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# TEST REPORT ON HAC

**Model Tested:** SCH-U940  
**FCC ID (Requested) :** A3LSCHU940  
**Job No :** AE-062  
**Report No :** AE-062-M1  
**Date issued :** Nov. 28, 2007  
**Result Summary :** M4 (RF EMISSION Category)

- Abstract -

This document reports on HAC Tests carried out in accordance with ANSI C63.19(2006), FCC Rule Part(s) FCC 47 CFR §20.19, §6.3, §7.3

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## 1. GENERAL INFORMATION

Test Sample : Dual-Band CDMA Phone with Bluetooth

Model Number : SCH-U940

Serial Number : Identical prototype (S/N : # AE-062-C )

Manufacturer : SAMSUNG ELECTRONICS Co., Ltd.

Contact : MK KIM

Phone : +82-54-479-5931

Fax : +82-54-479-5866

Test Standard : ANSI C 63.19 (2006), FCC 47 CFR § 20.19, §6.3, §7.3

FCC Classification : Licensed Portable Transmitter Held to Ear (PCE)

Test Dates : Nov.15 ,2007

Tested for : FCC/TCB Certification

## 2. DESCRIPTION OF DEVICE

Tx Freq. Range : 824.70 ~ 848.31 MHz(CDMA)  
1851.25 ~ 1908.76 MHz(PCS)

Rx Freq. Range : 869.70 ~ 893.31 MHz(CDMA)  
1931.25 ~ 1988.76 MHz(PCS)

Antenna Configuration : SCH-U940

Antenna Manufacturer : PANASONIC

Antenna Dimensions : 39.6mm

### 3. DESCRIPTION OF TEST EQUIPMENT

#### 3.1 HAC Measurement Setup

##### Robotic System

Measurements are performed using the DASY4 automated dosimetric assessment system. Which is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland and consists of high precision robotics system (Stäubli), robot controller, measurement server, Samsung computer, near-field probe, probe alignment sensor, and the SAM twin phantom containing the brain equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF) (see Fig. 3.1).

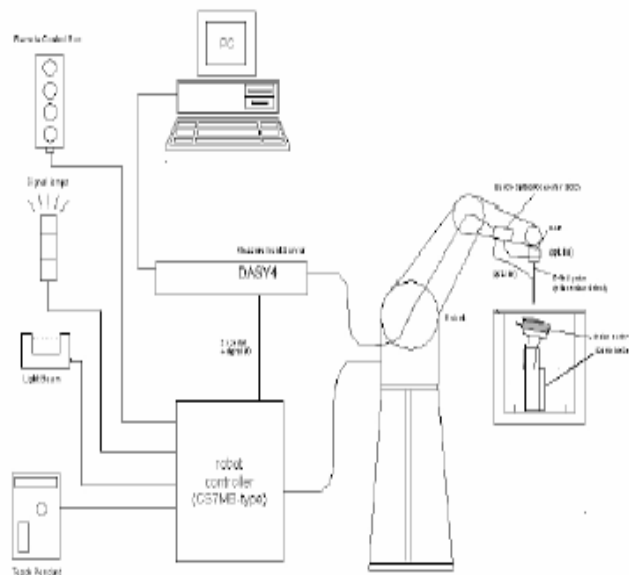


Figure 3.1 HAC Measurement System Setup

##### System Hardware

A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and a remote control is used to drive the robot motors. The PC consists of the Samsung computer with Windows XP system and HAC Measurement Software DASY4, LCD monitor, mouse and keyboard. The Stäubli Robot is connected to the cell controller to allow software manipulation of the robot. A

data acquisition electronic (DAE) circuit that performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the measurement server

### **System Electronics**

The DAE4(or DAE3) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.

### 3.2 Probe Description

#### ER3DV6 E-Field Probe Description

|               |                                                                                                                              |
|---------------|------------------------------------------------------------------------------------------------------------------------------|
| Construction: | One dipole parallel, two dipoles normal to probe axis<br>Built-in shielding against static charges                           |
| Calibration:  | In air from 100 MHz to 3.0 GHz<br>(absolute accuracy $\pm 6.0\%$ , $k=2$ )                                                   |
| Frequency:    | 100 MHz to > 6 GHz;<br>Linearity: $\pm 0.2$ dB (100 MHz to 3 GHz)                                                            |
| Directivity   | $\pm 0.2$ dB in air (rotation around probe axis)<br>$\pm 0.4$ dB in air (rotation normal to probe axis)                      |
| Dynamic Range | 2V/m to 1000V/m<br>(M3 or better device readings fall well below diode compression point)                                    |
| Linearity :   | $\pm 0.2$ 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 |



**Figure 3.2 E-field Probe**

#### H3DV6 H-Field Probe Description

|                      |                                                                                                                                                              |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Construction:        | Three concentric loop sensors with 3.8 mm loop diameters Resistively loaded detector diodes for linear response<br>Built-in shielding against static charges |
| Frequency:           | 200 MHz to 3 GHz (absolute accuracy $\pm 6.0\%$ , $k=2$ ); Output linearized                                                                                 |
| Directivity:         | $\pm 0.25$ dB (spherical isotropy error)                                                                                                                     |
| Dynamic Range:       | 10mA/m to 2A/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)                                                                                                                              |



**Figure 3.3 H-field Probe**

### 3.3 Test Arch Phantom

Enables easy and well defined positioning of the phone and calibration dipoles as well as simple teaching of the robot (See Figure 3.4)

Dimensions: 370 x 370 x 370 mm

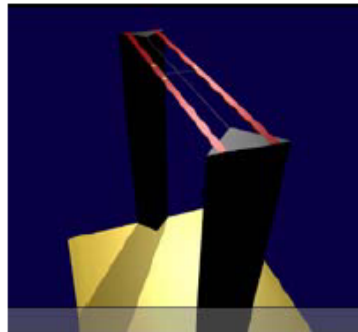


**Figure 3.4 Test Arch Phantom**

### 3.4 Validation Dipole

The reference dipole should have a return loss better than  $-20$  dB (measured in the setup) at the resonant frequency to reduce the uncertainty in the power measurement.

|             |                                                                                                                                                                                                                                                                     |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Application | <ul style="list-style-type: none"> <li>- Free space antenna</li> <li>- Hearing Aid susceptibility measurements according to ANSI C 63.19</li> <li>- Validation of Hearing Aid RF setup for wireless device emission measurement according to ANSI C63.19</li> </ul> |
| Frequency   | 835 MHz, 1880 MHz, 2450 MHz                                                                                                                                                                                                                                         |
| Return Loss | $< -20$ dB at specified validation position                                                                                                                                                                                                                         |
| Dimensions  | 835 MHz : 166 x 330 mm<br>1880MHz : 80.8 x 330 mm<br>2450MHz : 59.9 x 330 mm                                                                                                                                                                                        |

### 3.5 Equipment Calibration

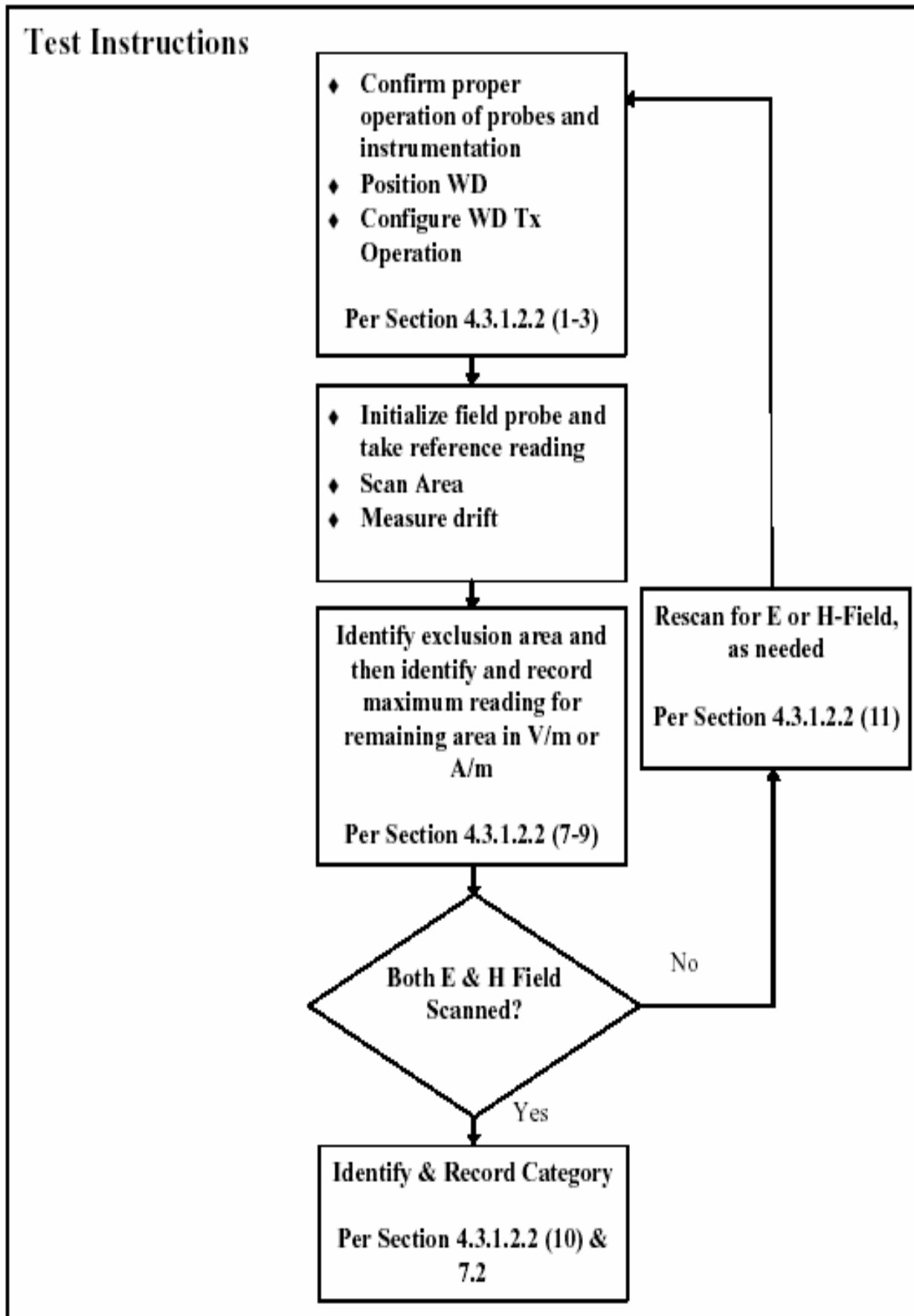
**Table 3.2 Test Equipment Calibration**

| Type                              | Calibration Due Date | Serial No.      |
|-----------------------------------|----------------------|-----------------|
| Stäubli Robot RX90BL              | Not Required         | F05/51G6A1/A/01 |
| HAC Phantom                       | Not Required         | 1018            |
| DAE4 V1                           | 2008.08.30           | 468             |
| SPEAG E-Field Probe ER3DV6        | 2008.09.25           | 2342            |
| SPEAG H-Field Probe H3DV6         | 2008.09.25           | 6159            |
| SPEAG Validation Dipole CD835 V3  | 2009.03.21           | 1021            |
| SPEAG Validation Dipole CD1880 V3 | 2009.03.21           | 1016            |
| E4438C Signal Generator           | 2008.03.21           | MY45092224      |
| BBS3Q7ECK Power Amp               | 2008.01.22           | 1023            |
| E4419B Power Meter                | 2008.05.10           | MY45101764      |
| E9300B Power Sensor               | 2008.04.27           | MY52505880      |
| DASY4 S/W (ver 4.7)               | Not Required         | -               |
| Directional Coupler               | 2008.05.31           | 18862           |
| Spectrum Analyzer                 | 2008.02.05           | MY46186167      |
| Base Station Simulator            | 2008.06.20           | GB45360270      |

**NOTE:**

The E-field and H-field probe was calibrated by SPEAG,

#### 4. HAC MEASUREMENT PROCEDURE



The evaluation was performed using the following procedure.

1. Confirm proper operation of the field probe, probe measurement system, and other instrumentation.
2. WD is positioned in its intended test position, acoustic output point of the device perpendicular to the field probe.
3. The WD operation for maximum rated RF output power was configured and confirmed with the base station simulator, at the test channel and other normal operating parameters as intended for the test. The battery was ensured to be fully charged before each test.
4. The center sub-grid was centered over the center of the acoustic output (also audio band magnetic output, if applicable). The WD audio output was positioned tangent (as physically possible) to the measurement plane.
5. A surface calibration was performed before each setup change to ensure repeatable spacing and proper maintenance of the measurement plane using the HAC Phantom.
6. The measurement system measured the field strength at the reference location.
7. Measurements at 2mm increments in the 5 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.
10. The HAC measurement software calculates a reference point at the start and end of the test to check for power drifts. If conducted power deviations of more than 5% occurred, the tests were repeated.

## 5. DESCRIPTION OF TEST POSITION

### 5.1 Measurement reference and plane

1. The grid is 5 cm by 5 cm area that is divided into 9 evenly sized blocks or sub-grids.
2. The grid is centered on the audio frequency output transducer of the WD (speaker or T- coil).
3. The grid is in a reference plane, which is defined as the planar area that contains the highest point in the area of the phone that normally rests against the user's ear. It is parallel to the centerline of the receiver area of the phone and is defined by the points of the receiver-end of the WD handset, which, in normal handset use, rest against the ear.
4. The measurement plane is parallel to, and 1.0 cm in front of, the reference plane.



**Figure 5.1 Wireless Device and Measurement Plane**

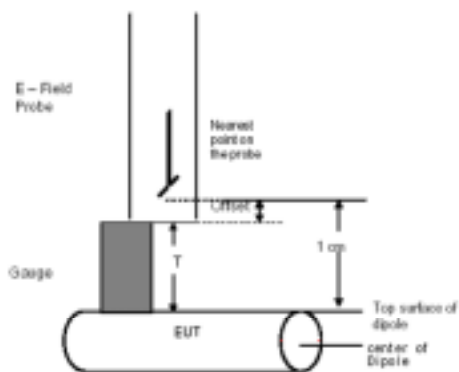


**Figure 5.2 Gauge block with E-field probe**

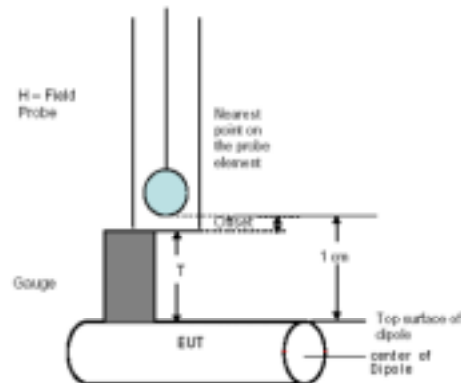


**Figure 5.3 Gauge block with H-field probe**

## 6. MEASUREMENT UNCERTAINTY

| Source of Uncertainty                          | Value | Probability distribution | Divisor | $c_i$<br>E | $c_i$<br>H | Standard uncertainty |       | $v_i$ or $v_{eff}$ |          |
|------------------------------------------------|-------|--------------------------|---------|------------|------------|----------------------|-------|--------------------|----------|
|                                                |       |                          |         |            |            | E                    | H     | E                  | H        |
| Measurement System                             |       |                          |         |            |            |                      |       |                    |          |
| Probe Calibration                              | 10.20 | normal                   | 2.000   | 0.99       | 1          | 5.05                 | 5.10  | $\infty$           | $\infty$ |
| Axial Isotropy                                 | 4.70  | rectangular              | 1.732   | 1          | 1          | 2.71                 | 2.71  | $\infty$           | $\infty$ |
| Sensor Displacement                            | 16.50 | rectangular              | 1.732   | 1          | 0.145      | 9.53                 | 1.38  | $\infty$           | $\infty$ |
| Boundary Effects                               | 2.40  | rectangular              | 1.732   | 1          | 1          | 1.39                 | 1.39  | $\infty$           | $\infty$ |
| Linearity                                      | 4.70  | rectangular              | 1.732   | 1          | 1          | 2.71                 | 2.71  | $\infty$           | $\infty$ |
| Scaling to Peak Envelop Power                  | 2.00  | rectangular              | 1.732   | 1          | 1          | 1.15                 | 1.15  | $\infty$           | $\infty$ |
| System Detection Limit                         | 1.00  | rectangular              | 1.732   | 1          | 1          | 0.58                 | 0.58  | $\infty$           | $\infty$ |
| Readout Electronics                            | 0.30  | normal                   | 1.000   | 1          | 1          | 0.30                 | 0.30  | $\infty$           | $\infty$ |
| Response Time                                  | 0.80  | rectangular              | 1.732   | 1          | 1          | 0.46                 | 0.46  | $\infty$           | $\infty$ |
| Integration time                               | 2.60  | rectangular              | 1.732   | 1          | 1          | 1.50                 | 1.50  | $\infty$           | $\infty$ |
| RF Ambient condition                           | 3.00  | rectangular              | 1.732   | 1          | 1          | 1.73                 | 1.73  | $\infty$           | $\infty$ |
| RF Reflections                                 | 1.74  | normal                   | 1.000   | 1          | 0.68       | 1.74                 | 1.19  | $\infty$           | $\infty$ |
| Probe Positioner                               | 1.20  | rectangular              | 1.732   | 1          | 0.67       | 0.69                 | 0.46  | $\infty$           | $\infty$ |
| Probe Positioning                              | 4.70  | rectangular              | 1.732   | 1          | 0.67       | 2.71                 | 1.82  | $\infty$           | $\infty$ |
| Extrap. And Interpolation                      | 1.00  | rectangular              | 1.732   | 1          | 1          | 0.58                 | 0.58  | $\infty$           | $\infty$ |
| Test Sample Related                            |       |                          |         |            |            |                      |       |                    |          |
| Device Positioning                             | 1.53  | normal                   | 1.000   | 1          | 0.94       | 1.53                 | 1.44  | 23                 | 23       |
| Device Holder and Phantom                      | 2.40  | rectangular              | 1.732   | 1          | 1          | 1.39                 | 1.39  | $\infty$           | $\infty$ |
| Power Drift                                    | 5.00  | rectangular              | 1.732   | 1          | 1          | 2.89                 | 2.89  | $\infty$           | $\infty$ |
| Phantom and Setup Related                      |       |                          |         |            |            |                      |       |                    |          |
| Phantom Thickness                              | 2.40  | rectangular              | 1.732   | 1          | 0.67       | 1.39                 | 0.93  | $\infty$           | $\infty$ |
| Combined Standard Uncertainty                  |       | normal                   | -       | -          | -          | 12.88                | 8.38  | 147117             | 26396    |
| Expanded Uncertainty [95% confidence]          |       |                          |         |            |            | 25.76                | 16.76 |                    |          |
| Expanded Uncertainty [95% confidence] on Field |       |                          |         |            |            | 12.88                | 8.38  |                    |          |

## 7. SYSTEM VERIFICATION

### 7.1 Test System Validation

Prior to assessment, the system is verified to the  $\pm 10\%$  of the specification at 835MHz, 1880MHz, by using the system validation kit(s). (see Appendix C, Graphic Plot Attached)

**Table 7.2 System Validation Results**

| Frequency | Targeted E-field (V/m) | Measured E-field (V/m) | Deviation (%) | Targeted H-field (A/m) | Measured H-field (A/m) | Deviation (%) | Date       |
|-----------|------------------------|------------------------|---------------|------------------------|------------------------|---------------|------------|
| 835 MHz   | 163.8                  | 157.4                  | -3.88         | 0.451                  | 0.454                  | 0.67          | 2007.11.15 |
| 1880 MHz  | 133.55                 | 137.8                  | 3.18          | 0.444                  | 0.448                  | 0.90          | 2007.11.15 |

\*Validation was measured with input power 100 mW.

