Noise from Amplified Entertainment Venues

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ABSTRACT

Under the offence provisions of the Queensland EPA Act 1994 an occupier of a premises may generate noise from an outdoor event of up to 70 dB(A) at a nearby noise sensitive receptor, between the hours of 7am and 10pm, and between 10pm and midnight of up to 50 dB(A) or background + 10 dB(A) (whichever is the lessor). This has often been seen to be the operating limit but is in reality the level at which penalties can be applied. With current technology of music systems being employed in music festivals the focus is to generate high sound pressure levels at low frequencies (40 to 80 Hz), with very little mid to high frequency sound. At these frequencies the "A" scale correction (– 26 dB) applied to the music means that the dB(A) reading from a sound meter does not represent audibility. The result is a sound that is well under the Queensland EPA offence limits, meets the expectations of the patrons; and yet can travel 10 km and be clearly audible but not measurable as a dB(A). Based upon experience in managing noise from music festivals this paper presents a case for the use of dB(C) for the management of environmental noise from entertainment venues and the use of lower performance criterion to protect residential amenity.
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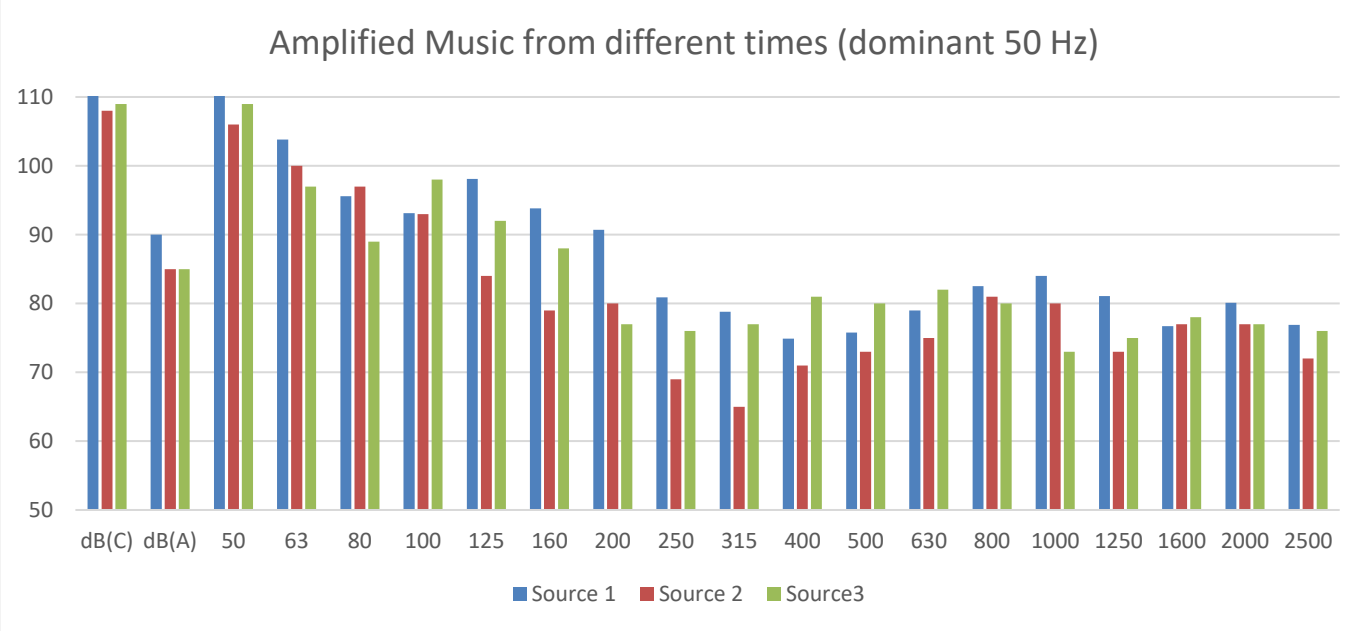
1 INTRODUCTION

Outdoor festivals are a feature of western culture. The idea being is for 1,000 to 20,000 people to spend up to a week in an open space listening to high levels of amplified music, ideally (for them) 24 hrs per day. Such events go back to the 1960's, however changes in technology mean that the clarity of the sounds and the ability to transit high levels of focused low frequency sound has greatly increased. Much of this sound energy is focused in the 63 Hz octave band (40 to 80 Hz). This sound mainly for physiological and not necessarily auditory reasons attracts large gatherings of people generally in the 20's to 40's age bracket. The effect is what we describe as a "legal high" and works as we understand on the physiology of the body exciting natural frequencies within the body. This is not regular "music" but sound focused to create a physiological effect that could be considered to be trance like. In effect this is more of a medical and not auditory acoustic matter.

