MOTOROLA

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Supplement to HAC Test Report for Motorola portable cellular phone (FCC ID IHDT56EL1)

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There was a request for additional information regarding Motorola's HAC Test Reports for Motorola portable cellular phone (FCC ID IHDT56EL1). The requested information is addressed below in the same numbering sequence received.

1)
Please fully address the FCC 3G policy recently issued to the TCBs during the May 2006 conference call. Details of device capability and justification for tested modes are needed. Please include not only RF modes but vocoders modes/options.

RESPONSE: The FCC 3G policy release in the May 2006 conference call addressed SAR measurements of CDMA 1x, EV-DO and UMTS capable products. CDMA 1x and EV-DO are both primarily used for data transfer. Motorola does not understand this policy to apply to HAC. HAC is measured with the device in a "voice call" which utilizes IS-95 for CDMA products. The RC and SO used for this IS-95 connection was described in section "6 Test Results" of this Class II Permissive Change HAC filing. The DUT was tested at both Full vocoder rate and 1/8 vocoder rate, the resulting data is tabulated in this same section.

T - COIL REPORT

2)
Please provide more details of how ABM2 is measured by the system. Please demonstrate that the ABM2 measurement is implemented according to C63.19. One option for the later might be to compare expected result progression as each curve is added for a white Gaussian noise input.

RESPONSE (provided by Schmid & Partner Engineering, AG): Our processing applies a convolution in the time-domain. This filtering is composed of integrator (straight-forward), Half-Band filter (first-order filter) and A-weighting. The convolved data stream is then integrated over the desired period and represented and stored numerically in DASY4 as the ABM Noise (= ABM2). During the validation process of our system, the functionality of this process has been verified by debugging the filters step-by-step progressive and comparing the results also with a Rohde & Schwarz UPL Analyzer. The intermediate steps are not accessible in the final software code operated by the end user. In addition, the following verification has been made, using a single frequency (sine) signal: At the reference frequency of 1 kHz, the signal is equivalent to ABM1. ABM1 is visible from the calibration job, inclusive its frequency slope from 100Hz to 5kHz. This function (conversion of the coil voltage to the field) is the same integration function. The verification of the probe linearity and the linearity of the integrator has been determined and documented in the certificate 880-SP AM1 001 A, inclusive the integrator, over the required frequency range (exceeding 5 kHz). The additional frequency slope of the Half-Band filter and the A-weighting have also been tested by changing the applied frequency over the full range. The attenuation was verified for each third-octave-band and up to > 10 kHz. In addition, the correct processing of multiple sine-wave signals was verified.

The convolutions work over the full frequency range available in the analog path, only limited by AC-coupling at the low end and anti-aliasing filter at the high frequency end. White noise signal without band limitation has not been used for filter measurements. Pink noise, decreasing with frequency, resulting in a frequency independent response of the third-octave filter bank was used to optically verify the correct filtering function. Precision measurements were however made with pure sine signals.

Frequency components beyond the visible range of 5 kHz are contained in the ABM2 figure.

3)

Please include a demonstration that the probe/system complies with the frequency and linearity response requirements in C63.19 Annex C.5 up to at least 10 KHz. The calibration and ambient noise charts provided only go up to 5 KHz. Significant audio band noise components beyond 10 KHz should be addressed.

RESPONSE (provided by Schmid & Partner Engineering, AG):
See also probe certificate of conformity in Appendix 5, titled 880-SP AM1 001 A-A
See also coil certificate of conformity in Appendix 6, titled 880-SD HAC P02A-A

Frequency response has been tested to be within +/- 0.5 dB of ideal differentiator from 100 Hz to 10 kHz. The test was made with the real integrator and deducting the ideal integrator values. Reference signal was the Helmholtz calibration coil current which is equivalent to the field. The coil is qualified according to certificate 880-SD HAC P02 A-A.

The test data up to 5 kHz are visible directly in the calibration job result (coil current / shunt voltage, and probe voltage). Separate measurements were made for a very wide frequency range, including higher frequencies. For the third-octave bands up to 5 kHz do not exceed 0.05 dB and decay by < 0.2 dB to 5 kHz and by < 0.5 dB to 10 kHz, as required.