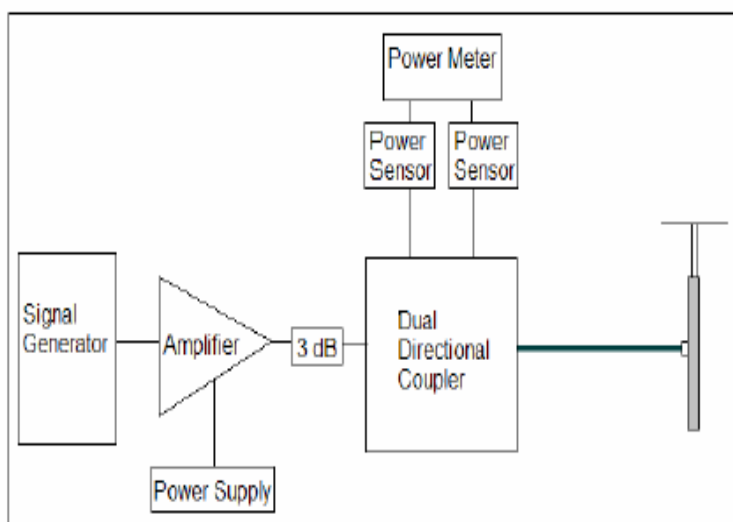


Figure 7.1 Dipole Validation Test Setup

Validations of the DASY4 test system were performed using the measurement equipment listed in Section 3.2. All validations occur in free space using the DASY4 test arch. Note that the 10mm probe to dipole separation is measured from the top edge of the dipole to the calibration reference point of the probe. SPEAG uses the center point of the probe sensor(s) as the reference point when establishing targets for their dipoles. Therefore, because SPEAG's dipoles and targets are used, it is appropriate to measure the 10mm separation distance to the center of the sensors as they do. This reference point was used for validation only. Validations were performed at 835 MHz and/or 1880 MHz. These frequencies are within each operating band and are within 2MHz of the mid-band frequency of the test device. The obtained results from the validations are displayed in the table 7.2.

## 8. MODULATION FACTOR

After every probe calibration, the response of the probe to each applicable modulated signal (CDMA, GSM, etc) must be assessed at both 835 MHz and 1880 MHz. 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. For each PMF assessment, a Signal Generator was used to replace the original CW signal with the desired modulated signal. The PMF results are shown in Tables 5.

RF Field Probe Modulation Response was measured with the field probe and associated measurement equipment. The proposed setup corresponds to the procedure as required in the Standard.

1. Install a validation dipole for the appropriate frequency band under the Test Arch Phantom. Move the probe to the field reference point. Do not move the probe between the corresponding CW and modulated measurements.
2. Install the field probe in the setup.
3. The signal to the dipole must be monitored to record peak amplitude. Set a CW signal to the same level (refer to Appendix B)
4. Set the procedure properties (frequency, modulation frequency and crest factor) according to the measured signal. Define a multimeter job for the field reading.
5. Define a second procedure for the evaluation of the CW signal (frequency set as above, modulation frequency = 0, crest factor = 1) and a multimeter job.
6. The ratio of the CW reading to modulated signal reading is the probe modulation factor(PMF) for the modulation and field probe combination. This was repeated for 80% AM.
7. Steps 1-6 were repeated at all frequency bands and for both E and H field probes.

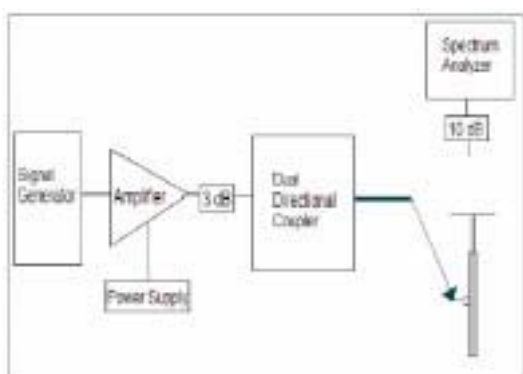


**Figure 8.1 Setup to Dipole**

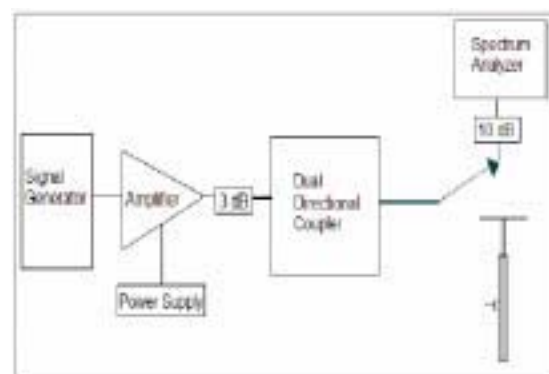


**Figure 8.2 Setup to Peak Power using Spectrum Analyzer**

## 8.1 Modulation Factors

| Frequency | Protocol | E-field (V/m) | H-field (A/m) | E-Field PMF | H-Field PMF |
|-----------|----------|---------------|---------------|-------------|-------------|
| 835 MHz   | AM       | 44.9          | 0.083         | 1.55        | 1.54        |
| 835 MHz   | CDMA     | 67.0          | 0.124         | 1.04        | 1.03        |
| 835 MHz   | CW       | 69.7          | 0.128         | -           | -           |
| 835 MHz   | CDMA/SO3 | -             | -             | -           | -           |
| 835 MHz   | CW       | -             | -             | -           | -           |
| 1880 MHz  | AM       | 34.8          | 0.081         | 1.56        | 1.55        |
| 1880 MHz  | CDMA     | 52.4          | 0.124         | 1.03        | 1.01        |
| 1880 MHz  | CW       | 54.2          | 0.125         | -           | -           |
| 1880 MHz  | CDMA/SO3 | 26.2          | -             | 2.82        | -           |
| 1880 MHz  | CW       | 73.8          | -             | -           | -           |

Table 8.1 Modulation Factors

## 8.2 CW and Modulated Signal Zero-span plots:

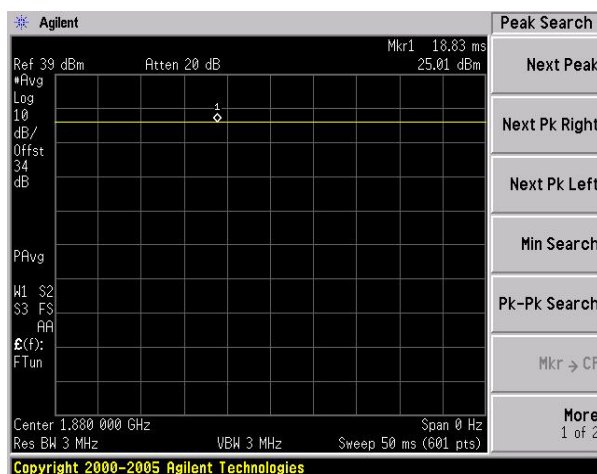


Figure 8.3 CW Signal

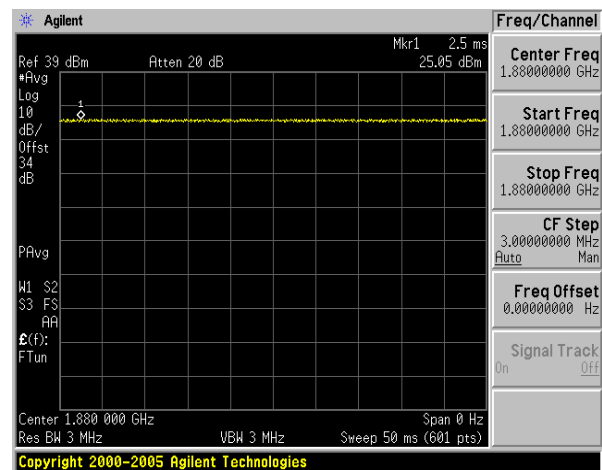


Figure 8.4 CDMA Signal

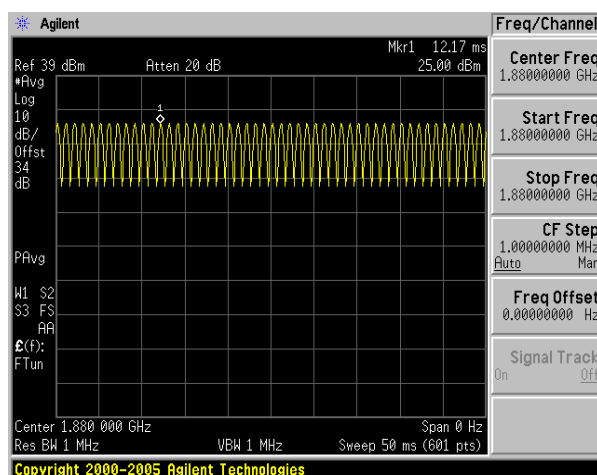


Figure 8.5 AM 80% Signal

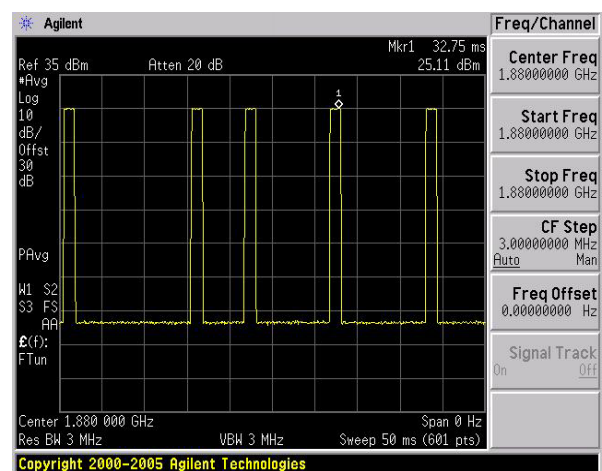


Figure 8.6 1/8 rate Signal

## 9. FCC 3G MEASUREMENTS – MAY/JUNE 2006

Sample pre-testing of the various modes were performed at the worst case probe location as part of subset testing justification. See below for measured conducted power for applicable device modes.

### 9.1 Handset Capabilities\*

\* See Device Capabilities attachment for applicable device modes and powers



### 9.2 Worst-Case Probe Location Measurements

Below are RC/SO mode investigation results of the device at the worst-case(maximum) field point location.

| Mode                     | Channel | Back light | RC/SO    | Battery  | Antenna | Conducted Power at BS(dBm) | Time Avg. Field [V/m] | Peak Field [V/m] | Peak Field [dBV/m] | Category | FCC limit [dBV/m] | FCC Margin [dB] |
|--------------------------|---------|------------|----------|----------|---------|----------------------------|-----------------------|------------------|--------------------|----------|-------------------|-----------------|
| <b>E-field Emissions</b> |         |            |          |          |         |                            |                       |                  |                    |          |                   |                 |
| PCS                      | 600     | off        | RC3/SO55 | Standard | Intenna | 25.3                       | 56.8                  | 58.45            | 35.34              | M4       | 41.0              | -5.66           |
| PCS                      | 600     | on         | RC3/SO55 | Standard | Intenna | 25.3                       | 56.4                  | 58.13            | 35.29              | M4       | 41.0              | -5.71           |
| PCS                      | 600     | off        | RC1/SO2  | Standard | Intenna | 25.2                       | 58.7                  | 60.41            | 35.62              | M4       | 41.0              | -5.38           |
| PCS                      | 600     | off        | RC3/SO2  | Standard | Intenna | 25.3                       | 55.9                  | 57.60            | 35.21              | M4       | 41.0              | -5.79           |
| PCS                      | 600     | off        | RC1/SO55 | Standard | Intenna | 25.2                       | 55.2                  | 56.84            | 35.09              | M4       | 41.0              | -5.91           |
| PCS                      | 600     | off        | RC2/SO9  | Standard | Intenna | 25.2                       | 55.4                  | 57.02            | 35.12              | M4       | 41.0              | -5.88           |
| PCS                      | 600     | off        | RC1/SO3  | Standard | Intenna | 25.1                       | 21.4                  | 60.21            | 35.59              | M4       | 41.0              | -5.41           |
| PCS                      | 600     | off        | RC3/SO3  | Standard | Intenna | 24.8                       | 54.4                  | 56.06            | 34.97              | M4       | 41.0              | -6.03           |
| PCS                      | 600     | off        | RC2/SO17 | Standard | Intenna | 25.2                       | 20.8                  | 58.63            | 35.36              | M4       | 41.0              | -5.64           |
| PCS                      | 600     | off        | RC1/SO2  | Extended | Intenna | 25.2                       | 49.2                  | 50.67            | 34.09              | M4       | 41.0              | -6.91           |

**Table 9-1 Handset 3G mode variation on RF Emission**

## 10. Test Results

### 10.1 Measurement Results(E-field)

#### E-FIELD EMISSIONS:

| Mode                     | Channel | Back light | RC/SO   | Battery  | Antenna | Conducted Power at BS(dBm) | Time Avg. Field [V/m] | Peak Field [V/m] | Peak Field [dBV/m] | Category | FCC limit [dBV/m] | FCC Margin [dB] | Excl Blocks Per 4.3.1.2.2 |
|--------------------------|---------|------------|---------|----------|---------|----------------------------|-----------------------|------------------|--------------------|----------|-------------------|-----------------|---------------------------|
| <b>E-field Emissions</b> |         |            |         |          |         |                            |                       |                  |                    |          |                   |                 |                           |
| CDMA                     | 1013    | off        | RC1/SO2 | Standard | Intenna | 25.6                       | 65.0                  | 67.6             | 36.60              | M4       | 51.0              | -14.40          | None                      |
| CDMA                     | 384     | off        | RC1/SO2 | Standard | Intenna | 25.7                       | 51.5                  | 53.6             | 34.58              | M4       | 51.0              | -16.42          | None                      |
| CDMA                     | 777     | off        | RC1/SO2 | Standard | Intenna | 25.5                       | 56.7                  | 59.0             | 35.42              | M4       | 51.0              | -15.58          | None                      |
| PCS                      | 25      | off        | RC1/SO2 | Standard | Intenna | 25.2                       | 52.0                  | 53.6             | 34.58              | M4       | 41.0              | -6.42           | None                      |
| PCS                      | 600     | off        | RC1/SO2 | Standard | Intenna | 25.2                       | 53.5                  | 55.1             | 34.82              | M4       | 41.0              | -6.18           | None                      |
| PCS                      | 1175    | off        | RC1/SO2 | Standard | Intenna | 25.2                       | 52.1                  | 53.7             | 34.60              | M4       | 41.0              | -6.40           | None                      |
| PCS                      | 600     | on         | RC1/SO2 | Standard | Intenna | 25.2                       | 51.8                  | 53.40            | 34.55              | M4       | 41.0              | -6.45           | None                      |
| PCS                      | 600     | off        | RC1/SO2 | Extended | Intenna | 25.2                       | 50.2                  | 51.7             | 34.27              | M4       | 41.0              | -6.73           | None                      |

