HAC (RF Emission) TEST REPORT

Summary Result: M-Rating Category = M4

REPORT NO.: HC110705C18C

MODEL NO.: PH98100

FCC ID: NM8PH98100

RECEIVED: Aug. 23, 2011

TESTED: Sep. 07, 2011

ISSUED: Sep. 19, 2011

APPLICANT: HTC Corporation

ADDRESS: 23, Xinghua Rd., Taoyuan 330, Taiwan, R.O.C.

ISSUED BY: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

LAB ADDRESS: No. 47, 14th Ling, Chia Pau Tsuen, Lin Kou Hsiang, Taipei Hsien 244, Taiwan, R.O.C.

TEST LOCATION: No. 19, Hwa Ya 2nd Rd, Wen Hwa Tsuen, Kwei Shan Hsiang, Taoyuan Hsien 333, Taiwan, R.O.C.

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
Original release	NA	Sep. 19, 2011

1. CERTIFICATION

PRODUCT: Smartphone
MODEL NO.: PH98100
FCC ID: NM8PH98100
BRAND: HTC
APPLICANT: HTC Corporation
TESTED: Sep. 07, 2011
STANDARDS: FCC Part 20.19
ANSI C63.19 2007
TEST ITEM: RF emissions

This report is issued as a supplementary report of **HC110705C18** for a new inductive cover. This report shall be used combining with its original report. The above equipment have been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's characteristics under the conditions specified in this report.

PREPARED BY : Ivonne Wu , **DATE:** Sep. 19, 2011
Ivonne Wu / Senior Specialist

APPROVED BY : Gary Chang , **DATE:** Sep. 19, 2011
Gary Chang / Technical Manager

Note: Only the test mode of worst case according to the original report was performed for this addendum. Other testing data refers to original report.

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Smartphone
MODEL NO.	PH98100
FCC ID	NM8PH98100
CLASSIFICATION	Production Unit
MODULATION TYPE	QPSK, OQPSK, HPSK
FREQUENCY RANGE	824.7MHz ~ 848.31MHz; 1851.25MHz ~ 1908.75MHz
CHANNEL FREQUENCIES UNDER TEST AND ITS CONDUCTED OUTPUT POWER	Refer to note as below
HAC RATE CATEGORY	M4
ANTENNA TYPE	Fixed internal antenna with -1dBi gain
I/O PORTS	Refer to user's manual
DATA CABLE	Refer to note as below
ACCESSORY DEVICES	Refer to note as below

Air Interfaces/Bands List						
Air Interface	**Band**	**Type**	**C63.19 Tested**	**Simultaneous Transmissions**	**Reduced Power**	**VOIP**
CDMA 1xRTT	850	Voice	Yes	EVDO+WLAN+BT LTE+WLAN+BT	N/A	N/A
	1900	Voice	Yes	EVDO+WLAN+BT LTE+WLAN+BT	N/A	N/A
CDMA 1xEVDO	850	Data	N/A	1xRTT+WLAN+BT	N/A	Yes
	1900	Data	N/A	1xRTT+WLAN+BT	N/A	Yes
LTE	750	Data	N/A	1xRTT+WLAN+BT	N/A	Yes
WLAN	2450, 5G	Data	N/A	1xRTT EVDO LTE	N/A	Yes
BT	2450	Data	N/A	1xRTT EVDO LTE	N/A	N/A

Note: The HAC rating was evaluated for voice mode only.

NOTE:

1. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.
2. This is a supplementary report of HC110705C18. This report shall be combined together with its original report.
3. This report is prepared for FCC class II permissive change. Difference compared with the original report is adding inductive cover (Part Number: BR C700). Therefore, only the testing was performed for this addendum according to original worst case mode.

2.2 DESCRIPTIONOF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.
1	Universal Radio Communication Tester	R&S	CMU200	101095

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	NA

NOTE: All power cords of the above support units are non shielded (1.8m).

2.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

According to the specifications of the manufacturer, this product must comply with the requirements of the following standards:

FCC Part 20.19

ANSI C63.19 – 2007

All test items have been performed and recorded as per the above standards.

3. GENERAL INFORMATION OF THE DASY5 SYSTEM

3.1. GENERAL INFORMATION OF TEST EQUIPMENT

DASY5 (Software 52 Build 52.6) consists of high precision robot, probe alignment sensor, phantom, robot controller, controlled measurement server and near-field probe. The robot includes six axes that can move to the precision position of the DASY5 software defined. The DASY5 software can define the area that is detected by the probe. The robot is connected to controlled box. Controlled measurement server is connected to the controlled robot box. The DAE includes amplifier, signal multiplexing, AD converter, offset measurement and surface detection. It is connected to the Electro-optical coupler (ECO). The ECO performs the conversion form the optical into digital electric signal of the DAE and transfers data to the PC.

ER3DV6 E-FIELD PROBE

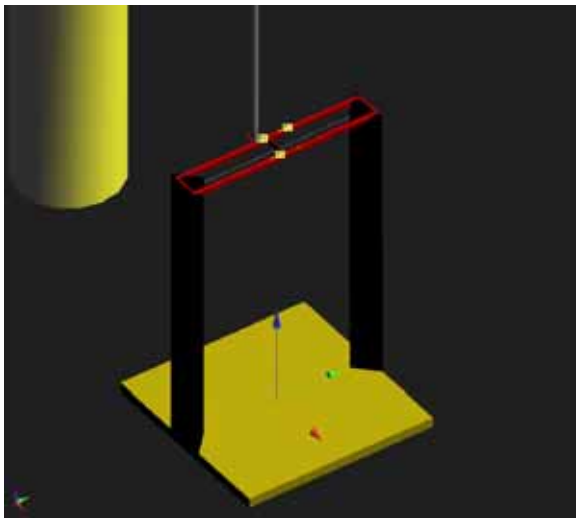
CONSTRUCTION	One dipole parallel, two dipoles normal to probe axis Built-in shielding against static charges
CALIBRATION	In air from 100MHz to 3.0GHz (absolute accuracy ± 6.0%, k = 2)
FREQUENCY	100MHz to > 6GHz; Linearity: ± 0.2dB (100MHz to 3GHz)
DIRECTIVITY	± 0.2dB in air (rotation around probe axis) ± 0.4dB in air (rotation normal to probe axis)
DYNAMIC RANGE	2V/m to > 1000V/m (M3 or better device readings fall well below diode compression point) Linearity: ± 0.2dB
DIMENSIONS	Overall length: 330mm (Tip: 16mm) Tip diameter: 8mm (Body: 12mm) Distance from probe tip to dipole centers: 2.5mm

H3DV6 H-FIELD PROBE

CONSTRUCTION	Three concentric loop sensors with 3.8mm loop diameters Resistively loaded detector diodes for linear response Built-in shielding against static charges
FREQUENCY	200MHz to 3GHz (absolute accuracy ± 6.0%, k = 2); Output linearized
DIRECTIVITY	± 0.25dB (spherical isotropy error)
DYNAMIC RANGE	10mA/m to 2A/m at 1GHz (M3 or better device readings fall well below diode compression point)
DIMENSIONS	Overall length: 330mm (Tip: 40mm) Tip diameter: 6mm (Body: 12mm) Distance from probe tip to dipole centers: 3mm
E-FIELD INTERFERENCE	< 10% at 3GHz (for plane wave)

NOTE: The Probe parameters have been calibrated by the SPEAG. Please reference APPENDIX B for the Calibration Certification Report.

HAC ARCH



DIMENSIONS 370 x 370 x 370mm

SYSTEM VALIDATION KITS:

CD835V3

Frequency Band: 800 ~ 960MHz (free space)
Return Loss: > 15dB
Calibrated at: 835MHz
Power Capability: 50W continuous
Length & Height: 166 x 330mm

CD1880V3

Frequency Band: 1710 ~ 2000MHz (free space)
Return Loss: > 18dB
Calibrated at: 1880MHz
Power Capability: 50W continuous
Length & Height: 80.8 x 330mm

DEVICE HOLDER

CONSTRUCTION Supports accurate and reliable positioning of any phone effect on near field <+/- 0.5dB

DATA ACQUISITION ELECTRONICS (DAE)

CONSTRUCTION The data acquisition electronics (DAE3) consists of a highly sensitive electrometer grade preamplifier with auto-zeroing, a channel and gain-switching multiplex, a fast 16 bit AD converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock. The mechanical probe is mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of the DAE3 box is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80dB.

3.2. TEST EQUIPMENT LIST

ITEM	NAME	BRAND	TYPE	SERIES NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
1	HAC ARCH	S & P	SD HAC P01 BA	1034	NA	NA
2	Signal Generator	Agilent	E8257C	MY43320668	Dec. 27, 2010	Dec. 26, 2011
3	E-Field Probe	Speag	ER3DV6	2293	Jan. 24, 2011	Jan. 23, 2012
4	H-Field Probe	Speag	H3DV6	6124	Jan. 14, 2011	Jan. 13, 2012
5	DAE	S & P	DAE 3	579	Sep. 20, 2010	Sep. 19, 2011
6	Robot Positioner	Staubli Unimation	NA	NA	NA	NA
7	Validation Dipole	S & P	CD835V3	1041	Mar. 15, 2011	Mar. 14, 2012
8	Validation Dipole	S & P	CD1880V3	1032	Apr. 12, 2011	Apr. 11, 2012

NOTE: Before starting the measurement, all test equipment shall be warmed up for 30min.

3.3. MEASUREMENT UNCERTAINTY

HAC UNCERTAINTY BUDGET ACCORDING TO ANSI C63.19[1]							
ERROR DESCRIPTION	**UNCERTAINTY VALUE**	**PROBABILITY DISTRIBUTION**	**DIVISOR**	**(Ci) E**	**(Ci) H**	**STD. UNC. E (%)**	**STD. UNC. H (%)**
MEASUREMENT SYSTEM							
Probe calibration	5.1	Normal	1	1	1	5.1	5.1
Axial isotropy	0.5	Rectangular	√3	1	1	0.3	0.3
Sensor Displacement	16.5	Rectangular	√3	1	0.145	9.5	1.4
Boundary Effects	2.4	Rectangular	√3	1	1	1.4	1.4
Linearity	0.6	Rectangular	√3	1	1	0.3	0.3
Scaling to Peak Envelope Power	2.0	Rectangular	√3	1	1	1.2	1.2
System Detection Limit	1.0	Rectangular	√3	1	1	0.6	0.6
Readout Electronics	0.3	Rectangular	√3	1	1	0.2	0.2
Response Time	0.8	Rectangular	√3	1	1	0.5	0.5
Integration Time	2.6	Rectangular	√3	1	1	1.5	1.5
RF Ambient Condition	3.0	Rectangular	√3	1	1	1.7	1.7
RF Reflections	12.0	Rectangular	√3	1	1	6.9	6.9
Probe Positioner	1.2	Rectangular	√3	1	0.67	0.7	0.5
Probe Positioning	4.7	Rectangular	√3	1	0.67	2.7	1.8
Extrap. And Interpolation	1.0	Rectangular	√3	1	1	0.6	0.6
TEST SAMPLE RELATED							
Device Positioning Vertical	2.6	Normal	1	1	1	2.6	2.6
Device Positioning Lateral	2.6	Normal	1	1	1	2.6	2.6
Device Holder and Phantom	2.4	Rectangular	√3	1	1	1.4	1.4
Power Drift	5.0	Rectangular	√3	1	1	2.9	2.9
PHANTOM AND SETUP RELATED							
Phantom Thickness	2.4	Rectangular	√3	1	0.67	1.4	0.9
COMBINED STD. UNCERTAINTY						14.4	10.7
EXPANDED STD. UNCERTAINTY ON POWER						28.8	21.3
EXPANDED STD. UNCERTAINTY ON FIELD						14.4	10.7

NOTE: Worst-case uncertainty budget for HAC free field assessment according to ANSI C63.19 [1]. The budget is valid for the frequency range 800MHz ~ 3GHz and represents a worst-case analysis. For specific tests and configurations, the uncertainty could be considerably smaller.

3.4. GENERAL DESCRIPTION OF THE HAC EVALUATION

The DASY5 post-processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the micro-volt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	- Sensitivity	$Norm_i$, a_{i0}, a_{i1}, a_{i2}
	- Conversion factor	$ConvF_i$
	- Diode compression point	dcp_i
Device parameters:	- Frequency	F
	- Crest factor	Cf

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \bullet \frac{cf}{dcp_i}$$

V_i	= compensated signal of channel i	(i = x, y, z)
U_i	= input signal of channel I	(i = x, y, z)
Cf	= crest factor of exciting field	(DASY parameter)
dcp_i	= diode compression point	(DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

$$\textbf{\textit{E-field probes:}}\quad E_i = \sqrt{\frac{V_1}{Norm_i \cdot ConvF}}$$

$$\textbf{\textit{H-field probes:}}\quad H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1} f + a_{i2} f^2}{f}$$

V_i = compensated signal of channel I (i = x, y, z)

$Norm_i$ = sensor sensitivity of channel i μV/(V/m)2 for E-field Probes (i = x, y, z)

ConvF = sensitivity enhancement in solution

a_{ij} = sensor sensitivity factors for H-field probes

F = carrier frequency [GHz]

E_i = electric field strength of channel i in V/m

H_i = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

E = field strength in V/m

E_{tot} = total field strength in V/m

NOTE: The signal response time is evaluated as the time required by the system to reach 90% of the expected final value after an on/off switch of the power source with an integration time of 500ms and a probe response time of < 5ms. In the current implementation, DASY5 waits longer than 100ms after having reached the grid point before starting a measurement, i.e., the response time uncertainty is negligible.

4. PERFORMANCE CATEGORIES

The ANSI Standard presents 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.

CATEGORY NEAR FIELD	TELEPHONE RF PARAMETERS < 960MHz				
	AWF	E-FIELD EMISSION CW (dBV/m)	E-FIELD EMISSION CW (V/m)	H-FIELD EMISSION CW (dBA/m)	H-FIELD EMISSION CW (A/m)
M1	0	56.0 to 61.0	631.0 to 1122.0	5.6 to 10.6	1.91 to 3.39
	-5	53.5 to 58.5	473.2 to 841.4	3.1 to 8.1	1.43 to 2.54
M2	0	51.0 to 56.0	354.8 to 631.0	0.6 to 5.6	1.07 to 1.91
	-5	48.5 to 53.5	266.1 to 473.2	-1.9 to 3.1	0.80 to 1.43
M3	0	46.0 to 51.0	199.5 to 354.8	-4.4 to 0.6	0.60 to 1.07
	-5	43.5 to 48.5	149.6 to 266.1	-6.9 to -1.9	0.45 to 0.80
M4	0	< 46.0	< 199.5	< -4.4	< 0.60
	-5	< 43.5	< 149.6	< -6.9	< 0.45

CATEGORY NEAR FIELD	TELEPHONE RF PARAMETERS > 960MHz				
	AWF	E-FIELD EMISSION CW (dBV/m)	E-FIELD EMISSION CW (V/m)	H-FIELD EMISSION CW (dBA/m)	H-FIELD EMISSION CW (A/m)
M1	0	46.0 to 51.0	199.5 to 354.8	-4.4 to 0.6	0.60 to 1.07
	-5	43.5 to 48.5	149.6 to 266.1	-6.9 to -1.9	0.45 to 0.80
M2	0	41.0 to 46.0	112.2 to 199.5	-9.4 to -4.4	0.34 to 0.60
	-5	48.5 to 53.5	84.1 to 149.6	-11.9 to -6.9	0.25 to 0.45
M3	0	36.0 to 41.0	63.1 to 112.2	-14.4 to -9.4	0.19 to 0.34
	-5	33.5 to 38.5	47.3 to 84.1	-16.9 to -11.9	0.14 to 0.25
M4	0	< 36.0	< 63.1	< -14.4	< 0.19
	-5	< 33.5	< 47.3	< -16.9	< 0.14

ARTICULATION WEIGHING FACTOR (AWF)

The following AWF factors shall be used for the standard transmission protocols:

STANDARD	TECHNOLOGY	AWF (dB)
TIA/EIA/IS-2000	CDMA	0
TIA/EIA-136	TDMA (50Hz)	0
iDENTM	TDMA (22 and 11Hz)	0
J-STD-007	GSM (217)	-5
T1/T1P1/3GPP	UMTS (WCDMA)	0

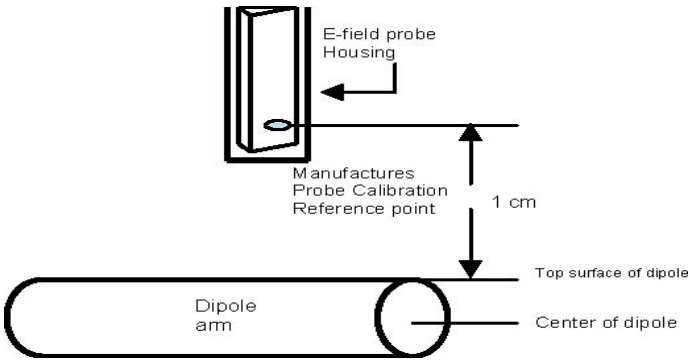
5. SYSTEM CHECK

The measured values (E-field and H-field) were compared with the values provided by the probe manufacturer and must within the allowed tolerance of **25%**.