Linearity has also been tested and is stated in the certificate. Deviation was not measurable from 5 dB below limitation to 26 dB above noise level. For lower levels, the deviation increased to 0.1 dB at 16 dB above noise level, which corresponds to the theoretical value of
0.11 dB expected at that noise suppression level.

Significant noise contribution beyond 10 kHz will be attenuated by the convoluting A-filter as explained in answer #2. Such interferences contribute also to ABM2 represented as numerical value from the integration.

4)

Please provide more details of how the systems make all measurements such as timing, averaging, spectral processing, measurement sequence, and mathematical processing. For frequency response please discuss how input signal level is measured, and how the input source's spectral response is accounted for.

RESPONSE:
Details regarding timing and averaging of the reported final measured points are as follows:

	Narrowband Signal	Broadband Signal
Signal Length (sec):	1	2
Total Data Acquisition Time per Location (sec):	2	12
	Averaging is over 2 signal repetitions	Averaging is over 6 signal repetitions

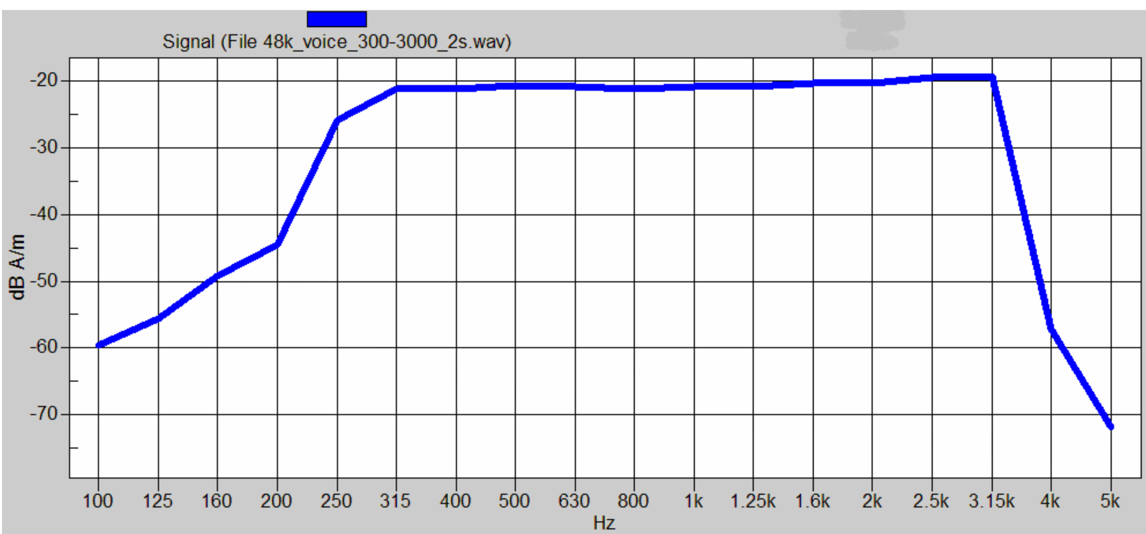
The measurement sequence is contained in section 5.1 of the report. Additional details are as follows:

a) Geometry & signal check
b) Background noise measurement
c) Coarse resolution axial scan (narrowband signal, 1sec measurement times, 50x50mm grid with 5.55mm spacing)
d) Fine resolution axial, radial-transverse, & radial-longitudinal scans, positioned appropriately based on optimal ABM1 of coarse resolution axial scan (narrowband signal, 1sec measurement times, variable grid size with 2mm spacing)
e) Signal Quality & Signal Intensity point measurements in axial, radial-transverse, & radial-longitudinal coil orientations, positioned appropriately based on optimal signal quality of fine resolution scans (narrowband signal, 2sec measurement times)
f) Frequency Response point measurement in axial coil orientation, positioned appropriately based on optimal signal quality of fine resolution axial scan (broadband signal, 12sec measurement time)

Mathematical processing is not required because the preferred method (as described in IEEE ANSI C63.19-2006 section 6.3) is utilized. The broadband audio signal is used only for assessment of frequency response.

