

# THE MASKING HANDBOOK (FOR AUDIOMETRY)

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## APPENDIX A9

### DEFINITIONS

#### **Active masking level (AML)**

A level of masking that is incorporated into a masking presentation level once all other factors (e.g., the hearing threshold of the Non-Test Ear and the occlusion effect) have been compensated for. The AML is the amount of masking that may create an actual masking effect.

#### **ANSI**

The American National Standards Institute is a private, non-profit organization that develops and publishes standards for products, services, and systems in the USA. These standards “ensure that the characteristics and performance of products are consistent, that people use the same definitions and terms, and that products are tested the same way.” With regards to audiometric equipment and assessment, ANSI is supported by the Acoustical Society of America to provide technical guidelines.

#### **Central masking**

An effect created within the central auditory system that can influence hearing threshold. For example, a low level of masking noise presented to a Non-Test Ear may produce a worsening of the hearing threshold of the Test Ear.

#### **Circum-aural headphones**

Phones that are designed to position around the pinna of the external ear and press against the cranio-facial bones. The casing of these phones would have a pliable, cushion style of insulation that provides comfort and acoustic isolation from environmental noise. Circum-aural headphones have an “ear-muff” style appearance.

#### **Cochlear reserve**

Refers to the level of cochlear hearing sensitivity that is present in an ear that shows a conductive or mixed hearing loss. This is represented by the bone-conduction hearing of that specific ear. Often used in the context of a pre-surgical, otologic consultation that seeks to determine if surgery is a viable option.

#### **Cranial bones**

The bones of the skull some of which encase the various parts of the hearing mechanism. These include the parietal, temporal, frontal, occipital, ethmoid, and sphenoid bones.

### **Critical band theory**

Articulated by Fletcher in 1940, this idea on auditory masking proposed that a wide-band noise (e.g., white noise) would not be required to mask a simple, tonal signal. A narrow, band of noise would effectively---and more efficiently---mask a tone. Fletcher also noted how the width of the band of noise necessary to act in this manner would vary depending on the frequency of the tone.

### **Cross-hearing**

A hearing event that occurs in an unintended, non-target ear. When delivering sound to a specific, individual ear, crossover may occur. Once the sound has crossed via the cranial bones, the cochlea on the opposite side may be able to hear/detect it. If the cochlear hearing on that opposite side can hear/detect such a crossed sound, then “cross hearing” has occurred.

### **Crossover**

A mechanical-acoustic event that occurs through the cranial bones. When delivering a sound to a single ear (using air or bone-conduction delivery systems,) the signal will, at some point of increasing intensity, cross to the opposite ear via this route.

### **Effective masking level (EML)**

The level of a masking noise that is calibrated to change the threshold of a test signal to a certain dB HL. Audiometers are calibrated in terms of EML and referenced to dB HL. A 40 dB masking noise, for example, delivered to an ear with a 10 dB air-conduction threshold, should raise that threshold up to 40 dB.

### **Etymotic Research**

Acoustic and auditory research company founded in 1983 by Killion and DeVilbiss. Etymotic introduced insert earphones to the marketplace in 1984.

### **Initial masking level (IML)**

The introductory level of masking noise that is first delivered to a Non-Test Ear to begin the masking process.

### **Insert earphones**

A miniaturized phone designed to deliver test signals directly into the ear canal. These audiometric devices have a foam, coupling tip that is inserted into, and seals off, the ear canal.

### **Interaural attenuation (IA)**

The amount of sound energy that gets reduced from one ear to the other when an acoustic signal is presented to a single side; the amount of “blockage” to the opposite ear that is provided by the device coupling to the head.

### **Masking**

The change in the audibility of one sound with the presentation of another sound signal.

### **Masking dilemma**

A challenging, audiometric situation in which a required level of masking noise presented to an ear creates an overmasking response. Typically can occur when the masked, Non-Test Ear has poor, air-conduction hearing while the target, Test Ear has decent cochlear hearing. The classic, masking dilemma refers to a situation where both ears have significant, purely conductive hearing loss.

### **Minimum-possible interaural attenuation (minIA)**

Population based IA values that are utilized during audiometry to make decisions about masking. minIA values are minimum-possible projections of attenuation based on research from groups. These lowest, possible, IA values from the group studies are then referenced as the lowest, possible IA information known to occur for various test signals and transducers in the clinical context.

### **Narrowband noise**

An aggressively filtered variation of white noise that results in energy distribution over a small (or narrow) section of the audible range. As opposed to the original, broadband, white noise signal, only a frequency “band” of energy is produced.

