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Purpose of the ANSI/TIA/EIA-568-B Standard

The Purpose:

- Establish a generic telecommunications cabling standard that will support a multivendor environment
- Enable the planning and installation of a structured cabling system for commercial buildings
- Establish performance and technical criteria for various cabling system configurations

The Standard Specifies:

- Minimum requirements for telecommunications cabling within an office environment
- Recommended topology and distances
- Media parameters which determine performance
- Connector and pin assignments to ensure interconnectability
- The useful life of telecommunications cabling systems as being in excess of 10 years

Building telecommunications cabling specified by this standard is intended to support a wide range of different commercial building sites and applications (e.g., voice, data, text, video and image). Typically, this range includes sites with a geographical extent from 10,000 to 10,000,000 sq ft (3,000-1,000,000 m^2) of office space, and with a population of up to 50,000 individual users.

This standard replaces ANSI/TIA/EIA-568-A dated October 6, 1995.

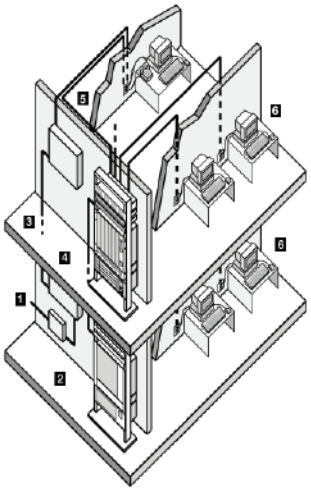
This standard also incorporates and refines the technical content of TSB67, TSB72, TSB75, TSB95 and TIA/EIA-568-A-1, A-2, A-3, A-4 and A-5.

Section Contents

ANSI/TIA/EIA-568-B

Commercial Building Telecommunications Cabling Standard
TIA/EIA-568-B.1 General Requirements

TIA/EIA-568-B.1 General Requirements



The Six Subsystems of a Structured Cabling System

1. Entrance Facilities (EF)

Building entrance facilities (EF) provide the point at which outdoor cabling interfaces with the intrabuilding backbone cabling. The physical requirements of the network interface are defined in the TIA/EIA-569-B standard.

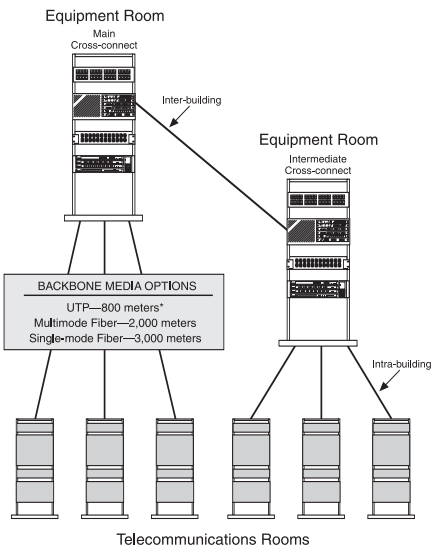
2. Equipment Room (ER)

The design aspects of the equipment room are specified in the TIA/EIA-569-B standard. Equipment rooms usually house equipment of higher complexity than telecommunication rooms. Any or all of the functions of a telecommunications room may be provided by an equipment room.

3. Backbone Cabling

The backbone cabling provides interconnection between telecommunication rooms, equipment rooms and entrance facilities. It consists of the backbone cables, intermediate and main cross-connects, mechanical terminations and patch cords or jumpers used for backbone-to-backbone cross-connection. This includes:

- Vertical connection between floors (risers)
- Cables between an equipment room and building cable entrance facilities
- Cables between buildings (inter-building)



Specified Backbone Cabling Topology: Star

Other Design Requirements

- Star topology
- No more than two hierarchical levels of backbone cross-connects
- Bridge taps are not allowed
- Main and intermediate cross-connect jumper or patch cord lengths should not exceed 20 m (66 ft)
- Avoid installing in areas where sources of high levels of EMI/RFI may exist
- Grounding should meet the requirements as defined in J-STD-607-A

Note: It is recommended that the user consult with equipment manufacturers, application standards and system providers for additional information when planning shared-sheath applications on UTP backbone cables.

Maximum Backbone Distances

Media Type	Main to Horizontal Cross-Connect	Main to Intermediate Cross-Connect	Intermediate to Horizontal Cross-Connect
Copper (Voice*)	800 m (2,624 ft)	500 m (1,640 ft)	300 m (984 ft)
Multimode	2,000 m (6,560 ft)	1,700 m (5,575 ft)	300 m (984 ft)
Single-mode	3,000 m (9,840 ft)	2,700 m (8,855 ft)	300 m (984 ft)

*Note: Backbone distances are application-dependent. The maximum distances specified above are based on voice transmission for UTP and data transmission over fiber. A 90 m distance applies to UTP at spectral bandwidths of 5-16 MHz for Cat 3 and 20-100 MHz for Cat 5e. Current state-of-the-art distribution facilities usually include a combination of both copper and fiber optic cables in the backbone.

