

Decibels in the context of ADSL

19 Jonathan Tue, Jul 25, 2017 [Broadband / IC-Air](#) 3653

The decibel

The decibel is a logarithmic unit which specifies the ratio of two powers. It was devised for transmission systems. The original unit was the Bel, and they derived this as: $\text{Power gain in dB} = 10 \times \log_{10} \left(\frac{\text{Output Power}}{\text{Input Power}} \right)$. Belts = logarithm (base 10) of the ratio Output Power / Input Power. This unit is used in many other contexts as well. One of the advantages of specifying a power gain or loss in dB is that you can add the gains or losses of each stage. This is a lot easier than multiplying and dividing the power ratios. In the beginning, you have negative dB values. If the input and output powers are equal, the gain is 0 dB.

Some example values

Decibel value	Arithmetic equivalent
-6 dB	0.25
-3 dB	0.5
0 dB	1
3 dB	2
6 dB	4
10 dB	10
20 dB	100
30 dB	1000

Attenuation

One of the main reasons for using dB is that it is a logarithmic scale. What may surprise you is just how much gets lost between the exchange and the user. What may surprise you is just how much gets lost between the exchange and the user. In September 2002, the limiting attenuation figure for a UK ADSL installation was of about 32 million. Lower levels of attenuation are obviously preferable. A power ratio of 1000 is 30 dB.

Signal-to-noise ratio

Just to make life even more complicated for the rest of us, a wide range of terms are used to describe the signal-to-noise ratio, or SNR. The greater this ratio is, the better the signal. The limiting ratio of SNR is 1000:1, or 30 dB. This is a very low SNR. In ADSL, a lower value of SNR will make it very difficult to separate out a clear signal. It should be noted that ADSL modems and routers normally report a noise margin. If a measured SNR was 40 dB, then the modem/router would report a noise margin of 4 dB.

Decibels used as power measurement

Another common use of decibels is to specify the power level of a signal. This is done by dividing the power by a reference power level, and then the power is specified as that number of dBm. For example, 3 converted

Power	dBm equivalent
1 mW	0 dBm
2 mW	3 dBm
10 mW	10 dBm

100 mW	20 dBm
1 W (1000 mW)	30 dBm
100 W (100,000 mW)	50 dBm

What is the power level in dBm for the following power levels? (Note: dBm is a unit of power level, not a unit of power. It is the power level relative to 1 mW. For example, 100 mW is 20 dBm, 1 W is 30 dBm, and 100 W is 50 dBm.)

Online URL: <https://kb2.ic.uk/article.php?id=19>