1. Introduction and Overview

1.1 Project Overview

Contractor shall provide the design, engineering, required equipment, implementation services, training, and continued maintenance services for a regional Association of Public-Safety Communications Officials (APCO) Project 25 (P25) Phase I FDMA 700/800 MHz public safety trunked digital simulcast radio system, and will be named the Suncoast Regional Communications Network. The P25 system collectively, and all of its subsystems and components, is hereinafter referred to as the “System”.

The System will service the needs of participating public safety and local government agencies in both Sarasota and Manatee County. The System shall be scalable to allow the addition of other local, State and federal agencies with resources to expand further. The System shall provide all of the components of an APCO P25 standards-based digital communications network to meet the current and foreseeable needs of the regional public safety community.

Sarasota is located on the west coast of Florida south of Tampa and encompasses a land area of approximately 600 square miles. It has a seasonal population of approximately 400,000 people. Sarasota operates a 16-year old Motorola ASTRO 800 MHz SmartZone digital trunked public safety communications system that provides mission critical communications to thirty-eight (38) public safety and general intergovernmental support agencies. These agencies use 4,800 mobiles and portables generating in excess of 40,000 push-to-talks a day with a 99.999% connect success rate.

The existing Sarasota communications system infrastructure consists of seven (7) tower sites utilizing 51 licensed NPSPAC channels in a simulcast/multisite configuration.

Manatee is also located on the west coast of Florida and encompasses a land area of approximately 740 square miles. It has a seasonal population of approximately 350,000 people. Manatee operates a 20-year old Harris Corporation EDACS 800 MHz analog/digital voice radio system that provides mission critical communications to approximately 3,500 subscriber units composed of dispatch consoles, portables, mobiles, and control station radios.

The existing Manatee communications system infrastructure consist of nine (9) tower sites utilizing 29 licensed NPSPAC and non-NPSPAC channels in a simulcast/multisite configuration. The Manatee Sheriff’s Office, Emergency Management Service (EMS), and Fire Departments use commercial air-cards for data services.

1.2 Summary of Scope of Work

The Contractor shall assume complete responsibility for the system design, engineering, hardware, software, functionality, radio coverage, licensing, installation, optimization, testing, training, cutover, and maintenance of a standards based P25 compliant, digital trunked simulcast communications system based upon the performance specifications, and trunking features contained in this document and in the P25 Standards. In addition to the P25 system infrastructure, the Contractor shall provide P25 compliant subscriber radio equipment for optional purchase by participating agencies.

Additionally, the Contractor shall be responsible for all new proposed additions to the microwave network required in its system design.

The Contractor shall complete and pass all acceptance tests of system components, including hardware, software, and required functionality per the requirements of this Purchase Agreement and the P25 standards.

The Contractor shall provide a complete and fully operational system that meets or exceeds the specifications described herein. If the Contractor’s System, as installed, does not meet the technical requirements of this Purchase Agreement, all additions or modifications required to meet those requirements shall be at the sole expense of the Contractor.

1.3 Definitions

The meaning of certain words as used within this Exhibit A shall be controlled with the following definitions unless stated otherwise.

**AC** means alternating current

**Agency** means a local government or operational unit thereof

**APCO** means the Association of Public-Safety Communications Officials
**Backhaul** means a network that provides communications between RF transmission sites, communications centers where consoles are located, and the master control locations.

**Bounded Area Percent Coverage (BAPC)** means the percentage of coverage within a defined polygon or contour meeting the required area reliability and delivered audio quality requirements.

**BER** means bit error.

**CAI** means Common Air Interface for a P25 radio network.

**CAP** means the P25 Compliance Assessment Program.

**Contractor** means Motorola Solutions, Inc. and includes all subcontractors engaged by Motorola Solutions, Inc.

**Conventional Channel** means a non-trunked radio channel.

**CSSI** means Console Sub-System Interface for a P25 radio network.

**DC** means direct current.

**FAA** means Federal Aviation Administration.

**FCC** means the Federal Communications Commission.

**FDMA** means frequency division multiple access.

**Fixed Network Equipment** means all hardware and software 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, antennas, microwave transceivers and dishes, etc.

**In-building Coverage** means the amount of signal margin in decibels or dB provided for in a radio system design for overcoming signal attenuation due to the building structure, in order to provide the minimum received signal level necessary to provide acceptable portable radio communications inside a building.

**ISSI** means Inter-Sub-System Interface for a P25 radio network.

**MHSB** means Monitored Hot Standby.

**NG9-1-1** means Next Generation 9-1-1.

**Network Site** means a location for the installation of the fixed network equipment.

**NPSPAC** means the National Public Safety Planning and Advisory Committee.

**NPSPAC Region 9** means the coordinating body authorized by the National Public Safety Planning Advisory Committee with administrative authority over the Counties.

**Project Administrator or PA** means the Counties’ Project Administrators.

**Project Manager or PM** means the Contractor’s Project Manager.

**Project 25 or P25** means a standard for digital radio communications for use by federal, state/province, and local public safety agencies in North America to enable them to communicate with other agencies and mutual aid response teams in an emergency.

**RAN** means radio area network.

**Repeater** means an electronic device designed to retransmit at a higher power the transmission of a subscriber.

**Semi-Duplex (Half-Duplex)** means the ability to non-simultaneously transmit and receive a radio signal using two discrete radio frequencies.

**System** means all electronics, hardware, and software components routinely employed to operate the 700/800 MHz digital trunked radio network including but not limited to fixed network equipment, antenna, transmission lines, electronic control consoles, microwave system, towers, tower grounding systems, associated subsystems, etc., resulting in a fully operational, licensable, highly reliable 700/800 MHz digital trunked public safety radio communications capability meeting the requirements of this Purchase Agreement.

**Talkgroup** means a trunked virtual talk channel that is synonymous with a conventional radio channel or frequency.

**TDMA** means time division multiple access.

**TDR** means time-domain reflectometer.

**VAC** means volts alternating current.
Exhibit A – Scope of Work
800 MHz Emergency Communications Systems
For Sarasota and Manatee Counties
RFP 142842TM

700 MHz means the radio spectrum between 763 and 805 Megahertz as currently authorized by the FCC
800 MHz means the radio spectrum between 806 and 862 Megahertz as currently authorized by the FCC
VDC means volts direct current

1.4 Standards of Work

The applicable sections or portions of the standards, regulations, and codes of the entities listed below shall apply to Contractor for the equipment and site preparation and for the installation, operation, maintenance, and service of the System by Contractor.

APCO Project 25 System and Standards Definition
FCC Rules and Regulations, Code of Federal Regulations, Title 47, Chapter I, including:
Part 17 – Construction, Marking and Lighting of Antenna Structures
Part 90 – Private Land Mobile Radio Services
Part 101 – Fixed Microwave Services
FAA Regulations
Vol. XI – Objects affecting Navigable Airspace Part 77
Advisory Circular for Obstruction Marking and Lighting, AC 70/7460-1K
Advisory Circular – Specification for Obstruction Lighting Equipment, AC 150/5345-43E
Electronic Industries Association (EIA) Standards:
EIA-152 Minimum Standards for Land Mobile Communications, FM, or PM Transmitters
EIA-204 Minimum Standards for Land Mobile Communication FM or PM Receivers (25-927 MHz)
EIA-210 Terminating and Signaling Equipment for Microwave Communication Systems
EIA-220 Minimum Standards for Land Mobile Communications Continuous Tone Controlled Squelch Systems (CTCSS)
EIA-232 Interface between data terminal equipment and data circuit-terminating equipment employing serial binary data interchange
EIA-310 Racks, Panels, and Associated Equipment
EIA-316 Minimum Standards for Portable/Personal Radio Transmitters, Receivers, and Transmitter/Receiver Combination
Land Mobile Communications FM or PM Equipment, 25-1000 MHz
EIA-329 Minimum Standard for Land Mobile Communications Antennas, Part I - Base or Fixed Station Antennas, and Part II - Vehicular Antennas
Telecommunications Industry Association Standard TIA-603 latest revision
Telecommunications Industry Association Standard Technical Service Bulletin TSB-88 latest revision
Telecommunications Industry Association / Electronic Industries Association (TIA/EIA) Standard TIA-222 latest revision for communications towers
Telecommunications Industry Association (TIA) Standard TIA-102 latest revisions
Association of Public-Safety Communications Officials Project 25 Functional Requirements
IEEE – Institute of Electrical and Electronic Engineers
Military Standard 810 – where specified, radio equipment shall meet specific requirements of parts of Military Standard 810 C, D, E, F, and G
National Electrical Code
Local Electrical and Building Codes
NEMA – National Electrical Manufacturer’s Association
National Fire Protection Association - (NFPA):
NFPA #1221 – Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems
1.5 Services to be Provided by the Contractor

1.5.1 Turnkey

This Purchase Agreement requires the “turnkey” design, construction, installation, testing, and delivery of a completely operational system as specified herein. The Contractor shall furnish all design, services, materials, equipment, tools, skill, engineering, testing, and labor necessary to complete the System required by this Purchase Agreement.

1.5.2 System Design

Except as specifically noted elsewhere in this Exhibit, the Contractor shall be solely responsible for the design of the radio communications system. The Contractor warrants, guarantees, and covenants that the System is and will be engineered, furnished, installed, optimized, tested, and warranted by Contractor to meet or exceed the requirements of the Counties.

1.5.3 Integration

Contractor shall be solely responsible for the proper installation and interfacing of all equipment provided pursuant to this Purchase Agreement. In any circumstances where existing equipment is utilized in the System, the Contractor warrants that the new equipment will perform in strict conformance to these specifications.

Contractor shall be responsible for a complete, integrated factory staging of the radio communications system and ancillary subsystems, and if applicable, any associated microwave system, prior to shipment of the equipment for field integration.

Field integration of the radio and microwave communication systems shall be the sole responsibility of the Contractor. Shipment, storage, and warehousing, at Contractor-provided facilities, of equipment prior to site availability shall be the responsibility of the Contractor. All electrical and mechanical work necessary to commission each site for usage and testing shall be the responsibility of the Contractor. Coordination of electrical service providers shall be the responsibility of the Contractor.

The Contractor shall meet all state and local building codes as well as the Contractor’s own published internal quality and workmanship standards.

The Contractor shall agree to prepare and submit all necessary forms and to obtain all permits, licenses, certificates of occupancy, and clearances, as required.
1.5.4 Microwave System
The Contractor shall engineer, design, and implement a public safety grade, highly available, microwave system. The Contractor provided microwave equipment shall include all indoor radios from nationally recognized brands such as Alcatel-Lucent, Aviat, MNI and NEC. The Contractor shall be responsible for required frequency coordination, as well as for fully processing the FCC license application for all microwave frequencies required to implement the System in accordance with the requirements of this Exhibit. All field site survey and path studies necessary to design the microwave system are the sole responsibility of the Contractor. The Contractor shall design the microwave system so that any non-loop protected microwave hop is configured for transmitter and receiver MHSB operation.

1.5.5 FAA/FCC Regulatory Work
The Contractor is responsible for obtaining all required FAA, FCC, and other miscellaneous licenses necessary to commission the entire radio communications system at all of the selected Network Sites. The Contractor shall be responsible for producing all required technical analyses, frequency coordination, coordinating all licensing activities, and processing the licensing documentation with the appropriate licensing and regulatory authorities.

1.6 Other Contractor Requirements

1.6.1 Inspection of Sites
Contractor acknowledges it has had the opportunity to make on-site inspections to become completely familiar with the existing conditions and other factors which may affect the work. No pleas of ignorance of conditions that may exist or hereafter exist as a result of the failure to make the necessary investigation shall excuse the Contractor from performance in accordance with the requirements of this Purchase Agreement.

1.6.2 Property Damage
When working on the Counties’ property, the Contractor shall neither remove any of the Counties’ fixtures or personal property, from the Counties’ premises, nor temporarily or permanently affix any equipment to the Counties’ premises not specifically required by this Purchase Agreement without the express written consent of the Counties. To the extent that any real or personal property of the Counties 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 Counties, either immediately repair or replace such damage to the reasonable satisfaction of the Counties, or upon the Counties’ presentation of an invoice, reimburse the Counties for the actual reasonable cost of repairing or replacing such damaged property. The Contractor shall regularly keep the Counties’ premises reasonably clean of accumulations of rubbish or scrap resulting from the work covered by this Purchase Agreement. Upon completion of the System, the Contractor shall leave the Counties’ premises free from rubbish or scrap material resulting from the Contractor’s performance. At any time during the project, if the Counties deem a site to be in need of trash removal due to the Contractor efforts, the Contractor shall be responsible for removing the rubbish at its expense upon notification by the Counties.

1.6.3 Existing System Interruptions
The Contractor fully understands that the System will at times be operating in parallel with the Counties’ current communication systems. The Contractor also understands that interruptions to the existing communication systems must be minimized or altogether eliminated during the field implementation due to the commitment of the Counties to provide for the health, welfare, and safety of its citizens. Therefore, the Contractor agrees that at no time will its employees, agents, subcontractors or servants perform any work under this Purchase Agreement that may interrupt the existing communication systems or any components of such system unless coordinated in advance with the Counties. If an interruption is unavoidable for the Contractor to perform work under Purchase Agreement, the Contractor shall first contact the Counties’ Project Administrators and authorized representatives of the police and fire departments and other public safety agencies served by the radio communication systems 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 Counties’ PAs that the interruption is both unavoidable and can be tolerated by the Counties. If the Contractor fails to follow the procedure described above or if the Contractor’s work causes an
interuption 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.

1.6.4 Shipment

The Contractor shall be responsible to ship all equipment and software to mutually agreeable locations for storage in accordance with the Project Schedule provided by the Contractor and approved by the Counties. The Contractor shall receive all materials purchased at the storage location, job site or other mutually agreed upon location. Any equipment or parts required to provide the System shall be the sole responsibility of the Contractor without any claim for additional payment.

Deliveries shall be made in accordance with the Project Schedule, as amended from time to time, and shall be made F.O.B. Destination to the mutually agreeable facilities, Contractor staging facilities, warehousing facilities, or any combination thereof, which in any event shall be located in Sarasota County or Manatee County, Florida or other such locations as may be mutually agreed to by the parties (the “Facilities”). Subject specifically to the requirements section entitled “Factory Staging”, the Contractor shall advise prior to shipment of actual destination and delivery date.
1.6.5 Delivery, Storage, Title, and Risk of Loss

The Contractor shall be responsible for transportation and storage of all Hardware and Software components of the System as described in this Purchase Agreement. All risk of loss or damage to Contractor provided Hardware and Software while in transit, storage, installed in sites of work but prior to Final System Acceptance, shall be the responsibility of the Contractor. The Counties shall in no circumstances assume liability for Contractor provided hardware and software until the Contractor has received Final System Acceptance from the Counties.

The Contractor will ship, transport, and install the System at the Counties’ designated installation sites. Except as otherwise provided for in this Purchase Agreement, full and complete title for the System will pass from the Contractor to each of the Counties for their respective portion of the System upon Final System Acceptance by the Counties, except for software and other products for which title does not transfer. The Contractor warrants that each County shall have clear title in and to its portion of the System, free and clear of all encumbrances, upon Final System Acceptance by the Counties.

1.6.6 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 under this Purchase Agreement.

1.6.7 Testing

The Contractor shall perform all testing and re-testing as described throughout this Purchase Agreement.
**1.6.8 Training Courses**

The Contractor shall conduct a comprehensive suite of training courses to instruct the Counties' personnel in the proper operation, use, and maintenance of the System as well as to instruct employees in how to train other personnel in such subjects. The Contractor shall comply with all training requirements contained in the Purchase Agreement. The Counties agree to notify the Contractor promptly in the event that a date change for a scheduled training program is required.

See Exhibit J – Training Plan
1.6.9 Project Management and Engineering

The Contractor shall assign a Project Manager (PM) who is an actual full-time employee of the Contractor and is authorized to exercise technical direction of this project.

The Contractor shall provide a PM with exceptional verbal and written communicative and technical skills as well as a thorough knowledge of the components to be provided by the Contractor and experienced in project management. The Contractor's PM is subject to initial approval and continual review by the Counties, which approval shall not be unreasonably withheld. The Counties shall reserve the right at any time to require the Contractor to replace the PM within thirty (30) days upon written notification to the Contractor’s executive management team.

The Contractor’s PM shall, at a minimum:

- Attend regular project meetings as scheduled;
- Generate meeting minutes for each project meeting within three (3) days of the respective meeting;
- Produce a running log of project issues and punch list items;
- Provide written monthly status reports in draft and final forms in a format as approved by the Counties no later than the fifth business day after the end of each month for the draft report; and
- Archive all project correspondence to be supplied with final System documentation.

The Counties shall review the draft report and submit comments and/or corrections. A final monthly report shall be provided no later than five (5) days after the end of the preceding month. The Contractor's PM shall provide written schedule updates to the Counties' project team every fourteen (14) days, as required, using Microsoft Project conforming to the Counties' formatting and content requirements and transmitted to the Counties' PAs in both hardcopy and soft format. The Contractor's PM shall provide other reports related to the System or its implementation as reasonably requested by the Counties’ PAs.

1.6.10 Site Plans

The Contractor shall prepare site plans, where required, for zoning or any permit approvals, as well as to file and be responsible for all necessary zoning and applications for permits of any kind related to the System design and implementation. All plans shall be submitted to the Counties' PAs for review and approval prior to final submission to the appropriate regulatory body or office. The Contractor is responsible for coordinating, processing, and leading all zoning/permitting/licensing efforts (Site Plan Approval, Conditional Use Permit, etc.) on behalf of the Counties. Attendance and involvement at any relevant hearings or committees shall be the responsibility of the Contractor throughout the course of the P25 Project.

1.7 P25 CAP Compliance

CAP Testing Program & Interoperability Testing (IOT)

Contractor currently participates and anticipates participation for the term of this Purchase Agreement in the P25 CAP. As a member of the APCO P25 and Telecommunications Industry Association TR8 Mobile and Personal Private Radio Standards Committee(s) since its inception, Contractor, contributes to the documents that support the P25 CAP. Contractor has voluntarily tested its ASTRO Radio products since the P25 CAP inception.

Contractor has worked with, or is currently working with:

Tait Electronics Ltd Teltest Laboratories (P25 CAP Laboratory certification #P25CAP081015, Christchurch, New Zealand and Houston, Texas)

TIMCO Engineering Inc. (P25 CAP Laboratory certification #TIMCO081016, Newberry, Florida) for completion of P25 CAP testing.

Harris Corporation, P25CAP081017
Teltest Laboratories, P25CAP081015

EF Johnson Technologies, P25CAP081010

The P25 CAP process (NIST Handbook 153, LABORATORY RECOGNITION PROCESS FOR PROJECT 25 COMPLIANCE ASSESSMENT, 2009REV, section 3.3. Laboratory Availability) requires certified P25 CAP laboratories to be available to stakeholders and to establish policies for “minimum requirements or expectations for invitational testing sessions, provisions for quick turnaround testing sessions, terms for minimum intervals between announced testing sessions, and periods of time for advance notice of testing.” Contractor is regularly made aware by the laboratories of invitational testing sessions and regularly inquires when testing sessions may be upcoming. Additionally, many of the manufacturers communicate directly when P25 CAP testing is being considered to ensure availability of a wide variety of equipment for testing.

Refer to Exhibit O – Product Specification Sheets titled Supplier’s Declaration of Project 25 Compliance (SDoc) and Project 25 Compliance Summary Test Report.

Contractor also performs extensive Inter-Operability Testing (IOT) that goes far beyond the P25 CAP test requirements in its test laboratories to ensure the behavior of other manufacturer’s equipment is consistent with the intent of the standards and to the expectations of public safety users. Additional detail is provided in Section 7.2 APCO Project 25 Compliance.

Infrastructure

 Contractor’s ASTRO Radio infrastructure is Project 25 CAP-compliant. Contractor’s ASTRO Radio infrastructure testing was performed with representative subscriber radios per the Project 25 CAP process.

Subscriber Units

Contractor has CAP tested and IOT approved an extensive selection of subscriber units. This list is provided in Section 7.2 APCO Project 25 Compliance.
1.8 Detailed Design

The Contractor shall perform a comprehensive detailed design prior to the commencement of any manufacturing or field integration work. The Counties will actively participate in the detailed design review (DDR) of the System implementation with the Contractor, and the Counties shall provide signature signoff upon completion of this work effort to trigger the manufacturing and field integration process. Completion of the detailed design review process shall take place upon mutual agreement between the Contractor and the Counties. Detailed design documents shall be supplied to the Counties in both electronic PDF and paper format. The detailed design must include, at a minimum, the following items for every affected System site:

- Network and Subsystem Block Drawings
- Line Item Equipment and Pricing Lists
- Infrastructure, Console, and Network Element Programming Parameters
- Console and MCNM Database Parameters/Design
- Physical Site Requirements/Facilities/Tower Design (where applicable)
- Final Coverage and Site Configuration Design
- Final Microwave Path Design and System Availability/Reliability Calculations
- Software Version Control/Equipment Hardware and Software Roadmaps
- Antenna Subsystems
- Failure Mode Analysis/System Availability
- Preliminary Factory and Field ATPs
- Final Coverage ATP
- Preliminary Cutover Plan/Migration Strategy/Downtime Requirements
- Revised Statement of Work (if modified)
- Operations, Administration, Installation, and Maintenance Manuals for the System
- Change Orders
- Spares Equipment List and Pricing Matrix

See Exhibit E – System Description for initial drafts of the System design drawings.

1.9 Technology Convergence

Recent advances in technology are leading to a convergence of wireless technologies such as commercial carrier, LTE, Wi-Fi, Bluetooth, and others, with LMR systems. During the lifetime of the System, it is anticipated that a number of new features will evolve in LMR due to convergence. This section provides the Contractor with an opportunity to describe any planned features or functionality that may become available during the procurement and implementation of the System. Specifically, any features that will enhance connectivity, radio coverage, radio data functionality, are of particular interest.

If the Contractor is currently manufacturing and selling products in this category, a description of the product, its availability, features, functionality and pricing should be provided for optional purchase consideration by the Counties. If such products are offered, the Contractor shall be specific regarding the requirements on the infrastructure and subscriber side hardware or software required to support the technology.

2 Current System Description

The following sections contain a description of the existing communications system for Sarasota and Manatee Counties.

2.1 Sarasota Communication System

2.1.1 Trunked System Infrastructure

Sarasota’s 800 MHz trunked communication system consists of seven (7) RF tower sites, of which two (2) are configured as a simulcast system, and the remaining five (5) are intelligent Repeater sites (IR) configured as a multisite system. The 2-site simulcast system has fourteen (14) 800 MHz channels, while the remaining five (5) sites have between six (6) and nine (9) 800 MHz channels per site.
The 800 MHz radio system is a Motorola proprietary, SmartZone trunked digital system that was purchased in the mid-1990s and supports approximately 4,500 users.

The SmartZone controller is located at the PSC and the Prime Site controllers for the simulcast system is located at the Vo-Tech tower site. The Prime site equipment consists of a redundant pair of 6809 model central controllers that perform the management functions of the system and other subsystems that control the receiver audio voting and the simulcast transmitter audio processing. Each of the two simulcast tower sites has a model 6809 remote site controller installed.

2.1.2 System Frequencies

As of Amendment #14 of the Florida Region 9 Plan, Sarasota is allocated fifty-four (54) 800 MHz NPSPAC channels and is licensed for operation on these channels under FCC licenses WPTW640 and WPKY904.

These channels are as follow:

<table>
<thead>
<tr>
<th>Channel</th>
<th>Frequency (MHz)</th>
<th>Channel</th>
<th>Frequency (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>851.0375</td>
<td>118</td>
<td>852.5625</td>
</tr>
<tr>
<td>4</td>
<td>851.0625</td>
<td>122</td>
<td>852.6125</td>
</tr>
<tr>
<td>16</td>
<td>851.2125</td>
<td>124</td>
<td>852.6375</td>
</tr>
<tr>
<td>22</td>
<td>851.2875</td>
<td>126</td>
<td>852.6625</td>
</tr>
<tr>
<td>28</td>
<td>851.3625</td>
<td>130</td>
<td>852.7125</td>
</tr>
<tr>
<td>30</td>
<td>851.3875</td>
<td>134</td>
<td>852.7625</td>
</tr>
<tr>
<td>46</td>
<td>851.6125</td>
<td>136</td>
<td>852.7875</td>
</tr>
<tr>
<td>48</td>
<td>851.6375</td>
<td>140</td>
<td>852.8375</td>
</tr>
<tr>
<td>50</td>
<td>851.6625</td>
<td>142</td>
<td>852.8625</td>
</tr>
<tr>
<td>52</td>
<td>851.6875</td>
<td>154</td>
<td>853.0375</td>
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<td>851.7125</td>
<td>156</td>
<td>853.0625</td>
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<tr>
<td>58</td>
<td>851.7625</td>
<td>157</td>
<td>853.0750</td>
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<tr>
<td>60</td>
<td>851.7875</td>
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</tr>
<tr>
<td>64</td>
<td>851.8375</td>
<td>162</td>
<td>853.1375</td>
</tr>
<tr>
<td>66</td>
<td>851.8625</td>
<td>169</td>
<td>853.2250</td>
</tr>
<tr>
<td>68</td>
<td>851.8875</td>
<td>170</td>
<td>853.2375</td>
</tr>
<tr>
<td>70</td>
<td>851.9125</td>
<td>172</td>
<td>853.2625</td>
</tr>
</tbody>
</table>
### Channel Frequency (MHz) | Channel Frequency (MHz)
--- | ---
82 | 852.0875 | 174 | 853.2875
84 | 852.1125 | 180 | 853.3625
86 | 852.1375 | 192 | 853.5125
88 | 852.1625 | 198 | 853.5875
93 | 852.2250 | 200 | 853.6125
98 | 852.2875 | 205 | 853.6750
104 | 852.3625 | 207 | 853.7000
106 | 852.3875 | 209 | 853.7250
108 | 852.4125 | 212 | 853.7625
116 | 852.5375 | 214 | 853.7875

Contractor will use existing Sarasota and Manatee Spectrum. For the frequency plans refer to Exhibit E System Description Sarasota Frequency Plan

The Sarasota trunked radio system utilizes fifty-one (51) NPSPAC frequencies. Fourteen (14) frequencies are used in each of the two simulcast sites, and the remaining frequencies are utilized to support five (5) multisites. The channels utilized in the trunked system are as follows:

<table>
<thead>
<tr>
<th>Simulcast System</th>
<th>Number of Channels</th>
<th>Frequencies (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Name</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

A-14
Exhibit A - Scope of Work
800 MHz Emergency Communications Systems
For Sarasota and Manatee Counties
RFP 142842TM

|-----------------|--------|----|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|

### Multisite System (IR Sites)

<table>
<thead>
<tr>
<th>Site Name</th>
<th>Number of Channels</th>
<th>Frequencies (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Englewood</td>
<td>6</td>
<td>851.3625 851.7625 852.5375 853.0375 853.2375 853.5875</td>
</tr>
<tr>
<td>Hi-Hat Ranch</td>
<td>6</td>
<td>851.6125 851.8375 852.0875 852.8375 853.0750 853.7000</td>
</tr>
</tbody>
</table>


Contractor will use existing Sarasota and Manatee Spectrum.

### 2.1.2.2 Mutual Aid Channels
Sarasota operates a conventional mutual aid system using the NPSPAC Mutual Aid 8CALL90 and the 8TAG92 channels. These channels are configured at the 12th St, Englewood, North Port, Osprey, Venice and Vo-Tech tower sites and are licensed under Call Sign WPZ538.

### 2.1.2.3 Short-Spaced Channels
Sarasota is assigned the following channels that are short-spaced with Pinellas County.
Exhibit A – Scope of Work
800 MHz Emergency Communications Systems
For Sarasota and Manatee Counties
RFP 142842TM

<table>
<thead>
<tr>
<th>Channel</th>
<th>Frequency (MHz)</th>
<th>Channel</th>
<th>Frequency (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>851.0375</td>
<td>140</td>
<td>852.8375</td>
</tr>
<tr>
<td>46</td>
<td>851.6125</td>
<td>142</td>
<td>852.8625</td>
</tr>
<tr>
<td>82</td>
<td>852.0875</td>
<td>154</td>
<td>853.0375</td>
</tr>
<tr>
<td>98</td>
<td>852.2875</td>
<td>157</td>
<td>853.0750</td>
</tr>
<tr>
<td>104</td>
<td>852.3625</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The following channel is short-spaced with the State of Florida Department of Corrections conventional radio system on the tower site located in DeSoto County:

<table>
<thead>
<tr>
<th>Channel</th>
<th>Frequency (MHz)</th>
<th>Channel</th>
<th>Frequency (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>157</td>
<td>853.0750</td>
<td>209</td>
<td>853.7250</td>
</tr>
</tbody>
</table>

2.1.3 Dispatch Console System

2.1.3.1 Sarasota Dispatch Consoles

Sarasota’s main dispatch facility will be located in the Public Safety Communications (PSC) Center at 6050 Porter Way, Sarasota, FL. The building houses the fifteen (15) Motorola Centrosome Gold Elite dispatch console operator positions and the Central Electronics Bank (CEB) that is the core of the centralized signal processing. The CEB is connected to the Prime Site at Vo-Tech via a fiber network.

Dispatchers currently use a wired headset that uses a 4-wire interface; however, they had expressed interest in using a combination of both wired and wireless headsets. The wireless headset adapters use a 6-wire interface.

The dispatch operator positions are distributed in the following manner:

<table>
<thead>
<tr>
<th>Agency</th>
<th>Number of Positions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheriff’s Office Pod</td>
<td>4</td>
</tr>
<tr>
<td>City of Sarasota Police Department Pod</td>
<td>4</td>
</tr>
<tr>
<td>Fire Department Pod</td>
<td>5</td>
</tr>
<tr>
<td>MOTOBridge™ / Supervisor Position</td>
<td>1</td>
</tr>
<tr>
<td>Network Manager Office</td>
<td>1</td>
</tr>
</tbody>
</table>

Contractor’s MCC7500 Console System supports 4-wire and 6-wire Headset Interface. This customization is part of the Console Configuration specific to the System.
2.1.3.2 Sarasota Conventional Interfaces

The PSC radio dispatch consoles support conventional interfaces for mutual aid, and other interoperability purposes. A list of conventional interfaces is provided below:

<table>
<thead>
<tr>
<th>Med 8 Sarasota</th>
<th>Forestry Red</th>
<th>Forestry White</th>
<th>Forestry Blue</th>
<th>Inter-City</th>
</tr>
</thead>
<tbody>
<tr>
<td>8CAL90</td>
<td>8TAC91</td>
<td>8TAC92</td>
<td>USCG 16</td>
<td>USCG 83</td>
</tr>
<tr>
<td>FL-LE-1</td>
<td>FL-LE-2</td>
<td>FL-LE-3</td>
<td>FL-LE-4</td>
<td>FL-PS-1</td>
</tr>
<tr>
<td>FL-PS-2</td>
<td>FL-PS-3</td>
<td>FL-PS-4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Contractor’s MCC7500 Console System supports the Conventional Interface through the use of Conventional Channel Gateways (CCGW) which convert between IP used by the P25 system and 4-wire interface to the Conventional Radios.

2.1.3.3 City of North Port Dispatch Consoles

North Port Fire Rescue has a dispatch facility located at 4980 City Hall Blvd., North Port, FL 34286. The North Port dispatch facility has four (4) Gold Elite operator positions that are wireline via leased T1 to the Sarasota system. Wired and wireless headsets are used for radio dispatch, and telephone handsets are used for 9-1-1 calls. Each dispatch position has a backup control station radio, two headset jacks and one footswitch for radio dispatch. North Port utilizes console tones to signal incident priority or when no response.

Contractor’s MCC7500 Console System has the ability to generate Console Tones to indicate Signal Incident Priority, etc. There are up to three (3) Tones that are customizable to the agency level through the Console Configuration.

2.1.3.4 City of North Port Conventional Interfaces

The City of North Port has one control station for backup purposes.

Contractor will provide a Fixed Mobile CSR (Console Standby Radio) in the immediate vicinity of the City of North Port Dispatch Consoles.

2.1.3.5 Logging Recorders

Sarasota uses a logging recorder system manufactured by Voice Print International (VPI) and desire to integrate the existing VPI system with the new P25 radio system.

North Port Fire Rescue has a voice logging recorder system manufactured by Voice Print International (VPI).

Contractor will provide a new EXACOM Hindsight-G2 equivalent logging recorder system to replace the legacy Sarasota VPI System.

Please refer to Exhibit A, Section 14 for a detailed description of the logging recorder system.
2.1.4 **Backhaul Network**

The Backhaul Network for the Sarasota radio communications system consists of a combination of leased T1 lines from Verizon and Sarasota-owned fiber.

Contractor will provide a new Digital Microwave Radio System to support the Suncoast Regional Communications System.

2.1.5 **Ancillary Systems**

2.1.5.1 **Fire Station Alerting**

Sarasota has a Fire Station Alerting system that utilizes the existing 800 MHz radio system as a means of control and alerting communications. Sarasota Fire and EMS and North Port Fire Rescue use a custom Fire Alerting system that was custom made by WTEC. The system consists of two mobile radios; one of the mobile radios monitors the control channel for alerting and the other mobile radio monitors the Fire Main talkgroup for voice messages. Data for the “Tear-and-Run” printer is sent via POTS.

The mobile radio monitoring the control channel is interconnected to an external enclosure containing relays that control the various functions within the fire station. Each fire station is equipped with speakers and switching equipment that operates lights and turn of the gas to the stove.

Contractor’s MCC7500 Consoles will interface to the legacy Sarasota Fire Station Alerting System via a 4-Wire Interface. No downstream modifications to the legacy Sarasota Fire Station Alerting System are anticipated.

2.1.6 **Building Amplifier Systems**

There are multiple bi-directional amplifier (BDA) systems deployed throughout Sarasota. The BDAs are owned by different agencies as listed below:

<table>
<thead>
<tr>
<th>Location</th>
<th>Owned By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old Jail</td>
<td>Sarasota</td>
</tr>
<tr>
<td>East Wing on Balcony 1st Floor</td>
<td></td>
</tr>
<tr>
<td>New Jail</td>
<td>Sarasota</td>
</tr>
<tr>
<td>First Floor Electrical Room</td>
<td></td>
</tr>
<tr>
<td>Criminal Justice Center</td>
<td>Sarasota</td>
</tr>
<tr>
<td>3rd Floor Waiting Room Closet</td>
<td></td>
</tr>
<tr>
<td>Court House</td>
<td>Sarasota</td>
</tr>
<tr>
<td>Storage Room on Roof</td>
<td></td>
</tr>
<tr>
<td>Sarasota Memorial Hospital</td>
<td>Sarasota</td>
</tr>
<tr>
<td>EMS Room by ER Ambulance Door</td>
<td></td>
</tr>
<tr>
<td>City of Sarasota PD</td>
<td>City of Sarasota PD</td>
</tr>
</tbody>
</table>
Contractor's P25 system is in the same operating frequency band as the legacy Sarasota Radio Communications System, so the multiple BDA's distributed throughout Sarasota will continue to operate as they currently do.

### 2.1.7 Interoperability Capabilities

Sarasota interoperates with local, state, and national public safety agencies on a constant basis. Depending upon the Agency that requires interoperability communications, different methods are used to accomplish communications.

Interoperable communications are accomplished by the use of shared talkgroups, hard audio patches or dispatch console cross patches, deploying a cache of portable radios to the field, and the use of the NPSPAC Conventional Mutual Aid channels.

The following sections describe the current interoperability capabilities of the Sarasota system.

Contractor’s P25 system supports interoperability at the field subscriber level by sharing talkgroups.

### 2.1.7.1 800 MHz Mutual Aid Channels

Sarasota has implemented the 800 MHz Mutual Aid 8CALL90 and the 8TAC92 channels at six (6) tower sites and can access these channels with portable, mobiles, and control station radios.

Contractor will deploy new GTR8000 Analog 800 MHz Base Stations at six (6) tower sites. At the Contractor’s MCC7500 Console, each of these sites will have their own “Pads” to differentiate amongst the sites as 8CALL90 and 8TAC92 are not being deployed as a Simulcast System.

### 2.1.7.2 Interoperability with Manatee

Both Longboat Key and the Sarasota-Manatee Airport Authority (SRQ) service area extends into both Sarasota and Manatee. On a day-to-day basis, Longboat Key and SRQ operations requires access to the radio communications system of Manatee and mutual aid with Sarasota. Since Sarasota operates Motorola proprietary system and Manatee operates a Harris proprietary system the users are required to carry multiple radios to provide direct interoperability.

With the deployment of Contractor’s P25 Radio System, Longboat Key and SRQ operations personnel will no longer have to carry two radios. A single radio will support access to the Sarasota Simulcast Cell and the Manatee Simulcast Cell.
2.1.7.3 **Interoperability with Florida Interoperability Network (FIN)**

Interoperability with the Florida Interoperability Network (FIN) is accomplished through dispatch console cross patches which links the FIN to conventional resources or to one or many trunked talkgroups.

Contractor’s MCC7500 Console System supports the cross-patching of radio resources regardless of what frequency band is involved.

2.2 **Sarasota Communication System Sites**

Contractor understands that the following sections describe the current Sarasota communication sites.

Contractor shall use the following Sarasota Sites to make the Sarasota Simulcast Cell:

- 12th Street
- Hi Hat
- Englewood Fire Station
- Emergency Operations Center (EOC)
- Toledo Blade
- North Port
- Osprey
- Venice
- Vo-Tech
- Ringling (receiver only)
- Kinnan Park (receiver only)

2.2.1 **Public Safety Communications Center**

The Sarasota PSC is located at 6050 Porter Way, Sarasota, FL.

The PSC is a multi-agency center that provides communication services for the Sarasota Fire Department, Nokomis Fire Department, Venice Fire Department, North Port Fire Department, Englewood Fire Department, Sarasota Police Department (SPD), and the Sarasota Sheriff's Office (SSO).

The PSC houses the SmartZone trunked controller and other communication system core infrastructure equipment.
2.2.2 12th St Tower Site

The 12th St site is located at 1750 12th Street, Sarasota and supports the following major system components:

- A Remote Site Controller
- A 14-channel simulcast Repeater system
- A 2-channel conventional Repeater system (NPSPAC Mutual Aid)
- Premisys channel banks

The tower is a 180-foot self-supporting tower that is owned by Sarasota.

The communication shelter is a 12-ft x 20-ft x 9-ft Rohn concrete shelter. The shelter has the following attributes:

- 200-amp, single phase, 240VAC electrical service
- Two 3-ton, wall mounted, Bard HVAC units with a Bard controller
- 8-port entry panel with (3) open ports

The backup generator is a propane-powered Onan model CSG-6491-6005-A rated at 45 KW connected to an Onan model OT400 400-amp-transfer switch. The LP tank is 500 gallons with a maximum capacity of 400 gallons.

2.2.3 Englewood Tower Site

2.2.3.1 General

The Englewood site is located at 599 South Indiana Avenue, Englewood and supports the following major system components:

- A 6-channel trunked Repeater system
- A 2-channel conventional Repeater system (NPSPAC Mutual Aid)
- Premisys channel banks

2.2.3.2 Tower Structure

The tower is a 196-foot monopole tower with FCC Antenna Structure Registration Number 1012258. Englewood Fire Department has an agreement with Crown Castle for use of this facility.

2.2.3.3 Communications Shelter

The Englewood site is at the fire station. The fire station provides a small room (12’-3” x 4’-8”) to Sarasota to house the communications equipment. The equipment room has the following attributes:

- LG window AC unit
- 4-port entry panel with (1) open port

2.2.3.4 Generator and UPS Systems

The backup generator is a diesel-powered Onan model 15DKAC rated at 15 KW connected to an Onan model OT125 125-amp transfer switch. The generator has a sub-base diesel tank.

The site is equipped with (1) FERRUPS FE series (model 10K04499) UPS system. The batteries of the UPS are replaced every 16 months. The UPS is located in the adjacent room.

2.2.4 Hi-Hat Tower Site

2.2.4.1 General

The Hi-Hat site is located at 11706 Fruitville Road, Sarasota and supports the following major system components:

- 6-channel trunked Repeater system
- Premisys channel banks
2.2.4.2 Tower Structure

The tower is a 250-foot self-supporting tower with FCC Antenna Structure Registration Number 1208693. Sarasota leases tower space from SBA.

2.2.4.3 Communications Shelter

The communication shelter is a 12-ft x 20-ft x 9-ft Oldcastle concrete shelter. The shelter has the following attributes:
200-amp, single phase, 240VAC electrical service
Two 3-ton, wall mounted, Marvair HVAC units with a Marvair controller
12-port entry panel with (9) open ports

2.2.4.4 Generator and UPS Systems

The backup generator is a diesel-powered Generac model 6817040100 rated at 50 KW connected to a Generac transfer switch. The generator has a sub-base diesel tank.
The site is equipped with (1) Liebert Nfinity UPS system model NB16S0412600S.

2.2.5 North Port Tower Site

2.2.5.1 General

The North Port site is located at 6654 W Price Boulevard, North Port and supports the following major system components:
An 8-channel trunked Repeater system
A 2-channel conventional Repeater system (NPSPAC Mutual Aid)
Premisys channel banks

2.2.5.2 Tower Structure

The tower is a 285-foot self-supporting tower with FCC Antenna Structure Registration Number 1015215. The City of North Port has an agreement with Crown Castle for use of this facility.

2.2.5.3 Communications Shelter

The communication shelter is a 12-ft x 20-ft x 9-ft Rohn concrete shelter. The shelter has the following attributes:
200-amp, single phase, 240VAC electrical service
(2) 3-ton, wall mounted, Bard HVAC units with a Bard controller
8-port entry panel with (4) open ports

2.2.5.4 Generator and UPS Systems

The backup generator is a propane-powered Onan model CSG-6491-6005-A rated at 45 KW connected to an Onan model OT400 400-amp transfer switch. The LP tank is 500 gallons with a maximum capacity of 400 gallons.
The site is equipped with (2) FERRUPS FE series (model 10K04499) UPS system. The batteries of the UPS are replaced every 16 months.

2.2.6 Osprey Tower Site

2.2.6.1 General

The Osprey site is located at 101 Old Venice Road, Osprey and supports the following major system components:
2.2.6.2 Tower Structure

The tower is a 300-foot self-supporting tower with FCC Antenna Structure Registration Number 1001589. Sarasota County School Board has an agreement with AT&T for use of this facility.

2.2.6.3 Communications Shelter

The communication shelter is a 12-ft x 20-ft x 9-ft Rohn concrete shelter. The shelter has the following attributes:
- 200-amp, single phase, 240VAC electrical service
- Two 3-ton, wall mounted, Bard HVAC units with a Bard controller
- 8-port entry panel with (3) open ports

2.2.6.4 Generator and UPS Systems

The backup generator is a propane-powered Onan model CSG-6491-6005-A rated at 45 KW connected to an Onan model OT400 400-amp transfer switch. The LP tank is 500 gallons with a maximum capacity of 400 gallons.

The site is equipped with (2) FERRUPS FE series (model 10K04499) UPS system. The batteries of the UPS are replaced every 16 months.

2.2.7 Venice Tower Site

2.2.7.1 General

The Venice site is located at 721 Center Road, Venice and supports the following major system components:
- A 9-channel trunked Repeater system
- A 2-channel conventional Repeater system (NPSPAC Mutual Aid)
- Premisys channel banks

2.2.7.2 Tower Structure

The tower is a 240-foot guyed tower with FCC Antenna Structure Registration Number 1003602. Sarasota leases tower space from American Tower Corp.

2.2.7.3 Communications Shelter

The communication shelter is a 12-ft x 20-ft x 9-ft Rohn concrete shelter. The shelter has the following attributes:
- 200-amp, single phase, 240VAC electrical service
- Two 3-ton, wall mounted, Bard HVAC units with a Bard controller
- 8-port entry panel with (4) open ports

2.2.7.4 Generator and UPS Systems

The backup generator is a propane-powered Onan model CSG-6491-6005-A rated at 45 KW connected to an Onan model OT400 400-amp transfer switch. The LP tank is 500 gallons with a maximum capacity of 400 gallons.

The site is equipped with (2) FERRUPS FE series (model 10K04499) UPS system. The batteries of the UPS are replaced every 16 months.
2.2.8 Vo-Tech Tower Site

2.2.8.1 General
The Vo-Tech site is located at 4748 Beneva Road, Sarasota and supports the following major system components:
- Main and Backup Central Controllers
- A Remote Site Controller
- The simulcast audio processing and control equipment
- Simulcast optimization equipment rack
- The Digitac receiver voting comparators
- A 14-channel simulcast Repeater system
- A 2-channel conventional Repeater system (NPSPAC Mutual Aid)
- Premisys channel banks

2.2.8.2 Tower Structure
The tower is a 290-foot self-supporting tower with FCC Antenna Structure Registration Number 1019025. Sarasota County School Board has an agreement with Crown Castle for use of this facility.

2.2.8.3 Communications Shelter
The communication shelter is a 12-ft x 28-ft x 9-ft Rohn concrete shelter. The shelter has the following attributes:
- 200-amp, single phase, 240VAC electrical service
- Two 3-ton, wall mounted, Bard HVAC units with a Bard controller
- 8-port entry panel with two (2) open ports

2.2.8.4 Generator and UPS Systems
The backup generator is a propane-powered Onan model CSG-6491-6005-A rated at 45 KW connected to an Onan model OT400 400-amp transfer switch. The (2) LP tanks are 500 gallons each with a maximum capacity of 400 gallons each.

The site is equipped with one (1) Liebert Nfinity UPS system model NB16S0412600s.

2.3 Manatee Communication System

2.3.1 Trunked System Infrastructure
Manatee currently operates a Harris EDACS ProVoice analog 800 MHz trunked radio system. The system consists of nine (9) RF tower sites, of which, six (6) sites are configured as a sixteen (16) channel simulcast system, and the remaining three (3) sites are configured as a multisite system with either four (4) or five (5) channels at each site.

The Manatee Control Point site along with a collocated simulcast site is located at the PSC tower site. The remaining simulcast tower sites are located at Main/GTE Building, NW Water Tank, Cortez Water Tank, Buffalo Creek Water Tank, and Lorraine Road. The system also supports three multi-sites that are located at East Tower, Duette Park and Myakka tower sites. Manatee also supports 800 MHz conventional mutual aid channels, VHF Conventional Channels for Fire back up and tone alerting at several of their sites.

2.3.2 System Frequencies
As of Amendment #14 of the Florida Region 9 Plan, Manatee is allocated eight (8) 800 MHz NPSPAC channels. Manatee is licensed for operation on these eight (8) channels under FCC license WQCS228.

These channels are as follows:
Contractor shall use the existing Sarasota and Manatee Spectrum.

Manatee is licensed for operation on twenty-one (21) non-NPSPAC frequencies under FCC licenses WQPZ834 and WNKA279.

These frequencies are as follow:

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>Frequency (MHz)</th>
<th>Frequency (MHz)</th>
<th>Frequency (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>854.1875</td>
<td>854.3375</td>
<td>854.4625</td>
<td>854.4875</td>
</tr>
<tr>
<td>854.7375</td>
<td>855.3875</td>
<td>855.9375</td>
<td>855.9875</td>
</tr>
<tr>
<td>856.4875</td>
<td>857.4875</td>
<td>857.6875</td>
<td>857.7875</td>
</tr>
<tr>
<td>858.4875</td>
<td>858.6875</td>
<td>859.4875</td>
<td>859.7875</td>
</tr>
</tbody>
</table>

Contractor shall use the existing Sarasota and Manatee Spectrum. For the frequency plans refer to Exhibit E System Description – Manatee Frequency Plan

### 2.3.2.1 Trunked System Frequencies

The Manatee trunked radio system utilizes twenty-nine (29) frequencies. Sixteen (16) non-NPSPAC frequencies are used in each of the six (6) simulcast sites, five (5) non-NPSPAC frequencies are used in one of the multisites, and eight (8) NPSPAC frequencies are utilized to support the remaining two (2) multisites.

The frequencies utilized in the Manatee trunked system are as follows:

<table>
<thead>
<tr>
<th>Simulcast System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Name</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
## Simulcast System

<table>
<thead>
<tr>
<th>Site Name</th>
<th>Number of Channels</th>
<th>Frequencies (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSC (Control Point)</td>
<td></td>
<td>854.1875</td>
</tr>
<tr>
<td>Buffalo Creek NW</td>
<td></td>
<td>854.3375</td>
</tr>
<tr>
<td>Main</td>
<td></td>
<td>854.4625</td>
</tr>
<tr>
<td>Cortez</td>
<td></td>
<td>854.4875</td>
</tr>
<tr>
<td>Lorraine</td>
<td>16</td>
<td>854.7375</td>
</tr>
<tr>
<td></td>
<td></td>
<td>855.3875</td>
</tr>
<tr>
<td></td>
<td></td>
<td>855.9375</td>
</tr>
<tr>
<td></td>
<td></td>
<td>855.9875</td>
</tr>
<tr>
<td></td>
<td></td>
<td>856.4875</td>
</tr>
<tr>
<td></td>
<td></td>
<td>857.4875</td>
</tr>
<tr>
<td></td>
<td></td>
<td>857.6875</td>
</tr>
<tr>
<td></td>
<td></td>
<td>857.7875</td>
</tr>
<tr>
<td></td>
<td></td>
<td>858.4875</td>
</tr>
<tr>
<td></td>
<td></td>
<td>858.6875</td>
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<tr>
<td></td>
<td></td>
<td>859.4875</td>
</tr>
<tr>
<td></td>
<td></td>
<td>859.7875</td>
</tr>
</tbody>
</table>

## Multisite System

<table>
<thead>
<tr>
<th>Site Name</th>
<th>Number of Channels</th>
<th>Frequencies (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Tower</td>
<td>5</td>
<td>854.9875</td>
</tr>
<tr>
<td></td>
<td></td>
<td>855.1375</td>
</tr>
<tr>
<td></td>
<td></td>
<td>855.6875</td>
</tr>
<tr>
<td></td>
<td></td>
<td>856.9875</td>
</tr>
<tr>
<td></td>
<td></td>
<td>859.9875</td>
</tr>
<tr>
<td>Duette</td>
<td>4</td>
<td>851.1500</td>
</tr>
<tr>
<td></td>
<td></td>
<td>851.6500</td>
</tr>
<tr>
<td></td>
<td></td>
<td>851.8750</td>
</tr>
<tr>
<td></td>
<td></td>
<td>852.3375</td>
</tr>
</tbody>
</table>
Contractor shall use the existing Sarasota and Manatee Spectrum.

