

## HAC RF Emissions Test Report

|                                                  |                                                                                                                                                                                                                                                                                |                         |                                                                                                                                            |
|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Test report no.:                                 | Salo_HAC_0816_07                                                                                                                                                                                                                                                               | Date of report:         | 2008-04-21                                                                                                                                 |
| Template version:                                | 4.0                                                                                                                                                                                                                                                                            | Number of pages:        | 24                                                                                                                                         |
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| Measurements made by:                            | Ari Orte                                                                                                                                                                                                                                                                       |                         |                                                                                                                                            |
| Tested devices:                                  | RM-188                                                                                                                                                                                                                                                                         |                         |                                                                                                                                            |
| FCC ID:                                          | LJPRM-188                                                                                                                                                                                                                                                                      |                         |                                                                                                                                            |
| Supplement reports:                              | -                                                                                                                                                                                                                                                                              |                         |                                                                                                                                            |
| Testing has been carried out in accordance with: | ANSI C63.19-2006<br>American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids                                                                                                                            |                         |                                                                                                                                            |
| Documentation:                                   | The documentation of the testing performed on the tested devices is archived for 15 years at TCC Nokia.                                                                                                                                                                        |                         |                                                                                                                                            |
| Test results:                                    | <b>The tested device complies with the requirements in respect of all parameters subject to the test.</b> The test results and statements relate only to the items tested. The test report shall not be reproduced except in full, without written approval of the laboratory. |                         |                                                                                                                                            |
| Date and signatures:                             |                                                                                                                                                                                                                                                                                |                         |                                                                                                                                            |
| For the contents:                                |                                                                                                                                                                                                                                                                                |                         |                                                                                                                                            |

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## 1. SUMMARY OF HAC RF EMISSION TEST REPORT

### 1.1 Test Details

|                                             |                                                              |
|---------------------------------------------|--------------------------------------------------------------|
| Period of test                              | 2008-04-14 to 2008-04-18                                     |
| SN, HW, SW and DUT numbers of tested device | SN: 353249/01/306356/1, HW: 12061001, SW: v03.52, DUT: 12691 |
| Batteries used in testing                   | BL-5C, DUT: 12692, 12693                                     |
| State of sample                             | Prototype unit                                               |
| Notes                                       | AWF = -5                                                     |

### 1.2 Maximum Results

The maximum measured HAC RF emission values and categories for electric and magnetic fields are given in section 1.2.

#### 1.2.1 Electric field measurements

| Band & Mode | Ch / Freq. [MHz] | Radiated power | Limit of E-field max. value in category M3 [V/m] | Maximum E-field value after exclusion [V/m] | Category  |
|-------------|------------------|----------------|--------------------------------------------------|---------------------------------------------|-----------|
| GSM 850     | 190 / 836.6      | 31.0 dBm ERP   | 149.6 – 266.1                                    | 153.7                                       | M3 (-5dB) |
| GSM 1900    | 661 / 1880.0     | 31.9 dBm EIRP  | 47.3 – 84.1                                      | 59.2                                        | M3 (-5dB) |

#### 1.2.2 Magnetic field measurements

| Band & Mode | Ch / Freq. [MHz] | Radiated power | Limit of H-field max. value in category M3 [A/m] | Maximum H-field value after exclusion [A/m] | Category  |
|-------------|------------------|----------------|--------------------------------------------------|---------------------------------------------|-----------|
| GSM 850     | 251 / 848.8      | 30.6 dBm ERP   | 0.45 – 0.80                                      | 0.175                                       | M4 (-5dB) |
| GSM 1900    | 810 / 1909.8     | 29.9 dBm EIRP  | 0.14 – 0.25                                      | 0.115                                       | M4 (-5dB) |

#### 1.2.3 Overall RF emissions category of the tested device

| Band & Mode           | Combined category (E- and H-fields) | Verdict     |
|-----------------------|-------------------------------------|-------------|
| GSM 850               | M3                                  | Pass        |
| GSM 1900              | M3                                  | Pass        |
| <b>Final Category</b> | <b>M3</b>                           | <b>Pass</b> |

#### 1.2.4 Maximum Drift

|                                   |         |
|-----------------------------------|---------|
| Maximum drift during measurements | 0.12 dB |
|-----------------------------------|---------|

#### 1.2.5 Measurement Uncertainty

|                                         |        |
|-----------------------------------------|--------|
| Extended Uncertainty (k=2) 95%, E-field | 14.7 % |
| Extended Uncertainty (k=2) 95%, H-field | 10.9 % |

## 2. DESCRIPTION OF THE DEVICE UNDER TEST (DUT)

| Modes of Operation | Bands | Modulation Mode | Duty Cycle | Transmitter Frequency Range (MHz) |
|--------------------|-------|-----------------|------------|-----------------------------------|
| GSM                | 850   | GMSK            | 1/8        | 824 – 849                         |
| GSM                | 1900  | GMSK            | 1/8        | 1850 – 1910                       |
| WLAN               | 2450  | 11Mbps QPSK     | 1          | 2412 – 2462                       |

Outside of USA the transmitter of the device is capable of operating also in 900MHz and 1800MHz bands, which are not part of this filing.

### 2.1 Picture of Device



Flip closed



Flip open

---

### 3. TEST CONDITIONS

#### 3.1 Temperature and Humidity

|                           |          |
|---------------------------|----------|
| Ambient temperature [°C]: | 18 to 25 |
| Ambient humidity [RH %]:  | 30 to 70 |

#### 3.2 Test Signal, Frequencies, and Output Power

The transmitter of the device was put into operation by using a call tester. Communications between the device and the call tester were established by air link.

For all tests the device output power was set to maximum power level; a fully charged battery was used for every test sequence.

The measurements were performed on low, middle and high channels.

#### 4. DESCRIPTION OF THE TEST EQUIPMENT

##### 4.1 Measurement system and components

The measurements were performed using an automated near-field scanning system, DASY 4, manufactured by Schmid & Partner Engineering AG (SPEAG) in Switzerland.  
The following table lists calibration dates of SPEAG components:

| Test Equipment                  | Serial Number | Calibration interval | Calibration expiry |
|---------------------------------|---------------|----------------------|--------------------|
| DAE 3                           | 454           | 12 months            | 2009-01            |
| E-field Probe ER3DV6            | 2333          | 12 months            | 2009-01            |
| H-field Probe H3DV6             | 6053          | 12 months            | 2009-01            |
| Dipole Validation Kit, CD835V3  | 1004          | 24 months            | 2009-02            |
| Dipole Validation Kit, CD1880V3 | 1003          | 24 months            | 2009-02            |

Additional test equipment used in testing and validation:

| Test Equipment             | Model        | Serial Number | Calibration interval | Calibration expiry |
|----------------------------|--------------|---------------|----------------------|--------------------|
| Signal Generator           | SML03        | 101265        | 12 months            | 2008-07            |
| Amplifier                  | ZHL-42 (SMA) | N072095-5     | 12 months            | 2008-07            |
| Power Meter                | NRVS         | 849305/028    | 12 months            | 2008-07            |
| Power Sensor               | NRV-Z32      | 839176/020    | 12 months            | 2008-07            |
| Radio Communication Tester | CMU 200      | 104983        | 12 months            | 2008-07            |

#### 4.1.1 Isotropic E-field probe ER3DV6

|                      |                                                                                                                                                          |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Construction</b>  | One dipole parallel, two dipoles normal to probe axis<br>Built-in shielding against static charges<br>PEEK enclosure material                            |
| <b>Frequency</b>     | In air 100 MHz to >6 GHz; Linearity: $\pm 0.2$ dB (100 MHz to 3 GHz)                                                                                     |
| <b>Directivity</b>   | $\pm 0.2$ dB in air (rotation around probe axis)<br>$\pm 0.4$ dB in air (rotation normal to probe axis)                                                  |
| <b>Dynamic Range</b> | 2 V/m to > 1000 V/m; Linearity: $\pm 0.2$ dB                                                                                                             |
| <b>Dimensions</b>    | Overall length: 330 mm<br>Tip length: 16 mm<br>Body diameter: 12 mm<br>Tip diameter: 8 mm<br>Distance from probe tip to nearest point of dipole: 1.25 mm |
| <b>Application</b>   | General near-field measurements up to 6 GHz<br>Field component measurements<br>Fast automatic scanning in phantoms                                       |