5.1. VALIDATION STRUCTURE

The input signal was an un-modulated continuous wave. The following points were taken into consideration in performing this check:

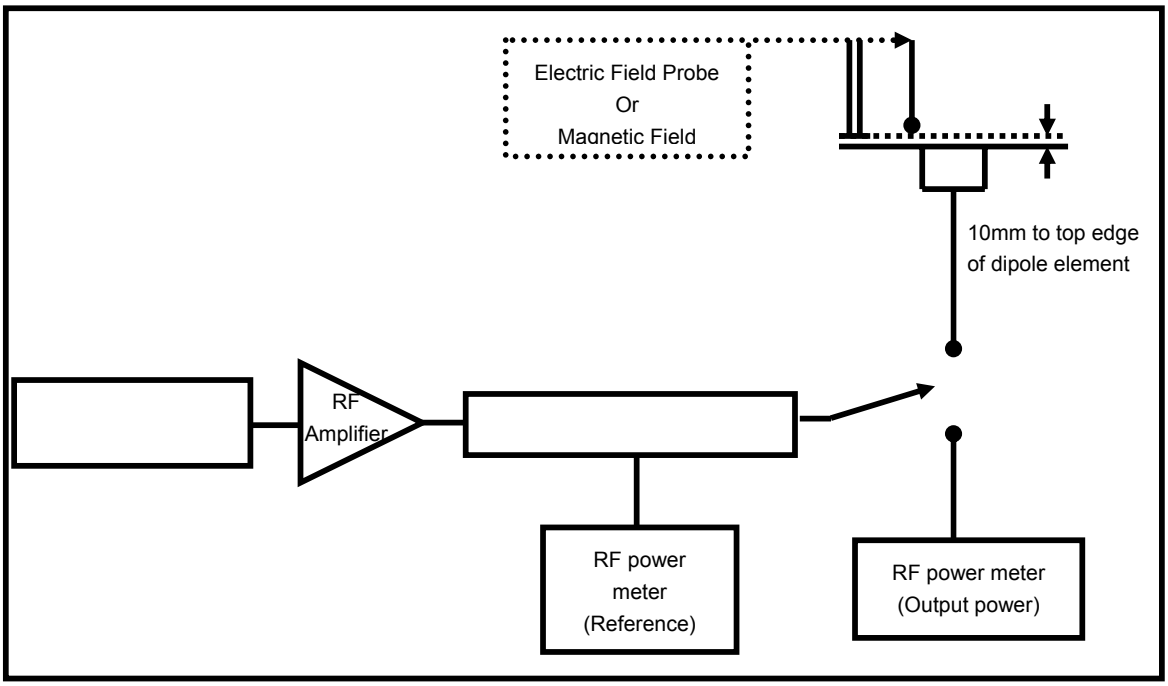
- Average Input Power P = 100mW RMS (20dBm RMS) after adjustment for return loss
- The test fixture must meet the 2 wavelength separation criterion
- The proper measurement of the 1cm probe to dipole separation, which is measured from top surface of the dipole to the calibration reference point of the sensor, defined by the probe manufacturer is shown in the following diagram:



5.2. SYSTEM CHECK PROCEDURE

1. Before you start the system performance check, need only to tell the system with which components (probe type, validation dipole and HAC arch) are performing the system performance check; the system will take care of all parameters.

The system check configuration is shown in the following figure:



2. The dipole was energized with a 20dBm unmodulated continuous-wave signal.
3. The length of the dipole was scanned with both E-field and H-field probes and the maximum values for each were recorded.

5.3. VALIDATION RESULTS

Frequency (MHz)	Input Power (dBm)	Target Value (V/m)	E-Field 1 (V/m)	E-Field 2 (V/m)	Average Value (V/m)	Deviation (%)	Date
835	20	168	189.6	191.3	190.45	13.36	Sep. 07, 2011
1880	20	142.1	152.6	155.3	153.95	8.34	Sep. 07, 2011
Frequency (MHz)	**Input Power (Power)**	**Target Value (A/m)**	**H-Field (A/m)**			**Deviation (%)**	**Date**
835	20	0.471	0.477			1.27	Sep. 07, 2011
1880	20	0.471	0.457			-2.97	Sep. 07, 2011

NOTE: Please see Appendix for the system validation test data.

6. 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 10dB 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.

This was done using the following procedure:

1. Fixing the probe in a set location relative to a field generating device, such as a reference dipole antenna, as illustrated in the system check procedure.
2. Illuminate the probe using the wireless device connected to the reference dipole with a test signal at the intended measurement frequency, Ensure there is sufficient field coupling between the probe and the antenna so the resulting reading is greater than 10dB above the probe system noise floor but within the systems operating range.
3. Record the amplitude applied to the antenna during transmission and the field strength measured by the E-field probe located near the tip of the dipole antenna.
4. Replace the wireless device with an RF signal generator producing an unmodulated CW signal and set to the wireless device operating frequency.
5. Set the amplitude of the unmodulated signal to equal that recorded from the wireless device.
6. Record the reading of the probe measurement system of the unmodulated signal.
7. The RF signal generator producing an 80%AM signal and set to the wireless device operating frequency. Set the amplitude of the signal to equal that recorded from the wireless device.
8. Record the reading of the probe measurement system of the 80%AM signal.
9. The ratio, in linear units, of the probe reading in Step 3) or 8) to the reading in Step 6) is the E-field modulation factor.
10. Steps 1-9 were repeated at all frequency bands and for both E and H field probes.

NOTE: The ratio of the CW to modulated signal reading is the modulation factor. The modulation factors obtained were applied to readings taken of the actual wireless device, in order to obtain an accurate peak field reading using the formula:

$$\mathbf{Peak = 20 \cdot log(Raw \cdot ProbeModulationFactor)}$$

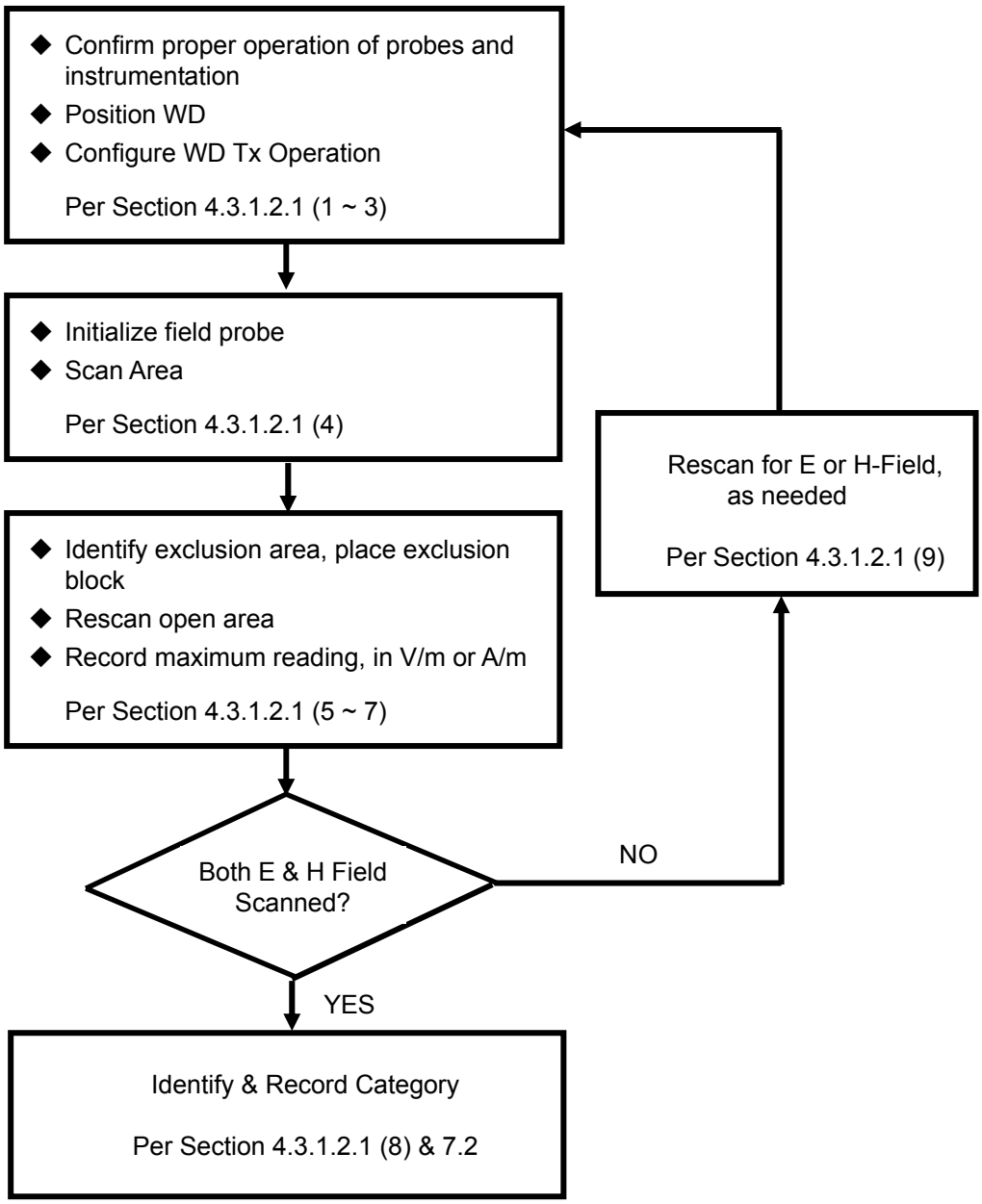
6.1 MODULATION FACTOR TEST RESULTS

TEST FREQUENCY (MHz)	PROTOCOL	REFERENCE LEVEL (dBm)	MEASURED E-FILED (V/m)	E-FILED MODULATION FACTOR	TESTED DATE
836.52	CW	23.5	153.4	NA	Sep. 07, 2011
	80% AM		138.2	1.11	
	CDMA 850		154.6	0.99	
TEST FREQUENCY (MHz)	**PROTOCOL**	**REFERENCE LEVEL (dBm)**	**MEASURED E-FILED (V/m)**	**H-FILED MODULATION FACTOR**	**TESTED DATE**
1880.00	CW	23.5	118.6	NA	Sep. 07, 2011
	80% AM		106.3	1.12	
	CDMA 1900		114.4	1.04	

TEST FREQUENCY (MHz)	PROTOCOL	REFERENCE LEVEL (dBm)	MEASURED H-FILED (A/m)	H-FILED MODULATION FACTOR	TESTED DATE
836.52	CW	23.5	0.473	NA	Sep. 07, 2011
	80% AM		0.445	1.06	
	CDMA 850		0.496	0.95	
TEST FREQUENCY (MHz)	**PROTOCOL**	**REFERENCE LEVEL (dBm)**	**MEASURED H-FILED (A/m)**	**H-FILED MODULATION FACTOR**	**TESTED DATE**
1880.00	CW	23.5	0.433	NA	Sep. 07, 2011
	80% AM		0.411	1.05	
	CDMA 1900		0.453	0.96	

7. RF EMISSION TEST PROCEDURES

7.1. TEST INSTRUCTION



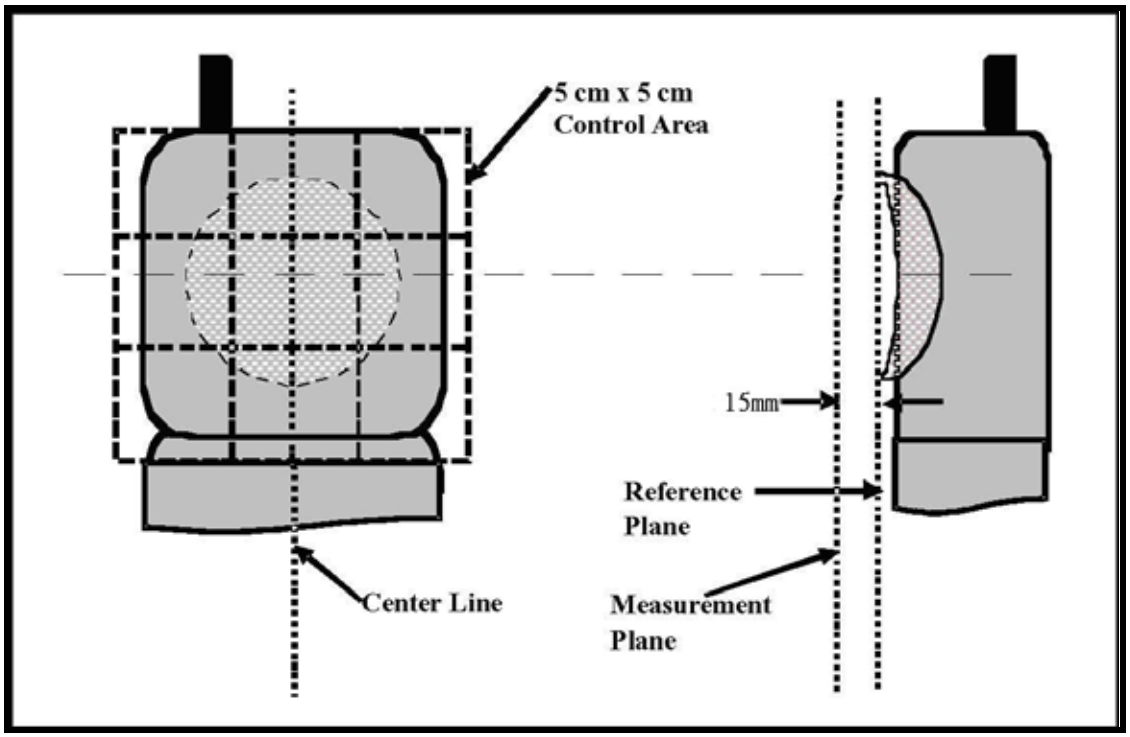
7.2. TEST PROCEDURES

The EUT makes a phone call to the GSM base station. Establish the simulation communication configuration rather the actual communication. Then the EUT could continuous the transmission mode. Adjust the PCL of the base station could controlled the EUT to transmitted the maximum output power. The base station also could control the transmission channel.

The recommended procedure for assessing the RF emission value consists of the following steps:

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 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.
4. A surface calibration was performed before each setup change to ensure repeatable spacing and proper maintenance of the measurement plane using the HAC arch.
5. The measurement system measured the field strength at the reference location.
6. Measurements at 2mm increments in the 5 x 5cm region were performed and recorded. A 360^{o} 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.
7. Steps 1-6 were done for both the E and H-Field measurements.