2.3.2.2 Mutual Aid Channels
Manatee also operates a conventional mutual aid system using the NPSPAC Mutual Aid Calling Channel, 8CALL90, 8TAC91, and 8TAC92. These channels are licensed under Call Sign WQCS935 and deployed at the following Manatee tower sites:

- MAIN: 8CALL90, 8TAC91, 8TAC92
- PSC EAST: 8CALL90, 8TAC91, 8TAC92,
- EAST: 8CALL90, 8TAC91, MAFLA
- DUETTE: 8CALL90, 8TAC92
- MYAKKA: 8CALL90, 8TAC93

Note: Manatee’s existing conventional mutual aid system will not be replaced under this Purchase Agreement.

2.3.2.3 Short-Spaced Channels
Manatee is assigned channel 144 (852.8875 MHz) that is short-spaced with Pinellas County.
Manatee is assigned channel 11 (851.1500 MHz) that is short-spaced with Polk County.
Manatee is licensed for following non-NPSPAC frequencies that are short-spaced with Polk County:

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>Frequency (MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>854.1875</td>
<td>855.9875</td>
</tr>
</tbody>
</table>

2.3.3 Dispatch Console System
The ECC is located within the PSC building at 2101 47th Terrace East, Bradenton, FL, and is the 9-1-1 dispatch center for Manatee EMS and eleven (11) local Fire agencies. The ECC is the 9-1-1 call-processing center for the Manatee Sheriff’s Office (MCSO) and the City of Bradenton Beach Police Department. Between the ECC and the MCSO, there are sixteen (16) Harris Maestro dispatch console positions.

Contractor shall deploy MCC7500 Consoles to replace the legacy Manatee radio consoles.
2.3.3.1 ECC Dispatch
The ECC is equipped with the following dispatch system components:

There are sixteen (16) console positions in the ECC dispatch, including six (6) radio dispatch positions that includes one (1) supervisor position, and nine (9) call-taker positions.

There is one (1) radio dispatch console located in the Prime Site equipment room for maintenance purposes.

Each radio dispatch console is equipped with one (1) boom mic, two (2) headset jacks (wired and wireless), two (2) footswitch pedals, and one (1) backup radio control head connected to a control station in the Control Point equipment room.

Contractor shall deploy MCC7500 Consoles to replace the legacy Manatee Radio Consoles.

2.3.3.2 ECC Conventional Interfaces
ECC radio dispatch consoles support a number of conventional interfaces for mutual aid, and other interoperability purposes as depicted in the table below.

<table>
<thead>
<tr>
<th>MA-FLA</th>
<th>A8 W LAW</th>
<th>A9-W-FIRE</th>
<th>8CAL90-D</th>
<th>8TAC92-D</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC-FD-W</td>
<td>FL-LE-1</td>
<td>FL-LE-2</td>
<td>FL-LE-3</td>
<td>FL-LE-4</td>
</tr>
<tr>
<td>FL-PS-1</td>
<td>FL-PS-2</td>
<td>FL-PS-3</td>
<td>FL-PS-4</td>
<td>8CAL90-E</td>
</tr>
<tr>
<td>8TAC91-E</td>
<td>MED 8</td>
<td>8CAL90-M</td>
<td>8TAC92-M</td>
<td>8CAL90-W</td>
</tr>
<tr>
<td>8TAC91-W</td>
<td>8TAC92-2</td>
<td>STATEIA</td>
<td>STATETAC</td>
<td>MC-FD-E</td>
</tr>
<tr>
<td>WMFD-AR</td>
<td>NRFD-AR</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Contractor’s MCC7500 Console System supports a wide variety of conventional interfaces for Mutual Aid and other interoperability requirements.

2.3.3.3 MCSO Dispatch
The MCSO dispatch is equipped with the following dispatch system components:

There are fourteen (14) console positions in the MCSO dispatch, including eight (8) radio dispatch positions that includes one (1) supervisor position, and six (6) call-taker positions.

Each radio dispatch console is equipped with one (1) boom mic, two (2) headset jacks (wired and wireless), two (2) footswitch pedals, and one (1) backup radio control head connected to a control station in the Control Point equipment room.

Contractor shall deploy MCC7500 Consoles to replace the legacy MCSO Radio Consoles.

2.3.3.4 MCSO Conventional Interfaces
MCSO radio dispatch consoles also support the same conventional interfaces that are listed for the ECC above.

Contractor’s MCC7500 Console System supports a wide variety of conventional interfaces for Mutual Aid and other interoperability requirements.
2.3.3.5 City of Bradenton

The Bradenton Fire Department and Police Department are dispatched from the Bradenton Police Department at 100 10th Street, West Bradenton, FL. They utilize three (3) radio dispatch consoles and have one (1) control station radio at each console for backup communications.

Contractor shall deploy MCC7500 Consoles to replace the legacy Bradenton Radio Consoles.

2.3.3.6 Logging Recorders

Manatee uses a Nice voice logging recorder system and will replace the existing system as part of the System.

Contractor shall provide a new EXACOM Hindsight-G2 equivalent logging recorder system to replace the legacy Manatee NICE System.

Please refer to Section 14 for details for the logger recorder system.

2.3.3.7 Backup Dispatch Center

The backup dispatch location for Manatee utilizes ten (10) control station radios and is located at:
Manatee Public Works Building
1022 26th Avenue East
Bradenton, FL

Contractor shall install ten (10) new Control Station Radios at the Manatee Backup Dispatch Center. These new radios will use the Existing Antenna System currently in place. No MCC7500 Consoles will be used for the Manatee Backup Dispatch Center.

2.3.4 Backhaul Networks

The Backhaul Network for the Manatee radio communications system consists of a combination of Manatee-owned fiber, leased fiber, licensed microwave in the 6 GHz and 4.9 GHz bands, and leased T1 lines. Each site in Manatee’s network has a redundant connection back to the PSC site. The table below details these connections:

<table>
<thead>
<tr>
<th>Site</th>
<th>Primary Connection</th>
<th>Backup Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main</td>
<td>6 GHz Microwave</td>
<td>Fiber</td>
</tr>
<tr>
<td>NW</td>
<td>Fiber</td>
<td>4.9 GHz MW through Main</td>
</tr>
<tr>
<td>Cortez</td>
<td>Fiber</td>
<td>Fiber</td>
</tr>
<tr>
<td>Buffalo Creek</td>
<td>Fiber</td>
<td>4.9 GHz MW through PSC</td>
</tr>
<tr>
<td>Lorraine</td>
<td>6 GHz MW</td>
<td>Leased T1</td>
</tr>
</tbody>
</table>
Contractor shall provide a new Aviat digital microwave radio system to support the System.

### 2.3.5 Fire Station Alerting

Manatee has a fire station alerting system that utilizes the existing 800MHz radio system and a VHF Paging System. Both systems are interfaced to the Maestro's dispatch consoles via conventional interfaces.

The VHF system utilizes two base stations in a multi-configuratio operating on frequencies 154.370 MHz (VHF West) and 153.950 MHz (VHF East), to provide two-tone sequential paging to all the fire stations throughout the Manatee. The two frequencies are multi-cast to the fire stations to set off the station Klaxon and tone the station. The district fire stations are equipped with a VHF mobile radio tuned to one of the multicast frequencies. The VHF paging channel audio is hard-patche to the Fire Dispatch talkgroup as well, so tones are broadcast on the primary dispatch channel.

The second Fire Station Alerting system is provided by First-In and utilizes the Manatee’s 800 MHz trunked radio system. Not all Fire stations are equipped with the First-In Fire Station Alerting systems.

Contractor’s MCC7500 Consoles will interface to the legacy Manatee Fire Station Alerting System via a 4-wire interface. No downstream modifications to the legacy Manatee Fire Station Alerting System are anticipated.

### 2.3.6 Building Amplifier Systems

Manatee currently has three (3) bi-directional amplifier (BDA) systems deployed. The BDA systems are at end-of-life and located at the following facilities:

<table>
<thead>
<tr>
<th>Location</th>
<th>Owned By</th>
</tr>
</thead>
<tbody>
<tr>
<td>County Jail</td>
<td>Manatee</td>
</tr>
<tr>
<td>PSC Building</td>
<td>Manatee</td>
</tr>
<tr>
<td>Judicial Building</td>
<td>Manatee</td>
</tr>
</tbody>
</table>

Contractor’s ASTRO Radio system is in the same operating frequency band as the legacy Manatee Radio Communications System, so the multiple BDA’s distributed throughout Manatee County should continue to operate as they currently do.
2.3.7 Interoperability Capabilities

Manatee public safety agencies interoperate with local, state, and federal public safety agencies on a regular basis. Depending upon the Agency that requires interoperability communications, different methods are used to accomplish communications.

Interoperable communications are accomplished by the use of shared talkgroups, Conventional Channels, audio patches, deploying a cache of portable radios to the field, and the use of the NPSPAC Conventional Mutual Aid channels.

The following sections describe the interoperability capabilities of the trunked system.

Contractor’s ASTRO Radio, combined with the MCC7500 Consoles, supports shared talkgroups between the Sarasota and Manatee Simulcast Cells and Conventional Channels that can be cross-patched as needed.

2.3.7.1 800 MHz Mutual Aid Channels

Manatee also operates a conventional mutual aid system using the NPSPAC Mutual Aid Calling Channel, 8CALL90, 8TAC91, and 8TAC92. These channels are licensed under Call Sign WQCS935 and deployed at the following Manatee tower sites:

- MAIN: 8CALL90, 8TAC91, 8TAC92
- PSC EAST: 8CALL90, 8TAC91, 8TAC92
- EAST: 8CALL90, 8TAC91, MAFLA
- DUETTE: 8CALL90, 8TAC92
- MYAKKA: 8CALL90, 8TAC93

Note: Manatee’s existing conventional mutual aid system will not be replaced under this Purchase Agreement.

Contractor shall incorporate these legacy Manatee 800 MHz Mutual Aid Channels into the new P25 Radio System via the use of Conventional Channel Gateways (CCGW).

2.3.7.2 Interoperability with Sarasota

Both Longboat Key and the Sarasota-Manatee Airport Authority (SRQ) service area extends into both Sarasota and Manatee. On a day-to-day basis, Longboat Key and SRQ operations requires access to the radio communications system of both counties.

Since Sarasota operates Motorola proprietary system and Manatee operates a Harris proprietary system the users are required to carry multiple radios to provide direct interoperability.

With the deployment of Contractor’s ASTRO Radio System, Longboat Key and SRQ operations personnel will no longer have to carry two radios. A single radio will support access to the Sarasota Simulcast Cell and the Manatee Simulcast Cell.

2.3.7.3 Interoperability with Florida Interoperability Network (FIN)

Interoperability with Florida Interoperability Network (FIN) is accomplished through the FIN terminal and conventional interfaces programmed on the dispatch consoles that may be patched to Conventional Channels or talkgroups.

Contractor’s MCC7500 Console System supports the cross patching of Radio Resources regardless of what frequency band is involved.
2.4 Manatee Communication System Sites

Contractor understands that the following sections describe the current Manatee communication sites.

Contractor shall use the following Sarasota Sites to make the Manatee Simulcast Cell:

- Buffalo Creek Water Tower
- Cortez Booster Station
- Duette
- East Tower
- Kinnan Park
- Main
- Lorraine
- Myakka
- Hidden Harbor
- PSC
2.4.1 Emergency Communications Center

2.4.1.1 General

The Emergency Communications Center (ECC) is the 9-1-1 dispatch center for Manatee EMS and eleven (11) local Fire agencies, and is located within the PSC Building at 2101 47th Terrace East, Bradenton, FL.

2.4.1.2 Dispatch Equipment

The ECC is equipped with the following major system components:

- Six (6) radio dispatch positions and nine (9) call-taker positions
- One (1) radio dispatch console in the Prime Site equipment room
- ECC has RF control stations as a backup to the dispatch consoles and a bank of 6 portable radios and a gang charger to provide additional backup communications

Contractor shall deploy MCC7500 Consoles to replace the legacy Manatee ECC Dispatch Consoles.

2.4.1.3 Generator and UPS Systems

The backup generator system is provided by two Caterpillar whole building diesel-powered generators, model C32 rated at 1 MW each. The fuel tanks provide approximately two (2) weeks of run time.

UPS backup power is provided by an Eaton Powerware series, 480VAC, 3-phase UPS.

2.4.2 Sheriff's Office Dispatch

2.4.2.1 General

The MCSO dispatches calls for the Sheriff's Office in Manatee, and is located within the PSC building at 2101 47th Terrace East, Bradenton, FL.

2.4.2.2 Dispatch Consoles

The MCSO is equipped with the following major system components:

- Eight (8) radio dispatch positions, and six (6) call-taker positions
- MCSO utilizes RF control stations and portable radios as backup and secondary backup to the dispatch consoles.

Generator and UPS Systems

The backup generator and UPS systems are described in the ECC section above.

Contractor shall deploy MCC7500 Consoles to replace the legacy Manatee Sheriff's Office Dispatch Consoles.
2.4.3 PSC Tower Site

2.4.3.1 General

The PSC Building site is located at 2101 47th Terrace East, Bradenton, FL and serves as a RF site and Control Point for the EDACS trunked radio system. This site supports the following major system components:

- IMC Control Point
- Voting system and associated equipment
- Servers: CSD System Manager, IMC Controller, Trunking Recorder Interface Monitor (TRIM)
- Harris Intraplex MUX
- 16 channel simulcast site with MASTRIII 800 MHz Repeaters
- Microwave equipment for Lorraine site and DC battery supply
- 800 MHz and VHF conventional Repeaters
- 800 MHz combiner and multicoupler systems
- Backup control stations for ECC and MSO dispatch

2.4.3.2 Tower Structure

The tower is a 200-foot self-supporting tower with FCC Antenna Structure Registration Number 1256202. The tower was constructed in 2007.

2.4.3.3 Communications Room

The PSC site does not have a communications shelter. All radio equipment for this site is routed from the tower, through a wall entry port, into the Control Point equipment room. The Control Point equipment room is a 30-ft W x 34-ft L room located on the 1st floor of the building. The Control Point equipment room has the following attributes:

- 480VAC Eaton Powerware Series UPS and backup up by (2) 1,000 MW Caterpillar generator system
- Liebert floor mounted, HVAC units with associated controller
- 24-port entry panel with (1) open port; it is possible some cleanup could free up additional ports

2.4.3.4 Generator and UPS Systems

The backup generator and UPS systems are described in the ECC survey above.

2.4.4 Main Tower Site

2.4.4.1 General

The Main Tower Site is located in downtown Bradenton, FL at the old GTE building and serves as one of the systems' remote simulcast sites. This use of this facility is being discontinued by Manatee. This site supports the following major system components:

- 2 Harris Intraplex MUX
- Optimux
- 16 channel simulcast site with MASTRIII 800 MHz Repeaters
- 6 GHz microwave equipment to the PSC
- 4.9 GHz microwave equipment to the NW and Buffalo Creek sites
- DC battery supply for microwave equipment
- 800 MHz and VHF conventional Repeaters
- 800 MHz combiner and multicoupler systems

2.4.4.2 Tower Structure

The tower is a 250-foot self-supporting tower with FCC Antenna Structure Registration Number 1240784.
### 2.4.4.3 Communications Shelter

The communication equipment room is located on the third floor of the old GTE building and is approximately 25-ft x 25-ft x 9-ft. The equipment room has the following attributes:

- 200-amp, single phase, 208VAC UPS protected panel; and a 200-amp, three phase, 208VAC unprotected panel.
- Two 5-ton, split mount American Standard HVAC units
- Two 8-port entry panels with (0) open ports although (4) lines are no longer in use

### 2.4.4.4 Generator and UPS Systems

The backup generator is a diesel-powered Kohler rated at 150 KW connected to a Kohler 400-amp transfer switch. The generator is mounted on a diesel tank of unknown capacity.

The site is equipped with one (1) 35-kVA Powerware UPS system model 9330 installed in 2004.

### 2.4.5 Cortez Water Tank Site

#### 2.4.5.1 General

The Cortez site is located at 5907 Cortez Road, West Bradenton, FL and serves as one of the systems 6 simulcast RF sites. This site supports the following major system components:

- Harris Intralplex MUX
- Optimux
- 16 channel simulcast site with MASTRIII 800 MHz Repeaters

#### 2.4.5.2 Tower Structure

The tower is a 170-foot water tank that is owned and operated by Manatee.

#### 2.4.5.3 Communications Shelter

The communication shelter is a 14-ft x 20-ft x 9-ft VFP concrete shelter. The shelter has the following attributes.

- 200-amp, single phase, 240VAC electrical service
- Two 5-ton, wall mounted, Bard HVAC units with a Bard controller
- 8-port entry panel with (3) open ports

#### 2.4.5.4 Generator and UPS Systems

The backup generator is a propane-powered Generac model rated at 55 KW connected to a Generac 200-amp transfer switch. The LP tank is 1000 gallons with a maximum capacity of 800 gallons.

The site is equipped with one (1) 12 kVA Liebert Nfinity UPS system model N112C0412600 and (1) external battery cabinet model N900E0500000.

### 2.4.6 NW Water Tank Site

#### 2.4.6.1 General

The NW site is located at 7200 1st Avenue West, Bradenton, FL and serves as one of the systems 6 simulcast RF sites. This site supports the following major system components:

- Harris Intralplex MUX
- Optimux
- 16 channel simulcast site with MASTRIII 800 MHz Repeaters
2.4.6.2 Tower Structure
The tower is a 170-foot water tank that is owned and operated by Manatee.

2.4.6.3 Communications Shelter
The communication shelter is a 14-ft x 20-ft x 9-ft VFP concrete shelter. The shelter has the following attributes:
- 200-amp, single phase, 240VAC electrical service
- Two 5-ton, wall mounted, Bard HVAC units with a Bard controller
- 8-port entry panel with (3) open ports

2.4.6.4 Generator and UPS Systems
The backup generator is a propane-powered Generac model rated at 55 KW connected to a Generac 200-amp transfer switch. The LP tank is 1000 gallons with a maximum capacity of 800 gallons.

The site is equipped with (1) Liebert Nfinity UPS system model N212C0812600 and (1) external battery cabinet model N900E0500000.

2.4.7 Buffalo Creek Water Tank Site

2.4.7.1 General
The Buffalo Creek site is located at 7920 69th Street East, Palmetto, FL and serves as one of the systems 6 simulcast RF sites. This site supports the following major system components:
- Harris Intraplex MUX
- Optimux
- 16 channel simulcast site with MASTRIII 800 MHz Repeaters
- 4.9 GHz microwave as backup connection via the Main site

2.4.7.2 Tower Structure
The tower is a 200-foot water tank that is owned and operated by Manatee.

2.4.7.3 Communications Shelter
The communication shelter is a 14-ft x 20-ft x 9-ft VFP concrete shelter. The shelter has the following attributes.
- 200-amp, single phase, 240VAC electrical service
- Two 5-ton, wall mounted, Bard HVAC units with a Bard controller
- 8-port entry panel with (1) open ports

2.4.7.4 Generator and UPS Systems
The backup generator is a propane-powered Generac rated at 55KW connected to a Generac 200-amp transfer switch. The LP tank is 1000 gallons with a maximum capacity of 800 gallons.

The site is equipped with one (1) 12-kVA Liebert Nfinity UPS system model N212C0812600.
2.4.8 Lorraine Tower Site

2.4.8.1 General
The Lorraine site is located at 15015 59th Avenue East, Bradenton, FL and serves as one of the systems 6 simulcast RF sites. This site supports the following major system components:

Harris Intraplex MUX
16 channel simulcast site with MASTRIII 800 MHz Repeaters
800 MHz conventional Repeaters
6 GHz microwave as backup connection via the PSC site and East tower
DC battery supply for the microwave equipment

2.4.8.2 Tower Structure
The tower is a 198-foot monopole with FCC Antenna Structure Registration Number 1252985.

2.4.8.3 Communications Shelter
The communication shelter is a 15-ft x 14-ft x 9-ft SkyWaves concrete shelter. The shelter has the following attributes.

200-amp, single phase, 240VAC electrical service
Two 4-ton, wall mounted, Eubank HVAC units with a Marvair controller
8-port entry panel with (0) open ports although (1) line is no longer in use

2.4.8.4 Generator and UPS Systems
The backup generator is a propane-powered Generac rated at 60KW connected to a Generac 200-amp transfer switch. There are (2) LP tanks 500 gallons each with a maximum capacity of 400 gallons each.

The site is equipped with one (1) 12-kVA Liebert Nfinity UPS system model N116S0412600 and (1) external battery cabinet model N900E040000.

2.4.9 East Tower Site

2.4.9.1 General
The East Tower site is on State Highway 64 East on the bank of Lake Manatee and serves as one of the systems 3 multisite RF sites. This site supports the following major system components:

Harris Intraplex MUX
5-channel multisite with MASTRIII 800 MHz Repeaters
800 MHz, VHF and UHF conventional Repeaters
6 GHz microwave as backup connection via the Lorraine site and Duette site
DC battery supply for the microwave equipment

2.4.9.2 Tower Structure
The tower is a 250-foot self-supporting tower with FCC Antenna Structure Registration Number 1258432.

2.4.9.3 Communications Shelter
The communication shelter is a 22-ft x 9-ft x 8-ft concrete block shelter. The shelter has the following attributes:

100-amp, single phase, 240VAC electrical service
One 4-ton, wall mounted, Eubank HVAC unit
One small window unit AC
2.4.9.4 Generator and UPS Systems

The backup generator is a propane-powered Generac rated at 25 KW connected to a Generac 100-amp transfer switch. The LP tank is 500 gallons with a maximum capacity of 400 gallons.

The tower is equipped with one (1) 10-kVA Toshiba UPS system installed in 1995.

2.4.10 Duette Tower Site

2.4.10.1 General

The Duette site is located at 3755 Duette Road Manatee, FL, and serves as one of the systems 3 multisite RF sites. This site supports the following major system components:

Harris Intraplex MUX
4-channel multisite with MASTRIII 800 MHz Repeaters
800 MHz conventional Repeaters
6 GHz microwave as backup connection via the East Tower site and Myakka site
DC battery supply for the microwave equipment

2.4.10.2 Tower Structure

The tower is a 198-foot monopole tower with FCC Antenna Structure Registration Number 1251521.

2.4.10.3 Communications Shelter

The communication shelter is a 15-ft x 14-ft x 9-ft SkyWaves concrete shelter. The shelter has the following attributes:

- 200-amp, single phase, 240VAC electrical service
- (2) 4-ton, wall mounted, Eubank HVAC units with a Marvair controller
- 8-port entry panel with (2) open ports

2.4.10.4 Generator and UPS Systems

The backup generator is a propane-powered Generac rated at 25 KW connected to a Generac 125-amp transfer switch. The LP tank is 500 gallons with a maximum capacity of 400 gallons.

The site is equipped with one (1) 16-kVA Powerware UPS system in service since 2006.

2.4.11 Myakka Tower Site

2.4.11.1 General

The Myakka site is located at 36550 Arcadia Avenue, Myakka City, FL, and serves as one of the systems 3 multisite RF sites. This site supports the following major system components:

Harris Intraplex MUX
4-channel multisite with MASTRIII 800 MHz Repeaters
800 MHz conventional Repeaters
6 GHz microwave as backup connection via the East Tower site and Myakka site
DC battery supply for the microwave equipment

2.4.11.2 Tower Structure

The tower is a 198-foot monopole tower with FCC Antenna Structure Registration Number 1244506.
2.4.11.3 Communications Shelter

The communication shelter is a 26-ft x 14-ft x 9-ft SkyWaves concrete shelter. The shelter has the following attributes:

- 200-amp, single phase, 240VAC electrical service
- Two (2) four (4) ton, wall mounted, Eubank HVAC units with a Marvair controller
- 8-port entry panel with two (2) open ports

2.4.11.4 Generator and UPS Systems

The backup generator is a propane-powered Generac rated at 30 KW connected to a Generac 125-amp transfer switch. The LP tank is 500 gallons with a maximum capacity of 400 gallons.

The site is equipped with one (1) 16-kVA Powerware UPS system in service since 2006.
3. **System Implementation**

The System implementation shall include the complete turnkey installation and optimization of the infrastructure and subscriber equipment that is comprised of multiple Repeater tower sites, Microwave Backhaul Network, base station Repeaters, trunked system controllers, and network management systems, dispatch consoles and associated subscriber equipment.

All equipment furnished by the Contractor shall be new, meet the requirements of RFP No. 142842TM and the manufacturers’ published specifications, comply with all Federal, State, and Local laws, rules, regulations, and ordinances, at the time of delivery, reflect high quality workmanship throughout, and be suitable for the intended purposes delineated herein.

The Contractor shall provide detailed plans of processes for tracking and controlling the project and shall include a high-level project plan for the overall project schedule, work breakdown structure, project communications, quality assurance, change control procedures, and a transition and cutover plan for each Sarasota and Manatee Agency.

The project plan will be a dynamic document that will be continually updated and evaluated as the project progresses. The Contractor shall provide a detailed project plan and schedule after the System design review.

Refer to Exhibit G - Project Management Plan, Implementation Schedule and Cutover Plan.
4. ♦ Communication System General Requirements

4.1 ♦ General

The Counties intend to replace the current 800 MHz radio systems with a modern, interoperable, P25 communications system. The replacement system shall be turnkey and shall include all base stations and antenna systems, system management and control systems, the Microwave Backhaul Network, dispatch consoles, and associated user and system equipment. Also included are other system upgrades as specified in this Purchase Agreement such as Fire Station Alerting and Fire Paging.

The System shall provide the functionality and flexibility to support the Counties’ growth and interoperability requirements throughout the life of the System. The design shall be modular in nature and provide the flexibility to accommodate additional channel capacity and the expansion of tower sites.

To ensure a high level of system availability, the System shall be configured with redundant equipment in key areas that affect the delivery of wide-area system operation and trunked radio operation between personnel in the field, and between field personnel and their dispatch or office personnel. A single point of failure shall not inhibit or interrupt wide-area communications and shall not inhibit trunked console operation.

The Sarasota County and Manatee complete P25 ASTRO Radio system shall contain all of the following components:

- P25 Phase 1 Trunked two-zone simulcast system with geo-redundant controllers
  - 17-channel, 9 TX/RX site and 2 site RX only zone for Sarasota County
  - 16-channel, 10 site zone for Manatee County
  - 4-channel multicast site for aircraft communications
- Dispatch Console Systems for Sarasota and Manatee County
- Microwave Backhaul Sub-System with connectivity to 21 sites
- Console and system interoperability with legacy systems
- 800 MHz Mutual Aid Channels (Sarasota)
- Connection to Existing Mutual Aid Conventional Radios (Manatee)
- P25 capable Logging Recorder subsystem
- Packet Data Service to support GPS, OTAR and OTAP
- Key Management Facility for OTAR
- Interface to Sarasota and Manatee Fire Station Alerting System
- FleetEnable (Manatee only)
- Choice of Multiple Vendor Subscriber Units

To meet Sarasota and Manatee Counties’ need for a P25 Trunking System, Contractor shall provide a two cell 800 MHz P25 Phase 1 Simulcast Trunking System that is Phase 2 upgradable via server software and Repeater firmware. The 17-channel Sarasota simulcast cell contains 9 TX/RX and 2 RX only sites. The 16-channel Manatee simulcast cell contains 10 TX/RX sites. All RF sites are connected to an advanced ASTRO Radio network core via a state-of-the-art IP microwave Backhaul. The two redundant Master Site Controllers are geographically separated. One System Controller is in Sarasota County and another in Manatee County. Each simulcast cell has two geo-redundant simulcast controllers. The multicast site has redundant Site Controllers that are co-located at the site with the four multicast Repeaters.
The sites used to service Sarasota and Manatee Counties for the P25 Trunking System and other RF systems are listed in Exhibit F.

**Dispatch Console System**

The Dispatch Console System shall provide each County with state-of-the-art MCC7500 Dispatch Consoles. This system will be organized as a dispatch system for each county providing the following capabilities:

**Sarasota County**

- 15 dispatch positions at the new EOC site
  - Interim Motorola Gold Elite Console Sub-System to support fifteen (15) Gold Elite Consoles interfaced to the Sarasota Legacy SmartZone Radio System. Contractor will provide a turnkey installation of this interim solution including all cables to interconnect the console positions to the CEB. Sarasota County is responsible for fiber interconnectivity to the current AEB.
  - MCC7500 Console Sub-System for the new ASTRO Radio system to support fifteen (15) positions
  - Both the Interim Motorola Gold Elite Console Sub-System and the MCC7500 Console Sub-System will run concurrently until the legacy Motorola SmartZone system is Decommissioned at which time the Gold Elite Console Sub-System can be Decommissioned.
- Software licenses for 8 remote table console positions
- Interfaces to:
  - 800 MHz P25 Trunked System
  - 800 MHz Mutual Aid Channels (15 Stations distributed across 6 sites)
  - Legacy Mutual Aid Channels (15 resources distributed across 4 sites)
  - P25 Recorder for Conventional Channels and Consoles
  - Key Management Facility (KMF)
  - Sarasota Fire Station Alerting System

**Manatee County**

- 19 dispatch positions at the Manatee PSC site
- 3 dispatch positions at the Bradenton Dispatch site
- Software licenses for 10 remote tablet console positions
- Interfaces to:
  - 800 MHz P25 Trunked System
  - 800 MHz legacy Mutual Aid Channels (27 resources distributed across 5 sites)
  - P25 Recorder for Conventional Channels and Consoles
  - KMF
  - Manatee Fire Station Alerting System
Logging Recorder System

Contractor shall provide EXACOM Logging Recorders for both Sarasota County and Manatee County that are natively P25 capable and are KMF compatible using Over-the-Network-Rekeying. As part of the upgrade, each County will be able to record the following:

Sarasota County

**Sarasota EOC:**
- P25 trunked radio system voice traffic in a geo-redundant configuration with North Port PD
- Existing 31 Intrado-Viper NG911 Calltaker Positions in a local redundant configuration
- Existing 20 Avaya IP Phone System in a local redundant configuration
- Existing 16 CAMA Trunks in a local redundant configuration
- Interim 15 Motorola Gold Elite Dispatch Consoles in a local redundant configuration
- Total of 8 existing and future Mutual Aid and other conventional radios in a local redundant configuration

**North Port PD:**
- P25 trunked radio system voice traffic in a geo-redundant configuration with (new) Sarasota EOC
- Existing 12 Intrado-Viper NG911 Calltaker Positions in a local redundant configuration
- Existing 20 Avaya IP Phone System in a local redundant configuration
- Existing 12 Motorola Gold Elite Dispatch Consoles in a local redundant configuration
- Existing 8 Analog Phone Lines in a local redundant configuration

To support centralized user access, a Hindsight-G2 Access Server will be deployed at the (new) Sarasota EOC. This installation consists of the HS-2020/G2/T630/ACCESS Server with the following licenses:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Hindsight-G2/Quality Assurance SW (Per Evaluator)</td>
</tr>
<tr>
<td>24</td>
<td>Hindsight-G2/TimeGate-P25/NG911 Instant Recall Client License</td>
</tr>
<tr>
<td>9</td>
<td>Hindsight-G2/TimeGate-P25/NG911 Instant Recall/Playback/Monitor Client License</td>
</tr>
</tbody>
</table>

Manatee County P25 and 911 Logging Recorder solutions. This also includes the remote PSAP’s Bradenton PD, Bradenton – Manatee County Backup, Holmes Beach & Palmetto.
Manatee PSC:
- P25 trunked radio system voice traffic in a geo-redundant configuration with Manatee MCA
- Existing legacy Harris EDACS voice radio system voice traffic in a standalone configuration
- New call taker positions on the VESTA 9-1-1 System in a local redundant configuration
- Existing nine (9) phone sets on Cisco IP Phone System in a local redundant configuration

Manatee MCA:
- P25 trunked radio system voice traffic in a geo-redundant configuration with Manatee PSC
- New call taker positions on the VESTA 9-1-1 System in a local redundant configuration
- Existing nine (9) phone sets on the Cisco IP phone system in a local redundant configuration

Bradenton PD Remote PSAP
- Existing Motorola Gold Elite Dispatch Consoles, selected audio on three (3) consoles
- New call taker positions on the VESTA 9-1-1 System, three (3) positions

Bradenton – Manatee County Backup Remote PSAP
- New call taker positions on the VESTA 9-1-1 System, twelve (12) positions

Holmes Beach Remote PSAP
- New call taker position on the VESTA 9-1-1 System

Palmetto Remote PSAP
- New call taker positions on the VESTA 9-1-1 System, two (2) positions

To support centralized user access, a Hindsight-G2 Access Server will be deployed at the Manatee PSC. This installation consists of the HS-2020/G2/T630/ACCESS Server with the following licenses:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Hindsight-G2/Quality Assurance SW (Per Evaluator)</td>
</tr>
<tr>
<td>10</td>
<td>Hindsight-G2/TimeGate-P25/NG911 Instant Recall/Playback/Monitor Client License</td>
</tr>
</tbody>
</table>

For further details on the Sarasota - Manatee Logger Solution please see Section 14.

**Subscriber Radios**

Existing P25-capable Motorola radios in Sarasota County and any P25 Phase 1 upgradable Harris radios in Manatee County will be able to operate on the ASTRO Radio system.
Exhibit A – Scope of Work
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Microwave Backhaul

Contractor shall provide a new microwave system for the new P25 ASTRO Radio system. The system is configured in a multiple loop (with select spurs) configuration for added reliability.

4.2 Regional System Configuration

The System shall be configured as a two-county, regional system with one simulcast site per county and a pair of geo-redundant master core sites. A master core site shall be installed in each county and they shall be configured to operate in a fully redundant mode.

4.3 Use of Existing and New Tower Sites

Exhibit F lists the sites and associated equipment.

4.4 Intermodulation and MPE Analyses

Prior to implementation and for each RF site, the Contractor shall perform an intermodulation analysis and shall consider the equipment from all tenants located at the proposed site, per FCC licensed information.

4.5 User and Talkgroup Capacity

The available range of subscriber unit IDs of the System is from 1 to 16,777,212. The Group ID range is from 1 to 65534. Talkgroup ID 65535 is reserved for System Calls per the P25 Standard.
4.6 P25 Phase 1 and Phase 2 Operation

The Counties intend to implement a P25 Phase 1, FDMA system. The System shall support migration to mixed-mode/dual-mode, P25 Phase 1 FDMA, and Phase 2 TDMA communications without additional or replacement hardware.

Contractor’s ASTRO Radio system provides a P25 standard compliant Phase 1 FDMA software that can be upgraded to Phase 2 TDMA. To ensure that the Phase 1 to Phase 2 upgrade is seamless, Contractor will work closely with the Counties’ assigned personnel to ensure detailed planning of Phase 1 and Phase 2 talkgroup schemas. With all of the hardware already being in place, there will not be any physical changes needed during the upgrade. The RF Subsystems, including the antennas and lines, will not need to be altered in any way for Phase 2 operation. A Phase 2 coverage analysis will be performed and provided to insure adequate coverage of the system in Phase 2 mode.

The Phase 1 to Phase 2 upgrade procedure will consist of a software upgrade to the Contractor’s GTR8000 RF Repeaters, console subsystem and ASTRO Radio System and Site Controller servers. After this action is complete, the Site Controller will assign either Phase 1 or Phase 2 dynamically, thus allowing Phase 1 and Phase 2 subscribers to operate on the system simultaneously. No additional licenses for dual Phase 1 and 2 operations are needed.

Any Portable/Mobile Subscribers and Control Stations that are Phase 2 equipped are to be programmed with a fleet map that supports both Phase 1 and Phase 2 talkgroup modes. This removes the need to reprogram the radios for the Phase 1 to Phase 2 upgrade. Existing Phase 1 subscribers will continue to operate on the VESTA Radio Phase 2 system in Phase 1 mode. To ensure that the subscriber radio upgrade is painless to the end user, Contractor will work in conjunction with the subscriber vendors to ensure a smooth migration. The removal of the Phase 1 programming in the subscribers can occur during scheduled preventive maintenance windows, without the need for additional programming of the radios.

4.7 700/800 MHz Capable

The Repeater and subscriber unit radios provided under this Purchase Agreement will operate on 700 and 800 MHz bands.

4.8 Frequencies and FCC Licenses

Both Sarasota and Manatee have a significant quantity of licensed 800 MHz frequencies that may be used to construct the regional P25 system design described in this Purchase Agreement.

The two simulcast systems shall be implemented using seventeen (17) frequencies from Sarasota’s existing pool and sixteen (16) frequencies from Manatee’s existing pool of 800 MHz frequencies.

As of Amendment #14 of the Florida Region 9 Plan, Sarasota County is currently allocated fifty-four (54) 800 MHz NPSPAC channels/frequencies.

RCC’s initial review indicates that a few of these frequencies are short-spaced with the Pinellas County trunked radio system and/or the State of Florida Department of Corrections conventional radio system. The Contractor has performed its own analysis prior to the effective date of this Purchase Agreement.

Pending a coverage and interference analysis with the Florida Region Interference Program (FRIP) and Frequency Coordinator approval, the remaining channels/frequencies that are currently not short-spaced may be available for implementation of a countywide simulcast radio system in Sarasota County. Refer to the Sarasota frequency table below.
### Sarasota County NPSPAC Frequencies

| 851.0375 | 851.8625 | 852.6125 | 853.2375 |
| 851.0625 | 851.8875 | 852.6375 | 853.2625 |
| 851.2125 | 851.9125 | 852.6625 | 853.2875 |
| 851.2875 | 852.0875 | 852.7125 | 853.3625 |
| 851.3625 | 852.1125 | 852.7625 | 853.5125 |
| 851.3875 | 852.1375 | 852.7875 | 853.5875 |
| 851.6125 | 852.1625 | 852.8375 | 853.6125 |
| 851.6375 | 852.2250 | 852.8625 | 853.6750 |
| 851.6625 | 852.2875 | 853.0375 | 853.7000 |
| 851.6875 | 852.3625 | 853.0625 | 853.7250 |
| 851.7125 | 852.3875 | 853.0750 | 853.7625 |
| 851.7625 | 852.4125 | 853.1125 | 853.7875 |
| 851.7875 | 852.5375 | 853.1375 |        |
| 851.8375 | 852.5625 | 853.2250 |        |

### Legend

| xxx.xxxx | Available for Countywide Simulcast under NPSPAC rules |
| xxx.xxxx | Limited use for Countywide Simulcast under NPSPAC rules |
As of Amendment #14 of the Florida Region 9 Plan, Manatee County is allocated eight (8) 800 MHz NPSPAC channels/frequencies. Additionally, Manatee County is licensed for operation on twenty-one (21) non-NPSPAC frequencies.

RCC’s initial review indicates that a few of the NPSPAC frequencies are short-spaced with the Pinellas County trunked radio system and/or the Polk County trunked radio system. The Contractor has performed its own analysis prior to the effective date of this Purchase Agreement. Refer to the Manatee frequency tables below.

### Manatee County NPSPAC Frequencies

<table>
<thead>
<tr>
<th>Channel</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>851.1500</td>
<td>851.8750</td>
</tr>
<tr>
<td>851.6500</td>
<td>852.0000</td>
</tr>
</tbody>
</table>

### Manatee County Non-NPSPAC Frequencies

<table>
<thead>
<tr>
<th>Channel</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>854.1875</td>
<td>855.1375</td>
</tr>
<tr>
<td>854.3375</td>
<td>855.3875</td>
</tr>
<tr>
<td>854.4625</td>
<td>855.6875</td>
</tr>
<tr>
<td>854.7375</td>
<td>855.9875</td>
</tr>
<tr>
<td>854.9875</td>
<td>855.9875</td>
</tr>
</tbody>
</table>

### Legend

- **xxx.xxxxx** Limited use for Countywide Simulcast under NPSPAC rules
- **xxx.xxxxx** Available for Countywide Simulcast under NPSPAC rules
- **Short Spaced (<55 miles Co-Channel)** - May be available for Countywide Simulcast
- **Short Spaced (55 > 70 miles Co-Channel)** - Available for Countywide Simulcast
- **Not Short Spaced (>70 miles Co-Channel)** - Available for Countywide Simulcast

Contractor will use existing Sarasota and Manatee Spectrums.

Contractor has developed a frequency plan using the channels listed herein. An analysis of those channels indicates all of the frequencies selected pass the short spacing study.

For the frequency plans refer to Exhibit E – System Description.
4.9 Aircraft Communications

The Counties have a number of aircraft that require radio communications. For simulcast radio systems aircraft may have problems receiving radio transmissions after they have reached a sufficient altitude where the aircraft is able to receive radio transmissions from multiple simulcast sites. The Counties require a 4-channel trunked (minimum) aircraft communications site that is centrally located, but in Sarasota, to serve the regional area of operation. The aircraft site shall be co-located at a simulcast site and shall be interconnected to the P25 Network Core. All aircraft public safety communications shall be directed to the aircraft site while in the air, and to the respective simulcast system while on the ground.

Contractor shall provide a multicast radio site controller, four (4) base stations, a four (4)-channel combiner, and transmit antenna at the 12th Street radio site specifically for aircraft communications use. The 12th Street site also contains one of the candidate simulcast sites, allowing the sharing of the network equipment and the receive antenna system.
4.10 Interoperability

4.10.1 P25 Regional Interoperability

One of the primary reasons for the technology upgrade to P25 is for the enhanced interoperability that a common communications protocol provides. It is required that the Counties are able to communicate with surrounding agencies operating P25 systems. Wherever possible, the Counties would like to benefit from the extended radio coverage created by other 700/800 MHz P25 systems. The reverse would be true for surrounding Agency users to roam onto the Counties’ regional system.

Contractor’s VESTA Radio system provides the capability to interoperate with up to 19 other P25 systems using ISSI depending on the licensing purchased. All hardware for ISSI connectivity is included in the price of the System. Only ISSI software licenses need to be installed to interface to another P25 system. These licenses can be added at any time.

4.10.2 Interoperability with Other P25 Systems

ISSI is the preferred method to interface to other P25 systems from an operational point of view. ISSI is used to connect both data and voice services from one P25 Master Site to another Master Site of the same or different manufacturer. Some of the features offered by the ISSI are:

- Group Affiliation
- Group Calls (encrypted or unencrypted, Emergency and non-Emergency calls)

The ASTRO Radio system natively allows automatic roaming from users belonging to the same system without requiring a software upgrade to the subscriber devices.

Manual Roaming from Remote System

ASTRO Radio System ISSI natively allows manual roaming from users belonging to another system without requiring a software upgrade to the subscriber devices. The manual roaming relies on the assumption that each roamer has as many addresses (P25 SUID – Subscriber Unit Identity) as the number of systems it needs to register to. The user has to manually select the right address (SUID) whenever he wishes to register in a given system so that the system ID of the SUID address matches the system ID of the registered system.

Automatic Roaming from Remote System

The ASTRO Radio System allows automatic roaming from users of Motorola Subscribers belonging to another ASTRO system. Automatic roaming requires that the other ASTRO infrastructure is equipped with the automatic inter-system roaming software feature and roaming is into an IP-based G-series or later ASTRO system. Motorola Subscribers must be equipped with software capable of intra- or inter-WACN roaming and that functionality must be enabled.

End-to-End Encryption
ISSI services are delivered while keeping the voice payload encrypted from one subscriber device to another.

4.10.2.1 ISSI Interface Connectivity

Contractor ensures interoperability with other P25 systems, particularly for P25 systems from other manufacturers, via the open standard TIA-102/P25 Inter-RF Sub-System Interface (P25 ISSI or ISSI) as shown in Table 1, TIA-102 Standards Compliance List.

Contractor pursues three avenues to support a highly interoperable ISSI offering that adheres to the P25 standards.

**P25 ISSI Standards Development** - Contractor has been a leader, author, editor, and a significant contributor to the development of the TIA-102/P25 ISSI standards since the inception of the current ISSI thrust starting in 2000. Contractor chaired the APCO Project 25 Interface Committee (APIC) ISSI Task Group in the ISSI standards formative stages from 2000 until 2008. Contractor’s intimate knowledge of the details of the published TIA-102/P25 ISSI specifications ensures an ISSI product is a highly standards compliant, multivendor interoperable, and robust sub-system for intersystem connectivity.

**P25 ISSI Internal Product Testing** – The P25 ISSI specifications contain eight (8) important test specification documents to allow manufacturers to thoroughly test their ISSI products. As noted earlier Contractor continues to be a significant contributor to the development and maintenance of the TIA-102/P25 ISSI test specifications. Contractor utilizes and exercises all of the appropriate test specifications in development and testing of the VESTA Radio ISSI offering. See Table 14 for a list of the TIA-102/P25 ISSI testing specifications.

**P25 ISSI External/Multivendor Testing/Demonstrations** – Contractor exercises two avenues for testing ISSI externally. First, manufacturers have been cooperating extensively to provide a fully open and interoperable P25 ISSI by planning and completing significant multivendor test sessions and public demonstrations. All major manufacturers offer some level of ISSI and Contractor has been testing ISSI interoperability with these manufacturers since 2007 when the first ISSI multivendor demo was done at APCO 2007 in Baltimore. Since that time Contractor has participated in continuing multivendor tests and demonstrations. Each demonstration or presentation event required just a couple of weeks of integration testing prior to the public events. The “couple of weeks” timeframe is credit to the completeness of the specifications and the vendor cooperation to fully support a multivendor interoperable ISSI:

- APCO 2007 Baltimore multivendor demonstration
- IWCE 2008 Las Vegas multivendor demonstration
- APCO 2009 Kansas City multivendor demonstration
- IWCE 2010 Las Vegas ISSI Multivendor Status Presentation
- IWCE 2012 Las Vegas CSSI demonstration
- Various vendor-to-vendor tests as recently as June 2014

Contractor will continue to participate in integration testing with various manufacturers to ensure interoperable products and functionality verification to the P25 specifications.
Second. Contractor fully supports the voluntary DHS P25 CAP. The DHS P25 CAP published a Compliance Assessment Bulletin for the P25 ISSI. The bulletin can be found along with the other DHS P25 CABs at:

https://www.dhs.gov/science-and-technology/bulletins

CAB titled as: *Baseline Inter-RF Sub-System Interface Testing Requirements CAB - March 2010*

Contractor notes that as of the time of the effective date of this Purchase Agreement no DHS authorized CAP laboratory has applied to be certified for testing the P25 ISSI per the *Baseline Inter-RF Sub-System Interface Testing Requirements CAB - March 2010* document. However this does not prevent manufacturers from exercising the tests detailed in the P25 ISSI CAB. Contractor also tests our ISSI offering per the *Baseline Inter-RF Sub-System Interface Testing Requirements CAB - March 2010* DHS requirements.
In summary, Contractor diligently strives to design and test our ISSI offering to all the relevant standards and requirements, internally and externally, including multivendor venues. Contractor, as a significant contributor to all the ISSI standards, demonstrates our commitment to provide an ISSI product offering that is a highly standards compliant, multivendor interoperable and robust sub-system for demonstrated intersystem connectivity per the P25 standards.

### Table 1  
**TIA-102 Standards Compliance List**

<table>
<thead>
<tr>
<th>Document</th>
<th>Publication Date</th>
<th>Title</th>
<th>RFP Compliance Response (as detailed in Table 5)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIA-102.CACA</td>
<td>Apr-07</td>
<td>Project 25 Inter-RF Subsystem Interface (ISSI) Measurement Methods for Voice Services</td>
<td>Comply</td>
<td>Details how to make measurements to validate the ISSI performance criteria in TIA-102.CACB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIA-102.CACA-1</td>
<td>Dec-08</td>
<td>Project 25 Inter-RF Subsystem Interface (ISSI) Measurement Methods for Voice Services – Addendum 1 – Trunked Console ISSI</td>
<td>Comply</td>
<td>Addendum adds console measurements to TIA-102.CACA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIA-102.CACB</td>
<td>Mar-13</td>
<td>Project 25 Inter-RF Subsystem Interface (ISSI) Performance Recommendations for Voice Services</td>
<td>Comply</td>
<td>Details the performance criteria to be obtained using the TIA-102.CACA measuremen nt methods</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIA-102.CACB-1</td>
<td>Jan-13</td>
<td>Project 25 Inter-RF Subsystem Interface (ISSI) Performance Recommendations for Voice Services – Addendum 1 – Trunked Console</td>
<td>Comply</td>
<td>Addendum adds console performance criteria to TIA-102.CACB</td>
</tr>
</tbody>
</table>

1 TIA-102/P25 documents current as of the May 2014 TIA and Project 25 meetings in Charlotte, NC
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<table>
<thead>
<tr>
<th>Document</th>
<th>Publication Date</th>
<th>Title</th>
<th>RFP Compliance Response (as detailed in Table 5)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIA-102.CACC</td>
<td>Jan-09</td>
<td>Project 25 Inter-RF Subsystem Interface (ISSI) Conformance Test Procedures</td>
<td>Comply</td>
<td>Details the conformance criteria to allow a manufacturer to self test their product to validate compliance to the message and procedure specifications</td>
</tr>
<tr>
<td>TIA-102.CACC-1</td>
<td>Aug-11</td>
<td>Project 25 Inter-RF Subsystem Interface (ISSI) Conformance Test Procedures – Addendum 1 – Supplementary Data</td>
<td>Comply</td>
<td>Addendum adds Supplementary Data elements to the TIA-102.CACC</td>
</tr>
<tr>
<td>TIA-102.CACD-B</td>
<td>Feb-13</td>
<td>Project 25 Inter-RF Subsystem Interface Interoperability Test Procedures for Trunked Systems</td>
<td>Comply</td>
<td>Details interoperability tests that manufacturers can run with each other</td>
</tr>
<tr>
<td>TIA-102.CBBK-A</td>
<td>Mar-10</td>
<td>Project 25 Recommended Compliance Assessment Tests - Trunking ISSI</td>
<td>Comply</td>
<td>P25 CAP RCAT – the subset of tests recommended to DHS for support of the P25 CAP</td>
</tr>
</tbody>
</table>

ISSI Interface Connectivity – Features and Functionality

The TIA-102/P25 ISSI standards were created with user and manufacturer input and provide recommended P25 compatible features between systems. The TIA-102/P25 standards also encompass the CSSI protocols, procedures, and associated testing criteria.
Contractor notes the TIA-102/P25 ISSI (and CSSI) standards provide standardized features, services, and functionality. In some cases, the functionality may not be entirely detailed in the standard, but the construction of the ISSI/CSSI protocol messages (and procedures) enable a manufacturer to implement the feature. As an example, console cross-muting is not entirely detailed, but the protocol contains individual console IDs and sending unit information to allow the console manufacturer the ability to manage the talk spurts to avoid duplication and provide muting of adjacent console microphones to avoid duplicate audio and feedback loops.

