



Understanding FEXT and ELFEXT

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Far end crosstalk is a source of noise for twisted pair networks that use more than one pair for transmission. It is important to qualify far end crosstalk on the cabling used for running gigabit Ethernet.

FEXT (Far End Crosstalk) is the coupling between two or more transmitting pairs as the signal propagates from the transmit end of the pair to the receive end. Far end crosstalk coupling can be expressed as FEXT or ELFEXT (Equal Level Far End Crosstalk), both measured in dB. FEXT and ELFEXT are the same coupling but measured with respect to two different references (figure 10). FEXT is measured with respect to the disturbing signal. ELFEXT is measured with respect to the attenuated disturbing signal. If FEXT is mathematically subtracted from ELFEXT the result is the attenuation of the channel.

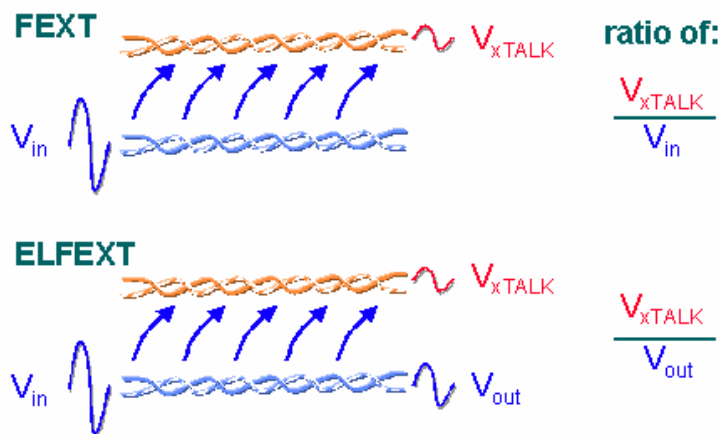


Figure 1: Explanation of FEXT and ELFEXT Coupling. FEXT and ELFEXT are the same coupling but measured with respect to two different references. FEXT is measured with respect to the full power transmit signal (V_{in}) while ELFEXT is measured with respect to the attenuated transmit signal (V_{out}).

FEXT and ELFEXT – Pair Combinations

Both FEXT and ELFEXT can be measured from one end of the cable. There are 12 combinations of FEXT. For example, when FEXT is measured by transmitting on pair 1 and receiving on pair 2, we can refer to it as FEXT12. The twelve FEXT combinations are:

FEXT12, FEXT21
 FEXT13, FEXT31
 FEXT14, FEXT41
 FEXT23, FEXT32
 FEXT24, FEXT42
 FEXT34, FEXT43

There are 24 combinations of ELFEXT since each FEXT combination listed above must be qualified with the attenuation of each of the two pairs in the FEXT pair combination. For example, ELFEXT derived from FEXT12 and the attenuation of pair 1 is ELFEXT12-1. The 24 ELFEXT combinations are formed as follows:

ELFEXT12-1, ELFEXT12-2, ELFEXT21-1, ELFEXT21-2
ELFEXT13-1, ELFEXT13-3, ELFEXT31-1, ELFEXT31-3
etc.

ELFEXT Data Storage

Saving 24 ELFEXT plots requires a lot of storage. However, since the cabling standards are only concerned with the worst case values, it is possible to compress the number of ELFEXT plots from 24 down to 6. We can do this by selecting one worst case ELFEXT point out of the 4 points measured (i.e. the worst of ELFEXT12-1, ELFEXT12-2, ELFEXT21-1, ELFEXT21-2) at each frequency. This way, instead of saving all four plots of ELFEXT12-1, ELFEXT12-2, ELFEXT21-1, ELFEXT21-2, we can select the worst case points among these four plots and store only one plot instead of four. This one plot represents the peak of the four ELFEXT combinations for pairs 1 and 2. This 4 to 1 reduction allows us to reduce 24 ELFEXT plots down to 6 ELFEXT plots while still preserving standards compatibility and saving the worst case ELFEXT measurements.

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