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: Nov. 11,2008 Test Report No.: HCT-IA0811-0102 Test Site: HCT CO., LTD.

FCC ID: TYKNX9250

APPLICANT: CASIO HITACHI Mobile Communications Co., Ltd.

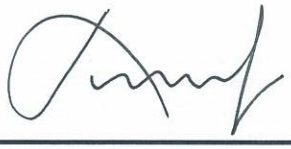
EUT Type:	Dual-Band CDMA Phone with Bluetooth (CDMA/PCS CDMA)
Tx Frequency:	824.70 - 848.31 MHz (CDMA) 1 851.25 – 1 908.75 MHz (PCS CDMA) 2 402 – 2 480 MHz (Bluetooth)
Maximum Conducted Power (HAC):	0.251 W CDMA (24.0 dBm) 0.251 W PCS CDMA (24.0 dBm)
Trade Name/Model(s):	CASIO HITACHI / CASIO EXILIM
FCC Classification:	Licensed Portable Transmitter Held to Ear (PCE)
FCC Rule Part(s):	§20.19
HAC Standard:	ANSI C63.19-2006

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.

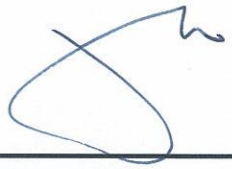
HCT Co., Ltd. Certifies that no party to this application has been denied FCC benefits pursuant to section 5301 of the Anti- Drug Abuse Act of 1998, 21 U.S. C. 862.



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

1.2 EUT Description

- EUT Type: Dual-Band CDMA Phone with Bluetooth (CDMA/PCS CDMA)
- Trade Name: CASIO HITACHI
- Model(s): CASIO EXILIM
- FCC ID: TYKNX9250
- Serial Number(s): #1
- Tx Frequency: 824.70 - 848.31 MHz (CDMA)
  1 851.25 – 1 908.75 MHz (PCS CDMA)
  2 402 – 2 480 MHz (Bluetooth)
- FCC Classification: Licensed Portable Transmitter Held to Ear (PCE)
- FCC Rule Part(s): § 20.19(b); §6.3(v), §7.3(v)
- Modulation(s): CDMA835/ PCS1900
- Antenna Type: Intenna
- Date(s) of Tests: Nov. 10, 2008
- Place of Tests: HCT CO., LTD.
  Icheon, Kyoung ki-Do, KOREA
- Report Serial No.: HCT-IA0811-0102
- Max E-Field Emission: channel 600, 1 880.00 MHz = 33.7 dBV/m (M4)
- Max H-Field Emission: channel 1175, 1 908.75 MHz = - 21.2 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.

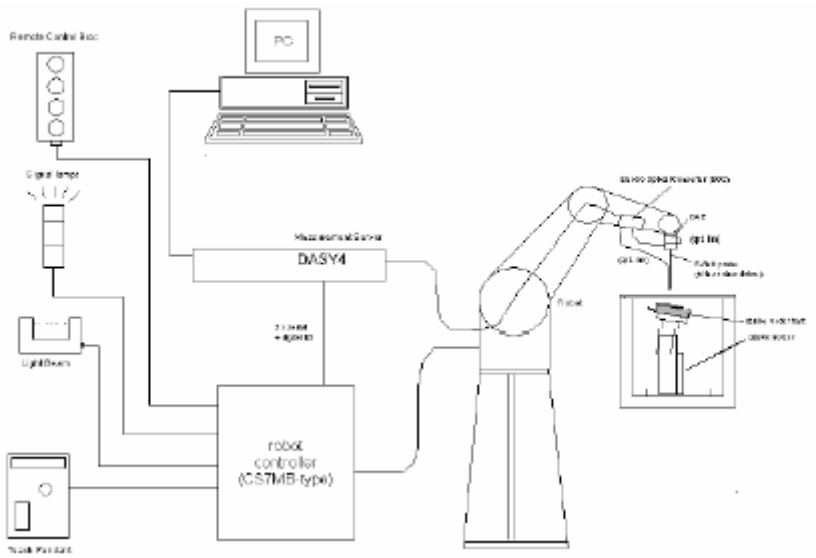


Figure 1. HAC Test Measurement Set-up

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

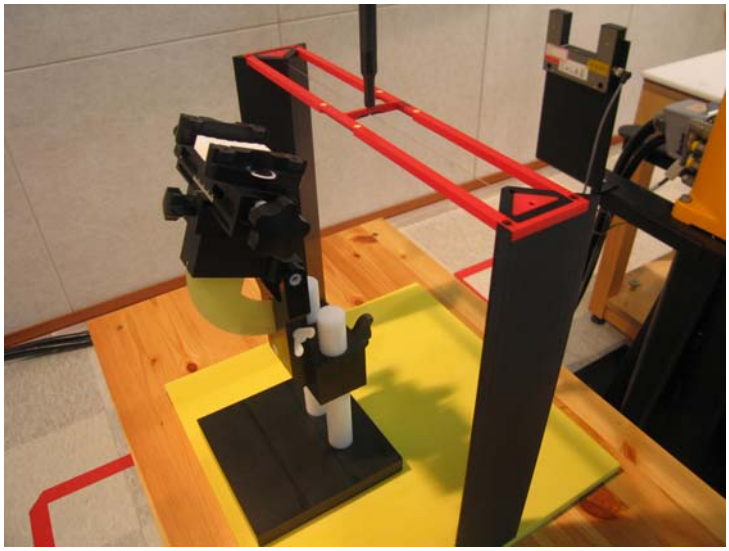


Figure 2. HAC Phantom & Device Holder

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 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 1.0 cm in front of, the reference plane.

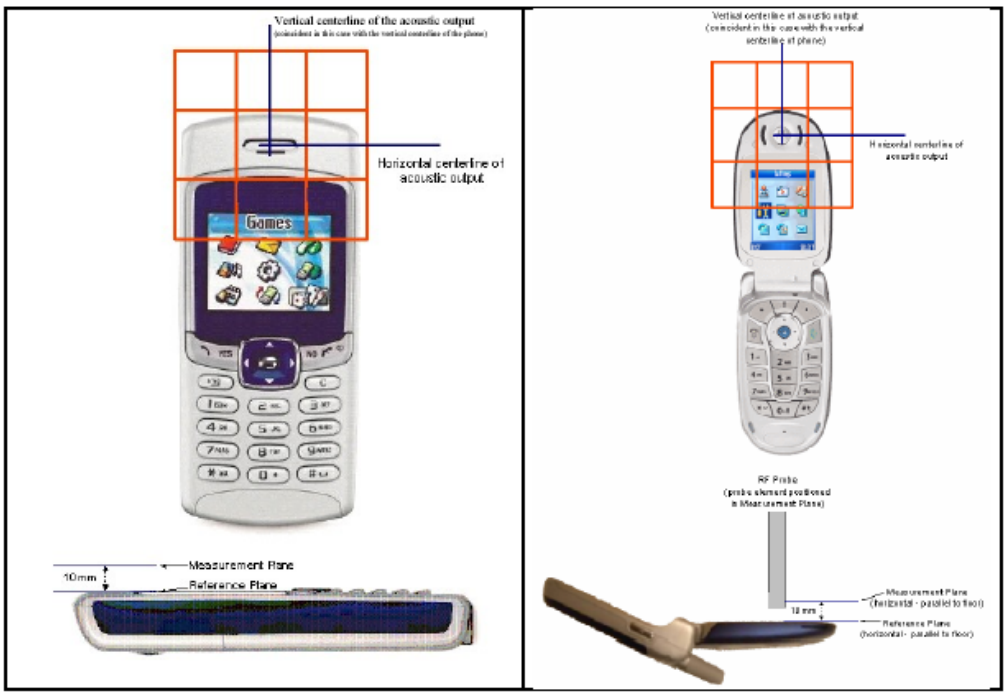


Figure 3. WD reference and plane for RF emission measurements

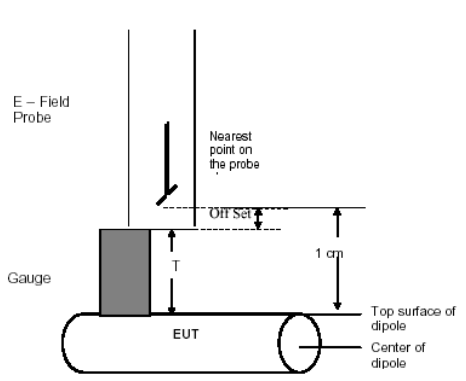


Figure 4. Gauge Block with E-Field Probe

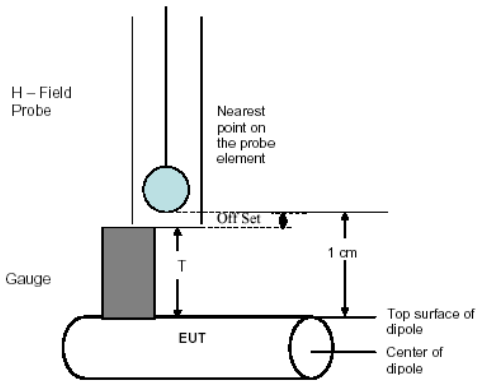


Figure 5. Gauge Block with H-Field Probe

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.

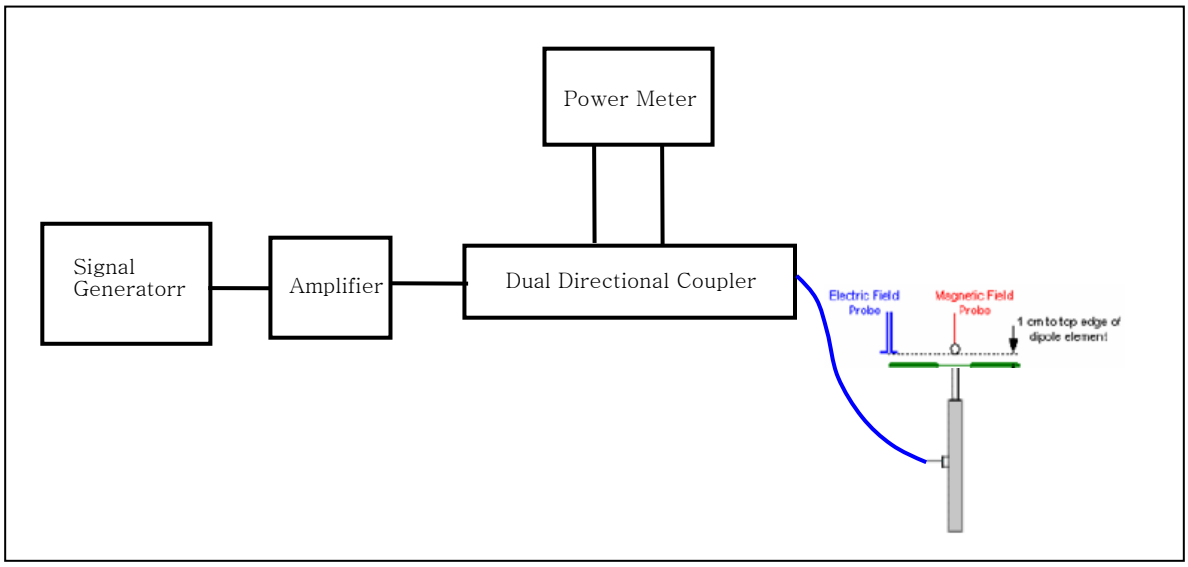


Figure 6. Dipole Validation SET-UP

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	165	159	+ 3.77	± 25
CW	1 880	20	141.05	140.25	+ 0.57	± 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	0.449	0.445	+ 0.90	± 25
CW	1 880	20	0.475	0.469	+ 1.28	± 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:

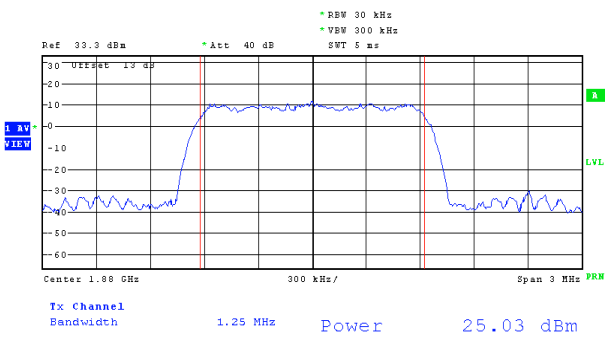


Figure. 7

Signal Generator Modulated Signal

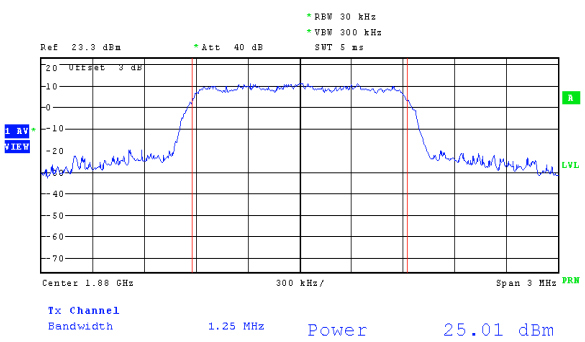


Figure. 8

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	273.8	-
80 % AM		24	168.9	1.621
CDMA (Full Rate)		24	285.5	0.959
CDMA (1/8 Rate)		24	87.7	3.122
CW	1 880	24	198.9	-
80 % AM		24	125.3	1.587
CDMA (Full Rate)		24	204.6	0.972
CDMA (1/8 Rate)		24	64.83	3.068

6.2.2 H-Field

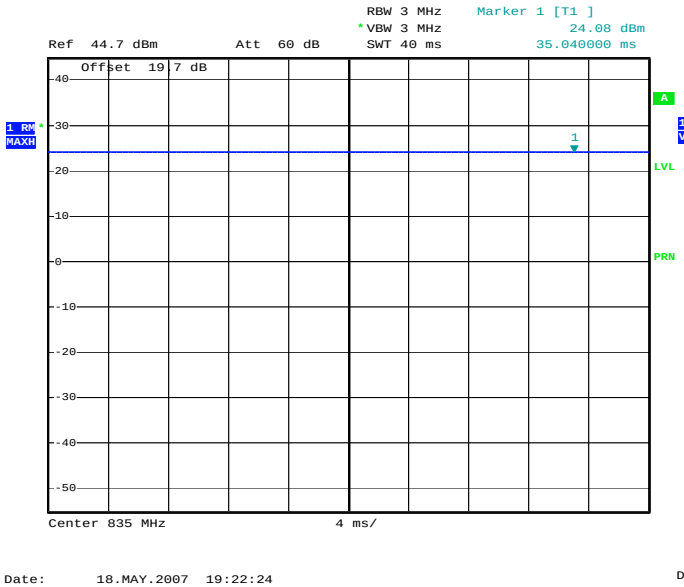
Mode	Freq. [MHz]	Input Power [dB]	H-Field measured value [A/m]	Probe Modulation Factor
CW	835	24	0.826	-
80 % AM		24	0.541	1.527
CDMA (Full Rate)		24	0.975	0.847
CDMA (1/8 Rate)		24	0.299	2.763
CW	1 880	24	0.754	-
80 % AM		24	0.507	1.487
CDMA (Full Rate)		24	1.002	0.752
CDMA (1/8 Rate)		24	0.287	2.627