Table 2 has three columns delineating (1) the TIA-102/P25 ISSI/CSSI feature/functionality/service, (2) the TIA-102.XXXX standard that contains the ISSI/CSSI feature/functionality/service, and (3) Contractor’s level of support for these ISSI/CSSI features and services. Each feature or service is traceable to the current revisions of the TIA-102 specifications provided and the name/function of the feature is typically self-explanatory. Contractor notes that the TIA-102/P25 standards are dynamic and thus are at various revision levels at any given time. A revision is denoted by TIA-102.XXXX-A (or B, C, etc.) and addendums/errata are shown by TIA-XXXX-1 (or 2, 3, etc.) or TIA-XXXX-X-1 (or 2, 3, etc.).

Table 2  TIA-102/P25 ISSI Features and the ASTRO Radio Feature Support

<table>
<thead>
<tr>
<th>Trunked Inter-RF Sub-System – ISSI</th>
<th>TIA-102 Reference</th>
<th>Support/Feature Level and Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trunked Console Sub-System Interface – CSSI</td>
<td>BACC, BAGA</td>
<td></td>
</tr>
<tr>
<td>ISSI &amp; CSSI Trunked Voice &amp; Data Services</td>
<td>BACA</td>
<td>Supported</td>
</tr>
<tr>
<td>Voice Services</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full Rate Vocoder</td>
<td></td>
<td>Supported</td>
</tr>
<tr>
<td>Half Rate Vocoder</td>
<td></td>
<td>Supported – requires compatible consoles</td>
</tr>
<tr>
<td>Vocoder Native Mode</td>
<td></td>
<td>Not Supported</td>
</tr>
<tr>
<td>Voice Encryption</td>
<td></td>
<td>Supported</td>
</tr>
<tr>
<td>Group Voice Service Unconfirmed</td>
<td></td>
<td>Not Supported</td>
</tr>
<tr>
<td>Group Voice Service Confirmed</td>
<td></td>
<td>Supported as serving RFSS</td>
</tr>
<tr>
<td>Announcement Group Voice Call</td>
<td></td>
<td>Supported</td>
</tr>
<tr>
<td>Emergency Group Voice Call</td>
<td></td>
<td>Supported</td>
</tr>
<tr>
<td>Pre-emptive Emergency Group Voice Call</td>
<td></td>
<td>Supported</td>
</tr>
<tr>
<td>Group Voice Call Telephone Interconnect</td>
<td></td>
<td>Not Supported</td>
</tr>
<tr>
<td>Individual Voice Call with Availability Check</td>
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<td>Not Supported</td>
</tr>
<tr>
<td>Individual Voice Call without Availability Check</td>
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<td>Not Supported</td>
</tr>
<tr>
<td>Individual Voice Call Duplex Mode</td>
<td></td>
<td>Not Supported</td>
</tr>
<tr>
<td>Individual Voice Call Telephone Interconnect</td>
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<td>Not Supported</td>
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<tr>
<td>Packet Data Services</td>
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<tr>
<td>Unit-to-Unit Packet Data</td>
<td>BACA</td>
<td>Supported</td>
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<tr>
<td>Mobility Management Functions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit Registration</td>
<td>BACA</td>
<td>Supported</td>
</tr>
<tr>
<td>Unit Tracking</td>
<td></td>
<td>Supported</td>
</tr>
<tr>
<td>Unit Roaming</td>
<td></td>
<td>Supported</td>
</tr>
<tr>
<td>Unit Authentication</td>
<td></td>
<td>Supported</td>
</tr>
<tr>
<td>Unit Supplementary Data Management</td>
<td></td>
<td>Not Supported</td>
</tr>
<tr>
<td>Group Affiliation</td>
<td></td>
<td>Supported</td>
</tr>
<tr>
<td>Group Tracking</td>
<td></td>
<td>Supported</td>
</tr>
<tr>
<td>Group Roaming</td>
<td></td>
<td>Supported</td>
</tr>
<tr>
<td>Group Supplementary Data Management</td>
<td></td>
<td>Not Supported</td>
</tr>
<tr>
<td>RFSS Capability Polling</td>
<td>BACA</td>
<td>Not Supported</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Trunked Inter-RF Sub-System – ISSI</th>
<th>Trunked Console Sub-System Interface – CSSI</th>
<th>TIA-102 Reference</th>
<th>Support/Feature Level and Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adj System SD Capabilities, Vocoders, Encryption &amp; Roaming</td>
<td></td>
<td></td>
<td>Not Supported</td>
</tr>
<tr>
<td>Adjacent Site – Info on adjacent site on adjacent network</td>
<td></td>
<td></td>
<td>Not Supported</td>
</tr>
<tr>
<td>Supplementary Data (SD) Services</td>
<td></td>
<td>BACA, BACC, BACD</td>
<td>Supported</td>
</tr>
<tr>
<td>Emergency Alarm</td>
<td></td>
<td></td>
<td>Supported</td>
</tr>
<tr>
<td>Emergency Alarm Cancellation</td>
<td></td>
<td></td>
<td>Not Supported</td>
</tr>
<tr>
<td>Group Emergency Cancellation</td>
<td></td>
<td></td>
<td>Not Supported</td>
</tr>
<tr>
<td>Call Alert</td>
<td></td>
<td></td>
<td>Not Supported</td>
</tr>
<tr>
<td>Short Message / Pre-programmed Data Messaging</td>
<td></td>
<td></td>
<td>Not Supported</td>
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<tr>
<td>Status Update</td>
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<td>Not Supported</td>
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<tr>
<td>Radio Unit Monitor</td>
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<td>Not Supported</td>
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<tr>
<td>Radio Check</td>
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<td>Not Supported</td>
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<tr>
<td>Radio Inhibit</td>
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<td>Supported</td>
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<tr>
<td>Radio Uninhibit</td>
<td></td>
<td></td>
<td>Supported</td>
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<tr>
<td>Console Functionality</td>
<td></td>
<td></td>
<td>Supported</td>
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<tr>
<td>Console Cross Patch</td>
<td></td>
<td>BACA, BAGA</td>
<td>Supported</td>
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<tr>
<td>Console Priority</td>
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<td>Supported</td>
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<tr>
<td>Console Takeover by Another Console</td>
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<td>Supported</td>
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<tr>
<td>Console Display of Transmission Source Type</td>
<td></td>
<td></td>
<td>Supported</td>
</tr>
<tr>
<td>Console Mutes Its Speakers to Prevent Audio Feedback</td>
<td></td>
<td></td>
<td>Supported</td>
</tr>
<tr>
<td>Console Knowledge of when it is Receiving Duplicate Audio</td>
<td></td>
<td></td>
<td>Supported</td>
</tr>
</tbody>
</table>

Since the ASTRO Radio ISSI/CSSI is based on the TIA-102/P25 open standards, there are no inherent limitations imposed by the addition of the ISSI/CSSI to the Contractor’s ASTRO Radio network. For the few ISSI/CSSI features not completely supported by Contractor, VESTA Radio either provides a higher level of functionality, the feature is hampered by other critical elements outside of Contractor’s control, or the feature will be supported in the future.

### ISSI/CSSI Elements Not Currently Supported

**Vocoder Native Mode** – *Native Mode* on a call segment means the audio is left in its original format. For example, ISSI connected Master Sites have the means to send and receive Half Rate or Full Rate audio on a talk spurt by talk spurt basis. At this time due to the limited deployment of ISSI interconnected systems it is not necessary to manage multimode calls. Calls originated in the TDMA architecture to an ISSI connected system will occur in the Half Rate mode unless the ISSI interconnected Master Site does not support Half Rate vocoders, in which case the call will proceed as a Full Rate Vocoder mode (i.e., Phase 1 FDMA). As ISSI deployments expand in the future Contractor will consider offering Native Mode driven by Counties’ requirements.

**Group Voice Service Confirmed** – ASTRO Radio manages our network backbone and RF architecture to ensure resources are tracked and allocated on priority basis to ensure connectivity and service availability. ASTRO Radio’s enhanced use of queuing and priorities provides superior system resource allocation. Confirmed calls can hang network resources waiting for all invited units to become available. Thus at this time ASTRO Radio supports a confirmed call via the ISSI when ASTRO Radio is a Serving (i.e., visited) system, but not when ASTRO Radio is the Home system.
ISSI Individual Voice Call Without Availability Check – Individual voice calls without availability check is intended to lower call setup latency. Contractor’s distributed network architecture implementation continuously tracks all subscribers and provides the lowest possible latency. Elimination of availability check does not speed up the call processing in Contractor’s network.

ISSI Individual Voice Call Duplex Mode – In the case of full duplex calls, there is no availability of open standard full duplex subscriber units to implement the duplex feature over the ISSI.

Individual ISSI Supplementary Services Management – The standards provide for configuration of individual supplementary data features to each user/talk group. At this time ASTRO Radio automatically registers all users for all ISSI Supplementary Data features. As ISSI deployments expand in the future Contractor will consider offering Supplementary Data feature registration in the future driven by Counties’ needs.

Master Site Capability Polling for Adjacent System Supplementary Data (SD) Capabilities; Vocoder, Encryption, & Roaming – The standards provide for a system to poll the ISSI connected/adjacent system for its ability to support various SD capabilities (see the list in Table 2), multiple vocoders, and automatic roaming of subscribers. At this time the ASTRO Radio ISSI function does not consider these elements as many decisions must be made in advance by different jurisdictions to interconnect via the ISSI. Thus the capabilities of each System are well understood in advance and thus the capabilities are taken into account in setting up the ISSI between the two Systems. As noted in Table 2, the important information of adjacent sites in a neighboring system is requested and conveyed by the ASTRO Radio Master Site in response to the capabilities polling messages to ensure subscriber units that roam across the neighboring systems boundary are informed of the appropriate site and system parameters to transition from one system to the other.

Contractor’s ISSI/CSSI Solution

The ASTRO ISSI functionality is furnished through the ISSI gateway, a server contained within the Master Site.

The System is licensed for 10 ISSI connections to other systems and licensed for the capability to connect to 10 talkgroups per system.

- ASTROMaster SiteMaster SiteMaster SiteMaster SiteMaster SiteMaster SiteMaster SiteMaster SiteMaster SiteMaster Site

4.10.2.2 Shared Network Core

The Master Site System Controller is capable of accepting neighboring systems for integration into the System. These systems can be in the form of simulcast cells consisting of multiple sites or multicast sites outside of a simulcast cell. As other systems are added, users in each added system would benefit from the ability to wide-area trunk in the added system and between all sites in this new regional network. Each additional Agency would have its own login for the Master Site System Controller and would be restricted to tactical administration of their own subscriber units and talkgroups.
4.10.3 Interoperability with the FIN

Contractor is providing eight (8) four-wire interfaces to Sarasota County FIN resources and four (4) four-wire interfaces for Manatee County FIN resources. This will allow the console subsystem to communicate directly with the FIN interfaces, listed in sections 4.10.4 and 7.5.6.

4.10.4 7.5.6 Conventional Analog Channel Interface

A conventional gateway shall be incorporated into the System that will interface with the conventional base stations/Repeaters. The console system shall support conventional analog interfaces to facilitate communications interoperability with a variety of outside agencies and interface technologies. The gateway shall support various radio channel interfaces and shall be capable of 2-wire and 4-wire audio and tone and E&M for local control of radio channels and provide local control for analog resources such as control station radios and the FIN interface.

The console system shall be equipped to enable these conventional resources to be patched to trunked talkgroups and other Conventional Channel resources.

Refer to Exhibit E – System Description and specifically the Sarasota – Manatee System Description which details the quantities of conventional interfaces included as specified by Contractor.

7.5.6.1 Refer to Exhibit E – System Description and specifically the Sarasota – Manatee System Description which details the quantities of conventional interfaces included as specified by Contractor.

7.5.6.2 Using the Motorola Conventional Channel Gateway (CCGW). A dispatcher will select a resource window on their console position to connect with the desired FIN resource which will allow the dispatcher to PTT or receive audio. The FIN resources that will be connected to the console system will include:

- FL-LE-1
- FL-LE-2
- FL-LE-3
- FL-LE-4
- FL-PS-1
- FL-PS-2
- FL-PS-3
- FL-PS-4

Contractor’s MCC7500 Console system supports the cross-patching of radio resources regardless of what frequency band is involved.
4.10.4 Interoperability with Legacy and Conventional Systems

The Counties’ mutual aid and legacy radio systems are interfaced into the console system via radio over CCGWs. Each talkpath on the CCGW can be patched to an ASTRO Radio P25 talkgroup.

- For Interoperability with the Legacy Sarasota SmartZone System, Contractor proposes to deploy an Interim Motorola Gold Elite Console Sub-System to support fifteen (15) Gold Elite Consoles interfaced to the Sarasota Legacy SmartZone Radio System. Note that this is refurbished equipment. This Interim Solution will emulate the Legacy Gold Elite Consoles.

Interoperability with the legacy Manatee EDACS Radio System is accomplished in a similar fashion except that instead of interfacing to SmartZone Radios the CCGW will interface to Manatee provided Harris M7300 EDACS Radios. This supports an over-the-air interface to the legacy Manatee EDACS System. Interfaces to more legacy talkgroups can be provided to the Counties during the transition if needed.

4.11 Conventional Mutual

Contractor’s ASTRO Radio, combined with the MCC7500 Consoles, supports shared talkgroups between the Sarasota and Manatee Simulcast Cells, and FIN Channels that can be cross-patched as needed.

4.11.1 Mutual Aid Infrastructure

4.11.1.1 Sarasota

Contractor shall deploy new GTR8000 800 MHz Base Stations at six (6) tower sites listed below. At the console position, each of these sites will have their own resource window to differentiate amongst the sites. 8CALL90, 8TAC92, 8TAC93 and 8TAC94 are not being deployed as a Simulcast System:

EOC (8CALL90 and 8TAC92)
- 12th Street (8CALL90, 8TAC92, 8TAC93)
- Englewood (8CALL90 and 8TAC92)
- Hi Hat (8CALL90 and 8TAC92)
- North Port (8CALL90, 8TAC92, 8TAC93)
- Osprey (8CALL90,8TAC92, 8TAC94)
- Toledo Blade (8CALL90 and 8TAC92)
- Venice (8CALL90 and 8TAC92)
- Vo-Tech (8CALL90 and 8TAC92)

Sarasota Legacy Conventional Channels

Contractor shall deploy Conventional Channel Gateways to interface to Sarasota legacy channels at the following sites:
- EOC (Med 8, Forestry, Charlotte County, SLERS)
800 MHz Emergency Communications Systems
For Sarasota and Manatee Counties
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Exhibit A – Scope of Work

4.11.1.2 Manatee

Manatee operates a conventional mutual aid system using the NPSPAC Mutual Aid Calling Channel, 8CALL90, 8TAC91, and 8TAC92. These channels are licensed under Call Sign WQCS935 and deployed in a multisite configuration at the following Manatee tower sites:

MAIN - 8CALL90, 8TAC91, 8TAC92
PSC - 8CALL90, 8TAC91, 8TAC92
EAST - 8CALL90, 8TAC91, MAFLA
DUETTE - 8CALL90, 8TAC92
MYAKKA - 8CALL90, 8TAC93

Manatee intends to retain the existing configuration and equipment for the new P25 system.

The existing conventional equipment can be integrated into the P25 system by the use of the CCGW which can support either four (4) or eight (8) radios per CCGW through the use of a two-wire or four-wire interface. The CCGWs will be provisioned at each the radio sites listed above and connect to the console system using a network interface on the CCGW.

- EOC (11 channels)
- Duette (8CALL90, 8TAC92)
- East (FD-EAST, MED-8, MA-FLA, 8CALL90, 8TAC92)
- Main (FD-WEST, MARINE, BFD-VHF)
- Myakka (8CALL90, 8TAC92)

4.11.2 Mutual Aid Channels for Subscriber Units

At a minimum, all subscriber units shall be programmed to contain the following mutual aid channels and talk-around:

- Five NPSPAC National Mutual Aid conventional repeated channels
  - 8CALL90
  - 8TAC91
  - 8TAC92
  - 8TAC93
  - 8TAC94
  - MAFLA (Florida Mutual Aid)

- Five TAC Mutual Aid channels for operation in the talk-around mode
  - 8CALL90D
  - 8TAC91D
  - 8TAC92D
  - 8TAC93D
  - 8TAC94D
  - MAFLA (Florida Mutual Aid)

- All of the 700 MHz designated mutual aid interoperability channels
4.12 Network Core and Simulcast Control Point

It is the intent of the Counties that the Network Core and Simulcast Control Point equipment shall be constructed in a manner to maximize redundancy and leverage the regional design of the communications system. The Contractor shall provide the Network Core and trunking control equipment in a redundant / geo-redundant manner wherever possible.

Geographically redundant trunking control equipment is required such that the redundant controller would maintain the simulcast trunking communications in the event of the loss of the primary trunking controller.

The Contractor shall provide Network Core and Simulcast Control Point redundancy. The equipment shall be mounted in freestanding equipment racks or equipment cabinets, and shall be provided in a fault tolerant configuration with redundant components, including power supplies.

The ASTRO Radio system solution design supports total redundancy of system control equipment in the case of a catastrophic loss of one of the host controller sites. The nature of IP networks is such that any site is reachable from any other site via the Backhaul network and the implementation of multicast IP.

Two zone controllers are located at the Sarasota County primary control point located at the EOC building, with two zone controllers located at the Manatee County PSC control point in a geo-redundant configuration, connected via the Backhaul network creating a robust and resilient system.

This configuration produces public safety grade geographic redundancy for the system and automatic restoration of service in case of any failure without manual intervention.

The Sarasota prime site simulcast cell controllers are located at the EOC and Manatee PSC sites. The Manatee prime site simulcast cell controllers are located at the Manatee PSC and Sarasota EOC sites.

The databases are continually updated across all of the zone controllers. This ensures synchronization of all databases.

A heartbeat message is passed between the two redundant controllers to test the availability of the other controller. If a heartbeat is not received, the controller configured as the redundant sends a ping to the arbiter router to confirm the accessibility of the primary controller in the network. If the ping to the arbiter is successful, the redundant controller assumes the primary controller is failing and proceeds to become the active controller. The switch over will take less than 30 seconds for the zone controller once the primary zone controller is not available. For the Simulcast Controller the switchover takes less than 20 seconds once the primary Simulcast Controller becomes unresponsive.

Note that for the 12th Street site which contains the four-channel multicast site for aircraft communications, the redundant Site Controllers are both located at this site due to fact that the four Repeaters that they control are only at this location.

The zone controller and Simulcast Site Controller application resides on HP DL380 servers. These servers have been extensively tested in Contractor’s System Integration Test lab to ensure compatibility with these applications. The HP Servers are fitted with dual redundant hot swappable hard drives and AC power supplies. The HP DL380 also has two Ethernet ports to support the LAN switches configured for redundancy.
4.13 Dispatch Consoles and Locations

The MCC7500 Console system is fully compatible and integrated into the ASTRO25 system.

4.13.1 Sarasota Dispatch Console System

All new dispatch consoles will be located at the Sarasota EOC building at 6050 Porter Way, Sarasota, FL. Sarasota requires fifteen (15) new IP based P25 dispatch console positions in the EOC.

In addition, four (4) additional IP based P25 dispatch console operator positions are required for the City of North Port.

The Contractor shall provide a console solution for operations at the Sarasota County EOC for both the existing Smartzone system and the new P25 System as required. This requirement assumes the P25 System will not be operational by June 1, 2015, and will require an interim dispatch solution.

4.13.2 The City of North Port

The City of North Port requires four (4) new IP based P25 dispatch console positions at 4980 City Hall Blvd., North Port, FL 34286 location.

4.13.3 Manatee Dispatch Console System

All new dispatch consoles will be located in the PSC building, ECC and MCSO dispatch centers at 2101 47th Terrace East, Bradenton, FL.

Manatee requires a total of nineteen (19) new IP based P25 dispatch console operator positions consisting of eight (8) consoles in the ECC dispatch center, ten (10) consoles for the MCSO dispatch center, and one (1) console for the radio system control point / equipment room.

4.13.4 City of Bradenton

The City of Bradenton requires three (3) new IP based P25 dispatch console positions at the Bradenton PD location, 100 10th Street, West Bradenton, FL.

4.13.5 Manatee County Jail (Previously City of Holmes Beach)

The City of Holmes Beach requires one (1) new IP based P25 dispatch console position.

The Manatee County Jail MCC7500 Console will be deployed at the Manatee PSC as requested by Manatee County.

4.14 Network Monitoring and Control System

An integrated Network Monitoring and Control System (NMCS) shall be provided to configure system parameters, monitor system activity, and generate system reports, and to monitor all critical systems and site status alarms. Network management terminals providing access to the NMCS shall be provided at the following locations:

Sarasota:
EOC 6050 Porter Way Sarasota, FL
Sarasota Sheriff 425 Old Venice Road Osprey, FL

Manatee:
Radio Shop 1801 5th Street West, Bradenton, FL
Radio Network Operations Center (NOC) 2101 47th Terrace East, Bradenton, FL
The Network Management Client Workstation provides access to the ASTRO25 Radio System suite of network management applications – Unified Network Configuration (UNC), Provisioning Manager (PM), Zone Watch and Historical Report. The Unified Event Manager (UEM) furnished fault management capability using Simple Network Management Protocol (SNMP). These applications perform:

- Radio network configuration
- Supervision and maintenance
- Agency, subscriber and group management

The applications collect data for a number of system activities, including group call, unit call, subscriber and console registrations and affiliations, history reports, etc. This data is correlated on a centralized server for review by network managers and can be exported in the form of spreadsheets. In addition to the reporting capability the applications also provide the ability to view P25 system activity, channel activity and summary status in real-time.

The SNMP server provides ASTRO Radio equipment monitoring (RF Repeaters and controller status), and failure detection for System operations via a Web based interface. The SNMP server also monitors non-ASTRO Radio specific equipment at all sites, such as routers, switches, console system, recording system, site alarms and other IP-connected equipment. The SNMP server provides graphical displays of current system status as well as provides a means to view historical events and alarms. The SNMP server will also forward SNMP traps, both of monitored equipment and internally generated traps based upon detected events, to the Contractor's System Support Center that provides the first level fault detection.

Each of the radio sites and the control points contains an alarm aggregator that provides the capability to remotely monitor the environmental condition of each site as well as non-network connected equipment (e.g. generator, UPS, transfer switches, fire detection, door sensors) that provide closed contact outputs for monitoring. Upon detection of a fault condition, the alarm aggregator generates a SNMP trap that is sent to the SNMP Server.

Due to the IP based nature of the network, any IP based computer equipped with the Network Management Client application can access these resources from the P25 IP network, provided the user has the proper login credentials for each service.

The Network Management Client originally identified for the Sarasota Sheriff site is now being installed at 1301 Cattleman Drive, Building C, Sarasota County, FL.
4.15 Fleet Mapping

Contractor's ASTRO Radio system, with its open system architecture, offers users the choice of end-user products (e.g. subscriber radios, consoles and recorders). APCO Project 25 provides a basic level of testing through the CAP. Contractor goes above and beyond CAP testing with our internal Interoperability Testing (IOT) that tests the behavior of a radio on a Contractor ASTRO Radio system.

As part of the fleetmapping maintenance process, an inventory of field subscriber units (FSU) will be maintained. Within this inventory, details such as firmware version, hardware version and code plug version will be logged. These details are needed to ensure conformance with Contractor testing parameter configurations. It is the responsibility of the Counties to upgrade the field subscriber firmware and hardware to the respective versions of the testing configuration.

Note that some field subscribers may not be upgradeable as required. In that event Sarasota and Manatee Counties are solely responsible for the supply and delivery of Replacement field subscriber Units with the appropriate Firmware and Hardware Versions. Contractor will be responsible for the programming of these replacement FSUs as per this section.

For details on the Radio Programming, Refer to Exhibit G - Project Management Plan, Implementation Schedule and Cutover Plan.

4.16 Trunked System Functional Requirements

4.16.1 Digital Voice Encryption

The System shall provide end-to-end digital voice encryption for all dispatch consoles and for specific subscriber equipment as specified. The encryption shall be the Advanced Encryption Standard 256 (AES256).

The loading of encryption keys for subscriber equipment shall be via a manual key loader and over-the-air-rekeying (OTAR).

4.16.2 P25 Data

The System shall be equipped to provide P25 data service to support data communications with subscriber equipment for features such as over-the-air-rekeying OTAR, over-the-air-programming (OTAP), and other features that require P25 data communications.

4.16.3 Over-the-Air Programming (Optional Purchase)

The Counties are interested in programming subscriber radio code plugs “Over-the-Air” (OTAP) to reduce the amount of time and effort required in making changes to the radio fleet in the event of system changes or expansions.

Over-the-Air Programming (OTAP) relies on Packet Data Service (PDS) to transport updated programming configuration for the subscriber units. In the absence of approved standards, OTAP operation is dependent upon each radio manufacturer for features and capabilities. The ASTRO Radio network provides the PDS to support the interconnection of a manufacturer’s OTAP server to mobile and portable radios.
If using Tait subscriber units, Tait offers Enable Fleet as a complete database manager for OTAP.

The 9400 series of radios are the very latest offering from Tait, supporting all mandatory P25 features and is constantly being upgraded with new features to meet customer requirements. At first release it will not fully support OTAP.

Tait is in the process of developing this feature in the radios along with a server based application that manages the programming of the radios over the Network. Tait and Contractor are cooperatively working to implement this feature in subscriber radios in a future software release. At first release this will allow configuration and Software Feature Enabler Keys (SFE’s) changes over the air interface. Firmware upgrades occur through the programming cable (due to the relative size of the data being transferred and the narrowband channel of 12.5 kHz).

This is an optional feature of the Scope of Services and applies to Contractor-provided equipment only. Additionally, it requires the purchase of a SFE in each of the radios requiring this operation, as well as the server to manage the application.

4.16.4 Over-the-Air Re-Keying

The System shall be capable of Over-The-Air-Rekeying (OTAR) of the encryption algorithms.

Project 25 OTAR Protocol (TIA-102.AACA) provides interoperability with P25 Compliant OTAR systems. Interoperability with Motorola and Harris OTAR systems has been verified.

P25 OTAR relies on to the ASTRO Radio, PDS to transport new or updated encryption keys over the air to P25 encryption-capable radios. OTAR uses a Key Management Facility (KMF) server for management and deployment of the encryption keys. The ASTRO Radio network provides the PDS infrastructure to interconnect a KMF to radios, consoles and recorders that are compliant to the P25 OTAR interface.

OTAR is managed centrally using separate Web interfaces. All OTAR operations are scheduled by the Counties and the user interface displays information on devices that have their encryption keys up to date and those that are not up to date. In the same way the configuration of the fleet is managed centrally. Once devices are updated, the status of those terminals is displayed in the management interface.
4.16.5 GPS

The System shall be equipped to provide GPS position data from the GPS equipped subscriber radios via the P25 data channel. Contractor’s pricing includes all required System hardware and software to support the transmission of GPS positioning data.

The Contractor’s GPS Location Services functionality provides Sarasota and Manatee Counties with the ability to securely track and store GPS data information from subscriber units, and then pass that data to each County’s mapping application of choice via the GPS Location Service API.

The Contractor’s GPS Location Service consists of the following elements:

- Mobile Data Gateway
- Encrypted interface for collection of GPS data from subscriber units
- GPS Location Server
- The database for the storage of collected subscriber GPS data
- The user interface for the Dispatch Console Operator
- The API for Sarasota and Manatee Counties’ CAD

GPS data is transferred to the ASTRO Radio system Intelligent Middleware Server (IMW) via the system’s P25 compliant PDS. IMW then passes the data on to the CompassTrac location server.

Dispatchers will be enabled to poll individual radios in order to update the radio’s position on the CompassTrac map. System administrators can adjust the rate of GPS updates via the CompassTrac web interface based on elapsed time and distance travelled.

4.16.6 Common System Features and Services

The System shall provide public safety features and services based upon the most current P25 Standard, and shall provide the following functions and services at a minimum:

- Affiliation
- Announcement Group Call
- Broadcast Voice Call
- Busy Queuing and Call Back
- Call Alert
- Call Interrupt
- Call Restriction
- Call Routing
- Channel Marker
- Continuous Assignment Updating
- Discreet Listening
- Dynamic Regrouping
- Emergency Call
- Encryption
- Group Voice Call
- Individual Voice Call
4.17 System Reliability, Redundancy, and Backup Requirements

4.17.1 Single Point Failure Modes

The System shall be designed to prevent the loss of trunked communications due to any single point failure within the System. The System shall provide a failure mode matrix identifying the failed component, the resulting System failure, and a description of what functionality is lost in the System.

The tables below describe the impact to the System, and its responses, for each major component of the ASTRO Radio system proposed to Sarasota and Manatee Counties. For each component, the failure type, impact to subscriber, recovery method and notifications are described.
Radio Network Failure Modes

**Scenario:** Failure of Zone Controller at the Master Site

**Result:** The proposed service provides redundant zone controllers at each master site. As shown above, failure of the active zone controller “A” at the master site results in an automatic switchover to the redundant zone controller “B”. During the transition between the primary and backup zone controllers, the repeater sites and simulcast cells are in site trunking. During the transition, dispatch operators revert to operating on control stations that are selected from the console. In a matter of seconds following the switch to the backup zone controller, the sites return to wide-area operation. The zone controllers have redundant power supplies as a standard feature, which help keep the controllers operational in case of a failure of that component. The redundant controller is regularly updated with all pieces of critical information, so that, if it needs to become the active controller, the current system configuration and operational characteristics are maintained.

**Protection:** Redundant Zone Controllers at the Master Site

**Detection:** Alarm on NMS Terminal

**Impact to User:** None
Exhibit A – Scope of Work
800 MHz Emergency Communications Systems
For Sarasota and Manatee Counties
RFP 142842TM

**Scenario:** Failure of Master Site Core LAN Switch

**Result:** The proposed Service employs dual LANs to create multiple IF pathways to critical call processing components. The dual LANs are deployed on two physical Ethernet switches at the core sites. Failure of one Ethernet switch on the active master site (Core LAN Switch 1) forces critical traffic to the alternate path (Core LAN Switch 2). The entire system remains in the wide area trunking mode. The failure is transparent to all system users.

**Protection:** Redundant LAN Switches at the Master Site

**Detection:** Alarm on NMS Terminal

**Impact to User:** None

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*Failure of Master Site Core LAN Switch*
**Scenario:** Failure of Master Site Core Router / Gateway Router / Exit Router

**Result:** The master site configuration for the service consists of redundant routers. The routers are configured so that all RF cells and dispatch centers are connected to both routers. Failure of one router at the active core site results in an automatic switchover to the redundant router. The entire system remains in wide area operation. The failure is transparent to all system users.

**Protection:** Redundant Routers, Spare Routers, Redundant Site Links

**Detection:** Alarm on NMS Terminal

**Impact to User:** None
Exhibit A – Scope of Work
800 MHz Emergency Communications Systems
For Sarasota and Manatee Counties
RFP 142842TM

Failure of Master Site Core Router

Scenario: Loss of Primary Wide Area Controller Site

Result: The proposed service offers a redundant wide area controller site system configuration, called Dynamic System Resiliency (DSR). In a DSR system, there are two wide area controller sites; a primary and backup. Both cores are live on the system. Failure of the key components at the active wide area controller site results in the automatic switchover of control to the backup wide area controller site. During a switchover, all RF and dispatch sites automatically switch to their backup master site.

As the switchover process takes place, the system temporarily enters the site trunking mode. Wide area trunking is restored when the switchover process is complete (typically less than 30 seconds). All calls generated after automatic switchover to the backup wide area controller will not observe any change of service.

Dispatchers must operate via backup control stations when in site trunking mode. There are no operational changes for field users or dispatchers.

Protection: Redundant Wide Area Controller Site

Detection: Alarm on Network Management Terminal (NEM)

Impact to User: Momentary switch to Site Trunking mode (typically less than 30 seconds)

Failure of Wide Area Controller at the Primary Master Site
Exhibit A – Scope of Work
800 MHz Emergency Communications Systems
For Sarasota and Manatee Counties
RFP 142842TM

Scenario: Failure of Network Management Servers

Result: The network management subsystem is made up of ruggedized servers and other components to form the Private Radio Network Management (PRNM) Suite. The failure of any specific server on the LAN will result in loss of the management function associated with that server. In the proposed DSR system, the network management functionality can be accomplished from the backup master site. Failure of the network management servers does not affect the wide area trunking operation of the system. The failure is transparent to all radio and console users.

Protection: Distributed computing network with independent processes at both primary and backup wide area master sites, redundant AC power supplies, redundant disk drives, and spare components for servers.

Impact to User: None

Failure of Network Management Servers

Scenario: Failure of the Simulcast Prime Site Controller at Prime Site

Result: The proposed service includes redundant simulcast prime site controllers (GCP 8000) at the simulcast prime site. Failure of the active controller results in an automatic switchover to the redundant controller. The system remains in the simulcast wide area trunking mode from the prime site. The failure is transparent to all voice system users. Console operation remains unaffected.

Protection: Redundant Prime Simulcast Controllers, Spare Controller Modules

Detection: Alarm on NMS Terminal

Impact to User: None

Failure of Simulcast Prime Site Controller at Prime Site
Connections to Master Sites

Scenario: Failure of Simulcast Comparator at Simulcast Prime Site

Result: Failure of a simulcast comparator will result in that channel being taken out of service. No other channels are affected. Subscriber units normal wide area operation is not affected.

Protection: Spare Comparator Modules

Detection: Alarm on NMS Terminal

Impact to User: None

Failure of Simulcast Comparator at Simulcast Prime Site
Connections to Master Sites

Connections to Simulcast Subsites

**Scenario:** Failure of Simulcast Prime Site Gateway

**Result:** If the primary site gateway to the master site fails, the secondary prime site gateway takes over. The switchover is automatic. The failure is transparent to all system users.

**Protection:** Redundant Simulcast Prime Site Gateway

**Detection:** Alarm on NMS Terminal

**Impact to User:** None

**Failure of Simulcast Prime Site Gateway to Master Site**
Failure of Simulcast Prime Site Ethernet Switch

Scenario: Failure of Simulcast Prime Site Ethernet Switch

Result: Failure of the simulcast prime site Ethernet switch results in an automatic switchover to the redundant Ethernet switch. The entire system remains in the simulcast wide area trunking mode. The failure is transparent to all system users.

Protection: Redundant Prime Site Ethernet Switch

Detection: Alarm on Manager Terminal

Impact to User: None

Failure of Simulcast Prime Site Reference (GPS)

Scenario: Failure of Simulcast Prime Site Reference (GPS)

Result: If the site reference fails, the controllers and comparators continue to run on the internal reference. The site reference package includes two antennas, GPS receivers, oscillators, and power supplies. The failure is transparent to all system users.

Protection: Redundant Primary Site Reference, Internal Site Reference

Detection: Alarm on NMS Terminal

Impact to User: None
Connections to Master Sites

Connections to Simulcast Subsites

Scenario: Failure of Simulcast Sub Site Gateway to Remote Sites

Result: If the primary prime site subsite access gateway to the remote simulcast sites fails, the redundant subsite access gateway will take over. The switchover is automatic. The failure is transparent to all system users.

Protection: Redundant Simulcast Sub Site Gateway

Detection: Alarm on NMS Terminal

Impact to User: None

Failure of Simulcast Prime Subsite Access Gateway to Remote Sites
**Scenario:** Failure of Simulcast Remote/Multisite Site Main Gateway

**Result:** The service employs redundant remote site gateway routers. Failure of one site gateway at a remote simulcast site results in an automatic switchover to the redundant gateway. The entire system remains in the simulcast mode. The failure is transparent to all system users. For a trunked repeater site, the same redundancy protection applies. In the event that both the main and backup simulcast remote site gateways fail, the failed remote site is removed from the simulcast cell, and the remaining simulcast remote sites within that cell remain unaffected. Coverage from that site is not available, possibly reducing the coverage footprint. Network management alarms and software download capability is lost for the remote site. All other remote simulcast sites within the cell have network management alarming capability. A trunked repeater site operates in site trunking mode if both gateways fail.

**Protection:** Standby Simulcast Remote Site Router

**Detection:** Alarm on Manager Terminal

**Impact to User:** None
Exhibit A – Scope of Work
800 MHz Emergency Communications Systems
For Sarasota and Manatee Counties
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Scenario: Failure of Simulcast Remote/Multisite Site Ethernet LAN Switch

Result: Failure of the primary simulcast remote site Ethernet switch results in an automatic switchover to the redundant Ethernet switch. The entire system remains in the simulcast trunking mode. The failure is transparent to all system users. In the rare event that both LAN switches fail, the system removes the site from simulcast operation. A trunked repeater site is also removed if both Ethernet switches fail.

Protection: Redundant Simulcast Remote Site Ethernet switch

Detection: Alarm on Manager Terminal

Impact to User: None

Failure of Simulcast Remote/Multisite Site Ethernet LAN Switch
Scenario: Failure of a Single Control Channel or Voice Channel

Result: The proposed trunking system provides up to four possible control channels in a simulcast cell or Project 25 repeater site. If the currently active control channel fails, another channel automatically takes over and the failed control channel is automatically taken out of service. All other channels within the simulcast cell/repeater site remain unaffected. The simulcast cell remains in the wide-area trunking mode. The failure is transparent to all system users. Dispatch console operation remains unaffected. In a trunking system, multiple channels inherently provide redundancy for both simulcast remote sites and trunked repeater sites. The failure of one voice channel is transparent to all system users. The failure of a voice channel base station results in the zone controller removing that channel from service, resulting in some reduced channel capacity. Any calls in progress on the failed channel will be lost, and on the next push-to-talk, radio traffic will be restored on another channel. All other channels in the simulcast cell/repeater site remain unaffected. The entire system remains in the wide area trunking mode. Dispatch console operation remains unaffected.

Protection: Multiple potential control channels

Detection: Alarm on NMS Terminal

Impact to User: None
Dispatch Failure Modes

Scenario: Failure of a Single Dispatch Operator Position

Result: The failure of a dispatch operator position results in that particular dispatcher moving to another operator position or reverting to a fallback control station or portable radio. All other dispatch terminals operate normally and remain unaffected. The entire system remains in the wide area trunking mode.

Protection: Multiple Consoles, Backup Control Stations

Detection: Console User Detection, Console Diagnostics

Impact to User: None to SU. Dispatch operator would need to move to alternate position.

Failure of a Single Console Position
Exhibit A – Scope of Work
800 MHz Emergency Communications Systems
For Sarasota and Manatee Counties
RFP 142842TM

Scenario: Failure of a Dispatch Center Ethernet LAN Switch.

Result: The proposed service console has computers with dual Ethernet connectivity and dual Ethernet switches that connect the operator positions to the network. If an Ethernet switch fails, the backup Ethernet switch takes over.

Protection: Dual Network Connections in Computers, Dual Ethernet Switches, Spare Ethernet Switches, Backup Control Stations

Detection: Console user detection, console diagnostics

Impact to User: None

Failure of Ethernet LAN Switch at Dispatch Center
**Exhibit A – Scope of Work**

800 MHz Emergency Communications Systems

For Sarasota and Manatee Counties

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**Scenario:** Failure of Console Network Site Router

**Result:** The service employs redundant dispatch center site routers. Failure of one site router at a dispatch site result in an automatic switchover to the redundant router. The entire system remains in the wide trunking mode. The failure is transparent to all system users. In the unlikely event that both site routers should fail (or both site links fail) trunking operations would continue via backup RF control stations connected to the console dispatch position. Conventional system communications are unaffected and continue through conventional stations connected to the local console network LAN.

**Protection:** Standby Site Router, Spare Site Router, Backup RF Trunked Control Stations

**Detection:** Alarm on Network Management Terminal (UEM)

**Impact to User:** None for single failure

---

*Failure of Console Network Router*
4.17.2 Network Core and Simulcast Control Point Redundancy

The ASTRO Radio system solution design supports total redundancy of system control equipment in the case of a catastrophic loss of one of the host controller sites. The nature of IP networks is such that any site is reachable from any other site via the Backhaul network and the implementation of multicast IP.

The redundant zone controllers are located at the Sarasota County EOC building and the Manatee County PSC control point, connected via the Backhaul network.

The Sarasota simulcast cell controllers are located at the new EOC and Manatee PSC sites. The Manatee simulcast cell controllers are located at the Manatee PSC and Sarasota EOC sites.

The SNMP Manager will collect SNMP traps from the controllers for the detection of a failure condition including a controller switch over. In addition, the SNMP Manager provides for SNMP monitoring of the controllers to detect and alarm on an unresponsive controller condition.

4.17.3 Simulcast Site Failure

In the event of the failure of one or more simulcast sites, the remaining simulcast sites shall maintain full operation.

Please refer to failure scenarios in section 4.17.1.

4.17.4 Simulcast Base Station Failure

Should a single base station fail, the site shall continue to operate in the trunked mode.

4.17.5 Dispatch Console System Failure

In the event of the failure of one or more console dispatch operator positions, the remaining dispatch console operator positions shall maintain full operation.

If one or more console dispatch operator positions fails, the remaining dispatch console operator positions will maintain full operation.

4.17.6 Infrastructure Power Systems Failure

In the event of the failure of commercial power, the trunked system infrastructure and dispatch consoles shall be powered by a suitable uninterruptible power source of sufficient capacity to maintain full operation of the equipment during transition to the backup power generator system.
4.17.7 Catastrophic System Failure

Should the trunked radio system fail to the point that wide area simulcast trunking can no longer be maintained, then the trunking system shall revert to what is commonly known as a "failsoft" mode of operation.

In failsoft mode, the Repeater switches to a conventional mode of operation. Each of the simulcast channel groups can operate as an independent failsoft channel. Users can make and receive group calls on the same frequency pair as the channel group but using a Conventional Channel definition instead of the trunking talk group they used previously. Failsoft messages continue even when the channel is transmitting voice since the messages are interleaved with the digitized voice.

Backup control stations are used to maintain over the air communications during a failsoft condition.

When trunking operation is restored, the Repeater ceases to be in failsoft mode, and SUs may switch to normal trunking operation.

Note that conventional signaling blocks are not supported, which means features such as status messaging will not work in failsoft mode.

If multiple agencies share a failsoft frequency, the users hear each others' conversations during failsoft. No trunked features are preserved in failsoft - it is simply push to talk, release to listen. Subscriber units can be configured to select different failsoft channels during failsoft operation by selecting a different talkgroup.

4.17.8 Control Channel Reliability

In the event that the control channel fails, the failure shall be detected and one of the remaining stations shall be automatically assigned to transmit the control signaling. By December of 2016, the System shall monitor and detect the presence of illegal carriers on the control channel. If an illegal carrier is detected, the System shall switch to an alternate control channel.

Illegal carrier detection is a standard feature in ASTRO systems.
5. Radio Coverage Requirements

5.1 General Requirements

For public safety systems, it is recommended that communication systems be designed to achieve a service area reliability of 97% for portable radios operating outdoors, and 95% for portable radios operating within buildings with a Delivered Audio Quality (DAQ) of 3.4.

All references to coverage reliability in this document cover service area reliability. The Contractor shall provide the guaranteed BAPC indicated on its coverage maps meeting the service area reliability requirements for all defined service areas and polygons in this Scope of Services.

See the Exhibit H – Coverage Description and Contract Maps.

5.2 Radio Coverage Definition

Radio coverage is defined as the ability to successfully complete inbound, (field-to-dispatch) outbound, (dispatch-to-field) and radio-to-radio communications throughout the designated service area, while stationary or in motion, with the required delivered audio quality (DAQ) and the specified level of reliability.

In the TIA/EIA Technical Service Bulletin TSB-88, the Telecommunications Industry Association (TIA) defines the delivered audio quality (DAQ), which is a numeric rating of the intelligibility of speech. Contractor has submitted, recorded audio samples of digital voice messages for the following DAQ levels:

See the Attachments window of the submitted Project Approach PDF file for the audio samples as listed in Table 3.

Table 3 DAQ Audio Quality Sample Files

<table>
<thead>
<tr>
<th>Delivered Audio Quality</th>
<th>Subjective Performance Description</th>
<th>File Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAQ 5.0</td>
<td>Speech easily understood.</td>
<td>DAQ 5.wav</td>
</tr>
<tr>
<td>DAQ 4.0</td>
<td>Speech easily understood. Occasional Noise/Distortion.</td>
<td>DAQ 4.wav</td>
</tr>
<tr>
<td>DAQ 3.4</td>
<td>Speech understandable with repetition only rarely required. Some Noise/Distortion.</td>
<td>DAQ 3.4.wav</td>
</tr>
<tr>
<td>DAQ 3.0</td>
<td>Speech understandable with slight effort. Occasional repetition required due to Noise/Distortion.</td>
<td>DAQ 3.wav</td>
</tr>
<tr>
<td>DAQ 2.0</td>
<td>Understandable with considerable effort. Frequent repetition due to Noise/Distortion.</td>
<td>DAQ 2.wav</td>
</tr>
</tbody>
</table>

5.3 Radio Coverage Requirements

5.3.1 Radio System Service Area

The individual and combined jurisdictional boundaries of Sarasota and Manatee Counties, and the In-Building Coverage contours provided in this Purchase Agreement shall define the required portable subscriber radio based coverage requirements for the System.

See the Exhibit H – Coverage Description and Contract Maps.
5.3.2 User Radio Configuration

For purposes of defining radio coverage, and for the purpose of coverage acceptance testing, the following mobile and portable radio configurations shall be used for talk-out and talk-back:

Portable radio with a ½-wave flexible whip antenna worn at hip level, three feet above ground level, for transmit and receive using a speaker-microphone

5.3.3 Outdoor and In-Building Coverage Requirements

The System shall provide a minimum Delivered Audio Quality (DAQ) radio signal of DAQ 3.4 to portables operating outdoors, and inside of 15 dB, 20 dB, and 30 dB buildings. An outdoor radio coverage service area reliability goal of 97% is required on a countywide basis for each of Sarasota and Manatee. Additionally, a radio coverage service area reliability of 95% is required for the various in-building polygons described and depicted below. The Contractor shall provide the guaranteed BAPC meeting the service area reliability requirements for all defined service areas and polygons in this Scope of Services. ESRI shapefiles for the Counties’ polygons will be provided to the Contractor upon request.

The required level of outdoor and In-Building Coverage areas and defined polygons of Sarasota and Manatee are identified by the following:

A. Sarasota County boundary and Manatee County boundary
B. Yellow polygons indicate a 15 dB In-Building Coverage requirement
C. Red polygons indicate a 20 dB In-Building Coverage requirement
D. Orange polygons indicate a 30 dB In-Building Coverage requirement

Any area in Sarasota or Manatee not defined by an in-building polygon will be required to meet the requirements for a portable radio operating outdoors on-the-hip coverage. In addition to this requirement, a mutual aid agreement between Sarasota and Charlotte County requires portable on-the-hip street level coverage for a defined area in Charlotte County.

For detailed information, see Exhibit H – Coverage Description and Contract Maps.

5.3.4 Coverage Requirements for Sarasota

The required level of outdoor and in-building portable coverage for the Sarasota P25 simulcast system is depicted in the following maps:
Exhibit A - Scope of Work
800 MHz Emergency Communications Systems
For Sarasota and Manatee Counties
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[Map showing coverage requirements for Sarasota and Manatee Counties]

Sarasota 15 dB In-Building Coverage Requirement

Sarasota 20 dB In-Building Coverage Requirement
Exhibit A – Scope of Work
800 MHz Emergency Communications Systems
For Sarasota and Manatee Counties
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For detailed information, see Exhibit H – Coverage Description and Contract Maps.
5.3.5 Coverage Requirements for Manatee

The required level of outdoor and in-building portable coverage for the Manatee P25 simulcast system is depicted in the following maps:
Manatee 30 dB In-Building Coverage Requirement

For detailed information, see Exhibit H – Coverage Description and Contract Maps.

5.3.6 Special Coverage Requirement for Sarasota and Manatee

Sarasota and Manatee have a common area of operation and response where both Counties require 20 dB In-Building Coverage. This area is depicted in the map below:
Sarasota and Manatee 20 dB In-Building Coverage Requirement

Coverage maps showing individual system coverage (Sarasota – Manatee) and composite system coverage (Sarasota – Manatee combined) pertaining to the special coverage requirement have been supplied to the Counties.

For detailed information, refer to Exhibit H – Coverage Description and Contract Maps.

5.3.7 Coverage Maps

The coverage design shall be based upon TSB-88 (the most recent edition at time of the proposal), DAQ 3.4, with 97% service area reliability outdoors and 95% service area reliability in-buildings using the portable radio configuration described in Section 5.3.3.

