

**Request for Quote  
For a  
Category 6  
Structured Cabling System  
At**

**Lowndes County School District  
1053 Hwy 45 South  
Columbus, MS 39701**

**BID PACKAGE**

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## 1 INTRODUCTION

### 1.1 GENERAL BACKGROUND

This document is issued as a request for quote for the supply and installation of a structured telecommunications cabling system for [Lowndes County School District](#).

The structured cabling system will support voice, data, and imaging applications within each district facility. This document describes the system requirements to be met in the proposals of the telecommunications cabling vendors to secure under contract all materials, design, engineering, installation, supervision and training services for the structured cabling system.

### 1.2 TERMS AND CONDITIONS OF BIDS

This is an invitation to submit a bid based on the materials, systems and equipment described in this document.

All bids must be submitted in accordance with the specifications and information contained herein, as well as with any addenda, if required, issued by the purchaser.

The bid package shall be accompanied by a presale warranty commitment binding the awarded contractor and manufacturer to the customer selected, extended warranty package not less than 20 years in length.

It is the intent of the Drawings and Specifications to provide a complete workable telecommunication cabling system ready for the Owner's use. Any item not specifically shown on the Drawings or called for in the Specification, but normally required for a complete system, are to be considered a part of the contract.

Consideration other than cost alone will be used in making the determination of the successful contractor.

These factors will include financial stability, availability, design support, project management and field supervision.

The Manufacturers and Products specified in the document are to be used. No substitutions of components specifically referenced will be allowed, without prior written customer consent after submittal review.

### 1.3 INSTRUCTIONS TO THE BIDDER

Bids shall be valid for 1 year and other factors such as material and labor rate increases during the duration of this project must be taken into account.

The Bidder shall consider the nature and amount of work to be done as well as the difficulties involved in its proper execution.

No bid will be accepted by any contractor who did not attend the scheduled mandatory site survey.

The bid shall include all costs deemed necessary to cover all contingencies essential to the installation of the specified system.

Total cost for installation materials, labor project management, permit fees, sales tax and other miscellaneous items must be listed separately.

A complete materials list, including description, manufacturer, part number, quantity, unit price and total price must also be included.

A statement of estimated labor hours and prevailing hourly labor rates must be included.

All products and materials shall be new, clean, free of defects and free of damage and corrosion.

Where discrepancies are found during the bid process, the most stringent requirements must be included in the bid.

Any cost encountered, which is not specifically itemized in the bid, shall not be incurred unless specifically agreed upon, in writing.

No additional compensation will be allowed for extra work incurred on the part of the Contractor due to the bidders failure to notice any existing condition, which may cause the additional labor.

Bid responses shall be concise following the format and numbering of this specification. Items not requiring responses shall be acknowledged by the bidder as being understood.

Bidders must notify the Purchaser as soon as detected any omissions or errors in the specification so corrective addenda may be issued. Such notification must be received by the Purchaser, at least (10) days prior to the date for receipt of bids.

#### **1.4 RIGHTS OF THE PURCHASER**

The Purchaser reserves the right to accept any bid or, at its discretion, reject any or all bids for whatever reason it deems appropriate.

The Purchaser reserves the right to purchase ALL or PART of the cabling materials and Hardware needed for the project.

Receipt of a bid response does not obligate the Purchaser to pay any expenses incurred by the bidder in preparation of the bid response or obligate the Purchaser in any other respect.

The Purchaser reserves the right to modify the specifications contained in the Request for Quote anytime during the bidding period.

Only changes issued as an addendum will be binding upon the Purchaser. No verbal instructions or interpretations of requirements shall be accepted. QUALITY ASSURANCE

#### **1.5 CONTRACTOR QUALIFICATIONS**

The Contractor shall at a minimum possess the following qualifications:

Be in business a minimum of five (5) years.

Contractor shall demonstrate satisfaction of sound financial condition and can be adequately bonded and insured if the project deems necessary.

Possess those licenses/permits required to perform telecommunications installations in the specified jurisdiction.

Personnel knowledgeable in local, state, province and national codes and regulations. All work shall comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.

Must possess current liability insurance certificates.

Contractor must be registered with BICSI and have at least one RCDD on full time staff.

Contractor Must have BICSI Technician on staff.

Must have personnel fluent in the use of Computer Aided Design and possess and operate CAD software using .DWG or .DXF format.

#### **1.6 REQUIRED CONTRACTOR TRAINING**

The Contractor shall be fully conversant and capable in the cabling of low voltage applications such as, but not limited to data, voice and imaging network systems. The Contractor shall at a minimum possess the following qualifications:

Personnel trained and certified in the design of the Siemon Cabling System or equivalent.

Personnel trained and certified to install the Siemon Cabling System or equivalent.

The Designer and Installer shall show proof of current certification of the Siemon Cabling System or equivalent via an updated certificate.

Provide references of the type of installation provide in this specification.

Personnel trained and certified in fiber optic cabling, splicing, termination and testing techniques. Personnel must have experience using an optical light source and power meter plus OTDR.

Personnel trained in the installation of pathways and support for housing horizontal and backbone cabling.

#### **1.7 CONTRACTOR RESPONSIBILITY**

Contractor shall be obligated to exercise the highest standard of care in performing its obligations as defined in this request for proposal.

Contractor acknowledges that **(client)** will rely on contractor's expertise, ability and knowledge of the system being proposed and shall be obligated to exercise the highest of standard care in performing its obligation as defined in the following Scope of Work.

#### **1.8 MANUFACTURER QUALITY & PRODUCT SUBSTITUTIONS**

All telecommunications connecting hardware and cable must be made by an ISO 9001:2000 Certified Manufacturer.

All products must meet the technical requirements listed in sections 6-8. Any products not meeting these requirements will not be considered.