### **Non-Test Ear (NTE)**

When delivering a test signal to assess a specific ear, the opposite ear on the other side is known as the Non-Test Ear.

### **Occlusion effect**

An increase in sound-pressure level of bone-conducted sound within an external ear canal with the introduction of a blockage at the distal region of the canal. This can result in an improvement in hearing sensitivity for low frequency, bone-conduction sounds.

### **Optimized Method**

Audiometric masking method proposed by Turner in 2004. This method is designed to be used when testing the poorer ear in asymmetrical hearing losses. The air-conducted threshold of the Test Ear is used as a reference to determine the introductory level of masking noise to the Non-Test Ear.

### **Overmasking**

An event that can occur with the delivery of moderate to high intensity masking signals to the Non-Test Ear. These louder masking noises are at risk of crossing over to the Test Ear if they exceed a subject's interaural attenuation characteristics. This crossed masking noise can sometimes interfere with attempts at testing the Test Ear.

### **Plateau method**

Audiometric masking method first proposed by Liden et al in 1959. This method uses step-increases in masking noise that gets presented to the Non-Test Ear. The increases in masking confirm whether the target, Test Ear is hearing the test signals or if the unintended, Non-Test Ear is hearing them.

### **Potential Crossover (potCR)**

A mathematical summary to determine if a signal presented to a target ear has an opportunity or chance to cross to the opposite, non-target ear. The determination compares the level of the test signal to an interaural attenuation value. If the calculated value exceeds 0 dB, the conclusion is that a crossover event is possible. The resulting value may also quantify the maximum amount of crossover sound that would be possible for a given situation.

### **RadioEar**

Company founded in 1924 by E.A. Myers, a lawyer who had developed significant hearing loss. Initially started as a manufacturer of hearing aids, the company eventually moved into the development of bone-conduction transducers. In 1971, the company introduced their B71 bone-conduction test device which is still used in audiometric testing to this day.

### **Risk of overmasking (ROM)**

A determination on the possibility that a masking noise signal presented to a Non-Test Ear could cross to the opposite, unintended, Test Ear where it could be heard and where it could contaminate attempts at testing. The determination compares a "risk of masking crossover" value (potCR Mask) to the cochlear hearing from the Test Ear.

### **Shadow response/shadow hearing**

When an unmasked (often air-conduction) signal is delivered to a Test Ear but crosses, and is heard by, the Non-Test Ear. If left unchecked, such results can be misinterpreted and lead to an inaccurate report on the hearing status.

### **Situational interaural attenuation (sitIA)**

An individual IA value that is deduced in real-time from a specific audiometric situation. The sitIA is based on individual, situational audiometric considerations as opposed to the population-based values that are otherwise applied.

**Soundfield**

A defined, three-dimensional space that has sound isolation/ambient noise-reduction characteristics. Within the volume of the area, installed loudspeakers can deliver acoustic signals in a calibrated and controlled manner.

**Speech noise**

A type of filtered, white noise, the speech-noise signal has (like white noise) a flat frequency response up to 1000 Hz but then shows a gradually decreasing response up into the higher frequencies. According to ANSI specifications, speech-noise will “decrease at a rate of 12 dB per octave up to 6000 Hz.”

**Supra-aural headphones**

A type of headphone that is designed to press directly against the pinna of the external ear on each side. The phones are held into position by an over-the-head bracket that has some spring action that generates force in the medial direction to maintain position. The Telephonics company is well-known as the manufacturer of the TDH model, supra-aural phones.

**Telephonics**

A communications, aeronautics, and military technology company founded in 1933. The company is well known in hearing healthcare as the manufacturer of TDH supra-aural headphones for audiometry.

**Test Ear (TE)**

When attempting to deliver a test signal to a specific ear, that target ear is known as the Test Ear. The ear that is being measured during an audiometric procedure.

**Transducer**

A device that converts and conveys one form of energy into an alternate form.

**Transduction**

An event during which one form of energy gets converted into an alternate form.

**Undermasking**

When the delivery of a masking signal to the Non-Test Ear is not strong enough to adequately mask crossed, test signals from the Test Ear side.

**White noise**

A signal that has an equal output spectrum (i.e., a flat response) across a wide frequency range. Sometimes referred to as “random noise.” ANSI specifies that a white noise signal should be within 5 dB of the level that is present at 1000 Hz through the frequency range from 250 Hz to 5000 Hz.