HearingScan-Pro

User Manual

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HearingScan-Pro

Please read this manual carefully before using the software. Be aware that high volumes can be generated which could be harmful after exposure.

ⓘ What is HearingScan Pro

HearingScan Pro:

For healthcare providers and individuals interested in monitoring their hearing health, HearingScan Pro is the top choice for precise and dependable hearing evaluation. This advanced application raises the bar in hearing assessments, outperforming standard professional devices used by audiologists. With its accuracy and ease of use, HearingScan Pro enables healthcare professionals to offer outstanding service and support to their patients.

Unmatched Accuracy and Compliance

HearingScan Pro adheres to stringent professional standards, including strict ANSI S3.6-2018, ANSI S 3.6-2010, ANSI S1.42-2001, ISO 389-7:2005 and AAO-HNS 2020, guaranteeing that the displayed values meet medical benchmarks. This level of accuracy is critical for identifying and addressing a range of hearing issues, from common conditions to complex disorders like Ménière's disease. The app's ability to display average pure tone loss and the speech banana facilitates early detection and tailored treatment plans. Moreover, the comprehensive Pure Tone Audiometry assessment covers frequencies from 125Hz to 8000Hz with an impressive accuracy

of up to ±0.1dB, making HearingScan Pro an indispensable tool for healthcare professionals.

Streamlined Monitoring and Analysis

HearingScan Pro offers healthcare professionals a quick and efficient solution for monitoring patients' hearing health. With rapid calibration and the ability to conduct a full-spectrum audiometry measurement in minutes, professionals can easily track changes in patients' hearing over time. The app's wide range of dB HL levels tested, from 0 to 120 in 5 dB increments, ensures comprehensive and accurate results. By utilizing HearingScan Pro, healthcare providers can proactively address potential hearing issues and tailor treatment plans to meet their patients' needs effectively.

Elevate Your Practice with HearingScan Pro

- "Professional-Grade Precision": Exceeds industry standards for accuracy and compliance.

- "Efficiency and Convenience": Streamlines the testing process for quick and reliable results.

- "Enhanced Patient Care": Enables early detection and personalized treatment strategies.

- Seamless Integration": Compatible with professional equipment for optimal testing conditions.

- "Trusted by Professionals": Recommended by healthcare providers for its reliability and accuracy.

ⓘ Platform & License

HearingScan-Pro can be purchased from the App Store. One purchase give the user the right to use it on all suitable platforms. At this moment the license is a Perpetual license meaning that all updates are included in the price.

This version of HearingScan-Pro can be used on most of your Apple devices such as Mac and iOs platforms. Platforms with a large screen, such as MacBook (Pro) and iPad (Pro) are recommended. Although the app does run on smaller devices such as iPhone it is good to understand that the small screen size make the readability of the graphs difficult. The export of the measurement is the same on all devices. So a measurement in the field can be done with an iPhone or iPad and the printout is the same.

Although there is no difference in functionality between platforms we created a table for intended use.
✓= Suitable
×= Not properly displayed due to small screen size

Function	Mac	iPad (Pro)	iPhone
Pure Tone Audiogram (PTA)	✓	✓	✓
Calibration	✓	✓	✓
Masking Sound	✓	✓	✓
Average PTA Level	✓	✓	✓
Average PTA Level (500Hz, 1000Hz and 2000Hz)	✓	✓	✓
Hearing Loss Category	✓	✓	✓
Speech Banana	✓	✓	✓
Patient details	✓	✓	✓
Key Board Control	✓	×	×
Full Graph of measurement	✓	✓	✓
Technical Support by mail	✓	✓	✓

ⓘ Intended User Groups

HearingScan Pro is an advanced software designed to evaluate hearing ability with professional precision. Tailored for use by General Practitioners (GPs), hearing care professionals such as ENT's, audiologists and institutions conducting collective company hearing tests, HearingScan Pro also serves well in home, hospital, education, corporal or care home settings where rapid but accurate assessments need to be made.

ⓘ Key Features and Benefits:

Professional Quality Audiometry Tool

- **High Precision**: HearingScan Pro provides professional-grade audiometry, making it a reliable alternative to conventional audiometric equipment.
- **Calibration**: It is the only software tool that can be fully calibrated, setting it apart from typical consumer tests. This ensures accuracy and reliability in various environments.

Versatile and Affordable

- **Platform Compatibility**: The software runs seamlessly on almost all Apple devices, including iPhones, iPads, and Mac computers, providing a cost-effective solution compared to traditional audiometric devices.

- **Portability**: Its portability makes it ideal for field assessments, allowing hearing care professionals to conduct tests in diverse settings, including on-site company assessments, home visits, and remote locations.