7.3. DESCRIPTION OF TEST POSITION AND CONFIGURATIONS



7.4. SUMMARY OF MEASURED HAC RESULTS

E-FIELD EMISSION

Plot No.	Band	Mode	Channel	Battery	Peak E-Field (V/m)	E-Field M Rating
1	CDMA850	RC3+SO55	777	1	54.676	M4
2	CDMA1900	RC3+SO55	25	1	35.802	M4

H-FIELD EMISSION

Plot No.	Band	Mode	Channel	Battery	Peak H-Field (A/m)	E-Field M Rating
3	CDMA850	RC3+SO55	777	1	0.09	M4
4	CDMA1900	RC3+SO55	25	1	0.096	M4

Note:

1. Only the testing was performed for this addendum according to original worst case mode.

8. INFORMATION ON THE TESTING LABORATORIES

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

Copies of accreditation certificates of our laboratories obtained from approval agencies can be downloaded from our web site: www.adt.com.tw/index.5.phtml. If you have any comments, please feel free to contact us at the following:

Linko EMC/RF Lab:
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF Lab:
Tel: 886-3-5935343
Fax: 886-3-5935342

Hwa Ya EMC/RF/Safety/Telecom Lab:
Tel: 886-3-3183232
Fax: 886-3-3185050

Email: service.adt@tw.bureauveritas.com
Web Site: www.adt.com.tw

The address and road map of all our labs can be found in our web site also.

---END---

HAC_E_Dipole_835_20110907

DUT: Dipole 835 MHz

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
Ambient Temperature：22.4 ℃;

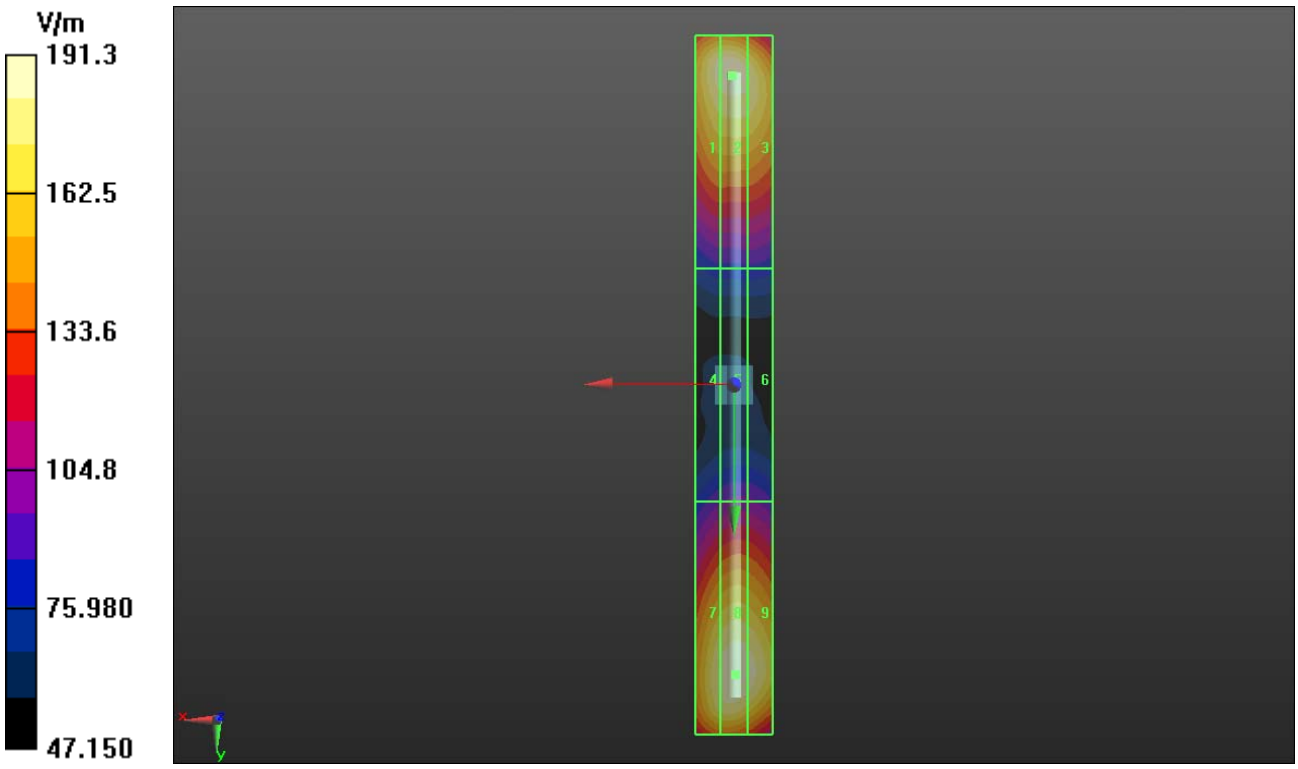
DASY5 Configuration:
- Probe: ER3DV6 - SN2293; ConvF(1, 1, 1); Calibrated: 2011/1/24
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial:
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

E Scan-ER Probe center 10mm above CD835 Dipole/Hearing Aid Compatibility Test (41x361x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 191.3 V/m
Probe Modulation Factor = 0.990
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 140.8 V/m; Power Drift = -0.0086 dB
Average Value of Total = (189.6 + 191.3) / 2 = 190.45 V/m

Peak E-field in V/m

Grid 1 **187.0 M4**	Grid 2 **189.6 M4**	Grid 3 **183.5 M4**
Grid 4 **94.567 M4**	Grid 5 **99.092 M4**	Grid 6 **98.196 M4**
Grid 7 **184.1 M4**	Grid 8 **191.3 M4**	Grid 9 **188.1 M4**

Cursor:
Total = 191.3 V/m
E Category: M4
Location: -0.5, 74.5, 4.7 mm


V/m
191.3
162.5
133.6
104.8
75.980
47.150
1
2
3
4
6
7
8
9

HAC_E_Dipole_1880_20110907

DUT: HAC Dipole 1880 MHz

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
Ambient Temperature：22.4 ℃;

DASY5 Configuration:
- Probe: ER3DV6 - SN2293; ConvF(1, 1, 1); Calibrated: 2011/1/24
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

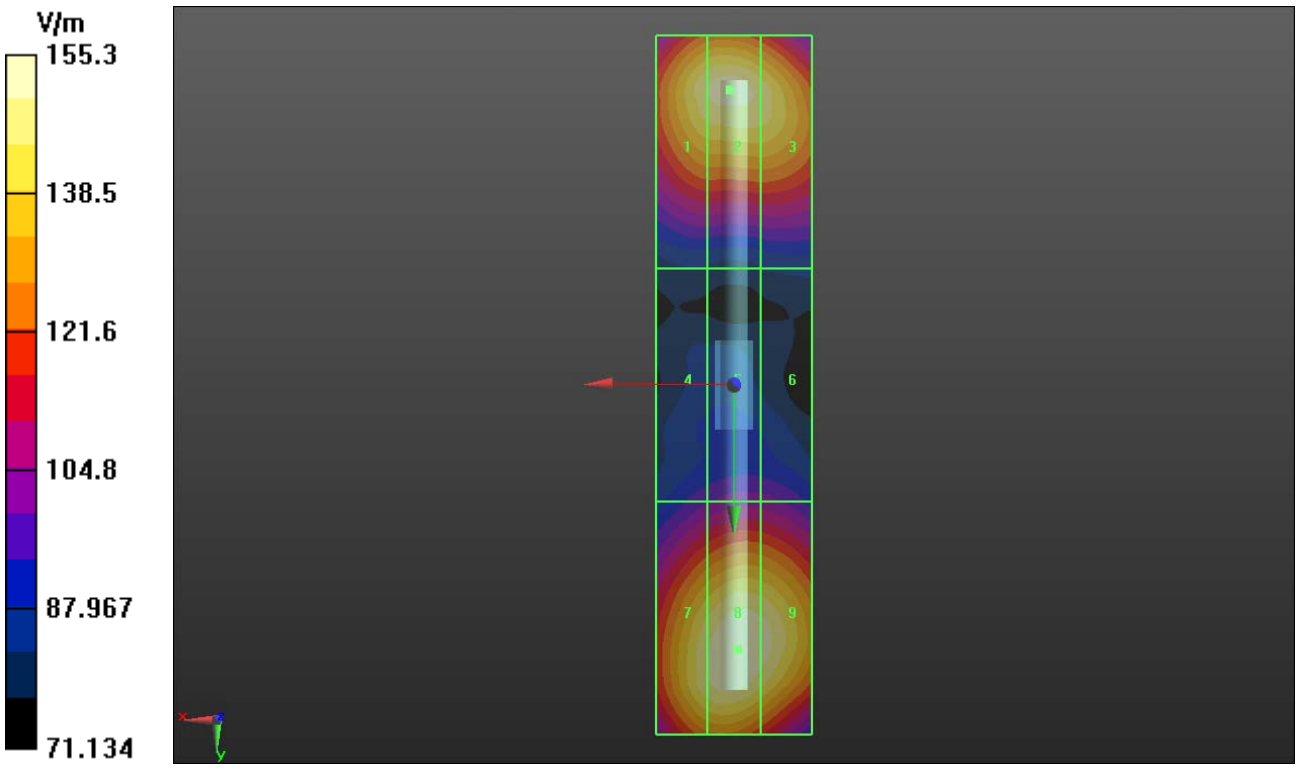
E Scan - ER probe center 10mm above CD1880 Dipole/Hearing Aid Compatibility Test (41x181x1): Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 155.3 V/m
Probe Modulation Factor = 1.040
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 161.4 V/m; Power Drift = 0.02 dB
Average Value of Total = (152.6 + 155.3) / 2 = 153.95 V/m

Peak E-field in V/m

Grid 1 **149.5 M2**	Grid 2 **152.6 M2**	Grid 3 **148.0 M2**
Grid 4 **98.579 M3**	Grid 5 **103.0 M3**	Grid 6 **102.3 M3**
Grid 7 **149.6 M2**	Grid 8 **155.3 M2**	Grid 9 **152.8 M2**

Cursor:
Total = 155.3 V/m
E Category: M2
Location: -0.5, 34, 4.7 mm


V/m
155.3
138.5
121.6
104.8
87.967
71.134
1
2
3
4
6
7
8
9

HAC_H_Dipole_835_20110907

DUT: HAC-Dipole 835 MHz

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
Ambient Temperature：22.4 ℃;

DASY5 Configuration:
- Probe: H3DV6 - SN6124; ; Calibrated: 2011/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

H Scan - measurement distance from the probe sensor center to CD835 Dipole = 10mm/Hearing Aid Compatibility Test (41x361x1): Measurement grid: dx=5mm, dy=5mm

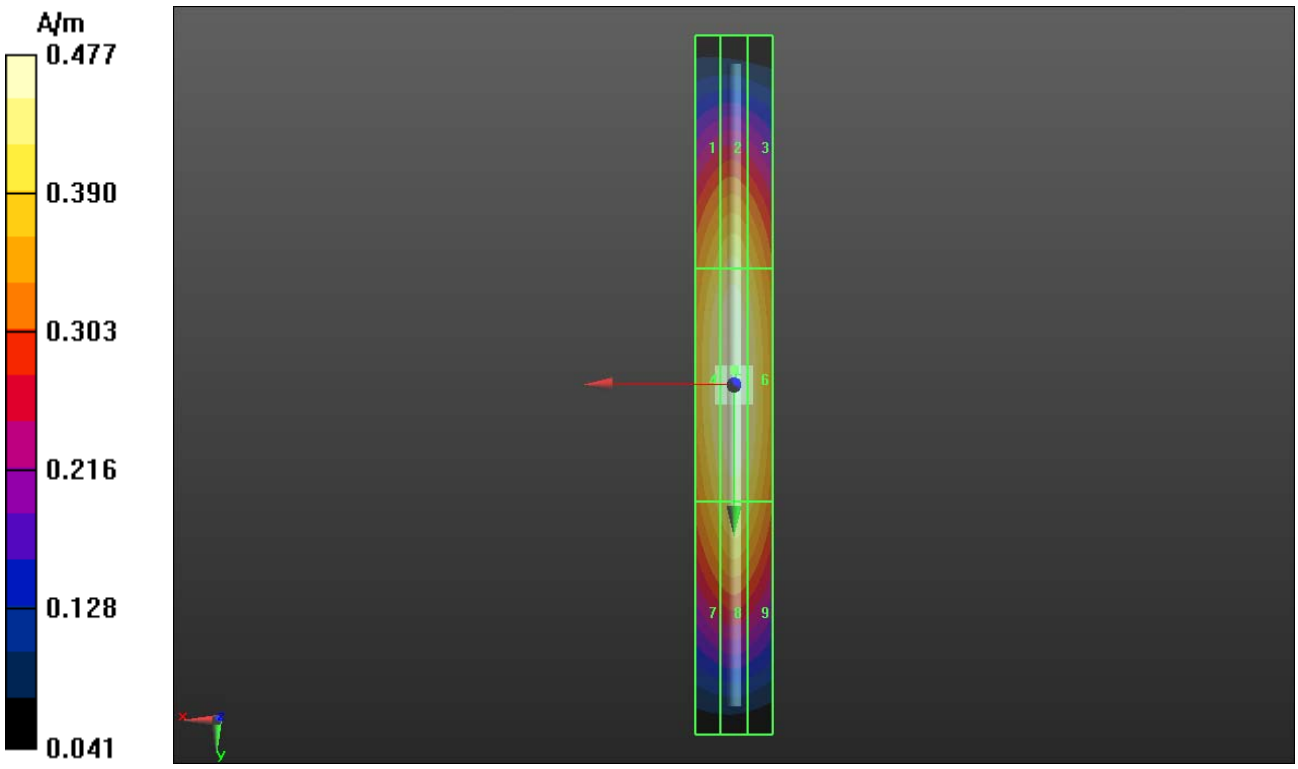
Maximum value of peak Total field = 0.477 A/m
Probe Modulation Factor = 0.950
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 0.559 A/m; Power Drift = -0.05 dB

Maximum value of Total = 0.477 A/m

Peak H-field in A/m

Grid 1 **0.412 M4**	Grid 2 **0.433 M4**	Grid 3 **0.406 M4**
Grid 4 **0.455 M4**	Grid 5 **0.477 M4**	Grid 6 **0.451 M4**
Grid 7 **0.405 M4**	Grid 8 **0.430 M4**	Grid 9 **0.408 M4**

Cursor:
Total = 0.477 A/m
H Category: M4
Location: 0, -4, 5.2 mm


A/m
0.477
0.390
0.303
0.216
0.128
0.041
1
2
3
4
6
7
8
9

HAC_H_Dipole_1880_20110907

DUT: HAC Dipole 1880 MHz

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
Ambient Temperature：22.4 ℃;

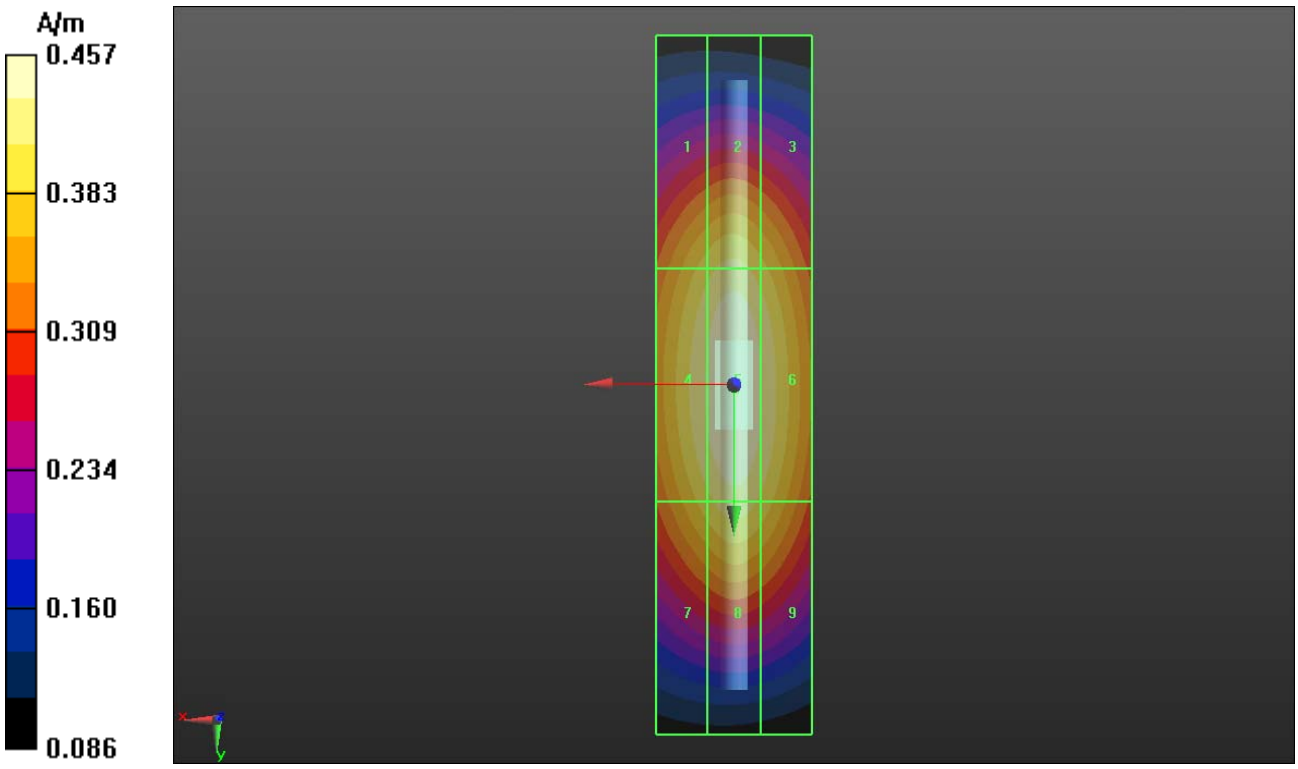
DASY5 Configuration:
- Probe: H3DV6 - SN6124; ; Calibrated: 2011/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