## 2 INDUSTRY REQUIREMENTS

The following installation, documentation, component and system industry specifications shall be met or exceeded:

- ANSI/TIA-568.0-D  
*"Generic Telecommunications cabling for Customer Premises"*
- ANSI/TIA-568.1-D  
*"Commercial Building Telecommunications Infrastructure Standard"*
- ANSI/TIA-568-2-D  
*"Balanced Twisted-Pair Telecommunications Cabling & Component Standard"*
- ANSI/TIA-568.3-D  
*"Fiber Optic Cabling Components Standard"*
- ANSI/TIA-569-E  
*"Telecommunications Pathways and Spaces"*
- ANSI/TIA-606-C  
*"Administration Standard for the Telecommunications Infrastructure"*
- ANSI/TIA-607-C  
*"Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises"*
- ANSI/TIA-526-7-A  
*"Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant"*
- ANSI/TIA-526-14-C  
*"Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant"*
- IEC/TR 61000-5-2 - Ed. 1.0 and amendments  
*"Electromagnetic compatibility (EMC) - Part 5: Installation and mitigation guidelines - Section 2: Earthing and cabling"*
- ISO/IEC 11801-1  
*"Information technology - Generic cabling for customer premises – Part 1: General requirements"*
- ISO/IEC 11801-2  
*"Information technology - Generic cabling for customer premises – Part 2: Office Premises"*

### **3 GENERAL REQUIREMENTS**

- Insurance
- Contractor must have workman's compensation insurance in the state in which work is performed.
- The Contractor should be prepared to furnish surety, performance and completion bonds if required.
- Liability
- Payment Terms
- Contracts
- Disclosures and Patent Infringement
- Inspection, Tests and Guarantees

#### **4 SCOPE OF WORK**

- There are 12 schools we are looking at the need to have additional drops added or a complete rewire of the data network.
- For Office areas we are needing a D4 to be determined by office layout.
- For Classrooms we are wanting a total of seven drops, 1 D4, 2 D1 drops to be determined later and 1 D1 for the WAP.
- All Labs will have 32 drops.
- A Jhook paths must be installed for all new cabling. No cabling can be taken down until the new is active.
- Closet are shown on the Plans
- All Data Drops will be done with Cat6.
- All Fiber is to be replaced with a 24 Strand Single Mode.



## 5 BALANCED TWISTED-PAIR PRODUCT SPECIFICATIONS

In addition to meeting the category 6 specifications outlined in ANSI/TIA-568.2-D, the requirements in this section must also be met for all applicable balanced twisted-pair products as listed below.

### 5.1 OUTLETS

All category 6 information outlets designed for termination of 4-pair balanced twisted-pair category 6 copper cable must possess the following characteristics at the minimum:

- Exceed category 6 component compliance through the frequency range of 1 to 250MHz
- Be UL listed for plenum environments
- Be available in black, white, red, gray, yellow, blue, green, orange, ivory, bright white, light ivory and alpine white
- Universal design allows the same outlet to be mounted in flat or angled orientation.
- Terminates with an ergonomic and easy to use Z-tool to ensure fast and simple terminations.
- Have a patented curved or “crowned” contact shape, eliminating the risk of permanent contact deformation due to mechanical stress and ensure that arcing that occurs during mating and un-mating under load will not affect the mating integrity of both the outlet and the plug contacts.
- Compliant to IEC 60512-99-001
- Have an available spring door allowing one handed operation.
- Have a lacing module that offers linear lacing and zero-cross termination, which eliminates pair crossing
- Have available termination tool included with each box of 20 outlets
- Be backwards compatible to allow lower performing categories of cables or connecting hardware to operate to their full capacity
- Support industry standards for T568A or T568B wiring options on each individual outlet
- Allow installation from the front or rear of the faceplate, and allow for the jack to pass through the faceplate without re-termination
- Provide color-coded, snap-in icons available for circuit identification
- Allow for a minimum of 5 terminations without signal degradation below standards compliance limits
- Have a bezel constructed of high impact, glass reinforced nylon.
- Have, as an option, an outlet, which can be mounted into an IEC 60603-7 compliant opening (keystone)
- Must be certified by Underwriters Laboratories to United States Standards and C22.2 Canadian Telecommunications Standards

### 5.2 PATCH CORDS

All Category 6 modular equipment cords shall conform to the following minimum performance standards:

- Be factory assembled and 100% transmission tested with laboratory grade network analyzers for proper performance up to 250 MHz
- Be backwards compatible with lower performing categories
- Be equipped with identical modular 8-position plugs on both ends, wired straight through with standards compliant wiring
- Utilize patented metallic isolator shields pairs inside plug for optimum NEXT performance and a 360-degree crimp for providing excellent plug-to-cable strain relief without causing pair deformation
- Obtain the required performance without use of printed circuit board components
- Incorporate internal stranded cordage isolator within a round, flame-retardant jacket to provide extended flex life and maintain ideal pair geometry
- Have a boot that features an ultra slim design for high density applications and snag free operation.

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- Use modular plugs which exceed FCC CFR 47-part 68 subpart F and IEC 60603-7 specifications, have 50 micro-inches minimum of gold plating over nickel contacts and are resistant to corrosion from humidity, extreme temperatures, and airborne contaminants
- Be available in standard lengths of 3, 5, 7, 10, 15 and 20 ft. with custom lengths available upon request
- Offer multiple cable colors (with ultra slim boots for high density applications) in standard colors of black, white, red, gray, yellow, blue and green for proper circuit identification
- Be certified by Underwriters Laboratories to United States Standards and C22.2 Canadian Telecommunications Standards
- Meet the following specifications:

ELECTRICAL	
Contact Resistance	20 mΩ
Input to Output DC Resistance	200 mΩ
Min. Dielectric Withstand Voltage (contact to contact)	1000 V DC or AC peak
Insulation Resistance	500 mΩ
Compatibility	Category 6 and 5e
Current Rating @ 25°C (77°F)	1.5 A
Remote Powering	PoE Type 1, Type 2, UPoE, PoH
Attenuation De-rating Factor	1.9
MECHANICAL — GENERAL	
Operating Temperature	-20 to 75 °C (-4 to 167 °F)
Flammability Rating	UL 94 - V0
Green Features	RoHS, lead-free, halogen-free, PVC free
Contact Materials	Copper alloy with contact plating of 50 microinches gold or equivalent
Plastic Materials	Flame retardant thermoplastic
Marking	P/N, length, performance level
MECHANICAL — PLUG	
Number of Plug Insertion Cycles	750
Min. Plug Retention Force	50N (11.24 lbf)
Plug Compatibility	Compatible with RJ45 outlets
MECHANICAL — CABLE	
Wire Size (Nominal)	28 AWG 7x36 Stranded bare copper
Construction	UTP
Cable O.D. (Nominal)	4.0mm (0.16 in.)
Wiring	T568A/B as specified by part #
Jacket Type	CM/LSOH
Bend Radius	16mm (0.64 in.)

- *Category 6 SkinnyPatch UTP Modular Cords Recommended*

### 5.3 PATCH PANELS

All termination panels shall facilitate cross-connection and inter-connection using modular patch cords and shall conform to EIA standard, 19-inch relay rack mounting requirements.

- Offered in kit form to include Z-MAX™ Panel outlets.
- Be made of lightweight, high strength steel with durable black finish in 24 & 48 port 1U configurations
- Panel outlets feature a patented angled IDC contact.
- Have a quick release lever that allows individual outlets to be easily removed even in tight installations.
- Be available in both flat and angled configurations
- Have port identification numbers on the front of the panel
- Accommodate both 24 & 48 ports for each rack mount space (1RMS = 44.5 mm [1.75 in.]

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- Come equipped with integrated rear wire management system
- Be provided with high visibility snap-on magnifying label holders that contain paper labels or Z-MAX icons for port identification.
- Patch cords should come with available color options including blue, white, and yellow as the district uses varied colors to denote the type of equipment connected (blue for general data, white for wireless APs, and yellow for security devices...i.e... cameras, access control panels).

**5.4 CABLE**

All Category 6 cable shall conform to the following minimum performance standards:

- Meet or exceed category 6 requirements provided for both ANSI/TIA-568-C.2 and ISO/IEC 11801 industry standards
- Have a round cable jacket with a nominal cable O.D. of less than or equal to 0.22 in.)
- Have a construction comprised of 4-pairs of 24 AWG solid bare copper conductors
- Have a rip cord installed under the jacket for jacket removal
- Have reverse sequential measurement markings on jacket
- Be available in a 1000' ft Reelex packaging
- Be available in white, red, gray, yellow, blue, green, violet, and orange jacket colors
- Meet the following electrical & physical specifications:

**ELECTRICAL SPECIFICATIONS**

DC Resistance	<8.8Ω/100m
DC Resistance Unbalance	5%
Mutual Capacitance	5.2 nF/100m
Capacitance Unbalance	<330 pF/100m
NVP	67%
LCL	30-10 log(f/100) dB
Delay Skew	≤45ns

**PHYSICAL PROPERTIES**

	CMP
Pulling Tension (max)	110N (25 lbf)
Bend Radius (min)	25mm (1 in.)
Installation Temperature	0 to 50°C (+32 to 122°F)
Storage Temperature	-20 to 75°C (-4 to 167°F)
Operating Temperature	-20 to 75°C (-4 to 167°F)

- Provide the following worse case 100m, transmission performance guarantees:

**TRANSMISSION PERFORMANCE**

GUARANTEED WORST CASE     SIEMON TYPICAL

Frequency (MHz)	Insertion Loss (dB)		NEXT (dB)		PS NEXT (dB)		ACR-F (dB)		PS ACR -F (dB)		Return Loss (dB)		ACR-N (dB)		PS ACR-N (dB)		Propagation Delay (ns)	
	2.0	1.9	74.3	90.8	72.3	87.4	67.8	79.8	64.8	79.4	20.0	27.8	72.3	88.9	70.3	85.5	570	516
4.0	3.8	3.6	65.3	77.8	63.3	74.4	55.8	68.3	52.8	67.7	23.0	31.4	61.5	74.2	59.5	70.8	552	500
10.0	6.0	5.7	59.3	70.2	57.3	68.4	47.8	60.5	44.8	59.7	25.0	31.5	53.3	64.5	51.3	62.7	545	494
16.0	7.6	7.3	56.2	65.5	54.2	63.0	43.7	56.5	40.7	55.6	25.0	33.2	48.7	58.3	46.7	55.8	543	492
20.0	8.5	8.2	54.8	64.9	52.8	62.7	41.8	54.6	38.8	53.6	25.0	31.6	46.3	56.8	44.3	54.6	542	491
31.25	10.7	10.2	51.9	60.2	49.9	57.0	37.9	51.0	34.9	49.8	23.7	31.4	41.3	50.1	39.3	46.9	540	489
62.5	15.4	14.7	47.4	55.9	45.4	55.1	31.9	46.1	28.9	45.6	21.5	33.5	32.0	41.5	30.0	40.4	539	488
100.0	19.8	18.8	44.3	52.5	42.3	50.4	27.8	42.8	24.8	41.5	20.1	30.5	24.5	34.2	22.5	32.0	538	487
160.0	25.6	24.1	41.2	51.8	39.2	50.4	23.7	43.8	20.7	40.6	18.7	32.3	15.6	27.9	13.6	26.4	537	486
200.0	29.0	27.1	39.8	49.1	37.8	47.2	21.8	37.1	18.8	35.7	18.0	30.3	10.8	22.5	8.8	20.2	537	486
250.0	32.8	30.6	38.3	45.1	36.3	43.5	19.8	33.1	16.8	30.9	17.3	34.7	15.5	15.1	3.5	13.5	536	485
300.0*	-	34.7	-	43.8	-	42.1	-	27.9	-	27.3	-	28.6	-	10.0	-	7.6	-	485
400.0*	-	40.7	-	42.8	-	40.4	-	27.5	-	27.0	-	23.6	-	3.1	-	-0.2	-	485
500.0*	-	46.0	-	41.5	-	39.8	-	30.4	-	29.5	-	28.5	-	-3.5	-	-5.2	-	485
550.0*	-	48.7	-	42.8	-	39.7	-	27.2	-	26.6	-	22.0	-	-5.4	-	-8.5	-	485

\*Values for frequencies above industry requirements are for information only.

