



# HCT CO., LTD.

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## HAC RF Emission TEST REPORT

### SHARP CORPORATION

22-22 Nagaike-cho, Abeno-ku, Osaka 545-8522  
Japan

Date of Issue: Dec.23, 2010

Test Report No.: HCTA1012FM02

Test Site: HCT CO., LTD.

### FCC ID: APYNAR0074

### APPLICANT: SHARP CORPORATION

Application Type:	Certification
EUT Type:	GSM/UMTS Phone with Bluetooth/WiFi
Tx Frequency:	824.20 - 848.80 MHz (GSM850) 1 850.20 -1 909.80 MHz (GSM1900) 826.4 - 846.6 MHz (WCDMA850) 1 852.4 – 1 907.6 MHz (WCDMA1900)
Maximum Conducted Power (HAC):	1.78 W GSM850 (32.5 dBm), 0.89 W GSM1900 (29.5 dBm)
Trade Name/Model(s):	0.22 W WCDMA850 (23.5 dBm), 0.22 W WCDMA1900 (23.5 dBm)
FCC Classification:	SHARP CORPORATION / ADS1
FCC Rule Part(s):	Licensed Portable Transmitter Held to Ear (PCE)
HAC Standard:	§20.19 ANSI C63.19-2007

### Hearing Aid Near-Field Category: M3

This wireless portable device has been shown to be hearing-aid compatible under the above rated category, specified in ANSI/IEEE Std. C63.19-2007 and had been tested in accordance with the specified measurement procedures. Hearing-Aid Compatibility is based on the assumption that all production units will be designed electrically identical to the device tested in this report.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

HCT Co., Ltd. Certifies that no party to this application has been denied FCC benefits pursuant to section 5301 of the Anti- Drug Abuse Act of 1998, 21 U.S. C. 862.

Report prepared by  
: Young-Soo Jang  
Test Engineer of SAR Part

Approved by  
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Manager of SAR Part

## Table of Contents

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1. APPLICANT / EUT DESCRIPTION .....	3
2. HAC MEASUREMENT SET- UP .....	4
3. SYSTEM SPECIFICATIONS .....	5
4. EUT ARRANGEMENT .....	7
5. SYSTEM VALIDATION .....	8
6. PROBE MODULATION FACTOR .....	10
7. FCC 3G MEASUREMENTS – MAY / JUNE 2006 .....	15
8. TEST PROCEDURE .....	17
9. ANSI/IEEE C63.19 PERFORMANCE CATEGORIES .....	19
10. MEASUREMENT UNCERTAINTIES .....	20
11. HAC TEST DATA SUMMARY .....	21
12. HAC TEST EQUIPMENT LIST .....	26
13. CONCLUSION .....	27

Appendix A\_HAC TEST PLOTS

Appendix B\_TEST SET-UP PHOTO

Appendix C\_DIPOLE VALIDATION PLOTS

Appendix D\_PROBE CALIBRATION DATA

Appendix E\_DIPOLE CALIBRATION DATA

# HAC MEASUREMENT REPORT

## 1. APPLICANT / EUT DESCRIPTION

### 1.1 Applicant

- Company Name: SHARP CORPORATION
- Attention: 22-22 Nagaike-cho, Abeno-ku, Osaka 545-8522 Japan
- Tel. / Fax : TEL: +81 743 55 4091 FAX: +81 743 55 2553

### 1.2 EUT Description

- EUT Type: GSM/UMTS Phone with Bluetooth/WiFi
- Trade Name: SHARP CORPORATION
- Model(s): ADS1
- FCC ID: APYNAR0074
- Serial Number(s): #1
- Tx Frequency: 824.20 - 848.80 MHz (GSM850), 1 850.20 - 1 909.80 MHz (GSM1900)  
826.4 - 846.6 MHz (WCDMA850), 852.4 - 1 907.6 MHz (WCDMA1900)
- FCC Classification: Licensed Portable Transmitter Held to Ear (PCE)
- FCC Rule Part(s): § 20.19(b); §6.3(v), §7.3(v)
- Modulation(s): GSM850, GSM1900, WCDMA850, WCDMA1900
- Antenna Type: Intenna
- Date(s) of Tests: Dec. 20, 2010
- Place of Tests: HCT CO., LTD.  
Icheon, Kyoung ki-Do, KOREA
- Report Serial No.: HCTA1012FM02
- Max E-Field Emission: GSM1900 512ch, 1 850.2 MHz = 36.6 dBV/m (M3)  
WCDMA1900 9400ch, 1 880.00 MHz = 31.9 dBV/m (M4)
- Max H-Field Emission: GSM1900 810ch, 1 909.8 MHz = -13.8 dBA/m (M3)  
WCDMA1900 9400ch, 1 880.00 MHz = -19.4 dBV/m (M4)

## 2. HAC MEASUREMENT SET-UP

These measurements are performed using the DASY4 automated dosimetric assessment system. It is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland. It consists of high precision robotics system (Staubli), robot controller, Pentium IV computer, near-field probe, probe alignment sensor. The robot is a six-axis industrial robot performing precise movements.

A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The PC consists of the HP Pentium IV 3.0 GHz computer with Windows XP system and HAC Measurement Software DASY4, A/D interface card, monitor, mouse, and keyboard. The Staubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card.

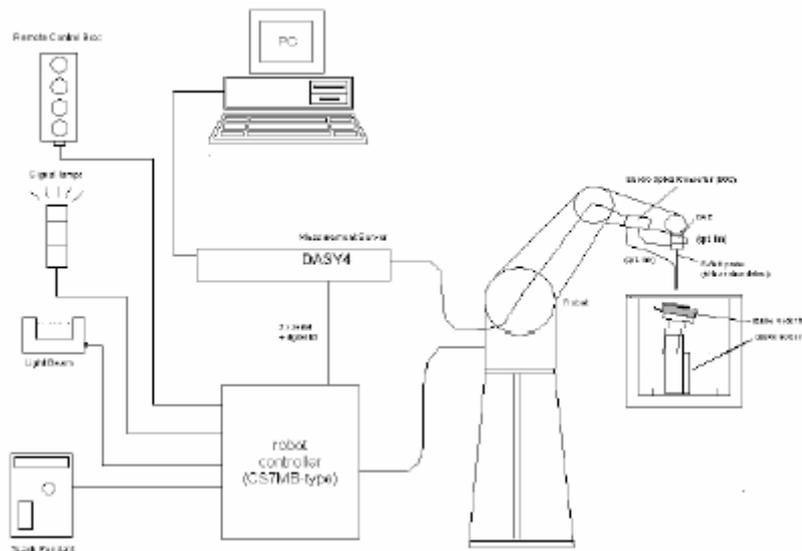


Figure 1. HAC Test Measurement Set-up

The DAE4 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 PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.

### 3. SYSTEM SPECIFICATIONS

#### 3.1 Probe

##### 3.1.1 E-Field Probe Description

Construction	One dipole parallel, two dipoles normal to probe axis Built-in shielding against static charges	 <p>[ E-Field Probe ]</p>
Calibration	In air from 100 MHz to 3.0 GHz (absolute accuracy $\pm 6.0\%$ , $k = 2$ )	
Frequency	100 MHz to > 6 GHz; Linearity: $\pm 0.2$ dB (100 MHz to 3 GHz)	
Directivity	$\pm 0.2$ dB in air (rotation around probe axis) $\pm 0.4$ 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	$\pm 0.2$ 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	

##### 3.1.2 H-Field Probe Description

Construction	Three concentric loop sensors with 3.8 mm loop diameters resistively loaded detector diodes for linear response Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., glycoether)	 <p>[ H-Field Probe ]</p>
Frequency	200 MHz to > 3 GHz (absolute accuracy $\pm 6.0\%$ , $k = 2$ ); Output linearized	
Directivity	$\pm 0.25$ dB (spherical isotropy error)	
Dynamic Range	10 mA/m to 2 A/m at 1 GHz	
E-Field Interference	< 10 % at 3 GHz (for plane wave)	
Dimensions	Overall length: 330 mm (Tip: 40 mm) Tip diameter: 6 mm (Body: 12 mm) Distance from probe tip to dipole centers: 3 mm The closest part of the sensor element is 1.9 mm closer to the tip	

### 3.2 Phantom & Device Holder



Figure 2. HAC Phantom & Device Holder

The Test Arch phantom should be positioned horizontally on a stable surface. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

The devices can be easily, accurately, and repeatable positioned according to the FCC specifications.

### 3.3 Robotic System Specifications

<b>Specifications</b>	
<b>POSITIONER:</b>	Stäubli Unimation Corp. Robot Model: RX90LB
<b>Repeatability:</b>	0.02 mm
<b>No. of axis:</b>	6
<b>Data Acquisition Electronic (DAE) System</b>	
<b>Cell Controller</b>	
<b>Processor:</b>	Pentium IV
<b>Clock Speed:</b>	3.0 GHz
<b>Operating System:</b>	Windows XP
<b>Data Card:</b>	DASY4 PC-Board
<b>Data Converter</b>	
<b>Features:</b>	Signal Amplifier, multiplexer, A/D converter, and control logic
<b>Software:</b>	DASY4 software
<b>Connecting Lines:</b>	Optical downlink for data and status info. Optical uplink for commands and clock
<b>PC Interface Card</b>	
<b>Function:</b>	24 bit (64 MHz) DSP for real time processing Link to DAE 16 bit A/D converter for surface detection system serial link to robot direct emergency stop output for robot

## 4. EUT ARRANGEMENT

### 4.1 WD RF Emission Measurements Reference and Plane

Figure 3. Illustrate the references and reference plane that shall be used in the WD emissions measurement.

- 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 WD (speaker or T-coil).
- 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 WD handset, which, in normal handset use, rest against the ear.
- The measurement plane is parallel to, and 1.5 cm in front of, the reference plane.



Figure 3. WD reference and plane for RF emission measurements

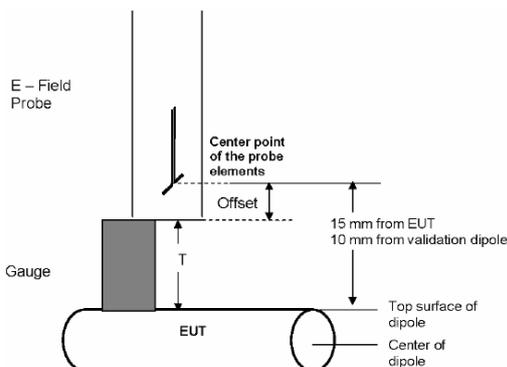


Figure 4. Gauge Block with E-Field Probe

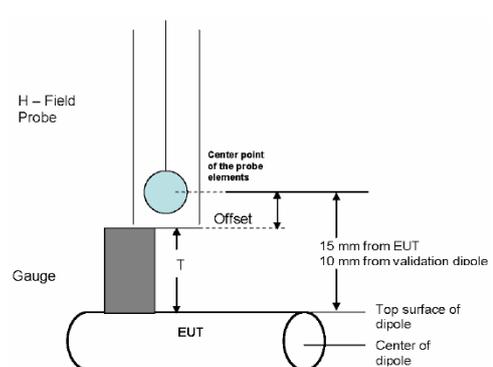


Figure 5. Gauge Block with H-Field Probe

## 5. SYSTEM VALIDATION

The test setup was validated when configured and verified periodically thereafter to ensure proper function. The procedure is a validation procedure using dipole antennas for which the field levels were computed by FDTD modeling.

### 5.1 Validation Procedure

Place a dipole antenna meeting the requirements given in ANSI-C63.19 in the position normally occupied by the WD. The dipole antenna serves as a known source for an electrical and magnetic output. Position the E-field and H-field probes so that:

- the probes and their cables are parallel to the coaxial feed of the dipole antenna
- the probe cables and the coaxial feed of the dipole antenna approach the measurement area from opposite directions; and
- the probes are 10 mm from the surface of the dipole elements.

Scan the length of the dipole with both E-field and H-field probes and record the maximum values for each. Compare the readings to expected values.

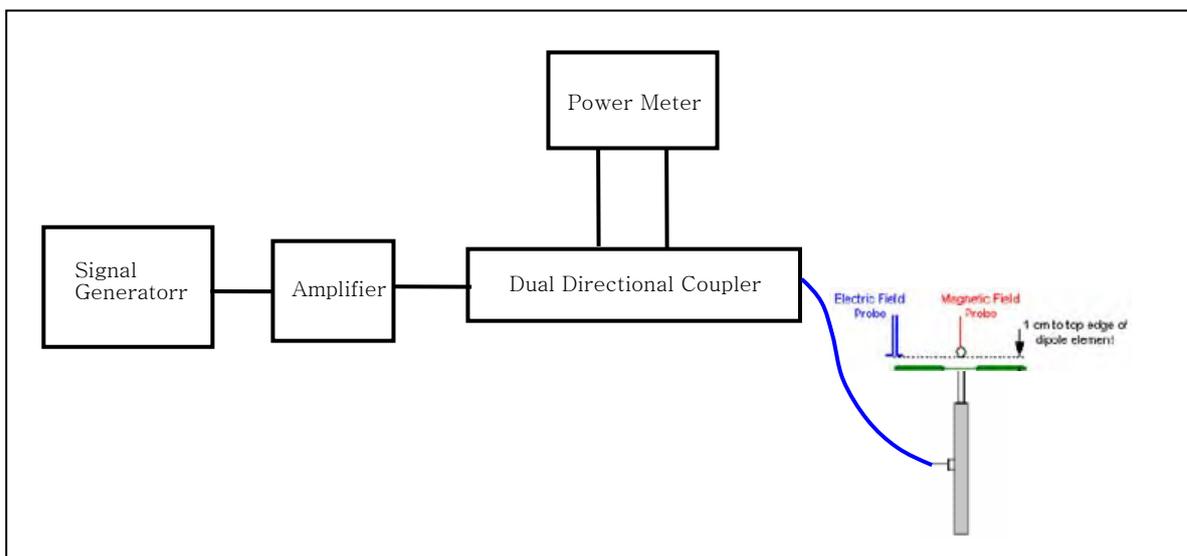


Figure 6. Dipole Validation SET-UP

## 5.2 Validation Result

### 5.2.1 E-Field Scan

Mode	Freq. [MHz]	Input Power [dBm]	Measured Value [V/m]	Target Value [V/m] SPEAG	Deviation [%]	Limit [%]
CW	835	20	163.2	161.3	+ 1.17	± 25
CW	1 880	20	142.3	139.5	+ 2.00	± 25

### 5.2.2 H-Field Scan

Mode	Freq. [MHz]	Input Power [dBm]	Measured Value [A/m]	Target Value [A/m] SPEAG	Deviation [%]	Limit [%]
CW	835	20	0.451	0.464	- 2.80	± 25
CW	1 880	20	0.460	0.472	- 2.54	± 25

**Notes:**

- 1) Deviation (%) = 100 \* (Measured value minus Target value) divided by Target value.  
ANSI-C63.19 requires values to be within 25 % of their targets. 12 % is deviation and 13 % is measurement uncertainty.
- 2) The maximum E-field or H-field were evaluated and compared to the target values provided by SPEAG in the calibration certificate of specific dipoles.
- 3) Please refer to the attachment for detailed measurement data and plot.

## 6. Probe Modulation Factor

A calibration was made of the modulation response of the probe and its instrumentation chain. This calibration was performed with the field probe, attached to its instrumentation. The response of the probe system to a CW field at the frequency of interest is compared to its response to a modulated signal with equal peak amplitude to that of a CW signal. The field level of the test signals are ensured to 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 reading was applied to the DUT measurements.

All voice modes for this device have been investigated in this section of the report. According to the FCC 3G Measurement Procedures, May 2006 for RF Emissions, variations in peak field and power readings.

### This was done using the following procedure:

1. The probe was illuminated with a CW signal at the intended measurement frequency and wireless device power.
2. The probe was positioned at the field maxima over the dipole antenna (determined after an area scan over the dipole) illuminated with the CW signal.
3. The reading of the probe measurement system of the CW signal at the maximum point was recorded.
4. Using a Spectrum Analyzer, the modulated signal adjusted with the same peak level of the CW signal was determined.
5. The probe measurement system reading was recorded with the modulated signal. The appropriate system crest factors for the modulation type were configured in the software to the system measurements.
6. The ratio of the CW reading to modulated signal reading is the probe modulation factor (PMF) for the modulation and field probe combination. This was repeated for 80 % AM.
7. Steps 1-6 were repeated at all frequency bands and for both E and H field probes.

The modulation factors obtained were applied to readings taken of the actual wireless device, in order to obtain an accurate peak field reading using the formula:

$$\text{Peak} = 20 \cdot \log (\text{Raw} \cdot \text{PMF})$$

This method correlates well with the modulation using the DUT in the alternative substitution method.

