

Client

NOKIA TCC SALO

Certificate No: CD835V3-1004\_Feb05

## CALIBRATION CERTIFICATE

Object

CD835V3 - SN: 1004

Calibration procedure(s)

QA CAL-20.v2  
 Calibration procedure for dipoles in air

Calibration date:

February, 23, 2005

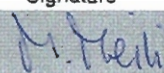
Condition of the calibrated item

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 ( $22 \pm 3$ )°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 EPM E442        | GB37480704       | 12-Oct-04 (METAS, No. 251-00412)          | Oct-05                 |
| Power sensor HP 8481A       | US37292783       | 12-Oct-04 (METAS, No. 251-00412)          | Oct-05                 |
| Reference 20 dB Attenuator  | SN: 5086 (20g)   | 10-Aug-04 (METAS, No 251-00402)           | Aug-05                 |
| Reference 10 dB Attenuator  | SN: 5047.2 (10r) | 10-Aug-04 (METAS, No 251-00402)           | Aug-05                 |
| Reference Probe ER3DV6      | SN 2328          | 06-Oct-04 (SPEAG, No. ER3-2328_Oct04)     | Oct-05                 |
| DAE4                        | SN 601           | 07-Jan-05 (SPEAG, No. DAE4-601_Jan05)     | Jan-06                 |
| Secondary Standards         | ID #             | Check Date (in house)                     | Scheduled Check        |
| Power sensor HP 8481A       | MY41092312       | 10-Aug-03 (SPEAG, in house check Jan-04)  | In house check: Oct-05 |
| Power sensor HP 8481A       | MY41093315       | 10-Aug-03 (SPEAG, in house check Jan-04)  | In house check: Oct-05 |
| RF generator Agilent E8251A | US41140111       | 4-Aug-03 (Agilent)                        | In house check: Aug-05 |
| Network Analyzer HP 8753E   | US37390585 S4206 | 18-Oct-01 (SPEAG, in house check Nov-04)  | In house check: Nov-05 |
| Probe H3DV6                 | SN: 6065         | 10-Oct-04 (SPEAG, No. H3-6065-Oct04)      | Calibration, Oct-05    |

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

Issued: February 27, 2005

This calibration certificate is issued as an intermediate solution until the specific calibration procedure is submitted and accepted in the frame of the accreditation of the Calibration Laboratory of Schmid & Partner Engineering AG (based on ISO/IEC 17025 International Standard)

1 Measurement Conditions

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

|                                    |                  |                      |
|------------------------------------|------------------|----------------------|
| DASY Version                       | DASY4            | V4.5 B13             |
| DASY PP Version                    | SEMCAD           | V1.8 B144            |
| 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                  | < 0.05 dB        |                      |

2 Maximum Field values

|                                    |                      |                      |
|------------------------------------|----------------------|----------------------|
| H-field 10 mm above dipole surface | condition            | interpolated maximum |
| Maximum measured                   | 100 mW forward power | 0.439 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 | 166.8 V/m            |
| Maximum measured above low end     | 100 mW forward power | 157.4 V/m            |
| Averaged maximum above arm         | 100 mW forward power | 162.1 V/m            |

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

3 Appendix

3.1 Antenna Parameters

|           |             |                      |
|-----------|-------------|----------------------|
| Frequency | Return Loss | Impedance            |
| 800 MHz   | 18.3 dB     | ( 42.0 - j7.9 ) Ohm  |
| 835 MHz   | 26.2 dB     | ( 54.9 + j1.6 ) Ohm  |
| 900 MHz   | 15.7 dB     | ( 50.2 - j16.7 ) Ohm |
| 950 MHz   | 23.6 dB     | ( 48.1 + j6.2 ) Ohm  |
| 960 MHz   | 18.3 dB     | ( 57.8 + j10.7 ) 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.

