

SECTION 27 53 19

DISTRIBUTED RADIO ANTENNA (WITHIN BUILDING) EQUIPMENT AND SYSTEM

SPEC WRITER NOTES:

1. Edit between //-----// Delete if not applicable to project. Defer to VA SMCS (0050P2H3 - see Paragraph 1.3.D for specific contact info) for technical assistance.
2. It is the responsibility of the Spec Writer to select, edit and renumber the appropriate portions of this document to conform to the overall TIP requirements. Where deviations occur, the Spec Writer shall contact the appropriate authorities identified herein for technical assistance and approval(s) BEFORE THE FINAL CONTRACT DOCUMENT CAN BE APPROVED BY VA.

PART 1 - GENERAL

- A. Pursuant to the Department of Veterans Affairs (VA), General Council's (GC) Decision (FY1998 and Grand-Fathered to be fully implemented in FY2000) directing VA that all VOICE (aka TELEPHONE) and DATA (aka DIGITAL) Low Voltage Communications Wires and Cables have been "DECLARED AS BUILDING FIXTURES;" AND are to be provided as a part of the BUILDING STRUCTURE Installed During Construction by Construction and Facilities Management's (CFM) AND each Facility's (VAMC, OPC, CBOPC, etc.) Construction / Renovation Projects.
- B. VA - IS REQUIRED TO INSTALL AND MAINTAIN A STRUCTURED AND FULLY FUNCTIONING COMMUNICATIONS WIRE, CABLE AND SIGNAL DISTRIBUTION TIP CONTAINING ALL LOW VOLTAGE COMMUNICATIONS SYSTEMS, EQUIPMENT, PATHWAY(S), DISTRIBUTION AND INTERFACE POINT[S] THAT RENDERS A FULLY FUNCTIONING TIP FOR EACH VA FACILITY THROUGHOUT ITS MEDICAL CARE NETWORK.
- C. THIS DOCUMENT FORMS BUT ONE (1) PART OF CFM'S REQUIRED FOUR (4) PART TIP TECHNICAL SPECIFICATION REQUIREMENTS REQUIEMENTS OUTLINED HEREIN AND IN SECTIONS: 27 10 00 - COMMUNICATIONS ROOMS FITTINGS (that included all Outside and In-side TIP Conduit Systems and Equipment; 27 13 00 - COMMUNICATIONS STRUCTURED (aka Backbone) TIP CABLING EQUIPMENT AND SYSTEMS; AND 27 15 00 - COMMUNICAITONS HORIZONTAL TIP CABLING SYSTEMS AND EQUIPMENT.
- D. ADDITONALLY, THIS DOCUMENT CONTAINS COMMON REFERENCE(S) ADDRESSING ALL DIVISION 27 & 28 SECTIONS AND IS TO BE INCLUDED AS THE BASIC PART OF EACH LOW VOLTAGE SYSTEM'S CONTRACT DOCUMENTS. EACH DIVISION 27 & 28 SECTION WILL REFER BACK TO THE APPROPRIATE PARAGRAPH(S) HEREIN IN-LIEU OF REPEATING THE SAME INFORMATION AND WRITING OVER AN OVER. THE SPEC WRITER IS CAUTIONED TO INSURE EACH APPROPRIATE DIVISION 27 & 28 SECTION IS MADE A PART OF THE CONTRACT PACKAGE

WHERE THIS DOCUMENT FORMS THE BASIS FOR ALL (re PART 1.1 STATEMENT). THEREFORE, IN ADDITION TO THE REQUIREMENTS OF SECTION 01 42 19-REFERENCE STANDARDS, THESE DOCUMENTS AND THE INFORMATION DEPICTED HEREIN SHALL BE THE MINIMUM STANDARD(S), CODES AND REQUIREMENTS FOR EACH DIVISION 27 AND 28 COMMUNICAITONS SYSTEM SO IDENTIFIED (re PART 1, PARAGRAPH 1.3.A.1 for VA HEADQUARTERS [aka VACO], and other required project contact information DO NOT DELETE)

1.1 DESCRIPTION

- A. This Section describes the interfacing, technical and performance requirements for a fully installed, functioning and operating Distributed RF Antenna (Within House) Equipment and System (hereinafter will be referred to as "the system"). The system is based upon outside antenna(s), inside plant, active amplification functions and architecture to support local two way communications for Public Safety Radio (aka Emergency Responder, local and state police, sheriff, ambulance, etc) Radio Coverage, other RF (VA radios) commercial Wireless Service Providers (WSP), and wireless (Cell) equipment and systems when approved by the **AHJ** via IWS architecture for the // _____// VA Facility. The Contractor:
- B. SHALL USE ALL SECTIONS IDENTIFIED IN PART 1, PARAGRAPH 1.2 THAT HAVE BEEM DETERMINED, BY VA, NECESSARY FOR THE COMPLETE SYSTEM PROJECT(S), TO THE EXTENT THAT IS DESCRIBED HEREIN AND IN EACH SECTION, IN ORDER TO PROVIDE THE VA FACILITY A STATE-OF-THE-ART, VIABLE, COMPLETE AND FULLY FUNCTIONAL REQUIRED LOW VOLTAGE COMMUNICAITONS SYSTEM(S).
1. IF A REFERENCED SECTION APPEARS NOT NEEDED, THE CONTRACTOR SHALL NOTIFY THE RE, IN WRITING, OF EXACTLY WHY HE/SHE FEELS THAT PARTICULAR SECTION APPEARS NOT NECESSARY,
 2. THE RE, IN TURN, WILL RESEARCH THE ISSUE AND CONTACT VA'S SMCS (0050P2H3a) FOR AN OFFICAL TECHNICAL DETERMINATION AND WILL REPLY TO THE CONTRACTOR, IN WRITING, OF THE OFFICIAL CONTRACT DECISION CONCERNING THE REQUEST AFFECTING THE PROJECT, and
 3. Is cautioned to obtain, in writing, all approvals for system changes (ie corrections, updates, additions, subtractions, etc.) relating to the published bid contract specifications, drawings and other ap-proved contract document(s), from CFM'S PE, PM and / or the RE BEFORE proceeding with the change.
- C. The voice (telephone) and data portion of the horizontal TIP is managed by VA and/or the Facility's OI&T. The FMS (low-voltage special communications) portion of the TIP is managed by the Facility's FMS with technical assistance provided by VA OI&T's SMCS 0050P2H3.

- D. The system Contractor shall provide all system design, project management, coordination with WSPs and Public Safety, Radio Enhancement / Emergency Responder Services, and with VAMC Entities (ie Police, FMS, OI&T (local for wireless LAN/VoIP) and VACO Spectrum Management (SMCS 0050P2H3B) for technical and RF authorization compliance).
- E. The DAS is designated by VA as an "Emergency and Public Safety" Communications System.

1.2 RELATED WORK

- A. (re PART 1, PARAGRAPH 1.1.): In addition to the requirements identified in SECTION 01 00 01, GENERAL CONDITIONS; the following SECTIONS, that are not bracketed (i.e. // _____ //), ARE THE MINIMUM REQUIRED FOR ALL SYSTEMS'S). The bracketed (i.e. // _____ //) SECTIONS MAY - ALL, PART OR NONE be required to form a complete and functioning system depending system design, present and approved future requirements.

SPEC WRITER NOTES:

1. **It is the responsibility of the Spec Writer** to select, edit and renumber the appropriate portions of this document to conform to the overall system requirements. Where deviations occur, the Spec Writer shall contact the appropriate AHJ identified herein for guidance and approval(s) **BEFORE** THE FINAL CONTRACT DOCUMENT(S) CAN BE APPROVED BY VA.
 2. Edit between **EACH BOLD //-----//**. Delete and renumber if not applicable to project. **Defer to SMCS (0050P2H3a - see SECTION 1, PARAGRAPH 1.3.A.2 for specific contact info) for technical assistance.**
- B. In the event of conflict or discrepancy between this Section and the requirements of the PSRAS Code, the requirements stated herein for PSRAS shall govern unless the local PSRAS requirement is more stringent and is furthermore not contrary to the National Requirements for PSRAS.
- C. The Contractor shall identify the portion(s) of this Section that has exceeded the requirements and receive approval from the AHJ and RE for acceptance. The following SECTIONS are the minimum required,
1. 00 01 15 - List of Drawing Sheets.
 2. 01 00 01 - General Conditions.
 3. 01 33 23 - Shop Drawings, Product Data and Samples.
 4. 01 42 19 - Reference Standards.
 5. 01 57 19 - Temporary Environmental Controls.
 6. 01 74 19 - Waste Management.

- 7. 07 02 00 - Joint Sealants.
- 8. 07 84 00 - Firestopping.
- 9. 26 05 11 - Requirements for Electrical Installations.
- 10. 26 05 21 - Low Voltage Electrical Power Conductors and Cables (600 Volts and Below).
- 11. 26 05 26 - Grounding and Bonding for Electrical Systems.
- 12. 26 05 33 - Raceways and Boxes for Electrical Systems.
- 13. 26 05 41 - Underground Electrical Construction.
- 14. 26 41 00 - Facility Lightning Protection.
- 15. 27 05 11 - Requirements for Communications Installations.
- 16. 27 05 26 - Grounding and Bonding for Communications Systems.
- 17. 27 05 33 - Raceways, Conduits and Boxes for Communications Systems.
- 18. 27 11 00 - Communications Equipment Room Fittings.
- 19. 27 13 00 - Communications Backbone Cable Equipment and System.
- 20. 27 15 00 - Communications Horizontal Cable Equipment and Systems.
- 21. 28 05 13 - Conductors and Cables for Electronic Safety and Security.
- 22. 28 05 26 - Grounding and Bonding for Security Systems.
- 23. 28 05 28.33 - Conduits and Back boxes for Electronic Safety and Security.
- // 24. 27 31 00 - Voice (Telephone PBX) Communications Switching Equipment and Systems.//
- // 25. 27 31 31 - Voice (Telephone PBX) Communications Switching Equipment and Systems - EXTENSION.//
- // 26. 27 32 41 - Two Way Radio Equipment.//
- // 27. 27 41 31 - Master Antenna Television Equipment and System.//
- // 28. 27 51 16 - Public Address Equipment and Systems.//
- // 29. 27 51 20 - Integrated Audio and Video Equipment and Systems.//
- // 30. 27 51 23 - Intercommunications and Program Equipment and System.//
- // 31. 27 52 23 - Nurse Call and Code Blue Equipment and Systems.//
- // 32. 27 52 41 - Miscellaneous Medical Systems. //

C. The following information is in addition to those identified herein: AHJ Ordinance and / or Supplemental Rules for Public Safety Radio Enhancement / Emergency Responder Amplification Systems.

1.3 DEFINITIONS

- A. In addition to the requirements of SECTION 01 00 01, GENERAL CONDITIONS; the following are made a part of this document:
- B. REVIEW OF CONTRACT DCOUMENTS - a service by the CFM AE, PM, RE AND VACO SMCS to reduce the possibility of materials being ordered which do not comply with contract documents. The review shall not relieve the Contractor of

responsibility for dimensions or compliance with the contract documents. The reviewer's failure to detect an error does not constitute VA's permission for the Contractor to proceed in or with the error.

1. VA Headquarters (aka VACO) Project Review: Is required for National and Local Building Codes, Standards and Guidelines Com-pliance, contact:
 - a. RE: //XXXXXXXX// CFM, Resident Engineer,
 - b. SRE: //XXXXXXXX// CFM, Senior Resident Engineer,
 - c. PM: //XXXXXXXX// CFM, Project Manager (may be intermixed with the Facility's PM),
 - d. PE: //XXXXXXXX// CFM, Project Executive (also relates to the "Professional Engineer" Certification),
 - e. CO: //XXXXXXXX// CFM, Contracting Officer (may be intermixed with the Facility's CO), and
 - f. Owner: //XXXXXXXX// Typically (VA, VAMC, OPC, CBOC, etc.).
 - h. AE: //XXXXXXXX// CFM's, Contracted Project's Architectural Engineering Firm.
2. VACO Technical Review: Is required for VA Security; Low Voltage Telecommunications, RF, FAA, FCC and other Spectrum Coordination, Licensing and operating permits; Life and Public Safety, Critical and Emergency Codes, Standards and Guideline Compliance; AND, System(s) Interim and Proof of Performance Testing, VA Final Technical Acceptance, Functional and Operational Certification, contact:
 - a. VACO: Department of Veterans Affairs Office of Telecommunications (005) Telecommunications Engineering (005OP) Spectrum Management and COMSEC Service Special Communications Team (005OP2H3a)
810 Vermont Avenue NW, (1100 1st NW, Area 501L) Washington, DC 20420
301-734-0376, 202, 632, 7754 or 202-461-5897
 - b. VACO, OFFICE OF TELECOMMUNICATIONS, ENTERPRISE ENGINEERING, SPECTRUM MANAGEMENT AND COMMUNICATIONS SECURITY (COMSEC) SERVICE (SMCS) IS THE AUTHORITY HAVING JURISTITION (AHJ - see SME PART 1, PARAGRAPHS 1.3.A.2, 1.3.B.41 & 1.4.B.1.a.[7][a]) FOR THE LOW VOLTAGE SPECIAL COMMUNICATIONS AND COMSEC SYSTEMS AND EQUIPMENT (EXCEPT FIRE ALARM, Telephone and Data); PLUS, RF CO-ORDINATION REQUIRED THROUGH-OUT VA'S MEDICAL SYSTEM BY ORDER OF THE SECRETARY (RE PART 1, PARAGRAPH 1.4.B.1.a.(7) (a): VICE THE SIGNED AND EXECUTED MP-6, PART VIII - TELECOMMUNICAITONS, CHAPTER 5-AUDIO, RADIO AND TELEVISION COMMUNICAITONS SYSTEMS.

- 1) For each of the DIVISION 27 & 28 Publication referred and used here-in, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should and will" where it appears.
- 2) Interpret references in these publications to the "AHJ," or words of similar value, to mean the CFM: PE, PM, RE or CO for Project / Contract Guidance; AND VACO SMCS for Technical Concurrence.
3. Construction Responsible Entities: The following firms / individuals form the Project / Contract's primary core for the building / construction:
 - a. PC: //XXXXXXXX// Prime Contractor (aka General Contractor),
 - b. System Contractor: //XXXXXXXX// The Contractor; you - the successful bidder,
 - c. OEM: //XXXXXXXX// The Systems' "Original Equipment Manufacturer,"
 - d. Project Engineer(s): //XXXXXXXX// **The System OEM's:**
 //XXXXXXXX// **Lead Designer,**
 //XXXXXXXX// Lead Engineer,
 //XXXXXXXX// Lead Technician,
 //XXXXXXXX// Other OEM Technicians, and
 //XXXXXXXX// Project Manager.

B. **THE FOLLOWING ACRONYMS** are made a part of this document and are in addition to the ones aforementioned and later herein:

1. AHJ - Authority Having Jurisdiction - SMCS (0050P2H3) for Low Voltage Telecommunications Systems (Re PART 1, PARAGRAPHS 1.3.A.2.a & b; 1.4.b.1.a. (7) (a) and 1.8.A.& B,
2. AWG - American Wire Gauge (originally North American Wire Gauge; see STP & UTP) - also known as the Brown & Sharpe wire gauge, is a system used for standardizing all wire and cable conductors cross-sectional area (diameters) that has been in use since c1857 pre-dominantly in the United States and Canada,
3. AWS - Advanced Wireless Services (synonymous with AWS and UMTS),
4. BDA - Bi-Directional Amplifier,
5. BICSI - Building Industries Communications Services Installation,
6. BIM - Building Information Modeling (aka Model),
7. BOM - CFE or GFE Bill of Materials,
8. BUCR - Back-up Computer Room - (re PG 18-10, Page B-5; OI&T Design Guide PG 18-12, Page 4-4),
9. BTS - Base Transceiver Station,
10. CFE - Contractor (or OEM) Furnished Equipment,

11. CFR - Consolidated Federal Regulations - that governs ALL Federal Contracts / Projects.
12. CUP - Conditional Use Permit(s)-Federal/GSA for VA,
13. DBm - Deci-Bell, Measured.
14. DBmV - Deci-Bell per Mili-Volt,
15. ECC - Engineering Control Center; sometimes referred to The Emergency Control Center, - (see EMCR, re PG 18-10, Page B-5),
16. EMCR - Emergency Management Control Room" - (see ECC, re PG 18-10, Page B-5),
17. EMI - Electromagnetic Interference - also called Radio Fre-quency Interference or RFI when a high frequency (or radio frequency) disturbance affects an electrical cir-cuit due to either electromagnetic induction or electro-magnetic radiation emitted from an external source (see ESI, RFI),
18. EMT - Electrical Metallic Tubing - relates to "thin wall" non-rigid metal conduit,
19. ENTR - Utilities Entrance Location (see DEMARC, POTS, LEC)" - (re PG 18-10, Page B-5),
20. ESI - Electrostatic Interference - also called "Electro-static Discharge Interference (ESD) - ESD is the tran-sfer of static charge between bodies of different elec-trostatic potential, in the proximity or through direct contact (see EMI, RFI),
21. ESR - Vendor Engineering Service Report,
22. ERTF - Real Time Location System,
23. FA - Fire Alarm - is a system that is installed in VA Facili-ties to protect the building and installed property,
24. GFE - Government Furnished Equipment,"
25. HE - Antenna Head End Room - (re PG 18-10, Page B-5; OI&T De-sign Guide PG 18-12, Page 4-76; see HEC, HEIC, PA, RPEC),
26. HEC - Head End Cabinet(s) - (re PG 18-10, Page B-5; OI&T De-sign Guide PG 18-12, Page 4-76; see HE, HEIC, PA, RPEC),
27. HEIC - Head End Interface Cabinet(s) - (re PG 18-10, Page B-5; OI&T Design Guide PG 18-12, Page 4-76; see HE, HEC, PA RPEC),
28. HSPA - High Speed Packet Access,
29. iDEN - Integrated Digital Enhanced Network,
30. ICRA - Infection Control Risk Assessment,
31. ILSM - Interim Life Safety Measures,
32. ISM - Industrial, Scientific, Medical,

33. LAN - Local Area Network (see VoIP, WAN) - is a digital / data based network localized within a given structure (VA'S LAN IS NOT AUTHORIZED FOR LIFE AND PUBLIC SAFETY, CRITICAL OR EMERGENCY FUNCTIONS UNTIL IT'S CERTIFIED AND LISTED MEETING NFPA'S LIFE SAFETY CODE BY AN AP-PROVED UDOC NRTL - SEE PART 1, PARAGRAPH 1.4.B.1.a. [5]),
34. LBS - Location Based Services,
35. LEC - Local Exchange Carrier - (aka the Local Telephone Company; see DEMARC, PBX & POTS),
36. LMR - Land Mobile Radio,
37. LTE - Long Term Evolution,
38. MCR - Main Computer Room - (re PG 18-10, Page B-5, OI&T De-sign Guide PG 18-12, Pages 2-18, 4-9),
39. MCOR - Main Computer Operators Room - (re PG 18-10, Page B-5),
40. MH - Man Hole (aka Maintenance Holes) are structures used to provide access to outside buried conduit runs in order to allow compliance for signal interconnection, protection and long run operations across wide areas and multiple buildings/locations,
41. MOU - Memorandum of Understanding,
42. MW - Microwave (RF Band, Equipment or Services),
43. NID - Network Interface Device - (see DEMARC),
44. NEC - National Electric Code - is the main part of NFPA's Standards and Guides referenced herein,
45. NFPA - National Fire Protection Association - establishes minimum standards for the protection of life and buildings in VA Projects,
46. NOR - Network Operations Room - (re PG 18-10, Page B-5; OI&T Design Guide PG 18-12, Page 4-54),
47. NS - Nurse Station(s) - (re PG 18-10, Page B-5),
48. OI&T - VA's Office of Information and Telecommunications (re OI&T Design Guide PG 18-12, Page 2-1),
49. OSHA - Occupational Safety and Health Administration,
50. OTDR - Optical Time Domain Reflectometer relating to the primary piece of test equipment for evaluating fiberoptic cable plants,
51. PA - Public Address / Cabinet(s) (re PG 18-10, Page B-5; see HE, HEIC, RPEC),
52. PBX - Private Branch Exchange (see DEMARC, LEC, POTS; aka EPBX or Electronic Private Branch Exchange - a reference that is being phased out and will no longer be used in VA) is the typical acronym for a Telephone Switch not owned by the Telephone Company that is NFPA CRITICAL SERVICE LIST-ED AND VA

APPROVED FOR THE DIRECT MANAGEMENT OF THOSE LIFE SAFETY CODE AND OSHA
 REQUIRED FACILITIES MANAGEMENT SERVICE'S (FMS) LIFE & PUBLIC SAFETY, CRITICAL
 AND EMER-GENCY COMMUNICATIONS SYSTEMS (re OI&T Design Guide PG 18-12, Page 4-
 20),

- 53. PCR - Police Control Room (see SPCC), could be designated SCC" (re
 PG 18-10, Page B-5),
- 54. PCS - Personal Communications Service,
- 55. POE - Power over Ethernet,
- 56. POTS - Plain Old Telephone System (see DEMARC, LEC, PBX),
- 57. PSRAS - Public Safety Radio Amplification Systems,
- 58. PTS - Pay Telephone Station (may or may not be required); OR may be
 provided on as a portable station controlled by the using Service Chief (re
 PG 18-10, Page B-5),
- 59. PVC - Poly-Vinyl Chloride" - relates to a form of plastic,
- 60. RAN - Radio Access Network,
- 61. RFI - "Radio Frequency Interference" is the Electromagnetic
 Radiation which is emitted by electrical circuits car-rying rapidly changing
 signals, as a by-product of their normal operation, and which causes unwanted
 signals (in-terference or noise) to be induced in other circuits (see EMI,
 ESI),
- 62. RFID - RF Identification,
- 63. RPEC - Radio Paging Equipment Cabinet(s) - (see HE, HEC, HEIC, PA; PG
 18-10, Page B-5),
- 64. RUS - The DoA's - "Rural Utilities Service" which is technical
 standards issued (for telecommunications services here-in). Also, RUS BULL is
 "Rural Utilities Service Bul-letin" applied for the aforementioned telecom
 service,
- 65. RSSI - Mobile Telecommunications System,
- 66. RTLS - Real Time Location Service / System,
- 68. SME - Subject Matter Expert - (re, PART 1-GENERAL, PARA-GRAPHS
 1.3.A.2-[VACO SMCS] and 1.4.B.1.a. [7] [a] - VACO SMCS as AJS),
- 69. SMR - Specialized Mobile Radio,
- 70. STP - Shielded Twisted Pair (see AWG & UTP)- relating to
 communications wire and cable that has copper conductors that are twisted to
 reduce or eliminate interference and crosstalk with an internal cable shield
 necessary for installation in locations susceptible to high levels of
 interference,

71. STR - Stacked Telecommunications Rooms; also just Telecommunications Room (see TR)" - this term replaces "Signal and/or Telecommunications Closet" that are no longer used. Additionally, each TR shall be designed to provide occupancy for all OI&T AND FMS Low Voltage Communications Systems/Equipment (re Electrical Design Manual, PG 18-10, Sections 7 & 8, Physical Security Design Manual for VA Facilities, PG 18-10 AND OI&T Design Guide PG 18-12, Pages 2-20 & 4-84),
72. TCO - Telecommunications Outlet - is a device that is specifically constructed to afford the TIP a place to terminate in a useable apparatus in designated locations. The TCO's design is detailed herein,
73. TOR - Telephone Operators Room - (re PG 18-10, Page B-5; OI&T Design Guide PG 18-12, Page 4-92),
74. TER - Telephone Equipment Room - (see PBX; re PG 18-10, Page B-5; OI&T Design Guide PG 18-12, Page 4-50),
75. TR - Telecommunications Room - is a standalone room that houses OI & T and FMS equipment and systems cross-connections for servicing a specific area (see STR),
76. UMTS - Universal Mobile Telecommunications System,
77. UPCS - Unlicensed Personal Communications Service
78. UL - Underwriters Laboratories - is one of the approximate 15 USDC approved NRTLs (see PART 1, PARAGRAPH 1.4.B.1.a. [5]),
79. UTP - Unshielded Twisted Pair (see AWG & TWP) - relates to communication wire and cable that has copper conductors and are twisted to reduce or eliminate interference and cross-talk without an internal cable shield,
80. UV - Ultra Violet,
81. VoIP - Voice over Internet Protocol (see PBX, LAN, WAN) - is an emerging technology that is replacing POTS & PBX voice equipment (VA'S VoIP IS NOT AUTHORIZED FOR LIFE & PUBLIC SAFETY, CRITICAL, EMERGENCY OR SAFETY FUNCTIONS UNTIL IT'S CERTIFIED AND LISTED MEETING NFPA'S LIFE SAFETY CODE BY AN APPROVED UDOC NRTL - SEE PART 1, PARAGRAPH 1.4.C.1.e.; OI&T Design Guide PG 18-12, Page 4-14),
82. WAN - "Wide Area Network (see LAN, VoIP)" is a digital (data) network that transcends localized LANs within a given structure (VA'S WAN IS NOT AUTHORIZED FOR LIFE & PUBLIC SAFETY, EMERGENCY OR SAFETY FUNCTIONS UNTIL IT'S CERTIFIED AND LISTED MEETING NFPA'S LIFE SAFETY CODE BY AN APPROVED UDOC NRTL - SEE PART 1, PARAGRAPH 1.4.C.1.e; see LAN),
83. WiFi - Wireless Fidelity,

- 84. WiMAX - Worldwide Interoperability for MW Access,
- 85. WMTS - Wireless medical Telemetry Service, and
- 86. 24/7 - Is the shortened designation of 24 hours a day, seven days per week and 52 weeks per year.

