HEARING AID COMPATIBILITY

RF EMISSION TEST REPORT

Model No.	:	RM-375
Applicant	:	Nokia Inc.
Address of Applicant	:	12278 Scripps Summit Dr. San Diego CA92131 USA
FCC ID		QMNRM-375
Date of Receipt	:	2009-01-06
Date of Test(s)	:	2009-01-14 ~ 2009-01-15
Date of Issue	:	2009-01-16

EUT Type	CDMA 2000 1xRTT Mobile Phone
Tx Frequency	CDMA Cellular (824.70 MHz ~ 848.31 MHz) CDMA AWS (1711.25 MHz ~ 1753.75 MHz) CDMA PCS (1851.25 MHz ~ 1908.75 MHz)
FCC Classification	Licensed Transmitter Held to Ear (PCE)
FCC Rule Part(s)	§ 20.19(b), §6.3(v), §7.3(v)
HAC Standard	ANSI PC63.19 – 2007

C63.19-2007 HAC Category : M4 (RF EMISSIONS CATEGORY)

Tested by	**:**	**Leo Kim**	**2009-01-16**
Approved by	**:**	**Charles Kim**	**2009-01-16**

Contents

1. General Information

1.1 Testing Laboratory

SGS Testing Korea Co., Ltd.

Wireless Div. 2FL, 18-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea 435-040

Telephone : +82 +31 428 5700

FAX : +82 +31 427 2371

Homepage : www.electrolab.kr.sgs.com

1.2 Details of Applicant

Applicant : Nokia Inc.

Address : 12278 Scripps Summit Dr. San Diego CA92131 USA

Contact Person : Stephen Walmsley

Phone No. : +1 604 456 5544

Fax No. : -

1.3 Version of Report

Version Number	Date	Revision
00	2009-01-16	Initial issue

1.4 Description of EUT(s)

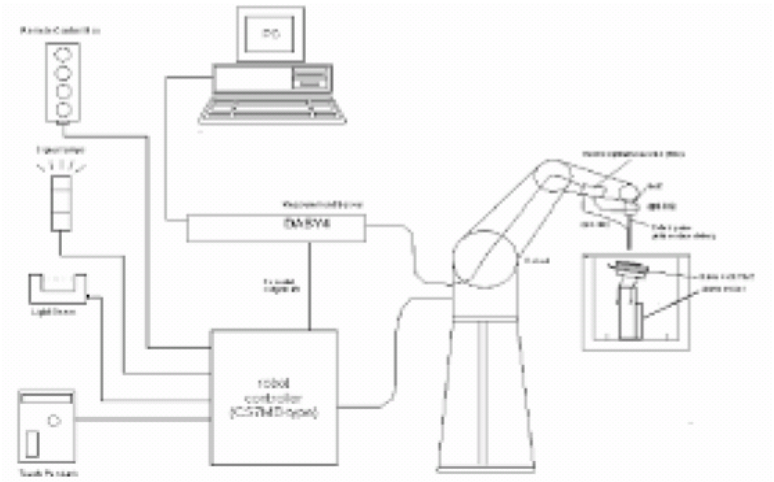
EUT Type	: CDMA 2000 1xRTT Mobile Phone
Model	: RM-375
FCC ID	: QMNRM-375
Hardware Version	: 6001
Software Version	: DS_4453B_GEN
Mode of Operation	: CDMA (Cellular, AWS, PCS)
Serial Number (MEID)	: A000000126A3C5
Max Conducted Power	: CDMA Cellular (24.35 dBm) , CDMA AWS (23.69 dBm) CDMA PCS (23.75 dBm)
Duty Cycle	: 100%
Tx Frequency Range	: CDMA Cellular (824.70 MHz ~ 848.31 MHz) CDMA AWS (1711.25 MHz ~ 1753.75 MHz) CDMA PCS (1851.25 MHz ~ 1908.75 MHz)
Antenna	: Fixed Internal

1.5 Test Environment

Ambient temperature	: 22.2 ° C ± 2
Tissue Simulating Liquid	: 22.2 ° C ± 2
Relative Humidity	: < 60 %

1.6 HAC Measurement System

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 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

1.7 System Components

E-Field Probe

Construction	One dipole parallel, two dipoles normal to probe axis built-in shielding against static charges PEEK enclosure material	
Calibration	In air from 100 MHz to 3.0 GHz (absolute accuracy ±6.0%, k=2)	
Frequency	40 MHz to > 6 GHz (can be extended to < 20MHz) 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 ; 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	
Application	General near-field measurements up to 6 GHz Field component measurements Fast automatic scanning in phantoms	

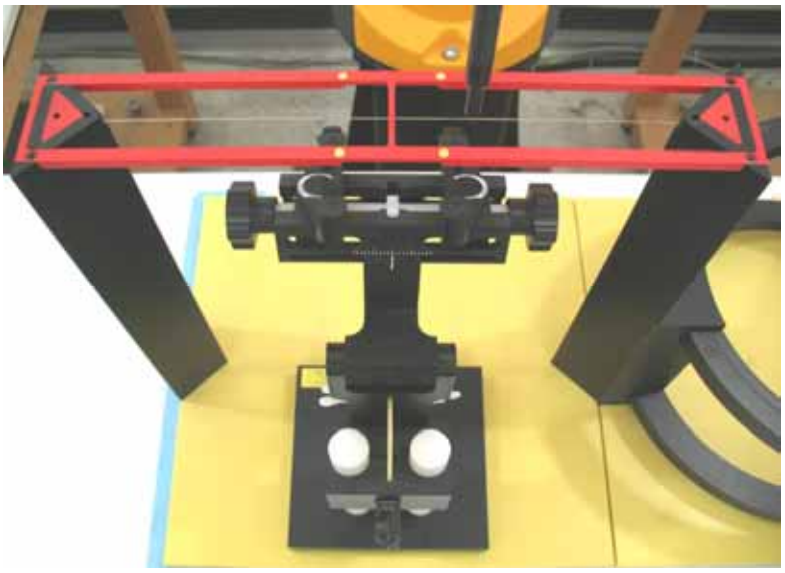
H-Field Probe

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)	
Frequency	200 MHz to > 3 GHz (absolute accuracy ±6.0 %, k=2); Output linearized	
Directivity	±0.2 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	
Application	General magnetic near-field measurements up to 3 GHz (in air or liquids) Field component measurements Surface current measurements Low interaction with measured field	

Phantom & Phone positioner

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.

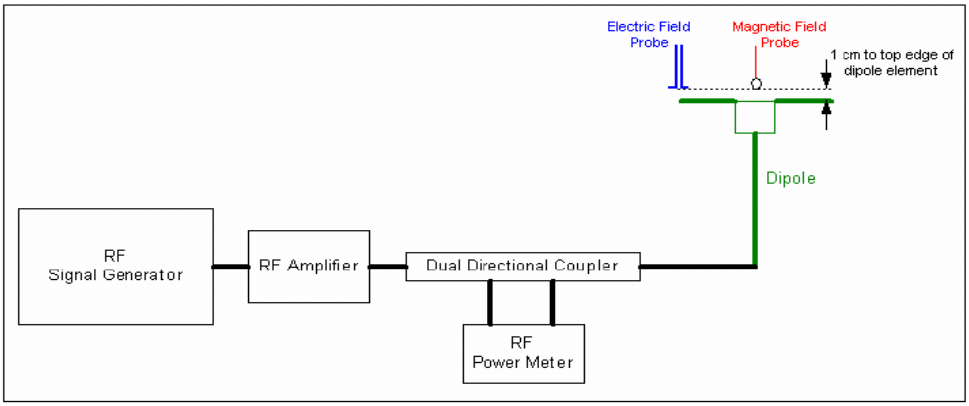
The devices can be easily, accurately, and repeatable positioned according to the FCC specifications.



<Figure-2> HAC Phantom & Phone positioner

1.8 HAC System Verification

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



<Figure-3> Calibration Procedure

Place a dipole antenna meeting the requirements given in ANSI-PC63.19 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.

Validation Results

E-Field

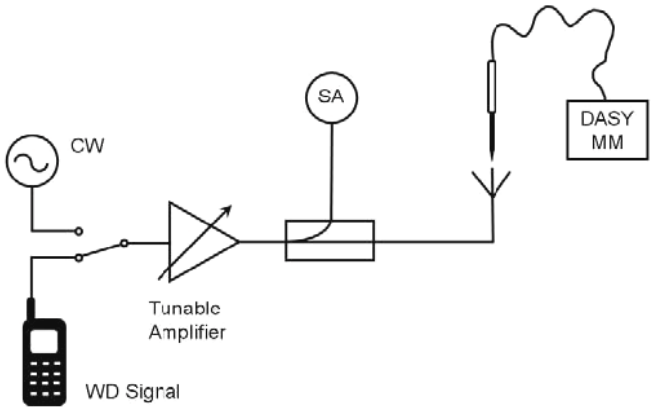
Frequency (MHz)	Input Power (dBm)	Measured Value (V/m)	Target Value (V/m)	Deviation (%)
835	20	160.1	156.3	2.43
1880	20	128.7	133	-3.23

H-Field

Frequency (MHz)	Input Power (dBm)	Measured Value (A/m)	Target Value (A/m)	Deviation (%)
835	20	0.449	0.447	0.45
1880	20	0.422	0.453	-6.84

1.9 RF Field 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.



<Fig- 4 > PMF

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.

Modulation Factor

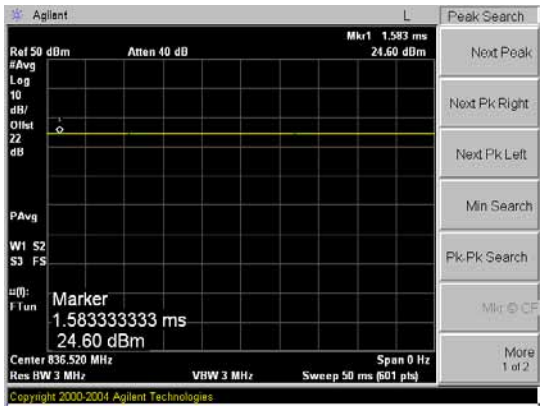
E-Field

Frequency (MHz)	Mode	Measured Value (V/m)	Probe Modulation Factor
836.52	CW	155.2	-
	AM	96.94	1.601
	CDMA (Full Rate)	157.1	0.988
	CDMA (1/8 Rate)	56.23	2.76
1731.25	CW	156.9	-
	AM	98.62	1.591
	CDMA (Full Rate)	157.8	0.994
	CDMA (1/8 Rate)	55.64	2.82
1880	CW	156.3	-
	AM	99.05	1.578
	CDMA (Full Rate)	157.7	0.991
	CDMA (1/8 Rate)	55.04	2.84

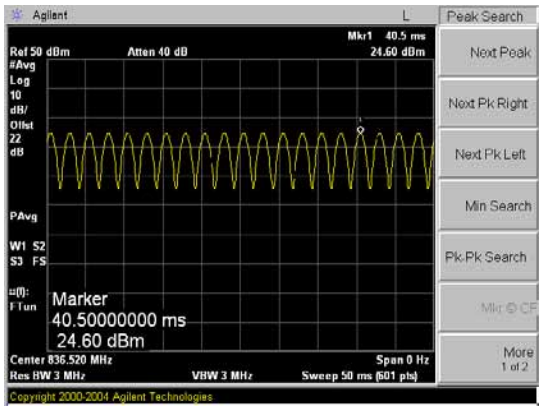
H-Filed

Frequency (MHz)	Mode	Measured Value (V/m)	Probe Modulation Factor
836.52	CW	0.544	-
	AM	0.338	1.608
	CDMA (Full Rate)	0.550	0.989
	CDMA (1/8 Rate)	0.201	2.70
1731.25	CW	0.502	-
	AM	0.313	1.604
	CDMA (Full Rate)	0.530	0.947
	CDMA (1/8 Rate)	0.183	2.74
1880	CW	0.498	-
	AM	0.309	1.610
	CDMA (Full Rate)	0.533	0.935
	CDMA (1/8 Rate)	0.181	2.75

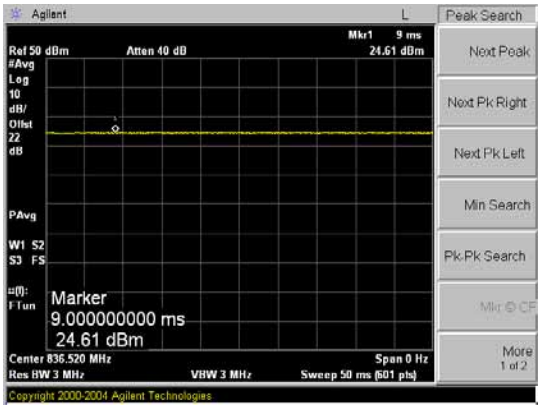
Spectrum Plots for RF Field Probe Modulation Factor



