Background amplified audio levels and verbal communication in hospitality settings in the context of Scottish Government Covid-19 restrictions

Field test summary

19 November 2020

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Background amplified audio levels and verbal communication in hospitality settings in the context of Scottish Government Covid-19 restrictions

Executive summary

In partnership with the UK Acoustics Network (UKAN), KSG Acoustics has undertaken a series of field studies to investigate the effects of varying background audio levels on verbal communication in the context of Scottish Government Covid-19 restrictions applicable to hospitality settings.

This report has been prepared in response to statutory guidance published by the Scottish Government on 14 August 2020, which introduced measures to eliminate background music and audio in hospitality settings. In the context of other published studies, it aims to examine the effects of controlled low levels of background audio on the ability of groups of test subjects to verbally communicate without significantly raised vocal effort and within the constraints of current physical distancing requirements.

Amplified audio signals comprising open source 'speech babble' and pre-recorded music content were generated through in-house PA systems, and typical levels measured adjacent to a group of test subjects positioned 1m from each other at a table located closest to the PA loudspeakers. Each test comprised a timed two-minute period, during which test subjects were required to participate in a discussion around a range of pre-agreed subjects. After each test, subjects were asked to complete a set of subjective response questions before repeating the test at an increased audio signal volume.

The absolute and accurate measurement of speech intelligibility is complex, and this study does not pertain to reproduce it. The tests are, however, based on controlled listening conditions using in-house PA loudspeakers in real hospitality settings affected by the current restrictions.

The results of the field tests reflect the results of other relevant published studies and provide a clear indication that well-managed background amplified audio can be safely reintroduced to hospitality settings without increasing the risk of significantly increased vocal effort, or breaching physical distancing requirements.

1. Introduction

On 14 August 2020, the Scottish Government introduced statutory guidance in response to the ongoing Covid-19 pandemic. Applicable to all hospitality settings, the guidance requires:

no background music and televisions on mute and subtitled

The reason cited for the statutory guidance was to:

ensure every effort is made to reduce noise levels to a minimum in hospitality premises so people do not need to raise voices to be heard or get closer to others

The published guidance also notes however that:

noise control is a complex area with many variables, further work is required to understand how it can be managed safely and consistently across the sector so that it does not pose a risk. The Scottish Government will work with industry on this issue and it will be kept under review but a cautious approach is required at this time in the interest of public health.

This field tests described in this paper are designed to examine the hypothesis that controlled re-introduction of background audio in real hospitality settings does not significantly affect the ability of individuals to hear and be heard in sociable conversation, such that they may significantly raise their vocal effort, or breach current Scottish Government physical distancing guidelines.

This short paper summarises the methodology applied and results of these field tests. The results of the tests reflect the results of other relevant published studies, and provide a clear indication that well-managed background amplified audio can be safely reintroduced to hospitality settings without increasing the risk of significantly increased vocal effort, or breaching physical distancing requirements.

2. Scottish Government Covid-19 safe behaviours in hospitality settings

Maintenance of physical distancing in hospitality settings is a key Scottish Government Covid-19 safe behaviour. In its Tourism and Hospitality Sector guidance, the Scottish Government defines the requisite physical distancing in a hospitality setting as a minimum of 1 meter (1m) between those who are not from the same household or recognised 'bubble'. This only applies to groups of up to six customers from a maximum of two households seated at a table. Under these circumstances, they are also not required to wear face coverings.

The premise behind maintaining physical distancing between members of different households is to limit the potential for spread of Covid-19.

The Scottish Government justification for the current statutory guidance relating to elimination of background music and audio also makes reference to the raising of voices to be heard. No definition of *raised voices* is set out, however other Scottish Government Covid-19 guidance makes reference to amplified music and raised voices, for example:

- *…refraining from playing music or broadcasts that may encourage shouting, including if played at a volume that makes normal conversation difficult*[1]
- *Playing music at a volume that makes normal conversation difficult or that may encourage shouting*[2]
- *The projection of voices, including shouting*[3]

These descriptions, and the subjective responses of test subjects, have been used to inform appropriate level setting for the purposes of these field tests.

[1] Coronavirus (COVID-19): guidance for the performing arts and venues sector
[2] Coronavirus (COVID-19): protests and demonstrations
[3] Coronavirus (COVID-19) Phase 3: guidance for the safe use of places of worship

3. Methodology

This section sets out the methodology applied to the field studies described. For the purposes of this assessment, audio signals have been classified as audio **Level 1, Level 2, and Level 3**, reflecting increasing volume. It is important to recognise that these classifications apply only to the assessment of background audio (speech babble and background music) in this context. All audio signals used were subjectively representative of background sound at varying levels and these tests are not designed to assess events where amplified audio is a focus.

Eight hospitality settings in Glasgow city centre were selected in which to conduct field tests. Each setting is unique in aspects including, but not limited to capacity, room dimensions, room finishes, PA design, and preferred background music genre. A brief overview of each hospitality setting is included as Appendix A.

A cohort of 5 test subjects was recruited to undertake the tests. All test subjects were drawn from the Scottish audio engineering community and, although familiar with some of the venues, no participant had a personal interest in any of the hospitality venues in which tests took place. The audio background of the test subjects facilitated relevant observations about the PA design and functionality in each location, as well as the room acoustics of each space. Although often present during the testing, venue operators were not invited to participate in the tests to limit the potential for unconscious bias.

All test subjects were male and under 40 years of age. None reported significant impairment to hearing in either ear.

Venue operators were asked to identify a table within the space which experiences the highest levels of amplified sound from in-house PA. Typically, this was determined by proximity to loudspeakers. Groups of 3 or 4 test subjects were positioned around the table at a separation distance of least 1m from one another. No face coverings were applied per Scottish Government guidance.

An amplified audio signal comprising either speech babble representative of a busy hospitality setting, or typical background music of a genre selected by the venue operator was played through the house PA system. A calibrated type 1 01dB Duo sound level meter with audio capture enabled and mounted on a tripod circa 1.2m above local ground height facilitated

level setting of amplified sound representative of typical sound levels received by the group of test subjects. It was also used to gather quantitative A-weighted (broadband) and frequency specific data throughout each level setting exercise and each set of verbal communication tests.

Each test comprised a timed two-minute period, during which test subjects were required to participate in a discussion around a range of pre-agreed subjects. After each test, test subjects completed a questionnaire, the content of which is presented in section 4.

The sound pressure level of the amplified audio signal was then increased, and the test repeated after a short break. Speech babble signal tests were completed first, followed by background music.

In the first two hospitality settings, Level 1, Level 2 and Level 3 test data was gathered, however it was agreed that the low level (Level 1) had minimal impact on the ability to hear and be heard under test conditions. All subsequent field tests therefore progressed with two test levels, Level 2, and Level 3.

Charts presenting measured speech babble and background music signals during all tests are presented as Appendix B.

4. Survey questionnaire - summary of results

This section details the questions completed by test subjects on conclusion of each test, and the selection of available answers. Test subjects were also asked to volunteer any of their own observations. Each question has been assigned a reference number for ease of reporting. These reference numbers are used in the short form results presented later in this section.

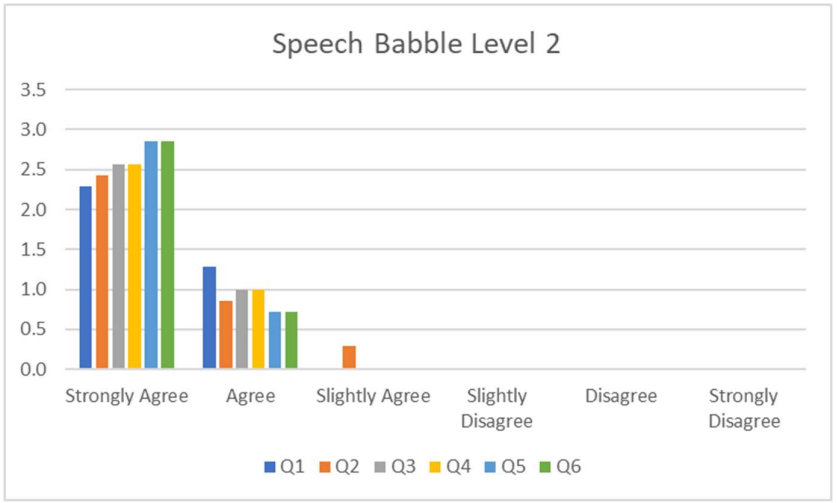
Reference	Question	Strongly agree	Agree	Slightly agree	Slightly disagree	Disagree	Strongly disagree
Q1	It was easy to hear other participants speech during the test.						
Q2	All conversation was clearly intelligible						
Q3	Other participants could hear my speech during test						
Q4	Other participants found my speech clearly intelligible						
Q5	It was easy to maintain physical distancing during the test						
Q6	Other participants were able to maintain physical distancing during the test						