H Scan - measurement distance from the probe sensor center to CD1880 Dipole = 10mm/Hearing Aid Compatibility Test (41x181x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.457 A/m
Probe Modulation Factor = 0.960
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 0.526 A/m; Power Drift = -0.01 dB
Maximum value of Total = 0.457 A/m

Peak H-field in A/m

Grid 1 **0.397 M2**	Grid 2 **0.416 M2**	Grid 3 **0.393 M2**
Grid 4 **0.435 M2**	Grid 5 **0.457 M2**	Grid 6 **0.433 M2**
Grid 7 **0.398 M2**	Grid 8 **0.422 M2**	Grid 9 **0.401 M2**

Cursor:
Total = 0.457 A/m
H Category: M2
Location: 0, 0.5, 5.2 mm


A/m
0.457
0.383
0.309
0.234
0.160
0.086
1
2
3
4
6
7
8
9

P01 E-Field CDMA850_RC3+SO55_Ch777

DUT: 110823C21

Communication System: CDMA; Frequency: 848.3 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Ambient Temperature：22.4 ℃;

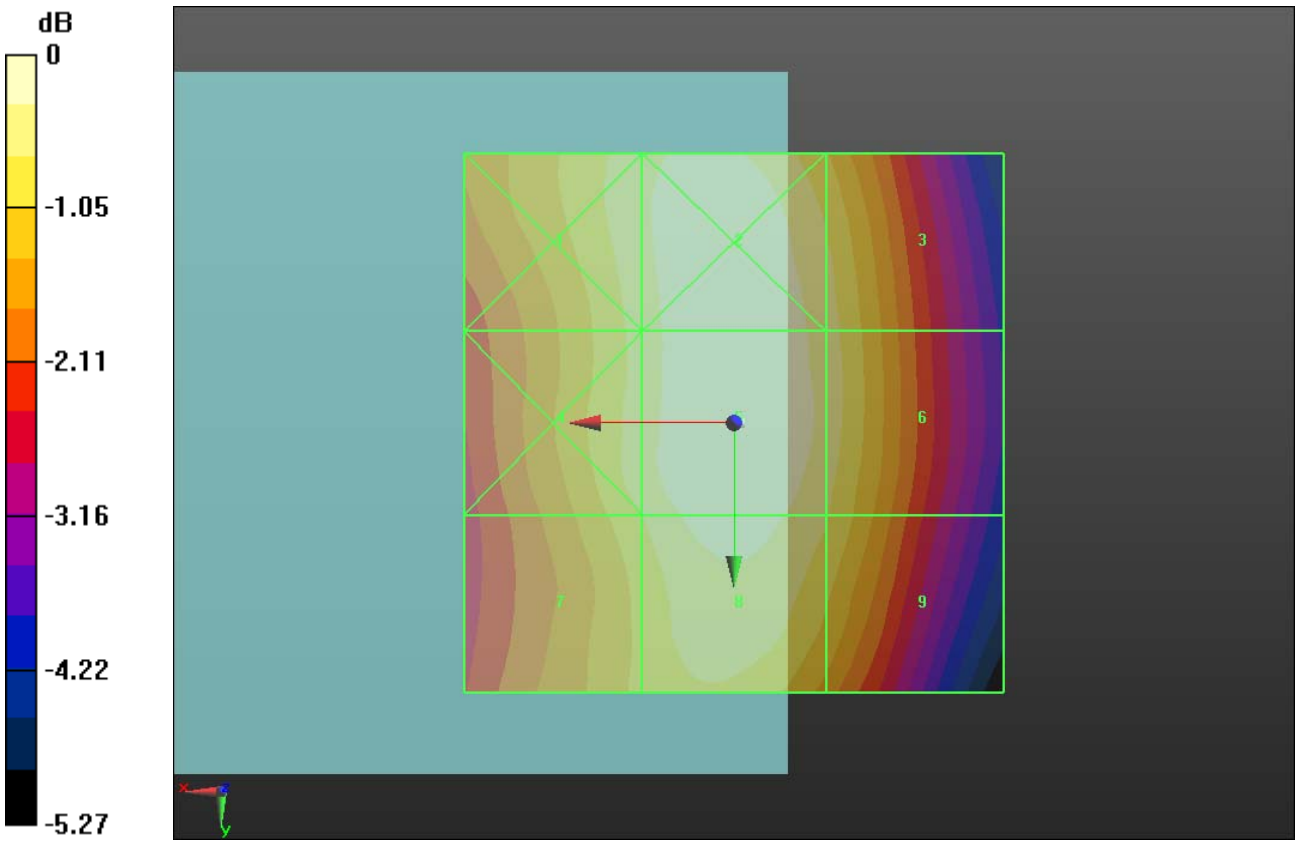
DASY5 Configuration:
- Probe: ER3DV6 - SN2293; ConvF(1, 1, 1); Calibrated: 2011/1/24
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch777/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 54.676 V/m
Probe Modulation Factor = 0.990
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 72.743 V/m; Power Drift = -0.0065 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **52.137 M4**	Grid 2 **54.295 M4**	Grid 3 **51.493 M4**
Grid 4 **51.695 M4**	Grid 5 **54.676 M4**	Grid 6 **51.796 M4**
Grid 7 **50.473 M4**	Grid 8 **53.484 M4**	Grid 9 **50.637 M4**

Cursor:
Total = 54.676 V/m
E Category: M4
Location: 0, 0, 8.7 mm



0 dB = 54.680V/m

P02 E-Field CDMA1900_RC3+SO55_Ch25

DUT: 110823C21

Communication System: CDMA1900; Frequency: 1851.25 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Ambient Temperature：22.4 ℃;

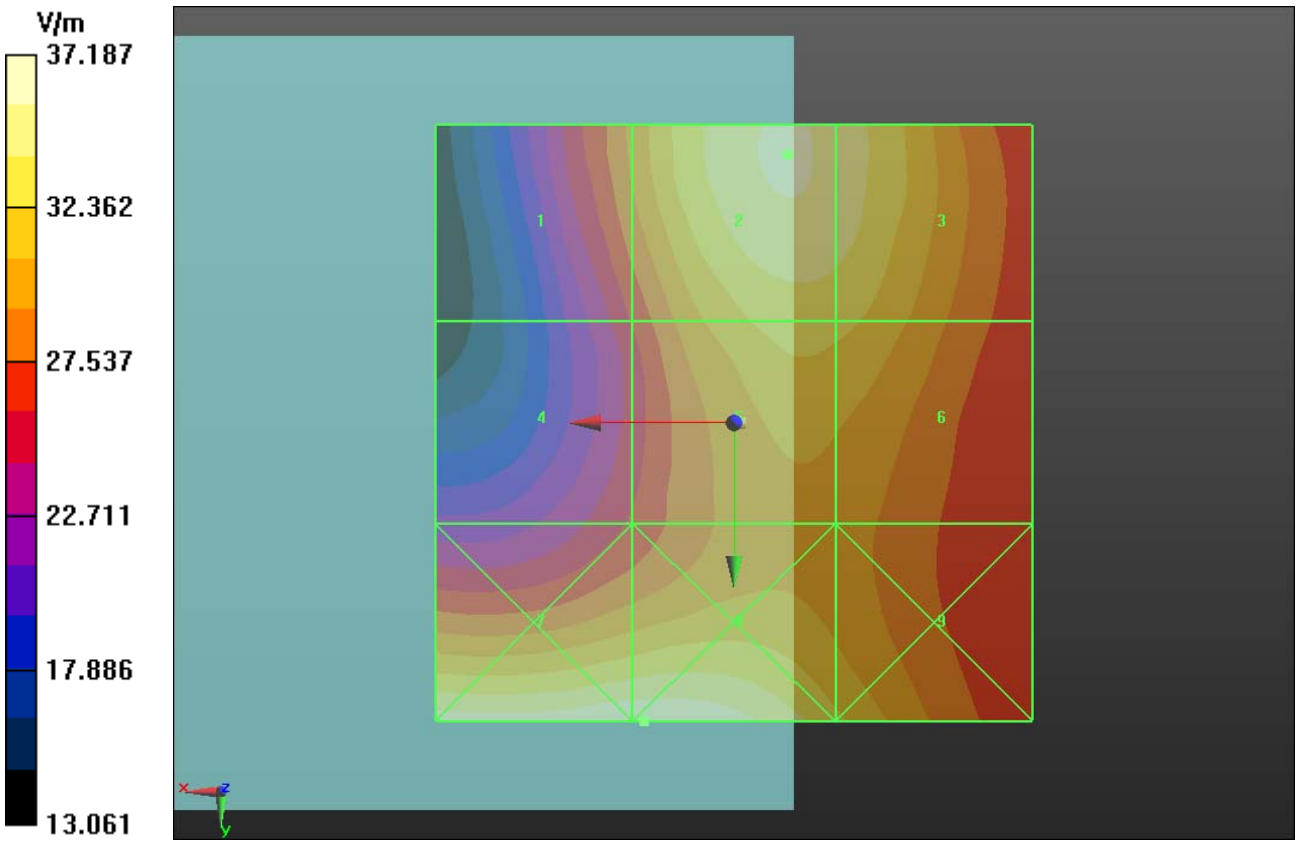
DASY5 Configuration:
- Probe: ER3DV6 - SN2293; ConvF(1, 1, 1); Calibrated: 2011/1/24
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch25/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 35.802 V/m
Probe Modulation Factor = 1.040
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 36.842 V/m; Power Drift = 0.04 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **29.665 M4**	Grid 2 **35.802 M4**	Grid 3 **35.082 M4**
Grid 4 **26.304 M4**	Grid 5 **33.096 M4**	Grid 6 **32.867 M4**
Grid 7 **37.173 M4**	Grid 8 **37.187 M4**	Grid 9 **32.814 M4**

Cursor:
Total = 37.187 V/m
E Category: M4
Location: 7.5, 25, 8.7 mm


V/m
37.187
32.362
27.537
22.711
17.886
13.061
1
2
3
4
6
5
X
Z
Y

P03 H-Field CDMA850_RC3+SO55_Ch777

DUT: 110823C21

Communication System: CDMA; Frequency: 836.5 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Ambient Temperature：22.4 ℃;

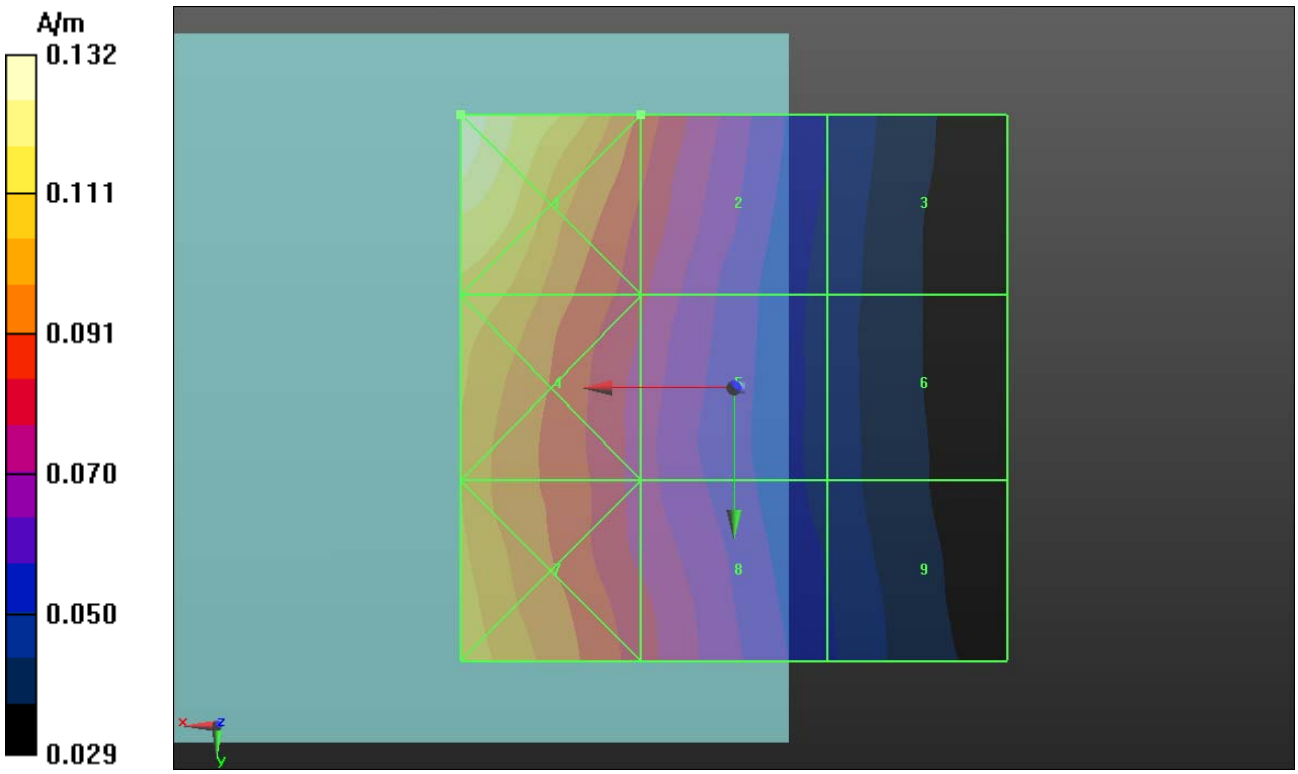
DASY5 Configuration:
- Probe: H3DV6 - SN6124; ; Calibrated: 2011/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch777/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.090 A/m
Probe Modulation Factor = 0.950
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 0.065 A/m; Power Drift = -0.14 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.132 M4**	Grid 2 **0.090 M4**	Grid 3 **0.051 M4**
Grid 4 **0.110 M4**	Grid 5 **0.079 M4**	Grid 6 **0.047 M4**
Grid 7 **0.110 M4**	Grid 8 **0.081 M4**	Grid 9 **0.051 M4**

Cursor:
Total = 0.132 A/m
H Category: M4
Location: 25, -25, 8.7 mm


A/m
0.132
0.111
0.091
0.070
0.050
0.029
2
3
6
8
9

P04 H-Field CDMA1900_RC3+SO55_Ch25

DUT: 110823C21

Communication System: CDMA1900; Frequency: 1851.25 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Ambient Temperature：22.4 ℃;

