



UNITED STATES MARINE CORPS
MARINE AIR GROUND TASK FORCE TRAINING COMMAND
MARINE CORPS AIR GROUND COMBAT CENTER
BOX 788100
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SEP 02 2008

COMBAT CENTER ORDER 2010.1

From: Commanding General
To: Distribution List

Subj: MARINE AIR GROUND TASK FORCE TRAINING COMMAND (MAGTFTC), MARINE
CORPS AIR GROUND COMBAT CENTER (MCAGCC) INTERIM TELECOMMUNICATIONS
DESIGN STANDARDS

Ref: (a) DODD 4640.13 Management of Base and Long-Haul Telephone
Equipment and Services
(b) MCO P11000 Real Property Facilities Manual
(c) MCO P2066.1 Marine Corps Installation Telephone Equipment
(d) MCO 2400 Marine Corps Management of the Radio Frequency
Spectrum
(e) MCO 11000.25 Installation GeoSpatial Information and Services

Encl: (1) MAGTFTC - MCAGCC TELECOMMUNICATIONS DESIGN STANDARDS

1. Situation. Telecommunications and Information Systems are governed by multiple Public Law, Department of Defense (DoD), Department of the Navy (DoN), and service policy and directives. Reference (a) establishes DoD policy for management of Base and Long Haul Telecommunications Equipment and Services. Reference (b) provides Marine Corps policy and procedures for facilities real property of which telecommunications infrastructure and facilities is part. Reference (c) provides policy for telephone services aboard Marine Corps Installations. Reference (d) establishes the policy for Radio Frequency Spectrum management for the Marine Corps. Reference (e) establishes the Marine Corps Geospatial Information Services program. Telecommunications and Information Systems policy is also included in DoD, DoN and service directives in the 2000, 5000 and 8200 series.

2. Mission. Implement design, installation and operating standards for Telecommunications and Information Systems for all information technology (IT) fixed plant resources procured, developed, operated, maintained, or managed on board MCAGCC and for MAGTFTC.

3. Execution

a. Commander's Intent and Concept of Operations

(1) Commander's Intent. Implement comprehensive Telecommunications and Information Systems design, installation and operating standards for all fixed plant communications and information systems and associated infrastructure hosted by MAGTFTC, MCAGCC to ensure the efficient, effective and compliant installation, operation and full

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life cycle support. All command fixed plant telecommunication systems and associated infrastructure must be compliant with DOD, Defense Information Service Agency (DISA) Global Information Grid (GIG)/Defense Information Service Network (DISN), DoN, and Marine Corps Enterprise Network (MCEN) policies and standards.

(2) Concept of Operations

(a) Telecommunication and information infrastructure and systems as specified in references (a) through (d) is tasked to the command and installation Command Information Officer/Senior Telecommunications Manager. For MAGTF/TC, MCAGCC that oversight is assigned to the Assistant Chief of Staff G-6 (AC/S G-6). A key function of telecommunications and information systems oversight is the comprehensive management of existing and new telecommunications and/or information system from design, installation, operation and resulting full life cycle support.

(b) All fixed plant telecommunication infrastructure and information systems require service and command certification and accreditation prior to being granted Authority to Operate and when necessary integration into the Marine Corps Enterprise Network (MCEN) and/or Defense Information Systems Network via an Authority to Connect. Ensuring telecommunications infrastructure and information systems certification and accreditation is the responsibility of the Commanding General's assigned Designated Approving Authority (DAA).

b. Subordinate Element Missions. Overarching command responsibilities include:

(1) AC/S G-6. Implement and administrator all telecommunications design standards in accordance with higher headquarters policy and approved MCAGCC Design Standards.

(2) Designated Approving Authority (DAA), MAGTF/TC, MCAGCC. Ensure all telecommunications and information systems and associated infrastructure are certified and accredited for installation and operation throughout their respective life cycle aboard the Combat Center.

(3) Assistant Chief of Staff G-4. Ensure telecommunications infrastructure and information systems support for all military construction and facility sustainment and restoration projects are coordinated through the AC/S G-6.

(4) MAGTF/TC, MCAGCC General/Staff. Ensure all telecommunications infrastructure and information systems hosted by their respective organizations are coordinated through A/CS G-6 and are designed, installed and operated through their life cycle in accordance with the MCAGCC Design Standards.

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4. Administration and Logistics. Distribution Statement B directives issued by the Commanding General are distributed via e-mail upon request.

This Order can be viewed at:

<http://www.29palms.usmc.mil/dir/manpower/adj/ccotoc.asp>.

5. Command and Signal

a. Command. This Order is applicable to Active Duty, Reserve and Civilian Personnel on board MCAGCC.

b. Signal. This Order is effective the date signed.



R. J. ABLITT
Chief of Staff

CCO 2010.1

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MARINE AIR GROUND TASK FORCE TRAINING COMMAND
MARINE CORPS AIR GROUND COMBAT CENTER
TELECOMMUNICATIONS DESIGN STANDARDS

Enclosure (1)

SEP 02 2008

RECORD OF CHANGES

IDENTIFICATION OF
CORRECTION OR CHANGE

DATE OF CHANGE

DATE OF ENTRY

ENTERED BY

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REFERENCES

<u>Directive NO.</u>	<u>SUBJECT</u>
a. ASN RDA	Assist Sec of the Navy Research Development and Acquisition (ASN RDA) Memorandum of 8 Oct 2004
b. CCO 5239.2	"Information Technology Related Procurements" Combat Center Order 5239.2 Marine Air Ground Task Force Training Command (MAGTFTC), Marine Air Ground Combat Center (MCAGCC Information Assurance Program (IAP)
c. CCO 5090.4	National Environment Policy Act (NEPA) Compliance
d. CJCSM 6510.01	Defense in Depth: Information Assurance and Computer Network Defense (CND)
e. DAA	Designated Approving Authority (DAA) HQMC ltr, 5239 C4/IA dtd 8 Jan 07
f. DoD 8570.01-M	Information Assurance Workforce Improvement Program, 19 Dec 2005
g. DODD 4640.13	Management of Base and Long-Haul Telephone Equipment and Services
h. DoDD 8100.1	Global Information Grid (GIG) Overarching Policy
i. DoDD 8100.02	Use of Commercial Wireless Devices, Services, and Technologies in the Department of Defense (DoD) Global Information Grid (GIG)
j. DODD 8100.2	Use of Commercial Wireless Devices, Services and Technologies in the DOD Global Information Grid, April 14, 2004
k. DODD 8500.1	Information Assurance (IA)
l. DODI 8500.2	Information Assurance (IA) Implementation
m. FAA-STD-019D	Lighting and Surge Protection, Grounding, Bonding and Shielding Requirements for Facilities and Electronic Equipment
n. FAA-STD-020B	Transient Protection, Grounding, Bonding and Shielding Requirements for Electronic Equipment
o. JCSI 6510.01D	Information Assurance and Computer Network Defense, 15 June 2004
p. JTF-GNO	Washington DC 162000ZNOV2006 "DoD Information Operations Condition (INFOCON) Global INFOCON Level 4
q. IA OPDir 046-07	"Log Retention for Critical Devices (U)
r. IA OPDir 074-07	"INFOCON 5" Implementation
s. IAED 014	Wireless Networks
t. OPSTD 017	INFOCON Implementation
u. OPSTD 008	Update to removable secondary storage media device
v. OPSTD 010	Unauthorized Disclosure and Electronic Spillage Handling
w. IAED 014	Marine Corps Information Assurance Enterprise Directive 014, 6 July 2007
x. MCO 5239.2	Marine Corps Information Assurance Program (MCIAP)

y. MCO P5530.14	Marine Corps Physical Security Program Manual
z. MCO 2400.2X	Marine Corps Management of the Radio Frequency Spectrum
aa. MARADMIN 348/06	"Use of Data Protected By "The Privacy Act"
ab. MARADMIN 389/07	"Disposal Procedures For Documents Containing Personally Identifying Information"
ac. MARADMIN 473/01	"Revised Information Procurement Approval Process"
ad. MARADMIN 486/06	"Information Technology (IT) Funding, Approval and Procurement"
ae. MARADMIN 490/03	"Revised USMC Software Baseline Waiver Process"
af. MARADMIN 631/06	"Crypto Login (CLO) Exception Management Tool (EMT) Administration 30 Dec 2006
ag. MARADMIN 590/05	"Update to Removable Secondary Storage Media Device Policy" 14 Dec 2005
ah. MIL-STD-188-124B	Grounding, Bonding and Shielding for Common Long Haul/Tactical Communication Systems Including Ground Based Communications- Electronics Facilities and Equipments
ai. MCO 2400	Marine Corps Management of the Radio Frequency Spectrum
aj. MCO P11000	Real Property Facilities Manual
ak. MCO 11000.25	Installation Geo-Spatial Information and Services
al. MCO P2066.xx	Marine Corps Installations Telephone Systems
am. MCO P2066.1	Marine Corps Installation Telephone Equipment
an. NAVFAC Inst 11010.32	Navy Facilities Manual
ao. UFGS 00 01 15	List of Drawings
ap. UFGS 01 30 00	Administrative Requirements
aq. UFGS 01 32 01.00 10	Project Schedule
ar. UFGS 01 32 16.00 20	Design and Construction Progress Documentation
as. UFGS 01 35 23.00 40	Owner Safety Requirements
at. UFGS 27 05 14.00 10	Cable Television Premises Distribution System
au. UFGS 27 05 28.36 40	Cable Trays for Communications Systems
av. UFGS 27 10 00	Building Telecommunications Cabling System
aw. UFGS 27 15 19.00 10	Wire Line Data Transmission System
ax. UFGS 27 21 00.00 20	Intercommunication System
ay. UFGS 27 21 10.00 10	Fiber Optic Data Transmission System
az. UFGS 27 31 00.00 20	Administrative Telephone Equipment, Inside Plant
ba. UFGS 28 05 26	Grounding and Bonding for Electronic Safety and Security
bb. UFGS 31 23 00.00 20	Excavation and Fill
bc. UFGS 33 82 00	Telecommunications Outside Plant (OSP)
bd. UFGS 40 95 33.23 20	Fiber Optic (FO) Outside Plant (OSP)
be. UFGS 40 95 33.23 40	Fiber Optic Process Control Networks
bf. UFC 1-300-02	Unified Facilities Guide Specifications (UFGS) Format Standard

bg. UFC 3-580-01	Telecommunications Building Cabling Systems Planning and Design
bh. UFC 3-580-10	Navy and Marine Corps Intranet (NMCI) Standard Construction Practices
bi. UFC 3-600-01	Fire Protection Engineering for Facilities
bj. UFC 3-600-02	O&M: Inspection, Testing, and Maintenance of Fire Protection Systems
bk. UFC-4-133-01N	
bl. SECNAV M-5239.1	Department of the Navy Information Assurance Program
bm. SECNAVInst 5000.36	DoN Data Management and Interoperability
bn. SECNAVINST 5211.5E	"Department of the Navy Privacy Program"

CHAPTER 1
TELECOMMUNICATIONS CODES AND STANDARDS

1-1 Code and Standards References. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

- ASTM B 1 - (2001) Hard-Drawn Copper Wire
- ASTM B 8 - (2004) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- ASTM D 1557 (2002e1) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
- ASTM D 709 (2001) Laminated Thermosetting Materials

ELECTRONIC INDUSTRIES ALLIANCE (EIA)

- ANSI/TIA/EIA-455-107A (1999) Component Reflectance or Link/System Return Loss using a Loss Test Set
- ANSI/TIA/EIA-455-204 (2000) FOTP-204 Measurement of Bandwidth on Multimode Fiber
- ANSI/TIA/EIA-455-46A (1990) FOTP-46 Spectral Attenuation Measurement for Long-Length, Graded-Index Optical Fibers
- ANSI/TIA/EIA-455-59A (2000) FOTP-59 Measurement of Fiber Point Discontinuities Using an OTDR
- ANSI/TIA/EIA-455-61A (2000) FOTP-61 Measurement of Fiber or Cable Attenuation Using an OTDR
- ANSI/TIA/EIA-455-B (1998) Test Procedures for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and other Fiber Optic Components (ANSI)
- ANSI/TIA/EIA-472D000-A (1993) Fiber Optic Communications Cable for Outside Plant Use
- ANSI/TIA/EIA-492AAAA-A (1998) 62.5-um Core Diameter/125-um Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers (ANSI/TIA/EIA-492AAAA-A)
- ANSI/TIA/EIA-492AAAB (1998; R2002) 50-Um Core Diameter/125-Um Cladding Diameter Class IA Graded-Index Multimode Optical Fibers
- ANSI/TIA/EIA-492CAAA (1998; R 2002) Class IVA Dispersion-Unshifted Single-Mode Optical Fibers
- ANSI/TIA/EIA-492E000 (1998; R 2002) Class IVd Nonzero-Dispersion Single-Mode Optical Fibers for the 1550 nm Window (ANSI/TIA/EIA-492E000)

ANSI/TIA/EIA-526-14A (1998) OFSTP-14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant (ANSI/TIA/EIA-526-14A)

ANSI/TIA/EIA-526-7 (1998) OFSTP-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant (ANSI/TIA/EIA-526-7)

ANSI/TIA/EIA-568-B.1 (2001; Addendum 2001) Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements (ANSI/TIA/EIA-568-B.1)

ANSI/TIA/EIA-568-B.2 (2001) Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Cabling Components (ANSI/TIA/EIA-568-B.2)

ANSI/TIA/EIA-568-B.3 (2000; Addendum 2002) Optical Fiber Cabling Components Standard (ANSI/TIA/EIA-568-B.3)

ANSI/TIA/EIA-569-A (1998; Addenda 2000, 2001) Commercial Building Standards for Telecommunications Pathways and Spaces (ANSI/TIA/EIA-569-A)

EIA TIA/EIA-590-A (1997) Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant

ANSI/TIA/EIA-598-B (2001) Optical Fiber Cable Color Coding

ANSI/TIA/EIA-606-A (2002) Administration Standard for the Telecommunications Infrastructure (ANSI/TIA/EIA-606)

ANSI/TIA/EIA-758 (1999; Addendum 1999) Customer-Owned Outside Plant Telecommunications Cabling Standard (ANSI/TIA/EIA-758)

TIA J-STD-607-A (2002) Commercial Building Grounding (Earthen) and Bonding Requirements for Telecommunications

EIA/TIA TSB-75 (1996) Additional Horizontal Cabling Practices for Open Offices

ANSI/TIA 222-G (2005) Structural Standards for Steel Antenna Towers and Antenna Supporting Structures

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2002) National Electrical Safety Code

IEEE Std 100 (2000) The Authoritative Dictionary of IEEE Standards Terms

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-87-640 (1999) Fiber Optic Outside Plant Communications Cable

ICEA S-98-688 (1997) Broadband Twisted Pair, Telecommunications Cable Aircore, Polyolefin Insulated Copper Conductors

ICEA S-99-689 (1997) Broadband Twisted Pair Telecommunications Cable Filled, Polyolefin Insulated Copper Conductors

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA C62.61 (1993) Gas Tube Surge Arresters on Wire Line Telephone Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2005) National Electrical Code

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 6 (2000) Commercial Blast Cleaning

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS 1755 Telecommunications Standards and Specifications for Materials, Equipment and Construction

RUS Bul 1751F-630 (2002) Underground Plant Design

RUS Bul 1751F-640 (1995) Design of Buried Plant, Physical Considerations

RUS Bul 1751F-643 (1996) Design of Aerial Plant

RUS Bul 1751F-815 (1979) Electrical Protection of Outside Plant

RUS Bul 1753F-201 (1997) Acceptance Tests of Telecommunications Plant (PC-4)

RUS Bul 1753F-401 (1995) Splicing Copper and Fiber Optic Cables (PC-2)

RUS Bul 345-50 (1979) Trunk Carrier Systems (PE-60)

RUS Bul 345-65 (1985) Shield Bonding Connectors (PE-65)

RUS Bul 345-72 (1985) Filled Splice Closures (PE-74)

RUS Bul 345-83 (1979; Rev Oct 1982) Gas Tube Surge Arrestors (PE-80)

UNDERWRITERS LABORATORIES (UL)

UL 467 (1993; Rev thru Apr 1999) Grounding and Bonding Equipment

UL 497 (2001) Protectors for Paired Conductor Communication Circuits

UL 510 (2005) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape

UL 83 (2003; Rev thru Mar 2004) Thermoplastic-Insulated Wires and Cables

UL 1286 (1993; Bul. 1998, R 1998) Office Furnishings

1-2 Related Requirements. All codes/standards and specifications stated in this document shall be considered the minimum requirements. All standards and specifications shall be implemented in order to provide a seamless integration in the MCAGCC environment. Where applicable the most stringent

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specification applies. Leased or Government Owned Relocatables shall be for single and double wide trailers only. Prefabricated buildings and triple wide trailers shall be treated as like facilities for a building. Prefabricated buildings and triple wide trailers do not fall within the standards of Chapter 6 of this document. Clarification can be obtained by contacting the Operations Section of the G6. All waivers shall be obtained, in writing, from the G6 prior to execution. Prior approval, in writing, shall be obtained prior to use of existing: space, infrastructure, services, pathways, and right of ways. Allow up to 90 calendar days to process, no exceptions.