Notes:

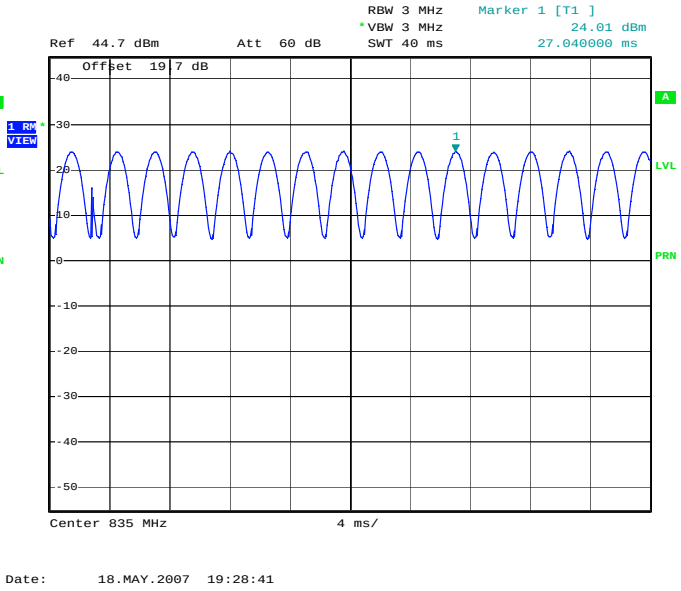
1) Modulation Factor =CW / WD_CDMA

6.2.3 PMF Peak Power Measurement Plots

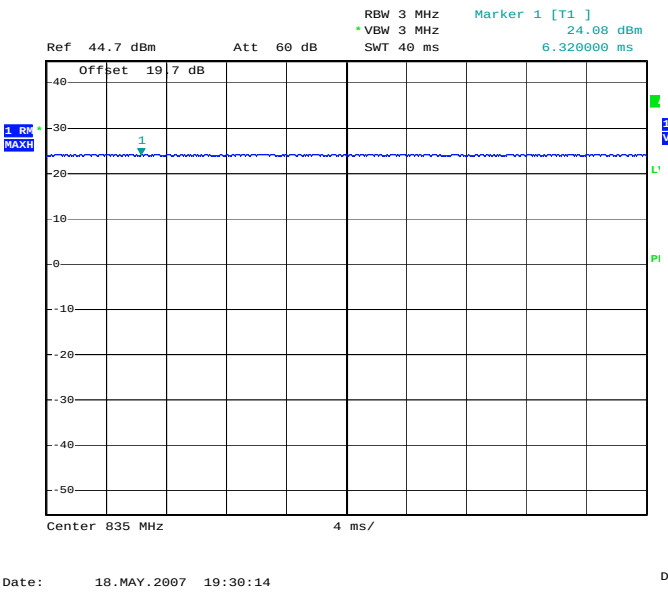
■ Probe Modulation Factor (CW)



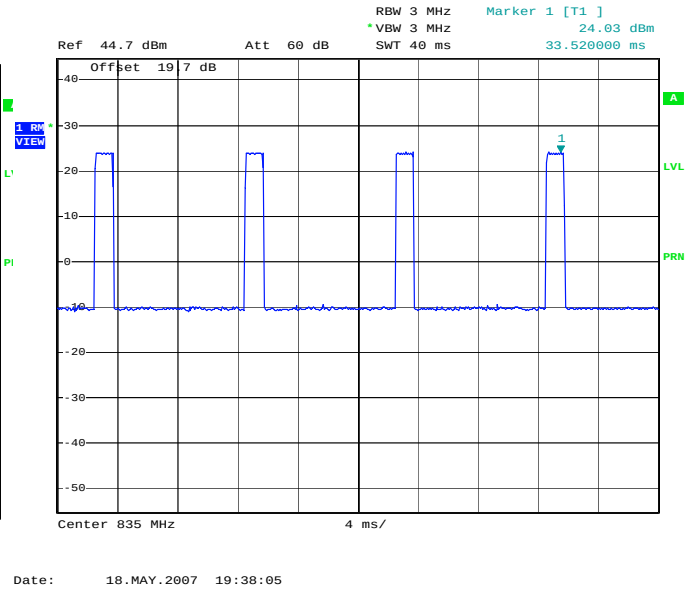
■ Probe Modulation Factor (AM 80 %)



■ 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: TYKNX9250

Band	Channel	SO2	SO2	SO55	SO55	TDSO SO32	1xEvDO Rev.0	1xEvDO Rev.0	1xEvDO Rev.A	1xEvDO Rev.A
		RC1/1	RC3/3	RC1/1	RC3/3	RC3/3	(FTAP)	(RTAP)	(FETAP)	(RETAP)
CDMA	1013	23.86	23.85	23.84	23.66	23.78	24.35	24.34	24.32	24.54
	384	24.12	24.07	24.10	24.06	24.00	24.60	24.65	24.65	24.62
	777	23.97	24.04	23.99	24.03	23.83	24.30	24.30	24.49	24.47
PCS	25	23.91	23.77	23.91	23.88	23.86	24.29	24.26	24.31	24.29
	600	23.82	23.83	23.84	23.91	23.94	24.35	24.39	24.36	24.49
	1175	24.12	24.04	24.15	24.02	23.98	24.48	24.77	24.57	24.57

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	600	off	SO55/RC3	Standard	Intenna	23.91	48.93	33.5	41	- 7.46	**M4**
PCS	600	on	SO55/RC1	Standard	Intenna	23.84	49.84	33.7	41	- 7.30	**M4**
PCS	600	off	SO2/RC1	Standard	Intenna	23.82	49.76	33.7	41	- 7.31	**M4**
PCS	600	off	SO3/RC1	Standard	Intenna	23.91	17.39	34.5	41	- 6.46	**M4**
PCS	600	off	SO55/RC1	Standard	Intenna	23.84	49.87	33.7	41	- 7.29	**M4**
PCS	600	off	SO9/RC2	Standard	Intenna	23.95	49.38	33.6	41	- 7.38	**M4**
PCS	600	off	SO2/RC3	Standard	Intenna	23.83	49.22	33.6	41	- 7.40	**M4**
PCS	600	off	SO3/RC3	Standard	Intenna	23.87	49.55	33.7	41	- 7.35	**M4**

8. TEST PROCEDURE

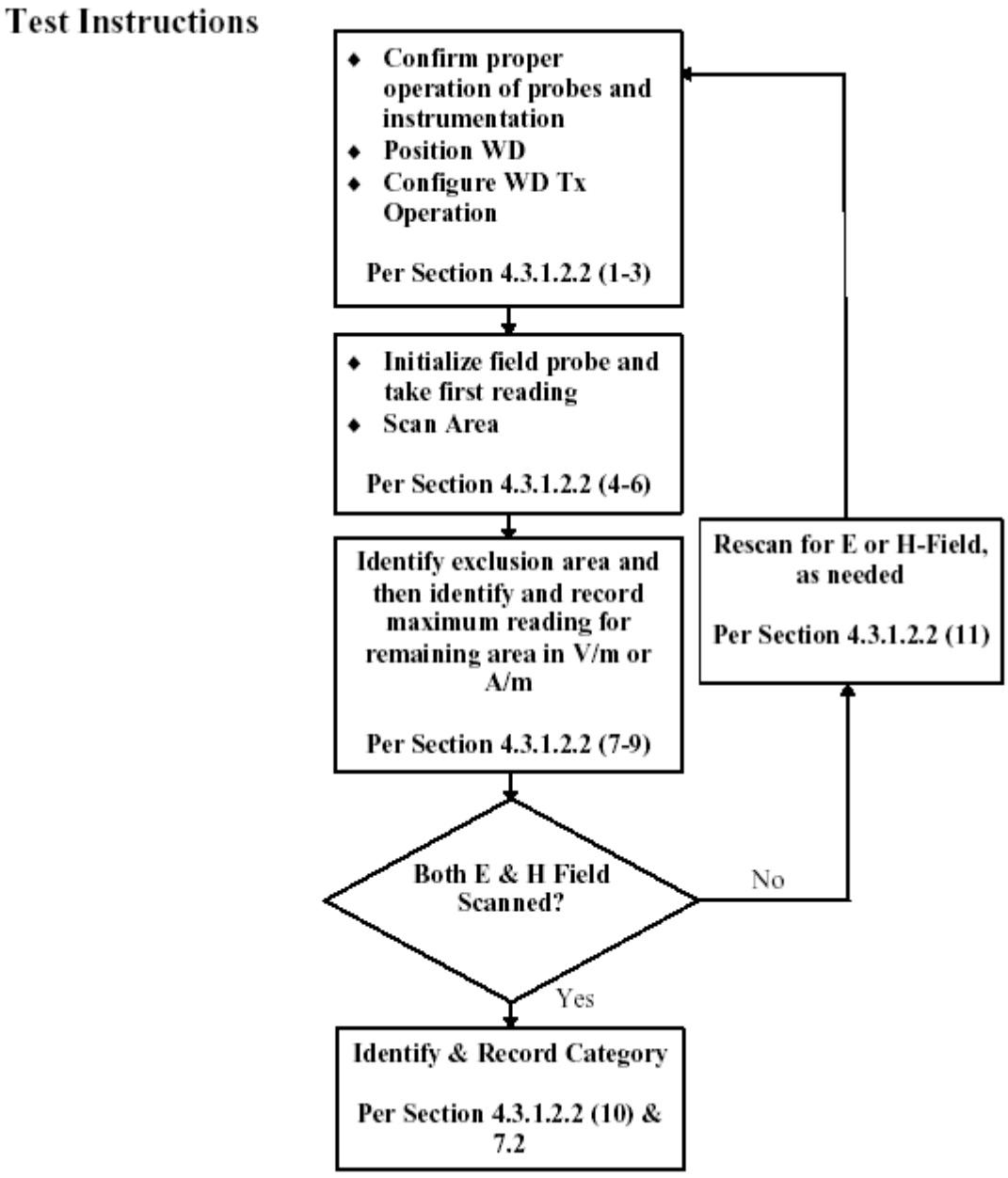


Figure 9. WD near-field emission automated test flowchart

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 2 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 3. 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

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

Ambient TEMPERATURE (°C): 21.5

S/N: #1

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	23.84	55.6	34.5	51	- 16.47	none	M4
CDMA	384	off	SO55/RC1	Standard	Intenna	24.10	81.8	37.9	51	- 13.11	none	M4
CDMA	777	off	SO55/RC1	Standard	Intenna	23.99	58.4	35.0	51	- 16.04	none	M4
PCS	25	off	SO55/RC1	Standard	Intenna	23.91	46.7	33.1	41	- 7.86	none	M4
PCS	600	off	SO55/RC1	Standard	Intenna	23.84	49.8	33.7	41	- 7.30	none	M4
PCS	1175	off	SO55/RC1	Standard	Intenna	24.15	47.1	33.2	41	- 7.78	none	M4
PCS	600	off	SO55/RC1	Extended	Intenna	23.84	47.3	33.3	41	- 7.75	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. HAC Measurement System ☒ SPEAG

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

Ambient TEMPERATURE (°C): 21.5

S/N: #1

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	23.84	0.098	- 21.6	0.6	- 22.21	none	M4
CDMA	384	off	SO55/RC1	Standard	Intenna	24.10	0.152	- 17.8	0.6	- 18.41	none	M4
CDMA	777	off	SO55/RC1	Standard	Intenna	23.99	0.100	- 21.4	0.6	- 22.03	none	M4
PCS	25	off	SO55/RC1	Standard	Intenna	23.91	0.110	- 21.6	- 9.4	- 12.25	none	M4
PCS	600	off	SO55/RC1	Standard	Intenna	23.84	0.112	- 21.5	- 9.4	- 12.09	none	M4
PCS	1175	off	SO55/RC1	Standard	Intenna	24.15	0.116	- 21.2	- 9.4	- 11.79	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. HAC Measurement System ☒ SPEAG

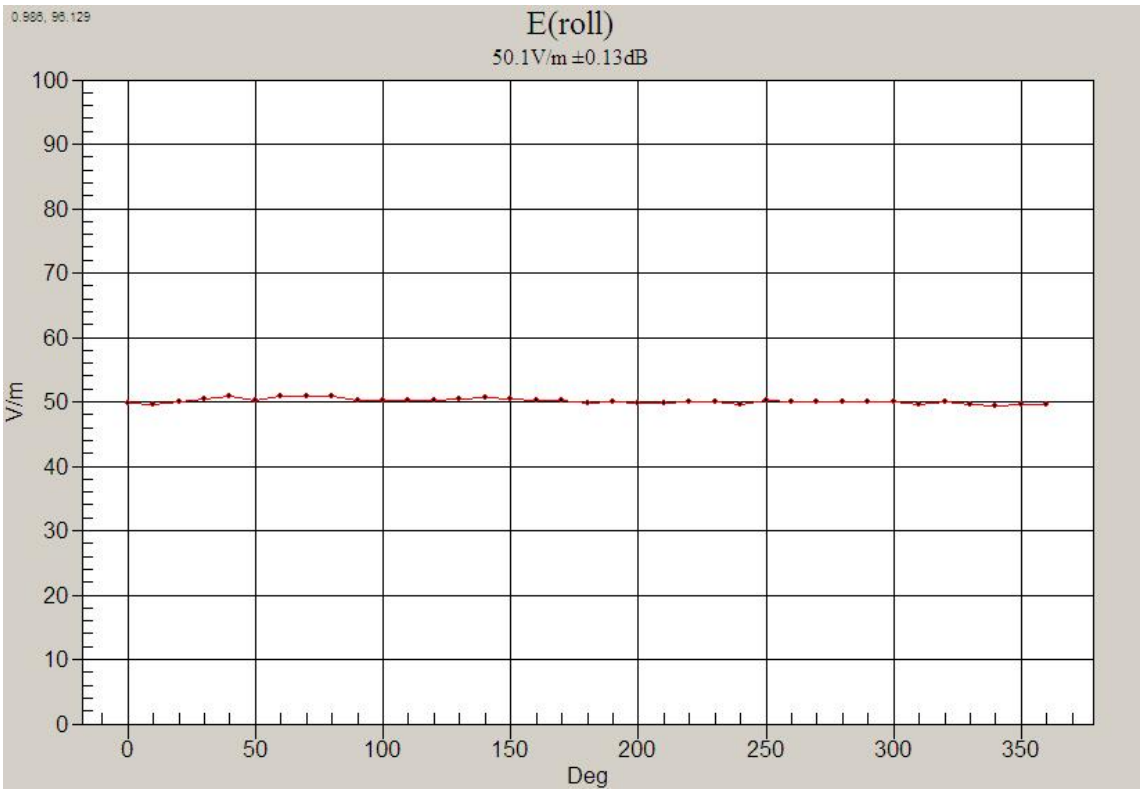
11.3 Worst-case Configuration Evaluation