#### NOTES:

- The test data reported are the worst-case HAC value with the test position set in a typical configuration. Test procedures used are according to ANSI C 63.19 (2006).
- All modes of operation were investigated, and the worst-case results are reported.
- Battery is fully charged for all readings.
- \*Power Measured ☒ Conducted
- Battery Option ☒ Standard ☒ Extended ☐ Slim
- Bluetooth deactivated (According to customer's request)

Note: Worst-case measurement evaluated for worst-case 1/8 rate gating condition in RC1/SO3; Mute=Yes

## 10.2 Measurement Results(H-field)

### H-FIELD EMISSIONS:

| Mode                     | Channel | Back light | RC/SO   | Battery  | Antenna | Conducted Power at BS(dBm) | Time Avg. Field [A/m] | Peak Field [A/m] | Peak Field [dBA/m] | Category | FCC limit [dBA/m] | FCC Margin [dB] | Excl Blocks Per 4.3.1.2.2 |
|--------------------------|---------|------------|---------|----------|---------|----------------------------|-----------------------|------------------|--------------------|----------|-------------------|-----------------|---------------------------|
| <b>H-field Emissions</b> |         |            |         |          |         |                            |                       |                  |                    |          |                   |                 |                           |
| CDMA                     | 1013    | off        | RC1/SO2 | Standard | Intenna | 25.6                       | 0.115                 | 0.118            | -18.56             | M4       | 0.6               | -19.16          | None                      |
| CDMA                     | 384     | off        | RC1/SO2 | Standard | Intenna | 25.7                       | 0.095                 | 0.098            | -20.18             | M4       | 0.6               | -20.78          | None                      |
| CDMA                     | 777     | off        | RC1/SO2 | Standard | Intenna | 25.5                       | 0.107                 | 0.110            | -19.17             | M4       | 0.6               | -19.77          | None                      |
| PCS                      | 25      | off        | RC1/SO2 | Standard | Intenna | 25.2                       | 0.128                 | 0.129            | -17.79             | M4       | -9.4              | -8.39           | None                      |
| PCS                      | 600     | off        | RC1/SO2 | Standard | Intenna | 25.2                       | 0.131                 | 0.132            | -17.59             | M4       | -9.4              | -8.19           | None                      |
| PCS                      | 1175    | off        | RC1/SO2 | Standard | Intenna | 25.2                       | 0.130                 | 0.131            | -17.65             | M4       | -9.4              | -8.25           | None                      |

### NOTES:

1. The test data reported are the worst-case HAC value with the test position set in a typical configuration. Test procedures used are according to ANSI C 63.19 (2006).
2. All modes of operation were investigated, and the worst-case results are reported.
3. Battery is fully charged for all readings.
4. \*Power Measured ☒ Conducted
5. Battery Option ☒ Standard ☒ Extended ☐ Slim
6. Bluetooth deactivated (According to customer's request)

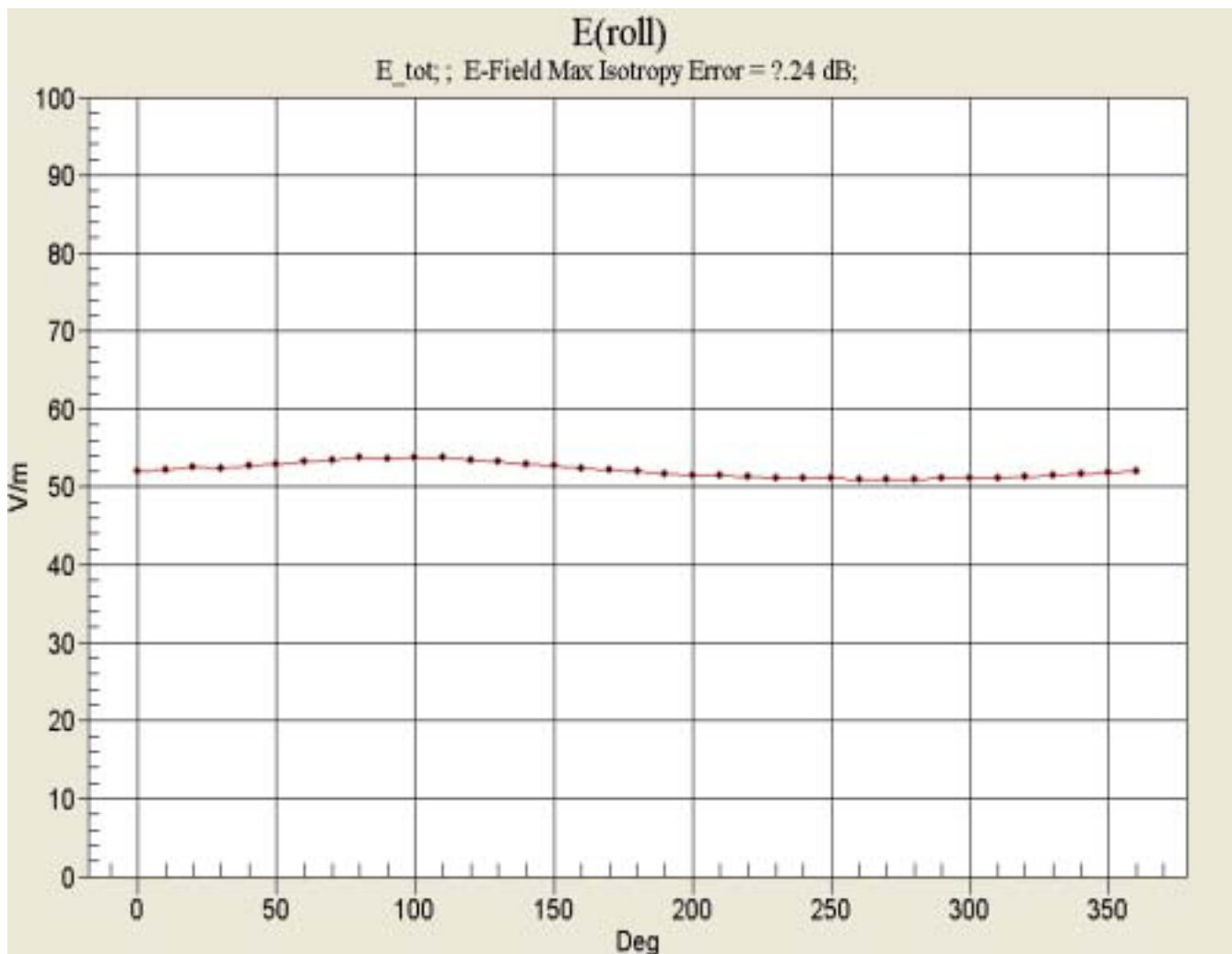
Note: Worst-case measurement evaluated for worst-case 1/8 rate gating condition in RC1/SO3; Mute=Yes

### 10.3 Worst-case Configuration Evaluation

#### PCS E-field Emission

| Mode              | Channel | Back light | RC/SO   | Battery  | Antenna | Conducted Power at BS(dBm) | Time Avg. Field [V/m] | Peak Field [V/m] | Peak Field [dBV/m] | Category | FCC limit [dBV/m] | FCC Margin [dB] |
|-------------------|---------|------------|---------|----------|---------|----------------------------|-----------------------|------------------|--------------------|----------|-------------------|-----------------|
| E-field Emissions |         |            |         |          |         |                            |                       |                  |                    |          |                   |                 |
| PCS               | 600     | off        | RC1/SO2 | Standard | Intenna | 25.2                       | 53.9                  | 55.47            | 34.88              | M4       | 41.0              | -6.12           |

#### Peak Reading 360 degree Probe Rotation at Azimuth axis



#### Worst-Case Probe Rotation about Azimuth axis

Note: Location of probe rotation is shown in APPENDIX E

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## APPENDIX A

### Probe Modulation Factor

#### Measurement procedure

1. Modulated signal measurement: Connect the modulated signal with the correct frequency via the cable to the dipole.
2. Run the multimeter in the procedure with the corresponding modulation setting in continuous mode.
3. Adjust the signal amplitude to achieve the same field level display in the multimeter as during the WD field scan. Read the multimeter display and note it together with the probe ID, modulation type and frequency.
4. Read the peak envelope on the monitor in order to adjust the CW signal later to the same level.
5. Switch the signal source off and verify that the ambient and instrumentation noise level is at least 10dB lower.
6. CW measurement: Change the signal to CW at the same center frequency, without touching or moving the dipole or probe in the setup.
7. Adjust the CW signal amplitude to the same peak level on the monitor.
8. Run the multimeter in the CW procedure in continuous mode.
9. Read the multimeter display and note it together with the probe ID, modulation type and frequency.
10. Calculate the Probe Modulation Factor as the ratio between the CW multimeter field reading and the r for the applicable modulation.
11. Perform the above setup and procedure for E-field and H-field probes.

#### Spectrum Analyzer setting.

1. Frequency Setting

ex) 835 MHz, 1880MHz, 2450 MHz

2. RBW/VBW/SPAN/Detector Setting.

|          | CW                                               | GSM  | CDMA    | WCDMA   | AM80% |
|----------|--------------------------------------------------|------|---------|---------|-------|
| RBW      | Same setting with modulated signal respectively. | 1MHz | 3MHz    | 5MHz    | 1MHz  |
| VBW      |                                                  | 1MHz | 3MHz    | 5MHz    | 1MHz  |
| SPAN     |                                                  | 0MHz | 0MHz    | 0MHz    | 0MHz  |
| DETECTOR |                                                  | Peak | Average | Average | Peak  |

3. Trigger: Video or IF trigger, adjusted to give a stable display of the transmission
4. Sweep rate: Sufficiently rapid to permit the transmit pulse to be resolved accurately.

## APPENDIX B

### ANSI C63.19 (2006)- Telephone near-field categories.

| Category       | Telephone RF Parameters <960MHz |                   |     |                   |     |
|----------------|---------------------------------|-------------------|-----|-------------------|-----|
| Near Field     | AWF                             | E-Field Emissions |     | H-Field Emissions |     |
| Category M1/T1 | 0                               | 631.0 to 1122.0   | V/m | 1.91 to 3.39      | A/m |
|                | -5                              | 473.2 to 841.4    | V/m | 1.43 to 2.54      | A/m |
| Category M2/T2 | 0                               | 354.8 to 631.0    | V/m | 1.07 to 1.91      | A/m |
|                | -5                              | 266.1 to 473.2    | V/m | 0.80 to 1.43      | A/m |
| Category M3/T3 | 0                               | 199.5 to 354.8    | V/m | 0.60 to 1.07      | A/m |
|                | -5                              | 149.6 to 266.1    | V/m | 0.45 to 0.80      | A/m |
| Category M4/T4 | 0                               | < 199.5           | V/m | < 0.60            | A/m |
|                | -5                              | < 149.6           | V/m | < 0.45            | A/m |
| Category       | Telephone RF Parameters >960MHz |                   |     |                   |     |
| Near Field     | AWF                             | E-Field Emissions |     | H-Field Emissions |     |
| Category M1/T1 | 0                               | 199.5 to 354.8    | V/m | 0.60 to 1.07      | A/m |
|                | -5                              | 149.6 to 266.1    | V/m | 0.45 to 0.80      | A/m |
| Category M2/T2 | 0                               | 112.2 to 199.5    | V/m | 0.34 to 0.60      | A/m |
|                | -5                              | 84.1 to 149.6     | V/m | 0.25 to 0.45      | A/m |
| Category M3/T3 | 0                               | 63.1 to 112.2     | V/m | 0.19 to 0.34      | A/m |
|                | -5                              | 47.3 to 84.1      | V/m | 0.14 to 0.25      | A/m |
| Category M4/T4 | 0                               | <63.1             | V/m | <0.19             | A/m |
|                | -5                              | <47.3             | V/m | <0.14             | A/m |

Table B.1 Telephone near-field categories in linear units.

| Category       | Telephone RF Parameters <960MHz |                   |          |                   |          |
|----------------|---------------------------------|-------------------|----------|-------------------|----------|
| Near Field     | AWF                             | E-Field Emissions |          | H-Field Emissions |          |
| Category M1/T1 | 0                               | 56 to 61          | dB (V/m) | +5.6 to +10.6     | dB (A/m) |
|                | -5                              | 53.5 to 58.5      | dB (V/m) | +3.1 to +8.1      | dB (A/m) |
| Category M2/T2 | 0                               | 51 to 56          | dB (V/m) | +0.6 to +5.6      | dB (A/m) |
|                | -5                              | 48.5 to 53.5      | dB (V/m) | -1.9 to +3.1      | dB (A/m) |
| Category M3/T3 | 0                               | 46 to 51          | dB (V/m) | -4.4 to +0.6      | dB (A/m) |
|                | -5                              | 43.5 to 48.5      | dB (V/m) | -6.9 to -1.9      | dB (A/m) |
| Category M4/T4 | 0                               | <46               | dB (V/m) | < -4.4            | dB (A/m) |
|                | -5                              | < 43.5            | dB (V/m) | < -6.9            | dB (A/m) |
| Category       | Telephone RF Parameters >960MHz |                   |          |                   |          |
| Near Field     | AWF                             | E-Field Emissions |          | H-Field Emissions |          |
| Category M1/T1 | 0                               | 46 to 51          | dB (V/m) | -4.4 to 0.6       | dB (A/m) |
|                | -5                              | 43.5 to 48.5      | dB (V/m) | -6.9 to -1.9      | dB (A/m) |
| Category M2/T2 | 0                               | 41 to 46          | dB (V/m) | -9.4 to -4.4      | dB (A/m) |
|                | -5                              | 38.5 to 43.5      | dB (V/m) | -11.9 to -6.9     | dB (A/m) |
| Category M3/T3 | 0                               | 36 to 41          | dB (V/m) | -14.4 to -9.4     | dB (A/m) |
|                | -5                              | 33.5 to 38.5      | dB (V/m) | -16.9 to -11.9    | dB (A/m) |
| Category M4/T4 | 0                               | <36               | dB (V/m) | <-14.4            | dB (A/m) |
|                | -5                              | <33.5             | dB (V/m) | <-16.9            | dB (A/m) |

Table B.2 Telephone near-field categories in logarithmic units.



## **APPENDIX C**

### **The Validation Measurements**

**DUT: Dipole 835 MHz; Serial: D835V2 - SN:1021**  
**Program Name: HAC E Dipole Tested date : 2007.11.15**  
**Procedure Name: E Scan 10mm above CD 835 MHz**

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1  
 Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
 Phantom section: E Dipole Section

DASY4 Configuration:

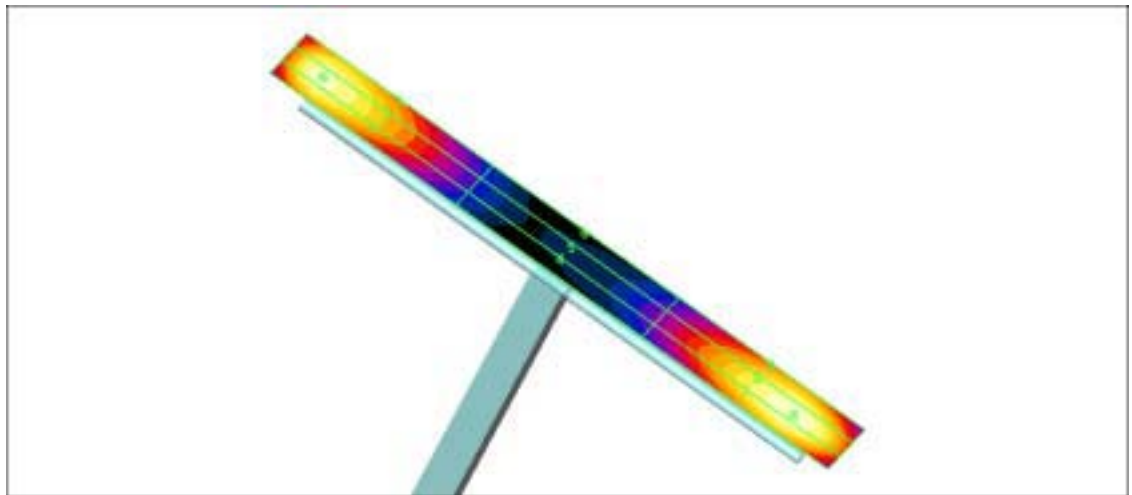
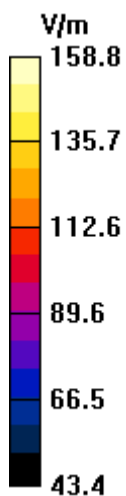
- Probe: ER3DV6 - SN2342; ConvF(1, 1, 1); Calibrated: 2007-09-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn468; Calibrated: 2007-08-30
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

**E Scan 10mm above CD 835 MHz/Hearing Aid Compatibility Test (41x361x1):**

Measurement grid: dx=5mm, dy=5mm  
 Maximum value of peak Total field = 158.8 V/m  
 Probe Modulation Factor = 1.00  
 Device Reference Point: 0.000, 0.000, 354.7 mm  
 Reference Value = 117.6 V/m; Power Drift = 0.021 dB  
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak E-field in V/m

|                           |                           |                           |
|---------------------------|---------------------------|---------------------------|
| Grid 1<br><b>153.0 M4</b> | Grid 2<br><b>156.0 M4</b> | Grid 3<br><b>150.8 M4</b> |
| Grid 4<br><b>84.2 M4</b>  | Grid 5<br><b>85.8 M4</b>  | Grid 6<br><b>82.6 M4</b>  |
| Grid 7<br><b>156.7 M4</b> | Grid 8<br><b>158.8 M4</b> | Grid 9<br><b>150.1 M4</b> |