1-3 Definitions. Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in TIA/EIA-568-B.1, TIA/EIA-568-B.2, TIA/EIA-568-B.3, TIA/EIA-569-A, TIA/EIA-606-A, and IEEE Std 100 and herein.

1-3.1 Campus Distributor (CD)/Main Distribution Frame (MDF). A distributor from which the campus backbone cabling emanates. International expression for main cross-connect - (MC). Main Distribution Frame (MDF) A physical structure at a central location for terminating permanent backbone cables to interconnect with service provider (SP) equipment at the activity minimum point of presence. The MDF generally includes vendor specific components to support voice and data circuits, building surge protector assemblies, main cross connect blocks, equipment support frames, and wood backboard (if MDF is wall mounted). Depending upon local site conditions, the MDF and BDF may be identical.

1-3.2 Entrance Facility (EF)/ Telecommunications Entrance Facility (TEF). An entrance to the building for both private and public network service cables (including antennae) including the entrance point at the building wall and continuing to the entrance room or space. Telecommunications Entrance Facility (TEF) The entrance facility is required to provide signal paths from the closest point of presence to the new facility, including free standing frames or backboards, interconnecting hardware, terminating cables, lightning and surge protection modules. The work consists of providing, testing and making operational cabling, interconnecting hardware and lightning and surge protection necessary to form a complete outside plant telecommunications system for continuous use. All entrance facilities must provide the correct interface between outside plant (cabling and infrastructure) to the inside plant (cabling and infrastructure).

1-3.3 Entrance Room (ER)/ Building Distribution Frame (BDF). A centralized space for telecommunications equipment that serves the occupants of a building. Equipment housed therein is considered distinct from a telecommunications room because of the nature of its complexity. Building Distribution Frame (BDF) A structure with terminations for connecting backbone, campus, and horizontal cabling. The BDF generally includes a cross connect, equipment support frame, and wooden backboard or terminal cabinet. The BDF shall include building protector assemblies when used for campus backbone or SP cabling.

1-3.4 Building Distributor (BD)/Telecommunications Room (TR). A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made. International expression for intermediate cross-connect - (IC). Telecommunications Room (TR) An enclosed space for telecommunications equipment, terminations, and cross-connect wiring for horizontal cabling.

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1-3.5 Pathway. A physical infrastructure utilized for the placement and routing of telecommunications cable.

1-3.6 Intermediate Distribution Frame (IDF). An intermediate termination point for horizontal wiring and cross-connections within telecommunications rooms or wiring closets.

1-3.7 Infrastructure. A collection of those telecommunications components, including equipment, that together provides the base support for the distribution of all information within a building and/or campus. The sub structure of all systems used to support the physical plant being installed. Can also include transport layers, and other electronics for distribution of information (voice, video, data).

1-3.8 Information Systems. Set of information resources organized for the collection, storage, processing, maintenance, use, sharing, dissemination, disposition, display, or transmission of information. Includes automated information system (AIS) applications, enclaves, outsourced IT-based processes, and platform IT interconnections.

1-3.9 Inside Plant (ISP). A collection of those telecommunications components, including equipment, that together provides the base support for the distribution of all information within a building. Includes Telecommunications electronics, patch panels, distribution frames, power supplies, telecommunications rooms, outlets, horizontal cabling and wireless devices.

1-3.10 Outside Plant (OSP). A collection of those telecommunications components, including equipment, that together provides the base support for the distribution of all information within a campus. The sub structure of all systems used to support the physical plant being installed. The outside plant also includes: cables, conduits, poles and other supporting structures. This also includes: Building Entrance Terminals (BET), pedestals, telecommunications huts, and cable vaults.

CHAPTER 2
ADMINISTRATIVE REQUIREMENTS

2-1 Contractor or Vendor Support. Communications and Information System Services and support for contractors/commercial vendors shall comply with current version of CCO 5239.2 (Reference (b)).

2-2 Telecommunications Qualifications. Work under this section shall be performed by and the equipment shall be provided by the approved telecommunications contractor and key personnel. Qualifications shall be provided for: the telecommunications system contractor, the telecommunications system installer, the supervisor (if different from the installer), and the cable splicing and terminating personnel. A minimum of 30 days prior to installation, submit documentation of the experience of the telecommunications contractor and of the key personnel.

2-3 Minimum Contractor Qualifications. Prior to installation, submit data of contractors experience and qualifications. Submit all certificates verifying IA and FISMA compliancy. Submit all documents verifying Authority to Operate (ATO), Authority to Connect (ATC), or Authority to Test (ATT). Submit Site Specific IA compliancy on contractor equipment, requested networks, or systems. All work under this section shall be performed by and all equipment shall be provided by a certified Telecommunications Contractor, hereinafter referred to as the Contractor. Work under this section shall be performed by and the equipment shall be provided by the approved telecommunications contractor and key personnel. Qualifications shall be provided for: the telecommunications system contractor, the telecommunications system installer, the supervisor (if different from the installer), and the cable splicing and terminating personnel. A minimum of 30 days prior to installation, submit documentation of the experience of the telecommunications contractor and of the key personnel. The Contractor shall have the following qualifications in Telecommunications Systems installation:

- Contractor shall have a minimum of 3 years experience in the application, installation and testing of the specified systems and equipment.

- All supervisors and installers assigned to the installation of this system or any of its components shall have factory certification from each equipment manufacturer that they are qualified to install and test the provided products.

- All installers assigned to the installation of this system or any of its components shall be Building Industry Consulting Services International (BICSI) Certified Cabling Installation Technicians, Installer Level 2, or have a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components. Include names and locations of two projects successfully completed using optical fiber and copper communications cabling systems. Include written certification from users that systems have performed satisfactorily for not less than 18 months. Include specific experience in installing and testing structured telecommunications distribution systems using optical fiber and Category 5e cabling systems.

- The telecommunications contractor shall be a firm which is regularly and professionally engaged in the business of the applications, installation, and testing of the specified telecommunications systems and equipment. The telecommunications contractor shall demonstrate experience in providing

successful telecommunications systems that include outside plant and broadband cabling within the past 3 years. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for the telecommunications contractor. Each of the key personnel shall have 3 years experience.

- All contractors must comply with current IA, FISMA, and Base policies.

2-4 Key Personnel Qualifications

2.4.1 General. Contractors will provide key personnel who are regularly and professionally engaged in the business of the application, installation and testing of the specified telecommunications systems and equipment. There may be one key person or more key persons proposed for this solicitation depending upon how many of the key roles each has successfully provided. Each of the key personnel shall demonstrate experience in providing successful telecommunications systems within the past 3 years.

2.4.2. Cable Splicers. Cable splicing and terminating personnel assigned to the installation of this system or any of its components shall have training in the proper techniques and have a minimum of 3 years experience in splicing and terminating the specified cables. Modular splices shall be performed by factory certified personnel or under direct supervision of factory trained personnel for products used.

2.4.3. Installer. Supervisors and installers assigned to the installation of this system or any of its components shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products.

2.4.4. Qualification Documentation. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for each of the key personnel. Documentation for each key person shall include at least two successful system installations provided that are equivalent in system size and in construction complexity to the telecommunications system proposed for this solicitation. Include specific experience in installing and testing telecommunications outside plant systems, including broadband cabling, and provide the names and locations of at least two project installations successfully completed using optical fiber and copper telecommunications cabling systems. All of the existing telecommunications system installations offered by the key persons as successful experience shall have been in successful full-time service for at least 18 months prior to the issuance date for this solicitation. Provide the name and role of the key person, the title, location, and completed installation date of the referenced project, the referenced project owner point of contact information including name, organization, title, and telephone number, and generally, the referenced project description including system size and construction complexity.

2.4.5. Employment Status. Indicate that all key persons are currently employed by the telecommunications contractor, or have a commitment to the telecommunications contractor to work on this project. All key persons shall be employed by the telecommunications contractor at the date of issuance of this solicitation, or if not, have a commitment to the telecommunications contractor to work on this project by the date that the bid was due to the Contracting Officer.

2-4.6. Key Personnel Approval. Note that only the key personnel approved by the Contracting Officer in the successful proposal shall do work on this solicitation's telecommunications system. Key personnel shall function in the same roles in this contract, as they functioned in the offered successful experience. Any substitution for the telecommunications contractor's key personnel requires approval from the Contracting Officer.

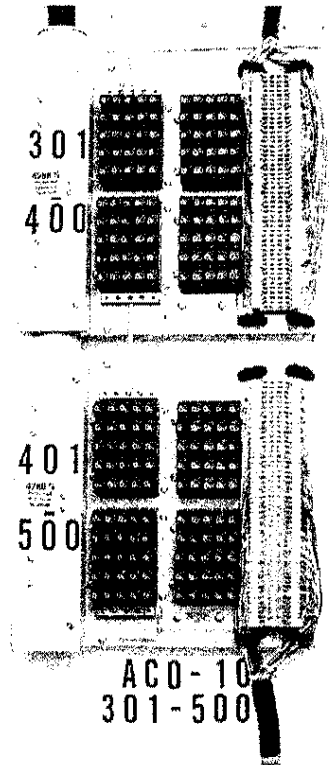
2-4.6. Key Personnel Approval. Note that only the key personnel approved by the Contracting Officer in the successful proposal shall do work on this solicitation's telecommunications system. Key personnel shall function in the same roles in this contract, as they functioned in the offered successful experience. Any substitution for the telecommunications contractor's key personnel requires approval from the Contracting Officer.

2-5 Standard Products. Provide materials and equipment that are standard products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship and shall be the manufacturer's latest standard design that has been in satisfactory commercial or industrial use for at least 2 years prior to bid opening. The 2 year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturer's catalogs, or brochures during the 2 year period. Products supplied shall be specifically designed and manufactured for use with outside plant telecommunications systems. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

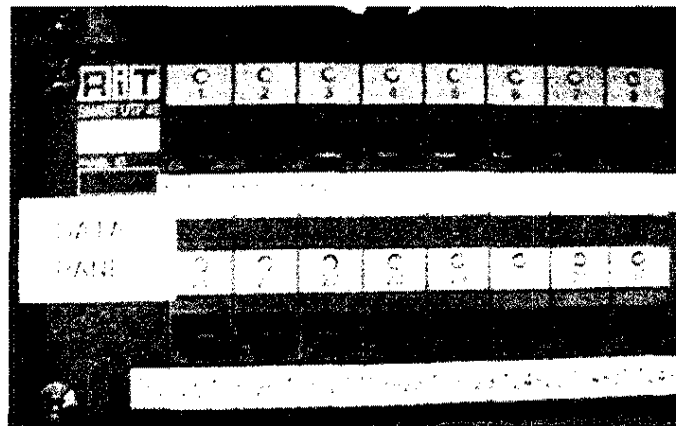
2-6 Alternative Qualifications. Products having less than a 2 year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, is provided.

2-7 Labeling Procedures. Visibility and Durability - The size, color and contrast of all labels should be selected to ensure that the identifiers are easily read. Labels should be visible during the installation of and normal maintenance of the infrastructure. Labels should be resistant to the environmental conditions at the point of installation (such as moisture, heat or ultraviolet light), and should have a design life equal to or greater than that of the labeled component. All labels shall be printed or generated by a mechanical device. All conduits, either empty or used, shall be clearly and permanently marked at both ends to indicate destination. Marking must be clearly visible after construction is completed. Examples are provided below:

BET:



Each rack will be numbered. Each patch panel shall be numbered from the top, descending. Patch panel ports: Label each port with room and jack number: (Example below)



Face plates: Label each drop with building number, room number and outlet as shown below:

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2133-102-025



TC1-1-1F

TOP: 2133 is the building number, 102 is the room number, and 025 is the jack number.

JACKS: White is for voice port, red is for data port.

BOTTOM: TC1 is the telecommunications room, 1 is the rack number, and 1F is the patch panel number.

Outside Plant Labeling Scheme:

- Cable Name
- Pairs/Count
- Cut dead (XD)

All fire stopping shall be tagged with a label that at a minimum documents the following information:

- | | |
|-------------------------------------|-----------------------------------|
| -Installed by | -Re-entered by |
| -Date | -Date |
| -Tech | -Tech |
| -UL System # | -State License # |
| -Cables Installed (type and number) | -Cables Installed (type & number) |

2-8 Material and Equipment Manufacturing Date. Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

2-9 Regulatory Requirements. In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

2-10 Independent Testing Organization Certificate. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

2-11 Delivery, Storage and Handling. MCAGCC Public Works Division shall approve all real estate, assigned for storage or operations aboard MCAGCC/MAGTFTC. Ship cable on reels in 5000 foot lengths for 25, 50 or 100 pair configuration and 1250 feet length for larger cables. Radius of the reel drum shall not be smaller than the minimum bend radius of the cable. Wind cable on the reel so that unwinding can be done without kinking the cable. Two meters of cable at both ends of the cable shall be accessible for testing. Attach permanent label on each reel showing length, cable identification number, cable size, cable type, and date of manufacture. Provide water resistant label and the indelible writing on the labels. Apply end seals to each end of the cables to prevent moisture from entering the cable. Reels with cable shall be suitable for outside storage conditions when temperature ranges from minus 40 degrees C to plus 65 degrees C, with relative humidity from 0 to 100 percent. Equipment, other than cable, delivered and placed in storage shall be stored with protection from weather, humidity and temperature variation, dirt and dust, or other contaminants in accordance with manufacturer's requirements.