Ambient TEMPERATURE (°C): 21.5

S/N: #1

Peak Reading 360° Probe Rotation at Azimuth axis

Mode	Channel	Backlight	RC/SO	Antenna	Conducted Power (dBm)	Time Avg. Field (V/m)	Peak Field (dBV/m)	FCC Limit (dBV/m)	FCC MARGIN (dB)	Exclusion Block	RESULT
PCS	600	off	SO55/RC1	Standard	23.84	51.0	33.9	41	- 7.10	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	DAE3V1	466	07/17/08	Annual	07/17/09
SPEAG	E-Field Probe	2343	05/19/08	Annual	05/19/09
SPEAG	H-Field Probe	6101	05/19/08	Annual	05/19/09
SPEAG	Validation Dipole CD835V2	1024	03/11/08	Annual	03/11/09
SPEAG	Validation Dipole CD1880V2	1019	03/11/08	Annual	03/11/09
Agilent	Power Meter(F) E4419B	MY41291386	11/05/08	Annual	11/05/09
Agilent	Power Sensor(G) 8481	MY41090870	11/05/08	Annual	11/05/09
HP	Signal Generator E4438C	MY42082646	12/24/07	Annual	12/24/08
EM POWER	Power Amp BBS3Q7ELU	1013-D/C-0127	4/12/ 08	Annual	4/12/ 09
HP	Network Analyzer 8753ES	JP39240221	04/11/08	Annual	04/11/09
HP	Dual Directional Coupler 778D	16072	11/05/08	Annual	11/05/09
R&S	Base Station CMU200	110740	07/26/08	Annual	07/26/09
Agilent	Base Station E5515C	GB44400269	02/10/08	Annual	02/10/09
R&S	Spectrum Analyzer FSP30	839117/011	07/31/08	Annual	07/31/09

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	21.5°C /1013
Test Date	Nov. 10, 2008

DUT: CASIO EXILIM; 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 71; Postprocessing SW: SEMCAD, V1.8 Build 176

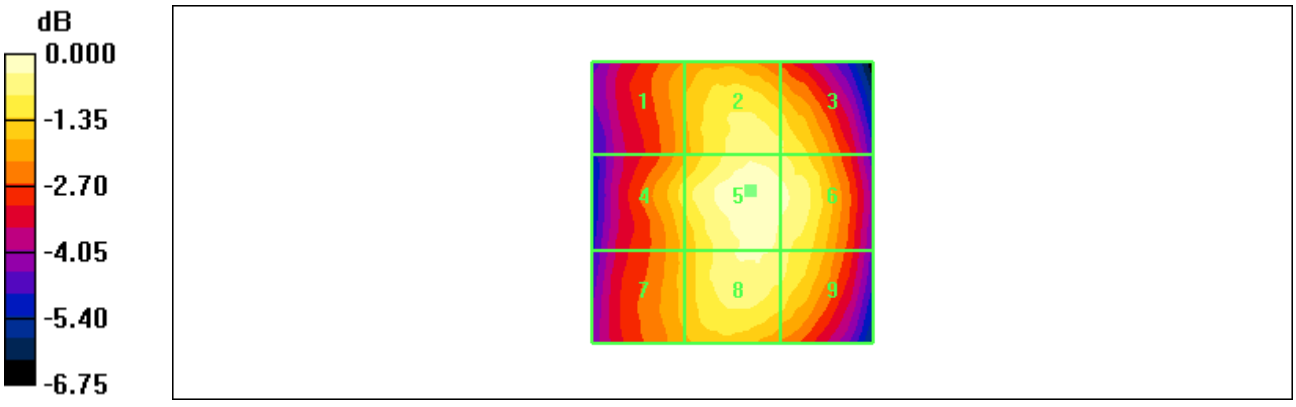
DASY4 Configuration:
- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2008-05-19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn466; Calibrated: 2008-07-17
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

E Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 53.3 V/m
Probe Modulation Factor = 0.959
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 58.9 V/m; Power Drift = 0.107 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 43.4 M4	Grid 2 50.0 M4	Grid 3 48.8 M4
Grid 4 47.0 M4	Grid 5 53.3 M4	Grid 6 51.9 M4
Grid 7 44.4 M4	Grid 8 51.0 M4	Grid 9 49.7 M4

Cursor:
Total = 53.3 V/m
E Category: M4
Location: -3.2, -2.2, 364.8 mm



0 dB = 53.3V/m

Test Laboratory: HCT CO., LTD.

Ambient Temperature / Channel 21.5°C /384

Test Date Nov. 10, 2008

DUT: CASIO EXILIM; 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 71; Postprocessing SW: SEMCAD, V1.8 Build 176

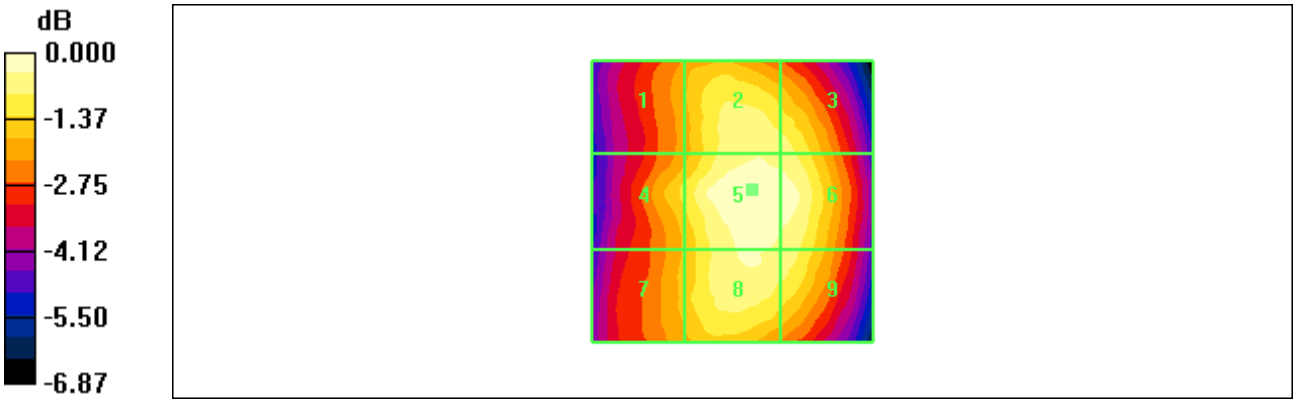
DASY4 Configuration:
- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2008-05-19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn466; Calibrated: 2008-07-17
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

E Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 78.4 V/m
Probe Modulation Factor = 0.959
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 84.9 V/m; Power Drift = 0.157 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **63.4 M4**	Grid 2 **74.4 M4**	Grid 3 **72.6 M4**
Grid 4 **68.3 M4**	Grid 5 **78.4 M4**	Grid 6 **77.7 M4**
Grid 7 **65.1 M4**	Grid 8 **74.8 M4**	Grid 9 **73.3 M4**

Cursor:
Total = 78.4 V/m
E Category: M4
Location: -3.4, -2.2, 364.8 mm



0 dB = 78.4V/m

Test Laboratory:	HCT CO., LTD.
Ambient Temperature / Channel	21.5°C /777
Test Date	Nov. 10, 2008

DUT: CASIO EXILIM; 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 71; Postprocessing SW: SEMCAD, V1.8 Build 176

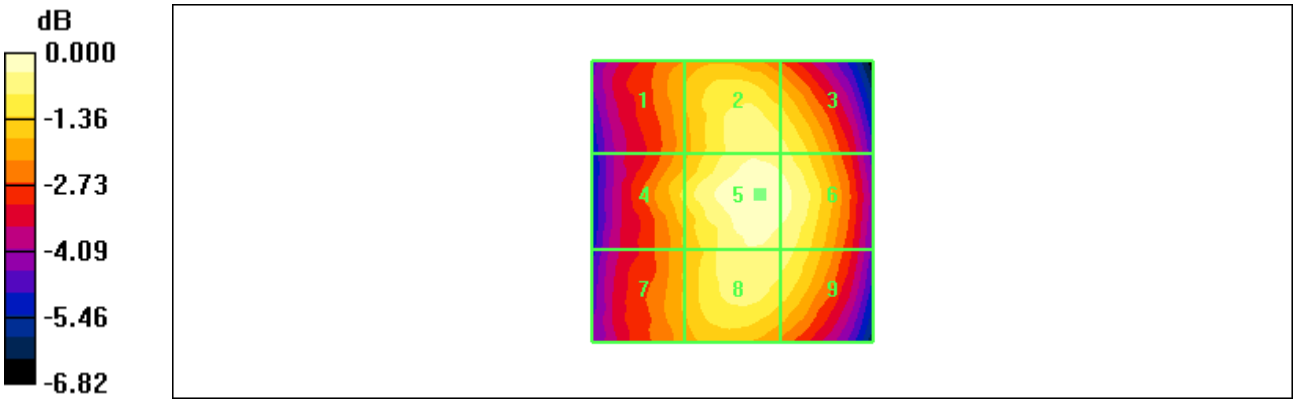
DASY4 Configuration:
- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2008-05-19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn466; Calibrated: 2008-07-17
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

E Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 56.0 V/m
Probe Modulation Factor = 0.959
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 61.6 V/m; Power Drift = -0.014 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **45.8 M4**	Grid 2 **53.0 M4**	Grid 3 **51.9 M4**
Grid 4 **48.8 M4**	Grid 5 **56.0 M4**	Grid 6 **54.9 M4**
Grid 7 **46.0 M4**	Grid 8 **53.0 M4**	Grid 9 **51.9 M4**

Cursor:
Total = 56.0 V/m
E Category: M4
Location: -5, -1.2, 364.8 mm



0 dB = 56.0V/m

Test Laboratory:	HCT CO., LTD.
Ambient Temperature / Channel	21.5°C /25
Test Date	Nov. 10, 2008

DUTDUT: CASIO EXILIM; 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 71; Postprocessing SW: SEMCAD, V1.8 Build 176

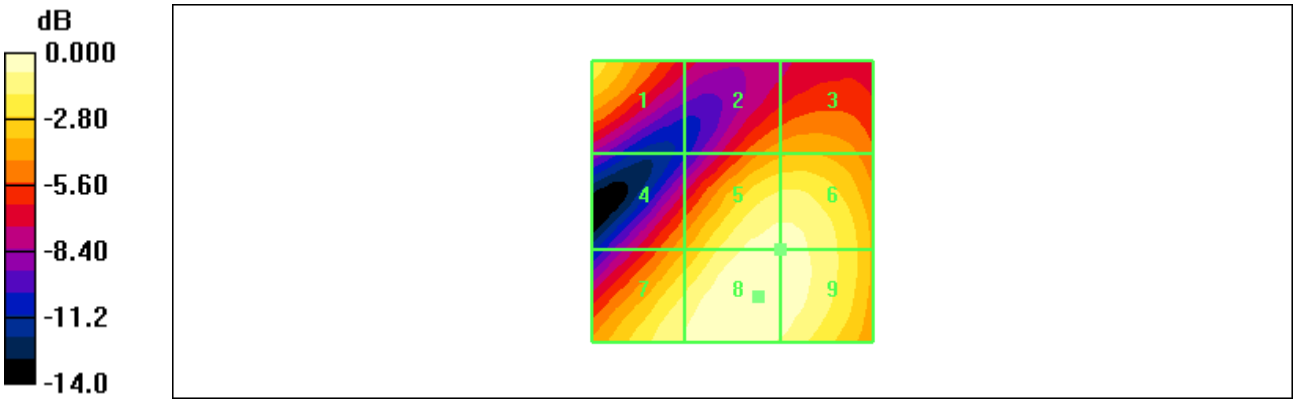
DASY4 Configuration:
- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2008-05-19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn466; Calibrated: 2008-07-17
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

E Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 45.4 V/m
Probe Modulation Factor = 0.972
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 35.8 V/m; Power Drift = -0.119 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **34.9 M4**	Grid 2 **28.8 M4**	Grid 3 **29.9 M4**
Grid 4 **29.3 M4**	Grid 5 **43.2 M4**	Grid 6 **43.2 M4**
Grid 7 **41.1 M4**	Grid 8 **45.4 M4**	Grid 9 **44.5 M4**

Cursor:
Total = 45.4 V/m
E Category: M4
Location: -4.6, 16.8, 364.8 mm



0 dB = 45.4V/m

Test Laboratory:	HCT CO., LTD.
Ambient Temperature / Channel	21.5°C /600
Test Date	Nov. 10, 2008

DUT: CASIO EXILIM; 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 71; Postprocessing SW: SEMCAD, V1.8 Build 176

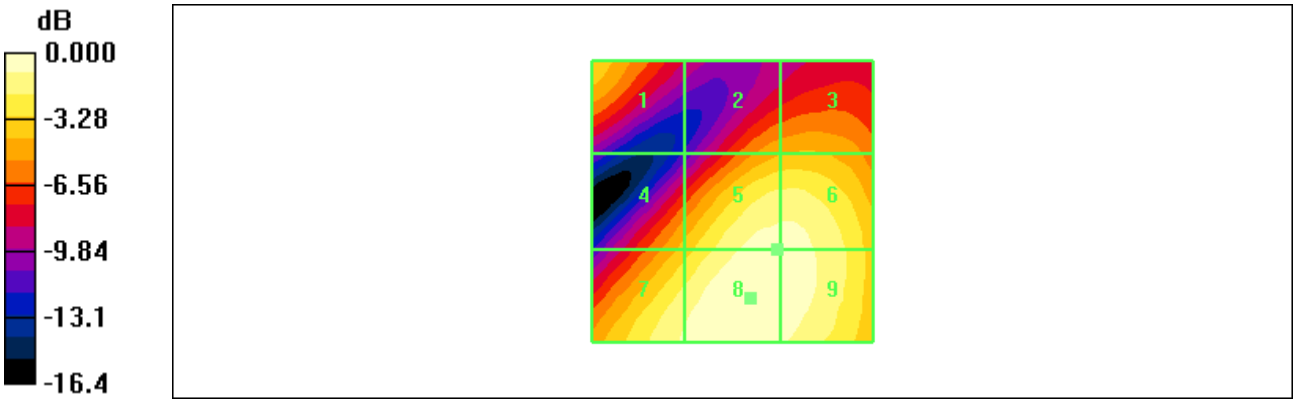
DASY4 Configuration:
- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2008-05-19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn466; Calibrated: 2008-07-17
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

E Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 48.4 V/m
Probe Modulation Factor = 0.972
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 37.2 V/m; Power Drift = 0.039 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **32.6 M4**	Grid 2 **29.2 M4**	Grid 3 **30.0 M4**
Grid 4 **31.3 M4**	Grid 5 **45.9 M4**	Grid 6 **45.8 M4**
Grid 7 **43.6 M4**	Grid 8 **48.4 M4**	Grid 9 **47.5 M4**

Cursor:
Total = 48.4 V/m
E Category: M4
Location: -3.2, 17.2, 364.8 mm



0 dB = 48.4V/m

Test Laboratory:	HCT CO., LTD.
Ambient Temperature / Channel	21.5°C /1175
Test Date	Nov. 10, 2008

DUT: CASIO EXILIM; 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 71; Postprocessing SW: SEMCAD, V1.8 Build 176

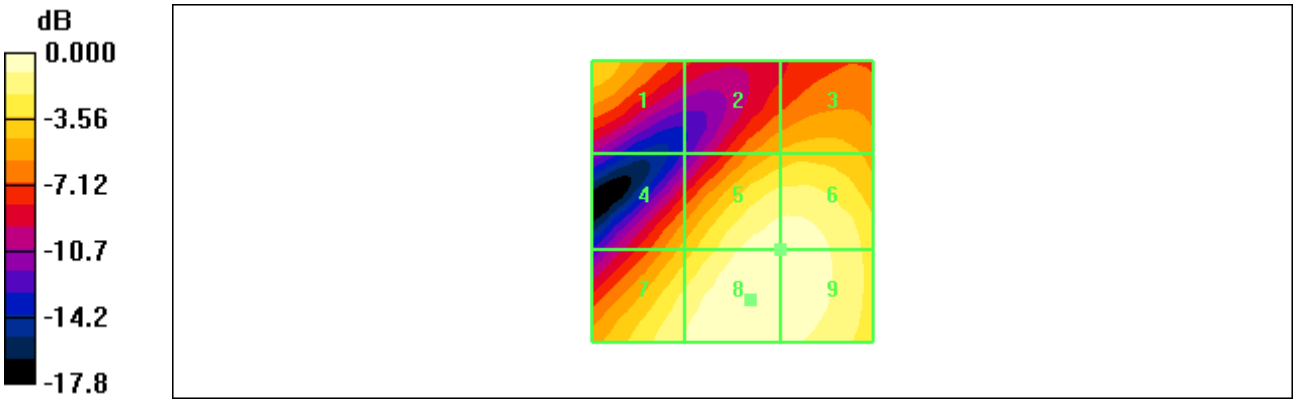
DASY4 Configuration:
- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2008-05-19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn466; Calibrated: 2008-07-17
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

E Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 45.8 V/m
Probe Modulation Factor = 0.972
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 34.1 V/m; Power Drift = -0.133 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **29.7 M4**	Grid 2 **27.3 M4**	Grid 3 **29.1 M4**
Grid 4 **28.3 M4**	Grid 5 **43.2 M4**	Grid 6 **43.4 M4**
Grid 7 **40.2 M4**	Grid 8 **45.8 M4**	Grid 9 **45.0 M4**

Cursor:
Total = 45.8 V/m
E Category: M4
Location: -3.2, 17.4, 364.8 mm



0 dB = 45.8V/m

Test Laboratory:	HCT CO., LTD.
Ambient Temperature / Channel	21.5°C /1013
Test Date	Nov. 10, 2008

DUT: CASIO EXILIM; 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 71; Postprocessing SW: SEMCAD, V1.8 Build 176

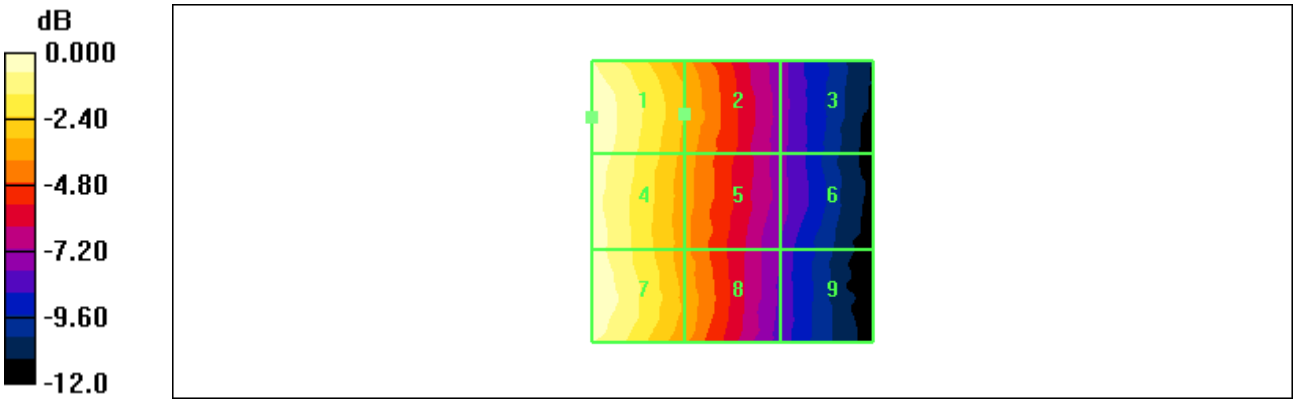
DASY4 Configuration:
- Probe: H3DV6 - SN6101; ; Calibrated: 2008-05-19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn466; Calibrated: 2008-07-17
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

H Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 0.083 A/m
Probe Modulation Factor = 0.847
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.052 A/m; Power Drift = -0.038 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 0.083 M4	Grid 2 0.058 M4	Grid 3 0.035 M4
Grid 4 0.080 M4	Grid 5 0.056 M4	Grid 6 0.035 M4
Grid 7 0.082 M4	Grid 8 0.056 M4	Grid 9 0.033 M4

Cursor:
Total = 0.083 A/m
H Category: M4
Location: 25, -14.8, 365.6 mm



0 dB = 0.083A/m

Test Laboratory:	HCT CO., LTD.
Ambient Temperature / Channel	21.5°C /384
Test Date	Nov. 10, 2008

DUT: CASIO EXILIM; 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 71; Postprocessing SW: SEMCAD, V1.8 Build 176

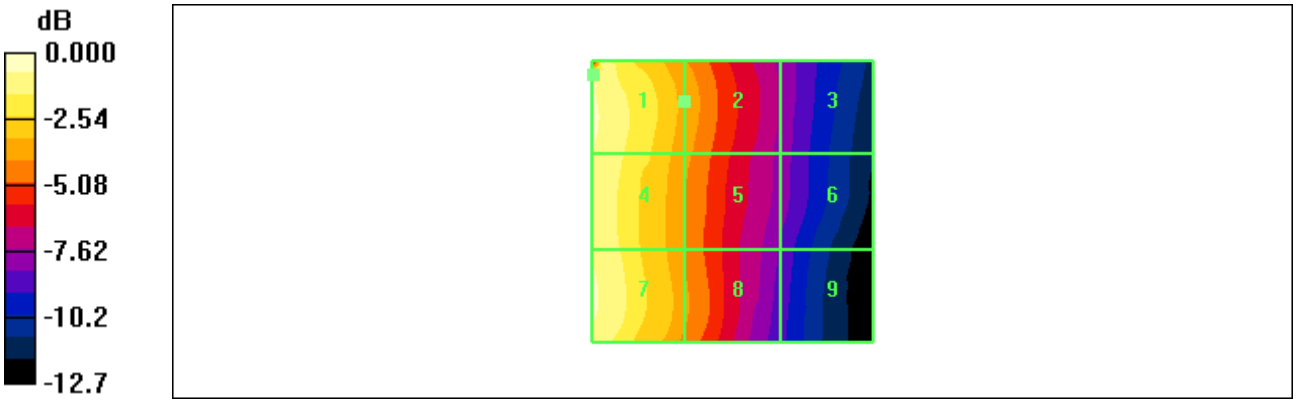
DASY4 Configuration:
- Probe: H3DV6 - SN6101; ; Calibrated: 2008-05-19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn466; Calibrated: 2008-07-17
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

H Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 0.129 A/m
Probe Modulation Factor = 0.847
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.075 A/m; Power Drift = 0.081 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 0.129 M4	Grid 2 0.085 M4	Grid 3 0.053 M4
Grid 4 0.118 M4	Grid 5 0.081 M4	Grid 6 0.052 M4
Grid 7 0.120 M4	Grid 8 0.081 M4	Grid 9 0.048 M4

Cursor:
Total = 0.129 A/m
H Category: M4
Location: 24.8, -22.4, 365.6 mm



0 dB = 0.129A/m

Test Laboratory:	HCT CO., LTD.
Ambient Temperature / Channel	21.5°C /777
Test Date	Nov. 10, 2008

DUT: CASIO EXILIM; 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 71; Postprocessing SW: SEMCAD, V1.8 Build 176

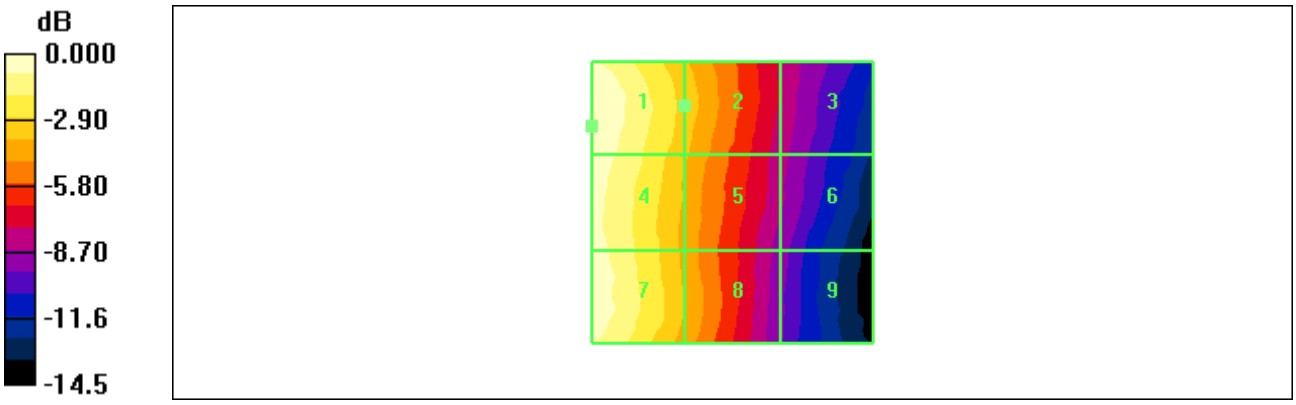
DASY4 Configuration:
- Probe: H3DV6 - SN6101; ; Calibrated: 2008-05-19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn466; Calibrated: 2008-07-17
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

H Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 0.085 A/m
Probe Modulation Factor = 0.847
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.050 A/m; Power Drift = -0.081 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 0.085 M4	Grid 2 0.058 M4	Grid 3 0.035 M4
Grid 4 0.083 M4	Grid 5 0.056 M4	Grid 6 0.033 M4
Grid 7 0.083 M4	Grid 8 0.054 M4	Grid 9 0.030 M4

Cursor:
Total = 0.085 A/m
H Category: M4
Location: 25, -13.4, 365.6 mm



0 dB = 0.085A/m

Test Laboratory:	HCT CO., LTD.
Ambient Temperature / Channel	21.5°C /25
Test Date	Nov. 10, 2008

DUT: CASIO EXILIM; 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 71; Postprocessing SW: SEMCAD, V1.8 Build 176

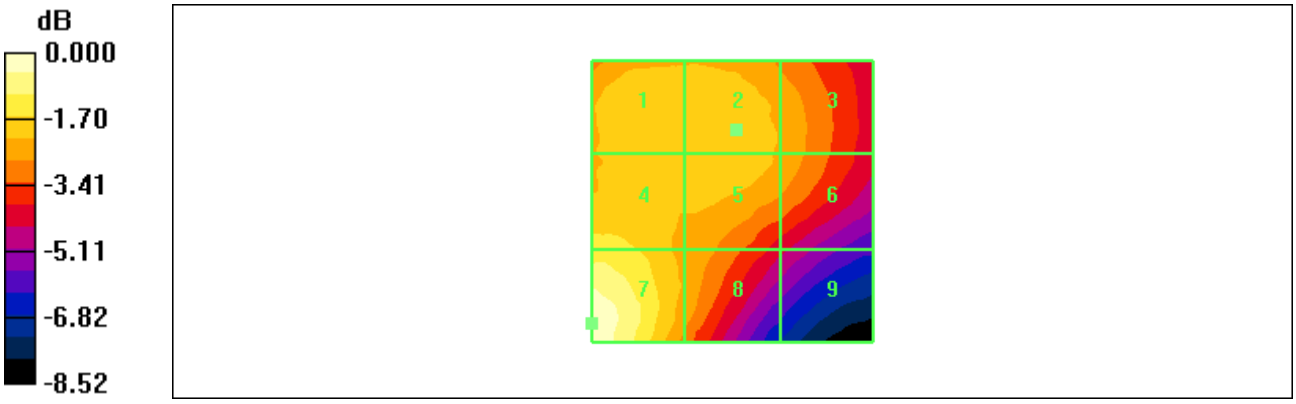
DASY4 Configuration:
- Probe: H3DV6 - SN6101; ; Calibrated: 2008-05-19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn466; Calibrated: 2008-07-17
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

H Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 0.083 A/m
Probe Modulation Factor = 0.752
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.088 A/m; Power Drift = -0.069 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.067 M4**	Grid 2 **0.067 M4**	Grid 3 **0.064 M4**
Grid 4 **0.070 M4**	Grid 5 **0.067 M4**	Grid 6 **0.063 M4**
Grid 7 **0.083 M4**	Grid 8 **0.063 M4**	Grid 9 **0.051 M4**

Cursor:
Total = 0.083 A/m
H Category: M4
Location: 25, 21.6, 365.6 mm



0 dB = 0.083A/m

Test Laboratory: HCT CO., LTD.

