Delay < 1 second**

The CONTRACTOR shall use the initial number of radios (mobiles, portables, desktop radios and consoles) for all Departments and Agencies from SAW listed in Appendix D Price Proposal Workbook and project the future growth for 15 years after Final System Acceptance. The SAW region estimates 0.65% growth per year; so, the CONTRACTOR shall multiply the initial number of radios by 0.65% to obtain the number of radios for traffic loading analysis. The number of channels shall include talk-paths (voice) and the control channel.

SAW Departments and Agencies	Portables	Mobiles	Control / Desktop Stations	Backup Control Stations	Consoles
Staunton Police	90	75		4	4
Staunton Sheriff	8	2			
Staunton Fire Department	40	15	2		
Staunton Public Works	9	21	2		
Staunton City Schools	118	69	8		
Staunton Augusta Rescue Squad	55	6			
Waynesboro Police	80	25			
Waynesboro Sheriff	6	6			
Waynesboro Emergency Management	7	2	2	4	4
Waynesboro Fire and Rescue	56	10	2		
Waynesboro EMS	51	6	2		
Waynesboro Public Works	20				
Waynesboro Public Schools	50	30			
Augusta County Sheriff	155	156	2		
Augusta County Dispatch	35	5	7	7	7
Augusta County Fire and Rescue	719	261			
Augusta County Emergency Management	55	22			
Augusta County Public Works/ Maintenance	75	50			
Augusta County Schools	200	230			

Table 6-1 Subscribers by agency and Dispatch Center consoles (including back-up control stations)

The CONTRACTOR shall use public safety industry best practices traffic data in their traffic loading analysis – number of messages per unit per hour (Busy Hour Impact), and the length of each message, usually separated by discipline.

The CONTRACTOR shall include and identify the Working Channel Call Overhead to the number of seconds needed for channel access time.

6.1.4 Interoperability

SAW requires interoperability channels for mutual aid, and other special events. SAW requires the ability to talk with all surrounding jurisdictions both within and outside the SAW service area.

6.1.4.1 Interoperability Channels

The PROPOSER shall describe in detail and provide all equipment: hardware and software necessary to provide interoperability to each of the agencies/jurisdictions provided in the table

below. The PROPOSER shall provide all new control stations for each of the interoperability channels required in the table below.

Item #	Name	Existing / New	Frequency Band	System Type	Analog / Digital	Conventional / Trunked
1	Harrisonburg/Rockingham	Existing	UHF/700/800 MHz	P25	Digital	Trunked
2	Albemarle/Charlottesville/UVA	Existing	800 MHz	P25	Digital	Trunked
3	Nelson County	Existing	VHF	P25	Digital	Trunked
4	Wintergreen Resort	Existing	UHF	Legacy	Analog	Conventional
5	SIRS – Virginia State Police	Existing	VHF – Low Band	Legacy	Analog	Conventional
6	Rockbridge County	Existing	UHF	P25	Digital	Trunked
7	Bath County	Existing	UHF	Legacy	Analog	Conventional
8	Highland County	Existing	UHF	Legacy	Analog	Conventional

Table 6-2 SAW Interoperability Channels

6.1.4.2 SAW/Albemarle/Charlottesville/UVA/VDOT Interoperability Solution

There is an existing outdoor cabinet located near the intersection of I-64 and State Route 250 that is used for interoperability in the Afton Mountain area. Each of the jurisdictions has a control station in this cabinet that are patched together and are accessible at each respective dispatch center's consoles. The new P25 system shall integrate into this existing interoperability solution and shall make this resource available on the SAW P25 consoles.

6.1.4.3 Interoperability Channel Recording

All interoperability channels shall be recorded by the logging recorder at each of the Dispatch Centers. Interoperability channels shall be defined separately from the radio system talk groups. Describe how the proposed interoperability solution will interface with the logging recorders. Include all costs for hardware/software required to interface the interoperability solution to the logging recorder.

6.1.4.4 MANDATORY Option: ISSI

SAW may add an Inter-RF Subsystem Interface (ISSI) to facilitate connection with regional jurisdictions.

6.2 Features and Functions

6.2.1 Project 25 Phase 2 TDMA Compliance

The communications system must be fully compliant with the latest versions of the P25 (TIA-102) Phase 2 (12.5 kHz TDMA) standards and shall be fully interoperable with all (TIA-102) compliant portable and mobile radios.

6.2.2 System Identification Codes

The system shall utilize digital system ID codes to prevent interference between systems of like protocol. The PROPOSER shall guarantee that it will not assign the same unique system ID to any system other than SAW's for the life of the SAW system.

6.2.3 Unit and Talk-group Identifiers

The system shall support at least 64,000 non-fixed consoles and subscriber units, each with a separate discrete numeric identifier (ID). The system shall be capable of supporting a minimum of 16,000 talk-groups. When a unit transmits, its ID shall be displayed at properly equipped consoles and subscriber units.

6.2.4 Talk-Group Calls

Each unit shall be affiliated with a talk-group. When a unit transmits, all units affiliated with the same talk-group receive the call.

6.2.5 Individual Calls

A user may call an individual user, whether that user is on the same talk-group or not. Depending upon the features of the subscriber unit, a user may select a target user from a list or may enter the target unit ID by keypad.

6.2.6 Late Entry

When a unit affiliates with a talk-group while a conversation is already in progress, the unit shall automatically switch to the appropriate traffic-bearing channel and receive talk-group transmissions.

6.2.7 Busy Queue and Callback

When all channels or talk paths in the system are busy, the calling unit shall receive a unique busy tone and be placed in a queue for the next available channel or talk path. The user shall be alerted by another unique tone when he has been assigned a channel or talk path for communications.

6.2.8 Priority Levels

The radio system shall offer at least five priority levels. When the system is busy and units are placed in queue, units with the highest level of priority shall be placed ahead of units with lower levels of priority.

When callers of the same priority level are placed in queue, the most recently active caller shall be placed ahead of the others in order to maintain message continuity.

The highest priority level shall be the emergency priority level and shall not be the normal priority level of any unit or talk-group.

6.2.9 Emergency Access

Emergency access shall be by means of an emergency button on the unit. Depressing the emergency button shall have two results:

- Preemptive emergency notification to a continuously manned dispatch position within 0.5 second will be ensured.
- The talk-group of the user pressing the emergency button shall be assigned the highest priority and shall be brought up for use within the same 0.5 seconds even if there is traffic on all working channels. All members of the talk-group shall be automatically notified that there is an emergency in progress.

6.2.10 Trunking Modes

The system shall be capable of operating in either a message-trunked mode (with an adjustable hang time) or a transmission-trunked mode (no hang time). Hang time shall be terminated by activation of a switch or reprogramming via the network management system.

6.2.11 Denial of Access

The system shall deny access to selected units under the control of the system manager. When a unit is denied access to the system, that unit shall not be able to transmit to the system on any channel and it shall not be allowed to receive any operational voice or data traffic from the system on any channel. The unit shall monitor the control channel to allow reactivation by the system manager.

6.2.12 Unit Disable

The system shall remotely disable compromised units under the control of the system manager. When a unit is disabled, that unit shall not be able to operate until reprogrammed. Once disabled, the unit shall not monitor the control channel to allow reactivation by the system manager.

6.2.13 Over-the-Air Programming (OTAP)

The radio system shall be equipped with over-the-air-programming so that subscriber unit operational parameters may be modified securely without removing a unit from service and returning it to a central location.

6.2.14 Encryption

6.2.14.1 Encryption Algorithms and Keys

The system and designated subscriber units shall be equipped with multiple key AES encryption.

6.2.14.2 End-to-End Encryption

The system shall provide end-to-end encryption, i.e., there shall be no point between sending unit and receiving unit, whether subscriber unit or console, where a message is decrypted and transported in the clear. All equipment shall be capable of being manually rekeyed by interfacing with a portable key fill device (KFD).

6.2.14.3 MANDATORY OPTION: Over-the-Air Rekeying

The system shall support over-the-air rekeying (OTAR) of encrypted subscriber units.

6.2.14.3.1 MANDATORY OPTION: Key Management Facility

OTAR shall be accomplished, and encryption keys shall be maintained by a key management facility (KMF). The KMF shall be capable of managing the rekeying subscriber units in groups and/or individually. The KMF shall incorporate means of tracking the rekeying process, identifying which units are rekeyed and which have not been rekeyed.

The KMF shall incorporate security partitioning to allow multiple agencies to utilize the same KMF without compromising security across operational groups.

The KMF shall support and shall be capable of managing manual rekeying via a KFD.

The KMF shall have a means to clear all keys in a compromised subscriber unit.

6.2.14.3.2 MANDATORY OPTION: KMF Workstations

The following quantity of KMF workstations shall be installed at these locations:

Location	Workstations
Augusta County Dispatch Center	1
City of Staunton Dispatch Center	1
Waynesboro Emergency Communications Center	1

Table 6-3 KMF Workstations

6.2.15 Station Identification

The system shall use an automatic means to conform to FCC requirements regarding station identification.

6.3 Performance

6.3.1 System Access Time

System access time is the time from the radio user's pressing the push-to-talk button to the radio unit's transmission on a working channel (assuming working channels are available). The system access time shall be less than following:

- 691.5 ms for a talk-group call on a single trunked radio site
- 841.5 ms for a talk-group call on a simulcast trunked radio system

6.3.2 System Throughput Delay

System throughput delay is the time from the transmission of an audio signal into a transmitting digital radio microphone to reception of the identical audio signal from a receiving digital radio speaker. The system throughput delay shall be less than the following:

- 250 ms for direct radio-to-radio communications
- 350 ms for direct radio-to-radio communications through a single repeater station
- 500 ms for direct radio-to-radio communications within an RF subsystem
- 1250 ms for direct radio-to-radio communications through two or more RF subsystems

6.3.3 Interference

6.3.3.1 Self-Interference

The radio system shall not cause self-interference. At each radio site, the static sensitivity of each radio system receiver shall be degraded by no more than 3 dB with any combination of radio system transmitters in operation.

6.3.3.2 Interference to Collocated Equipment

The radio system shall not cause interference to incumbent collocated RF equipment within 1000 ft of the new radio system equipment.

6.3.4 Radio System Reliability

6.3.4.1 System Failure Modes

All possible system failure modes shall be defined in the system's operational capabilities and limitations:

- GPS timing system failure
- Master oscillator failure

- Voter/comparator failure
- Interconnection circuit failure
- Transmitter failure
- Control channel failure
- Receiver multicoupler failure
- Tower top amplifier failure
- Trunking controller failure
- P25 system core failure
- Simulcast controller failure

The Proposer shall describe typical and maximum fault detection and failover times associated with redundant controller equipment. System acceptance testing shall demonstrate that each of these failures results in system recovery within the maximum failover 30 seconds.

6.3.4.2 Geo-Redundant P25 System Cores

The radio system shall have two geographically separated redundant cores to provide redundancy in the radio system. The primary radio system core shall be located at the City of Staunton Dispatch. The secondary radio system core shall be located at the City of Waynesboro ECC.

6.3.4.3 Simulcast System Failures

The simulcast system must maintain reliability in the event of system failure and must operate in a by-pass mode of operation. In the event of a multi-point failure of wide-area or simulcast capabilities, the trunked radio system shall revert to either local trunking, where the individual site continues to function as a standalone trunked radio site, or conventional operation where each subscriber unit is assigned to a specific channel.

6.3.4.4 Control Channel Redundancy

The radio system shall incorporate control channel redundancy. When a single control channel fails, the control channel should automatically switch to another available frequency pair, and the system shall continue to operate as a full-featured trunked system.

6.3.5 Radio System Coverage

6.3.5.1 Service Areas

The radio system shall provide coverage in the service areas shown in Figure 6-1. There are four separate service areas for SAW – one is mobile countywide, and 3 separated portable service areas:

- Mobile service area is Augusta County (including Staunton and Waynesboro)
- Portable Outdoor service area (excludes some of the outer edges of the County, and excludes the indoor portable service areas below)

- Portable Light Building service area (City of Waynesboro and other areas within the county)
- Portable Medium Building service area (City of Staunton)

KML Files and Shape files for the 3 portable services areas are included with the RFP package.

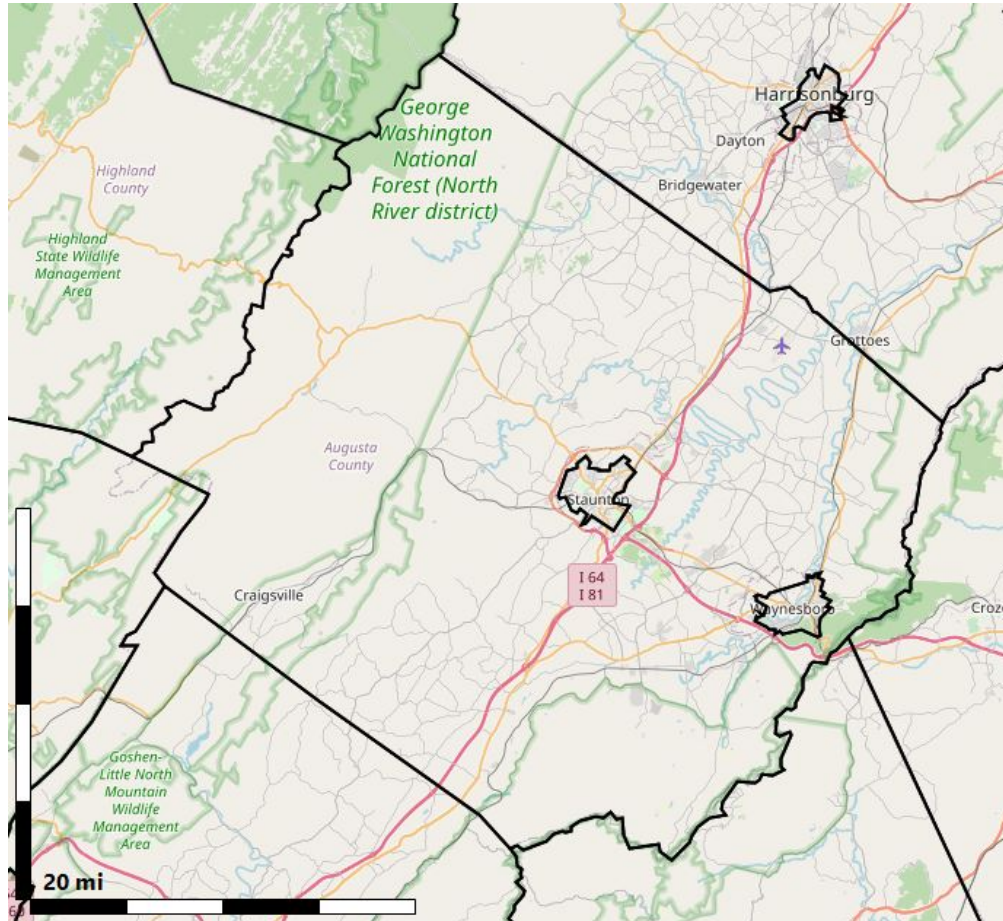


Figure 6-1 Mobile Service Area

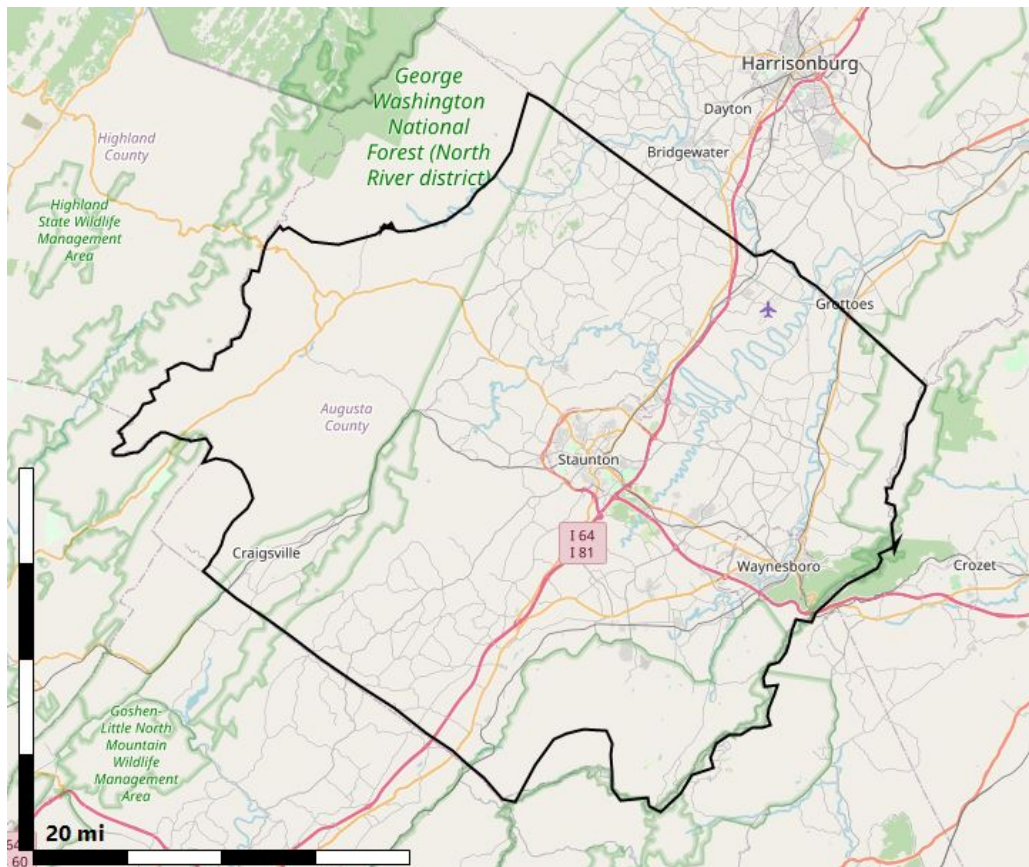


Figure 6-2 Portable Outdoor Service Area

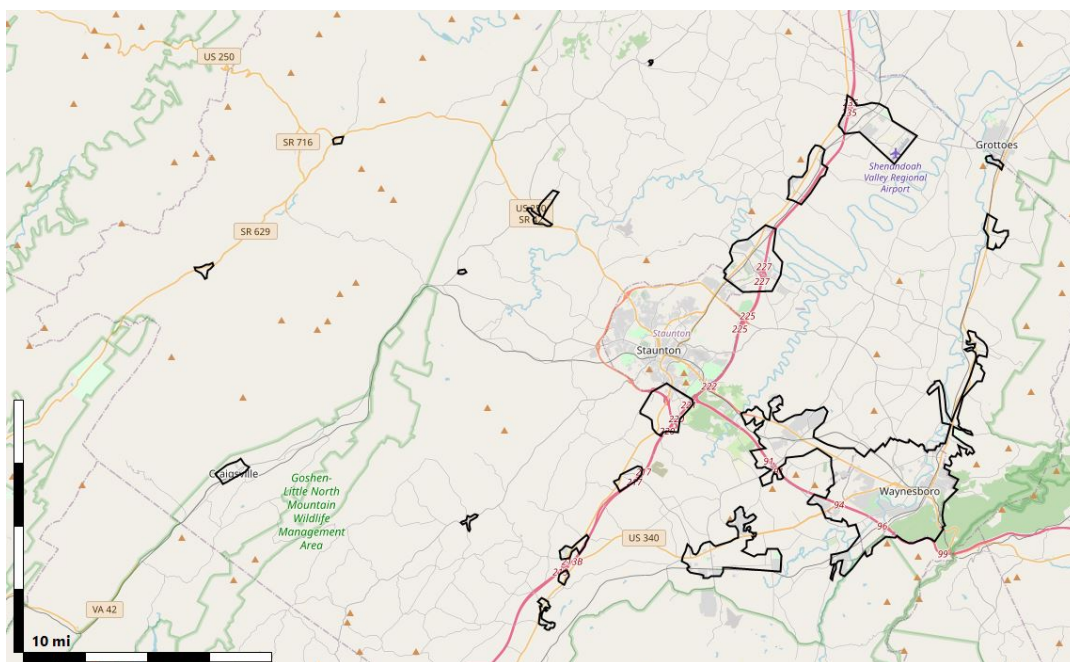


Figure 6-3 Portable Light Building Service Area

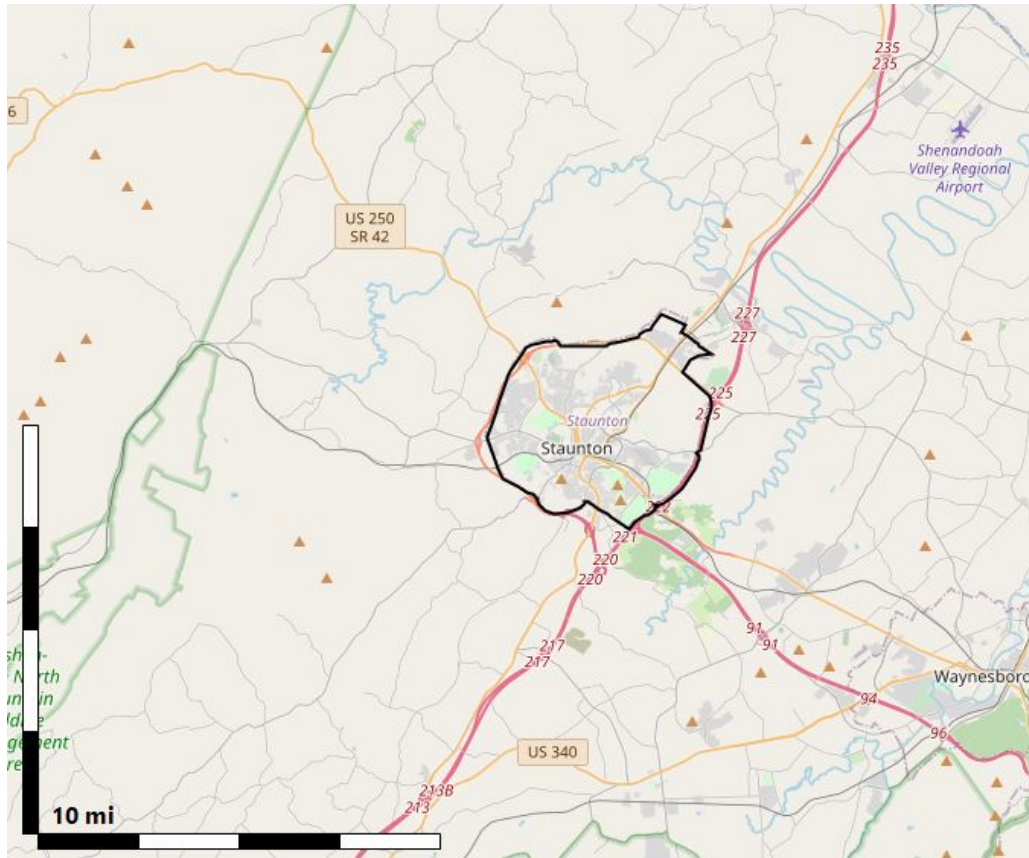


Figure 6-4 Portable Medium Building Service Area

The level of signal loss is required for the indoor portable service areas and provided in Table 6-4 below.