The Contractor shall provide individual coverage maps for both the Sarasota and Manatee simulcast systems for the following configurations:

P25 Phase I, Contractor-selected, 700/800 MHz portable on-the-hip, 97% service area reliability, outdoors for both talk-out and talk-back configurations. The Contractor shall provide the guaranteed BAPC under this configuration.

For each of the two portable configurations above, 95% service area reliability, talk-out and talk-back, individual coverage maps for the portables operating inside 30 dB buildings within the areas designated in the maps above. The Contractor shall provide the guaranteed BAPC under this configuration.

For each of the two portable configurations above, 95% service area reliability, talk-out and talk-back, individual coverage maps for the portables operating inside 20 dB buildings within the areas designated in the maps above. The Contractor shall provide the guaranteed BAPC under this configuration.

For each of the two portable configurations above, 95% service area reliability, talk-out and talk-back, individual coverage maps for the portables operating inside 15 dB buildings within the areas designated in the maps above. The Contractor shall provide the guaranteed BAPC under this configuration.

For each of the two portable configurations above, 95% service area reliability, talk-out and talk-back, individual and two-simulcast system composite coverage maps for the portables operating inside...
20 dB buildings within the special coverage area along University Parkway designated in the maps above. The Contractor shall provide the guaranteed BAPC from both the individual systems and as a regional system under this configuration.

The 40 dBu service contour for each transmit/receive site, Sarasota only.

Any areas that are predicted to have a service area reliability of less than 97% or 95% for the applicable conditions and required coverage parameters shall be clearly identified on the coverage maps.

The Contractor shall consider simulcast time delay interference (TDI) zones where a high BER may be encountered and clearly depict (separate layer) any areas that are predicted to experience TDI degraded communications on its coverage maps.

For detailed information, refer to Exhibit H – Coverage Description and Contract Maps.

5.3.8 Coverage Map Technical Parameters

The following minimum information shall be clearly defined for each map and each site:

- Transmit and receive antenna models, gain, beamwidth, azimuth, downtilt, sidearm length, and mounting height referenced to center of radiation
- Transmission line type and length for transmit and receive antenna systems
- Insertion loss values (noted in decibels) for all proposed transmit combiners, receiver multicouplers, filters, duplexer, connectors, circulators, lightning arrestors, jumper cables, attenuators, etc.
- Transmitter power level for all base station transceivers and subscriber units
- Effective radiated power level for each site
- Net amplification gain for the tower top amplifier system
- Receiver sensitivity specifications for all base station transceivers and subscriber units
- The faded performance margin \((Cf/(I+N))\) utilized per TSB-88 for the required CPC (channel performance criterion) requirement for DAQ 3.4 and BER
- The portable antenna gain/loss factor utilized and the height AGL
- The minimum received signal level (MRSL) for DAQ 3.4 and BER
- The propagation model, diffraction model, and effective antenna model utilized in the coverage modeling for the proposed system
- Environmental and adaptive loss parameters (e.g., land use land clutter) as specified in TSB-88
- The simulcast minimum capture ratio (in decibels) and maximum delay spread (in microseconds) and a coverage modeling map indicating TDI

The terrain and land use database resolution in arc-seconds for all coverage modeling. The source and publication date of your land use/land cover database shall be provided. The latest available data is preferred along with a color land use map showing where each use category was used. A table that describes each use category and lists the loss value associated with it shall accompany this map.

Additionally, the engineering submittal shall include a complete schematic diagram for each transmit and receive antenna system per site noting all proposed antennas, transmission lines, tower top amplifiers, receiver multicouplers, transmit combiners, circulators, filters, connectors, etc.

Product data sheets shall be provided for all proposed antennas, transmission lines, tower top amplifiers, receiver multicouplers, transmit combiners, circulators, filters, connectors, attenuators, etc.

All engineering analysis and coverage modeling shall be executed in accordance with NPSPAC Region 9 requirements, parameters, and restrictions.

Color-coded talk-out and talk-back coverage maps shall be provided in a high-resolution format in the coverage service area noting:

- The NPSPAC Region 9 required contours, Sarasota only
- Area of the required service area coverage reliability

The coverage maps shall be provided to the Counties in both printed and electronic PDF document format.
Coverage maps shall indicate the relevant jurisdictional boundaries that include portions of adjacent counties, base site locations, interstate highways, primary roads, and any areas of non-coverage.

Technical parameters for each site within each simulcast cell (Sarasota – Manatee) with the information requested is located in Exhibit H – Coverage Description and Contract Maps. In addition, the propagation tool parameters have been provided in Exhibit H.

As part of the design process, Contractor will execute a Continuous Wave (CW) test. The CW testing is performed to increase the accuracy of the predicted coverage by delivering a real-world value for clutter losses (land use).
6. Communication Sites and Requirements

6.1 General

Renovation to the existing facilities may be required at some sites to support the new communications System. The Contractor is responsible for assessing existing facilities for suitability and for the inclusion of the costs for all upgrades in their proposals.

The Counties’ consultant indicated that the Regional P25 Sarasota Manatee system will require approximately nine (9) transmit/receive tower sites in both Sarasota and Manatee to meet the minimum coverage requirements expressed by system users during the needs assessment phase of the project.

During the preliminary site selection process and wherever possible, the consultant attempted to utilize existing sites when developing the conceptual System design. The Contractor is not bound by the site selection utilized in the conceptual design and may utilize these or other sites as it determines the best way to meet the coverage and other requirements of the Counties. However, the Contractor’s design must meet FCC license constraints for the available frequencies and other constraints as may be applicable.

While the site selection is up to the Contractor, the site must be viable for the intended purpose. A potential site must be available for use by the Counties, and have space and potential antenna loading capability to support the proposed design. If the proposed tower site is a leased site, the Contractor must verify the availability of space, the application fees, and expected rents for the site. The site fees and monthly/annual rental cost are identified in Exhibit N, Pricing Summary.

Refer to Exhibit I – Site Development and Installation statement of work for detailed information on equipment and services to be supplied by Contractor.

Exhibit N, Pricing Summary includes estimated leasing prices for the collocation sites. Prices may vary with market conditions at the time of lease execution and are subject to overall price negotiations between the individual Counties and the site operators / owners and is provided for informational purposes only.

6.2 Tower Structural Analysis

The Contractor shall include the cost for structural analyses for existing towers utilized in its design to ensure that the structures will safely support the antenna system loading. The structural analyses shall be performed per TIA-222- G-2 (or latest version) and any applicable local building codes. If the local building code requires a higher basic wind speed, it shall be used. Risk Category III shall be used to classify all structures. One original sealed copy and one electronic copy in PDF format of the analysis report shall be provided to the Counties by the Contractor.

6.3 Sarasota’s conceptual 9-site simulcast design includes the following sites:

<table>
<thead>
<tr>
<th>Site Name</th>
<th>New Tower</th>
<th>New Shelter</th>
<th>New Generator</th>
<th>Structural Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 Street Tower Site</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vo-Tec Tower Site</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hi Hat Tower Site</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osprey Tower Site</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Venice Tower Site</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northport Tower Site</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EOC Tower Site</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Two rental tower sites, one located in the extreme southern area of Sarasota, and one located in the southeast area of Sarasota have been identified as possible candidates.
Exhibit A – Scope of Work
800 MHz Emergency Communications Systems
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Sarasota Conceptual Design P25 System Site Matrix

<table>
<thead>
<tr>
<th>Site Name</th>
<th>New Tower</th>
<th>New Shelter</th>
<th>New Generator</th>
<th>Structural Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>12th Street</td>
<td>No, existing 180’ SS</td>
<td>No, existing 12’ x 20’ Concrete</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Hi-Hat</td>
<td>No, existing 250’ SS</td>
<td>No, existing 12’ x 20’ Concrete</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>North Port</td>
<td>No, existing 285’ SS</td>
<td>No, existing 12’ x 20’ Concrete</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Osprey</td>
<td>No, existing 300’ SS</td>
<td>No, existing 12’ x 20’ Concrete</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Venice</td>
<td>No, existing 240’ Guyed</td>
<td>No, existing 12’ x 20’ Concrete</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Vo-Tech</td>
<td>No, existing 290’ SS</td>
<td>No, existing 12’ x 28’ Concrete</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>New EOC</td>
<td>No, existing 250’ SS</td>
<td>Yes, new 24’ x 36’ Concrete</td>
<td>No, existing</td>
<td>No</td>
</tr>
<tr>
<td>Toledo Blade</td>
<td>Yes, new 250’ SS</td>
<td>Yes, new 12’ x 20’ Concrete</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Englewood Fire Station</td>
<td>Yes, new 250’ SS</td>
<td>Yes, new 12’ x 20’ Concrete</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

6.4 Manatee Tower Sites

Manatee’s conceptual 9-site simulcast system includes the following sites:

Main Tower Site – However, this site is no longer available to Manatee and has been replaced with the Judicial Center site
Buffalo Creek Water Tank Site
Lorraine Tower Site
East Tower Site
Duette Tower Site
Myakka Tower Site
New leased tower site, the “TV Station” tower located in the north central area of Manatee
New greenfield tower site and 250’ self-supporting tower at Booster Station (Manatee-owned property)
New greenfield tower site and 250’ self-supporting tower at Jiggs (Manatee-owned property)

Manatee Conceptual Design P25 System Site Matrix

<table>
<thead>
<tr>
<th>Site Name</th>
<th>New Tower</th>
<th>New Shelter</th>
<th>New Generator</th>
<th>Structural Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSC</td>
<td>No, existing 200’ SS</td>
<td>No, existing room in PSC building</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
6.5 Greenfield Tower Sites

For any greenfield sites that may be proposed, the Contractor shall provide pricing in their proposal to provide a 60-ft by 60-ft communications compound, a 250-ft self-supporting communication tower, a 12-ft x 20-ft concrete equipment shelter, a backup generator system, and all associated foundations, grounding and bonding systems, and other facilities necessary for the complete implementation of a new greenfield site constructed on Sarasota or Manatee property.

At the Judicial Center site in Manatee, a rooftop tower will be required. Manatee will provide an equipment room with backup generator power. The cost for the structural design and analysis (including the analysis of the supporting roof) of this site is included in Exhibit N, Pricing Summary. Microwave connectivity is required for this site and is included in Exhibit N, Pricing Summary.

The pricing for a roof-top structural analysis is included in Exhibit N, Pricing Summary. In regards to the roof loading and structural conditions, insufficient information is available to make a determination of the feasibility of a tower at this location as of the effective date of this Purchase Agreement. Assuming sufficiency of structure and regulatory approvals, Contractor intends to comply with the requirement. Upon completion of the required structural analysis, Contractor will provide a separate cost proposal for any required structural modification and upgrades required to fulfill the requirement for the Counties’ review and approval.

6.6 General Site Development Requirements

The following requirements are applicable depending upon the tasks specified for each site:

The Contractor shall perform all work necessary to install the communication sites which meet all County, State or Federal requirements and the requirements set forth in this Purchase Agreement,
and which provide the necessary tower structures, equipment shelters, environmental conditioning, security, power, standby power, lighting, and cable support structures.

The Contractor shall be responsible for preparing specifications and site development documents for a complete and fully operable installation which is in compliance with the latest version of the National Electrical Code (or local electrical code, if applicable), local building codes, environmental laws, zoning and planning regulations or ordinances, land use restrictions, FAA and FCC rules and regulations, State or County regulations governing road access and entry, OSHA guidelines and all other applicable local, State or Federal codes, regulations, laws and/or ordinances. The Contractor shall prepare all specifications, plans, documents, and required forms and exhibits required to obtain the necessary approvals from each of the above entities.

The Contractor shall assume full responsibility for the specification of materials and equipment employed in construction of the project and agrees to make no claims against the Counties for damages to such materials and equipment except for that which is directly caused by Counties. The Contractor shall be responsible for managing the storage of all materials purchased 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 coordinate the work of the site development subcontractors to ensure that interference between electrical conduits, cable support trays, grounding wire, structural members, and radio system work shall be avoided so that the project is completed within budget and on schedule.

The Contractor shall make all necessary electrical and mechanical connections and shall be responsible for the electrical connections to the communications equipment shelters from Sarasota or Manatee provided sources.

The building, fuel tank, and tower foundation areas shall be graded to prevent the pooling and standing of run-off water. The final grade shall slope away in all directions from the tower base and building.

The Contractor shall oversee clean up and remove from the work site, all rubbish and construction debris resulting from the site development work. The Contractor shall supply a dumpster or similar trash storage/removal device where a substantial amount of construction debris is generated. Upon completion of all work, the entire job site areas shall be left clean and free of trash, debris, mud, dirt, dust, scrap materials, and excess materials. Floors in radio equipment shelters and rooms shall be mopped and polished to the satisfaction of the Counties’ PAs upon completion of installation and construction work.


6.6.1 Permitting

The Contractor shall be responsible for all fees, documentation, filings, etc. associated with permitting the construction of the new communication system. The Contractor shall prepare all specifications, plans, documents, and required forms and exhibits required to obtain the necessary approvals from all regulatory agencies.
6.6.2 FAA and FCC Filings and Authorizations

The Contractor shall be responsible for obtaining all FAA Studies and Determinations prior to construction, and for the notification of the FAA upon the commencement of construction through the filing of appropriate forms.

The Contractor shall be responsible for obtaining all FCC environmental studies and any other requirements to obtain an FCC Antenna Structure Registration for new towers provided in this project.

The Contractor shall be responsible for any and/or all frequency coordination, modifications to existing licenses, Region 9 coordination, applications, FCC filing, waivers, etc. for the licensing of the communication system frequencies. The Contractor shall be responsible for any fees levied by the frequency coordinators.

The Contractor shall file all applications for frequency coordination and FCC licensing for the microwave radio paths and shall be responsible for the cost of microwave frequency coordination and any FCC filing fees that may be imposed.

6.6.3 Site Plan

A site plan shall be prepared for the Counties’ approval for each site where modifications to site compounds for the 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.

For this information, refer to Exhibit G – Project Management Plan, Implementation Schedule and Cutover Plan.

6.6.4 Site Preparation

As to Contractor-provided materials, proposed site development and regulatory/site owner approvals, the following shall apply:
The Contractor shall remove all rubbish, debris, and other refuse from the site construction and dispose of it legally. The Contractor shall comply with all environmental protection requirements.

The Contractor shall treat the newly fenced area with an herbicide approved by the Counties and shall provide and install weed prevention material. The areas extending to three feet outside of the fence shall be treated to prevent the recurrence of vegetative growth. The Contractor shall provide gravel or crushed rock to cover the newly fenced area and the area extending to three feet outside of the fence. The gravel or crushed rock shall not exceed two inches in diameter, so that foot traffic is not difficult. The depth of gravel or rock shall be greater than four inches.

All existing active sewer, water, gas, electric, or other utilities where encountered during the work shall be protected at all times and where required, shall be relocated as directed by the utility and the Counties. The Contractor shall provide any signage that may be required at the work site.

For each communications site, the Contractor shall prepare engineering plans and specifications for site development that shall include but not be limited to the following:

- Secure all permits and approvals required for site work
- Perform site preparation and improvements for drainage, erosion, and sediment control
- Installation of foliage control measures to control vegetation growth within the compound. The Contractor shall furnish Counties with the material safety data sheets (MSDS) for the proposed herbicide
- Construction of all foundations for the equipment shelter, tower, generator, fuel tank pad, etc.
- Provide a communications tower as specified, including soil exploration, geotechnical report, tower lighting, grounding, installation of antennas, transmission lines, cable ladders, waveguide bridges, anti-climbing devices, climbing ladders, and related equipment
- Provide a communications equipment shelter
- Provide a standby power generator, automatic transfer switch, and fuel tank where required
- Installation of the grounding system
- Installation of a chain link security fence around the equipment site compound
- Provide site alarm system including sensors, transducers, detectors and contacts

### 6.6.5 Fencing

For new sites, the Contractor shall provide an 8-ft high, commercial grade chain-link fence with razor wire above the 8-foot level, around the Counties’ site facilities including tower, equipment shelter, generator, and fuel storage tank.

The fence shall be constructed with a walk-through gate and a 12-foot wide drive-through swinging gate for vehicle access. The perimeter fencing system shall be complete with all hardware, posts, rails, and unions.

The Contractor shall provide a chain locking system for walk-through swing gates and the drive-through swinging gate if applicable.

The fence posts shall be spaced no more than ten feet apart. Fence posts shall be set in concrete that shall be of a commercial grade with a minimum 28-day compressive strength of 2500 psi and bonded to the site grounding system using an exothermic welding process (Cadweld).

### 6.6.6 Site Electrical

All electrical wiring and installations shall be performed by the Contractor, and shall conform to the NEC and local codes in effect at the site of installation and at the time of installation.

The Contractor is responsible for the installation of suitable power. The power feeds to shelters shall be buried and shall enter the building through conduit. If a main cutoff switch is required outside of the shelter, this switch shall be padlocked with a lock keyed.

### 6.6.7 Construction

The Contractor is responsible for geotechnical exploration at the locations of each foundation. The soil analysis shall include field borings, laboratory testing, and a report containing a summary of the analysis with an evaluation and recommendations for structural foundations. The report shall be generated and certified by a registered Professional Engineer, licensed to practice in the State of Florida and qualified in the area of subsurface investigation and engineering evaluation.
Boring logs and report shall provide:
- Date, sampling methods, number and type of samples
- Description of the soil strata according to the Unified Soil Classification System
- Depths at which strata changes occur referenced to a site benchmark elevation
- Standard Penetration Test blow counts for each soil layer
- Soil density for each soil layer
- Internal angle of friction for each soil layer
- Cohesion for each soil layer
- Ultimate bearing capacities for each soil layer or at the recommended bearing depth(s)
- For expansive soil conditions, the active zone of influence and recommendations for design
- Elevation of free water encountered and the ground water depth below grade to be considered for design
- Soil electrical resistivity, pH values and corrosive nature of soil
- Other pertinent soil design data and recommendations
- Recommendations for alternate foundation types
- Topographic information for the site
- Note the location within 1,000 feet (300 m) of the structure of underground pipelines, buried concentric neutral power wires, and electrical substations as these may affect electrolytic corrosion

6.6.8 Construction Notifications

The Contractor shall notify the Counties as to construction status at the following times:
- Ten days prior to start of installation - notify as to the start date of construction and estimated completion date of construction
- The day installation is completed

Counties have the option to have a building inspector present during concrete pours and sample retrieval. The Contractor is required to notify the Counties 48 hours in advance when these tasks are scheduled.

6.6.9 Foundation Design

Pricing for the foundation design is based upon normal soil conditions.

6.6.10 Temporary Power

The Contractor shall be responsible for any temporary power that may be required for site construction.

6.6.11 Landscaping

The Contractor shall be responsible for landscape grading and seeding of the disturbed soil.

The Contractor shall be responsible for the restoration of the site surroundings by fertilizing, seeding, and strawing of the disturbed areas as required.

6.7 Tower Requirements

This section applies to new towers for greenfield sites.

6.7.1 Reference Standards

Unless otherwise specified herein, all materials, design, and construction procedures shall be in accordance with the latest versions of the Florida Building Code, National Electrical Code,
6.7.2 General Requirements
For the locations specified, towers shall be self-supporting and constructed with solid or tubular legs and cross members. Solid legs and cross members are preferred.

6.7.3 Materials
All steel materials used in the construction of the towers shall be new, shall be rated for their intended purpose, and shall conform to the provisions of the most recent issue of the TIA-222 with respect to physical properties, manufacture, workmanship, and factory finishes.

6.7.4 Height
Contractor shall assume a tower height of 250-feet excluding appurtenances.

6.7.5 Corrosion Protection
All tower steel shall be hot-dip galvanized after fabrication in accordance with the requirements of the most recent issue of the TIA-222. All hardware and other attachments, including antenna mounts, climbing ladders, transmission line support systems, etc., shall be galvanized or constructed of inherently corrosion resistant materials suitable for such applications. All exposed portions of anchor bolts, step bolts, or climbing ladders shall be galvanized.

The Contractor shall touch-up any areas where the galvanizing has been nicked or damaged during handling and installation. This shall be done in dry weather and shall not be applied over wet surfaces.

6.7.6 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 in the most recent issue of the TIA-222 shall apply under the most severe combination of dead load plus live loading.

6.7.7 Appurtenances
Appurtenances shall include, but not be limited to, the following: tower-mounted equipment, antennas, antenna mounts, antenna platforms, microwave antennas and radomes, lighting, transmission line, transmission line cable ladder, climbing ladder and safety device, lightning rods, conduit, and lighting controls.

6.7.8 Antenna and Transmission Line Loading
The towers shall be designed to maximize their efficiency to support antenna loads. The sidearm brackets shall include an integral vertical antenna mounting mast to permit proper installation of antennas.

The towers shall be designed to support, at a minimum, the antennas and transmission lines required by the System as specified in this Purchase Agreement for a greenfield site.

6.7.9 Distributed Loads
The land mobile radio and microwave antenna loads are site specific and are specified in this Purchase Agreement for the greenfield sites.

6.7.10 Concentrated Loads
In addition to the distributed loads, growth loading for commercial carrier antennas shall be provided for new towers and are specified in this Purchase Agreement for the greenfield sites.
6.7.11 Wind Speed and Loading
The tower and foundations shall be designed and constructed in accordance with the ASCE-7-2010 Category III Wind Load Map with the current and specified future loads. Risk Category III shall be used to classify the structures.
The Contractor is responsible for verification of wind loading requirements per TIA-222-G-2 (or latest version) and any applicable local building codes. If the local building code requires a higher basic wind speed, it shall be used. Risk Category III shall be used to classify all structures.

6.7.12 Tower Twist, Sway, and Displacement
The tower shall be designed to ensure that the twist and sway limits at the microwave antenna mounting positions do not exceed their 3 dB degradation points under conditions of a 120 mph service wind speed for the microwave antennas specified.

6.7.13 Transmission Line Support
Transmission lines shall be installed to minimize tower face wind loading. For self-supporting towers, a cable support system shall be installed on each leg of the tower and each shall accommodate twenty-four (24) standard hangers. Standard bolt-in hangers shall be used; snap-in hangers are not acceptable.
For guyed towers, a cable support system shall be installed on each face of the tower and each shall accommodate twenty-four (24) standard hangers. Standard bolt-in hangers shall be used; snap-in hangers are not acceptable.
The cable support systems 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 required to install the cable support device.
The cable ladder structures shall be spaced to enable hangers to be installed at intervals not to exceed 3 feet.
Holes shall be provided in the tower support members, tower hanger adapter plates, or separate ladder structures to allow installation of bolt-in cable hangers. Transmission lines shall be attached to the transmission line cable support using stainless steel hangers and adapters of the appropriate size for the transmission line supplied.

6.7.14 Waveguide Bridge
A 2-foot wide waveguide bridge shall be installed between the tower and the equipment shelter to support transmission lines and to protect them from any debris that may fall from the tower or antennas. The waveguide bridge shall be designed to match the height of the cable entry port on the equipment shelter. A gratings type of waveguide bridge is required. Microreflect waveguide cushions, hangers, and crosses are the preferred method of attachment to the waveguide bridge. The waveguide bridge shall be designed to accept support devices to properly attach the transmission lines at the intervals specified.
The waveguide bridge facility shall be installed so that it is self-supporting with its own foundations and not rigidly attached to the tower or equipment shelter. Galvanized steel construction shall be used for the waveguide bridge and its ancillary components. Waveguide bridge sections shall be bonded together exothermically or with jumpers and 2-hole lugs.

6.7.15 Climbing Ladder
The tower shall be provided with a climbing ladder, safety cable, and climbing belt. The climbing ladder shall be attached to tower legs in a manner that would not interfere with the installation or maintenance of antennas, or installation of additional transmission lines on the cable ladder. Similarly, the placement of cable ladder structures shall not interfere with the climbing facility. It shall be possible to lockout the climbing facility to preclude unauthorized use. The climbing facilities shall meet all OSHA requirements.

6.7.16 Tower Lighting and Controls
The Contractor shall provide a dual lighting system with the tower or an alternate system if specified by the FAA. The lighting system shall consist of medium intensity white beacon for daytime lighting
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and red obstruction lighting for nighttime operation. The lighting system shall conform to all FAA, NEC, local, and FCC Regulations, and shall further conform to FAA publication AC 70/7460-1K. The lighting system shall be a “No EMI or RF” interference model.

Placement of the lighting systems on the towers shall be in a manner that allows unobstructed view through 360°.

Activation of any required lighting systems shall be via a light sensitive, photoelectric type switch and controller that will activate the lights at dusk (or other cloud-darkened condition) and extinguish the lights at sunrise. The controller shall automatically switch from red lights at sunrise to strobe lights and back to red lights when the sky darkens.

Wiring for the tower lighting shall be provided and installed in conformance with the lighting manufacturer's specifications and in accordance with local electrical codes. All cable ties used on the tower shall be stainless steel or weather resistant black acetal. Standard white or black cable ties made of nylon or polypropylene shall not be used.

The lighting control system shall be equipped to provide form "C" dry contact closure alarm indication of lighting failures of the top strobe, middle strobes, and obstruction lights. Upon failure of the lighting system, the alarm condition shall be reported by the master alarm system.

6.7.17 Submittals

The required design documentation shall be approved, signed, dated, and sealed by a registered Professional Engineer (structural) qualified and licensed to practice in the State of Florida.

At no later than fifteen calendar days prior to foundation excavations for the tower, the Contractor shall deliver signed and sealed copies of all required tower structure and foundation design documentation. One original sealed copy and one electronic copy in PDF format shall be provided to the Counties. The documentation shall be delivered to the Counties' PAs.

These submittals are in addition to any documentation submittals that may be required by the local building official. The Contractor shall contact the local building official to determine what submittals are required.

The Contractor shall prepare and submit for the Counties approval, all plans, specifications, foundation drawings and scale drawings of the tower depicting its overall height, the number and height of sections, the width of each section, guy points (if applicable), antenna loading and their specified heights, and obstruction lighting details.

The Contractor shall submit for the Counties approval, a profile view of the tower containing structural details, tower loads, and engineering notes. Any documentation for the tower requested by the Counties for planning approvals shall be supplied in a timely manner.

In accordance with the most recent issue of the TIA-222, complete plans, assembly drawings, or other documentation shall be supplied showing the necessary marking and details for the proper assembly and installation of the components, including the member sizes, design yield strength of the structural members and the grade of structural bolts required. Foundation reactions, when provided, shall be based upon factored loads.

The tower plans shall detail attachment height, antenna quantity, antenna model or type, mount quantity, mount type and line size that was included in the structural analysis. Alternatively, the total effective projected area representative of all of the antennas and mounts at each elevation may be provided along with the associated line sizes.

The tower plans shall detail the following data for the site specified used in the structural analysis:

Basic wind speed (3 second gusts, 50-year mean recurrence interval) with and without ice
Exposure category C or D shall be used
Structure classification (III) shall be used
Topography category (1, 2, 3, 4, or 5)
Earthquake spectral response acceleration at short periods
Foundation reactions for the loading combinations considered
Soil design parameters or source of data

Upon completion of tower construction, the Contractor shall deliver to the Counties, one (1) complete original copy of the tower and foundation’s as-built documentation, and one (1) copy in an electronic PDF format.
6.8 Equipment Shelter Requirements

6.8.1 Building Size
Except at Sarasota’s EOC, communications equipment shelters shall be a minimum of 12-ft by 20-ft in size measured to the outside of finished walls. At the Sarasota EOC, the minimum communications equipment shelter shall be a minimum of 24-ft by 36-ft in size measured to the outside of finished walls. The interior height shall be a minimum of 9-ft from finished floor to finished ceiling.

6.8.2 Design Loading
General construction shall be steel reinforced high strength precast concrete with a horizontal wind loading in accordance with ASCE-7-2010.

6.8.3 Foundation
The building foundation shall be a concrete slab that is installed in compliance with local building codes including frost depth. The entrance to the equipment shelter shall be graded or concrete steps installed such that the distance from the grade or final step to the shelter floor does not exceed eight inches.

6.8.4 Flooring
The floor section shall be constructed of steel reinforced concrete and be rated to support all communications equipment, battery plants, UPSs, generators, etc. Wood floors are not acceptable. All surfaces shall be smooth. Floors shall be bolted to adjoining walls and all structures shall be shipped with floor systems fully assembled to walls. The interior floor surface shall be commercial grade 1/8” x 12” x 12” vinyl floor tile over concrete. Base molding shall be installed around all perimeter walls.

6.8.5 Roof Section
Roof sections shall be bolted or welded to the adjoining walls and constructed with properly reinforced 5000-PSI lightweight concrete. The roof shall be a cap and fit over the walls, leaving no exposed roof to wall joints. The roof shall be constructed with at least a 1/8” per foot drainage slope to prevent accumulation of water. The roof section shall utilize a membrane system and provide a 2” overhang on all sides. The roof shall be insulated to a minimum of R-16 and shall be covered with sheetrock laminated with FRP.

6.8.6 Walls
The wall sections shall be steel reinforced solid concrete with concrete aggregate rock exterior. Interior surfaces within the equipment room shall have a fire resistant white textured finish wall covering with molding on all corners. All floor/wall intersections shall have four-inch vinyl baseboards installed. Molding shall also be provided at wall/ceiling intersections and all wall panel intersections. Interior walls shall be designed to allow mounting of electrical and electronic equipment using standard fasteners available from local hardware stores. The walls shall be insulated to a minimum of R-11 and shall be covered with sheetrock laminated with FRP.

6.8.7 Electrical
The electrical system includes the entrance facility, main breaker or fused disconnect switch, a manual transfer switch that is connected to an external generator receptacle, power line surge protection, electrical power distribution panel, emergency generator automatic transfer switch, generator surge protection, etc.

AC power shall enter the shelter through an entrance elbow, which can be rotated to accommodate connection to conduit from the power company feed. The main power shall feed a primary disconnect switch to allow for the manual disconnection of commercial power. The main power shall then be routed to an automatic transfer switch that will switch to emergency generator power in the event commercial power is lost. The load side of the automatic transfer switch shall then feed a manual
6.8.8 Doors

One entrance to the building equipment room shall be provided. All exterior doors shall be of galvanized steel in a cast-in galvanized steel frame, and be a minimum size of 3.5-ft x 7-ft. The door frames shall be 16 gauge galvanized steel, primed painted, cast into the wall panel, and installed flush with the exterior wall.

The doors and frames shall be painted to match the exterior trim. Hinges shall be steel ball bearing type and tamper resistant to prevent removal of the pins from outside the building. The doors shall be insulated, primed, and painted, and include a door closer, doorstop, pull handle, and magnetic weather stripping. Doors shall be installed with a threshold and a door sweep.

The lockset shall be a Best cylinder entrance lock with lever handle and strikeplate and protected on the exterior by anti-prying plate. All locks and keys shall be approved by County.

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

6.8.9 Lighting

There shall be sufficient interior lighting to provide a level of 150 foot-candles at 4-feet above the floor in the equipment room. Fluorescent fixtures using two standard 4-ft tubes per fixture shall provide interior light. The switch for the light fixtures shall be located inside and on the latch side of 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.

The Contractor shall provide one 35W high-pressure sodium vandal resistant light with photocell sensor mounted on the outside near the entrance door and an interior light switch shall be furnished and installed to control the lights.

Interior two-head emergency light with exit sign, rechargeable batteries, charger, pilot, and test light shall be provided for the equipment room.

6.8.10 HVAC

For all equipment shelters, the Contractor shall provide a minimum of two wall-mounted vertical wall air conditioner units and a controller, sized to meet the BTU load requirements of the proposed system equipment.

The controller shall provide for unattended heating and cooling of the communications equipment shelter's equipment room without personnel intervention. The controller shall have a time delay to prevent the HVAC system from sustaining compressor damage if energized prematurely following a power failure. Provide for redundancy operation (alternating operation between the two units) and capacity (both units operating) as heating and cooling conditions may require.

The HVAC units shall be capable of safely operating when the outside temperature falls below 60°F, allowing continuous interior equipment cooling and dehumidification in cold weather.

Transfer switch that is connected to an external generator receptacle, type to be determined by the County. The load side of the manual transfer switch shall feed the load center.

At a minimum, the Contractor shall provide a 200-amp, single phase, 120/240V, 42-circuit load center. The load center shall not be rated for less than 200-amp service. The load center shall contain separate, appropriately sized circuit breakers for the HVAC units, DC rectifiers, and each major communications equipment component.

All electrical conduits shall be installed in a neat and orderly fashion to provide an aesthetically appealing layout. Symmetry shall be employed throughout.

A four-plex grounded receptacle group or equivalent shall be installed on the outside of the cable tray at typical 20.5-inch intervals corresponding to equipment rack locations. A separate 20-amp circuit shall protect each duplex receptacle of the four-plex group.

Four-plex receptacles shall be installed every four feet on each wall of the equipment shelters at a level of four feet above the floor. The wall receptacle loads shall be protected by a sufficient quantity of 20-amp circuit breakers to meet the requirements of NEC and local electrical codes.

One (1) 20-amp, exterior GFCI type duplex receptacle supported by the generator shall be provided near the equipment room shelter entrance.
6.8.11 Fire Detection and Suppression

The communications equipment room smoke and fire detection shall include a combination of ionization/photoelectric smoke detectors in conformance with UL 268 standards and installed in a cross-zoned detector configuration.

The communications equipment room shall include individual high and low temperature thermostats that are connected to the shelter alarm system. Separate wall-mounted portable fire extinguishers; one five-pound all-purpose dry chemical Class ABC, and one seven-pound minimum Class BC CO2 extinguisher, shall be located adjacent to the door of the equipment and generator rooms.

FM200 or other equivalent agent fire suppression system, conforming to NFPA Standards 72E, and sized to provide 5 - 7% concentration at full discharge and effective against Class A, B, and C fires shall be provided. Additional requirements include:

- All air conditioning shall be automatically shut down prior to discharge
- The fire suppression system shall be capable of being manually discharged and manually aborted
- Initial visible and audible warning for personnel evacuation and confirmation, secondary warning upon discharge, with adjustable delay prior to discharge (capable of 30 to 60 second delay)
- FM200 signage at building entrance
- Warning light on building exterior adjacent to entrance door
- Warning system shall provide dry contact closures connected to the shelter alarm system to indicate fire alarm, FM200 discharge, and any other fault conditions

6.8.12 Shelter Alarms

All alarm conductors shall be in conduit. The conduits necessary for installing the alarm conductors shall be 3/4-inch EMT conduit. Conduit and wires necessary for power connection shall be routed to the equipment room and terminated in the alarm junction box.

The alarm system shall utilize normally closed contacts when no alarm is present and the alarm system mapping shall be standardized to the maximum extent possible for all shelters.

The following alarms shall be provided and wired to Contractor-provided type 66 blocks. Each termination must be labeled and interfaced with the communications system alarm system.

- Power Fail relay alarm dry contact
- Door intrusion alarms, all doors, magnetic reed type switch
- HVAC failure alarm dry contact type
- Fire/Smoke detector alarms and fire suppression system discharge and trouble alarm, dry contact type
- TVSS failure alarm dry contact
- High and low temperature alarms dry contact type
- High humidity
- All generator system alarms as detailed in the Generator Section
- Transfer switch position utility or backup source
- UPS/Rectifier alarms
- Tower lighting alarms

6.8.13 Transmission Line Entry Port

A transmission line entry port and an entrance panel kit (Harger EPK18 or equivalent) shall be provided and installed with through-wall mounting bolts to bond the interior shelter master ground bus bar to the shelter exterior ground bus bar. The ground bar may not be integrated with the transmission line entry panel. The exterior ground bar shall be wall-mounted and shall utilize a minimum of three 3” by 1/32” thick flat copper ground straps on the exterior ground bar which are exothermically welded to a copper 1/4” x 1” copper bar for connection to the site grounding electrode system. The copper straps shall be secured to the building exterior and protected by channel supports similar to Harger EPKPCST5 to eliminate wind vibration. Both the interior and the exterior ground bar shall be predrilled to provide ground connections for equipment.

The Contractor shall provide an interior wall-mounted trapeze style entry port grounding system similar to Harger LABKT18UGBAS and shall accommodate 18 surge suppressors such as the PolyPhaser Model IS-B50LN-C2 protectors.
6.8.14 Cable Trays

Cable trays shall be provided to support the electrical power conduits and duplex circuits, and all control and alarm wires associated with the radio communications equipment.

All cable trays shall be 24 inches in width and fabricated in an open ladder-type arrangement to permit easy cable routing anchored to the walls where practical and suspended from the ceiling as necessary.

Cable trays shall be painted steel or anodized aluminum and installed over all equipment rack spaces, and to the telephone equipment panel, and to any future expansion space in the shelter. The cable trays shall be installed in a suspended fashion, 12 to 18 inches below the ceiling and shall be bonded to one another and to the building interior ground bar by #2 AWG copper wire and compression fittings.

6.8.15 Telephone Backboard

A telephone backboard shall be installed on the interior wall of the building and shall be painted with fire-retardant paint. The available wall space shall dictate the size.

Two, two-inch diameter ports with threaded caps for telephone/fiber cable entry shall be installed beneath the telephone backboard.

A ground bus bar of 12-inches in length shall be installed beneath the telephone backboard and bonded to the interior ground system.

6.8.16 First-Aid Kit and Eye-Wash Station

The Contractor shall provide a wall-mounted First-Aid Kit for the communications equipment shelter. The kit shall include, but not be limited to, adhesive bandages, bandage pads, ammonia inhalants, iodine wipes, triangular bandage, eyewash solution, insect sting wipes, and an instant cold pack.

The Contractor shall provide a 32 oz. double bottle emergency eyewash station at each communication site. The emergency eyewash station shall be Fendall’s Eyesaline® Wall Station model number 32-000462-0000 or approved equivalent.

6.9 UPS System Requirements

Contractor shall provide a 48VDC power system for each radio site as preferred by the Counties and will not be utilizing UPSs.
6.9.1 General

The unit supplied shall be comprised of a microprocessor-controlled inverter, battery charger, and necessary metering to provide operator information. The UPS shall include a computerized self-diagnostic monitoring and control package in order to keep operators advised of system status. The UPS shall operate as an on-line, fully automatic system capable of operating in the following modes:

NORMAL - The rectifier/charger derives power as needed from the commercial AC utility or generator source and provides filtered and regulated DC power to the on-line inverter and simultaneously charges the batteries. The inverter converts the DC power to highly regulated and filtered AC power for the critical loads.

EMERGENCY - Upon failure of the commercial AC utility or generator source, the inverter continues to power the critical loads. The inverter receives its power without interruption, from the batteries.

RECHARGE - Upon restoration of the commercial AC utility or generator source, the rectifier/charger again provides filtered and regulated DC power to the inverter and simultaneously recharges the batteries. This shall be an automatic function and occurs without interruption to the critical loads.

AUTOMATIC BYPASS - The automatic bypass transfers the critical loads to the commercial AC source in the case of an overload, load fault, or internal failures. Return from bypass mode to normal mode is automatic except in the case, which the overload exceeds specified limits or an internal failure has occurred.

MANUAL BYPASS - The manual bypass provides the capability to transfer the critical loads to the commercial AC source for UPS servicing.

Contractor shall provide a -48VDC power system for each radio site as preferred by the Counties and will not be utilizing UPSs.

6.9.2 UPS Run-Time

Contractor shall provide a -48VDC power system for each radio site as preferred by the Counties and will not be utilizing UPSs.

6.9.3 Batteries

Contractor shall provide a -48VDC power system for each radio site as preferred by the Counties and will not be utilizing UPSs.

6.9.4 AC Load Center

Contractor shall provide a -48VDC power system for each radio site as preferred by the Counties and will not be utilizing UPSs.

6.10 DC Power System Requirements

Contractor shall provide -48VDC power systems for all Network Core and RAN sites. All RAN site equipment shall be powered by -48VDC power systems. The -48VDC power system shall supply both the radio and microwave equipment at the RAN site via a single battery supply.

6.10.1 General

The Contractor shall furnish plans and specifications to all materials and labor necessary to complete the installation of DC power systems at all backbone sites.

The Contractor shall furnish and install a -48VDC power plant system at each radio system infrastructure site. All 800 MHz communications system equipment shall be powered by the DC power plant. The Contractor shall provide all batteries, battery mounting or racking facilities, float-type battery chargers/rectifiers, low voltage disconnects, and DC load centers.

When sizing the system, the Contractor shall consider the required run-time and the load of the equipment specified in this project, plus a growth factor equivalent to a 50% base station load.
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expansion. Controller and other network equipment shall be powered either directly from the DC power plant or by individual, redundant -48VDC to 120VAC power inverters. These inverters shall have a capacity of at least twice that of the calculated equipment loads.

Ancillary site equipment essential to continuous system operation, tower-top preamp and receiver multicoupler, GPS reference oscillators, etc. shall be powered by the site's -48VDC power plant system.

6.10.2 Battery Run-Time

The Contractor shall consider the load of the radio and microwave equipment specified in this project, plus a growth factor equivalent to a 50% load expansion when calculating battery run time. The DC power plant shall have sufficient capacity to sustain site communications for full radio trunked system operation for a minimum of 2 hours, and the microwave system for a minimum of 8 hours following the loss of AC power to the rectifier systems.
6.10.3 Batteries

Modular stationary batteries shall be sealed maintenance-free type with sufficient ampere-hour capacity to support the run-time requirements. Battery life expectancy shall be at least 20 years in normal float-type service. Battery capacity ratings shall also be adjusted by a factor of 1.25 to compensate for battery capacity degradation over their 20-year life. No venting facilities or special battery rooms shall be required for normal operating conditions. Batteries shall be EnerSys PowerSafe DDm series, or engineer-approved equivalent. Secure mounting facilities shall be incorporated in the design of the battery bank.

6.10.4 Battery Chargers/Rectifiers

Battery chargers/rectifiers shall provide 100% redundancy with sufficient current capability to supply all site equipment load requirements plus a 50% load expansion and simultaneous charging of a discharged battery bank to full capacity in 24 hours. Each rectifier chassis shall be powered by a dedicated 240VAC, properly sized breaker and receptacle.

Battery chargers/rectifiers shall be capable of battery eliminator operation and power switching and disconnect capability such that the rectifiers, batteries, and commercial power sources may be separately isolated in a manner whereby each component may be serviced safely. This switching and disconnect capability shall be designed such that radio communications system operation is not impaired or interrupted during any repair or maintenance action.

The rectifier modules shall be provided on a redundant N+1 basis and shall operate in ambient temperatures of 0º C to +50º C. Rectifier modules shall operate from 240VAC, as appropriate to the site of installation. The battery chargers/rectifiers shall be rack-mounted in an EIA 19-inch rack.

The battery chargers/rectifiers shall be provided with AC circuit breakers, DC circuit breakers, minimum 2% accuracy DC voltmeter and DC ammeter, current limiting and high voltage shutdown circuitry, continuous float and equalizing voltage adjustment, and 24-hour equalizing timer. These features may be integral to the chargers/rectifiers or provided in separate rack mount assemblies. The chargers/rectifiers shall have the following minimum alarm points:

- Battery charger low voltage
- Battery charger high voltage
- Battery charger no charge

6.10.5 DC Load Center

A rack-mounted DC load center with circuit breakers shall be provided with the battery power system to provide a protected DC distribution to all 48VDC powered communications equipment. Additionally, the Contractor shall furnish and install a minimum of five spare DC circuit breakers of the same type supplied on the panel for future use.

The DC-power circuit breakers shall be configured in a manner to preserve System redundancy.

6.10.6 Battery Disconnect

A separate (not in the DC distribution panel) rack-mounted DC load breaker shall be provided to disconnect the battery from the -48VDC rectifier system. The DC battery disconnect shall be equipped with alarm relay contacts and connected to the System NMS.

6.10.7 Low Voltage Disconnects

To protect the battery supply, automatic low-voltage disconnects shall be provided for the radio and microwave equipment to remove the load from the battery bank at the point when the battery voltage reaches a preset dropout voltage level.

6.11 Generator System Requirements

At all sites where new generator systems are proposed, the Contractor shall furnish plans and specifications for standby power generators. Generators shall be mounted on a concrete foundation in accordance with the manufacturers’ specifications for shock and vibration mounting, ventilation, cooling, fuel supply, and electrical connections. Generators and fuel tanks shall be installed on concrete foundations and be securely anchored and installed at the same elevation as the equipment shelter.
6.11.1 General
It shall be the responsibility of the Contractor to provide plans and specifications to install and test the generator and automatic transfer switch at each tower site. All equipment shall be new and factory tested.

6.11.2 Installation
The Contractor shall provide and install all the electrical wiring necessary to connect the standby emergency power generator, automatic transfer panel, alarm monitoring points, and equipment shelter electrical loads.
All wiring shall meet or exceed manufacturer specifications for designated load requirements of the equipment to be powered. All wiring shall be run in conduit and meet applicable NEC and local codes. All electrical materials and work shall be inspected and approved by the inspector with jurisdiction at the site of installation.

6.11.3 Documentation
The following documentation shall be supplied to the Counties 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 and maintenance manuals that outline routine maintenance and troubleshooting procedures
- Transfer switches manual and wiring diagram
The above documentation shall be included in each copy of the as-built documentation delivered to the PAs.

6.11.4 Generator Warranty
A no deductible warranty, which provides for onsite service by a factory authorized service provider, shall be provided.

6.11.5 Start Up Service and Load Bank Testing
A factory authorized service representative shall provide initial startup service and acceptance load testing for each new generator system. Test records shall be furnished to the Counties in both printed and electronic PDF format.
Load testing shall be performed to confirm that the fuel system capacity is adequate to enable the full rated output power of the generator. A load bank of sufficient capacity shall be connected to the generator that will demonstrate that the generator is capable of delivering its full rated output power for a minimum period of one (1) hour. The Contractor shall demonstrate the operation of the transfer switch and that all systems within the equipment shelter will operate properly from the generator.
It shall not be acceptable if the UPS is required to support communication shelter equipment loads during high-current transients such as the HVAC compressor starting currents.

6.11.6 Diesel Generator
The diesel generator equipment, including the engine, AC alternator, exciter, voltage regulator, and automatic transfer switch, shall be designed and manufactured by a single source manufacturer. This manufacturer shall have a local representative who can provide factory-trained service members, required stock of replacement parts, and technical assistance.
The generator shall be furnished complete with outdoor enclosure, and all accessories and equipment needed for the proper operation of the unit. These shall include, but not be limited to, starting batteries, battery racks, battery chargers, battery cables, cooling systems, residential grade...
6.11.7 Foundation

The generator set shall be mounted on a steel base and on a concrete foundation. The base shall include vibration isolators.

6.11.8 Ratings

Output power rating of the generator shall be shall be capable of delivering electrical power output to support the electrical equipment and shelter loads plus a 25% growth factor. No generators shall be rated for less than 60 kW standby output.

6.11.9 Alternator

The alternator shall be capable of providing the specified power capacity at no less than a 0.8 power factor. The output shall be 60 Hz and commensurate with site requirements.

The alternator shall be a 105°C rise model, separately-excited (PMG excitation), single-bearing, self-aligning, four-pole, synchronous type and direct drive centrifugal blower for proper cooling and minimum noise, with a temperature compensated solid-state voltage regulator and a brushless rotating rectifier exciter system. No brushes will be allowed.

The voltage regulator shall provide no load to full load regulation of rated voltage within ± 2% during steady-state conditions.

Frequency regulation shall be by an electronic isochronous governor (± 0.5%) from steady state no load to steady-state rated load.

6.11.10 Generator Instrumentation, Control, and Alarms

At a minimum, the generator set shall include the following instrumentation:

- Voltmeter
- Frequency Meter
- Running Time Meter
- Fuel Gauge
- Ammeter with Phase Selector Switch
- Oil Pressure Gauge
- Coolant Temperature Gauge

A control box local to the generator set shall be provided containing the start, run, and stop switches for manual operation, and remote-control terminals for connection to the automatic transfer control panel. AC line circuit breakers, commensurate to the electrical interface required at each site, shall be provided.

- 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 status on fault alarms for any of the above conditions, plus:

- Control switch not in auto position
- Generator set is running, and when the generator is on-line under load conditions
6.11.11 Diesel Fuel Supply

The generator set shall utilize diesel as a fuel source. The Contractor shall provide a sub base or other above ground diesel fuel tank and all fuel system piping and regulation equipment sized as required for proper fuel flow to the engine. Proposed fuel systems shall meet all applicable DEP, EPA, NFPA, and other federal, state and local codes, standards, and requirements for such systems and enable operation of the generator at full load.

The tank shall be sized to provide a minimum of 72 hours of continuous operation at 100% system load. The tank shall be installed and anchored in a manner that will prevent it from moving in a wind or flood condition. Tank installation and all connections and plumbing to connect the fuel system to the engine shall comply with applicable codes and regulations. The fuel tank must be easily accessible for refueling.

A fuel level sensing device shall provide a means to monitor the actual fuel level in the tank such that the percent amount of fuel in the tank is visible at any time from the Network Monitoring system. The fuel level sensing device shall also provide a dry contact closure-type alarm to issue an alarm when the tank reaches a threshold as determined by the Counties.

A TVSS device shall be installed on the fuel sensing probe cable as it enters the equipment shelter.

All necessary supplies needed for an installation that meets industry, local fire and building codes shall be furnished and installed.

The Contractor shall fill the fuel tank(s) prior to conducting the radio system acceptance tests, as needed for testing, and immediately following final system acceptance.

Upon Substantial Completion, a full tank of diesel fuel will be provided for each generator supplied by Contractor.

6.11.12 Exhaust System

An exhaust system with a "critical silencer" residential type muffler shall be provided and sized as recommended by the manufacturer. The muffler shall mount so that the engine does not support its weight.

A flexible exhaust connection shall be provided as required for connection between the engine’s exhaust manifold and the exhaust line, in compliance with applicable codes and regulations.