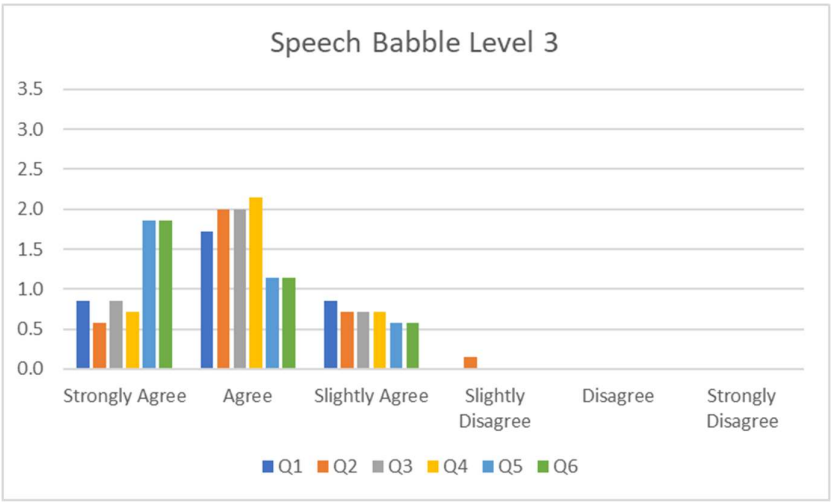
Reference	Question	Normal conversational level	Increased effort to loud voice	Increased effort to very loud voice	Shouting
Q7	During the test my vocal effort was				
Q8	During the test the vocal effort of other participants was				

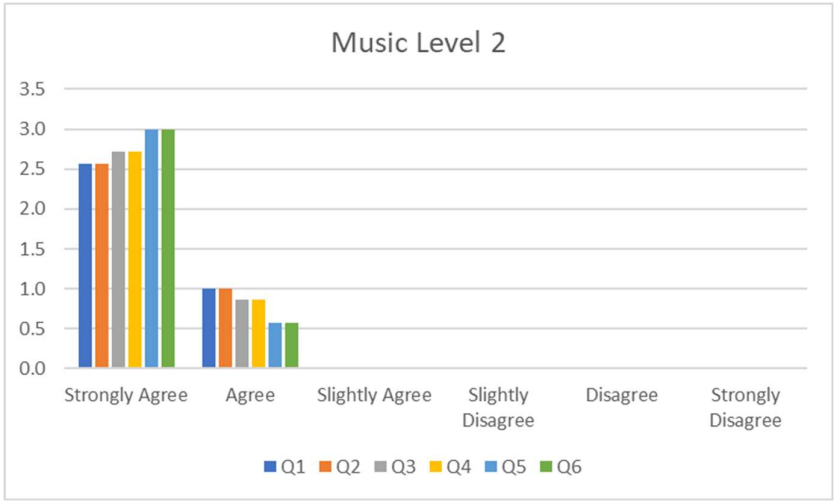
Reference	Question	I was able to hear / be heard at all times, while maintaining physical distancing	I could hear / be heard most of the time while maintaining physical distancing	I could hear / be heard some of the time while maintaining physical distancing	I could not hear / be heard while maintaining physical distancing
Q9	What best describes the relationship between your ability to hear / be heard and maintaining physical distancing during the test?				

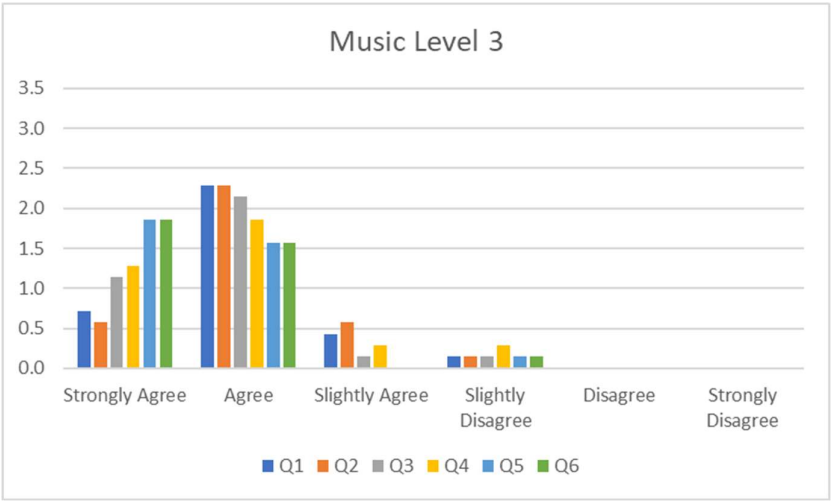
Reference	Question	Others were able to hear / be heard at all times, while maintaining physical distancing	Others could hear / be heard most of the time while maintaining physical distancing	Others could hear / be heard some of the time while maintaining physical distancing	Others could not hear / be heard while maintaining physical distancing
Q10	What was your impression of the ability of other participants to hear / be heard and maintain physical distancing during the test?				

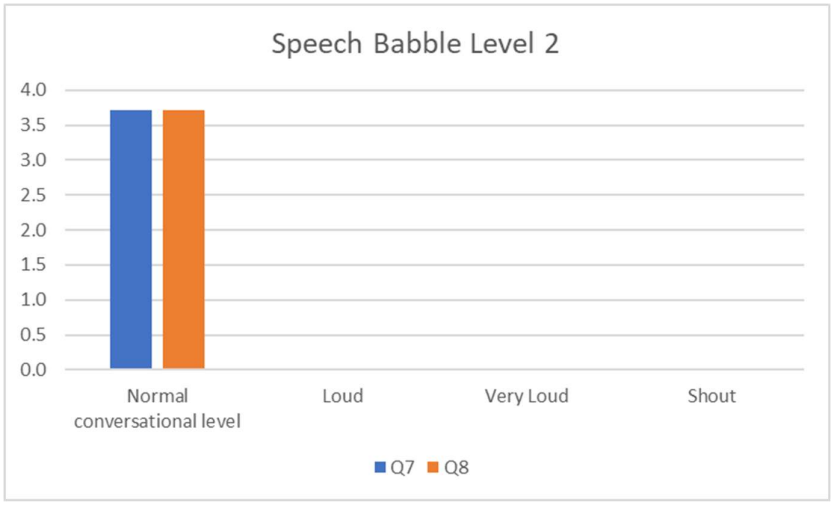
The following charts summarise the questionnaire responses, considered as mean values from all test subjects and across all eight hospitality venues.

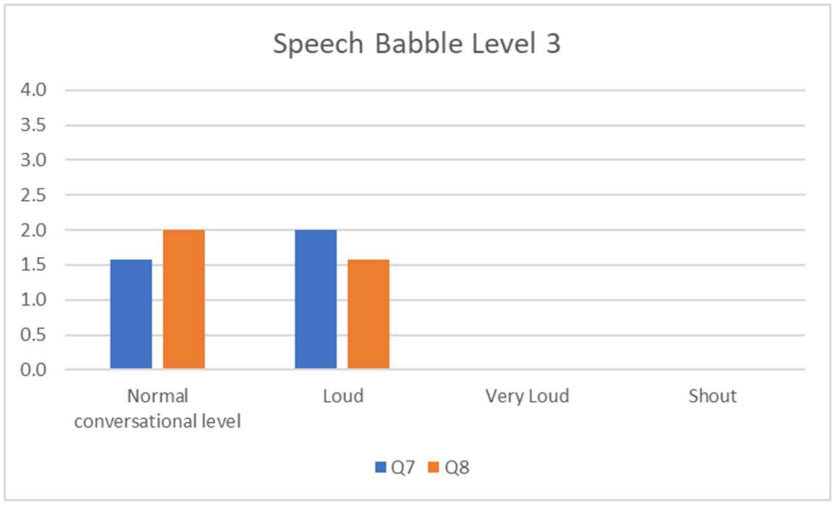

Speech Babble Level 2
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Strongly Agree
Agree
Slightly Agree
Slightly Disagree
Disagree
Strongly Disagree
Q1 Q2 Q3 Q4 Q5 Q6

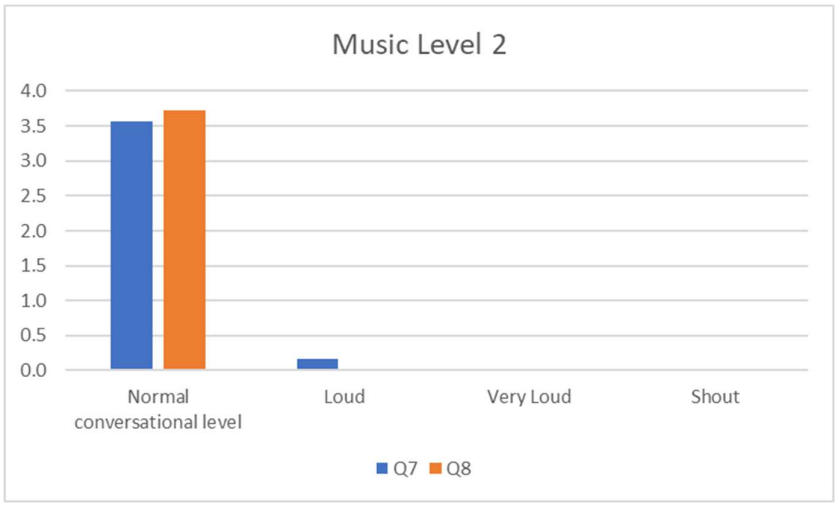

Speech Babble Level 3
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Strongly Agree
Agree
Slightly Agree
Slightly Disagree
Disagree
Strongly Disagree
Q1 Q2 Q3 Q4 Q5 Q6

