# Variant Hearing Aid Compatibility (HAC) RF Emissions Test Report

| | |
|---|---|
| **APPLICANT** | **: Hewlett Packard Company** |
| **EQUIPMENT** | **: HP iPAQ KB1** |
| **BRAND NAME** | **: HP** |
| **MODEL NAME** | **: HSTNH-P21C** |
| **FCC ID** | **: B94HHP21C** |
| **STANDARD** | **: FCC 47 CFR §20.19<br>ANSI C63.19-2007** |
| **M CATEGORY** | **: M4** |

**This is a variant report which is only valid combined with the original report. The product was received on Aug. 10, 2009 and completely tested on Aug. 13, 2009. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and shown the compliance with the applicable technical standards.**



**Reviewed by:**

**Roy Wu / Manager**

Testing Laboratory
1190

***SPORTON INTERNATIONAL INC.***
***No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.***

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# Revision History

| REPORT NO. | VERSION | DESCRIPTION | ISSUED DATE |
|---|---|---|---|
| HA961307-04A | Rev. 01 | This is a variant report which can be referred to appendix F for hardware release notes for HW and SW change. All the test cases were performed on original report which can be referred to Sporton Report Number HA961307A as appendix G. Based on the original report; only worst case of WCDMA Band V was verified for HW and SW change. | Aug. 18, 2009 |
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# 1. *Statement of Compliance*

The maximum results of RF Emission of Hearing Aid Compliance (HAC) were found during testing for the **Hewlett Packard Company HP iPAQ KB1 HP HSTNH-P21C**, which are as follows (with expanded uncertainly ±30.4% for E-field and ±21.6% for H-field):

| Band | HAC RF Emission Test Result | | M Rating |
|---|---|---|---|
| WCDMA Band V | E-Field (V/m) | 68.9 | M4 |
| | H-Field (A/m) | 0.083 | M4 |

They are in compliance with HAC limits specified in guidelines FCC 47 CFR §20.19 and ANSI Standard ANSI C63.19 for HAC Rated category M3.

**Results Summary : M Category = M4 (ANSI C63.19-2007)**

# 2. Administration Data

## 2.1 Testing Laboratory

| | |
|---|---|
| **Test Site** | SPORTON INTERNATIONAL INC. |
| **Test Site Location** | No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park,<br>Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.<br>TEL: +886-3-327-3456<br>FAX: +886-3-328-4978 |
| **Test Site No.** | **Sporton Site No. :**<br>SAR02-HY |

## 2.2 Applicant

| | |
|---|---|
| **Company Name** | Hewlett Packard Company |
| **Address** | 3000 Hanover Street, Palo Alto, CA 94304 |

## 2.3 Manufacturer

| | |
|---|---|
| **Company Name** | Pegatron Corporation |
| **Address** | 5F., No. 76, Ligong St., Beitou Dist., Taipei City 112, Taiwan (R.O.C.) |

## 2.4 Application Details

| | |
|---|---|
| **Date of Receipt of Application** | Aug. 10, 2009 |
| **Date of Start during the Test** | Aug. 12, 2009 |
| **Date of End during the Test** | Aug. 13, 2009 |

# *3. General Information*

## *3.1 Description of Device Under Test (DUT)*

| Product Feature & Specification | |
|---|---|
| **DUT Type** | HP iPAQ KB1 |
| **Brand Name** | HP |
| **Model Name** | HSTNH-P21C |
| **FCC ID** | B94HHP21C |
| **Tx Frequency** | GSM850 : 824 MHz ~ 849 MHz<br>GSM1900 : 1850 MHz ~ 1910 MHz<br>WCDMA Band V : 824 MHz ~ 849 MHz<br>WCDMA Band II : 1850 MHz ~ 1910 MHz |
| **Rx Frequency** | GSM850 : 869 MHz ~ 894 MHz<br>GSM1900 : 1930 MHz ~ 1990 MHz<br>WCDMA Band V : 869 MHz ~ 894 MHz<br>WCDMA Band II : 1930 MHz ~ 1990 MHz |
| **Maximum Output Power to Antenna** | WCDMA Band V : 23.85 dBm |
| **Antenna Type** | Fixed Internal Antenna |
| **HW Version** | DVT2 |
| **SW Version** | Obsidian_0.30.88.03 |
| **Type of Modulation** | GSM / GPRS : GMSK<br>EDGE : 8PSK<br>WCDMA : QPSK<br>HSDPA : QPSK / 16QAM |
| **DUT Stage** | Identical Prototype |

**List of Accessory:**

| Specification of Accessory | | |
|---|---|---|
| **AC Adapter 1** | **Manufacturer** | Flextronics |
| | **Brand Name** | HP |
| | **Part Number** | 538745-001 |
| | **Power Rating** | I/P:100-240Vac, 50-60Hz, 200mA;<br>O/P: 5Vdc, 1A |
| **AC Adapter 2** | **Manufacturer** | Phihong |
| | **Brand Name** | HP |
| | **Model Name** | PSAA05A-050 (for US)<br>PSAA05N-050 (for Argentina) |
| | **Power Rating** | I/P:100-240Vac, 50-60Hz, 200mA;<br>O/P: 5Vdc, 1A |
| | **AC Power Cord Type** | 1.8 meter shielded cable without ferrite core |
| **Battery 1** | **Brand Name** | HP |
| | **Model Name** | HSTNH-T21C-H |
| | **Power Rating** | 3.7Vdc, 11.3Wh |
| | **Type** | Li-ion |
| **Battery 2** | **Brand Name** | HP |
| | **Model Name** | HSTNH-T21C-S |
| | **Power Rating** | 3.7Vdc, 5.7Wh |
| | **Type** | Li-ion |
| **Earphone** | **Brand Name** | foster |
| | **Model Name** | 492854 |
| | **Signal Line Type** | 1.3 meter non-shielded cable without ferrite core |
| **USB Cable** | **Brand Name** | Foxconn |
| | **Model Name** | 486113-001 |
| | **Signal Line Type** | 1.2 meter shielded cable without ferrite core |
| **LCD Panel** | **Brand Name** | Samsung Mobile Display |
| | **Model Name** | AMS250CU01 |

**Remark:**

1. The above DUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. PSAA05A-050 and PSAA05N-050 have the same circuit design. The difference between these models is plug.

## 3.2 Product Photos

Refer to Appendix D.

## 3.3 Applied Standards

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

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

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

**Table 3.1 Articulation Weighting Factor (AWF)**

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

**Table 3.2 Telephone near-field categories in linear units**

## 3.4 Test Conditions

### 3.4.1 Ambient Condition

| | |
|---|---|
| **Ambient Temperature** | 20 to 24 ℃ |
| **Humidity** | < 60 % |

### 3.4.2 Test Configuration

The device was controlled by using a base station emulator R&S CMU200. Communication between the device and the emulator was established by air link. Measurements were performed on the low, middle and high channels of both bands. The DUT was set from the emulator to radiate maximum output power during all tests.

# 4. Hearing Aid Compliance (HAC)

## 4.1 Introduction

The federal communication commission (FCC) adopted ANSI C63.19 as HAC test standard.

# 5. HAC RF Emission Measurement Setup

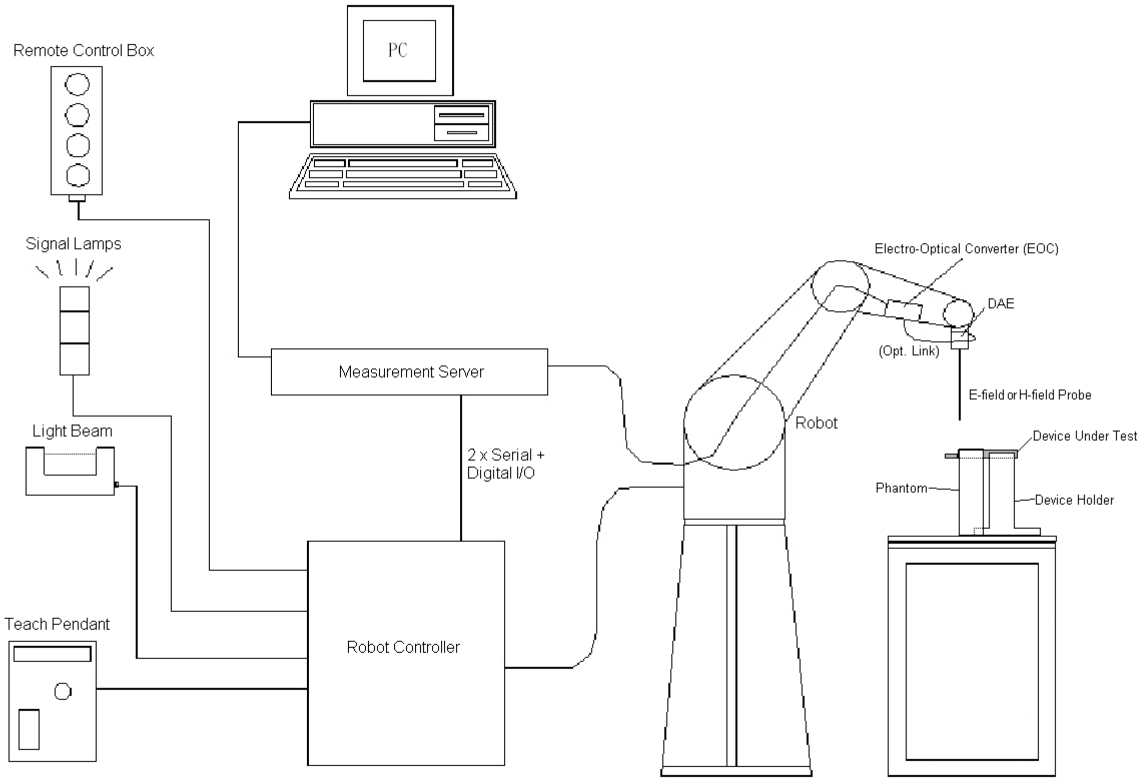



**Fig 5.1 SPEAG DASY4 or DASY5 System Configurations**

The DASY4 or DASY5 system for performance compliance tests is illustrated above graphically. This system consists of the following items:

- A standard high precision 6-axis robot with controller, a teach pendant and software
- A data acquisition electronic (DAE) attached to the robot arm extension
- A dosimetric probe equipped with an optical surface detector system
- The electro-optical converter (ECO) performs the conversion between optical and electrical signals
- A measurement server performs the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the accuracy of the probe positioning
- A computer operating Windows XP
- DASY4 or DASY5 software
- Remove control with teach pendant and additional circuitry for robot safety such as warming lamps, etc.
- The SAM twin phantom
- A device holder
- Tissue simulating liquid
- Dipole for evaluating the proper functioning of the system

Some of the components are described in details in the following sub-sections.

## 5.1 E-Field and H-Field Probe System

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 to prevent from collision with DUT.

### 5.1.1 E-Field Probe Specification

**<ER3DV6>**

| | |
|---|---|
| **Construction** | One dipole parallel, two dipoles normal to probe axis Built-in shielding against static charges |
| **Calibration** | In air from 100 MHz to 3.0 GHz<br>(absolute accuracy ±6.0%, k=2) |
| **Frequency** | 100 MHz to 6 GHz;<br>Linearity: ± 2.0 dB (100 MHz to 3 GHz) |
| **Directivity** | ± 0.2 dB in air (rotation around probe axis)<br>± 0.4 dB in air (rotation normal to probe axis) |
| **Dynamic Range** | 2 V/m to 1000 V/m<br>(M3 or better device readings fall well below diode compression point) |
| **Linearity** | ± 0.2 dB |
| **Dimensions** | Overall length: 330 mm (Tip: 16 mm)<br>Tip diameter: 8 mm (Body: 12 mm)<br>Distance from probe tip to dipole centers: 2.5 mm |

**Fig 5.2 Photo of E-field Probe**

### 5.1.2 H-Field Probe Description

**<H3DV6>**

| | |
|---|---|
| **Construction** | Three concentric loop sensors with 3.8 mm loop diameters Resistively loaded detector diodes for linear response Built-in shielding against static charges |
| **Frequency** | 200 MHz to 3 GHz (absolute accuracy ± 6.0 %, k=2); Output linearized |
| **Directivity** | ± 0.25 dB (spherical isotropy error) |
| **Dynamic Range** | 10 m A/m to 2 A/m at 1 GHz<br>(M3 or better device readings fall well below diode compression point) |
| **Dimensions** | Overall length: 330 mm (Tip: 40 mm)<br>Tip diameter: 6 mm (Body: 12 mm)<br>Distance from probe tip to dipole centers: 3 mm |
| **E-Field Interference** | < 10% at 3 GHz (for plane wave) |

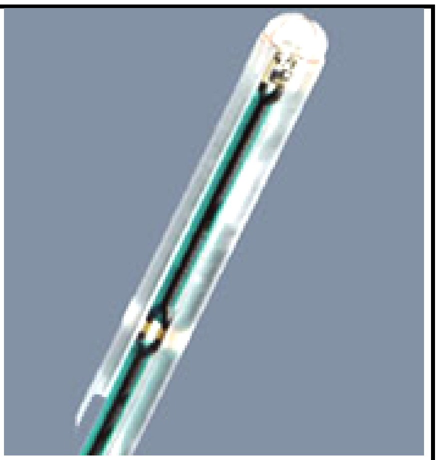


**Fig 5.3 Photo of H-field Probe**

### *5.1.3 Probe Tip Description*

HAC field measurements take place in the close near field with high gradients. Increasing the measuring distance from the source 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 the H-field across their sensor 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 border of the loop.

Consequently, two sensors with different loop diameters – both calibrated ideally – would give different results when measuring from the edge of the probe sensor elements. The behavior for electrically small E-field sensors is equivalent. See below for distance plots from a WD which show the conservative nature of field readings at the probe element center vs. measurements at the sensor end:

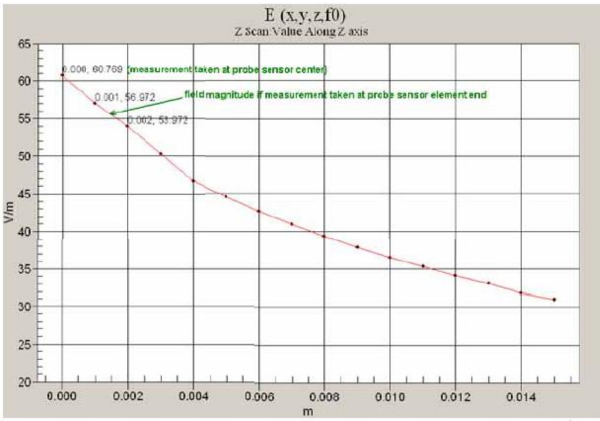



**Fig 5.4 Z-Axis Scan at maximum point above a typical wireless device for E-field**

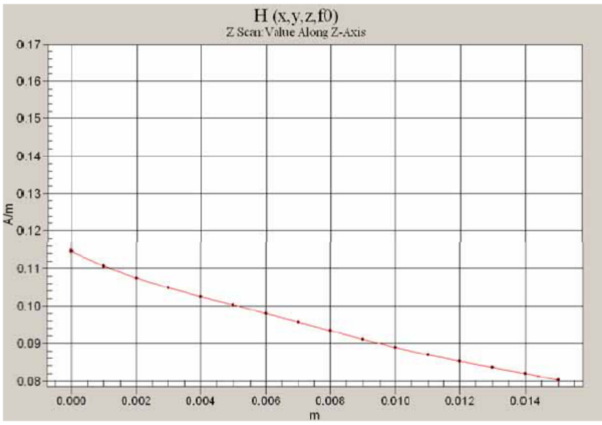



**Fig 5.5 Z-Axis Scan at maximum point above a typical wireless device for H-field**

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

Their radius is 1.9 mm.

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 effect of the different sensor centers is accounted for in the 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.