**DUT: Dipole 835 MHz; Serial: D835V2 - SN:1021**  
**Program Name: HAC H Dipole Tested date : 2007.11.15**  
**Procedure Name: H Scan 10mm above CD 835 MHz**

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1$  kg/m<sup>3</sup>

Phantom section: H Dipole Section

DASY4 Configuration:

- Probe: H3DV6 - SN6159; ; Calibrated: 2007-09-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn468; Calibrated: 2007-08-30
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

### **H Scan 10mm above CD 835 MHz/Hearing Aid Compatibility Test (41x361x1):**

Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 0.454 A/m

Probe Modulation Factor = 1.00

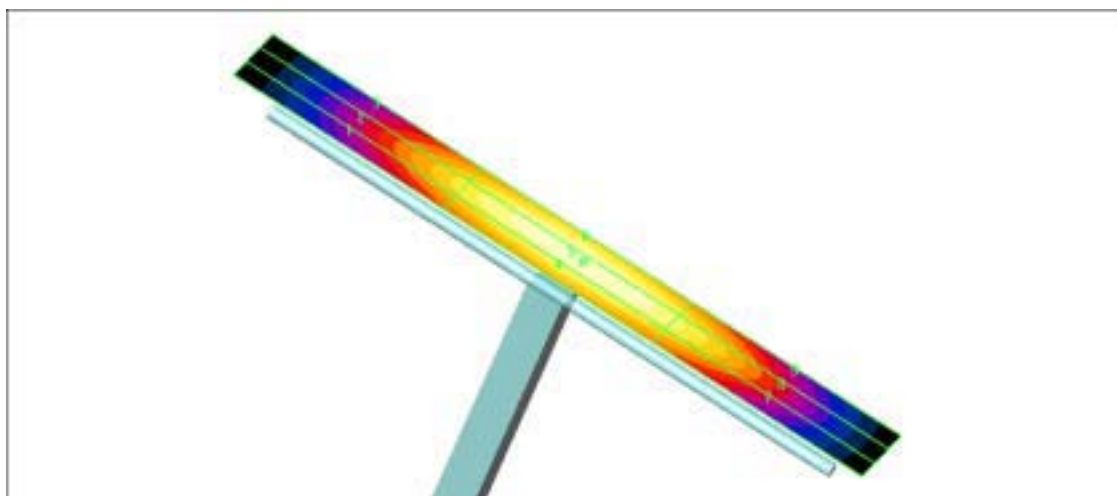
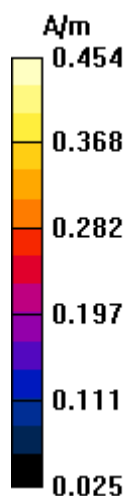
Device Reference Point: 0.000, 0.000, 354.7 mm

Reference Value = 0.476 A/m; Power Drift = 0.096 dB

**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak H-field in A/m

|                           |                           |                           |
|---------------------------|---------------------------|---------------------------|
| Grid 1<br><b>0.356 M4</b> | Grid 2<br><b>0.382 M4</b> | Grid 3<br><b>0.372 M4</b> |
| Grid 4<br><b>0.419 M4</b> | Grid 5<br><b>0.454 M4</b> | Grid 6<br><b>0.439 M4</b> |
| Grid 7<br><b>0.377 M4</b> | Grid 8<br><b>0.409 M4</b> | Grid 9<br><b>0.392 M4</b> |



**DUT: HAC Dipole 1880 MHz; Serial: SN:1016**  
**Program Name: HAC E Dipole, Tested Date : 2007.11.15**  
**Procedure Name: E Scan 10mm above CD 1880 MHz**

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

DASY4 Configuration:

- Probe: ER3DV6 - SN2342; ConvF(1, 1, 1); Calibrated: 2007-09-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn468; Calibrated: 2007-08-30
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

**E Scan 10mm above CD 1880 MHz/Hearing Aid Compatibility Test (41x181x1):**

Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 141.3 V/m

Probe Modulation Factor = 1.00

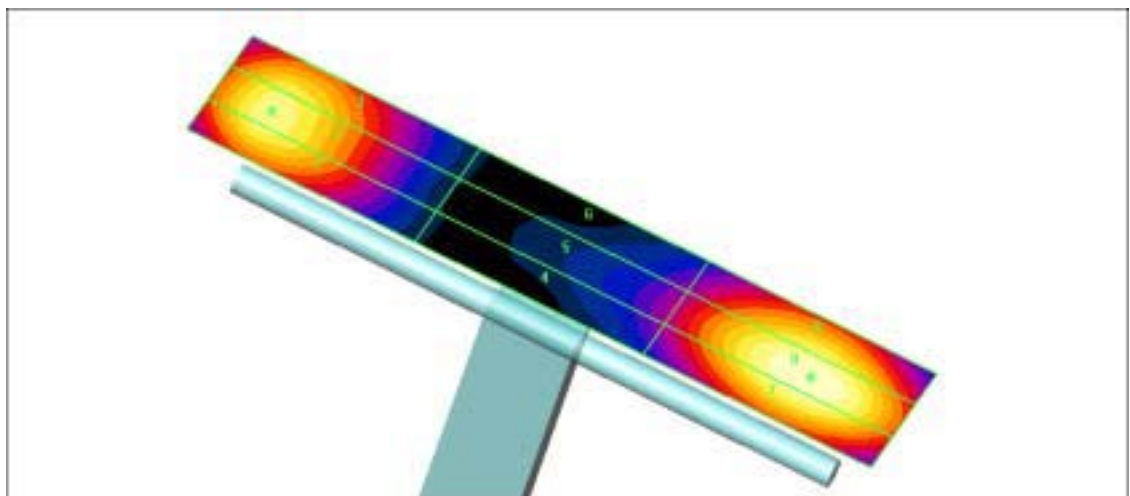
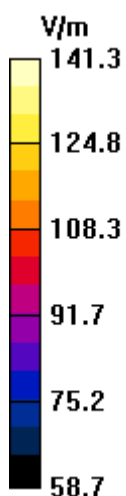
Device Reference Point: 0.000, 0.000, 354.7 mm

Reference Value = 144.7 V/m; Power Drift = 0.009 dB

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

Peak E-field in V/m

|                           |                           |                           |
|---------------------------|---------------------------|---------------------------|
| Grid 1<br><b>132.7 M2</b> | Grid 2<br><b>134.3 M2</b> | Grid 3<br><b>130.2 M2</b> |
| Grid 4<br><b>92.0 M3</b>  | Grid 5<br><b>94.7 M3</b>  | Grid 6<br><b>90.9 M3</b>  |
| Grid 7<br><b>137.9 M2</b> | Grid 8<br><b>141.3 M2</b> | Grid 9<br><b>132.9 M2</b> |



**DUT: HAC Dipole 1880 MHz; Serial: SN:1016**  
**Program Name: HAC H Dipole Tested date : 2007.11.15**  
**Procedure Name: H Scan 10mm above CD 1880 MHz**

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

Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1$  kg/m<sup>3</sup>

Phantom section: H Dipole Section

DASY4 Configuration:

- Probe: H3DV6 - SN6159; ; Calibrated: 2007-09-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn468; Calibrated: 2007-08-30
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

### **H Scan 10mm above CD 1880 MHz 2/Hearing Aid Compatibility Test (41x181x1):**

Measurement grid: dx=5mm, dy=5mm

Maximum value of peak Total field = 0.448 A/m

Probe Modulation Factor = 1.00

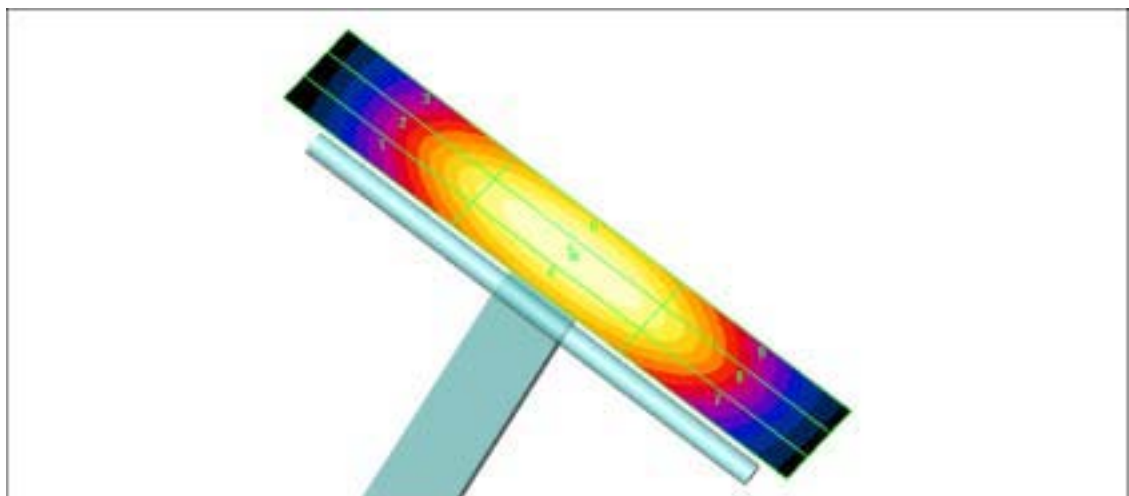
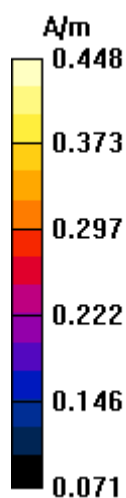
Device Reference Point: 0.000, 0.000, 354.7 mm

Reference Value = 0.448 A/m; Power Drift = -0.014 dB

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

Peak H-field in A/m

|                           |                           |                           |
|---------------------------|---------------------------|---------------------------|
| Grid 1<br><b>0.381 M2</b> | Grid 2<br><b>0.406 M2</b> | Grid 3<br><b>0.395 M2</b> |
| Grid 4<br><b>0.421 M2</b> | Grid 5<br><b>0.448 M2</b> | Grid 6<br><b>0.436 M2</b> |
| Grid 7<br><b>0.387 M2</b> | Grid 8<br><b>0.411 M2</b> | Grid 9<br><b>0.398 M2</b> |





## **APPENDIX D**

### **Plots of The HAC Measurements**

**DUT: SCH-U940; Serial: AE-062-C**

**Program Name: SCH-U940(CDMA) E-Field, Date: Nov/15/2007**

**Procedure Name: Ch.1013, Ant, Intenna, Bat. Standard**

Communication System: CDMA(HAC); Frequency: 824.7 MHz;Duty Cycle: 1:1

Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: E Device Section

DASY4 Configuration:

- Probe: ER3DV6 - SN2342; ConvF(1, 1, 1); Calibrated: 2007-09-25

- Sensor-Surface: (Fix Surface)

- Electronics: DAE4 Sn468; Calibrated: 2007-08-30

- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018

- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

**Ch.1013, Ant, Intenna, Bat. Standard/Hearing Aid Compatibility Test (251x251x1):**

Measurement grid: dx=2mm, dy=2mm

Maximum value of peak Total field = 67.6 V/m

Probe Modulation Factor = 1.04

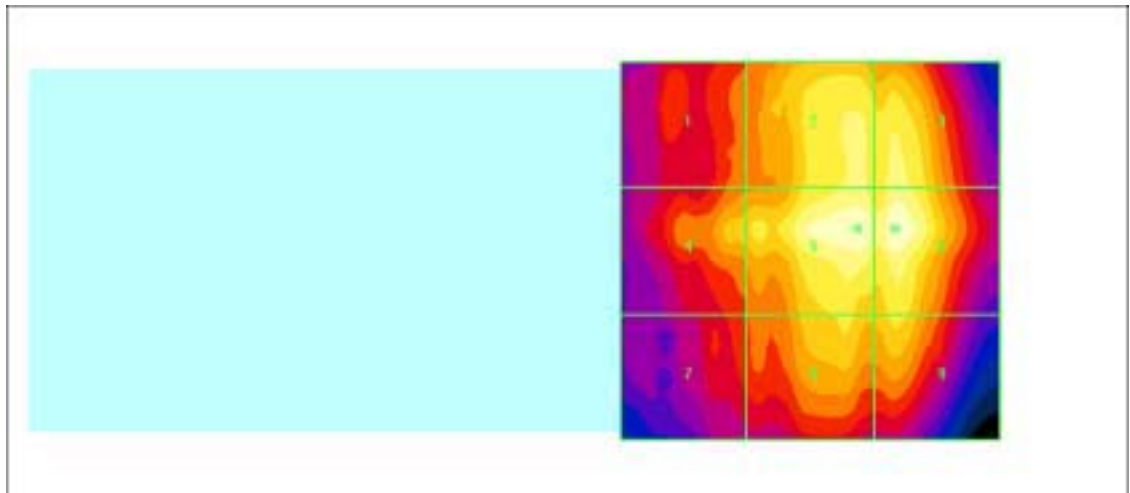
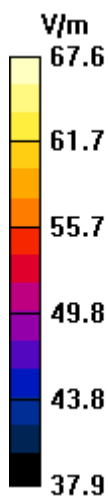
Device Reference Point: 0.000, 0.000, 353.7 mm

Reference Value = 62.6 V/m; Power Drift = 0.143 dB

**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak E-field in V/m

|                |                |                |
|----------------|----------------|----------------|
| Grid 1         | Grid 2         | Grid 3         |
| <b>57.4 M4</b> | <b>64.2 M4</b> | <b>64.9 M4</b> |
| Grid 4         | Grid 5         | Grid 6         |
| <b>61.0 M4</b> | <b>67.2 M4</b> | <b>67.6 M4</b> |
| Grid 7         | Grid 8         | Grid 9         |
| <b>55.6 M4</b> | <b>62.4 M4</b> | <b>62.4 M4</b> |



**DUT: SCH-U940; Serial: AE-062-C**

**Program Name: SCH-U940(CDMA) E-Field, Date: Nov/15/2007**

**Procedure Name: Ch.0384, Ant, Intenna, Bat. Standard**

Communication System: CDMA(HAC); Frequency: 836.52 MHz;Duty Cycle: 1:1

Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: E Device Section

DASY4 Configuration:

- Probe: ER3DV6 - SN2342; ConvF(1, 1, 1); Calibrated: 2007-09-25

- Sensor-Surface: (Fix Surface)

- Electronics: DAE4 Sn468; Calibrated: 2007-08-30

- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018

- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

### **Ch.0384, Ant, Intenna, Bat. Standard/Hearing Aid Compatibility Test (251x251x1):**

Measurement grid: dx=2mm, dy=2mm

Maximum value of peak Total field = 53.6 V/m

Probe Modulation Factor = 1.04

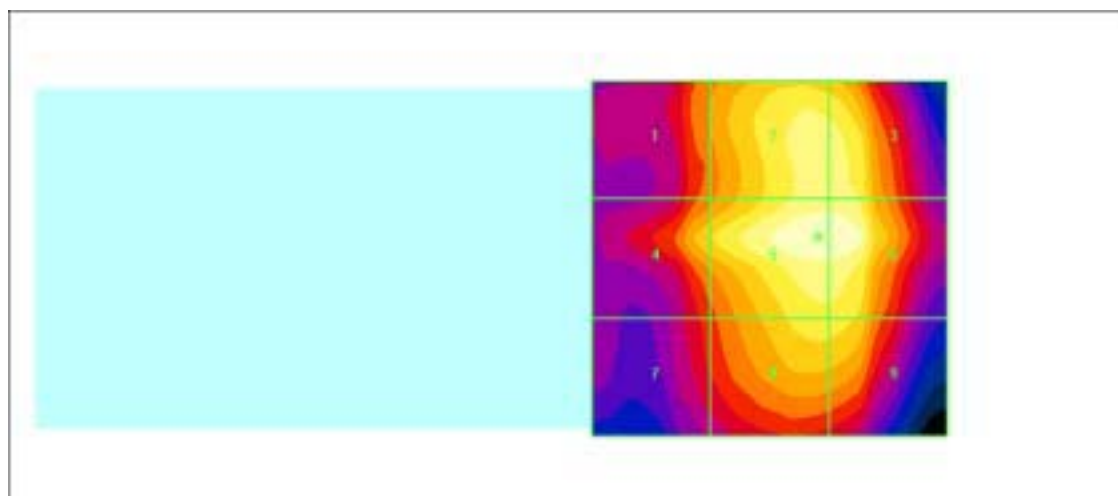
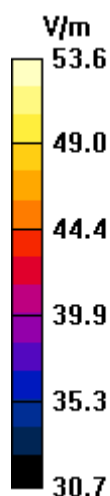
Device Reference Point: 0.000, 0.000, 353.7 mm

Reference Value = 48.6 V/m; Power Drift = 0.130 dB

**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak E-field in V/m

|                |                |                |
|----------------|----------------|----------------|
| Grid 1         | Grid 2         | Grid 3         |
| <b>46.1 M4</b> | <b>51.5 M4</b> | <b>51.5 M4</b> |
| Grid 4         | Grid 5         | Grid 6         |
| <b>48.8 M4</b> | <b>53.6 M4</b> | <b>53.6 M4</b> |
| Grid 7         | Grid 8         | Grid 9         |
| <b>43.9 M4</b> | <b>49.9 M4</b> | <b>49.9 M4</b> |



