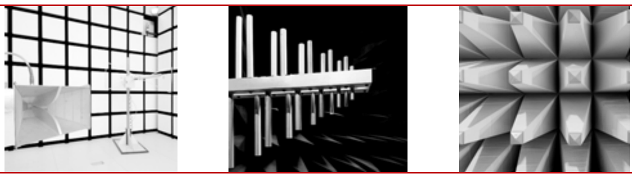

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DAR

# TEST REPORT

**Test Report No.: 1-2403-02-07/10**


## Testing Laboratory

**CETECOM ICT Services GmbH**
Untertürkheimer Straße 6 – 10
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**Accredited Test Laboratory:**
The test laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025

DAR registration number: DGA-PL-176/94-D1


## Applicant

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95801 Cergy Pontoise Cedex/France

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## Manufacturer

**CETECOM Shanghai**
Room 102, Building 27, No. 1387 Zhangdong Road
Shanghai/CHINA


## Test Standard/s

| | |
|---|---|
| ANSI C63.19-2007 | Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids |
| FCC 47 CFR §20.19 | Hearing Aid Compatible Mobile Headsets |

## Test Item

| | |
|---|---|
| Kind of test item: | GSM Mobile Phone |
| Device type: | portable device |
| **Model name:** | **COSY Phone 3G** |
| S/N serial number: | FFCSTR400767 |
| FCC-ID: | M9HCOSY3G |
| IC: | N/A |
| IMEI-Number: | 352330040009493 |
| Hardware status: | V0x |
| Software status: | EB,R07 |
| Frequency: | see technical details |
| Antenna: | integrated antenna |
| Battery option: | Li-ion battery ABD463450LA BD-L4C 900mAh |
| Test sample status: | identical prototype |
| HAC M-Rating | M3 |


This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

## Test performed:

cn=Thomas Vogler, o=CETECOM ICT Services GmbH, ou=VOG-100727, email=thomas.vogler@cetecom.com, c=DE
2010.08.24 16:52:37 +02'00'

2010-08-24 Thomas Vogler

## Test Report authorised:

cn=Bernd Rebmann, o=CETECOM ICT, ou=REB-100122, email=Bernd.Rebmann@ict.cetecom.de, c=DE
2010.08.24 17:07:01 +02'00'

2010-08-24 Bernd Rebmann

# 1 Table of contents

# 2 General information

## 2.1 Notes

The test results of this test report relate exclusively to the test item specified in this test report. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM ICT Services GmbH.
This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

## 2.2 Application details

| | |
|---|---|
| Date of receipt of order: | 2010-07-22 |
| Date of receipt of test item: | 2010-08-16 |
| Start of test: | 2010-08-17 |
| End of test: | 2010-08-18 |
| Person(s) present during the test: | |

## 2.3 Statement of compliance

TheCOSY Phone 3G GSM Mobile Phone has been tested in accorance with ANSI C63.19-2007: American National Standard for Methods of Measurement of Compatibility between Wireless Communication Devices and Hearing Aids.

C63.19 HAC Rated Category: M3

## 2.4 Technical details

| Band tested for this SAR test report | Technology | Frequency band | Lowest transmit frequency/MHz | Highest transmit frequency/MHz | Lowest receive Frequency/MHz | Highest receive Frequency/MHz | Kind of modulation | Power Class | Tested power control level | GPRS/EGPRS mobile station class | GPRS/EGPRS multislot class | (E)GPRS voice mode or DTM | Test channel low | Test channel middle | Test channel high | Maximum output power/dBm )* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ☐ | GSM | GSM | 880.2 | 914.8 | 925.2 | 959.8 | GMSK<br>8-PSK | 4<br>E2 | 5 | B | 10 | no | 975 | 37 | 124 | -- |
| ☐ | GSM | DCS | 1710.2 | 1784.8 | 1805.2 | 1879.8 | GMSK<br>8-PSK | 1<br>E2 | 0 | B | 10 | no | 512 | 698 | 885 | -- |
| ☒ | GSM | cellular | 824.2 | 848.8 | 869.2 | 893.8 | GMSK<br>8-PSK | 4<br>E2 | 5 | B | 10 | no | 128 | 190 | 251 | 32.9 |
| ☒ | GSM | PCS | 1850.2 | 1909.8 | 1930.2 | 1989.8 | GMSK<br>8-PSK | 1<br>E2 | 0 | B | 10 | no | 512 | 661 | 810 | 29.6 |
| ☐ | UMTS | FDD I | 1922.4 | 1977.6 | 2112.4 | 2167.6 | QPSK | 3 | max | -- | -- | -- | 9612 | 9750 | 9888 | -- |
| ☐ | UMTS | FDD VIII | 882.4 | 912.6 | 927.4 | 957.6 | QPSK | 3 | max | -- | -- | -- | 2712 | 2787 | 2863 | -- |
| ☐ | BT | ISM | 2412 | 2462 | 2412 | 2462 | GFSK | 3 | max | -- | -- | -- | 0 | 39 | 78 | <10.0 |

)*: slotted peak power for GSM, averaged max. RMS power for UMTS and BT.

## 3 Test standard/s:

| Test Standard | Version | Test Standard Description |
|---|---|---|
| ANSI C63.19 | 2007 | Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids |
| FCC 47 CFR §20.19 | | Hearing Aid Compatible Mobile Headsets |

## 3.1 Categories of hearing aid compatibility for wireless devices

| Telephone RF Parameters | | | | | |
|---|---|---|---|---|---|
| Category | AWF (dB) | Limits for E-Field Emissions | | Limits for H-Field Emissions | |
| | | | | | |
| < 960 MHz | | V/m | dBV/m | A/m | dBA/m |
| M1 | 0 | 631 - 1122 | 56 – 61 | 1.91 - 3.39 | 5.6 – 10.6 |
| | -5 | 473.2 - 841.4 | 53.5 – 58.5 | 1.43 - 2.54 | 3.1 – 8.1 |
| M2 | 0 | 354.8 - 631 | 51 – 56 | 1.07 - 1.91 | 0.6 – 5.6 |
| | -5 | 266.1 - 473.2 | 48.5 – 53.5 | 0.8 - 1.43 | -1.9 – 3.1 |
| M3 | 0 | 199.5 - 354.8 | 46 – 51 | 0.6 - 1.07 | -4.4 – 0.6 |
| | -5 | 149.6 - 266.1 | 43.5 – 48.5 | 0.45 - 0.8 | -6.9 – -1.9 |
| M4 | 0 | <199.5 | <46 | <0.6 | < -4.4 |
| | -5 | <149.6 | <43.5 | <0.45 | < -6.9 |
| | | | | | |
| > 960 MHz | | V/m | dBV/m | A/m | dBA/m |
| M1 | 0 | 199.5 – 354.8 | 46 – 51 | 0.6 – 1.07 | -4.4 – 0.6 |
| | -5 | 149.6 – 266.1 | 43.5 – 48.5 | 0.45 – 0.8 | -6.9 – -1.9 |
| M2 | 0 | 112.2 – 199.5 | 41 – 46 | 0.34 – 0.6 | -9.4 – -4.4 |
| | -5 | 84.1 – 149.6 | 38.5 – 43.5 | 0.25 – 0.45 | -11.9 – -6.9 |
| M3 | 0 | 63.1 – 112.2 | 36 – 41 | 0.19 – 0.34 | -14.4 – -9.4 |
| | -5 | 47.3 – 84.1 | 33.5 – 38.5 | 0.15 – 0.25 | -16.9 – -11.9 |
| M4 | 0 | <63.1 | <36 | <0.19 | < -14.4 |
| | -5 | <47.3 | <33.5 | <0.14 | < -16.9 |

**AWF : Articulation Weighting Factor**

| Standard | Technology | AWF |
|---|---|---|
| TIA/EIA/IS-2000 | CDMA | 0 |
| TIA/EIA-136 | TDMA (50 Hz) | 0 |
| **J-STD-007** | **GSM (217 Hz)** | **-5** |
| **T1/T1P1/3GPP** | **UMTS (WCDMA)** | **0** |
| iDEN | TDMA (22 Hz and 11 Hz) | 0 |

## 4 Summary of Measurement Results

| | |
|---|---|
| ☒ | **No deviations from the technical specifications ascertained** |
| | **HAC-Category : M3** |
| ☐ | Deviations from the technical specifications ascertained |

## 5 Test Environment

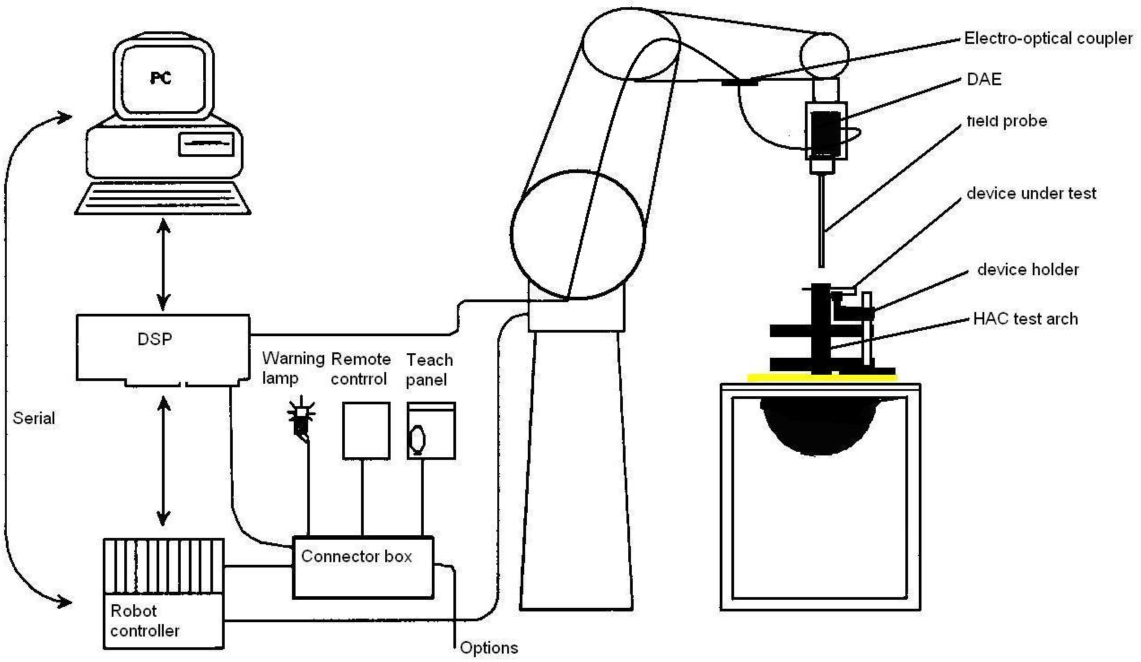
| | |
|---|---|
| Ambient temperature: | 20 – 24 °C |
| Relative humidity content: | 40 – 50 % |
| Air pressure: | not relevant for this kind of testing |
| Power supply: | 230 V / 50 Hz |

# 6 Test Set-up

## 6.1 Measurement system

### 6.1.1 System Description

For performing HAC measurements the Schmid & Partner DASY4 dosimetric assessment system is used which is described below. Instead of dosimetric probes E-field and H-field probes for measurement in air are in use together with a HAC test arch:




The DASY4 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronic (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- A unit to operate the optical surface detector which is connected to the EOC.
- The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY4 measurement server.
- The DASY4 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 2000
- DASY4 software and SEMCAD data evaluation software.
- Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
- The generic twin phantom enabling the testing of left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- System validation dipoles allowing to validate the proper functioning of the system.

### 6.1.2 Test environment

The DASY4 measurement system is placed at the head end of a room with dimensions :
5 x 2.5 x 3 m³, the SAM phantom is placed in a distance of 75 cm from the side walls and 1.1m from the rear wall. Above the test system a 1.5 x 1.5 m² array of pyramid absorbers is installed to reduce reflections from the ceiling.
Additional absorbers are placed around the HAC test set-up to prevent reflections from the robot arm.
Picture 1 of the photo documentation shows a complete view of the the test environment.
The system allows the measurement of E-field values larger than 2 V/m and H-field values larger than 10mA/m.

### 6.1.3 Probe description

Isotropic E-Field Probe ET3DV6 for Dosimetric Measurements

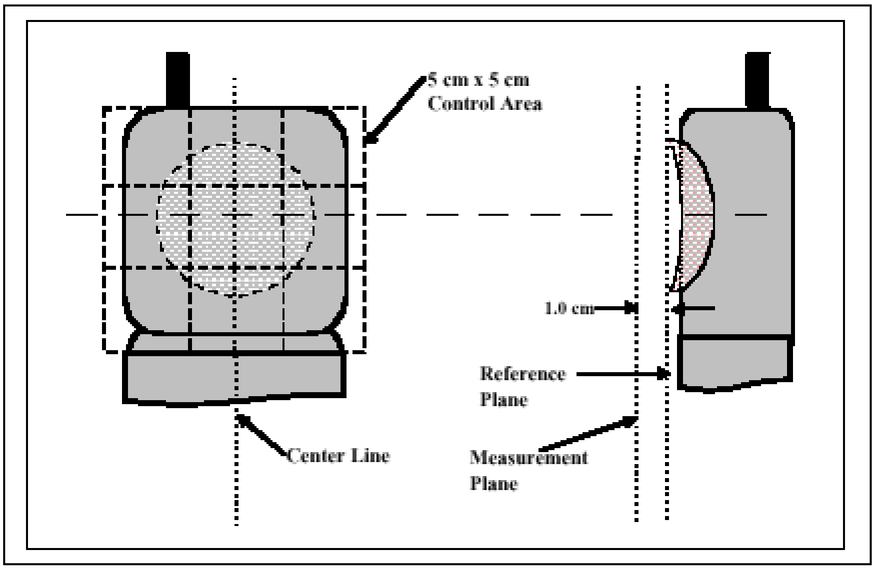
| E-Field Probe ER3DV6<br>(Technical data according to manufacturer information) | |
|---|---|
| Construction | One dipole parallel and two dipoles normal to probe axis<br>Built-in shielding against static charges |
| Calibration | In air from 100 MHz to 3 GHz<br>(absolute accuracy ± 6.0%; k=2) |
| Frequency | 100 MHz to >6 GHz; Linearity: ± 0.2 dB (100MHz to 3 GHz) |
| Directivity | ± 0.2 dB in air (rotation around probe axis)<br>± 0.4 dB in air (rotation normal to probe axis) |
| Dynamic range | 2 V/m to > 1000 V/m<br>(M3/M4 device readings fall well below diode compression point) |
| Dimensions | Overall length: 330 mm; Tip length: 16 mm<br>Body diameter: 12 mm; Tip diameter: 8 mm<br>Distance from probe tip to dipole centers: 2.5mm |

| H-Field Probe H3DV6<br>(Technical data according to manufacturer information) | |
|---|---|
| Construction | Three concentric loop sensors with 3.8 mm loop diameters.<br>Resistively loaded detector diodes for linear response<br>Built-in shielding against static charges |
| Calibration | In air from 100 MHz to 3 GHz<br>(absolute accuracy ± 6.0%; k=2) |
| Frequency | 200 MHz to 3 GHz; Linearity: ± 0.2 dB (100MHz to 3 GHz) |
| Directivity | ± 0.25 dB (spherical isotropy error) |
| Dynamic range | 10 mA/m to 2 A/m at 1 GHz<br>(M3/M4 device readings fall well below diode compression point) |
| Dimensions | Overall length: 330 mm; Tip length: 40 mm<br>Body diameter: 12 mm; Tip diameter: 6 mm<br>Distance from probe tip to loop centers: 3 mm |
| E-Field Interference | < 10% at 3 GHz (for plane wave) |

### 6.1.4 HAC test arch description

The HAC test arch is especially designed for performing measurements according to the requirements of ANSI C63.19. It allows centering the wireless device inside a 5 x 5 cm control area marked with 4 points for position adjustment. Plastic bridges allow an exact adjustment of the measurement distance to 1 cm from the DUT, which also includes the distance of the dipole center to the probe tip.
For centering the mobile phone speaker inside the control area and for adjusting the validation dipole position the test arch contains a nylon thread for alignment (see picture).

The HAC test arch is placed on the cover of the DASY4 SAM phantom.




### 6.1.5 Device holder description

The DASY4 device holder (see picture above) has three scales for device inclination, height and side adjustment. The device holder position is adjusted to the standard measurement position e.g. center of the DUT speaker to the center of the 5 x 5 cm² control area with the device touching the plastic bridge of the HAC test arch. This device holder is used for standard mobile phones or PDA’s only. If necessary an additional support of polystyrene material is used.

## 6.1.6 Scanning procedure

The DASY4 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All tests are performed with the same configuration of test steps an in accordance with the requirements described in C63.19-2007 Chapter 4.4.1.2.2.

1. The HAC test setup is placed at the pre-defined position on top of the SAR phantom cover.
2. A phantom adjustment and verification is performed, which allows checking the borders and center position of the 5 x 5 cm² control area. The probe tip touches down on the 4 points at the corners of the control area
3. The wireless device (WD) is oriented in its intended test position (see photo documentation) with the reference plane in the horizontal plane and secured by the device holder. The acoustical output is placed in the center of the control area (predefined by the HAC test arch)
4. The DUT is set to transmit at maximum output power at the desired test channel(s).
5. „Reference“ and „drift“ measurements are located at the beginning and the end of the test batch process. They measure the field drift at one single point above the DUT over the complete procedure. The indicated drift is mainly the variation of the DUT’s output power and should vary max. +/- 5 % (+/- 0.2 dB).
6. The „area scan“ measures the electrical or magnetic field strenth above the WD on a parallel plane to the surroundings of the control area at the upper end of the HAC test arch. It is used to locate the approximate location of the peak field strength with 2D spline interpolation. The robot performs a stepped movement along one grid axis while the local electrical or magnetic field strenth is measured by the probe. The probe is moving at a distance of 1 cm to a defined plane above the WD during acquisition of measurement values. Standard grid spacing is 5 mm in x- and y- dimension. If a finer resolution is needed, the grid spacing can be reduced. Results of this scan are shown in annex 2.
7. At the maximum interpolated position a 360° rotation of the probe around the azimuth is performed. The maximum and delta reading from this rotation is used in re-evaluating the HAC category.
8. The automatic data evaluation performed by the software in respect of the requirements of the test standard subdivides the tested area of 5 x 5 cm into 9 squares. Within each square the maximum electrical or magnetic field strength is detected. For classification of M categories the 3 squares with highest field values are excluded. Among the remaining 6, one of which is the center square, 4 squares with highest values both in E-field and in H-field scan are evaluated. The results are automatically exported by the SEMCAD evaluation software together with the measurement plots.

The SEMCAD software also respects the articulation weighing factor (AWF), and converts the measured values to peak V/m or peak A/m using appropriate factors derived from the probe modulation factor, which is determined by system validation measurements.

