

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

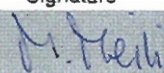
Condition of the calibrated item

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 $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter 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.

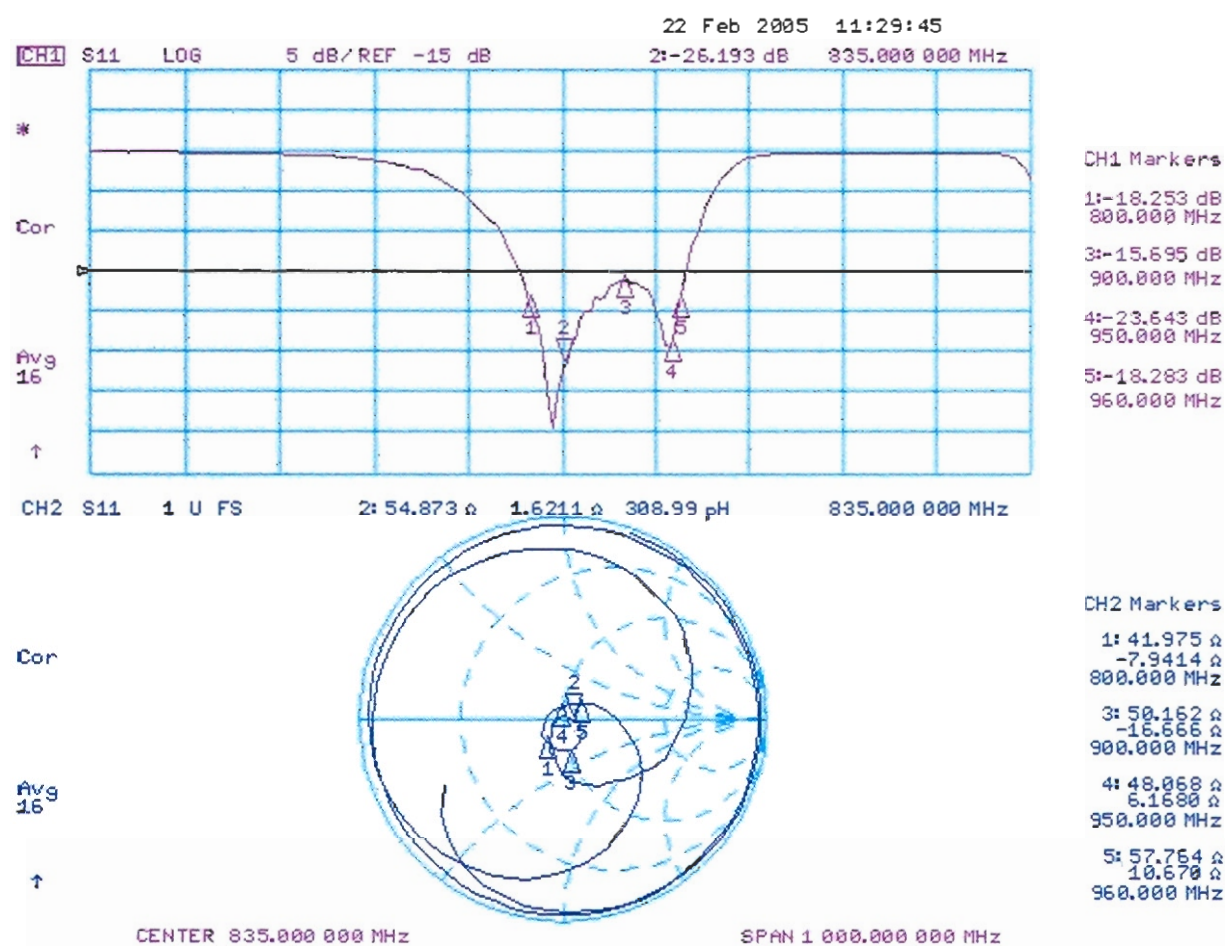
The dipole is built of standard semirigid coaxial cable. The internal matching line is open ended. The antenna is therefore open for DC signals.