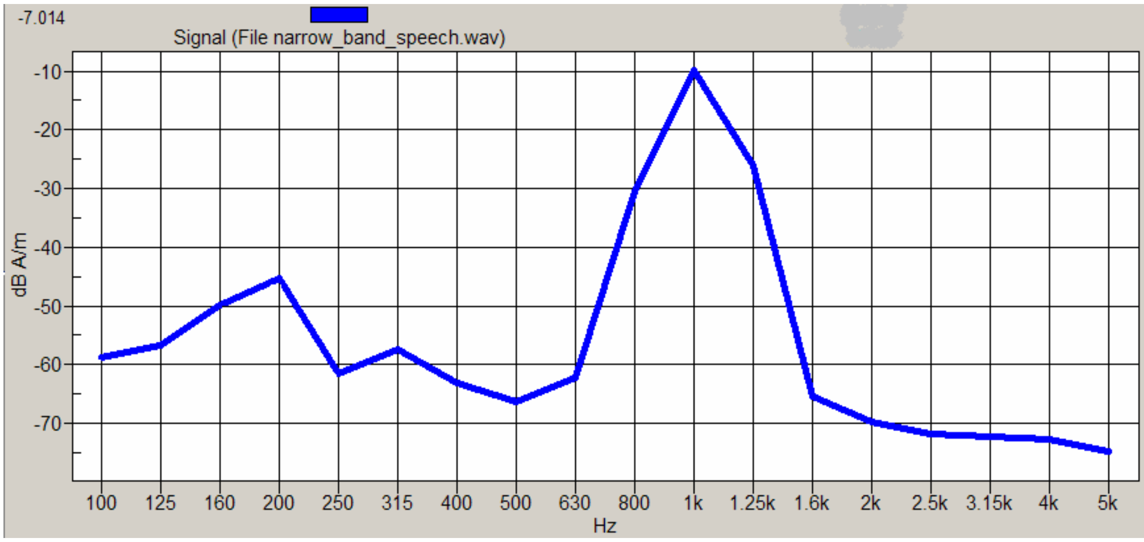
The DASY4 system corrects for the spectral response after measurement since it knows the spectrum of the input signal. However, please note that for the signal that we use, the spectrum is flat when measured in 1/3 octave bands, covering the range up to 3kHz.

The broadband signal utilized is shown in the following plot:



Measurement of the input signal level for frequency response (ie – broadband signal) is covered in question #6 below.

The narrowband signal utilized is shown in the following plot:



5)
Please show the measurement locations overlaid on a graphic of the phone. On Table 4 what are the units of location (x,y).

RESPONSE: The locations overlaid on the graphic of the phone are shown in Appendix 3 of the "HAC Test Report for T-coil IHDT56EL1 REV 2".

Table 4 has been modified in the "HAC Test Report for T-coil IHDT56EL1 REV 2" to include the point location units, which are mm.

6)
Please provide more details about establishing the input level requirement for the base station simulator. For example it is understood that CMU-200s require a vocoder calibration. Provide more details and any related calculations. How are narrowband and broadband sources measured to set the input signal level? Also, the B&K 2144 analyzer was mentioned. How was the 0 dBm0 level for the CMU-200 accounted for in the 2144?

RESPONSE: Please refer to Operational Description A.

7)
Please provide details for the -28.28 V/ (A/m) probe sensitivity shown in Graph 1. Is this for a 1 KHz CW signal or broadband? Does Speag have additional probe calibration factors that are also accounted for? The graphs mention an internal cal factor. Is the voltage shown in the graph that measured over the 10 ohm shut resister or elsewhere?

RESPONSE:

Is this for a 1 KHz CW signal or broadband? The -26.28 V/ (A/m) sensitivity is for 1 KHz sine signal

Does Speag have additional probe calibration factors that are also accounted for? The sensitivity includes both probe sensitivity and pre-amplifier sensivity. It is the total calibration, and there are no additional probe calibration factors.

The graphs mention an internal cal factor. Internal voltage measurements are used to calculate sensitivity of -26.28 V/ (A/m).