See below for correlation of signal:

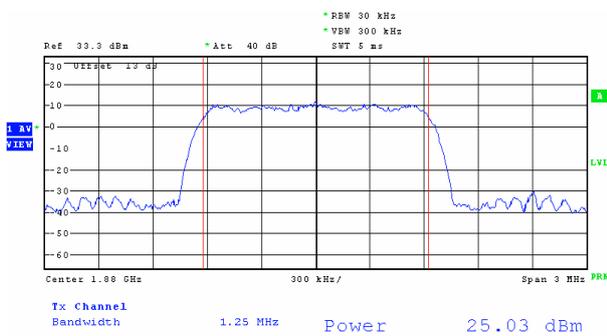


Figure. 7

Signal Generator Modulated Signal

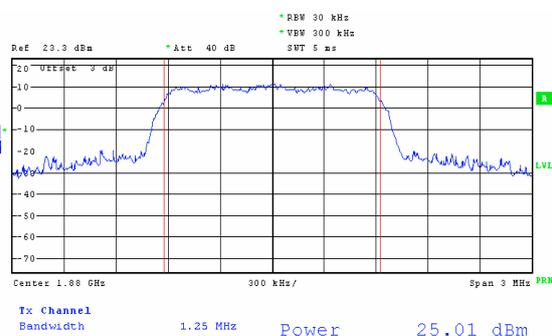


Figure. 8

Wireless Device Modulated Signal

## 6.2 Modulation Factor

### 6.2.1 E-Field (GSM)

Mode	Freq. [MHz]	Input Power [dB]	E-Field measured value [V/m]	Probe Modulation Factor
CW	835	32.5	739	-
80 % AM		32.5	529.6	1.395
GSM		32.5	279.5	2.644
CW	1 880	29.5	417	-
80 % AM		29.5	372.5	1.119
GSM		29.5	163.8	2.546

### 6.2.2 H-Field (GSM)

Mode	Freq. [MHz]	Input Power [dB]	E-Field measured value [A/m]	Probe Modulation Factor
CW	835	32.5	2.128	-
80 % AM		32.5	1.64	1.298
GSM		32.5	1.009	2.109
CW	1 880	29.5	1.458	-
80 % AM		29.5	1.253	1.164
GSM		29.5	0.637	2.289

Notes:

- 1) Modulation Factor = CW / WD\_GSM

### 6.2.3 E-Field (WCDMA)

Mode	Freq. [MHz]	Input Power [dB]	E-Field measured value [V/m]	Probe Modulation Factor
CW	835	23.5	238.7	-
80 % AM		23.5	157.7	1.514
WCDMA		23.5	314.3	0.759
CW	1 880	23.5	207.1	-
80 % AM		23.5	130.2	1.591
WCDMA		23.5	248.7	0.833

### 6.2.4 H-Field (WCDMA)

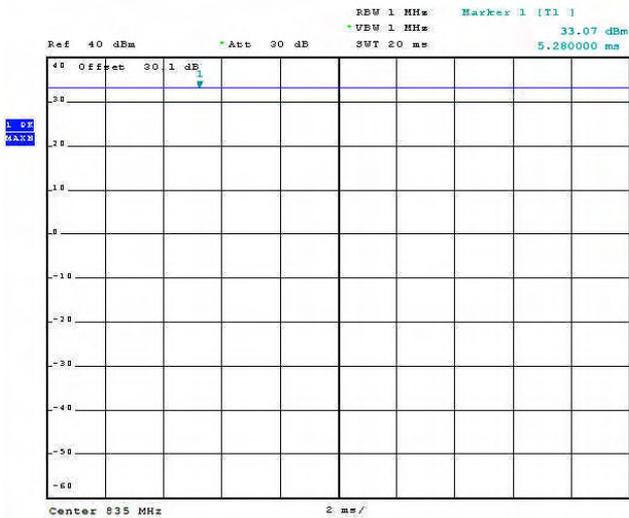
Mode	Freq. [MHz]	Input Power [dB]	E-Field measured value [A/m]	Probe Modulation Factor
CW	835	23.5	0.733	-
80 % AM		23.5	0.475	1.543
WCDMA		23.5	0.868	0.844
CW	1 880	23.5	0.703	-
80 % AM		23.5	0.497	1.414
WCDMA		23.5	0.841	0.836

Notes:

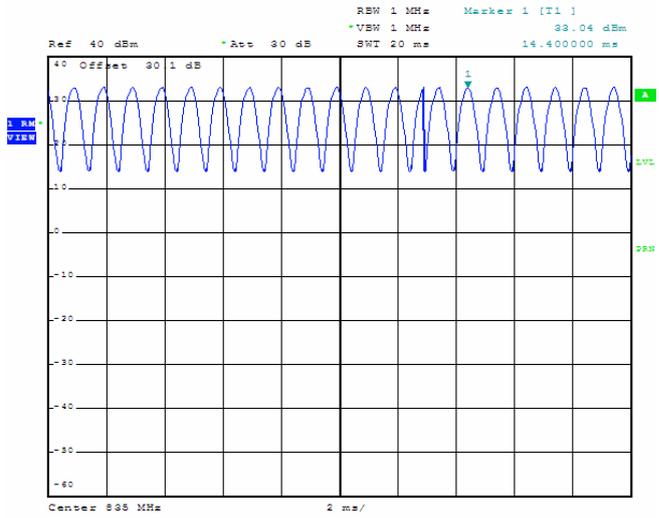
Modulation Factor =CW / WD\_WCDMA

## 6.2.5 PMF Peak Power Measurement Plots

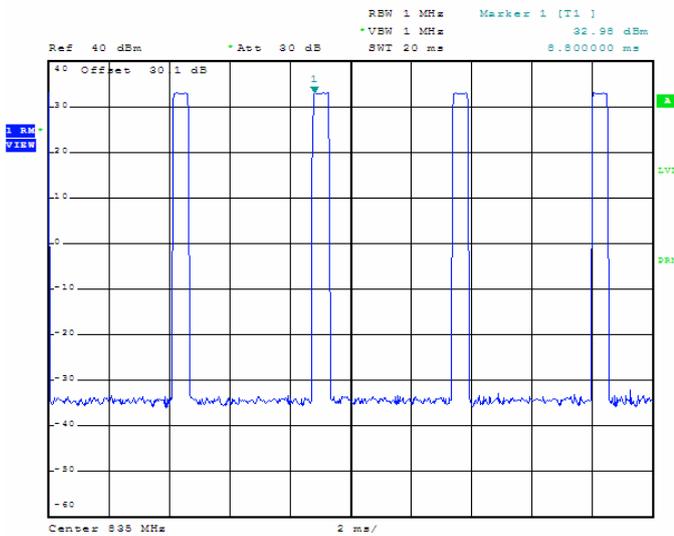
### Probe Modulation Factor (CW)



### Probe Modulation Factor (AM 80 %)



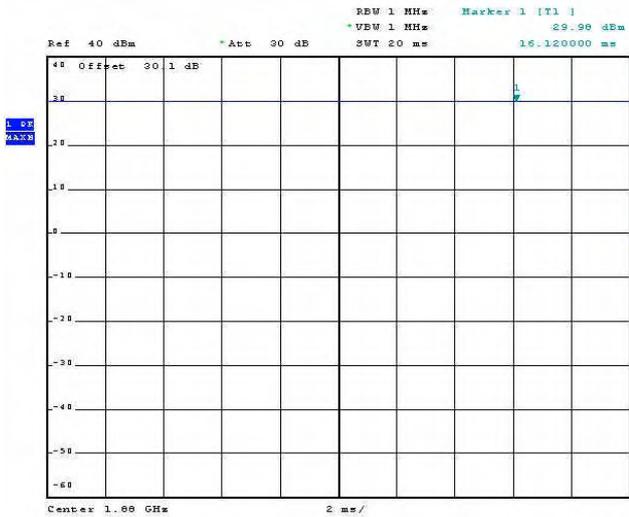
### Probe Modulation Factor (GSM)



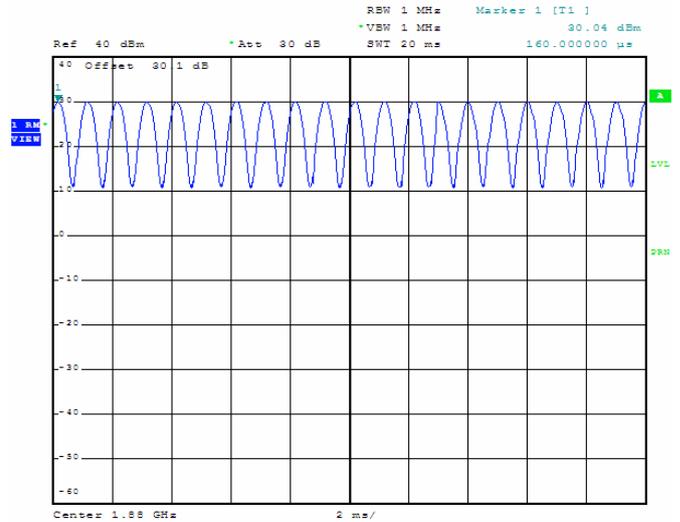
### Spectrum Analyzer Settings

- Input Power: 33.0 dBm, 30.0 dBm
- RBW: 1 MHz
- Video Bandwidth: 1 MHz
- Span: Zero
- Sweep Time: 20 ms
- Detection: Peak detection (RMS)

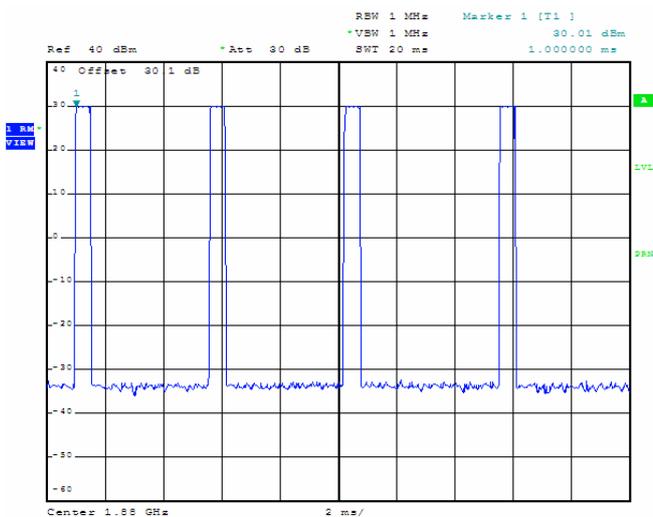
■ Probe Modulation Factor (CW)



■ Probe Modulation Factor (AM 80 %)



■ Probe Modulation Factor (GSM)



**Spectrum Analyzer Settings**

- Input Power: 33.0 dBm, 30.0 dBm
- RBW: 1 MHz
- Video Bandwidth: 1 MHz
- Span: Zero
- Sweep Time: 20 ms
- Detection: Peak detection (RMS)

## **7. FCC 3G MEASUREMENTS – MAY / JUNE 2006**

Power measurements were performed using a base station simulator under digital average power.

### **7.1 Procedures Used to Establish RF Signal for HAC Testing**

The handset was placed into a simulated call using a base station simulator in a shielded chamber.

Such test signals offer a consistent means for testing HAC and are recommended for evaluating HAC.

Measurements were taken with a fully charged battery. In order to verify that the device was tested and maintained at full power, this was configured with the base station simulator. The HAC measurement software calculates a reference point at the start and end of the test to check for power drifts. If conducted power deviations of more than 5 % occurred, the tests were repeated.

### **7.1 HAC Measurement Conditions for UMTS**

#### **Output Power Verification**

Maximum output power is verified on the High, Middle and Low channel according to the general description in section 5.2 of 3GPP TS 34.121, using the appropriate RMC or AMR with TPC(transmit power control) set to all "1s".

#### **HAC Measurements**

HAC is measured using the 12.2 kbps RMC with TPC bits configured to all "1s". HAC in AMR configurations is not required when the maximum average output of each RF channel for 12.2 kbps AMR is less than 1/4 dB higher than that measured in 12.2 kbps RMC. Otherwise, HAC is measured on the maximum output channel in AMR with a 3.4kbps SRB (signaling radio bearer) using the configuration that results in the highest HAC for that RF channel in 12.2 RMC.

## 8. TEST PROCEDURE

### Test Instructions

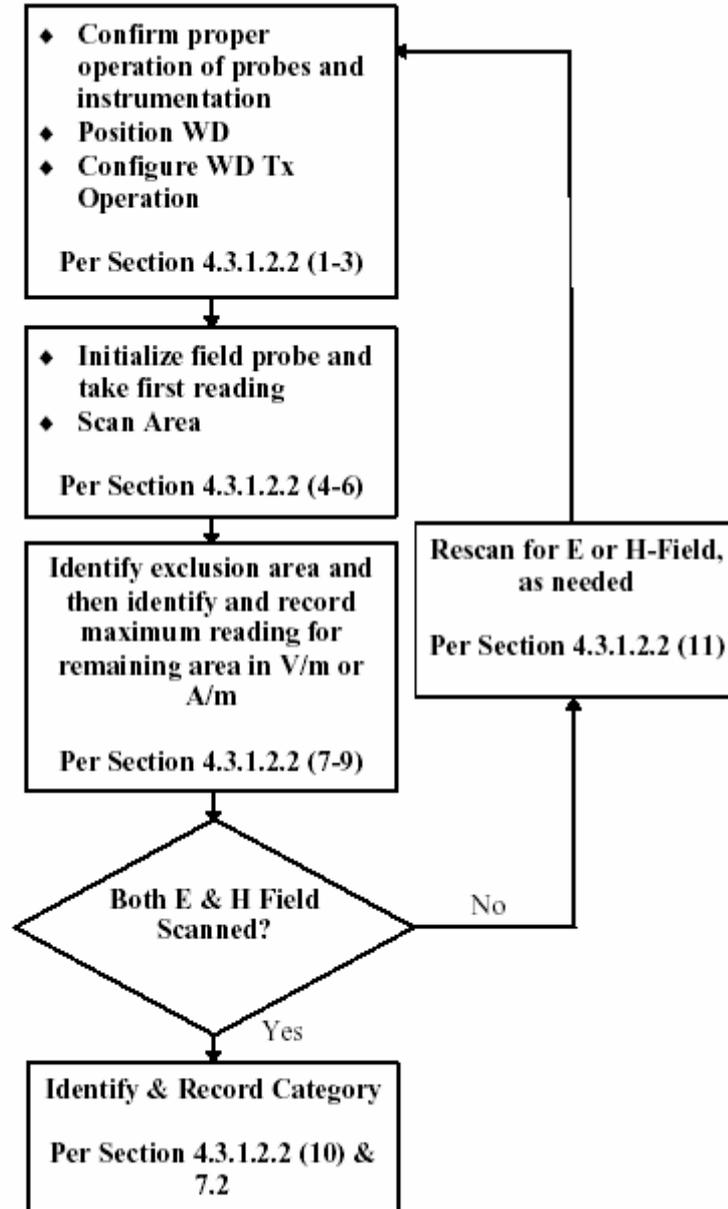


Figure 9. WD near-field emission automated test flowchart

**The evaluation was performed with the following procedure:**

1. Confirm proper operation of the field probe, probe measurement system and other instrumentation and the positioning system.
2. Position the WD in its intended test position. The measurement should be performed at a distance 1.5 cm from the probe elements so the gauge block can simplify this positioning.
3. Configure the WD normal operation for maximum rated RF output power, at the desired channel and other operating parameters, as intended for the test.
4. The center sub-grid shall be centered on the center of the WD output (acoustic or T-Coil output), as appropriate.
5. A Surface calibration was performed before each setup change to ensure repeatable spacing and proper maintenance of the measurement plane using the HAC Phantom.
6. Locate the field probe at reference location and measure the field strength.
7. Scan the entire 5 cm by 5 cm region at 5 mm increments and record the reading at each measurement point.
8. Identify the maximum field reading within the non-excluded sub-grids identified in Step 7.
9. Move the probe to the location of maximum scan measurement and then 360° rotating the probe to align it for the maximum reading at that position.
10. Locate the field probe at the reference location and measure the field strength for drift evaluation. If conducted power deviations of more than 5 % occurred, the tests were repeated.
11. Convert the maximum field strength reading identified in Step 8 to V/m or A/m, as appropriate. For probes which require a probe modulation factor, this conversion shall be done using the appropriate probe modulation.
12. Repeat Step 1 through Step 11 for both the E and H field measurements.

## 9. ANSI/IEEE C63.19 PERFORMANCE CATEGORIES

The EUT must meet the following M3 or M4 category:

Category	Telephone RF Parameters		
Near Field	AWF [dB]	E-Field Emissions dB [V/m]	H-Field Emissions dB [A/m]
Frequency < 960 MHz			
M1	0	56 to 61	+ 5.6 to + 10.6
	-5	53.5 to 58.5	+ 3.1 to + 8.1
M2	0	51 to 56	+ 0.6 to + 5.6
	-5	48.5 to 53.5	- 1.9 to + 3.1
M3	0	46 to 51	- 4.4 to + 0.6
	-5	43.5 to 48.5	- 6.9 to - 1.9
M4	0	< 46	< - 4.4
	-5	< 43.5	< - 6.9
Frequency > 960 MHz			
M1	0	46 to 51	- 4.4 to 0.6
	-5	43.5 to 48.5	- 6.9 to -1.9
M2	0	41 to 46	- 9.4 to - 4.4
	-5	38.5 to 43.5	-11.9 to - 6.9
M3	0	36 to 41	- 14.4 to - 9.4
	-5	33.5 to 38.5	- 16.9 to -11.9
M4	0	< 36	< - 14.4
	-5	< 33.5	< - 16.9

**Table 1. Telephone near-field categories in linear units**

## 10. MEASUREMENT UNCERTAINTIES

### 10.1 E-Field

HAC (E-Field) Uncertainty Budget [According to ANSI C63.19]										Note/ Comment
Error Description	Uncertainty [%]	Probability Distribution	Divisor	ci [E]	Standard Uncertainty [E]	Stand Uncert*2	(Stand Uncert*2) X (ci*2)	Vi & Veff		
<b>Measurement system</b>										
1	Probe Calibration	5.1 %	Normal	1.00	1	5.1 %	26.01	26.01	∞	
2	Axial Isotropy	4.7 %	Rectangular	1.73	1	2.7 %	7.36	7.36	∞	
3	Sensor Displacement	16.5 %	Rectangular	1.73	1	9.5 %	90.75	90.75	∞	
4	Boundary effect	2.4 %	Rectangular	1.73	1	1.4 %	1.92	1.92	∞	
5	Linearity	4.7 %	Rectangular	1.73	1	2.7 %	7.36	7.36	∞	
6	Scaling to peak Envelope Power	2.0 %	Rectangular	1.73	1	1.2 %	1.33	1.33	∞	
7	System Detection limits	1.0 %	Rectangular	1.73	1	0.6 %	0.33	0.33	∞	
8	Readout Electronics	0.3 %	Normal	1.00	1	0.3 %	0.09	0.09	∞	
9	Response time	0.8 %	Rectangular	1.73	1	0.5 %	0.21	0.21	∞	
10	Integration time	2.6 %	Rectangular	1.73	1	1.5 %	2.25	2.25	∞	
11	RF Ambient Conditions	3.0 %	Rectangular	1.73	1	1.7 %	3.00	3.00	∞	
12	RF Reflections	1.2 %	Rectangular	1.73	1	0.7 %	0.50	0.50	∞	
13	Probe positioner	1.2 %	Rectangular	1.73	1	0.7 %	0.48	0.48	∞	
14	Probe positioning	4.7 %	Rectangular	1.73	1	2.7 %	7.36	7.36	∞	
15	Extrap. And Interpolation	1.0 %	Rectangular	1.73	1	0.6 %	0.33	0.33	∞	
<b>Test Sample Related</b>										
16	Device Positioning Vertical	4.7 %	Rectangular	1.73	1	2.7 %	7.36	7.36	∞	
17	Device Positioning Lateral	1.0 %	Rectangular	1.73	1	0.6 %	0.33	0.33	∞	
18	Device Holder and Phantom	2.4 %	Rectangular	1.73	1	1.4 %	1.92	1.92	∞	
19	Test Sample	0.4 %	Normal	1.00	1	0.4 %	0.16	0.16	9	0.17 dB
20	Power drift	3.0 %	Rectangular	1.73	1	1.7 %	3.00	3.00	∞	
<b>PMF Calculations</b>										
21	Power Sensor	1.0 %	Rectangular	1.73	1	0.6 %	0.32	0.32	∞	
22	Dual Directional Coupler	1.0 %	Rectangular	1.73	1	0.6 %	0.32	0.32	∞	
<b>Phantom and Setup Related</b>										
23	Phantom Thickness	2.4 %	Rectangular	1.73	1	1.4 %	1.92	1.92	∞	
Combined standard Uncertainty [%]						12.8 %		164.64		0.523 dB
Expanded standard Uncertainty [k = 2 , Confidence 95 %]						25.7 %				0.993 dB

