U.S. Citizenship and Immigration Services

Structured Cable Plant Standard

Office of Information Technology

in collaboration with

Office of Facilities and Space Management

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1.0 INTRODUCTION

1.1 Purpose

This document has been prepared for the Citizenship and Immigration Services (USCIS) with the specific purpose of setting standards for structured cable plants in support of Local Area Network (LAN), voice connectivity and security applications that will function as follows:

- Accommodate the functional requirements of present and future information services.
- Support a multi-product and multi-vendor environment.
- Facilitate the planning and installation of cabling systems that will support the diverse communication needs of building occupants.
- Ensure uniformity of structured wiring and hardware infrastructure installations in all USCIS facilities.

The primary focus of this document is to define the standards for material, infrastructure, design, installation, and certification with respect to structured cabling systems for USCIS facilities. This document shall replace, modify, or otherwise supersede previous releases of these standards. An electronic version of this document resides in the Office of Information Technology (OIT) intranet Web site. For questions or comments regarding this document, contact:

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1.2 Background

Citizenship and Immigration Services (USCIS) is a component of the U.S. Department of Homeland Security (DHS). The mission of U.S. Citizenship and Immigration Services (USCIS) is to secure America's promise as a nation of immigrants by providing accurate and useful information to our customers, granting immigration and citizenship benefits, promoting an awareness and understanding of citizenship, and ensuring the integrity of our immigration system.

Due to the increasing demands on Service resources, USCIS personnel must be able to share information rapidly and efficiently in order to succeed in fulfilling the Service mission.

In addition to this document, which establishes the cabling standards for USCIS, other documents are being developed that provide additional related information such as:

- USCIS Computer and Telephone Room Standards & Appendix A
- USCIS AV Standards (Audio Visual)
- USCIS FSS Requirements (OSI – Facility Specific Security - Standards)
- USCIS Computer Equipment Standards

- Facility LAP (Lease Acquisition Projects) will typically include coordination meetings and approximately three (3) site visits for the installation of cable plant in accordance with the site specific S.O.W. Typical project schedule: **1st)** cable plant kick-off meeting prior to start of

installation and acceptance of submittal package to review process, drop totals, faceplate configuration and labeling sequence prints along with wireless / overhead / reservation drop requirements, Visio layout & elevation drawings and A/V requirements, manufacturer warranty, building Demarcation, circuit installations, network, PBX & server hardware deployments, occupancy, etc. **2nd)** review cable plant installation, closet build-outs, etc. prior to ceiling tile installation **3rd)** final GSA acceptance and inspection of cable plant to verify labeling & drop locations, inventory of specified components per S.O.W., MDF / Computer Room and if applicable, TR('s) / IT Closet(s) final build-out, electrical requirements, Demarcation cable extension, etc.

1.3 Scope

1.3.1 System

Typical structured cabling systems include the following elements:

- Horizontal cable
- Horizontal cross-connects (HC / TC)
- Transition or consolidation point (optional)
- Main cross-connect (MC / MDF)
- Intermediate cross-connect (IC / IDF)
- Backbone cabling (Intra and Inter)
- Equipment Outlet / Telecommunication Outlet (EO / TO)
- Work area (WA)
- Computer (MDF) & Telecommunication Rooms / Remote Wiring Closet (TR / RWC)
- Entrance facility (EF)
- Equipment room (ER)
- Bonding (Grounding & Earthing)
- Administration

1.3.2 Documentation

This document is intended to address the following specifications and installation practices related to structured cable plant installation:

- Recognized media
- Closet requirements, environmental and design
- Distribution cabling
- Cabling specifications and limits
- Installation practices
- Performance testing
- Supporting documentation

1.4 Regulatory references

The cabling system described in this document is derived from the recommendations made in recognized Telecommunications Industry Standards. The following documents are incorporated by reference: ***NOTE: Please reference latest versions of the standards and documents listed below if applicable.**

1. USCIS Structured Cable Plant Standard & ANSI/TIA/EIA Standards with special sections noted below
2. ANSI/TIA-526-7-A – Measurement of Optical Power Loss of Installed Singlemode Fiber Cable Plant
3. ANSI/TIA-526-14-C – Measurement of Optical Power Loss of Installed Multimode Fiber Cable Plant
4. ANSI/TIA-568.0-E – Generic Telecommunications Cabling Standard for Customer Premises
5. ANSI/TIA-568.1.E – Commercial Building Telecommunications Cabling Standard
6. ANSI/TIA-568.2-D – Copper Cabling Standard - Balanced Twisted-Pair Telecommunications Cabling
7. ANSI/TIA-568.3-D – Optical Fiber Cabling Components Standard
8. ANSI/TIA-569-E – Commercial Building Cabling Standard for Telecommunications Pathways and Spaces
9. ANSI/TIA-570-D – Residential Telecommunications Cabling Standard
10. ANSI/TIA-862-B – Structured Cabling Infrastructure Standard for Intelligent Building Systems
11. ANSI/TIA-5017 - Telecommunications Physical Network Security Standard
12. ANSI/TIA-598-D – Optical Fiber Cable Color Coding
13. ANSI/TIA-606-C – Administration Standard for Telecommunications Infrastructure of Commercial Building
14. ANSI/TIA-607-D – Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
15. ANSI/TIA-758-B – Customer-Owned Outside Plant Telecommunications Cabling Standard
16. ANSI/TIA-862-B – BAS, Building Automation Systems Cabling for Commercial Buildings
17. ANSI/TIA-942-B – Telecommunications Infrastructure for Data Centers
18. ANSI/TIA-1005-A – Telecommunications Infrastructure for Industrial Premises
19. TIA TSB 5018 - Structured Cabling Infrastructure Guidelines to Support Distributed Antenna Systems
20. TIA 455-C, TIA-492 Series 2000, TIA-526-7-A, TIA-526-14-C, ANSI/TIA-568.3-D – Guidelines for Multimode and Singlemode Fiber Optic Cabling & Field-Testing
21. TIA TSB 140 – Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Optic Cabling
22. TIA TSB 4979 - Practical Considerations for Implementation of Encircled Flux Launch Conditions in the Field
23. ANSI/TIA-492-AAAC-D – Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class 1a Graded-index Multimode Optical Fibers (OM3/OM4). Current Edition
24. ANSI/TIA-1062 - Telecommunications Telephony Aspects of MLTS and Packet based Equipment, including VoIP Interface Requirements for Packet-based Gateways
25. ANSI/TIA-1152-A - Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
26. ICSI-TDMM Latest Edition, Building Industries Consulting Services International
27. National Fire Protection Agency
28. National Electrical Code (NEC)
29. NEMA 250
30. National Electrical Safety Code (NESC)
31. IEEE-C2
32. FSS Requirements (OSI Security Standard)

If this document and any of the documents listed above are in conflict, then, as a general principle, the more stringent requirement shall apply. However, in all cases where there appears to be conflict or a specification is not clear to the contractor, the USCIS Cable Plant Management or USCIS Technical Representative must be contacted for clarification.

The contractor will abide by all applicable federal, state, county and local building codes and safety regulations along with providing required permits if applicable.

2.0 OBJECTIVES

2.1 Network Requirements

The objective of this network approach is to provide USCIS with a standardized, cost-effective cable plant infrastructure that will accommodate present and future voice, video, data and security requirements. To ensure the longevity of the application, the structured cable plant will include a minimum 15 year application assurance warranty. Workstation cabling infrastructure shall support bandwidth demands from 100 Megabits per second (Mbps) up to 10 Gigabit speeds. Fiber optic backbone cable infrastructure shall support bandwidth demands for 10 Gigabit Ethernet. SM (Singlemode) fiber optic cable into the facility will support these larger data circuits provided by the service provider. The installation of the cable plant infrastructure shall comply with UL ratings and installation requirements of ANSI/TIA/EIA – 568C, NFPA, ASTM, NEC, local, state and federal codes and standards. This standard also provides the implementation of a one-wire solution for VoIP applications typical for USCIS facilities.

2.1 Cable Plant Specific Site Requirements

The structured cable plant standard design shall utilize the following cable distribution methods to support conductivity throughout the building:

- Horizontal workstation cabling, which will connect the user workstation, or equipment outlet / telecommunication out (EO / TO) to the nearest Computer / Telecommunication Room (MDF / TR) in a star topology shall be plenum Category 6. The EO / TO shall consist of two (2), Cat 6, plenum cables white in color (2D - two data) unless otherwise specified. A wall phone location shall consist of one (1), Cat 6 plenum white cable for voice. If the quantity of cables deviates from these standard and S.O.W. Site Specific Requirements, the quantity will be specified on the provided print(s). NOTE: The previous triplex standard, V2.1 with three (3), Cat 6, plenum cables white in color (2D/1V - two data & one voice) may apply for existing facilities or special applications. The V2.1 standard is available upon request.

- The EO /TO shall consists of two (2) Cat 6, modules or jacks, two data "A" & "B" (1 - blue & 1 - red in color) in a 2-port faceplate. **Exception: If the previous standard applies, one voice "C" (white in color) will be utilized in a 4-port faceplate. Also "D" may be applied for special application for training room requirement, multi-user work area application or security, etc. (gray in color – Cat 6A) or F-Series module for a CATV RG6U coaxial cable.**

- The faceplate of the EO / TO shall be white in color and have the flexibility of supporting two (2) inserts (jacks, modules, etc.). Any unoccupied opening(s) shall be filled with a blank insert which matches the color of the faceplate. The faceplate color may be changed to match the décor of the electrical devices and system furniture (utilized in baseboard). **Exception: 4 or 6-port faceplates may be utilized for locations with multiple drops.**

- The wall phone outlet shall consist of one (1) Cat 6, modules or jacks for voice (white in color) in a stainless steel plate with mounting studs. The outlet shall be at the specified height for mounting of the device to meet ADA compliance.

- The horizontal workstation cabling for the EO / TO drop locations will be terminated in the nearest Computer / Telecommunication Room (MDF or TR) to Category 6, forty-eight (48) & twenty-four (24) port patch panels with horizontal wire management with hinged covers. The patch

panels will be labeled accordingly with "A" & "B" to identify the data and voice cabling. **Exception: "C" & "D" if applicable.**

- The horizontal workstation cabling for the wall phone drop locations will be terminated in the nearest Computer / Telecommunication Room (MDF / TR) to Category 6, twenty-four (24) port patch panel with horizontal wire management with hinged covers. The patch panel will be labeled accordingly with "W" to identify the single voice locations. **NOTE: A minimum of twelve (12) Cat 6 cables may also be terminated on the last twelve ports on the "W" wall phone patch panel for closet to closet conductivity for special applications to include equipment monitoring devices, Q-Flow, etc. Exception: ("D" cables may also be terminated on "W" patch panel if applicable)**

- The MDF / Computer & Telecommunication Room(s) will consist of standard equipment rack(s), 7' x 19", with 10" vertical, doubled-sided, hinged wire management (6" may apply depending on TR / IT Closet size) and double-sided horizontal 3U, 2U & 1U wire managers, black in color (to support all cable routing), shelves and PDU's along with complete 24" ladder runway system with rack elevation kits and drop-outs mounted above rack / cabinet configurations. (18" ladder runway may be specified in TR('s) / IT Closet(s).

- The MDF / Computer Room will support a minimum of four (4) - twelve 12-port remote patch panels with Cat 6 cables will be installed on the ladder runway above the Server and PBX / VoIP enclosures and cabinets along with Security for network connections. These remote patch panels will have bundles of twelve (12) Category 6 cables routed to a Category 6, twenty-four 24-port patch panel located in an equipment rack and installed with horizontal wire management with hinged covers. The patch panel(s) will be labeled accordingly with "S" to identify the server cabling. **Exception: Special application due to space allocation may allow for fewer remote patch panels with prior approval.**

- The Building Demarcation is typically required to be extended to the MDF / Computer Room with a minimum, CMP plenum-rated or CMR riser-rated 50-pair Category 3, copper backbone cable, terminated on 110 stand-off blocks (110FT) on each end for extension of voice, data and security circuits or analog (POTS) lines will be specified. Also an armored, plenum cable 50/125um LOMM OM3, Multimode, fiber optic backbone cable is extended for data circuit extensions with LC LOMM duplex panels and LOMM connectors in a wall-mount enclosure int the Building Demarcation and rack-mount in the MDF / Computer Room. SM (Singlemode) armored, plenum fiber cable may be specified as an exception for longer distances in facility risers. Two (2) 4" EMT conduit raceways with pull strings are provided by the electrician for the installation to the Building Demarcation, which is for security requirements and may be on the same floor or many so the cable length will depend on the actual distance. An additional 24-port patch panel mounted on a 19" stand-alone rack may be specified to extend circuits to the plywood backboard for extension of the circuits in the S.O.W.

- If applicable, where closet to closet conductivity is required for voice between the TR(s) and the MDF, a plenum Category 3 multiple pair, copper backbone cable will be specified. For intra-building conductivity the pair count will be specified and terminated on 24 or 48-port patch panels for voice cross-connect. (Pre-terminated, 25-pair Amphenol style patch panels may also be specified in the S.O.W. for PBX / Voice Server connections for analog port connections.)

- Where closet to closet conductivity is required for data, voice (VoIP) and security between the TR(s) and the MDF / Computer Room, a plenum armored, 12-strand (Exception: 24-strand for

special applications), 50/125um LOMM OM3, Multimode, fiber optic backbone cable will be specified. An armored, plenum cable is specified for intra-building conductivity for data, voice and security applications (standard to utilize last pair), with enclosures, SC LOMM duplex panels and LOMM connectors are required for the system installation along with specified lengths and type of duplex 50um LOMM fiber optic jumpers, aqua in color. (SC-SC, SC-LC, LC-LC, etc.) **Exception: USCIS existing infrastructure is 62.5um fiber optic cable for many facilities and applications, which may be specified with prior approval. Plenum armored, twenty-four strand, 50/125um LOMM OM3 or OM4 may also apply for special applications.** Also copper tie cables will be extended for voice and overhead paging requirements consisting of a combination on 5 or 50-pair Cat 3, Cat 6 and 22 or 18 AWG multi-conductor type cables.

- The equipment rack elevations and Computer / Telecommunication room layout(s) of the patch panels, wire management, enclosures, shelves, PDU's, UPS (if specified), etc. will be provided in the elevation drawings. The installer contractor is required to install networking hardware and provide patch cable installation. The standard configuration is: 100% of "A" ports blue in color, 20% of "B" ports, red in color and 100% of "S" ports, violet in color shall be patched in the MDF & TR(s) locations. Provide 10' black patch cables for "A" and "B" ports patched for workstation at EO / TO. The patch cables for voice are also required with quantities and lengths specified in the S.O.W. for 20% of the "W" ports. (Additional quantities may be required if cross-connect if TR location exist) Other miscellaneous colors, lengths and quantities of patch cables for special applications may be requested in the provided S.O.W.

- The patch cable length may vary depending on specified network hardware deployment. Network switches may be mounted above or below Category 6, forty-eight (48) & twenty-four (24) port patch panels and utilize shorter, certified manufacturer specific patch cables. Lengths may vary in Computer / Telecommunication Rooms: 1', 3', 5', 7', etc. **NOTE:** Patch cables must be labeled on each end with designated sequence as specified, Section 5.3. **Exception: 1' patch cables may utilize one identification label due to length.**

- **Wireless Applications:** The installation requirements for the USCIS Wireless application throughout a facility will be included in the build-out of a project. The requirement includes two (2) Cat 6 plenum cables, with two (2) data Cat 6, modules or jacks, "A" & "B" (1 - blue & 1 - red in color) in a 2-port surface boxes, mounting brackets, termination on "A" & "B" patch panels, wire management, green patch cables, etc. along with installation labor, which will be typically specified in a provided S.O.W. Site specific details will be included in the S.O.W. for the requested installation and components to comply with the facility requirements. **NOTE: Two (2) data Cat 6, "green" modules or jacks, "AP" may be specified for existing facilities for the wireless application.**

- **Q-Flow Application & Digital Signage:** Where applicable, the installation requirements for the USCIS Q-Flow application in the Information / Adjudication Waiting Rooms will be included in the build-out of a project for LCD locations. The requirement includes Cat 6 plenum cabling, with two (2) data Cat 6, modules or jacks, "A" & "B" (1 - blue & 1 - red in color) in a 2-port faceplate, termination on "A" & "B" patch panels, patch cables, etc. along with installation labor, which will be typically specified in a provided S.O.W. Site Specific Requirements for installation and components to comply with the facility.

- **Voice Overhead Paging & Reservation Applications:** Where applicable, the installation requirements for the USCIS Overhead Paging System application throughout the facility and in the Information / Adjudication Waiting Rooms, etc. along with reservation systems for

Conference, Team and Training rooms will be included in the build-out of a project. The requirement includes two (2) Cat 6 plenum cables, with two (2) data Cat 6, modules or jacks, "A" & "B" (1 - blue & 1 - red in color) in a 2-port surface boxes, mounting brackets, termination on "A" & "B" patch panels, violet (purple) patch cables, etc. along with installation labor, which will be typically specified in a provided S.O.W. Site Specific Requirements for installation and components to comply with the facility.

- **Security System Application:** **NOTE: As part of a new USCIS process, the OIT contractor will typically be responsible for the installation of the security cable installation for LAP projects only, which the security vendor will terminate accordingly with the exception of the Cat 6A cable. The security cable requirements and labeling are included in the Site Specific Cable Plant S.O.W.** The installation requirements for the USCIS Security System applications on the network throughout a facility will be included in the build-out of a project. The cable requirements include plenum Cat 6A (gray in color), banana-peel or type and multi-conductor cables (18/6, 18/2, 22/2, etc. - gray in color), Cat 6A patch panels, wire management, Cat 6A conductivity / termination hardware, plenum surface boxes, faceplates, patch cables (also gray in color), racks, cabinet (provided by the security vendor), etc. along with installation labor. These requirements are also referenced in the Security S.O.W., for the requested installation and components to comply with the facility requirements. **NOTE: The security Cat 6A cables may route with the IT cable plant within the basket tray and category-rated j-hook assemblies, but all of the multi-conductor cables must maintain a minimum of 2" clearance and shall be installed in separate supporting assemblies accordingly along with separation throughout routing in the basket tray, racks, cabinets, vertical wire management, etc. Security cabling should also follow the industry standard for maximum length requirements of 90m / 295' along with utilizing designated new or existing OIT specified spaces (Computer/LAN Room & TR's / RWC's) per floor for the security equipment, following the typical star topology noted below for horizontal cabling. OIT may authorize an exception if the manufacturer's cable specifications provide different direction for length. Also the AWG # conductor gauge size may also need to be increased due to voltage drop for longer cable lengths based on design. Reference the manufacturer installation specifications for specifications.**

- **CATV (Cable Television) Application:** Where applicable, the installation requirements for the USCIS CATV application may include the Information / Adjudication Waiting Rooms, FDNS Suites, Conference Rooms, Natz. Ceremony Rooms, District or Field Director's offices, etc. will be included in the build-out of a project. The requirements may include plenum RG6U cabling, RG11 backbone cabling, conductivity / termination hardware, etc. along with installation labor, which will be typically specified in a provided S.O.W. Site specific details will be included in the S.O.W. for the requested installation / components to comply with the facility requirements.

- **Tool Kit, Butt Set & Step Stool:** Where applicable, items may be included with the site specific details included in the S.O.W. for IT service support to perform miscellaneous M.A.C. requests accordingly following occupancy of a new facility.

- **Bonding and Grounding**: Must be installed in accordance of standard J-STD-607-A and ANSI/TIA/EIA – 606 for labeling requirements. **All USCIS OIT and security cabinets must be grounded by the IT contractor accordingly with wire / components included in the S.O.W.**

*NOTE: Enhanced / Premium Cat 6e may be specified for facilities with length concerns / challenges or a design to support the servicing multi-floors from a MDF / TR. * Also if applicable, reference the provided USCIS Cable Plant S.O.W. for specific projects. The document will include site specific details, elevation / layout drawings, etc. for a project.*

3.0 GENERAL REQUIREMENTS: Commercial Building Telecommunication Cabling Standard

This section includes the six subsystems of a structure cabling system. These specifications reference the American National Standards Institute (ANSI)/Telecommunications Industries Association (TIA)/Electronic Industries Association (EIA) 568C recommendations. Detailed cable plant specifications and guidelines unique to USCIS are provided in Section 4.

3.1 Entrance Facilities (EF)

The building entrance facilities provide an interface for services within the structure. Outdoor cabling from a service provider or inter-building between facilities which enter the building will interface to the intra-building backbone cabling. Please refer to TIA/EIA -568C standard which defines physical requirements of the network interface. The network cable plant shall utilize the following cable distribution methods to support connectivity throughout the building.

3.2 Equipment Room (ER) / MDF (Main Distribution Frame / Computer Room)

The equipment room will contain high-end hardware for the facility and provide an interface to the Computer /Telecommunication room(s) through intra-building backbone cabling. The functions of a TR may also be provided in the ER, this may be determined on the size of the facility. Please refer to TIA/EIA -568C standard for design requirements. USCIS may incorporate the functions of the EF & ER within a single space which is typically referred to as the MDF / Computer Room in a facility.

