HAC TEST REPORT

<RF-Emission>

Applicant Name	Nokia Inc.
Address of Applicant	12278 Scripps Summit Dr., San Diego CA92131, USA
EUT Type	CDMA 2000 1xRTT Mobile Phone
Model Number	RM-375
Date of receive	2008.06.25
Date of Test(s)	2008.06.27
Date of Issue	2008.06.30

Standards:

ANSI C63.19-2006 v3.12

FCC RULE PART(S): 47 CFR PART 20.19(B)

HAC RATE CATEGORY: M4 (M Category)

In the configuration tested, the EUT complied with the standards specified above.

Remarks:

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS Taiwan Electronics & Communication Laboratory or testing done by SGS Taiwan Electronics & Communication Laboratory in connection with distribution or use of the product described in this report must be approved by SGS Taiwan Electronics & Communication Laboratory in writing.

Tested by : Ricky Huang

Ricky Huang
Sr. Engineer Date: 2008/06/30

Approved by: Robert Chang

Robert Chang
Tech Manager Date: 2008/06/30

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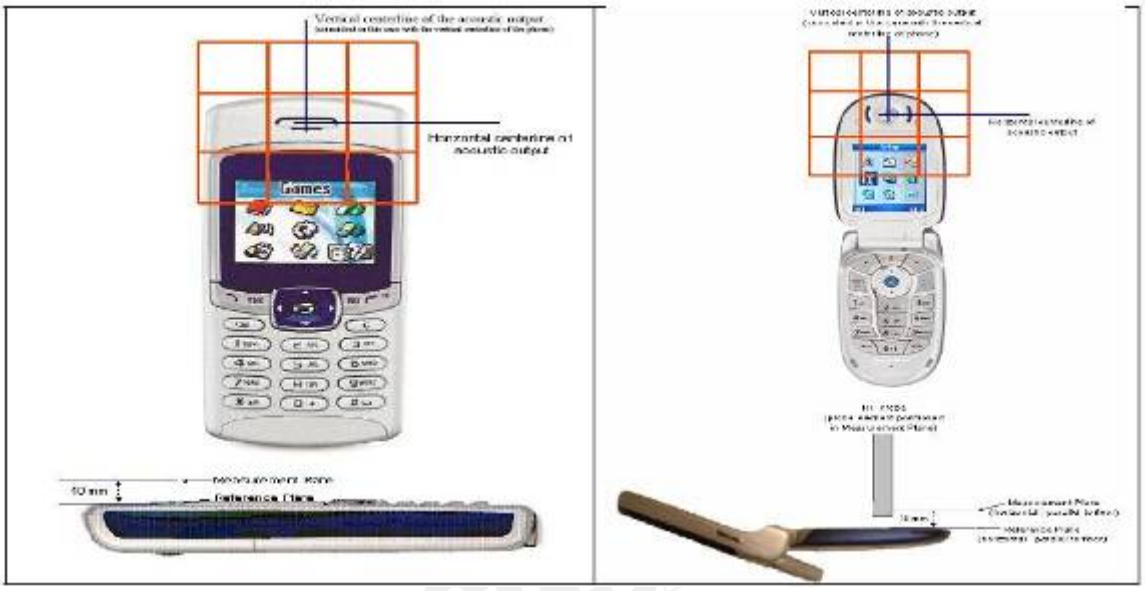
1. Introduction

The purpose of the Hearing Aid Compatibility extension is to enable measurements of the near electric and magnetic fields generated by wireless communication devices in the region controlled for use by a hearing aid in accordance with ANSI-C63.19-2006

FCC has granted a request for waiver of the HAC rules in section 20.19 for dual band GSM handsets. The waiver has specific conditions, as stated in the order (FCC 05-166) and expires 1 August 2006.
The purpose of this standard is to establish categories for hearing aids and for WD (wireless communications devices) that can indicate to health care practitioners and hearing aid users which hearing aids are compatible with which WD, and to provide tests that can be used to assess the electromagnetic characteristics of hearing aids and WD and assign them to these categories. The various parameters required, in order to demonstrate compatibility and accessibility are measured. The design of the standard is such that when a hearing aid and WD achieve one of the categories specified, as measured by the methodology of this standard, the indicated performance is realized.
In order to provide for the usability of a hearing aid with a WD, several factors must be coordinated:
a) Radio frequency (RF) measurements of the near-field electric and magnetic fields emitted by a WD to categorize these emissions for correlation with the RF immunity of a hearing aid.
Hence, the following are measurements made for the WD:
a) RF E-Field emissions
b) RF H-Field emissions

The measurement plane is parallel to, and 1.0cm in front of, the reference plane.



Applications for certification of equipment operation under part 20, that a manufacturer is seeking to certify as hearing aid compatible, as set forth in §20.19 of that part, shall include a statement indication compliance with the test requirements of §20.19 and indicating the appropriate U-rating for the equipment. The manufacturer of the equipment shall be responsible for maintaining the test results.

2. Testing Laboratory

Company Name	SGS Taiwan Ltd. Electronics & Communication Laboratory
Company address	134, Wu Kung Road, Wuku Industrial Zone Taipei, Taiwan, R.O.C.
Telephone	+886-2-2299-3279
Fax	+886-2-2298-0488
Website	http://www.tw.sgs.com/

3. Details of Applicant / Manufacturer

3.1 Details of Applicant

Applicant Name	Nokia Inc.
Applicant Address	12278 Scripps Summit Dr. San Diego CA92131 USA
Applicant Telephone	+1 604 456 5544
Applicant Contact Person	Stephen Walmsley

3.2 Details of Manufacturer

Manufacturer Name	Compal Communications(Nanjing) Co. Ltd
Manufacturer Address	Nanjing Jiangning Export Processing Zone (South Area)No.68-2 Suyuan Street
Manufacturer Contact Person	Dennis Hung
Manufacturer mailing address	Dennis_hung@compalcomm.com

4. Description of EUT

EUT Type	CDMA 2000 1xRTT Mobile Phone		
Mode(s) of Operation	CDMA Tri Band (Cellular/US PCS/AWS) (Report only AWS Band in the HAC Report)		
FCC ID	QMNRM-375		
Hardware Version	4000		
Software Version	DS_1100B_GEN		
TX Frequency range (MHz)	AWS Band		
	1711.25-1753.75		
Channel Number (ARFCN)	25-875		
Maximum Output Power Setting (dBm)	24.52		
Duty Cycle	1		
MEID	268435456102530125		
Maximum RF Conducted Power(Average)	AWS		
	CH25	CH450	CH875
	23.91dbm	24.52 dbm	24.06 dbm

5. Test Environment

Ambient Temperature	22.1° C
Relative Humidity	<60 %

6. System Specifications of DASY4

6.1 Measurement system Diagram for SPEAG Robotic

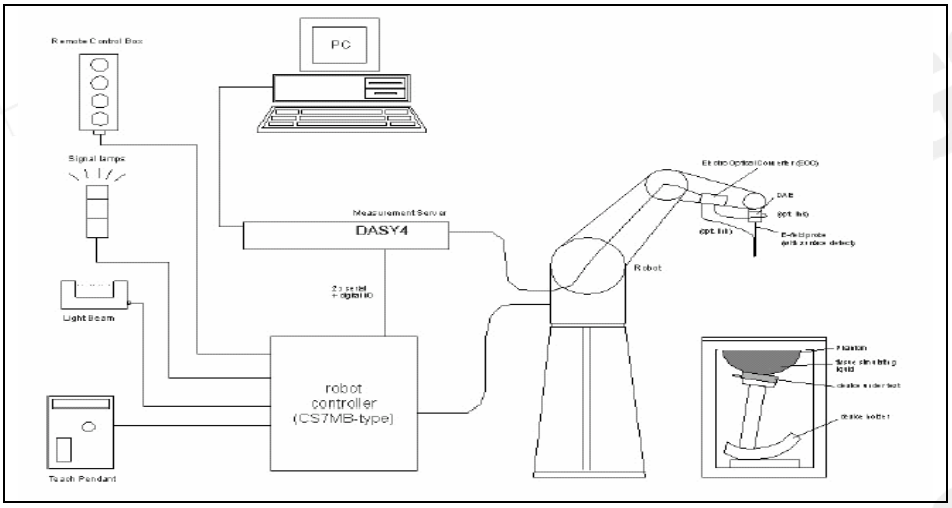


Fig 1. The SPEAG Robotic Diagram

The DASY4 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (Stabile RX family) with controller, teach pendant and software. An arm extension is for accommodating the data acquisition electronics (DAE).
- E and H Field probe.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 2000 or Windows XP.
- DASY4 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The Test Arch phantom.

- The device holder for handheld mobile phones.
- Validation dipole kits allowing to validate the proper functioning of the system.

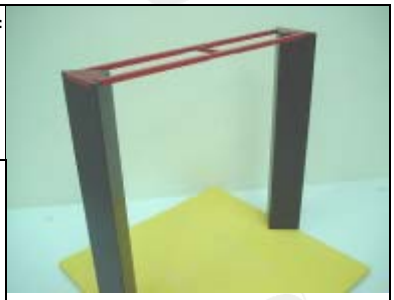
6.2 E and H Field Probe

Construction	One dipole parallel, two dipoles normal to probe axis Built-in shielding against static charges PEEK enclosure material	 ER3DV6 E-Field Probe
Calibration	In air from 100 MHz to 3.0 GHz (absolute accuracy ±6.0%, k=2)	
Frequency	100 MHz to > 6 GHz (extended to 20 MHz for MRI), 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	

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)	 H3DV6 H-Field Probe
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 the measured field

6.3 Test Arch

Description	Enables easy and well defined positioning of the phone and validation dipoles as well as simple teaching of the robot.	 Test Arch
Dimensions	length: 370 mm width: 370 mm height: 370 mm	

6.4 Phone Holder

Description	Supports accurate and reliable positioning of any phone Effect on near field <+/- 0.5 dB	 Phone Holder

7. Measurement Procedure

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

1. Proper operation of the field probe, probe measurement system, other instrumentation, and the positioning system was confirmed.
2. WD is positioned in its intended test position, acoustic output point of the device perpendicular to the field probe.