All exhaust components shall be mounted and installed as recommended by the manufacturer and as required to comply with all applicable codes and regulations. All components shall be properly sized to ensure proper operation without excessive backpressure when installed. The installation shall allow for pipe expansion and contraction.

6.11.13 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 an appropriate sized voltage regulated charger, which is powered by 120VAC. Float, taper, and equalize charge settings shall be provided.

The battery charger shall be located in the generator room.
6.11.14 Cooling System

A radiator-cooled engine is required. The radiator shall be filled with a water and 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.

6.11.15 Transfer Switch

An automatic load transfer switch shall be provided to transfer AC load between commercial power and the standby emergency power generator specified herein. The automatic transfer switch shall be sized for proper operation in accordance with the transferred loads.

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 control 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 to be mounted on a wall in the generator room of the electronic equipment shelter. 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 U.L. listed and labeled, tested per U.L. Standard 1008 and CSA Approved.

6.11.16 Transfer Switch Specifications

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

The transfer switch shall be rated for continuous operation in ambient temperature ranges of -40 to +50 degrees Celsius. Transfer switches shall be rated to carry 100% of the rated current in the enclosure.

6.11.17 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.

Time delayed automatic start of, and transfer to, the emergency power generator system for any of the following conditions:

- Commercial power failure
- Under-voltage condition for any and all phases
- Overvoltage condition for any and all phases
- Over/under frequency condition for any and all phases

Controls shall be provided with solid-state over-voltage 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 at least 0 to 5 seconds, shall be provided to avoid nuisance startups. Battery voltage starting contacts shall be gold, dry type contacts, which have been factory, wired to a field wiring terminal block.

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 zero to 120 seconds.

Protection shall be provided for low and high generator voltage and over/under generator frequency. Appropriate sensors shall be provided to ensure that load is not transferred, or that load is disconnected, when these parameters are out of (adjustable) limits.

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

A control shall automatically signal the engine generator to stop after a time delay, which shall be adjustable from at least 0 to 10 minutes, the time starting on return to commercial power.
The generator shall continue to run in an unloaded condition (engine cool-down) for an adjustable period of approximately five minutes after transfer to commercial power, and then automatically shut down.

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

### 6.11.18 Front Panel Control Devices

A key operated selector switch shall be provided which will 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 will provide an override of the retransfer time delay and cause immediate return to the commercial power source (if available).

### 6.11.19 Exerciser Clock

An exerciser timer shall be provided to periodically operate the generator without user presence or intervention to maintain the reliability of the unit. The timer shall be a user-programmable solid-state 168-hour (seven-day) clock timer adjustable to day of week, time of day, and duration of exercise period. The timer shall incorporate a selector switch to choose whether the engine-generator exercises with load or without load.

### 6.12 Grounding Systems

All communications towers, equipment shelters, and sites shall be provided with a protective grounding and bonding system for protection of equipment and personnel. All sites shall have a single point external and internal ground system installed to provide the greatest possible protection against equipment damage from lightning strikes and power faults. This includes existing tower sites that will have a new equipment shelter installed as part of the project.

For sites with existing structures and buildings, the Contractor shall make their best effort to locate a suitable low impedance ground point for interconnection of the protective grounding and bonding system. The connection point should be the main building electrical service ground and/or building structural steel and tower ground system.

Site planning shall require that the main electrical service be brought into the shelter at a location as close to the transmission line entry port as practical.

At any site where building structural members are used for grounds, connections to those main structural steel members shall be made with exothermic “Cadweld”, Burndy press, or equivalent type connectors. Any paint or fire-retardant material shall be scraped away down to bare metal before applying the connector. Surface preparation recommendations of the manufacturer of the exothermic welding process to be used shall be followed.

All grounding and bonding conductors shall be as straight as possible with a minimum number of bends. The minimum bending radius of any grounding/bonding conductor shall be one foot. All ground connections that are not exothermically welded shall use 2-hole long barrel compression lugs. Connections between dissimilar metals shall not be made unless a material specifically approved for use with the dissimilar metals separates the conductors.
Star or split lock washers shall be placed under the head of the screws, bolts, or nuts and not between the conductive surfaces of the lug and the metal surface to be bonded. Self-tapping sheet metal screws shall not be used for attaching grounding conductors to any surface. Paint shall be removed from any painted surface before ground connections are made and the appropriate antioxidant compound shall be applied to the connection.

All power feeders and branch circuits shall contain an equipment grounding conductor which shall have green colored THWN/THHN insulation or green identifying tape at both ends and which shall be suitably terminated to an equipment ground bus or device screw terminal at both ends.

6.12.1 Standards

Standard requirements for the installation of radio communications sites shall include the adherence to the following standards at a minimum:

American National Standard for Telecommunications:
T1.334-2002, Electrical Protection of Communications Towers and Associated Structures
T1.313-2003, Electrical Protection for Telecommunications Central Offices and Similar Type Facilities
T1.333.2001, Grounding and Bonding of Telecommunications Equipment
ANSI/NFPA 780-2004, Standard for the Installation of Lightning Protection Systems
National Electrical Code

6.12.2 Exterior Grounding Systems

The existing sites have extensive grounding systems that consist of grounding conductors, and ground rods. The Contractor must make every effort possible to avoid damage to the existing system while working on site. The Contractor’s personnel shall perform all excavation by hand within existing fenced compounds to identify any buried grounding conductors or rods that may be present.

The Contractor shall make its best effort to locate a suitable low impedance ground point for interconnection of the protective grounding and bonding system for the new shelter, generator, fuel tanks, waveguide bridge support structure, and fencing. The connection point shall be approved by the Counties.

The new communications site equipment and other metallic structures shall be installed with a protective grounding and bonding system for the protection of equipment and personnel. All ground system installations and modifications shall at a minimum, meet the local building and electrical codes and Contractors’ installation standards that are applicable at the time of installation.

All exterior and underground connections shall utilize the exothermic welding process such as Cadweld. A ground ring consisting of a #1/0 AWG tinned bare copper wire shall be installed in a trench at a minimum depth of 30” below final grade at a maximum distance of 3 feet from the foundation of the equipment shelter where the equipment is installed. The ground ring shall be supplemented with copper clad steel ground rods that shall have a minimum length of 20-ft and a minimum diameter of 5/8 inches. The ground rods shall be located no closer than 20-ft and no farther than 40-ft apart. All ground rods shall be interconnected and bonded to the concrete foundation Ufer grounds to form a common ground grid system.

The minimum requirements for the quantity of ground rods shall be based upon the following:

- At least one ground rod at each corner of all equipment shelters shall be installed
- Guyed and self-supporting towers if provided, shall have a minimum of three (3) equally spaced ground rods connected to the tower ground ring
- The top of ground rods shall be 30-inches below grade
- Inspection wells with removable lids shall be installed at the following junction points:
  - Old shelter to tower ground ring (if applicable)
  - New shelter to tower ground ring
  - New shelter electrical utility ground location

All connections to equipment room or shelter internal perimeter grounds shall be made as straight as possible with a minimum number of bends. The minimum bending radius of any ground wire shall be 1 foot.
6.12.3 Earth Ground System Test

At existing tower sites, the Contractor shall verify and report to the Counties the earth ground resistance by testing both before and after the new exterior ground system is and bonded to the existing site grounding systems.

The ground connection point for the interconnection to the existing grounding system shall be measured by a ground resistance test instrument prior to connection to the existing site ground system, and a written record of the results shall be provided to the Counties. The report shall include details of the instrumentation (model, serial and date of last calibration) and local conditions (wet, dry, temp. etc.)

If local soil conditions do not allow a ground resistance of 5 ohms to be achieved by the grounding system requirements of this Purchase Agreement, the Contractor shall notify the PAs in writing and discuss possible enhancements to achieve a ground resistance of 5 ohms or less.

6.12.4 Transmission Lines and Waveguides

Each coaxial transmission line and microwave waveguide shall be bonded to the tower using tower manufacturer approved methods, typically a mechanical clamp, at a point near the antenna and at intervals not exceeding 75 feet for the vertical run. These ground kits shall be installed in accordance with the manufacturer’s specifications, sealed against entry of moisture at any location where the outer sheath of the transmission line has been cut or removed.

Each coaxial transmission line and waveguide shall be grounded at a point above the bend required to exit the tower mounted cable ladder to the waveguide bridge leading to the radio equipment shelter or room, and at the exterior ground bar at the entrance panel of the equipment shelter. These ground kits shall be installed in accordance with the manufacturer’s specifications, sealed against entry of moisture at any location where the outer sheath of the transmission line has been cut or removed, and shall be connected to the tower ground bus bar.

The shelter’s exterior ground bus bar shall serve as the bonding point for the transmission line entry port panel and the transmission line grounding kits. The grounding kits shall attach directly to the exterior ground bus bar. All above grade grounding conductors shall be routed downward toward the earth and only horizontal where necessary.

6.12.5 Metallic Objects within the Compound

All exterior bonding/grounding conductors above grade shall be enclosed in non-metallic flex conduit wherever possible to protect the conductors.

Any metallic object within the fenced compound or within 5-ft of the fenced compound shall be bonded to the ground system. If any object outside the compound is bonded to the ground system, any object within 5-feet of that object shall also be bonded. All bonds shall be made with #1/0 AWG tinned copper wire, exothermically bonded to the ground system, and exothermically bonded to the object where practical. At a minimum, the bond to the object shall be a double lug connection. The following items, if applicable, shall be bonded to the exterior ground system:

Concrete foundations rebar
Skid or metal frame of the equipment shelter
Skid or metal chassis and enclosure of the generator
Fuel tanks within the compound whether above or below ground
Electrical and Telco service equipment and/or any other metallic shields, conduits, etc.
HVAC unit cabinets
Waveguide bridge support posts, metallic piping, fence posts, and fencing
All railings, hand rails, and other metallic structures
Light posts or external light fixtures
Any other grounding systems present at the site

Contractor shall comply with the above requirements as to Contractor-provided equipment and site development.

6.12.6 Fence Grounding

The security fence shall be bonded to the exterior ground system. Ground attachments to the fence posts shall be exothermic and at each corner and gatepost, at a minimum. At each corner post, a
#1/0 AWG tinned copper wire shall be bonded to the razor wire and the fence mesh at three locations using split bolts. The mesh shall be bonded to the copper wire at the top, center, and bottom of the fence and the copper conductor bonded to the exterior ground system.

The following requirements apply if fencing modifications include installation of a walk-through gate. A #1/0 AWG tinned copper wire shall be installed between the gate posts at a minimum depth of 30 inches below grade level. The walk-through gate shall be bonded to the gateposts by 1-inch wide braided copper flexible straps exothermically welded and installed between the gates and the gateposts.

Contractor shall comply with the above requirements as to Contractor-provided fencing.

## 6.12.7 Interior Grounding System

An internal perimeter ground bus (split halo) shall be installed in all equipment rooms or shelters that consists of #2 AWG tinned bare copper conductor, running along the perimeter of the room on each interior wall, at a maximum of 6 inches below the ceiling. The perimeter bus shall not form a continuous loop around the room. It shall have an opening of 12 to 16 inches on the opposite side of the room from the master ground bus bar. Insulated mounting standoffs shall be installed to provide a maximum separation of 2-ft to accommodate bends and avoid sag. Standoffs shall provide 1 to 2 inches of clearance from the wall or the nearest metallic object. Any splices of the interior perimeter ground shall be made with irreversible crimp connections.

All exposed noncurrent carrying metal parts of fixed equipment that could become energized shall be bonded to the internal perimeter ground bus. At a minimum, the following bonding connections shall be made directly to the internal perimeter ground (split halo) using green insulated #2 AWG stranded copper wire.

- Electrical conduits, ventilation louvers and metal ductwork, transmission line pressurization equipment.
- Metal doors shall be grounded to the doorframes (using 1-inch wide braided copper flexible straps, and door frames shall be bonded to the internal perimeter ground (split halo) with green insulated #2 AWG stranded copper conductor.
- All metal racks and cabinets, including tower lighting cabinets, generator transfer switch cabinet, power panel cabinets, metal conduits, fire suppression chemical storage tanks, Telco/alarm panel demarcation block cabinet, metal HVAC lead-lag controller cabinets, cable trays, file cabinets, metal desks and other exposed metal surfaces. Mechanical connections between sections of the cable trays shall be bonded to one another by #2 AWG copper wire jumpers.

## 6.12.8 Equipment Grounding and Bonding

Grounding of electronic communications equipment and components, cabinets, and all associated equipment within the equipment shelter shall conform to the latest version of the radio manufacturers’ company standards or guidelines for site grounding, bonding, and lightning protection. Each unique piece of equipment or chassis shall be bonded to its associated equipment rack or equipment cabinet ground bus. The “daisy-chaining” of grounding and bonding jumpers is not acceptable.

Should a discrepancy or conflict arise between manufacturers’ guidelines or standards, the more stringent of the standards shall apply.

## 6.13 Lightning and Surge Suppression

It is Counties’ goal to minimize equipment damage and failure due to lightning strikes or other forms of induced surge currents. The Contractor shall adhere to current practices in providing protection to sensitive electronic equipment. At a minimum, the Contractor shall comply with the surge protection practices depicted in this section and the latest version of the manufacturers’ guidelines and standards.

All metallic conductors entering the equipment shelter shall be protected with the appropriate surge protection devices. Surge suppressors shall be installed and bonded to the interior ground system as
6.13.1 AC Power Surge Protection

Parallel Surge Protection Devices (SPD) shall be provided with the equipment building to protect the AC main and sub panels. The primary units shall be installed with disconnect switches to allow for service of the devices. The surge protection devices shall be installed indoors in accordance with the manufacturer’s instructions, with particular attention to minimizing lead length. The units shall provide isolated dry contacts for remote monitoring of protector status, replaceable surge protection modules, and offer normal mode protection:

- Line-to-line
- Line-to-ground
- Line-to-neutral
- Neutral-to-ground

A second surge protection device shall be installed at the load center. The surge protection devices shall be installed in accordance with the manufacturer’s instructions, with particular attention to minimizing lead length and connected through a dedicated breaker for maintenance purposes. The units shall provide isolated dry contacts for remote monitoring of protector status, replaceable surge protection modules, and offer normal mode protection:

- Line-to-line
- Line-to-ground
- Line-to-neutral
- Neutral-to-ground

Contractor shall comply with the above requirements as to Contractor provided electrical service and panels.

6.13.2 Coaxial Transmission Lines

For all equipment shelters, a coaxial surge suppressor such as PolyPhase series or equivalent shall be mounted and grounded at the entry port panel for each transmission line.

The Contractor-provided outdoor antennas for control stations shall be equipped with a PolyPhase series surge suppressor or equivalent. These lightning arrestors shall be grounded to a 5/8" X 8-ft copper clad steel driven ground rod with #2 AWG tinned copper wire attached to the rod using exothermic welding. It is preferred that the grounding system used for the control station lightning arrestor shall be connected back to the building ground system at the power service entrance.

The Contractor shall maximize their efforts to protect all communications equipment from transient surge voltages.

6.13.3 Tower Lighting System

The tower light controller SPD shall be provided for the tower light controller. The Contractor shall mechanically connect the tower light controller SPD to its associated copper ground. The SPD shall be configured to protect all tower light lines, all markers, strobes, and beacons, connected to the
Contractor shall comply with the above requirements as to Contractor-provided tower lighting systems.

6.13.4 Telco and Low Voltage Lines Surge Suppression

Fiber optic cable is preferred over copper conductors and shall be used wherever possible.

All Telco leased line circuits and all other copper conductors that enter an electronic equipment room or equipment shelter shall be equipped with electrical surge suppression devices utilizing a common mode SPD, Transtector series, Northern Technologies TMC-50, or equivalent. These arrestors shall be installed as close as practicable to the point of entry to the facility. SPDs used on Telco leased circuits shall consist of both primary at the Telco demarcation and secondary at the point of cross-connection to communications equipment. Primary SPDs shall use silicon avalanche diode technology, and shall be bonded to the equipment shelter/room ground system.

Contractor shall comply with the above requirements as to Contractor-provided and installed low voltage wiring.
6.14 Conduits and Raceways

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

All AC power electrical 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 like manner. UL approved locknuts and grounding bushings or EMT box connectors shall be used at boxes and equipment enclosures.

All alarm conductors and Telco cabling inside the shelter shall be enclosed in 3/4-inch EMT conduit.

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

All conduit routings shall be horizontally and vertically straight, neat in appearance, indicative of professional workmanship, and shall conform to existing conduit routings where applicable. Where existing conduit supports are adequate, they may 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 support of conduits. Conduit support intervals shall be based upon the NEC Table 346-12.

Contractor shall comply with the above requirements as to Contractor-provided electrical and low-voltage alarm wiring.

6.15 Wiring and Devices

Power conductor insulation shall be color coded with tape at each termination end. Branch circuit conductors shall be labeled using Brady or approved equivalent wire markers at each end with the appropriate circuit numbers. Generator and HVAC control wiring shall be labeled with the terminal numbers corresponding to the Contractor’s wiring diagrams to be furnished with the equipment.

All outlet boxes shall be metallic surface mounted types suitable for the quantity of devices enclosed. Faceplates shall match the outlet boxes. The outlet boxes shall be marked with the associated circuit and breaker numbers. Outlet boxes that are fed by emergency power shall be plainly marked and identified. Orange outlets shall be used for circuits protected by both UPS and generator power; red outlets shall be used for any circuits that are protected by generator only.

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 lighting shall be #14 AWG.

Electrical equipment such as DC power plant rectifiers, generators, HVAC units, heaters, etc. shall be wired in accordance with the manufacturers wiring diagrams furnished with the equipment.

Contractor shall comply with the above requirements as to Contractor-provided and installed electrical boxes, receptacles, conductors and wiring.
7 P25 Trunked Communications System

7.1 General

It is the intent of the Counties to procure a state-of-the-art, digital APCO Project 25 compliant communications system that will meet their combined radio communication needs for the foreseeable future and provide the capability and reliability for mission critical communications to public safety officials and other system users.

The new communications system shall improve radio coverage throughout Sarasota Manatee Counties, provide In-Building Coverage with handheld radios, and establish improved interoperability with surrounding agencies and technologies.

The new communications system shall provide direct interoperability between participating agencies and will be capable of interoperable communications at the CAI, ISSI, and CSSI level with surrounding P25 systems.

7.2 APCO Project 25 Compliance

The System architecture shall conform to the objectives and user requirements outlined in the current APCO Project 25 standards (see TIA/EIA-102 family of specifications) in terms of digital modulation, spectral efficiency, enhanced audio quality, conventional and trunking modes, ID methodology, and direct interoperability with equipment from other manufacturers.

The Project 25 standards provide multiple performance, conformance, and interoperability tests for many of the documented interfaces in the Telecommunications Industry Association (TIA) 102/P25 suite of standards. Additionally the TIA has created a suite of P25 CAP Performance and Recommended Compliance Assessment Tests (RCATs) to support the Department of Homeland Security’s (DHS) P25 CAP. The DHS P25 CAP refers to TIA’s P25 CAP Performance and RCAT document to create the DHS P25 Compliance Assessment Bulletins (CABs) used by manufacturers and DHS certified P25 CAP laboratories to perform third-party compliance testing of manufacturers of P25 products.

In all cases of P25 performance, conformance, interoperability, P25 CAP Performance, and P25 CAP RCAT published standards documents, Contractor extensively tests its ASTRO Radio products in Contractor’s test laboratories to the TIA-102/P25 published standards. Additionally, since TIA-102/P25 standards document interfaces do not test all possible behaviors of other manufacturer’s equipment that interfaces (i.e., consoles) or operates on (i.e., portable radios) Contractor’s ASTROASTRO Radio solution, Contractor also performs extensive IOT in its test laboratories to ensure that the behavior of other manufacturer’s equipment is consistent with the intent of the standards and to the expectations of public safety users.

Contractor extensively tests its ASTRO Radio solution to the published TIA-102/P25 standards. Table 4 documents Contractor’s compliance to these standards.

Compliance to DHS-OIC P25 Compliance Assessment Program

Refer to Exhibit O – Product Specification Sheets titled Supplier’s Declaration of Project 25 Compliance (SDoc) and Project 25 Compliance Summary Test Report for the proposed GTR8000 Repeaters and associated subscriber unit tests.
The DHS Office for Interoperability and Compatibility (OIC) P25 CAP is an ongoing process to address Project 25 standardized interfaces. At this time not all Project 25 interfaces are addressed by the P25 CAP. Please note at the time of this proposal DHS-OIC is currently redesigning the P25 CAP program.

Details on the P25 CAP program can be found at this time at the following link. This link may change in the future as DHS-OIC redesigns the P25 CAP:

The P25 CAP Board publishes documents called Compliance Assessment Bulletins (CABs). The CABs address the following functions at this time:

- **Process Documents** – Suppliers Declaration of Conformance (SDoC) and Summary Test Report (STR) Requirements
- **Testing Documents** – P25 interface test documents where the DHS OIC CABs leverage Project 25 Recommended Compliance Assessment Tests (RCATs) and other P25 test documents for specific tests to evaluate P25 multivendor interoperability and interface compliance

The current list of P25 CABs can be found at:

- Summary Test Report Requirements CAB - September 2009 (process document)
- Baseline Inter-RF Sub-System Interface Testing Requirements CAB - March 2010 (test document)
- Supplier’s Declaration of Compliance Requirements CAB - September 2009 (process document)

At this time the DHS-OIC have not completed CAB documents for:

- Console
- Telephone Interconnect
- Network Management
- Data Network

ISSI CAB Note – please note that the P25 Inter-RF Sub-System Interface (P25 ISSI) has a published CAB but if one refers to the "List of DHS-Recognized Laboratories" link and each laboratory’s “Scope of Recognition”, at this time no laboratory is recognized as a qualified test laboratory for the P25 ISSI. To date no recognized laboratory has applied to be recognized for the P25 ISSI CAP. The list of recognized laboratories and their associated “Scope of Recognition” can be found at:

**Contractor’s Internal IOT Program**
Table 4  ASTRO Radio Compatible Radio Equipment Providers

<table>
<thead>
<tr>
<th>P25 Products</th>
<th>Product Description</th>
<th>Compatibility with ASTRO Radio System</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EF Johnson 5100/5300 Series Portable Radios</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>EF Johnson VP600 Series of Portable Radios</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Harris Unity XG-100P Series of Portable Radios</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Kenwood TK 5200/ 5300/5400 Series of Portable Radios</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Kenwood TK 5700/ 5800/5900 Series of Mobile Radios</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Motorola APX Series of Portable and Mobiles Radios</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Motorola XTS 5000 Series (XTS 5000/2500/1500) of Portable Radios</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Motorola XTL 5000/1500 of Mobiles Radios</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Relm KNG P25 Trunking Portable and Mobile Radios</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Tait Series of Portable and Mobile Radios</td>
<td>✓</td>
</tr>
</tbody>
</table>

ASTRO Contractor has determined full compatibility with the recorder manufacturers identified in Table 5 below, and is currently working with other logging recorder manufacturers to increase the choices an end user has when selecting a P25 logging recorder solution.
### Table 5  ASTRO Radio Compatible Logging Recorder Equipment Providers

<table>
<thead>
<tr>
<th>ASTRO Radio Products</th>
<th>Product Description</th>
<th>Compatibility with ASTRO Radio System</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXACOM</td>
<td>EXACOM Digital Multi-Media Logging Recorder</td>
<td></td>
</tr>
<tr>
<td>NICE</td>
<td>NICE Recording platform with a dedicated driver for the Contractor’sASTRO Radio system</td>
<td></td>
</tr>
</tbody>
</table>

**Contractor’s Compliance to the P25 Standards**
7.3  Radio System Infrastructure Equipment Requirements

7.3.1  Trunked Repeater Stations

All base station equipment shall be certified to be FCC type accepted and meet all applicable FCC technical standards. All stations shall meet the performance standards and specifications as specified in TIA-102.CCAB and performance recommendation.

All equipment shall be FCC type accepted for the proposed application and proposals shall provide the type acceptance numbers in their proposals.

The trunked Repeater stations shall be capable of supporting the radio frequency signals and modulation modes defined in the P25 Standard for Phase 1 and Phase 2 modulations, and be 700 MHz and 800 MHz capable. All base stations shall be capable of operating at a 100% duty cycle at the full rated transmitter power output of 100 watts. All base stations shall be of the same model and power rating to minimize the equipment spares requirements.

The Contractor shall provide extensive specifications and documentation for the proposed base station equipment and related systems such as but not limited to:

- Station construction details (enclosure type, chassis type, etc.)
- Transmitter specifications
- Receiver specifications
- Tuning procedures
- RF devices such as isolators, filters, duplexers, shielding, transmitter combiners, receiver multi-couplers, tower top amplifiers, etc.
- FCC Station ID devices
- Power supplies and voltage requirements
Refer to Exhibit O – Product Specification Sheets

7.3.2 Antenna Systems

A complete antenna system shall be provided at each simulcast site. All base station antennas and transmission lines shall be furnished with 7/16-inch DIN or N connectors. Splices or adaptors are not permitted and will be rejected.

The Contractor shall specify the antenna type and model, antenna heights (centerline AGL), antenna mount type, antenna sidearm type and length, and antenna orientation and downtilt for all transmit and receive antennas needed to meet the Counties’ coverage requirements and where applicable the requirements of Region 9.

The antennas shall be supplied with mounting brackets, masts, and all other suitable mounting hardware for mounting on a communications tower. Base station antennas shall be high quality, long life, and suitable for public safety applications. All brackets, masts, clamps, and hardware shall be of hot-dipped galvanized steel, or stainless steel. All antennas shall be mounted on standoff's that provide a minimum of 6-foot spacing from the tower leg or face. All new antenna systems and mounts shall be rated for high wind speed applications.

Refer to Exhibit O – Product Specification Sheets for the following pieces of antenna equipment:

- BMR12S-D-B1
- BMR12S-A-B1
- BMR12S-D-B1
- BMR12S-H-B1
- BMR12S-O-B1
- SC412-HF2LDF
- SE419-SWBP2LDF
- SC473-HF1LDF
- SC479-HF1LDF
- SE414-SWBP4LDF
- SE419-SWBP2LDF

Antenna systems per system per site are provided as part of the coverage map technical parameters document (refer to Exhibit H – Coverage Description and Contract Maps).

7.3.2.1 Transmission Lines

All transmission lines and jumpers shall be continuous length, Andrew Model, LDF, FSJ Superflexible type (interior only), 100% shielded, foam polyethylene dielectric, UV resistant, as manufactured by CommScope, or engineer-approved equivalent as required to meet coverage requirements. All connectors shall be properly installed and match the appropriate bulkhead entrance connectors.

The Contractor shall perform line sweeps and TDR measurements for all transmission line systems and provide the distance to fault, sweep and return loss data as part of the as-built documentation package.

Contractor has provided complete data sheet for the equipment selected as part of this Purchase Agreement. Refer to Exhibit O – Product Specification Sheets.

7.3.2.2 Transmitter Combiners

Factory tuned transmitter combiners shall be supplied for combining transmitters at each tower site.

**TRANSMITTER COMBINER MINIMUM REQUIREMENTS**
<table>
<thead>
<tr>
<th>Power Rating</th>
<th>The combiner shall provide sufficient operating margin to support the full output power of the transmitter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolation</td>
<td>Dual isolators shall be equipped with terminating loads rated for the full output power of the transmitter</td>
</tr>
<tr>
<td>VSWR</td>
<td>1.25:1 or less</td>
</tr>
<tr>
<td>Mechanical</td>
<td>Shall be mounted in a self-supporting steel relay rack or within the equipment cabinet</td>
</tr>
<tr>
<td>Insertion Loss</td>
<td>4.0 dB maximum, per channel</td>
</tr>
</tbody>
</table>

Contractor has provided complete data sheet for the equipment selected as part of this Purchase Agreement. Refer to Exhibit O – Product Specification Sheets.

Combining plan has also been provided as part of the drawing package. See Exhibit E – System Description.

### 7.3.2.3 Receiver Multicoupler and Tower-Top Amplifier

A receiver multicoupler per receive antenna shall be provided for each 700/800 communication site. The multicoupler shall consist of a redundant tower mounted preamp, preselector filter, tower-top amplifier test port, and equipment shelter based receiver distribution system including power supply and associated controls. The tower-mounted preamplifier shall be redundant, and it shall be possible to switch the "main" or "backup" preamp into service or bypass them altogether from the switching controller located in the shelter. A minimum 7/8" transmission line size shall be installed to connect the tower top amplifier and the receiver multicoupler.

The tower-top amplifier test port shall allow the preselector input to be transferred to an internal termination load for testing purposes. An internal coupler shall be provided to permit injection of test signals between the termination and the preselector filter via a shelter mounted test port input and connecting coaxial cable.

The antenna multicoupler systems shall be expandable to accommodate 50% growth beyond the requirements of the fully implemented communications System.

The receiver multicoupler system shall be integrated to the Network Control and Management System for alarm purposes.

The receiver multicoupler contains alarm sensors that monitor the top and bottom amplifier current and voltages, plus provide amplifier switching control via a proven power control circuitry to the top redundant amps. Monitoring and control is available via the UEM.

Contractor has provided complete data sheet for the equipment selected as part of this Purchase Agreement. Refer to Exhibit O – Product Specification Sheets.

### 7.3.3 Receiver Desense

It is desired that no receiver installed at any site by the Contractor, as part of the new System, shall be desensed by more than one (1) dB due to the presence of carrier signal from any transmitter that is also located at that site.

The Tower-Top Amplifier (TTA) selected for the Sarasota-Manatee system solution provides > 120 dB isolation between the transmit and receive frequencies. A band-pass (window) filter has been added to the receive antenna system to address any out of band spurious frequencies. Contractor conducts De-Sense testing as part of its site commissioning testing. Any deficiencies noted will be corrected prior to system turn-up.
7.3.4 **Network Core and Simulcast Site Controllers**

The System Network Core and Simulcast Control Point equipment shall be designed and proposed in a geo-redundant configuration to provide increased reliability for the regional System.

The equipment shall be mounted in freestanding equipment racks or equipment cabinets, and shall be provided in a fault tolerant configuration with redundant components, including power supplies.

The communications system Network Core and Simulcast Control Point equipment shall be installed at the following locations in Sarasota and Manatee:

7.3.4.1 **Sarasota**

The primary/secondary Network Core and Simulcast Control Point equipment shall be installed at the EOC located at 6050 Porter Way Sarasota, FL. The EOC is a dispatch location, and probable System simulcast site as well. The Contractor shall provide install the Network Core and Simulcast Control Point equipment in a Contractor provided pre-fabricated concrete equipment building for this location meeting the spatial and other requirements in this Purchase Agreement.

The ‘primary’ control point is to be at the EOC. The ‘secondary’ control point is at the Manatee PSC. The reason for utilizing PSC is that it is a CAT5 hurricane structure and as such may have better survivability in the event of a natural disaster. The PSC is also only two (2) microwave hops away from EOC and is planned to have backup fiber directly between the two facilities.

7.3.4.2 **Manatee**

Network Core and Simulcast Control Point equipment at the PSC equipment room, 2101 47th Terrace East, Bradenton, FL.

The ‘primary’ control point is to be at the Manatee PSC. The ‘secondary’ control point is at the EOC. The reason for utilizing the EOC is that it is CAT5 hurricane structure and as such may have better survivability in the event of a natural disaster. The PSC is also only two (2) microwave hops away from EOC and is planned to have backup fiber directly between the two facilities.

7.3.5 **Precision Frequency Source**

A precision frequency source shall be redundant, and shall be provided at each simulcast site to stabilize frequency synthesizers in the Repeater stations, and to provide synchronization of simulcast transmission equipment. The precision frequency source shall be a redundant “off-the- air” GPS frequency locked source. The frequency source shall be capable of maintaining the proper frequency stability and synchronization of the System upon failure/loss of the primary GPS reference signal receiver.

The GPS frequency source systems shall be integrated to the Network Control and Management System.

7.4 **Network Control and Management System**

A Network Control and Management System (NCMS) shall be provided and installed. The NCMS shall provide system administrators access to databases for data entry and retrieval, record keeping, adjustment of the system operating parameters, and system usage statistics. The NCMS shall support multiple users and sessions.

The NCMS shall monitor the integrity of all major communications system components and subsystems, and routinely poll system devices to determine status. This shall include, but not be limited to, the trunked system status, dispatch console systems, the digital microwave system, primary and backup power systems, and all related site status and alarms.

The NCMS shall allow operators to create, change, and delete items such as adding sites, talkgroups, aliases, channels, and updating subscriber programming including encryption keys.
The NCMS will contain the user interfaces to the ASTRO system management applications. The Key Management Facility is separate and described in section 4.16.4. The OTAP system is separate and described in section 4.16.3.

7.4.1 NCMS Network Security

The following security measures will be put in place to protect the P25 radio network from both unauthorized physical and electronic access:

- Physical access to the radio sites and therefore site equipment is controlled via a keyed door lock and a magnetic sensor
- Access to the network is controlled based upon the type of equipment:
  - Network switches
    - All unused ports on the network switches will be shutdown to prohibit unauthorized access
    - All ports in use by the P25 system will be configured with port security to ensure only authorized MAC addresses are allowed to access the network
  - Network Routers
    - All unused ports will be shutdown
  - Network Firewalls
    - A firewall, provided by the Counties, will be placed at every location where the P25 network connects to the Sarasota County or Manatee County networks. The network firewall should be configured as a stateful firewall to prohibit access to the network from unauthorized users and to only allow traffic on authorized IP ports.
    - A firewall, provided by Contractor, will be placed to allow connection to the P25 radio network to its Managed Services group and remote maintenance personnel. The network firewall will be configured as a stateful firewall to prohibit access to the network from unauthorized users and to only allow traffic on authorized IP ports.
  - Access to the information systems and network connected devices is either through a HTTPS or SSL based username/password login capability. These controls may only be accessed if a user is authorized access via the common controls as stated earlier in this document. This equipment includes:
    - All ASTRO Radio System Servers
    - Radio Base Station Equipment
    - SNMP Manager server
    - Logging Recorders
    - Dispatch Equipment (servers, console position PCs, radio gateways)
    - Key Management Facility Servers
    - Power System Controller
    - Maintenance PCs
    - Network Management Client Workstations
    - GPS Time References
    - Network Routers and Switches
7.4.2 Network Management Terminals

Alarm status information shall be accessible from the system manager terminal. The system supervisor shall be able to ask for and receive alarm conditions concerning the alarm status of ancillary systems and equipment.

Network management terminals shall be provided at the following locations for each County:

- **Sarasota**
  - EOC 6050 Porter Way Sarasota, FL
  - Sarasota Sheriff 425 Old Venice Road Osprey, FL

- **Manatee**
  - Radio Shop 1801 5th Street West, Bradenton, FL
  - Radio Network Operations Center (NOC) 2101 47th Terrace East, Bradenton, FL

The network management terminals shall provide the following functionality:

- **Programmable display screens including the following:**
  - System summary – High level screen summary window with links to other screens
  - Change of state – Summary of points that have changed state from alarm to normal or normal to alarm
  - Standing alarms – Summary of all points in alarm condition
  - Programmable alarm windows – Allowing logical grouping of alarms such as by type or site.

- **Graphic depiction of the network allowing annunciation and point selection via icons:**
  - Nested tree depiction of the network with drill down capability
  - Capability to drive external display devices

- **Programmable console environment including:**
  - Database definition
  - Screen colors
  - Alarm summary formats
  - Blink attributes
  - Pager alarm formats
  - Audible alert formats

- **Status points – the following status types shall be supported:**
  - Simple status – contact open or closed
  - Change detect – simple status plus change detect since last scan

- **Analog points – display the value of a monitored quantity such as temperature, fuel level, Voltage Standing Wave Ration (VSWR), etc.**

- **Time stamp indicating date and time of message**
Exhibit A – Scope of Work
800 MHz Emergency Communications Systems
For Sarasota and Manatee Counties
RFP 142842TM

- Conditional assignable text messages for each point to be issued on a change of state or alarm
- Alarm qualification – on a point basis, programmable delay before alarm is issued
- Alarm deactivation – on a point basis, the ability for the operator to deactivate an alarm to inhibit additional annunciation
- Alarm history:
  - Logging of all alarms to disk and printer (selectable)
  - Minimum history log of 500,000 entries
- E-mail support – text message of alarm sent to e-mail lists
- Ping interrogator – to confirm that servers, routers, and IP based equipment are physically present on the network
- Security – multiple levels of user name and password protection to all for flexible system management

The NCMS and user terminals shall be powered from 120VAC 60 Hz power.

The network management terminals located at the two Manatee County (Radio Shop and Radio NOC) and two Sarasota County (EOC and Sheriff) locations provide the ability to view the network health, status and statistics as provided by the SNMP Manager and ASTRO Network Management applications. The access to the SNMP server is through a standard Web browser window. Some configuration, such as setting event and alarm rules (e.g. email notification) is accomplished through applications running on the SNMP Manager. Access to the Network Management applications is through a client loaded on the network management terminal.

Contractor shall utilize the Unified Element Manager to provide equipment status (RF Repeater, all servers, routers, switches other network connected equipment), failure detection, and corrective actions in a synthetic view through a friendly user interface. SolarWinds provides a clear graphical Web interface for the network supervision. The Web interface is configurable and allows presenting the information in different format such as maps, graphs, and tables. In case of abnormal or failure conditions on the network, a visual message such as a change in the color of the faulty element informs the network supervisor. An audible alert and/or email can also be triggered.

Fault management information gathers servers hardware faults, P25 controllers restart event, P25 cluster switch over event, loss of connectivity events between the site controller and the RF Repeaters. All of the fault management information is either stored in the MIB or reported through an SNMP trap. RF Repeater’s have their specific MIB and trap events in order to report the hardware and software faults as well as loss of digitized voice packets across the IP backbone.

At each site, an SNMP alarm aggregator will collect the alarms from equipment that does not support SNMP and convert them into SNMP messages, for centralized monitoring by a SNMP manager.
The UEM integrates a powerful network alerting engine which allows triggering different kind of notifications based on the information received by the SNMP Manager (traps, non-response to polling, thresholds on counter value, etc.). Possible actions include sending an E-mail or page, playing a sound, logging alerts to a file, logging an alert to the Windows Event Log, sending a Syslog message, executing an external program, or sending an SNMP Trap.

For e-mail, it is possible to define the recipients, the subject and the body of the message. The body of the message can be defined to include variables automatically linked to the event triggering the notification (date, time, trap identification, faulty element). The email will be sent from the SNMP manager (acting as a client) to the SMTP server.

7.4.3 Remote Access

The Counties desire to access the NCMS from remote locations including sites on the proposed radio system network and external unspecified locations. Access shall be provided using a Windows based computer. A secure Web browser interface shall be provided for common management functions, and to monitor alarms and perform control and management functions via Intranet or Internet.

The administration of the ASTRO Radio servers, as well as the SNMP Manager, is through a standard Web browser via a secure HTTPS. Contractor shall utilize a Network Security Appliance to create a secure tunnel between the Service Management Center (SMC) and the Sarasota/Manatee Counties radio network for remote maintenance access. This device provides for comprehensive network security, including Application Control, Intrusion Protection, Advanced Antimalware, Web Filtering, VPN and WAN Optimization. Communication between the VPN Client and the Firewall is via an SSL client application that is sourced from the Firewall to the client PC.

7.4.4 System Manager Access Levels

The system management function shall have multiple levels of security access. The system management function shall be password protected and keep a log of all entries into the system by date, time, and authorized individual.

7.4.5 Data Base Partitioning

The system management function shall be capable of partitioning the database such that different managers have access and control over the units and groups for which they have been authorized.

7.4.6 Communications System Administration and Diagnostic

The system management terminal shall allow the radio system manager to control certain aspects of the system such as channel disable, channel hold time, how emergency activations are controlled (such as what priority an emergency takes on the system with options such as “ruthless preemption”).

The system management terminal shall provide the capability to switch from primary to redundant controllers. The terminals shall display the real-time activity of the system controllers. The Contractor shall describe in detail the extent of the system’s ability to perform software updates and/or changes to fixed infrastructure as well as subscriber units.

Contractor’s Software Updates and Releases Service, based on the Release Management process, provides Sarasota and Manatee Counties with new software releases and updates.
New software releases include:
- All the latest software release improvements
- New basic features and minor enhancements
- Release documentation which includes all technical information and information about new optional features

Contractor’s complete software services will provide Sarasota and Manatee Counties with new software releases and new software updates that maximize the performance of the ASTRO25 Radio system. New software releases include all the latest software release improvements and new standard features. Updates are natural improvements of the product based on feedback from existing software releases and system changes. Software releases are accompanied by documentation, which includes all technical information and standard feature information.

Contractor’s software upgrades are released on a pre-announced schedule which is updated periodically. A System Manager dedicated to Sarasota and Manatee Counties will notify the Counties of available upgrades that they may be interested in implementing on the System.

The Counties will receive the information before the upgrade is scheduled and they will have the opportunity to review the full process with their Customer Support Manager and the Contractor’s Technical staff necessary to implement the upgrade.

With the use of the Contractor’s centralized software update process, the upgrade of a system removes the traditional travel required to each site. All software updates are performed through the remote satellite server which is an application hosted at the Zone Controller sites. The remote satellite server stores all system software, and alternate versions, before being downloaded to each physical device. All provisioned data is saved so that partial or complete system recovery can be achieved.

During the software update process, each controller will be taken out of service, updated and rebooted. During this period, communications over the Contractor’s ASTRO25 Radio network is maintained. The function for each controller will be forced onto the backup controller to maintain system operations.

### 7.4.7 Communication System Failure Notification and Alerting

This feature provides the capability for e-mail alerts to be sent to designated responders when critical failures occur within the system enabling failures to be quickly communicated to the appropriate personnel, even when they are not in front of the network management terminal. The System shall provide this functionality.

### 7.4.8 System Database Management

The existing system maintains a backup of system configuration information, such as talkgroup configurations and allowed radio ID ranges. Without this, a failure to the system could possibly require the complete reprogramming of these parameters that could lengthen the amount of time of any resulting outage. The System must retain this capability.

A database shall be maintained to simultaneously store and update system user profiles such as user group access, priority levels, dynamic regrouping plans, authorization codes, call statistics, traffic recordings for each radio, talkgroup, fleet map and Agency, etc. Additionally, whenever a field unit is powered up and is within RF coverage range of the System, the unit’s discrete address and user group selection shall be recorded into the system database.
The database shall permit user defined sorting of calls by units, groups, time of day, duration of call, channel, site, and priority.

The database shall be continuously backed up in real time. The backup database shall act as a "fault tolerant" database that is automatically kept current. Should there be a failure with the primary database; the backup database shall automatically be activated for system access with no drop in service. The database shall have sufficient capacity to store all system profiles, as well as the capacity to store a minimum of 90 days of system activity for report generation.

7.4.9 System Management Report Generation

The system manager shall be capable of generating management reports to provide the necessary information for management personnel to review the reports and make decisions regarding staff resource allocation, altering system size, and evaluating the operational effectiveness of the various components of the trunked radio system. The System shall be capable of archiving a minimum of sixty days of data and reports shall include at least three months of System activity.

The Network Management Client suite of applications are provided as part of the ASTRO25 Radio system solution, is used to monitor the radio system performance and utilization of the system over time. It provides many reports on system capacity, call statistics, system availability, and system utilization. The ASTRO25 Radio servers provide specific accounting and monitoring data from a zone controller to the network management server. The server then processes the data for many different system activities, such as showing Repeater activity, group or unit calls, subscriber and console affiliations, PTT IDs, and history reports.

The server accumulates, decodes and stores system usage data from the ASTRORadio system. Data can be accessed from inside the radio network and used regularly for performance and usage reports. It provides detailed activity in near real time and provides a flexible suite of csv and pdf-based reports.

Reports Provided in the Basic Package

The following reports are included:

- **Airtime by Radio ID** – Shows total of airtime and PTTs for each unit ID. Viewer can see all IDs or a range of IDs.
- **Busy Seconds by Hour** – Shows busy seconds (all types) by hour for the specified time range.
- **Busy Seconds by Type** – Shows busy seconds for each “busy type” during the specified time range.
- **Call Activity** – Shows a detailed call list of each call for the specified time range. Details include: date/time, call type, source site, target, duration, status, etc.
- **Call Details** – This report is meant to be used to 'track' the sites and channels utilized by calls. It can be used with the Call Activity report when specific calls are identified for further investigation. Match the 'Uniq Call#' field from the Call Activity report to the same field in this report to see all the sites used on the call and the associated details for each site.
- **Database Status** – Shows the date range of the data in the database. It is also useful as an awareness that the 'backend' processes are indeed running and doing their job (indicated by a current date/time in "newest" record).
- **Detailed Busies** – Shows details for each “busy” that occurred during the specified time range. Details include the busy and source site of the call(s).
Remote Terminal Units

A remote terminal unit (RTU) shall be provided to capture diagnostic and alarms reports from all communication sites. The alarm system shall automatically notify maintenance personnel of the nature and extent of the alarm condition by way of text message and email. Alarms shall be reported with the following minimum information:

- Site name
- System and equipment in alarm
- Site status description
- Nature and severity of the alarm
- An optional instruction line
- The date and time of the event reported to the nearest second

The RTU capacity shall be sized to support the total number of site alarms to be reported plus an additional 50% expansion.

Control outputs at the RTUs shall provide minimum isolated one-amp resistive Form C contact closures. Control outputs shall be assigned as latching or momentary on a point-by-point basis.

Certain control points will be verified by status point status changes. The system must correlate alarm events to control transmissions and generate a control failure message if the expected alarm point status change does not occur. Station report failures and return to manual reporting shall be identified at the master terminal. The number of polling attempts before reporting a failure shall be adjustable.
The operator shall be able to selectively enable/disable status and analog points as well as reporting from an entire remote terminal. The operator shall be able to selectively change remote terminal values from the master terminal station.

7.4.11 Alarm Status and Priority

All status changes shall be displayed on the master station display. The workstation shall present status changes to the operator for acknowledgment. The most critical messages shall be given priority over lower priority events. User definable colors shall be assigned to each priority level. There shall be a minimum of seven priority levels. In addition to presenting status changes graphically to the operator, the master station shall display any of the reports or menus at the operator’s discretion.

At a minimum, the following alarms shall be logged and displayed:

- Site alarms (as applicable for each site)
  - Tower lighting (combined beacon, side lamps, power failure)
  - Building intrusion (combined all entrances)
  - Building low temperature
  - Building high temperature
  - Building smoke/fire
  - Fire suppression system discharge
  - Fire suppression system trouble fault
  - Air conditioner A failure
  - Air conditioner B failure
  - Commercial power failure
  - Transfer switch position
  - TVSS failure

- Generator alarms (as applicable)
  - Generator running
  - Generator control switch not set
  - Generator low oil pressure pre-alarm
  - Generator low coolant temperature pre-alarm
  - Generator high coolant temperature pre-alarm
  - Generator low oil pressure alarm
  - Generator low coolant temperature alarm
  - Generator high coolant temperature alarm
  - Generator low fuel
  - Generator over crank
  - Generator other failure (combined alarm)
  - Generator battery charger alarm

- UPS power system alarms (as applicable)
  - UPS on line
  - Rectifier/Battery charger low voltage

- Microwave system alarms (as applicable)
  - Transmitter (each transmitter, not combined)
  - Receiver (each receiver, not combined)
  - Microwave received signal level
  - Rectifier/Battery DC voltage
  - Rectifier/Battery charger low voltage
  - Rectifier/Battery charger high voltage
  - Rectifier/Battery charger no charge
  - Transmission line high pressure
Control Outputs

The following relay control types shall be supported:
- Direct control – open or close contact

The Contractor shall provide eight control outputs at each location for future use.

Dispatch Center Console Requirements

It shall be the responsibility of the Contractor to fully understand the current dispatch console functionality for each county and to maintain the current level of functionality when implementing the new dispatch console equipment.

General

Operators shall be able to perform all functions through the LCD display by using the interface device (mouse or touch screen). The LCD display shall be designed so that the number of items which will appear on the screen at a given time shall be minimized thereby reducing the potential distractions to the operators. However, all radio dispatch functions shall be operable from one display screen. Operators shall not be required to access another screen display in order to perform a radio dispatch function.

The console electronics shall use a distributed IP based multi-processor concept and shall employ a physical architecture that consists of servers, routers, LAN/WAN equipment, Conventional Channel interfaces, auxiliary IOs, instant recall recorder, logging recorder interface, and dispatch operator positions.

The screen display shall be flexible allowing authorized personnel to determine which functions are available at each operator position, which channels are available, how these channels appear on the screen, and the names associated with channels, channel options, auxiliary functions, and indicators. Each channel or auxiliary function shall be referenced by alphanumeric characters not numeric only or cryptic references.

Furniture

The Contractor shall install the new dispatch console equipment into the existing dispatch console furniture provided at each dispatch center by the respective county or city Agency. The Contractor shall provide any/all equipment racks, grounding and bonding, and miscellaneous hardware and components required for completion of the dispatch console and backup radio installation.

Dispatch Center Timing/Synchronization

The 9-1-1 centers in Sarasota and in Manatee have existing GPS-based systems for the synchronization of 9-1-1 center equipment. Manatee currently utilizes a Symmetricom Syncserver S250 netclock and Network Time Protocol (NTP) format for synchronization at the ECC and MCSO communications centers. The Contractor shall work with the Counties and all dispatch centers to assure that the Contractor provided radio dispatch consoles remain synchronized with other 9-1-1 center systems.

The ASTRO Radio System will get its NTP from the Master Site GPS reference. This NTP will propagate through the ASTRO Radio System, including the Consoles, ensuring that the timing will be synchronized between the ASTRO Radio System and the various legacy county systems.
7.5.4 **Console Auxiliary I/O Functions**

Each operator position shall be able to support a minimum of sixteen (16) unique input/output modules at each dispatch center location. Each module shall include a “soft button” and descriptive test line to identify the function and the status, respectively. Text colors shall be user definable. Auxiliary I/O shall support:

- Input
- Momentary output
- Toggled output
- Alarm input

Inputs/outputs shall be optically isolated or control relay switches that activate relays, open doors, and perform special tasks by depressing the associated “soft button”.

