*** BlackBerr	ry	Appendix D for the RFV121LW SAR F	Page <b>1(81)</b>		
Author Data	Dates of Test	t	Test Report No	FCC ID:	
Andrew Becker	July 12	- October 16, 2013	RTS-6046-1310-25 Rev 3	L6ARFV120LW	
	March	24-26. 2014			
	Decemb	per 8-12, 2014			

## APPENDIX D: PROBE & DIPOLE CALIBRATION DATA

	Revision History							
Rev. Number Date Changes								
Initial	Oct 17, 2013							
Rev 2	Dec 15, 2014	Added equipment used for 802.11a Hotspot mode SAR testing 1. Page 63-81						



2(81)

Author Data Dates of Test

**Andrew Becker** 

July 12 – October 16, 2013 March 24-26. 2014 December 8-12, 2014

Test Report No

RTS-6046-1310-25 Rev 3

FCC ID: L6ARFV120LW

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





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

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RTS (RIM Testing Services)

Certificate No: ES3-3225\_Jan13

## CALIBRATION CERTIFICATE

Object

ES3DV3 - SN:3225

Catibration procedure(s)

QA CAL-01.v8, QA CAL-23.v4, QA CAL-25.v4 Calibration procedure for dosimetric E-field probes

Calibration date:

January 10, 2013

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 E4419B	GB41293874	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	20-Jun-12 (No. DAE4-660_Jun12)	Jun-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

Function Signature Calibrated by: Jeton Kastrati Laboratory Technician Katia Pokovic Technical Manager Approved by: Issued: January 14, 2013 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: ES3-3225\_Jan13

Page 1 of 11



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Author Data

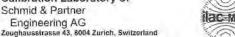
**Andrew Becker** 

Dates of Test July 12 – October 16, 2013 March 24-26. 2014

December 8-12, 2014

Test Report No RTS-6046-1310-25 Rev 3 FCC ID: L6ARFV120LW

Calibration Laboratory of Schmid & Partner Engineering AG





Schweizerischer Kalibrierdienst S Service suisse d'étalonnage C 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

#### Glossary:

NORMx,y,z ConvF DCP

tissue simulating liquid sensitivity in free space sensitivity in TSL / NORMx,y,z diode compression point

A, B, C, D

crest factor (1/duty\_cycle) of the RF signal modulation dependent linearization parameters

Polarization φ

φ rotation around probe axis

Polanzation 8

9 rotation around an axis that is in the plane normal to probe axis (at measurement center),

i.e., 9 = 0 is normal to probe axis

#### Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

#### Methods Applied and Interpretation of Parameters:

- NORMx, v. z: Assessed for E-field polarization 9 = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E2-field uncertainty inside TSL (see below ConvF).
- NORM(f)x,y,z = NORMx,y,z \* frequency\_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCPx,y,z: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z; A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx,y,z \* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100
- Spherical isotropy (3D deviation from isotropy): in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Certificate No: ES3-3225\_Jan13

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*** BlackBerry		Appendix D for the RFV121LW SAR R	Page <b>4(81)</b>		
Author Data	Dates of Test		Test Report No RTS-6046-1310-25 Rev 3	FCC ID: L6ARFV120LW	
Andrew Becker	March	– October 16, 2013 24-26, 2014 per 8-12, 2014	R15-0040-1510-25 Rev 5	LOAKF V 120L W	

ES3DV3 - SN:3225

January 10, 2013

# Probe ES3DV3

SN:3225

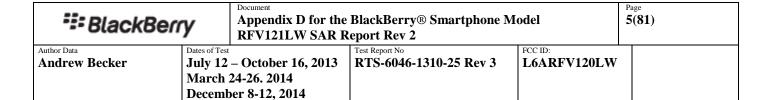
Manufactured: Calibrated:

September 1, 2009 January 10, 2013

Calibrated for DASY/EASY Systems (Note: non-compatible with DASY2 system!)