3.3 Backbone Cabling

The backbone may consist of inter-building or intra-building cabling providing the facility with an interconnection between the TR, ER and EF. A vertical connection or risers between floors will be required for a facility with multiple floors. Multiple closets may be required depending on the size of the site. The cross-connection for backbone cabling will be with intermediate and main cross-connects mechanical terminations, patch cords, jumpers, etc. for interface of multiple services types. Some design requirements include:

- Star topology
- No more than two hierarchical levels of backbone cross-connects
- No bridge taps are allowed
- Main and intermediate cross-connect patch cords or jumpers should not exceed 20m or 66 feet
- Areas of high levels and sources of EMI/RFI should be avoided
- Work zone distribution cabling for open office space
- Bonding (Grounding & Earthing) should meet the standard requirements of J-STD-607-A

3.4 Computer & Telecommunications Room (MDF & TR)

The Computer / Telecommunications Rooms will contain the components of the structured cabling system and equipment or connection for services supporting the users of voice and data. The terminations and cross-connections for voice and data of the horizontal and backbone cabling are contained in this space. Please refer to the TIA/EIA - 569 standard for design requirements.

3.5 Horizontal Cabling

The horizontal cabling is the connection extending services from the Telecommunications Room (TR) to the Equipment Outlet (EO) / Telecommunications Outlet (TO). This connection consists of horizontal cabling (UTP, ScTP, fiber optic, etc.), telecommunications outlet (faceplate, furniture outlet, multiple outlet system, etc.), cable terminations (patch panels, blocks, jacks, modules, etc.) and cross-connections (patch cables, cross-connect wire, jumpers, etc.). The four types of recognized media for horizontal cabling are:

- 4-pair UTP cable
- 4-pair ScTP cable
- 2-fiber, 62.5/125um optical cable
- 2-fiber, 50/125um optical cable

The maximum distance of horizontal cabling is 90m or 295 feet. A total of 10m or 33 feet is allowed for the patch cables in the TR and at the work area. To comply with TIA/EIA-568C specification distance limits, the cable run from any user workstation location to the nearest wiring center shall not exceed 100 meters (328 feet). The actual length of a cable run is defined as the total combined length of the horizontal cable, work area and TR patch cables. When planning or designing office space the TR locations should be located within 90 meters of any workstation outlet. This design approach allows for the addition of patch cables without exceeding the specification distance limits. **NOTE: Enhanced / Premium Cat 6 may be specified for facilities with length concerns / challenges or a design to support the servicing multi-floors from a MDF / TR. This allows for a cable length up to 106 meters and 10 meters of patch cables, which will meet some manufacturer requirements for an extended distance channel warranty for a 15-year time frame. See compliant manufacturers for specifications.**

A multi-user equipment outlet assembly (MUTOA) is optional for open office environments. The MUTOA is not allowed in ceiling or access or raised floor applications. Special work cable area (patch cable) lengths are required depending on the horizontal cable length. Please refer to the standard requirements of TIA/EIA-568C for installation, labeling and a table for horizontal and work area cable lengths.

A consolidation point is also an option for open office environments or similar application with multiple variations for installation. Only one consolidation point is allowed in the horizontal cabling and a distance of 15m or 49 feet for the TR and UTP cable must be extended to the work outlet. The transition from UTP to flat under carpet cable is not allowed. Please refer to the standard requirements of TIA/EIA-568C for installation, labeling and spare requirements.

The use of centralized optical fiber cabling offers flexibility with centralized electronics or server farms with fiber horizontal and backbone. Please refer to the standard requirements of TIA/EIA-568C for installation requirements.

Note: Building pathways shall be installed in "dry" locations that protect cables from moisture levels that are beyond the intended operating range of "inside" premise cable. Slab-on-grade designs wherein the pathways are installed underground or in concrete slabs that are in direct contact with earth are considered to be "wet locations". If applicable, the appropriate OSP (Outside Plant) cabling for this location should be installed to meet the specification of the condition along with the associated hardware.

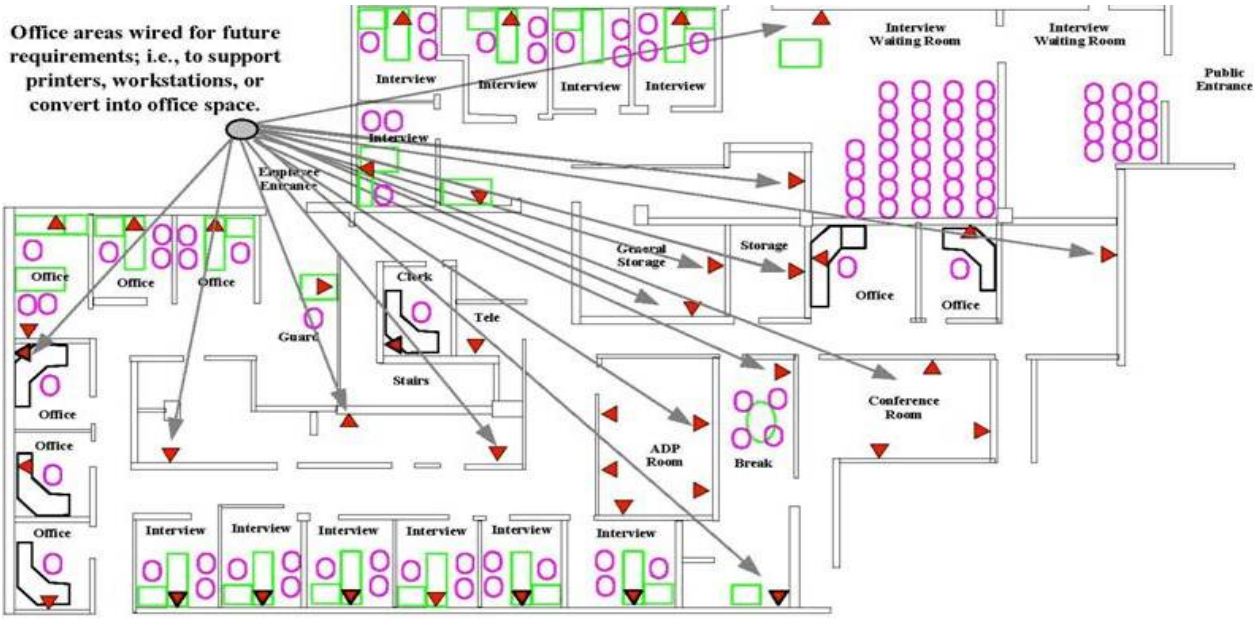
3.6 Equipment Outlet / Telecommunication Outlet

The Equipment Outlet / Telecommunication Outlet should have a minimum of two outlet ports, one

for voice (100 ohm UTP/ScTP 4-pair, 568A or 568B) and one data (100 ohm UTP/ScTP 4-pair, 62.5/125um or 50/125um fiber). Please refer to TIA/EIA -568C standard for requirements.

*NOTE: Please reference USCIS typical Equipment Outlet / Telecommunication Outlet (EO / TO) configuration listed above in the Cable Plant Specific Site Requirements and Exhibit # 10.

Exhibit 1: Typical Office Cable Design



4.0 SPECIFICATIONS

This section provides detailed component characteristics and specifications with respect to the materials used to install the structured cable plant. The key design requirements have been include for each section.

Exceptions:

If an existing facility is collocated with another DHS agency then all new cabling will follow the current building standards of the hosting agency, except it must meet the minimum requirement of Category 6 cable as specified in Exhibit 2.

Any questions should be directed to the Branch Chief – Converged Services Implementation

USCIS Office of Information Technology
Enterprise Infrastructure Division
70 Kimball Ave.
South Burlington, VT 05403

NOTE: A minimum 15 year performance / application assurance warranty on the Structured Cable System Installation shall be issued by the manufacturer of the conductivity hardware. All components of the cable plant shall be included in the provided warranty with the manufacturer of the conductivity hardware or the cable manufacturer as the single point of contact. Any exception on the manufacturer support of warranty must be reviewed and approved by an OIT USCIS representative.

4.1 Horizontal Cabling

The specified horizontal cabling will consist of a star topology extending from the TR to the work area EO. The horizontal cabling system components consist of the horizontal cabling, information outlet, cable terminations, cross-connect patch cables. All cable, equipment, and materials shall meet applicable ANSI/TIA/EIA-568C, National Electrical Code (NEC), Institute of Electrical and Electronics Engineers (IEEE) 802 and Underwriters Laboratory (UL) Verification Program standards. All cable equipment and materials must be manufactured by facilities that are International Organization for Standardization (ISO) 9001 registered and certified.

- Shall be Category 6 rating in accordance with ANSI/TIA/EIA-568C along with offering Enhanced / Premium Cat 6 cable products.
- Four-pair, eight conductor, 100-Ohm, 23-24 American Wire Gage (AWG), solid annealed bare high quality copper.
- The cable should have contiguous, 2-foot segment-length markers printed on the cable jacket. The markings must also show the applicable performance CAT 6, as well as the fire rating of the cable being installed.
- The finished cable shall be 100% plenum, CMP, rated in accordance with the requirements of UL 444, NFPA 262, and ASTM D 4566-05 standards. **(See Exceptions Below)**
- **All horizontal cables must have a jacket color of white (unless otherwise specified).**
- If an existing cabling infrastructure is in place, the specifications may vary to match the color and cable type. Any deviation from the above standards must be authorized.

Note: Category 6 cable must meet or exceed specifications listed in Exhibit 2.

Exhibit 2: Category 6 Cable Specifications

Specification	Category 6 (250MHz)
Frequency Range	1-250 MHz
Insertion Loss (minimum)	32.8 dB
NEXT (minimum)	38.3 dB
PSNEXT (minimum)	36.3 dB
ACR (minimum)	6.6 dB
PSACR (minimum)	3.6 dB
ELFEXT (minimum)	19.8 dB
PSELFEXT (minimum)	16.8 dB
Return Loss (minimum)	17.3 dB
Propagation Delay(maximum)	538 nanoseconds (ns) @ 250MHz
Delay Skew (maximum)	45 ns / 100m @ all frequencies

Exception: CM or CMR may be utilized if installed in conduit raceway or in specified space for application with prior authorization only. Category 6A UTP may be specified for a unique and / or security requirements (cameras, video, environment, etc.) upon prior approval only or per specifications listed in a S.O.W. provided by USCIS. All components must be compliant for a specification of Cat 6A UTP systems and meet manufacturer requirements.

4.2 Equipment Outlets / Telecommunication Outlets

Each workstation area shall use a standard EO / TO (faceplate, system furniture plates & surface boxes) that can support a minimum of four (4) inserts (jacks, modules, etc. of RJ-45 footprint non-keyed). Dual-connection interfaces may be utilized if EO supports minimum of (4) connections. If a fiber optic termination is utilized in the EO, an insert(s) which support SC simplex or duplex connection are required. Regardless of the installation contractor, all voice and data cable shall utilize a single Equipment Outlet, which includes surface boxes for above ceiling installation for wireless / overhead paging applications. Equipment Outlets must be capable of future growth without the need to replace the entire assembly. If the EO / TO utilizes a dual gang plate at the workstation drop location the designated ports shall be located in a left to right configuration (consider location as two standard drops).

• Shall be White or Off-White in color.

• Shall provide for two (2) or four (4) inserts (jacks, modules, etc.).

• Shall offer six (6) inserts in a single-gang footprint (jacks, modules, etc.).

• Shall accommodate opening size provided in system furniture baseboard or channel opening.

• Shall offer a double-gang footprint (accepts typical of eight (8) – twelve (12) jacks, etc.).

• Shall offer ANSI/TIA/EIA symbol icons or shutters for application identification (DATA, VOICE, etc) in multiple colors and configurations.

• Provide individual label window(s) for cable identification (mandatory requirement).

• Provides a high-density design.

• Constructed of high impact, flame-retardant thermoplastic to meet requirement for above ceiling installation for wireless / overhead paging / reservation system applications.

• Be independently verified for Category 6 compliance.

• Provided Channel Solution with patch cable assemblies for Category 6 compliance.

• Meets or exceeds ANSI/TIA/EIA- 568C for Category 6 specifications and have designation visually displayed.

• Must be certified by the UL.

• Mounts to standard electrical single gang and dual gang boxes.

• Available in a multitude of colors.

• Offers non-keyed RJ-45 style connectors with shutter or protection cover assembly.

• Provide category ratings on outlet per ANSI/TIA/EIA standard.

• Allow termination with a single conductor impact tool.

• Provides backward compatibility to allow performing categories of cables or connecting hardware to operate to their full capacity.

• Provides standard 110D type Insertion Displacement Connector (IDC) Printed Circuit Board (PCB) mounted connector.

• Support industry standard for T568B wiring options on each individual module.

• Shall offer solutions for secure environments.

• Allows for a minimum of 200 terminations without signal degradation below standards compliance limits.

• Meets all ANSI / TIA – 1096-A, previously Federal Communications Commission (FCC) Part 68 specifications (shall have minimum of 50 micro of gold plating on each tine with minimum force of 100 grams).

• Must match make and model in existing facilities.

• Keystone style inserts (modules, jacks, etc.) required for all assemblies or adapters. The keystone allows for flexibility of manufacturer's products and compatibility within an existing faceplate.

• Provides interchangeability between multiple manufacturer type modules.

• Provides option in which module can be mounted into an IEC 60603-7 compliant opening (keystone).

• Shall offer SC simplex and duplex inserts for fiber optic connection(s) and also except LC, MTRJ, ST, etc. inserts.

• Match manufacturer and design of existing facility installations. (The faceplate color may be changed to match existing product type and/or the décor of the electrical devices. Any deviation from the standard must be authorized.)

• Shall offer plenum-rated assembly to meet requirement for above ceiling installation for wireless / overhead paging applications.

• Module must meet the following Category 6 performance specifications below.

Exhibit 3: Category 6 Module Specifications @ 250 MHz

PARAMETERS	Worst Case	Typical
Insertion Loss (dB)	0.12	0.14
NEXT (dB)	0.8432 dB	4.37
FEXT (dB)	2.1	5.1
Return Loss (dB)	6.9	8.3

4.3 Patch Cables

The installer contractor is required to install networking hardware and provide patch cable installation. The standard configuration is: 100% of "A" ports blue in color and 30% of "B" ports red in color shall be patched in the MDF and TR(s) locations. Provide 10' black patch cables for "A" and "B" ports patched for workstation at the EO / TO. The patch cables for voice are only required if specified in the S.O.W. for the "C" ports. If the quantity of patch cables deviates from these standards or if labeling is required, these items will be specified in the provided Scope of Work.

• Shall be compliant in accordance with ANSI/TIA/EIA-568C specifications for Category 6 transmission parameters up to 250 MHz and have designation visually displayed.

• 4-pair, UTP stranded conductors for extended flex-life cables.

• RJ-45 modular connector on both ends straight through termination (8 position / 8 conductor).

• Certified by the manufacturer of the termination hardware (best channel performance characteristics).

• Cables shall be available in a wide variety of colors and lengths.

• Length of any patch cable typically shall not exceed 16' (5m) unless otherwise specified for special application (training rooms, COOP, etc.).

• Provides backward compatibility with lower performing categories.

• Meets all Federal Communications Commission (FCC) Part 68 and IEC 60603-7 specifications (shall have minimum of 50 micro of gold plating on each tine with minimum force of 100 grams) and are resistant to corrosion from humidity extreme temperatures and airborne contaminants.

• Patch cable shall be secured with Velcro (tie-wraps shall not be used for any application of the installation)

• Quantities and lengths may vary due to layout of racks and equipment. * See Cable Plant S.O.W. Attachment A – Site Specific Requirements

• The patch cable length may vary depending on specified network hardware deployment. Network switches may be mounted above or below Category 6, forty-eight (48) & twenty-four (24) port patch panels and utilize shorter, certified manufacturer specific patch cables. Lengths may vary in Computer / Telecommunication Rooms: 1', 3', 5', 7', etc.

• See designation charts for specifications, color and length requirements. * See Exhibit 5 below

• Patch cables shall be labeled on each end with designated sequence as specified, Section 5.3. **Exception: 1' patch cables may utilize one identification label due to length if applicable.**

Exhibit 4: Category 6 Patch Cable Specification Chart

Frequency (MHz)	Attenuation (dB/100m)	PS ELFEXT (dB)	PS NEXT (dB)
1	2.4	67.8	72.3
4	4.5	55.8	63.3
10	7.1	47.8	57.3
16	9.1	43.7	54.2
20	10.2	41.8	52.8
31.25	12.8	37.9	49.9
62.5	18.5	31.9	45.4
100	23.8	27.8	42.3
200	34.8	21.8	37.8
250	39.4	19.8	36.3

Exhibit 5: Category 6 Patch Cable Color Chart (NOTE: Cat 6A utilized for Security)

Specification	Color	Length
"A" Port - Data(equipment rack)	**Blue**	1', 3' & 5' (unless otherwise specified)
"B" Port - Data(equipment rack)	**Red**	1', 3' & 5' (unless otherwise specified)
"C&W" Port - Voice (equip. rack)	White	7' & 10' (unless otherwise specified)
"D & Security" - Port (application)	Gray	3', 5' - 20'(unless otherwise specified)
Servers / AV (equipment rack)	**Black & Violet / Purple**	1', 5'- 15' (unless otherwise specified)
Servers / AV (cabinet / enclosure)	**Violet / Purple**	10' & 15' (unless otherwise specified)
Overhead Paging (equip. rack)	**Violet / Purple**	1', 3' & 5'(unless otherwise specified)
Wireless Use (drop & equip. rack)	**Green** / Gray (plenum)	1', 3' & 5' (unless otherwise specified)
Data A&B ports(VoIP phones/desktops)	**Black**	7',10'& 20' (unless otherwise specified)

Exception: Refer to USCIS Cable Plant Scope of Work for "Specific Site Requirements" which include lengths and quantities for individual projects.

4.4 Patch Panels

The patch panels for the data and voice, horizontal cabling shall be installed in the equipment racks in the TR(s). The patch panels shall be Category 6, forty-eight (48) & twenty-four (24) port with horizontal wire management with hinged covers. The patch panels will be labeled accordingly with "A", "B", "W" & "S" (if applicable "C") to identify the termination of data and voice cabling. Layout and elevation drawings will be provided for equipment rack(s).

The single voice wall phone, horizontal cabling shall be installed in the equipment racks in the TR(s) on a separate patch panel. This patch panel shall be a Category 6, twenty-four (24) ports with horizontal wire management with hinged covers. The patch panel will be labeled accordingly with "wall phone locations" to identify the termination of single voice locations.

- Shall be compliant in accordance with ANSI/TIA/EIA-568C specifications for Category 6 transmission parameters up to 250 MHz and have designation visually displayed.
- T568B wiring standards.
- Forty-eight (48) port & twenty-four (24) port standard configuration.
- Provide RJ-45 interface.
- Provides standard 110D type IDC termination.
- Provide rear wire management hardware for cable support.
- Provide modular design to facilitate field repairs.
- Available in low and high-density configurations.
- Meet the standard EIA-310 relay rack spacing specifications.
- Meets all ANSI / TIA – 1096-A, previously FCC Part 68 specifications.
- Available in twelve (12) port configuration (for server applications with mounting bracket or assembly); Utilized for application similar to consolidation point, MOS, MUTOA, etc.

• Available in blank port configuration, 12, 24, 48, etc. (multimedia, modular, quick port, keystone, etc.) to accept keystone modular assemblies; **Note - Utilized with prior authorization only.**

• Match manufacturer and design of existing facility installations. (The patch panel may be changed to match existing product type. Any deviation from the standard must be authorized.)

Exhibit 6: Category 6 Patch Panel Specifications

Specification	Category 6 (250MHz)
Frequency Range	250 MHz
Insertion Loss (minimum)	32 dB
NEXT (minimum)	46 dB
FEXT (minimum)	35.1 dB
Return Loss (minimum)	16 dB
LCL (minimum)	20 dB

4.5 Backbone Cabling

Intra and Inter-backbone cabling may consist of either or both copper and optical fiber cables and are required where there exists more than one wire center. The intra and inter-backbone shall be installed to provide structured connectivity between closets (see Exhibit 11). The installation provides a star-topology cable infrastructure that is capable of supporting high-speed and high bandwidth requirements between key resources in an enterprise building or campus environment. A multimode, singlemode or combination (hybrid) of fiber-optic backbone structure provides the means of interconnecting all wiring closets to the MDF in a multi-segmented environment. Optical fiber not only provides extensive bandwidth capabilities to the LAN and voice, but it also provides a solution to the distance-related problems encountered with copper cables in large installations and campus environments.

Copper backbone cabling is required to support voice services, however, the specifications and designs are determined on a site-by-site basis. This is due to the variety, funding, capacity and availability of voice services and designs. Copper backbone may also be installed to support networking services, where distance limitations do not exceed the ANSI/TIA/EIA-568C specifications. Copper backbone cabling provides a redundant connectivity option in the event of a catastrophic fiber failure, and shall be installed where voice and data closets are physically separated.

Each TR shall be connected to the MDF with a multimode 12-strand, LOMM OM3 fiber optic and a multi-pair Category 3, Cat 6 (if length permits) and if applicable a copper voice backbone cable. Considering the myriad of site functions, building designs, physical layout, application requirements and future technologies, backbone design is a critical element in the planning stages. Facilities and OIT will assist in the engineering design to ensure the short-term and long-term requirements are met in a cost-effective manner.

4.5.1 Intra-Building Voice Backbone Cabling (If applicable)

With VoIP, the distribution of voice conductivity from the MDF to the TR('s) may be plenum (CMP) Category 3 rated, 25 or 50-pair cable construction. The multi-pair cable for voice shall be gray in color. The pair count will be determined by the occupancy requirements and specified in the Scope of Work. The termination of the 25 or 50--pair cable will be distributed on Category 5e, twenty-four (24) port or forty-eight (48) patch panel with horizontal wire management. The cable will be terminated on the center-pins (white/blue & blue/white pair) for voice extension of the phone switch from the MDF location. The violet/slate & slate/violet pair will not be utilized on the patch panel. The patch panel shall be labeled accordingly to reflect the termination of pairs.