#### 4.1.2 Isotropic H-field probe H3DV6

|                      |                                                                                                                                                                                            |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Construction</b>  | Three concentric loop sensors with 3.8 mm loop diameters<br>Resistively loaded detector diodes for linear response<br>Built-in shielding against static charges<br>PEEK enclosure material |
| <b>Frequency</b>     | 200 MHz to 3 GHz; Output linearized (absolute accuracy $\pm 6.0\%$ , $k=2$ )                                                                                                               |
| <b>Directivity</b>   | $\pm 0.25$ dB (spherical isotropy error)                                                                                                                                                   |
| <b>Dynamic Range</b> | 10 mA/m to 2 A/m at 1 GHz                                                                                                                                                                  |
| <b>Dimensions</b>    | Overall length: 330 mm<br>Tip length: 40 mm<br>Body diameter: 12 mm<br>Tip diameter: 6 mm<br>Distance from probe tip to nearest point of dipole: 1.1 mm                                    |
| <b>Application</b>   | General magnetic near-field measurements up to 3 GHz<br>Field component measurements, surface current measurements<br>Measurements in air or liquids, low interaction                      |

#### 4.1.3 Device Holder

The Device Holder and Test Arch are manufactured by Speag (<http://www.dasy4.com/hac>). Test arch is used for all tests i.e. for both validation testing and device testing. The holder and test arch conforms to the requirements of ANSI C63.19.

The SPEAG device holder (see Section 5.1) was used to position the test device in all tests.

#### 4.2 Validation of the System

The manufacturer calibrates the probes annually. Validation measurements are made regularly using the dipole validation kit. The power level used by manufacturer in dipole calibration is supplied to the dipole antenna. The antenna is scanned at 1.0cm distance between top surface of the dipole and calibration point of the probe.

**System Validation, H-field and E-field**

| f [MHz] | Description      | E-field [V/m] | H-field [A/m] |
|---------|------------------|---------------|---------------|
| 835     | Reference result | 160.0         | 0.452         |
|         | ± 10% window     | 144.0 – 176.0 | 0.406 – 0.497 |
|         | 2008-04-14       | 162.1         | 0.487         |
| 1880    | Reference result | 128.8         | 0.452         |
|         | ± 10% window     | 115.9 – 141.7 | 0.406 – 0.497 |
|         | 2008-04-14       | 125.1         | 0.462         |

Plots of the system validation scans are given in Appendix A.

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## 5. DESCRIPTION OF THE TEST PROCEDURE

### 5.1 Test Arch and Device Holder

The test device was placed in the Device Holder (illustrated below) that is supplied by SPEAG. Using this positioner the tested device is positioned under Test Arch.



Device holder and Test Arch supplied by SPEAG

### 5.2 Test Positions

#### 5.2.1 Scan area centered at the acoustic output

The device was positioned such that Device Reference plane was touching the bottom of the Test Arch. The scan is centered at the acoustic output by aligning the acoustic output with the intersection of the Test Arch's middle bar and dielectric wire.



Photo of the device positioned under Test Arch

### 5.3 Scan Procedures

Near field scans of 5cm x 5cm were used for determination of the field distribution. Measurement plane distance from WD reference plane is 1cm. Scans were performed for both E- and H-field using appropriate probe. DASY software divides detected values into 3 x 3 sub grids as described in the C63.19 standard.

### 5.4 Scan area centered at the maximum magnetic T-coil coupling

Scanning centered at the maximum magnetic T-coil coupling was not applicable for the tested device.

### 5.5 Probe Modulation Factor

All raw measurements in DASY4 system are presented as RMS values. The measurement software then applies Probe Modulation Factor (PMF) to convert readings to “slot averaged” peak values as required by C63.19 standard.

Therefore PMF was assessed as described in C63.19 standard along with Speag's Application Note (AN\_Hearing\_Aid\_Compatibility.pdf, section 28.8, "Definition / Determination of the Probe Modulation Factor").

#### Observed Modulation Factor:

$$PMF_{(E)} = E\text{-field}_{(CW)} / E\text{-field}_{(Modulated)}$$

$$PMF_{(H)} = H\text{-field}_{(CW)} / H\text{-field}_{(Modulated)}$$

#### Observed Crest Factor:

$$CF_{(E)} = (PMF_{(E)})^2$$

$$CF_{(H)} = (PMF_{(H)})^2$$

Modulation factors, GSM

| <i>f</i> [MHz] | <i>p</i> [dBm] | E-field [V/m]<br>Probe SN: 2333 |      | H-field [A/m]<br>Probe SN: 6053 |       | PMF<br>E-field | PMF<br>H-field |
|----------------|----------------|---------------------------------|------|---------------------------------|-------|----------------|----------------|
|                |                | CW                              | GSM  | CW                              | GSM   |                |                |
| 835.0          | 20             | 95.6                            | 33.9 | 0.452                           | 0.173 | 2.82           | 2.61           |
| 1880.0         | 20             | 136.3                           | 48.4 | 0.506                           | 0.249 | 2.82           | 2.03           |

## 5.6 Slot Averaged Calculation Method

The slot-averaged values for the every measured signal type were calculated using observed PMFs.

## 5.7 Sub-grid Exclusion

The measurement grid defined in C63.19 consists of 9 evenly sized blocks, which are used to define permissible exclusion areas. For both E- and H-field measurements three contiguous blocks may be excluded from the measurements except center block may never be excluded. There must be 4 blocks left that are common for both E- and H-field measurements, so maximum of 5 different blocks can be excluded (e.g. 3 blocks excluded from E-field and 2 blocks from H-field).

## 5.8 Category Limits

From remaining maximum values after exclusion process, Hearing Aid M-category is defined according to the category limits of c63.19 – 2006.

| Category | AWF [dB] | Limits for RF-parameters <960MHz |              |               |             | Limits for RF-parameters >960MHz |              |               |             |
|----------|----------|----------------------------------|--------------|---------------|-------------|----------------------------------|--------------|---------------|-------------|
|          |          | E-field [V/m]                    |              | H-field [A/m] |             | E-field [V/m]                    |              | H-field [A/m] |             |
|          |          | Min                              | Max          | Min           | Max         | Min                              | Max          | Min           | Max         |
| M1       | 0        | 631.0                            | 1122.0       | 1.91          | 3.39        | 199.5                            | 354.8        | 0.60          | 1.07        |
| M1       | -5       | 473.2                            | 841.4        | 1.43          | 2.54        | 149.6                            | 266.1        | 0.45          | 0.80        |
| M2       | 0        | 354.8                            | 631.0        | 1.07          | 1.91        | 112.2                            | 199.5        | 0.34          | 0.60        |
| M2       | -5       | 266.1                            | 473.2        | 0.80          | 1.43        | 84.1                             | 149.6        | 0.25          | 0.45        |
| M3       | 0        | <b>199.5</b>                     | <b>354.8</b> | <b>0.60</b>   | <b>1.07</b> | <b>63.1</b>                      | <b>112.2</b> | <b>0.19</b>   | <b>0.34</b> |
| M3       | -5       | <b>149.6</b>                     | <b>266.1</b> | <b>0.45</b>   | <b>0.80</b> | <b>47.3</b>                      | <b>84.1</b>  | <b>0.14</b>   | <b>0.25</b> |
| M4       | 0        |                                  | <199.5       |               | <0.60       |                                  | <63.1        |               | <0.19       |
| M4       | -5       |                                  | <149.6       |               | <0.45       |                                  | <47.3        |               | <0.14       |