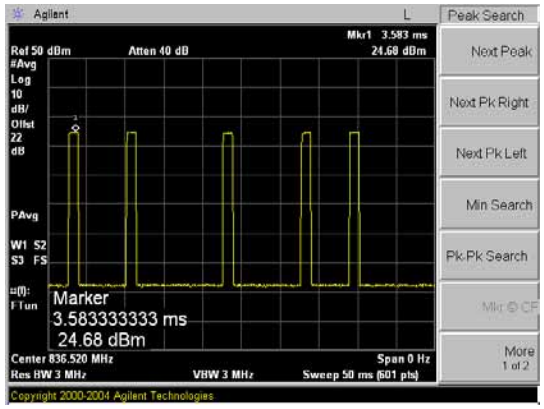
Cellular – SG_CW



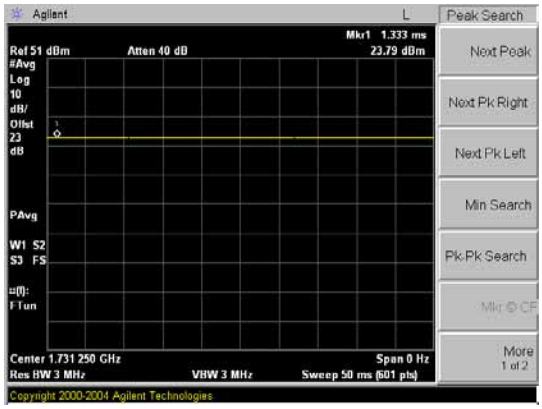
Cellular – SG_AM 80%



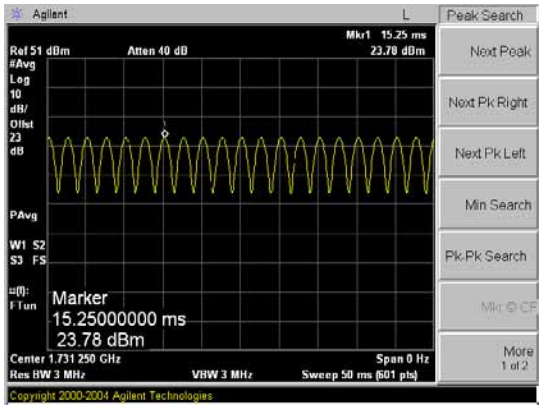
Cellular – WD



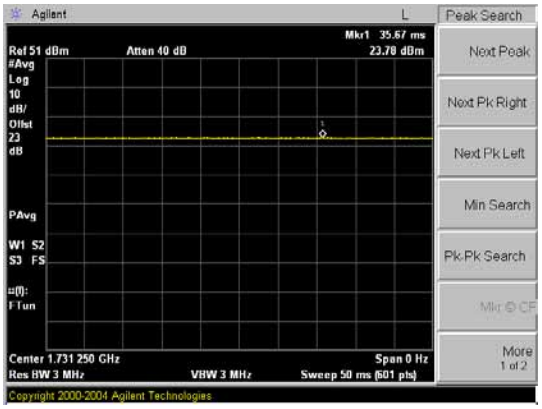
Cellular – WD_1/8



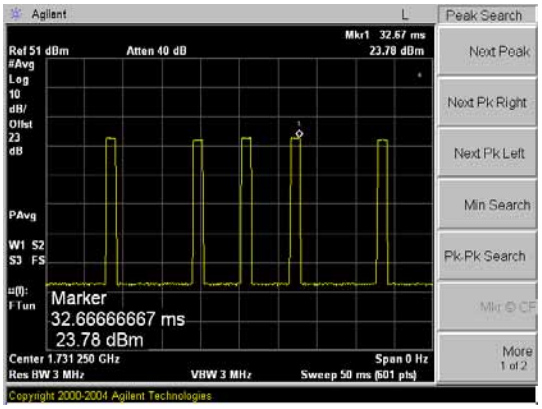
AWS – SG_CW



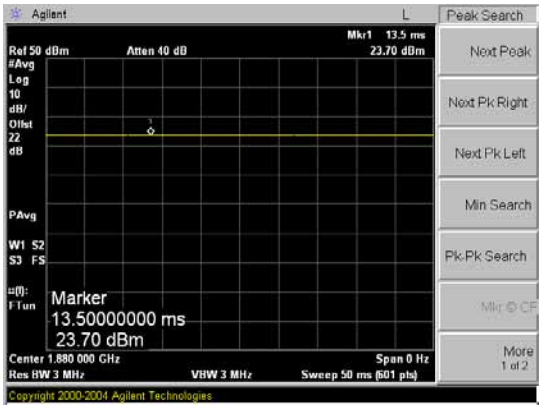
AWS – SG_AM 80%



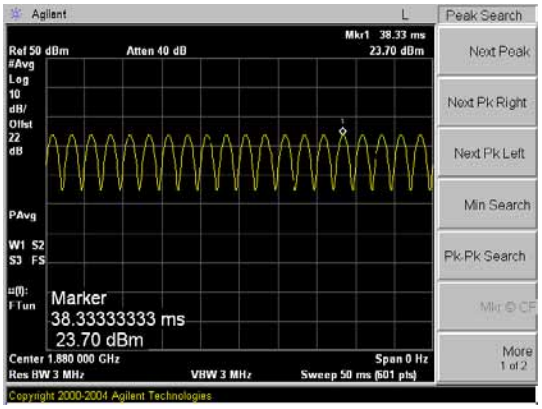
AWS – WD



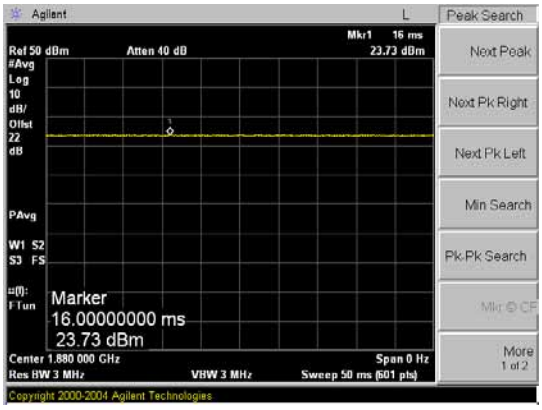
AWS – WD_1/8



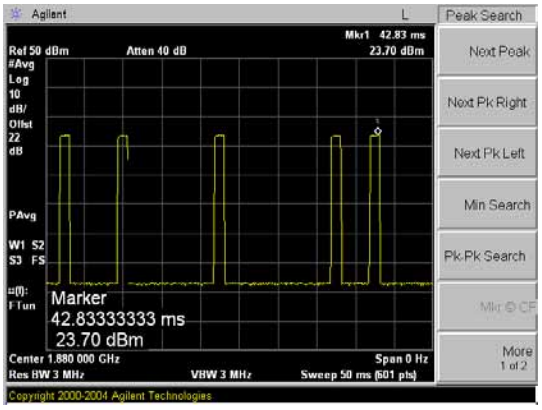
PCS – SG_CW



PCS – SG_AM80%



PCS – WD



PCS – WD_1/8

1.10 DUT Positioning

<Figure-5> illustrate the references and reference plane that shall be used in the WD emissions measurement.

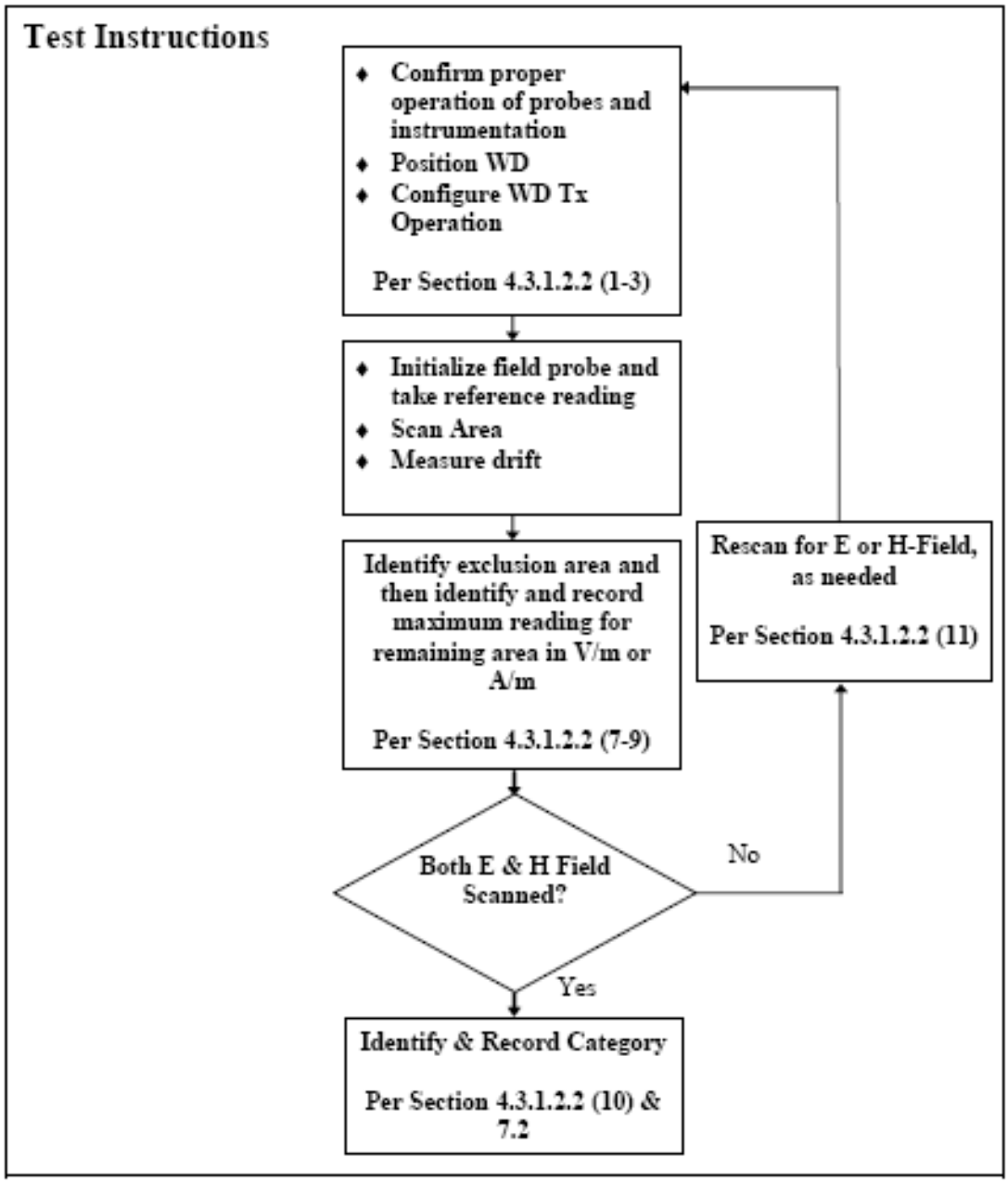
1. The grid is 5 cm by 5 cm area that is divided into 9 evenly sized blocks or sub-grids.
2. The grid is centered on the audio frequency output transducer of the WD (speaker or T-coil).
3. The grid is in a reference plane, which is defined as the planar area that contains the highest point in the area 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.
4. The measurement plane is parallel to, and 1.0 cm in front of, the reference plane.

<Figure-5> WD reference and plane for RF emission measurements

1.11 Test Procedure

The following illustrate a typical RF emission test scan over a wireless communication device :

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



< Figure- 6> Test Instructions

1.12 Standard & Limit

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

Standard	Technology	AWF (dB)
TIA/EIA/IS-2000	CDMA	0
J-STD-007	GSM (217)	-5
TI/TIP1/3GPP	UMTS (WCDMA)	0
iDEN™	TDMA (22 and 11 Hz)	0

<Table-1> Articulation Weighting Factor (AWF)

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

<Table- 2 > Telephone near-field categories in linear units

2. Measurement Equipment

Maunfacturer	Device	Type	Serial Number	Due date of Calibration
Stäubli	Robot	RX90BL	F03/5W05A1/A/01	N/A
SPEAG	Probe	H3DV6	6206	September 22, 2009
SPEAG	Probe	ER3DV6	2375	July 21, 2009
SPEAG	Dipole Validation Kits	CD835V3	1081	July 12, 2009
SPEAG	Dipole Validation Kits	CD1880V3	1063	July 12, 2009
Agilent	Dual Directional Coupler	778D	50454	October 1, 2009
SPEAG	Data acquisition Electronics	DAE3	567	September 24, 2009
SPEAG	Software	DASY 4 V4.7	-	N/A
SPEAG	Test Arch	SD HAC P01 BB	1065	N/A
R & S	Universal Radio Communication Tester	CMU 200	109495	October 2, 2009
Empower RF Systems, Inc.	Power Amplifier	2001-BBS3Q7ECK	1032 D/C 0336	May 9, 2009
Agilent	Power Meter	E4419B	GB43311126	October 1, 2009
Agilent	Power Sensor	E9300H	MY41495308	October 14, 2009
Agilent	Power Sensor	E9300H	MY41495314	October 6, 2009
Agilent	Signal Generator	E4421B	MY43350132	October 1, 2009

3.Summary of Results

3.1 3G Measurement Conditions – 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.

Conducted Power Table

Band	Channel	CDMA2000 RC	S02 (dBm)	S09 (dBm)	S032(+SCH) (dBm)	S032(+F-SCH) (dBm)	S055 (dBm)
CDMA Cellular	384	(Fwd1,Rvs1)	23.95				24.39
		(Fwd2,Rvs2)		24.13			24.40
		(Fwd3,Rvs3)	**24.49**		24.09	24.00	24.24
		(Fwd4,Rvs3)	24.39		24.44	24.17	24.20
		(Fwd5,Rvs4)		24.07			24.08

Band	Channel	CDMA2000 RC	S02 (dBm)	S09 (dBm)	S032(+SCH) (dBm)	S032(+F-SCH) (dBm)	S055 (dBm)
CDMA AWS	425	(Fwd1,Rvs1)	23.79				23.73
		(Fwd2,Rvs2)		23.72			**23.90**
		(Fwd3,Rvs3)	23.72		23.46	23.53	23.30
		(Fwd4,Rvs3)	23.37		23.70	23.51	23.61
		(Fwd5,Rvs4)		23.64			23.44

Band	Channel	CDMA2000 RC	S02 (dBm)	S09 (dBm)	S032(+SCH) (dBm)	S032(+F-SCH) (dBm)	S055 (dBm)
CDMA PCS	600	(Fwd1,Rvs1)	23.50				23.53
		(Fwd2,Rvs2)		23.52			23.58
		(Fwd3,Rvs3)	23.46		23.60	23.47	23.52
		(Fwd4,Rvs3)	23.48		23.57	23.61	**23.79**
		(Fwd5,Rvs4)		23.47			23.74

3.2 Test Data

Results of E-Field Emission

CDMA Mode	Channel	Frequency (MHz)	Conducted Power(dBm)	PMF	Power Drift (dB)	Peak Field (V/m)	Result (M-Rating)
Cellular	1013	824.70	24.48	0.988	-0.141	55.9	M4
Cellular	384	836.52	24.49	0.988	0.089	59.2	M4
Cellular	777	848.31	24.16	0.988	-0.008	64.8	M4
AWS	25	1711.25	23.74	0.994	-0.072	45.5	M4
AWS	425	1731.25	23.90	0.994	-0.063	42.9	M4
AWS	875	1753.75	23.84	0.994	-0.089	39.3	M4
PCS	25	1851.25	23.98	0.991	0.014	46.5	M4
PCS	600	1880.00	23.79	0.991	-0.044	43.1	M4
PCS	1175	1908.75	23.82	0.991	-0.046	48.6	M4

Result of H-Field Emission

CDMA Mode	Channel	Frequency (MHz)	Conducted Power(dBm)	PMF	Power Drift (dB)	Peak Field (V/m)	Result (M-Rating)
Cellular	1013	824.70	24.48	0.989	0.027	0.081	M4
Cellular	384	836.52	24.49	0.989	0.173	0.086	M4
Cellular	777	848.31	24.16	0.989	-0.035	0.093	M4
AWS	25	1711.25	23.74	0.947	-0.097	0.123	M4
AWS	425	1731.25	23.90	0.947	-0.051	0.116	M4
AWS	875	1753.75	23.84	0.947	0.036	0.114	M4
PCS	25	1851.25	23.98	0.935	-0.098	0.124	M4
PCS	600	1880.00	23.79	0.935	0.049	0.114	M4
PCS	1175	1908.75	23.82	0.935	-0.126	0.113	M4

Appendix

List

Appendix A	Photographs	- Test Setup
Appendix B	DASY4 Report (Plots of the HAC Measurements)	- 835 MHz Validation Test
		- 1880 MHz Validation Test
		- CDMA Cellular Test
		- CDMA AWS Test
		- CDMA PCS Test
Appendix C	Uncertainty Analysis	
Appendix D	Calibration Certificate	- E-Field PROBE
		- H-Field PROBE
		- DIPOLE
		- DAE

Appendix A

Test Setup Photographs

- Please see the attachment

Appendix B

Test Plot – DASY4 Report

835 MHz Validation Test – (E-Field)

Date/Time: 2009-01-14 2:30:16

Test Laboratory: SGS Testing Korea
File Name: HAC_E_835_Validation.da4

DUT: HAC-Dipole 835 MHz; Type: D835V3; Serial: 1081
Program Name: HAC RF E Dipole

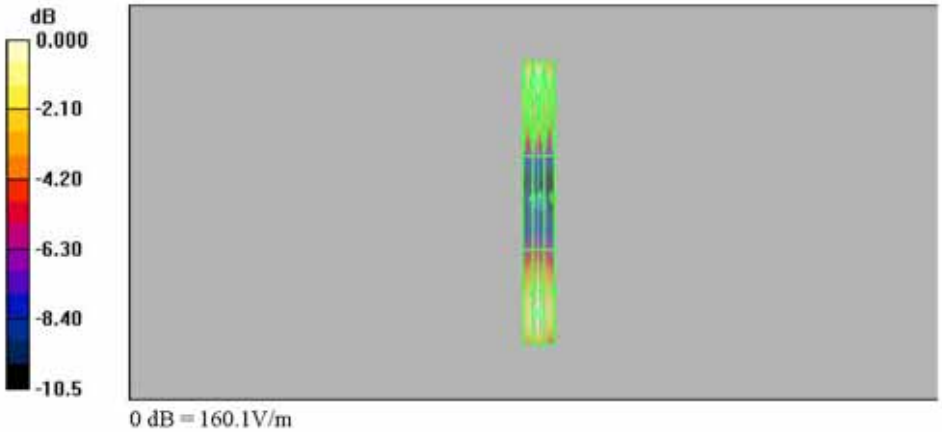
Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: s = 0 mho/m, e_r = 1; ? = 1000 kg/m^3
Phantom section: E Dipole Section

