55.7.3.3. Alien Crosstalk Margin Computation

The objective of alien crosstalk margin computation is to further characterize the alien crosstalk coupling “between” link segments. The alien crosstalk margin computation ensures the total combined PSAFEXT and PSANEXT coupled into a duplex channel is limited in order to maintain the minimum signal to noise ratio. The alien crosstalk margin computation can be applied in the event that the independently specified alien crosstalk limits in 55.7.3.1.1 (equation 55-23 and equation 55-24) and 55.7.3.2. (equation 55-28 and equation 55-29) are not met. The alien crosstalk margin is specified for each of the individual 4-pairs as well as the average “across the 4-pairs”.

The alien crosstalk margin is determined by the following algorithm:

Step 1. Calculate the individual-pair margins

1.1. Calculate XW(f) for each of the 4-pairs

$$XW(f) = -10\log10\left(10^{\frac{-AN(f)}{10}} + 10^{\frac{-AF(f)}{10}}\right) + 10\log10\left[10^{\frac{-(AN\_IPL(f)+2.5)}{10}} + 10^{\frac{-AF\_IPL(f)}{10}}\right] \quad \text{equation 1}$$

Where:

- AN(f) = measured PSANEXT Loss in dB from f=10 MHz to f=400 MHz
- AF(f) = measured PSAFEXT Loss in dB from f=10 MHz to f=400 MHz
- AN_IPL(f)= Individual-pair limit line for PSANEXT as specified in 55.7.3.1.1 utilizing the measured insertion loss of the individual-pair.
- AF_IPL(f) = Individual-pair limit line for PSAFEXT calculated from the PSAELFEXT equation specified in 55.7.3.2 utilizing the measured insertion loss of the individual-pair.

Note: The 2.5 dB is the PSANEXT allowance for the peak-to-average difference across frequency

1.2 Calculate the average value “across frequency” of XW(f) from 10 to 400 MHz, for each individual-pair of the 4-pair cabling, let these be XW1, XW2, XW3, XW4.

XWn= average(XWn(f)) $10 \le f \le 400$ equation 2

Where:

- f is the frequency in MHz
- XWn is the individual-pair number n (n=1,2,3,4)

1.3 Calculate the individual-pair margin as the minimum of the average value “across frequency” of each of the individual pairs of the 4-pair cabling from step (1.2).

Yinp = min (XW1, XW2, XW3, XW4) equation 3.

Where:

- Yinp is the the individual-pair margin

Step 2. Calculate the average margin

2.1 Calculate XA(f)

$$XA(f) = -10\log10\left(10^{\frac{-AN\_AVG(f)}{10}} + 10^{\frac{-AF\_AVG(f)}{10}}\right) + 10\log10\left[10^{\frac{-(AN\_AVGL(f)+2.5)}{10}} + 10^{\frac{-AF\_AVGL(f)}{10}}\right] \quad \text{equation 4}$$

Where:

- AN_avg(f) = Average measured PSANEXT Loss in dB “across the 4 pairs”.
- AF_avg(f) = Average measured PSAFEXT Loss in dB “across the 4 pairs”.
- AN_AVGL(f)= Average limit line for PSANEXT as specified in 802.3an D2.1 equation 55-24 where the coefficient for the equation is the minimum of the individual-pair PSANEXT coefficients.
  - o AN_AVGL(f)=(min(PSANEXT_coefficients)+1)-10*LOG(fMHz)/100) $1 \le fMHz \le 100$
    =(min(PSANEXT_coefficients)+1)-15*LOG(fMHz)/100) $100 < fMHz \le 500$

- AF_AVGL(f)= Average limit line for PSAFEXT obtained by adding the measured IL from the pair with the minimum AELFEXT coefficient to the PSAELFEXT limit specified in 802.3an D2.1 equation 55-29 where the coefficient for the equation is the minimum of the individual-pair PSAELFEXT coefficients.
    - o AF_AVGL(f) = (min(PSAELFEXT_coefficients)+4) -20*LOG(fMHz)/100)+ (measured IL of pair with minimum PSAELFEXT coefficient)

Note: The 2.5 dB is the PSANEXT allowance for the peak-to-average difference across frequency

2.2 Calculate the average margin as the average value across frequency of XA(f).

Yavg = average(XA(f)) $10 \le f \le 400$ equation 5

Where:

- f is the frequency in MHz
- Yavg is the average value “across frequency” of XA(f) from 10 to 400 MHz

Step 3. Calculate the alien crosstalk margin as the minimum value of the individual pair margin (step 1.) and the average margin (step 2.).

3.1 Calculate the alien crosstalk margin

YL = min (Yinp, Yavg) equation 6

Where:

- YL is the alien crosstalk margin

The alien crosstalk margin YL shall be greater than zero.