Certificate No: ES3-3225\_Jan13

Page 3 of 11



ES3DV3- SN:3225 January 10, 2013

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3225

#### **Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (µV/(V/m) <sup>2</sup> ) <sup>A</sup>	1.29	1.19	1.31	± 10.1 %
DCP (mV) <sup>e</sup>	100.5	101.5	99.9	

#### Modulation Calibration Parameters

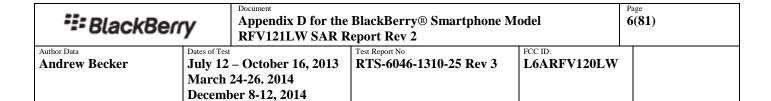
UID	Communication System Name		A dB	B dB√μV	С	D dB	VR mV	Unc <sup>t</sup> (k=2)
0	CW	×	0.0	0.0	1.0	0.00	157.5	±2.7 %
		Y	0.0	0.0	1.0		158.4	
		Z	0.0	0.0	1.0		165.9	

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Certificate No: ES3-3225\_Jan13

The uncertainties of NormX,Y,Z do not affect the E3-field uncertainty inside TSL (see Pages 5 and 6).

<sup>&</sup>lt;sup>9</sup> Numerical linearization parameter: uncertainty not required.
<sup>6</sup> Uncertainty is determined using the max, deviation from linear response applying rectangular distribution and is expressed for the square of the field value



ES3DV3-SN:3225 January 10, 2013

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3225

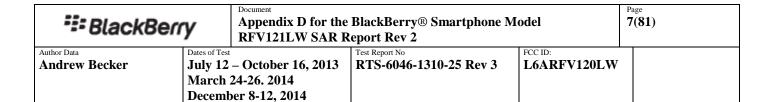
#### Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>c</sup>	Relative Permittivity	Conductivity (S/m) F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	6.56	6.56	6.56	0.42	1.54	± 12.0 %
900	41.5	0.97	6.19	6.19	6.19	0.43	1.52	± 12.0 %
1810	40.0	1.40	5.35	5,35	5.35	0.63	1.39	± 12.0 %
1950	40.0	1.40	5.09	5.09	5.09	0.80	1.23	± 12.0 %
2450	39.2	1.80	4.65	4.65	4.65	0.61	1.63	± 12.0 %
2600	39.0	1.96	4.43	4.43	4.43	0.80	1.32	± 12.0 %

Certificate No. ES3-3225\_Jan13

<sup>&</sup>lt;sup>0</sup> Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

At frequencies below 3 GHz, the validity of tissue parameters (ε and α) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and α) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.



January 10, 2013

ES3DV3-SN:3225

## DASY/EASY - Parameters of Probe: ES3DV3 - SN:3225

#### Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) C	Relative Permittivity	Conductivity (S/m) F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	6.27	6.27	6.27	0.48	1,51	± 12.0 %
900	55.0	1.05	6.12	6.12	6.12	0.73	1.25	± 12.0 %
1810	53.3	1.52	5.04	5.04	5.04	0.57	1.47	±12.0 %
1950	53.3	1.52	4.94	4.94	4.94	0.58	1,50	± 12.0 %
2450	52,7	1.95	4.35	4,35	4.35	0.70	1.16	±12.0 %
2600	52.5	2.16	4.11	4.11	4.11	0.67	0.99	± 12.0 %

Certificate No: ES3-3225\_Jan13

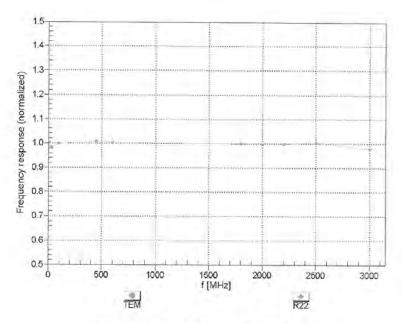
Frequency validity of  $\pm$  100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to  $\pm$  50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\epsilon$ ) can be relaxed to  $\pm$  10% if flound compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\epsilon$ ) is restricted to  $\pm$  5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target lissue parameters.