DASY4 Configuration:
- Probe: ER3DV6 - SN2375; ConvF(1, 1, 1); Calibrated: 2008-07-21
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn567; Calibrated: 2008-09-24
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

E Scan - measurement distance from the probe sensor center to CD835 Dipole = 10mm/Hearing Aid Compatibility Test (41x361x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 151.8 V/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 115.6 V/m; Power Drift = -0.040 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **157.4 M4**	Grid 2 **160.1 M4**	Grid 3 **151.3 M4**
Grid 4 **85.0 M4**	Grid 5 **85.7 M4**	Grid 6 **83.3 M4**
Grid 7 **150.4 M4**	Grid 8 **151.8 M4**	Grid 9 **145.3 M4**



0 dB = 160.1V/m

1880 MHz Validation Test – (E-Field)

Date/Time: 2009-01-14 6:40:19

Test Laboratory: SGS Testing Korea
File Name: HAC_E_1880_Validation.da4

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1063
Program Name: HAC RF E Dipole

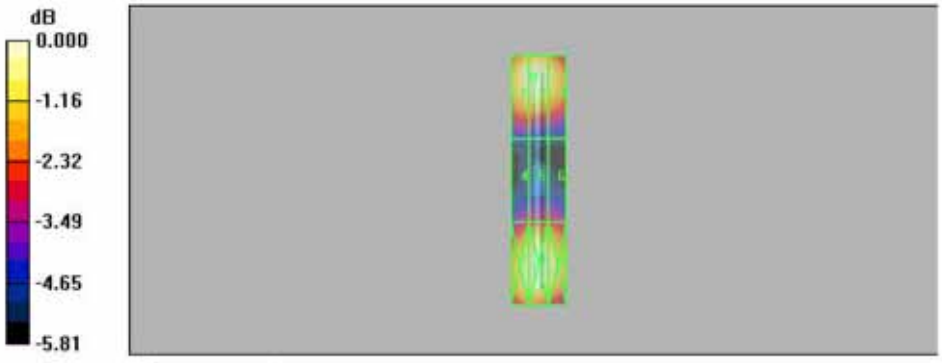
Communication System: CW; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: s = 0 mho/m, e_r = 1; ? = 1000 kg/m^3
Phantom section: E Dipole Section

DASY4 Configuration:
- Probe: ER3DV6 - SN2375; ConvF(1, 1, 1); Calibrated: 2008-07-21
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn567; Calibrated: 2008-09-24
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

HAC_E_1880_Validation/Hearing Aid Compatibility Test (41x181x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 128.6 V/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 128.2 V/m; Power Drift = 0.008 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **127.6 M2**	Grid 2 **128.6 M2**	Grid 3 **121.4 M2**
Grid 4 **92.6 M3**	Grid 5 **95.3 M3**	Grid 6 **94.1 M3**
Grid 7 **126.4 M2**	Grid 8 **128.7 M2**	Grid 9 **124.6 M2**



0 dB = 128.7V/m

835 MHz Validation Test – (H-Field)

Date/Time: 2009-01-14 3:47:06

Test Laboratory: SGS Testing Korea
File Name: HAC_H_835_Validation.da4

DUT: HAC-Dipole 835 MHz; Type: D835V3; Serial: 1081
Program Name: HAC RF H3DV6 Dipole

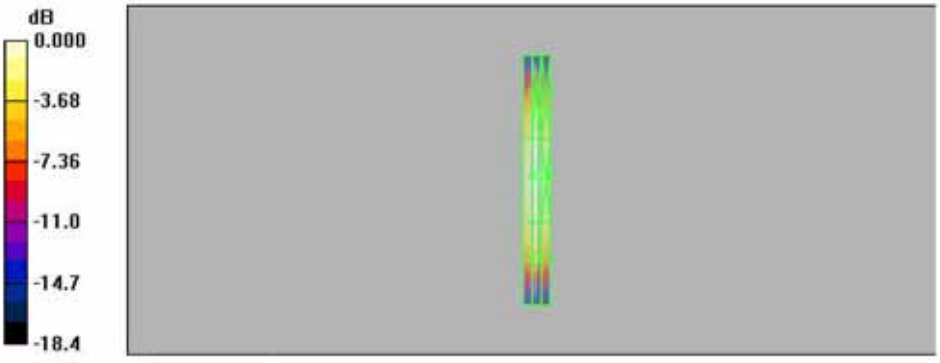
Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: s = 0 mho/m, e_r = 1; ? = 1 kg/m^3
Phantom section: H Dipole Section

DASY4 Configuration:
- Probe: H3DV6 - SN6206; ; Calibrated: 2008-09-22
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn567; Calibrated: 2008-09-24
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

HAC_H_835_Validation/Hearing Aid Compatibility Test (41x361x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.448 A/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 0.469 A/m; Power Drift = 0.041 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.386 M4**	Grid 2 **0.402 M4**	Grid 3 **0.390 M4**
Grid 4 **0.434 M4**	Grid 5 **0.448 M4**	Grid 6 **0.436 M4**
Grid 7 **0.383 M4**	Grid 8 **0.394 M4**	Grid 9 **0.382 M4**



0 dB = 0.448A/m

1880 MHz Validation Test – (H-Field)

Date/Time: 2009-01-14 5:03:33

Test Laboratory: SGS Testing Korea
File Name: HAC_H_1880_Validation.da4

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1063
Program Name: HAC RF H3DV6 Dipole

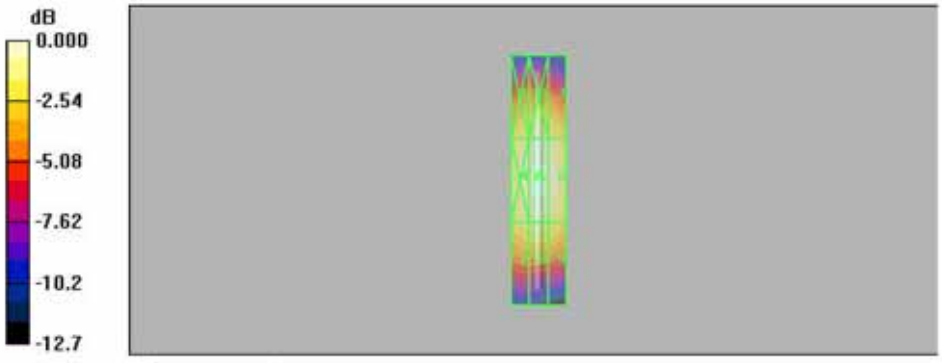
Communication System: CW; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: s = 0 mho/m, e_r = 1; ? = 1 kg/m^3
Phantom section: H Dipole Section

DASY4 Configuration:
- Probe: H3DV6 - SN6206; ; Calibrated: 2008-09-22
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn567; Calibrated: 2008-09-24
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

HAC_H_1880_Validation/Hearing Aid Compatibility Test (41x181x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.422 A/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 0.442 A/m; Power Drift = 0.003 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.378 M2**	Grid 2 **0.389 M2**	Grid 3 **0.375 M2**
Grid 4 **0.412 M2**	Grid 5 **0.422 M2**	Grid 6 **0.409 M2**
Grid 7 **0.367 M2**	Grid 8 **0.374 M2**	Grid 9 **0.362 M2**



0 dB = 0.422A/m

CDMA Cellular Test – (E-Field)

Date/Time: 2009-01-14 3:15:34

Test Laboratory: SGS Testing Korea
File Name: HAC_E_Cell_Low.da4

DUT: RM-375; Type: Folder; Serial: A000000126A3C5
Program Name: HAC RF ER3D Device

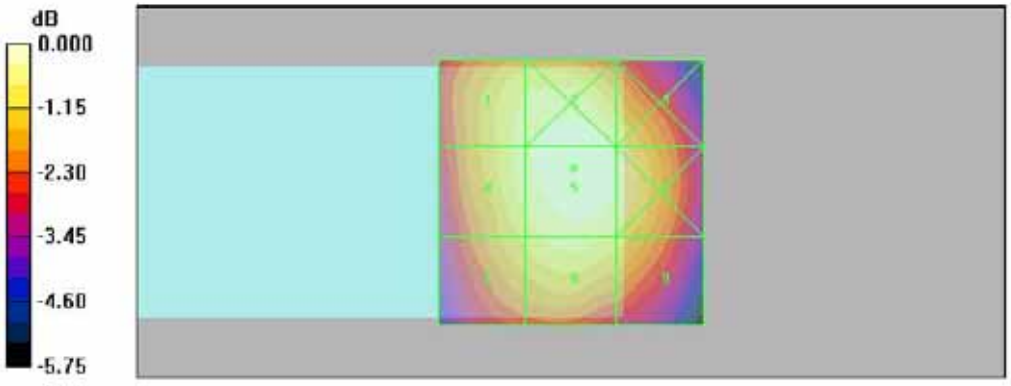
Communication System: CDMA 835MHz; Frequency: 824.7 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: E Device Section

DASY4 Configuration:
- Probe: ER3DV6 - SN2375; ConvF(1, 1, 1); Calibrated: 2008-07-21
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn567; Calibrated: 2008-09-24
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

HAC_E_Cell_Low/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 55.9 V/m
Probe Modulation Factor = 0.988
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 72.8 V/m; Power Drift = -0.141 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **52.6 M4**	Grid 2 **55.2 M4**	Grid 3 **52.7 M4**
Grid 4 **52.8 M4**	Grid 5 **55.9 M4**	Grid 6 **53.7 M4**
Grid 7 **49.7 M4**	Grid 8 **52.4 M4**	Grid 9 **50.4 M4**



0 dB = 55.9V/m

Date/Time: 2009-01-14 3:06:28

Test Laboratory: SGS Testing Korea
File Name: HAC_E_Cell_Mid.da4

DUT: RM-375; Type: Folder; Serial: A000000126A3C5
Program Name: HAC RF ER3D Device

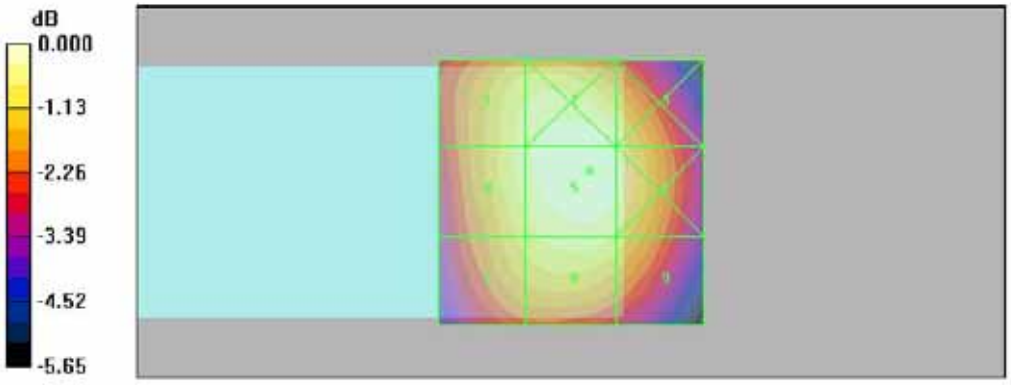
Communication System: CDMA 835MHz; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: E Device Section

DASY4 Configuration:
- Probe: ER3DV6 - SN2375; ConvF(1, 1, 1); Calibrated: 2008-07-21
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn567; Calibrated: 2008-09-24
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

HAC_E_Cell_Mid/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 59.2 V/m
Probe Modulation Factor = 0.988
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 76.8 V/m; Power Drift = 0.089 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **55.6 M4**	Grid 2 **58.4 M4**	Grid 3 **56.1 M4**
Grid 4 **55.8 M4**	Grid 5 **59.2 M4**	Grid 6 **57.4 M4**
Grid 7 **53.0 M4**	Grid 8 **55.7 M4**	Grid 9 **53.7 M4**



0 dB = 59.2V/m

Date/Time: 2009-01-14 3:21:34

Test Laboratory: SGS Testing Korea
File Name: HAC_E_Cell_High.da4

DUT: RM-375; Type: Folder; Serial: A000000126A3C5
Program Name: HAC RF ER3D Device

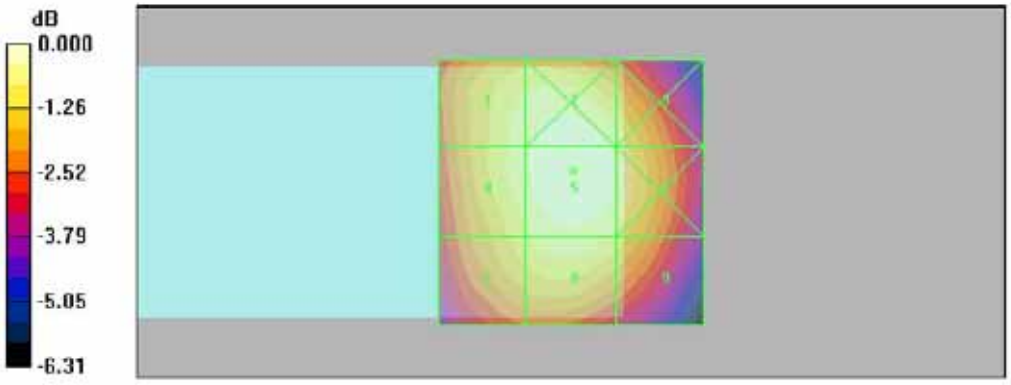
Communication System: CDMA 835MHz; Frequency: 848.31 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: E Device Section

DASY4 Configuration:
- Probe: ER3DV6 - SN2375; ConvF(1, 1, 1); Calibrated: 2008-07-21
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn567; Calibrated: 2008-09-24
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

HAC_E_Cell_High/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 64.8 V/m
Probe Modulation Factor = 0.988
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 84.9 V/m; Power Drift = -0.008 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **61.0 M4**	Grid 2 **64.1 M4**	Grid 3 **60.8 M4**
Grid 4 **61.3 M4**	Grid 5 **64.8 M4**	Grid 6 **62.0 M4**
Grid 7 **58.1 M4**	Grid 8 **60.9 M4**	Grid 9 **57.6 M4**



0 dB = 64.8V/m

CDMA AWS Test – (E-Field)

Date/Time: 2009-01-14 7:33:03

Test Laboratory: SGS Testing Korea
File Name: HAC_E_AWS_Low.da4

DUT: RM-375; Type: Folder; Serial: A000000126A3C5
Program Name: HAC RF ER3D Device

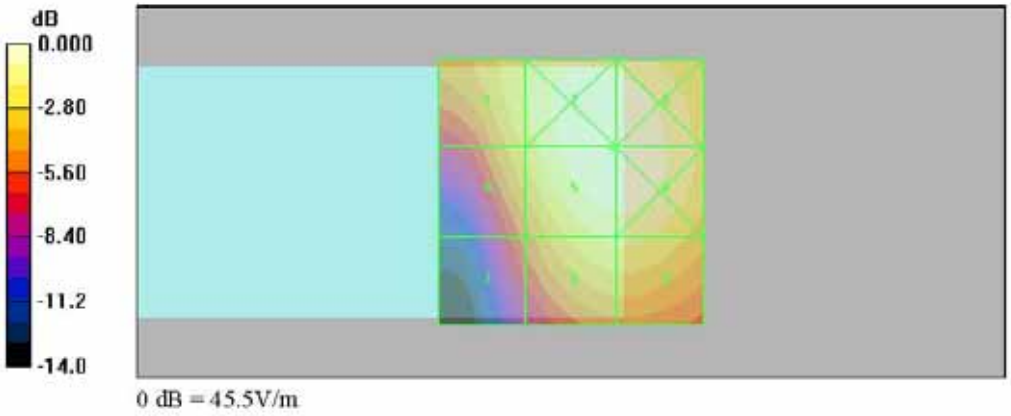
Communication System: AWS; Frequency: 1711.25 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: E Device Section