• 25-pair or one-hundred pair, 100-Ohm, 24 American Wire Gage (AWG), solid annealed bare high quality copper.

• The cable should have contiguous, 2-foot segment-length markers printed on the cable jacket. The markings must also show the applicable performance CAT 3, as well as the fire rating of the cable being installed.

• The finished cable shall be 100% plenum, CMP, rated in accordance with the requirements of UL 444, NFPA 262, and ASTM D 4565 & 4566 standards.

• All horizontal cables must have a jacket color of gray.

4.5.2 Inter-Building Voice Backbone Cabling

If the distribution of voice conductivity for building to building applications is required, an outdoor-rated, gel filled multi-pair cable shall be specified. The cable shall be terminated within fifty feet (50') upon building entrance in enclosures with protection-rated modules (gas or solid-state). Please refer to ANSI/TIA/EIA-568C standard for design and installation requirements. If applicable, the Scope of Work will specify the pair count, cable design and protection requirements designated for the site installation.

4.5.3 Intra-Building Fiber Optic Backbone Cabling

4.5.3.1 Multimode Fiber Optic

The distribution of data conductivity from the MDF to the TR(s) shall be an armored plenum twelve-stand, 50/125um 10G multimode (LOMM / OM3), fiber optic cable will be specified. An armored, plenum cable is specified for intra-building conductivity for data applications. Please refer to the ANSI/TIA/EIA-568C standard for design and installation requirements.

• 50/125-µm optical fiber, LOMM OM3 10G

• 12 strand

• Maximum Attenuation: 3.0/1.0 dB km at 850/1300 nm

• Minimum Bandwidth: 2000/500 MHz km at 850/1300 nm

• Tight buffered

• Plenum (OFNP) indoor rated

• Armored plenum construction (Aqua in color)

- Armored cable shall be grounded accordingly per manufacturer's warranty requirements.
- Available in 6 & 24 strand for special applications
- Available LOMM OM4 10G for special applications

Exception with prior authorization only: Plenum indoor rated cable installed in a 1" innerduct, plenum rated and orange in color is an acceptable substitution if approved by the site representative prior to installation. ***A 62.5um fiber optic solution for special applications upon prior approval, since it may still be the existing infrastructure of many USCIS sites.**

4.5.3.2 Singlemode Fiber Optic

If the network equipment specifications require the installation of a singlemode (SM), backbone for conductivity from the Building Demarcation or MDF to the TR(s), a plenum, twelve or twenty-four strand, 8.3/125um Singlemode fiber optic cable will be specified. An armored, plenum cable is specified for intra-building conductivity for this data applications. Please refer to ANSI/TIA/EIA-568C standard for design and installation requirements.

- 8.3 /125-µm optical fiber, SM
- 12 or 24 strand
- Maximum Attenuation: 1.0/1.0 dB km at 1310/1550 nm.
- Tight buffered
- Plenum (OFNP) indoor rated
- Armored plenum construction
- Armored cable shall be grounded accordingly per manufacturer's warranty requirements.

Exception: with prior authorization only. Plenum indoor rated cable installed in a 1" innerduct, plenum rated and white or clear in color is an acceptable substitution if approved by the site representative prior to installation.

4.5.4 Inter-Building Fiber Optic Outdoor Backbone Cabling

4.5.4.1 Multimode Fiber Optic

The distribution of conductivity for building to building applications shall be a minimum of twelve-stands of 50/125um 10G multimode (LOMM / OM3) fiber optic cable will be specified if applicable. An outdoor or indoor/outdoor rated cable is specified for inter-building conductivity applications. Please refer to ANSI/TIA/EIA-568C standard for design and installation requirements. If applicable, the Scope of Work will specify the requirements designated for the site installation.

- 50/125-µm optical fiber, LOMM / OM3
- 12 strand (minimum)

- Maximum Attenuation: 3.0/1.5 dB km at 850/1300 nm
- Minimum Bandwidth: 2000/500 MHz km at 850/1300 nm
- OFN or OFNR outdoor rated construction
- OFNR, or OFNP indoor/outdoor rated construction
- Hybrid construction (optional)

Exception: 62.5um fiber optic solution for special applications upon prior approval, since it may still be the existing infrastructure of many USCIS sites.

4.5.4.2 Singlemode Fiber Optic

The distribution of conductivity for building to building applications shall be a minimum of twelve-strands of 8.3/125um Singlemode (SM) fiber optic cable will be specified if applicable. An outdoor or indoor/outdoor rated cable is specified for inter-building conductivity applications. Please refer to ANSI/TIA/EIA-568C standard for design and installation requirements. If applicable, the Scope of Work will specify the requirements designated for the site installation.

- 8.3 /125-µm optical fiber, SM
- 12 strand (minimum)
- Maximum Attenuation: 0.5/0.5 dB km at 1310/1550 nm.
- Loose Tube
- OFN or OFNR outdoor rated construction
- OFNR, or OFNP indoor/outdoor rated construction
- Hybrid construction (optional)

4.6 Fiber Optic Enclosures

Enclosures will be utilized for termination of the fiber optic backbone installed for data conductivity between the MDF and TR(s). The enclosure for the fiber optic cabling shall be installed in the equipment racks of both the MDF and TR(s). The enclosures shall be labeled accordingly for identification. The fiber enclosures are usually located at the top of the equipment racks for protection of the fiber optic cable and strands. Layout and elevation drawings will be provided for the enclosure location in the equipment rack(s). Please refer to ANSI/TIA/EIA-568C standard for design and installation requirements.

- Shall be compliant in accordance with ANSI/TIA/EIA-568C specifications.
- Shall be 18 gauge steel, powder black.
- 2U in MDF with future growth (unless otherwise specified).
- 1U in TR locations (unless otherwise specified).
- Shall provide depth for high density termination and storage capabilities.
- Shall have transparent front hinged door to allow for ease of view inside enclosure.

• Shall have sliding trays for front and rear accessibility.

• All entry and exit points shall have grommets for cable protection and bend radius guides.

• All armored fiber optic cable shall be grounded per manufacturer's specifications.

• Design shall support six (6) or twelve (12) fiber SC duplex panels.

• Connector type shall be 568SC.

• Connector type mechanical or pre-terminated SC type.

• Meet the standard EIA-310 relay rack spacing specifications.

• Match manufacturer and design of existing facility installations. (The enclosure may be changed to match existing product type. Any deviation from the standard must be authorized.)

• Shall be available in LC, ST, etc. configurations upon prior approval only.

4.7 Equipment Racks & Swing Gates

The equipment racks acceptable for use in USCIS installations shall be of an open rack design, a standard 19 inches wide by 7 feet tall used in a floor mount configuration. Vertical cable management for equipment racks is mandatory and essential to provide a clean patching environment. When space considerations mandate, it is acceptable to use an open, wall-mounted equipment rack (swing gate). In these shared communications closets, open racks and swing gates may be used to meet the needs of the installation. If a wall mount configuration is used, the rack must be hinged, and space must be provided so that the rack can swing fully open and provide full access to the back of the rack.

• Shall conform to the ANSI/TIA/EIA standards.

• Shall be a 2-post - 7' x 19" configuration with grounding posts

• Conform to the standard EIA-310 mounting specification.

• Provide pre-tapped 10-32 threading with rack unit markings to indicate position.

• Provide a flexible modular concept.

• Provide combination front & rear vertical wire management with hinged covers attached to side of rack with a minimum of one pass through to go from front to back or vice versa.

• Provide combination front & rear horizontal wire management with hinged covers attached within the rack with a minimum of one pass through to go from front to back or vice versa.

• Provide floor mounting hardware except for swing gate style hardware.

• Design to support the weight of equipment and components specified for installation.

• Match make and model within existing facilities, where possible.

• Shall be individually grounded with AWG # 6 and per manufacturer's specifications.

*** See Exhibit 7 for a typical rack and cabinet structure.**

4.8 Supporting Tray and Hardware

All cables installed in overhead spaces (such as above ceiling panels) shall be supported with category-rated assemblies or basket trays that are fastened to the ceiling slab or structural steel to support the weight of the structured cabling system. Ladder runway shall be used to provide orderly arrangement of all installed cables in and around the equipment racks in the MDF & TR(s).

As a general rule, all cables shall be securely suspended and bundled with the appropriate assemblies (without damaging the outer cable jackets or creating kinks in the cable) to minimize the amount of space required for cabling and for neatness of cable routing.

4.8.1 Ladder Runway

A ladder runway system shall be utilized in the MDF and TR(s) for the management of horizontal and backbone cabling within the closets. The requested installation routing and size will generally be provided on layout drawings of the MDF and TR(s). The ladder runway shall be supported with the manufacturer suggested installation practices. Some design requirements include:

- Constructed of 3/8" x 1 ½" x .065" wall rectangular steel tubing
- Cross members welded at 12" intervals
- 18" & 24" in width (unless otherwise specified)
- Available in multiple widths - 6", 12", 18", 24", etc.
- Black in color
- Individually boxed to avoid scratches and damage
- Standard length of 9' – 11.5"
- Installed per manufacturer's specifications
- Installed with designed components to maintain cable bend radius (Radius Drop, etc.)
- Installed with supporting and mounting components (Radius bends, E-bend, Elevation, Wall Angle, Foot kits to include support of wall, floor, ceiling, etc. applications)
- Connected and coupled with designed components (Butt & junction splices, etc.)
- Bonding (Grounding & Earthing) should meet the standard requirements of J-STD-607 and manufacturer's specifications for warranty compliance.

4.8.2 Basket / Mesh Tray

A basket or mesh style of tray system shall be utilized in the facility ceiling space to distribute the structured cabling system through main distribution areas from the MDF and TR(s). **Also installed over MDF/Computer Rooms and TR's to support required slack loops above ceiling space.** The requested installation routing and size will generally be provided on prints of facility. The basket or mesh style tray system shall be installed and supported with the suggested manufacturer practices. Some design requirements include:

- Constructed of 5mm and 6mm diameter steel wire, welded on 2" x 4" intersections

- Available in multiple widths - 6", 12", 18", 24", etc.
- Available in multiple depths - 2", 4", 6", etc.
- Installed over MDF/Computer Rooms and TR's to support required slack loops above ceiling space.
- Zinc Electroplated finish (other colors available)
- Approved for plenum spaces
- Complete line of products, supporting hardware, accessories, etc.
- Installed per manufacturer's specifications
- Provide Under Floor application and supporting components
- Installed with designed components (Radius drop-outs, supports and wall brackets, etc.)
- Connected and coupled with designed components (splices, couplings, etc.)
- UL Classified as an equipment grounding conductor
- Bonding (Grounding & Earthing) should meet the standard requirements of J-STD-607-A and manufacturer's specifications for warranty compliance.

4.8.3 J-hook Assemblies

The category-rated j-hook assembly shall be utilized for the support of the structured cabling system upon exiting the basket or mesh style tray. This supporting assembly shall route the horizontal cabling to the designated drop location for the EO / TO. The assembly may also be used for routing of backbone cabling if a basket or mesh style of tray system cannot be utilized. The category-rated j-hook assemblies shall be installed and supported with the suggested manufacturer practices. Please refer to ANSI/TIA/EIA-568C standard for design and installation requirements. Some design requirements include:

- Provide the proper support of Category 6, etc. cabling
- Provide the proper support of innerduct, fiber optic and voice copper backbone cabling
- Complies with UL, NEC and EIA/TIA specifications & requirements for structure cabling systems
- Approved for plenum spaces
- Complete line of sizes, products, supporting hardware, accessories, etc.
- Galvanized finish (more corrosion resistant)
- Assembly retainer supplied for cable management **(NO TIE WRAPS)**
- Category-rated Loop assemblies approved for plenum spaces for cable support are acceptable upon prior approval

4.8.4 Velcro

Utilize Velcro fasteners for the management of all cabling components of the structured cabling system. **(Tie wraps are NOT acceptable in any application of the installation)**

- Available in various lengths (straps, puck, etc.)

. • Approved for plenum spaces

4.9 Cabinets & Enclosures

There are a multitude of equipment cabinets and enclosures that are acceptable for use in USCIS installations. In these shared telecommunications closets, cabinets, enclosures and swing gates may be used to meet the needs of the installation of servers, PBX equipment, etc. Please refer to ANSI/TIA/EIA-569 standard for design and installation requirements. The Scope of Work will specify the requirements designated for the site installation. Layout and elevation drawings will be provided with the location, patch panel, horizontal and vertical wire management and equipment configuration.

• Shall conform to the ANSI/TIA/EIA standards.

• Conform to the standard EIA-310 mounting specification.

• Provide pre-tapped 10-32 threading with rack unit markings to indicate position.

• Provide a flexible modular concept.

• Provide vertical wire management.

• Provide shelf with 4-post support.

• Provide floor mounting hardware except for swing gate style hardware.

• Match make and model within existing facilities, where possible.

• Design to support the weight of equipment and components specified for installation.

• Available in widths up to 26" inches or more.

• Available in depths up to 36 - 42" inches or more.

• Allow fan assembly installation.

• Lockable and offer matching key/lock design where multiple cabinets are installed.

• Are of a welded, uni-body construction.

• For areas located within seismic activity, meet Zone 4 earthquake vibration test conditions in accordance with National Electrical Bell Standards (NEBS) document.

• Installed per manufacturer's specifications.

• Available in wall mount configuration with swing-out cabinet body with pre-punched knock-outs.

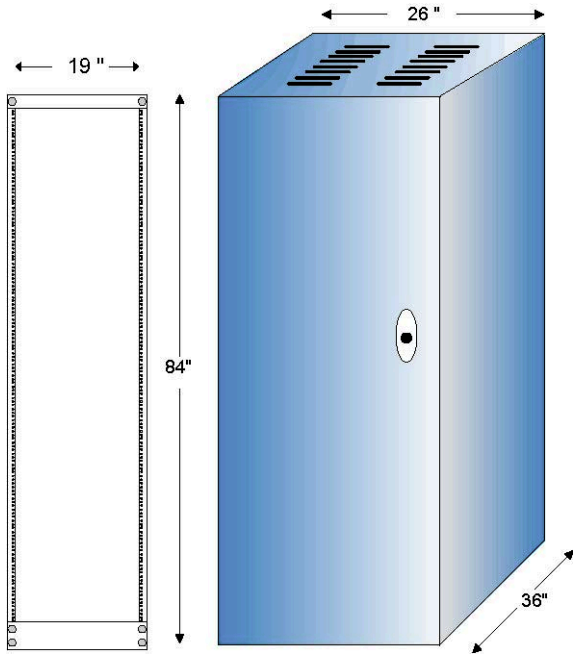
• Shall be individually grounded with minimum AWG # 6 and per manufacturer's specifications.

Note: All USCIS OIT and security cabinets must be grounded by the IT contractor accordingly with wire / components included in the Site Specific - Cable Plant S.O.W.

NOTE: Typically cabinets and enclosures are mobile on casters for serviceability, but may be required to be anchored accordingly due to local / state code requirements for earthquakes along with bonding / grounding.

*** See Exhibit 7 for a typical rack and cabinet structure.**

Exhibit 7: Typical Equipment Rack & Cabinet Enclosures



5.0 COPPER CABLE INSTALLATION SPECIFICATIONS

This section details the specifications that are to be used when installing all copper cabling. All work shall be ANSI/TIA/EIA–568C, ANSI/TIA/EIA-569, ANSI/TIA/EIA-606, NEC and IEEE standard specification quality (as applicable).

5.1 Horizontal Cables

These are the cables installed from a typical workstation location (EO / TO) back to a central point within a building or facility on each floor. Multi closets may be required depending on the square footage of each floor or on the number of floors of the building. These horizontal cables connect the EO / TO, back to a central point, within 90m of the closet, which will be the TR or MDF. Cables should never be exposed nor create any safety hazards for the public. All horizontal cables shall be of plenum construction, CMP.

All copper cables shall be positioned at a minimum distance of 4 inches from any EMI device (such as a light ballast, electrical motor, or power line). If contact is unavoidable, as in modular furniture applications, the horizontal cables shall not run more than 5 feet in parallel with the interference-generating medium. If traversing is necessary, all copper cables shall cross power lines and electrical conduits at a 90-degree angle to minimize interference.

Copper cables installed in a suspended ceiling environment shall at all times be self-suspended in the plenum air space by the use of a separate suspension system or installation in the building construction frame at the top of the permanent ceiling, if it exists. At no time shall cables be secured to the suspended ceiling grid, water pipes, or electrical conduits.

All cables should be installed as far above the suspended ceiling as possible, and should be supported with category-rated j-hook assemblies at staggered intervals of between 4 feet (4') and no more than five feet (5') per manufacturer's requirements. Utilize a dedicated basket / mesh cable tray system where available to support the cable. The key installation requirements are highlighted below.

- Install cable and supporting hardware in a neat and workmanlike manner.
- Install all horizontal cables in accordance with manufacturer's recommendations for warranty compliance.
- Ensure pulling tensions of cables are not exceeded.
- Maintain proper cable bend radius of 4 times the cable's outer diameter during placement.
- No splices are permitted.
- No link shall exceed 90 meters. Contractor is responsible for verifying proper footages.
- Shall utilize a star topology.
- Pull one additional "Mule Tape" or ¼" Nylon rope when pulling cables through any conduit utilizing existing pull string. (Replace all pull strings for future use.)
- Properly support horizontal cables in ceiling every 4'-5' using J-hooks and utilizing mesh cable tray and ladder tray where permissible.
- Supporting hardware for horizontal cables shall NOT utilize the suspended ceiling system, grid, tiles, etc., for support in any case.
- Place horizontal cables in pathways and spaces dedicated for communications cables with maximum fill ratio of 40% or per manufacturer specifications. See conduit fill chart below, Exhibit 8
- Provide 10' of slack at station end in ceiling and not inside wall and above IT Closet for future flexibility or relocation. Reference manufacturer's installation practices for warranty compliance.
- **Machine label all horizontal cables within 2" - 6" of termination at both ends of each cable with matching identification (cable) number.**
- When modular furniture poles are utilized for furniture applications, separation from power is mandatory with a divider or designated channel.
- Fire seal all sleeves and conduit openings after cable installation.

- Route all cables to backside of termination panels in an asymmetrical orientation to ensure cable bundles are split evenly (evenly split down the middle of patch panels in rear).
- Utilize Velcro fasteners. Tie wraps are NOT acceptable in any application of the installation.
- Utilize rear wire management bars for supporting cables into point of termination.
- Mount patch panels using supplied screws and ensure panels are at a straight 180 degree orientation.
- Contractor shall provide in a quick and timely fashion any additional materials or labor that may be damaged during the work at no charge to the owner.
- Label and document the horizontal cable installation to include labeling and pathways on the As-Built drawings.

Exhibit 8: Recommended cable fill ratio for conduit raceway (The chart below is only for reference. The manufacturer recommendations and installation practices for their particular product take precedence and may reflect in warranty specifications.)

Conduit Cable Fill Recommendations Based on Conduit and Cable Size

Conduit Size (in)	Cable Diameter (in)							
	0.18	**0.22**	**0.24**	**0.29**	**0.31**	**0.37**	**0.53**	**0.75**
1/2	1	1	0	0	0	0	0	0
3/4	5	4	3	2	2	1	0	0
1	8	7	6	3	3	2	1	0
1-1/4	14	12	10	6	4	3	1	1
1-1/2	18	16	15	7	6	4	2	1
2	26	22	20	14	12	7	4	3
2-1/2	40	36	30	17	14	12	6	4
3	60	50	40	20	19	17	7	6
3-1/2	82	69	56	26	26	22	12	8
4	107	91	73	34	34	28	14	11

5.2 Backbone Voice Multi-pair Copper Cable

Intra-backbone shall be installed to provide structured connectivity between closets (see Exhibit 11). The installation provides a star-topology cable infrastructure that is capable of supporting voice requirements between building floors or campus environment.

Intra-building, multi-pair copper backbone cabling is required to support voice services, however, the specifications and designs are determined by the specified site applications. This is due to the variety, funding, capacity and availability of voice services and designs.

Copper backbone may also be installed to support networking services, where distance limitations do not exceed the ANSI/TIA/EIA-568C specifications. Copper backbone cabling provides a redundant connectivity option in the event of a catastrophic fiber failure, and shall be installed where voice and data closets are physically separated.

The key voice intra-building, multi-pair copper backbone installation requirements are highlighted below.

- Install all intra-building cabling and components in a neat and workmanlike manner.
- Cabling shall utilize a star topology with no more than 2 levels of backbone.
- Copper backbone cable length shall not exceed 500 meters for the 1st level and 300 meters for the 2nd level for a total not to exceed distance of 800 meters.
- Install all copper backbone cables in accordance with manufacturer's recommendations.
- All backbone communications cables shall be installed in pathways and spaces designated for communications cables
- Ensure pulling tension of copper cables do not exceed a pull load of 25 foot pounds.
- No splices are permitted in any copper cable.
- Pull one additional "Mule Tape" or ¼" Nylon rope when pulling cables through any conduit.
- Properly support backbone cables in ceiling every 4'- 5' using J-Hooks or mesh cable tray where available.
- Provide 20' of service loop at both equipment closet ends if applicable.
- Terminate and support all cables to avoid strain on terminating equipment.

- Terminate all pairs and conductors at both ends according to manufacturer's instructions following color code sequence.

- Neatly and permanently label all backbone cables with the cable number at both ends.

- Utilize Velcro fasteners. Tie wraps are NOT acceptable in any application of the installation.