## 6. MEASUREMENT UNCERTAINTY

| Source of Uncertainty                    | Tolerance<br>±% | Probability<br>Distribution | Div. | ci<br>E | ci<br>H | Standard<br>Uncertainty<br>±%, E | Standard<br>Uncertainty<br>±%, H | Remark |
|------------------------------------------|-----------------|-----------------------------|------|---------|---------|----------------------------------|----------------------------------|--------|
| <b>MEASUREMENT SYSTEM</b>                |                 |                             |      |         |         |                                  |                                  |        |
| Probe Calibration                        | 5.1             | N                           | 1    | 1       | 1       | 5.1                              | 5.1                              |        |
| Axial Isotropy                           | 4.7             | R                           | √3   | 1       | 1       | 2.7                              | 2.7                              |        |
| Sensor Displacement                      | 16.5            | R                           | √3   | 1       | 0.145   | 9.5                              | 1.4                              |        |
| Boundary Effect                          | 2.4             | R                           | √3   | 1       | 1       | 1.4                              | 1.4                              |        |
| Linearity                                | 4.7             | R                           | √3   | 1       | 1       | 2.7                              | 2.7                              | SAR    |
| Scaling to Peak Envelope Power           | 2.0             | R                           | √3   | 1       | 1       | 1.2                              | 1.2                              |        |
| System Detection Limit                   | 1.0             | R                           | √3   | 1       | 1       | 0.6                              | 0.6                              |        |
| Readout Electronics                      | 0.3             | N                           | 1    | 1       | 1       | 0.3                              | 0.3                              | SAR    |
| Response Time                            | 0.8             | R                           | √3   | 1       | 1       | 0.5                              | 0.5                              |        |
| Integration Time                         | 2.6             | R                           | √3   | 1       | 1       | 1.5                              | 1.5                              | SAR    |
| RF Ambient Conditions                    | 3.0             | R                           | √3   | 1       | 1       | 1.7                              | 1.7                              | SAR    |
| RF Reflections                           | 12.0            | R                           | √3   | 1       | 1       | 6.9                              | 6.9                              |        |
| Probe Positioner                         | 1.2             | R                           | √3   | 1       | 0.67    | 0.7                              | 0.5                              |        |
| Probe Positioning                        | 4.7             | R                           | √3   | 1       | 0.67    | 2.7                              | 1.8                              |        |
| Extrapolation and Interpolation          | 1.0             | R                           | √3   | 1       | 1       | 0.6                              | 0.6                              | SAR    |
|                                          |                 |                             |      |         |         |                                  |                                  |        |
| <b>TEST SAMPLE RELATED</b>               |                 |                             |      |         |         |                                  |                                  |        |
| Device Positioning Vertical              | 4.7             | R                           | √3   | 1       | 0.67    | 2.7                              | 1.8                              |        |
| Device Positioning Lateral               | 1.0             | R                           | √3   | 1       | 1       | 0.6                              | 0.6                              |        |
| Device Holder and Test Arch              | 2.4             | R                           | √3   | 1       | 1       | 1.4                              | 1.4                              |        |
| Power Drift                              | 5.0             | R                           | √3   | 1       | 1       | 2.9                              | 2.9                              | SAR    |
|                                          |                 |                             |      |         |         |                                  |                                  |        |
| <b>TEST ARCH AND SETUP RELATED</b>       |                 |                             |      |         |         |                                  |                                  |        |
| Test Arch Thickness                      | 2.4             | R                           | √3   | 1       | 0.67    | 1.4                              | 0.9                              |        |
|                                          |                 |                             |      |         |         |                                  |                                  |        |
| <b>COMBINED STANDARD<br/>UNCERTAINTY</b> |                 |                             |      |         |         | <b>14.7</b>                      | <b>10.9</b>                      |        |
| Expanded Uncertainty on Power            |                 |                             |      |         |         | <b>29.4</b>                      | <b>21.8</b>                      |        |
| Expanded Uncertainty on Field            |                 |                             |      |         |         | <b>14.7</b>                      | <b>10.9</b>                      |        |

## 7. RESULTS

The calculated maximum field values for the test device are tabulated below:

### 850MHz RF emissions test results

| Option used   | Test configuration | Ch 128<br>824.2MHz | Ch 190<br>836.6MHz | Ch 251<br>848.8MHz |
|---------------|--------------------|--------------------|--------------------|--------------------|
| <b>GSM850</b> | <b>Power</b>       | 30.1 dBm           | 31.0 dBm           | 30.6 dBm           |
| Flip open     | E-field [V/M]      | 137.0              | <b>153.7</b>       | 152.3              |
|               | H-field [A/m]      | 0.150              | 0.161              | <b>0.175</b>       |
|               | Category           | M4 (-5dB)          | M3 (-5dB)          | M3 (-5dB)          |

### 1900MHz RF emissions test results

| Option used    | Test configuration | Ch 512<br>1850.2MHz | Ch 661<br>1880.0MHz | Ch 810<br>1909.8MHz |
|----------------|--------------------|---------------------|---------------------|---------------------|
| <b>GSM1900</b> | <b>Power</b>       | 32.2 dBm            | 31.9 dBm            | 29.9 dBm            |
| Flip open      | E-field [V/M]      | 50.3                | <b>59.2</b>         | 55.6                |
|                | H-field [A/m]      | 0.106               | 0.112               | <b>0.115</b>        |
|                | Category           | M3 (-5dB)           | M3 (-5dB)           | M3 (-5dB)           |

Plots of the measurement scans are shown in **Appendix B**. Excluded cells are colored orange.

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## APPENDIX A: SYSTEM VALIDATION SCANS

## SYSTEM VALIDATION DATA 850MHz

Date/Time: 2008-04-14 17:46:47

Test Laboratory: TCC Nokia

Type: D835V3; Serial: 1004

Communication System: CW

Frequency: 835 MHz; Duty Cycle: 1:1

Medium: Air; Medium Notes: Not Specified

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 - SN2333

- ConvF(1, 1, 1); Calibrated: 2008-01-21

- Sensor-Surface: (Fix Surface)

- Electronics: DAE3 Sn454; Calibrated: 2008-01-29

- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: 1004

- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW:

SEMCAD, V1.8 Build 176

**E Scan - ER3DV6 - measurement distance from the probe sensor center to CD835 Dipole = 10mm/Hearing Aid Compatibility Test (41x361x1):**

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

Maximum value of peak Total field = 162.5 V/m

Probe Modulation Factor = 1.00

Device Reference Point: 0.000, 0.000, 354.7 mm

Reference Value = 119.7 V/m; Power Drift = 0.015 dB

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

Date/Time: 2008-04-14 17:02:31

Test Laboratory: TCC Nokia

Type: D835V3; Serial: 1004

Communication System: CW835

Frequency: 835 MHz; Duty Cycle: 1:1

Medium: Air; Medium Notes: Not Specified

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 - SN6053

- ; Calibrated: 2008-01-21

- Sensor-Surface: (Fix Surface)

- Electronics: DAE3 Sn454; Calibrated: 2008-01-29

- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: 1004

- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW:

SEMCAD, V1.8 Build 176

**H Scan - H3DV6 - measurement distance from the probe sensor center to CD835 Dipole = 10mm/Hearing Aid Compatibility Test (41x361x1):**

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

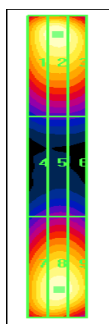
Maximum value of peak Total field = 0.487 A/m

Probe Modulation Factor = 1.00

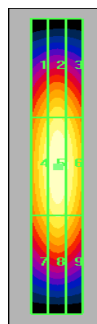
Device Reference Point: 0.000, 0.000, 354.7 mm

Reference Value = 0.519 A/m; Power Drift = 0.007 dB

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



|          |          |          |
|----------|----------|----------|
| Grid 1   | Grid 2   | Grid 3   |
| 158.5 M4 | 162.5 M4 | 157.1 M4 |
| Grid 4   | Grid 5   | Grid 6   |
| 82.6 M4  | 86.1 M4  | 84.8 M4  |
| Grid 7   | Grid 8   | Grid 9   |
| 156.0 M4 | 161.6 M4 | 158.0 M4 |



|          |          |          |
|----------|----------|----------|
| Grid 1   | Grid 2   | Grid 3   |
| 0.398 M4 | 0.429 M4 | 0.410 M4 |
| Grid 4   | Grid 5   | Grid 6   |
| 0.454 M4 | 0.487 M4 | 0.468 M4 |
| Grid 7   | Grid 8   | Grid 9   |
| 0.402 M4 | 0.432 M4 | 0.415 M4 |

## SYSTEM VALIDATION DATA 1900MHZ

Date/Time: 2008-04-14 17:30:42  
Test Laboratory: TCC Nokia  
Type: CD1880V3; Serial: 1003