DASY4 Configuration:
- Probe: ER3DV6 - SN2375; ConvF(1, 1, 1); Calibrated: 2008-07-21
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn567; Calibrated: 2008-09-24
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

HAC_E_AWS_Low/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 45.5 V/m
Probe Modulation Factor = 0.994
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 52.5 V/m; Power Drift = -0.072 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **37.1 M4**	Grid 2 **45.5 M4**	Grid 3 **45.5 M4**
Grid 4 **34.1 M4**	Grid 5 **45.5 M4**	Grid 6 **45.5 M4**
Grid 7 **25.3 M4**	Grid 8 **38.0 M4**	Grid 9 **38.1 M4**



0 dB = 45.5V/m

Date/Time: 2009-01-14 7:26:22

Test Laboratory: SGS Testing Korea
File Name: HAC_E_AWS_Mid.da4

DUT: RM-375; Type: Folder; Serial: A000000126A3C5
Program Name: HAC RF ER3D Device

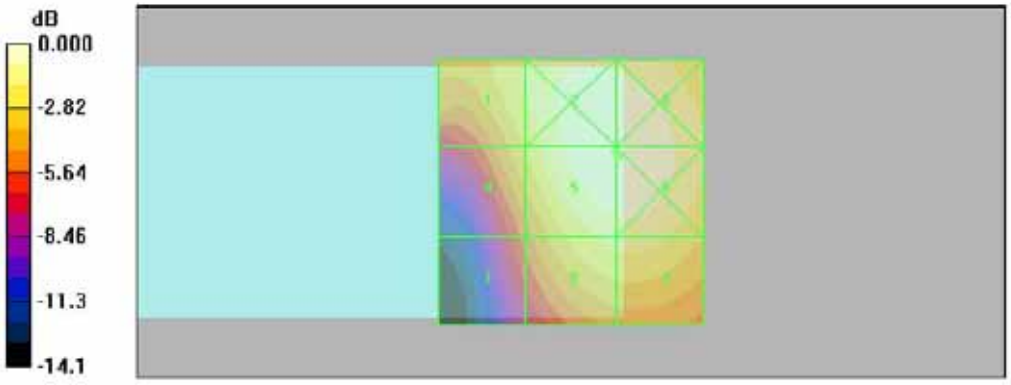
Communication System: AWS; Frequency: 1731.25 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: E Device Section

DASY4 Configuration:
- Probe: ER3DV6 - SN2375; ConvF(1, 1, 1); Calibrated: 2008-07-21
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn567; Calibrated: 2008-09-24
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

HAC_E_AWS_Mid/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 42.9 V/m
Probe Modulation Factor = 0.994
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 49.3 V/m; Power Drift = -0.063 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **35.0 M4**	Grid 2 **42.8 M4**	Grid 3 **42.8 M4**
Grid 4 **31.5 M4**	Grid 5 **42.9 M4**	Grid 6 **42.9 M4**
Grid 7 **23.7 M4**	Grid 8 **36.2 M4**	Grid 9 **36.5 M4**



0 dB = 42.9V/m

Date/Time: 2009-01-14 7:39:12

Test Laboratory: SGS Testing Korea
File Name: HAC_E_AWS_High.da4

DUT: RM-375; Type: Folder; Serial: A000000126A3C5
Program Name: HAC RF ER3D Device

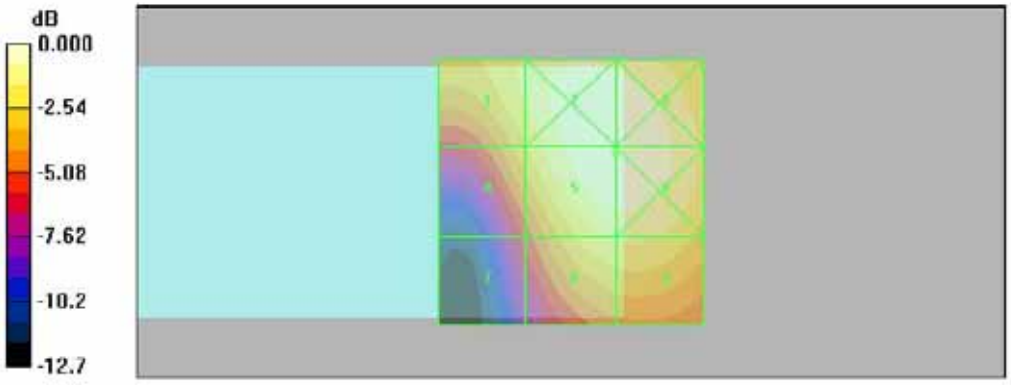
Communication System: AWS; Frequency: 1753.75 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: E Device Section

DASY4 Configuration:
- Probe: ER3DV6 - SN2375; ConvF(1, 1, 1); Calibrated: 2008-07-21
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn567; Calibrated: 2008-09-24
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

HAC_E_AWS_High/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 39.3 V/m
Probe Modulation Factor = 0.994
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 43.7 V/m; Power Drift = -0.089 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **33.3 M4**	Grid 2 **39.3 M4**	Grid 3 **39.3 M4**
Grid 4 **29.1 M4**	Grid 5 **39.3 M4**	Grid 6 **39.3 M4**
Grid 7 **20.7 M4**	Grid 8 **32.8 M4**	Grid 9 **33.2 M4**



0 dB = 39.3V/m

CDMA PCS Test – (E-Field)

Date/Time: 2009-01-14 7:08:24

Test Laboratory: SGS Testing Korea
File Name: HAC_E_PCS_Low.da4

DUT: RM-375; Type: Folder; Serial: A000000126A3C5
Program Name: HAC RF ER3D Device

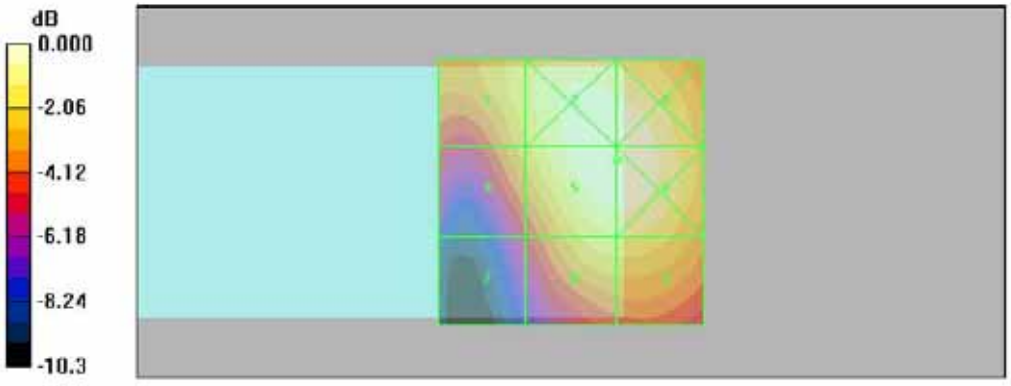
Communication System: PCS 1900; Frequency: 1851.25 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: E Device Section

DASY4 Configuration:
- Probe: ER3DV6 - SN2375; ConvF(1, 1, 1); Calibrated: 2008-07-21
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn567; Calibrated: 2008-09-24
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

HAC_E_PCS_Low/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 46.5 V/m
Probe Modulation Factor = 0.991
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 54.0 V/m; Power Drift = 0.014 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **39.0 M4**	Grid 2 **46.2 M4**	Grid 3 **46.1 M4**
Grid 4 **35.8 M4**	Grid 5 **46.5 M4**	Grid 6 **46.5 M4**
Grid 7 **26.2 M4**	Grid 8 **39.5 M4**	Grid 9 **39.6 M4**



0 dB = 46.5V/m

Date/Time: 2009-01-14 6:55:00

Test Laboratory: SGS Testing Korea
File Name: HAC_E_PCS_Mid.da4

DUT: RM-375; Type: Folder; Serial: A000000126A3C5
Program Name: HAC RF ER3D Device

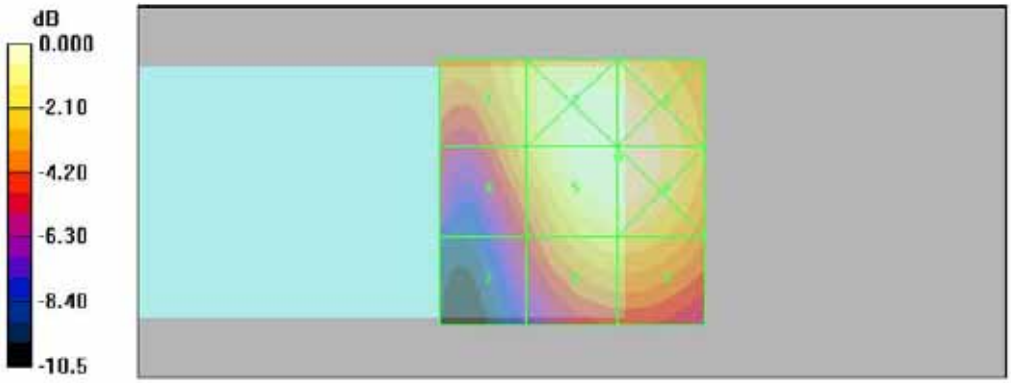
Communication System: PCS 1900; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: E Device Section

DASY4 Configuration:
- Probe: ER3DV6 - SN2375; ConvF(1, 1, 1); Calibrated: 2008-07-21
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn567; Calibrated: 2008-09-24
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

HAC_E_PCS_Mid/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 43.1 V/m
Probe Modulation Factor = 0.991
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 50.0 V/m; Power Drift = -0.044 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **35.6 M4**	Grid 2 **42.9 M4**	Grid 3 **42.9 M4**
Grid 4 **33.2 M4**	Grid 5 **43.1 M4**	Grid 6 **43.1 M4**
Grid 7 **24.7 M4**	Grid 8 **36.1 M4**	Grid 9 **36.1 M4**



0 dB = 43.1V/m

Date/Time: 2009-01-14 7:14:17

Test Laboratory: SGS Testing Korea
File Name: HAC_E_PCS_High.da4

DUT: RM-375; Type: Folder; Serial: A000000126A3C5
Program Name: HAC RF ER3D Device

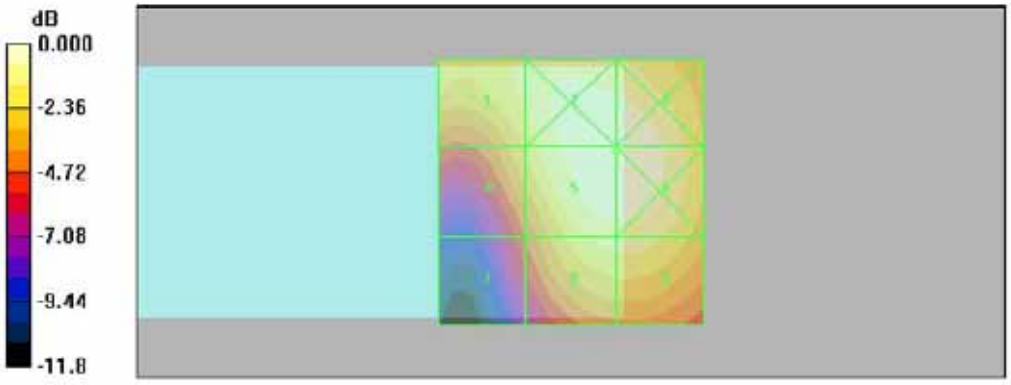
Communication System: PCS 1900; Frequency: 1908.75 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: E Device Section

DASY4 Configuration:
- Probe: ER3DV6 - SN2375; ConvF(1, 1, 1); Calibrated: 2008-07-21
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn567; Calibrated: 2008-09-24
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

HAC_E_PCS_High/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 40.8 V/m
Probe Modulation Factor = 0.991
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 48.6 V/m; Power Drift = -0.046 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **35.0 M4**	Grid 2 **40.8 M4**	Grid 3 **40.8 M4**
Grid 4 **31.6 M4**	Grid 5 **40.8 M4**	Grid 6 **40.8 M4**
Grid 7 **23.9 M4**	Grid 8 **35.7 M4**	Grid 9 **35.8 M4**



0 dB = 40.8V/m

CDMA Cellular Test – (H-Field)

Date/Time: 2009-01-14 4:34:09

Test Laboratory: SGS Testing Korea
File Name: HAC_H_Cell_Low.da4

DUT: RM-375; Type: Folder; Serial: A000000126A3C5
Program Name: HAC RF H3DV6 Device

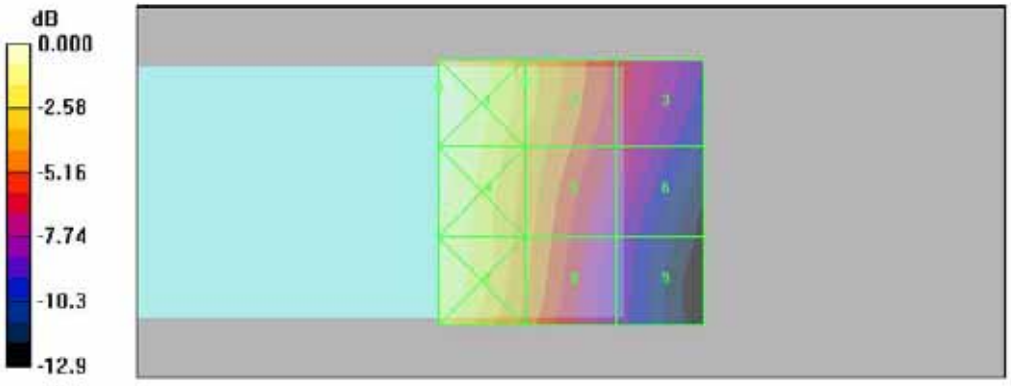
Communication System: CDMA 835MHz; Frequency: 824.7 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: H Device Section

DASY4 Configuration:
- Probe: H3DV6 - SN6206; ; Calibrated: 2008-09-22
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn567; Calibrated: 2008-09-24
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

HAC_H_Cell_Low/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.081 A/m
Probe Modulation Factor = 0.989
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.063 A/m; Power Drift = 0.027 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.114 M4**	Grid 2 **0.081 M4**	Grid 3 **0.056 M4**
Grid 4 **0.109 M4**	Grid 5 **0.077 M4**	Grid 6 **0.051 M4**
Grid 7 **0.106 M4**	Grid 8 **0.072 M4**	Grid 9 **0.044 M4**



0 dB = 0.114A/m

Date/Time: 2009-01-14 4:24:31

Test Laboratory: SGS Testing Korea
File Name: HAC_H_Cell_Mid.da4

DUT: RM-375; Type: Folder; Serial: A000000126A3C5
Program Name: HAC RF H3DV6 Device