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/m³

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

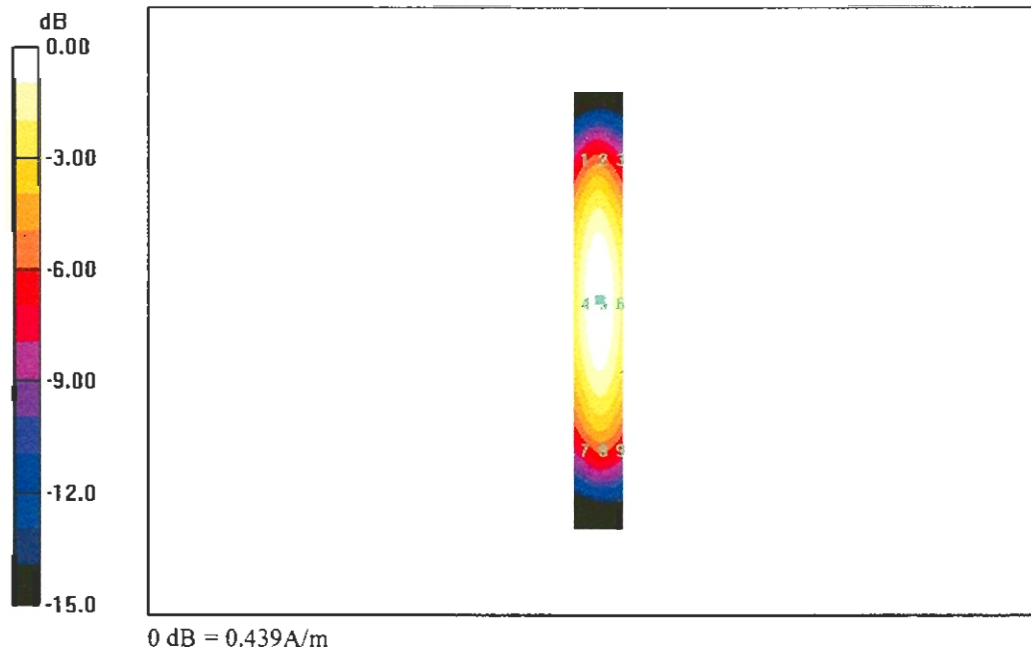
E Scan 10mm above CD 835 MHz/Hearing Aid Compatibility Test (41x361x1): Measurement grid: dx=5mm, dy=5mm, dz=5.5555mm

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
0.369	0.397	0.379	0.369	0.397	0.379
Grid 4	Grid 5	Grid 6	Grid 4	Grid 5	Grid 6
0.406	0.439	0.422	0.406	0.439	0.422
Grid 7	Grid 8	Grid 9	Grid 7	Grid 8	Grid 9
0.344	0.374	0.362	0.344	0.374	0.362



Test Laboratory: SPEAG, Zurich, Switzerland
File Name: [E_CD835_1004_050223.da4](#)

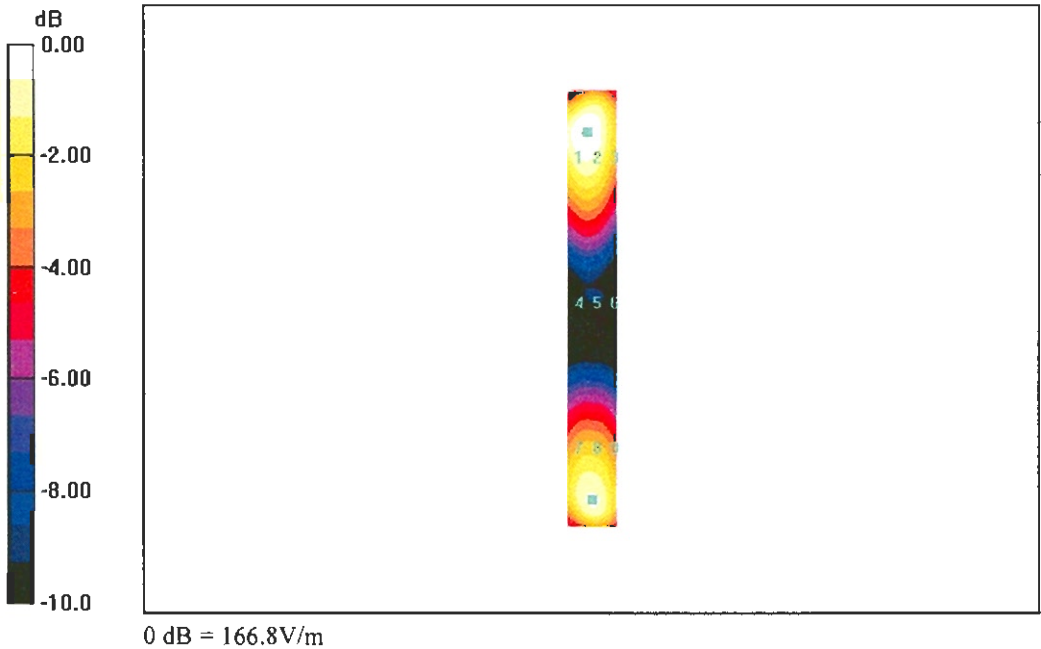
DUT: HAC-Dipole 835 MHz; Type: D835V3; Serial: 1004
Program Name: HAC E Dipole