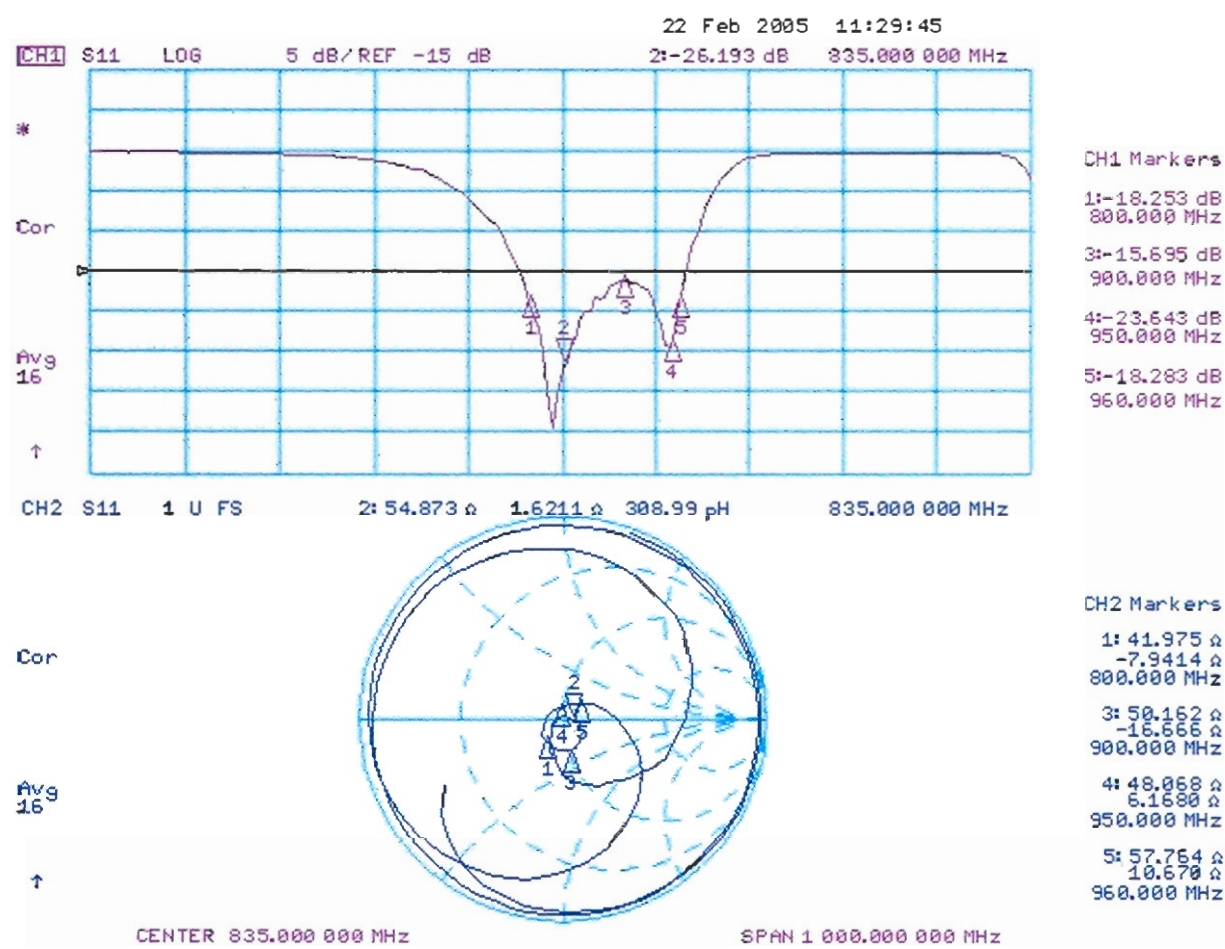
The dipole is built of standard semirigid coaxial cable. The internal matching line is open ended. The antenna is therefore open for DC signals.

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 Measurement Sheets

3.3.1 Return Loss and Smith Chart



3.3.2 DASY4 H-field result

See page 5

3.3.3 DASY4 E-Field result

See page 6

Test Laboratory: SPEAG, Zurich, Switzerland  
 File Name: [H\\_CD835\\_1004\\_050222.da4](#)

**DUT: HAC-Dipole 835 MHz; Type: D835V3; Serial: 1004**  
**Program Name: HAC H Dipole**

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 - SN6065; ; Calibrated: 10.12.2004
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn901; Calibrated: 29.06.2004
- Phantom: HAC Phantom; Type: SD HAC P01 BA; Serial: 1002
- Measurement SW: DASY4, V4.5 Build 13; Postprocessing SW: SEMCAD, V1.8 Build 144

