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USACE / NAVFAC / AFCEC / NASA **UFGS-27 53 19.13 (May 2020)**

Preparing Activity: USACE **NEW**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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DIVISION 27 - COMMUNICATIONS

SECTION 27 53 19.13

FIRST RESPONDER DISTRIBUTED ANTENNAE SYSTEMS (DAS)

05/20

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SECTION 27 53 19.13

FIRST RESPONDER DISTRIBUTED ANTENNAE SYSTEMS (DAS)
05/20

****
NOTE: This guide specification covers the requirements for distributed antenna systems (DAS).

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be as a Criteria Change Request (CCR).
****

PART 1 GENERAL

****
1. On telecommunications floor plans, show location of headend equipment and other active components.

2. On electrical floor plans, show branch circuits for all active components. In healthcare occupancies, connect all active components to the life safety branch of the essential electrical system.
****

1.1 RELATED SECTIONS

[Section 07 84 00 FIRESTOPPING for additional work related to firestopping.]

1.2 SUMMARY

1.2.1 Scope

****

NOTE: Modify scope to clearly include desired capabilities of the distributed antenna system.

NOTE: Types of DAS are generally classified into three different categories. These categories are passive DAS, active DAS, and hybrid DAS. Coupling two solutions together in the same space or facility is not recommended because they could interfere with each other.

NOTE: Passive DAS is typically used for buildings 125,000 square feet or less and in a building that does not have a large amount of metal, masonry, or concrete wall materials that block the RF signals. Passive DAS uses only coaxial cable to distribute the signals. It is the smallest, simplest, and often the least expensive DAS solution. Passive DAS is inherently limited in bandwidth and is only suitable for very small service frequency requirements. A Passive DAS is only allowed were permitted by the using military departnemt and is not allowed in military medical facilities.

NOTE; Active DAS is a solution used for larger spaces and spaces with more barrier materials that block the RF signals from traveling through the interior space. Active solutions use fiber optic cabling which changes the RF signals into light for distribution, and then back into usable signals at the desired locations. An active DAS is the preferred solution for military medical facilities. Specify an active system for all medical facilities.

NOTE: A hybrid DAS solution includes a combination of both active and passive DAS. Do not specify a hybrid DAS solution.

****

a. This work includes design and providing a new, complete, [passive] [active] distributed antenna system (DAS) as required and as described herein for the [building name]. Provide a turnkey system capable of receiving, processing, and transmitting indicated radio signals including the system wiring, raceways, pull boxes, terminal cabinets, outlet and mounting boxes, control equipment, active components, passive components, mounting hardware and other accessories and miscellaneous items required for a complete operating system even though each item is not specifically mentioned or described. Provide system[s] complete and ready for operation. See paragraph titled SYSTEM DESCRIPTION for additional requirements.

b. Provide equipment, materials, installation, workmanship, inspection, and testing in strict accordance with the required provisions of NFPA 72 [and NFPA 1221].

[c. The system layout on the drawings show the intent of coverage and are shown in suggested locations. Submit plan view drawing showing all component locations, cable routing, junction boxes, other related equipment, conduit routing, and wire counts for all floors.]

****
NOTE: Include project specific frequencies in the brackets.
****

d. Provide a DAS capable of receiving, processing, and transmitting first responder[, military and local emergency medical services (EMS),][radio paging,] [and][required [UHF][and VHF]] frequencies. Provide initial system capable of processing services of frequencies from [_____] to [_____]. Provide a system that is upgradeable to allow future additional frequencies as required by NFPA 1221.

e. Provide letters of permission for all used frequencies for which the Government does not already have a license.

1.3 1.1 REFERENCES

****
NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.
****

The publications listed below form a part of this section to the extent referenced. The publications are referred to within the text by the basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 72	(2019; TIA 19-1; ERTA 1 2019) National Fire Alarm and Signaling Code
NFPA 99	(2021) Health Care Facilities Code

NFPA 780	(2017) Standard for the Installation of Lightning Protection Systems
NFPA 1221	(2019) Standard for the Installation, Maintenance and Use of Emergency Services Communications Systems

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST SP 800-82	(2015; Rev 2) Guide to Industrial Control Systems (ICS) Security

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-329.1-D	(2009; R 2013) Minimum Standards for Communication Antennas Base Station Antennas
TIA-455-13	(1996a; R 2012) FOTP-13 Visual and Mechanical Inspection of Fiber Optic Components, Devices, and Assemblies
TIA-569	(2015d) Commercial Building Standard for Telecommunications Pathways and Spaces

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD 8510.01	(2014; Change 1-2016; Change 2-2017) Risk Management Framework (RMF) for DoD Information Technology (IT)
UFC 4-010-06	(2016; with Change 1, 2017) Cybersecurity of Facility-Related Control Systems

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC EMC	(2002) FCC Electromagnetic Compliance Requirements
FCC Part 15	Radio Frequency Devices (47 CFR 15)
FCC Part 95	Personal Radio Services (47 CFR 95)

UNDERWRITERS LABORATORIES (UL)

UL 924	(2016; Reprint May 2020) UL Standard for Safety Emergency Lighting and Power Equipment

1.4 DEFINITIONS

1.4.1 System Integrator

A person or organization that specializes in distributed antenna systems in bringing together component subsystems in to a complete system and ensuring that those subsystems function together as a complete system. The system integrator is responsible for the system design, installation, testing including all warranties required by this specification.

1.5 SUBMITTALS

****

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Qualifications; G[, [_____]]

SD-02 Shop Drawings

System Description; G[, [_____]]

System Layout; G[, [_____]]

Detail Drawings; G[, [_____]]

Coordination Drawings; G[, [_____]]

In addition to Section 01 33 00 SUBMITTAL PROCEDURES, provide shop drawings in accordance with paragraph SHOP DRAWINGS.

SD-03 Product Data

Material and Equipment; G[, [_____]]

Uninterruptible Power Supply; G[, [_____]]

Warranty; G[, [_____]]

SD-05 Design Data

Design Analysis and Calculations; G[, [_____]]

SD-06 Test Reports

Acceptance Test Plan; G[, [_____]]

Acceptance Test Procedure; G[, [_____]]

Acceptance Test Report; G[, [_____]]

SD-07 Certificates

Accreditation; G[, [_____]]

Certificates of Compliance; G[, [_____]]

SD-08 Manufacturer's Instructions

Installation; G[, [_____]]

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G[, [_____]]

Submit Data Package 5 for each component in accordance with requirements of Section 01 78 23 OPERATION AND MAINTENANCE DATA.

