Lab Code: 200167-0

Bay Area Compliance Labs. Corp.

Hearing Aid Compatibility (HAC)

RF EMISSIONS TEST REPORT

For

UMEOX Mobile Limited

3409 Times Square Excellence, FuTian

Shenzhen, Guangdong, China 518000

FCC ID: WNKUMEOX-Q421

Report Type: Original Report	**Product Type:** GSM Mobile Phone

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Report Number:	R0906027-HAC-M
Report Date:	2009-06-22
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R0906027-HAC-M	Original Report	2009-06-22

GENERAL INFORMATION

Product Description for the EUT

This Bay Area Compliance Laboratories Corp. test report has been prepared on behalf of UMEOX MOBILE LIMITED and their product, GSM Dual Band Mobile Phone (FCC ID: WNKUMEOX-Q421) or the EUT (Equipment Under Test) as referred to in the rest of this report.

**The data gathered are from a typical production sample provided by the manufacturer, serial number: R0906027-1*

Item	Content
Modulation	GMSK
Frequency Band	Cellular Band: 824-849 MHz (Tx) 869-894 MHz (Rx) PCS Band: 1850-1910 MHz (Tx) 1930-1990 MHz (Rx)
Dimensions (L x W x H)	102 mm (L) x 52 mm (W) x 23 mm (H)
Weight	123.5 g
Power Source	3.7VDC/550mAH Rechargeable Battery
Operation Mode	Head/Body Worn

EUT Photo

Additional EUT photos in Appendix G

Objective

The objective is to determine compliance with FCC rules for Heading Aid Compatibility (HAC) using ANSI/IEEE Std. C63.19-2007 (American National Standard Method of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids) and test in accordance with the specified measurement procedures.

TEST FACILITIES AND ACCREDIATION

The test site used by Bay Area Compliance Laboratories Corp. (BACL) to collect data is located at 1274 Anvilwood Ave., Sunnyvale, California 94089, USA.

BACL is a National Institute of Standards and Technology (NIST) accredited laboratory under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0).

The current scope of accreditations can be found at:
http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm

STANDARDS AND GUIDELINES

Application Standards

This report describes the methodology and results of experiments performed on wireless data terminal. The objective was to assess the electromagnetic characteristics and operational compatibility and accessibility of hearing aids used with wireless communications devices, including cordless, cellular, and personal communications service (PCS) phones.

ANSI C63.19-2007 Clause 7 provides the requirements for acceptable interoperability of hearing aids with wireless devices. When these requirements are met, as defined by the tests described in this standard, a hearing aid operates acceptably with a WD.

Compatibility Tests involved:

The standard calls for wireless communications device to be measured for:

1) RF Electric-field emissions
2) RF Magnetic-field emissions
3) T-coil mode, magnetic-signal strength in the audio band.
4) T-coil mode, magnetic-signal frequency response through the audio band.
5) T-coil mode, magnetic-signal and noise articulation index

The hearing aid must be measured for:

1) RF immunity in microphone mode
2) RF immunity in T-coil mode

The categories begin with a minimal level of performance, which is described as “usable.” From this minimum level, steps are provided for both the WD and hearing aid. Improvement in either device moves the performance first to the “regular use” and then to the “excellent performance” categories.

In addition to immunity and emission requirements, hearing aid response performance, as measured by gain, can be adversely affected by WD RF interference. The criterion established Clause 7 sets the requirement for achieving these levels and gain requirements.

The values in Table 1 are built on a set of premises, which are documented in items a) through d).

a) First, 80 dB(SPL) is assumed as the level of the intended audio input signal.

b) Secondly, the values given are for an equivalent CW signal. Thus, for hearing aid immunity testing, a CW signal is used to establish a field at the specified RF power level. Then the signal is modulated with 1 kHz, 80% AM modulation for the test. Thus, the peak field strength for the test is higher than the CW level by the increase created by the modulation. In a reciprocal fashion, the peak field emissions from the WD are measured. These are then adjusted by the computed AWF, which reflects the interference potential of the modulation method used.

c) Finally, the hearing aid gain deviation is a measurement of the gain response change of the hearing aid when exposed to the E- and H-fields created by the dipole.

d) The category levels represent available volume control adjustment availability. For instance, if the volume control requires 4 dB to 6 dB of adjustment to use the WD, it is considered within the residual reserve gain of the hearing aid but may become a problem during normal use and therefore is considered usable but not acceptable for regular use.

Where a value is contained in two categories, the stricter limit applies.

Table 1—Hearing aid and telephone near-field parameters

Category		Telephone RF parameters < 960 MHz			
Near field	AWF	E-field emissions		H-field emissions	
Category M1/T1	0	631.0 to 1122.0	V/m	1.91 to 3.39	A/m
	–5	473.2 to 841.4	V/m	1.43 to 2.54	A/m
Category M2/T2	0	354.8 to 631.0	V/m	1.07 to 1.91	A/m
	–5	266.1 to 473.2	V/m	0.80 to 1.43	A/m
Category M3/T3	0	199.5 to 354.8	V/m	0.60 to 1.07	A/m
	–5	149.6 to 266.1	V/m	0.45 to 0.80	A/m
Category M4/T4	0	< 199.5	V/m	< 0.60	A/m
	–5	< 149.6	V/m	< 0.45	A/m

Category		Telephone RF parameters > 960 MHz			
Near field	AWF	E-field emissions		H-field emissions	
Category M1/T1	0	199.5 to 354.8	V/m	0.60 to 1.07	A/m
	–5	149.6 to 266.1	V/m	0.45 to 0.80	A/m
Category M2/T2	0	112.2 to 199.5	V/m	0.34 to 0.60	A/m
	–5	84.1 to 149.6	V/m	0.25 to 0.45	A/m
Category M3/T3	0	63.1 to 112.2	V/m	0.19 to 0.34	A/m
	–5	47.3 to 84.1	V/m	0.14 to 0.25	A/m
Category M4/T4	0	< 63.1	V/m	< 0.19	A/m
	–5	< 47.3	V/m	< 0.14	A/m

Equipment, which is categorized according to these requirements, shall be coordinated according to Table 2. It should be noted that because the common interference response of hearing aid circuitry is proportional to the square of the RF field, a 5 dB change in the RF yields a 10 dB change in the interference level.

Table 2—System performance classification table

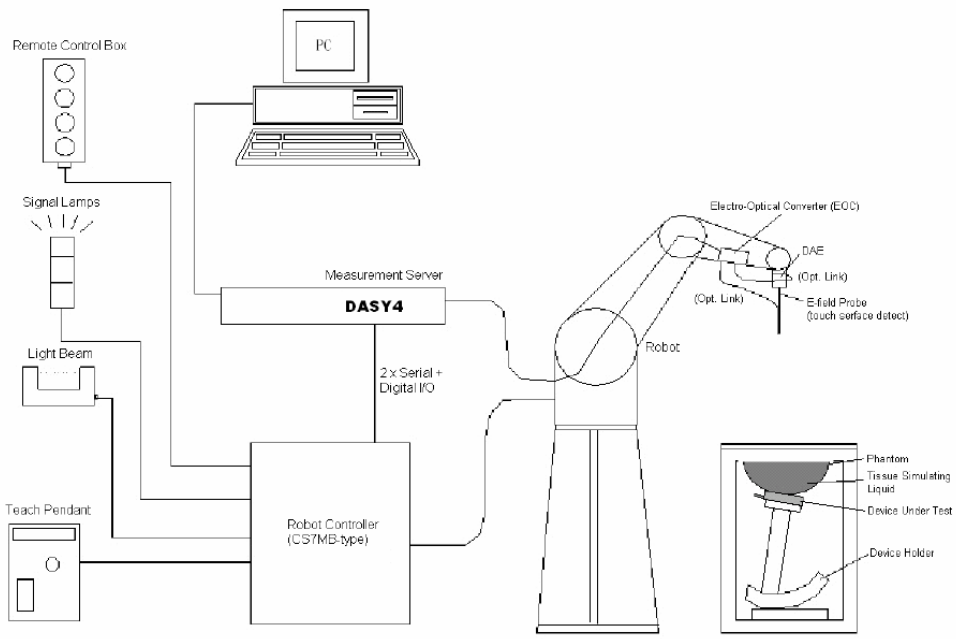
System classification	Articulation index (AI)	Category sum sum of hearing aid category + telephone category
Usable	0.3	Hearing aid category + telephone category = 4
Normal use	0.5	Hearing aid category + telephone category = 5
Excellent performance	0.7	Hearing aid category + telephone category = ≥6

DESCRIPTION OF TEST SYSTEM

These measurements were performed with the automated near-field scanning system DASY4 from Schmid & Partner Engineering AG (SPEAG) which is the fourth generation of the system shown in the figure hereinafter:

The system is based on a high precision robot (working range greater than 0.9m), which positions the probes with a positional repeatability of better than ±0.02mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit.

Measurement System Diagram



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

• A standard high precision 6-axis robot (Stäubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).

• A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.

• 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 XP.

• DASY4 software.

• Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.

• The SAM twin phantom.

• The device holder for handheld mobile phones.

• Dipole for evaluating the proper functioning of the system.

• Arch Phantom.

• Validation dipole kits allowing it to validate the proper functioning of the system.

System Components

• DASY4 Measurement Server
• Data Acquisition Electronics
• Probes
•Light Beam Unit
• Medium
• SAM Twin Phantom
•Device Holder for SAM Twin Phantom
•System Validation Kits
•Robot

DASY4 Measurement Server

The DASY4 measurement server is based on a PC/104 CPU board with a 166MHz low-power Pentium, 32MB chip disk and 64MB RAM. The necessary circuits for communication with either the DAE4 (or DAE3) electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY4 I/O-board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. The PC-operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with two expansion slots which are reserved for future applications. Please note that the expansion slots do not have a standardized pinout and therefore only the expansion cards provided by SPEAG can be inserted. Expansion cards from any other supplier could seriously damage the measurement server.

Data Acquisition Electronics

The data acquisition electronics DAE3 consists of a highly sensitive electrometer grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

Light Beam Unit

The light beam switch allows automatic "tooling" of the probe. During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, so that the robot coordinates are valid for the probe tip. The repeatability of this process is better than 0.1 mm. If a position has been taught with an aligned probe, the same position will be reached with another aligned probe within 0.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position.

Robot

The DASY4 system uses the high precision industrial robots RX60L, RX90 and RX90L, as well as the RX60BL and RX90BL types out of the newer series from Stäubli SA (France). The RX robot series offers many features that are important for our application:

- High precision (repeatability 0.02mm)
- High reliability (industrial design)
- Low maintenance costs (virtually maintenance-free due to direct drive gears; no belt drives)
- Jerk-free straight movements (brushless synchrony motors; no stepper motors)
- Low ELF interference (the closed metallic construction shields against motor control fields)

For the newly delivered DASY4 systems as well as for the older DASY3 systems delivered since 1999, the CS7MB robot controller version from Stäubli is used. Previously delivered systems have either a CS7 or CS7M controller; the differences to the CS7MB are mainly in the hardware, but some procedures in the robot software from Stäubli are also not completely the same. The following descriptions about robot hard- and software correspond to CS7MB controller with software version 13.1 (edit S5). The actual commands, procedures and configurations, also including details in hardware, might differ if an older robot controller is in use. In this case please also refer to the Stäubli manuals for further information.

E-Field and H-Field Probes

The HAC measurement is conducted with the dosimetric probe ER3DV6 and H3DV6 (manufactured by SPEAG). The probe is specially designed and calibrated. This probe has a built in optical surface detection system from collision with DUT.

ER3DV6 E-Field Probe Description

Construction	One dipole parallel, two dipoles normal to probe axis Built-in shielding against static charges PEEK enclosure material
Calibration	In air from 100 MHz to 3.0 GHz (absolute accuracy ±6.0%, k=2)
Frequency	40 MHz to > 6 GHz (can be extended to < 20 MHz) 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

E-Filed Free-space Probe (ER3DV6)

H3DV6 H-Field Probe Description

Construction	Three concentric loop sensors with 3.8 mm loop diameters Resistively loaded detector diodes for linear response Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., glycolether)
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

H-Filed Free-space Probe (H3DV6)

Probes Tip Description

HAC field measurements take place in the close near field gradients. Increasing the measuring distance from the surce3 will generally decrease the measured field values (in case of the validation dipole approx. 10% per mm)

Magnetic field sensors are measuring the integral of H-field across area surrounded by the loop. They are calibrated in a precise, homogeneous field. When measuring a gradient field, the result will be very close to the field in the center of the loop which is equivalent to the value of a homogeneous field equivalent to the center value. But it will be different from the field at the field at the board of the loop.

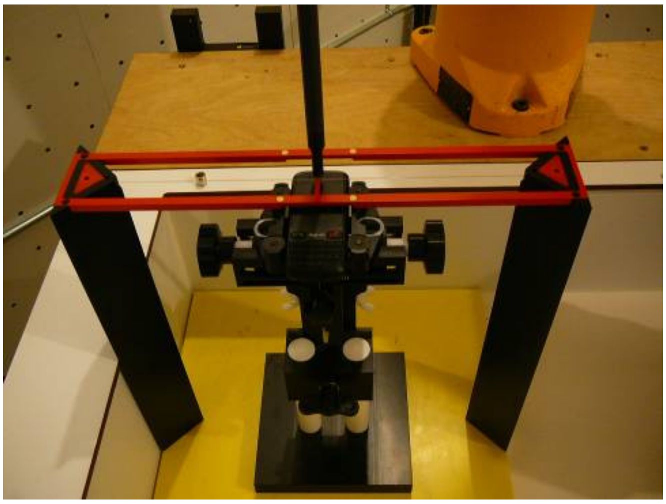
Consequently, two sensors with different loop diameters – both calibrated ideally- would give different results when measuring from the edge of probe of the probe sensor elements. The behavior for electronically small E-field sensors is equivalent.

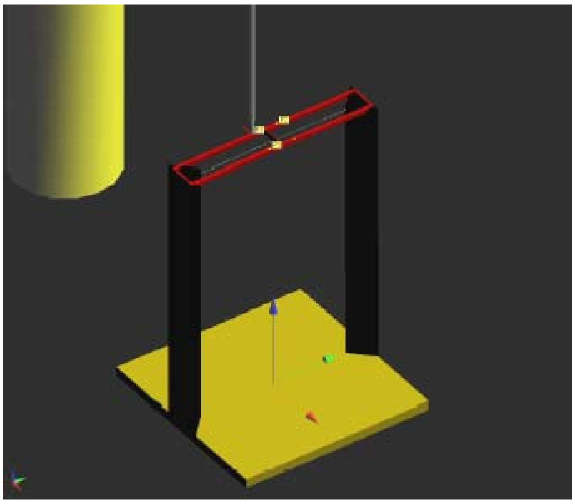
The magnetic field loops of the H3D probes are concentric, with the center 3 mm from the tip for H3DV6.

The electric field probes have a more irregular internal geometry because it is physically not possible to have the 3 orthogonal sensors situated with the same center. The different sensor center is accounted for in HAC uncertainty budget (“sensor displacement”). Their geometric center is at 2.5 mm from the tip, and the element ends are 1.1 mm closer to the tip.