**Table 2. Uncertainties (E-Field)**

**Notes:**

1. Worst-Case uncertainty budget for HAC free field assessment according to ANSI-C 63.19[1]. The budget is valid for the frequency range 800 MHz-3 GHz and represents a worst-Case analysis. For specific test sand configurations, the uncertainty could be considerably smaller. Some of the parameters are dependent on the user situations and need adjustment according to the actual laboratory conditions.
2. \* Uncertainty specifications from Schmidt & Partner Engineering AG (not site specific)

## 10.2 H-Field

HAC (H-Field) Uncertainty Budget [According to ANSI C63.19]										Note/ Comment
Error Description	Uncertainty [%]	Probability Distribution	Divisor	ci [H]	Standard Uncertainty [H]	Stand Uncert*2	(Stand Uncert*2) X (ci^2)	Vi & Veff		
<b>Measurement system</b>										
1	Probe Calibration	5.1 %	Normal	1.00	1	5.1 %	26.01	26.01	∞	
2	Axial Isotropy	4.7 %	Rectangular	1.73	1	2.7 %	7.36	7.36	∞	
3	Sensor Displacement	16.5 %	Rectangular	1.73	0.145	1.4 %	1.91	0.04	∞	
4	Boundary effect	2.4 %	Rectangular	1.73	1	1.4 %	1.92	1.92	∞	
5	Linearity	4.7 %	Rectangular	1.73	1	2.7 %	7.36	7.36	∞	
6	Scaling to peak Envelope Power	2.0 %	Rectangular	1.73	1	1.2 %	1.33	1.33	∞	
7	System Detection limits	1.0 %	Rectangular	1.73	1	0.6 %	0.33	0.33	∞	
8	Readout Electronics	0.3 %	Normal	1.00	1	0.3 %	0.09	0.09	∞	
9	Response time	0.8 %	Rectangular	1.73	1	0.5 %	0.21	0.21	∞	
10	Integration time	2.6 %	Rectangular	1.73	1	1.5 %	2.25	2.25	∞	
11	RF Ambient Conditions	3.0 %	Rectangular	1.73	1	1.7 %	3.00	3.00	∞	
12	RF Reflections	1.1 %	Rectangular	1.00	1	1.1 %	1.14	1.14	∞	
13	Probe positioner	1.2 %	Rectangular	1.73	0.67	0.5 %	0.22	0.10	∞	
14	Probe positioning	4.7 %	Rectangular	1.73	0.67	1.8 %	3.31	1.48	∞	
15	Extrap. And Interpolation	1.0 %	Rectangular	1.73	1	0.6 %	0.33	0.33	∞	
<b>Test Sample Related</b>										
16	Device Positioning Vertical	4.7 %	Rectangular	1.73	0.67	1.8 %	3.31	7.32	∞	
17	Device Positioning Lateral	1.0 %	Rectangular	1.73	1	0.6 %	0.33	0.33	∞	
18	Device Holder and Phantom	2.4 %	Rectangular	1.73	1	1.4 %	1.92	1.92	∞	
19	Test Sample	0.3 %	Normal	1.00	1	0.3 %	0.08	0.08	9	0.013 dB
20	Power drift	3.0 %	Rectangular	1.73	1	1.7 %	3.00	3.00	∞	
<b>PMF Calculations</b>										
21	Power Sensor	1.0 %	Rectangular	1.73	1	0.6 %	0.32	0.10	∞	
22	Dual Directional Coupler	1.0 %	Rectangular	1.73	1	0.6 %	0.32	0.32	∞	
<b>Phantom and Setup Related</b>										
23	Phantom Thickness	2.4 %	Rectangular	1.73	0.67	0.9 %	0.86	0.39	∞	
Combined standard Uncertainty [%]					8.2 %		66.44		0.342 dB	
Expanded standard Uncertainty [k = 2 , Confidence 95 %]					16.3 %				0.6558 dB	

**Table 2. Uncertainties (H-Field)**

**Notes:**

1. Worst-Case uncertainty budget for HAC free field assessment according to ANSI-C 63.19[1]. The budget is valid for the frequency range 800 MHz-3 GHz and represents a worst-Case analysis. For specific test sand configurations, the uncertainty could be considerably smaller. Some of the parameters are dependent on the user situations and need adjustment according to the actual laboratory conditions.

2. \* Uncertainty specifications from Schmidt & Partner Engineering AG (not site specific)

## 11. HAC TEST DATA SUMMARY

**Ambient TEMPERATURE (°C):** 21.4
**S/N:** #1

### 11.1 E-Field Measurement Results (GSM850 / GSM1900 DATA)

Mode	Ch.	Back light	Battery	Antenna	Time Avg. Field [V/m]	Peak Field [dBV/m]	FCC Limit [dBV/m]	FCC MARGIN [dB]	RESULT	Exclusion Block
GSM850	128	off	Standard	Intenna	57.7	43.7	48.5	-4.83	<b>M3</b>	none
GSM850	190	off	Standard	Intenna	65.5	44.8	48.5	-3.73	<b>M3</b>	none
GSM850	251	off	Standard	Intenna	57.1	43.6	48.5	-4.92	<b>M3</b>	none
GSM1900	512	off	Standard	Intenna	26.7	36.6	38.5	-1.86	<b>M3</b>	none
GSM1900	661	off	Standard	Intenna	25.5	36.3	38.5	-2.24	<b>M3</b>	none
GSM1900	810	off	Standard	Intenna	22.5	35.2	38.5	-3.33	<b>M3</b>	none

**NOTES:**

- All modes of operation were investigated and the worst-case are reported.
- Battery Type  Standard  Extended  Fixed
- Power Measured  Conducted  EIRP  ERP
- Test Signal Call Mode  Manual Test cord  Base Station Simulator
- SAR Measurement System  SPEAG

## 11.2 H-Field Measurement Results (GSM850 / GSM1900 DATA)

**Ambient TEMPERATURE (°C):** 21.4
**S/N:** #1

Mode	Ch.	Back light	Battery	Antenna	Time Avg. Field [A/m]	Peak Field [dBA/m]	FCC Limit [dBA/m]	FCC MARGIN [dB]	RESULT	Exclusion Block
GSM850	128	off	Standard	Intenna	0.112	-12.6	-1.9	-10.66	<b>M4</b>	none
GSM850	190	off	Standard	Intenna	0.127	-11.4	-1.9	-9.54	<b>M4</b>	none
GSM850	251	off	Standard	Intenna	0.112	-12.5	-1.9	-10.62	<b>M4</b>	none
GSM1900	512	off	Standard	Intenna	0.078	-15.0	-11.9	-3.06	<b>M3</b>	none
GSM1900	661	off	Standard	Intenna	0.085	-14.3	-11.9	-2.35	<b>M3</b>	none
GSM1900	810	off	Standard	Intenna	0.089	-13.8	-11.9	-1.88	<b>M3</b>	none

**NOTES:**

- All modes of operation were investigated and the worst-case are reported.
- Battery Type  Standard  Extended  Fixed
- Power Measured  Conducted  EIRP  ERP
- Test Signal Call Mode  Manual Test cord  Base Station Simulator
- SAR Measurement System  SPEAG

### 11.3 E-Field Measurement Results (WCDMA850 /WCDMA1900 DATA)

Ambient TEMPERATURE (°C): 21.4

S/N: #1

Mode	Ch.	Back light	Battery	Antenna	Time Avg. Field [V/m]	Peak Field [dBV/m]	FCC Limit [dBV/m]	FCC MARGIN [dB]	RESULT	Exclusion Block
WCDMA850	4132	off	Standard	Intenna	57.7	32.8	51	-18.17	<b>M4</b>	none
WCDMA850	4183	off	Standard	Intenna	64.1	33.7	51	-17.25	<b>M4</b>	none
WCDMA850	4233	off	Standard	Intenna	62.7	33.6	51	-17.44	<b>M4</b>	none
WCDMA1900	9262	off	Standard	Intenna	41.0	30.7	41	-10.33	<b>M4</b>	none
WCDMA1900	9400	off	Standard	Intenna	47.2	31.9	41	-9.11	<b>M4</b>	none
WCDMA1900	9538	off	Standard	Intenna	44.5	31.4	41	-9.61	<b>M4</b>	none

**NOTES:**

- All modes of operation were investigated and the worst-case are reported.
- Battery Type                     Standard    Extended    Fixed
- Power Measured                 Conducted    EIRP         ERP
- Test Signal Call Mode         Manual Test cord    Base Station Simulator
- SAR Measurement System  SPEAG

## 11.4 H-Field Measurement Results (WCDMA850 /WCDMA1900 DATA)

Ambient TEMPERATURE (°C): 21.4

S/N: #1

Mode	Ch.	Back light	Battery	Antenna	Time Avg. Field [A/m]	Peak Field [dBA/m]	FCC Limit [dBA/m]	FCC MARGIN [dB]	RESULT	Exclusion Block
WCDMA850	4132	off	Standard	Intenna	0.113	-20.5	0.6	-21.05	<b>M4</b>	none
WCDMA850	4183	off	Standard	Intenna	0.123	-19.7	0.6	-20.31	<b>M4</b>	none
WCDMA850	4233	off	Standard	Intenna	0.125	-19.6	0.6	-20.17	<b>M4</b>	none
WCDMA1900	9262	off	Standard	Intenna	0.119	-20.1	-9.4	-10.67	<b>M4</b>	none
WCDMA1900	9400	off	Standard	Intenna	0.129	-19.4	-9.4	-9.95	<b>M4</b>	none
WCDMA1900	9538	off	Standard	Intenna	0.123	-19.7	-9.4	-10.34	<b>M4</b>	none

**NOTES:**

1. All modes of operation were investigated and the worst-case are reported.
2. Battery Type                     Standard    Extended    Fixed
3. Power Measured                 Conducted    EIRP       ERP
4. Test Signal Call Mode         Manual Test cord    Base Station Simulator
5. SAR Measurement System  SPEAG

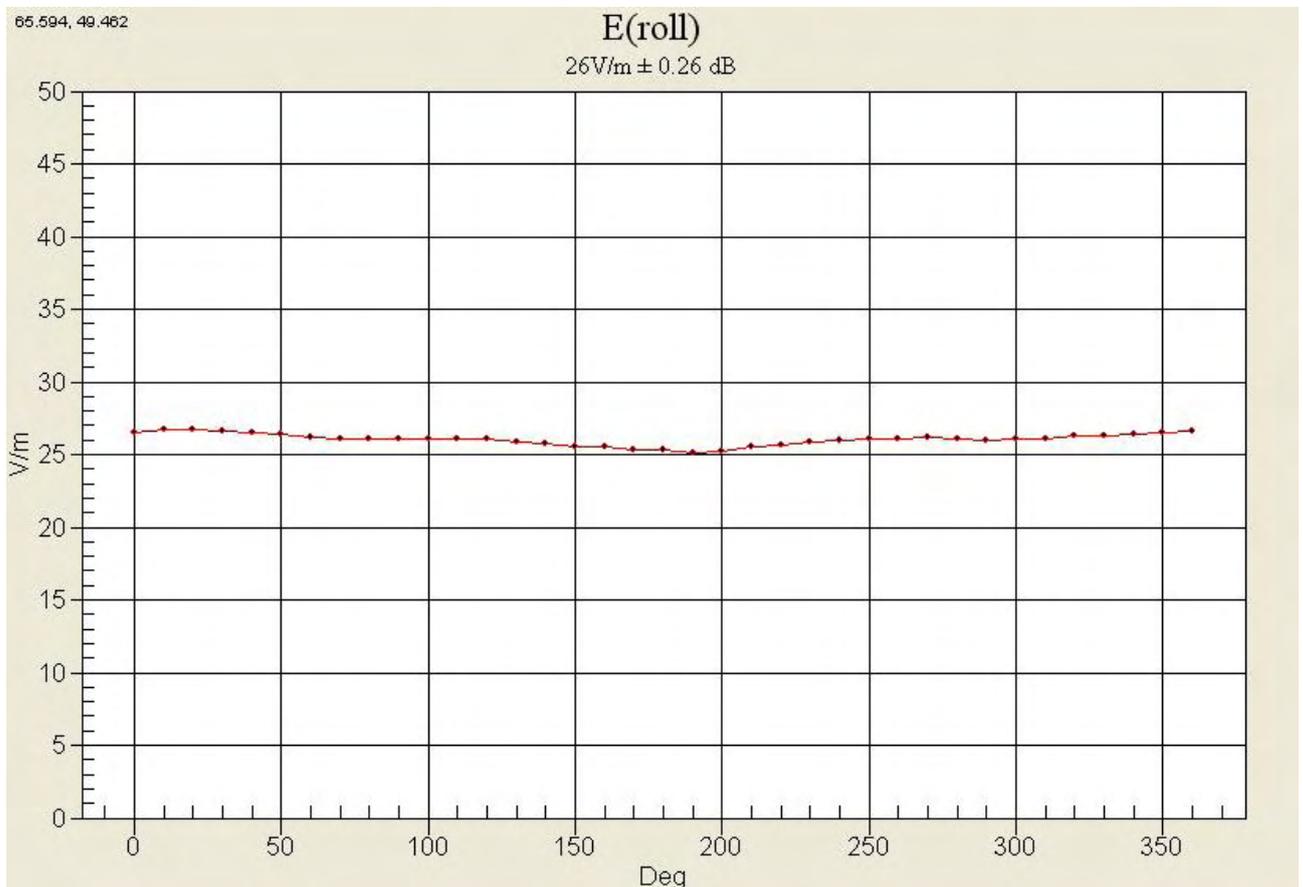
## 11.5 Worst-case Configuration Evaluation

**Ambient TEMPERATURE (°C):** 21.4

**S/N:** #1

### Peak Reading 360° Probe Rotation at Azimuth axis

Mode	Chan nel	Backlight	RC/SO	Antenna	Time Avg. Field (V/m)	Peak Field (dBV/m)	FCC Limit (dBV/m)	FCC MARGIN (dB)	Exclusion Block	RESULT
GSM1900	512	off	Standard	Intenna	26.7	36.6	38.5	-1.85	none	<b>M3</b>



**Worst-Case Probe Rotation about Azimuth axis**

## 12. HAC TEST EQUIPMENT LIST

Manufacturer	Type / Model	S/N	Calib. Date	Calib. Interval	Calib. Due
Staubli	Robot RX90L	F01/ 5K09A1/A/01	N/A	N/A	N/A
Staubli	Robot ControllerCS7MB	F99/5A82A1/C/01	N/A	N/A	N/A
Staubli	Teach Pendant (Joystick)	D221340.01	N/A	N/A	N/A
HP	Pavilion t000_puffer	KRJ51201TV	N/A	N/A	N/A
SPEAG	SPEAG HAC Phantom	-	N/A	N/A	N/A
SPEAG	Light Alignment Sensor	265	N/A	N/A	N/A
SPEAG	DAE	869	09/21/10	Annual	09/21/11
SPEAG	E-Field Probe	2343	05/20/10	Annual	05/20/11
SPEAG	H-Field Probe	6101	05/27/10	Annual	05/27/11
SPEAG	Validation Dipole CD835V2	1024	02/16/10	Biennial	02/16/12
SPEAG	Validation Dipole CD1880V2	1019	02/17/10	Biennial	02/17/12
Agilent	Power Meter(F) E4419B	MY41291386	11/05/10	Annual	11/05/11
Agilent	Power Sensor(G) 8481	MY41090870	11/05/10	Annual	11/05/11
HP	Signal Generator E4438C	MY42082646	12/24/09	Annual	12/24/10
EM POWER	Power Amp BBS3Q7ELU	1009D/C0028	11/05/10	Annual	11/05/11
HP	Dual Directional Coupler 778D	16072	11/05/10	Annual	11/05/11
R&S	Base Station CMU200	110740	07/26/10	Annual	07/26/11
Agilent	Base Station E5515C	GB44400269	02/10/10	Annual	02/10/11
R&S	Spectrum Analyzer FSP30	839117/011	03/25/10	Annual	03/25/11

**NOTE:**

The probe was calibrated by SPEAG, by the waveguide technique procedure. Dipole Validation measurement is performed by HCT Lab. before each test.

## **13. CONCLUSION**

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The HAC measurement indicates that the EUT complies with the HAC limits of the ANSI-C63.19-2007.

These measurements are taken to simulate the RF effects exposure under worst-case conditions. Precise Laboratory measures were taken to assure repeatability of the tests.