Training Plan; G[, [_____]]

SD-11 Closeout Submittals

As-built System Drawings; G[, [_____]]

Closeout Documentation; G[, [_____]]

1.6 SYSTEM DESCRIPTION

1.6.1 Design Requirements

Provide a Distributed Antenna System (DAS), capable of distributing first responder radio signals from equipment including [Government Furnished, Government Installed (GFGI) wireless (802.11a/b/g/n) and LAN controllers,] communication links, antenna systems, bi-directional amplifiers, [coaxial cabling,] [broadband repeaters] in necessary bandwidths to support desired frequencies, couplers, decouplers, battery backup, power line surge

protection and all other necessary components to make a complete and operational system. Provide a complete and operational system to distribute system two-way radio service from the first response radio system. Complete coverage in accordance with NFPA 1221 will be provided for all interior spaces including [mechanical areas,] [open stairwells,] [and] [storage areas][_____].

Provide all headend interface, antenna interfaces and amplification components, conditioners and any other equipment necessary.

Provide system features that include, at a minimum, frequency conditioners, auto isolation detection (Uplink/Downlink) and auto turn on-off (Downlink) functions to ensure that the repeater unit is optimally positioned and safe guarded at all times. It will also have LED displays to show uplink and downlink connection, as well as LED lights for power and uplink and downlink alarms.

Provide all materials and labor needed for a complete and operational system for the services in this specification plus the additional system capabilities as indicated. This includes but not limited to all necessary equipment, interfaces, jumpers, terminations, cabling, antennas, amplifiers, conditioners, power supplies, battery backup, software and all components required to attach access points to the system.

1.6.2 System Application Design

****

NOTE: At a minimum, include the following on the telecommunications drawings: System block diagrams showing major components, a system riser showing relative locations of major equipment, telecommunications room layouts showing locations of major equipment, roof conduit penetrations and antenna mounting details, and cable riser and major pathway locations.

****

Provide the system application design required to provide a DAS that complies with and satisfies all of the requirements specified in this Section[and as indicated on the Telecommunications Drawings] for this application and project.

1.6.3 Standard Products

Provide an application design that utilizes standard system components that are the product of a Manufacturer regularly engaged in the manufacture of DAS, and that have been in satisfactory use for at least six months. The System must be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the facility.

Provide hardware, software, and installation of a complete and engineered system. Provide a submitted design that is properly engineered for the operational requirements. Include all components required to meet this specification section in the design, other than a change in, or in addition to the operational frequencies identified herein.

1.6.4 Local Products

Incorporate local materials to the greatest extent possible. All proposed local products must meet all applicable hardware and software requirements set forth in these specifications.

1.6.5 Minimum Requirements

Specifications are minimum requirements. If the provided system requires enhanced specifications that exceed those specified herein in order to satisfy the specified design, configuration, capability, and performance requirements, then provide a system with the enhanced specifications.

1.6.6 Current State-of-the-Art Technology

Provide DAS application design and products that utilize current state-of-the-art products that provide the enhanced capability and performance specified herein. Provide DAS design and products representing the latest manufacturer make and model.

1.6.7 Continuous Duty Design

Provide equipment designed for 24 hours per day, 365 days per year continuous 100 percent duty operation.

1.6.8 Design Analysis and Calculations

Provide a comprehensive design analysis and calculations to i, at a minimum, the following:

a. Power supply requirements for each component of the system in accordance with the manufacturer's instructions and the worst-case loading conditions for power supplies that are not part of the component. Provide power consumption and dissipation data under normal and maximum operating conditions.

b. Cable type, size, and attenuation calculations for all cables connecting the components of the system according to manufacturer's instructions.

c. Definition of all interface protocols and specific preparation and application items including coordination issues.

d. Signal calculations and anticipated signal strength for various areas of the buildings.

e. Frequencies of operation and the transmission characteristics throughout the facility.

f. Amount of concurrent users per frequency and service.

g. Uninterruptible power supply meeting the secondary power source requirements of NFPA 1221 and UL 924.

h. System monitoring meeting the requirements of NFPA 1221 for Two-Way Radio Communications Enhancement Systems.

1.6.9 Environmental Requirements

Provide equipment to be used indoors rated for continuous duty operation under ambient environmental conditions of 35 to 120 degrees F1.7 to 49 degrees C dry bulb and 10 to 95 percent reflective humidity, noncondensing. Provide all other equipment rated for continuous operation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified or normally encountered for the installed location.

1.6.10 Electrical Requirements

105 VAC to 130 VAC at 60 Hz operating voltage range, plus or minus 2 percent.

1.6.11 Power supplies

Provide primary and secondary power supplies in accordance with NFPA 1221 that provide sufficient power for worst-case conditions of system operation that could occur without signal loss or perceptible degradation. Provide power supply monitoring in accordance with NFPA 1221.

1.6.12 Power Line Surge Protection

Provide power line surge protection for all equipment connected to AC power. Provide surge protection integral to the equipment or installed as an accessory item in accordance to manufacturer's recommendations. Do not use fuses for surge protection.

1.6.13 Antenna Line Surge Protection

Provide power line surge protection for all equipment connected to a radio antenna. Provide surge protection in accordance to manufacturer's recommendations. Do not use fuses for surge protection.

1.6.14 Shielding and Grounding

Provide shielding and grounded as required by the system design, Manufacturer's instructions, FCC Part 15 listing, and regulatory requirements.

1.6.15 System Capability and Configuration

1.6.15.1 System Capability

Provide a DAS to support all indicated frequencies and services.

Coordinate requirements for interfacing with the trunked radio system which supports fire and police departments and emergency personnel with the Contracting Officer.

1.6.15.2 System Configuration and Major Functional Components

Provide system of automatically controlled bi-directional amplifiers (BDA), antennas, decoupling cavities, coaxial cables, fiber optic cables, related filtering devices engineered into one tuned system that will accomplish the specified functionality on all specified frequencies.

1.6.16 Performance Requirements

Provide DAS coverage within the facility in accordance with NFPA 1221 and as follows:

****

NOTE: Include comprehensive list of all locations where 99 percent floor area radio coverage is required. Included this list in this specification. Consult with using military department during construction document design for required areas.