<b>≅</b> BlackBerry		Appendix D for the RFV121LW SAR R	Page <b>8(81)</b>		
Author Data	Dates of Test	:	Test Report No	FCC ID:	
Andrew Becker	July 12	- October 16, 2013	RTS-6046-1310-25 Rev 3	L6ARFV120LW	
	March	24-26. 2014			
	Decemb	oer 8-12, 2014			

ES3DV3-SN:3225 January 10, 2013

# Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)

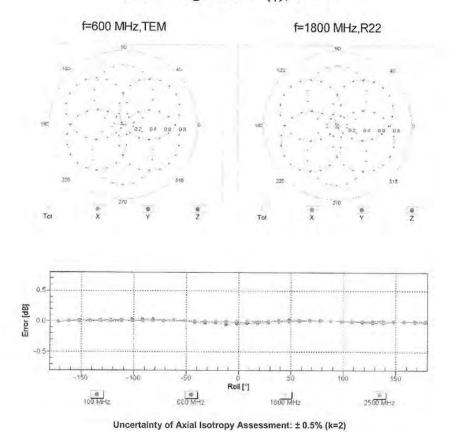


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

*** BlackBer	ry	Appendix D for the RFV121LW SAR R	Page <b>9(81)</b>		
Author Data	Dates of Test		Test Report No	FCC ID:	
Andrew Becker	July 12	- October 16, 2013	RTS-6046-1310-25 Rev 3	L6ARFV120LW	
	March	24-26. 2014			
	Decemb	oer 8-12, 2014			

ES3DV3- SN:3225 January 10, 2013

## Receiving Pattern ( $\phi$ ), $9 = 0^{\circ}$



Certificate No: E\$3-3225\_Jan13



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Author Data

**Andrew Becker** 

Dates of Test **July 12 – October 16, 2013** March 24-26. 2014 December 8-12, 2014

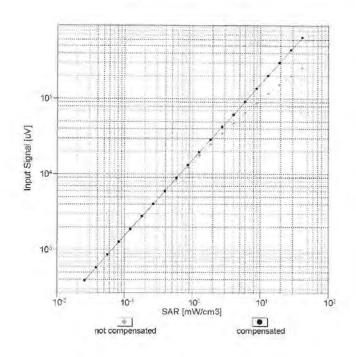
Test Report No RTS-6046-1310-25 Rev 3

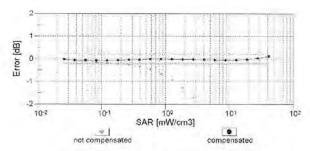
FCC ID: L6ARFV120LW

ES3DV3-SN:3225

January 10, 2013

# Dynamic Range f(SAR<sub>head</sub>) (TEM cell , f = 900 MHz)



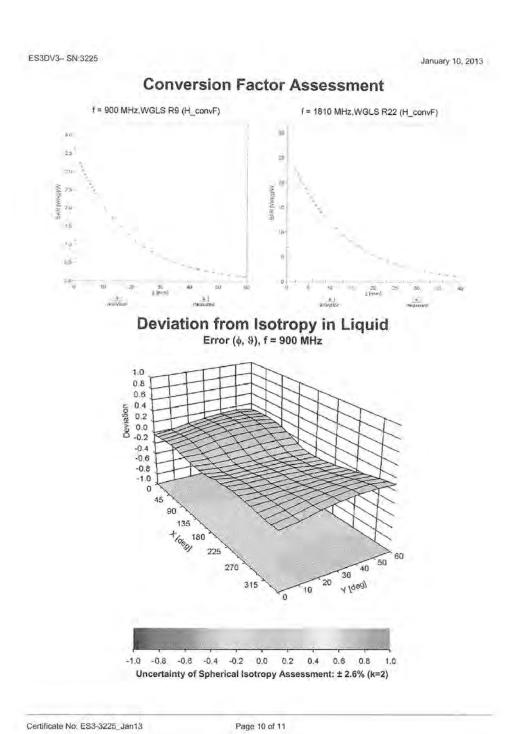


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Certificate No: ES3-3225\_Jan13