Ambient Temperature / Channel 21.5°C /600

Test Date Nov. 10, 2008

DUT: CASIO EXILIM; 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 71; Postprocessing SW: SEMCAD, V1.8 Build 176

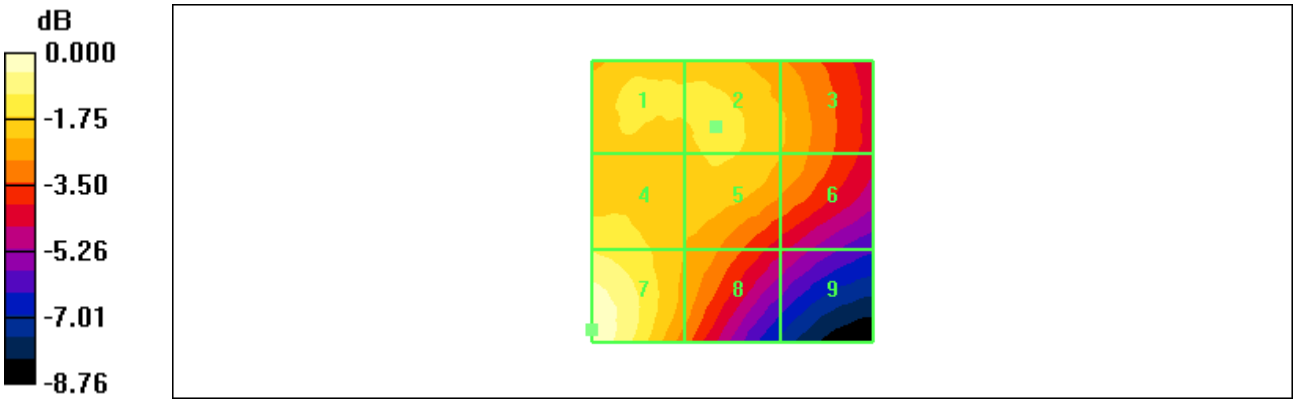
DASY4 Configuration:
- Probe: H3DV6 - SN6101; ; Calibrated: 2008-05-19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn466; Calibrated: 2008-07-17
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

H Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 0.084 A/m
Probe Modulation Factor = 0.752
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.091 A/m; Power Drift = -0.012 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.070 M4**	Grid 2 **0.070 M4**	Grid 3 **0.065 M4**
Grid 4 **0.073 M4**	Grid 5 **0.069 M4**	Grid 6 **0.064 M4**
Grid 7 **0.084 M4**	Grid 8 **0.064 M4**	Grid 9 **0.050 M4**

Cursor:
Total = 0.084 A/m
H Category: M4
Location: 25, 22.6, 365.6 mm



0 dB = 0.084A/m

Test Laboratory:	HCT CO., LTD.
Ambient Temperature / Channel	21.5°C /1175
Test Date	Nov. 10, 2008

DUT: CASIO EXILIM; 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 71; Postprocessing SW: SEMCAD, V1.8 Build 176

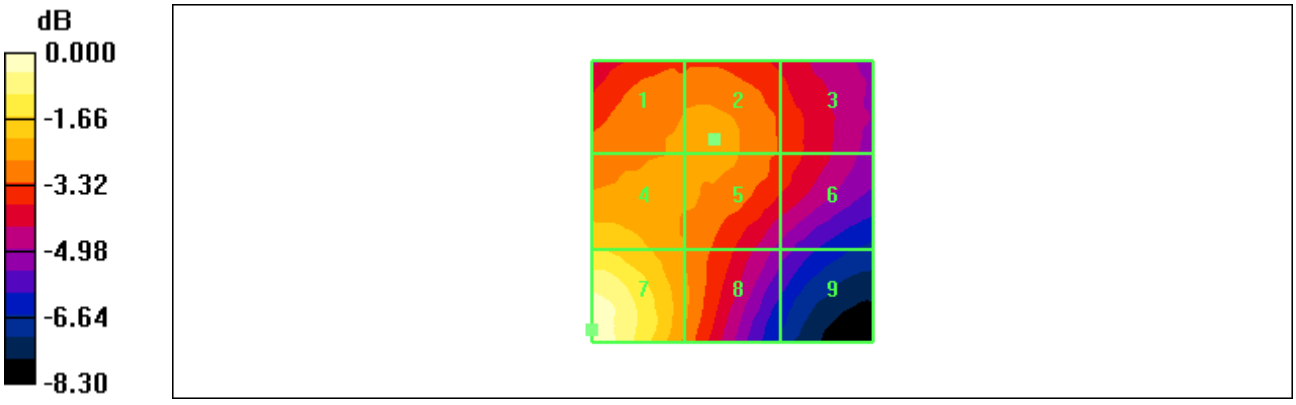
DASY4 Configuration:
- Probe: H3DV6 - SN6101; ; Calibrated: 2008-05-19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn466; Calibrated: 2008-07-17
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

H Scan 10mm above Device Reference/Hearing Aid Compatibility Test (251x251x1): Measurement grid: dx=2mm, dy=2mm
Maximum value of peak Total field = 0.087 A/m
Probe Modulation Factor = 0.752
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.085 A/m; Power Drift = -0.073 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 0.064 M4	Grid 2 0.065 M4	Grid 3 0.059 M4
Grid 4 0.072 M4	Grid 5 0.065 M4	Grid 6 0.059 M4
Grid 7 0.087 M4	Grid 8 0.064 M4	Grid 9 0.048 M4

Cursor:
Total = 0.087 A/m
H Category: M4
Location: 25, 22.8, 365.6 mm



0 dB = 0.087A/m

APPENDIX C (DIPOLE VALIDATION)

Test Laboratory: HCT CO., LTD.

Ambient Temperature 21.5 °C

Test Date Nov.10, 2008

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

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 71; Postprocessing SW: SEMCAD, V1.8 Build 176

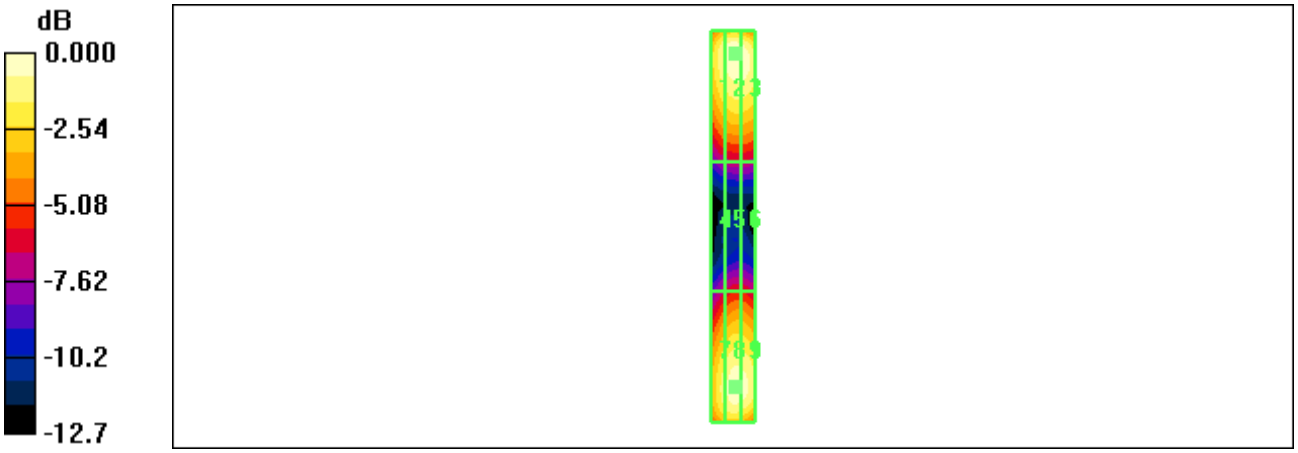
DASY4 Configuration:
- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2008-05-19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn466; Calibrated: 2008-07-17
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

E Scan 10mm above CD 835 MHz/Hearing Aid Compatibility Test (41x361x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 167.7 V/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 130.0 V/m; Power Drift = -0.020 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 157.3 M4	Grid 2 167.7 M4	Grid 3 165.8 M4
Grid 4 78.0 M4	Grid 5 85.3 M4	Grid 6 85.0 M4
Grid 7 149.3 M4	Grid 8 162.3 M4	Grid 9 161.2 M4

Cursor:
Total = 167.7 V/m
E Category: M4
Location: -1, -79, 365.8 mm



0 dB = 167.7V/m

Test Laboratory: HCT CO., LTD.

Ambient Temperature 21.5 °C

Test Date Nov.10, 2008

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

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 Dipole Section ; Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 176

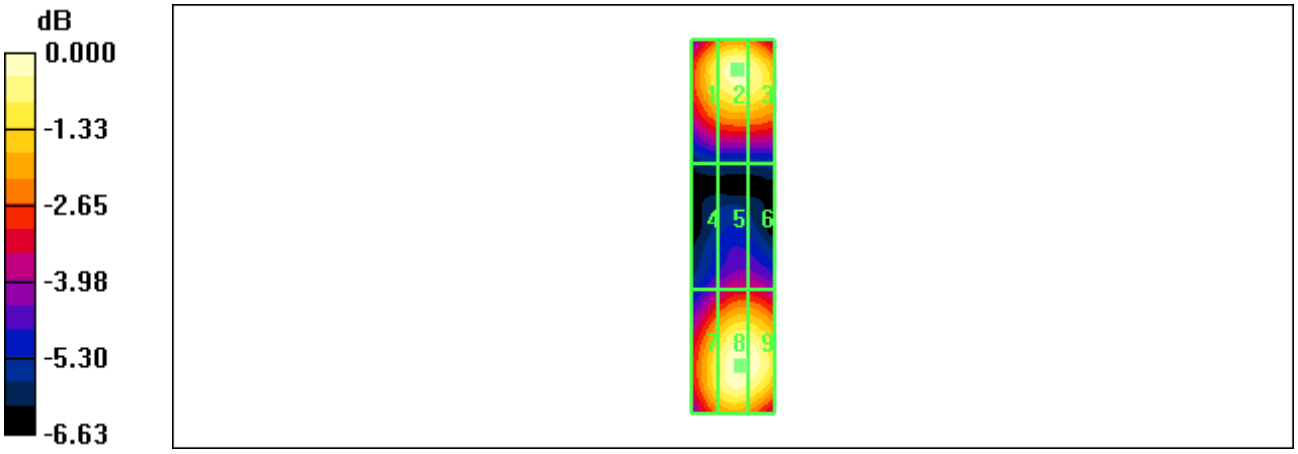
DASY4 Configuration:
- Probe: ER3DV6 - SN2343; ConvF(1, 1, 1); Calibrated: 2008-05-19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn466; Calibrated: 2008-07-17
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

E Scan 10mm above CD 1880 MHz/Hearing Aid Compatibility Test (41x181x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 143.5 V/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 170.0 V/m; Power Drift = 0.002 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak E-field in V/m

Grid 1 132.6 M2	Grid 2 140.9 M2	Grid 3 138.9 M2
Grid 4 89.0 M3	Grid 5 96.9 M3	Grid 6 96.8 M3
Grid 7 131.3 M2	Grid 8 143.5 M2	Grid 9 142.7 M2

Cursor:
Total = 143.5 V/m
E Category: M2
Location: -2, 33.5, 365.8 mm



0 dB = 143.5V/m

Test Laboratory: HCT CO., LTD.

Ambient Temperature 21.5 °C

Test Date Nov.10, 2008

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

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 71; Postprocessing SW: SEMCAD, V1.8 Build 176

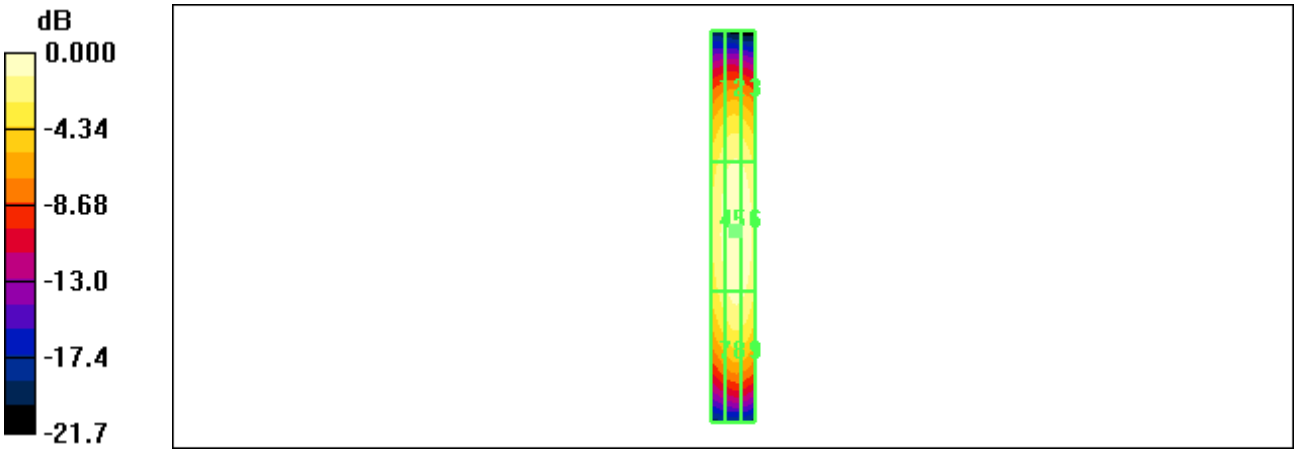
DASY4 Configuration:
- Probe: H3DV6 - SN6101; ; Calibrated: 2008-05-19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn466; Calibrated: 2008-07-17
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

H Scan 10mm above CD 835 MHz/Hearing Aid Compatibility Test (41x361x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.449 A/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 0.560 A/m; Power Drift = -0.015 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.357 M4**	Grid 2 **0.385 M4**	Grid 3 **0.378 M4**
Grid 4 **0.409 M4**	Grid 5 **0.449 M4**	Grid 6 **0.441 M4**
Grid 7 **0.365 M4**	Grid 8 **0.404 M4**	Grid 9 **0.397 M4**

Cursor:
Total = 0.449 A/m
H Category: M4
Location: -1.5, 2, 366.6 mm



0 dB = 0.449A/m

Test Laboratory: HCT CO., LTD.

