

TIA/EIA Cable Test Parameters What do they mean and what is important when comparing specifications

The best way to look at the significance of each of the parameters is to look at the way each impact the Transmission Quality.

Transmission Quality is impacted by the signal strength and by the noise present in the transmission channel; in other words, the signal to noise ratio.

#1 Near End Crosstalk (NEXT) (Noise)

Near end crosstalk is the result of one pair transferring or “*coupling*” some amount of signal into an adjacent pair. In a simplex system (one where transmission of a signal is in one direction only), the noise source is the near end transmitter and the target is the near end receiver, ex. paging system. The noise is undesirable so the better the cable is able to minimize the crosstalk, the less the impact on Transmission Quality. This concept is even more vital in a full duplex system (one where a signal is transmitted in both directions) such as in phone lines or data transferring. The design of the cable has the greatest impact on performance and is the first line of defense in preserving the signal quality. It is easier for the cable designer to reduce the noise or crosstalk than it is to increase the signal strength. This makes NEXT the most important parameter.

- NEXT – the bigger the dB the better

#2 Attenuation or Insertion Loss (Signal Strength)

Attenuation or Insertion Loss directly impacts the signal strength. It is a measurement that is obtained by comparing the signal strength from the input power (load) to the output power (source). All cables have loss but some are better than others. The loss is primarily controlled by the amount of copper in the conductor. Since all manufacturers have the same constraints in the size of copper, this parameter, though important, is more restricted from a design point of view.

When comparing specifications, the loss value at each of the key frequencies should be equal to or better than the TIA standard. It is desirable to have cables with less loss, a smaller number.

- Loss – the smaller the dB the better

#3 Return Loss (Noise)

Return Loss is a measure of signals reflections created throughout the cable because of small imperfections. Reflected signals will interfere with the main signal and contribute to the noise level. Return Loss can be compared to reflectivity of a window or mirror. A mirror is an excellent reflector and all the light hitting the mirror is bounced back to the light source. From the point of view of the light source, none of the light is lost into the mirror. The “Return Loss” of the mirror would be Zero or all the light returns. A window is better at transmitting the light than reflecting it. The light hitting the window would pass through and none would be reflected. To the source of the light, all the light is lost so it would have a “Return Loss” of infinite. Because the reflected signal in the cable is noise, it is desirable to have an infinite Return Loss.

Increased RL performance is vital to the cable in a gigabit network that uses all 4 pairs to employ full duplex transmission; any impedance mismatch between the components will cause reflections that appear as noise at the receiver disrupting the transmission. Mohawk’s cable has pairs that are set up so that the impedance between pairs is very closely matched, therefore reducing the chance of reflected energy to the source increasing the amount of guaranteed headroom.

- Return Loss – the bigger the dB the better

#4 Power Sum NEXT (Noise)

Power Sum crosstalk is a measure of how much interference or noise can be contributed to one pair in the cable as a result of signals in the other pairs. In other words, if 3 or 4 pairs in the cable are used to transmit a portion of the data, then each of the other pairs will be impacted by the noise created by the crosstalk.

The better the cable’s ability to isolate one pair from another the less impact there is on adjacent pairs.

- Power Sum NEXT – the bigger the dB the better

#5 Equal Level Far End Crosstalk (ELFEXT) (Noise)

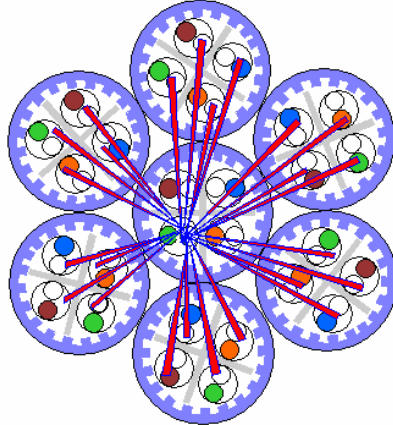
Equal Level Far End crosstalk, ELFEXT, is a concern when using a full duplex transmission scheme. With transceivers at each end of the channel there will be a strong signal source next to a sensitive receiver. The crosstalk from the near end transmitter will travel to the far end receiver through the cable and contribute to the noise level at the far end receiver. This calculation is balanced (hence the equal level) using the contribution of the cables attenuation.

- ELFEXT – the bigger the dB the better

#6 Alien Crosstalk (ANEXT) (Noise)

Alien Crosstalk is a concern as we start pushing bandwidth application to the realm of Category 6A transmission up to 550 MHz. It occurs when a signal is coupled to a disturbed pair within a cable (the victim) from a disturbing pair in an adjacent cable (the aggressor). The noise being emitted from one cable is picked up by another cable in its close vicinity, usually in the same bundle.

- Power Sum Alien Crosstalk is the sum of crosstalk noise from external cabling pairs into a victim pair. (see attached diagram)



#7 Delay Skew (signal speed)

Delay is the time specified for a signal to travel from one end of the pathway or cable to the other. The delay of a signal in the cable is a function of the length; the longer the cable, the more delay.

Skew is a measure of the difference between the fastest pair and the slowest pair in a cable. This happens because the twists rate of each pair is slightly different so the delay is therefore different. The electronics can handle a maximum of 45 nanoseconds of skew. Skew is not a critical parameter as long as it is less than 45 nanoseconds.

The 4x0 construction Mohawk employs in its plenum cables is the industry preferred standard vs a 3x1 due to the delay values of the pairs. The delay is very important when using the cables for video transmission; any large variance in skew will mean some of the data is arriving before the rest of it. In a 3X1 construction with one pair being insulated with Poly VS FEP on the other three pairs, there is a variance in the delay values based on the insulation type. The probability of a disrupted signal then increases. There are also some flame and smoke concerns that have been brought up by some of the Testing labs concerning the 3x1 and 2x2 constructions.