C. **ADDITIONALLY:** The following language is required to form a part of this document (re SECTION 27 05 26, GROUNDING AND BONDING FOR COM-MUNICATIONS SYSTEMS for additional required information). The terms:

- 1. Provide is considered as being: Designed, engineered, furnished, installed, tested and guaranteed by the Contractor AND the system equipment's OEM; plus, being concurred and certified by SMCS-0050P2H3,
- 2. Supervision:

a. <u>Electrical</u>	Is the electrical and/or elec-tronic operation of completely (aka full time) analyzing a system's functional components (ie cable breaks / shorts), in-operative stations, lights and state(s) of change (ie from primary to backup) functions 24/7/365; and provides aural and visual emergency notifica-tion signals to at least two remote designated / approved monitoring stations,
b. <u>Government</u>	It is the responsibility of the RE or the RE's assigned inspec-tor to observe the Contractor's employees installing cable, conduit & pathway(s)/ wire way(s), System Ground develop-ment and installation, inside and outside plant housings, splices, cleanup, and other related work items associated with the system(s) construction project.
c. <u>Contractor</u>	It is the responsibility of the Contractor to directly manage the Contractor's employees work as outlined by this document throughout the system(s) project.
d. <u>OEM</u>	It is the responsibility of the OEM or the OEM's assigned liai-son to assist the Contractor in all functions / requirements / operations outlined herein throughout the project.

- 3. System: Used interchangeably with "The System" is the common word that is applied for each SECTION's specific system in order to shorten each SECTION's written NOT TECHNICAL content,
- 4. Work: Materials furnished and completely installed by the Con-tractor. The System work shall be complete, OSHA NRTL (i.e. [UL]) - Listed AND Labeled on each item of installed equipment / part; AND VACO SMCS 0050P2H3a tested, certified and designated ready for operation (re "Work Performance," PART 1, PARAGRAPH 1.12).

5. Grounding and Bonding (re SECTION 27 05 26 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS):

<p>a. <u>Grounding electrode conductor</u></p>	<p>Shall refer to the earth ground-ing electrode that is connected to the seperate circulating telecommunications grounding conductor, to the equipment grounding conductor at the source of a separately derived system.</p>
<p>b. <u>Grounding electrode system</u></p>	<p>Refers to an electrode(s) as specified in the National Ele-ctrical Code, Article 250. All electrodes required by NEC, as well as including supplementary, telecommunications system grounding electrodes.</p>
<p>c. <u>Telecommunications Bonding Backbone</u></p>	<p>Or "<u>TBB</u>" shall refer to a con-ductor(s) of appropriate size (minimum 1/0 Stranded AWG), which connects each telecommuni-cations main grounding busbar (<u>TMGB</u>) and circulates to interconnect various telecomm-unications grounding busbars (<u>TGB</u>) and in the locations shown on the drawings.</p>
<p>d. <u>Connect and bond</u></p>	<p>Are used interchangeably herein and shall mean "the permanent joining of metallic parts to form an electrically conductive path that will assure electrical continuity and the capacity to conduct safely any current likely to be imposed" having the same meaning.</p>
<p>e. <u>effectively grounded</u></p>	<p>Shall mean intentionally con-nected to earth through a ground connection or connections of sufficiently low impedance and having sufficient current carry-ing capacity to prevent the buildup of voltages that may result in undue hazard to con-nected equipment or persons.</p>
<p>f. <u>Grounding equalizer</u></p>	<p>Shall refer to the conductor that interconnects elements of the telecommunications grounding infrastructure.</p>

1.4 APPLICABLE PUBLICATIONS AND VESTED FEDERAL, STATE AND LOCAL LAWS (DO NOT DELTE):

A. In addition with the requirements in SECTION 01 00 01, GENERAL CONDITIONS; the following is made a part of this document:

1. ORDER OF PRECEDENCE OF APPLYING STANDARDS AND CODES: In the case of a conflict or duplicate code or standard (re PART 1, PARAGRAPHS 1.8.A), use the following deciding guidance for:

- a. Duplicate Codes / Standards: Use the most recent Federal Code / Standard (unless the State and Local Code addresses increased specific regional safety requirements [ie roof construction in Florida, increased Seismic requirements in California, etc.]), and
- b. Conflict of Codes / Standards: Use the more stringent Code / Standard.

- B. **IN ADDITION TO THE REQUIREMENTS OF SECTION 01 42 19 - REFERENCE STANDARDS (DO NOT DELTE)**: The following information is made a part of the System's design and installation minimum requirements; and the installation shall fully comply with all governing authorities, laws and ordinances, regulations, and including, but not limited to UNITED STATES FEDERAL LAW and The following Agencies' requirements form a part of the System's Project Documents a directed by formal regulations vested in United States Federal Law:
- C. **US Departments of Agriculture, (USDA** - Title 7, USC, Chapter 55, Sections 2201, 2202 & 2202) - organized in 1862 by President Abraham Lincoln and formally established by Congress in 1820 & 1825 and final establish Law on February 9, 1889. The following USDA Standards apply to this document:
- RUS 1755 Telecommunications Standards and Specifications for
Materials, Equipment and Construction,
- RUS Bull 1751F-630 Design of Aerial Cable Plant(s),
- RUS Bull 1751F-640 Design of Buried Cable Plant, Physical Considerations,
- RUS Bull 1751F-643 Underground Plant Design,
- RUS Bull 1751F-815 Electrical Protection of Outside Plant(s),
- RUS Bull 1753F-201 Acceptance Tests of Telecommuni-cations Plant(s) (PC-4),
- RUS Bull 1753F-401 Splicing Copper and Fiber Optic Cables (PC-2),
- RUS Bull 345-50 Trunk Carrier Systems (PE-60),
- RUS Bull 345-65 Shield Bonding Connectors (PE-65),
- RUS Bull 345-72 Filled Splice Closures (PE-74),
- RUS Bull 345-83 Gas Tube Surge Arrestors (PE-80).
- D. **US Department of Commerce, (USDC** - Public Law 426-62, CFR, Title 15 - Under the Information Technology Management Reform Act; Public Law 104-106, the Secretary of Commerce approves standards and guidelines that are developed by the):
- National Institute of Standards Technology, (NIST** - formerly the National Bureau of Standards, now P/O Com-merce). Under Section 5131 of the Information Technology Management Reform Act of 1996 and the Federal Information Security Management Act of 2002 (*Public Law 107-347*), NIST develops **Federal Information Processing Standards Publication (FIPS)** requirements, Chapter II. The following NIST FIPS Documents forms a part of this document:
- FIPS PUB 1-1 Telecommunications Information Ex-change,
- FIPS PUB 100/1 Interface between Data Terminal Equipment (DTE) Circuit
Terminating Equipment for operation with Packet Switched
Networks, or Between Two DTEs, by Dedicated Circuit,
- FIPS PUB 140/2 Telecommunications Information Security Algorithms,

FIPS PUB 143 General Purpose 37 Position Interface between DTE and Data Circuit Terminating Equipment,
 FIPS 160/2 Electronic Data Interchange (EDI),
 FIPS 175 Federal Building Standard for Telecom-munications Pathway and Spaces,
 FIPS 191 Guideline for the Analysis of Local Area Network Security,
 FIPS 197 Advanced Encryption Standard (AES)
 FIPS 199 Standards for Security Categorization of Federal Information and Information Systems.

E. **Federal Communications Commission**, (FCC, P/O Commerce - *The Communications Act of 1934* [as amended], CFR, Title 47, Telecommunications) - the following FCC Rules / Regulations / Requirements applies to this document:

Part 15 Restrictions of use for Part 15 listed RF Equipment in Safety of Life Emergency Functions and Equipment Locations (also see CFR, Title 15 - Department of Commerce, Chapter XXIII - NTIA below),
 Part 47 Chapter A, Paragraphs 6.1-6.23, Access to Telecommunications Service, Telecommunications Equipment and Customer Premises Equipment,
 Part 58 Television Broadcast Service,
 Part 73 Radio and Television Broadcast Rules,
 Part 90 Rules and Regulations, Appendix C,
 Form 854 Antenna Structure Registration.
 Chapter XXIII National Telecommunications and Information Administration (NTIA - aka 'Red Book') Chapters 7. 8. / 9; CFR, Title 47 FCC Part 15, RF Restriction of Use and Compliance in "Safety of Life" Functions & Locations.

F. **Department of Defense**, (**DoD**, The National Security Act of 1947) - formed the National Military Establishment; re-organized to The Department of Defense (DoD) on August 10, 1949 as an Amendment to the 1947 Law. The following DoD guidelines apply to this document:

MIL-STD-188-110 Interoperability and Performance Stand-ards for Data Modems,
 MIL-STD-188-114 Electrical Characteristics of Digital Interface Circuits,
 MIL-STD-188-115 Communications Timing and Synchronizations Subsystems,
 MIL-C-28883 Advanced Narrowband Digital Voice Terminals.

UL486D Standard for Insulated Wire Connector Systems for
 Underground Use or in Damp or Wet Locations,
 UL486E Standard for Equipment Wiring Terminals for Use with
 Aluminum and/or Copper Conductors,
 UL493 Standard for Thermoplastic-Insulated Under Ground Feeder
 and Branch Circuit Cable,
 UL497 Protectors for Paired Conductor Communications Circuits,
 UL497A Secondary Protectors for Communications Circuits,
 UL510 Polyvinyl Chloride, Polyethylene and Rubber Insulating
 Tape,
 UL514A Metallic Outlet Boxes,
 UL514B Standard for Fittings for Cable and Conduit,
 UL514C Non-Metallic Outlet Boxes, Flush Devices and Covers,
 UL651 Schedule 40 and 80 Rigid PVC Conduit,
 UL797 EMT,
 UL884 Under Floor Raceways and Fittings,
 UL1069 Hospital Signaling and Nurse Call Equipment,
 UL1198 Distress Signaling.
 UL1242 Intermediate Medal Conduit,
 UL1333 Riser Low Smoke Vertical Rating,
 UL1449 Standard for Transient Voltage Surge Suppres-sors,
 UL1459 Standard for Safety, Telephone Equipment,
 UL1479 Standard for Fire Tests of Through-Penetra-tion Fire
 Stops,
 UL1666 Standard for Wire/Cable Vertical (Riser) Tray Flame
 Tests,
 UL1685 Vertical Tray Fire Protection and Smoke Re-lease Test
 for Electrical and Fiber Optic Cables,
 UL1861 Communication Circuit Accessories,
 UL1863 Standard for Safety, communications Circuits
 Accessories,
 UL1865 Standard for Safety for Vertical-Tray Fire Protection
 and Smoke-Release Test for Electrical and Optical-Fiber
 Cables,
 UL2024 Standard for Optical Fiber Raceways,
 UL2196 Standard for Test of Fire Resistive Cable,
 UL60950-1/2 Standard for Safety of Information Technology Equipment
 Safety.

Canadian Standards Association, (CSA - same tests as presented by UL),
Communications Certifications Laboratory, (CCL - same tests as presented by UL),
Intertek Testing Services NA, Inc., (ITSNA - formerly Edison Testing Laboratory
[ETL] - same tests as presented by UL),
Subpart 35 - Compliance with NFPA 101, Life Safety Code,
Subpart 36 - Design and construction requirements for exit routes,
Subpart 268 - Telecommunications,
Subpart 305 - Wiring methods, components, and equipment for general use.

- I. Department of Transportation, (DoT, Public Law 85-625, CFR, Title 49, Part 1,
Subpart C - Federal Aviation Administration [FAA]) - the following FAA
requirements form a part of this document:

AC 110/460-ID & AC 707 / 460-2E - Advisory Circulars Standards for Construction
of Antenna Towers,

7450 and 7460-2 - Antenna Construction Registration Forms.

Federal Specifications for Signal / Communications Standards (FED SPEC) - the
following FED SPECS forms a part of this document:

A-A-59544-00 Cable and Wire, Electrical (Power, Fixed Installation),

1003 Synchronous Bit Oriented Data Link Control Procedures,

1020 Electrical Characteristics of Balanced Voltage Digital
Interface Circuits,

1030 Electrical Characteristics of Un-Balanced Voltage
Digital Interface Circuits, and

1037 Glossary of Telecommunications Terms.

- J. Department of Veterans Affairs (USDVA or VA, Public Law No. 100-527), CFR, Title
38, Volumes I & II) - the following VA requirements form a part of this
document:

OFFICE OF TELECOMMUNICAITONS, MP-6, PART VIII, TELECOMMUNICAITONS, CHAPTER 5,
AUDIO, RADIO AND TELEVISION (and COMSEC) COMMUNICATIONS SYSTEMS (RE PART 1,
PARAGRAPH B):

Spectrum Management and COMSEC Service (SMCS):

FAA, FCC, & NTIA RF Compliance and Licensing Program,

COMSEC co-ordination and control of security / classified communication assets,

CoG, "Continuance of Government" communications guidelines and compliance,

COOP, "Continuance of Operations" emergency com-munications guidelines and
compliance,

Wireless and Handheld Device(s) guidelines and compliance,

SATCOM - "Satellite Communications" guidelines and compliance,

Low Voltage Special Communications - Construction Contract Specifications and Drawings Conformity, Proof of Performance Testing, VACO Compliance and Life Safety Certification(s) for CFM and VA Facility Low Voltage Special Communications Projects (EXCEPT Fire Alarm, Telephone and Data Systems).

Handbook 6100 - Telecommunications: - Cyber and In-formation Security (OCIS), Handbook 6500 - Information Security Program.

VA's National Center for Patient Safety - Veterans Health Administration Warning System, Failure of Medical Alarm Systems using Paging Technology to Notify Clinical Staff, July 2004.

VA's Center for Engineering Occupational Safety and Health, concurrence with warning identified in VA Directive 7700.

OFFICE OF CFM:

PG-18-1, Master Construction Specifications (See Paragraph 1.1.2),

PG-18-4, Standard Detail and CAD Standards

PG-18-5, Equipment Guide List

PG-18-10, Manuals by Discipline

Electrical Design Manual,

Physical Security, Mission Critical Facilities

Physical Security, Life-Safety Protected,

VA Directive 0730, Security and Law Enforcement,

PG-18-3,.Design and Construction Production Procedures

Fire Protection,

Heating, Air, Ventilation and Cooling (HAVC),

PG-18-12, OI&T Design Guide

Additional CFM Design Guides & Manuals (re Part 1, Paragraph 1.2),

PG-18-15, Minimum Requirements of A/E Submissions:

Volume B - Major New Facilities, Major Additions; and Major Renovations, Article VI, Paragraph B,

Volume C - Minor and NRM Projects, Article III, Paragraph S,

Volume E - Request for Proposals Design/Build Projects, Article II, Paragraph F, Solicitation for Offerors (SFO) for Lease Based Clinics (05-2009).

- K. Local and Regional Codes (LRC): The following Regional requirements form a part of the System's Project Documents as directed by each formal regulation(s) vested in State, City /Town Local Law and Jurisdictional Code(s) / Regulations (re PART 1, PARA-GRAPHS 1.4.A,E, 1.6 & 1.8.A). The following LRC's apply to this document:

State:

Law,

Hospital Code(s),
 Regulations,
 Directives,
 Codes,
Town:
 Ordinances,
 Regulations,
 Codes,
City:
 Ordinances,
 Regulations,
 Codes,
County:
 Ordinances,
 Regulations,
 Codes.

- L. COMMERCIAL / NATIONAL CODES: The following Agencies' requirements have been accepted to form a part of the System's Project Documents as provided by formal agreement(s) by VA and each Agency (re PART 1, PARAGRAPHS 1.4.A,D, 1,6 & 1.8.A):
- JCAHO - Re PART 1, PARAGRAPH 1.4.C.1.d,
 - American Institute of Architects (AIA) - Guidelines for Health Care Facilities,
 - American National Standards Institute / Electronic Industries Association / Telecommunications Industry Association (ANSI/ EIA / TIA) - the following ANSI/EIA/TIA Standards apply to this document:
 - ANSI-C2 National Electrical Safety Code, Part 2 - Safety Rules for Overhead Lines,
 - TIA/EIA-423 Electrical Characteristics of Unbalanced Voltage Digital Interface Circuits,
 - TIA-455-46A Spectral Attenuation Measurement for Long Length, Graded Index Optical Fibers,
 - TIA/EIA-455 Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and Other Fiber Optic Components,
 - TIA-455-78B Optical Fibres - Part 1-40: Measurement Methods and Test Procedures - Attenuation,
 - TIA-455-107 Determination of Component Reflectance or Link/ System Return Loss using a Loss Test Set,

TIA/EIA-455-204 Standard for Measurement of Bandwidth on Multimode Fiber,

TIA/EIA 455-213 Optical Fiber Amplifiers, Basic Specification Test methods for Out-of-Band Insertion Losses Filtered Optical Power Meter,

TIA-472D-000 Fiber Optic Communications Cable for Outside Plant Use,

IA-492AAA 62.5- μ m Core Diameter/125- μ m Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers,

TIA-492AAAB 50- μ m Core Diameter/125- μ m Cladding Diameter Class IA Graded-Index Multimode Optically Optimized AMERICAN STANDARD Fibers (DO NOT SUBSTITUTE; re PART 2, PARAGRAPH 2.4.E.2.b.),

TIA-492CAAA Detail Specification for Class IVa Dispersion- Unshifted Single-Mode Optical Fibers,

TIA-492E000 Sectional Specification for Class IVd Nonzero-Dispersion Single-Mode Optical Fibers for the 1,550 nm Window,

EIA/TIA 496A Interface between Data Circuit Terminating Equipment and the Public Switched Telephone Network,

TIA 526-7 Measurement of Optical Power Loss of Installed Single Mode Fiber Cable Plant,

EIA 526-14 Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant,

EIA 530 High Speed 25 Position interface for Data Terminal Equipment and Data Circuit Terminating Equipment,

TIA 562 Electrical Characteristics for an Unbalanced Digital Interface,

TIA 568/0 Standard for Installing Commercial Building Telecommunications Cabling,

TIA 568/2 Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cable Components,

TIA 568-C0 Telecommunications Cabling for Customer Premises,

TIA 568-C1 Commercial Building Telecommunications Cabling Standard,

TIA 568-C2 Balanced Twisted-Pair Telecommunications Cabling and Components Standards,

TIA 568-C3 Optical Fiber Cabling Components Standard,

TIA 569-A Commercial Building Standard for Telecommunications Pathways and Spaces,

TIA 569-B Commercial Building Standard for Telecommunications Pathways and Spaces,
TIA 569-B.1 Part 1, General Requirements, Commercial Building Telecommunications Cabling,
TIA 574-9 Position Non-Synchronous Interface between Data Terminal equipment and Data Circuit Terminating Equipment Employing Serial Binary Interchange,
TIA-590 Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant,
TIA 606A Administration Standard for the Telecommunications Infrastructure of Communications Buildings,
TIA J-STD-607 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications,
EIA 613 High Speed Serial Interface for Data Terminal Equipment and Data Circuit Terminal Equipment,
TIA 668-527 Wireless Features Description,
TIA 758 Customer Owned Outside Plant Telecommunications Infrastructure Standard,
TIA 942 Telecommunications Infrastructure Standard for Data Centers,
TIA 1152 Requirements for Field Testing Instruments and Measurements for Balanced Twisted Pair Cabling,
TIA 1179 Healthcare Facility Telecommunications Infrastructure Standard,
BS EN 50109-2(*) Hand Crimping Tools - Tools for The Crimp Termination of Electric Cables and Wires for Low Frequency and Radio Frequency Applications - All Parts & Sections.

American Society of Mechanical Engineers (ASME) - the following ASME Standards apply to this document:

Standard 17.4 Guide for Emergency Personnel,
Standard 17.5 Elevator & Escalator Equipment (prohibited of installing non-elevator equipment in Elevator Equipment Room / Mechanical Penthouse).

American Society of Testing Material (ASTM) - the following ASTM Standards apply to this document:

B1 Standard Specification for Hard Drawn Copper Wire,
B8 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, or Soft,

- B258 Standard Specification for Standard Nominal Diameters and Cross-Sectional Areas AWG Sizes of Round Wires Used as Electrical Conductors,
- D709 Laminated Thermosetting Materials,
- D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2700 kN-m/m³),
- D2301 Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape,
- D4566 Standard Test Methods for Electrical Performance Properties of Insulation and Jackets for Telecommunications Wire and Cable.

American Telephone and Telegraph Corporation (AT&T)- the following AT&T Publications apply to this document (copies may be obtained at <https://ebiznet.sbc.com/SBCNEBS/>):

- ATT-TP-76200 Network Equipment and Power Grounding, Environmental, and Physical Design Requirements,
- ATT-TP-76305 Common Systems Cable and Wire Installation and Removal Requirements - Cable Racks and Raceways,
- ATT-TP-76300 AT&T Installation Requirements (and ICRN's Change Notices),
- ATT-TP-76306 Electrostatic Discharge Control,
- ATT-TP-76400 Detail Engineering Requirement (and ICRN's Change Notices),
- ATT-TP-76402 AT&T Raised Access Floor Engineering and Installation Requirements,
- ATT-TP-76405 Technical Requirements for Supplemental Cooling Systems in Network Equipment Environments,
- ATT-TP-76416 Grounding and Bonding Requirements for Network Facilities,
- ATT-TP-76440 Ethernet Copper Cable & Ethernet Copper Assembly Specification,
- ATT-TP-76450 Common Systems Equipment Interconnection Standards for the AT&T Local Exchange Companies and AT&T Corporation,
- ATT-TP-76461 Fiber Optic Cleaning,
- ATT-TP-76900 AT&T Installation Testing Requirement,
- ATT-TP-76911 AT&T LEC Technical Publication Notice,

ATT-812-000-705 Technical Requirements for Thermal Management Systems in Network Equipment Environments.

(NOTE: SMCS-0050P2H3a - will evaluate contractor considered and produced equal document(s) to the aforementioned AT&T Commercial Publications, on a case-by-case basis as long as each supplied document is complete and on the originator (not the contractor or OEM) letterhead and enclosed in its published technical binder.

Building Industries Communications Services Installation (BICSI) - the following BICSI Standards apply to this document:

All standards for smart building wiring, connections and devices for commercial and medical facilities,

Standards for Structured Building Cable Topologies,

Standards in consort with ANSI/EIA/TIA.

Institute of Electrical and Electronics Engineers (IEEE) - the following IEEE Standards apply to this document:

C62.41 Surge Voltages in Low Voltage AC Power Circuits

SO/TR 21730 Use of mobile wireless communication and computing technology in healthcare facilities, Recommendations for electromagnetic compatibility (management of unintentional electromagnetic interference) with medical devices,

81-1983 IEEE Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Ground System,

100 The Authoritative Dictionary of IEEE Standards and Terms,

0739-5175 Medical Grade, Mission Critical and Wireless Networks,

1100 Powering and Grounding Sensitive Electronic Equipment.

Insulated Cable Engineers Association (ICEA) - the following ICEA Standards apply to this document:

S-87-640 Optical Fiber Outside Plant Communications Cable,

S-98-688 Broadband Twisted Pair Telecommunication Cable, Aircore, Polyolefin Insulated, Copper Conductors Technical Requirements,

S-99-689 Broadband Twisted Pair Telecommunication Cable Filled, Polyolefin Insulated, Copper Conductors Technical Requirements.

National Electrical Manufacturers Association (NEMA) - the following NEMA Standards form a part of this document:

- C62.61 American National Standard for Gas Tube Surge Arresters on Wire Line Telephone Circuit,
- FB-1 Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Metallic Tubing and Cable,
- OS-1 Sheet Steel Outlet Boxes, Device Boxes, Covers and Box Supports,
- TC-3PVC Fittings for Use with Rigid PVC Conduit and Tubing.

NFPA - the following NFPA Standards apply to this document:

- 69 National Electrical Safety Code (NES, current date of issue),
- 70 NEC (current date of issue); Articles 300, 517, 645, 700 & 800,
- 72 National Fire Alarm and Signaling Code,
- 75 Standard for Protection of Electronic Computer Data Processing Equipment,
- 76 Standard for the Fire Protection of Telecommunications Facilities,
- 77 Recommended Practice on Static Electricity,
- 99 Healthcare Facilities,
- 101 Life Safety Code,
- 1221 Emergency Communications Systems.

The Society for Protective Coatings (SSPC) - the following SSPC Standard apply to this document: SSPC SP 6/NACE No.3 - Commercial Blast Cleaning.

International Telecommunication Union (ITU) - the following ITU Standard applies to this document: Telecommunication Standardization Sector (ITU-T).

1.5 QUALIFICATIONS (OEM AND SERVICES)

- A. MANUFACTURERS (refer to SECTION 2, PARAGRAPH 2.3): The OEM shall have had experience with three (3) or more installations of systems of comparable size and interfacing complexity with regards to type and design as specified herein. Each of these installations shall have performed satisfactorily for at least two (2) years in seriatim after final acceptance by the user. Include the names, locations and point of contact for these installations as a part of the technical submittal (see PART 1, PARAGRAPH 1.8).
 - 1. The Contractor shall submit certified documentation they have been an authorized distributor and service organization for the OEM for a minimum of three (3) years; the:

- b. Contractor shall provide OEM certification they are authorized to pass thru the OEM's warranty of the installed equipment to VA,
 - c. OEM and Contractor shall accept complete responsibility for the design, installation, certification, operation, and physical support for the System.
2. The Contractor's Communications Engineers and Technicians assigned to the System shall be fully trained, qualified, and certified by the OEM on the engineering, installation, operation, and testing of the System. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the technical submittal (see PART 1, PARAGRAPH 1.8). VA will not approve technical submittals without this information.
 3. The OEM shall ensure that all management, sales, engineering and installation personnel have read and understand the requirements of this document before the system is provided. The Contractor shall furnish a written statement attesting this requirement as a part of the technical submittal (see PART 1, PARAGRAPH 1.8) that includes each name and certification, including the OEMs. VA will not approve technical submittals without this information.

B. SERVICES

1. The System will be delivered free of engineering, manufacturing, installation, and functional defects. It shall be designed, engineered and installed for ease of operation, maintenance, and testing.
2. Provide communications cabling, systems, communications equipment fittings, equipment, conduits, wireways and accessories in accordance with the specifications and drawings. Capacities and ratings of conduit, wireways, cable, locations, other items and arrangements for the specified requirement(s) shall be shown on drawings AND CO-ORDINATED WITH AND LIKE IDENTIFIED IN THE SPECIFICATION CHAPTERS/PARAGRAPHS FOR THE PARTICULAR SYSTEM.

1.6 CODES AND PERMITS (RE PART 1, PARAGRAPHS 1.4.A, D&E. & 1.8.A)

- A. Provide all necessary permits and schedule all inspections as identified in the contract's milestone chart, so that the system is proof of performance tested and ready for operation on a date directed by VA.
- B. The OEM and Contractor are responsible to adhere to all codes, standards and requirements described herein.
- C. The Contractor shall display all applicable national, state and local licenses and permits on the Job Site at the direction of the RE.

