

APPENDIX E (DIPOLE CALIBRATION DATA)



Report No.: HCTA1108FM02

FCC ID:

JYCAPACHE

Date of Issue:

Aug. 24,2011

Calibration Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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Accreditation No.: SCS 108

Client HCT (Dymstec)

Certificate No: CD835V3-1024_Mar11

bject	CD835V3 - SN: 1024		
Calibration procedure(s)	QA CAL-20.v5 Calibration proc	edure for dipoles in air	
Calibration date:	March 15, 2011		
All calibrations have been condu	acted in the closed laboration RTE critical for calibration)	ational standards, which realize the physical un ory facility: environment temperature (22 \pm 3)°C	C and humidity < 70%.
Primary Standards	ID#	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Probe ER3DV6	SN: 2336	29-Dec-10 (No. ER3-2336_Dec10)	Dec-11
Probe H3DV6	SN: 6065	29-Dec-10 (No. H3-6065_Dec10)	Dec-11
DAE4	SN: 781	20-Oct-10 (No. DAE4-781_Oct10)	Oct-11
	ID#	Check Date (in house)	Scheduled Check
Secondary Standards	TVANTAL SANCTON STATE OF THE S	09-Oct-09 (in house check Oct-10)	In house check: Oct-11
	SN: GB42420191		
Power meter Agilent 4419B	SN: GB42420191 SN: 3318A09450	09-Oct-09 (in house check Oct-10)	In house check: Oct-11
Power meter Agilent 4419B Power sensor HP 8482H		09-Oct-09 (in house check Oct-10)	In house check: Oct-11
Power meter Agilent 4419B Power sensor HP 8482H Power sensor HP 8482A Network Analyzer HP 8753E	SN: 3318A09450		In house check: Oct-11 In house check: Oct-11 In house check; Oct-11
Power meter Agilent 4419B Power sensor HP 8482H Power sensor HP 8482A Network Analyzer HP 8753E	SN: 3318A09450 SN: US37295597	09-Oct-09 (in house check Oct-10) 09-Oct-09 (in house check Oct-10)	In house check: Oct-11
Secondary Standards Power meter Agilent 4419B Power sensor HP 8482H Power sensor HP 8482A Network Analyzer HP 8753E RF generator E4433B	SN: 3318A09450 SN: US37295597 US37390585 MY 41000675	09-Oct-09 (in house check Oct-10) 09-Oct-09 (in house check Oct-10) 18-Oct-01 (in house check Oct-10) 03-Nov-04 (in house check Oct-09)	In house check: Oct-11 In house check: Oct-11 In house check: Oct-11
Power meter Agilent 4419B Power sensor HP 8482H Power sensor HP 8482A Network Analyzer HP 8753E	SN: 3318A09450 SN: US37295597 US37390585	09-Oct-09 (in house check Oct-10) 09-Oct-09 (in house check Oct-10) 18-Oct-01 (in house check Oct-10)	In house check: Oct-11 In house check: Oct-11
Power meter Agilent 4419B Power sensor HP 8482H Power sensor HP 8482A Network Analyzer HP 8753E RF generator E4433B	SN: 3318A09450 SN: US37295597 US37390585 MY 41000675	09-Oct-09 (in house check Oct-10) 09-Oct-09 (in house check Oct-10) 18-Oct-01 (in house check Oct-10) 03-Nov-04 (in house check Oct-09) Function Laboratory Technician	In house check: Oct-11 In house check: Oct-11 In house check: Oct-11

Certificate No: CD835V3-1024_Mar11

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Accreditation No.: SCS 108

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The Swiss Accreditation Service is one of the signatories to the EA

Multilateral Agreement for the recognition of calibration certificates

References

[1] ANSI-C63.19-2007

American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids.