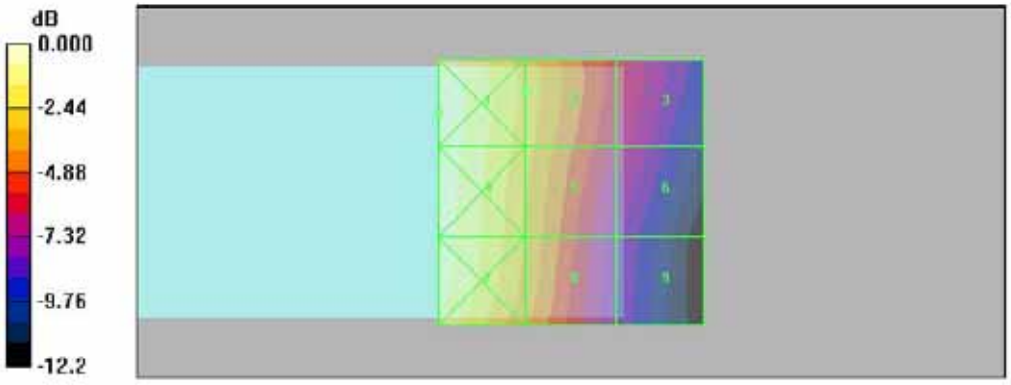
Communication System: CDMA 835MHz; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: H Device Section

DASY4 Configuration:
- Probe: H3DV6 - SN6206; ; Calibrated: 2008-09-22
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn567; Calibrated: 2008-09-24
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

HAC_H_Cell_Mid/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.086 A/m
Probe Modulation Factor = 0.989
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.068 A/m; Power Drift = 0.173 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.117 M4**	Grid 2 **0.086 M4**	Grid 3 **0.058 M4**
Grid 4 **0.115 M4**	Grid 5 **0.083 M4**	Grid 6 **0.054 M4**
Grid 7 **0.112 M4**	Grid 8 **0.080 M4**	Grid 9 **0.048 M4**



0 dB = 0.117A/m

Date/Time: 2009-01-14 4:40:46

Test Laboratory: SGS Testing Korea
File Name: HAC_H_Cell_High.da4

DUT: RM-375; Type: Folder; Serial: A000000126A3C5
Program Name: HAC RF H3DV6 Device

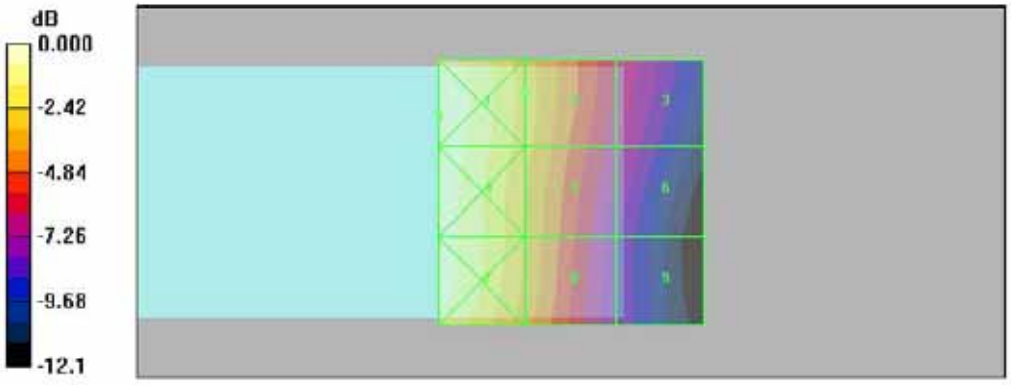
Communication System: CDMA 835MHz; Frequency: 848.31 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: H Device Section

DASY4 Configuration:
- Probe: H3DV6 - SN6206; ; Calibrated: 2008-09-22
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn567; Calibrated: 2008-09-24
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

HAC_H_Cell_High/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.093 A/m
Probe Modulation Factor = 0.989
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.074 A/m; Power Drift = -0.035 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.128 M4**	Grid 2 **0.093 M4**	Grid 3 **0.061 M4**
Grid 4 **0.127 M4**	Grid 5 **0.091 M4**	Grid 6 **0.057 M4**
Grid 7 **0.124 M4**	Grid 8 **0.088 M4**	Grid 9 **0.052 M4**



0 dB = 0.128A/m

CDMA AWS Test – (H-Field)

Date/Time: 2009-01-14 5:59:13

Test Laboratory: SGS Testing Korea
File Name: HAC_H_AWS_Low.da4

DUT: RM-375; Type: Folder; Serial: A000000126A3C5
Program Name: HAC RF H3DV6 Device

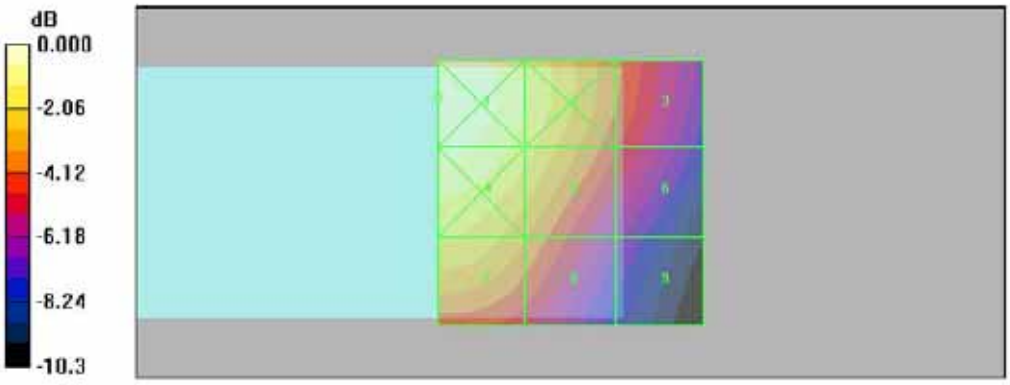
Communication System: AWS; Frequency: 1711.25 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: H Device Section

DASY4 Configuration:
- Probe: H3DV6 - SN6206; ; Calibrated: 2008-09-22
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn567; Calibrated: 2008-09-24
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

HAC_H_AWS_Low/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.123 A/m
Probe Modulation Factor = 0.947
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.110 A/m; Power Drift = -0.097 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.150 M4**	Grid 2 **0.129 M4**	Grid 3 **0.095 M4**
Grid 4 **0.143 M4**	Grid 5 **0.123 M4**	Grid 6 **0.088 M4**
Grid 7 **0.119 M4**	Grid 8 **0.102 M4**	Grid 9 **0.071 M4**



0 dB = 0.150A/m

Date/Time: 2009-01-14 5:53:42

Test Laboratory: SGS Testing Korea
File Name: HAC_H_AWS_Mid.da4

DUT: RM-375; Type: Folder; Serial: A000000126A3C5
Program Name: HAC RF H3DV6 Device

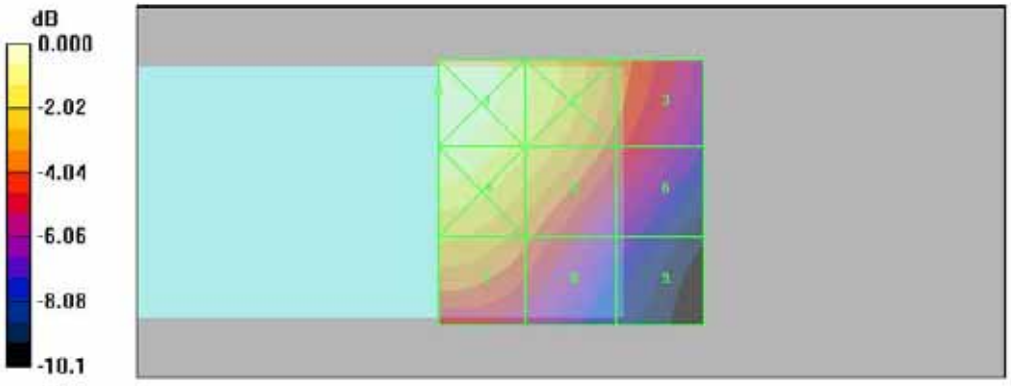
Communication System: AWS; Frequency: 1731.25 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: H Device Section

DASY4 Configuration:
- Probe: H3DV6 - SN6206; ; Calibrated: 2008-09-22
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn567; Calibrated: 2008-09-24
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

HAC_H_AWS_Mid/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.116 A/m
Probe Modulation Factor = 0.947
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.104 A/m; Power Drift = -0.051 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.144 M4**	Grid 2 **0.125 M4**	Grid 3 **0.095 M4**
Grid 4 **0.134 M4**	Grid 5 **0.116 M4**	Grid 6 **0.087 M4**
Grid 7 **0.107 M4**	Grid 8 **0.093 M4**	Grid 9 **0.067 M4**



0 dB = 0.144A/m

Date/Time: 2009-01-14 6:23:35

Test Laboratory: SGS Testing Korea
File Name: HAC_H_AWS_High.da4

DUT: RM-375; Type: Folder; Serial: A000000126A3C5
Program Name: HAC RF H3DV6 Device

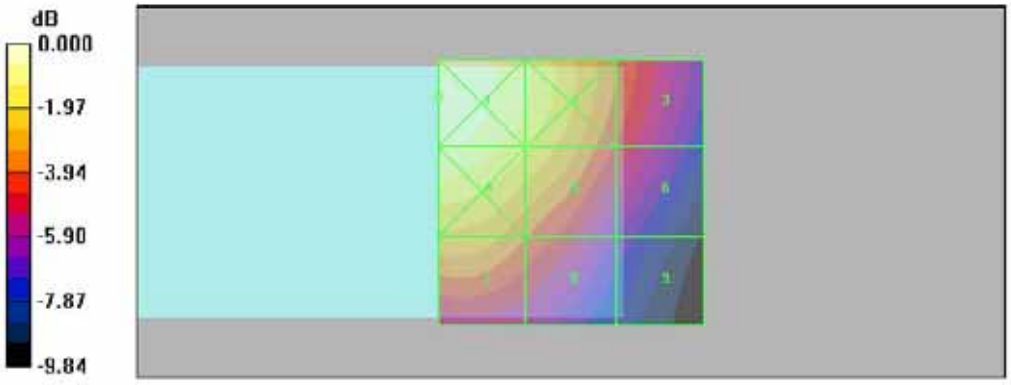
Communication System: AWS; Frequency: 1753.75 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: H Device Section

DASY4 Configuration:
- Probe: H3DV6 - SN6206; ; Calibrated: 2008-09-22
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn567; Calibrated: 2008-09-24
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

HAC_H_AWS_High/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.114 A/m
Probe Modulation Factor = 0.947
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.103 A/m; Power Drift = 0.036 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.141 M4**	Grid 2 **0.123 M4**	Grid 3 **0.090 M4**
Grid 4 **0.130 M4**	Grid 5 **0.114 M4**	Grid 6 **0.083 M4**
Grid 7 **0.102 M4**	Grid 8 **0.090 M4**	Grid 9 **0.066 M4**



0 dB = 0.141A/m

CDMA PCS Test – (H-Field)

Date/Time: 2009-01-14 5:28:06

Test Laboratory: SGS Testing Korea
File Name: HAC_H_PCS_Low.da4

DUT: RM-375; Type: Folder; Serial: A000000126A3C5
Program Name: HAC RF H3DV6 Device

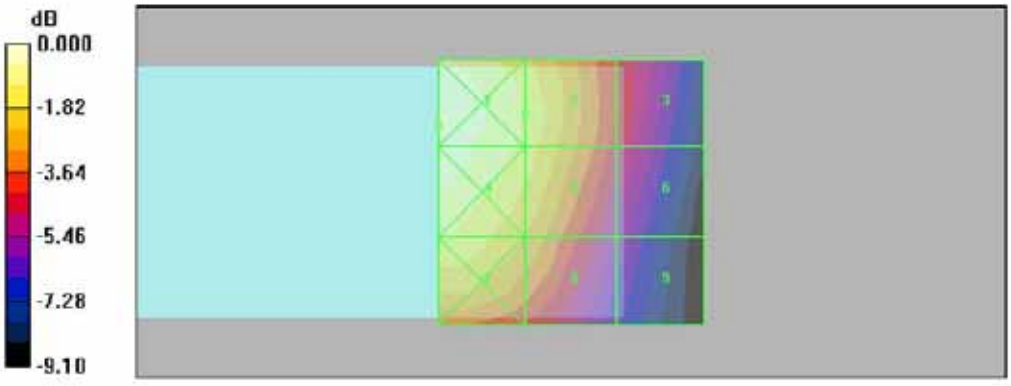
Communication System: PCS 1900; Frequency: 1851.25 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: H Device Section

DASY4 Configuration:
- Probe: H3DV6 - SN6206; ; Calibrated: 2008-09-22
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn567; Calibrated: 2008-09-24
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

HAC_H_PCS_Low/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.124 A/m
Probe Modulation Factor = 0.935
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.114 A/m; Power Drift = -0.098 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.144 M4**	Grid 2 **0.124 M4**	Grid 3 **0.089 M4**
Grid 4 **0.142 M4**	Grid 5 **0.122 M4**	Grid 6 **0.086 M4**
Grid 7 **0.126 M4**	Grid 8 **0.109 M4**	Grid 9 **0.076 M4**



0 dB = 0.144A/m

Date/Time: 2009-01-14 5:15:24

Test Laboratory: SGS Testing Korea
File Name: HAC_H_PCS_Mid.da4

DUT: RM-375; Type: Folder; Serial: A000000126A3C5
Program Name: HAC RF H3DV6 Device

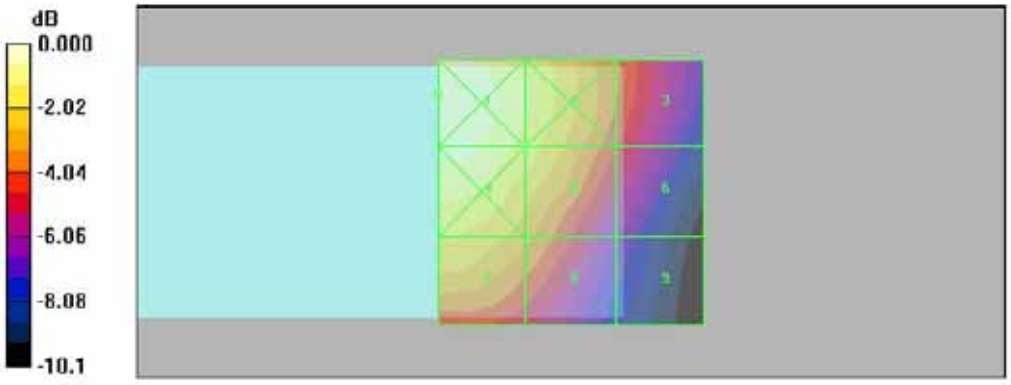
Communication System: PCS 1900; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: H Device Section

DASY4 Configuration:
- Probe: H3DV6 - SN6206; ; Calibrated: 2008-09-22
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn567; Calibrated: 2008-09-24
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

HAC_H_PCS_Mid/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.114 A/m
Probe Modulation Factor = 0.935
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.102 A/m; Power Drift = 0.049 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.138 M4**	Grid 2 **0.120 M4**	Grid 3 **0.088 M4**
Grid 4 **0.133 M4**	Grid 5 **0.114 M4**	Grid 6 **0.081 M4**
Grid 7 **0.110 M4**	Grid 8 **0.096 M4**	Grid 9 **0.064 M4**



0 dB = 0.138A/m

Date/Time: 2009-01-14 5:34:40

Test Laboratory: SGS Testing Korea
File Name: HAC_H_PCS_High.da4

DUT: RM-375; Type: Folder; Serial: A000000126A3C5
Program Name: HAC RF H3DV6 Device

