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Recommendations For “C” Revision of TIA-568

The Fiber Optic Association Board of Directors has reviewed the current document carefully and makes the follow recommendations for changes during the next revision. These are recommended changes listed by TIA 568B sections. Refer to the original document for exact wording.

For TIA-568B.1

Sec. 3.2. Definition of Terms

The following terms should be qualified as “copper” terms: bridged tap, cord, delay skew, ELFEXT, FEXT (and PS equivalents), modular jack, multipair cables, ScTP, work area cable.

Adapter: *add* (5) Mating of two male fiber optic connectors. Also called “mating adapter,” “bulkhead connector” and “splice bushing.”

Adapter, optical fiber, duplex: *delete, redundant. See (5) above. If retained, should drop “duplex” as it applies to simplex male connectors.*

Connector, small form factor: A miniature fiber optic connector, simplex, duplex or multifiber, designed to allow high density connections.

High-Order Mode Transient Loss: *Losses in power caused by the increased attenuation of the higher order modes in the core of multimode optical fiber.*

Jumper:

(1) An assembly of twisted pairs without connectors, used to join telecommunications circuits/links at the cross connect.
(2) A short fiber optic cable assembly used for cross connects or testing.

Media (telecommunications): *Wire, conductors, optical fiber, or cable used for telecommunications.*

Mode: *A single electromagnetic field pattern that travels in optical fiber*.

Patchcord:

(1) A length of copper cable with a plug on one or both ends.
(2) A short fiber optic cable with connectors on both ends.

Sec 4.2 Topology

Remove exclusion of splitters in optical fiber networks. PONs (passive optical networks) used for FTTx often use splitters and one could expect them to find use in campus or premises networks.

Sec 5.1 General

Add to last paragraph: When designing fiber optic backbone cabling, consider installing hybrid cables with both multimode and singlemode fibers.

Sec 5.5.1 NOTES:

NOTE 3. The user should consider both multimode and singlemode fiber cable, *including hybrid cables which include both fibers in one cable,* to support backbone cabling systems.

Sec 6.3 Work Area Cords *(Copper Cabling)*

Sec 6.4.1 *Does the MUTOA refer to copper only?*

Sec 10.3.1 Minimum Bend Radius and Maximum Pulling Tension

Paragraph 2: Is this intended to refer to 2/4 fiber cable only? Why 15XOD here on bend radius under tension?

Sec 11.3 Optical fiber transmission performance and test requirements

General comment: Incorporate TSB 140, less the “two tier” nomenclature. No other standard testing procedures use such a structure and it can be confusing to the user. Explain there are two tests (continuity/polarity and insertion loss) which are mandatory and the others (OTDR and return loss) are optional but often useful for troubleshooting. The current document does not address return loss, but it can be very important on premises or campus singlemode networks. We have seen several GBE networks fail due to reflections from poorly installed SM connectors.

Sec 11.3.1 Purpose
This subclause describes the ~~minimum~~ recommended performance test criteria for an optical fiber cabling system installed in compliance with this standard. The purpose of this subclause is to provide users with recommended field test procedures and

acceptance values. This subclause will address the testing and link performance requirements of singlemode and multimode optical fiber systems in the horizontal and backbone infrastructure.
NOTE: All fiber optic links must be tested for "polarity" or correct connection between transmitters and receivers and insertion loss. Connectors in singlemode cable sytems should be tested for return loss. In addition, for troubleshooting or documenting the cable plant installation, OTDR testing may be advisable.

Sec 11.3.2 Link Segment

First paragraph: The last sentence should read:
It does not , however, include the performance of the actual patchcords used to connect the equipment, nor the connector at the eqipment interface.

NOTE 1. We do not believe this is universally true. Delete this note or amend to say "and others, <u>may</u> include".

Sec 11.3.3 Link Segment Performance

Paragraph 1. Comment: This paragraph is somewhat deceptive and in part untrue. First of all, link attenuation is of course a required test parameter, but polarity is also required and should be mentioned. Singlemode connector return loss is a big problem in premises and campus cable plants. Multimode fiber bandwidth can also be affected by installation. Testing by Eric Pearson and Jim Hayes has shown that bandwidth can be changed by 50%, for example, by variations in mode power distribution caused by fusion splices. However, at the current time, bandwidth testers are not field instruments, but in the future the committee should address the increasingly important issue of multimode bandwidth. We suggest the paragraph be:

The two parameters necessary for testing when installing components compliant with this standard are polarity and link attenuation. Singlemode connectors may require return loss testing. In addition, for troubleshooting or documenting the cable plant installation, OTDR testing may be advisable.

