

**Public Safety Communications Equipment –
700 MHz Systems**

Contract No. GSS21869-700MHz

Appendix E- Technical Requirements

State of Delaware
700 MHz Communications System

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1.0 GENERAL INFORMATION AND SPECIFICATIONS

1.1 INTRODUCTION

The State of Delaware Department of Corrections (DOC) is soliciting proposals from Offerors capable of providing a new or upgraded state-of-the-art 700 MHz system, offering reliable and integrated digital voice and data communications to and from fixed stations and mobile subscriber devices throughout all parts of Delaware. This system shall operate in full conformity with 47 CFR §90 Subpart R and provide round-trip coverage within 97% of each individual county within the State as measured by TSB88C at a delivered audio quality level (DAQ) of 3.4.

The new system shall be spectrally efficient which means that it must support one voice talkpath or a minimum data rate of 4.8 kbps per 6.25 KHz channel to achieve an integrated voice and data capability. Beyond this mandatory requirement, the State requests a 700 MHz system that is in compliance with the P-25 Phase II TDMA standard for fixed infrastructure and mobile subscriber devices.

The Offeror's proposal shall provide a comprehensive migration strategy including specific dates in which system components and/or software would be provided to achieve P-25 Phase II TDMA. The information outlining compliance with the P-25 Phase II TDMA standard should also address costs and all issues related to implementation to the greatest extent practical so the State can understand fully the benefits of the Offeror's proposal.

The Offeror shall provide a turnkey system including software, hardware, ancillary equipment, and necessary subsystems, which results in a fully integrated and operational communications system meeting the requirements of this Request for Proposal (hereinafter collectively referred to as the "System").

1.2 INTEROPERABILITY WITH THE 800 MHz SYSTEM

The Offeror shall provide interoperability between the proposed statewide 700 MHz System and the existing 800 MHz statewide Motorola SmartZone Trunking (Release 7.X) land mobile radio network, 800 MHz Conventional ITAC System as well as other existing public safety LMR systems now interoperable with the existing 800 MHz public safety system. Existing public safety systems include those that are critical to multi-jurisdictional and multi-state operations, such as covert operations, tactical operations, aerial operations, State operations utilizing regional interoperability systems, and other systems necessary to support the initiatives of Transportation, Transit, Corrections, fire, emergency medical services ("EMS"), police, and others. The State shall not accept new technology that results in the loss of existing substantive capabilities.

1.3 AVAILABLE INFRASTRUCTURE

The State desires a system that is designed so that it utilizes existing resources to the greatest extent possible. These resources include, but are not limited to, state-owned towers, shelters, facilities, UPS, generators, microwave resources, and fiber optic digital transport capabilities. Instead of infrastructure, the State prefers that the Offeror explore the comprehensive re-use of the existing infrastructure with proposed components focusing on transceivers, transceiver control systems, and interoperability gateways providing comprehensive communications between the new and existing public safety radio system.

1.4 DEFINITIONS

These terms used within this Agreement have the following meanings :

- a) "Acceptance Date" shall be the date the system is accepted.
- b) "Acceptance Tests" means those tests described in the Statement of Work.
- c) "Agreement" means the main body of an Agreement, the Contract Documents, and any amendments to this Agreement.
- d) "CATP" means the Coverage Acceptance Test Plan, described in the RFP and Statement of Work.
- e) "Channel" means a discrete 6.25 KHz portion of radio spectrum incorporated within 47 CFR §90.531. Unless advised to the contrary, in the RFP, the term Channel shall include a 6.25 KHz portion of radio spectrum within the 769-775 MHz band that is paired with a companion channel in the 799-805 MHz band.
- f) "Detailed Design Review" is the intellectual process of finalizing engineering, operational, and any other requirements necessary prior to System Implementation.
- g) "Day", for purposes of computing time when performance is due, means one (1) calendar day, unless specifically noted otherwise.
- h) "Effective Date" means that date upon which the last party to sign this Agreement has executed the Agreement. The "Effective Date" shall be the date inserted on the first page of this Agreement.
- i) "Equipment" means the equipment that the State purchases from Offeror under this Agreement. Equipment that is part of the System is described in the Equipment List.
- j) "FAA" means the Federal Aviation Administration.
- k) "FATP" means the Functional Acceptance Test Plan, described in the Statement of Work.
- l) "FCC" means the Federal Communications Commission.
- m) "FDMA" means frequency division multiple access.
- n) "Final System Acceptance" shall mean acceptance of the System.

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- o) “Fixed Network Equipment” or “FNE” means all hardware and software permanently installed in a fixed location and used to transmit and receive radio signals including but not necessarily limited to: the system’s 700/800 MHz transceivers, comparator/voter, system control systems, combiners, multiplexers, antennae, etc.
- p) “General Pool” means those channels identified by the FCC in 47 CFR §90.531(b)(6).
- q) “Greenfield” means an area of land that contains no developed infrastructure for a FNE site.
- r) “Infringement Claim” means a third-party claim alleging that the Equipment manufactured by Offeror or the Offeror Software infringes upon the third party’s U.S. patent, trademark, copyright or other Proprietary Right. With respect to non-U.S. claims, the claim must originate from a country where Offeror sells the applicable product and that has established intellectual property laws.
- s) “Materials” means, unless otherwise specified, all hardware, firmware, documentation, and other materials, equipment, and things used in the performance of or supplied under this Agreement.
- t) “Offeror” includes Offeror, its agents and employees and is a term assigned to an entity that submits a proposal to this RFP and Specifications.
- u) “Offeror Software” means Software that Offeror owns and as further described in the Software License Agreement.
- v) “Non-Offeror Software” means Software that Offeror does not own.
- w) “P-25 Phase II TDMA” means 6.25 kbps 2-slot Time Division Multiple Access (TDMA) air interface standard utilizing the enhanced half-rate DVSI Vocoder. The proposed system shall also comply with the P-25 Inter Sub System Interface (ISSI) standards
- x) “Project” means the effort and activities associated with the definition, engineering, provision, delivery, installation, construction, configuration, optimization, testing, training, and acceptance of the System as defined in this Agreement and concluding with Final System Acceptance.
- y) “Proprietary Rights” means the patents, patent applications, inventions, copyrights, trade secrets, trademarks, trade names, mask works, know-how, and other intellectual property rights in and to the Equipment, Software, Materials utilized in the System, including those created or produced by Offeror under this Agreement, and any corrections, bug fixes, enhancements, updates, or modifications to or derivative works from the Software whether made by Offeror or another party.
- z) “Software” means the Offeror and Non-Offeror Software in object code format that is furnished with the System or listed on the Equipment List and as further described in the Software License Agreement.
- aa) “Statement of Work” shall mean the description of the work to be performed by the parties, including the services that will be provided by Offeror and its sub-contractors to install, optimize, implement, and test the system and its equipment, hardware, materials, and software components.

- bb) “State Channels” means those channels identified by the FCC in 47 CFR §90.531(b)(5).
- cc) “System” shall mean the radio communication system comprised of the Equipment and Software to be furnished by Offeror to the State pursuant to the terms set forth in the Contract Documents.
- dd) “System Implementation” means the process of engineering, permitting, licensing, equipment manufacturing, installation, and testing of the System.
- ee) “TDMA” means time division multiple access
- ff) “700 MHz” means those frequencies identified in 47 CFR §90.531 for which the State of Delaware is licensed or eligible
- gg) “800 MHz” means those frequencies identified in 47 CFR §90 Subpart S for which the State of Delaware is licensed or eligible

1.5 BACKGROUND AND GENERAL DESCRIPTION OF WORK

1.5.1 SCOPE OF WORK

The Offeror to whom a contract is awarded under this RFP (hereinafter the “Contractor”) shall assume complete responsibility for engineering, furnishing, and installing a new or upgraded State of Delaware 700 MHz System in accordance with one of three bid packages. The Contractor shall be responsible for System performance, including a guarantee of radio coverage; installation of base station equipment, antennas and cables, system/network management terminals, communication dispatch consoles, control stations and recorders; optimization of the 700 MHz radio infrastructure, connection to the existing microwave and fiber backbone supporting the County 9-1-1 systems; interoperability gateways to the existing 800 MHz and other defined systems, and the training of System users and maintenance personnel.

Offerors shall propose a complete and fully operational System. If the System as installed does not meet the technical requirements of this RFP and any resulting contract, all additions or modifications required to meet those technical requirements to the satisfaction of the State shall be at the sole expense of the Contractor.

1.5.2 CURRENT SYSTEM DESCRIPTION

The State’s existing Digital 700 MHz Trunked Radio System consists of a Harris P25 IP based multi-cast system. The RF infrastructure provides for high performance in-street and in-building coverage from State-owned and private tower sites that are strategically located within the boundaries of the State of Delaware. The system provides interoperability for all state, county, and local first responders and other governmental services within the entire state for the Department of Corrections.

1.5.3 Telecom Network

The backbone of the current system consists of a Nokia Digital microwave in a loop configuration.

1.5.4 Audio Recording Systems

The State is currently using a Verint logging and recording system that records radio audio from the 700 MHz trunked radio system. radio is recorded at the central site (DEMA). The network utilizes a comprehensive redundancy strategy that provides radio audio archived to a central on-line storage application. The storage Center is located at the DEMA site

1.5.5 Facilities

In general, each of the existing trunked radio sites has a large custom fiberglass or concrete shelter. For back-up power, all sites are configured with single or dual UPS systems and diesel or propane fueled generators. RF site towers range in height from 300-500 feet in height and are generally self-supporting structural designs. A complete inventory of existing State towers, water tanks, land parcels, commercial towers, utility towers, and other government towers can be obtained by contacting Thomas Kadunce Division of Communications, at (302) 697-4487. All existing facilities comply with Motorola's R-56¹ standards for grounding.

In addition, adjunct radio systems may be added in facilities of the Department of Correction. Floor plans and site visits for a correctional facility will be provided by the Department of Correction. These drawings and security issues pertaining to them can be obtained by contacting Mike Merson , Department of Correction, at (302) 857-5258.

1.5.6 Subscriber Units

700 MHz subscriber radios in use are Harris M7300 and P7300 models. The State intends to use the existing radios if feasible or upgrade approximately 1,300 700 MHz subscriber radios and 40 700 MHz RF control stations if necessary.

1.6 SYSTEM FUNCTIONAL OBJECTIVES

- A. Deliver 700 MHz "on-street" level mobile radio communications coverage to no less than 97% of the land and inland water areas in each individual county.
- B. The delivered audio quality (DAQ) shall be no less than 3.4.

¹ Complied with the R-56 standards in place at time of installation

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- C. Provide 700 MHz portable coverage within the compound walls of correctional facilities to the standards defined in this RFP.
- D. Provide the ability for the new 700 MHz system to interoperate with the State's existing 800 MHz radio system with no loss of present capabilities, features, or functionality and in a manner that shall maximize resource sharing and cooperation among all State, County, and Municipal governments as well as police, fire and emergency medical services, and select federal agencies through direct radio communications using a 700 MHz radio system with the following features:
 - a. Communications between subscribers, and to and from the appropriate dispatch center, and to and from control stations throughout the State;
 - b. Emergency call, private call, call alert, regrouping, scan and inhibit capabilities, and unit identification from all suitably equipped radio units;
 - c. Automatic unit identification throughout the duration of each call upon every push-to-talk on a radio unit;
 - d. Encryption between suitably equipped units.
 - e. Provide reliable communications under the DOC traffic load.
- E. Provide redundancy such that there are no single points of failure in any aspect of the delivered system.
- F. Employ an architecture to:
 - a. Allow shared use by State, County and Municipal governments and their police, fire, and emergency medical services and select federal agencies;
 - b. Provide expandability for future growth;
 - c. Support compatible, multiple vendor subscriber hardware such as mobile, portable, and control station units.

1.7 MAJOR SYSTEM COMPONENTS

The major components of the System are anticipated to be a:

- A. A spectrally efficient 700 MHz Digital Trunked Voice and Data System utilizing the Internet Protocol (IP) architecture.
- B. A 700 MHz system which can be easily upgraded and expanded to add 700 MHz transceivers statewide through an IP backbone and existing microwave network to support the growth of statewide first responder and other governmental requirements of up to 15,000 total subscriber devices operating in the three counties of the State of Delaware plus up to 10,000 additional subscriber identification codes for federal and out-of-state users².
- C. A comprehensive technological hardware and software migration strategy, including all requirements and financial costs.
- D. A choice of IP-based communications consoles that can be located at various locations.
- E. A graphical user interface-based site monitoring and alarm system that shall report to the Division of Communications any unusual System events.
- F. A selection of mobile vehicular radios and data devices that meet the functional requirements of the user agencies.
- G. Interoperability gateways or other equipment enabling integration of the System with the existing 800 MHz radio system.
- H. Gateways or other equipment enabling integration of the System with other systems, such as those used by jurisdictions surrounding the State.
- I. As an option, an additional 700 MHz site(s) and/or bi-directional amplifiers or other suitable equipment to provide facilities of the Department of Correction with reliable in-building and in-compound communications.

² The State recognizes that many additional fixed stations would be required to support a 50,000 subscriber device network. The requirement limits the responsibility of the Offeror to provide a system, including subscriber devices, that is capable through a migration path identified by the Offeror that details the components necessary to grow the system to support 50,000 up to subscriber devices.

1.8 SERVICE TO BE PROVIDED BY THE CONTRACTOR

1.8.1 Turnkey

The State contemplates a “turnkey” form of system construction, installation, testing, and delivery of a completely operational System as specified by this RFP and any resulting agreement. The word “turnkey” means that the Offeror assumes complete responsibility to make the system components provided, installed, and tested by the Offeror operate in the manner and purpose for which the components were designed. Further, the Offeror will be responsible to ensure that all provided and installed components operate as a system providing the full communications functionality as described in the Offeror’s proposal.

Offerors may propose to sub-contract major subsystems in lieu of a complete turnkey System. The Offeror shall be responsible for the systemic operation of any sub-contracted items.

The Contractor shall furnish all materials, equipment, tools, skills, engineering, and labor of all kind necessary to deliver, install, test, and implement the system components provided. The Offeror’s work shall be performed in a professional and timely manner consistent with the requirements of this RFP and any resulting agreement according to the specifications, terms, schedule, and conditions contained in this RFP, including any Exhibits and Appendices.

The Contractor assumes full responsibility for materials and equipment employed in construction of the System and agrees to make no claims against the State for damages to such materials or equipment except for that which is caused solely by the State, its employees or agents.

1.8.2 Right of State to Amend the Delivery of Turnkey Systems

Nothing in this RFP shall restrict the right of the State of Delaware to exempt any component(s) or service(s) from this Agreement and provide them through a means outside of an Agreement resulting from this RFP.

1.8.3 System Design

The Contractor shall be solely responsible for the design of the 700 MHz System. The Contractor shall acknowledge that it has made a complete inquiry into the current and currently projected growth requirements of the State for the 700 MHz System and fully understands and identifies the nature and scope of such requirements. The Contractor shall warrant, guarantee, and covenant that the System is and shall be designed, delivered, installed, tested, and maintained by the Contractor to meet or exceed the current needs and currently projected future growth needs of the State.

1.8.4 Inability to Meet System Performance Criteria

Any and all changes required due to the System's inability to meet the contractual System performance criteria shall be provided by the Contractor at the Contractor's sole expense. Any additional sites or changes in antennas not contemplated by the Contractor's response to this RFP or the resulting agreement that may be required to correct deficiencies because the Contractor has failed to satisfy the coverage requirements of this RFP and any resulting agreement shall be provided by the Contractor at the Contractor's sole expense.

The Contractor shall provide a Design Specification allowing for traceability between the applicable System and Subsystem Specifications herein and the Contractor's Detailed Design. System or Subsystem acceptance shall be based upon verification against the approved Design Specification document in accordance with acceptance criteria in Section 14.0.

1.8.5 Detailed Design Review (DDR)

The Contractor shall perform a comprehensive detailed design review with representatives of the State of Delaware as the initial part of project commencement. The State shall actively participate in the detailed design of the entire system with the Contractor. Offerors shall note; however, that State participation in the detailed design and detailed design review shall in no way relieve the Contractor from full responsibility for system performance. Completion of the detailed design process shall take place upon mutual agreement between the Contractor and the State. Contractor shall not place equipment orders until the completion of the DDR process. Detailed design documents shall be supplied to the State in both electronic (original file format) and paper format. The Contractor shall supply six (6) copies of the detailed design document in both electronic (CD-ROM) format and paper format. The detailed design shall include, at a minimum, the following items for all system elements:

- Site acquisition risk analysis, if needed
- Satisfactory frequency plan³
- Final shelter designs
- Microwave path certifications, if necessary
- Complete geo-technical studies
- Final tower and foundation designs, if necessary
- Structural Analyses
- National Environmental Protection Agency site environmental risk analyses, if necessary

³ In the development of the frequency plan, the Offeror shall use a mix of frequencies as authorized under the State's blanket 700 MHz license as well as "general" channels defined in 47 CFR §90.531(b)(6)

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- Utility service and route plans
- Revised detailed statement of work
- Revised detailed implementation plan
- Revised project schedule
- FCC regulatory review and frequency acquisition risk analysis
- Network and Subsystem Block Drawings
- Line Item Equipment Lists
- Infrastructure, Console, and Network Element Programming Parameters
- Console and SmartZone Database Parameters/Design
- Fleet mapping Parameters
- Transport Requirements/Design/DS0 and DS1 Channelization
- Composite IM/TNRD Analysis for all new and existing sites
- Site RF Balance Analysis
- Racking/Floor plan Drawings
- Physical Site Requirements
- Power and HVAC Requirements
- Channel Bank Layouts/Configurations
- Network Timing Requirements/Design
- Antenna Subsystems
- Feature Loss/Feature Gain Matrix
- Failure Mode Analysis
- LAN/WAN Design
- TCP/IP Network Addressing Scheme
- Upgrade Strategy/Preliminary Cutover Plan/Downtime Requirements
- Change Orders
- Test plans
- Spares

1.8.6 Integration

The Contractor shall be solely responsible for the proper installation and interfacing of all equipment provided pursuant to this RFP and any resulting agreement. In circumstances where existing equipment of the State/County is being utilized in the System, the Contractor shall warrant that the equipment provided by the Contractor shall fully perform in strict conformance to the specifications and conditions incorporated in this RFP and any resulting agreement, and said Equipment shall be compatible with the State's existing communications system, as required by this RFP and any resulting agreement.

1.8.7 Sites and Inspection

The State strongly prefers that the system design be based upon the re-use of existing sites owned by the State of Delaware.

Any proposals suggesting the need for Greenfield sites are strongly discouraged unless the Offeror can provide clear and convincing evidence of the need for a Greenfield site.

Prior to the completion of the detailed design phase, the Contractor shall have completed a site inspection by qualified personnel of each potential and proposed site comprising the System, and shall agree that the present condition of such sites and any existing facilities are acceptable to the Contractor and that the System can be installed in a workable condition at the identified site.

During the term of any resulting agreement, should it become necessary that alternative sites and facilities be substituted for other sites and facilities, the Contractor shall inspect the submitted sites and facilities and report to the State, in writing, those conditions that make substitution necessary. The Contractor shall agree to correct malfunctions, hardware defects, and failures of the System to perform in strict conformance with the specifications of this RFP and any resulting agreement. The Contractor shall, prior to installation of the System at each site, re-inspect such site including structures located thereon and shall identify, in writing, to the State any changes in sites and facilities since the initial inspection that may affect the System. If the Contractor fails to re-inspect the sites prior to installation of components of the System, it shall thereafter be liable for any failure of the System to perform in conformance with this RFP and any resulting agreement caused, in whole or in part, by changes at any site.

1.8.8 Installation and Alteration

Prior to installing any components of the System at any site, the Contractor shall determine and ensure that the construction and alterations required for the System to be properly installed, including the following, are present, sufficient, and appropriate at each site:

- Access
- Electrical power
- Wiring
- Standards-compliant site grounding
- Environmental controls and equipment
- UPS and emergency generators
- Towers
- Shelter and fuel tank slabs
- Console cabinets and furniture
- Floor and rack space.

All of the Contractor's work shall comply with all applicable federal, state, and local codes and ordinances.

1.8.9 Microwave

It is anticipated that the Contractor will utilize available channels on the existing microwave system. An evaluation of the current 4.9GHz microwave equipment shall be conducted to determine sustainability and upgraded as required to ensure system integrity and redundancy. If any new microwave paths are required, the Contractor shall agree to engineer, design, and implement public-safety-reliable (99.9999% reliability) redundant microwave paths, and coordinate and obtain the FCC license for all microwave frequencies required to implement the System in accordance with the requirements of this RFP and any resulting agreement.

1.8.10 Existing System Interruptions

The Contractor fully understands that the proposed 700 MHz System will often operate “alongside” or in conjunction with the State’s current 800 MHz system. The Contractor also understands that no interruption in the existing State 800 MHz communications system can be tolerated due to the commitment of the State to provide for the health, welfare, and safety of its citizens. Therefore, the Contractor agrees that at no time shall its employees, agents, subcontractors, or servants performing any work under this RFP and any resulting agreement interrupt the existing 800 MHz communications system of the State or any components of such system. If an interruption is unavoidable for the Contractor to perform work under this RFP and any resulting agreement, the Contractor shall first contact the State’s Program Manager and set out in writing the following:

- The nature of the work that will cause the unavoidable interruption
- The nature of the interruption
- The duration of the interruption
- A detailed statement of the scope and sequence of the work to be performed during the interruption.

After giving notice and providing the written notification described above, the Contractor may proceed with the work only after receiving written confirmation from the State’s Program Manager that the interruption is both unavoidable and can be tolerated by the State. If the Contractor fails to follow the procedure described above or if the Contractor’s work causes an interruption to a greater extent or duration than was set out in the writing described above, the Contractor shall be strictly liable for all actual damages arising from and caused by the interruption. In no event shall the Contractor be granted any extensions of time for performance under any resulting agreement for the time spent following the above-described procedures.

1.8.11 Factory Staging

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1.8.12 Testing

The Contractor shall perform all testing described in this RFP and any resulting agreement.

1.8.13 Training

The Contractor shall conduct a comprehensive training course to instruct State personnel in the proper operation, use, upgrading, and maintenance of the new 700 MHz system as the State may require and to instruct State personnel how to train other personnel in such subjects. The Contractor shall comply with all training requirements contained in this RFP and any resulting agreement. The State agrees to notify the Contractor promptly in the event that a date change for a scheduled training program is required.

1.8.14 Maintenance & System Management

The Contractor shall provide all labor, parts, tools, and test equipment required for the maintenance of the components acquired from the Contractor as part of the 700 MHz system through the warranty period and any extensions thereof covered by a maintenance agreement. The Contractor shall provide a recommended system management plan (personnel and location) to ensure operational efficiency, monitoring, and control. The Contractor shall also provide a recommended maintenance program for the 700 MHz components acquired through this RFP, including, but not limited to, personnel training/specialization; number of personnel; equipment required for analysis and troubleshooting; optimization; and schedules for preventive maintenance.

1.8.14.1 **Maintenance Documentation**

The State of Delaware anticipates that its internal Division of Communications technicians will maintain the 700 MHz system and related support components acquired from the contractor following the warranty period. As such, continuing documentation relative to the components acquired is essential.

The Contractor shall furnish to the State six (6) sets of equipment and maintenance manuals and System drawings in hard copy and electronic formats of commercial standard. Sufficient information shall be included therein so that an average technician or engineer with basic electronic knowledge and experience, but unfamiliar with the System, shall be able to define its operations and perform corrective and preventive maintenance.

The manuals shall note in detail any special circuitry, special wiring, special interfacing, and custom or non-standard procedures required to operate, maintain, and install any of the equipment furnished under this RFP and any resulting agreement.

All documentation shall be specifically applicable to the 700 MHz System components acquired from the contractor, except that documentation for standard issue equipment may be standard issue documentation. The Contractor shall warrant that any inability of the State or subcontracted technicians or engineers to perform corrective and preventive maintenance on the System caused in whole or in part by the Contractor's failure to provide accurate or sufficient information in said manuals shall cause the Contractor to be liable for damage if such failure results in damage to or interruption of the System.

1.8.15 Project Management

It is anticipated that site development will not be an issue with this project since the State has already developed a number of towers throughout Delaware. Additionally, Delaware already holds a FCC licensee for state government 700 MHz channels⁴ and has developed a plan of coordination with our neighboring states relative to the use of these channels. As such, once a contract has been awarded, the Project Manager should be continuously engaged on project duties as time consuming real estate and frequency issues will hopefully be avoided.

The Contractor shall assign a dedicated, full-time Project Manager who is authorized to exercise technical direction of each project. The Contractor's proposed Project Manager is subject to approval by the State, which approval shall not be unreasonably withheld.

The Contractor's Project Manager shall, at a minimum: attend bi-weekly project meetings as scheduled by the State; provide a monthly status report no later than the fifth business day after the end of each month. Provide schedule updates, as required, conforming to the State's formatting and content requirements and transmitted to the State or the State's designee in both electronic format; and provide other reports as reasonably requested by the State.

1.8.16 Site Plans

In the unlikely event that a new site is required, other than as contained within a Department of Correction facility, the Contractor shall prepare site plans where required for zoning or permit approvals and file all necessary zoning and permit applications.

⁴ See 47 CFR §90.531(b)(5)

Unless waived by the State, the contractor shall also be required to perform all tasks associated with Section 106 of the National Historic Preservation Act as well as the filing of applications and documentation for tower approval with the Federal Aviation Administration and Federal Communications Commission.