Ambient Temperature 21.5 °C

Test Date Nov.10, 2008

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

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 71; Postprocessing SW: SEMCAD, V1.8 Build 176

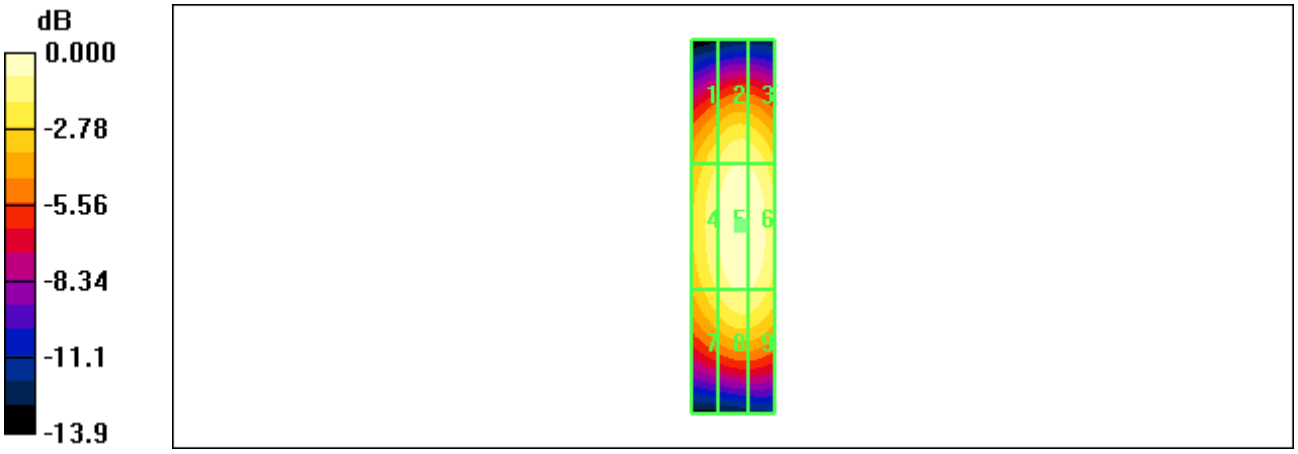
DASY4 Configuration:
- Probe: H3DV6 - SN6101; ; Calibrated: 2008-05-19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn466; Calibrated: 2008-07-17
- Phantom: HAC Test Arch; Type: SD HAC P01 BA

H Scan 10mm above CD 1880 MHz/Hearing Aid Compatibility Test (41x181x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.475 A/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 0.579 A/m; Power Drift = -0.034 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.390 M2**	Grid 2 **0.432 M2**	Grid 3 **0.428 M2**
Grid 4 **0.429 M2**	Grid 5 **0.475 M2**	Grid 6 **0.470 M2**
Grid 7 **0.391 M2**	Grid 8 **0.433 M2**	Grid 9 **0.431 M2**

Cursor:
Total = 0.475 A/m
H Category: M2
Location: -2, 0, 366.6 mm



0 dB = 0.475A/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_May08**

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:	May 19, 2008
Condition of the calibrated item	In Tolerance

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41495277	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41498087	1-Apr-08 (No. 217-00788)	Apr-09
Reference 3 dB Attenuator	SN: S5054 (3c)	8-Aug-07 (No. 217-00719)	Aug-08
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-08 (No. 217-00787)	Apr-09
Reference 30 dB Attenuator	SN: S5129 (30b)	8-Aug-07 (No. 217-00720)	Aug-08
Reference Probe ER3DV6	SN: 2328	2-Oct-07 (No. ER3-2328_Oct07)	Oct-08
DAE4	SN: 654	24-Apr-08 (No. DAE4-654_Apr08)	Apr-09

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

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

Issued: May 20, 2008

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:

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:	June 25, 2007
Recalibrated:	May 19, 2008

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ER3DV6 SN:2343 **May 19, 2008**

DASY - Parameters of Probe: ER3DV6 SN:2343

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

NormX	**1.65** ± 10.1 % (k=2)	DCP X	**95** mV
NormY	**1.59** ± 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 **68** °

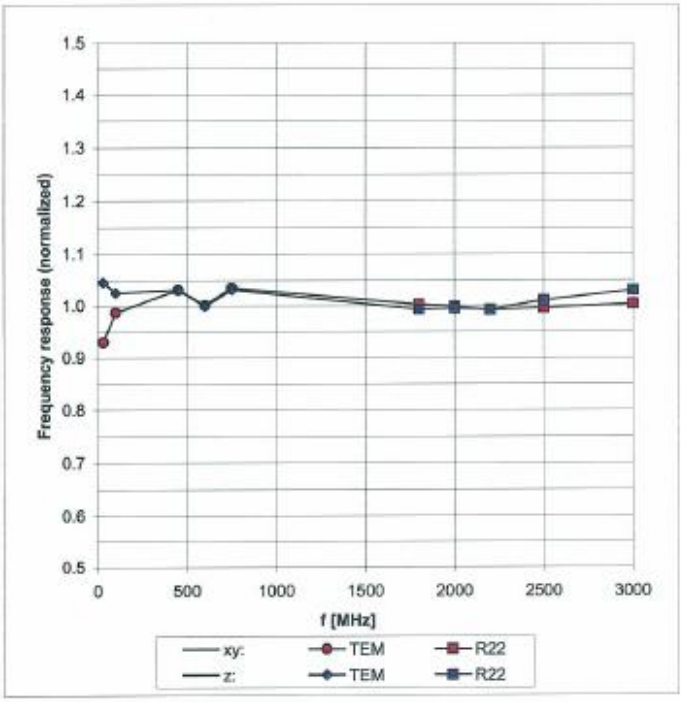
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] numerical linearization parameter: uncertainty not required

ER3DV6 SN:2343 **May 19, 2008**

Frequency Response of E-Field

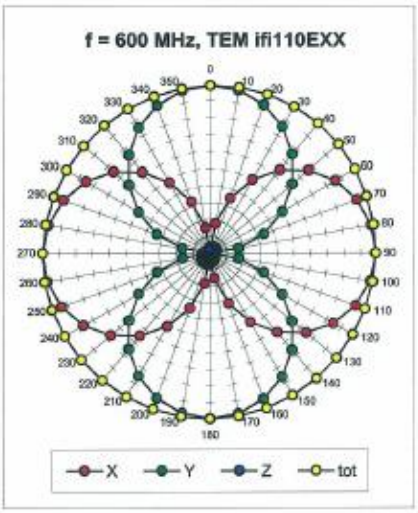
(TEM-Cell:ifi110 EXX, Waveguide R22)

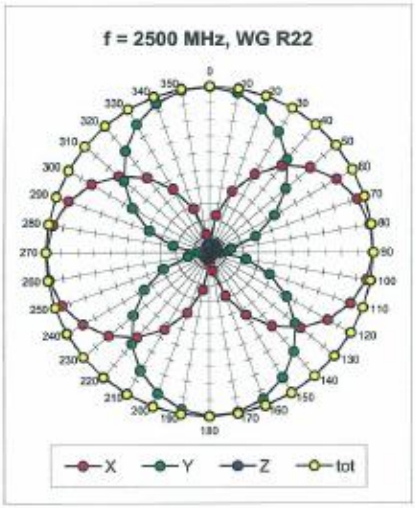


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

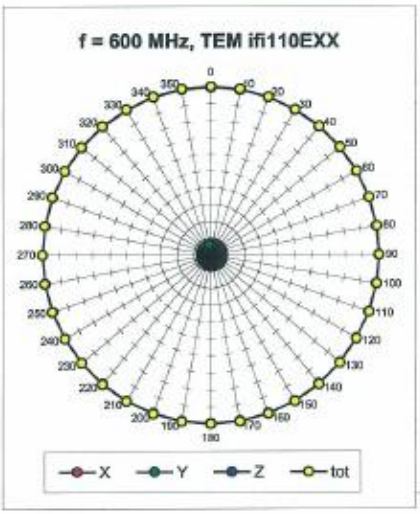
ER3DV6 SN:2343 **May 19, 2008**

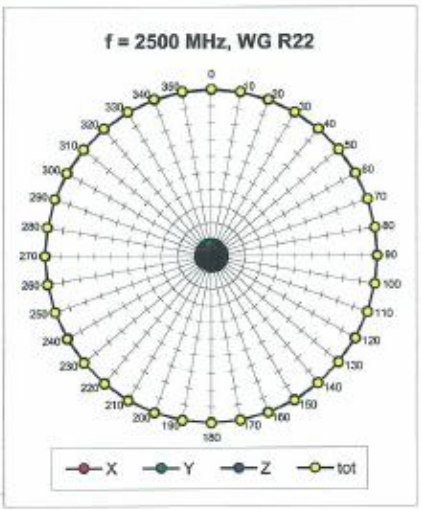
Receiving Pattern (ϕ), ϑ = 0°





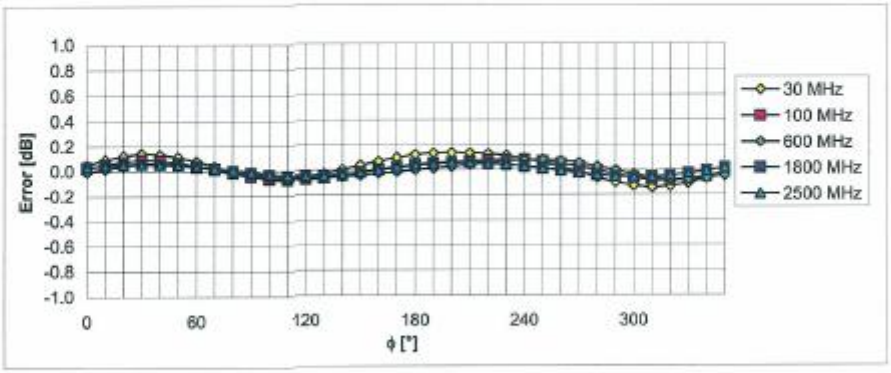
Receiving Pattern (ϕ), ϑ = 90°





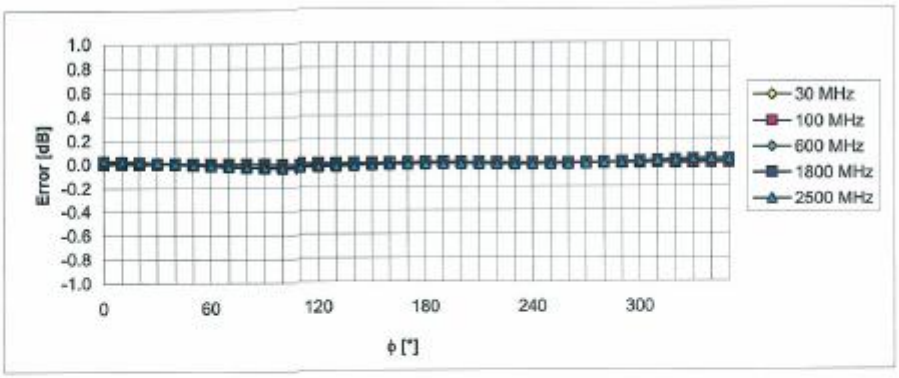
ER3DV6 SN:2343 **May 19, 2008**

Receiving Pattern (ϕ), ϑ = 0°



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

Receiving Pattern (ϕ), ϑ = 90°

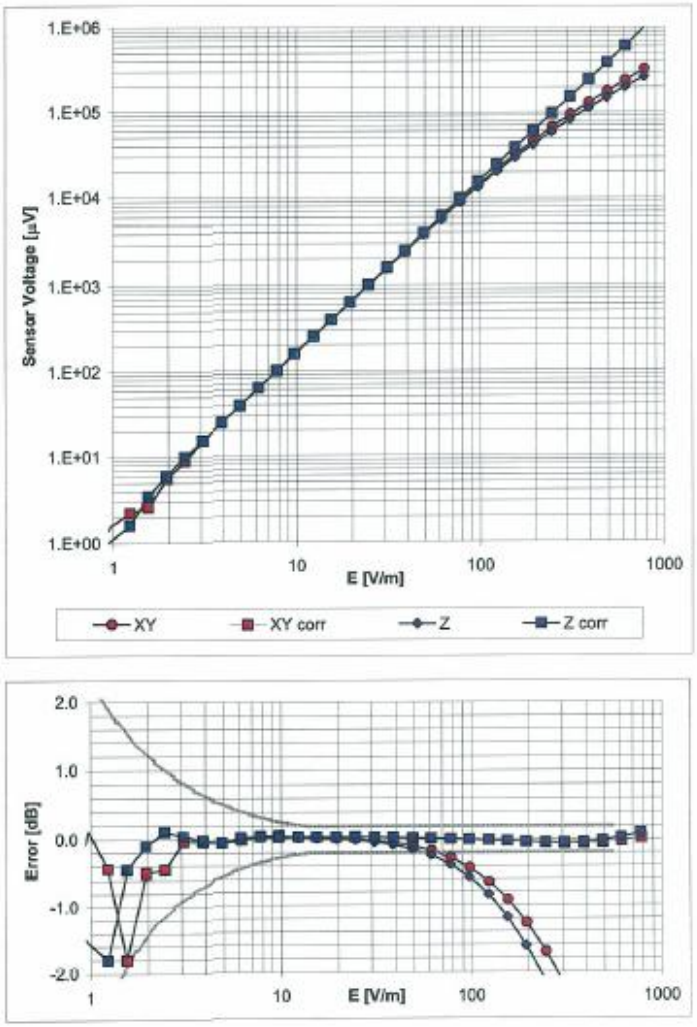


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

ER3DV6 SN:2343 **May 19, 2008**

Dynamic Range f(E-field)

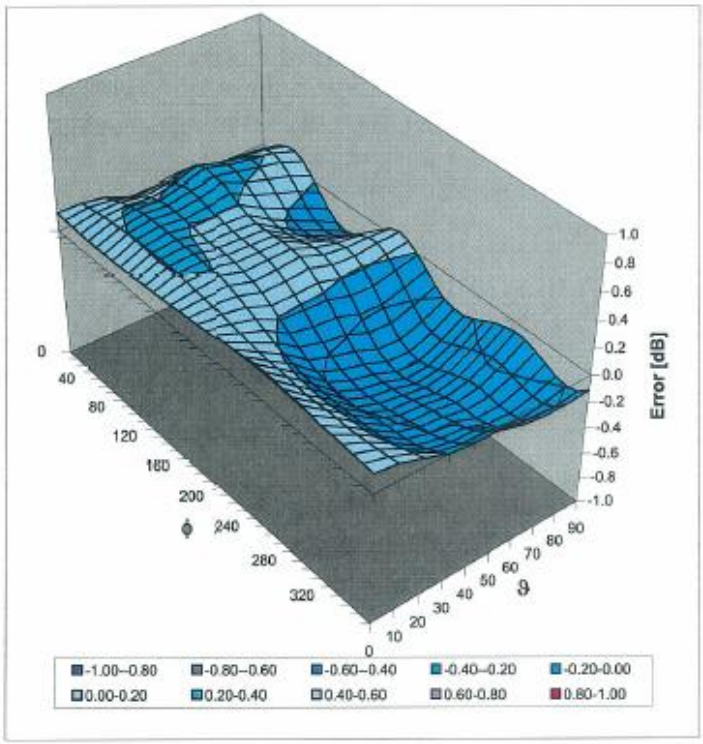
(Waveguide R22, f = 1800 MHz)



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

ER3DV6 SN:2343 **May 19, 2008**

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



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

Calibration Laboratory of
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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: **SCS 108**

Client **HCT (Dymstec)** Certificate No: **H3-6101_May08**

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:	May 19, 2008
Condition of the calibrated item	In Tolerance

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41495277	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41496087	1-Apr-08 (No. 217-00788)	Apr-09
Reference 3 dB Attenuator	SN: S5054 (3c)	8-Aug-07 (No. 217-00719)	Aug-08
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-08 (No. 217-00787)	Apr-09
Reference 30 dB Attenuator	SN: S5129 (30b)	8-Aug-07 (No. 217-00720)	Aug-08
Reference Probe H3DV6	SN: 6182	2-Oct-07 (No. H3-6182_Oct07)	Oct-08
DAE4	SN: 654	24-Apr-08 (No. DAE4-654_Apr08)	Apr-09

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

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

Issued: May 20, 2008

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:

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).