Paragraph 4. While this calls for TIA/EIA 526-14-A, Method B (one cable reference method), it is important to note that all networks do not reference OFSTP-14 Method B for testing. ESCON uses Method C (3 cable reference) and 10BaseF uses Method A (two cable reference.) Furthermore, the complicated procedures using non-standard kludges originally proposed as part of TSB-140 are a result of incompatibility between test equipment and certain types of connectors, notably the male/female or plug/jack duplex connectors. Allowing all three methods, <u>with proper documentation</u>, will reduce confusion and measurement errors.

Paragraph 5. Short link lengths do not "appear to have higher than expected attenuation," they DO have higher attenuation, especially when used with the typical LED source. The mandrel wrap is a very old way to filter higher order modes for testing

long haul multimode cables, typical of telco OSP installations of the early 1980s. It also gives variable results due to cable construction. Applying this method to short cabling used premises or campus installations is inappropriate and should not be required. It leads to underestimation of link loss and can permit passing marginal or failing links. Instead, the source modal output alone should be specified. CPR works for this, but it not widely understood, even among test equipment manufacturers. Research by Eric Pearson of the FOA indicates no significant difference between sources with Category 1 or 2 CPR, so either should be allowed.
An additional explanation of the lower loss encountered with lasers (F-P or VCSEL) used with multimode fiber and how to test that may be appropriate also.

Sec. 11.3.3.1 Horizontal Link Measurement
Testing at both 850 nm and 1300 nm can provide valuable data. Fibers overstressed in installation or left with inadequate bend radii will show normal loss at 850 nm and higher than expected loss at 1300 nm. This should be mentioned as an informative note if not required testing. Remove the requirement for using Method B as it is incompatible with many current test set/connector requirements and not universally required by network standards.

11.3.3.4 Link Attenuation Equation and Graphs
While we understand the need for setting GO/NO GO performance levels at such high levels if it covers all termination types and processes, it creates a serious problem in many applications. Certainly some types of connectors like the prepolished/splice type have average losses approaching 0.75 dB, but the normal adhesive/polish connector (epoxy/polish, anaerobic/polish or “Hot Melt”) has a loss of 0.3 dB or less. Fusion splices in singlemode fiber are never over 0.1 dB. Typical fiber today is lower loss than the current standards.
<u>It is the connector standard that bothers the FOA the most. If one uses the 0.75 dB limit on a link with two adhesive/polish connectors, a good one at 0.3 dB allows the other one to be 1.2 dB and still allow the link to pass.</u>
We suggest either 1) changing the limits to 0.3 dB for adhesive/polish connectors and 0.75 dB for others, along with new fiber attenuation values from a canvassing of fiber manufacturers, or 2) providing a explanatory note, such as the one below, as part of any discussion of performance values.
Suggested NOTE: The performance values given are worst case values for calculating link performance. Certain types of components, such as connectors or splices, may have typical performance values that are quite different and much lower. It is recommended that each link budget analysis be done with both typical and worst case values to facilitate installation quality and initiate troubleshooting.

Annex E, Table E1, Needs updating for 10G Ethernet variants.

Recommendation – Color Codes
This standard must address color codes. Users have been installing hybrid (MM+SM) cables in the backbone for years. With the premises fiber optic cabling now including two varieties of 50/125 fiber, 62.5/125 and singlemode fibers, managing the cable plant

is more difficult. We have already seen instances of users and installers being confused and getting bad test results, as well as having problems with networks operating when connected over the wrong fiber type.

There is a standard in process, TIA-598C that addresses this issue, which we could adopt and reference:

4.3 Colored outer jackets or print may be used on Premises Distribution Cable, Premises Interconnect Cable or Interconnect Cord, or Premises Breakout Cable to identify the classification, as in TIA-4920000, and fiber sizes, as in TIA-492A000, of the fiber.