1.8.17 Errors and Omissions

The Contractor shall assume full responsibility for the acts and omissions of all its agents, servants, and employees, and all subcontractors, their agents, servants, and employees, and all other persons performing any of the work required under this RFP and any resulting agreement.

The Contractor shall neither remove any State fixture nor State property, real or personal, from State premises, nor temporarily nor permanently affix any equipment to State premises not specifically required by this RFP and any resulting agreement without the express written consent of the State. In the event that any real or personal property of the State is damaged by any act or omission of the Contractor, or any of its employees, agents, subcontractors or servants, the Contractor shall, at the sole option of the State, either immediately repair or replace such damage to the complete satisfaction of the State, or, upon the State's presentation of an invoice, reimburse the State for the actual reasonable cost of repairing such damaged property.

The Contractor shall keep the State's premises reasonably clean of accumulations of rubbish or scrap resulting from the work covered by this RFP and any resulting agreement. Upon completion of the System, the Contractor shall leave the State's premises reasonably free from rubbish or scrap material resulting from the Contractor's performance.

1.9 SERVICES PROVIDED BY THE STATE

Work by the State includes:

- A. Securing access to existing base sites and if necessary, site leases and utility rights-of-way where required.
- B. Filing the frequency coordination and FCC license applications, prepared by the Contractor, for any required "general" 700 MHz frequencies⁵ and microwave system channels.
- C. Designating a State Program Manager, and as necessary, assisted by a professional engineering consulting firm(s), to manage the implementation of the System.

⁵ See 47 CFR §90.531(b)(6)

1.10 STANDARDS OF WORK

All requirements and recommendations contained in applicable sections or portions of the standards, regulations, and codes of the entities listed below shall apply to the Contractor for site preparation and for the installation, operation, maintenance, and service of the System by the Contractor, in no order of precedence:

Federal Communications Commission (FCC)
Federal Aviation Administration (FAA)
Federal Environmental Protection Agency (EPA)
American National Standards Institute (ANSI)
National Fire Protection Association (NFPA)
National Electronic Manufactures Assoc (NEMA)
National Electric Code (NEC)
Occupational Safety and Health Act (OSHA)
Institute of Electrical and Electronics Engineers (IEEE)
Electronics Industries Association (EIA)
Underwriters Laboratories (UL)
American Institute of Steel Construction (AISC)
American Concrete Institute (ACI)
American Society for Testing and Materials (ASTM)
Any State or local ordinances and building, fire, and zoning codes
American Welding Society (AWS)
County and local government building and construction standards
Associated Public Safety Communications Officials (APCO); Projects 16 and 25, as appropriate
Bellcore TR-TSY-000499
International Standards Organization (ISO)
Motorola R56 Standards and Guidelines for Communications Sites

In the event that the requirements of the standards, regulations, or codes differ or are revised during the project, the most stringent shall apply.

2.0 SUBSCRIBER EQUIPMENT

The State intends that via this RFP, various types of subscriber equipment and devices shall be made available to the agencies and other permitted users on the System, on an as-needed basis. The State, County, Municipal Governments and other agencies operating on the System shall purchase subscriber units that may require different features, depending on the user agencies and their operational needs. Therefore, Offerors shall supply information on the tier of their products by completing the matrix contained in 4.1.6.4 herein. In their proposal, Offeror shall provide pricing for all tiers of subscribers and associated accessories.

“Subscriber equipment” refers to mobile radios, portable radios, control station radios, vehicular repeaters, and data modems. Logic and transceiver design for subscriber devices require similar design characteristics and shall be delineated as such. Where features and accessories are required for a specific variety of subscriber equipment, they shall be indicated as such.

For all subscriber units proposed, the transmitter, transmitter RF power output, transmitter emissions, and receiver shall meet or exceed all applicable EIA Standards and FCC type acceptance Rules and Regulations as well as the provisions of 47 CFR §90 Subpart R.

Offerors shall provide all cables (antenna, battery, control head[s], and others), mounting hardware, antennas, fusing facilities and accessories to provide a completely functional subscriber unit. Items omitted by the following lists shall be added by Offerors to ensure complete and compatible integration onto the System.

2.1 GENERAL

Subscriber units are required in five different packages: mobiles, portables, mobile adapters, control stations, and remote desk sets. Packages for DTC voice operations must also interface with the existing mobile data/AVL system. This system utilizes 800 MHz for voice operations and 450 MHz data radios for mobile data/AVL. The 450 MHz data system controls the activation and talkgroup assignment to 800 MHz mobile voice radio when voice communications with the driver is necessary.

The voice radio equipment shall consist of an integral radio set, capable of multiple RF channels, with automatic channel switching under the control of channel switching logic. Voice radio equipment shall include such other items as are necessary for a complete, highly reliable, two-way digital radio suitable for communications in a multi-channel/mode system.

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All voice subscriber system parameters (personality) shall be software configurable without the need to replace internal components for parameter configuration. All voice subscriber internal software shall be able to be downloaded from a programming device without the need to replace internal components for new software versions. Offerors shall indicate capabilities for over-the-air reprogramming of system parameters and internal operating software.

The units shall be of current production and shall be capable of withstanding the harsh environment associated with use in emergency service vehicles. More specifically, the mobile and portable equipment shall meet the applicable sections of MIL-STD-810E "Environmental Test Methods and Engineering Guidelines" as follows”:

Methods 506.3	Rain	Procedure I – Blowing Rain
Method 509.3	Salt and Fog	Procedure I – Aggravated Screening
Method 510.3	Sand and Dust	Procedure I – Blowing Dust
Method 514.4	Vibration	Procedure I Category 10 Minimum Integrity Test (3 axes)
Method 516.4	Shock	Procedure I – Functional Shock

All radio equipment shall meet the requirements of TIA/EIA-603 "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards" when operated in the analog mode.

The units shall be feature & function compatible with the fixed equipment supplied under this contract.

The radio (subscriber unit) shall contain an Electronic Serial Number (ESN). An ESN query of the radio shall result in a validation response.

All radio equipment shall:

- Support all digital communications within this system.
- Subscriber devices shall support analog communications within this system when involved in a call from an analog unit pursuant to the limitations of 47 CFR §90 Subpart R.
- Support analog communications on an 800 MHz conventional channel.
- Subscriber devices shall as a standard option, support a 12.5 kHz analog (11K0F3E) mode and a 25 kHz analog (20K0F3E/16K0F3E mode where permitted by FCC/NTIA rules) for Phase II TDMA equipment.
- Subscriber devices shall support a digital P-25 Phase I 12.5 kHz CAI direct mode.

- Subscriber devices shall permit variable RF power outputs by talkgroup or other means to comply with the requirements of 47 CFR §90.531(b)(3) and 47 CFR §90.531(b)(4).
- Support a multi-point data port to multiple external peripherals.
- Subscriber devices shall be able to *sequentially* scan both conventional channels (at least 8) and trunked talk-groups (at least 8) in both clear and encrypted voice. The Offeror shall provide the maximum scan time required between trunking and conventional reception. The scan shall be a selectable priority, which means that the transmitter channel or talk-group selected by the user is the priority channel or talk-group. The manner, abilities, and limitations of the scanning capabilities of each subscriber device shall be explained in detail.
- Support an optional Subscriber Unit Transmitter Inhibit Mode. This is an optional mode on portable and mobile equipment which when selected by the user would inhibit the transmitter under all conditions until the mode was deselected by the user. While in the transmitter inhibited mode, the receiver would still be capable of receive operation.

2.1.1 Audible Signaling

Subscriber radio equipment shall support audible signaling to and from subscriber units for functions as described below:

Because of the inability to faithfully pass audio signaling through vocoders, audible signals shall use data messages that cause the receiving unit to generate standardized tone signals. These standardized tone signals correspond to a specific signaling command. Audible signals use data messages in the system to initiate audible signals both in the subscriber units and also in the consoles.

It is a mandatory requirement that users shall be able to select no audible signaling, or any or all of the default types of signaling described below. As a standard option, users may require alternative signals, which are subject to personality programming in the subscriber unit and/or in the console. All audio frequencies specified herein shall have a +/- 5% frequency tolerance.

The mandatory default audible signaling shall be limited to four standardized signals:

Emergency – indicates the highest level of a declared emergency.

The Emergency audible alert shall consist of a complex signal comprised of sequential pulsed 600 Hz and 1800 Hz sinusoidal tone signals.

The signal volume shall ramp from barely audible to maximum set equipment volume over a nominal two-second period.

The Emergency alert shall be initiated by the operation of a momentary switch at the subscriber unit and may also be initiated by a console. It shall terminate after sending for a nominal two seconds regardless of how long the operator holds the switch. Receipt of an Emergency alert at a console shall cause a latch up output for operation of external alarms. The console operator shall be able to release this latch.

A receiving terminal unit shall continue to emit periodic Emergency signals until any digital control on the radio is operated.

In the case of Emergency Alert, the choices shall include that the initiating terminal unit either shall or shall not generate a local indication of the signal being transmitted.

Communications Modes shall include Clear audio and Encrypted audio.

2.1.2 Mobile Subscriber Units

2.1.2.1 Power Supply

The equipment shall operate from an external negative ground primary power source supplying a nominal 12 VDC. All power circuits shall provide for reverse polarity protection without damage to the equipment.

If there are units requiring positive ground kits, costs per unit shall be clearly identified in the pricing section of the Offeror's response. If there is an incremental installation cost related to the positive ground vehicles, the costs shall also be clearly and individually identified in the response.

2.1.2.2 Mobile Equipment Housing

The transceiver housing shall house all electronic circuits and/or circuit cards associated with the equipment.

Palm microphones, external speaker housings and transceiver housings shall be constructed of high impact polycarbonate plastic or other suitable high impact material.

Trunk mounted transceiver housings shall be equipped with a base plate. The base plate shall allow for the removal of the transceiver from its mounted location for

replacement or servicing. Removal of the transceiver from the base plate shall not expose its internal circuitry.

2.1.2.3 Mobile Accessories

The units shall be equipped with a palm type microphone with coiled cord. The microphone shall be of the plug-in type. Remote units for outside vehicle use shall have, at a minimum, a weatherproof rating.

Each unit shall be equipped with an in-vehicle speaker. The speakers shall be of the plug-in type. Remote speakers for outside vehicle use shall have, at a minimum, a weatherproof rating.

Contractor shall supply gain-type antennas for new subscriber equipment unless the radio is provided with a vehicular repeater. If a vehicular repeater, the Offeror shall provide the type of antenna recommended by the manufacturer for mobile/VRS operation.

Mobile radios shall accept the installation of common fire apparatus headset systems.

2.1.2.4 Mobile Radio Features

The unit shall be equipped with an alphanumeric character display to identify the operating trunked talk group or conventional channel; to adopt 4 rows by 3 columns matrix as the minimum key pad configuration with the first level and shifted functions to be software programmable and assignable; and Label Configuration to conform to the North American telephone keypad standard numerical and symbol layout, as a Standard Option.

The display shall not display less than 8 characters and its brightness shall be user adjustable.

The unit shall be equipped with a user-operated switch to activate the radio's emergency status mode.

The unit shall be equipped with a user configurable trunked talk group/conventional channel scanner. The scanner shall allow the user to selectively add or omit talk groups or channels from the scanning sequence. A mix of talk groups and channels shall be allowed in the scanning sequence. User selectable talk group/channel priority shall be a feature.

On dual control head units, the switch to enable or disable scanning shall be on the front control head only.

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On dual control head units, each control head shall be equipped with a switch to take over control of the unit.

On dual control head units, transmit and receive audio shall, at all times, be available from both front and rear positions regardless of the position of the takeover control switch.

Offerors shall define the following specifications for all mobile radio subscriber units proposed. Three columns are provided in the chart for convenience. Offerors proposing more than three models per radio type may submit multiple copies of the chart.

Mobile Subscriber Radio Units Specifications			
Specification	Model A	Model B	Model C
Input Voltage			
Power Consumption (idle)			
Power Consumption (receive)			
Power Consumption (transmit)			
Temperature Range			
Physical dimensions			
Weight			
Control head dimensions			
Antenna port impedance			
Channel Spacing			
Shock and Vibration			
Humidity			
Receiver Frequency Stability			
Sensitivity			
Data Sensitivity			
Selectivity			
Intermodulation			
Spurious and Image Rejection			
Transmitter Frequency Stability			
Transmit power			
Spurious & Harmonic Emissions			
FM Hum and Noise			

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Offerors shall indicate which features are supported under each model offering. Offerors shall check each feature, as required, and provide this information as part of the proposal response for each model proposed. Three columns are provided in the chart for convenience. Offerors proposing more than three models per radio type may submit multiple copies of the chart.

Mobile Subscriber Radio Units Features			
FUNCTION	Model A	Model B	Model C
Analog Conventional			
Analog Trunked			
Digital Conventional			
Digital Trunked			
MIL-SPEC 810 C/D/E			
Dual Band Operation			
Trunk Mount			
Dash Mount			
RF Power Output switch (High/Low)			
Dual Control Head			
Remote/removable control head/mic/speaker			
Remote covert on/off switch			
Dual Transceiver			
Antenna Types – gain, elevated fed, disguise (list all available)			
Control head Dim (auto/manual)			
Backlit DTMF Key Pad			
Emergency Button			
Audible and Visual Indication Disable			
Channel Capacity			
Talk Group Capacity			
CTCSS			
Digital CTCSS			
Priority Scan			
Dual Priority Scan			
DES Encryption			
DES Encryption Key Loader			
Siren and Light Control Module			
100 Watt Speaker for Light Bar			
100 Watt external speaker			
Dynamic Regrouping			
Selective Inhibit			
Selective Call/Alert			

Emergency Call/Alert			
Data Interface Cable			
Radio Data Interface Module			
External Horn/Alarm Kit			
Status Message			
Talkaround			
DTMF Microphone			
Carrier Controlled Timer			
Noise Canceling Microphone			
Extended/External Option Cables			
Motorcycle Conversion			
Boat Conversion			
Motorcycle Helmet Kit			
Other and optional (Offeror defined)			

2.1.3 Portable Subscriber Units

2.1.3.1 Power Supply

The equipment shall operate from a negative ground internal battery power source. All power circuits shall provide for non-destructive reverse polarity protection.

2.1.3.2 Portable Radio Equipment Housing

The transceiver housing shall house all electronic circuits and/or circuit cards associated with the equipment.

The housing shall be constructed of high impact polycarbonate plastic or other suitable high impact material.

Removal of the battery from the unit shall not expose its internal circuitry.

2.1.3.3 Portable Radio Accessories

External accessory connections shall be provided as an integral part of the radio, for the connection of a remote speaker-microphone-antenna combination.

The portable radio shall have the capability of being inserted into a vehicular charger. This device shall operate from the vehicle's battery and provide a charger system for the portable radio battery. The portable radio shall operate in the receive mode while being charged in this vehicular charger. The charger shall operate from a nominal 12 VDC vehicular source. The charger shall be mechanically configured to provide electrical contact to the radio battery upon insertion of the radio or

separate battery into the charger. Battery charging shall be possible whether the battery is out of or installed in the radio.

The portable radio shall have the capability of being inserted into a vehicular mobile adapter. A separate antenna system, microphone with keypad and LCD screen, and separate speaker shall enable the unit to operate as a mobile radio. This device shall operate from the vehicle's battery and provide a charger system for the portable radio battery. The portable radio shall operate in both transmit and receive modes while being charged in this vehicular adapter. The adapter shall operate from a nominal 12 VDC vehicular source. The charger shall be mechanically configured to provide electrical contact to the radio battery upon insertion of the radio or separate battery into the charger. Battery charging shall be possible whether the battery is out of or installed in the radio.

The portable radio shall have the capability to be charged in a single-unit desktop charger or a multi-unit desktop charger that utilizes the most current charging and battery conditioning technology.

2.1.3.4 Portable Radio Features

The unit shall be equipped with an alphanumeric character display to identify the operating trunked talk group or conventional channel.

To adopt 4 rows by 3 columns matrix as the minimum keypad configuration with the first level and shifted functions to be software programmable and assignable. Label Configuration to conform to the North American telephone keypad standard numerical and symbol layout, as a Standard Option.

The display shall be top or front mounted.

The display shall not display less than 8 characters and its brightness shall be user adjustable.

The unit shall be equipped with a top mounted rotary volume control switch.

The primary trunked talk group or conventional channel selector switch shall be top mounted and of the rotary type.

The unit shall be equipped with a user-operated switch to activate the radio's emergency status mode.

The unit shall be equipped with a user configurable trunked talk group/conventional channel scanner. The scanner shall allow the user to selectively add or omit talk groups or channels from the scanning sequence. A mix of talk groups and channels shall be allowed in the scanning sequence. User selectable talk group/channel priority shall be a feature.

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The unit shall be equipped with an external data port. This data port shall allow for connection of test equipment, radio programming devices, etc.

Offerors shall define the following specifications for all portable radio subscriber units proposed. Three columns are provided in the chart for convenience. Offerors proposing more than three models per radio type may submit multiple copies of the chart.

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Portable Subscriber Radio Units Specifications			
Specification	Model A	Model B	Model C
Input Voltage			
Power Consumption (idle)			
Power Consumption (receive)			
Power Consumption (transmit)			
Temperature Range			
Dimensions			
Weight			
Antenna port impedance			
Channel Spacing			
Shock and Vibration			
Humidity			
Receiver Frequency Stability			
Sensitivity			
Data Sensitivity			
Selectivity			
Intermodulation			
Spurious and Image Rejection			
Transmitter Frequency Stability			
Transmit power			
Spurious & Harmonic Emissions			
FM Hum and Noise			

Offerors shall indicate which features are supported under each model offering. Offerors shall check each feature, as required, and provide this information as part of the proposal response for each model proposed. Three columns are provided in the chart for convenience. Offerors proposing more than three models per radio type may submit multiple copies of the chart.

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Portable Subscriber Radio Units Features			
FUNCTION	Model A	Model B	Model C
Analog Conventional			
Analog Trunked			
Digital Conventional			
Digital Trunked			
MIL-SPEC 810 C/D/E			
Dual Band Operation			
RF Power Output Switch (High/Low)			
Audible and Visual Indication Disable			
Extra Hi Capacity Battery (14 Hr 5/5/90)			
Hi Capacity Battery (12 Hr 5/5/90)			
“AA” battery adapter packages			
Antenna Types – helical, flex whip (list all available)			
Backlit DTMF Keypad			
Emergency Button			
Channel Capacity			
Talk Group Capacity			
CTCSS			
Digital CTCSS			
Priority Scan			
Dual Priority Scan			
DES Encryption			
DES Encryption Key Loader			
Dynamic Regrouping			
Selective Inhibit			
Selective Call/Alert			
Emergency Call/Alert			
Data Interface Cable			
Status Message			
Talkaround			
DTMF Microphone			
Carrier Controlled Timer			
Intrinsically Safe Hi Capacity Battery			
Intrinsically Safe Extra Hi Cap. Battery			
Carry Case alternatives (list all)			
Belt loop, clips, strap alternatives (list all)			
Single Charger (slow rate)			
Single Charger (fast rate)			
Multi-Charger (slow rate) (define quantity)			

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Multi-Charger (fast rate) (define quantity)			
Speaker Mic			
Speaker Mic/Antenna			
Earpiece/Mic with Remote PTT			
Throat mic			
Vehicular Charger			
Vehicular Charger with S-M-A adapter			
Other and optional (Offeror defined)			

2.1.4 RF Control Station

Control station radios shall be offered including necessary power supplies for use of fixed facility 120 VAC; desktop microphone with PTT paddle; transmission line, connectors, grounding kit, surge suppressors; pole mounted or rooftop antennas and any other ancillary components necessary to facilitate fixed location subscriber access.

The control station radios shall meet all mechanical, electrical, and operational requirements specified for “Mobile Subscriber Units” in the previous subsection, in addition to devices and components necessary to facilitate a fixed subscriber installation as described in the previous paragraph.

Offerors shall define the following specifications for all mobile radio subscriber units proposed. Three columns are provided in the chart for convenience. Offerors proposing more than three models per radio type may submit multiple copies of the chart.

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RF Control Station Subscriber Radio Units Specifications			
Specifications	Model A	Model B	Model C
Input Voltage			
Power Consumption (idle)			
Power Consumption (receive)			
Power Consumption (transmit)			
Dimensions			
Weight			
Temperature Range			
Antenna port impedance			
Channel Spacing			
Shock and Vibration			
Humidity			
Receiver Frequency Stability			
Sensitivity			
Data Sensitivity			
Selectivity			
Intermodulation			
Spurious and Image Rejection			
Transmitter Frequency Stability			
Transmit power			
Spurious & Harmonic Emissions			
FM Hum and Noise			

Offerors shall indicate which features are supported under each model offering. Offerors shall check each feature, as required, and provide this information as part of the proposal response for each model proposed. Three columns are provided in the chart for convenience. Offerors proposing more than three models per radio type may submit multiple copies of the chart.

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RF Control Station Subscriber Radio Units Features			
FUNCTION	Model A	Model B	Model C
Analog Conventional			
Analog Trunked			
Digital Conventional			
Digital Trunked			
Local Control Operation			
Remote Control Operation (indicate # desk sets supported)			
12-24 Hour Clock			
VU Meter			
MIL-SPEC 810 C/D/E			
Dual Band Operation			
Standby Power Transfer Kit			
Audible and Visual Indication Disable			
External Speaker			
Remote Speaker-only with volume control			
External Weatherproof Speaker			
RF Power Output			
Dual Transceiver			
Backlit DTMF Keypad			
Emergency Button			
Channel Capacity			
Talk Group Capacity			
CTCSS			
Digital CTCSS			
Priority Scan			
Dual Priority Scan			
DES Encryption			
DES Encryption Key Loader			
Dynamic Regrouping			
Selective Inhibit			
Selective Call/Alert			
Emergency Call/Alert			
Data Interface Cable			
Radio Data Interface Module			
Status Message			
Talkaround			
DTMF Microphone			
Carrier Controlled Timer			
Noise Canceling Microphone			

Other and optional (Offeror defined)			
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2.1.4.1 Control Station Desk Sets

Offerors shall indicate which features are supported under each model offering. Offerors shall check each feature as required and provide this information as part of the proposal response for each model proposed. Three columns are provided in the chart for convenience. Offerors proposing more than three models per radio type may submit multiple copies of the chart.

Desk set functionality is an extension of the control station. Therefore, Offerors shall use this chart to indicate available functionality at remote desks or the ability of the desk set to activate and deactivate the feature.

Control Station Desk set Units			
FUNCTION	Model A	Model B	Model C
Analog Conventional			
Analog Trunked			
Digital Conventional			
Digital Trunked			
Remote Control Operation (indicate # desk sets supported)			
12-24 Hour Clock			
VU Meter			
MIL-SPEC 810 C/D/E			
Dual Band Operation			
External Speaker			
External Weather Proof Speaker			
RF Power Output			
Power Consumption (Tx, Rx, idle)			
Dimensions			
Dual Transceiver			
Backlit DTMF Key Pad			
Emergency Button			
Channel Capacity			
Talk Group Capacity			
CTCSS			
Digital CTCSS			
Priority Scan			
Dual Priority Scan			
DES Encryption			
DES Encryption Key Loader			
Dynamic Regrouping			

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Selective Inhibit			
Selective Call/Alert			
Emergency Call/Alert			
Data Interface Cable			
Radio Data Interface Module			
Status Message			
Talkaround			
DTMF Microphone/Keypad			
Noise Canceling Microphone			
Other and optional (Offeror defined)			

2.1.5 Interfacing Requirements

A description of what is required to connect the Offeror supplied equipment to the microwave and fiber optic network shall be provided as part of the Offeror's proposal. Multiplexers, synchronization, data and bit error rate requirements, etc., are required as part of the provided information. The Offeror's equipment list shall contain this interface equipment and be indicated as required for interfacing to the microwave and fiber optic system.

2.1.6 Grooming

Offerors shall specify to what extent DS0 grooming between 3DS3, DS3, and DS1 data rates are tolerable and any performance requirements that shall be met.

2.1.7 Routing

Offerors shall specify routing (origination and termination of DS1 circuits) and DS1 capacity requirements per site. Offerors shall also specify to what extent alternate routing is tolerable and any performance requirements that shall be met. A system-wide DS1 routing table is required in Offeror's proposal.

2.1.8 General Requirements

Unless otherwise modified herein, materials, design and construction procedures shall be in accordance with the following codes as well as all federal, state and local building codes.

Installation of all electrical equipment, power distribution, lighting and outlet assemblies, alarm and grounding systems, including associated wire ways, and wiring, shall comply with the most recent edition of the National Electrical Code (NEC), National Fire Protection Association (NFPA), and Occupational Safety and Health Administration (OSHA).

All electrical equipment and devices shall be listed, approved, or certified by Underwriters Laboratories (UL).