**DUT: SCH-U940; Serial: AE-062-C**

**Program Name: SCH-U940(CDMA) E-Field, Date: Nov/15/2007**

**Procedure Name: Ch.777, Ant, Intenna, Bat. Standard**

Communication System: CDMA(HAC); Frequency: 848.31 MHz;Duty Cycle: 1:1

Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: E Device Section

DASY4 Configuration:

- Probe: ER3DV6 - SN2342; ConvF(1, 1, 1); Calibrated: 2007-09-25

- Sensor-Surface: (Fix Surface)

- Electronics: DAE4 Sn468; Calibrated: 2007-08-30

- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018

- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

### **Ch.777, Ant, Intenna, Bat. Standard/Hearing Aid Compatibility Test (251x251x1):**

Measurement grid: dx=2mm, dy=2mm

Maximum value of peak Total field = 59.0 V/m

Probe Modulation Factor = 1.04

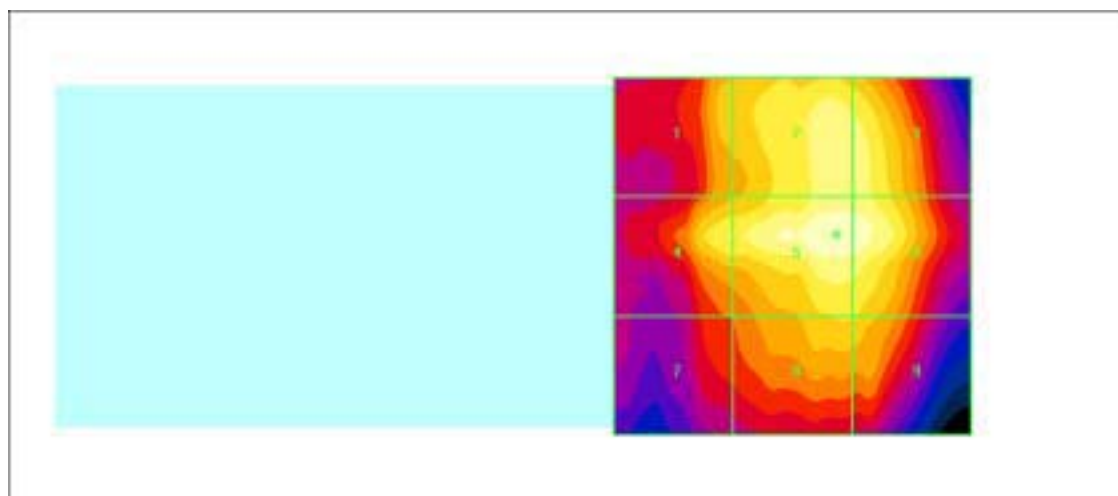
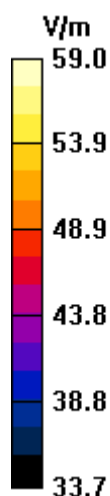
Device Reference Point: 0.000, 0.000, 353.7 mm

Reference Value = 54.5 V/m; Power Drift = 0.010 dB

**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak E-field in V/m

|                |                |                |
|----------------|----------------|----------------|
| Grid 1         | Grid 2         | Grid 3         |
| <b>53.3 M4</b> | <b>57.0 M4</b> | <b>56.5 M4</b> |
| Grid 4         | Grid 5         | Grid 6         |
| <b>55.7 M4</b> | <b>59.0 M4</b> | <b>58.7 M4</b> |
| Grid 7         | Grid 8         | Grid 9         |
| <b>49.2 M4</b> | <b>54.2 M4</b> | <b>54.1 M4</b> |



**DUT: SCH-U940; Serial: AE-062-C**  
**Program Name: SCH-U940(PCS) E-Field, Date: Nov/15/2007**  
**Procedure Name: Ch.25, Ant, Intenna, Bat. Standard**

Communication System: PCS; Frequency: 1851.25 MHz;Duty Cycle: 1:1  
Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: H Device Section

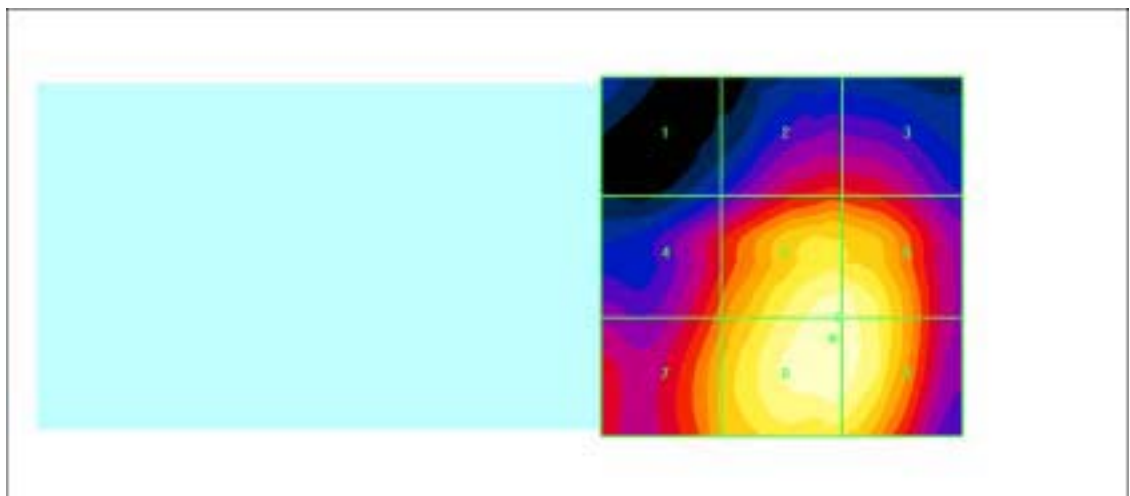
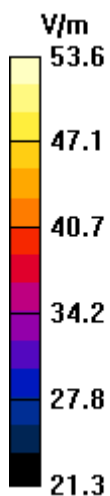
DASY4 Configuration:  
- Probe: ER3DV6 - SN2342; ConvF(1, 1, 1); Calibrated: 2007-09-25  
- Sensor-Surface: (Fix Surface)  
- Electronics: DAE4 Sn468; Calibrated: 2007-08-30  
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018  
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

**Ch.25, Ant, Intenna, Bat. Standard/Hearing Aid Compatibility Test (251x251x1):**

Measurement grid: dx=2mm, dy=2mm  
Maximum value of peak Total field = 53.6 V/m  
Probe Modulation Factor = 1.03  
Device Reference Point: 0.000, 0.000, 353.7 mm  
Reference Value = 46.6 V/m; Power Drift = -0.156 dB  
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak E-field in V/m

|                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| Grid 1<br><b>29.8 M4</b> | Grid 2<br><b>40.0 M4</b> | Grid 3<br><b>39.6 M4</b> |
| Grid 4<br><b>42.0 M4</b> | Grid 5<br><b>52.8 M4</b> | Grid 6<br><b>52.7 M4</b> |
| Grid 7<br><b>45.4 M4</b> | Grid 8<br><b>53.6 M4</b> | Grid 9<br><b>53.3 M4</b> |



**DUT: SCH-U940; Serial: AE-062-C**  
**Program Name: SCH-U940(PCS) E-Field, Date: Nov/15/2007**  
**Procedure Name: Ch.600, Ant, Intenna, Bat. Standard**

Communication System: PCS; Frequency: 1880 MHz;Duty Cycle: 1:1  
Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: H Device Section

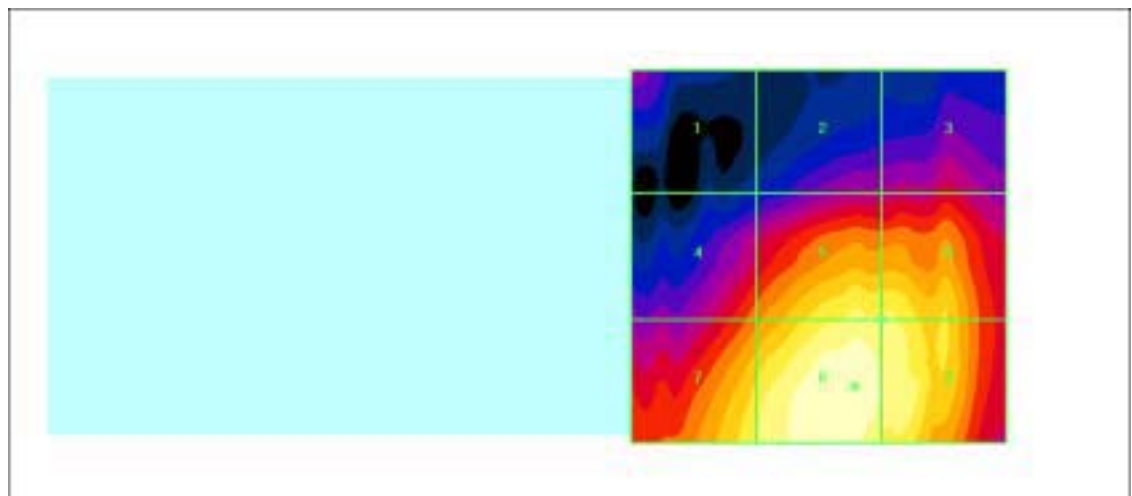
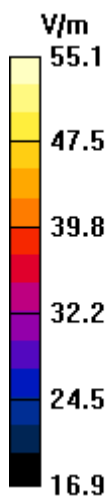
DASY4 Configuration:  
- Probe: ER3DV6 - SN2342; ConvF(1, 1, 1); Calibrated: 2007-09-25  
- Sensor-Surface: (Fix Surface)  
- Electronics: DAE4 Sn468; Calibrated: 2007-08-30  
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018  
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

**Ch.600, Ant, Intenna, Bat. Standard/Hearing Aid Compatibility Test (251x251x1):**

Measurement grid: dx=2mm, dy=2mm  
Maximum value of peak Total field = 55.1 V/m  
Probe Modulation Factor = 1.03  
Device Reference Point: 0.000, 0.000, 353.7 mm  
Reference Value = 42.7 V/m; Power Drift = 0.105 dB  
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak E-field in V/m

|                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| Grid 1<br><b>30.8 M4</b> | Grid 2<br><b>33.2 M4</b> | Grid 3<br><b>36.2 M4</b> |
| Grid 4<br><b>41.5 M4</b> | Grid 5<br><b>51.1 M4</b> | Grid 6<br><b>51.2 M4</b> |
| Grid 7<br><b>50.4 M4</b> | Grid 8<br><b>55.1 M4</b> | Grid 9<br><b>52.7 M4</b> |



**DUT: SCH-U940; Serial: AE-062-C**  
**Program Name: SCH-U940(PCS) E-Field, Date: Nov/15/2007**  
**Procedure Name: Ch.1175, Ant, Intenna, Bat. Standard**

Communication System: PCS; Frequency: 1908.75 MHz; Duty Cycle: 1:1  
Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: H Device Section

DASY4 Configuration:

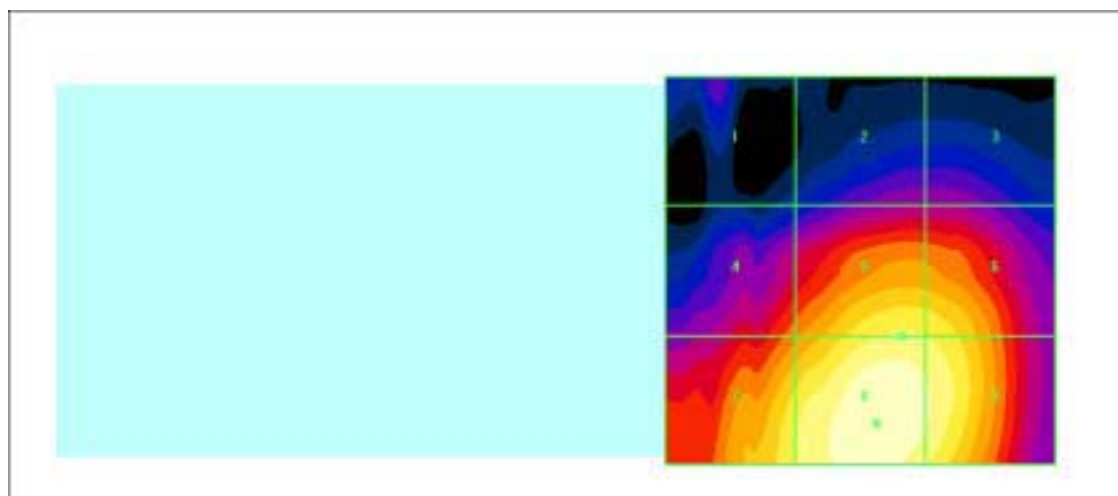
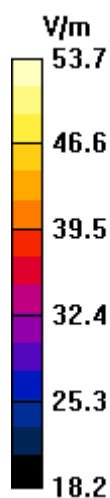
- Probe: ER3DV6 - SN2342; ConvF(1, 1, 1); Calibrated: 2007-09-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn468; Calibrated: 2007-08-30
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

### **Ch.1175, Ant, Intenna, Bat. Standard/Hearing Aid Compatibility Test (251x251x1):**

Measurement grid: dx=2mm, dy=2mm  
Maximum value of peak Total field = 53.7 V/m  
Probe Modulation Factor = 1.03  
Device Reference Point: 0.000, 0.000, 353.7 mm  
Reference Value = 42.8 V/m; Power Drift = -0.070 dB  
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak E-field in V/m

|                |                |                |
|----------------|----------------|----------------|
| Grid 1         | Grid 2         | Grid 3         |
| <b>30.0 M4</b> | <b>32.7 M4</b> | <b>32.6 M4</b> |
| Grid 4         | Grid 5         | Grid 6         |
| <b>41.2 M4</b> | <b>49.5 M4</b> | <b>48.9 M4</b> |
| Grid 7         | Grid 8         | Grid 9         |
| <b>49.1 M4</b> | <b>53.7 M4</b> | <b>51.7 M4</b> |



**DUT: SCH-U940; Serial: AE-062-C**  
**Program Name: SCH-U940(PCS) E-Field, Date: Nov/15/2007**  
**Procedure Name: Ch.600, Ant, Intenna, Bat. Standard Back Light ON**

Communication System: PCS; Frequency: 1880 MHz;Duty Cycle: 1:1  
Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: H Device Section

DASY4 Configuration:

- Probe: ER3DV6 - SN2342; ConvF(1, 1, 1); Calibrated: 2007-09-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn468; Calibrated: 2007-08-30
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

### **Ch.600, Ant, Intenna, Bat. Standard Back Light ON/Hearing Aid Compatibility**

**Test (251x251x1):** Measurement grid: dx=2mm, dy=2mm

Maximum value of peak Total field = 53.4 V/m

Probe Modulation Factor = 1.03

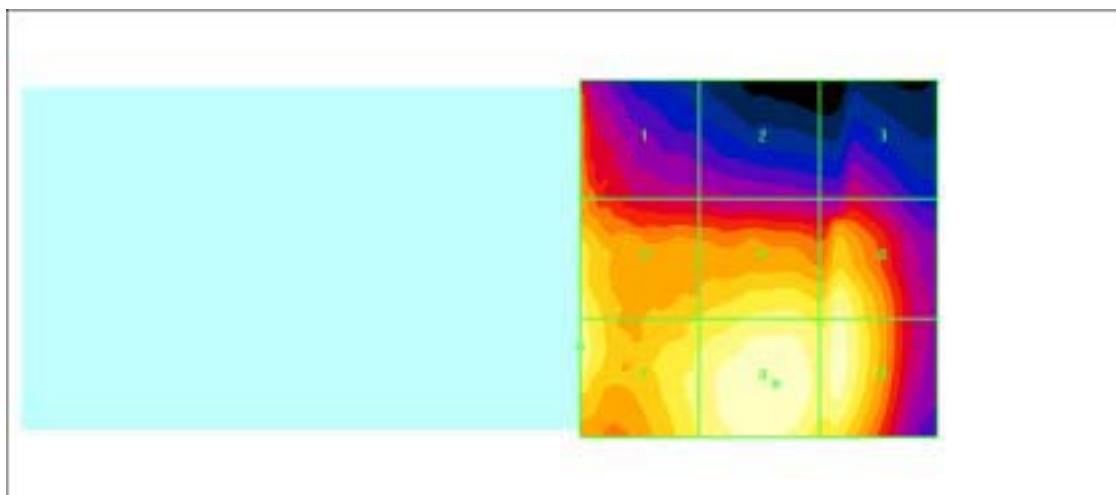
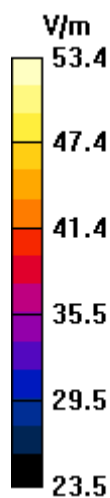
Device Reference Point: 0.000, 0.000, 353.7 mm

Reference Value = 44.6 V/m; Power Drift = -0.139 dB

**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak E-field in V/m

|                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| Grid 1<br><b>45.1 M4</b> | Grid 2<br><b>36.9 M4</b> | Grid 3<br><b>37.9 M4</b> |
| Grid 4<br><b>50.7 M4</b> | Grid 5<br><b>50.3 M4</b> | Grid 6<br><b>51.7 M4</b> |
| Grid 7<br><b>51.3 M4</b> | Grid 8<br><b>53.4 M4</b> | Grid 9<br><b>52.8 M4</b> |



