

Annex B to Hearing Aid Compatibility RF Emissions Test Report for the BlackBerry® Smartphone model RFM121LW

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Author Data

Daoud Attayi

Feb. 17-29, June 28, 2012 April 03-04, 2013 Report No RTS-6026-1304-09

FCC ID L6ARFM120LW

Annex B: Probe and dipole descriptions and calibration certificates

B.2 Dipole calibration certificate



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Calibration Laboratory of Schmid & Partner

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

Accreditation No.: SCS 108

Report No

Accredited by the Swiss Accreditation Service (SAS)
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Multilateral Agreement for the recognition of calibration certificates

Client RTS (RIM Testing Services)

Certificate No: CD835V3-1011 Nov11

CALIBRATION CERTIFICATE CD835V3 - SN: 1011 Object Calibration procedure(s) QA CAL-20.v5 Calibration procedure for dipoles in air Calibration date: November 08, 2011 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 (Certificate No.) Scheduled Calibration Power meter EPM-442A GB37480704 05-Oct-11 (No. 217-01451) Oct-12 Power sensor HP 8481A US37292783 05-Oct-11 (No. 217-01451) Oct-12 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-Apr-11 (No. DAE4-781_Apr11) Apr-12 Secondary Standards Check Date (in house) Scheduled Check Power meter Agilent 4419B SN: GB42420191 09-Oct-09 (in house check Oct-11) In house check: Oct-12 Power sensor HP 8482H 09-Oct-09 (in house check Oct-11) SN: 3318A09450 In house check: Oct-12 Power sensor HP 8482A SN: US37295597 09-Oct-09 (in house check Oct-11) In house check: Oct-12 Network Analyzer HP 8753E US37390585 18-Oct-01 (in house check Oct-11) In house check: Oct-12 RF generator E4433B MY 41000675 03-Nov-04 (in house check Oct-11) In house check: Oct-13 Name Function Calibrated by: Approved by: Issued: November 8, 2011 This calibration certificate shall not be reproduced except in full without written approval of the laboratory

Certificate No: CD835V3-1011_Nov11

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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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S Swiss Calibration Service

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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Feb. 17-29, June 28, 2012 April 03-04, 2013

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Report No

FCC ID L6ARFM120LW

Measurement Conditions

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

DASY5	V52.6.2
Advanced Extrapolation	
HAC Test Arch	
10 mm	
dx, dy = 5 mm	
835 MHz ± 1 MHz	
< 0.05 dB	
	Advanced Extrapolation HAC Test Arch 10 mm dx, dy = 5 mm 835 MHz ± 1 MHz

Maximum Field values

H-field 10 mm above dipole surface	condition	interpolated maximum
Maximum measured	100 mW input power	0.462 A / m ± 8.2 % (k=2)

E-field 10 mm above dipole surface	condition	Interpolated maximum
Maximum measured above high end	100 mW input power	161.2 V / m
Maximum measured above low end	100 mW input power	158.2 V / m
Averaged maximum above arm	100 mW input power	159.7 V / m ± 12.8 % (k=2)

Appendix

Antenna Parameters with Head TSL

Frequency	Return Loss	Impedance
800 MHz	14.5 dB	41.1 Ω - 15.0 jΩ
835 MHz	24.4 dB	48.1 Ω + 5.6 jΩ
900 MHz	16.0 dB	56.8 Ω - 15.6 jΩ
950 MHz	17.8 dB	40.7 Ω + 7.2 jΩ
960 MHz	14.6 dB	46.7 Ω + 17.9 jΩ

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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Author Data

Daoud Attayi

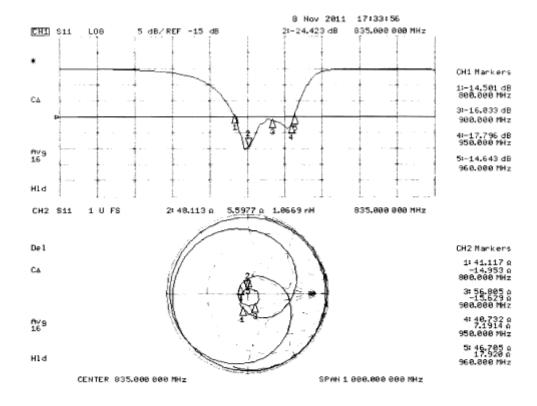
Dates of Test Feb. 17-29, June 28, 2012 April 03-04, 2013

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Impedance Measurement Plot





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Author Data **Daoud Attayi**

Dates of Test Feb. 17-29, June 28, 2012 April 03-04, 2013

RTS-6026-1304-09

Report No

FCC ID L6ARFM120LW

DASY4 H-field Result

Date/Time: 08.11.2011 10:14:07

Test Laboratory: SPEAG Lab2

DUT: HAC-Dipole 835 MHz; Type: CD835V3; Serial: CD835V3 - SN: 1011

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)