All microwave radio equipment and microwave path design and construction shall comply with the latest editions of the following rules, regulations, and specifications:

Federal Communications Commission (FCC):

Rules, Part 2
Rules, Part 15, Subpart B for Class A devices
Rules, Part 101, Fixed Microwave Services

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Bellcore Technical References and Advisories and Compatibility Bulletins:

GR-1089-CORE – Electromagnetic Compatibility and Electrical Safety General Criteria for Network Telecommunications Equipment
TR-NWT-000063 – NEBS Generic Equipment Requirements
GR-NWT-000253, Issue 6 – Synchronous Optical Network (SONET) Transport Systems: Common Generic Criteria
TR-TSY-000332 – Reliability Prediction Procedures for Electronic Equipment
TR-TSY-000496, Issue 3 – SONET Add-Drop Multiplex Equipment (SONET ADM): Generic Criteria
GR-1400-CORE, Issue 1 – SONET Dual-Fed Unidirectional Path Switched Ring (UPSR) Equipment Generic Criteria
TR-TSY-000499 – Transport Systems Generic Requirements (TSGR) Common Requirements, Issue 2
TA-TSY-000752 – Microwave Digital Systems Criteria
TR-TSY-000009 – Asynchronous Digital Multiplexer Requirements and Objectives

American National Standards Institute (ANSI) standards:

T1.105 – Digital Hierarchy Optical Interface Rates and Formats Specifications
T1.106 – Digital Hierarchy Optical Interface Specifications (single mode)
T1.102 – North American Digital Hierarchy – Electrical Interfaces
T1.403 – Extended Superframe Format Interface Specification
C37.90.1 – Surge Withstand Capability Tests
C37.90.2 – Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers
TIA/EIA-222-F – Structural Standards for Steel Antenna Towers and Antenna Supporting Structures
RS-252-A – Standard Microwave Transmissions Systems
TSB-10-F – Interference Criteria for Microwave systems
EIA-195 (revision C) – Electrical and Mechanical Characteristics for Terrestrial Microwave Relay System Antennas and Passive Reflectors
EIA- 210 – Terminating and Signaling Equipment for Microwave Communications Systems
EIA-310 – Racks, Panels, and Associated Equipment

Electromagnetic Interference: Shielding and filtering shall be provided to prevent interference from, or to, other radio frequency equipment installed near or in the vicinity of the proposed equipment. The equipment shall meet or exceed spurious frequency emissions, conducted or radiated, as outlined in Part 15 of the FCC Rules and Regulations, Subpart J, Class B Computing Devices. Equipment shall be operationally compatible with the following types of equipment located adjacent to the microwave radio:

FDM-FM DTL Channel Equipment
VHF Base/Mobile Stations
UHF Base/Mobile Stations
700/800 MHz Base Stations
VHF/UHF Hand-held Radios
FDM-FM Baseband Translation Equipment
DC Power Systems

All equipment shall operate within the full specification requirements over a temperature range of 0° to 55° C with up to 95% humidity at 50° C (non-condensing). Equipment mounted within a shelter shall meet or exceed this requirement to accommodate operation during environmental control system failure.

2.2 Local Control and Monitoring Functions

Local control and monitoring capability of any new microwave radio shall be provided by the Contractor. In addition, performance monitoring of radio errors, errored seconds, severely errored seconds, and BER shall be provided by the Contractor. This information shall also be made available for the Network Manager System through the user system interface. Microwave Offerors shall describe their offering and provide detailed information on this feature.

2.3 Remote Control and Monitoring Functions

Offerors shall provide capability to monitor and control a system access port of selected contiguously linked radios via a laptop PC. The user shall have access to the far end radio as well as each of the radios in the selected chain. This feature shall be totally independent of other network management and alarm systems. Offerors shall describe their offering and provide detailed information on remote monitoring functions, remote control functions software, laptop/desktop PC requirements, and method/medium of accessing this information.

2.3.1 Local and Remote Programming

Offerors shall describe the manner in which local and remote programming parameters and options are performed. A description of this feature and the details associated with its operational use shall be included as part of the Offeror's response. The description shall contain a list of programmable items, software options, computer access requirements, and manner of access to the microwave radio(s).

2.4 Alarms and Alarm Network Interfacing

The microwave radios shall be supplied with alarming capability. The Offeror shall supply a list of alarms that are available for monitoring the microwave radios. The microwave radios shall be supplied with external control capability. The Offeror shall supply a list of external controls that are available for remote operation of the microwave radios.

3.0 DISPATCH CONSOLES

3.1 SCOPE

This Section outlines the requirements for the dispatch consoles needed for this project. The effort required by the State shall consist of adding if required, new 700Mhz System LAN-Based consoles.

Offerors shall review the existing State dispatch console network to familiarize themselves with existing State dispatch operations, as well as conduct a system design review with DOC personnel to ensure future requirements are addressed. Detailed console information can be obtained through site visits.

Offerors shall provide a detailed list of any special requirements needed for the installation and operation of their equipment as deemed necessary. Offerors are instructed to re-use as much existing console equipment throughout the upgrade/expansion process so as to maximize the previous equipment investment made by the State.

3.2 INTERFACE TO VOICE RADIO SYSTEM

Access to the radio system by the control center console via microwave or fiber optic circuits shall be provided whenever feasible as defined by the State telecommunications backbone. Offerors shall define all console position voice and data connectivity requirements as part of this proposal for each dispatch position requested. Offerors shall define any new transport hardware (i.e., channel banks, multiplexers, modems, etc.) required as part of this proposal for each dispatch position requested.

3.2.1 Console Reliability

Due to the critical nature of the communications services provided by State dispatch facilities, the communications control console shall have a high degree of reliability.

3.2.2 Power Supply

It is a critical requirement that electrical power loss or surges shall not affect system operations. Power loss or surges shall not alter the system software or operating parameters at the radio dispatch positions. External power to the console shall be supplied at a nominal 120 VAC, 60 Hz, and single phase.

This AC power for all remote dispatch equipment in the dispatch centers shall be backed up with a separate UPS and emergency generator system. Offerors shall provide a detailed HVAC (BTU) and AC power load calculation matrix for all new electronics with its proposal.

3.2.3 Master Time Source

Contractor shall either interface the new console network to an existing Net Clock timing source in the State system or provide an alternative master timing source that shall synchronize all new and console positions. This unit shall interface to and control the time of the radio consoles, console electronics, trunking system management terminals, alarm terminals and to the existing systems and equipment currently connected to the master time source. Client workstations shall be capable of maintaining a highly stable time/date in the event of disconnection from failure of the master timing source.

3.2.4 Console Electronics Reliability

The console system shall be designed such that no single failure point of any module or component results in a catastrophic failure, or disables more than one channel or more than one operator console. Reliability may be achieved through a distributed architecture, redundancy, or a combination of both. Any duplication of circuits, or multiple level redundancies, required to attain this level of performance shall be provided.

3.2.5 Databases

Offerors are responsible for provisioning and implementing all software and hardware associated with this console subsystem. Offerors shall completely interface, re-create or migrate the existing State Console Databases 700 MHz console subsystem to mimic and/or enhance existing State dispatch functionality. The State requires the Contractor to support and maintain all existing State functionality with the new platform. All new databases shall be capable of supporting the current number of DOC console and radio users. Offerors shall

specify the excess capacity with respect to each applicable database and any licensing or configuration restrictions associated with each database.

Database management of all affected databases shall be thoroughly explained by the Offerors. Since the State supports multiple dispatch communication centers statewide, Offerors shall define and explain the logistics associated with database entry, database security, database management, database restoration, and database backup. Correction shall have the capability to modify, query, and archive all of their console databases. All Division of Communications maintenance shops shall have the capability to modify, query, and archive all console (or equivalent) databases.

3.2.6 Network and Fault Management

Network and fault management capabilities are critical to ensuring overall system reliability and availability. Offerors shall design and define the necessary hardware and software to monitor/diagnose/troubleshoot all equipment provided as part of the console upgrade/subsystem expansion.

3.2.7 LAN/WAN Design

Offerors shall propose a comprehensive design for the LAN-based /expanded console network. Since the State maintains dispatch facilities statewide, the network design shall also include wide area networking throughout the State. Offerors shall design and define all hardware and software to create a computer-based console LAN/WAN to mimic and enhance the existing console subsystem.

All LAN/WAN network elements shall be capable of being remotely monitored through the State network/fault management system. LAN/WAN baseline testing for the entire network for throughput, efficiency, and traffic characteristics shall be included by the Offerors as part of the overall upgrade/subsystem expansion.

Offerors shall be responsible for provisioning of all proposed network elements. All programming scripts and/or configuration parameters shall be captured and provided by the Offeror both electronically and in hard copy format for the State system management/radio maintenance team.

3.2.8 Software Version Control

Offerors shall provide the latest software and firmware revisions as a requirement for project completion.

3.2.9 Technology Roadmap/Support

The State intends to maximize and protect its console investment. Contractors are required to provide support for the proposed offering for a period of no less than

seven (7) years from the date of console final system acceptance. The proposed offering consists of all hardware, software, cabling, and services rendered to implement the proposed console subsystem.

Contractor support is defined as the ability of the Contractor to remedy to State satisfaction any hardware and/or software problem with any equipment and services provided as part of this offering. Contractor support shall take the form of a 24x7x365 technical support hotline, product engineering, field service technicians, and field engineering.

Contractor support also requires the Contractor to be able to provide new and/or spare equipment for the proposed offering for no less than seven (7) years from the date of console upgrade/expansion final system acceptance.

3.2.10 Cutover

The Contractor shall make all attempts to minimize and eliminate downtime throughout the entire process since the State system handles mission-critical radio traffic for state and local agencies. Contractor shall provide a detailed implementation and cutover plan per the project schedule that captures the entire console installation effort noting any integration processes requiring console downtime. The cutover plan shall include durations of activities, opportunities for downtime, planned downtime, roles/responsibilities of involved parties, sequence of events, and fallback strategies in the event of failure.

3.2.11 Physical Site Requirements

Offerors shall provide a detailed list, for all sites, of any special requirements needed for the installation and operation of their equipment as deemed necessary. Contractors are instructed to re-use as much existing console equipment throughout the upgrade/expansion process so as to maximize the previous equipment investment made by the State.

Offeror shall detail all AC, DC, HVAC, equipment dimensions, and equipment floor loading requirements for each affected site. The State requires Offeror to provide a quotation for each affected site for electrical and installation services to adequately prepare the facility for the console upgrade/subsystem expansion. The Contractor shall adhere to the latest applicable installation and R56 grounding standard throughout entire installation effort.

3.2.12 Cabling/Punchblocks/Interface Panels

Contractor shall provide all cabling, punch blocks, interface panels, adaptors, connectors, etc. for the console upgrade/subsystem expansion to emulate the current system wiring configurations. Whenever possible and practical, the Contractor shall conform to existing wiring/hookup practices and conventions for uniformity

and maintenance purposes. All cables provided by Contractor shall come labeled in the same fashion as the current system implementation with a spare set of cable labels. A corresponding cable matrix reflecting the labels used for each site shall accompany all cable labels.

Power Line Surge Protection

For any AC circuits/wiring supplied by the Contractor, AC line transient and surge protection shall be provided for all console electronics, master site equipment, and each dispatch console in the system. The nominal discharge current rating for each line surge protector shall be 10,000 amperes or more. Contractor shall adhere to the latest applicable installation and R56 grounding standard.

3.2.13 Dispatch Logging

Contractor shall provide fully operational and functional dispatch logging recording systems to completely mimic, at a minimum, all current State logging capabilities as provided by the current method.

3.3 INTERFACE TO THE 700 MHz RADIO SYSTEM

Access to the radio system from the various network control points shall be provided via microwave or fiber optic circuits whenever feasible as defined by the State telecommunications backbone. The Offeror should assume that there will be a minimum of one control point per county. Private or leased telephone lines are not a preferred means of connectivity for remote network control points, but leased lines are acceptable if the Offeror cannot utilize the State telecommunications backbone in a cost-effective or practical manner.

3.3.1 Direct Communications

The system shall allow direct subscriber-to-subscriber communication at any time without degrading normal system performance. Direct subscriber communication, while in range of the fixed equipment, shall do no more than temporarily capture receivers from possible outbound messages. Direct communication shall be possible at any time while out of range of the fixed equipment with no degradation in system performance or capacity.

3.3.2 Digital Encryption

The Offeror's proposed subscriber devices shall be capable of digital voice encryption calls. All subscriber units equipped with encryption shall be able to scan between and converse on encrypted and clear talk groups. All dispatch console positions shall be capable of operation to transmit and receive encrypted voice

operations. The coverage range of the system in encrypted mode shall equal the range of the system in clear mode.

The encryption process shall not degrade the audio quality of the system. Encryption shall be available in trunked, conventional and talk-around modes. Multiple keys shall be provided in the fixed equipment and the subscriber units. Offerors shall fully discuss the intended encryption scheme.

3.3.3 Interoperability

Mobile and portable transmitters operating on narrowband channels in the 769-775 MHz and 799-805 MHz frequency bands must be capable of operating on all of the designated nationwide narrowband Interoperability channels pursuant to the standards specified 47 CFR §90.547.

3.3.4 Transmission Attempt Definition

A transmission attempt shall be defined as one initiation of a message transmission by either a mobile equipment operator / application and host application program connected to the radio data controller, message switch, or Gateway. No message retransmissions other than those provided as part of the radio transmission protocol are permitted.

3.3.5 Radio Transmission Protocol Retransmissions

No more than three radio protocol user data transmission retries shall be permitted for the radio coverage reliability design as shown by the Vendor's coverage prediction map.

3.3.6 Mobile Unit Radio Channel Distribution

The system shall distribute mobile units across available operating radio channels when more than one is available. This distribution shall operate in a manner that assists in preventing a single radio channel from becoming overly congested when other, less congested channels are available to a mobile unit with adequate radio signal levels to meet communications reliability requirements.

3.3.7 Radio Channel Protocol Contention

The system shall employ methods for efficiently controlling the shared use of a base station and radio channel by multiple active mobile users. These methods shall provide for minimization of simultaneous transmission of user data by two or more mobile units.

3.3.8 Radio Channel Protocol Error and Fault Handling

The system shall provide transmission error and fault handling techniques. These techniques shall provide the following features, at a minimum:

- Forward Error Correction (FEC) for user data transmission packets,
- Automatic retransmission of user data received in error.

3.3.9 Successful Communications Definition

Successful communications shall be defined as the ability to successfully send and receive a message with one transmission attempt from a vehicle.

3.4 Grade of Service

3.4.1 General

Designing mission critical public safety systems requires consideration for worse case scenarios that may require a tremendous increase in traffic in any one area of the service territory as well as an increase in traffic for a wide-area incident. The State shall require in this RFP a comparable grade of service (GOS) analysis based on the 700 MHz System configuration, utilizing The Department of Corrections current number of voice subscribers and usage.

3.5 Site Trunking

The master network management system(s) shall employ a redundant design to ensure that a single point of failure does not result in any complete system failure. Should the system encounter a master network management system failure, the LMR system shall not lose any trunking system features and shall continue to function in the trunking mode with all features operational, redundant, or fallback trunking controllers are required.

Failure mode operation occurs when a management subsystem fails or becomes disconnected. Remote subsystems shall be capable of maintaining complete local area site trunking operations despite being disconnected from the wide area system. Network fault management computers and dispatch consoles shall be capable of providing visual and audible notification to users of the disconnected or failed subsystem(s) in real time.

Failure Mode Analysis

Offerors shall provide a complete and detailed Failure Mode Analysis of the proposed system design, which varies from loss of a channel at a single site to catastrophic failures such as the total destruction of a primary system control point

facility and/or total destruction of a single radio site facility. Offerors shall clearly identify and define any changes/improvements associated with the various system failure mode scenarios for the system.

3.5.1 System Roaming and Affiliation

The system shall continue to allow mobiles and portables to seamlessly roam over the statewide radio coverage area with automatic connection as the unit enters a new site coverage area within any interconnected radio subsystem. The system shall provide for automatic registration and authorization control over subscriber units and talk groups roaming between radio subsystems. Manual and automatic roaming capabilities shall be provided between radio subsystems. Offerors shall clearly identify and define any changes/improvements associated with system roaming algorithms and parameters for the system.

3.5.2 Interference Control/Resistance

The system shall be designed to be equally or more resistant to interference from co-channel, adjacent-channel, and intermodulation. Offerors shall clearly identify and define any changes/improvements associated with interference rejection/mitigation for the system.

System receivers shall be capable of detecting interference such that interference is logged within a network diagnostics subsystem. Furthermore, the channel experiencing interference shall be temporarily disabled automatically so that the network's master control system does not grant assignments on the channel experiencing trouble.

3.6 Master Network Control System

3.6.1 General Requirements

The system design shall provide for high reliability under extreme emergency conditions and redundant network controllers with automatic fallback designs implemented. to be located in two different locations anywhere in the network.

3.6.2 Master Network Control Features and Functions

Software and firmware to provide functions and features described shall reside in the Master Network and associated computer software/hardware. The associated computer software/hardware shall provide the following functions:

3.6.2.1 Alarm Monitoring and Diagnostic Functionality

Monitoring of the operational status of all system devices and providing alarms when subsystems fail. Diagnostic functions shall allow an operator to view current status and status history of the system. The system shall also allow for diagnostic tests to be performed on all network devices to verify component and path integrity.

3.6.2.2 Signaling (Control) Channel Backup

Automatic transfer of signaling functions to another channel in the event of transmitter or receiver failure or interference on the signaling channel. The system shall have one active and a minimum of three backup signaling channels. Backup is defined as a channel of different frequency. Hot standby backup of a signaling channel to a station of the same frequency is not acceptable.

3.6.2.3 Disabling of Failed Voice Channels

Automatic disablement of defective voice channels due to subsystem failure. Failures shall be detected prior to the channel being assigned by the controller. Subsystem failures to be detected shall include, at a minimum:

- Low forward power
- High-reflected power
- Unidentified carrier on unassigned voice channel
- Signaling interface failure between base and controller
- Audio circuit failure between controller and base
- Voter receiver failed
- Voter receiver disabled

3.6.2.4 System Usage Reports

Collection and processing of data with regard to system usage. Offerors shall describe how the data is extracted for displaying at the network management terminals. All reporting functions shall be easily electronically exported into real-time, standardized, spreadsheet and word processing formats for easy retrieval and custom report formatting. Data to be routed to a printer shall, at a minimum, also include the following:

3.6.2.5 System/subsystem(s) configuration

- Configuration information for all components in the system
- Functional configuration of controllers, channels and sites

3.6.2.6 Subscriber Management

- Manager database (list of system managers)

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- Logged on managers
- Regrouped radios
- Inhibited radios
- Storm plans
- Commands (tasks)-in-Progress (regroups, inhibits)
- Subscriber configuration and attributes (by individual, talk group and multi-group)

3.6.2.7 Channel Usage

- Identification of calling units by talk group and unit identification number
- Time of channel access
- Duration of transmission
- Categorization of call
- Channel assigned
- Site or Subsystem(s) involved in a call
- Incidence of busy indications

3.6.2.8 Fault Management

- Current alarms
- Alarm history (daily, weekly, monthly)
- Alarm history (by component)
- Technician notes

3.6.2.9 Channel Access Priority Levels

As a minimum requirement, radio channel control assignments and system access shall be provided in accordance with APCO 16 guidelines. Levels of priority shall be variable from any dispatch console in the system to allow assignment of specific talk group members to a higher system access priority for the duration of a special event or tactical operation. Access and control of priority levels shall be partitioned so as to allow separate control by the respective State agencies.

3.6.2.10 Dynamic Talk group Reconfiguration

Dynamic regrouping of mobile and portable radios' talk group affiliation shall be provided. This function shall allow units from different talk groups to be regrouped into a common talk group via the signaling channel. Preprogramming of regrouping functions to allow rapid implementation of emergency plans by the State shall be provided. The time required for such regrouping, both for preprogrammed groups and individual units, shall be specified by the Offerors in

their response including any limitations on group size and the number of preprogrammed groups that can be accommodated by their systems.

3.6.2.11 Selective Disablement of Field Units

Selective disablement of individual mobile or portable radios shall be provided. Reactivation of such radios that have been disabled shall also be provided.

These functions shall be performed on the signaling channel. Control of this feature shall be partitioned/authorized by network manager user name.

3.6.2.12 Control of Time Out Parameters

Control of time out parameters shall be provided at any network manager user terminal. Any valid network manager logged in with this capability shall be able to control, at a minimum:

- Channel Hang Time (message trunking)
- Interfering Carrier Time (length of time channel remains enabled with an interfering carrier)
- Remote Link Failure Time (length of time site remains enabled without a remote site data link)
- Channel Fade Time (length of time channels remain assigned without a carrier or low speed data present)
- Emergency Call Time (length of channel hang time when an emergency call is initiated)

3.6.2.13 Channel Partitioning

Channel partitioning shall allow talk group and individual calls to be directed or steered to a single or group of channels. The partitioning capability shall not prohibit any group from being allowed access to all channels. Channel partitioning shall be definable at the "subsystem" level. Subsystem partitioning means that, if multiple subsystems are networked together by a Master Network controller/switch, partitioning "tables" shall be defined in each subsystem.

System Programming – Remote client management terminals, networked to the trunked system management servers, shall provide GUI programming/provisioning functionality of system operational parameters. These terminals shall provide for "user friendly" operation by trained personnel. Access to system programming functions shall be protected by password security and various levels of access shall be provided for respective State agencies. Hard copy printout of programming functions or data via laser printer is required. Offerors shall supply compatible laser printers for all client management terminals.

To facilitate interoperability, system management shall be capable of being partitioned. Manager partitioning shall allow different State agency managers to control their user database independently of one another. The system shall allow the partitioning of subscribers and subsystem infrastructures. Partitioning shall be defined and protected by a user name and a respective password. Partitioning shall allow access to, as well as prohibit, users from different subsystems, programming and system management areas, and subscriber ID ranges (talk group and individual ID ranges).

3.6.2.14 System Signaling & Special Functions

Unit Identification - A real-time display of push-to-talk unit identification at the network management and console dispatch positions shall be provided in an alphanumeric alias format. Display of the ID shall be on the operator position console monitor. Offerors shall specify the maximum number of alias ID's provided per network management and console operator position and system wide in the response.

Signaling (Control) Channel Updating - The signaling channel shall continually transmit the current channel assignments of the system. This feature is intended to insure that radios "signing on", coming into range, or switching talk group modes are directed to calls in progress on their selected talk group.

Voice Channel Embedded Signaling - Embedded or sub-audible signaling shall be transmitted on assigned voice channels in order to prevent subscribers from being misdirected or allowed to transmit on an improperly assigned channel.

Emergency Alarm & Call - A display and audible alert to the network management terminal and console dispatch positions upon activation of an emergency switch on portable or mobile radios shall be provided. The display shall identify the unit number or corresponding alias of the radio initiating the emergency alarm. Upon activation of the "emergency unit's" P-T-T, a channel shall be assigned for a predetermined amount of time. The emergency call hang time shall be adjustable by the system manager. In the event all voice channels are occupied, the system shall be capable of functioning (via programming) in at least the following two (2) modes:

- Emergency Priority Queuing - If all voice channels are occupied when an emergency call is made, then the unit initiating the emergency shall be placed at the top of the busy queue list and allowed access to the next available voice channel. The "emergency unit" shall be given the highest level of priority regardless of how many units are already in queue or the current priority status.

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- Emergency Preemption - If all voice channels are occupied when an emergency call is made, then the unit initiating the emergency shall be allowed access to the voice channel with the lowest priority user currently assigned.
- It is understood that until the current user de-keys, there shall be RF contention between the emergency user and the current transmitting unit. However, once the "non-emergency" user de-keys, that unit shall be transmission-trunked back to the signaling channel so the voice channel can belong to the emergency user. The State understands the implications of this contending audio, but also realizes the possible advantages of having immediate access in an emergency situation.

Private Call - Selected users and dispatchers shall have the ability to selectively communicate "privately" with another individual on the system regardless of what talk group either unit is currently affiliated. The call shall allow the two users to utilize a single channel resource to communicate without the participation of other units in their respective talk groups.

If the recipient of a private call has a display-type radio, the radio shall display the ID of the calling party. Respectively, the calling party shall be able to determine if the recipient did not receive or is not available for the call (i.e. recipient's radio is turned off, out of range, etc.) by hearing a distinctive tone and receiving a message in their display.

The subscriber units on the system shall be programmable for at least the following three (3) modes of operation:

- Subscriber units shall be capable of Unlimited Private Call capability if desired.
- Subscriber units shall be programmable to hold a specific list of users that can be private called. The list shall be able to hold at least ten (10) individual ID's. Offerors shall specify the maximum size of this list and if this list is independent of the call alert list.
- Subscriber units shall be programmable to only receive private calls from other users. These units shall never be capable (unless programmed otherwise) of initiating a private call.

Call Alert - Selected users and dispatchers shall have the ability to selectively alert another individual user on the system regardless of what talk group either unit is currently affiliated. The call shall allow an individual to alert another user with a distinctive tone and their individual ID (on display radios only). The alert shall be accomplished over the signaling (control) channel and shall not affect any voice channels on the system. If the recipient of a call alert has a display-type radio, the

radio shall display the ID of the alerting party. Respectively, the alerting party shall be able to determine if the recipient did not receive or is not available for the alert (i.e. recipient's radio is turned off, out of range, etc.) by hearing a distinctive tone and receiving a message in their display.

The subscriber units on the system shall be programmable for at least the following three (3) modes of operation:

- Subscriber units shall be capable of Unlimited Call Alert capability if desired.
- Subscriber units shall be programmable to hold a specific list of users that can be call alerted. The list shall be able to hold at least ten (10) individual ID's. Offerors shall specify the maximum size of this list and if this list is independent of the private call list.
- Subscriber units shall be programmable to only receive call alerts from other users. These units shall never be capable (unless programmed otherwise) of initiating a call alert.

Multi-Group/Announcement Group Call - Multi-Group talk groups shall allow multiple talk groups to be affiliated to a single multi-group. When a call is placed on the multi-group talk group, all talk groups associated with the multi-group shall be assigned to a single voice channel for the conversation. Every user involved in the multi-group call shall have talkback capabilities for the duration of the call (if message trunked). The system shall be programmable to allow for the following two (2) modes of operation:

Ignore Mode - If a user initiates a multi-group call, the call shall immediately ignore calls in progress on affiliated talk groups. The multi-group call shall not wait for units in those talk groups to dekey and therefore those transmitting units shall not hear the multi-group call until they dekey.