## **APPENDIX A. HAC TEST PLOTS**

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Test Laboratory: HCT CO., LTD.  
 Ambient Temperature / Channel 21.4 °C /128  
 Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: GSM 850; Frequency: 824.2 MHz; Duty Cycle: 1:8.3  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: E Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**DASY4 Configuration:**

- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2010-05-20
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn869; Calibrated: 2010-09-21
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

**E Scan - ER3D - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**

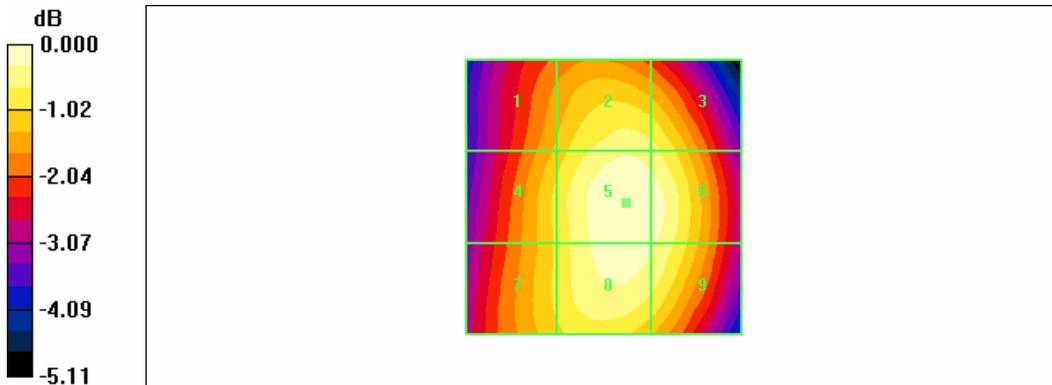
Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 152.5 V/m  
 Probe Modulation Factor = 2.64  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 81.7 V/m; Power Drift = -0.016 dB  
**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
132.0 M4	145.7 M4	143.3 M4
Grid 4	Grid 5	Grid 6
137.6 M4	152.5 M3	150.5 M3
Grid 7	Grid 8	Grid 9
137.1 M4	150.3 M3	147.6 M4

**Cursor:**

Total = 152.5 V/m  
 E Category: M3  
 Location: -4, 1, 369.9 mm



0 dB = 152.5V/m

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature / Channel 21.4 °C /190  
 Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: E Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**DASY4 Configuration:**

- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2010-05-20
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn869; Calibrated: 2010-09-21
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

**E Scan - ER3D - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**

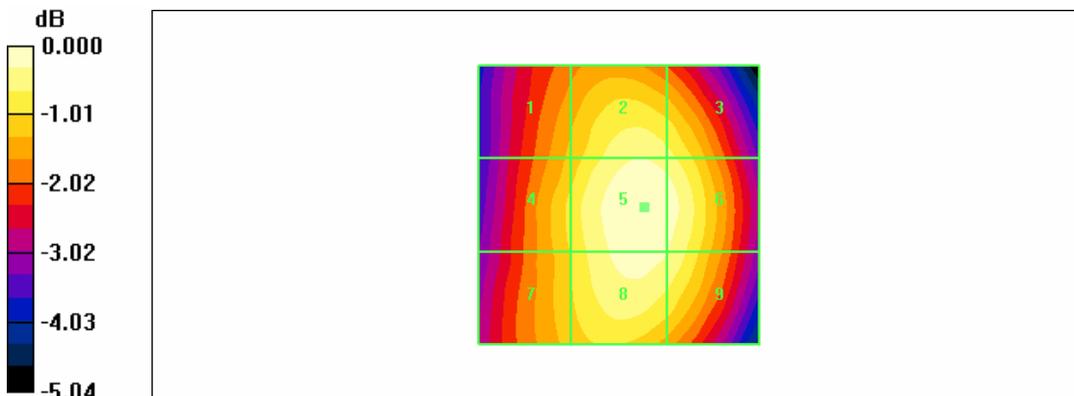
Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 173.3 V/m  
 Probe Modulation Factor = 2.64  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 93.1 V/m; Power Drift = -0.039 dB  
**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
150.6 M3	166.6 M3	163.1 M3
Grid 4	Grid 5	Grid 6
156.6 M3	173.3 M3	170.6 M3
Grid 7	Grid 8	Grid 9
154.7 M3	169.9 M3	166.9 M3

**Cursor:**

Total = 173.3 V/m  
 E Category: M3  
 Location: -4.5, 0.5, 369.9 mm



0 dB = 173.3V/m

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature / Channel 21.4 °C /251  
 Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: GSM 850; Frequency: 848.8 MHz; Duty Cycle: 1:8.3  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: E Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

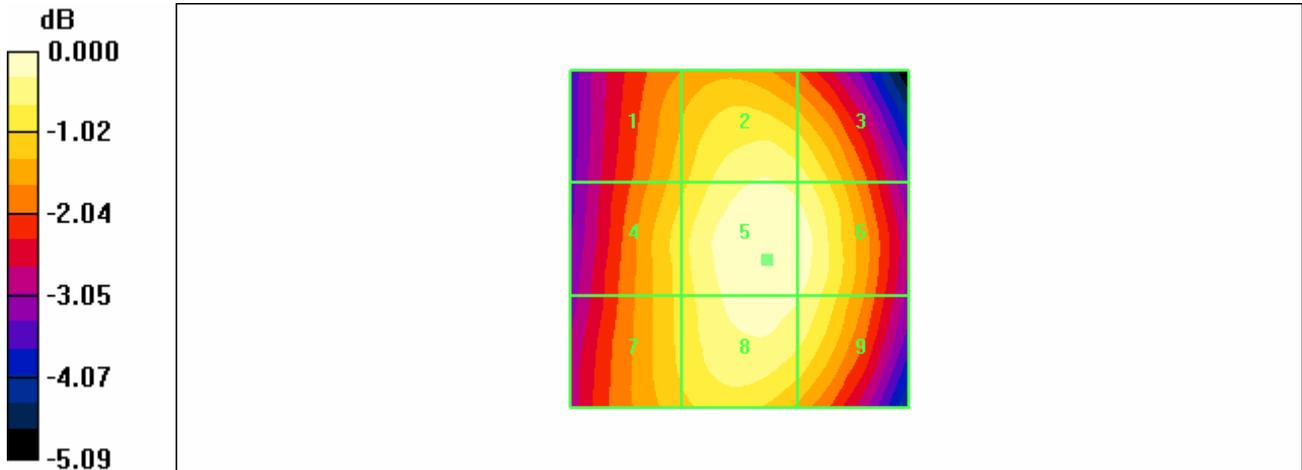
DASY4 Configuration:  
 - Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2010-05-20  
 - Sensor-Surface: (Fix Surface)  
 - Electronics: DAE4 Sn869; Calibrated: 2010-09-21  
 - Phantom: HAC Test Arch; Type: SD HAC P01 BA

**E Scan - ER3D - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**  
 Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 151.1 V/m  
 Probe Modulation Factor = 2.64  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 81.8 V/m; Power Drift = 0.018 dB  
**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
132.8 M4	145.8 M4	142.9 M4
Grid 4	Grid 5	Grid 6
137.8 M4	151.1 M3	148.9 M4
Grid 7	Grid 8	Grid 9
136.6 M4	148.7 M4	146.0 M4

**Cursor:**  
 Total = 151.1 V/m  
 E Category: M3  
 Location: -4, 3, 369.9 mm



0 dB = 151.1V/m

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature / Channel 21.4 °C /512  
 Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: GSM 1900; Frequency: 1850.2 MHz; Duty Cycle: 1:8.3  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: E Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2010-05-20
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn869; Calibrated: 2010-09-21
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

**E Scan - ER3D - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**

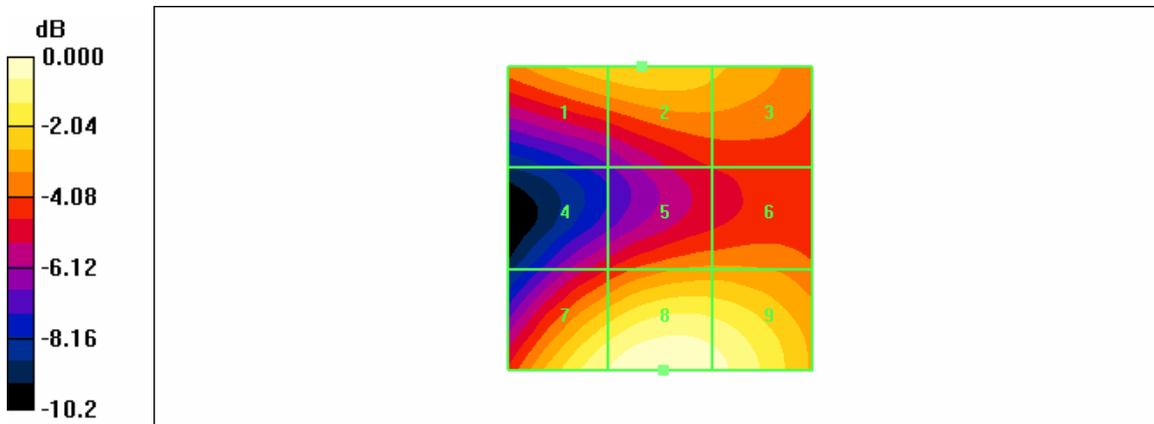
Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 67.9 V/m  
 Probe Modulation Factor = 2.55  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 12.8 V/m; Power Drift = -0.007 dB  
**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
52.5 M3	53.5 M3	50.8 M3
Grid 4	Grid 5	Grid 6
39.5 M4	47.1 M4	47.2 M4
Grid 7	Grid 8	Grid 9
63.3 M3	67.9 M3	64.9 M3

**Cursor:**

Total = 67.9 V/m  
 E Category: M3  
 Location: -0.5, 25, 369.9 mm



0 dB = 67.9V/m

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature / Channel 21.4 °C /661  
 Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: E Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**DASY4 Configuration:**

- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2010-05-20
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn869; Calibrated: 2010-09-21
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

**E Scan - ER3D - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**

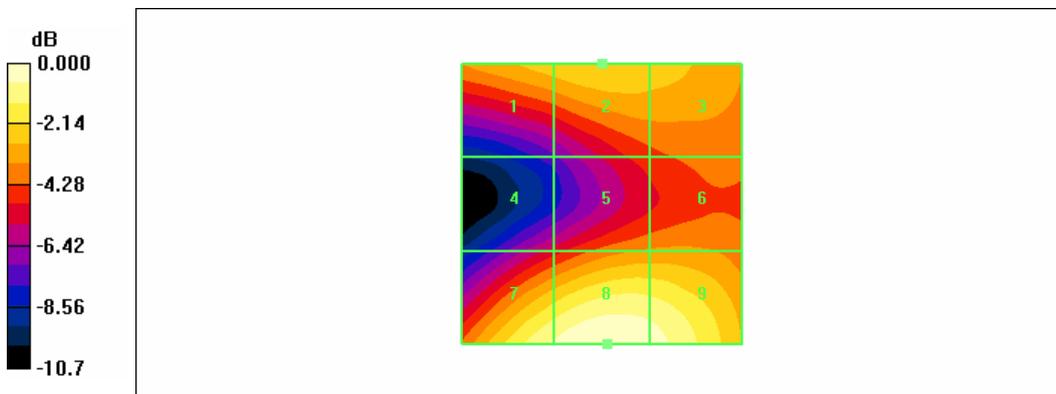
Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 65.0 V/m  
 Probe Modulation Factor = 2.55  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 12.4 V/m; Power Drift = 0.010 dB  
**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
49.6 M3	51.0 M3	49.6 M3
Grid 4	Grid 5	Grid 6
35.5 M4	43.9 M4	44.2 M4
Grid 7	Grid 8	Grid 9
60.7 M3	65.0 M3	62.5 M3

**Cursor:**

Total = 65.0 V/m  
 E Category: M3  
 Location: -1, 25, 369.9 mm



0 dB = 65.0V/m

Test Laboratory: HCT CO., LTD.

Ambient Temperature / Channel 21.4 °C /810

Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: GSM 1900; Frequency: 1909.8 MHz; Duty Cycle: 1:8.3  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: E Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2010-05-20
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn869; Calibrated: 2010-09-21
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

**E Scan - ER3D - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**

Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 57.4 V/m  
 Probe Modulation Factor = 2.55  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 12.3 V/m; Power Drift = 0.074 dB  
**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**

Peak E-field in V/m

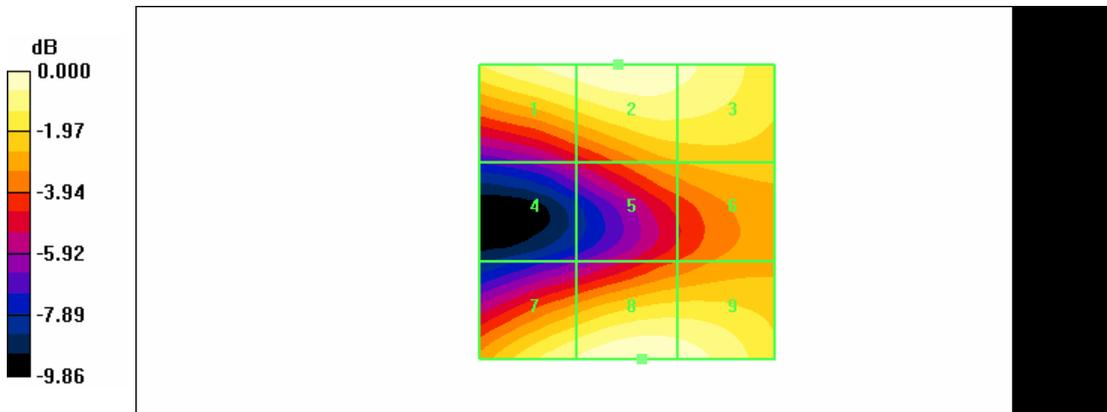
Grid 1	Grid 2	Grid 3
56.0 M3	57.4 M3	54.9 M3
Grid 4	Grid 5	Grid 6
32.0 M4	42.3 M4	44.0 M4
Grid 7	Grid 8	Grid 9
53.6 M3	57.2 M3	55.8 M3

**Cursor:**

Total = 57.4 V/m

E Category: M3

Location: 1.5, -25, 369.9 mm



0 dB = 57.4V/m

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature / Channel 21.4 °C /128  
 Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: GSM 850; Frequency: 824.2 MHz; Duty Cycle: 1:8.3  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1$  kg/m<sup>3</sup>  
 Phantom section: H Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

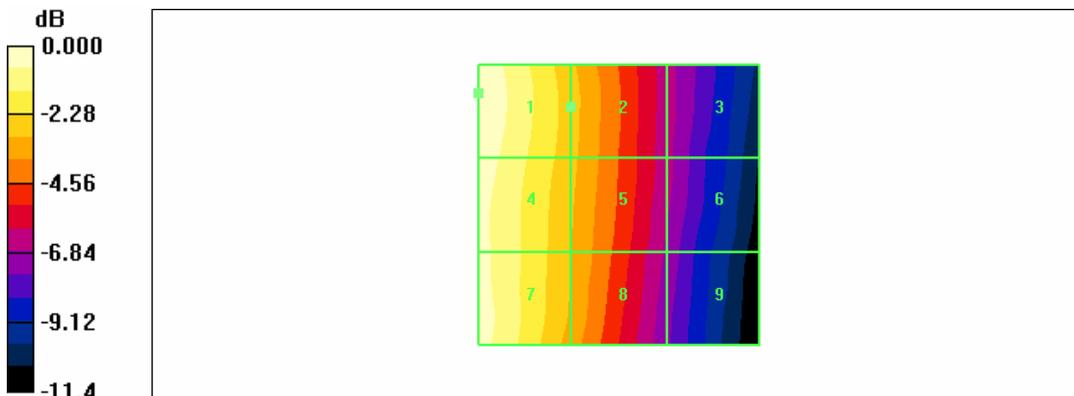
DASY4 Configuration:  
 - Probe: H3DV6 - SN6101; ; Calibrated: 2010-05-27  
 - Sensor-Surface: (Fix Surface)  
 - Electronics: DAE4 Sn869; Calibrated: 2010-09-21  
 - Phantom: HAC Test Arch; Type: SD HAC P01 BA

**H Scan - H3DV6 - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**  
 Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 0.236 A/m  
 Probe Modulation Factor = 2.11  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 0.069 A/m; Power Drift = -0.003 dB  
**Hearing Aid Near-Field Category: M4 (AWF -5 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.236 M4	0.173 M4	0.112 M4
Grid 4	Grid 5	Grid 6
0.228 M4	0.171 M4	0.111 M4
Grid 7	Grid 8	Grid 9
0.227 M4	0.167 M4	0.106 M4

**Cursor:**  
 Total = 0.236 A/m  
 H Category: M4  
 Location: 25, -20, 369.4 mm



0 dB = 0.236A/m

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature / Channel 21.4 °C /190  
 Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1$  kg/m<sup>3</sup>  
 Phantom section: H Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

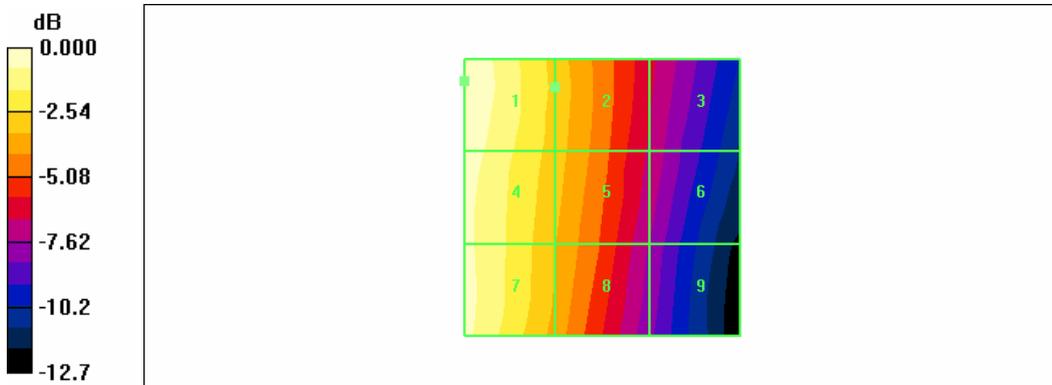
DASY4 Configuration:  
 - Probe: H3DV6 - SN6101; ; Calibrated: 2010-05-27  
 - Sensor-Surface: (Fix Surface)  
 - Electronics: DAE4 Sn869; Calibrated: 2010-09-21  
 - Phantom: HAC Test Arch; Type: SD HAC P01 BA

**H Scan - H3DV6 - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**  
 Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 0.268 A/m  
 Probe Modulation Factor = 2.11  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 0.076 A/m; Power Drift = -0.074 dB  
**Hearing Aid Near-Field Category: M4 (AWF -5 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
<b>0.268 M4</b>	<b>0.195 M4</b>	<b>0.127 M4</b>
Grid 4	<b>Grid 5</b>	Grid 6
<b>0.256 M4</b>	<b>0.191 M4</b>	<b>0.121 M4</b>
Grid 7	Grid 8	Grid 9
<b>0.252 M4</b>	<b>0.182 M4</b>	<b>0.111 M4</b>

**Cursor:**  
 Total = 0.268 A/m  
 H Category: M4  
 Location: 25, -21, 369.4 mm



0 dB = 0.268A/m

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature / Channel 21.4 °C /251  
 Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: GSM 850; Frequency: 848.8 MHz; Duty Cycle: 1:8.3  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1$  kg/m<sup>3</sup>  
 Phantom section: H Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

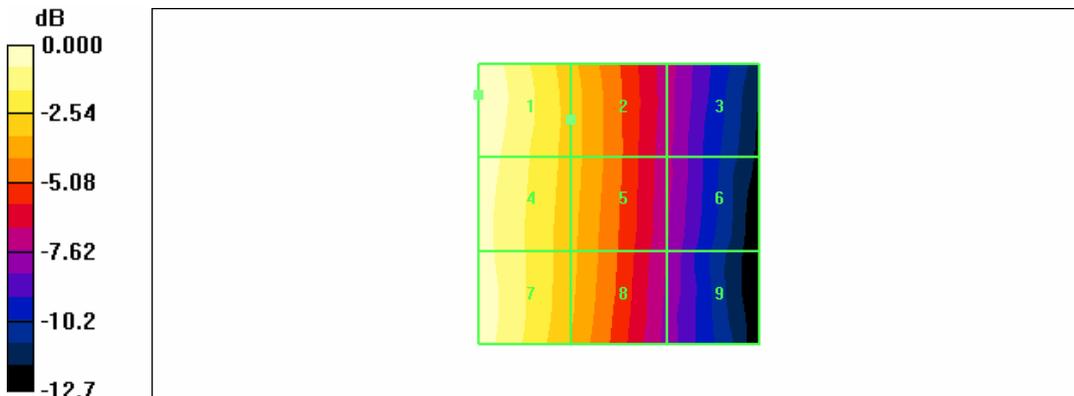
DASY4 Configuration:  
 - Probe: H3DV6 - SN6101; ; Calibrated: 2010-05-27  
 - Sensor-Surface: (Fix Surface)  
 - Electronics: DAE4 Sn869; Calibrated: 2010-09-21  
 - Phantom: HAC Test Arch; Type: SD HAC P01 BA

**H Scan - H3DV6 - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**  
 Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 0.237 A/m  
 Probe Modulation Factor = 2.11  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 0.067 A/m; Power Drift = 0.097 dB  
**Hearing Aid Near-Field Category: M4 (AWF -5 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
<b>0.237 M4</b>	<b>0.169 M4</b>	<b>0.104 M4</b>
Grid 4	<b>Grid 5</b>	Grid 6
<b>0.229 M4</b>	<b>0.168 M4</b>	<b>0.102 M4</b>
Grid 7	Grid 8	Grid 9
<b>0.228 M4</b>	<b>0.165 M4</b>	<b>0.099 M4</b>

**Cursor:**  
 Total = 0.237 A/m  
 H Category: M4  
 Location: 25, -19.5, 369.4 mm



0 dB = 0.237A/m

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature / Channel 21.4 °C /512  
 Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: GSM 1900; Frequency: 1850.2 MHz; Duty Cycle: 1:8.3  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1$  kg/m<sup>3</sup>  
 Phantom section: H Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

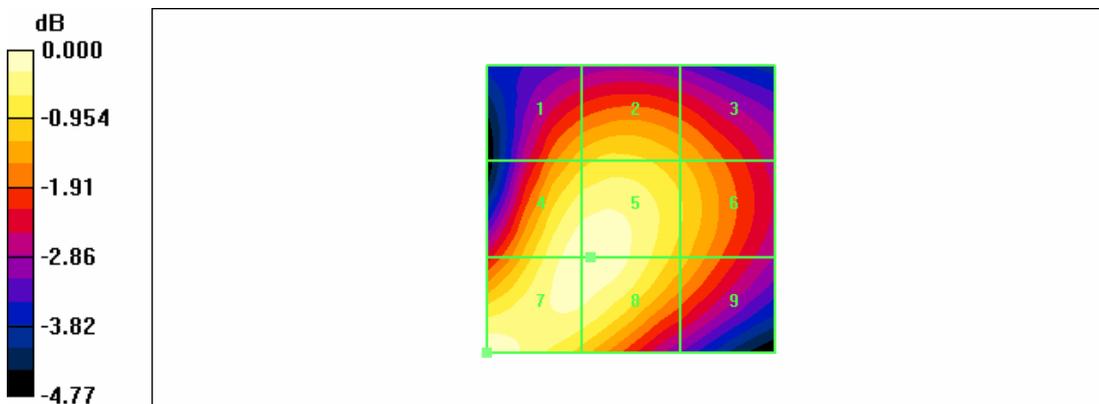
- DASY4 Configuration:  
 - Probe: H3DV6 - SN6101; ; Calibrated: 2010-05-27  
 - Sensor-Surface: (Fix Surface)  
 - Electronics: DAE4 Sn869; Calibrated: 2010-09-21  
 - Phantom: HAC Test Arch; Type: SD HAC P01 BA

**H Scan - H3DV6 - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**  
 Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 0.179 A/m  
 Probe Modulation Factor = 2.29  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 0.084 A/m; Power Drift = 0.011 dB  
**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.158 M3	0.162 M3	0.155 M3
Grid 4	Grid 5	Grid 6
0.177 M3	0.177 M3	0.161 M3
Grid 7	Grid 8	Grid 9
0.179 M3	0.177 M3	0.157 M3

**Cursor:**  
 Total = 0.179 A/m  
 H Category: M3  
 Location: 25, 25, 369.4 mm



0 dB = 0.179A/m

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature / Channel 21.4 °C /661  
 Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1$  kg/m<sup>3</sup>  
 Phantom section: H Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

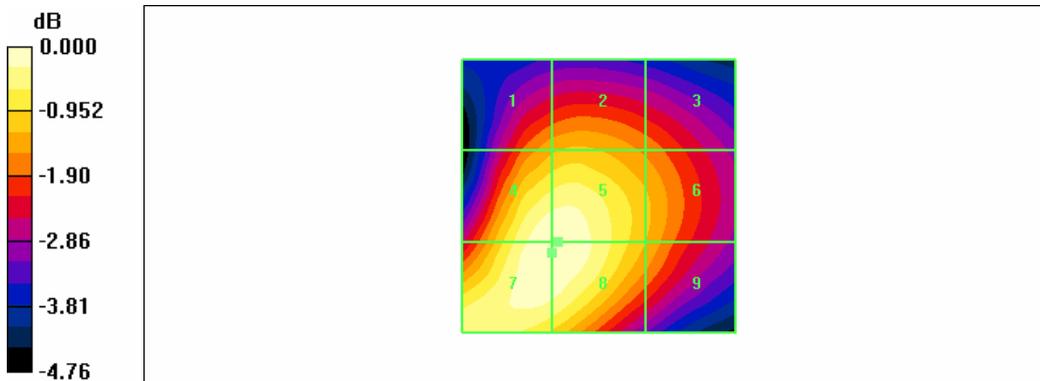
- DASY4 Configuration:
- Probe: H3DV6 - SN6101; ; Calibrated: 2010-05-27
  - Sensor-Surface: (Fix Surface)
  - Electronics: DAE4 Sn869; Calibrated: 2010-09-21
  - Phantom: HAC Test Arch; Type: SD HAC P01 BA

**H Scan - H3DV6 - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**  
 Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 0.194 A/m  
 Probe Modulation Factor = 2.29  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 0.090 A/m; Power Drift = -0.042 dB  
**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.166 M3	0.169 M3	0.160 M3
Grid 4	Grid 5	Grid 6
0.193 M3	0.193 M3	0.170 M3
Grid 7	Grid 8	Grid 9
0.194 M3	0.194 M3	0.168 M3

**Cursor:**  
 Total = 0.194 A/m  
 H Category: M3  
 Location: 8.5, 10.5, 369.4 mm



0 dB = 0.194A/m

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature / Channel 21.4 °C /810  
 Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: GSM 1900; Frequency: 1909.8 MHz; Duty Cycle: 1:8.3  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1$  kg/m<sup>3</sup>  
 Phantom section: H Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

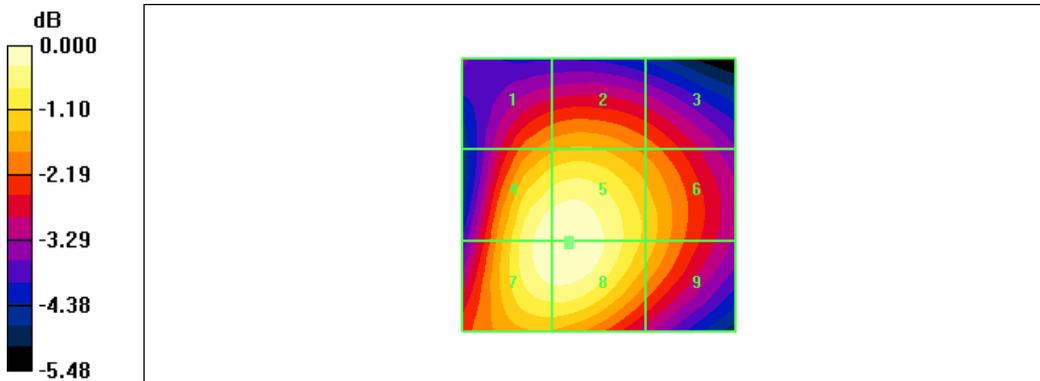
DASY4 Configuration:  
 - Probe: H3DV6 - SN6101; ; Calibrated: 2010-05-27  
 - Sensor-Surface: (Fix Surface)  
 - Electronics: DAE4 Sn869; Calibrated: 2010-09-21  
 - Phantom: HAC Test Arch; Type: SD HAC P01 BA

**H Scan - H3DV6 - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**  
 Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 0.205 A/m  
 Probe Modulation Factor = 2.29  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 0.095 A/m; Power Drift = 0.061 dB  
**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.171 M3	0.175 M3	0.164 M3
Grid 4	Grid 5	Grid 6
0.204 M3	0.205 M3	0.179 M3
Grid 7	Grid 8	Grid 9
0.204 M3	0.205 M3	0.178 M3

**Cursor:**  
 Total = 0.205 A/m  
 H Category: M3  
 Location: 5.5, 9, 369.4 mm



0 dB = 0.205A/m

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature / Channel 21.4 °C /4132  
 Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: WCDMA850; Frequency: 826.4 MHz; Duty Cycle: 1:1  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: E Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2010-05-20
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn869; Calibrated: 2010-09-21
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

**E Scan - ER3D - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**

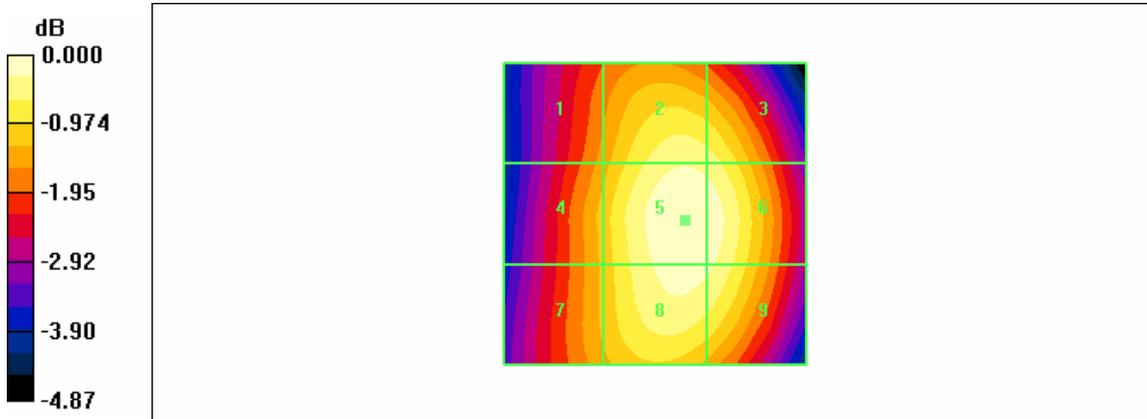
Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 43.8 V/m  
 Probe Modulation Factor = 0.759  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 81.1 V/m; Power Drift = -0.005 dB  
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
37.1 M4	42.0 M4	41.5 M4
Grid 4	Grid 5	Grid 6
38.4 M4	43.8 M4	43.4 M4
Grid 7	Grid 8	Grid 9
38.2 M4	43.0 M4	42.6 M4

**Cursor:**

Total = 43.8 V/m  
 E Category: M4  
 Location: -5, 1, 369.9 mm



0 dB = 43.8V/m

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature / Channel 21.4 °C /4183  
 Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: WCDMA850; Frequency: 836.6 MHz; Duty Cycle: 1:1  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: E Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**DASY4 Configuration:**

- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2010-05-20
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn869; Calibrated: 2010-09-21
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

**E Scan - ER3D - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**

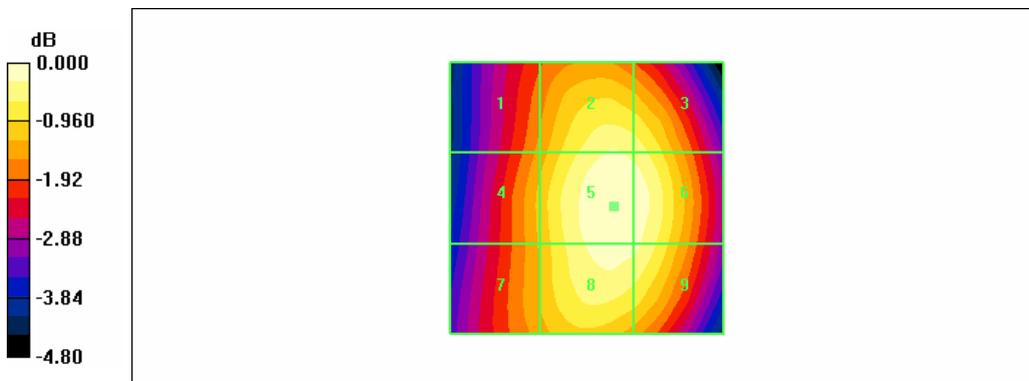
Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 48.7 V/m  
 Probe Modulation Factor = 0.759  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 90.3 V/m; Power Drift = 0.052 dB  
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
41.2 M4	47.1 M4	46.4 M4
Grid 4	Grid 5	Grid 6
42.6 M4	48.7 M4	48.4 M4
Grid 7	Grid 8	Grid 9
42.3 M4	47.8 M4	47.4 M4

**Cursor:**

Total = 48.7 V/m  
 E Category: M4  
 Location: -5, 1.5, 369.9 mm



0 dB = 48.7V/m

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature / Channel 21.4 °C /4233  
 Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: WCDMA850; Frequency: 846.6 MHz; Duty Cycle: 1:1  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: E Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**DASY4 Configuration:**

- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2010-05-20
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn869; Calibrated: 2010-09-21
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

**E Scan - ER3D - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**

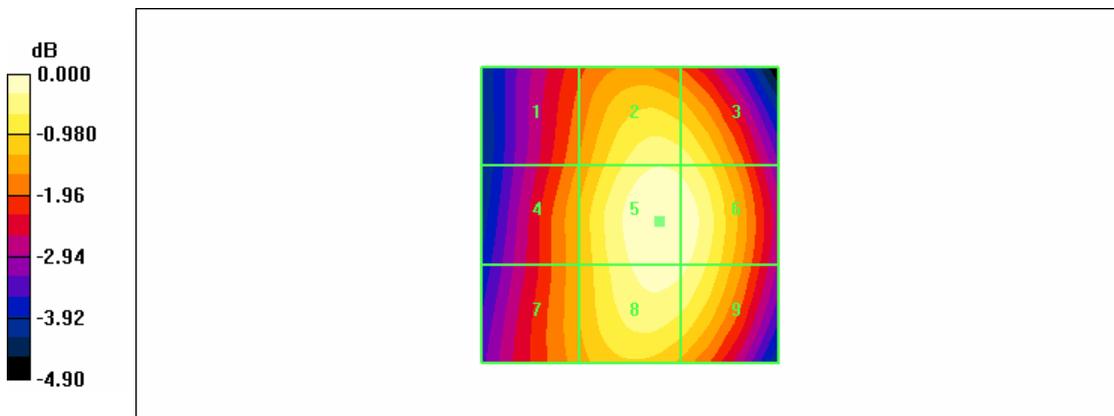
Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 47.6 V/m  
 Probe Modulation Factor = 0.759  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 88.8 V/m; Power Drift = -0.002 dB  
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
39.7 M4	45.7 M4	45.3 M4
Grid 4	Grid 5	Grid 6
41.2 M4	47.6 M4	47.3 M4
Grid 7	Grid 8	Grid 9
41.0 M4	46.7 M4	46.3 M4

**Cursor:**

Total = 47.6 V/m  
 E Category: M4  
 Location: -5, 1, 369.9 mm



0 dB = 47.6V/m

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature / Channel 21.4 °C /9262  
 Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: WCDMA1900; Frequency: 1852.4 MHz; Duty Cycle: 1:1  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: E Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

DASY4 Configuration:

- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2010-05-20
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn869; Calibrated: 2010-09-21
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

**E Scan - ER3D - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**

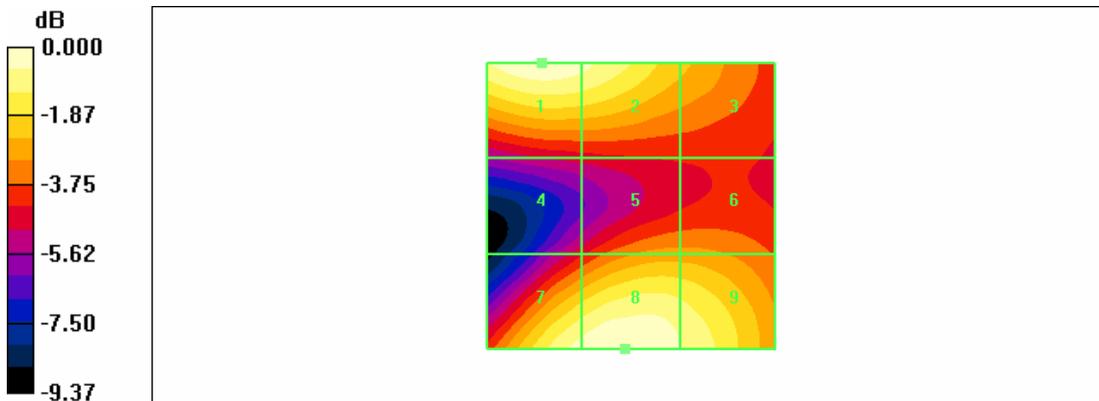
Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 34.1 V/m  
 Probe Modulation Factor = 0.833  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 22.3 V/m; Power Drift = -0.092 dB  
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
33.7 M4	32.7 M4	26.3 M4
Grid 4	Grid 5	Grid 6
20.5 M4	24.7 M4	24.7 M4
Grid 7	Grid 8	Grid 9
32.8 M4	34.1 M4	31.9 M4

**Cursor:**

Total = 34.1 V/m  
 E Category: M4  
 Location: 1, 25, 369.9 mm



0 dB = 34.1V/m

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature / Channel 21.4 °C /9400  
 Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: WCDMA1900; Frequency: 1880 MHz; Duty Cycle: 1:1  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: E Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**DASY4 Configuration:**

- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2010-05-20
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn869; Calibrated: 2010-09-21
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

**E Scan - ER3D - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**

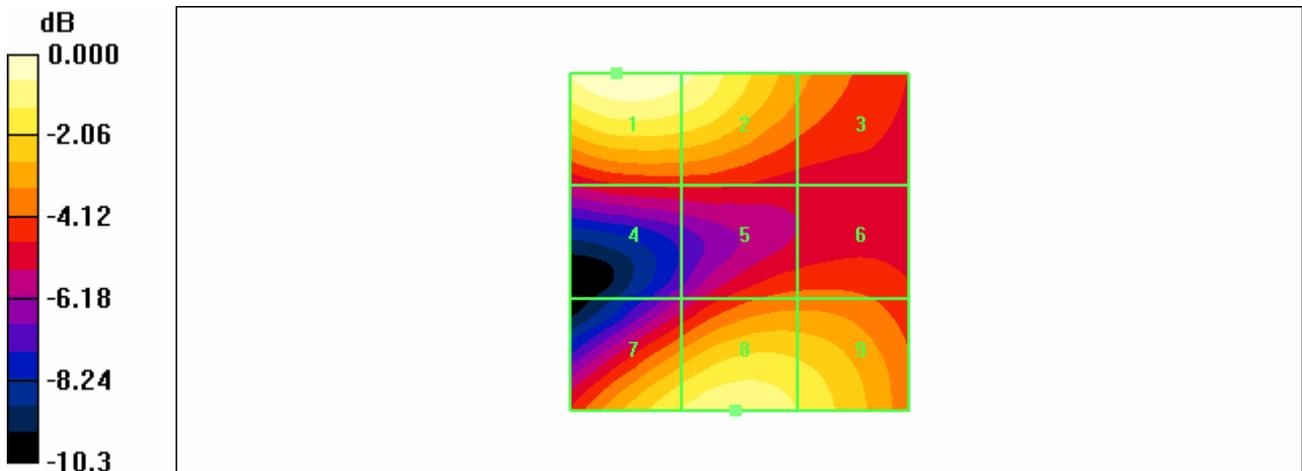
Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 39.3 V/m  
 Probe Modulation Factor = 0.833  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 23.8 V/m; Power Drift = 0.007 dB  
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
<b>39.3 M4</b>	<b>37.3 M4</b>	<b>27.4 M4</b>
Grid 4	Grid 5	Grid 6
<b>23.2 M4</b>	<b>25.4 M4</b>	<b>25.5 M4</b>
Grid 7	Grid 8	Grid 9
<b>33.7 M4</b>	<b>35.5 M4</b>	<b>33.5 M4</b>