Methods Applied and Interpretation of Parameters:

- Coordinate System: y-axis is in the direction of the dipole arms. z-axis is from the basis of the antenna
 (mounted on the table) towards its feed point between the two dipole arms. x-axis is normal to the other
 axes. In coincidence with the standards [1], the measurement planes (probe sensor center) are
 selected to be at a distance of 10 mm above the top edge of the dipole arms.
- Measurement Conditions: Further details are available from the hardcopies at the end of the certificate.
 All figures stated in the certificate are valid at the frequency indicated. The forward power to the dipole connector is set with a calibrated power meter connected and monitored with an auxiliary power meter connected to a directional coupler. While the dipole under test is connected, the forward power is adjusted to the same level.
- Antenna Positioning: The dipole is mounted on a HAC Test Arch phantom using the matching dipole positioner with the arms horizontal and the feeding cable coming from the floor. The measurements are performed in a shielded room with absorbers around the setup to reduce the reflections. It is verified before the mounting of the dipole under the Test Arch phantom, that its arms are perfectly in a line. It is installed on the HAC dipole positioner with its arms parallel below the dielectric reference wire and able to move elastically in vertical direction without changing its relative position to the top center of the Test Arch phantom. The vertical distance to the probe is adjusted after dipole mounting with a DASY5 Surface Check job. Before the measurement, the distance between phantom surface and probe tip is verified. The proper measurement distance is selected by choosing the matching section of the HAC Test Arch phantom with the proper device reference point (upper surface of the dipole) and the matching grid reference point (tip of the probe) considering the probe sensor offset. The vertical distance to the probe is essential for the accuracy.
- Feed Point Impedance and Return Loss: These parameters are measured using a HP 8753E Vector Network Analyzer. The impedance is specified at the SMA connector of the dipole. The influence of reflections was eliminating by applying the averaging function while moving the dipole in the air, at least 70cm away from any obstacles.
- E- field distribution: E field is measured in the x-y-plane with an isotropic ER3D-field probe with 100 mW forward power to the antenna feed point. In accordance with [1], the scan area is 20mm wide, its length exceeds the dipole arm length (180 or 90mm). The sensor center is 10 mm (in z) above the top of the dipole arms. Two 3D maxima are available near the end of the dipole arms. Assuming the dipole arms are perfectly in one line, the average of these two maxima (in subgrid 2 and subgrid 8) is determined to compensate for any non-parallelity to the measurement plane as well as the sensor displacement. The E-field value stated as calibration value represents the maximum of the interpolated 3D-E-field, 10mm above the dipole surface.
- H-field distribution: H-field is measured with an isotropic H-field probe with 100mW forward power to the
 antenna feed point, in the x-y-plane. The scan area and sensor distance is equivalent to the E-field
 scan. The maximum of the field is available at the center (subgrid 5) above the feed point. The H-field
 value stated as calibration value represents the maximum of the interpolated H-field, 10mm above the
 dipole surface at the feed point.

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1 Measurement Conditions

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

DASY Version	DASY5	V52.6.2 (424)
DASY PP Version	SEMCAD X	V14.4.4 (2829)
Phantom	HAC Test Arch	SD HAC P01 BA, #1070
Distance Dipole Top - Probe Center	10 mm	
Scan resolution	dx, dy = 5 mm	area = 20 x 180 mm
Frequency	835 MHz ± 1 MHz	
Forward power at dipole connector	20.0 dBm = 100mW	
Input power drift	< 0.05 dB	

2 Maximum Field values

H-field 10 mm above dipole surface	condition	interpolated maximum
Maximum measured	100 mW forward power	0.466 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	166.2 V/m
Maximum measured above low end	100 mW forward power	162.4 V/m
Averaged maximum above arm	100 mW forward power	164.3 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	(41.5 - j10.3) Ohm
835 MHz	24.4 dB	(48.6 + j5.8) Ohm
900 MHz	16.9 dB	(58.2 - j13.2) Ohm
950 MHz	17.6 dB	(47.6 + j12.8) Ohm
960 MHz	13.2 dB	(58.5 + j22.8) 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.

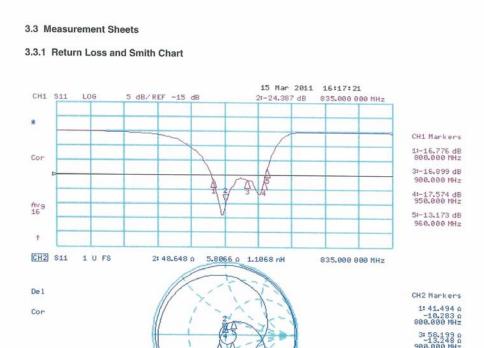
The dipole is built of standard semirigid coaxial cable. The internal matching line is open ended. The antenna is therefore open for DC signals.

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.