Wait Mode - If a user initiates a multi-group call while calls are in progress on affiliated talk groups, then the multi-group call shall wait (busy-queued) until all participating talk groups have finished their transmission. Initiating a multi-group call shall transmission trunk all calls in progress on affiliated talk groups in order to facilitate the multi-group call.

Systemwide/Sitewide Call – This feature shall allow a console dispatcher to initiate a call that shall simultaneously transmit to all affiliated talk groups/users on (1) all sites or subsystems and/or (2) any subset of subsystems as defined in the network management terminal. For this type of call, a simulcast sub-system is considered a single site. Multiple sitewide call resources shall be capable of being defined in the network management terminal.

Scan - This function shall provide the ability to scan through multiple modes (talk groups) within the same system. It shall also contain the capability to store and scan a list of conventional frequencies. Subscriber units shall be provided with at least one (1) scan list per system. Each list shall contain at least ten (10) talk groups or frequencies.

Priority Scan - This feature shall provide the ability to apply two priority levels to a defined scan list. While in the scan mode, a Priority One transmission shall be received regardless of the activity on the Priority Two (or other non-priority modes). A Priority-Two message is heard over all (except Priority One messages) non-priority modes.

3.7 Network Management Subsystem

All subsystems and associated subscriber units that comprise a radio system shall be under control of a single network management scheme with redundant capabilities. The scope of the single network management scheme includes the five basic elements of network management:

- Configuration Management
- Fault Management
- Security Management
- Performance Management
- Accounting Management

Implicit in the ability to manage these elements is the transfer of relevant managed object attributes which can, for example, be used to generate: Managed information reports, alarms, reconfigurations, etc.

Management of all system components and software levels shall be able to be performed from a single network management terminal. This shall be accomplished in such a manner that an entry change to one database shall automatically change all other associated databases with timestamps and other security logging features identifying the user without further user action. Overall system management shall be able to delegate vertical partitioning management to the organization responsible for the operation of the partition.

The system shall incorporate a graphical user interface (GUI) system manager/information management system to set selected parameters and allow the supervisory personnel to control and analyze system operation. It shall provide, to a single terminal, alarm conditions of board level failures of all network elements. Access to the management system shall be controlled through the use of an encrypted password (not displayed on the screen).

The system shall be capable of supporting a remote system manager user terminal without degradation of terminal performance. A remote user terminal shall be capable of performing/accessing all the same functions/information as that of a local terminal.

The speed at which the remote terminal operates shall be equivalent to that of a local terminal and the accessing of information shall not be noticeably different in physical appearance or access time. The remote terminal shall be transportable by T1 or fractional T1 data circuit. The remote terminal shall be implemented so that a user cannot determine whether they are using a local or remote terminal.

Required system manager capabilities as a minimum shall include:

- System Configuration - shall be able to control all of the programmable features of the trunking controller and radio infrastructure.
- Subscriber Management - shall allow an operator to view, set, or modify the talk group ID's, and the unique ID permissions.
- Manager Partitioning - System subscriber management functions shall be capable of user (agency) partitioning. Manager partitioning shall allow a user to view, set or modify subscriber information pertaining to a particular agency while restricting access to other agencies. The highest-level manager shall be capable of viewing all subscriber information. Partitioning shall allow access to as well as prohibit users from different subsystems, programming and system management areas, and subscriber ID ranges (talk groups and individual ID ranges).
- Diagnostic Management - shall allow an operator to view current status and status history of the system. It shall also allow for diagnostics to be performed on network devices (i.e. site controllers, base stations, comparators, etc.).
- Dynamic Radio Commands – permits the regrouping of system users, including the ability to predefine, store, and implement regrouping plans as needed. Sending and receiving of status messages to and from subscriber units shall be provided. Selective radio status information regarding radio's operating status (i.e. on/off, inhibited), last talk group affiliation and last site registration shall be retrievable in real-time.
- Selective inhibit/un-inhibit of control stations, mobile and handheld radios and trunked repeaters. All field subscriber equipment shall be equipped to respond to the system manager commands.

- Activity reporting by unit, talk group, department (if available), and system wide.
- User database maintenance with automatic sharing of data and updates between the console electronics and the trunking system.
- Activity monitor to display the status and activity of all RF channels of the active Prime Site controller(s).
- Capability of automatically updating the backup site controller when data base changes are made.
- All client management terminal positions shall be equipped with system printers to print activity reports/graphs or other output produced by the network management system. The printers shall be high-speed, color HP Laser Jet units or their equivalent.

3.7.1 Databases

Offerors are responsible for provisioning and implementing all software and hardware associated with this system platform. Offerors shall completely interface, re-create or migrate all existing Console Databases (e.g., FPP, RSS, CDM, ADM, etc.) to the new system to mimic and enhance existing State functionality. The State requires Offerors to support and maintain all existing State functionality with the new platform. All new databases shall be capable of supporting the current number of Transportation and Transit talk groups and console/radio users. Offerors shall specify the excess capacity with respect to each applicable database and any licensing or configuration restrictions associated with each database.

Database management of all affected databases shall be thoroughly explained by the Offerors. Since the State supports multiple network management and dispatch communication centers statewide, Offerors shall define and explain the logistics associated with database entry, database security, database management, database restoration, and database backup. All Division of Communications maintenance shops shall have the capability to modify, query, and archive all databases.

3.7.2 Network and Fault Management

Network and fault management capabilities are critical to ensuring overall system reliability and availability. Offerors shall design and define the necessary hardware and software to monitor/diagnose/troubleshoot all new equipment provided as part of the system platform. Management of network elements that shall be included in a comprehensive network and fault management design includes:

RF infrastructure (e.g., repeaters, controllers, comparators, audio distribution, etc.)

Console operator positions and associated components

Transport equipment (e.g., channel banks, DACs, modems, etc.) and associated components

Networking equipment and its associated components

Existing State fault management nodes shall be capable of monitoring and troubleshooting all equipment provided with this system platform upgrade. Offerors shall specify and provide details on what network and fault management capabilities are being provided with each proposed system platform upgrade network element.

3.7.3 LAN/WAN Design

Offerors shall propose a comprehensive design for the LAN-based network/fault management and console network(s). Since the State maintains network management and dispatch facilities statewide, the network design shall also support wide area networking throughout the State. Offerors shall design and define all hardware and software to create a computer-based console LAN/WAN to mimic and enhance the existing console subsystem(s).

The State realizes that a LAN/WAN design may create new telecommunications transport requirements (e.g., T-1s, fractional T-1s, etc.). Consequently, Offerors shall define all system platform upgrade voice and data LAN/WAN connectivity requirements as part of their proposals for each State site/facility. Offerors shall define any new transport hardware (i.e., channel banks, multiplexers, modems, etc.) required as part of this proposal for each State site. Offerors shall define any new networking equipment (i.e., routers, switches, bridges, etc.) required as part of their proposals for each State site/facility.

The State requires that the proposed LAN/WAN utilize industry-standard, non-proprietary LAN/WAN technologies designed to provide highly reliable, robust data communications. Commercial “off-the-shelf” or COTS components are encouraged. Throughput and network efficiency shall be maximized in the LAN/WAN design so that remote network clients experience similar, if not equivalent performance, to local client workstations. Network bottlenecks shall be eliminated from the design. Offerors shall provide network TCP/IP addressing schemes, if utilized, for the ultimate design. Internet and intranet connectivity capabilities with existing, external State networks shall be defined as it relates to the “openness” of the proposed LAN/WAN.

To the extent practical, the State prefers to utilize off-the-shelf network router equipment with integrated CSU/DSU functionality rather than external CSU/DSU or channel bank equipment, but channel bank designs shall be accepted if shown to be most practical and efficient.

The State requires that the CSU/DSUs utilized be capable of providing full-T-1 or fractional-T-1 based on telecommunications backbone bandwidth availability.

All LAN/WAN network elements shall be capable of being remotely monitored through the State network/fault management system, preferably through the use of Simple Network Management Protocol (SNMP) devices. LAN/WAN baseline testing for the entire network for throughput, efficiency, and traffic characteristics shall be proposed by the Offerors as part of the overall system platform upgrade. Any network element integrated into the provided LAN/WAN shall be capable of synchronizing its time to a master network timing standard using the Network Timing Protocol or similar scheme.

Contractor shall be responsible for the provisioning of all proposed network elements. All programming scripts and/or configuration parameters shall be captured and provided by the Offeror both electronically and in hard copy format for the State system management/radio maintenance team.

3.7.4 Site Controllers

The new site controllers provided with the system platform shall, at a minimum, provide the same functionality as the existing State controller subsystem. Channel capacities and licensing restriction shall mimic current State controller functionality whenever new/ controllers are integrated.

Offerors shall specify all applicable system compatibilities with respect to the various controller types proposed.

3.7.5 Channel Banks (If Required)

The new channel banks provided with the system platform shall, at a minimum, provide the same functionality as the existing State channel banks. Whenever possible, Contractors shall re-deploy as much existing State channel bank equipment throughout the upgrade process so as to maximize the previous equipment investment made by the State. Offerors shall define and design all new hardware and cabling necessary to accomplish such a platform. Existing State channel bank redundancy configurations shall be preserved and/or enhanced with the system platform.

3.7.6 Test Equipment/Optimization

Offerors shall specify any new or upgrades to test equipment required to maintain and optimize the system. The new test equipment provided with the system platform upgrade shall, at a minimum, provide the same functionality as the existing State test equipment.

Whenever possible, Offerors are instructed to upgrade as much existing State test equipment throughout the process so as to maximize the previous equipment investment made by the State. New and revised optimization and system procedures shall be defined and included by the Offeror with the system platform.

3.7.7 Application Licensing

Contractor shall maintain all existing State application and usage licenses with the system. In the event that licensing rules and constraints differ on the system platform, Offerors shall map all current State licenses to the new platform in a 1:1 fashion so that no functionality is sacrificed. All new/modified system licensing models and paradigms shall be thoroughly identified and explained by the Offerors and priced in a unit price format as part of the proposal response. All system usage and operational constraints with respect to software and hardware licensing shall be thoroughly explained by the Offeror. All Offeror and third-party vendor EULA (End User License Agreements) shall be defined and explained by the Offeror as part of their response. All Non-Disclosure Agreements shall be defined and explained by the Offeror as part of their response.

3.7.8 Network Timing/Synchronization

Offerors shall propose a comprehensive design for master network timing and synchronization with the system platform. To the extent practical, the master timing device shall interface with the proposed 700 MHz system as well as the legacy 800 MHz system. All network elements and transport equipment shall be synchronized to the master timing source. The master timing source shall be GPS-based with high stability, hot standby backup crystal oscillator. Redundancy shall be designed into the master timing source design to the greatest extent possible.

Stratum 1 timing shall be provided for the system and transport infrastructure. All system DS1/T1 links shall be capable of deriving clock from the master timing source. Network element equipment clocks shall be synchronized to the master timing source time/date clock for synchronization of diagnostic and failure tracking for internal equipment status logs. All system network/fault management, dispatch consoles, and infrastructure network elements shall derive time/date from the master timing source so that troubleshooting and diagnostic status logs are synchronized systemwide. The master timing source shall provide several additional timing ports for all current State network elements and provide additional timing ports for future synchronization of State network elements such as CAD/RMS, logging recorder, mobile data, etc.

3.8 Radio Subscribers

If possible, Offerors should propose a system platform design that enables the State to continue to utilize its current subscriber complement without the need for reprogramming or equipment upgrade. Offerors shall identify and explain any new subscriber devices which are required and any new features received with the system platform. Offerors shall explain the availability of over-the-air encryption and over-the-air subscriber reprogramming functionality.

3.9 Cutover/Upgrade Strategy

Offerors shall provide a detailed implementation and cutover plan that captures the entire system platform installation effort noting any integration processes requiring system or equipment downtime. The cutover plan shall include durations of activities, opportunities for downtime, planned downtime, roles/responsibilities of involved parties, sequence of events, and fallback strategies in the event of failure.

3.10 Physical Site Requirements

Offerors shall provide a detailed list, for all sites, of any special requirements needed for the installation and operation of their equipment as deemed necessary. Offerors are instructed to propose re-use of as much existing system equipment infrastructure throughout the system process so as to maximize the previous equipment and infrastructure investment made by the State.

Offeror shall detail all AC, DC, HVAC, equipment dimensions, and equipment floor loading requirements for each affected site. The State requires Offeror to provide a quotation for each affected site for electrical and installation services to adequately prepare the facility for the system platform upgrade. Offeror shall adhere to the latest applicable and grounding standard throughout entire installation effort.

3.10.1 Cabling/Punchblocks/Interface Panels

The Contractor shall provide all cabling, punch blocks, interface panels, adaptors, connectors, etc. for the system platform to emulate the current 800 MHz system wiring configurations. Whenever possible and practical, the Contractor shall conform to existing wiring/hookup practices and conventions for uniformity and maintenance purposes. All cables provided by Contractor shall come labeled in the same fashion as the current system implementation with a spare set of cable labels. A corresponding cable matrix reflecting the labels used for each site shall accompany all cable labels.

3.10.2 Grounding Standards

The Contractor shall connect all new system equipment to a State-provided single-point grounding ring or ground buss at each dispatch or radio site facility. Each Offeror shall meet grounding standards by utilizing Motorola's most recent version of the R-56 standard.

3.10.3 Power Supply

The power supply shall be of completely solid-state design and shall operate from nominal 120 VAC at 60 Hz, single phase.

3.10.4 Equipment Housing

Repeaters shall be housed in an EIA standard 19" rack.

3.10.5 Station Accessories

A rack mounted AC power utility strip, with a minimum of eight (8) outlets, shall be mounted at the top of each repeater rack.

3.10.6 Transmission Line & Accessories

The Contractor shall supply coaxial antenna transmission lines from the LDF series of transmission cable. Offeror shall state the size, length and type of transmission line being proposed at each site in the Detailed Site Matrix.

All connectors used shall be state-of-the-art characteristic of exhibiting least loss and least susceptibility for inter-modulation distortion. Connectors must be of non-ferrous construction. No splices or adapters shall be used in any permanent installations under any circumstance. However, the use of splice connections during temporary transition periods is permitted. It is permissible to utilize different connectors on opposite ends of a cable to avoid the use of adapters. When transforming from one diameter cable to another, it is acceptable to use flange reducers, so long as the cable V.S.W.R. specification is not changed.

3.10.7 Transmitter Combiner

On an as needed basis the Offeror shall propose for all radio sites the appropriate number of transmitter combiners designed for operation in the 769-775 MHz band. Combiners shall have no frequency-sensitive interconnection cabling and shall have no requirement for channel assignments in numerical order. Each combiner shall be attached to no more than eight (8) one hundred (100) watt transceivers.

The Offeror shall state the manufacturer and model number of the transmitter combiner(s) at each site and provide complete specifications and feature documentation. Each combiner shall be equipped with VSWR monitoring devices which are directly integrated to the NMS for proper alarm and reporting.

3.10.8 Receiver Multicoupler

On an as needed basis the Offeror shall propose for all main radio sites a multi-channel receiver multi-coupler system designed to receive frequencies operating in the 799-805 MHz frequency band. The Offeror shall state the manufacturer and model number of the receiver multi-coupler system being proposed at each site. The multi-coupler shall support a minimum of sixteen (16) receivers and be optionally expandable to 32 receivers.

3.10.9 Receiver Pre-Amplifier

On an as needed basis the Offer shall propose equipment that utilizes low noise tower top mounted amplifiers, if needed, to provide for a balanced system. Redundant amplifiers and window filters shall be used in the tower-mounted assembly. The Offeror shall state the manufacturer and model number of the tower top amplifier system being proposed at each site in the Detailed Site Matrix. The system shall have the following features:

- Test Amplifier Bypass - the system shall be capable of a bypass around the amplifier system such that the main line, jumper assemblies, and antenna may be tested.
- Catastrophic Failover- the system shall be capable of long-term manual bypass of the pre-amplifier assembly in the event of a major failure. If this capability cannot be provided, a second emergency receive antenna system (without TTA) shall be provided in the Offeror's design.
- Hot-Standby Amplifier - the system shall be equipped with a hot-standby amplifier that does not degrade the overall talk-in performance.
- Automatic Switchover - Automatic switchover to the standby amplifier shall be provided, and the means to accomplish the switchover shall be described in the response. Any performance degradation as a result of switchover shall be explained. Manual switchover shall also be provided at the control panel with indication of the amplifier in use.
- Test Port - the system shall be equipped with a test port and test line to allow the frequency performance of either amplifier to be tested from the equipment shelter.
- Alarming - the system shall be capable of providing complete system operation alarming of all modes of operation.

4.0 NEW SYSTEM DESIGN CONSIDERATIONS

4.1.1 Tolerance of CMRS Deployments

Interference to public safety radio systems has been an emerging problem nationwide. In general, the interference mechanisms are inter-modulation and increased noise floor disruptions, generally due to excessive CMRS transmitter radiation in combination with frequency operations in close proximity of public safety operations. These symptoms increase when the public safety systems are operating in their fringe areas where their signal levels are weaker.

The expanded receiver front-end of new subscribers today has the potential for increased interference susceptibility without new internal countermeasures.

The State also understands the need for cellular communications for the public as well as the need to subsidize State communications. Therefore, the State requires the System design to be tolerant of the existing, and predictable future deployment characteristics of the next generation of cellular technologies as well as the 700 MHz Broadband Network.

Offerors shall fully explain in detail how their system is designed to be tolerant of this type of interference source and how the degradation and impact to the proposed system shall be minimized. This discussion shall include, but shall not be limited to, such topics as:

- Inherent improvements in receiver technology
- Inherent benefits of higher ambient desired signal levels associated with in-building design
- Possible benefits of the particular architecture proposed

4.1.2 Non-Interference to Other Licensees

The FCC grants licenses to applicants based on maximum performance parameters such as Effective Radiated Power (ERP) and Antenna Height Above Average Terrain (HAAT). Applicants are permitted to operate at these maximum levels as long as they do not cause harmful interference to another licensee. Technically, an RF site licensed for 500W at 300 ft AGL is also licensed for 500W at 10 ft AGL.

Obviously, this would clearly cause interference to other licensees in other bands from receiver overload and desensitization. Historically, the FCC has required the interference between two licensees to be resolved by the last-deployed system.

It is not the intent of the State to procure a System design that causes interference to other existing licensees.

The Contractor shall ensure that the deployment of their system design, including RF sites, in-building enhancements and subscriber units, do not degrade or interfere with other licensed systems that are operating within the scope of their FCC license. The Contractor shall be responsible to resolve any interference to other licensed systems. Offeror shall provide a detailed explanation of how their proposed system is designed to minimize the potential for this occurrence.

4.2 RF COVERAGE DESIGN

Coverage is defined as providing the minimum design signal level while delivering the specified DAQ 3.4 audio quality. The subscriber configuration for coverage design is a mobile radio and for DOC it is a portable, worn at the hip with a swivel case, zero-gain antenna, and the use of a standard lapel speaker/microphone.

Minimum Received Signal Level (MRSL) is defined as the minimum signal level required at the receiver input port to meet the coverage requirements within the service area. Coverage in any one county will be entirely dependent on tower sites within that county's sub-system. One exception to this requirement is the area of Milford in which all emergency communications are dispatched from the Kent County Communications Center and Kent County sub-system. The 700 MHz backbone system shall be designed for the following coverage requirements, on a county-by-county basis:

- 97% contour reliability for mobile-on-street talk out/talk back coverage within land mass and inland water ways on a County-by-County basis
- 97% portable-in-building talk out/talk back coverage within the compound walls in the above-ground floors in Correction buildings throughout the state
- Control Stations are required to be 99.9% coverage reliable anywhere they are installed inside the required coverage area.

The voice system shall provide coverage to a minimum audio quality of DAQ 3.4 as defined in TSB-88 throughout 97% of each of the state's three counties' jurisdictional boundary contours including inland waterways.

The State reserves the right to have the Contractor revise coverage predictions as required. Measurement and verification methodology shall be provided to insure compliance.

The coverage design and performance testing shall comply with the most current version of TIA/EIA-TSB88, although this RFP may specify minor variations in this standard.

The radio coverage design shall take into account the current noise floor environment as well as predictable degradations for the near future. It is the intention of the State to procure a System that shall be tolerant of current and future interference from cellular and ESMR system deployments. Interference and system degradation to public safety radio systems from adjacent-band ESMR cellular and ESMR systems is becoming a nationwide problem. In addition to standard considerations for environmental losses, the coverage design shall take into account the following:

- Predictable Adjacent Band Noise/Interference from CMRS systems
- Predictable Co-channel Interference near the Contour
- Potential for Portable Receiver Desensitization from Mobiles Operating in the Fringe Coverage
- 8-point Body Absorption Averaging or Similar Assumptions

The above factors shall be taken into account in the Offeror's MRSL figure. Offeror shall provide a detailed signal path loss calculation in their response that reflects their assumptions.

4.3 RF COVERAGE METHOD

Offerors shall provide radio system coverage predictions through the use of a radio wave propagation model that has been developed from theoretical and empirical data, and shall take into account terrain irregularity, foliage, urban clutter, building penetration losses, noise, and long and short-term signal variations.

Offerors are required to understand fully all of the current issues involving the NPSPAC Regional Planning Committees and DA 01-406 requirements as related to the 40 dB μ contour requirements along the border of the state. Regional frequency plans which contain rules effecting RF coverage in the areas of frequency allocation, channel spacing, channel bandwidth, etc shall be incorporated as part of the RF coverage predictions.

Offerors shall provide system losses/gains figures by supplying a table listing all parameters. Offerors shall indicate system gains, system losses, and signal strength assumptions as indicated in the RF Coverage Prediction Parameter Tables. Offerors shall copy these tables and fill in the particular information in order to complete the tables. In addition, Offerors are required to provide a detailed explanation of their calculations in the form of Figure 2 of TSB-88A Prediction Factors.

4.4 RF COVERAGE PREDICTIONS AND SUBMITTALS

4.4.1 RF Coverage Predictions

RF Coverage Prediction Parameter Table: Offerors shall provide a complete listing of all site, component, and system parameters used to calculate and generate the predicted RF coverage. Offerors shall also state the RF coverage prediction model(s) utilized. If multiple models are used to generate a composite prediction, then a detailed explanation shall also be included. Offerors shall utilize 30-meter resolution digitized terrain database used for the predictions.

The following RF Coverage Prediction Parameter Table is provided for Offeror use and completion as indicated. Charts shall be provided for the proposed trunked radio system.

State of Delaware
 700 MHz Communications System

700 MHz RF Coverage Prediction Parameter Table

700 MHz Parameters	Values
Propagation Settings	
Prediction Model	
Environmental Loss	
Add'l. Enviro. Loss	
Reliability	
Terrain Data Base	
Base Tx Antenna Type and Height.	
Base Rcvr. Ant. Type and Heights.	
Add'l. Losses	
Antenna Azimuth	

700 MHz Parameters	Values
700 MHz Base Transmitter	
Transmit Power	
Tx Antenna Gain	
Tx Line Type and Loss	
Tx Combiner Loss	
Duplexer Insertion Loss	
Filter Insertion Loss	
Circulator Insertion Loss	
Connector Losses	
Other Losses	
Add'l. Losses	

State of Delaware
700 MHz Communications System

700 MHz Base Receiver	
Receiver Sensitivity	
Receiver Antenna Gain	
Receiver Tx Line Type and Loss	
Receiver Multi-coupler Loss	
Duplexer Insertion Loss	
Filter Insertion Loss	
Connector Losses	
Other Losses	
Add'l. Losses/Gains	
Antenna Azimuth	

700 MHz Parameters	Values
700 MHz Mobile Transmitter	
Transmit Power	
Tx Antenna Height	
Tx Antenna Gain	
Tx Line Loss	
Connector Losses	
Other Losses	
Add'l. Losses	
700 MHz Mobile Receiver	
Receiver Sensitivity	
Rcvr. Antenna Height	
Receiver Antenna Gain	
Receiver Tx Line Loss	
Connector Losses	
Other Losses	

Add'l. Losses	
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Prediction Maps: Offerors shall provide propagation prediction maps indicating a single reliability of 97% RF coverage in each individual county. Prediction maps shall indicate county borders including adjacent counties, RF base site location(s), and areas of non-coverage.

The prediction maps shall also indicate the level of coverage anticipated outside the jurisdictional boundaries of the State. This information is important to public safety operations with first responder responsibilities in adjacent counties, particularly in Maryland.

The State desires a graphical representation of the areas that fall below 97% RF coverage to be indicated on the coverage prediction maps. The areas that are above 97% of RF coverage shall not be “marked” on the coverage prediction maps.

Optionally, Offerors may include US Interstate roads. In addition, the RF coverage prediction maps shall be developed using the following map scale:

Non-Simulcast Scale: 1-inch equals 8 miles on “ANSI E” size paper

Simulcast Scale: 1 inch equals 8 miles on “ANSI E” size paper

4.5 Compliance with 40 dBu Contour at State Borders

The Offeror shall comply with the provisions of DA 01-406. The requirements include:

The Public Safety 700 MHz band is allocated for services—the sole or principal purpose of which is to protect the safety of life, health, or property—that are not made commercially available to the public by the provider.