Contractor will provide 16 Digital I/O lines at each of the five dispatch locations that have Radio Consoles being deployed. These I/O lines will be available for indication and control at any of the provisioned console positions.

7.5.5 **Logging Recorders**

7.5.5.1 **Sarasota**

Sarasota utilizes a Voice Print International (VPI) Replay series model 7045W-NTR logging recorder system, and desires to integrate the existing VPI system with the new P25 radio system.

7.5.5.2 **Manatee**

Manatee utilizes a NICE NRX series with INFORM logging recorder system, and desires to integrate the existing NICE system with the new P25 radio system.

7.5.5.3 **Logging System Requirements**

The new logging recorder system shall be a NG9-1-1 upgradeable, IP-based networked P25 compatible, digital logging recorder system that shall provide the ability to log / record the following:

- All trunked radio traffic
- All conventional radio traffic
- All landline and wireless 911 calls
- Call taker administrative calls

The logging recorder shall be equipped to archive radio and telephony audio to various storage media including, but not limited to:

- Internal, Redundant Array of Independent Discs (RAID) Level 1 or greater hard drive storage
- DVD R/W devices
- Network attached storage (NAS) devices

The logging recorder shall be capable of storing audio in variable bit rate, industry-standard digital formats such as WAV, WMP, MP3, etc.

The logging recorder shall be capable of storing 30,000 channel-hours before archiving is required. The logging recorder shall be capable of being upgraded to allow for greater capacity before archiving is necessary.

The logging recorder shall be capable of recording a minimum of 144 simultaneous audio sources. Client / server architecture shall be utilized that allows for the access, playback, and transfer of digital audio files across a TCP / IP-over Ethernet network.

The logging recorder shall be constructed to meet the requirements of 24 hour, seven day a week operation.
The logging recorder shall meet or exceed all FCC, IEEE, EIA/TIA and APCO standards.

- The ability of multiple search and playback techniques shall include, but not be limited to:
  - Console position
  - P25 emergency call activation
  - Subscriber unit ID
  - Talkgroup
  - Individual Call
  - RF channel (for conventional Repeaters/base stations only)
  - Date
  - Time
  - ANI/ALI data

The logging recorder subsystem shall share a common timing reference with the radio system.

The logging recorder shall be installed in an EIA/TIA standard 19” wide rack.

The logging recorder shall interface directly with the radio system for audio and P25 data. Recorders that interface through the dispatch consoles or the console subsystem are not allowed. This may require a standalone encrypt/decrypt device.

The logging recorder shall be equipped with dual power supplies.

The logging recorder shall be capable of individual user logon and various levels of access to channels and authorized permissions.

Refer to Exhibit A Section 14 for additional details on the Sarasota-Manatee Loggoer Sub-System.

7.5.6 Conventional Analog Channel Interface

A conventional gateway shall be incorporated into the System that will interface with the conventional base stations/Repeaters. The console system shall support conventional analog interfaces to facilitate communications interoperability with a variety of outside agencies and interface technologies. The gateway shall support various radio channel interfaces and shall be capable of 2-wire and 4-wire audio and tone and E&M for local control of radio channels and provide local control for analog resources such as control station radios and the FIN interface.

The console system shall be equipped to enable these conventional resources to be patched to trunked talkgroups and other Conventional Channel resources.

Refer to Exhibit E – System Description and specifically the Sarasota – Manatee System Description which details the quantities of conventional interfaces included as specified by Contractor.

7.5.6.1 Sarasota

The PSC radio dispatch consoles support conventional interfaces for mutual aid, and other interoperability purposes. A list of conventional interfaces is provided below:

<table>
<thead>
<tr>
<th>Med 8 Sarasota</th>
<th>Forestry Red</th>
<th>Forestry White</th>
<th>Forestry Blue</th>
<th>Inter-City</th>
</tr>
</thead>
<tbody>
<tr>
<td>8CAL90</td>
<td>8TAC91</td>
<td>8TAC92</td>
<td>8TAC93</td>
<td>8TAC94</td>
</tr>
<tr>
<td>USCG 16</td>
<td>USCG 83</td>
<td>FL-LE-1</td>
<td>FL-LE-2</td>
<td>FL-LE-3</td>
</tr>
<tr>
<td>FL-LE-4</td>
<td>FL-PS-1</td>
<td>FL-PS-2</td>
<td>FL-PS-3</td>
<td>FL-PS-4</td>
</tr>
</tbody>
</table>
Refer to Exhibit E – System Description and specifically the Sarasota – Manatee System Description which details the quantities of conventional interfaces included as specified by Contractor.

7.5.6.2 Manatee

ECC radio dispatch consoles support a number of conventional interfaces for mutual aid, and other interoperability purposes as depicted in the table below.

<table>
<thead>
<tr>
<th>MA-FLA</th>
<th>FL-LE-1</th>
<th>FL-LE-2</th>
<th>FL-LE-3</th>
<th>FL-LE-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC-FD-W</td>
<td>MC-FD-E</td>
<td>FL-PS-1</td>
<td>FL-PS-2</td>
<td>FL-PS-3</td>
</tr>
<tr>
<td>FL-PS-4</td>
<td>MED 8</td>
<td>WMFD-AR</td>
<td>8CAL90-M</td>
<td>8CAL90-E</td>
</tr>
<tr>
<td>8CAL90-W</td>
<td>8CAL90-D</td>
<td>8TAC92-D</td>
<td>8TAC91-E</td>
<td>8TAC91-W</td>
</tr>
<tr>
<td>8TAC92-W</td>
<td>8TAC93-M</td>
<td>STATEIA</td>
<td>STATETAC</td>
<td>NRFD-AR</td>
</tr>
</tbody>
</table>

Manatee has indicated that multi-frequency tone control is required for the control of some multi-channel base stations. The Contractor shall confirm their capabilities for multi-channel tone control with their conventional interface.

Refer to Exhibit E – System Description and specifically the Sarasota – Manatee System Description which details the quantities of conventional interfaces included as specified by Contractor.

7.5.7 Conventional Fire Alerting

7.5.7.1 Sarasota

Sarasota PSC uses a fire alerting system that consists of two mobile radios; one of the mobile radios monitors the control channel for alerting and the other mobile radio monitors the Fire Main talkgroup for voice messages. The mobile radio monitoring the control channel is interconnected to an external enclosure containing relays that control the various functions within the fire station. Each fire station is equipped with speakers and switching equipment that operates lights and turns of the gas to the stove.

This functionality has been critical to public safety operations and the System must support the retention of this capability.

7.5.7.2 Manatee

Manatee has a fire station alerting system that utilizes the existing 800 MHz radio system and a VHF two-tone paging system that are interfaced to the Maestro’s dispatch consoles via conventional interfaces.

The VHF system utilizes two base stations in a multi-cast configuration operating on frequencies 154.370 MHz (VHF West) and 153.950 MHz (VHF East), to provide two-tone sequential paging to all the Fire stations throughout the County. The two frequencies are multi-cast to the fire stations to set off the station Klaxon, and tone the station. The VHF paging channel audio is hard-patched to the Fire Dispatch talkgroup as well, so tones are broadcast on the primary dispatch channel.

The second Fire Station Alerting system is provided by First-In and utilizes the Manatee’s 800 MHz trunked radio system. This functionality has been critical to public safety operations and the System must support the retention of this capability.

7.5.8 Console Common Electronics Equipment

The common console electronics equipment such as servers, routers, external hard drives, conventional interface units, and LAN/WAN equipment shall be installed in equipment racks.
7.5.12 Agency Partitioning

The console system shall allow multiple agencies to share a common system while maintaining full control over and functional operation of their respective resources.

7.5.13 Centralized Fault Management

The console system shall provide for robust system fault management from a centralized location. Secondary remote fault management from an alternate location shall also be provided. Remote fault maintenance shall be protected from unauthorized access without proper credentials and security clearances.

The Contractor shall include descriptions of failure scenarios and discuss all redundant features that include dual circuitry, switchover circuitry and the time to accomplish switchovers. An alarm indicating that the failure and switchover occurred shall also be reported at the supervisor's console.

The MCC7500 console system provides resilience in the event of various failure scenarios. All configured alarms can be indicated on the supervisor console as required. Console system fault management is furnished via the Unified Event Manager.

- **Console Position Equipment Failure** – In the event any equipment from a console position fails, the console position in question would be unusable until the failed module was replaced. Any failure of a console position would not affect any other console position. This assumes the console positions are operating on a redundant LAN.
7.5.14 **Diagnostics**

The console system shall be equipped with a number of self-diagnostic subsystems that shall continuously monitor and verify the correct operation. Diagnostic capability shall be distributed among independent and redundant subsystems and shall not rely on one central diagnostic circuit. Should a fault be detected, the Supervisory consoles shall be notified via the Network Monitoring and Control System. Redundant equipment shall be automatically activated, and diagnostic information shall be logged. Diagnostic messages shall be presented in an easy to read format. Diagnostic systems that require the dispatch supervisor to cross-reference an error code to a fault message shall not be acceptable.

7.5.15 **End-to-End Encryption**

The console system shall provide a high level of security by providing end-to-end encryption of selected talkgroups that are configured for encrypted operation.

7.5.16 **Fallback Dispatch Operation**

When link connectivity is lost, a link failure message shall prominently appear on the LCD display to notify the operator that the console system is no longer in contact with the radio infrastructure. The operator can then select the desired talkgroup on a portable radio to communicate with field personnel.

7.5.17 **Patching Capability**

The console system shall provide for the flexible patching of talkgroups and Conventional Channels without the need for “double vocoding” of talkgroups. A patching window will identify all patched in operation at any moment. In addition, all channel modules will provide a displayed indication when a talkgroup or channel is involved in a patch.

It is essential that the communication resources to be patched within the System occur with as little delay as possible in bringing the patched system to a transmit ready state. It is desired that an access time of less 250 ms be accomplished for each patch. In addition, it is desirable that there be no unnecessary hang time at the end of any transmission after a radio user releases their transmit key.

The Contractor shall specify the total number of patches, on a temporary or permanent basis, that may be established from each operator position and the total number of patches supported by the System.

Contractor is fully compliant for P25 and Radio Channel Resources that provide positive carrier detect. Because of variability of Voice Operated Switch (VOX) connections, the access time of 250 ms may not be met.
7.5.18 Channel Control Requirements  
Each channel control window shall contain the specific command buttons and indicators required to control the corresponding base station/talkgroup. Each channel control window shall be supplied with the following minimum functions and features:

Name - an alphanumeric name of a channel or talkgroup
Call indicator - flashes when receive activity is present
Transmit indicator - illuminated whenever channel is keyed; including keying from a parallel remote control point or parallel console position

The following control functions shall be provided by on screen command buttons and/or function keys on a keyboard:

Transmit - provides independent and direct keying of a channel
Mute - mutes the individual channel to a predetermined level without affecting other channels. Once muted, the channel shall remain muted until unmuted by the console operator or it shall automatically unmute if the channel is selected. When deselected, it shall revert back to the muted condition
Select - routes the channel audio to selected speaker output and allows the channel to be keyed via the system transmit function or foot pedal. Any previously selected channel returns to unselected status

The Contractor shall determine the station control configuration of Counties’ current equipment, including frequency assignments, conventional paging and signaling, method of control, multiple frequency, and/or multiple receiver stations, etc. and ensure that the proposed dispatch equipment support these existing configurations and capabilities.

7.5.19 Power Supply  
Uninterruptable Power Supplies (UPS) shall be provided for sustaining power to all equipment that is not connected to an existing UPS. The UPS shall have a minimum run time of fifteen (15) minutes when fully loaded to keep all AC powered console equipment on line until the backup generator has stabilized. The UPS system requirements are:

True no break UPS utilizing ferroresonant technology
Line conditioning allowing for voltages sags, surges, spikes, noise and brownouts during stand-by operation from the power line at full load
Visual indications of operational status and battery condition
Automatic battery by-pass switch
60 Hz, single phase, 120VAC input power
Sized for 150% of initial System load, minimum of 50% surge while in the standby mode

7.5.20 Common Dispatch Console Functions  
Each of the radio dispatch consoles shall provide all controls that apply to the various channel/talkgroups and auxiliary functions for the console. Operator positions shall be PC based; utilizing equipment that is in current production at the time the system is installed to help provide a long equipment life. The operator position application shall be Microsoft Windows based.

Each console operator and Supervisory position shall include at a minimum the following:

The console positions Contractor shall use are Microsoft-Windows based desktop computers.

7.5.20.1 User Login Accounts  
Each operator position and supervisory position shall require a valid user login and security password to access the console system and its capabilities. The system shall provide multiple levels of access security for different levels of system usage.
7.5.20.2  Select Speaker
Select speaker shall provide audio from the selected channels/talkgroups, with an independent volume control. A volume level display shall be provided for each channel as well as a select speaker audio level adjustment that ranges from silent to full volume.

7.5.20.3  Unselect Speaker(s)
Unselect speaker(s) shall provide audio from unselected channels/talkgroups, with an independent volume control for the unselect speakers. Up to three (3) unselect speakers shall be available per operator position.

7.5.20.4  Speaker Volume Controls
Volume controls shall be provided for the control of each speaker.

7.5.20.5  Transmit Function
A color-coded transmit function to control the push-to-talk (PTT) function for the selected transmitter(s) and/or talkgroup(s). The PTT function shall be capable of being enabled by a PTT button on the headset, a PTT indication on the LCD display, and by the dual foot switch at the position.

7.5.20.6  Transmit PTT
A transmit function shall be provided on the screen or user interface. This function will allow the operator to transmit on all selected channels.

7.5.20.7  Instant Transmit Function
Each operator position shall provide an instant transmit function that will allow the dispatcher to quickly transmit on a Conventional Channel or talkgroup by depress the instant transmit "button".

7.5.20.8  Clock
Clock shall display time in a twelve or twenty-four-hour format (user selectable) and day of the year (HH:MM:SS day) at each operator position. The console clock shall derive its reference time signal from a Master Time Source.

7.5.20.9  VU Display
VU display shall present a visual indication of receive and transmit audio levels.

7.5.20.10  Keypad
Screen representation of a keypad for numeric data entry.

7.5.20.11  Keyed Channel Interlock
A means shall be provided to lock out control of a channel from other console positions if that channel is already keyed from another console position. The supervisor position can override this feature.

7.5.20.12  Channel Name
Designated channel control modules shall include a minimum of twelve-character alphanumeric display symbols to identify the channel.
7.5.20.13 Channel Marker: Not Required

7.5.20.14 Conventional Channel Monitor Function
A monitor function shall be provided to permit the operator to disable the continuous tone-controlled squelch system (CTCSS) of any selected conventional base station receiver (if so equipped) in order to permit monitoring of the communications channel prior to making a transmission.

7.5.20.15 Talkgroup/Channel Select
Each talkgroup or channel shall be capable of independent selection by the dispatcher. The channel window shall provide a visual window indication when the corresponding channel is selected and when it is transmitting.

7.5.20.16 Simultaneous Select
Controls shall be provided that allow the operator to manually select any combination of console controlled talkgroups and base stations for simultaneous transmissions. This mode of operation shall allow the selection of multiple trunked talkgroups and/or Conventional Channels. The combined transmission shall utilize a single trunked channel when involving more than one talkgroup. The trunked field units shall be able to talk-back to the dispatcher directly without having to change the user talkgroup selector switch.

Simulselect will utilize the same number of trunked channels as there are talkgroups involved unless dynamic regrouping is utilized.

7.5.20.17 Multi-Auto Select
Pre-programmed groups of conventional radio channels and/or trunked user groups shall automatically be selected by the selection of single command button or keystroke. These groups of channels shall be operator programmable.

7.5.20.18 Talkgroup Call
The console system shall support trunked talkgroup calls on any talkgroups programmed in the system with appropriate management approvals.

7.5.20.19 Talkgroup/Channel Busy Indicator
Consoles shall have channel busy indicators to visually indicate that the channel is in use.

7.5.20.20 Talkgroup Merge
When operating in this mode, the console shall patch the trunked user talkgroups together utilizing only one RF trunked channel resource.

7.5.20.21 Talkgroup/Channel/Telephone Cross Patch
This function shall allow cross patching talkgroups/channels and telephone conversations to permit intercommunications. As participants are added or deleted, there shall be no variation in audio levels or quality. All patch audio shall be digitally processed. The patch shall utilize a single trunked channel when patching more than one talkgroup.

7.5.20.22 Talkgroup/Channel Cross Patch
This function shall allow the dispatcher to patch any two or more resources together. The purpose is to allow field units of different conventional radio channels and/or trunked talkgroups to intercommunicate directly. If the dispatcher transmits on any talkgroup or channel included in a patch, then audio shall be heard by all members of the patch. Dispatch consoles shall support a minimum of six (6) individual patches per operator position.
The MCC7500 system provides for a minimum of 6 individual patches per console position.

7.5.20.23 Talkgroup/Channel Audio Cross Mute

Consoles shall include a programmable cross mute feature, which precludes voice communication from a dispatcher’s microphone being repeated over loud speakers at other consoles in the dispatch center.

7.5.20.24 Trunked Announcement Group Calls

The console system shall support trunked announcement group calls on any announcement groups programmed into the system, with appropriate management approvals.

7.5.20.25 Trunked Emergency Calls

The console system shall support trunked emergency calls from any user radio programmed in the system with appropriate management approvals. When a field unit initiates an emergency alert, the console shall provide an audible alert and display the unit ID (alias) of the calling unit in plain English.

7.5.20.26 Intercom

An intercom function shall be provided to permit the operator to selectively talk to another console position. In the intercom mode, the screen shall list the user-defined names of all consoles and prompt the operator to select the desired console position. The intercom function shall disconnect the keying signal from the transmit circuit in use so that the operator can use the console microphone circuit to communicate solely with any console or parallel remote-control unit similarly equipped. Multiple simultaneous intercom conversations between individual consoles shall be possible.

7.5.20.27 Private Call

A private conversation shall be possible between the console position operator and any properly equipped mobile, portable, or RF control station. This conversation shall not be able to be monitored by other units on the System.

7.5.20.28 Individual Volume Adjust

The console shall be capable of individual control of select and unselect volume levels.

The MCC7500 console maintains the set volume level whether selected or unselected. The console is capable of individual control of select and unselect volume levels.

7.5.20.29 Unselect Audio Mute

A timed unselect muting function shall be provided that reduces the audio level of all unselected channels to a predetermined level for a programmed period of time.

7.5.20.30 Emergency Reset

All consoles shall be capable of receiving emergency alerts from user radios and other operator positions operating on the trunked radio system regardless of the status of the channel control window. Emergency messages shall be indicated by a flashing indicator, an emergency ID character, and an audible alert. Dispatcher acknowledgment of the message shall silence the audible alert and stop the flashing display. The console system shall be capable of queuing multiple emergency messages in the display stack and the emergency ID character shall continue to flash until all messages have been viewed by the dispatcher. The most recent emergency declaration shall be displayed and the dispatcher shall be able to scroll through the queue to view queued emergencies. The Emergency feature shall be programmable to allow the alert message to be delivered and displayed in predefined ways, including display on the current talkgroup.
7.5.20.31 Alert Tones

The console system shall provide a minimum of three distinct over-the-air tones to be used for alerting purposes. Each alert tone shall be immediately broadcast on the selected talkgroup, group call or all call, when activated. Tones shall be presented in the headset as side tone audio only, at a reduced volume level to confirm that the tone was generated and sent. The following selections shall be available as a minimum:

- Alert #1Steady Alert Tone - Anominal 1000 Hz steady tone
- Alert #2Warbling Tone - Alternate low and high frequency audio signals
- Alert #3Pulsed Alert Tone - Initiate an automatic sequence consisting of a nominal 1000 Hz tone, for a period of two (2) seconds

7.5.20.32 Selective Alert

Selected users and all dispatchers shall have the ability to selectively send and receive an alert to and from an individual user on the System regardless of the assigned talkgroup. The call shall allow an individual to alert another user with a distinctive tone and their individual ID (ID on display radios only).

7.5.20.33 Paging Encoder

Each console operator position and Supervisory positions shall include a multi-format paging / signaling encoder that is accessible through the data entry keypad and a one button per station encoder window. The encoder shall be capable of encoding industry standard two-tone sequential and DTMF signaling formats.

7.5.20.34 Preprogrammed Single Button Function Paging

Each console shall be capable of supporting a quantity of pre-programmed single-button paging functions.

7.5.20.35 Supervisory Control

The Supervisors’ consoles shall provide takeover control to prevent other dispatch consoles from keying Repeaters or base stations for each channel supported by parallel consoles. Supervisory consoles shall be capable of overriding transmissions from other consoles and field units.

7.5.20.36 Repeat Disable

The Supervisors’ positions shall be equipped with the ability to disable received audio from being repeated on conventional Repeaters, as desired.

7.5.20.37 Headset and Jack

Two headset jacks per operator position shall be installed at locations convenient to the operator. The headset jacks shall support both 4-wire and 6-wire configurations. When a headset is inserted into the jack, the operator shall have the capability of routing selected audio to the headset and/or selected speaker. Audio from the unselected channels shall remain routed to the unselected speaker output. The selected speaker audio shall operate normally with the headset removed from its associated jack or when telephone audio is routed to the headset. Individual headset volume controls for radio and telephone audio shall be provided and shall not affect the volume control setting of the selected speaker. PTT function shall be incorporated into the headset jack.
7.5.20.38 Microphone
A high-quality cardioid pattern gooseneck or swivel mount microphone having a uniform frequency response and a minimum front-to-back discrimination of 15dB shall be provided on a flexible arm. The microphone shall be resistant to interference, such as transmitting hum from lights and other devices used in the proximity of the console. Final selection of microphone types shall be determined during the preliminary design review.

7.5.20.39 Footswitch
Each console operator position shall be equipped with a dual footswitch. The unit shall have a dual pedal footswitch for PTT of the selected channel(s). The footswitch shall be heavy duty, designed for public safety use, and shall be designed so as not to skid on a smooth flooring surface.

7.5.20.40 Instant Recall Recorder
Each console operator position shall be equipped with an Instant Recall Recorder.

7.5.20.41 Call History Window
Each console position shall provide a call history window that allows the operator to review the last twenty (20) calls received at that position.

7.5.20.42 ID Display Queuing
Queuing of at least ten (10) plain English ID's (ID scroll list) on the channel window for standard calls and emergency calls.
7.5.20.43 Radio-Telephone Interface

The console equipment shall accommodate a radio/telephone interface with the console operator's headset. Operation shall be such that when the headset is not plugged into its associated jack, selected received audio is routed to the "selected" speaker and console microphone audio is routed to the selected radio functions. When the headset is plugged into the headset jack and no telephone line is selected, the selected speaker is muted, selected audio is routed to the headset, and transmit audio originates from the headset microphone and is routed to the selected radio functions. When the headset is plugged into the headset jack and a telephone line is selected, selected audio appears at the selected speaker, telephone audio appears in the headset, and headset microphone audio is routed to the telephone. With the latter configuration, should the console position be placed in a transmit condition, headset microphone audio would transfer from the telephone to the selected radio channel and would revert to the telephone upon release of the transmit key.

7.5.20.44 On-Screen Help

Extensive help instructions shall be available on the screen. These help instructions shall explain all major console operations and functions in an easily understandable way. The operator shall be able to access any help instructions through no more than two command button or keystroke selections, and shall be able to exit the help mode with only one command button or keystroke selection. All radio operations shall continue as normal and critical channels shall be able to be monitored while a help screen is being viewed.

Help can be provided via embedded HTML document allowing hyperlinks to navigate to relevant sections.

7.5.20.45 Full Duplex

The console shall operate in the full duplex mode so that a dispatcher can simultaneously transmit and receive on duplex RF channels without having to release the transmit function. The console supports this even when headsets are not being used as long as the speakers are not configured to mute during dispatcher PTTs.

7.5.20.46 Console Priority

The console shall have wireline priority over a field unit and shall have the capability to preempt the field unit's repeat transmit audio from the system.

7.5.20.47 Busy Tone

If the dispatcher attempts to make a call and all trunked channels are busy, a visible and audible alert shall be initiated at the console. When the channel becomes available, the console shall automatically alert the dispatcher with an audible tone. The console shall retain the channel availability for the dispatcher for a predetermined time to allow the dispatcher time to activate the transmit function for a user group.

With respect to busy tone, the MCC7500 console system operates according to the requirements listed above. This would not be the case for control station-based interfaces unless the radio was able to be programmed with these capabilities.

7.5.20.48 Talkgroup and ID Alias Display

The console system shall be capable of displaying the discrete unit ID, emergency ID, the alias name, and the talkgroup ID of trunked field units and other dispatch positions on each of the console operator positions.

7.5.20.49 Link Failure

The console system shall notify the operator and associated supervisory positions of a link failure between the operator position and the console and trunked system networks.
7.6 Subscriber Equipment Requirements (Optional Purchase)

7.6.1 General

The Contractor is expected to offer a range of end user subscriber radio equipment and accessories, to include a variety of options, providing a performance range from the highest quality, highest duty rating, rugged, high-quality subscriber equipment that is commensurate with public safety, mission critical communications down to less featured, less mission critical equipment for non-public safety users.

The Contractor shall include only equipment that is of current design and manufacture and FCC Type Accepted.

This section delineates the requirements for all mobile, portable, and RF control station subscriber equipment. The equipment shall be capable of operation without significant degradation when subjected to shock, humidity, and vibration. All proposed subscriber equipment shall incorporate heavy-duty construction, weather-sealed enclosures and weather sealed controls to meet Military Standard 810 C, D, E, F, and G for water, shock, vibration, dust, humidity, and high/low temperature performance. Specifications must be furnished with the Contractor’s response.

All proposed subscriber equipment shall incorporate electronic, alphanumeric displays with a minimum of eight characters to provide visual indication of system availability, channel/talkgroup selection, incoming user ID, call alerts, and operational status such as scan and channel busy.

All proposed subscriber equipment shall be capable of operating in an analog or P25 digital, trunked, or conventional FM mode. The determination of which mode the radio operates in shall be an automatic function of the channel or talkgroup selected by the user. Direct radio-to-radio communications (talk-around) capability is required and this capability shall be available using both analog and P25 digital modulations. When operating in talk-around mode, a P25 digital four level mode digital modulation intercommunications is mandatory.

The Contractor shall provide a matrix showing all models of portable radios available. The matrix data shall include the dimensions and weight of each model.

The Contractor shall propose high, mid, and low tier pricing for mobile and portable subscriber radios. The Contractor shall provide per unit pricing for subscriber equipment and accessories based upon the general tier descriptions and feature-sets listed below:

<table>
<thead>
<tr>
<th>Radio Feature</th>
<th>Low Tier</th>
<th>Mid Tier</th>
<th>High Tier</th>
</tr>
</thead>
<tbody>
<tr>
<td>700/800 MHz Capable</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Top-Mounted Group/Channel Selector, 16 Position</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Top-Mounted Volume Control</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Minimum Number of Modes</td>
<td>16</td>
<td>512</td>
<td>512</td>
</tr>
<tr>
<td>High Capacity Battery</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Vehicular Portable Charger</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Speaker Mic w/o Antenna</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Speaker Mic Antenna</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>GPS</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Scan Control with Priority Scan</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Alphanumeric Display Backlit</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Partial Keypad with Backlit Keys</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Full Keypad with Backlit Keys</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Emergency Button</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Over-the-air-Reprogramming</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Multi-Key Encryption (48 minimum)</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Over-the-air Rekeying</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Analog Voice</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Ruggedized Construction Option</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Intrinsically Safe Option</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
### 7.6.2 Features and Functions

#### 7.6.2.1 Call Alert

All mobile, portable, and control station equipment shall be equipped with “Call Alert” for the selective alerting of individual users and/or user groups. The Call Alert feature lets a dispatch console or certain radios leave a “page” at an unattended radio or dispatch console. Upon returning to the radio or dispatch console, the called user is notified that someone tried to call them. Additionally, a Call Alert can be used to trigger an activity. For instance, a Call Alert may cause a vehicle’s horn to sound and its lights to flash.

#### 7.6.2.2 Emergency Call

The public safety subscriber radios used on the current system have an easily identifiable “Emergency” button, recessed to prevent accidental initiation. When users find themselves in a dangerous situation, they can very quickly use that button to alert dispatchers and other users in their talkgroup of the situation.
7.6.2.3 Encryption
Certain talkgroups currently use encryption on radio calls. Although not needed on all radios, the new System needs to support the capability to use end-to-end encryption within the radios.

7.6.2.4 Loss of Trunking Indication
The Contractor shall describe the capabilities of the proposed mobile radios to provide an indication to the user that the trunked system is operating in a condition that is not normal such as a failsoft mode. It is preferred that users have the ability to silence the failure indication tone.

7.6.2.5 Time-Out-Timer
A transmitter time out timer shall be provided to limit key down time.

7.6.2.6 Priority Scan/Monitoring
This feature makes it possible for a radio user to scan talkgroups in their system, and to mark up to two Conventional Channels or talkgroups in their scan list as “Priority”. A non-priority conversation will be interrupted by Priority 1 or Priority 2 talkgroup activity. A priority channel or talkgroup is monitored more often than other channels, and will continue to be monitored if listening to another channel or talkgroup of lesser priority is captured.

7.6.2.7 Non-Priority Scan
This feature makes it possible for a radio user to scan between multiple systems, talkgroups, or Conventional Channels.

7.6.2.8 Man-Down Function
This functionality will initiate an emergency alarm on the system, in the event that a radio (and presumably its owner) has been in a static horizontal position for a certain amount of time. This functionality allows for dispatchers and other members of the talkgroup to be notified that a user is in need of assistance, even if the user has been incapacitated and is unable to initiate the emergency on their own. This functionality has been identified as critical by public safety users on the system and must be available as an option on the subscriber radios.

7.6.2.9 Multi-Band Capability: Not Required

7.6.2.10 Radio Case Options
Since the Public Safety personnel are often working in an environment that includes special circumstances, the available radio options shall include radios for special circumstances as well. Some specific examples of this are brightly colored casings, for limited visibility situations, as well as ruggedized and/or water-resistant casings.

7.6.2.11 GPS Location Operation
This functionality provides the capability to remotely monitor the location of radio units. When combined with the “Man Down” functionality, this becomes a very powerful tool for quickly coming to the aid of fallen users in need of assistance. The new System must include the option of this capability within the radio subscribers. In addition, it is desired by County that the GPS antenna be integrated within the subscriber radio or its antenna and that an additional external GPS unit and antenna not be required for this functionality.
7.6.2.12 **Bluetooth**

The Counties’ Fire Departments will (in the future) utilize a breathing apparatus, with a Bluetooth interface for voice communication. This is not the only possible scenario for the use of Bluetooth technology but is one of the many examples. There may be some law enforcement users who would benefit from being able to covertly monitor radio traffic from a Bluetooth headset. To meet the needs of the applicable public safety users, the available radio subscribers for the new system need to include the option of a Bluetooth interface.

7.6.2.13 **Digital Filtering/Noise Cancellation**

Voice intelligibility can be improved by eliminating the background noise picked up by the radio microphone and accurately filtering the caller’s voice from background noise. Subscriber radios for the new system must incorporate Noise Reduction Software (NRS) and dual microphone capability. This improves user safety by ensuring that transmissions are not only heard, but also clearly understood.

7.6.2.14 **Intelligent Radio Display**

Intelligent radio display feature enables the control of audio level, lighting, and tone alerts of the radio. For example, a user in bright sunlight or high-noise environments must be able to increase the lighting or audio level, or if the user is conducting ongoing, covert surveillance, they need to be able to create a profile that provides lower lighting with subdued alert tones and audio. The new System and the available subscriber radios must support this capability.

7.6.2.15 **Alphanumeric Texting**

This functionality provides the capability for radio users and/or dispatchers to send text messages, in place of voice transmissions. This feature would be very helpful in situations where public safety officers need detailed information such as location addresses or suspect descriptions. Rather than relying on memory or the need to write down the information, the user can go back and read the information stored in the radio. The new System and the available subscriber radios must support this capability.

7.6.3 **GPS Specifications**

Accuracy specifications are for long-term tracking, 95th percentile values, and greater than (> 5) satellites visible at a nominal signal strength of -130 dBm.

- TTFF Cold Start < 1 minute
- TTFF Hot Start < 10 seconds
- Horizontal Accuracy < 10 meters
7.6.4 Mobile Radio General Requirements

7.6.4.1 Power Supply
The mobile radio shall operate from a nominal 13.8VDC primary power source and shall be equipped with suitable reverse polarity protection to avoid damage if the radio or battery were to be incorrectly installed. The mobile radio shall be protected against voltages above 14VDC and operate at voltages as low as 11VDC without emitting any spurious emission or loss of programming.

7.6.4.2 Transmitter Power Output
Medium and High tier mobile radios shall have a transmitter output power of 30 watts minimum and furnished to operate on all channels in the 700/800 MHz bands. All installations, cabling, brackets, etc. shall be included.

7.6.5 Mobile Radio Configurations and Options

7.6.5.1 Features and Functions
The mobile subscriber equipment shall be a universal mount (front/rear) radio. Mobile equipment shall be available for motorcycle, watercraft, and aircraft applications. Open-air mobile units and all external headsets, microphones, and speakers shall be weatherproofed and suitable for outdoor installation.

A remote mounting kit and universal mounting kit shall be provided for designated units. The mounting kit shall include control cable, power cable, external control head and microphone, external speaker, and mounting hardware.

When front mounted, the control unit shall become an integral part of the radio set housing. The speaker may be internal or external where required. The unit shall be environmentally weatherproof in its design and operation.

7.6.5.2 Mobile Microphone
All mobile radios shall be equipped with a palm-type heavy-duty microphone. Different models shall be provided to designated radio units as described below:

- Heavy-duty palm microphone
- A hand-held control head microphone with the capability of selecting talkgroups and channels, adjustment of volume, and activation of the emergency function
- A noise canceling microphone for use in a high-noise environment

All noise canceling occurs within the radio unit.

7.6.5.3 Mobile Antenna and Transmission Line
The mobile antennas shall mount in a ¼-inch hole and be of all brass construction with O-ring seals. The Contractor shall provide a roof mounted ¼-wave heavy-duty mobile antenna for each mobile.

7.6.5.4 External Speaker
Designated mobile radio units shall be equipped with an external speaker (mounted in the vehicle). The speaker shall provide a minimum power output of ten (10) watts for use in high noise environments. Mounting brackets and interconnecting cable shall be supplied.
7.6.5.5 Dual Control Heads

Designated mobile radios shall offer dual control heads for a County-selected number of units and be interfaced with the current vehicle intercom and/or headset systems.

7.6.6 Portable Radio General Requirements

The radio set shall be small, lightweight, and rugged and shall be capable of withstanding severe operating conditions. The portable housing shall be constructed of high impact resistant material and shall be sealed and gasketed to protect internally mounted circuitry against dust, foreign particles, moisture, and splashing water. Opening the battery compartment shall not break the seal to the radio circuitry. “Ruggedized and weather resistant” portable radios are preferred. If available, ruggedized and weather resistant portable radios shall be offered and thoroughly described.

Controls shall be top-mounted rotary controls with positive stops for volume and channel mode selection. Control placement must be sufficient to allow operation wearing gloves as typically used by the fire service. A sealed transmitter “push-to-talk” (PTT) switch shall be provided on the side of the unit, and an emergency switch shall be provided for user-defined quantities of radios.

Transmitter RF power output shall be a minimum of 2.5 watts.

All proposed portable radios shall be equipped with a personal, desktop-style single battery charger, a spare battery of the same type and duty cycle rating as the primary battery provided with the radio, and a standard with a belt clip.

Portable radios, not operating in a vehicular charger or adapter, should provide no less than 500 milliwatts of audio output power.

All proposed portable radios shall be equipped standard with a ½-wavelength whip style antenna operational across the 700-800 MHz frequency bands per current FCC requirements.

The Contractor shall describe the capabilities of the proposed portable radios to provide an indication to the user that the trunked system is operating in a mode that is not normal. It is preferred that users have the ability to silence the failure indication tone.

Radios shall be delivered with all necessary channels already programmed. Detailed operational and technical instructions on programming shall also be

For each proposed portable radio, the Contractor shall clearly describe the applicable Military Standard (MIL-STD 810C, D, E, F, and G) and the test method and procedure.

7.6.7 Portable Radio Configurations and Options

7.6.7.1 Rechargeable Battery

The Contractor shall propose Nickel Metal Hydride (NiMH) or (Lithium-ion (Li-ion) “smart” rechargeable batteries, which shall be quickly and easily removed from the radio. The proposed “smart” battery technology shall be capable of monitoring and reporting its condition to the operator. Battery life, based on a 10% transmit, 10% receive, 80% stand-by duty cycle, measured in accordance with EIA RS-316 at 250 milliwatts of audio output, shall be at least twelve (12) hours. Batteries shall be capable of full recharge in one (1) hour or less. Batteries provided shall be capable of withstanding a 3-foot drop test to concrete without damaging battery performance or visibly cracking the battery housing.

The Contractor shall provide in the proposal a list of time parameters for each type of battery and capacity available for each type of portable radio.

Tait TP 9400 series of radios only utilize Li-ion batteries and require no conditioning.
7.6.7.2 Accessory Connections
External accessory connections shall be provided as an integral part of the radio, for the
connection of various types of remote speaker/earplug/microphone/antenna combinations.

7.6.7.3 Flexible Antenna
A flexible antenna shall be provided and shall connect to the appropriate connector on the radio or
speaker-microphone. Antennas mounted on the radios shall be ½-wave whip type.

7.6.7.4 Carrying Device
A belt-mounted carrying case or belt clips case shall be provided.

7.6.7.5 Speaker Microphones
Speaker microphones shall not have antennas on the microphone, shall be water resistant, and shall
use coiled cords in at least three (3) different lengths. Speaker microphones shall be noise canceling.
It shall be possible for an operator to remove the public safety speaker microphone from a portable
radio without the use of tools, and then operate the radio in normal fashion.

Predicted coverage has been performed assuming the antenna is attached to the radio.

7.6.7.6 Speaker-Microphone-Antenna Combination: Not Required

7.6.7.7 Single Unit Fast Smart Charger
The portable radio shall operate in the receive and transmit modes while being charged in the single
unit charger. The charger shall operate from a 120VAC, 60 Hz single-phase source.

7.6.7.8 Multi-Unit Fast Smart Charger
The portable radio shall operate in the receive and transmit modes while being charged in the multi-
unit charger. A multi-unit fast charger shall provide proper charging of batteries whether in or out of
the portable radios. The charger shall operate from a 120VAC, 60 Hz single-phase source.
The multi-unit fast charger shall be capable of charging a minimum of six (6) batteries simultaneously
and have a battery status indicator for each battery position.

7.6.7.9 Vehicular Charger
The portable radio shall be capable of operating in both the receive and transmit modes while being
charged in the vehicular charger. The vehicular charger shall be capable of charging a battery
whether on or off the respective radio (without the need for a spacer or adapter) and operate
from a nominal 13.8VDC vehicular source.
The vehicular charger shall be designed in a manner that will allow full view of the portable radio
 alphanumeric display.

7.6.7.10 Intrinsically Safe
Portable radios, batteries and accessories (used by the fire service) proposed must be approved by
Factory Mutual as intrinsically safe for the following hazardous environments: Class I and II Division
I, groups C, D, E, F and G and non-incentive for Class I, Division 2, Groups A, B, G and D.
7.6.8 **Control Station Radio Configurations and Options**

Control stations, excluding antennas and transmission lines, shall be provided that operate from 120VAC, 60Hz power. All radio equipment shall be FCC type accepted under Part 90 of the FCC Rules and Regulations. Additional equipment specifications are listed below.

Control stations shall be frequency synthesized with a transmitter output power of 15 watts minimum and furnished to operate on all channels in the 700/800 MHz bands.

Control stations where required shall be configured and supplied with the following options and capabilities.

7.6.8.1 **Desk Microphone**

Control stations shall be equipped with a desk-stand type microphone. The microphone shall contain a PTT transmit switch.

7.6.8.2 **Control Station Antenna and Transmission Line**

The new control stations may utilize the existing indoor and outdoor antenna systems.

Any newly installed control station that is not a replacement for an existing control station shall use an omni or yagi model or equivalent. For pricing purposes, the Contractor shall assume 100 feet of 1/2-inch foam LDF transmission line length for a typical control station installation. All installation hardware, transmission line surge suppressors, ground kits, etc. shall be provided.

7.6.8.3 **Digital Remote-Control Unit**

Digital remote-control units where required shall be compact desktop style units for remote operation of the control stations. The remote-control unit shall be capable of controlling the conventional and trunked features of the control station radio such as modes, talkgroups, channels, etc.

7.6.8.4 **Alerting Capabilities**

Control stations shall be equipped to provide a switched output with dry relay contacts that may be connected to County-provided signaling and control equipment typically used for Fire Station Alerting. Activation of the switched output shall be controlled by the transmission of a Call Alert message from dispatch.

7.6.9 **Subscriber Equipment Programming**

The Contractor shall provide two (2) sets of programming cables and current versions of programming and maintenance software for each type of device (mobiles, portables, Repeaters, etc.) installed.
8. Digital Microwave and Backhaul Network

8.1 General

The System will require IP network connectivity within Sarasota and Manatee connecting its RAN to both the Network Core and to the Simulcast Control Point. Additionally, IP network connectivity shall be provided between the georedundant Network Cores. The Contractor shall provide a digital microwave subsystem as a primary connection and utilize existing Sarasota and Manatee fiber networks wherever available.

All proposed microwave network links utilized to support the System shall be designed with the following assumptions:

A. 6 or 11 GHz licensed frequencies
B. 30 MHz channel bandwidth
C. 155 Mbps indoor-mounted radios
D. 80-foot tree heights

The equipment shall be designed and manufactured for continuous duty operation in a fixed station application and, with proper maintenance, have an expected operational and maintenance service life of at least 15 years with proper maintenance and service.

All equipment and hardware including wiring, connectors, cabling, fuses, circuit breakers, brackets, fasteners, power supplies, converters or conditioners, and other items that are necessary to provide a complete and fully functioning microwave network shall be new and be furnished by the Contractor.

The proposed microwave system shall consist of all indoor mounted radio equipment and shall be designed and manufactured by a company who has at least 10 years of experience in designing and providing microwave equipment for critical communications system users such as public safety. The system performance shall be designed using a technology which will not suffer any degradation due to adverse weather conditions throughout all seasons of the year for any length of time no matter how short the duration. A full and complete materials list and full and complete set of specifications describing the System are set forth in Exhibit O.

The microwave radios to be used by the Contractor are the Aviat all indoor Eclipse IRU600s which operate at either the 6 or 11 GHz licensed frequency bands and utilize a 30 MHz channel bandwidth to achieve the 155 Mbps bandwidth requirements. The Eclipse IRU600 is designed and manufactured for high reliability and continuous duty operation in a fixed station application. With proper maintenance, the IRU600 has an expected operational and maintenance service life of at least 15 years.

Contractor will supply all required hardware for each microwave link, including: the IRU600 all indoor solution, antenna system dehydrators, antennas, waveguide, connectors, fuses, circuit breakers, brackets, fasteners, power supplies, and any other required hardware.

Each path analysis was performed utilizing Pathloss 5 and 80-foot tree heights were taken into account. Each microwave link was designed to a minimum availability of 99.999% at 155 Mbps.
8.2 Microwave Network Configuration and Capacity

The Contractor shall propose a digital loop microwave system maximizing network reliability and availability that is commensurate with the capacity requirements stated herein. MHSB radios shall be required for spur or non-loop paths. The microwave network shall be designed to provide alternate routing between critical network controller sites, dispatch sites, and the communication system tower sites.

In addition to the connectivity requirements of the P25 radio system, County has future data Backhaul requirements for systems such as data hotspots, video links, security cameras, etc., and as such, County would like to implement a microwave system with 30 MHz channels. The Contractor shall identify the excess capacity of the microwave network after satisfying the communications systems requirements.

The proposed microwave system equipment shall be capable of providing the following protection options:

- Loop protection
- Non-protected
- MHSB
- MHSB space diversity
- Split transmitter space diversity
- Errorless Receive Switching - all receiver switching, including diversity path selection, shall be errorless

The digital microwave solution for both Manatee and Sarasota is a digital loop configuration. The proposed solution has spur links with MHSB radios.

There are three rings proposed:

- A full Sarasota ring.
- A full Manatee ring with the exception that the Buffalo Creek to Main tower site link will consist of a fiber connection directly from IRU to IRU to close the ring.
- A core ring consisting of links between Manatee PSC and 12th Street as well as EOC and Kinnan Park to link the Manatee and Sarasota links. The links between EOC and 12th Street and the link between PSC and Kinnan Park are both 2+0 links to support the Core Ring in addition to the Manatee and Sarasota Rings respectively.
The microwave topology is shown below:
The digital microwave system provides diverse route protection utilizing Ethernet ring protection for all radios that are in the loop. Each antenna coupling unit ships with an integrated expansion port which means that additional radio channels can be added as an overbuild utilizing the existing antenna system.

Each link has been designed using 30 MHz channels with a capacity of 155 Mbps and a reliability of at least 99.999%. There is no excess capacity beyond 155 Mbps designed into any of the proposed microwave links.

There are three spur links in the design: North Port PD Dispatch, Ringling and Charlotte County ISSI.

Please refer to Exhibit E – System Description for a diagram of the links.

### 8.3 Sarasota Backhaul Network

Sarasota requires a new IP microwave backbone network to support the primary network link between the P25 Network Core and Simulcast Control Point and it’s RAN, and would like to utilize Sarasota’s fiber network wherever possible as an alternate network path.
8.3.1 Backhaul Configuration for Sarasota

The following map depicts the conceptual Microwave Backhaul Network for Sarasota. The configuration connects all sites in a loop with the exception of the Toledo Blade site which utilizes a MHSB spur link. A fiber connection, wherever available, may be considered as an alternate network path in lieu of MHSB on a spur microwave path. In other words, a non-MHSB microwave spur path may be utilized with a redundant fiber network link.

The following table depicts a typical 6 GHz system design for the above configuration.

<table>
<thead>
<tr>
<th>Site 1</th>
<th>Site 2</th>
<th>Path Length (mi)</th>
<th>Frequency (GHz)</th>
<th>Site 1 Ant. Cnt. Line</th>
<th>Site 2 Ant. Cnt. Line</th>
<th>Site 1 Ant. Size (ft)</th>
<th>Site 2 Ant. Size (ft)</th>
<th>Bandwidth (Mbps)</th>
<th>Annual Outage (sec)</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Englewood Fire</td>
<td>Toledo Blade</td>
<td>13.8</td>
<td>6</td>
<td>200</td>
<td>200</td>
<td>6</td>
<td>6</td>
<td>155</td>
<td>130.05</td>
<td>99.99959</td>
</tr>
<tr>
<td>Toledo Blade</td>
<td>Northport</td>
<td>3.87</td>
<td>11</td>
<td>130</td>
<td>130</td>
<td>4</td>
<td>4</td>
<td>155</td>
<td>12.5</td>
<td>99.99996</td>
</tr>
<tr>
<td>Northport</td>
<td>Hi-Hat</td>
<td>21.8</td>
<td>6</td>
<td>225</td>
<td>225</td>
<td>6</td>
<td>6</td>
<td>155</td>
<td>101.73</td>
<td>99.99988</td>
</tr>
<tr>
<td>Hi-Hat</td>
<td>New EOC</td>
<td>6.04</td>
<td>11</td>
<td>130</td>
<td>130</td>
<td>6</td>
<td>4</td>
<td>155</td>
<td>113.26</td>
<td>99.99935</td>
</tr>
<tr>
<td>New EOC</td>
<td>Sarasota 12th ST</td>
<td>5.69</td>
<td>11</td>
<td>140</td>
<td>140</td>
<td>4</td>
<td>4</td>
<td>155</td>
<td>86.14</td>
<td>99.9995</td>
</tr>
<tr>
<td>Sarasota 12th ST</td>
<td>VoTECH</td>
<td>4.87</td>
<td>6</td>
<td>160</td>
<td>160</td>
<td>6</td>
<td>6</td>
<td>155</td>
<td>6.25</td>
<td>99.99998</td>
</tr>
<tr>
<td>VoTECH</td>
<td>Osprey</td>
<td>6.72</td>
<td>6</td>
<td>140</td>
<td>140</td>
<td>6</td>
<td>6</td>
<td>155</td>
<td>22.94</td>
<td>99.99993</td>
</tr>
<tr>
<td>Osprey</td>
<td>Venice</td>
<td>9.02</td>
<td>6</td>
<td>105</td>
<td>105</td>
<td>6</td>
<td>6</td>
<td>155</td>
<td>90.79</td>
<td>99.9971</td>
</tr>
<tr>
<td>Venice</td>
<td>Englewood Fire</td>
<td>9.03</td>
<td>6</td>
<td>180</td>
<td>180</td>
<td>6</td>
<td>6</td>
<td>155</td>
<td>18.34</td>
<td>99.9994</td>
</tr>
</tbody>
</table>

The Sarasota County Ring is shown in the figure and table in section 8.2 above.

In addition to the Microwave links listed above, provision will be made to incorporate a connection at each site to a Sarasota County provided fiber network.
8.4 Manatee Backhaul Network

Manatee desires to leverage its existing extensive fiber network combined with a new IP microwave backbone network as the primary network link between its Network Core or Simulcast Control Point, and it’s RAN.

8.4.1 Backhaul Configuration for Manatee

The following map depicts a typical Microwave Backhaul Network for Manatee. The microwave backhaul configuration depicts the connectivity to new sites that may be used for the new P25 System.

The following table depicts a typical 6 GHz system design for the above configuration.