2-12 Record Documentation

2-12.1. General. Provide the activity responsible for telecommunications system maintenance and administration a single complete and accurate set of record documentation for the entire telecommunications system with respect to this project. Provide T5 drawings including documentation on cables and termination hardware in accordance with TIA/EIA-606-A. T5 drawings shall include schedules to show information for cut-over and cable plant management, patch panel layouts, cross-connect information and connecting terminal layout as a minimum. T5 drawings shall be provided in both hard copy format and on electronic media using Windows based computer cable management software. A licensed copy of the cable management software including documentation shall be provided. Update existing record documentation to reflect campus distribution T0 drawings and T3 drawing schedule information modified, deleted or added as a result of this installation. Provide the following T5 drawing documentation as a minimum:

2-12.2 Cables. A record of installed cable shall be provided in accordance with TIA/EIA-606-A. The cable records shall include only the required data fields on the hard copy and the required data fields for each cable and complete end-to-end circuit report for each complete circuit from the assigned outlet to the entry facility for the soft copy in accordance with TIA/EIA-606-A. Include manufacture date of cable with submittal.

2-12.3 Termination Hardware. Provide a record of installed patch panels, cross-connect points, campus distributor and terminating block arrangements and type in accordance with TIA/EIA-606-A. Documentation shall include the required data fields in accordance with TIA/EIA-606-A.

2.13 Spare Parts

Provide a complete list of parts and supplies, with current unit prices and source of supply, and a list of spare parts recommended for stocking. Spare parts shall be provided no later than the start of field testing.

2-14 Warranty. The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

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2-15 Telecommunications Drawings. Provide approved drawings complete with wiring diagrams and details required to prove that the distribution system shall properly support connectivity from the telecommunications equipment room to telecommunications work area outlets. Show the entrance facility and layout of cabling and pathway runs, cross connect points, MDF, BDF, IDF, grounding system, terminating block arrangements and type. Drawings shall depict final telecommunications cabling configuration, including location, color coding, gage, pair assignment, polarization, and terminating blocks layout at cross connect points and patch panels after telecommunications cable installation. Provide a plastic laminated schematic of the as-installed telecommunications cable system showing cabling, MDF's, BDF's, IDF's, and equipment rooms keyed to floor plans by room number. Mount the laminated schematic in each telecommunications room as directed by the Contracting Officer. The Telecommunications Contractor will receive design approval from the Base G6 prior to installation. Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. Submittals shall include the nameplate data, size, and capacity. Submittals shall also include applicable federal, military, industry, and technical society publication references. Provide Outside Plant Design in accordance with TIA/EIA-758, RUS Bul 1751F-630 for aerial system design, RUS Bul 1751F-643 for underground duct system design and for direct buried system design. Provide T0 shop drawings that show the physical and logical connections from the perspective of an entire campus, such as actual building locations, exterior pathways and campus backbone cabling on plan view drawings, major system nodes, and related connections on the logical system drawings in accordance with TIA/EIA-606-A. Drawings shall include wiring and schematic diagrams for fiber optic and copper cabling and splices, copper conductor gage and pair count, fiber pair count and type, pathway duct and innerduct arrangement, associated construction materials, and any details required to demonstrate that cable system has been coordinated and will properly support the switching and transmission system identified in specification and drawings. Provide approved drawings of the telecommunications outside plant. Update existing telecommunication Outside Plant drawings to include information modified, deleted or added as a result of this installation in accordance with TIA/EIA-606-A. The telecommunications outside plant (OSP) shop drawings shall be included in the operation and maintenance manuals. Provide shop drawing showing layout of applicable equipment including incoming cable stub or connector blocks, building protector assembly, outgoing cable connector blocks and equipment spaces and racks. Provide T3 drawings for EF Telecommunications in accordance with TIA/EIA-606-A that include telecommunications entrance facility plan views, pathway layout (cable tray, racks, ladder-racks, etc.), mechanical/electrical layout, and cabinet, rack, backboard, and wall elevations. Drawings shall show layout of applicable equipment including building protector assembly, incoming cable connector blocks, patch panels and equipment spaces, and cabinet/racks. Drawings shall include a complete list of equipment and material, equipment rack details, proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation. Drawings may also be an enlargement of a congested area of T1 or T2 drawings. Provide T3 drawings for EF Telecommunications as specified in the paragraph

"Telecommunication Space Drawings" of Unified Facilities Guide Specifications (UFGS) Section 27 10 00 U, "Structured Telecommunications Cabling and Pathway Systems". The telecommunications entrance facility shop drawings shall be included in the operation and maintenance manuals.

2-16 Submittals. The following shall be submitted in accordance with current UFGS Section 01 33 00 "Submittal Procedures" and MCAGCC/MAGTFTC GIS Standards. All electronic submissions shall be formatted and configured in such a way, as to allow direct import to the MCAGCC G6 Master File.

- SD-02 Shop Drawings
- Telecommunications drawings
- Grounding and Bonding Drawings
- Cable Tray Drawings
- Inside Plant (ISP) Distribution
- Outside Plant (OSP) Distribution
- Seismic drawings
- Distribution frames
- Rack Elevations
- Telecommunications Outside Plant
- Telecommunications Cabling and Pathway Drawings
- Telecommunications Entrance Facility Drawings (includes AC or DC connects)
- Telecommunications Communications Rooms Drawings (includes AC or DC connects)
- SD-03 Product Data
- Telecommunications cabling (backbone and horizontal)
- Seismic parts and system applications
- Patch panels
- All types of wire and cable
- Cable splices and connectors
- Closures
- Cross-connect terminal cabinets
- Spare parts

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- Infrastructure (Towers, poles, manholes, hand holes and assemblages)
- All infrastructure (conduits, manholes, hand holes, poles, towers, support cables, mounting brackets, etc.)
- Telecommunications outlet/connector assemblies
- Equipment support frame
- Building protector assemblies
- Connector blocks
- Protector modules
- Grounding and Bonding (cabling and connector assemblies)
- SD-06 Test Reports
- Telecommunications cabling testing
- Grounding Tests
- System performance tests
- Factory reel tests
- Load test for infrastructure.
- Load tests and burn-in results for systems
- Furnish factory reel tests for optical fiber cables.
- SD-07 Certificates
- Contractor Qualifications
- Information Assurance Compliancy
- Federal Information Security Management Act Compliancy
- Manufacturer Qualifications
- Radio Frequency Spectrum Compliance Certifications
- Test plan
- SD-08 Manufacturer's Instructions
- Building protector assembly installation
- Cable tensions
- Seismic applications
- Grounding and/or bonding systems

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- Fiber Optic Splices
- Special products and new technology as identified by the Base G6.
- Submit instructions prior to installation.
- SD-10 Operation and Maintenance Data
- Telecommunications cabling and pathway system
- System operation and maintenance procedures

Submit operations and maintenance data in accordance with UFGS Section 01 78 23, Operation and Maintenance Data, as specified herein, and/ or as designated by the MCAGCC G6.

- SD-11 Closeout Submittals
- Record Documentation

2-17 Additional Submittal Requirements. All submittals of material, equipment and design must be approved by AC/S G6 for MCAGCC/MAGTFTC.

CHAPTER 3
TELECOMMUNICATIONS ROOMS AND FACILITIES

3-1 Telecommunications Entrance Facility

3-1.1 General. Building entrance facilities provide the point at which outside cabling interfaces with the intrabuilding backbone cabling. The physical requirements of the network interface are defined in the EIA/TIA-569. In accordance with NEC Article 800 Section 800-50 exception No.3 the entrance or outside building cables shall be terminated and protected on a listed primary protector within 50 ft. of entering the building. This room shall meet NEC Article Section 800-50 exception No. 3 for an Entrance room. It is from this room that feeder cables will be run to the Main Communication Room. A second option exists in that the outside plant cables can be transported through the building, in a straight run, encased in a conduit.

3-1.2 Entrance Facility. The entrance facility is required to provide signal paths from the closest point of presence to the new facility, including free standing frames or backboards, interconnecting hardware, terminating cables, lightning and surge protection modules. The work consists of providing, testing and making operational cabling, interconnecting hardware and lightning and surge protection necessary to form a complete outside plant telecommunications system for continuous use. All entrance facilities must provide the correct interface between outside plant (cabling and infrastructure) to the inside plant (cabling and infrastructure). Equipment housed therein is considered distinct from a telecommunications room because of the nature of its complexity. All telecommunications work must be coordinated with the Base G6 concerning layout and configuration of the EF telecommunications and OSP. The telecommunications contractor may be required to coordinate work effort for access to the EF telecommunications and OSP with the Base G6.

3-1.3 Multi-story Building. Any building that is multi-story or exceeds 9,000 square feet requires an entrance facility. All entrance facilities will be sized according to the requirements for the service being provided and the size of the facility. No Entrance Facility will be sized less than 10' x 8' x 8.5'.

3-1.4 Building Protector Assemblies. Building Protector Assemblies Building protector assembly shall be self-contained and have interconnecting hardware for connection to exterior cabling at full capacity. Provide manufacturers instructions for building protector assembly installation. Provide copper cable interconnecting hardware as specified in UFGS Section 27 10 00, "Structured Telecommunications Cabling and Pathway System". Provide in accordance with UL 497 3-electrode gas tube or solid state type 5 pin rated for the application. Provide gas tube protection modules in accordance with RUS Bul 345-83 and shall be heavy duty, 400 volt where A is the maximum single impulse discharge current, B is the impulse life and C is the AC discharge current in accordance with NEMA C62.61. The gas modules shall shunt high voltage to ground, fail short, and be equipped with an external spark gap and heat coils in accordance with UL 497. Provide the number of surge protection modules equal to the number of pairs of exterior cable of the building protector assembly. Minimum one wall should be covered with rigidly fixed 20mm (0.75 in.) A-C plywood.

3-1.5 Lighting. Minimum lighting same as telecommunication room. False ceilings shall not be provided.

3-1.6 Doors. Minimum requirements for doors, same as telecommunications room.

3-1.7 Electrical Power. Electrical power same as telecommunications room. No convenience receptacles mentioned.

3-1.8 Grounding. Grounding same as telecommunications room.

3-1.9 Fiber Optic Terminations. Provide fiber optic cable terminations that are compliant with current MAGTFTC G6 specifications.

3-1.10 Alternate Entrance Facility. Alternate entrance facility should be provided where security, continuity or other special needs exist.

3-1.11 Other Equipment. Equipment not related to the support of the entrance facility should not be installed in, pass through, or enter the telecommunications entrance facility.

3-2 Telecommunications Room

3-2.1 General. Any equipment, material, or service, which requires access by the building occupant, non-authorized maintenance personnel or outside agencies, is prohibited.

3-2.2 HVAC Services. HVAC services shall not use the Telecommunications Room space for pathways of ducts and pipes, other than those needed directly for environmental control of the room.

3-2.3 Multi-story Building. For multi-story buildings the Telecommunication rooms shall be vertically aligned, located at the bottom of the telecommunications riser system on the first floor. Telecommunications Rooms shall be located as close as practical to the center of the floor area being served.

3-2.4. Telecommunications Room Requirement. Each building will have a minimum of one Telecommunications Room on every floor, serving a maximum floor space of 9,000 square feet. The maximum horizontal cable length to the farthest outlet shall not exceed 295 feet. Should these limits need to be exceeded to provide service to any area of the building, additional Telecommunications Room(s) shall be required. These additional Telecommunications Room(s) shall be tied to the main Telecommunications Room with copper and fiber backbone cables terminated at each end to an appropriately sized patch panel. The copper cable minimum is 50 pair and the minimum multimode or single mode fiber is 24 strands. These requirements are subject to change based upon project requirements defined by the MAGTFTC G6. Telecommunications Rooms shall be located within the building as to avoid possible flooding, proximity to hazardous material storage, and exposure to sources of Electromagnetic Interference (transformers, generators, electrical motors, or transmitters).

3-2.5 Access. Telecommunications Rooms shall be accessible from a public corridor. Telecommunications Rooms shall not be ceiling accessible from adjacent rooms (except via approved connectivity pathways). Telecommunications Rooms shall not contain windows.

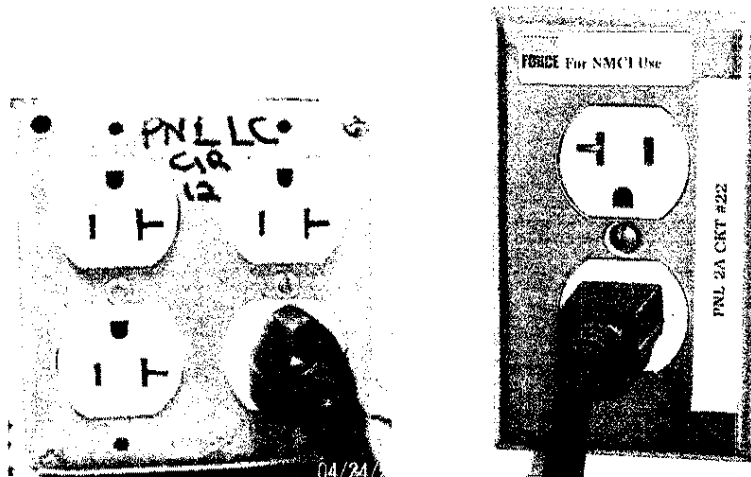
3.2.6 Size - Square Footage. The size of the Telecommunications Room is determined by the size and type of structure it supports. The minimum Room size is 10' x 8' x 8.5'.

3-2.7 Door Requirement. The door will open outward and be a minimum of 36" wide. Doors will be equipped with a Schlage compatible base-standard cipher lock.

3-2.8. Lighting. The Telecommunications Room will be equipped with independent lighting which provides a minimum of 500 lux (50 foot candles) measurable at 1 meter above the finished floor, within 1 meter of any racking.

3-2.9 Environmental Control. The Telecommunications Room will be equipped with environmental control to keep the temperature between 65 and 75 degrees farenheight and relative humidity between 30% and 55%, 24 hours per day, 7 days per week.

3-2.10 Electrical Power. The Telecommunications Room shall be equipped with a minimum of three, 3 wire 20 AMP Dedicated Data Circuits (DDC), 120V AC (non-switchable) quadraplex electrical outlets for equipment power. The outlets shall be marked as 20A DDC and with the panel and breaker number. (see example)

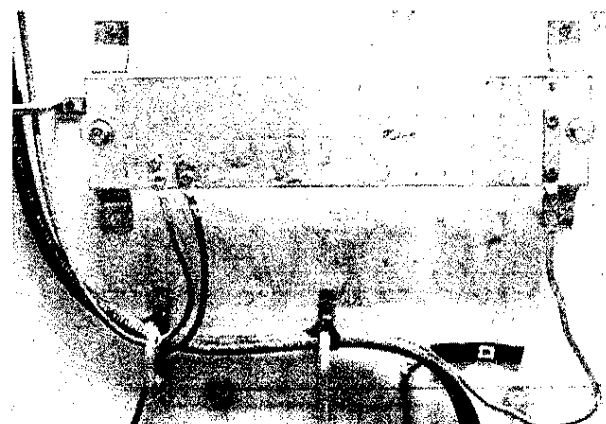


The Telecommunications Room shall be equipped with two, 3 wire 15A, 120V AC (non-switchable) duplex electrical outlet (for non-communications equipment). The Telecommunications Room shall be provided with at least one 4' x 8' x 1/4" AC grade plywood backboard that is painted with two coats of white fire-retardant paint on both sides. The plywood shall be fixed to the wall starting at finished floor level.

3-2.11 Painting. The walls and ceilings of Telecommunications Rooms shall receive 2 coats of a light colored anti-static paint. Sanding between coats is a mandatory requirement to achieve a static/dust free environment. The floor shall be a light colored static free covering (linoleum tile recommended). No carpet.

3-2.12 Grounding Bar. The Telecommunications Room will be equipped with a 4"x 10" x 1/4" copper ground bus bar that is permanently bonded to the electric service entrance panel by at least a 6 AWG green wire as directed by current National Electric Code (NEC) standards. Bus bars are to be drilled with parallel holes to accommodate 2-hole lugs. (see example) All Bus Bars will be located 6" to 18" below the ceiling, as to not interfere with Telecommunications cabling or Technician Work Space.