When planning sites or facilities, State Licensees must ensure compliance with Subpart R of Part 90 (Regulations Governing the Licensing and Use of Frequencies in the 769-775 and 799-805 MHz Bands) including:

- 47 CFR §90.533 (Transmitting sites near the U.S./Canada or U.S./Mexico border)
- 47 CFR §90.545 (TV/DTV interference protection criteria)
- State Licensees may operate facilities in interstate boundary areas so long as the field strength of station transmissions is limited to 40 dBu/m at the licensee’s geographic border. Adjoining states may agree to alternate field strengths at their common border.
- When planning sites or facilities, State Licensees must ensure compliance with 47 C.F.R. § 1.924 (Quiet Zones).

- State Licensees may operate facilities in interstate boundary areas so long as the field strength of station transmissions is limited to 40 dBu/m at the licensee's geographic border. Adjoining states may agree to alternate field strengths at their common border.
- State Licensees may share the use of their radio systems with any entity that would be eligible for licensing in the Public Safety 700 MHz band (*see* 47 C.F.R. §90.523) and Federal government entities. *See* 47 C.F.R. §90.179(g).

5.0 EXPANSION AND MIGRATION CAPABILITIES

5.1 EXPANSION AND MIGRATION CONSIDERATIONS

Offerors shall describe their offering as related to expansion and migration capabilities. As the system grows and expands in the areas of additional components and users, the State needs to understand the Offeror's proposal in order to meet these demands.

A similar understanding of the Offeror's migration plan (roadmap) needs to be reviewed since the Offeror's proposal shall be in stages or phases and could be impacted by product rollout or software/firmware/hardware developments and support. Offerors shall clearly define their migration plan as it relates to their offerings and requirements of the RFP specifications.

5.2 SYSTEM EXPANSION

Offerors shall provide detailed information on the expansion capabilities of the system being proposed. These details shall include the following items that shall allow the State a total understanding of the vendor's offering as related to expansion capabilities.

- Upper and Lower Limits of the Equipment's Inputs and Outputs
- Impact to the System Architecture
- Impact to System Access
- Impact to Other Support Systems
- Associated Relative Costs
- Impact on Existing Users

6.0 REDUNDANCY AND BACK-UP CONSIDERATIONS

6.1 GENERAL

Critical components and subsystems of the voice system infrastructure shall be designed with redundancy in order to provide high system availability. At a minimum, this shall include a redundant radio network controller option as well as any redundant data system controller equipment, servers, or host system interfaces. Such redundant equipment shall be in standby mode until such time as a failure requires that the redundant components be enabled. Enabling or switching over of redundant radio network controller and data system components shall be automatically performed by the proposed radio systems upon failure detection.

In their proposal, the Offeror shall provide a detailed System Fault Analysis to verify that no single point failures exist in their design. Offeror shall include a single point failure analysis of the existing system and components that shall be retained in the new System design to ensure that single point failures do not exist in the overall System Upgrade.

6.2 INFRASTRUCTURE COMPONENTS

Critical components of the radio system infrastructures shall be designed with redundancy in order to provide high system availability (e.g. 99.999% availability over 1 year).

Offerors, as solutions for the final radio system design, shall offer fault tolerant, distributed processing and hot-standby equipment configurations. Failure scenarios for hardware, software, radio sites and site links shall be developed by the Offerors and provided as part of the system description and proposal offerings.

Offerors may wish to propose critical network control equipment at an additional site; interfaced to the main site such that switchover to the backup site shall assure full functional control over the entire infrastructure.

The State requires a system that shall not suffer a loss of the trunking capability resulting from the failure of a single system component. Sufficient redundancy and fault tolerance shall be designed so that full trunking operations shall continue without interruption in existing communications.

The State further requires that any system component that can render 25% of its system resources malfunctioning from a single point of failure shall be made redundant or fault tolerant.

As an example, if redundant controllers are supplied, both controllers shall remain online in continuous duty operation with real-time parallel updating of static and dynamic system data so as to provide minimal disruption of service in the event of a failure of the primary controller equipment. Switching from main to standby operation shall be fully automatic with audible and visual indication of the switchover provided to the system network manager as well as to the supervisory console operators.

Offerors shall specify the amount of time it will take between primary controller failure and backup controller switchover by stating how long it will take for complete resumption of system service.

Remote switching from main to standby operation shall be provided at the supervisory console as a manual override to automatic switchover. The Offeror shall specify the period of time required and the procedure for manual switchover to a redundant system controller.

In the extremely unlikely event that failures shall cause system users to operate in conventional mode until trunked operation recovery can be made, Offerors shall describe the failure logic in complete detail, the mode of operation during such conditions, as well as the recovery process in their responses. The State considers this detail extremely important in the analysis of their evaluation.

6.3 INTERCONNECTION LINKS

Offerors shall describe all levels of link redundancy supported or required by the system and define the point-to-point capacity impact on the microwave system.

6.4 CONTINUITY OF RF COMMUNICATIONS

If a radio channel fails, the system design shall permit continued operation of all mobile units originally assigned to that channel. This shall be accomplished by automatic switching of the mobile unit to another radio channel. The system shall be designed to allow vehicles to roam throughout the State automatically acquiring a channel within RF coverage of the base site. The system design shall incorporate multi-frequency automatic switching radios

6.5 EXISTING FACILITY UPGRADES (Optional)

It is not the intent of this RFP for the Offeror to propose to upgrade any existing facilities, including shelters, towers, generators, etc., to the exact same standards as any new proposed facilities, if any, provided by the Offeror. The Offerors shall not propose upgrades to existing facilities that do not directly impact the functionality, performance, or reliability of the radio system.

For instance, fencing, outdoor lighting, general housekeeping upgrades, painting of towers, and similar non-critical characteristics at existing facilities shall not be included in facility upgrades. However, testing and upgrades to existing grounding and bonding systems, structural load analyses for all existing towers, alarming and control of existing generators, UPS systems and tower-top amplifiers, and expansions or replacement of shelters are examples of valid upgrades of existing facilities.

6.6 GENERAL CONDITIONS

Optionally, the Contractor shall engineer, furnish, and install complete and fully operational base station and/or microwave sites necessary for the proposed radio system. Site design work shall conform to these specifications and be stamped by a professional engineer with Delaware registration. A Delaware registered land surveyor or civil engineer shall prepare site plans. It is the Contractor's responsibility to evaluate the adequacy of existing State shelters. If the existing shelter is not adequate, a new shelter shall be proposed by the Offeror conforming to these specifications.

The Contractor shall be responsible for a complete and fully operable installation in accordance with the latest version of the National Electrical Code, local building codes, environmental laws, zoning and planning regulations or ordinances, land use restrictions, Federal Aviation Administration and Federal Communications Commission rules and regulations, Delaware Department of Transportation regulations governing road access and entry, and all other applicable local, state or Federal codes, regulations, laws and/or ordinances. In the event of conflict, the most stringent interpretation shall apply.

The contractor shall comply with all requirements and recommendations contained in Section 1.11 of the RFP.

Any materials furnished by the Contractor shall be new and of first quality as defined in industry standards. The Contractor shall not make substitutions unless prior approval has been obtained from the State Project Manager.

The Contractor assumes full responsibility for materials and equipment employed in construction of the project and agrees to make no claims against the State for damages to such materials and equipment except for that which is caused by the State, its employees or agents. The Contractor shall be responsible for storage of all materials purchased and turned over to him by the State and shall receive all delivered items by suppliers at the job site or at a staging area to be furnished by the Contractor.

The Contractor shall clean up and remove from the work site on a daily basis (or sooner if directed by the State Project Manager) all rubbish and construction debris, resulting from his own work. The Contractor shall supply a dumpster or similar trash storage/removal device wherever a substantial amount of construction debris is generated. Upon completion of work, the entire job site areas shall be left clean and free of trash, debris, mud, dirt, dust, scrap materials, and excess materials. Radio equipment shelters and rooms shall be thoroughly cleaned (including walls and floors) to the satisfaction of the State Project Manager upon completion of installation and construction work.

The Contractor shall coordinate the work of all the trades under his responsibility to ensure that interference between electrical conduits, cable support trays, grounding wire, structural, and the radio system components shall be avoided so that the project is completed within budget and schedule.

The Contractor shall keep up-to-date marked-up prints of the Project Drawings. Markings indicating changes to the drawings shall be red or green and clearly visible. Project Drawings shall also be supplied on disk in AutoCAD format and PDF format readable by Adobe Acrobat Reader software.

6.7 Lightning Protection

Delaware is a lightning prone location, and it is the State's goal to reduce possible system damage and failure due to strikes or induced currents. The Contractor shall adhere to current best engineering practices in providing protection to sensitive electronic equipment. At a minimum, the Contractors shall comply with the following practices:

6.7.1 Tower Lighting Control

Tower lighting controls shall be equipped with gas tube surge arrestors which shall prevent a lightning strike to the tower or lighting system from back feeding into the electrical distribution system of the equipment shelter.

6.8 Radio Frequency Transmission Lines

Each transmit transmission line shall be protected by coaxial surge/lightning protectors, PolyPhaser IS-CT50HN or equivalent, between the transmitter combiner output and the antenna. Lightning arrestors shall be grounded to the bulkhead panel.

On receiving antennas with a tower mounted amplifier, a PolyPhaser IS-DC50LN series lightning arrestor, or equivalent, shall be installed in the transmission line.

Control stations shall be equipped with a coaxial lightning arrester, PolyPhaser IS-50NX-C2 or equivalent. These lightning arrestors shall be grounded to a 5/8" X 8-foot driven ground rod by a #2 AWG tinned solid copper wire attached to the rod and the site ground ring system using an exothermic welding process.

Each transmission line shall be grounded at a point above the bend required to exit the tower mounted cable ladder to the ice bridge leading to the radio equipment shelter or room. These grounds shall be installed in accordance with the manufacturer's specifications and shall be sealed against entry of moisture at any location where the outer sheath of the transmission line has been cut or removed.

6.9 AC Power Supply for Electronic Equipment

All AC powered equipment to be installed in equipment shelters or rooms shall be equipped with a surge arrester, (MOV/SAD/gas tube combination), in addition to any surge protection equipment that may be installed across the shelter/room power mains.

6.10 GPS Receivers

If GPS receivers are used as frequency/time references in the simulcast system, the antenna line shall be equipped with a gas tube surge arrester, PolyPhaser IS-MR50LNZ+6 or +15, or equivalent.

6.11 Conduits and Raceways

All wiring inside of the building/shelter shall be enclosed in EMT (electro-metallic tubing) with compression type fittings (setscrew type fittings are unacceptable). EMT shall be surface mounted in a neat, professional manner. UL approved locknuts and grounding bushings (or EMT box connectors) shall be used at boxes and equipment enclosures.

All wiring outside of the building/shelter shall be enclosed in heavy wall galvanized rigid steel conduit with gasketed fittings. Weatherproof grounding type hubs shall be used at boxes and equipment enclosures. All wall penetrations shall be sealed with weatherproof compounds.

Telephone Company cable(s) shall be enclosed in GRS conduit.

Flexible metallic conduit (UL "Sealtite" or approved equal) with UL fittings shall be used as final connections to all mechanical vibrating/rotating machinery (A/C units, heaters, motors, transformers, UPS and generator set, etc.).

All new conduit routings shall be horizontally and vertically straight, neat in appearance, indicative of professional workmanship and conform to existing conduit routings. Where existing conduit supports are adequate, they shall be used. If new supports are required, they shall be installed at intervals in accordance with the NEC. Only structural members suitable for conduit supports shall be used; piping, HVAC ducts etc. shall not be used for conduit supports. Conduit support intervals shall be based on the NEC Table 346-12.

6.11.1 Wiring and Devices

Power conductor insulation shall be color-coded (with tape at each termination end). Identification shall be by color tape (black-phase A, red-phase B, blue-phase C, white-neutral and green-ground). Branch circuit conductors shall be labeled (using Brady or approved equivalent wire markers) at each end with the appropriate circuit numbers. Generator set and A/C unit control wiring shall be labeled with the terminal numbers corresponding to the Contractor's wiring diagrams furnished with the equipment.

All outlet boxes shall be surface mounted metallic and suitable for the quantity of devices enclosed. Faceplates shall match the outlet boxes. The outlet boxes shall be marked with the associated circuit numbers.

Radio equipment power feeds (120 VAC from UPS power panel) shall contain separate identifiable white neutral conductors. Common or shared neutrals for these protected loads shall not be utilized.

All wire for power, lighting, control and grounding systems shall be stranded copper with UL THWN/THHN 600V insulation, sizes as indicated. Minimum size for power shall be #12 AWG and minimum size for controls shall be #14 AWG. Electrical equipment, such as UPS, generator, A/C (air conditioning units), heater, etc. shall be wired in accordance with manufacturers wiring diagrams furnished with the equipment.

6.12 Ground Resistance Testing

A component of the system acceptance test plan to be completed by the Contractor shall be the testing of all existing grounding systems and any grounding systems installed, or utilized, for equipment associated with this procurement. This includes grounding at all base stations, dispatch centers, control stations and microwave terminal/repeater sites associated with this procurement.

All grounding systems shall be tested using an AEMC, or equivalent, clamp-on ground resistance tester or Biddle 500V Null Megger or equal (3-terminal fall-of-potential method). The resistance to ground shall measure 5 ohms or less.

Ground tests shall be conducted in the presence of a State installation representative and the results shall be recorded on a form approved by the State Project Manager. These forms shall be included as a part of the acceptance test documentation and are a component of final acceptance of the radio communications system.

6.13 Scope of Work

The Contractor shall be responsible for the following:

- Procurement and installation of materials necessary to complete the work
- Submittal for approval, all details, cuts and drawings of equipment and control systems
- Removal from the site and lawful disposal of debris and refuse as the result of performing his work
- Permits
- Compliance with all codes in accordance with the requirements set forth in the specifications

6.14 General Site Work

The following are specified for towers at any additional radio sites proposed by the Offeror.

6.14.1 Summary of Work

Site work includes clearing and earthwork; excavating and backfilling; compacting and grading; stone surfacing and fencing; site entry road; foundation work.

- Delivery and installation of shelters
- Delivery and installation of generators and fuel tanks
- Construction of towers as specified, including soil exploration, geotechnical report and foundation design
- Coordinate electrical power installation to the site
- Permits and approvals required for site work
- Coordinate telephone line installation

6.14.1.1 Stone Surfacing

The Contractor shall install stone surfacing to a depth of six inches within the fenced in site area. Material shall be ¾" broken stone with 10% binder material.

Two layers of polypropylene liner shall be installed under the stone for foliage suppression. Prior to the application of any material, an EPA approved defoliant shall be applied over the area.

Road construction shall consist of removal of the top soil, one 6" deep layer of #2 crushed stone, then one 6" deep layer of approx #57 sized "crusher run", then one 4" deep layer of #57 crushed stone. Each layer shall be compacted using a 10-ton (minimum) tandem vibratory roller prior to applying the next layer. Additionally, the crusher run layer shall be moistened prior to the compacting of that layer or during the compacting of that layer by using the rollers on board water spray system. Where needed, the transition from the tower access road to the pre-existing public road shall be in accordance with local highway ordinances and at a minimum provide a smooth and solid transition between the two road ways. Galvanized steel culvert pipe shall be provided, if needed, based on site specific conditions.

6.14.1.2 Fencing

The Contractor shall provide chain link security fencing and gates for the sites proposed. Fencing shall be a 9 gauge, 2-inch, galvanized steel, diamond mesh. Corner, line posts and gateposts (2½", 2" and 4" respectively) shall also be hot-dipped galvanized. Top rail brace (1¼") and truss rods (1¼"), as well as a bottom stringer also are required.

The mesh fencing material shall be secured to terminal posts using stretcher bars and galvanized steel bands and to line posts using aluminum wires specifically made for the purpose.

The top of the fencing shall have three strands of barbed wire with 45° extension arms pointed outside the fence area.

Gates shall be provided with a positive-type latching device. An appropriate length of 3/8" proof coil design, galvanized steel chain shall be provided to encircle the gate frames and be secured with a State approved padlock to be furnished by the contractor. A plunger rod and catch are also required to secure gate in the open position.

Fence posts shall be bonded to the site grounding system using an exothermic welding process. Fence fabric and barbed wire shall be bonded to the site grounding system in accordance with Section 8.17.2 of the RFP.

6.15 Shelter Specifications

6.15.1 General Description

For each additional site proposed by the Offeror, a prefabricated, bullet proof, Electronic Equipment Shelter, foundation, and ancillary equipment shall be furnished and installed on a turnkey basis as specified herein. The Offeror shall provide a host of optional shelter sizes from which the State can select as needed.

6.15.2 Reference Standards

Unless otherwise modified herein, materials, design and construction procedures shall be in accordance with ANSI/NFPA-70, The National Electrical Code, and all federal, state and local building codes.

6.15.3 Submittal

The Contractor shall prepare and submit for approval, 6 sets of engineering drawings of the shelter depicting its overall dimensions, electrical layout, and general floor plan. These drawings shall be used, as required, for obtaining zoning and building permits.

The Contractor shall submit for approval a suitable foundation design based upon normal soil conditions. Final foundation designs and costs shall be determined on receipt of soil boring information.

Drawings shall be sealed by a registered professional engineer licensed in the State of Delaware.

6.16 Shelter Features

6.16.1 Construction

Construction shall be concrete aggregate exterior with 5/8-inch plywood interior walls with maintenance-free laminate covering. Roofing shall be designed to prevent penetration by ice falling from the tower at the site. The roof shall be sloped to prevent accumulation of water. Interior walls shall be designed to allow mounting of electrical and electronic equipment using standard fasteners available from local hardware stores.

6.16.2 Bullet Proof

The shelter shall be bulletproof to a 30-06 round or a shotgun slug.

The shelter provided shall be equipped with an FM-200, or approved equivalent, clean agent, fixed fire suppression system specifically designed to meet the requirements of the shelter. The contractor shall submit a system design for State approval prior to purchasing/installing the system. The control panel shall provide the means for remote monitoring of the system status compatible with the State monitoring equipment installed in the shelter.

6.16.3 Lighting

There shall be sufficient interior lighting to provide a level of 75 foot-candles at 3 feet above the floor. Light shall be provided by fluorescent fixtures using two standard four-foot tubes per fixture. The switch for the light fixtures shall be located inside and next to the entry door. Light fixtures shall be installed to the front and rear of electronic equipment racks to provide sufficient lighting for service personnel to perform equipment maintenance.

Exterior lighting shall be provided adjacent to the entry door of the shelter. A photoelectric switch that allows automatic illumination and extinguishment at twilight and sunrise shall control this lighting. Exterior lighting shall be heavy duty, shatter and tamper resistant.

6.16.4 Power

AC power shall enter the shelter through an entrance elbow, which may be rotated to accommodate connection to conduit from the power company feed. A main cutoff switch shall be provided inside the shelter, followed by a distribution panel, which provides for a minimum of thirty branch circuit breakers.

The Equipment Room AC power shall be installed in EMT conduit with two duplex outlets mounted along the overhead cable ladder at the top of each equipment rack space, and at four foot intervals on each of the four interior walls of the equipment shelter (EMT conduit, grounded, duplex outlets). Each outlet shall be served by a separate circuit.

An all mode surge arrester device shall protect AC power mains. All electronic equipment in the shelter shall be equipped with transient voltage suppressors. The primary suppression system shall be silicon avalanche diode type, with MOV backup (Northern Technology Model TCS250BL or equivalent). It shall include a dry closure alarm relay, which shall be connected to the site alarm system.

All electrical equipment supplied shall be UL listed. The entire electrical installation and wiring shall be in strict compliance with the latest approved edition of the National Electrical Code and all state, County and local codes and ordinances.

6.17 Specifications

6.17.1 Building Size

The physical space anticipated for the radio sites is an area of no less than is required to house all equipment proposed plus provide space for a minimum of 50% system expansion and or 50% physical rack space, whichever is greater.

The shelter shall provide a minimum of 9' ceilings. Offeror shall provide a detailed description of the equipment building being proposed.

6.17.2 Doors

There shall be one exterior door that shall be of steel construction with a solid core and it shall have a steel door frame securely embedded into the concrete wall. Door hinges shall be tamper resistant to prevent removal of the hinge pins from the outside of the shelter.

Doors shall be equipped with a Best mortise lockset and a single cylinder lock. The lock set shall be protected by an anti-prying plate on the exterior of the door. All locks shall be keyed alike and match the existing State key code. Each shelter door shall be equipped with an emergency exit style latch release bar on its interior. This release bar shall also contain an electrically operated release mechanism that can be remotely activated from off site.

The contractor shall be responsible for all wiring, conduits, etc., internal to the shelter to make this device operational.

Wind: The shelter shall be designed to withstand sustained wind speeds of 110 miles per hour.

A drip awning shall be installed over each door to prevent water entry into the building.

Doors shall be sealed using adjustable weather stripping and an adjustable saddle.

A/C Power: A 120/240-volt AC Single Phase service shall be provided. Contractor shall size the service according to the requirements of the system proposed as well as a future 50% increase in system capacity.

HVAC: Low ambient temperature air conditioning equipment shall be provided. Electric heat strips or other devices shall be provided which shall maintain the interior temperature of the shelter between 55 and 85 degrees Fahrenheit when outside temperatures are -5 degrees Fahrenheit or greater. Relative humidity shall be maintained at a level acceptable to the equipment to be furnished in this procurement.

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There shall be two external vertical air conditioning units installed with a standard lead/lag switch arrangement, set to cycle between the two units.

Alarms: The following alarm inputs shall be installed and connected to the radio alarm system with alarm indications at the coordinator's position in the dispatch center:

- Tower Light Alarm
- Smoke Detector
- FM200 System Condition
- Intrusion (door) Alarm
- High Temperature Alarm
- Low Temperature Alarm
- Power Failure Alarm
- Generator in Operation
- Low Fuel Level
- Water on Floor

Waveguide Entry: Two waveguide openings, with 4-inch feed through plates shall be installed at the end of the shelter adjacent to the waveguide/ice bridge from the tower, and in alignment with interior cable ladders arranged over the equipment rack space. (PolyPhaser Earth Entry Port or Andrew part number 204673-8 or equivalent). The feed through plate shall be equipped with rubber boots and stainless-steel clamps to seal the coaxial transmission line to be supplied pursuant to this procurement. Cable boots with blank cushions shall be used to seal all unused entry ports (Andrew or Microflect). Seal Caps are NOT acceptable. Such blanks shall be shipped installed on the waveguide entry panel to prevent entry of rain, birds, insects, or rodents during shipping or installation of the equipment shelter. The waveguide entry port shall be attached to the exterior ground ring by #2 AWG solid copper wire or by copper ground strap.

Cable Tray: A minimum 18-inch cable tray shall be installed over all equipment rack spaces, and to the telephone equipment panel, and to any future equipment expansion space in the shelter. Cable tray sections shall be bonded to one another and to the building ground halo by #2 AWG copper wire and compression fittings.

Security: Ventilation openings shall be protected by security screens to prevent unauthorized entry.

Generator: A diesel engine powered emergency generator shall be provided for all sites at which new shelters are being installed (Offerors shall also propose propane fueled generator systems as an option). At time of acceptance, the contractor is responsible for the fuel tank being full of fuel. The capacity of the generator shall be sufficient to support the electrical service proposed by the Contractor as well as a 50% additional future system capacity.

Foundation: The building foundation shall be concrete slab and installed in compliance with local building codes. A 36"x 48" concrete entrance pad shall be installed at the entry door and shall be a continuous pour with the main foundation.

Flooring: Interior flooring shall be vinyl tile over concrete. Base moldings shall be installed around all interior walls.

6.18 Tower Specifications

6.18.1 Existing Tower Facilities

6.18.1.1 Structural Load Analysis

Offerors shall provide a structural load analysis with their proposal for any existing tower structures to be utilized in their proposal if it places additional load on the structure, either temporarily or permanently. All structural analyses shall be compliant with TIA/EIA-222.

6.18.1.2 Reference Standards

Unless otherwise modified herein, materials, design and construction procedures for any towers proposed by the Offeror shall be in accordance with Electronic Industries Association (EIA) standard EIA-222, Federal Aviation Administration (FAA) Advisory Circular AC 70/7460-1(current revision), and all applicable local codes.

6.18.1.3 Submittals

The Contractor shall prepare and submit for approval, six copies of scale drawings of the tower depicting its overall height, the number and height of sections, the horizontal spread of each section, guy points (if applicable), antenna loading at specified heights and obstruction lighting details.

The Contractor shall submit for approval a profile view of the tower, containing structural details and engineering notes. Any documentation on the tower needed by the State for planning approvals shall be supplied.

Drawings shall be sealed by a registered professional engineer (structural) licensed in the State of Delaware.

6.18.1.4 Antenna Towers

Materials: Galvanized steel. All steel materials used in the construction of the towers shall be new and shall conform to the provisions of EIA-222 (current version) with respect to physical properties, manufacture, workmanship and factory finishes.

Height: Tower heights, excluding appurtenances, shall be as specified by the Contractor to meet the proposed system performance levels.

Loads and Stresses: The design of the tower shall take into account dead and live loads induced by the structure itself and all appurtenances, and all stress applied to the tower and its appurtenances by wind forces. The minimum safety factors listed by EIA-222 (current revision) shall apply under the most severe combination of dead load plus live loading.

Appurtenances: Appurtenances include, but are not limited to, the following: antennas, antenna mounts, antenna platforms, microwave antennas and radomes, lighting, transmission line, transmission line hangers, cable ladder, climbing ladder and safety device, lightning rods, conduit, and ice shields.

Antenna and Transmission Line Loading: The towers shall be designed to support, at minimum, the antennas and transmission lines proposed by the Offeror plus a 30% growth factor, plus three typical commercial wireless carriers (12-panel sector antenna configurations) in the top 30% of the structure.