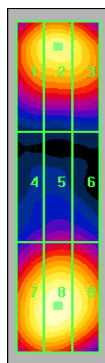
Communication System: CW  
Frequency: 1880 MHz; Duty Cycle: 1:1  
Medium: Air; Medium Notes: Not Specified  
Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Phantom section: E Dipole Section

### DASY4 Configuration:

- Probe: ER3DV6 - SN2333
- ConvF(1, 1, 1); Calibrated: 2008-01-21
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn454; Calibrated: 2008-01-29
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: 1004
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

**E Scan - ER3DV6 - measurement distance from the probe sensor center to CD1880 Dipole = 10mm/Hearing Aid Compatibility Test (41x181x1):**

Measurement grid: dx=5mm, dy=5mm  
Maximum value of peak Total field = 127.6 V/m  
Probe Modulation Factor = 1.00  
Device Reference Point: 0.000, 0.000, 354.7 mm  
Reference Value = 129.8 V/m; Power Drift = 0.005 dB  
**Hearing Aid Near-Field Category: M2 (AWF 0 dB)**



|             |             |             |
|-------------|-------------|-------------|
| Grid 1      | Grid 2      | Grid 3      |
| 118.5<br>M2 | 122.6<br>M2 | 119.1<br>M2 |
| Grid 4      | Grid 5      | Grid 6      |
| 85.1 M3     | 88.7 M3     | 87.3 M3     |
| Grid 7      | Grid 8      | Grid 9      |
| 124.4<br>M2 | 127.6<br>M2 | 124.1<br>M2 |

Date/Time: 2008-04-14 17:17:39  
Test Laboratory: TCC Nokia  
Type: CD1880V3; Serial: 1003

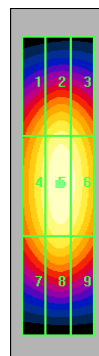
Communication System: CW  
Frequency: 1880 MHz; Duty Cycle: 1:1  
Medium: Air; Medium Notes: Not Specified  
Medium parameters used:  $\sigma = 0$  mho/m,  $\epsilon_r = 1$ ;  $\rho = 1$  kg/m<sup>3</sup>  
Phantom section: H Dipole Section

### DASY4 Configuration:

- Probe: H3DV6 - SN6053
- ; Calibrated: 2008-01-21
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn454; Calibrated: 2008-01-29
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: 1004
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

**H Scan - H3DV6 - measurement distance from the probe sensor center to CD1880 Dipole = 10mm/Hearing Aid Compatibility Test (41x181x1):**

Measurement grid: dx=5mm, dy=5mm  
Maximum value of peak Total field = 0.462 A/m  
Probe Modulation Factor = 1.00  
Device Reference Point: 0.000, 0.000, 354.7 mm  
Reference Value = 0.489 A/m; Power Drift = 0.003 dB  
**Hearing Aid Near-Field Category: M2 (AWF 0 dB)**



|          |          |          |
|----------|----------|----------|
| Grid 1   | Grid 2   | Grid 3   |
| 0.392 M2 | 0.423 M2 | 0.410 M2 |
| Grid 4   | Grid 5   | Grid 6   |
| 0.430 M2 | 0.462 M2 | 0.448 M2 |
| Grid 7   | Grid 8   | Grid 9   |
| 0.388 M2 | 0.416 M2 | 0.400 M2 |

---

## APPENDIX B: MEASUREMENT SCANS

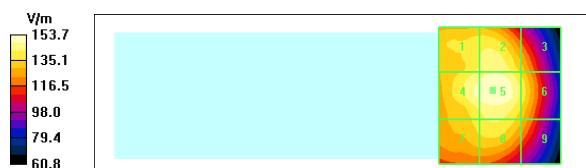
## MEASUREMENT DATA GSM850, CHANNEL MIDDLE (836.6 MHz)

Date/Time: 2008-04-18 10:30:13  
Test Laboratory: TCC Nokia  
Type: RM-188; Serial: 353249/01/306356/1

Communication System: GSM850 (ER3DV6)  
Frequency: 836.6 MHz; Duty Cycle: 1:7.95  
Medium: Air; Medium Notes: Not Specified  
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 - SN2333; Probe Notes:  
- ConvF(1, 1, 1); Calibrated: 21.01.2008  
- Sensor-Surface: (Fix Surface)  
- Electronics: DAE3 Sn454; Calibrated: 29.01.2008  
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA;  
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

**E Scan - ER3DV6 - from the closest probe sensor part to the Device = 10mm, Middle/Hearing Aid Compatibility Test (101x101x1):**  
Measurement grid: dx=5mm, dy=5mm  
Maximum value of peak Total field = 153.7 V/m  
Probe Modulation Factor = 2.82  
Device Reference Point: 0.000, 0.000, 353.7 mm  
Reference Value = 58.3 V/m; Power Drift = -0.025 dB  
**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**



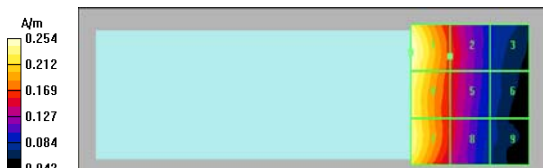
|                           |                           |                           |
|---------------------------|---------------------------|---------------------------|
| Grid 1<br><b>143.5 M4</b> | Grid 2<br><b>147.4 M4</b> | Grid 3<br><b>134.2 M4</b> |
| Grid 4<br><b>150.1 M3</b> | Grid 5<br><b>153.7 M3</b> | Grid 6<br><b>140.7 M4</b> |
| Grid 7<br><b>139.0 M4</b> | Grid 8<br><b>142.3 M4</b> | Grid 9<br><b>131.0 M4</b> |

Date/Time: 2008-04-18 11:20:26  
Test Laboratory: TCC Nokia  
Type: RM-188; Serial: 353249/01/306356/1

Communication System: GSM850 (H3DV6)  
Frequency: 836.6 MHz; Duty Cycle: 1:6.79  
Medium: Air; Medium Notes: Not Specified  
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 - SN6053; Probe Notes:  
- ; Calibrated: 21.01.2008  
- Sensor-Surface: (Fix Surface)  
- Electronics: DAE3 Sn454; Calibrated: 29.01.2008  
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA;  
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

**H Scan - H3DV6 - from the closest probe sensor part to the Device = 10mm, middle/Hearing Aid Compatibility Test (101x101x1):** Measurement grid: dx=5mm, dy=5mm  
Maximum value of peak Total field = 0.254 A/m  
Probe Modulation Factor = 2.61  
Device Reference Point: 0.000, 0.000, 353.7 mm  
Reference Value = 0.046 A/m; Power Drift = -0.016 dB  
**Hearing Aid Near-Field Category: M4 (AWF -5 dB)**



|                           |                           |                           |
|---------------------------|---------------------------|---------------------------|
| Grid 1<br><b>0.254 M4</b> | Grid 2<br><b>0.164 M4</b> | Grid 3<br><b>0.091 M4</b> |
| Grid 4<br><b>0.245 M4</b> | Grid 5<br><b>0.161 M4</b> | Grid 6<br><b>0.086 M4</b> |
| Grid 7<br><b>0.241 M4</b> | Grid 8<br><b>0.154 M4</b> | Grid 9<br><b>0.081 M4</b> |

## MEASUREMENT DATA GSM850, CHANNEL HIGH (848.8 MHz)

Date/Time: 2008-04-18 10:36:26

Test Laboratory: TCC Nokia

Type: RM-188; Serial: 353249/01/306356/1

Communication System: GSM850 (ER3DV6)

Frequency: 848.8 MHz; Duty Cycle: 1:7.95

Medium: Air; Medium Notes: Not Specified

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 - SN2333; Probe Notes:
- ConvF(1, 1, 1); Calibrated: 21.01.2008
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn454; Calibrated: 29.01.2008
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

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

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

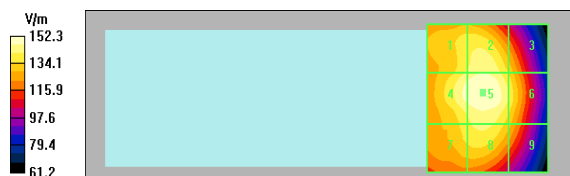
Maximum value of peak Total field = 152.3 V/m