## 6.1.7 Data Storage and Evaluation

Data Storage

The DASY4 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension ".DA4". The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

Data Evaluation by SEMCAD

The SEMCAD software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

| | | |
|---|---|---|
| Probe parameters: | - Sensitivity | $Norm_i$, $a_{i0}$, $a_{i1}$, $a_{i2}$ |
| | - Conversion factor | $ConvF_i$ |
| | - Diode compression point | Dcpi |
| Device parameters: | - Frequency | f |
| | - Crest factor | cf |
| Media parameters: | - Conductivity | $\sigma$ |
| | - Density | $\rho$ |

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY4 components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics.

If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot cf/dcp_i$$

| | | | |
|---|---|---|---|
| with | $V_i$ | = compensated signal of channel i | (i = x, y, z) |
| | $U_i$ | = input signal of channel i | (i = x, y, z) |
| | cf | = crest factor of exciting field | (DASY parameter) |
| | $dcp_i$ | = diode compression point | (DASY parameter) |

From the compensated input signals the primary field data for each channel can be evaluated:

E-field probes: $$E_i = (V_i / Norm_i \cdot ConvF)^{1/2}$$

H-field probes: $$H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1}f + a_{i2}f^2)/f$$

| | | | |
|---|---|---|---|
| with | $V_i$ | = compensated signal of channel i | (i = x, y, z) |
| | $Norm_i$ | = sensor sensitivity of channel i [mV/(V/m)$^2$] for E-field Probes | (i = x, y, z) |
| | ConvF | = sensitivity enhancement in solution | |
| | $a_{ij}$ | = sensor sensitivity factors for H-field probes | |
| | f | = carrier frequency [GHz] | |
| | $E_i$ | = electric field strength of channel i in V/m | |
| | $H_i$ | = magnetic field strength of channel i in A/m | |

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = (E_x^2 + E_Y^2 + E_z^2)^{1/2}$$

| | | |
|---|---|---|
| with | $P_{pwe}$ | = equivalent power density of a plane wave in mW/cm$^2$ |
| | $E_{tot}$ | = total electric field strength in V/m |
| | $H_{tot}$ | = total magnetic field strength in A/m |

### 6.1.8 Measurement uncertainty evaluation for HAC measurements

This measurement uncertainty budget is suggested by ANSI-C63.19 and determined by Schmid & Partner Engineering AG. It is valid for the frequency range 800 MHz – 3 GHz and represents a worst case analysis. The breakdown of the individual uncertainties is as follows:

| Error Sources | Uncertainty Value | Probability Distribution | Divi -sor | $c_i$ E | $c_i$ H | Standard Uncertainty E | Standard Uncertainty H |
|---|---|---|---|---|---|---|---|
| **Measurement System** | | | | | | | |
| Probe calibration | ± 5.1% | Normal | 1 | 1 | 1 | ± 5.1% | ± 5.1% |
| Axial isotropy )* | ± 4.7% | Rectangular | √3 | 1 | 1 | ± 2.7% | ± 2.7% |
| Sensor displacement | ±16.5% | Rectangular | √3 | 1 | 0.145 | ± 9.5% | ± 1.4% |
| Boundary effects | ± 2.4% | Rectangular | √3 | 1 | 1 | ± 1.4% | ± 1.4% |
| Probe linearity | ± 4.7% | Rectangular | √3 | 1 | 1 | ± 2.7% | ± 2.7% |
| Scaling to peak envelope power | ± 2.0% | Rectangular | √3 | 1 | 1 | ± 1.2% | ± 1.2% |
| System detection limits | ± 1.0% | Rectangular | √3 | 1 | 1 | ± 0.6% | ± 0.6% |
| Readout electronics | ± 0.3% | Normal | 1 | 1 | 1 | ± 0.3% | ± 0.3% |
| Response time | ± 0.8% | Rectangular | √3 | 1 | 1 | ± 0.5% | ± 0.5% |
| Integration time | ± 2.6% | Rectangular | √3 | 1 | 1 | ± 1.5% | ± 1.5% |
| RF ambient conditions )* | ± 3.0% | Rectangular | √3 | 1 | 1 | ± 1.7% | ± 1.7% |
| RF reflections )* | ± 7.5% | Rectangular | √3 | 1 | 1 | ± 4.3% | ± 4.3% |
| Probe positioner | ± 1.2% | Rectangular | √3 | 1 | 0.67 | ± 0.7% | ± 0.5% |
| Probe positioning | ± 4.7% | Rectangular | √3 | 1 | 0.67 | ± 2.7% | ± 1.8% |
| Extrapolation and Interpolation | ± 1.0% | Rectangular | √3 | 1 | 1 | ± 0.6% | ± 0.6% |
| **Test sample related** | | | | | | | |
| Device positioning vertical | ± 4.7% | Rectangular | √3 | 1 | 0.67 | ± 2.7% | ± 1.8% |
| Device positioning lateral | ± 1.0% | Rectangular | √3 | 1 | 1 | ± 0.6% | ± 0.6% |
| Device holder and Phantom | ± 2.4% | Rectangular | √3 | 1 | 1 | ± 1.4% | ± 1.4% |
| Power drift | ± 5.0% | Rectangular | √3 | 1 | 1 | ± 2.9% | ± 2.9% |
| **Combined Uncertainty** | | | | | | **± 13.6%** | **± 9.4%** |
| **Expanded Std. Uncertainty on Power** | | | | | | **± 27.2%** | **± 18.8%** |
| **Expanded Std. Uncertainty on Field** | | | | | | **± 13.6%** | **± 9.4%** |

)* : site specific

Table 1: Measurement uncertainties

## 6.1.9 Measurement uncertainty evaluation for system validation

This measurement uncertainty budget is suggested by ANSI-C63.19 and determined by Schmid & Partner Engineering AG. It is valid for the frequency range 800 MHz – 3 GHz and represents a worst case analysis. The breakdown of the individual uncertainties is as follows:

| Error Sources | Uncertainty Value | Probability Distribution | Divi -sor | $c_i$ E | $c_i$ H | Standard Uncertainty E | Standard Uncertainty H |
|---|---|---|---|---|---|---|---|
| **Measurement System** | | | | | | | |
| Probe calibration | ± 5.1% | Normal | 1 | 1 | 1 | ± 5.1% | ± 5.1% |
| Axial isotropy )* | ± 4.7% | Rectangular | √3 | 1 | 1 | ± 2.7% | ± 2.7% |
| Sensor displacement | ±16.5% | Rectangular | √3 | 1 | 0.145 | ± 9.5% | ± 1.4% |
| Boundary effects | ± 2.4% | Rectangular | √3 | 1 | 1 | ± 1.4% | ± 1.4% |
| Probe linearity | ± 4.7% | Rectangular | √3 | 1 | 1 | ± 2.7% | ± 2.7% |
| Scaling to peak envelope power | ± 0.0% | Rectangular | √3 | 1 | 1 | ± 0.0% | ± 0.0% |
| System detection limits | ± 1.0% | Rectangular | √3 | 1 | 1 | ± 0.6% | ± 0.6% |
| Readout electronics | ± 0.3% | Normal | 1 | 1 | 1 | ± 0.3% | ± 0.3% |
| Response time | ± 0.0% | Rectangular | √3 | 1 | 1 | ± 0.0% | ± 0.0% |
| Integration time | ± 0.0% | Rectangular | √3 | 1 | 1 | ± 0.0% | ± 0.0% |
| RF ambient conditions )* | ± 3.0% | Rectangular | √3 | 1 | 1 | ± 1.7% | ± 1.7% |
| RF reflections )* | ± 3.8% | Rectangular | √3 | 1 | 1 | ± 2.2% | ± 2.2% |
| Probe positioner | ± 1.2% | Rectangular | √3 | 1 | 0.67 | ± 0.7% | ± 0.5% |
| Probe positioning | ± 4.7% | Rectangular | √3 | 1 | 0.67 | ± 2.7% | ± 1.8% |
| Extrapolation and Interpolation | ± 1.0% | Rectangular | √3 | 1 | 1 | ± 0.6% | ± 0.6% |
| Probe calibration | ± 5.1% | Normal | 1 | 1 | 1 | ± 5.1% | ± 5.1% |
| **Dipole related** | | | | | | | |
| Distance dipole – scanning plane | ± 5.2% | Rectangular | √3 | 1 | 0.3 | ± 3.0% | ± 0.9% |
| Input power | ± 4.7% | Normal | 1 | 1 | 1 | ± 4.7% | ± 4.7% |
| **Combined Uncertainty** | | | | | | **± 13.4%** | **± 8.9%** |
| **Expanded Std. Uncertainty on Power** | | | | | | **± 26.9%** | **± 17.8%** |
| **Expanded Std. Uncertainty on Field** | | | | | | **± 13.4%** | **± 8.9%** |

)* : site specific

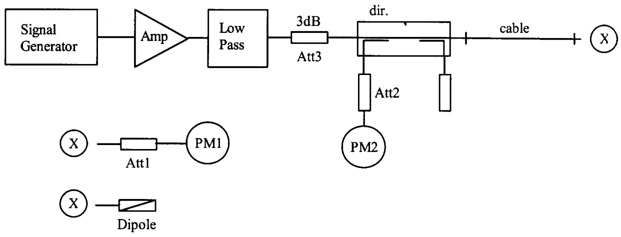
Table 2: Measurement uncertainties

## 6.1.10 System validation

The system validation is performed for verifying the accuracy of the complete measurement system and performance of the software. The following table shows validation results for all frequency bands and both for E- and H-fields. (graphic plot(s) see annex A).

## 6.1.11 Validation procedure

According to the requirements of ANSI C63.19 chapter 4.3.2.1.1 the validation is performed by using a validation dipole which is positioned parallel to the nylon fibre of the HAC test arch. The dipole is connected to the signal source consisting of signal generator and amplifier via a directional coupler, N-connector cable and adaption to SMA. It is fed with a power of 100 mW (20 dBm). To adjust this power a power meter is used. The power sensor is connected to the cable before the validation to measure the power at this point and do adjustments at the signal generator. At the outputs of the directional coupler both return loss as well as forward power are controlled during the validation to make sure that emitted power at the dipole is kept constant. This can also be checked by the power drift measurement after the test (result on plot).
During the validation the measurement system scans a grid along the length of the dipole and the maximum value is recorded.
This validation is performed periodically both with E and H field probes on the center frequencies of the frequency bands used by the wireless device.
Validation results have to be equal or near the values determined during dipole calibration (target SAR in table below) with the same test system set-up.




| Freq. / MHz | Signal type | Peak Output Power / dBm | Target Field Strenth (+/- 10%) | Measured Field Strength |
|---|---|---|---|---|
| 835 | CW | 20 | 168.6 V/m | 162.7 V/m |
| 1880 | CW | 20 | 138.3 V/m | 144.3 V/m |
| | | | | |
| 835 | CW | 20 | 0.463 A/m | 0.428 A/m |
| 1880 | CW | 20 | 0.472 A/m | 0.488 A/m |

Table 3: Results system validation

According to ANSI C63.19 Chapter 4.3.2.1.2 it is recommended to compare measurement results of 3 different test cases: CW, 80% AM and signal of the wireless device.

The probe is moved to the position with the highest field strength found during system validation with CW.
The wireless device (WD) or an emulated signal source (e.g. CMU 200) is set to apply full rated power into the reference dipole.
Average and peak output power of the WD or emulated signal source are measured using a peak power meter.
Average power emitted by the dipole is measured with the DASY4 system.
The same procedure is repeated with a CW and an AM signal with 80% modulation index which have the same peak power as determined with the signal modulation format of the wireless device.

From the measured results the peak-to-average-ratio (PAR) is determined.

Estimation of expected values:

CW

Peak-to-Average-Ratio: 0.0 dB

80% AM

Peak-to-Average Ratio (dB) = $10 * \log(m+1)^2$ with modulation index m = 0.8

$PAR_{log}$ = 5.1 dB
$PAR_{lin}$ = 1.8

c) GSM

$PAR_{log}$ = 9 dB
$PAR_{lin}$ = 8 (for one of eight timeslots in use)

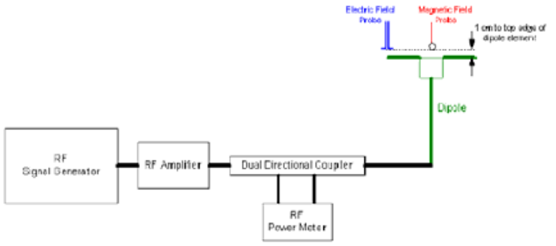
The linear PAR corresponds to the crest factor of the corresponding signal type.
(See following chapter for details)

## 6.1.12 Determination of probe modulation factor

The probe modulation factor indicates the relation between the measured RMS (average) field strength values and the peak field strength of a modulated signal, which will be used by the data evaluation software to calculate from measured RMS values to peak field values for HAC evaluation. It can be determined by comparing a CW signal with a modulated signal having the same peak envelope power as defined in ANSI C63.19 Annex C.3.1.

The following procedure according to the recommendations of DASY4 HAC application note chapter 28.6 has been used:

The probe remains in the position with the highest field strength found during system validation.
The probe is illuminated with a signal using the same modulation as the DUT (The WD itself or an emulated signal generated by the CMU 200) on the center of the WD's frequency band. The output power is adjusted to the standard peak envelope power of the WD's modulation system and measured with a spectrum analyzer in linear mode with 0 Hz span (ANSI recommendation) and/or a power meter being able to measure Peak envelope power (FCC recommendation).
The field strength at this position is recorded using the multi meter function of DASY4 software.
Then a CW signal is adjusted to the same frequency and peak reading as the modulated signal measured with spectrum analyzer or power meter.
This signal is fed to the validation dipole and the measured field strength is recorded.
The ratio of the CW to the modulated signal reading is the modulation factor.




Modulation Factor = Measured E/H-Field (CW signal) / Measured E/H-Field (modulated signal)

For E-field probes the following formula is generally valid:

$(\text{Probe Modulation Factor})^2 = \text{Crest Factor}$

For GSM with 1 of 8 timeslots in use the PMF should be ≈ 2.82

For H-field probes the modulation factor differs with amplitude, frequency, modulation and probe.

Specific information about the determination of the probe modulation factor (manufacturer application note) is attached to the calibration document delivered together with this test report.

Measured PAR and PMF

In general PMFs are smaller the higher the measured signal level is.
Therefore the peak output power of the validation signal was kept at 20 dBm as during system validation to represent a worst case situation, when calculating peak field values of the DUT.

| Freq. / MHz | Signal type | Peak-to Average Ratio / dB | Measured Field Strength with DASY4 System | Probe Modulation Factor |
|---|---|---|---|---|
| 835 | CW | 0.0 | 161 V/m | ---- |
| 835 | 80% AM | 5.1 | 110.2 V/m | 1.48 |
| 835 | GSM | 9.1 | 55.5 V/m | **2.89** |
| 835 | CW | 0.0 | 0.427 A/m | ---- |
| 835 | 80% AM | 5.1 | 0.294 A/m | 1.45 |
| 835 | GSM | 9.1 | 0.154 A/m | **2.79** |
| | | | | |
| 1880 | CW | 0.0 | 141.7 V/m | ---- |
| 1880 | 80% AM | 5.1 | 98 V/m | 1.56 |
| 1880 | GSM | 9.1 | 48.9 V/m | **2.90** |
| 1880 | CW | 0.0 | 0.455 A/m | ---- |
| 1880 | 80% AM | 5.1 | 0.299 A/m | 1.52 |
| 1880 | GSM | 9.1 | 0.189 A/m | **2.42** |

Table 4: Results system validation

Peak and average output power levels were measured using the Rhode & Schwarz NRP Power Meter and CMU200 analyzer functions (see annex A for screenshots).

Important note:

According to manufacturer information diode based probes are inherently non-symmetric and tend to peak detection for modulated signals. SPEAG's E-field probes are designed such they are largely symmetric and accurate RMS can be obtained from pulsed signals applying the correct crest factor. The same feature could not be applied for the H-field probes such that the RMS value cannot be detected for signals other than CW without additional calibration.
So probe modulation factors of H-field probes differ more or less from those determined for E-field probes or expected target values.
In DASY V4.7 the crest factor and probe modulation factor handling has been separated.
For HAC evaluation with SPEAG's SEMCAD software the above listed probe modulation factors need to be entered additionally, so that time averaged values are automatically calculated to slotted peak field strength values.
The crest factor setting is still necessary as it is used to perform the compensation of the diode compression on the peak power (DASY4 user manual chapter 4.4.2).

# 7 Detailed Test Results

## 7.1 Conducted power measurements

For the measurements a Rohde & Schwarz Radio Communication Tester CMU 200 was used.
The output power was measured using an integrated RF connector and attached RF cable.
The conducted output power was also checked before and after each SAR measurement. The resulting power values were within a 0.2 dB tolerance of the values shown below.

Note: CMU200 measures GSM peak and average output power for active timeslots.
For SAR e.g. the timebased average power is relevant. The difference inbetween depends on the duty cycle of the TDMA signal :

| ***No. of timeslots*** | ***1*** | ***2*** | ***3*** | ***4*** |
|---|---|---|---|---|
| Duty Cycle | 1 : 8 | 1: 4 | 1 : 2.66 | 1 : 2 |
| timebased avg. power compared to slotted avg. power | - 9 dB | - 6 dB | - 4.25 dB | - 3 dB |

The signalling modes differ as follows :

| ***mode*** | ***coding scheme*** | ***modulation*** |
|---|---|---|
| GPRS | CS1 to CS4 | GMSK |
| EGPRS (EDGE) | MCS1 to MCS4 | GMSK |
| EGPRS (EDGE) | MCS5 to MCS9 | 8PSK |

Apart from modulation change (GMSK/8PSK) coding schemes differ in code rate without influence on the RF signal. Therefore one coding scheme per mode was selected for conducted power measurements.

### 7.1.1 Conducted power measurements GSM 850 MHz

| Channel / frequency | modulation | timeslots | slotted avg. power | time based avg. power (calculated) |
|---|---|---|---|---|
| 128 / 824.2 MHz | GMSK | 1 | 32.7dBm | 23.7dBm |
| 190 / 836.6 MHz | GMSK | 1 | 32.8dBm | 23.8dBm |
| 251 / 848.0 MHz | GMSK | 1 | 32.9dBm | 23.9dBm |

Table 5: Test results conducted power measurement GSM 850 MHz

### 7.1.2 Conducted power measurements GSM 1900 MHz

| Channel / frequency | modulation | timeslots | slotted avg. power | time based avg. power (calculated) |
|---|---|---|---|---|
| 512 / 1850.2 MHz | GMSK | 1 | 29.6dBm | 20.6dBm |
| 661 / 1880.0 MHz | GMSK | 1 | 29.5dBm | 20.5dBm |
| 810 / 1909.8 MHz | GMSK | 1 | 29.6dBm | 20.6dBm |

Table 6: Test results conducted power measurement GSM 1900 MHz

## 7.2 Test results

The following tables summarize the worst case E- and H-field results of the measured field distributions shown in Annex A.2. In GSM 1900 band exclusion blocks have been applied in the area of highest E- and H-field.