DASY Configuration:

Probe: H3DV6 - SN6065; ; Calibrated: 29.12.2010

Sensor-Surface: (Fix Surface)

Electronics: DAE4 Sn781; Calibrated: 20.04.2011

Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070

DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

Dipole H-Field measurement @ 835MHz/H-Scan - 835MHz d=10mm/Hearing Aid Compatibility Test (41x361x1):

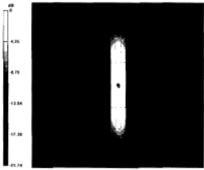
Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 0.462 A/m

Probe Modulation Factor = 1.000 Device Reference Point: 0, 0, -6.3 mm

Reference Value = 0.491 A/m; Power Drift = -0.0027 dB Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.372	0.396	0.381
M4	M4	M4
Grid 4	Grid 5	Grid 6
0.426	0.462	0.449
M4	M4	M4
Grid 7	Grid 8	Grid 9
0.375	0.410	0.399
M4	M4	M4



0 dB = 0.460 A/m



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Dates of Test Feb. 17-29, June 28, 2012 April 03-04, 2013

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Report No

FCC ID L6ARFM120LW

DASY4 E-field Result

Date/Time: 08.11.2011 15:05:22

Test Laboratory: SPEAG Lab2

DUT: HAC-Dipole 835 MHz; Type: CD835V3; Serial: CD835V3 - SN: 1011

Communication System: CW; Frequency: 835 MHz

Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m³

Phantom section: RF Section

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

DASY Configuration:

Probe; ER3DV6 - SN2336; ConvF(1, 1, 1); Calibrated: 29.12.2010

Sensor-Surface: (Fix Surface)

Electronics: DAE4 Sn781; Calibrated: 20.04.2011

Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070

DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

Dipole E-Field measurement @ 835MHz/E-Scan - 835MHz d=10mm/Hearing Aid Compatibility Test (41x361x1):

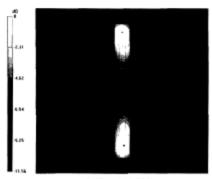
Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 161.2 V/m Probe Modulation Factor = 1.000

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 119.5 V/m; Power Drift = -7.4e-005 dB Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
154.9	161.2	156.1
M4	M4	M4
Grid 4	Grid 5	Grid 6
80.699	88.078	87.550
M4	M4	M4
Grid 7	Grid 8	Grid 9
142.8	158.2	157.7
M4	M4	M4



0 dB = 161.2 V/m

Certificate No: CD835V3-1011_Nov11



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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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C Service suisse d'étalonnage
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S Swiss Calibration Service

Accreditation No.: SCS 108

Accredited by the Swiss Accreditation Service (SAS)

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Multilateral Agreement for the recognition of calibration certificates

Client RTS (RIM Testing Services)

Certificate No: CD1880V3-1008_Nov11

CALIBRATION CERTIFICATE

Object CD1880V3 - SN: 1008

Calibration procedure(s) QA CAL-20.v5

Calibration procedure for dipoles in air

Calibration date: November 08, 2011

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 (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	U\$37292783	05-Oct-11 (No. 217-01451)	Oct-12
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-Apr-11 (No. DAE4-781_Apr11)	Apr-12
Secondary Standards	ID#	Check Date (in house)	Scheduled Check
Power meter Agilent 4419B	SN: GB42420191	09-Oct-09 (in house check Oct-11)	In house check: Oct-12
Power sensor HP 8482H	SN: 3318A09450	09-Oct-09 (in house check Oct-11)	In house check: Oct-12
Power sensor HP 8482A	SN: US37295597	09-Oct-09 (in house check Oct-11)	in house check: Oct-12
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-11)	In house check: Oct-12
RF generator E4433B	MY 41000675	03-Nov-04 (in house check Oct-11)	In house check: Oct-13
	Name	Function	Signature_\
Calibrated by:	Claudio Leubler	Laboratory Technician	(Jah
Approved by:	Katja Pokovic	Technical Manager	Selt.
			Issued: November 9, 2011

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

Certificate No: CD1880V3-1008_Nov11

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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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References

11 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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Author Data **Daoud Attayi**

Feb. 17-29, June 28, 2012 April 03-04, 2013 Report No RTS-6026-1304-09

FCC ID L6ARFM120LW

Measurement Conditions

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

DASY Version	DASY5	V52.6.2
Extrapolation	Advanced Extrapolation	
Phantom	HAC Test Arch	
Distance Dipole Top - Probe Center	10 mm	
Scan resolution	dx, dy = 5 mm	
Frequency	1880 MHz ± 1 MHz	
Input power drift	< 0.05 dB	