Probe Modulation Factor = 2.82

Device Reference Point: 0.000, 0.000, 353.7 mm

Reference Value = 58.0 V/m; Power Drift = 0.023 dB

Hearing Aid Near-Field Category: M3 (AWF -5 dB)



|          |          |          |
|----------|----------|----------|
| Grid 1   | Grid 2   | Grid 3   |
| 141.8 M4 | 146.5 M4 | 133.9 M4 |
| Grid 4   | Grid 5   | Grid 6   |
| 148.8 M4 | 152.3 M3 | 140.3 M4 |
| Grid 7   | Grid 8   | Grid 9   |
| 138.4 M4 | 142.3 M4 | 130.9 M4 |

Date/Time: 2008-04-18 11:27:03

Test Laboratory: TCC Nokia

Type: RM-188; Serial: 353249/01/306356/1

Communication System: GSM850 (H3DV6)

Frequency: 848.8 MHz; Duty Cycle: 1:6.79

Medium: Air; Medium Notes: Not Specified

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 - SN6053; Probe Notes:
- ; Calibrated: 21.01.2008
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn454; Calibrated: 29.01.2008
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

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

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

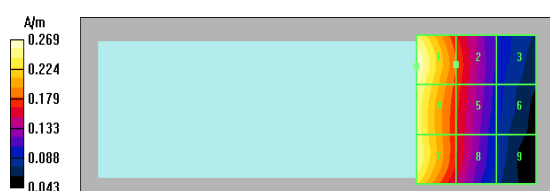
Maximum value of peak Total field = 0.269 A/m

Probe Modulation Factor = 2.61

Device Reference Point: 0.000, 0.000, 353.7 mm

Reference Value = 0.051 A/m; Power Drift = -0.010 dB

Hearing Aid Near-Field Category: M4 (AWF -5 dB)



|          |          |          |
|----------|----------|----------|
| Grid 1   | Grid 2   | Grid 3   |
| 0.269 M4 | 0.180 M4 | 0.104 M4 |
| Grid 4   | Grid 5   | Grid 6   |
| 0.261 M4 | 0.175 M4 | 0.099 M4 |
| Grid 7   | Grid 8   | Grid 9   |
| 0.256 M4 | 0.167 M4 | 0.092 M4 |

## MEASUREMENT DATA GSM1900, CHANNEL MIDDLE (1880 MHz)

Date/Time: 2008-04-18 09:50:43

Test Laboratory: TCC Nokia

Type: RM-188; Serial: 353249/01/306356/1

Communication System: GSM1900 (ER3DV6)

Frequency: 1880 MHz; Duty Cycle: 1:7.92

Medium: Air; Medium Notes: Not Specified

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 - SN2333; Probe Notes:
- ConvF(1, 1, 1); Calibrated: 21.01.2008
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn454; Calibrated: 29.01.2008
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

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

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

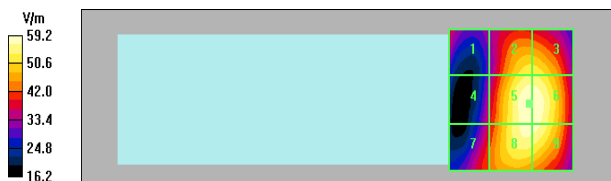
Maximum value of peak Total field = 59.2 V/m

Probe Modulation Factor = 2.82

Device Reference Point: 0.000, 0.000, 353.7 mm

Reference Value = 20.3 V/m; Power Drift = 0.017 dB

Hearing Aid Near-Field Category: M3 (AWF -5 dB)



|         |         |         |
|---------|---------|---------|
| Grid 1  | Grid 2  | Grid 3  |
| 38.4 M4 | 53.9 M3 | 53.9 M3 |
| Grid 4  | Grid 5  | Grid 6  |
| 38.3 M4 | 59.2 M3 | 59.1 M3 |
| Grid 7  | Grid 8  | Grid 9  |
| 42.9 M4 | 58.1 M3 | 58.0 M3 |

Date/Time: 2008-04-18 12:34:04

Test Laboratory: TCC Nokia

Type: RM-188; Serial: 353249/01/306356/1

Communication System: GSM1900 (H3DV6)

Frequency: 1880 MHz; Duty Cycle: 1:4.13

Medium: Air; Medium Notes: Not Specified

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 - SN6053; Probe Notes:
- ; Calibrated: 21.01.2008
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn454; Calibrated: 29.01.2008
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

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

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

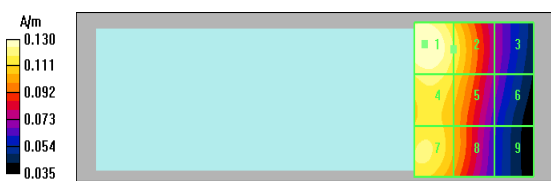
Maximum value of peak Total field = 0.130 A/m

Probe Modulation Factor = 2.03

Device Reference Point: 0.000, 0.000, 353.7 mm

Reference Value = 0.045 A/m; Power Drift = -0.010 dB

Hearing Aid Near-Field Category: M4 (AWF -5 dB)



|          |          |          |
|----------|----------|----------|
| Grid 1   | Grid 2   | Grid 3   |
| 0.130 M4 | 0.117 M4 | 0.075 M4 |
| Grid 4   | Grid 5   | Grid 6   |
| 0.122 M4 | 0.112 M4 | 0.072 M4 |
| Grid 7   | Grid 8   | Grid 9   |
| 0.119 M4 | 0.105 M4 | 0.063 M4 |

## MEASUREMENT DATA GSM1900, CHANNEL HIGH (1909.8 MHz)

Date/Time: 2008-04-18 10:00:04

Test Laboratory: TCC Nokia

Type: RM-188; Serial: 353249/01/306356/1

Communication System: GSM1900 (ER3DV6)

Frequency: 1909.8 MHz; Duty Cycle: 1:7.92

Medium: Air; Medium Notes: Not Specified

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 - SN2333; Probe Notes:
- ConvF(1, 1, 1); Calibrated: 21.01.2008
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn454; Calibrated: 29.01.2008
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

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

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

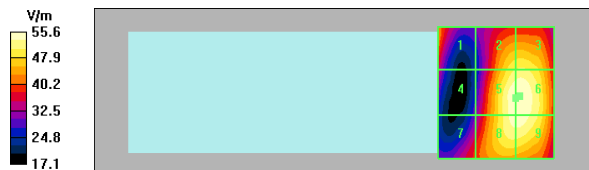
Maximum value of peak Total field = 55.6 V/m

Probe Modulation Factor = 2.82

Device Reference Point: 0.000, 0.000, 353.7 mm

Reference Value = 17.4 V/m; Power Drift = -0.008 dB

**Hearing Aid Near-Field Category: M3 (AWF -5 dB)**



|         |         |         |
|---------|---------|---------|
| Grid 1  | Grid 2  | Grid 3  |
| 44.2 M4 | 50.7 M3 | 51.1 M3 |
| Grid 4  | Grid 5  | Grid 6  |
| 36.4 M4 | 55.3 M3 | 55.6 M3 |
| Grid 7  | Grid 8  | Grid 9  |
| 39.1 M4 | 54.6 M3 | 54.8 M3 |

Date/Time: 2008-04-18 12:39:21

Test Laboratory: TCC Nokia

Type: RM-188; Serial: 353249/01/306356/1

Communication System: GSM1900 (H3DV6)

Frequency: 1909.8 MHz; Duty Cycle: 1:4.13

Medium: Air; Medium Notes: Not Specified

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 - SN6053; Probe Notes:
- ; Calibrated: 21.01.2008
- Sensor-Surface: (Fix Surface)
- Electronics: DAE3 Sn454; Calibrated: 29.01.2008
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

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

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

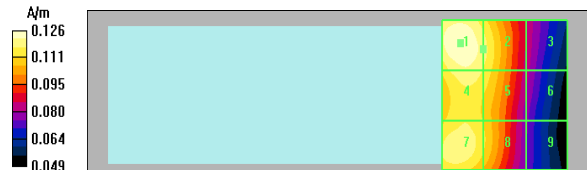
Maximum value of peak Total field = 0.126 A/m

