HCT CO., LTD.

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HAC RF Emission TEST REPORT

CASIO HITACHI Mobile Communications Co., Ltd.
2-229-1, Sakuragaoka, Higashiyamato-shi,
Tokyo 207-8501, Japan

Date of Issue: April 6,2008
Test Report No.: HCT-SAR08-0404
Test Site: HCT CO., LTD.

FCC ID: TYKNX9230

APPLICANT: CASIO HITACHI Mobile Communications Co., Ltd.

EUT Type:	Dual-Band CDMA /EVDO Phone with Bluetooth
Tx Frequency:	824.70 — 848.31 MHz (CDMA)
	1 851.25 — 1 908.75 MHz (PCS CDMA)
Maximum Conducted	0.251 W CDMA (24.0 dBm)
Power (HAC):	0.229 W PCS CDMA (23.6 dBm)
Trade Name/Model(s):	CASIO HITACHI / G'zOne Boulder
FCC Classification:	Licensed Portable Transmitter Held to Ear (PCE)
FCC Rule Part(s):	§20.19
HAC Standard:	ANSI C63.19-2006 V3.12

Hearing Aid Near-Field Category: M4

This wireless portable device has been shown to be hearing-aid compatible under the above rated category, specified in ANSI/IEEE Std. C63.19-2006 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
: Sun-Hee Kim
Test Engineer of HAC Part

Approved by
: Nam-Wook Kang
Manager of HAC Part

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HAC MEASUREMENT REPORT

1. APPLICANT / EUT DESCRIPTION

1.1 Applicant

• Company Name:	CASIO HITACHI Mobile Communications Co., Ltd.
• Address:	2-229-1, Sakuragaoka, Higashiyamato-shi, Tokyo 207-8501, Japan
• Attention:	Tsuchida Masahiko
• Tel. / Fax :	(042) 516-2183 / (042) 516-2505
• E-Mail :	tuchida@ch-mobile.co.jp

1.2 EUT Description

• EUT Type:	Dual-Band CDMA /EVDO Phone with Bluetooth
• Trade Name:	CASIO HITACHI
• Model(s):	G'zOne Boulder
• FCC ID:	TYKNX9230
• Serial Number(s):	#1
• Tx Frequency:	824.70 - 848.31 MHz (CDMA) 1 851.25 – 1 908.75 MHz (PCS CDMA)
• FCC Classification:	Licensed Portable Transmitter Held to Ear (PCE)
• FCC Rule Part(s):	§ 20.19(b); §6.3(v), §7.3(v)
• Modulation(s):	CDMA / PCS CDMA
• Antenna Type:	Intenna
• Date(s) of Tests:	April 5, 2008
• Place of Tests:	HCT CO., LTD. Icheon, Kyoung ki-Do, KOREA
• Report Serial No.:	HCT-SAR08-0404
• Max E-Field Emission:	channel 1175, 1 908.75 MHz = 35.2 dBV/m (M4)
• Max H-Field Emission:	channel 1175, 1 908.75 MHz = - 18.2 dBA/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.

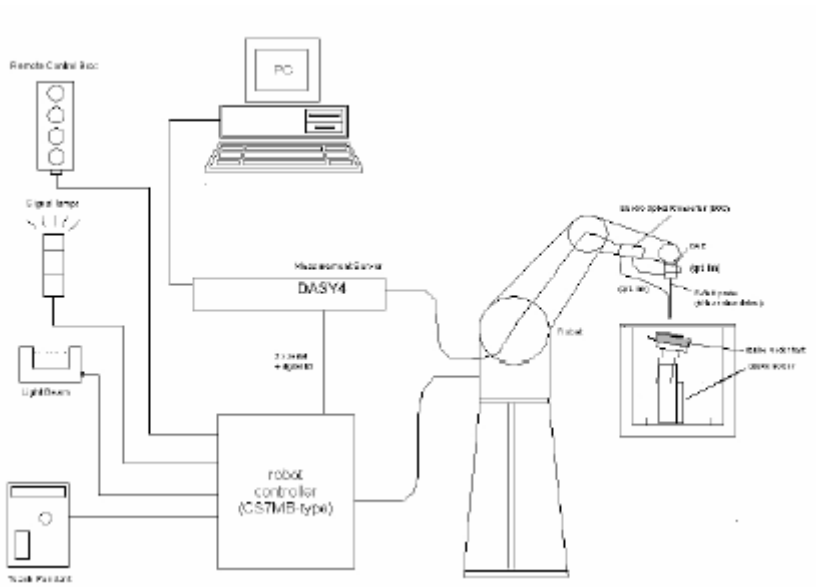


Figure 1. HAC Test Measurement Set-up

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	 [E-Field Probe]
Calibration	In air from 100 MHz to 3.0 GHz (absolute accuracy ± 6.0 %, *k* = 2)	
Frequency	100 MHz to > 6 GHz; Linearity: ± 0.2 dB (100 MHz to 3 GHz)	
Directivity	± 0.2 dB in air (rotation around probe axis) ± 0.4 dB in air (rotation normal to probe axis)	
Dynamic Range	2 V/m to > 1000 V/m (M3 or better device readings fall well below diode compression point)	
Linearity	± 0.2 dB	
Dimensions	Overall length: 330 mm (Tip: 16 mm) Tip diameter: 8 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.5 mm	

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., glycolether)	 [H-Field Probe]
Frequency	200 MHz to > 3 GHz (absolute accuracy ± 6.0 %, *k* = 2); Output linearized	
Directivity	± 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

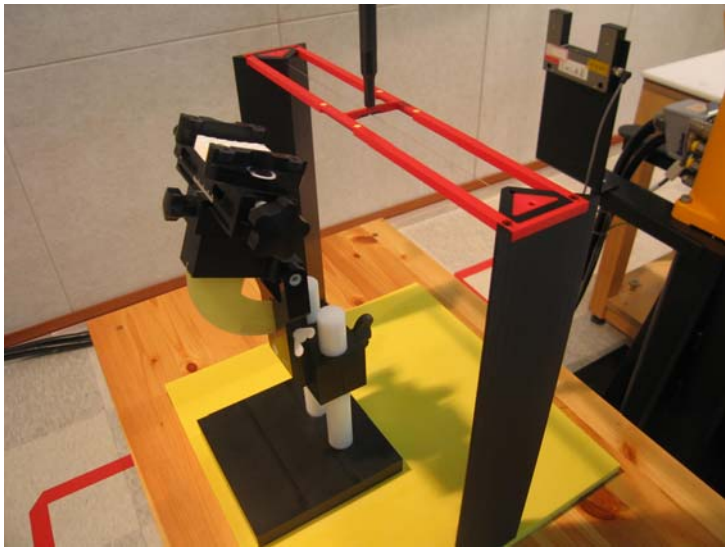


Figure 2. HAC Phantom & Device Holder

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

Specifications	
POSITIONER:	Stäubli Unimation Corp. Robot Model: RX90LB
Repeatability:	0.02 mm
No. of axis:	6
Data Acquisition Electronic (DAE) System	
Cell Controller	
Processor:	Pentium IV
Clock Speed:	3.0 GHz
Operating System:	Windows XP
Data Card:	DASY4 PC-Board
Data Converter	
Features:	Signal Amplifier, multiplexer, A/D converter, and control logic
Software:	DASY4 software
Connecting Lines:	Optical downlink for data and status info. Optical uplink for commands and clock
PC Interface Card	
Function:	24 bit (64 MHz) DSP for real time processing Link to DAE3 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 1.0 cm in front of, the reference plane.

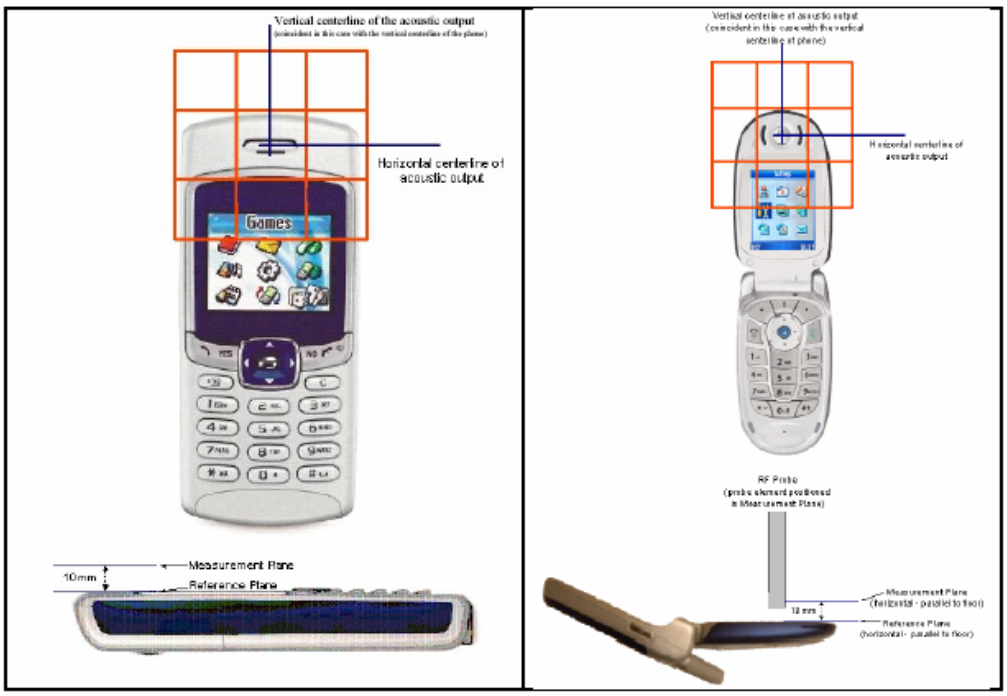


Figure 3. WD reference and plane for RF emission measurements

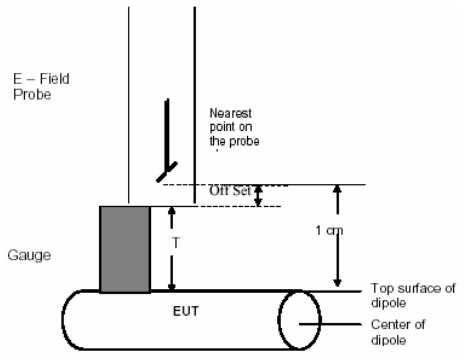


Figure 4. Gauge Block with E-Field Probe

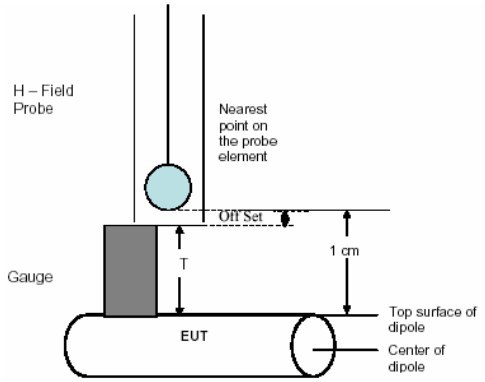


Figure 5. Gauge Block with H-Field Probe

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.

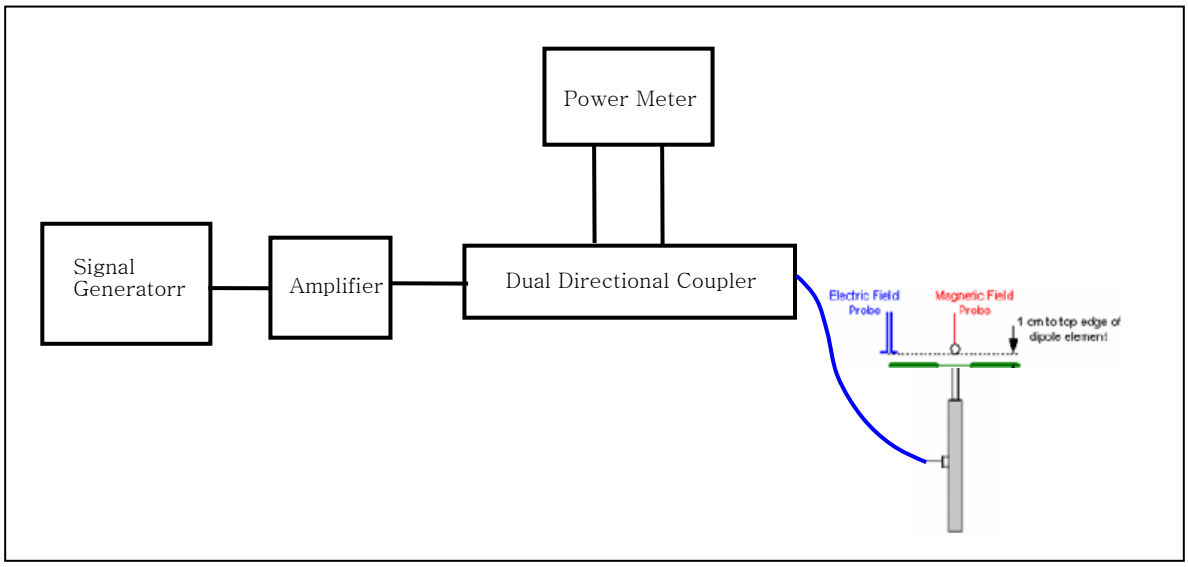


Figure 6. Dipole Validation SET-UP

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	171.05	162.4	+ 5.33	± 25
CW	1 880	20	132.85	134.6	- 1.30	± 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	0.459	0.446	+ 2.91	± 25
CW	1 880	20	0.437	0.441	- 0.91	± 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:

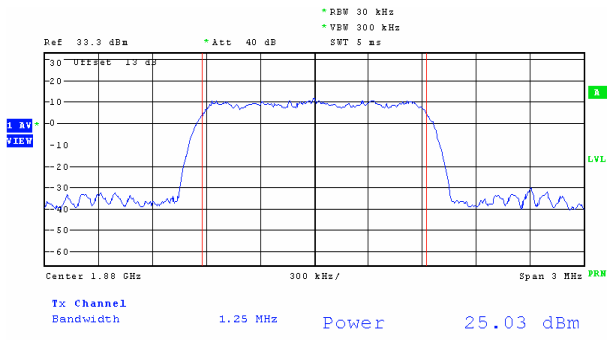


Figure. 7
Signal Generator Modulated Signal

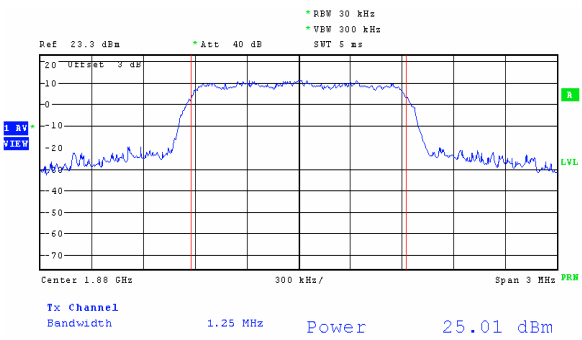


Figure. 8
Wireless Device Modulated Signal

6.2 Modulation Factor

6.2.1 E-Field

Mode	Freq. [MHz]	Input Power [dB]	E-Field measured value [V/m]	Probe Modulation Factor
CW	835	24.0	271.3	-
80 % AM		24.0	177.3	1.53
CDMA (Full Rate)		24.0	283.78	0.956
CDMA (1/8 Rate)		24.0	91.65	2.96
CW	1 880	23.6	196.4	-
80 % AM		23.6	122.06	1.609
CDMA (Full Rate)		23.6	202.06	0.972
CDMA (1/8 Rate)		23.6	65.82	2.984