ⓘ Professional Standards Compliance

HearingScan-Pro is developed around the requirements for hardware meters and offer the same or better quality performance. To comply with professionals we used the following compliances:

- **Medical Compliance**: HearingScan Pro comply to ANSI and ISO standards for hearing test equipment, ensuring that the equipment's performance is up to par with industry benchmarks.
- **AAO-HNS 2020 Compliance**: It also adheres to the standards set by the American Academy of Otolaryngology–Head and Neck Surgery (AAO-HNS) for 2020, guaranteeing that the displayed values meet stringent medical criteria.

This makes it ideal for Various Settings:

- **General Practitioners (GPs)**: Enables GPs to perform accurate hearing assessments in their clinics without the need for bulky and expensive traditional equipment.
- **Hearing Care Professionals**: Offers a high level of detail and accuracy necessary for professional audiologists.
- **Corporate Hearing Tests**: Perfect for conducting collective hearing tests in factories, workplaces, schools, ensuring employee and student health and safety.
- **Home Use**: Families can monitor their hearing health conveniently with professional accuracy.
- **Hospitals and Care Homes**: Facilitates hearing assessments in hospitals and care homes, improving patient care and accessibility to audiometric testing.

Conclusion

HearingScan Pro combines affordability, portability, and professional-grade accuracy, making it an indispensable tool for a

wide range of users, from healthcare professionals to organizations and individuals. Its compliance with industry standards ensures that users receive reliable and precise hearing assessments every time.

Required hardware

HearingScan-Pro requires additional hardware. The quality of this hardware can improve the quality and accuracy of the measurement tremendously. Select your hardware wise so that it fits the requirements for your specific use. Here an overview of the required hardware:

Headphones

It is best to use a high-quality pair of closed-back headphones with padded ear

cushions that fully cover the ears. Verify that the headphones offer a flat response range of at least 125Hz to 8000Hz and can produce 120 dB. Small deviations are okay since they will be removed during calibration (more details about the point can be found under Chapter Calibration, step 7) Also check if they are capable of playing the required volume without distortion. HearingScan Pro is compatible with both wired and wireless headphones. Noise-canceling headphones are not always sufficient; therefore, it is advisable to opt for other features. Confirm that the headphones are suitable for use with Apple products. If the impedance of the headphones is not in line with your hardware an additional headphone amplifier is required.

- Ear but style of headphones do work but are more challenging to calibrate and use in professional settings.
- Measuring over hearing aids is possible too as long as you can connect to them by bluetooth. This way you can check the current hearing. ⚠ This method is difficult to calibrate and not recommended for official hearing assessments!
- Bone conducting headphones present a suitable alternative for supplementary testing; however, they are not specifically covered in this context, as the testing procedure mirrors that of standard headphones. To calibrate bone conduction headphones, start by calibrating your standard headphones and then achieve an audible match by wearing the standard headphone on one side and positioning the bone conduction device near the opposite ear. This approach allows for the bone conduction output to be matched within a tolerance of 3 dB.

Headphone amplifier (optional)

Certain headphones can present a challenging load for your equipment, which may result in less-than-ideal audio response. This issue can be mitigated by incorporating an additional headphone amplifier. To assess whether the headphones deliver a flat response, always fine tune in the calibration panel. A flat response will be indicated by consistent sound pressure levels across all PTA volumes and frequencies.

dB meter (required for calibration)

Acquire a decibel meter, also known as a sound pressure meter, capable of measuring frequencies between 125Hz and 8000Hz. For enhanced accuracy, choose a hardware meter that includes a calibration certificate. Consider selecting a meter equipped with a test tone generator for self-recalibration or arrange for periodic recalibration with the supplier. Ensure the meter measures in dBA, as HearingScan Pro can automatically convert to dB HL.

Although software meters can be downloaded from the App Store, they generally provide lower accuracy compared to hardware meters. The calibration accuracy enhances the precision of measurements obtained with HearingScan Pro.

Summary:
The meter should have the following capabilities:
• Measures on the dBA scale
• Flat response from at least 125Hz to 8000Hz
• Fast response time is advisable
• Units that include a calibration unit are preferred
• Units that provide a calibration report are optimal
• Ensure the microphone can be positioned within the headphone

The quality of the decibel meter is paramount for measurement accuracy, with HearingScan Pro achieving precision of up to 0,1dB.