**DUT: SCH-U940; Serial: AE-062-C**  
**Program Name: SCH-U940(PCS) E-Field, Date: Nov/15/2007**  
**Procedure Name: Ch.600, Ant, Intenna, Bat. Extended**

Communication System: PCS; Frequency: 1880 MHz;Duty Cycle: 1:1  
Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: H Device Section

DASY4 Configuration:

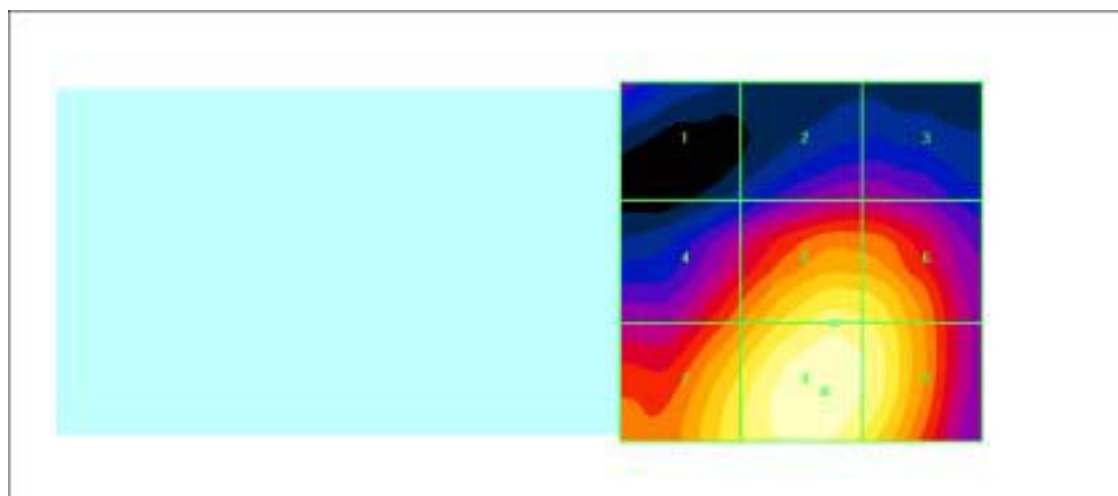
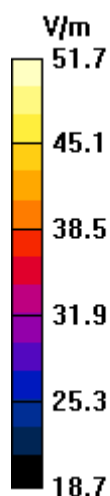
- Probe: ER3DV6 - SN2342; ConvF(1, 1, 1); Calibrated: 2007-09-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn468; Calibrated: 2007-08-30
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

### **Ch.600, Ant, Intenna, Bat. Extended/Hearing Aid Compatibility Test (251x251x1):**

Measurement grid: dx=2mm, dy=2mm  
Maximum value of peak Total field = 51.7 V/m  
Probe Modulation Factor = 1.03  
Device Reference Point: 0.000, 0.000, 353.7 mm  
Reference Value = 41.3 V/m; Power Drift = -0.145 dB  
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak E-field in V/m

|                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| Grid 1<br><b>29.2 M4</b> | Grid 2<br><b>32.8 M4</b> | Grid 3<br><b>32.8 M4</b> |
| Grid 4<br><b>40.6 M4</b> | Grid 5<br><b>48.5 M4</b> | Grid 6<br><b>47.8 M4</b> |
| Grid 7<br><b>47.0 M4</b> | Grid 8<br><b>51.7 M4</b> | Grid 9<br><b>49.9 M4</b> |



**DUT: SCH-U940; Serial: AE-062-C**  
**Program Name: SCH-U940(CDMA) H-field, Date: Nov/15/2007**  
**Procedure Name: Ch.1013, Ant. Intenna, Bat. Standard**

Communication System: CDMA(HAC); Frequency: 824.7 MHz;Duty Cycle: 1:1  
Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1$  kg/m<sup>3</sup>  
Phantom section: H Device Section

DASY4 Configuration:

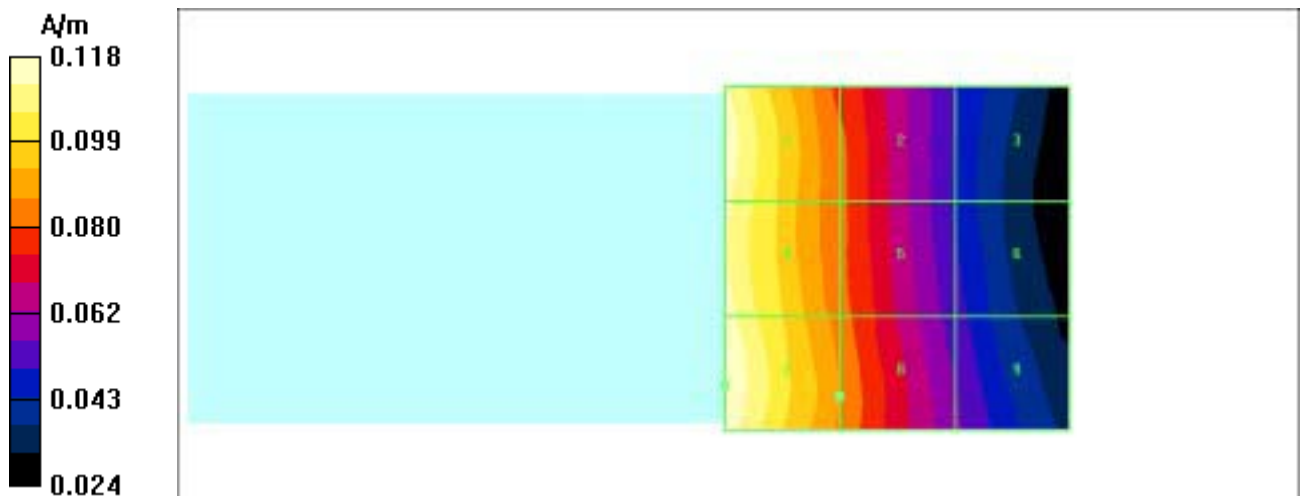
- Probe: H3DV6 - SN6159; ; Calibrated: 2007-09-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn468; Calibrated: 2007-08-30
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

**Ch.1013, Ant. Intenna, Bat. Standard/Hearing Aid Compatibility Test (251x251x1):**

Measurement grid: dx=2mm, dy=2mm  
Maximum value of peak Total field = 0.118 A/m  
Probe Modulation Factor = 1.03  
Device Reference Point: 0.000, 0.000, 353.7 mm  
Reference Value = 0.063 A/m; Power Drift = 0.166 dB  
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak H-field in A/m

|                           |                           |                           |
|---------------------------|---------------------------|---------------------------|
| Grid 1<br><b>0.116 M4</b> | Grid 2<br><b>0.082 M4</b> | Grid 3<br><b>0.050 M4</b> |
| Grid 4<br><b>0.114 M4</b> | Grid 5<br><b>0.084 M4</b> | Grid 6<br><b>0.052 M4</b> |
| Grid 7<br><b>0.118 M4</b> | Grid 8<br><b>0.087 M4</b> | Grid 9<br><b>0.057 M4</b> |



**DUT: SCH-U940; Serial: AE-062-C**  
**Program Name: SCH-U940(CDMA) H-field, Date: Nov/15/2007**  
**Procedure Name: Ch.384, Ant. Intenna, Bat. Standard**

Communication System: CDMA(HAC); Frequency: 836.52 MHz;Duty Cycle: 1:1  
Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1$  kg/m<sup>3</sup>  
Phantom section: H Device Section

DASY4 Configuration:

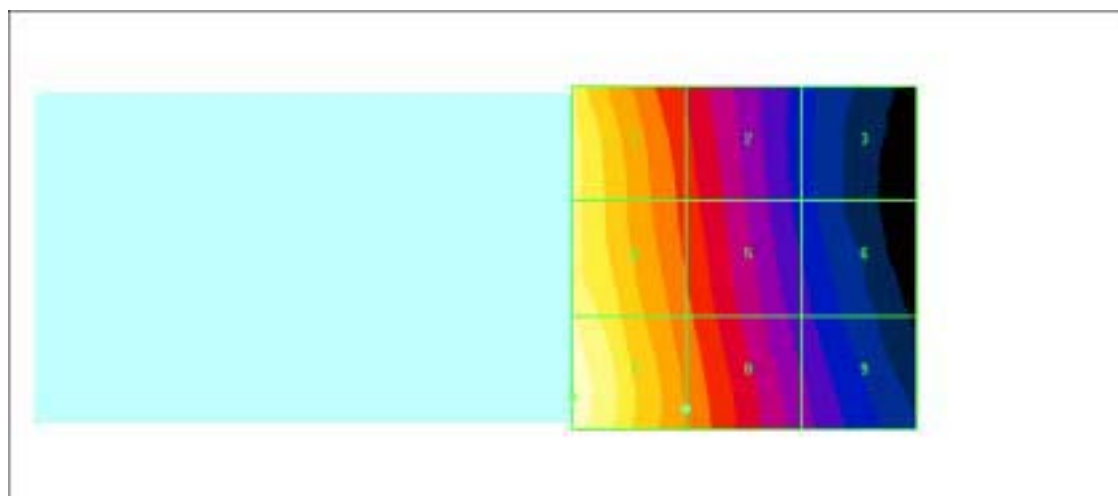
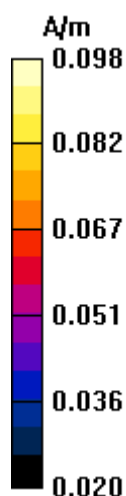
- Probe: H3DV6 - SN6159; ; Calibrated: 2007-09-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn468; Calibrated: 2007-08-30
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

### **Ch.384, Ant. Intenna, Bat. Standard/Hearing Aid Compatibility Test (251x251x1):**

Measurement grid: dx=2mm, dy=2mm  
Maximum value of peak Total field = 0.098 A/m  
Probe Modulation Factor = 1.03  
Device Reference Point: 0.000, 0.000, 353.7 mm  
Reference Value = 0.055 A/m; Power Drift = -0.140 dB  
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak H-field in A/m

|                           |                           |                           |
|---------------------------|---------------------------|---------------------------|
| Grid 1<br><b>0.093 M4</b> | Grid 2<br><b>0.065 M4</b> | Grid 3<br><b>0.039 M4</b> |
| Grid 4<br><b>0.094 M4</b> | Grid 5<br><b>0.068 M4</b> | Grid 6<br><b>0.043 M4</b> |
| Grid 7<br><b>0.098 M4</b> | Grid 8<br><b>0.072 M4</b> | Grid 9<br><b>0.049 M4</b> |



**DUT: SCH-U940; Serial: AE-062-C**  
**Program Name: SCH-U940(CDMA) H-field, Date: Nov/15/2007**  
**Procedure Name: Ch.777, Ant. Intenna, Bat. Standard**

Communication System: CDMA(HAC); Frequency: 848.31 MHz;Duty Cycle: 1:1  
Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1$  kg/m<sup>3</sup>  
Phantom section: H Device Section

DASY4 Configuration:

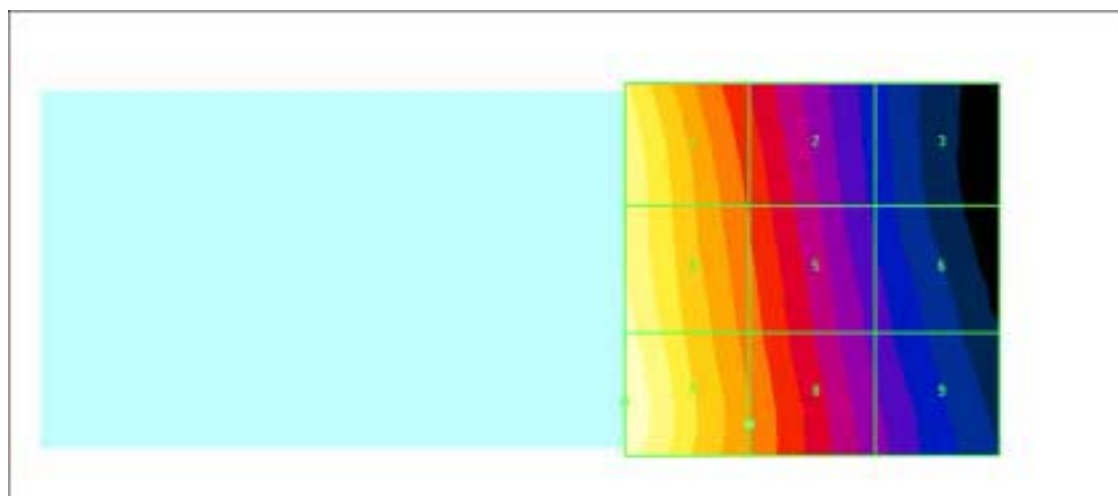
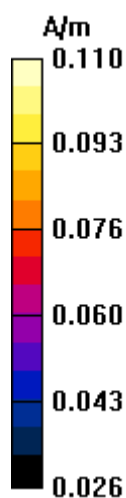
- Probe: H3DV6 - SN6159; ; Calibrated: 2007-09-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn468; Calibrated: 2007-08-30
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

### **Ch.777, Ant. Intenna, Bat. Standard/Hearing Aid Compatibility Test (251x251x1):**

Measurement grid: dx=2mm, dy=2mm  
Maximum value of peak Total field = 0.110 A/m  
Probe Modulation Factor = 1.03  
Device Reference Point: 0.000, 0.000, 353.7 mm  
Reference Value = 0.064 A/m; Power Drift = -0.094 dB  
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak H-field in A/m

|                           |                           |                           |
|---------------------------|---------------------------|---------------------------|
| Grid 1<br><b>0.105 M4</b> | Grid 2<br><b>0.076 M4</b> | Grid 3<br><b>0.047 M4</b> |
| Grid 4<br><b>0.107 M4</b> | Grid 5<br><b>0.080 M4</b> | Grid 6<br><b>0.052 M4</b> |
| Grid 7<br><b>0.110 M4</b> | Grid 8<br><b>0.082 M4</b> | Grid 9<br><b>0.057 M4</b> |



**DUT: SCH-U940; Serial: AE-062-C**  
**Program Name: SCH-U940(PCS) H-Field, Date: Nov/15/2007**  
**Procedure Name: Ch.25, Ant. Intenna, Bat. Standard**

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

DASY4 Configuration:

- Probe: H3DV6 - SN6159; ; Calibrated: 2007-09-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn468; Calibrated: 2007-08-30
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

### **Ch.25, Ant. Intenna, Bat. Standard/Hearing Aid Compatibility Test (251x251x1):**

Measurement grid: dx=2mm, dy=2mm

Maximum value of peak Total field = 0.129 A/m

Probe Modulation Factor = 1.01

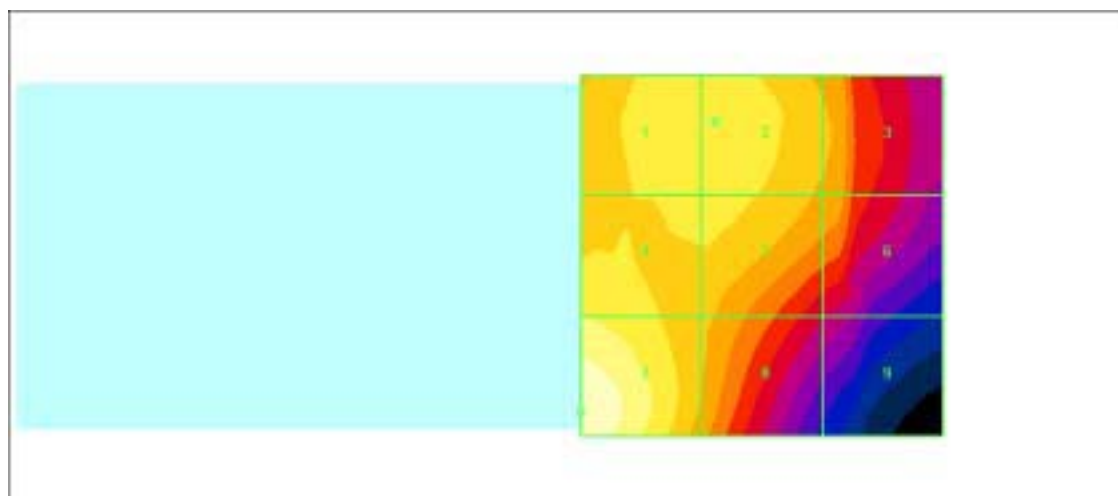
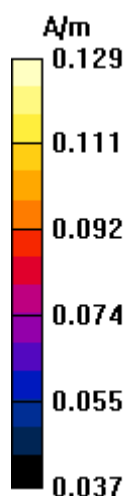
Device Reference Point: 0.000, 0.000, 353.7 mm

Reference Value = 0.107 A/m; Power Drift = 0.004 dB

**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak H-field in A/m

|                           |                           |                           |
|---------------------------|---------------------------|---------------------------|
| Grid 1<br><b>0.114 M4</b> | Grid 2<br><b>0.115 M4</b> | Grid 3<br><b>0.106 M4</b> |
| Grid 4<br><b>0.117 M4</b> | Grid 5<br><b>0.113 M4</b> | Grid 6<br><b>0.103 M4</b> |
| Grid 7<br><b>0.129 M4</b> | Grid 8<br><b>0.106 M4</b> | Grid 9<br><b>0.081 M4</b> |