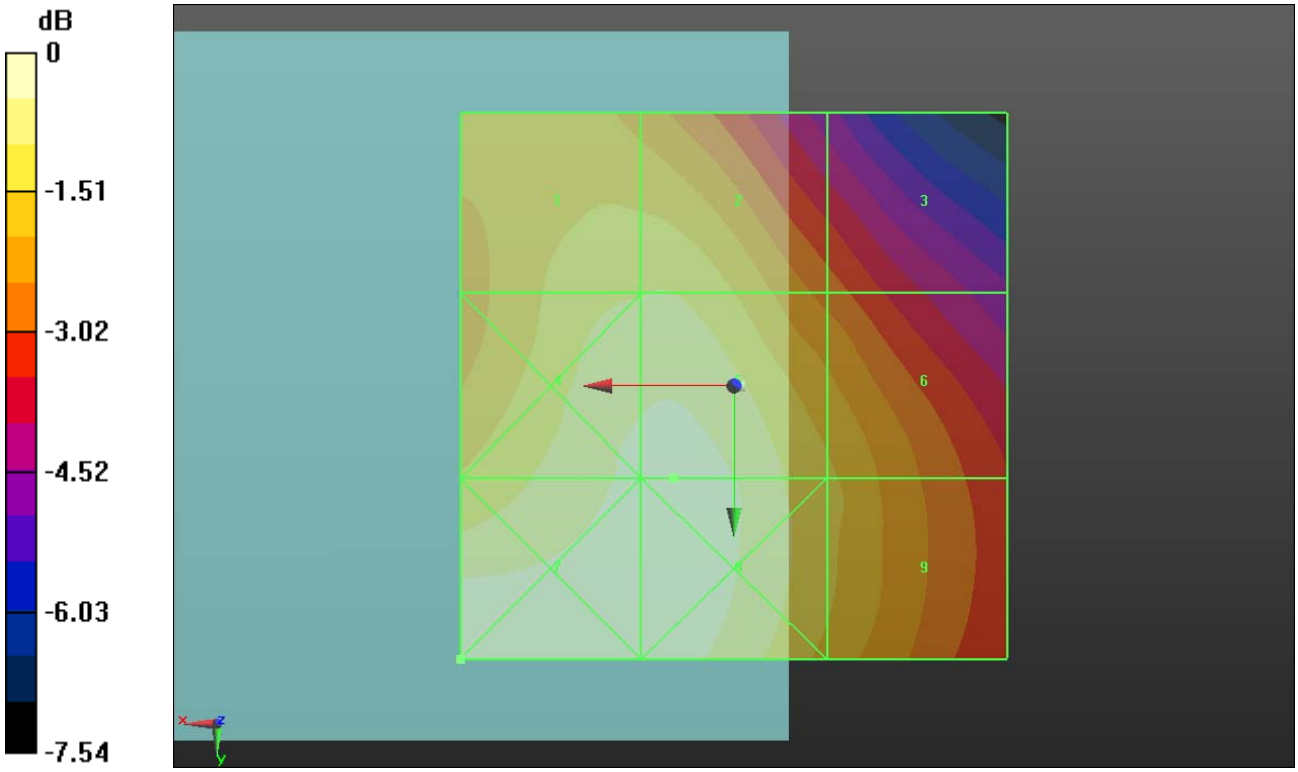
DASY5 Configuration:
- Probe: H3DV6 - SN6124; ; Calibrated: 2011/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn579; Calibrated: 2010/9/20
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.6 (2); SEMCAD X Version 14.4.5 (3634)

Ch25/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.096 A/m
Probe Modulation Factor = 0.960
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 0.106 A/m; Power Drift = 0.07 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.089 M4**	Grid 2 **0.089 M4**	Grid 3 **0.073 M4**
Grid 4 **0.096 M4**	Grid 5 **0.096 M4**	Grid 6 **0.085 M4**
Grid 7 **0.104 M4**	Grid 8 **0.098 M4**	Grid 9 **0.086 M4**

Cursor:
Total = 0.104 A/m
H Category: M4
Location: 25, 25, 8.7 mm



0 dB = 0.100A/m

APPENDIX B: SYSTEM CERTIFICATE & CALIBRATION

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

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

Accredited by the Swiss 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 **B.V. ADT (Auden)**

Certificate No: **ER3-2293_Jan11**

CALIBRATION CERTIFICATE

Object ER3DV6 - SN:2293

Calibration procedure(s) QA CAL-02.v6, QA CAL-25.v3
Calibration procedure for E-field probes optimized for close near field evaluations in air

Calibration date: January 24, 2011

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	01-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	01-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	01-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ER3DV6	SN: 2328	4-Oct-10 (No. ER3-2328_Oct10)	Oct-11
DAE4	SN: 789	31-Aug-10 (No. DAE4-789_Aug10)	Aug-11
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Fin Bomholt	R&D Director	

Issued: January 24, 2011

Glossary:

NORMx,y,z	sensitivity in free space
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization 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., $\vartheta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization $\vartheta = 0$ for XY sensors and $\vartheta = 90$ for Z sensor ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide).
- *NORM(f)x,y,z = 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 with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *Ax,y,z; Bx,y,z; Cx,y,z, VRx,y,z: A, B, C* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *Spherical isotropy (3D deviation from isotropy)*: in a locally homogeneous field realized using an open waveguide setup.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Probe ER3DV6

SN:2293

Manufactured: October 2, 2002
Calibrated: January 24, 2011

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: ER3DV6 - SN:2293

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)	1.28	1.08	1.41	± 10.1 %
DCP (mV)[B]	102.1	101.1	99.7	

Modulation Calibration Parameters

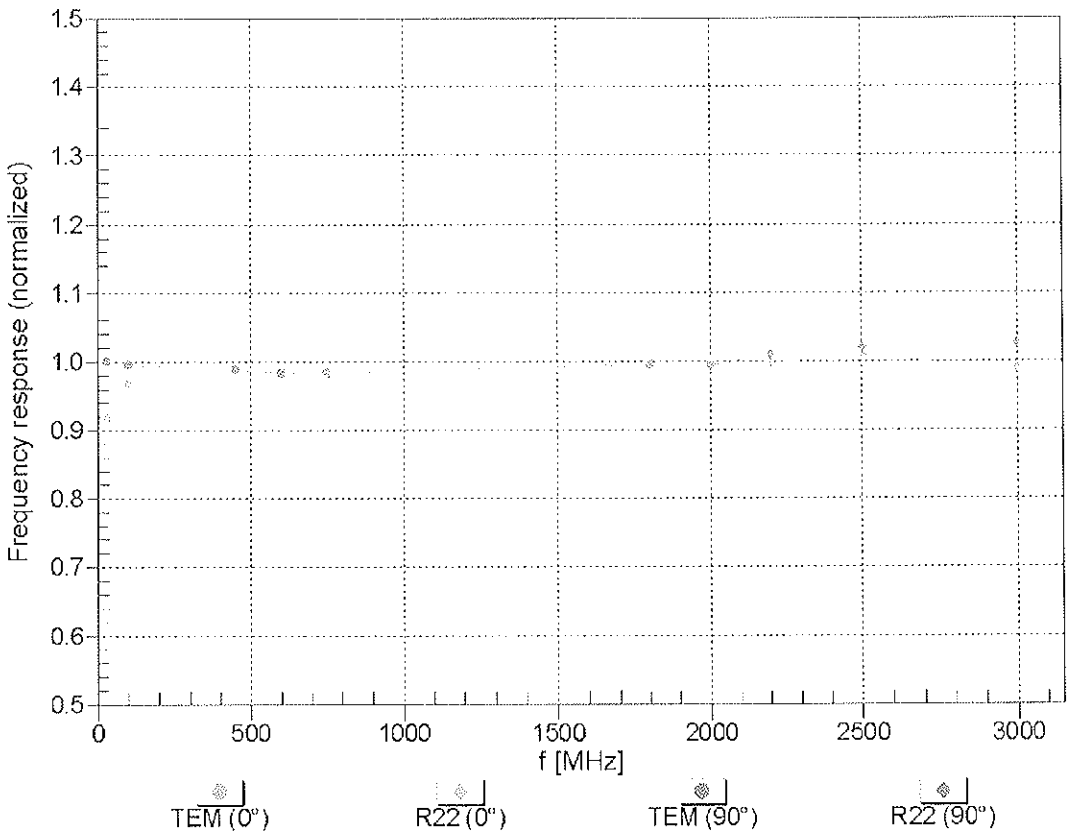
UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	141.0	±2.4 %
			Y	0.00	0.00	1.00	118.1	
			Z	0.00	0.00	1.00	124.3	

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%.

[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

Frequency Response of E-Field

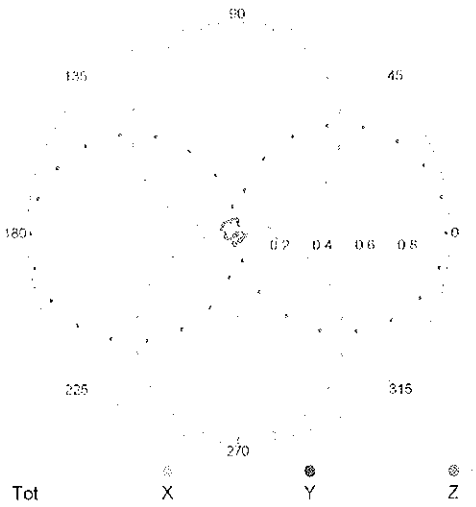
(TEM-Cell:ifi110 EXX, Waveguide: R22)



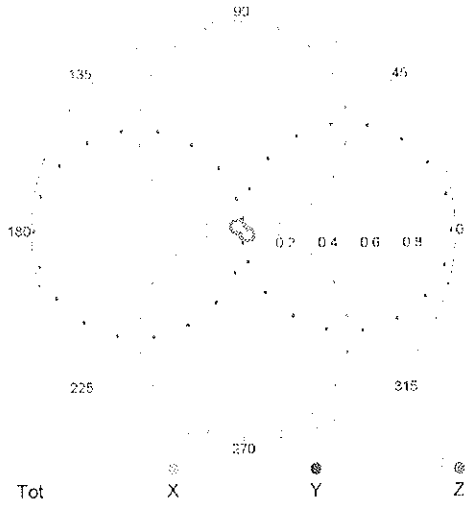
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM,0°

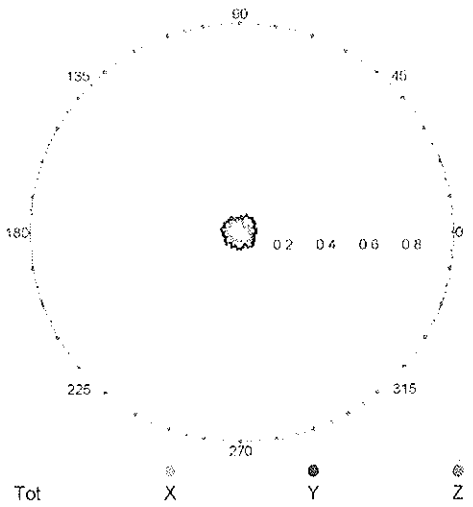


f=2500 MHz,R22,0°

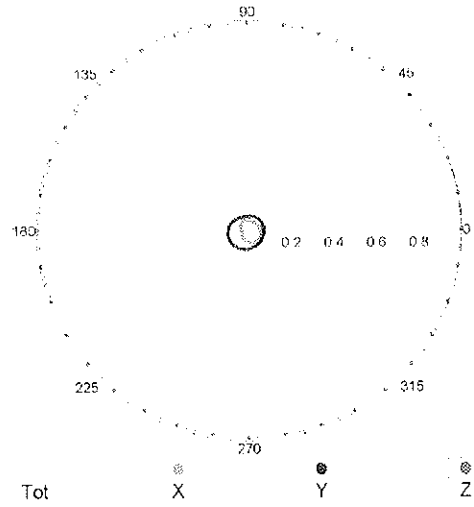


Receiving Pattern (ϕ), ϑ = 90°

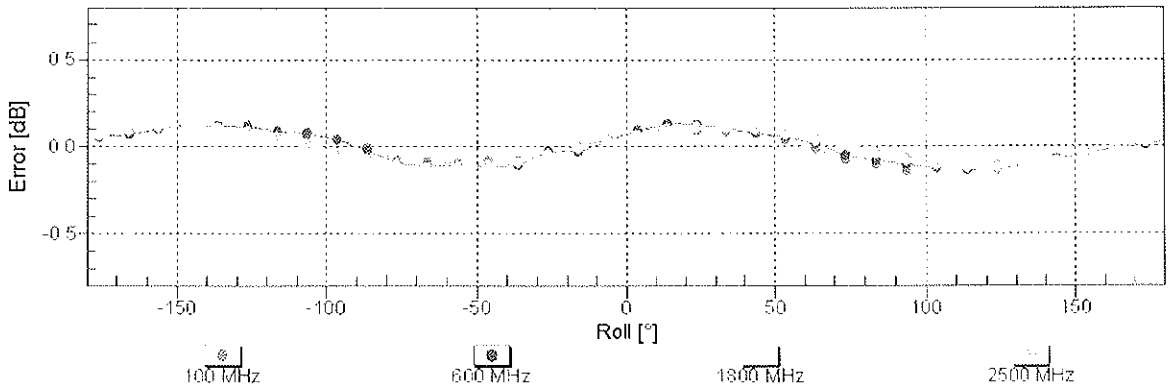
f=600 MHz,TEM,90°



f=2500 MHz,R22,90°

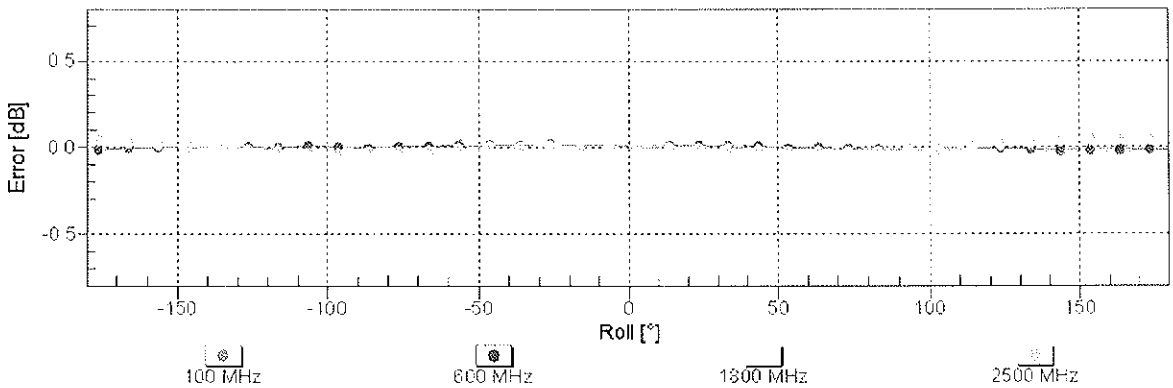


Receiving Pattern (ϕ), ϑ = 0°



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

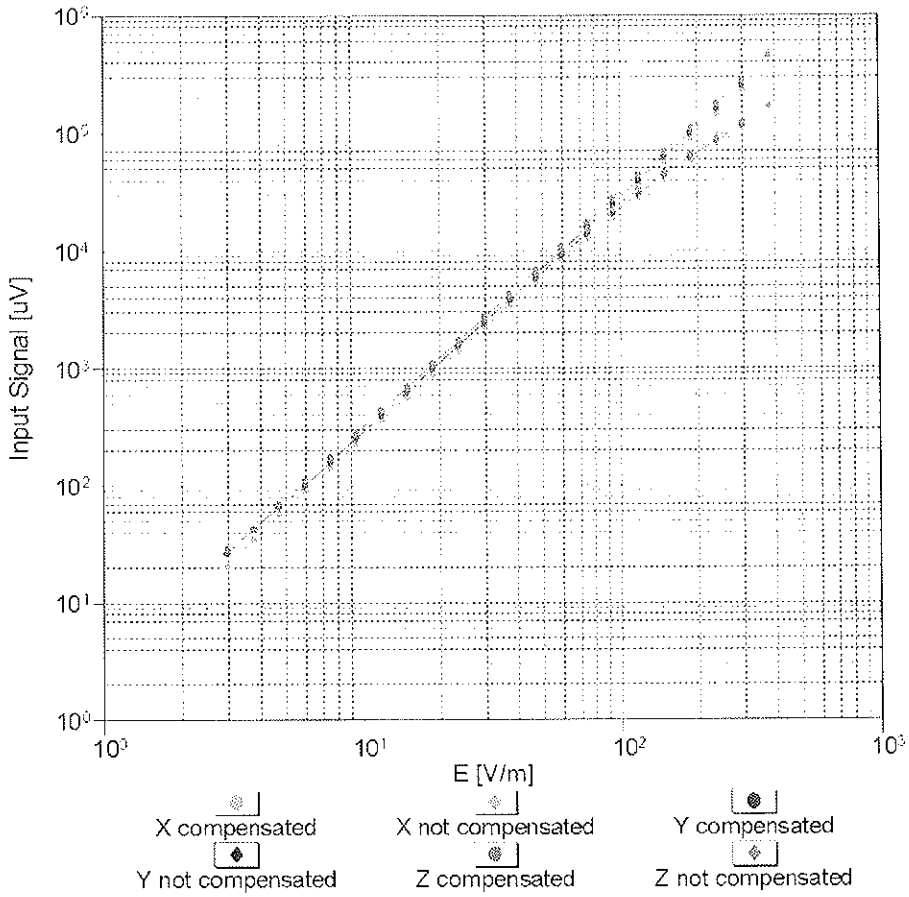
Receiving Pattern (ϕ), ϑ = 90°

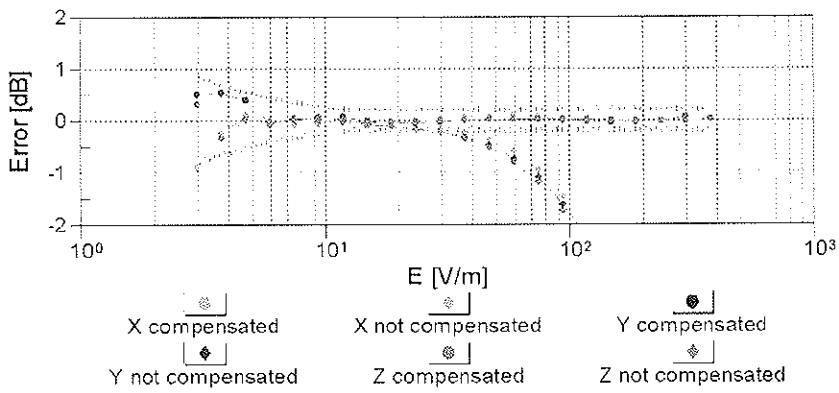


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(E-field)