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*** BlackBerry		Appendix D for the RFV121LW SAR R	Page 11(81)		
Author Data	Dates of Test	:	Test Report No	FCC ID:	
Andrew Becker	July 12	- October 16, 2013	RTS-6046-1310-25 Rev 3	L6ARFV120LW	
	March	24-26. 2014			
	Deceml	oer 8-12, 2014			



*** BlackBerr	y		Appendix D for the BlackBerry® Smartphone Model RFV121LW SAR Report Rev 2				
Author Data	Dates of Test		Test Report No	FCC ID:			
Andrew Becker	July 12	- October 16, 2013	RTS-6046-1310-25 Rev 3	L6ARFV120LW			
	March	24-26. 2014					
	Decemb	oer 8-12, 2014					

ES3DV3 - SN:3225 January 10, 2013

# DASY/EASY - Parameters of Probe: ES3DV3 - SN:3225

## Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	8.3
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

Certificate No: ES3-3225\_Jan13

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Author Data

**Andrew Becker** 

Dates of Test **July 12 – October 16, 2013** March 24-26. 2014

December 8-12, 2014

Test Report No RTS-6046-1310-25 Rev 3 FCC ID: L6ARFV120LW

Calibration Laboratory of Schmid & Partner

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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

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

Client

RTS (RIM Testing Services)

Certificate No: EX3-3548 Jan 13

Accreditation No.: SCS 108

## CALIBRATION CERTIFICATE

Object EX3DV4 - SN:3548

QA CAL-01.v8, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v4 Calibration procedure(s)

Calibration procedure for dosimetric E-field probes

Calibration date: January 15, 2013

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 al	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	20-Jun-12 (No. DAE4-660_Jun12)	Jun-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature	
Calibrated by:	Jeton Kastrati	Laboratory Technician	- 1 C	
Approved by:	Katia Pokovic	Technical Manager	V PP &	7
		•	אים איני בואיק	
			Innuerate Innuerant 55, 205	49
The land of the same of the same	shall not be reproduced except in full	without written annual of the labor	Issued: January 15, 201	13

Certificate No: EX3-3548\_Jan13 Page 1 of 11



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Author Data

**Andrew Becker** 

Dates of Test July 12 – October 16, 2013

March 24-26. 2014 December 8-12, 2014 Test Report No

RTS-6046-1310-25 Rev 3

FCC ID: L6ARFV120LW

#### Calibration Laboratory of

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





Schweizerischer Katibrierdienst Service suisse d'étalonnage C Servizio svizzero di taratura 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

#### Glossary:

TSL tissue simulating liquid NORMx,y,z sensitivity in free space ConvE sensitivity in TSL / NORMx,y,z DCP diode compression point

CF crest factor (1/duty\_cycle) of the RF signal A, B, C, D modulation dependent linearization parameters

Polarization o φ rotation around probe axis

Polarization 8 3 rotation around an axis that is in the plane normal to probe axis (at measurement center),

i.e., 9 = 0 is normal to probe axis

#### Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

#### Methods Applied and Interpretation of Parameters:

- NORMx,y,z: Assessed for E-field polarization 9 = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz; R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E2-field uncertainty inside TSL (see below ConvF).
- NORM(f)x,y,z = NORMx,y,z \* frequency\_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCPx,y,z: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx, y, z \* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy): in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Certificate No: EX3-3548 Jan13 Page 2 of 11

*** BlackBer	ry	Appendix D for the RFV121LW SAR F	Page 15(81)		
Author Data	Dates of Test		Test Report No	FCC ID:	
Andrew Becker	July 12	- October 16, 2013	RTS-6046-1310-25 Rev 3	L6ARFV120LW	
	March	24-26. 2014			
	Decemb	per 8-12, 2014			