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3-2.13 Communications Rack. The Telecommunications Room will be equipped with at least one 7' tall 19" wide communications rack mounted to the floor. CPI 46353-503 or approved equal. Each communications rack will be equipped with 2 vertical cable management organizers. CPI 11729-503 or approved equal. The Telecommunications Room will be equipped with ladder racking to provide wire management and three-point seismic stability. All ladder racking and communications racks will be permanently bonded to the copper ground bus bar by individual 6 AWG green wire. All grounding cables will be installed with minimal bends as determined by the MAGTFTC G6. All equipment racks and ladder racking shall be secured to the building in at least three separate points to mitigate seismic effects. All installations shall conform to current seismic regulations as directed by Federal, State, and County codes.

3-2.14 Patch Panels. The Telecommunications Room will be equipped with Category 5E patch panels to terminate the incoming CO (Central Office) cable, data switch cables and all station outlets. Size and number to be determined by the G6. All patch panels will be bonded to the racks using a outward turned star washer, or bonded to the rack with a individual 6 AWG green wire. The Telecommunications Room will be equipped with patch cord organizers. All organizers shall be sized so that when 100% port capacity is accommodated, it does not exceed 80% fill ratio of the organizer. All connectors used for grounding and bonding within the Telecommunications Room(s) shall be crimped on or exothermically welded to the conductor. TMGB ground wire connectors will be 2-hole lugs. (see example)



3-2.15 Connecting Satellites. In facilities that require more than 1 Telecommunications Room, there shall be at least two 4" Intermediate Metal Conduit (IMC) connecting each satellite Telecommunications Room to the Main Telecommunications Room. These additional Telecommunications Rooms'

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grounding bus bars shall be bonded back to the TMGB in the Main Telecommunications Room. All Intermediate Metal Conduit (IMC) used in support of grounding cables will be bonded (6 AWG green wire minimum) to the ground cable at point of entry to the conduit and at point of exit. The Telecommunications Room will be equipped with category 5E patch cords. Number to be determined by the number of ports available for patching. Lengths will accommodate neat cable management.

3-3 Grounding and Bonding

3-3.1 General. Comply with the current UL 467, TIA J-STD-607-A, ANSI/TIA/EIA 607, ANSI T1.318, and NFPA 70. Components shall be identified as required by ANSI/TIA/EIA-606-A and ANSI/TIA/EIA 607-A. Ground rods shall not be used, in buildings, in support of Telecommunications. The preferred ground for the Telephone Main Grounding Bus (TMGB) bar will be to the Main Distribution Panel (MDP). All grounding and bonding conductors within the Telecommunications room will be green sheathed copper conductor, either stranded or solid, and labeled as suitable for use as such and tagged "DO NOT REMOVE". The minimum size of the TMGB shall be no smaller than 6awg (4.1mm (0.16in)). Direct attachment shall be to the closest point in the building's electrical service grounding electrode system. Public Works Department (PWD) shall approve all ground systems/configurations prior to install.

3-3.2 Telecommunications Bonding Backbone. Telecommunication Bonding Backbone (TBB) shall be established to connect the TMGB to the Telecommunications Grounding Busbar (TGB) located in the Telecommunications Rooms. On every floor a separate connection will be provided connecting one TGB to another. All metallic conduit used, will be bonded to the ground wire at the entry and exit point of the conduit. The TMGB serves as the dedicated extension of the building grounding electrode system for the telecommunications infrastructure. The TMGB shall be placed in the Entrance Facility. When no Entrance Facility exists the Base G6 will designate the appropriate Telecommunications Room. The TGB is the grounding connection point for telecommunications systems and equipment in the areas served by a telecommunications room. The TGB shall be bonded to the power bonding and grounding system (serving that room) to ensure the two systems maintain minimal potential difference.

3-3.3 Electrical Distribution Panel. When an Electrical Distribution Panel (EPD) is located in the same room as the TMGB or TGB, that EPD equipment grounding bus or the panel board enclosure shall be bonded to the TMGB or TGB.

3-3.4 Bonding Connections. Bonding connections will be comprised of Compression or exothermic. Mechanical connections can be used when connecting a conductor to equipment, raceways or cable trays. The three methods utilized to bond racks to ground are:

- Attach the equipment to a rack bonding conductor (RBC) that extends from the equipment rack/cabinet to the telecommunications equipment bonding conductor (TEBC) using an irreversible compression connector sized to match the conductor gauges or a NRTL listed grounding block. The TEBC is then bonded directly to the TMGB/TGB.

- Install a horizontal rack grounding busbar located at the top or bottom of the rack. Each piece of equipment in the rack/cabinet is bonded directly to the horizontal rack grounding busbar via a unit bonding conductor. The horizontal rack grounding busbar is then bonded to the telecommunications equipment bonding conductor via a rack bonding conductor using an irreversible compression connector sized to match the conductor gauges.

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- Install a vertical rack grounding busbar that runs almost the entire length of the rack/cabinet. The equipment is then bonded to the vertical rack grounding busbar via a short unit bonding conductor. The vertical rack grounding busbar is then bonded to the telecommunications equipment bonding conductor via a rack bonding conductor using an irreversible compression connector sized to match the conductor gauges.

3-3.5 Acceptable Bonding Systems. Due to the numerous systems supported at MCAGCC, all grounding and bonding systems must be applicable to the support requirements and its environment. Motorola R56 standard, TIA J-STD-607-A, MIL-STD-188-124B w/Change Notice 3) Grounding, Bonding and Shielding for Common Long Haul/Tactical Communication Systems Including Ground Based Communications- Electronics Facilities and Equipments, UFC-4-133-01N lists two FAA requirements for Navy Air Traffic Control Facilities, FAA-STD-019D Lightning and Surge Protection, Grounding, Bonding and Shielding Requirements for Facilities and Electronic Equipment and FAA-STD-020B Transient Protection, Grounding, Bonding and Shielding Requirements for Electronic Equipment are applicable.

CHAPTER 4
INSIDE PLANT (ISP)

4-1 PATHWAYS (BACKBONE AND HORIZONTAL). Standard, TIA/EIA-569-A.

4-1.1 General. Pathway shall be conduit, cable tray, under floor duct, access floor, and wireway installations. Provide grounding and bonding as required by TIA J-STD-607-A. Cable tray wiring shall comply with NFPA 70. All conduits entering the Telecommunications Room will be home run conduits and shall either extend up from the floor 3 to 4 inches or down from the ceiling 3 to 4 inches and will be bonded to the TMGB or TGB by a minimum number 6 green sheathed conductor. All penetrations will be sealed in accordance with code (fire-stopping). A minimum of two 3 inch conduits will be installed between the Main Telecommunications Room and any sub closets.

- All empty conduits shall be clearly and permanently marked at both ends to indicate destination. Marking must be clearly visible after construction is completed.

- A pull tape shall be left in all conduits after installations of the cables and in all empty conduits.

- For conduit runs, no more than 100' shall pass between pull boxes.

- The bend radius for conduit 2" or less is 6 times the internal conduit diameter, and 10 times the internal diameter for conduit greater than 2".

- All conduit pathways will have no more than two 90-degree bends between pull boxes.

- Minimum conduit size running to each individual station outlet, will be sized to accommodate all four individual runs in support of a quad outlet.

- Ream all conduit ends and fit them with insulated bushings to eliminate sharp edges.

- The maximum fill ratio is 40% for all horizontal pathways.

- All penetrations shall be sleeved.

- When pathways must cross sources of electromagnetic interference, it shall be perpendicular to the source, not gradually over a long distance.

- Communications pathway may not be affixed to other pathways or supported fixtures.

- When J-hooks are used they must be placed in a manner to support the cable spaced at 4' to 5' irregular intervals.

- A combination of J-hooks, conduit, and/or surface mounted raceway may be used to run the cable from the tray to the individual station outlet.

- Sharp metal edges in cable trays shall be smoothed and the cable dressed away from these edges.

- Horizontal pathways and supports shall not be used for the attachment of conduit or cable containing line voltage conductors, to include branch wiring.

- When cable is installed in a false ceiling space that is not readily accessible, access hatches shall be provided at 10' intervals (nominal).

- Whenever possible, an open cable tray system will be used in all buildings in order to facilitate expansion (adds, moves, and changes). When conditions exist that prohibit the use of a cable tray system, J-hooks and/or conduit may be used.

- All cable and station outlets shall be tested IAW TSB-67 (Basic Link only). TIA level III and IEC class E tester requirements (1 MHz 250 MHz) to be met. One hard copy and one electronic copy (Microsoft Word format) of test results shall be provided to the G-6 a minimum of 10 working days prior to the scheduled Final Inspection for the project. Testing is applicable to both commercial and residential wiring.

- All station outlets, cables, patch panels, and terminating hardware shall be clearly labeled in accordance with the labeling standards of this document.

- Each office space will have a minimum of 4 station outlets, one per wall. In large office areas or conference rooms the station outlets must be placed so there is no more than ten feet of separation between outlets. Station outlets are to be placed at 36" above finished floor.

- All category 5e cabling will be terminated on the communications rack(s). Twenty feet of slack wiring is to be left on the ladder rack after termination, in a "S" configuration. Cable slack will not be coiled. The white cabling will be terminated on the patch panel(s) designated as voice and the red cabling will be terminated on the patch panel(s) designated as data.

- All cable runs will be continuous with a maximum of 250' (cable length) from the station outlet to the communications rack.

- Each cable at the station outlet will be terminated on category 5e rated RJ-45 jacks using T568A configuration. Jacks will be white for voice and red for data.

- All cable will be 24 AWG unshielded twisted-pair rated at category 5e or higher. Each station outlet will consist of a minimum of two cables, 1 white cable for voice, and 1 red cable for data.

4-1.2 Work Area Pathways. Comply with TIA/EIA-569-A, except 1-inch diameter conduit. System furniture pathways shall comply with UL 1286. Horizontal cabling for open offices shall comply with EIA/TIA TSB-75.

4-1.3 Pull Boxes. Construct of galvanized sheet steel with screw-fastened covers. Minimum size of boxes shall be not less than 4-inches wide by 4-inches in length by 3-inches deep for individual 1-inch diameter conduit; minimum size of boxes shall be not less than 12-inches wide by 60-inches long by 12-inches deep for 4-inch conduit. Provide pull boxes where length of conduit exceeds 100 feet or where there are more than two 90 degree bends, or equivalent. Align conduit ends on opposite side of pull boxes. Provide pull

boxes in straight lengths of conduit; neither pull boxes nor conduit bodies shall be permitted in lieu of bends. All pull boxes must be accessible, for pull box sizing, refer to ANSI/TIA/EIA-569-A Table 5.2-

4-1.4 Bends. Inside radius of conduit bend shall be at least 6 times the internal diameter of conduit.

4-1.5 Telecommunications Outlet Boxes. Standard type 4 inches square by 2 1/8 inches deep with 1-inch diameter side knock-outs, with a single gang plaster ring. Mount flush in finished walls at height indicated. Outlet boxes for wall-mounted telephones shall be 2 by 4 by 2 1/8 inches deep; mounted at 60 inches above finished floor. Outlet boxes for handicapped telephone station shall be mounted at a height 48 inches above finished floor. Each station outlet will have a dual gang quad faceplate. All unused positions will be furnished with blank inserts (right gang when only 2 RJ-45's are specified).

4-1.6 Telecommunications Cabling. Cabling shall be UL listed for the application and shall comply with TIA/EIA-568-B.1, TIA/EIA-568-B.2, TIA/EIA-568-B.3 and NFPA 70. Provide a labeling system for cabling as required by ANSI/TIA/EIA-606-A and UL 969. Cabling manufactured more than 12 months prior to date of installation shall not be used. All cable will be ordered from the same "lot". 100' of cable will be provided to the G6, 30 calendar days, prior to testing and Quality Control Inspections. This cable will allow the G6 to test the cable and establish the baseline.

4-1.7 Backbone Copper. Standard, ICEA S-80-576, TIA/EIA-568-B.1, TIA/EIA-568-B.2 and UL 444, copper backbone cable shall be solid conductor, 24 AWG, 100 ohm, 100-pair UTP (Unshielded twisted pair), NFPA 70 CMR rated formed into 25 pair binder groups covered with a thermoplastic jacket. NFPA 70 type CMP may be substituted for type CMR. Pair twist-lengths and frequency per unit length shall be determined by the manufacturer. A minimum of two conductor twists per foot is required. Color coding shall comply with industry standards for 25 pair cables. One 4 pair 24 AWG Category 5e riser (CMR) rated cable will be installed between the MDF and each of the IDF's and terminated in the patch panel in the last position.

4-1.8 Backbone Optical Fiber. TIA/EIA-492AAAA-A, TIA/EIA-568-B.3, UL 1666, NFPA 70. Optical fiber cable shall be 62.5/125-um, 12-fiber multimode, terminated on ST type connectors, with a non-conductive optical fiber riser cable (OFNR) rating. Nonconductive optical fiber Plenum (OFNP) cable may be substituted for type nonconductive optical fiber riser cable (OFNR). The cable jacket shall be orange.

4-1.9 Horizontal Cabling. Comply with NFPA 70, NEMA WC 63.1, ICEA S-80-576 and performance characteristics in TIA/EIA-568-B.1. All cable will be ordered from the same "lot". 100' of cable will be provided to the G6, 30 calendar days, prior to testing and Quality Control Inspections. This cable will allow the G6 to test the cable and establish the baseline.

4-1.10 Horizontal Copper. TIA/EIA-568-B.2, NFPA 70, UTP (unshielded twisted pair), 100 ohm. Provide four each individually twisted pair, 24 AWG conductors, Category 5e general purpose cable, with a white or gray PVC jacket for jack one and a blue PVC jacket for jack two. Plenum (CMP) or riser (CMR) cable may be substituted for general purpose cable. If the cabling passes thru a plenum air space then plenum (CMP) rated cable is required.

4-1.11 Horizontal Optical Fiber. Standards, TIA/EIA-492AAAA-A, TIA/EIA-568-B.3, NFPA 70. Optical fiber cable shall be 62.5/125-um, 2-fiber multimode, rated nonconductive optical fiber cable (OFN). Plenum (OFNP) or riser (OFNR) cable may be substituted for general purpose cable. The cable jacket shall be orange and be of single jacket construction. If the cabling passes thru a plenum air space then plenum (CMP) rated cable is required.

4-2 Distribution Frames. Provide building distribution frames (BDF's), intermediate distribution frames (IDF's), and main distribution frames (MDF's) as shown on design drawings for terminating and cross connecting permanent cabling.

4-2.1 Building Protector Assemblies. Building protector assembly shall have connector blocks for connection to the exterior cable at full capacity.

4-2.2 Protector Modules. Standard: UL 497, RUS TECM 823, three-electrode gas tube or solid state type rated for the application. Provide the number of surge protection modules equal to the number of pairs of exterior cable of the building protector assembly.

4-2.3 Connector Blocks. Insulation displacement type, 110, for Category 5e and higher systems. Provide blocks for the number of backbone cables terminated on the block plus 25 percent spare.

4-2.4 Patch Panels. Provide ports for the number of horizontal cables terminated on the panel plus 25 percent spare. Provide pre-connectorized Optical fiber and copper patch cords for patch panels. Provide patch cords with connectors specified. Patch cords shall meet minimum performance requirements specified in TIA/EIA-568-B.1, TIA/EIA-568-B.2, TIA/EIA-568-B.3 for cables and hardware specified.