<table>
<thead>
<tr>
<th>Site 1</th>
<th>Site 2</th>
<th>Path Length (mi)</th>
<th>Frequency (GHz)</th>
<th>Site 1 Ant. Cnt. Line</th>
<th>Site 2 Ant. Cnt. Line</th>
<th>Site 1 Ant. Size (ft.)</th>
<th>Site 2 Ant. Size (ft.)</th>
<th>Bandwidth (Mbps)</th>
<th>Annual Outage (sec)</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main</td>
<td>Booster Station</td>
<td>6.91</td>
<td>11</td>
<td>180</td>
<td>150</td>
<td>4</td>
<td>4</td>
<td>155</td>
<td>230.96</td>
<td>99.99955</td>
</tr>
<tr>
<td>Booster Station</td>
<td>Manatee PSC</td>
<td>8.85</td>
<td>6</td>
<td>165</td>
<td>140</td>
<td>6</td>
<td>6</td>
<td>155</td>
<td>83.76</td>
<td>99.99973</td>
</tr>
<tr>
<td>Manatee PSC</td>
<td>Tallest</td>
<td>3.83</td>
<td>11</td>
<td>115</td>
<td>170</td>
<td>4</td>
<td>4</td>
<td>155</td>
<td>13.58</td>
<td>99.99962</td>
</tr>
<tr>
<td>Tallest</td>
<td>Lorraine</td>
<td>8.09</td>
<td>6</td>
<td>140</td>
<td>155</td>
<td>6</td>
<td>6</td>
<td>155</td>
<td>119.5</td>
<td>99.99962</td>
</tr>
<tr>
<td>Lorraine</td>
<td>Myakka</td>
<td>8.36</td>
<td>6</td>
<td>200</td>
<td>190</td>
<td>6</td>
<td>6</td>
<td>155</td>
<td>115.37</td>
<td>99.99944</td>
</tr>
<tr>
<td>Myakka</td>
<td>Duette</td>
<td>13.22</td>
<td>6</td>
<td>180</td>
<td>170</td>
<td>6</td>
<td>6</td>
<td>155</td>
<td>104.32</td>
<td>99.99967</td>
</tr>
<tr>
<td>Duette</td>
<td>East Tower</td>
<td>11.89</td>
<td>6</td>
<td>165</td>
<td>225</td>
<td>6</td>
<td>6</td>
<td>155</td>
<td>69.51</td>
<td>99.99978</td>
</tr>
<tr>
<td>East Tower</td>
<td>Fort Hammer</td>
<td>8.51</td>
<td>6</td>
<td>170</td>
<td>180</td>
<td>6</td>
<td>6</td>
<td>155</td>
<td>15.56</td>
<td>99.99995</td>
</tr>
<tr>
<td>Fort Hammer</td>
<td>Buffalo Creek WT</td>
<td>4.69</td>
<td>11</td>
<td>200</td>
<td>200</td>
<td>4</td>
<td>4</td>
<td>155</td>
<td>66.1</td>
<td>99.99979</td>
</tr>
</tbody>
</table>

Regional system network core IP connectivity between the redundant network cores shall be accomplished by a combination of diverse route microwave and existing fiber networks.

The microwave system shall utilize IP technology and 30 MHz channels.

The new digital microwave communications network shall provide network connectivity to include the following:

- The 800 MHz communication system control and communication system infrastructure sites as specified herein
- Network communications to the Police Headquarters dispatch center
- The site alarm and network management systems
- Associated site communications needs e.g. phones, network data access, site surveillance, and remote monitoring/control to be determined by County

The Manatee County Ring is shown in the figure and table in section 8.2 above.
8.5 P25 Network Core Connectivity

It is anticipated that the regional P25 network design will have a Network Core for the P25 system present in each County, and that one Network Core will act as the primary and that the other as a georedundant backup. This type of design requires high reliability network connectivity between the Network Core sites. A minimum of one microwave path between the Network Core sites is required to allow communications between the two systems. It is required that the fiber networks of Sarasota and Manatee will be utilized to provide a second or redundant connectivity.

The conceptual design utilizes one 6 GHz microwave link and one 11 GHz microwave link to interconnect the two network cores. It is anticipated that Manatee’s Network Core for the System will be located at the PSC site, and that Sarasota’s Network Core will be located at the new EOC site. The following conceptual configuration provides for direct microwave connection between these two microwave networks.
The following table depicts a typical 6/11 GHz system design for the above configuration.

<table>
<thead>
<tr>
<th>Site 1</th>
<th>Site 2</th>
<th>Path Length (mi)</th>
<th>Frequency (GHz)</th>
<th>Site 1 Ant. Cnt.</th>
<th>Site 2 Ant. Cnt.</th>
<th>Site 1 Ant. Size (ft.)</th>
<th>Site 2 Ant. Size (ft.)</th>
<th>Bandwidth (Mbps)</th>
<th>Annual Outage (sec)</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manatee PSC</td>
<td>12th ST</td>
<td>7.43</td>
<td>6</td>
<td>170</td>
<td>170</td>
<td>6</td>
<td>6</td>
<td>155</td>
<td>76.93</td>
<td>99.99976</td>
</tr>
<tr>
<td>New EOC</td>
<td>Tallevast</td>
<td>7.14</td>
<td>11</td>
<td>160</td>
<td>175</td>
<td>4</td>
<td>4</td>
<td>155</td>
<td>267.9</td>
<td>99.99915</td>
</tr>
</tbody>
</table>

A Core ring consisting of 6 GHz links between Manatee PSC and 12th Street as well as between the EOC and Kinnan Park to link the Manatee and Sarasota links. The links between EOC and 12th Street and the link between PSC and Kinnan Park are both 2+0 links to support the Core Ring in addition to the Manatee and Sarasota Rings respectively.

8.6 Performance Objectives

Each microwave path shall be designed for an annual one-way, per-path availability of 99.999 % or better for 10-6 BER. It is recognized that the mathematical models to predict availability vary within the industry. Consequently, the Contractor is required to fully support its system design with the procedures, equations, and theories used to compute availability.

To calculate microwave availability, path clearance, multipath fading, rain/atmospheric fading and knife edge diffraction must be taken into account. The digital microwave design utilizes the following parameters:

- Microwave path clearance criteria: 100% of the first Fresnel zone+10’ (where possible). A universal tree height of 80’ was also taken into consideration.
- Microwave Multipath fade algorithm: Vigants-Barnett model
- Microwave Rain calculation: Crane rain model, E2 band using public city rain data.
- Multiple knife edge diffraction calculation method: Deygout Method (principle edge)
8.7 Microwave Equipment Requirements

8.7.1 Configuration and Operation
All spur paths shall be fully protected with monitored hot-standby (MHSB) transmitters and receivers with the exception of paths with a redundant fiber network connection. The antenna input to MHSB receivers shall be via an asymmetrical minimum loss splitter favoring the "A" receiver to maximize fade margin. The receiver outputs shall be switched in an "errorless" manner. The MHSB transmitters shall be switched in a manner to provide proper termination and isolation to the standby transmitter. Either the "A" or "B" transmitter may be active. Provisions shall be included for testing and alignment of the standby units without disturbing the active units. The transmitters and receivers shall be sensed and switched separately and both transmitters and receivers shall meet all requirements of these specifications when in the active mode (threshold of the "B" receiver excepted due to asymmetrical splitting).

The antenna input to MHSB receivers can be configured for a one (1) and seven (7) dB (asymmetrical) minimum loss splitter. Errorless switching in MHSB and SD radios is done on a frame-by-frame basis by comparing the airlink frames from both receivers and selecting the one that has no errors. Either the "A" or the "B" transmitter may be active as they are separated by a mechanical switch which provides proper termination, isolation, and has the added benefit of low loss to maximize system gain. The IRU600 radio also allows for an even switch between primary and standby transceivers for MHS configuration - this means that if a link encounters a failure to the primary transceiver the standby unit will not automatically degrade the fade margin by seven (7) dB.

The microwave system now contains these spur links per modification of design:

- North Port tower to North Port PD (1+0)
- 12th Street to Ringling (1+1 MHSB)
- Englewood to Charlotte County Sun Tower (1+1 MHSB)

8.7.2 System Management Locations
Microwave network management terminals shall be provided at the following locations:

Sarasota
EOC 6050 Porter Way Sarasota, FL
Sarasota Sheriff 425 Old Venice Road Osprey, FL

Manatee
Radio Shop 1801 5th Street West, Bradenton, FL
Radio Network Operations Center (NOC) 2101 47th Terrace East, Bradenton, FL

Major and Minor alarm outputs shall be connected to the site alarm system RTU.

8.8 DC Power Plant
The microwave radio equipment shall share a -48VDC power plant with the RAN. The microwave power plant shall be sized to provide a minimum 8-hour run time in the event of a total loss of electrical power.

8.9 Physical Path Survey
The Contractor shall physically survey all paths associated with the microwave network including the links between the existing sites. The Contractor shall document the location of antenna towers, building structures, significant trees, and other landmarks or improvements associated with the
microwave paths. The Contractor shall provide all personnel, transportation, lodging, subsistence, surveying instruments, maps, etc., necessary to perform the work.

Survey activities shall include the determination of the following:

- Critical obstructions on-path and potential obstructions off-path
- Reflection points/unblocked reflections
- Expected tree growth along paths
- Site geographic coordinates
- Site elevations
- Recommended antenna heights based on survey data and performance objectives

The report shall include the following documentation:

- Data determined by the survey activities
- Antenna tower locations accurately depicted on 8-1/2-inch by 11-inch sections of USGS 1:24,000 topographic maps; proposed path azimuths shall be depicted relative to True North
- Profile graphs for each path surveyed. Path profiles shall be constructed using terrain data from USGS 1:24,000 topographic maps and modified as necessary with field survey data. Path profiles shall consider radio refractive index and depict critical obstructions, reflection points, target height above obstructions, antenna centerlines, and line of sight
- Site plot plans depicting structures, landmarks, tower orientation, and improvements. Proposed path azimuths shall be depicted relative to True North. The plot plans are not meant to serve as construction drawings but should present the site features with reasonable accuracy
- Recommendations relative to the viability of the proposed microwave paths, reliability considerations, and/or alternate routings, and any suggestions that the Contractor deems appropriate to the project
- Site geographic coordinates referenced to NAD 83 and identified with notation NAD 83
- Photos depicting the view of the path from each end

The Contractor shall coordinate with the Counties and its technical consultant in advance of its field activities.

Should it be obvious to the Contractor during the field survey activity that a particular path is not viable, the Contractor shall immediately advise the Counties in writing.

8.10 Microwave Frequencies and Licensing

The paths for the digital microwave network shall utilize licensed FCC Part 101 frequencies assigned for full-period service.

The results of the required path engineering analysis and the applications for FCC authorization shall be submitted to the Counties for review prior to filing with the FCC.

8.11 Microwave Antenna Systems

The Contractor shall utilize all new antennas, transmission lines, mounting apparatus, and installation hardware for the digital microwave system. Solid parabolic dish antennas and jacketed copper elliptical waveguides appropriate for the proposed frequency band shall be utilized. Antenna system VSWR shall be commensurate with the return loss specification of the Contractor’s microwave radio antenna.

The Contractor shall furnish all required labor and mounts as required for support of the microwave antennas including any special mountings, brackets, or other apparatus for installation of antennas furnished under this Purchase Agreement.
The microwave solution will contain all new antennas, transmission lines, mounting apparatus and installation hardware. Each antenna will be a solid parabolic dish. All waveguides will be elliptical waveguides.

8.11.1 Antennas

Antennas shall be of solid construction with pressurized feeds and long-life radomes, and multiple tie back braces and shall be rated for a minimum survival wind speed of 155 mph.

The digital microwave solution includes all Andrew/Commscope antennas capable of sustaining 155 mph winds.

8.11.2 Transmission Lines

Jacketed copper elliptical waveguide shall be employed in continuous lengths for all waveguide transmission line runs and shall be installed in accordance with manufacturer's specifications. Splicing is not permitted. Flex waveguide shall not be used outdoors and the copper elliptical waveguide shall be terminated directly to the antenna. Waveguide shall be Andrew EW series as manufactured by Commscope, Inc. or engineer-approved equivalent.

8.11.3 Pressurization Equipment

A dry air pressurization system shall be furnished for pressurization of microwave antenna feeds and elliptical waveguides. The Contractor shall provide all required fittings, regulators and pressurization lines, gauges, distribution manifolds, low-pressure alarms, and installation hardware. Separate pressure metering shall be provided for each waveguide pressurized. The pressurization system shall be an Andrew MT-050 series dehydrator with ML series Line Monitor as manufactured by Commscope, Inc. or engineer-approved equivalent.

8.12 Data Service Channel

A digital data port shall be provided at each site on a drop/insert basis with an interface capable of transporting data at rates of at least 64 kbps.

9. Installation Requirements

9.1 General

The installation of the equipment furnished under this Purchase Agreement shall be performed in accordance with the industry practices and manufacturers' installation standards and specifications for the described items as well as other attachments, hardware, software, and procedures as may be required to ensure a complete installation which is in accordance with the standards of good engineering practice, all Federal, State, and County regulations and codes, and all building codes and ordinances in effect at the sites delineated in this Purchase Agreement.

Pricing includes all installation hardware, brackets, braces, fasteners of all kinds, wiring and cables, ancillary devices, procedures, and services required to install and/or interface components to provide a complete operating System.

To the extent possible, the existing radio communications systems shall remain in parallel operation during installation of the System and until the Counties provide final acceptance.

9.2 Installation Approval

All installation work shall be approved by the Counties prior to commencement of work on a site-by-site basis. The Contractor shall provide descriptions and layout drawings showing the proposed installations at each site at least thirty (30) days prior to beginning work at that site. No work shall commence without written approval from the Counties.

9.3 Equipment Storage and Delivery

The Contractor shall be responsible for delivering, storing, placing, handling, and disposition of materials. All aspects of the installation shall be planned and executed in a professional manner. All
initially unused material, brackets, hand mics, keys, hardware, accessories, etc. shipped with equipment/accessories to be installed, are to remain property of the Counties, and as such, shall be retained by the Counties.

9.4 Installation Coordination

The Contractor shall provide at least one full time on-site Project Manager (PM). The PM shall focus solely upon the System project from contract signing to final acceptance of the System and the close of the project.

The PM shall oversee all aspects of System implementation, including site preparation, equipment programming, staging, installation, etc. Other individuals may assist the PM in various functions such as reporting, accounting, testing, optimization, etc., but this individual shall have primary responsibility for the performance of the System.

The PM shall carefully coordinate all phases of the work with the Counties to provide site access and minimize equipment downtime. The coordination efforts shall be between the Contractor, subcontractors, and the Counties. Conflict resolution shall be at the sole discretion of Counties as described in the Purchase Agreement.

9.5 Infrastructure Equipment Installation

The location and position of all equipment shall be in accordance with good engineering practices, such that optimum functional efficiency and equipment maintainability shall result. All equipment shall be arranged and installed in a coordinated fashion so that each item of equipment's intended function shall not be impaired due to the influence of adjacent equipment or environmental factors. Sufficient space and clearance shall be provided so that service and maintenance of each item of equipment can be readily performed.

All external equipment inter-cabling, whether network, RF, electrical power, audio/data, or control cables and/or wiring, shall be labeled with pre-printed adhesive wire labels. Markers shall be placed at each end, and adjacent to the connector, plug, or terminus. This data shall be recorded in the installation documentation.

All equipment cables or cable bundles within the shelter, to the greatest extent feasible, shall be neatly tied by means of plastic tie wraps and secured by clamps to flat surfaces.

All cable/wiring bundles exiting the equipment must do so through the top of the cabinets or racks. Rubber grommets or other suitable protection shall be used at cabinet knockouts to protect the cable/wiring. Splicing of network, RF, electrical power, audio/data, or control cable/wiring will not be permitted.

9.5.1 Equipment Mounting

To maximize space utilization and facilitate equipment maintenance, the Contractor shall install the fixed equipment in open racks or equipment cabinets. The Contractor shall install the equipment and connect the equipment to commercial/emergency AC/DC power sources. All AC wiring is to be installed in appropriate conduit as specified in the NEC or local code.

9.6 Antenna Systems Installation

The Contractor shall provide figures and drawings that detail the antenna tower and antenna mounting assemblies. The tower loading detail, to be completed by the Contractor, is an elevation drawing that depicts the antenna tower with antenna mounting locations.

9.6.1 Communications System Antennas

The antennas shall be supplied with mounting brackets and all other suitable mounting hardware for mounting to a 6-ft sidearm mount located at the Contractor specified level of the tower. All brackets, mast, clamps, and hardware shall be of a suitable material to minimize corrosion and rust.

9.6.2 Transmission Lines

Transmission lines shall be cut to length and shall terminate at a point just inside the equipment shelter entry port where the lines terminate to a surge suppression device. All jumper cables shall be kept as short as possible.
The Contractor shall meet all manufacturers’ cable bending specifications for strain relief purposes.

9.6.3 Hangers and Hoist Grips

All transmission lines shall be securely fastened using the specified clamp devices. Hanger clamps shall be approved by the cable manufacturer, installed per cable manufacturers’ instructions, and properly torqued. The best commercially available parts shall be used, no snap-in hangers are allowed. Hoist grips shall be utilized at the manufacturer specified intervals for lifting the transmission line. Hoisting grips shall be left in place to secure the cable.

9.6.4 Ground Kits

Transmission line grounding kits shall be bonded to the tower using tower manufacturer approved methods, typically a mechanical clamp, and shall be installed on each transmission line as follows:

At the top near the antenna
At the bottom near the point of transition to the cable bridge
At intervals along the transmission line of no greater than 75 feet
At the cable entry port of each equipment shelter
The grounding kit pigtails shall utilize two-hole terminals and shall be routed by the most direct path to the nearest grounding system conductor
All ground kits connections at the transmission lines shall be wrapped with overlapping layers of black outdoor electrical tape and protected with Scotchkote or equivalent outdoor treatment approved by County

9.6.5 RF Connectors

The mating surfaces shall remain tightly wrapped and protected until mating; touching with the fingers shall be avoided. Silicone or other material shall not be used in the connectors. All connectors shall be approved by the cable manufacturer, installed per the manufacturers’ instructions, and be properly torqued.

Connectors shall be torqued to the manufacturer’s specifications with a proper torque wrench. After proper torquing, outdoor connections shall be shrink tube protected to preclude corrosion. Shrink tube size shall be in accordance with the manufacturer’s recommendations for the size of line and type of connector.

9.6.6 Transmission Line Surge Suppressors

The Contractor shall install the transmission line surge protection equipment on the interior of the bulkhead panel per the manufacturer’s instructions. Transmission lines shall be cut to proper length for connection to the surge protection equipment. Each connector on the bulkhead panel shall be labeled to identify its associated antenna and line.

9.6.7 Coaxial Jumpers

Coaxial jumper cables shall be used to interconnect all interference protection or multiplexing devices with the coaxial antenna transmission line and radio frequency equipment.

Coaxial jumper assemblies for each antenna system shall be factory constructed to length. The connection to the top of the transmission line shall be weather-protected and the connection to the antenna shall be weather-protected.

9.6.8 Control Station Antennas

All control station antennas shall be installed using solid-jacketed transmission line installed as specified above.

9.7 Transmitter Combiners, Duplexers, and Filters

The transmitter combiner components shall be securely anchored and mounted in an “open” equipment rack or integrated into equipment cabinets. All RF connectors shall be properly torqued; hand tightening is not acceptable.
9.8 **Receive Multicouplers and Tower-Top Amplifiers**

The receiver multicoupler shall be installed within the equipment room within a separate or shared equipment rack or cabinet.

All connectors shall be properly torqued; hand tightening is not acceptable. All joints and fasteners shall be securely tightened and properly torqued to preclude RF noise generation. All exterior connections shall be weatherproofed per the transmission line requirements of this Purchase Agreement.

9.9 **Infrastructure Equipment Removal and Disposal**

The Contractor shall be responsible for the removal of the existing infrastructure equipment following the successful system cutover and reliability test period as defined by the Counties.

All removed or de-installed equipment shall be properly stored at a location provided by the Counties. The Contractor shall provide a detailed inventory list of all equipment including model number, serial number, and location of removal.
9.10 Mobile Radio Installation

All installations shall be neat and professional and performed per the manufacturer’s recommendations using good engineering practice (wires and cables bundled, no sharp edges exposed, no wire exposed, wires insulated from catalytic converter and engine heat, etc.). All cabling, connectors, brackets, and hardware shall be provided and installed by the Contractor. The radio chassis shall be capable of being programmed and removed from the vehicle for servicing without disturbing the mounting rack or cabling installation.

A sample prototype installation shall be performed by the Contractor for each type of vehicle/mobile antenna configuration, for acceptance by the Counties, prior to continuing and completing the respective fleet installation. The mounting locations of the mobile subscriber equipment shall be solely at the discretion of the Counties and may vary from vehicle to vehicle dependent upon operational requirements. Mobile subscriber equipment and radio accessories are to be mounted in a manner that will permit safe operation of the vehicle and will not interfere with proper operation of safety equipment or air-bag systems.

Each remote mount mobile radio shall be installed in the trunk or other location designated by the Counties with the control unit, speaker, and microphone installed under the dash. The control unit and microphone shall be accessible from the driver’s position or as otherwise specified by the Counties. Interconnecting cabling shall be properly designed and constructed (shielding, twisting, placement) so as to preclude adverse effects from electrical interference that may be present within the operating area of the vehicle. Ribbon cable is not acceptable external to the various equipment components.

The mobile radios shall be installed by the Contractor at the Counties’ designated facilities or, at the Counties’ option, at the Contractor’s facilities.

Scheduling shall be completed by the Contractor no less than fifteen (15) calendar days prior to the start of the work. The Contractor shall provide a completion schedule approved and signed by County.

Current Agency mobile subscriber equipment shall remain operational in every vehicle until the new trunked communications System is complete and operational and their removal is approved by the Counties.

9.10.1 Mobile Radio Antennas

The mounting locations of the mobile radio antennas shall be solely at the discretion of the Counties and may vary from vehicle to vehicle. The Contractor shall recommend the best mounting and type of antenna to use, considering uniform pattern and best over-all performance. Should the antenna require a new location on the vehicle, the old antenna hole shall be plugged with an appropriate rubber plug.

The new antennas shall be installed per the manufacturer's instructions and shall be verified and documented for a VSWR of 1.5:1 or less. The RF coaxial connections shall be properly installed and properly tightened.

9.10.2 Interference

The mobile radio shall not be affected by the operation of any electronic, warning equipment or signal equipment that is either factory or field installed in the vehicle and is in good working order. Nor will the operation of the radio provide any adverse operation of any electronic component inherent in the vehicle or any of its accessories either factory or field installed.

Mobile radios may be installed in vehicles that have Mobile Data Terminals. The Contractor shall insure that neither the voice radio nor the MDT radio shall interfere with the full performance of the other radio.

9.11 Portable Subscriber Equipment Installation

Portable radios, single unit chargers, multi-chargers, spare batteries, and associated accessories shall be tested and delivered to a location designated by County. Radios shall be programmed for proper talkgroup and Conventional Channel operation prior to delivery.

Any mobile accessories shall be installed to the standards as specified in the Mobile Radios Section above.
9.12 Dispatch Center Installation

Console furniture at existing dispatch centers is the responsibility of the Counties. The Contractor shall provide any other equipment racks, grounding and bonding, surge suppression devices, and miscellaneous hardware and components required for completion of the dispatch console/backup radio installation.

All installations shall be neat and professional and performed per the manufacturer’s recommendations using good engineering practice with cables bundled, no sharp edges exposed, no wire exposed, etc.

All console related equipment shall be bonded to the dispatch facility ground system. All control stations shall have their antenna systems and transmission lines bonded to ensure that any surge currents do not reach the console operator positions and personnel.

Current dispatch equipment shall remain operational at every dispatch position until the System is complete and operational or until conventional dispatch capabilities are fully integrated into the new consoles. All console operator position installations shall be performed in such a way and to a schedule that shall minimize the interruptions to dispatch operations. The Contractor shall coordinate all dispatch operator installations and removals with the Counties.

Scheduling shall be completed by the Contractor no less than thirty (30) days prior to the start of the work.

9.12.1 Conventional Fire Tone Signaling

The Contractor shall supply and install any hardware, firmware, software, programming, interfaces, and other devices necessary to perform all existing signaling capabilities on the Conventional Channels from the new console system.

9.12.2 PSAP Equipment Integration

The Contractor shall be responsible for integrating all current PSAP equipment, including recording equipment, signaling equipment, FIN terminal, etc. that is presently interfaced to their existing dispatch consoles, into the new dispatch consoles to provide a completely functional communications System.

9.12.3 Logging Recorder System and Integration

The connections shall provide dedicated recording channels for each trunked talk group, conventional radio channel, console dispatch position, and 9-1-1 and administrative telephone circuit as required by the Counties’ at dispatch locations.

For Sarasota, the Contractor shall supply any necessary interface devices to connect the System to the existing logging recorder system manufactured by Voice Print International (VPI).

For Manatee, the Contractor shall supply any necessary interface devices to connect the System to the existing logging recorder system manufactured by NICE. The current NICE logging system is recording approximately 144 channels at the PSC complex.

9.13 Microwave System Installation

The microwave system installation shall include all of the equipment formally specified for the new digital microwave system and all other equipment, hardware, and procedures required for a complete operating system.

9.13.1 Equipment Installation

The microwave radio equipment shall be installed in accordance with the technical parameters of the FCC license authorizations and all applicable requirements of Part 101 of FCC Rules and Regulations.

The Contractor shall provide the necessary wiring, cabling, and conduits necessary for connection of the microwave station equipment to power and ground. Equipment racks shall be firmly bolted in place.

As necessary, the Contractor shall provide, route and terminate all cables to the demarcation blocks within the equipment shelter.
9.13.2 Antennas and Transmission Lines

Antennas shall be mechanically and electrically aligned for proper operation. All microwave transmission lines shall be "finish-cut" to length. All pressurized transmission lines routed to indoor mounted pressurization and radio equipment shall have a downward slope from the antenna support structure to the radio equipment shelter (no drip loop).

Pressurization systems shall be installed to all elliptical waveguides provided by the Contractor. Unused pressurization ports shall be properly terminated.

During any microwave antenna installations, the antenna end of the waveguide shall be immediately sealed with the appropriate pressure window. The Contractor shall replace at no additional cost to the Counties, any waveguide that is not pressurized within twelve (12) hours of installation.

9.13.3 Transmission Line Grounding and Weatherproofing Kits

The Contractor shall follow good engineering and installation practices when performing the installation of lightning protection equipment for the antenna systems.

All provided waveguides shall be grounded with Andrew Corporation Model ground kits with field attachable two-hole crimp-on lugs, or approved equivalent. The crimp connection shall be made with factory recommended crimping device.

The waveguide ground kits shall be installed on the exterior of the cable entry port and grounded to the exterior ground bus bar with field attachable two-hole crimp-on lugs, or approved equivalent.

In addition to grounding at the waveguide entrance point, at a minimum, all waveguides shall be bonded to the tower, at the top, at 75-foot intervals, and at the bottom of the tower using the appropriate ground kits. At the top of the tower and at the center of the tower, a mechanical connection between the transmission line ground and the tower is acceptable. The grounding strap may be attached to a tower member by bolting or clamping. Each ground strap shall be separately attached. At the bottom of the tower, the ground kit shall be connected to the tower ground bar.

Weatherproofing for transmission lines and connectors shall be Andrew Corporation Connector/Splice Weatherproofing Kit, or approved equivalent.

The cut in the jacket of the waveguides made for grounding shall be carefully wrapped with rubber weatherproofing tape. The rubber tape shall then be covered with Scotch brand #88 all-weather vinyl electrical tape, or approved equivalent, per the manufacturer's instructions. Use of other grades of Scotch tape or their equivalents is not acceptable. The entire spliced area shall then be painted with Scotchkote brand electrical coating.

9.14 New Tower Installation

Tower installations shall adhere to the latest of all applicable industry standards, specifications, FAA requirements, TIA/EIA-222, Florida, or local building code requirements. Standards listed herein are meant to serve as a guide and shall be superseded by all current applicable industry standards, FAA requirements, and/or local codes at the time of the installation.

The Contractor shall file the required notifications with the FAA and FCC notifying them that the construction of the tower is complete. The Contractor shall copy the Counties on all official correspondence and notifications. The Contractor shall install the FCC ASR number in a conspicuous place so that it is readily visible near the base of the antenna structure.

9.14.1 Tower Foundation Installation

The tower foundations shall be installed according to existing conditions at the tower site and shall support the tower loading requirements including the antennas, transmission lines, climbing ladders, and antenna brackets.

A concrete materials test shall be performed for the tower foundation. This test shall include slump testing of the concrete materials and unconfined compressive strength testing of concrete cylinders molded at the time of concrete placement. Cylinders shall be provided for each foundation pier and shall be tested at 7 and 28 days after concrete placement. A report of test results for slump testing and unconfined compressive strength testing shall be provided to the Counties immediately after the test.

The Counties shall be notified when the inspection of the various construction phases of the tower and its foundation are required.
9.15 Site Cleanup

At the completion of the installations specified herein, the Contractor shall remove all debris that are a result of such installations and return the work areas to normal conditions. Special consideration must be given to the public safety communications center during equipment relocation and installation to minimize the disruption of "ongoing" dispatch operations.

Damage to any equipment, floor tiles, rooftops, exposed surfaces, or other building facilities in any way shall be repaired or replaced by the Contractor at the Contractor's expense; repair or replacement shall be at the sole discretion of the Counties.

10. Performance Verification and Acceptance

10.1 General

Performance verification will consist of factory tests, mechanical installation inspections, field specification tests, field functional and operational tests, and radio coverage tests. The Contractor, in conjunction with the Counties' technical personnel and representatives, shall verify that all equipment is properly installed, fully functional and meets the requirements of this Purchase Agreement.

The Contractor shall provide all necessary acceptance test plans, technical personnel, transportation, and test equipment to conduct the performance verification tests. The Contractor shall coordinate scheduling of the testing with the Counties. All deviations, anomalies, and test or specification failures discovered during testing shall be documented in a project punch list and remedied by the Contractor in a timely manner.

When the System has been fully installed, optimized, programmed, made operational, and fully tested by the Contractor according to the agreed upon test scripts, the Counties shall then be notified in writing that the System is ready for acceptance testing. The proposed schedule shall include an appropriate amount of time for County's officials to witness all such tests.

All test results shall be recorded in a standardized format to be determined by the Contractor. The format to be used for recording of test program data shall be submitted to the Counties for approval thirty (30) days prior to testing. All recorded test program data shall be dated, witnessed, and signed by the PAs or designated representative of the Counties and the Contractor. All test data shall be presented in a single test report.

10.2 Site and Regional Verification and Acceptance Testing

Comprehensive testing shall be performed individually for both the Sarasota and Manatee simulcast sites. Following the successful testing of each simulcast site, the Contractor shall perform testing of the system as a regional System to demonstrate the required redundancy and functionality.

10.3 Factory Staging and Acceptance Tests

The Contractor shall provide a Factory Acceptance Test Plan (FATP) and stage all trunked and conventional communication systems and microwave communication systems fixed infrastructure equipment at the Contractor's factory location for conducting a Factory Acceptance Test (FAT). The equipment shall be made operational as a system and shall be factory tested prior to shipment and installation in the field. The Counties, at their option, shall supply representatives to witness the factory staging and testing of the equipment. All equipment must be fully functional within the factory-staged systems prior to acceptance of the FAT by the Counties. Microwave equipment may be staged together or separately from the radio system.

At the successful completion of the FAT and written approval by the Counties, the fixed network shall be shipped to the field. Upon receipt of the Counties' approval, Fixed Network Equipment shall be delivered to the Counties by a method designed to safely transport sophisticated electronic equipment. Upon arrival at the destination, all equipment will be received and inventoried by the Contractor. Any interim storage required for the equipment is the responsibility of the Contractor.

Contractor will perform the FAT at its staging facility in Elgin, IL. The Digital Microwave Radio System will have a separate FAT that will be staged and performed by Aviat Networks in Austin, TX.

A sample of factory staging and acceptance is presented in Exhibit K – System Acceptance Plan.
10.4 System Acceptance Test Plan

The Contractor shall provide a System Acceptance Test Plan (SATP) for the System inclusive of all subsystems for establishing the basis of System acceptance. This plan shall form the basis for a mutually agreed upon SATP between the Counties and the Contractor. The SATP shall, as closely as possible, resemble the "real life" application of the Communications System and equipment. An example of the topic areas to be analyzed in depth in the field shall include, but not be limited to, the following testing areas that must show conformance to all of the specifications contained in this document:

- Regional infrastructure P25 features, functionality, programming, and performance
- Simulcast site infrastructure P25 features, functionality, programming, and performance
- Dispatch console and logging recorder functionality and performance
- Subscriber P25 features, functionality, programming, and performance
- Interoperability and mutual aid interface infrastructure functionality and performance
- Conventional interface infrastructure functionality and performance
- Network Control and Management Systems functionality and performance
- Base station transceiver functionality, optimization, and performance
- Radio coverage design verification
- Site facilities installation and mechanical inspection, functionality and performance (e.g., generators, power plant systems, shelter alarms, fire suppression, grounding, etc.)
- P25 ISSI interoperability conformance if purchased
- Microwave/network system functionality and performance

For more information, see Exhibit K – System Acceptance Plan for the System Acceptance Test Plan.

10.5 Tower and Facilities Mechanical Inspection and Tests

10.5.1 General

The entire infrastructure installation effort shall be inspected for conformity to this Purchase Agreement and to the standards of good engineering practice. All equipment and installation services provided under the requirements of this Purchase Agreement shall be inspected for compliance to the standards of good engineering practice, all Federal, State, County, and City regulations and codes, and all building codes and ordinances in effect at the sites delineated in this Purchase Agreement. Particular attention shall be given to the following:

- All installation work performed in a neat and professional manner in compliance with manufacturer's recommendations
- All fasteners and hardware tightened and properly torqued
- All backup power and electrical systems are properly configured and installed
- All antennas are plumb and of proper orientation
- All transmission lines are properly installed, labeled, and swept
- Site free of debris and excavations backfilled, compacted, and restored
- Towers properly oriented
- Interior and exterior ground systems properly installed and bonded
- All SPD/TVSS devices are appropriate and properly installed and bonded
- Tower lighting systems fully operational
- All alarms, circuits, and outlets properly labeled
- Shelters free from water leaks
- First aid kits and eye wash stations are installed
- Fire extinguishers installed

- Based on Contractor’s provided equipment only and does not include retrofitting of existing equipment
- All backup power and electrical systems are properly configured and installed
  - As applicable, to Contractor-provided DC Power Plants, Generators and Automatic Transfer Switches (ATS)
- Interior and exterior ground systems properly installed and bonded
10.5.2 Communication Site Tests

In addition to the foregoing detailed inspection, the following tests shall be performed on the appropriate equipment or structure. Any equipment not meeting the requirements of this Purchase Agreement included anywhere in this document, shall be immediately repaired or replaced by the Contractor.

These tests shall include, but not be limited to:

- Ground testing using triangulation method and approved test equipment
- Generator testing under full load
- Transfer switch operation to demonstrate loss of commercial power, operation of generator unit, and restoration to commercial power
- Proper operation of site alarms
- Power distribution panel circuit verifications
- Proper installation of all lighting (building and tower) and associated switches and controls
- Proper installation and operation of all timers, thermostats, and HVAC systems including cycling of units
- Proper installation of fire detectors and fire extinguishers

**Fully Compliant**

- Generator testing under full load
  - As applicable, to Contractor-provided new generators
- Proper installation of all lighting (building and tower) and associated switches and controls
  - As applicable, to Contractor-provided new shelters
- Proper installation and operation of all timers, thermostats, and HVAC systems including cycling of units
  - As applicable, to Contractor-provided new HVAC units
- Proper installation of fire detectors and fire extinguishers
  - As applicable, to Contractor-provided new shelters

10.5.3 Earth Ground System Test

The tower base grounding system shall be measured by a ground resistance test instrument and shall be 5 ohms or less. If the resistance to earth is greater than this amount, the Contractor shall
supply and install the additional ground rods required to achieve 5 ohms or less. The use of soil treating chemicals to lower the resistance is specifically not allowed except by prior approval by the Counties. A written record of the test results shall be provided to the Counties in both hard and soft copy format. The Contractor’s test report shall also include details of the instrumentation including model, serial and date of last calibration, and local conditions; wet, dry, temperature, etc.

10.5.4 Generator System Tests

The complete installation shall be initially started and checked out for operational compliance by factory-trained representatives of the engine-generator set manufacturer. The engine lubrication oil, as recommended by the manufacturer for operation under environmental conditions specified, shall be provided by the Contractor.

Upon completion of initial start-up and System checkout, the Contractor shall perform a field test to demonstrate load carrying capability and voltage and frequency stability, with the Counties notified in advance. The Contractor shall demonstrate that each genset will deliver its full rated output power for a period of one (1) hour when connected to a load bank.

Written certification shall be provided attesting to proper installation and operation and provided to the Counties in hard and soft copy format.

10.5.5 UPS Systems

UPS systems may consist of a combination of DC power plants (Rectifiers and Batteries, strongly preferred) that are the primary power source at a site, conventional UPS systems providing 120/240VAC output from a dedicated battery power source, and UPS systems providing 120VAC output from power inverters that derive their power from the site’s DC power plant.

These tests shall include, but not be limited to:

- Normal operation
- Simulated power outage to switch to generator
- Battery/UPS only operation at rated load for specified run times
- Return to normal operation from the conditions above
- Maintenance bypass
- Verification of specified run times

10.6 Equipment Specification Testing and Line Sweeps

Following equipment installation and System optimization, the following tests shall be performed for each piece of equipment including any modified and/or relocated existing equipment. In addition, the results of the antenna system Time Domain Reflectometry (TDR) test data shall be provided to the Counties. A representative of the Counties shall witness these tests.

The Contractor shall provide documentation of the test results in both hard copy and electronic copy in PDF format on flash drive to the Counties.

These tests shall include, but not be limited to:

- Base stations:
  - Forward and reflected power at transmitter output
  - Forward and reflected power at combiner output
  - Insertion loss of combiner
  - Receiver threshold sensitivity at the chassis
  - Receiver threshold sensitivity through the tower-top-amplifier test port
- Receiver multicoupler and tower-top preamp gain/loss
- Antenna and transmission line tests:
  - All infrastructure site antennas and transmission lines shall be tested from the interior of the equipment shelters using Time Domain Reflectometry (TDR) providing distance to fault, and a TDR unit capable of producing a soft copy of the results on a flash drive in PDF format. This method of measurement shall indicate any impedance irregularities in the transmission line/antenna system.
    - The VSWR shall be determined at the input connector of the transmission line
- RF control stations:
  - Forward and reflected power at transmitter output
  - Proper programming of talkgroups/channels, features and functions
10.7 Radio Coverage Acceptance Testing

10.7.1 General

The Counties’ acceptance of the radio coverage of the System shall be based upon successful passage of the Coverage Acceptance Test Plan (CATP). Coverage testing will only take place when full foliage conditions exist and shall not begin until the System has been fully optimized and the infrastructure tests have been successfully completed.

The Counties recognize that the radio coverage testing will require significant time and effort from the Counties’ staff, its technical representative, and the Contractor. Accordingly, radio coverage testing will not be conducted until the radio system infrastructure has been properly installed, tested, and fully optimized. Prior to initiation of the coverage testing process, the Contractor shall provide the Counties with written certification that the System has been properly installed and fully optimized so that CATP testing may begin.

Documentation of both the infrastructure and coverage test results shall be presented for the Counties’ review following successful completion of the coverage tests. The proposed schedule shall allow at least two weeks for the Counties to review and approve the test documentation after all testing has been completed.

Refer to Exhibit K – System Acceptance Plan for the Draft CATP.

10.7.2 Site and Regional Coverage Acceptance Testing

A CATP shall be performed independently for both the Sarasota and Manatee simulcast sites. Following the successful testing of each simulcast site, the Contractor shall perform testing of the System to demonstrate the required radio coverage in the designated common areas of operation and response.

Refer to Exhibit K – System Acceptance Plan for the Draft CATP.

10.7.3 CATP Requirements

The CATP shall reflect the System as constructed and include (at a minimum) the following items:

- A schedule showing the CATP activities
- A description of how the test shall be conducted
- An explanation of the testing methodology
- An explanation of how the results shall be tabulated and documented
- An explanation of why the methodology of data gathering and presentation of the results to the Counties shall “prove” that the coverage requirements of this document shall be met
- The Contractor’s expectation, including time commitments, of the Counties’ personnel during testing
- A list of mobiles and portables required for the testing

Coverage Acceptance Test Plan shall consist of the following:

- Automated BER and informational signal level tests
- Subjective DAQ voice quality tests for inbound and outbound messages
- In-building testing of the critical and mandatory buildings

The coverage performance tests shall be performed in all areas of Sarasota and Manatee. The Contractor’s coverage maps shall represent the required service area coverage for the Counties and shall be based upon a measured signal level equivalent to the levels calculated in accordance with the most recent version of TSB-88.

Any equipment not meeting the requirements of this Purchase Agreement shall be adjusted, repaired, or replaced by the Contractor without additional cost to the Counties.
The Contractor shall clearly show the calculations and assumptions used in arriving at the minimum signal levels. The minimum signal level and calculations shall be reviewed by the Counties and is subject to the Counties’ approval.

The Contractor shall perform coverage tests for talk-out and talk-back under full foliage conditions utilizing the newly installed fixed transmitters, receivers, and antenna multicoupler systems, while operating in the trunked mode. Rain shall not delay the scheduled testing.

Refer to Exhibit K – System Acceptance Plan for the Draft CATP.

10.7.4 Infrastructure Modifications

Once radio coverage testing has been initiated, System modifications such as replacement or reorientation of base station antennas or other factors that influence radio coverage, including software-roaming parameters if applicable, shall not be made without the Counties’ approval. Modifications affecting radio coverage will require that the radio coverage test be restarted from the beginning.

10.7.5 Test Equipment Records

The Contractor shall keep thorough records during the equipment testing process and shall provide a permanent record of the testing results to the Counties and its consulting firm prior to the initiation of the coverage testing process. The Contractor shall record the make, model, serial number, and calibration date for all radio test equipment used during the equipment testing process.

The Contractor shall record and track the make, model, and serial numbers of all radio equipment used during the radio coverage testing process. This documentation shall include the versions of software and settings programmed into each of the radios.

10.7.6 Test Grids and Locations

Sarasota and Manatee shall be divided into grid squares with sizes as determined in the latest version of TSB-88 to yield a 99% confidence level.

An automated BER and subjective voice quality test shall be performed in each grid where a portion of that grid is within the county boundary. Testing points within each grid shall be chosen per TSB88 and the test point must be randomly chosen as to not be biased by either party.

The DAQ test is normally performed following the auto triggered BER sample and, to the extent possible, should not cluster adjacent grid test points together. Successful completion of the test shall occur when in-building 95% or more of all grids pass the automated test with the agreed upon maximum BER for the objective test, and a successful voice quality test.

Each test (objective automated and subjective voice) however stands alone in that failure of an objective test grid does not constitute failure of the subjective test and vice versa.

For every test grid, the voice quality test will be performed using a portable radio modified to simulate a portable radio in buildings (95%) of the painted area depicted on the Contractor’s coverage maps.

For grids tested outdoors, a single test location will be tested. For grids tested from within buildings, a single test location will not be sufficient.

Note: a grid passes when the subjective voice quality test and the automated BER measurement test receive a pass for that grid. The subjective DAQ round trip voice test and the objective outbound BER tests, although run at the same time, are separately evaluated. Failure of the DAQ test does not constitute failure of the tile for the BER test and vice versa.
10.7.7 Automated RF Testing

The Contractor shall perform an automated BER and informational signal strength measurement tests. This automated coverage test shall incorporate critical time constants for communications system radio coverage testing. A method of correlating the location and the signal measurements, such as a GPS receiver, shall be employed to assist with subsequent coverage performance analysis. The test instrumentation shall be capable of operation in a vehicle for talk-out tests. The Contractor shall perform a BER test using a digital modulation test signal for FDMA modulation.

A test route shall be developed by the Contractor and approved by the Counties. Continuous data shall be recorded throughout the test route. Transportation for the automated coverage test shall be provided by the Counties. The test data shall be statistically significant for the required reliability.

The automated coverage test shall consider the effects of Time Delay Interference (TDI) on the outbound control or test channel of the simulcast system. A test location shall be considered to pass only if the BER measurements are greater than or equal to the minimum agreed upon thresholds for PASS/FAIL criteria in TSB88.

10.7.8 Radio Configurations

A modified (attenuated) radio will be used to simulate a portable radio operating within a building. This process involves modification of a radio of the same model as purchased by the Counties for the project to simulate the performance degradation that would be encountered operating within a building having those loss characteristics. The Contractor shall provide a thorough description, including block diagrams of the proposed test setup. The Contractor shall certify to the Counties that the testing methodology and modifications to the radios provide a loss equal to that of a portable radio in a building.
10.7.9 Voice Quality Tests

The test evaluation team(s) shall be made up two representatives of the County in which the test is being conducted and one representative of the Contractor. Each test call shall be graded by the Contractor and the Counties’ representatives at their respective locations using the DAQ definitions. If the test messages meet or exceeds the test criteria, as agreed by a majority of the test evaluation team, the grid is considered to have passed. If the test messages do not meet the test criteria, as agreed by a majority of the test evaluation team, the grid fails.

This test is performed by evaluating the voice quality of test calls placed between a dispatcher and a field radio user. In each test location, test calls are placed to and from a dispatcher and a field radio user. Both the dispatcher and the portable radio user must successfully transmit and receive test messages in order to complete the test.

If a test call in a grid fails, a single “retry” will be permitted and the user may move up to 5-feet and retry the test. All retries shall be counted and no more than 5% retries will be allowed for passage of this portion of the coverage test. All retries shall be recorded on the grading template.

The test message shall consist of a short message representative of typical public safety call durations and shall include the identification of the location being tested. The suggested test message is “TEST TEAM #ONE, TESTING BUILDING YYY, LOCATION NUMBER XXX”, followed by a short sentence or two, approximately 8-20 words total.

To ensure that the message is understood, the test message is repeated by the dispatcher or other portable radio user who will then make a similar test call. The suggested response test message is “TEST TEAM #TWO, CONFIRMING BUILDING YYY, LOCATION NUMBER XXX”, followed by a different short sentence or two from a newspaper or periodical. The dispatcher or Test Team 1 will then repeat the message transmitted by Test Team 2. Either test team may report the test results to the monitoring team at the conclusion of the test for each location.

Each of the test representatives marks the test score for each test location. PASS or FAIL determination is made based upon successful messages in both the inbound and outbound directions from both test teams. If a majority of the graders agrees that the voice quality does not meet the defined DAQ criteria, then that test location is recorded as a FAIL. If a DAQ score differs between testers on the same test team and results in a failing score from only one tester, that location will be tested again to determine the cause of the discrepancy. If the discrepancy cannot be rectified, then that grid will be set aside for discussion and evaluation.

10.7.10 Voice Quality Test Results

The Coverage Acceptance Test documentation of both the infrastructure and coverage test results shall be presented for the Counties’ review following successful completion of the coverage tests. The proposed schedule shall allow at least twenty-one (21) days for the Counties to review and approve the test documentation after all testing has been completed.

The Contractor’s coverage testing report shall include the following information for each test:

Description of the test methodology
Test location (map grid, address, or intersection for non-moving tests, etc.)
Audio quality results
Measured signal level results
Date and time
Test conditions (type of radio, antenna, serial numbers, etc.)
Names of the test team participants
Test results shall be displayed on 11” x 17” maps. Grids shall be color keyed to indicate test results. Red indicates a grid failure, green indicates a passed grid.

The test report shall summarize the test results and recommend any corrective steps that may be required to fix any failed test.

10.7.11 Coverage Test Failures

The coverage test for the trunked System shall be considered to have failed if any of the following conditions are demonstrated:

Unauthorized changes to the system or equipment under test
Failure to demonstrate the required BER for building penetration and DAQ audio quality within 95% of the grids for in-building contours tested throughout each county
Failure to demonstrate the required BER and DAQ audio quality within 97% of the grids for outdoor contours tested throughout each county

If the System fails the coverage test as described above, then the Contractor shall take corrective action to resolve the coverage problems and repeat the coverage tests in whole or in part as decided by the Counties. This action shall be at no cost to the Counties.

10.7.12 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 may not degrade areas of coverage that were previously accepted. A retest of coverage shall be conducted in any area (previously failed or not) potentially affected by the remedy in order to verify that the composite coverage is maintained. All remedies must meet the performance, feature-functionality, and reliability requirements of this specification. These remedies may include the following:
Modification of antenna or transmitter configurations, as long as those modifications comply with regulatory and zoning restrictions at no additional cost to the Counties
Addition of simulcast sites, at no additional cost to the Counties

10.8 Functional and Operational Tests
The functional and operational testing shall be performed following the CATP.
The Contractor shall provide and define a detailed "step-by-step" functional test procedure and check list specific for their System that exercises and demonstrates each and all of the proposed functions and capabilities including those of the dispatch consoles.

10.9 Microwave Network Tests
The Contractor shall furnish a microwave network acceptance test plan (ATP) for the Counties review and approval at least thirty (30) days prior to the commencement of acceptance testing.
Following equipment installation and System optimization, at a minimum, the following tests shall be performed for the microwave subsystem. A representative of the Counties shall witness these tests.
The Contractor shall provide documentation of the test results in both hard copy and electronic PDF format on a flash drive. Any equipment not meeting the requirements of this Purchase Agreement shall be adjusted, repaired, or replaced by the Contractor without additional cost to the Counties.
These tests shall include, but not be limited to:
- Microwave Radio
- Visual mechanical inspection
- Compliance with FCC Rules and Regulations including:
  - Transmitter power output
  - Transmitter frequency
  - Emission bandwidth
  - Antenna height
  - Net path loss shall be measured and recorded for each path
  - Received carrier power for each end of each path
  - Calculation of flat fade margin
  - Data service channel
  - Receiver threshold sensitivity for 10-6 BER
  - Transmitter fade and receiver fade margin verification tests
  - Adaptive modulation steps
  - Switches and indicators
  - Meter readings
• Simulated local failures to demonstrate MHSB and loop switching
• Antenna system VSWR/return loss across the frequency band of operation

Microwave Network Monitoring and Control System
• RTU alarm monitoring points shall be tested using local display
• Verify reporting of alarm remote terminals to workstation terminals. Verify performance of controls to remote terminals
• Master terminal station shall be verified for proper programming, redundant switching, reporting, and report generation
• Workstation terminals shall be demonstrated for proper operation and presentation of graphics and textual displays

Contractor will provide a microwave ATP to the Counties for approval at least 30 days prior to the test.

