Hearing Aid Compatibility (HAC) RF Emissions Test Report

APPLICANT	**: Hewlett Packard Company**
EQUIPMENT	**: HP iPAQ KB1**
BRAND NAME	**: HP**
MODEL NAME	**: HSTNH-P21C**
FCC ID	**: B94HHP21C**
STANDARD	**: FCC 47 CFR §20.19**
	ANSI C63.19-2007
M CATEGORY	**: M3**

The product sample received on Jun. 13, 2009 and completely tested on Jun. 30, 2009. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and shown the compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by:

Roy Wu

Roy Wu / Manager

ilac-MRA   TAF
Testing Laboratory
1190

SPORTON INTERNATIONAL INC.
No. 52, Hwa Ya 1ˢᵗ Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.

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TEL : 886-3-327-3456
FAX : 886-3-328-4978
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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
HA961307A	Rev. 01	Initial issue of report	Jul. 01, 2009

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1. *Statement of Compliance*

The maximum results of RF Emission of Hearing Aid Compliance (HAC) found during testing for the **Hewlett Packard Company HP iPAQ KB1 HP HSTNH-P21C** are as follows (with expanded uncertainly ±30.4％ for E-field and ±21.6% for H-field):

Band	HAC RF Emission Test Result		M Rating
GSM850	E-Field (V/m)	191.9	M3
	H-Field (A/m)	0.198	M4
GSM1900	E-Field (V/m)	66.6	M3
	H-Field (A/m)	0.096	M4
WCDMA Band V	E-Field (V/m)	70.9	M4
	H-Field (A/m)	0.11	M4
WCDMA Band II	E-Field (V/m)	36.1	M4
	H-Field (A/m)	0.053	M4

They are in compliance with HAC limits specified in guidelines FCC 47 CFR §20.19 and ANSI Standard ANSI C63.19 for HAC Rated category M3.

Results Summary : M Category = M3 (ANSI C63.19-2007)

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2. *Administration Data*

2.1 *Testing Laboratory*

Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	**Sporton Site No. :** SAR01-HY

2.2 *Applicant*

Company Name	Hewlett Packard Company
Address	3000 Hanover Street, Palo Alto, CA 94304

2.3 *Manufacturer*

Company Name	Pegatron Corporation
Address	5F., No. 76, Ligong St., Beitou Dist., Taipei City 112, Taiwan (R.O.C.)

2.4 *Application Details*

Date of Receipt of Application	Jun. 13, 2009
Date of Start during the Test	Jun. 28, 2009
Date of End during the Test	Jun. 30, 2009

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3. *General Information*

3.1 *Description of Device Under Test (DUT)*

Product Feature & Specification	
DUT Type	HP iPAQ KB1
Trade Name	HP
Model Name	HSTNH-P21C
FCC ID	B94HHP21C
Tx Frequency	GSM850 : 824 MHz ~ 849 MHz GSM1900 : 1850 MHz ~ 1910 MHz WCDMA Band V : 824 MHz ~ 849 MHz WCDMA Band II : 1850 MHz ~ 1910 MHz
Rx Frequency	GSM850 : 869 MHz ~ 894 MHz GSM1900 : 1930 MHz ~ 1990 MHz WCDMA Band V : 869 MHz ~ 894 MHz WCDMA Band II : 1930 MHz ~ 1990 MHz
Maximum Output Power to Antenna	GSM850 : 32.79 dBm GSM1900 : 29.75 dBm WCDMA Band V : 23.87 dBm WCDMA Band II : 23.79 dBm
Antenna Type	Fixed Internal Antenna
HW Version	EVT2
SW Version	Obsidian_0.21.58.03
Type of Modulation	GSM / GPRS : GMSK EDGE : 8PSK WCDMA : QPSK HSDPA : QPSK / 16QAM
DUT Stage	Identical Prototype

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List of Accessory:

Specification of Accessory		
AC Adapter 1	**Manufacturer**	Flextronics
	Brand Name	HP
	Part Number	538745-001
	Power Rating	I/P:100-240Vac, 50-60Hz, 200mA; O/P: 5Vdc, 1A
AC Adapter 2	**Manufacturer**	Phihong
	Brand Name	HP
	Model Name	PSAA05A-050 (for US) PSAA05N-050 (for Argentina)
	Power Rating	I/P:100-240Vac, 50-60Hz, 200mA; O/P: 5Vdc, 1A
	AC Power Cord Type	1.8 meter shielded cable without ferrite core
Battery 1	**Brand Name**	HP
	Model Name	HSTNH-T21C-H
	Power Rating	3.7Vdc, 11.3Wh
	Type	Li-ion
Battery 2	**Brand Name**	HP
	Model Name	HSTNH-T21C-S
	Power Rating	3.7Vdc, 5.7Wh
	Type	Li-ion
Earphone	**Brand Name**	foster
	Model Name	492854
	Signal Line Type	1.3 meter non-shielded cable without ferrite core
USB Cable	**Brand Name**	Foxconn
	Model Name	486113-001
	Signal Line Type	1.2 meter shielded cable without ferrite core
LCD Panel	**Brand Name**	Samsung Mobile Display
	Model Name	AMS250CU01

Remark:

1. The above DUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

2. PSAA05A-050 and PSAA05N-050 have the same circuit design; the difference between these models is plug.

3.2 *Product Photos*

Refer to Appendix D.

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3.3 Applied Standards

The ANSI Standard ANSI C63.19-2007 represents performance requirements for acceptable interoperability of hearing aids with wireless communications devices. When these parameters are met, a hearing aid operates acceptably in close proximity to a wireless communications device.

The following AWF factors shall be used for the standard transmission protocols:

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

Table 3.1 Articulation Weighting Factor (AWF)

Category	Telephone RF Parameters		
Near Field	AWF	E-Field Emissions	H-Field Emissions
< 960 MHz			
Category M1	0	631.0 – 1122.0 V/m	1.91 – 3.39 A/m
Category M1	-5	473.2 – 841.4 V/m	1.43 – 2.54 A/m
Category M2	0	354.8 – 631.0 V/m	1.07 – 1.91 A/m
Category M2	-5	266.1 – 473.2 V/m	0.80 – 1.43 A/m
Category M3	0	199.5 – 354.8 V/m	0.6 – 1.07 A/m
Category M3	-5	149.6 – 266.1 V/m	0.45 – 0.80 A/m
Category M4	0	< 199.5 V/m	< 0.60 A/m
Category M4	-5	< 149.6 V/m	< 0.45 A/m
> 960 MHz			
Category M1	0	199.5 – 354.8 V/m	0.60 – 1.07 A/m
Category M1	-5	149.6 – 266.1 V/m	0.45 – 0.80 A/m
Category M2	0	112.2 – 199.5 V/m	0.34 – 0.60 A/m
Category M2	-5	84.1 – 149.6 V/m	0.25 – 0.45 A/m
Category M3	0	63.1 – 112.2 V/m	0.19 – 0.34 A/m
Category M3	-5	47.3 – 84.1 V/m	0.14 – 0.25 A/m
Category M4	0	< 63.1 V/m	< 0.19 A/m
Category M4	-5	< 47.3 V/m	< 0.14 A/m

Table 3.2 Telephone near-field categories in linear units

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3.4 *Test Conditions*

3.5.1 *Ambient Condition*

Ambient Temperature	20 to 24 ℃
Humidity	< 60 %

3.5.2 *Test Configuration*

The device was controlled by using a base station emulator R&S CMU200. Communication between the device and the emulator was established by air link. Measurements were performed on the low, middle and high channels of both bands. The DUT was set from the emulator to radiate maximum output power during all tests.

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4. _Hearing Aid Compliance (HAC)_

4.1 _Introduction_

The federal communication commission (FCC) adopted ANSI C63.19 as HAC test standard.

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5. *HAC RF Emission Measurement Setup*
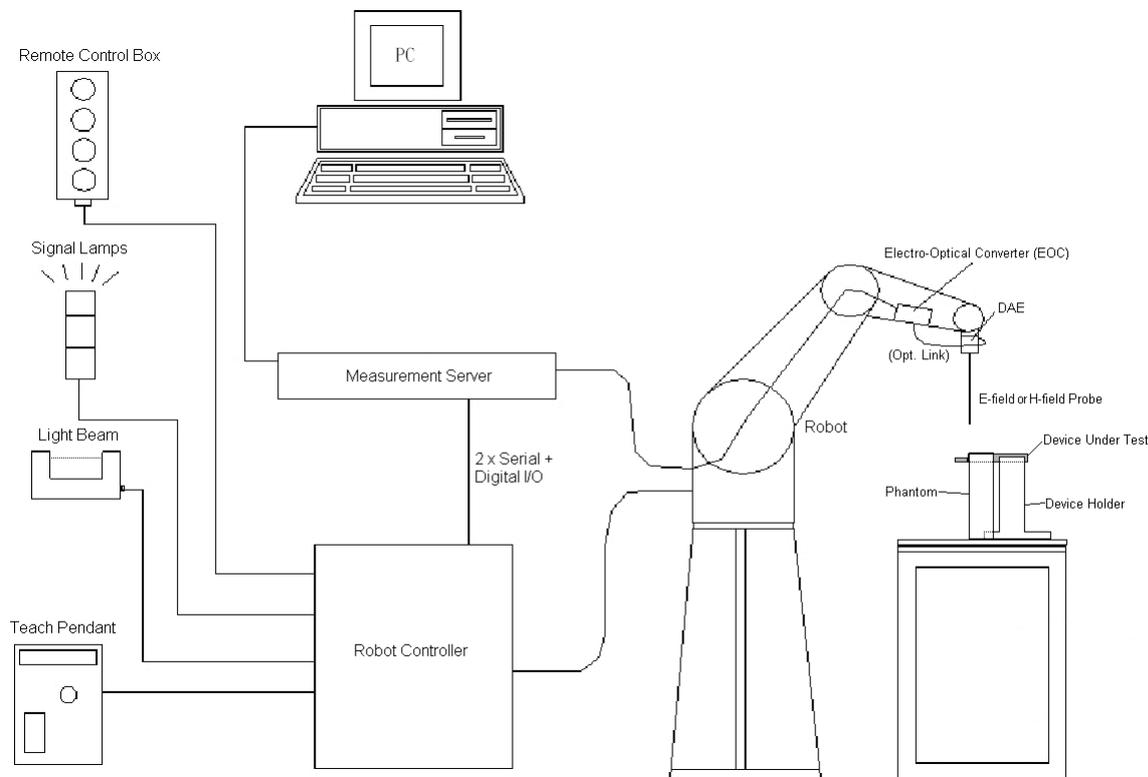
Fig. 5.1 SPEAG DASY4 or DASY5 System Configurations

The DASY4 or DASY5 system for performance compliance tests is illustrated above graphically. This system consists of the following items:

➢ A standard high precision 6-axis robot with controller, a teach pendant and software
➢ A data acquisition electronic (DAE) attached to the robot arm extension
➢ A dosimetric probe equipped with an optical surface detector system
➢ The electro-optical converter (ECO) performs the conversion between optical and electrical signals
➢ A measurement server performs the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
➢ A probe alignment unit which improves the accuracy of the probe positioning
➢ A computer operating Windows XP
➢ DASY4 or DASY5 software
➢ Remove control with teach pendant and additional circuitry for robot safety such as warming lamps, etc.
➢ The SAM twin phantom
➢ A device holder
➢ Tissue simulating liquid
➢ Dipole for evaluating the proper functioning of the system

Some of the components are described in details in the following sub-sections.

5.1 E-Field and H-Field Probe System

The HAC measurement is conducted with the dosimetric probe ER3DV6 and H3DV6 (manufactured by SPEAG). The probe is specially designed and calibrated. This probe has a built in optical surface detection system to prevent from collision with DUT.

5.1.1 E-Field Probe Specification
<ER3DV6>

Construction	One dipole parallel, two dipoles normal to probe axis Built-in shielding against static charges	
Calibration	In air from 100 MHz to 3.0 GHz (absolute accuracy ±6.0％, k=2)	
Frequency	100 MHz to 6 GHz; Linearity: ± 2.0 dB (100 MHz to 3 GHz)	
Directivity	± 0.2 dB in air (rotation around probe axis) ± 0.4 dB in air (rotation normal to probe axis)	
Dynamic Range	2 V/m to 1000 V/m (M3 or better device readings fall well below diode compression point)	
Linearity	± 0.2 dB	
Dimensions	Overall length: 330 mm (Tip: 16 mm) Tip diameter: 8 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.5 mm	**Fig. 5.2 Photo of E-field Probe**

5.1.2 H-Field Probe Description
<H3DV6>

Construction	Three concentric loop sensors with 3.8 mm loop diameters Resistively loaded detector diodes for linear response Built-in shielding against static charges	
Frequency	200 MHz to 3 GHz (absolute accuracy ± 6.0 ％, k=2); Output linearized	
Directivity	± 0.25 dB (spherical isotropy error)	
Dynamic Range	10 m A/m to 2 A/m at 1 GHz (M3 or better device readings fall well below diode compression point)	
Dimensions	Overall length: 330 mm (Tip: 40 mm) Tip diameter: 6 mm (Body: 12 mm) Distance from probe tip to dipole centers: 3 mm	
E-Field Interference	< 10％ at 3 GHz (for plane wave)	**Fig. 5.3 Photo of H-field Probe**

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5.2.3 *Probe Tip Description*

HAC field measurements take place in the close near field with high gradients. Increasing the measuring distance from the source will generally decrease the measured field values (in case of the validation dipole approx. 10％per mm).

Magnetic field sensors are measuring the integral of the H-field across their sensor area surrounded by the loop. They are calibrated in a precise, homogeneous field. When measuring a gradient field, the result will be very close to the field in the center of the loop which is equivalent to the value of a homogeneous field equivalent to the center value. But it will be different from the field at the field at the border of the loop.

Consequently, two sensors with different loop diameters – both calibrated ideally – would give different results when measuring from the edge of the probe sensor elements. The behavior for electrically small E-field sensors is equivalent. See below for distance plots from a WD which show the conservative nature of field readings at the probe element center vs. measurements at the sensor end:
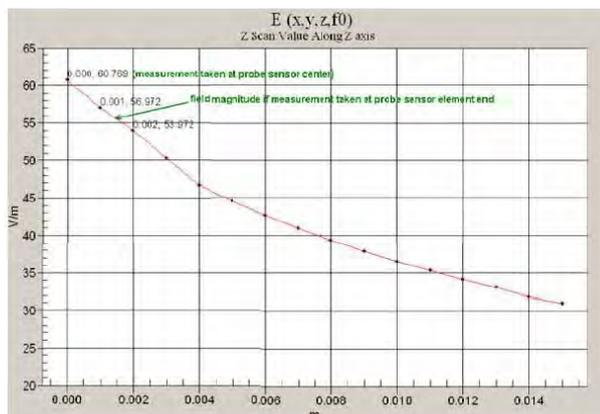
Fig. 5.4 Z-Axis Scan at maximum point above a typical wireless device for E-field
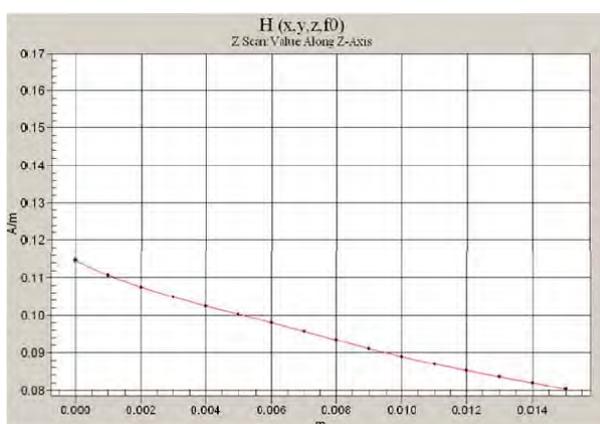
Fig. 5.5 Z-Axis Scan at maximum point above a typical wireless device for H-field

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The magnetic field loops of the H3D probes are concentric, with the center 3mm from the tip for H3DV6.

Their radius is 1.9 mm.

The electric field probes have a more irregular internal geometry because it is physically not possible to have the 3 orthogonal sensors situated with the same center. The effect of the different sensor centers is accounted for in the HAC uncertainty budget ("sensor displacement"). Their geometric center is at 2.5 mm from the tip, and the element ends are 1.1 mm closer to the tip.

Where:

Peak Field = Peak field (in dB V/m or dB A/m)
Raw = Raw field measurement from the measurement system (in V/m or A/m).
PMF = Probe Modulation Factor (in Linear units). See Chapter 8 of test report.

5.2 *DATA Acquisition Electronics (DAE)*

The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

Fig. 5.6 Photo of DAE

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5.3 Robot

The SPEAG DASY system uses the high precision robots (DASY4: RX90BL; DASY5: TX90XL) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY4: CS7MB; DASY5: CS8c) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

➢ High precision (repeatability ± 0.035 mm)

➢ High reliability (industrial design)

➢ Jerk-free straight movements

➢ Low ELF interference (the closed metallic construction shields against motor control fields)

➢ 6-axis controller

| Fig. 5.7 Photo of DASY4 | Fig. 5.8 Photo of DASY5 |

5.4 Measurement Server

The measurement server is based on a PC/104 CPU board with CPU (DASY4: 166 MHz, Intel Pentium; DASY5: 400 MHz, Intel Celeron), chipdisk (DASY4: 32 MB; DASY5: 128 MB), RAM (DASY4: 64 MB, DASY5: 128 MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O board, which is directly connected to the PC/104 bus of the CPU board.

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The measurement server performs all the real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operations.

Fig. 5.9 Photo of Server for DASY4

Fig. 5.10 Photo of Server for DASY5

5.5 *Phone Positioner*

The phone positioner shown in Fig. 5.11 is used to adjust DUT to the suitable position.

Fig. 5.11 Phone Positioner

5.6 *Test Arch Phantom*

Construction :	Enables easy and well defined positioning of the phone and validation dipoles as well as simple teaching of the robot.	
Dimensions :	370 x 370 x 370 mm	**Fig. 5.12 Photo of Arch Phantom**

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5.7 Data Storage and Evaluation

5.7.1 Data Storage

The DASY software stores the assessed data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all the necessary software parameters for the data evaluation (probe calibration data, and device frequency and modulation data) in measurement files. The post-processing 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 erroneous parameter settings.

5.7.2 Data Evaluation

The DASY post-processing software (SEMCAD) 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	dcp_i
Device parameters：	- Frequency	f
	- Crest factor	cf
Media parameters：	- Conductivity	σ
	- Density	ρ

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 DASY components. In the direct measuring mode of the multi-meter 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：

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

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)

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

$$\text{E-field Probes：} \mathbf{E_i} = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

$$\text{H-field Probes：} \mathbf{H_i} = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1}f + a_{i2}f^2}{f}$$

with
V_i = compensated signal of channel i, (i = x, y, z)
$Norm_i$ = sensor sensitivity of channel i, (i = x, y, z), µV/(V/m)^2 for E-field Probes
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)：

$$\mathbf{E_{tot}} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

The measurement/integration time per point, as specified by the system manufacturer is > 500 ms. The signal response time is evaluated as the time required by the system to reach 90％ of the expected final value after an on/off switch of the power source with an integration time of 500 ms and a probe response time of < 5 ms. In the current implementation, DASY waits longer than 100 ms after having reached the grid point before starting a measurement, i.e., the response time uncertainty is negligible.

If the device under test does not emit a CW signal, the integration time applied to measure the electric field at a specific point may introduce additional uncertainties due to the discretization. The tolerances for the different systems had the worst-case of 2.6％.

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5.8   Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	Isotropic E-Filed Probe	ER3DV6	2358	Jan. 14, 2009	Jan. 13, 2010
SPEAG	Isotropic H-Filed Probe	H3DV6	6184	Jan. 19, 2009	Jan. 18, 2010
SPEAG	Audio Magnetic 1D Field Probe	AM1DV2	1038	Jan. 12, 2009	Jan. 11, 2010
SPEAG	Audio Magnetic Calibration Coil	AMCC	1049	NCR	NCR
SPEAG	Audio Measuring Instrument	AMMI	1041	NCR	NCR
SPEAG	835MHz Calibration Dipole	CD835V3	1045	Sep. 25, 2007	Sep. 24, 2009
SPEAG	1880MHz Calibration Dipole	CD1880V3	1038	Sep. 27, 2007	Sep. 26, 2009
SPEAG	2450MHz Calibration Dipole	CD2450V3	1039	Sep. 27, 2007	Sep. 26, 2009
SPEAG	Data Acquisition Electronics	DAE3	577	Nov. 12, 2008	Nov. 11, 2009
SPEAG	Data Acquisition Electronics	DAE4	778	Sep. 22, 2008	Sep. 21, 2009
SPEAG	Test Arch Phantom	N/A	N/A	NCR	NCR
SPEAG	Phone Positoiner	N/A	N/A	NCR	NCR
Agilent	Wireless Communication Test Set	E5515C	MY48360820	Dec. 15, 2008	Dec. 14, 2009
R&S	Universal Radio Communication Tester	CMU200	105934	Nov. 11, 2008	Nov. 10, 2009
Agilent	Dual Directional Coupler	778D	50422	NCR	NCR
AR	Power Amplifier	5S1G4M2	0328767	NCR	NCR
R&S	Power Meter	NRVD	101394	Oct. 20, 2008	Oct. 19, 2009
R&S	Power Sensor	NRV-Z1	100130	Oct. 20, 2008	Oct. 19, 2009
R&S	Spectrum Analyzer	FSP7	101131	Mar. 12, 2009	Mar. 11, 2010

Table 5.1 Test Equipment List

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6. *Uncertainty Assessment*

The component of uncertainly may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainly by the statistical analysis of a series of observations is termed a Type A evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience and knowledge of the behavior and properties of relevant materials and instruments, manufacture's specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in Table 6.1.

Uncertainty Distributions	Normal	Rectangular	Triangular	U-Shape
Multi-plying Factor[a]	$1/k$[b]	$1/\sqrt{3}$	$1/\sqrt{6}$	$1/\sqrt{2}$

(a) standard uncertainty is determined as the product of the multiplying factor and the estimated range of variations in the measured quantity

(b) κ is the coverage factor

Table 6.1 Multiplying Factions for Various Distributions

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual "root-sum-squares" (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %. The DASY uncertainty Budget is showed in Table 6.2.

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Error Description	Uncertainty Value (±%)	Probability Distribution	Divisor	Ci (E)	Ci (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 %
Test Arch	7.2	Rectangular	√3	1	0	± 4.1 %	± 0.0 %
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 Limit	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	12.0	Rectangular	√3	1	1	± 6.9 %	± 6.9 %
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 %
Extrap. 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 %
Phantom and Setup Related							
Phantom Thickness	2.4	Rectangular	√3	1	0.67	± 1.4 %	± 0.9 %
Combined Standard Uncertainty						± 15.2 %	± 10.8 %
Coverage Factor for 95 %						K = 2	
Expanded Uncertainty						**± 30.4 %**	**± 21.6 %**

Table 6.2 Uncertainty Budget of DASY

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7. HAC RF Emission Measurement Evaluation

Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to fix it underneath the test Arch and a corresponding distance holder.

7.1 Purpose of System Performance Check

The system performance check verifies that the system operates within its specifications. System and operator errors can be detected and corrected. It is recommended that the system performance check be performed prior to any usage of the system in order to guarantee reproducible results. The system performance check uses normal HAC measurements in a simplified setup with a well characterized source. This setup was selected to give a high sensitivity to all parameters that might fail or vary over time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.

7.2 System Setup

In the simplified setup for system evaluation, the DUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave which comes from a signal generator. The calibrated dipole must be placed beneath the arch phantom. The equipment setup is shown below:
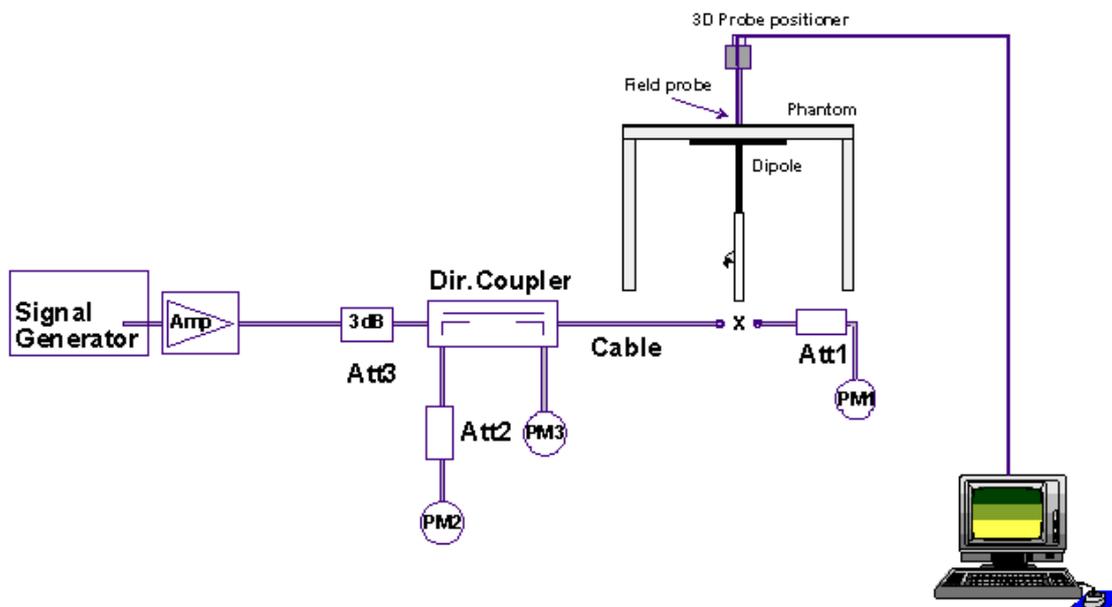
Fig. 7.1 System Setup of System Evaluation

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1. Signal Generator
2. Amplifier
3. Directional Coupler
4. Power Meter
5. Calibrated Dipole

The output power on dipole port must be calibrated to 20dBm (100mW) before dipole is connected.

Fig 7.2 Dipole Setup

7.3 Validation Results

Comparing to the original E-field or H-field value provided by SPEAG, the validation data should be within its specification of 25 %. Table 7.1 shows the target value and measured value. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to appendix A of this report.