****

a. 99 percent floor area radio coverage for critical areas such as the [emergency command center,] [fire pump rooms,] exit passageways, [elevator lobbies,] [standpipe cabinets,] fire suppression valve locations, [_____] and other areas deemed critical by the Contracting Officer.

b. 90 percent floor area radio coverage for general building areas.

1.6.16.1 System Initiation and Operation

No user controlled features are permitted on this system. System is to be active on power up and perform as specified without any form of manual control.

1.6.16.2 Signal Processing Rates

System processing rates are real time and occur without interference. Include proper engineering to remove intermodulation effects, interference within system components, echo, delay or disparity reception caused by active or passive components or by the transmission media. System must be capable of supporting a large amount of users per frequency.

1.6.16.3 Priority

All devices coexist on the system without channel control within the system.

1.6.16.4 Signal Strength

Provide minimum signal strength in accordance with NFPA 1221 throughout the coverage areas.

1.6.16.5 Reception

Provide complete reception and transmission within the facility without shadows or dead spots.

1.7 QUALITY ASSURANCE

1.7.1 Cybersecurity

****

NOTE: Coordinate DAS integration requirements with facility needs and cybersecurity requirements. Simple DAS may be segregated from the facility

network and greatly reduce the cost of cybersecurity compliance.
****

a. The Risk Management Framework (RMF) is the process by which information systems are accredited for operation by a designated official from the Using Military Department. It is the standard process under which all DoD information systems must achieve and maintain their Authority To Operate. The Cyber Security process is documented in DOD 8510.01 and NIST SP 800-82. Refer to UFC 4-010-06 for additional requirements.

b. All systems that are IP addressable or interface with the Assured Network must be certified to operate. Coordinate with the Government to initiate and complete the accreditation process.

c. Cybersecurity requires input from the system vendor or provider and support from the local IMD. The local IMD-IA office is the point of contact for all Cybersecurity requirements. The local CMIO is the point of contact for all clinical and functional system requirements.

1.7.2 Shop Drawings

In exception to Section 01 33 00 SUBMITTAL PROCEDURES, submitted plan drawings must be a minimum of 279 by 432 mm 11 by 17 inches in size using a minimum scale of one mm per 100 mm 1/8 inch per foot[, except as specified otherwise]. Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Identify circuit terminals on the wiring diagrams and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. Include the nameplate data, size, and capacity. Also include applicable federal, military, industry, and technical society publication references.

1.7.2.1 Detail Drawings

Provide drawings certified by the qualified system integrator. Include drawings specifically prepared to indicate the work for this project. Generic drawings are not acceptable. Submit drawings to include:

a. System block diagram, riser diagrams, wiring and schematic diagrams, run sheets including number of conductors and wire number (ID), custom assembly details, installation details, location of donor antennae and maps showing donor equipment sites and signal strength at the construction site for each donor system. Provide a drawing that indicates all RF emitting elements, antennae or radiating cable within the system, differentiated from all interconnecting cables and or elements, and the location and value of any non RF emitting terminations, stubs or loads.

b. Riser diagrams that indicate the identification number (ID) for all equipment components.

c. Installation details that indicate layout and mounting of equipment, equipment relationship to other parts of the work, including clearances required for maintenance and operation, and plan and

elevation details that indicate the exact and totally coordinated physical location and size of each individual item of equipment.

d. Installation details for equipment and cabling that is mounted within or on the ceiling, ceiling grid, or hard ceiling structure and that includes the make and model of the surface or recess mounted boxes and wireways, and details for any mounting hardware.

e. Details for the custom assembly of equipment that indicate the assembly configuration, elevations and dimensions. Typical custom assembly details include equipment panels, and equipment mounted in a rack or cabinet.

f. Legend of graphic symbols used.

[g. Details that indicate anchoring and bracing provided for seismic protection in accordance with the requirements of the Section 26 05 48.00 10 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT]

1.7.2.2 Coordination Drawings

Submit coordination drawings to include:

a. The details of all electronic and physical interfaces between the DAS System and all interfaced telecommunications systems and other systems, including the exact point and type of demarcation.

b. The layout and mounting of all DAS equipment, and the routing and mounting of cabling in telecommunications rooms and the communications equipment room as coordinated with the layout of all other systems equipment in these rooms.

c. The layout, routing, and mounting details of all equipment, cables and apparatus located in ceilings, passageways, or other areas not indicated as communications spaces, and to coordination of those items with ductwork, plumbing, lighting and other materials so located in those respective areas.

1.7.3 Qualifications

1.7.3.1 General Qualification Requirements

a. The System Integrator and Installer must each have the minimum qualifications specified, related to the type of system specified for this project. All system components must meet the minimum requirements of this specification.

b. The Government reserves the right to accept or reject the System Integrator or Installer based upon qualifications and ability to conform to specified technical or licensing requirements of this Section. System Integrator, Installers that do not have the specified qualifications will not be accepted.

c. The Government will determine the acceptability of any proposed System Integrator or Installer based on submitted and verified documentation that substantiates that the proposed System Contractor, Installer and Manufacturer have the qualifications specified in this Section.

d. Submit documented verification of the specified qualifications as part

of the Data Qualifications submittal. The Government maintains the right to request, inspect and verify references and resumes of all technical and managerial personnel assigned to the project.

e. Include qualification documentation, but not limited to the information outlined below:

(1) A list of projects performed by the System Integrator and Installer during the last five years explicitly involving the type of system specified in this section, including:

(a) Name of facility where work was completed.

(b) Name, title, address and telephone number of a point of contact for the listed facility.

(c) The make and model of the system provided and total scope of work for the facility.

(d) Restrict list to the facilities where the same type of system was installed for the same purpose provided.

(2) An organizational chart of the DAS System Integrator and Installer project team that will perform the work included in this specification section.