4. Telecommunications Room (TR)

A telecommunications room is the area within a building that houses the telecommunications cabling system equipment. This includes the mechanical terminations and/or cross-connects for the horizontal and backbone cabling system. Please refer to TIA/EIA-569-B for the design specifications of the telecommunications room.

5. Horizontal Cabling

Specified Horizontal Cabling Topology: Star

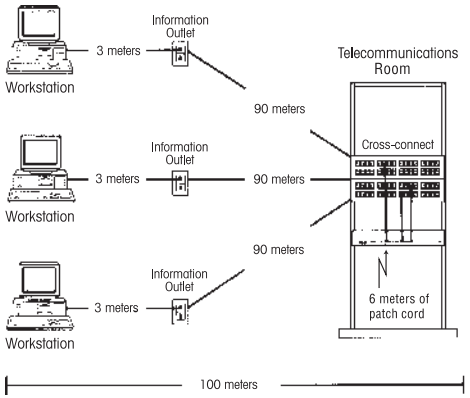
The horizontal cabling system extends from the work area telecommunications information outlet to the telecommunications room and consists of the following:

- Horizontal cabling
- Telecommunications outlet
- Cable terminations
- Cross-connections
- Patch cords

Four media types are recognized as options for horizontal cabling, each extending a maximum distance of 90 m:

- 4-pair, 100 ohm UTP/ScTP cable (24 AWG solid conductors)
- 2-fiber, 62.5/125 µm or 50/125 µm optical cable

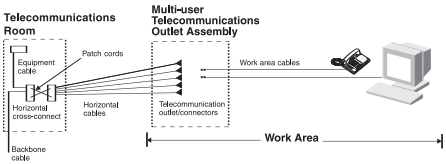
Maximum Distances for Horizontal Cabling



In addition to the 90 m of horizontal cable, a total of 10 m is allowed for work area and telecommunications room patch and jumper cables.

Multi-user Telecommunications Outlet Assembly (MUTOA)

Optional practices for open office environments are specified for any horizontal telecommunications cabling recognized in TIA/EIA 568-B.

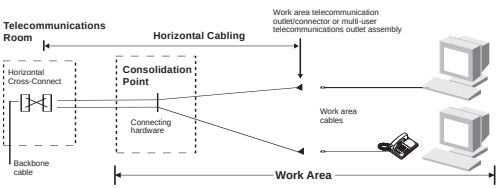


A multi-user telecommunications outlet assembly (MUTOA) facilitates the termination of multiple horizontal cables in a common location within a column, wall or permanently secured furniture cluster. Work area cables may then be routed through furniture pathways and directly connected to work area equipment. Each furniture cluster should have one MUTOA which serves a maximum of 12 work areas. Ceiling and access floor mounting is not allowed by TIA/EIA-569-B.

Maximum work area cable length is determined by the following table:		
Length of horizontal cable m (ft)	Maximum length of work area cable (24AWG) m (ft)	Maximum combined length of work area cables, patch cords and equipment cable m (ft)
90 (295)	5 (16)	10 (33)
85 (279)	9 (30)	14 (46)
80 (262)	13 (44)	18 (59)
75 (246)	17 (57)	22 (72)
70 (230)	22 (72)	27 (89)

Note: No work area cable length may exceed 22 m (72 ft).
For optical fiber, any combination of horizontal, work area cables, patch cords and equipment cords may not exceed 100 m (328 ft).

Consolidation Point

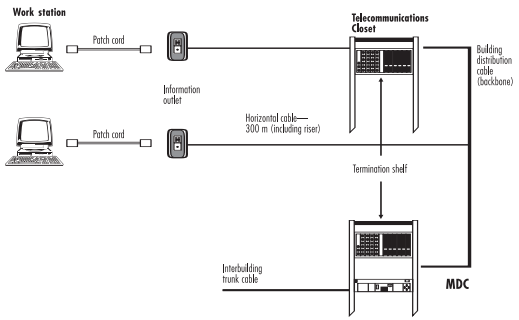


A consolidation point differs from a MUTOA in that it requires an additional connection for each horizontal cable run. Only one consolidation point (an interconnection point in the horizontal cabling) is allowed at a distance of at least 15 m (49 ft) from the telecommunications room. A transition point (transition from round to flat under carpet cable) is not allowed. A consolidation point is installed in unobstructed building columns, permanent walls, ceilings or access floors (if accessible).

The multi-user telecommunications outlet and consolidation point methods are intended to be mutually exclusive. Labeling and allowance for spares is required. Moves, adds and changes should be administered in the telecommunications room.

Centralized Optical Fiber Cabling

The ANSI/TIA/EIA-568-B.1 standard offers maximum flexibility for distributed electronics for multi-tenant buildings by providing for single-tenant users who prefer centralized electronics (i.e., server farms) connected by a fiber horizontal and fiber backbone.



