

## Am I too loud? Is the Noise Police here?

Many questions arise when measuring sound pressure levels (SPLs) during concerts and in dance clubs:

*How to measure the sound level?*

*Are there any measurement standards?*

*Are there any sound level limits?*

*For whom are these regulations or recommendations intended?*

**Here are some quick answers:**

- *Sound levels shall be measured at the worst-case location in the venue, i.e., where the highest SPL is present and the audience has access to this location.*
- *Yes, there are standards such as IEC 61 672 and ANSI S1.43*
- *There are no international regulations or standards for SPL limits, (besides the World Health Organisation, WHO. However, you should check national recommendations or local regulations. Most stipulate a sound dose of approximately 100 dB LAeq and a maximum SPL of 110-120 dB LAFmax or 130-140 dBC peak.*
- *Only the audience. There are other regulations for Musicians/Crew and other regulations concerning the discomfort of the neighbours.*

## Three different situations

### Musicians/Crew

The Musicians/Crew is regularly exposed for a sound dose much higher than the audience. It is assumed that the audience only are exposed for an hour or two, and therefore their dose of Leq are higher. For Musicians/Crew an occupational noise level limit is therefore applicable. A sound dose of max 85dBA Leq per 8 hour, 5 days a week is the established rule in the industry. However, research has shown that humans can stand 5dB higher level if the noise is music. This gives only a Leq of 90dBA per day.

Therefore it is advisable for the Musicians/Crew and bar-personnel to wear ear protection.

### Neighbours

Another noise problem is that music events with high SPL levels very often disturb neighbours in the surroundings. If the music is played in a club for example and there are apartments in the same building it is a serious architectural and construction problem to isolate vibrations and sound. In this area there are a lot of research and regulations, which are not the scope of this paper. Just to mention a recommendation from WHO [1]; 30 dBA Leq in bedrooms and 35 dB in indoor dwellings. National regulations may differ +/-5 dB around this.

### Audience

In the regulations and recommendations for the audience, it is assumed that they don't wear ear protection. This is because it very hard to control the quality of the protection, especially if there are kids in the audience. And what is the meaning of that both the Musicians/Crew and the audience wear ear-protection?

There are some exceptions where it is necessary to distribute ear-protection to the audience. If the event contains parts where the sound system can't control the noise level, i.e. fireworks or if the army or air force is part of the show.

Most maximum level recommendations from authorities on max sound level ends up in a level of around 100dBA (Leq) for a music event.

**Note:** This is a two-page appetiser of a 7 pages paper included in the RT-Capture documentation.

## Industrial noise vs. High SPL at music events.

### What is Leq?

*The Equivalent Continuous SPL or Leq is the value of the sound pressure level that contains the same dose of energy over time as the dynamic sound level contains.*

Leq is a dose of sound and is specified after for example one, two, four or eight hours. Most maximum level recommendations from authorities on max sound level ends up in a level of around 100dBA (Leq) for a music event.

*What is the background for this?*

The last thirty years there has been an extensive research around the world [1] about hearing damage in the manufacturing industry. The aim for this is to find an “occupational noise level” limit. A sound dose of max 85dBA Leq per 8 hour, 5 days a week is established on a statistical background. This figure is based on a big statistical material and reference groups. These investigations show that 80% of the population manage an 85dB dose per day without hearing damage. The remaining 20% will not manage an 85dB level dose, but they will get some hearing damage anyway. The reason for this is that individuals are differently equipped to stand high SPLs.

*Further research about exposure of high SPL produced by music [2] has shown that humans can stand 5dB higher level of music than industrial noise.*

However if the exposure is limited to four hours, the dose can be doubled, i.e. 3dB more, or 93dB.

Most recommendations from authorities in Europe are based on this one-hour 99dBA Leq maximum dose. WHO recommends a maximum dose of 100 dBA during 4 hour of

entertainment and celebration [1]. The assumption here is that members of an audience only attend a music event with high SPL levels one hour per day or alternative a 4 hours event once a week. This also implies that no other sound from earphones etc. may exceed the 85dB limit during that week.

For music there is a 90dBA Leq maximum dose for 8 hours. 93 dBA Leq for 4 hours. 96 dBA Leq for 2 hours. 99 dBA Leq for 1 hour.
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### How to measure sound levels professionally?

To have professional activity means that the activity is made for living. In the case of self-examination of noise levels it is an activity to measure professionally to minimize the risk in the activity. The best way to minimize the risk is to create a measurement, which can be a legal proof. The proof has to show that the noise levels don't violate regulations or recommendations.

The best way to create such a proof is to make a **professional measurement protocol**. This includes; Place and date, Measurement equipment used, Calibration data, Name or description of the measurement method used, environmental data (temperature etc), Name of the measurement technician, Measurement uncertainties calculation, a sketch or drawing over the place.

It is obvious that a PC creates such measurement protocols very easily.

To get a measurement accepted as professional, a credited laboratory must verify the equipment. Such laboratories also offer that the quantities that are measured have **traceability** to national and international references. The references are used to make a **calibration**.

Verification and calibrations are wise to make at least every second year, sometimes recommended methods states calibration more often.

### References:

[1] WHO: Occupational and community noise, Fact sheet N°258, Revised February 2001,

<http://www.who.int/mediacentre/factsheets/fs258/en/print.html>

[2] Axelsson, Prasher: Tinnitus induced by occupational and leisure noise.

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