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1.0 Terms and Conditions

1.1 Purpose

This Specification encompasses a turnkey project to provide Grundy County, Missouri (further known throughout this document as "Customer") with a new Project-25 700/800 MHz digital simulcast conventional radio network capable of meeting the current and future communication needs, both reliably and functionally.

1.2 Instructions

This RFP Specification is a complete document and must be returned intact with vendor responses provided in a point-by-point fashion. The RFP Authorization Form (See Attachments) must be completed. All responses and attachments should be placed into the RFP Response immediately behind the area in which the information was requested i.e., a point-by-point response.

If supplementary materials are inserted, each inserted page must be labeled in the bottom margin with the number of the Specification page behind which it is being placed. If more than one page is inserted behind a particular RFP Specification page, then each must be labeled with the appropriate page number plus a letter designator, e.g. 121a, 121b, 121c, etc.

When submitting responses to RFPs, corporate entities are required to comply with State law regarding authorized signatures. A letter of proposal submittal is required. If some official with the proposing corporation other than its president executes the letter of transmittal such signature must be accompanied by a certificate or a copy of a resolution adopted by the corporation setting forth the authority of that individual to execute a contract.

1.2.1 Proposal Timeline

Release of Request for Proposal	July 6th, 2021
Mandatory Pre-Proposal Conference	July 20th, 2021 at 10am
Deadline for Submission of Questions	August 16th, 2021 at 4pm
Answers Provided through Addendum No Later than	August 25th, 2021 at 4pm
Proposal Due Date and Time	September 7th 2021 at 4pm

All proposed times are Central Standard Time (CST).

1.2.2 Pre-RFP Conference

This RFP constitutes the full scope of the information request. An RFP mandatory proposal conference will be conducted approximately three weeks after the release of these Specifications to the Public. The time and place of the pre-proposal conference will be at Grundy County Courthouse, 700 Main Street, Trenton Missouri 64683 **on July 20th, 2021, at 10 am CST.**

1.2.3 RFP Questions

If during the review or preparation of the RFP response submittal, a Proposer discovers any errors, omissions or ambiguities, they should submit, in writing, their questions to the Customer. Written questions should be received by the Customer as designated by the RFP schedule.

1.2.4 Late RFP Response Submission

Any RFP Response submitted after the specified submission due date and time, will not be accepted and will be returned unopened to the submitting organization. All RFP responses will be held in confidence, to the extent permissible by State and County law, as applicable.

1.2.5 RFP Response Submittal

The Proposal Response shall be divided into two sections:

Technical Response.

Infrastructure Pricing and User Equipment Pricing.

The following documents are to be submitted:

Five (5) copies each of the Technical Response.

One (1) electronic searchable copy of the Technical Proposal.

Five (5) copies each of the Infrastructure and User Equipment Pricing Proposal.

One (1) electronic searchable copy Pricing Proposal.

The Pricing Responses (including electronic copy) shall be separated from the Technical Response (including electronic copy) and independently sealed. Do NOT put your price in the proposal or it will be disqualified.

Each Proposal Response shall be submitted in standard 8 1/2" x 11" three ring binders. The entire Response package must be submitted in a sealed container addressed to:

Grundy County Clerk
Re: Radio RFP
700 Main Street
Trenton MO 64683

The proposal responses must identify the title and RFP Number of the procurement. The time and date of the Proposal Opening must be plainly marked on the container as well as the Proposer's name, address and State Contractor's License Number.

All Proposal Responses should be delivered by hand, with receipt requested, or by certified or registered mail. All Proposal Responses become property of the Customer. A cover letter transmitting the Proposal Response must accompany the package.

1.2.5.1 Typical Current Radio User Configuration

Technical and Pricing Proposals shall be evaluated separately using a weighted point system whereby out of a maximum 100% Overall Project Score, 70% shall be allocated to Technical Proposal evaluation scores with 30% being allocated and equally shared between Infrastructure and Subscriber Equipment Price Proposals.

Technical Proposals will first be evaluated for overall responsiveness and completeness to the RFP Specifications. Proposals that are determined responsive and complete will be evaluated by the Consultant.

Technical Proposals will be graded in the following areas, listed in relative order of importance, with respect to the requirements as outlined in this RFP:

1. Performance, compatibility, expansion capabilities and versatility (32%)
2. Reliability, redundancy and warranty (20%)
3. Proposer qualifications, history of product support and RFP deviations (10%)
4. Equipment repair, installation, and implementation (10%)
5. Interoperability (10%)
6. Training (7%)
7. Maintenance, Availability of Service Parts (6%)
- 8 Organization, Scope, and Proposal Detail (5%)

The scored results of this Technical Evaluation will be multiplied by 0.70, thereby yielding a weighted technical project-total score. The results of this portion of the Evaluation shall be submitted to the Customer.

At the direction of the Customer as to the suitability and acceptability of the Technical Evaluation Results, the Consultant will next open and evaluate proposed costs for each responsive Technical Proposal.

The relative cost differences between responsive Cost Proposals shall be compared and evaluated. Each of the Infrastructure and Subscriber Equipment Cost Proposals received from responsive Proposers shall have their individual evaluation raw scores multiplied by 0.30 and those two portion results added together and with the Technical Evaluation score, thus yielding an Overall Project Score for each Proposer's Submittal.

That Proposer Submittal receiving the highest Overall Project Score shall be recommended by the Consultant as being the most responsive, best proposal. In the case of a tied Overall Project Score, the Consultant shall recommend that Proposal Submittal having the highest Technical Proposal evaluation score.

1.2.5.2 Total Costs

The Customer reserves the right to evaluate total project price on the basis of initial cost and life cycle analyses. Any deviations by Proposers from the pricing requirements herein shall be approved in advance of Proposal Submittal or they will be construed as being non-conforming and the Proposal Submittal will not be given further consideration.

1.3 Definitions

Definitions as used herein:

- a) Responder, Proposer:
Any organization, company, vendor, or supplier responding to this RFP Specification
- b) Contractor:
The Proposer to whom a Contract is awarded.
- c) Proposal, RFP Response, Submittal:
Correspondence or material furnished by Responders in response to this specification.
- d) Customer:
Grundy County, Missouri
- e) Consultant:
TUSA Consulting Services II, LLC.

1.4 RFP Proposer Standards

The Proposer must have manufactured, delivered and installed at least three radio systems of comparable technology (700/800MHz Project-25 digital voice simulcast transmit/receiver voted), having comparable size and scope. These three systems shall be described with enough information that the Customer or its Consultant can reasonably determine their project equivalency. These submittals should include a detailed summary of the system and its significant operational features/components as well as a current contact for the customer including name, address, and phone number, title, department and system responsibility.

RFP Responders will likewise be required to provide sufficient information necessary to support claims that both proposed infrastructures and user equipment will be functionally and operationally compatible with 700MHz channels (764-767MHz and 773-776MHz, paired with 794-797MHz and 803-806MHz, respectively) as well as the newly configured 800MHz NPSPAC channel plan as a result of FCC-Ordered 800MHz Rebanding. Failure to propose equipment capable of operations on this new spectrum and/or unable to support Project-25 operations shall be considered non-responsive and that vendor's RFP submittal shall be given no further consideration.

A factory authorized service center that is fully staffed and trained to support the proposed infrastructure network, and all related subsystem equipment, must be located within a 120-minute (2-hour) response time of the Customers location, to be considered adequate to satisfy initial installation, implementation, optimization, warranty and ongoing maintenance needs. The Contractor and all envisioned subcontractors, if any, must be able to legally conduct business within the State of Missouri.

The following standards shall apply, as a minimum, to all equipment, installation methods and materials:

- A. EIA/TIA-Electronic/Telecommunications Association
- B. NEC - National Electric Code
- C. NEMA - National Electrical Manufacturer's Association
- D. IEEE - Institute of Electrical and Electronic Engineers, Inc.
- E. FCC - Federal Communications Commission
- F. FAA - Federal Aviation Administration
- G. NFPA - National Fire Prevention Association
- H. Building Codes for Grundy County, Missouri
- I. OSHA - Occupational Safety and Health Administration

1.5 Workmanship

All proposed workmanship supportive of the RFP must conform to normal and accepted standards for the telecommunications industry. All fixed site equipment, including electronic communications infrastructure, dispatch consoles; alarm system consoles, network management consoles, electrical wiring, towers, antennas, mounts etc. are to be installed by or under the supervision of the Contractor.

The Contractor must completely remove and properly dispose of residue due to its work, return the site to a useable state and will be responsible for the cost of repairing all damage caused by the Contractor or its Sub-Contractors during network installation.

The Customer and its Consultant would reserve the right to halt any radio equipment or civils installation process due to poor workmanship, housekeeping, scheduling, work interruptions, etc. Work halts that are the result of poor workmanship would not relieve the Contractor of their responsibility to conform to the installation time requirements as stated by Contract.

1.6 Materials

All equipment, except with the expressed written permission of the Customer and its Consultant, must be new and unused, meet telecommunications industry standards, and, where applicable, **be registered with and approved by the Federal Communications Commission**. The Customer or its Consultant would reserve the right to reject and require the return, at the Contractor's expense, of any and all components which are defective or fail to comply with this RFP Specification or lack FCC type approval. Such rejections and/or returns will neither validate nor invalidate the remainder of any Contract. Rejections of material for cause would not provide an extension of time to the Contractor in the performance of contracted requirements.

1.7 Subcontractors

It is intended that a single Contractor have total turnkey responsibility for the subsequent Customer project so as to assure a fully operational network. Therefore, any Proposer desiring to use Sub-Contractor(s) must include within their RFP Response a list and description of potential, qualified Sub-Contractor(s). The Customer may require documentation and references to ensure the qualification of a proposed Sub-Contractor.

The customer does not require but has a preference for local subcontractors where appropriate.

1.8 Premises Visits

Responders, before submitting an RFP Response, may desire to visit the existing Customer's radio infrastructure and site premises in order to gain familiarity with conditions which may affect the work or planned solution(s). The Customer, its designated local representative or the Consultant will coordinate access and escort to the various sites. If more than one visit to a site is requested and time allows, the Customer will support the necessary arrangements. **Site Visits will take place immediately following the Pre-Proposal Conference.**

RFP Responders must indicate any special requirements, i.e., architectural, mechanical, electrical, civil or structural modifications, that their equipment may need at either Customer-owned or non-Customer-owned locations that are intended to be utilized in the offered solutions.

Estimated costs for these special requirements shall be disclosed in the RFP Submittal.

1.9 Contact

All contact and inquiry concerning this RFP Specification shall be directed in writing via email to:

Glen Briggs
Director
Grundy County Emergency Management
glen.briggs@grundycountymoema.com

1.10 Notification

Responders will be notified of the Customer's desire to enter into additional discussions as well as an oral presentation of proposed solutions, if determined necessary. The Customer's ranking of proposals shall be published after a recommendation of the best and most advantageous proposal is presented to Customer's Chief Administrative Officer/Manager or other recognized body.

1.11 Installation

1.11.1 Project Time Frame for Completion

The Project's anticipated time frame for completion is no greater than (18) months from a formal Notice to Proceed. The Project will not be deemed completed until a fully-compliant Project-25 simulcast infrastructure has been installed; all network functionality, audio quality and mandatory coverage testing has satisfactorily been completed in accordance with the Contract's Acceptance Test Plan; receipt of as-built documentation has occurred; and a Certificate of Substantial Completion has been issued by the Consultant for any remaining punch list items.

So-called vendor "Standard Contracts" will not be acceptable unless suitably modified to be in compliance with this RFP and/or subsequent RFP Specifications.

1.12 Training

The Customer considers training to be of paramount importance. Administrative and dispatcher training shall be completed on-site by the Contractor's personnel. Dispatcher training shall be more extensive and will involve all designated regular and relief dispatchers employed or utilized by the Customer at the time of system operational testing. The Contractor shall provide administrative training for two Communication Network Managers. Software training shall be provided which will enable these personnel to perform functionality/feature changes to fixed site equipment and portables/mobiles, poll the network diagnostics perform traffic and feature usage studies, etc. It is the desire of the Customer that such training is to commence within 60 days upon completion of contract negotiations and execution, and be completed prior to the Customer Design Review (CDR) meeting or a suitable time as desired by the Customer.

Additionally, the Contractor shall develop and train radio system dispatchers in the proper operation of radio console and backup control station equipment, as is necessary to operate the new P25 trunked radio system. The Contractor shall coordinate all training and, all sessions must be approved by the Customer. Dispatch, maintenance personnel and network manager follow-up training shall be provided and scheduled no more than sixty (60) days after project completion for the purpose of training reinforcement. All training costs, direct or indirect, such as meeting rooms, instructor travel, lodging and transportation, must be included in the final proposed price.

As an option, the Contractor must provide comprehensive maintenance training for one person, whereby the Customer's service/support personnel are qualified in the proper diagnostic, maintenance and repair service skills needed to quickly resolve 700/800MHz communications equipment malfunctions as well as microwave backhaul operational problems.

The Contractor is required to provide operational and full maintenance training for all service/support personnel, either on site or at remote factory locations. This level of training will be essentially equivalent to the level of service training required by the Contractor for its employed maintenance providers. Additionally, the Contractor must develop and train service/support personnel in those aspects of maintenance necessary to ensure the highest availability and reliability of infrastructure and subscriber equipment resources.

Preventative maintenance training should encompass all elements of proposed infrastructure equipment, inclusive of base stations, trunking controllers, network switches, microwave backhaul, standby generator equipment, battery plants, battery charging systems, tower light systems, site grounding systems, alarm systems and all other subsystems directly or indirectly related to infrastructure reliability and operations.

1.13 Parallel Implementation

In development of RFP submittals, Responders must consider that the new radio network must be installed in a parallel implementation. The current system is the Customer's only Public Safety Voice communications system and must operate 24/7/365. No interruptions in service of any duration may be allowed without prior approval of the Customer or their designee. Therefore, fully duplicated voice radio systems will coexist for some period of

The period of time of parallel installation will be used to perform testing of operational functionality of the entire network, dispatch consoles, mobiles, portables, network features, and high capacity receiver-voting and simulcast transmitter operations.

Since existing dispatch console equipment will control the old system during the parallel phase, the Contractor would be responsible for developing a plan to accommodate both existing and proposed equipment during the parallel and transitional periods of installation and implementation.

1.14 Manufacturer Support

The Customer requires at a minimum one-year comprehensive warranty on all infrastructure equipment required by the new P-25 radio network. No less than a two-year warranty is acceptable for user radio equipment. Warranty will not begin until complete system acceptance.

1.15 Parts Availability

All proposed backbone infrastructure components, inclusive of microwave equipment and repair parts shall be available for at least fifteen (15) years from the date of system acceptance. End user equipment (i.e. portables, mobile, etc.) repair parts shall be available for at least five (5) years from the date of cessation of equipment manufacturer.

1.16 Warranty of Network Performance

In submitting their RFP Response, the Proposer acknowledges that it has carefully reviewed the functional requirements and warrants that the proposed P-25 radio network solutions shall function according to equipment specifications, industry standards and the minimum operative characteristics specified in this RFP.

1.17 Remedies

Remedies shall be part of any Contract awarded and negotiated with the Successful Proposer. The scope of these remedies will become part of a negotiated contract and shall minimally include a graduated set of monetary penalties for unexcused late or delayed performance by the Contractor. The project schedule's indicated completion date shall be the basis for assessment of completion remedies.

Remedies shall be applied as follows:

Unexcused project completion delays of between 1 day and 30 days beyond the Contract's indicated completion date shall be assessed a penalty of \$1,000 per day. Unexcused completion delays that extend from Day 31 through Day 70 beyond the Contract's indicated completion shall be assessed a penalty of \$1,500 per day. Unexcused completion delays beyond 70 days shall be assessed a remedy of \$2,000 per day.

Any unexcused project completion delay that exceeds 180 days from the Contract's indicated completion date shall trigger an automatic default of the Contract. If the Contractor is unable to cure the reason for its completion failure within 45 additional days, the Contract will self-cancel and the Owner will initiate action against the Contractor's performance bond unless some acceptable accommodation is reached by the Contractor with the Owner. During the 45-day default period, remedies will be assessed at the rate of \$1,000 per day.

Remedies shall also apply to warranty repair service. The RFP and its subsequent contract with the Successful Proposer/Contractor include a mandatory warranty period where repair services performed in the field will be necessary. These Specifications contain response time periods within which the Contractor is required provide services and materials.

A failure to perform on the part of the Contractor to meet its contracted response time requirements shall result in a financial penalty of the scope and amount indicated by these Specifications or as modified during contract negotiations.

1.18 Acceptance Testing Process

Acceptance testing procedures will be defined during downstream Contract Negotiations. These procedures would essentially test and verify the performance of hardware/software features; coverage performance; reliability and interoperability with neighboring jurisdictions.

1.18.1 A staging verification of network functionality. It is acceptable to perform the equipment staging and verification at the vendors local service location.

1.18.2 An installed determination of compliance with Industry standards and published specifications of the various equipment elements provided under the Contract.

1.18.3 Functionality of standby power systems.

1.18.4 Functionality and path reliability of microwave link segments and the network as a whole;

1.18.5 A successful completion of a set of voice quality and signal level coverage tests of sufficient scope to confirm that the outdoor, in-vehicle and in- building coverage required by the Contract has been achieved.

1.18.5 Completion of a mandatory 30-day reliability burn in absent of any major network failures (i.e., loss of tower site, loss of 30% of network capacity, unreliable m/w functionality, etc.)

1.19 Right of Refusal

The Customer reserves the right to reject any and all RFP Responses received. Acceptance of any Response will not place the Customer under any obligation to purchase any equipment, system or services.

1.20 Performance and Payment Bonds

A Performance Bond in the amount of one hundred percent (100%) of the Contract Price shall be provided by the Contractor in the event a contract is subsequently awarded through either a sole-source or competitive procurement process. The Performance Bond shall be exercised by the Customer for failure of the Contractor to perform according to the terms of the Contract, i.e., an uncured default condition that results in Contract

A Payment Bond in the amount of one hundred percent (100%) of the Contract price would likewise be required. The Payment Bond must be from a surety company authorized to do business in (State of Missouri) with a rating of A- or better in the most current edition of the A.M. Best Insurance Report.

The cost of these Performance and Payment Bonds shall be the responsibility of the Contractor.

1.21 Proposal Pricing Summary Sheets

Responders shall provide detailed price breakdown submittals for infrastructure and subscriber equipment items, network integration/project management and installation/engineering services. It is not acceptable to lump category costs. Proposers must provide sufficient detail in their pricing proposals whereby it is possible to identify equipment types and services groupings. The format of the price submittal shall follow that as indicated by RFP Section 16 Pricing Considerations.

1.22 Corporate Resolution

RFP Response submittals must contain a Corporate Resolution or Power of Attorney authorizing and identifying agents to sign their Proposal or other documents as required by this Specification. This Corporate Resolution or Power of Attorney must be certified and notarized.

1.23 Non-Collusion Affidavit

Proposers must complete and submit the following Non-Collusion Affidavit form. Attach an executed original in the Original-Marked proposal submittal and a copy of this executed form in all subsequent proposal copies, as required.

1.24 Brokerage Fee

The Contractor warrants that he has not employed any person to solicit or secure this Contract upon an agreement for a commission, percentage, brokerage or contingent fee. Breach of this warranty shall give the Customer the right to terminate the Contract, or, at the discretion of the Customer, to deduct from the Contract price or consideration, the amount of such commission, percentage, brokerage or contingent fee. This warranty shall not apply to commissions payable by contractors upon contracts or established commercial or selling agencies maintained by the Contractor for the purpose of securing business.

No elected official or employee of the Customer shall be permitted to share any part of this Contract or any benefit that may arise wherefrom, and any contract made by the Customer in which such individual(s) shall be personally interested shall be void, and no payments shall be made thereon by the Customer or any officers thereof.

1.25 Conflict of Interest

In the interest of ensuring that efforts of the Contractor do not conflict with the interests of the Customer, and in recognition of the Contractor's professional responsibility to the Customer, the Contractor agrees to decline any offer of employment if its independent professional work on behalf of the Customer is likely to be adversely affected by the acceptance of such employment. The initial determination of such a possibility rests with the Contractor. It is incumbent upon the Contractor to notify the Customer and provide full disclosure of the possible effects of such employment on the Contractor's independent, professional work on behalf of the Customer. Final decision on any disputed offers of other employment for the Contractor shall rest with the Customer.

1.26 Contracts

This Specification and the Proposer's Response will be an integral part of the Contract. Any and all statements made in the Proposal Response will automatically become part of the final Contract for equipment and services.

Omission in the Proposal Response of any equipment, services or provisions herein prescribed shall not be construed so as to relieve the Contractor of any responsibility or obligation necessary to the complete and satisfactory installation of any and all systems, equipment, and services specified. The network price and any optional prices quoted must include all equipment, service, features, materials, labor, etc. necessary to make all the features, services, and equipment, which are included, fully functional. The Proposer agrees that the cost of additional equipment, materials, or labor necessary to meet these requirements, which was not otherwise calculated in his Proposal Response, shall be solely at the Contractor's expense.

If there are specific items that are purposefully excluded in the Proposer's indicated price, those must be defined by the Proposer's submittal. If, however, those Proposer-excluded items are what the Customer and its Consultant consider to be normal and customary for a project of this type, any proposal response excluding such items will be graded as not meeting minimum requirements for the appropriate Specification category(s) that are impacted by that exclusion.

Each Proposal Response must be signed by a duly authorized officer who is empowered to contractually bind the Proposer.

The Customer shall enter into contract negotiations with the apparent responsive and best Proposer. Should the Customer be unable to negotiate a Contract with the apparent responsive and best Proposer, the Customer may exercise the right to enter into Contract negotiations with the apparent responsive Proposer having the next- highest evaluation score.

1.27 Non-Appropriation of Funds

In the event no funds or insufficient funds are appropriated and budgeted by the Customer, or are otherwise unavailable for fulfilling the requirements of the Contract, the obligations of the Customer shall terminate on the last day of the fiscal period for which appropriations are received without penalty or expense to the Customer of any kind whatsoever. The Customer will immediately notify the Contractor or its assignee of such occurrence. In the event of such termination, the Customer agrees to peaceably surrender possession of the equipment to the Contractor or its assignee on the date of such termination. The Contractor will be responsible for packing all equipment and any freight charges. The Customer will not cancel if any funds are appropriated to it, or by it, for the acquisition, retention or operation of the equipment or other equipment performing similar functions for the current fiscal period in which the termination occurs or the next succeeding fiscal period thereafter and that it will not during the funding period give priority to other functionally similar equipment or services.

The Contractor shall covenant and agree to indemnify and hold the Customer harmless against any loss, damage liability, cost, penalty or expense, including attorney's fees, which it is not otherwise agreed to by the Customer in the equipment Contract and which is incurred and arises upon a failure of the Customer to appropriate funds in the manner described herein for a continuation of the Contract or exercise of the option to purchase the equipment.

1.28 Purchase Payment Schedule

The following payment schedule shall apply:

- 10% at Contract execution
- 30% at delivery of and inventory by the Customer designee of network infrastructure components to the Customer designated location(s)
- 20% upon infrastructure installation completion
- 15% upon satisfactory completion of audio quality and range coverage testing
- 15% upon issuance of subscriber equipment and satisfactory completion of all training
- 10% upon Final Network Acceptance

The Proposer agrees that all prices quoted in its Proposal Response are valid for one year from the Contract execution date. Future price discounts are valid for the time periods indicated in Section 14 Phased Implementation.

1.29 Contractor's Insurance

The Contractor shall be responsible for any and all loss of material connected with the construction due to unexplained disappearance, theft or misappropriation of any kind or nature. The foregoing provisions shall not operate to relieve the Contractor and any Subcontractors of responsibility for loss or damage to their own or rented property or property of their employees of whatever kind or nature, including but not limited to tools, equipment, forms, scaffolding and temporary structures including their contents. The Customer shall in no event be liable for any loss or damage to any of the aforementioned items or any other property of Contractor and any Subcontractors, which is not included in the permanent construction. The Contractor and any Subcontractors hereby waive any right of recovery they may have against the Customer for damage or destruction of property of whatever kind or nature whether it is their own property or property of their

The Contractor shall procure and maintain for the duration of the Contract the following insurance policies as mandated by and with minimum limits set by the Customer's Procurement Policy with coverage for occurrences and claims that may arise from or in connection with the performance of the obligations hereunder by the Contractor, its agents, employees, representatives and subcontractors:

1. The contractor shall maintain in full force and effect throughout the lease term liability and property damage (casualty) policies. The policy of liability insurance shall cover all of the contractor's operations on the leased premises, including bodily injury and property damage; shall provide a per-occurrence limit of at least and shall name the Customer as an additional insured. The property damage policy shall cover the replacement value of the structures and equipment the contractor installs on site.
2. The contractor shall also maintain workers' compensation insurance as required by law, and employers' liability coverage of at least \$1,000,000. The Customer will consider proposals offering reasonable exceptions to the requirements stated above. All policies shall be issued by an insurer of substantial size and financial stability.

The policies or certificates evidencing the coverage provided above shall be submitted at a Pre-Construction Conference prior to commencing any work or Customer issuance of a formal Notice to Proceed. Such policies or certificates shall provide that insurance will not be materially altered or cancelled without thirty (30) days prior written notice to the Customer.

1.29.1 Other Provisions

The insurance policies required by the Contract shall contain, or be endorsed to contain, the following provisions:

1. The Customer, its officers, agents, servants and employees, shall be added as "additional insureds" under the Comprehensive General Liability and Automobile Liability Coverages.
2. The Workers' Compensation and Employer's Liability coverages shall contain an express waiver of all rights of subrogation against the Customer, its officers, agents, servants, and employees, for losses arising from work performed by the Contractor for the Customer.
3. All insurance policies required by this Contract shall be endorsed to state that coverage shall not be suspended, voided, cancelled by either party, or reduced in coverage or in limits except after thirty (30) days prior written notice by certified mail to the Customer.

1.29.2 Acceptability of Insurers

All insurance required by this Section shall be placed with insurers that are authorized to do business in the State of Missouri and have a rating of no less than A- in the most current edition of the A.M. Best Insurance Report. Insurers shall have a minimum financial size category of V2I according to A.M. Best.

1.29.3 Certificates of Insurance

The Contractor shall furnish to the Customer Certificates of Insurance affecting coverage required by this Contract. The certificates are to be signed by a state licensed agent authorized by that insurer to bind coverage on its behalf and endorsements. The certificates and endorsements must be received and approved by the Customer prior to the Contract's effective date.

1.3 Indemnify

Indemnity shall be negotiated with the apparent responsive and best Proposer as part of Contract negotiations.

1.31 Additional Required Forms

Proposers must fill out and return the following forms:

- A. Immigration and Security Form
- B. Non-collusion Affidavit of Prime
- C. Payment Bond
- D. Performance Bond
- E. Subcontractor Affidavit
- F. Any documentation required by existing site owners

The remainder of this page is intentionally left blank.

2.0 Identified User Needs and Requirements

The Proposer shall provide a point-by-point and narrative response that must be met as described below. The Proposers shall clearly delineate in its point-by-point response its position with respect to the stated requirement, meaning the statement of any of the following:

- **Understood** – meaning that the item has been read and its direction or meaning is understood;
- **Comply** – meaning that the item has been read and that the Proposer agrees and accepts the requirement(s) as stated;
- **Comply with Clarification** – meaning that the Proposer fully accepts the requirement and is in addition providing an explanation of how it intends to adhere to the requirement(s);
- **Exception** – meaning that the Proposer understands Customer's item but cannot accept or undertake Customer's requirement(s).

Proposal responses that take exception to a stated RFP requirement risk being graded down in the proposal evaluation process. Proposers are encouraged to request clarification of RFP items that are unclear during the period provided within Customer's open procurement cycle.