Soundproof Booth (optional)

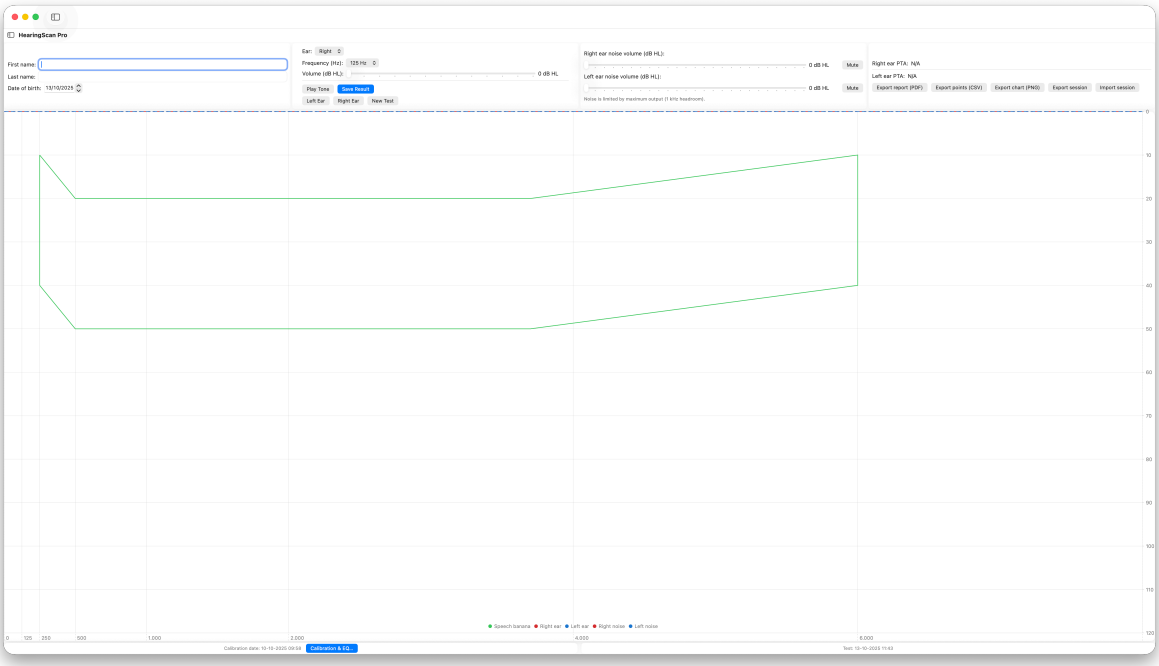
To achieve optimal results, the use of a soundproof booth may be necessary to eliminate unwanted noise. While it may not be essential for brief evaluations in quiet environments, it is advisable to consider a basic booth to enhance the quality of the measurements.

Installing the software

If you have not yet acquired a copy of HearingScan Pro, please visit the App Store. The app can be installed on all compatible devices linked to the same iCloud account. Once the download is complete, the app will be installed and can be found in your Apps folder (Mac) or as an icon on your desktop(iOS).

The app does not collect data from your system, making it safe for use and installation in medical and high-privacy environments.

Navigating the software



The main interface of the HearingScan Pro application is designed to be both straightforward and effective. It features a layout that includes the Persona field, PTA field, Noise field, Test result and export field, Graphical display, and at the bottom, the Calibration field, arranged from top to bottom and left to right. On iOS you have the same functions but the layout differs slightly.

On Mac, the primary pages of the app are located on the left side but can be hidden.

Shortcut keys

Version 29 introduces keyboard control, significantly improving the efficiency of the hearing assessment process. Below is a summary of the keys implemented and their corresponding functions.

Shortcut Key	Triggers
▶	Increase PTA volume
◀	Decrease PTA volume
▼	Increase PTA frequency
▲	Decrease PTA frequency
⌘ + R	Switch to right ear
⌘ + L	Switch to left ear
⇧	Play PTA sound again
⏎	Write PTA frequency to chart

These new controls reduce the time required for a comprehensive hearing assessment and alleviate strain on the tester's wrist, as they necessitate less time spent using the mouse. Shortcut keys are only available on Mac.

🎧Calibration

Before you can do a hearing assessment one need to calibrate the whole setup first. Without calibration the app is blocked to prevent faulty measurements.

Step1

Ensure that the headphones are connected either directly, through an amplifier, or wireless.

