The Psychoacoustic Check: A Preferred Method for Audiometric Room Quietness Certification in South African Occupational Health

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Abstract

This white paper advocates for the adoption of an Psychoacoustic Check as the preferred, scientifically robust, and practical method for verifying audiometric room quietness in South African occupational health settings. Traditional physical sound level measurements (e.g., SANS 10182) for room certification, particularly for mobile units, present significant cost, logistical, and functional limitations. Furthermore, recent problematic interpretations within standards, such as Note 1 in SANS 10083:2023 [1], introduce scientifically questionable and impractical barriers to effective audiometry. The proposed Psychoacoustic Check utilizes the audiometric results of the first two suitable individuals tested on a given day who achieve stringent, predefined hearing thresholds (critically ≤0 dBHL at 2000-4000 Hz, and ≤15 dBHL at 500, 1000, 6000, and 8000 Hz). Their qualifying audiograms serve as direct, functional evidence of room suitability. This method offers a more trusted, cost-effective, and convenient alternative, aligning with established biological calibration principles and international standards (e.g., ISO 8253-1), and is particularly advantageous for modern mobile audiometric technologies like the GeoAxon Kuduwave. This paper details the methodology, critiques existing challenges, and provides recommendations for its implementation, aiming to elevate the standard of hearing conservation programmes in South Africa.

1. Introduction: Addressing Deficiencies in Current Audiometric Room Verification

The integrity of occupational hearing conservation programmes (HCPs) in South Africa hinges on accurate audiometric testing for the early detection of Noise-Induced Hearing Loss (NIHL).[1] A critical prerequisite for such accuracy is a sufficiently quiet testing environment. Current practices predominantly rely on physical sound level measurements, as stipulated by standards like SANS 10182, for room certification.[1] However, this approach is fraught with practical and financial challenges, especially for mobile audiometric units.[1] Moreover, recent amendments to related standards, notably Note 1 of Section 15.1.2.3 in SANS 10083:2023 ("The measurement and assessment of occupational noise for hearing conservation purposes"), have introduced

scientifically flawed and operationally impractical requirements that threaten to impede, rather than support, effective audiometry.[1] This note, which implies that audiometric devices are unsuitable if their attenuation cannot be field-measured by end-users with basic equipment, misinterprets acoustic measurement principles and could effectively render most earphone-based audiometry non-compliant.[1]

This paper posits that the traditional paradigm for audiometric room certification is outdated and often inadequate. It proposes the Psychoacoustic Check as a scientifically sound, functionally superior, and economically viable alternative. This method, which leverages the verified hearing capabilities of routine patients, offers a direct and practical means of "self-certification," particularly aligning with the operational advantages of advanced mobile audiometric systems such as the GeoAxon Kuduwave.[3]

2. The Psychoacoustic Check: Methodology and Rationale

The Psychoacoustic Check is a functional verification method that uses the human auditory system as the definitive instrument for assessing whether an environment is sufficiently quiet for reliable audiometric screening.

2.1. Operational Definition

The procedure involves the following:

- **Test Subjects:** The audiometric results of the first two individuals tested on a given day (i.e., routine patients) whose hearing acuity meets the specified certification thresholds are utilized. This obviates the need for pre-selected, dedicated test subjects.[1]
- **Certification Thresholds:** For the room to be certified, both individuals must achieve the following air conduction hearing thresholds in both ears, as determined by a calibrated audiometer operated by a competent person:
  - 500 Hz: ≤15 dBHL
  - 1000 Hz: ≤15 dBHL
  - **2000 Hz:** ≤0 **dBHL**
  - **3000 Hz:** ≤0 **dBHL**
  - **4000 Hz:** ≤0 **dBHL**
  - 6000 Hz: ≤15 dBHL
  - 8000 Hz: ≤15 dBHL
- **Certification Criterion:** The room is deemed functionally quiet if the audiograms from these two individuals demonstrate achievement of all specified thresholds. These audiograms, duly signed by the competent person, constitute direct evidence for room certification.[1]

2.2. Scientific and Practical Rationale

The Psychoacoustic Check is predicated on several key principles:

- **Functional Relevance:** It directly answers the critical question: "Is this environment, with this specific audiometer and transducer combination, quiet enough to detect threshold-level sounds accurately?" If individuals can achieve the stringent 0 dBHL

thresholds at frequencies critical for NIHL detection (2-4 kHz) [1], it provides incontrovertible functional evidence of the room's suitability for STS testing, surpassing the inferential nature of isolated sound pressure level measurements.[5]