(3) List and resumes of the principle personnel that will be assigned to the work on this project to include responsibility and relationship to the project management structure. For each individual, include education, certification of factory training, and experience relevant to work assignments for this project. Do not include unrelated experience with other systems. Include the following personnel:

(a) System project manager

(b) System Application Designer

(c) [CAD][BIM] staff that will prepare submittal drawings

(d) Installation technician and supervisory personnel

(e) Acceptance Testing Personnel

(f) Training Personnel

(4) Define the work and services that will be performed at locations other than on the project site, and provide points of contact, the address and telephone number of the locations where such off-site work is to be done. Include the following, at a minimum:

(a) Project management

(b) System application and design and documentation

(c) Testing and training plans

(d) Repair and maintenance services

(e) Maintenance supplies warehouse

(f) Training personnel

95) Telephone number that will be answered by staff 24 hours per day, 365 days per year, to obtain repair parts and maintenance service.

(6) The System Integrator and Installer qualifications relative to the the type of system specified in this Section.

(7) A letter from the System Integrator stating that system being provided satisfies all functional and product requirements specified in this Section.

8. A letter from the System Integrator guaranteeing the availability of parts as specified.

1.7.3.2 System Integrator Qualifications

a. System Integrator qualifications must include the following:

(1) The System Integrator is regularly engaged in the system application design, documentation, installation, testing, training, and maintenance of the type of system specified in this section.

(2) The System Integrator has a minimum of five years experience providing these services for systems having the same level of features and functions as the system being provided.

(3) The System Integrator has a minimum of five years as the manufacturer or an authorized distributor and service organization for the manufacturer of the system provided.

b. System Integrator personnel qualifications must:

(1) Be factory trained or certified for the make and model of the components used in the system provided.

(2) Have a minimum of five years experience performing the services specified in this specification section.

(3) Maintain a full compliment of spare parts for the provided system with the ability to furnish on-call maintenance 24 hours per day, 365 days per year.

1.7.3.3 Installer Qualifications

a. The installer personnel must be regularly engaged in the installation of the type of system in this specification section.

b. The installation supervisor must be factory trained and certified or licensed for the type of the system provided.

c. The installation supervisor must have a minimum of five years experience providing services having the same level of features and functions for the system included in this specification section.

d. The installation personnel must have a minimum of three years

experience providing services having the same level of features and functions for the system included in this specification section.

1.7.3.4 Manufacturer Qualifications

The system manufacturer must:

a. Have a minimum of five years experience in producing the products and type of system included in this specification section.

b. Produce a system that satisfies all specified features, functions and product requirements.

c. Guarantee the availability of the replacement parts for the designed system for a minimum of seven years from the date of final acceptance of the system by the Contracting Officer.

1.7.4 Regulatory Requirements

1.7.4.1 Products

Provide products which comply with FCC Part 15

1.7.4.2 Design and Installation Work

Provide design and installation work compliant with FCC Part 95, UL 924, NFPA 70, and TIA-569

1.7.4.3 Electromagnetic Interference (EMI)

a. Comply with FCC EMC and the EMI standards specified in FCC Part 15 for EMI caused by electronics devices.

b. Provide a system that does not generate nor is susceptible to any harmful electromagnetic emission, radiation, or induction that degrades, obstructs, or interrupts the operation of the installed system, any computer system, [or] life safety system[, medical equipment] [or patient monitoring system].

c. In the event that any part of the system is certified by the FCC, and subject to CFR technical rules and standards, and are different or in addition to those set forth herein, the standard relating to these parts apply.

d. Comply with current CFR standards that are applicable to the system at the time of system acceptance testing.

e. In the event of a breach of representations or warranties, the System Integrator or Installer, and its own expense, is responsible to put the offending system into compliance with the current applicable CFR standards or replace the offending system with an acceptable system.

1.8 DELIVERY, STORAGE, AND HANDLING

1.8.1 Protection

Store all products delivered and placed in storage protection from the weather, humidity and temperature variation, dirt and dust, or other contaminants.

1.8.2 Delivery Coordination

Coordinate deliveries with the Contracting Officer to insure a timely installation.

1.8.3 Loss Liability

The System Integrator or Installer is liable for any loss due to delivery and storage problems.

1.8.4 Delivery Restrictions

a. Do not deliver products or installation material the project site more than one month prior to commencement of its installation.

b. System products must not leave the factory prior to six months before the time that the facility is ready for installation of the products. Obtain prior written approval of the shipping date from the Contracting Officer.

1.8.5 System Integrator Responsibility

The System Integrator or Installer is responsible for all handling and control of products provided under this contract.

1.9 SEQUENCE AND SCHEDULING

a. Install each part of the system and phase into operation as required by the project schedule.

b. Schedule and coordinate work with all other trades and suppliers whose work is critical to the successful installation of the system.

c. Furnish and install all required items for a complete and operating installation so as to cause no delay in work by others, or completion of the project.

d. Perform final inspection and acceptance testing of each system after the system installation has been completed and all pre-testing, [and commissioning] have been successfully completed.

1.10 WARRANTY

Provide equipment items that are supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

Warranty the operational and physical integrity of the provided system, including a warranty against all defects in design, equipment, materials, software, workmanship, and improper installation and adjustments, for a period of at least one year from the date of final acceptance of the work. If the System Integrator or Manufacturer warranty is for a period longer than one year, the longest warranty period governs. Include a warranty document with the Product Data submittal.

During the warranty period any maintenance, make adjustments or repairs in accordance with the Warranty Maintenance specifications herein. Warranty

repair of minor malfunctions desired by the Government at other than normal working hours may be charged at current labor rates for the premium portion of time.

1.11 MAINTENANCE

1.11.1 Operation and Maintenance Manuals

Furnished commercial off the shelf manuals for operation, installation, configuration, and maintenance of products. Submit operations and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein not later than [2] [_____] months prior to the date of beneficial occupancy. In addition to requirements of Data Package 5, include the requirements of paragraphs DETAIL DRAWINGS, and COORDINATION DRAWINGS. Ensure that these drawings and documents depict the as-built configuration.

1.11.2 Extra Materials

1.11.2.1 Off-The-Shelf Maintenance Parts

Provide guarantee that a stock of the subsystem component parts required for maintenance service will be available off-the-shelf from the system integrator, and can be express shipped to the Facility if not available locally within a 150 mile driving radius of the Facility. Parts that must be ordered from the Manufacturer for the repair of a major malfunction, as defined herein, must be express shipped for delivery within one day after the major malfunction has been identified. Parts that must be ordered from the Manufacturer for the repair of a minor malfunction, as defined herein, must be express shipped for delivery two days after the minor malfunction has been identified.