Frequency (MHz)	Input Power (dBm)	Target Value (V/m)	E-Field 1 (V/m)	E-Field 2 (V/m)	Average Value (V/m)	Deviation (%)	Date
835	20	167.1	186.5	185.3	185.9	11.25	Jun 30, 2009
1880	20	138.9	150.1	151.8	150.95	8.68	Jun 28, 2009
Frequency (MHz)	Input Power (dBm)	Target Value (A/m)	H-Field (A/m)		Deviation (%)	Date
835	20	0.453	0.504		11.26	Jun 30, 2009
1880	20	0.471	0.484		2.76	Jun 30, 2009

Table 7.1 Test Results of System Validation

Note: Deviation = ((E or H-field Result) - (Target field)) / (Target field) * 100%

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8. *RF Field Probe Modulation Factor*

A calibration shall be made of the modulation response of the probe and its instrumentation chain. This calibration shall be performed with the field probe, attached to the instrumentation that is to be used with it during the measurement. The response of the probe system to a CW field at the frequency(s) of interest is compared to its response to a modulated signal with equal peak amplitude. The field level of the test signals shall be more than 10 dB above the ambient level and the noise floor of the instrumentation being used. The ratio of the CW reading to that taken with a modulated field shall be applied to the readings taken of modulated fields of the specified type.
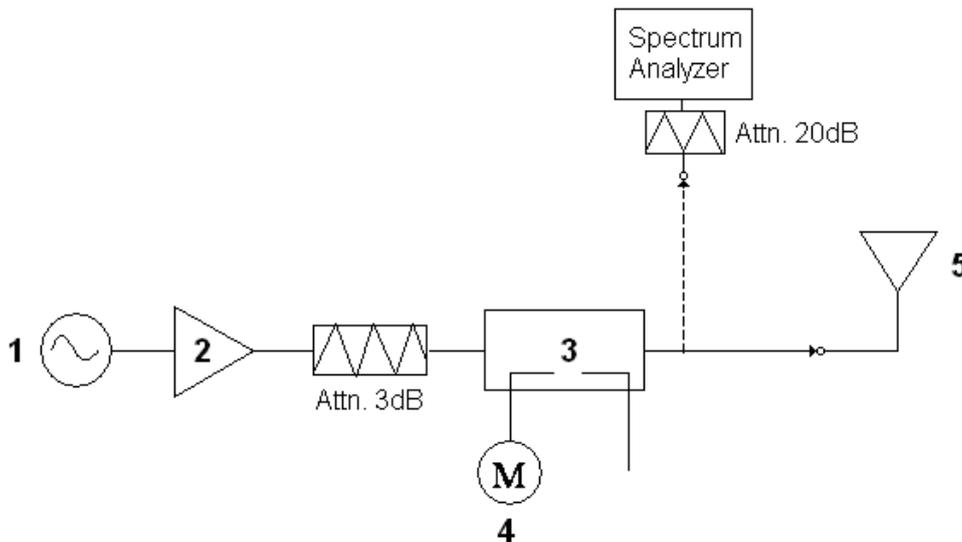
Fig. 8.1 System Calibration

This was done using the following procedure:
1. Fixing the probe in a set location relative to a field generating device.
2. Illuminate the probe with a CW signal at the intended measurement frequency.
3. Record the reading of the probe measurement system of the CW signal.
4. Determine the level of the CW signal being used to drive the field generating device.
5. Substitute a signal using the same modulation as that used by the intended WD for the CW signal.
6. Set the peak amplitude during transmission of the modulated signal to equal the amplitude of the CW signal.
7. Record the reading of the probe measurement system of the modulated signal.
8. The ratio of the CW to modulated signal reading is the modulation factor.
9. Repeat 2~8 steps at intended measurement frequency for both E and H field probe.

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PMF Measurement Summary:

Frequency (MHz)	Functions	E-field	H-field	PMF	
		V/m	A/m	E-field	H-field
835	CW	755.0	2.050	-	-
835	AM 80%	468.0	1.650	1.61	1.24
835	GSM	286.0	1.444	2.64	1.42
1880	CW	464.0	1.523	-	-
1880	AM 80%	294.1	1.280	1.58	1.19
1880	GSM	171.9	1.190	2.70	1.28
835	CW	337.1	0.697	-	-
835	AM 80%	219.9	0.495	1.53	1.41
835	WCDMA	351.3	0.907	0.96	0.77
1880	CW	247.8	0.815	-	-
1880	AM 80%	161.1	0.653	1.54	1.25
1880	WCDMA	251.8	1.581	0.98	0.52

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Zero span Spectrum Plots for RF Field Probe Modulation Factor
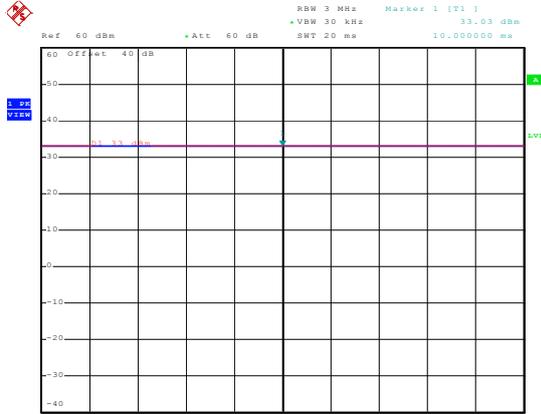
835MHz - CW
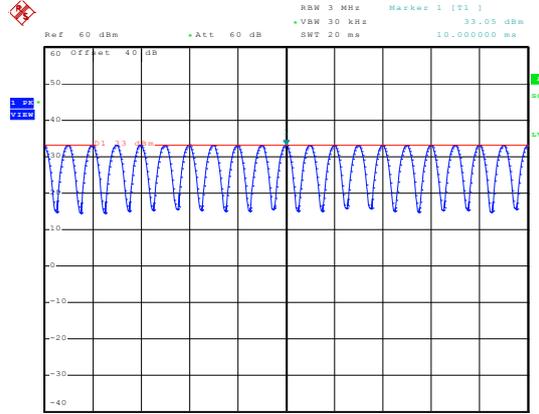
835MHz - 80% AM
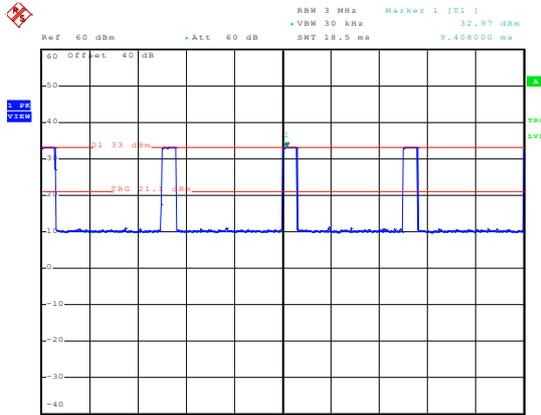
835MHz - GSM
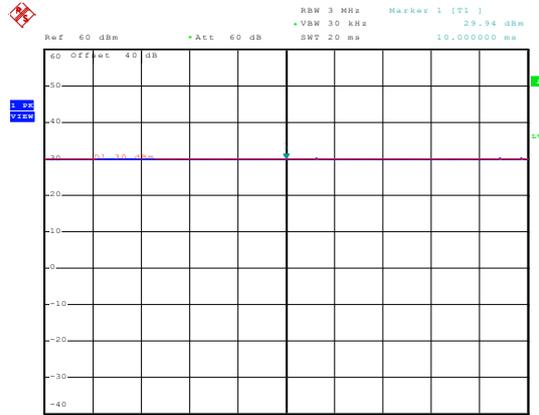
1880MHz - CW
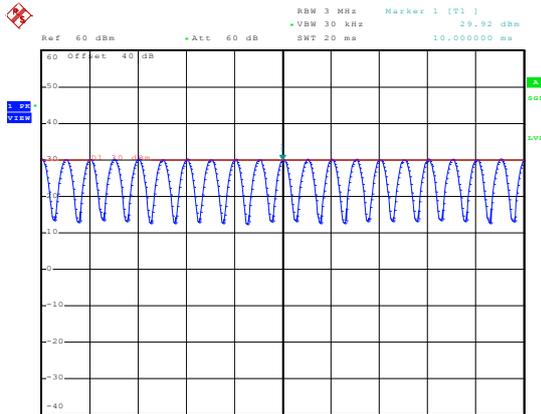
1880MHz - 80% AM

1880MHz - GSM

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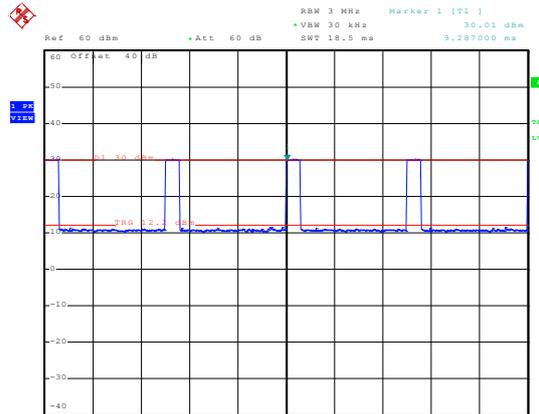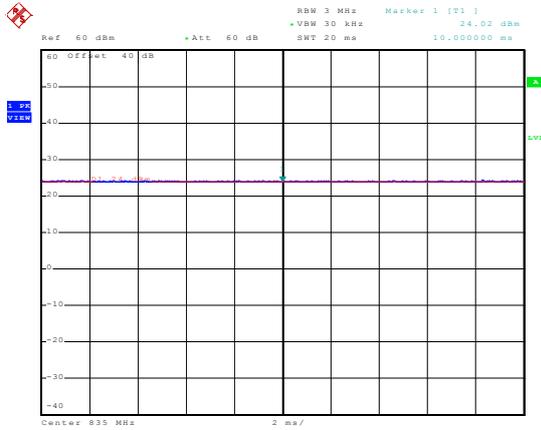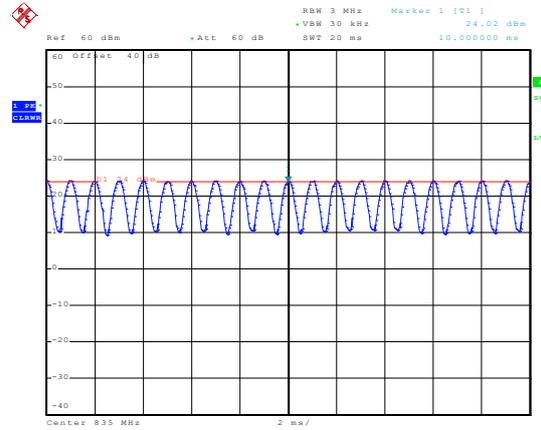
835MHz - CW
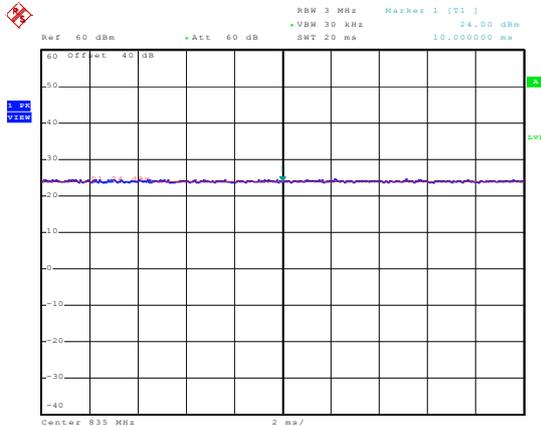
835MHz - 80% AM

835MHz - WCDMA

1880MHz - CW
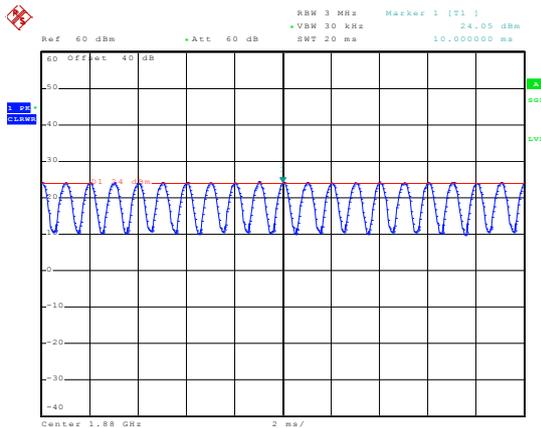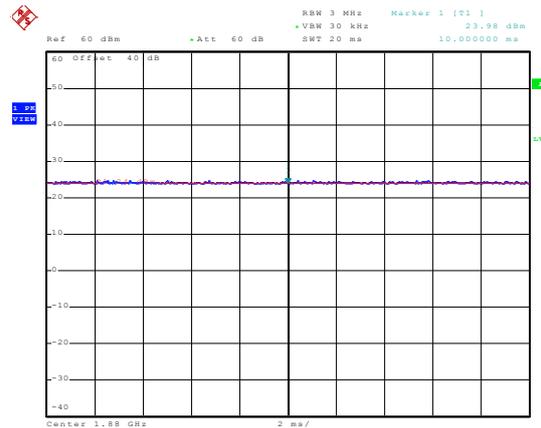
2nd comment ...
Date: 2.SEP.2008 00:55:31

1880MHz - 80% AM

2nd comment ...
Date: 2.SEP.2008 01:03:50

1880MHz - WCDMA

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9. *Description for DUT Testing Position*

The DUT was put on device holder and adjusted to the accurate and reliable position. Please refer to Appendix E for the Setup photographs.

Fig. 9.1 illustrate the references and reference plane that shall be used in a typical DUT emissions measurement. The principle of this section is applied to DUT with similar geometry.

➢ The grid is 5 cm by 5 cm area that is divided into 9 evenly sized blocks or sub-grids.
➢ The grid is centered on the audio frequency output transducer of the DUT.
➢ The grid is in a reference plane, which is defined as the planar area that contains the highest point in the area of the phone that normally rests against the user's ear. It is parallel to the centerline of the receiver area of the phone and is defined by the points of the receiver-end of the DUT handset, which, in normal handset use, rest against the ear.
➢ The measurement plane is parallel to, and 15 mm in front of, the reference plane.

Fig 9.1 A typical DUT reference and plane for HAC measurements

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E – Field
Probe

Center point
of the probe
elements

Offset

15 mm from EUT
10 mm from validation dipole

T

Gauge

Top surface

EUT
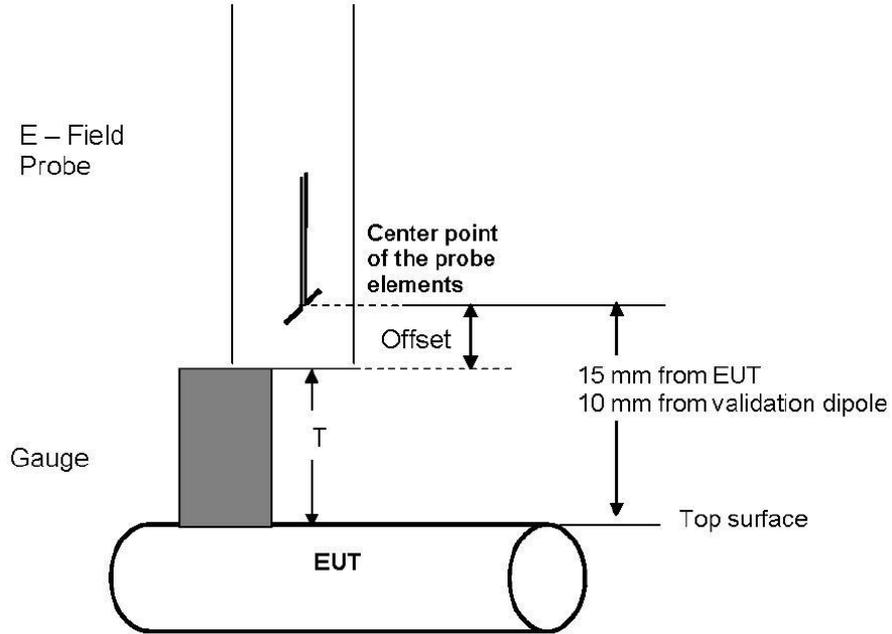
Fig. 9.2 Gauge block with E-field probe

H – Field
Probe

Center point
of the probe
elements

Offset

15 mm from EUT
10 mm from validation dipole

T

Gauge

Top surface

EUT
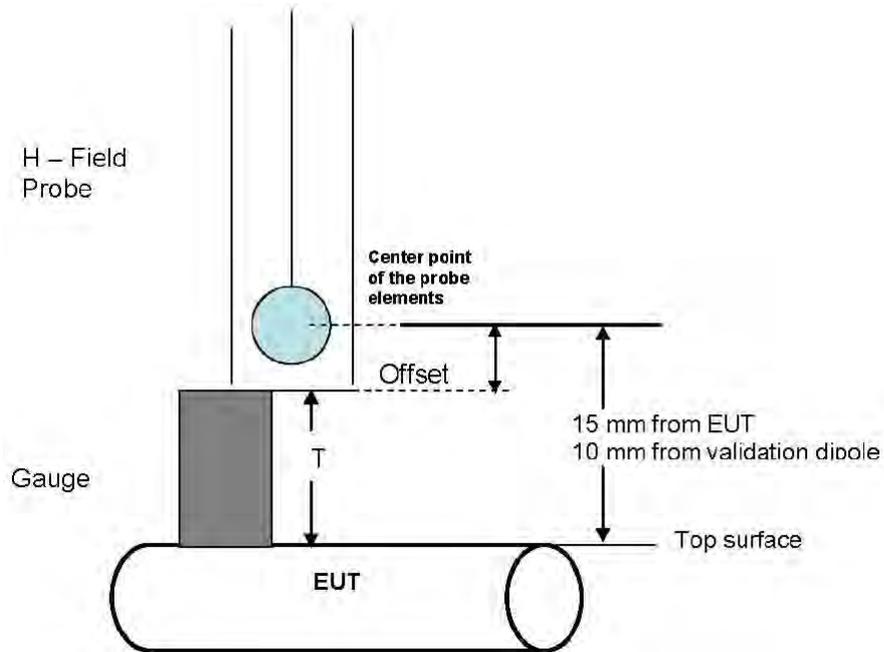
Fig. 9.3 Gauge block with H-field probe

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10. _RF Emissions Test Procedure_

The following illustrate a typical RF emissions test scan over a wireless communications device:

1. Proper operation of the field probe, probe measurement system, other instrumentation, and the positioning system was confirmed.
2. DUT is positioned in its intended test position, acoustic output point of the device perpendicular to the field probe.
3. The DUT operation for maximum rated RF output power was configured and confirmed with the base station simulator, at the test channel and other normal operating parameters as intended for the test. The battery was ensured to be fully charged before each test.
4. The center sub-grid was centered over the center of the acoustic output (also audio band magnetic output, if applicable). The DUT audio output was positioned tangent (as physically possible) to the measurement plane.
5. A surface calibration was performed before each setup change to ensure repeatable spacing and proper maintenance of the measurement plane using the test Arch.
6. The measurement system measured the field strength at the reference location.
7. Measurements at 5 mm increments in the 5 x 5 cm region were performed and recorded. A $360°$ rotation about the azimuth axis at the maximum interpolated position was measured. For the worst-case condition, the peak reading from this rotation was used in re-evaluating the HAC category.
8. The system performed a drift evaluation by measuring the field at the reference location.
9. Steps 1 ~ 8 were done for both the E and H-Field measurements.

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11. HAC RF Emission Test Results

11.1 Conducted Power (Unit: dBm)

Band	GSM850			GSM1900		
Channel	128	189	251	512	661	810
Frequency (MHz)	824.2	836.4	848.8	1850.2	1880.0	1909.8
GSM	32.49	32.63	32.79	29.75	29.50	29.29
GPRS 8	32.51	32.64	32.78	29.74	29.58	29.48
GPRS 10	32.48	32.61	32.76	29.72	29.55	29.45
EDGE 8	27.16	27.28	27.45	26.33	26.12	26.06
EDGE 10	27.15	27.31	27.42	26.32	26.14	26.09

Band	WCDMA Band II			WCDMA Band V		
Channel	9262	9400	9538	4132	4182	4233
Frequency (MHz)	1852.4	1880.0	1907.6	826.4	836.4	846.6
RMC 12.2K	23.65	23.87	23.69	23.74	23.79	23.73
HSDPA Subtest-1	23.54	23.60	23.45	23.43	23.59	23.54
HSDPA Subtest-2	23.44	23.41	23.28	23.33	23.46	23.42
HSDPA Subtest-3	23.03	22.92	22.97	22.91	23.04	22.96
HSDPA Subtest-4	22.84	22.87	22.76	22.86	23.00	23.01

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11.2 *E-Field Emission*

Plot No.	Band	Modulation Type	Channel	Battery	PMF	Peak E-Field (V/m)	M Rating
#04	GSM850	GSM	128	2	2.64	178.5	M3
#05	**GSM850**	**GSM**	**189**	**2**	**2.64**	**191.9**	**M3**
#06	GSM850	GSM	251	2	2.64	188.1	M3
#26	GSM850	GSM	189	1	2.64	175.2	M3
#01	GSM1900	GSM	512	2	2.70	65.5	M3
#02	**GSM1900**	**GSM**	**661**	**2**	**2.70**	**66.6**	**M3**
#03	GSM1900	GSM	810	2	2.70	62.4	M3
#25	GSM1900	GSM	661	1	2.70	62.5	M3
#10	WCDMA V	RMC 12.2k	4132	2	0.96	63.6	M4
#11	WCDMA V	RMC 12.2k	4182	**2**	0.96	64.2	M4
#12	**WCDMA V**	**RMC 12.2k**	**4233**	2	**0.96**	**70.9**	**M4**
#28	WCDMA V	RMC 12.2k	4233	1	0.96	62.9	M4
#07	**WCDMA II**	**RMC 12.2k**	**9262**	2	**0.98**	**36.1**	**M4**
#08	WCDMA II	RMC 12.2k	9400	**2**	0.98	31.6	M4
#09	WCDMA II	RMC 12.2k	9538	2	0.98	31.0	M4
#27	WCDMA II	RMC 12.2k	9262	1	0.98	33.7	M4

11.3 *H-Field Emission*

Plot No.	Band	Modulation Type	Channel	Battery	PMF	Peak H-Field (A/m)	M-Rating
#16	GSM850	GSM	128	2	1.42	0.179	M4
#17	**GSM850**	**GSM**	**189**	**2**	**1.42**	**0.198**	**M4**
#18	GSM850	GSM	251	2	1.42	0.196	M4
#30	GSM850	GSM	189	1	1.42	0.192	M4
#13	**GSM1900**	**GSM**	**512**	**2**	**1.28**	**0.096**	**M4**
#14	GSM1900	GSM	661	**2**	1.28	0.094	M4
#15	GSM1900	GSM	810	2	1.28	0.093	M4
#29	GSM1900	GSM	512	1	1.28	0.095	M4
#22	WCDMA V	RMC 12.2k	4132	2	0.77	0.101	M4
#23	WCDMA V	RMC 12.2k	4182	**2**	0.77	0.100	M4
#24	**WCDMA V**	**RMC 12.2k**	**4233**	2	**0.77**	**0.110**	**M4**
#32	WCDMA V	RMC 12.2k	4233	1	0.77	0.101	M4
#19	**WCDMA II**	**RMC 12.2k**	**9262**	2	**0.52**	**0.053**	**M4**
#20	WCDMA II	RMC 12.2k	9400	**2**	0.52	0.048	M4
#21	WCDMA II	RMC 12.2k	9538	2	0.52	0.050	M4
#31	WCDMA II	RMC 12.2k	9262	1	0.52	0.052	M4

Remark:

1. The output power is adjusted to maximum level and the backlight turned off during RF Emission testing.
2. This device does not support HAC.
3. Test Engineer：Gordon Lin, Tang Liu, and A-Rod Chen

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12. *References*

[1] ANSI C63.19-2007, "American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids", 8 June 2007

[2] SPEAG DASY System Handbook

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Appendix A – Plots of System Performance Check

The plots are shown as follows.

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Appendix B – Plots of RF Emission Measurement

The plots are shown as follows.

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Appendix C – DASY Calibration Certificate

The DASY calibration certificates are shown as follows.

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HAC_E_Dipole_835_090630

DUT: HAC-Dipole 835 MHz

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1

Medium: Air Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3

Ambient Temperature 22.9

DASY4 Configuration:
- Probe: ER3DV6 - SN2358; ConvF(1, 1, 1); Calibrated: 2009/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

E Scan - measurement distance from the probe sensor center to CD835 Dipole = 10mm/Hearing Aid Compatibility Test (41x361x1):

Measurement grid: dx=5mm, dy=5mm

Probe Modulation Factor = 1.00

Reference Value = 139.3 V/m; Power Drift = -0.006 dB

Average value of Total = (186.5 + 185.3) / 2 = 185.9V/m

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
177.1 M4	**186.5 M4**	**181.1 M4**
Grid 4	Grid 5	Grid 6
94.6 M4	**99.9 M4**	**98.0 M4**
Grid 7	Grid 8	Grid 9
178.3 M4	**185.3 M4**	**181.3 M4**
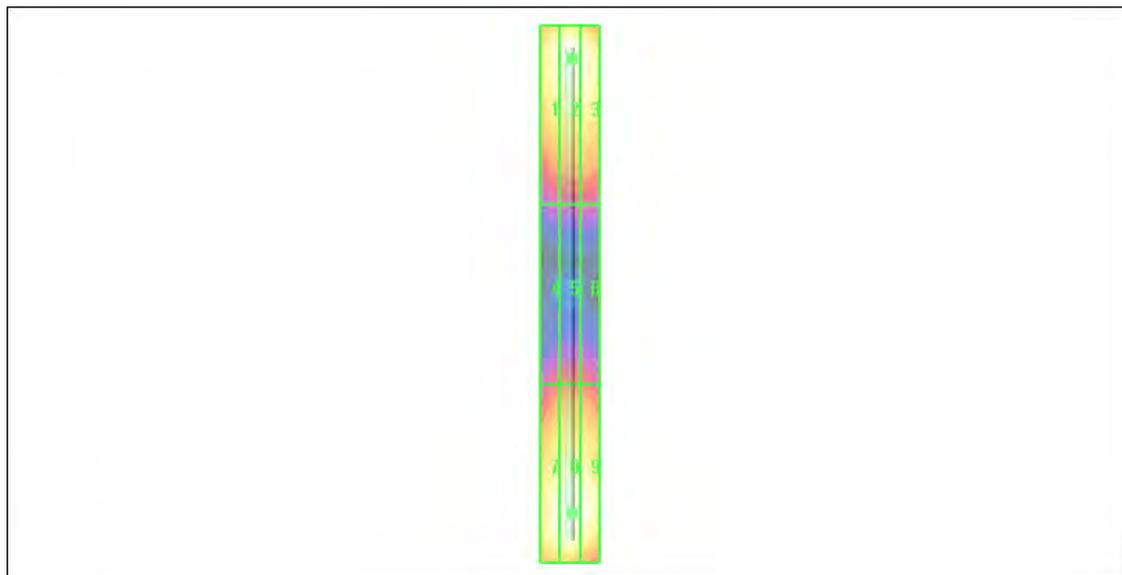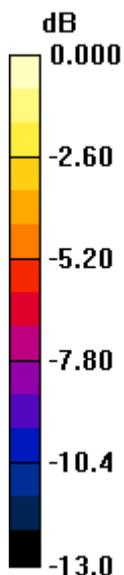
0 dB = 186.5V/m

HAC_E_Dipole_1880_090628

DUT: HAC Dipole 1880 MHz

Communication System: PCS; Frequency: 1880 MHz;Duty Cycle: 1:1

Medium: Air Medium parameters used: σ = 0 mho/m, ε$_r$ = 1; ρ = 1000 kg/m^3

Ambient Temperature   23.1

DASY4 Configuration:
- Probe: ER3DV6 - SN2358; ConvF(1, 1, 1); Calibrated: 2009/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

E Scan - measurement distance from the probe sensor center to CD1880 Dipole = 10mm/Hearing Aid Compatibility Test (41x181x1):

Maximum value of peak Total field = 151.8 V/m

Probe Modulation Factor = 1.00 m

Reference Value = 154.6 V/m; Power Drift = -0.020 dB

Average value of Total = (150.1 + 151.8) / 2 = 150.95 V/m

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
141.2 M2	**150.1 M2**	**145.9 M2**
Grid 4	Grid 5	Grid 6
93.9 M3	**100.4 M3**	**99.0 M3**
Grid 7	Grid 8	Grid 9
146.1 M2	**151.8 M2**	**148.2 M2**
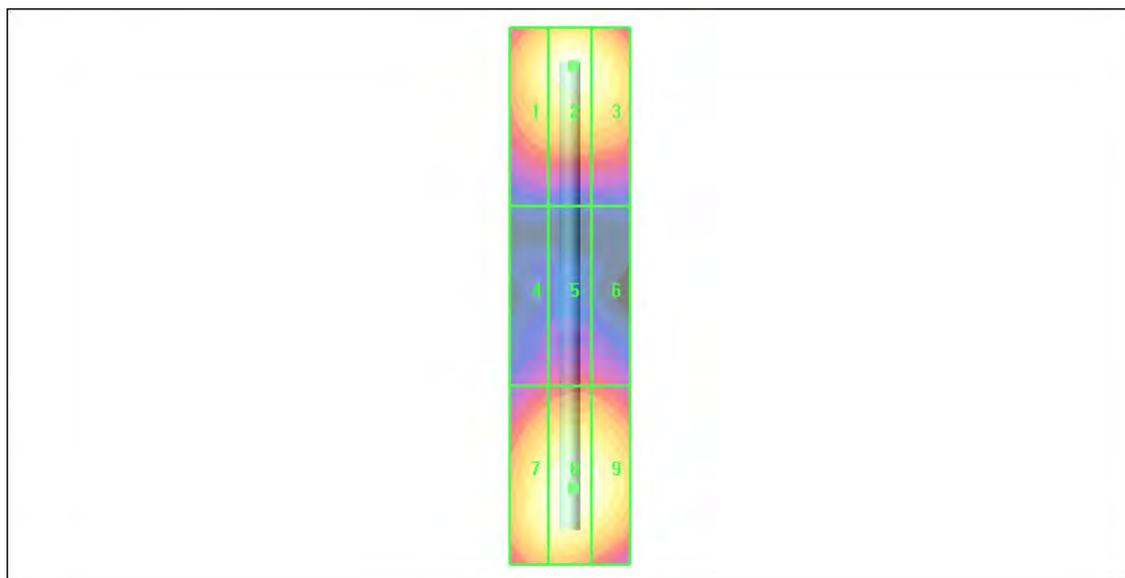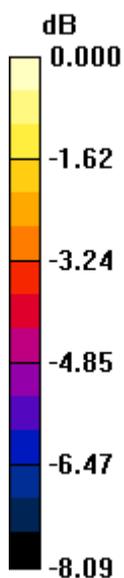
0 dB = 151.8V/m