Centralized Cabling Scheme

To connect fiber from the work area to the equipment room within a single building, the user may use a splice or interconnect in the telecommunications room. The combined distance limitation is 300 m (984 ft) for horizontal, intra-building backbone and patch cords. Alternatively, the user may simply pull cables through the closet. In this last case, the fiber horizontal and backbone consist of one continuous fiber pair, and the pull-through distance limitation is 90 m (295 ft). Cabling is 62.5/125 µm multimode or 50/125 µm multimode. Sufficient space should be allowed for slack, addition and removal of cables, spares and conversion to a full cross-connect system. Labeling should be in accordance with TIA/EIA-606-A with additional labeling to identify A-B pairs with specific work areas.

6. Work Area (WA)

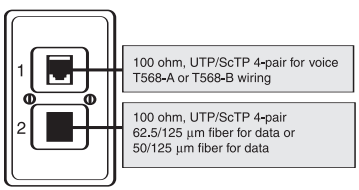
The work area components extend from the telecommunications (information) outlet to the station equipment. Work area wiring is designed to be relatively simple to interconnect so that moves, adds and changes are easily managed.

Work Area Components

- Station equipment – computers, data terminals, telephones, etc.
- Patch cables – modular cords, PC adapter cables, fiber jumpers, etc.
- Adapters – baluns, etc. (must be external to telecommunications outlet)

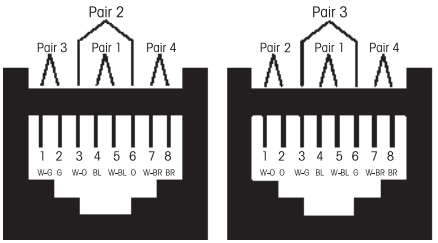
Telecommunications Outlet

Each work area should have a minimum of two information outlet ports, one for voice and one for data.



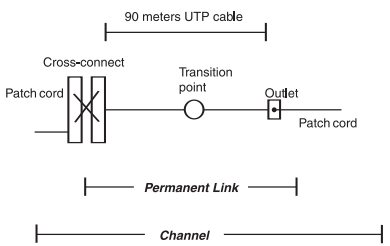
Telecommunications Outlet

8-Position Modular Jack Pair Assignments for UTP



Channel and Permanent Link

For the purpose of testing UTP cabling systems, the horizontal channel is assumed to contain a telecommunications outlet/connector, a transition point, 90 m of UTP cable, a cross-connect consisting of two blocks or panels and a total of 10 m of patch cords. The figure below shows the relationship of these components.



Two link configurations are defined for testing purposes. The permanent link includes the horizontal distribution cable, telecommunications outlet/connector or transition point and one horizontal cross-connect component including the mated connections. This is assumed to be the permanent part of a link. The channel is comprised of the permanent link plus cross-connect equipment, user equipment cord and cross-connect patch cable.

Minimum Bend Radius	
Horizontal UTP (4-pair)	4 x diameter
Horizontal ScTP	8 x diameter
Backbone Cable	10 x diameter
Patch Cord	Not determined

Physical requirements of 4-pair UTP:

- Maximum diameter: 1/4 inch
- Breaking strength: 90 lbs.
- Maximum pulling tension: 25 lbs.

Definitions of Electrical Parameters

Insertion Loss: This term has replaced the term "attenuation" (ATTN). It is a measure of the decrease of signal strength as it travels down the media.

NEXT (near-end crosstalk): A measure of the unwanted signal coupling from a transmitter at the near-end into a neighboring (non-energized) pair measured at the near-end.

PSNEXT (powersum near-end crosstalk): A computation of the unwanted signal coupling from multiple transmitters at the near-end into a neighboring (non-energized) pair measured at the near-end.

FEXT (far-end crosstalk): A measure of the unwanted signal coupling from a transmitter at the near-end into a neighboring pair measured at the far-end.

ELFEXT (equal-level far-end crosstalk): A measure of the unwanted signal coupling from a transmitter at the near-end into a neighboring pair measured at the far-end, relative to the received signal level measured on that same pair. Referred to as ACR-F (insertion loss to crosstalk ratio far-end) in the TIA/EIA-568-B.2-Addendum 10 draft. (ELFEXT is FEXT adjusted to discount insertion loss.)

PSAACRF (powersum insertion loss to alien crosstalk ratio far-end): A computation of signal coupling from multiple pairs of disturbing channels, to a disturbed pair in another channel measured at the far-end and relative to the received signal level in the disturbed pair at the far-end. Also referred to as powersum alien equal-level far-end crosstalk (PSAELFEXT).

PSANEXT (powersum alien near-end crosstalk): A computation of signal coupling from multiple near-end disturbing channel pairs into a disturbed pair of a neighboring channel or part thereof, measured at the near-end.

PSAFEXT (powersum alien far-end crosstalk): A computation of signal coupling from multiple near-end disturbing channel pairs into a disturbed pair of a neighboring channel or part thereof, measured at the far-end.

