Technical Note

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NOISE FROM OTHER PEOPLES' HEADSETS

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Noise leaking from under the headsets of personal stereo users is sometimes found annoying by those in the immediate vicinity and can be the subject of complaints. Measurements presented here demonstrate that the associated noise levels should be minimal in nature and not pose a significant source of difficulty for most people.

INTRODUCTION

As acousticians at some stage you will have no doubt been indignantly informed that many users of personal stereo players (PSPs) have the levels of their headphones set at extremely loud values. We are frequently told that this noise is not only damaging the hearing of the user of the PSP but also annoying others by disturbing their acoustic amenity. The National Acoustic Laboratories (NAL) recently had the opportunity to measure such 'leakage' noise from sixteen circumaural and supra-aural headsets.

METHOD AND RESULTS

Eight circumaural and eight supra-aural devices were assessed to provide an indication of typical levels that can be expected to be heard by adjacent listeners (i.e. leakage) and the insertion loss provided by the devices.

Circumaural devices sit on the side of the head and encompass the pinna as in the case of an ear-muff. Supra-aural devices sit on the surface of the pinna and thus provide less attenuation of background noise when compared to circumaural devices while allowing more of the signal to escape. Insertion loss and leakage measurements were taken using an acoustic test fixture (ATF) specified in ISO 4869-3: 2007 [1] (Figure 1). This insertion loss measurement is similar to the SLC_{80} but not equivalent.

To test device sound leakage the equivalent continuous A-weighted free-field sound pressure level output of the earphones was set to an LAeq of around 90 dB in accordance with the procedures outlined in AS/NZS 1269.1:2005 [2]. The actual signal input level for an output of 90 dB had previously been determined using a GRAS Ear and Cheek Simulator Type 43AG. The sound 'leaking' from under the devices was measured using a B&K C-Frame Portable Pulse 3560 spectrum analyser at a microphone distance of 300 mm. All noise sources used were pink noise and systems were calibrated appropriately.

Both leakage and insertion loss results are presented in Table 1. The ATF essentially acts as an 'artificial head' and for this exercise it was fitted with an artificial pinna to accommodate supra-aural devices.

Figure 1. Photo of the acoustic test fixture as per ISO 4869-3:2007 [1], showing mounting of the circumaural headset under test

Table 1. Summary of test results for insertion loss, and leakage at 300 mm referenced to an equivalent at ear L_{Aeq} of 90 dB free field

Device code	Type	Leakage @ 300 mm (L_{Aeq} ref = 90 dB)	Insertion loss (dB)
01BEA	Supra-aural	49	9.0
02BOS	Supra-aural	50	8.0
03BOW	Supra-aural	52	1.7
04FAN	Supra-aural	45	6.6
05GRA	Supra-aural	65	2.0
06HAR	Circumaural	31	12.0
07MON	Circumaural	41	9.1
08PHI	Supra-aural	43	9.5
09PIO	Supra-aural	39	8.5
10SEN	Circumaural	66	3.2
11SKU	Circumaural	42	6.6
12SMS	Circumaural	36	5.3
13SOL	Supra-aural	48	4.9
14SON	Circumaural	41	10.0
15ULT	Circumaural	41	14.8
XXSON	Circumaural	41	10.1

DISCUSSION

A summary of the test result statistics is presented in Table 2. As can be seen from the summary statistics the noise levels escaping from the above devices are not particularly significant in terms of hearing health. This does not mean that these levels may not cause some annoyance to adjacent individuals. In particular those levels at the higher end of the range, around 65 dB, may be noticeable in a very quiet environment. Most levels would be readily masked when travelling on public transport.

The reference value of 90 dB was selected as a worst case scenario and to ensure that equivalent measurements could be comparable for all devices. Previous studies show that typical L_{Aeq} values average around the 80 to 85 dB level, much less than the 90 dB selected [3,4]. It should also be noted that the measured insertion loss for the devices does not govern the attenuation of the leaking noise. The attenuation of the devices is comparatively low as would be expected as they are not intended to act as a conventional ear-muff. Typically circumaural devices provide greater attenuation but this is not generalisable as some circumaural devices are more acoustically transparent than others when that may be designed to permit the wearer to monitor their acoustic environmental.

The limitations of this study are that music tracks themselves were not used as the sources of the noise and that some individuals may, and do, select much higher noise levels when listening to their favourite music. However the results measured should give a reasonable order of magnitude of the levels to expect when PSPs are in use.

Unfortunately the testing only included circumaural and supra-aural devices but no in-ear devices, such as ear-buds or inserts. However even these limited results are interesting as they provide an indication of the maximum noise levels that can be expected to be heard by adjacent listeners particularly those travelling on public transport.

Table 2. Summary of device test descriptive statistics for insertion loss, and leakage at 300 mm referenced to an equivalent at ear L_{Aeq} of 90 dB free field

Device type	Average leakage @ 300 mm L_{Aeq} (rel) 90 dB at source (range)	Insertion loss dB (range)
All devices (16 devices)	45.5 (σ = 9.3) (65.7 - 31.3)	7.6 (σ = 3.6) (14.8 - 1.7)
Supra-aural devices (8 devices)	48.7 (σ = 7.6) (64.6 - 39.1)	6.3 (σ = 3.1) (9.0 - 1.7)
Circumaural devices (8 devices)	42.3 (σ = 10.1) (65.7 - 31.3)	8.9 (σ = 3.7) (14.8 - 3.2)

CONCLUSION

The leakage of sound from headset use associated with personal stereo players should have minimal impact on those in close proximity to the user. This cannot of course guarantee that some people will not be affected and chose to complain about the use of personal stereos and the noise they may produce.

REFERENCES

[1] International Organization for Standardization ISO 4869–3:2007, *Acoustics – Hearing protectors -, Part 3: Measurement of insertion loss of ear-muff type protectors using an acoustic test fixture*

[2] Australian/New Zealand Standard AS/NZS 1269.1: 2005, *Occupational noise management Part 1: Measurement and assessment of noise immission and exposure*

[3] W. Williams, "Trends in listening to personal stereos", *International Journal of Audiology* **48**(11), 784-788 (2009)

[4] C.D.F. Portnuff, B.J. Fligor and K.H. Arehart, "Teenage use of portable listening devices: A hazard to hearing?", *Journal of the American Academy of Audiology* **22**(10), 663-677 (2011)