3. the WD 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 WD audio output was positioned tangent (as physically possible) to the measurement plane.
5. A surface calibration was performed before each setup change to ensure repeatable spacing and proper maintenance of the measurement plane using the HAC Phantom.
6. The measurement system measured the field strength at the reference location.
7. Measurements at 2mm increments in the 5 × 5 cm region were performed and recorded. A 360° rotation about the azimuth axis at the maximum interpolated position was measured. For the worst-case condition, the peak reading from this rotation was used in re-evaluating the HAC category.
8. The system performed a drift evaluation by measuring the field at the reference location.
9. Steps 1-8 were done for both the E and H-Field measurements.

8. System Verification

A dipole antenna meeting the requirements given in PC63.19 was placed in the position normally occupied by the WD.
The length of the dipole was scanned with both E-field and H-field probes and the maximum values for each were recorded.

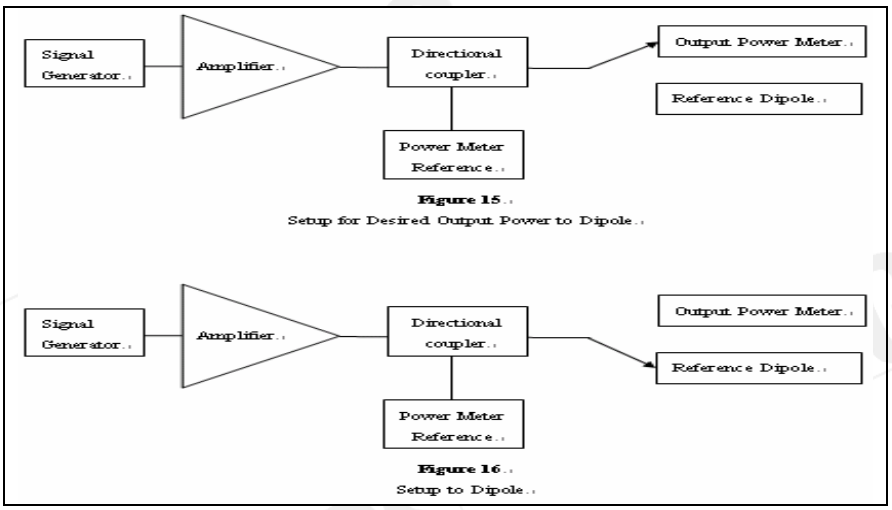


Figure 15
Setup for Desired Output Power to Dipole

Figure 16
Setup to Dipole

For E-Field Scan

Mode	Frequency (MHz)	Input Power(dBm)	Measured Value(V/m)	Target Value(V/m)	Measured Date
CW	1880	20	135.6	141.4	2008/06/27

For H-Field Scan

Mode	Frequency	Input Power	Measured Value(V/m)	Target Value(V/m)	Measured Date
CW	1880	20	0.460	0.464	2007/06/27

9. Probe Modulation Factor

The measurement setup for determination of the PMF is given in DASY4 manual section 28.2. The following points describe the installation, the measurement procedure and the evaluation.

1. Install the field probe in the DASY4 window setup.
2. Mount a validation dipole for the appropriate frequency band under the Test Arch. Move the probe manually to a point of high field strength for the specific field type. The probe may

be very close to the dipole and might even touch it. During the fine adjustment of the probe with a signal applied to the dipole, read the x, y and z channel amplitudes in a multimeter job. They should all show a similar amplitude.

3. For comparing the peak amplitudes of modulated and CW signal, the same spectrum analyzer settings are required. The signal path (and setup geometry) between spectrum analyzer and probe must not be changed during the evaluation of the PMF! Only signal type and amplitudes as well as DASY4 settings may be varied.

Spectrum analyzer settings:

• Center Frequency: nominal center frequency of channel
• Span: zero
• Resolution bandwidth >= emission bandwidth
• Video bandwidth = 20dB
• Detection: RMS detection
• Trigger: Video or IF trigger, adjusted to give a stable display of the transmission
• Sweep rate: Set to show a complete tranmission cycle
• Line max hold may be used temporarily to ease the peak reading.

4. Define a DASY4 document and set the procedure properties (frequency as above, modulation frequency and crest factor for the modulated signal) according to the measured signal. Define a multimeter job (continuous mode) for the field reading. The probe shall not move. A predefined document is available.

5. Define a DASY4 document with a procedure for the evaluation of the CW signal (frequency, modulation frequency = 0, crest factor = 1) with a multimeter job.

The HAC measurement procedure is as follows:

6. Prepare the evaluation sheet for the installed field probe, frequency and modulation type.

7. Modulated signal measurement: Connect the modulated signal using the appropriate frequency via the cable to the setup. Do not move the setup between the following measurements.

8. Run the multimeter job in the procedure with the corresponding modulation setting in continuous mode.

9. Adjust the signal amplitude to achieve the the desired field level display in the multimeter. (A number of levels over the full dynamic range of the probe in the desired range shall be set, including the values read during the WD scans.)

10. Read the total field for the modulated signal.

11. Read the peak envelope signal on the spectrum analyzer.

12. Repeat these readings for other amplitude settings.

13. Switch the signal source off and verify that the ambient and instrumentation noise level is at least 10dB lower (a factor of 3 in field).

14. CW measurement: Change the signal to CW at the same center frequency, without touching or moving dipole or probe in the setup.
15. Adjust the CW signal amplitude to a similar range of peak levels on the spectrum analyzer.
16. Run the multimeter in the CW procedure in continuous mode.
17. Read the multimeter total field display.
18. Read the signal on the spectrum analyzer.
19. Repeat these readings for other amplitude settings.
20. Select the correct type of predefined Excel calculation sheet and insert the readings into the appropriate measurement columns. Conversion from linear DASY readings to logarithmic will be automatically made. The diagrams contain fitting curves for the logarithmic quantities.
CW and E-field values will be fitted by linear trendlines, H-field values by quadratic.

10. Test Standards and Limits

The measurements were performed to ensure compliance to the ANSI PC63.19-2006 rd 3.12 standard,

Category	AWF (dB)	Limits for E-Field Emissions (V/m) > 960MHz	Limits for H-Field Emissions (A/m) > 960MHz
M1	0	199.5 - 354.8	0.6 - 1.07
M2	0	112.2 - 199.5	0.34 - 0.6
M3	0	63.1 - 112.2	0.19 - 0.34
M4	0	<63.1	<0.19
Category	AWF (dB)	Limits for E-Field Emissions (V/m) < 960MHz	Limits for H-Field Emissions (A/m) < 960 MHz
M1	0	631 - 1122	1.91 - 3.39
M2	0	354.8 - 631	1.07 - 1.91
M3	0	199.5 - 354.8	0.6 - 1.07
M4	0	<199.5	<0.6

11. Instruments List

Manufacturer	Device	Type	Serial number	Date of last calibration
Schmid & Partner Engineering AG	E-Field and H-Field Probe	ER3DV6 H3DV6	2306 6142	Apr.17.2008 Apr.21.2008
Schmid & Partner Engineering AG	1880 MHz System Validation Dipole In Air	CD1880V3	1044	Apr.10.2008
Schmid & Partner Engineering AG	Data acquisition Electronics	DAE4	547	Jan.24.2008
Schmid & Partner Engineering AG	Software	DASY 4 V4.7 Build 55	N/A	Calibration isn't necessary
Agilent	Dielectric Probe Kit	85070D	US01440168	Calibration isn't necessary
Agilent	Dual-directional coupler	778D	50313	Aug.21.2007
Agilent	RF Signal Generator	8648D	3847M00432	May.21.2008
Agilent	Power Sensor	8481H	MY41091361	May.20.2008
R&S	Radio Communication Test	CMU200	113508	Aug.24.2007
Schmid & Partner Engineering AG	Test Arch SD HAC	P01	1047	N/A
Agilent	Spectrum Analyzer	E4405B	MY45113250	Jun.03.2008

12. Summary of Results

E-Filed

E-Field Emission	Band	Channel	Modulation Factor	Conducted Power at BS (dBm)	Measured Drift(%)	Time Avg. Field (V/m)	RESULT	Excl Blocks per 4.3.1.2.2
CDMA	AWS	25	0.987	23.91	-0.026	62.7	M4	236
		450	0.987	24.52	-0.047	62.7	M4	236
		875	0.987	24.06	-0.062	57.5	M4	236

H-Filed

H-Field Emission	Band	Channel	Modulation Factor	Conducted Power at BS (dBm)	Measured Drift(%)	Time Avg. Field (A/m)	RESULT	Excl Blocks per 4.3.1.2.2
CDMA	AWS	25	0.975	23.91	-0.047	0.162	M4	124
		450	0.975	24.52	-0.047	0.174	M4	124
		875	0.975	24.06	-0.027	0.159	M4	124

13. Measurement Data

Date/Time: 2008/6/27 08:16:44

HAC_E_AWS Band_CH25

DUT: RM-375; MEID: 268435456102530125

Communication System: AWS; Frequency: 1711.25 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3
Phantom section: H Device Section

DASY4 Configuration:
- Probe: ER3DV6 - SN2306; ConvF(1, 1, 1); Calibrated: 2008/4/17
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn547; Calibrated: 2008/1/24
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

E Scan - ER3DV6 - measurement distance from the closest probe sensor part to the Device = 10mm / Hearing Aid Compatibility Test (101x101x1):