- Fire seal all sleeves and conduit openings after the cable installation are complete.

- The multi-pair voice backbone cables shall be utilized to extend PBX extensions and shall be terminated on patch panels to accommodate the application. The multi-pair cable will be terminated only the center pairs, 4 & 5, which will utilized the white/blue & blue/white pairs on the patch panels to extend dial tone from the PBX in the MDF to the TR(s). The cross-connecting will utilize patch cables for this application.

- Test voice backbone pairs for continuity and wire-map with a Fluke Level V or greater tester within calibration period. Supply documentation of calibration and serial number(s) with test results.

- Contractor shall provide in a quick and timely fashion any additional materials or labor that may be damaged during the work at no charge to the owner.

- Label and document the backbone cable installation to include labeling and pathways on the As-Built drawings.

5.3 Patch Cables (Workstation / Drop location)

The workstation patch cable connects the end user devices (personal computer, terminals, etc.) to the EO / TO. For most installations, these patch cables will be provided and left on-site for the deployment team or local IT to install when setting up workstations. The workstation patch cable is generally ten feet (10') but may specify a different length as long as the overall total length of the workstation patch cable, horizontal cabling, and the patch-panel patch cable do not exceed 100 meters (328 feet). The patch cables are manufacturer specific in standard one-foot incremental lengths and shall match the conductivity components for the best channel performance.

- Install all patch cables in accordance with manufacturer recommendations.

- Utilize Velcro fasteners. Tie wraps are NOT acceptable in any application of the installation.

- Maintain proper cable bend radius of 4 times the cable's outer diameter during placement.

- Patch cables shall never create a trip hazard or other risk to equipment, services or personnel.

- Patch cables shall be CMP plenum-rated for applications (Overhead Paging, Reservation Systems, etc.) above the ACT in the plenum.

- The appropriate colors are to be used to patch equipment as specified in Exhibit 5.

5.4 Patch Cables (Panel)

The patch-panel cable connects the horizontal cable port to the voice and data electronics within a central wire center or closet, typically a TR or MDF. These cables are identical to the workstation cables and are certified by the manufacturer of the conductivity components. It is the cable installer contractor's responsibility for patching all active cable locations into active ports, unless otherwise directed by the USCIS manager or designated representative. Utilization of wire management and organization is important to facilitate troubleshooting, repair, and documentation and, as such, there are key elements to ensure patch cords are properly installed. The following requirements shall be followed for patching workstation ports to the electronics.

- Install all patch cables in accordance with manufacturer recommendations.

- Utilize Velcro fasteners (tie wraps are NOT acceptable in any application of the installation.

- Maintain proper cable bend radius of 4 times the cable's outer diameter during placement or have kinks.

- Ensure patch panels have horizontal wire management above and below the panels. Note: Network switches may be mounted above and below as specified in provided drawings which utilize shorter patch cable lengths.

- Machine-printed labels must be applied to both ends of the patch cables for ease of identification. Utilize provided number sequence.

- Utilize patch cables with machine-printed labels on each end which have been assembled by the manufacturer if applicable. Utilize provided number sequence.

- Patch cables must be dressed utilizing available horizontal and vertical wire management in accordance with manufacturer recommendations.

- Patch cables shall utilize the left and right vertical wire management to reduce cable patch congestion and provide an even cable distribution on the front of the equipment rack.

- Patch cables shall never create a trip hazard or other risk to equipment, services or personnel.

- The appropriate colors are to be used to patch equipment as specified in Exhibit 5.

5.5 Copper Cable Termination

This section applies to both the workstation and closet cable termination practices. All copper cable terminations shall conform to ANSI/TIA/EIA-568C standards. The key installation requirements are highlighted below.

- Install all components in a neat and workmanlike manner.
- Install all horizontal cables and termination frames in accordance with manufacturer's recommendations.
- Ensure terminations are at 180 degrees to the jack with no more than ¼" un-twisting and no more than ½" un-jacketing.
- Ensure terminations have no un-twisting and that tower separators are utilized to separate pairs.
- Pin/Pair assignments shall follow the T568B configuration. (see Exhibit 9 below)
- All four pairs must be terminated.
- Maintain proper cable bend radius of 4 times the cable's outer diameter during placement.
- Terminate all pairs and conductors at all ends according to manufacturer's specifications in accordance with warranty compliance following color code sequence.
- No link shall exceed 90 meters. Contractor is responsible for verifying proper footages. **Exception – 100 meters if Cat 6e is installed per manufacturer's requirements to meet the required warranty.**
- **Machine-printed labels shall be applied to all horizontal cables with the designated cable number at both ends within 2"– 6" of termination point.**
- Machine-printed labels shall be installed on all faceplates and termination panels with associated cable identification numbers.
- Utilize Velcro fasteners (tie wraps are NOT acceptable in any application of the installation.

- Contractor shall provide in a quick and timely fashion any additional materials or labor that may be damaged during the work at no charge to the owner.
- Test and certify all cabling with a Fluke Level IV or greater tester within calibration period. Supply documentation of calibration and serial number(s) with test results upon completion of installation.

- Label and document the horizontal cable installation to include labeling and pathways on the As-Built drawings.

Exhibit 9: T568B Pair/Pin Assignments

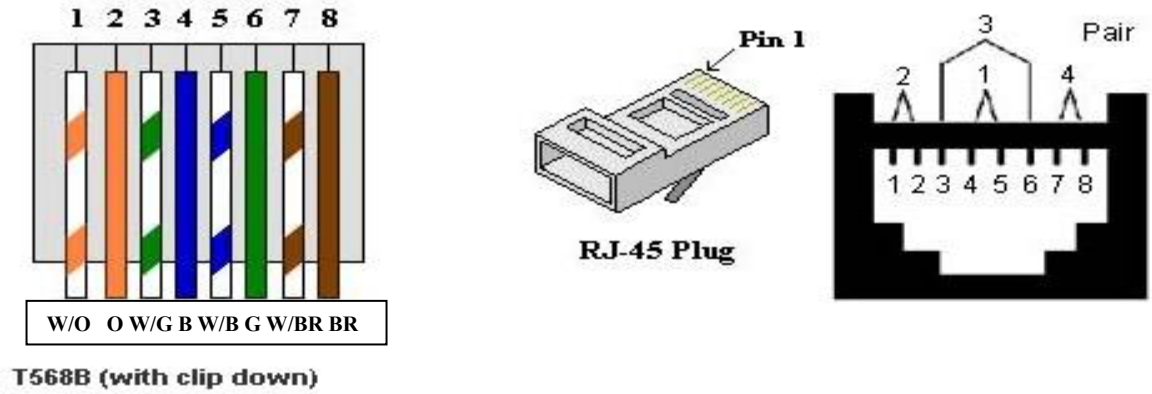
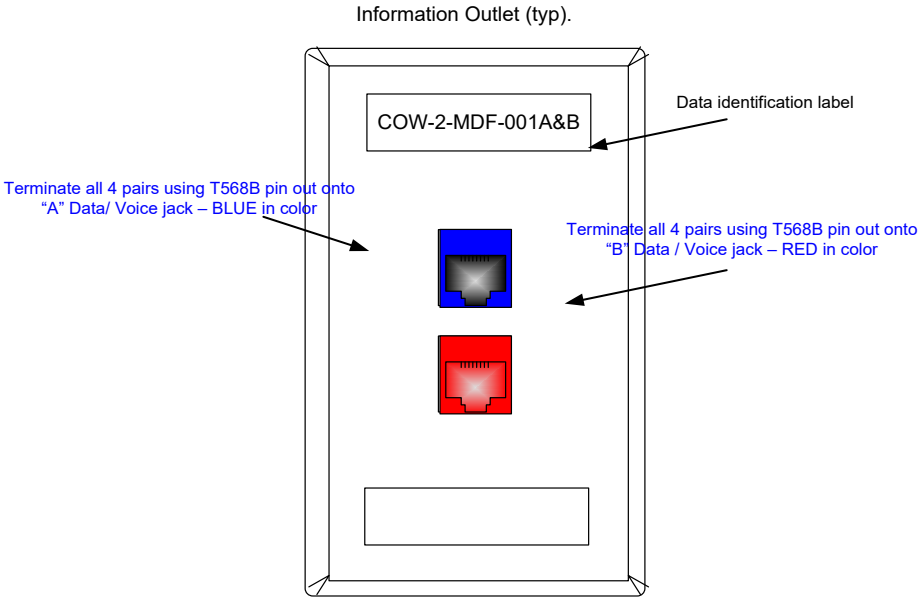
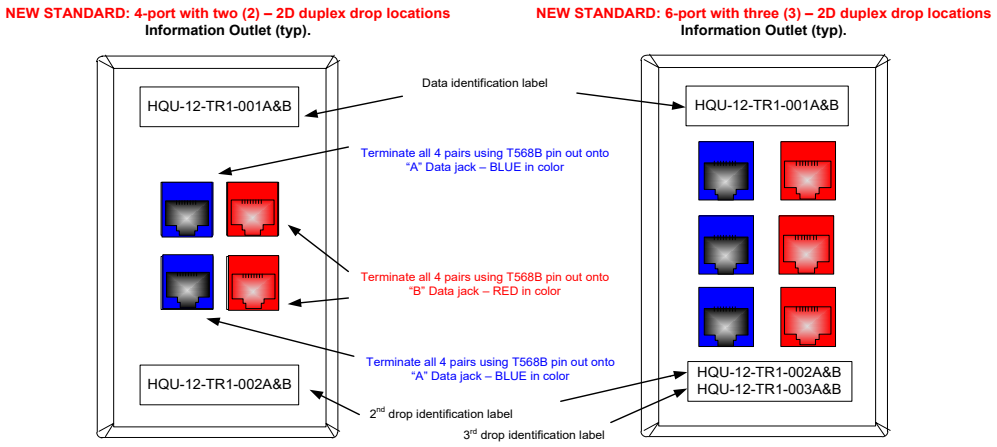


Exhibit 10: Example: Flush wall outlet "CURRENT" 2D – DUPLEX DROP STANDARD





6.0 INSTALLATION OF OPTICAL FIBER CABLES AND CONNECTORS

This section provides the specifications to be used when installing all optical fiber cabling. All fiber optic installation and termination shall conform to ANSI/TIA/EIA-568C standards. All work shall also comply with ANSI/TIA/EIA–568C, ANSI/TIA/EIA-569, ANSI/TIA/EIA-606, TIA-455, TIA-492, TIA-526-14-A for multimode and TIA-526-7 for singlemode, NEC and IEEE standard specification quality (as applicable).

6.1 Backbone Fiber Optic Cable

The optical fiber backbone cable shall connect each TR (remote wiring closet) to the MDF. The fiber strand count shall be a minimum of 12 strands, multi-mode, 50/125 µm optical LOMM OM3 fiber cable with graded index, 250 or 900 µm buffer, with contiguous, 2-feet, segment-length markers printed on the cable jacket. All intra-building backbone fiber optic cables shall be an armored plenum construction or plenum (OFNP) cable installed in a (CMP) plenum-rated innerduct. All inter-building backbone fiber optic cables shall be installed in conduit.

Fiber-optic cable shall not share conduits with copper medium unless separation between copper and fiber is maintained. For large campus or complex backbone fiber installations where multiple conduits or pathways exist, fiber-optic cable shall be separated from the copper cable installation, wherein fiber-optic cable is dedicated to one conduit, copper to another. In retrofit or existing buildings, where pathways are insufficient to maintain separation between copper and fiber, USCIS OIT shall review and approve the design prior to installation.

All optical fiber cables shall be light tested prior to installation. This is typically done while the cable is still on spools or reels and only ensures all strands pass light prior to pulling cable into conduits and pathways. All fiber optic strands of backbone cabling shall be terminated with the appropriate SC connectors, unless specified otherwise, and capped with a dust boot. All strands shall be tested bi-directional (both directions) with a Fluke Level V or greater tester. The key installation requirements are highlighted below.

- Install all fiber optic cabling and components in a neat and workmanlike manner.
- Optical fiber cable length shall not exceed 300 meters.
- Install all fiber optic backbone cables in accordance with manufacturer's recommendations.
- All backbone communications cables shall be installed in pathways and spaces designated for communications cables.
- All optical fiber cables shall be of the interlocking plenum CMP armor design for protection or appropriately plenum-rated CMP plastic tubing (innerduct) upon prior approval from USCIS.
- Ensure pulling tension of optical fiber cables do not exceed a pull load of 50 foot pounds.
- Optical fiber cables shall support a bend radius of 10 times the cable outside diameter when not subject to tensile load, and 15 times the cable outside diameter when subject to tensile loading up to the cable's rated limit.
- Contractor shall provide in a quick and timely fashion any additional materials or labor that may be damaged during the work at no charge to the owner.
- Pull one additional "Mule Tape" or ¼" Nylon rope when pulling cables through any conduit.
- Properly support backbone cables in ceiling every 4'-5' using J-Hooks or cable tray.
- Provide 20' of service loop at both equipment closet ends.
- Terminate and support cables to avoid strain on terminating equipment.
- Neatly and permanently label all backbone cables with the cable number at both ends.
- Terminate all pairs, conductors and strands at all ends according to manufacturer's instructions following color code sequence.
- Utilize Velcro fasteners. Tie wraps are NOT acceptable in any application of the installation.
- Label all fiber pairs using the 568SC method.
- Fire seal all sleeves and conduit openings after the cable installation is complete.

- All optical fiber cable shall be installed in the fiber panels in accordance with the manufacturer's instructions.

- Field test instruments for multimode and singlemode fiber optic cabling shall meet the requirements of TIA-526-14-A & and TIA-526-7.

- When using a mandrel wrap, the reference jumper should be wrapped in five non-overlapping turns around a smooth round mandrel (rod) during the reference calibration of the source to the detector and for all loss measurements in accordance with TIA-568C and TIA-455.

- Link attenuation testing shall use the One Reference Jumper Method specified by TIA-568C along with TIA-526-14-A for multimode and TIA-526-7 for singlemode.

- Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices.

- The backbone optical fiber cabling link segment shall be tested in both directions at both operating wavelengths of 850 nanometers and 1300 nanometers to account for attenuation deltas associated with wavelength for multimode.

- The backbone optical fiber cabling link segment shall be tested in both directions at both operating wavelengths of 1330 nanometers and 1500 nanometers to account for attenuation deltas associated with wavelength for singlemode.

- Total loss budget for any fiber Channel shall not exceed 2.0 dB.

- Splices are not permitted. If applicable, spliced optical fiber cables shall not exceed .3 dB.

- If applicable, because backbone length and the potential number of splices vary depending upon site conditions, the link attenuation equation (1) should be used to determine acceptance values based upon this Standard's component requirement at each of the applicable wavelengths.
    - *Link Attenuation Allowance (db) = Cable Attenuation Allowance (db) + Connector Insertion loss Allowance (db) + Splice Insertion loss Allowance (db)*
    - *Where: Cable Attenuation Allowance (db) = Maximum Cable Attenuation Coefficient (db/km) x Length (km)*
    - *Where: Connector Insertion Loss Allowance (db) = Number of Connection Pairs x Connector Loss Allowance (db)*
    - *Where applicable: Splice Insertion Loss Allowance (db) = Number of Splices x Splice Loss Allowance (db)*

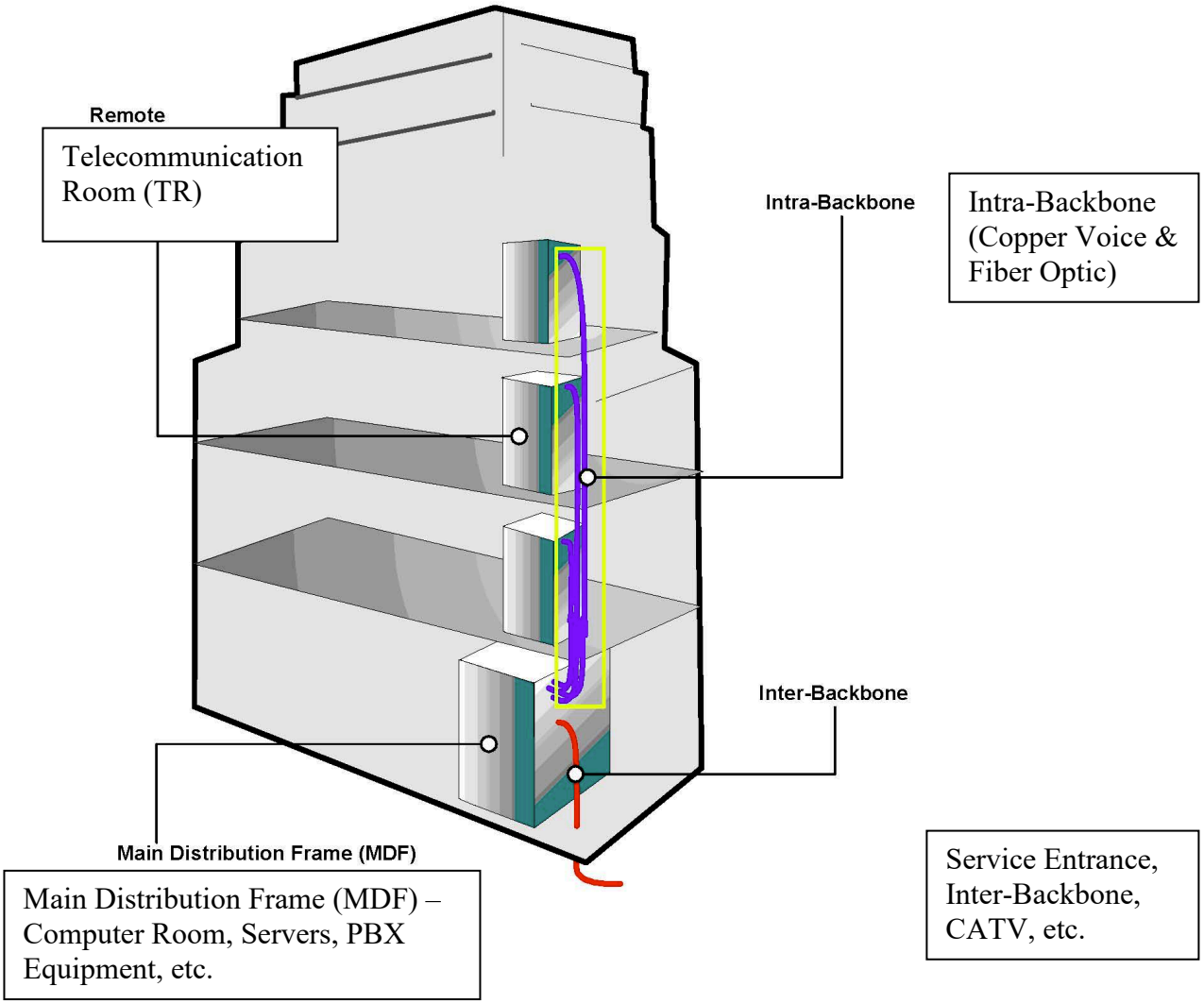
- If applicable, ensure that all splice closures for optical fibers are properly sealed for protection of the cable and splices. Label the splice location(s) accordingly.

- Contractor shall provide in a quick and timely fashion any additional materials or labor that may be damaged during the work at no charge to the owner.

- Test and certify all cabling with a Fluke Level V or greater tester within calibration period. Supply documentation of calibration and serial number(s) with test results upon completion of installation.

- Label and document the horizontal cable installation to include labeling and pathways on the As-Built drawings.

Exhibit 11: Typical Fiber Optic & Voice Copper Building Backbone



6.2 Horizontal Workstation Fiber Optic Cable

If the application is required, the fiber horizontal workstation cable connects the workstation to the TR. The cable shall be a two (2) – six strand, multi-mode, 50/125 µm LOMM OM3 optical fiber cable with graded index 250 or 900 µm buffer with contiguous, 2-foot, segment-length markers shall be printed on the cable jacket. The bend radius of any optical fiber cable installed shall be at least eight times the outside diameter of the cable. All horizontal fiber optic cables shall be an armored plenum construction or plenum (OFNP) cable installed in a (CMP) plenum-rated innerduct. Pulling tension for optical fiber cables must adhere to and not exceed manufacturer specifications. All fiber optic strands of the horizontal cable shall be terminated with the appropriate SC connectors and capped with a dust boot. A module adapter for the EO / TO faceplate shall accommodate the duplex SC termination. **Note: Under special circumstances, LC duplex connectors and panels may be utilized upon prior approval from USCIS (Example: service provider fiber from the Building Demarcation).**

EXCEPTION: 62.5um fiber optic solution for special application upon prior approval.

6.3 Fiber Optic Cable Jacket

All fiber optic installations shall use optical cable with a plenum-graded jacket that is marked with a UL rating of "OFNP" or equivalent.

Exhibit 12: Fiber optic jacket color reference chart

Common Industry Jacket Colors	
Single-mode (SM)	Yellow
Multimode (MM)	Orange / Slate
Laser Optimized	Aqua

6.4 Fiber Optic Connector

The optical fiber connector for workstation or backbone connections shall follow the ANSI/TIA/EIA standards for installation. The optical fiber connector shall be SC type connectors for workstation and/or backbone installation.

In retrofit buildings, fiber connectors should match the existing installed connectors unless otherwise specified.

- Comply with Section 4.6 per recommended manufacturer specifications for termination and testing.

Note: Under special circumstances, LC duplex connectors and panels may be utilized upon prior approval from USCIS or a requirement listed in the Cable Plant S.O.W. (Example: Service Provider armored fiber from the Building Demarcation or a HSDN / Talon Room).