**Where:**

Peak Field = Peak field (in dB V/m or dB A/m)
Raw = Raw field measurement from the measurement system (in V/m or A/m).
PMF = Probe Modulation Factor (in Linear units). See Chapter 8 of test report.

## *5.2 DATA Acquisition Electronics (DAE)*

The data acquisition electronics (DAE) 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.
The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

**Fig 5.6 Photo of DAE**

## *5.3 Robot*

The SPEAG DASY system uses the high precision robots (DASY4: RX90BL; DASY5: TX90XL) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY4: CS7MB; DASY5: CS8c) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability ±0.035 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)
- 6-axis controller

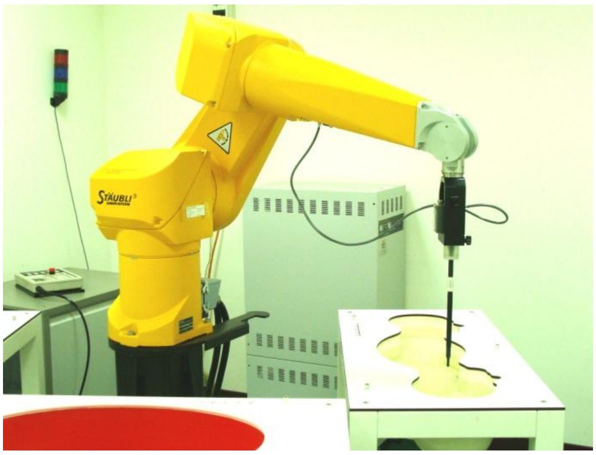


**Fig 5.7 Photo of DASY4**

**Fig 5.8 Photo of DASY5**

## *5.4 Measurement Server*

The measurement server is based on a PC/104 CPU board with CPU (DASY4: 166 MHz, Intel Pentium; DASY5: 400 MHz, Intel Celeron), chipdisk (DASY4: 32 MB; DASY5: 128 MB), RAM (DASY4: 64 MB, DASY5: 128 MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all the real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operations.


**Fig 5.9 Photo of Server for DASY4**

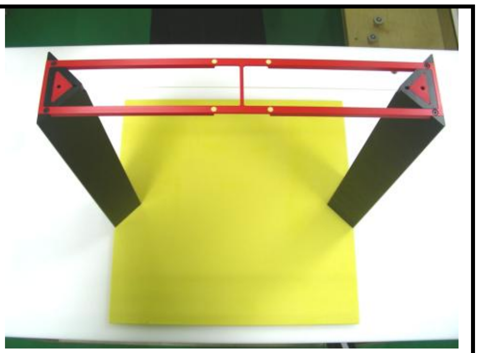

**Fig 5.10 Photo of Server for DASY5**

## 5.5 Phone Positioner

The phone positioner shown in Fig. 5.11 is used to adjust DUT to the suitable position.

**Fig 5.11 Phone Positioner**

## 5.6 Test Arch Phantom

<table>
<tr><td>Construction :</td><td>Enables easy and well defined positioning of the phone and validation dipoles as well as simple teaching of the robot.</td><td rowspan="2"><br>Fig 5.12 Photo of Arch Phantom</td></tr>
<tr><td>Dimensions :</td><td>370 x 370 x 370 mm</td></tr>
</table>

## 5.7 Data Storage and Evaluation

### 5.7.1 Data Storage

The DASY software stores the assessed data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all the necessary software parameters for the data evaluation (probe calibration data, and device frequency and modulation data) in measurement files. The post-processing software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of erroneous parameter settings.

### 5.7.2 Data Evaluation

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

| | | |
|---|---|---|
| **Probe parameters**： | - Sensitivity | $Norm_i$, $a_{i0}$, $a_{i1}$, $a_{i2}$ |
| | - Conversion factor | $ConvF_i$ |
| | - Diode compression point | $dcp_i$ |
| **Device parameters**： | - Frequency | f |
| | - Crest factor | cf |
| **Media parameters**： | - Conductivity | σ |
| | - Density | ρ |

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multi-meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

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

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

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

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

$$\text{E-field Probes：}\mathbf{E_i} = \sqrt{\frac{\mathbf{V_i}}{\mathbf{Norm_i \cdot ConvF}}}$$

$$\text{H-field Probes：}\mathbf{H_i} = \sqrt{\mathbf{V_i}} \cdot \frac{\mathbf{a_{i0} + a_{i1}f + a_{i2}f^2}}{\mathbf{f}}$$

with $V_i$ = compensated signal of channel i, (i = x, y, z)
$Norm_i$ = sensor sensitivity of channel i, (i = x, y, z), μV/(V/m)$^2$ for E-field Probes
ConvF = sensitivity enhancement in solution
$a_{ij}$ = sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
$E_i$ = electric field strength of channel i in V/m
$H_i$ = magnetic field strength of channel i in A/m

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

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

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

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

If the device under test does not emit a CW signal, the integration time applied to measure the electric field at a specific point may introduce additional uncertainties due to the discretization. The tolerances for the different systems had the worst-case of 2.6％.

## 5.8 Test Equipment List

| Manufacturer | Name of Equipment | Type/Model | Serial Number | Calibration | |
|---|---|---|---|---|---|
| | | | | Last Cal. | Due Date |
| SPEAG | Isotropic E-Filed Probe | ER3DV6 | 2358 | Jan. 14, 2009 | Jan. 13, 2010 |
| SPEAG | Isotropic H-Filed Probe | H3DV6 | 6184 | Jan. 19, 2009 | Jan. 18, 2010 |
| SPEAG | Audio Magnetic 1D Field Probe | AM1DV2 | 1038 | Jan. 12, 2009 | Jan. 11, 2010 |
| SPEAG | Audio Magnetic Calibration Coil | AMCC | 1049 | NCR | NCR |
| SPEAG | Audio Measuring Instrument | AMMI | 1041 | NCR | NCR |
| SPEAG | 835MHz Calibration Dipole | CD835V3 | 1045 | Sep. 25, 2007 | Sep. 24, 2009 |
| SPEAG | 1880MHz Calibration Dipole | CD1880V3 | 1038 | Sep. 27, 2007 | Sep. 26, 2009 |
| SPEAG | 2450MHz Calibration Dipole | CD2450V3 | 1039 | Sep. 27, 2007 | Sep. 26, 2009 |
| SPEAG | Data Acquisition Electronics | DAE3 | 577 | Nov. 12, 2008 | Nov. 11, 2009 |
| SPEAG | Data Acquisition Electronics | DAE4 | 778 | Sep. 22, 2008 | Sep. 21, 2009 |
| SPEAG | Test Arch Phantom | N/A | N/A | NCR | NCR |
| SPEAG | Phone Positoiner | N/A | N/A | NCR | NCR |
| Agilent | Wireless Communication Test Set | E5515C | MY48360820 | Dec. 15, 2008 | Dec. 14, 2009 |
| R&S | Universal Radio Communication Tester | CMU200 | 105934 | Nov. 11, 2008 | Nov. 10, 2009 |
| Agilent | Dual Directional Coupler | 778D | 50422 | NCR | NCR |
| AR | Power Amplifier | 5S1G4M2 | 0328767 | NCR | NCR |
| R&S | Power Meter | NRVD | 101394 | Oct. 20, 2008 | Oct. 19, 2009 |
| R&S | Power Sensor | NRV-Z1 | 100130 | Oct. 20, 2008 | Oct. 19, 2009 |
| R&S | Spectrum Analyzer | FSP7 | 101131 | Mar. 12, 2009 | Mar. 11, 2010 |

**Table 5.1 Test Equipment List**

# 6. Uncertainty Assessment

The component of uncertainly may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainly by the statistical analysis of a series of observations is termed a Type A evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience and knowledge of the behavior and properties of relevant materials and instruments, manufacture's specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in Table 6.1.

| Uncertainty Distributions | Normal | Rectangular | Triangular | U-Shape |
|---|---|---|---|---|
| Multi-plying Factor[(a)] | 1/k[(b)] | $1/\sqrt{3}$ | $1/\sqrt{6}$ | $1/\sqrt{2}$ |

(a) standard uncertainty is determined as the product of the multiplying factor and the estimated range of variations in the measured quantity

(b) $\kappa$ is the coverage factor

**Table 6.1 Multiplying Factions for Various Distributions**

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual "root-sum-squares" (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %. The DASY uncertainty Budget is showed in Table 6.2.

| Error Description | Uncertainty Value (±%) | Probability Distribution | Divisor | Ci (E) | Ci (H) | Standard Uncertainty (E) | Standard Uncertainty (H) |
|---|---|---|---|---|---|---|---|
| **Measurement System** | | | | | | | |
| Probe Calibration | 5.1 | Normal | 1 | 1 | 1 | ± 5.1 % | ± 5.1 % |
| Axial Isotropy | 4.7 | Rectangular | √3 | 1 | 1 | ± 2.7 % | ± 2.7 % |
| Sensor Displacement | 16.5 | Rectangular | √3 | 1 | 0.145 | ± 9.5 % | ± 1.4 % |
| Test Arch | 7.2 | Rectangular | √3 | 1 | 0 | ± 4.1 % | ± 0.0 % |
| Linearity | 4.7 | Rectangular | √3 | 1 | 1 | ± 2.7 % | ± 2.7 % |
| Scaling to Peak Envelope Power | 0.0 | Rectangular | √3 | 1 | 1 | ± 0.0 % | ± 0.0 % |
| System Detection Limit | 1.0 | Rectangular | √3 | 1 | 1 | ± 0.6 % | ± 0.6 % |
| Readout Electronics | 0.3 | Normal | 1 | 1 | 1 | ± 0.3 % | ± 0.3 % |
| Response Time | 0.8 | Rectangular | √3 | 1 | 1 | ± 0.5 % | ± 0.5 % |
| Integration Time | 2.6 | Rectangular | √3 | 1 | 1 | ± 1.5 % | ± 1.5 % |
| RF Ambient Conditions | 3.0 | Rectangular | √3 | 1 | 1 | ± 1.7 % | ± 1.7 % |
| RF Reflections | 12.0 | Rectangular | √3 | 1 | 1 | ± 6.9 % | ± 6.9 % |
| Probe Positioner | 1.2 | Rectangular | √3 | 1 | 0.67 | ± 0.7 % | ± 0.5 % |
| Probe Positioning | 4.7 | Rectangular | √3 | 1 | 0.67 | ± 2.7 % | ± 1.8 % |
| Extrap. and Interpolation | 1.0 | Rectangular | √3 | 1 | 1 | ± 0.6 % | ± 0.6 % |
| **Test Sample Related** | | | | | | | |
| Device Positioning Vertical | 4.7 | Rectangular | √3 | 1 | 0.67 | ± 2.7 % | ± 1.8 % |
| Device Positioning Lateral | 1.0 | Rectangular | √3 | 1 | 1 | ± 0.6 % | ± 0.6 % |
| Device Holder and Phantom | 2.4 | Rectangular | √3 | 1 | 1 | ± 1.4 % | ± 1.4 % |
| Power Drift | 5.0 | Rectangular | √3 | 1 | 1 | ± 2.9 % | ± 2.9 % |
| **Phantom and Setup Related** | | | | | | | |
| Phantom Thickness | 2.4 | Rectangular | √3 | 1 | 0.67 | ± 1.4 % | ± 0.9 % |
| **Combined Standard Uncertainty** | | | | | | ± 15.2 % | ± 10.8 % |
| **Coverage Factor for 95 %** | | | | | | K = 2 | |
| **Expanded Uncertainty** | | | | | | **± 30.4 %** | **± 21.6 %** |

**Table 6.2 Uncertainty Budget of DASY**

# 7. HAC RF Emission Measurement Evaluation

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. System validation kit includes a dipole, tripod holder to fix it underneath the test Arch and a corresponding distance holder.

## 7.1 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 in order to guarantee reproducible results. The system performance check uses 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 over time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.

## 7.2 System Setup

In the simplified setup for system evaluation, the DUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave which comes from a signal generator. The calibrated dipole must be placed beneath the arch phantom. The equipment setup is shown below:

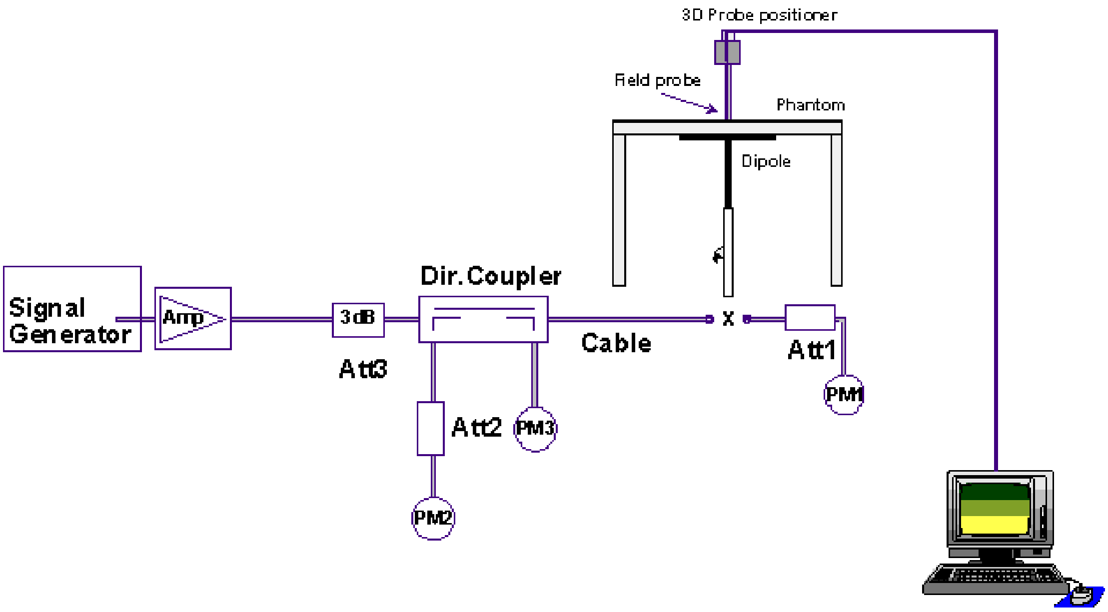



**Fig. 7.1 System Setup of System Evaluation**

1. Signal Generator
2. Amplifier
3. Directional Coupler
4. Power Meter
5. Calibrated Dipole

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

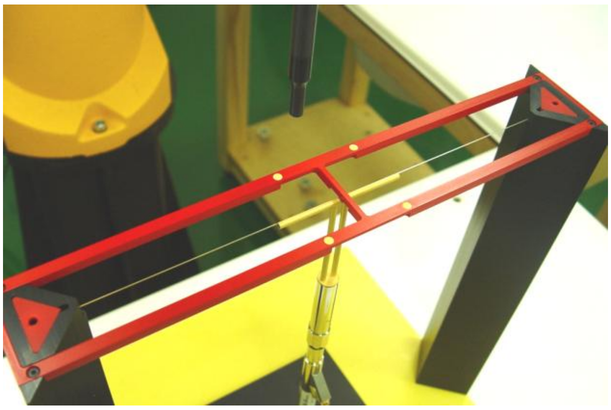


**Fig 7.2 Dipole Setup**

## *7.3 Validation Results*

Comparing to the original E-field or H-field value provided by SPEAG, the validation data should be within its specification of 25 %. Table 7.1 shows the target value and measured value. The table below indicates the system performance check can meet the variation criterion and the plots can be referred to appendix A of this report.

| Frequency (MHz) | Input Power (dBm) | Target Value (V/m) | E-Field 1 (V/m) | E-Field 2 (V/m) | Average Value (V/m) | Deviation (%) | Date |
|---|---|---|---|---|---|---|---|
| 835 | 20 | 167.10 | 175.6 | 177.9 | 176.75 | 5.77 | Aug. 13, 2009 |
| **Frequency (MHz)** | **Input Power (dBm)** | **Target Value (A/m)** | **H-Field (A/m)** | | | **Deviation (%)** | **Date** |
| 835 | 20 | 0.453 | 0.409 | | | -9.71 | Aug. 13, 2009 |

**Table 7.1 Test Results of System Validation**

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

# 8. RF Field Probe Modulation Factor

A calibration shall be made of the modulation response of the probe and its instrumentation chain. This calibration shall be performed with the field probe, attached to the instrumentation that is to be used with it during the measurement. The response of the probe system to a CW field at the frequency(s) of interest is compared to its response to a modulated signal with equal peak amplitude. The field level of the test signals shall be more than 10 dB above the ambient level and the noise floor of the instrumentation being used. The ratio of the CW reading to that taken with a modulated field shall be applied to the readings taken of modulated fields of the specified type.

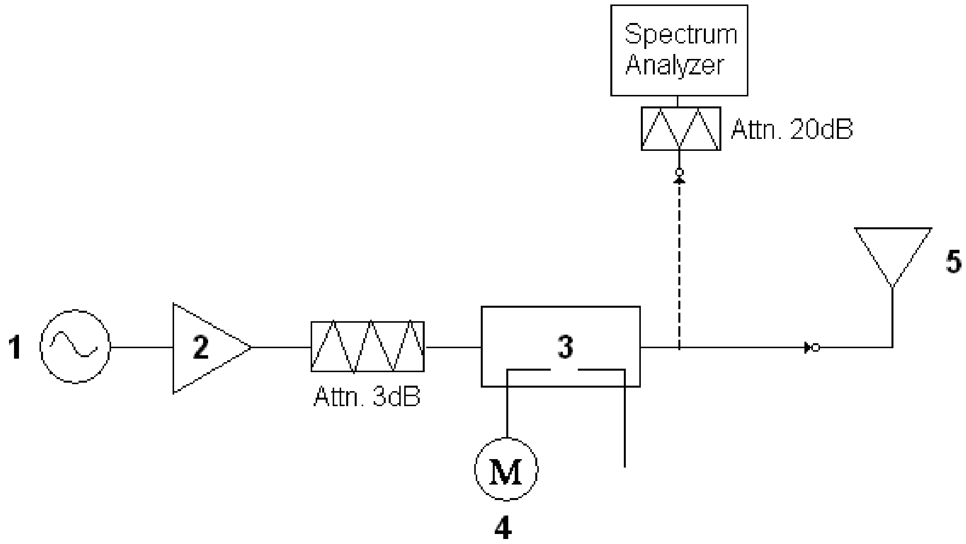



**Fig. 8.1 System Calibration**

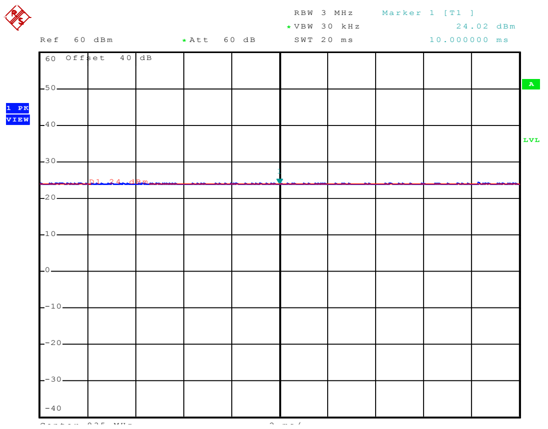
This was done using the following procedure:

1. Fixing the probe in a set location relative to a field generating device.
2. Illuminate the probe with a CW signal at the intended measurement frequency.
3. Record the reading of the probe measurement system of the CW signal.
4. Determine the level of the CW signal being used to drive the field generating device.
5. Substitute a signal using the same modulation as that used by the intended WD for the CW signal.
6. Set the peak amplitude during transmission of the modulated signal to equal the amplitude of the CW signal.
7. Record the reading of the probe measurement system of the modulated signal.
8. The ratio of the CW to modulated signal reading is the modulation factor.
9. Repeat 2~8 steps at intended measurement frequency for both E and H field probe.

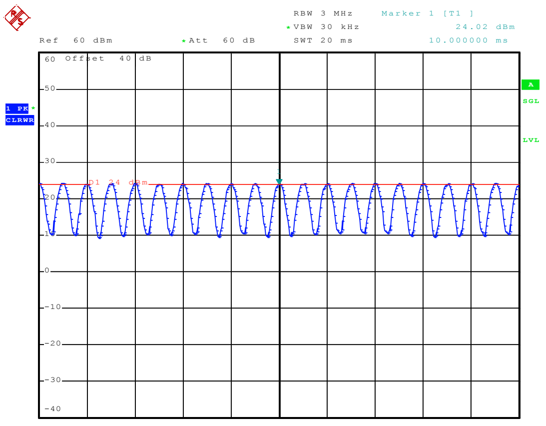
**PMF Measurement Summary:**

| Frequency (MHz) | Functions | E-field | H-field | PMF | |
|---|---|---|---|---|---|
| | | V/m | A/m | E-field | H-field |
| 835 | CW | 337.1 | 0.697 | - | - |
| 835 | AM 80% | 219.9 | 0.495 | 1.533 | 1.408 |
| 835 | WCDMA | 351.3 | 0.907 | 0.960 | 0.768 |

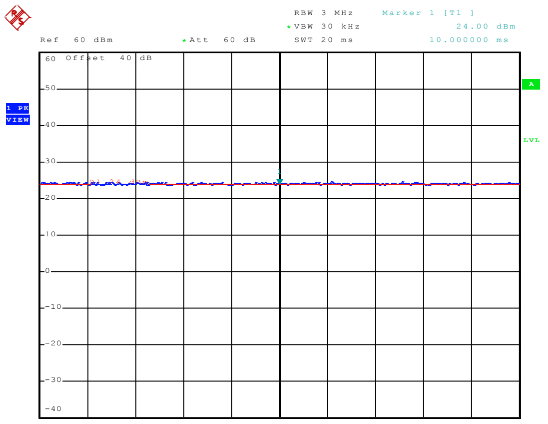
**Zero span Spectrum Plots for RF Field Probe Modulation Factor**



835MHz - CW



835MHz - 80% AM



835MHz - WCDMA

# 9. Description for DUT Testing Position

The DUT was put on device holder and adjusted to the accurate and reliable position. Please refer to Appendix E for the Setup photographs.

Fig. 9.1 illustrate the references and reference plane that shall be used in a typical DUT emissions measurement. The principle of this section is applied to DUT with similar geometry.

- The grid is 5 cm by 5 cm area that is divided into 9 evenly sized blocks or sub-grids.
- The grid is centered on the audio frequency output transducer of the DUT.
- 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 DUT handset, which, in normal handset use, rest against the ear.
- The measurement plane is parallel to, and 15 mm in front of, the reference plane.


**Fig 9.1 A typical DUT reference and plane for HAC measurements**

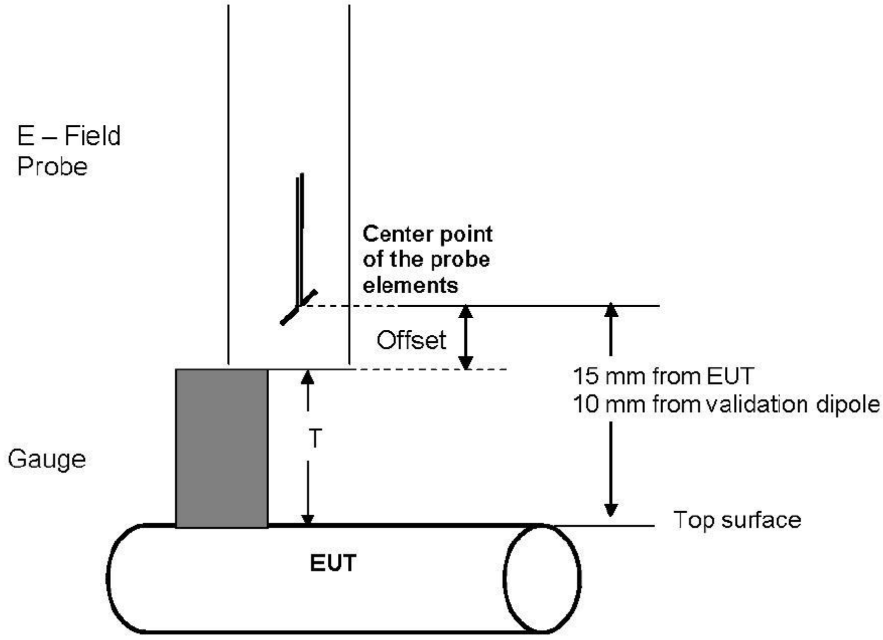



**Fig. 9.2 Gauge block with E-field probe**

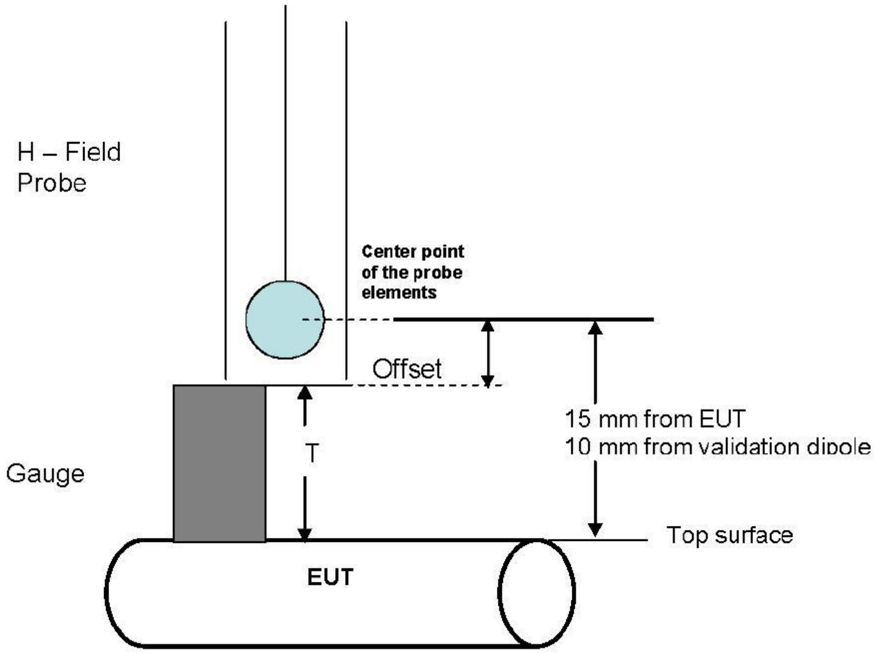



**Fig. 9.3 Gauge block with H-field probe**

# 10. RF Emissions Test Procedure

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

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

# 11. HAC RF Emission Test Results

## 11.1 Conducted Power (Unit: dBm)

| Band | WCDMA Band V | | |
|---|---|---|---|
| Channel | 4132 | 4182 | 4233 |
| Frequency (MHz) | 826.4 | 836.4 | 846.6 |
| RMC 12.2K | 23.75 | 23.85 | 23.57 |

## 11.2 E-Field Emission

| Plot No. | Band | Mode | Channel | Battery | PMF | Peak E-Field (V/m) | M-Rating |
|---|---|---|---|---|---|---|---|
| #01 | WCDMA Band V | RMC12.2K | 4233 | 2 | 0.960 | 68.9 | M4 |

## 11.3 H-Field Emission

| Plot No. | Band | Mode | Channel | Battery | PMF | Peak H-Field (A/m) | M-Rating |
|---|---|---|---|---|---|---|---|
| #02 | WCDMA Band V | RMC12.2K | 4233 | 2 | 0.768 | 0.083 | M4 |

**Remark:**

1. The volume was adjusted to maximum level and the backlight turned off during RF Emission testing.
2. There is no special HAC mode software on this DUT.
3. Test Engineer：Robert Liu

## 12. References

[1] ANSI C63.19-2007, “American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids”, 8 June 2007

[2] SPEAG DASY System Handbook

## Appendix A. Plots of System Performance Check

The plots are shown as follows.

# Appendix B. Plots of RF Emission Measurement

The plots are shown as follows.

## *Appendix C. DASY Calibration Certificate*

The DASY calibration certificates are shown as follows.

## Appendix F. Hardware Release Notes

# Hardware Release Notes

## Hewlett Packard

## Codename: Obsidian

EVT2 to DVT2 build

<July 20, 2009>

**Note: This Hardware Release Note Template is not providing a mandatory format for release notes. Vendors are free to use whatever format they fill is suitable for their release notes.**
**However, in any case <u>all</u>** the information requested in this document shall appear as well in the vendor's release notes.

# 1. Purpose

The purpose of this document is to outline the HW changes from EVT2 to DVT2. It includes the reason for change and solution implemented in each phase of development build phase.

# 2. Electrical Changes from EVT2 to DVT2

| Electrical Changes |
|---|
| **For Halogen-free request**<br>1. Change CON1401, CON1901, D1401, D2004, D801, D802, D2001, D2003, D2005, D2101, U1802 and U1803 to Halogen-free component. |
| **To improve the Headset mode sending Distortion**<br>1. Change C708 to NM (no mount). |
| **To improve the Headset mode sending Distortion**<br>1. Change C1838 from 0.1uF/6.3V(0201) to 0 ohm<br>2. Change R1834 from 0 ohm(0201) to 0.1uF/6.3V(0201)<br>3. Change C1839 from NM to 0 ohm(0201)<br>4. Change R1826 from 0 ohm(0201) to NM<br>5. Change C1842 from 0 ohm(0201) to 0.1uF/6.3V(0201) |
| **To improve the luminance of EL lamp**<br>1. Change R2043 to 150ohm |
| **To improve the RF D-sense performance.**<br>1. Change the L1401 from BLM15BA100SN1D to BLM15BA220SN1D<br>2. Change RP1401 to 0201 10K Ohm (R1412/R1414/R1415/R1419)<br>3. Add 0402 0 Ohm(R1421~R1425) at SD IF |
| **To fix the LCM Flicker issue**<br>1. Change the C1628/C1629/C1630 from 0603 4.7uF to 0805 10uF<br>2. Change the C1610/C1612 from 0402 1uF to 0603 4.7uF<br>3. Change the L1601/L1603 from 6.8uH to 4.7uH |
| **To ensure the working stability of U1803**<br>1. Add R1817 to ensure the voltage level of GPIO85. |
| **To find tune the saturation point of light sensor**<br>1. Change R1404 from 1M to 300K |
| **To improve the efficiency of status LED**<br>1. Change R2005 to 300Ohm, R2026 to 120Ohm |
| **To ensure the USB_VBUS don't damage capacitor**<br>1. Change C802 from 0402/6.3V to 0603/10V |
| **Can differentiate the HW version between EVT2 and DVT2**<br>1. Change R1003 to 845K |

| **RF** |
|---|
| **No store for WALSIN 0 ohm Jumper**<br>1. Change R1505 and R1514 from WALSIN/WR04X000PTL to TA-I/RM04JTN0<br>(DVT1 0ohms-> DNT2 0 ohms) |
| **Modified WCMA BC1 current consumption**<br>1. Change C2715 => MURATA/LQW15AN10NH00<br>(DVT1 N.M.-> DNT2 10nH)<br>2. Change C2712 => 1A20-01PC600<br>(DVT1 33pF -> DNT2 3.6pF) |
| **Modified WCMA BC5 current consumption**<br>1. Change C2810 => MURATA/LQW15AN5N6C10D<br>(DVT1 8.2nH -> DNT2 5.6nH)<br>2. Change C2806 => 11G23207R074360 MLCC TAIYO/UMK105CH070DW-F<br>(DVT1 10pF -> DNT2 7pF) |

## Obsidian_SW_Release_Notice_V0 30 75 03P

| |
|---|
| Enable feature FEATURE_MMGSDI_MCC_VERIFICATION again, this feature will automatically detect and sets NV_GPRS_ANITE_GCF_I (947) to 1 for a "Test SIM" and 0 for a commercial SIM. Some NV items' setting will be ignored if a Test SIM is inserted, hard code will be used, like scan time |
| Report 0x380 to FTM application if NV_BAND_PREF_I is 0x180, to fix FTM Radio Access Technology and Band Selection display blank issue |

## Obsidian_SW_Release_Notice_V0.21.59.03

| |
|---|
| [OB864] |
| 1. Revert luxiao's change in sdmemory driver. |
| 2. Try to fix the issue caused by SD initialization issue when resuming from suspend. |
| [TD864] don't register sdbus driver as power-managed devices |
| [SAP]ObsidianTD2458. Recommit SAP pin issue. |
| 1. When TAI get PinstatusCb() from modem, it will change the phone ready state immediately. |
| 2. In sap profile, when SAP disconnect, delay 5s and then open the phone. |
| Change FOTA server time out registry key setting from default 7 Days to 1 Hour |
| [USSD] Obsidian TD1647. Add code to parse an USSD cause value and translate to unsupported command. |
| [OB1139]UIM_USIM_MBDN is not read and go into default, so that SendRefreshCompleted(TRUE) not called |
| [Wifi] fix Obsidian TD 2172: Wi-Fi connecton is turned off after turning off power and then on in Phone and BT connection off state. |
| Enable USB2PC |
| [OB2470]Fix the issue that BT icon will disapeared when WiFi button is pressed. |
| [AT&T UE]Add some png files for some folder |
| show nothing on shuwdown aniscreen title bar |
| [ModemLink]Fixed Macro ATT_SPECIFIC define issue. |
| Disable VCP for charging timeout function. |
| Fix sometimes the touch will lose function issue after the call in very tricky condition.(20090610) |
| Rootcause: the GPIOIst thread and Sensor service is not sync during the phone call state change |
| revert Group tag index fix for SIM Manager according to the disscussion with BLStream. Now group tag index will start from 1 |
| remove EF_GAS/EF_AAS checking before reading/writing group/ANR tag |
| fix a memory leak issue |
| TD1318,2126 - Possible workaround for Aircomm testing where CMU unable to read 1900 power class of the device. |
| [Application] BLStream Update 6/10's drop |
| disable Adaptxt |
| [Westtek]Update to 5.3.1142 |
| remove adaptxt from CTO, otherwise the CTO would not be installed successful. |

## Obsidian_SW_Release_Notice_V0.21.60.03

| |
|---|
| HP_lzbLimit NITZ handler under CM_SS_EVENT_SRV_CHANGED evnet condition |
| [AMSS][Phonebook]Fix TD1823- Error Handler of SIM Reading |
| [audio][TD1772]Remove some video type file from ringtone support list. |
| [HP Theme]Update to 1.3.0.11 |
| [FLO DRM]Add FLO DRM for AT&T |
| [ObTD#1844]Clean boot will reset RTC to 2009/01/01 12:00PM |
| [OB2695]: Disable auto-close-camera-when-inactive function to avoid OB2695 issue. |

| |
|---|
| [LockScreen]Add this cab for test |
| [SAP] Revert commit 3733. Need further study. |
| close media player when shut down |
| [OB2326][New Fn Feature] Support FN key for multi key press function. Fix TD#2326 (0615) |
| [HP Theme]Currently we need add this jpg because it seems Theme monitor dll is not workable. |
| [OB2126] - Removing workaround and adding actual fix for PowerClass 1900 bug in Aircomm testing.<br>Qualcomm has accepted HP solution and they will release it later date. |

Obsidian_SW_Release_Notice_V0.21.63.03

| |
|---|
| FTM - Fixing up Obsidian TD 2311 and 2165 to display GSM 2/3 screen and Call drop list. |
| [AT&T]Update AT&T Music icon and IM icon |
| Update code base to Qualcomm SBA526005 |
| But I did not include NV and RIL/TAI related code change in SBA526005, the reason is there is a big change in NV and RIL/TAI,<br>most of fix in RIL/TAI is double fix with our code base and there is no any open bugs in our database related to those changes so far. |
| This merge will not impact the check in of r3909, r3910, r3913, r3916 of main trunk |
| We will review the remaining changes and update code later to align with Qualcomm code base for any of potential risk and next merge. |
| revert Qualcomm SBA526005 BT registry change to previously version,<br>because driver engineer told me the change is useless and will have big side effect. We will continue to check with Qualcomm |
| [APPS]Update HP_DataConnect_XML_v1.75ppc_iPAQ. |
| According to Marketing requirements, change all occurrences of "Mobile Phone" in network connection names to "iPAQ" |
| [NV] Change comments only |
| Remove the USB Mass Storage support from platforms |
| Change the device string from "HP iPAQ USB Device" to "HP iPAQ USB". |

Obsidian_SW_Release_Notice_V0.21.65.03

| |
|---|
| [MusicID2]Update to 1.1.0.0 version |
| [AT&T Update]Add AT&T Update application |
| [Pocket Express]Update to 4.70.32 LR |
| [audio]add headset irq as wakeup source |
| update memory layout. this change has been verified in both retail build and ship build. |
| [OB2430, OB2448, OB 2837] Fix display issue. |
| merge ril devel branch, update to 5.2.6005 |
| [OB2246][SR00166171]1.time.c: add some debug message for tracing the time information when issue happens. |
| 2.time_tod.c: add a potential fix for time |
| [OB 2710]Add space after "Master reset done.",<br>change "software" to "softwares" and change "Click <strong>Start</strong>" to "Click<b>  Start</b> in CustEngnScr1_0409.html. |
| [Modem Link]Change device name to HP iPAQ USB Modem |
| [Application]Update to BLStream 6/22 drop. |
| [APPS]Update SJWC_201106_20090622_OBS |
| [Java] Modify Java UAProfile |
| [FLO DRM]Merge Sly registry to obsidian for some related issues |
| show complete aniscreen |

| |
|---|
| [OB1831] Make a workaround for [Defect #512 - GSM-BTR-1-1830 ] TU fails to receive Push SI message with blank fields. |
| Correct POP3 port to 110 |
| [OB2469]: DUT would auto reboot when suspend/resume repeatedly. |
| [Java] Change default connection profile name to "iPAQ WAP" first, before Stephan release new xml drop; in future, Stephan will set corresponding value in xml files |
| Fix an error, the range of bank3 should be 69-94 |
| [RIL] Increase Packet count function's performance |
| [APPS]Update Arcsoft MMS_Dshow_Camera_Streaming Player |
| Change transport type from 1 (IMAP4) to 0 (POP3) for earthlink and BellSouth by ATT specification |

Obsidian_SW_Release_Notice_V0.21.67.03

| |
|---|
| TD 2811 - Added missing case for Registration Denied during PIN1 locking. |
| [AT&T Update]Update to 1.0.0.2 |
| merge code for DVT HW |
| [Lockscreen]Remove Lockscreen.cab |
| [BT][OPP/FTP] fix Obsidian TD1790 [Defect #488 - GSM-BTR-1-1992] Bluetooth: when a BT transaction such as OPP or FTP, there is no user confirmation present |
| root cause: MSFT UI don't match the requirement. |
| fix: make a shadow to add a confirm UI. |
| [BT][OPP/FTP] fix message error |
| [AT&T UE]1,Modify the name of the folder from "Microsoft Service" to "Microsoft Services"; 2,Remove the Microsoft My phone cpl from the setting directory |
| revert SD driver to to r3183 |
| merge change for Obsidian DVT build |
| [jIM Plug in]Update the jIM plug from Chris to solve Camera LTK rotation issue |
| [Modem] Workaround to avoid "can't attach to EDGE" issue because MMR_CELL_SERVICE_IND event is lost, and mm_serving_plmn.egprs_supported is not set to 0 |
| Bug fixed for the GPIO key function abnormal |
| FN/SHIFT/SYM key not work after resume device |
| SEND/END key could not wake up device. |
| Copied the MS sample code for USB Mass storage class function driver and modified for our use. |
| 1. Added a thread to call SystemIdleTimerReset every 30 seconds, if the USB Mass Storage Class driver is in use and the USB cable is connected. So when USB Mass Storage is being used by PC user, the device will not suspend. |
| 2. Allow the device to show up in PC side even when there is no SD card in the slot. However, on PC side, it will prompt you to insert card if you try to open that device. |
| [jIM]Add CIRType registry to TD2830 |
| [Application]Update to BLStream's 6/24 drop |
| [User Agent] Change User Agent "HP-KB1" to "HP_KB1" based on Bryan's confirm |
| [BT][OPP/FTP]set the confirm UI timeout from 5s to 10s |
| [AT&T UE]1, Change the MusicID from binary to stub; |
| 2, Change the name of link file: "JETCET PRINT.lnk" to "Jet Cet Print.lnk", "MusicID 2.lnk" to "Music ID.lnk". |
| [Battery]Revert 3895 commit, enable charging over temperature notification |

| |
|---|
| [OB2895]Fix the TD 2895 |
| [HP Theme]Update HP Theme to 1.3.0.12 |
| speedup anisreen when startup |
| [AT&T UE]Change the "ShopApplication.lnk" to "Shop Applications.lnk" |
| [AT&T Certificate]Follow the document 13340_36.pdf to add certificates for AT&T |

Obsidian_SW_Release_Notice_V0.30.69.03

| |
|---|
| Update the driver date and version in USB Modem INFO, for WHQL test requirement. |
| Factory BootStrap |
| Temp solution for Display DIM issue. |
| [FLO DRM]Revert to 1.0-20081217-0039 because 1.0-20090625-0146 does not work normally. |
| [audio]acoustic parameters update to V13B |
| [keyboard]Revert to previously version to lower the risk of the side effect of new code |

Obsidian_SW_Release_Notice_V0.30.71.03

| |
|---|
| [Application]Update to BLStream 6/29's drop |
| [BT][OPP/FTP] fix Obsidian TD1790 [Defect #488 - GSM-BTR-1-1992]<br>Bluetooth: when a BT transaction such as OPP or FTP there is no user confirmation present |
| root cause: There is %5 failure that cannot pop up msg box when user send multi vcard to DUT at the same time and choice "NO" or timeout. |
| reason: there is no enough time to destroy msg box, which cause the new msg box cannot be created if DUT receive muilt vcard at the same time.<br>so we delay 50ms if we don't recevie this OPP. |
| [USB]Remove it for side effect for the J/K and receiver sensitivity performance |
| [Modem] Disable Fatal Err Message in ship ROM, give modem a chance to try if error can be recover,<br>and try if QXDM log will not be broken by FATAL Error. it will not affect exception FATAL ERR function |

Obsidian_SW_Release_Notice_V0.30.80.03

| |
|---|
| fix HPQ 817 - [6.5] - ATT Power Up / Down Animation Performance |
| Change the position of ADC Calibration related items in NV table and also update sensor driver for BT cases |
| [Music]Use small size Confess to Impress.wma(2M) to replace the Familiar Places.wma(8M) for saving flash |
| TD 1272 - Wrong RSSI indicator count..Changed preferred method for RSSI display to use raw dBm value from RIL to allow 1-1 match to ATT<br>requirement. |
| [HP Theme]Update BLStream's STK Titanium plug in |
| Change the charging current, by EE's requirement. |
| [audio]codec tx gain 0xca62 to 0x1a00 |

Obsidian_SW_Release_Notice_V0.30.82.03

| |
|---|
| [Sensor] Update to 20090707_Sensor.rar: |
| 1. Bug fixed for TD#3036 |
| - Config GPIO 76 to input/pull-down in suspend mode. |
| - Turn off VREG_WLAN in suspend mode |
| - control MPP17 in order to save power. |

| |
|---|
| Fix the bug that some sd card have special partition table |
| [Keypad] Update to 20090707_keypad driver; |
| 1. Bug fixed for the GPIO keys function abnormal. |
| 2. Implement the multi key press with CAP key. |
| [Sprite Backup][TD3098]Use right registry for pbf file to fix TD3098 |
| [APPS]Add Arcsoft localization resources(0416, 0C0A) |
| [Audio]modify notification in call setting registry setting |
| Try to fix the TD bug 2355 : USB can not be recognized if device is rebooted automatically with USB connected. |
| add notification when clean bootup |
| [audio]acoustic parameters update to V15 |
| [LockScreen]Use Microsoft new lockscreen cab for wipe issue in retail build |
| Revert to old version for cleartype issue |

Obsidian_SW_Release_Notice_V0.30.84.03

| |
|---|
| [jIM]Update to 2.0.0.B69 |
| Update to BLStream 7/13's drop |
| [cvc]update to 2.5.3-907131 |
| change clean boot message "clean boot" to "Factory Restore is Done" |
| [HP Theme]Update to 1.3.0.21 |
| [Notification] 1, set "Play Sound" to ON under Sounds & Notifications – SMS/MMS/Email;<br>2. Disable all pop up notifications under Sounds & Notifications (Notifications tab) |

Obsidian_SW_Release_Notice_V0.30.85.03

| |
|---|
| [APPS]Update localization resources for Westtek |
| [OB TD3215]Use sign fakecpl.cpl to avoid the pop up issue |
| [FactoryRestore]Fix the loc issue for FactoryRestore |
| [java]update to 2.0.1.1.08 |
| Fix GPIO key related bugs. |
| 1. Hardware key can not work after HOME key down without key up message. |
| 2. Send windows virtual key by sending VK_LWIN directly not by customized VK code. |
| [OB3065]Override IDS_DENIED="No service" to "SOS call only" |
| [AT&T UE][OB TD 3222]Change the order for some directories |
| [LockScreen]Update the cab per Microsoft requirement for Wipe issue. |
| [APPS]Update localization for Arcsoft Camera |
| [DataConnect XML]Update to DataConnect XML 1.76 |
| [Charging]Change the timeout from 1 hour to 3 hours for CC charging period. |
| [OB TD 3226]Disables WMP RAM caching |

Obsidian_SW_Release_Notice_V0.30.87.03

| |
|---|
| [jIM]Update to 2.0.0.B70 |
| ODM_SIMLOCK_DATA_LEN==512 bytes only can store 13 plmns, change to 1000 in order to meet new PRD 14 plmns |

| |
|---|
| [Audio]modify power up control |
| [bug:Unknown window on front of today screen]Remove WS_POPUP and try if this bug is fixed. |
| Change WiFi Button Behavior to consistence with the definition of PRD |
| [BT][HCI] add a workaround for passing BQP testing( PTS V3.200) |
| [Obsidian TD3088] [Defect #939 - GSM-BTR-1-0736] EONS: Fail: TU Constantly Displays "AT&T MicroCell" Even when registered to 3G Micro Network |
| [BT][BPP/BIP] remove BPP and BIP profiles |
| [Audio]add Qualcomm workaround solution for obsidian TD3063 keep sample rate 48K in voice call |
| [Application]Update to BLStream 7/20 drop. |
| [TD3345]Increase Obsidian font size by one notch higher per AT&T and HP marketing requirement |

Obsidian_SW_Release_Notice_V0.30.88.03

| |
|---|
| [Audio]eliminate the pop noise when device sleep then wake up |
| [USBFN]Try to fix the TD bug 3351 : When disable "Use USB Charging" than insert USB cable,battery still charging. |
| [TWC]Update to new version |
| [StarWars]Update to 1.1.7.5 |
| [Reminder][TD:3344]Per Marketing requirement, set the "repeat" box of reminder default to enable |
| [AT&T UE]Fix Jetcet Print icon display issue. |
| [HP Theme]Update STK and CB 's latest cpr |
| [ATTWifi][TD:3363]Replace the icon per AT&T LE ROM requirement.(This icon is 90*90 size, actually we need 45*45 for better effect.) |
| [Audio]fix headset key irq bug when sleep and wakeup |
| [VoiceCommander]We don't need this item because Obsidian dose not have a dedicated key for the VoiceCommander. |
| [BT][SAp] modify for passing BQB test case: TC_SERVER_RPS_BV_01_I, disable this workaround when SAP connected. |
| [TD3360][AT&T CDR-CON-3074] device requirement - CLIR<br>(calling line identification restriction) control through ATD command does not work.Added parser for #31#,*31#,*82,*67. |
| [BSP] Update BSP version to 5.2.6008 |
| [TD1831] [Defect #512 - GSM-BTR-1-1830 ] TU fails to receive Push SI message with blank fields.<br>Make a workaround to handle the case that the SI-ID flag is present even if its contents is NULL. |
| [java]update it to 2.0.1.1.09 |
| [audio]modify headset mic gain as device mic gain setting in 3pole headset MMA mode |
| [09platform][Obsidian][Keypad] Update to 20090722_Keypad.rar |
| 1. Bug Fix for TD#3348 |
| 2. Remove APP5 key for Camera function, call CreateProcess() directly in keypad driver. |
| [09platform][Obsidian][Backlight/Sensor/Display] Update to 20090722_DisplayBacklightSensor.rar |
| 1. Bug Fix for TD#3208, 3216 |
| [Obsidian] Fix Backlight issue |

# Appendix G. Original Report

Please refer to Sporton Report Number HA961307A as below.

**HAC_E_Dipole_835_20090813**

**DUT: Dipole 835 MHz**

Communication System: GSM850; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$
Ambient Temperature：22.5 °C

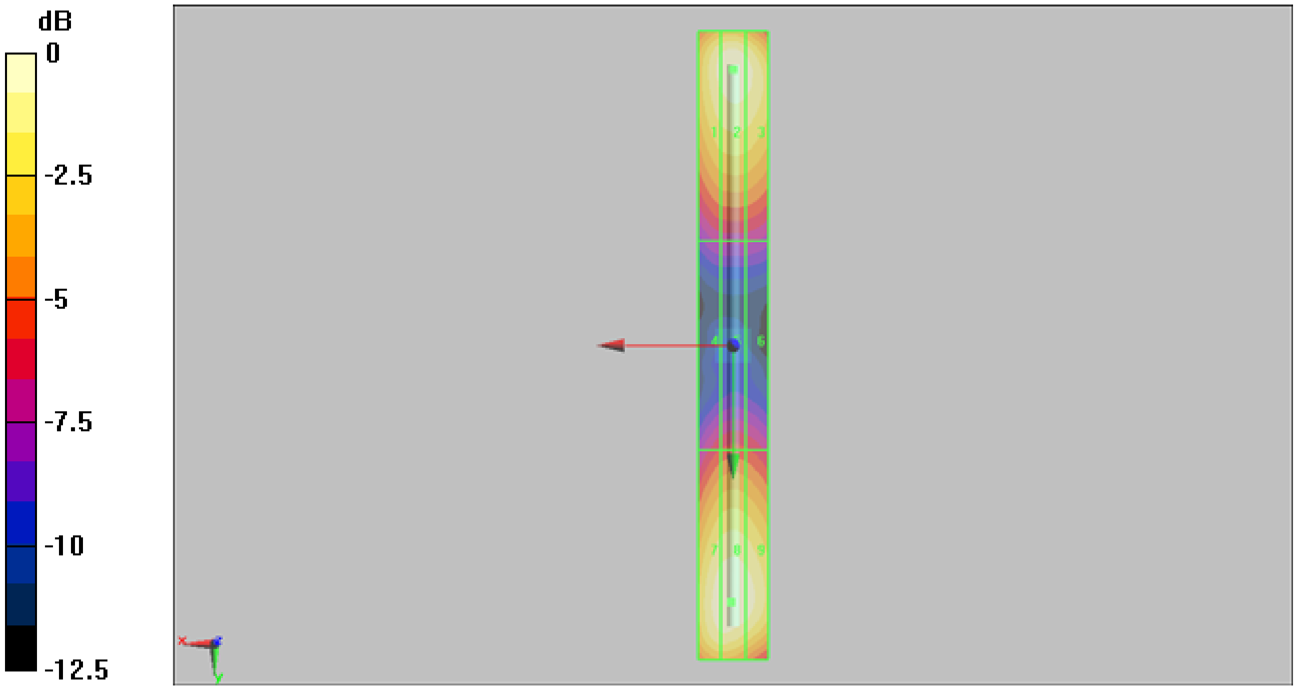
DASY5 Configuration:
- Probe: ER3DV6 - SN2358; ConvF(1, 1, 1); Calibrated: 2009/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

**E Scan - measurement distance from the probe sensor center to CD835 Dipole = 10mm/Hearing Aid Compatibility Test (41x361x1):** Measurement grid: dx=5mm, dy=5mm
Probe Modulation Factor = 1
Reference Value = 132.8 V/m; Power Drift = -0.011 dB
**Aversge vslue of Total=(175.6 + 177.9) / 2 = 176.75 V/m**

Peak E-field in V/m

| | | |
|---|---|---|
| Grid 1 **168.4 M4** | Grid 2 **175.6 M4** | Grid 3 **170.2 M4** |
| Grid 4 **92.3 M4** | Grid 5 **95.5 M4** | Grid 6 **93.3 M4** |
| Grid 7 **174.6 M4** | Grid 8 **177.9 M4** | Grid 9 **172.0 M4** |

**Cursor:**
Total = 177.9 V/m
E Category: M4
Location: 0.5, 73.5, 4.7 mm



0 dB = 177.9V/m

**HAC_H_Dipole_835_20090813**

**DUT: HAC-Dipole 835 MHz**

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m$^3$
Ambient Temperature：22.4 °C

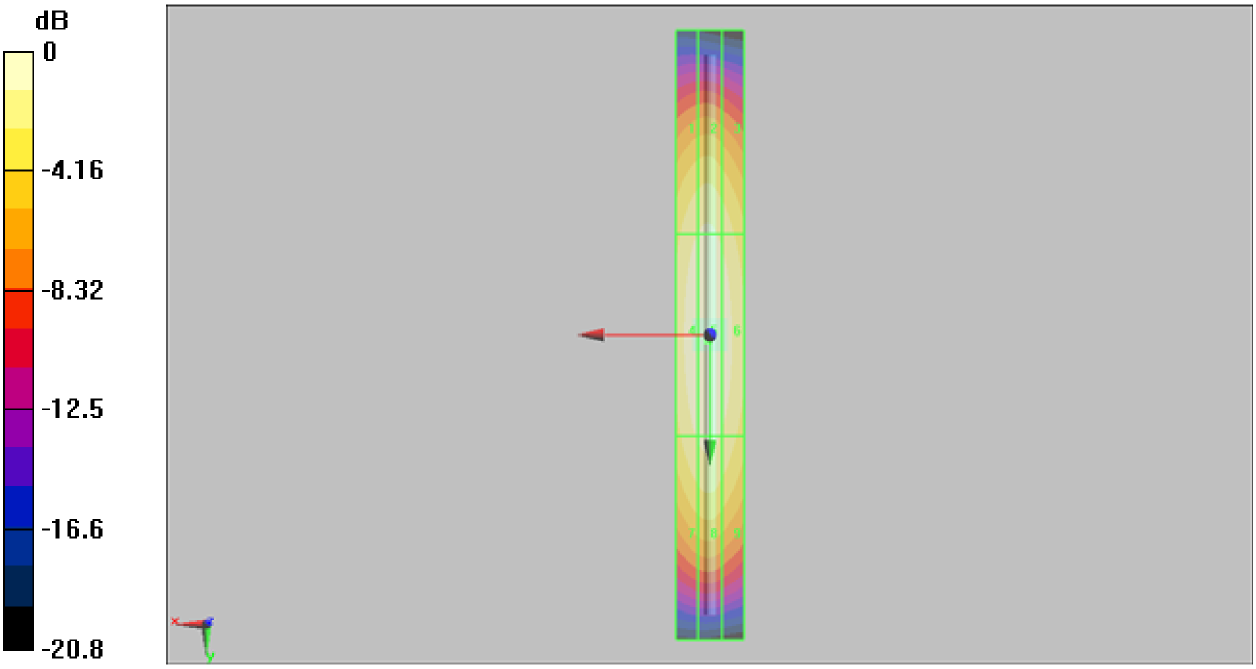
DASY5 Configuration:
- Probe: H3DV6 - SN6184; ; Calibrated: 2009/1/19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

**H Scan - measurement distance from the probe sensor center to CD835 Dipole = 10mm/Hearing Aid Compatibility Test (41x361x1):** Measurement grid: dx=5mm, dy=5mm
Probe Modulation Factor = 1
Reference Value = 0.453 A/m; Power Drift = 0.024 dB
**Maximum value of Total = 0.409 A/m**

Peak H-field in A/m

| | | |
|---|---|---|
| Grid 1 **0.350 M4** | Grid 2 **0.360 M4** | Grid 3 **0.336 M4** |
| Grid 4 **0.396 M4** | Grid 5 **0.409 M4** | Grid 6 **0.384 M4** |
| Grid 7 **0.354 M4** | Grid 8 **0.368 M4** | Grid 9 **0.343 M4** |

**Cursor:**
Total = 0.409 A/m
H Category: M4
Location: 0.5, 1.5, 5.2 mm



0 dB = 0.409A/m

**#01 HAC_E_WCDMA V Ch4233_Battery2**

**DUT: 961307-04**

Communication System: WCDMA; Frequency: 846.6 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$
Ambient Temperature：22.5 °C

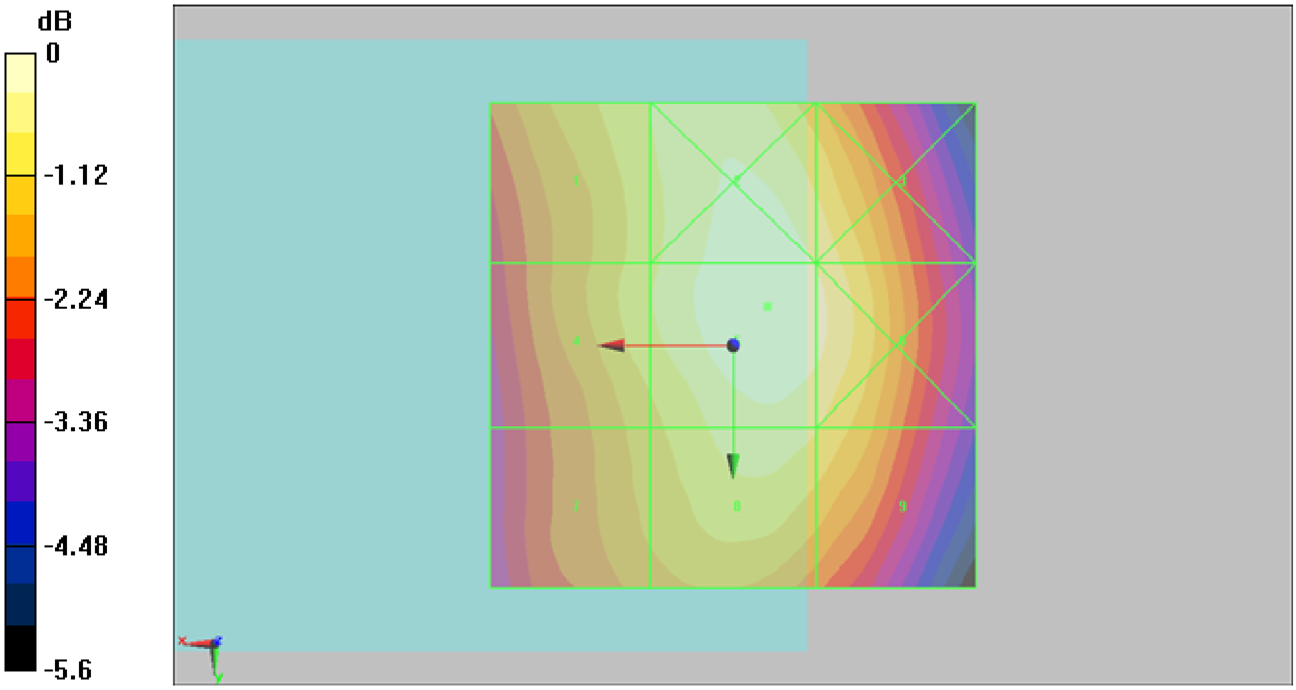
DASY5 Configuration:
- Probe: ER3DV6 - SN2358; ConvF(1, 1, 1); Calibrated: 2009/1/14
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

**Ch4233/Hearing Aid Compatibility Test (101x101x1):** Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 68.9 V/m
Probe Modulation Factor = 0.960
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 92 V/m; Power Drift = -0.010 dB
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak E-field in V/m

| | | |
|---|---|---|
| Grid 1 **63.3 M4** | Grid 2 **68.1 M4** | Grid 3 **65.8 M4** |
| Grid 4 **63.1 M4** | Grid 5 **68.9 M4** | Grid 6 **66.9 M4** |
| Grid 7 **59.7 M4** | Grid 8 **65.1 M4** | Grid 9 **63.4 M4** |

**Cursor:**
Total = 68.9 V/m
E Category: M4
Location: -3.5, -4, 8.7 mm



0 dB = 68.9V/m

**#02 HAC_H_WCDMA V Ch4233_Battery2**

**DUT: 961307-04**

Communication System: WCDMA; Frequency: 846.6 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m$^3$
Ambient Temperature：22.4 °C

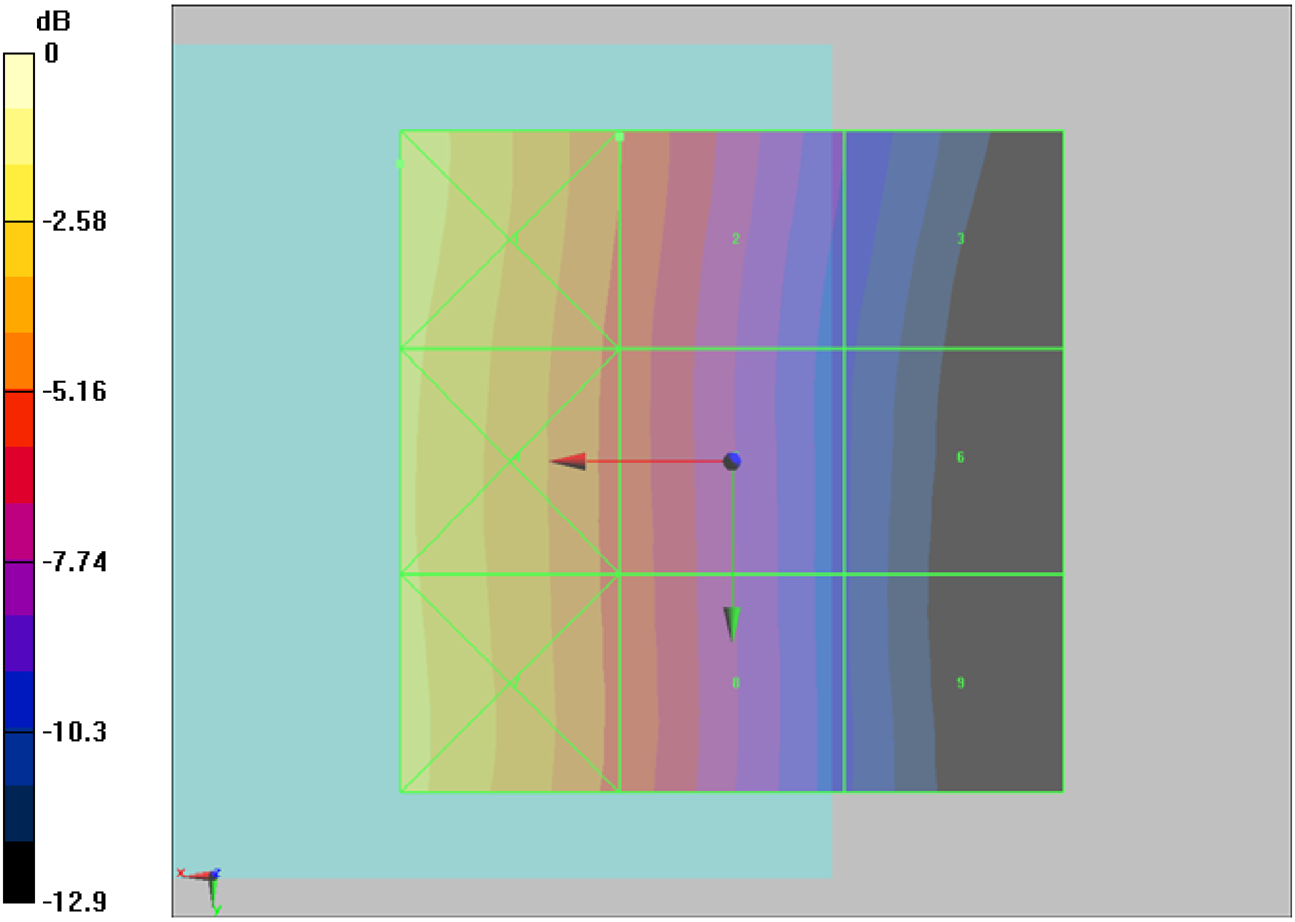
DASY5 Configuration:
- Probe: H3DV6 - SN6187; ; Calibrated: 2008/5/19
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn778; Calibrated: 2008/9/22
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY5, V5.0 Build 125; SEMCAD X Version 13.4 Build 125

**Ch4233/Hearing Aid Compatibility Test (101x101x1):** Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.083 A/m
Probe Modulation Factor = 0.768
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 0.082 A/m; Power Drift = -0.109 dB
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak H-field in A/m

| | | |
|---|---|---|
| Grid 1 **0.120 M4** | Grid 2 **0.083 M4** | Grid 3 **0.051 M4** |
| Grid 4 **0.115 M4** | Grid 5 **0.080 M4** | Grid 6 **0.047 M4** |
| Grid 7 **0.117 M4** | Grid 8 **0.081 M4** | Grid 9 **0.047 M4** |

**Cursor:**
Total = 0.120 A/m
H Category: M4
Location: 25, -22.5, 8.7 mm




0 dB = 0.150A/m

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

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

Accredited by the Swiss Federal Office of Metrology and Accreditation
**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 **Sporton (Auden)**

Certificate No: **CD835V3-1045_Sep07**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | CD835V3 - SN: 1045 |
| Calibration procedure(s) | QA CAL-20.v4<br>Calibration procedure for dipoles in air |
| Calibration date: | September 25, 2007 |
| Condition of the calibrated item | In Tolerance |

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Power meter EPM-442A | GB37480704 | 03-Oct-06 (METAS, No. 217-00608) | Oct-07 |
| Power sensor HP 8481A | US37292783 | 03-Oct-06 (METAS, No. 217-00608) | Oct-07 |
| Probe ER3DV6 | SN: 2336 | 27-Dec-06 (SPEAG, No. ER3-2336_Dec06) | Dec-07 |
| Probe H3DV6 | SN: 6065 | 27-Dec-06 (SPEAG, No. H3-6065-Dec06) | Dec-07 |
| DAE4 | SN: 903 | 19-Sep-07 (SPEAG, No. DAE4-903_Sep07) | Sep-08 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---|---|---|---|
| Power meter EPM-4419B | GB42420191 | 11-May-05 (SPEAG, in house check Nov-06) | In house check: Nov-07 |
| Power sensor HP 8482A | US37295597 | 11-May-05 (SPEAG, in house check Nov-06) | In house check: Nov-07 |
| Power sensor HP 8482H | 3318A09450 | 08-Jan-02 (SPEAG, in house check Nov-06) | In house check: Nov-07 |
| Network Analyzer HP 8753E | US37390585 | 18-Oct-01 (SPEAG, in house check Oct-06) | In house check: Oct-07 |
| RF generator E4433B | MY 41310391 | 22-Nov-04 (SCV, TRS 001-021-0354) | In house check: Nov-07 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Mike Meili | Laboratory Technician | M. Meili |
| Approved by: | Fin Bomholt | Technical Director | F. Bomholt |

Issued: September 27, 2007

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

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C Service suisse d'étalonnage
S Servizio svizzero di taratura
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Accredited by the Swiss Federal Office of Metrology and Accreditation
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 B55 |
| **DASY PP Version** | SEMCAD | V1.8 B176 |
| **Phantom** | HAC Test Arch | SD HAC P01 BA, #1070 |
| **Distance Dipole Top - Probe Center** | 10 mm | |
| **Scan resolution** | dx, dy = 5 mm | area = 20 x 180 mm |
| **Frequency** | **835 MHz** ± 1 MHz | |
| **Forward power at dipole connector** | 20.0 dBm = 100mW | |
| **Input power drift** | < 0.05 dB | |

## 2 Maximum Field values

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

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

| **E-field 10 mm above dipole surface** | condition | **Interpolated maximum** |
|---|---|---|
| Maximum measured above high end | 100 mW forward power | 168.2 V/m |
| Maximum measured above low end | 100 mW forward power | 165.9 V/m |
| Averaged maximum above arm | 100 mW forward power | **167.1 V/m** |

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

## 3 Appendix

### 3.1 Antenna Parameters

| Frequency | Return Loss | Impedance |
|---|---|---|
| 800 MHz | 15.4 dB | ( 41.9 – j13.5) Ohm |
| **835 MHz** | **30.8 dB** | **( 49.7 + j2.8 ) Ohm** |
| 900 MHz | 17.1 dB | ( 55.1 – j13.9 ) Ohm |
| 950 MHz | 18.9 dB | ( 48.6 + j11.1 ) Ohm |
| 960 MHz | 15.0 dB | ( 54.9 + j18.3 ) Ohm |

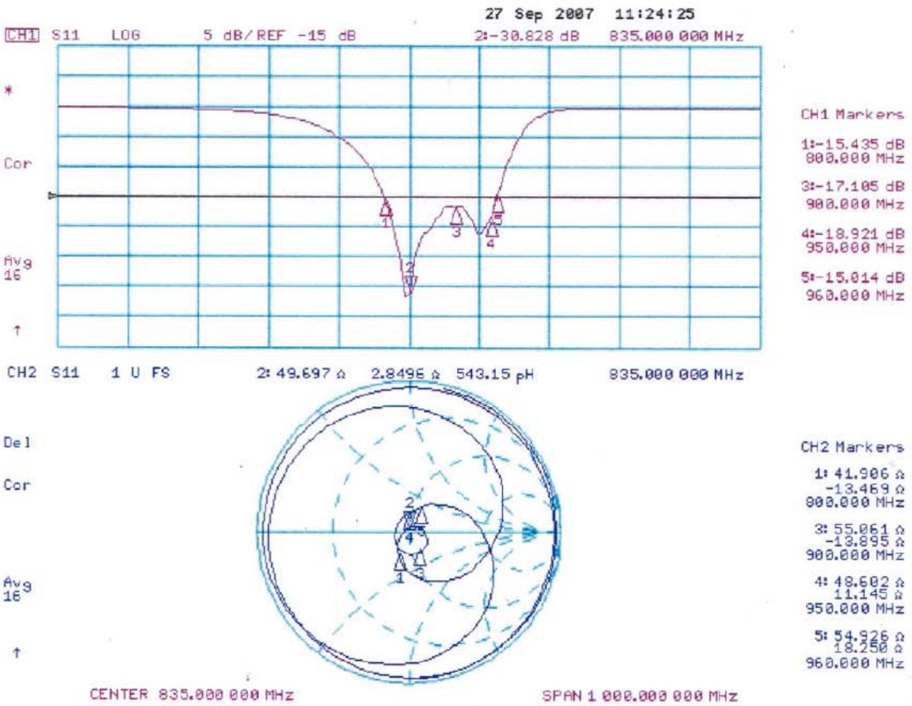
### 3.2 Antenna Design and Handling

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

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

### 3.3 Measurement Sheets

#### 3.3.1 Return Loss and Smith Chart



### 3.3.2 DASY4 H-field result

Date/Time: 25.09.2007 13:54:05

Test Laboratory: SPEAG Lab 2

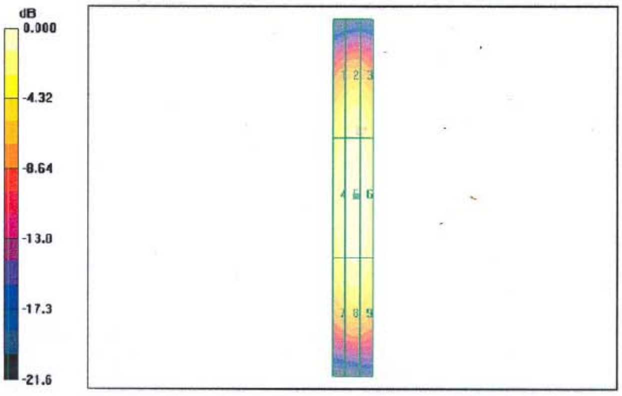
**DUT: HAC-Dipole 835 MHz; Type: CD835V3; Serial: 1045**
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m$^3$
Phantom section: H Dipole Section
Measurement Standard: DASY4 (High Precision Assessment)
DASY4 Configuration:

- Probe: H3DV6 - SN6065; Calibrated: 27.12.2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn903; Calibrated: 19.09.2007
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

**H Scan - Sensor Center 10mm above CD835 Dipole/Hearing Aid Compatibility Test (41x361x1):**
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.453 A/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 0.477 A/m; Power Drift = 0.000 dB
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak H-field in A/m

| | | |
|---|---|---|
| Grid 1 **0.364** **M4** | Grid 2 **0.405** **M4** | Grid 3 **0.396** M4 |
| Grid 4 **0.411** M4 | Grid 5 **0.453** **M4** | Grid 6 **0.444** M4 |
| Grid 7 **0.362** M4 | Grid 8 **0.398** **M4** | Grid 9 **0.391** M4 |




0 dB = 0.453A/m

### 3.3.3 DASY4 E-Field result

Date/Time: 25.09.2007 11:58:13

Test Laboratory: SPEAG Lab 2

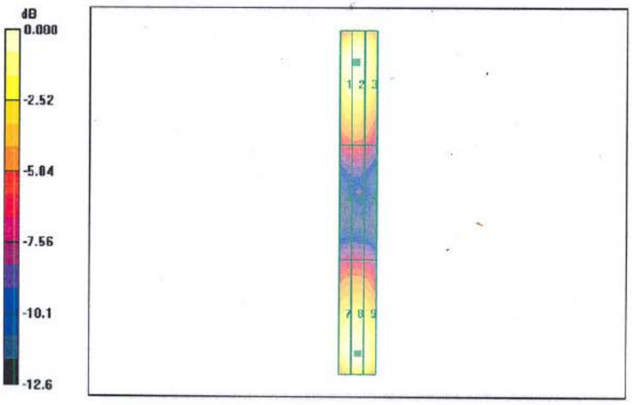
**DUT: HAC-Dipole 835 MHz; Type: D835V3; Serial: 1045**
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m$^3$
Phantom section: E Dipole Section
Measurement Standard: DASY4 (High Precision Assessment)
DASY4 Configuration:

- Probe: ER3DV6 - SN2336; ConvF(1, 1, 1); Calibrated: 27.12.2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn903; Calibrated: 31.08.2006
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

**E Scan - Sensor Center 10mm above CD835 Dipole/Hearing Aid Compatibility Test (41x361x1):**
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 168.2 V/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 109.0 V/m; Power Drift = -0.007 dB
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak E-field in V/m

| | | |
|---|---|---|
| Grid 1<br>**164.2**<br>**M4** | Grid 2<br>**165.9**<br>**M4** | Grid 3<br>**157.1**<br>**M4** |
| Grid 4<br>**87.2**<br>**M4** | Grid 5<br>**88.4**<br>**M4** | Grid 6<br>**84.0**<br>**M4** |
| Grid 7<br>**163.2**<br>**M4** | Grid 8<br>**168.2**<br>**M4** | Grid 9<br>**161.1**<br>**M4** |




0 dB = 168.2V/m

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Accreditation No.: **SCS 108**

Client **Sporton (Auden)**

Certificate No: **ER3-2358_Jan09**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | ER3DV6 - SN:2358 |
| Calibration procedure(s) | QA CAL-02.v5<br>Calibration procedure for E-field probes optimized for close near field evaluations in air |
| Calibration date: | January 14, 2009 |
| 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 | 1-Oct-08 (No. ER3-2328_Oct08) | Oct-09 |
| DAE4 | SN: 789 | 19-Dec-08 (No. DAE4-789_Dec08) | Dec-09 |

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

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

Issued: January 20, 2009

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ilac-MRA

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Accreditation No.: **SCS 108**

## Glossary:

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

## Calibration is Performed According to the Following Standards:

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

## Methods Applied and Interpretation of Parameters:

- *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:2358 January 14, 2009

# Probe ER3DV6

# SN:2358

Manufactured: July 7, 2005
Last calibrated: January 28, 2008
Recalibrated: January 14, 2009

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

# DASY - Parameters of Probe: ER3DV6 SN:2358

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

| | |
|---|---|
| NormX | **1.74** ± 10.1 % (k=2) |
| NormY | **1.57** ± 10.1 % (k=2) |
| NormZ | **1.60** ± 10.1 % (k=2) |

Diode Compression[A]

| | |
|---|---|
| DCP X | **90** mV |
| DCP Y | **92** mV |
| DCP Z | **98** 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 **-245** °

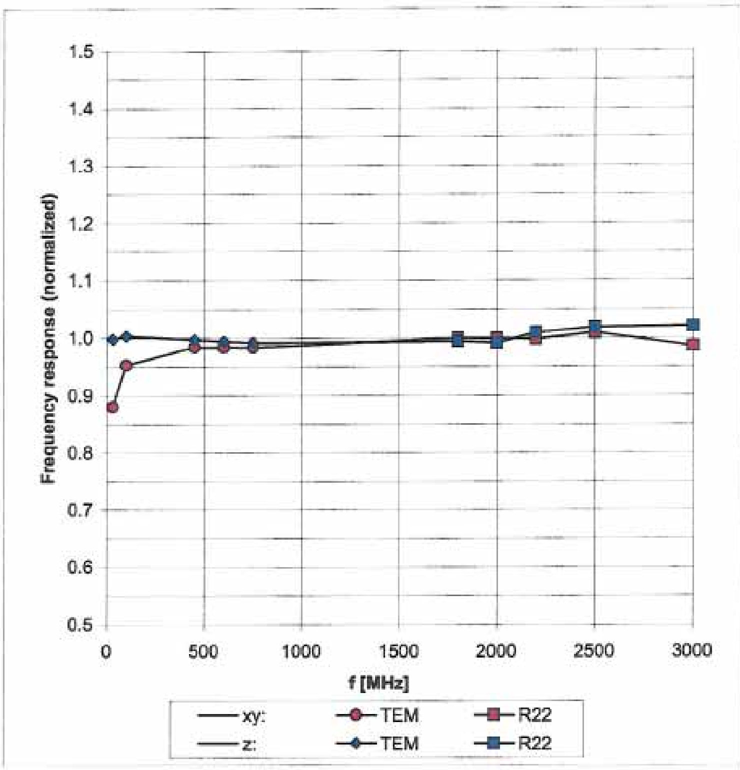
**The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.**

[A] numerical linearization parameter: uncertainty not required

**ER3DV6 SN:2358** **January 14, 2009**

# Frequency Response of E-Field

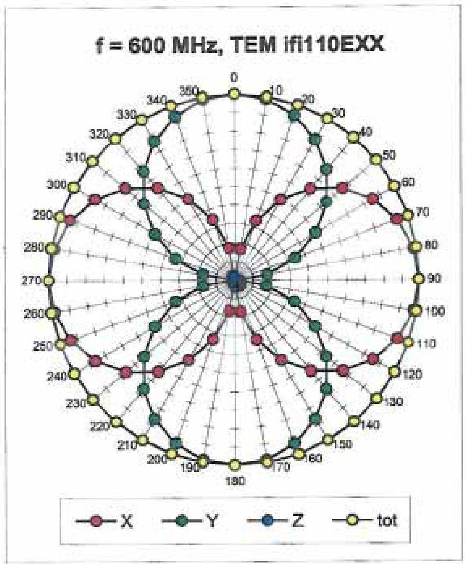
**(TEM-Cell:ifi110 EXX, Waveguide R22)**

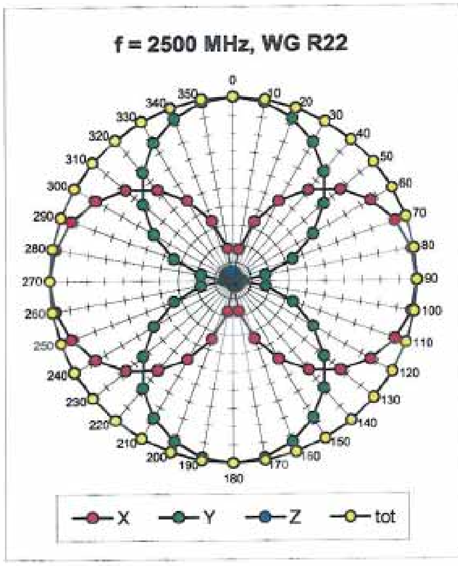



**Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)**

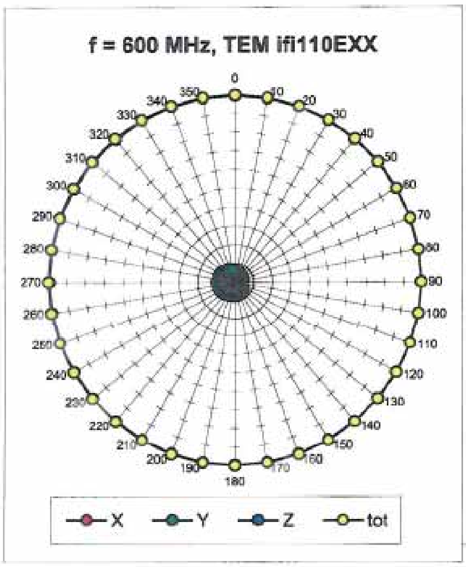
ER3DV6 SN:2358 January 14, 2009

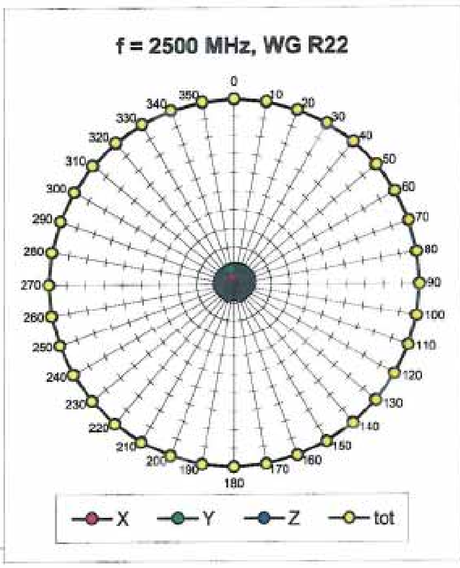
## Receiving Pattern (ϕ), ϑ = 0°



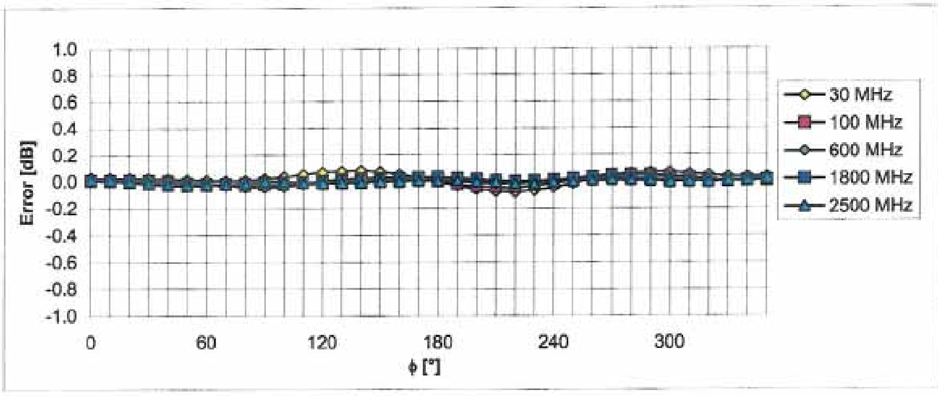

## Receiving Pattern (ϕ), ϑ = 90°



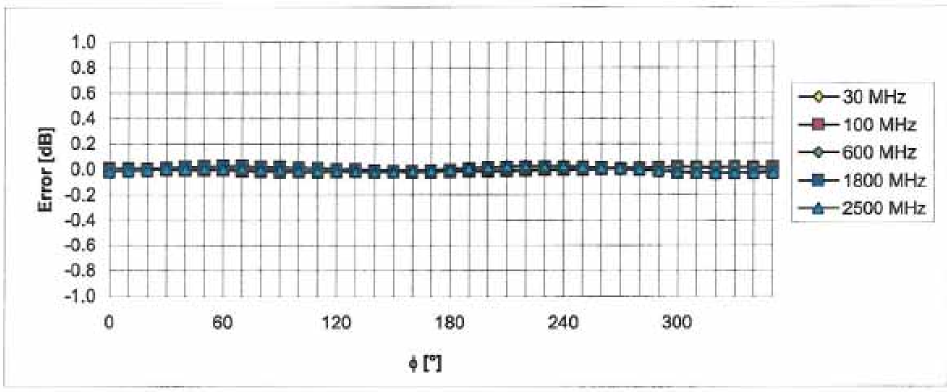
ER3DV6 SN:2358 January 14, 2009

## Receiving Pattern (ϕ), ϑ = 0°




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

## Receiving Pattern (ϕ), ϑ = 90°

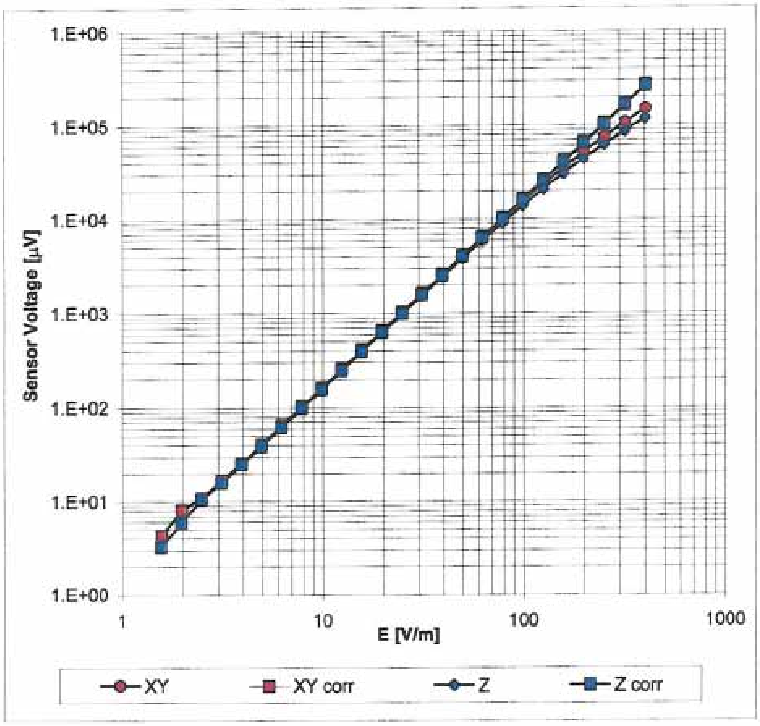


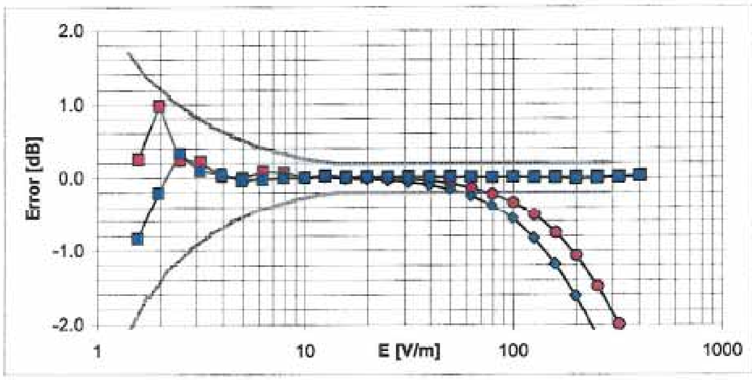

Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

ER3DV6 SN:2358 January 14, 2009

## Dynamic Range f(E-field)

**(Waveguide R22, f = 1800 MHz)**

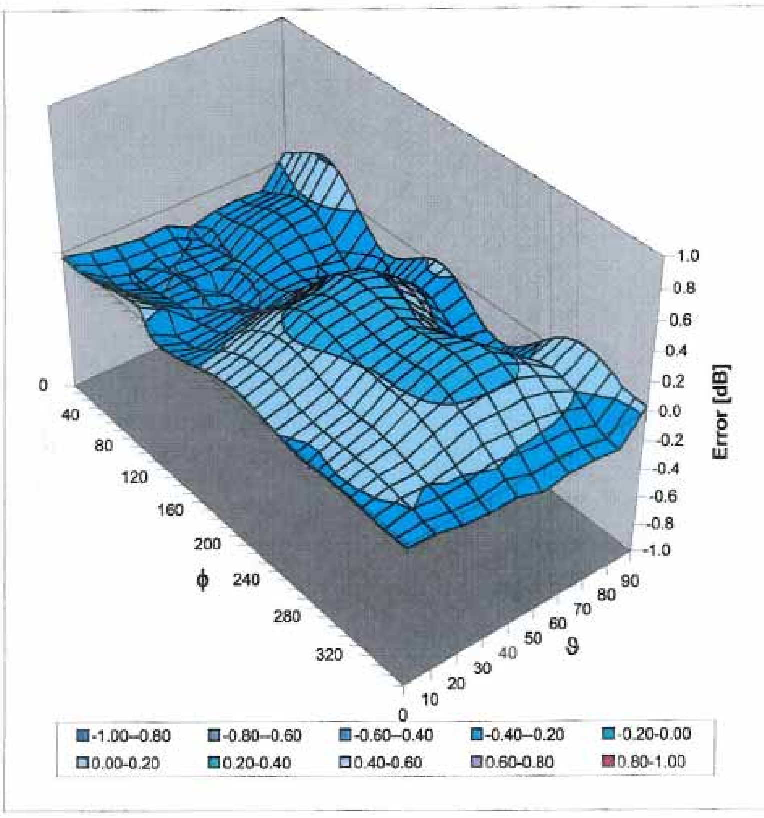



Uncertainty of Linearity Assessment: ± 0.6% (k=2)

ER3DV6 SN:2358 January 14, 2009

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




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

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**Accreditation No.: SCS 108**

Client **Sporton (Auden)**

Certificate No: **H3-6184_Jan09**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | H3DV6 - SN:6184 |
| Calibration procedure(s) | QA CAL-03.v5<br>Calibration procedure for H-field probes optimized for close near field evaluations in air |
| Calibration date: | January 19, 2009 |
| 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 | 1-Oct-08 (No. H3-6182_Oct08) | Oct-09 |
| DAE4 | SN: 789 | 19-Dec-08 (No. DAE4-789_Dec08) | Dec-09 |

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

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

Issued: January 20, 2009

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Accreditation No.: **SCS 108**

**Glossary:**

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

**Calibration is Performed According to the Following Standards:**

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

**Methods Applied and Interpretation of Parameters:**

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

# Probe H3DV6

# SN:6184

| | |
|---|---|
| Manufactured: | June 8, 2004 |
| Last calibrated: | January 28, 2008 |
| Recalibrated: | January 19, 2009 |

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

## DASY - Parameters of Probe: H3DV6 SN:6184

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

| | a0 | a1 | a2 |
|---|---|---|---|
| X | **2.489E-03** | **1.472E-6** | **1.050E-5** ± 5.1 % (k=2) |
| Y | **2.547E-03** | **-9.311E-5** | **1.728E-6** ± 5.1 % (k=2) |
| Z | **3.002E-03** | **-1.194E-4** | **6.741E-5** ± 5.1 % (k=2) |

Diode Compression[1]

| | |
|---|---|
| DCP X | **88** mV |
| DCP Y | **80** mV |
| DCP Z | **84** mV |

Sensor Offset (Probe Tip to Sensor Center)

| | |
|---|---|
| X | **3.0** mm |
| Y | **3.0** mm |
| Z | **3.0** mm |

Connector Angle **-246** °

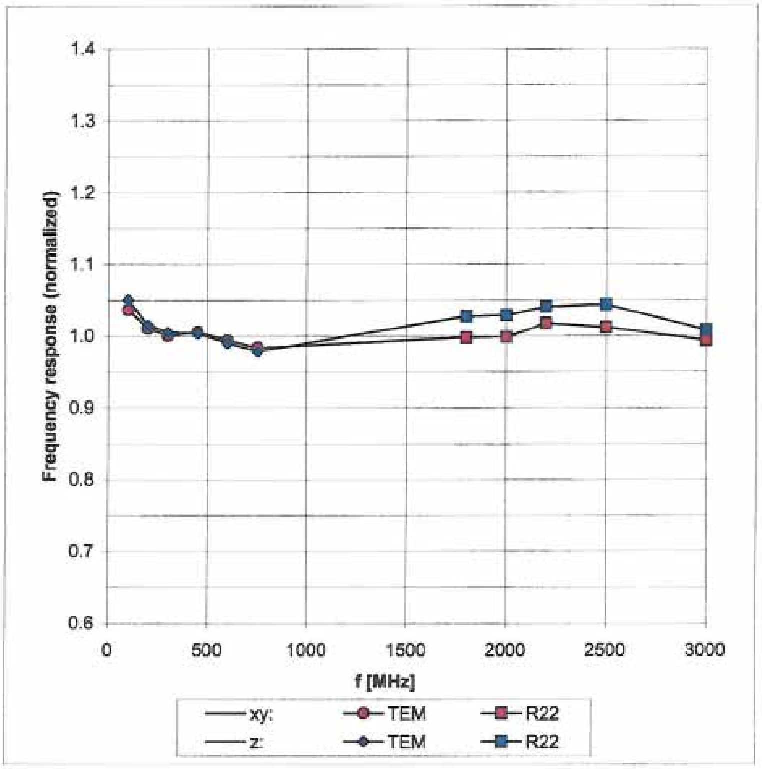
**The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.**

[1] numerical linearization parameter: uncertainty not required

H3DV6 SN:6184 January 19, 2009

## Frequency Response of H-Field

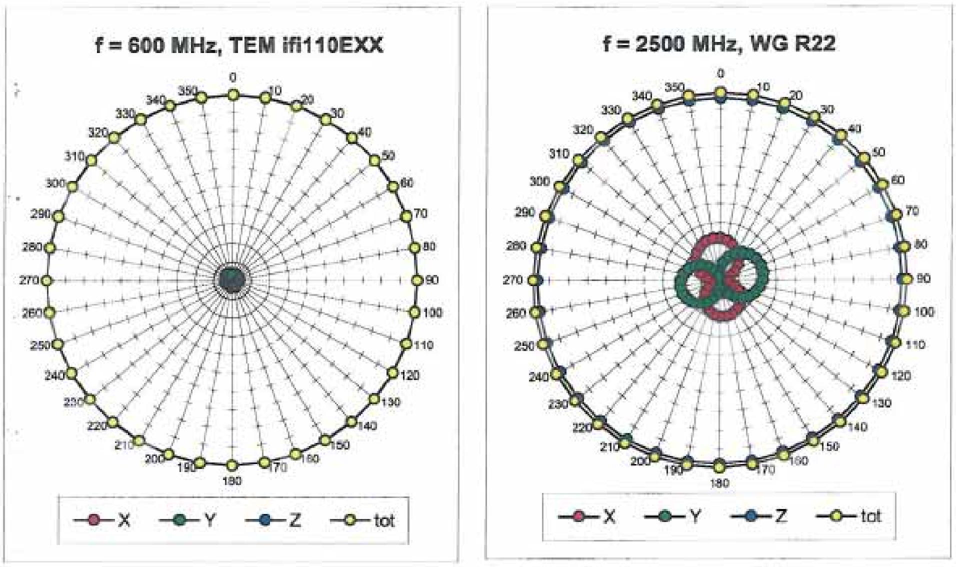
(TEM-Cell:ifi110 EXX, Waveguide R22)



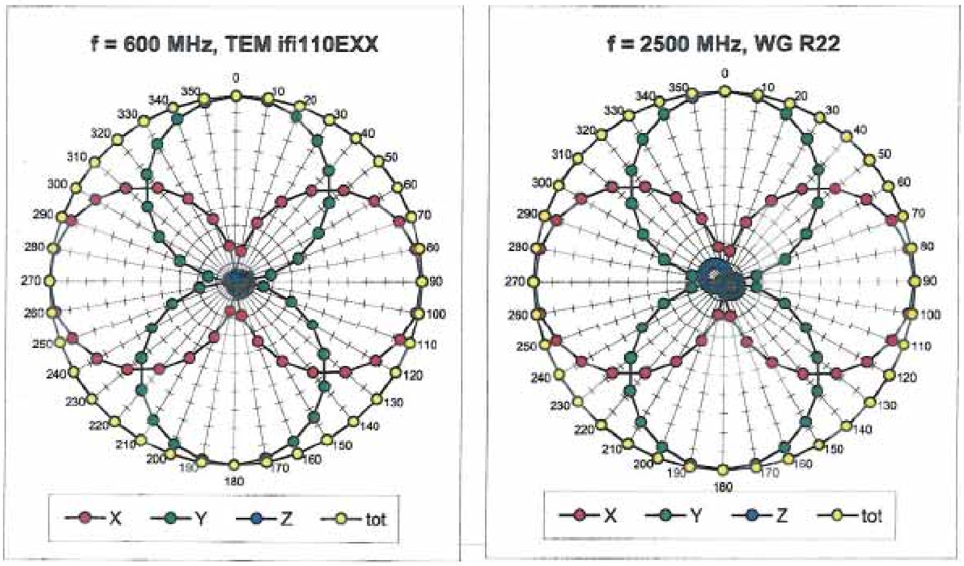

Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

H3DV6 SN:6184 January 19, 2009

## Receiving Pattern (ϕ), ϑ = 90°

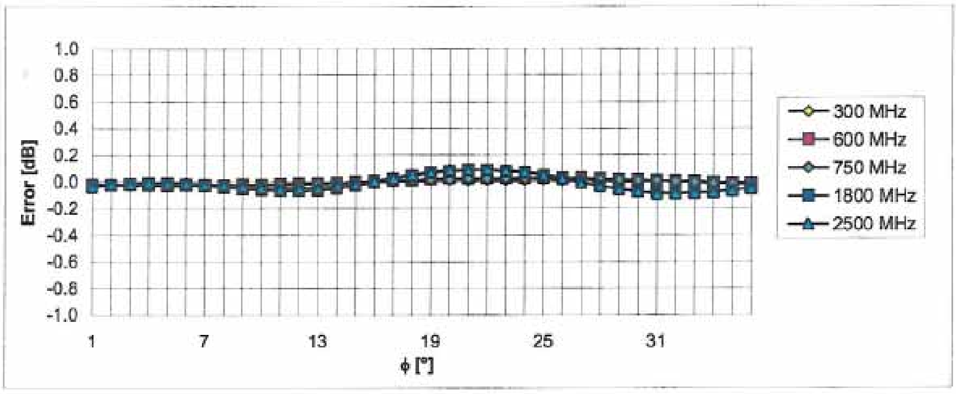



## Receiving Pattern (ϕ), ϑ = 0°



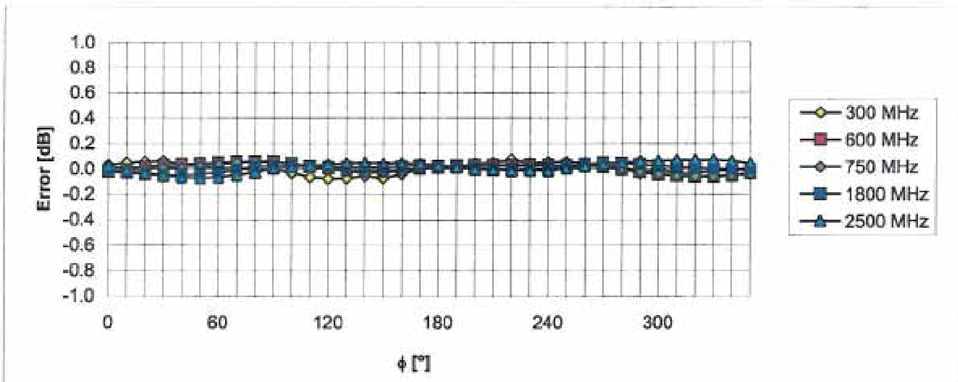
H3DV6 SN:6184 January 19, 2009

## Receiving Pattern (ϕ), ϑ = 90°




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

## Receiving Pattern (ϕ), ϑ = 0°

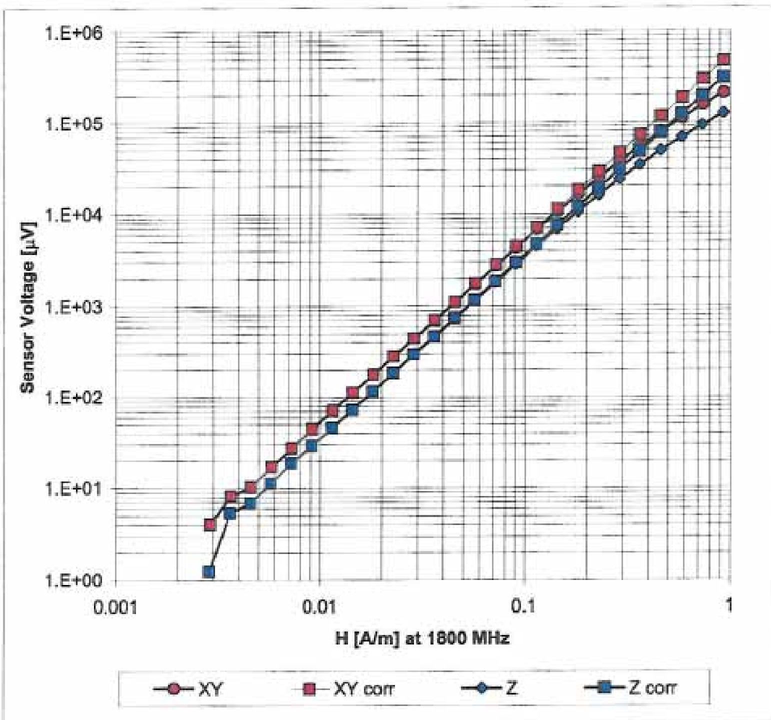


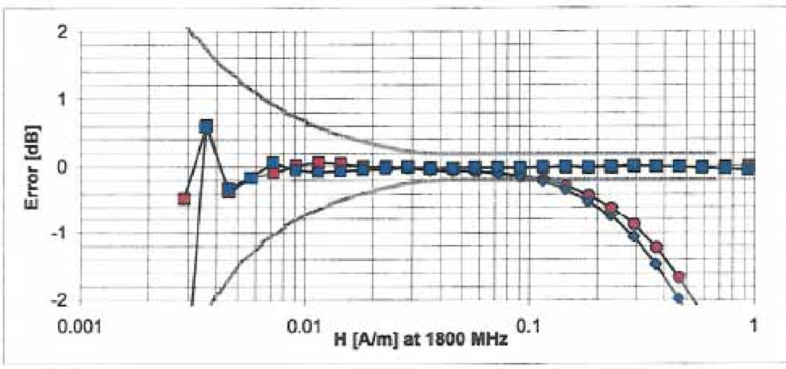

Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

H3DV6 SN:6184 January 19, 2009

## Dynamic Range f(H-field)

(Waveguide R22, f = 1800 MHz)



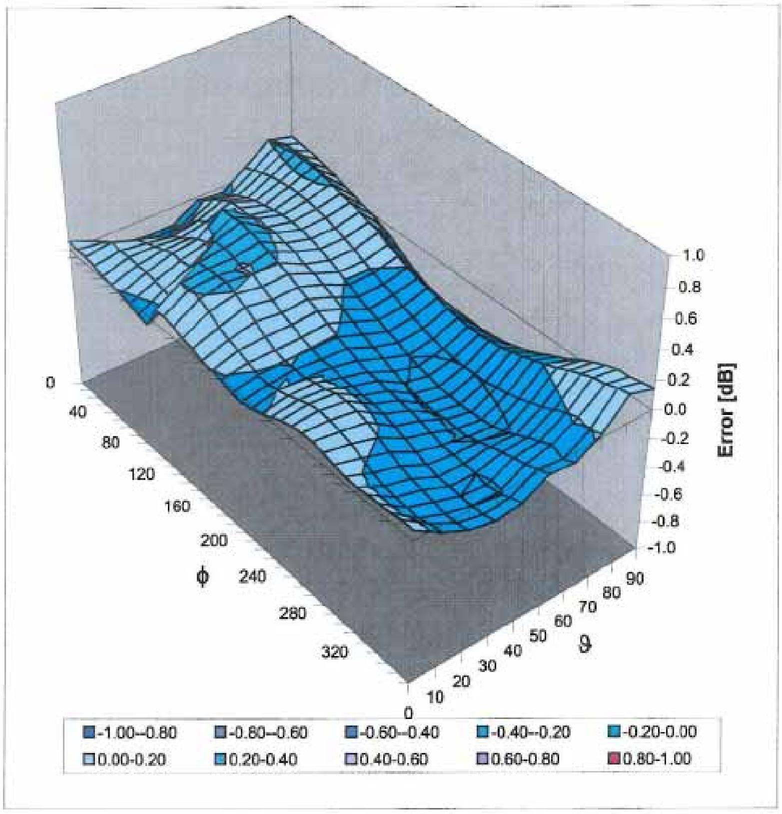




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

H3DV6 SN:6184

January 19, 2009

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




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

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**Accreditation No.: SCS 108**

**Client** **Sporton (Auden)**

**Certificate No: DAE4-778_Sep08**

# CALIBRATION CERTIFICATE

| | |
|---|---|
| Object | DAE4 - SD 000 D04 BG - SN: 778 |
| Calibration procedure(s) | QA CAL-06.v12<br>Calibration procedure for the data acquisition electronics (DAE) |
| 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 |
|---|---|---|---|
| Fluke Process Calibrator Type 702 | SN: 6295803 | 04-Oct-07 (No: 6467) | Oct-08 |
| Keithley Multimeter Type 2001 | SN: 0810278 | 03-Oct-07 (No: 6465) | Oct-08 |

| Secondary Standards | ID # | Check Date (in house) | Scheduled Check |
|---|---|---|---|
| Calibrator Box V1.1 | SE UMS 006 AB 1004 | 06-Jun-08 (in house check) | In house check: Jun-09 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Andrea Guntli | Technician | [signature] |
| Approved by: | Fin Bomholt | R&D Director | [signature] |

Issued: September 22, 2008

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

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**Accreditation No.: SCS 108**

## Glossary

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

## Methods Applied and Interpretation of Parameters

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

## DC Voltage Measurement

A/D - Converter Resolution nominal

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

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

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

| Calibration Factors | X | Y | Z |
|---|---|---|---|
| **High Range** | 404.686 ± 0.1% (k=2) | 403.490 ± 0.1% (k=2) | 405.045 ± 0.1% (k=2) |
| **Low Range** | 3.99455 ± 0.7% (k=2) | 3.96369 ± 0.7% (k=2) | 3.99417 ± 0.7% (k=2) |

## Connector Angle

| | |
|---|---|
| **Connector Angle** to be used in DASY system | 309 ° ± 1 ° |

## Appendix

### 1. DC Voltage Linearity

| High Range | | Input (μV) | Reading (μV) | Error (%) |
|---|---|---|---|---|
| Channel X | + Input | 200000 | 200000.3 | 0.00 |
| Channel X | + Input | 20000 | 20004.24 | 0.02 |
| Channel X | - Input | 20000 | -20002.46 | 0.01 |
| Channel Y | + Input | 200000 | 200000.4 | 0.00 |
| Channel Y | + Input | 20000 | 20002.60 | 0.01 |
| Channel Y | - Input | 20000 | -20002.26 | 0.01 |
| Channel Z | + Input | 200000 | 200000.6 | 0.00 |
| Channel Z | + Input | 20000 | 20000.78 | 0.00 |
| Channel Z | - Input | 20000 | -20005.75 | 0.03 |

| Low Range | | Input (μV) | Reading (μV) | Error (%) |
|---|---|---|---|---|
| Channel X | + Input | 2000 | 2000 | 0.00 |
| Channel X | + Input | 200 | 199.37 | -0.31 |
| Channel X | - Input | 200 | -200.28 | 0.14 |
| Channel Y | + Input | 2000 | 2000 | 0.00 |
| Channel Y | + Input | 200 | 199.63 | -0.19 |
| Channel Y | - Input | 200 | -200.88 | 0.44 |
| Channel Z | + Input | 2000 | 2000.1 | 0.00 |
| Channel Z | + Input | 200 | 198.60 | -0.70 |
| Channel Z | - Input | 200 | -201.07 | 0.53 |

### 2. Common mode sensitivity

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

| | Common mode Input Voltage (mV) | High Range Average Reading (μV) | Low Range Average Reading (μV) |
|---|---|---|---|
| Channel X | 200 | -7.46 | -6.40 |
| | - 200 | 10.00 | 6.86 |
| Channel Y | 200 | -2.73 | -2.45 |
| | - 200 | 0.84 | 0.43 |
| Channel Z | 200 | -10.91 | -10.94 |
| | - 200 | 7.89 | 8.22 |

### 3. Channel separation

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

| | Input Voltage (mV) | Channel X (μV) | Channel Y (μV) | Channel Z (μV) |
|---|---|---|---|---|
| Channel X | 200 | - | 3.08 | -1.34 |
| Channel Y | 200 | 1.18 | - | 4.64 |
| Channel Z | 200 | -1.74 | 1.44 | - |

## 4. AD-Converter Values with inputs shorted

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

| | High Range (LSB) | Low Range (LSB) |
|---|---|---|
| Channel X | 16048 | 16021 |
| Channel Y | 16167 | 15166 |
| Channel Z | 16416 | 15977 |

## 5. Input Offset Measurement

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

| | Average (μV) | min. Offset (μV) | max. Offset (μV) | Std. Deviation (μV) |
|---|---|---|---|---|
| Channel X | -0.13 | -0.88 | 0.92 | 0.33 |
| Channel Y | -0.88 | -2.47 | 0.72 | 0.55 |
| Channel Z | -1.16 | -2.17 | -0.19 | 0.42 |

## 6. Input Offset Current

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

## 7. Input Resistance

| | Zeroing (MOhm) | Measuring (MOhm) |
|---|---|---|
| Channel X | 0.2000 | 201.1 |
| Channel Y | 0.2000 | 201.0 |
| Channel Z | 0.2001 | 201.7 |

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

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

## 9. Power Consumption (verified during pre test)

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