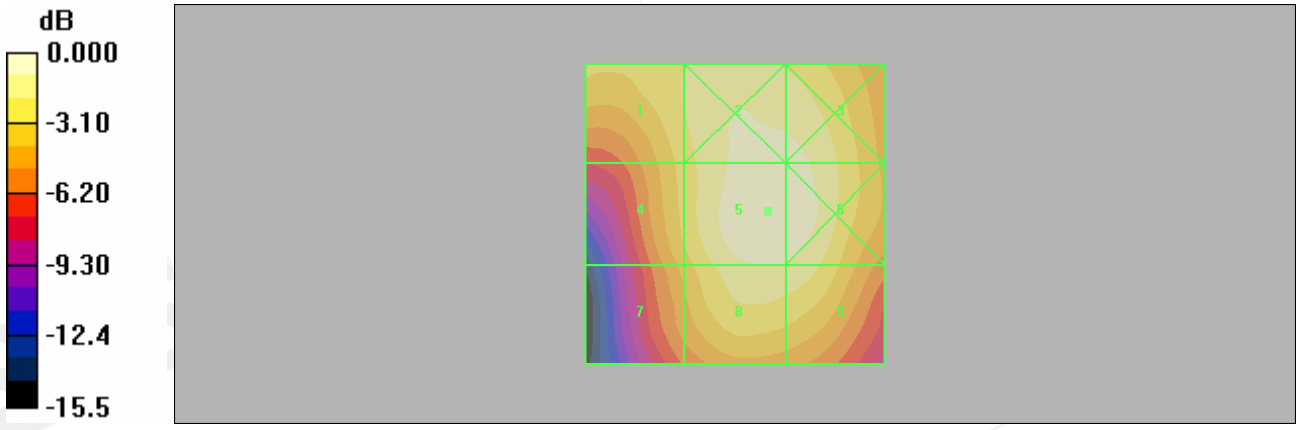
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 62.7 V/m
Probe Modulation Factor = 0.987
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 63.9 V/m; Power Drift = -0.026 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **49.9 M4**	Grid 2 **59.2 M4**	Grid 3 **58.6 M4**
Grid 4 **46.5 M4**	Grid 5 **62.7 M4**	Grid 6 **61.2 M4**
Grid 7 **41.2 M4**	Grid 8 **55.6 M4**	Grid 9 **55.2 M4**

Category	AWF (dB)	Limits for E-Field Emissions (V/m) > 960MHz	Limits for H-Field Emissions (A/m) > 960MHz
M1	0	199.5 - 354.8	0.6 - 1.07
	-5	149.6 - 266.1	0.45 - 0.8
M2	0	112.2 - 199.5	0.34 - 0.6
	-5	84.1 - 149.6	0.25 - 0.45
M3	0	63.1 - 112.2	0.19 - 0.34
	-5	47.3 - 84.1	0.14 - 0.25
M4	0	<63.1	<0.19
	-5	<47.3	<0.14

Category	AWF (dB)	Limits for E-Field Emissions (V/m) < 960MHz	Limits for H-Field Emissions (A/m) < 960 MHz
M1	0	631 - 1122	1.91 - 3.39
	-5	473.2 - 841.4	1.43 - 2.54
M2	0	354.8 - 631	1.07 - 1.91
	-5	266.1 - 473.2	0.8 - 1.43
M3	0	199.5 - 354.8	0.6 - 1.07
	-5	149.6 - 266.1	0.45 - 0.8
M4	0	<199.5	<0.6
	-5	<149.6	<0.45



0 dB = 62.7V/m

HAC_E_AWS Band_CH450

DUT: RM-375; MEID: 268435456102530125

Communication System: AWS; Frequency: 1732.5 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3
Phantom section: H Device Section

DASY4 Configuration:
- Probe: ER3DV6 - SN2306; ConvF(1, 1, 1); Calibrated: 2008/4/17
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn547; Calibrated: 2008/1/24
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

E Scan - ER3DV6 - measurement distance from the closest probe sensor part to the Device = 10mm / Hearing Aid Compatibility Test (101x101x1):

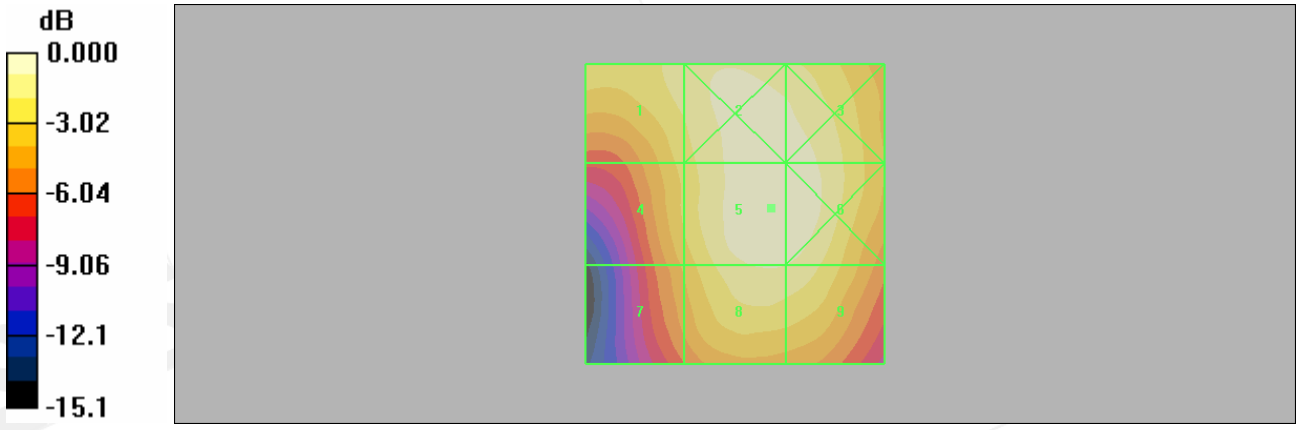
Measurement grid: dx=5mm, mm
Maximum value of peak Total field = 62.7 V/m
Probe Modulation Factor = 0.987
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 64.1 V/m; Power Drift = -0.047 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **52.6 M4**	Grid 2 **60.6 M4**	Grid 3 **59.9 M4**
Grid 4 **46.7 M4**	Grid 5 **62.7 M4**	Grid 6 **62.0 M4**
Grid 7 **40.7 M4**	Grid 8 **56.5 M4**	Grid 9 **55.9 M4**

Category	AWF (dB)	Limits for E-Field Emissions (V/m) > 960MHz	Limits for H-Field Emissions (A/m) > 960MHz
M1	0	199.5 - 354.8	0.6 - 1.07
	-5	149.6 - 266.1	0.45 - 0.8
M2	0	112.2 - 199.5	0.34 - 0.6
	-5	84.1 - 149.6	0.25 - 0.45
M3	0	63.1 - 112.2	0.19 - 0.34
	-5	47.3 - 84.1	0.14 - 0.25
M4	0	<63.1	<0.19
	-5	<47.3	<0.14

Category	AWF (dB)	Limits for E-Field Emissions (V/m) < 960MHz	Limits for H-Field Emissions (A/m) < 960 MHz
M1	0	631 - 1122	1.91 - 3.39
	-5	473.2 - 841.4	1.43 - 2.54
M2	0	354.8 - 631	1.07 - 1.91
	-5	266.1 - 473.2	0.8 - 1.43
M3	0	199.5 - 354.8	0.6 - 1.07
	-5	149.6 - 266.1	0.45 - 0.8
M4	0	<199.5	<0.6
	-5	<149.6	<0.45



0 dB = 62.7V/m

HAC_E_ AWS Band_CH875

DUT: RM-375; MEID: 268435456102530125

Communication System: AWS; Frequency: 1753.75 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3
Phantom section: H Device Section

DASY4 Configuration:
- Probe: ER3DV6 - SN2306; ConvF(1, 1, 1); Calibrated: 2008/4/17
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn547; Calibrated: 2008/1/24
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

E Scan - ER3DV6 - measurement distance from the closest probe sensor part to the Device = 10mm / Hearing Aid Compatibility Test (101x101x1):

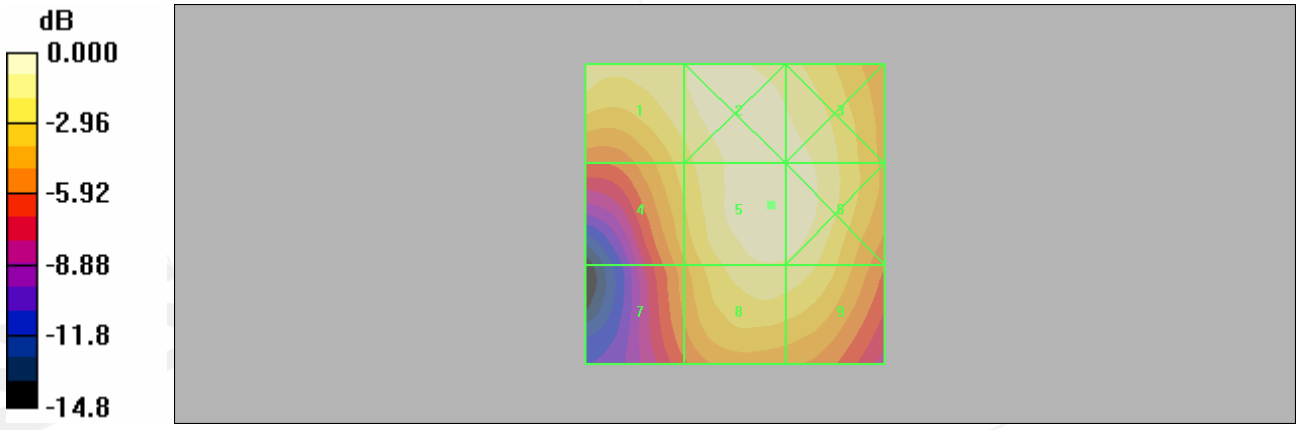
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 57.5 V/m
Probe Modulation Factor = 0.987
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 58.4 V/m; Power Drift = -0.062 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **51.0 M4**	Grid 2 **54.9 M4**	Grid 3 **54.4 M4**
Grid 4 **43.5 M4**	Grid 5 **57.5 M4**	Grid 6 **56.6 M4**
Grid 7 **35.6 M4**	Grid 8 **50.9 M4**	Grid 9 **50.3 M4**