Exhibit 13: TIA / EIA 568C Requirements for Duplex SC Standard Configuration

Attenuation Loss (per mated pair)	< .75 dB
MM Return Loss @ 850/1300 nm	> -20 dB
SM Return Loss @ 1310/1550 nm	> -26 dB
3.0mm Jacketed Cable Retention @ 0 degrees	15 lbs.
3.0mm Jacketed Cable Retention @ 90 degrees	4.4 lbs.
900 micron (Distribution) Cable Retention @ 0/90 degrees	.50 lbs.
250 micron (Bare) Fiber Retention @ 0/90 degrees	.50 lbs.
Operating Temperature	0 to +50oC
Bandwidth	NONE
Connector performance at Equipment Interface	NONE

6.5 Fiber Optic Cable Termination

All optical fiber cables shall be light tested prior to installation. This is typically done while the cable is still on spools or reels and only ensures all strands pass light prior to pulling cable into conduits and pathways.

The minimum termination shall be two strands for a horizontal cable. When installing fiber-optic backbone cabling, all strands will be terminated with the appropriate connectors and capped with a dust boot. All strands shall be terminated and tested.

All optical fiber cables shall have a twenty (20) foot storage coil (wrapped in an appropriately sized loop for the minimum bend radius of the cable) positioned at each end, where possible before being terminated with connectors. All intermediate slack in the optical fiber cable shall be loosely coiled and suspended to avoid hard bends or kinks.

- Comply with Section 4.6 per recommended manufacturer specifications for termination and testing.

Exhibit 14: Fiber optic strand color reference chart

Color Codes: Fiber Optic Strands			
Sequence Number	Color	Sequence Number	Color
1	Blue	7	Red
2	Orange	8	Black
3	Green	9	Yellow
4	Brown	10	Violet
5	Slate	11	Rose
6	White	12	Aqua

Exhibit 15: Fiber optic wavelength reference chart

Transmission Wavelengths of Various Fiber Optic Cabling		
Type	Fiber Size	Transmission Wavelength
Multimode	62.5/125	850nm 1300 nm
Multimode	50/125	850nm 1300 nm
Single-mode	8.3/125	1310nm 1550nm

Exhibit 16: Fiber optic application & distance reference chart

Application	Data Rate (bps)	Source Type(s)	Laser Optimized 50 Micron 2000/500 MHz/km	Typical 50 Micron 500/500 MHz/km	Typical 62.5 Micron 200/500 MHz/km	Single mode 8 – 9 Micron
10BASE-FL	10 M	*850 nm LED*	1,250	1,250	2,000	Not Supported
100BASE-SX	10/100 M	*850 nm LED*	300	300	300	Not Supported
100BASE-FL	100 M	1300 nm LED	2,000	2,000	2,000	Not Supported
1000BASE-SX	1 G	*850 nm VCSEL*	900 – 1,000	550	275	Not Supported
1000BASE-LX	1 G	1310 nm FP or VCSEL	600	550	550	5,000
10GBASE-SR	10 G	*850 nm VCSEL*	300	82	33	Not Supported
10GBASE-LR	10 G	1310 nm DFB	Not Supported	Not Supported	Not Supported	10,000
10GBASE-LX4	10 G (4x2.5 G)	Four 1310 nm DFBs	300	300	300	10,000
Video					5,500	38,000

7.0 EQUIPMENT RACK

There are a multitude of equipment racks and cabinets that are acceptable for use in USCIS installations. In these shared Computer / Telecommunication Rooms, the open racks, cabinets and swing gates may be used to meet the needs of the installation. When open racks or swing gates are used, they shall be located within the Computer / Telecommunication Rooms and shall provide structural support for the patch panels and required electronics. The open rack will be a standard 19 inches wide by 7 feet tall when used in a floor mount configuration. When space considerations mandate, it is acceptable to use an open, wall-mounted equipment rack (swing gate). If a wall mount configuration is used, the rack must be hinged, and space must be provided so that the rack can swing fully open and provide full access to the back of the rack.

All floor or wall-mounted equipment racks, cabinets and swing gates installed in earthquake-prone geographic areas shall be installed in compliance with specific seismic guidelines, regulations and codes. Special attention must be taken to ensure the proper installation techniques are followed to minimize risk to electronics and cable plant, and most importantly prevent the mounting hardware from toppling over during seismic activity. Floor mounted racks and cabinets shall have a minimum of 36 inches of clearance in front of, behind, and on at least one side. Where space or room layouts limit the minimum clearances required, the installation contractor shall notify the OIT designated representative for technical direction.

Equipment shall be mounted on the rack via holes in the frame or by using mounting hardware that conforms to the EIA-310 mounting-hole spacing standard. As an alternative for non-rack devices, equipment may be placed on flat shelves that are attached to the rack. All racks shall be secured either to the floor or wall with bolts or other fasteners that are rated to withstand the recommended weight limits and shear loads for the rack. Each rack shall include all mounting and assembly hardware (such as nuts and bolts) for full configuration use.

All racks will be bonded (grounded / bonded) to appropriate TMGB or TGB (Telecommunication Main Grounding Busbar) with a minimum #6 AWG green ground wire with required lugs. When multiple racks and/or cabinets are used and they are butted together in the closet, they shall be bolted together for additional stability. Each enclosure and equipment rack shall be bonded to the TGB separately with individual #6 AWG green ground wire and lugs. Bonding shall be in accordance with J-STD-607 for installation and the ANSI/TIE/EIA-606 standards for labeling.

Equipment layout, specifically with respect to rack, cabinet, and swing gate location are critical design elements that ensure future growth, maintenance and flexibility are protected. Proper clearances also allow installers and maintenance personnel the required room to perform work safely and ensure electronics environmental conditions are maintained.

The patch cables shall run neatly through the horizontal and vertical wire management panels to the appropriate electronics and port. The cables between the patch panels and the electronics shall not be excessively long nor shall they lie on the floor. The patch cables shall be secured and bundled using Velcro securing straps.

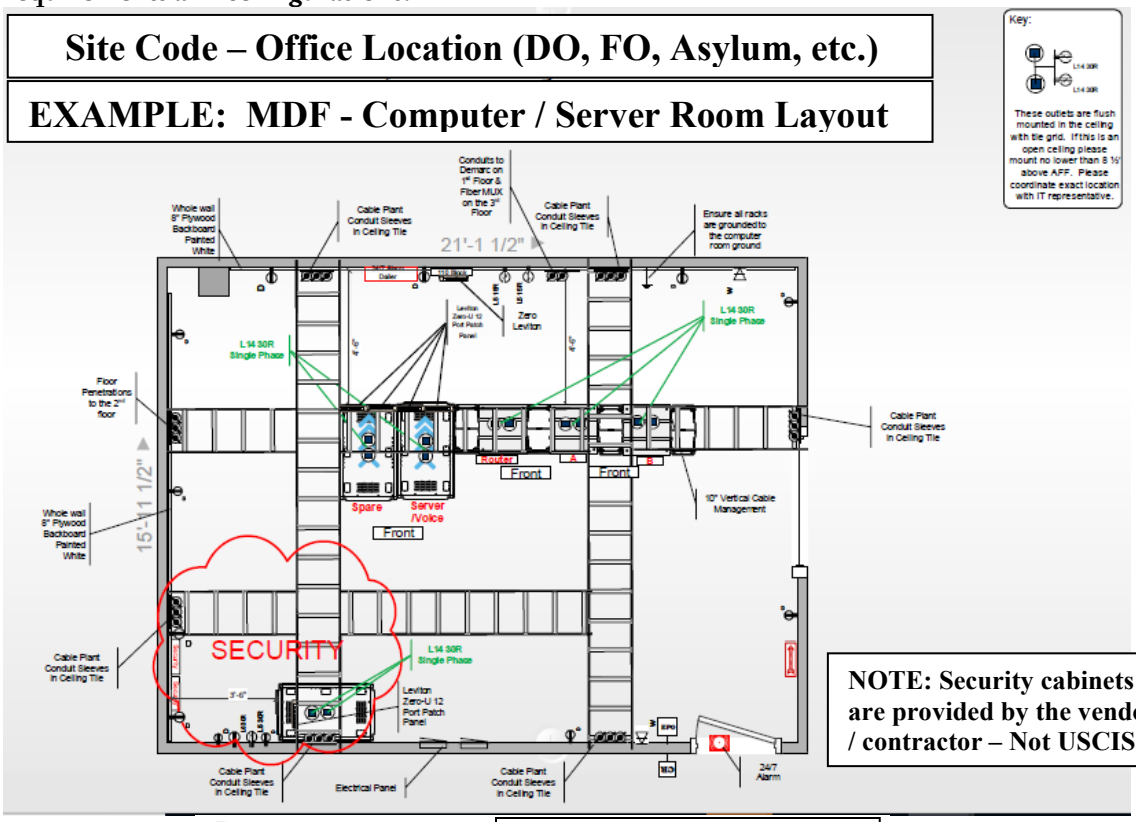
A PDU (Power Distribution Unit) with surge suppression, network connection capability and an on/off switch shall be mounted to the back of the rack to supply at least ten outlets for AC power (120-volt, 20-amp service) which will be plugged into the UPS unit specified. The key installation requirements are highlighted below.

- Assemble free standing racks according to manufacturer's instructions.
- Verify that equipment mounting rails are sized properly for rack-mount equipment before attaching the rack to the floor. All fiber optic cabling and components in a neat and workmanlike manner.
- All racks must be attached to the floor in four places using appropriate floor mounting anchors. When placed over a raised floor, threaded rods should pass through the raised floor tile and be secured in the structural floor below.
- Racks shall be bonded (grounded) to the Telecommunication TMGB connected to the TBB bus bars located in the MDF and TR(s) TGB using minimum #6 AWG green insulated solid copper wire and any necessary attachment hardware provided by the Installer Contractor in accordance with the J-STD -607 and ANSI/TIE/EIA-606 standards.
- The equipment load should be evenly distributed and uniform on the rack. Place large and heavy equipment towards the bottom of the rack. Secure all equipment to the rack with equipment mounting screws.
- Mount the PDU (Power Distribution Unit) or rack mount power strips within 6' of where the UPS (Uninterruptible Power Supply) equipment will be placed. If applicable, quantities and designated locations within equipment rack will be shown in provided elevation drawings.

Exhibit 17: Example – MDF /Computer Room Equipment Racks and Enclosures Elevation with patch panel, vertical and horizontal wire management, shelves, PDU, UPS, Network Switches, PBX, Servers, remote server 12-port patch panels, etc. & Room Layout below with Ladder Runway, equipment rack, cabinet, electrical panel, outlet, EPO, CR, security, plywood, etc. requirements and configurations.

Site Code – Office Location (DO, FO, Asylum, etc.)

EXAMPLE: MDF - Computer / Server Room Layout



NOTE: Security cabinets are provided by the vendor / contractor – Not USCIS

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Enterprise Infrastructure Documentation

EXAMPLE: Rack Elevations

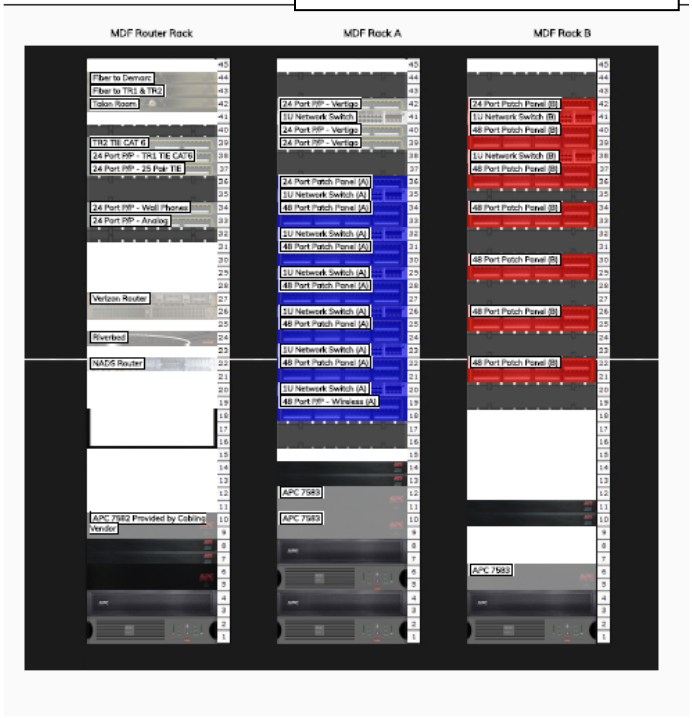
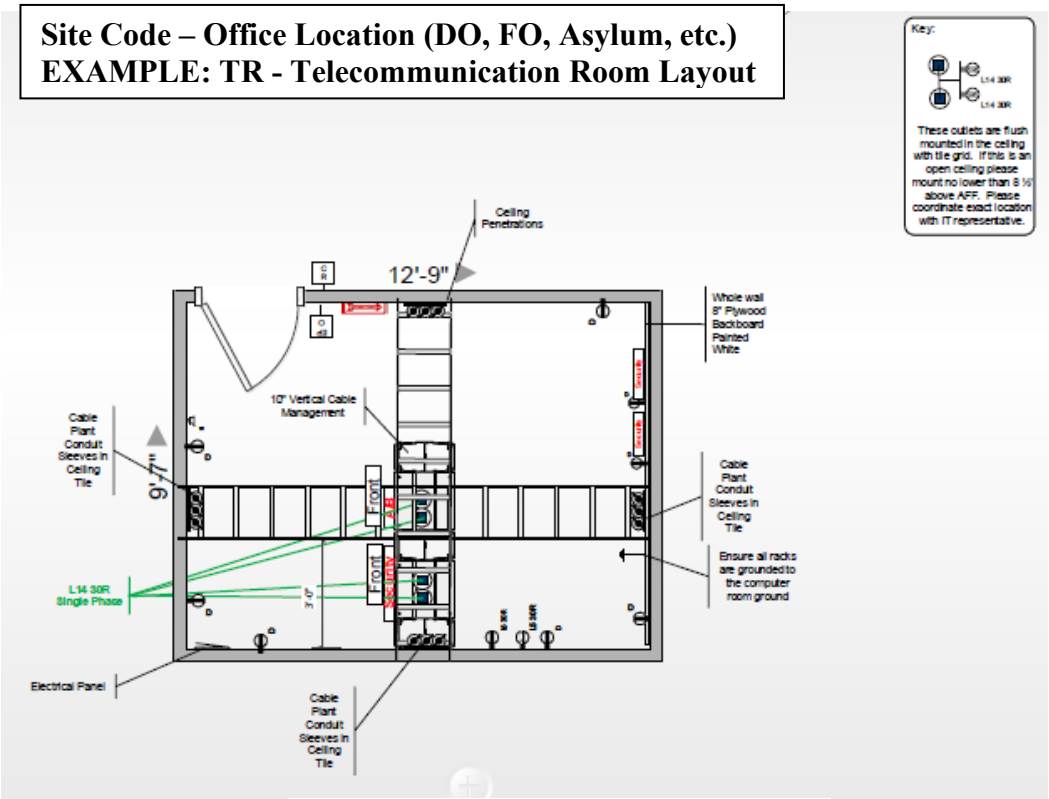


Exhibit 18: Example – TR (Telecommunication Room) Equipment Rack Elevation with patch panel, vertical and horizontal wire management, PDU, UPS, Network Switches, etc. & Room Layout below with Ladder Runway, equipment rack, cabinet, electrical panel, outlet, EPO, CR, security, plywood, etc. requirements and configurations.

Site Code – Office Location (DO, FO, Asylum, etc.)
EXAMPLE: TR - Telecommunication Room Layout



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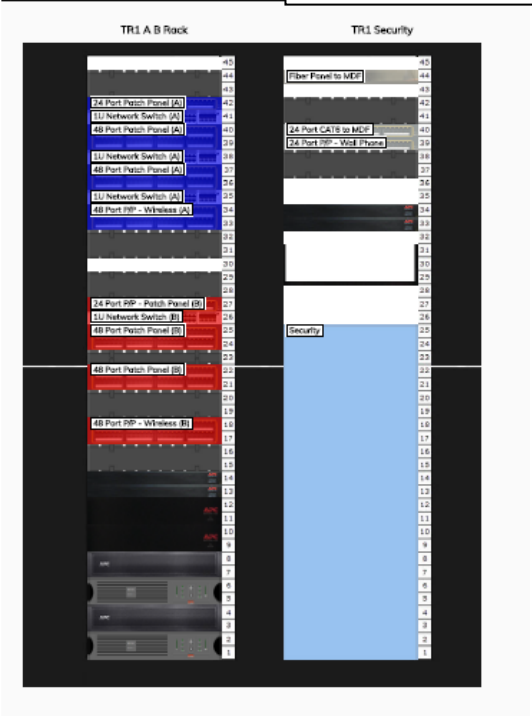
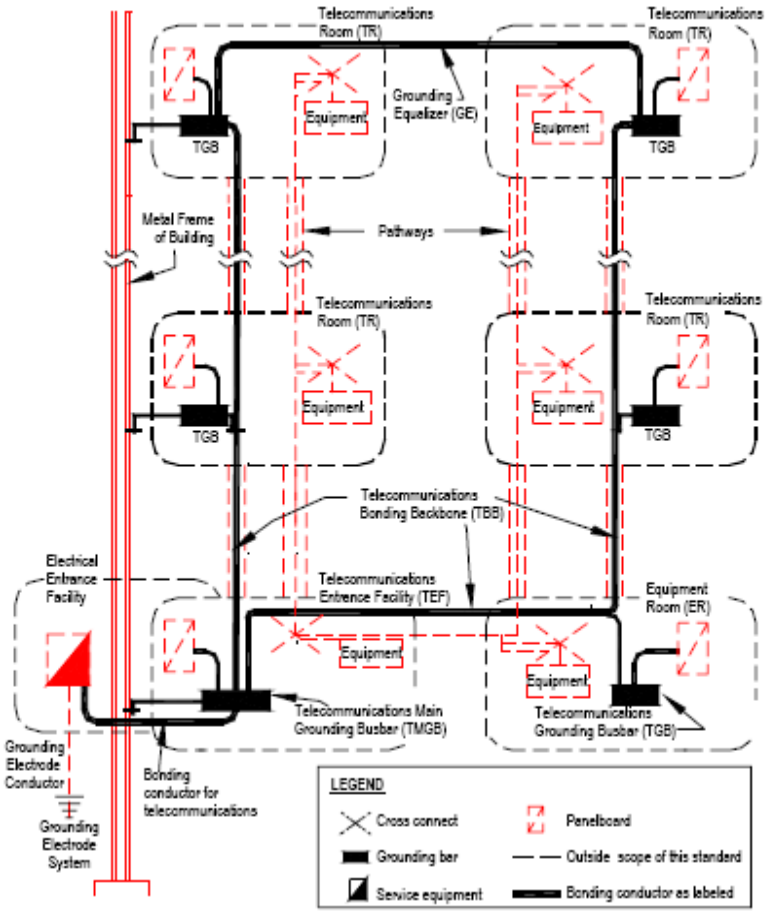
EXAMPLE: TR – Rack Elevations



8.0 BONDING & GROUNDING (EARTHING)

Due to the advancements in technology, a reliable electrical ground reference potential is required for protecting active electronics. Bonding or grounding to the nearest building steel, iron pipe, etc. is no longer a satisfactory or acceptable. The standards provide the design and proper installation to ensure these requirements. The installation of the telecommunication bonding and grounding system shall follow the requirements in accordance with J-STD-607-A for installation and the ANSI/TIE/EIA-606 standards for labeling. The NEC (National Electrical Code) also provides guidelines to ensure that electrical installations in buildings meet the necessary safety practices to prevent electrical shock hazards to personnel, ensure fault clearance of unintentional electrical breakdowns that could cause fire, and prevent transient voltages from causing electrical damage to installed network components. Installations shall also be in accordance with local and state codes as well.

Exhibit 19: Bonding & Grounding reference diagram for Commercial Building Installation



TIA/EIA-J-STD-607-A

Exhibit 20: Specifications for sizing of the TBB

TBB Length Linear Feet (meter)	TBB Size (AWG)
Less than 13' (4)	6
14' – 20' (4 - 6)	4
21' – 26' (6 – 8)	3
27' – 33' (8 – 10)	2
34' – 41' (10 – 13)	1
42' – 52' (13 – 16)	1/0
53' – 66' (16 – 20)	2/0
Greater than 66' (20)	3/0

NOTE: USCIS expectation is that # 3/0 + AWG - TBB will be extended from the Main Electrical Building Entrance to the MDF / Computer Room TMGB with a secondary ground connection, # 4 + AWG to building steel. If applicable, an AWG 3/0 + TBB will be extended to each of the Telecommunication Rooms (TR's) TGB from the MDF / Computer Room TMGB along with a secondary ground connection, AWG # 4 + to building steel to each TGB, which are typically installed by the electrical contractor for LAP projects. All bonding / grounding requirements within the Computer Room and TR's shall be installed by the awarded cabling contractor to include each equipment rack separately, ladder runway sections, armored fiber optic cable, etc., with a # 6 + AWG. The electrical contractor is also required to ground / bond the basket tray accordingly per the manufacturer's specifications.

9.0 ADMINISTRATION AND LABELING CONVENTIONS

Label conventions shall apply to all sites, regardless of the number of buildings at the site. This section describes the USCIS standard labeling convention for all cable installations, whether new or retrofit.