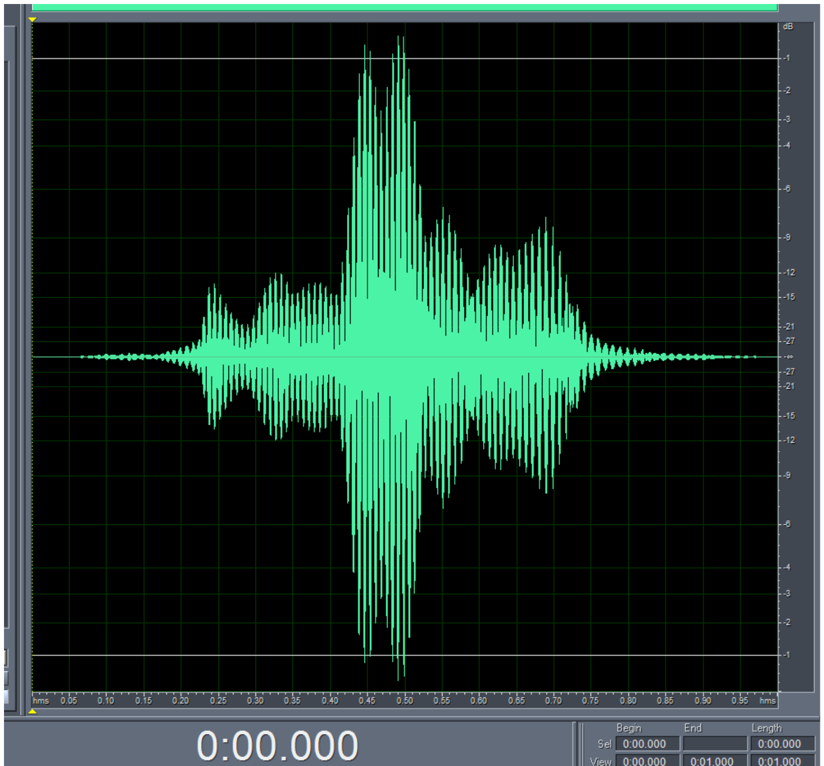
Formula: 20* Log (1.19135 / (2.45397 / 0.1)) = -26.28 V / (A/m

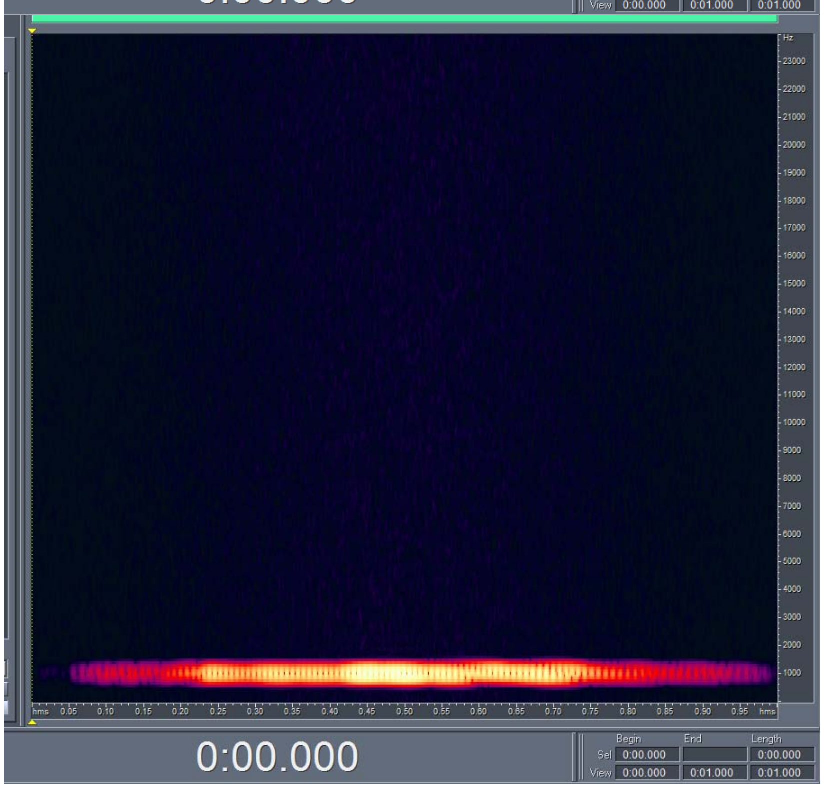
Is the voltage shown in the graph that measured over the 10 ohm shut resister or elsewhere? The voltage into the Helmholtz coil is across the shunt resistor.