4-2.5 Fiber Optic Patch Panel. Provide panel for maintenance and cross-connecting of optical fiber cables. Panel shall be constructed of 2.2 mm minimum aluminum and shall be compatible with EIA 482.6 mm equipment racks. Each panel terminating backbone fiber optic cable shall provide SC multimode or single mode adapters. Adapters shall utilize metallic alignment sleeves. Provide dust cover for all unused adapters. The rear of each panel shall have a cable management tray a minimum of 203 mm deep with removable cover, incoming cable strain-relief and routing guides. Panels shall have each adapter factory numbered and be equipped with laminated plastic nameplates above each adapter.

4-3 Telecommunications Outlet/Connector Assemblies

4-3.1 Outlet/Connector Copper. Outlet/connectors shall comply with FCC Part 68.5, TIA/EIA-568-B.1, and TIA/EIA-568-B.2. UTP Outlet/connectors shall be UL 1863 listed, non-keyed, 4-pair, constructed of high impact rated thermoplastic housing and shall be third party verified and shall comply with EIA/TIA Category 5e requirements, Siemon's CT couplers, CT-F-C5-C5-20, or indicated color. Outlet/connectors provided for Category 5e UTP cabling shall meet or exceed the requirements for the cable provided. Outlet/connectors shall be terminated using a 110-style PC board connector, color-coded for both T568A and T568B wiring. Each jack shall be wired T568A as indicated. UTP outlet/connectors shall comply with TIA-455-21-A for 500 mating cycles.

- All cable will be 24 AWG unshielded twisted-pair rated at category 5e or higher. Each station outlet will consist of a minimum of two cables, 1 white cable for voice, and 1 red cable for data.

- Each cable at the station outlet will be terminated on category 5e rated RJ-45 jacks using T568A configuration. Jacks will be white for voice and red for data.

- All cable runs will be continuous with a maximum of 250' (cable length) from the station outlet to the communications rack.

- All category 5e cabling will be terminated on the communications rack(s). Twenty feet of slack wiring is to be left on the ladder rack after termination in an "S" configuration. No cables slack will be in a coiled configuration. The white cabling will be terminated on the patch panel(s) designated as voice and the red cabling will be terminated on the patch panel(s) designated as data.

- Each office space will have a minimum of 4 station outlets, one per wall. In large office areas or conference rooms the station outlets must be placed so there is no more than ten feet of separation between outlets. Station outlets are to be placed at 15" above finished floor.

- Each station outlet will have a dual gang quad faceplate. All unused positions will be furnished with blank inserts (right gang when only 2 RJ-45's are specified).

4-3.2 Cover Plates. Telecommunications cover plates shall comply with UL 514C, and TIA/EIA-568-B.1, TIA/EIA-568-B.2, TIA/EIA-568-B.3; flush or oversized design constructed of high impact thermoplastic, Siemon's CT4-FP-20, or indicated color. Stenciled lettering for voice and data circuits shall be provided using thermal ink transfer process.

4-4 Optical Fiber Distribution Panel. Wall or rack mounted optical fiber distribution panel (OFDP) shall be constructed of 2.2 mm minimum anodized aluminum. Panel shall be divided into two sections, distribution and user. Distribution section shall have strain relief, routing guides and shall be lockable, user section shall have a cover for patch cord protection. Each distribution panel shall provide 6 or 12 ST adapters. Adapters shall utilize metallic alignment sleeves. Provide dust covers for all adapters. User panels shall have MTRJ type connectors with dust covers.

4-4.1 Optical Fiber Connectors. Optical fiber connectors shall be MTRJ type for horizontal user.

4-5 Backboards. Provide void-free, interior grade plywood 19 mm (3/4 inch) thick as indicated. Backboards shall be fire rated, with the fire stamp visible, or covered with two coats of gray or a lighter color, nonconductive, fire-retardant paint.

4-6 Grounding and Bonding Products. Comply with UL 467, TIA J-STD-607-A, and NFPA 70. Components shall be identified as required by ANSI/TIA/EIA-606-A. Ground rods shall be in accordance with Section 26 51 00, "Interior Distribution System." The preferred ground for the Telephone Main Grounding Bus (TMGB) bar will be to the Main Distribution Panel (MDP). All grounding and bonding conductors within the Telecommunications room will be green sheathed copper conductor, either stranded or solid, and labeled as suitable for use as such and tagged "DO NOT REMOVE". The minimum size of the TMGB shall be no smaller than 4" by 10" by 1/4 inch thick.

4-7 Firestopping Material. Provide in accordance with "Fire stopping". Provide asbestos free fire stopping system capable of maintaining an effective barrier against flame and gases. System shall be UL listed and comply with ASTM E 814. Include UL system number UL listed print from manufacturer for each type of floor, wall, and ceiling penetration. All fire stopping systems shall be in compliance with current fire stopping systems used by the G6. Specifications will be provided upon request.

4-8 Nameplates. Provide nameplates for equipment rooms and telecommunications rooms doors in accordance with schedule provided on drawings. Provide equipment nameplates in accordance with Section 26 00 00, "Basic Electrical Materials and Methods".

4-9 Pathway System Installation. Telecommunications pathway systems, including the horizontal and backbone pathway systems, telecommunications outlet/connector assemblies, and associated hardware shall be installed in accordance with TIA/EIA-568-A, TIA/EIA-569-A, NFPA 70, and UL standards as applicable. Metal raceway bases, covers, and dividers shall be bonded and grounded in accordance with TIA J-STD-607-A. Pathways shall be installed in accordance with the following minimum clearance distances of 1.2 meters (4 feet) from motors, generators, frequency converters, transformers, x-ray equipment or uninterruptible power system, 300 mm (12 in) from power conduits and cable systems, 125 mm (5 inches) from fluorescent or high frequency lighting system fixtures.

4-9.1 Cabling. Install Category 5e UTP and optical fiber telecommunications cabling and pathway system as detailed in TIA/EIA-568-B.1, TIA/EIA-568-B.2, and TIA/EIA-568-B.3. Screw terminals shall not be used. Do not untwist Category 5e UTP cables more than 12 mm from the point of termination to maintain cable geometry. Provide service loop on each end of the cable, 3 meters in the telecommunications closet, 1 meter in the work area outlet for optical fiber and 150 mm (6 inch) for UTP. Service loops will not be coiled. Do not exceed manufacturers' cable pull tensions for copper and optical fiber cables. Provide a device to monitor cable pull tensions. Do not exceed 110 Newton pull tension for four pair copper cables. Do not chafe or damage outer jacket materials. Use only lubricants approved by cable manufacturer. Do not over cinch cables, or crush cables with staples. Only Velcro type cable straps are allowed on Category 5e cable and optical fiber cable. For UTP cable bend radii shall not be less than four times the cable diameter.

4-9.2 Backbone Cable. Install backbone copper cable between MDF, BDF, and IDF equipment as indicated on drawings. Optical fiber Backbone Cable, install backbone optical fiber in indicated pathways. Do not exceed manufacturer's recommended bending radii and pull tension. Prepare cable for pulling by cutting outer jacket 250 mm leaving strength members exposed for approximately 250 mm. Twist strength members together and attach to pulling eye. Vertical cable support intervals shall be in accordance with Manufacturer's recommendations.

4-9.3 Horizontal Cabling. Install horizontal cabling and pathway as indicated on drawings between MDF, BDF, IDF, and telecommunications outlet assemblies at workstations.

4-9.4 Pathway Installations. Comply with TIA/EIA-569-A, for the diameter of conduit to each outlet from the telecommunications room backboard. Conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum 150 mm (6 inches) away from parallel runs of electrical power equipment, flues, steam, and hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit is visible after completion of project. Run conduits in crawl spaces and under floor slabs as if exposed. Install no more than two 1.57 radii (90 degree) bends for a single horizontal cable run. All bends/turns in conduits will be in straight runs of conduit with a pull box after every 180 degrees of bends; in no case will a turn be made within a pull box. The minimum size for a pull box in a one inch home run conduit will be 4" long by 4" wide by 3" deep, and for a four inch conduit 60" long by 12" wide by 12" deep.

4-9.5 Under Floor Duct Pathway Systems. Under Floor Pathway installations shall be on a waiver approval basis only. If approved, install cabling and under floor duct in accordance with manufacturers' recommendations.

4-9.6 Conduit Installed Under Floor Slabs. Conduit installed under the floor shall be on a waiver approved basis only. If approved, conduit shall be located a minimum of 300 mm (12 inches) below the vapor barrier. Seal around conduits at penetrations through vapor barrier. Shall be installed in accordance with manufacturers' recommendations.

4-9.7 Service Entrance Conduit-Overhead. Service Entrance Conduit installations shall be on a waiver approved basis only. Galvanized rigid steel or IMC from service entrance to service entrance fitting or weather head outside of building.

4-9.8 Service Entrance Conduit-Underground. PVC Type EPC-40, galvanized rigid steel, or steel IMC. Underground portion shall be encased in minimum of 75 mm (3 inches) of concrete extending from the building entrance to 1500 mm (5 feet) out from the building and shall be a minimum of 450 mm (18 inches) below slab or grade.

4-9.9 Cable Tray Installation. Install cable tray components in accordance with TIA/EIA-569-A.

4-9.10 Work Area Outlets. Each station outlet will have a dual gang quad faceplate. All unused positions will be furnished with blank inserts (right gang when only 2 RJ-45's are specified). All four wires in support of the quad outlet shall be installed. At the outlet two of the wires will be marked for future use. All four wires will be punched down on the patch panels in the Telecommunications Room. All station outlets, cables, patch panels, and terminating hardware shall be clearly labeled in accordance with the labeling standards of this document.

4-9.11 Modular Furniture. Modular Furniture is not part of the permanent facility. Therefore, no horizontal infrastructure will terminate as part of the furniture. All service shall be provided via a wall outlet mounted on the finished wall that is part of the facility. A telecommunications cables will be provided to extend service from the wall outlet to a telecommunications outlet mounted on the furniture. Telecommunications cables shall not exist in the same tray, trough, or pathway with other cables. Telecommunications cables that are not shielded, shall not co-exists with other telecommunications cables unless it originates from the same service provider.

4-9.12 Terminations. Terminate UTP cable in accordance with TIA/EIA-568-B.1, TIA/EIA-568-B.2, TIA/EIA-568-B.3 and wiring configuration as specified, T568A.

4-9.13 Faceplates. Outlet faceplates will be metallic in a warehouse or warehouse environment.

4-9.14 Cables. Unshielded twisted pair shall have a minimum of 152 mm (6 inch) slack cable and fiber optic cables shall have a minimum of 1 m of slack cable loosely coiled into the telecommunications outlet boxes. Minimum manufacturer's bend radius for each type of cable shall not be exceeded.

4-9.15 Pull Cords. Pull cords shall be installed in all conduit serving telecommunications outlets which do not initially have cable installed.

4-10 Telecommunications Room Termination. Install termination hardware required for Category 5e and optical fiber system. An insulation displacement tool shall be used for terminating copper cable to insulation displacement connectors.

4-10.1 Equipment Support Frame. Install in accordance with TIA/EIA-569-A:

- Bracket, wall mounted. Mount bracket to plywood backboard per manufacturer's recommendations. Mount rack so height of highest panel does not exceed 1980 mm (76 inches) above floor.

- Racks, floor mounted modular type, Siemon's RS2-07-S or equivalent. Permanently anchor rack to the floor per manufacturer's recommendations.

4-10.2 Grounding and Bonding. Will be conducted in accordance with TIA J-STD-607-A, and NFPA 70.

4-10.3 Fire Stopping. Seal openings around raceway penetrations through fire resistance rated walls, partitions, floors and ceiling utilizing proper fire stopping materials to maintain fire resistive integrity. All fire stopping systems shall be in compliance with current G6 fire stopping products.

4-11 Labeling

4-11.1 Labels. All labels shall be in accordance with ANSI/TIA/EIA-606-A. The jacks will be numbered in a logical, sequential, clockwise numbering system.

4-11.2 Cable. All cables shall be labeled using color labels on both ends with encoded identifiers per ANSI/TIA/EIA-606-A.

4-11.3 Termination Hardware. All workstation outlets and patch panel connections shall be labeled using color coded labels with encoded identifiers as per ANSI/TIA/EIA-606-A.

4-12 Testing

4-12.1 Telecommunications Cabling Testing. Perform telecommunications cabling inspection, verification, and performance tests in accordance with TIA/EIA-568-B.1, TIA/EIA-568-B.2, TIA/EIA-568-B.3.

4-12.2 Inspection. Visually inspect cabling jacket materials for UL or third party certification markings. Visually inspect UTP and optical fiber jacket materials for UL or third party certification markings. Inspect cabling terminations in telecommunications rooms and at workstations to confirm color code for tip and ring pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1, TIA/EIA-568-B.2, and TIA/EIA-568-B.3. Visually confirm Category 5e marking of outlets, wallplates, outlet/connectors, and patch panels.

4-12.3 Verification Tests. UTP backbone copper cabling shall be tested for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has overall shield. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connected. Perform 100 MHz near-end-cross-talk (NEXT) and attenuation tests for Category 5e systems installations. Perform optical fiber end to end attenuation tests using an optical time domain reflectometer (OTDR) and manufacturer's recommended test procedures. Perform tests in accordance with TIA/EIA-526-14-A, Method B for horizontal, multimode optical fiber and TIA/EIA-526-7, Method B for backbone, single mode optical fiber. Perform verification acceptance tests and factory reel tests.

4-12.4 Performance Tests

4-12.4.1 Category 5e Links. Perform UTP link tests in accordance with TIA/EIA-568-B.1, TIA/EIA-568-B.2, TIA/EIA-568-B.3.

4-12.4.2 Optical Fiber Links. Perform optical fiber end-to-end attenuation tests and reel tests at jobsite.

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4-12.4.3 As Built Drawings. As built drawings showing all telecommunications outlets and their numbers.

4-12.5 Final Verification Tests. Perform verification tests for UTP and optical fiber systems after the complete telecommunications cabling and workstation outlet/connectors are installed. These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and DSN telephone call. The final QC and certification of installation will be performed by Base Telephone after the contractor has provided the test results to the government contract representative with both a hard and soft copy (printed and computer disk).

4.13 Records

4.13.1 Copper Installation Records. Records to be provided for copper shall include the cable specification sheets from the manufacturer, the cable routing and locations, all splice point locations, patch panel and jack locations, cable length, cable reel numbers and installation location, the test results in both hard copy and electronic version.

4.13.2 Fiber Installation Records. Records to be provided for fiber shall include the cable specification sheets from the manufacturer, the cable routing and locations, all splice point locations, patch panel and jack locations, cable length, cable reel numbers and installation location, the test results in both hard copy and electronic version.

4.13.3 As Built. As built drawings showing all telecommunications outlets and their numbers.

CHAPTER 5
OUTSIDE PLANT (OSP) AND SUPPORTING INFRASTRUCTURES

5-1 General. If there is no existing or there is insufficient Central Office (CO) copper or fiber optic cable to the facility, new cable and pathways must be provided from a point of connection to be determined by the G6. A minimum of three 4" buried entrance conduits must be provided to the telecommunications room and connect to the nearest G6 designated point of connection. A pull tape is to be placed inside each of the conduits and each innerduct. The conduit identified for NMCI will contain three innerducts (two 41 mm (1.55 in) and one 25 mm (1 in)). One of the remaining two conduits will contain a 1" 3 cell Maxell or equivalent innerduct. Conduits will extend 4" above the finished floor. All metallic conduits will be grounded or bonded in accordance with Article 250 and Chapter 8 of the NEC and as specified in this document. All unused conduits will be capped with appropriate ducts plugs. No caps will be installed using any type of glue, epoxy or like materials. All conduits containing cables, will be plugged with appropriate plugs, as to not interfere with performance of cables. Intent is to block critters, water and other debris from entering the conduits.