Return Loss: A measure of the degree of impedance mismatch between two impedances. It is the ratio, expressed in decibels, of the amplitude of a reflected wave echo to the amplitude of the main wave at the junction of a transmission line and a terminating impedance.

Propagation Delay: The time needed for the transmission of signal to travel the length of a single pair.

Delay Skew: The difference between the propagation delay of any two pairs within the same cable sheath. Delay skew is caused primarily because twisted pairs are designed to have different twists per foot (lay lengths). Delay skew could cause data transmitted over one channel to arrive out of sync with data over another channel.

Tests should also measure physical length of each link, and employ wire map to verify pin terminations at each end and identify simple electrical faults. Level IIe field test equipment accuracy is defined.

The following tables show the limitations for both the permanent links and channel.

Category 3 Permanent Link		
Frequency (MHz)	Insertion Loss (dB)	NEXT (dB)
1.0	3.5	40.1
4.0	6.2	30.7
8.0	8.9	25.9
10.0	9.9	24.3
16.0	13.0	21.0

Category 3 Permanent Link Requirements

Category 3 Channel		
Frequency (MHz)	Insertion Loss (dB)	NEXT (dB)
1.0	4.2	39.1
4.0	7.3	29.3
8.0	10.2	24.3
10.0	11.5	22.7
16.0	14.9	19.3

Category 3 Channel Requirements

Category 5e Permanent Link						
Frequency (MHz)	Insertion Loss (dB)	NEXT (dB)	PSNEXT (dB)	ELFEXT (dB)	PSELFEXT (dB)	Return Loss (dB)
1.0	2.1	>60	>57	58.6	55.6	19.0
4.0	3.9	54.8	51.8	46.6	43.6	19.0
8.0	5.5	50.0	47.0	40.6	37.5	19.0
10.0	6.2	48.5	45.5	38.6	35.6	19.0
16.0	7.9	45.2	42.2	34.5	31.5	19.0
20.0	8.9	43.7	40.7	32.6	29.6	19.0
25.0	10.0	42.1	39.1	30.7	27.7	18.0
31.25	11.2	40.5	37.5	28.7	25.7	17.1
62.5	16.2	35.7	32.7	22.7	19.7	14.1
100.0	21.0	32.3	29.3	18.6	15.6	12.0

Category 5e Permanent Link Requirements

Maximum link propagation delay: 518 ns at 10 MHz

Maximum link delay skew: 45 ns at 100 MHz

Category 5e Channel						
Frequency (MHz)	Insertion Loss (dB)	NEXT (dB)	PSNEXT (dB)	ELFEXT (dB)	PSELFEXT (dB)	Return Loss (dB)
1.0	2.2	>60	>57	57.4	54.4	17.0
4.0	4.5	53.5	50.5	45.4	42.4	17.0
8.0	6.3	48.6	45.6	39.3	36.3	17.0
10.0	7.1	47.0	44.0	37.4	34.4	17.0
16.0	9.1	43.6	40.6	33.3	30.3	17.0
20.0	10.2	42.0	39.0	31.4	28.4	17.0
25.0	11.4	40.3	37.3	29.4	26.4	16.0
31.25	12.9	38.7	35.7	27.5	24.5	15.1
62.5	18.6	33.6	30.6	21.5	18.5	12.1
100.0	24.0	30.1	27.1	17.4	14.4	10.0

Category 5e Channel Requirements

Maximum channel propagation delay: 555 ns at 10 MHz

Maximum channel delay skew: 50 ns at 100 MHz

TIA/EIA-568-B.2
Balanced Twisted Pair Cabling Components

100 ohm Unshielded Twisted Pair (UTP)

Horizontal Cable

As transmission rates have increased, higher performance UTP cabling has become a necessity. In addition, some means of classifying horizontal UTP cables and connecting hardware by performance capability had to be established. These capabilities have been broken down to a series of categories. The following categories are currently recognized:

Category 3

Cables/connecting hardware with transmission parameters characterized up to 16 MHz

Category 5e

Cables/connecting hardware with transmission parameters characterized up to 100 MHz

Category 3 Horizontal and Backbone Cable (100 meters)			
Frequency (MHz)	Insertion Loss (dB)	NEXT (dB)	PSNEXT (dB)
0.772	2.2	43.0	43
1.0	2.6	40.3	41
4.0	5.6	32.3	32
8.0	8.5	27.8	28
10.0	9.7	26.3	26
16.0	13.1	23.2	23

