# Sound Levels, dBA dBB & dBC

By G8MNY (updated Jan 06)
(8 Bit ASCII Graphics use code page 437 or 850)

## THE EAR

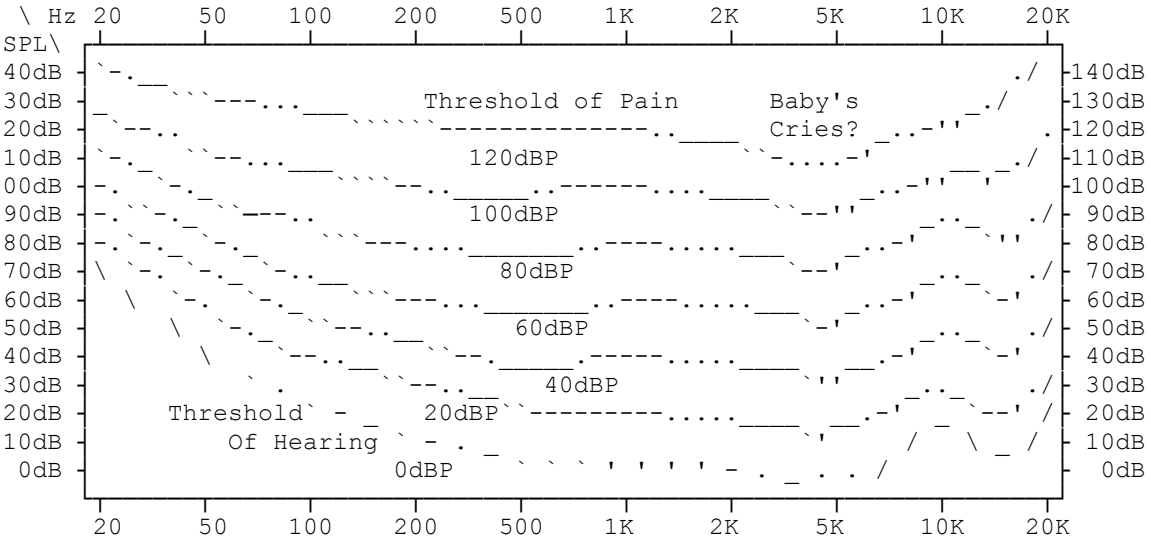
The human ear has a very wide frequency & level range. From the faint 0dBA that approximates to the threshold of hearing & represents an ear drum movement in the order of the width of an atom, to energy levels greater than a million million times stronger, or greater than a million times that movement. This huge dynamic range is achieved by an AGC action in the ear that uses muscles to dampen the movement of the acoustic path to the cochlea. The minimum level change that can be detected is about 2dB over this range.

Too much sound for short time results in ringing in the ear, some damage usually has happened if you hear this. Long periods of loud sound actually breaks off the frequency sensing hairs in the cochlea, resulting in permanent loss of that frequency!

Frequency resolution is about 2% at most frequencies, eg 20Hz @ 1KHz.

## NON LINEAR EAR RESPONSE

This chart shows a young human ear response dBP (phons) of equal loudness measured against Sound Pressure Level, (0dB = 2 dynes/cm2 or 20 uPascals).




You will see that the response is far from flat, & that the bass end is also very compressed a 20dB change only seems like 10dB.

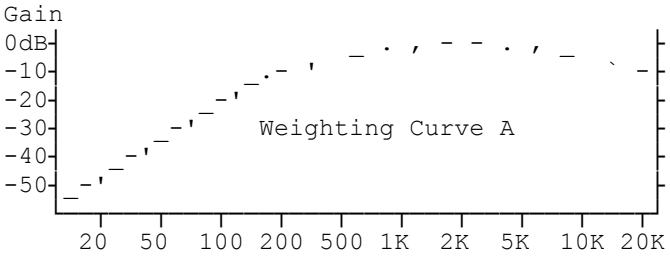
Frequency range & sensitivity changes with age, from 20Hz-20KHz when young, to -20dB @ 4KHz when old with some 20 to 40dB reduction in overall sensitivity as well, but the threshold of pain remains the same.

Here is a large list of typical sound levels taken from a 1963 DAWE Meter H/B & some from G4WYW's bul. Some sounds may be louder now!