**DUT: SCH-U940; Serial: AE-062-C**

**Program Name: SCH-U940(PCS) H-Field, Date: Nov/15/2007**

**Procedure Name: Ch.0600, Ant. Intenna, Bat. Standard**

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

Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1$  kg/m<sup>3</sup>

Phantom section: H Device Section

DASY4 Configuration:

- Probe: H3DV6 - SN6159; ; Calibrated: 2007-09-25

- Sensor-Surface: (Fix Surface)

- Electronics: DAE4 Sn468; Calibrated: 2007-08-30

- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018

- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

**Ch.0600, Ant. Intenna, Bat. Standard/Hearing Aid Compatibility Test (251x251x1):**

Measurement grid: dx=2mm, dy=2mm

Maximum value of peak Total field = 0.132 A/m

Probe Modulation Factor = 1.01

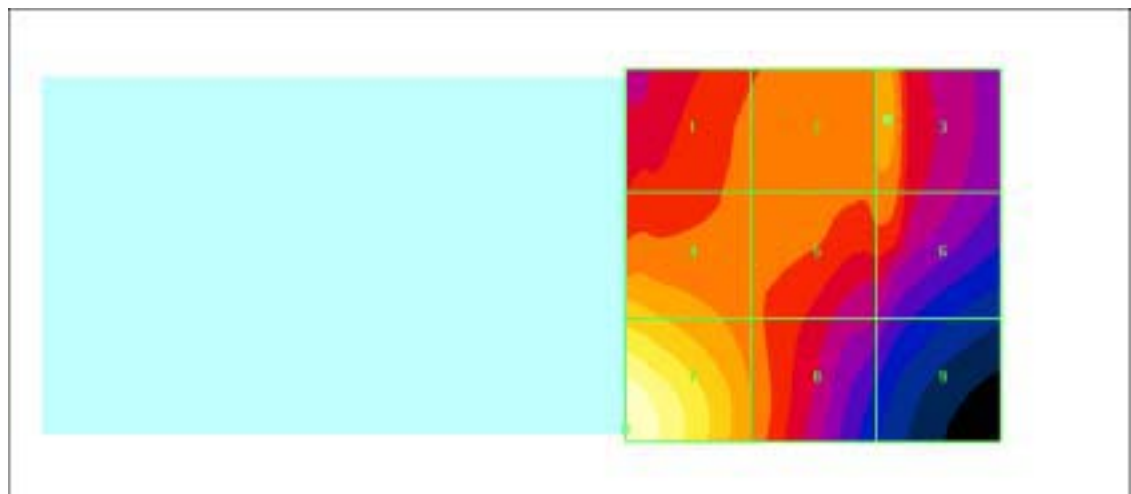
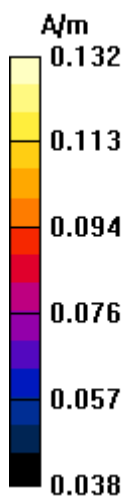
Device Reference Point: 0.000, 0.000, 353.7 mm

Reference Value = 0.092 A/m; Power Drift = -0.114 dB

**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak H-field in A/m

|                           |                           |                           |
|---------------------------|---------------------------|---------------------------|
| Grid 1<br><b>0.097 M4</b> | Grid 2<br><b>0.102 M4</b> | Grid 3<br><b>0.103 M4</b> |
| Grid 4<br><b>0.111 M4</b> | Grid 5<br><b>0.099 M4</b> | Grid 6<br><b>0.099 M4</b> |
| Grid 7<br><b>0.132 M4</b> | Grid 8<br><b>0.101 M4</b> | Grid 9<br><b>0.075 M4</b> |



**DUT: SCH-U940; Serial: AE-062-C**  
**Program Name: SCH-U940(PCS) H-Field, Date: Nov/15/2007**  
**Procedure Name: Ch.1175, Ant. Intenna, Bat. Standard**

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

DASY4 Configuration:

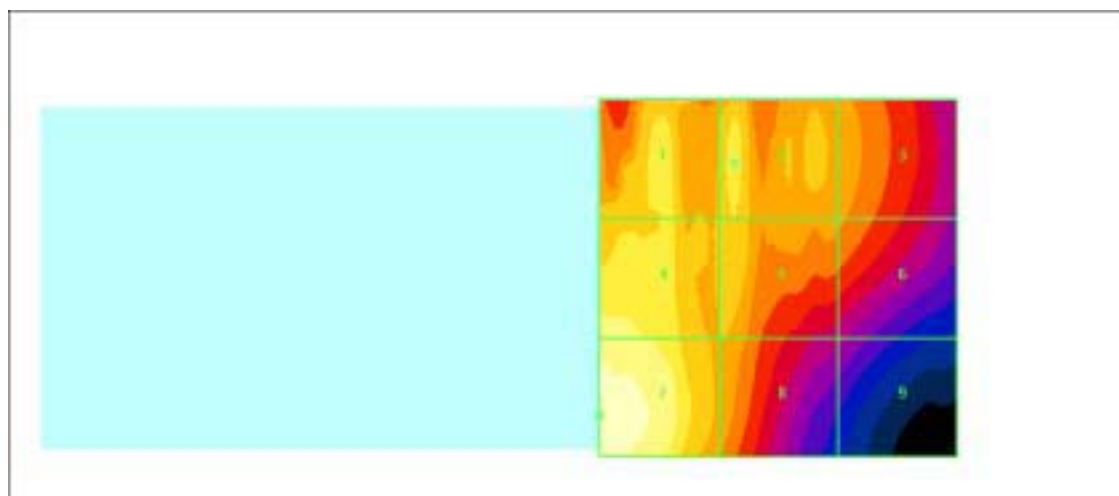
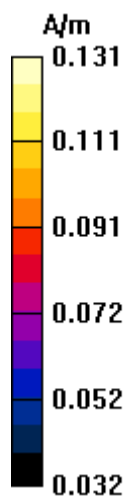
- Probe: H3DV6 - SN6159; ; Calibrated: 2007-09-25
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn468; Calibrated: 2007-08-30
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1018
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

### **Ch.1175, Ant. Intenna, Bat. Standard/Hearing Aid Compatibility Test (251x251x1):**

Measurement grid: dx=2mm, dy=2mm  
Maximum value of peak Total field = 0.131 A/m  
Probe Modulation Factor = 1.01  
Device Reference Point: 0.000, 0.000, 353.7 mm  
Reference Value = 0.099 A/m; Power Drift = 0.127 dB  
**Hearing Aid Near-Field Category: M4 (AWF 0 dB)**

Peak H-field in A/m

|                           |                           |                           |
|---------------------------|---------------------------|---------------------------|
| Grid 1<br><b>0.114 M4</b> | Grid 2<br><b>0.113 M4</b> | Grid 3<br><b>0.103 M4</b> |
| Grid 4<br><b>0.121 M4</b> | Grid 5<br><b>0.111 M4</b> | Grid 6<br><b>0.100 M4</b> |
| Grid 7<br><b>0.131 M4</b> | Grid 8<br><b>0.105 M4</b> | Grid 9<br><b>0.074 M4</b> |





## Probe Calibration(E-field)



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 **Samsung C (Dymstec)**

Certificate No: **ER3-2342\_Sep07**

## CALIBRATION CERTIFICATE

Object **ER3DV6 - SN:2342**

Calibration procedure(s) **QA CAL-02.v5**  
**Calibration procedure for E-field probes optimized for close near field evaluations 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).  
 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  $(22 \pm 3)^\circ\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards          | ID #            | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration |
|----------------------------|-----------------|-------------------------------------------|-----------------------|
| Power meter E4419B         | GB41293874      | 29-Mar-07 (METAS, No. 217-00670)          | Mar-08                |
| Power sensor E4412A        | MY41495277      | 29-Mar-07 (METAS, No. 217-00670)          | Mar-08                |
| Power sensor E4412A        | MY41498087      | 29-Mar-07 (METAS, No. 217-00670)          | Mar-08                |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 8-Aug-07 (METAS, No. 217-00719)           | Aug-08                |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 29-Mar-07 (METAS, No. 217-00671)          | Mar-08                |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 8-Aug-07 (METAS, No. 217-00720)           | Aug-08                |
| Reference Probe ER3DV6     | SN: 2328        | 2-Oct-06 (SPEAG, No. ER3-2328_Oct06)      | Oct-07                |
| DAE4                       | SN: 654         | 20-Apr-07 (SPEAG, No. DAE4-654_Apr07)     | Apr-08                |

| Secondary Standards       | ID #         | Check Date (in house)                    | Scheduled Check        |
|---------------------------|--------------|------------------------------------------|------------------------|
| RF generator HP 8648C     | US3642U01700 | 4-Aug-99 (SPEAG, in house check Nov-05)  | In house check: Nov-07 |
| Network Analyzer HP 8753E | US37390585   | 18-Oct-01 (SPEAG, in house check Oct-06) | In house check: Oct-07 |

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

Issued: September 25, 2007

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

OK to use   
 2007. 10. 25



**Glossary:**

|                                            |                                                                                                                                                      |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>NORM<sub>x,y,z</sub></b>                | sensitivity in free space                                                                                                                            |
| <b>DCP</b>                                 | diode compression point                                                                                                                              |
| <b>Polarization <math>\varphi</math></b>   | $\varphi$ rotation around probe axis                                                                                                                 |
| <b>Polarization <math>\vartheta</math></b> | $\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis |
| <b>Connector Angle</b>                     | 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:**

- **NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\vartheta = 0$  for XY sensors and  $\vartheta = 90$  for Z sensor ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide).
- **NORM(f)<sub>x,y,z</sub>** = NORM<sub>x,y,z</sub> \* frequency\_response (see Frequency Response Chart).
- **DCP<sub>x,y,z</sub>**: 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 NORM<sub>x</sub> (no uncertainty required).

# Probe ER3DV6

## SN:2342

|                  |                    |
|------------------|--------------------|
| Manufactured:    | January 1, 2005    |
| Last calibrated: | September 20, 2006 |
| Recalibrated:    | September 25, 2007 |

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

**DASY - Parameters of Probe: ER3DV6 SN:2342****Sensitivity in Free Space [ $\mu\text{V}/(\text{V}/\text{m})^2$ ]**

|       |                                            |
|-------|--------------------------------------------|
| NormX | <b><math>1.63 \pm 10.1 \%</math> (k=2)</b> |
| NormY | <b><math>1.34 \pm 10.1 \%</math> (k=2)</b> |
| NormZ | <b><math>1.75 \pm 10.1 \%</math> (k=2)</b> |

**Diode Compression<sup>A</sup>**

|       |              |
|-------|--------------|
| DCP X | <b>84 mV</b> |
| DCP Y | <b>84 mV</b> |
| DCP Z | <b>95 mV</b> |

**Frequency Correction**

|   |            |
|---|------------|
| X | <b>0.0</b> |
| Y | <b>0.0</b> |
| Z | <b>0.0</b> |

**Sensor Offset** (Probe Tip to Sensor Center)

|   |               |
|---|---------------|
| X | <b>2.5 mm</b> |
| Y | <b>2.5 mm</b> |
| Z | <b>2.5 mm</b> |

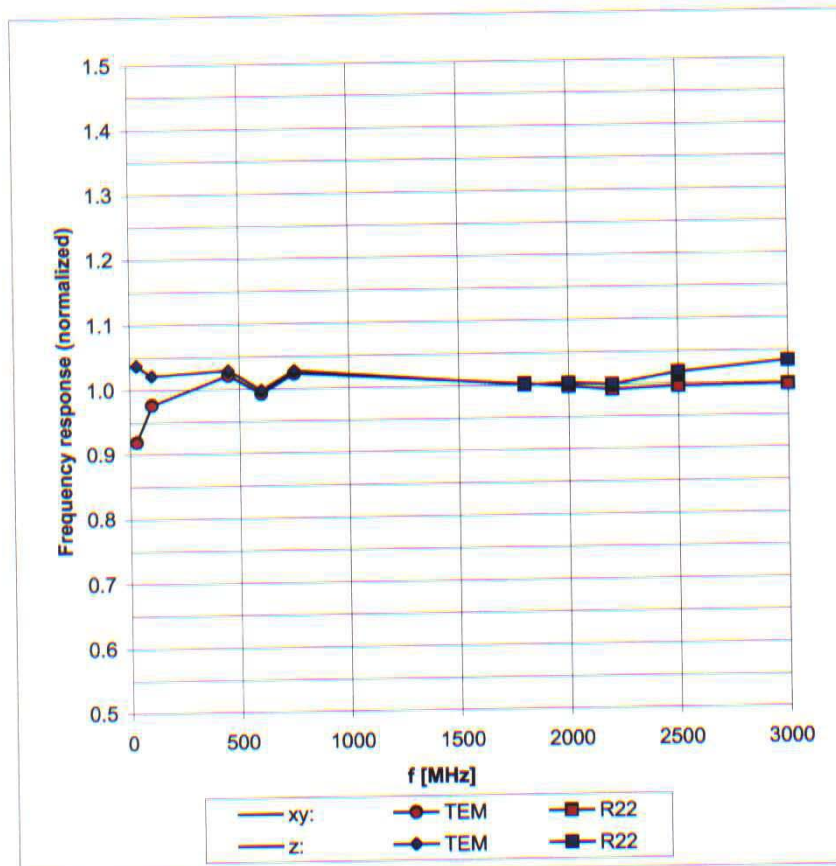
**Connector Angle** **-195 °**

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%.

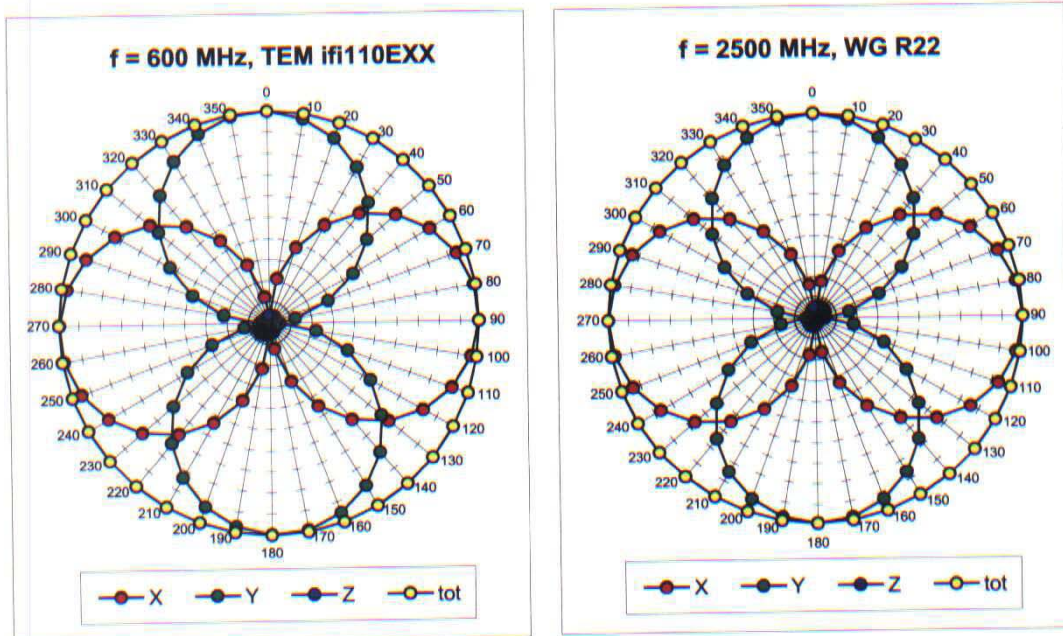
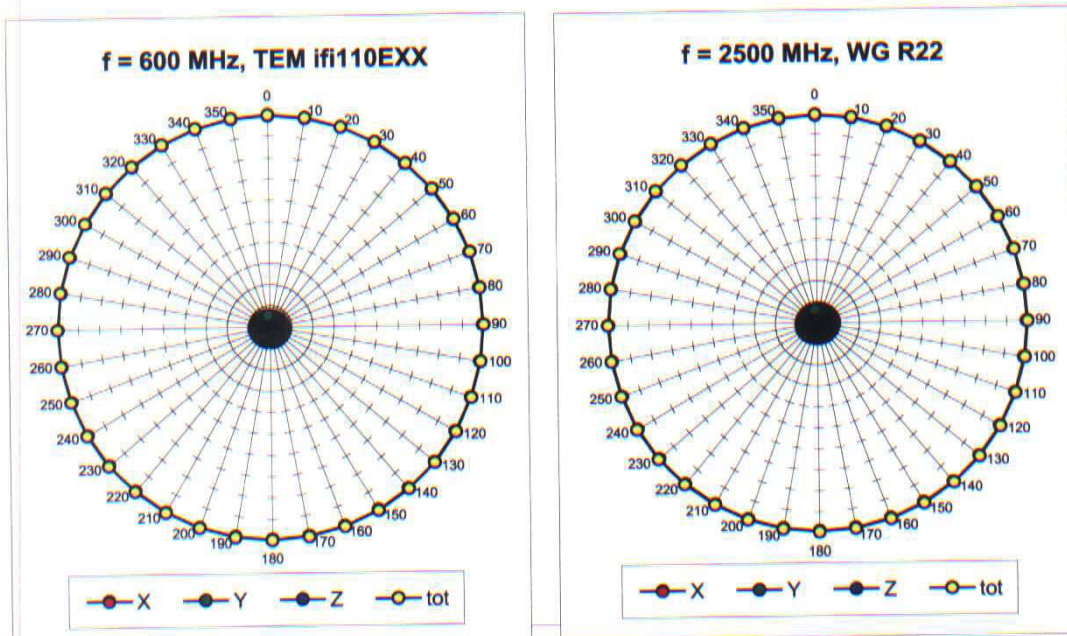
<sup>A</sup> numerical linearization parameter: uncertainty not required

