S100 UTP 1394B loss budget

Alistair Coles
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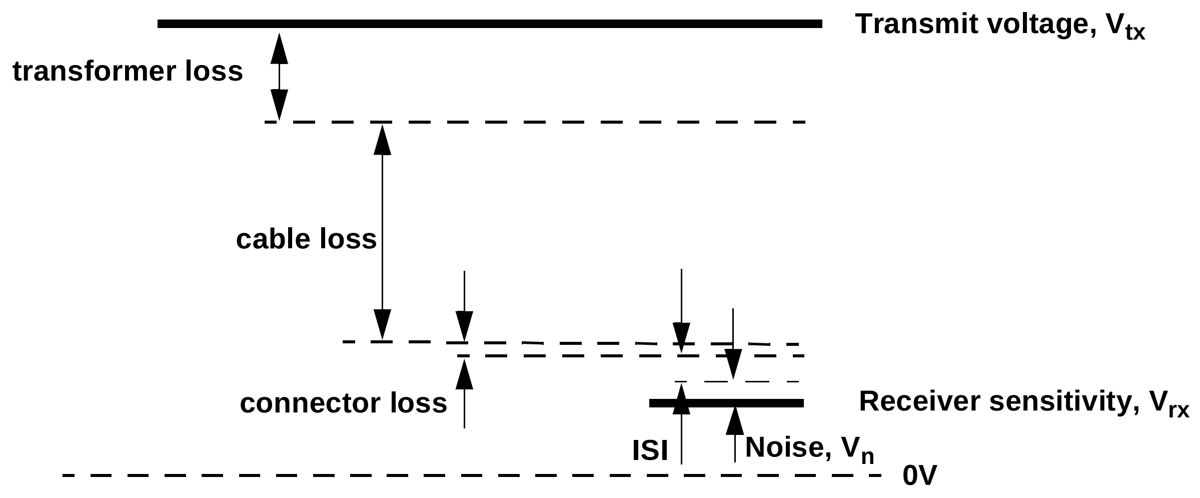

Assumptions

- Lossy components:
  - Cable:

    $2.06\sqrt{f} + 0.013f$ dB/100m, f in MHz. i.e. .17dB/m at S100 Nyquist freq.

  - Connectors:

    $0.04\sqrt{f}$ dB per mated pair, f in MHz. i.e. .3dB at S100 Nyquist freq.

  - Transformers: allow 1dB per transformer
- Factors causing eye closure
  - ISI (due to misequalization), allow 10%
  - Baseline wander

    $ISI_{baseline} = \frac{2\pi f_c}{122.88 \times 10^6} \times \text{Runlength}$ where fc is the transformer high pass cutoff frequency. Using a typical value, fc=50kHz, $ISI_{baseline} = 2.5\%$
- Noise sources
  - predominantly ingress noise, allow 20mV peak

Max. length with 100mV sensitivity

- For a link with 4 connectors, R m cable, two transformers,

$$\text{Total link loss} = 4 \times 0.3 + 2 + R \times 0.17 \ \text{dB} = 3.2 + R \times 0.17 \ \text{dB}$$

- $$\text{Total sustainable loss} = 20\left(\log\left(\frac{(1 - ISI_{baseline} - ISI_{eq}) \times V_{tx}}{V_n + V_{rx}}\right)\right) \ \text{dB}$$

- $$\text{Total sustainable loss} = 20\left(\log\left(\frac{(1 - 0.025 - 0.1) \times V_{tx}}{20 + V_{rx}}\right)\right) \ \text{dB}$$

- With a transmit voltage of 600mV and a receiver sensitivity of 100mV, total sustainable loss is 12.8dB.
- Maximum cable length possible for this combination of transmit voltage and receiver sensitivity is:

$$R = \frac{12.8 - 3.2}{0.17} = 57 \ \text{m}$$

Transmit voltage vs. receiver sensitivity for R=50m

- If receiver sensitivity can be reduced to 50mV, then transmit power (i.e. radiated emissions) will be reduced by almost 6dB.

Receiver sensitivity V_{rx}	Transmit voltage V_{tx}	tx power relative to V_{tx}=600mV
100mV	527mV	-1.1dB
75mV	418mV	-3.1 dB
50mV	308mV	-5.8 dB