### 7.2.1 Test Results at speaker position

| Hearing Aid Compatibility results for E-Field | | | | | |
|---|---|---|---|---|---|
| Channel / frequency | | Max E-Field (peak) | M3 limit | category | air temperature |
| 128 / 824.2 MHz | | 202.3 V/m | 266.1 V/m | M3 | 22.9 °C |
| 190 / 836.6 MHz | | 215.8 V/m | 266.1 V/m | M3 | 22.9 °C |
| 251 / 848.8 MHz | | 224.4 V/m | 266.1 V/m | M3 | 22.9 °C |
| 251 / 848.8 MHz | worst case | 238.0 V/m | 266.1 V/m | M3 | 22.9 °C |
| 512 / 1850.2 MHz | | 79.6 V/m | 84.1 V/m | M3 | 22.9 °C |
| 661 / 1880.0 MHz | | 73.6 V/m | 84.1 V/m | M3 | 22.9 °C |
| 810 / 1909.8 MHz | | 74.1 V/m | 84.1 V/m | M3 | 22.9 °C |
| 512 / 1850.2 MHz | worst case | 83.4 V/m | 84.1 V/m | M3 | 22.9 °C |

Table 7: Test results GSM 850 and 1900 MHz (E-field) at speaker position

| Hearing Aid Compatibility results for H-Field | | | | | |
|---|---|---|---|---|---|
| Channel / frequency | | Max H-Field (peak) | M3 limit | category | air temperature |
| 128 / 824.2 MHz | | 0.422 A/m | 0.8 A/m | M4 | 22.8 °C |
| 190 / 836.6 MHz | | 0.461 A/m | 0.8 A/m | M3 | 22.8 °C |
| 251 / 848.8 MHz | | 0.505 A/m | 0.8 A/m | M3 | 22.8 °C |
| 251 / 848.8 MHz | worst case | 0.521 A/m | 0.8 A/m | M3 | 22.8 °C |
| 512 / 1850.2 MHz | | 0.218 A/m | 0.25 A/m | M3 | 22.8 °C |
| 661 / 1880.0 MHz | | 0.216 A/m | 0.25 A/m | M3 | 22.8 °C |
| 810 / 1909.8 MHz | | 0.224 A/m | 0.25 A/m | M3 | 22.8 °C |
| 810 / 1909.8 MHz | worst case | 0.225 A/m | 0.25 A/m | M3 | 22.8 °C |

Table 8: Test results GSM 850 and 1900 MHz (H-field) at speaker position

Note : Exclusion blocks applied on GSM 1900 frequencies.

Overall category: M3

### 7.2.2 General description of test procedures

The device was tested using a CMU 200 communications tester as controller unit to set test channels and maximum output power to the DUT, as well as for measuring the conducted peak power. The conducted output power was measured using an integrated RF connector and attached RF cable.
Worst case configuration evaluation was performed at channel with highest field level by rotating the probe 360° at azimuth axis (see annex B) and calculation to maximum peak.

## 8 Test equipment and ancillaries used for tests

To simplify the identification of the test equipment and/or ancillaries which were used, the reporting of the relevant test cases only refer to the test item number as specified in the table below.

| No | used | Equipment | Type | Manufacturer | Serial No. | Last Calibration | Frequency (months) |
|---|---|---|---|---|---|---|---|
| 1 | ☒ | E-Field Probe | ER3DV6 | Schmid & Partner Engineering AG | 2262 | January 8, 2010 | 12 |
| 2 | ☒ | H-Field Probe | H3DV6 | Schmid & Partner Engineering AG | 6086 | January 8, 2010 | 12 |
| 3 | ☒ | 835 MHz System Validation Dipole | CD900V3 | Schmid & Partner Engineering AG | 1027 | May 17, 2010 | 12 |
| 4 | ☒ | 1880 MHz System Validation Dipole | CD1880V3 | Schmid & Partner Engineering AG | 1021 | May 7, 2010 | 12 |
| 5 | ☐ | 2450 MHz System Validation Dipole | CD2450V3 | Schmid & Partner Engineering AG | 1023 | May 31, 2007 | 12 |
| 6 | ☒ | Data acquisition electronics | DAE3V1 | Schmid & Partner Engineering AG | 477 | May 7, 2010 | 12 |
| 7 | ☒ | Software | DASY 4 V4.7 | Schmid & Partner Engineering AG | --- | N/A | -- |
| 8 | ☒ | HAC test arch | SD HAC P01 BA | Schmid & Partner Engineering AG | 1022 | N/A | -- |
| 9 | ☒ | Universal Radio Communication Tester | CMU 200 | Rohde & Schwarz | 106826 | January 12, 2010 | 12 |
| | | | | | | | |
| 10 | ☒ | Signal Generator | 8665A | Hewlett Packard | 2833A00112 | January 8, 2010 | 12 |
| 11 | ☒ | Amplifier | M20.40.30 | Nucletudes | 35/2001 | N/A | -- |
| 12 | ☒ | Power Meter | NRP | Rohde & Schwarz | 101367 | January 8, 2010 | 12 |
| 13 | ☒ | Power Meter Sensor | NRP Z22 | Rohde & Schwarz | 100227 | January 8, 2010 | 12 |
| 14 | ☒ | Power Meter Sensor | NRP Z22 | Rohde & Schwarz | 100234 | January 8, 2010 | 12 |

## 9 Observations

No observations exceeding those reported with the single test cases have been made.

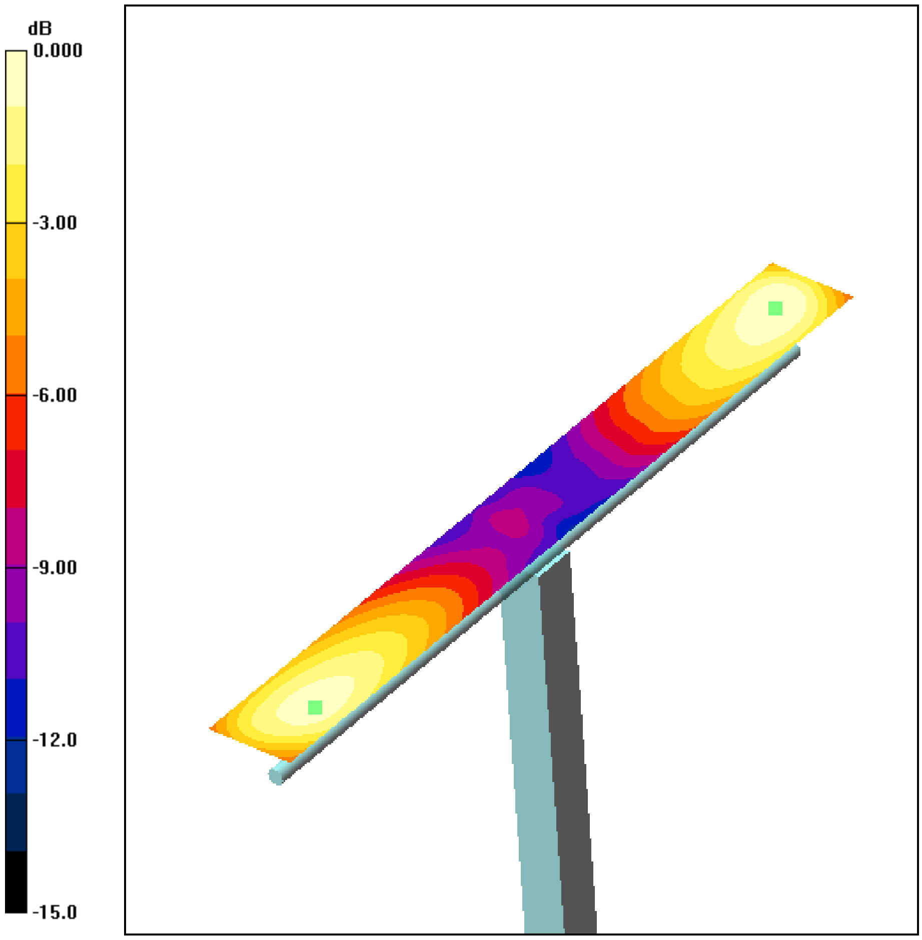
## Annex A: System performance verification

Date/Time: 17.08.2010 11:26:04

# HAC_Validation_E_835

**DUT: HAC-Dipole 835 MHz; Type: D835V3; Serial: 1027**
Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: σ = 0 mho/m, $\varepsilon_r$ = 1; ρ = 1000 kg/m$^3$
Phantom section: E Dipole Section
DASY4 Configuration:
- Probe: ER3DV6 - SN2262; ConvF(1, 1, 1); Calibrated: 08.01.2010
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn477; Calibrated: 07.05.2010
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**E Scan - measurement distance from the probe sensor center to CD835 Dipole = 10 mm/Hearing Aid Compatibility Test (41x361x1):** Measurement grid: dx=5mm, dy=5mm
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 57.0 V/m; Power Drift = -0.110 dB
Maximum value of Total (interpolated) = 162.7 V/m




0 dB = 162.7V/m

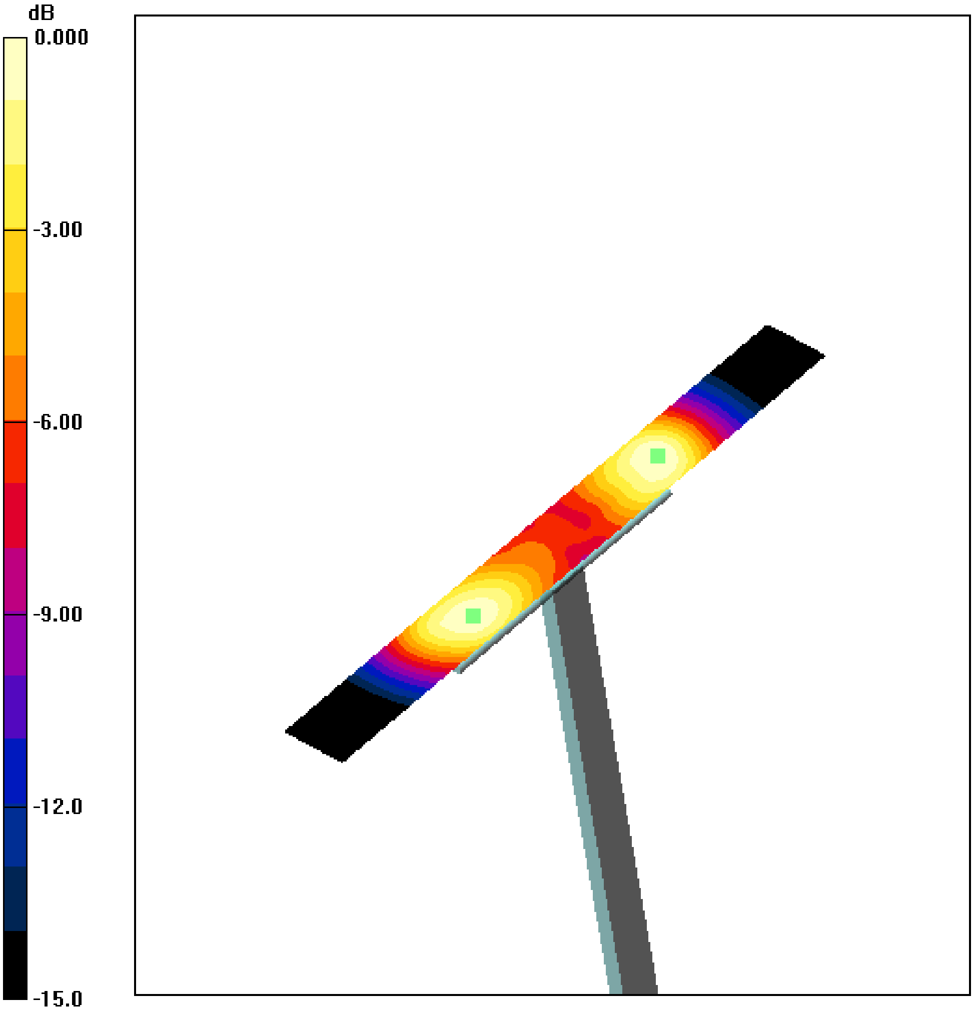
Date/Time: 17.08.2010 11:52:52

## HAC_Validation_E_1880

**DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1021**

Communication System: CW; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$
Phantom section: E Dipole Section
DASY4 Configuration:
- Probe: ER3DV6 - SN2262; ConvF(1, 1, 1); Calibrated: 08.01.2010
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn477; Calibrated: 07.05.2010
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**E Scan - measurement distance from the probe sensor center to CD1880 Dipole = 10 mm/Hearing Aid Compatibility Test (41x361x1):** Measurement grid: dx=5mm, dy=5mm
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 69.5 V/m; Power Drift = 0.006 dB
Maximum value of Total (interpolated) = 144.3 V/m



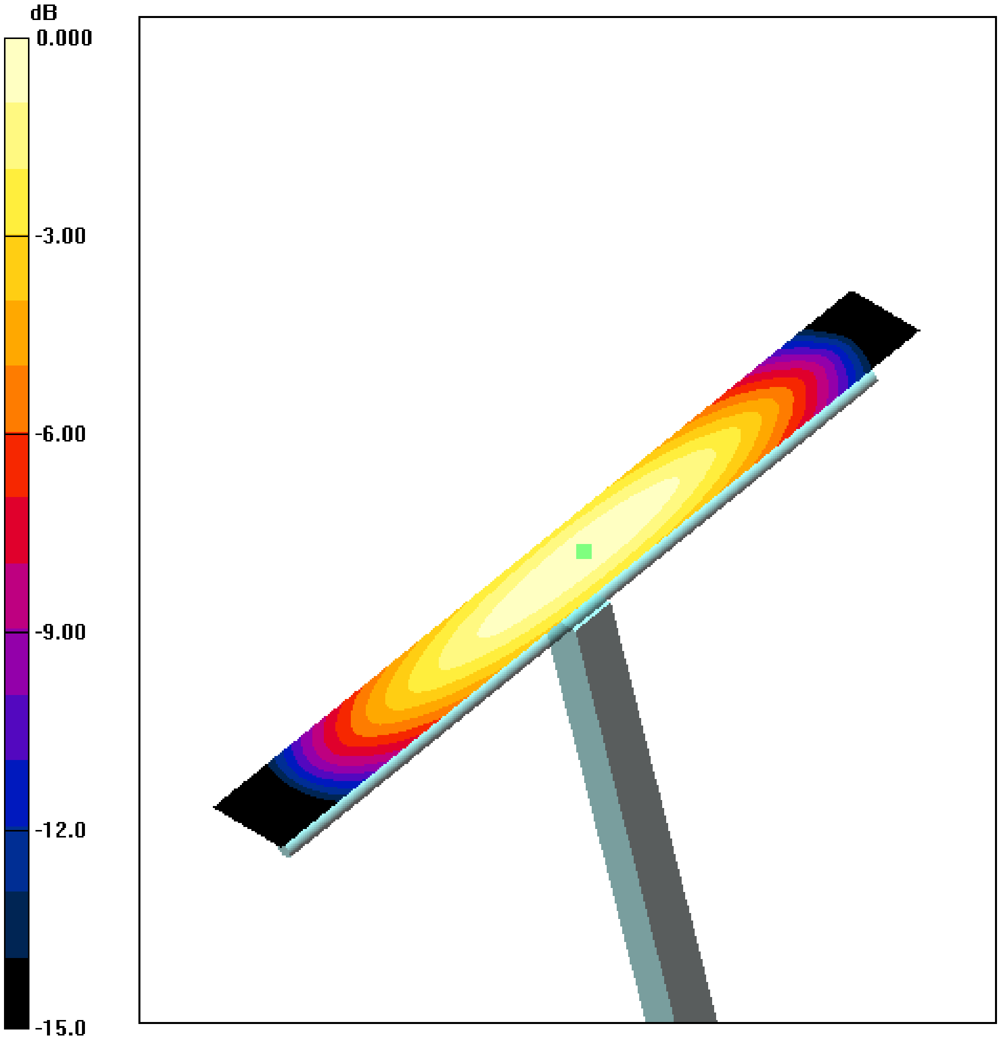

0 dB = 144.3V/m

Date/Time: 17.08.2010 13:17:31

## HAC_Validation_H_835

**DUT: HAC-Dipole 835 MHz; Type: D835V3; Serial: 1027**
Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m$^3$
Phantom section: H Dipole Section
DASY4 Configuration:
- Probe: H3DV6 - SN6086; ; Calibrated: 08.01.2010
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn477; Calibrated: 07.05.2010
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**H Scan - measurement distance from the probe sensor center to CD835 Dipole = 10 mm/Hearing Aid Compatibility Test (41x361x1):** Measurement grid: dx=5mm, dy=5mm
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 0.426 A/m; Power Drift = -0.003 dB
Maximum value of Total (interpolated) = 0.428 A/m



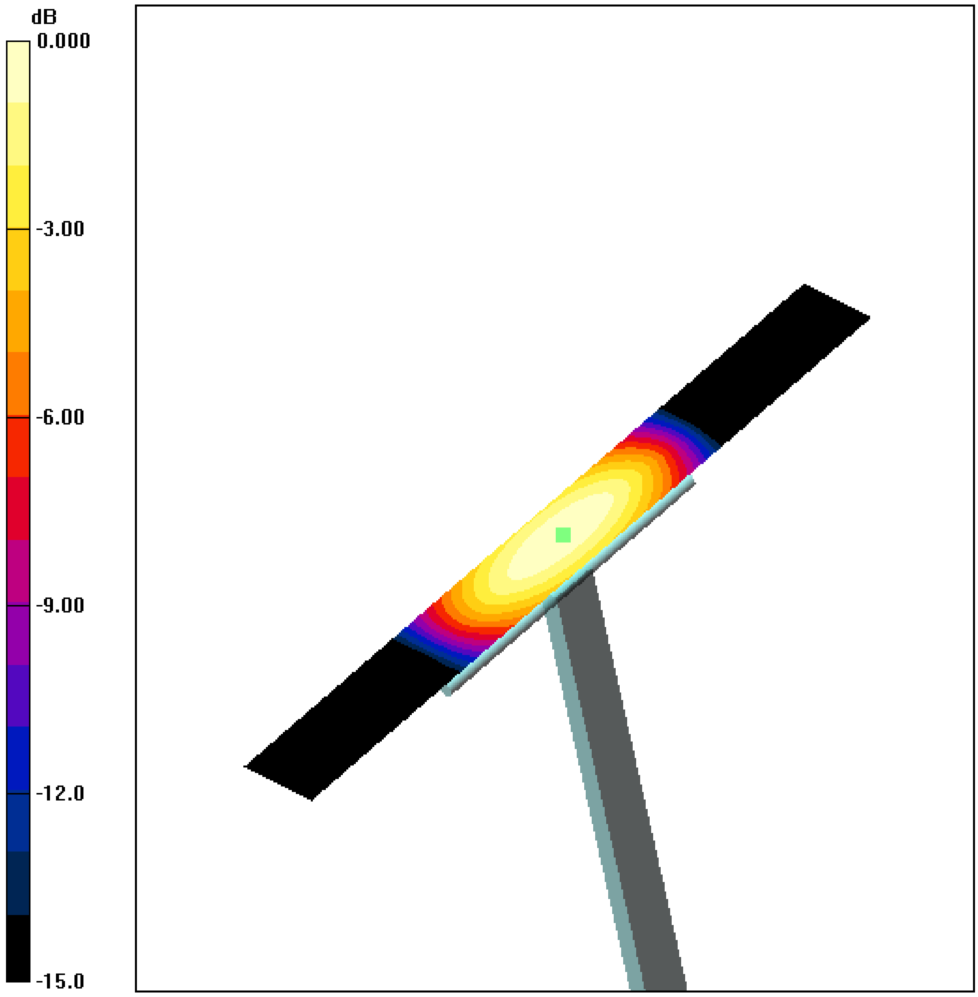

0 dB = 0.428A/m

Date/Time: 17.08.2010 13:03:16

## HAC_Validation_H_1880

**DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1021**
Communication System: CW; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m$^3$
Phantom section: H Dipole Section
DASY4 Configuration:
- Probe: H3DV6 - SN6086; ; Calibrated: 08.01.2010
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn477; Calibrated: 07.05.2010
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**H Scan - measurement distance from the probe sensor center to CD1880 Dipole = 10 mm/Hearing Aid Compatibility Test (41x361x1):** Measurement grid: dx=5mm, dy=5mm
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 0.486 A/m; Power Drift = 0.030 dB
Maximum value of Total (interpolated) = 0.488 A/m