All performance based on 100 meters (328 ft.).

- Be in groupings of 4-pair units.

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- Be power sum NEXT tested where any disturbed pair within the hybrid/bundle cable shall be 3 dB better than the specified pair-to-pair NEXT loss of a single 4-pair cable of the same category.

## 6 OPTICAL FIBER PRODUCT SPECIFICATIONS

In addition to meeting the specifications outlined in ANSI/TIA-568.3-D and ISO/IEC 11801-1, the requirements in this section must also be met for all applicable optical fiber products as listed below.

### 6.1 OUTLETS/ADAPTERS

All optical fiber outlets/adapters shall meet the following characteristics:

<<Note to Specifier: [Click here](#) to insert the applicable fiber outlet/adaptor requirements here or delete this section if this product is not applicable to this proposal>>

### 6.2 CONNECTORS

All optical fiber connectors shall meet the following characteristics:

<<Note to Specifier: [Click here](#) to insert the applicable fiber connector requirements here or delete this section if this product is not applicable to this proposal>>

### 6.3 PATCH CORDS/PIGTAILS

Fiber equipment cords shall possess the following characteristics:

<<Note to Specifier: [Click here](#) to insert the applicable fiber patch cord/pigtail requirements here or delete this section if this product is not applicable to this proposal>>

### 6.4 FIBER TRUNK CABLES

Fiber trunk assemblies shall meet the following minimum characteristics:

<<Note to Specifier: [Click here](#) to insert the applicable fiber trunk assembly requirements here or delete this section if this product is not applicable to this proposal>>

### 6.5 ENCLOSURES

All interconnect centers, panels and trays (units) shall provide cross-connect, inter-connect, splicing capabilities and contain cable management for supporting and routing the fiber cables/jumpers.

<<Note to Specifier: [Click here](#) to insert the applicable optical fiber cable requirements here or delete this section if this product is not applicable to this proposal>>

### 6.6 CABLE

In addition to meeting the applicable performance specifications, all optical fiber cable shall be appropriate for the environment in which it is installed.

#### MULTIMODE OPTICAL FIBER CABLE

All backbone multimode optical fiber cable must be a minimum of two strands of 62.5/125 or 50/125µm multimode.

<<Note to Specifier: [Click here](#) to insert the applicable optical fiber cable requirements here or delete this section if this product is not applicable to this proposal>>

#### SINGLEMODE OPTICAL FIBER CABLE

Singlemode optical fiber cable shall be used for 1<sup>st</sup> and 2<sup>nd</sup> Level Backbone applications only.

<<Note to Specifier: [Click here](#) to insert the applicable optical fiber cable requirements here or delete this section if this product is not applicable to this proposal>>

## 7 MOUNTING OPTIONS

### 7.1 FACEPLATES

All faceplates installed, as part of this specification shall have these minimum features listed below:

- Be available in 1-, 2-, 4-, or 6- port versions.
  - Have built-in cable management for both fiber and copper applications.
  - Be UL listed for plenum environments
  - Be available in black, white, ivory and light ivory.
  - Have at least three sides with breakouts and an opening in the base for cable or raceway entry.
  - Provide for an optional spring-loaded shutter door for added protection from dust and other airborne contaminants.
  - Have a designation area for printed or adhesive labels for circuit identification.
  - Have optional magnets, which can be internally mounted.
  - Have pockets for color-coded snap in icons for circuit identification.
  - Allow mounting of flat, work area outlets both MAX and Z-MAX.
  - Have left and right thumb release buttons to allow the cover to be easily removed.
  - Must be Communications Circuit Accessory Listed per Underwriters Laboratories Standard UL 1863.
- 
- Be applicable to both fiber and copper applications.
  - Be available in 1-, 2-, 3-, 4- and 6-port single-gang configurations or 6-, 8- and 12-port double-gang configurations.
  - Allow modules to be removed from the front of the faceplate.
  - Allow UTP modules to pass through faceplates even after termination.
  - Have write on designation labels for circuit identification together with a clear plastic cover.
  - Feature easily removable designation label covers which can be removed without use of tools.
  - Be available in single-gang and double-gang configurations.
  - Have as a minimum the standard colors of black, white, gray, ivory and light ivory.
  - Have optional modular furniture adapters available.
  - Have Designer style faceplates and mounting frames available
  - Have stainless steel versions available with designation label option.
  - Have surface mount boxes and standoff rings available for both single and double gang faceplates.
  - Be manufactured using UV resistant, high impact thermoplastic to prevent color fading and provide additional durability.
  - Must be certified by Underwriters Laboratories to United States Standards and C22.2 Canadian Telecommunications Standards.

## 8 SYSTEM DESIGN REQUIREMENTS

### 8.1 HORIZONTAL CABLING

The Horizontal Subsystem is the portion of the telecommunications cabling system that extends from the work area telecommunications outlet/connector to the horizontal cross-connect in the telecommunications room. It consists of the telecommunications outlet/connector, the horizontal cables, optional consolidation point, and that portion of the cross-connect in the telecommunications room serving the horizontal cable. Each floor of a building should be served by its own Horizontal Subsystem.

### 8.2 BACKBONE CABLING

Cables allowed for use in the backbone include: 4-pair 100 $\Omega$  balanced twisted-pair copper, multi-pair 100 $\Omega$  balanced twisted-pair copper, hybrid or bundled 100 $\Omega$  balanced twisted-pair copper, 50/125 $\mu\text{m}$  or 62.5/125 $\mu\text{m}$  multimode optical fiber, and singlemode optical fiber cables. The cable shall support voice, data and imaging applications. The bending radius and pulling strength requirements of all backbone cables shall be observed during handling and installation.