(TEM cell , f = 900 MHz)

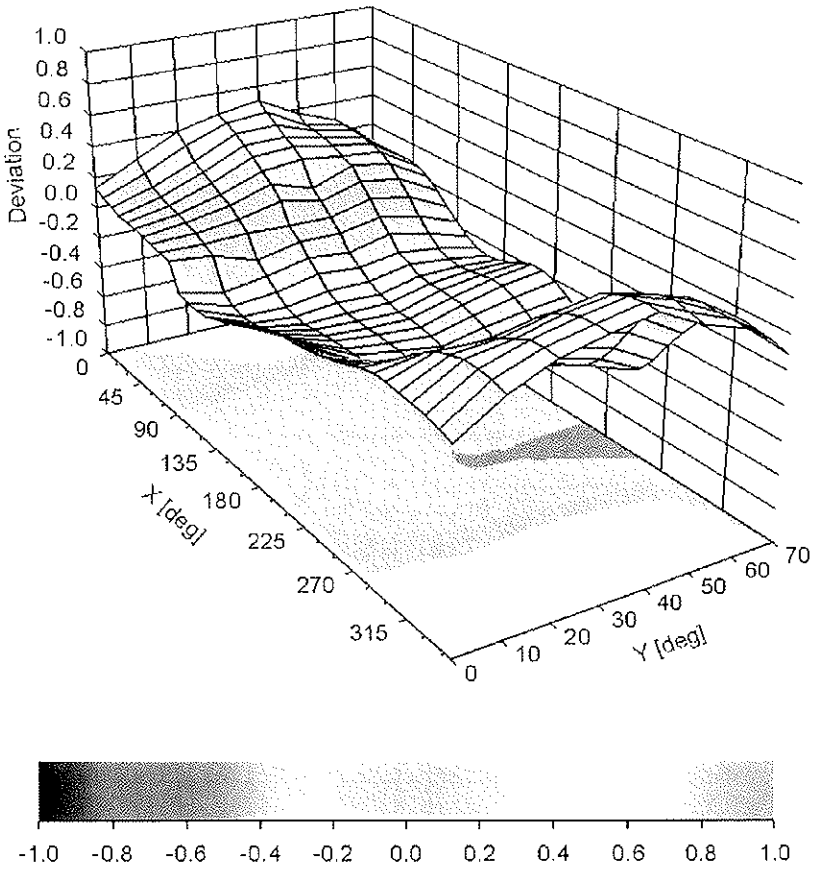




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Deviation from Isotropy in Air

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: ER3DV6 - SN:2293

Other Probe Parameters

Sensor Arrangement	Rectangular
Connector Angle (°)	163.7
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	8 mm
Probe Tip to Sensor X Calibration Point	2.5 mm
Probe Tip to Sensor Y Calibration Point	2.5 mm
Probe Tip to Sensor Z Calibration Point	2.5 mm

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Accreditation No.: SCS 108

Client B.V. ADT (Auden)

Certificate No: H3-6124_Jan11

CALIBRATION CERTIFICATE

Object: H3DV6 - SN:6124

Calibration procedure(s): QA CAL-03.v6, QA CAL-25.v3
Calibration procedure for H-field probes optimized for close near field evaluations in air

Calibration date: January 14, 2011

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	01-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	01-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	01-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe H3DV6	SN: 6182	4-Oct-10 (No. H3-6182_Oct10)	Oct-11
DAE4	SN: 789	31-Aug-10 (No. DAE4-789_Aug10)	Aug-11
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

	Name	Function	Signature
Calibrated by:	Marcel Fehr	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 25, 2011

Glossary:

NORMx,y,z	sensitivity in free space
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization 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).
- *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 with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *Ax,y,z; Bx,y,z; Cx,y,z, VRx,y,z: A, B, C* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *Spherical isotropy (3D deviation from isotropy)*: in a locally homogeneous field realized using an open waveguide setup.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *X_a0a1a2* (no uncertainty required).

Probe H3DV6

SN:6124

Manufactured: June 8, 2002
Calibrated: January 14, 2011

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: H3DV6 - SN:6124

Basic Calibration Parameters

		Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (A/m / √(mV))	a0	2.84E-003	2.94E-003	3.18E-003	± 5.1 %
Norm (A/m / √(mV))	a1	-2.51E-004	-3.82E-004	-3.47E-004	± 5.1 %
Norm (A/m / √(mV))	a2	9.03E-005	6.51E-005	5.46E-005	± 5.1 %
DCP (mV)[B]		92.7	92.3	95.4	

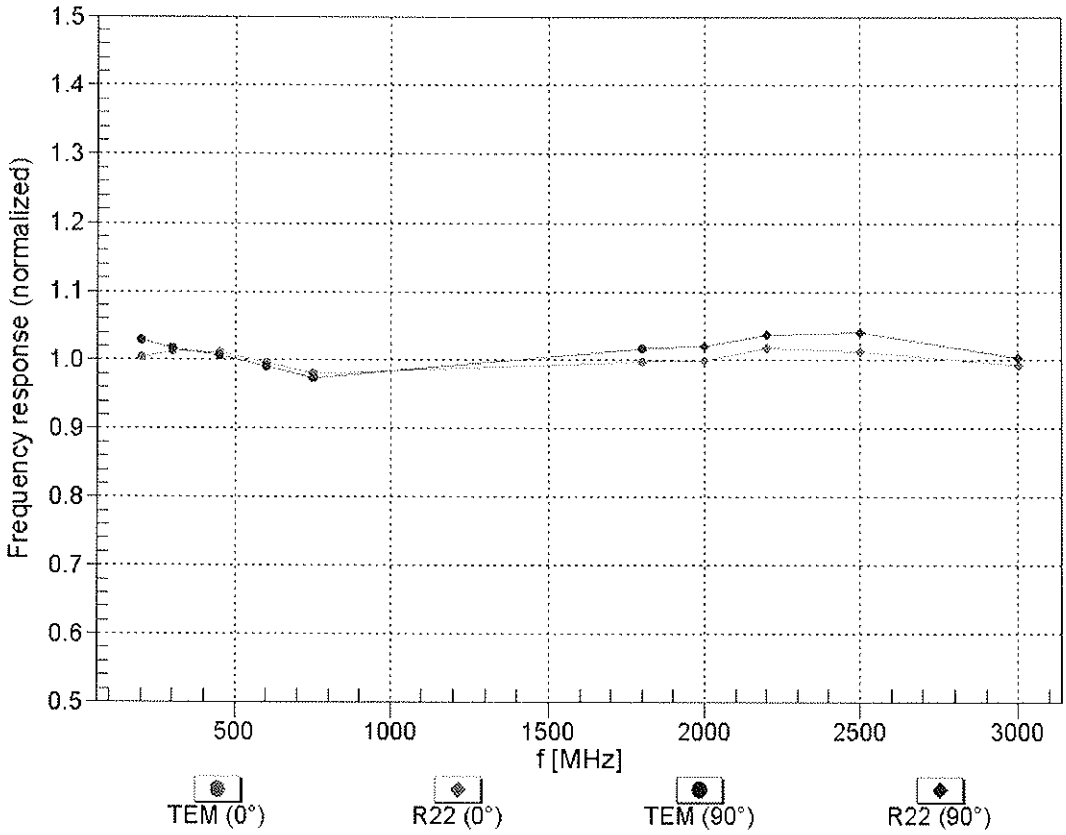
Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	236.8	±1.9 %
			Y	0.00	0.00	1.00	237.5	
			Z	0.00	0.00	1.00	240.1	

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%.

[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

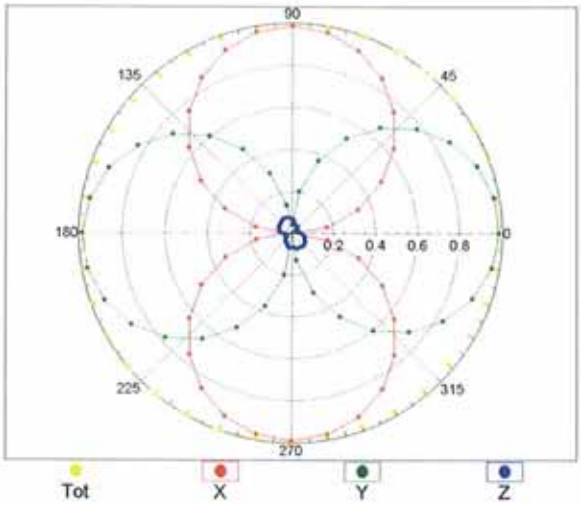
Frequency Response of H-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



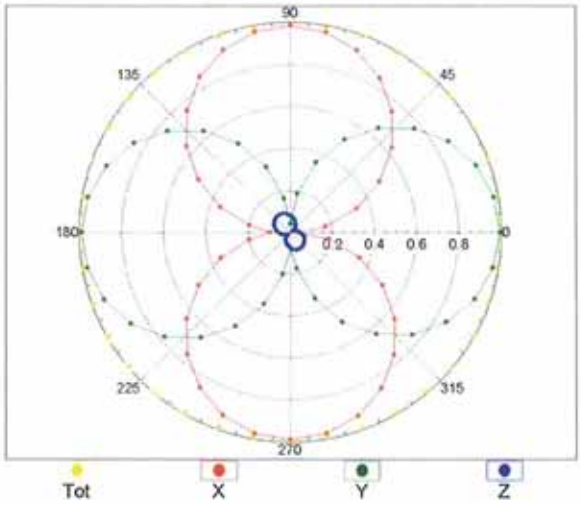
Uncertainty of Frequency Response of H-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM,0°