Category 3 Horizontal and Backbone Cable

Maximum Cat 3 cable propagation delay: 545 ns/100 m at 10 MHz

Maximum Cat 3 cable delay skew: 45 ns/100 m at 16 MHz

Category 5e Horizontal and Backbone Cable (100 m)						
Frequency (MHz)	Insertion Loss (dB)	NEXT* (dB)	PSNEXT (dB)	ELFEXT* (dB)	PSELFEXT (dB)	Return Loss (dB)
0.772	1.8	67.0	64.0			19.4
1.0	2.0	65.3	62.3	63.8	60.8	20.0
4.0	4.1	56.3	53.3	51.8	48.8	23.0
8.0	5.8	51.8	48.8	45.7	42.7	24.5
10.0	6.5	50.3	47.3	43.8	40.8	25.0
16.0	8.2	47.2	44.2	39.7	36.7	25.0
20.0	9.3	45.8	42.8	37.8	34.8	25.0
25.0	10.4	44.3	41.3	35.8	32.8	24.3
31.25	11.7	42.9	39.9	33.9	30.9	23.6
62.5	17.0	38.4	35.4	27.9	24.9	21.5
100.0	22.0	35.3	32.3	23.8	20.8	20.1

Category 5e Horizontal and Backbone Cable

Maximum Cat 5e cable propagation delay: 538 ns/100 m at 100 MHz Maximum Cat 5e cable delay skew: 45 ns/100 m at 100 MHz

Characteristic impedance of horizontal cabling = 100 ohms ± 15 percent from 1 MHz to the highest referenced frequency (16 or 100 MHz) of a particular category.

*Requirements for 25-pair cable are identical to those for 4-pair cable.

Bundled and Hybrid Cable

Bundled, wrapped or hybrid cables are allowed for use in horizontal cabling, provided that each individual cable type meets TIA/EIA-568-B.2 specifications and that powersum NEXT loss created by adjacent jacketed cables be 3 dB better than the normally allowed pair-to-pair NEXT for the cable type being tested. Color codes must follow individual cable standards to distinguish them from multipair UTP backbone cabling.

UTP Connecting Hardware

To ensure that installed connecting hardware (telecommunications outlets, patch cords and panels, connectors, cross-connect blocks, etc.) will have minimal effect on overall cabling system performance, the characteristics and performance parameters presented in this section must be met.

Category 3 Connecting Hardware		
Frequency (MHz)	Insertion Loss (dB)	NEXT (dB)
1.0	0.1	58.0
4.0	0.2	46.0
8.0	0.3	39.9
10.0	0.3	38.0
16.0	0.4	33.9

Category 3 Connecting Hardware

Category 5e Connecting Hardware				
Frequency (MHz)	Insertion Loss (dB)	NEXT (dB)	FEXT (dB)	Return Loss (dB)
1.0	0.1	65.0	65.0	30.0
4.0	0.1	65.0	63.1	30.0
8.0	0.1	64.9	57.0	30.0
10.0	0.1	63.0	55.1	30.0
20.0	0.2	57.0	49.1	30.0
25.0	0.2	55.0	47.1	30.0
31.25	0.2	53.1	45.2	30.0
62.5	0.3	47.1	39.2	24.1
100.0	0.4	43.0	35.1	20.0

Category 5e Connecting Hardware

The preferred termination method for all UTP connecting hardware includes the insulation displacement contact (IDC). To ensure overall system integrity, horizontal cables need to be terminated with connecting hardware of the same category or higher.

The following requirements apply only to wire and cable used for patch cords and cross-connect jumpers:

UTP Patch Cords

Jumper/Patch Cord Maximum Length Limitations:

- 20 m (66 ft) in main cross-connect
- 20 m (66 ft) in intermediate cross-connect
- 6 m (20 ft) in telecommunications room
- 3 m (10 ft) in the work area

Patch Cord Cable Construction:

- Stranded conductors for extended flex-life cables used for patch cords and cross-connect jumpers need to be of the same performance category (or higher) as the horizontal cables they connect.
- UTP cabling systems are not Category 3- or 5e-compliant unless all components of the system satisfy their respective category requirements.

Category 5e Assembled Patch Cords				
Frequency (MHz)	2 m Cord NEXT (dB)	5 m Cord NEXT (dB)	10 m Cord NEXT (dB)	Return Loss (dB)
1.0	65.0	65.0	65.0	19.8
4.0	62.3	61.5	60.4	21.6
8.0	56.4	55.6	54.7	22.5
10.0	54.5	53.7	52.8	22.8
16.0	50.4	49.8	48.9	23.4
20.0	48.6	47.9	47.1	23.7
25.0	46.7	46.0	45.3	24.0
31.25	44.8	44.2	43.6	23.0
62.5	39.0	38.5	38.1	20.0
100.0	35.1	34.8	34.6	18.0

Category 5e Assembled Patch Cords

Insertion Loss (Attenuation): per 100 m (328 feet) at 20˚C = horizontal UTP cable insertion loss + 20 percent (due to stranded conductors)

TIA/EIA-568-B.2-1
Balanced Twisted Pair Cabling Components

Category 6 Transmission Performance

This addendum describes Category 6 cables, patch cords, connecting hardware, permanent link and channel transmission parameters characterized up to 250 MHz.

Matrix of Backward Compatible Mated Component Performance				
	Cat 3	Cat 5	Cat 5e	Cat 6
Cat 3	Cat 3	Cat 3	Cat 3	Cat 3
Cat 5	Cat 3	Cat 5	Cat 5	Cat 5
Cat 5e	Cat 3	Cat 5	Cat 5e	Cat 5e
Cat 6	Cat 3	Cat 5	Cat 5e	Cat 6

Matrix of Backward Compatible Mated Component Performance
The lowest rated component determines the rating of the link or channel.