Wind Loading: Wind loading shall be calculated per EIA-222 (current revision), with all appurtenances installed plus the 30% future system growth factor (30% does not apply to commercial carrier loads).

Iced Loading: The structures shall be designed per EIA-222 (current revision) to withstand additional horizontal wind pressures and dead loading produced by the accumulation of ½" thickness of radial ice.

Tower Twist, Sway and Displacement: Each tower shall be designed to meet twist, sway and displacement specifications for all loading conditions as recommended by EIA-222 (current revision) for the antennas proposed by Offeror.

6.18.1.5 Transmission Line Support

Cable Ladder: A transmission line cable ladder shall be installed along the inner side of one face of each tower (nearest to the building).

The cable ladder shall be of galvanized steel construction and shall have mounting hardware of stainless steel or galvanized steel construction. No drilling of the tower legs or cross bracing shall be allowed to install the cable support device.

Transmission lines shall be attached to the transmission line cable ladder using stainless steel hangers and adapters of the appropriate size for the transmission line supplied. Hangers shall be Andrew models 43211, 42396A or equivalent. Andrew E Angle Adapter, or equivalent, kits may be used to attach the hangers to the transmission line support ladder.

Transmission line shall be supported on the cable ladder and ice bridge at intervals as recommended for 100 mph wind with ½ inch radial ice by the manufacturer of the cable.

Waveguide Bridge: A waveguide bridge/ice shield shall be installed between the tower and the equipment room/shelter to support transmission lines and to protect them from ice falling from the tower or antennas. The waveguide bridge shall be designed to accept support devices to properly attach the transmission lines at the intervals specified above. The waveguide bridge shall be supported by galvanized steel pipe columns. Galvanized steel construction shall be used for the waveguide bridge and its ancillary components. A grating type of waveguide bridge is required to reduce snow accumulation. Microflect waveguide cushions, hangers, and crosses are the preferred method of attachment to the waveguide bridge.

6.18.2 Lighting and Controls

Lighting: The towers shall be lighted and/or marked in accordance with the applicable chapters of FAA Advisory Circular AC 70/7460-1 (current revision), as required by the particular Aeronautical Study performed by the FAA for each tower.

Controls: Activation of any required lighting systems shall be via a light sensitive, photoelectric type switch and controller which shall activate the lights at dusk (or other cloud darkened condition) and extinguish the lights at sunrise. If a dual lighting system is required at any site, the controller shall automatically switch modes at sunset and sunrise.

Wiring: Wiring for the tower lighting shall be installed per the lighting manufacturer's instructions.

Bulb Failure Indications: The lighting control system shall be equipped to provide form "C" dry contact closure alarm indications of bulb failures.

6.19 Ice Shields

Each tower shall be equipped with steel mesh ice shields to be installed above each of the microwave antennas to protect them from falling ice. The ice shield shall cover the width and length of the microwave antenna it is intended to protect. Should an existing tower have insufficient weight to support the ice shield, the Offeror shall report the overloading condition to the State and provide a credit to the State should the State elect to delete the ice shield.

6.20 Climbing Ladder

Each tower provided shall be equipped with an OSHA approved climbing ladder and safety climbing cable with belt. Where possible, the ladder shall be placed inside the tower structure. Step bolts on the outside of the tower structure are not to be the primary climbing device. Tower maintenance climbers shall be able to climb the entire height of the structure without disconnecting from the cable.

6.21 Scope of Work

6.21.1 Contractor Responsibility

The Contractor shall be responsible for obtaining all permits, providing the towers, designing and installing suitable foundations and all furnishing and installing of all associated hardware and appurtenances, for performing all planning and installation of the tower, and for site restoration and cleanup. The Contractor shall be responsible for ensuring that the tower meets all design criteria, labor services, guarantees and installation requirements of the tower manufacturer, those contained in these specifications, and in national or industry standards to which this specification refers.

6.22 Purchaser's Responsibility

The State shall provide an installation representative to coordinate field installation activities and to act as a liaison between the Contractor, and the property owner (if the State is not the property owner).

6.22.1 Scope

The work to be performed under this Section of the Specification shall include: site preparation, tower erection, installation of antennas, transmission lines, lighting systems, ice shields, climbing ladders, cable ladders, waveguide bridges, antenna support brackets, platforms, tower foundations, tower lighting controls, lightning rods, grounding systems, guy anchors (if applicable), and touch up of any nicks in the galvanizing or paint. Contractor shall be responsible for dismembering and removing any existing tower facilities.

6.22.2 Construction

6.22.2.1 Soil Analysis

The Contractor shall be responsible for geotechnical exploration at the locations of each tower leg foundation, tower base foundation, and guy anchor point. A geotechnical engineer licensed in the State of Delaware shall be employed to perform soil exploration and analysis. A copy of the soil report prepared by the geotechnical engineer shall be furnished to the State by the Contractor prior to commencement of work.

6.22.2.2 Foundation Design

The proposal price for the foundation design shall be based on normal soil conditions. The final foundation design shall be determined when the geotechnical report is provided to the Contractor.

6.22.2.3 Site Plan

A site plan shall be prepared for State approval at each site at which construction of a tower or installation of an equipment shelter is required. The Contractor shall install the tower and shelter in conformance with the site plan. The Contractor shall note that regardless of its size at the base, the tower shall be installed such that a minimum of 10-foot spacing is maintained between the building and the tower face nearest the building. Ground space shall be reserved for deployment of the cellular carrier electronics equipment associated with the reserved tower capacity. Of the three carriers held in reserve, two shall be typical equipment shelters and one shall be typical outdoor cabinets.

6.22.2.4 Power

The Contractor shall be responsible for providing commercial power to the multi-gang meter bay within the compound. Temporary power may be required for the obstruction lighting on the tower during construction. The Contractor shall be responsible for arranging and installing this temporary power. Temporary obstruction lights shall be installed while the tower is being erected.

6.22.2.5 FAA Notification

The Contractor shall be responsible for meeting all FAA required notifications.

6.22.2.6 Painting

If the FAA Aeronautical Study requires any tower to be painted, the paint shall be applied at the factory with touch up painting to be completed at the site.

Touch-up galvanizing, if needed, shall be done in dry weather. Galvanizing shall not be applied over wet surfaces.

6.22.2.7 Grounding

Grounding of the tower shall be in conformance with the specifications provided in ANSI/IEEE Std 142-1982 and the guidelines contained in Section 8.17.2 of this RFP.

6.22.2.8 Site Landscaping

The Contractor shall be responsible for landscape grading and seeding of the disturbed soil. The Contractor shall use Fescue grass seed at all tower sites. If planning authorities require foliage screening or other plantings at the tower sites, the Contractor shall provide professional planting of the required species of trees or shrubs.

The Contractor shall restore any disturbed land adjacent to the site to its original condition.

6.23 Generator Specifications

The Contractor shall furnish standby power generators where required and upgrade existing generators as required.

6.23.1 General Requirements

It shall be the responsibility of the Contractor to provide, install, and test a complete and operable standby power generator and automatic transfer switch in each electronic equipment shelter to be supplied pursuant to this procurement. All equipment shall be new. The generator assembly shall be installed in a sound attenuating and weather resistant housing specifically recommended for it by the manufacturer near the communications shelter. The contractor shall be responsible for having the authorized service dealer of the generator manufacturer perform an on-site load test after the installation is completed. This test shall be conducted by connecting a resistive load bank device to the output of the transfer switch, operating the generator at full rated output for two hours without failure of any kind and by interrupting and restoring commercial power at the main disconnect to ensure the transfer switch operates as designed. The generator and all related equipment shall be continuously rated for operation in ambient temperature ranges of -40 to +50 degrees Celsius, 0 to 95% relative humidity, non-condensing. Transfer switches shall be rated to carry 100% of the rated current in the enclosure.

6.23.2 Documentation

The following documentation shall be supplied to the State for each generator set and transfer switch supplied:

- Specification and data sheets for the exact type and model generator and transfer switch supplied pursuant to this procurement, including all options and accessories
- Manufacturer's certification of prototype testing
- Manufacturer's warranty documents
- Shop drawings showing plan and elevation views of the equipment
- Interconnection wiring diagrams showing all external connections required; with field-wiring terminals marked in a consistent point-to-point manner
- Manufacturer's installation instructions
- Operator's and Maintenance manuals that outline routine maintenance and troubleshooting procedures
- Transfer switch manual and wiring diagram

6.23.3 Warranty

A non-deductible warranty, which provides for on-site service by a factory authorized service dealer, shall be provided by the Contractor. This warranty shall provide coverage against all defects in materials and workmanship for a minimum of two years from the acceptance date of the radio communications system.

6.23.4 Start Up Service

The Contractor shall provide initial start up service and shall conduct acceptance testing at each site at which the equipment is installed. Testing shall be witnessed by the State and test records shall be furnished to the State.

6.23.5 Type of Generator

Generators shall be diesel- or propane-fueled, four-cycle, engine-driven sets with a low reactance, brushless alternator. Generator sets shall be equipped with a temperature compensated automatic voltage regulator with under speed protection function, a control panel, and high ambient temperature cooling system. Offerors shall provide optional pricing as applicable for propane-fueled generators meeting the requirements herein.

6.23.6 Ratings

Output power rating of the generator shall be based on the load requirements of the Contractor's proposed equipment and shall provide for 50% excess expansion capacity. The contractor shall evaluate any existing generator to ensure it will meet this requirement. If it will not, then the contractor shall propose a replacement generator. All generators shall be capable of full single-phase output @ 1.0 pf.

Site conditions:

Voltage Regulation: +/- 0.05% of rated voltage, no load and full load

Frequency Regulation: Isochronous

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

6.23.7 Generator Set Control

The generator shall be a remote start type compatible with the automatic transfer switch to be supplied pursuant to this procurement. Manual starting and stopping shall be provided from the control panel.

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

Generator Protection Controls: (per NFPA 110)

The generators shall shut down and lock out upon:

- Failure to start (overcrank)
- Over speed
- Low lubricating oil pressure
- High engine temperature

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 indication when the generator set is running. These alarm contacts shall be wired into and shall be reported by the radio alarm system being supplied pursuant to this procurement. Meters shall be provided to indicate output voltage, output current, running time, frequency/RPM.

6.23.8 Fuel Supply

The Contractor shall supply a new, fully painted, double-lined diesel (or propane, per generator type) fuel storage tank to be installed and secured to a concrete pad at a location near the equipment shelter and which is accessible for refueling. The fuel tank shall hold sufficient fuel to provide seven days continuous operation of the generator set at full load under low ambient temperature (0 degrees Fahrenheit). The tank shall be filled before conducting acceptance tests.

Propane fuel lines shall be buried below the frost line and any point at which the line exits above grade, it shall be insulated to reduce condensation at the regulator. All necessary regulators, drip pots, piping, meters, or other supplies needed for an installation that meets local fire and building codes shall be furnished and installed. Contractors shall supply a full fuel tank at time of System Acceptance. Diesel fuel supplied shall be premium grade (must meet or exceed all specifications detailed in ASTM D-975-07b, or latest revision, Grade 2-D, S15) and contain long term storage stabilizer and biocide additives.

6.23.9 Exhaust System

A residential grade exhaust silencer shall be installed in the engine exhaust stack resulting in noise energy levels of 65 dBA (A-weighted) or less at 48 feet from the exhaust output in any direction.

6.23.10 Battery and Charger

A lead acid starting battery rated for the engine type to be supplied shall be furnished and installed with the generator set. This battery shall be float charged by a 10-amp voltage regulated charger, which is powered by 120 volts AC. Float, taper and equalize charge settings shall be provided.

6.23.11 Cooling System

The engine shall be radiator cooled. The radiator shall be filled with a water and antifreeze coolant mixture in accordance with the engine manufacturer's recommendations. A thermostatically controlled water jacket coolant heater shall be provided and installed in accordance with the manufacturer's recommendations.

6.23.12 Base

The generator set shall be mounted on a heavy-duty steel base, which is anchored to the top of the fuel tank. The base shall maintain alignment between generator set components and shall include vibration isolators.

6.23.13 Transfer Switch

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 generator set. The 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. Permanently attached manual handles shall also be installed on the transfer switch. The switch shall provide positive mechanical and electrical interlocking and mechanically held contacts. Quick-make and quick-break contact mechanisms shall be provided for manual transfer under load.

The transfer switch shall be installed in a key locking, UL listed, NEMA cabinet. The switch shall be fully wired and integrated with the engine generator set in accordance with local electrical and fire codes.

All transfer switches and accessories shall be UL listed and labeled, tested per UL Standard 1008 and CSA Approved.

6.23.13.1 General Specifications

Transfer switches shall be double throw, electrically and mechanically interlocked and mechanically held in both positions.

Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishment. Arc chutes shall have insulating covers to prevent inter-phase flashover.

Form C contacts shall be provided in each position for alarm reporting purposes. These contacts shall be connected to the radio alarm system for reporting transfer switch status.

6.23.13.2 Automatic Controls

Transfer switch control shall be solid state and designed for a high level of immunity to power line surges and transients. The device shall be tested in accordance with IEEE Standard 587-1980 (or latest revision). Controls shall have optically isolated logic inputs and isolation transformers for AC inputs. Relays shall be installed on all outputs.

Solid state under voltage sensors shall simultaneously monitor all phases of the standby power source and the commercial power source. Pick up and drop out voltage settings shall be adjustable. Voltage sensors shall allow for adjustment to sense partial loss of voltage on any phase.

Controls shall be provided with solid-state overvoltage sensors, adjustable from 100-130% of nominal input voltage to monitor the source. An adjustable time delay shall be provided.

Automatic controls shall signal the engine-generator to start upon signal from normal source sensors. A time delay start, variable from 0 to 10 seconds, shall be provided to avoid nuisance start ups.

The switch shall transfer when the emergency source reaches the set point voltage and frequency. A time delay shall be provided for transfer, which is variable from 0 to 120 seconds.

The switch shall retransfer the load to commercial power after a time delay retransfer. This time delay shall be variable (adjustable) from 0 to 30 minutes to avoid short engine run times. The retransfer time delay shall be immediately bypassed if the emergency generator fails.

The switch shall automatically signal the generator engine to stop after a time delay, which shall be adjustable from 0 to 30 minutes, the time starting on return to commercial power.

Power for transfer operation shall be from the source to which the load is being transferred.

Diagnostic indicators shall be provided to allow the last successful step in the sequence of control functions to be pinpointed. The present status of the control functions shall also be indicated. These functions, at a minimum, shall include:

- Source 1 OK
- Start generator set
- Source 2 OK
- Transfer timing
- Transfer complete
- Retransfer timing
- Retransfer complete
- Timing for stop

6.23.13.3 Front Panel Control Devices

A selector switch shall provide the following functions:

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

Normal - leaves the switch in its normal operating position

Retransfer - a momentary position, which shall provide an override of the retransfer time delay and cause immediate return to the commercial power source when sufficiently restored within transfer switch parameters

6.23.13.4 Exerciser Clock

The transfer switch shall be equipped with a digital, electronic exerciser clock 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.

6.24 UNINTERRUPTIBLE POWER SUPPLY (UPS) SPECIFICATIONS

UPS systems shall be furnished by the Contractor for each of the proposed equipment sites. There shall be no potential for single point failure in the UPS design. UPS battery backup times shall be as follows:

- 30 minutes at all radio sites
- 60 minutes at all major console system locations
- 60 minutes at prime simulcast or master control site locations

The UPS systems shall incorporate single-phase input and output over current protection and maintenance bypass switch. The system shall be "on-line" ferroresonant transformer technology or an alternate static Pulse Width Modulated (PWM) technology. The UPS shall be UL 1778 and 1449 listed. Acceptable vendors are Powerware, Liebert,, Chloride Inc., or an approved equivalent.

6.24.1 General Requirements

It shall be the responsibility of the Contractor to provide, install, and test a complete and operable UPS system in each electronic equipment shelter to be supplied pursuant to this procurement. Equipment shall be new and factory tested. The contractor shall be responsible for providing a full power output test to be performed by the UPS manufacturers authorized personnel. This test will be performed by connecting the UPS to a resistive load bank, running the UPS at full output while on commercial power input for two hours without failure of any kind; then, the commercial power shall be interrupted by opening the main disconnect for the shelter to induce a generator start and transfer to generator power. The test shall continue for 15 minutes on generator power, then the main disconnect shall be closed and the test shall continue until the transfer switch returns to commercial power. Then, UPS shall be run at full power output on battery power to ensure rated output time is achievable for the specific UPS being tested.

6.24.2 Documentation

The following documentation shall be supplied to the State for each UPS supplied:

- Specification and data sheets depicting dimensions, weight, location of conduit entry, grounding and wiring requirements and details for bolting assembly frames to floor
- Schematic wiring diagrams showing input and output protective devices and field connections, battery connections, interconnect wiring, controls and instruments
- Manufacturer's certified standard test data
- Manufacturer's warranty documents
- Manufacturer's installation instructions
- Manufacturer's Operating and Maintenance Manuals

6.24.3 Warranty

A non-deductible warranty that provides for on-site service by a factory authorized service personnel shall be provided by the Contractor. This warranty shall provide coverage against all defects in materials and workmanship for a period of one (1) year from the acceptance date of the radio communications system.

6.24.4 Start Up Service

A factory authorized service representative shall provide initial start up service and shall conduct acceptance testing at each site at which the UPS is installed. A complete load test of the UPS system shall be required. Test records shall be furnished to the State.

6.24.5 Ratings

UPS shall employ the latest, state-of-the-art, solid state components incorporating microprocessor-based Pulse Width Modulated (PWM) technology or ferroresonant transformer design. The UPS system shall consist of freestanding cabinets consisting of a rectifier section, inverter section, batteries, isolation transformer, manual synchronized make-before-break bypass switch and input and output over current protective devices. The system shall include all status and alarm displays, a remote interface communicator (typically RS-232 type), control devices, meters, components, cabling and connectors. Alarm monitoring shall be remoted to the NMS.

UPS and associated components shall be housed in heavy-duty reinforced steel freestanding finished cabinets requiring front access only. Batteries shall be housed within the UPS or, if necessary, matching cabinetry.

UPS rating shall be based on the load requirements of the Contractor's proposed equipment and shall provide for 50% excess expansion capacity.

6.24.6 Description and Operation

The capacity of the solid-state rectifier section shall be sufficient to maintain the battery in a fully charged condition and continuously supply the required load through the inverter while floating the battery.

The system offered shall not include any switching device or devices that shall interrupt the continuity of power in any way.

The output voltage of the UPS shall be maintained within $\pm 3\%$ over the nominal output voltage under any load conditions within UPS rating and ambient temperature range specified.

The sine wave output shall have a maximum of 5% total harmonic distortion over the entire range of output voltage at any load or power factor.

Automatic Frequency regulation shall maintain the output frequency to within ± 0.1 Hz for all combinations of temperature, input voltage variation and load variation. The output shall not follow the reference source beyond $\pm 0.3\%$ Hz of nominal frequency. When input returns to normal, the UPS shall automatically synchronize to the line frequency.

The components shall be selected to provide sufficient voltage capability and ample current-carrying capacity to furnish reasonable margin for handling over-currents and minor voltage variations. In no case shall components be operated at greater than 80% of the device's maximum steady state rating.

The UPS shall be capable of withstanding, without failure, short circuit currents and surges of magnitude and duration in accordance with ANSI/IEEE Standard C62.41, categories A and B.

The UPS shall be capable of providing 100% of the rated UPS output current continuously and shall be capable of providing 150% of rated output current for approximately 10 minutes.

The system transient response shall be $\pm 5\%$ from nominal peak voltage for 100% load step. Voltage recovery shall be within 4 msec. to $\pm 3\%$ of nominal voltage. The battery system shall be of the lead acid maintenance-free sealed, non-gaseous type.

The rectifier shall maintain a DC output voltage regulation of $\pm 1\%$ with a maximum of 2% RMS ripple. Rectifier shall be of the solid-state full wave SC bridge design to limit AC wave-shape distortion on the power system.

As a minimum, over current protection (10KAIC circuit breakers or 100 KAIC C. L. Fuses) shall be provided for:

- AC Input
- Rectifier Input
- Inverter Input
- AC Output
- Battery Input

6.24.7 Accessories

The following items shall be mounted on the instrument panel of the UPS cabinet via microprocessor based LED or equal display (including lights/meters) for the following characteristics:

Mode Select Switch (UPS Normal, UPS Bypass & Battery Modes)
Input AC Voltage
Battery DC Voltage
Rectifier DC Voltage
Output AC Voltage
Output AC Amperage
Output AC Frequency
Synchronizing verification
Low Battery DC Voltage Indication
Static Switch Position Indication
Manual bypass Mode Indication
Float-Equalize switch/timer DC Circuit Indication
% Rated Load Indication
Battery back-up time available in Minutes

The following conditions shall have audible and visual alarms in addition to dry contacts for use by Customer:

Low & High Battery Voltage
Automatic By-pass operation
Emergency Operation (UPS on Battery)
Rectifier/Inverter Failure
Common Trip alarm (form "C")

All external power and control connections shall be terminated on terminal blocks and identified clearly on wiring diagrams.

The UPS cabinet and battery cabinet (if not in UPS cabinet) shall be provided with a 1/4" x 1" copper ground bus with mechanical type lug connector to interface to a copper ground cable at the installation location. UPS manufacturer shall indicate on applicable drawing(s) requirements for neutral-ground bonding per UL Listing qualifying as "Separately Derived System" per NEC Art. 250.

6.24.8 Remote Alarms

The following alarms shall be remotely monitored through the radio alarm system:

Over Voltage
Frequency
Load Drain

7.0 SYSTEM ACCEPTANCE TESTING

The Acceptance Testing Procedure (ATP) for all systems shall consist of a series of tests, inspections, and analyses and demonstrations that are defined in this section. The ATP shall cover all field-testing procedures and which inspections shall be made in order to show Contractor compliance to the RFP (System) Specifications and the approved Design Specifications.

All Test Plans shall include a Verification Matrix containing the following information:

- Specification Name to which the verification applies
- Specification Paragraph to which the verification applies
- Test Method (Test, Inspection, Analysis, Demonstration)
- Test Phase (Unit/Equipment, Factory Acceptance, Site Integration, Field Acceptance)

The State's representative and the Contractor's representative shall conduct these tests and inspections as defined. The results of the tests and the associated punch list of outstanding items to be completed or re-tested shall be signed by both parties and forwarded to the State for review and acceptance. The outstanding items shall be resolved within 7 working days and these items shall be re-tested. If the outstanding items have an effect on other previously performed tests then re-testing of those tests shall also be included. Final acceptance of each individual system shall include, but not be limited to, the list of tests and inspections contained in the following sections.

The remote site equipment of the system shall be assembled as complete sites for direct shipment to the site locations in the field. All cabling, wiring, programming and equipment configurations shall be completely integrated in their final configuration prior to shipment. Upon arrival to their final destination, the hookup of racks, external power, grounding and antennas to the site equipment shall complete the physical integration of the sites and allow them to be "on-air" ready. No additional work shall be needed to ready the site for operation. It is understood that additional optimization (level setting, power adjustment, etc.) may be required to meet the technical requirements of this specification.

7.1.1 Equipment Cabling

The Contractor shall determine cable lengths between all interconnected equipment. All cabling shall be plenum rated, where required by code.

Circuit identification shall be provided on the modular panels and the cabling. The use of any conventional type punch blocks is acceptable. All cabling shall be terminated with appropriate connectors for ease of field installation and shall be terminated to the nearest 1-foot length. All cabling used for system interconnects shall be tested during factory staging of the system prior to shipment to the field.

All cables shall be clearly labeled with pre-printed (not hand-written) adhesive labels with "To-From" information to clarify interconnection for field installation and maintenance. Cable label information shall directly correlate to system documentation/drawings that define or depict the interconnecting cables (i.e. cable label text shall match drawing text). A spare set of cable labels shall be provided with the site documentation package.

A description and detailed wiring diagram of each modular panel utilized shall be provided.

Offerors shall describe in detail the manner in which the entire system shall be factory staged. The State's Project Manager shall visit the contractor's staging facility for the purpose of examining the system and viewing a functional test. The contractor shall develop a functional test plan and schedule this visit at the appropriate time prior to field delivery. The State's project manager, prior to the actual test, shall approve the functional test plan. System drawings, cabling diagrams, and interconnect diagrams shall be part of the test and be available for viewing.

7.1.2 Hardware Testing

Each hardware component shall be inspected and tested per the ATP. A test procedure and checklist shall be used to perform these tests based upon the ATP.

7.1.3 Software Testing

Each software feature shall be tested per the ATP. A test procedure and checklist shall be used to perform these tests based upon the ATP.

7.2 FIELD ACCEPTANCE TESTING

The Acceptance Testing for all systems shall consist of a series of tests, inspections, and verifications that are defined in this section. The ATP shall cover all field testing procedures and which inspections shall be made in order to show Contractor compliance to the RFP specifications as well as define each and every required sub-system interface. The State's representative and the Contractor's representative shall conduct these tests and inspections as defined.