EX3DV4 - SN:3548 January 15, 2013

# Probe EX3DV4

SN:3548

Manufactured: Calibrated: November 16, 2004 January 15, 2013

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

Certificate No: EX3-3548\_Jan13

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≅ BlackBer	y	Appendix D for the RFV121LW SAR R	BlackBerry® Smartphone Meport Rev 2	Iodel	Page <b>16(81)</b>
Author Data	Dates of Test	:	Test Report No	FCC ID:	
Andrew Becker	July 12	- October 16, 2013	RTS-6046-1310-25 Rev 3	L6ARFV120LW	
	March	24-26. 2014			
	Decemb	oer 8-12, 2014			

EX3DV4- SN:3548 January 15, 2013

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3548

#### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm $(\mu V/(V/m)^2)^A$	0.36	0.44	0.43	± 10.1 %
DCP (mV) <sup>B</sup>	103.2	98.0	98.7	

#### Modulation Calibration Parameters

UID	Communication System Name		Α	В	С	D	VR	Unc⁵
			dB	dB√μV		dB	mV	(k=2)
0	CW	X	0.0	0.0	1.0	0.00	181.3	±3.3 %
		Y	0.0	0.0	1.0		149.2	
		Z	0.0	0.0	1.0		198.9	

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

<sup>&</sup>lt;sup>5</sup> The uncertainties of NormX,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Pages 5 and 6).

Numerical linearization parameter: uncertainty not required.

<sup>\*</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

*** BlackBerr	ry	Appendix D for the RFV121LW SAR R	BlackBerry® Smartphone Meport Rev 2	Iodel	Page 17(81)
Author Data	Dates of Test		Test Report No	FCC ID:	
Andrew Becker	July 12	- October 16, 2013	RTS-6046-1310-25 Rev 3	L6ARFV120LW	
	March	24-26. 2014			
	Decemb	oer 8-12, 2014			

EX3DV4-SN:3548 January 15, 2013

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3548

### Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
2600	39.0	1.96	7.15	7.15	7.15	0.47	0.86	± 12.0 %
5200	36.0	4.66	5.13	5.13	5.13	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.79	4.79	4.79	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.61	4.61	4.61	0.45	1.80	± 13.1 %

Certificate No: EX3-3548\_Jan13 Page 5 of 11

<sup>&</sup>lt;sup>0</sup> Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the Com/F uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

FAt frequencies below 3 GHz, the validity of tissue parameters (s and o) can be released to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (s and o) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

*** BlackBerr	ry	Appendix D for the RFV121LW SAR R	BlackBerry® Smartphone Meport Rev 2	Iodel	Page <b>18(81)</b>
Author Data	Dates of Test	i .	Test Report No	FCC ID:	
Andrew Becker	July 12	- October 16, 2013	RTS-6046-1310-25 Rev 3	L6ARFV120LW	
	March	24-26. 2014			
	Decemb	oer 8-12, 2014			

EX3DV4- SN:3548 January 15, 2013

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3548

#### Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity F	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
2600	52.5	2.16	7.08	7.08	7.08	0.80	0.50	± 12.0 %
5200	49.0	5.30	4.68	4.68	4.68	0.52	1.90	± 13.1 %
5500	48.6	5.65	4.15	4.15	4.15	0.52	1.90	± 13.1 %
5800	48.2	6.00	4.19	4.19	4.19	0.60	1.90	± 13.1 %

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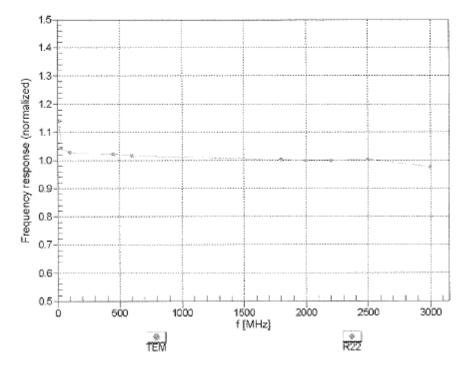
<sup>&</sup>lt;sup>o</sup> Frequency validity of  $\pm$  100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to  $\pm$  50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