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START 335,000 000 MHz

Av9

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4: 47.619 Ω 12.799 Ω 950.000 MHz

5: 58.539 Ω 22.785 Ω 960.000 MHz

STOP 1 335,000 000 MHz

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3.3.3 DASY4 H-field Result

Date/Time: 15.03.2011 09:34:20

Test Laboratory: SPEAG Lab2

HAC RF_CD835_1024_H_110315_CL

DUT: HAC-Dipole 835 MHz; Type: CD835V3; Serial: 1024

Communication System: CW; Frequency: 835 MHz Medium parameters used: $\sigma=0$ mho/m, $\epsilon_r=1$; $\rho=1$ kg/m³ Phantom section: RF Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: H3DV6 SN6065; ; Calibrated: 29.12.2010
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 20.10.2010
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY52, V52.6 Build 2, Version 52.6.2 (424)
- Postprocessing SW: SEMCAD X, V14.4 Build 4, Version 14.4.4 (2829)

Dipole H-Field measurement @ 835MHz/H Scan - 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 = 0.466 A/m

Probe Modulation Factor = 1.000

Device Reference Point: 0, 0, -6.3 mm Reference Value = 0.497 A/m; Power Drift = -0.02 dB

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

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.384	0.406	0.385
M4	M4	M4
Grid 4	Grid 5	Grid 6
0.445	0.466	0.437
M4	M4	M4
Grid 7	Grid 8	Grid 9
0.397	0.410	0.377
M4	M4	M4



0 dB = 0.470 A/m

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3.3.2 DASY4 E-field Result

Date/Time: 15.03.2011 12:08:08

Test Laboratory: SPEAG Lab2

HAC RF_CD835_1024_E_110315_CL

DUT: HAC-Dipole 835 MHz; Type: CD835V3; Serial: 1024

Communication System: CW; Frequency: 835 MHz Medium parameters used: $\sigma=0$ mho/m, $\epsilon_r=1$; $\rho=1000$ kg/m 3 Phantom section: RF Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ER3DV6 SN2336; ConvF(1, 1, 1); Calibrated: 29.12.2010
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 20.10.2010
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY52, V52.6 Build 2, Version 52.6.2 (424)
- Postprocessing SW: SEMCAD X, V14.4 Build 4, Version 14.4.4 (2829)

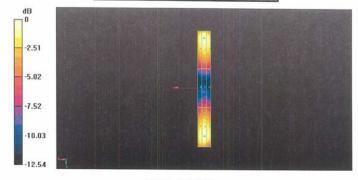
Dipole E-Field measurement @ 835MHz/E Scan - measurement distance from the probe sensor center to CD835 Dipole = 10mm/Hearing Aid Compatibility Test (41x361x1):

Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 166.2 V/m Probe Modulation Factor = 1.000

Device Reference Point: 0, 0, -6.3 mm Reference Value = 123.1 V/m; Power Drift = 0.02 dB Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
160.1	166.2	161.4
M4	M4	M4
Grid 4	Grid 5	Grid 6
85.999	90.077	87.980
M4	M4	M4
Grid 7	Grid 8	Grid 9
156.3	162.4	158.2
M4	M4	M4



0 dB = 166.2 V/m

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Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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Accreditation No.: SCS 108

Client HCT (Dymstec) Certificate No: CD1880V3-1019_Mar11 CALIBRATION CERTIFICATE CD1880V3 - SN: 1019 Calibration procedure(s) QA CAL-20.v5 Calibration procedure for dipoles in air Calibration date: March 15, 2011 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 (Certificate No.) Scheduled Calibration Power meter EPM-442A GB37480704 06-Oct-10 (No. 217-01266) Oct-11 Power sensor HP 8481A US37292783 06-Oct-10 (No. 217-01266) Oct-11 Probe ER3DV6 SN: 2336 29-Dec-10 (No. ER3-2336_Dec10) Dec-11 Probe H3DV6 SN: 6065 29-Dec-10 (No. H3-6065_Dec10) Dec-11 DAE4 SN: 781 20-Oct-10 (No. DAE4-781_Oct10) Oct-11 Secondary Standards ID# Check Date (in house) Scheduled Check Power meter Agilent 4419B SN: GB42420191 09-Oct-09 (in house check Oct-10) In house check: Oct-11 Power sensor HP 8482H SN: 3318A09450 09-Oct-09 (in house check Oct-10) In house check: Oct-11 Power sensor HP 8482A SN: US37295597 09-Oct-09 (in house check Oct-10) In house check: Oct-11 Network Analyzer HP 8753E US37390585 18-Oct-01 (in house check Oct-10) In house check: Oct-11 RF generator E4433B MY 41000675 03-Nov-04 (in house check Oct-09) In house check: Oct-11 Name Function Calibrated by: Claudio Leubler Laboratory Technician Approved by: Fin Bomholt Technical Director Issued: March 16, 2011