9.1 Building Designation

The designation for the building shall be a two to four character alphanumeric scheme. The designation is assigned by USCIS facilities and is generally three characters (Ex. HQU – WA Headquarters). Buildings typically have unique names/numbers, whether in multi-story complexes or in campus environments. The first designation should represent the unique building the cable plant is wired within. This nomenclature will rarely change throughout the life of the building and allows a structured naming convention to be used for Inter & Inter-building backbone cable installations as well.

9.1.1 Floor

The designation for the floor shall be a two-digit number. If the floor is a single number such as "4," place a leading zero before the single-digit, for example "04."

9.1.2 Computer & Telecommunications Rooms (Remote Wiring Closets)

The designation for a wiring center is a single letter. The Computer / LAN Room or MDF shall always have the designation of "MDF." Telecommunication Rooms (Remote Wiring Closets) shall be labeled TR1, TR2, etc.

9.1.3 Cable Numbers

The Equipment Outlet (EO) / Telecommunication Outlet (TO) designation for the cable shall be a three-digit number, followed by an "A" and "B" (If applicable "C"). This designation indicates the "A" and "B" (If applicable "C") cable for that drop. For example, the designation for drop # 3A would become 003A.

The single wall phone designation for the cable shall be a three-digit number, followed by a "W", which will be terminated on a separate 24-port patch for single voice drop locations. For example, the designation for wall phone # 3 would become 003W.

Exception: "D" may be applied for special application for training room requirement, etc. (gray in color)

9.2 Equipment Outlet / Telecommunication Outlet

The EO / TO is the interface for the workstation cable and the horizontal workstation cable, that terminates in a wiring closet. This is typically referred to as the "jack" in the industry, also an enhancement to the Bell Labs Universal Service Order Code (USOC) specifications. These specifications also referenced the RJ pin assignments. The ANSI/TIA/EIA now prefers to use the term 8-pin modular plug or connector when describing jack pin-outs. Each equipment outlet should be labeled according to the following guidelines:

The designations on single-gang and double-gang faceplates will be as follows:

- Building (HQU, or combination).
- Floor (12, leading with zero if single digit).
- Wiring center /closet (TR1).
- Cable drop (001[A&B], leading zero(s) for total of three digits).

For example: "HQU-12-TR1-111A"
Site location: HQU = WA Headquarters building, 12 = 12th floor, TR1 = Telecommunication Room, and 111A = cable drop #111 cable A.

Single wall phone example: "HQU-12-TR1-011W"
Site location: HQU = WA Headquarters building, 12 = 12th floor, TR1 = Telecommunication Room, and 011W = wall phone cable drop #011 cable W.

9.3 Intra and Inter-Building Backbone Cables

These backbone cables interconnect wiring closets either within a building or interconnect buildings in a campus environment.

The naming convention applies for Intra-backbone cable labeling. Standard nomenclature for backbone cabling shall be as follows:

- MDF Location (3–6 alphanumeric characters).
- MDF Location (includes floor, closet and pair or strand designations).
- TR Location (3–6 alphanumeric characters).
- TR Location (includes floor, closet and pair or strand designations).

For example, "HQU-1/MDF-2/TR1-001"

From MDF location: HQU = Site code of the first location within building (origination point), 1 = 1st floor, MDF = Computer Room, 001 = cable pair (copper) or strand (fiber) if applicable –

To TR location: HQU = Site code of the second location within building (designation point), 2 = 2nd floor, TR1 = Telecommunication Room, 001 = cable pair (copper) or strand (fiber) if applicable.

These backbone cables interconnect wiring closets either within a building or interconnect buildings in a campus environment.

The naming convention applies for Inter-backbone cable labeling. Standard nomenclature for backbone cabling shall be as follows:

- First Building Location (2–6 alphanumeric characters).
- First Building MDF / TR Location (includes floor, closet and pair or strand designations).
- Second Building Location (2–6 alphanumeric characters).
- Second Building MDF / TR Location (includes floor, closet and pair or strand designations).

For example, "HQU-1-MDF-001 – ULL-1-MDF-001"

From location: HQU = Site code of the first building (origination point), 1 = 1st floor, MDF = Computer Room, 001 = cable pair (copper) or strand (fiber).

To location: ULL = Site code of the second building (destination point), 1 = 1st floor, MDF = Computer Room, 001 = cable pair (copper) or strand (fiber).

*** The cable labels shall be affixed to both ends of the cable, approximately 2 to 6 inches from the termination point. Machine printed, wrap-around labels are required.**

Exhibit 21: TIA/EIA 606-A color coding reference chart

	Color Coding of Termination Fields
Orange	Demarcation Point
Green	Network Connections on Customer's Side
Violet	Common Equipment
White	1st Level Backbone
Slate	2nd Level Backbone
Blue	Horizontal Cabling (HC end only)
Brown	Inter-building (campus) Backbone
Yellow	Auxiliary Circuits
Red	Reserved for Fire Alarm Circuits

10.0 TEST AND DOCUMENTATION PROCEDURES

The installation contractor shall complete all testing of the cable plant. The installation contractor is responsible for providing all personnel, equipment, instrumentation, and supplies that are necessary to perform the required testing.

10.1 Testing of Installed Horizontal Copper Cable Plant

All installed copper cables shall be tested with a Fluke Level V or greater cable tester to certify that the cable conforms to ANSI/TIA/EIA-568C specifications. The test device shall provide printed and electronic (soft) Pass/Fail test results that show the following (Fluke Linkware flw. format):

- Length in feet (accurate to 0.5 feet)
- Wire map
- Insertion loss (attenuation)
- Propagation delay
- Delay skew
- NEXT loss
- PSNEXT loss
- ACRF / PSACRF loss
- ACRN / PSACRN loss
- Return loss (RL)
- Continuity (for all eight wires)
- Capacitance
- Resistance / DC loop
- Frequency
- Cable type
- Test limit
- Drop number
- Date of test / time
- Headroom
- Test summary: PASS
- Name, model and serial numbers of the field tester (i.e. Fluke).
- Adapter used for test.
- Software version or level.
- Date the field tester was last calibrated.
- Test performed (TIA Cat 6 Permanent link).

Exhibit 22: Example – Fluke Cat 6 Permanent Link Certification

LINKWARE™ PC
CABLE TEST MANAGEMENT SOFTWARE

Cable ID: MVT-1-MDF-001W
Test Limit: TIA Cat 6 Perm. Link
Limits Version: V7.5
Date / Time: 10/16/2020 07:28:14 AM
Operator: [redacted]
Headroom 7.2 dB (NEXT 1,2-4,6)
Cable Type: LANmark-2000 CMP
NVP: 73.0%

Main: Versiv
S/N: 2016033
Software Version: V6.5 Build 5
Calibration Date: 09/21/2020
Adapter: DSX-8000 (DSX-PLA804)
S/N: 20358529

Test Summary: PASS
Remote: Versiv
S/N: 2021162
Software Version: V6.5 Build 5
Calibration Date: 09/21/2020
Adapter: DSX-8000R (DSX-PLA804)
S/N: 20358539

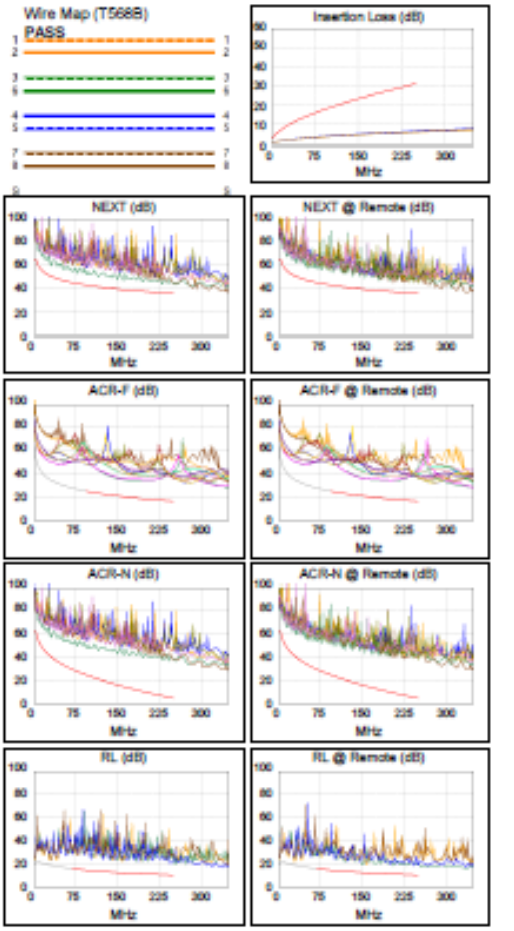
Length (ft), Limit 295	[Pair 1,2]	64
Prop. Delay (ns), Limit 498	[Pair 4,5]	94
Delay Skew (ns), Limit 44	[Pair 4,5]	5
Resistance (ohms)	[Pair 3,6]	3.10
Insertion Loss Margin (dB)	[Pair 4,5]	24.6
Frequency (MHz)	[Pair 4,5]	250.0
Limit (dB)	[Pair 4,5]	31.1

64 ft

Wire Map (T568B)
PASS

	Worst Case Margin		Worst Case Value	
PASS	MAIN	SR	MAIN	SR
Worst Pair	1,2-4,5	3,6-4,5	1,2-4,5	3,6-4,5
NEXT (dB)	7.2	8.2	7.2	8.2
Freq. (MHz)	230.0	227.0	230.0	227.0
Limit (dB)	35.9	36.0	35.9	36.0
Worst Pair	4,5	3,6	4,5	3,6
PS NEXT (dB)	8.1	8.0	8.4	8.0
Freq. (MHz)	231.0	226.5	247.5	226.5
Limit (dB)	33.3	33.4	32.8	33.4
PASS	MAIN	SR	MAIN	SR
Worst Pair	1,2-4,5	1,2-4,5	1,2-4,5	1,2-4,5
ACR-F (dB)	14.8	15.0	15.6	15.8
Freq. (MHz)	168.5	168.5	194.0	206.0
Limit (dB)	19.7	19.7	18.4	17.9
Worst Pair	4,5	4,5	4,5	4,5
PS ACR-F (dB)	13.7	13.6	16.7	17.3
Freq. (MHz)	1.0	1.5	194.0	206.0
Limit (dB)	61.2	57.7	15.4	14.9
N/A	MAIN	SR	MAIN	SR
Worst Pair	1,2-4,5	1,2-4,5	1,2-4,5	3,6-4,5
ACR-N (dB)	16.7	17.0	31.9	33.6
Freq. (MHz)	8.1	14.4	241.5	247.5
Limit (dB)	54.3	48.7	5.1	4.5
Worst Pair	4,5	1,2	4,5	3,6
PS ACR-N (dB)	17.6	18.7	32.9	33.7
Freq. (MHz)	4.0	3.4	247.5	250.0
Limit (dB)	58.3	58.8	1.9	1.6
PASS	MAIN	SR	MAIN	SR
Worst Pair	1,2	3,6	4,5	3,6
RL (dB)	9.9	6.8	9.9	7.4
Freq. (MHz)	157.5	150.5	245.0	205.5
Limit (dB)	12.0	12.2	10.1	10.9

Compliant Network Standards:
10BASE-T, 100BASE-TX, 100BASE-T4, 1000BASE-T, 2.5GBASE-T, 5GBASE-T, ATM-25, ATM-51, ATM-155, 100VG-AnyLan, TR-4, TR-16 Active, TR-16 Passive



LinkWare™ PC Version 10.7

Project: GSA
GSA Label name Test results.flw
Page 238

FLUKE networks

10.2 Testing of Optical Fiber Cables

Testing shall be of the optical link as specified in TIA-568C and TIA-455 for multi-mode and single-mode fiber optics. An optical fiber link is defined as the passive cabling network between two optical cross-connects (patch panels or outlets). This includes cable, connectors and splices but does not include active components. The link test contains the representative connector loss at the patch panel associated with the mating of patch cords, but does not include the performance of the connector at the equipment interface.

If the manufacturer of cables or connecting hardware has supplied post-manufacture performance data, copies of such data are to be included in the documentation.

All installed fiber optic cables shall be tested with a Fluke Level V or greater cable tester to certify that the cable conforms to ANSI/TIA/EIA-568C and TIA-455 specifications. The test device shall provide printed and electronic (soft) Pass/Fail test results that show the following (Fluke Linkware flw format):

Exhibit 23: Typical Signal (Attenuation, Insertion Loss) for Fiber Optic Cables & Connectors

Optical Fiber Cable Type	Transmission wavelength (nm)	Estimated Maximum Attenuation (dB/km)
62.5 / 125 um MM	850 / 1300	3.5 / 1.5
50 / 125 um MM / LOMM	850 / 1300	3.0 / 1.5
Singlemode – Inside plant	1310 / 1550	1 / 1
Singlemode – Outside plant	1310 / 1550	.5 / .5

Test reports shall include the following information for each cabling element tested:

- Actual measured and maximum allowable attenuation (loss) at the specified wavelengths.
- Reference method.
- Number of mated connectors and number of splices (if any).
- Actual length and maximum allowable length.
- Group refractive index (GRI) for the type of fiber tested, if length was optically measured.
- Tester manufacturer, model, serial number and software version.
- Fiber Optic Cable ID number and project/job name.
- Link criteria used.
- Overall pass/fail indication.
- Cable type
- Test limit
- Identification number (pair, strand, etc.)

- Date of test / time
- Test summary: PASS
- Name, model and serial numbers of the field tester (i.e. Fluke).
- Adapter used for test.
- Software version or level.
- Date the field tester was last calibrated.
- Test performed (multimode 62.5um or 50um, singlemode, etc.).

*** Test reports are to be submitted in an electronic format along the Linkware .flw file on a CD or emailing option. Please consider the environment and do NOT print or provide hard copies of the test results.**

11.0 COMPUTER / TELECOMMUNICATION ROOM SPECIFICATIONS

11.1 Computer / Telecommunication Rooms (MDF and TR)

Typical telecommunications rooms house common equipment required to support both voice and data connectivity to workstations. Communication closets/rooms are typically centrally located on the floor, and adhere to the ANSI/TIA/EIA specifications for cable lengths (e.g. maximum cable from closet to workstation will not exceed 100 meters, end-to-end with an exception for extended distance of 350' utilizing Cat 6e if installed per manufacturer's requirements to meet the required warranty.). Closets/rooms should be vertically stacked, with a sufficient number of sleeves interconnecting each closet.

*** Refer to the Computer and Telephone Standard and Appendix (if applicable) documents for the following specifications and requirements.**

11.2 General Requirements

- Space should be environmentally temperate, convenient, and professional looking.

- Computer/ Telecommunication Rooms must have sufficient infrastructure required to support the variety of communication services provided to USCIS and contractor staff. Typically this includes items such as conduits, basket / cable trays, building grounding system, etc.

- Computer / Telecommunication Rooms should be designed for growth, and flexibility supporting new technologies without the need for major room modifications and rearrangements.

11.3 Conduit, Pathways & Sleeve Requirements

Conduit installations shall comply with all ANSI/TIA/EIA-569 specifications and NEC requirements. Highlights of that specification are as follows:

• Maximum fill factor of 40% per conduit shall be adhered to for new conduits. If possible, installers shall avoid using those conduits that have exceeded the 40% fill factor.

• Pull-box shall be installed every 100 feet and / or every two 90-degree turns.

• All bends in the conduit must be made hydraulically to create smooth, sweeping turns.

• All pull-boxes shall be sized to allow for the largest minimum bend radius for any of the cables that are used.

• Where local codes mandate that rigid conduit must be installed from the distribution closet to the EO / TO, a minimum of one 1-inch diameter conduit from wiring center to workstation EO / TO is required. This single, 1-inch conduit will support both voice and data grade cabling to the workstation and requires a consolidated voice and data closet.

• In buildings which local codes do not mandate rigid conduit from the distribution closet to the EO / TO, a minimum of one 1-inch diameter conduit from above ceiling grids to respective EO / TO is recommended. These conduits are referred to as "ring and string" within the industry, and typically provide a pathway for plenum cable installation into the outlet box. Although many local codes do not require rigid conduits for low voltage wiring, USCIS OIT recommends the general contractor install these for each EO / TO. The box, mounting ring and conduit stub with bushing to above ceiling space is typically provided by the electrician.

• Open office space (e.g., systems furniture where two or more EO / TO's are fed by a single column or feed) areas typically do not require conduit stubs or home run conduits. If conduits or stubs are installed, then conduit sizing shall ensure fill factor does not exceed 40%. Wall plates, bushings, loom tubing or spiral wrap for protection shall be utilized for the transition into the system furniture for a neat installation.

• Minimum of three (3) 4-inch diameter conduits shall be provided into any building or campus environment to utilize for entrance facility services, which is typical for new construction and coordinated by the lessor or GC with service providers to be extended to existing utility locations.

• Conduit sleeves shall be provided for horizontal penetrations for routing of cabling through sheetrock, block, etc. wall assemblies. Penetrations should be properly fire sealed in accordance with standards and code regulations.

• Minimum of three (3) 4-inch diameter sleeves shall be provided for vertically stacked closets. In open plenum environment where access to closets is not blocked by building structures or fixtures, and a clear pathway exists, conduit installation is not required to interconnect closets.

• Minimum of three (3) 4-inch diameter sleeves with plastic bushings shall be provided for the vertical transition of the horizontal cable plant from the above ceiling space down to the ladder runway in the MDF & TR's over the equipment racks for termination onto patch panels. Service loops shall be located in the basket tray or j-hooks above the MDF & TR's.

• Minimum of two (2) 4-inch diameter conduits shall be provided in any building or campus environment to the Building Demarcation Room location and where cable is subject to damage or there is no clear pathway for installation. These may be areas such as underground parking garages, outside cable routes, pathways through office space not under USCIS control, or areas that prevent cable installation at future dates, such as main building lobbies, under-floor pathways, etc.

• Minimum of four (4) 4-inch diameter conduits between buildings in a campus environment.

• Pull strings ("Mule Tape" or ¼" Nylon rope) shall be installed in all conduits intended for IT requirements.

• Pull one additional "Mule Tape" or ¼" Nylon rope when pulling cables through any conduit to replace the one previously installed for future requirements.

• Conduit pathways are required through office space not under USCIS control for floor box or drop locations and in public shared hallways for security and protection of the IT cabling. The requirement also applies in wall spaces shared with public or perimeter walls for protection.

*** Exceptions will be reviewed by the USCIS OIT representative.**

12.0 DOCUMENTATION

Upon completion of the cable plant installation, a documentation package will be completed within 30 calendar days that shall include the following items:

• Letter of certification of the installing organization from the structured cable plant vendor. **The Warranty for the installed structured cable plant shall be held by the manufacturer of the conductivity hardware (not the cable manufacturer)**.

• Completed Contractor Information Form.

• Detailed materials list.

• Cable plant test certification letter.

• Electronic Copper cable test results (soft) in Fluke Networks Linkware format (.flw). (Full plot data)

• Electronic Fiber Optic cable test results (soft) in Fluke Networks Linkware format (.flw). (Full plot data)

• Structured media warranty (system warranty) and warranty claim information document.

• As-built site drawings.

*** Please note that a rough draft floor plan with cable # identification must be left on site in the MDF / Computer Room for the OIT engineers to utilize for the deployments of new facilities. Surveying the cable plant is in the contact as a task of the voice vendor.**

All of this information shall be provided in both hardcopy and electronic formats, except as follows:

• Electronic Fiber Optic test results (soft).

• Electronic Copper test results (soft).

12.1 Letter of Certification & Information Form

A letter of certification shall be supplied to the designated USCIS Program Manager from the authorized project supervisor. A sample of the recommended letter of certification is included below in Attachment A & B of this document. The letter of certification should be submitted in electronic format using word Processing software compatible with Microsoft Word.

12.2 Implementation Report

A brief implementation report shall be submitted as part of the completed documentation package. This implementation report, at a minimum, should include the following information:

- Installing company name and address.
- Contract number and Task or Delivery Order, if any.
- Beginning and ending dates of the installation project.
- Names of personnel assigned to the installation project.
- Installation summary, including deviations from the original task order.
- Responsible party names, address, and phone number.

The electronic version of this report shall be submitted using word Processing software compatible with Microsoft Word. A sample implementation report is provided as Attachment C of this document.

12.3 Detailed Materials List

A detailed materials list shall be included as part of the completed documentation package. At a minimum, this list shall include all materials originally called for from the site survey report, actual materials used for the installation project, and a column that shows the deviation between the two. Any unusual deviations in required quantities should be explained in the implementation report, as described previously.

The detailed materials list should be completed and submitted using spreadsheet software compatible with Microsoft Excel. A sample form to be used for this list is provided as Attachment D of this document.

12.4 Cable Plant Test Certification Letter

In lieu of the responsible installation supervisor providing a signature on each printed cable test result, a letter of certification from the installation supervisor may be included to verify that installation personnel doing the testing have been properly trained in the use of the test equipment and that the test results included have been reviewed and are an accurate reflection of the installed cable plant.

The certification letter should be submitted in electronic format as a word Processing document compatible with Microsoft Word. A sample cable plant test certification letter is included as Attachment E of this document.

12.5 Copper Cable Test Results

Permanent Link, Category 6 test results for all cables shall be included in electronic format (Fluke Linkware format) within the completed documentation package upon completion of the project. The cable test results shall be provided in numeric order on a per closet basis for horizontal cables. All copper tie and backbone cable test results for continuity shall be included as a sub-section and also numbered. A sample cable plant test certification letter is included as Attachment F of this document.

12.6 Fiber Optic Backbone Cable Test Results

Test results for all cables shall be included in electronic format (Fluke Linkware format) within the completed documentation package upon completion of the project. Opposite ends of each fiber strand tested should be included side by side or in direct sequential order. The fiber optic test results shall be submitted in a closet-by-closet format. A sample cable plant test certification letter is included as Attachment G of this document.