2.1 General

- 2.1.1 The intent of this RFP is to provide a two (2) site three channel (3)conventional P25 simulcast system, which shall include multiple tower sites provided with equipment shelters, generators, and additional site hardware including HVAC to support the Vendor's proposed infrastructure. New buildings must accommodate all proposed radio/microwave equipment, battery plants, DC power supplies, and ancillary equipment as necessary.
- 2.1.2 The Vendor shall be responsible to conduct tower and foundation structural analysis and reinforcement as necessary to any of the existing towers in use by Customer. Vendors are required to propose a comprehensive set of equipment and services that satisfy this RFP's minimum requirements and are encouraged to describe specific areas within their proposal solutions that materially exceed these minimum objectives. Since the existing radio system exhibits a lack of reliable portable in-building coverage, completely new tower sites (in addition to the existing locations) must be proposed to satisfy the coverage requirements listed within this document.

2.1.3 Section 11 Site Work Requirements, provides for specific workmanship standards for communications facilities that must be met by the Contractor in the course of constructing the System. This RFP contains specifications that provide a baseline of technical requirements coupled with functional objectives that must be considered by responding Vendors. The RFP allows flexibility in the selection of sites and antenna placements by responding Vendors such that their response fully addresses the coverage reliability/audio quality requirements contained in RFP Section 6 Coverage Criteria.

2.2 Current Usage Requirements

A summarized detail of user needs, and expectations follows:

2.2.1 Improved Coverage

One area of concern communicated by the Customer is the coverage being provided to support critical operations. Mobile and portable radio coverage deficiencies are reported by the users to exist in multiple areas throughout the service area. This has become more prevalent since rebanding of VHF frequencies.

The Customer desires that coverage is improved to meet public safety best practices. A complete list of the coverage requirements can be found in Section 6 Coverage Criteria, of this RFP.

2.2.5 Typical Current Radio User Configuration

Most radio users are equipped with hand-carried portable radios operated on-hip with an accessory speaker-microphone installed. While a leather carry case is generally used, most users simply clip the radio to their belts. This configuration allows good positioning flexibility yet exposes the radio to more physical damage as compared to radios holstered into leather carry cases.

Most of the Customer's agencies currently lack a comprehensive preventative maintenance program for user equipment. This leads to degraded user equipment functionality accumulating over time. The result is complaints regarding radio coverage or performance, with focus placed on tower sites. The actual problem may be with the user's actual radio device.

Radio ergonomics are important to users, which is one reason why an electrically shortened antenna configuration for portable radio units has been defined in Section 6 Coverage Criteria.

2.3 New-System General Objectives

2.3.2 Call Privacy

The Customer's current radio system is intrinsically open to transmission monitoring with radio equipment operable on those frequencies (i.e., trunk-tracking scanning receivers, etc.). Accordingly, the replacement conventional P25 System shall include voice-layer encryption (described later). This provision must offer sufficient flexibility such that the desirable features of monitoring can be retained while permitting privacy to conversations that are potentially confidential.

2.3.3 Voice Encryption

2.3.3.1 Be capable/upgradeable to digital voice 256-bit AES encryption, using Advanced Multi-Band Excited +2 (AMBE+2 or newer) vocoder technology coupled, shall be included in the System.

2.3.3.2 Two modes of encrypted digital voice operation expected are:

2.3.3.2(a) Unit-to-unit, where conversations transacted in an encrypted talk group are secure. These cannot be monitored at a dispatch or control point;

2.3.3.2(b) Dispatcher-to-unit, where conversations between Customer's dispatch center(s) and field units;

2.3.3.3 The P25 System shall provide encrypted transmission functionality so that user radio access delays are equal to those in the clear mode, in accordance with published TIA P25 standard specifications. Encrypted transmissions shall not degrade the operation of clear-voice features nor lengthen system access or audio transport delays to other users. Encryption shall not degrade the range or coverage to any level less than that for normal P25 clear-mode digital performance.

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2.3.4 End User Equipment

In general, public safety/local government communications needs have shifted from car based, with equipment fixed within vehicles, to user-based where portable radio equipment is assigned to individual users.

This migration to portable units, with that equipment's reduced output power level and often-degraded antenna performance, has placed greater technical demands on radio communications network infrastructures.

The coverage needs for mobile-based systems are relatively straightforward as the available effective radiated power from a mobile unit can closely approach that of a base station. Talk-in/talk-out balance can thus be easily achieved with simple backbone system configuration.

The Customer's current tower site configuration currently does benefit portable radio operations in needed locations. With the age of the fixed site infrastructure, and radio equipment, along with VHF rebanding, portable radio coverage problems are compounded.

The subscriber equipment must be:

- 2.3.4.1** Small, light-weight and easy to operate.
- 2.3.4.2** The antenna should be physically short and in keeping with the size of the radio package.
- 2.3.4.3** Radio unit battery packs are expected to operate to provide sufficient power for a full twelve-hour work period.
- 2.3.4.4** A range of accessories is expected to be available to support in-field battery charging.
- 2.3.4.5** The battery packs should provide a reasonably long-life (i.e., two years) within the typical operational profile of 5% transmit, 5% receive and 90% standby/on.
- 2.3.4.6** While most radio users operate in the clear, unencrypted mode, a need for standards-based voice encryption is necessary.

- 2.3.4.7** The Vendor shall provide documentation, and demonstrate P25 operational compliancy with, minimally, BK Technologies (RELM), EF Johnson/Kenwood, L3Harris, Motorola Solutions, & Tait portable, mobile, and control station radios. These radios must have been tested and certified to function on its proposed P25 infrastructure technology.
- 2.3.4.8** The customer will need as an option to communicate with the MOSWIN (Missouri Statewide Interoperability Network) system.
 - 2.3.4.8 (a)** All proposed subscriber equipment must capable of but not required for operation on that system.
 - 2.3.4.8 (b)** All equipment must be approved by MOSWIN for operation on MOSWIN system. More information can be obtained on the Missouri Department of Public Safety website,
<https://dps.mo.gov/dir/programs/intercomm>
- 2.3.4.9** The subscriber equipment must be dual band capable in the 700/800 Mhz and VHF bands.
- 2.3.4.10** The Vendor shall also describe those processes and methods it employs to confirm where infrastructure software releases and hardware changes to its P25 network/site controllers, base station, and gateway products are verified for continued compatibility with P25 equipment manufactured and offered for purchase by others.
- 2.3.4.11** The portable radio package, itself, is expected to be compact, light-weight, simple to operate and have a minimum of operator controls or feature selections.
- 2.3.4.12** Radios contain a microphone, speaker, talk group selector, volume control, power switch, emergency button, and normal transmit push-to-talk button. These input/output devices are subject to near-constant physical abuse within a public safety environment and affect overall equipment reliability.
- 2.3.4.13** The user is expected to be able to disable backlighting and tones, when necessary. Commonly known as stealth mode.
- 2.3.4.14** The volume control is expected to be fully adjustable from zero to maximum audio output level.

- 2.3.4.15** Unit is expected to be extremely rugged to withstand shock and vibration typical of public safety operations. For some agencies, other features are needed such as Intrinsically Safe operation and the ability for the equipment to survive short term water submersion.
- 2.3.4.16** Radio units are expected to be equipped with alphanumeric displays to readily identify selected talk groups and operating modes, i.e. clear voice, encrypted voice, etc.
- 2.3.4.17** Radios are expected to be capable of operation with traditional speaker/microphones as well as sub-miniature radio surveillance accessories.
- 2.3.4.18** In addition to the specific desired features indicated above, all furnished equipment is expected to meet minimum equipment requirements identified in Section 4 Minimum Operative Characteristics.
- 2.3.4.19** Radios and equipment that is proposed for fire agency use, must be fire grade equipment that is offered by the vendor. Any additional training for the specialize fire equipment must be provided by the vendor.

2.3.5 User Equipment Training

- 2.3.5.1** A comprehensive training program must be established by the Vendor in its Technical Submittal, to be implemented if selected as the Contractor. This program would include not only user familiarization with physical features and functions of assigned radio equipment, but also instruction pertinent to the System's structure and how the System's infrastructure establishes local, wide-area and outside interoperable call transactions.
- 2.3.5.2** The Contractor's training program must include the necessary graphics, visual simulations, and printed media tools to establish an appropriate training process for users. Training videos must be available to users on a private web-based portal, thereby allowing for individual refresher training.

- 2.3.5.3** The Contractor must also supply technical assistance during the initial warranty period that allows for ongoing modifications to these training resources, to keep the customer in-step with additions and changes to the operable and interoperable resources within the System.
- 2.3.5.4** The Vendor shall provide a detailed description of its proposed user/infrastructure training program. Examples of training tools developed for similar conventional P25 regional radio configurations and the MOSWIN system shall be provided within the Vendor's Technical Proposal Submittal.
- 2.3.5.5** The Customer must approve all training curriculum prior to training.
- 2.3.5.6** The Vendor must provide resumes of professional training staff that will train the user on how the radio operates on the proposed system.

2.3.6 Gateway Interfaces

- 2.3.6.1** The utilization of gateway technology is necessary for the System and provides a useful and important function in the integration of outside trunked and non-trunked radio systems such as those surrounding agencies, and the Missouri statewide system (MOSWIN) and neighboring Counties.
- 2.3.6.2** The proposed System must be capable of a base station gateway technology that shall provide an interface both analog and digital land mobile radio base stations, on a channel basis, within the P25 solution. By so doing, it would then be possible for radio users equipped with P25 radios operable on the System to select, monitor and individually control these various link-radio resources.
- 2.3.6.5** The customer requires the implementation of each of these gateway technologies as part of the Vendor's proposed configuration as further described by RFP Section 5 Minimum Equipment Requirements.

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3.0 Infrastructure System Configuration

3.1 General

The Customer has valid licenses for its current radio network, as outlined in Appendix E FCC License. The Contractor will be required to undertake necessary FCC license modifications, as required, to accommodate the modernized/expanded System. Any frequency modifications and site additions will be coordinated with the Region 24, Missouri State Regional Planning Committee.

3.2 System Configuration

- 3.2.1** The Vendor is required to provide a comprehensive functional and technical solution for a conventional P25-compliant System. The new digital radio configuration shall utilize the necessary number of infrastructure sites, as determined by the Vendor, to meet Customer's expressed coverage requirements as described by Section 6.0. Coverage Criteria.
- 3.2.2** The System must be designed and deployed to utilize conventional P25 modulation format.
- 3.2.3** The Vendor shall indicate a guaranteed level of portable and mobile area coverage and delivered audio quality indicative of their designed solution. Customer recognizes that portable radio coverage to the same degree as required for mobile operations increases system complexity. These requirements are outlined in Section 6.0. Coverage Criteria.
- 3.2.4** Physical plant modifications to newly-proposed tower sites, rental sites or existing Customer-owned sites as necessary to accommodate the Vendor's proposed System configuration shall be the responsibility of the Contractor and must be factored into the Vendor's Response Submittal Cost Proposal. The Vendor's failure to disclose physical plant modifications (and cost) is contrary to Customer's turnkey project requirement and shall result in an unfavorable grade of the Vendor's Submittal.
- 3.2.5** The Vendor shall provide all pertinent information concerning their equipment, relative to electrical, mechanical, structural and physical space requirements. The Vendor must consider enhanced physical security, cyber security and environmental issues in preparing their Response.

- 3.2.6** It shall be the responsibility of the Contractor to provide a turnkey System and to install Industry-accepted standard electrical grounding systems and lightning protection devices to protect proposed equipment from damage due to electrical transients on antenna systems, power, telephone and/ or control cables.
- 3.2.7** Sites determined by the Vendor to be potentially prone to flooding must be so noted in the Technical Response Submittal. Engineering remedies must be based on 100-Year Flood Plain data. Remedies are to include elevated equipment shelters as needed to ensure such new equipment is no less than 24-inches above FEMA-predicted 100-year flood plain levels.
- 3.2.8** The delivery and installation of: equipment shelters, security systems, standby and emergency power systems, towers, antenna systems, electrical grounding systems, lightning protectors, transmission lines, cable attachment hardware, transmission line shields, tower-to-building cable tray hardware and all necessary permitting is part of this project and must be furnished by the Contractor.
- 3.2.9** All transmit/receive site-related equipment is to be backhaul-connected via digital microwave and/or fiber linkages. All equipment is to be provided by the contractor. This microwave and/or fiber backhaul layer shall be configured as a monitored hot-standby loop-protected ring(s) that encompass radio tower sites, simulcast control points, and dispatch centers. The new microwave backhaul layer shall operate principally at 6GHz. 11GHz microwave link segments are permissible only for path segments that are less than 4-miles in length.

There is fiber available between the current Customer site locations that is owned and operated by Northwest Electric Cooperative.

- 3.2.10** The Contractor shall furnish and install all radios, antennas, wiring, wiring hardware, interface electronics and materials necessary, and at no additional cost than that identified in their Contract, to complete the successful implementation and operation of this System and its related equipment groupings.

3.3 System Planning and Capacity

Please refer to Appendix B Existing Channel Structure and Appendix E Existing FCC License for more details.

3.3.1 The Contractor shall utilize best engineering practice in modifying the System's frequency plan to maximize the effectiveness of channel resources. This frequency plan must ensure that frequencies installed at sites cause no adverse receiver desensitization because of intermodulation products and, further, that the Contractor's frequency plan complies with FCC regulations with respect to co-channel and adjacent-channel interference protection criteria.

3.3.2 The Vendor's Technical Response must fully describe its frequency engineering process and must include an initial frequency plan for its proposed configuration (if differences between the Vendor's plan and the existing-system's frequency plan are anticipated). The Vendor must describe its best-practice approach to the monitoring of noise floor levels/degradation at radio tower sites and the steps it would undertake to identify and resolve interference issues, both internal to the radio system's infrastructure, as well as external.

3.4 Major System Equipment Groupings

The Vendor shall provide and describe, minimally, the following major equipment groupings:

3.4.1 Simulcast Controller

3.4.2 Console Electronics/ Audio Controller

3.4.3 Tower/Shelter Sites

3.4.4 Microwave / Fiber Backhaul Network

3.4.5 Redundant local area network (LAN) routers/switches

3.4.6 Battery Plant & Charger Systems

3.4.7 Auxiliary power generators

3.4.8 Interoperability Link Base Stations

3.4.9 Base Station Gateways

- 3.4.10** The Contractor shall furnish and install all wiring hardware, cable trays, interface electronics, terminal blocks, and materials necessary to complete the successful implementation and operation of this site and its equipment groupings. Infrastructure equipment proposed for the Control Point must meet the minimum requirements specified by Section 5. Minimum Equipment Requirements.
- 3.4.11** The Vendor is required to incorporate a network simulcast control point design into its proposed infrastructure solution.
- 3.4.12** The Vendor shall describe its network controller and simulcast control point redundancy configuration scheme and, if virtualized controller/control point configurations are proposed, the number of such configurations allowable within the proposed solution.
- 3.4.13** The Vendor shall describe the method used to automatically transition to such backup configurations and the transitional latency such transitions apply to the radio network, in seconds or milliseconds.

3.5 Typical Infrastructure Site Deployment

The Vendor is required to supply a turnkey solution to include: all technical support, equipment, material and labor necessary to develop each proposed infrastructure radio site into a functional conventional P25 digital radio facility, fully incorporated.

- 3.5.1** A typical P25 radio infrastructure site equipment shelter shall contain, minimally, the following major equipment groupings:
 - 3.5.1.1** 700/800MHz Conventional P25 Base Stations
 - 3.5.1.2** GPS-Disciplined Frequency Standard (Redundant)
 - 3.5.1.3** Transmitter Combiner System
 - 3.5.1.4** Transmitter Antenna Systems
 - 3.5.1.5** Receiver Multi-Coupler System
 - 3.5.1.6** Receiver Antenna System
 - 3.5.1.7** Remote Site MPLS Microwave/Fiber Linkage

- 3.5.1.8** Local Area Network Equipment
- 3.5.1.9** Conventional Base Station Gateway
- 3.5.1.10** Site Alarm Equipment
- 3.5.1.11** Battery Plant & Charger Systems
- 3.5.1.12** Standby Generator Transfer Switch

Infrastructure equipment proposed for all radio sites must meet or exceed the minimum requirements specified by Sections 4.0. Minimum Operative Characteristics, and 5.0. Minimum Equipment Requirements.

3.5.2 Tower Site Equipment Configuration

- 3.5.2.1** The Conventional P25 simulcast configuration and any other conventional radio base stations shall operate from a 48 VDC battery-based power source, sized for no less than 4-hours of uninterrupted operation.
- 3.5.2.2** The battery system shall utilize sealed, long-life lead-calcium, or similar modern cells and 100% redundant battery charger components rated for telecommunication service.
- 3.5.2.3** An automatic, low voltage disconnect device shall be provided to protect the battery plant from discharge-related damage.
- 3.5.2.4** Electrical power switching/disconnect capability shall exist at all sites such that rectifiers, batteries as well as commercial power sources may be separately isolated in a way each component may be serviced safely.
- 3.5.2.5** This switching/disconnect capability shall be designed and configured such that radio network operation is otherwise unimpaired and uninterrupted during any repair or maintenance cycle.
- 3.5.2.6** Base stations shall be housed in open equipment racks. Racks shall be free standing and incorporate drilled rails to accept standard 19" rack panels.

- 3.5.2.7** Each equipment rack shall incorporate a circuit-breaker power distribution panel incorporating protection for power amplifier, exciter and receiver groupings.
- 3.5.2.8** Individual base station ventilation fan(s), if required, shall be DC powered, thermostatically controlled, internally installed, and shielded.
- 3.5.2.9** Each equipment rack shall be protected by a DC-power circuit breaker, sized for nominal load plus 35% overload factor.
- 3.5.2.10** The primary battery chargers, low-voltage disconnect equipment and a primary DC circuit breaker panel shall be installed in a freestanding enclosed cabinet unit.
- 3.5.2.11** Likewise, the network's primary/backup simulcast controllers and related LAN switch/router devices shall be housed in freestanding equipment racks like those used for repeater stations.
- 3.5.2.12** Auxiliary tower site electrical loads essential to proper system operation, i.e. tower top preamp, redundant GPS reference oscillators and receiver multi-coupler shall be interconnected directly to the site's battery system.

3.5.3 Failover Scenario Equipment Descriptions

The Vendor shall furnish a description of the effect each of the below listed failure modes would have on their proposed conventional P25 System configuration. The Vendor shall also describe appropriate mitigation/restoration steps to return the System to full operational capability in response to each of the below listed failure conditions, and the time required to achieve restoration.

- 3.5.3.1** Loss of transmitter(s) operation
- 3.5.3.2** Loss of receiver(s) operation
- 3.5.3.3** Failure of dispatch console terminal(s)
- 3.5.3.4** Failure of console/audio interface
- 3.5.3.5** Commercial power failure

- 3.5.3.6** Site generator failure
- 3.5.3.7** Failure of entire tower site
- 3.5.3.8** Loss of Control Point
- 3.5.3.9** Loss of single/multiple microwave path/fiber connectivity

3.5.4 Tower Site Antenna Systems

The Contractor shall:

- 3.5.4.1** Furnish and install antenna systems designed to meet the coverage requirements and objectives described by Section 6 Coverage Criteria.
- 3.5.4.2** Equip all antenna transmission lines with gas tube lightning arrestor devices (Polyphaser or equivalent).
- 3.5.4.3** Ensure all coaxial cable elements used as interconnecting jumpers for outdoor-mounted equipment or indoor transmitter/receiver components are 1/2" Andrew FSJ4-50B or equal.
- 3.5.4.4** Furnish and install hot dip galvanized side mount hardware sufficient to extend the transmitter and receiver antennas a minimum of 60-inches from the nearest tower-structure element.
- 3.5.4.5** Ensure transmission lines are grounded at the antenna, at 200-foot tower intervals, at the top most part of the tower location, at the midpoint (for all towers greater than 200-feet in height), at the location where the transmission lines enter the cable bridge and at the equipment shelter's transmission line copper entry port.
- 3.5.4.6** Utilize only manufacturer-approved grounding strap kits for the type of transmission line installed.
- 3.5.4.7** Ensure all connecting hardware will be a snap-in type of a size designed for the cable. No tie wraps or electrical tape will be allowed for attaching cables to towers.
- 3.5.4.8** Utilize antenna system mounting brackets, components and associated transmission line attachment hardware that are either stainless steel or hot-dipped galvanized steel.

3.5.5 Network/Audio Control Scheme

The Vendor shall provide detailed descriptions of how the system incorporates high levels of redundancy to assure continued system operation. To provide the highest level of trunked reliability, site/system control schemes shall be IP-based, fully redundant and utilize distributed processor technology to the maximum extent possible.

Primary/Redundant Network schemes must include protected, redundant power supply units so that the loss of a single power supply will not interrupt control scheme operations.

3.5.6 Radio Network Alarm System

The Contractor shall furnish and install an automatic alarm system to monitor and alert, as a minimum, operational status (per site) for the following parameters:

3.5.6.1 Major Alarm Conditions (Defined as a condition that could lead to equipment failure in less than 2 hours).

- 3.5.6.1(a)** Primary Network Controller Failure
- 3.5.6.1(b)** Redundant Network Controller Failure
- 3.5.6.1(c)** Site Channel Failure
- 3.5.6.1(e)** Console/Audio Controller Failure
- 3.5.6.1(f)** Base Station Gateway Failure
- 3.5.6.1(g)** Receive Multicoupler Failure
- 3.5.6.1(h)** AC Power Failure
- 3.5.6.1(i)** High Reflected Power -TX Antenna
- 3.5.6.1(j)** Battery Charger Failure, Major
- 3.5.6.1(k)** Generator Failure/Shutdown
- 3.5.6.1(l)** Tower Light Failure

3.5.6.1(m) Over/Under Temperature Alarm (HVAC failure)

3.5.6.1(n) Low Transmitter Output (each transmitter)

3.5.7.2 Minor Alarm Conditions (Defined as a condition that has little, to no risk of leading to equipment failure prior to arrival of technical staff).

3.5.7.2(a) Door Alarm

3.5.7.2(b) Tripped DC Breakers(s)

3.5.7.2(c) Battery Charger Failure, Minor

3.5.7.2(d) Low Fuel

3.5.7.3 System Alarm Monitoring

The use of a software-based alarm network scheme is desired since this would allow for off-site maintenance personnel to interrogate the System in response to agency/user-reported operational deficiencies.

In addition, the Contractor shall provide:

3.5.7.3(a) A summed major/minor alarm indication should be displayed on each alarm system terminal position.

3.5.7.3(b) These alarm positions will be located at both network controller locations and the Customer dispatch location.

3.5.7.3(c) This alarm indication should appear as a flag at a conspicuous area on the flat-screen display field.

3.5.7.3(d) Determination of specific alarm point conditions shall be obtainable from any dedicated alarm system terminal position.

3.5.7.3(e) These alarms must be capable of email or other common messaging alert to Customer-designated personnel.

- 3.5.7.3(f)

This solution shall allow for view of individual component functionality and status involving, at a minimum, base stations, controllers, gateways, charging systems, GPS timing equipment and other devices essential to the operation of the System.

3.6 Regional Interoperability

Grundy County Sheriff will be migrating to or interoperating with MOSWIN. Surrounding agencies/counties are operating on VHF systems. The Customer has a frequent need to communicate with these partners. Counties and frequency bands adjacent to the Customer are:

Mercer County (north)	MOSWIN/VHF
Sullivan County (east)	VHF
Linn County (southeast)	MOSWIN/VHF
Livingston County (south)	MOSWIN/VHF/UHF
Daviess County (southwest)	VHF
Harrison County (northwest)	VHF/UHF

Seamless interoperability between these radio networks, of various types and manufactures, is a desired goal. In preparation of such regional interoperability, the Customer requires the following:

3.6.1 Base Station Gateway

To include effective interoperability linkages to outside radio systems operated by federal, state and other non-public safety agencies, The Vendor shall provide:

- 3.6.1.1

Base Station Gateway devices shall be located at the radio tower sites and allow the interconnection of legacy analog, and other digital radio systems onto the new radio network. The location of the gateways should be part of the vendor’s design and located to best serve the interoperability requirements of Customer.
- 3.6.1.2

The Base Station Gateway shall additionally facilitate appropriate Radio-to-IP interfaces and Four-Wire ‘Ear and Mouth’ (4W E/M) interfaces that are compatible with new radio system’s infrastructure and dispatch center configuration).

3.6.1.3 The furnished Gateway shall provide the below-listed functionality:

- 3.6.1.3(a)** Base Station Gateway shall allow System users to initiate and drop appropriate control link/base stations via talk-group selection on appropriately-programmed System user radios.
- 3.6.1.3(b)** Users shall be able to monitor traffic on the outside radio systems, via the Base Station Gateway device.
- 3.6.1.3(c)** Customer radio dispatchers shall have the ability to patch the System's Base Station Gateway channel traffic onto other P25 networks, on an ad-hoc basis.

3.7 System Voice Encryption

- 3.7.1** Each of the network's conventional P25 digital RF channels shall be equipped to support voice encryption using the Advanced Multiband Excited +2 (AMBE+2) or newer vocoder.
- 3.7.2** Encrypted mobile and portable units shall be of the same physical size and general configuration as non-encrypted units.
- 3.7.3** Accessory equipment shall be compatible with both types of units.
- 3.7.4** Proposed conventional P25 radio coverage throughout the area defined in Section 6 Coverage Criteria, in the digital encrypted mode, shall be equal to that in the digital clear mode.

3.8 Cyber Security

The system includes potential "back door" entry points via external radio communications facilities operated by others as well as accessibility of the radio system to field technical and engineering resources via the Internet. Each of these points must be appropriately secured using firewalls, data encryption, and other means to prevent intentional hacking of critical information or the installation of viruses and malware that could inhibit or disrupt mission-critical communications.

The Vendor shall provide within its Technical Response Submittal, a detailed description of the various cyber security measures it would employ to protect the proposed new System, both initially and throughout the prescribed warranty period.

4.0 Minimum Operative Characteristics

4.1 General

In this Section, channel usage characteristics for agencies now operable on Customer's legacy radio system are presented. From this information, the Vendor can better determine the channel capacity (and subsequently the channel plan) needed to satisfy talk group structure requirements for this project.

4.2 Minimum System Performance

The Vendor should assume that the current channel usage will be replaced with a three (3) channel conventional P25 digital radio overlay. Appendix B contains a detail of the current conventional structure now being utilized.

The Vendor shall describe in its response submittal:

- 4.2.1** The processs of typical audio processing delays, due to vocoding and digital signal processing, within the Vendor's specific radio technology solution. These delays shall be described for Emergency Calls, Group Calls, Patched Calls, and Base Station Gateway Calls.

4.3 Intermodulation Study Requirement

- 4.3.1** The Vendor shall ensure that the constructed System will be, within the accepted limits of Industry-accepted engineering practice, free of interference or degradation due to intermodulation (IM) noise/sideband products.
- 4.3.2** An IM study shall be required to be provided by the Contractor prior to the project's Customer Design Review (CDR) meeting, and subsequent meetings, as the new radio network is deployed. This study shall investigate the impact of both conventional P25 system channels as well as those channels utilized by the conventional mutual aid and interoperability subsystem.
- 4.3.3** The Vendor, as part of its Technical Response, shall fully describe the methodology it intends to use in developing and completing these necessary noise and IM studies. The Vendor is required to submit a representative sample of its noise and IM reporting documentation of sufficient scope and detail to support the methodology, as provided in its Technical Response Submittal.

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5.0 Minimum Equipment Requirements

5.1 General

This Section describes minimally-acceptable requirements for mobile, portable, control station, and fixed-site radio equipment. All radio equipment installed or provided by the Contractor shall be FCC type accepted under Part 90 of the FCC Rules and Regulations. All supplied equipment shall be in current production and shall meet or exceed the requirements of this Section. User equipment devices (i.e. portable, mobile and control station radios) shall conform to TIA-603-D – *Land Mobile FM or PM Communications Equipment Measurement and Performance Standards* and TIA-102.CAAB-D (or current) – *Land Mobile Radio Transceiver Performance Recommendations Project 25* .

Base station/repeaters shall support P25 Phase 1 and Phase 2 modulation formats and shall support narrowband (9.6kb/s) P25 trunked data technology.

The stated minimum requirements, below, for end-user equipment will not necessarily be required on all individual units assigned to non-public safety user agencies. Subscriber Radio Requirements contain those user radio configurations needed for user agency. This listing of users will require radio equipment having varying levels or complexity (termed tiers) in this RFP. The Pricing section contains further information on those equipment configuration breakdowns.