- **Alignment with Biological Calibration:** The method is an extension of established biological calibration principles, which are recognized in South African standards (e.g., SANS 10154-1, NER 2024 COP for Audiometry) for audiometer verification.[1] It also aligns with international standards like ISO 8253-1, which includes provisions for psychoacoustic environmental checks.[1]
- **Holistic System Assessment:** The check inherently evaluates the entire testing system: the ambient noise, the audiometer's performance, and the attenuation characteristics of the specific transducers used.[1] This is particularly important as different headsets offer varying degrees of sound attenuation.[1]
- **Enhanced Clinical Utility:** The inclusion of 0 dBHL thresholds at 2000, 3000, and 4000 Hz directly supports STS calculations and early NIHL detection. The addition of 500 Hz, 1000 Hz, 6000 Hz and 8000 Hz further enhances sensitivity to the earliest PLH changes.[1]
- **Cost-Effectiveness and Convenience:** By utilizing existing resources (staff, calibrated audiometer, routine patients), the Psychoacoustic Check eliminates the substantial direct and indirect costs associated with external SANS 10182 certifications.[1] Its on-demand nature is especially beneficial for mobile units, allowing for immediate post-relocation verification.[1]

3. Critique of Current Standards and Practices

The impetus for adopting the Psychoacoustic Check is amplified by the limitations of current standards and practices.

3.1. Limitations of SANS 10182 for Routine Verification

While SANS 10182 provides foundational MPASPLs, its reliance on physical measurements for routine certification presents:

- **Economic Burden:** Annual (or more frequent for mobile units) certifications by accredited specialists are costly and unnecessary.1
- **Logistical Complexity:** Scheduling and operational downtime waiting for accredited specialists add to the inconvenience.[1]
- **Functional Disconnect:** Measurements in an empty room may not fully represent the acoustic conditions during actual patient testing with specific equipment.[1]

3.2. The Detrimental Impact of SANS 10083:2023 Note 1

Note 1 of Section 15.1.2.3 in SANS 10083:2023, which implies that audiometric devices are unsuitable if their attenuation cannot be field-measured by users with basic sound level meters, is particularly problematic.[1] This clause is:

- **Scientifically Flawed:** It confuses laboratory-validated device attenuation (determined via methods like REAT or acoustic test fixtures) with impractical and inappropriate end-user field checks. An SLM cannot accurately measure headset attenuation in the field for any type of earphone, including standard supra-aural ones.[1]

- **Contradictory:** It conflicts with SANS 10182 (Section 4.1) and ISO 8253-1 (Section 11.2), both of which accommodate various earphone types and psychoacoustic verification methods.[1]
- **Impedes Progress:** It creates an arbitrary barrier to the use of all earphone-based audiometry and particularly disadvantages advanced, validated boothless technologies (like the Kuduwave [3]) that rely on documented, lab-verified attenuation data for MPANL calculations.[1]
- **Reduces Access and Quality:** By potentially invalidating widely used and innovative equipment, it could limit access to hearing tests, increase costs, and stifle improvements in hearing conservation.[1]

The Psychoacoustic Check offers a robust, scientifically sound method to ensure environmental suitability, effectively navigating the challenges posed by such flawed regulatory interpretations.

4. Implementation Protocol for the Psychoacoustic Check

Responsible implementation by a "competent person" (as defined by NER 2024 [1]) is crucial:

1. **Prerequisite:** Ensure the audiometer holds a valid SANS 10154-1 electro-acoustic calibration certificate and has passed daily biological/listening checks.[1]
2. **Subject Identification:** During routine audiometric testing, identify the first two patients whose audiograms meet all criteria outlined in Section 2.1. The competent person must verify the reliability of these audiograms.
3. **Documentation for Self-Certification:**
    - A standardized "Psychoacoustic Room Certification Form" (see Annexure A) should be used.
    - Attach the two complete, qualifying patient audiograms to this form.
    - The form must record: date/time of certification, room/vehicle identification, audiometer details (make, model, serial number, last calibration date), and patient identifiers (linked to their audiograms).
    - The competent person signs and dates the form, certifying the room's suitability.
    - This documentation serves as the official internal certificate of room quietness.
4. **Frequency:**
    - **Annual Self-Certification:** Minimum for maintaining a current certificate.
    - **Mobile Units:** After each relocation, prior to commencing patient testing.[1]
    - **Ad-hoc:** Weekly for enhanced QA, or if ambient noise conditions are suspected to have changed.
5. **Failure Protocol:** If two qualifying audiograms cannot be readily obtained, the environment is presumed too noisy. Further expenditure on physical certification is ill-advised until the noise issues are remediated (e.g., finding a quieter location, improving insulation).[1]

5. Addressing Potential Limitations

- **Subject Availability:** In populations with high hearing loss prevalence, identifying two subjects meeting the criteria might take time. However, the nuanced thresholds (allowing ≤15 dBHL at some frequencies) increase feasibility. Any delay is typically offset by the overall convenience.