12.7 As-built Drawings

Complete as-built site drawings of the cable plant shall be included as part of the completed documentation package in AutoCAD. At a minimum, the following information shall be included on the drawing:

- Accurate, reasonable facsimile of the building floor plan
- Room and area numbers assigned for identification purposes
- Location and designation of all wiring closets
- Location and designation of all information outlets installed
- Routes for all cables, including horizontal, tie, and backbone
- Location of all vertical penetrations
- Location of horizontal penetrations through fire walls
- Any special service application notes
- Backbone and tie cable lengths between closets

These as-built site drawings shall be completed using computer-aided drawing software that produces vector graphics data files, submitted preferably in the AutoCAD version 2010.

Attachment A – Sample Letter of Certification

TO THE PROGRAM INSTALLATION PARTNER

CERTIFICATION AGGREEMENT

[*Solution Vendor*] Certification Program
Structured Cabling Installation Partner Certification

"*Installation Company*"

"*Installation Company*" has met the Certification Partner selection criteria and has successfully completed the program training. Therefore "*Installation Company*" is hereby certified as a Certification Program Installation Partner, and as such is authorized by *[Vendor*] to design and install [Solutions Vendor] Certified Systems, and to support the Certification Program 20-year Applications Assurance and an extended limited component warranty.

"*Installation Company*" has agreed top conform to all [*vendor*] specified and TIA/EIA compliant installation practices as presented in the Program training program.

[*Vendor*] approved systems designed for the TIA/EIA-570 Category 6 channel performance and registered with [*vendor*] by a certified Certification Program Installation Partner are covered by the Certification Program Applications Assurance and an extended limited component warranty.

Certification Number: _____ Certification Date: _____

Attachment B – Sample Contractor Information Form

CONTRACTOR INFORMATION
JOB NAME:
LOCATION:
DATE:
PROJECT: Cable Plant Installation

FIBER CONTRACTOR
NAME:
PHONE:
ADDRESS:
CITY, STATE, ZIP:
CONTACT NAME:
COMPLETION DATE:
SCOPE OF WARRANTY RESPONSIBILITY: In accordance with Existing Contract

SUPPLIED MATERIALS: In accordance with Task Order XXX-xxx

COPPER CONTRACTOR
NAME:
PHONE:
ADDRESS:
CITY, STATE, ZIP:
CONTACT NAME:
COMPLETION DATE:
SCOPE OF WARRANTY RESPONSIBILITY: In accordance with Existing Contract

SUPPLIED MATERIALS: In accordance with Task Order XXX-xxx

Attachment C - Sample Implementation Report

PROJECT IMPLEMENTATION REPORT - SITE "MVT "

INTRODUCTION

"Company A" under sub-contract to "Company B", and working under Task Order Number XXX-xxx, recently performed a local cable plant installation at "Site LKT". The project was begun on Monday July 7, 2020, and the installation was completed on Wednesday, December 23, 2020.

PROJECT PERSONNEL

The following "Company A" personnel participated in the installation project at "Site MVT":
Mr. X Program Manager, Mr. Y Task Team Leader, Mr. Z Senior Network Engineer.

INSTALLATION SUMMARY

The network installation was completed in accordance with the Task Order, using the Site Survey Report as the guide for project completion. In accordance with the design documentation the facility was cabled for a total of 82 Duplex wall / system furniture, 20 Duplex wireless / OH Paging System, 4 wall phone and 4 CATV cable drop locations. All drops were installed through a self-suspended overhead cable routing system, basket tray and j-hook assemblies, above the acoustic ceiling tiles in the office areas of the Site "MVT".

The three designated Computer Room MVT-1-MDF serves the workstation connectivity needs for the facility. The building cables are identified by labels starting with MVT-1-MDF. All 132 cable drops for the MDF terminate on the patch panels in the equipment racks located in Room # 118, which also serves as the main LAN / Computer Room.

One twelve-strand armored, plenum OM3 LOMM multi-mode fiber-optic cable connects the Building Demarcation to the MDF / Computer Room along with a 50-pair voice copper and RG11/U cables. A second twelve-strand armored, plenum OM3 LOMM multi-mode fiber-optic cable connects the HSDN / Talon Room to the MDF / Computer Room for the One-Net connection along with a 2D – Duplex drop location routes with 18" separation from the remaining cable plant.

There were no modifications made to the design documentation from the Site Survey Report. All material was provided and installed in accordance with the materials listing in the report.

PROJECT DOCUMENTATION

Included within the As-built documentation package, both in hard copy and electronic format, is the following information:

Item	Electronic Format
Letter of Certification	Word processing compatible with Microsoft Word for Windows
Implementation Report	Word processing compatible with Microsoft Word for Windows
Contractor Information	Word processing compatible with Microsoft Word for Windows
Cable Plant Database	Spreadsheet compatible with Microsoft Excel
Detailed Materials Listing	Spreadsheet compatible with Microsoft Excel
Cable Plant Test Results	Fluke Linkware .flw File
Active Equipment Installation Log	Spreadsheet compatible with Microsoft Excel
As-built Site Drawings	AutoCAD format compatible with AutoCAD Version 2010
Wiring Closet Detail	Visio or AutoCAD Version 2010

CONCLUSION

The installation project was completed on December 23, 2020.

All materials and workmanship provided by Company A are fully warranted under the terms of the existing contract between Company B and Company A.

Any questions concerning the project installation, documentation, and warranty may be addressed to Mr. Y of "Company A" or at (000) 555-0000.

Attachment D - Sample Detailed Materials List

Item No.	Description	Projected Quantity	Actual Quantity
1	Horizontal Hinged Double-Sided Wire Managers 1U	2	2
2	Horizontal Hinged Double-Sided Wire Managers 2U	6	6
3	VertiGo 12-port patch panel (Servers & PBX)	5	5
4	Cat 6 - 48 Port Patch Panel - 2U	5	5
5	Cat 6 - 24 Port Patch Panel - 1U	7	7
6	Cat 5e - 24 Port Patch Panel - 1U	2	2
7	Rack Mount Power Outlet Strip – APC -AP7582 PDU	1	1
8	Single Gang Faceplate, 2-port (white)	82	82
9	Single Gang Stainless Steel wall phone plate w/ studs	4	4
10	Horizontal Hinged Double-Sided Wire Managers 1U	1	1
11	Cat 6 - RJ-45 Jack, 568B modular outlet – keystone (blue)	102	102
12	Cat 6 - RJ-45 Jack, 568B modular outlet – keystone (red)	102	102
13	Cat 6 - RJ-45 Jack, 568B modular outlet – keystone (white)	4	4
14	Cat 6 - RJ-45 Jack, 568B modular outlet – keystone (violet)	60	60
15	Cat 6e Cable, 23-24AWG 4Pair, white plenum (feet)	45000	45343
16	Velcro ¾” x 75’	4	4
17	2-port surface box (white) & ceiling bracket	20	20
18	50-Pair, CAT 3 Cable (feet)	250	242
19	110FT Block w/ 5 pair clips	3	3
20	25 Pair, CAT 3 Riser Voice Backbone Cable (feet)	30	25
21	J-hook assemblies	240	255
22	10" Black Hinged Double-Sided Vertical Managers	4	4
22	19” Equipment Rack mounting kit	3	3
23	19” Equipment Rack, black stand-alone	3	3
25	Rack Mount 2U Power Distribution Unit – APC -AP7582 PDU	4	4
26	19" Black Vented Single-Sided Rack Shelves	2	2
27	24” x 10’ Ladder runway (black)	6	6
28	24” elevation kit & mounting plate - ladder runway (black)	3	3
29	24” Ladder runway - center supporting bracket (black)	3	3
30	Ladder runway wall angle bracket	5	5
31	Ladder runway 6” radius drop	6	6
32	Ladder runway junction & butt splices	4	4
33	Ladder runway grounding straps, 2-hole lugs, etc.	6	6
34	AWG # 6 ground wire	100	90
35	Cat 6 Patch Cable, blue, 1’ (foot)	120	120
36	Cat 6 Patch Cable, blue, 3’ (feet)	20	20

37	Cat 6 Patch Cable, red, 1' (foot)	20	20
38	Cat 6 Patch Cable, red, 3' (feet)	40	40
39	Cat 6 Patch Cable, red, 5' (feet)	20	20
40	Cat 6 Patch Cable, violet, 1'(foot)	40	40
41	Cat 6 Patch Cable, violet, 5' (feet)	20	20
42	Cat 6 Patch Cable, violet, 10' (feet)	20	20
43	Cat 6 Patch Cable, violet, 15' (feet)	20	20
44	Cat 6 Patch Cable, white, 5' (feet)	10	10
45	Cat 6 Patch Cable, gray, 10' (feet) – plenum for ceiling	10	10
46	Cat 6 Patch Cable, gray, 20' (feet) – plenum for ceiling	20	20
47	Cat 6 Patch Cable, green, 1' (foot)	20	20
48	Cat 6 Patch Cable, green, 3' (feet)	10	10
49	Cat 6 Patch Cable, black, 1' (feet)	10	10
50	Cat 6 Patch Cable, black, 10' (feet)	20	20
51	Cat 6 Patch Cable, black, 20' (feet)	110	110
52	3-step stool	1	1
53	Tool kit	1	1
54	Butt set	1	1
55	CATV RG6U Quad-shield cable, white plenum (feet)	1000	875
56	F-series modular outlet – keystone (CATV)	4	4
57	RG6U Quad-shield cable connectors (CATV)	8	8
58	Single Gang Faceplate, 1-port (white)	4	4
59	RG/11U Quad-shield Cable (feet)	250	242
60	RG/11U Quad-shield connectors (CATV)	2	2
61	12-Strand armored fiber optic 50um LOMM Cable (feet)	300	285
62	LC Duplex 50um LOMM fiber 12-fiber panels	4	4
63	LC 50um LOMM connectors	48	48
64	Wall-mount fiber enclosure	2	2
65	1U fiber enclosure	2	2
66	LC-LC Duplex 50um LOMM fiber jumper 3M	4	4
67	LC-LC Duplex 50um LOMM fiber jumper 5M	4	4
68	Misc. – grounding components, labels, tape, pull string, etc.	1	1

Attachment E – Sample Cable Test Certification Letter

[*Use Corporate letterhead*]

Date: [Current date]

To: [Full name of individual to whom the letter is being sent]

Address: [*of individual to whom letter is addressed*]

Re: USCIS Cable Plant Installation at "Site C"

Task Order No.: [*XXX-xxx*]

Dear [*Mr., Ms., or Dr. and last name*]:

This letter is to certify that all cable test results included for the above mentioned project has been completed by "Company A" personnel who have been trained, and are competent in the use of, the required cable testing equipment.

Please accept this letter as certification of the accuracy of the test results furnished in lieu of individual signatures on each cable test result.

[Mr., Ms., or Dr. and name] [Title]

Attachment F- Sample Cat 6 Cable Permanent Link Certification

LINKWARE™ PC
CABLE TEST MANAGEMENT SOFTWARE

Cable ID: MVT-1-MDF-001A
Test Limit: TIA Cat 6 Perm. Link
Limits Version: V7.5
Date / Time: 10/15/2020 09:36:22 AM
Operator:
Headroom 8.6 dB (NEXT 3,6-4,5)
Cable Type: LANmark-2000 CMP
NVP: 73.0%

Test Summary: PASS

Main: Versiv
S/N: 2016033
Software Version: V6.5 Build 5
Calibration Date: 09/21/2020
Adapter: DSX-8000 (DSX-PLA804)
S/N: 20358529

Remote: Versiv
S/N: 2021162
Software Version: V6.5 Build 5
Calibration Date: 09/21/2020
Adapter: DSX-8000R (DSX-PLA804)
S/N: 20358539

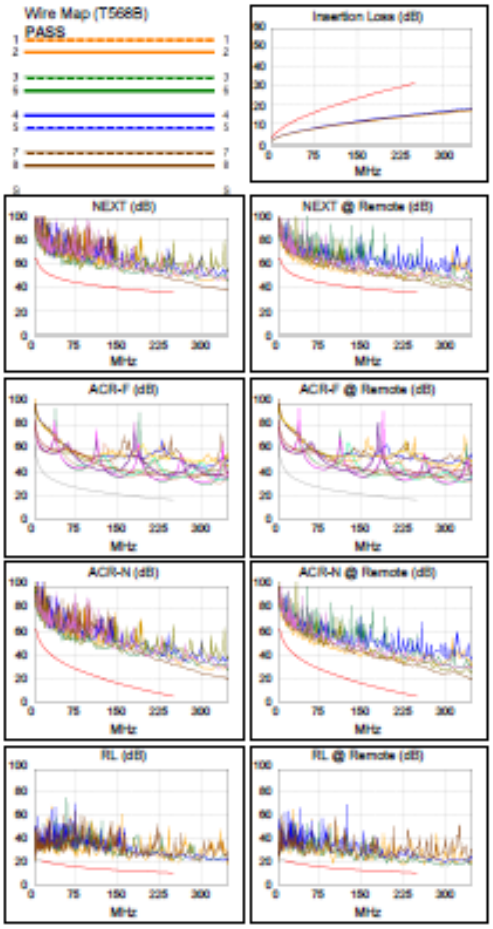
Length (ft), Limit 295	[Pair 1,2]	153
Prop. Delay (ns), Limit 498	[Pair 4,5]	226
Delay Skew (ns), Limit 44	[Pair 4,5]	13
Resistance (ohms)	[Pair 4,5]	7.09
Insertion Loss Margin (dB)	[Pair 4,5]	16.2
Frequency (MHz)	[Pair 4,5]	250.0
Limit (dB)	[Pair 4,5]	31.1

153 ft

Wire Map (T568B)
PASS

	Worst Case Margin		Worst Case Value	
PASS	MAIN	SR	MAIN	SR
Worst Pair	3,6-4,5	3,6-4,5	3,6-4,5	3,6-4,5
NEXT (dB)	10.4	9.5	10.4	9.7
Freq. (MHz)	249.0	240.0	249.0	246.5
Limit (dB)	35.4	35.6	35.4	35.4
Worst Pair	4,5	3,6	4,5	3,6
PS NEXT (dB)	11.0	8.3	11.0	8.3
Freq. (MHz)	244.5	227.5	244.5	227.5
Limit (dB)	32.9	33.4	32.9	33.4
PASS	MAIN	SR	MAIN	SR
Worst Pair	1,2-4,5	1,2-4,5	1,2-4,5	1,2-4,5
ACR-F (dB)	15.2	15.4	15.2	15.6
Freq. (MHz)	232.5	150.0	232.5	228.5
Limit (dB)	16.9	20.7	16.9	17.0
Worst Pair	4,5	4,5	4,5	4,5
PS ACR-F (dB)	15.6	15.9	16.6	17.2
Freq. (MHz)	1.4	1.6	242.5	242.0
Limit (dB)	58.4	57.0	13.5	13.5
N/A	MAIN	SR	MAIN	SR
Worst Pair	3,6-7,8	1,2-3,6	3,6-4,5	3,6-4,5
ACR-N (dB)	17.6	16.4	26.6	25.7
Freq. (MHz)	18.6	14.3	249.0	246.5
Limit (dB)	45.9	48.8	4.3	4.6
Worst Pair	1,2	3,6	4,5	3,6
PS ACR-N (dB)	18.7	16.8	27.0	25.9
Freq. (MHz)	7.1	26.5	244.5	249.0
Limit (dB)	53.1	39.6	2.2	1.7
PASS	MAIN	SR	MAIN	SR
Worst Pair	1,2	1,2	1,2	1,2
RL (dB)	6.9	4.4	8.5	6.6
Freq. (MHz)	16.6	99.5	249.5	223.5
Limit (dB)	19.9	14.0	10.0	10.5

Compliant Network Standards:
10BASE-T, 100BASE-TX, 100BASE-T4, 1000BASE-T, 2.5GBASE-T, 5GBASE-T, ATM-25, ATM-51, ATM-155, 100VG-AnyLan, TR-4, TR-16 Active, TR-16 Passive



LinkWare™ PC Version 10.7

Project: GSA
GSA Label name Test results.flw

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FLUKE networks.

LINKWARE™ PC
CABLE TEST MANAGEMENT SOFTWARE

Cable ID: MVT-1-MDF-001B

Test Summary: PASS

Test Limit: TIA Cat 6 Perm. Link
Limits Version: V7.5
Date / Time: 10/15/2020 12:35:54 PM
Operator: [redacted]
Headroom 9.0 dB (NEXT 1,2-4,6)
Cable Type: LANmark-2000 CMP
NVP: 73.0%

Main: Versiv
S/N: 2016033
Software Version: V6.5 Build 5
Calibration Date: 09/21/2020
Adapter: DSX-8000 (DSX-PLA804)
S/N: 20358529

Remote: Versiv
S/N: 2021162
Software Version: V6.5 Build 5
Calibration Date: 09/21/2020
Adapter: DSX-8000R (DSX-PLA804)
S/N: 20358539

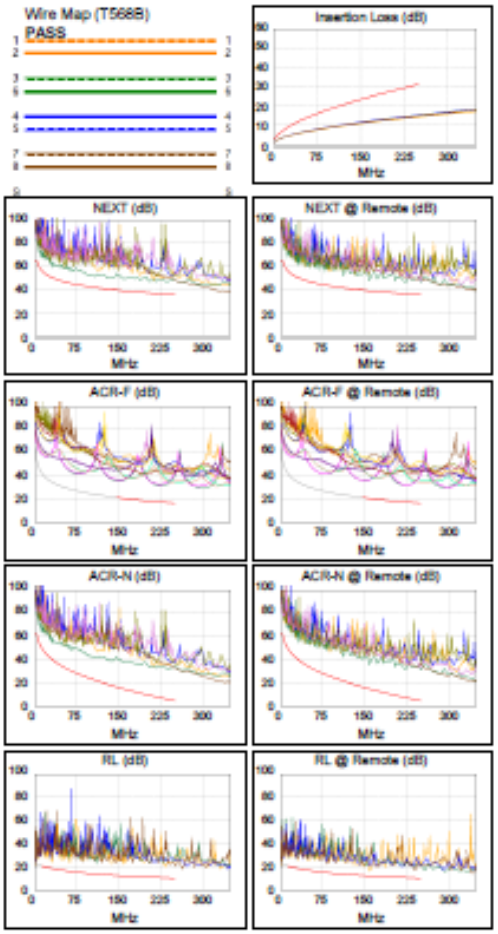
Length (ft), Limit 295	[Pair 1,2]	155
Prop. Delay (ns), Limit 498	[Pair 4,5]	230
Delay Skew (ns), Limit 44	[Pair 4,5]	14
Resistance (ohms)	[Pair 4,5]	7.18
Insertion Loss Margin (dB)	[Pair 3,6]	16.1
Frequency (MHz)	[Pair 3,6]	250.0
Limit (dB)	[Pair 3,6]	31.1

155 ft

Wire Map (T568B)
PASS

	Worst Case Margin		Worst Case Value	
PASS	MAIN	SR	MAIN	SR
Worst Pair	1,2-4,5	1,2-4,5	1,2-4,5	1,2-4,5
NEXT (dB)	9.1	9.0	10.6	9.5
Freq. (MHz)	106.0	159.0	237.0	223.0
Limit (dB)	41.4	38.6	35.7	36.2
Worst Pair	1,2	4,5	1,2	4,5
PS NEXT (dB)	10.3	10.3	10.3	10.3
Freq. (MHz)	212.0	250.0	212.0	250.0
Limit (dB)	33.9	32.7	33.9	32.7
PASS	MAIN	SR	MAIN	SR
Worst Pair	1,2-4,5	4,5-1,2	1,2-4,5	4,5-1,2
ACR-F (dB)	13.8	14.4	13.8	14.6
Freq. (MHz)	223.5	222.0	223.5	225.0
Limit (dB)	17.2	17.3	17.2	17.1
Worst Pair	4,5	4,5	4,5	4,5
PS ACR-F (dB)	15.8	15.8	15.9	17.1
Freq. (MHz)	1.5	1.0	231.0	229.0
Limit (dB)	57.7	61.2	13.9	14.0
N/A	MAIN	SR	MAIN	SR
Worst Pair	1,2-4,5	1,2-4,5	1,2-4,5	1,2-4,5
ACR-N (dB)	14.0	16.1	26.1	26.9
Freq. (MHz)	12.3	12.3	237.0	250.0
Limit (dB)	50.3	50.3	5.6	4.2
Worst Pair	1,2	1,2	4,5	4,5
PS ACR-N (dB)	16.0	17.1	28.1	26.4
Freq. (MHz)	12.3	7.8	250.0	250.0
Limit (dB)	47.9	52.4	1.6	1.6
PASS	MAIN	SR	MAIN	SR
Worst Pair	1,2	1,2	1,2	1,2
RL (dB)	5.6	4.5	9.7	4.5
Freq. (MHz)	30.5	159.5	233.0	159.5
Limit (dB)	18.6	12.0	10.3	12.0

Compliant Network Standards:
10BASE-T, 100BASE-TX, 100BASE-T4, 1000BASE-T, 2.5GBASE-T, 5GBASE-T, ATM-25, ATM-51, ATM-155, 100VG-AnyLan, TR-4, TR-16 Active, TR-16 Passive