2 SOUND SOURCE SPECTRUM

The outcome of the concentration of sound in the bass frequencies (up to 110 dB(C) at 30m from the speakers) is that there are little mid and high frequency sound (> 200 Hz).



Graph No 1: Typical sound spectrum, in this case dominant at 50 Hz (source Palmer Acoustic files)

From this it can be seen that the measure of the bass sounds (50 hz) is almost equal to the dB(C) measurement. In effect the mid to high sounds do not count in setting the dB(C) level, and hence for the management of such noise dB(C) is an easy descriptor. There are many handheld Type 2 meters (under $300 that measure dB(C)) and hence this becomes an easy way to set and manage compliance limit.

3 RECEPTOR SPECTRUM

This sound when assessed at nearby noise sensitive areas is the result of distance, topographical and atmospheric attenuation. It is not uncommon to find residential areas at 1 to 2km from these sites (and closer in some cases). The result is a receptor spectrum dominated by the low frequency sound (say 50 hz), with all the higher frequencies being totally inaudible. At a distance of 2 km and allowing for 5 dB topographical attenuation, noise attenuation in the bass frequencies can be expected to be close to 40 dB (30m to 2km), giving bass noise levels around 70 dB(C). At a distance of 10km the attenuation will be closer to 55 dB, with levels down to 55 dB(C). In such rural areas the night-time background dB(C) levels can drop down to as low as 30dB, with a similar dB(A) level. With base levels of 55 dB(C) such noise becomes quite audible.

In these rural areas the receptor spectrum although having low base levels down to 30 dB at 63 hz, can at times have mid to high frequency sounds from insects and wind in trees. Such noise will often generate noise levels of 35 to 55 dB(A) and in easily measurable with a dB(A) meter. However although this meter shows a dB(A) reading the level will not reflect the noise from the amplified entertainment and will simply be a measure of the noise from insects, birds, frogs or wind in trees. With the “A” scale correction being -26 dB, a noise impact from the venue of 55 dB at 63 Hz will only show as a level of 29 dB(A), yet the sound can be very audible (25 dB above the background at that frequency).

4 RECEPTOR SPECTRUM

The human ear as a device is incredibility sensitive to sound both in level (0 to 120 dB) and spectral content (typically 20 hz to 2000 Hz). Humans respond to noise as a rise above background and that is why many environmental regulations set limits based upon background + 5 dB, with corrections for any distinguishing characteristics. This applies well for many environments where the spectrum of the source is similar to the spectrum of the background. However with high bass music (say dominant at 63 hz) people with easily perceive a rise in the background of say +10 dB, whereas this will not register on a dB(A) meter. The meter will be showing the mid to high frequency sounds that are in the ambient and not from the venue.

The dB(A) spectrum has the following corrections:

Frequency Hz	31	63	125	250	500	1000	2000	4000
"A" correction dB	-39	-26	-16	-9	-3	0	1	1

Table 1: The standard dB(A) corrections.

We have been in situations when people are measuring noise from music venues at 1.7 km and though the reading is showing levels of 45 to 50 dB(A), above the day time compliance limit, the music was generating dB(A) levels of under 40 dB(A) which was below the compliance limit of background +10 dB(A). In this case the music was still clearly audible. In this case dB(A) was an inappropriate descriptor to manage the noise.

5 THE DELEMMA

Environmental noise is often assessed by the use of the "A" scale. This is used for enforcement of requirements and managing noise and this usually is a reasonable approach. However this does not work for low frequency sounds (<200 Hz). Low frequency sound can come from a multitude of sources, environmental plant and equipment at long distances, compressors, pumps, wind turbines, and under swimming pools in high rise buildings etc. Ideally such sounds should be measured with a 1/3 octave band real time analyser (20 Hz to 10,000 Hz 1/3 octave). Such meters are significantly more expensive and more complex to operate than the standard dB(A) meter or noise logger. A simpler and often equally effective way is to work with the dB(C) scale. Most dB(A) meters will include a dB(C) scale. Any detailed assessment of low frequency noise has to be carried out using as a minimum a 1/3 octave band meter down to 20 Hz 1/3 octave band. We suggest that for the management of low frequency noise that the noise be assessed as a rise above the background level in dB(C). Such a rise will reflect audibility and the level of intrusiveness of the sound. Such a change in methodology will require a shift in the mindset for many of the compliance authorities and require rewriting environment protection regulations. This change is proposed on the basis that music venues are only in recent years able to "punch" such clear and defined low frequency sounds, that travel long distances and are audible in those frequencies as a rise above the background.