#### INTRABUILDING CABLING

The cable route within a building, connecting closet to closet or closet to the equipment room is referred to as the Intrabuilding Backbone Subsystem. It links the Main Cross-connect (MC) in the equipment room to Intermediate Cross-connects (IC) and Horizontal Cross-connects (HC) in the Telecommunications Rooms (TR). It consists of the backbone transmission media between these locations and the associated connecting hardware terminating this media.

#### INTERBUILDING CABLING

When a distribution system encompasses more than one building, the components that provide the link between buildings constitute the Interbuilding Backbone Subsystem. This subsystem includes the backbone transmission media, associated connecting hardware terminating this media, and electrical protection devices to mitigate harmful voltages when the media is exposed to lightning and/or high voltage power surges that pass through the building cable. It is normally a first-level backbone cable beginning at the main cross-connect in the equipment room of the hub building and extending to the intermediate cross-connect in the equipment room of a satellite building.

### 8.3 TELECOMMUNICATIONS ROOM

- The Telecommunications Room is generally considered to be a floor serving facility. The Horizontal Cross-connect links the Horizontal Subsystem and the Backbone Subsystem together.
- The Horizontal Cross-connect shall consist of rack or wall mounted wiring blocks or panels for termination of copper cables or rack or wall mount interconnect centers or fiber management panels/trays for the termination of optical fibers.
- Cross-connect spaces include the labeling of hardware for providing circuit identification and patch cords or cross-connect wire used for creating circuit connections at the cross-connect.
- The telecommunications room shall be equipped to contain telecommunications equipment, cable terminations, and associated cross-connects.
- Separation from sources of EMI shall be in accordance with ANSI/TIA-569-E and local codes.
- Communication grounding / earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC/TR3 61000-5-2 - Ed. 1.0, ANSI/TIA-607-C, or both be observed throughout the entire cabling system.
- The telecommunications room shall be dedicated to the telecommunications function. Access to telecommunications rooms shall be restricted to authorized service personnel and shall not be shared with building services that may interfere with the telecommunications systems or be used for building maintenance services.
- Lighting in the telecommunications room should be a minimum of 500 lx (50 foot candles) at the lowest point of termination. Light switch should be easily accessible when entering the room.

- A minimum of two dedicated duplex or two dedicated simplex electrical outlet, each on a separate circuit, should be provided for equipment power. Additional convenience duplex outlets should be placed at 1.8 m (6 ft) intervals around the perimeter walls.

#### **8.4 EQUIPMENT ROOM**

- The Equipment Subsystem consists of shared (common) electronic communications equipment in the equipment room or telecommunications room and the transmission media required to terminate this equipment on distribution hardware.
- The equipment room shall be equipped to contain telecommunications equipment, cable terminations, and associated cross-connects.
- Separation from sources of EMI shall be as specified in the Telecommunication Room section of this specification.
- Communication grounding / earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC/TR3 61000-5-2 - Ed. 1.0, ANSI/TIA-607-C, or both be observed throughout the entire cabling system.
- The equipment room shall not be shared with building services that may interfere with the telecommunications systems or be used for custodial services.
- Lighting in the equipment room should be a minimum of 500 lx (50 foot candles) at the lowest point of termination.
- A minimum of two dedicated duplex or two dedicated simplex electrical outlet each on a separate circuit should be provided for equipment power. Additional convenience duplex outlets should be placed at 1.8 m (6 ft) intervals around the perimeter walls.

#### **8.5 ENTRANCE FACILITY**

- The entrance facility shall be equipped to contain telecommunications equipment, cable terminations, and associated cross-connects.
- Separation from sources of EMI shall be as specified ANSI/TIA-569-E.
- Communication grounding / earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC/TR3 61000-5-2 - Ed. 1.0, ANSI/TIA-607-C, or both be observed throughout the entire cabling system.
- The entrance facility shall not be shared with building services that may interfere with the telecommunications systems or be used for custodial services.
- The entrance facility shall be located in a dry area not subject to flooding and should be as close as possible to the electrical service room in order to reduce the length of the bonding conductor to electrical grounding system.
- Lighting in the entrance facility should be a minimum of 500 lx (50 foot candles) at the lowest point of termination.
- A minimum of two dedicated duplex or two dedicated simplex electrical outlet each on a separate circuit should be provided for equipment power. Additional convenience duplex outlets should be placed at 1.8 m (6 ft) intervals around the perimeter walls.



## 9 INSTALLATION

### 9.1 SITE SURVEY

Prior to placing any cable pathways or cable, the contractor shall survey the site to determine job conditions will not impose any obstructions that would interfere with the safe and satisfactory placement of the cables. The arrangements to remove any obstructions with the Project Manager need to be determined at that time.

### 9.2 PHYSICAL INSTALLATION

#### CABLE PATHWAYS

- Pathways shall be designed and installed to meet applicable local and national building and electrical codes or regulations.
- Grounding / Earthing and bonding of pathways shall comply with applicable codes and regulations.
- Pathways shall not have exposed sharp edges that may come into contact with telecommunications cables.
- The number of cables placed in a pathway shall not exceed manufacture specifications, nor, will the geometric shape of a cable be affected.
- Pathways shall not be located in elevator shafts.