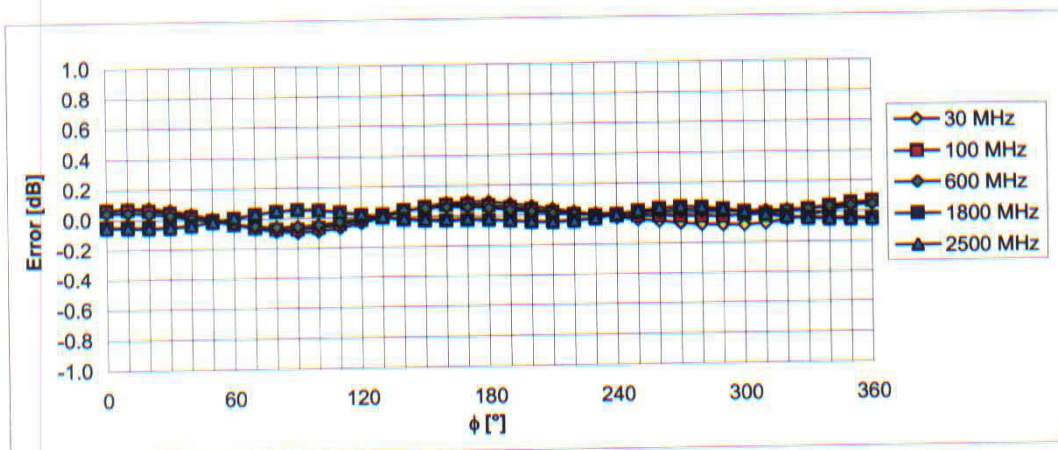
## Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide R22)

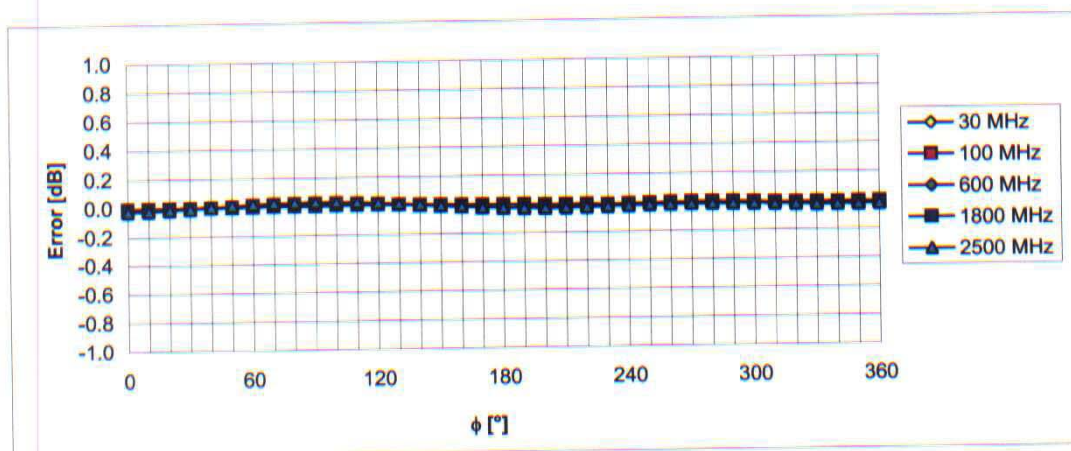


Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

Receiving Pattern ( $\phi$ ),  $\vartheta = 0^\circ$ Receiving Pattern ( $\phi$ ),  $\vartheta = 90^\circ$ 

**Receiving Pattern ( $\phi$ ),  $\vartheta = 0^\circ$** 

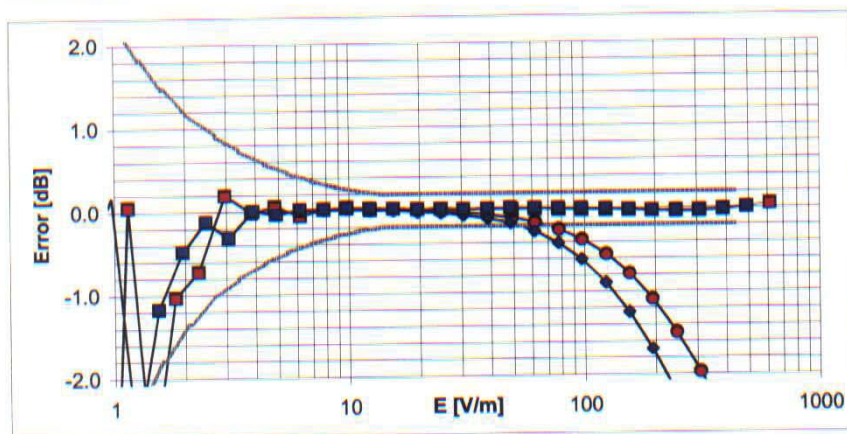
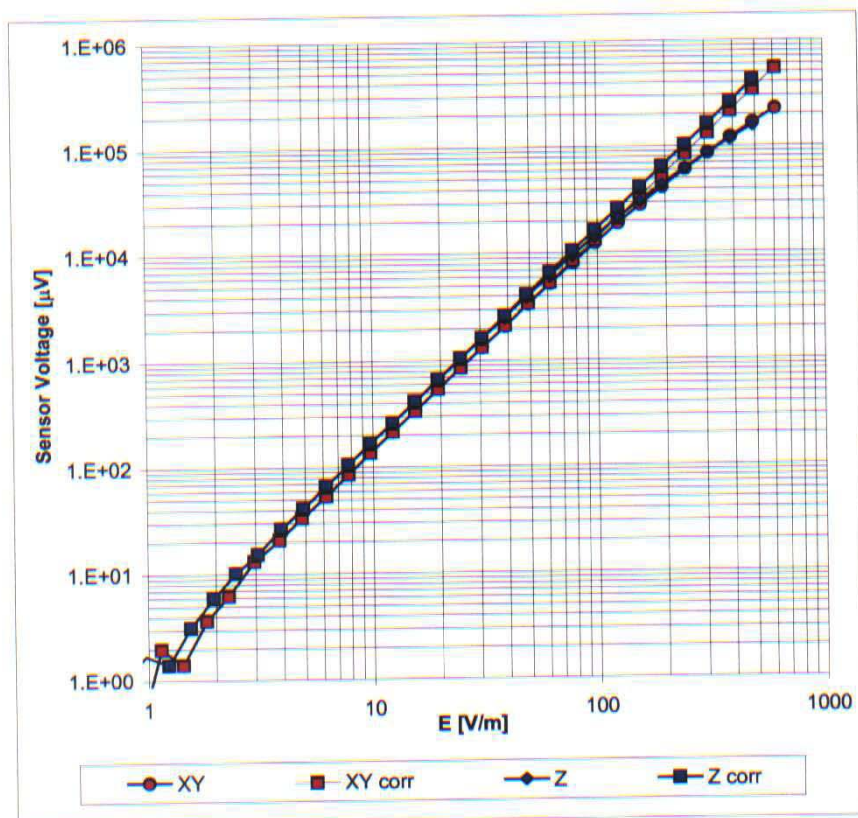
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

**Receiving Pattern ( $\phi$ ),  $\vartheta = 90^\circ$** 

Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

## Dynamic Range f(E-field)

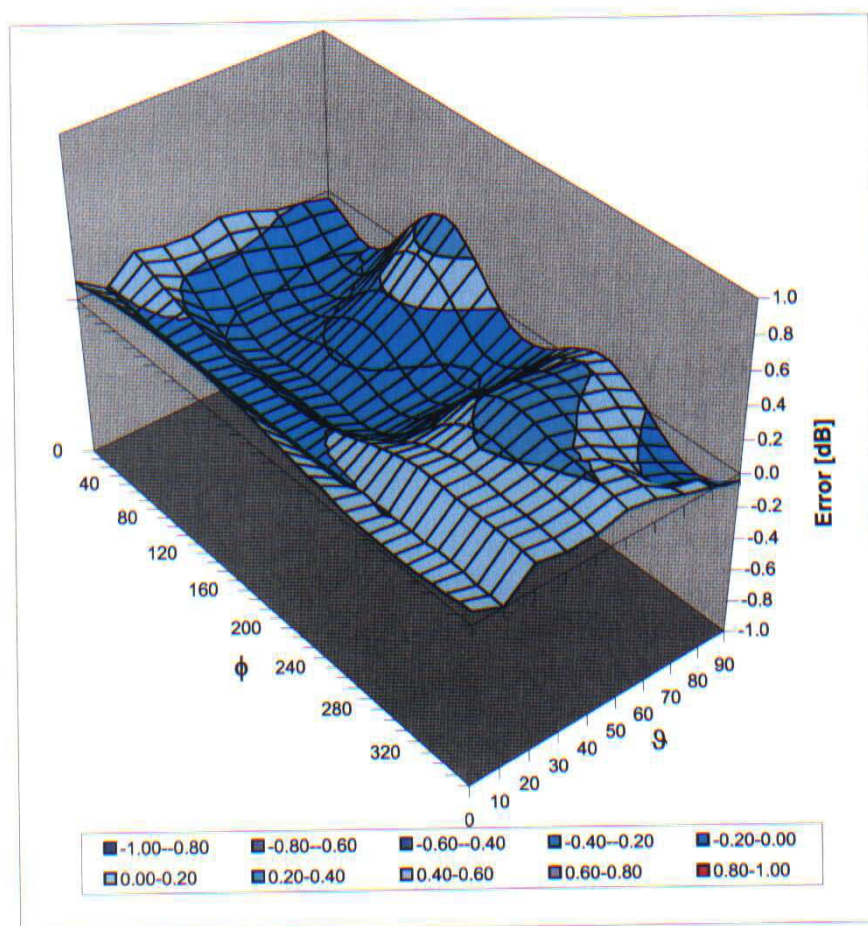
(Waveguide R22,  $f = 1800$  MHz)



Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

## Deviation from Isotropy in Air

Error ( $\phi$ ,  $\theta$ ),  $f = 900$  MHz



Uncertainty of Spherical Isotropy Assessment:  $\pm 2.6\%$  ( $k=2$ )



## **APPENDIX E**

### **Probe Calibration(H-field)**



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 **Samsung C (Dymstec)**

Certificate No: **H3-6159\_Sep07**

## CALIBRATION CERTIFICATE

Object **H3DV6 - SN:6159**

Calibration procedure(s) **QA CAL-03.v5  
 Calibration procedure for H-field probes optimized for close near field  
 evaluations 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).  
 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 ( $22 \pm 3$ )°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 E4419B         | GB41293874      | 29-Mar-07 (METAS, No. 217-00670)          | Mar-08                |
| Power sensor E4412A        | MY41495277      | 29-Mar-07 (METAS, No. 217-00670)          | Mar-08                |
| Power sensor E4412A        | MY41498087      | 29-Mar-07 (METAS, No. 217-00670)          | Mar-08                |
| Reference 3 dB Attenuator  | SN: S5054 (3c)  | 8-Aug-07 (METAS, No. 217-00719)           | Aug-08                |
| Reference 20 dB Attenuator | SN: S5086 (20b) | 29-Mar-07 (METAS, No. 217-00671)          | Mar-08                |
| Reference 30 dB Attenuator | SN: S5129 (30b) | 8-Aug-07 (METAS, No. 217-00720)           | Aug-08                |
| Reference Probe H3DV6      | SN: 6182        | 2-Oct-06 (SPEAG, No. H3-6182_Oct06)       | Oct-07                |
| DAE4                       | SN: 654         | 20-Apr-07 (SPEAG, No. DAE4-654_Apr07)     | Apr-08                |

| Secondary Standards       | ID #         | Check Date (in house)                    | Scheduled Check        |
|---------------------------|--------------|------------------------------------------|------------------------|
| RF generator HP 8648C     | US3642U01700 | 4-Aug-99 (SPEAG, in house check Nov-05)  | In house check: Nov-07 |
| Network Analyzer HP 8753E | US37390585   | 18-Oct-01 (SPEAG, in house check Oct-06) | In house check: Oct-07 |

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

Issued: September 25, 2007

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

OK to use   
 2007.10.25.



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

**Glossary:**

|                          |                                                                                                                                                      |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| NORM <sub>x,y,z</sub>    | sensitivity in free space                                                                                                                            |
| DCP                      | diode compression point                                                                                                                              |
| Polarization $\varphi$   | $\varphi$ rotation around probe axis                                                                                                                 |
| Polarization $\vartheta$ | $\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis |
| Connector Angle          | information used in DASY system to align probe sensor X to the robot coordinate system                                                               |

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

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

**Methods Applied and Interpretation of Parameters:**

- $X, Y, Z_{a0a1a2}$ : Assessed for E-field polarization  $\vartheta = 90$  for XY sensors and  $\vartheta = 0$  for Z sensor ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide).
- $X, Y, Z(f)_{a0a1a2} = X, Y, Z_{a0a1a2} * \text{frequency\_response}$  (see Frequency Response Chart).
- $DCP_{x,y,z}$ : 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:6159

|                  |                    |
|------------------|--------------------|
| Manufactured:    | July 9, 2004       |
| Last calibrated: | September 20, 2006 |
| Recalibrated:    | September 25, 2007 |

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

**DASY - Parameters of Probe: H3DV6 SN:6159**Sensitivity in Free Space [A/m /  $\sqrt{\mu\text{V}}$ ]

|   | a0        | a1        | a2                          |
|---|-----------|-----------|-----------------------------|
| X | 2.607E-03 | -6.463E-5 | 7.374E-7 $\pm$ 5.1 % (k=2)  |
| Y | 2.594E-03 | -2.659E-5 | 2.201E-5 $\pm$ 5.1 % (k=2)  |
| Z | 3.013E-03 | -1.855E-4 | -1.873E-5 $\pm$ 5.1 % (k=2) |

**Diode Compression<sup>1</sup>**

|       |       |
|-------|-------|
| DCP X | 85 mV |
| DCP Y | 85 mV |
| DCP Z | 85 mV |

Sensor Offset (Probe Tip to Sensor Center)

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

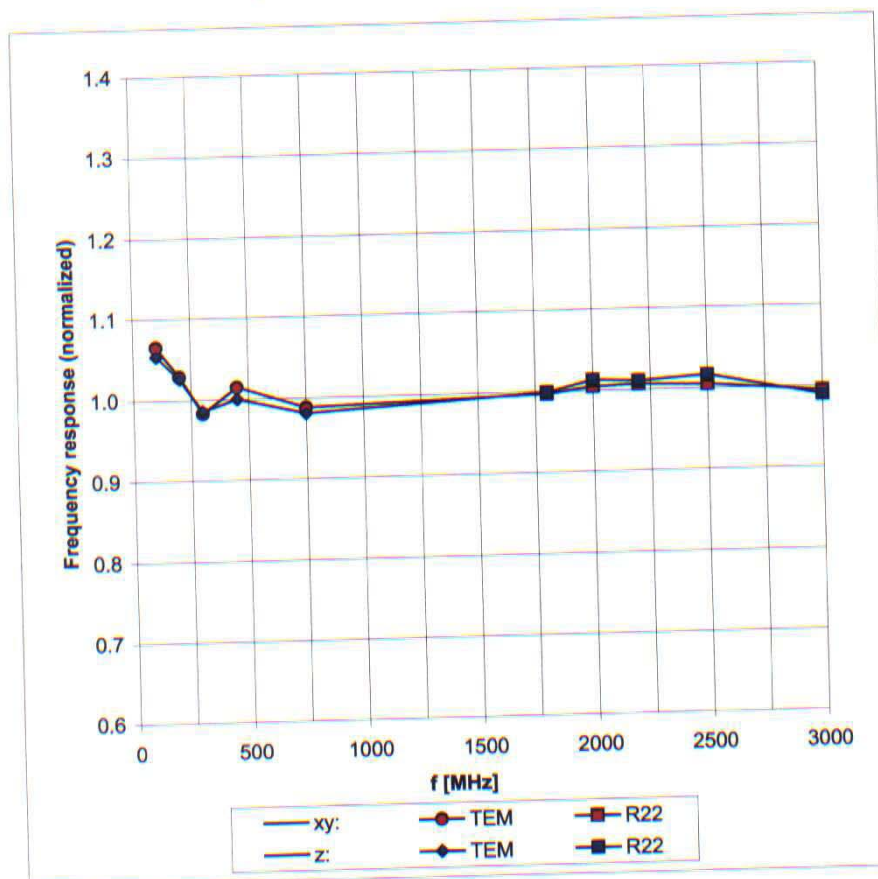
Connector Angle -282 °

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%.

<sup>1</sup> numerical linearization parameter: uncertainty not required

## Frequency Response of H-Field

(TEM-Cell:ifi110, Waveguide R22)



Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )