

# Leeson's equation

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**Leeson's equation** is an expression that describes an oscillator's phase noise spectrum.

Leeson's expression<sup>[1]</sup> for single-sideband (SSB) phase noise in dBc/Hz (decibels relative to output level per Hertz) is<sup>[2]</sup>

$$L(f_m) = 10 \log \left[ \frac{1}{2} \left( \left( \frac{f_0}{2Q_l f_m} \right)^2 + 1 \right) \left( \frac{f_c}{f_m} + 1 \right) \left( \frac{FkT}{P_s} \right) \right]$$

where  $f_0$  is the output frequency,  $Q_l$  is the loaded Q,  $f_m$  is the offset from the output frequency (Hz),  $f_c$  is the  $1/f$  corner frequency,  $F$  is the noise factor of the amplifier,  $k$  is Boltzmann's constant,  $T$  is absolute temperature in Kelvins, and  $P_s$  is the oscillator output power.

## References

- ↑ Leeson, D. B. (February 1966), "A Simple Model of Feedback Oscillator Noise Spectrum", *Proceedings of the IEEE* **54** (2): 329–330, doi:10.1109/PROC.1966.4682 (http://dx.doi.org/10.1109%2FPROC.1966.4682)
  - ↑ Rhea 1997, p. 115
- Rhea, Randall W. (1997), *Oscillator Design & Computer Simulation* (Second ed.), McGraw-Hill, ISBN 0-07-052415-7

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