1.7 SCHEDULING

- A. After the award of contract, the Contractor shall prepare detailed and proposed Contractor Project Schedule (CPS - aka milestone chart) using "Microsoft Project" software (or RE approved equivalent). The CPS shall:
1. Indicate detailed activities for the projected life of the project,
 2. Consist of specific activities and their restraining relationships,
 3. Detail manpower usage throughout the project,
 4. Show expected completed portions of the system, in percentage of the total system, which will be available for interim testing / technical investigation at the direction of the RE.
- B. It is the responsibility of the Contractor to coordinate all work with the other trades for scheduling, rough-in, and finishing all work specified. The VA will not be liable for any additional costs due to missed dates or poor coordination of the Contractor or their supplying trades.

1.8 REVIEW OF CONTRACT DRAWINGS, EQUIPMENT DATA AND SYSTEM OPERATION SUB-MITTALS (AKA TECHNICAL SUBMITTAL[S] - DO NOT DELETE)

- A. SPECIFICATION ORDER OF PRECEDENCE (Re PART 1, PARAGRAPHS 1.4.A,D,E & 1.6): In the event of a conflict between the text of these documents and the Project's Contract Drawings outlined and / or cited herein; THE TEXT OF DIVISION 27 SECTIONS TAKES PRECEDENCE OVER THE CONTRACT DRAWINGS. HOWEVER, NOTHING HEAREIN WILL SUPERSEDE APPLICABLE EMERGENCY AND SAFETY LAWS AND REGULATIONS, SPECIFICALLY NATIONAL AND / OR LOCAL LIFE AND PUBLIC SAFETY CODES.
1. The Local Fire Marshall and/or VA Public Safety Officer are the only authorities that may modify this document's EMERGENCY CODE COMPLIANCE REQUIREMENTS, on a case by case basis, in writing, with consensus with CFM's PM, PE and/or RE AND SMCS-0050P2H3a.
 2. CFM's PM, PE & RE are the only approving authority's for amendments to this document that may be granted, on a case by case basis, in writhing, with technical consensus by SCMS-0050P2H3a and identified Facility Project Personnel.
 3. It is the responsibility of the VA to clarify all issues with this document. When a concern arises - the Contractor shall notify the RE, in writing, on a case by case basis. The RE will render the VA's Official clarification and answer to the Contractor, in writing, covering each submitted question.
 4. The Contractor is again cautioned to obtain in writing, all ap-provals for system changes relating to the published contract specifications and drawings, from the RE BEFORE proceeding with the change.

5. Interpret references in these publications to the "AHJ (Re PART 1, PARAGRAPHS D, 1.3.B.1 & 1.4.B.a. (7) (a)," or words of similar value, to mean the CFM: PM, RE or CO for Project / Contract Guidance; AND VACO SMCS for Technical Concurrence.

B. SUBMITTALS - in addition with the requirements with SECTION 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

(Note: The Contractor is encouraged, but not required, to submit separate technical submittal(s) outlining additional or separate technical approach(s) to the system requirements stated here-in as long as each alternate technical document(s) is complete, separate, and submitted in precisely the same manner as outlined herein and meets the System Performance Standards. VA will review and rate each received alternate technical submittal in exactly the same procedure as outlined herein. Partial, add-on, or addenda type alternates will not be accepted or reviewed)

1. VA reserves the right to request the OEM to arrange for a VA Re-presentative (that includes SMCS-0050P2H3a) to see typical active systems in operation, when there has been no prior experience with the OEM or the type of equipment being submitted.
2. VA's approval (that includes SMCS-0050P2H3a certifications) shall be obtained for all equipment and material before delivery to the job site. Delivery, storage, or installation of equipment or material which has not had prior approval will not be permitted at the job site.
3. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
 - a. Mark the submittals, "SUBMITTED UNDER SECTION _____."
 - b. Submittals shall be marked to show specification reference including the section and paragraph numbers ALONG WITH CONTRACT DRAWING REFERENCE.
 - c. Submit each section separately.
4. Each submittal shall include the following: Information that confirms compliance with contract requirements. Include the OEM's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required drawings, and other Contractor data necessary for VA to ascertain the proposed equipment, materials and system design comply with the system's specification requirements.

- a. OEM Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted THAT INCLUDES ALL NECESSARY CODE COMPLIANCE FOR EACH ITEM OF SUBMITTED EQUIPMENT.
- b. IF THE SUPPLIED CUTS DO NOT CONTAIN CODE COMPLIANCE (ie FCC, UL, IEEE, etc.), THE CONTACTOR SHALL PROVIDE THE TESTING LABATORY COMPLIANCE SHEETS FOR EACH SUBMITTED EQUIPMENT ITEM.

SPEC WRITER NOTE: Include the following paragraph for projects in seismic areas of moderate-high, high and very high seismicities as listed in Table 4 of VA Handbook H-18-8, Seismic Design Requirements.

- c. Submittals are required to include all equipment anchors and supports, weights, dimensions, center of gravity, standard connections, OEM's recommendations and behavior problems (e.g., vibration, thermal expansion, etc.) associated with equipment, pathway or piping so the proposed installation can be properly reviewed.
 - 1) Manufacturer's Literature and Data: Showing each cable type, rating, testing criteria and performance.
 - 2) Show each physical equipment item(s) (ie conduit [outside and inside], conduit connections, penetrations, pathway/ wireway/ cabletrays, routes, etc.).//
- d. Surveys Required as a Part of the Technical Submittal:
 - 1) The Contractor shall provide the following System surveys that depict various system features and capacities required in addition to the on-site survey requirements described herein. Each survey shall be in writing and contain the following information (the formats are suggestions and may be used for the initial Technical Submittal Survey requirements), as a minimum:
 - 2) DAS Cable Design Plan: The DAS Communications Cabling System is in addition to the OEM and Contractor designed functional "Outside and Inside Vertical Riser (Backbone)" Conduit and shall occupy only conduits that were designated "for the DAS Communications Cable System."
 - a) The DAS Communications Cable System is to be provided as a part of the technical proposal that will form a fully viable and functioning TIP system.

b) DAS Communications Cable Plant Grounding: REFER TO 27 05 26, GROUNDING AND BONDING for COMMUNICATIONS SYSTEMS for MINIMUM DAS Grounding and Bonding requirements.

3) The minimum required DAS Cable Plant Equipment Locations (these are in addition to CFM PG 18-10, Electrical Design Manual, Articles 7 & 8, and Telecommunications One-Line Topology found in the end as a pull-out and Acronym Explanations; AND THE EQUIPMENT ROOM SIZING & LOCATIONS DEPICTED IN OI&T DESIGN GUIDE PG-18-12) are:

(Indicate here and at each point on the contract drawings)

EQUIPPED ITEM	CAPACITY	LOCATIONS
SPEP Points of Presence		
Required Location "A"		
Required Location "B"		
DAS Interface Location(s)		
Weatherproofing		
Security Requirements (Physical)		
MHs used to meet system design		
1.		
2.		
Others		
DAS Interface Location(s)		
Weatherproofing		
Security Requirements (Physical)		
Outside Grab / Pull Boxes used to meet system design		
1.		
2.		
Others		
DAS Interface Location(s)		
Weatherproofing		
Security Requirements (Physical)		
ENTRs (aka DEMARC - NOTE : THE DEMARC IS TO BE LOCATED IN THE TER //MCR//)		

Required Location "A"		
Required Location "B"		
Weatherproofing		
DAS Interface Location(s)		
Security Requirements (Physical)		
TER (if used)		
DAS Interface Location(s)		
Backup Batteries (aka UPS)		
Backup Generators (if needed)		
Telephone Console Operators Room		
Telephone Supervisor's Room / Office		
Main Power Source / Location		
Security Requirements (Physical)		
Emergency Systems Management		
Elevator Cab(s)		
Emergency Room		
Boiler Plant		
Security Control Room		
Nurses Station(s)		
Others		
MCR		
MCROR		
Backup Computer Room (if required)		
MCR Supervisor's Room / Office		
MCR's Operations Room / Office		
MCR's Sectional Room / Offices		
DAS Interface Location(s)		
Security Requirements (Physical)		
PCR		
SSCR		
Control Console(s) locations		
DAS Interface Location(s)		
Security Requirements (Physical)		

Others		
ECR		
Control Console(s) locations		
Main Power Source / Location		
DAS Interface Location(s)		
Security Requirements (Physical)		
Emergency / Disaster Control Room		
Main Power Source / Location		
DAS Interface Location(s)		
Security Requirements (Physical)		
STR(s), Equipment Rack/Cabinet(s) Location(s) & UPS Cabinet(s)		
1.		
2.		
Others		
Main Power Source / Location		
IDF & TIP Interface Location(s)		
Security Requirements (Physical)		
DAS interface location(s)		
NSs		
1.		
2.		
Others:		
Main Power Source / Location		
DAS Interface Location(s)		
Security Requirements (Physical)		
HER		
HEC(s)		
Emergency Communication Cabinet(s), Wall Enclosure(s), Roof, PCR & MCR cabling		
Others		
Main Power Source / Location		

DAS Interface Location(s)		
Security Requirements (Physical)		
Other locations required to meet system design		
1.		
2.		
3.		
DAS Telecommunications Outlets (TCOs)Locations		
<u>Depict each DAS TCO size and activated jacks here AND on the contract drawings for each TCO used in each room served by the Outside and Inside TIP</u>		
DAS Interface Location(s)		
1. Basement		
2. Ground Floor		
3. Each Additional Floor		
4. Interstitials		
5. Roof		
6. Others		

4) Vertical Riser (Backbone) DAS Cable System Design Plan:

- a) An OEM and Contractor designed functional DAS Cable System in accordance to the overall plan and plants that will form a part of the Facility's TIP shall be provided as a part of the technical proposal. A specific functioning Voice, Data and Special (FMS) DAS Communications cable distribution system shall coincide with the total growth items as described herein. It is the Contractor's responsibility to provide the Systems' entire DAS Cable System and accessory requirements and engineer a functional DAS distribution system and equipment requirement plan.
- b) The minimum required DAS System Backbone Communications Cable and Equipment Locations are in addition to the locations described in CFM PG 18-10, Electrical Design Manual, Articles 7 & 8, and Telecommunications One-Line Topology found in the same document's end as a pull-out and Acronym Explanations.

- c) The minimum required "Vertical" DAS Cable Plant Equipment Locations (these are in addition to those described in CFM PG 18-10, Electrical Design Manual, Articles 7 & 8, and Telecommunications One-Line Topology found in the end as a pull-out and Acronym Explanations; AND THE EQUIPMENT ROOM SIZING & LOCATIONS DEPICTED IN OI&T DESIGN GUIDE PG-18-12) are:

(Indicate here and at each point on the contract drawings)

EQUIPPED ITEM	CAPACITY	50% GROWTH
STRs (each floor's vertical stacked TR)		
Elevator Core		
Penthouse(s)		
Basement		
Other		

5) Horizontal DAS Cable System Design Plan:

- a) An OEM and Contractor designed functional DAS Cable System in accordance to the overall plan and plants shall be provided as a part of the technical proposal. A specific functioning Voice, Data and Special (FMS) Communications DAS cable distribution system shall coincide with the total growth items as described herein. It is the Contractor's responsibility to provide the Systems' entire DAS Cable System and accessory requirements and engineer a functional TIP distribution system and equipment requirement plan.
- b) The minimum required DAS System Horizontal Communications Cable and Equipment Locations are in addition to the ones identified in CFM PG 18-10, Electrical Design Manual, Articles 7 & 8, and Telecommunications One-Line Topology found in the same document's end as a pull-out and Acronym Explanations.
- c) The minimum required "Horizontal" DAS Cable Plant Equipment Locations are in addition to the ones identified in CFM PG 18-10, Electrical Design Manual, Articles 7 & 8, and Telecommunications One-Line Topology found in the end as a pull-out and Acronym Explanations; AND THE EQUIPMENT ROOM SIZING & LOCATIONS DEPICTED IN OI&T DESIGN GUIDE PG-18-12).
- d) Horizontal DAS Lateral Cables, at a minimum:

(Indicate here and at each point on the contract drawings)

EQUIP	EXPLANATION		5
P			

P E D I T E M			
TR NR	Identifies the number of cable pairs required to be provided for each floor.		
N	Identifies the number of cable pairs required to be provided for each floor.		
NUMBER OF CABLES	Identifies the number of strands in each run of fiber optic cable (TWO STRANDS PER CABLE PAIR)		
TCOS (Room, Ceiling, Wall, etc)	Identifies the number of cable pairs required to be provided for each TCO.		
INSTALLED	Identifies the method of installation in accordance with as designated herein		

METHOD			
D	Interface Location(s)		

e. DAS Devices(s): The Contractor shall clearly and fully indicate this category for each device location and compare the total count to the locations identified as a part of the technical submittal and the contract drawings. Additionally, the Contractor shall indicate the total number of spares.

EQUIPMENT	EXPLANATION	C	S
BUILDING	Identifies the building by number, title, or location, and MDF or IDF cabling is provided from		
BUILDING FLOOR	Identifies the floor by number (i.e. 1st, 2nd, etc.)		
TR RM NR	Identifies the room, by number, from which cabling shall be installed		
NUMBER OF ACTIVE TCOs	Identifies the number of jacks activated on each TCO along the DAS distribution horizontal and vertical cable plant		
INSTALLED METHOD	Identifies the method of installation in accordance with as designated herein		
DA	Interface Location(s)		

--	--	--	--

f. Equipment Parts List (aka BOMs)

- 1) Each interface / connection point shall be provided with internal and external items to maintain a neat and orderly system of DAS equipment, wire, cable and conduit connections and routing that are in addition to the locations in CFM's PG-18-10 Electrical Design Manual for VA Facilities Table 7-1 and Appendix B, Suggested Telecommunications Online Topology for technical assistance in identifying required TIP Interface Points and interconnecting conduit requirements. Identify and record for each SPDP and ENTR(s) - aka DEMARC), TER, TOR, MCR, MCOR, PCR, SSC, ECR, ST(s), NS(s), HER, HEC, HEIC RPEC and DAS Cable Plant / Room / Area TCOs.
- 2) Contractor Furnished Equipment Lists (CFELs-BOMS): (See PART 1, SECTION 27 15 00, PARAGRAPH 1.8.4.f.1) for additional instructions)
 - a) The Contractor is required to provide a list of the DAS CFE equipment to be furnished. The quantity, make and model number of each DAS item is required. Select the required equipment items quantities that will satisfy the needs of the system as described herein and with the OEM's concurrence applied to the list(s), in writing.
 - b) The following equipment items are the minimum requirements of VA to provide an acceptable system described herein.

CONTRACTOR NOTE: Select the required equipment items quantities that will satisfy the needs of the system and edit between the // - - - - - //. Do not delete equipment items that are not required - place a "0" in the appropriate Item location.

<u>1.</u> CFE ITEM NUMBER	NUMBER OF UNITS	DESCRIPTION
1.	//As Required//	SPEP Point(s) of entrance
2.	//As Required//	ENT (DEMARC to be in the //TER// //MCR//
2.	//As Required//	TER / TOR

3.	//As Required//	TCR
4.	//As Required//	MCR
5.	//As Required//	PCR
6.	//As Required//	ECR
7.	//As Required//	SSC
8.	//As Required//	PTS
9.	//As Required//	STRs for each floor
10.	//As Required//	NSs
11.	//As Required//	NER
12.m	//As Required//	HE
12.a	//As Required//	DAS TCO(s)
12.a.1	//As Required//	DAS Conduit(s)
12.a.1.a	//As Required//	Rigid
12.a.1.b	//As Required//	PVC
12.a.1.c	//As Required//	Interduct
12.a.1.d	//As Required//	Greenfield
12.a.1.e	//As Required//	Plastic Covered Flex
12.a.1.f	//As Required//	BX
12.a.1.g	//As Required//	OTHER TYPES
13.	//As Required//	DAS Cable Duct
13.a	//As Required//	Wire Duct
13.b	//As Required//	Path Ways
13.c	//As Required//	Race Ways
13.d	//As Required//	Wire Ways
14.	//As Required//	Telecommunications Approved Partitioned Cable Trays
14.a	//As Required//	Telecommunications Approved "Baskets"
14.b	//As Required//	Telecommunications Approved "Cable Ladders"
14.c	//As Required//	"Cable Hook(s) - ONLY WHEN SMCS 005OP2H3 APPROVED
14.d	//As Required//	"Cable Hanger(s) - ONLY WHEN SMCS 005OP2H3 APPROVED
15.e	//As Required//	"O" Ring(s) - ONLY WHEN SCMS 005OP2HE APPROVED
16.	//As Required//	Mounting Assembly(s)

16.a	//As Required//	Terminating Assembly(s)
17.	//As Required//	Cabinet(s) Assembly(s)
17.a	//As Required//	Environmental Cabinet(s) Assembly(s)
17.b	//As Required//	Distribution / Interface Cabinet(s)
17.c	//As Required//	Equipment Rack (aka Radio Relay)
18.	//As Required//	CCS Assembly(s)
18.a	//As Required//	Vertical
18.b	//As Required//	Horizontal
18.c	//As Required//	Room
18.d	//As Required//	Special Interface
19.	//As Required//	Distribution Frames
19.a	//As Required//	DAS Voice
19.b	//As Required//	DAS Data
19.c	//As Required//	Security
19.d	//As Required//	Emergency
19.e	//As Required//	Critical
20.	//As Required//	DAS Distribution Cables
20.a	//As Required//	Voice
20.b	//As Required//	Data
20.c	//As Required//	TWP
20.d	//As Required//	STP
20.e	//As Required//	Fiber-optic
20.f	//As Required//	Multi-mode
20.g	//As Required//	Single-mode
20.h	//As Required//	Baseband
20.i	//As Required//	Audio
20.j	//As Required//	Video
20.k	//As Required//	Other
21.a	//As Required//	DAS Security
21.b	//As Required//	TWP
21.c	//As Required//	STP
21.d	//As Required//	Fiber-optic
21.e	//As Required//	Multi-mode
21.f	//As Required//	Single-mode

21.g	//As Required//	Baseband
21.h	//As Required//	Audio
21.i	//As Required//	Video
21.j	//As Required//	Other
22.	//As Required//	DAS Emergency
22.a	//As Required//	TWP
22.b	//As Required//	STP
22.c	//As Required//	Fiber-optic
22.d	//As Required//	Multi-mode
22.e	//As Required//	Single-mode
22.f	//As Required//	Baseband
22.g	//As Required//	Audio
22.h	//As Required//	Video
22.i	//As Required//	Other
22.	//As Required//	DAS Critical
23.a	//As Required//	Emergency
23.b	//As Required//	TWP
23.c	//As Required//	STP
23.d	//As Required//	Fiber-optic
23.e	//As Required//	Multi-mode
23.f	//As Required//	Single-mode
23.g	//As Required//	Baseband
23.h	//As Required//	Audio
23.i	//As Required//	Video
23.j	//As Required//	Other
24.	//As Required//	DAS Special Communications
24.a	//As Required//	TWP
24.b	//As Required//	STP
24.c	//As Required//	Fiber-optic
24.d	//As Required//	Multi-mode
24.e	//As Required//	Single-mode
24.f	//As Required//	Baseband
24.g	//As Required//	Audio
24.h	//As Required//	Video
24.i	//As Required//	Coaxial (RF, Video, etc)

24j.j	//As Required//	Other
25.	//As Required//	DAS TCO(s) Connections / Patch
26.	//As Required//	STR(s)
27.	//As Required//	Environmental Requirements
28.	//As Required//	UPS Requirements
29.	//As Required//	Communications Grounding System
30.	1 each	Installation Kit
31.	1 each	Wire Management System
32.	//As Required//	DAS / TIP Interface Points and Systems
33.	//As Required//	OTHER
34. SPECIAL	Number Required by Specification and OEM	Provide System Spares as indicated in each equipment description

3) Government Furnished Equipment Lists (GFELs): (See PART 1, SECTION 27 15 00, PARAGRAPH 1.8.4.f.2) for additional instructions)

- a) The Contractor is required to provide a list of the DAS GFE equipment that has be approved to be used in the system. The quantity, make and model number of each item is required. Select the required equipment items quantities that will satisfy the needs of the system as described herein and with the RE's & OEM's concurrence applied to the list(s), in writing. All GFE that is approved to be used in the system will have the same system Gruanty applied as described herein.
- b) The following DAS GFE equipment items are the ones that have been approved to meet the minimum requirements of VA to provide an acceptable system described herein.

c) GFE ITEM NUMBER	NUMBER OF UNITS	DESCRIPTION
<u>1.</u>		

- g. Shop Drawings: Shall include wiring diagrams and installation details/pictorial of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork and other items that must be shown to ensure a co-ordinated installation.
 - 1) Wiring diagrams shall identify circuit terminals and indi-cate the internal wiring for each item of equipment and the interconnection between each item of equipment.

- a) Include elementary and interconnection wiring diagrams for communication and signal systems, control system and equipment assemblies.
 - b) All terminal points and wiring shall be identified on wiring diagrams and crossed referenced to the appropriate SPECIFICATION REQUIREMENT
- 2) Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.
 - 3) Submittals shall include each nameplate data, size, capacity, applicable federal, military, industry, and technical society publication references.
 - 4) The Contractor shall "update" the submitted shop drawings and wiring diagrams to form a "finished" system technical package as described herein.
- h. Singular Number: Where any device or part of equipment is referred to herein in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.
5. Certificates - provide the following certifications:
- a. Written certification from the OEM indicating the proposed supervisor of the installation and the proposed provider of the contract maintenance are authorized representatives of the OEM. Include the individual's exact name and address and OEM credentials in the certification.
 - b. Written certification from the OEM the installed wiring and connections/diagrams meet National and/or Government Life Safety Guidelines, NFPA, NEC, UL, this specification, and JCAHCO requirements and instructions, recommendations, and guidance set forth by the OEM for the proper performance of the System as described herein. VA will not approve any technical submittal without this certification.
 - c. Pre-acceptance Certification: This Contractor written certification shall be made in accordance with the test procedure outlined in PART 3 and the material, system and test readings are in accordance with the specifications and drawings and have been properly installed. The Contractor shall include a statement He/ She understands this requirement and will comply at the time stated herein and approved by the RE. VA will not approve any final testing/ system proof of performance and SMCS compliance without this certification.

6. Manuals - Submit in addition to the requirements outlined in SECTION 01 00 00, GENERAL REQUIREMENTS, provide:
- a. Maintenance and Operation Manuals - submit as required for systems and equipment specified in the technical sections. Furnish four (4) copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one (1) complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.
 - b. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment.
 - c. Provide a "Table of Contents" and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded.
 - d. The manuals shall include:
 - 1) Internal and interconnecting wiring and control diagrams with data to explain detailed system operation and control of the equipment.
 - 2) A control sequence describing startup, operation, and shut-down.
 - 3) Description of the function of each principal item of equipment.
 - 4) Installation and maintenance instructions.
 - 5) Safety precautions.
 - 6) Drawings and illustrations.
 - 7) Testing methods.
 - 8) Performance data.
 - 9) Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.
 - 10) Appendix - list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.
7. Approvals will be based on complete submission of manuals together with shop drawings.

8. Samples - A sample of each of the following items shall be furnished to the RE for approval and inventory prior to installation:

- a. One (1) each TCO Wall Outlet Box 4" x 4"x 2.5" with a six (6) // 8" x 8" x 2.5" with a eight (8)// // 12" x 12" x 4" with a twelve (12)// jack outlet body with:

a. Two (2) each	telephone (or voice) RJ45 jacks installed and activated.
b. Two (2) each	multi-pin (or data) RJ45 jacks installed and activated.
c. Cover Plate	installed and each jack/port labeled.
d. Fiber optic	//ST// //LC// //other____// jack(s) in-stalled and activated.
//e. Baseband, RF (F)/Video (BNC)/ Audio (XL) //	RF (F), video (BNC)/audio (XL) jack(s) installed and activated. (NOTE - IF THE FIBER OPTIC AND BASEBAND [RF, AUDIO] ARE NOT REQUIRED; EACH TCO SHALL BE PROVIDED WITH TWO UNIVERSAL JACK PLUGS. THESE EXTRA PLUGS SHALL BE PROVIDED TO THE RE WITH A SEPARATE INVENTORY SHEET AND BOXED)//

- b. One (1) each data patch panel, punch block or connection de-vice CROSS CONNECTION SYSTEM (CCS) with RJ45 connectors installed.
- c. One (1) each telephone CCS with Insulation Displacement Connectors (IDC) and/or RJ45 connectors and cable terminal and management equipment installed.
- d. One (1) each fiber optic CCS patch panel or breakout box with cable management equipment and //"ST"// //LC// //other// con-nectors installed.
- e. 305 mm (1 ft.) section of each type of conduit and pathway coupling, bushing and termination fitting indicating the UL or approved alternate testing seal.
- f. 610 mm (2 ft.) section of each raceway and pathway anchors, clamps and supports.
- g. One (1) each package of duct sealing compound.
- h. One (1) sheet of labeling and nomenclature design(s) and scheme(s).
- i. 610 mm (2 ft.) section of each copper cable to be used with OEM cable sweep tags specified herein with //RJ-45// //other// connectors installed.
- j. 610 mm (2 ft.) section of each fiber optic cable to be used with OEM cable sweep tags as specified herein with //"ST"// //LC// //other// connectors installed.
- //k. 610 mm (2 ft.) section of each analog RF, video coaxial and audio cable to be used with OEM cable sweep tags as specified herein and OEM specified connectors installed.//
- //l. Baseband video CCS patch panel or breakout box with cable management equipment and "BNC" connectors installed.//

SPEC WRITER NOTE: REFER TO OTHER DIVISION 27 SECTIONS FOR ADDITIONAL REQUIRED "TECHNICAL SUBMITTAL" REQUIREMENT[S] AND INFORMATION - DO NOT ERASE THIS STATEMENT)

1.9 PROJECT RECORD DOCUMENTS (AKA AS BUILTS) :

- A. In addition to the requirements of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES, the following information is made a part of this document's requirements:
- B. Throughout progress of the Work, maintain an accurate record of changes in and on Contract Documents. Upon completion of Work, transfer recorded changes to a set of Project Record Documents.
- C. The floorplans shall be marked in pen to include the minimum following:
 1. Device locations with applied UL labels.
 2. Conduit, Cable, Junction Boxes, Interface Points and specific locations.
 3. SPSP and specific locations.
 4. Manhole(s) and specific location(s).
 5. Outside Communication Cable Ducts.
 6. ENTR (aka DEMARC) and specific location(s).
 7. TER interface equipment and specific location.
 8. PA interface equipment and specific location
 9. TCR interface equipment and specific location.
 10. MCR interface equipment and specific location.
 11. MCOR interface equipment and specific location.
 12. PCR interface equipment and specific location.
 13. ECR interface equipment and specific location.
 14. PTS interface equipment and specific location.
 15. SSC interface equipment and specific location
 16. STR interface equipment and specific locations.
 17. NS interface equipment and specific locations.
 18. HER interface equipment and specific location.
 19. HEC interface equipment and specific location.
 20. HEIC interface equipment and specific location.
 21. RPEC interface equipment and specific location.
 22. TCO equipment and specific locations.
 23. Inside Vertical and Horizontal conduit locations.
 24. Wiring diagram(s).
 25. Labeling and administration documentation.
 26. Warranty certificate.
 27. System test results.

