

New High-Frequency Ear Simulator

Reliable measurements for hearing aids up to 20 kHz



GRAS Sound
& Vibration

Next Generation of High Frequency

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-Frequency 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 precisely in the reference plane, this resonance will move from test to test.

The new High-Frequency Ear Simulator mitigates this limitation as the steep resonance is much damped and the peak of the resonance does not change with the length of the ear canal. The damped nature of the resonance also limits the

differences caused by changes in the placement of the DUT. Therefore the useful frequency range is now extended to 20 kHz.

The High-Frequency 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 backward compatibility.

Accurate broadband measurements

The new High-Frequency 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.

It is therefore well suited as a high-frequency 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

Backward compatible up to 10 kHz

The 13.5 kHz resonance damped by approximately 14 dB

From 100 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 damped 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-Frequency Ear Simulator



RA0402
Prepolarized
High-Frequency Ear Simulator

Specifications

GRAS High-Frequency Ear Simulator

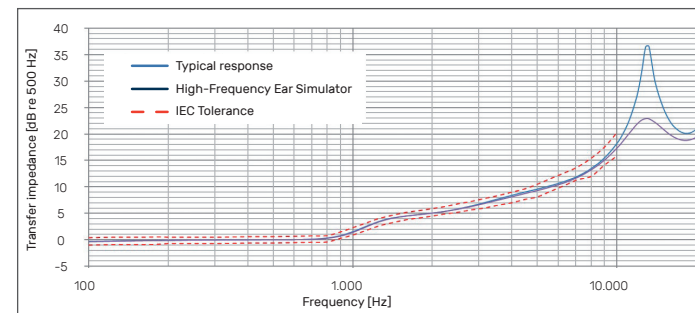
RA0401 Externally Polarized

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

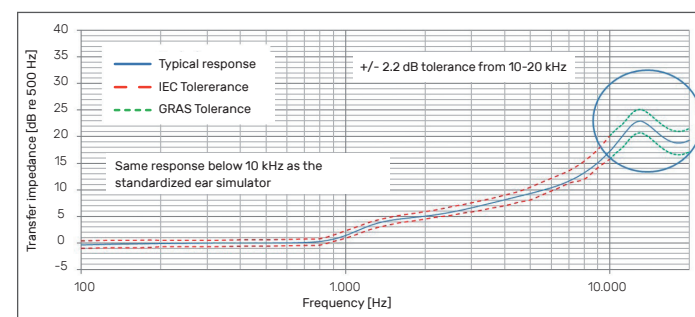
Advantages

The advantages of the resonance damping are clearly visible when comparing the RA0045 Ear Simulator and the new High-Frequency Ear Simulator.



The figure above shows the typical response of the new High-Frequency Ear Simulator compared to the standard ear simulator. By adding highly accurate acoustic damping to the ear simulator the resonance is damped by about 14 dB while adhering to the strict tolerances below 10 kHz imposed by IEC 60318-4.

Typical response



The damped resonance enables the introduction of production tolerances from 100-20 kHz. The IEC 60318-4 calls for a tolerance of ± 2.2 dB at 10 kHz, the High-Frequency 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 new ear 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 and analyzed in the same process.

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