Category	AWF (dB)	Limits for E-Field Emissions (V/m) > 960MHz	Limits for H-Field Emissions (A/m) > 960MHz
M1	0	199.5 - 354.8	0.6 - 1.07
	-5	149.6 - 266.1	0.45 - 0.8
M2	0	112.2 - 199.5	0.34 - 0.6
	-5	84.1 - 149.6	0.25 - 0.45
M3	0	63.1 - 112.2	0.19 - 0.34
	-5	47.3 - 84.1	0.14 - 0.25
M4	0	<63.1	<0.19
	-5	<47.3	<0.14

Category	AWF (dB)	Limits for E-Field Emissions (V/m) < 960MHz	Limits for H-Field Emissions (A/m) < 960 MHz
M1	0	631 - 1122	1.91 - 3.39
	-5	473.2 - 841.4	1.43 - 2.54
M2	0	354.8 - 631	1.07 - 1.91
	-5	266.1 - 473.2	0.8 - 1.43
M3	0	199.5 - 354.8	0.6 - 1.07
	-5	149.6 - 266.1	0.45 - 0.8
M4	0	<199.5	<0.6
	-5	<149.6	<0.45



0 dB = 57.5V/m

Date/Time: 2008/6/27 10:59:48

HAC_H_AWS Band_CH25

DUT: RM-375; MEID: 268435456102530125

Communication System: AWS; Frequency: 1711.25 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3
Phantom section: H Device Section

DASY4 Configuration:
- Probe: H3DV6 - SN6142; ; Calibrated: 2008/4/21
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn547; Calibrated: 2008/1/24
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

H Scan - H3DV6 - measurement distance from the closest probe sensor part to the Device = 10mm / Hearing Aid Compatibility Test (101x101x1):

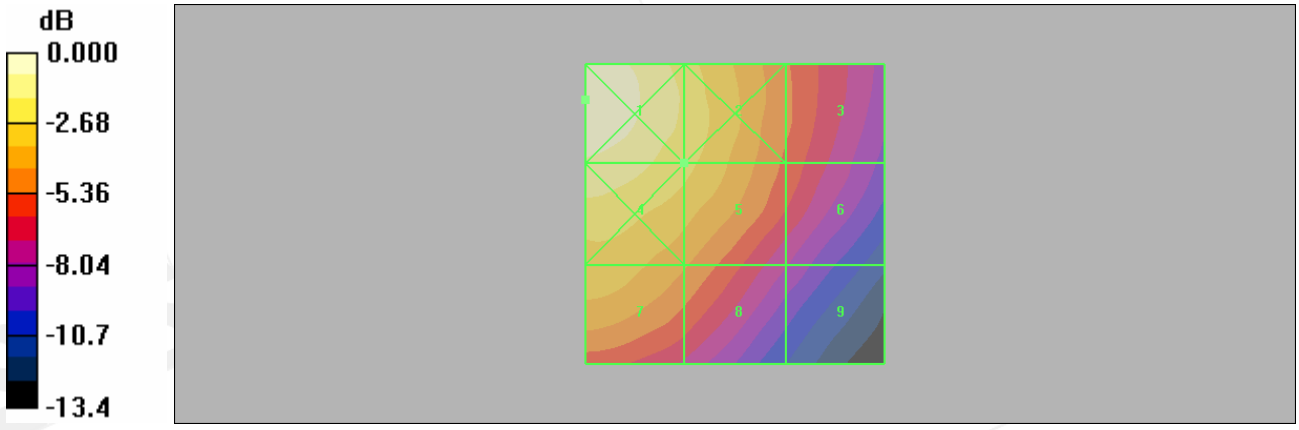
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.162 A/m
Probe Modulation Factor = 0.975
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.137 A/m; Power Drift = -0.047 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.215 M3**	Grid 2 **0.172 M4**	Grid 3 **0.119 M4**
Grid 4 **0.191 M3**	Grid 5 **0.162 M4**	Grid 6 **0.114 M4**
Grid 7 **0.152 M4**	Grid 8 **0.131 M4**	Grid 9 **0.086 M4**

Category	AWF (dB)	Limits for E-Field Emissions (V/m) > 960MHz	Limits for H-Field Emissions (A/m) > 960MHz
M1	0	199.5 - 354.8	0.6 - 1.07
	-5	149.6 - 266.1	0.45 - 0.8
M2	0	112.2 - 199.5	0.34 - 0.6
	-5	84.1 - 149.6	0.25 - 0.45
M3	0	63.1 - 112.2	0.19 - 0.34
	-5	47.3 - 84.1	0.14 - 0.25
M4	0	<63.1	<0.19
	-5	<47.3	<0.14

Category	AWF (dB)	Limits for E-Field Emissions (V/m) < 960MHz	Limits for H-Field Emissions (A/m) < 960 MHz
M1	0	631 - 1122	1.91 - 3.39
	-5	473.2 - 841.4	1.43 - 2.54
M2	0	354.8 - 631	1.07 - 1.91
	-5	266.1 - 473.2	0.8 - 1.43
M3	0	199.5 - 354.8	0.6 - 1.07
	-5	149.6 - 266.1	0.45 - 0.8
M4	0	<199.5	<0.6
	-5	<149.6	<0.45



0 dB = 0.215A/m

HAC_H_ AWS Band_CH450

DUT: RM-375; MEID: 268435456102530125

Communication System: AWS; Frequency: 1732.5 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3
Phantom section: H Device Section

DASY4 Configuration:
- Probe: H3DV6 - SN6142; ; Calibrated: 2008/4/21
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn547; Calibrated: 2008/1/24
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

H Scan - H3DV6 - measurement distance from the closest probe sensor part to the Device = 10mm / Hearing Aid Compatibility Test (101x101x1):

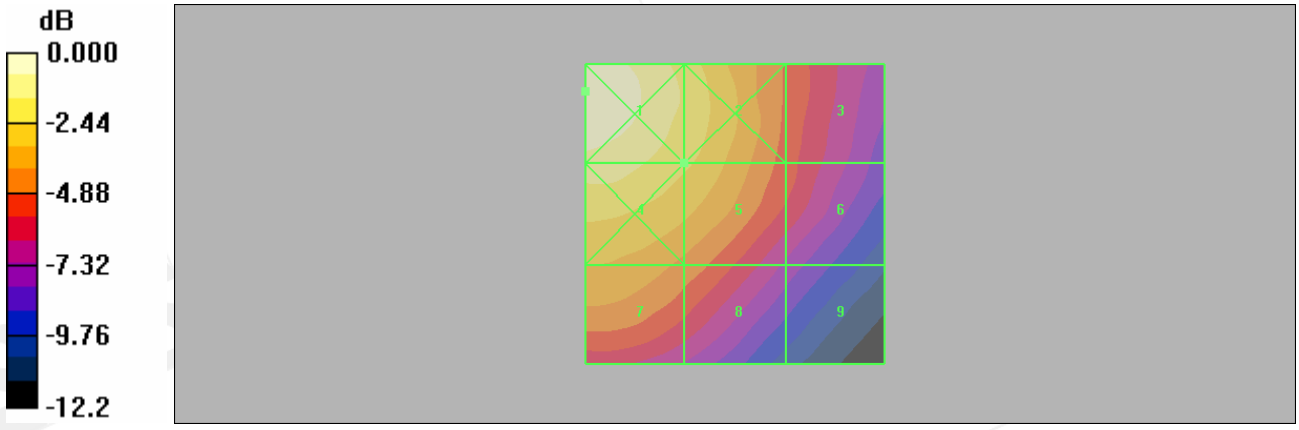
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.174 A/m
Probe Modulation Factor = 0.975
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.147 A/m; Power Drift = -0.047 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.226 M3**	Grid 2 **0.185 M4**	Grid 3 **0.128 M4**
Grid 4 **0.199 M3**	Grid 5 **0.174 M4**	Grid 6 **0.123 M4**
Grid 7 **0.156 M4**	Grid 8 **0.138 M4**	Grid 9 **0.095 M4**

Category	AWF (dB)	Limits for E-Field Emissions (V/m) > 960MHz	Limits for H-Field Emissions (A/m) > 960MHz
M1	0	199.5 - 354.8	0.6 - 1.07
	-5	149.6 - 266.1	0.45 - 0.8
M2	0	112.2 - 199.5	0.34 - 0.6
	-5	84.1 - 149.6	0.25 - 0.45
M3	0	63.1 - 112.2	0.19 - 0.34
	-5	47.3 - 84.1	0.14 - 0.25
M4	0	<63.1	<0.19
	-5	<47.3	<0.14

Category	AWF (dB)	Limits for E-Field Emissions (V/m) < 960MHz	Limits for H-Field Emissions (A/m) < 960 MHz
M1	0	631 - 1122	1.91 - 3.39
	-5	473.2 - 841.4	1.43 - 2.54
M2	0	354.8 - 631	1.07 - 1.91
	-5	266.1 - 473.2	0.8 - 1.43
M3	0	199.5 - 354.8	0.6 - 1.07
	-5	149.6 - 266.1	0.45 - 0.8
M4	0	<199.5	<0.6
	-5	<149.6	<0.45



0 dB = 0.226A/m

HAC_H_AWS Band_CH875

DUT: RM-375; MEID: 268435456102530125

Communication System: AWS; Frequency: 1753.75 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3
Phantom section: H Device Section

DASY4 Configuration:
- Probe: H3DV6 - SN6142; ; Calibrated: 2008/4/21
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn547; Calibrated: 2008/1/24
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

H Scan - H3DV6 - measurement distance from the closest probe sensor part to the Device = 10mm / Hearing Aid Compatibility Test (101x101x1):