28. System Completion MOU (if accomplished).

- D. Fifteen (15) working days prior to the acceptance test, the Contractor shall deliver four (4) complete sets of the Record Wiring Diagrams of the System to the RE. The diagrams shall show all inputs and outputs of electronic and passive equipment correctly identified according to the markers installed on the interconnecting cables, Equipment and room / area locations.
- E. The Record Wiring Diagrams shall be in hard copy and two (2) compact disk (CD) copies properly formatted to match the Facility's current operating version of Computer Aided Drafting (AutoCAD)//Rev IT 3D// system. The RE will verify and inform the Contractor of the version of AutoCAD being used by the Facility.

1.10 USE OF THE SITE

- A. Use of the site shall be at the PC's direction.
- B. Coordinate with the PC for lay-down areas for product storage and administration areas.
- C. Coordinate work with the PC and their sub-contractors.
- D. Access to buildings wherein the work is performed shall be directed by the PC.

1.11 EQUIPMENT

- A. EQUIPMENT REQUIREMENTS: Where variations from the contract requirements are requested in accordance with the GENERAL CONDITIONS and SECTION 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.
- B. EQUIPMENT PROTECTION - equipment and materials shall be protected during shipment and storage against theft, physical damage, dirt, moisture, cold and rain:
 1. During installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing and operating and repainting if required.
 2. Damaged equipment shall be, as determined by the RE placed in first class operating condition or be returned to the source of supply for repair or replacement.
 3. Painted surfaces shall be protected with factory installed removable heavy craft paper, sheet vinyl or equal.
 4. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas is not obvious.

- C. EQUIPMENT INSTALLATION (for additional requirements, see PART 3): Equipment location shall be as close as practical to locations shown on the drawings.
1. Inaccessible Equipment - where the Government determines the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and re-installed as directed by the RE at no additional cost to the Government.
 2. "Conveniently accessible" - equipment is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to: motors, pumps, belt guards, transformers, piping, ductwork, hard ceiling, piping, conduit, raceways, etc.
- D. EQUIPMENT IDENTIFICATION - shall be installed with identification sign(s) and nameplate(s) which clearly indicate information required for use and maintenance of equipment; including, but not limited to:
1. Service Panels,
 2. Faceplates.
 3. Cross-connecting and jacks,
 4. TIP cables,
 5. Conduits and sleeves,
 6. Telecommunication Grounding Bars, Conductors, Connections and System,
 7. Firestop certifications,
 8. Nameplates shall be laminated black phenolic resin with a white core with engraved lettering, a minimum of 6 mm (1/4 inch) high. Secure nameplates with screws. Nameplates that are furnished by the manufacturer as a standard catalog item, or where other method of identification is herein specified, are exceptions that will be considered by the RE and if approved, the Contractor will be given the RE's decision in writing.
- E. DELIVERY, STORAGE, AND HANDLING
1. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft.
 2. Store products in original containers.
 3. Coordinate with the GC for product storage. There may be little or no storage space available on site. Plan to potentially store materials off site.
 4. Do not install damaged products. Remove damaged products from the site and replaced with new product at no cost to the Owner.

1.12 WORK PERFORMANCE

- A. Job site safety and worker safety is the responsibility of the Contractor.

- B. For work on existing stations, arrange, phase and perform work to assure communications service for other buildings at all times. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.
- C. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.
- D. Coordinate location of equipment and pathways with other trades to minimize interferences. See the GENERAL CONDITIONS.

1.13 VA ACCEPTANCE OF SYSTEM MEMORANDUM OF UNDERSTANDING (MOU), CONTRACTORS WARRANTY/GUARANTEE

- A. MOU - shall be accomplished with written consensus and signatures of the PC; CFM RE / PM / PE / A/E; Facility's PM, CO / COTR & where re-quired, SMCS 0050P2H3a.
 - 1. Clearly states each system / equipment item / condition(s) need-ing attention.
 - 2. Attach the Punch List:
 - a. Initial Inspection document developed by SMCS 0050P2H3 during system proof of performance testing,
 - b. Contractor's documented compliance - listed item by item recorded and verified by VA's RE and Facility's Manager on the original Punch List.
 - 3. VA's Condition of Acceptance of the system language to be the last paragraph of the MOU stating (see PART 3, 3.2.E, Acceptance Test Conclusion for VA "Conditions of Acceptance").
 - a. Without acceptance - until the system fully meets the condi-tions of the contract; and the system's ownership / use / operation / Warranty / Guarantee to commence at the final acceptance date,
 - b. With conditional acceptance - stating condition(s) that needs addressed by the Contractor / OEM stating the system's owner-ship / use / operation may commence immediately and its War-ranty / Guarantee will commence at the final extended acceptance date,
 - c. Full acceptance - with the system's Ownership / Use / Opera-tion / Warranty / Guarantee to commence at the agreed date of final acceptance.
- B. SYSTEM WARRANTY / GURANTY - Telecommunication systems are subject to the terms of "Warranty of Construction", FAR clause 52.246-21.
 - 1. Warranty - The Contractor shall pass through the OEM's equipment warranty for a period of one (1) year // (2) years for Life & Public Safety and Emergency System //from the date of acceptance of the system by VA.
 - 2. Guaranty - the Contractor shall guarantee that system operation, all installed material and equipment will be free from defects, workmanship, and

will remain so for a period of one (1) year// (2) years for Life & Public Safety, Critical and Emergency Sys-tem // from date of final acceptance of the System by the VA.

1.14 SYSTEM PERFORMANCE

- A. GENERAL GUIDELINES: The IWS, herein referred to as the system shall be a DAS. The system shall reliably distribute RF signals and wireless services throughout the specified RF ranges / bands / channels and throughout the specified coverage spaces / areas.
1. The System shall be implemented based on proven state-of-the-art technology that can seamlessly integrate with the rapid evolution of RF, Wireless Technologies and Business Applications.
 2. The System shall include a head-end subsystem. The head-end shall include a wideband RF transceiver(s) for each required RF for the DAS and be a common interface node. The DAS Head End shall be located in the HE Equipment Room //____// and co-located with VA's FMS RF paging and two way radio systems, DAS PSRAS RF equipment, VA and other RF base stations from multiple cellular common carriers.
 3. The IWS shall have all active elements (aka remote units) in secured TRs located in the FMS portion to simplify maintenance and increase system physical security.
 - a. Locating active elements in or above ceilings is not acceptable.
 - b. Locations for active equipment outside the TRs shall be approved by the AHJ and RE.
 4. Radiating or "leaky" coax systems are not acceptable.
 5. Single Mode Fiber Optic cable, protected by conduit and telecommunications listed "partitioned" cable tray is the preferred transmission media for the DAS "trunk lines."
 6. DAS antenna coverage shall be depicted on the Contractor's Required Survey(s) and additionally shown on the contract drawings as described herein.
 7. The Contractor shall provide coverage antennas and/or "nodes" to meet the RF coverage and operational requirements described herein.
 8. The Contractor shall provide a predictive modeling coverage plan(s) showing the design RF coverage (signal strength) for each RF band required for the System.
 9. The Contractor shall provide plans indicating equipment, antenna, and / or component location(s), cable route(s) and other installation information - identify construction elements that would affect the System's performance (ie metallic ceiling materials, air ducts, piping, structural beams, rebar, etc).

10. The Contractor shall provide detail system one-line and functional block / line diagram(s).
- B. Where possible every building DAS should have two independent connections to the TIP Backbone Raceway.
1. Each DAS connection should enter the building from opposite ends of the building.
 2. Each DAS connection should be brought in through separate TIP paths that provide two distinct DAS connections to the TIP backbone raceway giving each building a redundant connectivity in the case of a cable plant damage.
 3. Due to the number of critical, emergency and safety systems that are now run on the VA Low Voltage TIP it is imperative that we provide redundancy into the TIP. Services such as DAS, fire alarm signaling, Security swipe card door locks, Emergency Phones, Emergency 911, Code Blue, Duress Alarm, Patient / Staff Location, etc. require a highly available, high quality TIP.

PART 2 - PRODUCTS

SPEC WRITER NOTE: Confer with the respective Facility Chiefs of Medical Media, OI&T, and Engineering Services; plus, technical assistance and approval from the VA's SMCS 0050H2P3 in order to select and insert the following paragraph(s) required by system design. At least one or more of these paragraphs must be used to ensure patient data access from each patient bed location. Edit between the //-----// and renumber the remaining paragraphs, as required.

2.1 GENERAL REQUIREMENTS FOR EQUIPMENT AND MATERIALS:

- A. Furnish and install a complete and fully functional DAS Equipment and cable distribution system for each: SPEP Points of Presence (2 ea), ENTRs (2 ea. - aka DEMARC - NOTE THE DEMARC SHALL BE PROVIDED IN THE //TER// //MCR//), MH(s), Interface Location, TER, PA, TOR, MCR, BCR (if used), MCOR, PCR, SSC, ECC, EMCR, STR(s), NS(s), HER, HEC, HEIC, RPEC and TCO(s) WHOSE COMMUNICAITONS EQUIPMENT ROOM FITTINGS, INSIDE AND OUTSIDE (BACKBONE INCLUDING VERTICAL AND HORIZONTAL) CONDUIT DISTRIBUTION SYSTEMS WERE PROVIDED AS A PART OF SECTION 27 11 00. ADDITIONAL TIP CABLE INSTALLATIONS AND MOUNTING METHOD(S) ARE NOT ALLOWED UNLESS PREVIOUSLY APPROVED BY THE RE AND SMCS 0050P2H3 IN WRITING.
- B. The specific locations for each: SPEP Point of Presence is //____ & ____ //, MH(s) are // _____, _____, _____, & --- //, ENTR(s) (aka DWARC[s] TO BE LOCATED IN THE //TER// //MCR// is _____ & _____ //, Interface Location(s) are // _____, _____, _____, & ----- //, TER is //____, // TOR is // _____, // PA is // _____, // MCR is // _____, // MCOR is // _____, // BCR (if used)is //____//, PCR // _____, // SSC is // _____, // EMCR //____, // EEC is // _____, // PTS is

// _____, // STR(s) are // _____, _____, _____, & ----- // each NS is // _____, _____, _____, & _____, // HER // _____, // HIC is // _____, // HC is // _____, // RPEC is // _____// and TCO(s) are // _____, _____, //. List all locations here AND indicate each location in/at the required location on the contract drawings.

B. TCO(s): Deliver at all TCOs fully functional DAS communications cables and 4ea operational jacks (2ea for voice, 2ea for data) in the specific locations shown on the drawings (Note - the inside vertical (Backbone) functional communications cables are in addition to those provided by SECTION 27 10 00 - STRUCTURED (BACKBONE) COMMUNICATIONS CABLING EQUIPMENT AND SYSTEMS; and, horizontal (lateral) functional cables provided by SECTTION 27 15 00 - COMMUNICATIONS HORIZONTAL CABLE EQUIPMENT AND SYSTEMS). IF THESE CABLESAND EQUIPMENT ARE FOUND NOT INSTALLED, IMMEDIATELY CONTACT THE RE FOR SPECIFIC DIRECTION[S]).

1. IN THE ABSENSE OF A/E IDENTIFIED TCO LOCATIONS / COUNTS SUBMITTED DURING THE PROJECTS' DESIGN PHASE(S) - PROVIDE A MINIMUM OF ONE (1) EACH FUNCTIONAL AND OPERATING TCO ON EACH WALL OF EACH DAS ROOM / AREA.
2. Provide activated special communications DAS functional jacks and corresponding plant, as dictated by the approved system design, in the unused jack space in each of the aforementioned TCOs.

C. The System shall include, but not be limited to: Directional (a.k.a. Hy-Gain), interior Omi-Directional and // _____ // outdoor antenna(s); coaxial (a.k.a. spiral line)cable and connectors; antenna masts; antenna multi-couplers; lightning protection system; HE and interface cabinets; RF terminals and amplifiers; UPS; electronic supervision functions and control consoles; system management, status reporting functions and control consoles; audio volume limiter or compressor; audio amplifiers; audio modulator, adapter, cable, wire and connectors; conduit, cable duct and/or partitioned cable tray; and, necessary passive devices such as fiberoptic and TWP (shielded or unshielded) cable with connectors; attenuators, combiners, traps, filters and splitters: microphones, headphones and/or speakers.

1. The System shall provide DAS two way radio communications from a minimum of the following services:

REQUIREMENTS	FUNCTIONS
a. Three (3) each	Emergency two-way emergency radio responder sub-systems (ie local fire department, police and EMS) to be operated by a separate RF connection to a common antenna coupling network, RF transmission line, and single outside antenna and provide appropriate interconnecting cabling to the system's

	control units.
b. Three (3) each	VAMC radio sub-systems (ie police, disaster/emergency, code blue paging) by only adding appropriate transmission lines and connecting them to three (3) ports on the aforementioned antenna coupler and provide appropriate interconnecting cabling to the system's control units.
c. Three (3) each	Future commercial cellular or radio sub-systems by only adding appropriate transmission lines and connecting them to three (3) unused ports on the aforementioned antenna coupler and provide appropriate interconnecting cabling to the system control units.
e. Three (3) each	Future // _____ (refer to PARAGRAPH 2.1.A.5 additional system sizing/functional requirements) // radio sub-systems by only adding appropriate transmission lines and connecting them to three (3) unused ports on the aforementioned antenna coupler and provide appropriate interconnecting cabling to the system control units.
f. Plus,	The three (3) emergency responder radio sub-systems; three (3) VAMC radio sub-systems; three (3) future cell/commercial radio sub-systems and three (3) unused (or spare) antenna coupler port(s) shall function from the same outside antenna. <u>The system shall allow the installation of an additional</u>

	<u>antenna coupler at the present or future time when system expansion is require above the numbers identified herein.</u>
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D. Please see PART 2, PARAGRAPH 2.1, SECTION 27 05 00 for additional requirements.

2.2 SYSTEM DESCRIPTION

A. The System shall meet the requirements of the AHJ for PSRAS functions and operation.

1. The DAS shall have active signal handling by using active element(s) that filter and amplify signals on RF specific band/channel basis to consistently deliver In House RF Services at the appropriate power levels in the locations described herein, depicted on the Contractor's Surveys and on as shown the contract drawings. When any of these mandatory requirements are found missing, contact the RE who will contact SMCS 0050P2H3 for directions.
2. Frequency Range: The system shall support all RFs between 150 MHz to 5,700 MHz.
3. The system shall distribute RF coverage at levels described herein in the following minimum areas of the building(s) and as listed herein:

REQUIREMENT	FUNCTION
a. Floor areas	Corridors, Lobbies, Concourse, Interstitial Spaces, Penthouses, Restrooms / Bathrooms, Elevator Lobbies & Shafts
b. External Building lobbies and floor area(s)	Bridges, tunnels and Building links, public spaces (ie courtyards, patios, etc)
c. General use spaces	ie break, staff, public, multipurpose rooms, etc
d. Excluded Areas	NO AREAS ARE EXCLUDED

4. The system shall be able to simultaneously support the following VA APPROVED minimum RF, wireless services, applications and / or technologies. The System shall:
 - a. Distribute cellular channels with signal strength at least +8.0 dBm greater than the signal outside the building and at least -85 dBm "wall to wall" inside the building.
 - b. Meet the:

REQUIREMENT	FUNCTION
1) Wireless Providers needs	ie NEXTELL/SPRINT, VERIZON, AT&T, T-MOBILE, ANY METRO PCS, ETC
// 2) Other	
a)	

b)	
c) //	

c. Support VA's FMS and other RF systems (RFs for the following radio systems shall be supported, at a minimum. The DAS Contractor shall confirm the RFs required at the time technical submittal submission and again at Facility opening):

REQUIREMENT	FUNCTION
1) Radio Pagers (aka pocket pagers) in the RF of //_____//	coordinate with SMCS 0050P2H3 for FCC Restrictions
2) 700 - 800 mHz	FCC Part 15- <u>Safety of Life</u> Restrictions
a) LTE	700 mHz
b) LMR	700 - 800 mHz
3) 800 - 900 mHz)	FCC Part 15- <u>Safety of Life</u> Restrictions
a) SMR	800 - 900 mHz
b) iDEN	800 / 900 mHz
c) Cellular	850 mHz
d) Broadband ISM	800 mHz - 2.4 GHz
e) Super Broadband	800 mHz - 2.9 GHz
f) Extreme Broadband	2.5 GHz - 5.7 GHz
4) One / two way radio paging (900 mHz)	FCC Part 15- <u>Safety of Life</u> Restrictions
5) AWS (1,700 / 2,100 mHz)	FCC Part 15- <u>Safety of Life</u> Restrictions
6) UPCS (1,920 - 1,930 mHz)	FCC Part 15- <u>Safety of Life</u> Restrictions
7) PSRAS Responder(s)	
a) The system shall distribute Public Safety Channels	with a signal strength that exceeds the minimum requirements specified herein and by the AHJ
b) 99 - 100% in house coverage	is expected in all areas of each building
<u>1.</u> Cellular coverage information	shall include expected dBm levels above the exterior macro
<u>2.</u> Note - 700 mHz based systems	now requires a minimum -75 dBm MIMO 2X2 throughout the cellular coverage areas.
c) Public Safety includes	VA, Local, City and State Police, County Sheriff, Emergency Medical Services (EMS), and Fire Departments
<u>1.</u> VHF (150 mHz)	no FCC restriction(s) if RF is assigned to

	VA
<u>2.</u> UHF (450 - 520 MHz)	no FCC restriction(s) if RF is assigned to VA
<u>3.</u> VA Police _____ MHz	no FCC restriction(s)
<u>4.</u> VA Engineering _____ MHz	no FCC restriction(s)
<u>5.</u> VA Emergency _____ MHz	no FCC restriction(s)
<u>6.</u> VA Disaster _____ MHz	no FCC Restriction(s)
<u>7.</u> Federal Trunking _____ MHz	no FCC restriction(s), FCC Part 25 listed requires MOU & CUP
<u>8.</u> Local PD _____ MHz	no FCC restriction(s), FCC Part 25 listed requires MOU & CUP
<u>9.</u> City PD _____ MHz	FCC restriction(s), FCC Part 25 listed requires MOU & CUP
<u>10.</u> State PD _____ MHz	no FCC restriction(s), FCC Part 25 listed requires MOU & CUP
<u>11.</u> County Sheriff _____ MHz	no FCC restriction(s), FCC Part 25 listed requires MOU & CUP
<u>12.</u> Fire Department(s) _____ MHz	no FCC restriction(s), FCC Part 25 listed requires MOU & CUP
<u>13.</u> Local EMS(s) _____ MHz	no FCC restriction(s), FCC Part 25 listed requires MOU & CUP
d) Other(s) _____ MHz	coordinate with SMCS 0050P2H3 for FCC Restrictions)

B. Specific Subsystems' Requirements: The system shall have the capability for separate control over each service (and wireless operator) to all the ability to adjust and control power levels without disturbing other services / operators.

The System shall:

1. Support multiple services in modular architecture so services can be added or removed without:
 - a. Requiring new infrastructure,
 - b. Readjustment of signal power levels,
 - c. Disturbing existing services.
2. Enable services to be added without requiring additional cabling or antennas.
3. Not impede any management feature(s) or functionality or any attached network and / or device management system.
4. Allow for proactive management and end-to-end alarming of active equipment components, resulting in rapid problem identification and resolution.

5. Be able to be integrated with third party SNMP based element management system(s) vial a separate internet/POE and provide fault management information and functions throughout the DAS.
6. Cellular Services:
 - a. The System's transmission media will take many forms, from traditional of-air radio repeater, or Base Transceiver Station (BTS) to a tethered architecture consisting coaxial, fiber optic and/or hybrid fiber optic / coaxial base/trunk solution.
 - b. The DAS shall extend the common wireless carrier services from the head end equipment/system by interfacing to either a passive or active DAS that is deployed to and within each of the building structures. The following system design(s) are meant to be typical only. Prospective Contactors are expected to describe their DAS solution in detail described herein:
 - 1) The System shall support the use of Legacy Cellular Enhancement and technologies such as:
 - a) GSM,
 - b) EDGE,
 - c) UMTS-HSPA.
 - 2) The GPS Navigational Signal must be brought to the Base Station at the System's Head End to support LBS functionally.
7. The System shall support:
 - a. VA's Single ended and two-way, Non-IP communications radio systems,
 - b. Associated wireless devices that comply with FCC's and Regional regulatory authorities' emission rules for wireless devices.
(Note - refer to: FCC Advisory #A, Local Government Official's Guide to Transmitting Antenna RF Emission Safety Rules, Procedures and Practical Guidance, FCC's OET Bulletin 65, FCC Rule 47, Part 15 "Safety of Life prohibitions" and ANSI/IEEE C95.1-1992, Hazardous Emission document)
8. The System's input AC power shall be provided with and connected to an UPS. The UPS shall support the System operation (under a full load) for a minimum of one (1) hour. The UPS shall be connected to the Facility's Essential Generator Backed-up Electrical System (Note: depending on System design - there may be necessary to provide multiple UPS for the System).
9. The System shall be provided with an Electrical Supervision Capability that shall monitor all operating states of the System and each UPS. The supervision panel shall contain audible and visual and other devices that will notify maintenance personnel of System Failure(s) and types. The supervision function may be an integral part of the System's component(s); or

a separate provided function / capability. The supervision system shall report to two (2) Alarm Panels at two (2) Facility locations (ie Telephone Operator, Security Console, Boiler Plant, MAS Duty Officer, etc) operated 24/7/365 via a System integrated or stand alone plant. Their locations are:

- // a. _____,
- b. _____. //
- c. It is not acceptable to use the Facility's LAN/WAN for the supervision transportation media and management function until it is certified to meet NFPA Life Safety Code 101 and listed or label so accordingly by a NRTL (ie UL).
- d. The electrical (or electronic) supervision function and alarm(s) shall be provided to a separate Supervision Alarm panel(s) in the FMS Bio-Medical Engineering Shop (or electronic shop //or _____ shop// if Bio-med does not provide support for the System).
- e. The Supervision Alarm(s) shall not be cancelled until the trouble / fault has been corrected and the System has been restored to normal operation. The Visual Alarm(s) shall be continuous and the Audible Alarm(s) may be silenced via a controlled circuit that will re-occur the alarm at designated time intervals (ie adjustable form 2 - 30 minutes Maximum).
10. The System shall be designed to minimize cross talk, background processor noise, inter-modulation and other signal interference. The HE equipment shall be installed and interfaced according to the OEM HE schematic diagram for adjacent audio, video, data and RF channel operation.
11. The contractor shall provide one (1) spare outside antenna with 100' of RF coaxial cable with connectors installed to be coiled, located and secured in the HE Room and be labeled "DAS EMERGENCY RESPONDER SPARE ANTENA."
12. The System shall be able to be accessed via the internet for remote monitoring, software upgrades and maintenance assistance. The internet connection shall be at only one location at the System Headend and controlled by the Facility's OI&T Service. The failure of this approved "external connection" shall not affect the Systems' Performance and Operation.

C. Cabling

1. Fiber Optic cabling is specified herein and shall be provided on Special System Fiber Optic DAS / TIP Backbone diagrams. The Contractor shall identify in shop drawing submittal one-line riser diagram(s) indicating the mode and number of strands required.
2. 50 Ohm coaxial cable and terminations as specified herein.

3. A system distribution design that promotes "looping" the fiber optic and coaxial cables from location to location shall not be permitted. Each location and/or floor fiber optic and coaxial cable transmission line system shall be a "tap" design where each cable is fed from a device provided from a centrally corridor located lateral DAS trunk-line cable(s). Each location or floor lateral DAS trunk-line cable shall be connected to a vertical DAS trunk-line riser cable in the associated TR. Each vertical riser DAS trunk-line cable shall be connected to the HE input and/or output, depending on system design. Distribution (floor or riser) DAS amplifiers may be needed to satisfy the System's DAS received and/or transmit signal level requirements at each location. The provided DAS trunk line that routes throughout the interior of the Facility shall be separated from other systems and protected from damage by conduit and partitioned cable tray.
 4. Each floor and/or office control and interface system shall be protected using conduit and partitioned cable tray. The use of open ladders and "U" clamps, etc is not allowed for installation of Emergency, and/or Support system cables.
 5. Each floor and/or office control and interface system shall be provided in a "buss" design where each location's and/or floor's radio control console and/or control equipment is fed from centrally located (usually in the corridor) lateral trunk-line cables. Each signal closet shall contain a MIN of one terminal cabinet capable of connection to vertical trunk-line riser cables to lateral trunk-line cables in the associated signal closet and as shown on the drawings or recommended by the OEM.
 6. Interface Cabinet Location (Consult Design Guide PG-18-10, Chapters 7 & 8 for specific instructions): Each cabinet shall be provided, protected, and located at the most central distribution system signal closet location to insure optimum origination, reception and control of all system signals. Each cabinet shall be provided with an internal active 120 VAC quad receptacle. Each cabinet shall be provided with a MIN of 610 mm (two feet) clearance from all obstructions in the signal closet where located. Each cabinet shall be provided as required to meet the multiple audio channel and RF requirements and system performance standards.
- D. Interference:** There shall be no interference between the applications and wireless operators specified herein and with the Facility's equipment.
- E. Telecommunication Rooms (TR):** refer to CFM's EDM and OI&T Design Guide for this requirement if not specifically identified in the projects' construction documents.