5.2 Mobile Radio Equipment

All mobile P25 radios proposed shall

- 5.2.1** Meet APCO minimum recommendations and EIA/TIA standards for P25 Public Safety 700/800MHz digital trunked radio systems. Furnished equipment must be operable on both Phase 1 and Phase 2 infrastructures.
- 5.2.2** Incorporate heavy-duty construction, weather-sealed enclosures and weather-sealed controls to meet Military Standard 810 C, D, E, F and G for water, shock, vibration, dust, humidity and high/ low temperature performance.
- 5.2.3** Allow operation on P25 trunked and conventional systems with priority scan of talkgroups.

- 5.2.4** Front mount and rear mount, dual control-head with single rear mount radio and dual radios with single control-head configurations must be available to meet the needs of the different public safety users. Rear mount radios may require weatherproof control heads, speakers, microphones and other accessories (specific for fire operations).
- 5.2.5** Include emergency button on mobile radio control panels to initiate an emergency call.
- 5.2.6** Be capable of providing 9.6kb/s data-messaging transmission capabilities.
- 5.2.7** Offer digital voice encryption, using an Advanced Multi-Band Excited +2 (AMBE+2) or newer P25 Phase 1 and Phase 2 vocoder technology, DES-OFB and federally approved 256-bit AES coding to provide security during transmission and reception of sensitive communications.
- 5.2.8** Ensure radio operating information is contained in an electrically erasable memory device. Unit will be fully programmable from a laptop/desktop computer.
- 5.2.9** Include a transmit time out timer to warn the user of excessive transmission length. Time out timer should automatically disable the radio's transmitter after a pre-determined period.
- 5.2.10** Ensure mobile radios in the 800MHz band must be operable on 800MHz NPSPAC frequencies as well as 700/800MHz conventional and trunked frequencies.
- 5.2.11** Where multiband radios are needed, the must be operable also in the VHF band must operate from 136 – 174 MHz.
- 5.2.12** Electrical Specifications are as follows:
 - 5.2.12.1** Primary Input Voltage: 11 to 16 VDC, negative ground
 - 5.2.12.2** Battery Drain:
 - 5.2.12.2(a)** Standby: 1.5 amperes, max.
 - 5.2.12.2(b)** Receive: 4.0 amperes, max.
 - 5.2.12.2(c)** Transmit: 15.0 amperes, max.

- 5.2.12.3** Environmental: MIL-STD 810 C, D, E, F, and G for shock, vibration, humidity, and high/low temperature.
- 5.2.12.4** Temperature Range: -30 °C to +60 °C
- 5.2.12.5** Humidity: 95% relative humidity at 50 °C
- 5.2.12.6** Talk Group Selection: Rotary-knob style

5.2.13 Transmitter specifications are as follows:

- 5.2.13.1** Frequency Range: 764 to 870MHz
- 5.2.13.2** Channel Capacity: 500 channels (Single band radio), 700 channels (Multi-band radio)
- 5.2.13.3** Talk Group Capacity: 16 minimum, per system
- 5.2.13.4** RF Output Impedance: 50 ohms
- 5.2.13.5** Output Power: 30 W (700MHz)/35W (800MHz) (Single band radio); 50 W (VHF) (Single Band Radio); 35 W (Multi-band radio)
- 5.2.13.6** Channel Spacing: 12.5/6.25 KHz/NPSPAC
- 5.2.13.7** Spurious/Harmonic: At least 64 dB below carrier
- 5.2.13.8** Frequency Stability: 1.5 PPM from -30°C to 60°C
- 5.2.13.9** Frequency Speed: 24MHz (700MHz)/18MHz (800MHz)
- 5.2.13.10** Emission: 16K0F3E; 11K0F3E; 8K10F1D; 8K10F1E; 9K80F1D, 9K80D7W or comparable Phase 2 Emission.
- 5.2.13.11** Modulation Deviation: +/- 2.5KHz for 12.5KHz Channel; +/- 3KHz for NPSPAC
- 5.2.13.12** Audio Distortion: Less than 5% at 1KHz

5.2.13.13 Audio Response: +/-3dB of a 6dB/octave pre-emphasis characteristic from 300Hz to 3KHz

5.2.13.14 Hum and Noise: -45dB

5.2.13.15 Duty Cycle: Transmitter 20%

5.2.14 **Receiver** specifications are as follows:

5.2.14.1 Frequency Range: 764 to 870MHz

5.2.14.2 Channel Capacity: 500 channels (Single band radio), 700 channels (Multi-band radio)

5.2.14.3 Channel Spacing: 12.5KHz/6.25KHz; NPSPAC

5.2.14.4 Digital Sensitivity: 0.25 μ V 5% Bit error Rate (BER):

5.2.14.5 Adjacent Channel: Rejection: -60dB

5.2.14.6 Frequency Stability: 1.5 PPM from -30° to 60°C

5.2.14.7 Frequency Spread: 24MHz (700MHz); 18MHz (800MHz)

5.2.14.8 Intermodulation: -75dB (Single band radio)

5.2.14.9 Rejection: -80dB (Multi band radio)

5.2.14.10 Spurious Response -75dB (Single band radio) -80dB (Multi band radio)

5.2.14.11 Audio Output: 10 W (Single band radio), 12 W (Multi-band radio)

5.2.14.12 Audio Distortion: No more than 2% at 1KHz

5.2.14.13 Duty Cycle: Receiver 100%

5.3 Portable Radio Equipment

All portable P25 radios proposed shall:

- 5.3.1** Meet APCO minimum recommendations and EIA/ TIA standards for P25 Public Safety 700/800MHz digital conventional and trunked radio systems. Furnished equipment must be operable on both Phase 1 and Phase 2 infrastructures.
- 5.3.2** Include heavy duty construction and weather-sealed cases to meet Military Standards 810 D, E, F and G for shock, vibration, dust, humidity, high/low temperature and blowing rain.
- 5.3.3** Allow operations on P25 trunked systems with priority scan of talk groups.
- 5.3.4** Include top mounted rotary controls with positive stops for volume and channel selection. Control placement must allow gloved hand operation, as is typically needed by the fire service.
- 5.3.5** Incorporate electronic, alphanumeric (minimum eight character) backlit display to provide visual indication of system availability, channel/talk group selected, incoming user ID, call alerts and operational status such as scan, transmit or low battery.
- 5.3.6** Include transmit time out timer to warn the user that the radio may be transmitting longer than a predetermined time limit and then disable the transmitter.
- 5.3.7** Contain no protruding push-to-talk switch, thereby preventing accidental transmitter operation or potential damage to the switch caused by impact.
- 5.3.8** Include a protected emergency button to allow easy access when needed but incorporating an ergonomic design in which the emergency function could not be accidentally activated.
- 5.3.9** An accessory receptacle shall be provided for the connection of external devices such as remote microphones or combination remote speaker/microphone units (with or without antenna), vehicular adapters, and mobile data computer equipment.
- 5.3.10** Radio operating information shall be contained in an electrically erasable memory device. Unit will be fully programmable from a laptop/desktop computer, via the accessory receptacle.

- 5.3.11** Portable radios, batteries and accessories must be configurable as intrinsically safe for use in hazardous environments.
- 5.3.12** Carrying case options should include leather carrying case with swivel mounts, as well as chemical resistant cases (nylon or similar plastic material) for use by hazardous material groups.
- 5.3.13** Optional surveillance accessories such as miniature microphones, earpieces and remote microphones and headset speaker microphones must be available for the proposed radios.
- 5.3.14** Offer digital voice encryption, using an Advanced Multi-Band Excited +2 (AMBE+2) or newer P25 Phase 1 and Phase 2 vocoder, DES-OFB, and federally approved 256-bit AES coding to provide enhanced security during transmission and reception of sensitive communications.
- 5.3.15** Provide single-unit 120VAC rapid charger capable of fully charging a discharged high capacity battery pack within a one-hour period. Provide optional single-unit 12VDC rapid charger for vehicular operation. Provide optional 120VAC multi-bank chargers with a minimum of 6 slots. Provide optional 12VDC multi-bank chargers with a minimum of 6 slots.
- 5.3.16** Battery shall operate the proposed radio equipment a minimum of twelve-hours using a duty cycle of 5% transmit, 5% receive and 90% standby.
- 5.3.17** Portable radios in the 800 MHz band must be operable on 800MHz NPSPAC frequencies as well as 700/800 MHz conventional and trunked frequencies. Dual band units shall operate on VHF (136-174MHz) or UHF (450-470MHz) as well as 700/800MHz.
- 5.3.18** User programmable audio alert in the event of loss of control channel (must be a standard feature in present and all future proposed public safety models).

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5.3.19 Electrical Specifications as follows:

- | | | |
|-----------------|-----------------------|---|
| 5.3.19.1 | Primary Power: | Battery pack (further defined in RFP) |
| 5.3.19.2 | Environmental: | MIL-STD 810 C, D, E, F and G for shock, vibration, humidity and high/low temperature. |
| 5.3.19.3 | Temperature Range: | -30°C to +60°C |
| 5.3.19.4 | Humidity: | 95% relative humidity at 50°C |
| 5.3.19.5 | Talk Group Selection: | Rotary-knob style |

5.3.20 Transmitter specifications are as follows:

- | | | |
|------------------|-----------------------|--|
| 5.3.20.1 | Frequency Range: | 764 to 870 MHz |
| 5.3.20.2 | Channel Capacity: | 500 channels (Single-band radio), 700 channels (Multi-band radio) |
| 5.3.20.3 | RF Output Impedance: | 50 ohms |
| 5.3.20.4 | Output Power: | 3 W 700/800MHz |
| 5.3.20.5 | Frequency | 1.5 PPM from -28°C to +58°C |
| 5.3.20.6 | Modulation Deviation: | +/-2.5KHz for 12.5KHz channel; +/-3 KHz for NPSPAC; |
| 5.3.20.7 | Emissions: | 16K0F3E; 11K0F3E; 8K10F1D; 8K10F1E; 9K80F1D, 9K80D7W or comparable Phase 2 Emission. |
| 5.3.20.8 | Audio Response: | +/-3 dB of a 6 dB/octave |
| 5.3.20.9 | Audio Distortion: | Less than 2% at 1 KHz |
| 5.3.20.10 | Spurious/Harmonic: | -50 dB |
| 5.3.20.11 | Hum and Noise: | -35 dB |

5.3.20.12 Duty Cycle: Intermittent

5.3.21 Receiver specifications are as:

5.3.21.1 Frequency Range: 764 870MHz

5.3.21.2 Channel Capacity: 500 channels (Single band radio), 700 channels (Multi-band radio)

5.3.21.3 Channel Spacing: 12.5/6.25 KHz/NPSPAC

5.3.21.4 Adjacent Channel: -60dB (Single band radio), -65dB (Multi band radio) Rejection

5.3.21.5 Digital Sensitivity: 5% BER: 0.25 μ V

5.3.21.6 Intermodulation Rejection: -72 dB (Single band radio) -74 dB (Multi-band radio)

5.3.21.7 Spurious Response Rejection: -72 dB (Single band radio) -70 dB (Multi-band radio)

5.3.21.8 Frequency Stability: 1.5 PPM from -30° to +60°C

5.3.21.9 Audio Output: 1.5 W

5.3.21.10 Audio Distortion: No more than 2% at 1 KHz

5.4 Control Station Equipment

All control station P25 radios proposed shall:

5.4.1 Be available either as an integrated 120VAC powered desktop radio rack or a remotely located, AC powered radio package with separate remote-control unit.

5.4.2 Control station and control unit shall have an optional provision to operate from standby 12VDC source upon failure of AC power.

5.4.3 Options shall be provided for local and remote-control operation of the control station.

- 5.4.4** Must meet APCO minimum recommendations and EIA/TIA standards for P25 Public Safety 700/800MHz digital trunked radio systems. Furnished equipment must be operable on both Phase 1 and Phase 2 infrastructures.
- 5.4.5** Allow operations on P25 trunked and conventional (analog/P25) systems with priority scan of talk groups or channels.
- 5.4.6** Offer digital voice encryption, using an Advanced Multi-Band Excited +2 (AMBE+2) or Newer P25 Phase 1 and Phase 2 vocoder, DES-OFB and federally approved 256-bit AES coding to provide enhanced security during transmission and reception of sensitive communications.
- 5.4.7** Incorporate electronic, alphanumeric displays (minimum of eight characters) to provide visual indication of system availability, channel/talk group selection, incoming user ID, call alerts and operational status such as scan and channel busy.
- 5.4.8** Include transmit time out timer to warn the user that the radio may be transmitting longer than a predetermined time limit and then disable the transmitter.
- 5.4.9** Control station packaging shall incorporate sufficient electromagnetic shielding of radio and power supply components to allow multiple control stations to be located at the same site without causing unit-to-unit interference.
- 5.4.10** Minimum electrical specifications as follows:
 - 5.4.10.1** Primary Input Voltage: 120 VAC, 60 Hz, single-phase with 3 conductor grounded line cord.
 - 5.4.10.2** Optional Battery: 12 VDC designed for 8 hrs. of operation
 - 5.4.10.3** Environmental: MIL-STD 810 C, D, E, F and G for shock, vibration, humidity and high/low temperature.
 - 5.4.10.4** Temperature Range: -30 °C to +60 °C
 - 5.4.10.5** Humidity: 95% relative humidity at 50 °C
 - 5.4.10.6** Talk Group Selection: Rotary-knob style

5.4.11 Transmitter specification are as follows:

5.4.11.1	Frequency Range:	764 to 870 MHz
5.4.11.2	Channel Capacity:	500 channels
5.4.11.3	Talk Group Capacity:	16 talk groups per system/tier, minimum
5.4.11.4	Talk Group Capacity:	16 talk groups per system/tier, minimum
5.4.11.5	RF Power Output:	18 W (700 MHz); 30 W (800 MHz)
5.4.11.6	RF Output Impedance:	50 ohms
5.4.11.7	Channel Spacing:	12.5/6.25 KHz, NPSPAC
5.4.11.8	Spurious/Harmonic:	At least 70 dB below carrier
5.4.11.9	Frequency Stability:	1.5 PPM from -25 °C to 60 °C
5.4.11.10	Emission:	16K0F3E; 11K0F3E; 8K10F1D; 8K10F1E; 9K80F1D, 9K80D7W or comparable Phase 2 Emission.
5.4.11.11	Modulation Deviation:	+/-2.5KHz for 12.5KHz channel, +/-4 KHz NPSPAC
5.4.11.12	Audio Distortion:	Less than 2% at 1 KHz
5.4.11.13	Audio Response:	+/-3 dB of a 6 dB-per-octave pre- emphasis, characteristic, 300Hz to 3KHz.
5.4.11.14	Duty Cycle:	Transmitter 20-80%
5.4.11.15	Hum and Noise:	-35dB

5.4.12 Receiver specifications are as follows:

5.4.12.1	Frequency Range:	764 to 870 MHz
5.4.12.2	Channel Capacity:	500 channels

5.4.12.3	Channel Spacing:	12.5/6.25 KHz/NPSPAC
5.4.12.4	Adjacent Channel Rejection:	-63 dB
5.4.12.5	Digital Sensitivity:	5% BER: 0.35 μ V
5.4.12.6	Frequency Stability:	1.5 PPM from -25 °C to 60 °C
5.4.12.7	Intermodulation Rejection:	-75 dB
5.4.12.8	Spurious Response Rejection:	-75 dB
5.4.12.9	Audio Output:	Not less than 3W
5.4.12.10	Audio Distortion:	No more than 2% at 1 KHz
5.4.12.11	Duty Cycle (EIA):	Receiver 100%

5.5 Base/Repeater Stations

All Base/Repeater P25 radios proposed shall:

- 5.5.1** Meet APCO minimum recommendations and EIA/TIA standards for P25 Public Safety digital trunked/conventional radio systems (depending upon application within sites).
- 5.5.2** Furnished equipment must be capable of operation as a combined Phase 1 and Phase 2 infrastructure.
- 5.5.3** Be designed for 100% continuous-duty operation at full manufacturer specification.
- 5.5.4** In P25 multi-site and simulcast configurations, base stations shall utilize linear RF power amplifiers and function in a linear simulcast mode that minimizes to the greatest extent possible destructive time-delay interference within site coverage-overlap regions and minimizes digital modulation distortion, termed modulation fidelity.
 - 5.5.4.1** Modulation fidelity, for this Specification, is a measurement of the degree of closeness that the transmitted modulation matches the ideal theoretical modulation for P25 Phase 2 waveforms.

5.5.5 Incorporate site monitor and infrastructure alarm systems having the ability to report major/minor infrastructure functionality alarms on multiple dispatch-located alarm console display devices. Additionally, the alarm reporting system shall have the capability of being remotely accessed for the monitoring and remote-interrogation of field/site related alarms, using a laptop configuration from any node within the network.

5.5.6 Utilize the proposed 48VDC battery backup subsystem.

5.5.7 700/800MHz P25 Repeater station specifications are as follows:

5.5.7.1 General Specifications:

5.5.7.1(a)	Frequency Range:	764-776MHz, 851 to
5.5.7.1(b)	Number of Frequencies:	One transmit; one receive
5.5.7.1(c)	Channel Spacing:	25/12.5KHz
5.5.7.1(d)	Channel Capacity:	1
5.5.7.1(e)	Input Voltage:	48VDC operation
5.5.7.1(f)	Temperature Range:	-30°C to +60°C
5.5.7.1(g)	Humidity:	90 % relative humidity @ 50°C (typical)

5.5.7.2 Transmitter specifications are as follows:

5.5.7.2(a)	Output Impedance:	50 Ohms
5.5.7.2(b)	Power Output:	100 watts
5.5.7.2(c)	Frequency Stability:	0.01 PPM from -30 °C to +60 °C ambient, when referenced to site-based
5.5.7.2(d)	Emission:	8K30F1W; 8K70D1W; 9K80F1D; 11K2F3E; 9K80F1D, 9K80D7W or

5.5.7.2(e)	Modulation Deviation:	+/-2.5KHz (12.5KHz), +/- 4KHz (NPSPAC)
5.5.7.2(f)	Channel Spacing:	25KHz; 12.5 KHz
5.5.7.2(g)	Audio Distortion:	2% at 1KHz
5.5.7.2(h)	Audio Response:	Within +1, -3db of 6dB/octave per EIA
5.5.7.2(i)	Spurious/Harmonic:	-65dB

5.5.7.3 Receiver specifications are as follows:

5.5.7.3(a)	Frequency Range:	792-825MHz
5.5.7.3(b)	Modulation Acceptance:	1KHz off channel
5.5.7.3(c)	Selectivity:	-70dB
5.5.7.3(d)	Sensitivity:	0.25uv
5.5.7.3(e)	Intermodulation:	-80dB
5.5.7.3(f)	Spurious/Image:	-85dB
5.5.7.3(g)	Frequency Stability:	0.01-PPM (GPS standard)
5.5.7.3(h)	Channel Spacing:	12.5KHz
5.5.7.3(i)	Audio Distortion:	2% at rated audio line level (600-Ohm)
5.5.7.3(j)	Audio Response:	Within +1/-3dB of 6dB/octave per EIA
5.5.7.3(k)	Duty Cycle (EIA):	Receiver 100%

5.5.8 Minimum 700/800MHz Analog Base/Repeater station specifications are as follows:

5.5.8.1 General Specifications:

5.5.8.1(a)	Frequency Range:	806 to 869MHz
5.5.8.1(b)	Number of Frequencies:	One transmit; one receive
5.5.8.1(c)	Channel Spacing:	25/12.5KHz
5.5.8.1(d)	Channel Capacity:	10, minimally
5.5.8.1(e)	Input Voltage:	48VDC operation
5.5.8.1(f)	Operating Temperature:	-30°C to +60°C
5.5.8.1(g)	Humidity:	90 % relative humidity @ 50°C (typical)

5.5.8.2 Transmitter specifications are as follows:

5.5.8.2(a)	RF Output Impedance:	50 Ohms
5.5.8.2(b)	Power Output:	100 watts
5.5.8.2(c)	Frequency Stability:	0.01 PPM from -30 °C to +60 °C ambient, when referenced to site-based
5.5.8.2(d)	Modulation Deviation:	0 to +/- 5KHz (25KHz), 0 to +/- 4KHz (NPSPAC)
5.5.8.2(e)	Modulation Type:	Analog FM 16K0F3E
5.5.8.2(f)	Channel Spacing:	25KHz; 12.5 KHz
5.5.8.2(g)	Audio Distortion:	2% at 1KHz
5.5.8.2(h)	Audio Response:	Within +1, -3db of 6dB/octave per EIA

5.5.8.2(i) Spurious/Harmonic: -65dB

5.5.8.3 Receiver specifications are as follows:

5.5.8.3(a) Frequency Range: 792-825MHz

5.5.8.3(b) Modulation Acceptance: 1KHz off channel

5.5.8.3(c) Selectivity: -70dB (-80db for 25KHz channel)

5.5.8.3(d) Sensitivity: 0.25uv

5.5.8.3(e) Intermodulation: -80dB

5.5.8.3(f) Spurious/Image: -85dB

5.5.8.3(g) Frequency Stability: 0.01-PPM

5.5.8.3(h) Channel Spacing: 12.5KHz

5.5.8.3(i) Audio Distortion: 2% at rated audio line level (600-Ohm)

5.5.8.3(j) Audio Response: Within +1/-3dB of 6dB/octave per EIA

5.5.8.3(k) Duty Cycle (EIA): Receiver 100%

5.6 Fixed Microwave Equipment Requirements

5.6.2 Digital voice/data technology shall be used to minimize audio-phase delays and/or incompatibility of audio levels within the proposed network solution.

5.6.3 Where VoIP techniques are used to interconnect infrastructure sites, in lieu of traditional PCM multiplex channel schemes, a robust means shall be provided thereby assuring that the highest priority possible is given to voice packet delivery.

- 5.6.4** Redundant transmit, receive and base band equipment for each site, configured for automatic hot standby operation, shall be provided by the Vendor. This redundant equipment will automatically switch to the hot standby component(s) upon failure of the primary equipment.
- 5.6.5** A Microwave Alarm System shall be provided by the Contractor to monitor microwave site functions and to provide alarm status of abnormal operational parameters of equipment associated with the microwave system.
- 5.6.6** Microwave major alarms shall be integrated within the radio alarm packaged supplied by the Contractor.
- 5.6.7** A separate 48VDC microwave standby battery system will be provided and sized for 48-hours of continuous microwave equipment operation at each infrastructure site.
 - 5.6.7.1** An automatic low-voltage disconnect system will be employed to protect the battery plant from deep-cycle discharge damage.
- 5.6.8** Microwave system availability shall be no less than 99.999%. 6GHz path segments longer than 12-miles must utilize space-diversity. The system shall be loop-configured with hitless directional switching.
 - 5.6.8.1** 11GHz path segments, if any, shall be no longer than 4-miles in length. The use of 11GHz and higher is discouraged, except in the instance where required by the FCC.
- 5.6.9** Microwave antennas, radomes, and antenna mounts supplied and installed will be capable of surviving wind speeds of up to 150mph and maintaining reliable operations during sustained storm force winds of up to 125mph. Each furnished antenna system will be equipped with dual stiff arms/ruggedized mounts to limit antenna vibration and flexing during high wind events.
- 5.6.10** Minimum operational service parameters of each microwave link are as follows:
 - 5.6.12.1** Unfaded Bit Error Rate (BER): Not Less Than 10⁻¹⁰
 - 5.6.12.2** Calculated RF Link Fade Margin: Not Less Than 40dB

5.6.12.3 Link Outage Level: To coincide with 10-3 BER, to occur at a signal level not less than 3db in excess of the calculated RF link fade

5.6.11 Microwave system shall incorporate a quadrature amplitude modulated adaptive protocol that automatically adjusts protocol to maintain critical communications during abnormally faded conditions. This technique is intended to extend the microwave system's functionality to beyond that of the normal 40db flat fade margin.

5.6.11.1 Proposers shall use high-power amplifiers (i.e., 36dBm to 39dBm), as may be necessary, to achieve the best balance between antenna size versus the 40db flat fade margin requirement.

5.6.12 In no case should antennas larger than 8ft. in diameter be considered for this project unless high-performance antennas are required due to interference mitigation requirements as noted by the Frequency Coordinator.

5.6.13 The Contractor shall be responsible for the engineering and filing costs for microwave system frequency coordination, prior coordination notification, FCC license application preparation and submittal of necessary microwave licensing documents on behalf of Customer.

5.6.14 The Vendor is not required to present a detailed path design of the proposed microwave subsystem for the purpose of its Technical Submittal, as such work is dependent upon exact antenna placements that will be resolved by the Contractor during the various design review meetings to be held prior to System construction. The Vendor shall provide the following information as part of its Technical Proposal Submittal:

5.6.15 Technical specification literature for its proposed microwave radio, antenna and related equipment.

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5.7 Additional Submittal Requirements:

- 5.7.1** A sample path profile analysis indicative of the scope to be used during the actual microwave analysis process.
- 5.7.2** A sample test and alignment verification process, to be used during the commissioning of the new microwave subsystem.
- 5.7.3** The Vendor may not reuse/reconfigure Customer's existing microwave equipment as this equipment is no longer supported and is expected to have no operational value within the new System's deployment.

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6.0 Coverage Criteria

6.1 General

The System's conventional P25 digital radio network shall be designed to support portable hand-carried radio equipment, operated on street, at physical locations throughout the identified operational area. The Vendor must fully identify and guarantee the coverage predicted for its solution, per the functional and operational requirements of this Specification. The Vendor shall provide within its proposal response a sample Coverage Test and Acceptance Plan that encompasses the elements described below:

6.2 Coverage parameters

The Vendor must consider the following operating parameters in the development of their coverage guarantee:

- 6.2.1** Shoulder/microphone units without antennas will be used with portable radio units in most instances and shall be the normal configuration considered for coverage design. Body and obstruction losses must therefore be considered in the proposed network design for both talk-in/talk-out coverage analyses.
- 6.2.2** Flexible, **quarter wavelength antennas** shall be required for portable units. Coaxial-skirt type or ½ wave antennas are not acceptable due to size and other mechanical/ergonomic limitations.
- 6.2.3** Mobile unit configurations shall utilize 3db 700/800MHz antennas. These antennas shall be located on the vehicle's trunk or roof, having an average base level height of 3.5 feet.

6.3 Noise Floor & Interference

It is the intent and requirement that the System shall be designed such that the indicated coverage goals and requirements herein, be met irrespective of external noise and interference. It is therefore important that the Contractor undertake whatever measurements, surveys and studies as necessary such that the state of the noise and interference environment is quantified prior to the final design of the System. The final design shall make such allowances as necessary, including but not limited to reduced repeater site effective sensitivity (predictions) in the presence of noise and interference (as measured) to achieve Customer's required degree of coverage.

The Contractor shall not excuse a failure of any portion of the coverage test due to external noise or interference, with one exception: If the Contractor can show, with certified measurement data, that the noise and/or interference environment has substantially changed between the initial pre-design measurements/surveys and the time of the performance of the coverage acceptance test. If such findings can be so demonstrated, then the coverage requirement for the affected portion of the coverage test may be conditionally accepted.

The Vendor, as part of its proposal development submittal, shall undertake a best-faith effort to investigate the existence of abnormal noise/interference levels, if any, and shall incorporate those findings within its coverage map submittals for the proposed System. These measurements must be conducted between the hours of 8 a.m. – 5 p.m. on normal business days. Off hours, and holiday time periods will not be acceptable periods for measurements. Ultimate final acceptance of the affected portion of the completed System may be given only if Customer is shown satisfactory information to demonstrate that any observed degradation is beyond the reasonable, Industry-recognized control of the Contractor. If, however, coverage degradation to the System is found to be within the Contractor's control, then whatever additions, modifications or costs incurred to resolve the coverage deficiency shall be borne solely by the Contractor.

6.4 Service Area

6.4.1 Portable radio on-street, on the hip coverage must extend throughout no less than 95% of that area within the land region encompassed by the County and the fire districts that extend beyond the Grundy County, Missouri. A service area map is shown in Appendix G Service Area Map

6.4.2 The system shall support mobile coverage throughout Grundy County, Missouri and the fire districts that extend beyond the Grundy County at 97% coverage/DAQ4.0 for mobiles and DAQ 3.4 for portables.

