Doubling Power vs. Doubling Output

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A common misunderstanding when it comes to audio is that doubling power (watts) will make it sound “twice as loud.” Doubling the power (or cutting it in half) actually provides very subtle changes to SPL levels. It will take a significant increase in power to sound "twice as loud". Lets take a deeper look into what increases in power are needed to make changes in SPL.

A 1 dB change in sound pressure level is the smallest difference perceptible by normal human hearing under very controlled conditions, using a pure tone (sine wave) stimulus. A 1 dB change in level is very difficult to hear when listening to dynamic music.

To produce an increase of +1 dB you need to increase power (watts) by a factor of 1.26. So, if you are getting 102 dB SPL from 100 watts and you want 103 dB SPL, you will need 126 watts of power. To produce a decrease of –1 dB you need to divide the reference power by 1.26, so you would reduce power from 100 watts to 79.4 watts.

A change of 3 dB is accepted as the smallest difference in level that is easily heard by most listeners listening to speech or music. It is a slight increase or decrease in volume.

To produce an increase of +3 dB you simply need to double power (watts).

So, if you are getting 102 dB SPL from 100 watts and you want 105 dB SPL, you will need 200 watts of power. To produce a decrease of –3 dB you need half the power, so you would reduce power from 100 watts to 50 watts.

Since this 3 dB plateau results in such a happy ratio, it is a very useful relationship to memorize:
“2 times the power = +3dB...

1/2 the power = –3dB”.

A change of 6 dB is accepted as a significant difference in level for any listener listening to speech or music. It is a quite noticeable increase or decrease in loudness.

To produce an increase of +6 dB you need to increase power (watts) by a factor of four. So, if you are getting 102 dB SPL from 100 watts and you want 108 dB SPL, you will need 400 watts of power (it adds up fast, doesn’t it?). To produce a decrease of –6 dB you need to divide the reference power by 4, so you would reduce power from 100 watts to 25 watts.

This 6dB plateau also results in happy ratios that should be memorized:

“4 times the power = +6dB...

1/4 power = –6dB”.

A change of 10 dB is accepted as the difference in level that is perceived by most listeners as “twice as loud” or “half as loud”.

To produce an increase of +10 dB you need to increase power (watts) by a factor of 10. Yes, to get twice as loud, you need **ten times the power!!!**

So, if you are getting 100 dB SPL from 100 watts and you want 110 dB

SPL, you will need 1000 watts of power. To produce a decrease of –10 dB you need to divide the reference power by 10, so you would reduce power from 100 watts to 10 watts.

The 10dB Rule should also be memorized:
“10 times the power = +10dB...

1/10 power = –10dB".

Here is a handy summary table which also lists the change in voltage and speaker excursion for each change in level:

Increases in Power / Voltage / Decibels:
1.26 x power (watts) = 1.12 x voltage/excursion = +1dB
1.59 x power (watts) = 1.26 x voltage/excursion = +2dB
2.00 x power (watts) = 1.41 x voltage/excursion = +3dB
2.52 x power (watts) = 1.59 x voltage/excursion = +4dB
3.18 x power (watts) = 1.78 x voltage/excursion = +5dB
4.00 x power (watts) = 2.00 x voltage/excursion = +6dB
5.04 x power (watts) = 2.24 x voltage/excursion = +7dB
6.35 x power (watts) = 2.52 x voltage/excursion = +8dB
8.00 x power (watts) = 2.83 x voltage/excursion = +9dB
10.0 x power (watts) = 3.16 x voltage/excursion = +10dB

Decreases in Power / Voltage / Decibels:
0.79 x power (watts) = 0.89 x voltage/excursion = –1dB
0.63 x power (watts) = 0.79 x voltage/excursion = –2dB
0.50 x power (watts) = 0.71 x voltage/excursion = –3dB
0.40 x power (watts) = 0.63 x voltage/excursion = –4dB
0.31 x power (watts) = 0.56 x voltage/excursion = –5dB
0.25 x power (watts) = 0.50 x voltage/excursion = –6dB
0.20 x power (watts) = 0.45 x voltage/excursion = –7dB
0.16 x power (watts) = 0.40 x voltage/excursion = –8dB
0.13 x power (watts) = 0.35 x voltage/excursion = –9dB
0.10 x power (watts) = 0.32 x voltage/excursion = –10dB

As mentioned above, a +10dB increase in SPL is considered "twice as loud" and to do so power will need to increase by ten times.