Certificate No: CD1880V3-1019_Mar11

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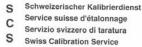
HCT CO., LTD.



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Accreditation No.: SCS 108

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References

[1] ANSI-C63.19-2007

American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids.

Methods Applied and Interpretation of Parameters:

- Coordinate System: y-axis is in the direction of the dipole arms. z-axis is from the basis of the antenna (mounted on the table) towards its feed point between the two dipole arms. x-axis is normal to the other axes. In coincidence with the standards [1], the measurement planes (probe sensor center) are selected to be at a distance of 10 mm above the top edge of the dipole arms.
- Measurement Conditions: Further details are available from the hardcopies at the end of the certificate.
 All figures stated in the certificate are valid at the frequency indicated. The forward power to the dipole connector is set with a calibrated power meter connected and monitored with an auxiliary power meter connected to a directional coupler. While the dipole under test is connected, the forward power is adjusted to the same level.
- Antenna Positioning: The dipole is mounted on a HAC Test Arch phantom using the matching dipole positioner with the arms horizontal and the feeding cable coming from the floor. The measurements are performed in a shielded room with absorbers around the setup to reduce the reflections. It is verified before the mounting of the dipole under the Test Arch phantom, that its arms are perfectly in a line. It is installed on the HAC dipole positioner with its arms parallel below the dielectric reference wire and able to move elastically in vertical direction without changing its relative position to the top center of the Test Arch phantom. The vertical distance to the probe is adjusted after dipole mounting with a DASYS Surface Check job. Before the measurement, the distance between phantom surface and probe tip is verified. The proper measurement distance is selected by choosing the matching section of the HAC Test Arch phantom with the proper device reference point (upper surface of the dipole) and the matching grid reference point (tip of the probe) considering the probe sensor offset. The vertical distance to the probe is essential for the accuracy.
- Feed Point Impedance and Return Loss: These parameters are measured using a HP 8753E Vector Network Analyzer. The impedance is specified at the SMA connector of the dipole. The influence of reflections was eliminating by applying the averaging function while moving the dipole in the air, at least 70cm away from any obstacles.
- E- field distribution: E field is measured in the x-y-plane with an isotropic ER3D-field probe with 100 mW forward power to the antenna feed point. In accordance with [1], the scan area is 20mm wide, its length exceeds the dipole arm length (180 or 90mm). The sensor center is 10 mm (in z) above the top of the dipole arms. Two 3D maxima are available near the end of the dipole arms. Assuming the dipole arms are perfectly in one line, the average of these two maxima (in subgrid 2 and subgrid 8) is determined to compensate for any non-parallelity to the measurement plane as well as the sensor displacement. The E-field value stated as calibration value represents the maximum of the interpolated 3D-E-field, 10mm above the dipole surface.
- H-field distribution: H-field is measured with an isotropic H-field probe with 100mW forward power to the
 antenna feed point, in the x-y-plane. The scan area and sensor distance is equivalent to the E-field
 scan. The maximum of the field is available at the center (subgrid 5) above the feed point. The H-field
 value stated as calibration value represents the maximum of the interpolated H-field, 10mm above the
 dipole surface at the feed point.

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1. Measurement Conditions

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

DASY Version	DASY5	V52.6.2 (424)
DASY PP Version	SEMCAD X	V14.4.4 (2829)
Phantom	HAC Test Arch	SD HAC P01 BA, #1070
Distance Dipole Top - Probe Center	10 mm	
Scan resolution	dx, dy = 5 mm	area = 20 x 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	0.475 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	146.6 V/m
Maximum measured above low end	100 mW forward power	137.7 V/m
Averaged maximum above arm	100 mW forward power	142.2 V/m

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

3. Appendix

3.1 Antenna Parameters

Frequency	Return Loss	Impedance
1730 MHz	27.2 dB	(52.1 + j3.9) Ohm
1880 MHz	20.7 dB	(48.3 + j8.9) Ohm
1900 MHz	20.4 dB	(51.0 + j9.7) Ohm
1950 MHz	25.7 dB	(54.5 + j3.0) Ohm
2000 MHz	25.1 dB	(45.4 + j2.7) 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.