6.4.3 Portable radio coverage within buildings is required. The System shall support no less than 95% coverage/DAQ-3.4 within 10dB residential structures throughout all areas of Grundy County.

6.4.3.1 The system shall support no less than 95% coverage within 20dB structures throughout the city of Trenton. In addition, portable radio to this same or greater reliability and audio quality is required within a specific set of critical building locations, as described herein and Appendix D Critical Building List.

6.4.5 All references to coverage reliability in this Specification refer to statistical area reliability. For example, the phrase "95% coverage" indicates that the total area described shall exhibit at least 95% statistical probability that coverage areas, if tested, would be found to support electrical performance which equals or exceeds that minimum signal level necessary for that Contracted delivered audio

6.4.5.1 It will not be acceptable to provide a coverage guarantee which includes a relatively large number of failed points within any single vicinity, while still meeting the overall goal of 95% coverage.

6.4.5.2 It will not be acceptable to have a failure of six or more contiguous test points.

6.5 Propagation Analysis

The Vendor shall provide written descriptions of the processes and propagation models used to calculate proposed area coverage objectives.

Coverage maps and other pertinent calculations must be submitted with the following

6.5.1 Transmitter site power output.

6.5.2 Antenna gain and type (Include transmission line losses).

6.5.3 Effective signal level necessary, at both infrastructure and user radio antenna ports, to produce DAQ 3.4 delivered audio quality in the typical land mobile radio environment (inclusive of noise floor degradation, if any).

6.5.4 Antenna height.

6.5.5 Portable unit effective radiated power.

6.5.6 Portable unit effective receiver sensitivity.

6.5.7 Transmitter site talk out range, individual site as well as composite coverage.

6.5.8 Portable unit talk-in range, individual sites as well as composite coverage.

6.5.9 A statement defining the percentage of land area covered shall be provided for each submitted map configuration.

6.5.10 Okamura modeling should be used for propagation projection.

6.6 Coverage Acceptance Criteria

Verification of the installed system's coverage is a component part of the Test and Acceptance criteria described in Section 14 Phased Implementation.

6.6.1 Vehicular coverage testing (performed within a road vehicle during terrestrial coverage testing or watercraft when performing river or lake coverage testing) shall be done with computer-controlled test equipment.

6.6.1.1 This equipment shall automatically record the position of the test vehicle (by means of GPS positioning) at the time of a reading and records the signal strength of at least 200 signal samples over a 40-wavelength period for each reading taken within a test grid. Signal strength measurements shall be made continuously along the drive

6.6.2 Test grid sizes shall utilize grid sizes no greater than 5280 x 1580 feet through out the County and It's fire districts, and 1320 feet x 1320 feet within the city of Trenton.

6.6.3 A minimum number of accessible grids, sufficient to provide statistical accuracy of results in the order of 0.25% or less, shall be tested.

6.6.4 Customer and the Contractor shall mutually determine a suitable drive route that encompasses the entirety of accessible grids. This testing shall apply to any area capable of being traversed by a 4x4 vehicle. Inaccessible grids will be excluded from the coverage result calculations.

6.6.5 Field strength test results obtained throughout the coverage area, in accordance with minimally required reliability percentages, shall be of sufficient level to produce a Delivered Audio Quality (DAQ) rating of 3.4 or higher (see Figure 1 below) throughout the predicted service area to be considered passing.

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DAQ	Description
5	Reception is very clear, and the message is perfectly readable. No background noise is present, and every word is understood.
4	Reception is clear, but with slight background noise. Message is readable and every word is understood.
3.4	Reception is clear, but with slight background noise. Message is readable and understood with few/occasional missing syllables.
3	Background noise is evident. Message is readable and understood even with missing syllables.
2	Background noise is prevalent. Message is readable with difficulty and requires repetition.
1	Evidence that transmission being made. Voice message is barely discernible, and no words are understood. Unusable.
0	No transmission is heard. No activity on the channel is evident.
CPC is set to the midpoint of the Range. SINAD values are NOT to be used for system performance assessment.	

- 6.6.6** Mobile radio signal strength measurements shall be made from either a terrestrial (land) vehicle moving at approximately 35 mph, or a watercraft (river/lake) vehicle traveling at approximately 20-knots.
- 6.6.7** The device used to measure field intensity shall be stable and have a dynamic range suitable for the conditions under test.
- 6.6.8** Prior to the execution of these test activities, all test equipment and data gathering equipment to be used shall be fully certified by an independent testing laboratory having calibration tools traceable to the National Institute of Standards and Technology. These certification documents shall be presented to Customer's project staff prior to coverage testing.
- 6.6.9** The test output shall be retained by a laptop computer or an equivalent computer device. The Contractor shall submit a written and/ or graphical report containing an analysis of the test results to Customer daily, and a formal report at the end of the test.

- 6.6.10** The Contractor's analysis shall include maps of the coverage area divided into grids, with the test results for drive tests displayed in each grid on a separate map.
- 6.6.11** All test data, in its raw form, shall be made available for independent inspection.
- 6.6.12** Customer reserves the right to reject any instrumentation or procedures.
- 6.6.13** During these tests, the System's P25 transmitter(s) output power shall be monitored by Customer and no adjustments shall be made to the transmitter(s), portable/mobile radio units or test instrumentation after appropriate calibration of all involved equipment.
- 6.6.14** Should Customer reject any portion of the test, the Contractor shall correct the errors and omissions as defined by Customer at no additional cost.

6.7 Audio Quality Test Process

In addition to the signal level collection method describe above, the Contractor shall be required to conduct a voice audio quality test of the System.

- 6.7.1** The P25 digital portion of the new radio system shall encompass an automated BER Test for both in-bound and outbound transmission pathways.
- 6.7.2** The Contractor shall, as part of its Acceptance Test, produce a BER Test Report that correlates actual BER to predicted results.
- 6.7.3** Of those accessible grids evaluated because of the field-testing process, no fewer than 97% shall achieve a BER that is directly correlated to DAQ-3.4, as defined by EIA/TIA TSB-88D, as depicted by Figure 1. A call transmission failure in either direction shall be considered a failure of the tested grid.
- 6.7.4** The BER test shall encompass the same grid structure are devised for the signal level test process.
- 6.7.5** A manually-conducted voice quality test simulating in-residence portable radio operations shall also be conducted.
 - 6.7.5.1** In conducting portable voice quality testing, vehicular-mounted mobile radios will be utilized in Contractor-equipped vehicles, but with appropriate transmission line attenuators installed to replicate outdoor portable radio operations.

- 6.7.5.2** Customer's service area shall be comprised of test grids equal to those used in BER testing.
- 6.7.5.3** Test calls for each grid will be transacted, vehicle-to-base and base-to-vehicle, with the results for each call segment scored as per TSB-88D recommendations.
- 6.7.5.4** No fewer than 95% of the total number of grids tested in this manner shall be ranked as achieving DAQ-3.4 audio quality, or higher.
- 6.7.5.5** A failure in either call direction shall be considered as a failure of the tested grid.
- 6.7.6** The following voiced audio quality verification process shall apply:
 - 6.7.6.1** The portable radio voice quality testing shall be performed using a minimum of ten phonetically balanced phrases, to be supplied by the Contractor.
 - 6.7.6.2** A successful test measurement shall be one which requires no repetition to understand the spoken phrase and with a DAQ of 3.4.
 - 6.7.6.3** A successfully tested grid is defined as one in which communications from a dispatch console to a field radio unit, as well as for the reverse path, are not less than DAQ 3.4 as described above.
- 6.7.7** Customer shall designate the test team(s) to participate in coverage testing.
- 6.7.8** All test vehicles shall be provided by the Contractor and be off-road capable. Where boats are required, these shall be provided by Customer.
- 6.7.9** Testing shall commence daily at 8:00 AM and will cease at 4:30 PM. At least three teams will conduct the tests in the interest of timely completion.
- 6.7.10** Failure of Contractor test equipment shall not be considered as an acceptable reason for a Contract time extension.
- 6.7.11** Customer will not pay for retesting caused by delays or equipment failures.
- 6.7.12** Testing will proceed through weekends and during peak foliage until concluded.

6.7.13 Final System Acceptance shall not be achieved until the constructed System successfully equals or exceeds the coverage performance guaranteed by the Contract.

6.8 Critical Building Coverage Test Process

6.8.1 Coverage shall be no less than 95% inside of the listing of representative buildings contained in Appendix D Critical Building List. It is desired that most of these building structures shall be supported by the proposed fixed infrastructure (tower sites). However, the Vendor shall exercise good judgment in balancing the proliferation of costly infrastructure tower sites with the number of building sites. The use of building amplifier systems, while necessary in some instances, shall likewise be minimized to the most practical and fiscally responsible extent

6.8.2 The Vendor shall specifically identify those buildings from that list that are likely to require building amplifier systems.

6.8.3 If any of these representative buildings fail to demonstrate 95% reliable coverage (DAQ 3.4 Audio Quality), the following procedure will be followed:

6.8.3.1(a) The vendor must propose a testing method showing how the failed building will be tested to verify that it does or does not meet the in building coverage criteria.

6.8.3.1(b) If insufficient coverage is identified from that previously predicted, the Contractor will be responsible for modifying the System, at no additional cost to Customer, as may be necessary to achieve the required reliability within the failed building. This may include any or all the following approaches:

- Bi-directional amplifier (BDA) system installed in the building.
- Passive repeater systems installed in the building.
- Passive repeater systems installed in the building.
- Satellite receiver systems in or near the building.
- Modifying/adjusting repeater site antenna systems.

The determination to utilize a BDA within any structure will be engineered as a part of a comprehensive system design. BDA systems shall not be installed in structures in such a manner or proliferation that creates interference with the overall System's operation.

If any changes are made to the fixed sites (such as re-orienting antenna patterns) in order to resolve building coverage failures, then a complete re-test of coverage shall be required at no additional cost to Customer.

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7.0 Dispatcher Console Requirements

7.1 General

It is a requirement that Customer's existing/legacy radio configuration remain operationally available during the installation and acceptance phases of the P25 System. The customer will permit the co-location of new dispatch console equipment with this legacy equipment during the project's user migration phase and until project acceptance.

7.2 Radio Console Locations

The Customer dispatch center for 911, Law, Fire, EMS, and other public safety agencies within the county is colocated with the Trenton Police Department and the Grundy County Sheriff's Office. The dispatch center is located at 610 Main St, Trenton, MO 64683. There is a quantity of two (2) consoles at this location.

7.3 Console Installation Requirements

In proposing a console solution, the Contractor shall:

- 7.3.1** Replace all existing radio dispatch consoles at Customer's dispatch center(s) with an IP-based solution and have seamless integration with the newly proposed System radio network.
- 7.3.2** Install new radio dispatcher equipment cabling that must, likewise, be completed in a manner that causes no interference with the operation of the existing legacy network.
- 7.3.3** Carefully evaluate dispatch facilities prior to initial design review to determine the most effective means to install and implement its new dispatch console equipment and associated subsystems.
- 7.3.4** Any solution that would cause the temporary interruption of the existing radio system for any duration must be reviewed and approved, in advance, by the affected entities and Customer.

7.4 Desired Functionality

Due to the critical nature of the communications services provided by these public safety dispatch facilities, a high degree of reliability for the new radio dispatch console subsystem is required.

7.4.1 General Operations

The console subsystem, to the greatest extent possible, shall:

- 7.4.1.1** Be automatically self-correcting.
- 7.4.1.2** Provide continuous and automatic self-testing and diagnosis.
- 7.4.1.3** Alert the operator in the event of component or sub-system failure.
- 7.4.1.4** Allow continued operation of the remaining consoles in the event of failure to a specific console, through isolation of the defective console device.
- 7.4.1.5** Be of a design that eliminates single points of failure.
- 7.4.1.6** Utilize packet-based, in lieu of traditional circuit-switched,
- 7.4.1.7** Modularity is likewise envisioned to reduce the number of sub-systems affected by a single component failure. Repair of sub-systems without totally disabling multiple radio console positions shall be required, as continued console operation is necessary during

7.4.2 Diagnostics

- 7.4.2.1** The new dispatch console subsystem shall be equipped with several self-diagnostic elements that continuously monitor and verify the correct operation of each distributed microprocessor, each audio path in the console electronics, and between the console electronics and the System.
- 7.4.2.2** Diagnostic capability shall be distributed among independent and redundant subsystems and shall not rely on one central diagnostic circuit.

7.4.3 Power Supply

It is a critical requirement that power loss or surges shall not affect radio dispatch operations.

7.4.3.1 Power loss or surges shall not alter the system software or operating parameters at the radio dispatch positions.

7.4.3.2 External power to each console shall be supplied by a nominal 120VAC, 60Hz, single-phase power source.

7.4.3.3 All dispatch console equipment, in each dispatch facility, shall be connected to an outlet on a circuit that is protected by a UPS and supported by the site's emergency power generator. Emergency Backup power at each dispatch site is not the responsibility of the Vendor.

7.4.4 Flat Panel Display

7.4.4.1 A state-of-the-art color, non-interlacing 20-inch touch screen display will be provided.

7.4.4.2 Each operator shall have the ability to change screen displays to suit operator preferences.

7.4.4.3 No less than eight console preferences shall be configurable for each console.

7.4.5 Headset Jack Configuration

7.4.5.1 All radio consoles shall, at a minimum accommodate both right-handed and left-handed operators.

7.4.5.2 All radio consoles shall be configured for dual headset and local microphone operations.

7.4.5.3 Each console shall provide independent transmit audio level settings for audio inputs from the headset microphone and a desktop microphone, such that dispatchers may freely switch operation without affecting dispatch audio quality.

7.4.5.4 Dual headset jacks shall be provided at each position for training and supervisory purposes.

7.4.6 Footswitch

7.4.6.1 The Contractor shall supply and install a switch for each console.

7.4.6.2 Each footswitch will operate PTT of the selected channel(s).

7.4.6.3 The footswitch shall be heavy duty, rated for constant and continuous use, and shall be designed so as not to skid on a smooth flooring surface.

7.4.7 Master Time Source

7.4.7.1 A time generator system shall be provided, by the Contractor that references the Global Positioning System to synchronize all dispatch clocks and logging recorders at all radio console positions/centers.

7.4.7.2 This time generator system shall be made to fully interface to and control the event-time display of the radio consoles, console audio recorder, radio network management tools, radio network alarm system, and microwave alarm system at each radio dispatch location.

7.4.8 Dispatcher Headsets

There is not a requirement for the vendor to provide dispatcher headsets, however fully functional and tested headset jacks need to be installed.

7.4.9 Digital Fixed Station Interface

The console system shall be capable of modern digital fixed-station interface (DFSI) connectivity to base stations and other fixed radios.

7.4.10 Dispatch Console Positions

Each of the radio dispatch consoles shall include all controls that apply to the various channel/talk groups and auxiliary functions for the console.

Each console position shall contain as a minimum:

7.4.10.1 Select Speaker – for audio from selected channels/ talk groups, with volume control.

- 7.4.10.2** Unselect speaker – for audio from unselected channels/ talk groups, with volume control.
- 7.4.10.3** Resource selectable speaker – Minimum of 4 additional speakers which allow for console audio resources to be dynamically assigned by the operator.
- 7.4.10.4** Transmit Function – a color-coded transmit function to control the push to talk (PTT) function for the selected transmitter(s) and/ or talk group(s).
- 7.4.10.5** CTCSS Monitor or Disable Function – shall disable the receiver CTCSS decoder of selected conventional base station(s) operating on conventional channels for monitoring purposes.
- 7.4.10.6** Clock – shall display time in twenty four-hour formats and shall be synchronized with the time server.
- 7.4.10.7** VU Meter or Audio Level Display.
- 7.4.10.8** Keypad or screen representation of a keypad for numeric data entry.
- 7.4.10.9** Microphone – desktop microphone type. This microphone shall be resistant to interference, such as transmitting hum from lights, cathode ray monitors, or other devices used in the proximity of the console.
- 7.4.10.10** Dual Headset Jack – a dual headset jack shall be provided which will allow for use of a headset equipped with RJ-327 type plug with modular adapter. Separate headset volume controls for radio and telephone audio output shall be provided.
- 7.4.10.11** Intercom – intercom between operator positions shall be provided. A visual display shall be provided to identify both the calling and called parties by console name. Multiple simultaneous intercom conversations between individual consoles shall be possible.
- 7.4.10.12** ID Display on the channel window for standard calls and emergency calls with a minimum of eight alphanumeric characters.
- 7.4.10.13** All Receiver Mute Function – a function, which will mute the received audio from all unselected channels, shall be provided. This muting function shall be programmable in predetermined

7.4.10.14 Simultaneous Select and Instant Transmit Function – controls shall be provided that allows the operator to manually select any combination of console controlled base stations for simultaneous transmissions. Three selectable combinations shall be allowed at the discretion of the dispatcher.

7.4.10.14(a) The patch shall utilize a single channel when patching a conventional channel to a control station or other interoperability source.

7.4.10.15 Emergency/ Reset

7.4.10.15(a) The Consoles shall receive emergency alerts from the trunked radio system regardless of the status of the channel control window.

7.4.10.15(b) Emergency messages shall be indicated by a flashing ID, and emergency ID character and an audible alert.

7.4.10.15(c) Dispatcher acknowledgment of the message shall silence the audible alert and stop the flashing

7.4.10.15(d) Multiple emergency messages shall be queued in the display stack and the emergency ID character shall continue to flash until all messages have been viewed and subsequently cleared by the dispatcher.

7.4.10.16 Alert Tones

the console shall be provided with three distinct tones used for alerting purposes over the air. Each alert tone shall be immediately broadcast, when activated, on the selected radio channel.

The following selections shall be available as a minimum:

7.4.10.16.(a) Alert 1 – Steady Alert Tone – shall generate a nominal 1000 Hz steady tone.

7.4.10.16(b) Alert 2 – Warbling Tone – shall generate a warbling tone.

7.4.10.16(c) Alert 3 – Pulsed Alert Tone – shall initiate an automatic sequence, consisting of a nominal 1000 Hz tone, for a period of two (2) seconds.

- 7.4.10.17** Paging Encoders – Each console shall include a multi-tone paging/signaling encoder that is accessible, minimally, through the data entry keyboard.
- 7.4.10.18** Call Indication – a color-coded status call indicator shall be provided for each receiver in a channel control window on the display screen.
- 7.4.10.19** Individual Volume Adjust – shall be provided for each channel on the console. Associated color-coded status indicators shall continuously show whether the channel is in the full or adjustable volume control shall be automatically bypassed when a channel is placed in select status.
- 7.4.10.20** Coventional Cross Patch.
- 7.4.10.21** Channel/Group Name – designated channel/ group control modules shall include a minimum of eight-character alphanumeric display symbols to identify the channel/group.
- 7.4.10.22** Channel Busy Indication.
- 7.4.10.23** NENA interface – Connectivity to existing E911 and future NG911/IP telephony system (provided by others) for single headset operation.

7.5 Video Display Installation

- 7.5.1** The installation of the Video Display(s) used for the radio dispatch positions shall be capable of desk mounted on furniture or dispatch console furniture display arms.
- 7.5.2** Contractor-furnished cabling shall be neatly installed and protected from physical damage. Installation plans will be approved by Customer prior to physical installation.
- 7.5.3** Cable raceways shall be used where possible.
- 7.5.4** No cabling shall create a safety or mobility problem for dispatch personnel.

7.6 Console Electronics Description

- 7.6.1** Console electronic circuitry shall be housed in an equipment rack/enclosure specific for each dispatch console position.
- 7.6.2** When installed by the Contractor, sufficient space for front and rear servicing of this equipment shall be provided.
- 7.6.3** The use of a centralized console electronic bank that supports audio and control signaling between multiple dispatch console positions is non-compliant and will be rejected.
- 7.6.4** Console electronic enclosures shall contain the various microprocessors, console interfaces, auxiliary function interfaces and other interfaces needed for radio dispatch operations.
- 7.6.5** If multiple circuit cards are required within the Vendor's enclosure solution, these shall be of plug-in design and shall be able to be inserted and/or removed with power applied and the location's other dispatch positions/equipment remaining on-line.

7.6.6 System Interfaces

- 7.6.6.1** The digital voice network's radio dispatch subsystem shall include the circuitry required to operate remotely-controlled base stations and the System repeaters as described by this Specification.
- 7.6.6.2** At a minimum, each base station interface shall consist of a plug-in circuit card (or the software equivalent) containing VoIP-related circuitry, line driver amplifiers, two-wire and four-wire receive
- 7.6.6.3** The interface shall also be capable of remotely controlling base stations via E/M multiplex-channel, and 2175Hz tone-burst signaling, as may be needed for legacy equipment.

7.6.7 Auto Diagnostics/Self-Healing and Diagnostic Features

- 7.6.7.1** The radio dispatch subsystem shall be equipped with many self-diagnostic capabilities that shall be configured to continuously monitor and verify the correct operation of each distributed microprocessor, each audio path in the console electronics and between the electronics and each radio network base station site.

- 7.6.7.2** In the case of voice transactions using the Internet Protocol, specialized coding shall be used to assure the timely delivery of audio packets to destinations such that recovered or transmitted audio is absent of noticeable voice delays or audio truncation.

7.6.8 Console Auxiliary I/O Functions

- 7.6.8.1** All external auxiliary input and/or output (Aux I/O [logic or relay]) functions shall be controlled through an auxiliary interface module.
- 7.6.8.2** These functions shall be controlled from the console position as required.
- 7.6.8.3** The Aux I/O shall be capable of operating a 3-light status light/alert system, supplied by the vendor, to indicate each position is operating a radio transmission, or telephone call, on each console position.

7.7 Fallback Control Stations

- 7.7.1** Each dispatch and supervisory position shall be equipped with a P25 trunked/conventional control station to permit radio dispatch operations to continue in the event of radio console equipment or connectivity failures.
- 7.7.2** These control stations, in addition to the minimum requirements specified by Section 5.3, must contain an alphanumeric display to provide information on talk group selection and emergency call alerts.
- 7.7.3** Each control station shall be operated either by a stand-alone footswitch and headset jack or be integrated to the console and operate with the console footswitch and headset jack.

7.8 Recorder Interface

The vendor shall insure the following capabilities of the Customer's existing Eventide Nexlog recorder with the new system.

- 7.8.1** The capability to record any talkgroup on the new system.
- 7.8.2** The capacity to record all talkpaths/channels added with the new system.

8.0 General Equipment Shelter Requirements

8.1 Shelter Design Considerations

Equipment shelters shall be of a concrete floor, bullet-resistant, prefabricated concrete aggregate type designed to house radio communications, the standby power generator/transfer switch, and sensitive electronic equipment:

8.1.1 The suggested exterior wall measurements shall be 10ft high, 12ft wide and 20ft long.

8.1.1.1 The shelter may be less than 12ft wide and 20ft long given the floor space must meet a 50 percent growth factor for future equipment.

8.1.1.2 The Interior dimensions shall include nominal wall, roof, and skid dimensions, to be determined by Contractor.

8.1.2 Equipment shelters must provide an interior climate suitable for the operation of sensitive electronic equipment, that is, it must be dust proof, watertight and airtight.

8.1.3 The shelter shall include a separate power generator equipment area that includes a separate access doorway and a fire-barrier separator that isolates the generator area from the HVAC-conditioned radio equipment space.

8.1.4 This generator equipment area shall also be equipped with a ceiling mounted, thermostatically controlled, electrical heater.

8.1.5 Each equipment shelter shall be supported by a concrete pad with attachment devices appropriate for securing the building assembly to survive hurricane or tornado induced straight line force (no less than 150-mph) winds.

8.1.6 In the case of sites determined by FEMA 100-Year Flood maps as requiring elevation due to potential flooding, the affected equipment shelter shall be set on concrete piers or a galvanized steel framework.

8.1.6.1 The finished length of piers/framework shall extend, minimally, four feet above ground level but otherwise in accordance with FEMA's 100-Year flood plain elevation height plus an 18-inch contingency margin.

8.1.7 Skid components, attachment hardware, cross-braces and lifting eyes shall be hot-dipped galvanized after fabrication.

8.2 Shelter Configuration Details

- 8.2.1** The exterior wall finish shall be exposed aggregate. Seeding of aggregate for an exposed aggregate finish is not acceptable. Exterior walls must be bullet resistant as defined below.
- 8.2.2** The roof shall be a flat, tapered type having a minimum slope of 1/2" per foot from the roof centerline.
 - 8.2.2.1** The roof shall be designed to support a minimum of 100-lbs/sq. ft. distributed load.
 - 8.2.2.2** A roof shield shall be provided and installed by the Contractor, above the equipment shelter and of sufficient size to adequately protect the shelter and personnel from falling materials via the nearby radio site's
- 8.2.3** All exterior wall, floor and roof joints shall be sealed using a compressible, resilient sealant. There shall be no exposed roof-to-wall or wall-to-floor joints.
- 8.2.4** Cement used in concrete shelters shall be standard Portland cement conforming to the requirements of the "Standard Specification of Portland Cement", ASTM Designation C150. Concrete aggregate shall conform to the requirements of the "Specifications for Concrete Aggregates" ASTM C33 and "Specifications for lightweight aggregates for structural concrete" ASTM C330.
- 8.2.5** Exterior concrete surfaces shall be sealed with a minimum of two coats of Thoroglaize H Sealer or equal.
- 8.2.6** The shelter's interior floor shall be covered with 1/8" x 12" x 12" industrial weight solid vinyl floor tile. Floor color shall be light beige.
 - 8.2.6.1** The subfloor shall be designed to support a minimum of 200 lbs. / sq. ft. distributed floor load, while on foundation, or as needed to support proposed equipment.
- 8.2.7** Walls shall have a minimum thermal insulation factor of R11.
- 8.2.8** The shelter's roof shall have a minimum thermal insulation factor of R19.

8.2.9 Interior wall surfaces shall be faced with white vinyl/coated wood paneling.

8.2.9.1 The interior ceiling surface shall be white, vinyl coated plywood. Seams in the plywood shall be trimmed with batten strips painted to match the ceiling.

8.2.10 Building openings for the door, air-conditioners, transmission line entrance and other entries shall be framed and sealed in such a manner that moisture cannot penetrate the insulation within the walls or the interior walls of the structure.

8.2.11 Two 36"W x 72"H x 3" thick insulated bullet-resistant steel doors (i.e., one door entry each for the radio equipment space and generator space), equipped with a three-point latch, shall be provided. All door hardware shall be stainless steel and incorporate three external hinges having non-removable hinge pins. Doors shall open outward to maximize internal building utilization.

8.2.11.1 The term 'bullet-resistant' is defined, for this Specification, as unable to be penetrated by a .30-06 or .308 commercial cartridge firing a lead tipped, 160-grain projectile, at not more than 2600 fps muzzle velocity. The projectile will be test-fired at a range of 100 yards. The structure/material must not be completely penetrated at that distance.

8.2.12 Fiberglass exterior awnings shall be provided to protect the door entrances and air-conditioner units.

8.2.13 All hardware used on the exterior surfaces of this shelter shall be either hot-dipped galvanized or stainless steel. Wafer or particleboard wood products are not an acceptable construction material for this project.

8.2.14 Contractor shall provide detailed fabrication drawings for the concrete foundation (or steel frameworks), designed to adequately support the proposed building structures and wind loads.

8.2.14.1 Additionally, the building frame shall be mechanically bonded to the concrete/steel foundation. Strapping and anchor materials shall be hot-dipped galvanized protected.

8.2.14.2 Building, and foundation detail drawings and related calculations must be reviewed and approved by a State of Arkansas-registered professional engineer.