4.3.1 When colored jackets are used to identify the type of fiber in cable containing only one fiber type, the colors shall be as indicated in Table 3. Other colors may be used providing that the print on the outer jacket identifies fiber classifications in accordance with subclause 4.3.3. Such colors should be as agreed upon between manufacturer and user.

Notes: Annex B may be used as a guide for other colors. Writers of Detail Specifications should note that for some Premises Cable functional types (e.g., plenum cables), colored jacketing material may not be available. Distinctive jacket colors for other fiber types may be considered for addition to Table 3 at some future date.

4.3.2 Unless otherwise specified, the outer jacket of premises cable containing more than one fiber type shall use a printed legend to identify the quantities and types of fibers within the cable. Table 3 shows the preferred nomenclature for the various fiber types, for example "12 Fiber - 8 x 50/125, 4 x 62.5/125."

4.3.3 When the print on the outer jacket of premises cable is used to identify the types and classifications of the fiber, the nomenclature of Table 3 is preferred for the various fiber types. Distinctive print characters for other fiber types may be considered for addition to Table 3 at some future date.

Fiber type	Jacket color(1)		
	Non-military Applications(3)	Military Applications	Suggested Print Nomenclature
Multimode (50/125) (TIA-492AAAB)	Orange	Orange	50/125
Multimode (50/125) (850 nm Laser-optimized)	Aqua	---	850 LO 50/125

(TIA-492AAAC)			
Multimode (62.5/125) (TIA-492AAAA)	Orange	Slate	62.5/125
Multimode (100/140)	Orange	Green	100/140
Single-mode (TIA-492C000 / TIA-492E000)	Yellow	Yellow	SM / NZDS SM
Polarization Maintaining Single-mode	Blue	---	Undefined(2)

NOTES:
1) Natural jackets with colored tracers may be used instead of solid-color jackets.
2) Because of the limited number of applications for these fibers, print nomenclature are to be agreed upon between manufacturer and enduser
3) Other colors may be used providing that the print on the outer jacket identifies fiber classifications per subclause 4.3.3.

For TIA 568B.3

Section 3. Add changes suggested for 568-B.1 (Definitions)

Sec 5.1 General
NOTE: add at end: The term “adapter” as used here also applies to devices that have also be known in the fiber optic industry as “mating adapter,” “splice bushing” and “bulkhead splice.”

Sec 5.6 Optical Fiber Spice
Multimode fiber bandwidth can also be affected by splicing. This was well documented by NBS (NIST) in the early 1980s. Testing by Eric Pearson and Jim Hayes has shown that link bandwidth can be changed by 50%, for example, by variations in mode power distribution caused by fusion splices. We believe that users should be cautioned about using fusion splicing with multimode fiber.

Section 6 Patchcords

Since patchcords are generally factory made with high quality epoxy/polish connectors that should have very low loss, there should be a requirement for patchcord performance, including loss and, for singlemode, return loss.

Section 7.1 Multimode
The testing requirement should require 526-14-A with a preference to using Method B but with Method A or C acceptable as long as it is properly documented. In addition, the

test source mode power distribution should be specified by this document and the requirement for a mandrel wrap deleted. See our comments on 568-B.1.

A.3.2 Attenuation
The limit of 0.75 dB for all connectors is inappropriate and can cause field problems. While we understand the need for setting GO/NO GO performance levels at such high levels if it covers all termination types and processes, it creates a serious problem in many applications. Certainly some types of connectors like the prepolished/splice type have average losses approaching 0.75 dB, but the normal adhesive/polish connector (epoxy/polish, anaerobic/polish or "Hot Melt") has a loss of 0.3 dB or less. Fusion splices in singlemode fiber are never over 0.1 dB. Typical fiber today is lower loss than the current standards.
It is the connector standard that bothers the FOA the most. If one uses the 0.75 dB limit on a link with two adhesive/polish connectors, a good one at 0.3 dB allows the other one to be 1.2 dB and still allow the link to pass.
We suggest either 1) changing the limits to 0.3 dB for adhesive/polish connectors and 0.75 dB for others, along with new fiber attenuation values from a canvassing of fiber manufacturers, or 2) providing a explanatory note, such as the one below, as part of any discussion of performance values.

A.3.3 Return Loss
Where was the value for SM return loss derived from? Is it adequate for short links? We have seen problems with premises and campus networks caused by return loss from field-installed SM connectors.