6.3.5.2 Building Attenuation

The Portable Light Building and Portable Medium Building service areas require coverage to and from portable radios in light, and medium buildings within the defined service areas. The following building attenuations are assumed:

Service Area	Building Characterization	Building Attenuation (dB)
Portable Outdoor	Outdoor	0
Portable Light Building	Light Building	10
Portable Medium Building	Medium Building	15

Table 6-4 Building Attenuation for Service Areas

6.3.5.3 Required Coverage Level

The radio system shall provide a minimum delivered audio quality (DAQ) of 3.4 to the receiver in both the talk-out (base to mobile) and talk-in (mobile to base) directions. DAQ is defined in

Telecommunications Industry Association (TIA) Telecommunications Systems Bulletin TSB-88.1-D, *Wireless Communications Systems – Performance in Noise and Interference-Limited Situations – Recommended Methods for Technology-Independent Modeling, Simulation, and Verifications*.

For test sectors requiring portable radio coverage, talk-in and talk-out coverage shall be based on the portable radio mounted at waist level.

6.3.5.4 Service Area Reliability

The radio system shall provide the specified service area reliability (as defined in TSB-88.1-D) to each of the service areas and radio transmission direction (talk-out and talk-in) as follows in Table 6-5 below.

		Talk-Out	Talk-In
Service Area	Conditions	Service Area Reliability	
Mobile	Mobile Countywide	90%	90%
Portable Outdoor	Portable Outdoors	95%	95%
Portable Light Building	Indoor Light Building	95%	95%
Portable Medium Building	Indoor Medium Building	95%	95%

Table 6-5 Service Area Reliability Requirements

Each service area reliability percentage shall guarantee the coverage level requirement. There is no time availability aspect to this specification. The PROPOSER is independent and may choose its propagation model, terrain database, statistical prediction method, and coverage charts.

The PROPOSER shall provide separate unbounded coverage maps for each service area and direction (talk-out and talk-in) to support your guarantees. Include your propagation model(s), identify radio models, site locations (longitude, latitude, elevation, Tx, and Rx antennas AGL), and detailed parameters.

6.3.5.5 MANDATORY OPTION: In-building BDA

SAW understands that the radio system may not provide portable radio coverage inside some medium and heavy buildings. As a mandatory option, please provide cost information for equipment and installation of a Bi-Directional Amplifier (BDA) for the following three scenarios:

- Single Story Building (Public Schools, County and City buildings)
- Multi-story Building (Public Schools, County and City buildings)
- Hospital/Prison, County and City Jails / Courts / Administration / Public Works
- Shenandoah Valley Regional Airport

6.3.6 NRAO Coordination

SAW service area is inside the NRAO quiet zone, and any new fixed radio transmitter must be coordinated with the NRAO. Any new FCC application and/or any changes of existing FCC licenses (e.g., ERP or emission designator) require the NRAO approval before submittal to the FCC.

6.4 Radio System Equipment

Equipment shall be of the highest quality, most durable public-safety-grade equipment available. Equipment shall meet or exceed current standards of the Electronic Industries Alliance (EIA) and the Telecommunications Industry Association, and the rules and regulations of the Federal Communications Commission (FCC), in addition to these specifications.

The absence of detailed specifications implies the best general practice will prevail, and high-quality material and workmanship will be applied.

6.4.1 Base Station

Base stations shall meet or exceed the performance requirements of a Class A transceiver as defined in the following standards:

- ANSI/TIA-603-D, *Land Mobile FM or PM Communications Equipment Measurement and Performance Standards*; and
- ANSI/TIA-102.CAAB-C, *Project 25 Land Mobile Radio Transceiver Recommendations, C4FM/CQPSK Modulation*; and
- ANSI/TIA-102.CCBA, *Project 25 Phase 2 Land Mobile Radio Transceiver Performance Recommendations, H-CPM/H-DQPSK Modulation*

6.4.2 Voting Comparator

Voting comparators shall vote both voice and data transmissions. Digital voting comparators shall select the best received signal based on bit error rate (BER). The digital voter shall be capable of selecting the best signal on a frame-by-frame basis.

6.4.3 Antenna Systems

The following minimum specifications, for each fixed antenna system proposed, shall be provided:

- Antenna mounting height and location on tower
- Antenna type and gain
- Transmission line type and loss
- Combining and multi-coupling network

6.4.3.1 Transmission Lines and Antenna System Accessories

Transmission lines shall be one continuous length with a copper conductor and weatherproof jacket. All RF connectors shall be installed in accordance with their manufacturer installation requirements.

All RF connectors shall be weathertight gold- or silver-plated contacts. All connectors shall be torqued to the manufacturer's specifications using a torque wrench. All connectors shall be soldered, not crimped. Manufacturer-approved wrapping and sealer shall be utilized on all outdoor transmission line in-line and grounding connections to prevent water intrusion. Outdoor installations shall include the proper minimum diameter drip loops in all cabling. Transmission lines shall be securely fastened to a cable tray or ladder attached to the tower using manufacturer approved devices and methods. Mounting hardware, cable hangers, grounding kits and other miscellaneous items shall be supplied to ensure proper installation of the antenna and transmission line. All metal components shall be intrinsically corrosion resistant. A hoisting grip shall be used at the top and at manufacturer recommended intervals to provide strain relief.

6.4.3.2 Transmit Combiners

Combiner insertion loss shall not vary from specifications by more than 0.5 dB on any port.

6.4.3.3 Receiver Multi-couplers

Each unused multi-coupler port shall be terminated with a 50-ohm load.

6.4.3.4 Tower-top Amplifier Systems

Receive antenna systems may utilize a tower-top amplifier (TTA) system comprising a tower-mounted pre-selector and amplifier, and an indoor rack-mounted multi-coupler. The TTA system shall be powered by a 120 VAC power supply. The TTA shall receive DC power transmitted via the transmission line.

The gain of the TTA and multi-coupler preamplifier shall be distributed between the two amplifiers so that failure of the TTA will cause minimum degradation of system sensitivity.

The TTA shall be equipped with redundant amplifiers. The TTA shall automatically switch to the backup amplifier upon failure of the primary amplifier.

The TTA system shall include alarm contacts to indicate a failure, an RF test port to measure gain and a bypass switch to bypass the TTA.

6.5 Simulcast Requirements

If a simulcast system is proposed the system shall meet the specifications of this section. The following simulcast system details shall be provided:

- System timing
- Launch delay
- Frequency stability
- Frequency deviation
- Simulcast alignment

6.5.1 Simulcast Design

A simulcast system shall be designed so once aligned, it shall remain aligned and shall not need routine realignment.

Under no conditions of failure shall the system be allowed to operate with two co-channel transmitters transmitting simultaneously unless that operation is in the intended simulcast bypass mode.

Parameters for simulcast alignment shall be determined by the CONTRACTOR to meet coverage requirements.

6.5.2 Transmitter Frequency Stability

The system shall be designed such that the radio frequency difference between any pair of co-channel transmitters operating in the simulcast mode shall not exceed 1.0 Hz.

6.5.3 Automated Simulcast System Timing

Automated simulcast system timing shall be referenced to GPS. Automated timing system shall allow for initial simulcast launch timing (bulk delay and offset) settings for each transmitter site. The system shall automatically readjust timing to maintain proper simulcast timing in the event a path reroute changes the transport delay from the simulcast prime/control site to a remote simulcast site.

6.5.4 Simulcast System Alignment

Simulcast system alignment procedures shall be straightforward and logical. After the system is initially aligned and accepted, there shall be procedures and alignment test facilities in place to allow routine verification of system alignment and equalization. There shall further be procedures, alignment equipment and facilities in place to allow realignment and re-equalization of the system under extraordinary situations such as replacement or repair of system components.

Routine verification of system alignment shall be possible using a single maintenance technician, preferably at a single location. Realignment may require more than one maintenance technician at more than one location.

6.6 Paging System

The SAW dispatch centers operate UHF analog tone paging systems. The systems use one existing Augusta County UHF channel that is transmitted from Augusta County and Staunton Dispatch Centers for their Fire and EMS, and one Waynesboro existing UHF channel that is transmitted from the Waynesboro ECC for their Fire and EMS. Analog paging tones are sent to the fire and rescue using analog tone encoders at dispatch console positions.

SAW intends to continue using UHF analog tone paging on the new P25 radio system. The CONTRACTOR shall provide all new UHF analog tone paging infrastructure equipment. SAW agencies will reuse their existing analog pagers. This solution shall include the UHF paging transmitters, the simulcast paging equipment, new analog tone encoders, and UHF control stations integrated into the P25 dispatch consoles and connectivity from dispatch center to tower sites.

6.7 Console System

6.7.1 Console System Description

SAW currently operates 7 dispatch consoles at the Augusta County Dispatch Center, 4 consoles at the City of Staunton Dispatch Center, and 4 consoles at the City of Waynesboro ECC.

SAW requires replacement of all existing dispatch consoles with new P25 dispatch consoles. The new dispatch consoles will interface with the conventional channels described in Table 6-2. The console system shall interface with the logging recorders.

6.7.2 Console System Configuration

The new console system shall maintain and provide the functionality of existing systems and equipment to the same level of performance as the existing configuration. Provide the new consoles and all necessary ancillary equipment to use the new P25 radio system and meet the requirements of this RFP. The table below provides the quantity and location for all new consoles.

Dispatch Center	Dispatch Location	Quantity of New Consoles
Augusta County Dispatch Center	18 Government Center Lane Verona VA 24482	7
City of Staunton Dispatch Center	116 W. Beverley Street Staunton, VA 24401	4
City of Waynesboro Emergency Communications Center	Thomas L. Gorsuch Municipal Bldg. 250 S. Wayne Ave., Suite 301 Waynesboro VA 22980	4

Table 6-6 New Console Locations

6.7.3 Features and Functions

6.7.3.1 Trunked Radio System

The console system shall interface with the trunked radio system and shall provide all console control features over the trunked radio system. The console system shall support both P25 Phase 1 and P25 Phase 2.

The console system shall provide full P25 open-standard encryption/decryption capabilities (AES) that are compatible with P25 subscriber units. The encryption/decryption functionality shall be under the control of authorized users through the radio console system. The console system shall support encrypted voice calls.

The consoles shall support emergency call operation and have both a visual and an audible notification of emergency calls initiated by the subscriber units.

6.7.3.2 Conventional Radio Channels

The new console system must interface with existing conventional channels and provide the same level of operation as the existing console system. The conventional channels must be capable of being patched to the trunked radio system.

6.7.3.2.1 Tone Remote Control

The console system shall be equipped with tone remote control capability. The system shall be compatible with industry-standard tone remote control protocols.

6.7.3.2.2 E&M Signaling

The console system shall be capable of E&M signaling to control any conventional radios, if necessary.

6.7.3.2.3 System Guard Tone

A system guard tone shall be available for the conventional radios. All modules shall be capable of generating EIA tone sets, which may be required for special purposes. In compliance with FCC regulations, if control circuit facilities should be lost, the system shall be designed such that the base station transmitter ceases transmitting within 500 milliseconds.

6.7.3.3 Backup Control Stations

Each console position shall be equipped with one full-featured backup control station. The control station may be located at the console position, or a remote controller may be located at the console position with the control station in a separate equipment room.

6.7.3.4 Instant Recall Recorder

Each console shall be equipped with an instant recall recorder (IRR). The IRR shall be capable of recording radio communications from the selected channel or talk-group. If telephone communications are performed through the console headset, the IRR shall be capable of recording audio from telephone communications. The IRR shall be capable of storing at least 30 minutes of audio. IRR audio shall be replayed through the console select speaker.

The IRR shall be equipped with the following features:

- Fast forward and reverse
- Simultaneous record and playback

6.7.3.5 Paging Encoder

The console system shall be equipped with integrated paging encoder capabilities and support the two-tone sequential paging format. The encoder shall be capable of initiating a single page or multiple pages at once. The console operator shall be able to review paging sequences before transmission is initiated. Paging sequences shall be queued while other paging sequences are being transmitted. An indication shall be provided at the console to indicate when a paging sequence is complete.

6.7.3.6 MANDATORY OPTION: CAD System Interface

The console system shall be equipped with hardware and software interfaces to SAW's computer-aided dispatch (CAD) systems to enable the CAD systems to display unit ID and status (and any other available information) from the radio system.

6.7.3.7 MANDATORY OPTION: Auxiliary Inputs and Outputs

The console system shall be equipped with auxiliary inputs and dry contact relay outputs (Aux I/Os) for doorbell, door controls and remote alarms. Auxiliary inputs shall be visible at each

console. Auxiliary outputs shall be operable at each console position. The system shall be equipped with at least eight (8) inputs and eight (8) outputs.

6.7.3.8 Concurrent Console Operation

Allowances shall be made for parallel console operation with the existing radio system and the new radio system until complete conversion to the new radio system.

6.7.4 Console Equipment

6.7.4.1 Physical Configuration

Console equipment shall be installed in the three (3) existing Dispatch Centers.

The individual consoles shall be modern workstations with CPU and audio cabinets, as necessary. Console monitors shall use flat-panel technology. Workstation CPUs shall be capable of being housed in the console furniture to maximize operator work surface.

6.7.4.2 Operator Position Hardware

The CONTRACTOR shall provide the following equipment:

- | | |
|-------------------|---|
| Footswitch: | One single pedal transmit footswitch per console. |
| Microphone: | One per console, high-quality microphone preferably on a pedestal. |
| Headset Jacks: | Two headset jacks per console, below table edge mountable, automatically disconnect external microphone and select speaker, the capability to converse on the telephone using the same operator headset and jack that is used for radio conversations shall be provided. Separate volume controls shall be provided to control radio volume and telephone volume to the headsets. |
| Wireless Headset: | One Wireless headset per console; operates with the same functions. |
| Handset: | One Handset per console (mandatory optional to replace headsets); operates with the same functions. |
| Speakers: | One select speaker and one unselect speaker per console, with volume controls. |

6.7.4.3 Workstation

The workstation shall be mounted below the work surface, but controls shall be accessible to the console operator with minimal effort.

The workstation shall use a mouse or similar pointing device. The operator can transmit using either the left or the right mouse button.

The workstation shall also have a standard PC keyboard.

6.7.4.4 Display

6.7.4.4.1 Flat-Panel Display

The display shall be a minimum 24-in flat-panel LCD display. Minimum resolution shall be 1920 x 1080 pixels. Display controls shall be accessible to the console operator.

6.7.4.4.2 MANDATORY OPTION: Touch Screen Display

The monitors shall be touch screen capable.

6.7.4.5 Select and Unselect Speakers

Speaker audio output shall be at least 3.5 watts. Each speaker shall have its own volume control. The select speaker shall reproduce the audio from the selected talk-groups or channels. The unselect speaker shall reproduce the audio from the other talk-groups or channels being monitored by the console.

6.7.4.6 Foot Switch

The footswitch shall permit the console operator to key the selected talk-group or channel. On conventional channels, the footswitch may be programmed to disable coded squelch.

6.7.4.7 Dual Headset Jacks

Each position shall be equipped with two headset jacks. Jacks shall be standard four- or six-wire connections for headsets with integrated microphones. Inserting the headset plug into either jack shall route the select audio to the headset and disable the console select speaker.

Headset jacks shall interface with the existing telephone system so dispatchers can use the same headset for telephone and radio communications.

6.7.5 Console System Operation

6.7.5.1 Console Operating Characteristics

The consoles shall be designed to enhance the operator's capabilities in performing resource management tasks and minimize the effort and concentration required for radio control.

Transmitting over the displayed selected talk-groups or conventional channel(s), and instant transmitting over a displayed talk-group or conventional channel shall be performed with only one operator action.

To minimize operator confusion and mistakes, all channels, talk-groups, and users shall be indicated by actual aliases, not numeric resource references. Cross-referencing a number to a talk-group or conventional channel name shall not be required when performing a dispatching operation. For maximum flexibility, these aliases shall be defined by SAW at system installation and shall be easily changed at any time after system installation. Aliases coding shall allow at least eight (8) alphanumeric characters.

6.7.5.2 Display Areas

Display screens shall be configured to minimize distractions to operators while providing access to all radio dispatch functions from a single screen. The screen shall display:

- System Status
- Radio Controls
- Call History
- Date and Time

6.7.5.3 Active Status Indicator

For each radio resource shown in the radio controls portion of the console screen, the following indications shall be available:

- Permanent indications
 - Resource Alias
 - Volume
 - Mute Status
- On-demand indications
 - Call Status
 - Select
 - Patch
 - Simultaneous Select
 - Busy
 - Multi-Frequency Transmitter
 - Squelch Disable

- Emergency Call indication and alarms

6.7.5.4 Console Capabilities

The console shall be capable of the following operations:

- **Supervisory Control:** Allows supervisor to override or disable a console position.
- **Patch:** Allows multiple talk-groups or channels to be patched together. The console shall be capable of at least three patches simultaneously.
- **Simultaneous Select:** Allows console operator to call multiple talk-groups or channels at once. The console shall be capable of at least three (3) simultaneous select groups.
- **Intercom:** Allows console operator to selectively talk to another console directly.
- **Console Cross Mute:** Prevents feedback between consoles.
- **Alert Tones:** The console shall be capable of transmitting alert tones over the radio system.
- **Console Pre-Empt:** The console shall have priority or console pre-emption transmit capabilities on either the trunked or conventional radio systems.

6.7.5.5 Time Synchronization

All consoles shall be synchronized to the radio system common time signal reference.

6.7.6 MANDATORY OPTION: Remote Dispatch Consoles

Remote dispatch operations shall be supported by the Console System to allow SAW to operate console positions at locations other than the dispatch centers. It is accessible to the network by direct connection to the network or via other means, such as satellite connectivity. This shall be a fully functional console for radio dispatch. Aux I/O is not required to be supported.

It is envisioned this application could operate on an existing PC or laptop using the microphone and audio/speaker connectors of the PC.

6.8 Logging Recorders

6.8.1 City of Staunton Logging Recorder

The CONTRACTOR shall replace the existing Staunton logging recorder to interface with the new P25 trunked radio system. The recorder shall function as a full featured “trunked” recorder with the capability of recording all talk-groups, encrypted and clear, on the radio system, conventional channels and all the Staunton Dispatch Center’s telephone lines. The recorder shall capture full call data for each date and time, caller unit ID and alias, talk-group or individual ID and alias, emergency, and encrypted status. Calls shall be retrievable later by searching date and time, talk-group and/or unit ID.

The new logging recorder shall be upgradeable to full IP interfacing to the Staunton 911 call-handling system.

The logging recorder shall provide redundant core equipment such that there are no single points of failure. Logging recorder system shall remain operational throughout the radio/console system and logging recorder transitions.

6.8.2 Augusta County Logging Recorder

Augusta County is in the process of upgrading their existing Revcord logging recorder with a P25 capable recorder, located at the Augusta County Dispatch Center. The CONTRACTOR shall provide all upgrades necessary to interface this existing logging recorder to the new P25 radio system including but not limited to P25 Software features, Hardware interfaces, installation, and programming, etc.

6.8.3 City of Waynesboro Logging Recorder

The City of Waynesboro recently replaced their logging recorder with a new NICE logging recorder, located at the Waynesboro ECC, that is P25 capable. The CONTRACTOR shall provide all upgrades necessary to interface this existing logging recorder to the new P25 radio system including but not limited to P25 Software features, Hardware interfaces, installation, and programming, etc.

6.9 Radio Network Management System

6.9.1 General

Network management consists of the following functions:

- configuration management
- performance management
- security management
- fault / alarm management

The Network Management System (NMS) may comprise one or more subsystems to perform these functions. For example, configuration, performance, and security may be provided on one NMS network, while alarm reporting may be provided on a separate NMS. The NMS shall be a GUI-based, multi-protocol network management tool. The NMS shall provide remote access via VPN with SSL web access control security. The NMS shall be capable of email and paging notifications of threshold events that require immediate response and deployment.

NMS access shall be available at the following locations:

- Augusta County Dispatch Center
- City of Staunton Dispatch Center
- City of Waynesboro ECC

6.9.2 Configuration Management

The NMS shall provide the human-machine interface for configuration of the radio system and associated subsystems. Radio system configuration includes items such as the following:

- channel partitions
- control channel designations
- encrypted channel designations
- enabling or disabling channels
- enabling or disabling sites
- trunking modes
- system fault definitions
- paging codes
- console configurations or personalities

Subscriber or user configuration includes items such as the following:

- allowable call length
- talk-group definitions
- unit IDs
- enabling or disabling subscriber units

The NMS shall provide a database for all radio system elements. The NMS shall allow the system administrator to perform multiple simultaneous database operations.

6.9.3 Performance Management

The NMS shall display and store system status and traffic data for functional and organizational management of the user base.

The NMS shall display system performance information on an NMS workstation with a summary printer. The system shall be capable of displaying channel activity for the entire system on screen.

The NMS shall store performance data on electronic media. Real-time storage capacity shall be sufficient to store system activity records for one full week.

Data displayed and stored shall include the following items as a minimum:

- System Traffic Data
 - Channels in use
 - Total channel minutes on the air
 - Transmitter use balance
 - System busy time
 - Emergency Priority utilization

- Usage Optimization
- System Status Data
 - System failures in progress
 - System organizational changes (unit reassignments)
 - Report Building
 - Activity Details
 - Activity Summaries
 - Alarm Control, Display, and Logging
 - Channel Statistics
 - Site Statistics
 - Event Logs
 - On Screen Reports
- Subscriber Traffic Data
 - Unit (including consoles) making call and the time the call was successfully completed
 - Length of transmission
 - Time in waiting queue
 - Type of call (e.g., group, individual, telephone, data, etc.)
 - Destination of call (e.g., group ID, individual ID, etc. that received call)

6.9.4 Security Management

Access to the NMS shall be password protected. There shall be at least two (2) levels of password access. Access to status, activity, alarms, and other system information shall be available to several authorized users. Control and diagnostic operations shall be accessible to a limited number of administrator-level users authorized to control these operations.