HAC_H_Dipole_835_090630

DUT: HAC-Dipole 835 MHz

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1

Medium: Air Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3

Ambient Temperature   22.9   ;

DASY4 Configuration:
- Probe: H3DV6 - SN6184; ; Calibrated: 2009/1/19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

H Scan - measurement distance from the probe sensor center to CD835 Dipole = 10mm/Hearing Aid Compatibility Test (41x361x1):

Measurement grid: dx=5mm, dy=5mm

Probe Modulation Factor = 1.00

Reference Value = 0.538 A/m; Power Drift = -0.011 dB

Maximum value of Total = 0.504 A/m

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.426 M4	**0.451 M4**	**0.426 M4**
Grid 4	Grid 5	Grid 6
0.478 M4	**0.504 M4**	**0.479 M4**
Grid 7	Grid 8	Grid 9
0.429 M4	**0.452 M4**	**0.427 M4**
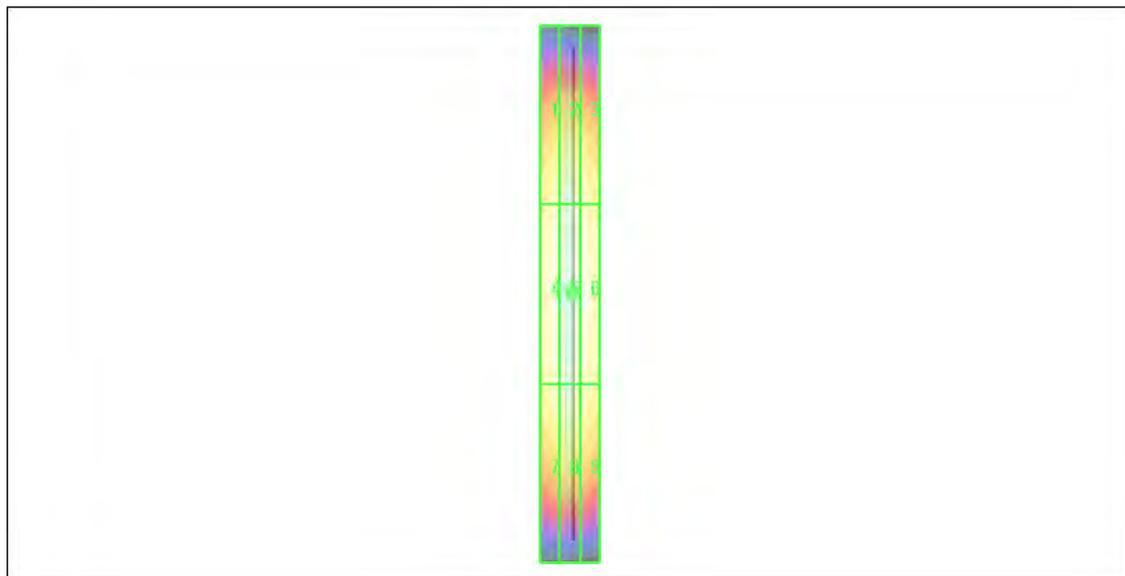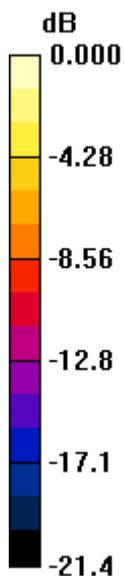
0 dB = 0.504A/m

HAC_H_Dipole_1880_090630

DUT: HAC Dipole 1880 MHz

Communication System: PCS; Frequency: 1880 MHz;Duty Cycle: 1:1

Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3

Ambient Temperature   22.9

DASY4 Configuration:
- Probe: H3DV6 - SN6184; ; Calibrated: 2009/1/19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

H Scan - measurement distance from the probe sensor center to CD1880 Dipole = 10mm/Hearing Aid Compatibility Test (41x181x1):

Measurement grid: dx=5mm, dy=5mm

Probe Modulation Factor = 1.00

Reference Value = 0.513 A/m; Power Drift = 0.012 dB

Maximum value of Total = 0.484 A/m

Peak H-field in A/m

Grid 1 **0.427 M2**	Grid 2 **0.443 M2**	Grid 3 **0.419 M2**
Grid 4 **0.465 M2**	Grid 5 **0.484 M2**	Grid 6 **0.459 M2**
Grid 7 **0.430 M2**	Grid 8 **0.450 M2**	Grid 9 **0.424 M2**
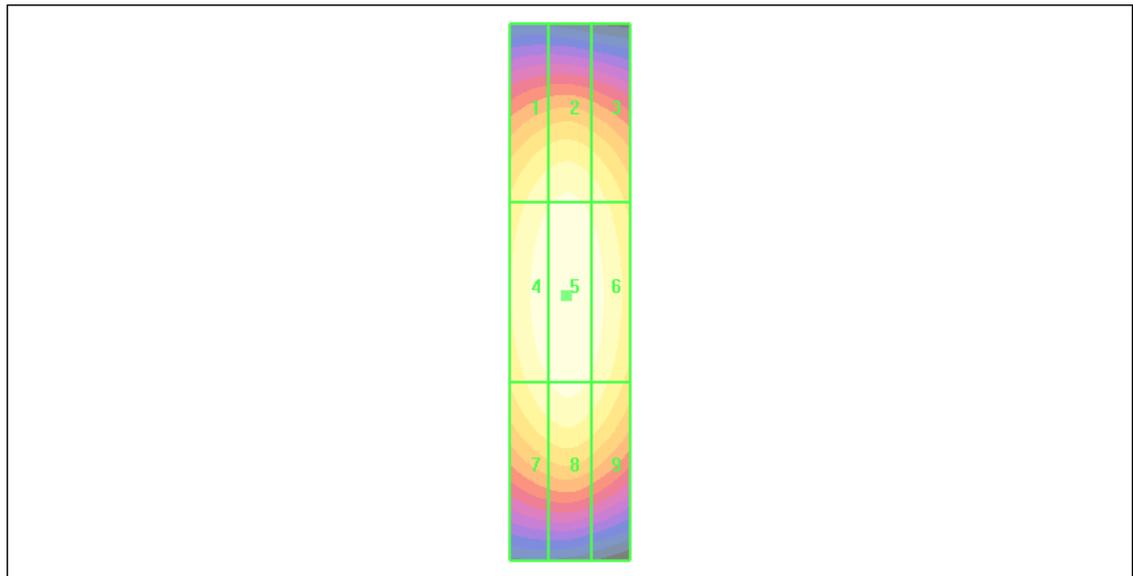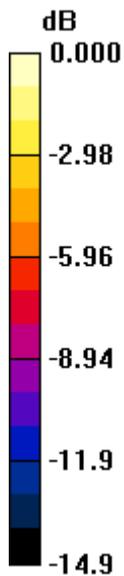
0 dB = 0.484A/m

#04 HAC_E_GSM850 Ch128_Battery2

DUT: 961307

Communication System: GSM850; Frequency: 824.2 MHz;Duty Cycle: 1:8.3

Medium: Air Medium parameters used: σ = 0 mho/m, $ε_r$ = 1; ρ = 1000 kg/m^3

Ambient Temperature   22.9

DASY4 Configuration:
- Probe: ER3DV6 - SN2358; ConvF(1, 1, 1); Calibrated: 2009/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch128/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 178.5 V/m

Probe Modulation Factor = 2.64

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 86.3 V/m; Power Drift = 0.022 dB

Hearing Aid Near-Field Category: M3 (AWF -5 dB)
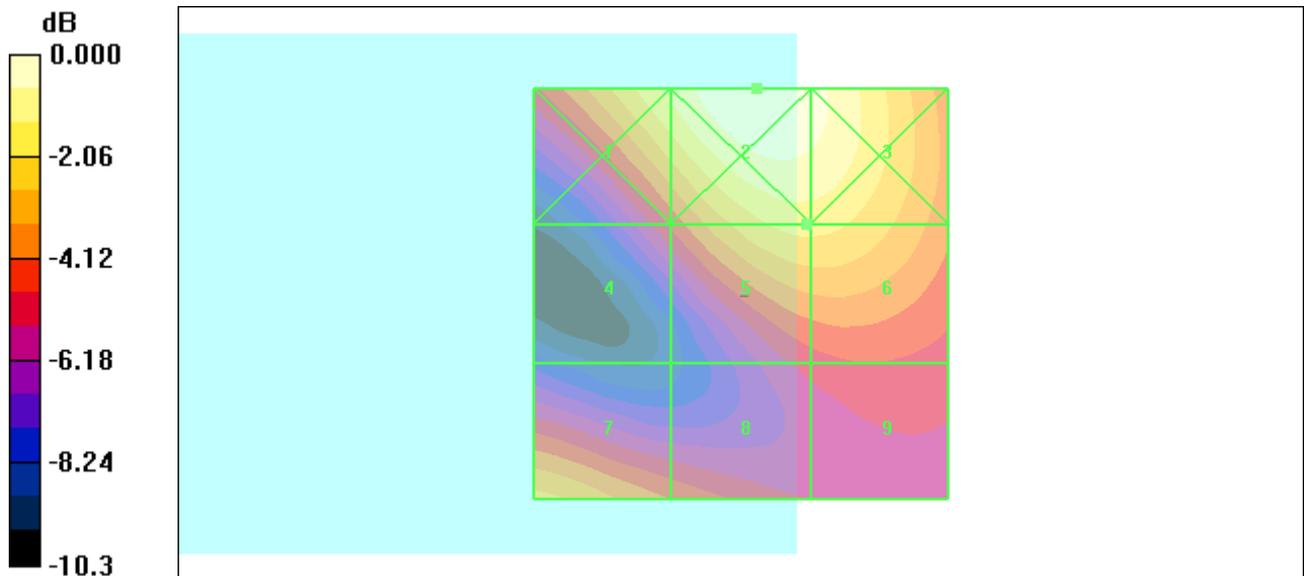
Peak E-field in V/m

Grid 1	Grid 2	Grid 3
167.2 M3	**177.6 M3**	**172.1 M3**
Grid 4	Grid 5	Grid 6
163.4 M3	**178.5 M3**	**174.1 M3**
Grid 7	Grid 8	Grid 9
152.5 M3	**166.9 M3**	**164.2 M3**

Cursor:
Total = 178.5 V/m
E Category: M3
Location: -2.5, -5, 8.7 mm
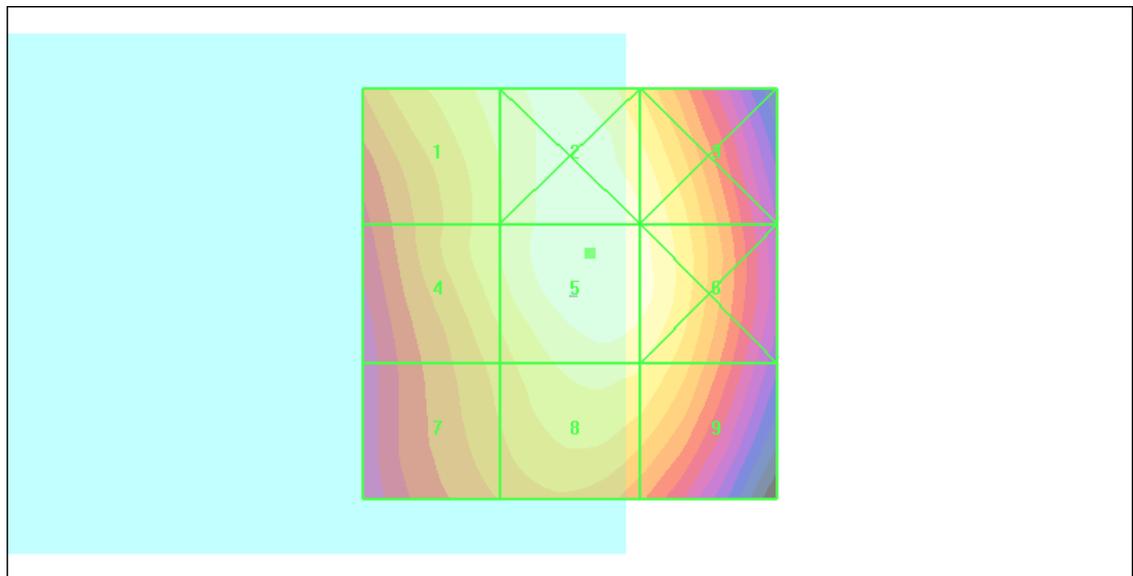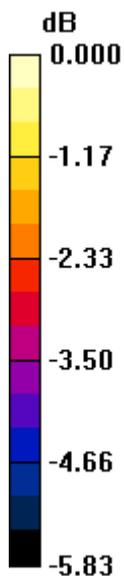
0 dB = 178.5V/m

#05 HAC_E_GSM850 Ch189_Battery2

DUT: 961307

Communication System: GSM850; Frequency: 836.4 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: σ = 0 mho/m, $ε_r$ = 1; ρ = 1000 kg/m^3
Ambient Temperature   22.9

DASY4 Configuration:
- Probe: ER3DV6 - SN2358; ConvF(1, 1, 1); Calibrated: 2009/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch189/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 191.9 V/m
Probe Modulation Factor = 2.64
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 92.1 V/m; Power Drift = 0.012 dB
Hearing Aid Near-Field Category: M3 (AWF -5 dB)
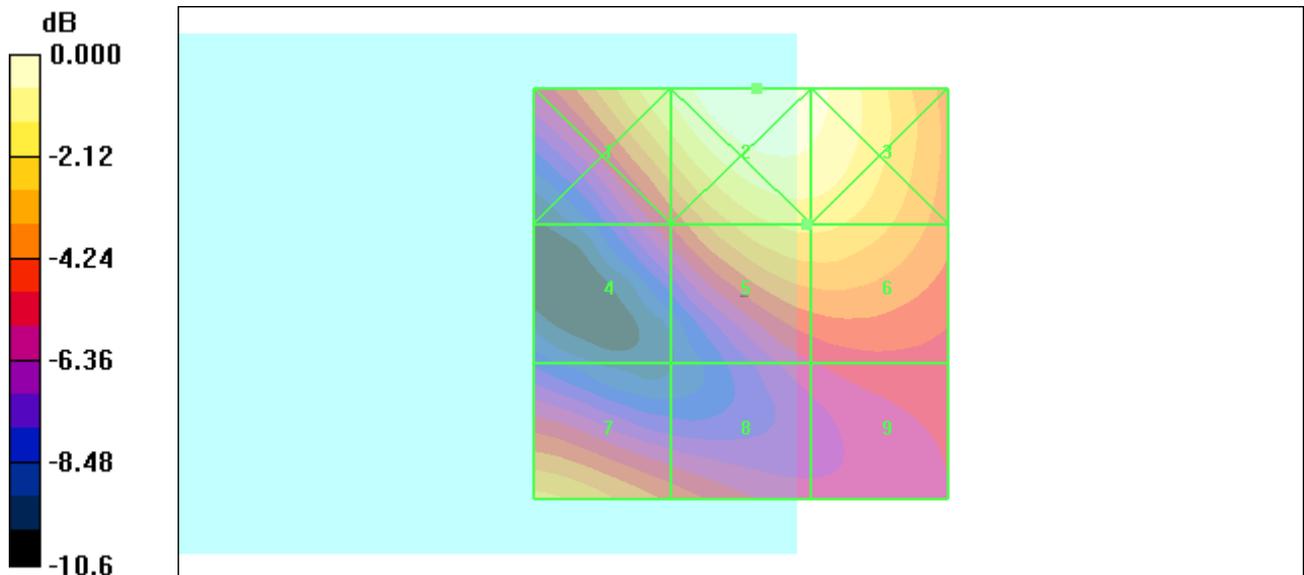
Peak E-field in V/m

Grid 1	Grid 2	Grid 3
179.2 M3	**190.1 M3**	**185.1 M3**
Grid 4	Grid 5	Grid 6
173.9 M3	**191.9 M3**	**187.5 M3**
Grid 7	Grid 8	Grid 9
161.3 M3	**178.5 M3**	**176.0 M3**

Cursor:
Total = 191.9 V/m
E Category: M3
Location: -3.5, -5, 8.7 mm
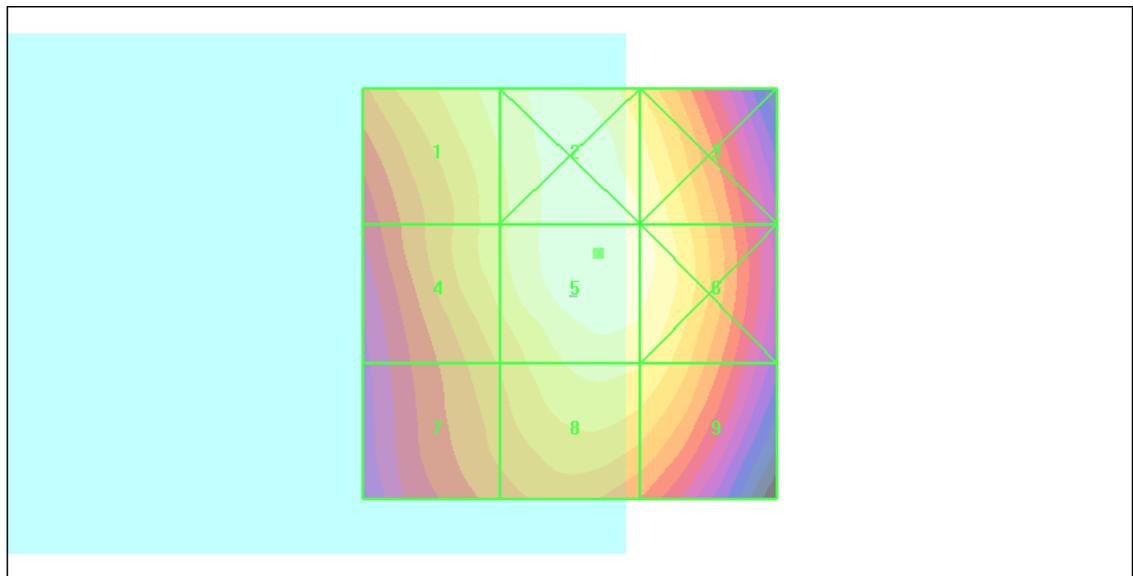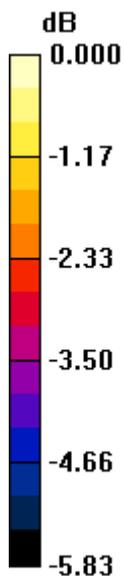
0 dB = 191.9V/m

#06 HAC_E_GSM850 Ch251_Battery2

DUT: 961307

Communication System: GSM850; Frequency: 848.8 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3
Ambient Temperature   22.9

DASY4 Configuration:
- Probe: ER3DV6 - SN2358; ConvF(1, 1, 1); Calibrated: 2009/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch251/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 188.1 V/m
Probe Modulation Factor = 2.64
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 90.6 V/m; Power Drift = -0.058 dB
Hearing Aid Near-Field Category: M3 (AWF -5 dB)

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
172.8 M3	**186.3 M3**	**181.1 M3**
Grid 4	Grid 5	Grid 6
169.0 M3	**188.1 M3**	**184.2 M3**
Grid 7	Grid 8	Grid 9
157.1 M3	**175.4 M3**	**173.5 M3**

Cursor:
Total = 188.1 V/m
E Category: M3
Location: -4, -4.5, 8.7 mm
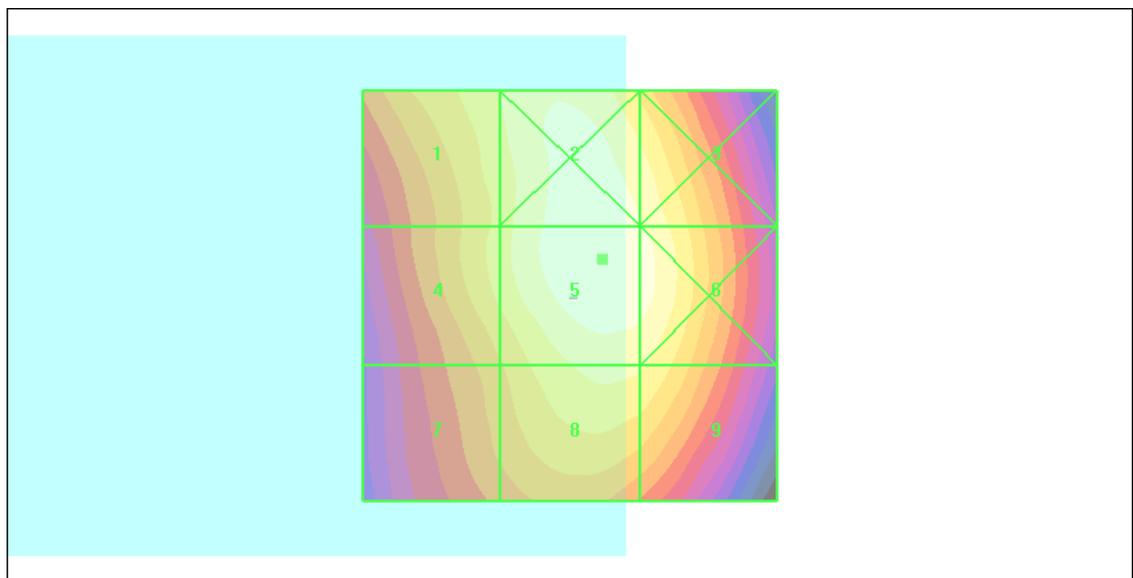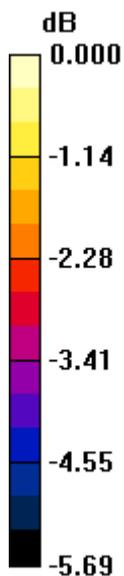
0 dB = 188.1V/m

#01 HAC_E_GSM1900 Ch512_Battery2

DUT: 961307

Communication System: PCS; Frequency: 1850.2 MHz;Duty Cycle: 1:8.3

Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3

Ambient Temperature：23.1 ℃

DASY4 Configuration:
- Probe: ER3DV6 - SN2358; ConvF(1, 1, 1); Calibrated: 2009/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch512/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 65.5 V/m

Probe Modulation Factor = 2.70

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 21.7 V/m; Power Drift = -0.026 dB

Hearing Aid Near-Field Category: M3 (AWF -5 dB)
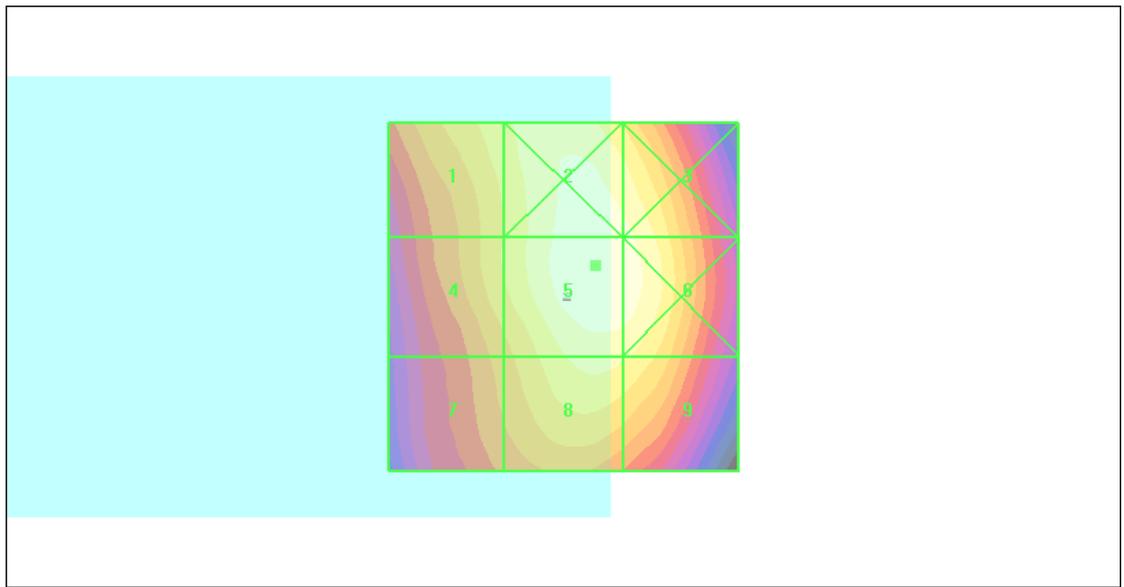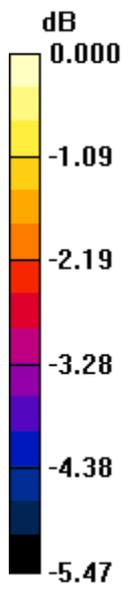
Peak E-field in V/m

Grid 1	Grid 2	Grid 3
72.2 M3	**80.5 M3**	**75.9 M3**
Grid 4	Grid 5	Grid 6
48.8 M3	**65.5 M3**	**65.5 M3**
Grid 7	Grid 8	Grid 9
58.3 M3	**45.0 M4**	**46.2 M4**

Cursor:
Total = 80.5 V/m
E Category: M3
Location: -1.5, -25, 8.7 mm
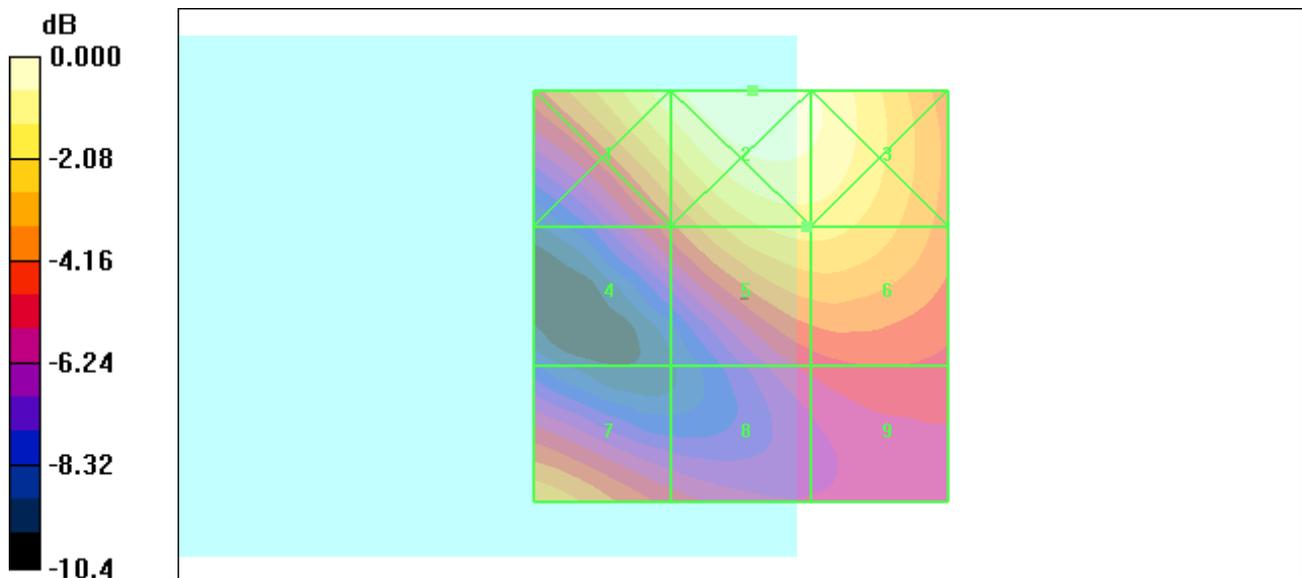
0 dB = 80.5V/m