1.11.2.2 Installation Spare Parts

The System Integrator is required to keep an adequate quantity of installation spare parts onsite to preclude work stoppages and to meet other contingencies that might arise prior to the final inspection and acceptance of the system.

1.11.2.3 Post Acceptance Spare Parts

a. After the system has been in acceptance by the Government, recommend and provide one of the minimum quantity and type of onsite spare parts as necessary to maintain the full operation of the system in case of failure.

b. System Integrator is required to maintain spare parts on-site during the warranty period to facilitate quick repair through plug-in module replacement of key system components, then replenished and turned over to the Government at the end of warranty period.

c. Provide recommendation of any additional onsite spare parts deemed necessary by the Manufacturer and or the System Integrator. Furnish to the Contracting Officer the cost of recommended additional spare components as a separate line item.

1.11.2.4 Special Tools and Equipment

Provide any special maintenance tools, equipment and software are defined

as those items that are uniquely required, due to Manufacturer make or model of the provided products, to install, setup, initialize, program, and maintain any component or function of the system such. Provide, after final inspection and acceptance, one set of any special tools, equipment and software necessary.

1.11.3 Maintenance Service

a. Perform warranty maintenance service on the system using qualified maintenance personnel that have been trained for the system being serviced.

b. System Integrator is required to offer a Service Agreement to the [medical] facility. Include a copy of the proposed Service Agreement with the Product Data Submittal.

c. As authorized by the [medical] facility, the contractor may utilize [medical] facility maintenance personnel that have been factory trained for maintenance of the provided system for the first level of response to a call for service.

d. If available at the project location, provide and on-line diagnostic maintenance support capability as specified herein.

1.11.4 Service Availability and Response Time

a. Provide maintenance service on a 24 hour per day, 7 days per week, 365 days per year basis for on-premises maintenance within 8 hours after notification of a major malfunction. Maintenance service must include a 24 hour answering service available to receive after hour maintenance requests and to dispatch on-call service personnel within the required response time.

b. All major repair malfunctions must be accomplished within 8 hours of the reported failure. A major malfunction is defined as failure of one of the following major functional components:

(1) Complete failure of any headend or remote equipment.

(2) Failure of a power supply, exclusive of loss of utility power feed.

(3) Failure of 20 percent or more of all antenna locations in the facility.

c. Repair of a minor malfunction is any failure other than a major malfunction. Minor malfunctions must be repaired within 48 hours.

PART 2 PRODUCTS

2.1 2.1 MATERIAL AND EQUIPMENT

2.1.1 New Products

Provide products, components, and devices that are new and free of defects. Coordinate floor space requirements and electrical branch circuits for all equipment requiring 120 VAC. Any special cabinetry or shielded enclosures are the responsibility of the System Integrator or Installer and are to be provided and installed as part of this system.

2.1.2 Unspecified Products

If the provided system requires additional products that are not specified or indicated on the Telecommunications Drawings in order to satisfy the specified performance requirements for the system, then provide additional component.

2.1.3 Product Modifications

Modification of products that nullifies the UL listing or other agency approval is not permitted.

2.1.4 Identical Products

Provide identical make and model for products such as component equipment, modules, assemblies, parts and materials of the same classification.

2.1.5 Nameplates and Equipment Markings

a. Provide nameplate and equipment marking for each major equipment component to include the Manufacturer's name, model, and serial number on a plate secured to the equipment. Also, include all compliance with regulatory requirements, such as UL and CFR on the nameplate or on adjacent labels.

b. Plainly and permanently label all controls with the identification of the function served. Stick on marker tapes are not acceptable.

[c. Markings on any exposed surfaces must be resistant to housekeeping solutions normally used in medical facilities.]

2.1.6 Mounting Alignment Capability

Provide wall mounted components with capability for adjustable mounting alignment to compensate for improperly aligned back boxes and to insure a plumb, square, and level installation.

2.1.7 Model and Enhancements

a. Provide products and components that are the manufacturer's latest model, design, version, and quality in production at time of delivery and installation.

b. Notify the Contracting Officer of any product enhancements that become available after delivery and installation, and up to time of system acceptance, must be brought to the attention of the Contracting Officer upon announcement by the Manufacturer and make enhancements available to the Government. If such enhancements customarily are provided at no additional cost, the Government must automatically be entitled to such enhancements. If such enhancements customarily are provided at additional cost, the Contracting Officer may chose to accept or reject such enhancements.

c. Submit a letter to the Contracting Officer from the Manufacturer guaranteeing that the Manufacturer will inform the Government of, and make available to the Government, all commercially available enhancements to the System at the then current price. Include the letter with the Data Submittal.

d. Substitutions, modifications, or improvements to a System are permissible provided that such substitution, modifications, or improvements will not reduce or degrade the performance or product requirements, nor violate regulatory requirements. No such substitutions, modifications, or improvements can be made without the written consent of the Manufacturer and Contracting Officer. Such consent must not be unreasonably withheld or delayed.

2.1.8 Software and License

a. Issue to the Government a nonexclusive, fully paid perpetual license to use the software provided.

b. Provide software maintenance that is offered to all other customers without charge to the Government without charge.

2.2 BIDIRECTIONAL AMPLIFIERS

a. The primary bidirectional amplifiers will be located in the [headend equipment room] [_____].

[b. Locate Any additional amplifiers required by the System Application Design in [telecommunications rooms][_____].]

2.3 ACTIVE AND PASSIVE EQUIPMENT

Locate all active equipment in [headend equipment room] and [telecommunications room] [_____] as may be required by system application design. Coordinate all mounting locations with the Contracting Officer. Provide all mounting materials as part of this system. Install any passive or other components, excluding coaxial cables and antenna, that are installed in the facility at locations other than the telecommunications rooms or equipment rooms in locked steel cabinets, keyed alike and provided and installed as part of this system.

2.4 ENCLOSURES

****

NOTE: In accordance with NFPA 1221, all repeater, transmitter, receiver, signal booster components, external filters, and battery systems shall be contained in NEMA 4 or NEMA 4X type enclosures

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Provide NEMA Type 4 enclosures in interior spaces where located in clean, dry environments. Provide NEMA Type 4X for enclosures located outdoors.