The servers shall have the ability to be remotely supported by via VPN. The database administrator shall have the capability to monitor all VPN access and activities being performed by the remote entity.

Web browser access shall be provided with support monitoring and control functions and administratively restrictive database modifications. Multiple locations and users should be able to access the monitoring screens concurrently.

6.9.5 Fault/Alarm Management

The NMS shall monitor the radio system and microwave network for critical and non-critical failures and status changes. The system shall be continuously and automatically monitored for failure of any key component. Any failure of a key component shall be automatically indicated at the NMS workstations.

6.9.5.1 Alarm Points

The NMS shall monitor and alarm major and minor failures, abnormal conditions of operation, and status changes of the radio system and connectivity network. Alarms monitored shall include equipment failures or link failures of or to the following equipment or systems:

- GPS receivers
- Repeaters
- Tower-top amplifiers
- Antenna systems
- Control systems
- Network management systems
- Database management systems
- Consoles
- Summary alarms from connectivity system
- Channel banks
- Loop switches
- Routers
- Network switches

The above list is a minimum requirement. The NMS shall allow any failure or abnormal operating condition to be traced to the equipment level.

In addition to radio system alarms, the following facility alarms at each communications location are to be integrated into the NMS:

- Building Intrusion
- Building Low/High Temperature
- Tower Lighting
- Building Smoke/Fire
- Fire Suppression System Discharge
- Air Conditioner Failure
- Commercial Power Failure
- Generator Run
- Generator Control Switch Not Set
- Generator Low Oil Pressure Pre-Alarm
- Generator Low Oil Pressure Alarm
- Generator Low/High Coolant Temperature Pre-Alarm
- Generator Low/High Coolant Temperature Alarm
- Generator Low Fuel in Tank
- Generator Failure Summary Alarm

6.9.5.2 Alarm Point Inputs

The alarm system shall accommodate the following types of status inputs, at a minimum:

- Form C relay (either N/O or N/C)
- TTL
- RS-232

Where available, SNMP is the preferred method for capturing and reporting alarms to the NMS.

Any additional third-party equipment that supports the overall communications system shall be provisioned with alarm ports that are compatible with the proposed alarm system.

6.9.5.3 Alarm Indication

When a major or minor failure or status change occurs, an indication shall be displayed on the alarm system terminal within 30 seconds of the alarm occurrence.

The alarm system terminal shall display a report for each alarm containing, at a minimum, the following information:

- Station name
- Point name
- Point status description
- Mandatory Optional instruction line

Alarms shall remain active until the failure is corrected and the alarm is reset by the operator.

6.9.5.4 Alarm Point Attributes

The primary alarm description text field shall provide a minimum of 40 characters for each alarm status. A secondary alarm description field shall assign the change of state severity:

- Critical
- Major
- Minor
- Status

The third field shall provide condition indicators for fail and clear, Door Open, Door Closed, etc. The system shall be capable of classifying alarms into selectable groups such as Critical, Power Alarm Group, Generator, etc.

The NMS Master shall have independent control of whether specified alarms are displayed on the workstation screen or are directly recorded within the history file. The system shall have the capability of assigning special resolution instructions per alarm point to provide operator direction. The operators shall have the ability to notate comments on alarm points. These comments shall be time stamped and log the operator who created the entry.

6.9.5.5 Redundancy

The NMS shall be fully redundant for both hardware and software, with a primary and a backup server. The geo-separated backup server shall be co-located with the backup radio system core, and must be updated with all alarm, provisioning, and measured data daily at a minimum, without interruption to the functionality of the NMS. In the event of equipment failure of the primary server, the backup server shall automatically switch in a seamless manner to the primary mode of operation. If the primary server loses visibility of any remote sites due to microwave equipment or hop outage, the backup server shall assume the primary function of operation for sites that have lost connectivity to the primary server but retain connectivity to the backup server.

6.9.5.6 Visible and Audible Annunciation

Each alarm indication shall provide a visible and audible annunciation when an alarm occurs. The audible alarm may be silenced when the alarm is acknowledged by the operator.

6.9.5.7 Historical Data

The alarm system shall store historical alarm data. Historical alarm reports shall be capable of querying, allowing the operator to produce alarm reports based on individual alarm, equipment, equipment type, subsystem, or time. Historical data shall be exportable to other software for analysis. The system shall store historical alarm data for a period of 90 days at a minimum.

6.10 MANDATORY OPTION: Subscriber Mapping System

The subscriber mapping system shall utilize the location data reported from the P25 subscribers via the radio system infrastructure to display the location of each P25 subscriber reporting its GPS location over a background map display.

The background map display shall be capable of being set to different background types, such as Road Map and Satellite Overview. The system shall be able to zoom into the background map and the background map shall rescale as it zooms in and out.

Subscriber locations shall be capable of being displayed with a minimum of four different icons and the icons colors shall be able to be changed. Subscriber location shall have an adjustable update time with minimum updated time of one second.

The subscriber mapping system shall be capable to be simultaneously access at each dispatch position in the dispatch center and shall be able to be displayed on a wall mounted 55-inch display. The minimum display resolution shall be 1920 x 1080.

7 Connectivity Network

The connectivity network shall provide IP digital connectivity among the trunked radio system RF sites and core network equipment at the three dispatch centers. The capacity of the network links must be at least 50 Mb/s to support the radio system, other existing circuits (such as circuits for conventional radio channels) and future applications of SAW. Dark single mode fiber-optic cable may be available to link existing SAW-owned radio sites and the three dispatch centers. The remainder of the telecommunications links shall be IP microwave provided by the CONTRACTOR.

The connectivity network shall be designed to meet the availability requirements specified in this RFP. True redundancy shall be provided for all LMR traffic and alarm system circuits, such that the failure of any single path or piece of equipment must not degrade radio system performance. It is expected that each RF site will be part of a telecommunications ring providing redundant routing to/from each RF site to the dispatch centers.

7.1 Existing Connectivity Network

SAW's existing systems are using a mixture of microwave connectivity and UHF control station links.

7.2 Microwave System Requirements

7.2.1 Configuration

The microwave system shall provide redundant routing to/from each RF site to the core equipment location and to the dispatch centers. Failure of a single telecommunications circuit shall not diminish the ability of the connectivity network to provide required connectivity between the RF sites and the three dispatch centers. The connectivity design shall have path and equipment redundancy. The system shall be scalable and capable of upgrading capacity by additional microwave RF channels via the proposed antenna system. SAW expects the designed connectivity system to utilize a ring topology. If any spur site cannot join the ring realistically, then this site must follow § 7.5.1.3 (MHSB).

Figure 7-1 is an example conceptual design of the general desired connectivity network topology. The connectivity network shall be designed to meet the availability requirements specified in this RFP.

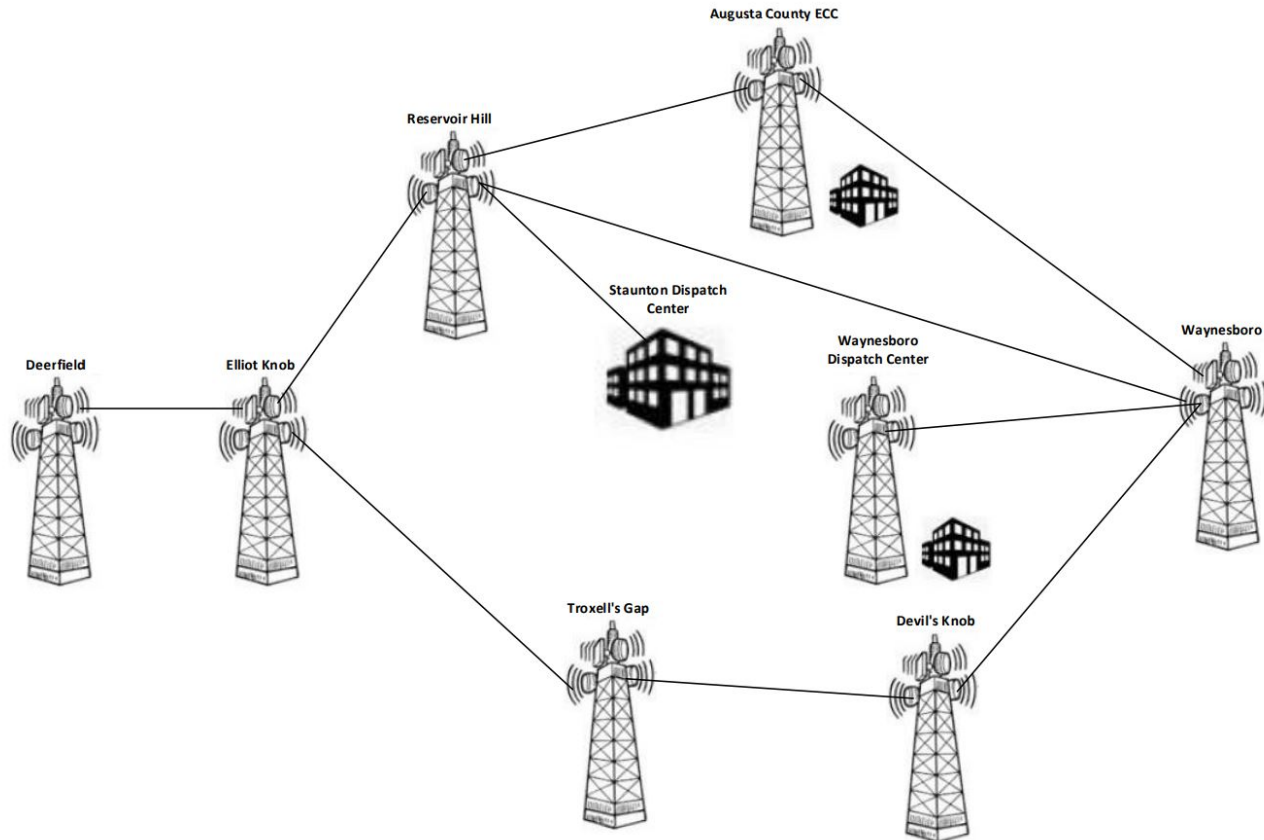


Figure 7-1 Example Conceptual Connectivity Network Topology

7.2.2 Microwave Frequency Bands

The microwave network shall use licensed frequencies in the 4.9, 6, 11, 18 and 22 GHz fixed service bands.

7.2.3 Microwave System Performance

7.2.3.1 Path Availability

Each microwave path shall be designed to provide a minimum two-way path (round-trip) availability of 99.9995 percent at a BER threshold of 1E-6. Note that a one-way microwave path (outbound or inbound) requires the minimum availability of 99.9999 percent at a BER threshold of 1E-6.

Microwave path propagation predictions and designs shall be based on line-of-sight conditions conforming to the following obstruction clearance criteria:

- $0.6 F1 + 10$ feet at $K = 1.0$
- $0.3 F1$ at $K = 2/3$
- $F1$ at $K = 4/3$

7.2.3.2 Circuit Quality

The microwave system shall be designed to provide a minimum 1E-6 BER for each DS1 end-to-end circuit, including any combination of contiguous microwave hops.

7.3 MANDATORY OPTION: MPLS Routers

As an option, the Proposer shall provide MPLS routers to support multiprotocol label switching (MPLS) routing to support seamless integration and ad hoc routing with landline-based Ethernet connections.

7.4 Connectivity Network Management System

The NMS shall provide a single platform for personnel to monitor the connectivity network and to provide adequate alarm information for first level response to system degradation and outages. The NMS shall be a GUI-based, multi-protocol network management tool. The NMS shall provide remote access via VPN with SSL web access control security. The NMS shall be capable of email and paging notifications of threshold events that require immediate response and deployment.

Network management consists of the following functions:

- equipment provisioning
- configuration management
- performance management
- security management
- alarm management

The NMS shall provide summary alarm outputs to the radio system NMS.

7.4.1 Configuration Management

The NMS shall provide the interface for configuration of the connectivity network. Connectivity configuration includes items such as the following:

- Provisioning of the microwave radio equipment
- Administrative functions

The NMS shall provide a database for all network elements and configuration parameters. The NMS shall allow the system administrator to perform multiple simultaneous database operations.

7.4.2 Performance Management

The NMS shall display and store system status, alarm indications, administrative functions, and NMS system access. The NMS shall store performance data on electronic media. Real-time storage capacity shall be enough to store system activity records for one full month.

The NMS shall display system performance information on an NMS workstation.

Data displayed and stored shall include the following items at a minimum:

- System failures (static and intermittent)
- Historical Report
- Activity Details
- Activity Summaries
- Alarm Control, Display, and Logging
- Equipment Statistics
- Site Statistics
- Event Logs
- On-Screen Reports
- Receive signal level (RSL)
- IP packet statistics such as collisions, jabbers, packet sizing and fragments

Data stored and reported, and thresholds for upper and lower limits shall be customizable.

7.4.3 Security Management

Access to the NMS and other system elements shall be password protected. There shall be at least two (2) levels of password access. Access to status, activity, alarms, and other system information shall be available to three (3) authorized users. Control and diagnostic operations shall be accessible to a limited number of administrator-level users, authorized to control these operations.

The servers shall have the ability to be remotely supported by via VPN. The database administrator shall have the capability to monitor all VPN access and activity while being performed by the remote entity.

Web browser access shall be provided with support monitoring and control functions and administratively restrictive database modifications. Multiple locations and users should be able to access the monitoring screens concurrently.

7.4.4 Fault Management

The NMS shall monitor the connectivity network for critical and non-critical failures and status changes. The system shall be continuously and automatically monitored for failure of any key component. Any failure of a key component shall be automatically indicated at the NMS workstations.

7.4.4.1 Self-Diagnostic Capabilities

The system shall have the following diagnostic capabilities to facilitate and enhance the troubleshooting ability of the NMS system and associated hardware.

- Monitor master and backup server hardware components (disk drives, fans, temperature).
- Gather statistics on quality of polling per address.
- Gather statistics on quality of polling per polling port.
- Ability to view polling activity in text as well as protocol (byte) level.
- Internal operational alarms shall be monitored and appear as other system event alarms.

7.4.4.2 Alarm Points

The NMS shall monitor and alarm major and minor failures, abnormal conditions of operation, and status changes of the radio system and connectivity network. Alarms monitored shall include equipment failures or link failures of or to the following equipment or systems:

- Network management systems
- Database management systems
- Microwave radios
- Network routers
- Network switches

The above list is a minimum requirement. The NMS shall allow any failure or abnormal operating condition to be traced to the shelf sub-system level.

The connectivity NMS shall provide summary alarm outputs connected to inputs of the radio system NMS.

7.4.4.3 Alarm Point Inputs

The alarm system shall accommodate the following types of status inputs, at a minimum:

- Ethernet (SNMP)
- Form C relay (either N/O or N/C)
- TTL

7.4.4.4 Alarm Indication

The NMS GUI screen display shall display the complete monitored network and associated programmed alarms, controls, and status. The GUI layer display progression shall be as follows:

- **Global View:** This shall be a mapped representation of all sites. If an alarm condition exists at a site, a single-colored icon shall illuminate red for critical/major, yellow for minor, green for normal, and blue for manual control.
- **Site Level View:** The site level views shall illustrate the equipment at each individual site. Each equipment sub-system shall be represented by an illuminated colored icon.

- **Equipment View:** The equipment view shall expand the equipment subsystem in the Site Level View and display the individual racks, shelves and modules generating the alarm. Each displayed rack, shelf and module shall have a colored icon illuminated.

When a major or minor failure or status change occurs, an indication shall be displayed on the alarm system terminal within 30 seconds of the alarm occurrence. When an alarm is generated, the icon shall blink the appropriate color and continue to do so until acknowledged. Once an alarm point is acknowledged, the icon shall cease to blink and maintain the color associated with the priority level until the alarm status is normal.

The alarm system terminal shall display a report for each alarm containing, at a minimum, the following information:

- Date and time (stamped by either the master or RTU)
- Station name
- Point name
- Point status description
- Mandatory Optional instruction line

The user shall have the capability to customize the system's alarm display field's format as to which fields are to be displayed, in what order and in what colors. Clear or normal alarms and/or conditions shall have the capability to be displayed in various colors independent of the coloration of the failed alarms. The system workstations shall have the capability of displaying in text and GUI representation all current system monitored alarm status. All event state changes that have not been acknowledged by the user shall be displayed in a separate list of event state changes.

7.4.4.5 Alarm Point Attributes

The primary alarm description text field shall provide a minimum of forty (40) characters for each alarm status. A secondary alarm description field shall assign the change of state severity: Critical, Major, Minor & Status. The third field shall provide condition indicators for fail and clear, Door Open, Door Closed, etc. The system shall be capable of classifying alarms into selectable groups such as Critical, Power Alarm Group, Generator, etc.

The NMS Master shall have independent control of whether specified alarms are displayed on the workstation screen or are directly recorded within the history file. The system shall have the capability of assigning special resolution instructions per alarm point to provide operator direction. The operators shall have the ability to notate comments on alarm points. These comments shall be time stamped and log the operator who created the entry.

7.4.4.6 Alarm Notification Media

The NMS shall provide remote access via VPN with SSL web access control security. The NMS shall provide automatic email and paging notifications of threshold events that require immediate response and deployment, utilizing the SAW's existing Internet connections and/or any new connections provisioned for purposes of contracted network monitoring services.

7.4.4.7 Alarm Analysis

The NMS shall have the capability to establish truth table and threshold routines for leveled response. For example: Site A reports "*Microwave PA output, Low*" (This alarm by itself would not constitute an after-hour's callout). However, coupled with a site B intermittent "*Microwave Signal Degrade*" and a site B "*MPLS BER Threshold Alarm*" the NMS routine script would report "*Site A Microwave Transmitter Alarm, Major, Immediate callout, John Doe.*"

7.4.4.8 Visible and Audible Annunciation

Each alarm indication shall provide a visible and audible annunciation when an alarm occurs. The audible alarm may be silenced when the alarm is acknowledged by the operator.

7.4.4.9 Historical Data

The alarm system shall store historical alarm data. Historical alarm reports shall be capable of querying, allowing the operator to produce alarm reports based on date and time, site or subsystem, alarm classification, equipment, or equipment type. Historical data shall be exportable to other software for analysis. The system shall store historical alarm data for a period of at least 30 days.

7.4.5 MANDATORY OPTION NMS Backup

A backup server must be updated with all alarm, provisioning, and measured data daily at a minimum, without interruption to the functionality of the NMS. In the event of equipment failure of the primary server, the backup server shall automatically switch in a seamless manner to the primary mode of operation. If the primary server loses visibility of any remote sites due to microwave equipment or hop outage, the backup server shall assume the primary function of operation for sites that have lost connectivity to the primary server but retain connectivity to the backup server.

7.4.6 Protocols

The NMS platform shall have the ability to support concurrently polled protocols on multiple ports. It shall be capable of alarm mediation, such as receiving collected alarms from another monitoring platform or element manager using one or more of the following protocols: SNMPv1,

SNMPv2, SNMPv2c, SNMPv3, MODBUS, and TL1. The NMS shall have a MoM SNMPv2c (minimum) port that will report all alarm information to a higher order MoM.

7.5 Software

The system shall support software modularity, which shall allow for selective functionality enhancements to be added or removed based on the specific requirements of SAW.

7.6 Equipment Requirements

The microwave system shall include all equipment required for a complete operational system. The equipment shall be complete, mounted, and wired in racks, ready for operation. Accessories shall include specialized test fixtures, test cords, and adapters. All equipment shall be completely tested at a staging location. Staging tests shall be documented.

The equipment shall be completely solid-state, employing the latest technology, and shall be convection-cooled. All necessary standby switching, alarm sensing, and control shall ensure fully automatic operation. Equipment shall have remote alarm/control capability for any equipment failure.

7.6.1 Digital Microwave Radio

RF terminal equipment shall meet the following requirements:

Primary Power Input:	-48 VDC
Maximum Residual BER:	1E-10
Capacity:	50 Mb/s

RF Terminals are expected to be indoor units unless a special circumstance is encountered. The use of outdoor units may be considered by SAW on a case-by-case basis.

7.6.1.1 Redundancy

The microwave equipment shall utilize redundancy against failure. All packets shall be automatically protected using BER threshold sensing, IP QoS monitoring and packet switching. All packet loss failures shall be sensed and remotely indicated.

The microwave equipment shall have fault-sensing capability that will detect transmitter and receiver failures and bit error rate degradation.

The equipment shall provide alarm outputs to the alarm system. The equipment shall provide status indications for local observation.

7.6.1.2 Mesh-Configured Microwave Equipment

In a mesh configuration, the microwave equipment shall be fully protected utilizing two or more microwave or fiber-optic routes to each site. If there is a failure or path/equipment degradation which exceeds the BER threshold of the primary link or equipment, the packets will reroute to alternate links before there is any degradation to traffic or loss of network and/or equipment synchronization.

7.6.1.3 Spur-Configured Microwave Equipment

Spur configured microwave equipment shall be fully protected with monitored hot-standby (MHSB) transmitters and receivers. The receiver outputs shall be switched in a “hitless” (fewer than 10 bit errors) manner. The MHSB transmitters shall be switched to provide proper termination and isolation to the standby transmitter. Either the primary or secondary transmitter may be active. Provisions shall be included for testing and alignment of the standby units without disturbing the active units.

7.6.2 Microwave Power Supplies

All proposed microwave equipment shall be powered from a nominal -48 VDC supply.

7.6.2.1 Battery Charger/Powerboard Equipment

Microwave and multiplex sites shall be equipped with -48 VDC, positive-ground redundant charger/powerboard units. Charger/powerboard unit's recharge time shall not exceed eight hours to charge a discharged battery plant to its specified capacity. The charger/powerboard supplied shall operate so that it provides adequate current output to support the microwave equipment site load. The charger/powerboard shall be equipped with and wired for operation in an EIA standard rack and shall consist of the following components:

- N + 1 multiple charger units configured for load sharing and redundancy
- Circuit breaker panel equipped with individual distribution circuit breakers
- Ground bar
- Volt/ammeter panel
- System load disconnect panel
- High/low voltage disconnect panels

The charger/powerboard units shall have the capability to operate in a battery-eliminator configuration.