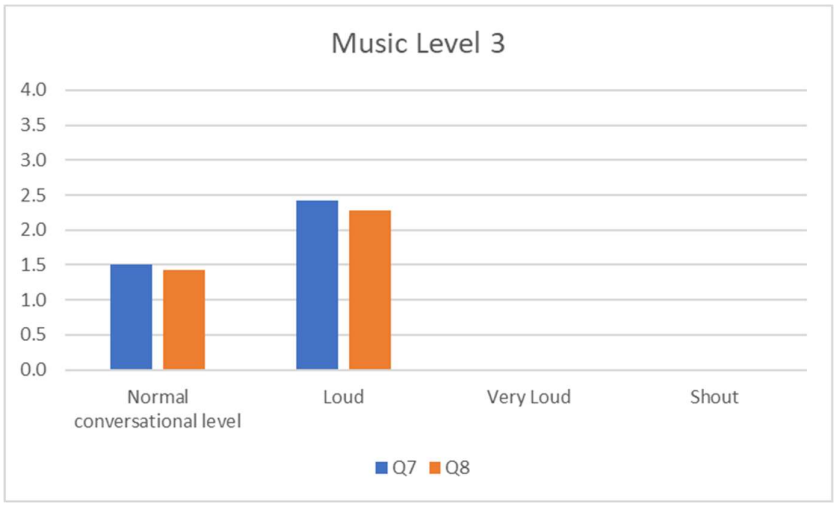

Music Level 2
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Strongly Agree
Agree
Slightly Agree
Slightly Disagree
Disagree
Strongly Disagree
Q1 Q2 Q3 Q4 Q5 Q6

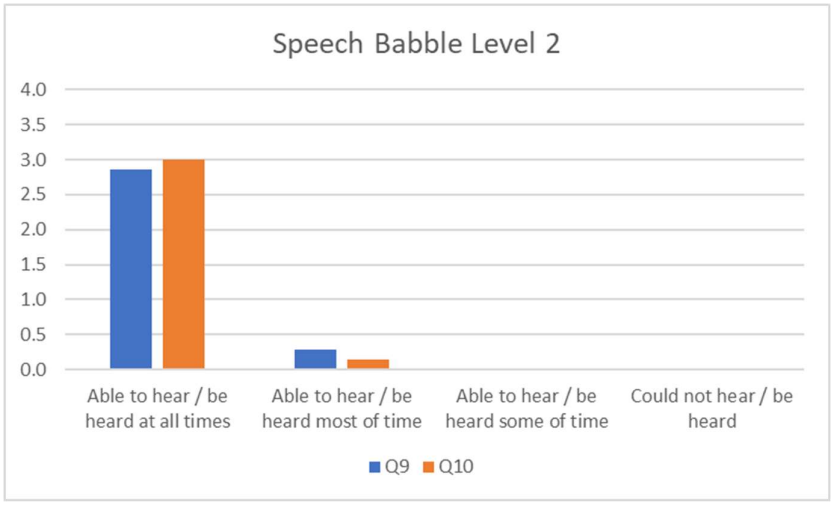

Music Level 3
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Strongly Agree
Agree
Slightly Agree
Slightly Disagree
Disagree
Strongly Disagree
Q1 Q2 Q3 Q4 Q5 Q6

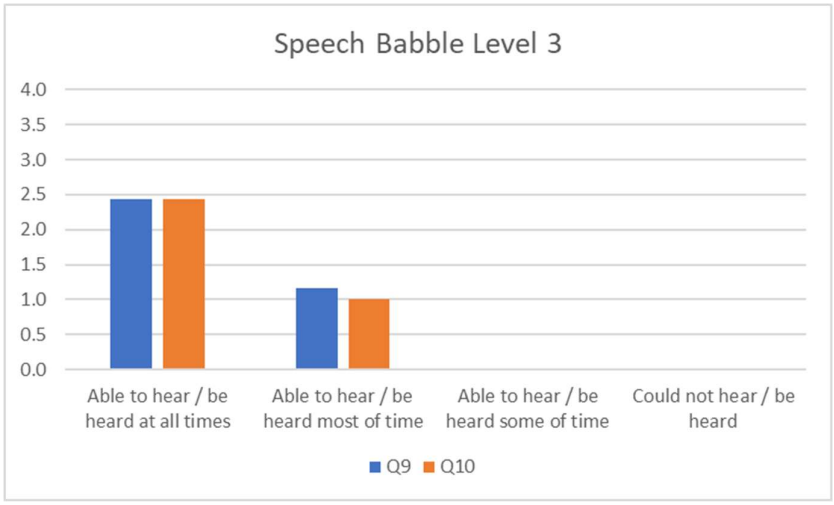

Speech Babble Level 2
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Normal conversational level
Loud
Very Loud
Shout
Q7
Q8

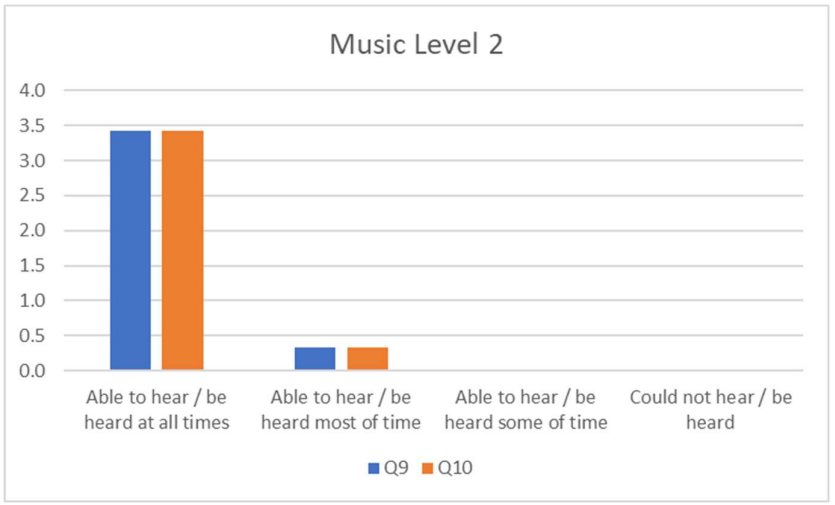

Speech Babble Level 3
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Normal conversational level
Loud
Very Loud
Shout
Q7
Q8

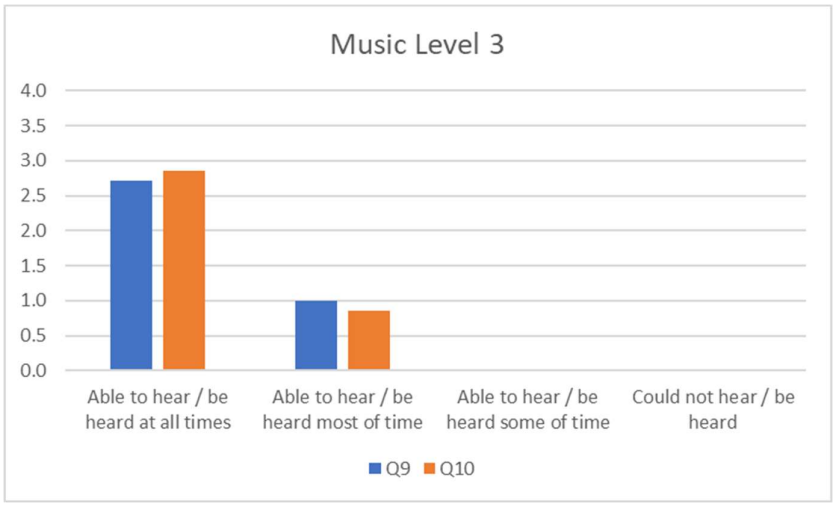

Music Level 2
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Normal conversational level
Loud
Very Loud
Shout
Q7
Q8


Music Level 3
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Normal conversational level
Loud
Very Loud
Shout
Q7
Q8


Speech Babble Level 2
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Able to hear / be heard at all times
Able to hear / be heard most of time
Able to hear / be heard some of time
Could not hear / be heard
Q9
Q10


Speech Babble Level 3
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Able to hear / be heard at all times
Able to hear / be heard most of time
Able to hear / be heard some of time
Could not hear / be heard
Q9
Q10


Music Level 2
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Able to hear / be heard at all times
Able to hear / be heard most of time
Able to hear / be heard some of time
Could not hear / be heard
Q9
Q10


Music Level 3
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Able to hear / be heard at all times
Able to hear / be heard most of time
Able to hear / be heard some of time
Could not hear / be heard
Q9
Q10

5. Discussion

The subjective responses provided by test subjects in the field studies confirm that the presence of background audio does not result in significantly increased vocal effort (very loud voice or shouting) at 1m separation from other test subjects.

This was the case in all hospitality venues assessed and at all test levels, regardless of background music selection, signal content and specific characteristics of the venue.

All test subjects considered that their own vocal effort, and those of other participants, did not progress beyond normal conversational level when the audio signal played was at Level 1 and 2, and did not progress beyond increased vocal effort to loud voice at Level 3. There was no perceived progression to very loud voice or shouting.

To put this study in the context of public health constraints and concerns, consideration has been given to particle emission rates and aerosol emission during speech, and its relationship to vocal effort.

Recent research indicates that the rate of particle emission during normal human speech is positively correlated with the loudness of vocalisation[4]. This key finding is reflected in the pre-publication results generated by the University of Bristol in their recent comprehensive PERFORM study[5], which confirms that aerosols and droplets generated by singing and speaking at the same sound pressure level are comparable, and concludes that a key public health consideration should be the volume at which vocalisation occurs, as well as venue capacity and ventilation.

Significantly increased vocal effort, which correlates with increased particle and aerosol emission, did not feature in the results from these field studies in any of the hospitality settings assessed. The field tests described have focused on comfortable levels for intelligible conversation, and test subjects have noted when background sound levels have started to interfere with their ability to hear and be heard effectively.

