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WireScope 350 White Paper

Fiber Optic Test Issues – What to Measure and Why?

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Fiber optic networking applications, such as Gigabit Ethernet, the emerging 10 Gigabit Ethernet and Storage Area Networks (SANs) are focusing much of the industry's attention on the need to properly evaluate fiber optic installations. Today there is no simple standards-based test method to assure that the installed cabling can support new fiber optic applications.

It is, therefore, important to use a tester such as the WireScope 350 that can produce pass/fail results for networking applications in addition to pass/fail results for generic cabling standards. Considering how complicated fiber optic network test limits get, having a tester that "knows" these standards are a practical necessity.

TIA 568B.3 and ISO 11801 specifications include generic loss limits based on wavelength and fiber type. Tables 1 and 2 show the loss limits for fiber cables, connectors and splices currently specified in draft TIA 568B.3 document being developed by the TIA TR42.8 committee.

Optical fiber cable type	Wavelength (nm)	Maximum attenuation (dB/km)
50/125 μm	850	3.5
	1300	1.5
62.5/125 μm	850	3.5
	1300	1.5
Singlemode inside plant cable	1310	1.0
	1550	1.0
Singlemode outside plant cable	1310	0.5
	1550	0.5

Table 1: TIA 568B.3 Fiber optic cable loss limits

	Attenuation (dB)
Splice	0.3
Connection, TIA	0.75
Connection, ISO	0.5

Table 2: TIA-568B.3 Connector and splice loss limits

A field tester can evaluate the measured fiber losses against the generic limits shown in tables 1 and 2 provided the test technician specifies the length of fiber and the number of connectors or splices[1].

However, testing to these generic limits does not guarantee that the applications would work. It is important to select a field tester that can automatically produce pass/fail limits for different networks.

[1] TIA 568B.3 [3] document references TIA-526-14 for field measurement methodology over multi-mode fiber and it references TIA-256-7 for measurement over singlemode fiber.

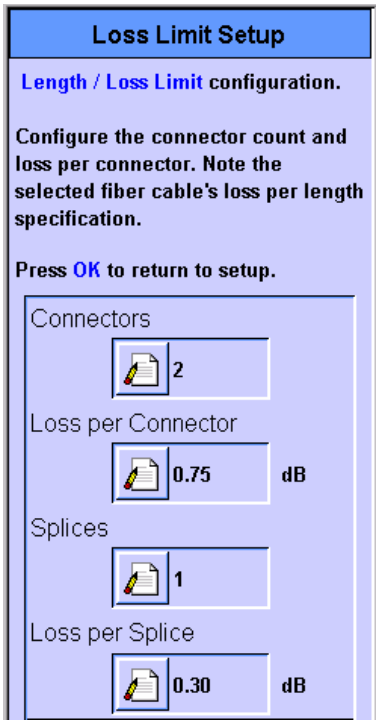

Figure 1: WireScope 350 set-up screen for specifying the loss budget per TIA and ISO standards.

The losses in the connectors and splices are added to the cable loss to come up with the overall loss limit. The cable loss is based on the loss per unit length times the cable length.

Clearly, such a limit has little to do with the requirements of any networking applications.

Test limits for networking applications are typically specified in the IEEE, ANSI and other standards defining these applications. Today, we have 7 different sets of length and loss limits specified by the IEEE for the existing variants of gigabit Ethernet (table 3).

Gigabit Ethernet Specification	Type of Fiber	Wave-length (nm)	Fiber Core Size (microns)	Modal Bandwidth (MHz • km)	Maximum Distance (m)	Attenuation (dB)
1000Base-SX	MMF	850	50	400	500	3.37
				500	550	3.56
			62.5	160	220	2.38
				200	275	2.60
1000Base-LX	MMF	1310	50	400,500	550	2.35
			62.5	500	550	2.35
	SMF	1310	10		5,000	4.57

Table 3: Maximum length and attenuation specifications for different versions of Gigabit Ethernet over various types of fiber optic media

The new 802.3ae 10 Gb/s Ethernet standard will likely require at least as many different sets of limits which will add considerably to field testing complexity. With so many different network test requirements, it is virtually impossible to use an old-fashioned stand-alone loss meter to guarantee proper operation of the fiber optic networks.

The loss and length limits for different networks are a function of cable type and transceiver operating wavelength. Because of the vast number of different applications and in many cases several different sets of

limits for each application, the field tester should automatically keep track of the application test limits (figure 2). The test report should document the pass/fail result for each network and the pass/fail result with respect to generic TIA or ISO limits (figure 3).

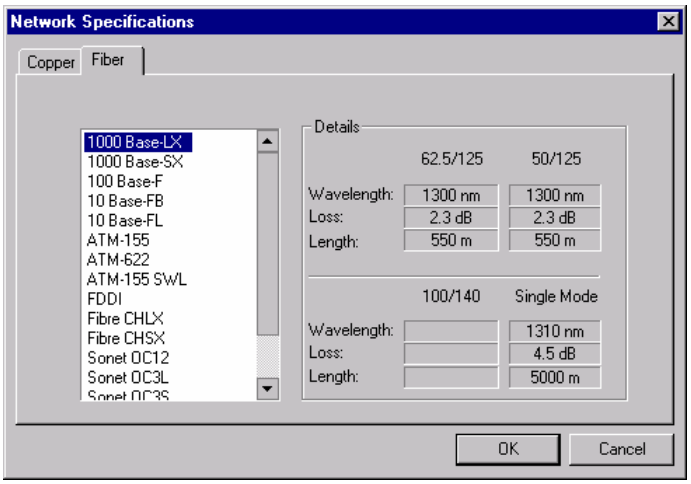

Figure 2: An example of fiber optic network test limits programmed into a field tester.

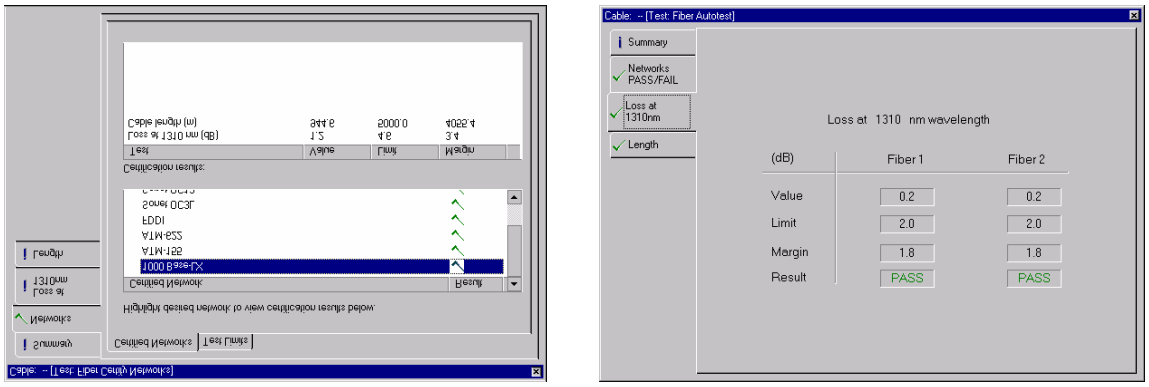

Figure 3: A sample test report displaying application-specific pass/fail results for each fiber optic network (left) in addition to the generic TIA and ISO pass/fail results for cable loss (right).

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