#02 HAC_E_GSM1900 Ch661_Battery2

DUT: 961307

Communication System: PCS; Frequency: 1880 MHz;Duty Cycle: 1:8.3

Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3

Ambient Temperature：23.1 ℃

DASY4 Configuration:
- Probe: ER3DV6 - SN2358; ConvF(1, 1, 1); Calibrated: 2009/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch661/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 66.6 V/m

Probe Modulation Factor = 2.70

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 21.6 V/m; Power Drift = -0.075 dB

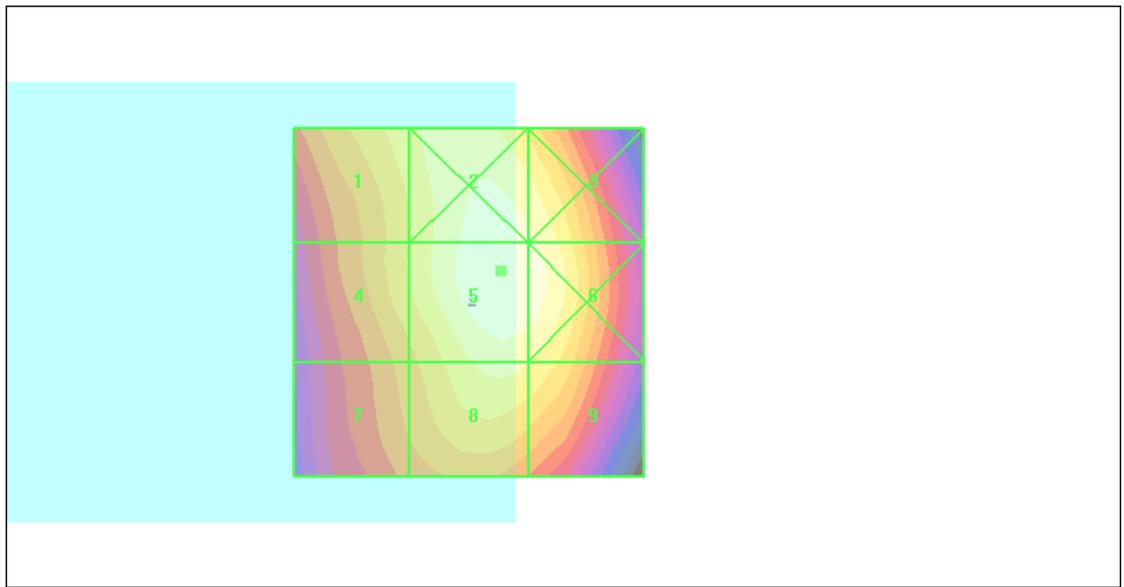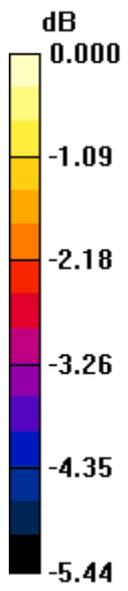**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
71.8 M3	**81.9 M3**	**77.9 M3**
Grid 4	Grid 5	Grid 6
48.0 M3	**66.6 M3**	**66.6 M3**
Grid 7	Grid 8	Grid 9
61.4 M3	**51.1 M3**	**47.1 M4**

Cursor:
Total = 81.9 V/m
E Category: M3
Location: -2, -25, 8.7 mm

0 dB = 81.9V/m

#03 HAC_E_GSM1900 Ch810_Battery2

DUT: 961307

Communication System: PCS; Frequency: 1909.8 MHz;Duty Cycle: 1:8.3

Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3

Ambient Temperature：23.1 ℃

DASY4 Configuration:
- Probe: ER3DV6 - SN2358; ConvF(1, 1, 1); Calibrated: 2009/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch810/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 62.4 V/m

Probe Modulation Factor = 2.70

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 19.6 V/m; Power Drift = 0.011 dB

Hearing Aid Near-Field Category: M3 (AWF -5 dB)
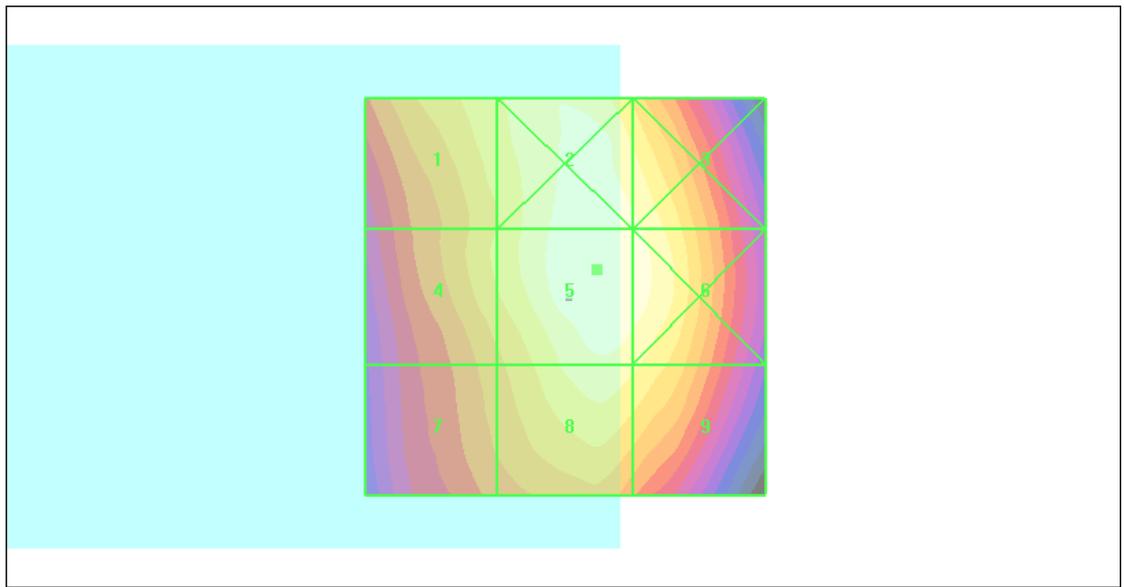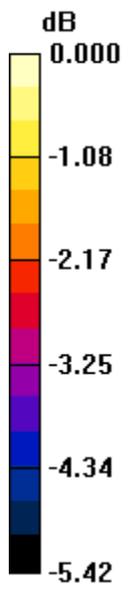
Peak E-field in V/m

Grid 1	Grid 2	Grid 3
67.7 M3	**77.8 M3**	**74.1 M3**
Grid 4	Grid 5	Grid 6
44.4 M4	**62.4 M3**	**62.4 M3**
Grid 7	Grid 8	Grid 9
57.9 M3	**47.1 M4**	**43.0 M4**

Cursor:
Total = 77.8 V/m
E Category: M3
Location: -2, -25, 8.7 mm

0 dB = 77.8V/m

#10 HAC_E_WCDMA V_RMC12.2k_Ch4132_Battery2

DUT: 839612

Communication System: WCDMA; Frequency: 826.4 MHz;Duty Cycle: 1:1

Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3

Ambient Temperature   22.7

DASY4 Configuration:
- Probe: ER3DV6 - SN2358; ConvF(1, 1, 1); Calibrated: 2009/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

CH4132/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 63.6 V/m

Probe Modulation Factor = 0.960

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 83.1 V/m; Power Drift = -0.013 dB

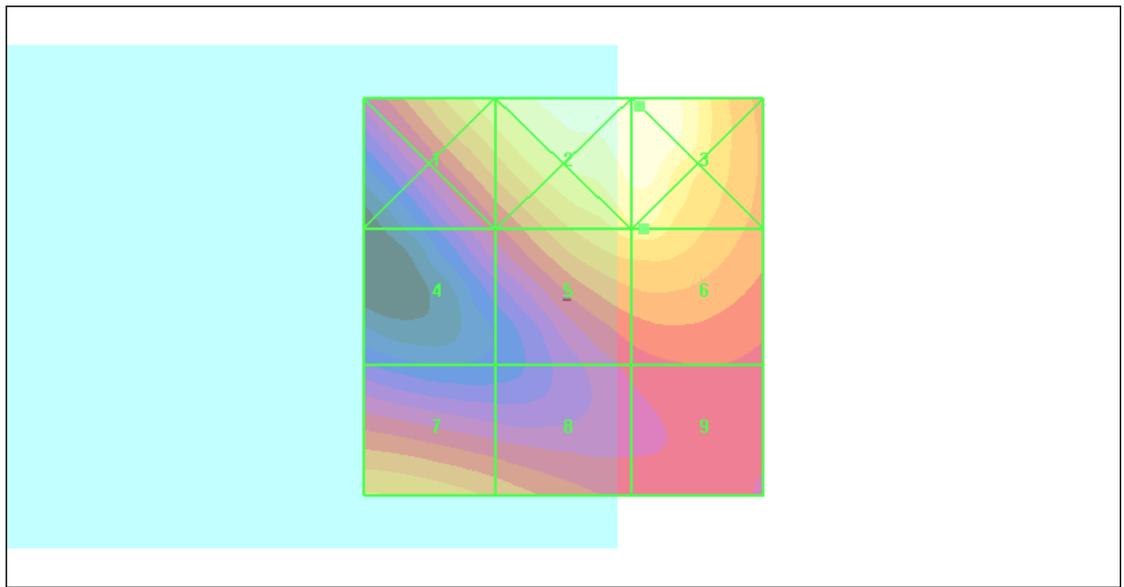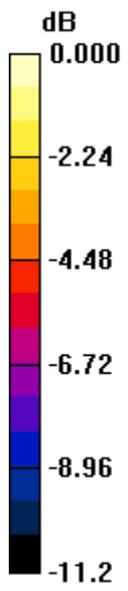**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
57.8 M4	**62.9 M4**	**62.0 M4**
Grid 4	Grid 5	Grid 6
56.3 M4	**63.6 M4**	**62.8 M4**
Grid 7	Grid 8	Grid 9
52.9 M4	**59.6 M4**	**59.0 M4**

Cursor:
Total = 63.6 V/m
E Category: M4
Location: -4.5, -4.5, 8.7 mm

0 dB = 63.6V/m

#11 HAC_E_WCDMA V_RMC12.2k_Ch4182_Battery2

DUT: 839612

Communication System: WCDMA; Frequency: 836.4 MHz;Duty Cycle: 1:1

Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3

Ambient Temperature   22.8

DASY4 Configuration:
- Probe: ER3DV6 - SN2358; ConvF(1, 1, 1); Calibrated: 2009/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

CH4182/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 64.2 V/m

Probe Modulation Factor = 0.960

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 83.2 V/m; Power Drift = 0.043 dB

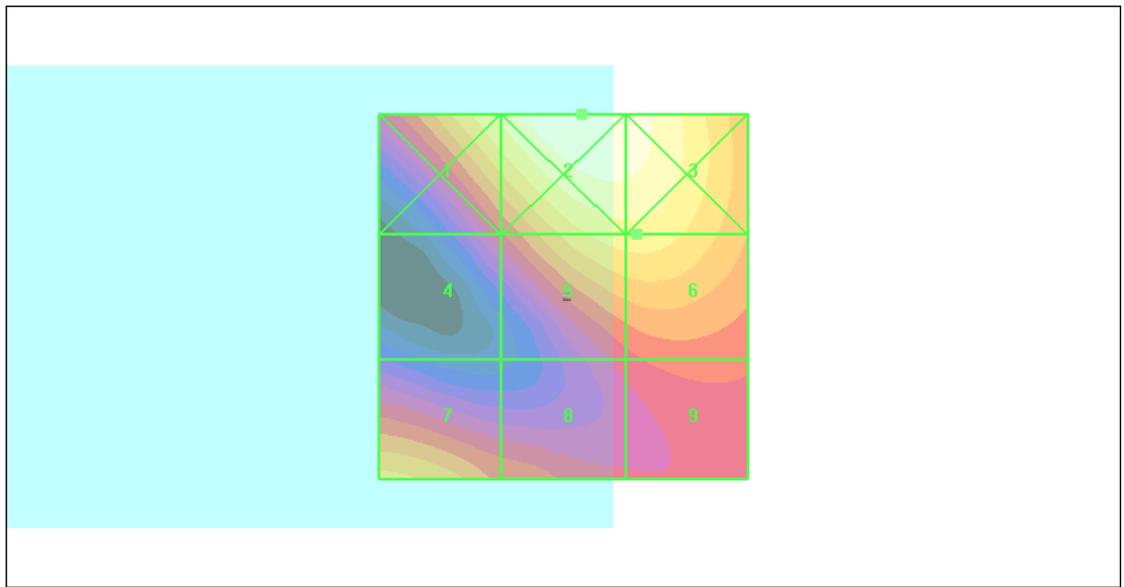**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
58.3 M4	**63.4 M4**	**62.4 M4**
Grid 4	Grid 5	Grid 6
56.9 M4	**64.2 M4**	**63.4 M4**
Grid 7	Grid 8	Grid 9
53.6 M4	**60.1 M4**	**59.3 M4**

Cursor:
Total = 64.2 V/m
E Category: M4
Location: -4.5, -4.5, 8.7 mm

0 dB = 64.2V/m

#12 HAC_E_WCDMA V_RMC12.2k_Ch4233_Battery2

DUT: 839612

Communication System: WCDMA; Frequency: 846.6 MHz;Duty Cycle: 1:1

Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3

Ambient Temperature   22.6

DASY4 Configuration:
- Probe: ER3DV6 - SN2358; ConvF(1, 1, 1); Calibrated: 2009/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

CH4233/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 70.9 V/m

Probe Modulation Factor = 0.960

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 92.5 V/m; Power Drift = -0.015 dB

Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
64.8 M4	**70.3 M4**	**68.8 M4**
Grid 4	Grid 5	Grid 6
63.2 M4	**70.9 M4**	**69.8 M4**
Grid 7	Grid 8	Grid 9
59.5 M4	**67.5 M4**	**65.8 M4**

Cursor:
Total = 70.9 V/m
E Category: M4
Location: -4, -3.5, 8.7 mm

0 dB = 70.9V/m

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab   Date: 2009/6/28

#07 HAC_E_WCDMA II_RMC12.2k_Ch9262_Battery2

DUT: 839612

Communication System: WCDMA; Frequency: 1852.4 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Ambient Temperature   22.7

DASY4 Configuration:
- Probe: ER3DV6 - SN2358; ConvF(1, 1, 1); Calibrated: 2009/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

CH9262/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 36.1 V/m
Probe Modulation Factor = 0.98
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 27.5 V/m; Power Drift = -0.127 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
36.3 M4	**43.3 M4**	**43.5 M4**
Grid 4	Grid 5	Grid 6
23.1 M4	**35.5 M4**	**36.1 M4**
Grid 7	Grid 8	Grid 9
31.2 M4	**27.9 M4**	**23.9 M4**

Cursor:
Total = 43.5 V/m
E Category: M4
Location: -9.5, -24, 8.7 mm

0 dB = 43.5V/m

#08 HAC_E_WCDMA II_RMC12.2k_Ch9400_Battery2

DUT: 839612

Communication System: WCDMA; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: σ = 0 mho/m, $ε_r$ = 1; ρ = 1000 kg/m^3
Ambient Temperature   22.7

DASY4 Configuration:
- Probe: ER3DV6 - SN2358; ConvF(1, 1, 1); Calibrated: 2009/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

CH9400/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 31.6 V/m
Probe Modulation Factor = 0.98
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 25.9 V/m; Power Drift = -0.047 dB
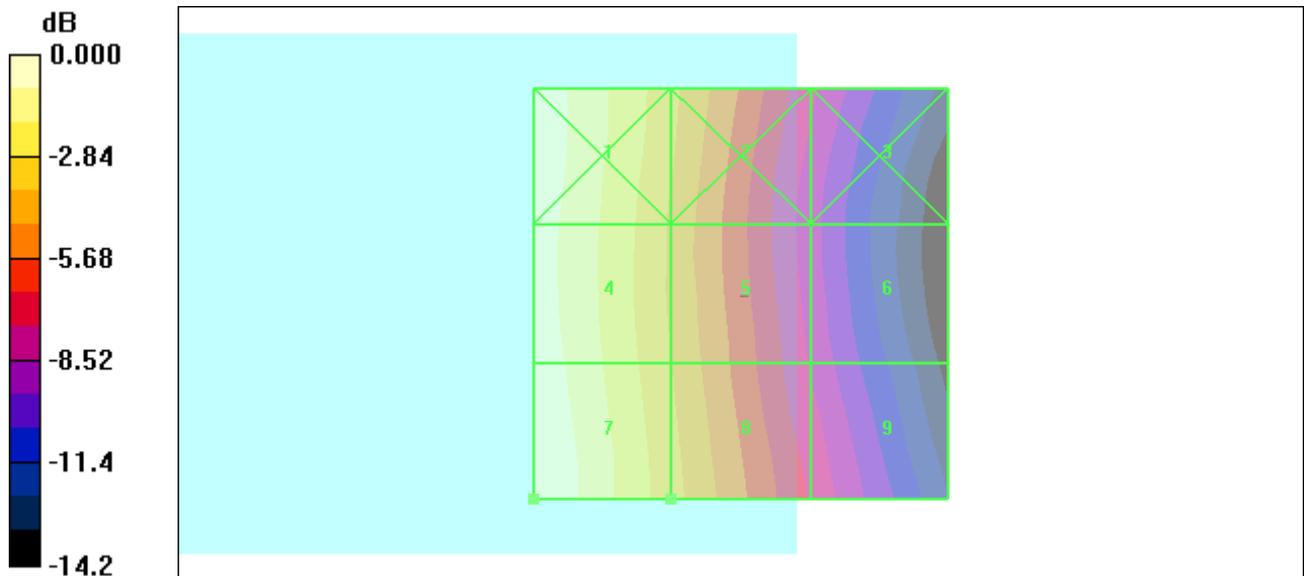**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
33.6 M4	**38.6 M4**	**37.3 M4**
Grid 4	Grid 5	Grid 6
21.4 M4	**31.6 M4**	**31.6 M4**
Grid 7	Grid 8	Grid 9
28.7 M4	**23.5 M4**	**22.6 M4**

Cursor:
Total = 38.6 V/m
E Category: M4
Location: -2.5, -25, 8.7 mm
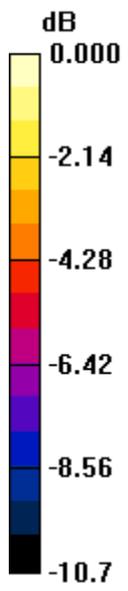
0 dB = 38.6V/m

#09 HAC_E_WCDMA II_RMC12.2k_Ch9538_Battery2

DUT: 839612

Communication System: WCDMA; Frequency: 1907.6 MHz;Duty Cycle: 1:1

Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3

Ambient Temperature   22.8

DASY4 Configuration:
- Probe: ER3DV6 - SN2358; ConvF(1, 1, 1); Calibrated: 2009/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

CH9538/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 31.0 V/m

Probe Modulation Factor = 0.98

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 25.2 V/m; Power Drift = -0.259 dB

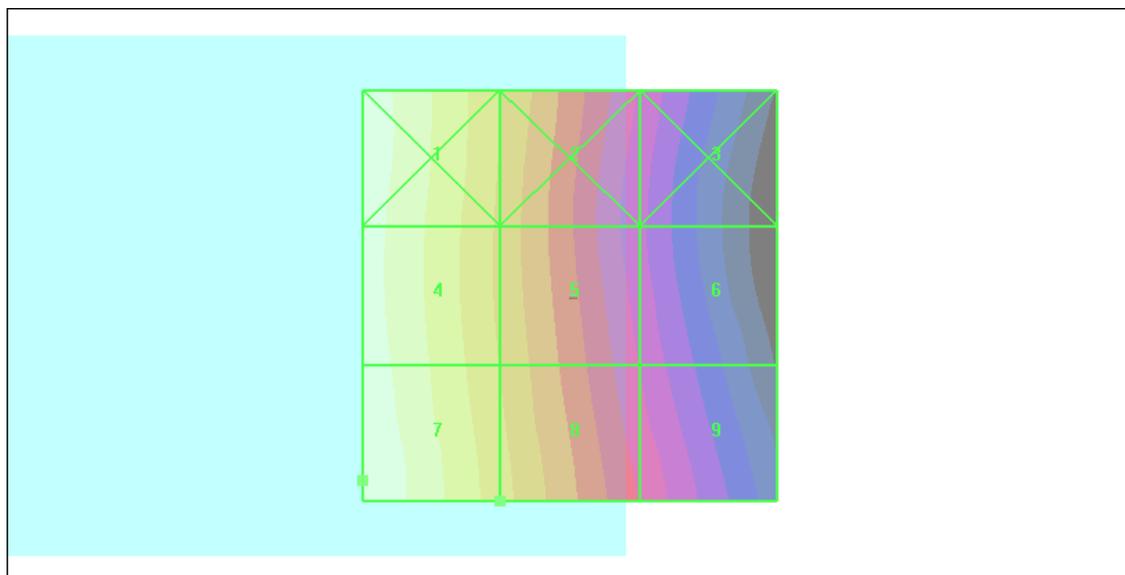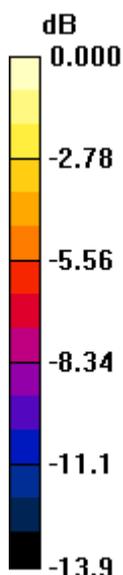**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak E-field in V/m

Grid 1 **33.9 M4**	Grid 2 **39.4 M4**	Grid 3 **38.2 M4**
Grid 4 **20.6 M4**	Grid 5 **30.9 M4**	Grid 6 **31.0 M4**
Grid 7 **30.1 M4**	Grid 8 **27.1 M4**	Grid 9 **21.8 M4**

Cursor:
Total = 39.4 V/m
E Category: M4
Location: -2.5, -25, 8.7 mm
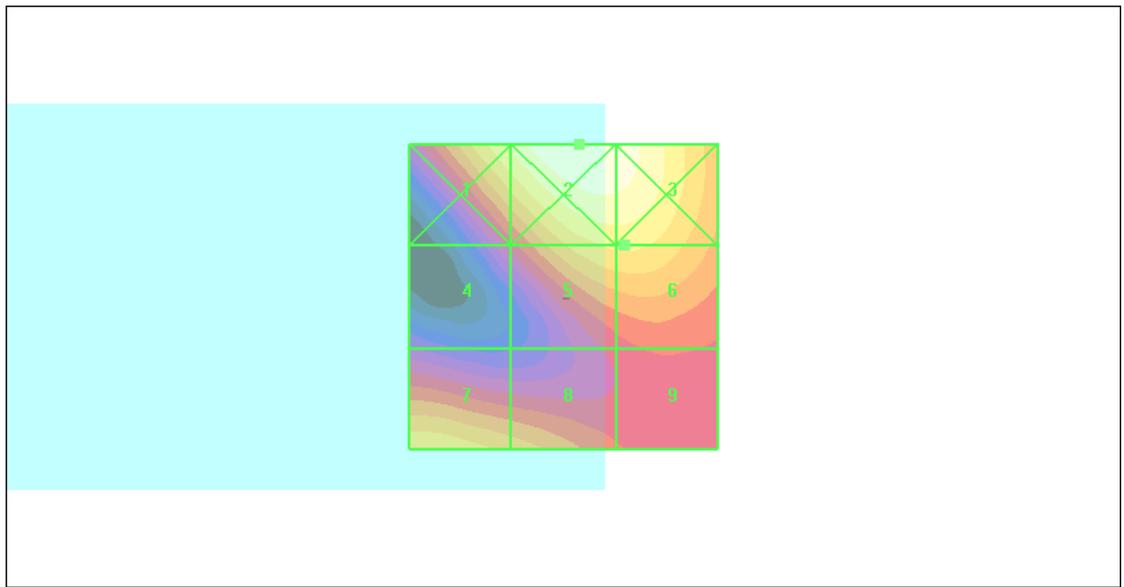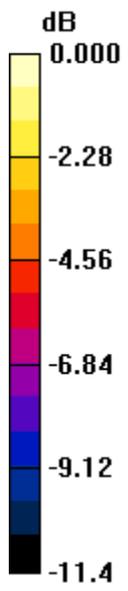
0 dB = 39.4V/m

#16 HAC_H_GSM850_Ch128_Battery2

DUT: 961307

Communication System: GSM850; Frequency: 824.2 MHz;Duty Cycle: 1:8.3

Medium: Air Medium parameters used: σ = 0 mho/m, $ε_r$ = 1; ρ = 1 kg/m^3

Ambient Temperature   22.9

DASY4 Configuration:
- Probe: H3DV6 - SN6184; ; Calibrated: 2009/1/19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch128/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 0.179 A/m

Probe Modulation Factor = 1.42

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 0.063 A/m; Power Drift = 0.060 dB

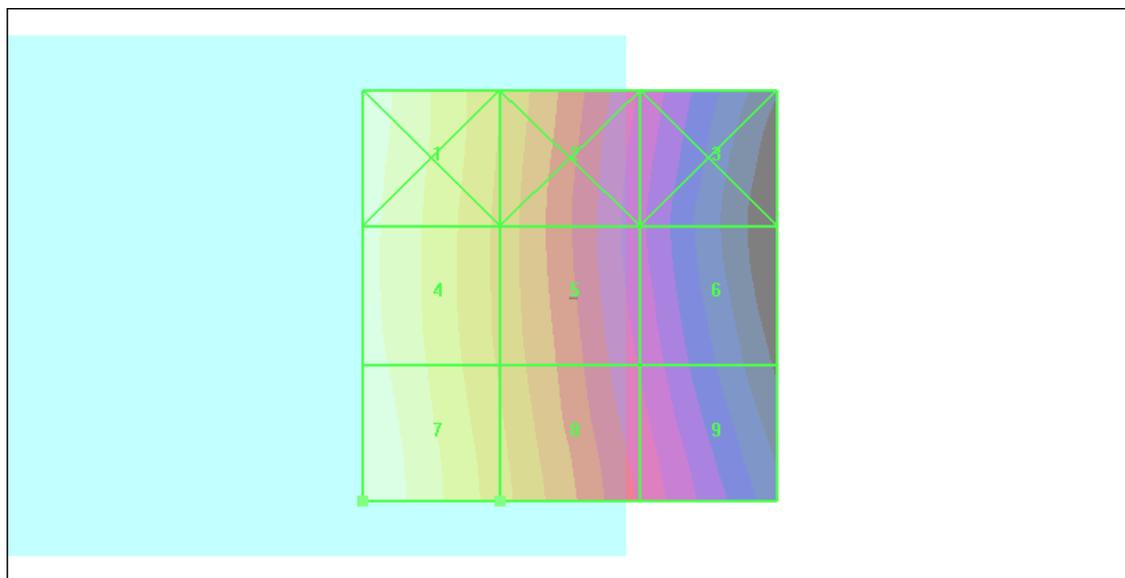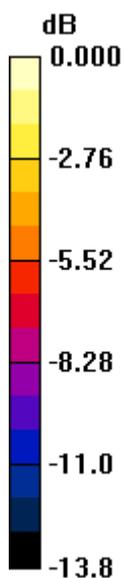**Hearing Aid Near-Field Category: M4 (AWF -5 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.175 M4	**0.120 M4**	**0.069 M4**
Grid 4	Grid 5	Grid 6
0.172 M4	**0.116 M4**	**0.067 M4**
Grid 7	Grid 8	Grid 9
0.179 M4	**0.121 M4**	**0.074 M4**