[4] Aerosol emission and superemission during human speech increase with voice loudness Asadi, S., Wexler A.S., Cappa, C.D., Barreda, S., Bouvier, N.M., Ristenpart, W.D. Nature (2019) 9:2348

[5] Comparing the respirable aerosol concentrations and particle size distributions generated by singing speaking and breathing Gregson F.K.A., Watson, N.A., Orton, C.M., Haddrell, A.E., McCarthy, L.P., Finnie, T.J.R., Gent, N., Donaldson, G.C., Shah, P.L., Calder, J.D., Bzdek, B.R., Costello, D., Reid, J.P. University of Bristol

The crucial factor in speech intelligibility is the signal to noise ratio. In context, this reflects the level at which speech (the signal) must be received at the listener's ear in relation to all other background sound (the noise). In general terms, signal to noise ratio of around +6dB allows for good listening conditions for intelligibility, however in a hospitality setting, this requirement is typically less. For listeners with hearing within 'normal' parameters, a signal to noise ratio of 0 to +3dB can be considered satisfactory[6]). This is likely to be because groups conversing together in a hospitality setting have full view of each other's faces and use other non-verbal cues, including facial expression and lip reading to improve understanding[7].

Current physical distancing requirements also extend to increased separation distance between tables; as previously noted, tables may only accommodate a maximum of six people from no more than two separate households, and each table must be a minimum of 2m from those around them. This has the beneficial effect for speech intelligibility of decreasing the contribution to the cumulative 'noise' at the listener's ear from those speaking at other tables. Limitations on capacity as a result of physical distancing measures also decreases the total number of people speaking in the room, which in turn has a positive effect on the signal to noise ratio.

Research into conversational speech levels and signal to noise ratio in realistic acoustic conditions[8], suggests that at 1m separation distance, signal to noise ratios can become negative at background sound levels of around 69dB. This finding correlates well with subjective responses and measured source levels from this field study (Appendix B), where average measured source levels were 68dB for Level 2 signals and 73dB for Level 3.

To further contextualise these results, the sound pressure level of speech at 1m in front of the mouth is typically accepted to be around 60dB for normal speech, 66dB for raised speech and 72dB for loud speech. Very loud speech, or significantly raised vocal effort, generates sound levels of around 78dB at 1m.[9] It can therefore be seen that, for speech levels that are less than significantly raised, background audio levels at which the signal to noise ratio would

[6] Restaurant acoustics – verbal communication in eating establishments Rindel, J.H. Acoustics in Practice (International e-Journal of the Euripean Acoustics Association (EAA)) Vol. 7 January 2019 No. 1
[7] Gaze and Gesture Activity in Communication Jokinen K., University of Finland
[8] Conversational speech levels and signal-to-noise ratio in realistic acoustic conditions Weisser, A., Buchholz, J.M. The Journal of the Acoustical Society of America
[9] ISO9921 Ergonomics – Assessment of speech communication Table A.1 Vocal effort of a male speaker and related A-weighted speech level (dB re 20µPa) at 1m in front of the mouth

become negative lie between Level 2 and Level 3 tests, which reflects the subjective test responses.

The Lombard effect is well documented as an involuntary response to conversing in a high noise environment. It causes the person speaking to increase their vocal effort in response to increasing noise, as well as implementing a range of other speech adaptations. Studies suggest that rising levels of speech frequencies is a significant trigger for the Lombard effect[10] inferring that it is less likely to occur as a result of increased levels of other auditory stimuli (eg background music).

It is likely, therefore, that removal of background music and audio will not necessarily have the linear effect of decreasing customer vocal effort.

Several of the hospitality venue operators interviewed during the field studies made anecdotal observations about customer behaviours where there is no background music or other amplified audio present. Behaviours included moving closer for privacy, raising voices to perceivably fill the silence, and even use of mobile phones or other devices to generate background music of their own. All of these behaviours are contrary to the aims of the Scottish Government removal of background music from hospitality settings.

In conclusion, these field studies reflect scientific evidence that well managed background music is unlikely to cause significantly increased vocal effort, or cause breach of current physical distancing requirements in hospitality settings. As such, reintroducing well managed background music and audio is unlikely to have an adverse effect on salient public health risks.

[10] Evidence that the Lombard effect of frequency specific in humans Stowe, L.M., Golob, E.J. The Journal of the Acoustical Society of America 2013 Jul 134(1):640-647

6. Conclusions

This report has been prepared in response to Covid-19 statutory guidance published by the Scottish Government, which introduced measures to eliminate background music and audio in hospitality settings. In the context of other published studies, it has examined the effects of controlled low levels of background audio on the ability of groups of test subjects to verbally communicate without significantly raised vocal effort and within the constraints of current physical distancing requirements.

Subjective responses from test subjects in the context of measured typical levels of amplified audio support the view that that well managed background audio can be safely re-introduced into hospitality settings, allowing sociable verbal conversation to occur without increasing the risk of significantly raised vocal effort or breaching of physical distancing requirements.

Appendix A: Hospitality setting overview

Thundercat, Miller Street

Thundercat is a subterranean space featuring American Diner style food offering and music. The ceiling is low and the PA is a distributed point source system. The space features a range of hard and soft surfaces and the acoustic is relatively dry (non-reflective).

The Admiral, Waterloo Street

The Admiral is a traditional bar with a focus on music, bar food offering and drinks. The bar and lounge have a mixture of soft and hard surfaces and the acoustic is subjectively dry (non-reflective). The PA system is a distributed point source system.

Spiritualist, Miller Street

Spiritualist is a modern cocktail bar and restaurant featuring spacious tables and booths. The ceiling is high and the PA is a distributed point source system with limited low frequency reproducibility. The space features a range of hard and soft surfaces and the acoustic is subjectively dry (non-reflective).

SWG3 Acid Bar, Eastvale Place

The Acid Bar at SWG3 features 'pop-up' residencies for established restaurants throughout the city, as well as music and drinks. The space comprises mainly hard surfaces with a vinyl floor covering; the acoustic is therefore subjectively live (reflective). The ceiling is low and the PA is a distributed point source system.

Bier Halle, Gordon Street

Bier Halle is a subterranean bar featuring music, beer and pizza. The ceiling is low and the PA is a distributed point source system. The acoustic is subjectively dry (non-reflective), owing to gabion-style boxes filled with mixed aggregate lining the walls and a mix of hard and soft surfaces.

Chinaskis, North Street

Chinaskis is a restaurant and bar, featuring a mixture of soft and hard surfaces. The ceiling is high and the PA is a point source system. The acoustic is relatively live (reflective). The location is close to the M8 motorway, and road traffic noise is intermittently audible.

The Garage, Sauchiehall Street

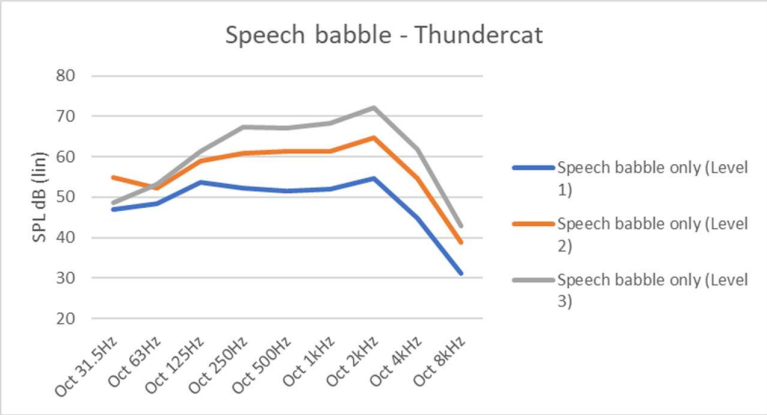
The Garage is a late night bar and Club. The main room is spacious and features a mezzanine, high ceiling and flown line array PA with a horizontal array of subs under the stage. There is a significant proportion of hard surfaces, resulting in a subjectively live (reflective) acoustic.

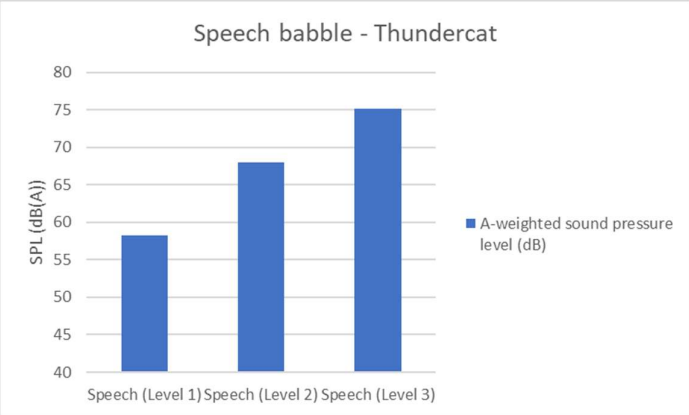
Club Tropicana, Renfield Street

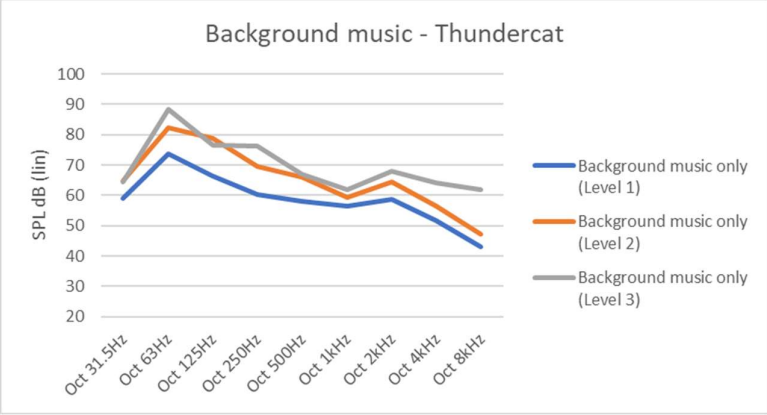
Club Tropicana is a late night bar and Club. It features a distributed PA around the dance floor with seating areas beyond. The room features a mix of hard and soft surfaces, resulting in a subjectively dry (non-reflective) acoustic.