Probe Modulation Factor = 2.03

Device Reference Point: 0.000, 0.000, 353.7 mm

Reference Value = 0.049 A/m; Power Drift = -0.009 dB

**Hearing Aid Near-Field Category: M4 (AWF -5 dB)**



|          |          |          |
|----------|----------|----------|
| Grid 1   | Grid 2   | Grid 3   |
| 0.126 M4 | 0.118 M4 | 0.085 M4 |
| Grid 4   | Grid 5   | Grid 6   |
| 0.120 M4 | 0.115 M4 | 0.083 M4 |
| Grid 7   | Grid 8   | Grid 9   |
| 0.119 M4 | 0.112 M4 | 0.077 M4 |

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**APPENDIX C: RELEVANT PAGES FROM PROBE CALIBRATION REPORT(S)**



Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **Nokia Salo TCC**

Certificate No: ER3-2333\_Jan08

CALIBRATION CERTIFICATE

Object **ER3DV6 - SN:2333**

Calibration procedure(s) **QA CAL-02.v5**  
**Calibration procedure for E-field probes optimized for close near field evaluations in air**

Calibration date: **January 21, 2008**

Condition of the calibrated item **In Tolerance**

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards          | ID #            | Cal Date (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-07 (SPEAG, No. ER3-2328_Oct07)      | Oct-08                 |
| 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 Oct-07)   | In house check: Oct-09 |
| Network Analyzer HP 8753E  | US37390585      | 18-Oct-01 (SPEAG, in house check Oct-07)  | In house check: Oct-08 |

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

Issued: January 21, 2008

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



Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **Nokia Salo TCC**

Certificate No: **H3-6053\_Jan08**

CALIBRATION CERTIFICATE

|                                  |                                                                                                            |
|----------------------------------|------------------------------------------------------------------------------------------------------------|
| Object                           | H3DV6 - SN:6053                                                                                            |
| Calibration procedure(s)         | QA CAL-03.v5<br>Calibration procedure for H-field probes optimized for close near field evaluations in air |
| Calibration date:                | January 21, 2008                                                                                           |
| Condition of the calibrated item | In Tolerance                                                                                               |

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

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards          | ID #                  | Cal Date (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-07 (SPEAG, No. H3-6182_Oct07)       | Oct-08                 |
| 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 Oct-07)   | In house check: Oct-09 |
| Network Analyzer HP 8753E  | US37390585            | 18-Oct-01 (SPEAG, in house check Oct-07)  | In house check: Oct-08 |
| Calibrated by:             | Name<br>Katja Pokovic | Function<br>Technical Manager             | Signature<br>          |
| Approved by:               | Niels Kuster          | Quality Manager                           |                        |
| Issued: January 21, 2008   |                       |                                           |                        |

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**APPENDIX D: RELEVANT PAGES FROM DIPOLE VALIDATION KIT REPORT(S)**



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

Accreditation No.: SCS 108

Client **Nokia Salo TCC**

Certificate No: **CD835V3-1004\_Feb07**

CALIBRATION CERTIFICATE

Object **CD835V3 - SN: 1004**

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

Calibration date: **February 13, 2007**

Condition of the calibrated item **In Tolerance**

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards         | ID #       | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration  |
|---------------------------|------------|-------------------------------------------|------------------------|
| DAE4                      | SN: 660    | 1-Mar-06 (SPEAG, No. DAE4-660_Mar06)      | Calibration, Mar-07    |
| Probe ER3DV6              | SN: 2336   | 27-Dec-06 (SPEAG, No. ER3-2336_Dec06)     | Calibration, Dec-07    |
| Probe H3DV6               | SN: 6065   | 27-Dec-06 (SPEAG, No. H3-6065-Dec06)      | Calibration, Dec-07    |
| Secondary Standards       | ID #       | Check Date (in house)                     | Scheduled Check        |
| Power meter EPM-4419B     | GB43310788 | 12-Aug-03 (SPEAG, in house check Oct-06)  | In house check: Oct-07 |
| Power sensor HP 8481A     | MY41093312 | 10-Aug-03 (SPEAG, in house check Oct-06)  | In house check: Oct-08 |
| Power sensor HP 8481A     | MY41093315 | 10-Aug-03 (SPEAG, in house check Oct-06)  | In house check: Oct-08 |
| Network Analyzer HP 8753E | US37390585 | 18-Oct-01 (SPEAG, in house check Oct-06)  | In house check: Oct-07 |
| RF generator R&S SMT06    | SN: 100005 | 26-Jul-04 (SPEAG, in house check Nov-05)  | In house check: Nov-07 |

|                |                                |                                          |               |
|----------------|--------------------------------|------------------------------------------|---------------|
| Calibrated by: | Name<br><b>Claudio Leubler</b> | Function<br><b>Laboratory Technician</b> | Signature<br> |
| Approved by:   | Name<br><b>Fin Bomholt</b>     | Technical Director                       |               |

Issued: March 6, 2007

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

1 Measurement Conditions

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

|                                    |                  |                      |
|------------------------------------|------------------|----------------------|
| DASY Version                       | DASY4            | V4.7 B53             |
| DASY PP Version                    | SEMCAD           | V1.8 B172            |
| Phantom                            | HAC Test Arch    | SD HAC P01 BA, #1002 |
| Distance Dipole Top - Probe Center | 10 mm            |                      |
| Scan resolution                    | dx, dy = 5 mm    | area = 20 x 180 mm   |
| Frequency                          | 835 MHz ± 1 MHz  |                      |
| Forward power at dipole connector  | 20.0 dBm = 100mW |                      |
| Input power drift                  | < 0.07 dB        |                      |

2 Maximum Field values

|                                    |                      |                      |
|------------------------------------|----------------------|----------------------|
| H-field 10 mm above dipole surface | condition            | interpolated maximum |
| Maximum measured                   | 100 mW forward power | 0.452 A/m            |

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

|                                    |                      |                      |
|------------------------------------|----------------------|----------------------|
| E-field 10 mm above dipole surface | condition            | Interpolated maximum |
| Maximum measured above high end    | 100 mW forward power | 161.7 V/m            |
| Maximum measured above low end     | 100 mW forward power | 158.3 V/m            |
| Averaged maximum above arm         | 100 mW forward power | 160.0 V/m            |

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

3 Appendix

3.1 Antenna Parameters

|           |             |                      |
|-----------|-------------|----------------------|
| Frequency | Return Loss | Impedance            |
| 800 MHz   | 16.8 dB     | ( 42.5 – j11.2 ) Ohm |
| 835 MHz   | 26.1 dB     | ( 52.9 + j4.2 ) Ohm  |
| 900 MHz   | 15.6 dB     | ( 57.3 – j16.4 ) Ohm |
| 950 MHz   | 24.7 dB     | ( 45.3 + j2.9 ) Ohm  |
| 960 MHz   | 19.1 dB     | ( 51.7 + j11.2 ) Ohm |

3.2 Antenna Design and Handling

The calibration dipole has a symmetric geometry with a built-in two stub matching network, which leads to the enhanced bandwidth.

The dipole is built of standard semirigid coaxial cable. The internal matching line is open ended. The antenna is therefore open for DC signals.

Do not apply force to dipole arms, as they are liable to bend. The soldered connections near the feedpoint may be damaged. After excessive mechanical stress or overheating, check the impedance characteristics to ensure that the internal matching network is not affected.