2.5 OPERATING FREQUENCIES

All RF emitting devices used must be certified by the radio licensing authority to achieve the required radio coverage. Any frequencies for which the facility does not have a license to retransmit must not be amplified nor retransmitted. All RF emitting devices must have the certification of the radio licensing authority and be suitable for public safety use prior to installation in accordance with NFPA 1221.

a. Provide capability to process required communications signals from outside the facility to include transmitted frequencies of:

****

NOTE: Include specific required frequencies in the specification. Coordinate frequencies in this paragraph with paragraph 1.2 Scope.

****

[(1) Military Band First Responder Trunked Radio Frequencies]

b. Coordinate any additional frequencies with the contracting officer.

[c. Receive and transmit frequencies for military and public EMS. Re-transmit frequencies unaltered. Coordinate frequencies with the installation frequency manager via the Contracting Officer.]

2.6 TRANSMISSION LINE

Provide all required cables and associated passive components in accordance with the system application design. Provide plenum rated feeder and riser cables in accordance with NFPA 1221that meet all performance requirements, fire and environmental regulations as installed by the specific design for this project.

2.7 DONOR ANTENNAS

a. Provide Antenna and antenna structure that conform to TIA-329.1-D. Engineer the antennas to the proper system performance for the TIA-455-13operating frequencies indicated in this specification.

b. Provide all required cables in accordance with the system application design and engineered to the correct performance of the system.

c. Antennas must not interfere with [medical equipment][_____] or any other system in accordance with this specification.

d. Provide lightning protection and equipment for separate grounding of the antenna mast as required by NFPA 780.

e. Provide isolation between donor antenna and all inside antennas to a minimum of 20dB under all operating conditions in accordance with NFPA 1221.

2.8 PORTABLE EQUIPMENT

No portable receivers, transmitters, or radio devices are to be provided as part of this system.

2.9 UNINTERRUPTIBLE POWER SUPPLY (UPS)

a. Volt-Amp capacity must be at least 130 percent of the total volt-amp load of the equipment connected to the UPS. UPS must provide of runtime required by NFPA 1221 under the highest system load possible. Include power requirement calculations with design data submittal to verify power requirements.

b. Upon an ac power line outage, the UPS must automatically transfer to battery power within 4.2 milliseconds of sensing ac power line loss, and provide at least 15 minutes of full power for operation of the

equipment connected to the UPS. On-battery output voltage must be 115 VAC, plus or minus 5 percent.

c. The UPS must use sealed, maintenance free type batteries that have an expected life of at least three years. Power batteries from a constant voltage or "float type" battery charger. Recharge time to 90 percent capacity after discharge to 50 percent capacity must not exceed 10 hours.

d. Surge energy rating must be at least 320 joules. Surge peak current capability must be at least 26 ka.

e. UPS visual indicators on the UPS front panel must indicate on-line operation, output overload, low battery, and replace battery. [Provide network reporting of UPS functions and warnings.]

PART 3 EXECUTION

3.1 EXAMINATION

Perform a site survey to verify all field conditions, become familiar with the details of the work and working conditions, verify dimensions in the field, and advise the Contracting Officer of any discrepancies before performing the work.

3.2 BUILDING UTILITY AND SUPPORT

****

Note: Indicate mounting space locations, electrical power connections, grounding system, and associated HVAC on the construction drawings.

Note: Provide pathway survivability in accordance with NFPA 72 and NFPA 1221. Pathway survivability normally includes 2-hour rated rooms that house the first responder DAS equipment and 2-hour rated riser pathways. Stacked telecommunications rooms that are 2-hour rated provide a 2-hour rated riser pathway.

****

Locate equipment and connect to branch circuits and grounding system and utilize pathways as indicated on the drawings. Where additional space, branch circuiting, grounding, or pathways are necessary to support the system as designed, notify the Contracting Officer of additional support needed.

3.3 PREPARATIONS

As part of the project planning and system application design, and prior to the submittal of documents and plans, gather the data required to design and install the system, and plan the work. Include the data listed below, at a minimum.

3.3.1 User Room Numbers and Names

Obtain from the Contracting Officer a listing of facility User room numbers and room names cross referenced to the architectural room numbers and names indicated on the contract documents. Use the facility User room numbers and room names for all system functions, applications software,

and as-built documentation.

3.3.2 Interfaces and Interconnections

a. Coordinate and define the details of all interfaces and interconnections with other systems and equipment as specified herein. Include a detailed definition of all electronic and physical interface requirements, interface protocols, and physical demarcation points, donor frequencies, donor signal levels and injection levels for directly coupled systems. Provide details as part of Drawings and Data submittals.

b. Include the following interfaces and connections:

(1) First Responder Trunked Radio

3.3.3 Certificates and Authorizations

Provide certificate of authority and/or operational authority from the licensee of all individual services utilizing this System. Include the FCC station identification information, details of frequency, power, and modulation, and a specific authority to operate a distribution and/or rebroadcast system on said frequency at the project location, any restrictions in operating conditions, levels, emissions or other conditions, and issued in the name of the facility with a point of contact at the Licensee.

3.4 INSTALLATION

3.4.1 General

a. Provide installation as indicated and specified, and in accordance with acknowledged industry and professional standards and practices, and the Manufacturer's instructions.

b. Comply with the requirements of NFPA 70, [NFPA 72,] [NFPA 1221,] [NFPA 99,] and TIA-569.

c. Only the Installer as qualified in Paragraph QUALITY ASSURANCE, subparagraph Installer Qualifications, is permitted install and connect all equipment and system cabling.

d. Maintain onsite a supervisor during the entire installation as qualified in Paragraph QUALITY ASSURANCE, subparagraph Installer Qualifications.

e. Provide all tools and equipment needed to install the system.

[f. Comply with the requirements of Section 26 05 48.00 10 SEISMIC PROTECTION OF ELECTRICAL SYSTEMS.]

3.4.2 Equipment Installation

a. Provide appropriate waterproof gaskets for equipment installations in exposed areas.

b. Locate equipment where indicated on the drawings or where indicated in this specification section. Mounting of system components in any room other than a Comm Room or above finished ceilings is not acceptable

without written authorization by the Contracting Officer.

c. Rack mount system components. Floor mounted equipment is prohibited.

d. Install equipment firmly secured in place, plumb, square, and level.

e. Provide adequate equipment ventilation and adequate equipment accessibility for service and repair.

****
Note: Indicate antenna locations and conduit pathway on the contract drawings.
****

f. Provide roof conduit penetration for antenna pathways[, including GFGI antenna pathways]. [Locate penetrations at antenna locations as indicated on the drawings.]

