Additional Transmission Performance Guidelines for 4-Pair 100 Ω Category 5 Cabling

The Telecommunications Systems Bulletin TSB-95 was developed and published to define new parameters as well as testing procedures and corrective actions that should be followed to ensure operational support of Gigabit Ethernet (1000Base-T) over installed-base ANSI/TIA/EIA-568-A Category 5 cabling systems. For new installations, Category 5e cabling is recommended (see Addendum 5 to ANSI/TIA/EIA-568-A page 1-15).

The new transmission parameters are:

Return Loss:

- Return Loss is a ratio of the power of the outgoing signal to the power of the reflected signal caused by the impedance mismatch between components. The better the impedance matching, the lower the reflected energy and the higher the return loss. It is an important factor especially for applications that uses simultaneous bi-directional transmission on the same pair such as Gigabit Ethernet.

Frequency (f) in MHz	Minimum Return Loss (dB)
1 to 20	15
20 to 100	15-10 log (f/20)

Channel Return Loss Formulas

Frequency (f) in MHz	Minimum Return Loss (dB)
1 to 20	15
20 to 100	15-7 log (f/20)

Basic Link Return Loss Formulas

For example, at a frequency of 100 MHz, the minimum Return Loss for a channel is 8 dB and for a Basic Link, it is 10 dB.

ELFEXT:

Equal Level Far-End CrossTalk (ELFEXT) is the crosstalk noise cause by the three neighboring pairs at the far end of the channel on to the fourth pair at the near end of the same channel.

From the equation ELFEXT $_{channel, link}$ = 17-20log (f/100) dB, it is possible to calculate the minimum ELFEXT requirement for all frequencies from 1 to 100 MHz. Which means, for a frequency of 100 MHz, the minimum ELFEXT for a channel or a Basic Link, worst pair scenario will have a value of 17 dB.

Propagation Delay:

The maximum propagation delay recommended in TSB-95 is based on the values given in the ANSI/TIA/EIA-568-A addendum 1.

For a channel, the maximum propagation delay should not exceed 555 ns at 10 MHz.

For a Basic Link, the maximum propagation delay should not exceed 518 ns at 10 MHz.

Delay Skew:

The maximum delay skew recommended in TSB-95 is based on the values given in the ANSI/TIA/EIA-568-A addendum 1.

For a channel, the maximum delay skew should not exceed 50 ns at 10 MHz.

For a Basic Link, the maximum delay skew should not exceed 45 ns at 10 MHz.

Testing procedures and corrective actions.

Field measurement should include, in addition to the parameters listed in the TSB-67, these four test parameters:

- Return Loss
- ELFEXT
- Propagation Delay
- Delay Skew

If an existing category 5 installation fails either Return Loss or the ELFEXT parameters given in the TSB-95, corrective actions should be taken. The document specifies different option to correct the failure. Select the option(s) which is the most appropriate to your situation.

- Option 1: Replace the category 5 patch cord with a category 5e patch cords. This will possibly correct Return Loss failures.
- Option 2: If possible, reconfigure the cross-connect as an interconnect.
- Option 3: Replace the category 5 transition point or consolidation point connector with a category 5e transition point or consolidation point connector.
- Option 4: Replace the category 5 work area outlet connector with a category 5e work area outlet connector.
- Option 5: Replace the category 5 interconnect with a category 5e interconnect.

Testing should be performed with an enhanced level II (level II-E) field tester or better. NORDX/CDT recommends a Level III tester.