Decibels in the context of ADSL

19 Jonathan Tue, Jul 25, 2017 Broadband / IC-Air 3504

The decibel

The decibel is a logarithmic unit which specifies the ratio of two powers. It was devised [illegible] transmission systems. The original unit was the Bel, and they defined this as:

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Number of Bels = logarithm (base 10) of the ratio OutputPower / InputPower.
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Because this was rather too coarse a unit for many purposes, they specified the decibel (dB) [illegible] rather cumbersome way of specifying a power gain or loss, but it has some advantages:

1. Because of the way that logarithms work, the overall gain of several cascaded stages [illegible] dB gains of each stage. This is a lot easier than multiplying and dividing the power ratios.

2. The log of a number less than 1 is negative, so all power gains have positive dB [illegible] have negative dB values. If the input and output powers are equal, then 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

Ordinary twisted-pair telephone lines were never designed for the high frequencies used [illegible] exchange and the user. What may surprise you is just how much gets lost...

Prior to (6 September 2004) the limiting attenuation figure for a UK ADSL installation was [illegible] a power ratio of about 32 million. Lower levels of attenuation are obviously preferable.

Signal-to-noise ratio

Just to make life even more complicated for the receiving equipment, spurious signals [illegible] is called the signal-to-noise ratio, or SNR. The greater this ratio is, the better.

The limiting value of SNR is generally taken to be 6 dB (= 0.6 Bel). This corresponds [illegible] lower values of SNR will make it very difficult to separate out a clean ADSL signal.

It should be noted that ADSL modems and routers generally report noise margin (or [illegible] measured SNR was 10 dB, then the modem/router would report a noise margin of 4 dB.

Decibels used as power measurement

As described above, decibels specify a ratio between two numbers (one number divided [illegible] to dB, and then the power is specified as that number of dBm. For example:

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

Most modern routers report the upstream and downstream power levels in dBm from the exchange. In (or remote) power is the power transmitted by the DSLAM or MSAN in the