8)
Please provide full details of the source audio signals for all aspects of the test. Please include spectral and temporal characteristics and any special processing requirements used in the system such as averaging.

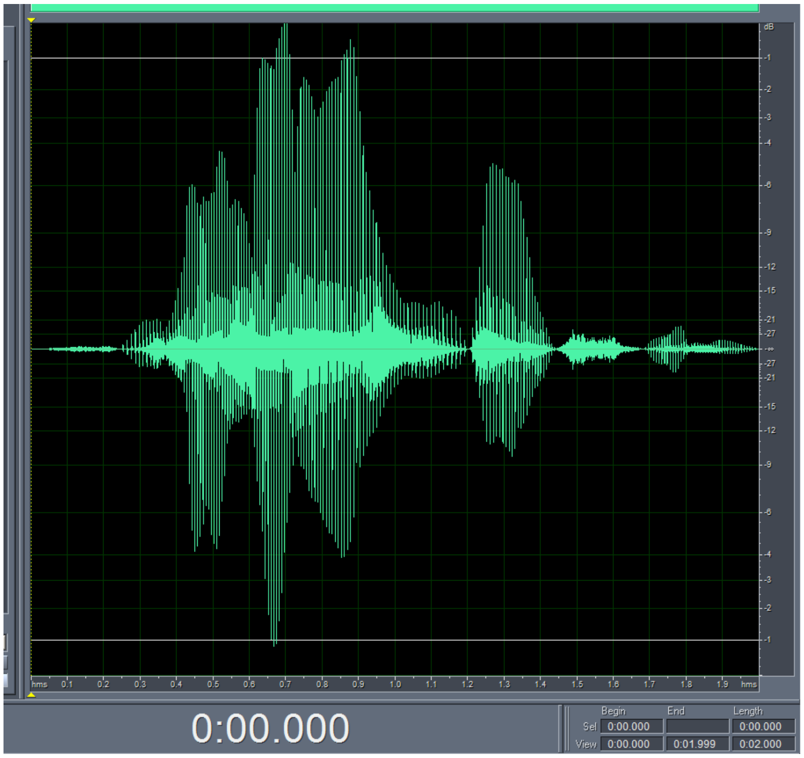
RESPONSE: For the details regarding timing, averaging and etc., please refer to the answer for question 4 listed above.

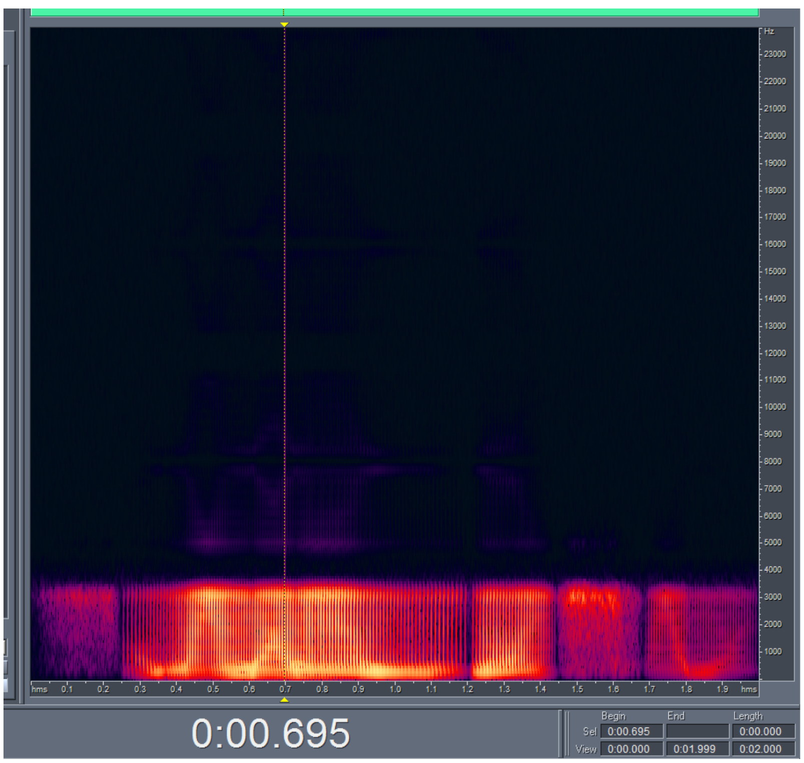
Here is the temporal response of the narrow band signal. The signal is one second of the standard P.50 speech band limited to the ANSI 1kHz 1/3 octave band. The signal is Hann windowed to ensure continuity of the signal.