Cursor:
Total = 0.179 A/m
H Category: M4
Location: 25, 25, 8.7 mm

0 dB = 0.179A/m

#17 HAC_H_GSM850_Ch189_Battery2

DUT: 961307

Communication System: GSM850; Frequency: 836.4 MHz;Duty Cycle: 1:8.3

Medium: Air Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3

Ambient Temperature   22.9

DASY4 Configuration:
- Probe: H3DV6 - SN6184; ; Calibrated: 2009/1/19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch189/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 0.198 A/m

Probe Modulation Factor = 1.42

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 0.070 A/m; Power Drift = 0.059 dB

Hearing Aid Near-Field Category: M4 (AWF -5 dB)
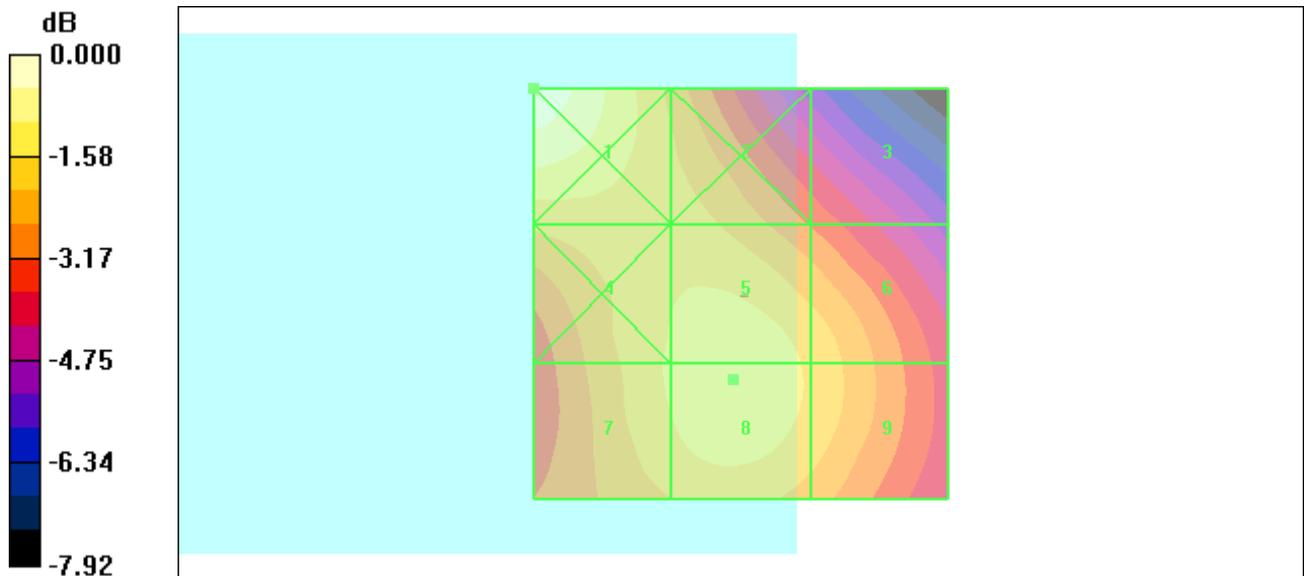
Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.193 M4	**0.130 M4**	**0.075 M4**
Grid 4	Grid 5	Grid 6
0.190 M4	**0.129 M4**	**0.076 M4**
Grid 7	Grid 8	Grid 9
0.198 M4	**0.136 M4**	**0.084 M4**

Cursor:
Total = 0.198 A/m
H Category: M4
Location: 25, 22.5, 8.7 mm

0 dB = 0.198A/m

#18 HAC_H_GSM850_Ch251_Battery2

DUT: 961307

Communication System: GSM850; Frequency: 848.8 MHz;Duty Cycle: 1:8.3

Medium: Air Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3

Ambient Temperature   22.9

DASY4 Configuration:
- Probe: H3DV6 - SN6184; ; Calibrated: 2009/1/19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch251/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 0.196 A/m

Probe Modulation Factor = 1.42

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 0.069 A/m; Power Drift = -0.025 dB

Hearing Aid Near-Field Category: M4 (AWF -5 dB)
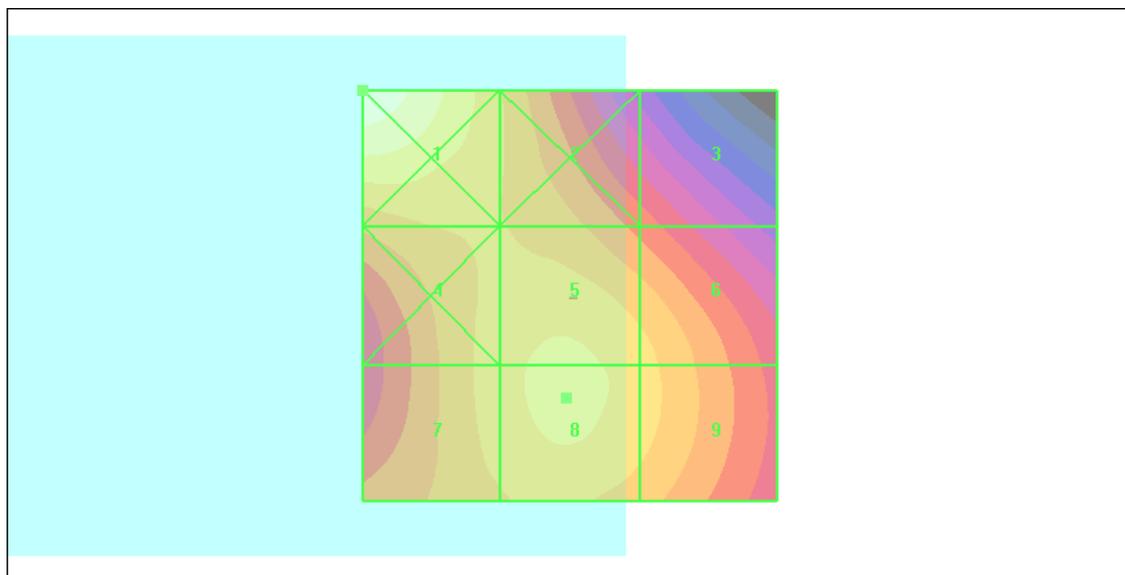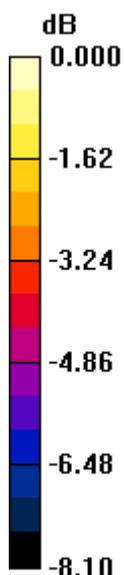
Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.189 M4	**0.129 M4**	**0.075 M4**
Grid 4	Grid 5	Grid 6
0.187 M4	**0.127 M4**	**0.075 M4**
Grid 7	Grid 8	Grid 9
0.196 M4	**0.135 M4**	**0.083 M4**

Cursor:
Total = 0.196 A/m
H Category: M4
Location: 25, 25, 8.7 mm

0 dB = 0.196A/m

#13 HAC_H_GSM1900_Ch512_Battery2

DUT: 961307

Communication System: PCS; Frequency: 1850.2 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: σ = 0 mho/m, ε$_r$ = 1; ρ = 1 kg/m^3
Ambient Temperature   23.1

DASY4 Configuration:
- Probe: H3DV6 - SN6184; ; Calibrated: 2009/1/19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch512/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.096 A/m
Probe Modulation Factor = 1.28
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 0.080 A/m; Power Drift = -0.038 dB
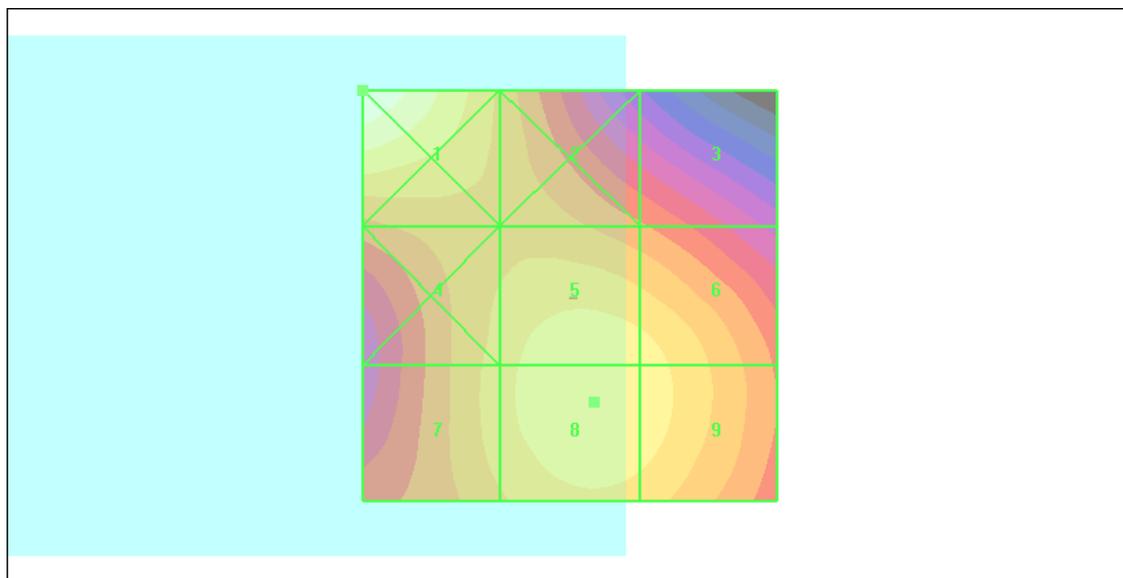**Hearing Aid Near-Field Category: M4 (AWF -5 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.110 M4	**0.089 M4**	**0.076 M4**
Grid 4	Grid 5	Grid 6
0.092 M4	**0.096 M4**	**0.091 M4**
Grid 7	Grid 8	Grid 9
0.092 M4	**0.096 M4**	**0.091 M4**

Cursor:
Total = 0.110 A/m
H Category: M4
Location: 25, -25, 8.7 mm

0 dB = 0.110A/m

#14 HAC_H_GSM1900_Ch661_Battery2

DUT: 961307

Communication System: PCS; Frequency: 1880 MHz;Duty Cycle: 1:8.3

Medium: Air Medium parameters used: σ = 0 mho/m, $ε_r$ = 1; ρ = 1 kg/m^3

Ambient Temperature   23.1

DASY4 Configuration:
- Probe: H3DV6 - SN6184; ; Calibrated: 2009/1/19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch661/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 0.094 A/m

Probe Modulation Factor = 1.28

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 0.079 A/m; Power Drift = 0.008 dB

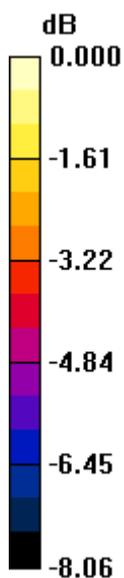**Hearing Aid Near-Field Category: M4 (AWF -5 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.111 M4	**0.087 M4**	**0.075 M4**
Grid 4	Grid 5	Grid 6
0.090 M4	**0.093 M4**	**0.089 M4**
Grid 7	Grid 8	Grid 9
0.090 M4	**0.094 M4**	**0.089 M4**

Cursor:
Total = 0.111 A/m
H Category: M4
Location: 25, -25, 8.7 mm

0 dB = 0.111A/m

#15 HAC_H_GSM1900_Ch810_Battery2

DUT: 961307

Communication System: PCS; Frequency: 1909.8 MHz;Duty Cycle: 1:8.3

Medium: Air Medium parameters used: σ = 0 mho/m, ε$_r$ = 1; ρ = 1 kg/m^3

Ambient Temperature   23.1

DASY4 Configuration:
- Probe: H3DV6 - SN6184; ; Calibrated: 2009/1/19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch810/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 0.093 A/m

Probe Modulation Factor = 1.28

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 0.077 A/m; Power Drift = -0.011 dB

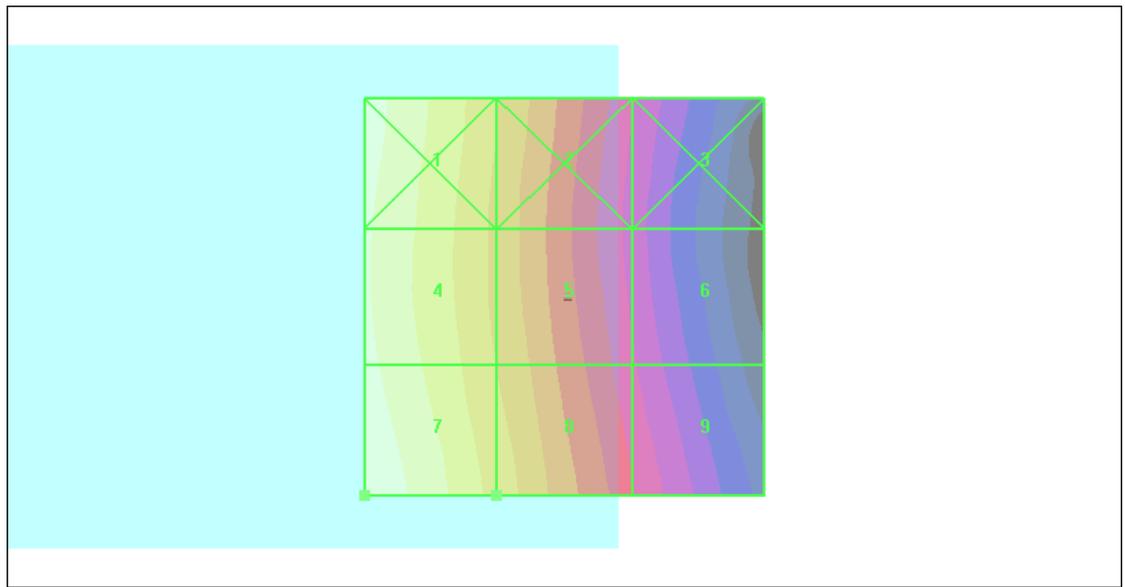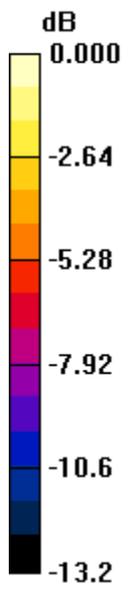**Hearing Aid Near-Field Category: M4 (AWF -5 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.105 M4	**0.081 M4**	**0.073 M4**
Grid 4	Grid 5	Grid 6
0.085 M4	**0.092 M4**	**0.090 M4**
Grid 7	Grid 8	Grid 9
0.085 M4	**0.093 M4**	**0.091 M4**

Cursor:
Total = 0.105 A/m
H Category: M4
Location: 25, -25, 8.7 mm

0 dB = 0.105A/m

#22 HAC_H_WCDMA V_RMC 12.2k_Ch4132_Battery2

DUT: 961307

Communication System: WCDMA; Frequency: 826.4 MHz;Duty Cycle: 1:1

Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3

Ambient Temperature   22.8

DASY4 Configuration:
- Probe: H3DV6 - SN6184; ; Calibrated: 2009/1/19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

CH4132/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 0.101 A/m

Probe Modulation Factor = 0.77

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 0.069 A/m; Power Drift = 0.081 dB

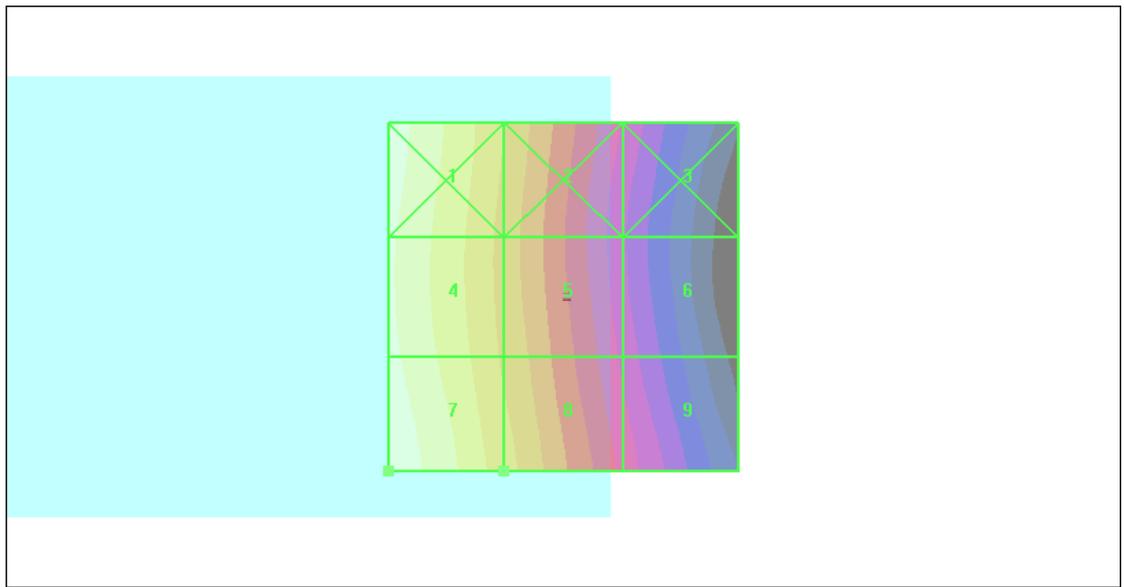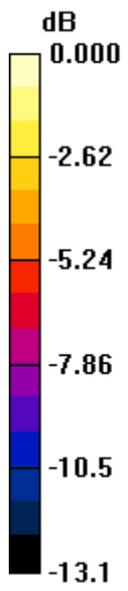**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.097 M4	**0.068 M4**	**0.041 M4**
Grid 4	Grid 5	Grid 6
0.095 M4	**0.067 M4**	**0.041 M4**
Grid 7	Grid 8	Grid 9
0.101 M4	**0.072 M4**	**0.045 M4**

Cursor:
Total = 0.101 A/m
H Category: M4
Location: 25, 25, 8.7 mm

0 dB = 0.101A/m

#23 HAC_H_WCDMA V_RMC 12.2k_Ch4182_Battery2

DUT: 961307

Communication System: WCDMA; Frequency: 836.4 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Ambient Temperature   22.9

DASY4 Configuration:
- Probe: H3DV6 - SN6184; ; Calibrated: 2009/1/19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

CH4182/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 0.100 A/m
Probe Modulation Factor = 0.77
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 0.067 A/m; Power Drift = -0.026 dB
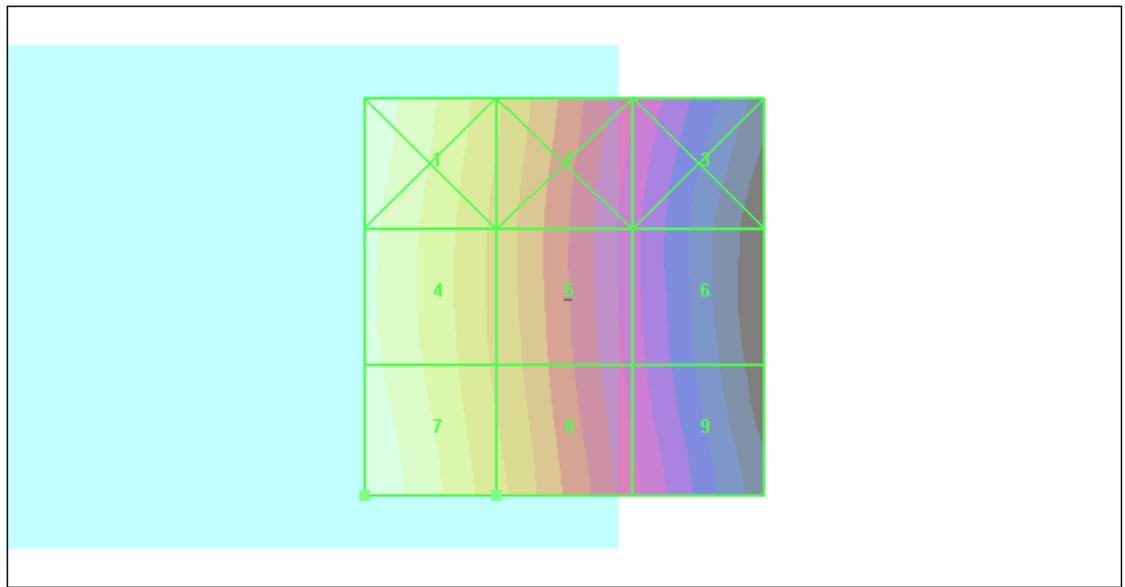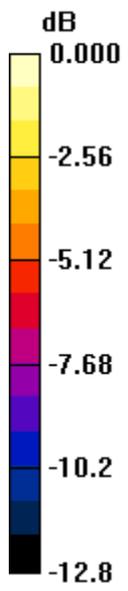**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.097 M4	**0.067 M4**	**0.040 M4**
Grid 4	Grid 5	Grid 6
0.094 M4	**0.066 M4**	**0.040 M4**
Grid 7	Grid 8	Grid 9
0.100 M4	**0.070 M4**	**0.043 M4**

Cursor:
Total = 0.100 A/m
H Category: M4
Location: 25, 25, 8.7 mm

0 dB = 0.100A/m

#24 HAC_H_WCDMA V_RMC 12.2k_Ch4233_Battery2

DUT: 961307

Communication System: WCDMA; Frequency: 846.6 MHz;Duty Cycle: 1:1

Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3

Ambient Temperature   22.8

DASY4 Configuration:
- Probe: H3DV6 - SN6184; ; Calibrated: 2009/1/19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

CH4233/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 0.110 A/m

Probe Modulation Factor = 0.77

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 0.076 A/m; Power Drift = -0.009 dB

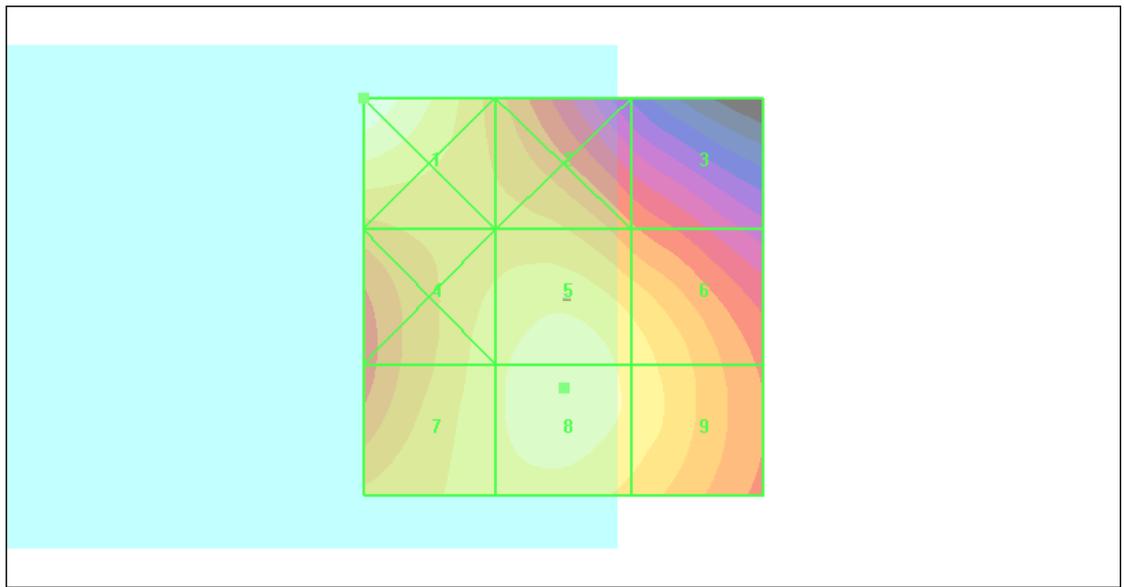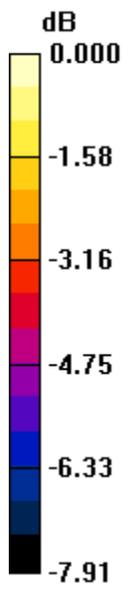**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.109 M4	**0.076 M4**	**0.046 M4**
Grid 4	Grid 5	Grid 6
0.104 M4	**0.073 M4**	**0.044 M4**
Grid 7	Grid 8	Grid 9
0.110 M4	**0.077 M4**	**0.047 M4**

Cursor:
Total = 0.110 A/m
H Category: M4
Location: 25, 25, 8.7 mm

0 dB = 0.110A/m

#19 HAC_H_WCDMA II_RMC 12.2k_Ch9262_Battery2

DUT: 961307

Communication System: WCDMA; Frequency: 1852.4 MHz;Duty Cycle: 1:1

Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3

Ambient Temperature　22.8

DASY4 Configuration:
- Probe: H3DV6 - SN6184; ; Calibrated: 2009/1/19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

CH9262/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 0.053 A/m

Probe Modulation Factor = 0.52

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 0.110 A/m; Power Drift = -0.180 dB

Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.057 M4	**0.046 M4**	**0.040 M4**
Grid 4	Grid 5	Grid 6
0.050 M4	**0.052 M4**	**0.049 M4**
Grid 7	Grid 8	Grid 9
0.050 M4	**0.053 M4**	**0.050 M4**

Cursor:
Total = 0.057 A/m
H Category: M4
Location: 25, -25, 8.7 mm

0 dB = 0.057A/m

#20 HAC_H_WCDMA II_RMC 12.2k_Ch9400_Battery2

DUT: 961307

Communication System: WCDMA; Frequency: 1880 MHz;Duty Cycle: 1:1

Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3

Ambient Temperature   22.9

DASY4 Configuration:
- Probe: H3DV6 - SN6184; ; Calibrated: 2009/1/19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

CH9400/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 0.048 A/m

Probe Modulation Factor = 0.52

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 0.100 A/m; Power Drift = -0.010 dB

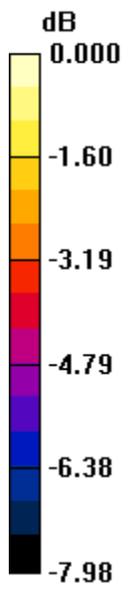**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.053 M4	**0.043 M4**	**0.038 M4**
Grid 4	Grid 5	Grid 6
0.045 M4	**0.048 M4**	**0.046 M4**
Grid 7	Grid 8	Grid 9
0.045 M4	**0.048 M4**	**0.046 M4**

Cursor:
Total = 0.053 A/m
H Category: M4
Location: 25, -25, 8.7 mm
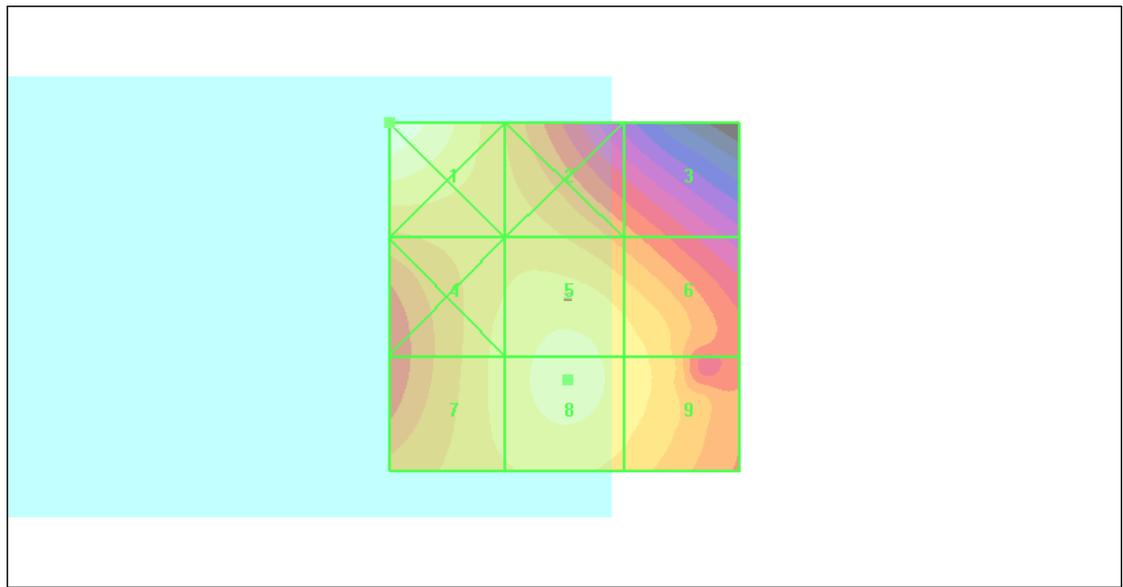
0 dB = 0.053A/m