2.3 MANUFACTURERS

- A. The products specified shall be new; FCC AND NRTL (aka UL) listed, labeled and produced by OEM of record. An OEM of record shall be defined as a company whose main occupation is the manufacture for sale of the items of equipment supplied and which:
1. Maintains a manufacturer and bench stock of replacement parts for the item(s) submitted,
 2. Maintains technical drawings and specifications; architectural, engineering, depot level repair and operating manuals for the items submitted,
 3. Has published and distributed descriptive literature and equipment specifications on the items of equipment submitted at least 30 days prior to the Invitation for Bid (IFB),
 4. Shall have equipment items that have been in satisfactory operation, on a minimum of three (3) installations of similar size, complexity and type as this project.
 - a. Materials and equipment furnished shall be of current production by OEM(s) regularly engaged in the manufacture of such items, for which replacement parts shall be available for at least five (5) years from the date of acceptance by VA.
 - b. When more than one unit of the same class of equipment is re-quired, the: equipment, cabling, terminating hardware, TCOs, and patch cords shall be sourced from the certifying OEM; OR at the OEM's direction, and support the System design, the OEM's quality control and validity of the OEM's warranty.
 5. VA reserves the right to require the Contractor to submit a list of installations and contact information where the products have been in operation before approval as described in Paragraph 1.8 - "Technical Submittal" portion of this document.
 - a. Equipment Assemblies and Components
 - 1) Components of assembled units need not be products of the same OEM.
 - 2) OEMs of equipment assemblies, which include components made by others, shall assume complete responsibility, warranty and guarantee for the final assembled unit as described herein.
 - 3) Components shall be compatible with each other and with the total assembly for the intended service.
 - 4) Constituent parts which are similar shall be the product of a single OEM.

- b. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.
- B. Specifications contained herein detail the SALIENT operating and performance characteristics of equipment in order for VA to distinguish acceptable items from unacceptable items of equipment. When an item of equipment is offered or furnished for which there is a specification contained herein, that item of equipment offered or furnished shall meet or exceed the specification.
- C. Equipment Standards and Testing
1. The System has been defined herein as connected to systems identified and listed as Emergency Care performing Life Support, Emergency and Safety Functions. Therefore, at a minimum, the system shall conform to all aforementioned National and/or Local Life Safety Codes (which ever are the more stringent), NFPA, NEC, this specification, JCAHCO Life Safety Accreditation requirements, and the OEM recommendations, instructions, and guidelines.
 2. The provided equipment required by the System design and approved technical submittal must conform with each NRTL (aka UL) standard in effect for the equipment, as of the date of acceptance of the technical submittal (OR the date when the RE approved system equipment necessary to be replaced) and was technically reviewed and approved by SMCS.
 - a. Where a NRTL (aka UL) standard is in existence for equipment to be used in completion of this contract, the equipment must bear the approved UL Seal or Mark; OR the Seal or Mark of the NRTL Testing Laboratory that warrants the equipment has been tested in accordance with, and conforms to the UL standard(s).

Contact DoL (OSHA) for an up to date list of NRTLs at:
http://www.osha.gov/dts/otpca/nrtl/faq_nrtl.html
 - b. The placement of the NRTL (aka UL) Seal or Mark shall be on a permanent part of the equipment that is not capable of being transported from one equipment item to another.
- D. When Factory Testing is Determined Necessary:
1. VA shall have the option of witnessing factory tests. The Contractor shall notify the VA through the RE a minimum of 21 days (aka three [3] weeks) prior to the OEMs making the factory tests.
 2. The OEM shall furnish four (4) copies of certified test reports containing all test data to the RE prior to final inspection and not more than 30 days after completion of the tests.

3. When equipment fails to meet factory test and reinspection is required, the OEM shall be liable for all additional expenses, including expenses of the Government.

2.4 EQUIPMENT ITEMS

- A. GENERAL REQUIREMENTS (see PART 2, PARAGRAPH 2.4, SECTION 27 05 11 for additional requirements): The equipment identified in this SECTION shall be the standard product(s) of an OEM regularly engaged in the manufacture of DAS and related products. All components used in the System shall be commercial quality products that comply with this document. Each component of equipment shall identify the OEM's name, model, serial number, FCC Listing and NRTL (aka UL) label or equal. The RE retains the right to reject products which reflect, in the RE's opinion, sub-standard design practices, manufacturing procedures, support services, or warranty/guarantee policies. Refer to contract drawing(s) note(s) for additional OEM information.
 1. All copper cables are not required to be plenum rated if run in protective conduit and not installed "Air Plenum Areas" designated by the RE. If run outside of conduit, each fiber optic cable shall contain an inner wrap of Kynar or Teflon (or equal) plus a metal protective wrap (sometimes called 'armor') just inside the outside protective jacket.
 2. Fiber Optic Transport: are not required to be plenum rated if run in protective conduit and not installed "Air Plenum Areas" designated by the RE. When Fiber Optic Transport media is utilized; the IWS shall utilize single-mode with angle polished connectors (APC) to distribute DAS signals.
 3. Broadband (Coaxial) Distribution: When Broadband Distribution is utilized; the IWS shall use coaxial cable in the horizontal runs and passive (ie non-powered) broadband antenna(s) in the respective area(s). The coaxial cables are not required are not required to be plenum rated unless installed in designated "Air Plenum Locations."
 4. Baseband (Video and Audio) Distribution: When Baseband Distribution is utilized; the IWS shall use TWP or STP cable in the horizontal runs and passive (ie non-powered) baseband equipment to compliment the DAS in respective area(s). The baseband cables are not required are not required to be plenum rated unless installed in designated "Air Plenum Locations."
 5. The Contractor is responsible for pricing all accessories and miscellaneous equipment required to form a complete and operating DAS system (and sub - systems) with 40% growth / expansion THAT IS BASED ON THE TOTAL NUMBER OF WIRED HORIZONTAL ANTENNA POINTS PLUS THE CAPABILITY OF ADDING AN ADDITIONAL

40% OF ANTENNA POINTS AND SUPPORT EQUIPMENT WITHOUT DISTURBING THE SYSTEM'S INFRASTRUCTURE DESCRIBED HEREIN.

- a. The equipment quantities provided herein shall be as indicated on the drawings with the exception of the indicated spare equipment where all shall be listed on the BOM.
- b. Each system interface point shall be provided with internal and external items to maintain a neat and orderly system of equipment and conduit connections and routing (Refer to CFM's PG-18-10 Electrical Design Manual for VA Facilities, Table 7-1 and Appendix B, Suggested Telecommunications Oneline Topology; AND OI&T Design Guide for technical assistance in identifying required Interface Point(s) and interconnecting DAS internal plant conduit requirements.
- c. Conduit, 1.0" minimum (¾" may be allowed on a case by case basis by the RE in writing) is required for all Life, Patient, Staff and Public Safety, Critical Service and Emergency Systems.
- d. Equipment Functional Characteristics

FUNCTIONS	CHARACTERISTICS
Input Voltage	105 to 130 VAC
POWER LINE FREQUENCY	60 HZ ±2.0 HZ
Operating Temperature	0 to 50 degrees (°) Centigrade (C)
Humidity	80 percent (%) minimum rating

6. SPECIFIC EQUIPMENT DESIGNATED BY THE DAS SYSTEM DESIGN

- a. Antenna Equipment and Materials
 - 1) Antenna Site(s) & Installation: It is the responsibility of the Contractor to re-verify and certify each external and internal antenna installation required by the system, in writing (four [4] copies MIN), to the RE 30 days prior to construction. The Contractor is required to provide all FAA, FCC and local licenses and permits for each radio antenna item(s) requiring such licenses and permits. Additionally, at a MIN, for each external antenna site that is 75' above average ground level (AGL) or taller than appurtenances and closer buildings or objects, the Contractor shall accomplish FCC Form 854, Application for Antenna Structure Registration, FAA Advisory Circular AC 70/7460-1, Obstruction Marking and Lighting and FAA Form 7460-1, Notice of Proposed Construction and Alteration for each item requiring this registration. It is the Contractor's responsibility to contact the local licensing authority(s) to determine if the antenna installation

requires additional hazard registration and accomplish all necessary documents.

- 2) THE SYSTEM PROOF OF PERFROMANCE AND VA CERTIFICATION TESTS WILL NOT BE CONDUCTED UNTIL THESE FORMS ARE ACCOMPLISHED AND SUBMITTED TO THE APPROPRIATE FEDERAL AUTHORITIES WITH COPIES PROVIDED TO THE RE, OR VAMC CO AND VACO SMCS (005OP2H3). The Contractor shall obtain onsite technical assistance from the OEM for installation of the external antenna(s) selected during the Field Site Visit. The Contractor shall provide the RE a detailed written report of the findings of this visit for approval. The site visit and report shall be completed during the 30 days after issuance of the notice to proceed.
- 3) Wherever possible, external antenna equipment shall be mounted so that maintenance can be accomplished without the need to climb towers, ladders, cherry pickers, etc.
- 4) External Antenna Masts: Wall mounted DAS antenna mast(s) shall be rigid thick wall and have a minimum 3.0 inch (75mm) outside diameter (OD), of hot dip galvanized steel and capable of surviving MIN wind loads of 100 miles per hour (160 kilometers per hour) sustained winds with all DAS antenna equipment and mounting hardware installed, with up to 1/2 inch (12.7 mm) radial ice at the height required to provide the System performance, as described herein.
 - a) Wall mounted external masts shall be attached to building walls, penthouse walls or other solid parts of the building exterior free of all obstructions.
 - b) For building and penthouse walls, attach masts with not less than three (3) rust proofed brackets three (3) inches (76.2 mm) wide, 5/16 inch (7.7.9375 mm) thick, eight (8) inches (177.8254 mm) wide and spaced not less than 20 inches (508.0 mm) apart. Do not attach masts to catwalks or metal structures unless specifically approved. If allowed, masts shall be welded or bolted to the structure using an approved method of attachment. All connections shall be rustproof and painted to match the existing structure(s).
 - c) Fasten the mounting brackets with rust proofed through bolts of a minimum 7/16 inch (11.1125 mm) diameter, each anchored with two (2 - one on the inside and one on the outside of the wall), (8 inch (203.2 mm) square, 5/16 inch (7.9375 mm) tick rust proofed steel back plates. Attachments to mortar or grout joints with lag bolts

are not permitted. Securely tighten all mounting hardware, antenna hardware and terminals.

- d) Do not mount the mast(s) directly on the roofs of the building or penthouse unless specifically approved in writing by the RE prior to installation. Any approved roof attachment or penetration shall be resealed to prevent water leakage; using pitch pocket or other method approved by the roof OEM and Roofing Contractor.
 - e) Do not install more than two (2) antennas on a single mast. Install separate masts, as required, with proper physical and frequency spacing between them and the antenna(s) installed. A MIN spacing shall be 1/2 wavelength (λ) vertically and 5/8 λ horizontally (element tip to element tip) for the lowest operating frequency.
 - f) Orient the antenna(s) to insure optimum signal receive level and S/N ratio.
 - g) Weatherproof all connections with approved sealing compound. Electrical cloth or plastic tape are not acceptable and will not be approved.
- 5) Antenna Site Physical Protection
- a) External
 - (1) Roof and/or Wall Type: When an antenna is installed on a building roof or wall that is accessible from the roof, signs shall be placed on all roof access points that say "Warning, Radio Antenna Radiation Hazard." The signs shall be professionally prepared, neat and permanent. The roof area where the antenna is installed shall be painted yellow or roped off with a yellow marker tape that indicates the approximate area of RF radiation.
 - (2) Each roof or attic access for the each antenna shall be controlled by the VA Police SMS Access Control System. The Police Chief will determine the appropriate number and individual(s) that are to be granted access in these areas.
 - b) Internal DAS: The antenna shall be placed inside a protective enclosure designed specifically for the product. The antenna shall not be visible when installed in the enclosure in the area located. DAS cables to each antenna shall be installed in protective conduit (EMT or Flex) from each Antenna Enclosure to the associated "J" Box. Each DAS Antenna Enclosure shall be provided with two (2) safety wires connected between each enclosure to solid building supports.

- 6) Antenna Site Lightning Protection System: Each protection system shall be provided in its entirety totally and externally to the building. The use of internal electrical or communications grounding systems is not acceptable, will not be approved; and if found during the system's proof-of-performance tests, it will be removed and the test may be terminated and rescheduled at the contractor's expense.
- a) Antenna, Mount & Mast: The antenna, antenna mount or mast and transmission line shall be grounded with cooper wire run external to the building and connected to the earth ground. If the antenna is to be installed in an area not protected by lightning rods or if the antenna is to be elevated above existing building's lighting rod protection, the Contractor shall immediately notify the RE in writing regarding the lightning strike hazard.
- b) RF Transmission Line and/or Coaxial Cable Lightning Protector: The protector shall be an in-line device equipped with screw type connectors to match the coaxial cable and dimensions specified. It shall be able to shunt high current surges to the earth ground protecting the system signal RF equipment. The protector shall have a minimal effect on the quality of the signal being received or transmitted. It shall be made of non-corrosive metal and be waterproof.

(1) Technical Characteristics

FUNCTIONS	CHARACTERISTICS
<u>a.</u> Peak Pulse Power	1,500 W @ 77° F
<u>b.</u> Protection Device	Gas Tube or as required by OEM
<u>c.</u> Dissipation	1.0 Milliseconds (mS)
<u>d.</u> Response Time	5.0 nano-Seconds (nS)
<u>e.</u> Connectors	As Specified
<u>f.</u> Ground Connection(s)	The protector shall be directly mounted, by a #4 ga. MIN self tapping sheet metal screw, on a MIN 5/16" (7.9375 mm) thick, 4.0" (101.6 mm) high X 22.0" (609.6 mm) Long solid copper buss grounding plate mounted directly inside and anchored to the wall at the exact coaxial cable entrance. The grounding plate shall be connected by a #0 AWG Stranded Copper Wire, MIN, or as required by the OEM, and/or the RE connected to the FACILITY'S OUTSIDE LIGHTNING PROTECTION SYSTEM.

(2) Each lightning major ground point shall be connected with MIN #0 AWG stranded copper wire run external to the building and connected to the antenna site lightning ground described herein.

7) Antennas

a) External: The external antenna shall be specified by the OEM for the specific system function and physical location. Acceptable designs are: ground plane fed with continuous polarization adjustment and or spread spectrum type. The antenna size, gain and beam width shall be chosen for optimum performance to meet the specified path and System reliability parameters.

(1) Each antenna shall be installed to meet the wind load specifications and environmental conditions.

(2) Technical Characteristics

FUNCTIONS	CHARACTERISTICS
<u>a.</u> Operating Standards	As herein outlined and specified
<u>b.</u> Size	As required to fully satisfy system design
<u>c.</u> Gain	25 dB
<u>e.</u> Half Power Beam Width	As specified by the OEM
<u>f.</u> Front-to-Back Ratio (FBR)	40 dB
<u>g.</u> VSWR	1.15 or Less
<u>h.</u> RFI	None measurable
<u>i.</u> Wind Load Rating	40 LBS Per Square Foot (PSF) or 100 (160 kilometers) per hour

(3) RF Transmission Line (External) - Coaxial: The provided transmission line shall be coaxial, jacketed with fire resistant material when run outside of conduit and/or cable tray, or as required by system design and described by the OEM; and, if required, pressurized to the OEM's specifications.

(i) The cable shall be as specified by the OEM. If not specified by the OEM, it shall be provided with the proper impedance, be double shielded, and contain other characteristics to satisfy all equipment and system requirements.

(ii) Technical Characteristics

(1 Outside Diameter	As specified by the OEM
(2 Center Conductor	Solid (Stranded when OEM specified) Copper, Silver Coated
(3 Outer Conductor (or Braid)	Braided Copper (solid when OEM specified)

	providing 100% coverage and EMI shielding
(4 Insulation	Cellular Polyethylene with air passages
(5 Jacket	Polyethylene; Teflon or Kynar (when required)

(iii) Attenuation:

Frequency (mHz)	Attn/dB per 100 ft (MAX)
100	2.5
200	3.5
400	5.0
890	8.0

(iv) External Antenna Feed Through: A feed through shall be provided for all Coaxial, Spiral line and/or other System wire/cable penetrations of exterior building walls or roofs. The feed through(s) shall be waterproof, sleeved, OEM recommended and RE approved.

b) Internal: Each DAS antenna shall be specified by the OEM for the specific system function and physical location. Acceptable designs are: ground plane fed with continuous polarization adjustment and or spread spectrum type. The antenna size, gain and beam width shall be chosen for optimum performance to meet the specified path and System reliability parameters. Each antenna shall be installed to meet the local environmental (outside and inside) conditions.

(1) Environmental

FUNCTIONS	CHARACTERISTICS
(a Application	Indoor
(b Operating Temperature	40°C to +60°C (40°F to +140°F)
(c Relative Humidity	Up to 100%

(2) Mechanical

FUNCTIONS	CHARACTERISTICS
(a Application	50 Ohm "N" type
(b Mounting	Thru-hole ceiling (typical)
(c Relative Humidity	Up to 100%
(d Radome	Required, ABS, UV resistant
(e Pigtail Cable	Required, plenum (if not protected) flexible with connectors installed

(3) Regulatory Compliance

FUNCTIONS	CHARACTERISTICS
(a RoHS	2002/95/EC (minimum)

(4) Omni-Directional Antenna: Omni-Directional Coverage Antenna(s) shall feature a multi-band design that accommodates multiple RF band and channels in a single unit.

(i) RF Band One (1)

FUNCTIONS	CHARACTERISTICS
(1 RF Range	690 - 800 mHz
(2 VSWR	$\leq 1.8:1$
(3 Gain	≥ 1.5 dBi
(4 Max input power	OEM Specified
(5 Impedance	50 Ohms
(6 Beamwidth:	
(a Vertical	80° nominal
(b Horizontal	360° Omni-directional
(7 Return Loss	≤ 11 dB, maximum,
(8 RFI	None measurable
(9 Wind Load Rating:	
(a External	40 LBS Per Square Foot (PSF) or 100 MPH
(b Internal	Not Applicable

(ii) RF Band Two (2)

FUNCTIONS	CHARACTERISTICS
(1 RF Range	
(a	710 - 2,700 mHz
(b	800 - 950 mHz
(2 VSWR	$\leq 1.8:1$
(3 Gain	
(a ≥ 1.5 dBi	800 - 950 mHz
(b ≥ 5.0 dBi	1,710 - 2,700 mHz
(4 Max input power	OEM Specified
(5 Impedance	50 Ohms
(6 Beamwidth:	
(a Vertical	70° nominal
(b Horizontal	360° Omni-directional
(7 Return Loss	≤ 14 dB, maximum,
(8 RFI	None measurable
(9 Wind Load Rating:	
(a External	40 LBS Per Square Foot (PSF) or 100 MPH

(b Internal	Not Applicable
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(iii) RF Bands Three (3) and four (4):

FUNCTIONS	CHARACTERISTICS
(1 RF Range	
(a 150 - 250 mHz,	(or per OEM direction)
(b 260 - 400 mHz	(or per OEM direction)
(c 450 - 750 mHz	(or per OEM direction)
//(d _____ mHz	(or per OEM direction)//
(2 VSWR	≤ 1.5:1 all bands
(3 Gain	
(a ≥ 1.5 dBi	150 - 750 Mhz
(b ≥ 3.0 dBi	800 mHz - 2.8 GHz (broadband)
(c ≥ 7.0 dBi	2.4 - 4.5 GHz (very broadband)
(d ≥ 18.0 dBi	3.0 - 5.7 GHz (extreme broadband)
(4 Max input power	OEM Specified
(5 Impedance	50 Ohms
(6 Beamwidth:	
(a Vertical	70° nominal
(b Horizontal	360° Omni-directional
(7 Return Loss	≤14 dB, maximum,
(8 RFI	None measurable
(9 Wind Load Rating:	
(a External	40 LBS Per Square Foot (PSF) or 100 MPH
(b Internal	Not Applicable

(5) Directional Coverage Antenna(s): shall feature a multi-band design that accommodates multiple RF band and channels in a single unit.

(i) RF Band One (1):

FUNCTIONS	CHARACTERISTICS
(1 RF Range	690 - 800 mHz
(2 VSWR	≤ 1.8:1
(3 Gain	≥ 5.0 dBi
(4 Max input power	50W MAX
(5 Impedance	50 Ohms
(6 Beamwidth:	
(a Vertical	Polarization

(b Horizontal	110° nominal
(7 Return Loss	≤11 dB, maximum,
(8 RFI	None measurable
(9 Wind Load Rating:	
(a External	40 LBS Per Square Foot (PSF) or 100 MPH
(c Internal	Not Applicable

(ii) RF Band Two (2):

FUNCTIONS	CHARACTERISTICS
(1 RF Range	
(a	710 - 2,700 mHz
(b	800 - 950 mHz
(2 VSWR	≤ 1.5:1
(3 Gain	
(a ≥ 1.5 dBi	All channels
(4 Max input power	50W MAX
(5 Impedance	50 Ohms
(6 Beamwidth:	
(a Vertical	Polarized
(b Horizontal	90° nominal
(7 Return Loss	≤14 dB, maximum,
(8 RFI	None measurable
(9 Wind Load Rating:	
(a External	40 LBS Per Square Foot (PSF) or 100 MPH
(b Internal	Not Applicable

(iii) RF Bands Three (3) and four (4):

FUNCTIONS	CHARACTERISTICS
(1 RF Range	
(a 150 - 250 mHz,	(or per OEM direction)
(b 260 - 400 mHz	(or per OEM direction)
(c 450 - 750 mHz	(or per OEM direction)
(d 800 mHz - 2.8 GHz (broadband)	(or per OEM direction)

(e 2.4 - 4.5 GHz (very broadband)	(or per OEM direction)
(f 3.0 - 5.7 GHz (extreme broadband)	(or per OEM direction)
//(g _____ mHz	(or per OEM direction)//
(2 VSWR	≤ 1.5:1 all bands (or per OEM direction)
(3 Gain	
(a ≥ 1.5 dBi	150 - 750 mHz
(b ≥ 3.0 dBi	800 mHz - 2.8 GHz (broadband)
(c ≥ 7.0 dBi	2.4 - 4.5 GHz (very broadband)
(d ≥ 18.0 dBi	3.0 - 5.7 GHz (extreme broadband)
(e ≥ 7.0 dBi	2.4 - 4.5 GHz (very broadband)
(f ≥ 3.0 dBi	800 mHz - 2.8 GHz (broadband)
(4 Max input power	50W MAX
(5 Impedance	50 Ohms
(6 Beamwidth:	
(a Vertical	Polarized
(b Horizontal	60 - 70° nominal
(7 Return Loss	≤14 dB, maximum,
(8 RFI	None measurable
(9 Wind Load Rating:	
(a External	40 LBS Per Square Foot (PSF) or 100 MPH
(b Internal	Not Applicable

b. Head End (HE) Equipment

1) DAS Equipment Room/Location

- a) The Contractor shall confirm each HE room/location depicted on the contract drawings conforms to the MIN requirements outlined in CFM's Design Manual PG-18-10 - Chapter 7 and OI&T Design (a copy can be obtained from the RE or SMCS [0050P2H3]).
- b) Any noted deviation(s) shall be provided to the RE in writing for an official determination concerning each noted item and how it/they will affect the system.
- c) The RE shall contact SMCS (0050P2H3) for technical assistance and the A/E for structural assistance.

- B. CABINET WITH INTERNAL EQUIPMENT MOUNTING RAIL(S) (DO NOT DELETE): shall be lockable, fabricated of heavy 16 gauge (ga) steel, and have fully adjustable internal equipment mounting racks and/or rails that allows front panel equipment mounting and access.
1. Each equipment mounting rail shall be able to provide an internal cabinet ground for each installed equipment when the equipment is properly bolted to the rail.
 2. Additionally, connect each equipment grounding terminal to a separate mounting hole on the equipment mounting rail to the right as one looks at it from the rear with a minim #12 AWG stranded copper wire with protective jacket.
 3. It shall have baked-on iron phosphate primer and baked enamel paint finish in a color to be selected by the RE or FMS Service Chief.
 4. It shall be floor or wall mounted with knock-out holes for cable entrance(s) and conduit connections, contain ventilation ports and a quiet fan with non disposable air filter for equipment cooling.
 5. Each cabinet shall be keyed alike and four (4) keys shall be provided to the RE for each 10 cabinets used when the VA accepts the System.
 6. A minimum of one (1) cabinet shall be provided with blank rack space, for additional expansion equipment. Blank panels shall be installed to cover any open or unused rack space. In addition, provide two (2) 120 VAC power strips connected to surge protector(s), a ventilation fan with non-disposable air filter, and a conduit or cable duct interfaced to adjacent cabinet(s) and local room wire management system, as part of this cabinet.
 - a. Blank panels shall be color matched to the cabinet, 1/8in. (3.175 mm) thick aluminum with vertical dimensions in increments of one rack unit (RU) or 1.75in. (44.8469 mm) with mounting holes spaced to correspond to EIA 19in. (482.6 mm) rack dimensions.
 - b. Single standard larger size blank panels shall be used to fill unused panel or rack spaces in lieu of numerous types. One blank 1.75in. (44.8469 mm) high blank panel shall be installed between each item of equipment.
 7. Provide internal cabinet communications grounding system and connect to communications ground buss bar with a minimum #6 AWG stranded copper wire with protective covering(see PART 2, PARAGRAPH 2.4.B).
 - a. Each cabinet shall be grounded to the communications grounding system.
 - b. Connect the communications system grounding wire to a cabinet provided ground terminal or with a bolt(s) screwed into one mounting hole of each equipment mounting rail (refer to PARAGRAPH 2.9 HEREIN).