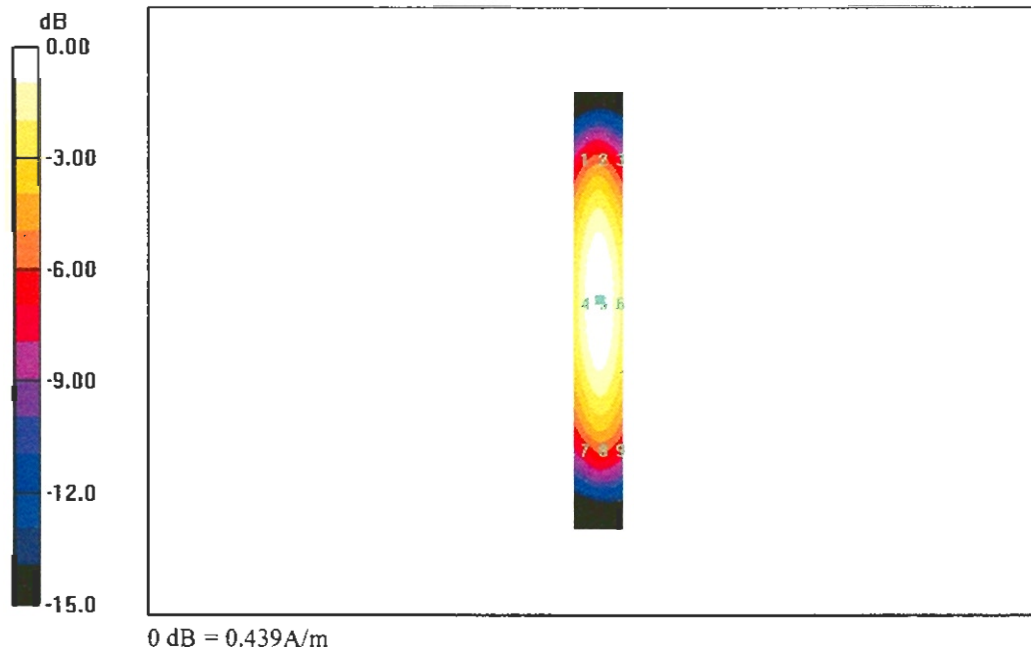
**E Scan 10mm above CD 835 MHz/Hearing Aid Compatibility Test (41x361x1):** Measurement grid: dx=5mm, dy=5mm, dz=5.5555mm

Maximum value of Total field (slot averaged) = 0.439 A/m

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

H in A/m (Time averaged)    H in A/m (Slot averaged)

|              |               |              |              |               |              |
|--------------|---------------|--------------|--------------|---------------|--------------|
| Grid 1       | Grid 2        | Grid 3       | Grid 1       | Grid 2        | Grid 3       |
| <b>0.369</b> | <b>0.397</b>  | <b>0.379</b> | <b>0.369</b> | <b>0.397</b>  | <b>0.379</b> |
| Grid 4       | <b>Grid 5</b> | Grid 6       | Grid 4       | <b>Grid 5</b> | Grid 6       |
| <b>0.406</b> | <b>0.439</b>  | <b>0.422</b> | <b>0.406</b> | <b>0.439</b>  | <b>0.422</b> |
| Grid 7       | Grid 8        | Grid 9       | Grid 7       | Grid 8        | Grid 9       |
| <b>0.344</b> | <b>0.374</b>  | <b>0.362</b> | <b>0.344</b> | <b>0.374</b>  | <b>0.362</b> |



Test Laboratory: SPEAG, Zurich, Switzerland  
File Name: [E\\_CD835\\_1004\\_050223.da4](#)

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

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

DASY4 Configuration:  
- Probe: ER3DV6 - SN2328; ConvF(1, 1, 1); Calibrated: 06.10.2004  
- Sensor-Surface: (Fix Surface)  
- Electronics: DAE4 Sn901; Calibrated: 29.06.2004  
- Phantom: HAC Phantom; Type: SD HAC P01 BA; Serial: 1002  
- Measurement SW: DASY4, V4.5 Build 13; Postprocessing SW: SEMCAD, V1.8 Build 144

E Scan 10mm above CD 835 MHz/Hearing Aid Compatibility Test (41x361x1): Measurement grid: dx=5mm, dy=5mm, dz=5.5555mm  
Maximum value of Total field (slot averaged) = 166.8 V/m  
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

| E in V/m (Time averaged) |        |        | E in V/m (Slot averaged) |        |        |
|--------------------------|--------|--------|--------------------------|--------|--------|
| Grid 1                   | Grid 2 | Grid 3 | Grid 1                   | Grid 2 | Grid 3 |
| 165.6                    | 166.8  | 155.5  | 165.6                    | 166.8  | 155.5  |
| Grid 4                   | Grid 5 | Grid 6 | Grid 4                   | Grid 5 | Grid 6 |
| 89.7                     | 90.9   | 85.8   | 89.7                     | 90.9   | 85.8   |
| Grid 7                   | Grid 8 | Grid 9 | Grid 7                   | Grid 8 | Grid 9 |
| 151.3                    | 157.4  | 153.4  | 151.3                    | 157.4  | 153.4  |