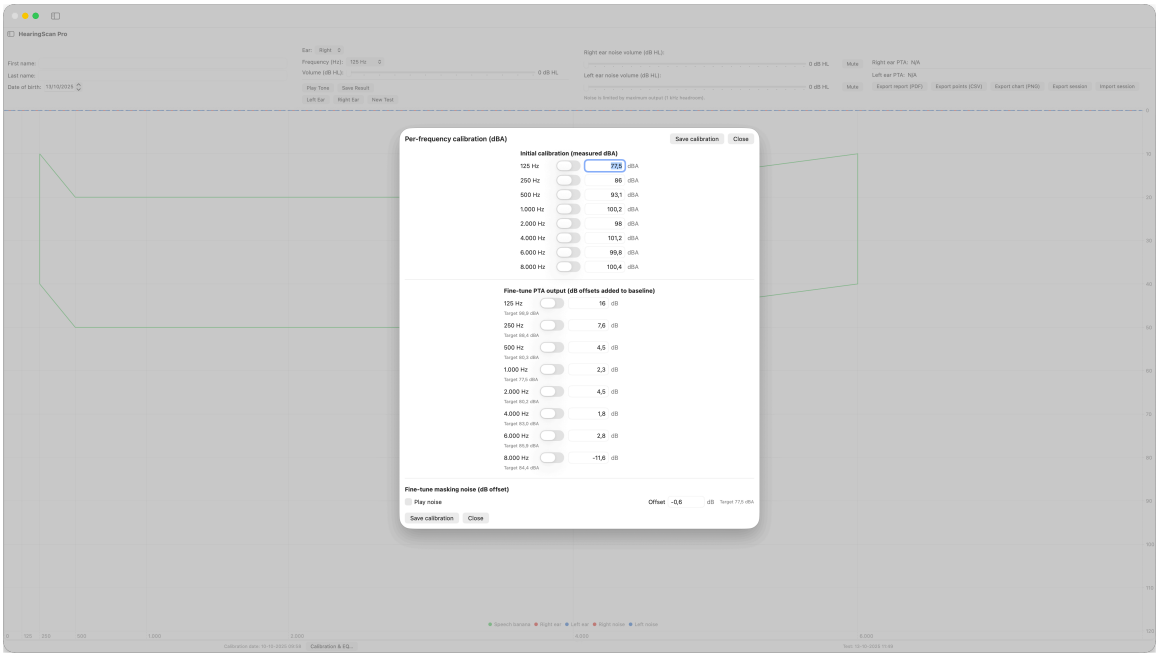
Step 2

Position the dB meter directly at the location of the headphone drivers. While a 90-degree angle is preferred, larger dB meters and/or snug-fitting headphones may allow for measurements to be taken as depicted in the image. Make sure your headphone amplifier is at maximum volume and warmed up. For most amplifiers 10

minutes is adequate.

Step 3

Open HearingScan Pro, go to the HearingScan Pro calibration tab, and toggle in the initial calibration field each frequency and add the reading from the dB meter in the right fields.



Step 4

In the fine tune menu you toggle each switch and the reading should correspond with the target dBA level. If not, you fill in the difference between the reading on your dB meter and the target dBA value. After this correction the value on your dB meter should be equal with the target dBA level for each frequency. On the bottom you toggle the noise level fine tune level. Here you should read 77,5 dBA on your meter. Once done click on Save calibration. A calibration is valid for one week and after that period a recalibration is required! (When hardware is changed recalibration is required too)

Step 5

HearingScan Pro is now calibrated up to 0,1 dBA and ready for hearing assessments.

Step 6

You can now click on close to go back to the main menu.

⚠ It is advisable to allow hardware to reach its operating temperature prior to

calibration, as measurements can vary between cold and warm states. At least 10 minutes are recommended but a second check after half and a full hour show if there deviations. On new equipment it is recommended to recheck after 30 and 60 minutes. Before a hearing assessment equipment needs to be warmed up too for best results.

🎧 Hearing Tests and Methods

🎧 Methodology

Participants must be instructed to signal upon hearing a tone, either by using a hand gesture or pressing a button. Additionally, assist them in properly positioning the headphones, ensuring they are oriented correctly and securely placed over the ear canal, with the headphone driver centered appropriately.

In accordance with ISO 8253-1, it is imperative to adhere to the following guidelines:

Parameter	Recommended Range
Tone duration	HearingScan-Pro uses a fixed length of the tone.
Interval between tones	2~5 seconds (randomized)
Response window	Up to 3 seconds after tone presentation
Time between attempts	Variable, non-predictable

Ascending Method for Hearing Threshold Determination

(Based on ASHA Guidelines and ISO 8253-1 Standards)

The **Ascending Method** is a standardized procedure for determining hearing thresholds using pure tones. It is recognised by the American Speech-Language-Hearing Association (ASHA, 2005) and the International Organization for Standardization (ISO 8253-1:2010), and is particularly suitable for automated hearing tests and self-assessment applications due to its consistency and ease of implementation.

Procedure

1 Starting Level
The test begins at a very low intensity level at **0 dB HL**.

2 Level Increments
If the subject does not respond to the tone, the presentation level is increased in fixed steps of **5 dB** until a response is obtained.

3 Threshold Confirmation
Once the subject responds to a tone, the level is decreased by **5 dB** and the

tone is presented again:

- If the subject responds again at the lower level, the procedure may continue decreasing in 5 dB steps until no further response is observed.

- If the subject does not respond at the lower level, the previous level at which a response occurred is recorded as the **hearing threshold**.