7.6.2.2 Battery Plant Equipment

The battery system shall consist of sealed maintenance-free cells and shall meet or exceed eight (8) hours of operating time for supplied microwave equipment. Battery operating life expectancy shall be at least eight (8) years.

Battery racks shall be installed, assembled, and wired as a complete operational system. Vendor-recommended corrosion-resistant hardware shall be provided to facilitate long-life operation of battery plants. Steel racks used to support battery units shall be protected by an acid-resistant material or coating. System shall be designed for easy access in the event batteries must be replaced.

7.6.3 Microwave Antenna Systems

The antennas, radomes, waveguide, and associated mounting hardware shall be rated to withstand winds and icing conditions common to the SAW's service area. Antennas shall be of solid construction with pressurized feed horns. Antennas may be single polarized or dual polarized. Antennas shall be furnished with long life radomes.

7.6.3.1 Microwave Antenna Mounting

All antennas 6 ft. or greater in diameter shall be secured to the tower with a minimum of two side-braces. Standard 4.5 inch diameter pipe mountings shall be utilized to support the microwave antennas. Ice bridges or ice shields shall be installed above microwave antennas.

7.6.3.2 Microwave Transmission Lines

Premium copper elliptical waveguide shall be employed in continuous lengths for all transmission line runs. Splicing is not permitted. The waveguide shall be installed and grounded in accordance with the manufacturer's recommendations, using hardware approved by the manufacturer for that purpose.

7.6.4 Dehydrator/Pressurization System

The pressurization equipment shall maintain at least 5 psig of positive pressure in the elliptical waveguide and antenna feed horn. The CONTRACTOR shall include all required fittings, regulators and pressurization lines, gauges, distribution manifolds, and installation hardware. Separate pressure metering shall be provided for each waveguide pressurized. Alarm outputs for low pressure, high pressure, high humidity, and excessive run time shall be provided and connected to the network monitoring and control system.

All installed antenna/transmission lines shall be purged, pressure-tested, and tested for low Voltage Standing Wave Ratio (VSWR) using return loss measurements over the specified frequency band.

7.7 Optical Transport Network Equipment

Dedicated fiber optic links and/or leased lines may be used as components in the connectivity network.

7.7.1 Fiber Optic Cable

Single mode fiber optic cable shall be constructed and installed in accordance with applicable TIA/EIA standards and the manufacturer's recommendations.

The system design shall use geographically diverse redundant cables routed utilizing separate conduits to facilitate communications redundancy between each node. Redundancy configurations should support ring protection and secondary routing capabilities to protect against operational failures along routes.

A cross-connect (x-con) junction rack will be provided to house the splice tray equipment and x-con panels. The rack shall be a standard EIA/TIA-310 relay rack with standard hole spacing and will include the following:

- Fiber management panel to facilitate x-con cable routing
- Universal cable clamp for cable support
- Fiber identification flip chart

7.7.2 Transport Node Equipment

Transport node equipment shall be configured to support loop, or single path with 1+1 or N+1 redundancy switching architectures.

ANSI 0900105 standards and the optical specifications, transmission capabilities, and interface as detailed in ANSI T1.106-1996. Units shall be provided for 1310 nm and 1550 nm.

In a loop configuration, the transport node equipment shall be fully redundant at the optical network line side and the DS3/DS1 electrical drop side. The network loop will provide a primary (clockwise) DS1 link with a dedicated secondary (counterclockwise) DS1 link for all sites on the loop. The receive section on the line or network side will monitor the OC3, STS-1, DS3 or DS1 signals from both directions and perform a comparative selection according to BER or loss of signal (LOS), then switch to the non-degraded path. The switch function BER threshold at the OC3 level shall be 1E-6. If there is a failure in the primary link or equipment, the traffic will switch to the secondary route. The optical node equipment will transmit the DS1 circuits in both directions to allow for receiver-side switching only. The electrical drop side of the transport node equipment shall perform error-free manual and automatic switching functions of all circuits.

The transport node equipment shall fully protect traffic, overhead orderwire, digital service channels and wayside circuits in the event of equipment failure, fiber cut or single link failure.

The transport node equipment shall have fault-sensing circuitry that will detect optical and electrical transmitter, receiver, and sub-rate card failures and BER degradation. The equipment

shall provide serial, contact and Simple Network Management Protocol (SNMP) alarm interfaces for reporting to the network management alarm system via a remote terminal unit (RTU). All available alarm points in the equipment and all external control inputs, which may be utilized for remote equipment control functions, shall be described.

Transport node equipment shall meet the following requirements:

- Primary power input of ± 24 or ± 48 VDC
- Link residual BER of less than $1\text{E-}10$

7.7.3 Digital Multiplexer Equipment

The digital multiplex equipment shall provide modulation and processing for the DS1 signals between the channel banks/routers and the fiber equipment.

The equipment shall be complete, mounted and wired in racks, ready for operation. Accessories shall include specialized test fixtures, test cords, and adapters. All equipment shall be completely factory-tested and documented in the final configuration.

The equipment shall be completely solid-state, employing the latest technology, and shall be convection-cooled. All necessary standby switching, alarm sensing, and controls shall ensure fully automatic operation, and it shall have remote alarm/control capability for any equipment failure.

Test points and facilities shall enable alignment and testing of all signal levels, including DS1 signals to and from the carrier equipment, levels, clock frequency, BER levels, framing, power supplies, and all interface signals, all with no interruption of service. Built-in alarms shall be provided for major, minor, power failure, BER, and loss of clock or framing.

In addition, a system-wide redundant master oscillator incorporating synchronization signals routed to all 1.544 Mb/s clocks shall be provided to ensure absolute phase coherence of the land mobile simulcast transmitter sites.

Mandatory Optional clocking should be provided as follows:

- Receive side recovered clocking.
- Transmit master clocking.
- External clocking: GPS, Stratum and Telco reference.

They shall have local and remote provisioning access, be capable of performing loop back functions and testing, and have full diagnostic capabilities.

8 Subscriber Equipment

8.1 Definitions

Subscriber unit: a mobile, portable or control station radio are considered Terminal Hardware.

Accessory: a device that interfaces with a subscriber unit such as an external microphone, antenna, control head or battery charger.

8.2 Public Safety versus Non-Public Safety

Two types of subscriber units shall be provided:

- Public Safety
- Non-Public Safety

Public Safety radios shall be the same family of radios with the only differences being equipped features or mandatory options, and price. Accessories for the same family of radios (such as microphones, antennas, batteries, and other features or mandatory options) shall be interchangeable. Non-Public Safety radios are single band radios, typically less expensive, and not necessarily in the same family as the Public Safety radios, with limited features and mandatory options. All subscribers typically include a keypad; some radios may offer a selection – full keypad, limited keypad, or without a keypad.

Subscriber units shall be equipped with the features and functions specified in Table 8-1. All subscribers shall be capable of operation in UHF frequency band (380-520 MHz). Selected units shall be dual band or all band, including operation in the VHF band (136-174 MHz) and/or 700/800 MHz band (768-861 MHz).

Feature	Configuration					
	Mobile		Portable		Control Station/Desktop Remote	
	Public Safety	Non- Public Safety	Public Safety	Non- Public Safety	Public Safety	Non- Public Safety
Multiband (Dual Band or All Band)	Yes		Yes		Yes	
Trunked Talk Groups or Conventional Channels	128 - 512	128	128 - 512	128	128 - 512	128
Time-Out Timer	Yes	Yes	Yes	Yes	Yes	Yes
Dynamic Regroup Capable	Yes	Yes	Yes	Yes	Yes	Yes
Out-of-Range Signal	Yes	Yes	Yes	Yes	Yes	Yes
Group Call Capable	Yes	Yes	Yes	Yes	Yes	Yes
Emergency Call Button	Yes	Yes	Yes	Yes	Yes	Yes
Talk-around Operation	Yes	Yes	Yes	Yes	Yes	Yes
Private Call Receive	Yes	Yes	Yes	Yes	Yes	Yes
Private Call Initiate	Option		Option		Option	
Vehicular Charger			Yes	Yes		
Keypad	Option	Option	Option	Option	Option	Option
Priority Group Scan	Yes	Yes	Yes	Yes	Yes	Yes
All Call Receive	Yes	Yes	Yes	Yes	Yes	Yes
All Call Initiate	Option		Option		Option	
Encryption Capable	Yes		Yes		Yes	
On/Off Switch	Yes	Yes	Yes	Yes	Yes	Yes
Volume Control	Yes	Yes	Yes	Yes	Yes	Yes
Eight-Character Alphanumeric Display	Yes	Yes	Yes	Yes	Yes	Yes
Transmit Indicator	Yes	Yes	Yes	Yes	Yes	Yes
System Busy Indicator	Yes	Yes	Yes	Yes	Yes	Yes
Low Battery Indicator			Yes	Yes		
Over-the-air Rekey (OTAR)	Option		Option		Option	
Intrinsically Safe			Yes			
Over-the-air Program (OTAP)	Yes		Yes		Yes	
GPS Location Services	Yes	Yes	Yes	Yes	Yes	Yes
PTT Cellular Application	Option		Option		Option	
Call Alert	Yes	Yes	Yes	Yes	Yes	Yes
Radio/Data Interface Port	Yes		Yes		Yes	
Selective Radio Inhibit	Yes	Yes	Yes	Yes	Yes	Yes
Wi-Fi Radio	Option		Option		Option	
LTE Radio	Option		Option		Option	
Bluetooth	Option		Option		Option	

Table 8-1 Subscriber Unit Features

8.3 Standards

Subscriber units shall meet or exceed the performance requirements of a Class A transceiver as defined in the following standards:

- ANSI/TIA-603-C, *Land Mobile FM or PM Communications Equipment Measurement and Performance Standards*; and
- TIA-102.CAAB-C, *Project 25 Land Mobile Radio Transceiver Recommendations, C4FM/CQPSK Modulation*.
- TIA-102.CCAB, *Project 25 Two-Slot Time Division Multiple Access Transceiver Performance Recommendations, H-CPM / H-DQPSK Modulation*.

8.4 Environmental Specifications

Subscriber equipment shall meet or exceed the environmental specifications listed in Table 8-2.

Standard	MIL-STD 810C Method/Procedure	MIL-STD 810D Method/Procedure	MIL-STD 810E Method/Procedure	MIL-STD 810F Method/Procedure	MIL-STD 810G Method/Procedure
Low Pressure	500.1 / I	500.2 / II	500.3 / II	500.4 / II	500.5 / II
High Temperature	501.1 / I, II	501.2 / I, II	501.3 / I, II	501.4 / I Hot, II Hot	501.5 / I A1, II A2
Low Temperature	502.1 / I	502.2 / I, II	502.3 / II	502.4 / I C3, II C1	502.5 / I C3, II C1
Temperature Shock	503.1 / I	503.2 / I	503.3 / I	503.4 / I	503.5 / I C
Solar Radiation	505.1 / II	505.2 / I	505.3 / II	505.4 / I	505.5 / I A1
Rain	506.1 / I, II	506.2 / I, II	506.3 / I, II	506.4 / I, III	506.5 / I, III
Humidity	507.1 / I	507.2 / II	507.3 / II	507.4	507.5 / II Aggravated
Salt Fog	509.1 / I	509.2 / I	509.3 / I	509.4	509.5
Dust	510.1 / I	510.2 / I	510.3 / II	510.4 / I	510.5 / I
Immersion (for portables)	512.1	512.2	512.3	512.4 / I	512.5
Vibration	514.2 / VIII Cat. F, Curve W	514.3 / I Cat. 1, 10, 11, Cat. 3	514.4 / I Cat. 1, 10	514.5 / I Cat. 24	514.6 / I Cta. 24
Shock	516.2 / I, II	516.3 / I, IV	516.4 / I, II	516.5 / I, IV	516.6 / I, IV, V, VI

Specification	
Temperature (Operating)	-30 to +60° C
Temperature (Storage)	-40 to +85° C
Altitude	15,000 ft
Altitude (Transit)	50,000 ft
Humidity	95% @ 50° C
Shock	1 m
Vibration	5 G
Immersion	IEC 60529 IP67

Table 8-2 Environmental Specifications for Subscriber Equipment

8.5 Project 25 Compliance

Subscriber units shall be fully compliant with the latest versions of the Project 25 Phase 1 (12.5-kHz FDMA) and Project 25 Phase 2 (12.5-kHz, two-slot TDMA) operation as defined in the TIA-102 series of standards and shall be fully interoperable with all TIA-102-compliant trunked and conventional radio systems.

The Supplier's Declarations of Compliance (SDoCs) and Summary Test Reports shall be provided in accordance with the Project 25 Compliance Assessment Program for any offered subscribers. Identify any features or functions of the proposed subscribers that do not comply with the TIA-102 standards. Also identify any proprietary features or functions of the proposed subscribers that are not defined in the TIA-102 standards.

8.6 Over-the-Air Programming (OTAP)

Subscriber equipment shall be capable of over-the-air programming (OTAP) so subscriber unit "personality" may be modified remotely without removing a unit from service and returning it to a central location.

8.7 MANDATORY OPTION: Dual-band

Subscriber equipment shall be capable of operating as dual-band radios and shall be equipped with appropriate antennas, features, and accessories.

8.8 All-band

Select subscriber equipment shall be capable of operating as all-band radios and shall be equipped with appropriate antennas, features, and accessories.

8.9 Encryption

Selected subscriber units shall be equipped with P25 compliant multiple key AES encryption.

8.9.1 Key Fill Device

The encryption key fill device (KFD) shall interface with subscriber units and shall provide the user the ability to load, erase and read key information.

8.9.2 MANDATORY OPTION: Over-the-Air-Rekeying (OTAR)

Subscriber units shall be capable of P25 compliant over-the-air rekeying (OTAR).

8.10 GPS Location Services

Subscriber equipment shall be equipped with GPS receivers and appropriate software to support P25 Phase 2 Location Services to provide location data to the fixed network for display on a subscriber mapping system (location service host system).

8.11 MANDATORY OPTION: PTT Cellular Application

The PROPOSER shall offer a PTT over cellular smartphone application that will allow users to talk on the radio system from a smartphone device. The application shall be capable of operation on 3G/4G/5G LTE cellular data networks. The application may be capable of operation on Wi-Fi connections as well.

8.12 MANDATORY OPTION: Wi-Fi/LTE Radio Module

Subscriber equipment shall be capable of communicating over Wi-Fi networks and/or LTE networks. The ability for the same radio to operate on both Wi-Fi and LTE networks can be proposed but is not required.

8.13 MANDATORY OPTION: Bluetooth

Subscriber equipment shall be equipped with Bluetooth.

8.14 Mobile Radio Equipment

Mobile radios shall include the following components and accessories:

- transceiver
- control head
- palm microphone and mounting hook
- speaker
- cabling
- antenna
- mounting hardware

The mounting hardware shall securely fasten the housing to the vehicle.

8.14.1 Trunk-Mounted Mobile Radio Units

Trunk-mounted radios shall come equipped with a key to lock the radio into the housing. The trunk-mounted radio shall be available in a dual-control-head unit option.

8.14.2 Dash-Mounted Mobile Radio Units

The dash-mounted radio shall have the controls mounted on the front panel or surface of the radio. No separate control head shall be required for proper operation of the radio. The radio's speaker shall be an integral part of the radio package. For configurations requiring a front-panel keypad, the speaker may be at a remote location from the unit.

8.14.3 Mobile Radio Antennas

The mobile radio antenna shall consist of a stainless-steel antenna element, antenna mount and low-loss antenna cable. The mobile radio antenna shall be available in two styles: standard and disguised. Each shall be supplied with a minimum of 15 ft of antenna cable and shall meet or exceed the following specifications:

Frequency Range	UHF: 380 - 520 MHz
Maximum VSWR	1.5:1 (dual-band or all-band VSWR < 2.0:1)
Power Capability	50 W (VHF, dual-band, or all-band: 100 W)

8.14.3.1 Standard Mobile Radio Antennas

Standard mobile radio antenna radiating element shall be removable and replaceable without disturbing the antenna mount. The antenna mount shall be suitable for mounting on a vehicle roof, trunk, light bar, or other similar locations.

8.14.3.2 MANDATORY OPTION: Disguised Mobile Radio Antenna

The disguised mobile antenna shall be similar in design and appearance to cellular mobile antennas. The disguised antenna shall provide “no-hole” mounting.

8.14.3.3 Mobile Antenna Installation

The CONTRACTOR shall observe the SAW’s current antenna mounting practices and recommend antenna mounting locations.

8.15 Portable Radio Equipment

The portable radio unit shall be small and of such a form factor that normal operation can be accomplished with one hand. The portable radio shall be supplied with antenna, and two Li-ion polymer rechargeable batteries. The batteries shall maintain a minimum capacity of 80% rated after one year of service. Each portable radio shall be provided with a carrier or belt clip options and a single-unit charger.

The housing of the portable radio shall be of high impact-resistant material. The Li-ion battery supplied shall provide at least twelve (12) hours of operation on a 5% transmit, 5% receive and 90% monitor duty cycle and shall be a positive lock, and quick disconnect type. The battery housing shall be constructed of a material as durable as the portable radio housing and shall match the color and footprint of the portable radio. The antenna provided with the unit shall be covered with soft plastic or rubber and be provided with a blunt safety tip.

8.15.1 Portable Battery Chargers

AC single- and multi-battery chargers shall be available to charge the portable radio batteries. Chargers shall be capable of charging batteries while either attached or not attached to the portable radio.

Chargers shall be capable of charging a mix of models of batteries. Chargers shall be suitable for either desk or wall mounting and shall be capable of recharging batteries to a full charge in eight hours or less. Illuminated LEDs shall be provided to indicate whether the unit is charging or is fully charged. Charging current shall be regulated and over-charging shall be electronically monitored, controlled, and prevented. Multi-battery chargers shall be capable of recharging a minimum of five (5) batteries at any one time. Battery conditioning shall also be a feature of the charger.

8.15.2 Intrinsically Safe Portable Radio

Portable radios for Fire/Rescue personnel shall be certified by Factory Mutual that their operation is intrinsically safe for Classes I, II and III; Division 1; Groups C, D, E, F and G; and

non-incentive for Class I, Division 2, Groups A, B, C and D. The batteries should also be intrinsically safe in the portable radios.

8.15.3 Vehicular Charger

The vehicular charger package shall accept the portable radio and automatically provide the proper charging current from the vehicle's electrical system. The charger package shall be suitable for mounting in the under the dashboard or other suitable locations in passenger vehicles, pick-up trucks, vans, and other types of vehicles such as fire engines.

The portable radio shall be held firmly in the vehicular charger. An illuminated LED shall indicate that the unit is charging. An illuminated LED shall also indicate that the unit is fully charged. Charging current shall be regulated and overcharging shall be electronically monitored, controlled, and prevented. Battery conditioning shall also be a feature of the vehicular charger.

8.15.4 Speaker / microphone

Speaker / microphones shall meet the same environmental requirements as the portable radio. Speaker / microphones shall have an audio jack.

8.15.4.1 Intrinsically Safe Speaker / microphone

Intrinsically Safe Speaker / microphones shall meet the same environmental and intrinsically safe requirements as the intrinsically safe portable radio.

8.16 Control Station

The control station shall be provided in a small cabinet. The PROPOSER is to determine the type of cabinet most suitable for the installation of each control station. The cabinet may be designed for desktop, floor or wall mounting. The station shall be powered from a 120-VAC, 60-Hz single-phase source. The station shall be operated either locally or remotely under control of the console equipment or a remote-control unit. All control stations provided shall be capable of functioning in either the trunked or conventional mode.

The control station may also be used as a limited system backup component in the event of a loss of the system trunking capabilities. A desktop remote control unit shall be available for operation with the control station. The remote-control unit shall interface with and provide all the features and functions of the control station. The remote-control unit shall provide the capability to control a minimum of five talk groups. The remote-control unit shall be housed in housing suitable for operation in an office or administrative area. The unit shall include a built-in speaker, volume control, and desk style microphone. The unit shall be furnished with control line and power line surge protectors. The unit shall provide control functions compatible with the control station.

The control station antenna system shall comprise a directional antenna, transmission line, connectors, and miscellaneous hardware. The control station antenna shall meet or exceed the following requirements:

Frequency Range	UHF: 380 - 520 MHz
Maximum VSWR	1.5:1 (dual-band or all-band VSWR < 2.0:1)
Power Capability	50 W (VHF, dual-band, or all-band: 100 W)

9 Physical Facilities Requirements

9.1 General Requirements

Communications facilities shall be of proven design to withstand severe weather including lightning, wind, flooding, ice and snow accumulation, wildfires, and earthquakes.

Facilities shall protect the communications system from the public and shall protect the public from potentially hazardous parts or emissions of the communications system.

Facilities shall be designed and installed in accordance with applicable current codes, ordinances and regulations imposed by authorities having jurisdiction; these current standards; and the communications equipment manufacturer's design and installation current revision standards. Where there is a conflict between requirements, the more stringent requirement shall apply.