0 dB = 0.488A/m

# Annex B: DASY4 measurement results

## Annex B.1: GSM 850 E-field

Date/Time: 17.08.2010 12:12:16

### HAC_GSM835_E-1

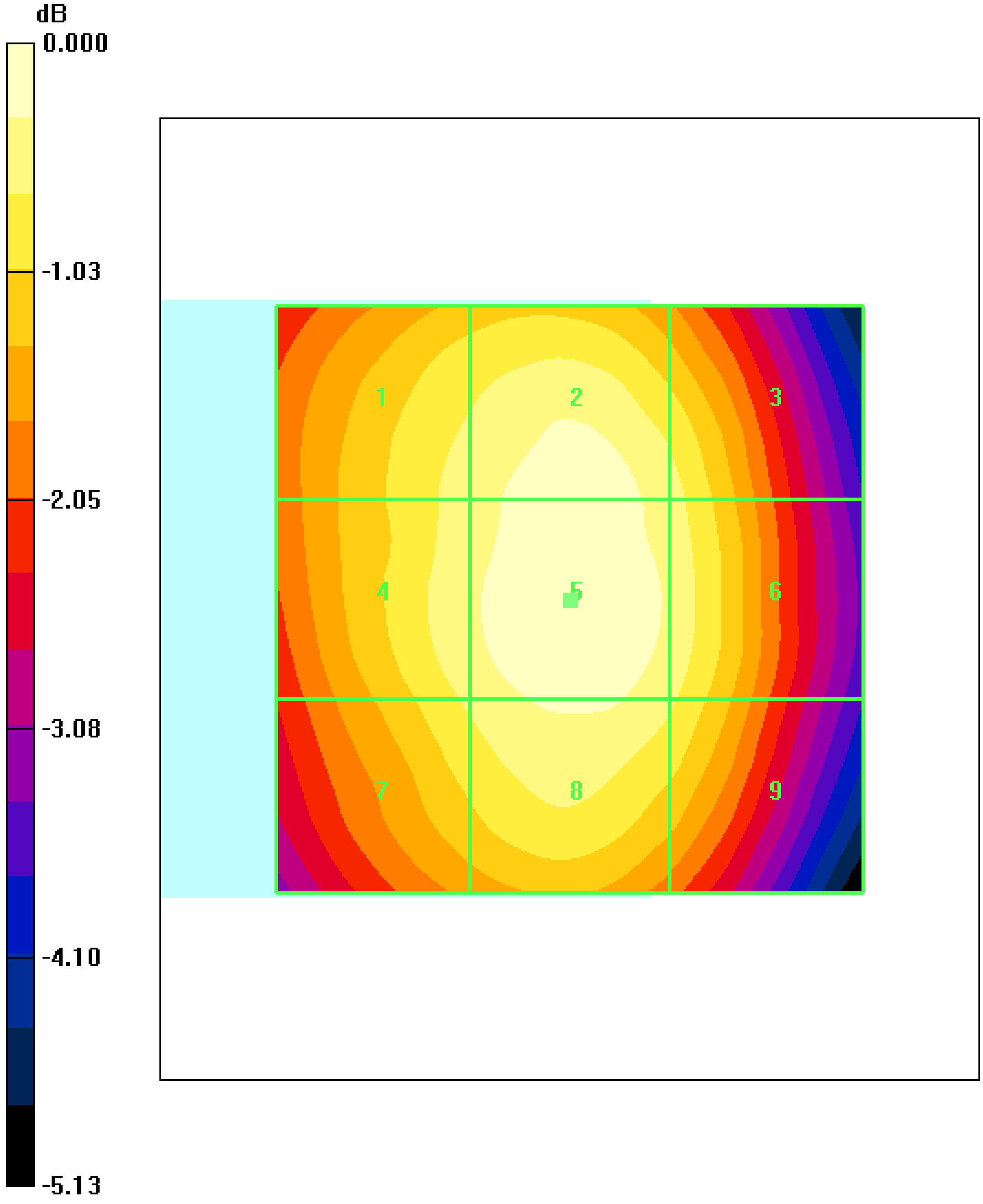
**DUT: Sagem; Type: Cosy Phone 3G; Serial: 352331040009493**
Communication System: PCS 850; Frequency: 824.2 MHz;Duty Cycle: 1:8
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$
Phantom section: E Device Section
DASY4 Configuration:
- Probe: ER3DV6 - SN2262; ConvF(1, 1, 1); Calibrated: 08.01.2010
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn477; Calibrated: 07.05.2010
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**E Scan - ER3D - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):** Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 202.3 V/m
Probe Modulation Factor = 2.89
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 95.2 V/m; Power Drift = -0.013 dB
**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**

Peak E-field in V/m

| | | |
|---|---|---|
| Grid 1 **190.9 M3** | Grid 2 **199.5 M3** | Grid 3 **190.4 M3** |
| Grid 4 **193.3 M3** | Grid 5 **202.3 M3** | Grid 6 **193.3 M3** |
| Grid 7 **188.5 M3** | Grid 8 **196.0 M3** | Grid 9 **188.4 M3** |

**Cursor:**
Total = 202.3 V/m
E Category: M3
Location: 0, 0, 369.9 mm




0 dB = 202.3V/m

Date/Time: 17.08.2010 12:17:55

## HAC_GSM835_E-2

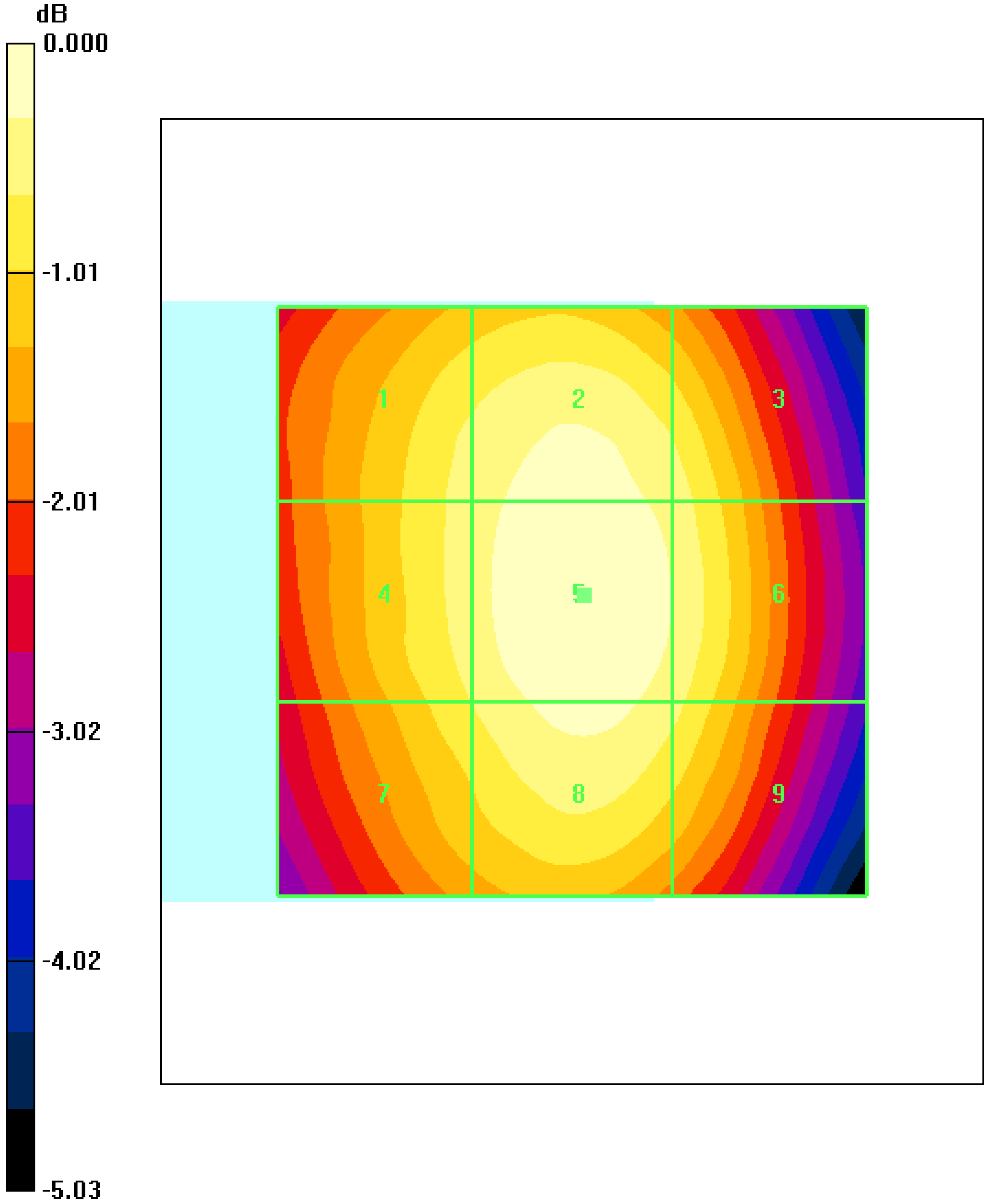
**DUT: Sagem; Type: Cosy Phone 3G; Serial: 352331040009493**
Communication System: PCS 850; Frequency: 836.6 MHz;Duty Cycle: 1:8
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$
Phantom section: E Device Section
DASY4 Configuration:
- Probe: ER3DV6 - SN2262; ConvF(1, 1, 1); Calibrated: 08.01.2010
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn477; Calibrated: 07.05.2010
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**E Scan - ER3D - 2007: 15 mm from Probe Center to the Device 2/Hearing Aid Compatibility Test (101x101x1):** Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 215.8 V/m
Probe Modulation Factor = 2.89
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 101.2 V/m; Power Drift = 0.120 dB
**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**

Peak E-field in V/m

| | | |
|---|---|---|
| Grid 1<br>**203.7 M3** | Grid 2<br>**212.2 M3** | Grid 3<br>**204.4 M3** |
| Grid 4<br>**204.5 M3** | Grid 5<br>**215.8 M3** | Grid 6<br>**207.6 M3** |
| Grid 7<br>**200.0 M3** | Grid 8<br>**210.9 M3** | Grid 9<br>**202.5 M3** |

**Cursor:**
Total = 215.8 V/m
E Category: M3
Location: -1, -0.5, 369.9 mm




0 dB = 215.8V/m

Date/Time: 17.08.2010 12:23:37

## HAC_GSM835_E-3

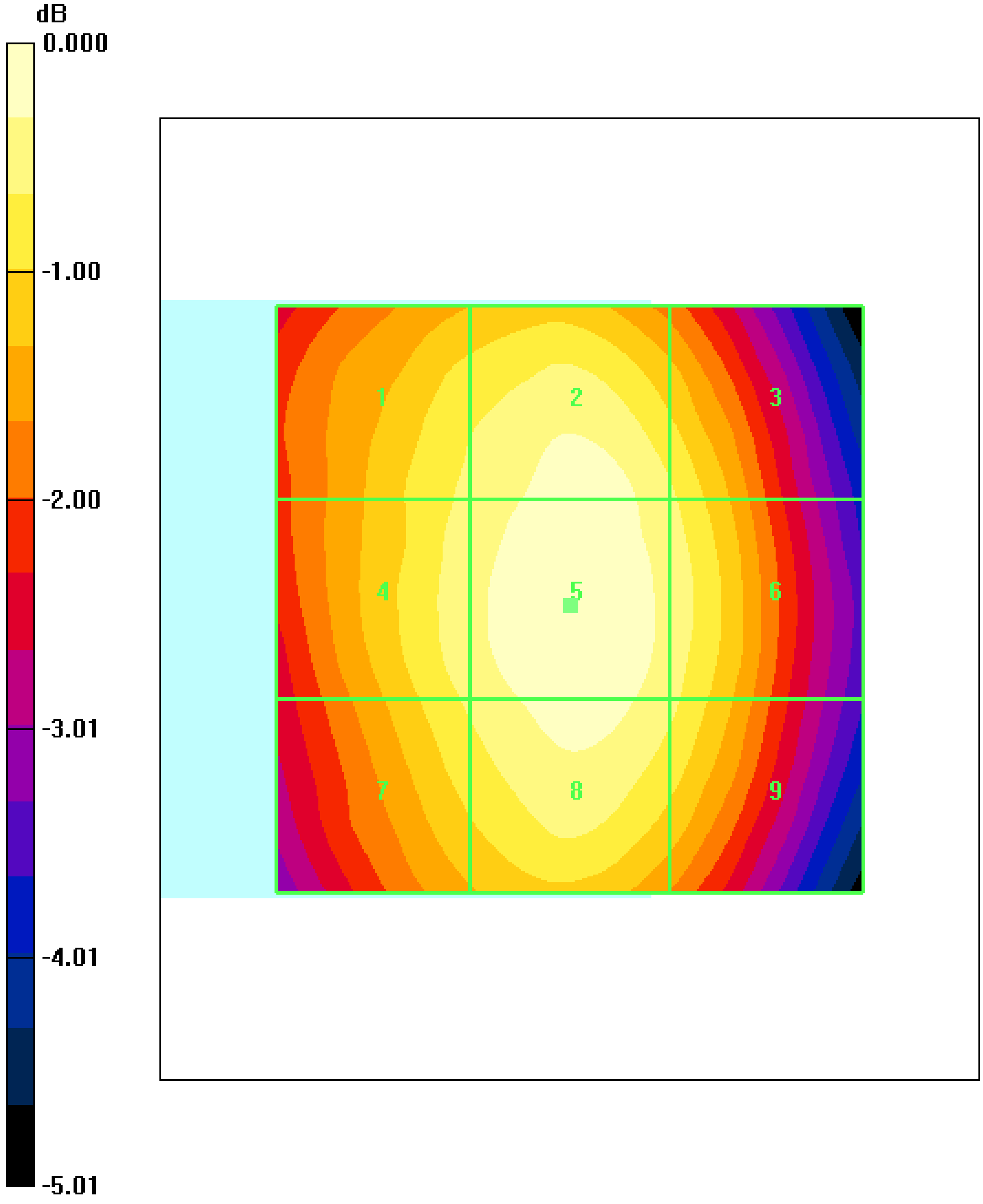
**DUT: Sagem; Type: Cosy Phone 3G; Serial: 352331040009493**
Communication System: PCS 850; Frequency: 848.8 MHz;Duty Cycle: 1:8
Medium: Air Medium parameters used: $\sigma$ = 0 mho/m, $\varepsilon_r$ = 1; $\rho$ = 1000 kg/m$^3$
Phantom section: E Device Section
DASY4 Configuration:
- Probe: ER3DV6 - SN2262; ConvF(1, 1, 1); Calibrated: 08.01.2010
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn477; Calibrated: 07.05.2010
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**E Scan - ER3D - 2007: 15 mm from Probe Center to the Device 3/Hearing Aid Compatibility Test (101x101x1):** Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 224.4 V/m
Probe Modulation Factor = 2.89
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 106.3 V/m; Power Drift = -0.036 dB
**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**

Peak E-field in V/m

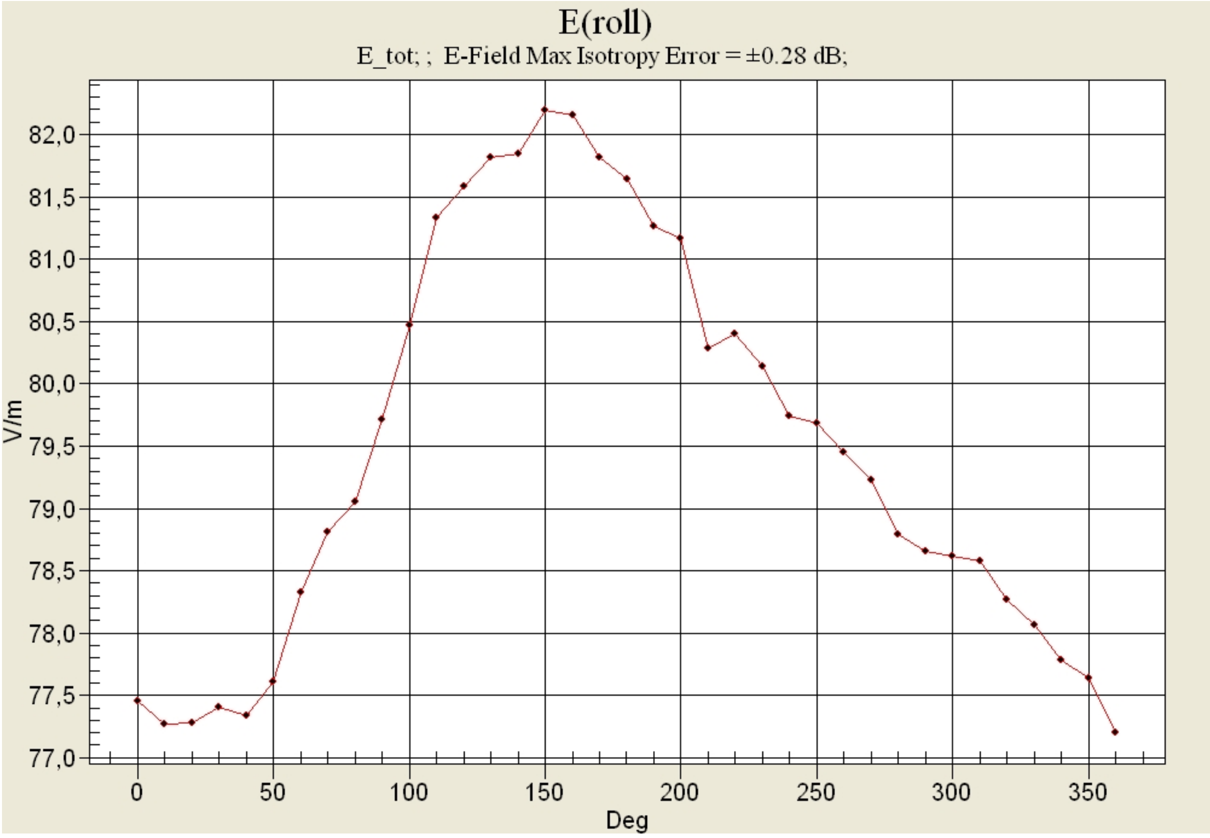
| | | |
|---|---|---|
| Grid 1<br>**210.2 M3** | Grid 2<br>**220.9 M3** | Grid 3<br>**209.6 M3** |
| Grid 4<br>**213.4 M3** | Grid 5<br>**224.4 M3** | Grid 6<br>**213.9 M3** |
| Grid 7<br>**209.4 M3** | Grid 8<br>**220.2 M3** | Grid 9<br>**210.1 M3** |

**Cursor:**
Total = 224.4 V/m
E Category: M3
Location: 0, 0.5, 369.9 mm




0 dB = 224.4V/m

Isotropy correction to maximum value :




(82.2 – 77.5) / 77.5 = 6.1 %

Worst case calculation of result above : 224.4 * 1.061 = 238 V/m.