LinkWare™ PC Version 10.7

Project: GSA
GSA Label name Test results.flw

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FLUKE networks

LINKWARE™ PC
CABLE TEST MANAGEMENT SOFTWARE

Cable ID: MVT-1-MDF-001S

Test Summary: PASS

Test Limit: TIA Cat 6 Perm. Link
Limits Version: V7.5
Date / Time: 10/13/2020 10:20:46 AM
Operator: [redacted]
Headroom 3.4 dB (NEXT 1,2-3,6)
Cable Type: LANmark-2000 CMP
NVP: 73.0%

Main: Versiv
S/N: 2016033
Software Version: V6.5 Build 5
Calibration Date: 09/21/2020
Adapter: DSX-8000 (DSX-PLA804)
S/N: 20358529

Remote: Versiv
S/N: 2021162
Software Version: V6.5 Build 5
Calibration Date: 09/21/2020
Adapter: DSX-8000R (DSX-PLA804)
S/N: 20358539

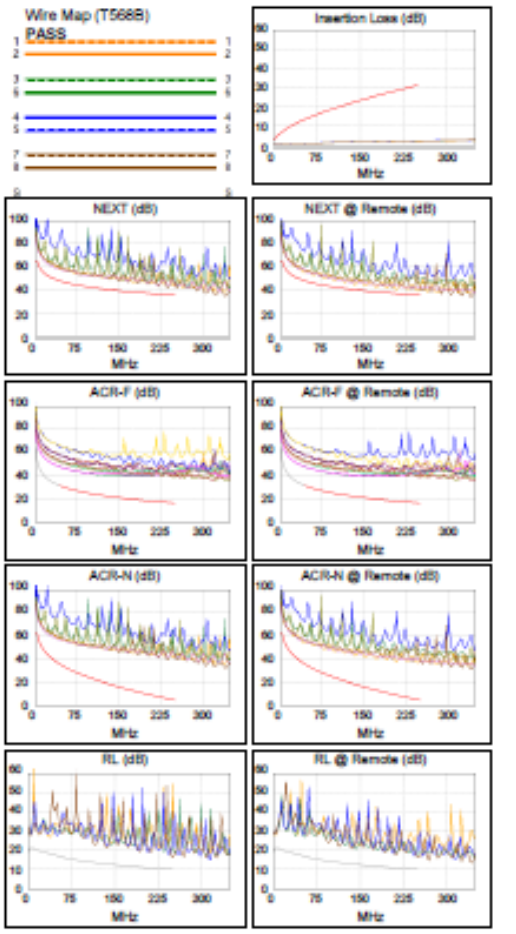
Length (ft), Limit 295	[Pair 1,2]	21
Prop. Delay (ns), Limit 498	[Pair 4,5]	30
Delay Skew (ns), Limit 44	[Pair 3,6]	1
Resistance (ohms)	[Pair 3,6]	1.12
Insertion Loss Margin (dB)	[Pair 7,8]	28.8
Frequency (MHz)	[Pair 7,8]	250.0
Limit (dB)	[Pair 7,8]	31.1

21 ft

Wire Map (T568B)
PASS

	Worst Case Margin		Worst Case Value	
PASS	MAIN	SR	MAIN	SR
Worst Pair	3,6-4,5	1,2-3,6	3,6-4,5	1,2-3,6
NEXT (dB)	5.6	3.4	5.6	3.6
Freq. (MHz)	238.0	207.5	238.0	246.5
Limit (dB)	35.7	36.7	35.7	35.4
Worst Pair	4,5	3,6	4,5	3,6
PS NEXT (dB)	5.9	4.6	5.9	4.6
Freq. (MHz)	238.0	250.0	238.0	250.0
Limit (dB)	33.1	32.7	33.1	32.7
PASS	MAIN	SR	MAIN	SR
Worst Pair	1,2-4,5	1,2-4,5	3,6-4,5	4,5-3,6
ACR-F (dB)	15.7	15.7	22.3	22.3
Freq. (MHz)	12.5	7.0	250.0	250.0
Limit (dB)	42.3	47.3	16.2	16.2
Worst Pair	4,5	4,5	4,5	4,5
PS ACR-F (dB)	16.3	16.2	20.6	19.7
Freq. (MHz)	1.1	1.5	210.5	174.5
Limit (dB)	60.2	57.7	14.7	16.4
N/A	MAIN	SR	MAIN	SR
Worst Pair	4,5-7,8	1,2-3,6	3,6-4,5	1,2-3,6
ACR-N (dB)	16.1	15.7	33.7	32.2
Freq. (MHz)	5.3	8.4	238.0	246.5
Limit (dB)	58.2	54.0	5.5	4.6
Worst Pair	4,5	3,6	4,5	3,6
PS ACR-N (dB)	15.4	14.6	34.1	33.5
Freq. (MHz)	5.1	8.6	238.0	250.0
Limit (dB)	56.1	51.4	2.8	1.6
N/A	MAIN	SR	MAIN	SR
Worst Pair	7,8	7,8	7,8	7,8
RL (dB)	6.1	6.0	6.1	6.0
Freq. (MHz)	250.0	250.0	250.0	250.0
Limit (dB)	10.0	10.0	10.0	10.0

Compliant Network Standards:
10BASE-T, 100BASE-TX, 100BASE-T4, 1000BASE-T, 2.5GBASE-T, 5GBASE-T, ATM-25, ATM-51, ATM-155, 100VG-AnyLan, TR-4, TR-16 Active, TR-16 Passive



LinkWare™ PC Version 10.7

Project: GSA
GSA Label name Test results.flw

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FLUKE networks

Attachment G – Sample Fiber Optic Cable Certification

LINKWARE™ PC
CABLE TEST MANAGEMENT SOFTWARE

Cable ID: MDF/TR1-FIBER-001A
Date / Time: 10/28/2020 10:05:56 AM
Cable Type: OM3 Multimode 50
Backscatter Coefficient: -68.0dB (850 nm)
n = 1.482000 (850 nm)
n = 1.477000 (1300 nm)
Backscatter Coefficient: -75.8dB (1300 nm)

Test Summary: PASS
Modal Bandwidth: 2000MHz-km (850 nm)
Modal Bandwidth: 500MHz-km (1300 nm)

Loss (M->R)
PASS
Test Limit: TIA-568.3-D-1 Multimode (STD)
Limits Version: 7.5
Date / Time: 10/28/2020 10:05:56 AM
Operator: JASON RICHARDSON
Main: Versiv
S/N: 20253040
Software Version: V5.5 Build 5
Module: CertiFiber Pro (CFP-MM)
S/N: 2455018
Calibration Date: 09/21/2020
Remote: Versiv
S/N: 20240074
Software Version: V5.5 Build 5
Module: CertiFiber Pro Remote (CFP-MM)
S/N: 3672009
Calibration Date: 09/21/2020

Propagation Delay (ns)	275	
Length ft	183	PASS
Limit 6562		
	850 nm	1300 nm
Result	PASS	PASS
Loss (dB)	0.48	0.52
Limit (dB)	2.27	2.18
Margin (dB)	1.79	1.66
Reference (dBm)	-24.01	-23.90

Number of Adapters: 2
Number of Splices: 2
Connector Type: SC
Patch Length1 (ft): 7
Reference Date: 10/22/2020 01:32:05 PM
1 Jumper

Compliant Network Standards:

10/100BASE-SX	1000BASE-LX	1000BASE-SX
100BASE-FX	100GBASE-SR10	100GBASE-SR4
10BASE-FL	10GBASE-LRM	10GBASE-LX4
10GBASE-SR	40GBASE-SR4	ATM155
ATM155SWL	ATM52	ATM622 Fiber Optic
ATM622SWL Fiber Optic	FDDI Fiber Optic	Fibre Channel 100-M5-SN-I
Fibre Channel 100-M6E-SN-I	Fibre Channel 1200-M5-SN-I	Fibre Channel 1200-M6E-SN-I
Fibre Channel 133	Fibre Channel 1600-M5E-SN-I	Fibre Channel 200-M5-SN-I
Fibre Channel 200-M6E-SN-I	Fibre Channel 266	Fibre Channel 266SWL
Fibre Channel 400-M5-SN-I	Fibre Channel 400-M6E-SN-I	Fibre Channel 800-M5E-SN-I

LinkWare™ PC Version: 10.7

Project: GSA
USCIS.flw

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FLUKE networks

LINKWARE™ PC
CABLE TEST MANAGEMENT SOFTWARE

Cable ID: MDF/TR1-FIBER-001B

Test Summary: PASS

Date / Time: 10/28/2020 10:05:56 AM
Cable Type: OM3 Multimode 50
Backscatter Coefficient: -68.0dB (850 nm)

n = 1.482000 (850 nm)
n = 1.477000 (1300 nm)
Backscatter Coefficient: -75.8dB (1300 nm)

Modal Bandwidth: 2000MHz-km (850 nm)
Modal Bandwidth: 500MHz-km (1300 nm)

Loss (R->M)
PASS

Test Limit: TIA-568.3-D-1 Multimode (STD)
Limits Version: 7.5
Date / Time: 10/28/2020 10:05:56 AM
Operator: JASON RICHARDSON
Main: Versiv
S/N: 2025040
Software Version: V5.5 Build 5
Module: CertiFiber Pro (CFP-MM)
S/N: 2468018
Calibration Date: 09/21/2020
Remote: Versiv
S/N: 20240074
Software Version: V5.5 Build 5
Module: CertiFiber Pro Remote (CFP-MM)
S/N: 3572009
Calibration Date: 09/21/2020

Propagation Delay (ns)	275		
Length ft	183	PASS	
Limit 6562			
	850 nm	1300 nm	
Result	PASS	PASS	
Loss (dB)	0.81	0.79	
Limit (dB)	2.27	2.18	
Margin (dB)	1.46	1.39	
Reference (dBm)	-24.24	-23.65	

Number of Adapters: 2
Number of Splices: 2
Connector Type: SC
Patch Length1 (ft): 7
Reference Date: 10/22/2020 01:32:05 PM
1 Jumper

Compliant Network Standards:

10/100BASE-SX	1000BASE-LX	1000BASE-SX
100BASE-FX	100GBASE-SR10	100GBASE-SR4
10BASE-FL	10GBASE-LRM	10GBASE-LX4
10GBASE-SR	40GBASE-SR4	ATM155
ATM155SWL	ATM52	ATM622 Fiber Optic
ATM622SWL Fiber Optic	FDDI Fiber Optic	Fibre Channel 100-M5-SN-I
Fibre Channel 100-M5E-SN-I	Fibre Channel 1200-M5-SN-I	Fibre Channel 1200-M5E-SN-I
Fibre Channel 133	Fibre Channel 1600-M5E-SN-I	Fibre Channel 200-M5-SN-I
Fibre Channel 200-M5E-SN-I	Fibre Channel 266	Fibre Channel 2665WL
Fibre Channel 400-M5-SN-I	Fibre Channel 400-M5E-SN-I	Fibre Channel 800-M5E-SN-I

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Attachment H – Sample Security Cat 6A Cable Permanent Link Certification

LINKWARE™ PC
CABLE TEST MANAGEMENT SOFTWARE

Cable ID: MVT-1-MDF-CAM01

Test Summary: PASS

Test Limit: TIA Cat 6A Perm. Link
Limits Version: V7.5
Date / Time: 10/28/2020 11:00:54 AM
Operator: [redacted]
Headroom 6.2 dB (NEXT 3,6-7,8)
Cable Type: LANmark XTP CMP
NVP: 68.0%

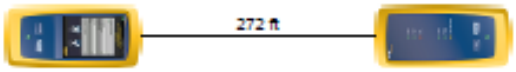
Main: Versiv
S/N: 2021162
Software Version: V6.5 Build 5
Calibration Date: 09/21/2020
Adapter: DSX-8000 (DSX-PLA804)
S/N: 20358529

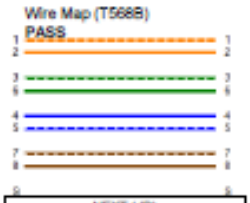
Remote: Versiv
S/N: 2016033
Software Version: V6.5 Build 5
Calibration Date: 09/21/2020
Adapter: DSX-8000R (DSX-PLA804)
S/N: 20358539

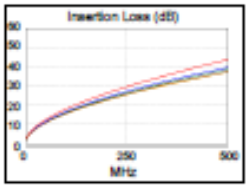
Length (ft), Limit 295	[Pair 1,2]	272
Prop. Delay (ns), Limit 498	[Pair 4,5]	440
Delay Skew (ns), Limit 44	[Pair 4,5]	33
Resistance (ohms)	[Pair 7,8]	13.38
Insertion Loss Margin (dB)	[Pair 4,5]	4.2
Frequency (MHz)	[Pair 4,5]	500.0
Limit (dB)	[Pair 4,5]	43.8

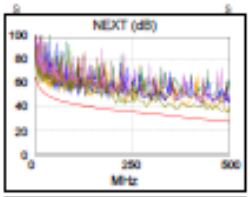
	Worst Case Margin		Worst Case Value	
PASS	MAIN	SR	MAIN	SR
Worst Pair	3,6-7,8	3,6-7,8	3,6-7,8	3,6-4,5
NEXT (dB)	5.2	5.9	7.6	8.1
Freq. (MHz)	207.0	13.5	482.0	481.0
Limit (dB)	36.7	55.8	27.2	27.2
Worst Pair	3,6	3,6	3,6	3,6
PS NEXT (dB)	6.8	6.5	8.0	7.2
Freq. (MHz)	231.5	428.0	492.0	469.0
Limit (dB)	33.3	26.1	24.0	24.7
PASS	MAIN	SR	MAIN	SR
Worst Pair	1,2-4,5	1,2-4,5	1,2-3,6	1,2-4,5
ACR-F (dB)	15.0	14.8	16.0	15.4
Freq. (MHz)	195.5	196.5	488.0	469.0
Limit (dB)	18.4	18.3	10.4	10.8
Worst Pair	4,5	4,5	3,6	4,5
PS ACR-F (dB)	17.1	16.3	18.0	16.3
Freq. (MHz)	193.5	469.0	488.0	469.0
Limit (dB)	15.5	7.8	7.4	7.8
N/A	MAIN	SR	MAIN	SR
Worst Pair	3,6-7,8	3,6-7,8	1,2-3,6	3,6-4,5
ACR-N (dB)	6.7	6.7	13.1	12.1
Freq. (MHz)	7.4	13.5	492.0	481.0
Limit (dB)	55.2	49.4	-16.5	-15.6
Worst Pair	3,6	3,6	3,6	3,6
PS ACR-N (dB)	8.2	8.3	13.0	12.0
Freq. (MHz)	11.5	11.6	492.0	469.0
Limit (dB)	48.6	48.5	-19.3	-17.4
PASS	MAIN	SR	MAIN	SR
Worst Pair	7,8	1,2	4,5	4,5
RL (dB)	5.7	6.6	7.3	6.6
Freq. (MHz)	11.3	13.5	499.0	461.0
Limit (dB)	20.7	20.3	8.0	8.0

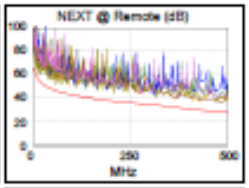
Compliant Network Standards:
10BASE-T, 100BASE-TX, 100BASE-T4, 1000BASE-T, 2.5GBASE-T, 5GBASE-T, 10GBASE-T, ATM-25, ATM-51, ATM-155, 100VG-AnyLan, TR-4, TR-16 Active, TR-16 Passive

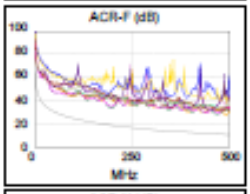


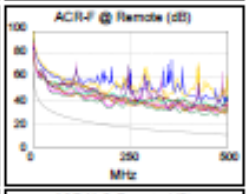


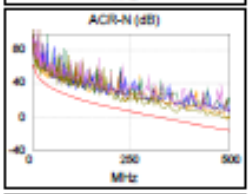


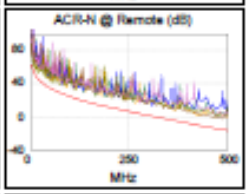


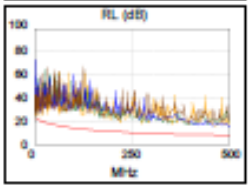


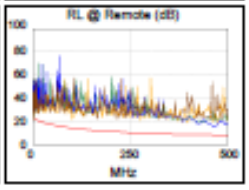












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LINKWARE™ PC
CABLE TEST MANAGEMENT SOFTWARE

Cable ID: MVT-1-MDF-VIR01

Test Summary: PASS

Test Limit: TIA Cat 6A Perm. Link
Limits Version: V7.5
Date / Time: 10/28/2020 11:45:17 AM
Operator: [redacted]
Headroom 2.6 dB (NEXT 1,2-7,8)
Cable Type: LANmark XTP CMP
NVP: 68.0%

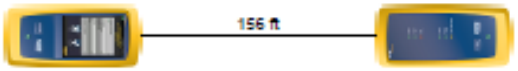
Main: Versiv
S/N: 2021162
Software Version: V6.5 Build 5
Calibration Date: 09/21/2020
Adapter: DSX-8000 (DSX-PLA804)
S/N: 20358529

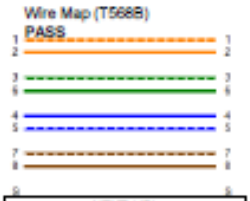
Remote: Versiv
S/N: 2016033
Software Version: V6.5 Build 5
Calibration Date: 09/21/2020
Adapter: DSX-8000R (DSX-PLA804)
S/N: 20358539

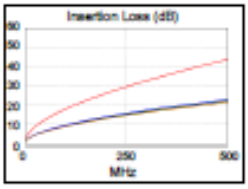
Length (ft), Limit 295	[Pair 1,2]	156
Prop. Delay (ns), Limit 498	[Pair 4,5]	253
Delay Skew (ns), Limit 44	[Pair 4,5]	19
Resistance (ohms)	[Pair 7,8]	7.82
Insertion Loss Margin (dB)	[Pair 4,5]	20.9
Frequency (MHz)	[Pair 4,5]	500.0
Limit (dB)	[Pair 4,5]	43.8

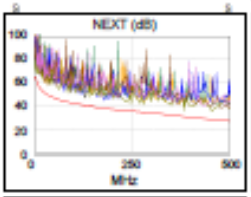
	Worst Case Margin		Worst Case Value	
PASS	MAIN	SR	MAIN	SR
Worst Pair	3,6-7,8	1,2-7,8	3,6-7,8	3,6-4,5
NEXT (dB)	6.7	2.5	7.8	8.4
Freq. (MHz)	64.0	108.5	453.0	496.0
Limit (dB)	45.0	41.3	28.1	26.8
Worst Pair	1,2	7,8	3,6	3,6
PS NEXT (dB)	7.5	4.3	10.6	7.9
Freq. (MHz)	179.5	108.5	500.0	484.0
Limit (dB)	35.1	38.7	23.8	24.2
PASS	MAIN	SR	MAIN	SR
Worst Pair	3,6-7,8	7,8-3,6	3,6-7,8	7,8-3,6
ACR-F (dB)	16.9	16.3	16.9	16.3
Freq. (MHz)	487.0	489.0	487.0	489.0
Limit (dB)	10.4	10.4	10.4	10.4
Worst Pair	4,5	3,6	7,8	3,6
PS ACR-F (dB)	18.3	17.5	18.7	17.5
Freq. (MHz)	159.5	487.0	494.0	487.0
Limit (dB)	17.1	7.4	7.3	7.4
N/A	MAIN	SR	MAIN	SR
Worst Pair	3,6-7,8	3,6-7,8	3,6-4,5	3,6-4,5
ACR-N (dB)	8.5	10.1	32.3	29.2
Freq. (MHz)	4.0	3.8	500.0	496.0
Limit (dB)	60.5	61.1	-17.1	-16.8
Worst Pair	3,6	3,6	4,5	3,6
PS ACR-N (dB)	10.1	11.9	31.5	29.1
Freq. (MHz)	4.0	4.0	500.0	489.0
Limit (dB)	58.3	58.3	-20.0	-19.1
PASS	MAIN	SR	MAIN	SR
Worst Pair	1,2	1,2	4,5	1,2
RL (dB)	5.3	6.4	6.8	7.8
Freq. (MHz)	36.8	126.0	494.0	478.0
Limit (dB)	18.2	13.0	8.0	8.0

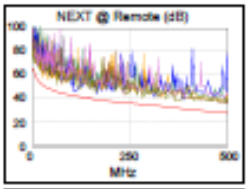
Compliant Network Standards:
10BASE-T, 100BASE-TX, 100BASE-T4, 1000BASE-T, 2.5GBASE-T, 5GBASE-T, 10GBASE-T, ATM-25, ATM-51, ATM-155, 100VG-AnyLan, TR-4, TR-16 Active, TR-16 Passive

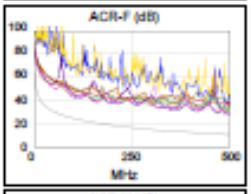


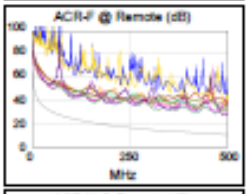


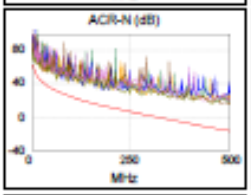


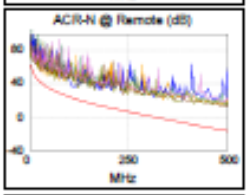


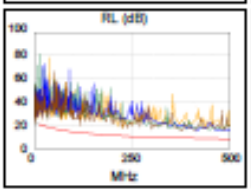


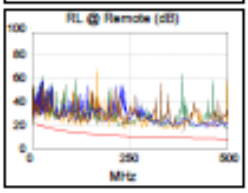












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