8.3 Shelter Electrical Requirements

- 8.3.1** Each shelter shall be equipped with overhead cable trays located above all planned equipment rack groupings.
 - 8.3.1.1** Auxiliary cable trays shall be provided to support transmission lines and telecommunications cables, as necessary.
 - 8.3.1.2** All cable tray joints shall be electrically bonded using No. 6 AWG copper wire jumpers with approved compression fittings.
 - 8.3.1.3** Trays shall be bonded to the interior ground halo.
- 8.3.2** Individual, properly grounded with home run grounds, 120VAC, 20A electrical circuits shall be provided to each of the equipment racks/cabinets.
- 8.3.3** Each shall be terminated as a single, duplex outlet mounted on the cable tray directly above the center of each planned equipment rack.
- 8.3.4** Individual, properly grounded with home run grounds, 240VAC, 30A electrical circuits shall be provided for each battery charger unit.
- 8.3.5** Sufficient flexible conduit shall be provided above the rack to permit interconnection to chargers located at the bottom of the rack.
- 8.3.6** DC wiring for the radio network's battery plant and interconnection to the various equipment groupings shall be furnished and installed, as required.
- 8.3.7** DC wiring for the radio network's battery plant and interconnection to the various equipment groupings shall be furnished and installed, as required.
- 8.3.8** Install twelve (6), properly grounded with home run grounds, quad 120VAC convenience outlets, two each on the two longest walls and one each on each of the remaining walls; four outlets shall be installed within the generator space.
- 8.3.9** Twelve (6) 120VAC ceiling mounted outlet boxes shall be provided, each with one (1) duplex receptacle and home run ground.
- 8.3.10** The Contractor shall furnish and install one circuit breaker panel board. Panel board shall be sized for all the indicated branch circuits, equipment loads plus a fifty percent growth factor.

8.4 Electrical/Transient Grounding System

8.4.1 The Contractor shall furnish and install an interior and buried exterior electrical grounding system and power surge protection for each location, as follows:

- 8.4.1.1** A single #2AWG copper conductor ground halo shall be installed on all four interior walls, spaced approximately six inches below ceiling level. The halo shall include a twelve-inch gap/break at the furthest point from the single-point ground attachment, which shall coincide with the RF transmission line entrance.
- 8.4.1.2** Ground halo shall be mounted on six-inch standoffs, located on twelve-inch centers. It shall be affixed to the transmission line ground entry-port buss bar.
- 8.4.1.3** This ground entry-port buss bar must be equipped with an Alarm, connected to the network's alarming system, to indicate ground failure, tamper, or theft.
- 8.4.1.4** All equipment cabinets, racks, transmission line entrance and cable trays shall be individually bonded to the halo using #6AWG copper conductors with approved compression fittings.
- 8.4.1.5** Interior halo shall be bonded to an exterior, buried ground network using low impedance copper conductors.
- 8.4.1.6** Electrical transient protectors shall utilize MOV and avalanche clamp devices such as the Transector Systems Model 1101-808 series or equivalent. This device shall be installed on the commercial power feed as well as the standby generator feed to the power transfer switch.
- 8.4.1.7** A single, stranded #00AWG copper exterior ground system shall be installed about the building and tower perimeter, located below the frost line, as identified locally, and exothermically bonded to the building frame, interior halo, transmission line ladder, generator system, ice shields, and radio tower legs. All site grounding practices and methods shall meet a recognized telecommunications standard such as IEEE, Motorola R56 or the current revision of Harris AE/LZT 123 46181/1.

8.5 Shelter Lighting Requirements

- 8.5.1** Install 4-foot, 2-bulb, 80-watt fluorescent light fixtures as necessary to provide effective illumination for each equipment rack, and within the generator room.
- 8.5.2** Install emergency exit and interior lighting as required by fire code.
- 8.5.3** Exterior lights above the doors and area lights on each of the exterior shelter corners shall be controlled by, at a maximum, two light switches located just inside the main door opening on the side away from the hinges at shoulder height.
- 8.5.4** No LED lights are permitted on exterior walls without prior approval by Customer.

8.6 HVAC Requirements

- 8.6.1** The Contractor shall furnish and install a dual, wall-mounted heating and air-conditioning system appropriately sized for each shelter/equipment heat load.
- 8.6.2** Each HVAC unit shall incorporate circuitry to ensure that both compressors do not attempt to restart at the same time.
- 8.6.3** HVAC configuration must include timer circuits to rotate use of the air conditioner units on a weekly basis.
- 8.6.4** The HVAC configuration shall include appropriate sensors to cause both air conditioners to run simultaneously as needed to more rapidly reduce the internal temperature to a safe operating level.
- 8.6.5** Equipment shall be furnished with compressor anti-cycle circuitry to prevent short-cycle starts against high compressor head pressure.
- 8.6.6** Equipment shall be furnished with a compressor hot gas bypass (or its equivalent) to minimize electrical power surges because of compressor cycling.
- 8.6.7** Design of HVAC system shall take into consideration the following environmental conditions:
 - 8.6.7.1** Desired Interior Temperature: 70 degrees F
 - 8.6.7.2** Maximum Outdoor Temperature: 105 degrees F
 - 8.6.7.3** Minimum Outdoor Temperature: -30 degrees F

- 8.6.7.4** Transmitter Power Dissipation: 8,000 watts (24 RF channels)
- 8.6.7.5** System Controller: 850 watts
- 8.6.7.6** Battery Charger/Inverter: 2,000 watts
- 8.6.7.7** Lighting: 750 watts (Intermittent)
- 8.6.8** Buildings shall incorporate a thermostatically controlled fan system designed to operate in the event of a total HVAC failure and where the building's interior temperature exceeds 90°F.
 - 8.6.8.1** This system shall incorporate appropriate dampers, screens and filters to limit dust and insect entry into the building.
 - 8.6.8.2** A second fan system of this type shall be installed within the generator space.

8.7 Shelter Alarm Systems

- 8.7.1** The Contractor shall furnish and install an over/under temperature sensor, continuously adjustable over the range of 32°F to 120°F, having independent Form-C output contacts suitable for high/ low temperature alarm activation.
- 8.7.2** The Contractor shall furnish and install a door entry alarm sensor, magnetic type, having a Form-C contact closure output.
- 8.7.3** The Contractor shall furnish and install single-loop smoke/ fire alarm system.
- 8.7.4** Smoke/fire alarm sensors shall be mounted above battery charger equipment, in the generator room, and in vicinity of AC power distribution panel board.
 - 8.7.4.1** Smoke/fire alarm panel shall have visual indicators depicting individual alarm sensor status.
 - 8.7.4.2** Smoke/fire alarm panel shall operate from both 120VAC and 12VDC battery power sources.
- 8.7.5** All shelters shall be equipped with an inert gas fire suppression system that is environmentally approved and not injurious to communications personnel. The system shall be connected to the shelter fire/ smoke system alarms. Trigger of the system causing a gas discharge shall cause the air conditioners to automatically shut off.

- 8.7.6** The air conditioner units must be manually restarted to purge the shelter of the gas, after all evidence of combustion is resolved. All necessary plumbing and overhead dispersal equipment shall be provided. The system shall have modes for test and maintenance that do not trigger activation. The system shall be installed and delivered with a primary tank, online and a spare, full tank, offline.

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9.0 LPG Generator Equipment Requirements

9.1 A standby power generator system shall be furnished by the Contractor for each infrastructure site. For its proposed infrastructure sites, the Vendor shall include:

9.1.1 The necessary labor and materials, as required, to furnish and install LPG fuel tanks, automatic transfer switches, manual-operated auxiliary generator connector facilities, alarm functionality and electrical wiring services to provide fully operational standby power systems.

9.1.2 A generator housed within the provided equipment shelter, in accordance with the manufacturer's specifications for shock and vibration mounting, ventilation, fuel supply and electrical connections.

9.1.3 The radiator air inlet shall incorporate a baffle to protect the radiator core from exterior wind-blown debris damage.

9.1.4 It shall be the responsibility of the Contractor to provide, install and test a complete and operable standby power generator with automatic transfer switch.

9.1.5 Equipment shall be new, factory tested at 0.8 power factor for 3-hours and shall be installed within the required equipment shelters, in accordance with local area building and electrical codes.

9.1.6 The following documentation shall be supplied by the Contractor for the generator set and transfer switch supplied:

9.1.6.1 Specification and data sheets for the exact type and model generator and transfer switch supplied pursuant to this procurement, including all options and accessories included.

9.1.6.2 Manufacturer's certification of prototype testing.

9.1.6.3 Manufacturer's warranty documents.

9.1.6.4 Shop drawings showing plan and elevation views of the equipment.

9.1.6.5 Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.

9.1.6.6 Manufacturer's installation instructions.

- 9.1.6.7 Operator's and maintenance manuals that outline routine maintenance and troubleshooting procedures.
 - 9.1.6.8 Transfer switch manual and wiring diagram.
 - 9.1.7 Start-Up Service shall be included with the following requirements:
 - 9.1.7.1 A factory authorized service representative shall provide initial start-up service and shall conduct on site acceptance testing.
 - 9.1.7.2 The representative must remain until site acceptance is completed, as witnessed by Customer.
 - 9.1.7.3 Load test records for the installed generator system shall be furnished to Customer.
 - 9.1.8 The following type of engine configuration will be used:
 - 9.1.8.1 The generator package shall include an LPG configured engine coupled with low reactance, brushless 120/240vac single-phase, 60Hz generator.
 - 9.1.8.2 The generator package shall be equipped with:
 - 9.1.8.2.1 A temperature compensated automatic voltage regulator;
 - 9.1.8.2.2 Under/over-speed protection function;
 - 9.1.8.2.3 A control panel;
 - 9.1.8.2.4 Engine block heater;
 - 9.1.8.2.5 High ambient-temperature cooling system.
 - 9.1.9.1 Output power rating of the generator shall be sized for the full calculated load of the affiliated site, inclusive of a 50% excess load factor.
 - 9.1.9.2 In no instance shall the proposed generator be configured for less than 45KW output.

9.1.9.3 The generator shall also be capable of continuous 24-hour operation, full single-phase output at 1.0 pf.

9.1.9.4 The following specifications shall also apply:

9.1.9.4.1 Voltage Regulation: Maintained with +/- 2% of rated voltage for constant load between no load and full

9.1.9.4.2 Frequency Regulation: Maintained within 0.5% from steady state no load to steady state rated load.

9.1.9.4.3 Single-Step Load Pickup: 100% of rated output power, less applicable derating factors, with the engine generator at operating temperature.

9.1.10 The generator shall have the following Set Controls:

9.1.10.1 The generator shall be a remote-start type compatible with the automatic transfer switch to be supplied pursuant to this procurement.

9.1.10.2 Manual starting and stopping shall be provided from the control panel.

9.1.10.3 Cranking control: Shall provide a minimum of three cranking cycles of at least 15-seconds before lockout and activation of an over-crank alarm condition.

9.1.10.4 The generator shall automatically shut down and lock out upon:

9.1.10.4.1 Failure to start (over-crank)

9.1.10.4.2 Over speed

9.1.10.4.3 Low lubricating oil pressure

9.1.10.4.4 High engine temperature

9.1.10.4.5 Low Coolant level

9.1.10.4.6 Other factors that may be harmful to the generator

- 9.1.11** Alarm contacts shall be provided to allow transmission of fault alarms for any of the above conditions, plus low oil pressure pre-warning, high coolant temperature pre-warning, low coolant temperature, low fuel and an alarm indication when the generator set is running.
 - 9.1.11.1** These alarm contacts shall be wired into, and shall be reported by, the radio network alarm system.
- 9.1.12** Meters shall be provided and located both at the generator and within the equipment shelter, to indicate output voltage, output current, running time, and frequency/RPM.
- 9.1.13** An AC rheostat (or electronic equivalent) shall be supplied for fine tuning of the generator's output voltage.
- 9.1.14** These devices shall be mounted either on the transfer switch door or a separate, remote panel.
- 9.1.15** Each generator must have the capability to communicate to a central control software terminal, via the IP network, to allow for remote start and other diagnostic capabilities.
- 9.1.16** Each LPG-Generator shall have the following Fuel Supply requirements:
 - 9.1.16.1** The Contractor shall supply a new, corrosion-proof, 1,000-gallon LPG storage tank to be installed on a concrete or elevated steel foundation, as dependent upon site flood plain conditions.
 - 9.1.16.2** The fuel tank shall provide sufficient fuel to provide six days of continuous operation of the generator set, at full load under low ambient temperature.
 - 9.1.16.3** The fuel tank shall have a shield installed above to prevent debris from the nearby tower puncturing or damaging the tank shell.
 - 9.1.16.4** The tank shall be refilled after the conclusion of radio network acceptance tests.
 - 9.1.16.5** Fuel lines shall be buried below the frost line, as determined by the location. At any point at which the fuel line exits above grade, the line shall be insulated to reduce condensation at the regulator.

- 9.1.16.6** A low fuel level alarm shall be provided.
- 9.1.16.7** All fuel supply lines will be sized accordingly for the generator running at full load.
- 9.1.16.8** All necessary regulators, drip pots, piping, meters, or other supplies needed for installation that meets local fire and building codes shall be furnished and installed.
- 9.1.16.9** Contractor shall supply a full fuel tank at time of System Acceptance.
- 9.1.17** A residential-grade exhaust silencer shall be installed on the generator.
- 9.1.18** Battery and Charger specifications are as follows:
 - 9.1.18.1** A lead acid starting battery, rated for the engine type to be supplied, shall be furnished and installed with the generator package.
 - 9.1.18.2** This battery shall be float charged by a 10-ampere, voltage-regulated charger which is powered by a protected 120VAC source.
 - 9.1.18.3** Float, taper and equalize charge settings shall be provided.
 - 9.1.18.4** Battery charger shall be physically located within the generator transfer switch enclosure.
 - 9.1.18.5** Battery and charger must be able to operate in, as low as, 0 degrees F.
 - 9.1.18.6** Form-C charging system alarm contacts shall be provided and connected to the network's alarm system to report loss of AC power, low battery voltage and excessively high battery charging current.
- 9.1.19** The following Cooling System components are required:
 - 9.1.19.1** A radiator-cooled engine is required.
 - 9.1.19.2** The radiator shall be filled with a water/coolant mixture in accordance with the engine manufacturer's recommendations.
 - 9.1.19.3** A thermostatically-controlled water jacket coolant heater shall be provided and installed in accordance with the manufacturer's recommendations.

9.1.20 The Generator Base shall have the following characteristics:

- 9.1.20.1** The generator set shall be mounted on a heavy-duty steel base which is anchored to a Contractor-furnished building foundation.
- 9.1.20.2** The base shall maintain alignment between generator set components and shall include vibration isolators.

9.2 The Generator Transfer Switch

9.2.1 An automatic transfer switch which provides switching of the equipment shelter electrical load between commercial power and generator power shall be supplied and installed for each Vendor proposed standby generator.

- 9.2.1.1** Each transfer switch shall be completely factory assembled and shall contain electronic controls designed for surge voltage isolation, with voltage sensors on all phases of both input power sources.
- 9.2.1.2** Permanently attached manual handles shall also be installed on the transfer switch.
- 9.2.1.3** The switch shall provide positive mechanical and electrical interlocking, and mechanically-held contacts.
- 9.2.1.4** Quick-make and quick-break contact mechanisms shall be provided for manual transfer under load.
- 9.2.1.5** Each transfer switch shall be installed in a key locking, UL listed, NEMA rack to be mounted on a wall within the radio equipment shelter.
- 9.2.1.6** The switch shall be fully wired and integrated with the engine generator set in accordance with local electrical and fire codes.
- 9.2.1.7** A manually-operated transfer switch, as well as appropriate power connectorization, shall be provided to allow the interconnection of an auxiliary, trailered generator set should the permanently-located generator fail in operation, utilizing an Appleton plug.
- 9.2.1.8** All transfer switches and accessories shall be U.L. listed and labeled, tested per U.L. Standard 1008 and CSA Approved.
- 9.2.1.9** Transfer switches shall be double-throw electrically and mechanically interlocked and mechanically-held in both positions.

- 9.2.1.10** Main switch contacts shall be high-pressure silver alloy.
- 9.2.1.11** Contact assemblies shall have arc chutes for positive arc extinguishment. Arc chutes shall have insulating covers to prevent inter phase flashover.
- 9.2.1.12** Form-C contacts shall be provided in each main switch position for alarm reporting purposes.
- 9.2.1.13** These contacts shall be connected to the network's alarm system for reporting transfer status.
- 9.2.1.14** Each transfer switch shall be continuously rated for operation in ambient temperature ranges of -40 to +50 degrees Celsius.
- 9.2.1.15** Transfer switches shall be rated, minimally, to carry the generator's full rated output, inclusive of the 50% added capacity over calculated equipment loading.
- 9.2.1.16** The Line-In, Generator-In and Load side terminations for the automatic transfer switch shall be protected from lightning transients using a combination of Metal Oxide Varistor (MOV) and avalanche Zener diode technologies.
- 9.2.1.17** All alarm and instrumentation wiring from the generator, that enters the equipment shelter, must likewise include appropriate lightning surge protection in the form of solid-state, fast-acting voltage clamp devices whose clamping voltage is closely matched to normal individual-alarm signal amplitudes.
- 9.2.1.18** Transfer switch control shall be solid state and designed for a high level of immunity to power line surges and transients.
- 9.2.1.19** The device shall be tested in accordance with IEEE Standard 587-1980 (or latest revision).
- 9.2.1.20** Controls shall have optically isolated logic inputs, and isolation transformers for AC inputs.
- 9.2.1.21** Relays shall be installed on all outputs.
- 9.2.1.22** Solid state under voltage sensors shall simultaneously monitor all phases of the standby power source and the commercial power

- 9.2.1.23** Pick up and drop out voltage settings shall be adjustable.
- 9.2.1.24** Voltage sensors shall allow for adjustment to sense partial loss of voltage on any phase.
- 9.2.1.25** Controls shall be provided with solid state over voltage sensors, adjustable from 100-130% of nominal input voltage to monitor the source.
- 9.2.1.26** An adjustable time delay shall be provided.
- 9.2.1.27** Automatic controls shall signal the engine generator to start upon signal from normal source sensors.
- 9.2.1.28** A time delay start, variable from 0 to 5 seconds, shall be provided to avoid nuisance startups.
- 9.2.1.29** Battery voltage starting contacts shall be gold, dry type contacts which have been factory wired to a field wiring terminal block.
- 9.2.1.30** The switch shall transfer when the emergency source reaches the set point voltage and frequency.
- 9.2.1.31** A time delay shall be provided for transfer that shall be continuously variable from 0 to 120 seconds.
- 9.2.1.32** The switch shall retransfer the load to commercial power after a delay.
- 9.2.1.33** This time delay shall be variable (adjustable) from 0 to 30 minutes to avoid short engine run times.
- 9.2.1.34** The retransfer time delay shall be immediately bypassed if the emergency generator fails.
- 9.2.1.35** A control shall automatically signal the engine generator to stop after a time delay, which shall be adjustable from 0 to 10 minutes, the time starting upon return to commercial power.
- 9.2.1.36** Power for transfer operation shall be from the source to which the load is being transferred.
- 9.2.1.37** Diagnostic indicators shall be provided to allow the last successful step in the sequence of control functions to be pinpointed.

9.2.1.38 The present status of the control functions shall also be indicated.

9.2.1.39 These functions, at a minimum, shall include:

9.2.1.39.1 Source 1 OK

9.2.1.39.2 Start generator set

9.2.1.39.3 Source 2 OK

9.2.1.39.4 Transfer timing

9.2.1.39.5 Transfer complete

9.2.1.39.6 Retransfer timing

9.2.1.39.7 Retransfer complete

9.2.1.39.8 Timing for stop

9.2.2 A key-operated Front Panel selector switch shall be provided which will provide the following functions:

9.2.2.1 Test to simulate commercial power loss to allow testing of the generator set with or without transfer of the load.

9.2.2.2 Normal - leaves the transfer switch in its normal operating position.

9.2.2.3 Retransfer a momentary position which will provide an override of the retransfer time delay and cause immediate return to the commercial power source (if available).

9.2.3 An Exerciser Clock setting shall be included which allows setting the day, time and duration of a generator set exercise/test period. Tests under load or with no load shall be selectable.

10.0 Tower Requirements

10.1 Basic Design

- 10.1.1** The basic standard for the design of newly required steel antenna towers, wave guide bridges and supporting structures, shall be ANSI/EIA-222H.
- 10.1.2** Towers shall be triangular shaped, solid-rod structure having an overall height to be determined by the Contractor, based on the requirements of area coverage and availability of unobstructed microwave paths for site connectivity. Limits of available space in certain areas may dictate the use of self-support towers.
- 10.1.3** Each tower shall be designed for a minimum sustained 150-mph wind speed with the full complement of necessary antennas and required lights and other Federally-required equipment.
- 10.1.4** Antenna loads shall be as determined by Contractor; however, the design shall include a minimum 30% growth factor in the top 1/3 of the tower, inclusive of microwave antennas.
- 10.1.5** All fabricated tower assemblies and parts shall be hot-dipped galvanized after fabrication per ASTM Standard A123. Hardware shall be galvanized per ASTM Standard A153 and B695. Other types of zinc coating or plating are not
- 10.1.6** Towers shall be supplied with a full-length transmission line ladder(s) designed to accept transmission lines needed for the proposed design plus a 30% growth factor.
- 10.1.7** Towers shall be equipped with an outside climbing ladder/cable type safety devices and LED lighted in accordance with FAA and current OSHA regulation 29 CFR 1910.27.
 - 10.1.7.1** This device shall not interfere with the ease of climbing from one rung of the ladder to the next.
 - 10.1.7.2** There must be at least two sources of climbing safety belts compatible with the safety climb anti fall system, as supplied with the tower.
- 10.1.8** Tower lighting shall conform to FAA Advisory Circular AC 70/7460-1L, or current revision, Obstruction Marking and Lighting. VHF, UHF and 800 MHz radio equipment may be operational/co-located at the various trunked radio sites. Therefore, it is imperative that only shielded, RFI-conditioned lighting devices be provided.

- 10.1.9** The Vendor shall provide detailed lighting equipment specification literature in its Submittal package sufficient in scope where Customer can determine the suitability of the proposed lighting system with respect to planned or anticipated radio operations.
- 10.1.10** Lighting system controls shall be installed on a temporary fixture adjacent to the tower, operate on a photocell and provide a Form-C contact to the alarm panel. (Note: This controller device is to be relocated within the site's equipment shelter once fully constructed. Please factor sufficient lighting control cable into the installation to allow the control equipment to be relocated.
- 10.1.11** Antennas, tower top pre-amps and transmission lines as specified by the licensed frequencies and Contractor's system design, shall be provided and installed by the Contractor.
- 10.1.1** A site's Electrical Grounding System shall be furnished and installed by the Contractor in accordance with the following minimum practices:
- 10.1.12.1** Install a ground ring around the base of the tower, consisting of 10'x 5/8" ground rods driven to a depth necessary to meet the required resistance measurement of the specifications, adjacent to the foundation of the tower at each leg.
 - 10.1.12.2** Ground rods are to be interconnected by a minimum #00AWG stranded copper wire, which is to be exothermically welded to the top of each ground rod.
 - 10.1.12.3** Copper wire and ground rods are to be installed in a trench below the local frost line.
 - 10.1.12.4** Maximum spacing between rods shall not exceed twice the length of the ground rod.
 - 10.1.12.5** Each tower leg shall be bonded to the ground ring using #00AWG stranded tinned copper cable, which has been exothermically welded to a flat, 4-inch square solid steel tab located near the base of each tower leg.
 - 10.1.12.6** Each cable lead will run to the closest ground rod through an insulated sleeve to minimize wire damage.

- 10.1.12.7** The upper end of the sleeve should be sealed with a non-shrinking compound such as RTV to prevent water from collecting within the sleeve.
- 10.1.12.8** The Contractor shall avoid making any acute bends as the ground wire transitions from the foundation.
- 10.1.12.9** Bends should be a minimum of 9-inches in radius.
- 10.1.12.10** To complete the exothermic welding process, attachment area on the tower tab shall be cleaned and coated with a cold galvanizing
- 10.1.12.12** The ground bar must be tamper and theft resistant. The wire lead must be sleeved so that it is protected from physical damage.
- 10.1.12.13** Like above, the upper end of the sleeve shall be sealed with a non-shrinking compound like RTV to prevent water from entering and collecting within the sleeve.
- 10.1.12.14** This ground wire lead shall be installed at the time the tower ground ring is installed.
- 10.1.12.15** The ground rod/ring system shall extend around the perimeter of the equipment shelter, transmission line copper entrance port into the shelter and to the perimeter fence.
- 10.1.12.16** Ground system ring around the tower base shall be located a minimum of 36 inches away from the tower foundation.
- 10.1.12.17** The tower ground system ring shall be connected to the equipment shelter ground ring in at least two places, on the closest corners of the shelter ring.
- 10.1.12.18** The Contractor shall electrically bond all transmission line outer shields to the structure at the top of the tower immediately below the antenna and at the line midpoint if the tower's height is over 200-feet.
- 10.1.12.19** Likewise, bond all transmission line shields near the bottom segment of the tower, approximately one-foot above the bend made to enter the waveguide-bridge and again at the shelter's antenna entry

- 10.1.12.20** Use only transmission line grounding kits approved by the manufacturer for use on the type and diameter of transmission lines provided. All installed grounding kits shall be weather sealed.
- 10.1.12.21** Fencing shall be grounded to the ground ring via #2AWG solid copper wires, bonded via exothermic welding at each fence post.
- 10.1.12.22** Exothermic welds shall be cleaned and protected with a minimum two coats of cold galvanize material. Gates shall utilize braided, flexible straps.
- 10.1.12.23** The shelter's interior halo ground and transmission line copper inside entrance port (buss bar) shall exothermically bond to the outdoor ground.
- 10.1.12.24** A ground test well shall be provided at a minimum of two locations along the ground loop.
- 10.1.12.25** One test well shall be located adjacent to the tower and the other at the far side of the equipment shelter loop.
- 10.1.12.26** Each test well shall consist of a minimum 6-inch diameter PVC material that extends down to the depth of two feet and shall allow the attachment of a test wire to measure ground resistance.
- 10.1.12.27** A screw on or drop on cover that is easily removable to allow testing shall be provided.
- 10.1.12.28** Grounding system resistance shall be measured to be 3-ohms or less between any point on the ground system and earth ground.
- 10.1.12.29** Measurement shall be done with a 4-point ground resistance tester and not by a clamp on resistance tester.

10.2 Guy Wires

- 10.2.1** Galvanized guy strand shall conform to the minimum requirements of ASTM Standard A475 Extra High Strength (EHS) or equivalent recognized standard.
- 10.2.2** Preformed guy grips and dead-ends shall be designed specifically for the length, size and type of cable being used. This shall include the size, number, and lay of the wires and electrochemical compatibility of the material.

- 10.2.3** An adequate bend radius shall be provided, as per the manufacturer's recommendations, at the inside of cable attachments consisting of a thimble.
- 10.2.4** Shackles used to connect guy assemblies shall be forged from AISI grade 1035 or 1045 steel or equivalent and suitably heat-treated (quenched and tempered, normalized or annealed).
- 10.2.5** Turnbuckle devices shall be installed at the anchor end of the guy assembly for adjusting the guy tension. In initial installations, the minimum take-up adjustment available after the structure is plumb and the guy tensions are set shall be 6 inches for guys with normal diameter of 0.5-inches and 10-inches for guys with normal diameter greater than 0.5 inches.
- 10.2.6** All guy wires shall be bonded to ground rods using, minimally, a #2AWG solid, tinned copper wire. Bonding shall include use of guy wire grounding clamps that are tin-plated bronze (or similar type material) to prevent electrolysis. Grounding attachment clamps shall be installed above the guy wire turnbuckle.
- 10.2.7** Guy wire anchor plates are to be grounded using, minimally, a #2AWG solid, tinned copper wire that is exothermically welded to the anchor plate. Welds shall be cleaned and treated with cold galvanized coatings to prevent rusting.
- 10.2.8** All guy wires shall include ice clips ahead of the preforms. Turnbuckle safety cables must use a "Figure 8" configuration.

10.3 Required Tower Submittals

- 10.3.1** The Contractor shall furnish wind-load stress, geotechnical reports and foundation calculations used in the design of the proposed tower structure. Existing towers shall be evaluated for structural, electrical grounding and foundation stability, inclusive of identification/resolution of corrosion within tubular members and the suitability to support additional antenna loads as necessary to accommodate the newly added Contractor- furnished equipment.
- 10.3.2** The Contractor shall furnish documentation approved by a registered professional engineer, licensed in the State of Georgia certifying that the proposed new tower(s) and foundation(s), as well as required modifications to be made to existing towers, meet the requirements of TIA-222H.
- 10.3.3** Prior to initial design review, Contractor shall perform soil pH value testing at all proposed new tower sites.