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

3.3.2 DASY4 H-Field Result

Date/Time: 2/13/2007 10:40:13 AM

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: HAC-Dipole 835 MHz; Type: CD835V3; Serial: 1004

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

Medium: Air

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 - SN6065; ; Calibrated: 12/27/2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn660: Calibrated: 3/1/2006
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: 1002
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

H Scan - Sensor Center 10mm above CD835 Dipole/Hearing Aid Compatibility Test (41x361x1):

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

Maximum value of peak Total field = 0.452 A/m

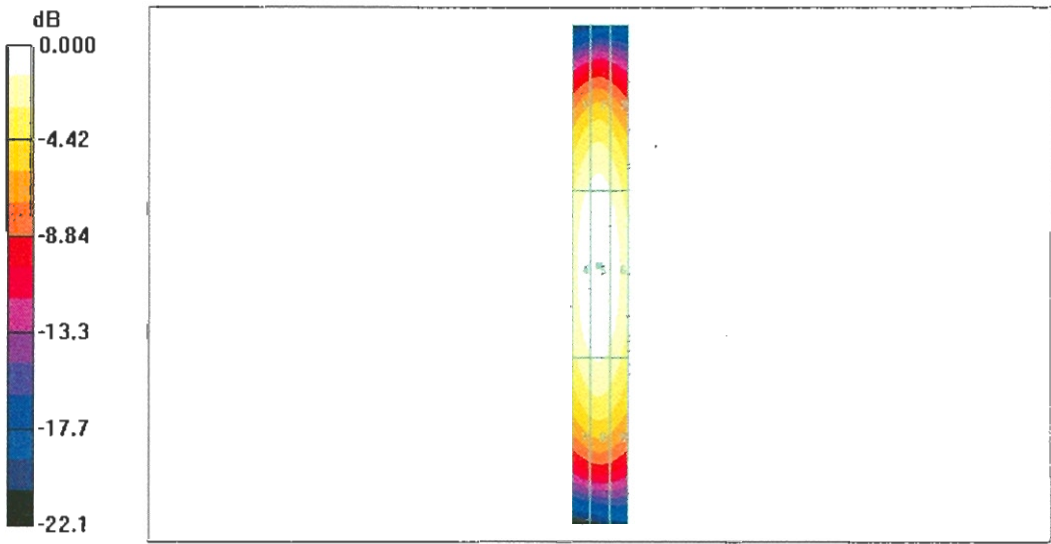
Probe Modulation Factor = 1.00

Reference Value = 0.479 A/m; Power Drift = 0.012 dB

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

Peak H-field in A/m

|        |        |        |
|--------|--------|--------|
| Grid 1 | Grid 2 | Grid 3 |
| 0.393  | 0.408  | 0.380  |
| Grid 4 | Grid 5 | Grid 6 |
| 0.436  | 0.452  | 0.425  |
| Grid 7 | Grid 8 | Grid 9 |
| 0.374  | 0.387  | 0.365  |



3.3.3 DASY4 E-Field Result

Date/Time: 2/13/2007 2:25:30 PM

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: HAC-Dipole 835 MHz; Type: D835V3; Serial: 1004

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

Medium: Air

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 - SN2336; ConvF(1, 1, 1); Calibrated: 12/27/2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn660; Calibrated: 3/1/2006
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: 1002
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

E Scan - Sensor Center 10mm above CD835 Dipole/Hearing Aid Compatibility Test (41x361x1):

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

Maximum value of peak Total field = 161.7 V/m

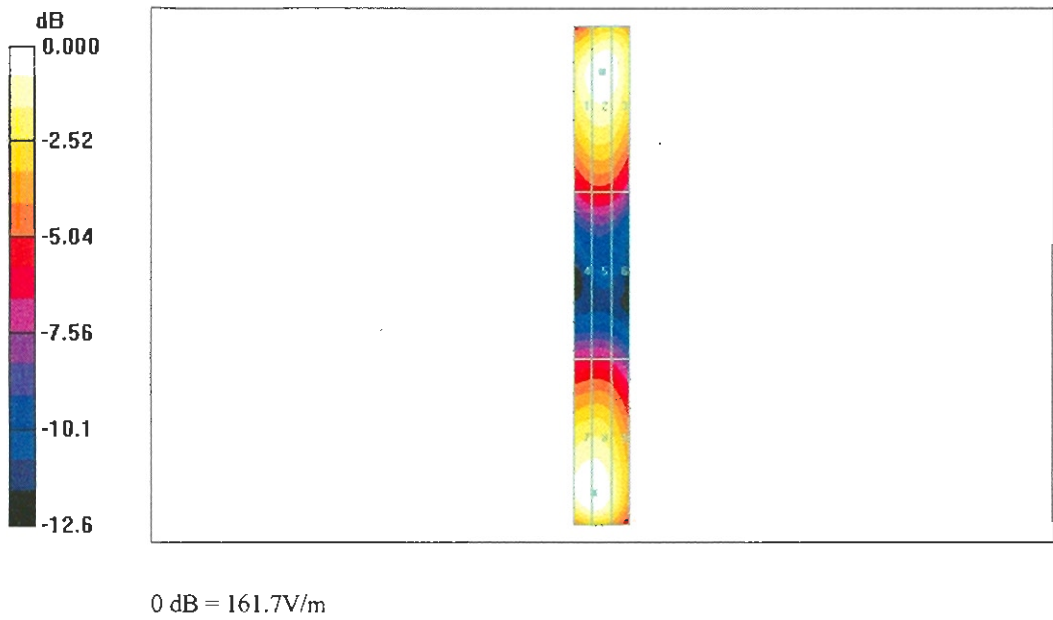
Probe Modulation Factor = 1.00

Reference Value = 107.2 V/m; Power Drift = 0.001 dB

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

Peak E-field in V/m

|        |        |        |
|--------|--------|--------|
| Grid 1 | Grid 2 | Grid 3 |
| 153.2  | 158.3  | 154.4  |
| Grid 4 | Grid 5 | Grid 6 |
| 84.7   | 85.8   | 82.6   |
| Grid 7 | Grid 8 | Grid 9 |
| 161.6  | 161.7  | 143.5  |





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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **Nokia Salo TCC**

Certificate No: **CD1880V3-1003\_Feb07**

**CALIBRATION CERTIFICATE**

|                                  |                                                          |
|----------------------------------|----------------------------------------------------------|
| Object                           | CD1880V3 - SN: 1003                                      |
| Calibration procedure(s)         | QA CAL-20.v4<br>Calibration procedure for dipoles in air |
| Calibration date:                | February 12, 2007                                        |
| Condition of the calibrated item | In Tolerance                                             |

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

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards         | ID #       | Cal Date (Calibrated by, Certificate No.) | Scheduled Calibration  |
|---------------------------|------------|-------------------------------------------|------------------------|
| DAE4                      | SN: 660    | 1-Mar-06 (SPEAG, No. DAE4-660_Mar06)      | Calibration, Mar-07    |
| Probe ER3DV6              | SN: 2336   | 27-Dec-06 (SPEAG, No. ER3-2336_Dec06)     | Calibration, Dec-07    |
| Probe H3DV6               | SN: 6065   | 27-Dec-06 (SPEAG, No. H3-6065-Dec06)      | Calibration, Dec-07    |
| Secondary Standards       | ID #       | Check Date (in house)                     | Scheduled Check        |
| Power meter EPM-4419B     | GB43310788 | 12-Aug-03 (SPEAG, in house check Oct-06)  | In house check: Oct-07 |
| Power sensor HP 8481A     | MY41093312 | 10-Aug-03 (SPEAG, in house check Oct-06)  | In house check: Oct-08 |
| Power sensor HP 8481A     | MY41093315 | 10-Aug-03 (SPEAG, in house check Oct-06)  | In house check: Oct-08 |
| Network Analyzer HP 8753E | US37390585 | 18-Oct-01 (SPEAG, in house check Oct-06)  | In house check: Oct-07 |
| RF generator R&S SMT06    | SN: 100005 | 26-Jul-04 (SPEAG, in house check Nov-05)  | In house check: Nov-07 |

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

Issued: February 14, 2007

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1 Measurement Conditions

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

|                                    |                  |                      |
|------------------------------------|------------------|----------------------|
| DASY Version                       | DASY4            | V4.7 B53             |
| DASY PP Version                    | SEMCAD           | V1.8 B172            |
| Phantom                            | HAC Test Arch    | SD HAC P01 BA, #1002 |
| Distance Dipole Top - Probe Center | 10 mm            |                      |
| Scan resolution                    | dx, dy = 5 mm    | area = 20 x 90 mm    |
| Frequency                          | 1880 MHz ± 1 MHz |                      |
| Forward power at dipole connector  | 20.0 dBm = 100mW |                      |
| Input power drift                  | < 0.05 dB        |                      |

2 Maximum Field values

|                                    |                      |                      |
|------------------------------------|----------------------|----------------------|
| H-field 10 mm above dipole surface | condition            | Interpolated maximum |
| Maximum measured                   | 100 mW forward power | 0.452 A/m            |