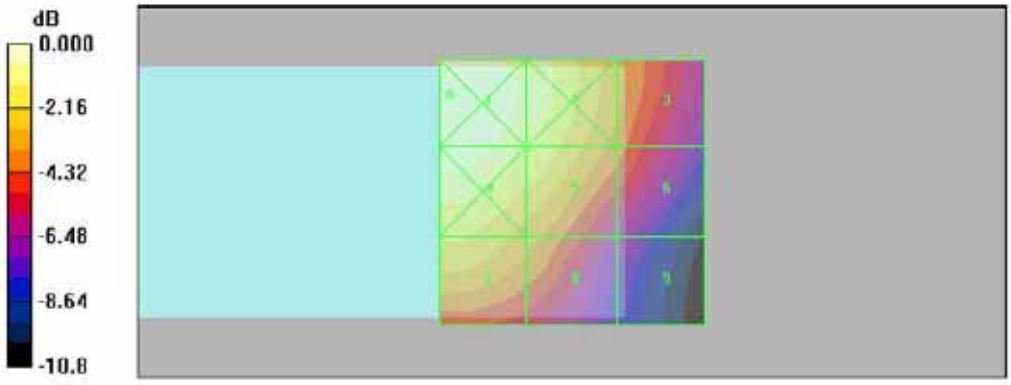
Communication System: PCS 1900; Frequency: 1908.75 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: H Device Section

DASY4 Configuration:
- Probe: H3DV6 - SN6206; ; Calibrated: 2008-09-22
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn567; Calibrated: 2008-09-24
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

HAC_H_PCS_High/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.113 A/m
Probe Modulation Factor = 0.935
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.102 A/m; Power Drift = -0.126 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.132 M4**	Grid 2 **0.120 M4**	Grid 3 **0.089 M4**
Grid 4 **0.127 M4**	Grid 5 **0.113 M4**	Grid 6 **0.084 M4**
Grid 7 **0.104 M4**	Grid 8 **0.091 M4**	Grid 9 **0.063 M4**



0 dB = 0.132A/m

Appendix C
Uncertainty

HAC Uncertainty Budget

Error Description	Uncertainty Value	Prob. Dist.	Div.	(Ci) E	(Ci) H	Std. Unc. E	Std. Unc. H
Measurement System							
Probe Calibration	± 5.1 %	N	1	1	1	± 5.1 %	± 5.1 %
Axial Isotropy	± 4.7 %	R	√3	1	1	± 2.7 %	± 2.7 %
Sensor Displacement	± 16.5 %	R	√3	1	0.145	± 9.5 %	± 1.4 %
Boundary Effects	± 2.4 %	R	√3	1	1	± 1.4 %	± 1.4 %
Linearity	± 4.7 %	R	√3	1	1	± 2.7 %	± 2.7 %
Scaling to Peak Envelope Power	± 2.0 %	R	√3	1	1	± 1.2 %	± 1.2 %
System Detection Limit	± 4.7 %	R	√3	1	1	± 0.6 %	± 0.6 %
Readout Electronics	± 2.0 %	N	1	1	1	± 0.3 %	± 0.3 %
Response Time	± 1.0 %	R	√3	1	1	± 0.5 %	± 0.5 %
Integration Time	± 0.3 %	R	√3	1	1	± 1.5 %	± 1.5 %
RF Ambient Conditions	± 0.8 %	R	√3	1	1	± 1.7 %	± 1.7 %
RF Reflections	± 2.6 %	R	√3	1	1	± 6.9 %	± 6.9 %
Probe Positioner	± 3.0 %	R	√3	1	0.67	± 0.7 %	± 0.5 %
Probe Positioning	± 12.0 %	R	√3	1	0.67	± 2.7 %	± 1.8 %
Extrap. and Interpolation	± 1.2 %	R	√3	1	1	± 0.6 %	± 0.6 %
Test Sample Related							
Device Positioning Vertical	± 4.7 %	R	√3	1	0.67	± 2.7 %	± 1.8 %
Device Positioning Lateral	± 1.0 %	R	√3	1	1	± 0.6 %	± 0.6 %
Device Holder and Phantom	± 2.4 %	R	√3	1	1	± 1.4 %	± 1.4 %
Power Drift	± 5.0%	R	√3	1	1	± 2.9 %	± 2.9 %
Phantom and Setup Related							
Phantom Thickness	± 2.4 %	R	√3	1	0.67	± 1.4 %	± 0.9 %
Combined Std. Uncertainty						± 14.7 %	± 10.9 %
Expanded Std. Uncertainty on Field						± 29.4 %	± 21.8 %

Appendix D

Calibration Certificate

- E-Field Probe

- H-Field Probe

- Dipole (835 MHz, 1880 MHz)

- DAE

E-Field Probe

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 SGS (Dymstec)

Certificate No: ER3-2375_Jul08

CALIBRATION CERTIFICATE

Object	ER3DV6 - SN:2375
Calibration procedure(s)	QA CAL-02.v5 Calibration procedure for E-field probes optimized for close near field evaluations in air
Calibration date:	July 21, 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)	1-Jul-08 (No. 217-00865)	Jul-09
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-08 (No. 217-00787)	Apr-09
Reference 30 dB Attenuator	SN: S5129 (30b)	1-Jul-08 (No. 217-00866)	Jul-09
Reference Probe ER3DV6	SN: 2328	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: July 21, 2008

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

Certificate No: ER3-2375_Jul08 Page 1 of 9

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

Accreditation No.: **SCS 108**

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

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:2375

Manufactured:	May 10, 2006
Last calibrated:	July 18, 2007
Recalibrated:	July 21, 2008

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ER3DV6 SN:2375 July 21, 2008

DASY - Parameters of Probe: ER3DV6 SN:2375

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

NormX	**1.63** ± 10.1 % (k=2)
NormY	**1.74** ± 10.1 % (k=2)
NormZ	**1.97** ± 10.1 % (k=2)

Diode Compression[A]

DCP X	**90** mV
DCP Y	**91** mV
DCP Z	**97** 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 **89** °

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%.

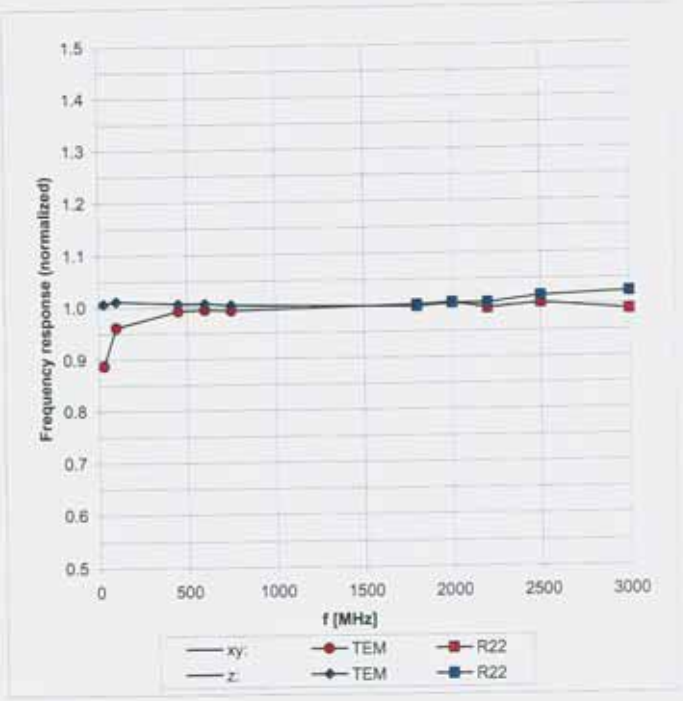
[A] numerical linearization parameter: uncertainty not required

ER3DV6 SN:2375

July 21, 2008

Frequency Response of E-Field

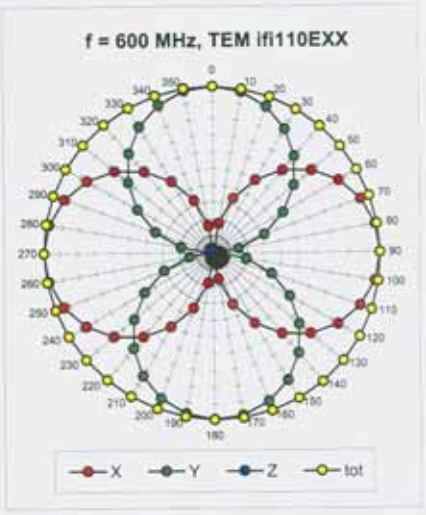
(TEM-Cell:ifi110 EXX, Waveguide R22)

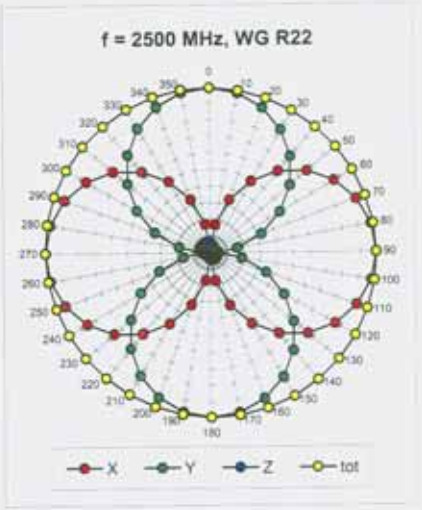


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

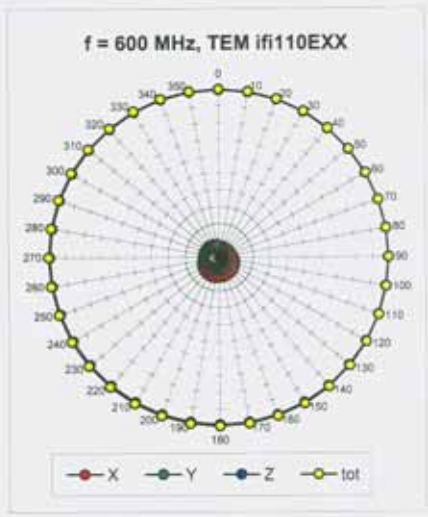
ER3DV6 SN:2375 July 21, 2008

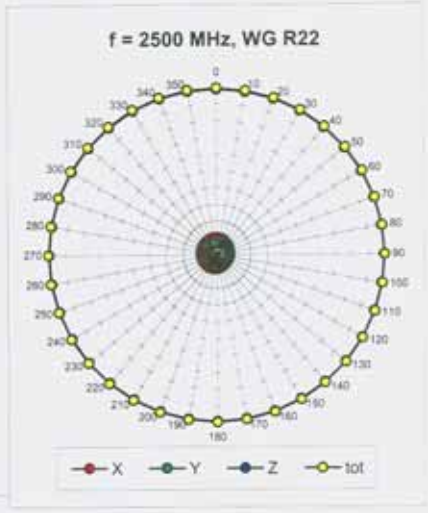
Receiving Pattern (ϕ), ϑ = 0°





Receiving Pattern (ϕ), ϑ = 90°



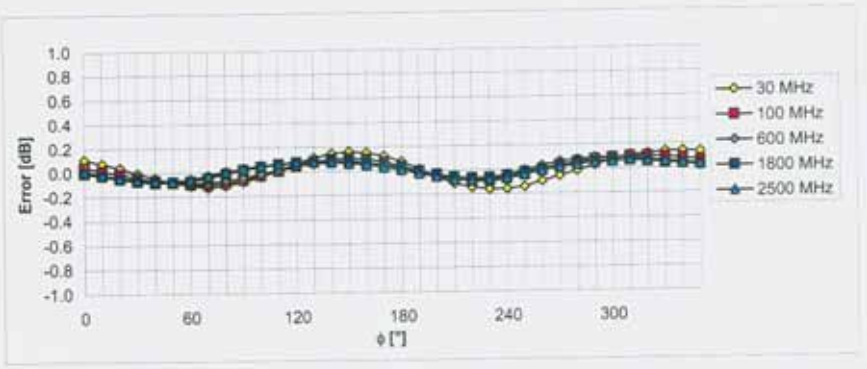


Certificate No: ER3-2375_Jul08 Page 6 of 9

ER3DV6 SN:2375

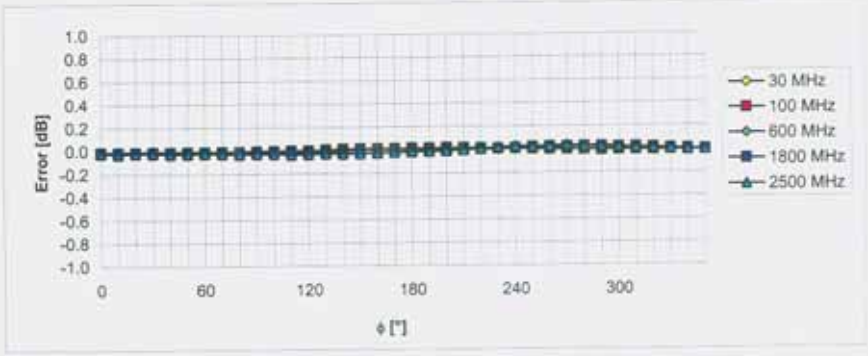
July 21, 2008

Receiving Pattern (ϕ), ϑ = 0°



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

Receiving Pattern (ϕ), ϑ = 90°



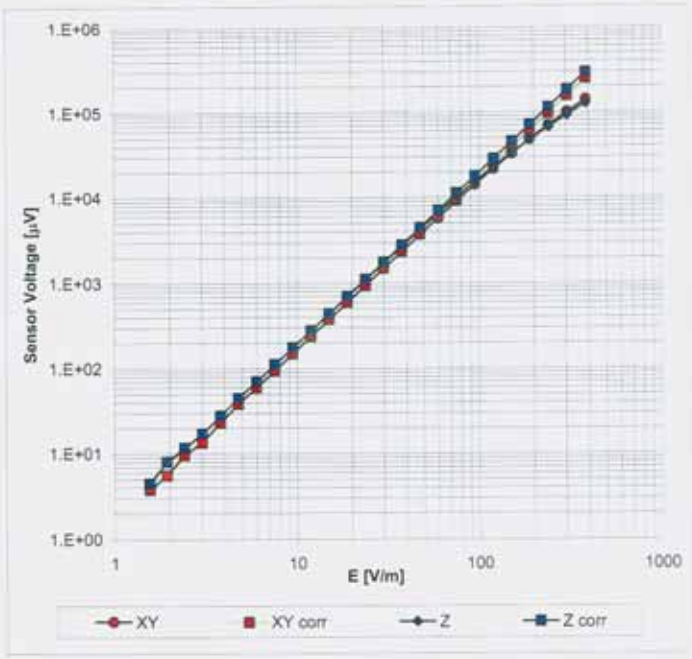
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

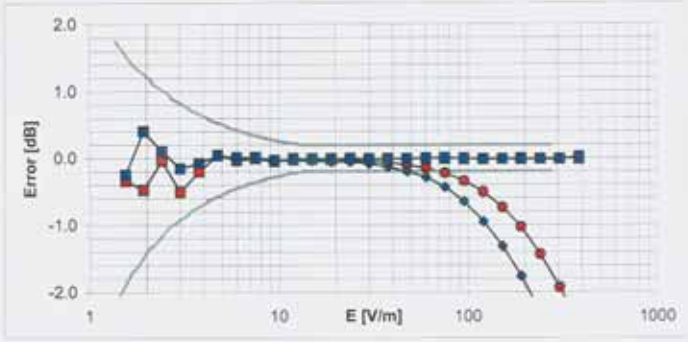
Certificate No: ER3-2375_Jul08 Page 7 of 9

ER3DV6 SN:2375 July 21, 2008

Dynamic Range f(E-field)

(Waveguide R22, f = 1800 MHz)