5-2 Record Documentation. Provide the activity responsible for telecommunications system maintenance and administration a single complete and accurate set of record documentation for the entire telecommunications system with respect to each specific project. Provide record documentation as specified in UFGS Section 27-10-00, "Structured Telecommunications Cabling and Pathway Systems", or as designated by the G6. Provide T5 drawings including documentation on cables and termination hardware in accordance with TIA/EIA-606-A. T5 drawings shall include schedules to show information for cut-over and cable plant management, patch panel layouts, cross-connect information and connecting terminal layout as a minimum. T5 drawings shall be provided in both hard copy format and on electronic media using Windows based computer cable management software. A licensed copy of the cable management software including documentation shall be provided. Update existing record documentation to reflect campus distribution T0 drawings and T3 drawing schedule information modified, deleted or added as a result of this installation. Provide the following T5 drawing documentation as a minimum:

Cables - A record of installed cable shall be provided in accordance with TIA/EIA-606-A. The cable records shall include only the required data fields on the hard copy and the required data fields for each cable and complete end-to-end circuit report for each complete circuit from the assigned outlet to the entry facility for the soft copy in accordance with TIA/EIA-606-A. Include manufacture date of cable with submittal.

Termination Hardware - Provide a record of installed patch panels, cross-connect points, campus distributor and terminating block arrangements and type in accordance with TIA/EIA-606-A. Documentation shall include the required data fields in accordance with TIA/EIA-606-A.

5-3 Outside Plant Test Plan. Prepare and provide a complete and detailed test plan for field tests of the outside plant including a complete list of test equipment for the copper conductor and optical fiber cables, components, and accessories for approval by the Contracting Officer. Include a cut-over plan with procedures and schedules for relocation of facility station numbers without interrupting service to any active location. Submit the plan at least

30 days prior to tests for Contracting Officer approval. Provide outside plant testing and performance measurement criteria in accordance with TIA/EIA-568-B.1 and RUS Bul 1753F-201. Include procedures for certification, validation, and testing that includes fiber optic link performance criteria.

5-4 Spare Parts. In addition to the requirements of UFGS Section 01 78 23, "Operation and Maintenance Data", provide a complete list of parts and supplies, with current unit prices and source of supply, and a list of spare parts recommended for stocking. Spare parts shall be provided no later than the start of field testing. Spare parts will be turned over to the appropriate G6 Section. This will facilitate Quality Control and Acceptance Testing prior to end of contract. All parts will be submitted 90 days prior to end of contract. The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract. All warranties will be turned over to the appropriate section within the G6 for execution.

5-5 Materials and Equipment. Products supplied shall be specifically designed and manufactured for use with outside plant telecommunications systems.

5-6 Copper Conductor Closures

5-6.1 Aerial Cable Closures. Provide cable closure assembly consisting of a frame with clamps, a lift-off polyethylene cover, cable nozzles, and drop wire rings. Closure shall be suitable for use on Figure 8 cables. Closures shall be free breathing and suitable for housing either straight-through type or the branch type splices of non-pressurized communications cables and shall be sized as indicated. The closure shall be constructed with ultraviolet resistant PVC.

NOTE: The installation of aerial cabling aboard MCAGCC/MAGFTC at Mainside is not authorized. Installation of aerial cable in the training areas is authorized only in designated areas. Written approval is required from the MCAGCC G6.

5-6.2 Underground Cable Closures

5-6.2.1 Aboveground Installation. Provide aboveground closures constructed of not less than 14 gauge steel and acceptable pole or stake mounting in accordance with RUS 1755.910. Closures shall be sized and contain a marker as indicated. Covers shall be secured to prevent unauthorized entry. All pedestals shall contain a minimum 8 foot x 5/8 inch copper ground rod.

5-6.2.2. Direct Buried. Provide buried closure suitable for enclosing a straight, butt, and branch splice in a container into which can be poured an encapsulating compound. Closure shall have adequate strength to protect the splice and maintain cable shield electrical continuity in the buried environment.

5-6.2.3 Vault/Manhole. Provide underground closure suitable to house a straight, butt, and branch splice in a protective housing into which can be poured an encapsulating compound. Closure shall be of suitable thermoplastic, thermoset, or stainless steel material supplying structural strength necessary to pass the mechanical and electrical requirements in a vault or manhole environment. Encapsulating compound shall be re-enterable and shall not alter the chemical stability of the closure. Provide filled splice cases in accordance with RUS Bul 345-72.

5-6.3 Fiber Optic Closures

5-6.3.1 Aerial. Provide aerial closure that is free breathing and suitable for housing splice organizer of non-pressurized cables. Closure shall be constructed from heavy PVC with ultraviolet resistance.

NOTE: The installation of aerial cabling aboard MCAGCC/MAGTFTC at Mainside is not authorized. Installation of aerial cable in the training areas is authorized only in designated areas. Written approval is required from the MAGTFTC/MCAGCC G6.

5-6.3.2 Direct Buried. Provide buried closure suitable to house splice organizer in protective housing into which can be poured an encapsulating compound. Closure shall have adequate strength to protect the splice and maintain cable shield electrical continuity, when metallic, in buried environment. All metallic shields shall be bonded and tested.

5-6.3.2 Vaults\Manholes. Provide underground closure suitable to house splice organizer in a protective housing into which can be poured an encapsulating compound. Closure shall be of thermoplastic, thermoset, or stainless steel material supplying structural strength necessary to pass the mechanical and electrical requirements in a vault or manhole environment. Encapsulating compound shall be re-enterable and shall not alter the chemical stability of the closure.

5.7 Pad Mounted Cross-Connect Terminal Cabinets. Provide in accordance with RUS 1755.910 and the following:

- Constructed of 14 gauge steel
- Equipped with a double set of hinged doors with closed-cell foam weather-stripping. Doors shall be locked and contain a marker as indicated
- Equipped with spool spindle bracket, mounting frames, binding post log, jumper instruction label and load coil mounting provisions
- Complete with cross connect modules to terminate number of pairs as indicated
- Sized as required to support all terminations.

5-8 Cable Splices, and Connectors

5-8.1 Copper Cable Splices. Provide multi-pair, in-line fold back or single pair, in-line splices of a moisture resistant, three-wire [insulation displacement connector held rigidly in place to assure maximum continuity in accordance with RUS Bul 1753F-401. Cables greater than 25 pairs shall be spliced using MS Squared, which accommodate 25 pairs of conductors at a time. Provide correct connector size to accommodate the cable gauge of the supplied cable. All splicing of Outside Plant Cables will be spliced using MS2 modules (4000-G/TR (Gel), 4000-D/TR (Dry)). Half Taps will use MS2 modules (4000-G/TR (Gel), 4000-D/TR (Dry)).

5-8.2 Copper Cable Splice Connector. Provide splice connectors with a polycarbonate body and cap and a tin-plated brass contact element. Connector shall accommodate 19 to 26 AWG solid wire with a maximum insulation diameter of 1.65 mm (0.065 inch). Fill connector with sealant grease to make a moisture resistant connection, in accordance with RUS Bul 1753F-401.

5-8.3 Fiber Optic Cable Splices. Provide fiber optic cable splices and splicing materials for fusion methods at locations shown on the construction drawings. The splice insertion loss shall be 0.3 dB maximum when measured in accordance with TIA/EIA-455-59A using an Optical Time Domain Reflectometer (OTDR). Physically protect each fiber optic splice by a splice kit specially designed for the splice.

5-8.4 Fiber Optic Splice Organizer. Provide splice organizer suitable for housing fiber optic splices in a neat and orderly fashion. Splice organizer shall allow for a minimum of 1 m (3 feet) of fiber for each fiber within the cable to be neatly stored without kinks or twists. Splice organizer shall accommodate individual strain relief for each splice and allow for future maintenance or modification, without damage to the cable or splices. Provide splice organizer hardware, such as splice trays, protective glass shelves, and shield bond connectors in a splice organizer kit.

5-8.6 Shield Connectors. Provide connectors with a stable, low-impedance electrical connection between the cable shield and the bonding conductor in accordance with RUS Bul 345-65.

5-8.7 Conduit. Provide conduit as specified in UFGS Section 33 71 01, "Underground Transmission and Distribution" and UFGS Section 33 70 02.00 10, "Electrical Distribution System, Underground".

5-8.8 Plastic Insulating Tape. Must comply with UL 510.

5-9 Wire and Cable

5-9.1 Copper Conductor Cable. 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. For special high frequency applications, the cable core shall be separated into compartments. Cable shall be completed by the application of a suitable core wrapping material, a corrugated copper or plastic coated aluminum shield, and an overall extruded jacket. Telecommunications 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; 19 gauge (6 to 400 pairs), 22 gauge (6 to 1200 pairs), 24 gauge (6 to 2100 pairs), and 26 gauge (6 to 3000 pairs). Copper conductors shall conform to the following: All copper conductor cable from 6 to 1800 pair shall be PE-39 type. All splicing will use Outside Plant Cables will be spliced using MS2 modules (4000-G/TR (Gel), 4000-D/TR (Dry)). Half Taps will use MS2 modules (4000-G/TR (Gel), 4000-D/TR (Dry)).

5-9.2 Underground. Provide filled cable (type PE-39) meeting the requirements of ICEA S-99-689 and RUS 1755.390.

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5-9.3 Aerial. Provide filled cable meeting the requirements of ICEA S-99-689, ICEA S-98-688, and RUS 1755.390 except that it shall be suitable for aerial installation and shall be Figure 8 distribution wire with 26,700 N (6,000 pound) Class A galvanized steel or 26,700 N (6,000 pound) aluminum-clad steel strand.

NOTE: The installation of aerial cabling aboard MCAGCC/MAGTFTC at Mainside is not authorized. Installation of aerial cable in the training areas is authorized only in designated areas. Written approval is required from the MCAGCC G6.

5-9.4 Screen. Provide screen-compartmental core cable filled cable meeting the requirements of ICEA S-99-689 and RUS 1755.390.

5-9.5 Fiber Optic Cable. Provide single-mode, 8/125-um, 0.10 aperture 1310 & 1550 nm fiber optic cable in accordance with TIA/EIA-492CAAA, TIA/EIA-472D000-A, and ICEA S-87-640 including any special requirements made necessary by a specialized design. Provide 12 optical fibers as indicated. Fiber optic cable shall be specifically designed for outside use with loose tubed buffer construction. Provide fiber optic color code in accordance with TIA/EIA-598-B

5-9.6 Strength Members. Provide central/non-central, and 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.

5-9.7 Shielding or Other Metallic Covering. Provide bare aluminum or coated aluminum single tape covering or shield in accordance with ICEA S-87-640.

5-9.8 Performance Requirements. Provide fiber optic cable with optical and mechanical performance requirements in accordance with ICEA S-87-640.

5-9.9 Grounding and Bonding Conductors. Provide grounding and bonding conductors in accordance with RUS 1755.200, TIA J-STD-607-A, IEEE C2, and NFPA 70. Solid bare copper wire meeting the requirements of ASTM B 1 for sizes number 8 AWG and smaller and stranded bare copper wire meeting the requirements of ASTM B 8, for sizes number 6 AWG and larger. Insulated conductors shall have 600-volt, Type TW insulation meeting the requirements of UL 83.

5-10 T-Span Line Treatment Repeaters. Provide as indicated. Repeaters shall be pedestal mounted with pressurized housings, sized as indicated and shall meet the requirements of RUS Bul 345-50.

5-11 Poles and Hardware. Provide poles and hardware as specified.

5-12 Cable Tags in Manholes, Handholes and Vaults. Provide tags for each telecommunications cable or wire located in manholes, hand holes, and vaults. Cable tags shall be stainless steel or polyethylene and labeled in accordance with TIA/EIA-606-A. Handwritten labeling is unacceptable.

5-12.1 Stainless Steel Tags. Provide stainless steel, cable tags 41.25 mm (1 5/8 inches) in diameter 1.58 mm (1/16 inch) thick minimum, and circular in shape. Tags shall be die stamped with numbers, letters, and symbols not less than 6.35 mm (0.25 inch) high and approximately 0.38 mm (0.015 inch) deep in normal block style.

5-12.2 Polyethylene Cable Tags. Provide tags of polyethylene that have an average tensile strength of 22.4 MPa (3250 pounds per square inch); and that are two millimeter (0.08 inch) thick minimum, non-corrosive non-conductive; resistive to acids, alkalis, organic solvents, and salt water; and distortion resistant to 77 degrees C (170 degrees F). Provide 1.3 mm (0.05 inch) minimum thick black polyethylene tag holder. Provide a one-piece nylon, self-locking tie at each end of the cable tag. Ties shall have a minimum loop tensile strength of 778.75 N (175 pounds). The cable tags shall have black block letters, numbers, and symbols 25 mm (one inch) high on a yellow background. Letters, numbers, and symbols shall not fall off or change positions regardless of cable tag orientation.

5-12.3 Buries Warning and Identification Tape. Provide fiber optic and copper cable media marking and protection in accordance with TIA/EIA-590-A. Provide color, type and depth of tape.

5-12.4 Grounding Braid. Provide grounding braid that provides low electrical impedance connections for dependable shield bonding in accordance with RUS 1755.200. Braid shall be made from flat tin-plated copper.

5-12.5 Manufacturer's Nameplate. Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

5-12.6 Field Fabricated Namplates. Provide laminated plastic nameplates in accordance with ASTM D 709 for each patch panel, protector assembly, rack, cabinet and other equipment or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 3 mm (0.125 inch) thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be 25 by 65 mm (one by 2.5 inches). Lettering shall be a minimum of 6.35 mm (0.25 inch) high, and of normal block style.

5-13 Tests, Inspections and Verifications

5-13.1 Factory Reel Test Data. Test 100 percent OTDR test of FO media at the factory in accordance with TIA/EIA-568-B.1 and TIA/EIA-568-B.3. Use TIA/EIA-526-7 for single mode optic fiber and TIA/EIA-526-14A Method B for multi mode optic fiber measurements. Calibrate OTDR to show anomalies of 0.2 dB minimum. Enhanced performance filled OSP copper cables, referred to as Broadband Outside Plant (BBOSP), shall meet the requirements of ICEA S-99-689. Enhanced performance air core OSP copper cables shall meet the requirements of ICEA S-98-688. Submit test reports, including manufacture date for each cable reel and receive approval before delivery of cable to the project site.

5-13.2 Installation. Install all system components and appurtenances in accordance with manufacturer's instructions IEEE C2, NFPA 70, and as indicated. Provide all necessary interconnections, services, and adjustments required for a complete and operable telecommunications system.

5-13.3 Contractor Damage. Promptly repair indicated utility lines or systems damaged during site preparation and construction. Damages to lines or systems not indicated, which are caused by Contractor operations, shall be treated as "Changes" under the terms of the Contract Clauses. When Contractor is advised in writing of the location of a non-indicated line or system, such notice shall provide that portion of the line or system with "indicated" status in determining liability for damages. In every event, immediately notify the Contracting Officer and the G6 of damage. Repairs shall be done immediately, before other work continues.

5-13.4 Cable Inspection and Repair. Handle cable and wire provided in the construction of this project with care. Inspect cable reels for cuts, nicks or other damage. Damaged cable shall be replaced or repaired to the satisfaction of the Contracting Officer. Reel wraps shall remain intact on the reel until the cable is ready for placement.