- 10.3.4** The Contractor shall furnish written certification that all installed tower components on both new and existing towers have been properly constructed and hot-dipped galvanized.
- 10.3.5** The Vendor shall furnish documentation as to any special condition or restriction applied to the use of materials, products or equipment contained in their Response Submittal.
- 10.3.6** Contractor shall provide to Customer, a minimum of two sets of completed “as-builts” on each tower and shelter installed or modified in this project. In the case of new structures, this shall include engineering and design documentation from the tower and shelter manufacturer.
- 10.3.7** Installed structural members or welded structural assemblies, except for standard hardware, shall have a part number. The part numbers shall correspond with the Contractor’s assembly drawings. Part numbers are to be permanently attached (stamped, welded lettering, and/or stamped on a plate that is welded to the member, etc.) to the member before all protective coatings are applied. Attached/affixed part numbers shall have a minimum character height of 0.50 inches.
- 10.3.8** The Contractor shall provide a detailed report of electrical ground resistance measurements of the completed, as-installed, electrical grounding system, on a per-site basis with field drawings to indicate the measurement at a specific

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11.0 Site Work Requirements

11.1 Site Preparation and Sub-grading

11.1.1 General

Site clearing, initial earthwork and rough grading and final grading as needed for installation of towers and equipment shelters is the responsibility of the Contractor. The following describes a set of minimum requirements for the execution and completion of site-related construction activities.

11.1.2 Dewatering of the Site

11.1.2.1 Control grading around excavations to prevent surface water from flowing into excavation areas.

11.1.2.2 Drain or pump as required thereby maintaining all excavations, trenches and pier holes free of water from any source and discharge to approved drains or channels. Commence dewatering action when water first appears and continue until work is complete to the extent that no damage will result from hydrostatic pressure, flotation, or other causes.

11.1.2.3 Use pumps of adequate capacity to ensure rapid drainage of area, and construct and use drainage channels and sub-drains with sumps, as required.

11.1.2.4 Remove unsuitable excessively wet sub-grade materials and replace with approved backfill material.

11.1.3 Soil Compaction

11.1.3.1 Compact sub-grades, fills, embankments and backfills using spreading equipment, tamping rollers, rubber-tired rollers, vibratory compactors, or power tampers, as required to obtain reasonable uniformity. Nuclear soil testing results are required to be provided in a report to the Consultant.

11.1.3.2 Perform within moisture content range as specified to obtain required results with equipment used.

11.1.3.3 Achieve minimum densities specified as references to:

11.1.3.3(a) Cohesive soils - 95 percent maximum density at optimum moisture, AASHTO T99.

11.1.3.3(b) Cohesionless Soils – 70 percent of maximum relative density.

- ASTM, STP 479 Bunnister method.
- USBR - E12 relative density.
- Relative density, ASTM D2049

11.2 Drilled Pier Foundations

11.2.1 General

Extent of Work: Perform all drilling and excavation and supply all labor and materials to construct drilled pier foundations, as necessary.

11.2.2 Performance

11.2.2.1 Quality Assurance will be met with a field inspection of the Customer's quality control designee.

11.2.2.1(a) Customer's Project Representative will be designated to be responsible for field inspection of the drilled pier foundations. The representative will transmit, in writing, to the consultant and contractor any materials or methods observed that do not conform to this specification and, if required, will not be considered for payment. Customer's Project Representative must inspect each drilled pier.

Specific responsibilities of the Customer's Project Representative will be:

- Observe drilling excavation of drilled pier foundations. Ensure the placement of anti-caving physical barriers or the use of special drilling mud to prevent excessive cavitation.

- Inspect bearing elevation of drilled piers.
 - Observe placement of concrete and rebar within the drilled pier foundation to match design specification. Ensure that no excessive earth contamination occurs. Contamination of poured concrete is sufficient to cancel the pour and request engineering inspection.
 - Customer's representative shall photograph or film all foundation excavation and pouring activities
- Contractor's Qualifications

11.2.2.1(b) The Contractor's qualifications must be minimum of two-year's experience in drilled pier construction, including experience with similar subsurface material, water conditions, shaft sizes, and special techniques as required.

11.2.2.2 Drilled Pier Details

11.2.2.2(a) Drilled pier shaft dimensions and top elevations shall be in accordance with foundation design calculations and drawings.

11.2.2.2(b) The drilled pier shaft bearing, or bottom elevation shall be at the elevation indicated, unless it is determined by the Customer that the bearing elevation should be adjusted.

11.2.2.2(c) The excavate pier shaft shall be drilled to required dimensions and elevations as indicated. Sidewall stability will be maintained during drilling and extend excavation to suitable material.

11.2.2.2(d) Inspection of each pier will be by the Customer's Project Representative and Contractor to determine suitability of supporting material for drilled piers.

11.2.2.2(e) Remove from bottom of drilled piers, loose material or free water in quantities sufficient to cause settlement or affect concrete strength as determined by

- 11.2.2.2(f)** Install temporary casing, where required, to prevent caving of drilled pier sides or excessive seepage.
- 11.2.2.2(g)** Dewater all drilled pier excavations prior to cleaning, inspection, and placing concrete.
- 11.2.2.2(h)** Each drilled pier must be inspected and approved by Customer's Project Representative before any concrete may be placed.
- 11.2.2.2(i)** Dispose of any excavated material at locations approved for that purpose.

11.2.2.3 Reinforcing Steel

- 11.2.2.3(a)** Place reinforcement for drilled piers in accordance with foundation design documents.
- 11.2.2.3(b)** Place bars as shown on foundation drawings with concrete cover of not less than 3-inches where exposed to soil.
- 11.2.2.3(c)** A reinforcing cage shall be designed as a structural element and braced to retain its configuration throughout the placing of concrete and the extraction of the casing (if used) from the shaft.
- 11.2.2.3(d)** Dewater drilled piers and maintain the excavation free of water prior to placing concrete.
- 11.2.2.3(e)** Place concrete immediately after final inspection.
- 11.2.2.3(f)** Place concrete immediately after completion of excavation and after Customer's Project Representative has completed his inspection. Do not leave uncased excavations open overnight.
- 11.2.2.3(g)** Free fall concrete (not over 6 feet) may be used provided it is directed through a hopper, or equivalent; such that fall is vertical down center of shaft without hitting sides. Vibrate concrete only after casing, if used, has been pulled.

- 11.2.2.3(h)** Place concrete in pier in one continuous pour operation from bottom to top.
- 11.2.2.3(i)** Customer's Project Representative will provide inspection during the removal of casing and placing of concrete. Withdraw casing, if used, only as shaft is filled with concrete. Always maintain an adequate head of concrete to balance outside soil and water pressure above the bottom of the casing during withdrawal. Specific procedures that the Contractor will follow to accomplish this objective shall be
- 11.2.2.3(j)** Where the casing is removed, provide specifically designed concrete with a minimum slump of 5-inches and with a retarder to prevent arching of concrete (during casing pulling) or setting concrete until after casing is pulled. Check concrete level prior to, during, and after pulling casing. Pull casing before slump decreases below 5-inches as determined by testing.
- 11.2.2.3(k)** During casing extraction, upward movement of the reinforcing steel shall not be permitted. Downward movement should not exceed 2-inches per shaft
- 11.2.2.3(l)** Remove all water and concrete contaminated with soil, or water before resuming concrete placement.
- 11.2.2.3(m)** Center reinforcing cages in the drilled pier excavation and suspend them in an approved manner prior to placement of concrete to the cutoff elevation.
- 11.2.2.3(n)** Leave forms on pier for a period of three days.
- 11.2.2.3(o)** Set anchor bolts to the manufacturer's required tolerances, using substantial templates or other approved method.

11.3 Concrete, Forms and Reinforcement

11.3.1 General

This Specification includes concrete, forms, and steel reinforcement. This includes drilled pier foundations with square caps for steel structures, concrete pads for transformers and breakers, equipment shelter and tower foundations, and cable trenches.

11.3.2 Quality Assurance and Applicable Standards

11.3.2.1 American Concrete Institute (ACI)

- 11.3.2.1(a)** ACI 304 - Recommend Practice for Measuring, Mixing, and Placing Concrete.
- 11.3.2.1(b)** ACI 305 - Committee Report on Hot-Weather Concreting.
- 11.3.2.1(c)** ACI 306 - Committee Report on Cold-Weather Concreting.
- 11.3.2.1(d)** ACI 315 - Manual of Standard Practice for Detailing Reinforced Concrete Structures.
- 11.3.2.1(e)** ACI 318 - Building Code Requirements for Reinforced Concrete.

11.3.2.2 American National Standards Institute (ANSI)

- 11.3.2.2(a)** B 1 8.2.1 - Square and Hex Bolts and Screws, Including Askew Head Bolts, Hex Screws, and Lag Screws.
- 11.3.2.2(b)** B 1 8.2.2 - Square and Hex nuts.

11.3.2.3 American Society for Testing and Materials (ASTM)

- 11.3.2.3(a)** A36 - Structural Steel.
- 11.3.2.3(b)** A82 - Cold-Drawn Wire.
- 11.3.2.3(c)** AI 85 - Welded Steel Wire Fabric for Concrete Reinforcement.

- 11.3.2.3(d)** A307 - Low-Carbon Steel Externally and Internally Threaded Standard Fasteners.
- 11.3.2.3(e)** A615 - Deformed Billet Steel Bars for Concrete Reinforcement.
- 11.3.2.3(f)** C31 - Making and Curing Concrete Compression and Flexure Test Specimens in the Field.
- 11.3.2.3(g)** C33 - Concrete Aggregates.
- 11.3.2.3(h)** C39 - Compressive Strength of Cylindrical Concrete Specimens.
- 11.3.2.3(i)** C94 - Ready-Mixed Concrete.
- 11.3.2.3(j)** C 143 - Slump of Portland Cement Concrete.
- 11.3.2.3(k)** C 150 - Portland Cement.
- 11.3.2.3(l)** C309 - Liquid Membrane-Forming Compounds for Curing Concrete.

11.3.2.4 Midwest Concrete Industry Board (MCIB)

11.3.3 Equipment and Materials

11.3.3.1 Concrete Materials

- 11.3.3.1(a)** Cement must conform to ASTM C 150. Portland cement Type 1.
- 11.3.3.1(b)** Water shall be clean and free from injurious amounts of oil, acids, alkaline, or other deleterious substances. Any potable drinking water will be acceptable.
- 11.3.3.1(c)** Fine Aggregates such as Clean natural sand. Manufactured sand may be used upon written approval of Customer's designee. They shall Conform to ASTM C33.
- 11.3.3.1(d)** Coarse aggregates such as Clean crushed stone or processed gravel, not containing organic materials shall conform to ASTM C33.

11.3.3.1(e) 4-6 percent air shall be used in all concrete.

11.3.3.1(f) Water reducing admixture shall conform to ASTM C494, Type A.

11.3.3.2 Concrete Mix

11.3.3.2(a) Ready-mixed Concrete shall meet requirements of ASTM C94, and of materials and proportions specified.

11.3.3.2(b) Ready-mixed concrete plant shall be subject to approval of Customer's Project Representative.

11.3.3.3 Form materials

11.3.3.3(a) Exterior grade plywood minimum 5/8 inch thick.

11.3.3.3(b) Approved wood fiberboard.

11.3.3.3(c) Dressed lumber, free of loose knots.

11.3.3.3(d) Form ties shall be approved break-back type.

11.3.3.4 Steel Reinforcement

11.3.3.4(a) Reinforcement bars shall conform to ASTM A615, Grade 60 for all bars No. 4 or larger.

11.3.3.4(b) Tie and-all No.3 bars shall conform to ASTM A615, Grade 40.

11.3.3.4(c) Welded wire fabric shall conform to ASTM A185, using bright basic wire conforming to ASTM A82. Wire gauge No. 11 or smaller shall be galvanized.

11.3.3.5 Anchor Bolts

11.3.3.5(a) All anchor bolts required for complete installation shall be provided.

11.3.3.5(b) Anchor bolts and accessories shall conform to ASTM A307 using A36 steel.

- 11.3.3.5(c)** Use hexagonal bolts and nuts conforming to ANSI B 1 8.2.1 and B 1 8.2.2.
- 11.3.3.5(d)** All exposed area of anchor bolts and nuts, plus a minimum of three inches of embedded area, shall be hot-dipped galvanized.
- 11.3.3.5(e)** Install as indicated on foundation drawings.

11.3.4 Performance

11.3.4.1 Field Testing

Field testing of concrete and making of the concrete test cylinders will be

11.3.4.2 Laboratory Testing

- 11.3.4.2(a)** Laboratory for testing shall be selected and paid by the Vendor.
- 11.3.4.2(b)** Laboratory will furnish cylinder molds with cap seals or adequate means of identification.
- 11.3.4.2(c)** Cylinders shall be tested conforming to ASTM C39. Average strength of two test cylinders (at 28 days) shall be used as result of the test. Break one test cylinder after 7-days curing, one after 14-days, and two after 28-days.
- 11.3.4.2(d)** Results shall be provided to the Project Representative in a formal report. A copy shall be provided to the Consultant and Contractor.

11.3.4.3 Low Strength Concrete

Low strength is defined as concrete whose 7-day and 14-day test (average of 2 cylinders) is less than 70% and 85%, respectively, of the specified minimum 28-day compressive strength.

- 11.3.4.3(a)** Concrete shall remain accessible with no other work performed that relates to or depends upon the questionable concrete until a formal decision as to the disposition of the concrete is given by Customer's Project Representative.
- 11.3.4.3(b)** Low strength concrete shall be removed and replaced if requested by Customer's designee.

11.3.4.4 Preparation and Placing of Concrete

- 11.3.4.4(a)** Clean bonding surfaces free from laitance and foreign materials.
- 11.3.4.4(b)** Place concrete on property prepared and unfrozen sub grade and only in dewatered excavations.
- 11.3.4.4(c)** Do not deposit partially hardened concrete or concrete contaminated by foreign materials.
- 11.3.4.4(d)** Placing the concrete shall Conform to ACI 304.
- 11.3.4.4(e)** Place concrete within 60 minutes after mixing, except Customer's designee may extend the period to 90 minutes (maximum) dependent upon weather conditions.
- 11.3.4.4(f)** Place in horizontal layers not exceeding 18-inches.
- 11.3.4.4(g)** Vibrate concrete to produce solid mass without honeycomb or surface air bubbles.

11.3.4.5 Curing of Concrete

- 11.3.4.5(a)** Cure with liquid membrane-forming compound conforming to ASTM C309, Type I. Apply per manufacturer's recommendations.

11.3.4.5(b) Apply curing compound to all exposed surfaces immediately after removing form or after finishing concrete.

11.3.4.5(c) Keep formwork wet until stripped.

11.3.4.6 Placing Concrete in Cold Weather

11.3.4.6(a) Conform to the practice recommended in ACI 306 when the temperature is below 40-degrees F or is likely to fall below 40-degrees F during a twenty-four-hour period after placing.

11.3.4.6(b) Protect pier caps and other concrete from freezing using insulating blankets.

11.3.4.7 Placing Concrete in Hot Weather

11.3.4.7(a) Conform to practices recommended in ACI 305 when temperature is 90-degrees Fahrenheit or above or is likely to rise above 90-degrees Fahrenheit within a twenty-four-hour period after placing.

11.3.4.8 Concrete Construction Joints

11.3.4.8(a) Locate where indicated. Conform to AC 318.

11.3.4.8(b) Clean and break laitance or other foreign material from bonding surface. Bed with 1-inch of grout for bonding in horizontal joints.

11.3.4.9 Concrete Surface Float Finish

11.3.4.9(a) Compact, accurately screed, and wood float all slabs to a true uniform surface.

11.3.4.9(b) Test surface with straightedge and eliminate high and low spots of more than 1/8-inch in 10 feet.

11.3.4.9(c) Use this finish in addition to the finishes specified below for all surfaces as indicated.

11.3.4.9(d) Use a final finish for footing slabs not exposed.

11.3.4.10 Concrete Hand-troweled Finish

- 11.3.4.10(a)** Finish surface as in Float Finish and in addition, trowel and steel trowel to obtain a smooth dense finish after concrete has hardened to ring under the trowel.
- 11.3.4.10(b)** Use this finish on all floors, slabs, and equipment bases not specifically designated for a different finish.

11.3.4.11 Concrete Broom Finish

- 11.3.4.11(a)** Finish surface as in Float Finish and, in addition, draw a stiff bristled broom across the previously floated surface.
- 11.3.4.11(b)** Corrugations shall be uniform in appearance, not more than 1/16-inch in depth and shall be perpendicular to direction of traffic.
- 11.3.4.11(c)** Use this finish on all outdoor slabs subject to vehicular or pedestrian traffic and areas to receive grout.

11.3.4.12 Concrete Burlap Finish

- 11.3.4.12(a)** Apply burlap surface treatment to exposed edges of slabs, curbs and foundations.
- 11.3.4.12(b)** Wet and fill all voids using mortar with the same sand-cement ratio as original concrete. Use approximately 20 percent white cement to match concrete color.
- 11.3.4.12(c)** Strike off all excess mortar flush with the surface using a burlap or canvas cloth with a circular motion.
- 11.3.4.12(d)** Remove all rough spots and rub with cloth to leave a surface of uniform texture and appearance.
- 11.3.4.12(e)** Finish shall result in a coating of mortar that will fill all small voids and air holes leaving a smooth surface.
- 11.3.4.12(f)** Cure as specified under Curing Concrete.

11.3.4.13 Defective Concrete Surface Treatment

11.3.4.13(a) After removal of forms, remove all fins, projections and form ties.

11.3.4.13(b) Grout and cure all voids, damaged areas, and tie holes.

11.3.4.14 Concrete Forms

11.3.4.14(a) Treat forms with an approved oil or lacquer prior to placing reinforcement.

11.3.4.14(b) Wet forms with clean, clear water prior to placing concrete.

11.3.4.14(c) Adequately brace and stiffen forms to prevent deflection and settlement.

11.3.4.15 Steel Reinforcement

11.3.4.15(a) Place accurately, tie at intersection, and support on chairs. Conform to ACI 318.

11.3.4.15(b) Tie securely with 16 gauge or larger annealed iron wire

11.3.4.15(c) Splice steel not less than 30 bar-diameters for A615, Grade 40, and 42 bar-diameters for A615, Grade 60, unless otherwise indicated.

11.3.4.15(d) Splice plain bars not less than twice that for deformed bars.

11.3.4.15(e) Lap welded wire fabric not less than the length of one mesh.

11.3.4.15(f) No.3 bars to be Grade 40, with all others to be Grade 60.

11.3.4.15(g) Provide ¾-inch chamfer for all exposed edges of concrete, vertical and horizontal.

11.4 Fences and Gates (Chain-Link Security Type)

11.4.1 General

11.4.1.1 Quality Insurance and Applicable Standards

- 11.4.1.1(a)** Federal specification RR-F-191 - Fencing, wire and post, metal and gates, chain-link fence fabric, chain-link and accessories.
- 11.4.1.1(b)** RR-F-191 - Fencing, wire and post, metal and gates, chain-link fence fabric, chain-link and accessories.
- 11.4.1.1(c)** RR-F-221 - Fencing, wire, barbed wire, woven-wire and netting, fence post and accessories.

11.4.2 Requirements

- 11.4.2.1** Manufacturer's standard materials where such materials conform to these specifications or have been approved by Customer.
- 11.4.2.2** Conform to FS RR-F-191 except as indicated or specified otherwise.
- 11.4.2.3** Fence height – 8 feet high galvanized chain link with 3-strand barbed wire at top (9½ feet overall height).
- 11.4.2.4** Gate widths as indicated on layout drawings.
- 11.4.2.5** Finish for fence framework and appurtenances (excluding fabric) – Galvanized with minimum weight for zinc per square foot as follows:
 - 11.4.2.5(a)** Pipe – 1.8 ounces.
 - 11.4.2.5(b)** Hardware and accessories – conform to FS RR-F-191.
 - 11.4.2.5(c)** Barbed wire – 0.80 ounce.
- 11.4.2.6** Finish for Fence Fabric
 - 11.4.2.6(a)** Galvanized per ASTM A392, Class-2 with 1.8-ounce, minimum weight, for zinc per square foot or, aluminum coated per ASTM A491, Class-2 with 0.40-ounce, minimum weight, for aluminum per square

11.4.2.7 All fence and gates to have 3-strand barbed wire at top.

11.4.2.8 All materials furnished shall comply with the above requirements.

11.4.3 Fence Fabric

11.4.3.1 No.9 gauge, 2-inch diamond mesh chain-link fabric.

11.4.3.2 Top and bottom selva twisted and barbed.

11.4.3.3 Fabric fastenings of 9-gauge galvanized wire ties.

11.4.4 Post, Top Rail, and Braces

11.4.4.1 Post

11.4.4.1(a) End, angle, corner or pull posts – 3-inches O.D. at 5.79 pounds per foot.

11.4.4.1(b) Line posts – 2.5-inches O.D. at 3.65 pounds per foot.

11.4.4.2 Top Rail

11.4.4.2(a) 1.625-inch O.D. standard weight steel pipe.

11.4.4.2(b) 18-foot minimum length of each section.

11.4.4.3 Expansion Type Coupling for Each Joint.

11.4.4.3(a) Diagonal truss rods 3/8 inch in diameter equipped with truss tightened.

11.4.4.3(b) Horizontal braces – 1.660-inch O.D. at 2.27 pounds per foot.

11.4.4.4 Post tops shall be designed as a weather tight closure cap for tubular post.

11.4.4.5 Top Rail Expansion Type Coupling for Each Joint.

11.4.4.6 Malleable Iron or Pressed Steel Barbed Wire Supporting Arms

- 11.4.4.6(a)** Single arm at 45-degrees with vertical, sloping to outside of fence.
- 11.4.4.6(b)** Constructed for attaching three rows of barbed wire to each arm and designed as a weather tight closure cap for tubular posts.
- 11.4.4.6(c)** Designed for 200-pound minimum pull-down load.
- 11.4.4.6(d)** Attached to steel posts or integral with post top.
- 11.4.4.6(e)** Provided with openings to receive top rail

11.4.4.7 Malleable Iron or Pressed Steel Stretcher Bars

- 11.4.4.7(a)** One-piece, full height of fabric.
- 11.4.4.7(b)** 3/6-inch x 3/4-inch, galvanized.
- 11.4.4.7(c)** Bands of galvanized steel or malleable iron.

11.4.4.8 Malleable Iron or Pressed Steel Bolts

- 11.4.4.8(a)** Zinc coated.
- 11.4.4.8(b)** Conform to FS FF-B-575.

11.4.5 Barbed Wire

- 11.4.5.1** Two-strand, 12½ gauge wire with 4-point barbs 5 inches O.C.
- 11.4.5.2** Conform to FS RR-F-221, Type 1, Style 2.
- 11.4.5.3** Three rows required on all fence and gates.

11.4.6 Gates

11.4.6.1 Framing

- 11.4.6.1(a)** Frames of tubular members, 2-inch O.D. at 2.72 pounds per foot.
- 11.4.6.1(b)** Intermediate horizontal and vertical members for proper gate operation and for attachment of fabric, hardware and accessories.
- 11.4.6.1(c)** Frames assembled by welding or watertight galvanized steel rigid fittings.
- 11.4.6.1(d)** Diagonal cross bracing of 3/8 inch diameter adjustable truss rods to provide frame rigidity.
- 11.4.6.1(e)** Diagonal cross bracing of 3/8 inch diameter adjustable truss rods to provide frame rigidity.

11.4.6.2 Gate hardware hinges shall be of pressed or forged steel, or malleable iron, non-lift- off type, 1 to 1.2 pair per leaf.

11.4.6.3 Latches and Gate stops – Double Leaf.

- 11.4.6.3(a)** Plunger-bar type latch, full gate height, designed to engage gate stop of flush-plate type with anchors.
- 11.4.6.3(b)** Locking device and padlock eyes an integral part of
- 11.4.6.3(c)** Keeper to automatically engage gate leaf and secure free end of gate in full 90-degrees open position.

11.4.6.4 Latches – Single Leaf

- 11.4.6.4(a)** Forked type to permit operation from either side of gate.
- 11.4.6.4(b)** Padlock eye as integral part of latch.

11.4.7 Performance and Fence Installation

11.4.7.1 Follow general contour of ground and properly aligned.

11.4.7.2 Fence Post

11.4.7.2(a) Set in concrete retaining wall. Trowel finish tops of footings and dome to direct water away from posts.

11.4.7.2(b) Install plumb and in straight alignment.

11.4.7.2(c) Temporarily brace until concrete in bases has set.

11.4.7.2(d) Spaced 10 feet center-to-center, maximum.

11.4.7.3 Post Bracing

11.4.7.3(a) Installed at each end, at the gatepost, and on each side of corner posts.

11.4.7.3(b) Install after the concrete in post base has set.

11.4.7.3(c) Install so posts are plumb when diagonal rod is under tension.

11.4.7.4 Top Rails

11.4.7.4(a) Run continuously through post caps or barbed wire supporting arms.

11.4.7.4(b) Install expansion coupling at each joint.

11.4.7.5 Tension wire shall be weaved through the fabric and tie to each post with minimum 6-gauge galvanized wire.

11.4.7.6 Fabric

11.4.7.6(a) Stretch taut with equal tension on each side of line posts.

11.4.7.6(b) Fasten to top rail and steel posts with wire ties.

- 11.4.7.6(c)** Space wire ties at 12-inches O.C. maximum on posts and at 24-inches O.C. maximum on top rail.

11.4.7.7 Stretcher Bars

- 11.4.7.7(a)** Thread through or clamp to fabric 4-inches on center.
- 11.4.7.7(b)** Secure to posts with metal bands spaced 15-inches on center maximum.
- 11.4.7.7(c)** Install at each gate, pull and end post, and each side of corner post.

11.4.7.8 Barbed Wire

- 11.4.7.8(a)** Attach three rows to each barbed wire supporting arm.
- 11.4.7.8(b)** Install four rows above fabric and on extended gate end members of gates.

11.4.7.9 Gates

- 11.4.7.9(a)** Install plumb, level, and free swinging through full opening without interference.
- 11.4.7.9(b)** Install all hardware, including keepers, ground set items and flush plate in concrete to engage gate stop.
- 11.4.7.9(c)** Furnish and install gate alarms.

11.4.7.10 Repairing Damaged Coatings

- 11.4.7.10(a)** Repair any damaged coating in the shop or field by recoating with compatible and similar coating.
- 11.4.7.10(b)** Apply per manufacturer's recommendations.

11.4.7.11 Furnish and install Danger signs as approved by Customer's designee.

11.5 Crushed Rock Surface

This section includes crushed rock surface and method of depositing for the placement of permanent crushed rock surfacing in equipment shelter areas.

11.5.1 Applicable Standards

11.5.1.1 American Society for Testing and Materials

- 11.5.1.1(a)** C117– Test for Materials Finer than No. 200 Sieve in Mineral Aggregate by Washing.
- 11.5.1.1(b)** C131– Test for Abrasion of Coarse Aggregates by Use of Los Angeles Machine.
- 11.5.1.1(c)** C136 – Test for Sieve or Screen Analysis of Fine and Coarse Aggregates.
- 11.5.1.1(d)** D423 – Test for Liquid Limit of Soils.
- 11.5.1.1(e)** D75 – Sampling Stone, Slag, Gravel, Sand and Stone Block for Use as Highway Materials.

11.5.1.2 American Association of State Highway and Transportation Officials (AASHTO)

- 11.5.1.2(a)** T99–Test for the Moisture Density Relations of Soils Using a 5.5-Pound Rammer and a 12-Inch Drop.

11.5.1.3 Sample and Testing

- 11.5.1.3(a)** Test to determine conformance with all requirements for material quality and properties specified herein will be performed by an independent laboratory approved by Customer and compensated by the Contractor.
- 11.5.1.3(b)** Obtain representative samples of material in accordance with ASTM D75 for testing. Furnish Customer's designee sufficient materials for testing from each sample at the time obtained.