#### INTRABUILDING CABLE ROUTING

- The backbone subsystem shall include cable installed in a vertical manner between floor telecommunications rooms and the main or intermediate cross-connect in a multi-story building and cable installed horizontally between telecommunications rooms and the main or intermediate cross-connect in a long single-story building like a school or factory.
- Unless otherwise recommended by the manufacturer, all fiber cables will be run in innerduct.
- Fibers will be terminated in the telecommunications rooms using SC or LC connectors in wall mounted interconnect centers or rack mounted panels equipped with sufficient ports, slack storage space and splice trays if required to terminate and secure all fibers.
- Adequate riser sleeve/slot space shall be available with the ability to ingress the area at a later date in all telecommunications rooms, such that no drilling of additional sleeves/slots is necessary.  
The backbone cables shall be installed in a star topology, emanating from the main cross-connect to each telecommunications room. An intermediate cross-connect may be present between the main cross-connect and the horizontal cross-connect. This is known as a hierarchical star topology.
- Optical fiber should be run for any backbone segment greater than 90 m (295 ft.). If the Intrabuilding backbone segment is less than 90 m (295 ft), and fiber is not routed.
- Backbone pathways shall be installed or selected such that the minimum bend radius of backbone cables is kept within manufacturer specifications both during and after installation.

#### INTERBUILDING CABLE ROUTING

- The backbone subsystem shall include cable installed between buildings via underground, tunnel, direct -buried, aerial or any combination of these from the main cross-connect to an intermediate cross-connect in a multi-building campus.
- Unless otherwise recommended by the manufacturer, all fiber cables will be run in innerduct.
- Fibers will be terminated in the telecommunications rooms using LC connectors in rack mounted panels equipped with sufficient ports, slack storage space and splice trays if required to terminate and secure all fibers.
- In an underground system, adequate underground conduit space shall be available and accessible at each building. The conduits shall not exceed a fill factor of 40%.
- All underground systems shall be designed to prevent water runoff from entering the building.

- The backbone cables shall be installed in a star topology, emanating from the main cross-connect to each satellite building telecommunications room. All Interbuilding cables shall be installed to the applicable codes and regulations.
- Optical fiber shall be run for all Interbuilding backbone segments.
- Backbone pathways shall be installed or selected such that the minimum bend radius and pulling tension of backbone cables is kept within cable manufacturer specifications both during and after installation.

## HORIZONTAL CABLE ROUTING

- All horizontal cables, regardless of media type, shall not exceed 90 m (295 ft) from the telecommunications outlets in the work area to the horizontal cross connect.
- The combined length of jumpers, or patch cords and equipment cables in the telecommunications room and the work area should not exceed 10m (33 ft) unless used in conjunction with a multi-user telecommunications outlet.
- Two horizontal cables shall be routed to each work area. At least one horizontal cable connected to an information outlet shall be 4-pair, 100  $\Omega$  balanced twisted-pair.
- It is recommended that a minimum horizontal cable distance of 15m (49 ft.) shall be maintained between the telecommunications room and the work area.
- For installations with consolidation points, a minimum horizontal cable distance of 15m (49 ft.) shall be maintained between the telecommunications room and consolidation point, and 5m (16 ft.) between the consolidation point and the work area.
- Horizontal pathways shall be installed or selected such that the minimum bend radius of horizontal cables is kept within manufacturer specifications both during and after installation.
- In open ceiling cabling, cable supports shall be provided by means that is structurally independent of the suspended ceiling, its framework, or supports. These supports shall be spaced no more than 1.5 m (5 ft) apart.
- Limiting the number of cables per bundle to 24 to reduce potential temperature rise caused by installation factors.
- **UTP ONLY:** Telecommunications pathways, spaces and metallic cables, which run parallel with electric power or lighting, which is less than 3kVA, shall be installed with a minimum clearance of 50 mm (2 in).
- **UTP ONLY:** Telecommunications pathways, spaces and metallic cables, which run parallel with electric power or lighting, which is more than 3kVA but less than 6kVA, shall be installed with a minimum clearance of 1.5 m (5 ft).
- **UTP ONLY:** Telecommunications pathways, spaces and metallic cables, which run parallel with electric power or lighting, which is more than 6kVA, shall be installed with a minimum clearance of 3 m (10 ft).
- For voice or data applications, 4-pair balanced twisted-pair or fiber optic cables shall be run using a star topology from the telecommunications room serving that floor to every individual information outlet. The customer prior to installation of the cabling shall approve all cable routes.
- The Contractor shall observe the bending radius and pulling strength requirements of the 4-pair balanced twisted-pair and fiber optic cable during handling and installation.
- Each run of balanced twisted-pair cable between horizontal portion of the cross-connect in the telecommunication closet and the information outlet shall not contain splices.
- In a false ceiling environment, a minimum of 75 mm (3 in) shall be observed between the cable supports and the false ceiling.
- Continuous conduit runs installed by the contractor should not exceed 30.5 m (100 ft) or contain more than two (2) 90 degree bends without utilizing appropriately sized pull boxes.
- All horizontal pathways shall be designed, installed and grounded to meet applicable local and national building and electrical codes.

- The number of horizontal cables placed in a cable support or pathway shall be limited to a number of cables that will not cause a geometric shape of the cables.
- Maximum conduit pathway capacity shall not exceed a 40% fill. However, perimeter and furniture fill is limited to 60% fill for move and changes.
- Horizontal distribution cables shall not be exposed in the work area or other locations with public access.

### **WORK AREA TERMINATION**

- All balanced twisted-pair cables wired to the telecommunications outlet/connector, shall have 4-pairs terminated in eight-position modular outlets in the work area. All pairs shall be terminated.
- The telecommunications outlet/connector shall be securely mounted at planned locations.
- The height of the telecommunications faceplates shall be to applicable codes and regulations.

### **PULLING TENSION**

- The maximum cable pulling tensions shall not exceed manufacturer's specifications.

### **BEND RADIUS**

- The maximum cable bend radii shall not exceed manufacturer's specifications.
- In spaces with balanced twisted-pair cable terminations, the maximum bend radius for 4-pair cable shall not exceed four times the outside diameter of the cable and ten times for multi-pair cable. This shall be done unless this violates manufacturer specifications.
- During the actual installation, bend radius on 4-pair cable shall not exceed four times the outside diameter of the cable and ten times for multi-pair cable. This shall be done unless this violates manufacturer specifications.