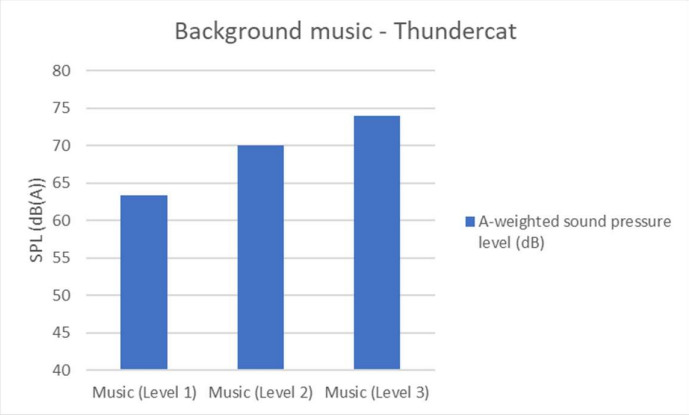
Appendix B: Measurement summary

Thundercat

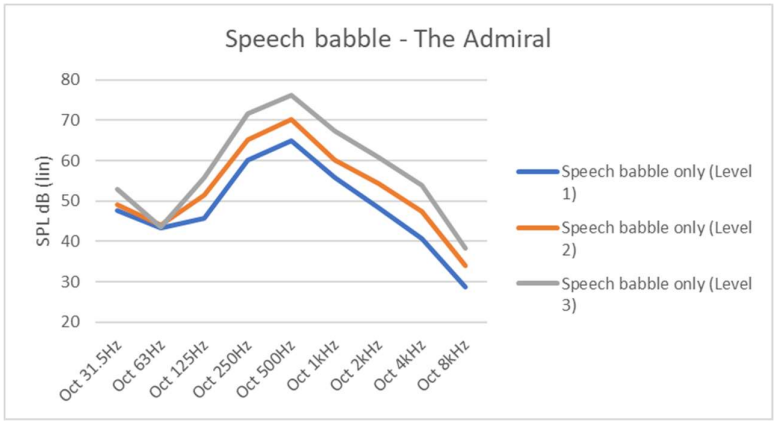


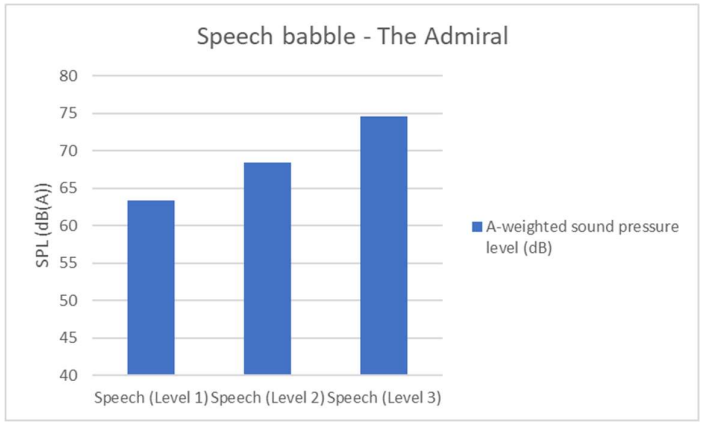


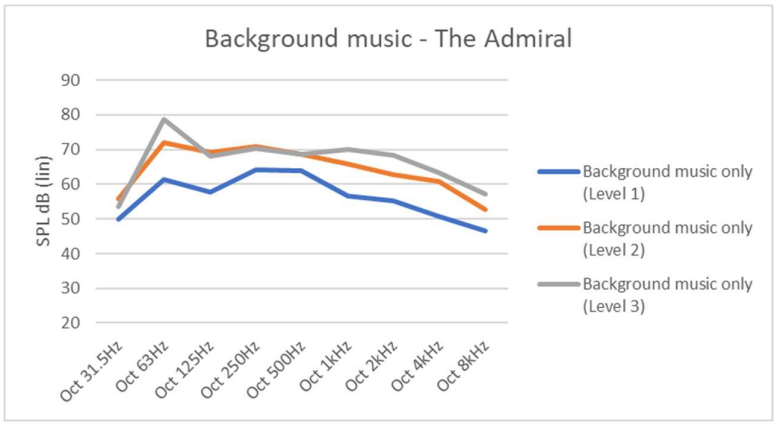


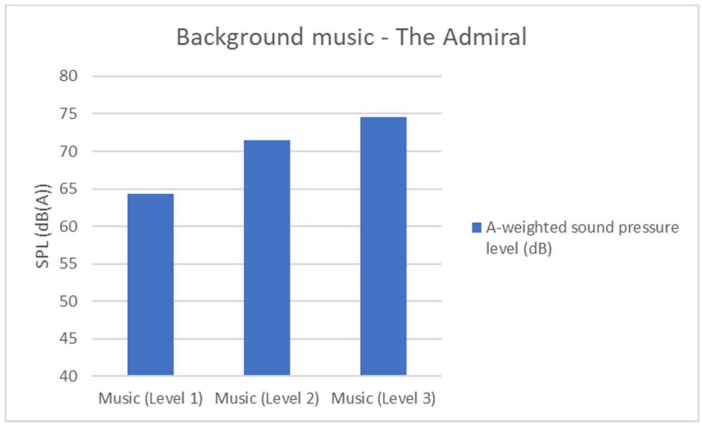


The Admiral

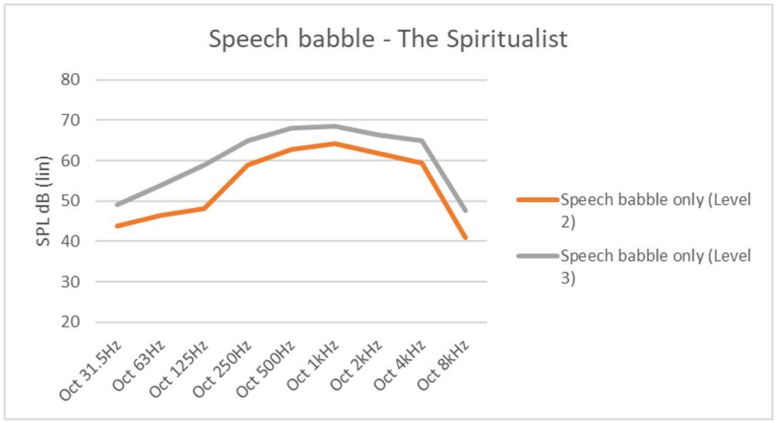

Speech babble - The Admiral
SPL dB (lin)
80
70
60
50
40
30
20
Oct 31.5Hz
Oct 63Hz
Oct 125Hz
Oct 250Hz
Oct 500Hz
Oct 1kHz
Oct 2kHz
Oct 4kHz
Oct 8kHz
Speech babble only (Level 1)
Speech babble only (Level 2)
Speech babble only (Level 3)

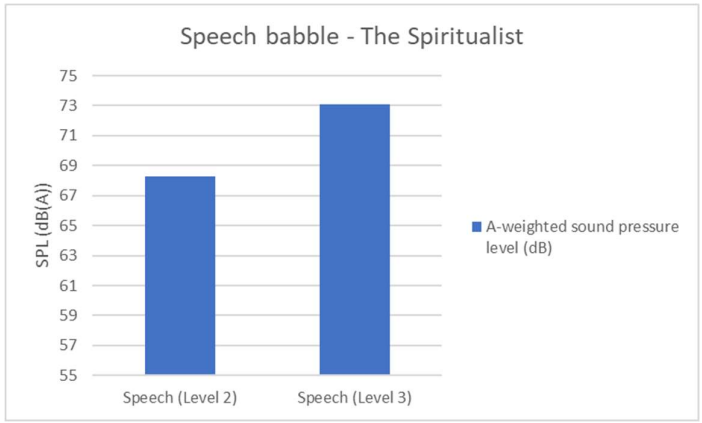

Speech babble - The Admiral
SPL (dB(A))
80
75
70
65
60
55
50
45
40
Speech (Level 1)
Speech (Level 2)
Speech (Level 3)
A-weighted sound pressure level (dB)

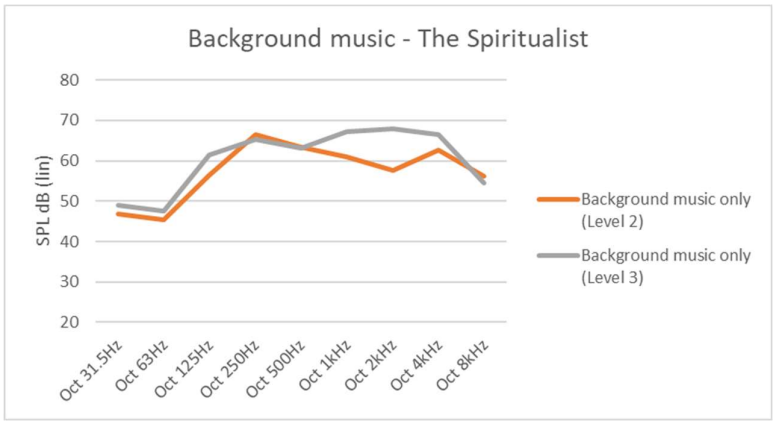

Background music - The Admiral
SPL dB (lin)
90
80
70
60
50
40
30
20
Oct 31.5Hz
Oct 63Hz
Oct 125Hz
Oct 250Hz
Oct 500Hz
Oct 1kHz
Oct 2kHz
Oct 4kHz
Oct 8kHz
Background music only (Level 1)
Background music only (Level 2)
Background music only (Level 3)