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



Client

NOKIA TCC SALO

Certificate No: CD1880V3-1003_Feb05

CALIBRATION CERTIFICATE

Object **CD1880V3 - SN: 1003**

Calibration procedure(s) **QA CAL-20.v2
Calibration procedure for dipoles in air**

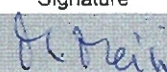
Calibration date: **February, 23, 2005**

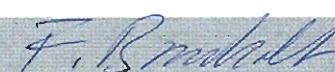
Condition of the calibrated item **In Tolerance**

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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
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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
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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

Calibrated by: **Mike Meili** **Laboratory Technician** 

Approved by: **Fin Bomholt** **Technical Director** 

Issued: February 27, 2005

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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 90 mm
Frequency	1880 MHz $\pm$ 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	0.444 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	134.0 V/m
Maximum measured above low end	100 mW forward power	133.8 V/m
Averaged maximum above arm	100 mW forward power	133.9 V/m

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

3 Appendix

3.1 Antenna Parameters

Frequency	Return Loss	Impedance
1710 MHz	18.6 dB	(57.4 + j11.4) Ohm
1880 MHz	18.9 dB	(61.9 + j4.6) Ohm
1900 MHz	19.4 dB	(60.8 + j0.3) Ohm
1950 MHz	23.5 dB	(54.1 - j4.2) Ohm
2000 MHz	25.0 dB	(46.3 + j4.1) Ohm

3.2 Antenna Design and Handling

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

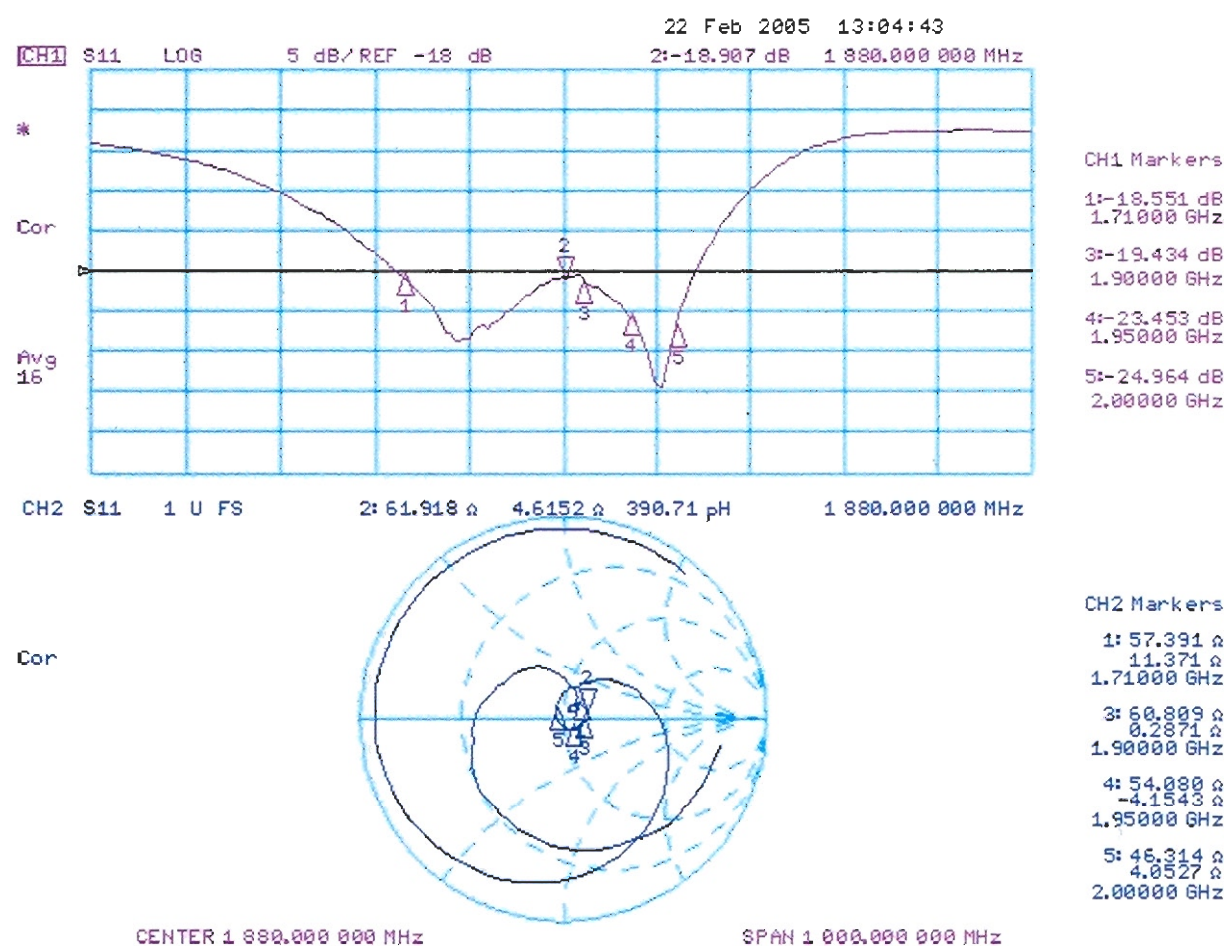
The dipole is built of standard semirigid coaxial cable. The internal matching line is open ended. The antenna is therefore open for DC signals.