Device Holder and Phantom

The test Arch phantom should be positioned horizontally on a stable surface. Reference marking on the phantom allows the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.





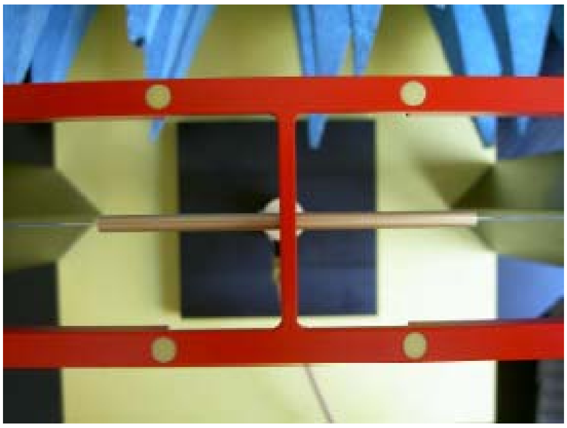
The DASY device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity "=3 and loss tangent _=0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

Installation of the Test Arch Phantom

The Test Arch phantom should be positioned horizontally on a stable surface. If the cover of the Twin SAM phantom is used, side shifting after the teaching shall be avoided. In order to allow a vertical position of the probe (for both DASY4 Professional and Compact versions) the section Park position should be not higher than 15mm above the top of the upper Arch frame. For improved user friendliness a predefined configuration file of the Test Arch phantom is provided by SPEAG.

Mounting of a Calibration Dipole

A set of three calibration dipoles (CD835, CD1880 and CD2450) is included as a part of the HAC extension. These are used for the validation of the test setup after its installation and prior to the DUT measurements. The calibration dipole is placed in the position normally occupied by the DUT. All three calibration dipoles have the same high which allows an exact fitting below the center point of the Test Arch.



Insert the base of the calibration dipole fully into the dipole holder and fix it against rotation by tightening the white screw. Connect the RF cable to the dipole and secure it before placing it below the Test Arch phantom in order to avoid mechanical stress to it. Hold the dipole on its plate at the base and press it down against the internal spring to reduce the height.

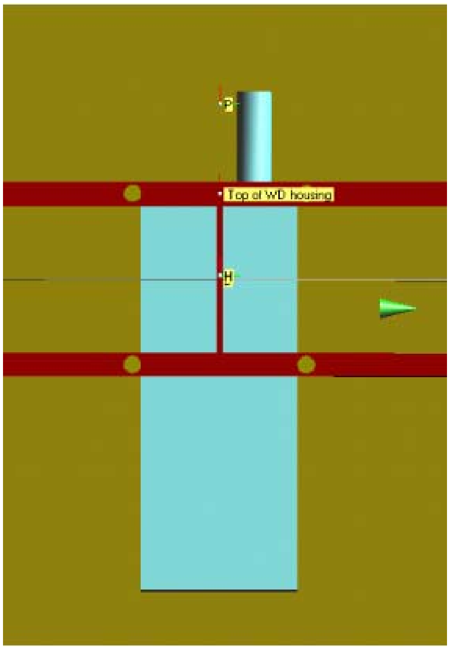
While holding the dipole down, slide the dipole on its holder centered below the arch, with the arms aligned to the dielectric wire (see graphics above). Release the dipole slowly and guide the gap between the arms into the matching center spacer below the dielectric wire.

To remove the dipole from the setup press it in the downwards direction before sliding it carefully out from below the arch.

Mounting the DUT

A DUT is mounted in the device holder equivalent as for classic dosimetric measurements The acoustic output of the DUT shall coincide with the center point of the area formed by the dielectric wire and the middle bar of the arch's top frame (see picture below).

The DUT shall be moved vertically upwards until it touches the frame. The fine adjustment is possible by sliding the complete DUT holder on the yellow base plate of the Test Arch phantom.



System Validation Kits

Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system performance check and system validation. For that purpose a well defined SAR distribution in the flat section of the SAM twin phantom is produced.

System validation kit includes a dipole, tripod holder to fix it underneath the flat phantom and a corresponding distance holder. Dipoles are available for the variety of frequencies between 300MHz and 6 GHz (dipoles for other frequencies or media and other calibration conditions are available upon request).

The dipoles are highly symmetric and matched at the center frequency for the specified liquid and distance to the flat phantom (or flat section of the SAM-twin phantom). The accurate distance between the liquid surface and the dipole center is achieved with a distance holder that snaps on the dipole.

TESTING EQUIPMENT LIST

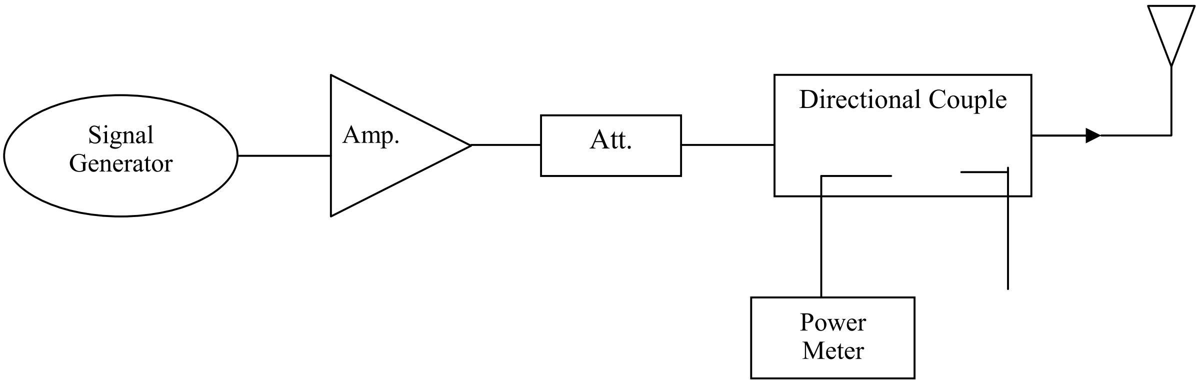
Type / Model	Calibration Date	Serial Number
DASY4 Professional Dosimetric System	N/A	N/A
Robot RX60L	N/A	CS7MBSP / 467
Robot Controller	N/A	F01/5J72A1/A/01
Dell Computer Dimension 3000	N/A	N/A
SPEAG EDC3	N/A	N/A
SPEAG DAE3	N/A	456
Probe, ER3DV6	2008-09-22	2338
Probe, H3DV6	2008-09-22	6158
SPEAG Arch Phantom	N/A	1010
SPEAG Light Alignment Sensor	N/A	278
DASY4 Measurement Server	N/A	1176
Antenna, Dipole, CD835V3	2008-09-17	1012
Antenna, Dipole, CD1880V3	2008-09-17	1009
Agilent, Spectrum Analyzer E4440A	2009-04-27	MY44303352
Microwave Amp. 8349A	N/A	2644A02662
Power Meter Agilent E4419B	2008-10-10	MY4121511
Power Sensor Agilent E4412A	2008-10-10	MY41497252
Rohde& Schwarz CMU 200	2009-05-21	103492
Dielectric Probe Kit HP85070A	N/A	US99360201
Agilent, Signal Generator, 8648C	2009-02-25	3347M00143
Amplifier, ST181-20	N/A	E012-0101
Antenna, Horn, DRG-11/A	2008-07-28	1132

HAC MEASUREMENT SYSTEM VERIFICATION

Purpose of System Performance Check

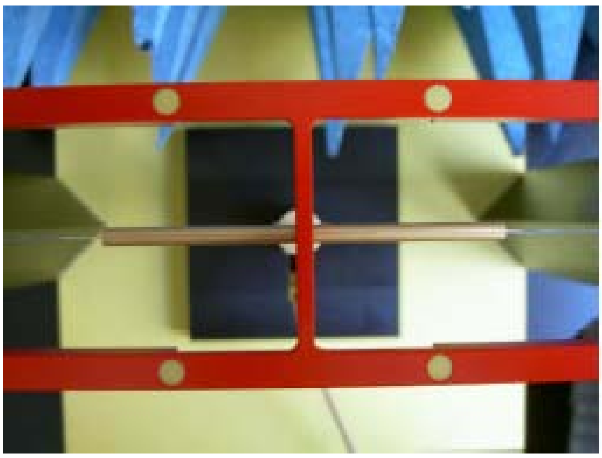
The system performance check verifies that the system operates within its specifications. System and operator errors can be detected and corrected. It is recommended that the system performance check be performed prior to any usage of the system. The system performance check use normal HAC measurements in a simplified setup with a well characterized source. This setup was selected to give a high sensitivity to all parameters that might fail or vary time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.

System Performance Check Setup



In the simplified setup for system evaluation, the EUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave which comes from a signal generator at frequency 835 MHz and 1880 MHz. The calibrated dipole must be placed beneath the flat phantom section of ARC with the correct distance holder.

The output power on dipole port must be calibrated to 20 dBm (100 mw) before dipole is connected.



System Validation Results

Table A: E-Field System Validation

Frequency (MHz)	Input Power (dBm)	E-Field Result (V/m)	Target E-Field (V/m)	Deviation (%)
835	20.0	161.0	169.7	-5.13%
1880	20.0	137.4	140.0	-1.86%

Table B: H-Field System Validation

Frequency (MHz)	Input Power (dBm)	H-Field Result (A/m)	Target H-Field (A/m)	Deviation (%)
835	20.0	0.469	0.455	3.08%
1880	20.0	0.434	0.467	-7.07%

Note: Deviation = ((E or H-Field Result)-(Target Field))/(Target Field) * 100%

Category	AWF (dB)	Limits for E-Field Emissions (V/m) > 960MHz	Limits for H-Field Emissions (A/m) > 960MHz
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

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

HAC_E_Dipole_835 System Validation

HAC-Dipole 835 MHz; Type: CD835V3; Serial: 1012

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3
Phantom section: RF Section

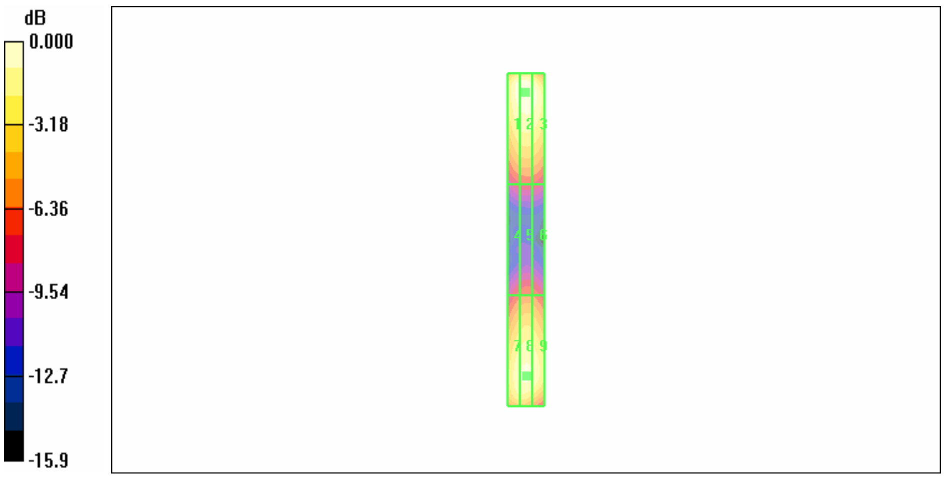
DASY4 Configuration:

- Probe: ER3DV6 - SN2338; ConvF(1, 1, 1); Calibrated: 09/22/2008
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 71; Post processing SW: SEMCAD, V1.8 Build 184

E Scan 10mm above CD 835 MHz/Hearing Aid Compatibility Test (41x361x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 161.0 V/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 39.2 V/m; Power Drift = 0.007 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **155.9 M4**	Grid 2 **161.0 M4**	Grid 3 **154.7 M4**
Grid 4 **74.3 M4**	Grid 5 **79.1 M4**	Grid 6 **77.4 M4**
Grid 7 **141.1 M4**	Grid 8 **147.0 M4**	Grid 9 **142.6 M4**



0 dB = 161.0 V/m

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

HAC_E_Dipole_1880 System Validation

HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1009

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

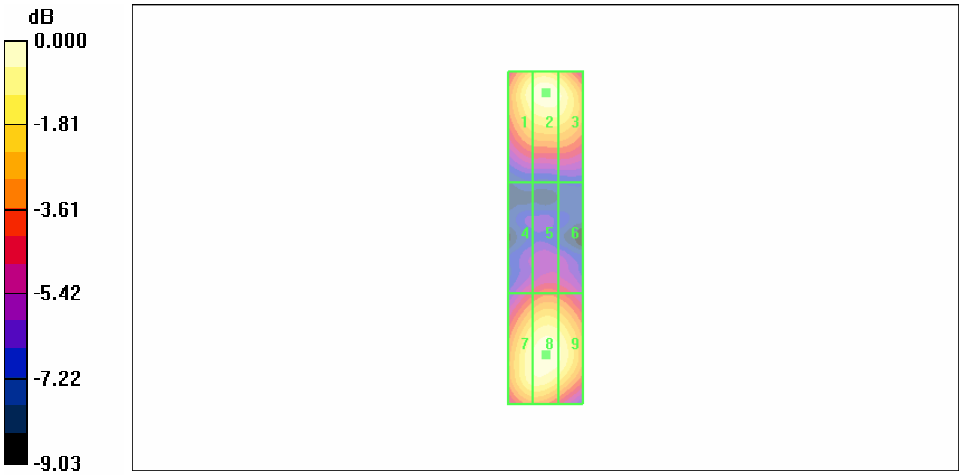
DASY4 Configuration:

- Probe: ER3DV6 - SN2338; ConvF(1, 1, 1); Calibrated: 09/22/2008
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 71; Post processing SW: SEMCAD, V1.8 Build 184

E Scan 10mm above CD 1880 MHz/Hearing Aid Compatibility Test (41x181x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 137.4 V/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 63.3 V/m; Power Drift = 0.022 dB
Hearing Aid Near-Field Category: M3 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **129.4 M2**	Grid 2 **137.4 M2**	Grid 3 **130.9 M2**
Grid 4 **82.6 M3**	Grid 5 **89.2 M3**	Grid 6 **86.7 M3**
Grid 7 **129.5 M2**	Grid 8 **135.6 M2**	Grid 9 **130.5 M2**



0 dB = 137.4 V/m

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

HAC_H_Dipole_835 System Validation

HAC-Dipole 835 MHz; Type: CD835V3; Serial: 1012

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3
Phantom section: RF Section