#21 HAC_H_WCDMA II_RMC 12.2k_Ch9538_Battery2

DUT: 961307

Communication System: WCDMA; Frequency: 1907.6 MHz;Duty Cycle: 1:1

Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3

Ambient Temperature   22.8

DASY4 Configuration:
- Probe: H3DV6 - SN6184; ; Calibrated: 2009/1/19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

CH9538/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 0.050 A/m

Probe Modulation Factor = 0.52

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 0.105 A/m; Power Drift = 0.094 dB

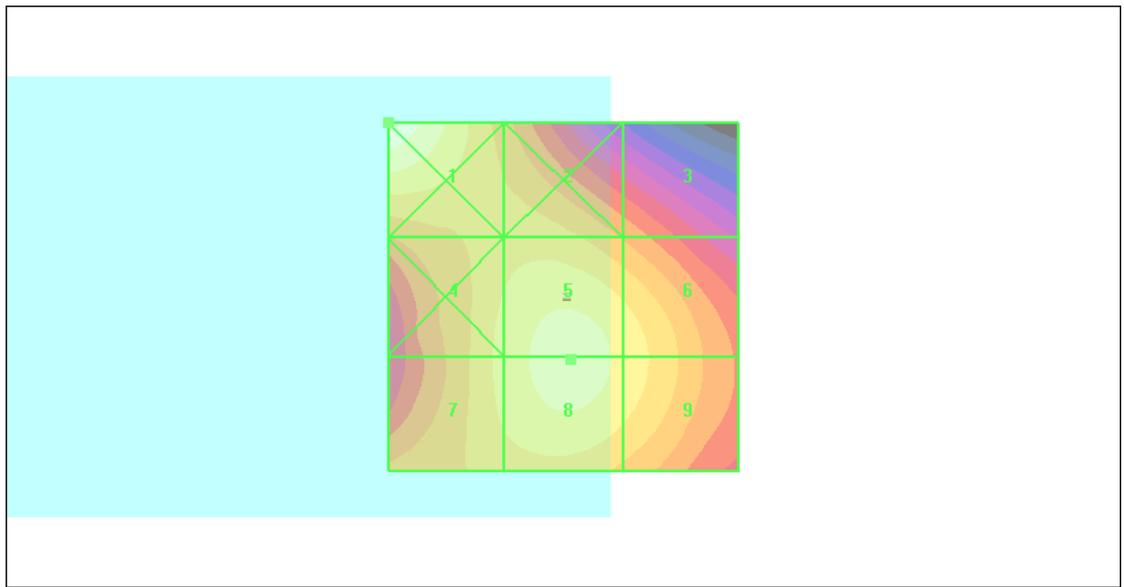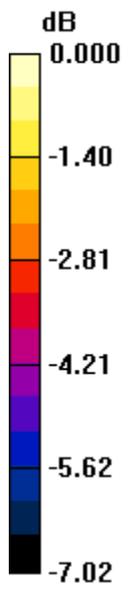**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.054 M4	**0.045 M4**	**0.041 M4**
Grid 4	Grid 5	Grid 6
0.047 M4	**0.050 M4**	**0.048 M4**
Grid 7	Grid 8	Grid 9
0.047 M4	**0.050 M4**	**0.048 M4**

Cursor:
Total = 0.054 A/m
H Category: M4
Location: 25, -25, 8.7 mm

0 dB = 0.054A/m

#25 HAC_E_GSM1900 Ch661_Battery1

DUT: 961307

Communication System: PCS; Frequency: 1880 MHz;Duty Cycle: 1:8.3

Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3

Ambient Temperature：23.1 ℃

DASY4 Configuration:
- Probe: ER3DV6 - SN2358; ConvF(1, 1, 1); Calibrated: 2009/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch661/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 62.5 V/m

Probe Modulation Factor = 2.70

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 17.7 V/m; Power Drift = 0.105 dB

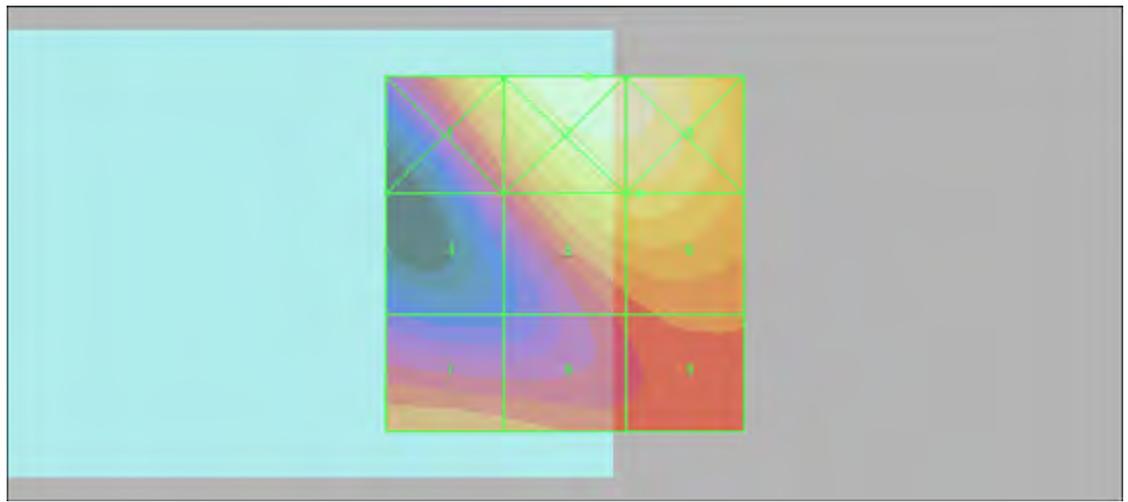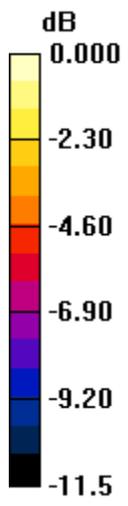**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
64.9 M3	**76.6 M3**	**74.4 M3**
Grid 4	Grid 5	Grid 6
39.9 M4	**62.3 M3**	**62.5 M3**
Grid 7	Grid 8	Grid 9
49.7 M3	**47.5 M3**	**46.3 M4**

Cursor:
Total = 76.6 V/m
E Category: M3
Location: -3.5, -25, 8.7 mm

0 dB = 76.6V/m

#26 HAC_E_GSM850 Ch189_Battery1

DUT: 961307

Communication System: GSM850; Frequency: 836.4 MHz;Duty Cycle: 1:8.3

Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3

Ambient Temperature：22.9 ℃

DASY4 Configuration:
- Probe: ER3DV6 - SN2358; ConvF(1, 1, 1); Calibrated: 2009/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch189/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 175.2 V/m

Probe Modulation Factor = 2.64

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 85.6 V/m; Power Drift = -0.063 dB

Hearing Aid Near-Field Category: M3 (AWF -5 dB)
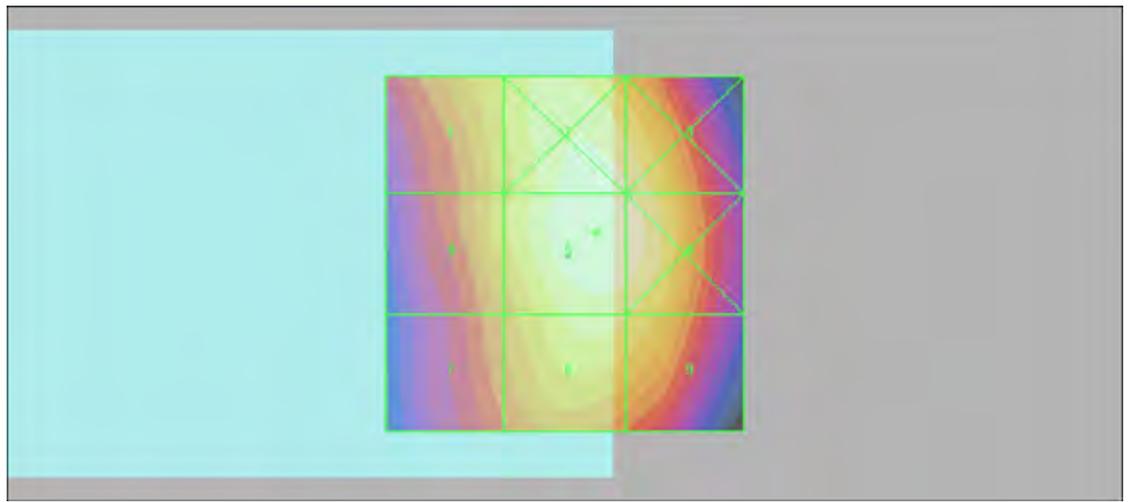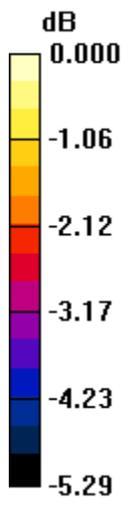
Peak E-field in V/m

Grid 1	Grid 2	Grid 3
156.7 M3	**173.6 M3**	**170.3 M3**
Grid 4	Grid 5	Grid 6
154.4 M3	**175.2 M3**	**173.2 M3**
Grid 7	Grid 8	Grid 9
145.2 M4	**165.5 M3**	**163.2 M3**

Cursor:
Total = 175.2 V/m
E Category: M3
Location: -4.5, -3, 8.7 mm

0 dB = 175.2V/m

#27 HAC_E_WCDMA II_RMC12.2k_Ch9262_Battery1

DUT: 961307

Communication System: WCDMA; Frequency: 1852.4 MHz;Duty Cycle: 1:1

Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3

Ambient Temperature：23.1 ℃

DASY4 Configuration:
- Probe: ER3DV6 - SN2358; ConvF(1, 1, 1); Calibrated: 2009/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch9262/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 33.7 V/m

Probe Modulation Factor = 0.98

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 26.4 V/m; Power Drift = -0.196 dB

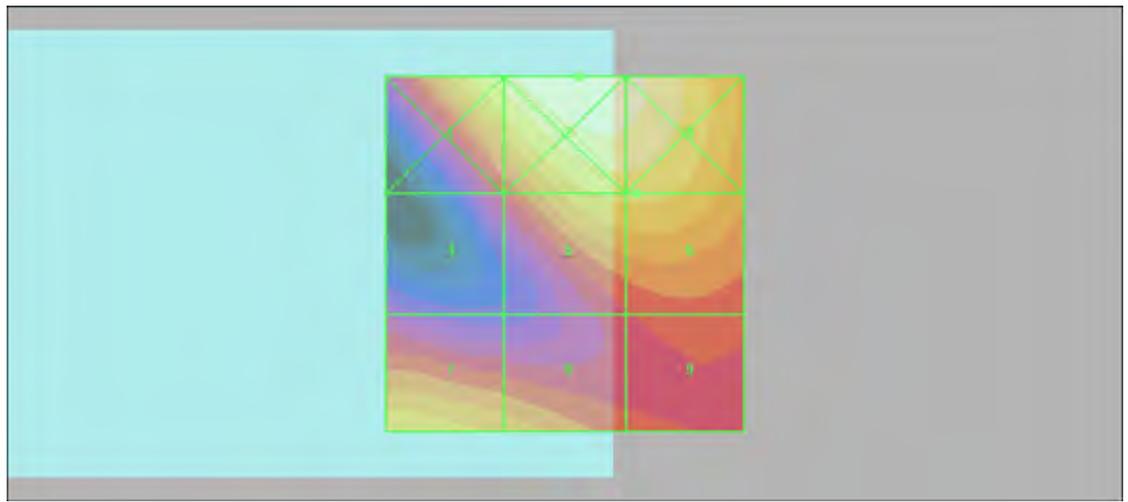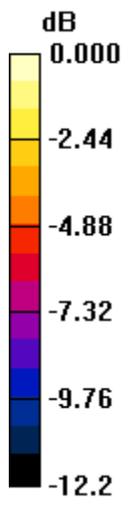**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
37.7 M4	**43.2 M4**	**41.2 M4**
Grid 4	Grid 5	Grid 6
22.4 M4	**33.6 M4**	**33.7 M4**
Grid 7	Grid 8	Grid 9
32.0 M4	**29.0 M4**	**23.9 M4**

Cursor:
Total = 43.2 V/m
E Category: M4
Location: -2, -25, 8.7 mm

0 dB = 43.2V/m

#28 HAC_E_WCDMA V_RMC12.2k_Ch4233_Battery1

DUT: 961307

Communication System: WCDMA; Frequency: 846.6 MHz;Duty Cycle: 1:1

Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3

Ambient Temperature：22.9 ℃

DASY4 Configuration:
- Probe: ER3DV6 - SN2358; ConvF(1, 1, 1); Calibrated: 2009/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch4233/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 62.9 V/m

Probe Modulation Factor = 0.960

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 82.7 V/m; Power Drift = 0.022 dB

Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
55.6 M4	**61.9 M4**	**60.9 M4**
Grid 4	Grid 5	Grid 6
54.0 M4	**62.9 M4**	**62.1 M4**
Grid 7	Grid 8	Grid 9
51.0 M4	**58.9 M4**	**58.4 M4**

Cursor:
Total = 62.9 V/m
E Category: M4
Location: -5.5, -4.5, 8.7 mm

0 dB = 62.9V/m

#29 HAC_H_GSM1900_Ch512_Battery1

DUT: 961307

Communication System: PCS; Frequency: 1850.2 MHz;Duty Cycle: 1:8.3

Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3

Ambient Temperature：22.9 ℃

DASY4 Configuration:
- Probe: H3DV6 - SN6184; ; Calibrated: 2009/1/19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch512/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 0.095 A/m

Probe Modulation Factor = 1.28

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 0.082 A/m; Power Drift = 0.125 dB

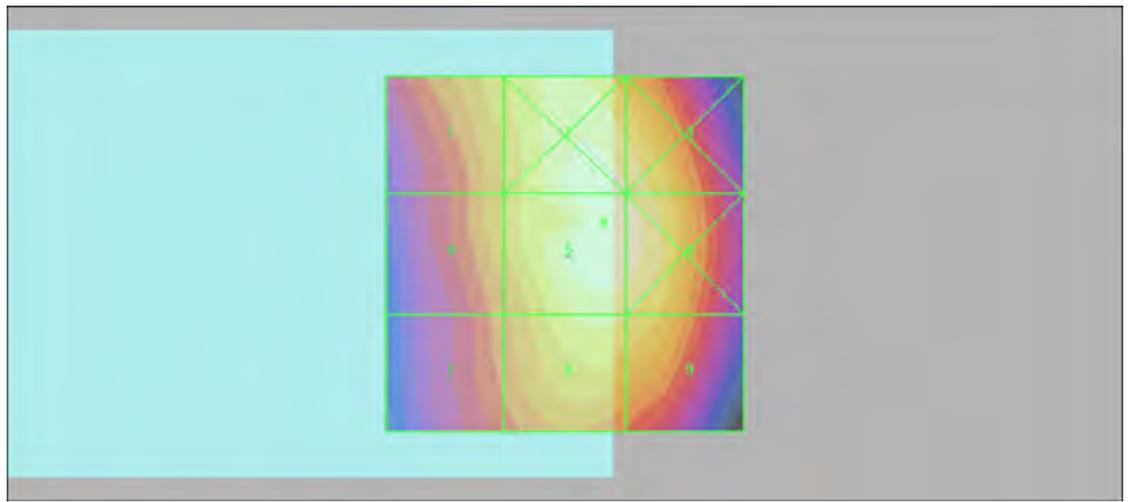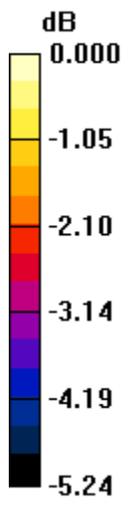**Hearing Aid Near-Field Category: M4 (AWF -5 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.114 M4	**0.091 M4**	**0.078 M4**
Grid 4	Grid 5	Grid 6
0.092 M4	**0.095 M4**	**0.089 M4**
Grid 7	Grid 8	Grid 9
0.091 M4	**0.095 M4**	**0.089 M4**

Cursor:
Total = 0.114 A/m
H Category: M4
Location: 25, -25, 8.7 mm

0 dB = 0.114A/m

#30 HAC_H_GSM850_Ch189_Battery1

DUT: 961307

Communication System: GSM850; Frequency: 836.4 MHz;Duty Cycle: 1:8.3

Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3

Ambient Temperature：22.9 ℃

DASY4 Configuration:
- Probe: H3DV6 - SN6184; ; Calibrated: 2009/1/19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch189/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 0.192 A/m

Probe Modulation Factor = 1.42

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 0.074 A/m; Power Drift = 0.053 dB

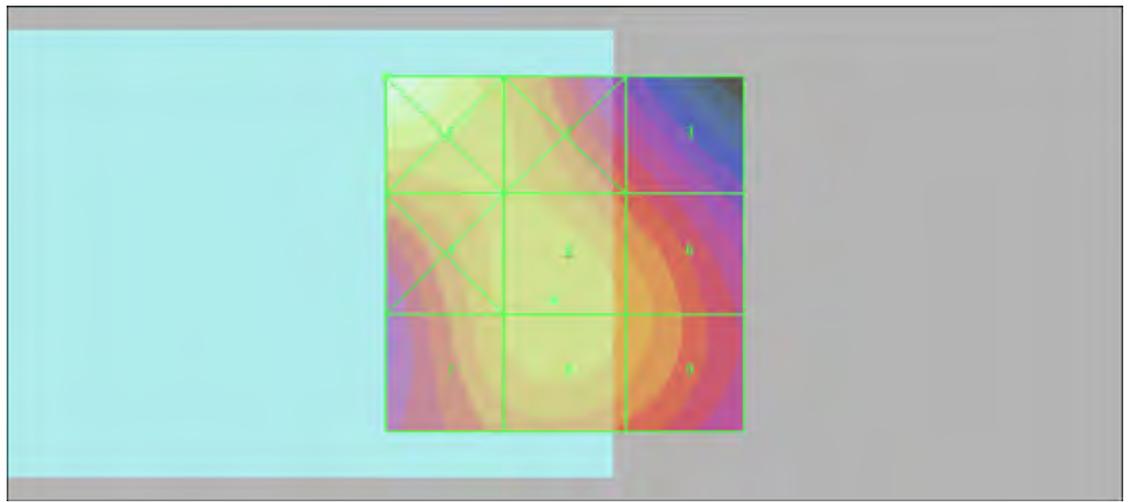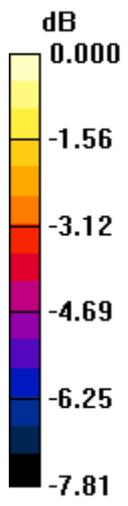**Hearing Aid Near-Field Category: M4 (AWF -5 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.191 M4	**0.136 M4**	**0.085 M4**
Grid 4	Grid 5	Grid 6
0.191 M4	**0.135 M4**	**0.083 M4**
Grid 7	Grid 8	Grid 9
0.192 M4	**0.136 M4**	**0.087 M4**

Cursor:
Total = 0.192 A/m
H Category: M4
Location: 25, 18.5, 8.7 mm

0 dB = 0.192A/m

#31 HAC_H_WCDMA II_RMC 12.2k_Ch9262_Battery1

DUT: 961307

Communication System: WCDMA; Frequency: 1852.4 MHz;Duty Cycle: 1:1

Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3

Ambient Temperature：22.9 ℃

DASY4 Configuration:
- Probe: H3DV6 - SN6184; ; Calibrated: 2009/1/19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch9262/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 0.052 A/m

Probe Modulation Factor = 0.52

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 0.110 A/m; Power Drift = -0.030 dB

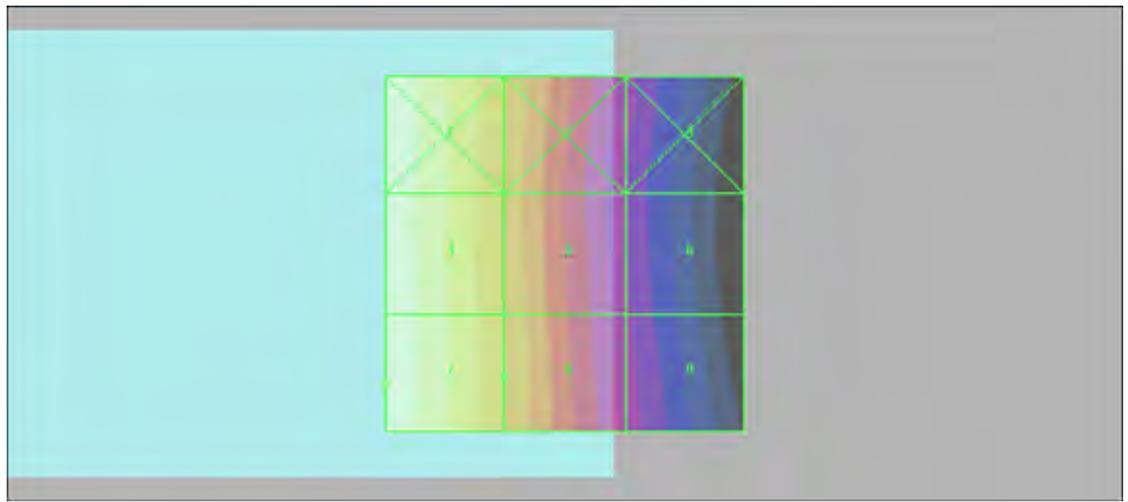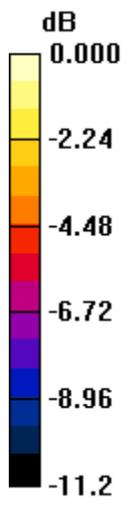**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.061 M4	**0.049 M4**	**0.043 M4**
Grid 4	Grid 5	Grid 6
0.050 M4	**0.052 M4**	**0.048 M4**
Grid 7	Grid 8	Grid 9
0.050 M4	**0.052 M4**	**0.048 M4**

Cursor:
Total = 0.061 A/m
H Category: M4
Location: 25, -25, 8.7 mm

0 dB = 0.061A/m

#32 HAC_H_WCDMA V_RMC 12.2k_Ch4233_Battery1

DUT: 961307

Communication System: WCDMA; Frequency: 846.6 MHz;Duty Cycle: 1:1

Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3

Ambient Temperature：22.9 ℃

DASY4 Configuration:
- Probe: H3DV6 - SN6184; ; Calibrated: 2009/1/19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Ch4233/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 0.101 A/m

Probe Modulation Factor = 0.77

Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 0.078 A/m; Power Drift = -0.351 dB

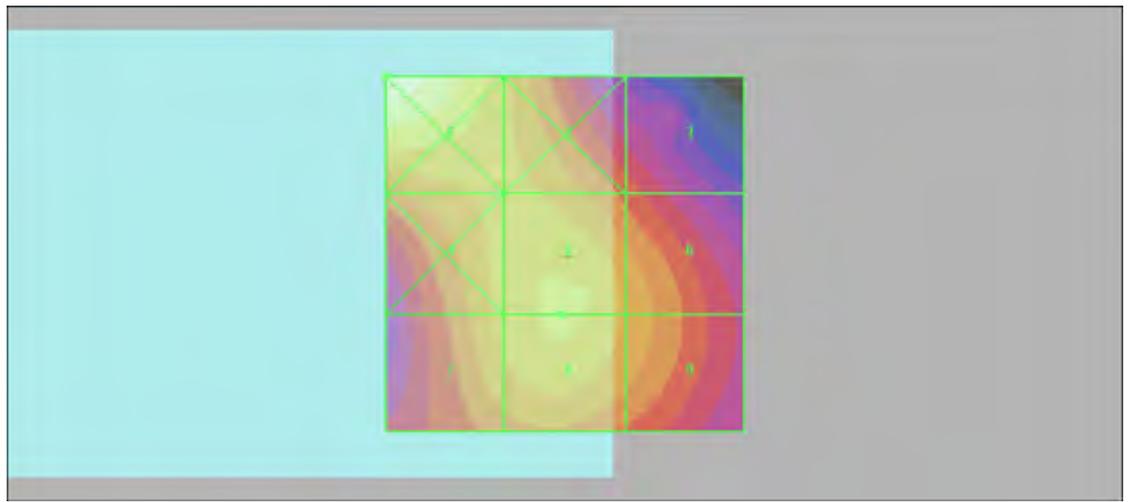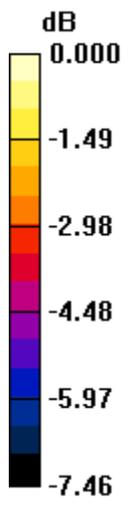**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.104 M4	**0.075 M4**	**0.049 M4**
Grid 4	Grid 5	Grid 6
0.101 M4	**0.073 M4**	**0.046 M4**
Grid 7	Grid 8	Grid 9
0.101 M4	**0.074 M4**	**0.047 M4**

Cursor:
Total = 0.104 A/m
H Category: M4
Location: 25, -21, 8.7 mm
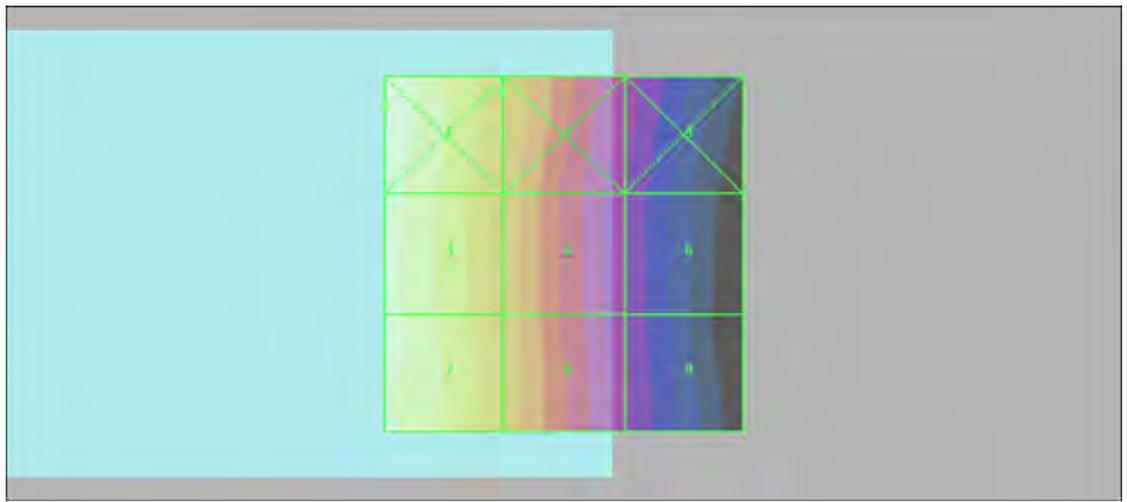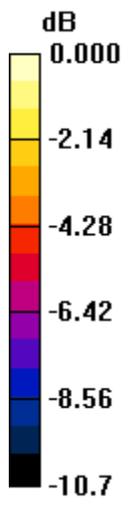
0 dB = 0.104A/m

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
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Accreditation No.: SCS 108

Client **Sporton (Auden)**

Certificate No: **CD835V3-1045_Sep07**

CALIBRATION CERTIFICATE

Object	CD835V3 - SN: 1045
Calibration procedure(s)	QA CAL-20.v4 Calibration procedure for dipoles in air
Calibration date:	September 25, 2007
Condition of the calibrated item	In Tolerance

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	03-Oct-06 (METAS, No. 217-00608)	Oct-07
Power sensor HP 8481A	US37292783	03-Oct-06 (METAS, No. 217-00608)	Oct-07
Probe ER3DV6	SN: 2336	27-Dec-06 (SPEAG, No. ER3-2336_Dec06)	Dec-07
Probe H3DV6	SN: 6065	27-Dec-06 (SPEAG, No. H3-6065-Dec06)	Dec-07
DAE4	SN: 903	19-Sep-07 (SPEAG, No. DAE4-903_Sep07)	Sep-08

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-4419B	GB42420191	11-May-05 (SPEAG, in house check Nov-06)	In house check: Nov-07
Power sensor HP 8482A	US37295597	11-May-05 (SPEAG, in house check Nov-06)	In house check: Nov-07
Power sensor HP 8482H	3318A09450	08-Jan-02 (SPEAG, in house check Nov-06)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-06)	In house check: Oct-07
RF generator E4433B	MY 41310391	22-Nov-04 (SCV, TRS 001-021-0354)	In house check: Nov-07

	Name	Function	Signature
Calibrated by:	Mike Meili	Laboratory Technician	
Approved by:	Fin Bomholt	Technical Director	

Issued: September 27, 2007

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S   Schweizerischer Kalibrierdienst
C   Service suisse d'étalonnage
C   Servizio svizzero di taratura
S   Swiss Calibration Service

Accredited by the Swiss Federal Office of Metrology and Accreditation

Accreditation No.: **SCS 108**

The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

References
[1]   ANSI-C63.19-2006
American National Standard for Methods of Measurement of Compatibility between Wireless
Communications Devices and Hearing Aids.