9.2 References

9.2.1 Normative References

The following documents, either in whole or in part, are referenced in this physical facilities specification:

American Association of State and Highway Transportation Officials (AASHTO) • AASHTO HB, <i>Standard Specifications for Highway Bridges</i>
American Concrete Institute (ACI) • ACI 301-05, Specifications for Structural Concrete • ACI 302.1R-04, Guide for Concrete Floor and Slab Construction • ACI 318-08, Building Code Requirements for Structural Concrete and Commentary
American National Standards Institute (ANSI) • ANSI J-STD-607-A-2002, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
American Society for Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) • ASHRAE Handbook—Fundamentals
American Society of Safety Engineers • ANSI/ASSE Z359, Fall Protection Code
ASTM International • ASTM A 615-08a, Standard Specifications for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement • ASTM C 31-08a, Practice for Making and Curing Concrete Test Specimens in the Field • ASTM C 33-01a, Standard Specifications for Concrete Aggregates • ASTM C 39-05e1, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens • ASTM C150-00, Standard Specification for Portland Cement

• ASTM D 420-98, Standard Guide to Site Characterization for Engineering Design and Construction Purposes • ASTM D1556-07, Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method • ASTM D 1557-07, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000-ft-lbf/ft³ (2,700 kN-m/m³)) • ASTM D 2487-06e1, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) • ASTM D 6938-08a, Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) • ASTM G 57-06, Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method
Electronics Industry Alliance (EIA) • EIA/ECA-310-E, Cabinets, Racks, Panels and Associated Equipment
Federal Aviation Administration (FAA) • Advisory Circular 70/7460-1K, Obstruction Marking and Lighting • Advisory Circular 150/5245-43F, Specification for Obstruction Lighting Equipment
Federal Communications Commission (FCC) • Code of Federal Regulations, Title 47, Telecommunications (47 CFR) • Office of Engineering and Technology (OET) Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
Institute of Electrical and Electronics Engineers (IEEE) • IEEE Std. 81-1983, IEEE Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Ground System • ANSI/IEEE Std. 81.2-1991, IEEE Guide to Measurement of Impedance and Safety Characteristics of Large, Extended or Interconnected Grounding Systems
National Electrical Contractors Association (NECA) • NECA 1, Standard Practices for Good Workmanship in Electrical Contracting
National Fire Protection Association (NFPA) • NFPA 70, National Electrical Code • NFPA 72, National Fire Alarm Code • NFPA 101, Life Safety Code • NFPA 110, Standard for Emergency and Standby Power Systems • NFPA 111, Standard on Stored Electrical Energy Emergency and Standby Power Systems • NFPA 780, Standard for the Installation of Lightning Protection Systems • NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems
Telecommunications Industry Association (TIA) • TIA-222, Structural Standard for Antenna Supporting Structures
Underwriters Laboratories (UL) • UL 467, Grounding and Bonding Equipment • UL 752, Standard for Bullet-Resisting Equipment • UL 1449, Standard for Surge-Protective Devices • UL 1778, Uninterruptible Power Systems

9.2.2 Informative References

The following references provide additional useful information but are not included in this document:

Alliance for Telecommunications Industry Solutions (ATIS) • ATIS 0600311, DC Power Systems – Telecommunications Environment Protection • ATIS 0600313, Electrical Protection for Telecommunications Central Offices and Similar Type Facilities • ATIS 0600316, Electrical Protection of Telecommunications Outside Plant • ATIS 0600318, Electrical Protection Applied to Telecommunications Network Plant at Entrances to Customer Structures or Buildings • ATIS 0600330, Valve-Regulated Lead-Acid Batteries Used in the Telecommunications Environment • ATIS 0600334, Electrical Protection of Communications Towers and Associated Structures
American Society of Civil Engineers (ASCE) • ASCE 7, Minimum Design Loads for Buildings and Other Structures
Illuminating Engineering Society (IESNA) • IESNA HB, Lighting Handbook Reference & Application
Institute of Electrical and Electronics Engineers (IEEE) • IEEE C2, National Electrical Safety Code (NESC) • IEEE Std. 142, Grounding of Industrial and Commercial Power Systems
International Code Council • International Building Code
Telecommunications Industry Association (TIA) • TIA-568-C.0, Generic Telecommunications Cabling for Customer Premises • TIA-568-C.1, Commercial Building Telecommunications Cabling Standard • TIA-568-B.2, Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components • TIA-568-C.3, Optical Fiber Cabling Components Standard • TIA-569-B, Commercial Building Standard for Telecommunications Pathways and Spaces

9.3 Sites

9.3.1 General

A typical, dedicated communications site layout is shown in Figure 9-1. The actual layout for each site will vary depending upon the:

- Size and shape of the lot
- Size and type of tower and building
- Number of current and future site tenants
- Existence and location of site utilities
- Federal, State and Local codes, ordinances, and regulations

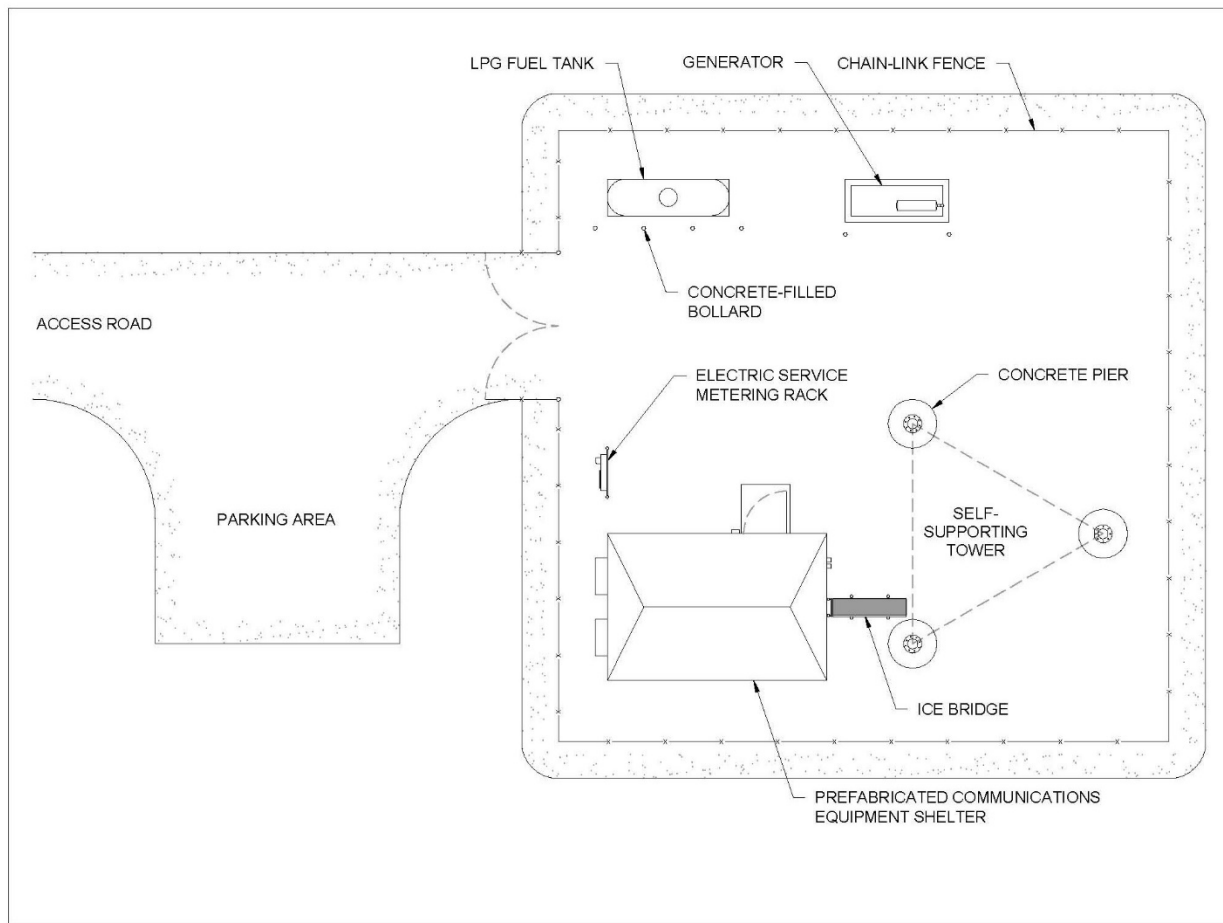


Figure 9-1 Typical Communications Site Layout

9.3.2 Existing Sites

The use of existing sites is encouraged as is appropriate or required. Table 9-1 provides name and address, tower type and height, building or shelter description, owner of property, and briefly lists existing radio equipment at each of the existing sites. (The owners with acronyms: SVEC – Shenandoah Valley Electric Company; and HRECC – Harrisonburg / Rockingham County Emergency Communications Center.)

Site #	Name	Latitude	Longitude	Tower Ht.	Building/Shelter	Owner
1	Augusta County Dispatch	38-11-35.93 N	79-00-49.89 W	195 ft	Equipment Room	Augusta County
2	Deerfield	38-11-50.50 N	79-24-20.10 W	285 ft	Existing Shelter	Augusta County
3	Devil's Knob	37-54-59.22 N	78-57-17.65 W	85 ft	Existing Shelter	Augusta County
4	Elliott Knob	38-09-54.50 N	79-18-50.59 W	50 ft	Existing Shelter	SVEC
5	Massanutten	38-23-37.28 N	78-46-13.20 W	120 ft	Existing Shelter	HRECC
6	Staunton Dispatch	38-08-57.01 N	79-04-89.00 W	N/A	Equipment Room	Staunton
7	Staunton Public Works	38-10-59.38 N	79-05-22.15 W	175 ft	Existing Shelter	Staunton
8	Staunton Reservoir Hill	38-09-13.72 N	79-04-41.95 W	195 ft	Existing Shelter	Staunton
9	Troxell Gap	38-02-50.64 N	79-19-17.44 W	220 ft	Existing Shelter	Augusta County
10	Waynesboro ECC	38-03-59.31 N	78-53-22.99 W	120 ft	Existing Shelter	Waynesboro
11	Waynesboro Tower	38-04-00.00 N	78-52-03.90 W	150 ft	Existing Shelter	Waynesboro

Table 9-1 Existing and Potential Radio / Microwave Sites

9.3.3 New Sites

New sites, leased or “greenfield”, will require various levels of development and construction as determined by the CONTRACTOR.

For any new sites proposed, lease or greenfield, the PROPOSER should make a reasonable effort to ensure that land/tower owners are agreeable to a lease agreement (or purchase land) with SAW. The PROPOSER shall provide correspondence with land/tower owners validating the use of the site(s) are feasible and verification of RAD center height is available. Provide the estimated annual lease cost for a 15-year period in the appropriate tab in Appendix D Pricing Workbook.

Greenfield sites shall be designed to accommodate one future 10 ft. by 16 ft. shelters. Ingress and egress shall be designed to allow for installation of these shelters or cabinets.

9.4 Utilities

9.4.1 Existing Utilities

Location of all existing utilities shall be verified before site work begins. Existing utilities must be protected during site work.

9.4.2 Temporary Electric Service

Temporary electric service may be necessary for site development. Temporary service must be coordinated and obtained through the local electric utility.

9.4.3 Permanent Electric Service

Permanent electric service must be coordinated and obtained through the local electric utility. Underground service is preferred.

Depending on the site layout and the number of tenants at the site, electric meters and service disconnects may be located on a meter support structure near the fence so that meters may be read by utility personnel without entering the compound. At new sites, where additional future tenants are planned, two underground conduits each shall be installed from the service entrance point to planned locations of future shelters.

As much as possible, building or shelter electric service entrance should be located near coaxial cable and telephone service entrances. The electric service ground shall be bonded to the site grounding system.

9.5 Earthwork

9.5.1 Geotechnical Investigations

Geotechnical investigations shall be performed at all sites involving earthwork. Geotechnical investigations and reporting shall be performed in accordance with ASTM D 420. Geotechnical reports shall be prepared and sealed by a professional engineer.

9.5.2 Erosion Control

An erosion control system shall be utilized to protect adjacent property in accordance with federal, state, and local standards and specifications for soil erosion and sediment control.

All areas disturbed by construction activities shall be seeded or vegetated with grass or other plants that are indigenous to the local area. All seeded areas shall be covered with straw. Erosion control measures shall be removed when the site has been stabilized and erosion control measures are no longer necessary.

9.5.3 Materials for Fill, Sub-Grade Preparation and Backfill

Soils shall be classified by test procedures outlined in ASTM D 2487. Moisture-density relations shall be established in accordance with ASTM D 1557 for all fill material to ensure its suitability.

Material for fill and backfill beneath buildings, structures, and towers; for backfill adjacent to buildings, structures, and towers; for trench backfill in every location; and for sub-grade preparation shall be GW, GP, GM, GC, SW, SP, SM, or SC. The largest particles in this fill and backfill shall be no greater than 2 in. diameter.

Fill material for non-structural applications shall consist of unclassified material from the excavations.

9.5.4 Clearing and Grubbing

Fenced compounds, access roads and parking areas shall be cleared and grubbed of trees and other vegetation, stumps, roots and other material or structures that would hinder the development of the site. Such materials shall be removed to a depth of at least 18 in. Depressions made by grubbing shall be filled with suitable material and compacted as required.

Materials unsuitable for fill shall be removed from the site and disposed of in accordance with local, state, and federal regulations.

9.5.5 Fills

Where fill is required to raise the subgrade for concrete slabs, fill material shall be placed in horizontal layers not exceeding 6 in. compacted thickness. Frozen material shall not be used for this purpose.

9.5.6 Backfilling Beneath and Adjacent to Buildings, Structures and Towers

For depths greater than 5 ft. select fill shall be used from the top of the footing to a point 5 ft. below finished grade. The select fill, defined as GW or SW material in ASTM D2487, shall extend from the outside and inside faces of the wall to the faces of the excavation if the excavation is sheeted and braced or 5 ft. from the outside and inside faces of the wall if the excavation is un-sheeted.

9.5.7 Backfilling Trenches

Fuel pipe joints shall be left exposed for testing. After testing, trenches shall be backfilled with suitable materials free from large clumps of earth and rock fragments. Material shall be deposited in 6 in. horizontal layers and thoroughly and carefully tamped until pipe and conduit have a cover of not less than 1 ft. Wrapped, coated and plastic material shall be backfilled 6 in. above the utility line with sand or other finely graded material. For trenches in open areas, remainder of backfill material shall then be placed in the trench in one-foot horizontal layers.

Trenches shall be backfilled simultaneously on opposite sides and compacted simultaneously without dislocating the utility line from installed positions. For trenches beneath pavement, buildings and structures, the entire depth of the trench shall be filled in 6 in. horizontal layers. Each layer shall be moistened or dried and compacted. Trenches improperly backfilled or where settlement occurs shall be reopened to depth required for proper compaction, refilled, and compacted, with surface restored to required grade and compaction, mounded over in open areas, and smoothed off.

9.5.8 Plastic Marking Tape

Warning tapes shall be installed directly above pipe and conduit at a depth of 6 in. below finished grade unless otherwise indicated. Tape color shall be as specified and shall bear a continuous printed inscription, identifying the specific utility.

Utility	Color
Electric	Red
Water	Blue
Telephone	Orange
Sewer	Green

9.5.9 Compaction

The degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D1557. Fill and backfill material shall be moistened or aerated as necessary to provide a moisture content that falls within 3 percent of either side of optimum.

The minimum compaction effort required for various fills, backfills, and sub-grades shall be as follows:

Fill, Backfill and Sub-Grade Compaction	Percent of Maximum Density
Under buildings, structures, towers, or adjacent to buildings, structures, or towers	95
Under exterior concrete slabs, including related utility trench backfill and scarified sub-grades	90
Under utility trench backfill in other areas	85

If required, field density tests shall be performed in accordance with ASTM D 1556 or ASTM D 6938.

9.5.10 Soil Sterilization

Areas specified to receive cover material shall be sterilized with a pre-emergent herbicide solution. Treatment shall be applied on the subgrade prior to placing cover material. Application shall be in accordance with the manufacturer's recommendations.

9.5.11 Fenced Compound

Inside the site fence (and guy anchor locations), geotextile fabric shall be installed in areas not covered by concrete. The geotextile fabric shall extend 18 in. outside the fence. The fabric shall be installed in accordance with manufacturer's instructions. The area under the fabric shall be cleared and sterilized. The top covering over the fabric shall be 6 in. of #57 aggregate compacted by roller.

9.6 Access Road

Access roads shall be 12 ft. wide and shall be designed for H20 vehicle (as defined in AASHTO HB-17) surface loading. Road surfaces shall be at least 6 in. of graded aggregate base course, compacted by roller.

Access roads shall be graded to provide positive drainage. Culverts shall be installed to prevent storm runoff from crossing the access road. Access roads shall be designed to allow for delivery of equipment shelters to the site. Access road entrances shall meet state or local requirements for driveway or uncontrolled intersection sight distances.

At some remote sites, an entrance barrier gate may be required across the access road at the entrance from the road. Entrance barriers shall be swinging tubular steel gates with standard padlock hardware. Entrance barriers shall be set at least 25 ft. from the road. Entrance barriers shall be equipped with reflectors to increase visibility at night.

9.7 Parking Area

Outside each fenced site, there shall be adequate parking and turnaround space for two pickup trucks. The parking area shall be designed for H20 vehicle surface loading. The area shall be cleared, sterilized, and covered with 6 in. of #57 aggregate cover material compacted by roller.

9.8 Chain-Link Fencing

Chain-link fencing shall be installed around communications tower site compounds and around tower guy anchors. Fencing shall include locking gates and other accessories required to provide security for tower sites. Gates shall be equipped with reflectors to increase visibility at night. Appropriate signage shall be installed on the fence and entrance gates.

9.9 Bollards

Bollards shall be installed at the corners of shelters, generators, and fuel tanks where these objects are exposed to vehicular traffic. Bollards shall be 4 in. O.D. concrete-filled steel pipe.

9.10 Foundations

Concrete foundations for towers, shelters, generators, fuel tanks and other site equipment shall be designed and installed in accordance with ACI 318, ACI 301 and ACI 302 and other applicable standards of ACI.

9.10.1 Design

Foundation designs shall be based on the geotechnical conditions at the site. Foundations for towers shall be designed in accordance with TIA-222. All foundation engineering design documentation shall be prepared and sealed by a professional engineer.

9.10.2 Installation

Forms shall be used to ensure proper pouring and forming of foundations. Forms shall be true, rigid, and strong enough to carry loads to which they will be subjected. Steel reinforcement, anchor bolts and other embedded items shall be held rigidly in place during pouring and curing of concrete. Concrete shall be vibrated during pours to eliminate air pockets. Care shall be taken to ensure concrete does not freeze before curing.

9.10.3 Materials

Cement shall meet the requirements of ASTM C150. Aggregates shall meet the requirements of ASTM C33. Reinforcing steel shall meet the requirements for Grade 60 reinforcing steel as defined in ASTM A615. Minimum compressive strength of concrete shall be 3000 psf at 28 days or higher as specified by foundation design documentation.

9.10.4 Concrete Testing

During concrete pours, four test cylinders shall be poured in accordance with ASTM C31 for each 25 cubic yd. concrete poured. Concrete tests and test reports shall be in accordance with ASTM C39. If tests indicate that concrete strength is not adequate, the concrete shall be removed and replaced. The CONTRACTOR shall submit concrete testing results report to SAW and the SAW representative within the timeframe of Table 4-1.

9.11 Towers

New towers and other antenna support structures shall be designed and installed according to TIA-222 and codes, ordinances and regulations of authorities having jurisdiction. Where these standards contain conflicting requirements, the more stringent requirements shall apply.

Upgrades to existing towers or structures where new antennas or other equipment are to be installed shall meet the same requirements of TIA-222 for new towers or structures.

9.11.1 Tower Classification

Towers for the use of public safety or critical infrastructure industry communications systems shall meet the requirements of Class III structures as defined in TIA-222.

9.11.2 Loads

Each tower shall be designed by a professional engineer in accordance with TIA-222 so its design strength exceeds the loading of the tower, antennas, and appurtenances (antenna support hardware, waveguides and transmission lines, grounding kits, tower lighting systems, tower climbing systems, etc.), ice, wind, and seismic loads. As practical, transmission lines shall be evenly distributed on tower faces to distribute loads.

All proposed current and future loads, including antennas and appurtenances from existing towers or structures, shall be carefully verified before tower analysis is performed. The following information for each proposed antenna shall be provided to the structural engineer:

- Manufacturer, model, size, weight, and effective projected area of the following:
 - Antennas
 - Antenna support hardware
 - Transmission lines or waveguide
- Antenna mounting height
- Tower leg or face on which the antenna will be mounted
- Routing of transmission lines or waveguide

A new tower shall be designed with all planned loads and for the future installation of up to one heavy wireless carrier platforms as defined in TIA-222, Annex C.

9.11.3 Twist and Sway

Towers and antenna support structures for the support of microwave antennas shall be designed to meet the twist and sway requirements of the microwave system design as defined in TIA-222.

9.11.4 Analysis of Towers and Antenna Support Structures

A structural analysis shall be performed in accordance with TIA-222 on new towers and on existing towers where new antennas or other appurtenances are to be installed. The analysis shall be based on actual geotechnical conditions, not on “typical” soil parameters. The analysis shall state the model and all assumptions used and shall be prepared and sealed by a professional engineer.

9.11.5 Existing Tower Condition Assessment and Mapping

To analyze the structural strength and integrity of an existing tower or other antenna support structure, detailed information is required on the structure and its appurtenances. If this

information is unavailable or insufficient, a tower condition assessment and mapping of appurtenances and structural components shall be performed in accordance with TIA-222, Section 15 and Annex J. The condition assessment and mapping shall be prepared and sealed by a professional engineer.

9.11.6 Materials and Fabrication

Materials and fabrication of all towers, guy assemblies, insulators and foundations shall meet the specifications of TIA-222.

9.11.7 Tower Construction

All work associated with the construction of towers shall be inspected and approved by a professional engineer. The erection of towers shall be in accordance with TIA-222. The tower shall be grounded continuously during erection.

9.11.8 Tower Climbing Facilities

A climbing ladder or other climbing facility shall be provided for each new tower in accordance with TIA-222. Each climbing facility shall be equipped with a safety climb device. Each tower shall be furnished with two personnel belts compatible with the safety climb device. Safety climb devices and personnel belts shall meet the requirements of ANSI/ASSE Z.359.

9.11.9 Obstruction Marking and Lighting

Towers shall be marked and lighted in accordance with FAA Advisory Circular AC 70/7460-1K. Where tower marking or lighting is required, dual lighting systems are preferred. Tower lighting systems shall meet the standards of FAA Advisory Circular AC 150/5245-43E. Lighting equipment shall be the same throughout the system to permit commonality of spare parts.

Lighting control systems shall be mounted inside the equipment building and shall have alarm outputs for connecting to remote alarm systems. Alarm outputs shall be wired to the radio system alarm system and displayed at the associated alarm system workstations.

9.11.10 Ice Bridges

An ice bridge shall be installed between the communications shelter and the tower to support and protect transmission lines and other cables. The ice bridge may be self-supporting, or it may be supported at one or both ends. Where the ice bridge is supported at both ends by the shelter and the tower, one of those supports must be electrically insulated to prevent the flow of lightning surge currents through the ice bridge.

9.11.11 Cable Installation

Vertical transmission line runs on towers shall be installed neatly on cable ladders. Horizontal transmission line runs between the tower and the building shall be protected by an ice bridge. Drip loops or another method to prevent water entry into the shelter shall be utilized.

Cables shall be installed as follows:

- Ice bridges shall be supported by angle brackets. Threaded rod assemblies shall be used to support the angle brackets.
- Cable hangers and hoists shall be installed per cable manufacturer's recommendations.
- For single or multiple cable entry ports, a rubber boot, clamp, and copper panel shall be used at the cable entry bulkhead.
- Cables shall be secured by hardware specially designed for the cable. Tie-wraps are not acceptable means of securing cables to cable ladders or ice bridges. They may be used to secure cables to cable tray.