FAI frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to  $\pm$  10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to  $\pm$  5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

*** BlackBerr	y		Appendix D for the BlackBerry® Smartphone Model RFV121LW SAR Report Rev 2			
Author Data Andrew Becker	Dates of Test		Test Report No RTS-6046-1310-25 Rev 3	FCC ID: L6ARFV120LW		
Andrew Becker	March	24-26. 2014	K15-0040-1310-23 RCV 3	LOAKI VIZUL W		

EX3DV4-- SN:3548 January 15, 2013

# Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)

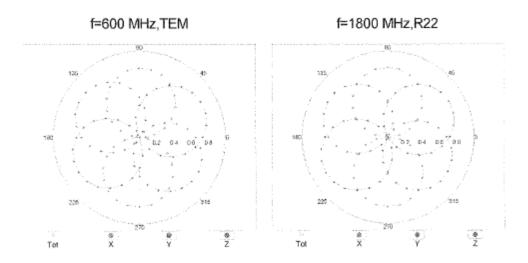


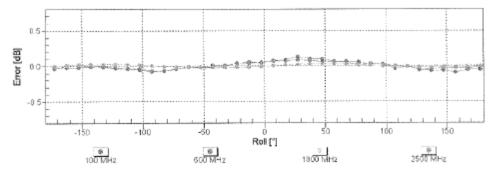
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

*** BlackBer	Appendix D for the RFV121LW SAR R		BlackBerry® Smartphone Meport Rev 2	Page <b>20(81)</b>	
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EX3DV4- SN:3548 January 15, 2013

# Receiving Pattern (\$\phi\$), \$\text{9} = 0°



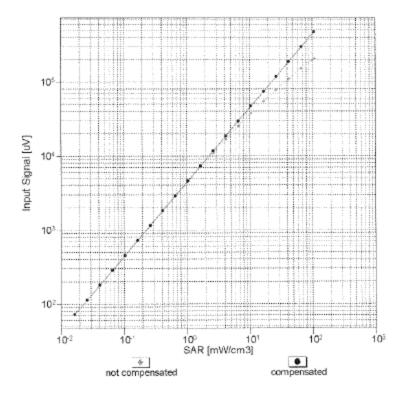


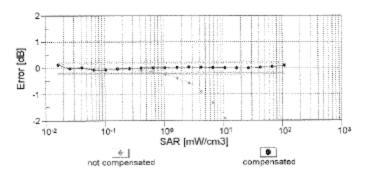
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

≅ BlackBer	ry	Appendix D for the RFV121LW SAR R	BlackBerry® Smartphone Meport Rev 2	<b>Iodel</b>	Page <b>21(81)</b>
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Andrew Becker	July 12	- October 16, 2013	RTS-6046-1310-25 Rev 3	L6ARFV120LW	
	March	24-26. 2014			
	Decemb	oer 8-12, 2014			

EX3DV4- SN:3548 January 15, 2013

## Dynamic Range f(SAR<sub>head</sub>) (TEM cell , f = 900 MHz)



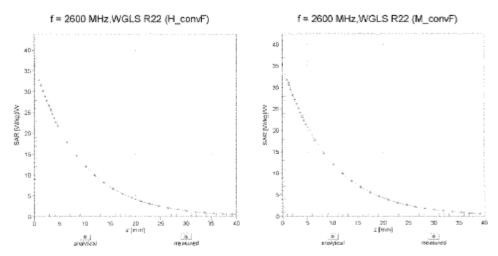


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

≅ BlackBer	ry	Appendix D for the RFV121LW SAR R	BlackBerry® Smartphone Meport Rev 2	Page <b>22(81)</b>	
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Andrew Becker	July 12	- October 16, 2013	RTS-6046-1310-25 Rev 3	L6ARFV120LW	
	March	24-26. 2014			
	Decemb	oer 8-12, 2014			