Methods Applied and Interpretation of Parameters:

- *Coordinate System:* y-axis is in the direction of the dipole arms. z-axis is from the basis of the antenna (mounted on the table) towards its feed point between the two dipole arms. x-axis is normal to the other axes. In coincidence with standard [1], the measurement planes (probe sensor center) are selected to be at a distance of 10 mm above the top edge of the dipole arms.

- *Measurement Conditions:* Further details are available from the hardcopies at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated. The forward power to the dipole connector is set with a calibrated power meter connected and monitored with an auxiliary power meter connected to a directional coupler. While the dipole under test is connected, the forward power is adjusted to the same level.

- *Antenna Positioning:* The dipole is mounted on a HAC Test Arch phantom using the matching dipole positioner with the arms horizontal and the feeding cable coming from the floor. The measurements are performed in a shielded room with absorbers around the setup to reduce the reflections.
It is verified before the mounting of the dipole under the Test Arch phantom, that its arms are perfectly in a line. It is installed on the HAC dipole positioner with its arms parallel below the dielectric reference wire and able to move elastically in vertical direction without changing its relative position to the top center of the Test Arch phantom. The vertical distance to the probe is adjusted after dipole mounting with a DASY4 Surface Check job. Before the measurement, the distance between phantom surface and probe tip is verified. The proper measurement distance is selected by choosing the matching section of the HAC Test Arch phantom with the proper device reference point (upper surface of the dipole) and the matching grid reference point (tip of the probe) considering the probe sensor offset. The vertical distance to the probe is essential for the accuracy.

- *Feed Point Impedance and Return Loss:* These parameters are measured using a HP 8753E Vector Network Analyzer. The impedance is specified at the SMA connector of the dipole. The influence of reflections was eliminating by applying the averaging function while moving the dipole in the air, at least 70cm away from any obstacles.

- *E- field distribution:* E field is measured in the x-y-plane with an isotropic ER3D-field probe with 100 mW forward power to the antenna feed point. In accordance with [1], the scan area is 20mm wide, its length exceeds the dipole arm length (180 or 90mm). The sensor center is 10 mm (in z) above the top of the dipole arms. Two 3D maxima are available near the end of the dipole arms. Assuming the dipole arms are perfectly in one line, the average of these two maxima (in subgrid 2 and subgrid 8) is determined to compensate for any non-parallelity to the measurement plane as well as the sensor displacement. The E-field value stated as calibration value represents the maximum of the interpolated 3D-E-field, 10mm above the dipole surface.

- *H-field distribution:* H-field is measured with an isotropic H-field probe with 100mW forward power to the antenna feed point, in the x-y-plane. The scan area and sensor distance is equivalent to the E-field scan. The maximum of the field is available at the center (subgrid 5) above the feed point. The H-field value stated as calibration value represents the maximum of the interpolated H-field, 10mm above the dipole surface at the feed point.

1 Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY4	V4.7 B55
DASY PP Version	SEMCAD	V1.8 B176
Phantom	HAC Test Arch	SD HAC P01 BA, #1070
Distance Dipole Top - Probe Center	10 mm	
Scan resolution	dx, dy = 5 mm	area = 20 x 180 mm
Frequency	835 MHz ± 1 MHz	
Forward power at dipole connector	20.0 dBm = 100mW	
Input power drift	< 0.05 dB	

2 Maximum Field values

H-field 10 mm above dipole surface	condition	interpolated maximum
Maximum measured	100 mW forward power	0.453 A/m

Uncertainty for H-field measurement: 8.2% (k=2)

E-field 10 mm above dipole surface	condition	Interpolated maximum
Maximum measured above high end-	100 mW forward power	168.2 V/m
Maximum measured above low end	100 mW forward power	165.9 V/m
Averaged maximum above arm	100 mW forward power	167.1 V/m

Uncertainty for E-field measurement: 12.8% (k=2)

3 Appendix

3.1 Antenna Parameters

Frequency	Return Loss	Impedance
800 MHz	15.4 dB	(41.9 – j13.5) Ohm
835 MHz	**30.8 dB**	**(49.7 + j2.8) Ohm**
900 MHz	17.1 dB	(55.1 – j13.9) Ohm
950 MHz	18.9 dB	(48.6 + j11.1) Ohm
960 MHz	15.0 dB	(54.9 + j18.3) Ohm

3.2 Antenna Design and Handling

The calibration dipole has a symmetric geometry with a built-in two stub matching network, which leads to the enhanced bandwidth.
The dipole is built of standard semirigid coaxial cable. The internal matching line is open ended. The antenna is therefore open for DC signals.
Do not apply force to dipole arms, as they are liable to bend. The soldered connections near the feedpoint may be damaged. After excessive mechanical stress or overheating, check the impedance characteristics to ensure that the internal matching network is not affected.

After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

3.3 Measurement Sheets

3.3.1 Return Loss and Smith Chart

3.3.2 DASY4 H-field result

Date/Time: 25.09.2007 13:54:05

Test Laboratory: SPEAG Lab 2

DUT: HAC-Dipole 835 MHz; Type: CD835V3; Serial: 1045
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m³
Phantom section: H Dipole Section
Measurement Standard: DASY4 (High Precision Assessment)
DASY4 Configuration:

- Probe: H3DV6 - SN6065; Calibrated: 27.12.2006

- Sensor-Surface: (Fix Surface)

- Electronics: DAE4 Sn903; Calibrated: 19.09.2007

- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1070

- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

H Scan - Sensor Center 10mm above CD835 Dipole/Hearing Aid Compatibility Test (41x361x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.453 A/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 0.477 A/m; Power Drift = 0.000 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.364	0.405	0.396
M4	M4	M4
Grid 4	Grid 5	Grid 6
0.411	0.453	0.444
M4	M4	M4
Grid 7	Grid 8	Grid 9
0.362	0.398	0.391
M4	M4	M4

0 dB = 0.453A/m

3.3.3 DASY4 E-Field result

Date/Time: 25.09.2007 11:58:13

Test Laboratory: SPEAG Lab 2

DUT: HAC-Dipole 835 MHz; Type: D835V3; Serial: 1045
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m³
Phantom section: E Dipole Section
Measurement Standard: DASY4 (High Precision Assessment)
DASY4 Configuration:

- Probe: ER3DV6 - SN2336; ConvF(1, 1, 1); Calibrated: 27.12.2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn903; Calibrated: 31.08.2006
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

E Scan - Sensor Center 10mm above CD835 Dipole/Hearing Aid Compatibility Test (41x361x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 168.2 V/m
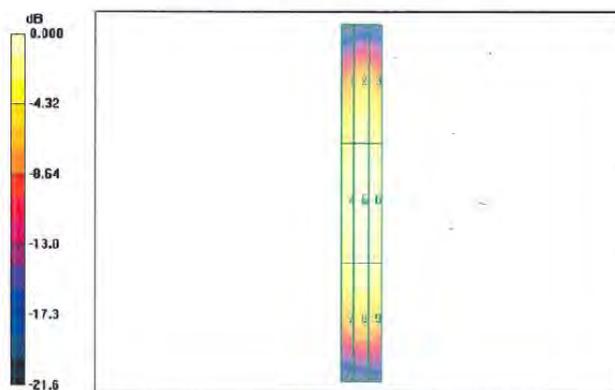Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 109.0 V/m; Power Drift = -0.007 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
164.2 M4	165.9 M4	157.1 M4
Grid 4	Grid 5	Grid 6
87.2 M4	88.4 M4	84.0 M4
Grid 7	Grid 8	Grid 9
163.2 M4	168.2 M4	161.1 M4
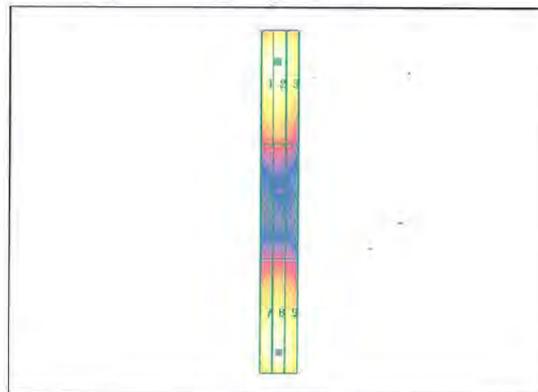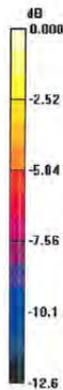
0 dB = 168.2V/m

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Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: **SCS 108**

Client   **Sporton (Auden)**

Certificate No: **CD1880V3-1038_Sep07**

CALIBRATION CERTIFICATE

Object	CD1880V3 - SN: 1038
Calibration procedure(s)	QA CAL-20.v4
Calibration procedure for dipoles in air
Calibration date:	September 27, 2007
Condition of the calibrated item	In Tolerance

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	03-Oct-06 (METAS, No. 217-00608)	Oct-07
Power sensor HP 8481A	US37292783	03-Oct-06 (METAS, No. 217-00608)	Oct-07
Probe ER3DV6	SN: 2336	27-Dec-06 (SPEAG, No. ER3-2336_Dec06)	Dec-07
Probe H3DV6	SN: 6065	27-Dec-06 (SPEAG, No. H3-6065-Dec06)	Dec-07
DAE4	SN: 903	19-Sep-07 (SPEAG, No. DAE4-903_Sep07)	Sep-08

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-4419B	GB42420191	11-May-05 (SPEAG, in house check Nov-06)	In house check: Nov-07
Power sensor HP 8482A	US37295597	11-May-05 (SPEAG, in house check Nov-06)	In house check: Nov-07
Power sensor HP 8482H	3318A09450	08-Jan-02 (SPEAG, in house check Nov-06)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-06)	In house check: Oct-07
RF generator E4433B	MY 41310391	22-Nov-04 (SCV, TRS 001-021-0354)	In house check: Nov-07

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Fin Bomholt	Technical Director	

Issued: September 28, 2007

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C	Service suisse d'étalonnage
C	Servizio svizzero di taratura
S	Swiss Calibration Service

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Accreditation No.: SCS 108

References

[1]   ANSI-C63.19-2006
American National Standard for Methods of Measurement of Compatibility between Wireless
Communications Devices and Hearing Aids.

Methods Applied and Interpretation of Parameters:

- *Coordinate System:* y-axis is in the direction of the dipole arms. z-axis is from the basis of the antenna
  (mounted on the table) towards its feed point between the two dipole arms. x-axis is normal to the other
  axes. In coincidence with standard [1], the measurement planes (probe sensor center) are selected to
  be at a distance of 10 mm above the top edge of the dipole arms.

- *Measurement Conditions:* Further details are available from the hardcopies at the end of the certificate.
  All figures stated in the certificate are valid at the frequency indicated. The forward power to the dipole
  connector is set with a calibrated power meter connected and monitored with an auxiliary power meter
  connected to a directional coupler. While the dipole under test is connected, the forward power is
  adjusted to the same level.

- *Antenna Positioning:* The dipole is mounted on a HAC Test Arch phantom using the matching dipole
  positioner with the arms horizontal and the feeding cable coming from the floor. The measurements are
  performed in a shielded room with absorbers around the setup to reduce the reflections.
  It is verified before the mounting of the dipole under the Test Arch phantom, that its arms are perfectly in
  a line. It is installed on the HAC dipole positioner with its arms parallel below the dielectric reference
  wire and able to move elastically in vertical direction without changing its relative position to the top
  center of the Test Arch phantom. The vertical distance to the probe is adjusted after dipole mounting
  with a DASY4 Surface Check job. Before the measurement, the distance between phantom surface and
  probe tip is verified. The proper measurement distance is selected by choosing the matching section of
  the HAC Test Arch phantom with the proper device reference point (upper surface of the dipole) and the
  matching grid reference point (tip of the probe) considering the probe sensor offset. The vertical
  distance to the probe is essential for the accuracy.

- *Feed Point Impedance and Return Loss:* These parameters are measured using a HP 8753E Vector
  Network Analyzer. The impedance is specified at the SMA connector of the dipole. The influence of
  reflections was eliminating by applying the averaging function while moving the dipole in the air, at least
  70cm away from any obstacles.

- *E- field distribution:* E field is measured in the x-y-plane with an isotropic ER3D-field probe with 100 mW
  forward power to the antenna feed point. In accordance with [1], the scan area is 20mm wide, its length
  exceeds the dipole arm length (180 or 90mm). The sensor center is 10 mm (in z) above the top of the
  dipole arms. Two 3D maxima are available near the end of the dipole arms. Assuming the dipole arms
  are perfectly in one line, the average of these two maxima (in subgrid 2 and subgrid 8) is determined to
  compensate for any non-parallelity to the measurement plane as well as the sensor displacement. The
  E-field value stated as calibration value represents the maximum of the interpolated 3D-E-field, 10mm
  above the dipole surface.

- *H-field distribution:* H-field is measured with an isotropic H-field probe with 100mW forward power to the
  antenna feed point, in the x-y-plane. The scan area and sensor distance is equivalent to the E-field
  scan. The maximum of the field is available at the center (subgrid 5) above the feed point. The H-field
  value stated as calibration value represents the maximum of the interpolated H-field, 10mm above the
  dipole surface at the feed point.

1 Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY4	V4.7 B55
DASY PP Version	SEMCAD	V1.8 B176
Phantom	HAC Test Arch	SD HAC P01 BA, #1002
Distance Dipole Top - Probe Center	10 mm	
Scan resolution	dx, dy = 5 mm	area = 20 x 90 mm
Frequency	1880 MHz ± 1 MHz	
Forward power at dipole connector	20.0 dBm = 100mW	
Input power drift	< 0.05 dB	

2 Maximum Field values

H-field 10 mm above dipole surface	condition	Interpolated maximum
Maximum measured	100 mW forward power	0.471 A/m

Uncertainty for H-field measurement: 8.2% (k=2)

E-field 10 mm above dipole surface	condition	Interpolated maximum
Maximum measured above high end	100 mW forward power	138.9 V/m
Maximum measured above low end	100 mW forward power	138.8 V/m
Averaged maximum above arm	100 mW forward power	138.9 V/m

Uncertainty for E-field measurement: 12.8% (k=2)

3 Appendix

3.1 Antenna Parameters

Frequency	Return Loss	Impedance
1710 MHz	19.2 dB	(48.9 + j10.9) Ohm
1880 MHz	22.1 dB	(53.8 + j7.2) Ohm
1900 MHz	22.1 dB	(56.5 + j5.2) Ohm
1950 MHz	26.1 dB	(54.3 - j2.9) Ohm
2000 MHz	19.1 dB	(40.1 + j0.4) Ohm

3.2 Antenna Design and Handling

The calibration dipole has a symmetric geometry with a built-in two stub matching network, which leads to the enhanced bandwidth.
The dipole is built of standard semirigid coaxial cable. The internal matching line is open ended. The antenna is therefore open for DC signals.
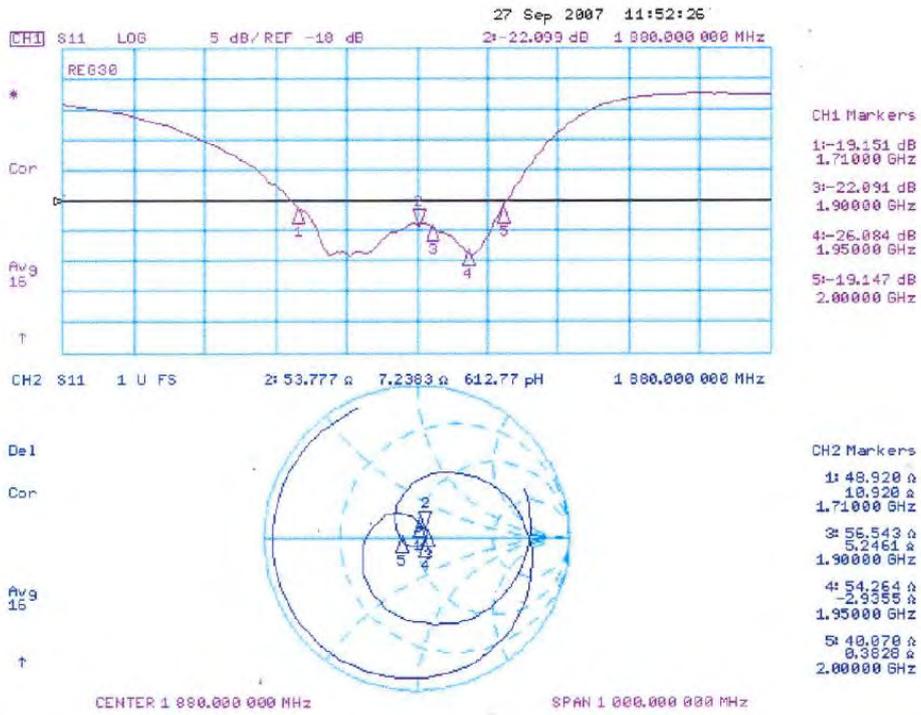Do not apply force to dipole arms, as they are liable to bend. The soldered connections near the feedpoint may be damaged. After excessive mechanical stress or overheating, check the impedance characteristics to ensure that the internal matching network is not affected.

After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

3.3 Measurement Sheets

3.3.1 Return Loss and Smith Chart

27 Sep 2007 11:52:26

CH1 S11 LOG 5 dB/REF -10 dB 2:-22.099 dB 1 880.000 000 MHz

REG30

CH1 Markers

1:-19.151 dB
1.71000 GHz

3:-22.091 dB
1.90000 GHz

4:-26.084 dB
1.95000 GHz

5:-19.147 dB
2.00000 GHz

CH2 S11 1 U FS 2: 53.777 Ω 7.2383 Ω 612.77 pH 1 880.000 000 MHz

Del

Cor

Avg
16

CH2 Markers

1: 48.920 Ω
10.920 Ω
1.71000 GHz

3: 56.543 Ω
5.2461 Ω
1.90000 GHz

4: 54.264 Ω
-2.9355 Ω
1.95000 GHz

5: 40.070 Ω
0.3828 Ω
2.00000 GHz

CENTER 1 890.000 000 MHz SPAN 1 000.000 000 MHz

3.3.2 DASY4 H-Field Result

Date/Time: 25.09.2007 15:53:23

Test Laboratory: SPEAG Lab 2

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1038
Communication System: CW; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: H Dipole Section
Measurement Standard: DASY4 (High Precision Assessment)
DASY4 Configuration:

- Probe: H3DV6 - SN6065; ; Calibrated: 27.12.2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn903; Calibrated: 19.09.2007
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

H Scan - Sensor Center 10mm above CD1880V3 Dipole/Hearing Aid Compatibility Test (41x181x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.471 A/m
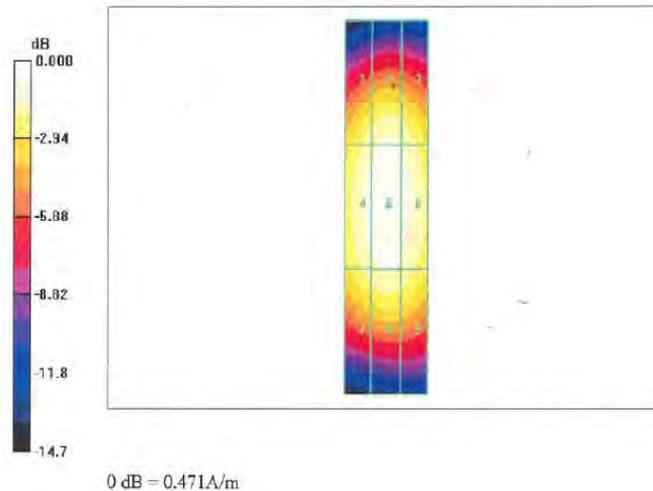Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 0.498 A/m; Power Drift = 0.009 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.404 M2	**0.435 M2**	**0.418 M2**
Grid 4	Grid 5	Grid 6
0.442 M2	**0.471 M2**	**0.454 M2**
Grid 7	Grid 8	Grid 9
0.402 M2	**0.426 M2**	**0.410 M2**

0 dB = 0.471A/m

3.3.3 DASY4 E-Field Result

Date/Time: 27.09.2007 12:27:44

Test Laboratory: SPEAG Lab 2

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1038
Communication System: CW; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: E Dipole Section
Measurement Standard: DASY4 (High Precision Assessment)
DASY4 Configuration:

- Probe: ER3DV6 - SN2336; ConvF(1, 1, 1); Calibrated: 27.12.2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn903; Calibrated: 19.09.2007
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 174

E Scan - Sensor Center 10mm above CD1880V3 Dipole/Hearing Aid Compatibility Test (41x181x1):
Measurement grid: dx=5mm, dy=5mm
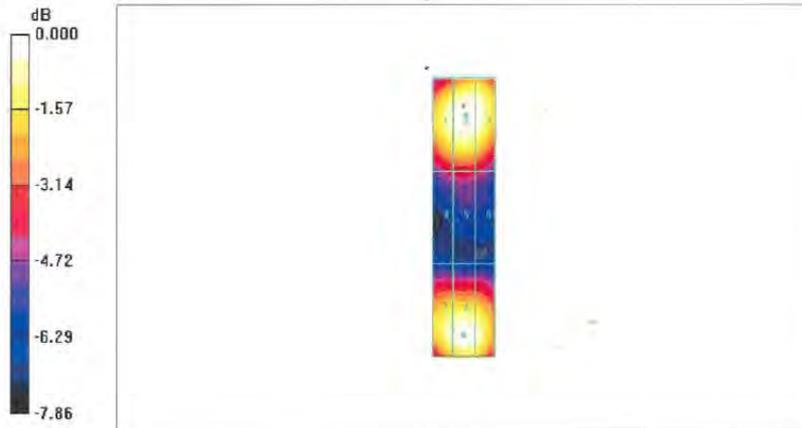Maximum value of peak Total field = 138.9 V/m
Probe Modulation Factor = 1.00
Reference Value = 156.3 V/m; Power Drift = 0.002 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
133.8 M2	**138.9 M2**	**137.0 M2**
Grid 4	Grid 5	Grid 6
89.9 M3	**92.3 M3**	**89.1 M3**
Grid 7	Grid 8	Grid 9
133.4 M2	**138.8 M2**	**133.8 M2**

dB
0.000
-1.57
-3.14
-4.72
-6.29
-7.86

0 dB = 138.9V/m

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client   **Sporton (Auden)**

Certificate No: **DAE4-778_Sep08**

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BG - SN: 778
Calibration procedure(s)	QA CAL-06.v12 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	September 22, 2008
Condition of the calibrated item	In Tolerance

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Fluke Process Calibrator Type 702	SN: 6295803	04-Oct-07 (No: 6467)	Oct-08
Keithley Multimeter Type 2001	SN: 0810278	03-Oct-07 (No: 6465)	Oct-08

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Calibrator Box V1.1	SE UMS 006 AB 1004	06-Jun-08 (in house check)	In house check: Jun-09

	Name	Function	Signature
Calibrated by:	Andrea Guntli	Technician	
Approved by:	Fin Bomholt	R&D Director	

Issued: September 22, 2008

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S   Swiss Calibration Service

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary

DAE   data acquisition electronics
Connector angle   information used in DASY system to align probe sensor X to the robot
                           coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.

- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.

- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.

   - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.

   - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.

   - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.

   - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage

   - *Input Offset Measurement:* Output voltage and statistical results over a large number of zero voltage measurements.

   - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.

   - *Input resistance:* DAE input resistance at the connector, during internal auto-zeroing and during measurement.

   - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.

   - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range:	1LSB =	6.1μV ,	full range =	-100...+300 mV
Low Range:	1LSB =	61nV ,	full range =	-1.......+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	404.686 ± 0.1% (k=2)	403.490 ± 0.1% (k=2)	405.045 ± 0.1% (k=2)
Low Range	3.99455 ± 0.7% (k=2)	3.96369 ± 0.7% (k=2)	3.99417 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	309 º ± 1 º

Appendix

1. DC Voltage Linearity

High Range		Input (μV)	Reading (μV)	Error (%)
Channel X	+ Input	200000	200000.3	0.00
Channel X	+ Input	20000	20004.24	0.02
Channel X	- Input	20000	-20002.46	0.01
Channel Y	+ Input	200000	200000.4	0.00
Channel Y	+ Input	20000	20002.60	0.01
Channel Y	- Input	20000	-20002.26	0.01
Channel Z	+ Input	200000	200000.6	0.00
Channel Z	+ Input	20000	20000.78	0.00
Channel Z	- Input	20000	-20005.75	0.03

Low Range		Input (μV)	Reading (μV)	Error (%)
Channel X	+ Input	2000	2000	0.00
Channel X	+ Input	200	199.37	-0.31
Channel X	- Input	200	-200.28	0.14
Channel Y	+ Input	2000	2000	0.00
Channel Y	+ Input	200	199.63	-0.19
Channel Y	- Input	200	-200.88	0.44
Channel Z	+ Input	2000	2000.1	0.00
Channel Z	+ Input	200	198.60	-0.70
Channel Z	- Input	200	-201.07	0.53

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	-7.46	-6.40
	- 200	10.00	6.86
Channel Y	200	-2.73	-2.45
	- 200	0.84	0.43
Channel Z	200	-10.91	-10.94
	- 200	7.89	8.22

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	3.08	-1.34
Channel Y	200	1.18	-	4.64
Channel Z	200	-1.74	1.44	-

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	16048	16021
Channel Y	16167	15166
Channel Z	16416	15977

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (µV)	min. Offset (µV)	max. Offset (µV)	Std. Deviation (µV)
Channel X	-0.13	-0.88	0.92	0.33
Channel Y	-0.88	-2.47	0.72	0.55
Channel Z	-1.16	-2.17	-0.19	0.42

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance

	Zeroing (MOhm)	Measuring (MOhm)
Channel X	0.2000	201.1
Channel Y	0.2000	201.0
Channel Z	0.2001	201.7

8. Low Battery Alarm Voltage (verified during pre test)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (verified during pre test)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.0	+6	+14
Supply (- Vcc)	−0.01	-8	-9

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	S	Swiss Calibration Service

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client   **Sporton (Auden)**

Certificate No.: **ER3-2358_Jan09**

CALIBRATION CERTIFICATE

Object	ER3DV6 - SN:2358
Calibration procedure(s)	QA CAL-02.v5 Calibration procedure for E-field probes optimized for close near field evaluations in air
Calibration date:	January 14, 2009
Condition of the calibrated item	In Tolerance

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41495277	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41498087	1-Apr-08 (No. 217-00788)	Apr-09
Reference 3 dB Attenuator	SN: S5054 (3c)	1-Jul-08 (No. 217-00865)	Jul-09
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-08 (No. 217-00787)	Apr-09
Reference 30 dB Attenuator	SN: S5129 (30b)	1-Jul-08 (No. 217-00866)	Jul-09
Reference Probe ER3DV6	SN: 2328	1-Oct-08 (No. ER3-2328_Oct08)	Oct-09
DAE4	SN: 789	19-Dec-08 (No. DAE4-789_Dec08)	Dec-09

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3042U01700	4-Aug-99 (in house check Oct-07)	in house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-08)	in house check: Oct-09

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: January 20, 2009

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Accreditation No.: **SCS 108**

Glossary:

NORMx,y,z	sensitivity in free space
DCP	diode compression point
Polarization φ	φ rotation around probe axis
Polarization θ	θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., θ = 0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

a) IEEE Std 1309-2005, " IEEE Standard for calibration of electromagnetic field sensors and probes, excluding antennas, from 9 kHz to 40 GHz", December 2005.