Probe H3DV6

SN:6101

Manufactured:	December 10, 2001
Last calibrated:	July 25, 2007
Recalibrated:	May 19, 2008

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

H3DV6 SN:6101 **May 19, 2008**

DASY - Parameters of Probe: H3DV6 SN:6101

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

	a0	a1	a2
X	**2.818E-3**	**2.575E-5**	**-3.338E-5** ± 5.1 % (k=2)
Y	**2.820E-3**	**-7.302E-5**	**-5.136E-5** ± 5.1 % (k=2)
Z	**2.981E-3**	**5.189E-5**	**2.858E-6** ± 5.1 % (k=2)

Diode Compression[1]

DCP X	**84** mV
DCP Y	**84** 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 **27** °

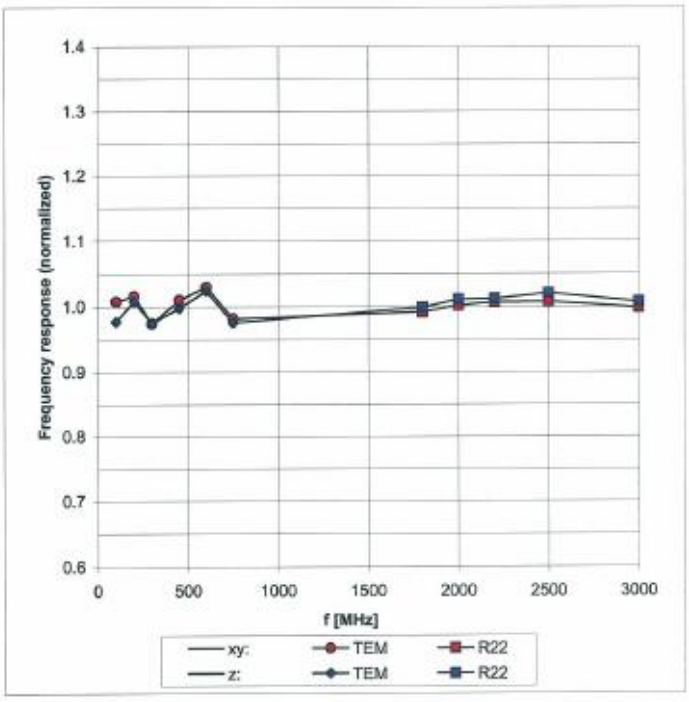
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[1] numerical linearization parameter: uncertainty not required

H3DV6 SN:6101 **May 19, 2008**

Frequency Response of H-Field

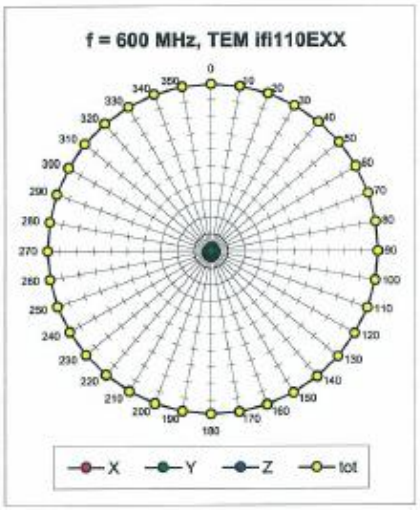
(TEM-Cell:ifi110 EXX, Waveguide R22)

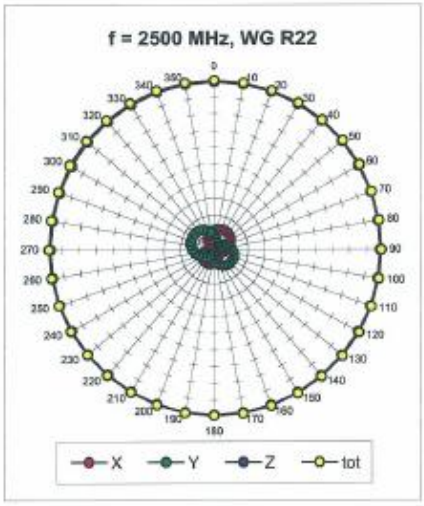


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

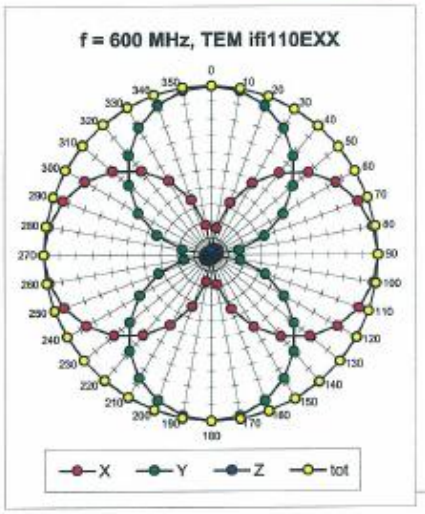
H3DV6 SN:6101 **May 19, 2008**

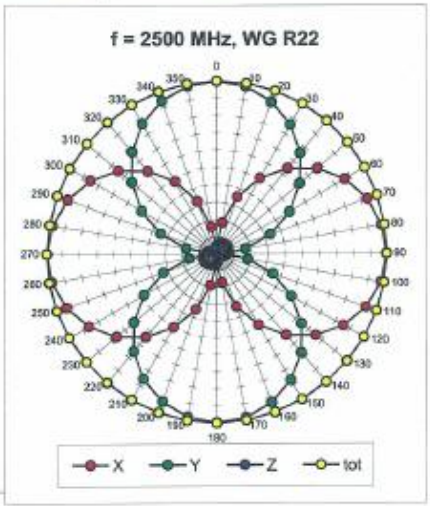
Receiving Pattern (ϕ), ϑ = 0°





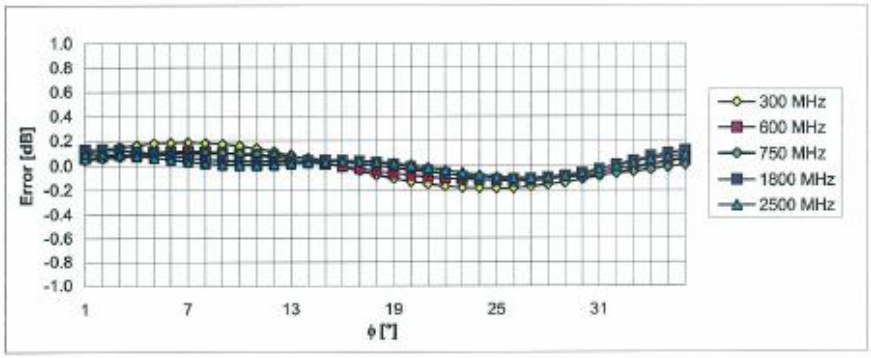
Receiving Pattern (ϕ), ϑ = 90°





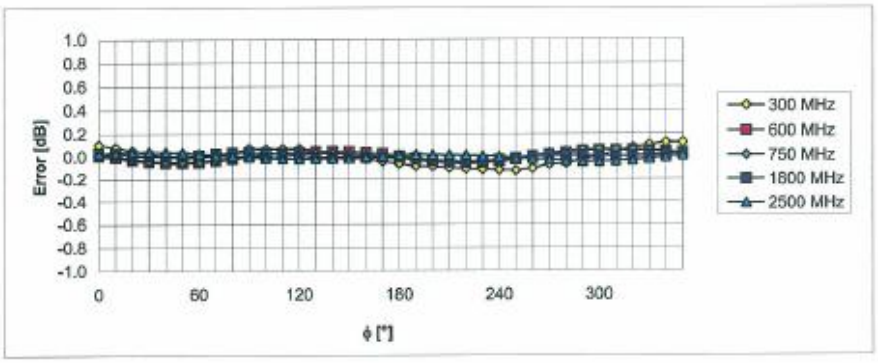
H3DV6 SN:6101 **May 19, 2008**

Receiving Pattern (ϕ), ϑ = 0°



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

Receiving Pattern (ϕ), ϑ = 90°

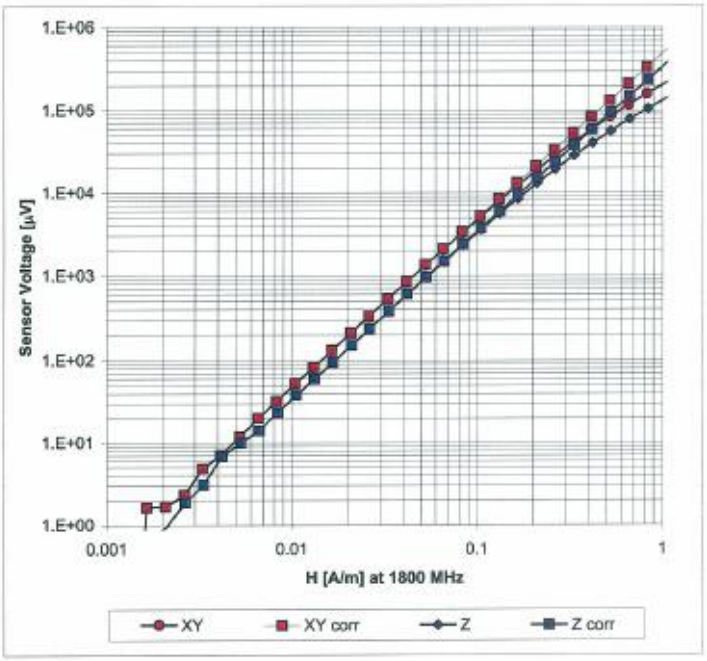


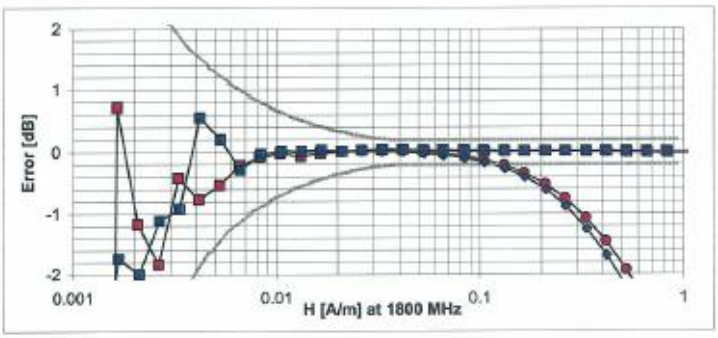
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

H3DV6 SN:6101 **May 19, 2008**

Dynamic Range f(H-field)

(Waveguide R22, f = 1800 MHz)

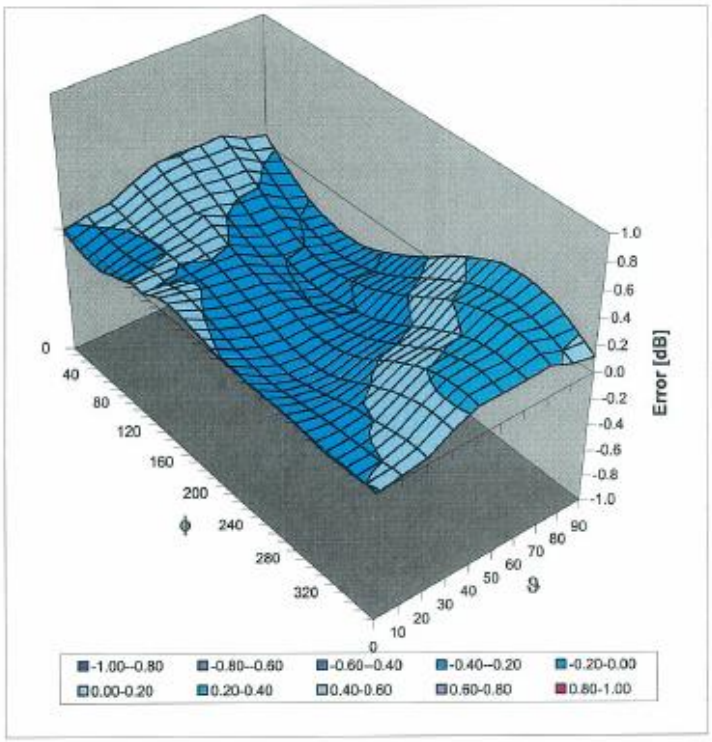




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

H3DV6 SN:6101 **May 19, 2008**

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



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

APPENDIX E (DIPOLE CALIBRATION DATA)

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Accreditation No.: SCS 108

Client H-CT (Dymstec)

Certificate No: CD835V3-1024_Mar08

CALIBRATION CERTIFICATE

Object	CD835V3 - SN: 1024
Calibration procedure(s)	QA CAL-20.v4 Calibration procedure for dipoles in air
Calibration date:	March 11, 2008
Condition of the calibrated item	In Tolerance

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	04-Oct-07 (METAS, No. 217-00736)	Oct-08
Power sensor HP 8481A	US37292783	04-Oct-07 (METAS, No. 217-00736)	Oct-08
Probe ER3DV6	SN: 2336	31-Dec-07 (SPEAG, No. ER3-2336_Dec07)	Dec-08
Probe H3DV6	SN: 6065	31-Dec-07 (SPEAG, No. H3-6065_-Dec07)	Dec-08
DAE4	SN: 781	2-Oct-07 (SPEAG, No. DAE4-781_Oct07)	Oct-08

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-4419B	GB42420191	11-May-05 (SPEAG, in house check Oct -07)	In house check: Nov-08
Power sensor HP 8482A	US37295597	11-May-05 (SPEAG, in house check Oct -07)	In house check: Nov-08
Power sensor HP 8482H	3318A09450	08-Jan-02 (SPEAG, in house check Oct -07)	In house check: Nov-08
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-07)	In house check: Nov-09
RF generator E4433B	MY 41310391	22-Nov-04 (SPEAG, in house check Oct-07)	In house check: Nov-09

	Name	Function	Signature
Calibrated by:	Mike Meili	Laboratory Technician	

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Accreditation No.: **SCS 108**

References

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

Methods Applied and Interpretation of Parameters:

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

1 Measurement Conditions

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

DASY Version	DASY4	V4.7 B61
DASY PP Version	SEMCAD	V1.8 B176
Phantom	HAC Test Arch	SD HAC P01 BA, #1070
Distance Dipole Top - Probe Center	10 mm	
Scan resolution	dx, dy = 5 mm	area = 20 x 180 mm
Frequency	**835 MHz** ± 1 MHz	
Forward power at dipole connector	20.0 dBm = 100mW	
Input power drift	< 0.05 dB	

2 Maximum Field values

H-field 10 mm above dipole surface	condition	**Interpolated maximum**
Maximum measured	100 mW forward power	**0.445 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	160.4 V/m
Maximum measured above low end	100 mW forward power	157.6 V/m
Averaged maximum above arm	100 mW forward power	**159.0 V/m**

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

3 Appendix

3.1 Antenna Parameters

Frequency	**Return Loss**	**Impedance**
800 MHz	18.0 dB	(44.2 – j10.4) Ohm
835 MHz	**24.7 dB**	**(48.7 + j5.6) Ohm**
900 MHz	17.3 dB	(59.2 – j11.8) Ohm
950 MHz	19.7 dB	(47.5 + j9.8) Ohm
960 MHz	14.3 dB	(57.2 + j19.7) Ohm