11.5.1.3(c) Furnish specific schedule for sampling to provide Customer's designee the opportunity to observe sampling.

11.5.1.4 Submittals. Includes, but not limited to, the following:

11.5.1.4(a) Test result reports from testing laboratory indicating conformance with the specifications.

11.5.1.4(b) Certification of conformance with the specifications.

11.5.2 Materials

11.5.2.1 Crushed rock surface shall consist of ¾-inch aggregate placed on top of a 6-mil polyvinyl barrier.

11.5.2.2 Aggregate shall consist of Crushed limestone or crushed natural gravel, free from lumps or balls of clay or other objectionable matter, and reasonably free from thin and elongated pieces of dirt. Aggregates shall consist of angular fragments, durable and sound, and shall be reasonably uniform in density and quality.

11.5.3 Performance and General Requirements

11.5.3.1 Stockpiles

11.5.3.1(a) Only with approval of Customer's designee in specified locations.

11.5.3.1(b) Clear and level storage sites prior to stockpiling.

11.5.3.1(c) Place in a manner and at locations designated by Customer, providing separate stockpiles for materials from separate sources.

11.5.3.2 Preparation of Sub-Grade

11.5.3.2(a) Clean off all foreign substances.

11.5.3.2(b) Correct any ruts, depressions, or soft yielding spots and areas with inadequate compaction.

11.5.3.2(c) Treat all sub-grade areas with soil sterilant.

- 11.5.3.2(d)** Customer's Project Representative will inspect, prior to placing crushed rock surface, for adequate compaction and surface tolerances.

11.5.3.3 Grade Control

- 11.5.3.3(a)** Establish and maintain by means of grade stakes, properly spaced so string lines may be stretched between stakes.

11.5.3.4 Placing of Materials

- 11.5.3.4(a)** Deposit and spread material in a uniform lift/layer and compact to the thickness indicated and as specified. Spread material uniformly on the prepared sub-grade from moving vehicles or spreader boxes.
- 11.5.3.4(b)** Level material to the required contour and grades.
- 11.5.3.4(c)** Remove those portions of the layer, which became segregated or mixed with sub-grade material in spreading and replace with new material as required by Customer's designee.
- 11.5.3.4(d)** Remove and repair sub-grade areas damaged during application of the crushed rock surface.

11.5.3.5 Shaping and Compacting Materials

- 11.5.3.5(a)** Compact layers no less than 3-inches or more than 6-inches thick.
- 11.5.3.5(b)** Roll to specified compaction requirements throughout full depth of layer with power rollers, rubber-tired rollers or combination.
- 11.5.3.5(c)** Shape and smooth by blading and rolling with power roller, rubber-tired roller, or both.
- 11.5.3.5(d)** Hand tamp in places not accessible to rolling equipment.

- 11.5.3.5(e)** Base compaction on weight per cubic foot of material passing ¾-inch sieve and compact to at least 100 percent of maximum density at optimum moisture.
- 11.5.3.5(f)** Determine and control compaction in accordance with AASHTO T99.
- 11.5.3.5(g)** Surface shall show no deviation in excess of 3/8-inch in any 10 feet when tested with a 10-foot straightened applied parallel with and at right angles to the center lines of the paved area.
- 11.5.3.5(h)** Correct any deviation specified in excess of this amount by loosening, adding or removing material, reshaping, watering, and compacting as requested by Customer's designee.

11.6 Herbicide Applications

11.6.1 Equipment and Materials

- 11.6.1.1** Sprayers and applicators shall be suitable for intended use.
- 11.6.1.2** Mix herbicide per manufacture's recommendations.
- 11.6.1.3** Herbicide shall be Krover (1) as manufactured by DuPont, Inc., or approved equal.
- 11.6.1.4** Do not apply herbicide if it is too windy or where other adverse weather conditions exist.
- 11.6.1.5** Apply at a rate of 10 pounds of product per acre, or in accordance with manufacturer's recommendations.

11.6.2 Performance

- 11.6.2.1** Apply only after final sub-grade has been established.
- 11.6.2.2** Apply before installation of vegetation barrier cloth and placement of crushed rock.
- 11.6.2.3** Follow manufacturer's recommendations on timing of application with respect to weather and barrier/crushed rock placement.

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12.0 System Configuration/Parts Support

12.1 System Configuration Requirements

- 12.1.1** Contractor shall assist Customer and various user agencies in determining user identification and channel assignments.
- 12.1.2** Contractor shall program all portable, mobile and control station radios, all System and all other equipment to operate on the FCC-licensed operating frequencies and determined profiles. This includes existing equipment that is capable, and may operate on the System, at the time of cutover, supplied by other P25 subscriber manufacturers.
- 12.1.3** Contractor shall prepare and furnish to Customer "as programmed" records for each radio (infrastructure & subscriber) placed on the System.
- 12.1.4** Contractor shall provide training for System/Network Managers sufficient to permit the Customer the capability to configure all system software-controlled features.
- 12.1.5** Provisions shall be incorporated into the system to allow the Contractor, from its Home Office to remotely interrogate the operating system and provide software assistance if requested by Customer.
- 12.1.6** Contractor must provide 2 sets of radio and equipment programming software, appropriately equipped laptop/desktop computers, and all other support equipment and special cables necessary to program each type of user equipment supplied by the Contractor.

12.2 Spare Parts Support

- 12.2.1** Contractor must provide and maintain a stock of spare parts, as determined necessary by the Contractor, to maintain all components of the System's infrastructure for the warranty period. These spare parts shall be located either at selected System radio infrastructure sites or at the Contractor's local maintenance service facility. A list of these spare parts determined to be necessary by the Contractor shall be provided to Customer.

12.2.2 As spare parts are consumed during routine or repair maintenance, the Contractor shall immediately replenish its stock of locally housed spare parts, where necessary. A report of the utilization frequency and rate of all spare materials shall be made available. If at any time the Contractor is aware of any equipment repair or recall notifications, the Contractor shall notify Customer by electronic and routine mail. Trends of unusual System or component failure shall be brought to the attention of Customer by the Contractor.

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13.0 Installation Guidelines

13.1 Contractor Project Management

13.1.1 The Contractor shall appoint a Project Manager (PM) for the full duration of the project's contracted term.

13.1.2 The Contractor's PM shall conduct an initial Design Review Meeting whereby the project's order of task progression, site/facility layout details, tower engineering studies, coverage design and related items will be presented to Customer for review, comment and approval for the Contractor to proceed with production tasks.

13.1.3 During the period prior to the Design Review Meeting, the Contractor will initiate monthly progress meeting with Customer whose purpose is to update on progress made in preparation for the Design Review Meeting

13.1.4 The Contractor's Project Manager is responsible for developing and maintaining an updated Project Time Line.

13.1.4.1 Project Time Line updates/revisions, commencing with Customer's official Notice to Proceed to the Contractor, shall be submitted by the PM on the last day of each project-month for review and approval by Customer.

13.1.4.2 The monthly Project Time Line submittal shall depict:

- Progress made per task in the preceding 30-day period;
- Work/tasks to be accomplished in the next 30-day period;
- Identification of critical path items and;
- Work/tasks to be undertaken by Customer (if any).

13.1.4.3 Coincident with production of the updated Project Time Line, the Contractor's PM shall identify any known or anticipated issues that will cause a delay to the project's implementation schedule that are not within the Contractor's control. Failure by the Contractor's PM to identify such issues in advance will negate any opportunity for schedule relief to the Contract's specified Project Completion Date.

- 13.1.5** Failure by the Contractor to produce a monthly updated Project Time Line within the period specified herein will result in an automatic 7-day reduction of the Contract's specified Project Completion Date (or that Project Completion Date as previously modified by Customer's executed Change Order, if any).

13.2 Engineering Drawings

- 13.2.1** Contractor shall furnish detailed drawings at the project's initial Design Review

13.2.1.1 Transmitter Site(s)

13.2.1.2 Receiver Site(s)

13.2.1.3 Site Antenna and Grounding System(s)

13.2.1.4 Receiver Voter Equipment

13.2.1.5 System Controller Equipment

13.2.1.6 Dispatcher Console Equipment

13.2.1.7 Microwave/Fiber Optic Equipment Terminal(s)

- 13.2.2** Drawings shall, as a minimum, illustrate:

13.2.2.1 Relative rack/rack locations

13.2.2.2 Equipment power wiring (primary and emergency)

13.2.2.3 Equipment interconnection wiring (signal and control)

13.2.2.5 Appropriate signal/voltage levels to facilitate alignment of level-

- 13.2.3** Civil drawings showing location details of equipment to be placed in existing or new facilities shall be provided by Contractor.

- 13.2.4** Contractor shall provide a comprehensive test record of alignment levels, settings and software versions installed within both infrastructure and user equipment. Contractor shall provide service manuals infrastructure and subscriber

- 13.2.5** In addition, the Contractor shall conduct baseline noise floor site measurements and shall develop, plan and resolve any determination of site/system-induced noise degradation as caused by the Contractor's design or work.

- 13.2.6** The scope and detail of the comprehensive equipment test and acceptance plan shall be completed prior to Contract Execution with the Contractor.
- 13.2.7** Prior to commencement of acceptance testing procedures, the Contractor shall ensure that all installed equipment has been furnished with the latest software releases available for those equipment items/groupings.
- 13.2.8** Contractor shall supply true copies of Final Project Record Documents which will include the Engineering Drawings, software releases and alignment details listed above, but amended to show system and equipment "as built" at the time of acceptance by the Customer.
- 13.2.9** The documentation package shall include in this document submittal a Permissible Exposure Study, as required by the FCC, for each radio infrastructure
- 13.2.10** The total number of documentation sets to be provided shall include one site-specific set for each infrastructure site and three comprehensive System documentation sets for Customer use.
- 13.2.1** Final Project Record Documents must be submitted to Customer within thirty days after system acceptance testing has been successfully concluded.
- 13.2.1** Submissions shall also include electronic versions of all documents submitted.
- 13.2.13** Final payment for Contracted services shall not be released by Customer until this documentation submittal has been successfully completed by the Contractor and reviewed and approved by Customer.

13.3 Workmanship

- 13.3.1** All workmanship shall be in accordance with Industry-accepted best practices and the National Electric Code.
- 13.3.2** Work areas shall be maintained in a neat, orderly fashion.
- 13.3.3** Work sites shall incorporate Contractor-provided trash containers and residue of the work shall be discarded as the work is underway.
- 13.3.4** All sites will be cleaned up at the end of each work day, swept clean, tools picked-up, and walkways free of obstacles and obstructions.

- 13.3.5** The installation of audio, signal, data and control cables within equipment racks, enclosures, racks and cable trays must be properly routed such that wires/cables do not cross over each within cable bundles.
- 13.3.6** Cables must be properly labeled, routed and secured.
- 13.3.7** To the maximum extent possible, cables carrying AC power, low-level audio, RF and digital signals must be grouped separately.
- 13.3.8** All DC wiring, particularly those areas where battery terminals and power distribution bus bars are located, must incorporate insulation barriers to prevent the accidental short-circuiting of otherwise exposed conductors.
- 13.3.9** Customer shall have the ability to temporarily stop work progress by the Contractor if workmanship falls below acceptable levels and shall have the authority to require the Contractor to remove and/or correct all observed instances of poor wiring practice, inappropriate use of installation materials and other obvious installation defects because of apparent poor workmanship.
- 13.3.1** Approval to resume installation work activities shall be provided to the Contractor once agreement is reached in resolving observed workmanship defects.
- 13.3.11** The determination of Contractor workmanship acceptability, as well as the suitability of any proposed rework plans offered by the Contractor, shall remain with Customer.

13.4 Equipment Storage

- 13.4.1** The Contractor shall provide the necessary storage space and skilled labor needed to receive, inventory and maintain supplies and consumables throughout the term of the contract. Customer reserves the right to inspect and inventory equipment at any time.

13.5 Factory Staging

- 13.5.1** Customer shall require a full factory staging of the Contractor's radio configuration within the manufacturing facilities used by the Vendor/Contractor.
 - 13.5.1.1** The Contractor shall install, configure and conduct a pre-test of the manufactured equipment and subsystems prior to inviting Customer to participate in functional test processes on the configured System's equipment.

13.5.1.2 Factory staging will not take place until 70% of the site infrastructure has been completed.

13.5.2 The Contractor shall provide a detailed description of functional tests to be undertaken as part of the factory staging process. These tests shall be pre-approved by Customer prior to the conducting of any on-site System verification.

13.5.3 The factory staged equipment shall not be shipped to Customer and the Contractor's staging area until the most recent levels of software version has been properly installed in the System's various components and that all portions of the functional staging test have been successfully completed and approved by Customer.

13.5.4 Wiring and construction anomalies, if observed during staging, must likewise be fully resolved and corrected prior to shipment of the equipment.

13.5.5 The Vendor shall, as part of its Technical Response, submit a sample staging test plan representing those functional tests anticipated for a project of this scope and complexity.

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14.0 Phased Implementation

14.1 Transition Planning

14.1.1 As part of the Response Submittal, the Vendor must prepare and submit a preliminary migration plan that will prevent disruption of communication on the existing radio network and provide a smooth transition to the proposed System:

14.1.1.1 The Vendor must supply a preliminary sequence of events for the installation of the System showing any effect the different stages of installation may have on existing systems. Any relocation or modification to existing equipment by the Contractor as part of its work must be stipulated and prior approval obtained from Customer.

14.1.1.2 The Vendor shall provide a completion period (in days) for the project, based on Customer's execution of a Notice to Proceed. The Vendor shall provide a schematic representation of the implementation process as well as a hypothetical migration plan.

14.1.1.3 These required proposal submittals will be used by Customer to evaluate the Vendor's ability and understanding of Specification requirements to perform this work in a manner that offers no disruption to ongoing public safety communications operations.

14.1.2 Upon contract award, the Contractor shall provide:

14.1.2.1 A detailed time schedule for the training of system managers, dispatchers, radio managers and other personnel.

14.1.2.2 Contractor will supply time schedules for the orderly transfer of departments onto the System and the estimated time-period when the transfer could be completed.

14.1.2.3 A detailed repair maintenance training plan for Customer's in-house technical staff members.

It shall encompass all operational elements of the System to include:

14.1.2.3(a) Network Controllers

14.1.2.3(b) Base Stations Gateways

14.1.2.3(c) Microwave Subsystem

14.1.2.3(d) Alarm System

14.1.2.3(e) Dispatch Consoles

14.1.2.3(f) Radio Control Stations, related appurtenances, and all third-party equipment.

14.1.2.4 This training shall be completed prior to the System's Acceptance Testing activity and is to be performed in within Customer. Training locations and dates will be determined between Customer and the contractor.

14.1.2.5 All curriculums for the training plan must be approved by Customer prior to the commencement of training. The Contractor must provide training and identify necessary tools, to include test equipment and software, to Customer's technical staff, as they would to their internal or contracted technical staff.

14.1.2.6 Coordinate the orderly transfer of services to the System network only after having successfully concluded equipment alignment and installation procedures, successful completion of the project's acceptance test, and completion of manager, dispatcher, user, and

14.1.3 Contractor must not dismantle or modify the existing radio system without prior approval of Customer.

14.1.4 Some portions of the existing system may remain operational after acceptance of the new system.

14.1.5 Customer will notify the Contractor when elements of the old infrastructure equipment may be reallocated to meet interoperability needs or otherwise can be decommissioned.

14.1.5.1 It is the Contractor's responsibility to remove or relocate all the old infrastructure equipment.

14.1.5.2 Customer desires a trade in value on any exiting portable, mobile and infrastructure equipment that is part of current communications system.

14.1.6 Contractor shall assist Customer and current radio user agencies in preparing user talkgroups, initial priority levels and shall complete the necessary user equipment installation, programming and record keeping, as required. This activity must be completed prior to service cutover.

14.1.7 All talkgroup structure documentation will be provided to Customer by the Contractor.

14.1.8 As part of contract negotiations with the Successful Vendor, Customer and Successful Vendor will jointly develop a final comprehensive test and acceptance plan that addresses, minimally, the following major functionality and operability issues:

14.1.8.1 Microwave Network

14.1.8.1(a) Provide RF power and Receive measurements for the microwave;

14.1.8.1(b) Test path fade loss for each direction on each path of the microwave network.

14.1.8.1(c) Test for proper frequency, modulation, digital signaling and stability.

14.1.8.1(d) Verify data integrity on the microwave system including network components utilizing BER Testing;

14.1.8.2 Transmitter Equipment

14.1.8.2(a) Provide RF power stage measurements at different levels of the transmitter system such as transmitter, filters, combiner, cable, antenna, etc.;

14.1.8.2(b) Test RF components for specified insertion loss (i.e., transmission line return loss);

14.1.8.2(c) Test for proper frequency, modulation, digital signaling and stability;

14.1.8.2(d) Test and report of delivered audio quality and signal margins throughout proposed service area.

14.1.8.3 Receiver Equipment

14.1.8.3(a) Test of compliance to specifications of equipment provided;

14.1.8.3(b) Provide log of signal gain or loss to equipment within the receiver system such as antenna, cable, preamp, splitter, or receiver antenna port;

14.1.8.3(c) Test of audio quality and level (reciprocal of that required for the transmit path) of system balance;

14.1.8.4 Console Audio/ System Controllers

14.1.8.4(a) Test of compliance to manufacturer's published specifications of equipment proposed;

14.1.8.4(b) Test of audio quality and level;

14.1.8.4(c) Verification of network failure modes in response to forced failures of individual communications/ control lines and complete site failures complete written explanation is required;

14.1.8.4(d) Verification of compliance to TIA/EIA P25 ISSI/CSSI Standards that allow for seamless interoperability with P25 radio networks fielded by other manufacturers;

14.1.8.4(e) Bit error-rate and voiced audio quality testing of System infrastructure, backhaul and site-specific local area networking infrastructure;

14.1.8.4(f) Fade margin verification of microwave link segments as used to interconnect radio sites, network controllers and radio dispatch facilities;

14.1.8.5 Dispatch Centers

14.1.8.5(a) Provide written results of testing of operational features per dispatch position;

14.1.8.5(b) Test system operation during simulated failures of system components i.e. console electronics, power loss, etc.

14.1.8.6 Third Party Vendor Equipment

14.1.8.6(a) Provide functional testing and verification of any third party equipment used;

14.1.8.7 Contractor shall provide all test equipment, diagnostic services, documentation, software, personnel, vehicles and other items as necessary to test the delivered and installed radio network in accordance with the Contracted Test and Acceptance Plan, inclusive of operational features, to complete a total system functional test.

14.1.8.8 The Vendor shall disclose test procedures and equipment that will be used to verify radio system coverage as specified in Section 6.0.

14.1.8.9 The Vendor shall submit within their Response Submittal a sample test and acceptance plan that is representative of the scope and complexity of the proposed System radio network infrastructure.

14.2 Implementation

14.2.1 Contractor is responsible for the provisions and cost of warehousing, insurance, storage and security of radio network infrastructure and user equipment prior to and during the construction and installation phases of the project.

14.2.2 Contractor will assign a Project Manager as a single point of contact between Customer and the Contractor. Contractor's Key Personnel shall be approved by Customer prior to assignment. Customer reserves the right to require replacement of the Contractor's Key Personnel at any time during the project. Contractor's Project Manager must conduct regularly scheduled meetings, as

14.2.3 Prior to installation of any portion of system, Customer must approve Contractor furnished detail drawings as specified in Section 13.0. Installation Guidelines.

14.2.4 Each portion of the P25 System must follow those technical parameters specified in the approved Testing and Acceptance Plan.

14.2.5 Contractor must supply comprehensive training on user operation of portable radios, mobile radios, control stations, and other user equipment as required. Contractor must also supply comprehensive training for system diagnostics, management systems, preventative and routine maintenance and system operation for System Managers and designated Customer staff.

14.2.6 Contractor is responsible for any site modifications required to accommodate infrastructure equipment proposed for location in Customer-owned, as well as in non-Customer-owned properties.

14.2.6.1 If the vendor proposes the use of any existing collocated sites, towers, or shelters, then all requirements of the site owner must be met.

14.2.7 Contractor shall provide technical support/engineering as required to modify existing FCC licenses or to acquire additional licenses required to facilitate operation of the System. This activity shall include all FCC licensing application development, frequency coordination and engineering fees. Any frequency work will be coordinated with the State of Arkansas' Regional Frequency Coordinator.

14.2.8 Any modification or relocation of existing equipment will require prior approval by Customer. Contractor shall supply "as built" drawings and complete written and electronic documentation of modifications or relocation to existing systems to facilitate maintenance of this equipment in the future.

14.2.9 The Contractor's Project Manager shall develop, monitor, and adapt/update the project's implementation schedule. The schedule shall be presented using Customer-approved project task-maintenance software such as Microsoft Project. Schedule updates must be submitted by the Contractor on regular dates that are approved by Customer, or sooner if implementation issues require more frequent schedule updates.

14.2.10 The Contractor's Project Manager shall, in addition to Item 14.2.9, prepare and submit, on regular dates approved by Customer, a project status report that details the anticipated accomplishments, work to be completed and risks for the period depicted by the revised, updated schedule.

14.2.11 Specific attention should be made to those items and due dates to be met by Customer to facilitate the unimpeded completion of the work.

14.2.12 The Contractor's System Engineer shall develop and submit appropriate block and level diagrams, site-specific configuration drawings, field technician workbooks and other related technical materials necessary for the accurate, timely completion of the work. The Contractor's Project Manager shall present the Contractor's internal Quality Control/Quality Assurance plan that depicts the steps and safeguards being undertaken to eliminate field issues with respect to hardware and software quality. This material and process shall be orally presented by the Contractor as part of its Design Review Meeting with Customer, prior to the commencement of any field installation activities by the Contractor.

15.0 Warranty and Maintenance Guidelines

15.1 Warranty

15.1.1 Equipment Warranty

The following conditions shall apply for equipment Warranty:

15.1.1.1 The proposer will provide post warranty maintenance and services that are comparable to the same services proposed for the warranty period.

15.1.1.1(a) All warranty and post warranty services will be clearly identified and provided in a matrix.

15.1.1.1(b) All post warranty services will include all the provided manufacturer's and third-party equipment. This includes any services that were provided to integrate the proposed system.

15.1.1.1(c) The customer can remove any post warranty services as determined by the customer's need to provide in-house or subcontract any of these respective services.

15.1.1.2 The Vendor shall warrant all provided network equipment furnished as part of the Contract and associated radio infrastructure, subscriber and related user equipment and software for a period of not less than one year, after the date of total System acceptance.

15.1.1.3 Warranty will commence at the time of total System acceptance and the Contractor shall provide all labor and parts for maintenance and repair, including preventative maintenance, of all equipment provided in the proposed network.

15.1.1.4 All cost for the one-year warranty will be borne by the Contractor.

15.1.1.5 Replacement parts must be of new or current manufacture and meet or exceed the specifications of the original supplied equipment (OEM).

15.1.1.6 Post-warranty replacement parts service for emergency infrastructure equipment repair, not available locally, shall be shipped out on the first available flight. Any parts required for non-emergency repair that are not available locally should be shipped out for next day delivery.

15.1.1.7 Contractor shall have factory trained technicians and system engineers available by telephone 24/7/365. The technicians or system engineers must respond by telephone within thirty (30) minutes of observed or reported service outage and be on-site, in response to a reported service outage, within two (2) hours.

15.1.1.7(a) Contractor shall be required to provide a list of certified factory trained technicians performing maintenance on the system including all sub systems

15.1.1.7(b) Documentation that supports the current certifications of factory train technicians must be provided. It is the Contractors responsibility to keep any certifications required to maintain the system current and up to

15.1.1.8 Service providers responding to emergency service outages must provide continuous non-stop support until the problem is resolved.

15.1.1.9 Non-critical service requests response will be within one (1) working day.

15.1.1.1 When a critical system failure occurs, more stringent requirements shall be met by the Contractor.

15.1.1.10(a) A critical system failure is defined as a significant reduction in the ability to communicate. Examples of such failures are: Site off the air, Dispatch console failure at a location with no backup console available, site link failure due to network equipment, or 50% or more failed base/repeaters at a radio site.

15.1.1.1 In the event of a critical system failure, Contractor will notify the Customer of the failure.

15.1.1.12 Critical failures will be restored in six hours or less from the time of notification to the Contractor, via Customer notifying the Contractor, or monitored software notification.

15.1.1.13 Major communications equipment manufacturer shall have a fully qualified, staffed and equipped service facility positioned and capable of meeting this Specification's response time criteria during the warranty and maintenance agreement periods. Any subcontractors used during the warranty and maintenance period, must be approved by the Customer prior to any work performed.

In the event of default on the response time to reported service outages, the Contractor agrees to pay the Customer the following response remedies:

- 15.2.1** Contractor shall pay \$250 for each occasion that it fails to meet the response time obligation for a reported infrastructure service outage.
- 15.2.2** Contractor shall pay \$500 per twenty-four-hour period in which a defective infrastructure site is not restored to operational status.
- 15.2.3** Should any specific equipment item (such as a specific portable radio, repeater station, station circuit board, power amplifier, etc.) be submitted for repair three times during the warranty period, Contractor will replace that equipment item with a new item and warranty the replacement for one additional year from the time of replacement.
- 15.2.4** The Contractor must make available replacement parts for all Contractor-manufactured components of the digital radio infrastructure for 15 years following acceptance.
- 15.2.5** The Contractor must identify life cycle and part availability of all third party equipment proposed.
- 15.2.6** Post-warranty replacement parts service for emergency infrastructure equipment repair, not available locally, shall be shipped out on the first available
- 15.2.7** Any parts required for non-emergency repair that are not available locally should be shipped out for next day delivery.
- 15.2.8** Contractor must guarantee the System's operating software, inclusive of user equipment software, for a one-year period following acceptance.
- 15.2.9** The Contractor shall provide all software updates, at no additional cost, for the entire period under which the Customer has committed for Contractor-provided after-warranty maintenance services.

15.2.1 Contractor shall fix by either update or upgrade, all known software “bugs” to installed software even if such warranty period has expired.

15.3 Maintenance

15.3.1 During the initial warranty period, the Contractor shall be responsible for:

15.3.1.1 Preventative maintenance of all proposed equipment and any supplied end-user equipment;

15.3.1.2 Repair maintenance of infrastructure equipment, inclusive of antenna systems;

15.3.1.3 Repair maintenance of subscriber and related user equipment;

15.3.1.4 Installation of mobile-mounted radio equipment.

15.3.2 Contractor-provided maintenance during the warranty period will be monitored by the Customer.

15.3.3 The Contractor must supply monthly service logs listing the site(s) where service is performed, the equipment involved and service details.

15.3.4 Failure of individual units, sub-assemblies and/or components must be reported in writing to the Customer. This report must, as a minimum, include unit identification (description and serial number), explanation and cause of failure, and corrective action taken.

15.3.5 Contractor is responsible for all actions of its employees or subcontractors. Any equipment failure(s) caused by any act or omission of Contractor's employee or subcontractor shall be the responsibility of the Contractor.

15.3.6 The Contractor shall submit a maintenance work plan that identifies the tasks required in accordance with Section 14.2, a listing of Contractor supplied personnel and identification of a single 24/7/365 contact point responsible for Contractor maintenance issues.

15.3.7 All required service logs and repair reports must be submitted to the Customer.

15.4 Service/Maintenance Software

The Contractor shall provide:

- 15.4.1** A suite of software applications for the Customer to be able to view and monitor all alarms and faults on the System, both non-critical and critical.
- 15.4.2** As part of its cost submittal, the Vendor shall provide for optional maintenance services that are equivalent to those provided by the initial warranty. The term of each optional extended maintenance support option shall be five years.
- 15.4.3** It is the intention of the Customer to utilize outside contract labor for maintaining its infrastructure equipment and subscriber equipment. With respect to outside contractor needs, the term of this extended maintenance service shall be as long as fifteen years, structured into three 5-year optional service intervals. Proposers shall provide a detailed description of services (as well as any service exclusions) to be provided for this extended maintenance service, inclusive of infrastructure software updates, hardware updates required to support newer software, defective parts replacements, and spare parts.