3.4.3 System Cabling Installation

Install system cabling using the approved qualified installer in accordance with NFPA 70. Install cables without kinks, sharp bends or deformations or abrasions as recommended by the cable manufacturer. Install cable in cable trays, conduits, and boxes as indicated. Coordinate the system cable routing with other cable routing of other systems to ensure that there will be no interference that will adversely affect the performance of this system of any other specified or GFGI system. The System Integrator is responsible to notify the Contracting Officer of any routing conflicts prior to placement of cable. Provide firestopping where penetrations are required in rated floors, walls, or ceilings in accordance with Section 07 84 00 FIRESTOPPING

3.4.4 Grounding

Ground equipment enclosures and all other non-current carrying exposed metal parts of electric equipment.

3.5 AC POWER CONNECTIONS

****
Note: Coordinate electrical circuit requirements with the project electrical engineer. For medical facilities, coordinate branch circuit connection requirements with UFC 4-510-01, NFPA 70 Article 517, and NFPA 99. Show all branch circuit connections on the electrical drawings.
****

AC power for all equipment must be circuited to the [electrical system] [emergency system] [life safety branch] in accordance with NFPA 70 [,] [NFPA 72,] [and] [NFPA 99].

[Connect the system to the essential electrical system life safety branch as indicated on the drawings.][The System Integrator is responsible for coordinating that the active system components are provided with required branch circuits.] The System Integrator is responsible coordinating any other power requirements to active devices with the Contracting Officer as necessary where adequate circuits are not indicated on the contract drawings.

3.6 TRANSMISSION LINE

****

Note: Indicate conduit pathway to roof on the contract drawings.

****

Install transmission line(s) to the roof in the indicated pathway, with the outer conductor and lighting arrestor grounded to the indicated grounding system in accordance with NFPA 70 and NFPA 780. Provide any additional grounding required.

3.7 INSTALLATION SETUP

Make all adjustments as necessary to setup the system to function in accordance with specific user requirements for the overall system.

3.8 FIELD QUALITY CONTROL

3.8.1 Inspection, Testing and Validation

a. Prepare and submit an Acceptance Test Plan that includes the requirements of this Section. Include step-by-step procedures and the expected results to demonstrate system compliance with the requirements of this specification. Include tests defined in the Manufacturer's installation instructions; list of all test equipment to be used, including data indicating that calibration of the test equipment is current; test data sheets; and names and qualifications of the person(s) who will perform the tests. [Coordinate the Test Plan with the Commissioning Plan as specified.]

b. Furnish required test equipment, tools, consumable supplies, and technically qualified and licensed personnel to perform inspections, testing and validation of the installed system. All test equipment must be in current calibration and must have a current calibration certification.

c. The Contracting Officer reserves the right to approve the System Contractor's choice of testing personnel, and, upon rejection of any testing personnel by the Contracting Officer at any time, the System Contractor is required to replace such testing personnel as soon as reasonably possible. Upon request, provide the Contracting Officer the opportunity to review the qualifications of each person proposed for testing work.

d. Conduct all inspections and testing in accordance with submitted and approved quality control, testing [and commissioning plans] and procedure, and requirements specified herein.

e. Notify Contracting Officer at least 30 days prior of any planned inspection and testing, but in no case prior the System Integrator having received written Government approval of the submitted test plans, including procedures.

e. Conduct inspection and testing during normal working hours with prior notice to the Contracting Officer so as not to interfere with orderly work processes.

f. Allow inspection by the Contracting Officer of all work and workmanship, and witnessing of System Integrator performed inspections, system readiness checks, integrated performance testing, and acceptance testing.

g. Expose any work that is enclosed or concealed before being inspected and tested and restore to the original condition after inspection and testing.

h. Submit results of each inspection and test in electronic and hard copy format to the Contracting Officer.

3.8.2 Periodic Inspection and Testing

The Contracting Officer reserves the right to inspect and test all work and workmanship at any and all times during preparation and installation. The Contracting Officer, in his or her sole discretion, may reject defective work and workmanship and require its correction. The Government right to inspect, test, and reject, or its failure to exercise such right, as provided herein, must in no way diminish the System Integrator's duty to inspect and reject work as necessary to comply fully with the requirements of the contract documents.

Licensee's who have granted permissions are responsible for their frequencies operating within their license. Licensee's are responsible for inspections for their operating signals and have the right to revoke permissions at any time.

3.8.3 System Readiness Checks

Place the system into complete working order in full compliance with specified requirements, system application design, and all setup requirements, including requirements listed in the Licensee's Authority to the Facility, programming and adjustments prior to the start of system testing and validation. Perform system readiness checks to certify that the system is ready for testing and validation.

3.8.4 Integrated Performance Testing

Perform all necessary performance testing of interoperability of the telecommunications systems with each other, and with other building systems. Such testing is to demonstrate full integration and/or interface of systems and to demonstrate they function as a comprehensive system where necessary.

3.8.5 Final Inspection and Acceptance Testing

3.8.5.1 General Requirements

a. After installation has been completed, and system readiness checks and integrated performance testing have been successfully completed, notify the Contracting Officer that the system is ready for final inspection and acceptance testing. Conduct final inspection and acceptance tests in accordance with the approved Test Plan [and Commissioning Plan], and the project schedule.

b. Draft as-built system drawings, and operating and maintenance manuals must be made available by the System Integrator for use during performance of final inspection and acceptance testing. Final

inspection or acceptance testing will not be scheduled nor performed without this documentation.

b. Upon successful completion of final acceptance tests, and 30 calendar days of consecutive operation in accordance with specified requirements without the occurrence of any major malfunctions, submit the final acceptance test report, including certificates of compliance and certificate(s) of Licensee Authority with Licensee inspection report stating that all specified requirements and conditions have been satisfied. The effective date for completion of the final system acceptance will be the date when the system has satisfied the 30 days of operation without a major malfunction as specified above.

3.8.5.2 Acceptance Test Procedure

a. Provide final acceptance tests that demonstrate that the system operates in full accordance with all specified requirements, system application design, and user setup requirements for the system. Demonstrate that each system operating mode performs as required by operation of each individual system component under normal or simulated normal system conditions.

b. Include the following tests, at a minimum:

(1) Operation under ac power failure conditions. Include demonstration of UPS capability under normal power loading conditions, and operation under emergency power conditions.