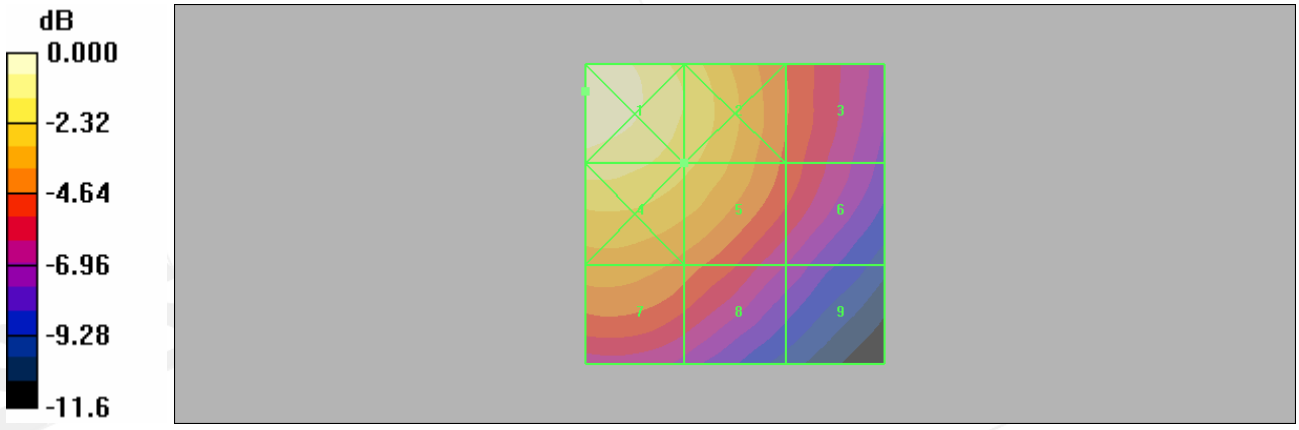
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.159 A/m
Probe Modulation Factor = 0.975
Device Reference Point: 0.000, 0.000, 353.7 mm
Reference Value = 0.138 A/m; Power Drift = -0.027 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.202 M3**	Grid 2 **0.169 M4**	Grid 3 **0.120 M4**
Grid 4 **0.178 M4**	Grid 5 **0.159 M4**	Grid 6 **0.116 M4**
Grid 7 **0.137 M4**	Grid 8 **0.125 M4**	Grid 9 **0.091 M4**

Category	AWF (dB)	Limits for E-Field Emissions (V/m) > 960MHz	Limits for H-Field Emissions (A/m) > 960MHz
M1	0	199.5 - 354.8	0.6 - 1.07
	-5	149.6 - 266.1	0.45 - 0.8
M2	0	112.2 - 199.5	0.34 - 0.6
	-5	84.1 - 149.6	0.25 - 0.45
M3	0	63.1 - 112.2	0.19 - 0.34
	-5	47.3 - 84.1	0.14 - 0.25
M4	0	<63.1	<0.19
	-5	<47.3	<0.14

Category	AWF (dB)	Limits for E-Field Emissions (V/m) < 960MHz	Limits for H-Field Emissions (A/m) < 960 MHz
M1	0	631 - 1122	1.91 - 3.39
	-5	473.2 - 841.4	1.43 - 2.54
M2	0	354.8 - 631	1.07 - 1.91
	-5	266.1 - 473.2	0.8 - 1.43
M3	0	199.5 - 354.8	0.6 - 1.07
	-5	149.6 - 266.1	0.45 - 0.8
M4	0	<199.5	<0.6
	-5	<149.6	<0.45



0 dB = 0.202A/m

14. SYSTEM Verification

Date/Time: 2008/6/27 07:21:02

HAC_E_Dipole_1880MHz

DUT: HAC-Dipole 1880MHz; Type: CD1880V3;

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

DASY4 Configuration:
- Probe: ER3DV6 - SN2306; ConvF(1, 1, 1); Calibrated: 2008/4/17
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn547; Calibrated: 2008/1/24
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

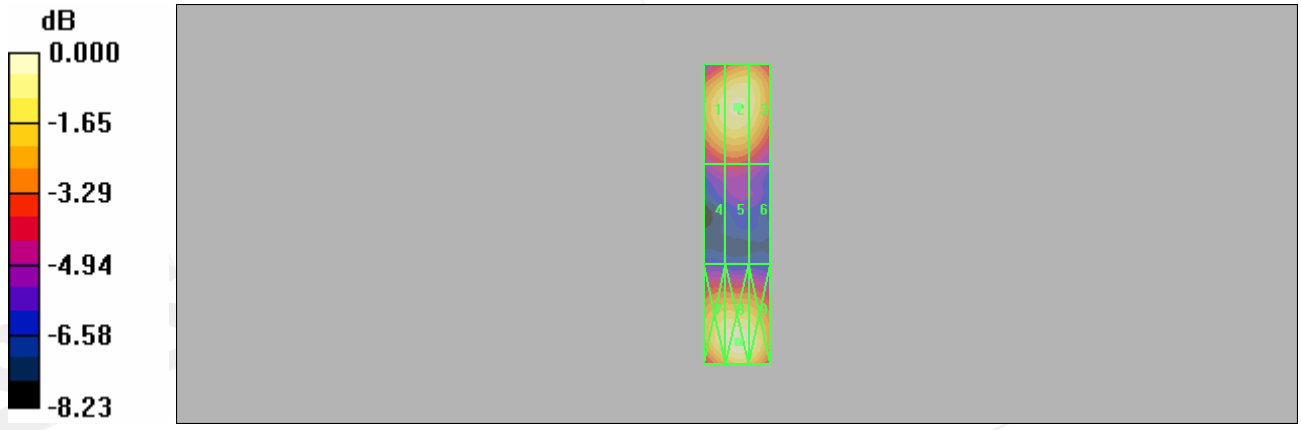
E Scan - ER probe center 10mm above CD1880 Dipole / Hearing Aid Compatibility Test (41x181x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 135.6 V/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 163.9 V/m; Power Drift = -0.046 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **132.3 M2**	Grid 2 **135.6 M2**	Grid 3 **132.4 M2**
Grid 4 **89.9 M3**	Grid 5 **91.6 M3**	Grid 6 **87.3 M3**
Grid 7 **136.5 M2**	Grid 8 **142.7 M2**	Grid 9 **138.7 M2**

Category	AWF (dB)	Limits for E-Field Emissions (V/m) > 960MHz	Limits for H-Field Emissions (A/m) > 960MHz
M1	0	199.5 - 354.8	0.6 - 1.07
	-5	149.6 - 266.1	0.45 - 0.8
M2	0	112.2 - 199.5	0.34 - 0.6
	-5	84.1 - 149.6	0.25 - 0.45
M3	0	63.1 - 112.2	0.19 - 0.34
	-5	47.3 - 84.1	0.14 - 0.25
M4	0	<63.1	<0.19
	-5	<47.3	<0.14

Category	AWF (dB)	Limits for E-Field Emissions (V/m) < 960MHz	Limits for H-Field Emissions (A/m) < 960 MHz
M1	0	631 - 1122	1.91 - 3.39
	-5	473.2 - 841.4	1.43 - 2.54
M2	0	354.8 - 631	1.07 - 1.91
	-5	266.1 - 473.2	0.8 - 1.43
M3	0	199.5 - 354.8	0.6 - 1.07
	-5	149.6 - 266.1	0.45 - 0.8
M4	0	<199.5	<0.6
	-5	<149.6	<0.45



0 dB = 142.7V/m

HAC_H_Dipole_1880MHz

DUT: HAC-Dipole 1880MHz; Type: CD1880V3;

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

DASY4 Configuration:
- Probe: H3DV6 - SN6142; ; Calibrated: 2008/4/21
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn547; Calibrated: 2008/1/24
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

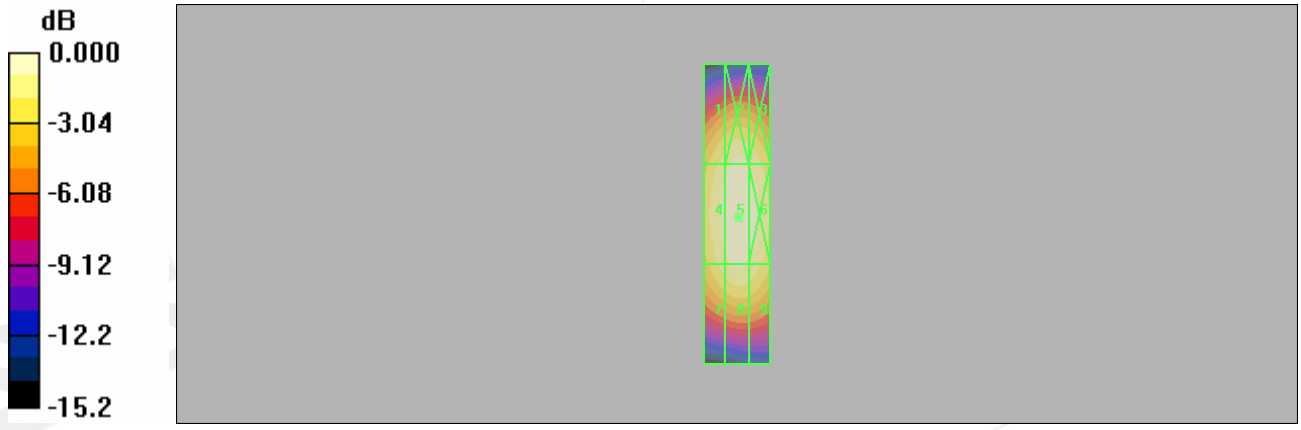
H Scan - H3DV6 probe center 10mm above CD1880 Dipole / Hearing Aid Compatibility Test (41x181x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.460 A/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 0.488 A/m; Power Drift = -0.025 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.394 M2**	Grid 2 **0.424 M2**	Grid 3 **0.409 M2**
Grid 4 **0.428 M2**	Grid 5 **0.460 M2**	Grid 6 **0.446 M2**
Grid 7 **0.391 M2**	Grid 8 **0.420 M2**	Grid 9 **0.406 M2**