10.10 Communications System Cutover Plan

The Contractor shall provide a preliminary cutover plan describing the transition of users to the new communications System. This plan shall include a chronological chart (Gantt-type format) with the tasks to be accomplished and the time for achievement of each task shown.

The Contractor shall provide a phased implementation plan that will ensure that no current dispatch function is negatively impacted or impaired during system cutover to the new communications System. The Contractor shall be required to implement the plan as part of this Purchase Agreement. The Contractor shall provide an updated detailed cutover plan for each user Agency sixty (60) days prior to equipment installation. The plan shall be approved by the Counties before commencement of installation. The detailed cutover plan shall include a narrative description of the sequential cutover steps and a clear delineation of which tasks are the responsibility of the Contractor and which tasks are the responsibility of the Counties.

The current communication systems shall remain operational during the cutover phase and after cutover for a period to be determined by the Counties.

Refer to Exhibit G - Project Management Plan, Implementation Schedule and Cutover Plan.

10.11 Performance Period and Final System Acceptance

Upon completion of cutover, a complete System performance reliability test shall be executed that will consist of specified period of time for uninterrupted system operation. The Performance Period is a live operational test and requires radio system subscribers to verify operation. During this test period, the Contractor shall keep detailed records of any failures or adjustments of the System or subscriber units. After the Performance Period has been successfully completed, and all outstanding punch list items have been remedied, the Contractor will be given Final System Acceptance by the Counties. The Warranty Period will begin on the date of Final System Acceptance.

The Contractor shall notify the Counties a minimum of fourteen (14) days prior to the start date of all performance tests. Further, The Contractor shall notify the Counties fourteen (14) days in advance of any substantial change to the testing schedule after testing has already commenced.

10.11.1 Performance Period

The 30-day operational test, or burn-in period, shall be scheduled to begin upon written notification to the Counties that the System is ready for the burn-in test and the initial user training and initial subscriber transitions have been successfully completed.

The System will be observed during this period to ensure that it performs as specified. Any failure to perform as specified in the contract will be remedied before the infrastructure is accepted.

If the System performs as specified for thirty (30) consecutive days, and the remainder of the acceptance tests and punch-listed items have been resolved, then the System infrastructure will be considered for Final System Acceptance.

Any major failure that occurs, at the discretion of the Counties’ PAs, may reset the 30-day operational test period clock. The PAs’ decision to reset the 30-day test period should be based, in part, upon the
source and severity of the failure as well as the operational impact suffered by the users. The decision of the PAs to reset the 30-day test period shall be final and binding on the Contractor.

The cutover and transition of the remaining the Counties’ agencies will follow the same process as the initial agencies but will not begin until the 30-day operational test has been successfully completed.

During the Performance Period, the Contractor shall provide replacement parts and materials, and qualified personnel to service the fixed equipment at the sites of work within one hour during normal work hours (8:00 a.m. through 5:00 p.m. Monday through Friday) and two hours at other times, after notification of a major equipment failure as reported to the Contractor’s service facility.

The Contractor shall have sufficient personnel and parts available to maintain the equipment so that the equipment can be repaired within eight hours after notification of equipment failure. This provision shall apply on a working hour basis of twenty-four hours per day, seven days per week including holidays.

Under no circumstances shall the Performance Period be deemed to consist only of beneficial use of the System by the Counties.

10.11.2 Major and Minor Failures

Successful operation is defined as the absence of any major failure of equipment or loss of System functionality. Minor failures, such as operational problems and adjustments normally encountered during implementation of a new System, shall not constitute a failure in achieving successful operation.

The following is a listing of items that define a major failure:

- System in failsoft
- System in “site trunking”
- Mobiles or portables receiving a denial or busy tone
- More than one dispatch console operator position off the air
- The loss of voice communications
- The loss of data communications
- Failure of the trunked System switch/controller
- Greater than two channel resources down
- A simulcast failure affecting one or more sites or more than two channels
- Loss or failure of System configuration database
- Loss or failure of user database
- Systems not properly transferring to standby generator
- UPS not providing sufficient buffer during power transfer
- Failures not specifically defined as minor, at the discretion of the PAs
- Failures that prevent acceptance criteria from being achieved

The following is a listing of items that define a minor failure:

- Failure of no greater than one Repeater channel, provided that such failures are corrected within the maintenance response time required by this Purchase Agreement
- Failure of any equipment which does not cause the interruption of trunking operation or dispatch console functionality, provided that redundant equipment automatically switches into operation in accordance with this Purchase Agreement
- Failure of a single dispatch console position that is not attributable to other system failures
- Failure of a site frequency standard provided that redundant equipment automatically switches into operation in accordance with this Purchase Agreement
- Failure of a single tower-top amplifier or multicoupler
- Momentary (thirty seconds or less) System outages during switching to redundant control equipment
10.11.3 Performance Documentation

The documentation shall be maintained in a common electronic database, the database shall permit sorting by field to facilitate the analysis of maintenance records. This database shall be maintained by the Contractor but shall be accessible, via remote login provided to the Counties by the Contractor to the Counties at all times. During the performance period, the Contractor shall establish and maintain the following documentation:

- Prepare and maintain a service/repair record system. Each major piece of equipment and radio subscriber unit shall be maintained by serial number and asset number.
- Prepare and maintain a failure reporting system to ensure that all failures are reported promptly to the Counties. A failure log shall be available for inspection by the Counties at all times. In addition, a formal failure report shall be submitted to the Counties on a monthly basis and shall show for each failure:
  - The problem and the time reported
  - The time that the technician responded
  - The problem actually found
  - The repairs performed and the time of restoration
  - An itemized list of parts replaced
  - The technician’s name
  - Any FCC required measurements made due to repairs

10.11.4 Final System Acceptance

Upon successful completion of the 30-day Performance Period and remedy of any outstanding punch list items, the Contractor will be given Final System Acceptance by the Counties. The Warranty Period will begin on the date of Final System Acceptance.
11.  Training

11.1  General

The Contractor shall develop and provide a comprehensive and detailed plan for all training associated with the use, operation, and management of the new communication System. The Contractor shall provide the training plan to the Counties for approval a minimum of ninety (90) days prior to the cutover of System to live operation.

The Contractor shall provide a comprehensive “Train-the-Trainer” training program for the identified audiences and the required knowledge areas as defined in this section. Such training shall include, at a minimum, sessions to select the Counties’ personnel with the operation of the trunked System, alarm systems, and with the control center equipment. The Contractor must specify the amount of classroom training to be provided for all levels of training. Written materials, and tailored end user audiovisual aids produced by the Contractor to provide training shall be furnished to the Counties for continuing education purposes.

The first training class in each category shall be given to supervisory personnel of the agencies involved. Any deficiencies in the training program shall be corrected before the rest of the affected personnel are trained. Training for the supervisory personnel shall begin after completion of the fixed end hardware tests.

Refer to Exhibit J, Training Plan.

12.  System Documentation Requirements

12.1  General

The Contractor shall supply a complete set of documentation that describes the overall system layouts, architecture, and its operating and failure modes for all systems, subsystems, and components supplied under the contract. The documentation shall consist of two (2) electronic copies on flash drives and two (2) bound hard copies of the entire System at each Network Core site. Additionally, the Contractor shall provide one (1) complete electronic copy of System documentation on a flash drive specific for each RAN site proposed in its design. Additionally, the Contractor shall provide System documentation on an online shared portal for access and use by the Counties.

12.2  System Diagrams and As-Built Drawings

The Contractor shall prepare engineering drawings for each site of work with all changes, configurations, and modifications documented for each individual communications site showing the equipment configuration, cabling schematic, cabling plan, and all other important system elements. The equipment shall be installed in accordance with these drawings and specifications, which shall be delivered to the Counties as an integral part of the communications system when it becomes operational. Any deviations from the planned installation shall be approved in writing by the Counties and noted in the “as-built, installed, programmed, wired, configured, and modified” drawings, in accordance with this Purchase Agreement.

Thorough “as built” documentation shall be provided by the Contractor and delivered to the Counties’ PAs prior to Final System Acceptance. At a minimum, the Contractor shall have the following list of updated “as-built, installed, programmed, wired, configured, and modified” drawings available at each site for all equipment and transmission systems. These drawings shall include any the Contractor modified and/or relocated existing equipment. All deviations from the original planned installation shall be noted in these final documents.

- System block diagrams including all drawings for cable and conduit runs, pair assignments, and terminal locations,
- All system equipment and components such as processors, controllers, switches, transmitters, receivers, power supplies, transmitter combiner and receiver multicoupler systems, racks, and shelves with the location of major component items identified
- Site layout, electrical, and floor plans for each equipment site and dispatch facility, exact dimensions and location of each equipment rack or item drawn to scale for each site
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- Rack equipment face drawings to scale
- All external equipment inter-cabling whether network, RF, electrical power, audio/data or control and alarm cables and/or wiring
- Numbering and labeling of all cabling and connections to termination blocks associated with the control consoles Aux IOs, conventional interfaces, etc.
- Numbering and labeling of all interconnecting cabling between Repeaters, the central control, any remote site controllers, switches, or processors, alarm circuits, and leased telephone company circuits, and the microwave system
- A record of telephone circuits by circuit number and telephone number for service on these circuits if installed
- Documentation and labeling of transmission line entry ports and transmission line routing and antenna mounting at all fixed sites with detailed drawings showing all mounting hardware and accessories
- Antenna heights, sizes, azimuths, and tower loading requirements for each site
- A complete inventory of all provided equipment and software including model numbers, serial numbers, version numbers in printed form and in the latest version of Microsoft Excel
- Final fleetmap configuration, with all group I.D.s and aliases
- A complete listing of unit I.D.s and aliases
- Documentation of final programming configuration for all software programmable equipment
- All equipment programming templates used in the system

Final Information to be provided as part of the CDR documentation.

12.3 Microwave Backhaul System

Microwave system route map depicting all sites
Physical path survey results
Path profile graphs for each path depicting obstruction heights
Microwave system path data sheets, antenna system documentation and acceptance testing results
Equipment rack profiles and floor space requirements for each site
Equipment power consumption budget for each site

Information to be provided as part of the CDR documentation. For draft information, refer to Exhibit E – System Description.
12.4 System Testing and Acceptance Documentation

Factory Staging test results and acceptance for all staged systems
Hardware Acceptance Test Plan, with all recorded measurements
System Acceptance and Equipment Specification Test plans and results
Radio propagation coverage maps
Final completed punch list
Coverage Acceptance Test Plan documentation and results including in-building testing
30-Day Performance period results and all major/minor system failures

12.5 Instruction and Operation Manuals

The Contractor shall supply a complete set of instruction and operation manuals for each type of equipment supplied and purchased in association with this project to assure that the Counties’ personnel shall be able to operate the communications system both initially and in the future. Each mobile radio, portable radio, control station, and dispatch console shall be provided with one (1) original printed user/operator manual. An operator’s quick reference card shall be provided with each equipment item that requires operation by the Counties’ personnel. These manuals and cards shall be specific to the Counties’ system.

All manuals shall be provided prior to training and shall be used during training sessions and updated as needed for revisions found during training. Revised documentation shall be re-submitted prior to system acceptance. This documentation shall be organized in a manner to allow the Counties’ personnel quick access to the information. As a minimum, the following shall be provided:

All field user equipment and dispatcher console operator manuals published by the equipment manufacturers
All supervisory and system management operator manuals

All equipment manufacturer’s manuals and system manuals will be supplied prior to the start of training.

12.6 Maintenance Manuals

Each manual shall be complete with materials guide, replacement part numbers, and descriptions of all components used in the system.

Control, processing, interface, and peripheral equipment manuals shall contain detailed instructions describing system control, terminal operation, technical theory and repair, along with control and problem-solving procedures.

Each manual shall contain an index of schematics, charts and diagrams, factory test procedures, setup diagrams with minimum acceptable voltages, signal performance values for each module, and individual module test and evaluation results.

All system documentation shall be provided prior to training and shall be used during training sessions and updated as needed for revisions found during training. Revised system documentation shall be re-submitted prior to system acceptance.

This documentation shall be organized in a manner to allow the Counties’ personnel quick access to the information. As a minimum, the following shall be provided:

- All system, and field equipment, and station user and maintenance manuals published by the equipment manufacturers
- Complete set of maintenance and operations manuals shall be provided for the system as whole and for each category of equipment purchased in association with this project
- A listing of all programming and test equipment required for service to the board level
- Manuals for each OEM component of the system
- Theory of operation
- Detailed equipment maintenance, setup, and alignment manuals
- Software documentation which describes system and equipment software and versions
- Detailed step-by-step instructions for each diagnostic test procedure
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- List of all error codes, meaning, description, and action to be taken
- Layout of all circuit boards and modules showing physical location of all components
- Functional block diagrams showing all data and signal paths
- Schematic diagrams for all circuits to the component level with all components labeled with a circuit identifier, which can be cross-referenced in the parts list
- An interconnection diagram showing all exit and entry points for all circuit boards and modules, with labeling of each pin by unique number or letter designation, along with purpose
- Source of availability of all extender cables and boards, along with part numbers and anticipated costs
13. Warranty and Maintenance Requirements

13.1 General

The Contractor shall provide a detailed warranty, service and maintenance plan in accordance with the requirements of this Scope of Work. The service and maintenance plan shall describe in detail how the Contractor will provide warranty, service and maintenance and network security for the System and its components.

Exhibit N – Pricing Summary includes the cost to provide an industry standard parts and labor warranty maintenance period, and the cost of a parts and labor infrastructure maintenance contract for years two through twelve that includes communications system monitoring, hardware and software maintenance, microwave network equipment, and scheduled network server and technology platform updates.

The Contractor shall provide within the warranty period, all labor, parts, technical support, supplies, transportation, test equipment, and facilities to maintain all subscriber equipment, dispatch consoles, and infrastructure communications system components, equipment, and software to the level of factory performance and within the requirements contained herein.

During the warranty maintenance period, the Contractor shall provide remote network monitoring of the system for security and maintenance purposes on a 7-day by 24-hour per day basis. Network monitoring shall provide the Contractor with visibility of all system specific elements, events, and alarms. The Contractor’s network monitoring center shall be continuously staffed with trained technologists, who are capable of acknowledging events, running diagnostics, and initiating an appropriate response. Summary system performance reports shall be provided on a monthly basis.

The warranty maintenance shall cover preventive maintenance, repair due to normal usage, and emergency response maintenance.

After Final System Acceptance, the Contractor shall provide the Counties one complete system infrastructure software upgrade to the latest version. The software upgrade shall include the cost of the software specific system modifications, if any, services and all labor to perform the upgrade. All labor to install the upgrade shall occur during a time convenient to public safety operations and selected by the Counties. This item is included in Exhibit N – Pricing Summary.

Contractor’s Service and Maintenance Plan details the first-year warranty provisions as well an optional maintenance agreement for years 2 – 12 of Contractor’s partnership with the Counties. For additional information refer to Exhibit L – Part 1 – Warranty and Maintenance Service Plan.

During both the warranty and maintenance periods all parts and labor for the ASTRO Radio system, microwave Backhaul, dispatch consoles, and logging recorders are covered. Contractor’s technical support ensures the highest level of system performance through 24x7 network monitoring and notification services, backed by Contractor’s technical help desk support.

The warranty period begins at Final System Acceptance, at which time the Counties’ system software will be at the latest version available. Subsequently, ASTRO Radio software updates will be available and deployed by Contractor at least every two (2) years. A hardware refresh is included as part of the maintenance agreement spread across years five (5) and six (6) to reduce System impact. The refresh ensures that the server hardware supporting Contractor’s Software-Centric radio system never reaches an end-of-life.

With respect to the Tait subscriber radios, the warranty covers software/hardware for repair or replacement of portable/mobile subscriber units for 12 months beginning from date of System Acceptance for Manatee County. The warranty excludes defects arising from customer misuse, neglect, alteration, removal or defacement of serial numbers, mishandling, or attempted repair of said subscriber units.
13.2 Warranty Commencement

The warranty period shall begin upon the date of Final System Acceptance.

13.3 Warranty Period

All warranty services shall be provided as part of the cost of the System without additional charge to the Counties for a period of one (1) year following the date of Final System Acceptance.

The ASTRO Radio system, and all peripheral or supporting infrastructure purchased, includes a comprehensive one-year warranty commencing at Final System Acceptance at no additional cost.

13.4 OEM Warranties

Contractor will pass to the Counties all OEM warranties from third-party equipment manufacturers that have periods extending beyond the Contractor’s one (1) year standard warranty. During the extended maintenance period, the Contractor's parts and labor warranty covers all Contractor-provided equipment, except as excluded below. Contractor does not provide a warranty past one (1) year for shelters, roofing, towers, fence, compound grounds, man and swing gates, and access roads that have been provided as part of this Purchase Agreement.

13.5 Maintenance Personnel

The Contractor shall provide competent, factory trained, experienced personnel to execute the required maintenance tasks during the warranty period. All maintenance personnel shall be trained and experienced in standard communications industry practices.

Personnel who perform maintenance on the System infrastructure shall have completed all required manufacturer-approved training for that equipment. Said training, or appropriate refresher courses, shall have been completed within the previous year and evidence thereof shall be provided to the Counties.

Contractor shall provide on-site maintenance via Contractor’s local Field Service Organization (FSO). Contractor will ensure that its maintenance personnel and contractors are fully trained and certified to provide all the necessary services to support the Counties.

Furthermore, Contractor’s local FSO is supported directly by Contractor’s technical experts through its technical support processes.

13.6 Contractor Service Facilities

The Contractor shall maintain one or more properly stocked, equipped, and staffed service facilities to maintain the communication System and equipment supplied under this Purchase Agreement within the area such that the maintenance response and restoration time requirements can be met.

The Contractor shall specify the testing and maintenance equipment that is available as a permanent part of the Contractor’s on-site maintenance facility and used for maintaining the communications system.

Contractor, via its local FSO, will procure and retain the tools and test equipment required to perform maintenance on the System. The available tool kit will include at a minimum the following items:

- Digital service monitor or LMR Master® S412E
- Power and VSWR meter
13.7 Major and Minor Failure Conditions

The following failure modes are intended to define the failures as Major or Minor. Major failures cause significant impairment of the System that requires an immediate service response.

For warranty information refer to Exhibit L – Part 1 – Warranty and Maintenance Service Plan.

13.7.1 A Major Failure is defined by the following:

- Loss of Master Site or switchover to Redundant Master Site (if equipped)
- Loss of one Site Controller or switchover to Redundant Site Controller
- Master Site LAN/WAN/distribution equipment failure
- Loss of an ISSI link
- Any loss of local or remote system monitoring
- Failure resulting in any simulcast sub-system reverting to “site-trunking”
- Loss of two (2) or more System Manager/Alarm Terminals
- Loss of two (2) or more dispatch consoles
- Loss of “full-featured” dispatch capability (revert to radio dispatch)
- Logging recorder interface failure
- Loss of the CCGS
- Microwave system failure resulting in path outage or revert to standby radio (if equipped)
- Loss of a simulcast Repeater site
- Repeater site antenna system failure adversely affecting multiple channels
- Any component or module failure which results in loss of 20% or more of trunked channel resources
- The loss of the Fire Station Alerting systems

In addition to each of the above items Contractor also improves System reliability by responding to the following occurrences:

- Reduction in any capacity/traffic measurement function
- Any loss of functional visibility and/or diagnostic capability
- Short outages equivalent to System or subsystem outages, with accumulated duration of greater than two (2) minutes in any 24-hour period, or that continue to repeat during longer periods
- Any component or module failure which results in loss of the availability of a single trunked channel resource
- Repeated degradation of service or connections
- Prevention of access for routine administrative activity
- Degradation of access for maintenance or recovery operations
- Degradation of the System’s ability to provide any required critical or major trouble notification
- Any significant increase in product-related problem reports by the Counties
A Minor Failure is defined by the following:

- Loss of single Repeater
- Loss of one (1) System Manager/Alarm Terminal
- Loss of one (1) dispatch console
- Any component or module failure which results in loss of the availability of a single trunked channel resource
- The failure of a control station radio

Contractor Service Response

Service for communication system infrastructure including but not limited to master site network controller, site controllers, dispatch console systems, base station Repeaters, antenna systems, control stations and communications center equipment, voting receiver equipment, microwave equipment, and simulcast control and optimization equipment, shall be provided on a twenty-four (24- hours) per day, seven (7-days) per week basis.

Contractor provides complete service support for all critical system infrastructure components 24x7. The condition of these components is constantly monitored, and any detected service issues are promptly responded to by our remote technical support and local service partner personnel.

Response to Major System failures, as defined above, shall be as follows:

- Telephone response within 30 minutes of notification by the Network Management System and/or the Counties
- Technician on-site within 2 hours of notification by the Network Management System and/or the Counties
- Fault restoration within 4 hours of notification by the Network Management System and/or the Counties
13.8.2 Response to Minor System failures, as defined above shall be as follows:

Telephone response within 30 minutes of notification by the Network Management System and/or the Counties.

Technician on-site within 4 hours of notification by the Network Management System and/or the Counties.

Fault restoration within 8 hours of notification by the Network Management System and/or the Counties.

Failure to meet the response times to a Major failure shall result in a deduction of one (1) week’s maintenance contract fees for each 30-minute period or fraction thereof beyond the 30-minute point. Failure to meet the response times to a Minor failure shall result in a deduction of one (1) day’s maintenance contract fees for each 30-minute period or fraction thereof beyond the 30-minute point. These fees shall be deducted from the annual maintenance contract. This clause shall be invoked at the sole discretion of the Counties.

Sufficient local supply of spare parts shall be maintained to allow rapid restoration of operation of the System infrastructure. In the event that these parts are consumed, they shall be replaced promptly. Replacement stock shall also be available via emergency request with expedited delivery within twenty-four (24) hours of the equipment failure.

Failure to ship essential parts within twenty-four (24) hours shall result in a charge of $2500 per day for Major outages, and $500 per day for Minor outages, as liquidated damages, until the system is restored. Charges will be assessed against the maintenance contract payments at the sole discretion of the Counties.

Mobile and portable equipment shall be serviced at the Counties’ facilities during normal working hours, Monday through Friday. The rate per hour for mobile and portable repair service outside of normal business hours shall be provided.

In the event of more than three (3) defaults on the response time commitment for Major Failures or Minor Failures during a one (1) year contract period, Motorola agrees to pay the Counties $500 for each occasion that it fails to meet the response time obligation.

### Escalation Process

<table>
<thead>
<tr>
<th>Escalation Trigger</th>
<th>Escalation Point and Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal process—automated monitoring and dispatch systems.</td>
<td>Initial diagnosis and restorative action. Dispatches field resources to effect restoration (if necessary).</td>
</tr>
<tr>
<td>First trigger—acknowledgment deadline is missed.</td>
<td>Automated escalation to local System Manager, who has access to service shop management.</td>
</tr>
<tr>
<td>Second trigger—response commitment is at risk of being missed.</td>
<td>Automated escalation to Regional Service Manager, who can authorize additional resources.</td>
</tr>
<tr>
<td>Third trigger—field response commitment is missed.</td>
<td>Automated escalation to Director of Service for Southeast territory, who directs a pool of over 300 professionals.</td>
</tr>
</tbody>
</table>
Fourth trigger—a larger scale response is required. Initiated at the discretion of NOC.

Fifth trigger—a larger scale response is required. Initiated at the discretion of NOC.

Scorecard Process
After Final System Acceptance, Motorola will develop with the Counties a scorecard of performance measurements for each year of the term of the contract. The scorecard will be agreed upon by the Parties during the first quarter of each calendar year. The scorecard will be used to define key performance indicators tied to the contract deliverables for the joint success of the system. The scorecard findings will be the focus for regular leadership performance reviews on a quarterly basis and used as an early warning system for corrective actions needed and ensure the partnership expectations are being met.

The scorecard each year will define a number of performance measurements that could include items such as quote cycle time, system roadmap, future plans, release plans, leadership communications and meetings, support communications and meetings, hardware and software releases, add-on solutions deployments, support operations, and delivery of functionality per approved product roadmap.

Hourly rates for repair service outside normal business hours is provided in the pricing breakdown.

<table>
<thead>
<tr>
<th>Table 6</th>
<th>Hourly Rates for Subscriber Equipment</th>
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</thead>
<tbody>
<tr>
<td>Hourly Rate by Billing Category</td>
<td>Hourly Rate</td>
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<tr>
<td>Normal Business Hours</td>
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<tr>
<td>After Normal Business Hours and Holidays</td>
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</table>
Spares and Test Equipment

The Contractor shall provide a list of the recommended infrastructure spares and spare parts, modules and assemblies, test equipment, tools, and fixtures required for the Contractor provided maintenance of the System. The Contractor shall provide all necessary spares and be responsible for the spares inventory under the maintenance plan. The Counties may allow storage of the spares at System sites, but the Contractor shall be responsible for maintaining the proper inventory of spares at all times for the System.

The Contractor shall specify the methods for maintaining the System to include hardware, servers, switches, operating systems, network security, and applications software. Such methodology shall define any user responsibilities necessary for total System operation.

Contractor has developed and included a customized set of spare parts for the Counties. Spare parts and tools will be maintained at the Sarasota, Florida location for the Motorola Solutions FSO, or at the Counties’ designated location(s). Additionally, replacement parts will be available for 24-hour replenishment should an emergency condition require it. This stock will be maintained in Contractor’s warehouse in Elgin, IL.

Contractor, via Contractor’s local FSO, will procure and retain the tools and test equipment required to perform maintenance on the System. The available tool kit will include at a minimum the following items:

- Digital service monitor or LMR Master® S412E
- Power and VSWR meter
- PC with Windows and a dedicated serial port not enabled by USB
- 100 watt, 50 ohms dummy loads with appropriate connectors
- Repeater tool kit (specific to the model[s] used on the System)
- Connectors and adapters (N, SMA, 7-16 DIN, etc.)
- Repeater Calibration Test Unit (CTU)
- Repeater Tool kit
- Standard hand tools (screwdrivers, wrenches, etc.)

Below is a list of the stock of spare parts that are provided by Contractor.

<table>
<thead>
<tr>
<th>Subsystem</th>
<th>Quantity</th>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manatee DSR</td>
<td>1</td>
<td>T8126</td>
<td>FORTINET FIREWALL APPLIANCE</td>
</tr>
<tr>
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<td>1</td>
<td>DSK3R64AA</td>
<td>HP 9.5MM SLIM SUPERMULTI DVD WRITER</td>
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<td>Manatee DSR</td>
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<td>DLN6865</td>
<td>600 GB HARD DRIVE</td>
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<td>HP X311 REDUNDANT POWER SUPPLY</td>
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<td>HPE Aruba 2930F 48G 4SFP+ SWITCH</td>
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<td>Subsystem</td>
<td>Quantity</td>
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<td>Description</td>
</tr>
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<td>CKN6906A</td>
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<td>Manatee DSR</td>
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<td>SRX 1500</td>
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<td>Manatee DSR</td>
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<td>CLN1866A</td>
<td>FRU: 1M DAC Cable</td>
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<td>Manatee DSR</td>
<td>1</td>
<td>CLN1867A</td>
<td>FRU: SFP Transceiver</td>
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<td>CKN6975</td>
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<td>HP X311 REDUNDANT POWER SUPPLY</td>
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<td>FRU: SFP Transceiver</td>
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<td>ISGW SERVER USED FOR ISSI / CSSI</td>
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<tr>
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<td>FOUR PORT DDM</td>
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<td>Manatee Site</td>
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<td>SITE ROUTER &amp; FIREWALL</td>
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</table>
## Exhibit A – Scope of Work
### 800 MHz Emergency Communications Systems
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<table>
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<th>Subsystem</th>
<th>Quantity</th>
<th>Model</th>
<th>Description</th>
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<tbody>
<tr>
<td>Manatee Site</td>
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<td>CA03445AA</td>
<td>ADD: MISSION CRITICAL HARDENING</td>
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<td>CA03448AA</td>
<td>ADD: STATEFUL FIREWALL</td>
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### Exhibit A – Scope of Work

800 MHz Emergency Communications Systems
For Sarasota and Manatee Counties
RFP 142842TM

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800 MHz Emergency Communications Systems
For Sarasota and Manatee Counties
RFP 142842TM

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RFP 142842TM

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Exhibit A – Scope of Work
800 MHz Emergency Communications Systems
For Sarasota and Manatee Counties
RFP 142842TM

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<th>Subsystem</th>
<th>Quantity</th>
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## Exhibit A – Scope of Work
### 800 MHz Emergency Communications Systems
For Sarasota and Manatee Counties
RFP 142842TM

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<th>Subsystem</th>
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### Exhibit A – Scope of Work
#### 800 MHz Emergency Communications Systems
For Sarasota and Manatee Counties
RFP 142842TM

<table>
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<th>Subsystem</th>
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13.10 Availability of Replacement Parts

The Contractor shall provide a statement of its corporate policy on the availability of replacement parts after manufacturer discontinuance.

The Contractor shall certify that they will maintain a stock of replacement parts for items included in the equipment response and are capable of replacing such parts, assemblies, modules, and devices for each equipment included in the purchase as well as updating all appropriate firmware and software. The Contractor shall also certify that a stock of replacement parts for critical components to be supplied as part of the System shall be immediately available at all times based upon availability during the initial warranty period.

If a specific component becomes manufacturer discontinued, Contractor will either purchase and maintain a sufficient stock of replacement parts, or systematically replace the retiring component with a like or better hardware component that is fully system compatible. This new hardware platform then resets the manufacturer support cycle for replacement parts.

Contractor certifies it will maintain a complete stock of replacement parts for the electronic systems it supplies, and is capable of replacing hardware, software and firmware as needed to support the system.

Contractor certifies the stock of critical replacement parts provided will be available for the exclusive use of the Counties at all times.

13.11 Maintenance Documentation

There shall be a maintenance log with sufficient detail on each failure or maintenance action to enable the maintenance personnel to analyze the problems within the System and take the required corrective or preventative action. This log shall be initiated at the start of equipment delivery and shall be maintained throughout the warranty maintenance period.

The log shall include all equipment purchased under this Purchase Agreement and shall include at a minimum make, model, serial number, date put in service, unit cost, state asset number, and to whom the unit is assigned. The maintenance log shall be stored in an electronic database that can be updated.

During the course of maintenance of the System, Contractor’s remote technical support personnel will work directly and collaboratively with its local FSO. The technical support representative will document all details of the maintenance action in Contractor’s Remedy ticketing system. Actions tracked in Remedy begin at equipment delivery and track through the life of the system.

The Remedy ticketing system will be used to capture all equipment stipulated by the Counties. As the ticketing system is Web based, it is available not only to all Contractor’s personnel but also to the Radio System Manager and anyone designated by the Counties for review and updating.

13.12 Hardware, Firmware and Software Maintenance

Contractor will maintain the most current software and firmware versions suited to the Counties’ network infrastructure. The costs for this support is included as part of the warranty. Contractor will continue the same level of support as part of the maintenance agreement cost.

13.13 Ongoing Contractor-Provided Maintenance

The Contractor shall include the cost to extend System maintenance on an annual basis for an additional eleven (11) years following the expiration of the one-year System warranty. Maintenance response, terms, and conditions shall be the same as those described for the first year of warranty coverage.

The optional extended maintenance quotation shall be broken down by year, and include the same services, systems and subsystems covered by the System warranty. The Counties will pay for the ongoing maintenance on an annual basis.

The warranty, service and maintenance plan shall clearly identify those items covered, items not covered, and conditions that would invalidate the coverage under the maintenance agreement.

The cost to extend system maintenance is provided in Exhibit N – Pricing Summary, while the list of services and covered equipment is found in the Service and Maintenance Plan Section.

The annual cost for extended maintenance is broken down not only by year, but also distributed between Sarasota and Manatee Counties. Contractor’s Service and Maintenance Plan clearly identifies covered and not-covered items, as well as invalidating conditions of the warranty and maintenance provisions.

Refer to Exhibit L – Part 1 – Warranty and Maintenance Service Plan.
13.14 Contractor-Provided Radio System Manager

The Contractor’s service and maintenance plan shall include the cost of a full time System Manager for the Warranty period and each year of System maintenance. Full time means 8 am to 5 pm, Monday through Friday, excluding County holidays. The Contractor shall provide a qualified Radio System Manager substitute for planned absences as required.

The Radio System Manager or any subsequent replacement shall be approved by the Counties. Upon notification by the Counties, the Contractor shall replace the Radio System Manager with a qualified and approved replacement. Work space accommodations will be provided for the Radio System Manager by the Counties.

This is an administrative position involved in the planning and management of the regional communications system. Typical duties include, but are not limited to: coordinating radio operations between and among public safety agencies, overseeing daily operations of the trunked simulcast and conventional radio systems, digital microwave systems, and other supporting systems; assisting with radio system maintenance and upgrades; monitoring system usage statistics; conducting and arranging training of staff and agencies’ radio equipment users; working with and coordinating activities of Contractor provided maintenance technicians; and performing other related duties as assigned. Additional qualifications and requirements for the Radio System Manager position are provided below:

- Preferred qualifications of the System Manager include the following: Minimum of five (5) years experience managing radio systems’ operations. Knowledge of local government purchasing practices and requirements, and local government laws and regulations;
- Working knowledge of trunked radio systems, microwave equipment, towers, consoles and related radio equipment including installation, programming, maintenance and repair of mobile, portable radios, mobile data terminals and pagers;
- Ability to recognize system and network problems or errors and take corrective action;
- Ability to coordinate and assist with subscriber and user equipment training;
- Ability to communicate effectively, both orally and in writing;
- Ability to pass a Level 2 background check;

The Contractor is, and shall be, in the performance of all work services and activities under this Purchase Agreement, an independent contractor, and not an employee, agent or servant of the Counties. All persons engaged in any of the work or services performed pursuant to this Purchase Agreement shall at all times and in all places, be subject to Contractor’s sole direction, supervision, and control. The Contractor shall exercise control over the means and manner in which it and its employees perform the work, and in all respects Contractor’s relationship and the relationship of its employees to the Counties shall be that of an independent contractor and not as employees or agents of the Counties. The Contractor does not have the power or authority to bind the Counties in any promise, agreement or representation.

The Contractor will be required to sign a “Business Associate Agreement” and a “Confidentiality and Non-Disclosure Agreement” in order to provide the Radio System Manager services specified above.

Contractor will hire a skilled professional to serve as Radio System Manager. This person will be fully trained and accredited on the ASTRO Radio system and meet the qualifications stipulated by the Counties. The Radio System Manager will serve the best interest of the Counties in a broad scope of support for the system, overseers, users and beneficiaries. The Radio System Manager will serve the Counties during the warranty period and each subsequent year of System Maintenance. The Radio System Manager will work closely with the dedicated Contractor Care Manager to ensure that the Counties’ concerns are addressed. The Radio System Manager will be supported by the Contractor from delivery of the System through the extended maintenance period.
14.0 Post Award investigation additional scope

14.1 BDA Installation at EOC

- Equipment to include:
  - One (1) Signal Booster operating in the Public Safety (806 – 869 MHz) frequency band
  - One (1) in-band exterior roof top antenna
  - Six (6) in-band interior antennas
  - Two (2) 50/50 split directional coupler
  - Two (2) 80/20 split directional coupler
  - One (1) 70/30 split directional coupler
  - Required connectors for integration to the LDF4-50A heliax cable provided by county

- Installation of the equipment in accordance with:
  - TX/RX design provided by Sarasota County, FL, drawing number 6-TBD, dated July 22, 2013.
  - Applicable manufacturer guidelines
  - Applicable building codes

- Commissioning of the complete in-building system through functional testing
  - In-Building Coverage performance is not guaranteed. Any coverage performance testing conducted will be used to demonstrate functionality of the in-building system and will not constitute a guarantee of service or performance of the in-building system.
EnableFleet will provide Manatee County total visibility and management of their radio fleet from a central point of control. The County will be able to configure and manage the entire fleet of mobiles and portable radios from this single location. This ensures consistent results and provides economies of scale that were previously not achievable because of the requirement for in-field experts to manage radio fleets.

EnableFleet key features and benefits:

- Centralized radio configuration and firmware management
- Accurate and reliable fleet information
- Consistent installation results
- Cost-effective, easy in-field programming
- Easy delivery of updates using client application or Over The Air Programming (OTAP)
- Real-time client-server updates and fleet status display
- File attachment support for installation auditing
- Secure data
- Flexible server-side hosting options
- Reporting
- Future proofing

EnableFleet records the current software configuration and license keys installed on each radio as well as additional information, such as, the location and status of the equipment. Radios returned for servicing can be easily replaced with other available radios in the same group, or refreshed with the correct configuration from the database.
EnableFleet utilizes workflows to ensure that every subscriber unit in your fleet is installed consistently.

The laptop-based client makes in-field programming easier and more cost-effective by significantly reducing the manual organization and distribution of files. In-field employees do not need any radio programming expertise to carry out the updates with EnableFleet.

Figure 2  Sample Tait EnableFleet Client Screen

Figure 3  Sample Tait EnableFleet Manager Screen
14.3 Manatee County Logging Recorder Solution for MCA Logging Recorder and Maintenance

Contractor to provide a complete logging solution for 911 and P25 voice recording comprised of Logging Recorders at both the Manatee County PSC and Manatee County Administration MCA locations. The total solution will record the following traffic at each location:

**PSC:**
- P25 trunked radio system voice traffic
- Existing legacy EDACS voice radio system
- Existing legacy Harris Maestro dispatch console position
- Existing 911 trunk lines
- PRI admin lines

**MCA:**
- P25 trunked radio system voice traffic
- 911 trunk lines
- PRI admin lines

14.3.1 PSC 911 Expansion Logging Solution

Manatee PSC Logging Recorder will be expanded to a 216-channel, multi-media recording solution inclusive of the following:

**Recorder 1:** Hindsight-G2 Primary Recorder:
- 24-P25 VoIP channels recording 24-talkpaths of P25 Trunked Radio System
- 48-Digital channels recording Harris-EDACS Trunked Radio System via 2-T1 spans & IP Integration with TRIM PC for Metadata
- 48-VoIP channels recording 45-call-taker positions on Motorola/Vesta-4X NG911 System via SIP Interface 16-VoIP channels recording 9-Phone Sets on Cisco IP Phone System via SIP Trunk Interface

**Recorder 2:** Hindsight-G2 Secondary Recorder:
- 48-VoIP channels recording 45-Motorola-DS/Vesta-4X NG911 PSAP positions, etc.
- 16-VoIP channels recording 9-Phone Sets on Cisco IP Phone System via SIP Trunk Interface
- Access Server with 10 P25/NG911 Instant Recall/Playback/Monitor Client Licenses
Additionally, the Manatee PSC logging solution will see the deployment of AudioCodes Session Border Controllers (Mediant 1000) to provide the required interfacing for the 911 trunk and PRI administrative lines.

As part of the installation two (2) new 66-blocks will be installed at the existing telecommunication field at the Manatee PSC facility to provide the cross-connect terminations between the existing 911 trunk lines and PRI administrative line to the new AudioCodes Session Border Controller SIP Gateway. A third, new 66-block will be installed, if an existing block does not exist, to provide cross-connection of the existing selected console audio to the logging recorder for the recording of legacy radio traffic.

It is anticipated that the existing telecommunication field is located within 50' cable-feet of the proposed equipment installation location at all facilities and that the 911 trunks, PRI administration lines and console audio are already present within the communications equipment room ready for cross-connection.

The following hardware is to be provided for Manatee County PSC:

Recorder 1 – "Hindsight-G2" Primary Redundant 136-Mixed Channel P25/NG911 Multi-Media Logging Recording System:

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<th>Description</th>
<th>Qty.</th>
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</tr>
<tr>
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<tr>
<td>Hindsight/16-Channel VoIP Acquisition Software w/Channel License (Cisco)</td>
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</tr>
<tr>
<td>Hindsight-G2/SNMP w/HS-G2 MIB</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight-G2/TimeGate-P25/NG911 Instant Recall/Playback/Monitor Client License</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight-G2/Motorola-DS P25 Trunked Radio Integration, Phase-1 (IMBE)</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight-G2/Motorola-DS P25 AES Encryption, supports KFD/KMF/OTAR</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight-G2/Motorola-DS Vesta V4x NG911 PSAP VoIP-SIP Integration</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight-G2/ANI-ALI Serial Interface</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight/NAS-3TB Archival Storage, 1U, RAID1 e/w 2-3TB HSDs, 420,000 Ch-Hrs</td>
<td>1</td>
</tr>
<tr>
<td>KVM-8 w/17&quot;LCD/KB/TP, 1U Rack Unit</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight/Speaker Assy, 2U (supports 2-recorders)</td>
<td>1</td>
</tr>
</tbody>
</table>

The following hardware is to be provided for Manatee County PSC Recorder 2 – "Hindsight-G2" Secondary Redundant 64-Mixed Channel NG911 Multi-Media Logging Recording System:

<table>
<thead>
<tr>
<th>Description</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hindsight-G2/Dell-T630 64-Mixed Channel Multi-Media Logging Recorder, w/4-NICs</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight/RAID5-3TB e/w 4-1TB Hot-Swap Drives, 420,000 Ch-Hrs</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight/24-Channel VoIP Acquisition Software w/Channel License (Motorola/Vesta-</td>
<td>2</td>
</tr>
</tbody>
</table>
Exhibit A – Scope of Work
800 MHz Emergency Communications Systems
For Sarasota and Manatee Counties
RFP 142842TM

### 14.3.2 MCA Logging Solution

A new logging recorder will be added at MCA providing a two recorder, multi-media recording solution inclusive of the following:

**Recorder 1:** “Hindsight-G2” Primary Redundant 88-Mixed Channel P25/NG911 Multi-Media Logging Recording System
- 24-P25 VoIP channels recording up to 24-talkpaths of Motorola Astro P25 Trunked Radio System
- 48-VoIP channels recording 45-call-taker positions on Motorola/Vesta-4X NG911 System via SIP Interface
- 16-VoIP channels recording 9-Phone Sets on Cisco IP Phone System via SIP Trunk Interface

**Recorder 2:** Hindsight-G2 Secondary Recorder:
- 48-VoIP channels recording 45-call-taker positions on Motorola/Vesta-4X NG911 System via SIP Interface
- 16-VoIP channels recording 9-Phone Sets on Cisco IP Phone System via SIP Trunk Interface

The following hardware is to be provided for Manatee County MCA Recorder 1:

<table>
<thead>
<tr>
<th>Description</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hindsight-G2/Dell-T630 88-Mixed Channel Multi-Media Logging Recorder, w/4-NICs</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight/RAID5-3TB e/w 4-1TB Hot-Swap Drives</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight/24-Channel VoIP Acquisition Software w/Channel License (Motorola Astro P25)</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight/24-Channel VoIP Acquisition Software w/Channel License (Motorola/Vesta-</td>
<td>2</td>
</tr>
</tbody>
</table>

To support centralized user access, a Hindsight-G2 Access Server will be deployed at the new Sarasota EOC. This installation consists of the HS-2020/G2/T630/ACCESS Server with the following licenses:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Hindsight-G2/Dell-T630 Access Server, 3TB RAID5 e/w 4-1TB Hot-Swap Drives, w/4-NICs</td>
</tr>
<tr>
<td>24</td>
<td>Hindsight-G2/Quality Assurance SW (Per Evaluator)</td>
</tr>
<tr>
<td>9</td>
<td>Hindsight-G2/TimeGate-P25/NG911 Instant Recall/Playback/Monitor Client License</td>
</tr>
</tbody>
</table>
### Exhibit A – Scope of Work
800 MHz Emergency Communications Systems
For Sarasota and Manatee Counties
RFP 142842TM

<table>
<thead>
<tr>
<th>Description</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4X NG911) 4X NG911)</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight/16-Channel VoIP Acquisition Software w/Channel License (Cisco)</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight-G2/SNMP w/HS-G2 MIB</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight-G2/TimeGate-P25/NG911 Instant Recall/Playback/Monitor Client License</td>
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</tr>
<tr>
<td>Hindsight-G2/Motorola-DS Vesta V4x NG911 PSAP VoIP-SIP Integration</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight-G2/ANI-ALI Serial Interface</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight/NAS-3TB Archival Storage, 1U, RAID1 e/w 2-3TB HSDs, 420,000 Ch-Hrs</td>
<td>1</td>
</tr>
<tr>
<td>KVM-8 w/17”LCD/KB/TP, 1U Rack Unit</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight/ Speaker Assy, 2U (supports 2-recorders)</td>
<td>1</td>
</tr>
</tbody>
</table>

The following hardware is to be provided for Manatee County MCA Recorder 2:

<table>
<thead>
<tr>
<th>Description</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hindsight-G2/Dell-T630 64-Mixed Channel Multi-Media Logging Recorder, w/4-NICs</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight/RAID5-3TB e/w 4-1TB Hot-Swap Drives, 420,000 Ch-Hrs</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight/24-Channel VoIP Acquisition Software w/Channel License (Motorola/Vesta-4X NG911)</td>
<td>2</td>
</tr>
<tr>
<td>Hindsight/16-Channel VoIP Acquisition Software w/Channel License (Cisco)</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight-G2/SNMP w/HS-G2 MIB</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight-G2/TimeGate-P25/NG911 Instant Recall/Playback/Monitor Client License</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight-G2/Motorola-DS Vesta V4x NG911 PSAP VoIP-SIP Integration</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight-G2/ANI-ALI Serial Interface</td>
<td>1</td>
</tr>
<tr>
<td>Hindsight/NAS-3TB Archival Storage, 1U, RAID1 e/w 2-3TB HSDs, 420,000 Ch-Hrs</td>
<td>1</td>
</tr>
</tbody>
</table>

### 14.4 Sarasota County Redundant Logging Recorder Solution

#### 14.4.1 Sarasota EOC

To support centralized user access, a Hindsight-G2 Access Server will be deployed at the Sarasota EOC. This installation consists of the HS-2020/G2/T630/ACCESS Server with the following licenses:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Hindsight-G2/Quality Assurance SW (Per Evaluator)</td>
</tr>
<tr>
<td>24</td>
<td>Hindsight-G2/TimeGate-P25/NG911 Instant Recall Client License</td>
</tr>
<tr>
<td>9</td>
<td>Hindsight-G2/TimeGate-P25/NG911 Instant Recall/Playback/Monitor Client License</td>
</tr>
</tbody>
</table>
Contractor originally proposed a 144-channel logger at the Sarasota EOC. This shall be replaced with 128 mixed licensed channel loggers expandable to 360 channels in a local redundant configuration. The licensed channels will be used as follows:

- 24 P25 RoIP channels recording 24 talkpaths of the ASTRO P25 trunked radio system via the AIS
- 40 VoIP channels recording 31 Intrado Viper NG911 call-taker positions, nine (9) spare
- 24 VoIP channels recording 20 Avaya IP Phone System, four (4) spare
- 16 analog channels recording 16 CAMA Trunks
- 16 analog channels recording 15 Motorola Gold Elite Dispatch Consoles, one (1) spare
- Eight (8) analog channels recording 8 mutual aid and other conventional radios

In addition, the loggers will include the following:

- Three (3) TB RAID Storage supporting 420,000 channel hours
- Speaker Assembly that supports two (2) recorders
- KVM (shared with the Access Server)

14.4.2 North Port PD

Contractor to provide a 64 mixed licensed channel loggers expandable to 360 channels in a local redundant configuration. The licensed channels will be used as follows:

- 24 P25 RoIP channels recording 24 talkpaths of the ASTRO P25 Trunked Radio System
- 16 VoIP channels recording 12 Intrado Viper NG911 call-taker positions, four (4) spare
- 16 analog channels recording 12 Motorola Gold Elite Dispatch Consoles, four (4) spare
- Eight (8) analog channels recording 8 analog phone lines
- Eight (8) Mitel ShoreTel VoIP channels with SIP Integration

In addition, the loggers will include the following:

- Three (3) TB RAID Storage supporting 420,000 Channel-Hours
- Speaker Assembly that supports two (2) recorders
- KVM

North Port PD HS-G2 users will access their recordings via network access to the Hindsight-G2 Access Server located at the new Sarasota EOC.

14.4.3 Legacy SmartZone Recording Solution for Interim Period

In addition to the above Loggers, Sarasota County has identified the need to support the logging of Legacy Motorola SmartZone Traffic after the disconnection of the Legacy VPI Logger and during the interim period discussed in Exhibit L Part 2 – Technical Support for Gold Elite Consoles. The “spare” Exacom Logger is to be configured and provisioned as a 168 channel analog recorder. This configuration is outlined below.
The Hindsight-G2 Access Server for the legacy SmartZone system will come equipped with 168 licensed analog channels expandable to 360 channels in a non-redundant configuration. Features of this server include:

- 168 analog channels recording the same traffic as the Legacy VPI Logger
- Three (3) TB RAID Storage supporting 420,000 Channel-Hours
- Speaker Assembly that supports two (2) recorders
- KVM

Exacom SmartZone Logger users will access their recordings via network access to the Hindsight-G2 Access Server located at the New Sarasota EOC.

Following completion of the interim period and Decommissioning of the legacy SmartZone system, this logger will be removed and re-allocated as a spare component.