5-13.5 Direct Burial System. Installation shall be in accordance with RUS Bul 1751F-640. Under railroad tracks, paved areas, and roadways install cable in conduit encased in concrete. Slope ducts to drain. Excavate trenches by hand or mechanical trenching equipment. Provide a minimum cable cover of 915 mm (36 inches) below finished grade. Trenches shall be not less than 155 mm (6 inches) wide and in straight lines between cable markers. Do not use cable plows. Bends in trenches shall have a radius of not less than 915 mm (36 inches). Where two or more cables are laid parallel in the same trench, space laterally at least 78 mm (3 inches) apart. When rock is encountered, remove it to a depth of at least 78 mm (3 inches) below the cable and fill the space with sand or clean earth, free from particles larger than 6 mm (1/4 inch). Do not unreel and pull cables into the trench from one end. Cable may be unreeled on grade and lifted into position.

5.14 Cable Placement. Prior to design and installation of any copper or optical fiber cable systems, cable routes and pathways must be approved by the Base Telephone Officer. Separate cables crossing other cables or metal piping from the other cables or pipe by not less than 78 mm (3 inches) of well tamped earth. Do not install circuits for communications under or above traffic signal loops. Cables shall be in one piece without splices between connections except where the distance exceeds the lengths in which the cable is furnished. Avoid bends in cables of small radii and twists that might cause damage. Do not bend cable and wire in a radius less than 10 times the outside diameter of the cable or wire. Leave a horizontal slack of approximately 915 mm (3 feet) in the ground on each end of cable runs, on each side of connection boxes, and at points where connections are brought aboveground. Where cable is brought above ground, leave additional slack to make necessary connections.

5.14.1 Identification Markers. Provide a marker at each change of direction of the cable, over the ends of ducts or conduits which are installed under paved areas and roadways and over each splice. Identification markers shall be of concrete, approximately 508 mm (20 inches) square by 155 mm (6 inches) thick.

5.14.2 Backfill for Rocky Soil. When placing cable in a trench in rocky soil, the cable shall be cushioned by a fill of sand or selected soil at least 53 mm (2 inches) thick on the floor of the trench before placing the cable or wire. The backfill for at least 103 mm (4 inches) above the wire or cable shall be free from stones, rocks, or other hard or sharp materials which might damage

the cable or wire. If the buried cable is placed less than 610 mm (24 inches) in depth, a protective cover of concrete shall be used.

5-14.3 Cable Protection. Provide direct burial cable protection in accordance with NFPA 70. Galvanized conduits which penetrate concrete (slabs, pavement, and walls) shall be PVC coated and shall extend from the first coupling or fitting outside either side of the concrete minimum of 155 mm per 305 mm (6 inches per 12 inches) burial depth beyond the edge of the surface where cable protection is required; all conduits shall be sealed on each end. Where additional protection is required, cable may be placed in galvanized iron pipe (GIP) sized on a maximum fill of 40% of cross-sectional area, or in concrete encased 103 mm (4 inches) PVC pipe. Conduit may be installed by jacking or trenching. Trenches shall be backfilled with earth and mechanically tamped at 155 mm (6 inches) lift so that the earth is restored to the same density, grade and vegetation as adjacent undisturbed material.

5-14.4 Cable End Caps. Cable ends shall be sealed at all times with coated heat shrinkable end caps. Cables ends shall be sealed when the cable is delivered to the job site, while the cable is stored and during installation of the cable. The caps shall remain in place until the cable is spliced or terminated. Sealing compounds and tape are not acceptable substitutes for heat shrinkable end caps. Cable which is not sealed in the specified manner at all times will be rejected.

5-14.5 Underground Duct. Provide underground duct and connections to existing manholes or handholes as specified.

5-14.6 Reconditioning of Surfaces. Provide reconditioning of surfaces as specified.

5-14.7 Penetrations. Caulk and seal cable access penetrations in walls, ceilings and other parts of the building. Seal openings around electrical penetrations through fire resistance-rated wall, partitions, floors, or ceilings in accordance "Fire stopping". All Fire stopping systems shall be in compliance with the current system utilized by the G6.

5-14.8 Cable Pulling. Test duct lines with a mandrel and swab out to remove foreign material before the pulling of cables. Avoid damage to cables in setting up pulling apparatus or in placing tools or hardware. Do not step on cables when entering or leaving the manhole. Do not place cables in ducts other than those shown without prior written approval of the Contracting Officer or Base Telephone Officer. Roll cable reels in the direction indicated by the arrows painted on the reel flanges. Set up cable reels on the same side of the manhole as the conduit section in which the cable is to be placed. Level the reel and bring into proper alignment with the conduit section so that the cable pays off from the top of the reel in a long smooth bend into the duct without twisting. Under no circumstances shall the cable be paid off from the bottom of a reel. Check the equipment set up prior to beginning the cable pulling to avoid an interruption once pulling has started. Use a cable feeder guide of suitable dimensions between cable reel and face of duct to protect cable and guide cable into the duct as it is paid off the reel. As cable is paid off the reel, lubricate and inspect cable for sheath defects. When defects are noticed, stop pulling operations and notify the Contracting Officer and the G6 Project Manager to determine required

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corrective action. Cable pulling shall also be stopped when reel binds or does not pay off freely. Rectify cause of binding before resuming pulling operations. Provide cable lubricants recommended by the cable manufacturer. Avoid bends in cables of small radii and twists that might cause damage. Do not bend cable and wire in a radius less than 20 times the outside diameter of the cable or wire.

5-14.9 Cable Tensions. Obtain from the cable manufacturer and provide to the Contracting Officer and MCAGCC G6, the maximum allowable pulling tension. This tension shall not be exceeded.

5-14.10 Pulling Eyes. Equip cables 32 mm (1.25 inches) in diameter and larger with cable manufacturer's factory installed pulling-in eyes. Provide cables with diameter smaller than 32 mm (1.25 inches) with heat shrinkable type end caps or seals on cable ends when using cable pulling grips. Rings to prevent grip from slipping shall not be beaten into the cable sheath. Use a swivel of 19 mm (3/4 inch) links between pulling-in eyes or grips and pulling strand.

5.15 Installation of Cables in Manholes, Handholes, and Vaults
Do not install cables utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, not to interfere with duct entrances, and support cables on brackets and cable insulators at a maximum of 1220 mm (4 feet). Install cable or cables in corresponding ducts entering and exiting the manholes. In existing manholes, handholes, and vaults where new ducts are to be terminated, or where new cables are to be installed, modify the existing installation of cables, cable supports, and grounding as required with cables arranged and supported as specified for new cables. Identify each cable with plastic tags.

5-15 Aerial Cable Installation. Where physical obstructions make it necessary to pull distribution wire along the line from a stationary reel, use cable stringing blocks to support wire during placing and tensioning operations. Do not place ladders, cable coils, and other equipment on or against the distribution wire. Wire shall be sagged in accordance with the data shown. Protect cable installed outside of building less than 2.5 meters (8 feet) above finished grade against physical damage. Cables crossing main roads shall not be less than 20' at center point of span.

NOTE: The installation of aerial cabling aboard MCAGCC/MAGTFTC at Mainside is not authorized. Installation of aerial cable in the training areas is authorized only in designated areas. Written approval is required from the Base G6.

5-15.1 Figure 8 Distribution Wire. Perform spiraling of the wire within 24 hours of the tensioning operation. Perform spiraling operations at alternate poles with the approximate length of the spiral being 4575 mm (15 feet). Do not remove insulation from support members except at bonding and grounding points and at points where ends of support members are terminated in splicing and dead-end devices. Ground the support wire at poles to the pole ground.

5-15.2 Suspension Strand. Place suspension strand as indicated. Tension in accordance with the data indicated. When tensioning strand, loosen cable suspension clamps enough to allow free movement of the strand. Place suspension strand on the road side of the pole line. In tangent construction, point the lip of the suspension strand clamp toward the pole. At angles in the line, point the suspension strand clamp lip away from the load. In level

construction place the suspension strand clamp in such a manner that it will hold the strand below the through-bolt. At points where there is an up-pull on the strand, place clamp so that it will support strand above the through-bolt. Make suspension strand electrically continuous throughout its entire length, bond to other bare cables suspension strands and connect to pole ground at each pole.

5-15.3 Aerial Cable. Keep cable ends sealed at all times using cable end caps. Take cable from reel only as it is placed. During placing operations, do not bend cables in a radius less than 10 times the outside diameter of cable. Place temporary supports sufficiently close together and properly tension the cable where necessary to prevent excessive bending. In those instances where spiraling of cabling is involved, accomplish mounting of enclosures for purposes of loading, splicing, and distribution after the spiraling operation has been completed.

NOTE: The installation of aerial cabling aboard MCAGCC/MAGTFTC at Mainside is not authorized. Installation of aerial cable in the training areas is authorized only in designated areas. Written approval is required from the Base G6.

5-16 Cable Splicing

5-16.1 Copper Conductor Splices. Perform splicing in accordance with requirements of RUS Bul 1753F-401 except that direct buried splices and twisted and soldered splices are not allowed. Exception does not apply for pairs assigned for carrier application.

5-16.2 Fiber Optic Splices. Fiber optic splicing shall be in accordance with manufacturer's recommendation and shall exhibit an insertion loss not greater than 0.3 dB for fusion splices. All splices shall be fusion.

5-16.3 Surge Protection. All cables and conductors, except fiber optic cable, which serve as communication lines through off-premise lines, shall have surge protection installed at each end which meets the requirements of RUS Bul 1751F-815.

5-16.4 Grounding. Provide grounding and bonding in accordance with RUS 1755.200, TIA J-STD-607-A, IEEE C2, and NFPA 70. Ground exposed non-current carrying metallic parts of telephone equipment, cable sheaths, cable splices, and terminals.

5-17 Telecommunications Main Ground Bar (TMGB). The TMGB is the hub of the basic telecommunications grounding system providing a common point of connection for ground from outside cable, CD, and equipment. Establish a TMGB for connection point for cable stub shields to connector blocks and CD protector assemblies as specified. The TMGB will at a minimum be 4 inches by 10 inches by 1/4 inch.

5-17.1 Incoming Cable Shields. Shields shall not be bonded across the splice to the cable stubs. Ground shields of incoming cables in the EF Telecommunications to the TMGB.

5-17.2 Campus Distributor Grounding

5-17.2.1. Protection Assemblies. Mount CD protector assemblies directly on the telecommunications backboard. Connect assemblies mounted on each vertical frame with number 6 AWG copper conductor to provide a low resistance path to TMGB.

5-17.2.2 TMGB Connection. Connect TMGB to TGB with copper conductor with a total resistance of less than 0.01 ohms.

5-18 Cut-Over. All necessary transfers and cut-overs shall be accomplished by the telecommunications contractor. All cut-overs will be scheduled a minimum of thirty days in advance with the G6.

5-19 Labels. Provide labeling for new cabling and termination hardware located within the facility in accordance with TIA/EIA-606-A. Handwritten labeling is unacceptable. Stenciled lettering for cable and termination hardware shall be provided using either thermal ink transfer process or laser printer. Install cable tags for each telecommunications cable or wire located in manholes, handholes, and vaults including each splice. Tag only new wire and cable provided by this contract. Tag new wire and cable which are indicated to have splices and terminations provided by this contract. The labeling of telecommunications cable tag identifiers shall be in accordance with TIA/EIA-606-A. Tag legend shall be as indicated. 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.

5-20 Termination Hardware. Label patch panels, distribution panels, connector blocks and protection modules using color coded labels with identifiers in accordance with TIA/EIA-606-A.

5-21 Field Applied Painting. Provide ferrous metallic enclosure finishes in accordance with the following procedures. Ensure that surfaces are dry and clean when the coating is applied. Prior to assembly, paint surfaces which will be concealed or inaccessible after assembly. Apply primer and finish coat in accordance with the manufacturer's recommendations. Provide ferrous metallic enclosure finishes.

5-22 Cleaning. Clean surfaces in accordance with SSPC SP 6.

5-23 Priming. Prime with a two component polyamide epoxy primer which has a bisphenol-A base, a minimum of 60 percent solids by volume, and an ability to build up a minimum dry film thickness on a vertical surface of 0.127 mm (5.0 mils). Apply in two coats to a total dry film thickness of 0.127 to 0.2 mm (5 to 8 mils).

5-24 Finish Coat. Finish with a two component urethane consisting of saturated polyester polyol resin mixed with aliphatic isocyanate which has a minimum of 50 percent solids by volume. Apply to a minimum dry film thickness of 0.05 to 0.076 mm (2 to 3 mils). Color shall be the manufacturer's standard.

5-25 Field Fabricated Nameplate Mounting. Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

5-26 Field Quality Control. Provide the Contracting Officer and the MCAGCC G6, 10 working days notice prior to each test. Provide labor, equipment, and incidentals required for testing. Correct defective material and workmanship disclosed as the results of the tests. Furnish a signed copy of the test results to the Contracting Officer within 3 working days after the tests for each segment of construction are completed. Perform testing as construction progresses and do not wait until all construction is complete before starting field tests.

5-27 Pre-Installation Tests. Perform the following tests on cable at the job site before it is removed from the cable reel. For cables with factory installed pulling eyes, these tests shall be performed at the factory and certified test results shall accompany the cable.

5-27.1 Cable Capacitance. Perform capacitance tests on all pairs within a cable to determine if cable capacitance is within the limits specified.

5-27.2 Loop Resistance. Perform DC-loop resistance on all of the pairs within a cable to determine if DC-loop resistance is within the manufacturer's calculated resistance.

5-27.3 Pre-Installation Test Results. Provide results of pre-installation tests to the Contracting Officer and G6 at least ten working days before installation is to start. Results shall indicate reel number of the cable, manufacturer, size of cable, pairs tested, and recorded readings. When pre-installation tests indicate that cable does not meet specifications, remove cable from the job site.

5-27.4 Acceptance Tests. Perform acceptance testing in accordance with RUS Bul 1753F-201 and as further specified in this section. Provide personnel, equipment, instrumentation, and supplies necessary to perform required testing. Notification of any planned testing shall be given to the Contracting Officer at least 14 days prior to any test unless specified otherwise. Testing shall not proceed until after the Contractor has received written Contracting Officer's approval of the test plans as specified. Test plans shall define the tests required to ensure that the system meets technical, operational, and performance specifications. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested. Provide test reports in booklet form showing all field tests performed, upon completion and testing of the installed system. Measurements shall be tabulated on a pair by pair or strand by strand basis.

5-27.5 Copper Conductor Cable. Perform the following acceptance tests in accordance with TIA/EIA-758:

- Wire map (pin to pin continuity)
- Continuity to remote end
- Crossed pairs
- Reversed pairs
- Split pairs

- Shorts between two or more conductors
- Grounded pairs.

5-27.6 Fiber Optic Cable. Test fiber optic cable in accordance with TIA/EIA-455-B and as further specified in this section. Two optical tests shall be performed on all optical fibers: Optical Time Domain Reflectometry (OTDR) Test, and Attenuation Test. In addition, a Bandwidth Test shall be performed on all multimode optical fibers. These tests shall be performed on the completed end-to-end spans which include the near-end pre-connectorized single fiber cable assembly, outside plant as specified, and the far-end pre-connectorized single fiber cable assembly.

5-27.6.1 OTDR Test. The OTDR test shall be used to determine the adequacy of the cable installations by showing any irregularities, such as discontinuities, micro-bendings or improper splices for the cable span under test. Hard copy fiber signature records shall be obtained from the OTDR for each fiber in each span and shall be included in the test results. The OTDR test shall be measured in both directions. A reference length of fiber, 1000 feet minimum, used as the delay line shall be placed before the new end connector and after the far end patch panel connectors for inspection of connector signature. Conduct OTDR test and provide calculation or interpretation of results in accordance with TIA/EIA-526-7 for single-mode fiber and TIA/EIA-526-14A for multimode fiber. Splice losses shall not exceed 0.3 db.