## Annex B.2: GSM 1900 E-field

Date/Time: 17.08.2010 12:36:55

### HAC_GSM1880_E-1

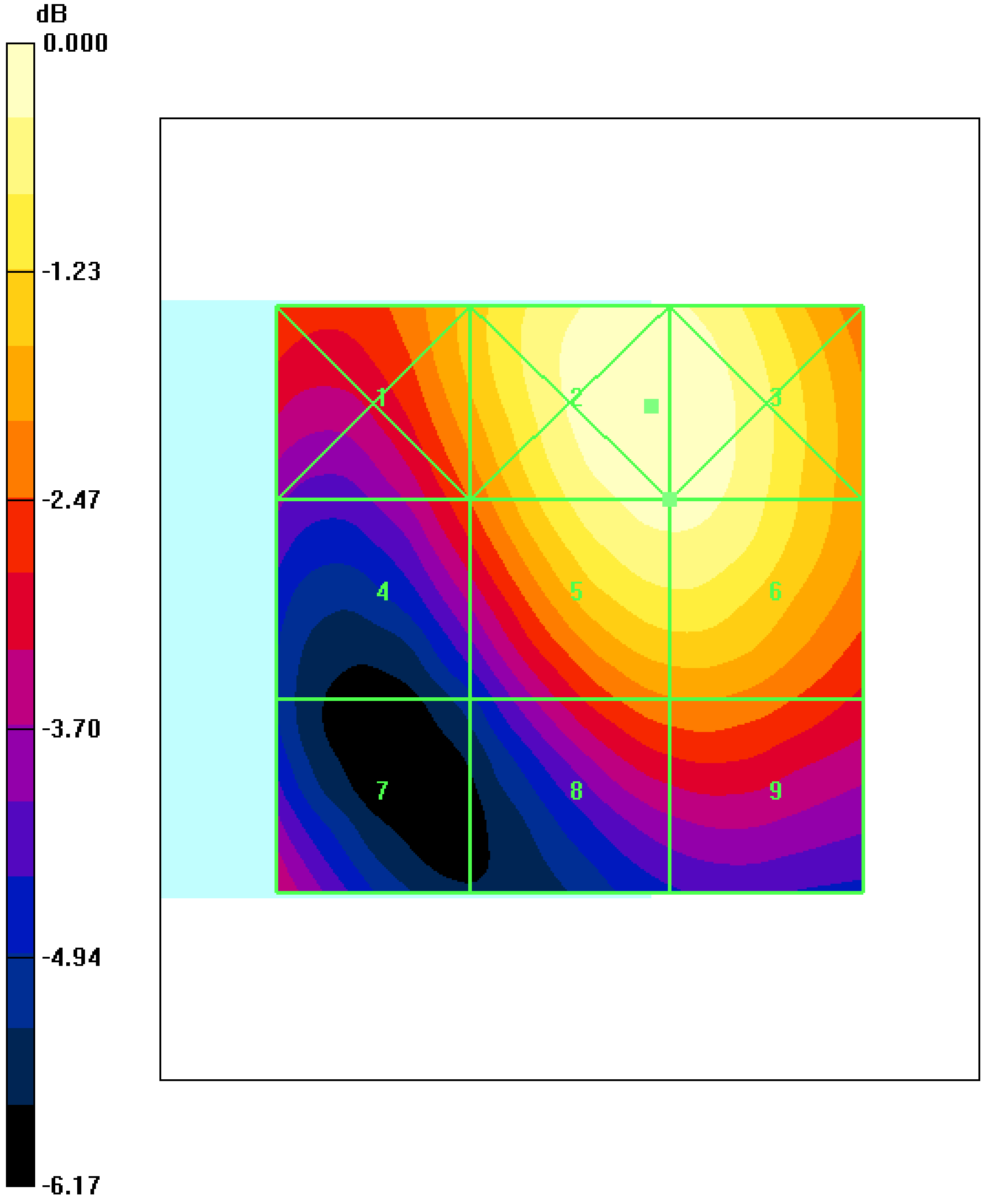
**DUT: Sagem; Type: Cosy Phone 3G; Serial: 352331040009493**
Communication System: PCS 1900; Frequency: 1850.2 MHz;Duty Cycle: 1:8
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$
Phantom section: E Device Section
DASY4 Configuration:
- Probe: ER3DV6 - SN2262; ConvF(1, 1, 1); Calibrated: 08.01.2010
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn477; Calibrated: 07.05.2010
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**E Scan - ER3D - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):** Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 79.6 V/m
Probe Modulation Factor = 2.90
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 29.5 V/m; Power Drift = 0.070 dB
**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**

Peak E-field in V/m

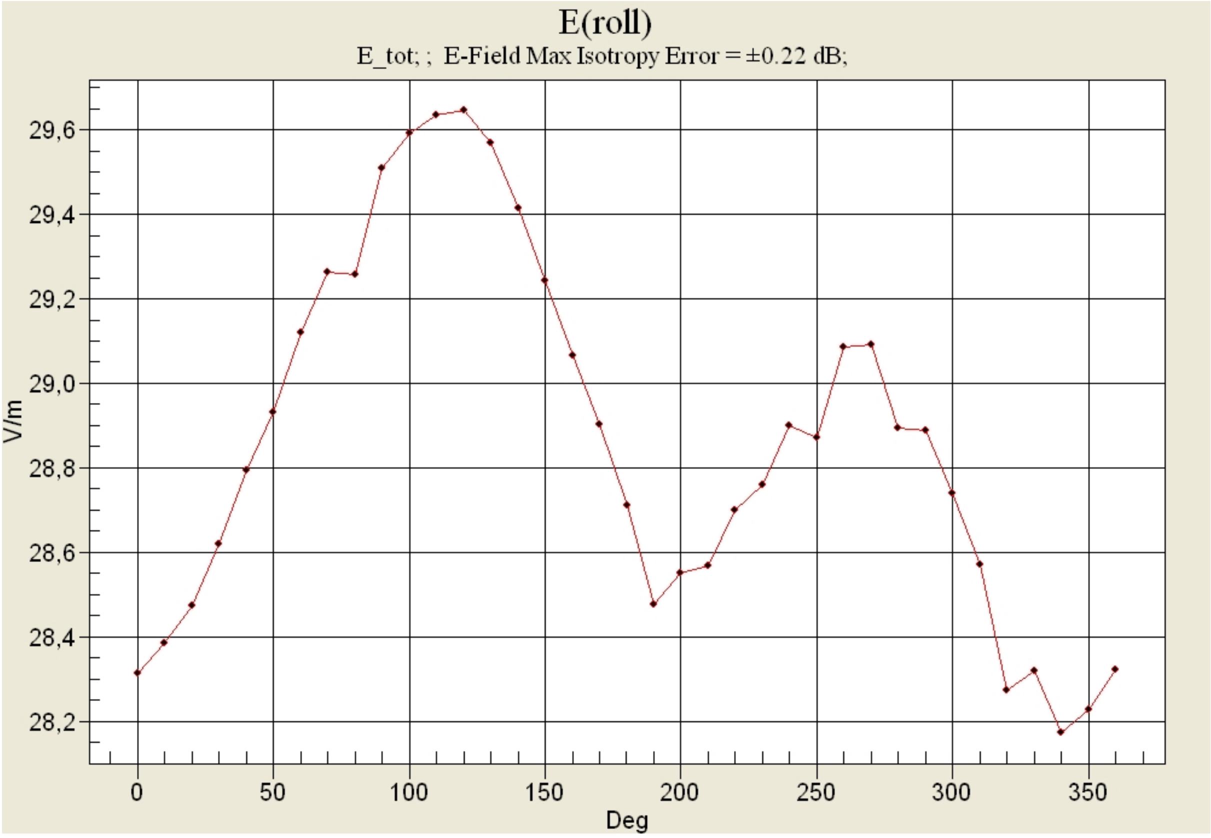
| | | |
|---|---|---|
| Grid 1<br>**69.3 M3** | Grid 2<br>**81.9 M3** | Grid 3<br>**81.7 M3** |
| Grid 4<br>**61.8 M3** | Grid 5<br>**79.6 M3** | Grid 6<br>**79.6 M3** |
| Grid 7<br>**56.4 M3** | Grid 8<br>**64.4 M3** | Grid 9<br>**64.9 M3** |

**Cursor:**
Total = 81.9 V/m
E Category: M3
Location: -7, -16.5, 369.9 mm




0 dB = 81.9V/m

Isotropy correction to maximum value :




(29.65 – 28.3) / 28.3 = 4.8 %

Worst case calculation of result above : 79.6 * 1.061 = 83.4 V/m.

Date/Time: 17.08.2010 12:31:35

## HAC_GSM1880_E-2

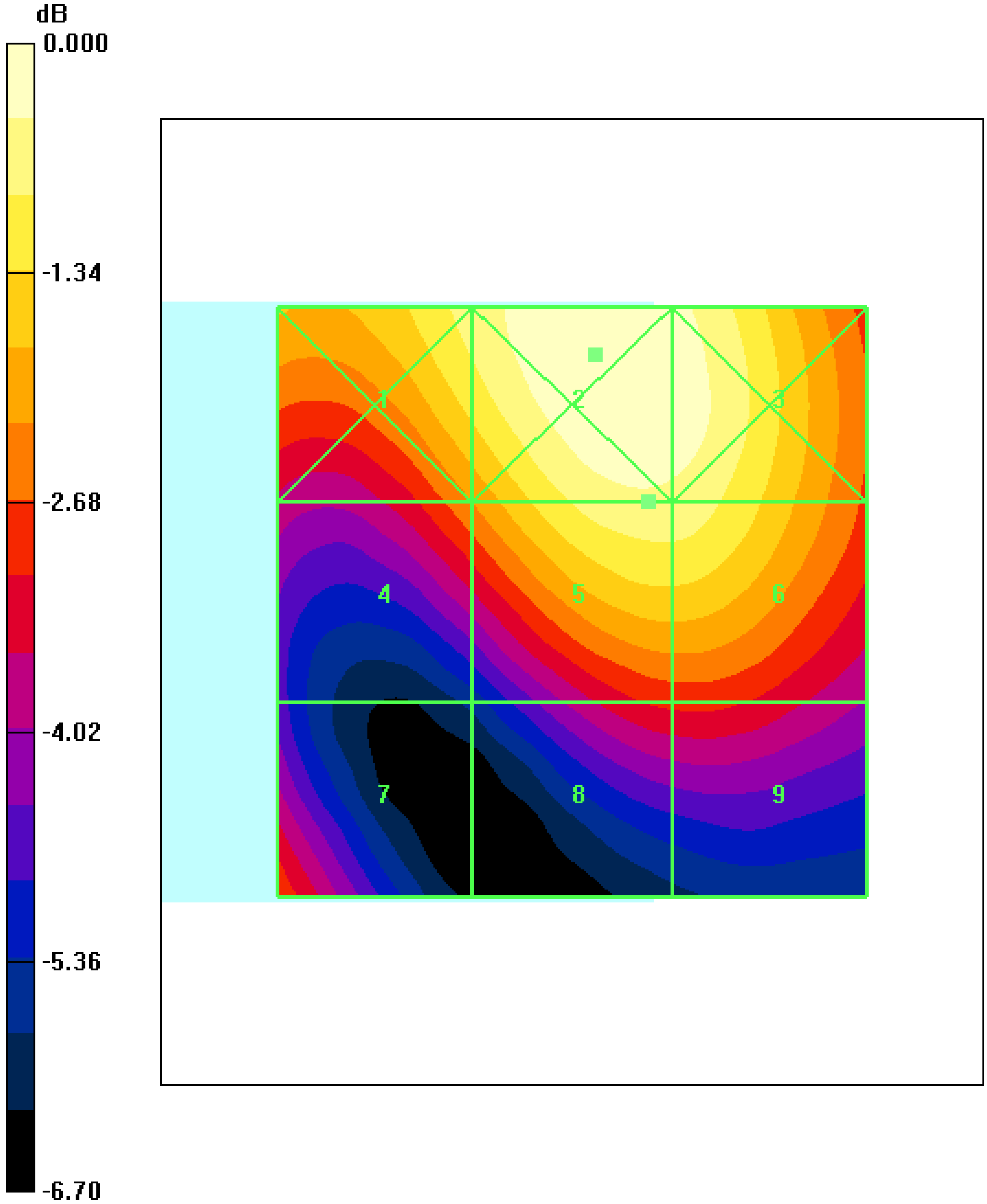
**DUT: Sagem; Type: Cosy Phone 3G; Serial: 352331040009493**
Communication System: PCS 1900; Frequency: 1880 MHz;Duty Cycle: 1:8
Medium: Air Medium parameters used: $\sigma$ = 0 mho/m, $\varepsilon_r$ = 1; $\rho$ = 1000 kg/m$^3$
Phantom section: E Device Section
DASY4 Configuration:
- Probe: ER3DV6 - SN2262; ConvF(1, 1, 1); Calibrated: 08.01.2010
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn477; Calibrated: 07.05.2010
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**E Scan - ER3D - 2007: 15 mm from Probe Center to the Device 2/Hearing Aid Compatibility Test (101x101x1):** Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 73.6 V/m
Probe Modulation Factor = 2.90
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 27.5 V/m; Power Drift = 0.028 dB
**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**

Peak E-field in V/m

| | | |
|---|---|---|
| Grid 1<br>**72.4 M3** | Grid 2<br>**78.4 M3** | Grid 3<br>**77.0 M3** |
| Grid 4<br>**60.7 M3** | Grid 5<br>**73.6 M3** | Grid 6<br>**73.3 M3** |
| Grid 7<br>**57.3 M3** | Grid 8<br>**55.6 M3** | Grid 9<br>**55.8 M3** |

**Cursor:**
Total = 78.4 V/m
E Category: M3
Location: -2, -21, 369.9 mm




0 dB = 78.4V/m

Date/Time: 17.08.2010 12:47:35

## HAC_GSM1880_E-3

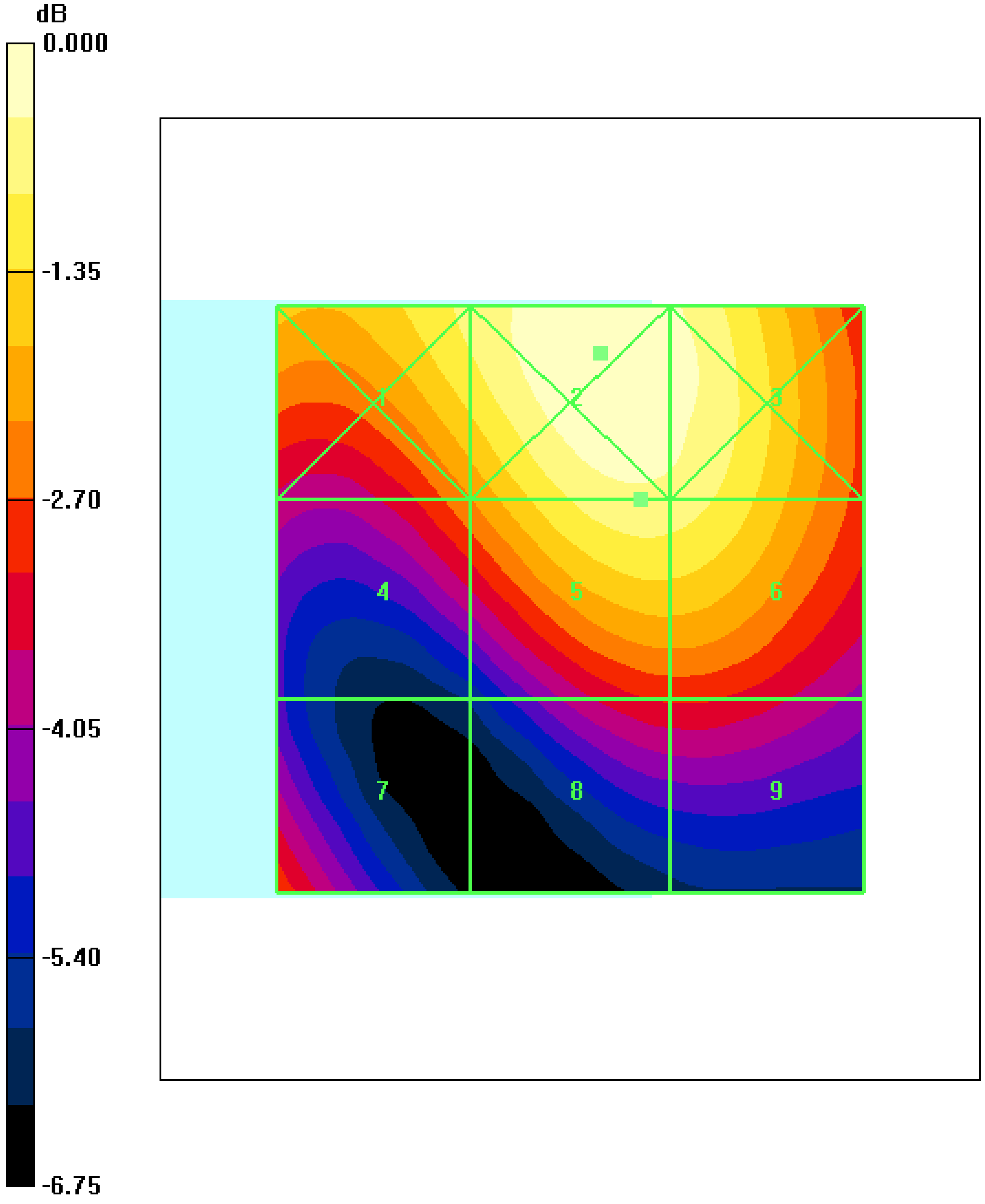
**DUT: Sagem; Type: Cosy Phone 3G; Serial: 352331040009493**
Communication System: PCS 1900; Frequency: 1909.8 MHz;Duty Cycle: 1:8
Medium: Air Medium parameters used: $\sigma$ = 0 mho/m, $\varepsilon_r$ = 1; $\rho$ = 1000 kg/m$^3$
Phantom section: E Device Section
DASY4 Configuration:
- Probe: ER3DV6 - SN2262; ConvF(1, 1, 1); Calibrated: 08.01.2010
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn477; Calibrated: 07.05.2010
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**E Scan - ER3D - 2007: 15 mm from Probe Center to the Device 3/Hearing Aid Compatibility Test (101x101x1):** Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 74.1 V/m
Probe Modulation Factor = 2.90
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 28.5 V/m; Power Drift = -0.273 dB
**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**