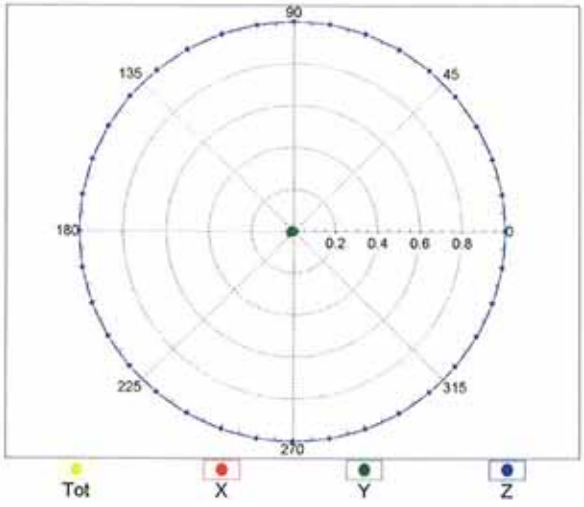


f=2500 MHz,R22,0°

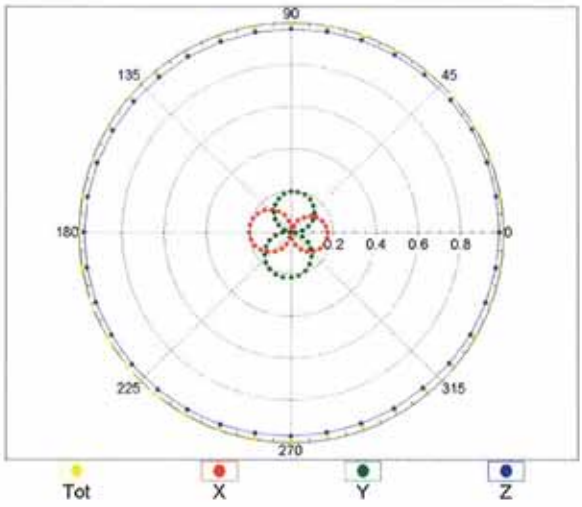


Receiving Pattern (ϕ), ϑ = 90°

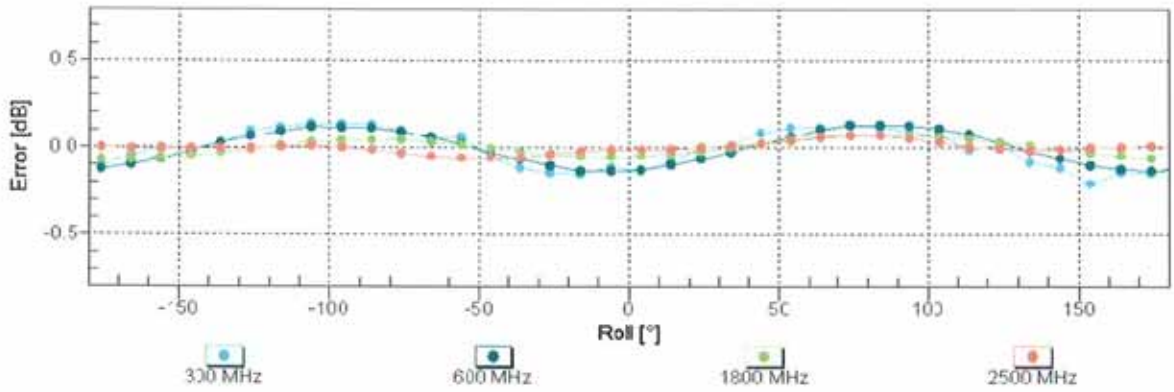
f=600 MHz,TEM,90°



f=2500 MHz,R22,90°

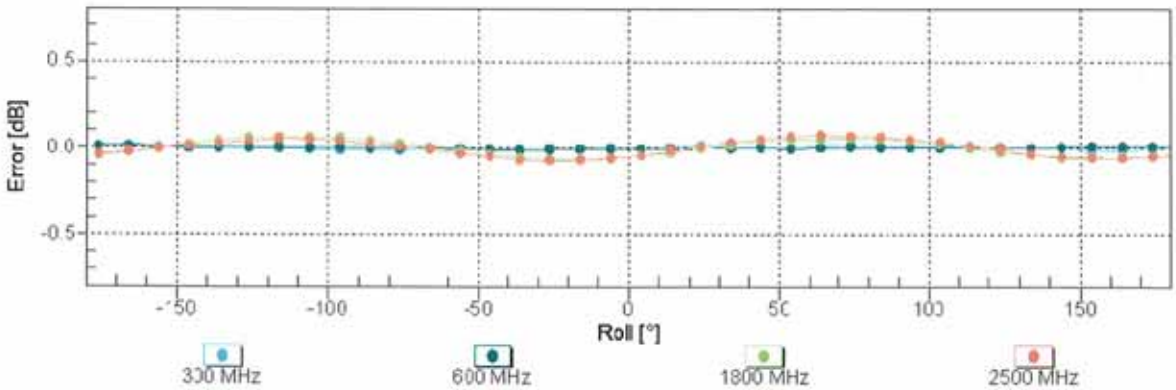


Receiving Pattern (ϕ), ϑ = 0°



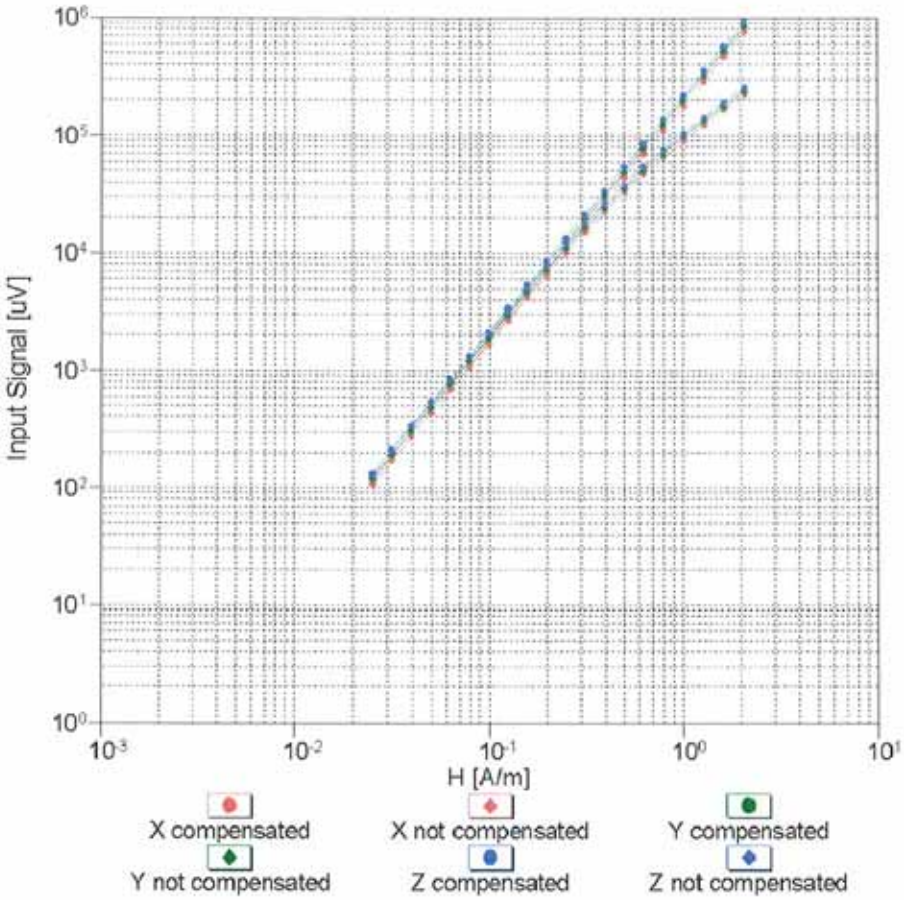
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

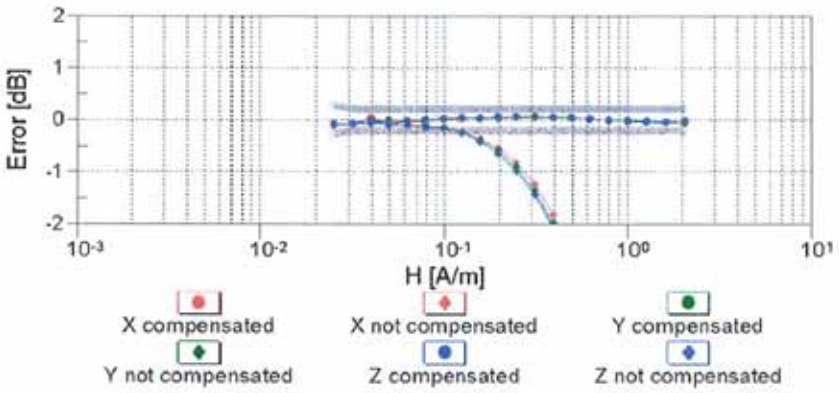
Receiving Pattern (ϕ), ϑ = 90°



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

Dynamic Range f(H-field)
(TEM cell, f = 900 MHz)

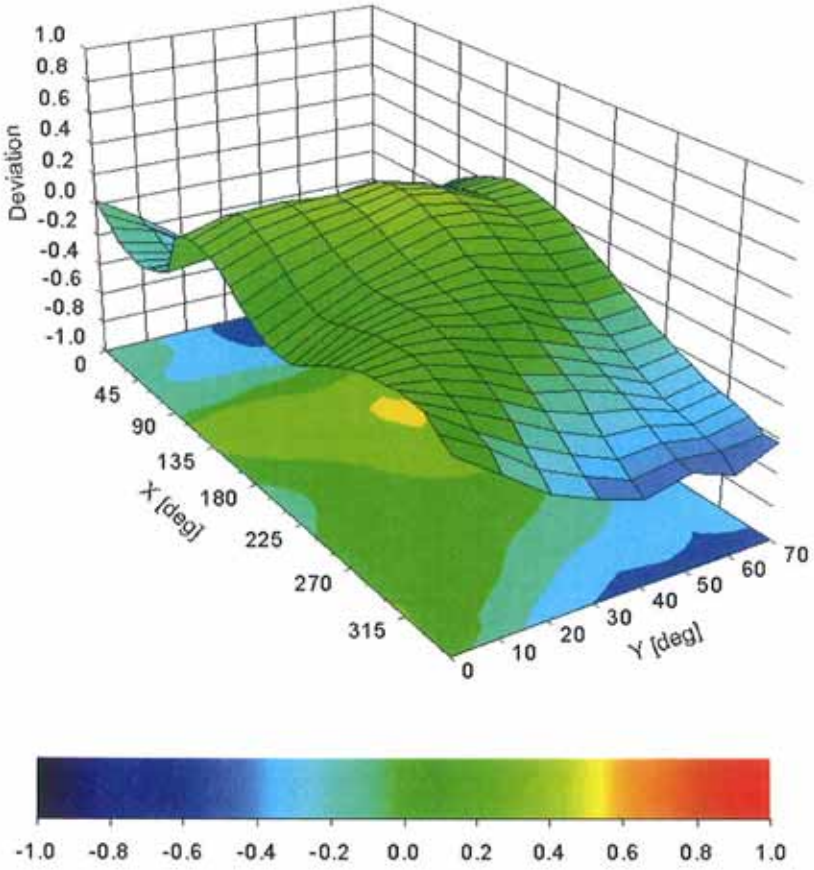




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Deviation from Isotropy in Air

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: H3DV6 - SN:6124

Other Probe Parameters

Sensor Arrangement	Rectangular
Connector Angle (°)	-146.1
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	20 mm
Tip Diameter	6 mm
Probe Tip to Sensor X Calibration Point	3 mm
Probe Tip to Sensor Y Calibration Point	3 mm
Probe Tip to Sensor Z Calibration Point	3 mm

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

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Accreditation No.: SCS 108

Client **BV-ADT (Auden)**

Certificate No: DAE3-579_Sep10

CALIBRATION CERTIFICATE

Object	DAE3 - SD 000 D03 AA - SN: 579
Calibration procedure(s)	QA CAL-06.v22 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	September 20, 2010

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	1-Oct-09 (No: 9055)	Oct-10
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Calibrator Box V1.1	SE UMS 006 AB 1004	07-Jun-10 (in house check)	In house check: Jun-11

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

Issued: September 20, 2010

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:* Typical value for information: 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	404.327 ± 0.1% (k=2)	404.379 ± 0.1% (k=2)	404.160 ± 0.1% (k=2)
Low Range	3.98675 ± 0.7% (k=2)	3.99301 ± 0.7% (k=2)	3.94834 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	358.0 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	200003.9	0.96	0.00
Channel X	+ Input	20003.19	3.09	0.02
Channel X	- Input	-19994.55	4.75	-0.02
Channel Y	+ Input	199992.4	-0.09	-0.00
Channel Y	+ Input	19999.51	0.41	0.00
Channel Y	- Input	-19997.22	3.18	-0.02
Channel Z	+ Input	200002.0	0.91	0.00
Channel Z	+ Input	20001.93	2.03	0.01
Channel Z	- Input	-19997.58	2.82	-0.01

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2000.0	0.02	0.00
Channel X	+ Input	199.82	0.12	0.06
Channel X	- Input	-200.46	-0.56	0.28
Channel Y	+ Input	2000.3	0.47	0.02
Channel Y	+ Input	199.12	-0.78	-0.39
Channel Y	- Input	-201.36	-1.16	0.58
Channel Z	+ Input	1999.9	-0.07	-0.00
Channel Z	+ Input	199.18	-0.72	-0.36
Channel Z	- Input	-201.47	-1.47	0.73

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	7.07	5.75
	- 200	-4.60	-6.25
Channel Y	200	9.48	9.62
	- 200	-10.39	-10.96
Channel Z	200	8.79	8.42
	- 200	-9.64	-9.80

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	-	0.03	0.35
Channel Y	200	1.14	-	2.31
Channel Z	200	2.01	0.80	-

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	16343	16314
Channel Y	16194	16427
Channel Z	15816	16265

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	-0.70	-1.94	0.80	0.49
Channel Y	-1.55	-2.12	-0.66	0.27
Channel Z	0.57	-0.11	5.61	0.62

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

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

9. Power Consumption (Typical values for information)

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

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Accreditation No.: **SCS 108**

Client **B.V. ADT (Auden)**

Certificate No: **CD835V3-1041_Mar11**

CALIBRATION CERTIFICATE

Object CD835V3 - SN: 1041

Calibration procedure(s) QA CAL-20.v5
Calibration procedure for dipoles in air

Calibration date: March 15, 2011

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 (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Probe ER3DV6	SN: 2336	29-Dec-10 (No. ER3-2336_Dec10)	Dec-11
Probe H3DV6	SN: 6065	29-Dec-10 (No. H3-6065_Dec10)	Dec-11
DAE4	SN: 781	20-Oct-10 (No. DAE4-781_Oct10)	Oct-11

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter Agilent 4419B	SN: GB42420191	09-Oct-09 (in house check Oct-10)	In house check: Oct-11
Power sensor HP 8482H	SN: 3318A09450	09-Oct-09 (in house check Oct-10)	In house check: Oct-11
Power sensor HP 8482A	SN: US37295597	09-Oct-09 (in house check Oct-10)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11
RF generator E4433B	MY 41000675	03-Nov-04 (in house check Oct-09)	In house check: Oct-11

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

Issued: March 16, 2011

References

[1] ANSI-C63.19-2007
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 the standards [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 DASY5 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	DASY5	V52.6.2 (424)
DASY PP Version	SEMCAD X	V14.4.4 (2829)
Phantom	HAC Test Arch	SD HAC P01 BA, #1070
Distance Dipole Top - Probe Center	10 mm	
Scan resolution	dx, dy = 5 mm	area = 20 x 180 mm
Frequency	**835 MHz** ± 1 MHz	
Forward power at dipole connector	20.0 dBm = 100mW	
Input power drift	< 0.05 dB	

2 Maximum Field values

H-field 10 mm above dipole surface	condition	**interpolated maximum**
Maximum measured	100 mW forward power	**0.471 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	170.8 V/m
Maximum measured above low end	100 mW forward power	163.2 V/m
Averaged maximum above arm	100 mW forward power	**168.0 V/m**

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

3 Appendix

3.1 Antenna Parameters

Frequency	**Return Loss**	**Impedance**
800 MHz	15.8 dB	(42.4 – j13.1) Ohm
835 MHz	**26.7 dB**	**(47.1 + j3.4) Ohm**
900 MHz	17.1 dB	(57.3 – j13.3) Ohm
950 MHz	17.8 dB	(47.6 + j12.4) Ohm
960 MHz	13.9 dB	(56.7 + j20.9) Ohm

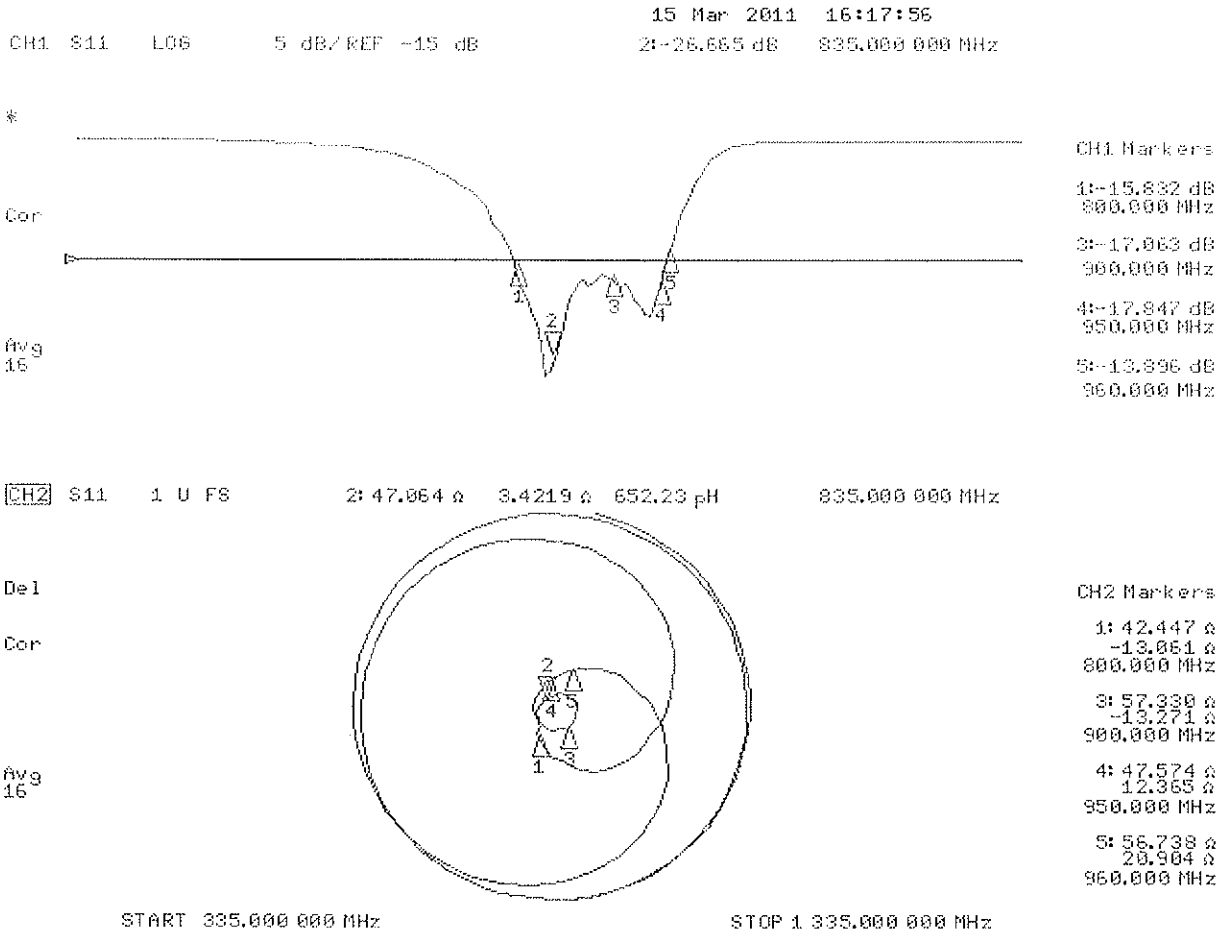
3.2 Antenna Design and Handling

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



3.3.3 DASY4 H-field Result

Date/Time: 15.03.2011 10:09:03

Test Laboratory: SPEAG Lab2

HAC RF_CD835_1041_H_110315_CL

DUT: HAC-Dipole 835 MHz; Type: CD835V3; Serial: 1041

Communication System: CW; Frequency: 835 MHz
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: RF Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

