

Annex B: Probe and dipole descriptions and calibration certificates

B.2 Dipole calibration certificate

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Certificate No: CD835V3-1011_Nov11

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Annex B to Hearing Aid Compatibility RF Emissions Test Report for the BlackBerry® Smartphone model RFH121LW

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FCC ID

Author Data Daoud Attavi Dates of Test

Feb. 17-22, June 28, Sep. 28-Nov. 08, 2012

RTS-6012-1210-20

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Calibration Laboratory of

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



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Swiss Calibration Service

Accreditation No.: SCS 108

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

References

ANSI-C63.19-2007 [1]

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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Report No

	Testing Services™	Annex B to Hearing Aid Compatibility Report for the BlackBerry® Smartpho		Page 4(13)
Author Data	Dates of Test		Report No	FCC ID
Daoud Attavi	Feb. 17-2	2. June 28. Sep. 28-Nov. 08. 2012	RTS-6012-1210-20	L6ARFH120LW

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	835 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	0.462 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.

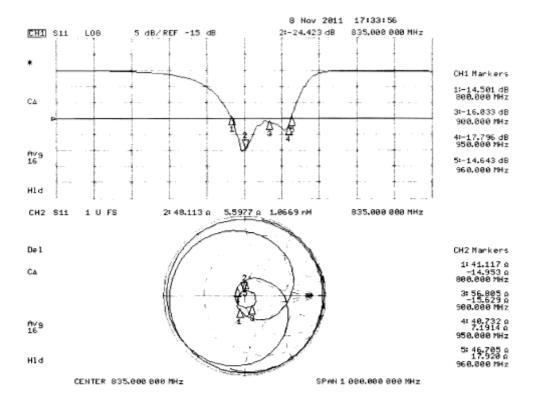
Do not apply force to dipole arms, as they are liable to bend. The soldered connections near the feedpoint may be damaged. After excessive mechanical stress or overheating, check the impedance characteristics to ensure that the internal matching network is not affected.

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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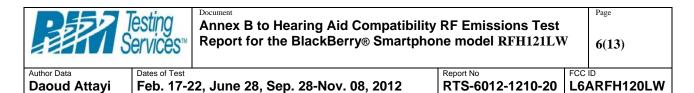


Impedance Measurement Plot



Certificate No: CD835V3-1011_Nov11

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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)

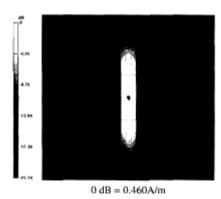
DASY Configuration:

- 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):

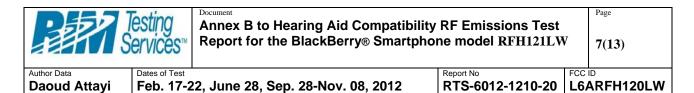
Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 0.462 A/m Probe Modulation Factor = 1.000 Device Reference Point: 0, 0, -6.3 mm Reference Value = 0.491 A/m; Power Drift = -0.0027 dB Hearing Aid Near-Field Category: M4 (AWF 0 dB)

> Peak H-field in A/m Grid 2 Grid 1 Grid 3 0.3720.396 0.381M4 M4 M4 Grid 5 Grid 4 Grid 6 0.4260.462 0.449 M4 M4 M4 Grid 7 Grid 8 Grid 9 0.375 0.399 0.410M4 M4 M4



Certificate No: CD835V3-1011_Nov11

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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, $\epsilon_r = 1$; $\rho = 1000$ kg/m³ Phantom section: RF Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

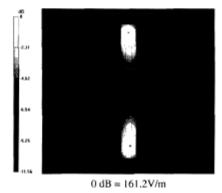
DASY Configuration:

- 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-fiel	d 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



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Accredited by the Swiss Accredit The Swiss Accreditation Servic Multilateral Agreement for the	ce is one of the signatori	es to the EA	ditation No.: SCS 108	
Client RTS (RIM Test	ting Services)	Certifi	icate No: CD1880V3-10	08_Nov11
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Certificate No: CD1880V3-1008_Nov11

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Annex B to Hearing Aid Compatibility RF Emissions Test Report for the BlackBerry® Smartphone model RFH121LW

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Page

Author Data Daoud Attavi

Dates of Test Feb. 17-22, June 28, Sep. 28-Nov. 08, 2012

FCC ID RTS-6012-1210-20

L6ARFH120LW

Calibration Laboratory of

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



Schweizerischer Kalibrierdienst s

Service suisse d'étalonnage с

Servizio svizzero di taratura s

Swiss Calibration Service

Accreditation No.: SCS 108

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

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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Report No

	Testing Services™	Annex B to Hearing Aid Compatibility Report for the BlackBerry® Smartpho		Page 10(13)
Author Data	Dates of Test		Report No	FCC ID
Daoud Attayi	Feb. 17-2	2, June 28, Sep. 28-Nov. 08, 2012	RTS-6012-1210-20	L6ARFH120LW

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.

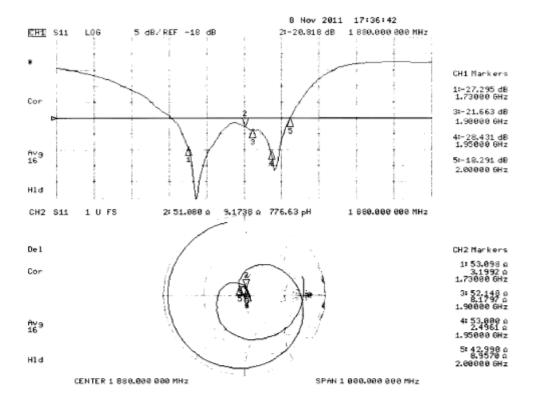
Do not apply force to dipole arms, as they are liable to bend. The soldered connections near the feedpoint may be damaged. After excessive mechanical stress or overheating, check the impedance characteristics to ensure that the internal matching network is not affected.

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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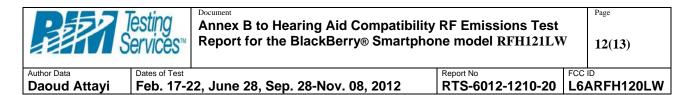


Impedance Measurement Plot



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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, $\epsilon_r = 1$; $\rho = 1$ kg/m³ Phantom section: RF Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

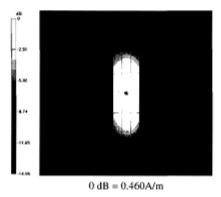
DASY Configuration:

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

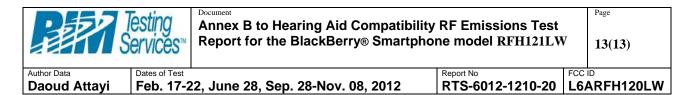
Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 0.456 A/m Probe Modulation Factor = 1.000 Device Reference Point: 0, 0, -6.3 mm Reference Value = 0.482 A/m; Power Drift = -0.0047 dB Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak H-fie	ld 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



Certificate No: CD1880V3-1008_Nov11

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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, $\varepsilon_r = 1$; $\rho = 1000$ kg/m³ Phantom section: RF Section Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

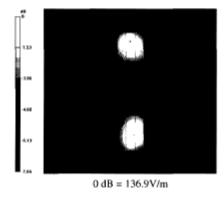
DASY Configuration:

- 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 @ 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



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