4 Threshold Definition

The hearing threshold is defined as the **lowest intensity level** at which the subject responds to the tone at least **50% of the time** on ascending runs (e.g., two out of three or three out of five presentations).

Standards Reference

- **ASHA (2005)** – *Guidelines for Manual Pure-Tone Threshold Audiometry*:
Describes ascending methods as appropriate for initial threshold estimation and screening purposes. Specifies the importance of response confirmation and the 50% response rule.

- **ISO 8253-1:2010** – *Acoustics – Audiometric Test Methods – Part 1: Pure-Tone Air and Bone Conduction Audiometry*:
Recognizes both ascending and modified Hughson-Westlake procedures. Emphasizes stepwise stimulus presentation, consistent response criteria, and threshold reproducibility.

Application Context

This method is particularly useful in automated or semi-automated hearing test systems, such as mobile applications or kiosks, where simplicity, reliability, and efficiency are required. The method is faster than traditional adaptive procedures and is less prone to bias introduced by subject anticipation.

Initial step

1. Ensure that the system is pre-calibrated prior to bringing your patient into the testing room. This practice not only enhances professionalism but also contributes to minimizing the noise floor in the testing environment.
2. Fill in the patients details: First name, Last name and date of birth.
3. Participants must be introduced how you do the assessment. Also instruct them how to signal when hearing a tone, either by using a hand gesture or pressing a button.
4. Assist them in properly wearing the headphones and optionally provide them with the test button.
5. Optionally: Close the soundproof booth

🎧 Procedure for Pure Tone Audiometry Using the Ascending Method

(Based on ASHA Guidelines and ISO 8253-1 Standards)

This procedure determines hearing thresholds by starting at a low intensity and increasing the tone level in fixed steps until the subject responds. It is especially suitable for automated or self-administered hearing tests.

Test Setup

- Testing is performed in a quiet environment with calibrated equipment.
- The subject is instructed to respond whenever they hear a tone, no matter how soft.

Test Frequencies

- Test frequencies typically include standard audiometric frequencies (e.g., 125 Hz to 8000 Hz).

Test Procedure

1 Starting Level
Begin presenting a pure tone at **0 dB HL** (or the system's minimum output level).

2 Ascending Intensity Steps
If the subject does not respond, increase the intensity in **5 dB steps**.

3 Response Detection and Confirmation

- Once the subject responds to a tone, present the tone again at **5 dB lower** to confirm the threshold.
- If the subject responds again at this lower level, decrease the intensity further in 5 dB steps.
- If the subject does **not** respond at the lower level, record the previous higher level as the hearing threshold for that frequency.

4 Threshold Definition
The threshold is defined as the lowest level at which the subject consistently responds (at least 50% of presentations).

5 Press Save Result or press enter to save the PTA reading to the

graph.

6 Repeat for All Frequencies and Both Ears
Continue this procedure for each test frequency and ear.

Advantages

- Simple and efficient, suitable for automated testing.
- Minimises false positives due to subject anticipation.
- Provides reliable threshold estimates within 5 dB precision.

🎧 Procedure for Pure Tone Audiometry Using the Ascending Method with Ear-by-Ear Masking

(Based on ASHA Guidelines and ISO 8253-1 Standards)

This procedure determines hearing thresholds by starting at a low intensity and increasing the tone level in fixed steps until the subject responds. It is particularly suitable for automated or self-administered hearing tests. Ear-by-ear masking is applied to the non-test ear to prevent cross-hearing during the measurement.

Test Setup

- Testing is performed in a quiet environment with calibrated audiometric equipment.
- The subject is instructed to respond whenever they hear a tone, regardless of how soft the tone is.
- Appropriate masking noise (typically narrowband or broadband noise) is presented to the **non-test ear** at a level sufficient to prevent cross-hearing.

Test Frequencies

- Test frequencies typically include standard audiometric frequencies, generally from 125 Hz to 8000 Hz.

Test Procedure

1 Starting Level
Begin presenting a pure tone to the test ear at **0 dB HL** (or the system's minimum output level).

2 Ear-by-Ear Masking

Simultaneously, present masking noise to the **non-test ear** at an initial masking level just above its hearing threshold, to prevent the non-test ear from detecting the test tone.

3 Ascending Intensity Steps

If the subject does not respond to the tone in the test ear, increase the intensity in **5 dB increments**.

4 Response Detection and Confirmation

- Once the subject responds to a tone, present the tone again at **5 dB lower** to confirm the threshold.
- If the subject responds again at this lower level, decrease the intensity further in 5 dB steps.
- If the subject does **not** respond at the lower level, record the previous higher level as the hearing threshold for that frequency.

5 Threshold Definition

The hearing threshold is defined as the lowest intensity level at which the subject consistently responds (at least 50% of the presentations) on ascending trials.