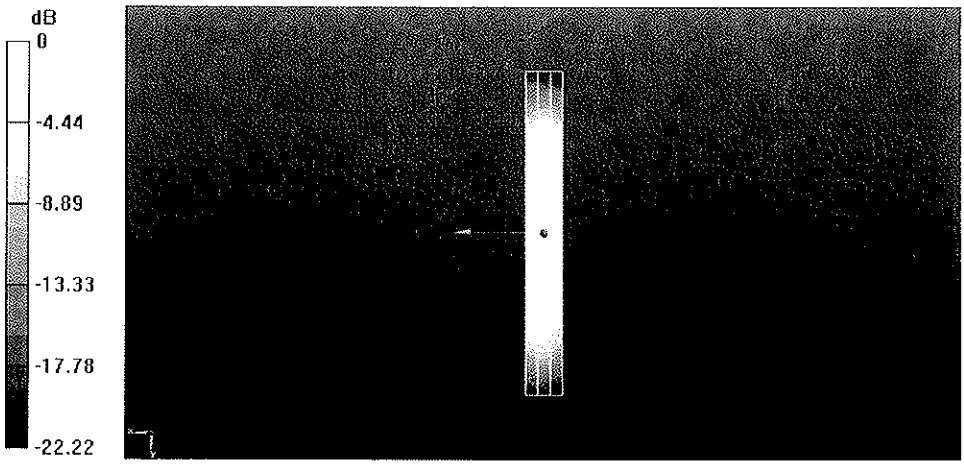
DASY5 Configuration:

- Probe: H3DV6 - SN6065; ; Calibrated: 29.12.2010
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 20.10.2010
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY52, V52.6 Build 2, Version 52.6.2 (424)
- Postprocessing SW: SEMCAD X, V14.4 Build 4, Version 14.4.4 (2829)

Dipole H-Field measurement @ 835MHz/H 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 = 0.471 A/m
Probe Modulation Factor = 1.000
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 0.502 A/m; Power Drift = 0.01 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.390 M4**	Grid 2 **0.413 M4**	Grid 3 **0.392 M4**
Grid 4 **0.449 M4**	Grid 5 **0.471 M4**	Grid 6 **0.442 M4**
Grid 7 **0.398 M4**	Grid 8 **0.414 M4**	Grid 9 **0.385 M4**



0 dB = 0.470A/m

3.3.2 DASY4 E-field Result

Date/Time: 15.03.2011 12:53:58

Test Laboratory: SPEAG Lab2

HAC RF_CD835_1041_E_110315_CL

DUT: HAC-Dipole 835 MHz; Type: CD835V3; Serial: 1041

Communication System: CW; Frequency: 835 MHz
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: RF Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

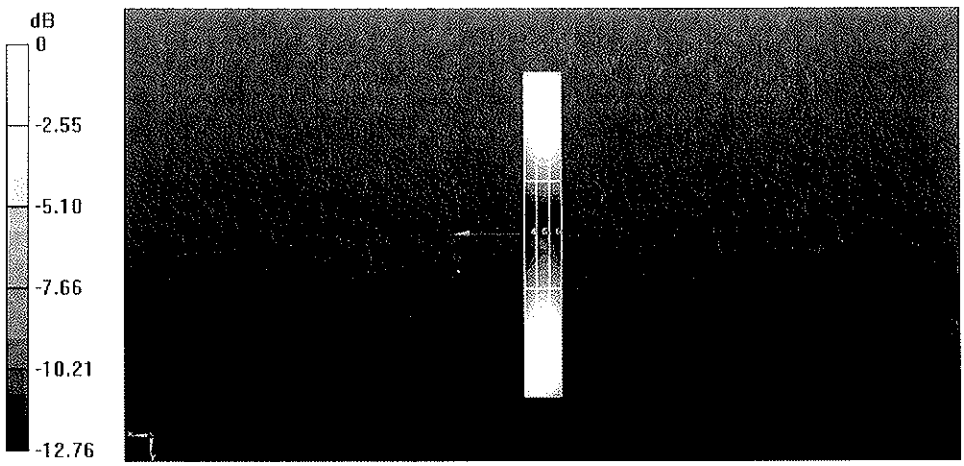
DASY5 Configuration:

- Probe: ER3DV6 - SN2336; ConvF(1, 1, 1); Calibrated: 29.12.2010
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 20.10.2010
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY52, V52.6 Build 2, Version 52.6.2 (424)
- Postprocessing SW: SEMCAD X, V14.4 Build 4, Version 14.4.4 (2829)

Dipole E-Field measurement @ 835MHz/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 = 170.8 V/m
Probe Modulation Factor = 1.000
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 124.9 V/m; Power Drift = -0.02 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **158.6 M4**	Grid 2 **170.8 M4**	Grid 3 **167.4 M4**
Grid 4 **86.752 M4**	Grid 5 **90.542 M4**	Grid 6 **88.762 M4**
Grid 7 **158.6 M4**	Grid 8 **163.2 M4**	Grid 9 **158.5 M4**



0 dB = 170.8V/m

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 **B.V. ADT (Auden)**

Certificate No: **CD1880V3-1032_Apr11**

CALIBRATION CERTIFICATE

Object	CD1880V3 - SN: 1032
Calibration procedure(s)	QA CAL-20.v5 Calibration procedure for dipoles in air
Calibration date:	April 12, 2011

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 (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Probe ER3DV6	SN: 2336	29-Dec-10 (No. ER3-2336_Dec10)	Dec-11
Probe H3DV6	SN: 6065	29-Dec-10 (No. H3-6065_Dec10)	Dec-11
DAE4	SN: 781	20-Oct-10 (No. DAE4-781_Oct10)	Oct-11

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter Agilent 4419B	SN: GB42420191	09-Oct-09 (in house check Oct-10)	In house check: Oct-11
Power sensor HP 8482H	SN: 3318A09450	09-Oct-09 (in house check Oct-10)	In house check: Oct-11
Power sensor HP 8482A	SN: US37295597	09-Oct-09 (in house check Oct-10)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11
RF generator E4433B	MY 41000675	03-Nov-04 (in house check Oct-09)	In house check: Oct-11

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Fin Bomholt	R&D Director	

Issued: April 12, 2011

References

[1] ANSI-C63.19-2007
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 the standards [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 DASY5 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	DASY5	V52.6.2 (424)
DASY PP Version	SEMCAD X	V14.4.4 (2829)
Phantom	HAC Test Arch	SD HAC P01 BA, #1070
Distance Dipole Top - Probe Center	10 mm	
Scan resolution	dx, dy = 5 mm	area = 20 x 90 mm
Frequency	**1880 MHz** ± 1 MHz	
Forward power at dipole connector	20.0 dBm = 100mW	
Input power drift	< 0.05 dB	

2. Maximum Field values

H-field 10 mm above dipole surface	condition	**Interpolated maximum**
Maximum measured	100 mW forward power	**0.471 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	143.9 V/m
Maximum measured above low end	100 mW forward power	140.3 V/m
Averaged maximum above arm	100 mW forward power	**142.1 V/m**

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

3. Appendix

3.1 Antenna Parameters

Frequency	**Return Loss**	**Impedance**
1730 MHz	25.8 dB	(51.2 + j5.1) Ohm
1880 MHz	**21.1 dB**	**(51.2 + j8.9) Ohm**
1900 MHz	21.2 dB	(53.5 + j8.4) Ohm
1950 MHz	27.3 dB	(54.5 – j0.1) Ohm
2000 MHz	22.8 dB	(43.5 + j1.9) Ohm

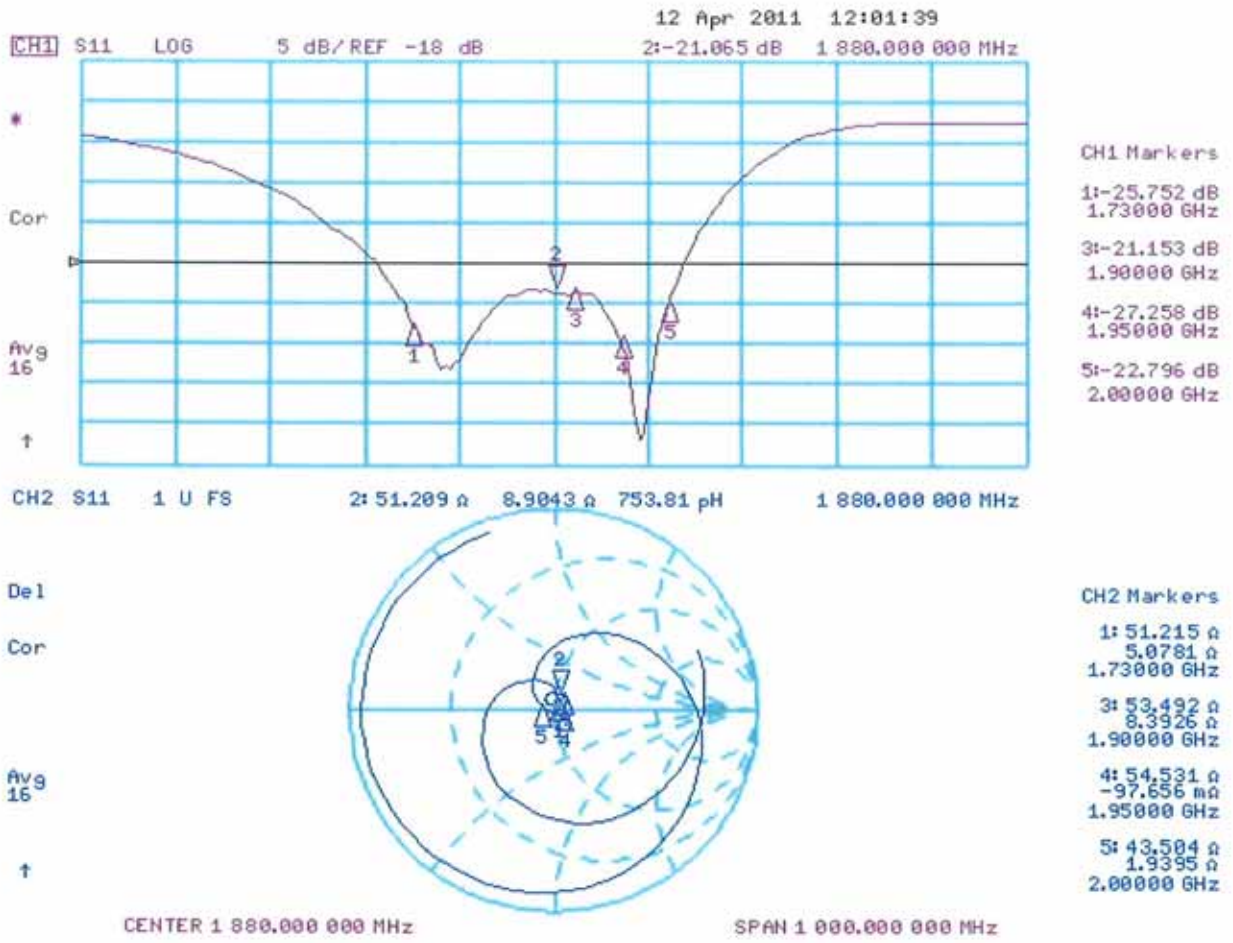
3.2 Antenna Design and Handling

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: 12.04.2011 12:39:46

Test Laboratory: SPEAG Lab2

HAC_RF_CD1880_1032_H_110412_CL

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1032

Communication System: CW; Frequency: 1880 MHz
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: RF Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

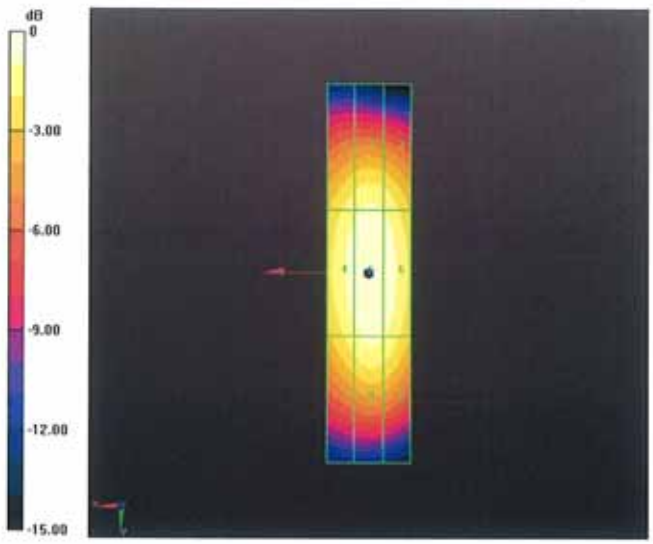
DASY5 Configuration:

- Probe: H3DV6 - SN6065; ; Calibrated: 29.12.2010
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 20.10.2010
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY52, V52.6 Build 2, Version 52.6.2 (424)
- Postprocessing SW: SEMCAD X, V14.4 Build 4, Version 14.4.4 (2829)

Dipole H-Field measurement @ 1880MHz/H Scan - measurement distance from the probe sensor center to CD1880 Dipole = 10mm/Hearing Aid Compatibility Test (41x181x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.471 A/m
Probe Modulation Factor = 1.000
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 0.500 A/m; Power Drift = -0.0016 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.406 M2**	Grid 2 **0.432 M2**	Grid 3 **0.416 M2**
Grid 4 **0.441 M2**	Grid 5 **0.471 M2**	Grid 6 **0.457 M2**
Grid 7 **0.401 M2**	Grid 8 **0.433 M2**	Grid 9 **0.421 M2**



0 dB = 0.470A/m

3.3.3 DASY4 E-Field Result

Date/Time: 12.04.2011 15:07:52

Test Laboratory: SPEAG Lab2

HAC_RF_CD1880_1032_E_110412_CL

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1032

Communication System: CW; Frequency: 1880 MHz
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: RF Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

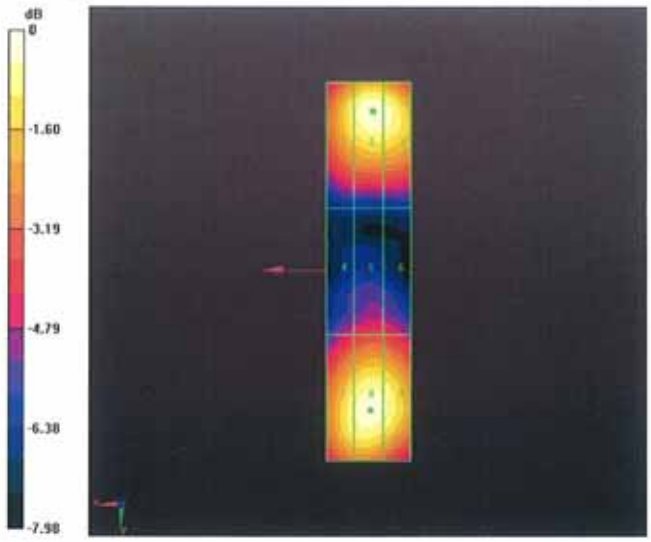
DASY5 Configuration:

- Probe: ER3DV6 - SN2336; ConvF(1, 1, 1); Calibrated: 29.12.2010
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 20.10.2010
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY52, V52.6 Build 2, Version 52.6.2 (424)
- Postprocessing SW: SEMCAD X, V14.4 Build 4, Version 14.4.4 (2829)

Dipole E-Field measurement @ 1880MHz/E Scan - measurement distance from the probe sensor center to CD1880 Dipole = 10mm/Hearing Aid Compatibility Test (41x181x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 143.9 V/m
Probe Modulation Factor = 1.000
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 144.4 V/m; Power Drift = -0.0043 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **131.8** **M2**	Grid 2 **143.9** **M2**	Grid 3 **141.3** **M2**
Grid 4 **86.926** **M3**	Grid 5 **92.728** **M3**	Grid 6 **91.584** **M3**
Grid 7 **133.8** **M2**	Grid 8 **140.3** **M2**	Grid 9 **137.0** **M2**



0 dB = 143.9V/m