### **SLACK**

- In the work area, a minimum of 300 mm (12 in) should be left for balanced twisted-pair cables, while 1 m (3 ft) be left for fiber cables.
- In telecommunications rooms a minimum of 3m (10 ft) of slack should be left for all cable types. This slack must be neatly managed on trays or other support types.

### **CABLE TIE WRAPS**

- Tie wraps shall be used at appropriate intervals to secure cable and to provide strain relief at termination points. These wraps shall not be over tightened to the point of deforming or crimping the cable sheath.
- Hook and loop cable managers should be used in the closet where reconfiguration of cables and terminations may be frequent.

*Siemon Company VCM Series Recommended*

### **GROUNDING**

- All grounding / earthing and bonding shall be done to applicable codes and regulations.

### **FIRE PROTECTION**

- Properly installed firestop systems shall be installed to prevent or retard the spread of fire, smoke, water, and gases through the building. This requirement applies to openings designed for telecommunications use that may or may not be penetrated by cables, wires, or raceways.
- Fire stops shall be done to applicable code.

### **WORKMANSHIP**

- All work shall be done in a workman like fashion of the highest standards in the telecommunications industry.

- All equipment and materials are to be installed in a neat and secure manner, while cables are to be properly dressed.
- Workers must clean any debris and trash at the close of each workday.

## 10 TESTING

Testing of all newly installed cable channels shall be performed prior to system cutover.

### 10.1 COPPER TESTING

- All category 6 field-testing shall be performed with an approved level III balanced twisted-pair field test device.
- All installed category 6 channels shall perform equal to or better than the minimum requirements as specified by the table below:

Parameter	Performance @ 100MHz	Performance @ 200MHz	Performance @ 250MHz
Insertion Loss	19.59 dB	29.01 dB	33.07 dB
NEXT Loss	46.9 dB	41.8 dB	40.1 dB
PS NEXT Loss	45.6 dB	40.4 dB	38.7 dB
ACR-N	27.3 dB	12.8 dB	7.0 dB
PS ACR-N	26.0 dB	11.3 dB	5.6 dB
ACR-F	31.3 dB	25.2 dB	23.3 dB
PS ACR-F	30.3 dB	24.2 dB	22.3 dB
Return Loss	14.0 dB	11.0 dB	10.0 dB
Propagation Delay	548 ns	547 ns	546 ns
Delay Skew	45 ns	45 ns	45 ns

- Category 6 balanced twisted-pair horizontal and backbone cables, whose length does not exceed 90 m (295 ft) for the permanent link, and 100 m (328 ft) for the channel shall be 100 percent tested according to ANSI/TIA-568.1-D. Test parameters include wire map plus ScTP shield continuity (when present), length, NEXT loss (pair-to-pair), NEXT loss (power sum), ACR-F loss (pair-to-pair), ELFEXT loss (power sum), return loss, insertion loss, propagation delay, and delay skew.

### TEST EQUIPMENT CRITERIA

- All balanced twisted-pair field testers shall be factory calibrated each calendar year by the field test equipment manufacturer as stipulated by the manuals provided with the field test unit. The calibration certificate shall be provided for review prior to the start of testing.
- Autotest settings provided in the field tester for testing the installed cabling shall be set to the default parameters
- Test settings selected from options provided in the field testers shall be compatible with the installed cable under test.

## 10.2 FIBER OPTIC TESTING

### BACKBONE FIBER TESTING

- Fiber backbone cables shall be 100% tested for insertion loss and length.
- Insertion loss shall be tested at 1310 and 1550 for singlemode cabling in at least one direction using the one reference-cord test procedure as specified in ANSI/TIA-526-7-A.
- Length shall be tested using an OTDR, optical length test measurement device or sequential cable measurement markings.

- The backbone link performance guarantees are as follows:

Backbone Link Performance		
Parameter	Singlemode (1310nm/1550nm)	
	Indoor Cable	Outdoor Cable
Max. Attenuation (dB)	2.9/2.9	1.85/1.55
Zero Dispersion Wavelength (nm) <sup>1</sup>	1300 - 1322	
Zero Dispersion Slope (nm <sup>2</sup> •km) <sup>1</sup>	<0.092	
Gigabit Transmission Distance (m) <sup>2</sup>	3,000/3,000	
10 Gigabit Transmission Distance (m) <sup>3</sup>	3,000/3,000	
Min. Return Loss (dB) <sup>4</sup>	40	

<sup>1</sup> Dispersion is an important performance parameter, but because it is intrinsic to the fiber and cannot be adversely affected by installation practices, it does not require testing in the field.

<sup>2</sup> The protocol pertinent to the transmission distances as noted is Gigabit Ethernet per IEEE 802.3z.

<sup>3</sup> The protocol pertinent to the transmission distances as noted is 10 Gigabit Ethernet per IEEE 802.3ae.

<sup>4</sup> If the insertion loss is within the limits as noted in the above chart, it is indicative that the Return Loss performance of the link will be within the limits as indicated.

Acceptable attenuation test results shall be determined using the following calculation:

*Link Attenuation = Cable Attenuation + Connector Attenuation + Splice Attenuation*

where:

*Cable Attenuation (dB) = Attenuation Coefficient (dB/km) x length (km)*

*Attenuation Coefficient (Inside Plant) = 0.5 dB/km @ 1310 and 1550 nm*

*Attenuation Coefficient (Outside Plant) = 0.4 dB/km @ 1310; 0.3 dB/km @ 1550 nm*

*Connector Attenuation (dB) = Number of Connector Pairs (n) x Connector Loss = n x 0.5 dB*

*Splice Attenuation (dB) = Number of Splices (s) x Splice Loss (dB) = s x 0.3 dB*

## **11 ADMINISTRATION & DOCUMENTATION**

### **11.1 LABELING**

- Horizontal and backbone cables shall be labeled at each end. The cable or its label shall be marked with its identifier.
- A unique identifier shall be marked on each faceplate to identify it as connecting hardware.
- Each port in the faceplate shall be labeled with its identifier.
- A unique identifier shall be marked on each piece of connecting hardware to identify it as connecting hardware.
- Each port on the connecting hardware shall be labeled with its identifier.

