Man-made burst noise

Middleton described a noise signal with

- AWGN and
- bursty man-made components,

PDF of noise voltage ζ is (infinite sum of Gaussian pdf's)

$$f_Z(\zeta) = e^{-A} \sum_{m=0}^{\infty} \frac{A^m}{m! \sqrt{2\pi \frac{m\bar{p}_m}{A}}} \exp\left\{ -\frac{\zeta A^2}{2m\bar{p}_m} \right\},$$

where

A is the impulsive index ($0.01 < A < 0.5$)

$\bar{p}_m$ the mean man-made noise power (10 to 30 dB above the AWGN).

Man-made noise power

Noise power is useful to compute outage probabilities

PDF of power

$$f_{p_m}(p) = e^{-A}\left[\delta(p) + \sum_{m=1}^{\infty} \frac{A^m}{m!} \frac{A}{m\bar{p}_m} \exp\left\{-\frac{Ap}{m\bar{p}_m}\right\}\right]$$

Total noise

AWGN and man-made noise

- are independent
- add incoherently

The Laplace image of the AWGN plus burst-noise power is

$$\mathcal{L}\left\{f_{p_n} \otimes f_{p_m}, s\right\} = e^{-s\bar{p}_n} e^{-A}\left[1 + \sum_{m=1}^{\infty} \frac{A^m}{m!} \frac{1}{1 + s\dfrac{m\bar{p}_m}{A}}\right].$$