Category 6 Solid Horizontal and Backbone Cable						
Frequency (MHz)	Insertion Loss (dB)	NEXT* (dB)	PSNEXT (dB)	ELFEXT* (dB)	PSELFEXT (dB)	Return Loss (dB)
0.772	1.8	76.0	74.0	70.0	67.0	19.4
1.0	2.0	74.3	72.3	67.8	64.8	20.0
4.0	3.8	65.3	63.3	55.8	52.8	23.0
8.0	5.3	60.8	58.8	49.7	46.7	24.5
10.0	6.0	59.3	57.3	47.8	44.8	25.0
16.0	7.6	56.2	54.2	43.7	40.7	25.0
20.0	8.5	54.8	52.8	41.8	38.8	25.0
25.0	9.5	53.3	51.3	39.8	36.8	24.3
31.25	10.7	51.9	49.9	37.9	34.9	23.6
62.5	15.4	47.4	45.4	31.9	28.9	21.5
100.0	19.8	44.3	42.3	27.8	24.8	20.1
200.0	29.0	39.8	37.8	21.8	18.8	18.0
250.0	32.8	38.3	36.3	19.8	16.8	17.3

Category 6 Solid Horizontal and Backbone Cable (100 m)*
Maximum Cat 6 cable propagation delay: 538 ns/100 m at 100 MHz (536 at 250 MHz)
Maximum Cat 6 cable delay skew: 45 ns/100 m at all frequencies
The PSNEXT performance of bundled or hybrid cables must be 1.2 dB greater than shown above.

*Horizontal and backbone cables are defined only as identical 4-pair cables.

Category 6 Connecting Hardware				
Frequency (MHz)	Insertion Loss (dB)	NEXT (dB)	FEXT (dB)	Return Loss (dB)
1.0	0.10	75.0	75.0	30.0
4.0	0.10	75.0	71.1	30.0
8.0	0.10	75.0	65.0	30.0
10.0	0.10	74.0	63.1	30.0
16.0	0.10	69.9	59.0	30.0
20.0	0.10	68.0	57.1	30.0
25.0	0.10	66.0	55.1	30.0
31.25	0.11	64.1	53.2	30.0
62.5	0.16	58.1	47.2	28.1
100.0	0.20	54.0	43.1	24.0
200.0	0.28	48.0	37.1	18.0
250.0	0.32	46.0	35.1	16.0

Category 6 Connecting Hardware

Category 6 Assembled Patch Cords				
Frequency (MHz)	2 m Cord NEXT (dB)	5 m Cord NEXT (dB)	10 m Cord NEXT (dB)	Return Loss (dB)
.772	65.0	65.0	65.0	19.4
1.0	65.0	65.0	65.0	19.8
4.0	65.0	65.0	65.0	21.6
8.0	65.0	65.0	64.8	22.5
10.0	65.0	64.5	62.9	22.8
16.0	62.0	60.5	59.0	23.4
20.0	60.1	59.6	57.2	23.7
25.0	58.1	56.8	55.4	24.0
31.25	56.2	54-9	53.6	23.0
62.5	50.4	49.2	48.1	20.0
100.0	46.4	45.3	44.4	18.0
125.0	44.5	43.5	42.7	17.0
150.0	43.0	42.1	41.4	16.2
175.0	41.8	40.9	40.2	15.6
200.0	40.6	39.8	39.3	15.0
225.0	39.7	38.9	38.4	14.5
250.0	38.8	38.1	37.6	14.0

Category 6 Assembled Patch Cords

Insertion loss (attenuation) per 100 m (328 ft at 20°C) is defined as equal to UTP solid cable insertion loss plus 20 percent. (The increased insertion loss allowance is due to stranded conductors.)

Category 6 Permanent Link

Frequency (MHz)	Insertion Loss (dB)	NEXT* (dB)	PSNEXT (dB)	ELFEXT* (dB)	PSELFEXT (dB)	Return Loss (dB)
1.0	1.9	65.0	62.0	64.2	61.2	19.1
4.0	3.5	64.1	61.8	52.1	49.1	21.0
8.0	5.0	59.4	57.0	46.1	43.1	21.0
10.0	5.5	57.8	55.5	44.2	41.2	21.0
16.0	7.0	54.6	52.2	40.1	37.1	20.0
20.0	7.9	53.1	50.7	38.2	35.2	19.5
25.0	8.9	51.5	49.1	36.2	33.2	19.0
31.25	10.0	50.0	47.5	34.3	31.3	18.5
62.5	14.4	45.1	42.7	28.3	25.3	16.0
100.0	18.6	41.8	39.3	24.2	21.2	14.0
200.0	27.4	36.9	34.3	18.2	15.2	11.0
250.0	31.1	35.3	32.7	16.2	13.2	10.0