Category	AWF (dB)	Limits for E-Field Emissions (V/m) > 960MHz	Limits for H-Field Emissions (A/m) > 960MHz
M1	0	199.5 - 354.8	0.6 - 1.07
	-5	149.6 - 266.1	0.45 - 0.8
M2	0	112.2 - 199.5	0.34 - 0.6
	-5	84.1 - 149.6	0.25 - 0.45
M3	0	63.1 - 112.2	0.19 - 0.34
	-5	47.3 - 84.1	0.14 - 0.25
M4	0	<63.1	<0.19
	-5	<47.3	<0.14

Category	AWF (dB)	Limits for E-Field Emissions (V/m) < 960MHz	Limits for H-Field Emissions (A/m) < 960 MHz
M1	0	631 - 1122	1.91 - 3.39
	-5	473.2 - 841.4	1.43 - 2.54
M2	0	354.8 - 631	1.07 - 1.91
	-5	266.1 - 473.2	0.8 - 1.43
M3	0	199.5 - 354.8	0.6 - 1.07
	-5	149.6 - 266.1	0.45 - 0.8
M4	0	<199.5	<0.6
	-5	<149.6	<0.45



0 dB = 0.460A/m

15. DAE & Probe Calibration certificate

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 (Auden)

Certificate No: DAE4-547_Jan08

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BA - SN: 547
Calibration procedure(s)	QA CAL-06.v12 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	January 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 (Calibrated by, Certificate No.)	Scheduled Calibration
Fluke Process Calibrator Type 702	SN: 6295803	04-Oct-07 (Elcal AG, No: 6467)	Oct-08
Keithley Multimeter Type 2001	SN: 0810278	03-Oct-07 (Elcal AG, No: 6465)	Oct-08
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Calibrator Box V1.1	SE UMS 006 AB 1004	25-Jun-07 (SPEAG, in house check)	In house check Jun-08

	Name	Function	Signature
Calibrated by:	Daniel Hess	Technician	
Approved by:	Fin Bomholt	R&D Director	

Issued: January 24, 2008

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

Certificate No: DAE4-547_Jan08 Page 1 of 5

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

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S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
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Accreditation No.: SCS 108

Client SGS (Auden)

Certificate No: ER3-2306_Apr08

CALIBRATION CERTIFICATE

Object	ER3DV6 - SN:2306
Calibration procedure(s)	QA CAL-02.v5 Calibration procedure for E-field probes optimized for close near field evaluations in air
Calibration date:	April 17, 2008
Condition of the calibrated item	In Tolerance

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41495277	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41498087	1-Apr-08 (No. 217-00788)	Apr-09
Reference 3 dB Attenuator	SN: S5054 (3c)	8-Aug-07 (No. 217-00719)	Aug-08
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-08 (No. 217-00787)	Apr-09
Reference 30 dB Attenuator	SN: S5129 (30b)	8-Aug-07 (No. 217-00720)	Aug-08
Reference Probe ES3DV2	SN: 3013	2-Jan-08 (No. ES3-3013_Jan08)	Jan-09
DAE4	SN: 654	20-Apr-07 (No. DAE4-654_Apr07)	Apr-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: April 17, 2008

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

Certificate No: ER3-2306_Apr08 Page 1 of 9

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Zeughausstrasse 43, 8004 Zurich, Switzerland

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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:2306

Manufactured:	December 17, 2002
Last calibrated:	April 20, 2007
Recalibrated:	April 17, 2008

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ER3DV6 SN:2306 April 17, 2008

DASY - Parameters of Probe: ER3DV6 SN:2306

Sensitivity in Free Space [μV/(V/m)²]		Diode Compression[A]	
NormX	1.08 ± 10.1 % (k=2)	DCP X	96 mV
NormY	1.11 ± 10.1 % (k=2)	DCP Y	96 mV
NormZ	1.26 ± 10.1 % (k=2)	DCP Z	100 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	-224 °

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%.

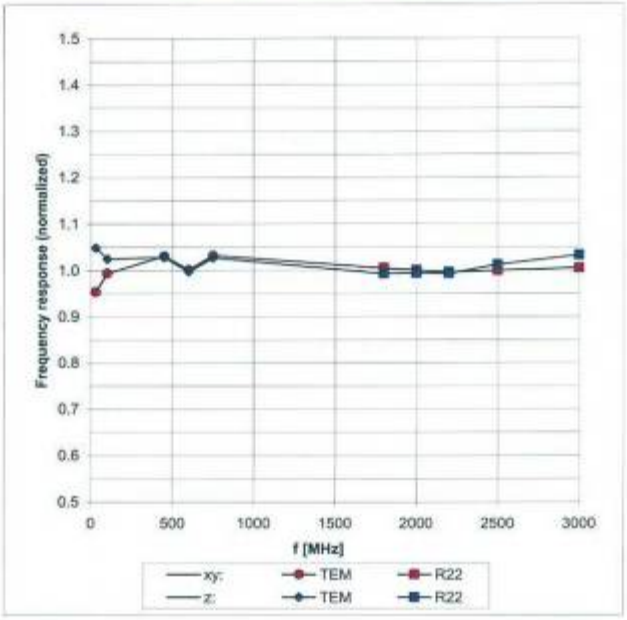
[A] numerical linearization parameter: uncertainty not required

Certificate No: ER3-2306_Apr08 Page 4 of 9

ER3DV6 SN:2306 April 17, 2008

Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide R22)

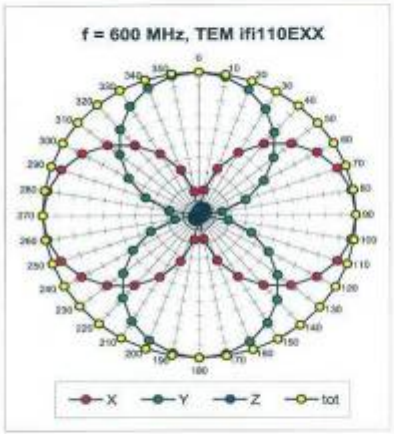


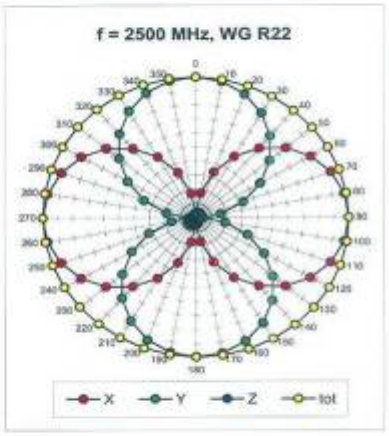
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

SGS Taiwan Ltd. 台灣檢驗科技股份有限公司
No.134, Wu Kung Road, Wuku Industrial Zone, Taipei County, Taiwan /台北縣五股工業區五工路 134 號
t (886-2) 2299-3279 f (886-2) 2298-0488 www.tw.sgs.com
Member of SGS Group

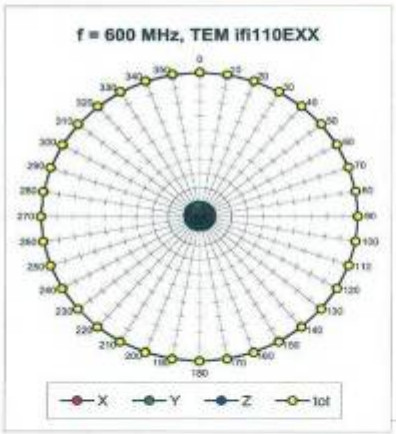
ER3DV6 SN:2306 April 17, 2008

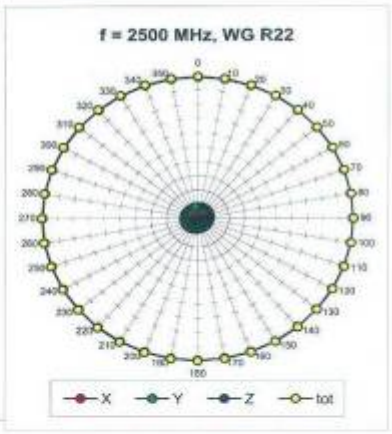
Receiving Pattern (ϕ), ϑ = 0°





Receiving Pattern (ϕ), ϑ = 90°

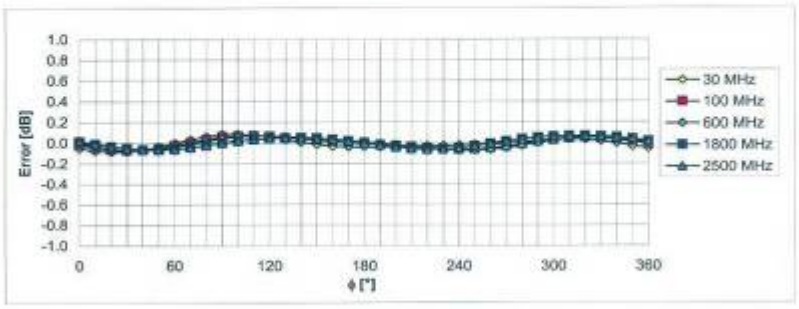




Certificate No: ER3-2306_Apr08 Page 6 of 9

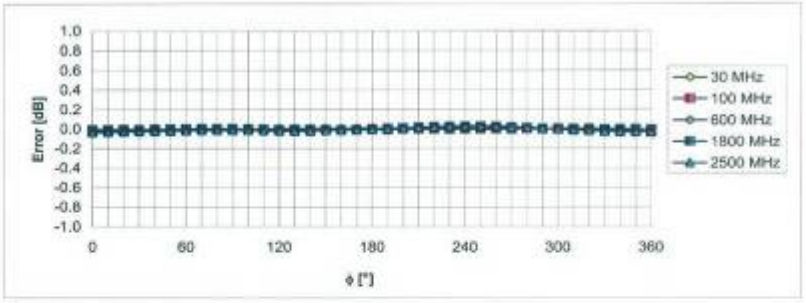
ER3DV6 SN:2306 April 17, 2008

Receiving Pattern (ϕ), ϑ = 0°



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

Receiving Pattern (ϕ), ϑ = 90°



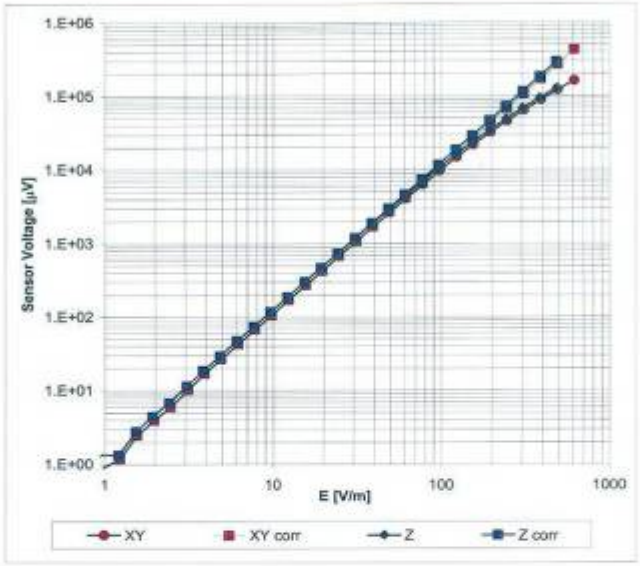
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