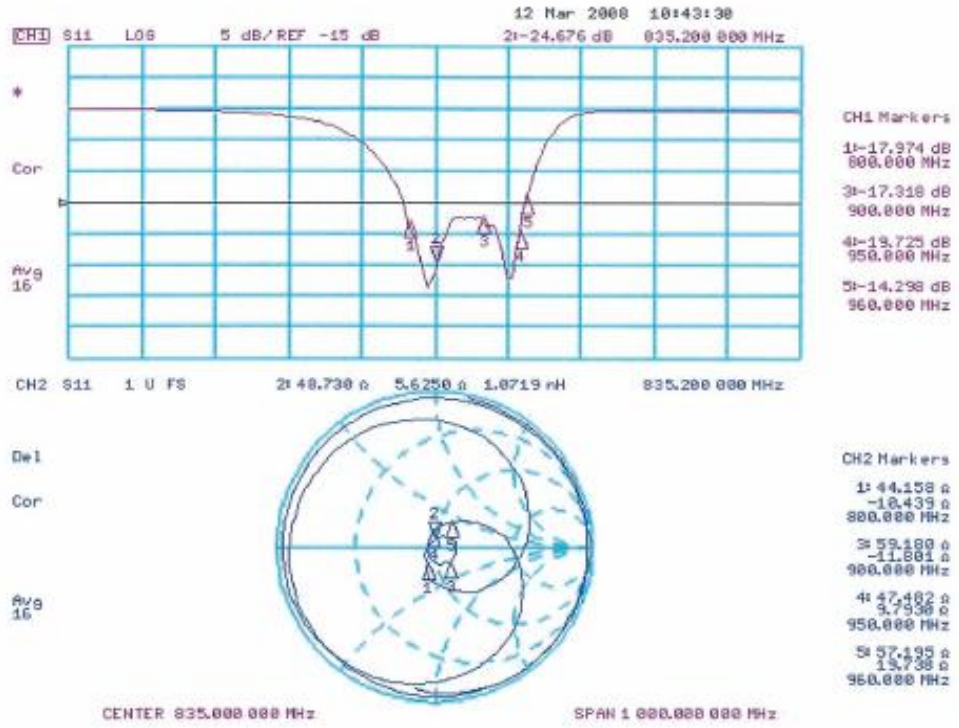
3.2 Antenna Design and Handling

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: 11.03.2008 10:51:20

Test Laboratory: SPEAG Lab 2

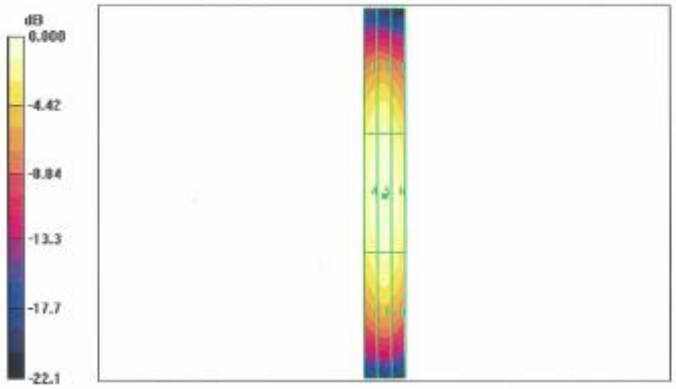
DUT: HAC-Dipole 835 MHz; Type: D835V3; Serial: 1024
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: H Dipole Section
Measurement Standard: DASY4 (High Precision Assessment)
DASY4 Configuration:

- Probe: H3DV6 - SN6065; Calibrated: 31.12.2007
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 02.10.2007
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY4, V4.7 Build 61; Postprocessing SW: SEMCAD, V1.8 Build 176

H Scan - Sensor Center 10mm above CD835 Dipole/Hearing Aid Compatibility Test (41x361x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.445 A/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 0.473 A/m; Power Drift = 0.003 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.376** **M4**	Grid 2 **0.391** **M4**	Grid 3 **0.362** **M4**
Grid 4 **0.424** **M4**	Grid 5 **0.445** **M4**	Grid 6 **0.419** **M4**
Grid 7 **0.369** **M4**	Grid 8 **0.392** **M4**	Grid 9 **0.369** **M4**



0 dB = 0.445A/m

3.3.3 DASY4 E-Field result

Date/Time: 11.03.2008 17:04:34

Test Laboratory: SPEAG Lab 2

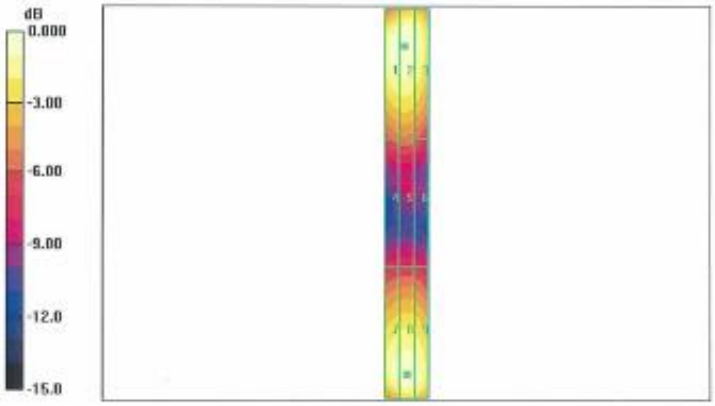
DUT: HAC-Dipole 835 MHz; Type: D835V3; Serial: 1024
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: E Dipole Section
Measurement Standard: DASY4 (High Precision Assessment)
DASY4 Configuration:

- Probe: ER3DV6 - SN2336; ConvF(1, 1, 1); Calibrated: 31.12.2007
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 02.10.2007
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY4, V4.7 Build 61; Postprocessing SW: SEMCAD, V1.8 Build 176

E Scan - Sensor Center 10mm above CD835 Dipole/Hearing Aid Compatibility Test (41x361x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 160.4 V/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 103.1 V/m; Power Drift = -0.022 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **157.7** **M4**	Grid 2 **160.4** **M4**	Grid 3 **152.7** **M4**
Grid 4 **86.2** **M4**	Grid 5 **87.6** **M4**	Grid 6 **83.7** **M4**
Grid 7 **152.1** **M4**	Grid 8 **157.6** **M4**	Grid 9 **153.7** **M4**



0 dB = 160.4 V/m

Calibration Laboratory of
Schmid & Partner
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S Schweizerischer Kalibrierdienst
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Accreditation No.: SCS 108

Client HCT

Certificate No: CD1880V3-1019_Mar08

CALIBRATION CERTIFICATE

Object	CD1880V3 - SN: 1019
Calibration procedure(s)	QA CAL-20.v4 Calibration procedure for dipoles in air
Calibration date:	March 11, 2008
Condition of the calibrated item	In Tolerance

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	04-Oct-07 (METAS, No. 217-00736)	Oct-08
Power sensor HP 8481A	US37292783	04-Oct-07 (METAS, No. 217-00736)	Oct-08
Probe ER3DV6	SN: 2336	31-Dec-07 (SPEAG, No. ER3-2336_Dec07)	Dec-08
Probe H3DV6	SN: 6065	31-Dec-07 (SPEAG, No. H3-6065_-Dec07)	Dec-08
DAE4	SN: 781	2-Oct-07 (SPEAG, No. DAE4-781_Oct07)	Oct-08
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Power meter EPM-4419B	GB42420191	11-May-05 (SPEAG, in house check Oct-07)	In house check: Nov-08
Power sensor HP 8482A	US37295597	11-May-05 (SPEAG, in house check Oct-07)	In house check: Nov-08
Power sensor HP 8482H	3318A09450	08-Jan-02 (SPEAG, in house check Oct-07)	In house check: Nov-08
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-07)	In house check: Nov-09
RF generator E4433B	MY 41310391	22-Nov-04 (SPEAG, in house check Oct-07)	In house check: Nov-09

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

Issued: March 12, 2008

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Accreditation No.: **SCS 108**

References

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

Methods Applied and Interpretation of Parameters:

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

1. Measurement Conditions

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

DASY Version	DASY4	V4.7 B61
DASY PP Version	SEMCAD	V1.8 B176
Phantom	HAC Test Arch	SD HAC P01 BA, #1070
Distance Dipole Top - Probe Center	10 mm	
Scan resolution	dx, dy = 5 mm	area = 20 x 90 mm
Frequency	**1880 MHz** ± 1 MHz	
Forward power at dipole connector	20.0 dBm = 100mW	
Input power drift	< 0.05 dB	

2. Maximum Field values

H-field 10 mm above dipole surface	condition	**Interpolated maximum**
Maximum measured	100 mW forward power	**0.469 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	141.5 V/m
Maximum measured above low end	100 mW forward power	139.0 V/m
Averaged maximum above arm	100 mW forward power	**140.3 V/m**

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

3. Appendix

3.1 Antenna Parameters

Frequency	**Return Loss**	**Impedance**
1710 MHz	22.7 dB	(50.7 + j7.4) Ohm
1880 MHz	**20.9 dB**	**(48.4 + j8.7) Ohm**
1900 MHz	21.0 dB	(50.7 + j9.0) Ohm
1950 MHz	25.8 dB	(53.7 + j3.8) Ohm
2000 MHz	25.6 dB	(46.3 + j3.4) Ohm

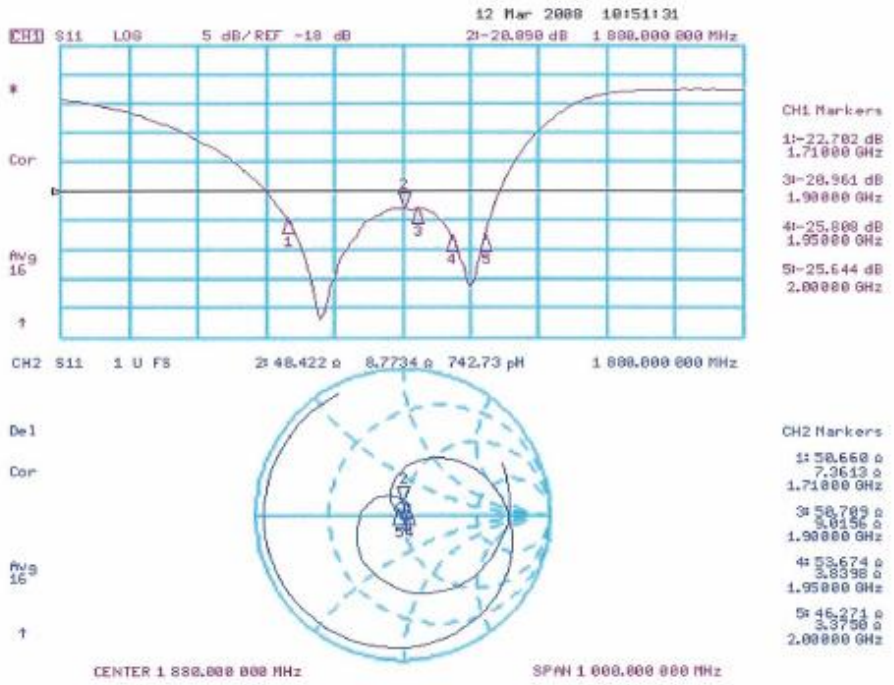
3.2 Antenna Design and Handling

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

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

3.3 Measurement Sheets

3.3.1 Return Loss and Smith Chart



3.3.2 DASY4 H-Field Result

Date/Time: 11.03.2008 14:25:06

Test Laboratory: SPEAG Lab 2

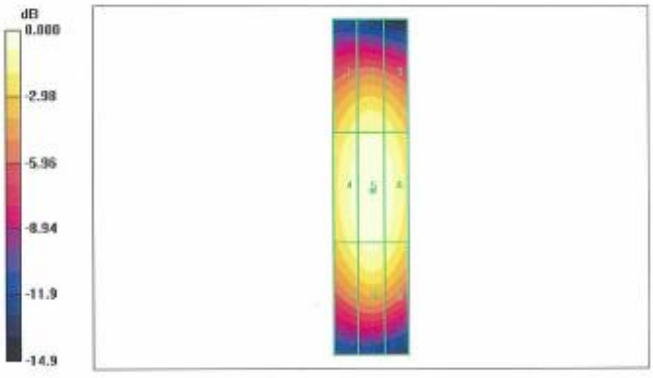
DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1019
Communication System: CW; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: H Dipole Section
Measurement Standard: DASY4 (High Precision Assessment)
DASY4 Configuration:

- Probe: H3DV6 - SN6065; Calibrated: 31.12.2007
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 02.10.2007
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY4, V4.7 Build 61; Postprocessing SW: SEMCAD, V1.8 Build 176

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 = 0.469 A/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 0.496 A/m; Power Drift = 0.010 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.400 M2**	Grid 2 **0.423 M2**	Grid 3 **0.406 M2**
Grid 4 **0.443 M2**	Grid 5 **0.469 M2**	Grid 6 **0.450 M2**
Grid 7 **0.407 M2**	Grid 8 **0.435 M2**	Grid 9 **0.417 M2**



0 dB = 0.469A/m

3.3.2 DASY4 E-Field Result

Date/Time: 11.03.2008 17:37:34

Test Laboratory: SPEAG Lab 2

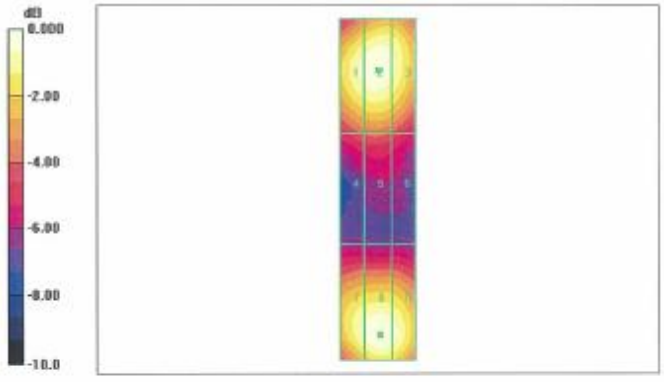
DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1019
Communication System: CW; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: E Dipole Section
Measurement Standard: DASY4 (High Precision Assessment)
DASY4 Configuration:

- Probe: ER3DV6 - SN2336; ConvF(1, 1, 1); Calibrated: 31.12.2007
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 02.10.2007
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY4, V4.7 Build 61; Postprocessing SW: SEMCAD, V1.8 Build 176

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 = 141.5 V/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 159.4 V/m; Power Drift = 0.007 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **134.8** **M2**	Grid 2 **139.0** **M2**	Grid 3 **134.2** **M2**
Grid 4 **91.0** **M3**	Grid 5 **93.3** **M3**	Grid 6 **89.0** **M3**
Grid 7 **133.4** **M2**	Grid 8 **141.5** **M2**	Grid 9 **137.7** **M2**



0 dB = 141.5V/m