### **11.2 DRAWINGS**

As-built drawings shall be supplied by the contractor showing the locations of and identifiers for all:

- Horizontal cable routing and terminations
- Telecommunications outlets/connectors
- Backbone cable routing and terminations

### **11.3 RECORDS AND REPORTS**

All records shall be created by the installation contractor and turned over at the completion of work. The format shall be computer based and both soft copies and hard copies shall be part of the As-built package.

The minimum requirements include:

- Cable records must contain the identifier, cable type, termination positions at both ends, splice information as well as any damaged pairs/conductors.
- Connecting hardware and connecting hardware position records must contain the identifier, type, damaged position numbers, and references to the cable identifier attached to it.
- Test documentation on all cable types shall be included as part of the As-built package.

All reports shall be generated from the computer-based program used to create the records above. These reports should include but not limited to:

- Cable Reports
- Cross-connect Reports
- Connecting Hardware Reports

## 12 WARRANTY

Either a permanent link or channel model configuration may be applied to the horizontal and/or backbone sub-systems of the structured cabling system. Applications assurance is only applied to a channel model configuration. All channels are to be qualified for linear transmission performance up to 250 MHz to ensure that high-frequency voltage phase and magnitude contributions do not prove cumulative or adversely affect channel performance.

### 12.1 SYSTEM WARRANTY

A twenty (20) year warranty available for the category 6 structured cabling system shall be provided for an end-to-end channel model installation which covers applications assurance, cable, connecting hardware and the labor cost for the repair or replacement thereof.

Additional features of the warranty shall include:

- Margin over category 6 channel specifications on all parameters across the entire frequency range of 1-250MHz as noted below:

Performance Guarantees for Z-MAX Premium 6 UTP Channels													
Parameter	Frequency (MHz)												Guaranteed Margin (1 - 250 MHz)
	1	4	8	10	16	20	25	31.25	62.5	100	200	250	
Insertion Loss	2.04	3.82	5.38	6.02	7.64	8.57	9.63	10.82	15.65	20.23	29.97	34.16	5%
Return Loss	21.0	21.0	21.0	21.0	20.0	19.5	19.0	18.5	16.0	14.0	11.0	10.0	2.0 dB
NEXT	72.0	70.0	65.2	63.6	60.2	58.6	57.0	55.4	50.4	46.9	41.8	40.1	7.0 dB
PS NEXT	70.5	69.0	64.1	62.5	59.1	57.5	55.8	54.2	49.1	45.6	40.4	38.7	8.5 dB
ACR-N	70.0	66.2	59.8	57.6	52.6	50.1	47.4	44.6	34.7	26.7	11.8	6.0	7.2 dB
PS ACR-N	68.5	65.2	58.7	56.5	51.5	48.9	46.2	43.4	33.4	25.3	10.4	4.5	8.7 dB
ACR-F	71.3	59.2	53.2	51.3	47.2	45.2	43.3	41.4	35.3	31.3	25.2	23.3	8.0 dB
PS ACR-F	70.3	58.2	52.2	50.3	46.2	44.2	42.3	40.4	34.3	30.3	24.2	22.3	10.0 dB
Propagation Delay	580	562	557	555	553	552	551	550	549	548	547	546	0 nS
Delay Skew	45	45	45	45	45	45	45	45	45	45	45	45	5 nS

<sup>1</sup> Guaranteed margin over ANSI/TIA-568-C.2 Category 6 and ISO/IEC 11801 Ed.2.0, Amendment 1: 2008 class E channel performance

Warranty performance claims are based on worst case testing and channel configurations. Typical channel performance may be significantly higher.

These performance guarantees are based upon a minimum horizontal cable length of 15m (50 ft.). For short length applications, horizontal cable lengths of less than 15m (50 ft.) can be supported but the resulting system performance is limited to System 6 performance.

- Performance claims based on worst case testing and channel configurations

### 12.2 PRODUCT WARRANTY

The manufacturer of passive telecommunications equipment used in a manner not associated with the Systems Warranty must have a minimum five (5) year Component Warranty on all its product. The Products Warranty covers the components against defects in material or workmanship under normal and proper use.

### 12.3 APPLICATIONS SUPPORTED

Existing and future applications supported for a channel model warranty include those approved by the Institute of Electronic and Electrical Engineers (IEEE), the Asynchronous Transfer Mode (ATM) Forum, the American National Standards Institute (ANSI) or the International Organization of Standards (ISO) that specify compatibility with the cable referenced herein.

## Bill of Materials (same or equivalent)

Manufacturer	Product	Description
Siemon	Z6-02	ZMax Cat 6 Module
Siemon	9C6P4-E4-06-RBA	Cat 6 Cable Plenum
Siemon	MX-SMZ102	Single Port SMB
Siemon	10GMX-FPS04-02	4 Port Single Gang Faceplate
Siemon	CT4-BOX-02	Surface Mount Boxes
Siemon	Z6-PNL-U48K	48 Port Patch Panel
Siemon	MC6-01-02-28	1' Skinny Patch Cord
Siemon	MC6-10-02-28	10' Skinny Patch Cord
Wiremold	Uniduct 2900	
Siemon	LVE-1U-MD-P01A	1U Fiber Drawer
Siemon	LVE-2U-MD-P01A	2U Fiber Drawer
Siemon	LVE-4U-MD-P01A	4U Fiber Drawer
Siemon	LVA24-LSU-BC-A	24 Strand LC Adapter
Siemon	FC1-LB-LCU-9BL	LC Termination
Siemon	FJ2-LCULCUL-03	LC to LC Patch Cord
Siemon	9GD8P024L-E201A	24 Strand Single Mode In/Out Fiber
Caddy	Cat32324	JHook