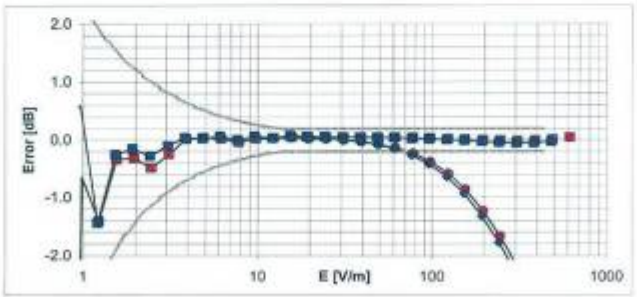
SGS Taiwan Ltd. 台灣檢驗科技股份有限公司 | No.134, Wu Kung Road, Wuku Industrial Zone, Taipei County, Taiwan /台北縣五股工業區五工路 134 號
t (886-2) 2299-3279 f (886-2) 2298-0488 www.tw.sgs.com
Member of SGS Group

ER3DV6 SN:2306 April 17, 2008

Dynamic Range f(E-field)

(Waveguide R22, f = 1800 MHz)





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

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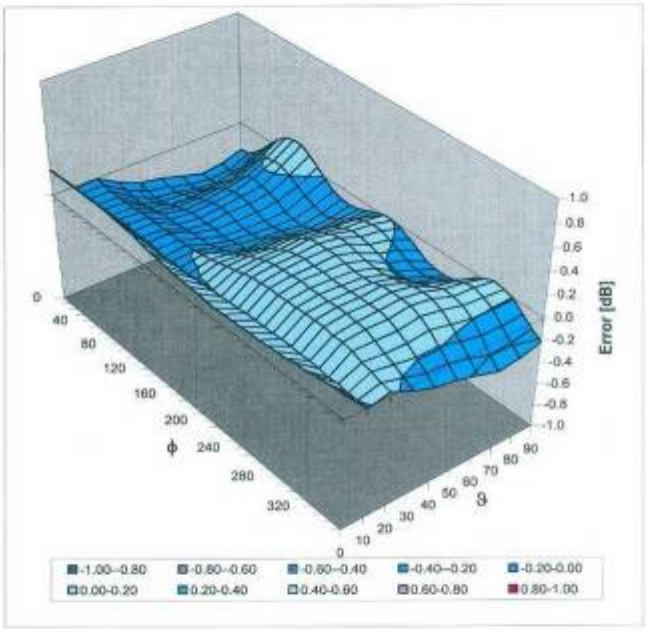
ER3DV6 SN:2306 April 17, 2008

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



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

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t (886-2) 2299-3279 f (886-2) 2298-0488 www.tw.sgs.com
Member of SGS Group

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 (Auden)

Certificate No: H3-6142_Apr08

CALIBRATION CERTIFICATE

Object	H3DV6 - SN:6142
Calibration procedure(s)	QA CAL-03.v5 Calibration procedure for H-field probes optimized for close near field evaluations in air
Calibration date:	April 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)	8-Aug-07 (No. 217-00719)	Aug-08
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-08 (No. 217-00787)	Apr-09
Reference 30 dB Attenuator	SN: S5129 (30b)	8-Aug-07 (No. 217-00720)	Aug-08
Reference Probe H3DV6	SN: 6182	2-Oct-07 (No. H3-6182_Oct07)	Oct-08
DAE4	SN: 660	3-Sep-07 (No. DAE4-660_Sep07)	Sep-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: April 21, 2008

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

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

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:

- *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:6142

Manufactured:	July 3, 2002
Last calibrated:	April 20, 2007
Recalibrated:	April 21, 2008

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

Probe H3DV6

SN:6142

Manufactured:	July 3, 2002
Last calibrated:	April 20, 2007
Recalibrated:	April 21, 2008

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

H3DV6 SN:6142 April 21, 2008

DASY - Parameters of Probe: H3DV6 SN:6142

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

	a0	a1	a2	
X	2.690E-03	-3.109E-5	-2.870E-5	± 5.1 % (k=2)
Y	2.661E-03	-5.442E-5	-6.570E-6	± 5.1 % (k=2)
Z	3.031E-03	-2.357E-4	1.583E-5	± 5.1 % (k=2)

Diode Compression[1]

DCP X	86 mV
DCP Y	86 mV
DCP Z	85 mV

Sensor Offset (Probe Tip to Sensor Center)

X	3.0 mm
Y	3.0 mm
Z	3.0 mm

Connector Angle -248 °

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

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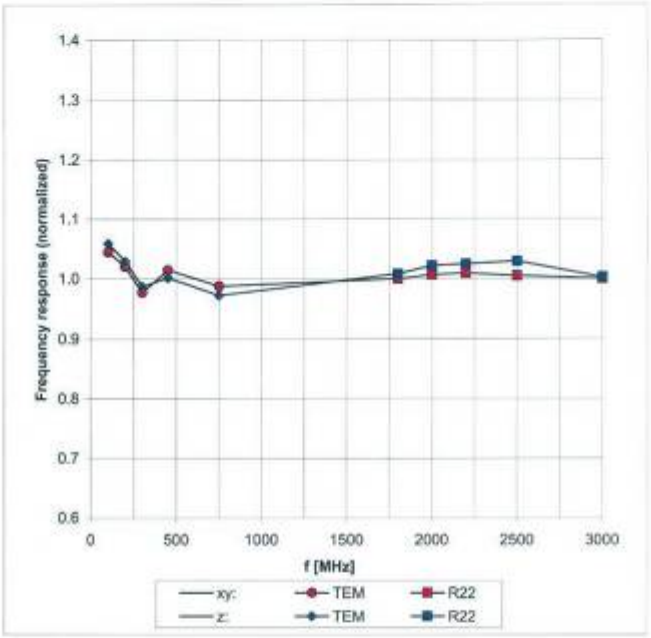
H3DV6 SN:6142 April 21, 2008

Frequency Response of H-Field

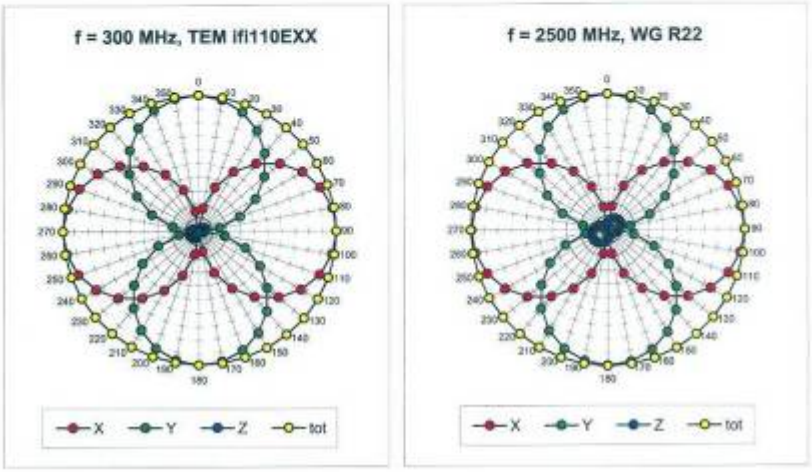
(TEM-Cell:ifi110, Waveguide R22)



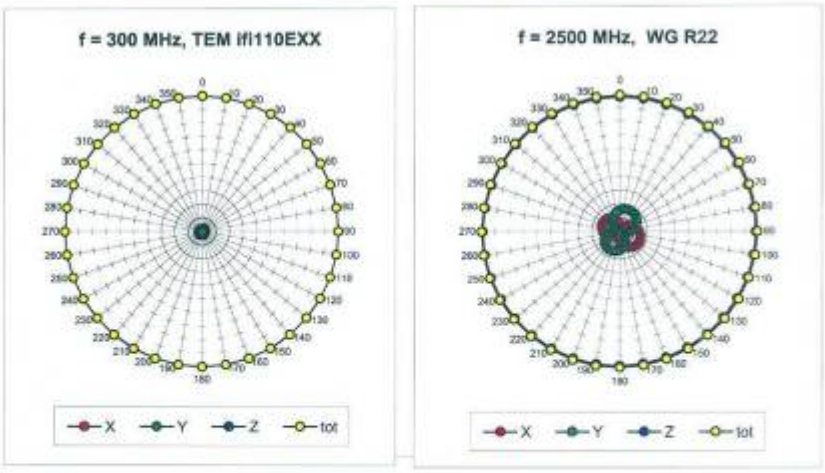
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