Maximum Field values

H-field 10 mm above dipole surface	condition	interpolated maximum
Maximum measured	100 mW input power	0.456 A / m ± 8.2 % (k=2)

E-field 10 mm above dipole surface	condition	Interpolated maximum
Maximum measured above high end	100 mW input power	136.9 V / m
Maximum measured above low end	100 mW input power	133.7 V / m
Averaged maximum above arm	100 mW input power	135.3 V / m ± 12.8 % (k=2)

Appendix

Antenna Parameters with Head TSL

Frequency	Return Loss	Impedance
1730 MHz	27.3 dB	53.1 Ω + 3.2 jΩ
1880 MHz	20.8 dB	51.1 Ω + 9.2 jΩ
1900 MHz	21.7 dB	52.1 Ω + 8.2 jΩ
1950 MHz	28.4 dB	53.0 Ω + 2.5 jΩ
2000 MHz	18.3 dB	43.0 Ω + 9.0 jΩ

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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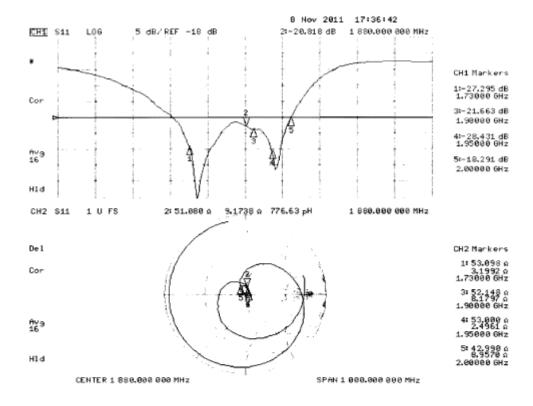
Dates of Test Feb. 17-29, June 28, 2012 April 03-04, 2013

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Impedance Measurement Plot





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Dates of Test Feb. 17-29, June 28, 2012 April 03-04, 2013

RTS-6026-1304-09

Report No

FCC ID L6ARFM120LW

DASY4 H-field Result

Date/Time: 08.11.2011 10:46:23

Test Laboratory: SPEAG Lab2

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: CD1880V3 - SN: 1008

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)

DASY Configuration:

Probe; H3DV6 - SN6065; ; Calibrated: 29.12.2010

Sensor-Surface: (Fix Surface)

Electronics: DAE4 Sn781; Calibrated: 20.04.2011

Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070

DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

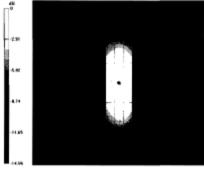
Dipole H-Field measurement @ 1880MHz/H-Scan - 1880MHz d=10mm/Hearing Aid Compatibility Test (41x181x1):

Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 0.456 A/m Probe Modulation Factor = 1.000 Device Reference Point: 0, 0, -6.3 mm

Reference Value = 0.482 A/m; Power Drift = -0.0047 dB Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak H-field in A/m

Grid 1	Grid 2	Grid 3
0.387	0.410	0.399
M2	M2	M2
Grid 4	Grid 5	Grid 6
0.427	0.456	0.446
M2	M2	M2
Grid 7	Grid 8	Grid 9
0.389	0.422	0.414
M2	M2	M2



0 dB = 0.460 A/m



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RTS-6026-1304-09

Report No

FCC ID L6ARFM120LW

DASY4 E-field Result

Date/Time: 08.11.2011 14:16:19

Test Laboratory: SPEAG Lab2

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: CD1880V3 - SN: 1008

Communication System: CW; Frequency: 1880 MHz Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: RF Section

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

DASY Configuration:

Probe: ER3DV6 - SN2336; ConvF(1, 1, 1); Calibrated: 29.12.2010

Sensor-Surface: (Fix Surface)

Electronics: DAE4 Sn781; Calibrated: 20.04.2011

Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070

DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

Dipole E-Field measurement @ 1880MHz/E-Scan - 1880MHz d=10mm/Hearing Aid Compatibility Test (41x181x1):

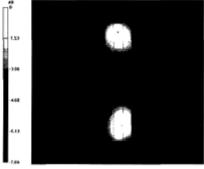
Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 136.9 V/m Probe Modulation Factor = 1.000

Device Reference Point: 0, 0, -6.3 mm

Reference Value = 139.6 V/m; Power Drift = 0.0093 dB Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak E-field in V/m

Grid 1	Grid 2	Grid 3
131.0	136.9	132.2
M2	M2	M2
Grid 4	Grid 5	Grid 6
79.581	88.112	88.112
M3	M3	M3
Grid 7	Grid 8	Grid 9
119.9	133.7	133.5
M2	M2	M2



0 dB = 136.9 V/m

Certificate No: CD1880V3-1008_Nov11