Peak E-field in V/m

| | | |
|---|---|---|
| Grid 1 **72.5 M3** | Grid 2 **79.1 M3** | Grid 3 **77.2 M3** |
| Grid 4 **60.9 M3** | Grid 5 **74.1 M3** | Grid 6 **73.6 M3** |
| Grid 7 **57.6 M3** | Grid 8 **55.5 M3** | Grid 9 **55.6 M3** |

**Cursor:**
Total = 79.1 V/m
E Category: M3
Location: -2.5, -21, 369.9 mm




0 dB = 79.1V/m

## Annex B.3: GSM 850 H-field

Date/Time: 17.08.2010 13:34:24

### HAC_GSM835_H-1

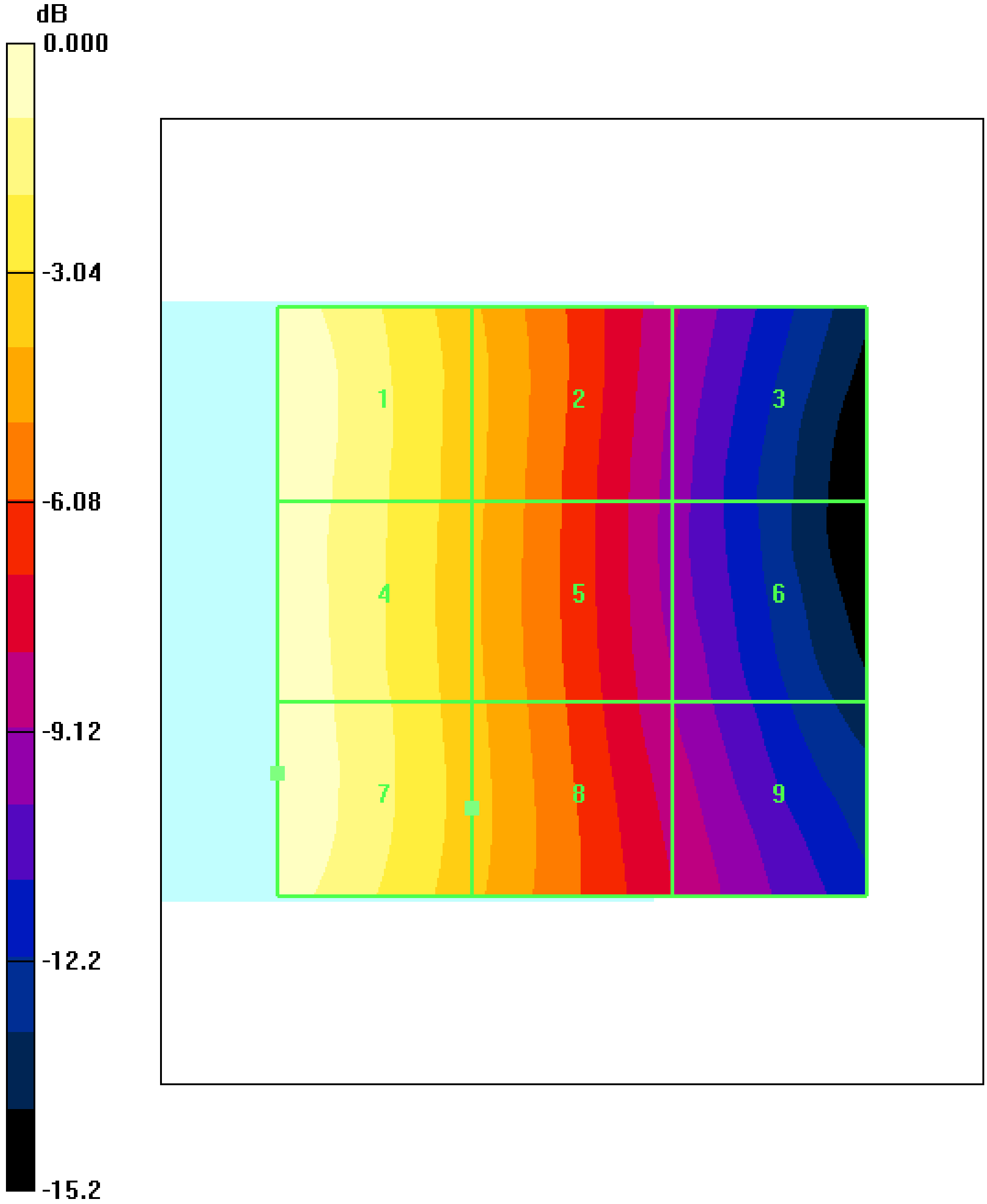
**DUT: Sagem; Type: Cosy Phone 3G; Serial: 352331040009493**
Communication System: PCS 850; Frequency: 824.2 MHz;Duty Cycle: 1:8
Medium: Air Medium parameters used: $\sigma$ = 0 mho/m, $\varepsilon_r$ = 1; $\rho$ = 1 kg/$m^3$
Phantom section: H Device Section
DASY4 Configuration:
- Probe: H3DV6 - SN6086; ; Calibrated: 08.01.2010
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn477; Calibrated: 07.05.2010
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**H Scan - H3DV6 - measurement distance from the probe sensor center to the device = 15 mm/Hearing Aid Compatibility Test (101x101x1):** Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.422 A/m
Probe Modulation Factor = 2.79
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.075 A/m; Power Drift = -0.142 dB
**Hearing Aid Near-Field Category: M4 (AWF -5 dB)**

Peak H-field in A/m

| | | |
|---|---|---|
| Grid 1 **0.420 M4** | Grid 2 **0.277 M4** | Grid 3 **0.152 M4** |
| Grid 4 **0.417 M4** | Grid 5 **0.275 M4** | Grid 6 **0.149 M4** |
| Grid 7 **0.422 M4** | Grid 8 **0.279 M4** | Grid 9 **0.167 M4** |

**Cursor:**
Total = 0.422 A/m
H Category: M4
Location: 25, 14.5, 368.7 mm




0 dB = 0.422A/m

Date/Time: 17.08.2010 13:41:21

## HAC_GSM835_H-2

**DUT: Sagem; Type: Cosy Phone 3G; Serial: 352331040009493**
Communication System: PCS 850; Frequency: 836.6 MHz;Duty Cycle: 1:8
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m$^3$
Phantom section: H Device Section
DASY4 Configuration:
- Probe: H3DV6 - SN6086; ; Calibrated: 08.01.2010
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn477; Calibrated: 07.05.2010
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

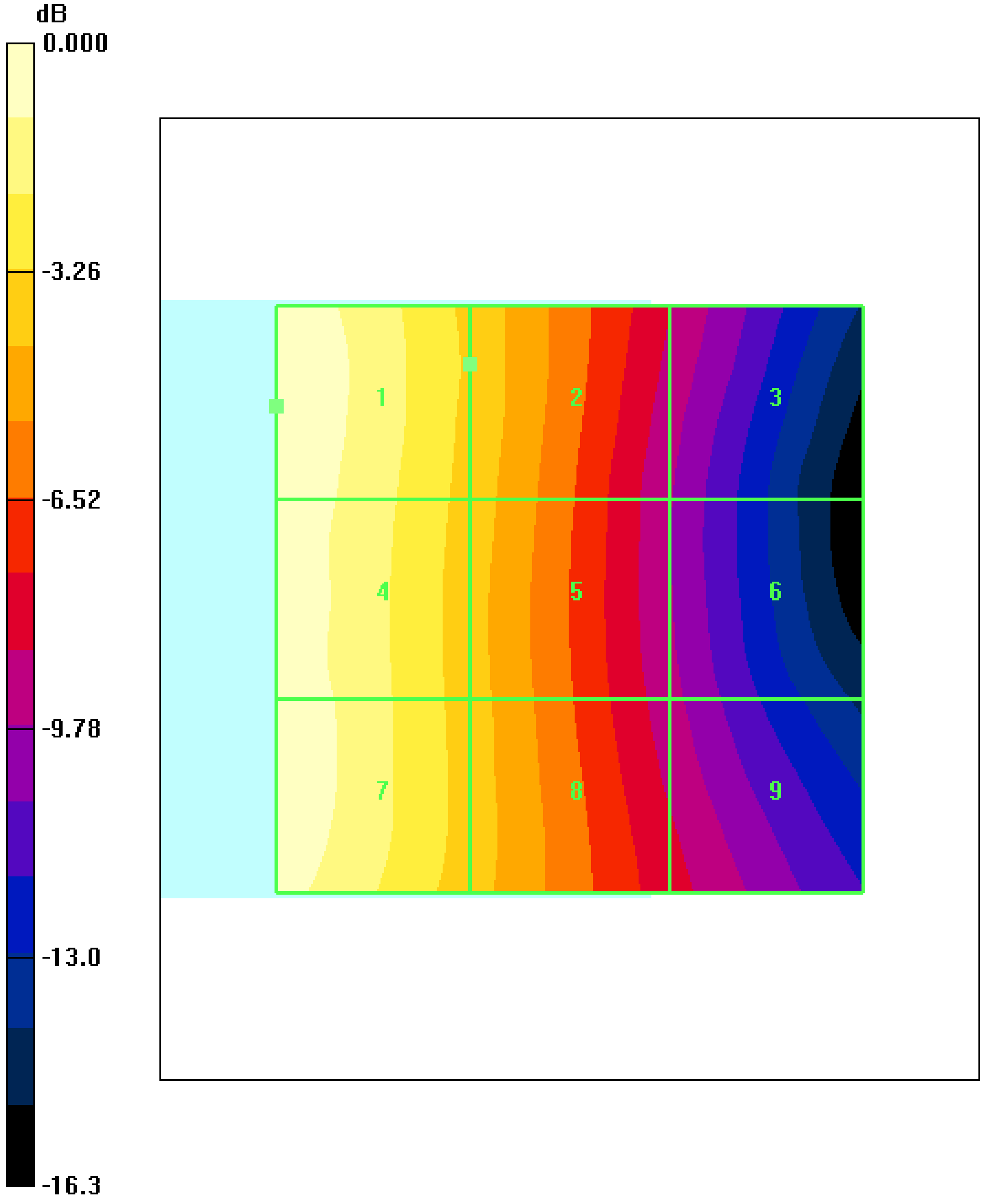
## H Scan - H3DV6 - measurement distance from the probe sensor center to the device = 15 mm 2/Hearing Aid Compatibility Test (101x101x1):

Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.461 A/m
Probe Modulation Factor = 2.79
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.081 A/m; Power Drift = 0.304 dB
**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**

Peak H-field in A/m

| | | |
|---|---|---|
| Grid 1<br>**0.461 M3** | Grid 2<br>**0.309 M4** | Grid 3<br>**0.171 M4** |
| Grid 4<br>**0.452 M3** | Grid 5<br>**0.301 M4** | Grid 6<br>**0.158 M4** |
| Grid 7<br>**0.452 M3** | Grid 8<br>**0.301 M4** | Grid 9<br>**0.180 M4** |

**Cursor:**
Total = 0.461 A/m
H Category: M3
Location: 25, -16.5, 368.7 mm




0 dB = 0.461A/m

Date/Time: 17.08.2010 13:46:25

## HAC_GSM835_H-3

**DUT: Sagem; Type: Cosy Phone 3G; Serial: 352331040009493**
Communication System: PCS 850; Frequency: 848.8 MHz;Duty Cycle: 1:8
Medium: Air Medium parameters used: $\sigma$ = 0 mho/m, $\varepsilon_r$ = 1; $\rho$ = 1 kg/$m^3$
Phantom section: H Device Section
DASY4 Configuration:
- Probe: H3DV6 - SN6086; ; Calibrated: 08.01.2010
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn477; Calibrated: 07.05.2010
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

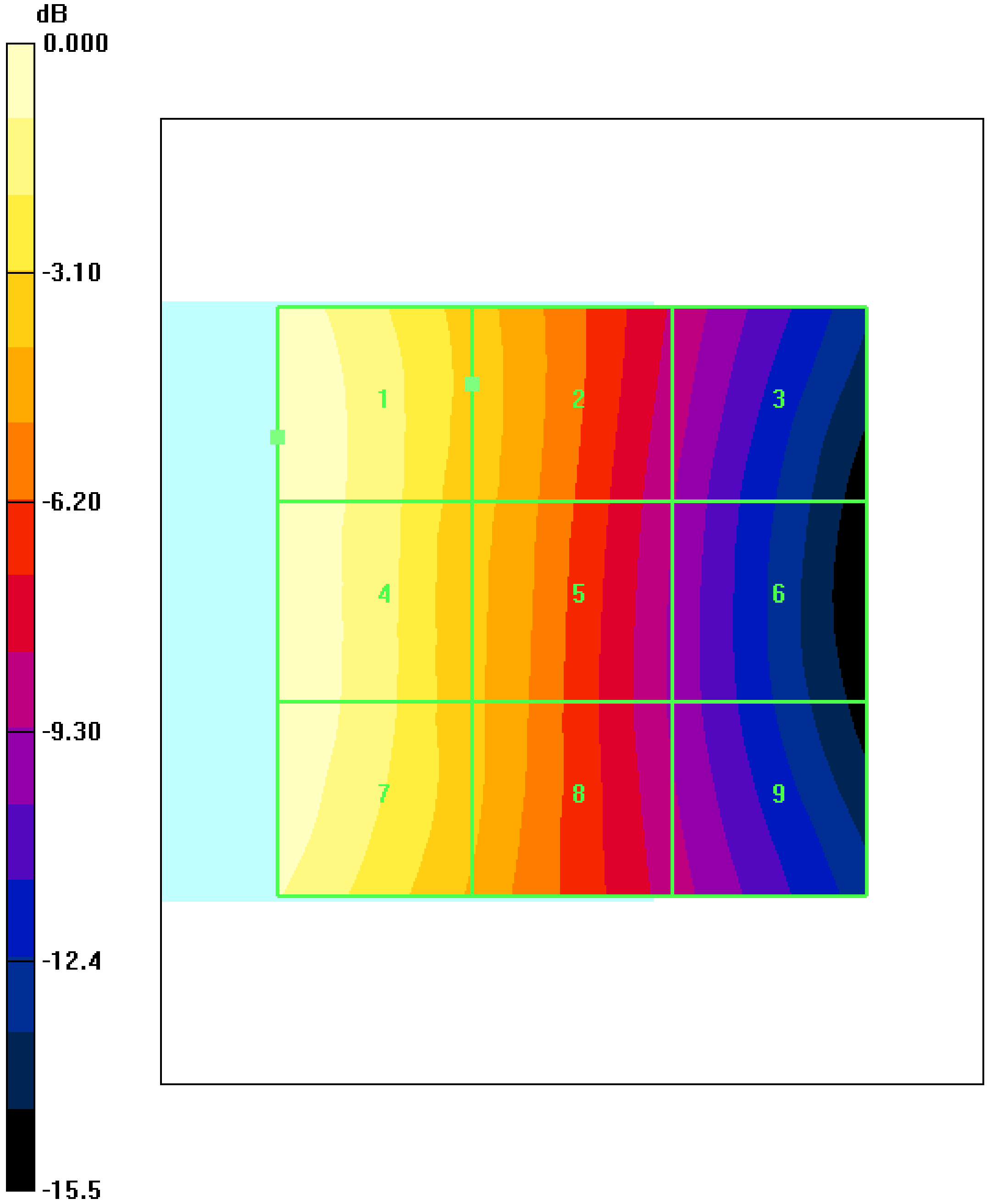
## H Scan - H3DV6 - measurement distance from the probe sensor center to the device = 15 mm 3/Hearing Aid Compatibility Test (101x101x1):

Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.505 A/m
Probe Modulation Factor = 2.79
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.091 A/m; Power Drift = 0.026 dB
**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**

Peak H-field in A/m

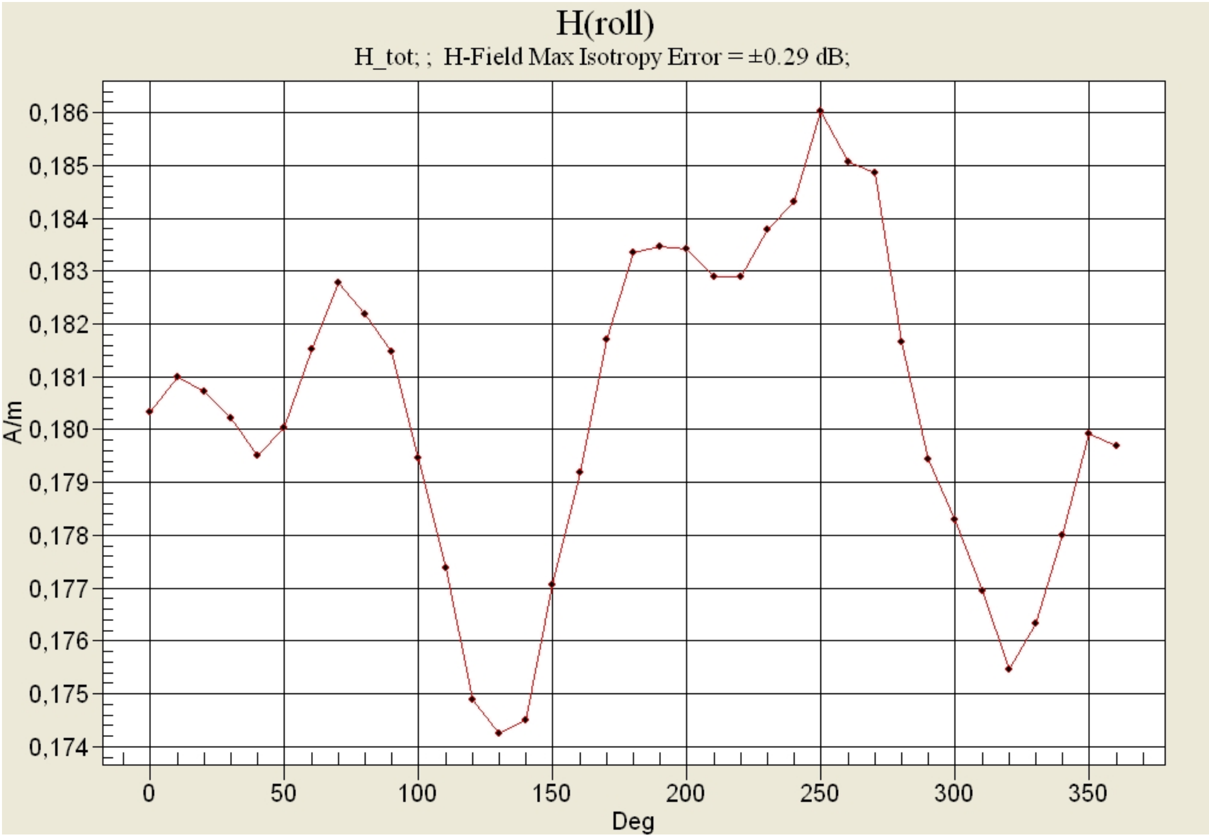
| | | |
|---|---|---|
| Grid 1<br>**0.505 M3** | Grid 2<br>**0.339 M4** | Grid 3<br>**0.193 M4** |
| Grid 4<br>**0.502 M3** | Grid 5<br>**0.330 M4** | Grid 6<br>**0.175 M4** |
| Grid 7<br>**0.499 M3** | Grid 8<br>**0.325 M4** | Grid 9<br>**0.185 M4** |

**Cursor:**
Total = 0.505 A/m
H Category: M3
Location: 25, -14, 368.7 mm




0 dB = 0.505A/m

Isotropy correction to maximum value :




(0.186 – 0.1802) / 0.1802 = 3.2 %

Worst case calculation of result above : 0.505 * 1.032 = 0.521 A/m.