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16.0 Pricing Considerations

16.1 General Pricing Information

This infrastructure and subscriber equipment-pricing portion of this Specification is developed as a guide for the Vendor so that the necessary information is provided to Customer for it to conduct an accurate assessment of proposed cost. This information is illustrative of the detail required for each infrastructure site, inclusive of sites having only dispatch-related equipment.

Vendors shall provide a per-site granular cost detail of proposed equipment, towers, generators, site civils program management, program engineering, installation services and maintenance services. As this is a turnkey project, any pricing omission of a scope that is normally considered part of a conventional simulcast trunked radio system of this type, will be provided for by the Contractor at no additional cost to Customer.

16.2 Site Modification Costs

16.2.1 For equipment to be installed at customer owned/leased sites which have requirements for site preparatory work involving architectural, mechanical, electrical, civil or structural construction modifications, a description and cost of the modifications required must be provided by the Vendor for each individually named site.

16.2.2 For newly-added sites, the cost provided by the Vendor shall include services normal and customary for the development and commissioning of a new site, exclusive of access roadway development. Site access roadways will be provided by Customer if the property is Customer-owned.

16.3 Lifecycle Costs

16.3.1 Customer retains the right to perform life-cycle analysis in determining the best price-value. One important component of such as analysis involves knowledge of the life cycle of the various major equipment elements making up a Proposer's solution. The production age of equipment families, and the platform as a whole, affects the downstream ability to source spare parts and software support and is a key factor in

16.3.2 Proposers shall disclose as part of their Pricing Proposal when base stations, P25 interface gateways, user equipment families and the operational software for the technology was first released for sale to the Public. Proposed product elements are likely to be discontinued and when parts/software support will cease to be available. These services will be the same as the services provided during the warranty period.

16.3.3 Proposers shall disclose as part of their Pricing Proposal when was first released for sale to the Public. requires the proposer to add life cycle for any proposed. Proposers shall also provide a life-cycle roadmap, referenced by year and so depicts when any third party equipment is likely to be discontinued and when parts/software support will cease to be available.

16.4 Warranty and Maintenance Costs

16.4.1 Costs for the initial warranty and extended maintenance service, inclusive of infrastructure software updates, hardware updates required to support newer software, defective parts replacements, and spare parts, shall be included as part of

16.4.2 The proposer will provide detailed pricing for all services proposed under the post warranty timeframe.

16.4.3 These post warranty services will replicate all services that were provided during the proposed warranty period, to include all third party equipment proposed.

16.4.4 The proposer will provide post warranty subscriber services as an extended warranty service from the start of post warranty to 15 years.

16.4.5 The proposer will provide post warranty depot services as a per subscriber cost from the start of warranty to 15 years.

16.4.5 Include optional pricing to replace subscriber replace every seven to eight years (7-8) years at discretion of the vendor.

16.4.6 Include optional pricing to subscriber batteries every three (3) years.

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16.5 Pricing Summaries

16.5.1 Pricing Summaries for Infrastructure and Subscriber equipment shall be provided as part of the Response Submittal. All summary information will be supported by detailed cost information as detailed further in this Section. Pricing Summaries include;

16.5.2 Infrastructure Equipment

16.5.3 Project Management, Engineering, & Installation Services

16.5.4 Subscribers by Agency Submitted

16.5.5 Subscriber Programming and Installation Services

16.5.6 Infrastructure Discount

16.5.7 Subscriber Discount

16.5.8 Turnkey Discount

16.5.9 System Maintenance

16.5.10 Subscriber Maintenance

16.5.11 Total Cost of Ownership at 5, 10, & 15 years

16.5.12 Optional Requests

16.6 Future Purchase Considerations

16.6.1 It is the intent of Customer to operate this new radio communications network for, minimally, the next twenty years. It is important that Customer receive reasonable safeguards regarding future Vendor equipment/services

16.7 Immediate Future Discounts

16.7.1 For all purchases within five (5) years after the System's acceptance date, the discount percentage received by Customer will be identical to the discount percentages derived from list-price unit equipment costs and Vendor-submitted unit costs as contained in its Proposal.

16.8 Purchase Price Discount Years 6 - 10



16.8.1 For years six (6) through ten (10) after the System’s acceptance date, Customer’s discount from the manufacturer's published equipment list price, as delivered to their authorized sales agents, shall be as follows:

Fixed Site Equipment	_____%
Antenna Related Equipment	_____%
Console Equipment	_____%
Control Station Equipment	_____%
Subscriber Equipment	_____%
Accessories	_____%
Spare Parts	_____%

16.9 Price Discount Years 11 - 15

16.9.1 For years eleven (11) through fifteen (15) after the System’s acceptance date, Customer’ discount from the manufacturer's published equipment list price as delivered to their authorized sales agents, shall be as follows:

Fixed Site Equipment	_____%
Antenna Related Equipment	_____%
Console Equipment	_____%
Control Station Equipment	_____%
Subscriber Equipment	_____%
Accessories	_____%
Spare Parts	_____%

16.10 Price Discount Years 16 - 20

16.10.1 For years sixteen (16) through twenty (20) after the System’s acceptance



date, Customer’s discount from the manufacturer's published equipment list price as delivered to their authorized sales agents, shall be as follows:

Fixed Site Equipment	_____%
Antenna Related Equipment	_____%
Microwave/Fiber Equipment	_____%
Console Equipment	_____%
Network Equipment	_____%
Control Station Equipment	_____%
Subscriber Equipment	_____%
Accessories	_____%
Spare Parts	_____%

16.11 Infrastructure Pricing Analysis Worksheets

16.11.1 The following pricing worksheets are to be used as an example to develop the Infrastructure Price Submittal. These worksheets are indicative of the detail required and may be amended or expanded by the Vendor as necessary. Any omission or error in developing the pricing proposal, shall be the sole responsibility of the Contractor.

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Primary/Redundant Site (individual submittals required)

Equipment Description	Number Req'd	List Unit Cost	Extended Cost	Maintenance Cost
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Radio Site (one per location)

Equipment Description	Number Req'd	List Unit Cost	Extended Cost	Maintenance Cost
Transmitters		\$	\$	\$

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16.12 Subscriber Equipment Pricing

16.12.1 Customer envisions several tiers of portable and mobile radio units for use by the various public safety and non-public safety agencies. Those non-public safety users having minimal interoperability needs may benefit from lower-tiered, less costly radios having smaller talk group capacities and a

limited list of feature options. Public Safety agencies, however, may require highest-tier devices capable of voice encryption, GPS location, status

16.12.2 The Vendor shall develop cost proposals for low, mid and high-tier radio products using the following general format:

16.12.2.1 High-Tier Portable

16.12.2.1(a) At least 500 modes/talk groups/channels

16.12.2.1(b) 700/800MHz operation (optional multiband operation)

16.12.2.1(c) Multi-line 12 character minimum, alpha-numeric LCD text display

16.12.2.1(d) Radio/network status icons

16.12.2.1(e) 256-bit AES voice encryption

16.12.2.1(f) AMBE+2 vocoder, or newer

16.12.2.1(g) Emergency button

16.12.2.1(h) Programmable option buttons

16.12.2.1(i) Talk group scan

16.12.2.1(j) System scan

16.12.2.1(k) Intrinsically safe (option)

16.12.2.1(l) Integrated voice/data capability (option)

16.12.2.1(m) GPS receiver

16.12.2.1(n) Wide range of optional accessories

16.12.2.2 Mid-Tier Portable

16.12.2.2(a) At least 250 modes/ talk groups/ channels

16.12.2.2(b) 700/800MHz operation

16.12.2.2(c) Multi-line 12 character minimum, alpha-numeric LCD text display

16.12.2.2(d) Radio/network status icons

16.12.2.2(e) 256-bit AES voice encryption

16.12.2.2(f) AMBE+2 vocoder, or newer

16.12.2.2(g) Emergency button

16.12.2.2(h) Programmable option buttons

16.12.2.2(i) Talk group scan

16.12.2.2(j) System scan

16.12.2.2(k) Intrinsically Safe (option)

16.12.2.2(l) Integrated voice/data capability (option)

16.12.2.2(m) GPS receiver

16.12.2.2(n) Wide range of optional accessories

16.12.2.3 Low-Tier Portable

16.12.2.3(a) At least 48 modes/talk groups/channels – Rotary Selector

16.12.2.3(b) 700/800MHz operation

16.12.2.3(c) Single line, 8 character minimum, alpha-numeric LCD text display

16.12.2.3(d) Radio/network status icons

16.12.2.3(e) AMBE+2 vocoder, or newer

16.12.2.3(f) Emergency Button

16.12.2.3(g) Programmable option buttons

16.12.2.3(h) Limited list of optional accessories

16.12.2.4 High-Tier Mobile Radio

16.12.2.4(a) At least 500 modes/talk groups/channels

16.12.2.4(b) 700/800MHz operation (optional multiband operation)

16.12.2.4(c) Remote control head/rear mount/dash mount configurations

16.12.2.4(d) Multi-line alpha-numeric LCD text display

16.12.2.4(e) Radio/network status icons

6.12.2.4(f) 256-bit AES voice encryption

16.12.2.4(g) AMBE+2 vocoder, or newer

16.12.2.4(h) Emergency button

16.12.2.4(i) Programmable option buttons

16.12.2.4(j) Talk group scan

16.12.2.4(k) System scan

16.12.2.4(l) Integrated voice/data capability (option)

16.12.2.4(o) GPS receiver

16.12.2.4(p) Wide range of optional accessories

16.12.2.5 Mid-Tier Mobile Radio

16.12.2.5(a) At least 250 modes/talk groups/channels

16.12.2.5(b) 700/800MHz

16.12.2.5(c) Remote control head/rear mount configuration

16.12.2.5(d) Multi-line alpha-numeric LCD text display

- 16.12.2.5(e)** Radio/network status icons
- 16.12.2.5(f)** 256-bit AES voice encryption
- 16.12.2.5(g)** AMBE+2 vocoder, or newer
- 16.12.2.5(h)** Emergency button
- 16.12.2.5(i)** Programmable option buttons
- 16.12.2.5(j)** Talk group scan
- 16.12.2.5(k)** System scan
- 16.12.2.5(l)** Integrated voice/data capability
- 16.12.2.5(m)** GPS receiver
- 16.12.2.5(n)** Wide range of optional accessories

16.12.2.6 Low-Tier Mobile Radio

- 16.12.2.6(a)** 700/800MHz operation
- 16.12.2.6(b)** Front mount/dash mount package
- 16.12.2.6(c)** At least 48 modes/talk groups/channels – Rotary Selector
- 16.12.2.6(d)** Two-line alphanumeric display
- 16.12.2.6(e)** Network/radio icons
- 16.12.2.6(f)** AMBE+2 vocoder, or newer
- 16.12.2.6(g)** Programmable option buttons
- 16.12.2.6(h)** Emergency button
- 16.12.2.6(i)** Limited range of optional accessories

Appendix C: Subscriber Radio Requirements, illustrates the quantities, types and tiers of subscriber equipment required.

- 16.12.3** Additionally, the Vendor shall prepare a detailed optional equipment catalog that describes the full range of options available for all Tiers and indicated portable and mobile radio configurations. The submitted catalog shall include list prices and the proposed discount percentage-reduced

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17.0 Additional Requirements

17.1 Optional Fiber Connectivity

The Customer is sensitive to the costly nature of new radio systems. Therefore, vendors may be able utilize existing fiber. Northwest Electric Cooperative currently has fiber between the existing tower sites. It will be acceptable to make use of this fiber for proposed system based on the following.

17.1.1 That the proposing vendor has consent from the fiber owner that the fiber can be utilized as part of the system design.

17.1.2 That cost of any configuration, equipment, or ongoing expense is clearly defined.

17.2 Fire Paging

The customer requires a fire paging solution to alert fire personnel throughout the coverage area defined in Section 6 Coverage Criteria.

17.2.1 The fire paging solution must provide a compact lightweight device that can be worn directly clipped to a belt, or in a carrying case attached to a belt.

17.2.2 The device must operate using the proposed P25 radio system.

17.2.3 The device must be dual band 700/800 MHz and VHF.

17.3 Fire Station Alerting System

Grundy County currently utilizes a Fire Station alerting system that incorporates a mobile radio connected to an audio amplifier system. The existing radio and fire alerting system will need to be replaced and operate on the newly proposed conventional P25 radio system.

The Trenton Emergency Services Complex is located at;
1001 east 17th Street.
Trenton MO 64683.

17.3.1 The fire station radios, and audio PA will be activated utilizing a the P25 network by making a call to each individual station.

17.3.2 Radio audio should not be heard until the radios is activated. Audio shall be user selectable allowing for manual activation of the audio when needed.

17.3.3 The vendor will be responsible for integration of the new radio and Fire Station Alerting system and shall provide all needed radio equipment and hardware.

17.3.4 A new antenna, coaxial cable, lighting protection and proper grounding is required at each location.

17.4 Storm Warning System

The Customer currently operates severe weather sirens throughout the service area utilizing a VHF repeater.

17.4.1 The current sirens are need to be activated from the dispatch consoles.

17.4.2 The vendor shall provide all needed radios, hardware, and labor to interface to the exitsting storm siren sysem.

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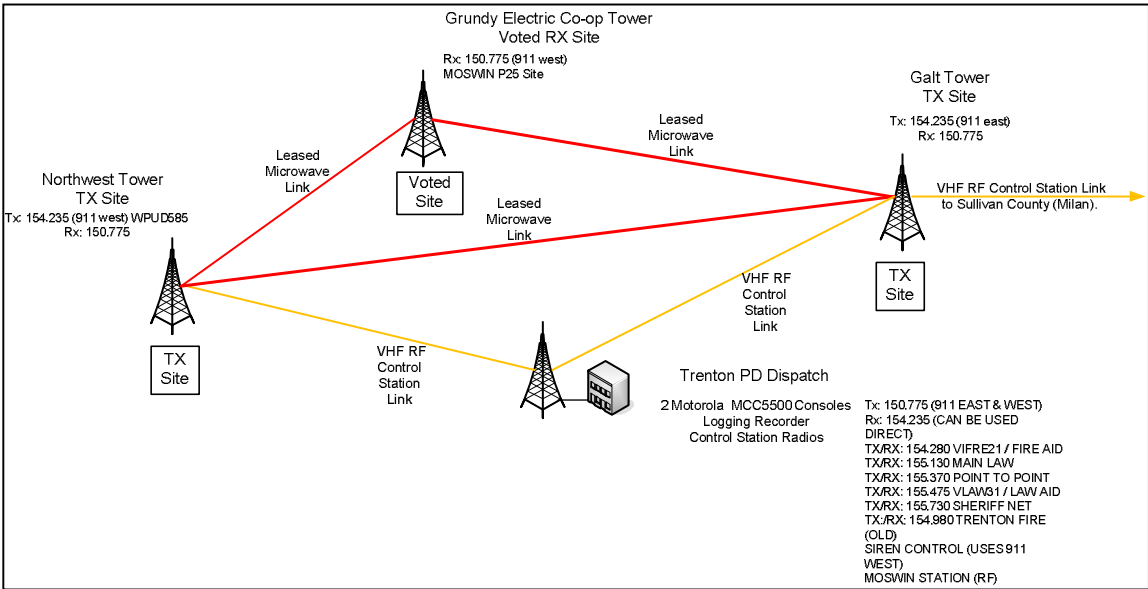
Appendix A: Current Infrastructure and Backhaul Network Configuration

Current System Configuration

The Customer currently employs multiple VHF conventional repeaters. The multiple repeaters at different site locations provide communications for police, fire, ems, and other County/City agencies. Communications are provided by the following site locations.

- Galt Tower
 Grundy Electric Co-op Tower
 Northwest Tower
 Trenton PD Dispatch

The transmit sites are connected via microwave/fiber or RF link. The diagram below shows the current system interconnectivity.



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Appendix B: Existing VHF Channels

This section contains the existing channel names and frequencies that are in use at the Customer's tower sites.

Trenton Police Department

Trenton Public Safety	154.98000	MHz
Police Mutual Aid	155.47500	MHz
Grundy Law County wide	155.13000	MHz
Fire Mutual Aid	154.28000	MHz
Sheriff's Network	155.73000	MHz

Grundy Electric Co-op

Fire/EMS Dispatch Receive Only	154.23500	MHz
Grundy County Recive Only	150.77500	MHz

Galt Tower Site

Fire/EMS Dispatch	155.23500	MHz
Grundy County	154.23500	MHz
	150.77500	MHz

Northwest Tower Site

Grundy County	154.23500	MHz
	150.775	MHz

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Appendix C: Subscriber Requirements

This section contains the anticipated quantities of subscriber equipment and accessories.

	County SO	County Rural Fire	County EMS	Emergency Management	Trenton PD	Galt Fire	Larado Fire	Spikard Fire	Trenton Fire	Totals
Mobiles										
Mid-tier Dash Mount P25 Single Band										0
Low-tier Dash Mount P25										0
High-tier Dash Mount P25 Multiband										0
High-tier Remote Mount P25 Multiband		10	4			7	7	9	4	41
Portables										
Mid-tier Portable P25 Police/EMS										0
Mid-tier Portable P25 Fire										0
Low-tier P25										0
High-tier Portable P25 Multiband		14				7	7	11	12	51
Carrying Case/Belt Clip		14				7		7	12	40
Speaker Mic Police/EMS										0
Speaker Mic Fire		14				7		7	12	40
Desktop Charger		14				7		7	12	40
Multi-Unit Charger		1				1		1	1	4



Desktop Stations

Desktop Station with External Antenna						1	1			2
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Pagers

P25 Compatable Dual Band Pager		14				7		7	12	40
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Appendix D: Critical Buildings List

This section provides a listing of buildings and areas identified as critical coverage and shall meet the coverage test process defined in section 6.8 Critical Building Coverage Test Process.

Building	Address
S.M. Rissler Elementary	801 W 4th Terrace, Trenton MO 64683
Trenton Middle/High Complex	1415 Oklahoma Avenue, Trenton MO 64683
Wright Memorial Hospital	191 Iowa Boulevard, Trenton MO 64683
Ketcham Community Center	1322 Mable, Trenton MO 64683
NCMC Residence Halls	1323 Mable, Trenton MO 64683 This includes adjacent buildings.
Spickard Housing	210 North 10th Street Spickard, MO 64679
Spickard R2 School	105 North 4th Street Spickard, MO 64679
Sunnyview Nursing Home	1311 East 28th Street Trenton, MO 64683
Eastview Nursing Home	1622 East 28th Street Trenton MO 64683
Modine	822 Industrial Drive, Trenton MO 64683
Nestle	1401 Harris Avenue, Trenton MO 64683

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Appendix E: FCC License

The following call signs are currently in use at the Customer's tower sites.

KNBN615
WPUD585
WQPU355
WPUD585
WPUD585







Appendix F: RFP Definition of Terms

Additional Services	Service or deliverable within the scope of the Contract, but not specifically provided under any Statement of Work.
AES	Advance Encryption Standard.
Agency	User operable on the Customer's radio communications
AMBE	Advanced Multiband Excited, P25 digital voice-coder.
ANSI/TIA-222H	American National Standards Institute / Telecommunications Industry Association: Structural Standard for Antenna Supporting Structures and Antennas.
APCO	Association of Public Safety Communications Officials.
ATP	Acceptance Test Plan.
BER	Bit Error Rate.
Computer Aided Dispatch	A computer-based system, which aids PSAP Telecommunicators by automating selected dispatching and record keeping activities.
CATP	Coverage Acceptance Test Plan.
Confidential Information	All tangible and intangible information and materials, including all Personally Identifiable Information, being disclosed in connection with this Contract, in any form or medium (and without regard to whether the information is owned by the Customer or by a third party), that satisfy at least one of the following criteria: (i) Personally Identifiable Information; (ii) Proprietary Information; (iii) non-public information related to the Customer's employees, customers, technology (including databases, data processing and communications networking systems), schematics, specifications, and all information or materials derived therefrom or based thereon; or (iv) information expressly designated as confidential in writing by the Customer. Confidential information includes all information that is restricted or prohibited from disclosure by state or federal law.

Contract	The final version of any contractually binding agreement between The Customer and the Contractor relating to the subject matter of this RFP; references to the Contract include all exhibits, attachments, and other documents attached thereto or incorporated therein by reference.
Contract Term	The initial term of the Contract and any renewals and/or extensions.
Contracted Personnel	Contractor's employees or other personnel (including officers, agents, and Subcontractors) provided by the Contractor to perform work related to the Contract.
Contractor	A Proposer awarded a Contract.
CSSI	Radio Console Subsystem Interface.
Customer Premises	Communications or terminal equipment located in the customer's facilities – terminal equipment at a PSAP.
DAQ	Delivered Audio Quality.
dB	Decibel, a unit of power.
DC	Direct Current.
Deliverable	All project materials, including goods, software licenses, data, and documentation created during the performance or provision of Services hereunder or identified as a Deliverable in an applicable Statement of Work of other contract documents.
Department	A public safety subdivision utilizing the Customer radio
DHS	United States Department of Homeland Security.
Dispatch Console	A specialized computer with a software application through which calls are made to and received from radio users and radio dispatch
Division	A sub-unit of a County agency.
DVB	A state-certified Disabled Veteran-Owned Business.
Dynamic Dual Mode	A feature of a P25 land mobile radio system whereby call requests are assigned to P25 Phase 1 or Phase 2 channels based upon the capability of the radio users participating in the call.

Effective Date	The date the contract has been fully executed by the Contractor and the Customer.
Emergency Services Internet	A managed Internet protocol network that is used for emergency services and can be shared by all public safety answering points. It provides the IP transport infrastructure upon which independent application platforms and core functional processes can be deployed, including, but not restricted to, those necessary for providing NG9-1-1 services. ESInets may be contracted from a mix of dedicated and shared facilities. ESInets may be interconnected at local, regional, state, federal, national, and international levels to form an IP based inter-network (network of networks).
ERP	Effective Radiated Power.
FCC	Federal Communications Commission.
FDMA	Frequency Division Multiple Access.
FEMA	Federal Emergency Management Agency.
FirstNet	The independent authority within the National Telecommunications & Information Administration (NTIA) created by the Middle-Class Tax Relief and Job Creation Act of 2012 to provide emergency responders with the first nationwide, high-speed, broadband network dedicated to public safety.
Form-C	Normally-open/normally closed relay contact arrangement.
Geographic Information System (GIS)	A computer software system that enables one to visualize geographic aspects of a body of data. It contains the ability to translate implicit geographic data (such as a street address) into an explicit map location. It can query and analyze data to receive the results in the form of a map. It also can be used to graphically display coordinates on a map such as Latitude/Longitude from a wireless 9-1-1 call
GHz	1-billion cycles per second, Giga-Hertz (or microwave)
GPS	Global Positioning System.

Home Run Grounds	A dedicated and continuous electrical ground wire connection (green insulated) between an electrical device and the electrical circuit breaker panel. This connection is used for personnel safety as per the National Electric Code.
HVAC	Heating, Ventilation and Air Conditioning.
Hz	1 cycle per second, Hertz.
ID	Radio Unit Identifier.
IMBE	Improved Multiband Excited, P25 digital voice-coder.
IEEE	Institute of Electrical and Electronic Engineers.
Inter RF Sub- System Interface (ISSI)	An electronic gateway device used to link disparate P25 radio networks, thereby allowing radio user roaming across radio
Interoperability	The ability of public safety responders to share information via voice and data communications systems on demand, in real time, when needed, and as authorized.
Key Personnel	Contracted personnel who play leading and critical roles in provided Services during the contract term.
KHz	1,000 cycles per second, Kilo-Hertz.
KMF	Key Management Facility.
kVA	Kilovolt-Ampere.
LCD	Liquid Crystal Display.
LMR	Land Mobile Radio.
LTE	Long Term Evolution.
MABAS	Mutual Aid Box Alarm System.
Mandatory	A requirement labeled as such must be present in the proposed solution, exactly as stated, or the solution will not be considered by the
MBE	A state-certified Minority Business Enterprise.

MHz	1,000,000 cycles per second, Mega-Hertz.
Municipality	Any county, city, village, town, school district, board of school directors, sewer district, drainage district, vocational, technical and adult education district, or any other public body having the authority to award public contracts.
NCC	Network Control Center.
Next Generation 9-1-1	An enhanced 9-1-1 system that incorporates the handling of all 9-1-1 calls and messages, including those using IP-enabled services or other advanced communications technologies in the infrastructure of the 9-1-1 system itself.
NMS	Network Management System.
NOC	Network Operations Center.
NPSTC	National Public Safety Telecommunications Council.
OSHA	Occupational Safety and Health Administration.
OTAP	Over the Air Programming.
OTAR	Over the Air Rekeying.
OTEK	Over the Ethernet Keying.
P25	Project 25.
P25 Phase 1	Project 25 radio system using FDMA and the IMBE voice-coder.
P25 Phase 2	Project 25 radio system using TDMA and the AMBE voice-coder.
Parties	The County and the Contractor, collectively.
Party	Either the County or the Contractor, individually.

Personally Identifiable	An individual's last name and the individual's first name or first initial, in combination with and linked to any of the following elements, if the element is not publicly available information and is not encrypted, redacted, or altered in any manner that renders the element unreadable: (a) the individual's Social Security number; (b) the individual's driver's license number or state identification number; (c) the individual's date of birth; (d) the number of the individual's financial account, including a credit or debit card account number, or any security code, access code, or password that would permit access to the individual's financial account; (e) the individual's DNA profile; or (f) the individual's unique biometric data, including fingerprint, voice print, retina or iris image, or any other unique physical characteristic.
Proposal	The complete response to this RFP submitted on the approved forms, in the required manner and setting forth the Proposer's prices for providing the products and services described in the RFP.
Proposer	The Vendor submitting a Proposal in response to this RFP.
PTT	Push-to-Talk.
Public Information	Information that (i) is collected, assembled or maintained under a law or ordinance or in connection with the transaction of official business by a governmental body or for a governmental body; and (ii) the governmental body owns or to which it has a right of access.
Public Safety Answering Point	A facility to which a call on a basic or sophisticated system is initially routed for response, and on which a public agency directly dispatches the appropriate emergency service provider, relays a message to the appropriate emergency service provider or transfers the call to the appropriate emergency services provider.
Response	A Vendor's response to this RFP, also referred to as a Proposal.
RF	Radio Frequency.
RFP	This Request for Proposal.
SATP	Service Acceptance Test Plan.

Secondary PSAP	A PSAP equipped with automatic number identification and automatic location identification displays. It receives 9-1-1 calls only when they are transferred from the primary PSAP or on an alternative routing basis when calls cannot be completed to the primary PSAP.
Services	All actions, recommendations, plans, research, customizations, modifications, documentation, maintenance, and support provided by the Contractor necessary to fulfill that which the Contractor is obligated to accomplish under the Contract.
SOW	Statement of Work.
State	The Customer's State identified in this RFP.
SU	Subscriber Unit - Portable or Mobile Unit.
Subcontract	Any contract, express or implied, between the Contractor and another party or between a Subcontractor and another party delegating or assigning, in whole or in part, the making or furnishing of any material or service requested for the performance of the Contract.
Subcontractor	A party to a Contractor, as included in the Vendor's Proposal.
System	The new radio communications network to be proposed by Vendors and installed by the Contractor.
TDMA	Time Division Multiple Access.
TIA	Telecommunications Industry Association.
TIA-102	Telecommunications Industry Association, P-25 Standards.
TIA-603E	Telecommunications Industry Association, Land Mobile FM and PM Communications Equipment Measurement and Performance
TIA TSB-88	Telecommunications Industry Association, Technical Service Bulletin-88, Wireless Communications Systems Performance in Noise and Interference-Limited Situations.
UHF	Ultra-High Frequency (i.e., 450-512MHz)
UPS	Uninterruptible Power Supply.

User	An entity or person that operates land mobile radio equipment.
User-Selectable	A radio feature that can be enabled/disabled by radio-equipped field personnel.
uV	One-millionth of a Volt.
VAC	Volts Alternating Current.
Vendor	The entity that is responding to this RFP Specification.
VHF	Very-High Frequency (i.e., 136-174MHz).
VPN	Virtual Private Network.

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Appendix G: Service Area Map

The following map shows the approximate service area consisting of Grundy County and its associated fire districts.