9.11.12 FAA Notifications

The FAA shall be notified of proposed or actual construction or alteration by completing FAA Forms 7460-1 and 7460-2 and providing supporting data. This submittal shall be provided within the timeframe identified in Table 4-1.

9.11.13 MANDATORY OPTION: Security Cameras on Tower Structure

Security cameras shall be provided by the CONTRACTOR and mounted to the tower structure to provide security to the site. Security cameras shall be movable to provide security to surrounding areas.

9.12 Equipment Shelters – Arrangement & Size

All radio communications equipment shelters shall be bullet-resistant, prefabricated shelters that meet industry standards and the specifications stated herein. Shelters shall be weatherproof and insulated as required by local climate. The roof shall be designed to survive the impact of falling ice. Floors shall be designed for at least 300 psf (for new shelters). All building penetrations shall be sealed.

New equipment shelters shall be sized to house the new radio and connectivity network equipment, existing equipment moved from existing shelters and at least 25% to 50% for future growth.

A typical shelter arrangement is shown in Figure 9-2; however, other configurations will be considered to meet requirements. Equipment racks shall have a minimum clearance of 36 inches in front and rear. All exterior doors shall be provided with intrusion alarm sensors, which are to be connected to the radio system alarm reporting system. All building alarm connections are to be terminated at a building alarm bus using Type 66 connector blocks.

Refurbished shelters may be proposed and must meet all the requirements of this section.

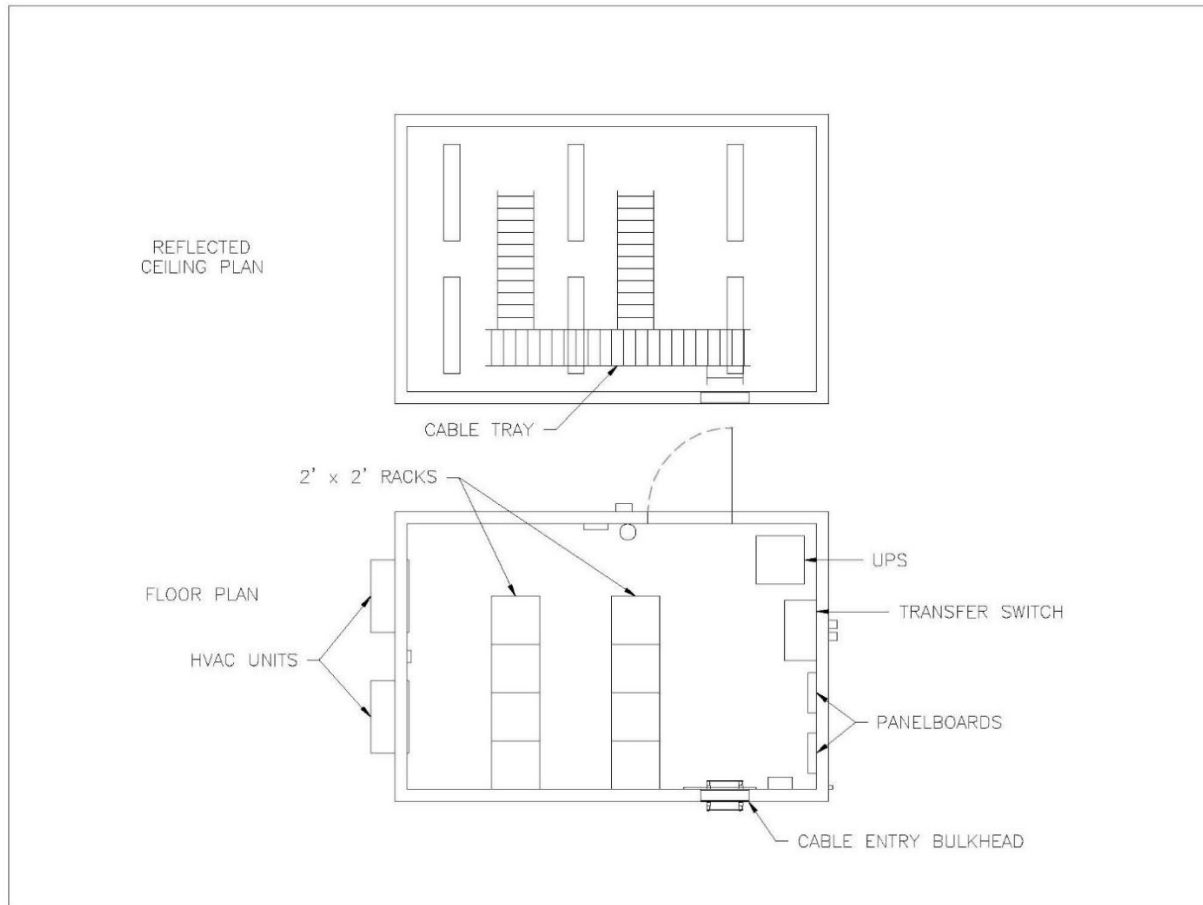


Figure 9-2 Typical New Shelter Layout

9.13 Building Systems

9.13.1 HVAC

The heating and cooling system for the radio room shall be sized and selected based on ambient conditions as indicated in the current ASHRAE Handbook Fundamentals for the nearest area applicable and shall include capacity for future building heat loads. The HVAC system shall be capable of maintaining an interior temperature between 70- and 75-degrees Fahrenheit. Heating for the radio room shall be sized to heat the room without equipment heat loads considered. Cooling system is to cool room with equipment, current and future, energized. Future equipment loads shall be assumed to be approximately 2 kW per additional 2 ft. x 2 ft. rack space.

The system shall consist of redundant units with either unit being able to carry the load. Redundant lead/lag controls with alternating timer allowing approximately equal operating time on each air conditioning unit shall be provided.

Load calculations shall be based on actual equipment loads, considering anticipated duty cycles and measured power consumption under operating conditions.

9.13.2 Fire Alarm System

Shelters shall be equipped with a fire alarm system. The fire alarm system shall meet the requirements of NFPA 72. Each zone shall have three (3) detectors. When two of the three detectors enter an alarm condition, all louvers in the zone actuated shall be automatically closed.

9.13.3 Electrical System

9.13.3.1 Codes and Standards

Electrical and cabling work for each shelter shall conform to all local codes, NFPA 70, NFPA 101, ANSI C2 and local utility company standards. Where a product is commercially available as a UL-listed device, a UL-listed device shall be used.

9.13.3.2 Electrical System Design

The general design of the electrical system shall be in accordance with the one-line diagram shown in Figure 9-3.

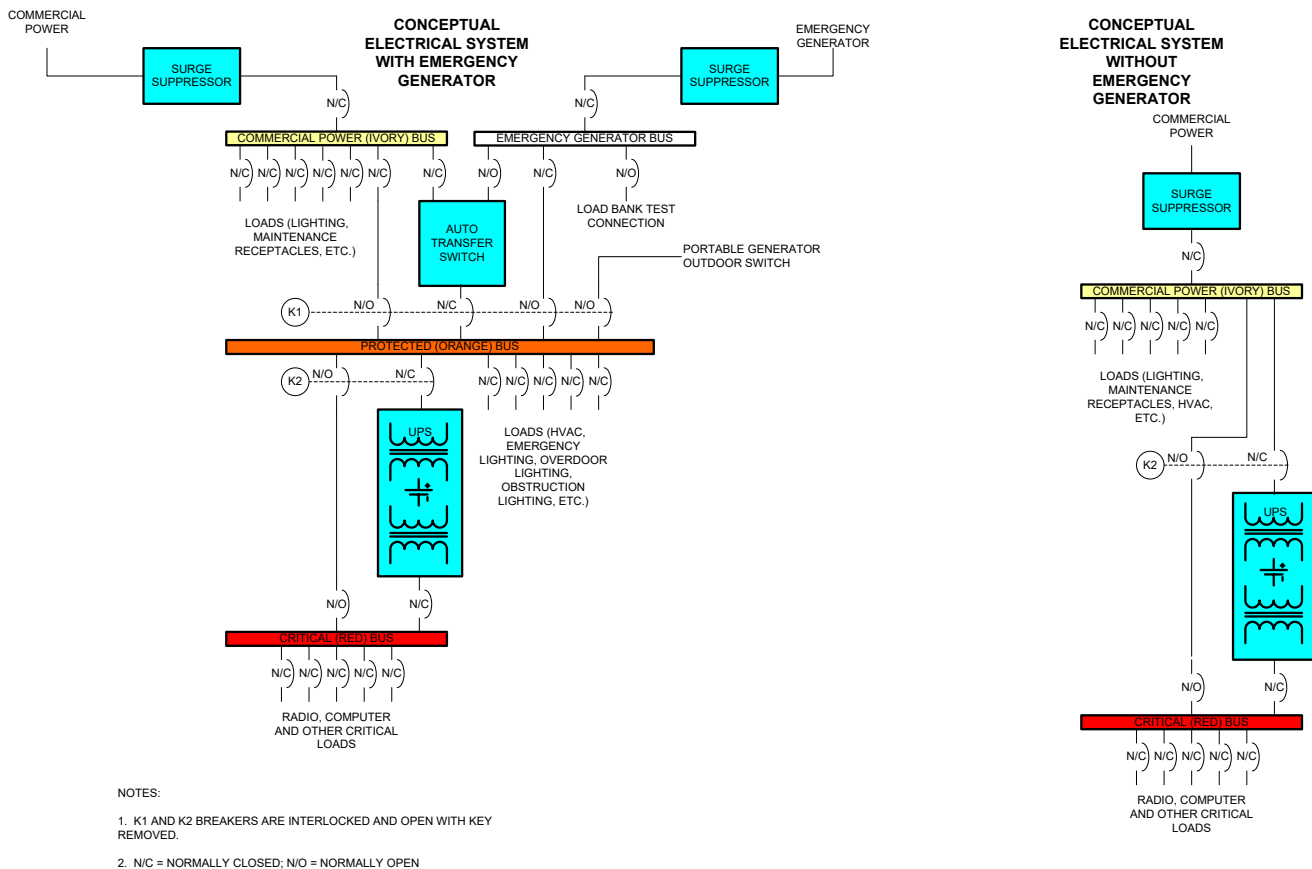


Figure 9-3 Typical Shelter One-Line Diagram

9.13.3.3 Buses

All equipment critical to the proper uninterrupted operation of the communications system shall be served by the critical bus or panelboard, which shall be served by an uninterruptible power supply (UPS). All equipment that may accept brief temporary interruptions (such as HVAC equipment) or has its own integrated emergency power supply (such as emergency lights) shall be served by the protected bus or panelboard, which shall be served by an emergency generator.

All other equipment not essential to the operation of the communications system may be served by the service bus or panelboard, which will be without power during electric service power failures. Service circuits shall not be run in the same conduit or raceway as critical or protected circuits. The service bus may be eliminated, and all circuits can be served by the protected bus.

9.13.3.4 Bypass Switches

Manual switches shall be provided to allow complete bypass and isolation of the UPS and the automatic transfer switch for maintenance purposes. The switches shall utilize keyed interlocks (Square D Kirk Key interlocks, or equivalent) to prevent simultaneous connection of more than

one power source to the bus. Out-of-position switches (i.e., bypass operation) shall be an input to the radio system alarm system.

9.13.3.5 Temporary Backup Generator

Provisions shall be made for placement and connection to the electrical system of a mobile generator outside the shelter in case the permanently installed standby generator fails. Standby generator operating instructions shall be posted in the room or outdoor cabinet.

9.13.3.6 Surge Suppression

The service entrance and the emergency generator output shall each have independent, appropriately designed surge suppression devices installed. Additionally, because of potential operation with the UPS bypassed, all critical (red) bus branch circuits shall be supplied with surge protection devices at the output of the UPS. Devices shall incorporate current technology and as a minimum should utilize metal oxide varistors (MOVs), gas tube devices and/or equivalent avalanche protection. These units shall have contact alarm and visual indication for device failure.

9.13.3.7 Equipment and Raceways

Minimum conduit size shall be 3/4 in. and all except underground conduit shall be of metal with a zinc coating (EMT or heavier construction). Conduits exposed to the outside shall be rigid, not EMT. Underground conduit shall be 2 in. or larger rigid PVC with a minimum of 20 percent excess capacity over code limits, or spare underground conduits shall be included.

9.13.3.8 Receptacles and Plugs

Shelters shall be equipped with one 20-amp double duplex receptacle every 10 feet or closer as required by local codes, around the interior perimeter of each shelter. A minimum of two 20-amp circuits shall be provided for this purpose with one circuit supplied from the protected bus using orange receptacles and one circuit supplied from the service bus using ivory receptacles. One exterior 20-amp GFCI receptacle on its own circuit shall be installed on the service bus. Where power cords are plugged into overhead receptacles, twist lock components shall be used.

9.13.3.9 Lighting

Shelter interior lighting shall be provided by fluorescent or LED (preferred) lighting to a level of 50 foot-candles at a working plane of 30 in. above the floor. Fluorescent light fixtures shall be supplied with 0°F ballasts.

Exterior LED lighting is to be mounted on exterior wall at each exterior door. A pole-mounted LED light fixture shall be installed at the parking location to supply at least 2 foot-candles of light at the vehicles. This light should be equipped with a photocell for dusk-to-dawn operation.

9.13.4 Safety

Emergency eyewash stations and fire extinguishers shall be installed in the radio room.

9.14 Backup Power Systems

9.14.1 Standby Generators

Standby generators shall meet the requirements of a Class 168 (168 hr runtime, 7 days), Type 60 (power restoration in 60 sec.), Level 1 (failure could result in loss of human life) emergency power supply system (EPSS) as defined in NFPA 110 and the requirements of NFPA 70, Article 700.

Generators shall be sized to serve 125 percent of current and future facility electrical loads. Future equipment loads shall be assumed to be approximately 2 kW per additional 2 ft x 2 ft rack space.

Generators shall include control-panel and alarm functionality that provides remote, TCP/IP-based status, configuration, and control. Remote control functions shall include start/stop functionality.

9.14.1.1 Generator Location

Generators may be located inside (preferred) or outside buildings or shelters. Standby generators located outside of the building or shelter shall be located to protect against ice, moisture, vehicles, vandalism, and rodents.

The automatic transfer switch, line surge suppressors and associated equipment should be located inside the building or shelter unless space limitations dictate otherwise. The system shall be designed to facilitate on-site full load testing.

9.14.1.2 Generator Installation

Generators located outdoors shall be mounted on a concrete pad according to the generator manufacturer's recommendations.

Generators located indoors shall be mounted on spring deflection vibration isolators according to generator manufacturer's recommendations. A drip pan shall be installed beneath the unit to collect spills and leaks.

All electrical connections to the unit shall have a section of flexible conduit for vibration isolation. Generators shall have a drain with a plugged ball valve accessible from the outside of the enclosure for draining oil.

9.14.1.3 Automatic Transfer Switches

Automatic transfer switches shall perform site load to generator transfer with an adjustable timer of 1 to 5 minutes. The transfer switch shall retransfer the site load to restored commercial power with an adjustable timer of 1 to 5 minutes followed by an adjustable 5 to 20-minute generator cool down before shutting off. A make before break bypass switch shall be provided to disconnect the transfer switch and isolate it from the commercial AC power and all site load equipment. This feature will permit transfer switch maintenance and troubleshooting without disconnecting the AC power from the site equipment.

Operating manuals shall be supplied with each generator.

9.14.1.4 Starting System

Batteries shall be maintenance-free with sealed cells. A battery charger shall be utilized to maintain the amp-hour rating and sufficient starting power of the generator battery when the generator is not running. If water-cooled generators are provided for outdoor installations, crankcase heaters and jacket water heaters shall be provided to facilitate cold weather starting. All external generators shall have oil pan heaters.

9.14.1.5 Fuel System

The fuel tank shall be of an approved design and installed in accordance with the local building codes. Standby generators may be powered by diesel fuel or liquified petroleum gas (LPG, propane). Fuel systems shall meet the requirements of NFPA 110 Section 7.9 or NFPA 58, LPG Code.

The fuel tank shall be of appropriate size to power and operate 100% of equipment at the site for a minimum 24 hours x 7 days.

9.14.1.6 Noise Abatement

Where standby generators are located within 1000 ft. of residences or occupied buildings, generators shall be of a quiet design, with appropriate mufflers or other devices making the unit suitable for installation in residential locations. Noise emissions in all locations shall be limited to levels in compliance with state and local regulations. Outdoor generators shall be installed in sound-attenuating enclosures.

9.14.1.7 Alarms

Safety indications listed in NFPA 110, §5.6.5.2 as Remote Audible shall be inputs to the radio system alarm system. Standby generator run status shall also be an input to the alarm system. Because sites are generally unmanned, audible alarms at the sites shall not be required.

9.14.1.8 Spare Parts

To reduce the need for spare parts inventories from various vendors, backup/standby generators should be from the same manufacturer. “High-mortality” spare parts referenced in NFPA 110, §8.2.4 may be stored offsite if typically stocked by the generator owner or the local backup/standby generator repair facility.

9.14.2 Uninterruptible Power Supplies

At sites with a standby generator, the uninterruptible power supplies (UPSs) shall meet or exceed the functional requirements for a Type 0 (non-interruption of power), Class 0.25 (functions 15 min. at full load), and Level 1 (protection of human life) device as specified in NFPA 111.

UPSs shall be of proven design. They shall meet the requirements of NFPA 70, Article 700 and the requirements for an Emergency Power System as defined in NFPA 111.

The UPS unit shall continuously protect and condition power for a fully loaded critical bus during normal operation. The UPS unit shall power all infrastructures (radio communications system equipment) for a minimum of 4 hours (local facilities or with personnel on duty 24 hours x 7 week and within 5 miles). Remote and/or hard to access sites shall provide power for a minimum of 14 hours UPS runtime.

UPSs shall provide TCP/IP Ethernet-based management facility, including SNMP network management and web-based status and configuration.

9.14.2.1 Emergency Shutoff

The UPS shall have an emergency shutoff switch on the UPS cabinet. Additionally, provisions shall be made to de-energize the facility by operation of a clearly marked emergency switch in proximity to the circuit breaker panel. To prevent inadvertent shutoff, two actions shall be required to engage any emergency UPS shutoff switch (i.e., lift a cover then push a switch, or similar).

9.14.2.2 Bypass Switch

For maintenance and troubleshooting, the UPS shall have an external manual switch that will bypass the UPS AC input to output and disconnect the UPS from the site load and AC input. This will be a make-before-break function switch design in such a way as to prohibit the loss of AC power to the site equipment during and after the switch transfer. This switch shall contain a contact closure that will provide an indication that the bypass function has been activated. The contact closure shall be wired to the alarm system.

In the event of a UPS failure or reduction in output voltage, the UPS shall perform an internal automatic bypass from the AC input to the AC output. This function shall be designed so AC power will be continuous to the site equipment contingent on the presence of commercial or standby generator AC sources.

9.15 Grounding

All site grounding and lightning protection shall be in accordance with the National Electric Code and the grounding and surge protection requirements of ANSI J-STD-607 or:

- Motorola R56 – Standards and Guidelines for Communication Sites
- L3Harris AE/LZT-1234618/1 - Site Grounding and Lightning Protection Guidelines

CONTRACTOR shall provide a grounding plan for each site as identified in Table 4-1.

9.15.1 Common Ground System

There shall be only one common ground system at a communications facility. Grounds for all systems and equipment (including electric service, telephone service, water pipes, etc.) and all metal objects at a site shall be interconnected to equalize voltage rise among all conducting objects at the communications site.

The ground system shall be designed to achieve an overall resistance of 5 ohms or less from any point in the ground system to ground.

9.15.2 Grounding Conductors

All grounding conductor sizes specified are minimum sizes. Flat metal straps or bars may be used in place of wire where the cross-sectional area of the strap or bar meets or exceeds the cross-sectional area of the specified wire. Grounding-conductor insulation shall be green, green with a yellow stripe or marked with green tape or adhesive labels or otherwise colored green at termination points.

Grounding conductors shall be supported or secured at intervals of 3 ft. or less. Grounding conductors shall not be run in metal conduit unless the wire is permanently bonded at both ends of the conduit. PVC conduit is preferred.

9.15.2.1 Exterior Grounding Conductors

Unless otherwise stated, exterior grounding conductors shall be solid or stranded, bare copper. Solid conductors are preferred.

Conductors installed below grade or partially below grade shall be #2 AWG solid. Below-grade conductors larger than #2 AWG may be stranded. If below-grade conductors are stranded, tinned copper conductors are recommended.

Unless otherwise stated, exterior conductors installed entirely above grade shall be #6 AWG. Insulated conductors are preferred for above-grade conductors. Conductors bonded to galvanized steel shall be tinned, bare copper.

9.15.2.2 Interior Grounding Conductors

Interior grounding conductors shall be tinned or untinned stranded copper wire. Interior grounding conductors shall be insulated unless otherwise specified.

9.15.2.3 Grounding Conductor Bends

Grounding conductor lengths shall be kept as short as possible with the minimum number of bends. Conductor bends shall exceed an 8 in. radius with an included angle of at least 90 degrees. Bends made at connection points shall turn in the direction of earth ground.

9.15.3 Grounding Equipment

Where a product is commercially available as a UL-listed device, a UL-listed device shall be used.

9.15.4 Connections

Above- and below-grade connections to the grounding electrode system shall be made by exothermic welding or irreversible high-compression connectors. All other above-grade connections shall be made using exothermic welding, lugs, compression connectors, clamps, or other approved means.

Connectors shall be designed for the size and type of grounding conductor(s), the surface being grounded, and the metals being bonded. An anti-oxidation compound shall be applied to the surfaces of all mechanical connections.

Where lugs are used, two-hole lugs are preferred. Lugs may not be stacked; each lug shall be in direct contact with the surface to which it is being bonded.

The removal of galvanization for the purpose of grounding is strictly prohibited. When making connections between dissimilar metals, precautions must be taken to prevent deterioration of grounding surfaces or protective surfaces.

9.15.5 Exterior Grounding System

An exterior grounding system consists of a grounding electrode system, tower ground bar, external building grounding bus bar and grounding conductors from ground bus bars, towers, buildings, fences, cable bridges, generators, and fuel tanks.