## Annex B.4: GSM 1900 H-fields

Date/Time: 17.08.2010 14:03:09

### HAC_GSM1880_H-1

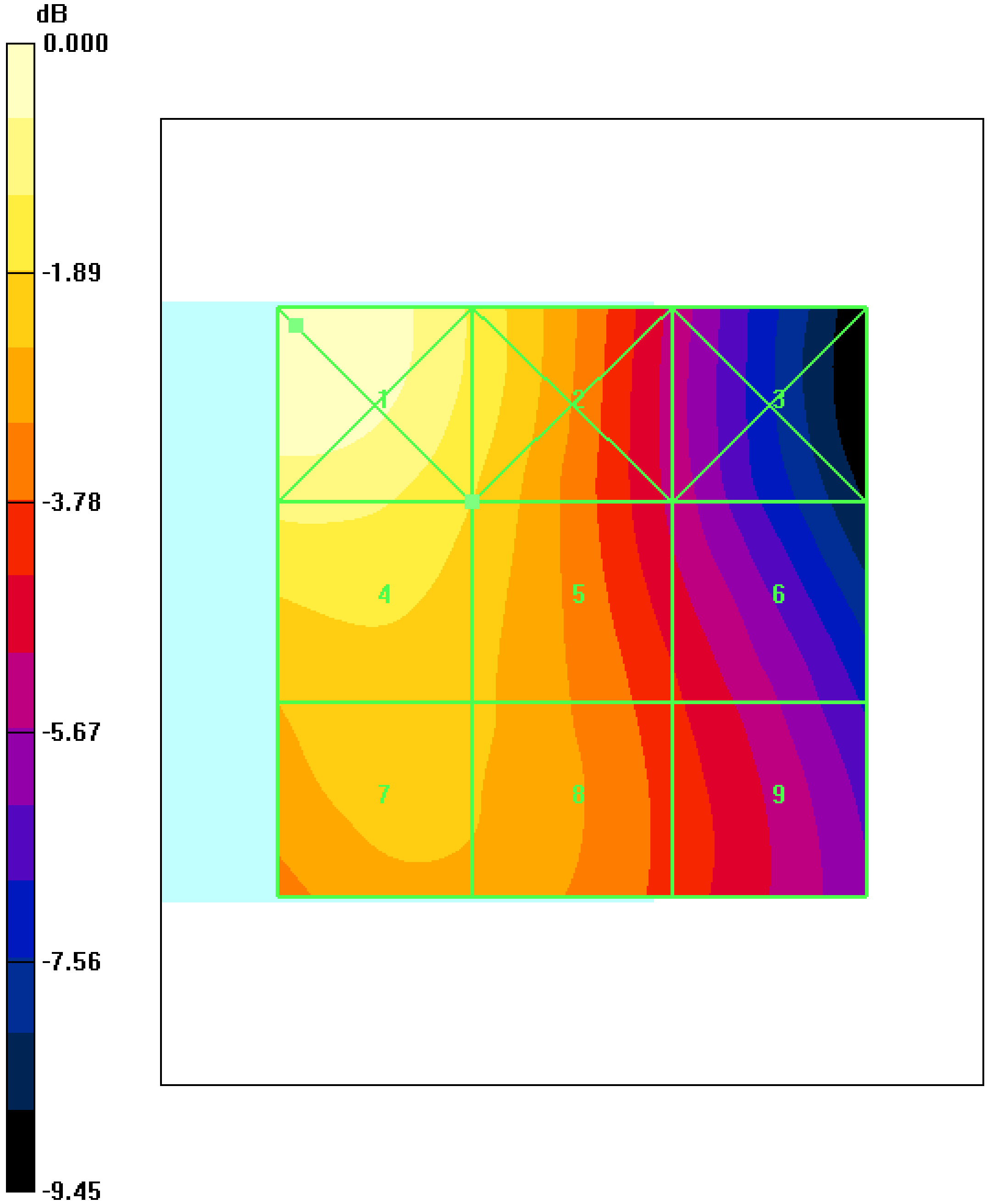
**DUT: Sagem; Type: Cosy Phone 3G; Serial: 352331040009493**
Communication System: PCS 1900; Frequency: 1850.2 MHz;Duty Cycle: 1:8
Medium: Air Medium parameters used: $\sigma$ = 0 mho/m, $\varepsilon_r$ = 1; $\rho$ = 1 kg/$m^3$
Phantom section: H Device Section
DASY4 Configuration:
- Probe: H3DV6 - SN6086; ; Calibrated: 08.01.2010
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn477; Calibrated: 07.05.2010
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**H Scan - H3DV6 - measurement distance from the probe sensor center to the device = 15 mm/Hearing Aid Compatibility Test (101x101x1):** Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.218 A/m
Probe Modulation Factor = 2.42
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.074 A/m; Power Drift = 0.038 dB
**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**

Peak H-field in A/m

| | | |
|---|---|---|
| Grid 1<br>**0.246 M3** | Grid 2<br>**0.211 M3** | Grid 3<br>**0.135 M4** |
| Grid 4<br>**0.218 M3** | Grid 5<br>**0.198 M3** | Grid 6<br>**0.151 M3** |
| Grid 7<br>**0.193 M3** | Grid 8<br>**0.187 M3** | Grid 9<br>**0.156 M3** |

**Cursor:**
Total = 0.246 A/m
H Category: M3
Location: 23.5, -23.5, 368.7 mm




0 dB = 0.246A/m

Date/Time: 17.08.2010 13:55:30

## HAC_GSM1880_H-2

**DUT: Sagem; Type: Cosy Phone 3G; Serial: 352331040009493**
Communication System: PCS 1900; Frequency: 1880 MHz;Duty Cycle: 1:8
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m$^3$
Phantom section: H Device Section
DASY4 Configuration:
- Probe: H3DV6 - SN6086; ; Calibrated: 08.01.2010
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn477; Calibrated: 07.05.2010
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

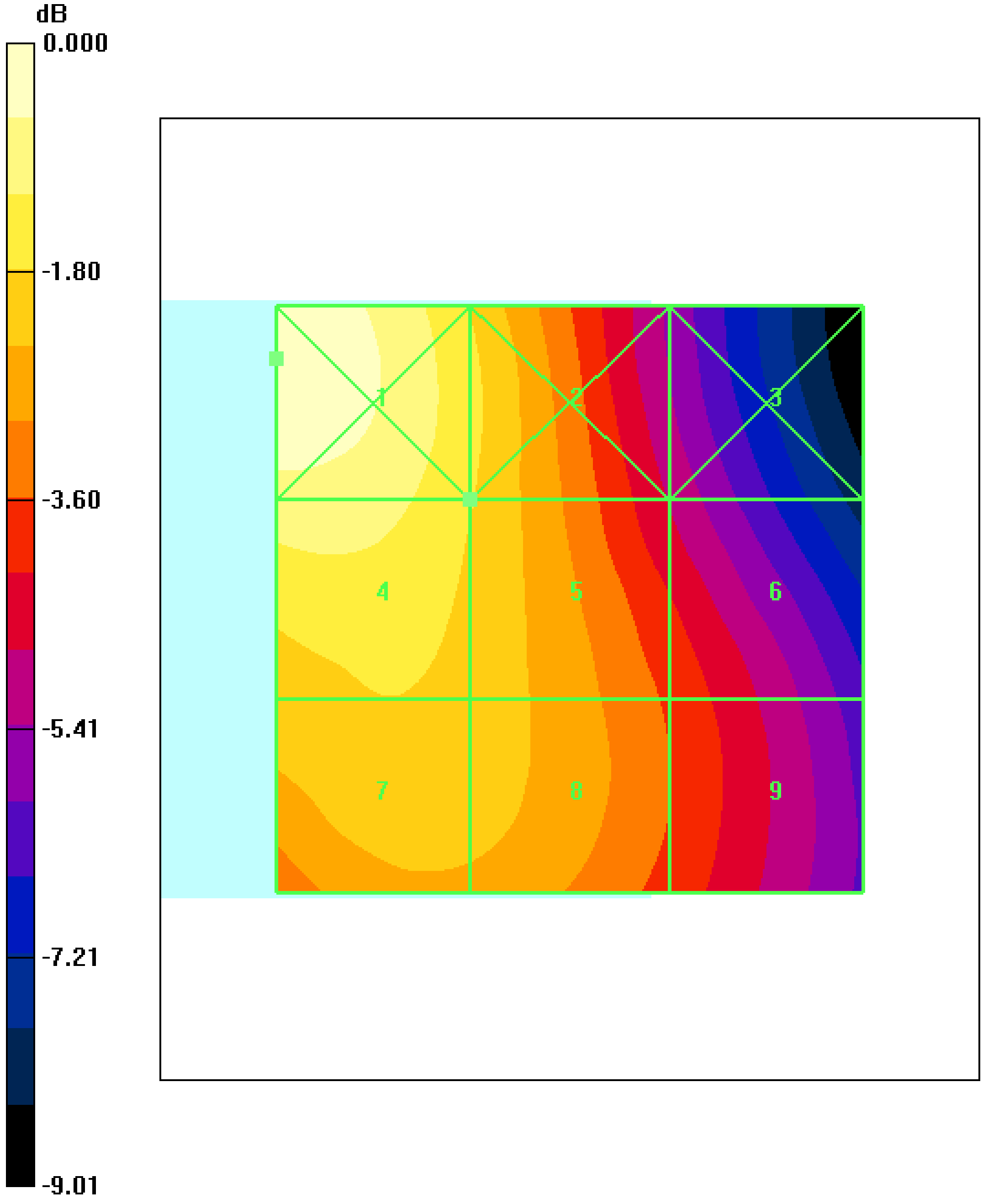
## H Scan - H3DV6 - measurement distance from the probe sensor center to the device = 15 mm 2/Hearing Aid Compatibility Test (101x101x1):

Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.216 A/m
Probe Modulation Factor = 2.42
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.074 A/m; Power Drift = 0.065 dB
**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**

Peak H-field in A/m

| | | |
|---|---|---|
| Grid 1<br>**0.237 M3** | Grid 2<br>**0.197 M3** | Grid 3<br>**0.136 M4** |
| Grid 4<br>**0.216 M3** | Grid 5<br>**0.194 M3** | Grid 6<br>**0.155 M3** |
| Grid 7<br>**0.193 M3** | Grid 8<br>**0.188 M3** | Grid 9<br>**0.157 M3** |

**Cursor:**
Total = 0.237 A/m
H Category: M3
Location: 25, -20.5, 368.7 mm




0 dB = 0.237A/m

Date/Time: 17.08.2010 14:08:21

## HAC_GSM1880_H-3

**DUT: Sagem; Type: Cosy Phone 3G; Serial: 352331040009493**
Communication System: PCS 1900; Frequency: 1909.8 MHz;Duty Cycle: 1:8
Medium: Air Medium parameters used: $\sigma$ = 0 mho/m, $\varepsilon_r$ = 1; $\rho$ = 1 kg/$m^3$
Phantom section: H Device Section
DASY4 Configuration:
- Probe: H3DV6 - SN6086; ; Calibrated: 08.01.2010
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn477; Calibrated: 07.05.2010
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

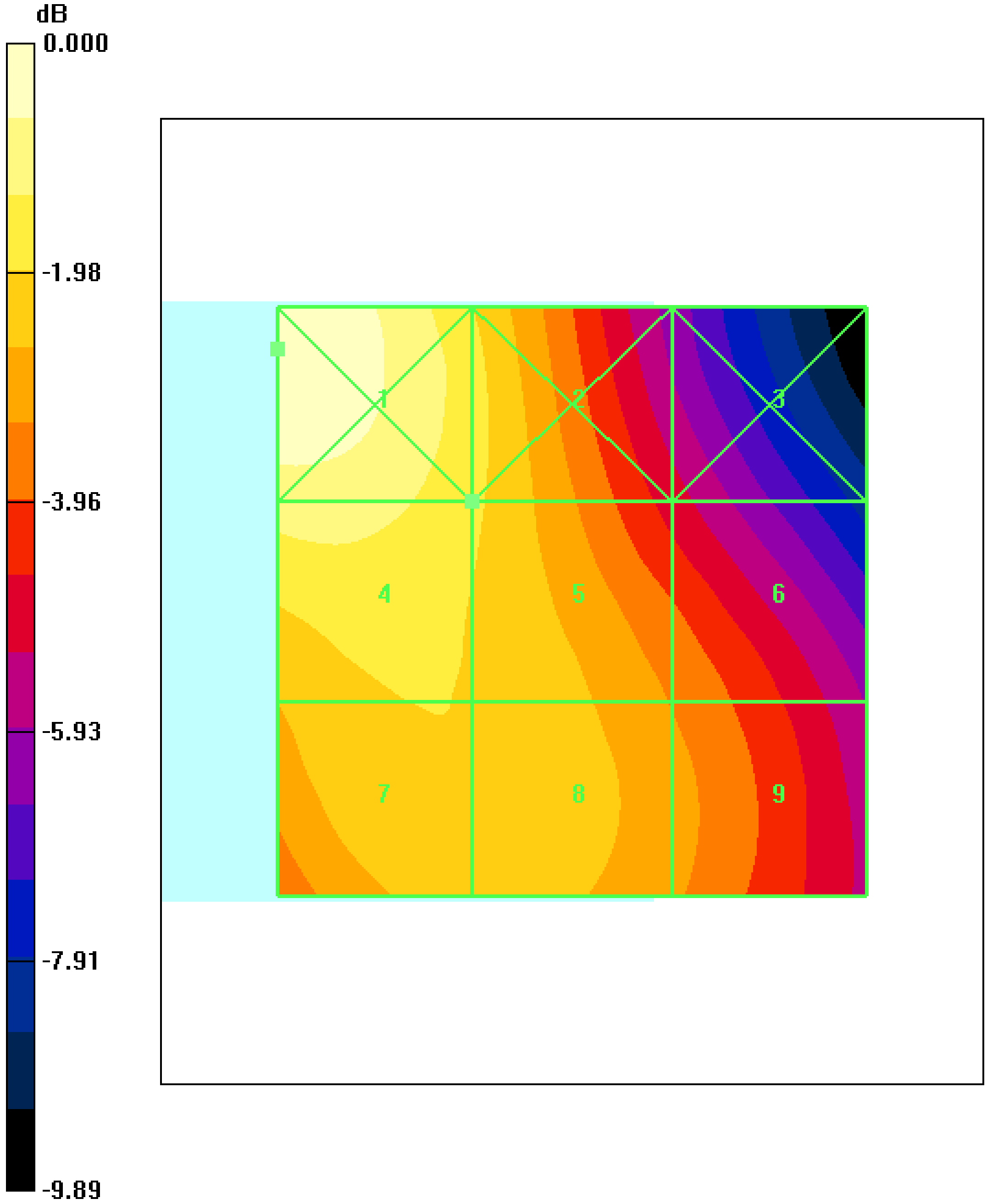
## H Scan - H3DV6 - measurement distance from the probe sensor center to the device = 15 mm 3/Hearing Aid Compatibility Test (101x101x1):

Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.224 A/m
Probe Modulation Factor = 2.42
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.079 A/m; Power Drift = 0.138 dB
**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**

Peak H-field in A/m

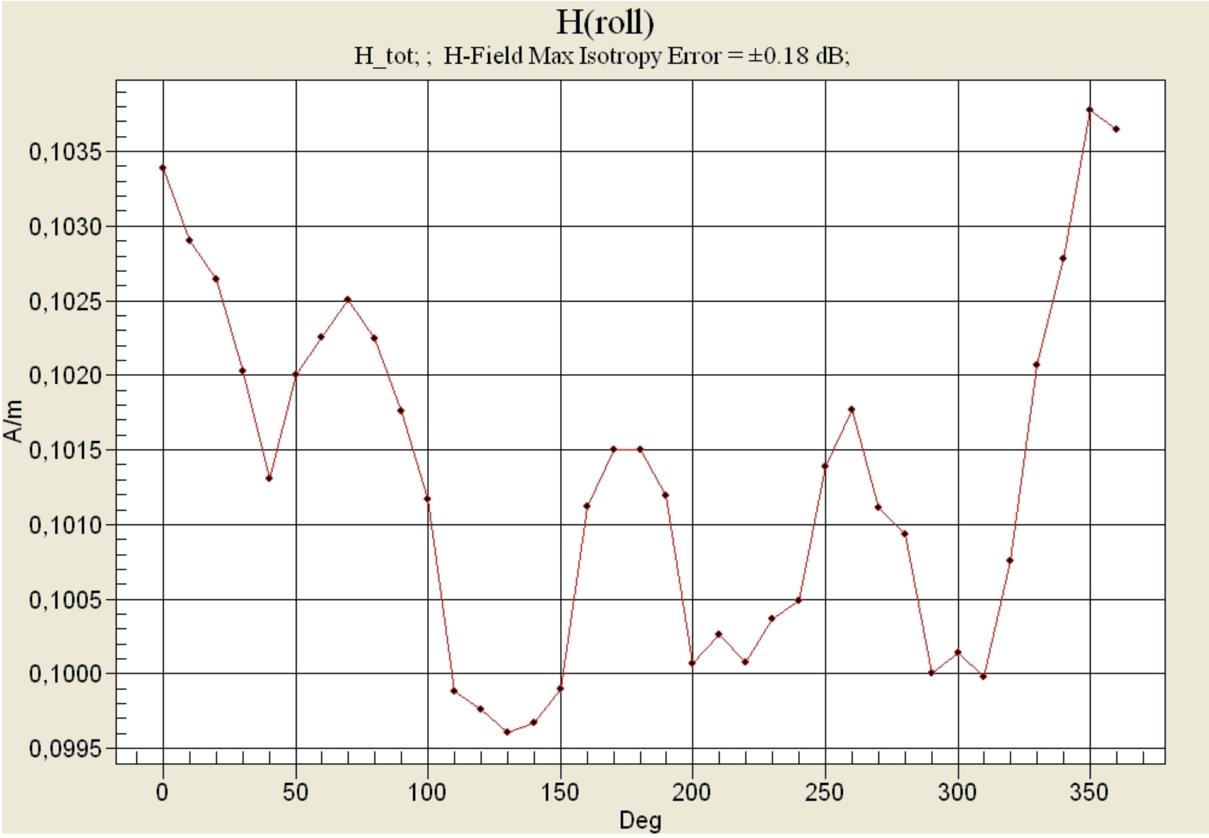
| | | |
|---|---|---|
| Grid 1<br>**0.250 M3** | Grid 2<br>**0.205 M3** | Grid 3<br>**0.142 M3** |
| Grid 4<br>**0.224 M3** | Grid 5<br>**0.203 M3** | Grid 6<br>**0.171 M3** |
| Grid 7<br>**0.200 M3** | Grid 8<br>**0.198 M3** | Grid 9<br>**0.176 M3** |

**Cursor:**
Total = 0.250 A/m
H Category: M3
Location: 25, -21.5, 368.7 mm




0 dB = 0.250A/m

Isotropy correction to maximum value :




(0.1038 – 0.1034) / 0.1034 = 0.4 %

Worst case calculation of result above : 0.224 * 1.004 = 0.225 A/m.

