Aurical® Freefit – IEC 61669 and ANSI S3.46 Technical Notes

Contents

Introduction

The Aurical Freefit product is designed for compliance with the international standard:

- IEC 61669:2015 Electroacoustics - Measurement of real-ear acoustical performance characteristics of hearing aids
- ANSI/ASA S3.46-2013 (R2018) Methods Of Measurement Of Real-Ear Performance Characteristics Of Hearing Aids

This paper describes detailed technical information related to characteristics of the Test Signals and Analysis provided by the equipment.

For general usage and technical information and specification, please refer to the Aurical Freefit User Guide and Reference Manual.

IEC 61699 & ANSI S3.46

Test Signals

Aurical Freefit provide several test signals for the measurement methods describe in IEC 61699 and ANSI S3.46 that is listed below. Furthermore, Aurical Freefit offers a "Free-Style" mode where additional test signals can be used, that are not a part of the measurement methods describe in the standards.

Pure-tone test signals

Pure-tone test signals	Signal type	Total harmonic distortion
1000 Hz	Pure-tone test signal	<2% @ 90 dB SPL
1500 Hz	Pure-tone test signal	<2% @ 90 dB SPL
2000 Hz	Pure-tone test signal	<2% @ 90 dB SPL
3000 Hz	Pure-tone test signal	<2% @ 90 dB SPL
4000 Hz	Pure-tone test signal	<2% @ 90 dB SPL
5000 Hz	Pure-tone test signal	<2% @ 90 dB SPL
6000 Hz	Pure-tone test signal	<2% @ 90 dB SPL
7000 Hz	Pure-tone test signal	<2% @ 90 dB SPL
8000 Hz	Pure-tone test signal	<2% @ 90 dB SPL

Random noise signals

Random noise signals	Signal type	Frequency spectrum	Crest factor
Noise - pink	Random noise	100 - 10 kHz	15 dB
Noise - White	Random noise	100 - 10 kHz	13 dB
Noise - Speech ANSI	Speech-like	100 - 10 kHz	13 dB

Warble signals

Warble signals	Signal type	Frequency spacing	Modulating frequency	Frequency deviation
Tone Sweep	Warble	1/3 octave spacing	15 Hz	200 Hz: 21 Hz deviation 250 Hz: 26 Hz deviation 315 Hz: 34 Hz deviation 400 Hz: 43 Hz deviation 500 Hz: 53 Hz deviation 630 Hz: 68 Hz deviation 800 Hz: 86 Hz deviation 1000 Hz: 108 Hz deviation 1250 Hz: 135 Hz deviation 1600 Hz: 173 Hz deviation 2000 Hz: 217 Hz deviation 2500 Hz: 270 Hz deviation 3150 Hz: 342 Hz deviation 4000 Hz: 437 Hz deviation 5000 Hz: 543 Hz deviation 6300 Hz: 676 Hz deviation 8000 Hz: 871 Hz deviation
MPO signal	Warble	1/3 octave spacing	15 Hz	200 Hz: 21 Hz deviation 250 Hz: 26 Hz deviation 315 Hz: 33 Hz deviation 400 Hz: 43 Hz deviation 500 Hz: 53 Hz deviation 630 Hz: 68 Hz deviation 800 Hz: 86 Hz deviation 1000 Hz: 107 Hz deviation 1250 Hz: 134 Hz deviation 1600 Hz: 173 Hz deviation 2000 Hz: 217 Hz deviation 2500 Hz: 270 Hz deviation 3150 Hz: 340 Hz deviation 4000 Hz: 431 Hz deviation 5000 Hz: 536 Hz deviation 6300 Hz: 676 Hz deviation 8000 Hz: 889 Hz deviation

Narrow-band noise signals

Narrow-band noise signals	Signal type	Standardized
NBN s	Narrow-band noise	Yes[1]
NBN sh	Narrow-band noise	Yes**Error! Bookmark not defined.**

[1] Verification of frequency transposition

Frequency transposition is an important feature of most modern hearing instruments.
This technology is enabling people with challenging hearing losses to get access to important sounds would not be available to them otherwise.
Some of the most important sounds are /s/ and /sh/. Western University in Canada (formerly known as university of Western Ontario, or UWO) have defined these signals and they are now available in PMM/FreeStyle.
To support the workflow, there is now also an option so that one can view the input/stimulus curve in addition to the regular measurement curves.
This makes it very easy to see the signals at the input and the output of the hearing instrument for closer investigation of the amount of frequency transposition.

DSLio – Frequency Lowering Verification (s and sh sounds)
https://www.dslio.com/?page_id=166

Speech-like signals

Speech-like signal	Signal type	Bandwidth	Number of bits	Sampling rate	Standardized
Bable	Speech-like	100 Hz - 10 kHz	Bit Resolution: 16 bit	44100	No
Rainbow passage	Speech	100 Hz - 20 kHz	Bit Rate: 256 kbps	44100	No
ICRA-2PB-1F1M-N	Speech noise	N/A	Bit Rate: 128 kbps	44100	Yes[2]
ICRA-3BSMN-F-N	Speech noise	N/A	Bit Rate: 128 kbps	44100	Yes[2]
ICRA-3BSMN-M-N	Speech noise	N/A	Bit Rate: 128 kbps	44100	Yes[2]
ICRA-6PB-N	Speech noise	N/A	Bit Rate: 128 kbps	44100	Yes[2]
ICRA-URGN-M-N	Speech noise	N/A	Bit Rate: 128 kbps	44100	Yes[2]
ISTS Signal	Speech-like	N/A	Bit Resolution: 16 bit	44100	Yes[3]
Mod. ILTASS Noise	Speech noise	N/A	Bit Resolution: 16 bit	44100	Yes[3]

Analysis characteristics

The Analysis method for Aurical Freefit is a mix between digital spectrum analysis and digital 1/3 octave filter banks, which enables Aurical Freefit to utilize the superior properties each method in the high and low frequency area, respectively.

The characteristics of the digital spectrum analysis.

Settings	Values
Sampling rate	24 kHz
Digital resolution	2048 points
Averaging time or number of averages	64 ms
Analysis bandwidth	100 Hz – 10 kHz
Block length	512 samples
Windowing type	Tukey FFT Window
Window overlap	25%
Total frequency range of analysis.	100 Hz – 10 kHz

The characteristics of the digital 1/3 octave filter banks.

Settings	Values
Centre frequencies	630, 500, 400, 315, 250, 200, 156, 125 Hz
Bandwidth	1/3 octave
Integration times.	64 ms

[2] ICRA noise

https://icra-audiology.org/Repository/icra-noise

[3] ISTS signal

The ISTS is shaped according to the LTASS (Long Term Average Speech Spectrum) standards. For more information, please refer to:
Holube, I. & EHIMA-ISMADHA Working Group. (2006). Short description of the international speech test signal (ISTS). Center of Competence HörTech and Institute of Hearing Technology and Audiology, Oldenburg, Germany.

Contact information

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