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

|                                    |                      |                      |
|------------------------------------|----------------------|----------------------|
| E-field 10 mm above dipole surface | condition            | Interpolated maximum |
| Maximum measured above high end    | 100 mW forward power | 130.9 V/m            |
| Maximum measured above low end     | 100 mW forward power | 126.7 V/m            |
| Averaged maximum above arm         | 100 mW forward power | 128.8 V/m            |

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

3 Appendix

3.1 Antenna Parameters

|           |             |                      |
|-----------|-------------|----------------------|
| Frequency | Return Loss | Impedance            |
| 1710 MHz  | 19.0 dB     | ( 49.8 + j11.3 ) Ohm |
| 1880 MHz  | 19.9 dB     | ( 53.7 + j9.9 ) Ohm  |
| 1900 MHz  | 19.8 dB     | ( 56.3 + j9.0 ) Ohm  |
| 1950 MHz  | 23.7 dB     | ( 57.0 – j0.7 ) Ohm  |
| 2000 MHz  | 26.2 dB     | ( 45.4 + j0.7 ) Ohm  |

3.2 Antenna Design and Handling

The calibration dipole has a symmetric geometry with a built-in two stub matching network, which leads to the enhanced bandwidth.

The dipole is built of standard semirigid coaxial cable. The internal matching line is open ended. The antenna is therefore open for DC signals.

Do not apply force to dipole arms, as they are liable to bend. The soldered connections near the feedpoint may be damaged. After excessive mechanical stress or overheating, check the impedance characteristics to ensure that the internal matching network is not affected.

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

3.3.2 DASY4 H-Field Result

Date/Time: 2/12/2007 4:55:48 PM

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1003

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

Medium: Air

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 - SN6065; ; Calibrated: 12/27/2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn660; Calibrated: 3/1/2006
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: 1002
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

H Scan - Sensor Center 10mm above CD1880V3 Dipole/Hearing Aid Compatibility Test (41x181x1):

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

Maximum value of peak Total field = 0.452 A/m

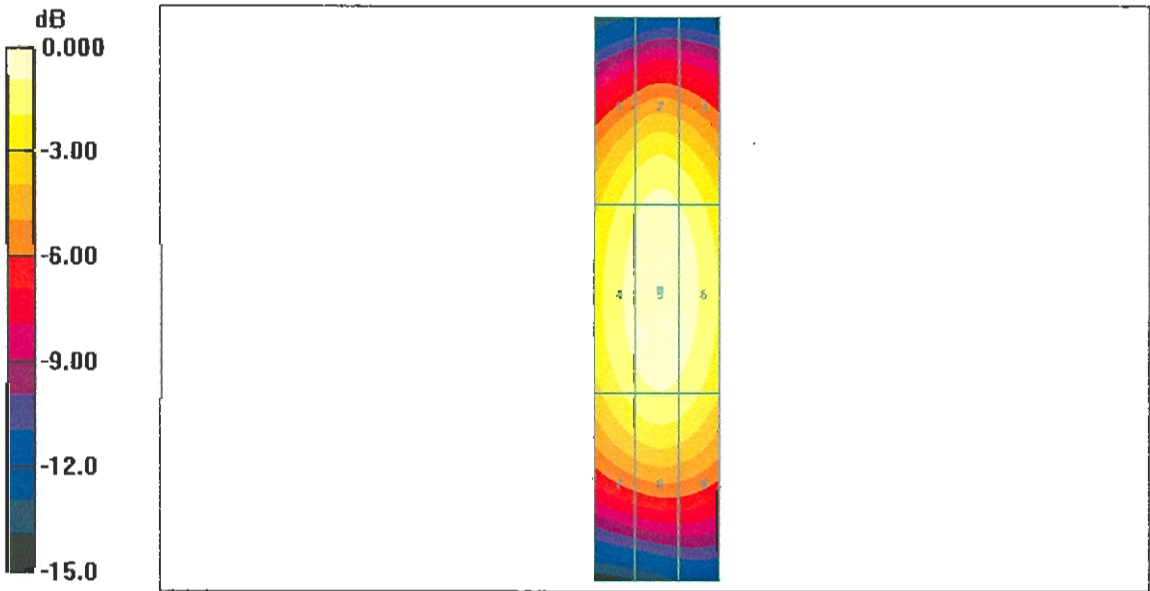
Probe Modulation Factor = 1.00

Reference Value = 0.476 A/m; Power Drift = 0.007 dB

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

Peak H-field in A/m

|        |        |        |
|--------|--------|--------|
| Grid 1 | Grid 2 | Grid 3 |
| 0.392  | 0.419  | 0.404  |
| Grid 4 | Grid 5 | Grid 6 |
| 0.425  | 0.452  | 0.437  |
| Grid 7 | Grid 8 | Grid 9 |
| 0.378  | 0.401  | 0.388  |



0 dB = 0.452A/m

3.3.3 DASY4 E-Field Result

Date/Time: 2/12/2007 2:59:33 PM

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1003

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

Medium: Air

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 - SN2336; ConvF(1, 1, 1); Calibrated: 12/27/2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn660; Calibrated: 3/1/2006
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: 1002
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

E Scan - Sensor Center 10mm above CD1880V3 Dipole/Hearing Aid Compatibility Test (41x181x1):

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

Maximum value of peak Total field = 130.9 V/m

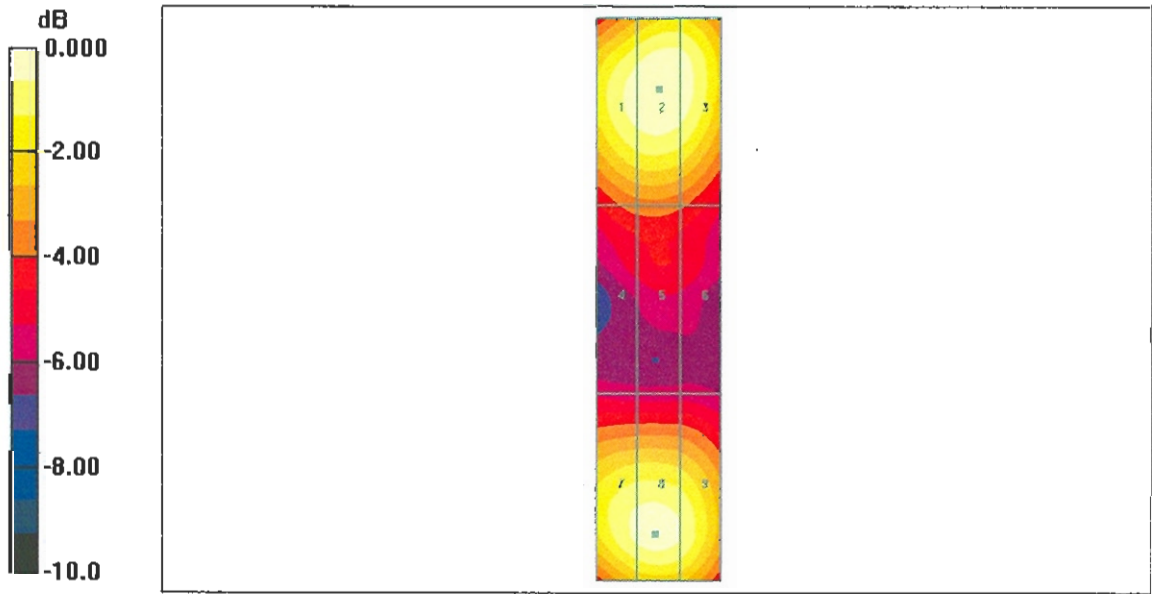
Probe Modulation Factor = 1.00

Reference Value = 139.0 V/m; Power Drift = 0.015 dB

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

Peak E-field in V/m

|        |        |        |
|--------|--------|--------|
| Grid 1 | Grid 2 | Grid 3 |
| 126.8  | 130.9  | 127.9  |
| Grid 4 | Grid 5 | Grid 6 |
| 86.2   | 87.1   | 84.0   |
| Grid 7 | Grid 8 | Grid 9 |
| 123.9  | 126.7  | 121.4  |



0 dB = 130.9V/m