9.15.5.1 Ground Rods

Ground rods shall be solid copper, hot-dipped galvanized steel, copper-clad steel, or stainless steel, at least 5/8 in. diameter and 8 ft. long.

Ground rods shall be driven into the earth using appropriate tools. The depth of the upper end of the ground rod shall be at the same depth as the ground ring, at least 30 in. below grade. If a ground rod cannot be driven straight down the total length of the ground rod, it shall be driven at an angle not greater than 45 degrees. Auguring and backfilling are not permissible unless used in conjunction with doping.

Maximum distance between ground rods shall be twice the length of a single ground rod.

9.15.5.2 Electrolytic Ground Rods

Electrolytic ground rods may be used in locations with poor soil conductivity or limited space where standard ground rods are insufficient to provide a low-impedance ground. Electrolytic ground rods should be considered for use in locations where the grounding electrode system will be covered by pavement or concrete. Electrolytic ground rods shall be UL-listed, maintenance-free and shall meet all federal, state, and local environmental regulations.

9.15.5.3 Ground Plates

Ground plates may be used in special locations where conditions prevent the use of standard ground rods. Ground plates shall be at least 0.06 in. thick with a surface area of at least 2 sq ft. They shall be installed at least 30 in. below grade.

9.15.5.4 Doping of Ground Systems

Doping of the soil may be necessary to enhance soil conductivity or protect the grounding electrode system from highly acidic soils. The doping material is added around the ground rod in an augured hole or around a conductor in a trench. The doping material shall have a constant cured resistivity of 12 ohm-cm or less. It shall set up to a hard, permanent material and shall not decompose or dissolve over time. It shall not require any maintenance after installation. It shall not accelerate corrosion of the grounding system. The doping material shall meet all federal, state, or local environmental regulations.

9.15.5.5 Grounding Electrode System Conductors

Grounding electrodes shall be interconnected by grounding electrode system conductors to create the grounding electrode system. Grounding electrode system conductors shall be #2 AWG. Grounding electrode system conductors shall be installed at least 30 in. below grade.

9.15.5.6 Ground Rings

Ground rods shall be interconnected to form a ground ring around each tower and communications shelter. Tower ground rings shall be installed at least 2 ft beyond tower foundations. Building ground rings shall be installed 3 ft beyond building foundations or 2 to 6 ft beyond the roof dripline.

All ground rings at a site shall be connected to each other with at least two #2 AWG wire.

9.15.5.7 Ground Radials

Ground radials are recommended at lightning-prone sites, sites with high soil resistivity or sites normally occupied. Radials may be 25 to 80 ft. in length. They shall be cut to different lengths to prevent resonance. Radials shall be equally spaced and radiate from the tower ground ring. They shall be installed 30 in. below grade. Ground rods shall be installed and connected to the radials separated by no more than the sum of their lengths.

9.15.6 Grounding of Towers and Other Antenna Support Structures

The following sections provide general instructions for grounding towers and other antenna support structures. Special situations, such as the use of cathodic protections systems, shall be designed by a professional engineer specializing in the design of these systems. Drilling holes in towers or loosening tower bolts to install grounding is strictly prohibited.

9.15.6.1 Steel Monopoles

Steel monopoles shall be bonded to a tower ground ring by four #2 AWG wires. The ground ring shall consist of at least four ground rods.

9.15.6.2 Self-Supporting Towers

Each leg of a self-supporting steel lattice tower shall be bonded to a tower ground ring by #2 AWG wire. The ground ring shall consist of at least one ground rod per leg with additional ground rods as required to keep the distance between ground rods to less than twice the length of a single ground rod.

9.15.6.3 Guyed Towers

The base of a guyed tower shall be bonded to a tower ground ring by three #2 AWG wire. The grounding conductors shall be bonded to the ground ring within 2 ft. of the ground rods. The ground ring shall consist of at least three ground rods.

At each guy anchor point, a ground rod shall be installed approximately 2 ft. from the anchor footing. Guy wires shall be bonded to the ground rod by one #2 AWG wire. The grounding conductor shall be connected to the guy wires using UL-listed mechanical clamps. Exothermic welds are not allowed. Where the guys are anchored within the fenced site compound, each ground rod shall be tied back to the tower ground ring below ground, using #2 AWG wire.

9.15.6.4 Antenna Support Structures on Buildings

Buildings on which an antenna support structure is mounted shall have a lightning protection system designed and installed in accordance with NFPA 780. A typical lightning protection system has a grounding conductor around the perimeter of the roof and at least two down conductors to the grounding electrode system. The lightning protection system may be bonded to building steel in at least two locations in lieu of the down conductors. Metal objects on the roof shall be bonded to the lightning protection system.

For a roof-mounted, self-supporting steel lattice tower, the tower legs shall be interconnected with #2 AWG wire to form a tower ground ring. The tower ground ring (or the base plate of antenna masts or guyed towers) shall be bonded to the lightning protection system by two #2 AWG wires. The conductors shall be extended in opposite directions and bonded to the lightning protection system within 2 ft of a down conductor or a connection to building steel.

Guy wires associated with towers on top of buildings shall be grounded at their anchor points to the lightning protection system in a similar manner.

9.15.6.5 Ice Bridge Grounding

Each support post of an ice bridge shall be bonded to the grounding electrode system by a #2 AWG wire. The ice bridge shall be bonded to each support post by #6 AWG wire. If the ice bridge consists of more than one section, the sections shall be bonded together by #6 AWG jumpers.

Where the ice bridge is supported by the tower and/or the building and does not have support posts, the following shall apply:

- Where an ice bridge is supported by the tower, it shall be bonded to the tower and electrically isolated from the building. Bonding to the tower may be accomplished by multiple mechanical connections or by bonding the ice bridge to the tower by a #6 AWG wire, to the TGB by a #6 AWG wire, or directly to the grounding electrode system by a #2 AWG wire in flexible non-metallic conduit.

- Where an ice bridge is supported by the building, it shall be bonded to the building and electrically isolated from the tower. At the building, the ice bridge shall be bonded either to the external ground bus bar by a #6 AWG wire or directly to the grounding electrode system by a #2 AWG wire.
- Where an ice bridge is supported by both the building and the tower, the tower end shall be isolated from the tower by an insulating slip-joint device. At the building, the ice bridge shall be bonded either to the external ground bus by a #6 AWG wire or directly to the grounding electrode system by a #2 AWG wire. At the tower, the ice bridge shall be bonded directly to the grounding electrode system by a #2 AWG wire in flexible non-metallic conduit.

9.15.6.6 Tower Ground Bus Bar

A tower ground bus bar (TGB) shall be mounted at the base of each tower or antenna support structure below the point where transmission lines turn toward the communications building or room. The TGB shall be solid copper at least 2 in. wide and 0.25 in. thick mounted on 2-in. insulators. In locations where the tower is not protected from runoff from the TGB, the TGB shall be tinned. The length of the TGB and the number of conductor mounting holes are determined by the expected current and future number of conductors to be attached.

The TGB shall be bonded to the grounding electrode system by a #2 AWG tinned, solid, bare copper wire in flexible non-metallic conduit. In addition, the TGB may be bonded to the tower either directly using approved hardware or by a jumper.

Additional TGBs may be installed on the tower for the grounding of transmission line grounding kits. These TGBs shall be bonded to the tower by #2 AWG tinned, solid, bare, copper wire.

9.15.6.7 Tower-Top Amplifiers

Tower-top amplifiers shall be grounded to the tower by a #6 AWG wire. Connections to the amplifier shall be made per manufacturer's recommendations.

9.15.6.8 Transmission Lines

The outer conductor of each transmission line, including waveguide, shall be grounded with appropriate coaxial cable grounding kits. These shall be installed per manufacturer's recommendations at a minimum of three locations:

- At the top of the vertical run near the antenna. The grounding kit grounding conductor shall be connected to a vertical structural member of the tower using the clamp provided with the grounding kit or to a TGB using an appropriate two-hole lug.
- At the bottom of the vertical run, just above where the transmission line turns from the tower toward the communications building or room. The grounding conductor shall be connected

to the TGB using an appropriate two-hole lug. This point shall be as low to the ground as feasible.

- Immediately outside the cable entrance to the equipment building, just ahead of the coaxial suppressor. The grounding conductor shall be connected to the external ground bus bar (EGB) using an appropriate two-hole lug.

Additional grounding bonds shall be installed to keep the distance between grounding kits to less than 75 ft. along the vertical run.

9.15.7 Grounding of Buildings or Shelters

9.15.7.1 Exterior Ground Ring

An exterior ground ring (EGR) shall be installed around the perimeter of each dedicated communications building or shelter. The EGR shall incorporate one ground rod at each corner of the building. As necessary, additional ground rods shall be added so the maximum distance between rods is less than the sum of the length of the ground rods. A ground rod shall be installed directly below the transmission line entrance to the building.

9.15.7.2 Exterior Ground Bus Bar

An exterior ground bus bar (EGB) shall be mounted on the exterior of the building below the cable entrance panel. The EGB shall be solid copper at least 2 in. wide and 0.25 in. thick mounted on 2 in. insulators. The length of the EGB and the number of conductor mounting holes are determined by the expected current and future number of conductors to be attached.

The EGB shall be bonded to the grounding electrode system by a #2 AWG wire. A larger size wire or copper straps are preferred.

The EGB may be eliminated where a cable entrance panel is installed that includes integrated coaxial ground clamps.

9.15.7.3 Cable Entrance Panel

The cable entrance panel shall be bonded to the EGB by a #2 AWG wire.

9.15.8 Grounding of Fences

All metal fences, including gates, within 6 ft. of the grounding electrode system or any grounded object shall be bonded to the grounding electrode system as follows:

- Each corner fence post and each gate support post shall be bonded to the grounding electrode system by #2 AWG wire.

- Each gate shall be bonded to the gate support post by a flexible copper grounding conductor (#6 AWG wire or equivalent). The flexibility of the grounding conductor shall not be compromised by the bonding process.

9.15.9 Grounding of Metal Objects

The following items must be bonded to the grounding electrode system:

- Emergency generator and generator support base
- Fuel tanks and metal fuel pipes, whether above or below ground
- Electric service and telephone service ground systems
- Any other sizable metal object within 6 ft of the grounding electrode system or any grounded object

9.15.10 Interior Grounding System

9.15.10.1 Single-Point Grounding System

Communications buildings, shelters or equipment rooms shall have a single-point grounding system. All equipment and metallic objects shall be connected to the exterior grounding system at a single location.

To facilitate creation of a single-point ground, transmission lines, electric service, telephone circuits, etc. shall enter the communications building or shelter near one another and the master ground bus bar.

9.15.10.2 Master Ground Bus Bar

A master ground bus bar (MGB) shall be installed below the cable entry panel. The MGB shall serve as the single-point ground connection for all internal communications system equipment.

The MGB shall be solid copper at least 2 in. wide and 0.25 in. thick mounted on 2 in. insulators. The length of the MGB and the number of conductor mounting holes are determined by the expected current and future number of conductors to be attached.

The MGB shall be bonded to the EGR by a #2 AWG wire. The grounding conductor shall extend downward from the MGB and exit the building at a 45-degree angle. The grounding conductor shall be run in flexible non-metallic conduit from the point it passes into the wall until it runs below ground.

9.15.10.3 Secondary Ground Bus Bars

Secondary ground bus bars (SGBs) may be installed in the same room or in other rooms as needed to simplify connections to the MGB. Equipment may be bonded to the SGB rather than

directly to the MGB. The SGB shall be at least 2 in. wide and 0.25 in. thick mounted on 2 in. insulators. The SGB shall be bonded to the MGB by a #2 AWG wire.

9.15.10.4 Grounding of Surge Suppressors

Each coaxial surge suppressor installed at the cable entry point shall be bonded to the MGB by a #6 AWG wire.

As an option, a secondary ground bus bar (SGB) may be installed below transmission lines to facilitate grounding of multiple surge suppressors. The SGB shall be bonded to the MGB by a #2 AWG wire.

Some cable entry panels may include an integrated surge-suppressor SGB. This SGB is bonded directly to the EGR through the cable entry panel, so bonding to the MGB is unnecessary.

9.15.10.5 Interior Grounding Ring

An interior grounding ring (IGR, often called a halo ground) shall be installed around the perimeter of the equipment room. The IGR shall be mounted on 2 in. insulators approximately 1 ft below the ceiling or 8 ft above floor level, whichever is lower. The IGR shall consist of two #2 AWG wires of approximately equal length. There shall be a gap between the two conductors of at least 4 in. at the opposite end of the room from the MGB.

9.15.10.6 Connections to the Interior Ground Ring

Items mounted along the perimeter of the equipment room, including the following, shall be bonded to the IGR by a #12 AWG wire:

- Electrical panelboards and transient-voltage surge suppressors (TVSSs)
- Telephone terminal block enclosures and surge suppressors
- Emergency generators (if located indoors)
- Metal battery racks
- Doors
- Door frames
- Ventilation ducts
- Water pipes
- Electrical conduits
- Any significant metal object within 6 ft of any other grounded object

9.15.10.7 Equipment Grounding Bus

An equipment grounding bus (EGB) consists of a conductor bonded to the MGB or SGB and radiating outward to equipment locations. The EGB typically runs within cable tray. The EGB may have multiple taps to branch to multiple rows of equipment racks or cabinets. The EGB

conductors shall be #2 AWG wire. EGB conductors shall be routed to minimize the distance from the equipment to the MGB or SGB.

9.15.10.8 Rack and Cabinet Ground Bus

A rack or cabinet ground bus (RGB) shall be installed at each rack or cabinet. The RGB shall be #6 AWG wire. The rack or cabinet shall be grounded to the EGB or the RGB by #6 AWG wire.

9.15.10.9 Grounding of Equipment

Each equipment chassis within a rack or cabinet shall be connected to the RGB by #12 AWG wire. Equipment grounds shall not be daisy chained. Communications equipment shall not be connected to the IGR.

All equipment, whether mounted in racks or cabinets or in some other manner, shall be connected either to the MGB, an SGB or an EGB.

9.15.10.10 Cable Trays

Cable trays shall be connected to the MGB by a #2 AWG copper wire. Cable tray sections shall be bonded together by #6 AWG copper wires.

9.15.11 Communications Center Grounding

A communications center ground bus (#2 AWG copper wire) shall be run under the flooring for each equipment row, if possible, in a manner to allow each equipment to tie into this ground with a #6 AWG solid or stranded, green-insulated copper wire. The ground bus shall be short and direct with no sharp bends and shall not run parallel within 2 in. of any power or signal leads. The ground bus shall connect to a single-point master ground bus bar, and then connect to the exterior building ground, except if no external ground system is being installed as part of the equipment installation. Any ground system installed shall be effectively connected to the existing building ground or electrical service ground.

Console bays shall be bonded together and shall be connected to the communications center ground bus with a short, direct run of #6 AWG or larger solid or stranded, green-jacketed copper wire, avoiding sharp bends.

9.16 Surge Suppression

All power and communications circuits entering and exiting the communications shelter or room shall be protected by the application of appropriate surge protective devices (SPDs) employing metal-oxide varistors (MOVs) or silicon avalanche diodes (SADs).

9.16.1 Transmission Line Surge Protective Devices

All RF transmission lines, including unused spares, must be protected by coaxial SPDs. Transmission line SPDs shall be located within 2 ft. of the entrance to the building, or if the communications equipment room is not near the building entrance, within 2 ft. of the entrance to the communications equipment room. Coaxial SPDs shall be grounded as indicated above.

9.16.2 Tower-Top Amplifier Protection

TTA protective measures shall be verified with the amplifier manufacturer. An input port surge suppression device shall be installed per the manufacturer's recommendation.

Internal preamplifier output port protective measures shall be verified with the amplifier manufacturer, and output port surge suppression devices shall be installed per amplifier manufacturer's recommendations.

Tower-top pre-amps with outputs carrying both DC and RF via the coaxial line shall be protected by an impulse suppressor with DC injection. These units shall be installed according to the manufacturer's instructions.

All surge protection devices shall be located and installed to be easily replaceable.

9.16.3 Electric Service Panelboard Surge Suppression

A Type 1 transient voltage surge suppressor (TVSS) shall be placed at on the source side of service entrance panels, and on the load side of transfer switches or distribution panels. The suppressor shall be installed in parallel via a circuit breaker sized according to the manufacturer's recommendation (typically 60-amp) rated for the interrupting current of the panel. The lead lengths from the protective devices shall be as short as possible. The TVSS enclosure shall be grounded to the IGR with #6 AWG wire. A remote status indicator must be available.

9.16.4 AC Power In-Line Protection

When the above TVSSs are used, no additional TVSSs are required on site. If main/branch panel TVSS is not available, each AC utility power line shall be equipped with a two-way surge protector.

9.16.5 Telephone Lines

All telephone lines, T1 lines, data, and control lines (excluding all fiber-optic lines) entering a site shall be equipped with bi-polar, bi-directional SAD surge protectors. The location for these protectors can be at the equipment or telephone patch panel depending upon the application. For

these hazards, protectors shall be connected with a #6 AWG or larger solid copper wire or strap to either the equipment ground or telephone patch panel ground.

9.16.6 GPS Receiver

When a GPS receiver with an active antenna mounted outside of the building is employed, a GPS system coaxial protector shall be installed to protect against the surge from a GPS antenna. The protector shall be located between the GPS antenna and GPS receiver with a #6 AWG or larger solid copper wire or strap to connect to the equipment rack ground.

10 Abbreviations & Acronyms

Abbreviations and Acronyms List			
AASHTO	American Association of State and Highway Transportation Officials	EGB	Equipment Grounding Bus
AC	Alternating Current	EGR	Exterior Ground Ring
AC	Advisory Circulars	EIA	Electronic Industries Association
ACI	American Concrete Institute	EMT	Electrical Metallic Tubing
AES	Advanced Encryption Standard	EPSS	Emergency Power Supply System
AM	Amplitude Modulation	ERP	Effective Radiated Power
ANSI	American National Standard Institute	F1	First Fresnel Zone Height
ASCE	American Society of Civil Engineers	FAA	Federal Aviation Administration
ASHRAE	American Society for Heating, Refrigeration and Air-conditioning Engineers	FCC	Federal Communications Commission
ASSE	American Society of Safety Engineers	FDMA	Frequency Division Multiple Access
ASTM	American Society for Testing and Materials	GC	Clayey Gravel
ATIS	Alliance for Telecommunications Industry Solutions	GP	Gravel Poorly Graded
ATP	Acceptance Test Plan	GPS	Global Positioning System
AUX I/Os	Auxiliary Inputs/Outputs	GUI	Graphical User Interface
AWG	American Wire Gauge	GW	Gravel Well-Graded
BAFO	Best and Final Offer	HIPS	Host-Bases Intrusion Prevention Software
BDA	Bi-Directional Amplifier	HVAC	Heating, Ventilation, and Air Conditioning
BER	Bit Error Rate	Hz	Hertz
C4FM/CQ PSK	Continuous 4-level Frequency Modulation / Continuous Quadrature Phase Shift Keying	I/O	Input / Output
CAD	Computer Aided Dispatch	ID	Identifier
CATP	Coverage Acceptance Test Plan	IDU/ODU	Indoor Unit/Outdoor Unit
CDR	Contract Design Review	IEEE	Institute for Electrical and Electronics Engineers
CFR	Code of Federal Regulations	IESNA	Illuminating Engineering Society of North America
COTS	Commercial Off-the-Shelf	IGR	Interior Ground Ring
CPU	Central Processing Unit	IP	Internet Protocol
DAQ	Delivered Audio Quality	IRR	Instant Recall Recorder
dB	Decibel	ISSI	Inter-RF Subsystem Interface
DC	Direct Current	KFD	Key Fill Device
DDR	Detailed Design Review	KMF	Key Management Facility
DMZ	Demilitarized Zone	LED	Light-Emitting Diode
DS1	Digital Signal 1	LMR	Land Mobile Radio
DS3	Digital Signal 3	LOS	Loss of Signal
DVR	Digital Vehicular Repeater	LPG	Liquefied Petroleum Gas
E&M	Ear & Mouth	MGB	Mater Ground Bus Bar

Abbreviations and Acronyms List			
MHSB	Monitored Hot Stand-by	SDoCs	Supplier's Declarations of Compliance
MoM	Manager of Managers	SGB	Secondary Ground Bus Bar
MOV	Metal Oxide Varistors	SHPO	State Historic Preservation Offices (National Register)
MPLS	Multiprotocol Label Switching	SNMP	Simple Network Management Protocol
N/C	Normally Closed	SNMPv1	Simple Network Management Protocol Version 1
N/O	Normally Opened	SNMPv2	Simple Network Management Protocol Version 2
NECA	National Electrical Contractors Association	SNMPv2c	Simple Network Management Protocol Sub-version 2
NEMA	National Electrical Manufacturers Association	SNMPv3	Simple Network Management Protocol Version 3
NEPA	National Environmental Policy Act	SPD	Surge Protection Devices
NESC	National Electrical Safety Code	SSL	Secure Sockets Layer
NFPA	National Fire Protection Association	STD	Standard
NIST	National Institute of Standards and Technology	STS-1	Synchronous Transport Signal 1
nm	nanometer	SAW	City of Staunton, Augusta County, City of Waynesboro
NMS	Network Management System	T1	T-Carrier
NTP	Notice to Proceed	TGB	Tower Ground Bus Bar
O.D.	Outside Diameter	TIA	Telecommunications Industry Association
OC3	Optical Carrier 3	TL1	Transaction Language 1
OEM	Original Equipment Manufacturer	TSB	Telecommunications Systems Bulletin
OET	Office of Engineering & Technology	TTL	Time to Live
OSHA	Occupational Safety & Health Administration	TTA	Tower-top Amplifier
OTAP	Over the Air Programming	TVSS	Transient-Voltage Surge Suppressor
OTAR	Over the Air Rekeying	TX	Transmitter
P25	APCO Project 25	UHF	Ultra-High Frequency
PA	Power Amplifier	UL	Underwriters Laboratories
PC	Personal Computer	UPS	Uninterruptible Power Supply
PDF	Portable Document Format	VAC	Voltage Alternating Current
PSF	Pounds-Force Per Square Foot	VDC	Voltage Direct Current
psig	pounds per square inch gage	VHF	Very-High Frequency
PVC	Polymerizing Vinyl Chloride	VPN	Virtual Private Network
QoS	Quality of Service	VSWR	Voltage Standing Wave Ratio
RF	Radio Frequency	W	Watt
RFP	Request for Proposal		
RGB	Rack or Cabinet Ground Bus		
RSL	Received Signal Level		
RTU	Remote Terminal Unit		
RX	Receiver		
SAD	Silicon Avalanche Diodes		

Appendix A – Evaluation Criteria

Proposals will be evaluated based on the categories below. Each Proposal may receive up to 100 points from the Pricing and Technical Evaluation Points.