8. Technical Characteristics

Overall Height	2,180 mm (85 7/8in.), maximum
Overall Depth	650 mm (25 1/2in.), maximum
Overall Width	535 mm (21 1/16in.), maximum
Front Panel Opening Width	480 mm (19in.), EIA horizontal
Hole Spacing	per EIA and Industry Standards

9. Internal Cabinet Components (MINIMUM REQUIRED)

a. AC power outlet strip(s - DO NOT DELETE):

- 1) Two (2) Power outlet strips shall be provided as directed by the OEM. The additional spare equipment cabinet with no installed items in the cabinet shall contain two (2) AC strips with a minimum of 10 ea. AC power outlets. Each strip shall be mounted inside and at the rear of the cabinet. It shall contain "U" grounded AC outlets for distributing AC power to the installed electronic equipment. The strip shall be self-contained in a metal enclosure and may be provided with a 2 M (6 ft.) long (maximum) connecting cord with three prong plug.
- 2) Technical Characteristics:
 - a) Power capacity 20 Ampere (AMP), 120 VAC continuous duty.
 - b) Wire gauge: Three conductor, #12 AWG copper.

b. Cabinet AC Power Line Surge Protector and Filter:

- 1) Each cabinet shall be equipped with a AC Surge Protector and Line Filter. The Protector and Filter shall be housed in one single enclosure. The Protector and Filter shall perform instantaneous regulation of the AC input voltage and isolate and filter any noise present on the AC input line. The unit shall be equipped with AC voltage and current surge protectors to prevent damage to the electronic equipment from power line induced voltage spikes, surges, lightning, etc. It shall be cabinet mounted and the cabinet AC power strip (maximum of two [2] strips) may be connected to it as long as the system design is met.
- 2) Technical Characteristics

Input Voltage range	120 VAC \pm 15%
Power capacity	20 AMP, 120 VAC
Voltage output regulation	\pm 3.0%
Circuit breaker	15 AMP, may be self contain
Noise filtering	Greater than -45 dB
AC outlets	Four (4) duplex grounded types, minimum

Response time	5.0 ns
Suppression	
Surge	10,000 A
Noise	
Common	-40 dB
Differential	-45 dB

- 3) Specific requirements for current and surge protection shall include:
- a) Voltage protection threshold, line to neutral, starts at no more than 220 Volts peak. The transient voltage shall not exceed 300 volts peak. The Contractor shall furnish documentation on peak clamping voltage as a function of transient AMP.
 - b) Peak power dissipation minimum 35 Joules per phase, as measured for 1.0 mS at sub branch panels, 100 Joules per phase at branch panels and 300 Joules per phase at service entrance panels. The Contractor shall furnish an explanation of how the ratings were measured or empirically derived.
 - c) Surge protector must not short circuit the AC power line at any time.
 - (1) The primary surge protection components must be silicon semiconductors. Secondary stages, if used, may include other types of devices.
 - (2) Surge protectors shall incorporate a visual device which indicates whether the surge suppression component(s) is (are) functioning.
 - (3) Surge protection devices shall be UL listed.
 - (4) Voltage and current surge protectors shall be provided on all ancillary equipment provided by the Contractor.
 - d) Power dissipation 12,000 Watts (W) for 1.0 mS (or 12 Joules).
 - e) Voltage protection threshold starts at not more than 100 VAC.
- c. Uninterruptible Power Supply (UPS): Each cabinet shall be provided with an internal UPS. This item may be combined with the Surge Protector & Filter in PART 2, PARAGRAPH 2.4.I.8.b as long as the 50% expansion is met. The UPS shall provide atleast one (1) hours continuous full load //two hours if working with an emergency / safety system// uninterruptible system primary AC Power, with a 25% (at least one //to two hours//) reserve capacity, in the event of Facility Primary or Emergency AC Power failure.
- 1) The UPS shall include, but not be limited to:

a) Protection switch	Required to automatically protect the UPS unit and associated equipment connected to it. This function is required to be a part of the System's electronic supervision requirements.
b) First/fast charge unit	Must provide clean predicable charge voltage / current when needed. This function is required to be a part of the System's electronic supervision requirements.
c) Over Voltage/Current protect	Must not short circuit the AC power line at any time. This function is required to be a part of the System's electronic supervision requirements.
d) Trickle charge unit	Must be cable of maintaining a suitable internal battery charge without damaging the batteries.
e) Internally mounted	Per OEM's direction.
f) Proper ventilation	Not override the cabinets' venti-lation system.
g) Power change from AC input	Shall be accomplished without interruption to the communications link or subsystem being protected. This change of state shall generate visual and aural alarms in its Electrical Supervision System.
h) Electrical supervision	Required - must be audile and visual locally and remotod to annunciating panel(s) via direct connection for trouble indication

C. ENVIRONMENTAL CABINET (if selected): The Contractor shall provide this enclosure in lieu of a standard equipment cabinet identified in Paragraph 2.4.B to meet system design in hostile TR locations as identified in CFM's OI&T Design Guide and locations as shown on the drawings.

1. The enclosure shall fully sustain the installed, including electronic, equipment in the same manner as the standard cabinet identified in Paragraph 2.4.B. Additionally, the enclosure shall fully support all installed equipment as if they were in a standalone air handling area regardless of the local area's air handling capabilities.
2. The enclosure shall be an OEM's fully assembled unit.
3. If more than two enclosures are required in any system location, those enclosures shall be OEM assembled for consolidating or combining two or more enclosures in a single unit to meet system space and equipment handling designs plus maintain OSHA spacing requirements.
4. Technical Characteristics

a. Environmental control	Automatic, heating and/or cooling, as required
b. Temperature conditions (rated at 1,300 W of install equipment heat generation):	
c. Internal Range	Maintains 80° to 105° of internal heat conditions, maximum
d. External Range	100° <u>±</u> 25°, maximum
e. Forced air unit	Required with non disposable air filter unobstructed and uninterruptible
f. Air conditioning	As required, fully internal mounted
g. Heater	As required, fully internal mounted
h. Uninterruptible power supply	As required, fully internal mounted
i. Front door	Full length, see through, EMI resistant, and lockable
j. Rear door	Full length, non-see through, EMI resistant, and lockable
k. Conduit wiring entrance	TOP AND/OR BOTTOM, FULLY SEALED
l, Input power	2 ea. minimum 120 VAC @ 20A, maximum, independent circuit, conduit for fixed or armored cable for moveable installations
m. Dimensions:	
n. Height	1980 mm (78in.), maximum
o. Width	635 mm (25in.), maximum
p. Depth	965 mm (38in.), maximum
q. Front panel opening	480 mm (19in.), w/ EIA mounting hole spacing

D. DISTRIBUTION OR SYSTEM INTERFACE CABINET: The cabinet shall be constructed of heavy 16 ga cold rolled steel, have top and side panels and hinged front and rear (front door only if wall mounted) doors.

1. It shall have baked-on iron phosphate primer and baked enamel paint finish in a color to be selected by the using FMS Chief or the RE, contain integral and adjustable predrilled rack mounting rails or frame that allows front panel equipment mounting and access.
2. When all equipment, doors and panels are installed, snap-in-place chrome trim strip covers are required to be installed that will cover all front panel screw fasteners.
3. It shall be equipped the same as the equipment cabinet.
4. Technical Characteristics

a. Overall height	2,180 mm (85 7/8in.), maximum
b. Overall depth	650 mm (25 1/2in.), maximum

c. Overall width	535 mm (21 1/16in.), maximum
d. Equipment vertical mounting space	1,960 mm (77 1/8in.), maximum
e. Front panel horizontal	484 mm (19 1/16in.), maximum width

E. STAND ALONE EQUIPMENT RACK (or sometimes called Radio Relay Rack): The rack shall be constructed of heavy 16 ga cold rolled steel and have fully adjustable equipment front mounting rails that allows front panel equipment mounting and access.

1. It shall have baked-on iron phosphate primer and baked enamel paint finish in a color to be selected by the using FMS Chief or the RE. It shall be floor or wall mounted or mounted on casters as directed by the RE.

2. Technical Characteristics

a. Overall Height	2,180 mm (85 7/8in.), maximum
b. Overall Depth	650 mm (25 1/2in.), maximum
c. Overall Width	535 mm (21 1/16in.), maximum
d. Front Panel Opening	480 mm (19in.), EIA horizontal width
e. Hole Spacing	per EIA and Industry Standards

F. WIRES AND CABLES

1. CONTROL WIRING: Is not required to be plenum rated when installed in conduit. It is required to be plenum rated when installed in designated "Air Plenum" spaces / areas. Wiring that is routed in cable trays via pathways that is not rated "Air Plenum" locations, the wiring is not required to be plenum rated; only when pathways pass through "Air Plenum" spaces/areas, the wiring shall be plenum rated.

a. Unless otherwise specified in other Specifications Sections of the TIP specifications (re SECTIONS 27 05 11, 27 11 00, 27 13 00 & 27 15 00), control wiring shall be as specified for power and lighting wiring, except the minimum size shall be not less than No. 16 AWG.

b. Control wiring shall be large enough so that the voltage drop under "turn-on" conditions does not adversely affect operation of the controls.

2. COMMUNICATIONS AND SIGNAL WIRING: Is not required to be plenum rated when installed in conduit. It is required to be plenum rated when installed in designated "Air Plenum" spaces / areas. Wiring that is routed in cable trays via pathways that is not rated "Air Plenum" locations, the wiring is not required to be plenum rated; only when pathways pass through "Air Plenum" spaces/areas, the wiring shall be plenum rated. The wires:

- a. Shall conform to the recommendations of the OEMs of the communication and signal systems; however, not less than what is shown.
 - b. Shown is for typical systems. Provide wiring as required for the systems being furnished.
 - c. Multi-conductor construction shall have the conductors color coded per TIA/TIA 569.
 - d. Shall provide minimum grade of service of BICSI Category 5E. If the Facility desires enhanced grade(s) of service, it must be fully identified and justified at the beginning of the project, during the Project's initial design phase.
3. COPPER CONDUCTOR CABLE: Is defined as solid copper conductors, covered with an extruded solid insulating compound. Insulated conductors shall be twisted into pairs which are then stranded or oscillated to form a cylindrical core. The copper cable is not required to be plenum rated when installed in conduit. It is required to be plenum rated when installed in designated "Air Plenum" spaces / areas. Wiring that is routed in cable trays via pathways that is not rated "Air Plenum" locations, the wiring is not required to be plenum rated; only when pathways pass through "Air Plenum" spaces/areas, the wiring shall be plenum rated.
- a. For special high frequency applications, the cable core shall be separated into compartments.
 - b. Cable shall be completed by the application of a:
 - 1) Suitable core wrapping material,
 - 2) Corrugated copper or plastic coated aluminum shield, and
 - 3) Overall extruded jacket.
 - c. The contractor shall verify distances between splice points prior to ordering cable in specific cut lengths. Gauge of conductor shall determine the range of numbers of pairs specified (ie):
 - 1) 19 gauge (6 to 400 pairs),
 - 2) 22 gauge (6 to 1,200 pairs),
 - 3) 24 gauge (6 to 2,100 pairs),
 - 4) 26 gauge (6 to 3,000 pairs).
 - d. Each copper cable shall meet or exceed the following specifications for the specific type of cable:
 - 1) Each cable reel shall be sweep tested and certified by the OEM by tags affixed to each reel. The Contractor shall turn over all sweep tags to the RE or PM. Additionally, the Contractor shall provide a 610 mm (2

ft.) sample of each provided cable, to the RE and receive approval before installation.

- 2) Cables installed in any outside location (i.e. above ground, underground in conduit, ducts, pathways, etc.) shall be filled with a waterproofing compound between outside jacket (not immediately touching any provided armor) and inter conductors to seal punctures in the jacket and protect the conductors from moisture.
 - 3) The Contractor shall provide all Systems cables that are OEM recommended and insure the approved System expansion is met.
- e. Data Multi-Conductor (Digital): The cable shall be multi-conductor, shielded or unshielded cable with stranded conductors. The cable shall be able to handle the power and voltage used over the distance required.
- 1) It shall meet BICSI Category 5e service at a minimum.
 - 2) Technical Characteristics:

REQUIREMENT	FUNCTION
a) Wire size	22 AWG, minimum
b) Working shield	350 V
c) Bend radius	10X the cable outside diameter
d) Impedance	100 Ohms \pm 15%, BAL
e) Bandwidth	100 mHz, minimum
F) DC RESISTANCE	10.0 Ohms/100M, maximum
g) Shield coverage	
h) Overall Outside (if OEM specified)	100%
i) Individual Pairs (if OEM specified)	100%
j) Attenuation	
k) Frequency in mHz	dB per 305 M (1,000ft.), maximum
0.7	5.2
1.0	6.5
4.0	14.0
8.0	19.0
16.0	26.0
20.0	29.0
25.0	33.0
31.0	36.0

62.0	52.0
100.0	68.0

f. Remote Control: The remote control cable shall be multi-conductor with stranded (solid is permissible) conductors.

- 1) The cable shall be able to handle the power and voltage necessary to control specified system equipment from a remote location.
- 2) The cable shall be NRTL listed and pass the FR-1 vertical flame test, at a minimum.
- 3) Each conductor shall be color-coded.
- 4) Combined multi-conductor and coaxial cables are acceptable for this installation, as long as all system performance standards are met.
- 5) Technical Characteristics

REQUIREMENT	FUNCTION
a) Length	As required, in 1K (3,000 m.) reels minimum
b) Connectors	As required by system design
c) Size	18 AWG, minimum, Outside 20 AWG, minimum, Inside
d) Color coding	Required, EIA industry standard
f) Bend radius	10X the cable outside diameter
g) Impedance	As required
h) Shield coverage	As required by OEM specification
i) Attenuation	
j) Frequency in mHz	dB per 305 M (1,000ft.), maximum
0.7	5.2
1.0	6.5
4.0	14.0
8.0	19.0
16.0	26.0
20.0	29.0
25.0	33.0
31.0	36.0
50.0	52.0

4. FIBER OPTIC CABLE: Is not required to be plenum rated when installed in conduit. It is required to be plenum rated when installed in designated "Air Plenum" spaces / areas. Wiring that is routed in cable trays via pathways that is not rated "Air Plenum" locations, the wiring is not required to be

plenum rated; only when pathways pass through "Air Plenum" spaces/areas, the wiring shall be plenum rated.

a. Single-mode

- 1) 8/125-um, 0.10 aperture 1,310 nm fiber optic cable in accordance with TIA-492CAAA,
- 2) 8/125-um, 0.10 aperture 1,550 nm fiber optic cable in accordance with TIA-492E000.

b. Multimode

- 1) 62.5/125-um, Bell System Standard, 0.275 aperture fiber optic cable in accordance with TIA-492AAAA, TIA-472D000, and ICEA S-87-640, OR
- 2) 50/125-um, American (NOT EUROPEAN) Standard, 0.275 aperture fiber optic cable that is optically enhanced in accordance with TIA-492AAAB, including any special requirements made necessary by using this specialized design (re PART 1, PARAGRAPH 1.4.E.3.h for minimum performance).

c. Strength Members: Provide //central// //non-central//, //non-metallic// //metallic// strength members with sufficient tensile strength for installation and residual rated loads to meet the applicable performance requirements in accordance with ICEA S-87-640. The strength member is included to serve as a cable core foundation to reduce strain on the fibers, and shall not serve as a pulling strength member.

d. Shielding or Other Metallic Covering: Provide //copper//, //copper alloy// //copper and steel laminate// //copper and stainless steel// //coated stainless steel// //bare low carbon steel// //bare aluminum or coated aluminum// //single// //dual// tape covering or shield// in accordance with ICEA S-87-640.

e. Fiber optic cable: Shall be specifically designed for inside or outside use with loose buffered construction. Provide fiber optic color code in accordance with TIA/EIA-598.

f. Performance Requirements: Provide fiber optic cable with optical and mechanical performance requirements in accordance with ICEA S-87-640.

- 1) End to End Link Performance as listed in Annex E of ANSI/ TIA/ EIA SP-2840A.
- 2) The cabling system must conform to the current issue of Industry Standard ANSI/TIA/EIA 568A.
- 3) The system shall support all applications for which it is designed, including, at a minimum ATM 155 Mbps for BICSI Certified Category 5E

(see PART 2, PARAGRAPH 2.4.C.4), during the lifetime of the certified system.

- 4) Quality and installation methods used shall be equal to or better than that found in the BICSI TDM Manual.
- 5) VA demands strict adherence to the performance specifications listed in ANSI/TIA/E1A SP-2840A, 568A and 569.
- 6) New construction AND major renovations of telecommunications spaces and pathways shall conform to EIA/TIA 569, at a minimum.
 - a) In cases of renovations in historic or otherwise restrictive buildings; where it has been determined as impossible to follow the above stated guidelines, the exceptions must not modify the maximum distances set forth in ANSI/TIA/EIA SP-2840A, 568A and 569 and must not in any way affect the performance of the entire cabling system.
 - b) Modification to administrative issues requires written approval(s) from CFM's PE/ PM and/or RE; with concurrence from the OEM, Contractor, SMCS and Using Authority(s).

G. TEMPORARY DAS TIP PATHS: (ie overhead tracks, road / path bridges, etc.) for copper, fiberoptic, RF, coaxial and designated electrical cables that are used to maintain Facility Communications Service in force during construction and shall be installed so as to not present a pedestrian and traffic (including construction) safety hazard.

1. TIP temporary cable installations are not required to meet Industry Standards; but, each must be reviewed and approved, in writing, by the RE with concurrences from SMCS 0050P2H3, the Facility OI&T and Safety Officer, prior to installation. The Contractor shall:
 - a. Be responsible for all work associated with each temporary TIP path installation required by system design; and, for its/their removal when determined no longer necessary,
 - b. Survey the outside TIP locations usually encountered, but are not limited to: Roads, driveways, marked paths, Hi traffic passageways, personnel walkways, etc, and provide the RE a plan for the temporary path, and
 - c. Ensure each temporary TIP path is installed so as to not present a pedestrian and vehicle safety hazard.

H. DAS CROSS-CONNECTION SYSTEM (CCS) EQUIPMENT BREAKOUT, TERMINATION CONNECTOR (OR BULKHEAD), AND PATCH PANELS (ARE IN ADDITION TO THE TIP CCS REQUIREMENTS): Each DAS CCS requires the use of a single tool, has the fewest amount of parts, and the least amount of assembly or projected trouble shooting time during the life of the system.

1. The CCS system used at each ENT (aka DEMARC), TER & MCR, MCOR, PCR, ECR, SCC, HER, STR's, TR's. The IDF shall force cross-connect cable slack management through adherence to the OEM's installation methods, provided cable management systems, and as described herein, so that moves, adds, and changes can be administered easily and cost effectively.
2. The connector panel(s) shall be made of flat smooth 3.175 mm (1/8 in.) thick solid aluminum, custom designed, fitted and installed in the cabinet. Bulkhead equipment connectors shall be mounted on the panel to enable all cabinet equipment's signal, control, and coaxial cables to be connected through the panel. Each panel shall be color matched to the cabinet installed.
3. Voice (or Telephone): The DAS CCS for voice or telephone service shall be Bell/ATT Telephone Industry Standard rated 110A (minimum) punch blocks for voice or telephone, and control wiring in lieu of patch panels, each being certified for BISCII Category 5E service.
 - a. IDC punch blocks (with internal RJ45 jacks) are acceptable for use in all DAS CCS and shall be specifically designed for BISCII Category 5E telecommunications service and the size and type of UTP cable used as described herein.
 - b. Punch block strips shall be secured to an OEM designed physical anchoring unit on a wall location in the DEMARC, MCR, TER, STRs, TRs & HER's DAS Vertical Cross Connection System (VCCS) & Horizontal Cross Connection System (HCCS) ARE IN ADDITION TO RIP V&HCCS REQUIREMENTS.
 - c. Console, cabinet, rail, panel, etc. mounting is allowed at the OEM recommendation and as approved by the RE.
 - d. Punch blocks shall not be used for Class II or 120 VAC power wiring.
 - e. Technical Characteristics

Horizontal rows	100, minimum
Terminals per row	4, minimum
Terminal protector	required for each used or unused terminal
Insulation splicing	required between each row of terminals
Wire management	Required, internal
Spares	25% circuit capacity by extra rows or punch blocks

4. Digital (or High Speed Data): The DAS CCS shall be a patch panel with modular female RJ45 jacks installed in rows.

- a. Patch panels and RJ45 jacks shall be specifically designed for BISCI Category 5E telecommunications service and the size and type of UTP or STP cable used.
- b. Each panel shall be 480 mm (19in.) horizontal EIA rack mountable dimensions with EIA standard spaced vertical mounting holes.
- c. Technical Characteristics

Horizontal rows	2 or 4, minimum
Jacks per row	24, minimum
Type of jacks	RJ45, female
Terminal protector	required for each used or unused jack
Insulation	required between each row of jacks
Product Reference	Ortronics Mdl. OR-B51004983 for four rows and OR-S51004912 for two rows, or equal
Wire management	Required, internal
Spares	25% circuit expansion jacks or extra jack panel(s)

- 5. Fiber Optic Distribution Panel (aka Light Wave Shelf) The panel shall be provided with pre-punched chassis mounting holes, contained in a metal enclosure with lockable & tinted see-thru protection cover.
 - a. This panel is not allowed to be used for 120 VAC power connections.
 - b. Technical Characteristics

Height	4 rack units (RUs), 176 mm (7.0 in.)
Width	484 mm (19 1/16in.), EIA minimum
Horizontal Rows	6 ea, minimum
Vertical Rows	12 ea, minimum
Total Connectors	72 ea, minimum
Connector Type	AT&T/Bell Standard "ST" female, or equal
Produce Reference	AT&T LST1U-072/7, or equal
Wire management	Required, internal
Spares	25% circuit expansion jacks or extra jack panel(s)

- 6. Mounting Strips and Blocks
 - a. Barrier Strips: Barrier strips are approved for AC power, data, voice, and control cable or wires. Barrier strips shall accommodate the size and type of audio spade (or fork type) lugs used with insulating and separating strips between the terminals for securing separate wires in a neat and orderly fashion. Each cable or wire end shall be provided with an audio spade lug, which is connected to an individual screw terminal on the

barrier strip. The barrier strips shall be surface secured to a console, cabinet, rail, panel, etc. 120 VAC power wires shall not be connected to signal barrier strips.

b. Technical Characteristics

Terminal size	6-32, minimum
Terminal Count	ANY COMBINATION
Wire size	20 AWG, minimum
Voltage handling	100 V, minimum
Protective connector cover	Required for Class II and 120 VAC power connections

7. Solderless Connectors: The connectors (or fork connectors) shall be crimp-on insulated lug to fit a 6-32 minimum screw terminal. The fork connector shall be installed using a standard lug-crimping tool.
8. Punch Blocks: As a minimum, Bell/AT&T Industry Standard 110A type punch blocks are approved for data, voice, and control wiring. Punch blocks shall be specifically designed for the size and type of wire used. Punch block strips shall be secured to a console, cabinet, rail, panel, etc. Punch blocks shall not be used for Class II or 120 VAC power wiring.
9. Wire Wrap Strips: Industry Standard wire wrap strips (16.5 mm (0.065in.) wire wrap minimum) are approved for data, voice and control wiring. Wire wrap strips shall be secured to a cabinet, rail, panel, etc. Wire wrap strips shall not be used for Class II or 120 VAC power wiring.
10. Analog Audio or Control System: Product reference of a Government Approved (US State Department) type is Telewire, PUP-17 with pre-punched chassis mounting holes arranged in two horizontal rows.
 - a. This panel may be used for audio, control cable, and Class II Low Voltage Wiring installations when provided with the proper connectors.
 - b. This panel is not allowed to be used for 120 VAC power connections.

c. Technical Characteristics

Height	Two rack units (RUs), 88 mm (3.5in.) minimum
Width	484 mm (19 1/16in.), EIA minimum
Number of connections	12 pairs, minimum
Connectors	
Audio Service	Use RCA 6.35 mm (1/4in.) Phono, XL or Barrier Strips, surface mounted with spade lugs (punch block or wire wrap type strips are acceptable alternates for barrier strips as long as system design is maintained and RE approved)

Control Signal Service	Barrier strips surface mounted with spade lugs (punch block or wire wrap type strips are acceptable alternates for barrier strips as long as system design is maintained and RE approved)
Low voltage power (class II)	Barrier strips with spade lugs and clear full length plastic cover, surfaced mounted
Fiber optic	"ST" Stainless steel, female

I. TELECOMMUNICAITONS OUTLETS (TCO): Is the final outlet/connector for the interface between the horizontal wiring and the designated room/area TCO locations. The Contractor shall clearly and fully indicate this category for each TCO location and compare the total count to the locations identified herein as a part of the technical submittal. Additionally, the Contractor shall indicate the total number of spares.

1. The System shall be capable of receiving the specified telephone (or voice) and data signals acquired from the LEC, FTS contracted carrier and computer system, //, and ____ each RF coaxial cable(s) // //, and ____ each fiber optic single mode and multimode cable(s)// and shall process and distribute them to the designated TCO's described herein and as shown on the drawings.
2. Each designated room/area shall be supplied with a TCO outlet/ connector (aka modular jack or RJ-45) for connection to the TIP Horizontal Cable Plant. All TCO outlet/connectors shall be installed in an appropriate faceplate designated by the OEM. All TCO outlet/connectors shall be complete with faceplate and attached permanently to a fixed structure, such as building walls, utility pales or modular furniture partitions.
3. The TCO shall be modular in construction and able to accept six (6) modular connection jacks mounted in a separate 100mm (4in.) x 100mm (4in.) x 63mm (2.5in.) steel outlet box with a labeled six (6) position modular faceplate.
4. The TCO Eight (8) position modular outlet/connectors (aka RJ45 jacks) shall accept six (6) position modular plugs (RJ1 1 or RJ1/2) while providing proper electrical connection and not damaging the jack. The OEM shall warrant all eight (8) position modular jack used in such a manner to be usable for 8 position modular plugs in the future.
5. The TCO shall be activated with one (1) minimum 25 //and _____// pair UTP cable that will sustain minimum BICSI Category 5e communications service punched down or connected to the respective TR HCCS (label each wire at each end and coil and tape unused wires in the TCO outlet box back) to contain two (2) RJ-45/11 telephone multipin jacks and two (2) RJ-45 data multipin //, and one single mode fiber optic //, and one multimode fiber optic //, and one

- baseband RF, video, or audio (not Telephone) // jacks that are connected to the respective HCCS. The:
- a. Top two (2) jacks shall be designated for telephone (voice) service,
 - b. Middle two (2) designated for data service,
 - c. Bottom two (2) // and two fiber optic "ST" connectors, one designated for multimode fiber optic cable and the other for single mode fiber optic cable connection(s) // // and one analog RF coaxial "F" connector. //
6. A second 100mm (4in.) x 100mm (4in.) x 63mm (2.5in.) steel outlet box with a stainless steel or color matched faceplate shall be provided adjacent to and attached to the activated outlet box for system expansion.
 7. In order to allow normal expansion of service during the life of the TIP system, flush work area TCOs shall provide sufficient density to support up to a maximum of:
 - a. Eight (8) jacks/ connectors per single gang TCO,
 - b. Twelve (12) jacks/connectors per double gang TCO, and
 - c. Surface mount TCO's shall provide up to six (6) jacks/ connectors.
 8. A non-impact termination method using a full-cycle terminating tool-having exhibiting both tactile and audible feedback to indicate proper termination shall be used. High impact tools are not acceptable and will not be approved. Terminated conductor ends shall be properly trimmed to assure a minimum clearance of 0.250 in. between the conductors of adjacent modules.
 9. TCO face plates shall be clean in appearance and OEM recommended for the service it's performing. Mounting hardware shall not be visible on the faceplate. Color coded modules shall be employed and colors shall comply with the requirements of EIA/TIA 606.
 10. The room/area TCO outlet/connectors shall not cause or create "resonance" on short cable runs as described in the Field Testing TSB 67 (Draft 13 section 7.8 Short Links/Channels).
 11. Each TCO outlet/connector shall require (or specifically not allow more than) only one single connection to the TIP Horizontal Cable serving its location as per TIA/EIA 568/568A standard.
 12. Flush mounted TCO faceplates shall accommodate modular TCO outlet/connectors and be available in one (1), two (2), four (4), six (6) and eight (8) connectors per single gang TCO.
 - a. The modular TCO outlet/connectors available shall include a minimum of four active (4) UTP eight (8) position (RJ-45), one inactive (1) optical fiber in //SC// //ST// terminations, one future (1) "F" OR one (1)"BNC"

connectors for coax and video service respectively and one (1) "Spare" unused space.