- **Subjectivity:** The use of two subjects and the oversight of a competent person ensuring reliable patient responses mitigate this inherent aspect of audiometry.[1]
- **Scope:** The Psychoacoustic Check verifies the room's functional quietness; it does not replace audiometer calibration.[1]

6. Conclusion and Recommendations

The traditional approach to audiometric room certification in South Africa is economically and logistically burdensome and, in light of recent flawed standard interpretations like SANS 10083:2023 Note 1 [1], increasingly impractical. The Psychoacoustic Check offers a scientifically sound, functionally superior, and economically prudent alternative. It empowers occupational health professionals with a reliable method for self-certification, ensuring that testing environments are genuinely conducive to accurate audiometry.

This method is particularly advantageous for mobile audiometry, including advanced boothless systems like the GeoAxon Kuduwave [3], enabling compliant and high-quality hearing testing in diverse settings.

Recommendations:

1. **Adoption:** South African occupational health professionals are strongly encouraged to adopt the Psychoacoustic Check as the primary method for routine verification of audiometric room quietness.
2. **Standardization:** Develop and disseminate standardized SOPs and documentation templates for the Psychoacoustic Check, such as the example provided in Annexure A.
3. **Advocacy:** Professional bodies (e.g., SASOHN, SASOM) should advocate for the formal recognition of the Psychoacoustic Check and for the urgent revision or removal of scientifically unsound clauses like Note 1 in SANS 10083:2023 to align with established scientific principles and international best practices.[1]

By embracing the Psychoacoustic Check, the South African occupational health community can significantly enhance the accessibility, reliability, and cost-effectiveness of its hearing conservation programmes, ultimately better protecting the nation's workforce.

References

1. Department of Employment and Labour. Noise Exposure Regulations, 2024, and Code of Practice for Audiometry. As cited in various SANS documents and occupational health guidelines.[1]
2. South African National Standard SANS 10182:2006. The measurement and assessment of acoustic environments for audiometric tests. Pretoria: SABS Standards Division.[1]
3. South African National Standard SANS 10083:2023. The measurement and assessment of occupational noise for hearing conservation purposes. Pretoria: SABS Standards Division.[1]
4. International Organization for Standardization. ISO 8253-1:2010. Acoustics -- Audiometric test methods -- Part 1: Pure-tone air and bone conduction audiometry. Geneva: ISO.[1]
5. Koekemoer, H.L. (2025, June 10). *A Scientific Critique of SANS 10083:2023 Section 15.1.2.3 Note 1: Rectifying an Impediment to Advanced Hearing Conservation Practices*. GeoAxon.[1]

Annexure A: Psychoacoustic Room Certification Form

This form is intended as an example for documenting the Psychoacoustic Check for audiometric room quietness verification.

Psychoacoustic Room Quietness Certificate	
Facility & Room Information	
Facility Name:	
Room Identifier/Name:	
Location (e.g., Building, Floor, Mobile Unit ID & Current Site Address):	
Date of Certification:	
Intended Audiometric Tests:	PLH and STS
Psychoacoustic Check Protocol & Criteria	
Reference Standard for Psychoacoustic Check Methodology: ● "The Psychoacoustic Check: A Preferred Method for Audiometric Room Quietness Verification in South African Occupational Health" (GeoAxon 2025, www.geoaxon.com) ● Underlying Principles are Based On SANS 10182, ISO 8253-1, NER 2024 COP for Audiometry	
Audiometer headset Used:	Kuduwave Ambidome
Test Subject Verification	

Name and surname File number	500 Hz (≤15 dB HL)	1000 Hz (≤15 dB HL)	2000 Hz (≤0 dB HL)	3000 Hz (≤0 dB HL)	4000 Hz (≤0 dB HL)	6000 Hz (≤0 dB HL)	8000 Hz (≤15 dB HL)	Passed/ Failed
1								
2								

Certification Statement & Sign-off	
Based on the successful achievement of the specified hearing thresholds by both test subjects, this audiometric testing environment is hereby certified as functionally quiet and suitable for the intended audiometric tests for a period of one year from the date of certification, or until significant changes in ambient noise conditions occur, or until the next scheduled check for mobile units post-relocation. The qualifying audiograms for both subjects are attached or referenced herein.	
Certified By (Competent Person Name & Surname):	
Professional Registration/Qualification (e.g., Audiologist, OHA Screener Cert. No.):	
Signature:	
Date:	