6 Press Save Result or press enter to save the PTA reading to the graph.

7 Repeat for All Frequencies and Both Ears

Repeat the procedure for each test frequency and both ears, ensuring appropriate masking is applied to the non-test ear during each measurement.

Advantages

- Simple and efficient method, well suited for automated or semi-automated hearing testing.
- Ear-by-ear masking minimises false responses due to cross-hearing and increases test accuracy.
- Ascending intensity steps reduce false positive responses caused by patient anticipation.
- Provides reliable threshold estimates within approximately 5 dB precision.

🎧 Procedure for Pure Tone Audiometry Using the Ascending Method with Bilateral Masking for Tinnitus Suppression

(Based on ASHA Guidelines and ISO 8253-1 Standards)

This procedure is designed to determine hearing thresholds in individuals experiencing tinnitus, where the perception of tinnitus may interfere with accurate tone detection. To improve threshold reliability, masking noise is presented to **both ears simultaneously** prior to and during tone presentation, with the specific purpose of reducing or eliminating the subject's perception of tinnitus during testing.

Test Setup

- Testing is performed in a quiet environment using properly calibrated audiometric equipment.
- The subject is instructed to respond whenever they hear the presented tone, even if it is very faint.
- Prior to threshold determination, **broadband or narrowband masking noise** is presented to both ears. The level of this masking is gradually increased until the subject reports that their tinnitus is no longer perceptible, or has been significantly reduced.

Test Frequencies

- Test frequencies typically include the standard audiometric range from 125 Hz to 8000 Hz.

Test Procedure

1 Tinnitus Masking Calibration

Begin by presenting masking noise to **both ears simultaneously**. Gradually increase the masking level in **5 dB steps** until the subject reports that their tinnitus is suppressed or no longer noticeable.

2 Starting Level

Present a pure tone to the test ear at **0 dB HL** (or the minimum output level of the system), while continuing bilateral masking noise at the tinnitus-suppression level.

3 Ascending Intensity Steps

If the subject does not respond to the test tone, increase the tone level in **5 dB increments** until a response is obtained.

4 Response Detection and Confirmation

- Once the subject responds, present the same tone again at **5 dB lower** to confirm the threshold.

- If the subject responds again at this lower level, continue decreasing in 5 dB steps.

- If no response is observed at the lower level, record the previous level (where a response occurred) as the threshold for that frequency.

5 Threshold Definition

The threshold is defined as the **lowest intensity level** at which the subject responds in at least **50% of ascending presentations**.

6 Save and Record Results

Press "Save Result" or press Enter to record the threshold for that frequency and ear.

7 Repeat for All Frequencies and Both Ears

Repeat the above procedure for all standard test frequencies and both ears, maintaining the bilateral masking noise at the tinnitus suppression level throughout the entire test.

Advantages

- Improves threshold accuracy in subjects with tinnitus by reducing the interference of phantom auditory perception.

- Bilateral masking stabilizes auditory focus and reduces false negatives caused by tinnitus overlap with test tones.

- The ascending method remains effective and easy to implement in both clinical and automated testing environments.

- Thresholds are reliably determined within a 5 dB margin of precision.

🎧 Procedure for Measuring Subjective Tinnitus Perception Using Bilateral Broadband Noise

(Adapted from ISO 8253-1 and ASHA guidelines with an extension for tinnitus characterization)

This procedure aims to determine the **subjectively perceived loudness of tinnitus**, based on the patient's own report of when their tinnitus is no longer perceptible. The method uses **broadband noise delivered simultaneously to both ears**, with intensity adjustments made in real time according to patient feedback.

While not formally described in ISO 8253-1 or ASHA (2005) guidelines, this method extends the principles of **Minimum Masking Level (MML)** and **Tinnitus Loudness Matching (TLM)**, which are accepted in clinical tinnitus evaluation. This patient-driven approach supports more realistic tinnitus volume estimation, particularly in cases where tinnitus is bilateral or diffuse in nature.

Test Setup

- The test must be conducted in a quiet environment using calibrated audiometric equipment capable of delivering **broadband noise binaurally**.
- The subject is instructed to focus on their tinnitus and report when it becomes **inaudible or significantly suppressed** by the noise.
- This test does **not assess hearing thresholds** and is **not a pure-tone audiometry (PTA)** procedure.

Test Procedure

1 Initial Presentation

Begin by delivering **broadband noise to both ears** simultaneously at a low starting level (e.g., 0 dB HL).

2 Stepwise Increase

Increase the noise level in **5 dB increments**. After each step, ask the patient if they can still perceive their tinnitus.