Here is the temporal response of the 300Hz-3kHz broadband signal. The signal is a 2 second segment of the standard P.50 speech that is equalized flat (for ANSI 1/3 octaves) over the 300Hz to 3kHz range. The signal is Hann windowed to ensure continuity of the signal.





9)
`Please provide the contour plots mentioned if available.`

RESPONSE: For the three probe positions, contour plots for the lowest SNR, indicated in **bold numbers** in Table 4, are given in Appendix 1 of the "HAC Test Report for T-coil IHDT56EL1 REV 2".

10)
`Please justify the choice of RF frequency for testing.`

RESPONSE: The center channel, which corresponds to the center frequency of the frequency band, was used. Per 6.2.2 of the standard, the frequency near the center of the frequency band should be used.

11)
`Please demonstrate that operation of the BT does not affect the measurement results.`

RESPONSE: No Bluetooth profile exists in this phone that will allow a Bluetooth link while in a cellular call that passes audio to the earpiece. If the user had Bluetooth enabled and a link established, they could not be listening to the phone through the earpiece.

RF - EMISSIONS

12)
Please provide more details about the measurement system in general and details of its measurement procedures.

RESPONSE:
For general description, refer to the flyer attached in the Appendix 1 of this supplement.

The sequence of the measurement is listed in steps below.

1) Geometry Check: probe phantom alignment and check of accuracy.
2) Power Reference Measurement
3) Area Scan: as described in paragraph 3 of section 6 of the report "HAC Test Report for T-coil IHDT56EL1 REV 2".
4) Power Drift Measurement

13)
Please explain intent or meaning of plots on page 14 and 15.

RESPONSE: PC Test has requested to provide details of the WD's signal. PC Test asked to include wideband and 0 span spectrum analyzer plots. These plots have become part of our filing based on the request from PC Test.

14)
Please explain/justify use of 10 KHz VBW in relation to the Standard's PMF procedure.

RESPONSE: The human ear can hear up to 20 kHz VBW. Our spectrum analyzer has VBW settings for 10 kHz and 30 kHz. Out of these two choices, 10 kHz VBW presents the worst-case.

15)
Please explain how differences in impedance with and without dipole are accounted for in the PMF procedure. Generally directional coupler techniques would be used for this purpose.

RESPONSE: Directional Coupler techniques are used for this purpose (refer to Figure 2a of "HAC Test Report for T-coil IHDT56EL1 REV 2"). The Forward power and Reverse power are measured and adjusted in order for the Input Power to equal 100 mW.

16)
Please demonstrate that operation of the BT does not affect the measurement results.

RESPONSE: No Bluetooth profile exists in this phone that will allow a Bluetooth link while in a cellular call that passes audio to the earpiece. If the user had Bluetooth enabled and a link established, they could not be listening to the phone through the earpiece.

17)
Please provide measurement data used for probe rotation uncertainty analysis mentioned.