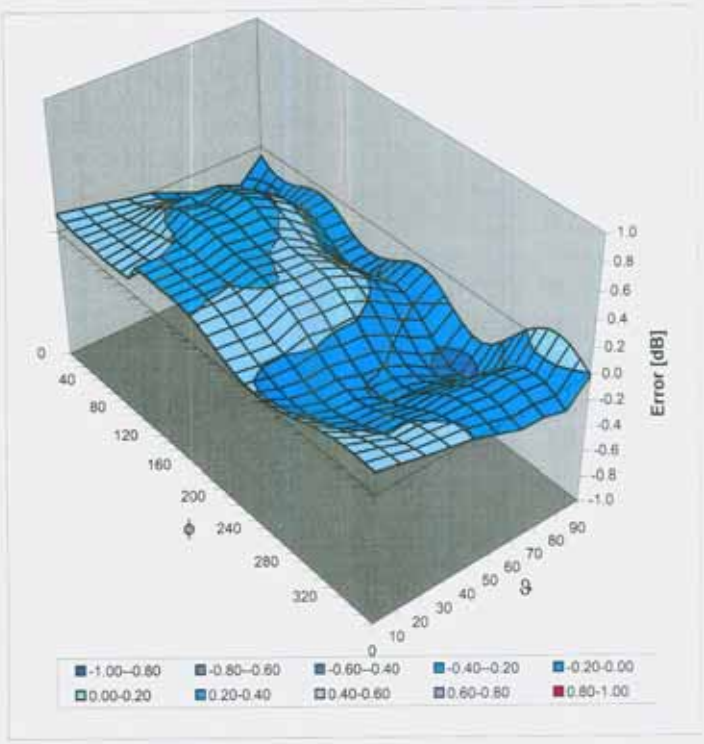
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Certificate No. ER3-2375_Jul08 Page 8 of 9

ER3DV6 SN:2375

July 21, 2008

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



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

H-Field Probe

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 SGS (Dymstec)

Certificate No: H3-6206_Sep08

CALIBRATION CERTIFICATE

Object	H3DV6 - SN:6206
Calibration procedure(s)	QA CAL-03.v5 Calibration procedure for H-field probes optimized for close near field evaluations in air
Calibration date:	September 22, 2008
Condition of the calibrated item	In Tolerance

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41495277	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41498087	1-Apr-08 (No. 217-00788)	Apr-09
Reference 3 dB Attenuator	SN: S5054 (3c)	1-Jul-08 (No. 217-00865)	Jul-09
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-08 (No. 217-00787)	Apr-09
Reference 30 dB Attenuator	SN: S5129 (30b)	1-Jul-08 (No. 217-00866)	Jul-09
Reference Probe H3DV6	SN: 6182	2-Oct-07 (No. H3-6182_Oct07)	Oct-08
DAE4	SN: 789	5-Dec-07 (No. DAE4-789_Dec07)	Dec-08

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: September 22, 2008

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

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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:

- *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:6206

Manufactured:	June 12, 2006
Last calibrated:	September 25, 2007
Recalibrated:	September 22, 2008

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

H3DV6 SN:6206 September 22, 2008

DASY - Parameters of Probe: H3DV6 SN:6206

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

	a0	a1	a2	
X	2.511E-03	3.863E-5	1.725E-4	± 5.1 % (k=2)
Y	2.414E-03	3.136E-4	2.072E-4	± 5.1 % (k=2)
Z	2.735E-03	5.649E-4	3.117E-4	± 5.1 % (k=2)

Diode Compression[1]

DCP X	85 mV
DCP Y	88 mV
DCP Z	90 mV

Sensor Offset (Probe Tip to Sensor Center)

X	3.0 mm
Y	3.0 mm
Z	3.0 mm

Connector Angle -14 °

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%.

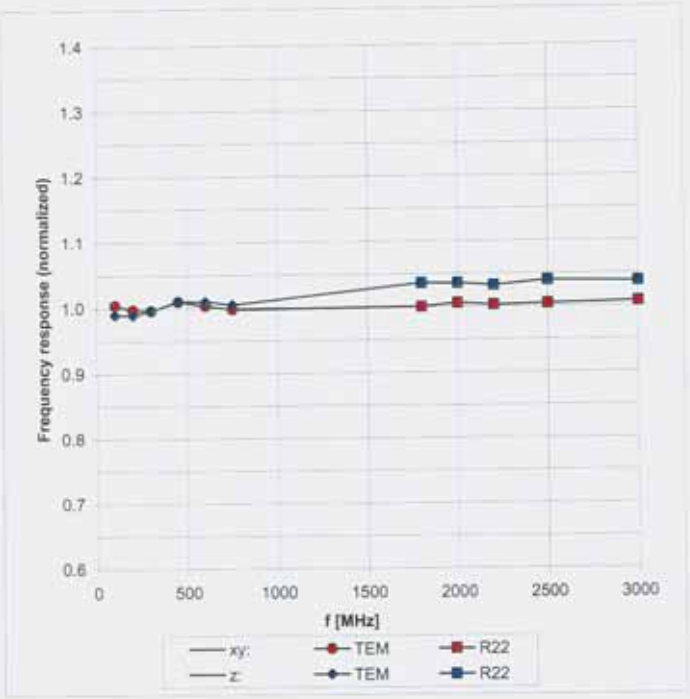
[1] numerical linearization parameter: uncertainty not required

Certificate No: H3-6206_Sep08 Page 4 of 9

H3DV6 SN:6206 September 22, 2008

Frequency Response of H-Field

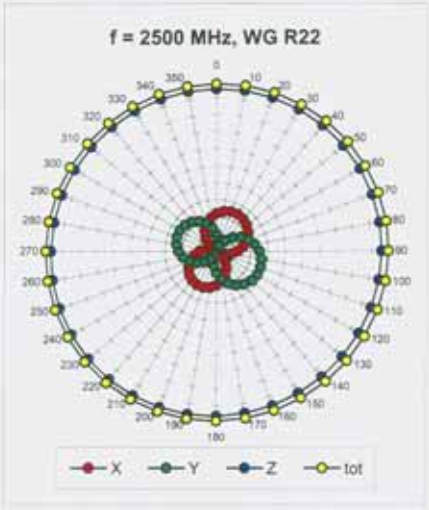
(TEM-Cell:ifi110 EXX, Waveguide R22)



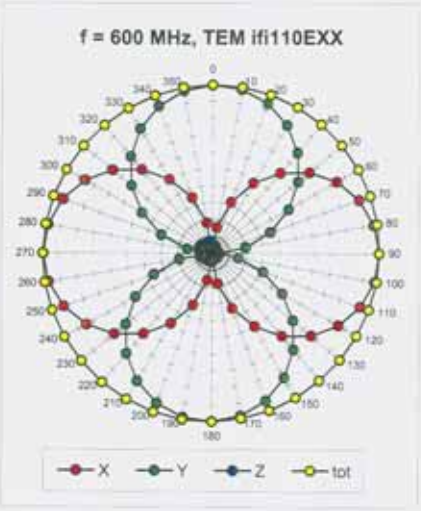
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

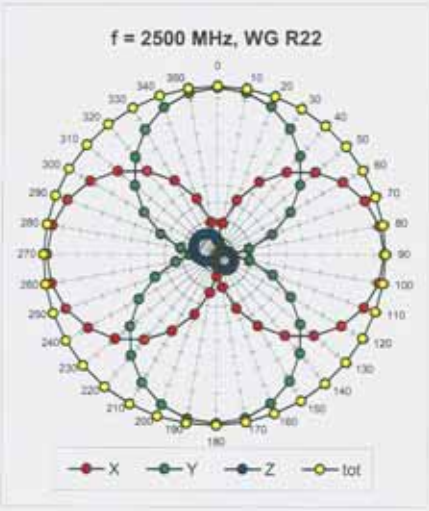
H3DV6 SN:6206 September 22, 2008

Receiving Pattern (ϕ), ϑ = 90°



Receiving Pattern (ϕ), ϑ = 0°

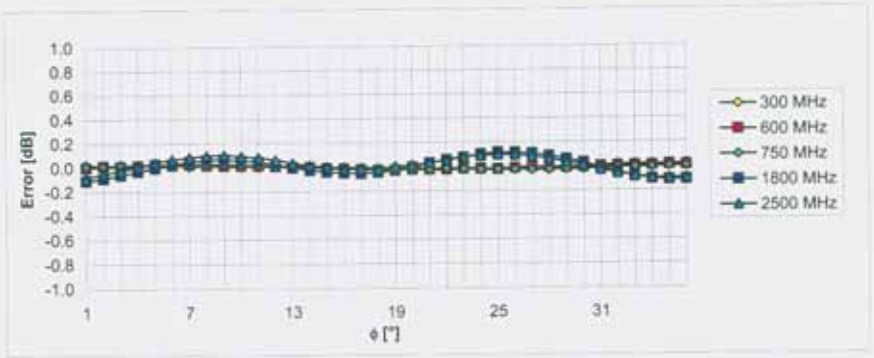




Certificate No: H3-6206_Sep08 Page 6 of 9

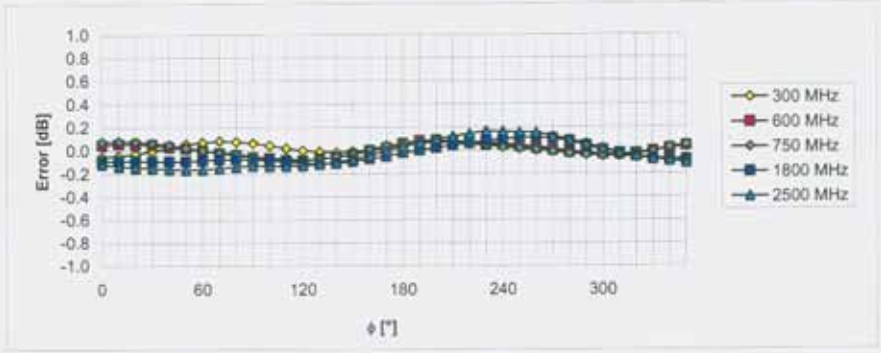
H3DV6 SN:6206 September 22, 2008

Receiving Pattern (ϕ), ϑ = 90°



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

Receiving Pattern (ϕ), ϑ = 0°



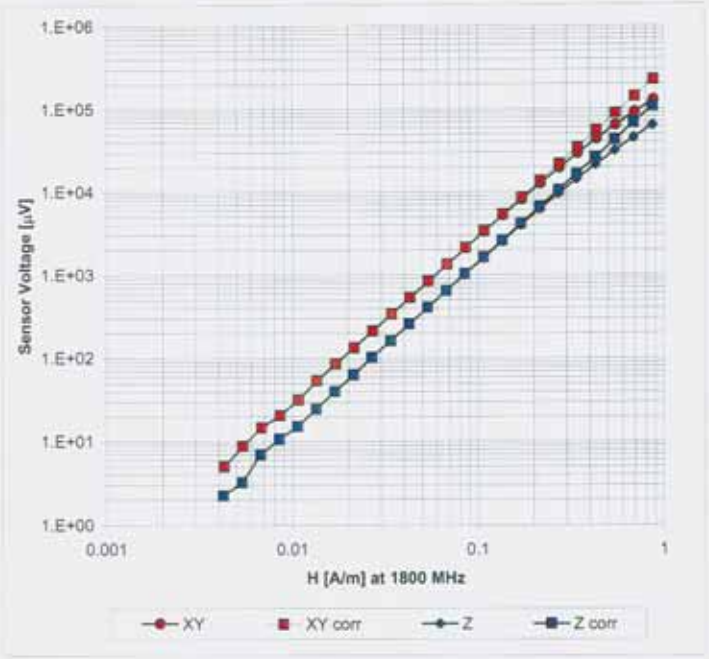
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

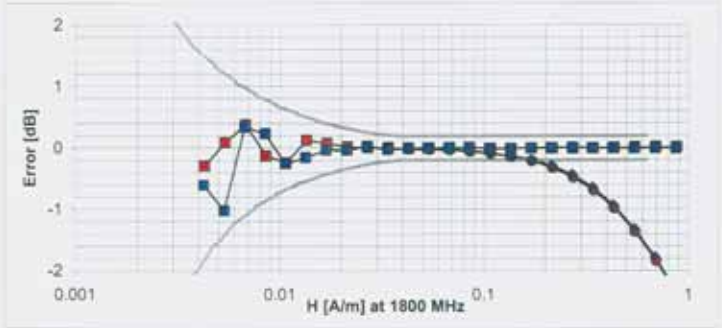
Certificate No: H3-6206_Sep08 Page 7 of 9

H3DV6 SN:6206 September 22, 2008

Dynamic Range f(H-field)

(Waveguide R22, f = 1800 MHz)



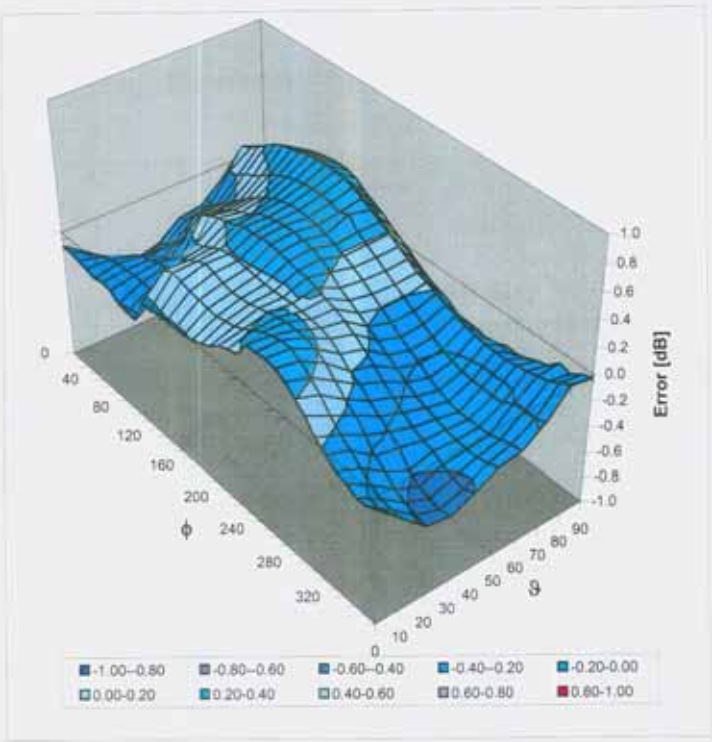


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Certificate No: H3-6206_Sep08 Page 8 of 9

H3DV6 SN:6206 September 22, 2008

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



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

835 MHz Dipole

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

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Accreditation No.: SCS 108

Client SGS (Dymstec)

Certificate No: CD835V3-1081_Jul07

CALIBRATION CERTIFICATE

Object	CD835V3 - SN: 1081
Calibration procedure(s)	QA CAL-20.v4 Calibration procedure for dipoles in air
Calibration date:	July 12, 2007
Condition of the calibrated item	In Tolerance

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

Calibration Equipment used (M&TE critical for calibration)

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

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

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

Issued: July 17, 2007

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

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Accreditation No.: SCS 108

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References

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

Methods Applied and Interpretation of Parameters:

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

1 Measurement Conditions

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

DASY Version	DASY4	V4.7 B53
DASY PP Version	SEMCAD	V1.8 B172
Phantom	HAC Test Arch	SD HAC P01 BA, #1002
Distance Dipole Top - Probe Center	10 mm	
Scan resolution	dx, dy = 5 mm	area = 20 x 180 mm
Frequency	**835 MHz** ± 1 MHz	
Forward power at dipole connector	20.0 dBm = 100mW	
Input power drift	< 0.05 dB	

2 Maximum Field values

H-field 10 mm above dipole surface	condition	**Interpolated maximum**
Maximum measured	100 mW forward power	**0.447 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	161.8 V/m
Maximum measured above low end	100 mW forward power	150.7 V/m
Averaged maximum above arm	100 mW forward power	**156.3 V/m**

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

3 Appendix

3.1 Antenna Parameters

Frequency	Return Loss	Impedance
800 MHz	16.9 dB	(43.8 – j11.9) Ohm
835 MHz	**25.1 dB**	**(50.9 + j5.5) Ohm**
900 MHz	16.9 dB	(58.0 – j13.4) Ohm
950 MHz	21.5 dB	(48.4 + j8.2) Ohm
960 MHz	15.8 dB	(55.4 + j16.4) Ohm

