



THE DECIBEL (dB) and the DECIBEL MICRO VOLT(dB μ V)

Product Ref.Code:AppIDECIBEL

General Description:

Everything you always wanted to know about :

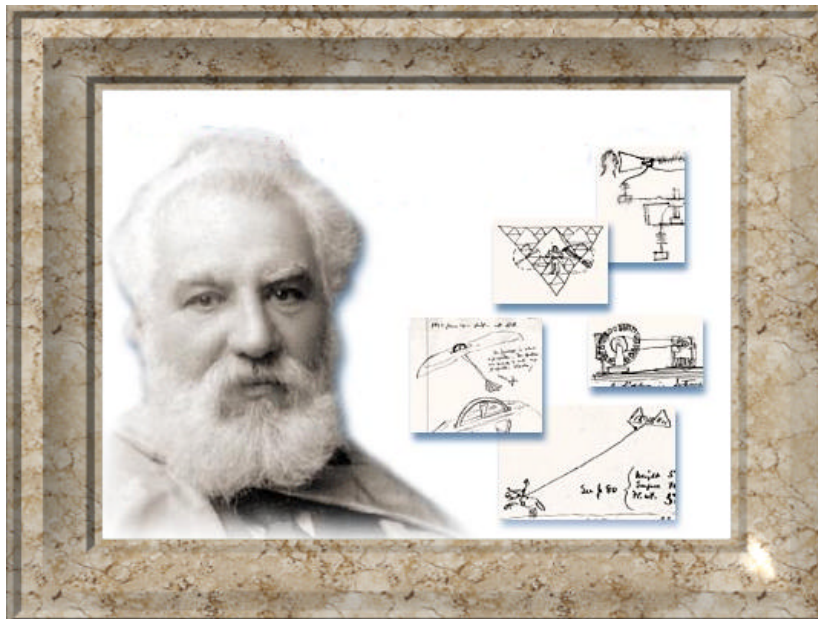
The Decibel.

Did you ever head about dB's, dBA, dBV, dBuV, dBm or even dBSDT. ???

The decibel is not a measuring unit like Volt, Ampere or any other unit, but it is a ratio between a reference unit and the measured value.

The decibel originally comes from quantifying signal strengths in terms of relative loudness as registered by the ear. For example if a person estimates that a signal is twice as loud when the transmitter power is increased from 10 watts to 100 watts, he or she will also estimate that a 1000 watt signal is twice as loud as a 100 watt signal. The human ear has a logarithmic response.

This fact is the basis for the use of a relative power unit called the decibel (written as dB). A decibel is one tenth of a Bel, the unit of sound named after Alexander Graham Bell.



A change of one dB in power is just detectable as a change in loudness under ideal conditions. The number of decibels corresponding to a given power ratio is given by:

$$\text{dB} = 10 \cdot \log_{10}(P2/P1)$$

Note that the decibel is based on power ratios. Voltage or current ratios can be given by:

$$\text{dB} = 20 \cdot \log_{10}(U2/U1)$$

It is very convenient to memorize the decibel values for a few of the common power and voltage ratios. For power changes, a numerical ratio of 2 is 3dB, 4 is 6 dB, 10 is 10dB, 100 is 20dB, 1000 is 30dB, and so on.

When voltage changes are considered, doubling the voltage causes a 6dB increase, a numerical ratio of 10 is worth 20dB, 100 is 40dB and so on. One can interpolate between known ratios to estimate a gain or loss within 1 decibel.

Example: a measured signal is about 52 dB's (in voltage mode), this means the signal is: 40 dB (=100x) + 6 dB (=2x) + 6 dB (=2x) equals 400 times bigger than the reference signal.

Inverting the numerical ratio simply inverts the algebraic sign of the decibel value. For example, a voltage gain of 10 corresponds to 20dB, while a gain of 1/10 (which is a loss of 10) corresponds to -20dB.

The decibel is a relative unit. When using dB's to specify an absolute voltage, current or power level, a reference level must qualify the decibel value. For example, in a discussion of sound intensity a reference level of 1 dB corresponds to acoustical field strength of 10^{-16} W/cm² (the normal human threshold at 600Hz). A lion's roar at 20 feet might have a sound intensity of 90dB, and the threshold of pain occurs at 130dB. Thus, the human ear/brain has a dynamic range of 130dB, or a ratio of 10 trillion to one.

*In radio work, power is often rendered in dBW (decibels referenced to 1 watt) or in dBm (decibels referenced to 1 milliwatt).

*In antennas technicians specify dB's with respect to some standard reference element such as isotropic radiator or a dipole. The measurement units are the dBi (gain over isotropic) and dBd (gain over half-wave dipole).

*In spectrum analysis, noise, spurious signals and distortion products can be referenced to the carrier (if one exists), dBc. A certain frequency synthesizer might have a phase-noise specification of -40dBc, 100Hz removed from the carrier.

*The acoustics people specify the sound in dBA.

*Voltages are sometimes given as decibel values with respect to 1 Volt (dBV) or to 1 μ V (dB μ V).

*SDT specifies a dB as the ratio of voltage generated at the sensor pins over 1 μ V (micro volts), The exact technical term for the dBSDT is dB μ V (decibel/microvolt or 0dB = 1 μ V).

Revision History:

DATE	Version	Revision
15 May 1999	1.0	Written by Ken Desmet
24 April 2001	1.1	English version for website

All rights reserved: No one is permitted to reproduce or duplicate, in any form, the whole or part of this document without the written permission of SDT International n.v. s.a.

The information herein is believed to be accurate to the best of our knowledge.

Due to continued research and development specifications of this product can change without prior notice.

SDT International n.v. s.a.

Bd de l'Humanité 415

B-1190 Brussels (Belgium)

Tel: ++32-(0)2-332.32.25

Fax: ++32-(0)2-376.27.07

e-mail: info@sdt.be