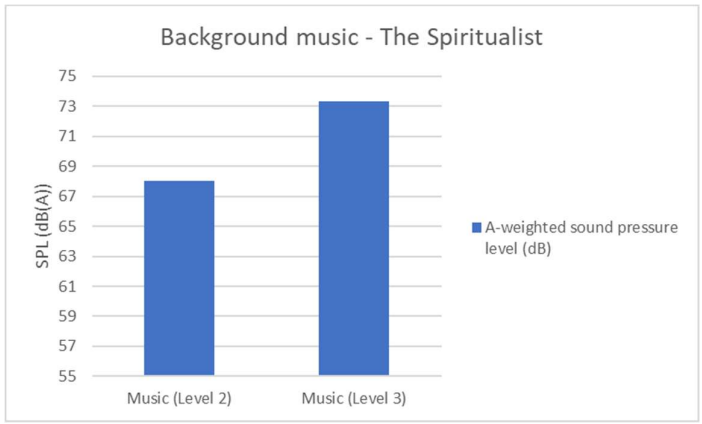

Background music - The Admiral
SPL (dB(A))
80
75
70
65
60
55
50
45
40
Music (Level 1)
Music (Level 2)
Music (Level 3)
A-weighted sound pressure level (dB)

The Spiritualist

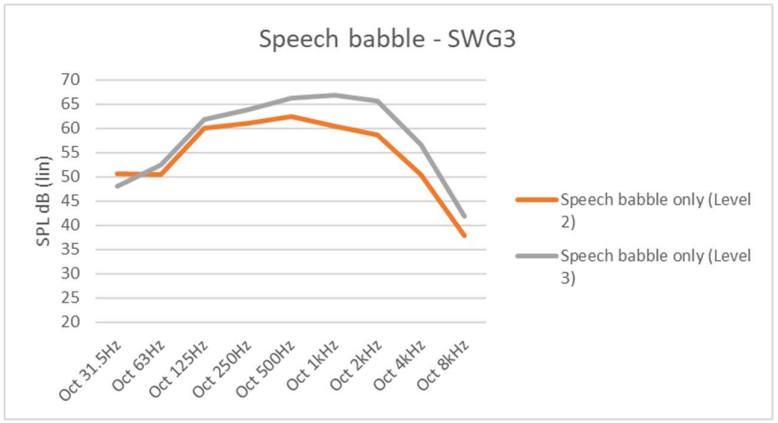


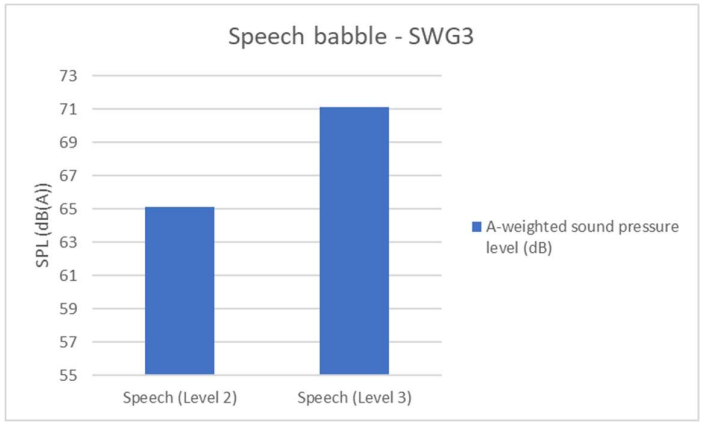


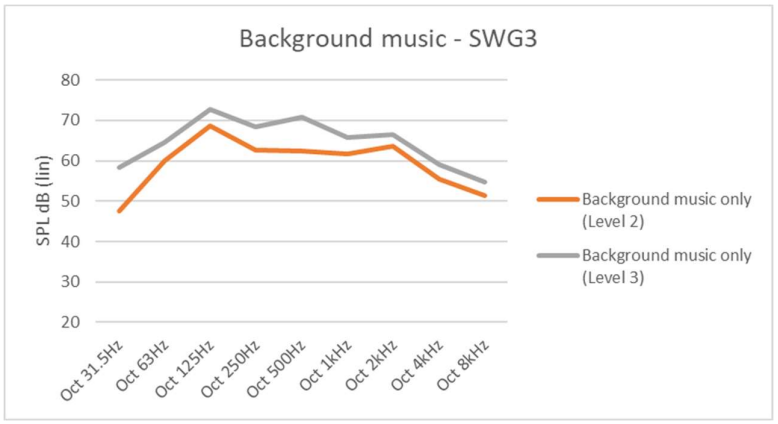


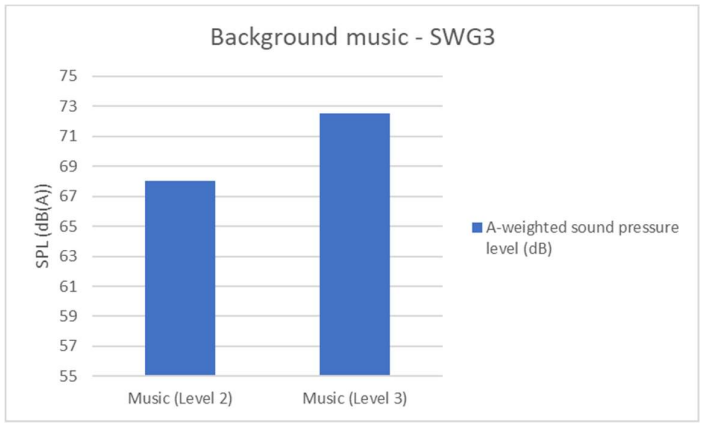


SWG3

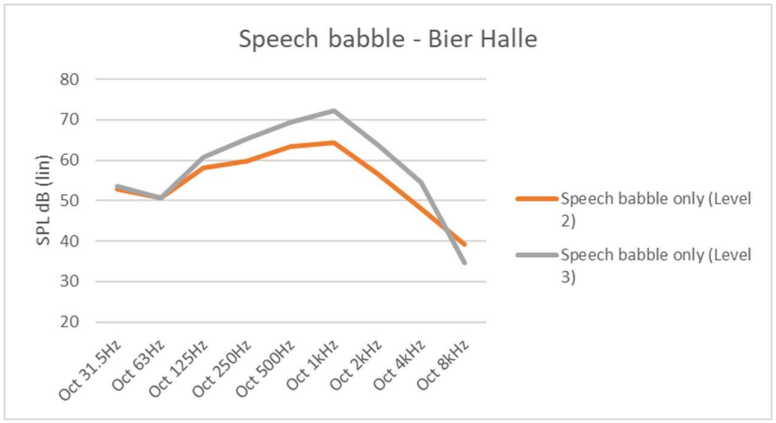

Speech babble - SWG3
SPL dB (lin)
70
65
60
55
50
45
40
35
30
25
20
Oct 31.5Hz
Oct 63Hz
Oct 125Hz
Oct 250Hz
Oct 500Hz
Oct 1kHz
Oct 2kHz
Oct 4kHz
Oct 8kHz
Speech babble only (Level 2)
Speech babble only (Level 3)

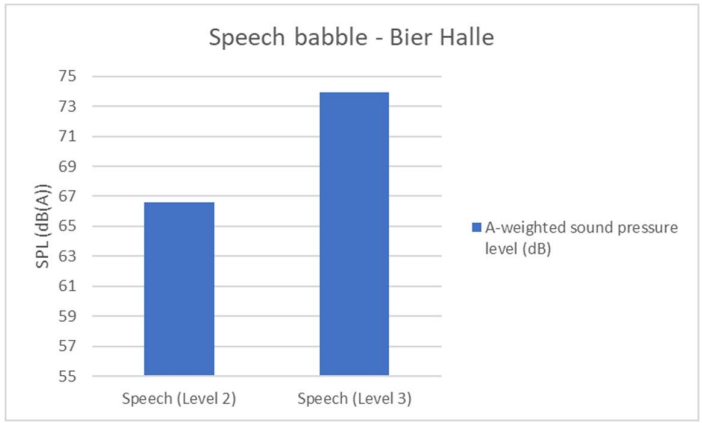

Speech babble - SWG3
SPL (dB(A))
73
71
69
67
65
63
61
59
57
55
Speech (Level 2)
Speech (Level 3)
A-weighted sound pressure level (dB)