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The tests and inspections listed in the following paragraphs shall be performed. Final Acceptance of each individual system shall include, but not be limited to, the following list of tests and inspections. The results of the tests and the associated punch list of outstanding items to be completed or re-tested shall be signed by both parties and forwarded to the State for review and acceptance. The outstanding items shall be resolved within 7 working days and these items shall be re-tested. If the outstanding items have an effect on other previously performed tests then re-testing of those tests shall also be included. The tests to be performed shall include, but not be limited to, the following:

- Transmitter power
- Transmitter Deviation
- Transmitter stability
- Site Noise Test
- Effective Site Sensitivity Test
- Receiver Intermodulation Susceptibility Test
- Receiver sensitivity
- Redundancy Testing
- Alarms
- Access Time
- Call Processing
- Group Calls
- Private Calls
- Emergency Calls
- Call Patching
- Interoperability
- Call Priority
-
- Failure Modes
- Reporting Features
- Talk Around
- Roaming
- Encryption

7.2.1 System Acceptance Sequence

System Acceptance shall take place in the following sequence:

1. Notification by the Contractor that the System installation is complete
2. Completion of inspections by State Project Manager
3. Notification by Contractor that final punch list is resolved and Acceptance Tests can commence
4. Hardware Acceptance Tests
5. Software Testing Test
6. Interconnect Testing
7. Microwave System Testing
8. Coverage Acceptance Test
9. 30 day Performance Test
10. Contractor provides draft system acceptance test report
11. Acceptance Test Results Approval by State Project Manager
12. All deliverables received by State Project Manager
13. Final System Acceptance Executed

7.2.2 Hardware Testing

Each hardware component shall be inspected and tested per the ATP. A test procedure and checklist shall be used to perform these tests based upon the ATP.

7.2.3 Software Testing

Each software feature shall be tested per the ATP. A test procedure and checklist shall be used to perform these tests based upon the ATP.

7.2.4 Interconnect Testing

Interconnects are defined as the electrical connections between two systems; for example, the connection between the 700 MHz System and the 800 MHz System, the radio system's channel bank and the microwave system's multiplex. Each system interconnect shall be tested per the ATP. A test procedure and checklist shall be used by the Contractor to perform these tests based upon the ATP.

7.3 MICROWAVE TESTS AND INSPECTION

The Acceptance Testing for all microwave system equipment shall consist of a series of tests, inspections, and verifications that are defined in this section. The State's representative and the Contractor's representative shall conduct these tests and inspections as defined in the Acceptance Test Plan (ATP).

The microwave factory acceptance testing shall include simulated system conditions for hop-to-hop and end-to-end BER measurements and availability calculations. The field acceptance testing shall consist of actual path measurements to ensure compliance with system design requirements.

Factory NMS testing shall simulate conditions of operational systems. The field acceptance testing shall consist of actual operational conditions.

The tests and inspections listed in the following paragraphs shall be performed by the Contractor. Final Acceptance of each individual microwave line, section, and path shall include, but not be limited to, the following list of tests and inspections.

The results of the tests and the associated punch list of outstanding items to be compiled or re-tested shall be signed by both parties and forwarded to the State for review and acceptance. The outstanding items shall be resolved within 7 working days and these items shall be re-tested. If the outstanding items have an effect on other previously performed tests, then re-testing of those tests shall also be included.

7.3.1 NMS Acceptance Testing

The NMS Acceptance Test Plan (ATP) shall cover all field-testing procedures and which inspections shall be made in order to show Contractor compliance to the RFP specifications and verify each system interface.

The ATP shall define all field testing after installation and optimization. This ATP shall be a comprehensive plan defining all aspects of the NMS. The contractor shall supply an ATP test plan for review by the State's project manager within 60 days of contract award. The ATP shall be a mutually agreed upon document prior to test execution.

7.3.1.1 Hardware Testing

Each hardware component of the NMS shall be inspected and tested per the ATP. A test procedure and checklist shall be used to perform these tests based upon the ATP.

7.3.1.2 Software Testing

Each software feature of the NMS shall be tested per the ATP. A test procedure and checklist shall be used to perform these tests based upon the ATP.

7.4 30-DAY PERFORMANCE TEST

Upon completion of the RF Coverage Test, a Performance Test shall be executed that shall consist of 30 consecutive days of uninterrupted operation. The System FNE and subscribers shall be equipped with the most current software and firmware for this test. During this test period, the Contractor shall keep detailed records of any failures or adjustments of the System or subscriber units. The test shall be considered a failure if any of the following events occurs; the test may be repeated at the discretion of the State.

The System experiences a catastrophic failure that results in:

- Failure of any APCO 16 features, functions or capabilities
- Failure of any APCO 25 features, functions or capabilities
- Failure of system control equipment
- Failure of site control equipment
- Failure of 25% of the channel assets anywhere in the system
- Failure of any or all console positions

The same device fails twice during the performance test

A non-critical failure, as defined in the warranty section of this RFP , is not restored according to the contracted response time.

8.0 RF COVERAGE ACCEPTANCE TEST PLAN

8.1 General

The purpose of this RF Coverage Acceptance Test Plan (CATP) is to verify, through in-place testing, that the delivered radio system meets the performance specifications required under this RFP. This section establishes the requirements with a generic, Contractor-independent methodology. Each Contractor shall submit the appropriate and source-peculiar details in its offering to permit both evaluation of compliance with this section and to also provide a definitive basis for a contractual specification.

8.2 Coverage Testing as a Part of Final Acceptance Testing

RF Coverage Testing is a subset of total System acceptance testing. Once the Contractor has completed testing in accordance with the approved CATP and the CATP results are accepted by the State, the Contractor shall have satisfied all RF System Coverage Testing required under Final Acceptance Testing ("FAT") so long as the requirements set forth in this section continue to be met.

8.3 Clarity of Proposal

The State has made no design or operational specification, which predisposes that the Offerors shall offer a particular solution regarding simulcast, non-simulcast voice or data radio system, or some combination thereof. Therefore, each Offeror shall, consistent with its individual offering, address testing only in context with its offering. If, for example, an Offeror proposes a statewide simulcast system, the requirements for testing in the simulcast environment shall be observed. Testing requirements for the non-simulcast environment would not pertain under this scenario and shall not be addressed by the Offeror.

Conversely, non-simulcast offerings need not address simulcast-testing requirements. Offerors are specifically cautioned, therefore, that if some "hybrid" form of simulcast and non-simulcast technologies are offered, the proposal shall be clear as to exactly which technology is being tested and how testing is proposed to be conducted.

8.4 CATP Submittal

Offerors shall prepare and submit a detailed outline of the CATP with its proposal. This outline shall conform to the specifications set forth herein and shall be in sufficient detail that it may become a definitive section of the resulting contractual agreement.

Subsequently, the selected contractor shall submit for the State's review and approval, a final CATP not less than one hundred twenty (120) days after acceptance of contract.

8.5 Schedule

Testing shall be scheduled by mutual agreement as soon as practical following commissioning of the Fixed Network Equipment ("FNE" or "Backbone"). Testing shall be scheduled while the trees in the coverage area are in full foliage as determined by the State Forestry experts.

8.6 FNE Integrity

The FNE shall remain essentially unmodified from the configuration that existed at the time of testing, continuing through successful completion of FAT.

8.7 RF System Configuration

The RF system actually tested shall remain essentially unmodified from the configuration that existed at the time of testing, continuing through successful completion of FAT.

8.8 Forms of Testing

The CATP shall consist of four (4) separate forms of testing generally described as Automated Signal Strength ("Automated"), Talk Out/Talk Back Circuit Merit ("CM"), Continuous Audio Quality ("Audio Quality") and Subscriber Receiver Desensitization ("Desense") testing. Successful completion of the four forms of testing is required as a part of Acceptance Testing. In each and every instance, however, CM testing and signal level measurements shall prevail as the determining methodology of the contractor's compliance with the coverage specifications and shall constitute coverage acceptance.

Successful passing of the coverage portion of the ATP shall consist of a simultaneous talkout/talkback (TO/TB) audio quality evaluation in addition to a minimum signal strength measurement. Both tests shall pass for each test location (grid) to be considered a PASS.

This CATP shall not only verify compliance with the RF coverage requirements but shall also concentrate on the identification of locations where coverage does not meet the requirements. CATPs are generally developed to validate the accuracy of the Contractor's propagation model and utilize statistical methods that do not take into account in-band interference levels similar to those found in the State.

With the knowledge of the locations where coverage is not compliant with the Specification, the State can take alternative action to document those locations and provide this information to the emergency personnel responsible for those areas. The CATP shall consist of the following test:

8.8.1 In-Street Testing Includes

- Appropriate In-street Signal Levels
- TO/TB Audio Quality Test
- Continuous Audio Quality Monitoring Test (informational only)
- Continuous Receiver Desensitization Test (informational only)

8.8.2 In-Building Testing Includes

- Appropriate In-facility Signal Levels
- TO/TB Audio Quality Test

8.8.3 Reciprocity and System Balance

Under most circumstances, a 700 MHz system that is properly designed with high-gain tower-top amplifier systems and effective receiver voting shall be talk-out limited in performance, that is, a portable that can “hear” the system shall likely be successful in accessing the system. With this in mind, a talk-in RF signal measurements test would not be cost-effective. In order to eliminate this portion of the test, the Offeror shall provide a TO/TB signal analysis with their proposal that shall prove that all radio sites are indeed balanced. The tower-top amplifier analysis shall include a Noise Figure Calculation and Multi-coupler (IMR) Inter-Modulation Rejection Performance Calculation. This analysis is critical to show system design balance is feasible without sacrificing receiver sensitivity or exposing the receiver to inter-modulation interference. A signal flow diagram is required that shall outline the signal flow from base station transmitter to portable receiver port and portable transmitter to base station receiver port. All gains and losses along the path shall be shown. If the Offeror utilizes other signal processing that result in overall improvement in audio or signal quality, these enhancements shall also be characterized and included in the calculations.

8.9 Determination of Number and Size of Test Tiles

8.9.1 In-street Testing

For in-street coverage testing, the Contractor shall ascertain the statistically correct number and size of test tiles per TSB-88A. Consistent with this section, the State clearly requires square or rectangular grids or tiles to be defined. Under no circumstances shall the tile be greater than ½ mile x ½ mile dimension.

The product of these computations shall be a test tile definition as to number and size for the Coverage Area. In all cases, consistent with TSB88 Paragraph 7.4.1, a confidence level not less than ninety-nine Percent (99%) shall be utilized.

8.9.2 In-Building Testing

For in-building coverage testing, the building shall be divided into equal grids of 625 (25'X25') square feet.

8.9.3 Inaccessible Test Grids

Grids that are considered inaccessible by the test vehicle shall be discarded from the calculations for RF coverage acceptance.

8.10 Remedies For Coverage Failure

Remedies for coverage failure shall address the entire problem area and not be limited to correcting a portion of the failed area. Remedies shall not degrade areas of coverage that were previously accepted. A retest of coverage shall be conducted in those areas (previously failed or not) potentially affected by the remedy in order to verify that the composite coverage is maintained. All remedies shall meet the performance, feature-functionality and reliability requirements of the Specification.

These remedies may include the following:

- Modification of antenna or transmitter configurations, as long as those modifications comply with regulatory and zoning restrictions placed on the State, at no additional cost to the State.
- Addition of complete remote simulcast sites or multi-cast sites, at no additional cost to the State.

8.11 Test Teams

The test teams shall consist of a Correction, and/or Division of Communications representative and Contractor. There shall be one test team located in central dispatch and multiple test teams in the field. The State shall provide the drivers for the in-street testing as well as the in-building testing process.

The driver shall only be responsible for the proper and safe operation of the vehicle and shall not participate in the audio quality testing. All navigation directions shall be the responsibility of the Contractor's representative and is expected to be provided via the automatic computerized signal measurement system.

8.12 Test Equipment and Apparatus

The basis for this RF coverage design is a mobile-in street design with the exception of DOC facilities, which is portable in-compound and in-building. Therefore, the Contractor shall execute the RF Coverage Test utilizing the appropriate mobile or portable radio operating configuration specified in this RFP.

The Contractor shall be required to provide all test equipment associated with the CATP processes including all portable and mobile radios. The radio equipment shall be configured with the current software and firmware available at the time of testing.

For in-building testing this portable radio-based equipment shall include the test backpack system or rolling cart system, as appropriate. For in-building testing, the portable radio shall be worn on the hip with a standard swivel case and standard lapel microphone.

For in-street testing, this mobile radio-based equipment shall include any materials and equipment required to modify a standard vehicle such as DC to AC power inverters and the test equipment cabinet. The Contractor shall be required to install all test equipment and apparatus in the test vehicles with minimal damage and restore the vehicles to reasonable condition upon completion of testing.

8.12.1 Test Vehicle

The State shall provide all vehicles required for the in-street coverage testing portion of this Specification. The standard test vehicle shall be a multi-passenger van sufficient to hold the test cabinet and equipment, four participants in addition to sufficient room for occasional observers.

8.12.2 Testing Elements

8.12.2.1 RF Signal Level Measurement Test

The signal measurements test portion of the CATP is required in order to verify that the Minimum Received Signal Level (MRSL) is present in the specified number of test tiles, thereby proving that the coverage prediction model is accurate. This test verifies the Service Area Reliability of 97% state-wide, which is directly related to the Coverage Specification for 95% Contour Reliability.

The test shall utilize a GIS-based, computer automated signal measurement system that will average the carrier signal over a 40 wavelength sample, one sample per test tile. This test shall be utilized for both in-street testing and the testing of all buildings.

8.12.2.2 Talk-Out and Talk-Back Audio Quality Test

TSB88 recommends that a talk-back test is unnecessary since there is reciprocity in the design and may be a waste of resources unless the service area is characteristic of high ambient noise. This high-noise characteristic has been found within the State, especially in the vicinity of high density cellular sites and shall be the basis for the more complex talk-out/talk-in test plan. Intelligibility tests shall be conducted in order to verify inbound and outbound audio quality for all digital channels. In the audio quality test portion of the RF Coverage Test, a particular test tile shall deliver the audio quality specified below, for the same test location in the tile under test, for both talk-in and talk-out. The specified audio quality shall meet the following criteria:

“The delivered audio quality for digital and analog units shall meet the DAQ 3.4 as per TIA Standard TSB88-A, which is defined as “Speech understandable with repetition only rarely required. Some Noise/Distortion”.

“Rarely” shall be quantified as not greater than 10 percent re-test. This means that a maximum of 10% of all the grids tested shall be allowed a repeated transmission within three feet of the original test location and shall be identified as a “pass-retry”. If the message meets or exceeds this criterion, as agreed by a majority of the test team, it shall be considered “passed”. If the message does not meet this criterion, as agreed by the majority of the test team, it shall be considered “failed”. The Contractor may then move no more than three feet in any one direction and repeat the audio test once. If this re-test meets or exceeds the original criterion, the tile shall be considered a pass and is recorded as a “retry-pass”. The test team may then move to the next test point.

Each member shall classify the message as a “pass” or “fail”. Then the test team shall reach a consensus as to whether the test point is a “pass” or a “fail” in the event the message classification is not unanimous. When the talk-out test is conducted, the operator shall state the following message: “*Dispatcher to Portable Team. Grid Number #. [Random Test Language]. Grid number #. How do you copy grid number #?*” When the talk-in test is conducted, the portable operator shall state the following message: “*Portable Team to Dispatcher. Grid Number #. [repeated Random Test Language]. Grid number #. How do you copy grid number #?*”. Each team member shall then classify the message as “pass” or “fail”. The speakers shall speak the test messages as clearly as possible and occasionally incorporate voice inflections characteristic of typical police and fire emergency transmissions.

The test language to be used shall be mutually agreed upon between the State and the Contractor prior to testing. The State shall provide a list of potential test messages representing commonly used dispatch language, void of acronyms, and not to exceed 10 seconds in length, for evaluation.

From the potential list of messages, one hundred shall be selected as the pseudo random messages to be used for testing purposes. The phrase to be used during each test shall be determined by the speaker. The final list shall be determined prior to testing.

8.13 Evaluation of Results

After all testing have been completed, Contractor and the State of Delaware will evaluate the test results by compiling all of the data gathered for each of the test grids. Contractor shall provide the State with a single pass/fail grid percentage that verifies a minimum of 97% grids that simultaneously pass the Audio Quality and Signal Strength Tests.

The percentage of area covered shall be based on the number of passing grids divided by the total number of valid grids tested. The formula shall determine the percentage of grids passed.

9.0 SYSTEM SHIPPING

The Contractor shall be responsible for shipping, safe transportation, delivery, and unloading of all material provided within this specification from the place of origin to designated locations within the State. No equipment shipments shall be made without the approval of the State. All shipping shall include the offloading of equipment from delivery vehicles by the Offeror's shipping company and not the State of Delaware personnel with delivery into a storage location as specified by the State. Specific delivery locations shall be to the facilities of the Division of Communications within the county in which the hardware will be installed.

All packaging of material shall conform to good packing practices to protect against any possible shipping damages.

Delivery shall be made to ensure that the system is installed to meet the State's critical dates as defined in the final implementation schedule.

The contractor shall indicate how equipment or systems shall be delivered, i.e. identifying the carrier, and shall notify the State's Project Manager of shipping dates. The State's Project Manager shall be informed of any changes in shipping dates.

Charges for freight express, cartage, or packing shall not be allowed or paid by the State unless otherwise expressly stated by the State.

Every package, bill of lading, shipping memorandum, and invoice shall be marked with a purchase order number of the purchaser.

An itemized delivery ticket, bearing the State's purchase order number shall be left with the goods to insure their receipt. If a carrier makes delivery, an itemized delivery ticket shall be attached to the outside of the package.

10.0 RADIO SYSTEM INSTALLATION

10.1 Installation Standards

All installation work performed shall be in accordance with laws, regulations, and ordinances of all State, Local, and Federal agencies.

The Contractor shall provide all the necessary personnel, tools, equipment, and transportation for the successful installation of all equipment provided under this RFP procurement.

The Contractor doing the installation shall be required to provide a Certificate of Insurance indicating the coverage limits as outlined by the State. The Contractor shall bear responsibility for the safety of their workmen and all others during the implementation phase of this RFP contract.

The Contractor is responsible and shall provide all the hardware and supplies necessary for the proper and complete installation of their equipment.

It shall be the responsibility of the Contractor to provide a turnkey installation of their equipment; this requirement applies equally to a turnkey total system supplier or to suppliers of individual subsystems or components. Optimization, trouble shooting, and adjustment of each sub-system shall be the system contractor's responsibility. This includes any changes and/or additions to the systems in order to meet performance criteria. Any additional equipment required after the proposal is awarded to meet the system performance criteria of the defined standards and/or specifications shall be at the sole expense of the contractor.

All existing radio communications systems shall remain fully operational during installation of the new radio systems. Because existing systems support public safety operations, interruptions in service due to contractor or contractor activities cannot be tolerated. If interruptions in service are deemed by the contractor to be unavoidable, written notification detailing the nature and duration of such interruptions shall be provided to the State for review and approval.

Equipment shall be installed in a neat and workmanlike manner, in accordance with good practice, by competent technicians or mechanics. Personnel designated by the State shall provide inspection and approval of all installations. Such approval shall be limited in scope to the specific sub-system physical installation and shall not be construed to imply full acceptance of the system or sub-system.

10.1.1 Subcontractors

Subcontractors performing installations of any equipment or any sub-system shall be identified in the Offeror's response. All subcontractor installation experience and qualifications to perform the tasks associated with this procurement shall be outlined in the proposal response.

Notwithstanding the details presented in these specifications, it is the responsibility of the Contractor's project manager to verify the correctness of the material lists and suitability of devices proposed to meet the intent of the specifications. The Contractor shall be responsible for providing or arranging for all parts necessary for the equipment and its installation up to and including Final System Acceptance.

10.1.2 Right to Conduct Background Checks

The State reserves the right to conduct background checks on any personnel proposed by the Offeror to install radio system components or access high-security fixed network public safety radio transmission sites. To conduct background checks, the Offeror shall provide to the State a copy of each worker's operator's license or other photo-identification card issued by a government agency as well as the social security number and birth date of the proposed personnel. Any employee of the Offeror or a sub-contractor of the Offeror convicted of a felony or crime of moral turpitude may be denied access to a high-security public safety radio network site or equipment room.

10.2 Equipment to be Installed

The contractor shall install the following Radio system equipment into the equipment shelter may include:

- Radio Base Stations
- Antennas and Transmission Systems
- Combiners and Multi-couplers
- Radio Switching and Routing Equipment
- Channel Bank Equipment
- Power Supplies
- Connection to Back-up Power Systems
- Equipment Racks
- Demarcation Blocks/Equipment
- Grounding Connections to Site Ground

All equipment racks shall be mechanically bonded to the equipment shelter's internal ground system using green insulated stranded copper wire.

All ground connections shall be made with minimum length conductors and vertical or horizontal runs where possible. Ground conductors shall have a minimum-bending radius of 12 inches. Ground conductors routed in cable trays parallel with transmission lines, telephone lines, power lines, etc., shall be separated by a distance of more than 6 inches.

The contractor shall install any additional equipment not included in above list that is required for a complete system.

The Contractor shall coordinate with the State for all installations in State-owned shelters.

10.3 Radio Subsystem Manager Installation

The radio subsystem manager, network elements, element managers, RTUs, and SCADA elements shall be installed at the remote radio sites. The radio contractor shall install and optimize the equipment based on a mutually agreed upon installation plan. Cabling, wiring, and equipment mounting shall be performed in a workmanship manner with the approval of the State project manager. All documentation and installation drawings shall be reviewed by the State within sixty (60) days of contract award and signed-off by the State's project manager prior to the commencement of the installation.

All equipment racks shall be mechanically bonded to the equipment shelter's internal ground system using green insulated stranded copper wire. All ground connections shall be made with minimum length conductors and vertical or horizontal runs where possible. Ground conductors shall have a minimum-bending radius of 12 inches. Ground conductors routed in cable trays parallel with transmission lines, telephone lines, power lines, etc., shall be separated by a distance of more than 6 inches.

The contractor shall install any additional equipment not included in above list that is required for a complete system. Offerors shall provide pricing and information for remote user installations, operational, and environmental requirements as well.

10.3.1 Equipment to be Installed

The contractor shall install the following Radio and Data Network Management system equipment into the equipment shelter:

- Manager Elements
- Manager Host Computer
- Remote Manager Terminals
- Software Applications

- Cabling
- Computer and Flat Panel Monitor Console Mounting
- Channel Bank Equipment
- Power Supplies
- Connection to Back-up Power Systems
- Equipment Racks
- Demarcation Clocks and Equipment
- Grounding Connections to Site Ground

The Contractor shall install any additional equipment not included in above list that is required for a complete system.

10.4 Communications Consoles (If Required)

10.4.1 General

The installation of the new consoles and associated equipment shall be provided by the Contractor at all designated locations. The Contractor shall supply and install all required punch blocks, terminal strips and/or cables needed to interface the new console electronics to the existing facilities such as radio equipment, telephone equipment, logging recorder equipment and/or auxiliary function and/or control circuits.

All new console cabling, including those that shall terminate at the existing punch blocks shall be labeled with pre-printed adhesive wire markers. The markers shall be placed at each cable end, adjacent to the connector or plug. All cables and/or cable bundles shall be hidden from view and shall be neatly secured by means of plastic tie wraps.

All cabling to the operator positions and to the central electronic assembly(s) shall be provided with sufficient slack to permit movement of at least ten (10) feet in any direction.

10.4.2 Physical Interface Requirements

The Contractor shall be responsible for the physical interface(s) between the radio system and the communications console.

The physical interface is expected to include, at a minimum, the following:

Wire connections from telephone company provided circuit termination block(s) to the appropriate console punch block(s)

Wire connections to the corresponding terminal and source locations on the voting comparator, audio distribution network and the console

Proper termination of all used and unused I/O ports on the voting comparator and audio distribution network

10.4.3 Functional Interface Requirements

The Contractor shall be responsible for the functional interface(s) between the radio system and the communications consoles.

- The functional interface is expected to include, at a minimum, the following:
- Adjustments of the input signal level(s) from the voting receivers to the comparator
- Adjustments of the output signal level(s) from the voting comparator to the console
- Adjustments of the output signal level(s) from the corresponding base station interface module
- Adjustments of the input signal level(s) to the audio distribution network from the corresponding base station interface module
- Verification of the necessary base station control format(s)
- Adjustments of the level and duration of the output signal(s) from the corresponding base station interface module

11.0 SALVAGE OPERATIONS

The Contractor shall remove all existing FNE and subscriber equipment, if any, no longer required to remain in operation in order to meet the performance requirements of this Specification. All removed equipment shall be properly stored at a location provided by the State. Contractor shall provide the State with a detailed inventory list of all equipment including model number, serial number and location of removal.

The State requires the Offeror to quote any applicable salvage values for existing, operational equipment that is entirely replaced and not reused following the completion of the work described by this Specification. The State shall not be obligated to accept the buyback or credit pricing provided by the Offeror, but the Offeror is highly encouraged to provide the opportunity for the State to recoup a portion of its past infrastructure investment.

12.0 WARRANTY MAINTENANCE AND SYSTEM SUPPORT

The Contractor shall guarantee that all equipment supplied pursuant to this RFP shall be new and of first quality throughout.

12.1 System Software and Hardware Warranty

The equipment supplied pursuant to this RFP and any subsequent agreement is warranted by the Contractor to be free from defects in materials, workmanship, and otherwise for one (1) year from final acceptance of the System unless otherwise provided in this RFP and any subsequent agreement.

The Contractor shall warrant that the System and each component of the System shall perform in strict accordance with the requirements of this RFP and any subsequent agreement and shall be free of System defects, including System latent defects for one (1) year after final acceptance of the System. Unless otherwise provided herein, all equipment and the Contractor furnished equipment is warranted for a period of one (1) year after final acceptance of the System. The warranty period for non- Contractor manufactured equipment is as specified by its manufacturer, but not less than one year.