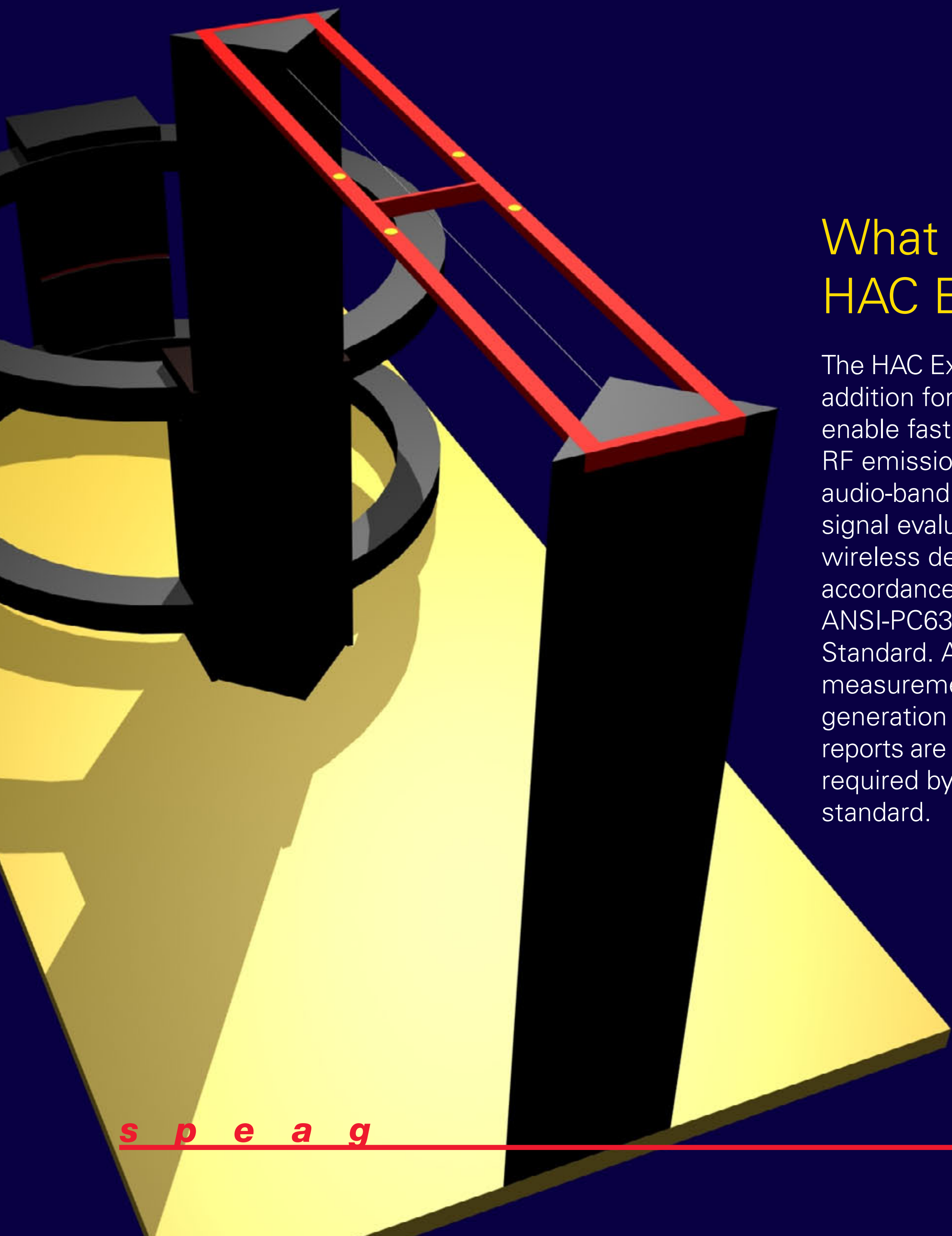
RESPONSE: Please refer to Operational Description B.

APPENDIX 1

The Latest DASY4 Addition

HAC Extension

for Testing Hearing Aid Compatibility in Accordance with ANSI-PC63.19



What is the HAC Extension?

The HAC Extension is an addition for DASY4 to enable fast and reliable RF emission tests and audio-band magnetic signal evaluations of wireless devices in accordance with the ANSI-PC63.19 Draft Standard. Automated measurements and the generation of test reports are supported as required by the standard.