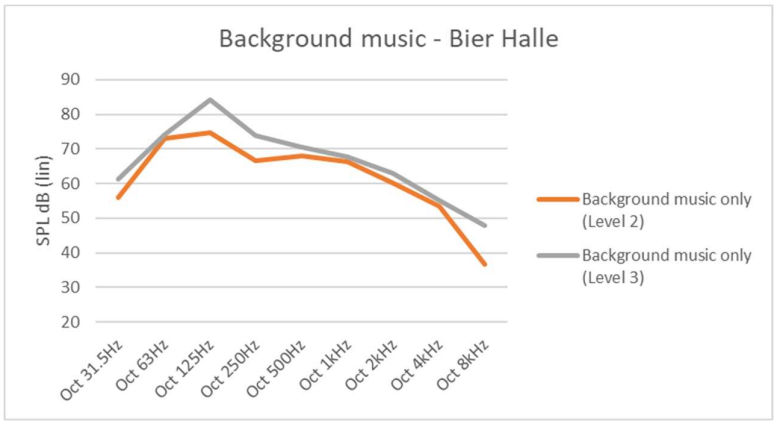

Background music - SWG3
SPL dB (lin)
80
70
60
50
40
30
20
Oct 31.5Hz
Oct 63Hz
Oct 125Hz
Oct 250Hz
Oct 500Hz
Oct 1kHz
Oct 2kHz
Oct 4kHz
Oct 8kHz
Background music only (Level 2)
Background music only (Level 3)

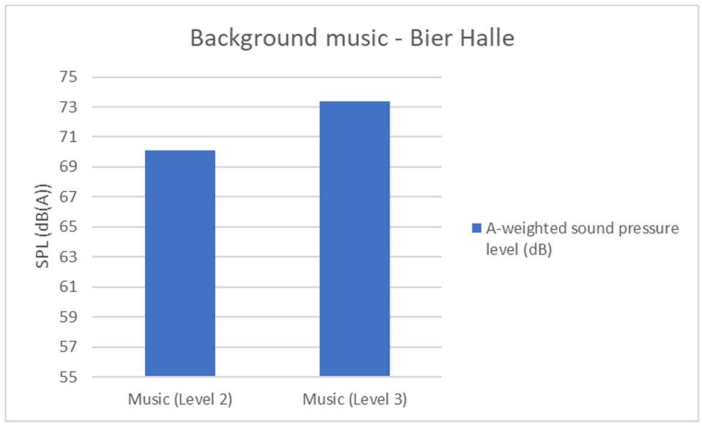

Background music - SWG3
SPL (dB(A))
75
73
71
69
67
65
63
61
59
57
55
Music (Level 2)
Music (Level 3)
A-weighted sound pressure level (dB)

Bier Halle

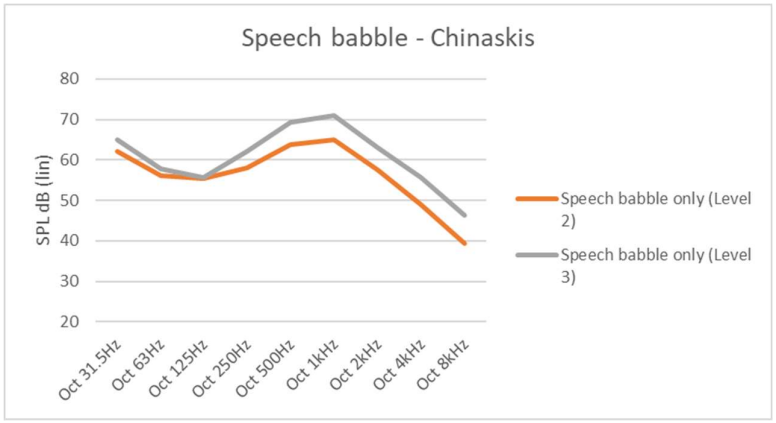

Speech babble - Bier Halle
SPL dB (lin)
80
70
60
50
40
30
20
Oct 31.5Hz
Oct 63Hz
Oct 125Hz
Oct 250Hz
Oct 500Hz
Oct 1kHz
Oct 2kHz
Oct 4kHz
Oct 8kHz
Speech babble only (Level 2)
Speech babble only (Level 3)

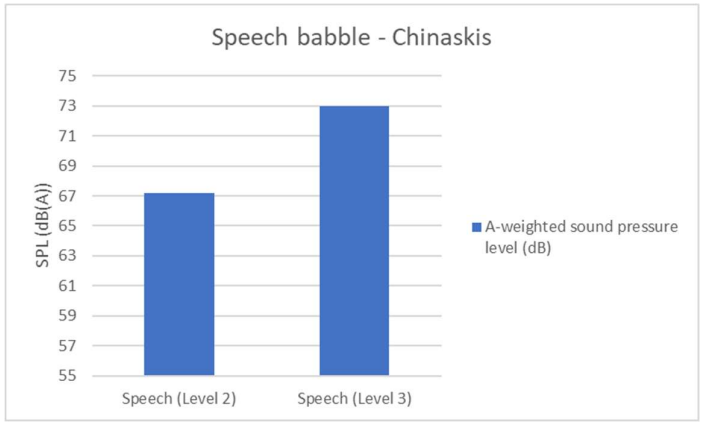

Speech babble - Bier Halle
SPL (dB(A))
75
73
71
69
67
65
63
61
59
57
55
Speech (Level 2)
Speech (Level 3)
A-weighted sound pressure level (dB)

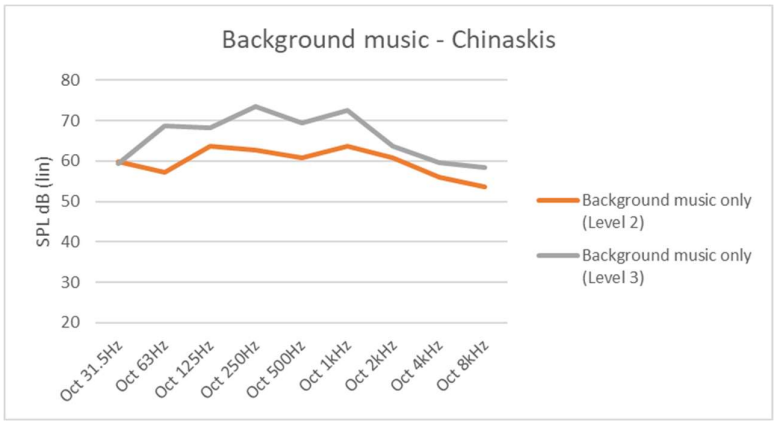

Background music - Bier Halle
SPL dB (lin)
90
80
70
60
50
40
30
20
Oct 31.5Hz
Oct 63Hz
Oct 125Hz
Oct 250Hz
Oct 500Hz
Oct 1kHz
Oct 2kHz
Oct 4kHz
Oct 8kHz
Background music only (Level 2)
Background music only (Level 3)

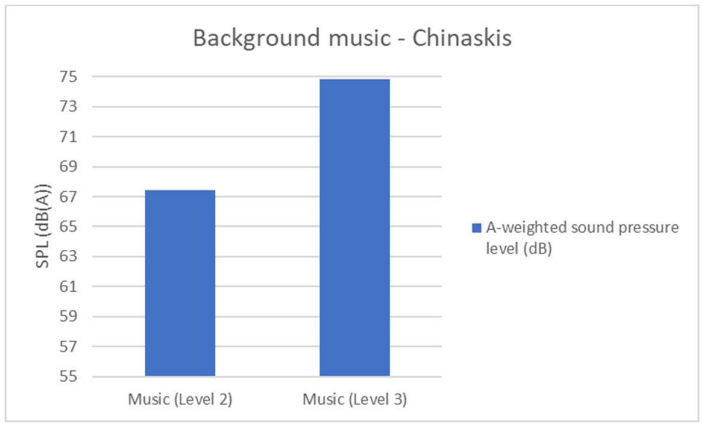

Background music - Bier Halle
SPL (dB(A))
75
73
71
69
67
65
63
61
59
57
55
Music (Level 2)
Music (Level 3)
A-weighted sound pressure level (dB)

Chinaskis

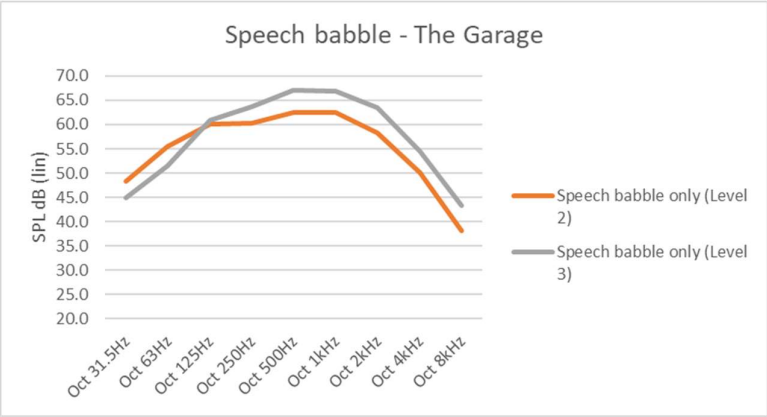

Speech babble - Chinaskis
SPL dB (lin)
80
70
60
50
40
30
20
Oct 31.5Hz
Oct 63Hz
Oct 125Hz
Oct 250Hz
Oct 500Hz
Oct 1kHz
Oct 2kHz
Oct 4kHz
Oct 8kHz
Speech babble only (Level 2)
Speech babble only (Level 3)

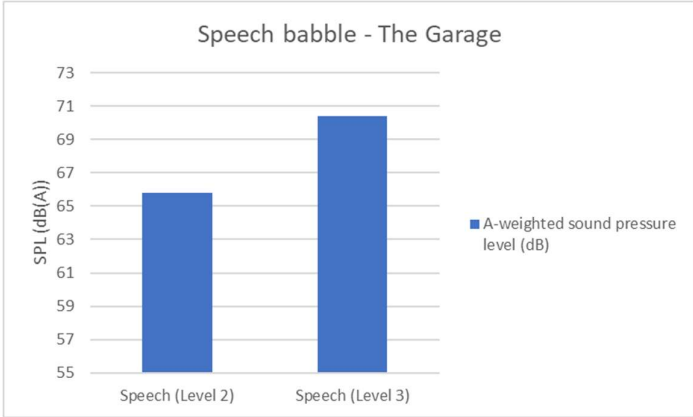

Speech babble - Chinaskis
SPL (dB(A))
75
73
71
69
67
65
63
61
59
57
55
Speech (Level 2)
Speech (Level 3)
A-weighted sound pressure level (dB)