Category 6 Permanent Link

Maximum Cat 6 permanent link propagation delay: less than 498 ns at 10 MHz

Maximum Cat 6 permanent link delay skew: less than 44 ns/100 m at 10 MHz

Category 6 Channel

Frequency (MHz)	Insertion Loss (dB)	NEXT* (dB)	PSNEXT (dB)	ELFEXT* (dB)	PSELFEXT (dB)	Return Loss (dB)
1.0	2.1	65.0	62.0	63.3	60.3	19.0
4.0	4.0	63.0	60.5	51.2	48.2	19.0
8.0	5.7	58.2	55.6	45.2	42.2	19.0
10.0	6.3	56.6	54.0	43.3	40.3	19.0
16.0	8.0	53.2	50.6	39.2	36.2	18.0
20.0	9.0	51.6	49.0	37.2	34.2	17.5
25.0	10.1	50.0	47.3	35.3	32.3	17.0
31.25	11.4	48.4	45.7	33.4	30.4	16.5
62.5	16.5	43.4	40.6	27.3	24.3	14.0
100.0	21.3	39.9	37.1	23.3	20.3	12.0
200.0	31.5	34.8	31.9	17.2	14.2	9.0
250.0	35.9	33.1	30.2	15.3	12.3	8.0

Category 6 Channel

Maximum Cat 6 channel propagation delay: less than 555 ns at 10 MHz

Maximum Cat 6 channel delay skew: less than 50 ns/100m at 10 MHz

Category 6 Longitudinal Conversion Loss (LCL)

Frequency (MHz)	Cable LCL (dB)	Connector LCL (dB)
1.0	40.0	40.0
4.0	40.0	40.0
8.0	40.0	40.0
10.0	40.0	40.0
16.0	38.0	40.0
20.0	37.0	40.0
25.0	36.0	40.0
31.25	35.1	38.1
62.5	32.0	32.1
100.0	30.0	28.0
200.0	27.0	22.0
250.0	26.0	20.0

Category 6 Longitudinal Conversion Loss (LCL)

Longitudinal Conversion Transfer Loss (LCTL) is not yet defined.

TIA Category 6 versus Augmented Category 6

	TIA Category 5e UTP	TIA Category 6 UTP	TIA Augmented Category 6 UTP	ISO Class E_A
Recognized by IEEE 802.3an	No	Yes	Yes	Yes
55 Meter Distance Support	No	Yes	Yes	Yes
100 Meter Distance Support	No	No	Yes	Yes
Extrapolated Test Limits for NEXT and PSNEXT to 500MHz	No	No	No	Yes

Note: This table compares current TIA Category 6 cabling with new TIA and ISO specifications for 10 Gigabit cabling. This table summarizes the various UTP cabling options and their respective 10 Gigabit performance attributes as defined by the latest draft standards. Category 5e is not recognized as a viable cabling media to support 10 Gigabit transmission regardless of its installed cabling distance. Category 6 cabling will only support 10 Gigabit at a maximum installed distance of 55 meters.

TIA/EIA-568-B.2-Addendum 10

Balanced Twisted Pair Cabling Components (Augmented Category 6)

Augmented Category 6 Transmission Performance

This addendum describes Augmented Category 6 cables, patch cords, connecting hardware, permanent link and channel transmission parameters characterized up to 500 MHz. (Please note: this addendum is in draft form at the time of this publication. This information does not reflect the final published standard).

Augmented Category 6 Permanent Link Requirements

Frequency MHz)	Insertion Loss (dB)	NEXT (dB)	PSNEXT (dB)	ACR-F (dB)	PSACR-F (dB)	Return Loss (dB)	PSANEXT (dB)	PSAACRF (dB)
1.0	1.9	65.0	62.0	64.2	61.2	19.1	67.0	67.0
4.0	3.5	64.1	61.8	52.1	49.1	21.0	67.0	65.7
8.0	4.9	59.4	57.0	46.1	43.1	21.0	67.0	59.6
10.0	5.5	57.8	55.5	44.2	41.2	21.0	67.0	57.7
16.0	6.9	54.6	52.2	40.1	37.1	20.0	67.0	53.6
20.0	7.7	53.1	50.7	38.2	35.2	19.5	67.0	51.7
25.0	8.7	51.5	49.1	36.2	33.2	19.0	67.0	49.7
31.25	9.7	50.0	47.5	34.3	31.3	18.5	66.2	47.8
62.50	13.9	45.1	42.7	28.3	25.3	16.0	63.1	41.8
100.0	17.9	41.8	39.3	24.2	21.2	14.0	61.1	37.8
200.0	26.0	36.9	34.3	18.2	15.2	11.0	56.6	31.8
250.0	29.4	35.3	32.7	16.2	13.2	10.0	55.5	29.8
300.0	32.6	34.0	31.4	14.6	11.6	9.2	53.9	28.2
400.0	38.4	29.9	27.1	12.1	9.1	8.0	52.1	25.7
500.0	43.8	26.7	23.8	10.2	7.2	8.0	50.6	23.7