3 Subjective Tinnitus Disappearance

When a patient indicates that the tinnitus is no longer perceptible or is completely masked by the noise, document this level as the **Subjective Tinnitus Suppression Level (STSL)**. In cases where individuals experience asymmetric tinnitus, if one ear is masked while the other is not, continue to adjust the level for the ear that remains unmasked.

4 Confirmation (Optional)

Reduce the level slightly (e.g., -5 dB) to confirm whether the tinnitus reappears. If so, the previously recorded level is accepted as the final tinnitus level.

5 Documentation

Save the measured noise level (in dB HL) and note whether the tinnitus was

fully or partially suppressed.

Threshold Definition

The **Subjective Tinnitus Suppression Level (STSL)** is defined as the **lowest broadband noise level delivered binaurally** at which the patient reports **no longer perceiving their tinnitus**. This level serves as a proxy for the subjectively experienced intensity of the tinnitus.

Standards Basis and Clinical Legitimacy

This method is a **clinically grounded extension** of two established procedures:

- **Minimum Masking Level (MML)** — as used in clinical tinnitus assessment to find the level at which tinnitus becomes inaudible using masking noise.
- **Tinnitus Loudness Matching (TLM)** — used to compare tinnitus loudness to external stimuli.

Though not formally standardized as a combined test, this procedure is **consistent with the masking principles** outlined in:

- **ISO 8253-1:2010** — *Acoustics — Audiometric test methods — Part 1: Pure-tone air and bone conduction audiometry*
- **ASHA (2005)** — *Guidelines for Manual Pure-Tone Threshold Audiometry*, especially sections on masking and tinnitus-related limitations.

As tinnitus remains a **subjective symptom with high variability**, this method supports clinicians and researchers in documenting **individual tinnitus burden** in a repeatable and interpretable manner.

Advantages

- Provides a direct and patient-centered method to estimate tinnitus loudness.
- Avoids the limitations of pitch or tone matching in diffuse or broadband tinnitus.
- Enables pre- and post-treatment comparison of perceived tinnitus intensity.
- Can be integrated into broader tinnitus profiling or self-assessment tools.

- Aligns with established masking principles, while addressing a known gap in standard audiometry protocols.

Suggested Label for Implementation

“Subjective Tinnitus Suppression Level (STSL)”
– A binaural broadband noise procedure for approximating the perceived volume of tinnitus.

Comprehensive Interpretation and Clinical Application of Hearing Test Results

HearingScan Pro provides an integrated audiological profile consisting of:

- **Pure Tone Average (PTA)** across all tested frequencies and the classical 3-frequency average (500, 1000, 2000 Hz)
- **Subjective Tinnitus Suppression Level (STSL)** based on bilateral broadband noise masking
- **Speech Banana visualization** highlighting speech sound frequency and intensity ranges

Together, these components enable a thorough understanding of hearing capacity, tinnitus perception, and functional speech recognition ability, which is critical for diagnosis, monitoring, and management of hearing disorders such as Ménière’s disease.

Pure Tone Average (PTA) — Static and Dynamic Components

Definition:
The PTA summarizes the hearing threshold, providing an average sensitivity level at specific frequencies:

- **3-Frequency PTA (3PTA):** Mean of thresholds at 500, 1000, and 2000 Hz — these frequencies are essential for speech perception and are the basis for many clinical guidelines.
- **Full-range PTA:** Mean of all tested frequencies (e.g., 125 Hz to 8000 Hz), providing a comprehensive hearing profile.

Classification of Hearing Loss (based on 3PTA):

PTA (dB HL)	Hearing Loss Severity
0–25	Normal hearing
26–40	Mild hearing loss
41–55	Moderate hearing loss
56–70	Moderately severe hearing loss
71–90	Severe hearing loss
>90	Profound hearing loss

Dynamic Hearing Loss and Ménière's Disease:

Ménière's disease is characterized by fluctuating hearing loss. The difference between PTA measurements taken during and between attacks (dynamic loss) is clinically important:

- **Static loss** refers to the baseline hearing threshold.
- **Dynamic loss** refers to temporary changes, often quantified as the difference between the PTA during an attack and baseline PTA.

Research and **AAO-HNS (American Academy of Otolaryngology–Head and Neck Surgery)** guidelines highlight that:

- A change of **≥10 dB** or a relative change of **≥15–20%** in PTA is significant and supportive for Ménière's diagnosis and staging.
- PTA-based staging (based on 3PTA) ranges from Stage I (≤25 dB) to Stage IV (>70 dB), guiding prognosis and treatment.

HearingScan Pro's ability to display both **static and dynamic PTA values**, including percentage changes, provides clinicians and patients with objective markers of disease progression.

Subjective Tinnitus Suppression Level (STSL)

This metric indicates the lowest level of binaural broadband noise at which the patient reports that their tinnitus is no longer perceivable.