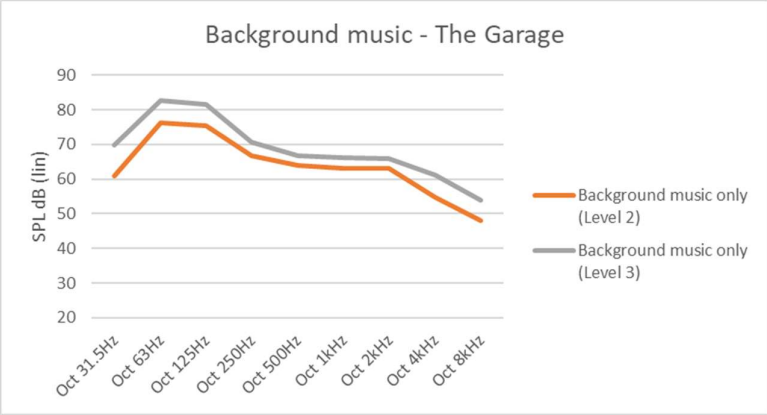

Background music - Chinaskis
SPL dB (lin)
80
70
60
50
40
30
20
Oct 31.5Hz
Oct 63Hz
Oct 125Hz
Oct 250Hz
Oct 500Hz
Oct 1kHz
Oct 2kHz
Oct 4kHz
Oct 8kHz
Background music only (Level 2)
Background music only (Level 3)

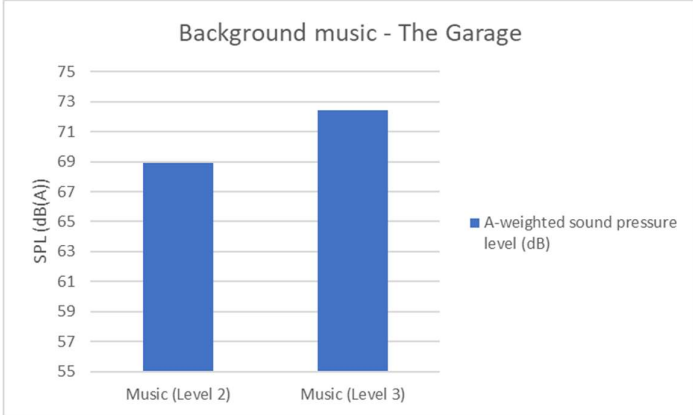

Background music - Chinaskis
SPL (dB(A))
75
73
71
69
67
65
63
61
59
57
55
Music (Level 2)
Music (Level 3)
A-weighted sound pressure level (dB)

The Garage

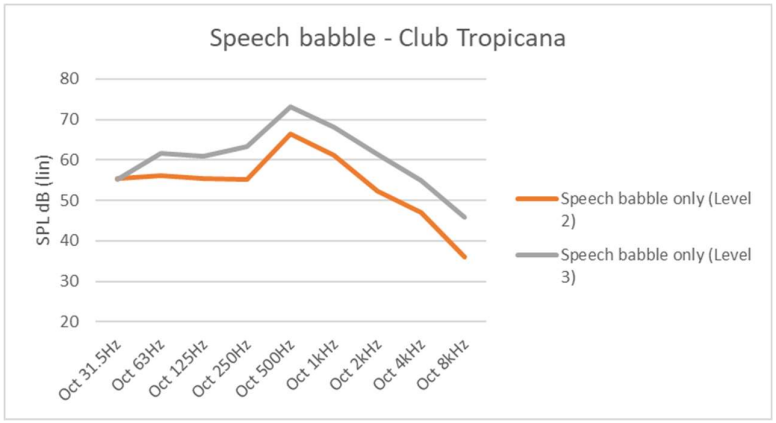

Speech babble - The Garage
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
SPL dB (lin)
Oct 31.5Hz
Oct 63Hz
Oct 125Hz
Oct 250Hz
Oct 500Hz
Oct 1kHz
Oct 2kHz
Oct 4kHz
Oct 8kHz
Speech babble only (Level 2)
Speech babble only (Level 3)

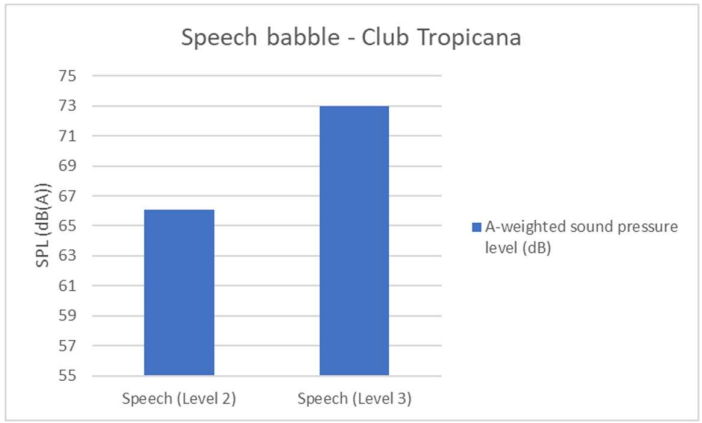

Speech babble - The Garage
73
71
69
67
65
63
61
59
57
55
SPL (dB(A))
Speech (Level 2)
Speech (Level 3)
A-weighted sound pressure level (dB)

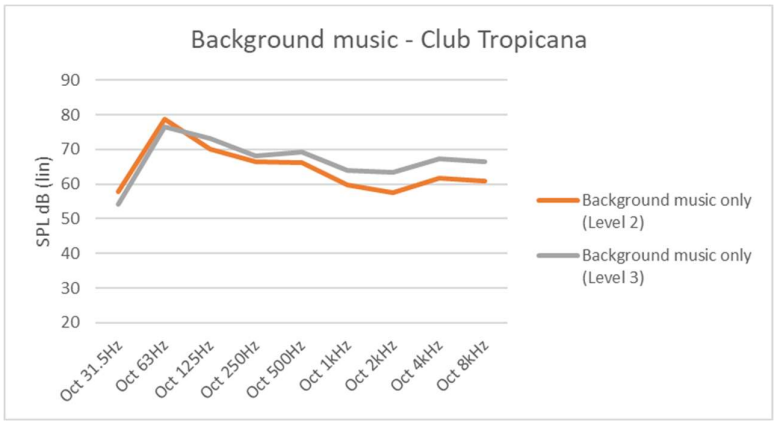

Background music - The Garage
90
80
70
60
50
40
30
20
SPL dB (lin)
Oct 31.5Hz
Oct 63Hz
Oct 125Hz
Oct 250Hz
Oct 500Hz
Oct 1kHz
Oct 2kHz
Oct 4kHz
Oct 8kHz
Background music only (Level 2)
Background music only (Level 3)

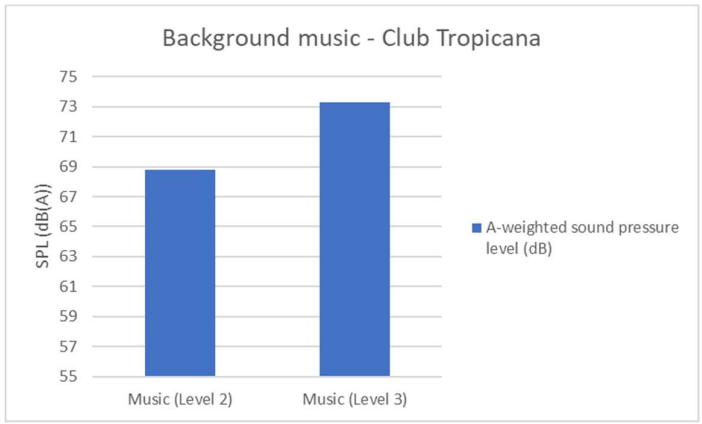

Background music - The Garage
75
73
71
69
67
65
63
61
59
57
55
SPL (dB(A))
Music (Level 2)
Music (Level 3)
A-weighted sound pressure level (dB)

Tropicana


Speech babble - Club Tropicana
SPL dB (lin)
80
70
60
50
40
30
20
Oct 31.5Hz
Oct 63Hz
Oct 125Hz
Oct 250Hz
Oct 500Hz
Oct 1kHz
Oct 2kHz
Oct 4kHz
Oct 8kHz
Speech babble only (Level 2)
Speech babble only (Level 3)


Speech babble - Club Tropicana
SPL (dB(A))
75
73
71
69
67
65
63
61
59
57
55
Speech (Level 2)
Speech (Level 3)
A-weighted sound pressure level (dB)


Background music - Club Tropicana
SPL dB (lin)
90
80
70
60
50
40
30
20
Oct 31.5Hz
Oct 63Hz
Oct 125Hz
Oct 250Hz
Oct 500Hz
Oct 1kHz
Oct 2kHz
Oct 4kHz
Oct 8kHz
Background music only (Level 2)
Background music only (Level 3)


Background music - Club Tropicana
SPL (dB(A))
75
73
71
69
67
65
63
61
59
57
55
Music (Level 2)
Music (Level 3)
A-weighted sound pressure level (dB)