H3DV6 SN:6142 April 21, 2008

Receiving Pattern (ϕ), ϑ = 90°



Receiving Pattern (ϕ), ϑ = 0°



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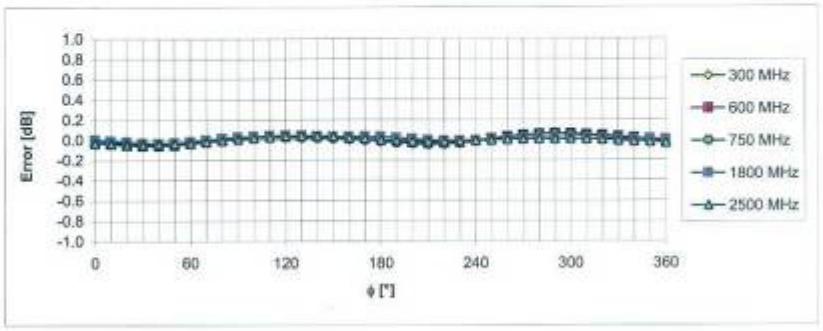
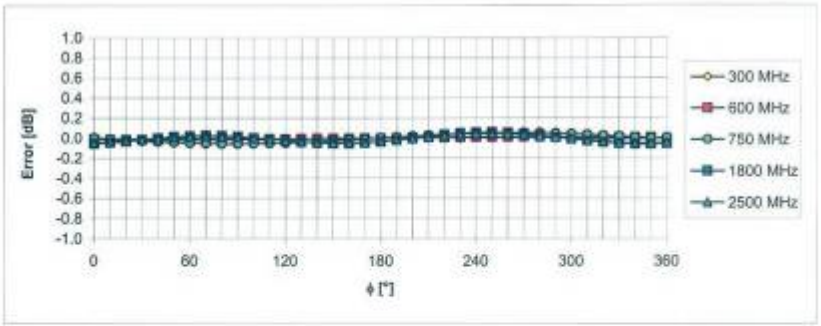
H3DV6 SN:6142 April 21, 2008

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)

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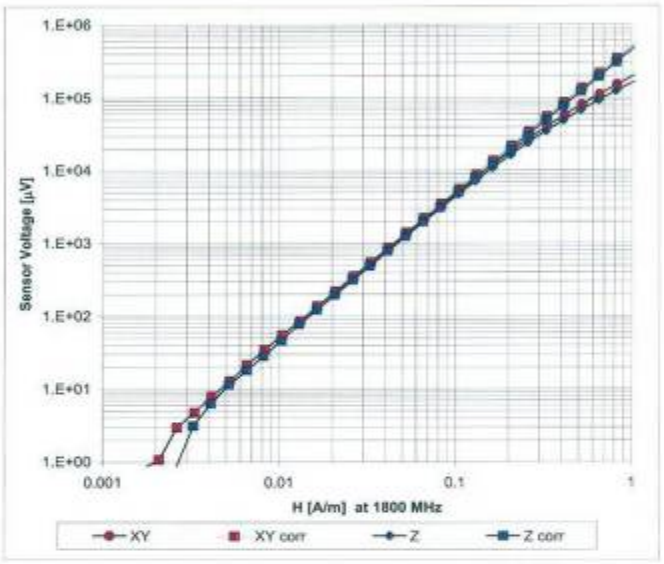
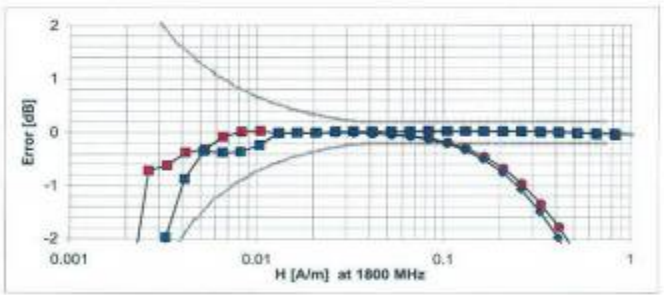
H3DV6 SN:6142 April 21, 2008

Dynamic Range f(H-field)

(Waveguide R22, f = 1800 MHz)





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

Certificate No: H3-6142_Apr08 Page 8 of 8

16. Uncertainty Analysis

HAC-Extension Setup Performance Test
Using SPEAG Calibration Dipoles

Error Description	Uncertainty value	Prob. Dist.	Div.	(c_i) E	(c_i) 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	$\sqrt{3}$	1	1	±2.7%	±2.7%
Sensor Displacement	±16.5%	R	$\sqrt{3}$	1	0.145	±9.5%	±1.4%
Boundary Effects	±2.4%	R	$\sqrt{3}$	1	1	±1.4%	±1.4%
Linearity	±4.7%	R	$\sqrt{3}$	1	1	±2.7%	±2.7%
Scaling to Peak Envelope Power	±0%	R	$\sqrt{3}$	1	1	±0%	±0%
System Detection Limit	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%
Readout Electronics	±0.3%	N	1	1	1	±0.3%	±0.3%
Respouse Time	±0%	R	$\sqrt{3}$	1	1	±0%	±0%
Integration Time	±0%	R	$\sqrt{3}$	1	1	±0%	±0%
RF Ambient Conditions	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%
RF Reflections	±6.0%	R	$\sqrt{3}$	1	1	±3.5%	±3.5%
Probe Positioner	±1.2%	R	$\sqrt{3}$	1	0.67	±0.7%	±0.5%
Probe Positioning	±4.7%	R	$\sqrt{3}$	1	0.67	±2.7%	±1.8%
Extrap. and Interpolation	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%
Dipole Related							
Distance Dipole – Scanning Plane	±5.2%	R	$\sqrt{3}$	1	0.3	±3.0%	±0.9%
Input power	±4.7%	N	1	1	1	±4.7%	±4.7%
Combined Std. Uncertainty						±13.7%	±9.3%
Expanded Std. Uncertainty on Power						27.4%	18.6%
Expanded Std. Uncertainty on Field						±13.7%	±9.3%

Table 28.1: Uncertainty budget for HAC setup performance test. The budget is valid for the frequency range 800 MHz - 3 GHz and represents a worst-case analysis with respect to power uncertainty of the field. Some of the parameters are dependent on the user situations and need adjustment according to the actual laboratory conditions.

17. System Validation from Original equipment supplier

3.3.2 DASY4 E-Field Result

Date/Time: 10.04.2008 12:31:18

Test Laboratory: SPEAG Lab 2

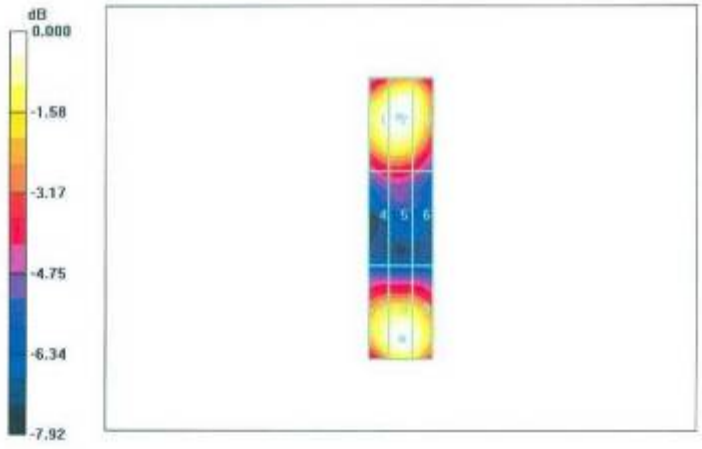
E_CD1880_1044_080410
DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1044
Communication System: CW; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3
Phantom section: E Dipole Section
Measurement Standard: DASY4 (High Precision Assessment)
DASY4 Configuration:

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

E Scan - Sensor Center 10mm above CD1880V3 Dipole/Hearing Aid Compatibility Test (41x181x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 141.4 V/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 160.0 V/m; Power Drift = 0.013 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **136.8 M2**	Grid 2 **139.9 M2**	Grid 3 **134.0 M2**
Grid 4 **91.9 M3**	Grid 5 **93.3 M3**	Grid 6 **87.9 M3**
Grid 7 **134.9 M2**	Grid 8 **141.4 M2**	Grid 9 **137.4 M2**



0 dB = 141.4V/m

Certificate No: CD1880V3-1044_Apr08 Page 6 of 6

3.3.2 DASY4 H-Field Result

Date/Time: 09.04.2008 15:00:21

Test Laboratory: SPEAG Lab 2

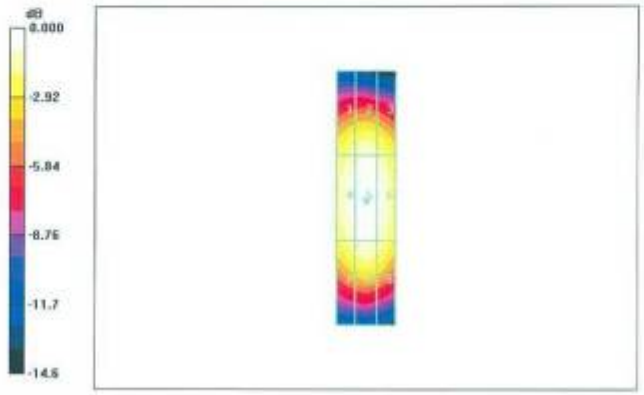
H_CD1880_1044_080409
DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1044
Communication System: CW; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3
Phantom section: H Dipole Section
Measurement Standard: DASY4 (High Precision Assessment)
DASY4 Configuration:

- Probe: H3DV6 - SN6065; ; Calibrated: 31.12.2007
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 02.10.2007
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY4, V4.7 Build 65; Postprocessing SW: SEMCAD, V1.8 Build 176

E Scan - Sensor Center 10mm above CD1880V3 Dipole/Hearing Aid Compatibility Test (41x181x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.464 A/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 0.492 A/m; Power Drift = -0.003 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.402 M2**	Grid 2 **0.420 M2**	Grid 3 **0.398 M2**
Grid 4 **0.444 M2**	Grid 5 **0.464 M2**	Grid 6 **0.442 M2**
Grid 7 **0.406 M2**	Grid 8 **0.430 M2**	Grid 9 **0.409 M2**



0 dB = 0.464A/m