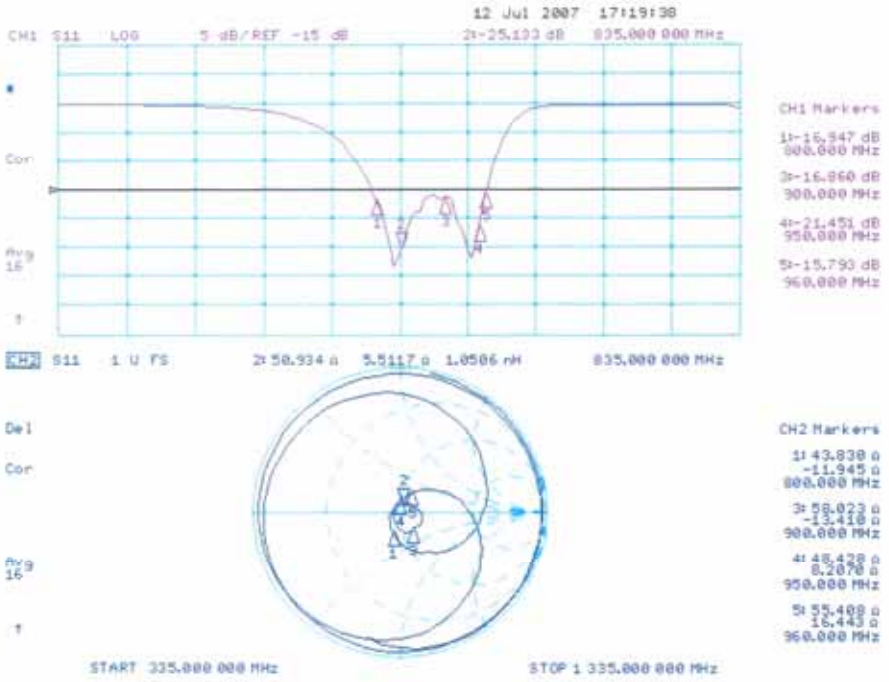
3.2 Antenna Design and Handling

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: 12.07.2007 20:53:12

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: HAC-Dipole 835 MHz; Type: CD835V3; Serial: 1081

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

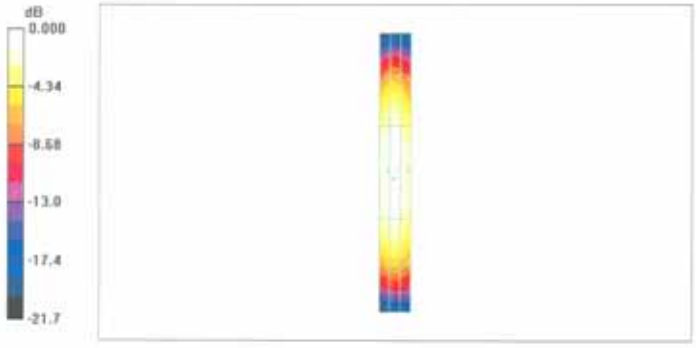
DASY4 Configuration:

- Probe: H3DV6 - SN6065; ; Calibrated: 27.12.2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn903; Calibrated: 31.08.2006
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: 1002
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

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 = 0.447 A/m
Probe Modulation Factor = 1.00
Reference Value = 0.473 A/m; Power Drift = -0.013 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.376**	Grid 2 **0.385**	Grid 3 **0.355**
Grid 4 **0.435**	Grid 5 **0.447**	Grid 6 **0.412**
Grid 7 **0.387**	Grid 8 **0.398**	Grid 9 **0.368**



0 dB = 0.447A/m

3.3.3 DASY4 E-Field result

Date/Time: 12.07.2007 20:06:23

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: HAC-Dipole 835 MHz; Type: D835V3; Serial: 1081

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

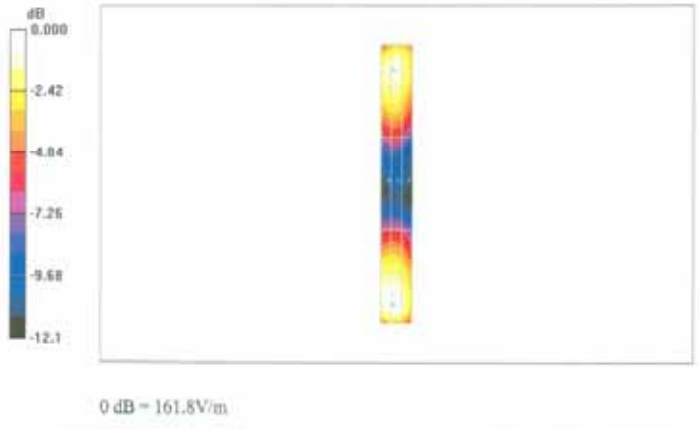
DASY4 Configuration:

- Probe: ER3DV6 - SN2336; ConvF(1, 1, 1); Calibrated: 27.12.2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn903; Calibrated: 31.08.2006
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; ;
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 171

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 = 161.8 V/m
Probe Modulation Factor = 1.00
Reference Value = 109.9 V/m; Power Drift = -0.042 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **149.1**	Grid 2 **150.7**	Grid 3 **141.3**
Grid 4 **80.8**	Grid 5 **81.5**	Grid 6 **75.2**
Grid 7 **160.3**	Grid 8 **161.8**	Grid 9 **147.9**



0 dB = 161.8V/m

1880 MHz Dipole

Calibration Laboratory of
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Engineering AG
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Accreditation No.: SCS 108

Client SGS (Dymstec)

Certificate No: CD1880V3-1063_Jul07

CALIBRATION CERTIFICATE

Object	CD1880V3 - SN: 1063
Calibration procedure(s)	QA CAL-20.v4 Calibration procedure for dipoles in air
Calibration date:	July 12, 2007
Condition of the calibrated item	In Tolerance

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: July 17, 2007

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Certificate No: CD1880V3-1063_Jul07 Page 1 of 6

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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 B53
DASY PP Version	SEMCAD	V1.8 B172
Phantom	HAC Test Arch	SD HAC P01 BA, #1002
Distance Dipole Top - Probe Center	10 mm	
Scan resolution	dx, dy = 5 mm	area = 20 x 90 mm
Frequency	**1880 MHz** ± 1 MHz	
Forward power at dipole connector	20.0 dBm = 100mW	
Input power drift	< 0.05 dB	

2 Maximum Field values

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

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

E-field 10 mm above dipole surface	condition	**Interpolated maximum**
Maximum measured above high end	100 mW forward power	136.1 V/m
Maximum measured above low end	100 mW forward power	129.8 V/m
Averaged maximum above arm	100 mW forward power	**133.0 V/m**

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

3 Appendix

3.1 Antenna Parameters

Frequency	Return Loss	Impedance
1710 MHz	22.3 dB	(51.9 + j7.6) Ohm
1880 MHz	**22.1 dB**	**(49.5 + j7.8) Ohm**
1900 MHz	22.1 dB	(52.2 + j7.7) Ohm
1950 MHz	31.6 dB	(52.7 + j0.5) Ohm
2000 MHz	20.5 dB	(41.8 + j2.8) Ohm

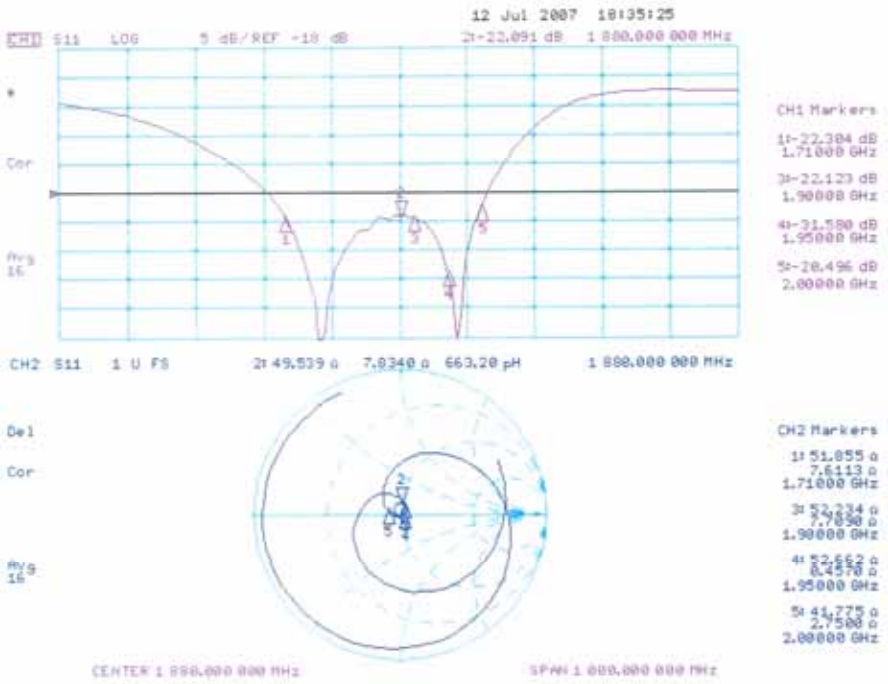
3.2 Antenna Design and Handling

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: 10.07.2007 17:19:44

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1063

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

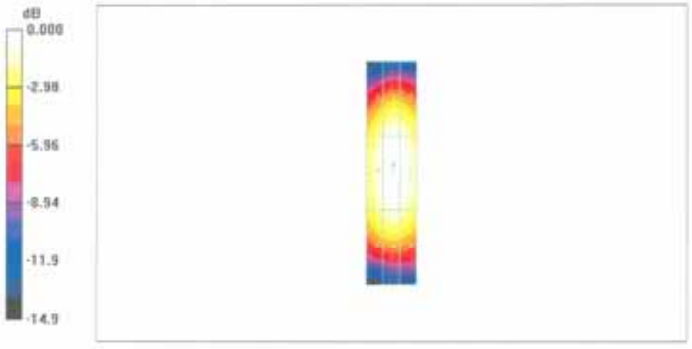
DASY4 Configuration:

- Probe: H3DV6 - SN6065; ; Calibrated: 27.12.2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn903; Calibrated: 31.08.2006
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: 1002
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

H Scan - Sensor Center 10mm above CD1880V3 Dipole/Hearing Aid Compatibility Test (41x181x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.453 A/m
Probe Modulation Factor = 1.00
Reference Value = 0.478 A/m; Power Drift = 0.000 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.391**	Grid 2 **0.426**	Grid 3 **0.413**
Grid 4 **0.421**	Grid 5 **0.453**	Grid 6 **0.440**
Grid 7 **0.382**	Grid 8 **0.405**	Grid 9 **0.392**



0 dB = 0.453A/m

3.3.3 DASY4 E-Field Result

Date/Time: 12.07.2007 14:55:17

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1063

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

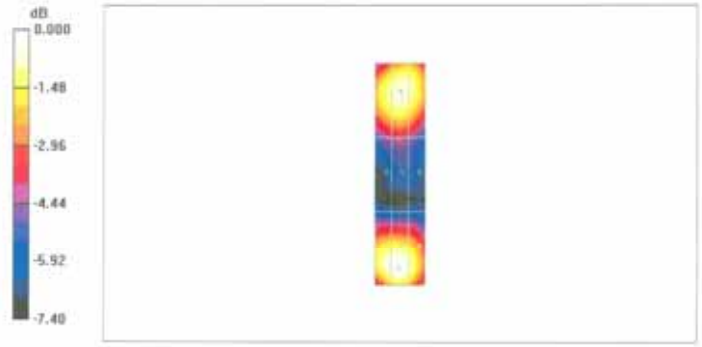
DASY4 Configuration:

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

E Scan - Sensor Center 10mm above CD1880V3 Dipole/Hearing Aid Compatibility Test (41x181x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 136.1 V/m
Probe Modulation Factor = 1.00
Reference Value = 151.5 V/m; Power Drift = 0.032 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **126.1**	Grid 2 **129.8**	Grid 3 **126.7**
Grid 4 **85.7**	Grid 5 **87.3**	Grid 6 **83.7**
Grid 7 **133.0**	Grid 8 **136.1**	Grid 9 **127.7**



0 dB = 136.1V/m

DAE Calibration Certificate

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Accreditation No.: SCS 108

Client SGS (Dymstec)

Certificate No: DAE3-567_Sep08

CALIBRATION CERTIFICATE

Object	DAE3 - SD 000 D03 AA - SN: 567
Calibration procedure(s)	QA CAL-06.v12 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	September 24, 2008
Condition of the calibrated item	In Tolerance

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Fluke Process Calibrator Type 702	SN: 6295803	04-Oct-07 (No: 6467)	Oct-08
Keithley Multimeter Type 2001	SN: 0810278	03-Oct-07 (No: 6465)	Oct-08
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Calibrator Box V1.1	SE UMS 006 AB 1004	06-Jun-08 (in house check)	In house check: Jun-09

	Name	Function	Signature
Calibrated by:	Dominique Steffen	Technician	
Approved by:	Fin Bomholt	R&D Director	

Issued: September 24, 2008

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Certificate No: DAE3-567_Sep08 Page 1 of 5

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Glossary

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

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity*: Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance:* DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

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

Low Range: 1LSB = 61nV , full range = -1.....+3mV

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

Calibration Factors	X	Y	Z
High Range	404.676 ± 0.1% (k=2)	404.415 ± 0.1% (k=2)	404.505 ± 0.1% (k=2)
Low Range	3.95084 ± 0.7% (k=2)	3.95932 ± 0.7% (k=2)	3.95189 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	85 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Input (μV)	Reading (μV)	Error (%)
Channel X	+ Input	200000	200000.4	0.00
Channel X	+ Input	20000	20004.42	0.02
Channel X	- Input	20000	-19999.98	0.00
Channel Y	+ Input	200000	200000	0.00
Channel Y	+ Input	20000	20003.82	0.02
Channel Y	- Input	20000	-20001.54	0.01
Channel Z	+ Input	200000	200000.2	0.00
Channel Z	+ Input	20000	20001.02	0.01
Channel Z	- Input	20000	-20001.77	0.01

Low Range		Input (μV)	Reading (μV)	Error (%)
Channel X	+ Input	2000	2000.1	0.00
Channel X	+ Input	200	200.08	0.04
Channel X	- Input	200	-200.46	0.23
Channel Y	+ Input	2000	2000.1	0.00
Channel Y	+ Input	200	199.44	-0.28
Channel Y	- Input	200	-200.67	0.33
Channel Z	+ Input	2000	1999.9	0.00
Channel Z	+ Input	200	198.93	-0.53
Channel Z	- Input	200	-201.01	0.50

2. Common mode sensitivity

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

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	4.45	3.07
	- 200	-1.97	-3.12
Channel Y	200	0.63	0.75
	- 200	-1.46	-2.02
Channel Z	200	5.71	5.24
	- 200	-6.82	-7.33

3. Channel separation

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

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	1.58	0.47
Channel Y	200	0.86	-	2.06
Channel Z	200	-2.64	0.26	-

4. AD-Converter Values with inputs shorted

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

	High Range (LSB)	Low Range (LSB)
Channel X	16354	16104
Channel Y	16145	17163
Channel Z	15912	15586

5. Input Offset Measurement

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

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	-0.07	-1.16	0.99	0.42
Channel Y	-0.59	-1.54	0.25	0.31
Channel Z	-0.69	-1.63	0.02	0.32

6. Input Offset Current

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

7. Input Resistance

	Zeroing (MOhm)	Measuring (MOhm)
Channel X	0.2001	201.2
Channel Y	0.2001	200.7
Channel Z	0.2001	199.3

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

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

9. Power Consumption (verified during pre test)

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