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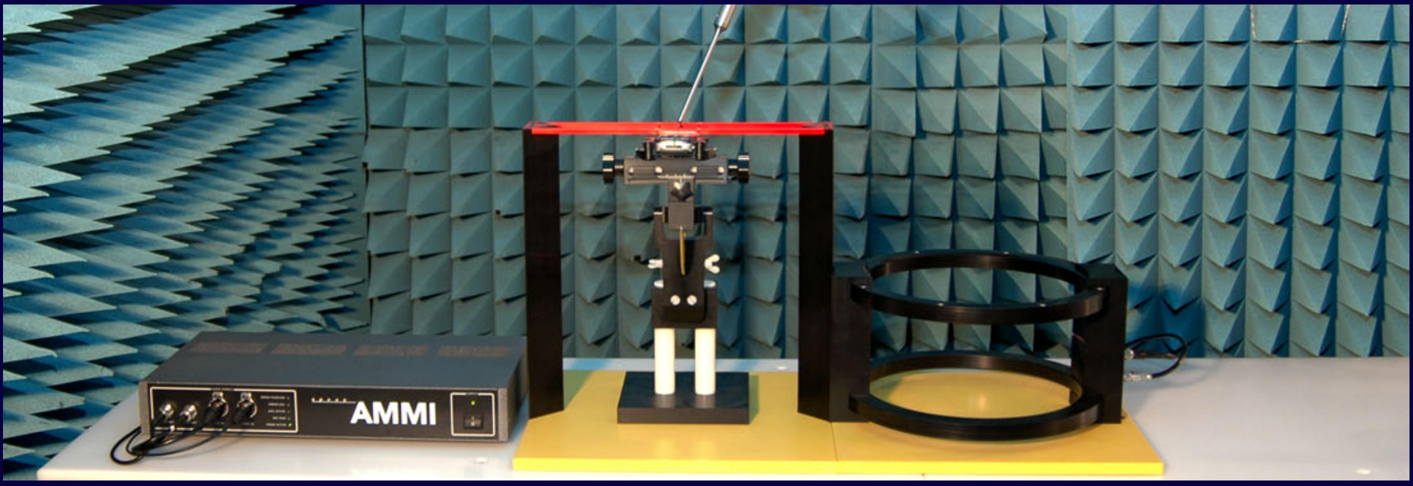
HAC Extension for Testing Hearing Aid Compatibility in Accordance with ANSI-PC63.19



Specifications

Test Arch (enables easy and well defined positioning of the phone and calibration dipoles as well as simple teaching of the robot)	370 x 370 mm x 375 mm
Device Holder / Positioner (supports accurate positioning of any phone) effect on near-field	 <+/- 0.5dB
Broadband Calibration Dipoles CD835 / CD1880 / CD 2450 frequency bands return loss calibrated at	including holder and transportation box 800 - 960 / 1710 - 2000 / 2250 - 2650 MHz >15 / >18 / >18 dB over frequency band 835 / 1880 / 2450 MHz (return loss >20 dB)
Audio Magnetic Field Probe AM1D frequency range sensitivity pre-amplifier dimensions	 0.1 - 20 kHz (RF sensitivity <-100 dB, fully RF shielded) <-50 dB A/m @ 1 kHz 40 dB, symmetric tip diameter / length: 6 / 290 mm, sensor according to ANSI-PC63.19
Audio Magnetic Measurement Instrument (AMMI) sampling rate dynamic range test signal generation calibration dimensions	 48 kHz / 24 bit 85 dB user selectable and predefined (via PC) auto-calibration / full system calibration using AMCC with monitor output 482 x 65 x 270 mm
Helmholtz Calibration Coil (AMCC) dimensions	 370 x 370 x 196 mm, according to ANSI-PC63.19
HAC Extension Software for DASY4 precise teaching measurement area evaluation report	 easy teaching with adaptive distance verification flexible selection of measurement area, predefined according to ANSI-PC63.19 RF: automatic exclusion of high-level areas ABM: spectral processing, filtering, weighting and evaluation according to ANSI-PC63.19 documentation ready for compliance report
Isotropic H-Field Probe H3D (optional) frequency band dynamic range linearity directivity dimensions	 200 - 3000 MHz (free space) 10 mA/m to 2 A/m at 1 GHz ± 0.2 dB (100 MHz to 3 GHz) ± 0.25 dB (spherical isotropy error) tip diameter / length: 6 / 330 mm
Isotropic E-Field Probe ER3D (optional) frequency dynamic range linearity directivity dimensions	 100 - 6000 MHz 2 V/m to > 1000 V/m ± 0.2 dB (100 MHz to 6 GHz) ± 0.2 dB in air (rotation around probe axis) ± 0.4 dB in air (rotation normal to probe axis) tip diameter / length: 8 / 330 mm

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