The proposed system release/platform being offered shall not be the last of its type with regard to future software and hardware compatibility. The next software release compatible with the system shall not require new hardware to support the existing functions of the system within the new release. In the event parallel system software development has been undertaken by the Contractor, and the software release in the State's system is abandoned (no further development or support), the Contractor shall upgrade the State's system to the surviving software release at no cost to the State.

The Contractor shall provide and install, at no additional cost, hardware, firm ware, software releases or patches that are required to correct any latent functionality or software defect that may exist in the proposed system (including system failures resulting from software problems, functionality fixes, and software upgrades to the State's system), for a fifteen (15) year period from the date of Final Acceptance. This shall include any upgrades to fixed network equipment, system management systems and subscriber units.

In the event that a defect is found in another customer's system that utilizes the same or similar release as the State's system, the Contractor shall notify and advise the State of the defect and when a new hardware, firmware, software release or patch shall be available to correct the problem. At that time, the State shall decide

whether they shall require an upgrade prior to observing the defect. Notification shall occur regardless of whether the State is currently affected by this defect.

The software release in the State's system at the time of final system acceptance shall be the latest version available at the time of shipment from the Contractor's development and manufacturing facility.

Under all warranties provided, all parts shall be replaced free of charge including labor. The Contractor may replace equipment, software or components rather than repair them, at the Contractor's option.

Where defective work (and damage to other work resulting therefrom) has been corrected, removed, or replaced under warranty, the warranty period with respect to such work shall be extended for an additional period of one (1) year after such correction or removal and replacement has been satisfactorily completed.

12.2 Equipment Support

The Contractor shall provide support in the form of replacement parts for the Contractor subscriber equipment for ten (10) years from the last date of manufacture of the product, and for ten (10) years on the Contractor supplied fixed infrastructure equipment from the last date of manufacture. The Contractor shall use commercially reasonable efforts to identify and to obtain replacement parts for the State's specific requirements.

12.3 Spare Parts Inventory

Offeror shall provide a strategic sparing plan for the proposed upgrade. Offeror shall review existing spare parts inventories and include all compatible spares in their inventory.

The cost for replacement parts shall be quoted as part of the Contractor's proposal. Parts pricing shall be in the form of a discount off of manufacturer's list price similar to those provided to dealers for the purpose of self-maintenance. This discount shall be part of the pricing sheets.

Spare parts required for this System shall include sufficient parts, modules and components to restore the System to full redundancy during a system or sub-system failure, within four hours of the outage occurrence. Spares inventories in any one County-wide sub-system shall not depend on spares from other sub-systems.

The Offeror is tasked to provision and test all spare equipment prior to final system acceptance.

12.4 Maintenance Test Equipment

Offerors shall propose a complete and detailed list of all test equipment, complete with their associated costs, that is required to fully maintain and service the equipment that shall be supplied per this RFP. The State shall review the listing of recommended test equipment against their existing inventory of equipment and may optionally purchase those items that are not currently in their inventory.

12.5 Warranty and Maintenance Performance Levels

Normal non-critical warranty maintenance shall be performed during normal business hours. Some equipment and sub-systems are critical; thus warranty and extended maintenance shall provide guaranteed response and restoration times on a 365 day by 24 hour basis. The following lists identify response and maintenance performance level required for the various sub-systems:

24-hour by 7-day – 30-minute phone response, 2 Hour On-Site Response,

Voice Radio System Infrastructure
Dispatch Console Infrastructure

8-hour by 5-day –,

Subscriber Units (Mobile, Portable)
Control Stations

Alternative Support Systems and Specialized Equipment

Malfunctions that cannot be immediately or definitively diagnosed and pinpointed to a certain item of equipment or service shall require the immediate participation of all service suppliers until responsibility for the problem has been established. In no instance shall the failure to resolve the issue of responsibility relieve any of the suppliers of the mutual obligation to restore system operability with the least impact on the availability of the system to the end users. The State reserves the right to adjudicate such matters after the fact and validate charges applicable to the provisions of the contractor of tariffs involved. The Contractor shall be the sole point of responsibility to resolve any and all maintenance matters to the satisfaction of the State.

Offerors shall provide proposals that include a complete description of preventive maintenance and shall specify the frequency of preventive maintenance required for all proposed equipment and systems. Preventive maintenance shall be performed according to a schedule that is mutually acceptable to the State and the Contractor, which, at minimum, shall meet the recommendations of all system component manufacturers.

The schedule shall be consistent with the operation requirements of the State and shall be based upon the specific needs of the equipment being maintained.

Offerors shall include in their proposals a description of any remote administration and maintenance service arrangements that shall be provided with the system.

12.6 Warranty Maintenance Performance Reports

The Contractor shall furnish the State with a monthly report of all maintenance requests. Offeror's proposals shall include information that shall be provided in their reports as well as a sample report form. As a minimum, the following data is required:

- Date and time notified
- Date and time of arrival on site
- Description of malfunction reported
- Diagnosis of failure and work performed
- Date and time failure was corrected
- Charges for service, if applicable
- Name of person performing service

13.0 OPERATIONAL, TECHNICAL AND USER TRAINING

Offerors shall fully describe their recommended training courses in their response. This shall include, as a minimum, class room style instruction, extensive hands-on training with actual equipment in realistic configurations, operational style classes, a detailed training plan, description of available training material, resume of potential course instructors and a customer reference list of trained personnel (to include: names, telephone numbers, company, and system description).

The Contractor shall train State's Division of Communications employees, State's contractors, or State's designees. The contractor shall permit videotaping of training sessions for use within the State for re-fresher training. All written and presentation training materials shall become property of the State.

In all technical and operational types of training, Offeror shall assume that training courses shall be held in each of the regional county communications maintenance shops, with two independent sessions per shop in order to reduce the likelihood of disruptions to daily maintenance operations and demands on personnel.

The following sections describe training for the radio system operational, maintenance and user type of training that is required for the system.

13.1 RADIO SYSTEM OPERATIONAL TRAINING

The Contractor shall provide on-site operational training for twenty-four (24) people. Training shall include system orientation and familiarization that includes discussion and equipment demonstration. The Contractor shall propose a training schedule that correlates to the implementation schedule. The Contractor's highly skilled personnel shall conduct the training.

The Contractor shall provide one set of manuals per student plus an additional four (4) sets of manuals. Additionally, all manuals shall be provided in an electronic version such as PDF (Portable Document Format) and read with the Adobe Acrobat Reader software. Four (4) CD ROM copies shall be supplied.

The Contractor's program shall include training in orientation, management, and operation of all equipment provided under the following items:

- Overview of the Radio System
- Use of Radio System
- Use of Diagnostic Tools
- Use of Alarm Monitoring Equipment

Offerors shall provide a list of courses required along with the duration (hours, days, weeks, etc.), cost and location for each course required. Whenever possible, the training shall be conducted with substantial hands on involvement using the State's system/equipment.

The training shall be designed so that upon completion, a user will be qualified to comprehend radio and system management, the network, and backup design, perform system diagnostics, and operate the subscriber units. The Contractor's highly skilled personnel shall conduct the training. Instruction material shall be included as a part of each course and shall become property of the State.

13.2 RADIO SYSTEM MAINTENANCE TRAINING

The Contractor shall provide on-site training for up to twenty-four (24) people. Training shall include system orientation, management, operation, and maintenance of all system infrastructures and associated system equipment provided. The training shall include education on the theory of operation and practical maintenance procedures for the entire system infrastructure and all systems contained therein. This training shall be designed primarily for technical and telecommunications personnel within the State that may require sufficient education to assist in the restoration of the system during a failure. Since this training is specific to the State's system design, the Contractor shall provide technicians from the local maintenance shop to attend this training.

The Contractor shall provide one (1) set of manuals per student electronically plus an additional four (4) sets of maintenance manuals in hard copy.

The course content shall include the following, as a minimum:

- Documentation structure, numbering system, and configuration control system
- Principles of digital transmission
- Block diagram and circuit description - all units
- Installation and turn-on procedure
- Alignment and testing procedure
- Trouble diagnosis to unit and board level
- Unit replacement procedure
- Operating and Safety

The Offerors shall provide a list of courses required along with the duration (hours, days, weeks, etc.), cost and location for each course required. Whenever possible, the training shall be conducted with substantial hands on involvement using the State's system/equipment.

13.3 RADIO SYSTEM MANAGEMENT TRAINING

The following sections describe training for the Radio System Management system operational and maintenance type of training.

The course content shall include the following, as a minimum:

- Documentation structure, numbering system, and configuration control system
- Block diagram and system description
- Installation documentation
- Use of software applications
- Trouble diagnosis to element level
- Troubleshooting techniques
- Database development

13.3.1 Radio System Management System - Operational Training

The Contractor shall provide on-site training for twenty-four (24) people. Training shall include system orientation and familiarization that includes discussion and equipment demonstration. Training shall be conducted on-site during system optimization.

The Contractor shall conduct comprehensive classroom operator training for the communications personnel operating the new Radio System Management system. This shall be conducted in a classroom environment, using training aids, and a model of the Radio System Management system. Training aids such as videos, system diagrams, training manuals showing working functionality and a qualified instructor shall be available for these classes. There shall be handouts available for all attendees. Each student shall receive a personal operator's training manual. In addition, the operator's training manual, an electronic version in PDF (Portable Document Format) readable with the Adobe Acrobat Reader software shall be made available. Four (4) hard copies and four (4) CD-ROM copies shall be supplied.

13.3.2 Radio System Management System - Maintenance Training

The Contractor shall provide on-site training for twenty-four (24) people in orientation, management, operation, and maintenance of all Radio System Management system and associated system equipment provided. The training shall include education on the theory of operation and practical maintenance procedures for the entire system infrastructure and all systems contained therein. Courses shall be rich in the essentials of computer networking including LAN, WAN architectures, types of protocols, routers and switches, servers and workstations.

The Contractor shall provide a list of courses required along with the duration (hours, days, weeks, etc.), cost and location for each course required. Whenever possible, the training shall be conducted using the State's system/equipment.

The training shall be designed so that upon completion, a technician will be qualified to perform all levels of installation/setup, optimization, trouble shooting and maintenance of the system to the board level. The contractor's highly skilled personnel shall conduct the training. Instruction material shall be included as a part of each course and shall become property of the State.

In addition, all maintenance manuals shall be provided in an electronic version such as PDF (Portable Document Format) and readable with the Adobe Acrobat Reader software. Four (4) hard copies and four (4) CD-ROM copies shall be supplied.

13.4 User Training - Train the Trainer

The contractor shall provide on-site Train the Trainer type courses for the following categories of equipment:

- Control Stations
- Dispatch Consoles
- Subscriber Equipment

Training shall include system orientation and familiarization that includes discussion and equipment demonstration. The training shall be designed so that upon completion, the student will be qualified to train system end users on the operation of the equipment. For example, the student will be qualified to train Correction personnel on the operation of the new consoles, mobiles and portables.

13.5 MICROWAVE SYSTEM TRAINING

The following sections describe training for microwave maintenance and operation.

13.5.1 4.9 GHz Microwave System Maintenance Training

The Contractor shall provide on-site training for twenty-four (24) people and shall be coordinated with the Radio System Maintenance Training Program. Training shall include system orientation, management, operation, and maintenance of all system infrastructures and associated system equipment provided. The training shall include education on the theory of operation and practical maintenance procedures for the entire system infrastructure and all systems contained therein.

The Contractor shall provide one (1) set of manuals for the training course for each student, plus four (4) additional sets for the Division of Communications.

Additionally, all manuals shall be provided in an electronic version such as PDF (Portable Document Format) and readable with the Adobe Acrobat Reader software. Four (4) CD ROM copies shall be supplied.

The course content shall include the following, as a minimum:

- Documentation structure, numbering system, and configuration control system
- Principles of digital transmission
- Block diagram and circuit description - all units
- Installation and turn-on procedure
- Alignment and testing procedure
- Trouble diagnosis to unit and board level
- Unit replacement procedure
- Operating and safety
- Traffic continuity procedures

The Offeror shall provide a list of courses required along with the duration (hours, days, weeks, etc.), cost and proposed location for each course required. Offeror shall delineate the costs of each course in their cost proposal via their completed pricing sheets. Whenever possible, the training shall be conducted with substantial hands on involvement using the State's system/equipment.

13.6 Network System Management Training

The following sections describe training for Network Management System maintenance and operation.

The course content shall include the following, as a minimum:

- Documentation structure, numbering system, and configuration control system
- Block diagram and system description
- Installation documentation
- Use of software applications
- Trouble diagnosis to element level
- Troubleshooting techniques
- Database development

13.6.1 Network Management System Maintenance Training

The Contractor shall provide on-site training for twenty-four (24) people; in orientation, management, operation, and maintenance of all NMS and associated system equipment provided.

The training shall include education on the theory of operation and practical maintenance procedures for the entire system infrastructure and all systems contained therein.

The Offeror shall provide a list of courses required along with the duration (hours, days, weeks, etc.), cost and location for each course required. Whenever possible, the training shall be conducted using the State's system/equipment.

In addition, all manuals shall be provided in an electronic version such as PDF (Portable Document Format) and readable with the Adobe Acrobat Reader software. The Contractor shall provide one (1) set of manuals for the training course for each student, plus four (4) additional sets for the Division of Communications. Four (4) CD-ROM copies shall be supplied.

13.6.2 Network Management System Operational Training

The Contractor shall provide on-site operational training for twenty-four (24) people. Training shall include system orientation and familiarization that includes discussion and equipment demonstration. Training shall be conducted on-site during system optimization.

The Contractor shall conduct comprehensive classroom operator training in two separate sessions. This shall be conducted in a classroom environment, using training aids, and a model of the NMS. Training aids such as videos, system diagrams, training manuals showing working functionality and a qualified instructor shall be available for these classes. There shall be handouts available for all attendees. Each student shall receive a personal operator's training manual. In addition to the operator's training manual, an electronic version such as PDF (Portable Document Format) and read with the Adobe Acrobat Reader software shall be made available. Four (4) hard copies and four (4) CD-ROM copies shall be supplied.

14.0 DESIGN AND INSTALLATION DOCUMENTATION

14.1 Installation, Maintenance, and Operator's Instruction Manuals

The Operator's Instruction Manual shall be provided by the Contractor and shall be clearly written and illustrated to instruct radio dispatch personnel in the proper use of all standard features available for the equipment. Drawings and/or photographs shall show the location of all operator controls and adjustments. This manual shall be provided in addition to all other manuals furnished. A quantity of four master quality Operator's Instruction Manuals shall be furnished in paper and electronic format. These instruction books shall also be available in a PDF (Portable Document Format) and read with the Adobe Acrobat Reader software. Four CD-ROM copies shall be supplied in addition to the paper copies. There shall be no restrictions or licensing requirements for information provided as reference or used for State training.

14.1.1 Installation and Maintenance Manuals

The Installation and Maintenance Manuals shall be clearly written and illustrated to instruct a radio technician skilled in the trade to unpack, assemble, and interconnect the various system components to prepare the system for operation. All base station site/console interconnect wiring, console and auxiliary function wiring shall be included as part of this manual and its attachments.

The Maintenance Manual shall be written and illustrated such that a radio technician skilled in the trade can service any portion of the system to the component level, if desired. The manual shall include the theory of design for each unit, a schematic diagram of each assembly, assembly drawings of each circuit board, detailed part numbers where applicable, the description of each component used and the name and part number of the original component manufacturer to facilitate locating parts locally. The manual and its attachments shall include complete system configuration data, programming data, and as-built drawings. Where applicable, such information shall also be supplied for any items furnished as part of the system but not manufactured by the Contractor.

A quantity of six Installation/Maintenance Manuals shall be furnished in both electronic and paper format. These instruction books shall be available in a PDF (Portable Document Format) and read with the Adobe Acrobat Reader software. Six CD-ROM and paper copies shall be supplied. There shall be no restrictions or licensing requirements for information provided as reference or used for training.

The equipment manufacturer (if other than the Contractor) shall maintain a complete set of original reference documentation for the system, to be supplied upon request as individual replacement sheets or complete replacement manuals. The manufacturer shall certify that this support shall be available.

The Contractor's project manager shall prepare a comprehensive "System As-Built Manual" for the entire System, including the updating of all existing system as-built documents made available to the Contractor by the State.

14.1.2 Content

The As-Built Documentation shall, at minimum, include the following inventory of information:

- Detailed Design Review Documents
- Detailed A&E Drawings Including Towers, Shelters, Compounds
- Equipment Inventory by Site
- Detailed Site Matrix
- Overall System Diagram
- RF Propagation Maps
- Detailed Radio Site Parameters Matrix
- Pre- and Post-Construction Photographs
- Telecommunications Network Channel Plan (DSO level)
- Telco Circuits
- Certified Coverage Testing Results
- System Optimization Records
- Network and Subsystem Block Drawings
- Equipment Lists/Inventory
- Infrastructure, Console, and Network Element Programming Parameters
- Console and Master Platform Database Parameters
- Fleet mapping Parameters/Unit ID Assignment
- Transport Requirements/Design/DS0 and DS1 Channelization
- Racking/Floor plan Drawings
- Physical Site Requirements
- Power and HVAC Requirements
- AEB and CEB Layouts/Configurations
- Antenna Transmission System Diagrams
- Channel Bank Layouts/Configurations
- Channel Bank and Network Element Programming Scripts/Configurations
- Network Timing Requirements/Design
- LAN/WAN Design
- Any Non-standard or Unique Wiring Configurations/Circuit Modifications
- TCP/IP Network Addressing Scheme

- Firmware/Software Inventory
- Completed Test Plans (Factory ATP, Field ATP, CATP, etc.)
- Equipment Configuration/Installation/Maintenance Manuals
- Level Setting and Optimization Documents/Procedures
- Equipment Jumpering/Switch Setting/Board Version Documentation
- Software Version Control Matrix
- Cabling/Wiring Matrices and Spare Cable Labels
- Punch block Wiring Matrices
- Additional Training Guides and Materials
- Change Orders
- Comprehensive Preventative Maintenance and Warranty Documentation
- Regulatory Manual including FAA/FCC Permits and Documents
- Meeting Minutes
- Spares Inventory

14.1.3 Format

The Contractor shall provide the Comprehensive As-built Documentation in the following format and in the following quantities. All hardcopy manuals shall be formatted in 3-ring binders to allow for frequent updates and sectional replacements. No binder shall be larger than 4” in thickness. All electronic documents shall be certified to be virus-free and shall be in unprotected formats approved by the State and shall have no copying limitations or restrictions.

14.1.4 System Master Documentation

Contractor shall provide three (3) hardcopies of the System Comprehensive Master As-Built Manuals. One set of manuals shall be distributed to the Master site and two sets shall be located at the Division of Communications office. These manuals shall include all as-built information for the entire System. Contractor shall provide three (3) copies of these manuals in electronic form.

14.1.5 Sub-system Master Documentation

Contractor shall provide two (2) copies of the New Castle County Comprehensive As-Built Manuals. One set of manuals shall be distributed to the NCC prime simulcast site at Lums Pond. The second set of manuals shall be located at the NCC Division of Communications Maintenance Shop. These manuals shall include all the as-built information for the entire NCC sub-system. In addition, these manuals shall include the minimum quantity of System-wide as-built documentation necessary for technicians to effectively maintain this site as a sub-system of the entire System. Contractor shall provide (2) copies of these manuals in electronic form.

Contractor shall provide two (2) copies of the Kent County Comprehensive As-Built Manuals. One set of manuals shall be distributed to the KC prime simulcast site at Dover HQ site. The second set of manuals shall be located at the Kent County Division of Communications Maintenance Shop. These manuals shall include all the as-built information for the entire KC sub-system. In addition, these manuals shall include the minimum quantity of System-wide as-built documentation necessary for technicians to effectively maintain this site as a sub-system of the entire System. Contractor shall provide two (2) copies of these manuals in electronic form.

Contractor shall provide two (2) copies of the Sussex County Comprehensive As-Built Manuals. One set of manuals shall be distributed to the SC prime simulcast site at the Milton site. The second set of manuals shall be located at the SC Division of Communications Maintenance Shop. These manuals shall include all the as-built information for the entire SC sub-system. In addition, these manuals shall include the minimum quantity of System-wide as-built documentation necessary for technicians to effectively maintain this site as a sub-system of the entire System. The Contractor shall provide two (2) copies of these manuals in electronic form.

14.1.6 Site Master Documentation

The Contractor shall provide one (1) copy of the Site Specific Comprehensive As-Built Manuals at each site/facility within the System. These manuals shall include all the as-built information for the entire site/facility. In addition, these manuals shall include the minimum quantity of System-wide as-built documentation necessary for technicians to effectively maintain this site/facility as a sub-system of the entire System. These site documents shall include a spare set of printed cable labels. Contractor shall provide one (1) copy of these manuals in electronic form.

15.0 DETAILED EQUIPMENT LIST BY SITE

Offeror proposals shall contain detailed equipment lists as required to meet the System Specification herein. The detailed equipment list shall be cross-referenced to the Offeror's itemized pricing sheets.

Where applicable detailed equipment lists shall be provided by radio sites, and shall include details of requirements needed for the installation and operation of their equipment as deemed necessary.

The equipment list shall contain equipment model numbers, description, equipment supplier, and the associated cross-reference to the provided pricing sheet items. Offerors shall provide this detailed equipment list as part of their technical support and documentation response to the RFP specifications.

16.0 DETAILED SITE LAYOUTS BY EQUIPMENT RACKS

The Contractor shall provide, as part of the as built documents, equipment rack layouts and drawings indicating dimensions and the model numbers of the equipment specified. Equipment rack numbers shall identify all site equipment racks. These layout drawings shall be provided by site and cross-referenced to the detailed equipment list.

Each Offeror shall also include equipment specifications containing equipment power consumption, power requirements, heat dissipation, size, weight and environmental requirements in a spreadsheet format by rack and site.

17.0 SYSTEM GUARANTEES

Offerors shall provide a description of all equipment, sub-systems, RF coverage and system related guarantees that are part of the Offeror's proposal. These guarantees shall be clearly defined for the State's review and comments. The State expects these guarantees to cover terms, conditions, and time frames for each type of guarantee. Offerors are required to provide all types of guarantees as part of the response support material.

17.1 Equipment

The State is requesting the Offerors to respond to equipment guarantees by defining each guarantee by product offering. Offerors shall list each product and define the guarantee as it applies to the product offered. All equipment, at a minimum, shall meet published specifications and or RFP specifications in order to meet product performance. Offerors are required to provide published specifications as part of the response support material.

17.2 Sub-Systems

Offerors are required to supply guarantees on each sub-system offered as part of the Offeror's response. Offerors shall list each sub-system and clearly define the guarantee as it applies to the sub-system offered. Each sub-system, at a minimum, shall meet the RFP specifications and performance requirements in order to be accepted as a compliant guarantee.

17.3 RF Coverage

The Offeror shall guarantee RF Coverage as specified in the RFP specifications. Offerors shall submit a RF coverage guarantee that is based on the coverage predictions. Offerors shall utilize the system design, coverage predictions, and coverage acceptance testing as the minimum elements of the RF Coverage guarantee. All changes in System design that may arise due to this System's inability to meet the system performance criteria shall be provided by the Contractor at the Contractor's expense. Any additional sites or changes in antennas that may be required to correct deficiencies where the Contractor has failed to satisfy the coverage requirements of this RFP and any resulting agreement shall be provided by the Contractor at the Contractor's sole expense, with the exception that the Contractor shall not be responsible for providing any additional site leases or purchases. Any modifications of antenna or transmitter configurations by the Contractor to address coverage issues shall comply with all regulatory and zoning restrictions placed on the State.

18.0 SYSTEM OWNERSHIP

In the event that the Offeror's proposal response is developed using Offeror-owned, existing commercial, or joint venture/limited ownership networks, the division of ownership, liabilities, access, and control of the proposed system solution meeting the RFP specifications shall be clearly defined to the State. This may also include Offeror offerings of access to rights of way, subscriber units, frequencies, and software.

Offerors shall provide definition of specific ownership and the terms and conditions that are being offered to the State. All costs, life cycle analysis, and contractual terms shall be defined by the Offeror's description of the offering.

Offerors are expected to provide a detailed cost analysis based on the life expectancy of the offered system. Offerors shall define the system's life expectancy and cost analysis based on sound business practices and professional criteria as related to telecommunication networks and the State's procurement practices.

18.1 Sites

Offerors proposing the use of privately owned sites that are not part of the State Site Database shall provide a detailed disclosure on the ownership and associated costs. These costs, terms, leasing arrangements, etc., shall be clearly defined as part of the Offeror's proposal.

18.2 Towers

Offerors proposing the use of privately owned towers shall provide a detailed disclosure on the ownership and associated costs. These costs, terms, leasing arrangements, access, etc., shall be clearly defined as part of the Offeror's proposal.

18.3 Infrastructure

Offerors proposing the use of privately owned infrastructure shall provide a detailed disclosure on the ownership and associated costs. These costs, terms, leasing arrangements, access, etc., shall be clearly defined as part of the Offeror's proposal.

18.4 Subscriber Units

Offerors proposing leasing, renting, or use of radio subscriber units shall provide a detailed disclosure on the ownership and associated costs.

These costs, terms, leasing arrangements, access, etc., shall be clearly defined as part of the Offeror's proposal.

18.5 Software

Offeror proposing software to support the radio network by means of leasing, renting, or selling shall clearly define the ownership and associated costs. Offerors shall provide definitions of software upgrades, fixes, and enhancements. These costs, terms, leasing arrangements, use, etc., shall be clearly defined as part of the Offeror's proposal.