New High Resolution Ear Simulator

Reliable measurements for hearing aids up to 20 kHz

GRAS Sound & vibration

Next Generation of High Resolution

IEC 60318-4 (60711) compliant Ear Simulator

Advances in hearing aid design have made it desirable to increase the frequency range of hearing aids.

This is why we have developed the High Resolution Ear Simulator. It offers a method for measuring up to 20 kHz with precision, consistency and good repeatability.

From 10 kHz to 20 kHz
The standardized 711 ear simulator (e.g. the GRAS RA0045) is a good tool for ear simulation up to 10 kHz. However, it has a high Q resonance at about 13.5 kHz that makes measurements above 10 kHz unreliable. For example, when a Device Under Test (DUT) is not placed in the reference plane, this resonance will move from test to test.

The new High Resolution Ear Simulator mitigates this limitation as the steep resonance is much dampened and the peak of the resonance does not change with the length of the ear canal.

The dampened nature of the resonance also limits the differences caused by changes in placement of the DUT. Therefore the useful frequency range is now extended to 20 kHz.

The High Resolution Ear Simulator complies with IEC 60318-4. Its acoustic transfer impedance is within the tolerance band specified by IEC 60318-4.

The link to historical data is therefore maintained and existing test procedures can still be used - with full backwards compatibility.

Accurate broadband measurements
The new High Resolution Ear Simulator thus meets the need for an accurate broadband measurement method – both frequency response and distortion measurements up to 20 kHz can now be made with confidence.

The GRAS High Resolution Ear Simulator is therefore well suited as a high resolution supplement to the standardized 60318-4 ear simulator – or as a new reference tool for hearing aids manufacturers R&D testing and design verification.

Key features

- Upgraded IEC60318-4 ear simulator - same form factor
- Backwards compatible up to 10 kHz
- The 13.5 kHz resonance dampened by approximately 14 dB
- From 10 to 20 kHz the response is within ± 2.2 dB

Benefits

- Improved repeatability above 10 kHz
- Measurements below and above 10 kHz both in the same measurement setup
- The dampened resonance means better distortion measurements, even from as low as 3-5 kHz
- Minimized operator error and improved accuracy

Two versions are available:

Externally polarized and prepolarized

RA0401
Externally Polarized
High Resolution Ear Simulator

RA0402
Prepolarized
High Resolution Ear Simulator

Specifications

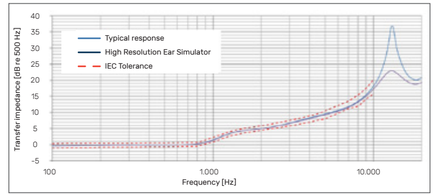
GRAS High Resolution Ear Simulator

RA0401 Externally Polarized & RA0402 Prepolarized		
Theoretical dynamic range lower limit with GRAS preamplifier	dB(A)	25
Theoretical dynamic range upper limit, RA0401 Externally Polarized Ear Simulator	dB	164
Theoretical dynamic range upper limit, RA0402 Prepolarized Ear Simulator	dB	153
Resonance frequency	kHz	13,5
Coupler volume	mm^3	1260 @ 500 Hz
Temperature range, operation	°C /°F	-30 to 60 /-22 to 140
Temperature coefficient @250 Hz	dB/ °C/ dB/ °F/	0,05
Humidity range non condensing	% RH	0 to 75
IEC standard		60318-4
ITU-T recommendations		P.57
CE/RoHS compliant/WEEE registered		Yes/Yes/Yes
Weight	g/oz	52 / 1.8

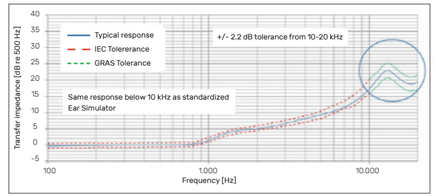
Advantages

The advantages of the resonance dampening are clearly visible when comparing the RA0045 Ear Simulator and new the High Resolution Ear Simulator (HRES).

Comparison: The standard 60318-4 ear simulator versus the RA0401/RA0402 High Resolution Ear Simulator (HRES)



Typical response overlaid with the tolerances for the HRES



The curves show the typical response of the new High Resolution Ear Simulator compared to the standard Ear Simulator. By adding highly accurate acoustic dampening to the Ear Simulator the resonance is dampened by about 14 dB while adhering to the strict tolerances below 10 kHz imposed by IEC 60318-4.

The dampened resonance enables the introduction of production tolerances in the frequency range from 10-20 kHz. The IEC 60318-4 calls for a tolerance of ±2.2 dB at 10 kHz. The High Resolution Ear Simulator is within ±2.2 dB up to 20 kHz.

This ensures that the difference between ear simulators will be much smaller with the High Resolution Ear Simulator compared to the standard Simulator. If two standard Ear Simulators have the resonance at the extremes of the IEC tolerance (12 and 15 kHz) the differences in response above 10 kHz would be profound. Results below and above 10 kHz can now be compared/analyzed in the same process.

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