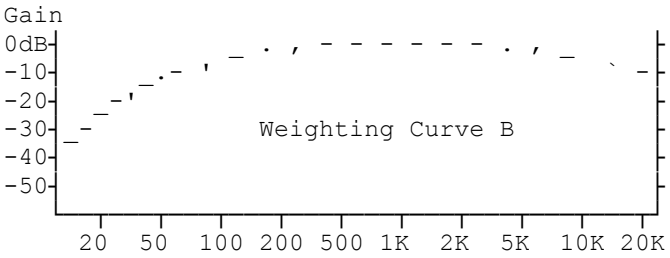
| EXAMPLE | dB | Wtg | NOISE | mPa | uBar | Ref Mic |
|---|---|---|---|---|---|---|
| Ear drum ruptures | 160 | dBC | Damage | 2K Pa | 20 Bar | damaged |
| Limit of safe exposure of body to continuous noise, Sensations of imbalance & skin heating. | 150 | dBC | Some damage | 6.3 KPa | 6.3 Bar | damaged |
| Military aircraft @ 30m | 140 | dBC | | 200 Pa | 2 Bar | damaged |
| Threshold of pain | 130 | dBC | !!!!!!! | 63 Pa | 630000 | damaged |
| Jet Aircraft @ 500ft & Threshold of discomfort. | 120 | dBC | Deafening | 20 Pa | 200000 | 112mV |
| Pneumatic Drill & Boiler Making Factory & Jet @ 150m Disco well away from LS. Powerful mower at 1m Train whistle at 15m. | 110 | dBC | Deafening | 6.3 Pa | 63000 | 35mV |
| Motor Horn | 105 | dBC | Deafening | 3.5 Pa | 35000 | 20mV |
| Noisy food blender @ 0.5m | 100 | dBC | Very Loud | 2.0 Pa | 20000 | 12mV |
| Inside train compartment when door is slammed & Lorry in narrow street. | | | | | | |
| Inside an Old Tube Train | 95 | dBC | Very Loud | 1,125 | 11000 | 6.3mV |
| Busy Street | 93 | dBC | Very Loud | 893 | 8.90 | 5.0mV |
| Upper limit of daily noise, Automatic lathe at 1m & exposure regarded as OK. | 90 | dBC | Very Loud | 630 | 6.3 | 3.6mV |
| Workshop | 88 | dBC | Very Loud | 502 | 5.00 | 2.8mV |
| Small Car @ 24ft | 83 | dBB | Very Loud | 282 | 2.80 | 1.6mV |
| Noisy Office, Alarm clsock | 80 | dBB | Very Loud | 200 | 2.0 | 1.2mV |
| Noisy Office | 78 | dBB | Loud | 158 | 1.60 | 980uV |
| Inside Small Car | 73 | dBB | Loud | 89 | .89 | 500uV |
| Less Busy Street | 70 | dBB | Loud | 63 | .63 | 360mV |
| Large Shop | 68 | dBB | Loud | 50 | .50 | 280uV |
| Radio Set @ Full Volume | 65 | dBB | Loud | 36 | .36 | 200uV |
| Normal conversation @ 1m | 60 | dBB | Loud | 20 | 2 | 120uV |
| Normal Conversation @ 2m | 58 | dBB | Moderate | 6 | .16 | 98uV |
| Urban House | 53 | dBA | Moderate | 9.8 | .098 | 50uV |
| Quiet Street | 50 | dBA | Moderate | 6.3 | .63 | 36mV |
| Quiet Office | 48 | dBA | Moderate | 5.2 | .052 | 28uV |
| Rural House | 43 | dBA | Moderate | 2.8 | .028 | 16uV |
| Quiet Speech & Residential area at night. | 40 | dBA | Moderate | 2.0 | .02 | 12mV |
| Public Library | 38 | dBA | Faint | 1.6 | .016 | 9uV |
| Quiet Conversation | 33 | dBA | Faint | 0.9 | .009 | 5uV |
| Ticking of watch | 30 | dBA | Faint | 0.63 | .006 | 3.6uV |
| Rustle of Paper | 28 | dBA | Faint | 0.5 | .005 | 3uV |
| Whisper | 23 | dBA | Faint | 0.3 | .003 | 2uV |
| Quiet country lane | 20 | dBA | Faint | 0.2 | .002 | 1.2uV |
| Quiet Church | 18 | dBA | Very Faint | 0.16 | | 1uV |
| Still Night in Country | 13 | dBA | Very Faint | 0.1 | | 0.5uV |
| Blood pulsing & Heartbeat & heartbeat. | 10 | dBA | Very Faint | 0.06 | | 0.3uV |
| Sound Proof Room | 5 | dBA | Very Faint | 0.04 | | 0.2uV |
| Threshold of Sound | 0 | dBA | Extremely Faint | 0.02 | | 0.1uV |

WEIGHTINGS

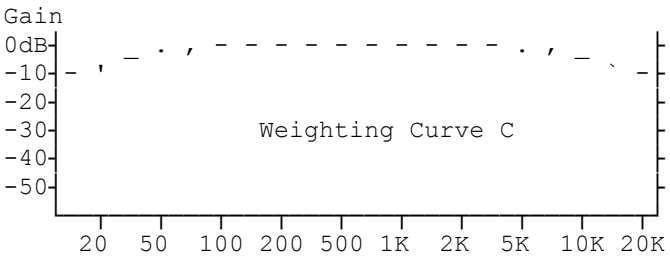
Frequency weighting filters are used to change the measured level to reflect the human ear response. It is achieved with gentle filters in the measuring system, normally manually switched in. The use of the wrong weighting for a particular sound may affect the measurement when compared to the apparent noise level as perceived by the ear or not, depending on the sound frequency content, so sometimes just dBA is used for all levels!




dBA is for sound levels up to 55dB, it has a response peaking at 2KHz with heavy LF cut of -50dB @ 20Hz & -10dB @ 20KHz.




dBB is for sound levels between 55dB & 85dB, it is flatter than dBA with only -24dB @ 20Hz LF roll off & the same -10dB @ 20KHz.




dBC Weighting is level above 85dB, it is quite flat 30Hz to 10KHz, & only -10dB roll off @ 10Hz & 20KHz. It is a frequency response with the flattest weighting, almost the same as an unweighted Sound Pressure Level (SPL).

N.B. dB"C" is not dB"c" which is dBs with respect to an RF carrier.

HIFI TRICKS

These ear response tonal level changes are the principle behind Loudness controls on modern audio domestic systems, eg. boost low frequency Bass & top end Treble when the volume control is set low, as it will sound much louder to the ear.

Why Don't U send an interesting bul?

73 De John, G8MNY @ GB7CIP