- b. All TCO's shall be made of OEM approved high impact plastic.
- 13. The same modular TCO outlet/connectors as found in the flush and surface mount TCOs shall be installable in utility poles and modular furniture using OEM faceplates or adapters for this purpose. Each TCO shall house at least four (4) active TCO modular RJ-45 outlet/connectors.
- 14. The same modular TCO outlet/connectors as found in the flush and surface telecommunications outlets shall be installable in readily available single gang and double gang stainless steel faceplates using OEM faceplates or adapters for this purpose. The eight (8) position modular UTP TCO outlet/connector and its pin assignments shall meet the requirements described in the standard TIA/EIA 568A.
- 15. Each TCO shall be uniquely labeled as described herein. The label shall form an integral part of the faceplate.
- 16. For PBPU installations, the cover plate shall be the unit's OEM approved.
- 17. Each TCO with appropriate jacks installed shall be provided by the Contractor in each designated location and as shown on the drawings.
 - a. If the TCO's are not shown on the drawings, at a minimum, one (1) TCO shall be provided on each room wall, associated with an active 120 VAC duplex outlet shall be provided.
 - b. The contractor shall provide a minimum of one spare TCO per 25% of the total system count (whichever is greater) to the RE as System Expansion/Maintenance items.
- 18. TCO Connection (aka Patch) Cables
 - a. Telephone (aka voice): The Contractor shall provide one (1) voice connection (Patch) cable for each TCO telephone jack and HCCS Patch Panel (if provided by system design) in the System with 15% spares.
 - b. The telephone (voice) connection cable shall connect the telephone instrument to one of the TCO telephone (voice) jacks. The Contractor shall not provide telephone instrument(s) or equipment.
 - c. Technical Characteristics

Length	1.8M (6ft.), minimum
Cable	Voice Grade
Connector	RJ-11/45 compatible male on each end
Size	24 AWG, minimum
Color coding	Required, telephone industry standard

d. Data (aka Digital): The Contractor shall provide one (1) data connection cable for each DAS TCO data jack and CCS patch panel in the system with 15% spares.

- 1) The data connection cable shall connect a data instrument to the TCO data jack and perform data signal interconnection on the CCS patch panel. DAS TCOs ARE IN ADDITION TO THE TIP REQUIRED TCOs.
- 2) The Contractor shall not provide active data terminal(s)/ equipment.
- 3) Technical Characteristics

Length	1.8M (6 ft.), minimum
Cable	Data grade Category Six
Connector	RJ-45 male on each end
Color coding	Required, data industry standard
Size	24 AWG, minimum

e. Fiber Optic: The Contractor shall provide one (1) fiberoptic connection cable for each DAS TCO fiber optic jack and CCS patch panel in the System with 15% spares.

- 1) The connection cable shall connect a fiber optic instrument to the DAS TCO fiber optic jack and perform voice, data or HDTV interconnection on the CCS patch panel. The Contractor shall not provide fiber optic instrument(s)/equipment.
- 2) Technical Characteristics

Length	1.8M (6 ft.), minimum
Cable	Flexible single conductor with jacket
Connector	ST male on each end
Size	To fit single mode or multimode cable

f. RF: The Contractor shall provide one (1) RF coaxial cable connection cable for each DAS TCO RF connector and CCS patch panel in the System with 1 5% spares.

- 1) The RF coaxial connection cable shall connect a RF instrument to the DAS TCO RF jack and perform HDTV signal interconnection on the HCCS patch panel (if provided).
- 2) Technical Characteristics

Length	1.8M (6 ft.), minimum
Cable	Flexible RG-6/U, minimum
Connector	"F" male on each end //

//g. Baseband / Video: The Contractor shall provide one (1) coaxial connection cable for each TCO baseband / video jack and HCCS patch panel in the

System with 15% spares. The coaxial video connection cable shall connect a baseband / video instrument to the TCO analog video jack and perform signal interconnection on the CCS patch panel (if provided). The Contractor shall not provide baseband / video instrument(s)/equipment.

1) Technical Characteristics:

Length	1.8M (6 ft.), minimum
Cable	Flexible RG-59/U, minimum
Connector	BNC male on each end //

//h. Baseband Audio: The Contractor shall provide one (1) audio connection cable for each TCO analog audio jack and HCCS patch panel in the System with 15% spares.

- 1) The audio connection cable shall connect an audio instrument to the TCO analog audio jack and perform signal interconnection on the HCCS panel (if provided).
- 2) The Contractor shall not provide active analog audio instrument(s)/equipment.
- 3) Technical Characteristics

Length	1.8M (6 ft.), minimum
Cable	Flexible 22 AWG, STP, minimum
Connector	"XL" male on each end//

J. COMMON EQUIPMENT ITEMS

1. Conduits

a. Rigid galvanized steel	Shall Conform to UL 6, ANSI C80.1.
b. Rigid aluminum	Shall Conform to UL 6A, ANSI C80.5.
c. Rigid intermediate steel (IMC)	Shall Conform to UL 1242, ANSI C80.6.
d. EMT	Shall Conform to UL 797, ANSI C80.3. Maximum size not to exceed 105 mm (4 inch) and shall be permitted only with cable rated 600 volts or less.
e. Flexible galvanized steel	Shall Conform to UL 1.
f. Liquid-tight flexible metal	Shall Conform to UL 360.
g. Direct burial plastic	Shall conform to UL 651 and UL 651A, and heavy wall PVC or high density polyethylene (PE).

2. Conduit Fittings

a. Rigid steel and IMC	
(1) Fittings	Shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
(a) Sealing	Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of

	water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
(2) Standard threaded couplings, locknuts, bushings, and elbows	Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
(3) Locknuts	Bonding type with sharp edges for digging into the metal wall of an enclosure.
(4) Bushings	Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
(5) Erickson (union-type) and set screw type couplings	Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
(6)	Must be OEM approved.
b. EMT	Shall meet the requirements of UL 514B and ANSI/ NEMA FB1
(1) fittings	Only steel or malleable iron materials are acceptable.
(2) Couplings and connectors	Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 50 mm (2 inches) and smaller. Use set screw type couplings with four set screws each for conduit sizes over 50 mm (2 inches). Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.
(3)	Must be OEM approved.
c. Flexible steel	Conform to UL 514B. Only steel or malleable iron materials are acceptable.
(1) Clamp type,	Must be provided with insulated throat.
(2)	Must be OEM approved.
d. Liquid-tight flexible metal	Shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
(1)	Only steel or malleable iron materials are acceptable.
(2)	Must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
(3)	Must be OEM approved.

e. Rigid aluminum	Malleable iron, steel or aluminum alloy materials; Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 per-cent copper are prohibited.
(1) Locknuts and bushings	As specified for rigid steel and IMC conduit.
(2) Set screw fittings	Not permitted for use with aluminum conduit.
(3) Indent type connectors or couplings	Are Prohibited.
(4) Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal"	Are prohibited.
(5)	Must be OEM approved.
e. Direct burial plastic conduit fittings	
(1)	Fittings shall meet the requirements of UL 514C and NEMA TC3.
(2)	As recommended by the conduit OEM.
f. Expansion and deflection couplings:	
(1) Conform	To UL 467 and UL 514B.
(2) Accommodates	19 mm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
g. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents	In accordance with UL 467, and the NEC code tables for ground conductors.
h. Jacket	Must be flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

3. Conduit Supports

a. Parts and hardware	Zinc-coat or provide equivalent corrosion protection.
b. Individual Conduit Hangers	Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
c. Multiple conduit (trapeze) hangers	Not less than 38 mm by 38 mm (1-1/2 by 1-1/2 inch), 12 gage steel, cold formed, lipped channels; with not less than 9 mm (3/8 inch) diameter steel hanger rods.
d. Solid Masonry and Concrete Anchors	Self-drilling expansion shields, or machine bolt expansion.

4. Junction, and Pull Boxes

a. Conforms	To UL-50 and UL-514A.
b. Cast metal	Where required by the NEC or shown, and equipped with rustproof boxes.

c. Sheet metal boxes	Galvanized steel, except where otherwise shown.
d. Flush mounted	Wall or ceiling boxes shall be installed with raised covers so that front face of raised cover is flush with the wall or ceiling. Surface mounted wall or ceiling boxes shall be installed with surface style flat or raised covers.

5. Telecommunications Pathways and Spaces - comply with TIA/EIA-569-A.

a. Cable trays	Shall be provided and utilized in the system to manage cable in an orderly fashion. Cable management shall be installed in racks and on walls as per OEM's recommendations. Appropriate fire barriers shall be placed around the cables in the sleeves, and unused sleeves shall be properly fire stop-ped.
b. Cable Duct	Equip with hinged covers, except where removable covers are allowed by specific authorization from the RE in writing.
c. Cable Duct Fittings	As recommended by the Cable Duct OEM.
d. Surface Metal Raceway	Shall conform to UL 5 and be " telecommunications service " rated with approved length-way partitions and cable straps to prevent wires and cables from changing from one partitioned pathway to another.
e. Surface Metal Raceway fittings	As recommended by the Raceway OEM.
f. Wireway, Metal or Approved Plastic	Shall be " telecommunications service " rated with approved length way partitions and cable straps to prevent wires and cables from changing from one partitioned pathway to another.
g. Wireway, Approved "Basket"	Shall be " telecommunications service " rated with approved length way partitions and cable straps to prevent wires and cables from changing from one partitioned pathway to another.
h. Wireway Fittings	As recommended by the Wireway OEM.

6. Interduct

- a. Outside plant innerduct may be plenum rated where each interduct is 3" (75 mm) and larger.
- b. Inside Plant Innerduct shall be listed and marked for installation in plenum airspaces and shall be a minimum 1.0" (25mm) inside diameter.
 - 1) Plenum innerducts shall be constructed of low smoke emission, flame retardant PVC.
 - 2) All Innerducts shall be furnished with factory installed nylon pull ropes.

- 3) Plenum innerducts shall have a UL 94 V-0 rating for flame spreading limitation.
- 4) All innerduct reel lengths shall be provided as necessary to insure that ducts are continuous; one piece runs from ENT to MH; MH to MH; DEMARC to MCR/TER; TR to TR. No innerduct connectors will be allowed between rooms.
- 5) Pulling accessories used for innerduct shall be compatible with materials being pulled. Accessories shall be furnished as required to complete the installation, including but not limited to, inner duct lubricants, spreaders, applicators, grips, swivels, harnesses, and line missiles (aka blown air).
- 6) Each segment of innerduct shall extend at least 12.0" (300mm) inches beyond the end of the service conduit tie and/or cable tray. Innerduct ends shall be neatly restrained with wall mount clamps and sealed when cable is installed.

K. WIRE LUBRICATING COMPOUND

1. Suitable for the wire insulation and conduit it is used, and shall not harden or become adhesive.
2. Shall not be used on wire for isolated type electrical power systems.
3. SHALL BE USED ONLY AT THE OEM'S DIRECTON FOR NURSE CALL, PA, FA, SECURITY MANAGEMENT AND OTHER LIKE EMERGENCY SYSTEMS.

L. FIREPROOFING TAPE

1. The tape shall consist of a flexible, conformable fabric of organic composition coated one side with flame-retardant elastomer.
2. The tape shall be self-extinguishing and shall not support combustion. It shall be arc-proof and fireproof.
3. The tape shall not deteriorate when subjected to water, gases, salt water, sewage, or fungus and be resistant to sunlight and ultraviolet light.
4. The finished application shall withstand a 200-ampere arc for not less than 30 seconds.
5. Securing tape: Glass cloth electrical tape not less than 0.18 mm (7 mils) thick, and 19 mm (3/4 inch) wide.

M. WARNING TAPE - conform to Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape // detectable // non-detectable // type, red with black letters, and imprinted with "CAUTION BURIED COMMUNICATIONS CABLE BELOW".

2.5 WIRE MANAGEMENT SYSTEM AND EQUIPMENT

A. Wire Management System: The system(s) shall be provided as the man-agement center of the respective cable system: TER, MCR, TR, HE, SCR, ECC, EMCC, etc. It

shall perform as a platform to house peripheral equipment in a standard relay rack(s), equipment, distribution, in-terface cabinet(s) and wall mounting boards, panels or rails. It shall be arranged in a manner as to provide convenient access to all instal-led Facilities Management Service (FMS), OI&T and other equipment.

1. All cables and connections shall be at the rear and/or top of each system interface to conduits, patch panels, punch blocks, wire wrap strips, barrier strip, etc.
2. Each system shall be custom configured to meet the System design and user needs. The MIN required is a rack, cabinet, or wall mounted TIA/EIA 19" wide and two RUs high.

B. Wire Management Equipment - the wire management equipment shall be the focal point of each wire management system. It shall provide an orderly interface between outside and inside wires and cables (where used), distribution and interface wires and cables, inter-connection wires and cables and associated equipment, jumper cables, and provide a uniform connection media for all system fire retardant wires and cables and other subsystems.

1. It shall be fully compatible and interface to each cable tray, duct, pathway, wireway, or conduit used in the system.
2. All interconnection or distribution wires and cables shall enter the system at the top (or from a wireway in the floor) via a over-head protection system and be uniformly routed down either side (or both at the same time) of the frames side protection system then laterally via a anchoring or routing shelf for termination on the rear of each respective terminating assembly.

a. Vertical Cable Management	Required, 4" X 5" duct style MIN, mounts to side or between 19" equipment racks, mounts in the front or rear of equipment racks or cabinets, contains cover to protect cables, has slots on each side for cable ingress and egress.
(1) Wall Brackets	Required - 19" wide and 6" deep MIN, accepts and mounts stand-ard TIA/EIA 19" wide patch pa-nels, mounting blocks, etc., hinged on one side to allow rear cable access.
(2) Floor Frames	Required - in very high density cable locations (ie PBX, TER, TR, MCR rooms), single or dou-ble sided metal construction, bold mountable for floor appli-cations, compatible for 300 pair, 66, 110 or 110A blocks, maintains MIN 6" high vertical cable channels, prevents opens, crosses or shorts in cables attached to it

b. Horizontal Cable Management	
(1) Combination Organizers	TIA/EIA minimum Category 5E, 19" rack width, in one RU (1.75") multiples to suite system design, front and rear cable routing rings required, six MIN.
(2) Cable Bars	
(a) Flat type	Required - 19" rack width rear or front cabinet or rack mountable, contains cable tie bars and/or wire saddles.
(b) Duct type	Required - 19" rack width rear (1" X 4" MIN) or front (1 1/2" X 3" MIN) cabinet or rack mountable; alternate 2" X 4" MIN rear and 3" X 3" front MIN ducts are allowed, each duct in multiple of 1.0 RU (1.75") height.
(3) Cable Hangers	<u>ALLOWED TO SUPPLEMENT CONDUIT RUNS - DO NOT USE FOR EMERGENCY/ LIFE & PUBLIC SAFETY/ CRITICAL SERVICE COMMUNICATION CABLES - THESE ARE REQUIRED TO BE IN CONDUIT.</u>
(a) Wall Mountable	<u>WHEN APPROVED</u> - in open cable runs, 3" X 2.5" 2.5" MIN, wall or ceiling mountable, allows cables to be installed and removed from hanger, black color metal or high impact plastic construction MIN required.
(b) Bar Type	<u>WHEN APPROVED</u> - in open cable runs shall be compliment TO AC-CESS Type 66, 110 OR 110A block cable loops; screw mountable required.
(c) Rack Mountable	Required - above and or inside 19" cabinet panels where wire looms are not provided, allows quick cable attachment or removal, screw mountable.
(4) Cable Ladder	<u>WHEN APPROVED</u> - shall nominally be 12 in. (305 mm) wide, rung spacing of 9" (225 mm) and be certified / listed for telecommunications service.
(5) Cable Support	NRTL labeled for support of minimum Category 5E cabling, designed to prevent degradation of cable performance and pin - points that could damage cable.
c. Vertical or Horizontal Cable Management	
(1) Cable Ties	Required - 4" MIN length, black in color, ultraviolet resistant.
(2) Cable Tie Mounting Devices	
(a) Adhesive Backed	Required - square style 0.5" X 0.5" MIN, allows two MAX cable ties to be attached in either direction, attaches directly to metal or slick surfaces, requires additional screw

	when mounted to wood or wall back-board.
(b) Screw Type	Required - rectangle style 0.5" X 0.75" MIN, allows one cable tie to be attached in only one direction, requires wood or dry-wall screw for wall or backboard mounting or sheet metal screw for metal mounting.
(c) Screw Anchor Type	Required - rectangle style 0.5 X 0.75" MIN with mounting hole on one end, allows one cable to be attached in only one direction, requires wood or drywall screw for wall or backboard mounting or sheet metal screw for metal mounting.
(3) Cable Clips	WHEN APPROVED - in open CONDUIT runs, nail able or screw mount-able designed with arch to fit CONDUIT diameter without da-maging the CONDUIT; plastic white or black color allowed.
(7) Wire Spools	WHEN APPROVED - in open cable runs, round in design with flange on outside to prevent cables from falling off spool, screw mountable via center of spool
(8) Spiral Cable Wrapping	Required - when cable ties are not used to secure all cables, 0.5" OD MIN, weather proof Polyethylene construction MIN required, neatly bonds all loose cables in one bundle without damaging cables, allows cable to ingress and egress from the bundle through the wraps.
(9) Wire Clips and Clamps	Required - when cable ties are not used on short runs, ad-hesive backed, requires screw mounting to wall or back boards OR metal.
(10) Support Brackets	Provided with cable tie slots for fastening cable ties to Lacing Bars / Brackets.

2.6 ENVIRONMENTAL REQUIREMENTS:

- A. Technical submittals shall identify the environmental specifications for housing the system. These environmental specifications shall identify the requirements for initial and expanded system configurations for:
- B. Floor loading for batteries and cabinets.
- C. Minimum floor space and ceiling heights.
- D. Minimum size of doors for equipment passage.
- E. Power requirements: The bidders shall provide the specific voltage, amperage, phases, and quantities of circuits required.
- F. Air conditioning, heating, and humidity requirements. The Contractor shall identify the ambient temperature and relative humidity operating ranges required preventing equipment damage.
- G. Air conditioning requirements (expressed in BTU per hour, based on adequate dissipation of generated heat to maintain required room and equipment standards).

H. Proposed floor plan based on the expanded system configuration of the Contractor's proposed PBX (if used) for this Facility.

I. Conduit size requirement (between equipment room and console room).

2.7 INSTALLATION KIT:

A. The kit(s) shall be provided that, at a MIN, includes all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks, wiring blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, etc., required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire terminal or wiring block.

B. Unfinished or unlabeled wire connections shall not be allowed and the system will not be accepted if these types of practices are used.

C. All unused partially opened installation kit boxes, coaxial cable reels, conduit, cable tray, and /or cable duct bundles, wire rolls, and physical installation hardware shall be turned over to the RE. THIS IS NOT AN ACCEPTABLE ALTERNATE TO THE INDIVIDUAL SPARE EQUIPMENT UNLESS the MIN spare items are provided in these counts meets the levels described herein.

D. The MIN required installation kits are as follows:

FUNCTIONS	CHARACTERISTICS
1. System Grounding	The grounding kit shall include all cable and installation hardware required. All radio equipment shall be connected to earth ground via internal building wiring, according to the NEC. This includes, but is not limited to:
a. Coaxial Cable Shields and Center Conductor	Only use the Building's Outside Lightning Grounding System.
b. Coaxial / System Cable Lightning Protectors	Only use the Building's Outside Lightning Grounding System.
c. Control Cable Shields	Only use the Building's Inside Signal Grounding System.
d. Data Cable Shields	Only use the Building's Inside Signal Grounding System.
e. Equipment Racks	Only use the Building's Inside Signal Grounding System.
f. Equipment Cabinets	Only use the Building's Inside Signal Grounding System.
g. Conduits	Only use the Building's Inside Signal Grounding System.
h. Cable Duct	Only use the Building's Inside Signal Grounding System.

i. Cable Trays	Only use the Building's Inside Signal Grounding System.
j. Power Panels	Only use the Building's Inside Signal Grounding System
k. Connector Panels	Only use the Building's Inside Signal Grounding System
2. COAXIAL CABLES	The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tabbing, hangers, clamps, etc., required to accomplish a neat and secure installation.
3. WIRE AND CABLES	The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, wiring blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.
4. CONDUIT, CABLE DUCT AND CABLE TRAY	The kit shall include all conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, and/or cable tray installation in accordance with the NEC and this document.
5. EQUIPMENT INTERFACE	The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface systems and sub-systems according to the OEM requirements and this document.
6. LABELS / LABELING	The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to completely and correctly label each sub-system according to the OEM requirements, record drawings, and this document - see Labeling Kit, Part 2, Section 2.8.
7. WIRE MANAGEMENT	The wire management kit shall include any item (i.e. cable wrap, guides, hangers, holders, forms, etc.) in sufficient quantity to provide a neat and orderly wire and cable installation between and inside all system components.
8. DOCUMENTATION	The documentation requirement of the Installation Kit shall include any item or quantity of items, computer discs, record drawings, equipment, maintenance, and operation manuals, and OEM materials needed to completely and correctly provide the system documentation as required by this specification document and explained herein.

2.8 LABELING

- A. Labels: Provide labeling for equipment, new cabling and termination hardware located within the Facility in accordance with TIA/EIA-606. Handwritten labeling is unacceptable. Stenciled lettering for cable and termination hardware shall be provided using (thermal ink trans-fer process) (laser printer) (other _____).
1. Cable Tag Installation: Install cable tags for each TIP cable or wire located in manholes, handholes, and vaults including each splice. Tag new wire and cable provided under this contract and existing wire and cable which are indicated to have splices and terminations provided by this contract. The labeling of TIP cable tag identifiers shall be in accordance with TIA/EIA-606. Do not provide handwritten letters. Install cable tags so that they are clearly visible without disturbing any cabling or wiring in the manholes, handholes, and vaults.
 2. Equipment Labels: System equipment shall be permanently labeled with contrasting plastic laminate or Bakelite material. System equipment shall be labeled on the face of the unit corresponding to its source. Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two (2) sheet-metal screws or two (2) rivets (Alternates to the nameplates will be considered during the technical submittal approval process).
 3. Clearly, consistently, logically and permanently mark switches, connectors, jacks, relays, receptacles and electronic and other equipment.
 4. Engrave and paint fill all receptacle panels using 1/8" (minimum) high lettering and contrasting paint.
 5. For rack-mounted equipment, use engraved Lamacoid labels with white 1/8" (minimum) high lettering on black background. Label the front and back of all rack-mounted equipment.
 6. Where multiple pieces of equipment reside in the same rack group, clearly and logically label each indicating to which room, channel, receptacle location, etc. they correspond.
 7. Permanently label cables at each end, including intra-rack connections. Labels shall be covered by the same, transparent heat-shrink tubing covering the end of the overall jacket. Alternatively, computer generated labels of the type which include a clear protective wrap may be used.
 8. Contractor's name shall appear no more than once on each continuous set of racks. The Contractor's name shall not appear on wall plates or portable equipment.

B. Ensure each OEM supplied item of equipment has appropriate NRTL (aka UL) Labels / Marks for the service the equipment is performed permanently attached / marked. EQUIPMENT INSTALLED NOT BEARING THESE MARKS WILL NOT BE ALLOWED TO BE A PART OF THE SYSTEM. THE CONTRACTOR SHALL BEAR ALL COSTS REQUIRED TO PROVIDE REPLACEMENT EQUIPMENT WITH APPROVED UL MARKS.