## Annex C: Photo documentation

Photo 1: Measurement System DASY 4 with HAC set-up

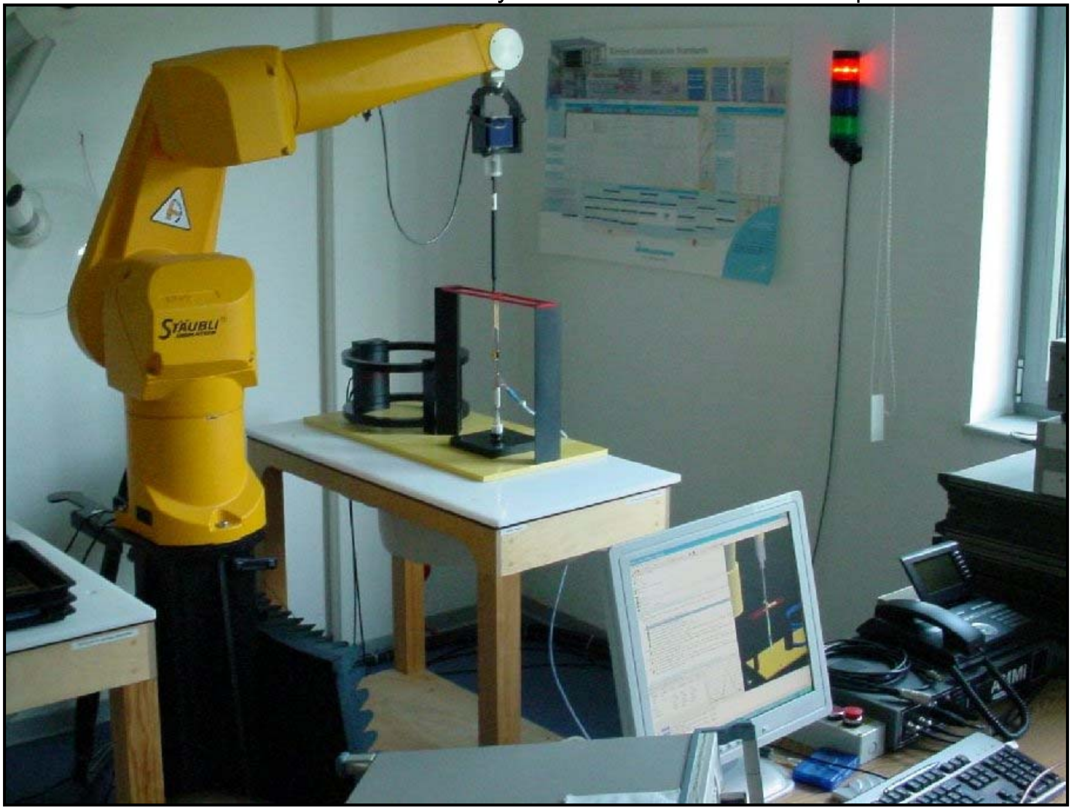



Photo 2: DUT - front view

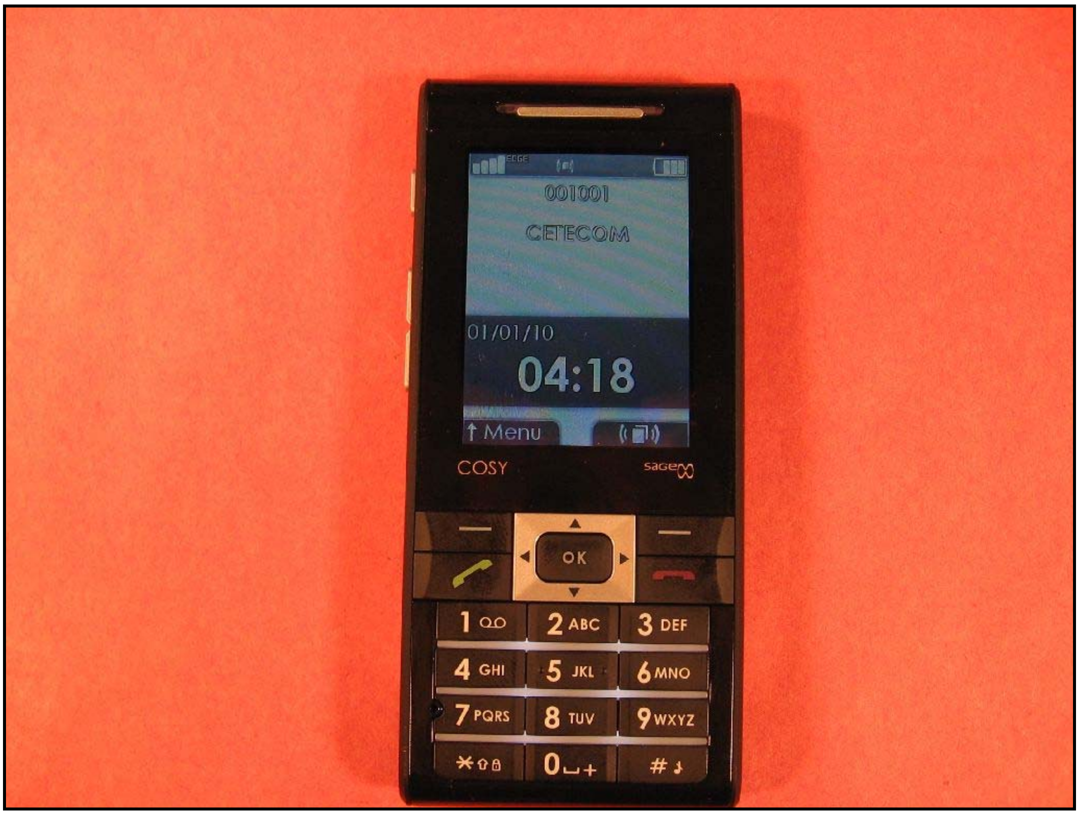


Photo 3: DUT - rear view (open) without battery

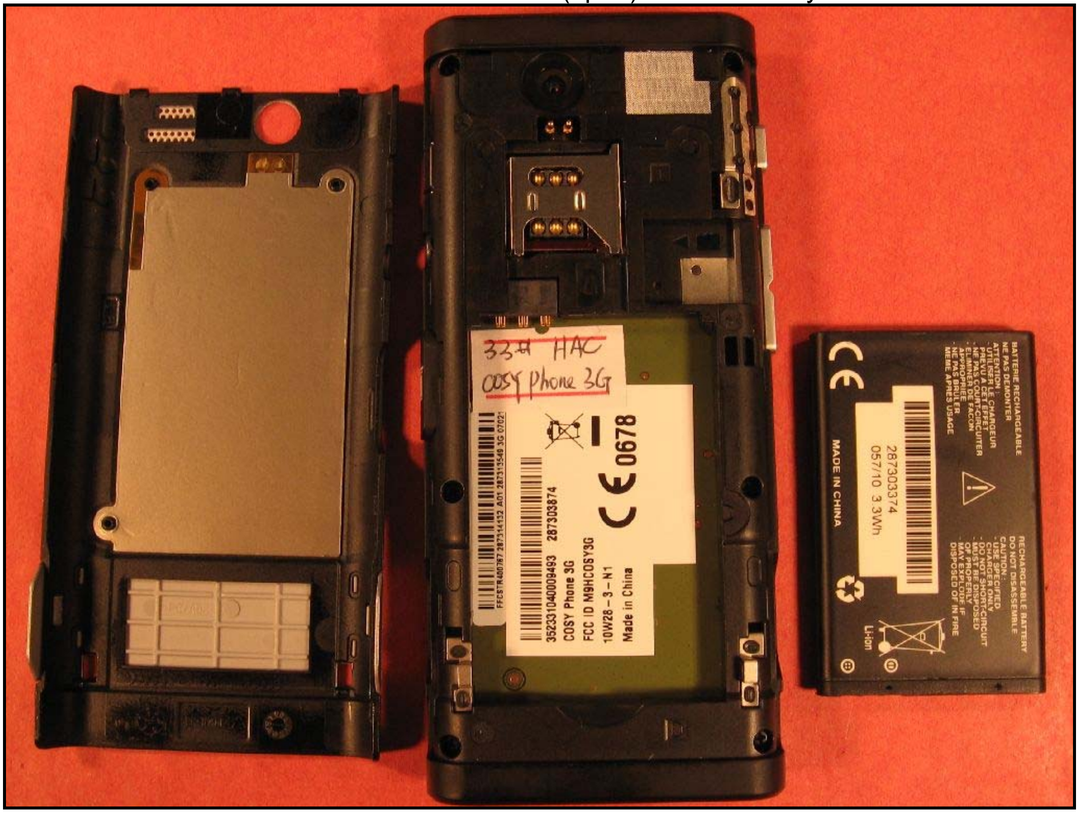


Photo 4: battery

Photo 5: DUT at test position


Photo 6: DUT at test position (side view)

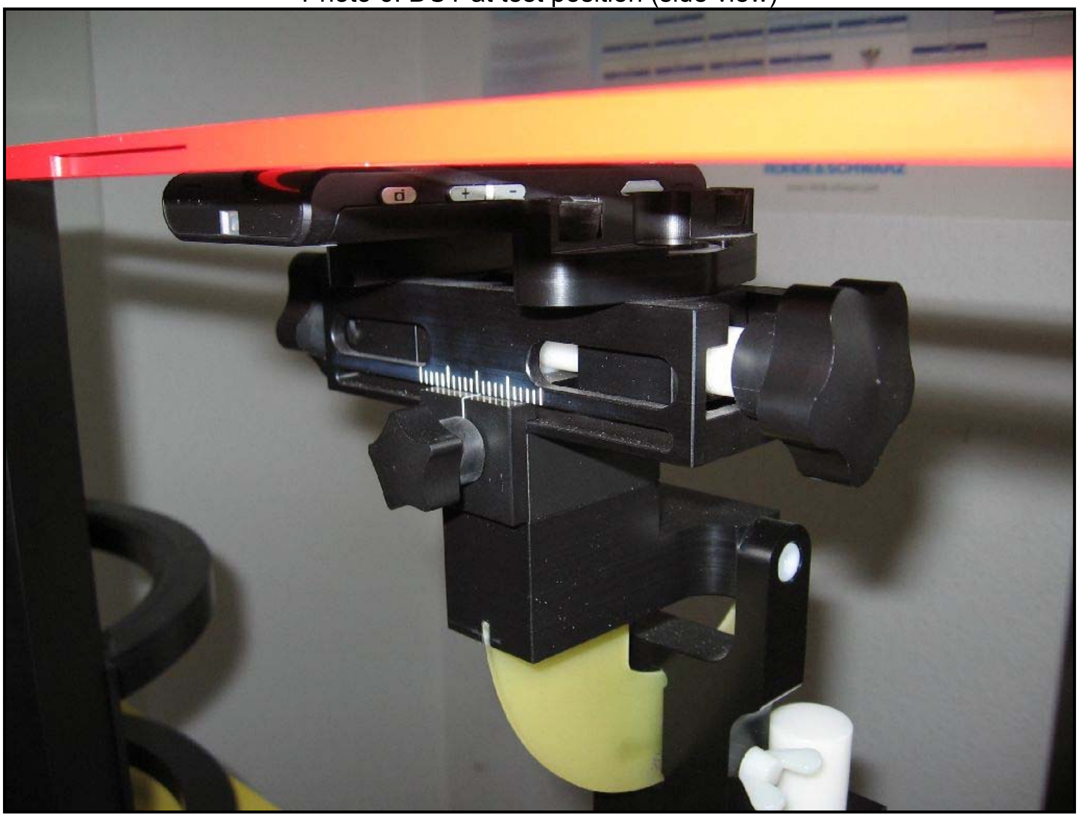


Photo 7: system validation (shown here with CD1880 dipole and H-field probe)

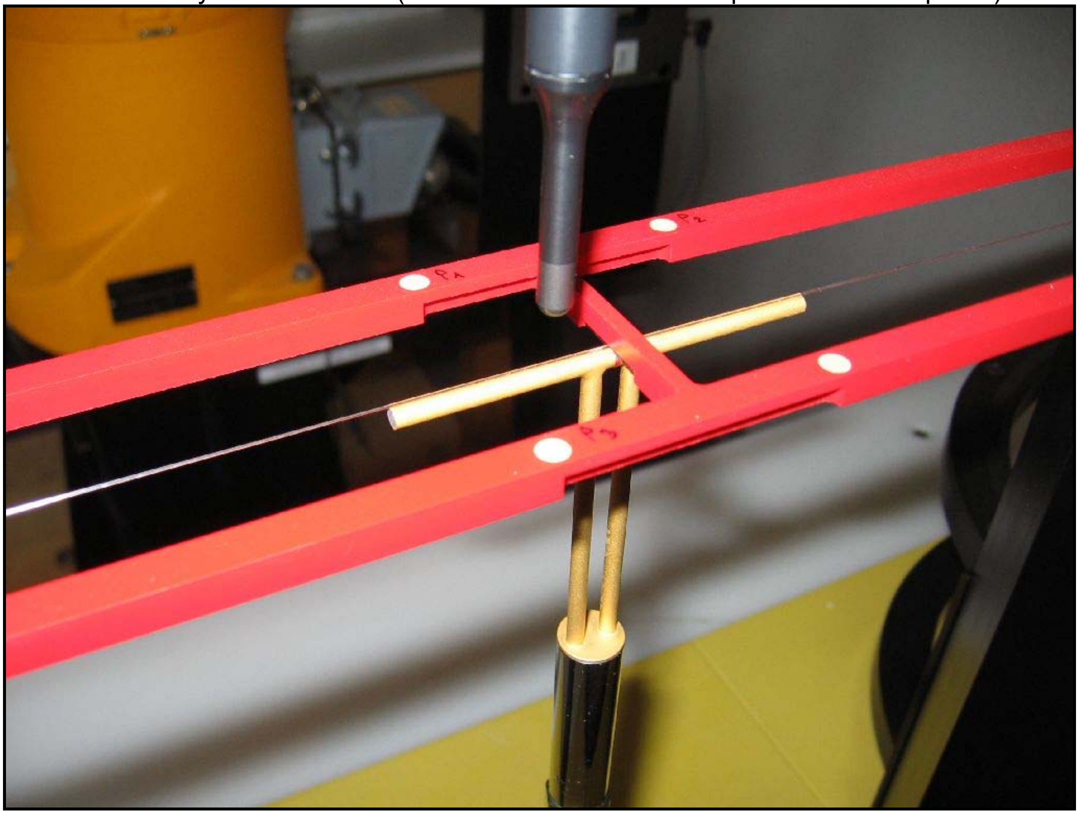
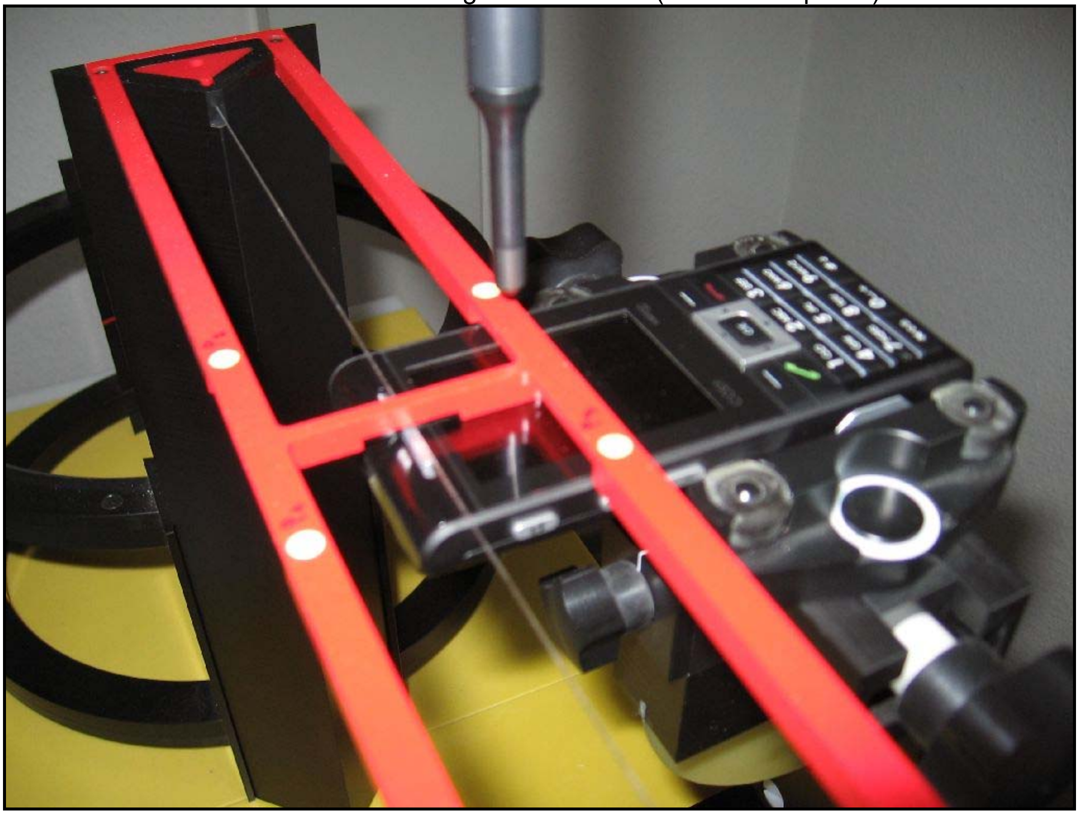


Photo 8: HAC M-Rating measurement (with H-field probe)



## Annex D: Calibration parameters

Calibration parameters are described in the additional document :

**Appendix to test report no. 1-2403-02-07/10**
**Calibration data and sytem validation information**

## Annex E: Document History

| Version | Applied Changes | Date of Release |
|---|---|---|
| | Initial Release | 2010-08-24 |
| | | |

## Annex F: Further Information

**Glossary**

DUT - Device under Test
EUT - Equipment under Test
FCC - Federal Communication Commission
FCC ID - Company Identifier at FCC
HAC . Hearing Aid Compatibility
HW - Hardware
IC - Industry Canada
Inv. No. - Inventory number
N/A - not applicable
S/N - Serial Number
SW - Software