There is a greater issue at stake in this matter and that is the management of low frequency sounds. Music venues are not the only generator of such noise and yet often dB(A) meters are used to assess the noise. Noise from wind farms can be dominate in frequencies close to 50 – 60 Hz or 100 – 150 hz Hz, with this sound modulating. The use of dB(A) is a poor tool to assess this noise. Ideally wind farms should be assessed using 1/3 octave noise meters and loggers with compliance established as a rise above the background in the dominate frequency. It is our view that for such noise, dB(C) would be a better descriptor to reflect audibility. Queensland has a draft Eco access Guideline for the management of low frequency noise " Assessment of Low Frequency Noise" . This guideline proposes a methodology to mange noise using 1/3 octave band levels from 8 to 200 Hz. This guideline should be finalised and not offered as it currently is as a draft.

6 NOISE FROM OUTDOOR AMPLIED ENTERTAINMENT VENUES

The location of music festivals is always a contentious matter. The venue operators and patrons ideally want these located close to urban areas, with the outcome that they are usually located in rural or semi-rural areas close to major cities. In such locations there are often residential, or family dwellings located within 10 Km of the venue. 10 km can easily be the range of audibility as the areas are often very quiet at night. A classic case of the NIMBY principle (not in my back yard). However, these are deemed to be a desirable social activity by patrons and many local authorities. Any decision has to be seen with regards to a balance of the rights of a large number of patrons to have festivals, and a much small number of residents to have quiet amenity.

In the management of noise from outdoor amplified entertainment it is not easy to set appropriate criterion. There has to be a balance between the rights of the venue and patrons (2,000 to 20,000 people) against the rights of nearby residences (maybe 5 to 10 dwellings within a radius of 5 km). Setting appropriate limits is not easy as the patrons want the music "loud" in bass frequencies and the residences want the music "inaudible" across all frequencies. The venue is likely to be located in a rural area where the background levels can easily be under 25

dB(A) at night and 30-35 dB(A) day. These areas have low bass ambient noise. With such parameters it is difficult to find a compromise that works for both the venue and residents.

The key issues to consider are the number of patrons, the number of residents affected, the buffer distances, the ambient noise levels and the levels of amplified music. Often music venues will operate 10am to midnight and in some cases 24/7, with the buffer distance being critical to limiting the impacts. It is our experience with music events that rely on high levels of amplified music (> 85 dB(C) at 30m), that buffer distances of > 2 km are often required (unless there is some form of topographical screening). For distances under 1 km there appears to be no workable compromise, unless the venue is fully enclosed.

Compliance criterion that has been applied reasonably in Queensland for licensed venues (hotels, taverns and clubs) under the Liquor Act of Queensland:

- *Between 6.00am and 10.00pm - the adjusted maximum sound pressure level LA10, plus adjustments for tonal and impulse components, must not exceed the background level LA90 by more than 10dB(A) when measured at any affected premises.*
- *Between 10.00pm and 6.00am - the sound pressure level Loct10, in a full octave band with centre frequencies from 63 Hz to 2000 Hz must not exceed the background level, Loct90, by more than 8 dB in any octave band when measured at any affected premises.*

In the management of this noise the QLD liquor licensing authority sets the venues compliance limit (based upon a noise test) as a measured dB(C) noise level normally at 3m from the speakers. This limit then becomes part of the license conditions and must be managed by the venue. From over 25 years' experience we have found these limits to be reasonable and generally limit complaints. However we suggest that for outdoor music festivals with music focused in the 63 octave band, such noise would be better managed with the same limits using dB(C) for day time events.

7 CONCLUSION

From experience in the assessment of environments noise and as a result of changes in music systems we find that the use of dB(A) to set compliance limits at a noise sensitive location does not reflect the levels of audibility of the sound. A dB(A) assessment over corrects at the bass levels. We propose that for the assessment of noise from outdoor amplified entertainment venues that noise at noise sensitive receptor locations be assess as a rise above the background by using the dB(C) weighting scale. Such an approach also has applicability in the assessment of other low sound sources and warrants further research.

References:

Queensland Environment Protection Act 1994
Queensland Liquor Act
Office of Liquor and Gaming Regulation Queensland -