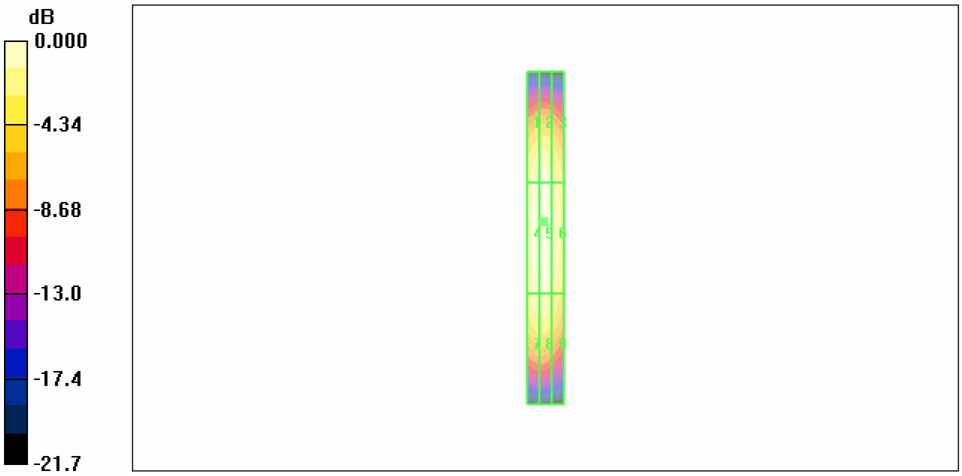
DASY4 Configuration:

- Probe: H3DV6 - SN6158; Calibrated: Calibrated: 09/22/2008
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 71; Post processing SW: SEMCAD, V1.8 Build 184

H Scan 10mm above CD 835 MHz/Hearing Aid Compatibility Test (41x361x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.469 A/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 0.443 A/m; Power Drift = -0.024 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.417 M4**	Grid 2 **0.431 M4**	Grid 3 **0.384 M4**
Grid 4 **0.456 M4**	Grid 5 **0.469 M4**	Grid 6 **0.418 M4**
Grid 7 **0.395 M4**	Grid 8 **0.401 M4**	Grid 9 **0.353 M4**



0 dB = 0.469 A/m

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

HAC_H_Dipole_1880 System Validation

HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1009

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: RF Section

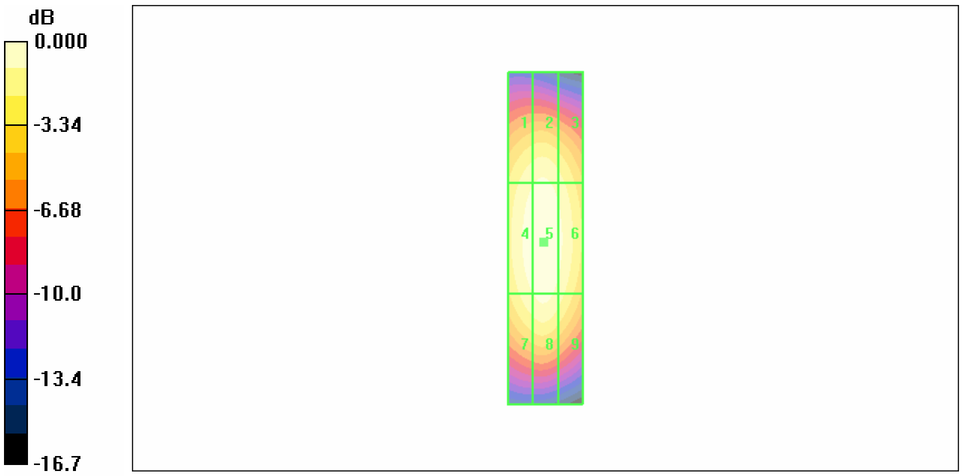
DASY4 Configuration:

- Probe: H3DV6 - SN6158; Calibrated: 09/22/2008
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 71; Post processing SW: SEMCAD, V1.8 Build 184

H Scan 10mm above CD 1880 MHz/Hearing Aid Compatibility Test (41x181x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.434 A/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 0.415 A/m; Power Drift = -0.019 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak H-field in A/m

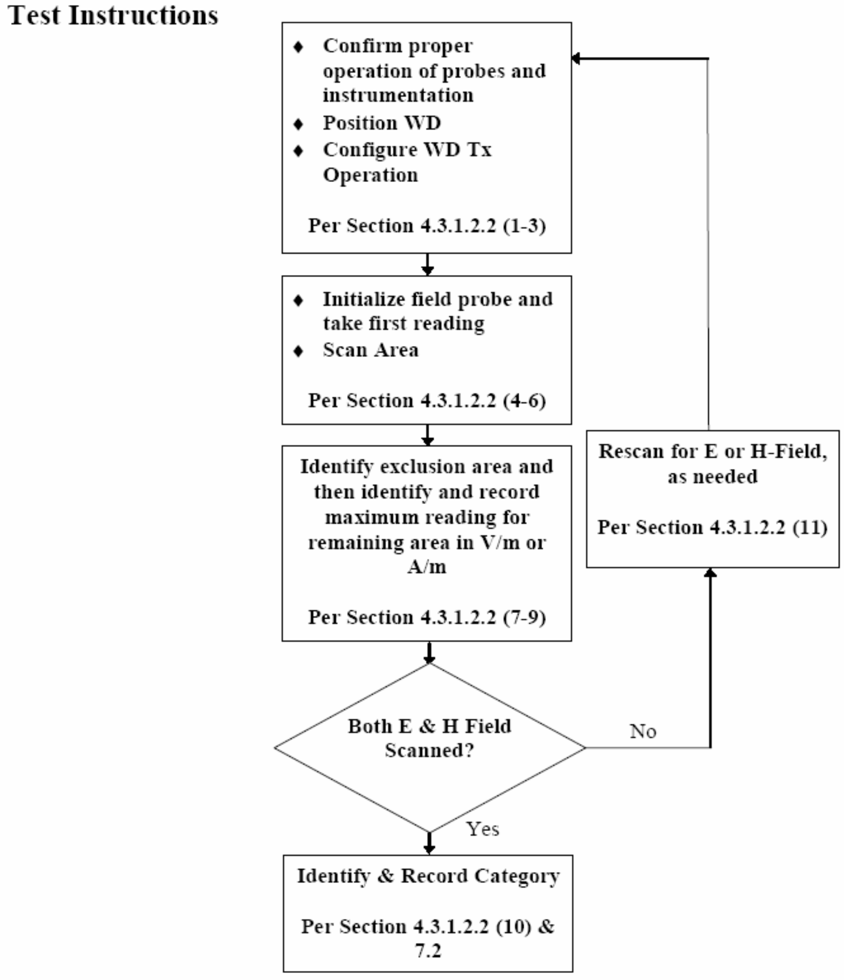
Grid 1 **0.376 M2**	Grid 2 **0.391 M2**	Grid 3 **0.359 M2**
Grid 4 **0.415 M2**	Grid 5 **0.434 M2**	Grid 6 **0.398 M2**
Grid 7 **0.380 M2**	Grid 8 **0.399 M2**	Grid 9 **0.360 M2**



0 dB = 0.434 A/m

HAC RF EMISSIONS TEST PROCEDURE

Test Instructions



Test Setup

Figure 1 through Figure 3 illustrates the references and reference plane that shall be used in the WD emissions measurement.

1) The grid is 5.0 cm by 5.0 cm area that is divided into nine evenly sized blocks or sub-grids.
2) The grid is centered on the audio frequency output transducer of the WD (speaker or T-Coil).
3) The grid is in a reference plane, which is defined as the planar area that contains the highest point in the area of the phone that normally rests against the user's ear. It is parallel to the centerline of the receiver area of the phone and is defined by the points of the receiver-end of the WD handset, which, in normal handset use, rest against the ear.
4) The measurement plane is parallel to, and 10.0 mm in front of, the reference plane.

Figure 1. WD reference and plan for RF emission measurement

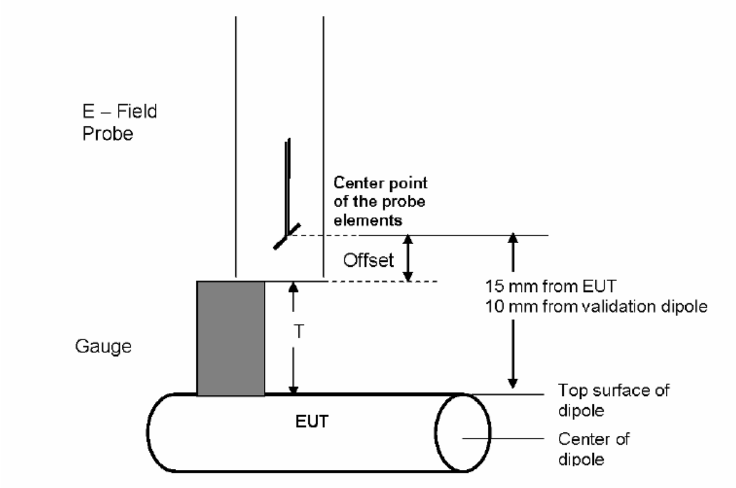


Figure 2. Gauge Block with E-field Probe

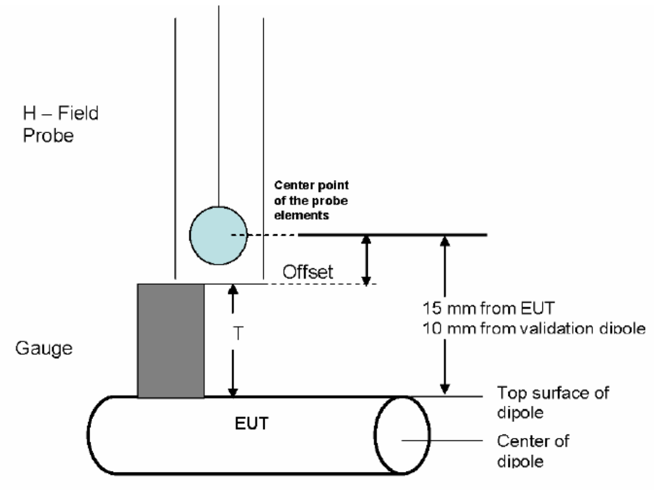


Figure 3. Gauge Block with H-field Probe

Near-Field Test Procedure

The electric field probe, and, separately, the magnetic field probe, is to be used to measure the highest field strength in the 5 cm by 5 cm scan surface. The average field strength measured over many pulse cycles may be measured, with the peak then being calculated from the measured average value and the known duty cycle of the WD.

The 5 cm by 5 cm area is divided into nine subgrids (see the diagram in Figure A.2). Three contiguous subgrids on the perimeter may be excluded from the measurement. This allows for RF “hot spots” that can easily be avoided in actual use. The highest reading found in the area defined by the middle subgrid and the remaining

subgrids determines the category rating. The field probe is carefully moved through the measurement area and the maximum reading is located. In order to accurately scan the entire 5 cm by 5 cm area, the center of the probe shall be moved through this area. Accordingly the total area covered by the outside edge of the probe shall be the 5 cm by 5 cm area, increased by half (1/2) the probe diameter on all sides.

The method of displaying the data is not important as long as good measurement techniques are followed and the resultant highest .eld strength is obtained.

The distance from the WD reference plane to the nearest point on the probe element shall be 1.0 cm. The WD reference plane is a plane parallel with the front “face” of the WD and containing the highest point on its contour. The probe element is that portion of the probe that is designed to receive and sense the field being measured. The physical body of the probe housing shall not be used when setting this 1.0 cm distance as this would place the sensing elements at an indeterminate distance from the reference plane. Although it is theoretically possible to measure at almost any distance and calculate the equivalent field strengths at 1.0 cm, it is not recommended as these calculations are very difficult and prone to errors.

In the case of a field probe that may have less than three orthogonal elements, it is necessary to rotate the probe to obtain the measurement. Two methods may be used. In the preferred method, the probe shall be rotated in three dimensions for maximum alignment and the reading at maximum field alignment used. An alternative method is to rotate the probe about its geometric center so as to obtain measurements in all three mutually orthogonal orientations. The geometric center is the point that is physically located at the center of the electromagnetic sensing element of the probe. This may be determined from physical measurements or from field pattern measurements during calibration. The maximum field shall be the vector sum of all three individual mutually orthogonal measurements. Note that even when using three element probes, the probe may be rotated so as to align one element for maximum field coupling. When this is done the reading of the single, maximally aligned element is used as the field reading at that location. Readings taken in this manner are preferred over those taken with the non-aligned method because of the greater accuracy. However, when the alignment method is used, the probe shall be realigned at every measurement point.

MEASUREMENT UNCERTAINTY

The uncertainty budget has been determined for the DASY4 measurement system and is given in the following Table.

Wireless Communication Device Near-Field Measurement Uncertainty Estimation (According to ANSI C63.19							
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%
Test Arch	±7.2%	R	$\sqrt{3}$	1	0	±4.1%	±0.0%
Linearity	±4.7%	R	$\sqrt{3}$	1	1	±2.7%	±2.7%
Scaling to Peak Envelope Power	±0.0%	R	$\sqrt{3}$	1	1	±0.0%	±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%
Response Time	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%
Integration Time	±2.6%	R	$\sqrt{3}$	1	1	±1.5%	±1.5%
RF Ambient Conditions	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%
RF Reflections	±12.0%	R	$\sqrt{3}$	1	1	±6.9%	±6.9%
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%
Test Sample Related							
Device Positioning Vertical	±4.7%	R	$\sqrt{3}$	1	0.67	±2.7%	±1.8%
Device Positioning Lateral	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%
Device Holder and Phantom	±2.4%	R	$\sqrt{3}$	1	1	±1.4%	±1.4%
Power Drift	±5.0%	R	$\sqrt{3}$	1	1	±2.9%	±2.9%
Phantom and Setup Related							
Phantom Thickness	± 2.4%	R	$\sqrt{3}$	1	0.67	±1.4%	±0.9%
Combined Std. Uncertainty						±15.2%	±10.8%
Expanded Std. Uncertainty on Power						±30.4%	±21.6%
Expanded Std. Uncertainty on Field						±15.2%	±10.8%

HAC MEASUREMENT SUMMARY

HAC Test Data

This page summarizes the results of the performed dosimetric evaluation. The plots with the corresponding E & H Fields distributions, which reveal information about the category of the wireless communication device with respect to the HAC test result, could be found in Appendix A.

Environmental Conditions

Temperature:	22° C
Relative Humidity:	56%
ATM Pressure:	102.1 kPa

** Testing was performed by Jimmy Nguyen on 2009-06-12*

Frequency (MHz)	Test Type	Medium	Phantom	Notes / Accessories	Peak Field (V/m, E-Field) (A/m, H-Field)	HAC Category	Plot #
824.2	E-Field	Air	Arch	none	148.2	M4	1
836.6	E-Field	Air	Arch	none	164.1	M3	2
848.8	E-Field	Air	Arch	none	162.5	M3	3
824.2	H-Field	Air	Arch	none	0.385	M4	7
836.6	H-Field	Air	Arch	none	0.425	M4	8
848.8	H-Field	Air	Arch	none	0.411	M4	9

Frequency (MHz)	Test Type	Medium	Phantom	Notes / Accessories	Peak Field (V/m, E-Field) (A/m, H-Field)	HAC Category	Plot #
1850.2	E-Field	Air	Arch	none	75	M3	4
18880.0	E-Field	Air	Arch	none	66.8	M3	5
1908.8	E-Field	Air	Arch	none	46.2	M4	6
1850.2	H-Field	Air	Arch	none	0.229	M3	10
1880.0	H-Field	Air	Arch	none	0.210	M3	11
1908.8	H-Field	Air	Arch	none	0.161	M3	12

APPENDIX A – HAC MEASUREMENT RESULTS

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

GSM-850 E Field Testing Low Channel

UMEOX MOBILE LIMITED; Type: GSM 850/1900 Dual Band Cellular Phone; Serial: R0906027-1

Communication System: GSM 850; Frequency: 824.2 MHz; Duty Cycle: 1:8.3
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: RF Section

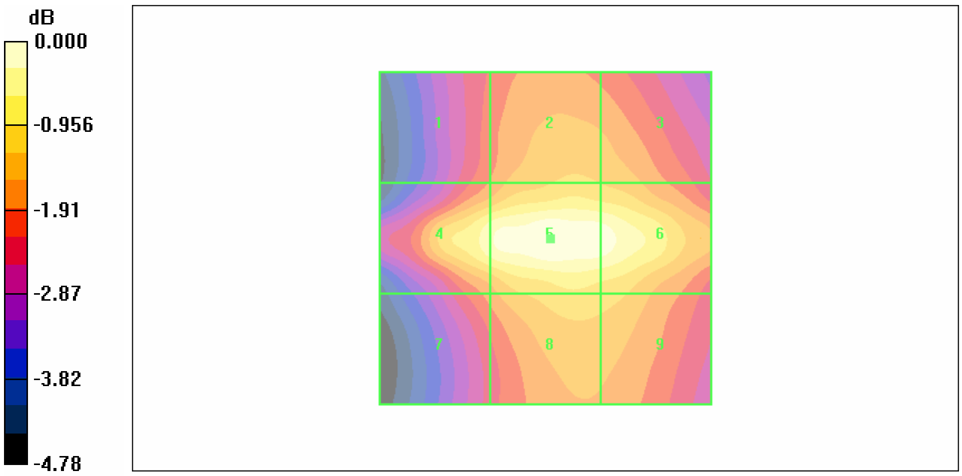
DASY4 Configuration:

- Probe: ER3DV6 - SN2338; ConvF(1, 1, 1); Calibrated: 09/22/2008
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 71; Post processing SW: SEMCAD, V1.8 Build 184

E Scan 10mm above CD/Hearing Aid Compatibility Test (61x61x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 148.2 V/m
Probe Modulation Factor = 2.88
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 48.3 V/m; Power Drift = -0.043 dB
Hearing Aid Near-Field Category: M4 (AWF -5 dB)

Peak E-field in V/m

Grid 1 **119.6 M4**	Grid 2 **129.5 M4**	Grid 3 **127.9 M4**
Grid 4 **141.8 M4**	Grid 5 **148.2 M4**	Grid 6 **145.9 M4**
Grid 7 **121.2 M4**	Grid 8 **132.0 M4**	Grid 9 **130.5 M4**



0 dB = 148.2 V/m

Plot # 1

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

GSM-850 E Field Testing Mid Channel

UMEOX MOBILE LIMITED; Type: GSM 850/1900 Dual Band Cellular Phone; Serial: R0906027-1

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3
Phantom section: RF Section

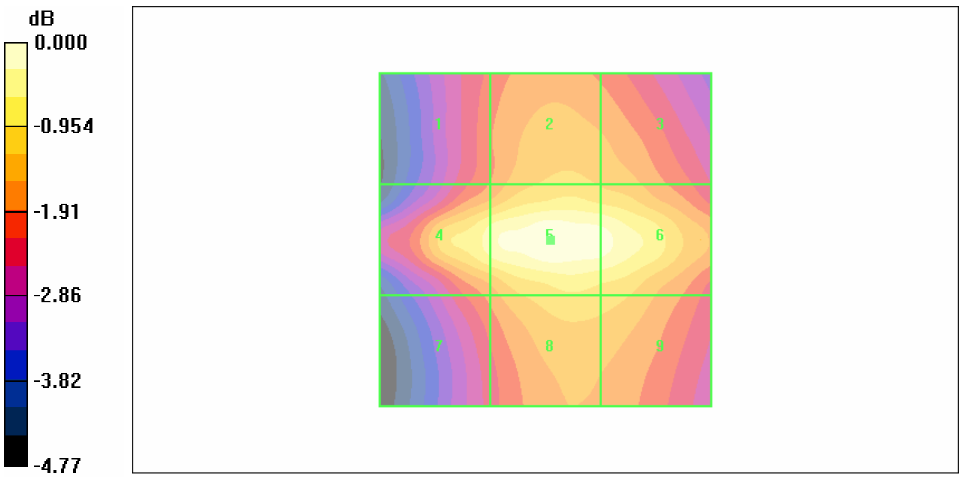
DASY4 Configuration:

- Probe: ER3DV6 - SN2338; ConvF(1, 1, 1); Calibrated: 09/22/2008
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 71; Post processing SW: SEMCAD, V1.8 Build 184

E Scan 10mm above CD/Hearing Aid Compatibility Test (61x61x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 164.1 V/m
Probe Modulation Factor = 2.88
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 53.2 V/m; Power Drift = -0.034 dB
Hearing Aid Near-Field Category: M3 (AWF -5 dB)

Peak E-field in V/m

Grid 1 **132.2 M4**	Grid 2 **144.0 M4**	Grid 3 **141.3 M4**
Grid 4 **155.7 M3**	Grid 5 **164.1 M3**	Grid 6 **160.8 M3**
Grid 7 **133.8 M4**	Grid 8 **146.4 M4**	Grid 9 **144.7 M4**



0 dB = 164.1 V/m

Plot # 2

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

GSM-850 E Field Testing High Channel

UMEOX MOBILE LIMITED; Type: GSM 850/1900 Dual Band Cellular Phone; Serial: R0906027-1

Communication System: GSM 850; Frequency: 848.8 MHz; Duty Cycle: 1:8.3
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: RF Section

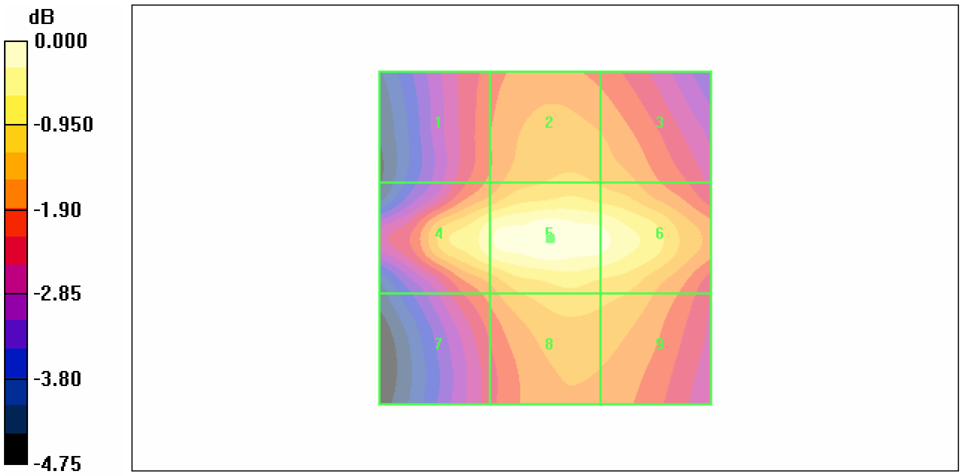
DASY4 Configuration:

- Probe: ER3DV6 - SN2338; ConvF(1, 1, 1); Calibrated: 09/22/2008
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 71; Post processing SW: SEMCAD, V1.8 Build 184

E Scan 10mm above CD/Hearing Aid Compatibility Test (61x61x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 162.5 V/m
Probe Modulation Factor = 2.88
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 52.6 V/m; Power Drift = 0.008 dB
Hearing Aid Near-Field Category: M3 (AWF -5 dB)

Peak E-field in V/m

Grid 1 **131.9 M4**	Grid 2 **142.2 M4**	Grid 3 **139.8 M4**
Grid 4 **155.5 M3**	Grid 5 **162.5 M3**	Grid 6 **158.7 M3**
Grid 7 **132.9 M4**	Grid 8 **144.5 M4**	Grid 9 **142.4 M4**



0 dB = 162.5 V/m

Plot # 3

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

PCS-1900 E Field Testing Low Channel

UMEOX MOBILE LIMITED; Type: GSM 850/1900 Dual Band Cellular Phone; Serial: R0906027-1

Communication System: PCS 1900; Frequency: 1850.2 MHz; Duty Cycle: 1:8.3
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: RF Section

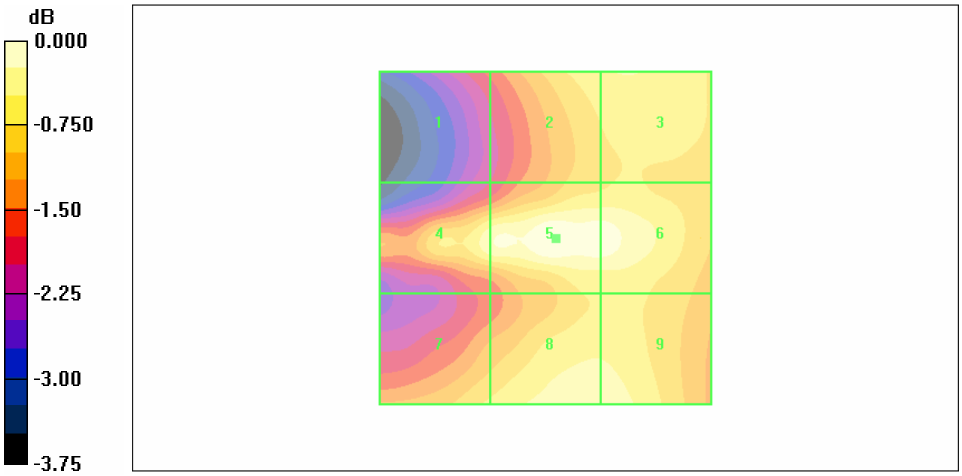
DASY4 Configuration:

- Probe: ER3DV6 - SN2338; ConvF(1, 1, 1); Calibrated: 09/22/2008
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 71; Post processing SW: SEMCAD, V1.8 Build 184

E Scan 10mm above CD/Hearing Aid Compatibility Test (61x61x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 75.8 V/m
Probe Modulation Factor = 2.88
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 24.5 V/m; Power Drift = 0.032 dB
Hearing Aid Near-Field Category: M3 (AWF -5 dB)

Peak E-field in V/m

Grid 1 **62.8 M3**	Grid 2 **71.3 M3**	Grid 3 **71.7 M3**
Grid 4 **73.3 M3**	Grid 5 **75.8 M3**	Grid 6 **74.9 M3**
Grid 7 **70.1 M3**	Grid 8 **73.2 M3**	Grid 9 **73.0 M3**



0 dB = 75.8 V/m

Plot # 4

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

PCS-1900 E Field Testing Middle Channel

UMEOX MOBILE LIMITED; Type: GSM 850/1900 Dual Band Cellular Phone; Serial: R0906027-1

Communication System: PCS 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: RF Section

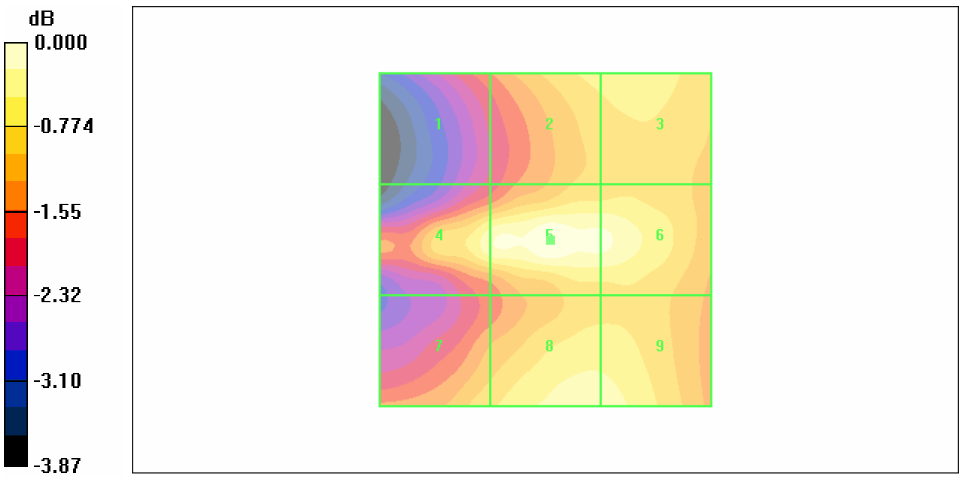
DASY4 Configuration:

- Probe: ER3DV6 - SN2338; ConvF(1, 1, 1); Calibrated: 09/22/2008
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 71; Post processing SW: SEMCAD, V1.8 Build 184

E Scan 10mm above CD/Hearing Aid Compatibility Test (61x61x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 66.8 V/m
Probe Modulation Factor = 2.88
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 21.5 V/m; Power Drift = 0.052 dB
Hearing Aid Near-Field Category: M3 (AWF -5 dB)

Peak E-field in V/m

Grid 1 **55.9 M3**	Grid 2 **62.0 M3**	Grid 3 **62.2 M3**
Grid 4 **64.5 M3**	Grid 5 **66.8 M3**	Grid 6 **65.4 M3**
Grid 7 **60.8 M3**	Grid 8 **64.1 M3**	Grid 9 **63.9 M3**



0 dB = 66.8 V/m

Plot # 5

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

PCS-1900 E Field Testing High Channel

UMEOX MOBILE LIMITED; Type: GSM 850/1900 Dual Band Cellular Phone; Serial: R0906027-1

Communication System: PCS 1900; Frequency: 1909.8 MHz; Duty Cycle: 1:8.3
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: RF Section

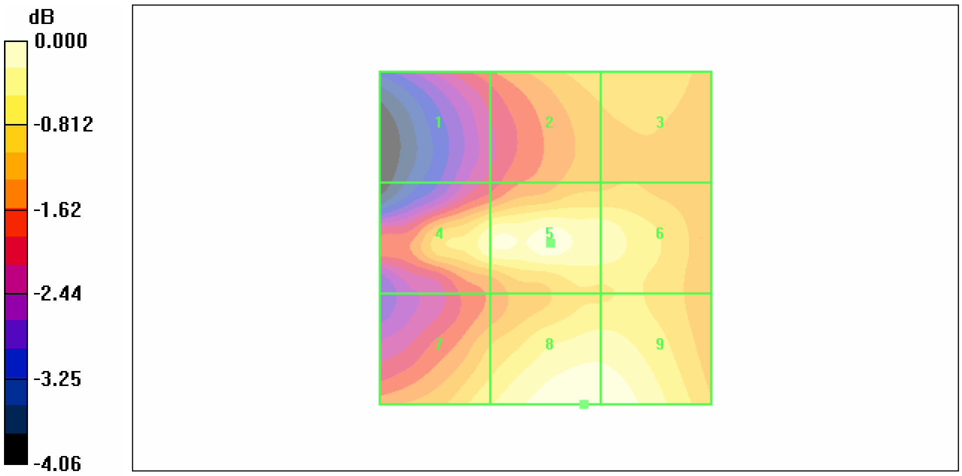
DASY4 Configuration:

- Probe: ER3DV6 - SN2338; ConvF(1, 1, 1); Calibrated: 09/22/2008
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 71; Post processing SW: SEMCAD, V1.8 Build 184

E Scan 10mm above CD/Hearing Aid Compatibility Test (61x61x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 46.2 V/m
Probe Modulation Factor = 2.88
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 14.9 V/m; Power Drift = -0.105 dB
Hearing Aid Near-Field Category: M4 (AWF -5 dB)

Peak E-field in V/m

Grid 1 **38.2 M4**	Grid 2 **41.8 M4**	Grid 3 **42.0 M4**
Grid 4 **44.7 M4**	Grid 5 **45.7 M4**	Grid 6 **44.6 M4**
Grid 7 **43.3 M4**	Grid 8 **46.2 M4**	Grid 9 **46.1 M4**



0 dB = 46.2 V/m

Plot # 6

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

GSM-850 H Field Testing Low Channel

UMEOX MOBILE LIMITED; Type: GSM 850/1900 Dual Band Cellular Phone; Serial: R0906027-1

Communication System: GSM 850; Frequency: 824.2 MHz; Duty Cycle: 1:8.3
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3
Phantom section: RF Section

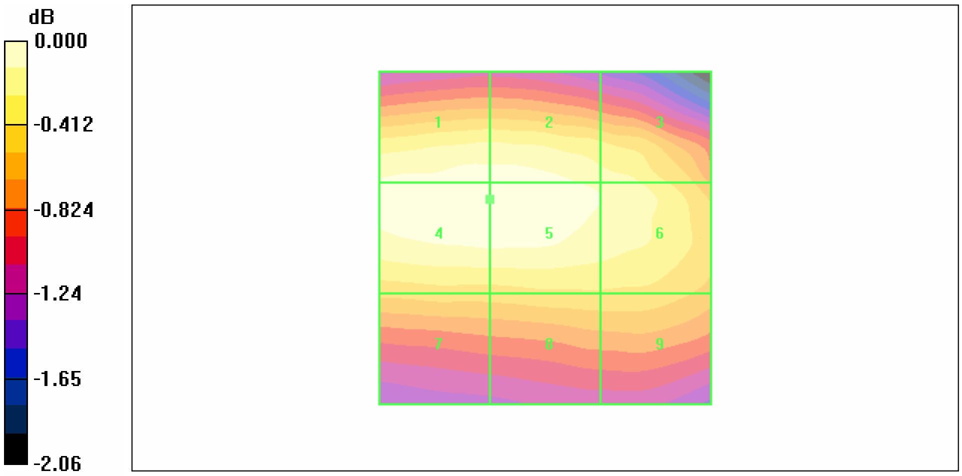
DASY4 Configuration:

- Probe: H3DV6 - SN6158; Calibrated: 09/22/2008
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 71; Post processing SW: SEMCAD, V1.8 Build 184

H Scan 10mm above CD 835 MHz/Hearing Aid Compatibility Test (61x61x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.385 A/m
Probe Modulation Factor = 2.88
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 0.130 A/m; Power Drift = 0.001 dB
Hearing Aid Near-Field Category: M4 (AWF -5 dB)

Peak H-field in A/m

Grid 1 **0.383 M4**	Grid 2 **0.383 M4**	Grid 3 **0.377 M4**
Grid 4 **0.385 M4**	Grid 5 **0.385 M4**	Grid 6 **0.379 M4**
Grid 7 **0.365 M4**	Grid 8 **0.366 M4**	Grid 9 **0.366 M4**



0 dB = 0.385 A/m

Plot # 7

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

GSM-850 H Field Testing Mid Channel

UMEOX MOBILE LIMITED; Type: GSM 850/1900 Dual Band Cellular Phone; Serial: R0906027-1

Communication System: GSM 850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: RF Section

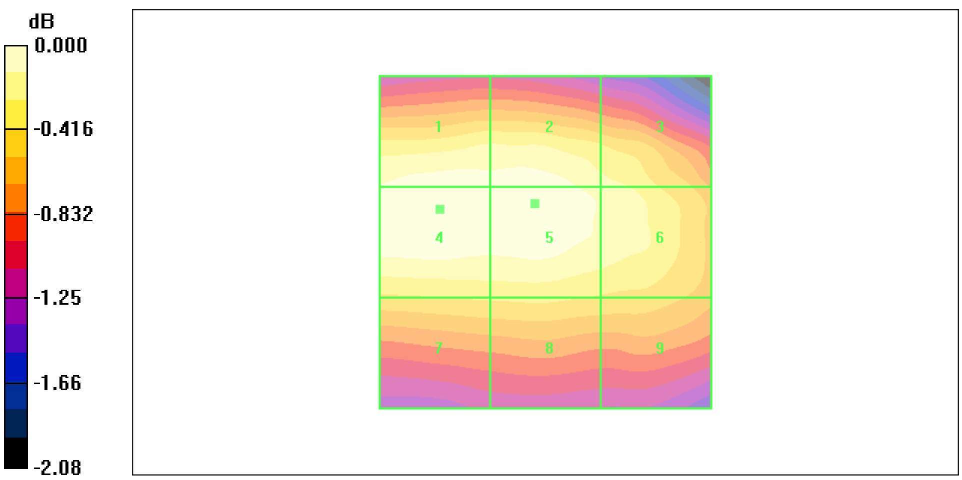
DASY4 Configuration:

- Probe: H3DV6 - SN6158; Calibrated: 09/22/2008
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 71; Post processing SW: SEMCAD, V1.8 Build 184

H Scan 10mm above CD 835 MHz/Hearing Aid Compatibility Test (61x61x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.425 A/m
Probe Modulation Factor = 2.88
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 0.143 A/m; Power Drift = 0.050 dB
Hearing Aid Near-Field Category: M4 (AWF -5 dB)

Peak H-field in A/m

Grid 1 **0.423 M4**	Grid 2 **0.423 M4**	Grid 3 **0.415 M4**
Grid 4 **0.425 M4**	Grid 5 **0.424 M4**	Grid 6 **0.418 M4**
Grid 7 **0.406 M4**	Grid 8 **0.407 M4**	Grid 9 **0.404 M4**



0 dB = 0.425 A/m

Plot # 8

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

GSM-850 H Field Testing High Channel

UMEOX MOBILE LIMITED; Type: GSM 850/1900 Dual Band Cellular Phone; Serial: R0906027-1

Communication System: GSM 850; Frequency: 848.8 MHz; Duty Cycle: 1:8.3
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3
Phantom section: RF Section

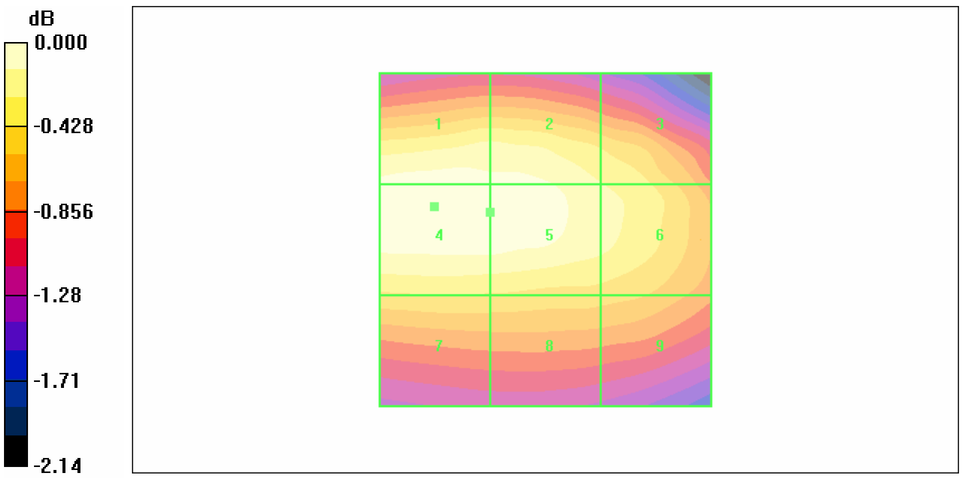
DASY4 Configuration:

- Probe: H3DV6 - SN6158; Calibrated: 09/22/2008
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 71; Post processing SW: SEMCAD, V1.8 Build 184

H Scan 10mm above CD 835 MHz/Hearing Aid Compatibility Test (61x61x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.411 A/m
Probe Modulation Factor = 2.88
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 0.138 A/m; Power Drift = 0.030 dB
Hearing Aid Near-Field Category: M4 (AWF -5 dB)

Peak H-field in A/m

Grid 1 **0.408 M4**	Grid 2 **0.407 M4**	Grid 3 **0.398 M4**
Grid 4 **0.411 M4**	Grid 5 **0.410 M4**	Grid 6 **0.401 M4**
Grid 7 **0.391 M4**	Grid 8 **0.391 M4**	Grid 9 **0.388 M4**



0 dB = 0.411 A/m

Plot # 9

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

PCS-1900 H Field Testing Low Channel

UMEOX MOBILE LIMITED; Type: GSM 850/1900 Dual Band Cellular Phone; Serial: R0906027-1

Communication System: PCS 1900; Frequency: 1850.2 MHz; Duty Cycle: 1:8.3
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: RF Section

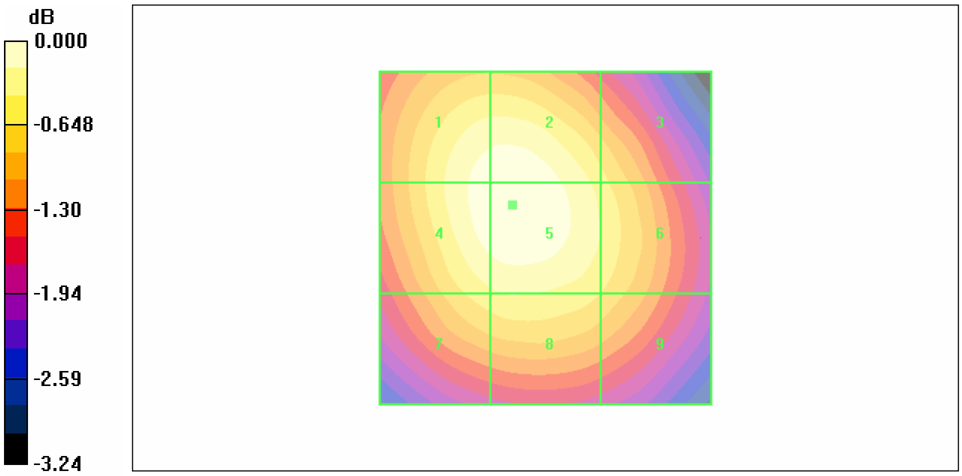
DASY4 Configuration:

- Probe: H3DV6 - SN6158; Calibrated: 09/22/2008
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 71; Post processing SW: SEMCAD, V1.8 Build 184

H Scan 10mm above CD 1880 MHz/Hearing Aid Compatibility Test (61x61x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.229 A/m
Probe Modulation Factor = 2.88
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 0.077 A/m; Power Drift = -0.036 dB
Hearing Aid Near-Field Category: M3 (AWF -5 dB)

Peak H-field in A/m

Grid 1 **0.227 M3**	Grid 2 **0.228 M3**	Grid 3 **0.215 M3**
Grid 4 **0.227 M3**	Grid 5 **0.229 M3**	Grid 6 **0.218 M3**
Grid 7 **0.217 M3**	Grid 8 **0.218 M3**	Grid 9 **0.212 M3**



0 dB = 0.229 A/m

Plot # 10

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

PCS-1900 H Field Testing Mid Channel

UMEOX MOBILE LIMITED; Type: GSM 850/1900 Dual Band Cellular Phone; Serial: R0906027-1

Communication System: PCS 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: RF Section

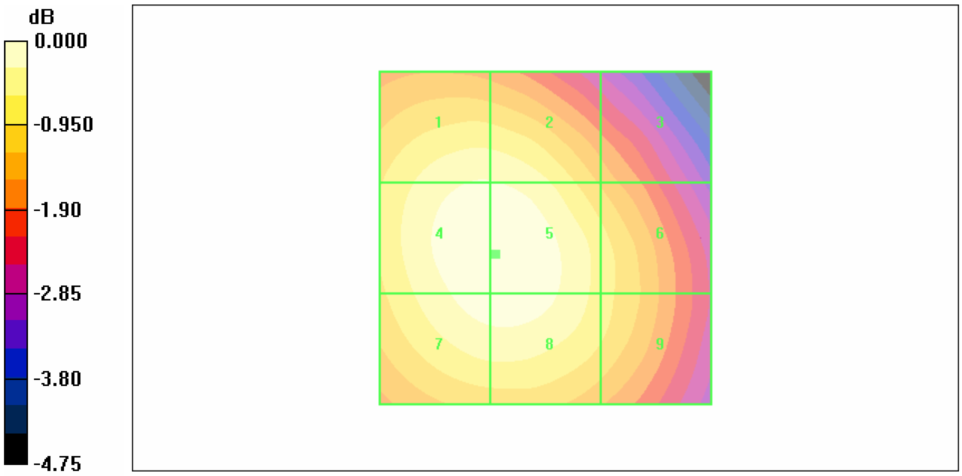
DASY4 Configuration:

- Probe: H3DV6 - SN6158; ; Calibrated: 09/22/2008
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 71; Post processing SW: SEMCAD, V1.8 Build 184

H Scan 10mm above CD 1880 MHz/Hearing Aid Compatibility Test (61x61x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.210 A/m
Probe Modulation Factor = 2.88
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 0.069 A/m; Power Drift = 0.009 dB
Hearing Aid Near-Field Category: M3 (AWF -5 dB)

Peak H-field in A/m

Grid 1 **0.203 M3**	Grid 2 **0.203 M3**	Grid 3 **0.180 M3**
Grid 4 **0.210 M3**	Grid 5 **0.210 M3**	Grid 6 **0.193 M3**
Grid 7 **0.207 M3**	Grid 8 **0.207 M3**	Grid 9 **0.192 M3**



0 dB = 0.210 A/m

Plot # 11

Test Laboratory: Bay Area Compliance Lab Corp. (BACL)

PCS-1900 H Field Testing High CH

UMEOX MOBILE LIMITED; Type: GSM 850/1900 Dual Band Cellular Phone; Serial: R0906027-1

Communication System: PCS 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: RF Section

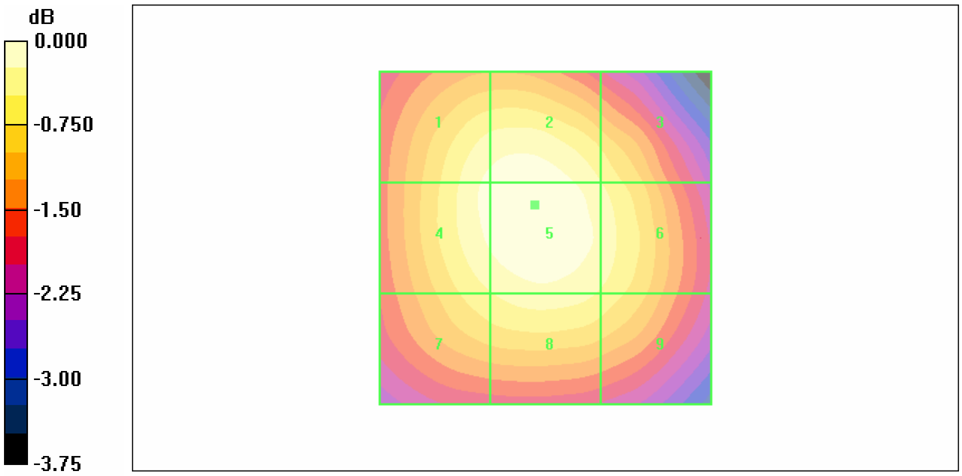
DASY4 Configuration:

- Probe: H3DV6 - SN6158; Calibrated: 09/22/2008
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn456; Calibrated: 11/8/2007
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 71; Post processing SW: SEMCAD, V1.8 Build 184

H Scan 10mm above CD 1880 MHz/Hearing Aid Compatibility Test (61x61x1): Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.161 A/m
Probe Modulation Factor = 2.88
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 0.054 A/m; Power Drift = -0.014 dB
Hearing Aid Near-Field Category: M3 (AWF -5 dB)

Peak H-field in A/m

Grid 1 **0.158 M3**	Grid 2 **0.160 M3**	Grid 3 **0.152 M3**
Grid 4 **0.158 M3**	Grid 5 **0.161 M3**	Grid 6 **0.155 M3**
Grid 7 **0.152 M3**	Grid 8 **0.155 M3**	Grid 9 **0.151 M3**



0 dB = 0.161 A/m

Plot # 12

APPENDIX B – PROBE CALIBRATION CERTIFICATIONS

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)
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 **BACL**

Certificate No: **ER3-2338_Sep08**

CALIBRATION CERTIFICATE

Object	ER3DV6 - SN:2338
Calibration procedure(s)	QA CAL-02.v5 Calibration procedure for E-field probes optimized for close near field evaluations in air
Calibration date:	September 22, 2008
Condition of the calibrated item	In Tolerance

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41495277	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41498087	1-Apr-08 (No. 217-00788)	Apr-09
Reference 3 dB Attenuator	SN: S5054 (3c)	1-Jul-08 (No. 217-00865)	Jul-09
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-08 (No. 217-00787)	Apr-09
Reference 30 dB Attenuator	SN: S5129 (30b)	1-Jul-08 (No. 217-00866)	Jul-09
Reference Probe ER3DV6	SN: 2328	2-Oct-07 (No. ER3-2328_Oct07)	Oct-08
DAE4	SN: 789	5-Dec-07 (No. DAE4-789_Dec07)	Dec-08

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

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

Issued: September 22, 2008

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

Certificate No: ER3-2338_Sep08 Page 1 of 9

Calibration Laboratory of
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The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- *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).

ER3DV6 SN:2338 September 22, 2008

Probe ER3DV6

SN:2338

Manufactured:	June 15, 2004
Last calibrated:	September 25, 2006
Recalibrated:	September 22, 2008

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

Certificate No: ER3-2338_Sep08 Page 3 of 9

ER3DV6 SN:2338 September 22, 2008

DASY - Parameters of Probe: ER3DV6 SN:2338

Sensitivity in Free Space [µV/(V/m)^2]		Diode Compression[A]	
NormX	1.64 ± 10.1 % (k=2)	DCP X	95 mV
NormY	1.70 ± 10.1 % (k=2)	DCP Y	95 mV
NormZ	1.97 ± 10.1 % (k=2)	DCP Z	97 mV

Frequency Correction

X	0.0
Y	0.0
Z	0.0

Sensor Offset (Probe Tip to Sensor Center)

X	2.5 mm
Y	2.5 mm
Z	2.5 mm

Connector Angle 21 °

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%.

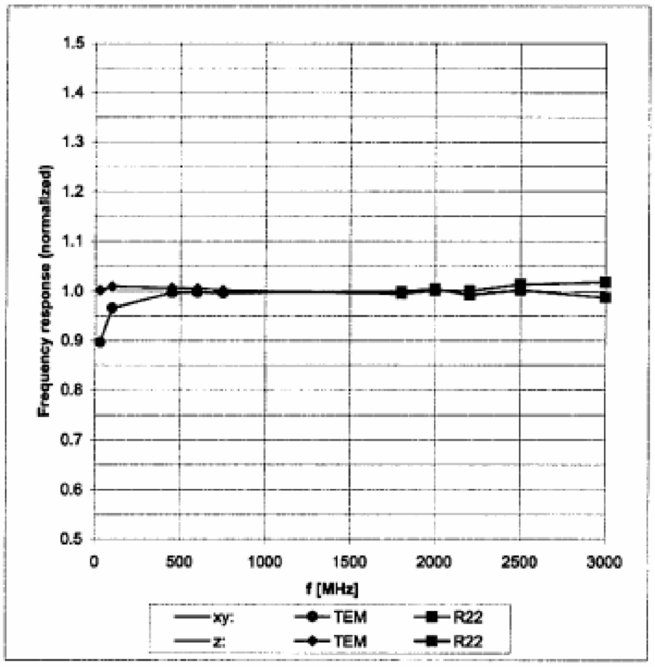
[A] numerical linearization parameter: uncertainty not required

Certificate No: ER3-2338_Sep08 Page 4 of 9

ER3DV6 SN:2338 September 22, 2008

Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide R22)



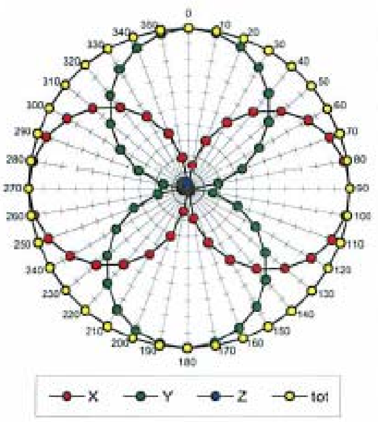
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Certificate No: ER3-2338_Sep08 Page 5 of 9

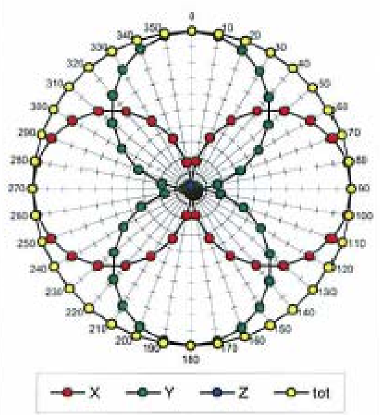
ER3DV6 SN:2338 September 22, 2008

Receiving Pattern (ϕ), ϑ = 0°

f = 600 MHz, TEM ifi110EXX

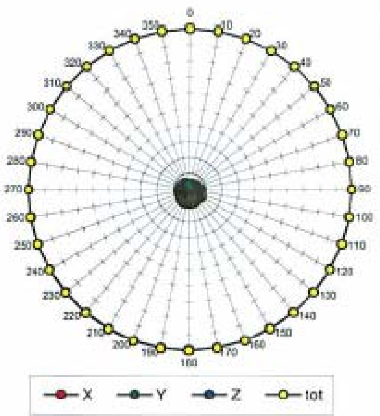


f = 2500 MHz, WG R22

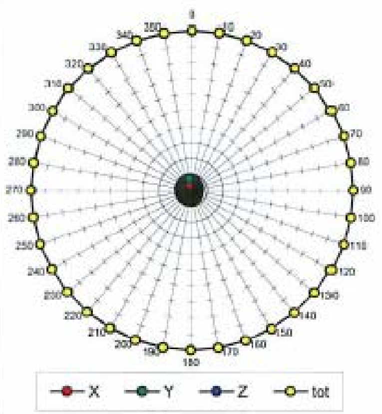


Receiving Pattern (ϕ), ϑ = 90°

f = 600 MHz, TEM ifi110EXX



f = 2500 MHz, WG R22



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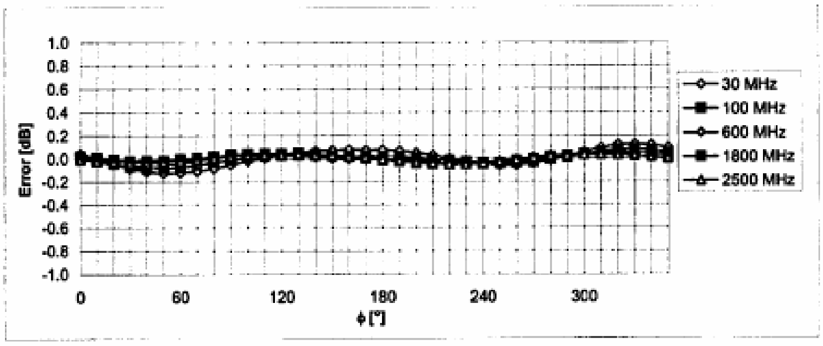
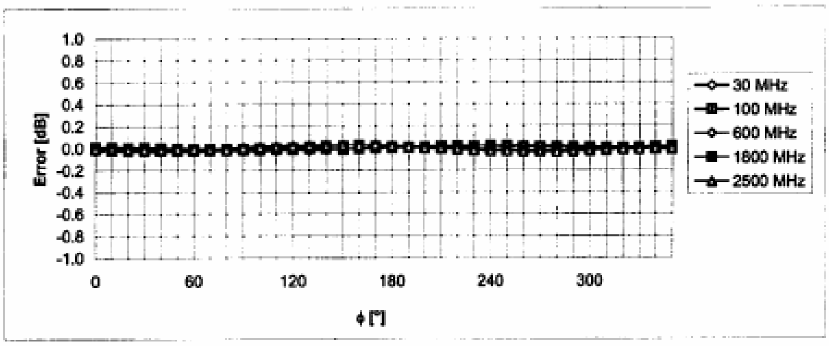
ER3DV6 SN:2338 September 22, 2008

Receiving Pattern (ϕ), ϑ = 0°



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

Receiving Pattern (ϕ), ϑ = 90°



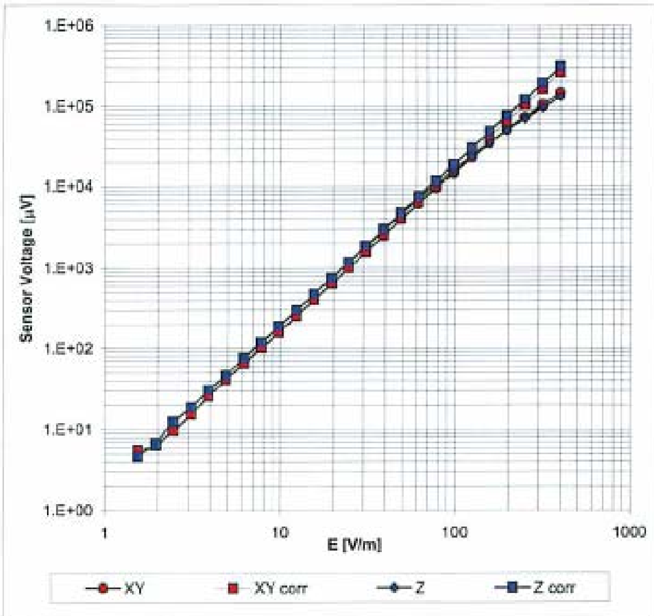
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

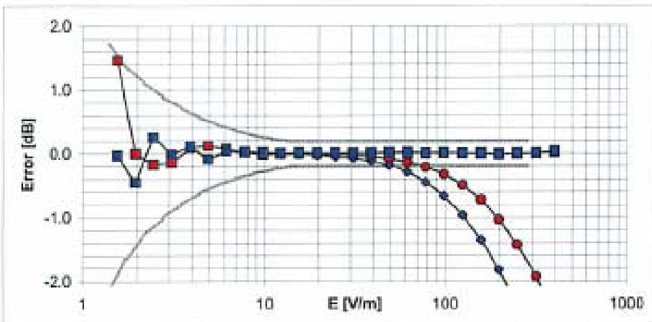
Certificate No: ER3-2338_Sep08 Page 7 of 9

ER3DV6 SN:2338 September 22, 2008

Dynamic Range f(E-field)

(Waveguide R22, f = 1800 MHz)



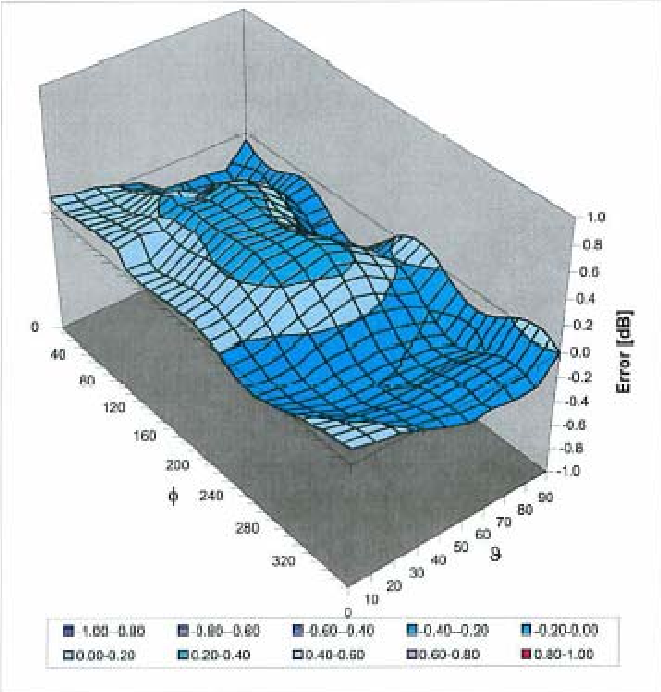


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Certificate No: ER3-2338_Sep08 Page 8 of 9

ER3DV6 SN:2338 September 22, 2008

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



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

Certificate No: ER3-2338_Sep08 Page 9 of 9

Calibration Laboratory of
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **BACL** Certificate No: **H3-6158_Sep08**

CALIBRATION CERTIFICATE

Object	H3DV6 - SN:6158
Calibration procedure(s)	QA CAL-03.v5 Calibration procedure for H-field probes optimized for close near field evaluations in air
Calibration date:	September 22, 2008
Condition of the calibrated item	In Tolerance

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41495277	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41498087	1-Apr-08 (No. 217-00788)	Apr-09
Reference 3 dB Attenuator	SN: S5054 (3c)	1-Jul-08 (No. 217-00865)	Jul-09
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-08 (No. 217-00787)	Apr-09
Reference 30 dB Attenuator	SN: S5129 (30b)	1-Jul-08 (No. 217-00866)	Jul-09
Reference Probe H3DV6	SN: 6182	2-Oct-07 (No. H3-6182_Oct07)	Oct-08
DAE4	SN: 789	5-Dec-07 (No. DAE4-789_Dec07)	Dec-08
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-07)	In house check: Oct-08

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

Issued: September 22, 2008

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Certificate No: H3-6158_Sep08 Page 1 of 9

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Certificate No: H3-6158_Sep08 Page 2 of 9

Probe H3DV6

SN:6158

Manufactured:	June 22, 2004
Last calibrated:	September 25, 2006
Recalibrated:	September 22, 2008

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

H3DV6 SN:6158 September 22, 2008

DASY - Parameters of Probe: H3DV6 SN:6158

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

	a0	a1	a2
X	2.617E-03	-5.925E-5	3.143E-5 ± 5.1 % (k=2)
Y	2.590E-03	-8.373E-5	1.400E-6 ± 5.1 % (k=2)
Z	2.996E-03	-1.719E-4	4.549E-5 ± 5.1 % (k=2)

Diode Compression[1]

DCP X	85 mV
DCP Y	91 mV
DCP Z	83 mV

Sensor Offset (Probe Tip to Sensor Center)

X	3.0 mm
Y	3.0 mm
Z	3.0 mm

Connector Angle 100 °

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

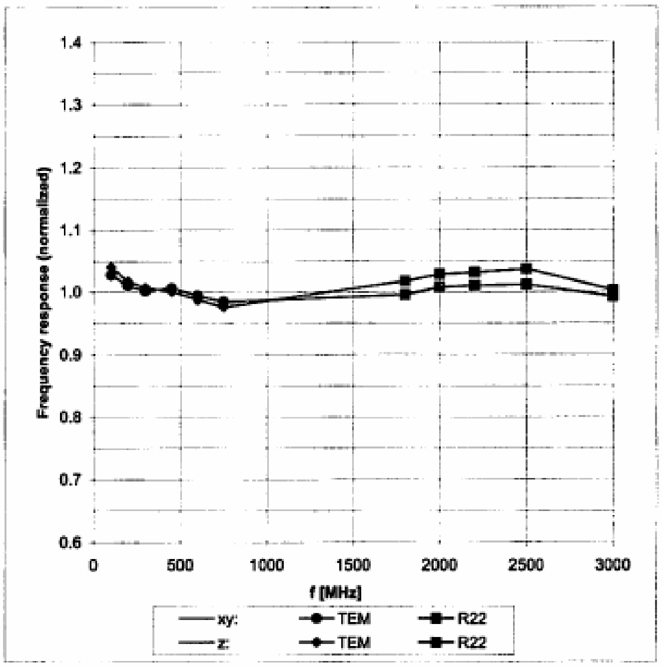
[1] numerical linearization parameter: uncertainty not required

Certificate No: H3-6158_Sep08 Page 4 of 9

H3DV6 SN:6158 September 22, 2008

Frequency Response of H-Field

(TEM-Cell:ifi110 EXX, Waveguide R22)



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

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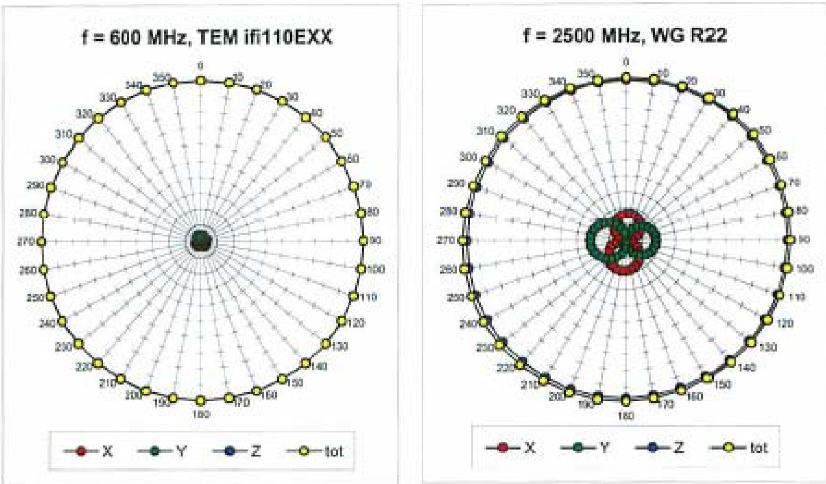
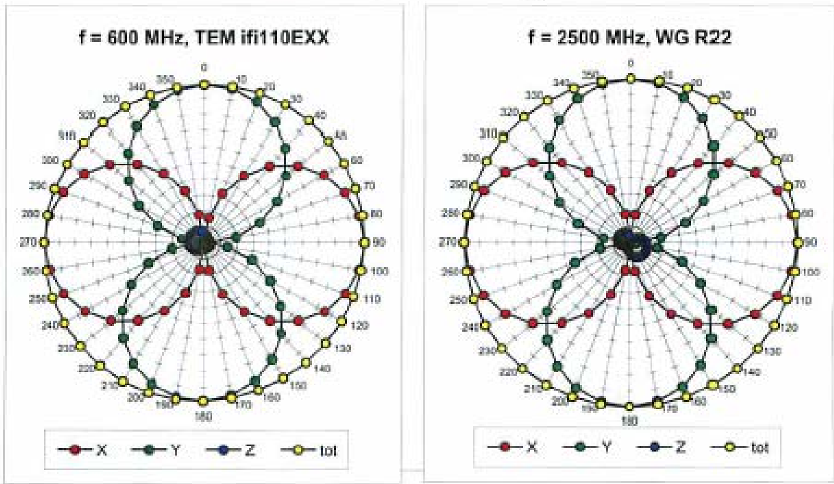
H3DV6 SN:6158 September 22, 2008

Receiving Pattern (ϕ), $\vartheta = 90°$



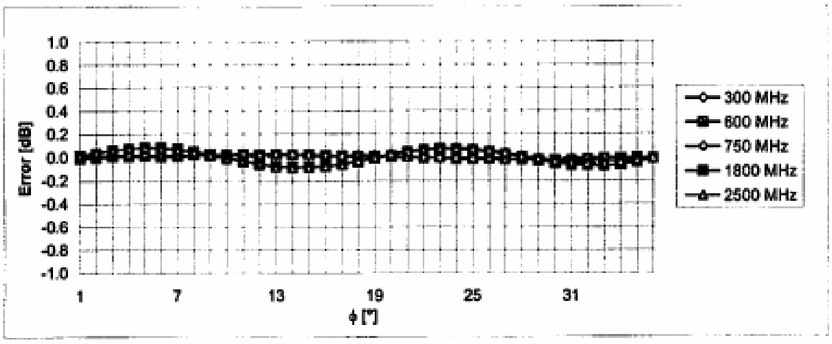
Receiving Pattern (ϕ), $\vartheta = 0°$



Certificate No: H3-6158_Sep08 Page 6 of 9

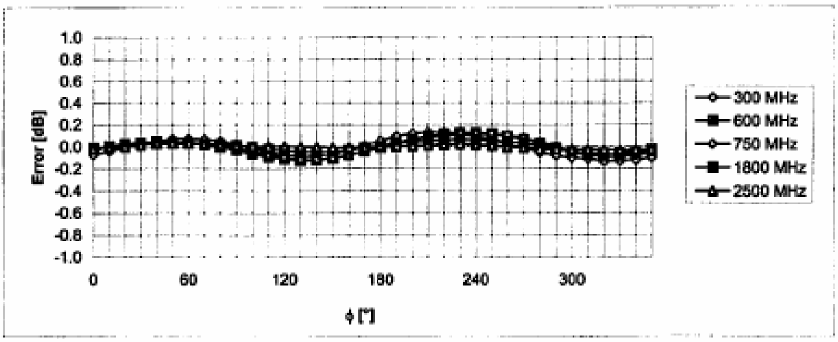
H3DV6 SN:6158 September 22, 2008

Receiving Pattern (ϕ), ϑ = 90°



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

Receiving Pattern (ϕ), ϑ = 0°



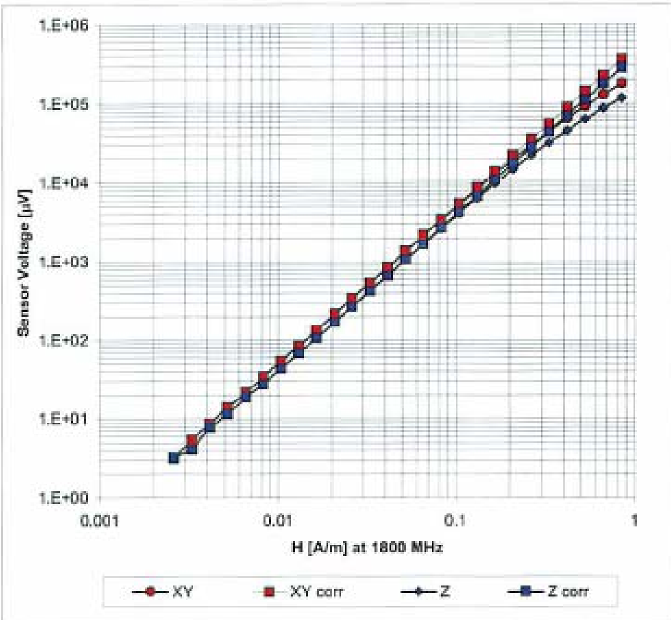
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

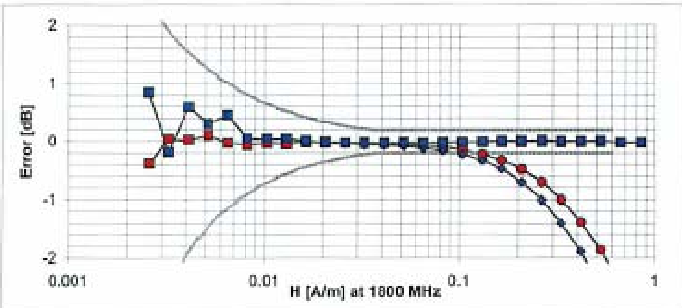
Certificate No: H3-6158_Sep08 Page 7 of 9

H3DV6 SN:6158 September 22, 2008

Dynamic Range f(H-field)

(Waveguide R22, f = 1800 MHz)



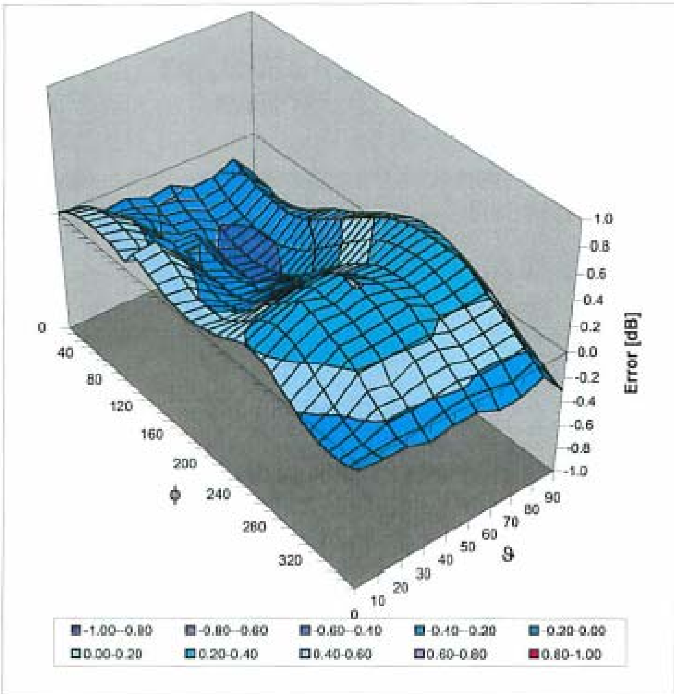


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Certificate No: H3-6158_Sep08 Page 8 of 9

H3DV6 SN:6158 September 22, 2008

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



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

Certificate No: H3-6158_Sep08 Page 9 of 9

APPENDIX C – DIPOLE CALIBRATION CERTIFICATES

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

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Swiss Calibration Service

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **BACL**

Certificate No: **CD835V3-1012_Sep08**

CALIBRATION CERTIFICATE

Object	CD835V3 - SN: 1012
Calibration procedure(s)	QA CAL-20.v4 Calibration procedure for dipoles in air
Calibration date:	September 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).
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	04-Oct-07 (No. 217-00736)	Oct-08
Power sensor HP 8481A	US37292783	04-Oct-07 (No. 217-00736)	Oct-08
Probe ER3DV6	SN: 2336	31-Dec-07 (No. ER3-2336_Dec07)	Dec-08
Probe H3DV6	SN: 6065	31-Dec-07 (No. H3-6065_-Dec07)	Dec-08
DAE4	SN: 781	2-Oct-07 (No. DAE4-781_Oct07)	Oct-08

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

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

Issued: September 17, 2008

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Certificate No: CD835V3-1012_Sep08 Page 1 of 6

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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**

References

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

Methods Applied and Interpretation of Parameters:

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

1 Measurement Conditions

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

DASY Version	DASY4	V4.7 B71
DASY PP Version	SEMCAD	V1.8 B184
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	**0.455 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	169.7 V/m
Maximum measured above low end	100 mW forward power	161.0 V/m
Averaged maximum above arm	100 mW forward power	**165.4 V/m**

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

3 Appendix

3.1 Antenna Parameters

Frequency	**Return Loss**	**Impedance**
800 MHz	15.5 dB	(42.8 – j14.1) Ohm
835 MHz	**34.2 dB**	**(50.2 + j1.9) Ohm**
900 MHz	17.2 dB	(54.9 – j13.7) Ohm
950 MHz	18.6 dB	(43.0 + j8.4) Ohm
960 MHz	14.9 dB	(49.5 + j18.1) Ohm

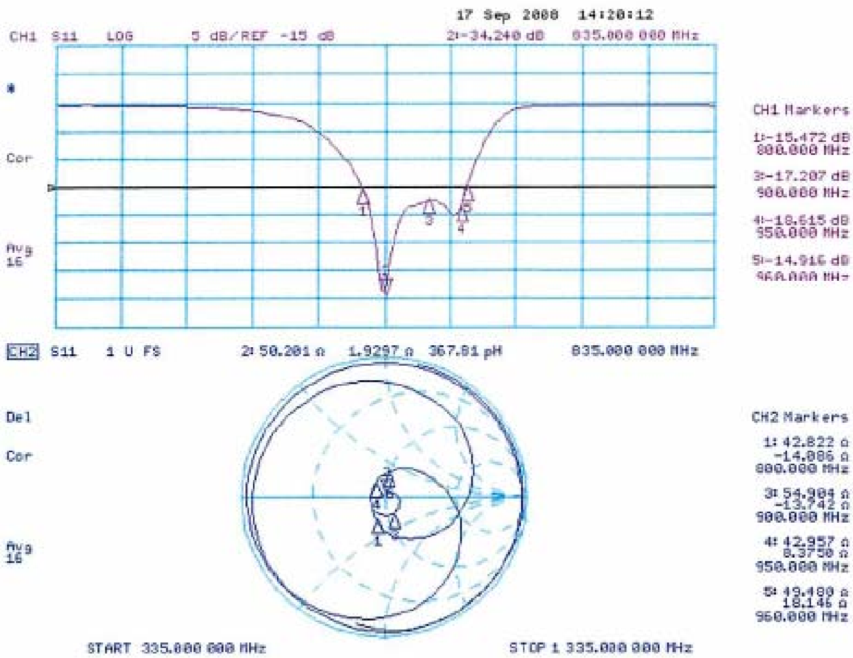
3.2 Antenna Design and Handling

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



Certificate No: CD835V3-1012_Sep08 Page 4 of 6

3.3.2 DASY4 H-field result

Date/Time: 16.09.2008 13:04:52

Test Laboratory: SPEAG Lab 2

H_CD835_1012_080916

DUT: HAC-Dipole 835 MHz; Type: D835V3; Serial: 1012

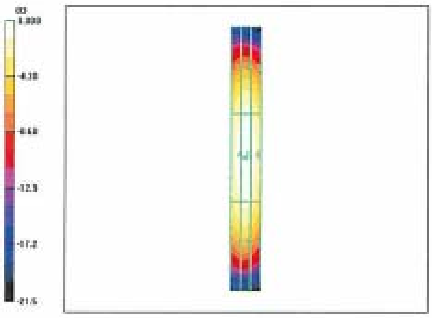
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: RF Section
Measurement Standard: DASY4 (High Precision Assessment)
DASY4 Configuration:

- Probe: H3DV6 - SN6065; ; Calibrated: 31.12.2007
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 02.10.2007
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

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 = 0.455 A/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 0.484 A/m; Power Drift = 0.006 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.389 M4**	Grid 2 **0.408 M4**	Grid 3 **0.381 M4**
Grid 4 **0.436 M4**	Grid 5 **0.455 M4**	Grid 6 **0.424 M4**
Grid 7 **0.388 M4**	Grid 8 **0.405 M4**	Grid 9 **0.371 M4**



0 dB = 0.455A/m

Certificate No: CD835V3-1012_Sep08 Page 5 of 6

3.3.3 DASY4 E-field result

Date/Time: 17.09.2008 13:03:59

Test Laboratory: SPEAG Lab 2

E_CD835_1012_080917

DUT: HAC-Dipole 835 MHz; Type: D835V3; Serial: 1012

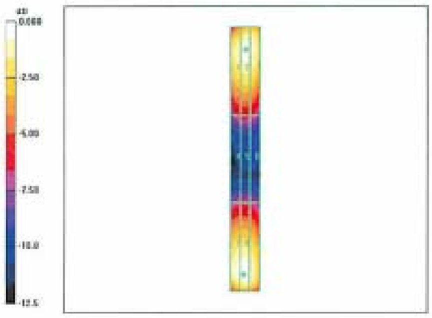
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: RF Section
Measurement Standard: DASY4 (High Precision Assessment)
DASY4 Configuration:

- 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 AMCC; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

E Scan - measurement distance from the probe sensor center to CD835 Dipole = 10mm/Hearing Aid Compatibility Test (41x361x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 169.7 V/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, -6.30 mm
Reference Value = 109.6 V/m; Power Drift = 0.011 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 155.2 M4	Grid 2 161.0 M4	Grid 3 158.2 M4
Grid 4 81.9 M4	Grid 5 83.9 M4	Grid 6 81.5 M4
Grid 7 164.6 M4	Grid 8 169.7 M4	Grid 9 159.1 M4



0 dB = 169.7V/m

Certificate No: CD835V3-1012_Sep08 Page 6 of 6

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Engineering AG
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Accredited by the Swiss Accreditation Service (SAS)
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **BACL**

Certificate No: **CD1880V3-1009_Sep08**

CALIBRATION CERTIFICATE

Object: CD1880V3 - SN: 1009

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

Calibration date: September 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).
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	04-Oct-07 (No. 217-00736)	Oct-08
Power sensor HP 8481A	US37292783	04-Oct-07 (No. 217-00736)	Oct-08
Probe ER3DV6	SN: 2336	31-Dec-07 (No. ER3-2336_Dec07)	Dec-08
Probe H3DV6	SN: 6065	31-Dec-07 (No. H3-6065_-Dec07)	Dec-08
DAE4	SN: 781	2-Oct-07 (No. DAE4-781_Oct07)	Oct-08

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

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

Issued: September 17, 2008

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Certificate No: CD1880V3-1009_Sep08 Page 1 of 6

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The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

References

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

Methods Applied and Interpretation of Parameters:

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

1. Measurement Conditions

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

DASY Version	DASY4	V4.7 B71
DASY PP Version	SEMCAD	V1.8 B184
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	**0.467 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	140.0 V/m
Maximum measured above low end	100 mW forward power	139.3 V/m
Averaged maximum above arm	100 mW forward power	**139.7 V/m**

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

3. Appendix

3.1 Antenna Parameters

Frequency	**Return Loss**	**Impedance**
1710 MHz	25.3 dB	(48.1 + j5.0) Ohm
1880 MHz	**22.8 dB**	**(49.8 + j7.2) Ohm**
1900 MHz	24.4 dB	(52.7 + j5.6) Ohm
1950 MHz	28.9 dB	(53.3 – j1.6) Ohm
2000 MHz	22.6 dB	(43.1 + j1.0) Ohm

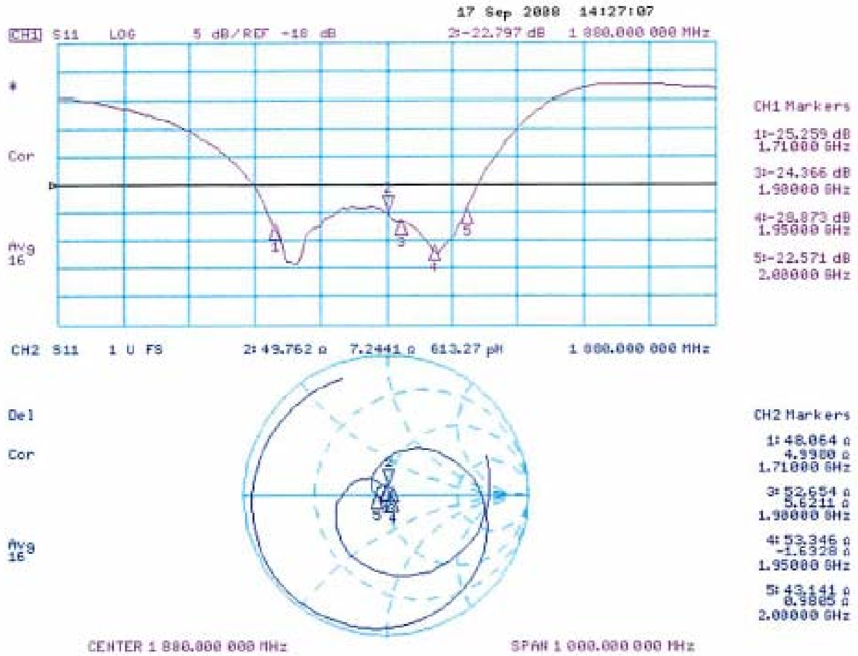
3.2 Antenna Design and Handling

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



Certificate No: CD1880V3-1009_Sep08 Page 4 of 6

DASY4 H-Field Result

Date/Time: 16.09.2008 14:30:31

Test Laboratory: SPEAG Lab 2

H_CD1880_1009_080916

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1009

Communication System: CW; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3

Phantom section: RF 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 AMCC; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

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 = 0.467 A/m

Probe Modulation Factor = 1.00

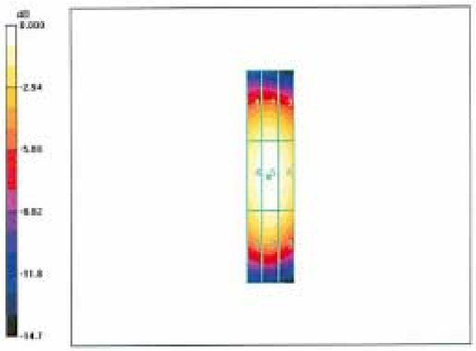
Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 0.495 A/m; Power Drift = -0.005 dB

Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak H-field in A/m

Grid 1 0.411 M2	Grid 2 0.426 M2	Grid 3 0.401 M2
Grid 4 0.450 M2	Grid 5 0.467 M2	Grid 6 0.439 M2
Grid 7 0.412 M2	Grid 8 0.430 M2	Grid 9 0.400 M2



0 dB = 0.467A/m

Certificate No: CD1880V3-1009_Sep08 Page 5 of 6

3.3.2 DASY4 E-Field Result

Date/Time: 17.09.2008 11:26:17

Test Laboratory: SPEAG Lab 2

E_CD1880_1009_080917

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1009

Communication System: CW; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3

Phantom section: RF 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 AMCC; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

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 = 140.0 V/m

Probe Modulation Factor = 1.00

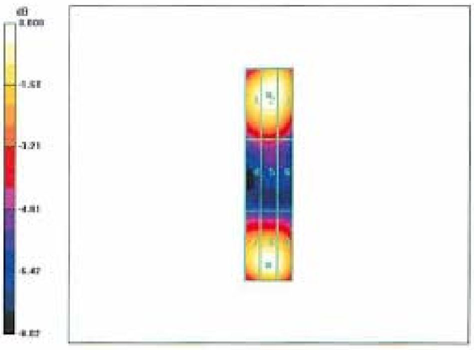
Device Reference Point: 0.000, 0.000, -6.30 mm

Reference Value = 155.2 V/m; Power Drift = -0.007 dB

Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak E-field in V/m

Grid 1 135.5 M2	Grid 2 140.0 M2	Grid 3 136.7 M2
Grid 4 87.5 M3	Grid 5 89.6 M3	Grid 6 86.3 M3
Grid 7 133.9 M2	Grid 8 139.3 M2	Grid 9 134.5 M2



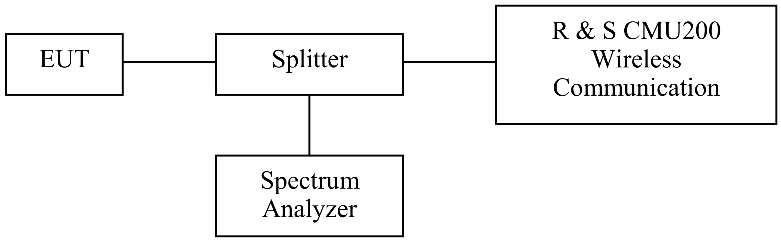
0 dB = 140.0V/m

Certificate No: CD1880V3-1009_Sep08 Page 6 of 6

APPENDIX D – OUTPUT POWER EASUREMENT

Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.



Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Rohde & Schwarz	Communication Test Set	CMU200	103492	2009-05-21
Agilent	Spectrum Analyzer	E4440A	MY44303352	2009-04-27

Test Results

Cellular Band (Part 22H)

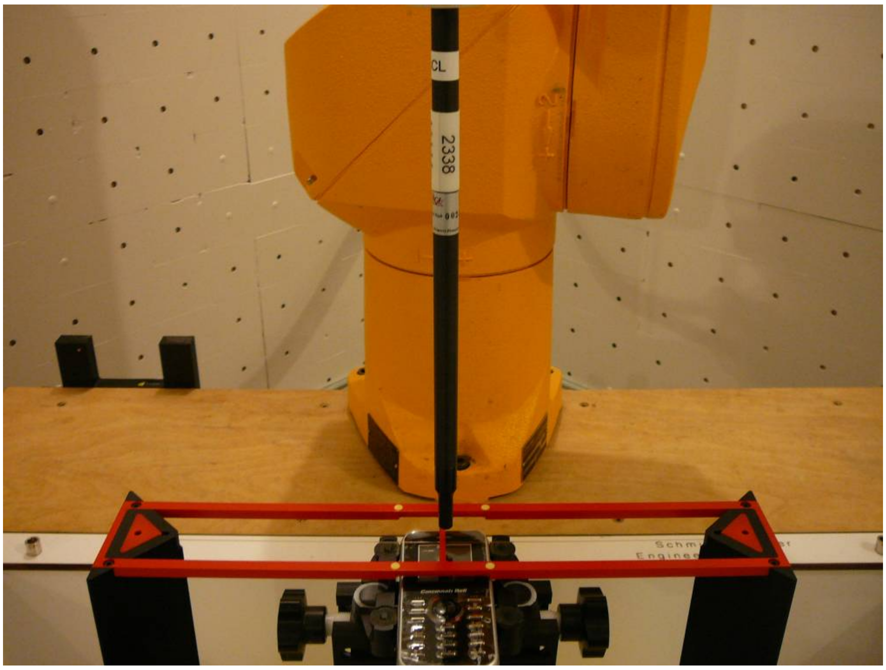
Channel	Frequency (MHz)	Output Power (dBm)	Output Power (Watt)
Low	824.2	31.85	1.531
Middle	836.6	31.90	1.549
High	848.8	31.93	1.560

PCS Band (Part 24E)

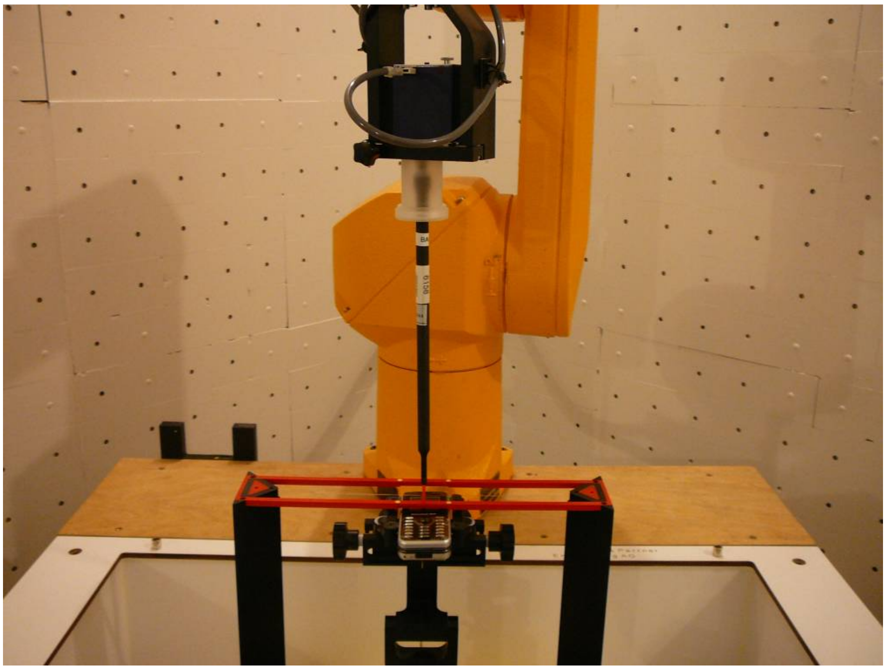
Channel	Frequency (MHz)	Output Power (dBm)	Output Power (Watt)
Low	1850.2	28.60	0.724
Middle	1880.0	28.65	0.733
High	1909.8	28.75	0.750

APPENDIX F – TEST SETUP PHOTOS

E-Field Setup View



H-Field Setup View



APPENDIX G– EUT PHOTO

EUT – Front View

EUT – Front View Open

EUT – Back View

EUT – Back View Open

EUT – Battery Compartment View

EUT – Battery View

EUT – Accessory Charger

EUT – Accessory Headset

APPENDIX H - REFERENCES

[1] ANSI C63.19:2007.Americation National Standard, Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids

[2] CFR47, Part20.19, Federal Communications Commission (FCC), Hearing Aid-Compatible Mobile Handsets

[3] FCC 08-68 A1, A2, A3, A4, A5, WT Docket 07-250, February 28, 2008.

[4] FCC OET KDB 285076, Equipment Authorization Guidance for Hearing Aid Compability, September 25, 2008.

******* END OF REPORT *******