- Higher STSL values indicate louder or more intrusive tinnitus.
- Tracking STSL longitudinally supports tinnitus management and assessment of treatment efficacy.
- Combined with PTA, STSL helps differentiate the impact of hearing

loss and tinnitus on patient experience.

The Speech Banana — Functional Hearing Interpretation

The **speech banana** is the region on the audiogram that maps the frequency and intensity of the majority of human speech sounds (approximately 250 Hz to 4000 Hz, between ~20 to 60 dB HL).

- Hearing thresholds **within or below** the speech banana indicate that the patient's hearing sensitivity is **impaired for those speech sounds**. This means certain speech phonemes — especially softer consonants — may be inaudible or distorted, causing difficulties in speech understanding and communication.

- Conversely, hearing thresholds **above** (i.e., better than) the speech banana suggest that the patient can perceive most speech sounds clearly at conversational volumes.

In practical terms, thresholds **inside or below the speech banana correspond to hearing loss that negatively impacts speech intelligibility** and daily communication. It is essential to recognize that the capacity to perceive pure tone average (PTA) frequencies does not automatically imply proficiency in speech comprehension. An individual may encounter challenges in hearing clearly in noisy settings if their hearing threshold is insufficient, despite PTA frequencies indicating otherwise. If you suspect this may apply, consider administering a speech-in-noise test.

Integrating All Results for Clinical Decision-Making and Patient Management

1. Comprehensive Hearing Assessment:
Use PTA (both full-range and 3PTA) to quantify hearing loss severity and track progression, including dynamic fluctuations indicative of Ménière's disease activity.

2. Functional Speech Understanding:
Leverage the speech banana visualization to translate PTA values into expected speech perception abilities, helping set realistic communication goals and counseling points.

3. Tinnitus Evaluation:
Interpret STSL alongside PTA to understand tinnitus loudness relative to hearing loss, facilitating tailored tinnitus management strategies.

4. Monitoring and Staging:
In Ménière's disease, use changes in PTA and STSL to stage the disease and

monitor response to therapy, consistent with AAO-HNS criteria.

5. Patient Communication and Rehabilitation Planning:
Present combined results in an accessible way to help patients understand their hearing and tinnitus status, guiding hearing aid fitting, counseling, and therapeutic choices.

▶ **Summary**

- **PTA** provides both a static and dynamic measure of hearing sensitivity critical for diagnosis and monitoring, especially in Ménière's disease.
- **STSL** quantifies tinnitus perception and its changes over time.
- The **speech banana** is a functional audiological tool that helps relate hearing thresholds to speech intelligibility.
- Combining these measurements allows for a detailed and actionable audiological profile to support clinical and rehabilitative decisions.

ⓘSaving a measurement

Upon completion of the hearing assessment, users can save the entire test as an image file, PDF or CSV file. Alternatively the session can be exported with the Export Session button. Reimporting can be done with the Import Session button. With ⌘N a new screen can be opened so that several measurements can be compared.

ⓘNew Measurement

To start a new assessment just press new.

⚙Data:

HearingScan Pro

dB HL step size	5 dB HL
Measuring Range dB HL	0~120 (maximum output level could be limited due to hardware limitations!)
Accuracy dBA	±0,1 dBA (depending on dB meter and calibration accuracy and used hardware)
PTA frequencies HZ	125, 250, 500, 1000, 2000, 4000, 8000 Hz
Frequency accuracy	0,1%
Average PTA Hz	500, 1000, 2000 Hz

Calibration frequency Hz	1000 Hz
Calibration volume dBA	hardware dependent
Recommended headphones	Circumaural (over ear) closed housing with flat response from 125~8000Hz

Comparison HearingScan Pro - Conventional Test equipment

	HearingScan Pro	Conventional
Accuracy	± 0,1 dB	± 3 dB
PTA	YES, 125~8000 Hz	LIMITED, 250~8000 Hz
Bone conducting	Yes, with bone conducting headphones	Depends on hardware
Easy to calibrate by user	YES	NO
Time to calibrate (minutes)	≦ 10	≧ 30
Hear in noice	YES	Depends on hardware
Speech banana	YES	Depends on hardware
Total test time (minutes)	±5	±15~45
Average PTA	YES	Depends on hardware
Mobile use	YES	NO
Self test possibility	YES	NO
Combined graph for left and right possible	YES	NO
Extended PTA frequencies	YES	Depends on hardware
License for multiple devices	Unlimited devices owned by user within same iCloud account	NO
Service Cost	NO	YES
Training level	VERY EASY	DIFFICULT

Support:

For inquiries regarding HearingScan Pro, please feel free to reach out to us. Please note that we do not offer medical advice.

Should you need additional assistance, we encourage you to visit our support page.
https://www.enlightenment.school/contact.html

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