Category	Point Allocation
Pricing (30 Points)	
Infrastructure Costs	10
Subscriber Costs	10
14 Year Running Costs (Operations & Maintenance)	10
Technical (70 Points)	
System Configuration and Design	20
Coverage Adequacy	20
Responsiveness to the Intent of the Specification	10
Project Manager / Lead Engineer Experience	5
Warranty and Maintenance Service	5
Warranty and Maintenance Service Organization Experience	5
Schedule	5
Total Evaluation Points	100

Grounds for Rejection

PROPOSERS who fail to submit required documentation or meet mandatory requirements, in such time, for evaluation purposes may be eliminated from further consideration.

Evaluation Categories

PRICING

The pricing evaluation is separated for three subcategories: Infrastructure Costs, Subscriber Costs, and 14-year running costs.

Infrastructure Costs

The infrastructure costs include all fixed equipment (Radio and Microwave systems), physical facilities (shelters, towers, generators, HVAC, access roads, etc.) all dispatch equipment (consoles, back-up control stations, logging recorder, etc.), alarm system, software, all costs associated with acquisition, designing, staging, delivery, installation, construction, implementation, configuration, testing, cutover, and all services (project management, engineering, training, etc.).

Infrastructure costs include all costs associated with acquisition, implementation and first-year operation of the base system, including the following:

- purchase or 1st year lease of sites or property
- 1st year lease of equipment room and/or tower space
- 1st year lease of connectivity network (e.g. fiber-optic)
- regulatory fees
- setup and implementation of utilities
- initial full tank of generator fuel
- 1-year warranty

Where these costs are not included in the Proposal, they will be estimated by the evaluation team.

The following costs are excluded in the calculation of infrastructure costs:

- subscriber units (mobiles, portables, pagers, and control stations)
- operations and maintenance
- contingent discounts
- mandatory options identified in the RFP
- options offered by the PROPOSER

Points will be awarded to each proposal based on the following formula:

$$PIC_n = \frac{MinIC}{IC_n} \times PIC_0$$

Where

PIC_n is the points awarded to Proposal n for this subcategory;

$MinIC$ is the lowest Infrastructure Costs of all valid proposals;

IC_n is the Infrastructure Costs of Proposal n ; and

IC_0 is the total points allocated to this category.

Subscriber Costs

The subscriber costs include the following:

- subscriber Units (mobiles, portables, pagers, control stations, etc.)
- subscriber services (delivery, programming, installation)
- required features and functionality specified by the RFP
- accessories requested by SAW in the RFP
- 2-year warranty

The following costs are excluded in the calculation of subscriber costs:

- operations and maintenance
- contingent discounts
- mandatory options identified in the RFP

- options offered by the PROPOSER

Subscriber costs will be based on pricing information in the Price Proposal worksheet, provided the proposed subscribers are compliant with the RFP. Where proposed subscriber equipment is not compliant, the cost will be estimated based on proposed list prices for compliant subscriber equipment. If proposed list prices are unavailable for compliant equipment, the evaluation team will estimate the cost of compliant proposed equipment.

Points will be awarded to each proposal according to the following formula:

$$PSubCost_n = \frac{MinSubCost}{SubCost_n} \times PSubCost_0$$

Where

$PSubCost_n$ is the points awarded to Proposal n for this category;
 $MinSubCost$ is the lowest Subscriber Costs of all valid proposals;
 $SubCost_n$ is the Subscriber Costs of Proposal n ; and
 $PSubCost_0$ is the total points allocated to this category.

14 Year Running Costs

14 Year Running Costs include operations listing the following:

- Years 2-15 maintenance plan
- annual preventive maintenance and site inspections
- system refresh or any incremental upgrades required
- software and system updates/upgrades
- mobile/portable radio replacement
- site leases
- equipment room and/or tower space leases
- connectivity network leases
- utilities
- maintenance contracts (e.g. physical facilities)

Where these costs are not included in the Proposal, they will be estimated by the evaluation team.

These costs will be based on pricing information in the Price Proposal worksheets, provided that proposed warranty and maintenance services are compliant with the RFP. Where proposed services and support is not compliant, the cost will be estimated based on proposed prices for compliant services and support. If proposed prices are unavailable for RFP required services and support, the evaluation team will estimate the cost of compliant support.

Points will be awarded to each proposal according to the following formula:

$$P15YearCost_n = \frac{Min15YearCost}{15YearCost_n} \times P15YearCost_0$$

Where

$P15YearCost_n$ is the points awarded to Proposal n for this category;

$Min15YearCost$ is the lowest 15 Year Running Costs of all valid proposals;

$15YearCost_n$ is the 15 Year Running Costs of Proposal n ; and

$P15YearCost_0$ is the total points allocated to this category.

TECHNICAL

System Configuration and Design

Evaluation points will be awarded for the proposed system configuration and design that meets the RFP requirements and will consider capacity (current and in the future), guaranteed coverage, planned locations with existing or new radio sites, connectivity network topology, simulcast design, interoperability, redundancy, reliability, functions, and features. If the evaluation team determines that the Proposal has not met the RFP requirements, the evaluation team will mark the non-compliance as a major exception at their discretion.

The following are examples of possible major exceptions, not meant to be exhaustive or all-inclusive:

- failure to substantially comply with RFP Terms and Conditions, and lack of willingness to substantially negotiate any specific RFP Term and Condition
- submission of additional Terms and Conditions that are in conflict with the RFP Terms and Conditions
- failure to propose all equipment and services necessary to provide a complete and working system as specified in the RFP
- proposing equipment that fails to meet specifications at numerous points
- system modes of operation fails the ability of a user to perform his duties safely and efficiently
- a system configuration that grossly affects dependability
- system redundancy that is significantly less than specified in the RFP
- coverage Guarantee does not substantially meet the coverage requirement
- system traffic loading capacity fails to meet current and future voice & data communications specified by the RFP
- Acceptance Test Plans not compliant with the RFP requirements
- failure to comply with the RFP re-testing requirements

Points for this category will be awarded based on the higher score obtained by one of the following two methods:

1. Two points will be deducted for each major exception; or
2. Points will be awarded based on the following formula:

$$PConfig_n = \frac{E_1 + E_2 + \dots + E_N - E_n}{E_1 + E_2 + \dots + E_N} \times \frac{PConfig_0}{2}$$

Where

$PConfig_n$ is the points awarded to Proposal n for this category;

E_n is the number of major exceptions found in Proposal n ;

N is the number of valid proposals; and

$PConfig_0$ is the points allocated to this category.

Coverage Adequacy

Evaluation points will be awarded according to coverage guaranteed. All PROPOSERS meeting the coverage specifications will be provided 100 percent (100%) of the points for this category.

For proposals not meeting the coverage specifications, a one-point deduction shall be assessed for each one percent inadequacy in meeting the specification in any direction (talk-out and/or talk-in) for any service area.

Responsiveness to the Intent of the Specifications

Points in this category will be allocated based on the following criteria:

Half of the points in this category will be awarded based on the evaluation team's determination of the difficulty experienced in evaluating a particular proposal. This is a measure in the anticipated quality of the PROPOSER'S submittals during the contract. If sections of a proposal require clarification, or need additional explanation, the evaluation team will submit a question. The total number of questions for each proposal will be calculated and points will be awarded using the following formula:

$$PQuestion_n = \frac{Q_1 + Q_2 + \dots + Q_N - Q_n}{Q_1 + Q_2 + \dots + Q_N} \times \frac{PResponse_0}{2}$$

Where

$PQuestion_n$ is the points awarded to Proposal n for this subcategory,

Q_n is the number of clarification questions asked for Proposal n ,

N is the total number of valid proposals; and,

$PResponse_0$ is the points allocated to this category.

The other half of the points in this category will be deducted if minor exceptions in equipment or system specifications are found by the evaluation team. The following are examples of minor exceptions, though this list is not intended to be all-inclusive or exhaustive:

- Equipment proposed does not meet the specifications, however the PROPOSER has a product line that does meet the specifications. The PROPOSER decided to offer a lower grade of equipment. Equipment proposed does not meet the specifications, and the PROPOSER'S product line does not meet the specifications.

- Proposed equipment does not meet the specifications, and the Proposal states “Exception” in the Compliance section (Appendix B).
- Proposed equipment does not meet the specifications, but the Proposal states “Comply” or “Comply with Clarification” in the Compliance section (Appendix B).
- Proposed equipment can meet the specifications and stated “Comply”, but the Proposal would require purchasing additional system features or functions listed “optional”.

Points will be awarded based on the following formula:

$$PMinorex_p_n = \frac{E_1 + E_2 + \cdots + E_N - E_n}{E_1 + E_2 + \cdots + E_N} \times \frac{PResponse_0}{2}$$

Where

$PMinorex_p_n$ is the points awarded to Proposal n for this subcategory,

E_n is the number of minor exceptions found in Proposal n ,

N is the number of valid proposals; and,

$PResponse_0$ is the points allocated to this category.

Project Manager / Lead Engineer Experience

The technical evaluation team will contact each of the five (5) references provided for the project manager and each of the five (5) references provided for the Lead Engineer. PROPOSER will receive one half point for every positive reference received.

Warranty and Maintenance Service

All the points in this category will be awarded to each PROPOSER who meets ***all*** warranty and maintenance requirements of the RFP, including the specified response times. Any PROPOSER not meeting all warranty specifications will have points deducted based on the evaluation team’s judgment of the severity of the warranty variance.

Warranty and Maintenance Service Organization Experience

The technical evaluation team will contact each of the five (5) references provided for the warranty and maintenance service organization. PROPOSER will receive one point for every positive reference received.

Schedule

All points in this category will be awarded to each PROPOSER that proposes a schedule that meets or exceeds the specified schedule. If the proposed schedule does not meet the schedule, points will be awarded based on the following formula:

If $Sched_n \leq RFP Sched$, then

$$PSched_n = PSched_0$$

If $RFP_{Sched} < Sched_n < 2 \times RFP_{Sched}$, then

$$PSched_n = PSched_0 \times \left(2 - \frac{Sched_n}{RFP_{Sched}} \right)$$

If $Sched_n \geq 2 \times RFP_{Sched}$, then

$$PSched_n = 0$$

Where

$PSched_n$ is the points awarded to Proposal n for this category;

RFP_{Sched} is the number of days in the schedule specified in the RFP

$Sched_n$ is the number of days in the schedule proposed in Proposal n ; and

$PSched_0$ is the points allocated to this category.

Appendix B – Compliance Matrix

See Attached Excel File

Appendix C – Responsibility Matrix

See Attached Excel File

Appendix D – Pricing Forms - Instructions

D.1 General Instructions

The PROPOSER shall enter detailed prices for the proposed system(s), equipment, software, and services in the Microsoft Excel workbook provided. The PROPOSER shall submit this completed workbook in its native Microsoft Excel format, failure to do so may result in rejection of the Proposal or loss of evaluation points. The PROPOSER shall also submit all sheets in the Microsoft Excel pricing pages as a PDF, and included in the Price Proposal submission, failure to provide all pricing information as a PDF copy may result in rejection of the Proposal.

The following notes apply, as appropriate, to all the cost pages:

- The PROPOSER shall include all costs for a turnkey system related to each specified cost area.
- PROPOSER **shall not bundle pricing**, when line items are available to submit detailed pricing.
- PROPOSER shall complete each worksheet in the pricing pages to allow for detailed evaluation.
- Items with no associated cost shall be indicated by zero (0) dollars in the appropriate cost column.
- Items that are not required or not applicable to the proposed system shall be noted as “N/A”, in the Note column, and no costs shall be included for these items.
- The PROPOSER shall enter costs not specifically requested in the “Other Related Costs” cells that have been provided in each section.
- Where costs for a line Item are included as part of another line item, the PROPOSER shall reference the item number which included the cost.
- In case of calculation errors or inaccuracies in the submitted pricing forms, the unit pricing shall prevail.
- All equipment required for a complete operational system shall be assumed to be included in the total system cost.

Failure to adhere to the above notes may result in rejection of the Proposal or loss of evaluation points.

D.2 Specific Instructions

D.2.1 General Setup

The price forms are provided in Microsoft Excel workbook file named “*Appendix D - Price Proposal Workbook.xlsx*”. Tabs are provided as follows:

- Project Information Worksheet
- Project Summation
- A. Physical Facilities

- B. Radio System
- C. Connectivity Network
- D. Dispatch Centers
- E. Services
- F. Public Safety Subscribers
- G. Non-Public Safety Subscribers
- H. Project Discount
- I. Ongoing Costs (Year 2 through Year 15)
- J. Maintenance Options
- K. Project Options
- L. Mandatory Unit Pricing
- Notes

D.2.2 Color Definition

The colors black, gray, and white are used throughout this workbook to simplify data entry. **Data or text shall only be entered into gray cells.** Text and data shall not be entered in cells that are not gray, to do so will create errors on the workbook and may result in rejection of the Proposal or loss of evaluation points. If an error occurs the PROPOSER shall reach out to the Procurement Officer immediately, in writing, to request a revised Appendix D.

D.2.3 Project Information

The PROPOSER shall enter the date of submission, the PROPOSER legal name, and the site names into the gray cells.

D.2.4 Base Quote Totals

The worksheet labeled “Project Summation” is used to display all the section totals, total base system, project discount, grand total, ongoing costs (year 2 thru year 15), project options, and maintenance options. Project options, maintenance options, and ongoing costs (year 2 thru year 15) are not summed into the grand total price.

The worksheet contains formulas that pull the numbers from the individual sections, worksheets, and performs elementary arithmetic for adding and subtracting. This page is for display purposes only and no information shall be added by the PROPOSER.

Each category below, with an alpha to the left, will take you to the corresponding worksheet if clicked.

D.2.5 Infrastructure Related Costs

Worksheets are included for the following categories of systems:

- Physical Facilities
- Radio System
- Connectivity Network
- Dispatch Centers
- Services

The PROPOSER shall use these worksheets to enter all related costs for systems, equipment, software, installation, and programming for that category. This includes the following:

- Equipment
- Installation
- Quantity

Columns A and B list equipment and installation totals per individual line item. Cells A3 and B3 sum all equipment and installation costs for the entire category. Cell A2 sums cells A3 and B3 together. The total from cell A2 (on each worksheet) is reported on the “Project Summation” worksheet and, if clicked, will take you to the Project Summation sheet.

If there are significant detailed notes that the PROPOSER believes necessary, enter a designated note number next to the line item in column C and insert the note in the worksheet labeled “Notes” at the end of the Price Proposal Workbook. Columns D and E list numbers and titles of each line item.

The PROPOSER shall denote all pricing information for each line item in the proposed system.

D.2.6 Services

The PROPOSER shall use this worksheet to enter all costs related to project management, engineering, testing, training, documentation for that category. (Note that dispatch and subscriber training are separated at the bottom of worksheets D, F, and G.) This includes the following:

- Labor (services/qty)
- Out-of-Pocket (expenses/qty)

D.2.7 Subscriber Related Costs

Worksheets are included for the following categories:

- Public Safety Subscribers
- Non-Public Safety Subscribers

The PROPOSER shall use this worksheet to enter all related costs for equipment, installation, programming, and training for that category. This includes the following:

- Equipment

- Install/Program
- Qty

The PROPOSER shall denote all pricing information for each line item used for a specified subscriber unit.

Column F provides the total number, all departments, for that line item. The next two columns are gray for PROPOSER input: column G is for equipment per unit costs; column H is for install/program per unit cost. The next column I has a mix of gray and white cells, the gray cell may be used to enter quantities and the white cells have been pre-populated quantities based upon the SAW agency needs. Columns J & K calculate total equipment and install/program costs for that line item for the SAW Agency. The two cells in columns J & K above the agency name total equipment and installation costs per site. Above these cells is a single cell that totals both equipment and installation costs per agency.

Columns G and H will use these prices to repeat columns I - K for each agency that will operate on the PROPOSED system.

D.2.8 Project Discount Worksheet

This worksheet is separated into the following categories:

- Infrastructure Project Discount
- Subscribers Project Discount

The PROPOSER shall use this worksheet to insert any discount associated with the proposed system design. The PROPOSER shall complete Column F to provide the monetary discount offered. The PROPOSER shall separate the discounts offered for infrastructure and subscribers as outlined in the worksheet.

D.2.9 Maintenance Related Ongoing Costs (Years 2 through 15)

The PROPOSER shall use this worksheet to enter all costs related to maintenance and spare parts for years 2 -15.

Columns A and B list services and spare parts totals per individual line item. Cells A3 and B3 sum all services and spare parts costs for the entire category. Cell A2 sums cells A3 and B3 together. The total from cell A2 is reported on the "Project Summation" worksheet.

The PROPOSER shall denote all pricing information for each line item that is necessary for maintaining the implemented system. The PROPOSER shall separate all necessary services and spare parts for complete ongoing costs as outlined in the worksheet.

The next two columns are gray for PROPOSER input: Column F is for 2nd year maintenance services costs; column G is for 2nd year spare parts costs. Columns F & G are repeated for each year of ongoing costs, through year 15.

D.2.10 Maintenance Options Related Costs (Years 2 through 15)

The PROPOSER may offer this worksheet to enter all costs related to maintenance options for 1st years warranty/maintenance and maintenance years 2 -15.

The PROPOSER shall denote all pricing information for each line item that is necessary for maintenance mandatory options. The PROPOSER shall separate all necessary services and spare parts for maintenance options in this worksheet.

The next two columns are gray for PROPOSER input: Column F is for optional 1st year warranty/maintenance services costs; column G is for 1st year warranty/maintenance spare parts costs. Column H is for optional 1st year warranty/maintenance services costs; column G is for 1st year warranty/maintenance spare parts costs. Column H is for 2nd year optional maintenance services costs; column I is for 2nd year optional spare parts costs. Columns H & I are repeated for each year of optional maintenance and spare parts costs, through year 15.

D.2.11 Project Options

The PROPOSER shall use this worksheet to enter all costs related to project options. The PROPOSER shall offer the options as described on this worksheet. If the PROPOSER desires to offer additional options, they may be included after the named options.

Columns A and B list equipment and installation totals per individual line item. The total from cell A2 is reported on the “Project Summation” worksheet.

If there are significant detailed notes the PROPOSER believes necessary, enter a designated note number next to the line item in column C and insert the note in the worksheet labeled “Notes” at the end of the Price Proposal Workbook. Columns D and E list numbers and titles of each line item. The lines that are gray may be used to describe the elements of each option.

The next two columns are gray for PROPOSER input: Column F is for equipment costs and column G is for installation costs.

D.2.12 Mandatory Unit Pricing Worksheet

The PROPOSER shall use this worksheet to enter subscriber equipment unit and unit installation costs, including features and accessories, that will be used for future purchasing. The PROPOSER shall offer the options as described on this worksheet. If the PROPOSER desires to offer additional options, they may be included after the named options.

This worksheet will not be included in the base quote total and will only be used as a reference in future purchasing by SAW. PROPOSERS shall enter necessary description/notes in the gray cells of column C, enter the per unit equipment cost in column D, and enter the per unit install and program costs in column E.

D.2.13 Notes

The PROPOSER shall use this worksheet to enter any detailed notes of explanation. The PROPOSER shall enter the following information: column A shall reference the specific worksheet to which the note corresponds; column B shall reference the assigned note reference # as entered in column C of the specified worksheet; and column C shall be the detailed notes of explanation.

APPENDIX E

PROPRIETARY/CONFIDENTIAL INFORMATION IDENTIFICATION FORM

Code of Virginia 2.2-4342F (updated 07/01/18): “Trade secrets or proprietary information submitted by a offeror or contractor in connection with a procurement transaction or prequalification application submitted pursuant to subsection B of § 2.2-4317 shall not be subject to the Virginia Freedom of Information Act (§ 2.2-3700 et seq.); however, offeror or contractor shall (i) invoke the protections of this section prior to or upon submission of the data or other materials, (ii) identify the data or other materials to be protected, and (iii) state the reasons why protection is necessary. A offeror or contractor shall not designate as trade secrets or proprietary information (a) an entire proposal or prequalification application; (b) any portion of a proposal or prequalification application that does not contain trade secrets or proprietary information; or (c) line item prices or total proposal or prequalification application prices.”

Trade secrets or proprietary information shall be identified in writing on this form, either before or at the time the data or other material is submitted. **Note: If proprietary/confidential information is identified, Offeror must submit a redacted copy (in electronic PDF format) of their proposal in addition to the required number of copies requested.** The proprietary or trade secret material must be clearly identified in the redacted proposal copy by a distinct method such as highlighting or underlining and must indicate only the specific words, figures, or paragraphs that constitute a trade secret or proprietary information. The designation of an entire proposal document, line item prices, and/or total proposal prices as proprietary or trade secrets is not acceptable. If, after being given reasonable time, the offeror refuses to withdraw such a classification designation, the proposal will be rejected.

SECTION NUMBER	PAGE NUMBER	REASON

Authorized Signature

Date

APPENDIX F

CERTIFICATION OF INTEREST & RELATIONSHIPS WITH CITY OF STAUNTON AND STAUNTON CITY COUNCIL

Contractor hereby certifies that neither Contractor, nor any of Contractor's officers, directors, or executive employees maintain a financial or familial relationship with any person acting for, or employed by, the City of Staunton or Staunton City Council (City Employee).

To the extent that such relationships exist, Contractor shall reveal the relationship below by describing the nature of the relationship and identifying the person with whom such relationship exists.

- ☐ Neither Contractor nor any of its officers, directors, or executive employees maintain a financial or familial relationship with any person acting for, or employed by, the City of Staunton and Staunton City Council.

- ☐ The following individuals currently maintain a **financial** relationship with Contractor.

City Employee's Name: _____

Position with City: _____

Nature of Relationship: _____

- ☐ The following individuals currently maintain a **familial** relationship with Contractor.

City Employee's Name: _____

Position with City: _____

Nature of Relationship: _____

Contractor

Date

By: _____

Name: _____

Title: _____

Appendix G – PROPOSER Questions

See Attached Excel File