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

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

3.3 Measurement Sheets

3.3.1 Return Loss and Smith Chart



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_CD1880_1003_050223.da4](#)

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1003
Program Name: HAC H Dipole

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

Medium parameters used: $\sigma = 0$; mho/m, $\epsilon_r = 1$; $\rho = 1$ kg/m³

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

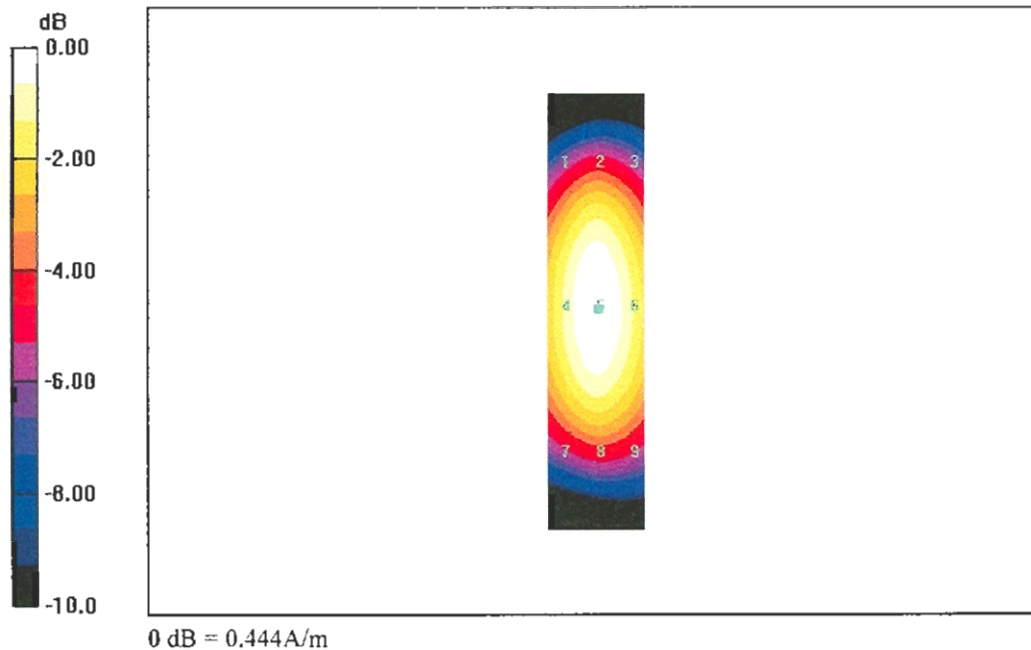
H Scan 10mm above CD 1880 MHz/Hearing Aid Compatibility Test (41x181x1): Measurement grid: dx=5mm, dy=5mm, dz=5.5555mm

Maximum value of Total field (slot averaged) = 0.444 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
0.377	0.406	0.389	0.377	0.406	0.389
Grid 4	Grid 5	Grid 6	Grid 4	Grid 5	Grid 6
0.416	0.444	0.427	0.416	0.444	0.427
Grid 7	Grid 8	Grid 9	Grid 7	Grid 8	Grid 9
0.375	0.400	0.385	0.375	0.400	0.385



Test Laboratory: SPEAG, Zurich, Switzerland
 File Name: [E_CD1880_1003_050223.da4](#)

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1003
Program Name: HAC E Dipole

Communication System: CW; Frequency: 1880 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 1880 MHz/Hearing Aid Compatibility Test (41x181x1): Measurement grid: dx=5mm, dy=5mm, dz=5.5555mm

Maximum value of Total field (slot averaged) = 134.0 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
128.7	133.8	131.0	128.7	133.8	131.0
Grid 4	Grid 5	Grid 6	Grid 4	Grid 5	Grid 6
89.7	92.3	88.8	89.7	92.3	88.8
Grid 7	Grid 8	Grid 9	Grid 7	Grid 8	Grid 9
127.5	134.0	131.4	127.5	134.0	131.4