6.2.2 H-Field

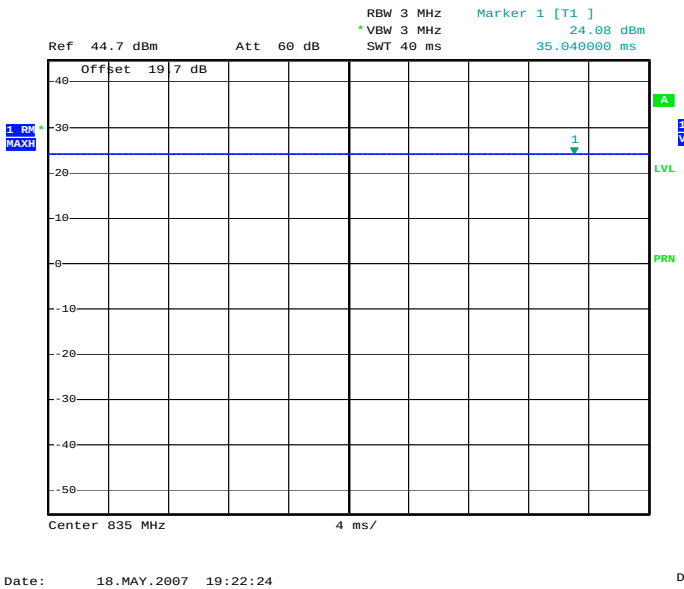
Mode	Freq. [MHz]	Input Power [dB]	H-Field measured value [A/m]	Probe Modulation Factor
CW	835	24.0	0.871	-
80 % AM		24.0	0.565	1.542
CDMA (Full Rate)		24.0	1.016	0.857
CDMA (1/8 Rate)		24.0	0.310	2.810
CW	1 880	23.6	0.736	-
80 % AM		23.6	0.502	1.466
CDMA (Full Rate)		23.6	0.977	0.753
CDMA (1/8 Rate)		23.6	0.269	2.736

Notes:

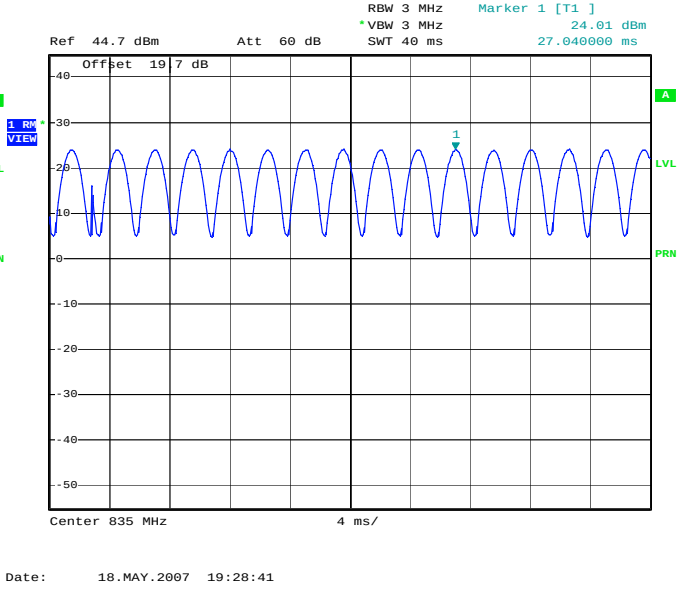
1) Modulation Factor =CW / WD_CDMA

6.2.3 PMF Peak Power Measurement Plots

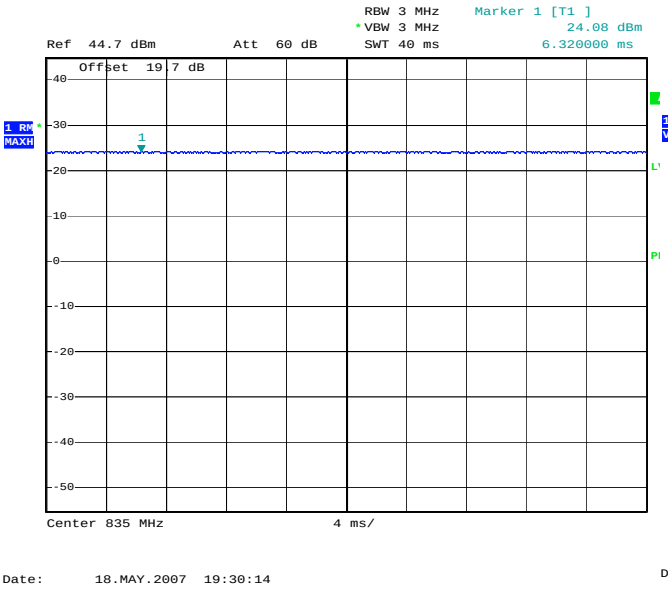
■ Probe Modulation Factor (CW)



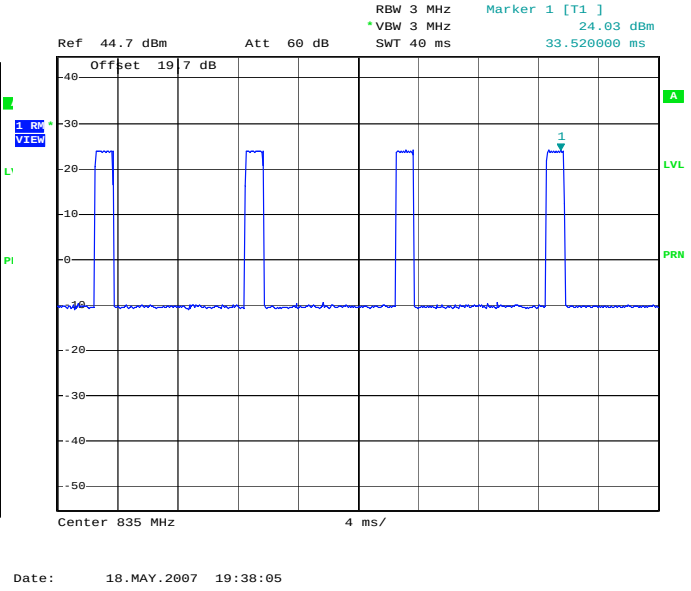
■ Probe Modulation Factor (AM 80 %)



■ Probe Modulation Factor (CDMA: full rate)



■ Probe Modulation Factor (CDMA: 1/8 rate)



Spectrum Analyzer Settings

- Input Power: 24.0 dBm
- RBW: 3 MHz
- Video Bandwidth: 3 MHz
- Span: Zero
- Sweep Time: 40 ms
- Detection: Peak detection (RMS)

7. FCC 3G MEASUREMENTS – MAY / JUNE 2006

Sample pre-testing of the various modes were performed at the worst case probe location as part of subset testing justification. See below for measured conducted power for applicable device modes:

7.1 Handset Measured Conducted Powers

Average Output Power Measurement for FCC ID: TYKNX9230

Band	Channel	SO2 RC1/1	SO2 RC3/3	SO55 RC1/1	SO55 RC3/3	TDSO SO32 RC3/3	1xEvDO Rev.0 (FTAP)	1xEvDO Rev.0 (RTAP)	1xEvDO Rev.A (FTAP)	1xEvDO Rev.A (RTAP)
CDMA	1013	24.08	24.11	24.04	24.10	24.11	24.10	24.13	24.13	24.15
	384	24.05	24.08	24.06	24.10	24.12	24.08	24.11	24.11	24.14
	777	23.92	23.90	23.90	23.91	23.92	23.93	23.94	24.93	23.96
PCS	25	23.81	23.75	23.74	23.77	23.80	28.85	23.83	23.82	23.80
	600	23.73	23.77	23.76	23.75	23.74	23.78	23.80	23.72	23.77
	1175	23.55	23.54	23.56	23.55	23.53	23.55	23.56	23.56	23.58

7.2 Worst-Case Probe Location Measurements

Below are RC/SO mode investigation results of the device at the worst-case (maximum) field point location. The worst-case RC/SO was used for HAC testing.

Mode	Channel	Backlight	RC/SO	Battery	Antenna	Conducted Power [dBm]	Time Avg. Field [V/m]	Peak Field [dBV/m]	FCC Limit [dBV/m]	FCC MARGIN [dB]	RESULT
PCS	1175	off	SO55/RC3	Standard	Intenna	23.55	55.98	34.7	41	- 6.29	M4
PCS	1175	on	SO55/RC1	Standard	Intenna	23.56	56.27	34.8	41	- 6.24	M4
PCS	1175	off	SO2/RC1	Standard	Intenna	23.55	56.59	34.8	41	- 6.19	M4
PCS	1175	off	SO3/RC1	Standard	Intenna	23.54	19.46	35.3	41	- 5.72	M4
PCS	1175	off	SO55/RC1	Standard	Intenna	23.56	57.41	34.9	41	- 6.07	M4
PCS	1175	off	SO9/RC2	Standard	Intenna	23.55	57.17	34.9	41	- 6.10	M4
PCS	1175	off	SO2/RC3	Standard	Intenna	23.54	56.24	34.8	41	- 6.25	M4
PCS	1175	off	SO3/RC3	Standard	Intenna	23.55	55.21	34.6	41	- 6.41	M4

8. TEST PROCEDURE

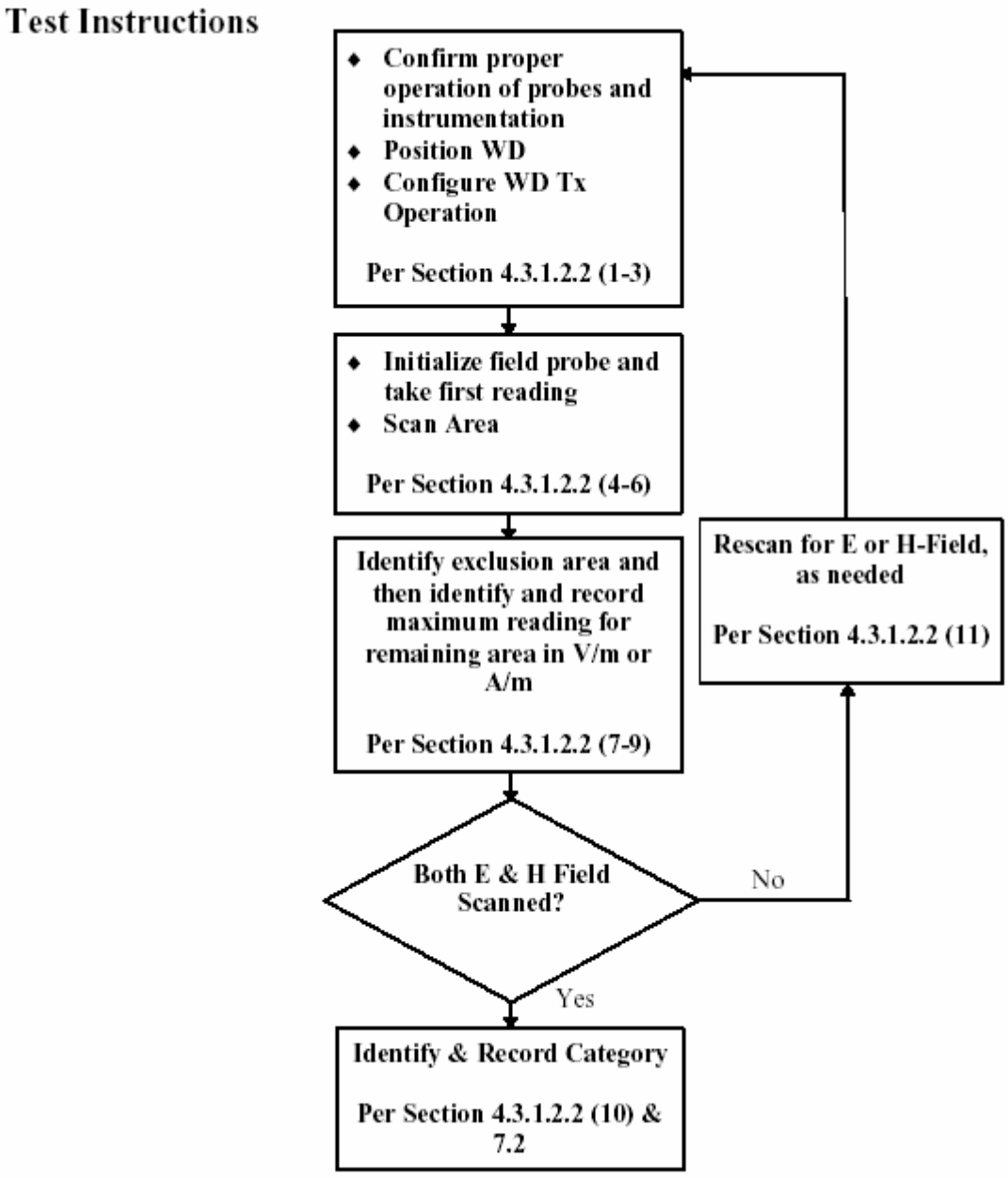


Figure 9. WD near-field emission automated test flowchart

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 1cm 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	
	Measurement system									
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 positionering	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	∞	
	Test Sample Related									
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	∞	
	PMF Calculations									
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	∞	
	Phantom and Setup Related									
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	
	Measurement system									
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 positionering	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	∞	
	Test Sample Related									
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	∞	
	PMF Calculations									
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	∞	
	Phantom and Setup Related									
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): 21.6

S/N: #1

11.1 Measurement Results (E-Field CDMA / PCS DATA)

Mode	Ch.	Backlight	RC/SO	Battery	Antenna	Conducted Power (dBm)	Time Avg. Field (V/m)	Peak Field (dBV/m)	FCC Limit (dBV/m)	FCC MARGIN (dB)	Exclusion Block	RESULT
CDMA	1013	off	SO55/RC1	Standard	Intenna	24.04	58.1	34.9	51	- 16.11	none	M4
CDMA	384	off	SO55/RC1	Standard	Intenna	24.06	76.3	37.3	51	- 13.74	none	M4
CDMA	777	off	SO55/RC1	Standard	Intenna	23.90	64.4	35.8	51	- 15.21	none	M4
PCS	25	off	SO55/RC1	Standard	Intenna	23.74	50.5	33.8	41	- 7.19	none	M4
PCS	600	off	SO55/RC1	Standard	Intenna	23.76	55.7	34.7	41	- 6.32	none	M4
PCS	1175	off	SO55/RC1	Standard	Intenna	23.56	58.9	35.2	41	- 5.84	none	M4

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. HAC TEST DATA SUMMARY

Ambient TEMPERATURE (°C): 21.6

S/N: #1

11.2 Measurement Results (H-Field CDMA / PCS DATA)

Mode	Ch.	Backlight	RC/SO	Battery	Antenna	Conducted Power (dBm)	Time Avg. Field (A/m)	Peak Field (dBA/m)	FCC Limit (dBA/m)	FCC MARGIN (dB)	Exclusion Block	RESULT
CDMA	1013	off	SO55/RC1	Standard	Intenna	24.04	0.105	- 20.9	0.6	- 21.50	none	M4
CDMA	384	off	SO55/RC1	Standard	Intenna	24.06	0.134	- 18.8	0.6	- 19.39	none	M4
CDMA	777	off	SO55/RC1	Standard	Intenna	23.90	0.115	- 20.1	0.6	- 20.72	none	M4
PCS	25	off	SO55/RC1	Standard	Intenna	23.74	0.142	- 19.4	- 9.4	- 10.03	none	M4
PCS	600	off	SO55/RC1	Standard	Intenna	23.76	0.163	- 18.2	- 9.4	- 8.84	none	M4
PCS	1175	off	SO55/RC1	Standard	Intenna	23.56	0.164	- 18.2	- 9.4	- 8.79	none	M4

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. HAC TEST DATA SUMMARY

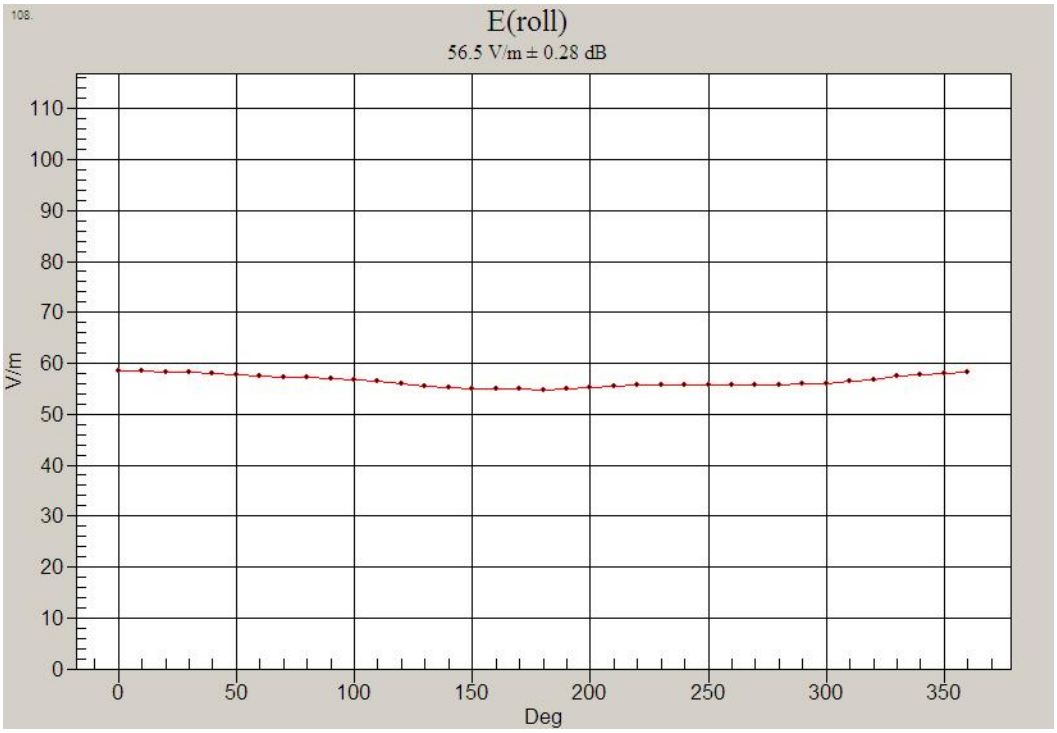
Ambient TEMPERATURE (°C): 21.6

S/N: #1

11.5 Worst-case Configuration Evaluation

Peak Reading 360° Probe Rotation at Azimuth axis

Mode	Channel	Backlight	RC/SO	Antenna	Conducted Power (dBm)	Time Avg. Field (A/m)	Peak Field (dBA/m)	FCC Limit (dBA/m)	FCC MARGIN (dB)	Exclusion Block	RESULT
PCS	1175	off	SO55/RC1	Standard	23.56	58.5	35.1	41	- 5.90	none	M4



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	DAE4V1	447	09/13/07	Annual	09/13/08
SPEAG	E-Field Probe	2343	06/25/07	Annual	06/25/08
SPEAG	H-Field Probe	6101	07/25/07	Annual	07/25/08
SPEAG	Validation Dipole CD835V2	1071	07/12/07	Annual	07/12/08
SPEAG	Validation Dipole CD1880V2	1082	07/12/07	Annual	07/12/08
Agilent	Power Meter(F) E4419B	MY40330223	11/05/07	Annual	11/05/08
Agilent	Power Sensor(G) 8481	MY41090870	11/05/07	Annual	11/05/08
HP	Signal Generator E4438C	MY42082646	12/24/07	Annual	12/24/08
EM POWER	Power Amp BBS3Q7ELU	1013-D/C-0127	04/17/07	Annual	04/17/08
HP	Network Analyzer 8753ES	JP39240221	04/11/07	Annual	04/11/08
HP	Dielectric Probe Kit 85070C	00721521	N/A	N/A	N/A
HP	Dual Directional Coupler 778D	16072	11/05/07	Annual	11/05/08
R&S	Base Station CMU200	838207/050	11/05/07	Annual	11/05/08
Agilent	Base Station E5515C	GB44400269	02/10/08	Annual	02/10/09
R&S	Spectrum Analyzer FSP30	839117/011	06/28/07	Annual	06/28/08

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

The HAC measurement indicates that the EUT complies with the HAC limits of the ANSI-C63.19-2006.

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

Test Laboratory:	HCT CO., LTD.
Ambient Temperature / Channel	21.6 °C /1013
Test Date	April 05, 2008

DUT: G'zOne Boulder; Type: folder; Serial: #1

Communication System: CDMA 835MHz FCC; Frequency: 824.7 MHz;Duty Cycle: 1:1
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3
Phantom section: E Device Section ; Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 176

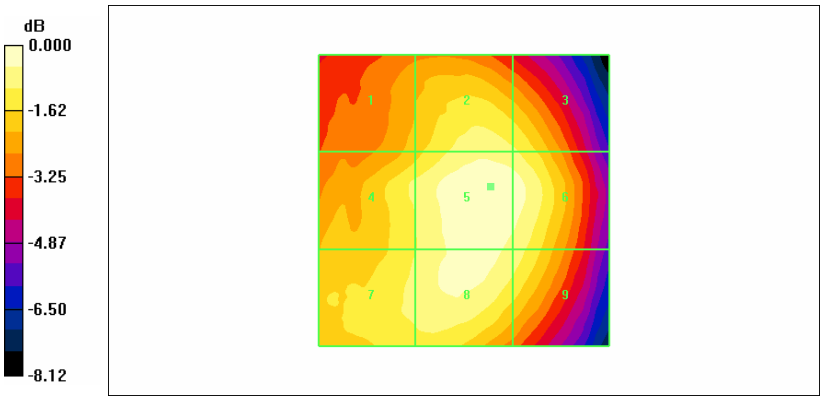
DASY4 Configuration:
- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2007-06-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn447; Calibrated: 2007-09-13
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

E Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 55.5 V/m
Probe Modulation Factor = 0.956
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 60.6 V/m; Power Drift = 0.207 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **45.0 M4**	Grid 2 **51.5 M4**	Grid 3 **49.7 M4**
Grid 4 **49.9 M4**	Grid 5 **55.5 M4**	Grid 6 **54.2 M4**
Grid 7 **50.0 M4**	Grid 8 **53.7 M4**	Grid 9 **51.1 M4**

Cursor:
Total = 55.5 V/m
E Category: M4
Location: -4.6, -2.4, 364.8 mm



0 dB = 55.5V/m

Test Laboratory:	HCT CO., LTD.
Ambient Temperature / Channel	21.6 °C /384
Test Date	April 05, 2008

DUT: G'zOne Boulder; Type: folder; Serial: #1

Communication System: CDMA 835MHz FCC; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3
Phantom section: E Device Section ; Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 176

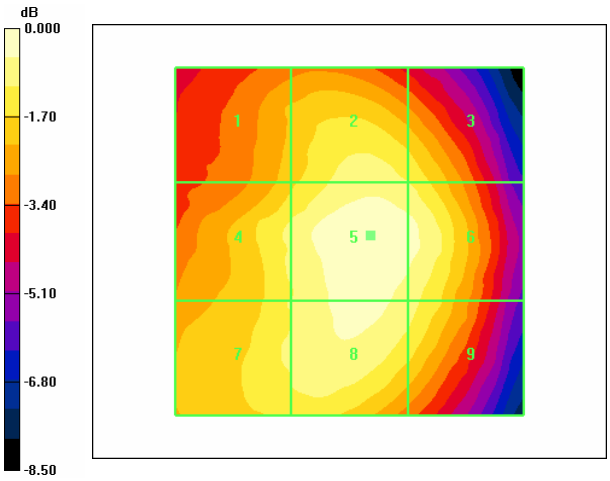
DASY4 Configuration:
- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2007-06-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn447; Calibrated: 2007-09-13
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

E Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 72.9 V/m
Probe Modulation Factor = 0.956
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 81.7 V/m; Power Drift = 0.002 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **59.3 M4**	Grid 2 **66.8 M4**	Grid 3 **64.2 M4**
Grid 4 **65.3 M4**	Grid 5 **72.9 M4**	Grid 6 **70.3 M4**
Grid 7 **65.2 M4**	Grid 8 **69.7 M4**	Grid 9 **66.2 M4**

Cursor:
Total = 72.9 V/m
E Category: M4
Location: -3, -0.8, 364.8 mm



0 dB = 72.9V/m

Test Laboratory:	HCT CO., LTD.
Ambient Temperature / Channel	21.6 °C /777
Test Date	April 05, 2008

DUT: G'zOne Boulder; Type: folder; Serial: #1

Communication System: CDMA 835MHz FCC; Frequency: 848.31 MHz;Duty Cycle: 1:1
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3
Phantom section: E Device Section ; Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 176

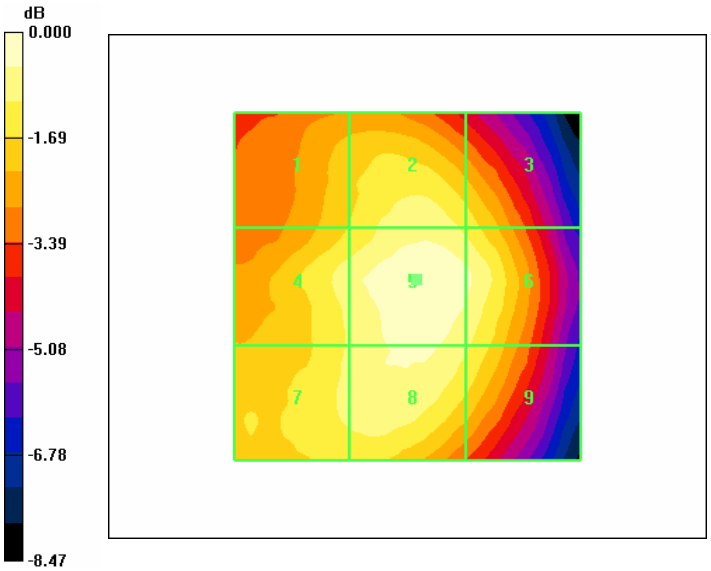
DASY4 Configuration:
- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2007-06-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn447; Calibrated: 2007-09-13
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

E Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 61.6 V/m
Probe Modulation Factor = 0.956
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 68.4 V/m; Power Drift = 0.035 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **51.0 M4**	Grid 2 **56.6 M4**	Grid 3 **53.2 M4**
Grid 4 **56.5 M4**	Grid 5 **61.6 M4**	Grid 6 **58.6 M4**
Grid 7 **55.0 M4**	Grid 8 **58.8 M4**	Grid 9 **54.9 M4**

Cursor:
Total = 61.6 V/m
E Category: M4
Location: -1.4, -1, 364.8 mm



0 dB = 61.6V/m

Test Laboratory: HCT CO., LTD.

Ambient Temperature / Channel 21.6 °C /25

Test Date April 05, 2008

DUT: G'zOne Boulder; Type: folder; Serial: #1

Communication System: PCS 1900MHz FCC; Frequency: 1851.25 MHz;Duty Cycle: 1:1
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3
Phantom section: E Device Section ; Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 176

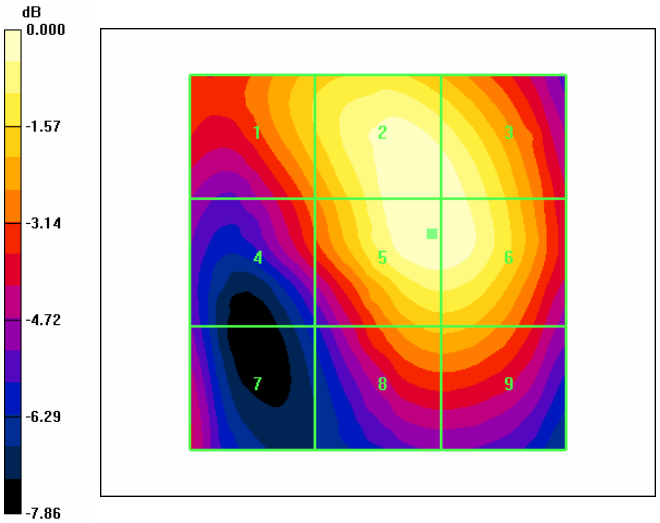
DASY4 Configuration:
- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2007-06-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn447; Calibrated: 2007-09-13
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

E Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 49.1 V/m
Probe Modulation Factor = 0.972
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 46.1 V/m; Power Drift = 0.178 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **41.3 M4**	Grid 2 **48.9 M4**	Grid 3 **48.4 M4**
Grid 4 **35.9 M4**	Grid 5 **49.1 M4**	Grid 6 **48.9 M4**
Grid 7 **30.9 M4**	Grid 8 **39.5 M4**	Grid 9 **39.5 M4**

Cursor:
Total = 49.1 V/m
E Category: M4
Location: -7.2, -3.8, 364.8 mm



0 dB = 49.1V/m

Test Laboratory:	HCT CO., LTD.
Ambient Temperature / Channel	21.6 °C /600
Test Date	April 05, 2008

DUT: G'zOne Boulder; Type: folder; Serial: #1

Communication System: PCS 1900MHz FCC; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3
Phantom section: E Device Section ; Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 176

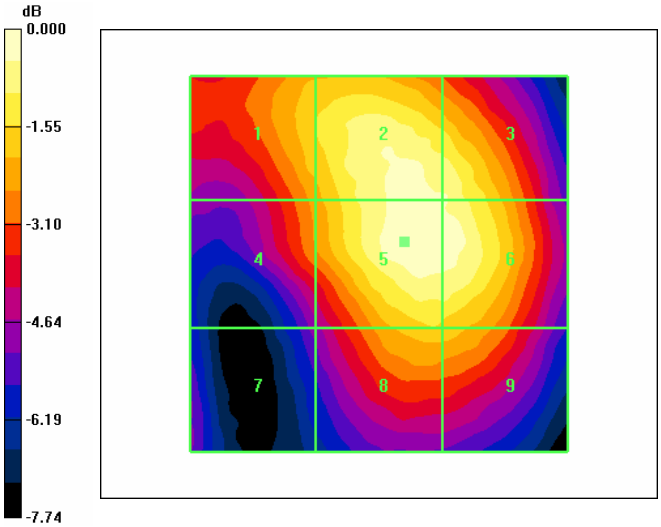
DASY4 Configuration:
- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2007-06-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn447; Calibrated: 2007-09-13
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

E Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 54.2 V/m
Probe Modulation Factor = 0.972
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 54.8 V/m; Power Drift = 0.040 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **45.3 M4**	Grid 2 **52.4 M4**	Grid 3 **51.5 M4**
Grid 4 **41.5 M4**	Grid 5 **54.2 M4**	Grid 6 **53.7 M4**
Grid 7 **31.1 M4**	Grid 8 **45.3 M4**	Grid 9 **45.0 M4**

Cursor:
Total = 54.2 V/m
E Category: M4
Location: -3.4, -3, 364.8 mm



0 dB = 54.2V/m

Test Laboratory:	HCT CO., LTD.
Ambient Temperature / Channel	21.6 °C /1175
Test Date	April 05, 2008

DUT: G'zOne Boulder; Type: folder; Serial: #1

Communication System: PCS 1900MHz FCC; Frequency: 1908.75 MHz;Duty Cycle: 1:1
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3
Phantom section: E Device Section ; Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 176

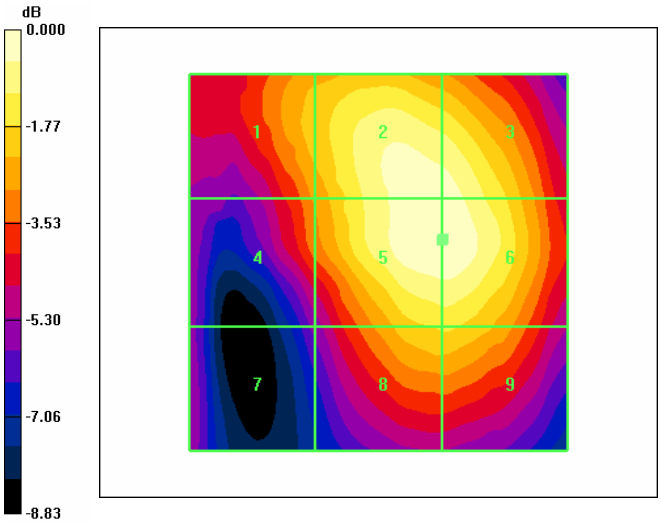
DASY4 Configuration:
- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2007-06-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn447; Calibrated: 2007-09-13
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

E Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 57.3 V/m
Probe Modulation Factor = 0.972
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 55.8 V/m; Power Drift = -0.146 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **45.5 M4**	Grid 2 **55.8 M4**	Grid 3 **55.7 M4**
Grid 4 **41.4 M4**	Grid 5 **57.3 M4**	Grid 6 **57.3 M4**
Grid 7 **31.3 M4**	Grid 8 **47.5 M4**	Grid 9 **47.5 M4**

Cursor:
Total = 57.3 V/m
E Category: M4
Location: -8.6, -3.2, 364.8 mm



0 dB = 57.3V/m

Test Laboratory:	HCT CO., LTD.
Ambient Temperature / Channel	21.6 °C /1013
Test Date	April 05, 2008

DUT: G'zOne Boulder; Type: folder; Serial: #1

Communication System: CDMA 835MHz FCC; Frequency: 824.7 MHz;Duty Cycle: 1:1
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3
Phantom section: H Device Section ; Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 176

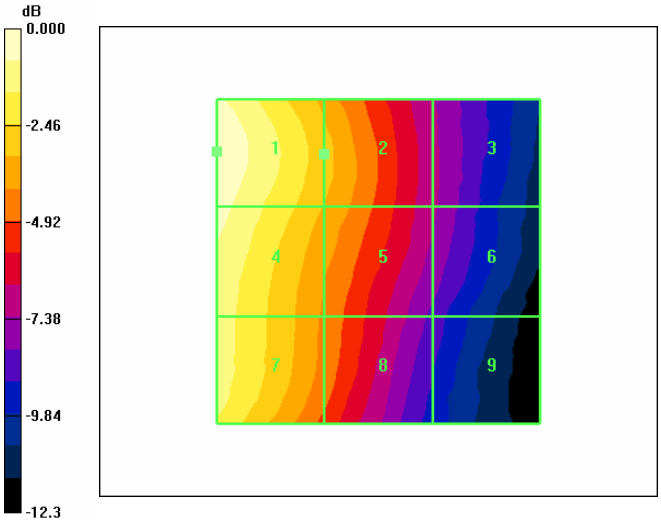
DASY4 Configuration:
- Probe: H3DV6 - SN6101; ; Calibrated: 2007-07-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn447; Calibrated: 2007-09-13
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

H Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 0.090 A/m
Probe Modulation Factor = 0.857
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.055 A/m; Power Drift = 0.060 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.090 M4**	Grid 2 **0.064 M4**	Grid 3 **0.040 M4**
Grid 4 **0.085 M4**	Grid 5 **0.062 M4**	Grid 6 **0.039 M4**
Grid 7 **0.078 M4**	Grid 8 **0.055 M4**	Grid 9 **0.034 M4**

Cursor:
Total = 0.090 A/m
H Category: M4
Location: 25, -17, 365.6 mm



0 dB = 0.090A/m

Test Laboratory: HCT CO., LTD.

Ambient Temperature / Channel 21.6 °C /384

Test Date April 05, 2008

DUT: G'zOne Boulder; Type: folder; Serial: #1

Communication System: CDMA 835MHz FCC; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3
Phantom section: H Device Section ; Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 176

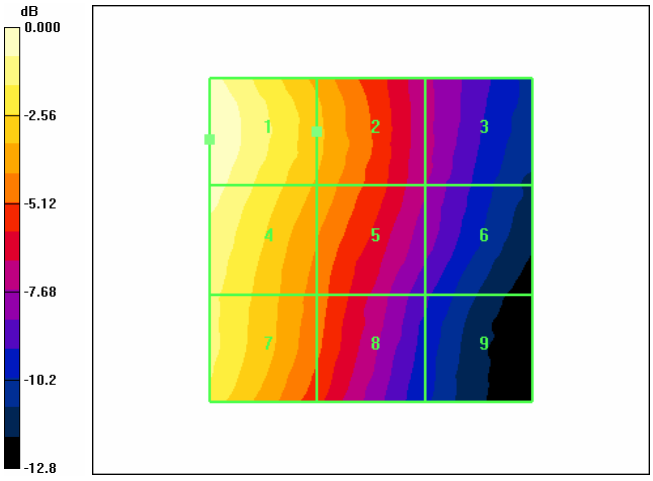
DASY4 Configuration:
- Probe: H3DV6 - SN6101; ; Calibrated: 2007-07-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn447; Calibrated: 2007-09-13
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

H Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 0.115 A/m
Probe Modulation Factor = 0.857
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.068 A/m; Power Drift = -0.114 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.115 M4**	Grid 2 **0.081 M4**	Grid 3 **0.050 M4**
Grid 4 **0.108 M4**	Grid 5 **0.077 M4**	Grid 6 **0.048 M4**
Grid 7 **0.098 M4**	Grid 8 **0.067 M4**	Grid 9 **0.040 M4**

Cursor:
Total = 0.115 A/m
H Category: M4
Location: 25, -15.6, 365.6 mm



0 dB = 0.115A/m

Test Laboratory:	HCT CO., LTD.
Ambient Temperature / Channel	21.6 °C /777
Test Date	April 05, 2008

DUT: G'zOne Boulder; Type: folder; Serial: #1

Communication System: CDMA 835MHz FCC; Frequency: 848.31 MHz;Duty Cycle: 1:1
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3
Phantom section: H Device Section ; Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 176

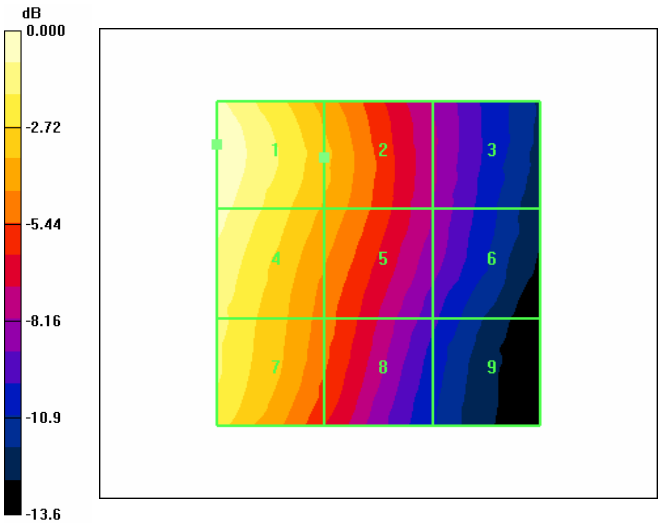
DASY4 Configuration:
- Probe: H3DV6 - SN6101; ; Calibrated: 2007-07-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn447; Calibrated: 2007-09-13
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

H Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 0.099 A/m
Probe Modulation Factor = 0.857
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.057 A/m; Power Drift = -0.172 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 0.099 M4	Grid 2 0.067 M4	Grid 3 0.040 M4
Grid 4 0.093 M4	Grid 5 0.064 M4	Grid 6 0.039 M4
Grid 7 0.083 M4	Grid 8 0.056 M4	Grid 9 0.033 M4

Cursor:
Total = 0.099 A/m
H Category: M4
Location: 25, -18.4, 365.6 mm



0 dB = 0.099A/m

Test Laboratory:	HCT CO., LTD.
Ambient Temperature / Channel	21.6 °C /25
Test Date	April 05, 2008

DUT: G'zOne Boulder; Type: folder; Serial: #1

Communication System: PCS 1900MHz FCC; Frequency: 1851.25 MHz;Duty Cycle: 1:1
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3
Phantom section: H Device Section ; Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 176

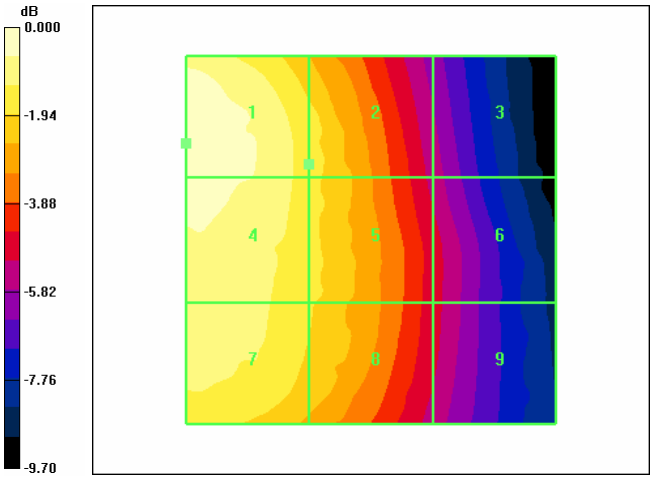
DASY4 Configuration:
- Probe: H3DV6 - SN6101; ; Calibrated: 2007-07-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn447; Calibrated: 2007-09-13
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

H Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 0.107 A/m
Probe Modulation Factor = 0.753
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.104 A/m; Power Drift = -0.057 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 0.107 M4	Grid 2 0.089 M4	Grid 3 0.058 M4
Grid 4 0.104 M4	Grid 5 0.089 M4	Grid 6 0.062 M4
Grid 7 0.097 M4	Grid 8 0.087 M4	Grid 9 0.061 M4

Cursor:
Total = 0.107 A/m
H Category: M4
Location: 25, -13, 365.6 mm



0 dB = 0.107A/m

Test Laboratory:	HCT CO., LTD.
Ambient Temperature / Channel	21.6 °C /600
Test Date	April 05, 2008

DUT: G'zOne Boulder; Type: folder; Serial: #1

Communication System: PCS 1900MHz FCC; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3
Phantom section: H Device Section ; Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 176

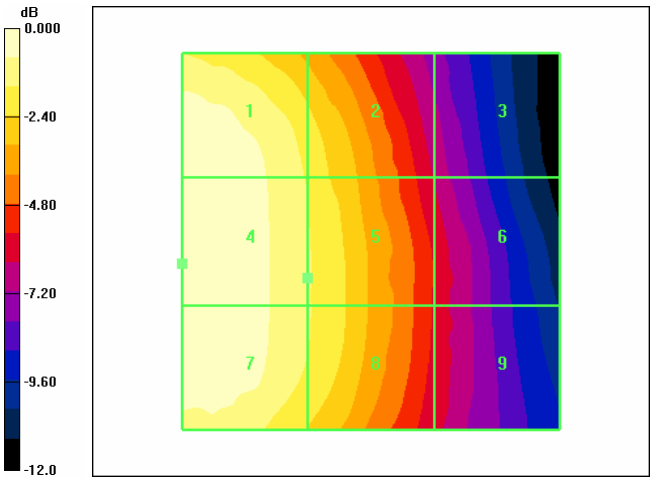
DASY4 Configuration:
- Probe: H3DV6 - SN6101; ; Calibrated: 2007-07-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn447; Calibrated: 2007-09-13
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

H Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 0.123 A/m
Probe Modulation Factor = 0.753
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.114 A/m; Power Drift = -0.019 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 0.122 M4	Grid 2 0.101 M4	Grid 3 0.059 M4
Grid 4 0.123 M4	Grid 5 0.104 M4	Grid 6 0.064 M4
Grid 7 0.122 M4	Grid 8 0.103 M4	Grid 9 0.064 M4

Cursor:
Total = 0.123 A/m
H Category: M4
Location: 25, 3, 365.6 mm



0 dB = 0.123A/m

Test Laboratory:	HCT CO., LTD.
Ambient Temperature / Channel	21.6 °C /1175
Test Date	April 05, 2008

DUT: G'zOne Boulder; Type: folder; Serial: #1

Communication System: PCS 1900MHz FCC; Frequency: 1908.75 MHz;Duty Cycle: 1:1
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3
Phantom section: H Device Section ; Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 176

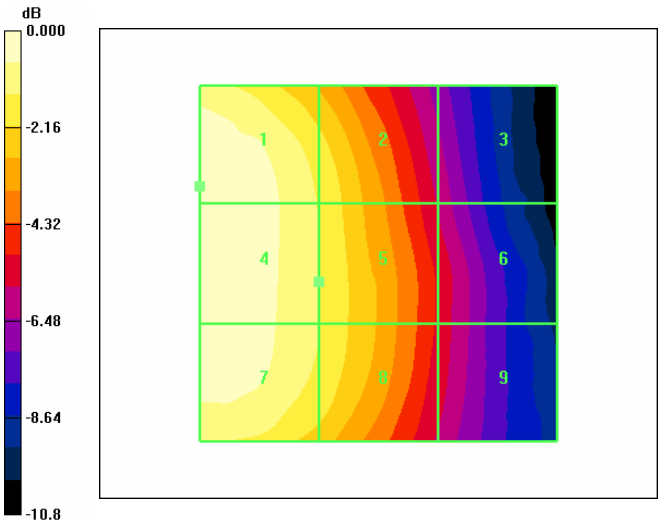
DASY4 Configuration:
- Probe: H3DV6 - SN6101; ; Calibrated: 2007-07-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn447; Calibrated: 2007-09-13
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

H Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 0.123 A/m
Probe Modulation Factor = 0.753
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.118 A/m; Power Drift = 0.157 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.123 M4**	Grid 2 **0.104 M4**	Grid 3 **0.063 M4**
Grid 4 **0.123 M4**	Grid 5 **0.105 M4**	Grid 6 **0.068 M4**
Grid 7 **0.120 M4**	Grid 8 **0.104 M4**	Grid 9 **0.068 M4**

Cursor:
Total = 0.123 A/m
H Category: M4
Location: 25, -10.8, 365.6 mm



0 dB = 0.123A/m

APPENDIX C (DIPOLE VALIDATION)

Test Laboratory:	HCT CO., LTD.
Ambient Temperature	21.6 °C
Test Date	April 05, 2008

DUT: HAC-Dipole 835 MHz; Type: D835V3; Serial: 1071

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3
Phantom section: E Dipole Section ; Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 176

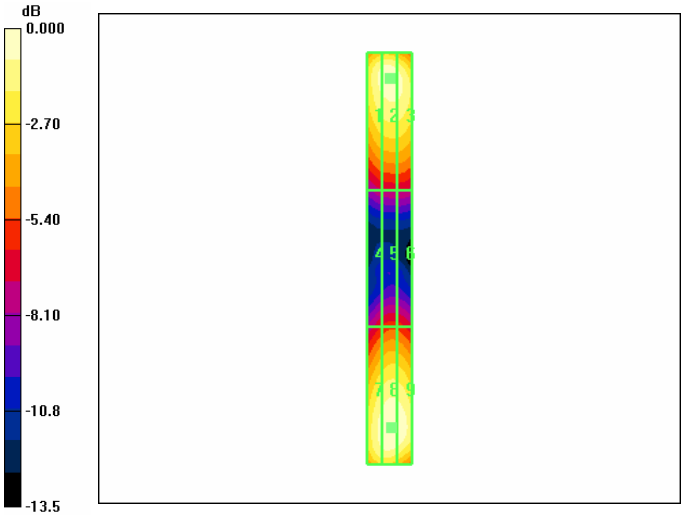
DASY4 Configuration:
- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2007-06-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn447; Calibrated: 2007-09-13
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

E Scan 10mm above CD 835 MHz/Hearing Aid Compatibility Test (41x361x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 173.5 V/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 140.6 V/m; Power Drift = -0.044 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 163.6 M4	Grid 2 168.6 M4	Grid 3 164.1 M4
Grid 4 85.5 M4	Grid 5 91.2 M4	Grid 6 90.1 M4
Grid 7 164.2 M4	Grid 8 173.5 M4	Grid 9 171.4 M4

Cursor:
Total = 173.5 V/m
E Category: M4
Location: -1, 74, 365.8 mm



0 dB = 173.5V/m

Test Laboratory: HCT CO., LTD.

Ambient Temperature 21.6 °C

Test Date April 05, 2008

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1082

Communication System: CW; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3
Phantom section: E Device Section ; Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 176

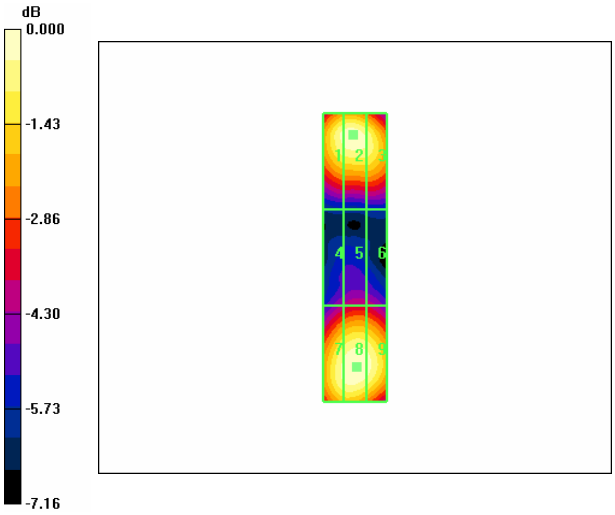
DASY4 Configuration:
- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2007-06-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn446; Calibrated: 2006-11-15
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

E Scan 10mm above CD 1880 MHz/Hearing Aid Compatibility Test (41x181x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 133.5 V/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 75.3 V/m; Power Drift = 0.043 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak E-field in V/m

Grid 1 129.8 M2	Grid 2 132.2 M2	Grid 3 126.5 M2
Grid 4 83.3 M3	Grid 5 87.3 M3	Grid 6 86.1 M3
Grid 7 129.0 M2	Grid 8 133.5 M2	Grid 9 130.7 M2

Cursor:
Total = 133.5 V/m
E Category: M2
Location: -0.5, 34, 364.8 mm



0 dB = 133.5V/m

Test Laboratory: HCT CO., LTD.

Ambient Temperature 21.6 °C

Test Date April 05, 2008

DUT: HAC-Dipole 835 MHz; Type: D835V3; Serial: 1071

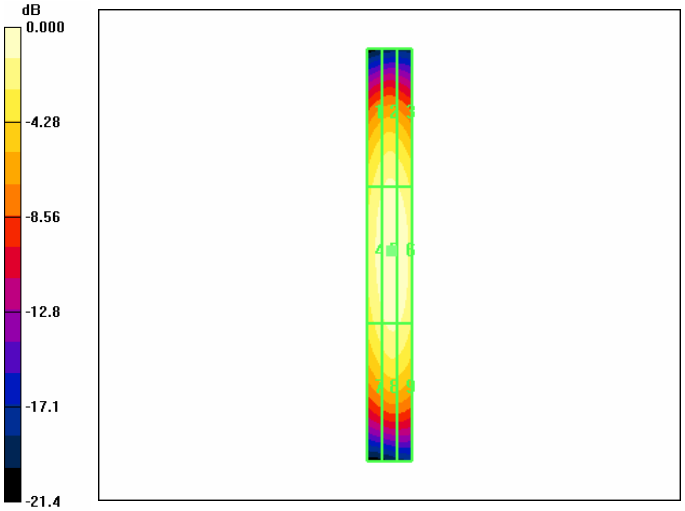
Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3
Phantom section: H Dipole Section ; Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 176
DASY4 Configuration:
- Probe: H3DV6 - SN6101; ; Calibrated: 2007-07-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn447; Calibrated: 2007-09-13
- 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 = 0.459 A/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 0.578 A/m; Power Drift = 0.021 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 0.378 M4	Grid 2 0.405 M4	Grid 3 0.391 M4
Grid 4 0.424 M4	Grid 5 0.459 M4	Grid 6 0.448 M4
Grid 7 0.368 M4	Grid 8 0.402 M4	Grid 9 0.395 M4

Cursor:
Total = 0.459 A/m
H Category: M4
Location: -1, -1.5, 366.6 mm



0 dB = 0.459A/m

Test Laboratory:	HCT CO., LTD.
Ambient Temperature	21.6 °C
Test Date	April 05, 2008

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1082

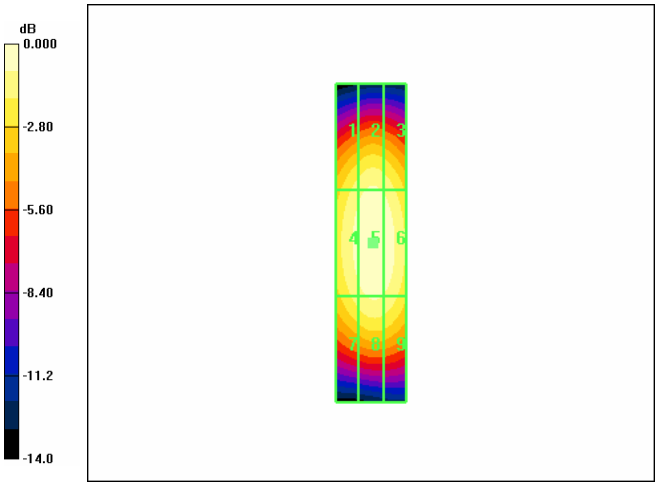
Communication System: CW; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3
Phantom section: H Dipole Section ; Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 176
DASY4 Configuration:
- Probe: H3DV6 - SN6101; ; Calibrated: 2007-07-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn447; Calibrated: 2007-09-13
- 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 = 0.437 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 = -0.044 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak H-field in A/m

Grid 1 0.375 M2	Grid 2 0.400 M2	Grid 3 0.387 M2
Grid 4 0.411 M2	Grid 5 0.437 M2	Grid 6 0.426 M2
Grid 7 0.374 M2	Grid 8 0.399 M2	Grid 9 0.390 M2

Cursor:
Total = 0.437 A/m
H Category: M2
Location: -0.5, 0, 366.6 mm



0 dB = 0.437A/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
Swiss Calibration Service

Accredited by the Swiss Federal Office of Metrology and Accreditation
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_Jun07**

CALIBRATION CERTIFICATE

Object ER3DV6 - SN:2343

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

Calibration date: June 25, 2007

Condition of the calibrated item In Tolerance

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
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 (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Power sensor E4412A	MY41495277	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Power sensor E4412A	MY41498087	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Reference 3 dB Attenuator	SN: S5054 (3c)	10-Aug-06 (METAS, No. 217-00592)	Aug-07
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-07 (METAS, No. 217-00671)	Mar-08
Reference 30 dB Attenuator	SN: S5129 (30b)	10-Aug-06 (METAS, No. 217-00593)	Aug-07
Reference Probe ER3DV6	SN: 2328	2-Oct-06 (SPEAG, No. ER3-2328_Oct06)	Oct-07
DAE4	SN: 654	20-Apr-07 (SPEAG, No. DAE4-654_Apr07)	Apr-08

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-06)	In house check: Oct-07

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

Issued: June 25, 2007

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

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

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

Accredited by the Swiss Federal Office of Metrology and Accreditation
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:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 for XY sensors and ϑ = 90 for Z sensor (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart).
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency.
- *Spherical isotropy (3D deviation from isotropy)*: in a locally homogeneous field realized using an open waveguide setup.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Probe ER3DV6

SN:2343

Manufactured:	January 1, 2005
Last calibrated:	February 21, 2007
Repaired:	June 21, 2007
Recalibrated:	June 25, 2007

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ER3DV6 SN:2343 June 25, 2007

DASY - Parameters of Probe: ER3DV6 SN:2343

Sensitivity in Free Space [μV/(V/m)^2]

NormX	**1.64** ± 10.1 % (k=2)	DCP X	**95** mV
NormY	**1.58** ± 10.1 % (k=2)	DCP Y	**95** mV
NormZ	**1.63** ± 10.1 % (k=2)	DCP Z	**96** mV

Frequency Correction

X	**0.0**
Y	**0.0**
Z	**0.0**

Sensor Offset (Probe Tip to Sensor Center)

X	**2.5** mm
Y	**2.5** mm
Z	**2.5** mm

Connector Angle **-295** °

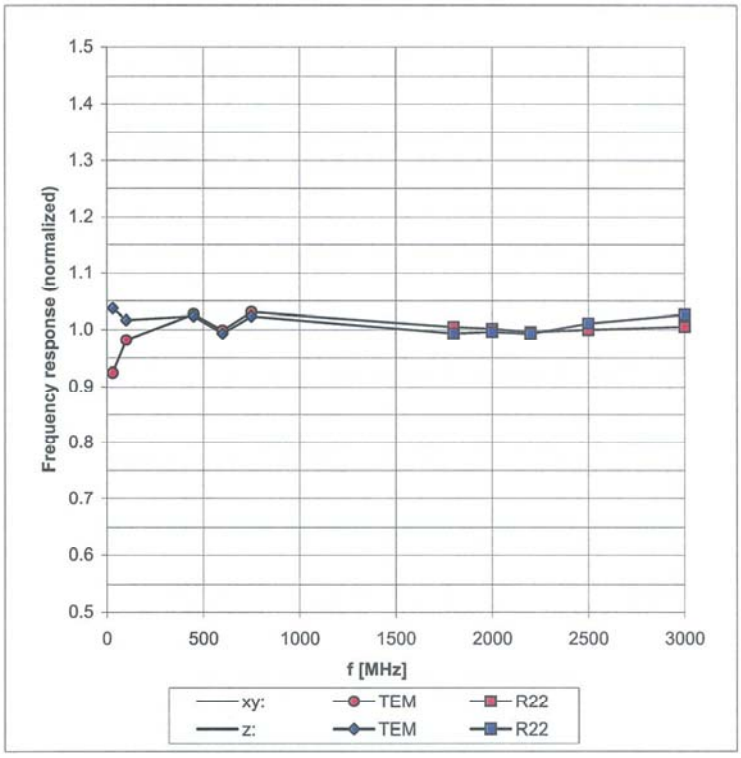
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] numerical linearization parameter: uncertainty not required

ER3DV6 SN:2343 June 25, 2007

Frequency Response of E-Field

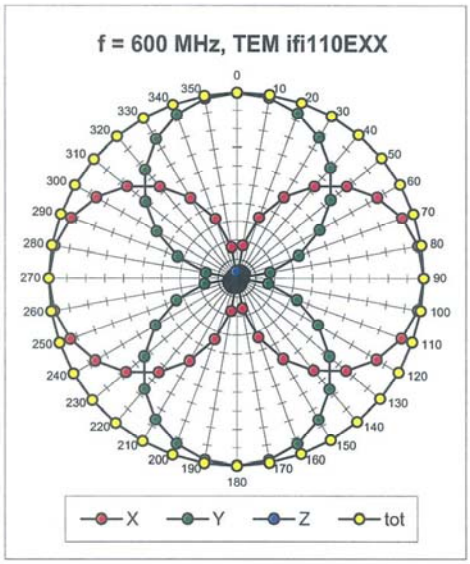
(TEM-Cell:ifi110 EXX, Waveguide R22)

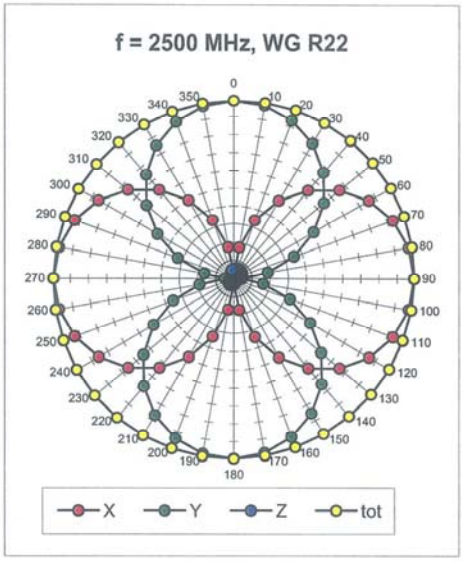


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

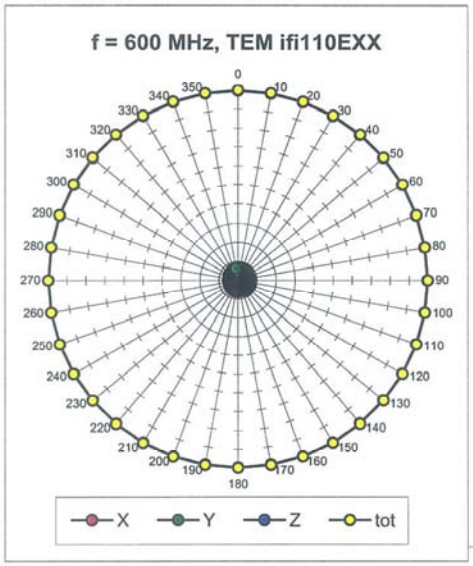
ER3DV6 SN:2343 June 25, 2007

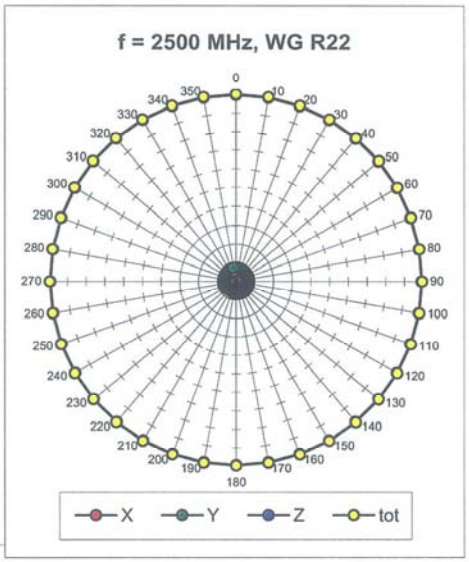
Receiving Pattern (ϕ), ϑ = 0°





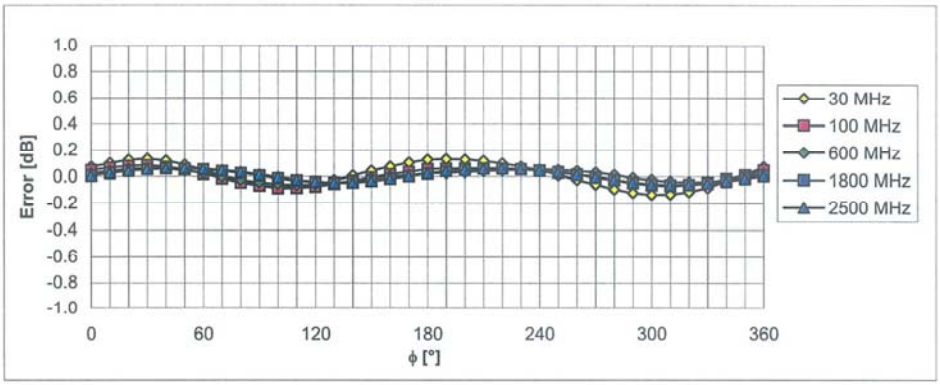
Receiving Pattern (ϕ), ϑ = 90°





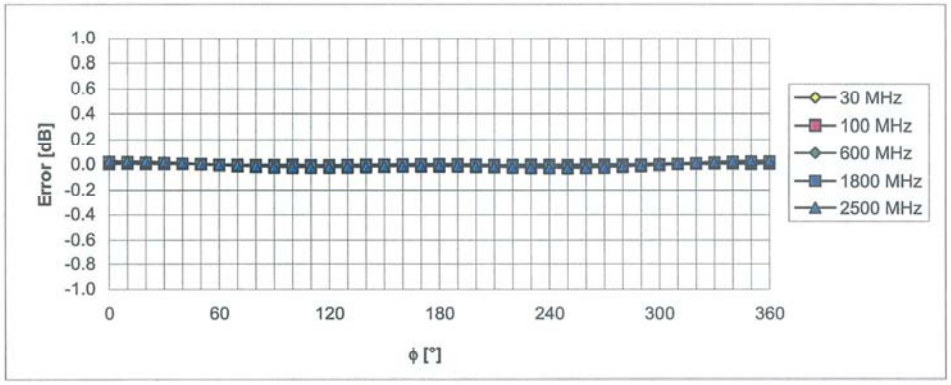
ER3DV6 SN:2343 June 25, 2007

Receiving Pattern (ϕ), ϑ = 0°



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

Receiving Pattern (ϕ), ϑ = 90°

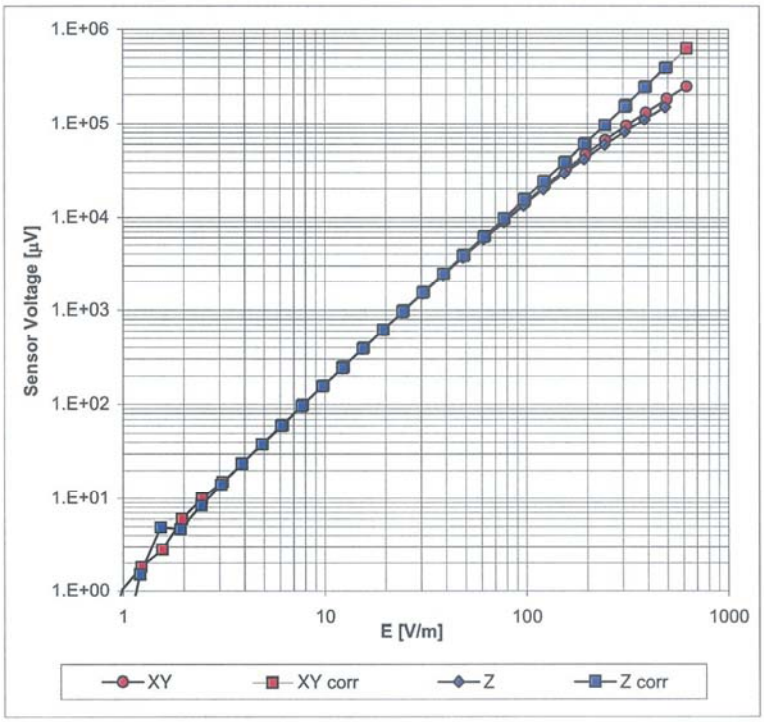


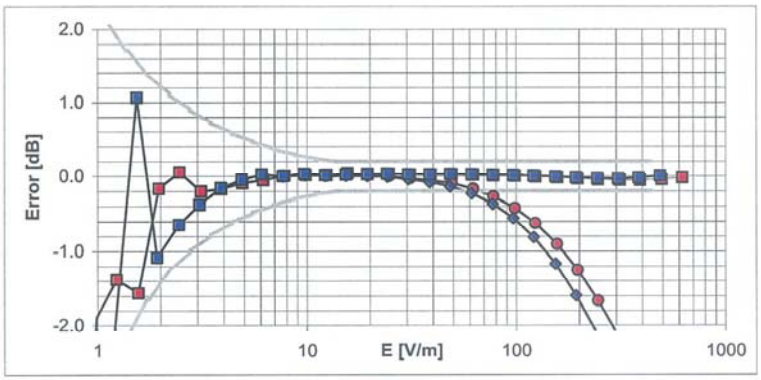
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

ER3DV6 SN:2343 June 25, 2007

Dynamic Range f(E-field)

(Waveguide R22, f = 1800 MHz)

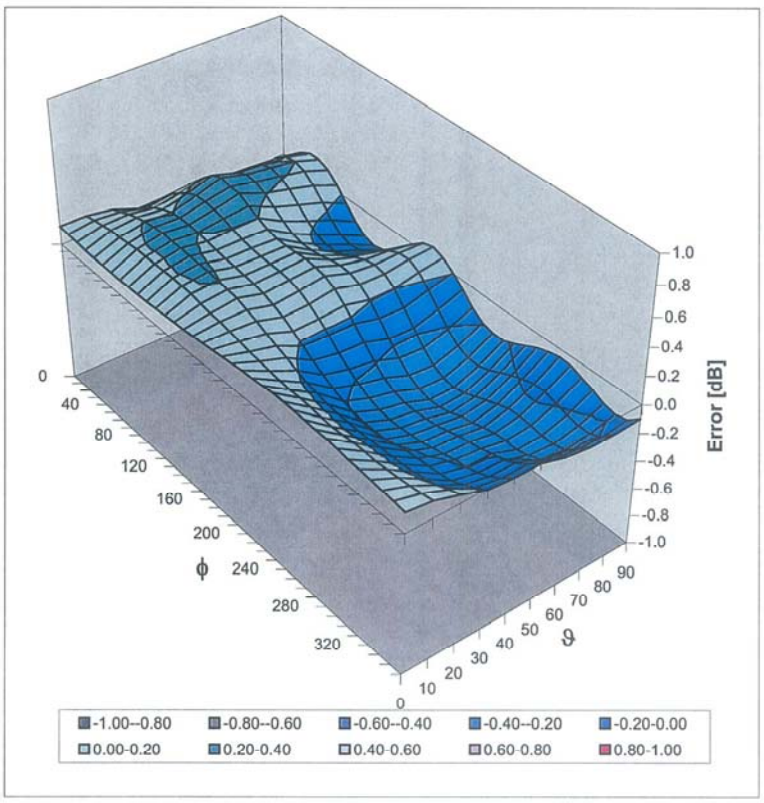




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

ER3DV6 SN:2343 June 25, 2007

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



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

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Client HCT (Dymstec)

Certificate No: H3-6101_Jul07

CALIBRATION CERTIFICATE

Object	H3DV6 - SN:6101
Calibration procedure(s)	QA CAL-03.v5 Calibration procedure for H-field probes optimized for close near field evaluations in air
Calibration date:	July 25, 2007
Condition of the calibrated item	In Tolerance

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
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 (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Power sensor E4412A	MY41495277	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Power sensor E4412A	MY41498087	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Reference 3 dB Attenuator	SN: S5054 (3c)	10-Aug-06 (METAS, No. 217-00592)	Aug-07
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-07 (METAS, No. 217-00671)	Mar-08
Reference 30 dB Attenuator	SN: S5129 (30b)	10-Aug-06 (METAS, No. 217-00593)	Aug-07
Reference Probe H3DV6	SN: 6182	2-Oct-06 (SPEAG, No. H3-6182_Oct06)	Oct-07
DAE4	SN: 654	20-Apr-07 (SPEAG, No. DAE4-654_Apr07)	Apr-08

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-06)	In house check: Oct-07

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

Issued: July 25, 2007

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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- *X,Y,Z_a0a1a2:* Assessed for E-field polarization ϑ = 90 for XY sensors and ϑ = 0 for Z sensor (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide).
- *X,Y,Z(f)_a0a1a2= X,Y,Z_a0a1a2* frequency_response* (see Frequency Response Chart).
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency.
- *Spherical isotropy (3D deviation from isotropy)*: in a locally homogeneous field realized using an open waveguide setup.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *X_a0a1a2* (no uncertainty required).

H3DV6 SN:6101 July 25, 2007

Probe H3DV6

SN:6101

Manufactured:	December 10, 2001
Last calibrated:	July 12, 2006
Repaired:	July 20, 2007
Recalibrated:	July 25, 2007

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

Certificate No: H3-6101_Jul07 Page 3 of 8

H3DV6 SN:6101 **July 25, 2007**

DASY - Parameters of Probe: H3DV6 SN:6101

Sensitivity in Free Space [A/m / √(μV)]

	a0	a1	a2	
X	**2.880E-03**	**-1.511E-5**	**-2.809E-5**	± 5.1 % (k=2)
Y	**2.863E-03**	**-9.496E-5**	**-4.991E-5**	± 5.1 % (k=2)
Z	**3.050E-03**	**-6.517E-5**	**1.944E-5**	± 5.1 % (k=2)

Diode Compression[1]

DCP X	**85** mV
DCP Y	**85** mV
DCP Z	**85** mV

Sensor Offset (Probe Tip to Sensor Center)

X	**3.0** mm
Y	**3.0** mm
Z	**3.0** mm

Connector Angle **-331** °

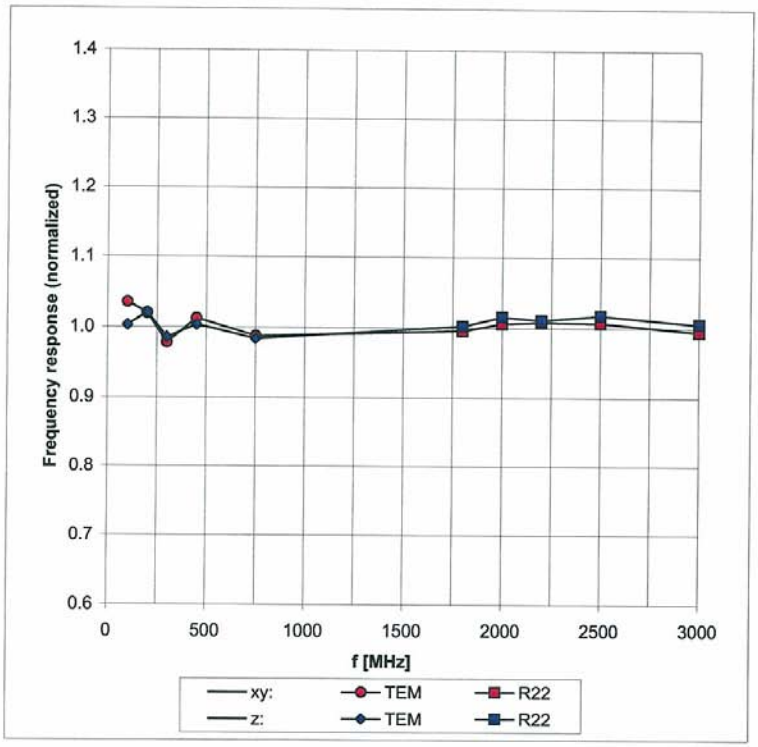
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[1] numerical linearization parameter: uncertainty not required

H3DV6 SN:6101 **July 25, 2007**

Frequency Response of H-Field

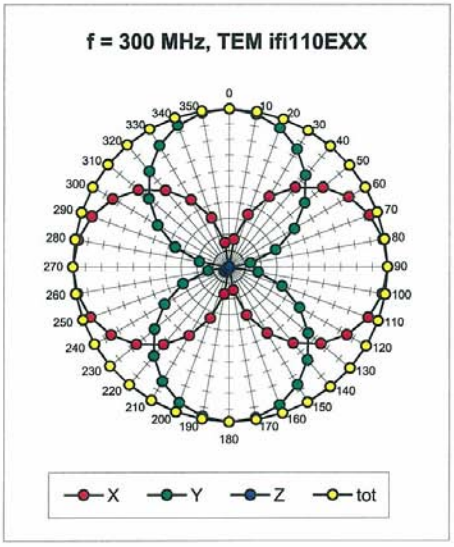
(TEM-Cell:ifi110, Waveguide R22)

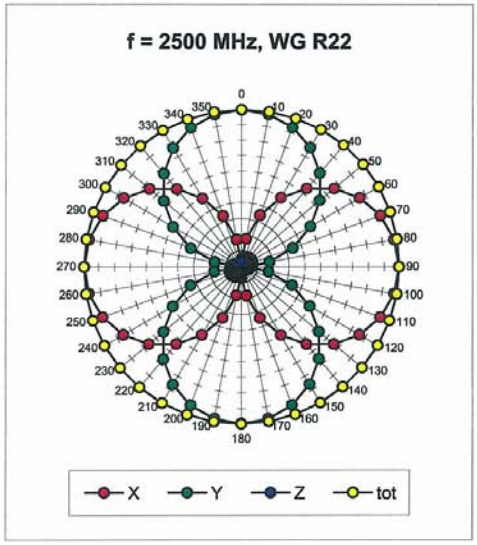


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

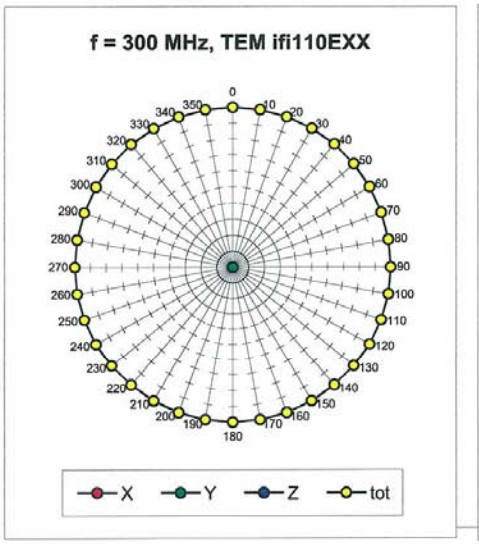
H3DV6 SN:6101 **July 25, 2007**

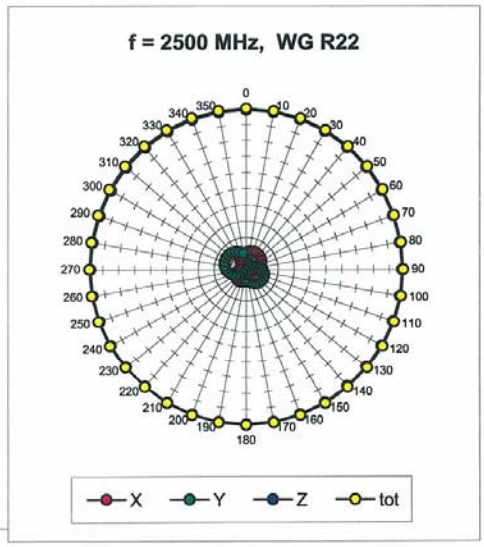
Receiving Pattern (ϕ), ϑ = 90°





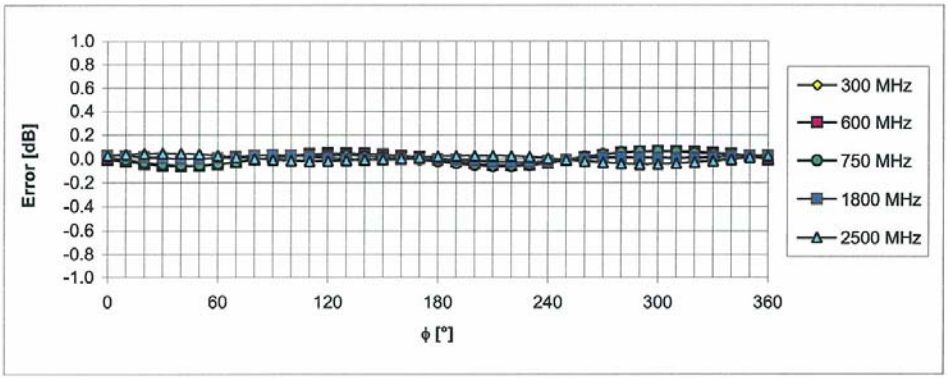
Receiving Pattern (ϕ), ϑ = 0°





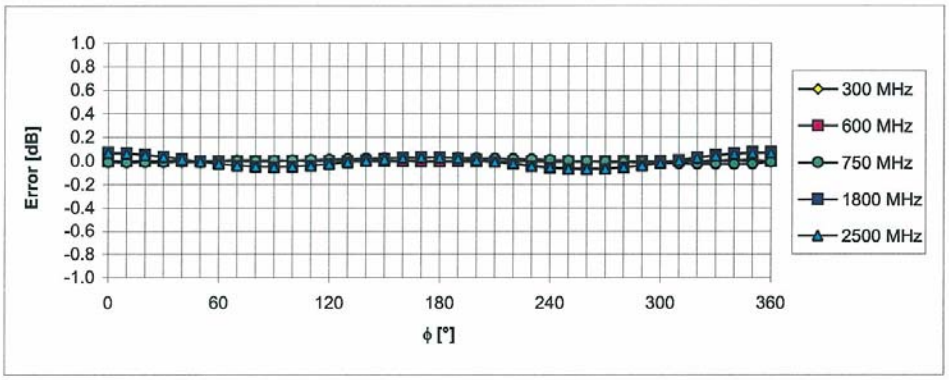
H3DV6 SN:6101 **July 25, 2007**

Receiving Pattern (ϕ), ϑ = 90°



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

Receiving Pattern (ϕ), ϑ = 0°

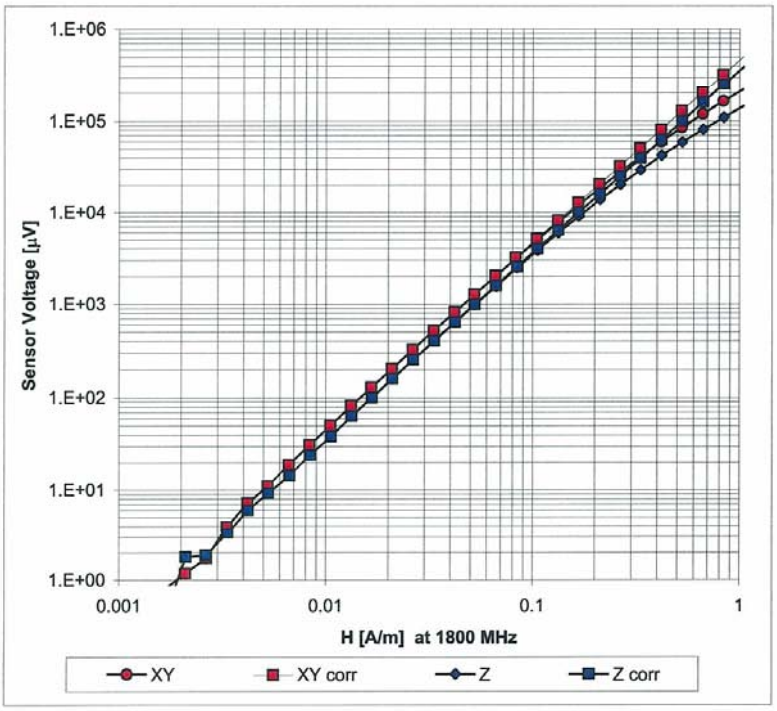


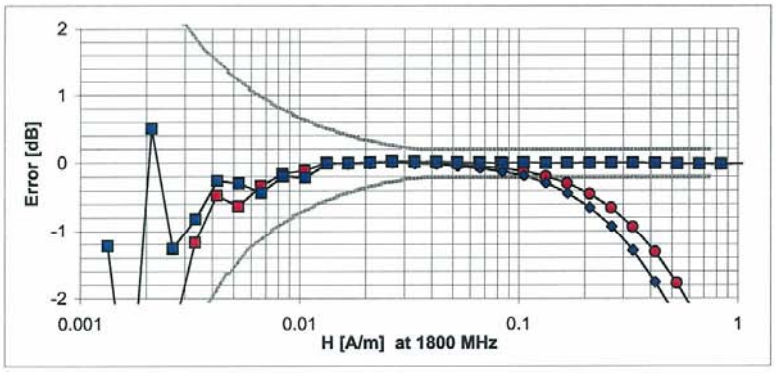
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

H3DV6 SN:6101 **July 25, 2007**

Dynamic Range f(H-field)

(Waveguide R22, f = 1800 MHz)





Uncertainty of Linearity Assessment: ± 0.6% (k=2)

APPENDIX E (DIPOLE CALIBRATION DATA)

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Accreditation No.: SCS 108

Client **KTL (Dymstec)** **Certificate No: CD835V3-1071_Jul07**

CALIBRATION CERTIFICATE

Object CD835V3 - SN: 1071

Calibration procedure(s) QA CAL-20.v4
Calibration procedure for dipoles in air

Calibration date: July 12, 2007

Condition of the calibrated item In Tolerance

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
DAE4	SN: 903	31-Aug-06 (SPEAG, No. DAE4-903_Aug06)	Calibration, Aug-07
Probe ER3DV6	SN: 2336	27-Dec-06 (SPEAG, No. ER3-2336_Dec06)	Calibration, Dec-07
Probe H3DV6	SN: 6065	27-Dec-06 (SPEAG, No. H3-6065-Dec06)	Calibration, Dec-07

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-4419B	GB43310788	12-Aug-03 (SPEAG, in house check Oct-06)	In house check: Oct-07
Power sensor HP 8481A	MY41093312	10-Aug-03 (SPEAG, in house check Oct-06)	In house check: Oct-08
Power sensor HP 8481A	MY41093315	10-Aug-03 (SPEAG, in house check Oct-06)	In house check: Oct-08
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-06)	In house check: Oct-07
RF generator R&S SMT06	SN: 100005	26-Jul-04 (SPEAG, in house check Nov-05)	In house check: Nov-07

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

Issued: July 30, 2007

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

Certificate No: CD835V3-1071_Jul07 Page 1 of 6

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References

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

Methods Applied and Interpretation of Parameters:

- *Coordinate System:* y-axis is in the direction of the dipole arms. z-axis is from the basis of the antenna (mounted on the table) towards its feed point between the two dipole arms. x-axis is normal to the other axes. In coincidence with standard [1], the measurement planes (probe sensor center) are selected to be at a distance of 10 mm above the top edge of the dipole arms.
- *Measurement Conditions:* Further details are available from the hardcopies at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated. The forward power to the dipole connector is set with a calibrated power meter connected and monitored with an auxiliary power meter connected to a directional coupler. While the dipole under test is connected, the forward power is adjusted to the same level.
- *Antenna Positioning:* The dipole is mounted on a HAC Test Arch phantom using the matching dipole positioner with the arms horizontal and the feeding cable coming from the floor. The measurements are performed in a shielded room with absorbers around the setup to reduce the reflections.
  It is verified before the mounting of the dipole under the Test Arch phantom, that its arms are perfectly in a line. It is installed on the HAC dipole positioner with its arms parallel below the dielectric reference wire and able to move elastically in vertical direction without changing its relative position to the top center of the Test Arch phantom. The vertical distance to the probe is adjusted after dipole mounting with a DASY4 Surface Check job. Before the measurement, the distance between phantom surface and probe tip is verified. The proper measurement distance is selected by choosing the matching section of the HAC Test Arch phantom with the proper device reference point (upper surface of the dipole) and the matching grid reference point (tip of the probe) considering the probe sensor offset. The vertical distance to the probe is essential for the accuracy.
- *Feed Point Impedance and Return Loss:* These parameters are measured using a HP 8753E Vector Network Analyzer. The impedance is specified at the SMA connector of the dipole. The influence of reflections was eliminating by applying the averaging function while moving the dipole in the air, at least 70cm away from any obstacles.
- *E- field distribution:* E field is measured in the x-y-plane with an isotropic ER3D-field probe with 100 mW forward power to the antenna feed point. In accordance with [1], the scan area is 20mm wide, its length exceeds the dipole arm length (180 or 90mm). The sensor center is 10 mm (in z) above the top of the dipole arms. Two 3D maxima are available near the end of the dipole arms. Assuming the dipole arms are perfectly in one line, the average of these two maxima (in subgrid 2 and subgrid 8) is determined to compensate for any non-parallelity to the measurement plane as well as the sensor displacement. The E-field value stated as calibration value represents the maximum of the interpolated 3D-E-field, 10mm above the dipole surface.
- *H-field distribution:* H-field is measured with an isotropic H-field probe with 100mW forward power to the antenna feed point, in the x-y-plane. The scan area and sensor distance is equivalent to the E-field scan. The maximum of the field is available at the center (subgrid 5) above the feed point. The H-field value stated as calibration value represents the maximum of the interpolated H-field, 10mm above the dipole surface at the feed point.

1 Measurement Conditions

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

DASY Version	DASY4	V4.7 B53
DASY PP Version	SEMCAD	V1.8 B172
Phantom	HAC Test Arch	SD HAC P01 BA, #1002
Distance Dipole Top - Probe Center	10 mm	
Scan resolution	dx, dy = 5 mm	area = 20 x 180 mm
Frequency	**835 MHz** ± 1 MHz	
Forward power at dipole connector	20.0 dBm = 100mW	
Input power drift	< 0.07 dB	

2 Maximum Field values

H-field 10 mm above dipole surface	condition	**Interpolated maximum**
Maximum measured	100 mW forward power	**0.446 A/m**

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

E-field 10 mm above dipole surface	condition	**Interpolated maximum**
Maximum measured above high end	100 mW forward power	167.7 V/m
Maximum measured above low end	100 mW forward power	157.1 V/m
Averaged maximum above arm	100 mW forward power	**162.4 V/m**

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

3 Appendix

3.1 Antenna Parameters

Frequency	**Return Loss**	**Impedance**
800 MHz	15.5 dB	(45.1 – j15.4) Ohm
835 MHz	**28.9 dB**	**(49.5 + j3.5) Ohm**
900 MHz	16.8 dB	(56.9 – j14.0) Ohm
950 MHz	20.2 dB	(42.8 + j5.6) Ohm
960 MHz	16.6 dB	(47.7 + j14.5) Ohm

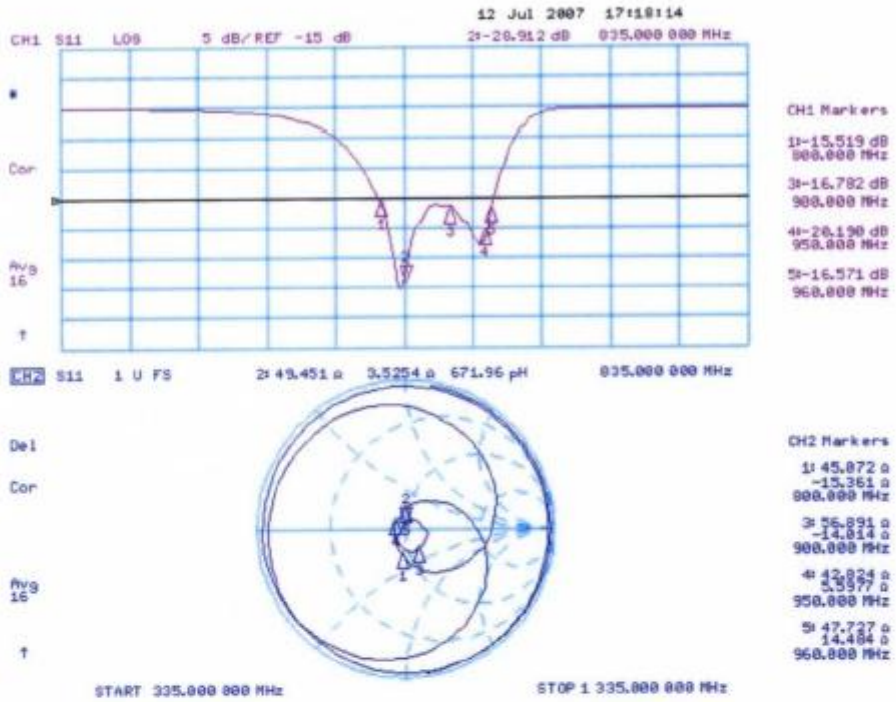
3.2 Antenna Design and Handling

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

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

3.3 Measurement Sheets

3.3.1 Return Loss and Smith Chart



3.3.2 DASY4 H-field result

Date/Time: 09.07.2007 15:55:48

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: HAC-Dipole 835 MHz; Type: CD835V3; Serial: 1071

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: Air;
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: H Dipole Section
Measurement Standard: DASY4 (High Precision Assessment)

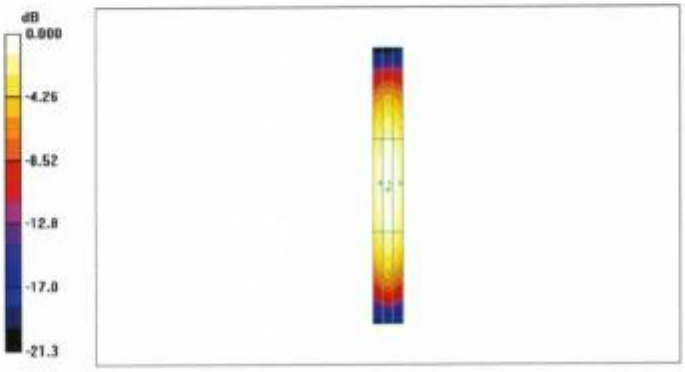
DASY4 Configuration:

- Probe: H3DV6 - SN6065; ; Calibrated: 27.12.2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn903; Calibrated: 31.08.2006
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; ;
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 171

H Scan - Sensor Center 10mm above CD835 Dipole/Hearing Aid Compatibility Test (41x361x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.446 A/m
Probe Modulation Factor = 1.00
Reference Value = 0.474 A/m; Power Drift = 0.002 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.367**	Grid 2 **0.389**	Grid 3 **0.374**
Grid 4 **0.421**	Grid 5 **0.446**	Grid 6 **0.427**
Grid 7 **0.372**	Grid 8 **0.394**	Grid 9 **0.376**



0 dB = 0.446A/m

3.3.3 DASY4 E-Field result

Date/Time: 12.07.2007 19:48:29

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: HAC-Dipole 835 MHz; Type: D835V3; Serial: 1071

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: Air
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: E Dipole Section

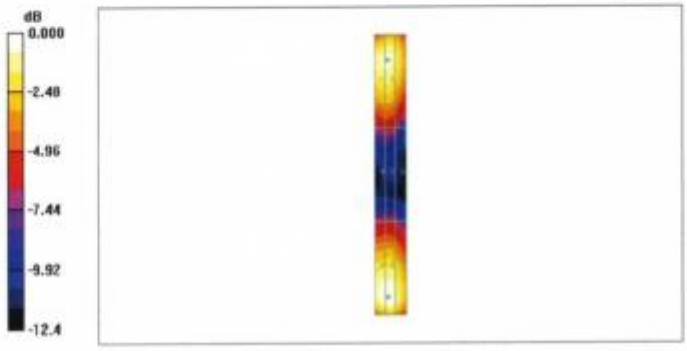
DASY4 Configuration:

- Probe: ER3DV6 - SN2336; ConvF(1, 1, 1); Calibrated: 27.12.2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn903; Calibrated: 31.08.2006
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: 1002
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

E Scan - Sensor Center 10mm above CD835 Dipole/Hearing Aid Compatibility Test (41x361x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 167.7 V/m
Probe Modulation Factor = 1.00
Reference Value = 109.8 V/m; Power Drift = -0.058 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **156.0**	Grid 2 **157.1**	Grid 3 **143.4**
Grid 4 **82.8**	Grid 5 **83.2**	Grid 6 **76.1**
Grid 7 **166.2**	Grid 8 **167.7**	Grid 9 **153.3**



0 dB = 167.7V/m

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Accreditation No.: SCS 108

Client **KTL (Dymstec)**

Certificate No: CD1880V3-1082_Jul07

CALIBRATION CERTIFICATE

Object	CD1880V3 - SN: 1082
Calibration procedure(s)	QA CAL-20.v4 Calibration procedure for dipoles in air
Calibration date:	July 12, 2007
Condition of the calibrated item	In Tolerance

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
DAE4	SN: 903	31-Aug-06 (SPEAG, No. DAE4-903_Aug06)	Calibration, Aug-07
Probe ER3DV6	SN: 2336	27-Dec-06 (SPEAG, No. ER3-2336_Dec06)	Calibration, Dec-07
Probe H3DV6	SN: 6065	27-Dec-06 (SPEAG, No. H3-6065-Dec06)	Calibration, Dec-07
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Power meter EPM-4419B	GB43310788	12-Aug-03 (SPEAG, in house check Oct-06)	In house check: Oct-07
Power sensor HP 8481A	MY41093312	10-Aug-03 (SPEAG, in house check Oct-06)	In house check: Oct-08
Power sensor HP 8481A	MY41093315	10-Aug-03 (SPEAG, in house check Oct-06)	In house check: Oct-08
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-06)	In house check: Oct-07
RF generator R&S SMT06	SN: 100005	26-Jul-04 (SPEAG, in house check Nov-05)	In house check: Nov-07

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

Issued: July 30, 2007

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

Certificate No: CD1880V3-1082_Jul07 Page 1 of 6

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

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

Accredited by the Swiss Federal Office of Metrology and Accreditation
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

References

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

Methods Applied and Interpretation of Parameters:

- *Coordinate System:* y-axis is in the direction of the dipole arms. z-axis is from the basis of the antenna (mounted on the table) towards its feed point between the two dipole arms. x-axis is normal to the other axes. In coincidence with standard [1], the measurement planes (probe sensor center) are selected to be at a distance of 10 mm above the top edge of the dipole arms.
- *Measurement Conditions:* Further details are available from the hardcopies at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated. The forward power to the dipole connector is set with a calibrated power meter connected and monitored with an auxiliary power meter connected to a directional coupler. While the dipole under test is connected, the forward power is adjusted to the same level.
- *Antenna Positioning:* The dipole is mounted on a HAC Test Arch phantom using the matching dipole positioner with the arms horizontal and the feeding cable coming from the floor. The measurements are performed in a shielded room with absorbers around the setup to reduce the reflections.
  It is verified before the mounting of the dipole under the Test Arch phantom, that its arms are perfectly in a line. It is installed on the HAC dipole positioner with its arms parallel below the dielectric reference wire and able to move elastically in vertical direction without changing its relative position to the top center of the Test Arch phantom. The vertical distance to the probe is adjusted after dipole mounting with a DASY4 Surface Check job. Before the measurement, the distance between phantom surface and probe tip is verified. The proper measurement distance is selected by choosing the matching section of the HAC Test Arch phantom with the proper device reference point (upper surface of the dipole) and the matching grid reference point (tip of the probe) considering the probe sensor offset. The vertical distance to the probe is essential for the accuracy.
- *Feed Point Impedance and Return Loss:* These parameters are measured using a HP 8753E Vector Network Analyzer. The impedance is specified at the SMA connector of the dipole. The influence of reflections was eliminating by applying the averaging function while moving the dipole in the air, at least 70cm away from any obstacles.
- *E- field distribution:* E field is measured in the x-y-plane with an isotropic ER3D-field probe with 100 mW forward power to the antenna feed point. In accordance with [1], the scan area is 20mm wide, its length exceeds the dipole arm length (180 or 90mm). The sensor center is 10 mm (in z) above the top of the dipole arms. Two 3D maxima are available near the end of the dipole arms. Assuming the dipole arms are perfectly in one line, the average of these two maxima (in subgrid 2 and subgrid 8) is determined to compensate for any non-parallelity to the measurement plane as well as the sensor displacement. The E-field value stated as calibration value represents the maximum of the interpolated 3D-E-field, 10mm above the dipole surface.
- *H-field distribution:* H-field is measured with an isotropic H-field probe with 100mW forward power to the antenna feed point, in the x-y-plane. The scan area and sensor distance is equivalent to the E-field scan. The maximum of the field is available at the center (subgrid 5) above the feed point. The H-field value stated as calibration value represents the maximum of the interpolated H-field, 10mm above the dipole surface at the feed point.

1 Measurement Conditions

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

DASY Version	DASY4	V4.7 B53
DASY PP Version	SEMCAD	V1.8 B172
Phantom	HAC Test Arch	SD HAC P01 BA, #1002
Distance Dipole Top - Probe Center	10 mm	
Scan resolution	dx, dy = 5 mm	area = 20 x 90 mm
Frequency	**1880 MHz** ± 1 MHz	
Forward power at dipole connector	20.0 dBm = 100mW	
Input power drift	< 0.07 dB	

2 Maximum Field values

H-field 10 mm above dipole surface	condition	**Interpolated maximum**
Maximum measured	100 mW forward power	**0.441 A/m**

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

E-field 10 mm above dipole surface	condition	**Interpolated maximum**
Maximum measured above high end	100 mW forward power	134.7 V/m
Maximum measured above low end	100 mW forward power	134.5 V/m
Averaged maximum above arm	100 mW forward power	**134.6 V/m**

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

3 Appendix

3.1 Antenna Parameters

Frequency	**Return Loss**	**Impedance**
1710 MHz	22.5 dB	(50.3 + j7.5) Ohm
1880 MHz	**20.4 dB**	**(49.9 + j9.6) Ohm**
1900 MHz	20.9 dB	(52.4 + j8.9) Ohm
1950 MHz	31.4 dB	(52.4 + j1.3) Ohm
2000 MHz	20.4 dB	(42.0 + j3.7) Ohm

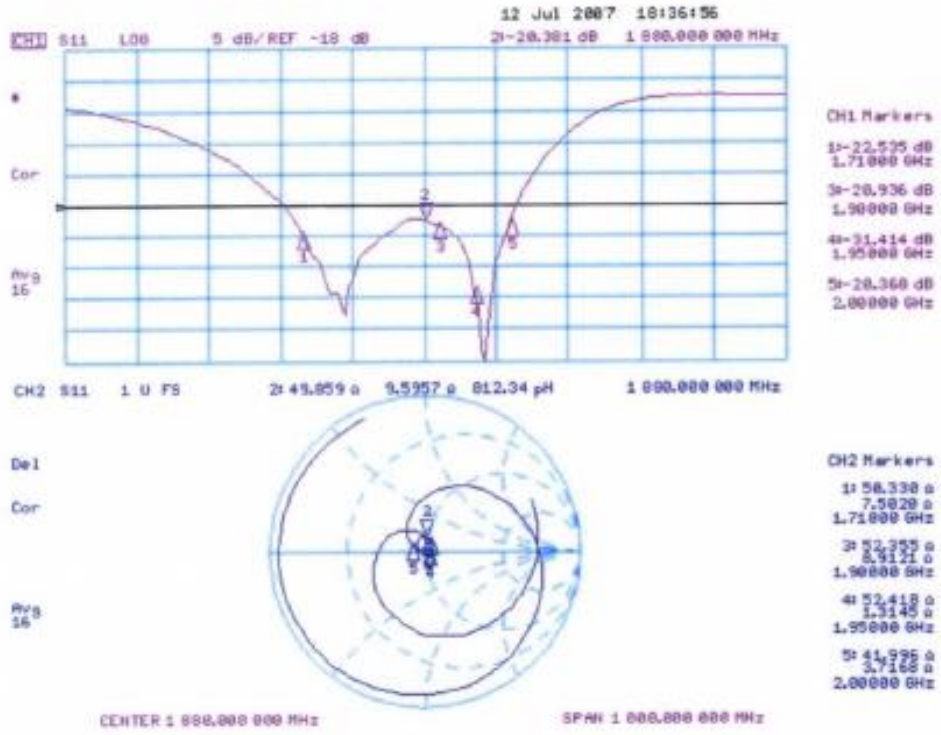
3.2 Antenna Design and Handling

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

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

3.3 Measurement Sheets

3.3.1 Return Loss and Smith Chart



3.3.2 DASY4 H-Field Result

Date/Time: 09.07.2007 17:45:24

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1082

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

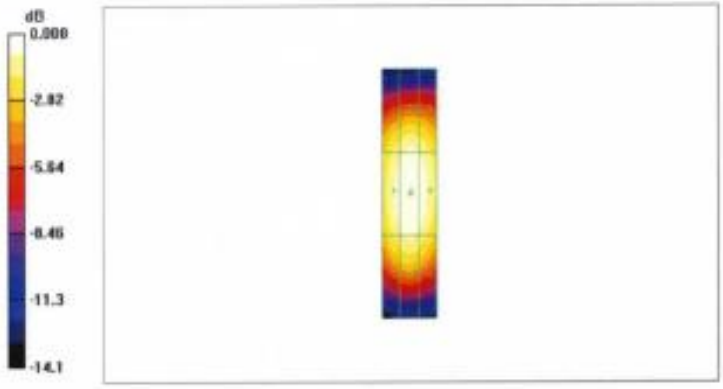
DASY4 Configuration:

- Probe: H3DV6 - SN6065; ; Calibrated: 27.12.2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn903; Calibrated: 31.08.2006
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; ;
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 171

H Scan - Sensor Center 10mm above CD1880V3 Dipole/Hearing Aid Compatibility Test (41x181x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.441 A/m
Probe Modulation Factor = 1.00
Reference Value = 0.465 A/m; Power Drift = 0.017 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.386**	Grid 2 **0.409**	Grid 3 **0.397**
Grid 4 **0.418**	Grid 5 **0.441**	Grid 6 **0.425**
Grid 7 **0.384**	Grid 8 **0.405**	Grid 9 **0.386**



0 dB = 0.441A/m

3.3.3 DASY4 E-Field Result

Date/Time: 12.07.2007 13:30:47

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1082

Communication System: CW; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: Air
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: E Dipole Section

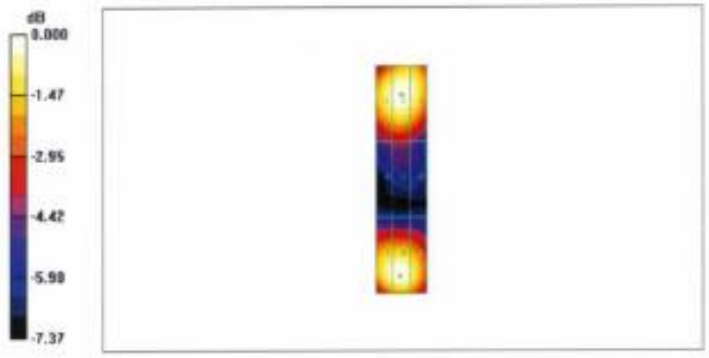
DASY4 Configuration:

- Probe: ER3DV6 - SN2336; ConvF(1, 1, 1); Calibrated: 27.12.2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn903; Calibrated: 31.08.2006
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: 1002
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

E Scan - Sensor Center 10mm above CD1880V3 Dipole/Hearing Aid Compatibility Test (41x181x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 134.7 V/m
Probe Modulation Factor = 1.00
Reference Value = 149.0 V/m; Power Drift = 0.027 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **131.0**	Grid 2 **134.5**	Grid 3 **130.9**
Grid 4 **86.2**	Grid 5 **87.8**	Grid 6 **83.9**
Grid 7 **131.6**	Grid 8 **134.7**	Grid 9 **127.2**



0 dB = 134.7V/m