(2) Signal quality under worst-case loading conditions of low voltage power supplies.

(3) Operation of electronic supervision circuitry.

(4) Operation of 100 percent of all components.

(5) All interface functions.

(6) Place and test devices from inside the facility to other mobile devices within the facility. Place and test devices from inside the facility to other mobile devices outside the facility. Place and test other devices from outside the facility to other mobile devices inside the facility. Perform each inside/outside test a minimum of ten times from various points selected by the Contracting Officer to demonstrate complete coverage throughout the facility.

(7) A test will be considered as passed if the device successfully connects and message is transferred without error. A pass rate of 100 percent is required.

(8) Sweep test all coaxial cables for all frequencies the system is capable of transmitting whether or not in service.

c. Include testing equipment for frequency and signal strength testing.

3.8.6 Corrective Action for Rejected Work

a. Correct all deficiencies and another re-test as necessary to demonstrate compliance with all requirements to the Contracting

Officer.

b. Complete all corrective action within a reasonable time consistent with project schedules and acceptable to the Contracting Officer.

c. If, after 30 calendar days from the start of acceptance testing, the system or any equipment component thereof fails to demonstrate complete and proper performance, the Government reserves the right to return the total system or any equipment component to the System Integrator. The System Integrator is required refund all costs thereof to the Government and to indemnify the Government from damages, costs, and expenses incurred in connection with such activity.

d. The Government retains absolute control of the actual date of return of any rejected system or equipment component. The Government reserves the right to continue to utilize such system and equipment until the actual date of removal.

3.8.7 Acceptance Test Report

Provide test reports in booklet form with witness signatures verifying execution of tests. Include physical routing and a test report for each cable from the installed outlet to the main termination point. Submit test report within 14 days after completion of the testing.

3.8.8 Warranty Period Inspection and Testing

Observe the system in operation at the end of the 4th and 9th months after the time of acceptance and re-conduct acceptance tests to demonstrate that system is continuing to perform as specified. Coordinate with the Contracting Officer. The Contracting Officer and a Customer Representative reserve the right to participate in this activity. Include interviews of users to determine if the system is satisfying specified requirements and that training is adequate. Provide written report of results to the Contracting Officer. During the 11th month of operation, re-inspect and retest the system to identify and correct any deficiencies prior to the end of the warranty period. A [medical] facility Government representative reserves the right to witness this procedure. Make all correction actions necessary. Provide written report of results to the Contracting Officer.

3.9 CLOSEOUT ACTIVITIES

3.9.1 Training Plan

a. Develop and submit a Training Plan for approval by the Contracting Officer. The training plan must describe the training to be provided. The Training Plan must include, but not be limited to the following items:

(1) Describe the operation and maintenance training programs, and instructional materials to be provided.

(2) As coordinated with the user, define the number of staff members that will be expected to attend each training session, and the classrooms to be used for on-site training.

(3) Furnish the identity and qualification of training instructors, and the instructional schedules for all classes.

b. Provide training to the Facility staff in accordance with the approved Training Plan.

3.9.2 General Preparations

During the week prior to the start of training for any system, check the system to assure that it has been successfully commissioned and acceptance tested, and is in full-specified operation condition.

3.9.3 Training Personnel

a. Furnish qualified factory trained or certified instructors to train designated Facility staff in the operation and maintenance of the provided system.

b. The Contracting Officer reserves the right to approve the System Integrator's choice of training personnel, and, upon rejection of a trainer by the Contracting Officer at any time, the System Integrator must immediately replace such trainers. Upon request, the System Integrator will provide the Contracting Officer the opportunity to review the qualifications of each proposed trainer.

3.9.4 Training Instructions

Include all specified performance and capabilities of the system in the training instructions, and all of the items contained in the operation and maintenance manuals. In addition, include preventive maintenance, routine maintenance, repair and troubleshooting procedures.

3.9.5 Training Materials and Recordings

Furnish all training materials and handouts. Provide the quantity needed for all of the Facility maintenance technicians, operations and user staff that will receive training. Provide [Six][_____] copies of all standard training media, such as video recordings, CDs, and DVDs, that are available from the Manufacturer to the Contracting Officer. [Provide four copies of video recordings of onsite training sessions to the Contracting Officer. This will be a coordinated effort between the System Integrator training staff and the Facility education department staff.]

3.9.6 Onsite Training Programs and Requirements

Provided all training onsite to all Facility staff as required throughout the contract and warranty period to train operations and maintenance staff for the provided system. Include two training courses, one for maintenance technicians, and one for user and operations staff. Include classroom training and field training. Field training for Facility staff will take place in the area where the staff will be working. Coordinate classroom training with the Contracting Officer. Conduct multiple instructional units for each onsite course on a three shift, seven days a week basis as required to train all staff during their normal on-duty working hours. The Contracting Officer will designate qualified personnel to be instructed in the operation and maintenance of each system, schedule instructional sessions, and provide suitable onsite instruction facilities.

3.9.7 User and Operational Staff Training

Comments user and operational staff training at a time acceptable to the

Contracting Officer and near the time the system is scheduled for operational use by the Facility staff. Provide classroom instructions for all Major Functional Components of the system, and field instructions in each area where equipment is installed. Nine months after the system is installed and accepted by the Government, provide refresher coerce to the user and operational staff.

3.9.8 Technician Training

Before the system is turned over to the Government for operational use, provide training for maintenance technicians designated by the Contracting Officer. Provide the number of instructional hours necessary to cover all aspects of system setup, programming, operations, preventive maintenance, routine maintenance, routine repair, and troubleshooting procedures for the system as installed. Nine months after the system is installed and accepted by the Contracting Officer, provide a comprehensive refresher course covering the final configuration for the system. Provide technician training on site and focus on failure diagnosis and field repair.

3.9.9 PROTECTION

Do not permanently install items that can be easily stolen, such as desktop computer and monitor equipment, until such time as the System Integrator has been notified by the Contracting Officer that the facility is secured.

3.9.10 CLOSEOUT DOCUMENTATION

a. Prepare and submit all documents as required.

b. Maintain a record of all maintenance and repair, including subsequent field strength readings, performed during the warranty period and submit the record at the end of the warranty period.

-- End of Section --