Methods Applied and Interpretation of Parameters:

*   *NORMx,y,z*: Assessed for E-field polarization θ = 0 for XY sensors and θ = 90 for Z sensor (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide).

*   *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart).

*   *DCPx,y,z*: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency.

*   *Spherical isotropy (3D deviation from isotropy)*: in a locally homogeneous field realized using an open waveguide setup.

*   *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

*   *Connector Angle*: The angle is assessed using the information gained by determining the NORMx (no uncertainty required).

Probe ER3DV6

SN:2358

Manufactured:	July 7, 2005
Last calibrated:	January 28, 2008
Recalibrated:	January 14, 2009

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ER3DV6 SN:2358

Sensivity in Free Space [$\mu V/(V/m)^2$]   Diode Compression[A]

NormX	1.74 ± 10.1 % (k=2)		DCP X	90 mV
NormY	1.57 ± 10.1 % (k=2)		DCP Y	92 mV
NormZ	1.60 ± 10.1 % (k=2)		DCP Z	98 mV

Frequency Correction

X	0.0
Y	0.0
Z	0.0

Sensor Offset   (Probe Tip to Sensor Center)

X	2.5 mm
Y	2.5 mm
Z	2.5 mm

Connector Angle   -245 °

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] numerical linearization parameter: uncertainty not required.

ER3DV6 SN:2358   January 14, 2009

Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide R22)
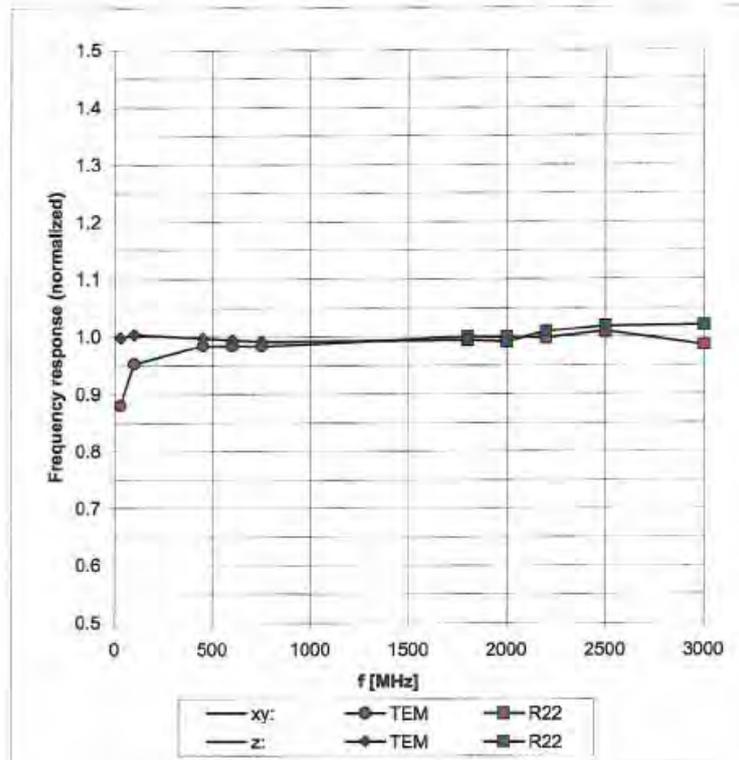
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

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ER3DV6 SN:2358

January 14, 2009

Receiving Pattern (φ), ϑ = 0°

f = 600 MHz, TEM ifi110EXX

f = 2500 MHz, WG R22

─●─ X   ─●─ Y   ─●─ Z   ─○─ tot

─●─ X   ─●─ Y   ─●─ Z   ─○─ tot

Receiving Pattern (φ), ϑ = 90°

f = 600 MHz, TEM ifi110EXX

f = 2500 MHz, WG R22

─●─ X   ─●─ Y   ─●─ Z   ─○─ tot

─●─ X   ─●─ Y   ─●─ Z   ─○─ tot

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ER3DV6 SN:2358   January 14, 2009

Receiving Pattern (φ), ϑ = 0°

Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Receiving Pattern (φ), ϑ = 90°

Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Certificate No: ER3-2358_Jan09   Page 7 of 9

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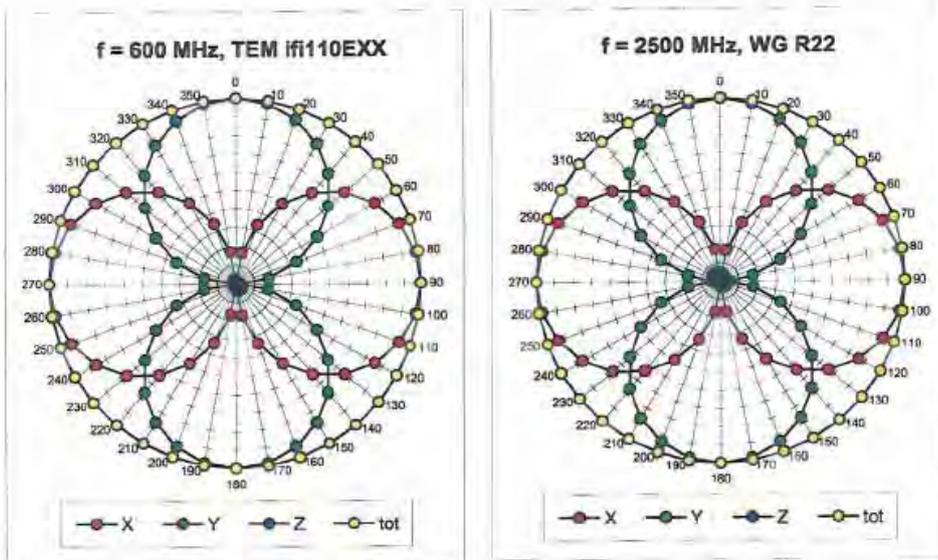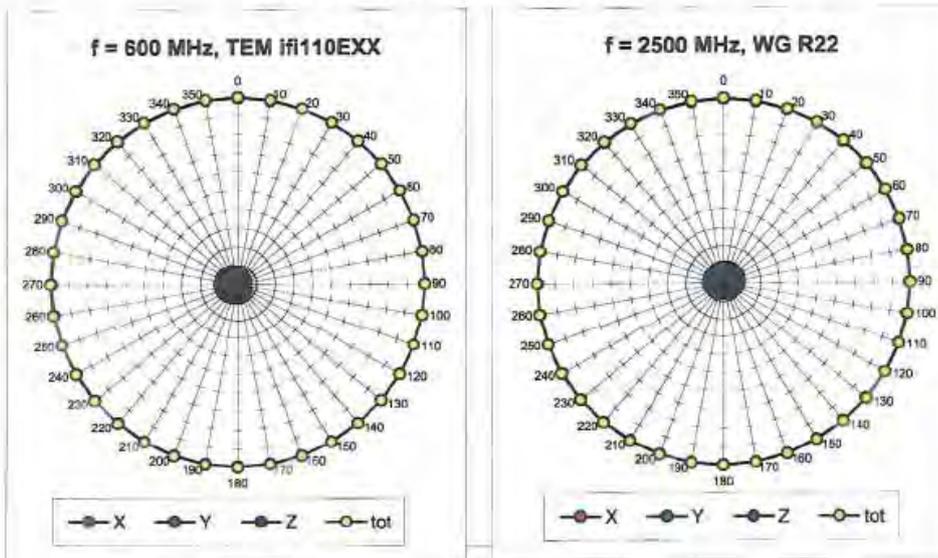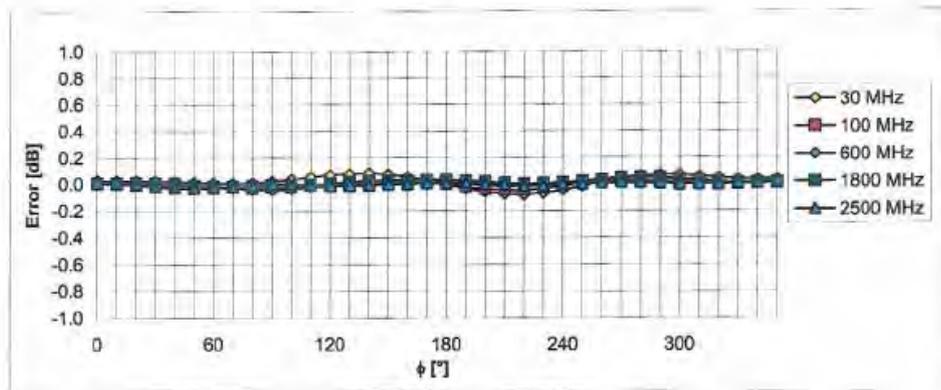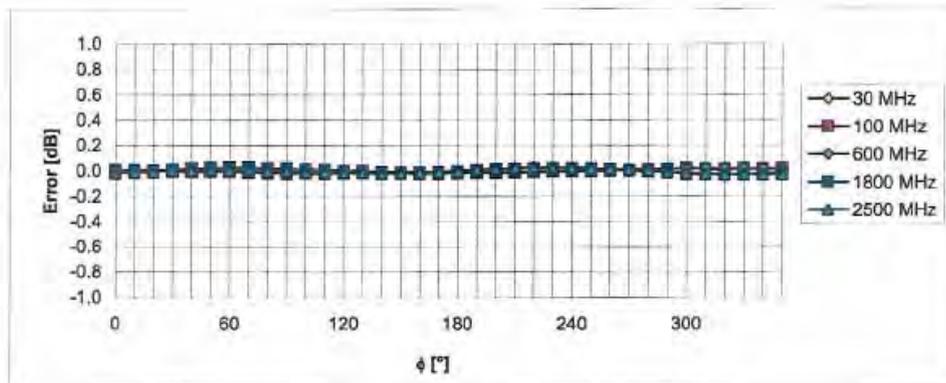
ER3DV6 SN:2358

January 14, 2009

Dynamic Range f(E-field)
(Waveguide R22, f = 1800 MHz)
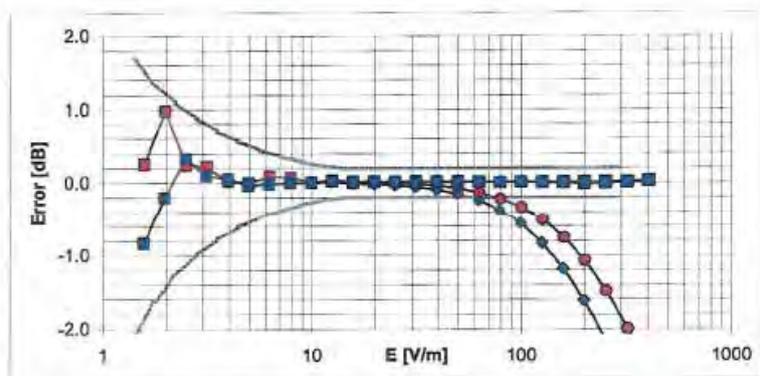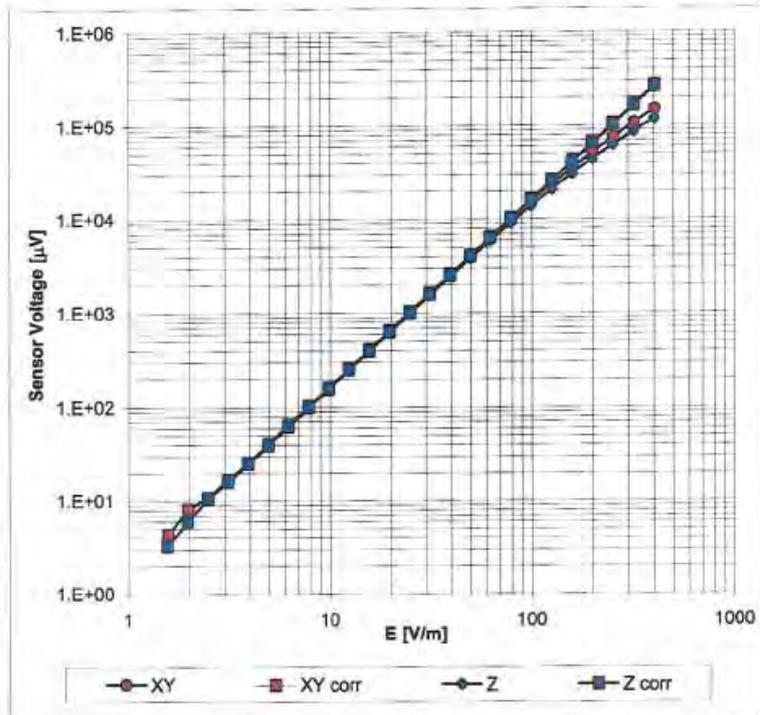
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

ER3DV6 SN:2358

January 14, 2009

Deviation from Isotropy in Air
Error (φ, ϑ), f = 900 MHz
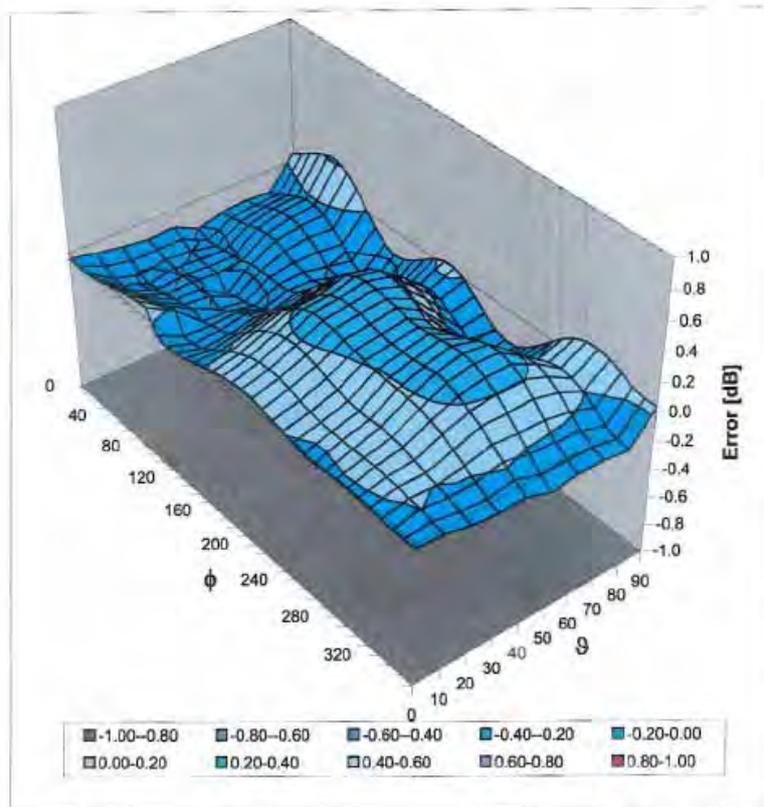
Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

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Accreditation No.: SCS 108

Client   Sporton (Auden)

Certificate No: H3-6184_Jan09

CALIBRATION CERTIFICATE

Object	H3DV6 - SN:6184
Calibration procedure(s)	QA CAL-03.v5 Calibration procedure for H-field probes optimized for close near field evaluations in air
Calibration date:	January 19, 2009
Condition of the calibrated item	In Tolerance

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41495277	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41498087	1-Apr-08 (No. 217-00788)	Apr-09
Reference 3 dB Attenuator	SN: S5054 (3c)	1-Jul-08 (No. 217-00865)	Jul-09
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-08 (No. 217-00787)	Apr-09
Reference 30 dB Attenuator	SN: S5129 (30b)	1-Jul-08 (No. 217-00866)	Jul-09
Reference Probe H3DV6	SN: 6182	1-Oct-08 (No. H3-6182_Oct08)	Oct-09
DAE4	SN: 789	19-Dec-08 (No. DAE4-789_Dec08)	Dec-09

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-08)	in house check: Oct-09

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: January 20, 2009

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Accreditation No.: **SCS 108**

Glossary:

NORMx,y,z	sensitivity in free space
DCP	diode compression point
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

a) IEEE Std 1309-2005, " IEEE Standard for calibration of electromagnetic field sensors and probes, excluding antennas, from 9 kHz to 40 GHz", December 2005.

Methods Applied and Interpretation of Parameters:

- X,Y,Z_a0a1a2: Assessed for E-field polarization $\vartheta = 90$ for XY sensors and $\vartheta = 0$ for Z sensor ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide).

- $X,Y,Z(f)\_a0a1a2 = X,Y,Z\_a0a1a2 *$ frequency_response (see Frequency Response Chart).

- $DCPx,y,z$: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency.

- Spherical isotropy (3D deviation from isotropy): in a locally homogeneous field realized using an open waveguide setup.

- Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

- Connector Angle: The angle is assessed using the information gained by determining the X_a0a1a2 (no uncertainty required).

Probe H3DV6

SN:6184

Manufactured:	June 8, 2004
Last calibrated:	January 28, 2008
Recalibrated:	January 19, 2009

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: H3DV6 SN:6184

Sensitivity in Free Space [A/m / $\sqrt{(\mu V)}$]

	a0	a1	a2
X	2.489E-03	1.472E-6	1.050E-5 ± 5.1 % (k=2)
Y	2.547E-03	-9.311E-5	1.728E-6 ± 5.1 % (k=2)
Z	3.002E-03	-1.194E-4	6.741E-5 ± 5.1 % (k=2)

Diode Compression[1]

DCP X	88 mV
DCP Y	80 mV
DCP Z	84 mV

Sensor Offset   (Probe Tip to Sensor Center)

X	3.0 mm
Y	3.0 mm
Z	3.0 mm

Connector Angle   -246 °

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[1] numerical linearization parameter: uncertainty not required

H3DV6 SN:6184   January 19, 2009

Frequency Response of H-Field

(TEM-Cell:ifi110 EXX, Waveguide R22)

Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (φ), ϑ = 90°

f = 600 MHz, TEM ifi110EXX

f = 2500 MHz, WG R22

Receiving Pattern (φ), ϑ = 0°

f = 600 MHz, TEM ifi110EXX

f = 2500 MHz, WG R22
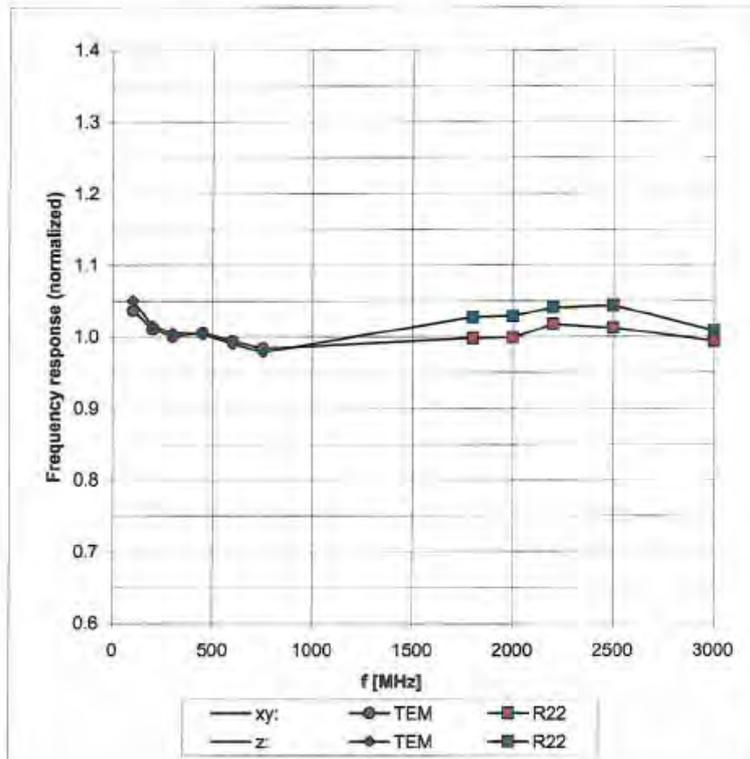
H3DV6 SN:6184

January 19, 2009

Receiving Pattern (ϕ), ϑ = 90°
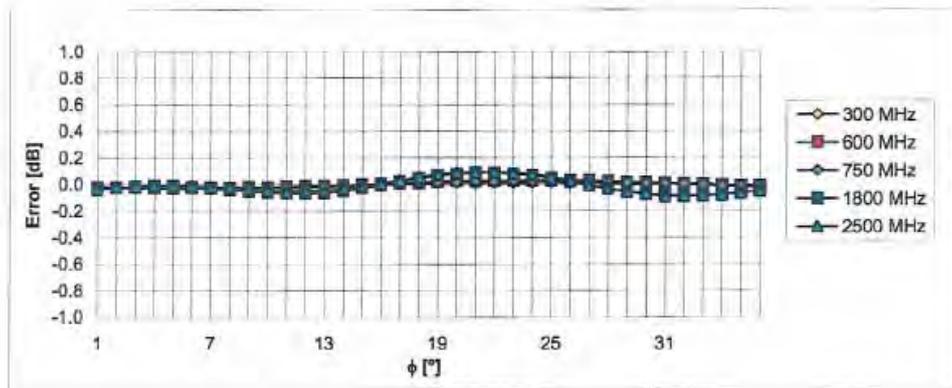
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)
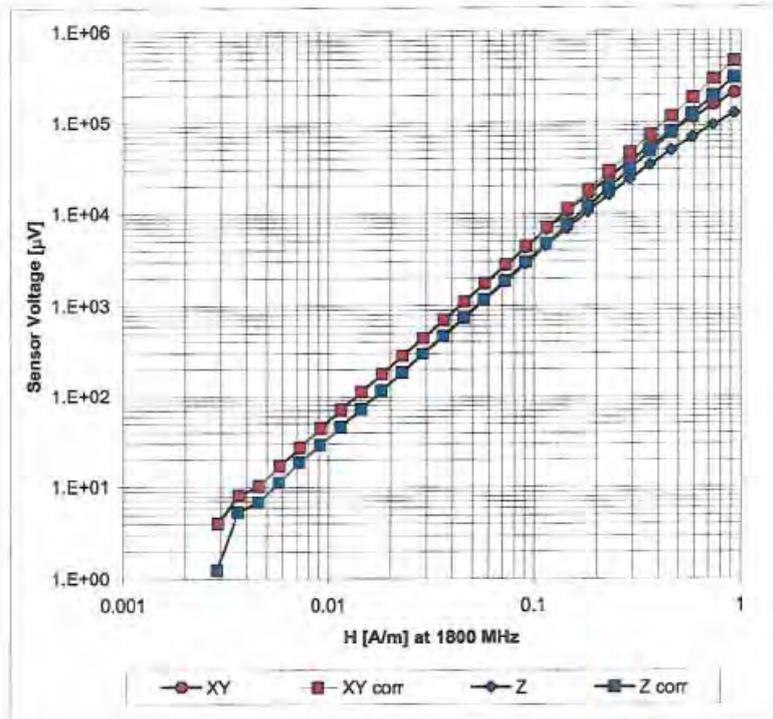
Receiving Pattern (ϕ), ϑ = 0°
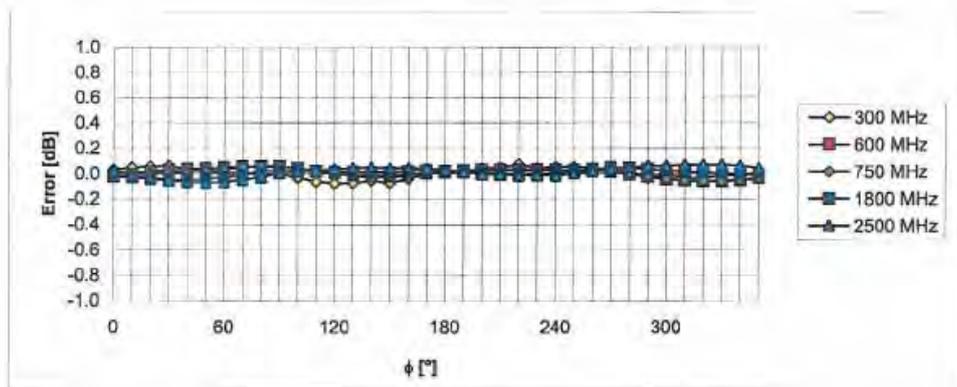
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)
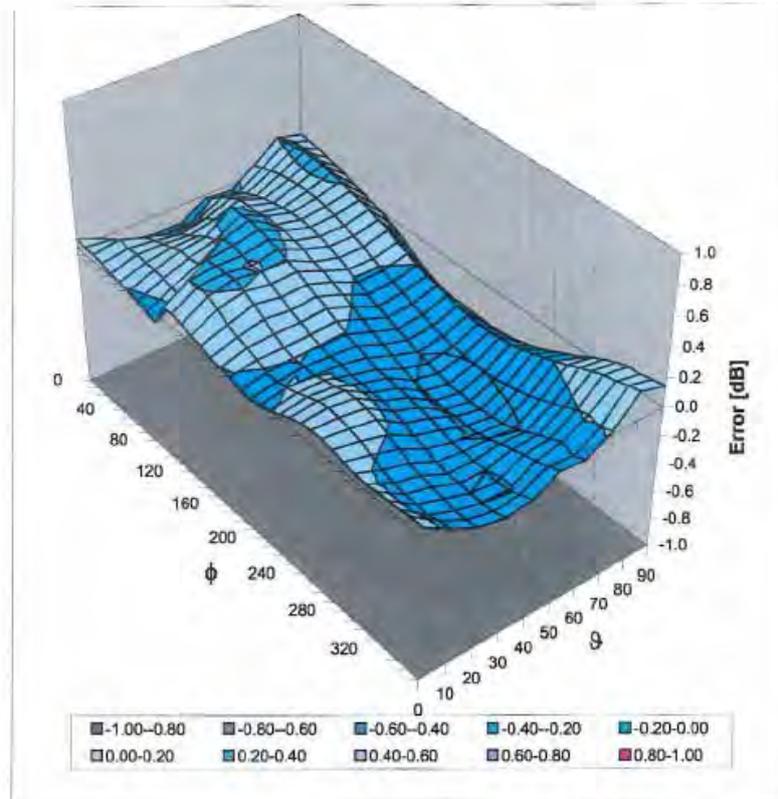
Dynamic Range f(H-field)
(Waveguide R22, f = 1800 MHz)
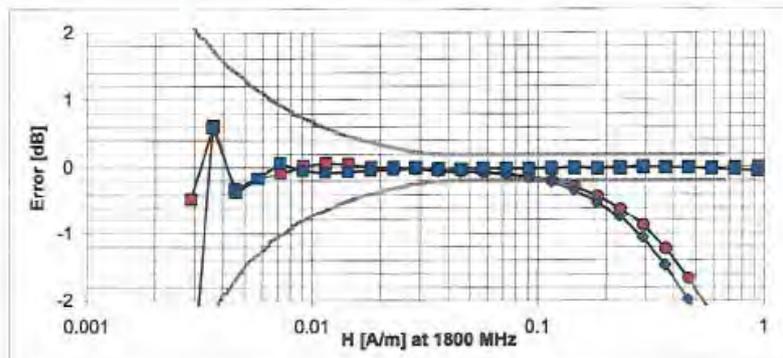
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

H3DV6 SN:6184

January 19, 2009

Deviation from Isotropy in Air
Error (ϕ, ϑ),   f = 900 MHz

Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)