

Noise spectral density

In communications, **noise spectral density**, **noise power density**, **noise power spectral density**, or simply **noise density** (N_0) is the power spectral density of noise or the noise power per unit of bandwidth. It has dimension of power over frequency, whose SI unit is watts per hertz (equivalent to watt-seconds or Joules). It is commonly used in link budgets as the denominator of the important figure-of-merit ratios, such as carrier-to-noise-density ratio as well as E_b/N_0 and E_s/N_0 .

If the noise is one-sided white noise, i.e., constant with frequency, then the total noise power N integrated over a bandwidth B is $N = BN_0$ (for double-sided white noise, the bandwidth is doubled, so N is $BN_0/2$). This is utilized in signal-to-noise ratio calculations.

For thermal noise, its spectral density is given by $N_0 = kT$, where k is Boltzmann's constant in joules per kelvin, and T is the receiver system noise temperature in kelvins.

See also

- Spectral density estimation
- Welch's method

References

- Jerry C. Whitaker (27 April 2005). *The Electronics Handbook, Second Edition* (https://books.google.com/books?id=FdSQSAC3_EwC&pg=PA636). CRC Press. p. 636. ISBN 978-1-4200-3666-4.

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