5-27.6.2 Attenuation Test. End-to-end attenuation measurements shall be made on all fibers, in both directions, using a 850 & 1300 for 62.5 multi-mode fiber and 1310 & 1550 for single mode nanometer light source at one end and the optical power meter on the other end to verify that the cable system attenuation requirements are met in accordance with [TIA/EIA-455-46A for multimode] and [TIA/EIA-526-7 for single-mode] fiber optic cables. The measurement method shall be in accordance with TIA/EIA-455-61A. Attenuation losses shall not exceed 0.5 db/km at 1310 nm and 1550 nm for single-mode fiber. Attenuation losses shall not exceed 5.0 db/km at 850 nm and 1.5 db/km at 1300 nm for multimode fiber.

5-27.6.3 Bandwidth Test. The end-to-end bandwidth of all multimode fiber span links shall be measured by the frequency domain method. The bandwidth shall be measured in both directions on all fibers. The bandwidth measurements shall be in accordance with TIA/EIA-455-204.

5-27.7 Soil Density Tests. Determine soil-density relationships for compaction of backfill material in accordance with ASTM D 1557, Method D. Determine soil-density relationships as specified for soil tests in Section 31 00 00, "Earthwork".

CHAPTER 6
LEASED OR GOVERNMENT OWNED RELOCATABLES

6-1 General-Leased or Government Owned Relocatables. Leased or Government Owned Relocatables shall be for single and double wide trailers only. This Chapter is not for prefabricated buildings and triple wide trailers. Prefabricated buildings and triple wide trailers will be wired as outlined in Chapters 1 thru 5 of this document.

6-2 Placement. Telecommunications Backboard: provide and install 4'X8'X3/4" AC grade plywood painted with fire retarding paint on both sides.

6-3 Grounding Bus Bar (GBB). For GBB provide and install 4"X10"X1/4" copper grounding bus bar on backboard. Permanently bond GBB to the electric service entrance panel by at least a 6 AWG green wire as directed by current National Electric Code (NEC) standards. GBB shall be drilled with parallel holes to accommodate 2-hole lugs. All connectors used for grounding and bonding within shall be crimped on or exothermically welded to the conductor. GBB ground wire connectors will be 2-hole lugs.

6-4 NEMA Box. Install NEMA-3 box on outside of trailer for the penetration. One penetration to accommodate two 4" schedule 40 conduit is required through the exterior wall to support each installed interior telecom cabinet. Conduits will be flush with the interior wall. In addition, all penetrations of fire rated barriers must be fire-stopped in accordance with applicable codes.

6-5 50-Pair Bet. Provide and install 50 pair building entrance terminal equipped with 50 gas block type protectors on the backboard.

6-6 Wall Mount Cabinet. Provide and install one each enclosed, secure, double swing-out, hinged, wall-mount telecommunications cabinet (48"X23"X24") which provide 19" wide rack mounting. Similar to "Southwest Data Products SWE4000", with a locking door.

6-7 Dedicated Electrical Outlets. The telecommunications cabinet shall be within 3-feet of two 20-AMP Dedicated Data Circuits (DDC), 120V AC (non-switchable) quadraplex electrical outlets for equipment power. The outlets shall be marked as 20A DDC and with the panel and breaker number.

6-8 Patch Panel. A minimum of Three PATCH PANELS: Provide and install three patch panels in wall mount cabinet, sized to accommodate corresponding incoming cable or number of outlets. One patch panel for incoming cable from BET, the additional two patch panels for horizontal wiring, one for data and one for voice.

6-9 Patch Cords. The Telecommunications Cabinet will be equipped with Category 5E patch cords, number to be determined by the number of ports available for patching. Lengths will accommodate neat cable management

6-10 Fiber Optic Enclosure. Provide and install one Line Interface Unit (LIU) rack mount fiber enclosure w/ minimum 24 port SC connectors and blanks. The LIU will be mounted in the telecommunications cabinet.

6-11 Organizers. The communications cabinet will be equipped with horizontal cable management organizers.

6-12 Quantity of Communications Outlets. Each office space will have a minimum of 4 station outlets, one per wall. In large office areas or conference rooms the station outlets must be placed so there is no more than ten feet of separation between outlets. Printed test results to be provided.

6-13 Height of Communications Outlets. Locate outlets at standard 66" above finished floor.

6-14 RJ45 Communications Outlets. Provide, install, terminate, test, and label Cat5e 350 MHz cables, one data (red) & one voice (white) with 18" of coiled slack in ceiling above each outlet. Far end termination on separate data and voice patch panels. All cables, copper and fiber, will have a minimum of 10' of slack coiled near telecommunications cabinet after termination.

6-15 RJ45 Jack Installation. Station outlets include one faceplate with two ea RJ45 jacks, one jack for data, and one jack for voice. One station outlet is required for each desk. Station outlets shall be in proximity of electrical outlets for ADP and other C4I access. All lines will run from patch panels to outlet. No line will be longer than 295'.

6-16 Labeling. All outlets, cables, patch panels, and terminating hardware shall be clearly labeled in accordance with the MCAGCC 29 Palms labeling standards.

6-17 Horizontal Wiring. J-hooks and Hardware as appropriate IAW industry standard. A combination of J-hooks, conduit, and/or surface mounted raceway may be used to run the cable from the tray to the individual station outlet. If flexible conduit is used, bushing must be placed on the end caps before pulling cable due to sharp edges of conduit. Minimum conduit size running to each individual station outlet is 1". When J-hooks are used they must be placed in a manner to support the cable spaced at 4' to 5' irregular intervals. Communications pathway may not be affixed to other pathways or supported fixtures. To avoid electromagnetic interference, all pathways will provide clearances of at least 4' from motors and transformers, 1' from electrical power cables and conduits, and 5" from fluorescent lighting. When pathways must cross sources of electromagnetic interference, it shall be perpendicular to the source, not gradually over a long distance. All penetrations shall be sleeved. A pull tape shall be left in all empty conduits.

6-18 Removal. Before Leased Relocatables are removed from the premise, the government will be notified 180 days in advance. This will allow the government time to remove all government equipment.

CHAPTER 7
Radio Frequency Management

7-1 Equipment Certification and Spectrum Supportability

7-1.1 General. DODD 4650.1 requires that all Communications Electronics systems obtain spectrum certification and guidance from the Military Communications Electronics Board (MCEB) as early as possible in the acquisition process.

7-1.2 Program Manager. Program Managers are responsible for initiating the Application for Equipment Frequency Allocation (DD-1494) for newly developed equipment and prior to acquisitions of new equipment intended to be added to the USMC inventory.

7-1.3 Contracting Officer. Contracting Officers are required by DOD 5000-series guidance to ensure acquisitions of new equipment obtain approved frequency allocation within the intended area of operation prior to activation IAW DoDD 4650.1. The equipment certification process reviews the DD-1494 submittal to ensure spectrum is available prior to the equipment being fielded. Once certification is obtained, the MCEB assigns a J/F-12 number for the equipment. The certification process ensures that all spectrum dependent systems are certified and authorized to operate within specific parameters. The parameters must conform to all local, state, national, and international laws and regulations.

7-1.4 DD-1494 Development. Organizations, activities, or commands developing and/or procuring the spectrum dependant equipment shall develop the DD-1494 submittal via the supporting Program Manager. The application for allocation must begin during the conceptual stage or as soon as an electromagnetic frequency band of operation is identified. The organization, activity, or command involved is also responsible for ensuring the initial application for allocation is updated whenever significant changes are made to the equipment, which affect or change the transmitter, receiver or antenna. Additionally, the application must be deleted via HQMC C4 CS when the equipment is no longer in the inventory.

7-2 Frequency Assignment

7-2.1. General. Per MCO 2400.2, requests for frequency assignments for equipment to be installed or used aboard MCAGCC require that the equipment has received spectrum supportability certification during the equipment acquisition process and prior to equipment activation within the intended area of operation. The intent is to eliminate unauthorized use of radio frequencies within the Marine Corps. This guidance does not change or nullify any applicable DoD publications or DON policy that pertains to frequency assignment. USMC frequencies/allocations shall be based on proper authority and the level of the operation/exercise.

7-2.2 Frequency Request Process. Requests for frequencies/assignments within the United States and Possessions (US&P) will follow procedures as directed in accordance with all guidance, regulations, and authority within MCO 2400.2

and the NTIA Manual of Regulations and Procedures for Federal Frequency Management. An approved frequency allocation or assignment within the United States must be coordinated with the National Telecommunications Information Agency (NTIA) via the Navy Marine Corps Spectrum Center (NMSC).

7-2.3 Frequency Requests and Assignments. Frequency requests shall be submitted 90 days prior to usage within CONUS and 120 days for frequencies used outside of CONUS in accordance with the NTIA Manual of Regulations and Procedures for Federal Frequency Management. Generally, requests for international spectrum support, Unmanned Vehicles, RADARS, ECCM and equipment under development or evaluation will require the longest lead times. Lead times for frequency assignment requests vary depending on geographical location, type of equipment, frequency, etc. All USMC equipment that transmits or receives electromagnetic radiation must have an approved frequency assignment or allocation, with the exception of equipment that operates on frequencies in bands above 3000GHz. Frequency assignments authorize equipment to operate within its allocated frequency band, at a designated location, and within the constraints of the authorized assignment parameters. Frequency assignments may be temporary or permanent. An approved frequency assignment or allocation acknowledges that development and/or procurement of equipment can be supported within the constraints of the authorized assignment parameters.

7-3 Part 15, Non-Licensed and Family Radio Service Devices (FRS). Part 15 devices are low power emitter equipment approved by the FCC for Government and Non-government use. Per the NTIA Manual of Regulations and Procedures for Federal Frequency Management, devices such as FRS, or the Multi-Use Radio Service (MURS) have an increased probability of causing or receiving interference to/from similar devices used by Government or Non-government personnel, agencies or organizations. Interference to Marine Corps Part 15 devices must be accepted without recourse. These devices must share each channel and no user is assured protection from interference caused by another user. Furthermore, these devices are un-encrypted. Per guidance within the NTIA Manual of Regulations and Procedures for Federal Frequency Management, chapter 7.5.8, "Federal organizations may not purchase and operate FRS radios for planned communications operations that safeguard human life or property".

7-4 Spectrum Manager. Spectrum Managers are those personnel who are trained and are responsible for requesting, maintaining, processing, and assigning spectrum to support equipment and operations. All use of frequencies by USMC commands, organizations or activities, other services, agencies, contractors and foreign country services aboard USMC installations will be coordinated with the applicable USMC installation spectrum manager.

7-5 Spectrum User Tasks and Responsibilities. A user is considered any person or personnel who activate equipment that requires spectrum or frequencies to operate.

- Users will ensure all frequencies are used in accordance with MCO 2400.2 and the NTIA Manual of Regulations and Procedures for Federal Frequency Management.

- Users will submit frequency requests to the appropriate Frequency Management Office for processing.

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- Users will report frequency interference immediately to the appropriate Frequency Management Office for resolution.
- Users will ensure all equipment that emits an electromagnetic signal has an approved frequency to operate on.
- Users will ensure all equipment, which is appropriated at the unit level, is properly spectrum certified prior to requesting frequencies and operating the system.

APPENDIX A: ACRONYMS AND TERMINOLOGY

AC/S: Assistance Chief of Staff
A&E: Architectural & Engineering
ANSI: American National Standards Institute
APL: Approved Products List
ASTM: American Society for Testing and Materials
ATC: Authority to Connect
ATO: Authority to Operate
BET: Building Entrance Terminal
BIA: Bilateral Infrastructure Agreement
Cat 5e: Category 5 enhanced wire
C&A: Certification & Accreditation
C4: Command, Control, Communications and Computers
CG: Commanding General
CIO: Chief Information Officer
CJCSI: Chairman Joint Command Staff Instruction
CO: Commanding Officer
COR: Contracting Officer Representative
COTR: Contracting Officer Technical Representative
DAA: Designated Approving Authority
DISA: Defense Information Systems Agency
DoD: Department of Defense
DoN: Department of the Navy
DASN: Deputy Assistant Secretary of the Navy
EDD: Electronic Design Deliverables
EIA: Electronic Industries Alliance
EIC: Engineer in Charge (PWD)
ET: Engineering Technician (ROICC)
FAM: Functional Area Manager
FAR: Federal Acquisition Regulations
FDM: Functional Data Manager
FM: Functional Manager
FSC: Facilities Support Contract/Contractor
FY: Fiscal Year
GBB: Grounding Bus Bar
GES: GIG Enterprise Services
GIG: Global Information Grid
GIS: Geospatial Information & Services
HQMC: Headquarters Marine Corps
NEMA: National Electrical Manufacturers Association
HQMC/C4: Director, Command Control Communication and Computers
HNFCA: Host Nation Funded Construction Agreement
IA: Information Assurance
IATC: Interim Authority to Connect
IATO: Interim Authority to Operate
IATT: Interim Authority to Test
IAW: In Accordance With
ICEA: Insulated Cable Engineers Association
IDIQ: Indefinite Delivery Indefinite Quantity
IEEE: Institute of Electrical and Electronics Engineers
ISP: Inside Plant
IT: Information Technology

APPENDIX A: ACRONYMS AND TERMINOLOGY (Continued)

ITI: Information Technology Infrastructure
MAGTF: Marine Air-Ground Task Force
MCAGCC: Marine Corps Air Ground Combat Center
MAP: Master Acquisition Plan
MCSC: Marine Corps Systems Command
MCCDC: Marine Corps Combat Development Command
MCHS: Marine Common Hardware Suite
MCO: Marine Corps Order
MCEITS: Marine Corps Enterprise Information Technology Services
MCEN: Marine Corps Enterprise Network
MILCON: Military Construction
NAVAIRSYS COM: Naval Air Systems Command
NAVFAC: Naval Facilities Command
NAVSEA: Naval Sea Systems Command
NFFPA: National Fire Protection Association
NMCI: Navy-Marine Corps Internet
NREA: Natural Resource Environmental Affairs (A/CS G-4)
NSA: National Security Agency
OASD: Office of the Assistant Secretary of Defense
OSD: Office of the Secretary of Defense
OSF: Outside Plant
PET: Protective Entrance Terminal
PG: Product Group / Program Management Office (example: PG-10)
PL: Project Lead
PM: Project Manager (normally A/CS G-6)
PMO: Provost Marshal Office (A/CS G-7)
PO: Project Officer (normally MCSC)
POA&M: Plan of Action and Milestones
POC: Point of Contact
POM: Program Objective Memorandum
POR: Program of Record
PPBE: Planning, Programming, Budgeting and Execution System
PWD: Public Works Division (A/CG G-4)
QC: Quality Control
RJ45: Registered Jack 45 (8 pin 8 connector)
SECNAV: Secretary of the Navy
SME: Subject Matter Expert
SOFA: Status of Forces Agreement
SPAWAR: Space and Warfare Systems Command
SSAA: System Security Authorization Agreement
SSPC: Society for Protective Coatings
TIA: Telecommunications Industry Association
TCO: Technical Control Office (A/CS G-6)
TC-DR: Technical Control Designated Representative
TLMS: Total Life Cycle Maintenance System
UFC: Unified Facilities Criteria
UL: Underwriter Laboratories
UFGS: Unified Facilities Guide Specifications
USMC: United States Marine Corps