2.9 COMMUNICATIONS SYSTEM GROUND:

- A. In addition to the requirements outlined in SECTION 27 05 26 - GROUNDING AND BONDING FOR COMMUNICAITONS SYSTEMS, the contractor shall provide a circulating system "Signal Ground" that is separate from other Facility grounding systems (i.e. electrical, lightning, building, etc.) as described herein.
- B. Proper communications system grounding and bonding shall be provided for each: SPDP of Presence, ENTR (DEMARC), TER, TOR, MCR, MCOR, PCR, SCC, ECR, EMCR, STR(s), HER, TRs, TCOs; and insure all internal telecommunications equipments installed in these areas are connected to it as described herein.
- C. Reference shall be made to proper codes and standards, such that all grounding systems must comply with all applicable National, Regional, and Local Building and Electrical codes. The most stringent code of these governing bodies shall apply.
- D. Technical Characteristics

1. Connectors	Enclosed Circular Coated, Sealed and Plated Copper MIN #0 AWG Lug, or as specified by the RE
2. Wire	Stranded Copper # 0 AWG (minimum) with protective jacket, or as specified by the RE

2.10 LIGHTNING PROTECTION SYSTEM/GROUND:

- A. In addition to SECTION 26 41 00 - FACILITY LIGHTNING PROTECTION requirements, the contractor shall provide a lightning protection connection system for the communications systems / circuits totally and externally to the building. The use of internal electrical or signal grounding systems is not acceptable and will not be approved. The Contractor shall provide this system if it is not previously provided as a part of the contract.
- B. System Building Inputs, Aerial Cables and Underground Cables: These locations and equipment items shall be grounded with cooper wire run external to the building and connected to the earth ground. If the location and/or equipment item is to be installed in an area not protected by lightning rods or if the location and / or equipment item is to be elevated above existing lightning rod protection, the Contractor shall immediately notify the RE in writing regarding the lightning strike hazard.
- C. Technical Characteristics

1. Connections	To the Facility's Lightning Protection System as required by the RE (if no Facility system is present - the contractor shall provide a separate Minimum #0 AWG stranded copper wire grounding cable secured and connected outside of the building to the earth as specified by the RE)
2. Connectors	Enclosed Circular Coated, Sealed and Plated Copper Minimum #0 AWG Lug, or as specified by the RE
3. Signal Wire/ Cable Grounding Protectors	Provided according to the OEM's recommendations for the specific cable, circuit or system's wires and cables. Each protector shall be connected to the lightning protection system as aforementioned.

D. System Building Inputs, Aerial Cables and Underground Cables: These locations and equipment items shall be grounded with cooper wire run external to the building and connected to the earth ground. If the location and/or equipment item is to be installed in an area not protected by lightning rods or if the location and / or equipment item is to be elevated above existing lighting rod protection, the Contractor shall immediately notify the RE in writing regarding the lightning strike hazard.

E. Technical Characteristics

Connections	To the Facility's Lightning Protection System as required by the RE (if no Facility system is present - the contractor shall provide a separate Minimum #0 AWG stranded copper wire grounding cable secured and connected outside of the building to the earth as specified by the RE)
Connectors	Enclosed Circular Coated, Sealed and Plated Copper Minimum #0 AWG Lug, or as specified by the RE
Grounding Protectors	Provided according to the OEM's recommendations for the specific cable, circuit or system's wires and cables. Each protector shall be connected to the lightning protection system as aforementioned.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. The Contractor shall use the criteria and requirements of this PART to complete the detailed installation of the System. The Design shall include computer RF modeling and site surveys as described herein. The Contractor shall be able to show design RF signal level(s) to sub-room precision for all room(s) /area(s) within the approved defined coverage area(s). The RE shall provide the Contractor with compatible drawings from the project Architect. If the drawings

are within BIM then it is the responsibility of the Contractor to modify the BIM Model for use in their wireless modeling which shall include, at a minimum, the creation of 2-D Floor Plans, Reflected Ceiling Plans (RCP) and elevations.

B. GENERAL SYSTEM INSTALLATION

1. After the contract's been awarded, and within the time period specified in the contract, the Contractor shall deliver the total system in a manner that fully complies with the requirements of this specification. The Contractor shall make no substitutions or changes in the System without written approval from the RE and PM.
2. The Contractor shall install all equipment and systems in a manner that complies with accepted industry standards of good practice, OEM instructions, the requirements of this specification, and in a manner which does not constitute a safety hazard. The Contractor shall insure that all installation personnel understands and complies with all the requirements of this specification.
3. The Contractor shall provide written verification to the RE at time of installation, that the type of wire/cable being provided is recommended and approved by the OEM. The Contractor is responsible for providing the proper size and type of cable duct and/or conduit and wiring even though the actual installation may be by another subcontractor.
4. Active electronic component equipment shall consist of solid state components, be rated for continuous duty service, comply with the requirements of FCC and NRTL standards for DAS equipment, systems, and service.
5. All passive distribution equipment shall meet or exceed -80 dB radiation shielding specifications.
6. All passive equipment shall be connected according to the OEM's specifications to insure future correct termination, isolation, impedance match, and signal level balance at each telephone/data outlet.
7. The Contractor shall install suitable filters, traps, directional couplers, splitters, TR's, and pads for minimizing interference and for balancing the System. Items used for balancing and minimizing interference shall be able to pass DAS control, Lightwave (fiber optic) // , RF// , Video// , HDTV// , Security// , Emergency// , Safety// and _____ // signals in the frequency bands selected, in the direction specified, with low loss, and high isolation, and with minimal delay of specified frequencies and signals. The Contractor shall provide all equipment necessary to meet the requirements outlined herein and the System performance standards.

8. Noise filters and surge protectors shall be provided for each equipment interface cabinet, switch equipment cabinet, control console, local, and remote active equipment locations to ensure protection from input primary AC power surges and noise glitches are not induced into low Voltage data circuits.
9. Where TCOs are installed adjacent to each other, install one outlet for each instrument.
10. All lines shall be terminated in a suitable manner to facilitate future expansion of the System as described (re 50% and expansion information) described in PART 2, PARAGRAPHS 2.4.A; 2.4.B.5; 2.4.B.8.c; 2.4.F.3.d.20; 2.4.F.3.e.3); 2.4.J.6 & 2.4.J.7 . There shall be a minimum of one (1) spare:
 - a. 25 pair UTP cable (current installed AWG),
 - b. 25 pair STP control cable (current installed AWG),
 - c. Six (6) pair single mode fiberoptic cable,
 - 1) 8/125-um; 0.10 Aperture; 1,300-nM; per TIA 492CAAA,
 - 2) 8/125-um; 0.10 Aperture; 1,550-nM; per TIA 492E000,
 - d. 12 pair multi-mode fiberoptic cable,
 - 1) 62.5/125-um; per TIA 4922AAA, 472D000, and ICEA S-87-640,
 - 2) 50/125-um; Optically Enhanced American (not European) Standard; per TIA 492AAAB.
 - e. Each cable shall be provided at each distribution point shown on the TIP drawings.
11. Terminating resistors or devices shall be used to terminate all unused branches, outlets, equipment ports of the System, and shall be devices designed for the purpose of terminating fiber optic or twisted pair // , and coaxial // // , and lightwave // cables carrying telephone and data // , and analog // signals in telephone and data // , and analog video // // , and lightwave // systems.
12. Equipment installed outdoors shall be weatherproof or installed in weatherproof enclosures with hinged doors and locks with two matching keys (NOTE ALL CABINET LOCKS SHALL BE VENDING MACHINE TYPE LOCKS LIKE KEYED WITH INDOOR CABINETS).
13. Equipment installed indoors shall be installed in metal cabinets with hinged doors and locks with two matching keys (NOTE ALL CABINET LOCKS SHALL BE VENDING MACHINE TYPE LOCKS LIKE KEYED WITH OUTDOOR CABINETS).
14. All interconnecting twisted pair, fiberoptic // or coaxial // cables shall be terminated on equipment terminal boards, punch blocks, breakout boxes, splice blocks, and unused equipment ports/taps shall be terminated according to the

OEM's instructions for telephone cable systems without adapters. The Contractor shall not leave unused or spare twisted pair wire, fiberoptic //, or coaxial // cable unterminated, unconnected, loose or unsecured

15. Color code all distribution wiring to conform to the Telephone Industry standard, EIA/TIA, and this document, whichever is the more stringent. At a minimum, all equipment, cable duct and/or conduit, enclosures, wiring, terminals, and cables shall be clearly and permanently labeled according to and using the provided record drawings, to facilitate installation and maintenance.
16. Connect the System's primary input AC power to the Facility' Critical Branch of the Emergency AC power distribution system as shown on the plans or if not shown on the plans consult with RE regarding a suitable circuit location prior to bidding.
17. Plug-in connectors shall be provided to connect all equipment, except coaxial cables and interface points. Coaxial cable distribution points and RF transmission lines shall use coaxial cable connections recommended by the cable OEM and approved by the System OEM. Base-band cable systems shall utilize barrier terminal screw type connectors, at a minimum. Crimp type connectors installed with a ratchet type installation tool are and acceptable alternate as long as the cable dress, pairs, shielding, grounding, and connections and labeling are provided the same as the barrier terminal strip connectors. Tape of any type, wire nuts, or solder type connections are unacceptable and will not be approved.
18. All equipment faceplates utilized in the System shall be stainless steel, anodized aluminum, or UL approved cycolac plastic for the areas where provided.

B. CONDUIT AND SIGNAL DUCTS

1. Conduit

- a. The Contractor shall employ the latest installation practices and materials. The Contractor shall provide conduit, junction boxes, connectors, sleeves, weather heads, pitch pockets, and associated sealing materials not specifically identified in this document as GFE. Conduit penetrations of walls, ceilings, floors, interstitial space, fire barriers, etc., shall be sleeved and sealed. The minimum conduit size shall be as described herein.
- b. All telecommunications emergency, critical, life support and safety cables shall be installed in separate conduit and/or signal ducts (exception from the separate conduit requirement to allow telecommunications cables to be

installed in telecommunications approved partitioned cable tray may be granted in writing by the RE if requested). The determination as to which SECTION 27 & 28 SYSTEM ARE RATED FOR EMERGENCY SERVICE CAN BE FOUND IN PART 1 OF THIS DOCUMENT. Conduits shall be provided as described herein and in accordance with Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and NEC Articles 517 for Critical Care and 800 for Communications systems, at a minimum.

- c. When metal, plastic covered, etc., flexible cable protective armor or systems are specifically authorized to be provided for use in the System, their installation guidelines and standards shall be as specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.
 - d. When "innerduct" flexible cable protective systems is specifically authorized to be provided for use in the System, it's installation guidelines and standards shall be as the specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.
 - e. Conduit (including GFE) fill shall not exceed 40%. Each conduit end shall be equipped with a protective insulator or sleeve to cover the conduit end, connection nut or clamp, to protect the wire or cable during installation and remaining in the conduit. Electrical power conduit shall be installed in accordance with the NEC. AC power conduit shall be run separate from communications conduit.
 - f. Ensure that Critical Care Nurse Call, PA, DAS, Radio Paging, Police Two-Way Radio, Police Security Management, Emergency and Safety Systems (as identified by NEC Section 517 & 800; and UL) are completely separated and mechanically protected from all other systems by conduit and approved telecommunications partitioned cable tray or baskets.
2. Signal Duct, Cable Duct, or Cable Tray
- a. The Contractor shall use existing conduit, signal duct, cable duct, and/or cable tray, when identified and approved by the RE.
 - b. Approved signal and/or cable duct shall be a minimum size of 100 mm x 100 mm (4 in. X 4 in.) inside diameter with removable tops or sides, as appropriate. Protective sleeves, guides or barriers are required on all sharp corners, openings, anchors, bolts or screw ends, junction, interface and connection points.
 - c. Approved cable tray shall be fully covered, mechanically and physically telecommunications approved partitioned for multiple electronic circuits

use, and be NRTL listed and labeled for use with telecommunication circuits and/or systems. The RE shall approve width and height dimensions.

C. CONNECTORS: Circuits, transmission lines, and signal extensions shall have continuity, correct connection and polarity. A uniform polarity shall be maintained between all points in the system.

1. Wires:

- a. Wire ends shall be neatly formed and where insulation has been cut, heat shrink tubing shall be employed to secure the insulation on each wire. Tape of any type is not acceptable.
- b. Audio spade lugs shall be installed on each wire (including spare or unused) end and connect to screw terminals of appropriate size barrier strips.
- c. AC barrier strips shall be provided with a protective cover to prevent accidental contact with wires carrying live AC current.
- d. Punch blocks are approved for signal, not AC wires.
- e. Wire Nut or "Scotch Lock" connectors are not acceptable for signal wire installation.

2. Cables: Each connector shall be designed for the specific size cable being used and installed with the OEM's approved installation tool. Typical system cable connectors include; but, are not limited to: Audio spade lug, punch block, wire wrap, etc.

3. Line or Microphone Audio: Each connector shall be installed according to the cable or connector OEM's instructions and use the OEM's approved installation tool. Install the connector's to provide and maintain the following audio signal polarity:

- a. XLR type connectors Signal or positive conductor is pin 3; common or neutral conductor is pin 2; ground conductor is pin 1.
- b. Two and 3 conductor 1/4" Signal or positive conductor is tip; neutral or 1/8" Phono plugs conductor is ring and ground or shield and jacks conductor is sleeve.
- c. RCA Phono Plugs the Signal or positive conductor is tip; and Jacks neutral or shield conductor is sleeve.

4. Speaker Line Audio:

- a. Each connector shall be installed according to the cable, transformer or speaker OEM instructions and using the OEM's approved installation tool. The Contractor shall ensure each speaker is properly phased and connected in the same manner throughout the System using two conductor type wires.

- b. One of the conductors shall be color coded to aid in establishing speaker signal polarity. Each speaker line shall be permanently soldered or audio spade lug connected to each appropriate speaker or line matching transformer connection terminal. Speaker line connection to each audio amplifier shall use audio spade lugs, as described herein.
- D. AC POWER: AC power wiring shall be run separately from communications cable.
- E. GROUNDING (SEE PARAGRAPH 2.9 HEREIN FOR THIS REQUIREMENT)
- F. EQUIPMENT ASSEMBLY
- 1. Cabinets: Each cabinet/enclosure shall be: floor or wall mounted with standard knockout holes for conduit connections or cable entrance; provide for ventilation of the equipment; have front and rear locking doors (except wall mounted cabinets that require only a front locking door); power outlet strip(s), and connector or patch panel(s).
 - a. Rack (including freestanding radio relay) mounted equipment shall be installed in the enclosure's equipment adjustable mounting rails with equipment normally requiring adjustment or observation mounted so operational adjustment(s) can be conveniently made.
 - 1) Heavy equipment shall be mounted with rack slides or rails allowing servicing from the front of the enclosure. Heavy equipment shall not depend only upon front panel mounting screws for support.
 - 2) Equipment shall be provided with sufficient cable slack to permit servicing by removal of the installed equipment from the front of the enclosure.
 - 3) A color matched blank panel (spacer) of 44 mm (1.75 in.) high, shall be installed between each piece of equipment (active or passive) to insure adequate air circulation.
 - 4) The enclosure shall be designed for efficient equipment cooling and air ventilation. Each console or cabinet shall be equipped with a quiet fan and non-disposable air filter.
 - b. Enclosures and racks shall be installed plumb and square. Each shall be permanently attached to the building structure and held firmly in place. Fifteen inches of front vertical space opening shall be provided for additional equipment.
 - c. Signal connector, patch, and bulkhead panels (i.e.: audio, data, control, analog video, etc.) shall be connected so that outputs from each source, device or system component shall enter the panel at the top row of jacks, beginning left to right as viewed from the front, which will be called "inputs". Each connection to a load, device or system component shall exit

the panel at the bottom row of jacks, beginning left to right as viewed from the front, which will be called "outputs".

- d. Equipment located indoors shall be installed in metal racks or enclosures with hinged doors to allow access for maintenance without causing interference to other nearby equipment.
 - e. Cables shall enter the equipment racks or enclosures in such a manner that allows all doors or access panels to open and close without disturbing or damaging the cables.
 - f. All distribution hardware shall be securely mounted in a manner that allows access to the connections for testing and provides sufficient room for the doors or access panels to open and close without disturbing the cables.
2. UPS: It is acceptable to power all TER, MCR, TR & STRs FMS Equipment from single battery backup system, in lieu of individual cabinet mounted UPS, as long as the system performance standards are met.
- a. If this option is used it is acceptable to provide one AC input surge protector to isolate the battery backup system from the Facility's Emergency AC Generator Circuit as long as it is properly sized and the system performance standards are met; AND has electrical supervision provided as described herein.

G. LABELING/LABELS (SEE PARAGRAPH 2.8 HEREIN FOR THIS REQUIREMENT)

H. LIGHTNING PROTECTION SYSTEM (SEE PARAGRAPH 2.10 HEREIN FOR THIS REQUIREMENT)

3.2 TESTS

- A. INTERIM INSPECTION: At approximately 40-50% of installation at the direction of the CFM PE, PM, SRE or RE (Additional inspection(s) may be required at the direction of the CFM PE, PM, SRE or RE):
- 1. This inspection shall verify the equipment and system being provided adheres to the installation and technical requirements of this document.
 - a. The interim inspection will be conducted by an OEM and factory-certified contractor representative; AND witnessed by a CFM RE Staff Member(s), Facility AND SMCS 0050P2H3 Representatives.
 - b. Each item of installed equipment shall be checked to insure appropriate NRTL (UL) listing labels and markings are in place.
 - c. This inspection shall verify cabling terminations in all telecommunications and head end rooms and at workstation locations adhere to color code for T568B // T568A // pin assignments and cabling connections are in compliance with ANSI/EIA/TIA standards.

- d. Visually confirm Category 5e // ----- // cable marking at TCOs, CCSs locations and patch cords.
- 2. The entire communications circulating ground system and each TGB, the separate earth ground point and lightning protection system shall be reviewed.
- 3. Cable tray, conduit and path/wire-way installation practice shall be reviewed.
- 4. Perform fiber optical cable field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.

SPEC WRITER NOTE (DO NOT DELETE): Two methods for measuring the installed single mode fiber optic cable plant are described in ANSI/EIA/TIA-526-7. Method A uses optical power measurement equipment. Method B uses an optical time domain reflector (OTDR). Method B is not recommended for installations containing branching devices and/or isolators. ANSI/EIA/TIA-526-14 does not recommend using a OTDR for testing multimode fiber optic cables. Building Industry Consulting Service International (BICSI) recommends using

- 5. The Contractor shall notify the RE, in writing, of the estimated date the Contractor expects to be ready for the interim inspection, at least 20 working days before the requested inspection start date.
- 6. Results of the interim inspection shall be provided to the CFM PE, PM, SRE and RE.
 - a. If major or multiple deficiencies are discovered, a second interim inspection may be required before permitting the Contractor to continue with the system installation until the present deficiency(s) are corrected.
 - b. The SRE or RE shall determine if an additional inspection(s) is/are required: OR if the Contractor will be allowed to proceed with the installation.
 - c. In either case, re-inspection of the deficiency(s) noted during the interim inspection(s), will be part of the proof of performance test final acceptance test.
 - d. The interim inspection shall not affect the Systems' completion date unless directed by the CFM PE, PM, SRE and RE.
 - e. The Facility Contracting Officer shall ensure all test documents become a part of the Systems' documentation.

B. PRETESTING: Upon completing the installation of the System, the Contractor shall align and balance the system. The Contractor shall pretest the entire system.

1. Pretesting Procedure:

- a. During the system pretest, the Contractor shall verify (utilizing the approved spectrum analyzer and test equipment) that the System is fully operational and meets all the system performance requirements of this standard.
- b. The Contractor shall pretest and verify that all System functions and specification requirements are met and operational, no unwanted aural effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise, etc. are present. The Contractor shall measure and record the aural carrier levels of each system DAS and data channel, at each of the following points in the system:
 - 1) Utility Provider Entrance.
 - 2) Buried Conduit Duct(s) locations (if required).
 - 3) Manhole(s) & Grab Boxes (if required).
 - 4) ENR (aka DEMARC).
 - 5) PBX (if used) Interconnections.
 - 6) MCR Interconnections.
 - 7) MCOR Interconnections.
 - 8) TER Interconnections.
 - 9) TOR Interconnections.
 - 10) PCR Interconnections.
 - 11) ECR Interconnections.
 - 12) SCR Interconnections.
 - 13) System interface(s) in locations listed herein.
 - 14) System Grounding.
 - 15) Waterproofing.
 - 16) UPS Areas.
 - 17) Other(s) as required by AHJ (SMCS 0050P2H3).

2. The Contractor shall provide four (4) copies of the recorded system pretest measurements and the written certification that the System is ready for the formal acceptance test shall be submitted to the RE.

C. ACCEPTANCE TEST: After the System has been pretested and the Contractor has submitted the pretest results and certification to the RE, then the Contractor shall schedule an acceptance test date and give the RE 30 days written notice prior to the date the acceptance test is expected to begin.

1. The System shall be tested in the presence of a Government Representative, SMCS 0050P2H3 and an OEM certified representative. The System shall be tested utilizing the approved test equipment to certify proof of performance and Life Safety compliance.
2. The System shall be tested to certify proof of performance and FCC compliance. The test shall verify that the total System meets all the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.
3. The acceptance test shall be performed on a "go-no-go" basis. Only those contractor minor adjustments required to show proof of performance shall be allowed.
 - a. The test shall demonstrate and verify that the installed System does comply with all requirements of this specification under operating conditions.
 - b. The System shall be rated as either acceptable or unacceptable at the conclusion of the test.
 - c. Failure of any part of the System that precludes completion of system testing, and which cannot be repaired in four (4) hours, shall be cause for terminating the acceptance test of the System. Repeated failures that result in a cumulative time of eight (8) hours to affect repairs shall cause the entire System to be declared unacceptable.
4. If it is determined the system will require retesting, System Retest shall be rescheduled at the convenience of the Government and all costs borne by the Contractor at the direction of the SRE.

D. Acceptance Test Procedure

1. Physical and Mechanical Inspection
 - a. The Government Representative(s) and SMCS 0050P2H3 will tour all major areas where the System is and all sub-systems are completely and properly installed to insure they are operationally ready for proof of performance testing. A system inventory including available spare parts will be taken at this time. Each item of installed equipment shall be checked to ensure appropriate UL certification labels are affixed.
 - b. The System diagrams, record drawings, equipment manuals, Telecommunications Infrastructure Plant (TIP) Auto CAD Disks, intermediate, and pretest results shall be formally inventoried and reviewed.
 - c. Failure of the System to meet the installation requirements of this specification shall be grounds for terminating all testing.

2. Operational Test

- a. After the Physical and Mechanical Inspection of each DAS location listed in 3.2.D.1, terminating, mounting and interface equipment shall be checked to verify that it meets all FCC requirements outlined herein. A spectrum analyzer shall be utilized to accomplish this requirement.
- b. The DAS Cable distribution system shall be checked at each interface, junction, and distribution point to insure all meets the standards outlined herein.
- c. Each DAS location shall be functionally tested at the same time utilizing the Spectrum Analyzer.
- d. Once these tests have been completed, each installed DAS sub-system function shall be tested as a unified, functioning and fully operating system.

3. Individual Item Test: The VACO SMCS 0050P2H3 Government Representative will select individual items of DAS equipment for detailed proof of performance testing until 100% of the System has been tested and found to meet the contents of this specification. Each DAS item shall meet or exceed the minimum requirements of this document

E. Test Conclusion: (see Part 1.13.A.3 for VA "Conditions of Acceptance"): At the conclusion of the Acceptance Test, using the generated punch list (or discrepancy list) the VA and the Contractor shall jointly agree to the results of the test, and reschedule testing on deficiencies and shortages with the RE. Any retesting to comply with these specifications will be done at the Contractor's expense.

1. Please refer to PART 1, PARAGRAPH 1.13 VA ACCEPANCE OF SYSTEM MOU, CONTRACTORS WARRANTY / GUARANTEE: SUB-PARAGRAPH 1.13.A.3 for VA Conditions of System Acceptance.
2. If the System is declared unacceptable without conditions, all rescheduled testing expenses will be borne by the Contractor.

F. CONNECTING TO THE IWS / DAS SYSTEM

1. The Contractor shall manage and collect all FCC License / Listings and provide them to the RE and VAMC Chief of FMS when VA's accepts the System.
2. MANAGE EACH WSP'S CONNECTION TO THE SYSTEM: The Contractor shall represent the VAMC during negotiations with each WSP, insure all VA / GSA Land Management and Conditional Use Permits / Agreements are completed and approved by VA (VA Chief of FMS will provide appropriate forms), coordinate site preparation, assist with each WSPs' installation, and coordinate connection of each WSP to the System. Each WSP's integration to the System,

shall be turn-key and shall include BDS(s), donor antenna(s), installation materials/equipment, wire management and updated system drawings.

3. MANAGE EACH VAMNC CONNECTION(S) TO THE SYSTEM: The Contractor shall coordinate site preparation, assist with each pre approved FMS installation, and coordinate connection of each FMS radio / wireless system to the System. Each FMS integration to the System, shall be turn-key and shall include BDS(s), donor antenna(s), installation materials/equipment, wire management and updated system drawings.
4. MANAGE ADDITIONAL SERVICE CONNECTION(S) TO THE SYSTEM: The Contractor shall represent the VAMC during negotiations with each Service, insure all VA / GSA Land Management and Conditional Use Permits / Agreements are completed and approved by VA (VA Chief of FMS will provide appropriate forms), coordinate site preparation, assist with the Service installation, and coordinate connection of each Service to the System. Each Service integration to the system, shall be turn-key and shall include BDS(s), donor antenna(s), installation materials/equipment, wire management and updated system drawings.

3.3 TRAINING: IN ADDITION TO THE TRAINING PROVIDED IN ACCORDANCE WITH ARTICLE, INSTRUCTIONS, OF SECTION 01 00 00, GENERAL REQUIREMENTS):

- A. Furnish the services of a factory-trained engineer or technician for a total of two (2) each four (4) hour classes to instruct designated Facility personnel. Instruction shall include cross connection, corrective, and preventive maintenance of the System and equipment.
- B. Before the System can be accepted by the VA, this training must be accomplished. Training will be scheduled at the convenience of the Facilities Contracting Officer and Chief of Engineering Service.
- C. Training shall be provided for the particular equipment(s) or system(s) as required in each associated specification and described as follows:
 1. A training schedule shall be developed and submitted by the contractor and approved by the RE at least 30 days prior to the planned training.
 2. Provide thorough training of all staff assigned to those units receiving new DAS (other) communications equipment(s) and system(s). A separate training room will be set up that allows this type of individualized training utilizing in-service training unit, prior to opening of the new Facility //or cut over of the new system//.
 3. Provide the following minimum training times and durations:

- a. Four (4) Weeks prior to the Facility opening for Engineering Staff (in 8-hour increments) - split evenly over 3 weeks and day and night shifts. Coordinate schedule with the RE and Facility Manager (aka Chief of FMS).
- b. One (1) Week prior to the Facility opening for IT Staff (in 8-hour increments) - both day and night shifts. Coordinate schedule with the RE and IT Staff Supervisor or Manager.
- c. During the Facility opening four (4) hours for supervisors and system administrators. Coordinate schedule(s) with the Facility's Chief of Staff (CoF) or other CoF designated individual(s).

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