**Cursor:**

Total = 39.3 V/m  
 E Category: M4  
 Location: 18, -25, 369.9 mm



0 dB = 39.3V/m

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature / Channel 21.4 °C /9538  
 Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: WCDMA1900; Frequency: 1907.6 MHz; Duty Cycle: 1:1  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: E Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**DASY4 Configuration:**

- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2010-05-20
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn869; Calibrated: 2010-09-21
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

**E Scan - ER3D - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**

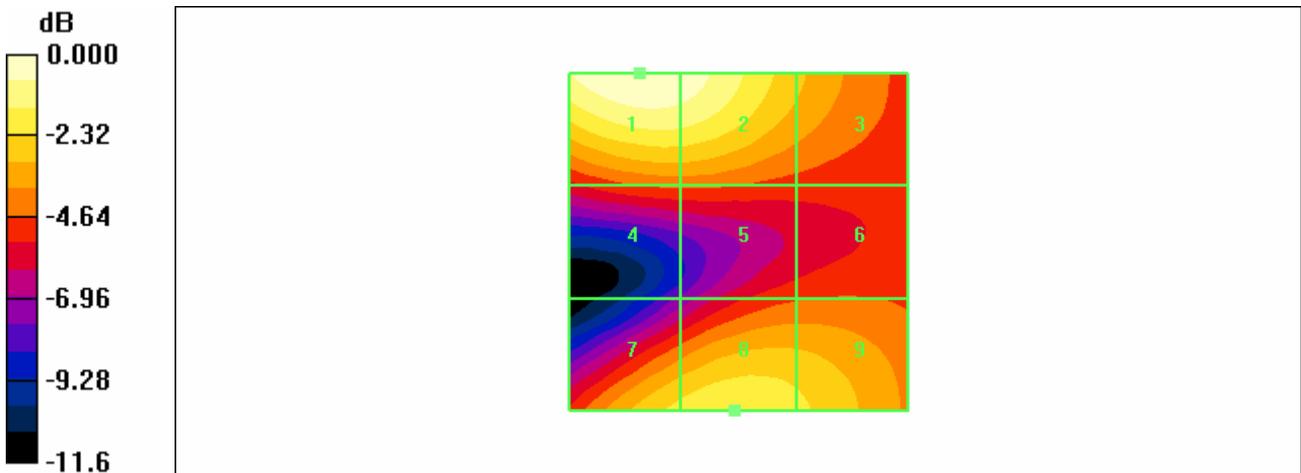
Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 37.1 V/m  
 Probe Modulation Factor = 0.833  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 20.6 V/m; Power Drift = -0.103 dB  
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
<b>37.1 M4</b>	<b>36.0 M4</b>	<b>26.7 M4</b>
Grid 4	Grid 5	Grid 6
<b>22.5 M4</b>	<b>22.5 M4</b>	<b>22.0 M4</b>
Grid 7	Grid 8	Grid 9
<b>29.3 M4</b>	<b>30.6 M4</b>	<b>29.1 M4</b>

**Cursor:**

Total = 37.1 V/m  
 E Category: M4  
 Location: 14.5, -25, 369.9 mm



0 dB = 37.1V/m

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature / Channel 21.4 °C /4132  
 Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: WCDMA850; Frequency: 826.4 MHz; Duty Cycle: 1:1  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1$  kg/m<sup>3</sup>  
 Phantom section: H Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

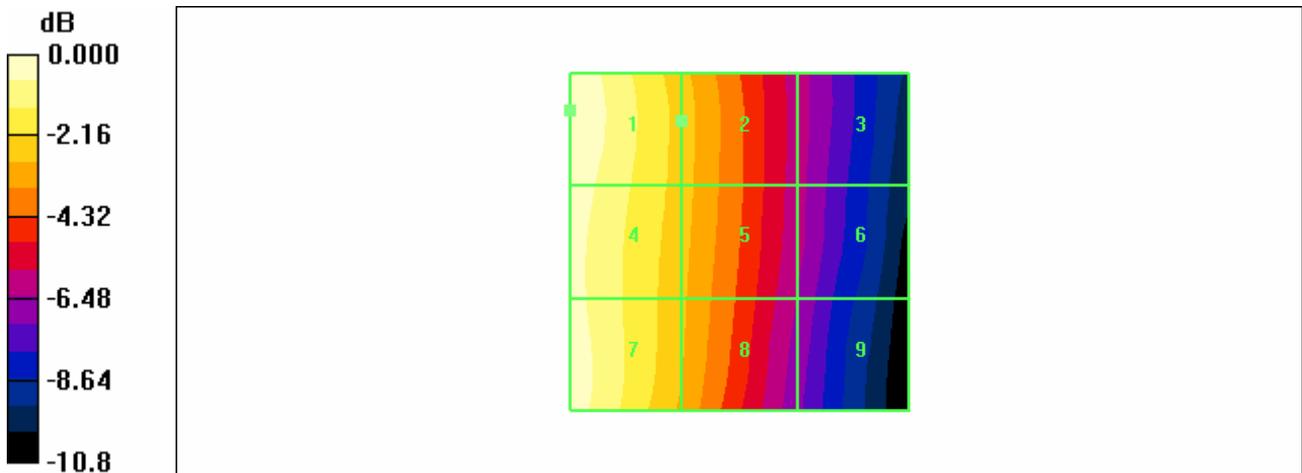
DASY4 Configuration:  
 - Probe: H3DV6 - SN6101; ; Calibrated: 2010-05-27  
 - Sensor-Surface: (Fix Surface)  
 - Electronics: DAE4 Sn869; Calibrated: 2010-09-21  
 - Phantom: HAC Test Arch; Type: SD HAC P01 BA

**H Scan - H3DV6 - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**  
 Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 0.095 A/m  
 Probe Modulation Factor = 0.844  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 0.072 A/m; Power Drift = 0.040 dB  
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.095 M4	0.071 M4	0.047 M4
Grid 4	Grid 5	Grid 6
0.092 M4	0.071 M4	0.047 M4
Grid 7	Grid 8	Grid 9
0.092 M4	0.069 M4	0.045 M4

**Cursor:**  
 Total = 0.095 A/m  
 H Category: M4  
 Location: 25, -19.5, 369.4 mm



0 dB = 0.095A/m

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature / Channel 21.4 °C /4183  
 Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: WCDMA850; Frequency: 846.6 MHz; Duty Cycle: 1:1  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1$  kg/m<sup>3</sup>  
 Phantom section: H Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

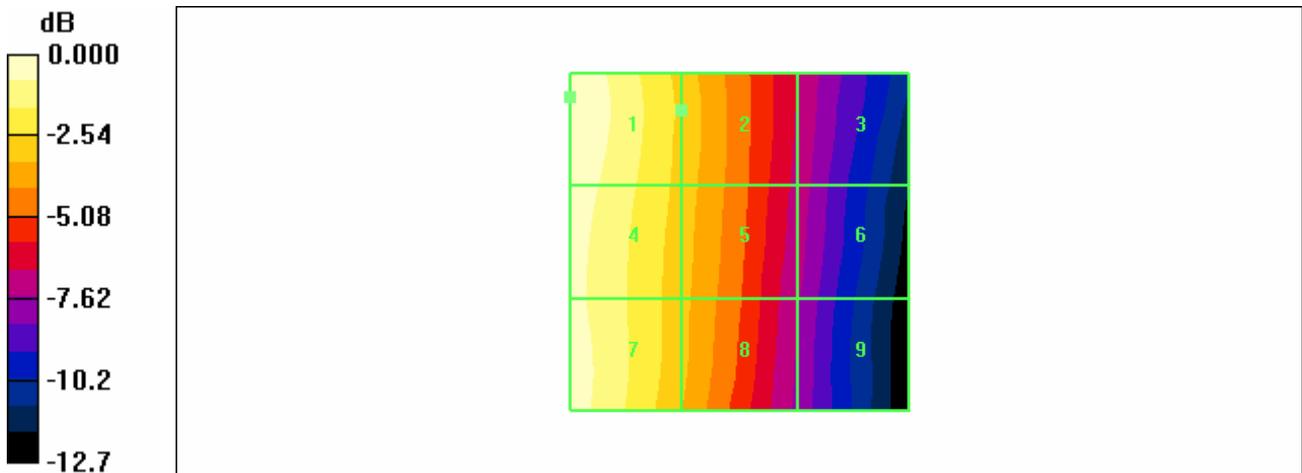
DASY4 Configuration:  
 - Probe: H3DV6 - SN6101; ; Calibrated: 2010-05-27  
 - Sensor-Surface: (Fix Surface)  
 - Electronics: DAE4 Sn869; Calibrated: 2010-09-21  
 - Phantom: HAC Test Arch; Type: SD HAC P01 BA

**H Scan - H3DV6 - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**  
 Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 0.103 A/m  
 Probe Modulation Factor = 0.844  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 0.074 A/m; Power Drift = -0.054 dB  
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.103 M4	0.075 M4	0.047 M4
Grid 4	Grid 5	Grid 6
0.100 M4	0.074 M4	0.046 M4
Grid 7	Grid 8	Grid 9
0.099 M4	0.072 M4	0.044 M4

**Cursor:**  
 Total = 0.103 A/m  
 H Category: M4  
 Location: 25, -21.5, 369.4 mm



0 dB = 0.103A/m

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature / Channel 21.4 °C /4233  
 Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: WCDMA850; Frequency: 836.6 MHz; Duty Cycle: 1:1  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1$  kg/m<sup>3</sup>  
 Phantom section: H Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

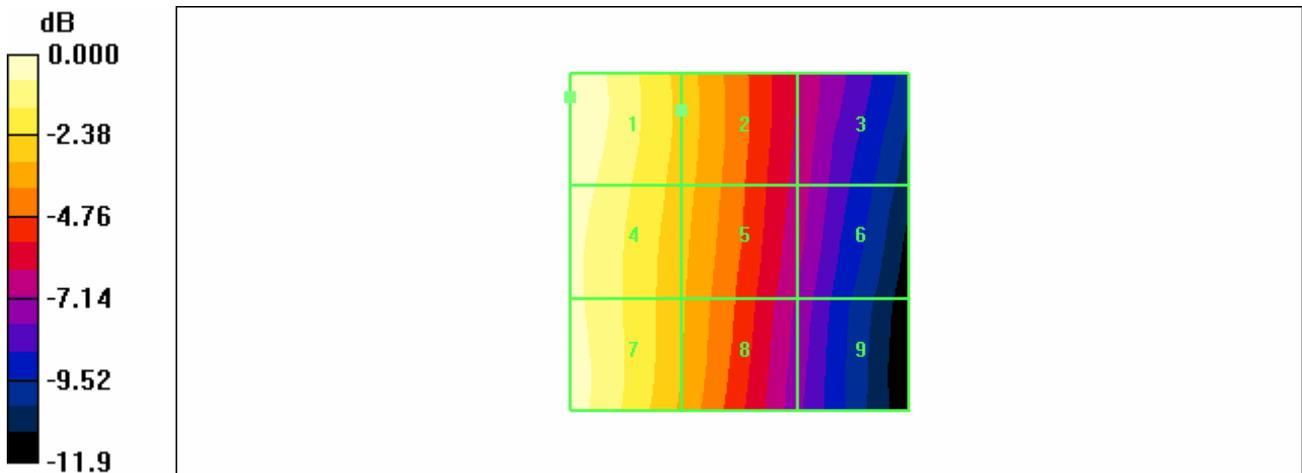
DASY4 Configuration:  
 - Probe: H3DV6 - SN6101; ; Calibrated: 2010-05-27  
 - Sensor-Surface: (Fix Surface)  
 - Electronics: DAE4 Sn869; Calibrated: 2010-09-21  
 - Phantom: HAC Test Arch; Type: SD HAC P01 BA

**H Scan - H3DV6 - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**  
 Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 0.105 A/m  
 Probe Modulation Factor = 0.844  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 0.077 A/m; Power Drift = -0.087 dB  
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.105 M4	0.078 M4	0.051 M4
Grid 4	Grid 5	Grid 6
0.101 M4	0.076 M4	0.049 M4
Grid 7	Grid 8	Grid 9
0.101 M4	0.074 M4	0.046 M4

**Cursor:**  
 Total = 0.105 A/m  
 H Category: M4  
 Location: 25, -21.5, 369.4 mm



0 dB = 0.105A/m

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature / Channel 21.4 °C /9262  
 Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: WCDMA1900; Frequency: 1852.4 MHz; Duty Cycle: 1:1  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1$  kg/m<sup>3</sup>  
 Phantom section: H Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

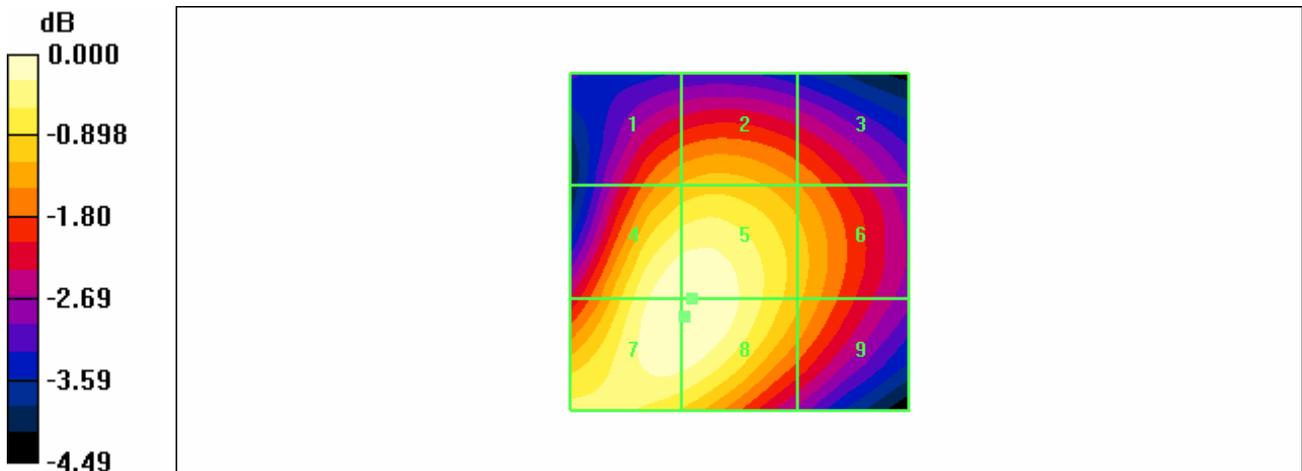
DASY4 Configuration:  
 - Probe: H3DV6 - SN6101; ; Calibrated: 2010-05-27  
 - Sensor-Surface: (Fix Surface)  
 - Electronics: DAE4 Sn869; Calibrated: 2010-09-21  
 - Phantom: HAC Test Arch; Type: SD HAC P01 BA

**H Scan - H3DV6 - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**  
 Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 0.099 A/m  
 Probe Modulation Factor = 0.836  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 0.123 A/m; Power Drift = 0.046 dB  
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.087 M4	0.088 M4	0.084 M4
Grid 4	Grid 5	Grid 6
0.099 M4	0.099 M4	0.088 M4
Grid 7	Grid 8	Grid 9
0.099 M4	0.099 M4	0.087 M4

**Cursor:**  
 Total = 0.099 A/m  
 H Category: M4  
 Location: 8, 11, 369.4 mm



0 dB = 0.099A/m

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature / Channel 21.4 °C /9400  
 Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: WCDMA1900; Frequency: 1880 MHz; Duty Cycle: 1:1  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1$  kg/m<sup>3</sup>  
 Phantom section: H Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

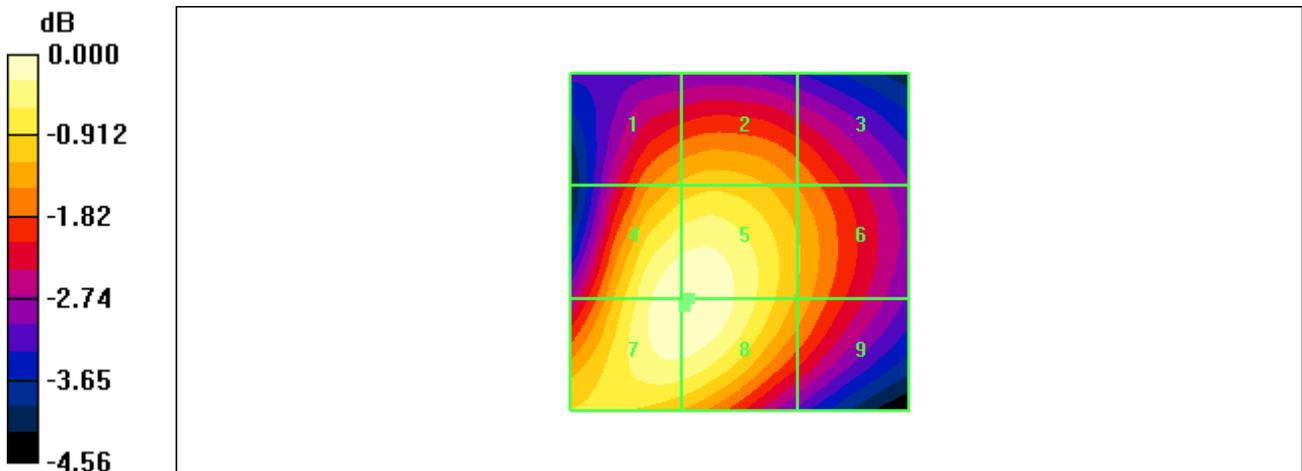
DASY4 Configuration:  
 - Probe: H3DV6 - SN6101; ; Calibrated: 2010-05-27  
 - Sensor-Surface: (Fix Surface)  
 - Electronics: DAE4 Sn869; Calibrated: 2010-09-21  
 - Phantom: HAC Test Arch; Type: SD HAC P01 BA