Augmented Category 6 Permanent Link Requirements

Augmented Category 6 Channel Requirement

Frequency MHz)	Insertion Loss (dB)	NEXT (dB)	PSNEXT (dB)	ACR-F (dB)	PSACR-F (dB)	Return Loss (dB)	PSANEXT (dB)	PSAACRF (dB)
1.0	2.2	65.0	62.0	63.3	60.3	19.0	67.0	67.0
4.0	4.1	63.0	60.5	51.2	48.2	19.0	67.0	65.0
8.0	5.7	58.2	55.6	45.2	42.2	19.0	67.0	58.9
10.0	6.4	56.6	54.0	43.3	40.3	19.0	67.0	57.0
16.0	8.1	53.2	50.6	39.2	36.2	18.0	67.0	52.9
20.0	9.1	51.6	49.0	37.2	34.2	17.5	67.0	51.0
25.0	10.2	50.0	47.3	35.3	32.3	17.0	66.0	49.0
31.25	11.4	48.4	45.7	33.4	30.4	16.5	65.1	47.1
62.50	16.3	43.4	40.6	27.3	24.3	14.0	62.0	41.1
100.0	20.8	39.9	37.1	23.3	20.3	12.0	60.0	37.0
200.0	30.0	34.8	31.9	17.2	14.2	9.0	55.5	31.0
250.0	33.8	33.1	30.2	15.3	12.3	8.0	54.0	29.0
300.0	37.3	31.7	28.8	13.7	10.7	7.2	52.8	27.5
400.0	43.6	28.7	25.8	11.2	8.2	6.0	51.0	25.0
500.0	49.3	26.1	23.2	9.3	6.3	6.0	49.5	23.0

Augmented Category 6 Channel Requirement

Note: The draft requirements for ISO (The International Organization for Standardization) 11801 Class E_A are more demanding compared to TIA/EIA Augmented Cat 6 draft requirements. Anixter's Enterprise Cabling Lab tests to the more stringent ISO 11801 draft standards.

ISO Compared to TIA

Characteristics 500MHz (dB)	ISO Class E_A	TIA Augmented Cat 6 Draft
PSNEXT Loss	24.8dB	23.2dB
NEXT Loss	27.9dB	26.1dB
PSANEXT Loss	49.5dB	49.5dB
Return Loss	8.0dB	6.0dB
Insertion Loss	49.3dB	49.3dB
Referred to by IEEE	Yes	No

Note: See the IEEE 802.3an and ISO Class E_A section of this book for more information on 10 Gigabit cabling and protocol methods.

TIA/EIA-568-B.3
Optical Fiber Cabling Components

Optical Fiber Cabling Systems

Optical Fiber Cabling Media

- Horizontal – 62.5/125 or 50/125 µm multimode optical fiber (minimum of two fibers)
- Backbone – 62.5/125 or 50/125 µm multimode or single-mode optical fiber

Cable Transmission Performance Parameters Multimode (Horizontal and Backbone)

Wavelength (nm)	Maximum Attenuation (dB/km)	50 µm Minimum Bandwidth (MHz/km)	62.5 µm Minimum Bandwidth (MHz/km)
850	3.5	500	160
1,300	1.5	500	500

Cable Transmission Performance Parameters Single-mode (Backbone)

Wavelength (nm)	Inside Plant Maximum Attenuation (dB/km)	Outside Plant Maximum Attenuation (dB/km)
1,310	1.0	0.5
1,550	1.0	0.5

Optical Fiber Bend Radius

Fiber Type	Bend Radius
Small Inside Plant Cable (2–4 fibers)	1" (no load)
	2" (with load)
All Other Inside Plant Cable	10 x diameter (no load)
	15 x diameter (with load)
Outside Plant Cable	10 x diameter (no load)
	20 x diameter (with load)

Outside plant cable must be water-blocked and have a minimum pull strength of 600 lbs. (Drop cable pull strength may be 300 lbs.)

Optical Fiber Connector

No specified connector: 568SC and other duplex designs may be used.

Color Identification

- Beige – multimode connector/coupling
- Blue – single-mode connector/coupling

Note: The ISO/IEC standard now specifies the 568SC-type fiber connector in the work area.

Optical Fiber Telecommunications Outlet

Required Features

- Capability to terminate minimum of two fibers into 568SC couplings or other duplex connection
- Means of securing fiber and maintaining minimum bend radius of 25 mm (1")

Optical Fiber Splices, Fusion or Mechanical

- Maximum insertion loss 0.3 dB
- Minimum return loss:
  - Multimode: 20dB
  - Single-mode: 26dB
  - Single-mode: 55dB (analog CATV)

Optical Fiber Connector (mated pair)

- Maximum insertion loss 0.75 dB

Patch Cords

- Shall be dual fiber of the same type as the horizontal and backbone fiber
- Polarity shall be keyed duplex