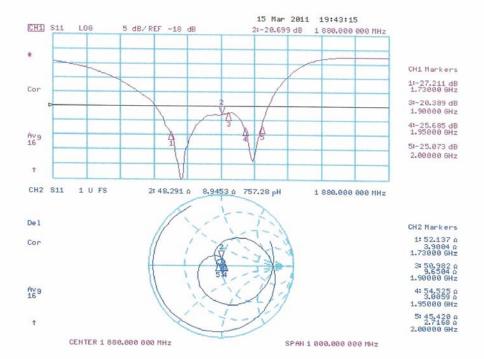
After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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3.3 Measurement Sheets

3.3.1 Return Loss and Smith Chart



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3.3.2 DASY4 H-Field Result

Date/Time: 15.03.2011 17:21:02

Test Laboratory: SPEAG Lab2

HAC_RF_CD1880_1019_H_110315_CL

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1019

Communication System: CW; Frequency: 1880 MHz Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m³

Phantom section: RF Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: H3DV6 SN6065; ; Calibrated: 29.12.2010
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 20.10.2010
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY52, V52.6 Build 2, Version 52.6.2 (424)
- Postprocessing SW: SEMCAD X, V14.4 Build 4, Version 14.4.4 (2829)

Dipole H-Field measurement @ 1880MHz/H Scan - measurement distance from the probe sensor center to CD1880 Dipole = 10mm/Hearing Aid Compatibility Test (41x181x1):

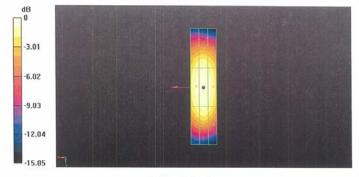
Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 0.475 A/m

Probe Modulation Factor = 1.000

Device Reference Point: 0, 0, -6.3 mm Reference Value = 0.503 A/m; Power Drift = 0.02 dB Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.414	0.433	0.413
M2	M2	M2
Grid 4	Grid 5	Grid 6
0.454	0.475	0.452
M2	M2	M2
Grid 7	Grid 8	Grid 9
0.415	0.437	0.412
M2	M2	M2



0 dB = 0.470 A/m

Certificate No: CD1880V3-1019_Mar11

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3.3.3 DASY4 E-Field Result

Date/Time: 15.03.2011 15:29:13

Test Laboratory: SPEAG Lab2

HAC_RF_CD1880_1019_E_110315_CL

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1019

Communication System: CW; Frequency: 1880 MHz Medium parameters used: σ = 0 mho/m, ϵ_r = 1; ρ = 1000 kg/m³ Phantom section: RF Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ER3DV6 SN2336; ConvF(1, 1, 1); Calibrated: 29.12.2010
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 20.10.2010
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY52, V52.6 Build 2, Version 52.6.2 (424)
- Postprocessing SW: SEMCAD X, V14.4 Build 4, Version 14.4.4 (2829)

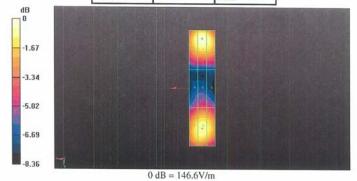
Dipole E-Field measurement @ 1880 MHz/E Scan - measurement distance from the probe sensor center to CD1880 Dipole = 10 mm/Hearing Aid Compatibility Test (41x181x1):

Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 146.6 V/m Probe Modulation Factor = 1.000 Device Reference Point: 0, 0, -6.3 mm

Reference Value = 136.3 V/m; Power Drift = -0.02 dB Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
139.0	146.6	141.5
M2	M2	M2
Grid 4	Grid 5	Grid 6
88.826	93.582	91.732
M3	M3	M3
Grid 7	Grid 8	Grid 9
133.0	137.7	133.7
M2	M2	M2



Certificate No: CD1880V3-1019_Mar11

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