**H Scan - H3DV6 - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**  
 Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 0.108 A/m  
 Probe Modulation Factor = 0.836  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 0.136 A/m; Power Drift = -0.028 dB  
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak H-field in A/m

Grid 1 0.095 M4	Grid 2 0.096 M4	Grid 3 0.091 M4
Grid 4 0.108 M4	Grid 5 0.108 M4	Grid 6 0.094 M4
Grid 7 0.108 M4	Grid 8 0.108 M4	Grid 9 0.093 M4

**Cursor:**  
 Total = 0.108 A/m  
 H Category: M4  
 Location: 8, 9.5, 369.4 mm



0 dB = 0.108A/m

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature / Channel 21.4 °C /9538  
 Test Date Dec. 20, 2010

**DUT: ADS1; Type: Bar; Serial: #1**

Communication System: WCDMA1900; Frequency: 1907.6 MHz; Duty Cycle: 1:1  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1$  kg/m<sup>3</sup>  
 Phantom section: H Device Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

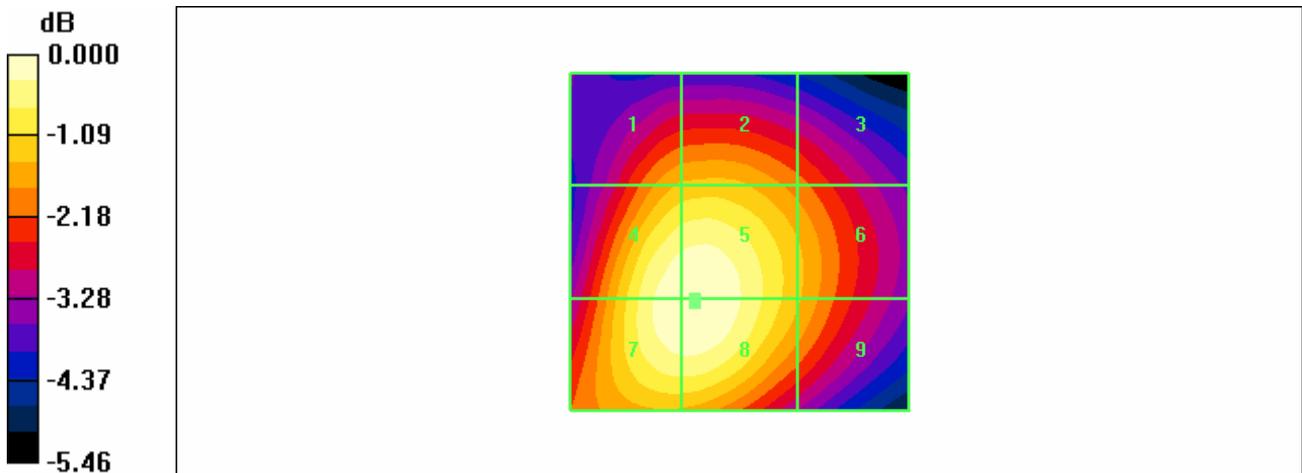
DASY4 Configuration:  
 - Probe: H3DV6 - SN6101; ; Calibrated: 2010-05-27  
 - Sensor-Surface: (Fix Surface)  
 - Electronics: DAE4 Sn869; Calibrated: 2010-09-21  
 - Phantom: HAC Test Arch; Type: SD HAC P01 BA

**H Scan - H3DV6 - 2007: 15 mm from Probe Center to the Device/Hearing Aid Compatibility Test (101x101x1):**  
 Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 0.103 A/m  
 Probe Modulation Factor = 0.836  
 Device Reference Point: 0.000, 0.000, 353.7 mm  
 Reference Value = 0.127 A/m; Power Drift = 0.045 dB  
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.088 M4	0.088 M4	0.082 M4
Grid 4	Grid 5	Grid 6
0.103 M4	0.103 M4	0.088 M4
Grid 7	Grid 8	Grid 9
0.103 M4	0.103 M4	0.088 M4

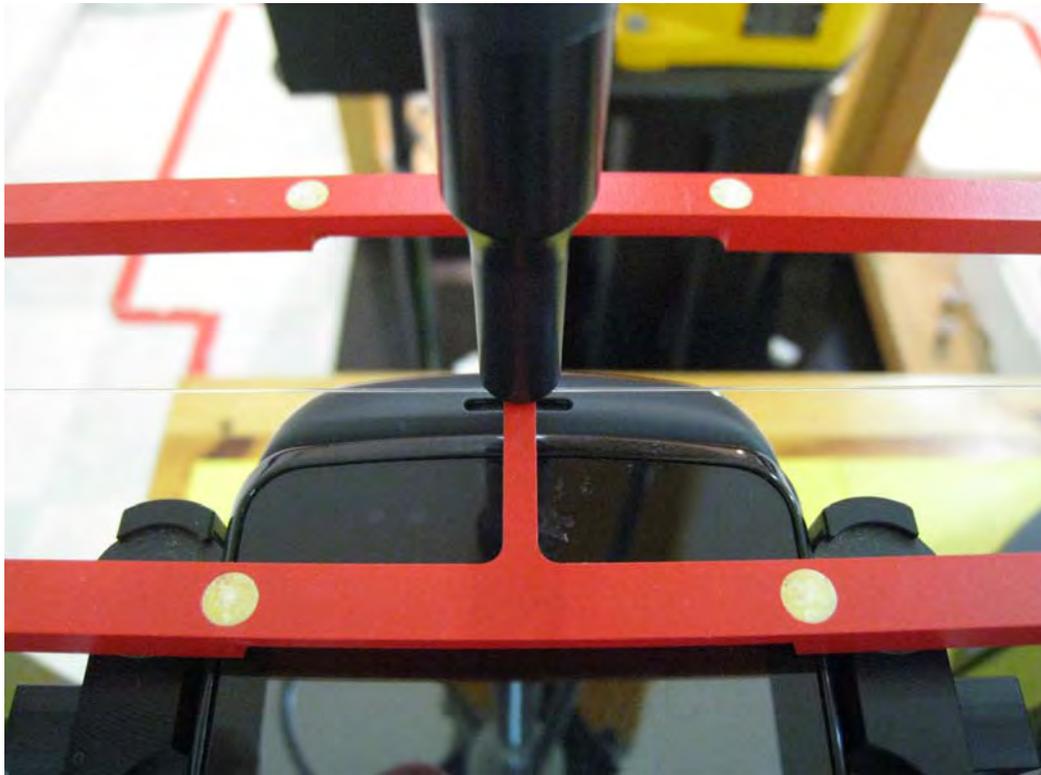
**Cursor:**  
 Total = 0.103 A/m  
 H Category: M4  
 Location: 6.5, 9, 369.4 mm

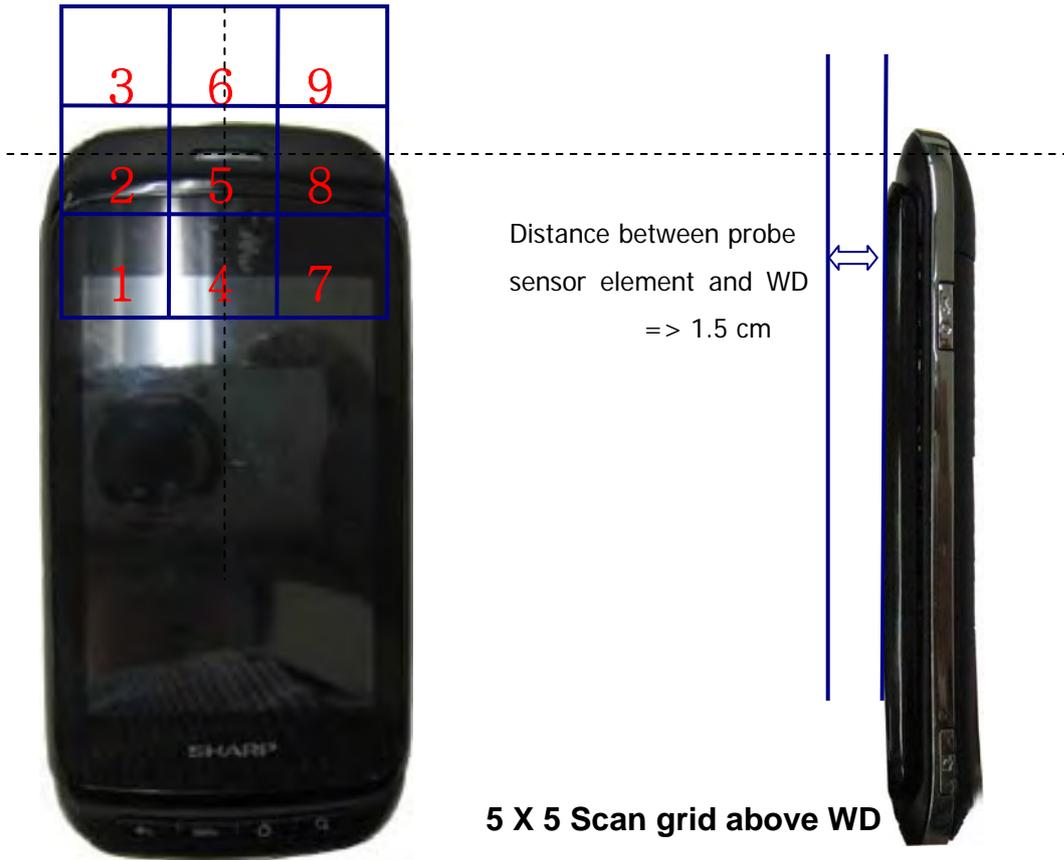


0 dB = 0.103A/m

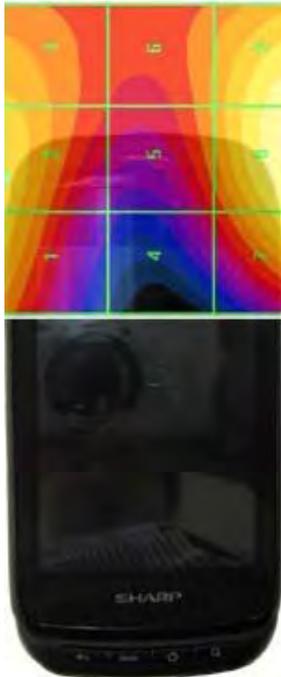
## **APPENDIX B (HAC TEST SET-UP PHOTO)**

■ Test Setup Photo

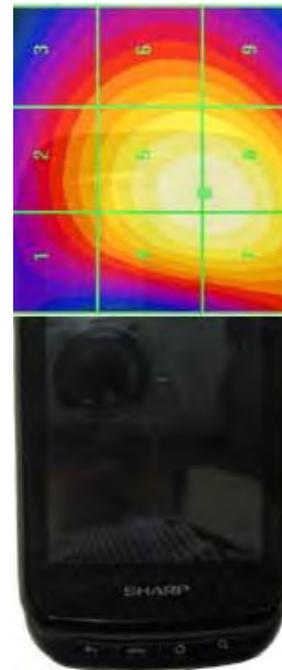




**GSM**

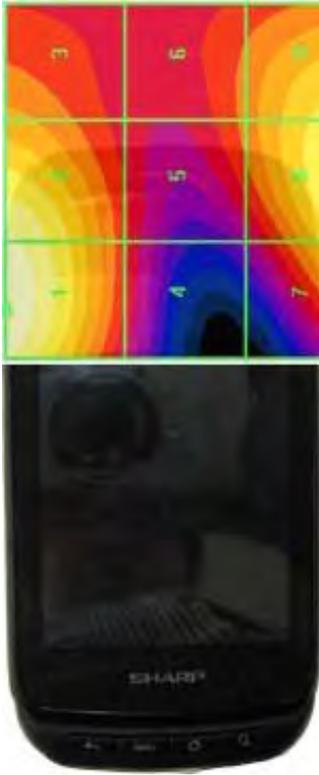


**E-Field WD Scan overlay**

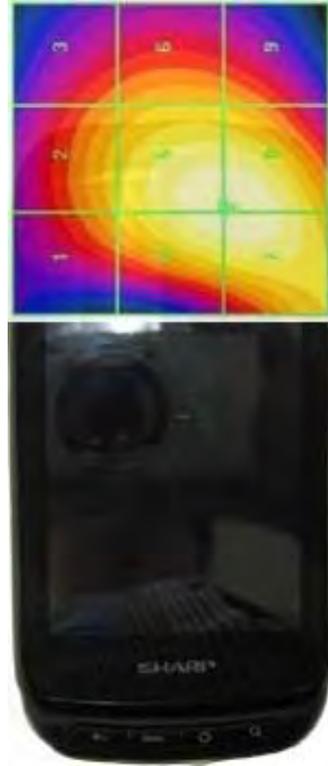


**H-Field WD Scan overlay**

### WCDMA



E-Field WD Scan overlay



H-Field WD Scan overlay

## **APPENDIX C (DIPOLE VALIDATION)**

---

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature 21.4 °C  
 Test Date Dec. 20, 2010

**DUT: HAC-Dipole 835 MHz; Type: D835V3; Serial:1024**

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: E Dipole Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

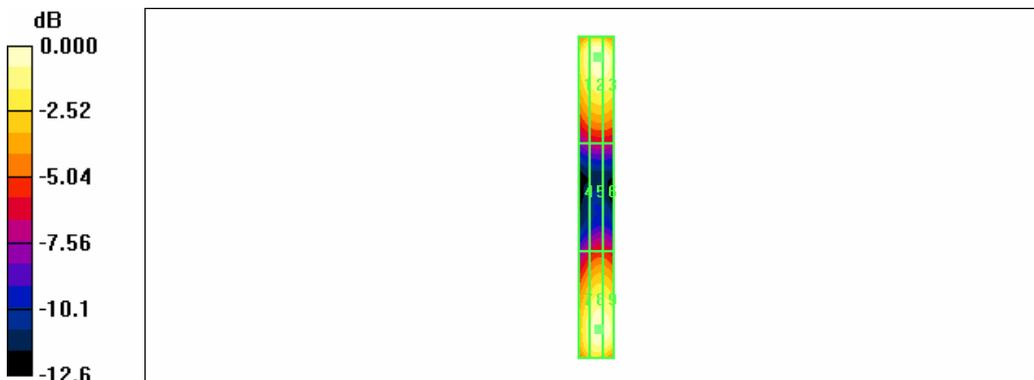
DASY4 Configuration:  
 - Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2010-05-20  
 - Sensor-Surface: (Fix Surface)  
 - Electronics: DAE4 Sn869; Calibrated: 2010-09-21  
 - Phantom: HAC Test Arch; Type: SD HAC P01 BA

**E Scan 10mm above CD 835 MHz/Hearing Aid Compatibility Test (41x361x1):** Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 164.4 V/m  
 Probe Modulation Factor = 1.00  
 Device Reference Point: 0.000, 0.000, 354.7 mm  
 Reference Value = 129.1 V/m; Power Drift = 0.001 dB  
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak E-field in V/m

Grid 1 155.0 M4	Grid 2 164.4 M4	Grid 3 161.8 M4
Grid 4 77.4 M4	Grid 5 84.8 M4	Grid 6 84.3 M4
Grid 7 148.1 M4	Grid 8 162.0 M4	Grid 9 161.1 M4

**Cursor:**  
 Total = 164.4 V/m  
 E Category: M4  
 Location: -1, -78.5, 365.8 mm



Test Laboratory: HCT CO., LTD.  
 Ambient Temperature: 21.4 °C  
 Test Date: Dec. 20, 2010

**DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial:1019**

Communication System: CW; Frequency: 1880 MHz; Duty Cycle: 1:1  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: E Dipole Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

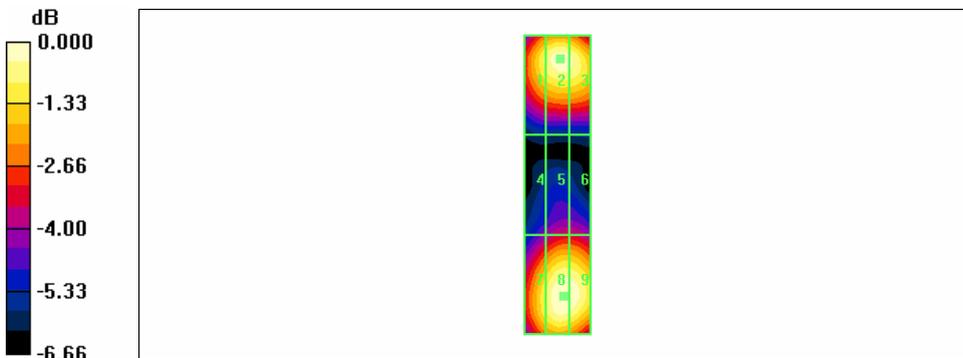
DASY4 Configuration:  
 - Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2010-05-20  
 - Sensor-Surface: (Fix Surface)  
 - Electronics: DAE4 Sn869; Calibrated: 2010-09-21  
 - Phantom: HAC Test Arch; Type: SD HAC P01 BA

**E Scan 10mm above CD 1880 MHz/Hearing Aid Compatibility Test (41x181x1):** Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 143.6 V/m  
 Probe Modulation Factor = 1.00  
 Device Reference Point: 0.000, 0.000, 354.7 mm  
 Reference Value = 169.8 V/m; Power Drift = 0.003 dB  
**Hearing Aid Near-Field Category: M2 (AWF 0 dB)**

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
132.4 M2	141.0 M2	139.0 M2
Grid 4	Grid 5	Grid 6
88.9 M3	97.0 M3	96.8 M3
Grid 7	Grid 8	Grid 9
131.1 M2	143.6 M2	142.8 M2

**Cursor:**  
 Total = 143.6 V/m  
 E Category: M2  
 Location: -2, 33.5, 365.8 mm



0 dB = 143.6V/m

Test Laboratory:                      HCT CO., LTD.  
 Ambient Temperature                21.4 °C  
 Test Date                                Dec. 20, 2010

**DUT: HAC-Dipole 835 MHz; Type: D835V3; Serial:1024**

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1$  kg/m<sup>3</sup>  
 Phantom section: H Dipole Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

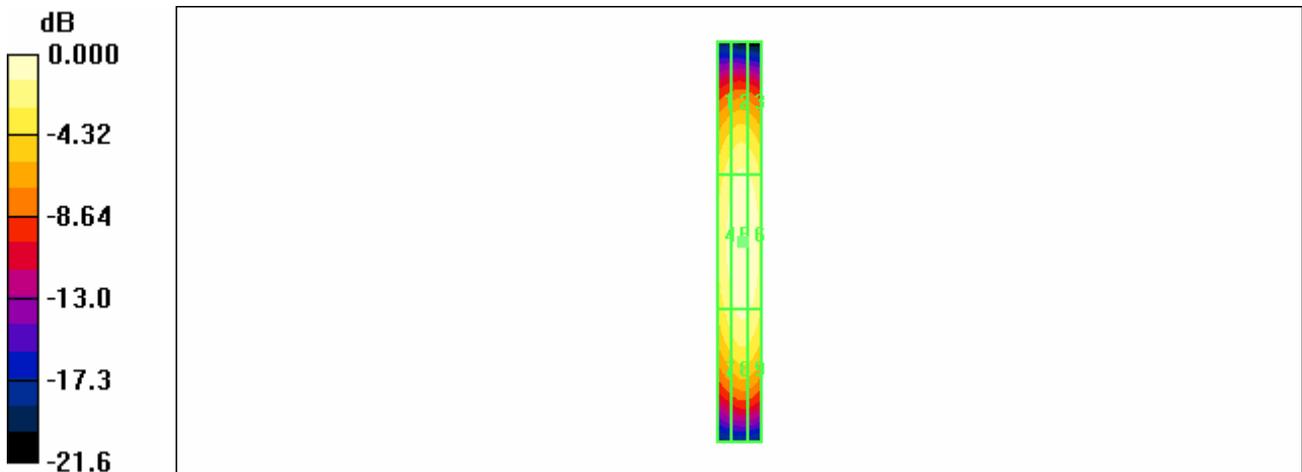
DASY4 Configuration:  
 - Probe: H3DV6 - SN6101; ; Calibrated: 2010-05-27  
 - Sensor-Surface: (Fix Surface)  
 - Electronics: DAE4 Sn869; Calibrated: 2010-09-21  
 - Phantom: HAC Test Arch; Type: SD HAC P01 BA

**H Scan 10mm above CD 835 MHz/Hearing Aid Compatibility Test (41x361x1):** Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 0.451 A/m  
 Probe Modulation Factor = 1.00  
 Device Reference Point: 0.000, 0.000, 354.7 mm  
 Reference Value = 0.563 A/m; Power Drift = -0.016 dB  
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.364 M4	0.394 M4	0.387 M4
Grid 4	Grid 5	Grid 6
0.412 M4	0.451 M4	0.443 M4
Grid 7	Grid 8	Grid 9
0.365 M4	0.402 M4	0.395 M4

**Cursor:**  
 Total = 0.451 A/m  
 H Category: M4  
 Location: -1.5, 0, 366.6 mm



0 dB = 0.451A/m

Test Laboratory: HCT CO., LTD.  
 Ambient Temperature 21.4 °C  
 Test Date Dec. 20, 2010

**DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial:1019**

Communication System: CW; Frequency: 1880 MHz; Duty Cycle: 1:1  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1$  kg/m<sup>3</sup>  
 Phantom section: H Dipole Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

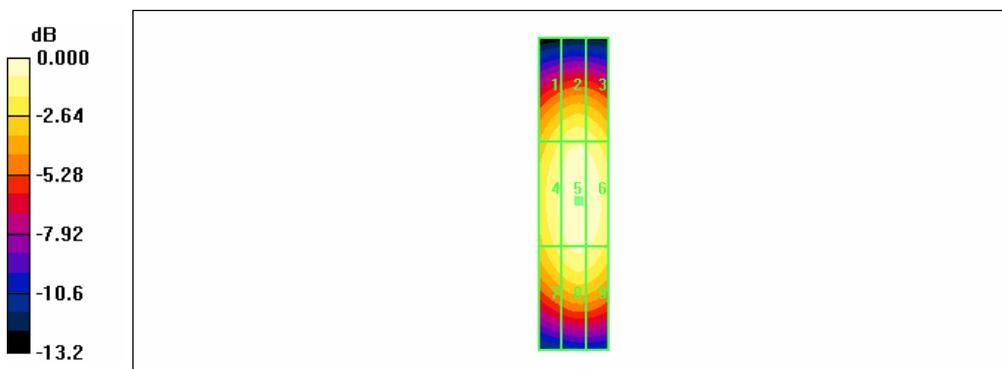
DASY4 Configuration:  
 - Probe: H3DV6 - SN6101; ; Calibrated: 2010-05-27  
 - Sensor-Surface: (Fix Surface)  
 - Electronics: DAE4 Sn869; Calibrated: 2010-09-21  
 - Phantom: HAC Test Arch; Type: SD HAC P01 BA

**H Scan 10mm above CD 1880 MHz/Hearing Aid Compatibility Test (41x181x1):** Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 0.460 A/m  
 Probe Modulation Factor = 1.00  
 Device Reference Point: 0.000, 0.000, 354.7 mm  
 Reference Value = 0.549 A/m; Power Drift = 0.013 dB  
**Hearing Aid Near-Field Category: M2 (AWF 0 dB)**

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.380 M2	0.409 M2	0.404 M2
Grid 4	Grid 5	Grid 6
0.429 M2	0.460 M2	0.455 M2
Grid 7	Grid 8	Grid 9
0.397 M2	0.429 M2	0.424 M2

**Cursor:**  
 Total = 0.460 A/m  
 H Category: M2  
 Location: -1.5, 2, 366.6 mm



0 dB = 0.460A/m

## **APPENDIX D (PROBE CALIBRATION DATA)**

---

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



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

Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **HCT (Dymstec)**

Certificate No: **ER3-2343\_May10**

**CALIBRATION CERTIFICATE**

Object: **ER3DV6 - SN:2343**

Calibration procedure(s): **QA CAL-02.v5 and QA CAL-25.v2  
Calibration procedure for E-field probes optimized for close near field evaluations in air**

Calibration date: **May 20, 2010**

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-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	1-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ER3DV6	SN: 2328	3-Oct-09 (No. ER3-2328_Oct09)	Oct-10
DAE4	SN: 789	23-Dec-09 (No. DAE4-789_Dec09)	Dec-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-09)	In house check: Oct10

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

Issued: May 22, 2010

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  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

#### Glossary:

$NORM_{x,y,z}$	sensitivity in free space
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization $\varphi$	$\varphi$ rotation around probe axis
Polarization $\vartheta$	$\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ 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:

- $NORM_{x,y,z}$ : Assessed for E-field polarization  $\vartheta = 0$  for XY sensors and  $\vartheta = 90$  for Z sensor ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide).
- $NORM(f)_{x,y,z} = NORM_{x,y,z} * frequency\_response$  (see Frequency Response Chart).
- $DCP_{x,y,z}$ : DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- $A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,y,z}$ : A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- 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  $NORM_x$  (no uncertainty required).

ER3DV6 SN:2343

May 20, 2010

# Probe ER3DV6

## SN:2343

Manufactured:                      December 14, 2004  
Last calibrated:                    May 22, 2009  
Recalibrated:                        May 20, 2010

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

ER3DV6 SN:2343

May 20, 2010

**DASY/EASY - Parameters of Probe: ER3DV6 SN:2343**

**Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ )	1.71	1.61	1.63	$\pm 10.1\%$
DCP (mV) <sup>A</sup>	90.2	92.0	97.3	

**Modulation Calibration Parameters**

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc <sup>E</sup> (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	300	$\pm 1.5\%$
			Y	0.00	0.00	1.00	300	
			Z	0.00	0.00	1.00	300	

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%.

<sup>A</sup> numerical linearization parameter: uncertainty not required

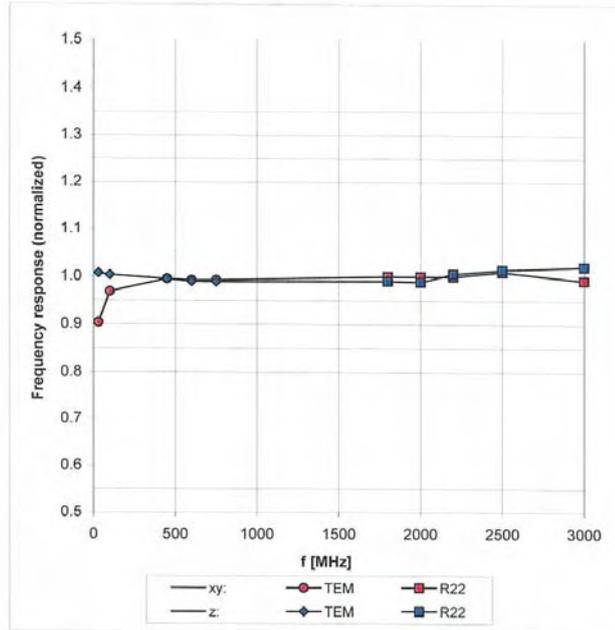
<sup>E</sup> Uncertainty is determined using the maximum deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

ER3DV6 SN:2343

May 20, 2010

### Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide R22)

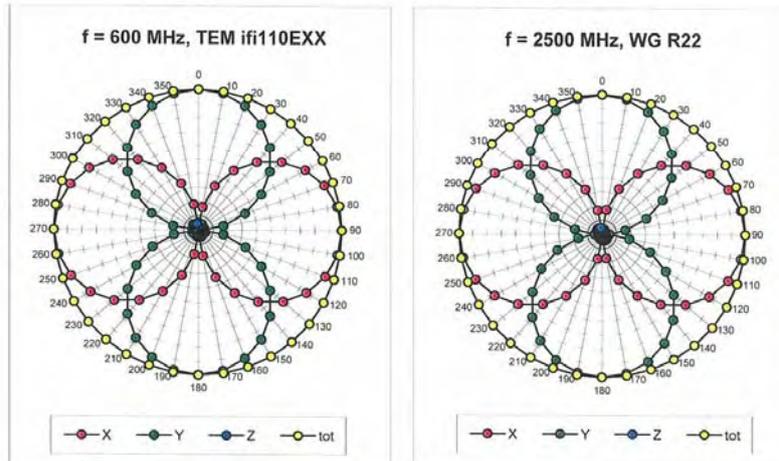


Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

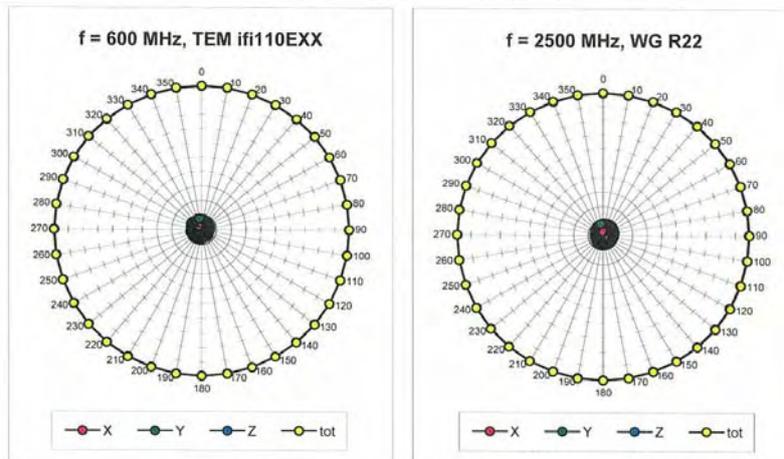
ER3DV6 SN:2343

May 20, 2010

**Receiving Pattern ( $\phi$ ),  $\vartheta = 0^\circ$**



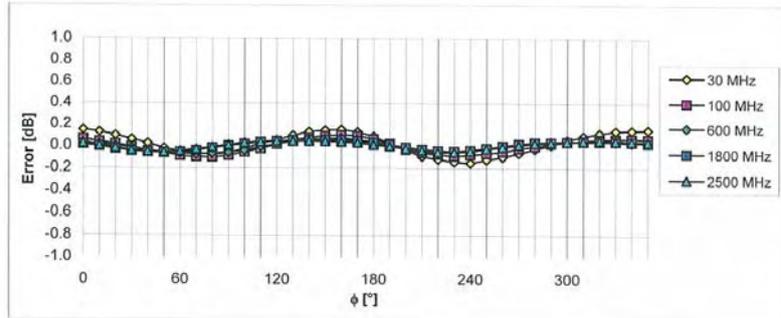
**Receiving Pattern ( $\phi$ ),  $\vartheta = 90^\circ$**



ER3DV6 SN:2343

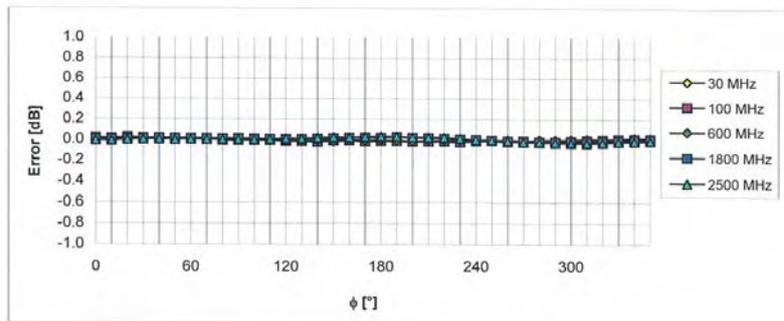
May 20, 2010

### Receiving Pattern ( $\phi$ ), $\vartheta = 0^\circ$



Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  (k=2)

### Receiving Pattern ( $\phi$ ), $\vartheta = 90^\circ$

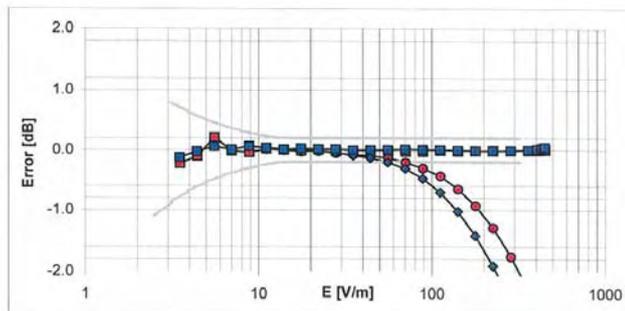
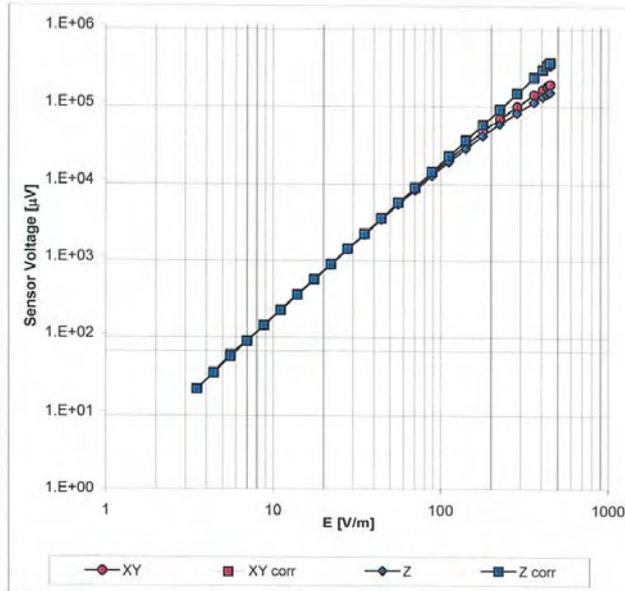


Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  (k=2)

ER3DV6 SN:2343

May 20, 2010

### Dynamic Range f(E-field) (Waveguide R22, f = 1800 MHz)

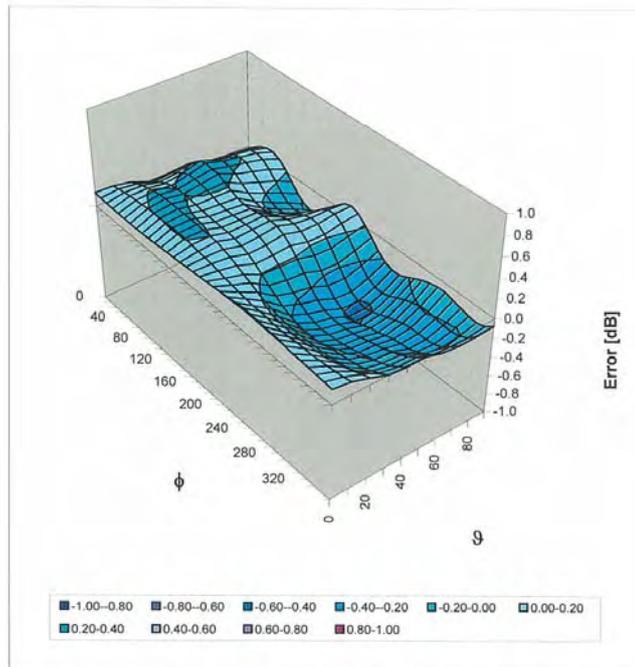


Uncertainty of Linearity Assessment:  $\pm 0.6\%$  (k=2)

ER3DV6 SN:2343

May 20, 2010

**Deviation from Isotropy in Air**  
**Error ( $\phi, \vartheta$ ),  $f = 900$  MHz**



Uncertainty of Spherical Isotropy Assessment:  $\pm 2.6\%$  ( $k=2$ )

ER3DV6 SN:2343

May 20, 2010

**Other Probe Parameters**

Sensor Arrangement	Rectangular
Connector Angle (°)	61.1
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	8.0 mm
Probe Tip to Sensor X Calibration Point	2.5 mm
Probe Tip to Sensor Y Calibration Point	2.5 mm
Probe Tip to Sensor Z Calibration Point	2.5 mm

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



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

Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **HCT (Dymstec)**

Certificate No: **H3-6101\_May10**

**CALIBRATION CERTIFICATE**

Object: **H3DV6 - SN:6101**

Calibration procedure(s): **QA CAL-03.v5 and QA CAL-25.v2  
Calibration procedure for H-field probes optimized for close near field  
evaluations in air**

Calibration date: **May 27, 2010**

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-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	1-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe H3DV6	SN: 6182	3-Oct-09 (No. H3-6182_Oct09)	Oct-10
DAE4	SN: 789	23-Dec-09 (No. DAE4-789_Dec09)	Dec-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-09)	In house check: Oct10

Calibrated by: **Name: Katja Pokovic      Function: Technical Manager      Signature: [Signature]**

Approved by: **Name: Fin Bomholt      R&D Director      Signature: [Signature]**

Issued: May 27, 2010

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

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Accreditation No.: SCS 108

#### Glossary:

NORM <sub>x,y,z</sub>	sensitivity in free space
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization $\varphi$	$\varphi$ rotation around probe axis
Polarization $\vartheta$	$\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ 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:

- 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:

- NORM<sub>x,y,z</sub>*: Assessed for E-field polarization  $\vartheta = 0$  for XY sensors and  $\vartheta = 90$  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).
- DCP<sub>x,y,z</sub>*: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; VR<sub>x,y,z</sub>*: *A, B, C* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- 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).

H3DV6 SN:6101

May 27, 2010

# Probe H3DV6

## SN:6101

Manufactured:	December 10, 2001
Last calibrated:	May 22, 2009
Repaired:	May 26, 2010
Recalibrated:	May 27, 2010

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)