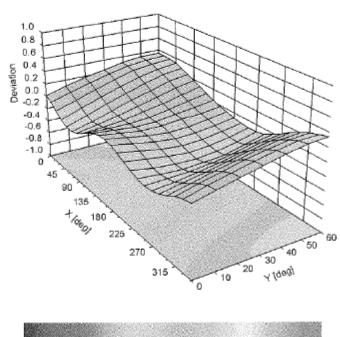
EX3DV4~ SN:3548 January 15, 2013

## Conversion Factor Assessment



# Deviation from Isotropy in Liquid

Error (φ, θ), f = 900 MHz



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	Decemb	oer 8-12, 2014			

EX3DV4- SN:3548 January 15, 2013

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3548

#### Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-72.5
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

Certificate No: EX3-3548\_Jan13 Page 11 of 11



Test Report No

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Author Data

**Andrew Becker** 

Dates of Test **July 12 – October 16, 2013** March 24-26. 2014

December 8-12, 2014

RTS-6046-1310-25 Rev 3

FCC ID: L6ARFV120LW

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





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RTS (RIM Testing Services)

Certificate No: D750V3-1021\_Jan13

Accreditation No.: SCS 108

#### CALIBRATION CERTIFICATE D750V3 - SN: 1021 Object Calibration procedure(s) QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz January 07, 2013 Calibration date: 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) Cal Date (Certificate No.) Primary Standards Scheduled Calibration Power meter EPM-442A GB37480704 01-Nov-12 (No. 217-01640) Oct-13 Power sensor HP 8481A US37292783 01-Nov-12 (No. 217-01640) Oct-13 Reference 20 dB Attenuator SN: 5058 (20k) 27-Mar-12 (No. 217-01530) Apr-13 Type-N mismatch combination SN: 5047.3 / 06327 27-Mar-12 (No. 217-01533) Apr-13 SN: 3205 28-Dec-12 (No. ES3-3205\_Dec12) Reference Probe ES3DV3 DAE4 SN: 601 27-Jun-12 (No. DAE4-601\_Jun12) Jun-13 Secondary Standards ID# Check Date (in house) Scheduled Check Power sensor HP 8481A MY41092317 18-Oct-02 (in house check Oct-11) In house check: Oct-13 RF generator R&S SMT-06 100005 04-Aug-99 (in house check Oct-11) In house check: Oct-13 Network Analyzer HP 8753E US37390585 S4206 18-Oct-01 (in house check Oct-12) In house check: Oct-13 Function Name Signature Calibrated by: Leif Klysner Laboratory Technician Katia Pokovic Technical Manager Approved by: Issued: January 8, 2013 This calibration certificate shall not be reproduced except in full without written approval of the laboratory

Certificate No: D750V3-1021\_Jan13

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Author Data

**Andrew Becker** 

Dates of Test July 12 – October 16, 2013

March 24-26. 2014 December 8-12, 2014 Test Report No

RTS-6046-1310-25 Rev 3

FCC ID: L6ARFV120LW

Calibration Laboratory of Schmid & Partner

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland





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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

#### Glossarv:

tissue simulating liquid

ConvF N/A

sensitivity in TSL / NORM x,y,z not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

#### Additional Documentation:

d) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- · SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Certificate No: D750V3-1021\_Jan13

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Author Data

**Andrew Becker** 

Dates of Test
July 12 – October 16, 2013
March 24-26. 2014

December 8-12, 2014

Test Report No **RTS-6046-1310-25 Rev 3** 

FCC ID: L6ARFV120LW

#### **Measurement Conditions**

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

DASY Version	DASY5	V52.8.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

#### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) "C	41.4 ± 6 %	0.89 mha/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	-	5

#### SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.12 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	8.46 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.51 W/kg ± 16.5 % (k=2)



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Author Data

**Andrew Becker** 

Dates of Test **July 12 – October 16, 2013** March 24-26. 2014

December 8-12, 2014

Test Report No RTS-6046-1310-25 Rev 3 FCC ID: L6ARFV120LW

## Appendix

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.7 Ω - 0.2 μΩ	
Return Loss	~ 25.4 dB	

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1,033 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

#### Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 01, 2010

Certificate No: D750V3-1021\_Jan13

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Author Data

**Andrew Becker** 

Appendix D for the BlackBerry® Smartphone Model

RFV121LW SAR Report Rev 2

Test Report No

RTS-6046-1310-25 Rev 3

FCC ID:

July 12 – October 16, 2013 March 24-26. 2014 December 8-12, 2014

L6ARFV120LW

#### **DASY5 Validation Report for Head TSL**

Date: 07.01.2013

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Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial; D750V3 - SN: 1021

Communication System: CW; Frequency: 750 MHz.

Medium parameters used: f = 750 MHz;  $\sigma = 0.89 \text{ S/m}$ ;  $\varepsilon_r = 41.4$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

Dates of Test

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

#### DASY52 Configuration:

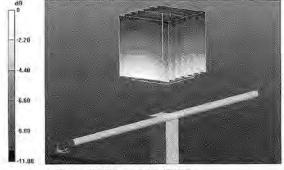
- Probe: ES3DV3 SN3205; ConvF(6.28, 6.28, 6.28); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.4(1052); SEMCAD X 14.6.8(7028)

#### Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 54.107 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.23 W/kg

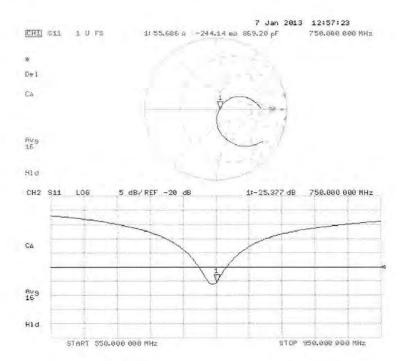
SAR(1 g) = 2.12 W/kg; SAR(10 g) = 1.38 W/kgMaximum value of SAR (measured) = 2.47 W/kg



0 dB = 2.47 W/kg = 3.93 dBW/kg

*** BlackBerr	y	Appendix D for the RFV121LW SAR R	BlackBerry® Smartphone Meport Rev 2	lodel	Page <b>29(81)</b>
Author Data	Dates of Test		Test Report No	FCC ID:	
Andrew Becker	July 12	- October 16, 2013	RTS-6046-1310-25 Rev 3	L6ARFV120LW	
	March	24-26. 2014			
	Decemb	oer 8-12, 2014			

#### Impedance Measurement Plot for Head TSL





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Author Data

**Andrew Becker** 

Dates of Test **July 12 – October 16, 2013** March 24-26. 2014

December 8-12, 2014

Test Report No RTS-6046-1310-25 Rev 3 FCC ID: L6ARFV120LW

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





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Client RTS (RIM Testing Services) Accreditation No.: SCS 108

Certificate No: D835V2-446\_Jan13

Object	D835V2 - SN: 44	6.	
Calibration procedure(s)	QA CAL-05.v9 Calibration proce	dure for dipole validation kits abo	ove 700 MHz
Calibration date:	January 07, 2013	3	
		ional standards, which realize the physical un robability are given on the following pages an	
All notherations have been accident	inted in the stand Inherita	as feedlikes on decomment temperature (00 - 500)	C and humidity - 700
All calibrations have been conducation Equipment used (M&		ry facility: environment temperature (22 ± 3)*(	C and humidity < 70%.
calibration Equipment used (M&		ry facility: environment temperature $(22 \pm 3)^{\circ}$ t  Cal Date (Certificate No.)	C and humidity < 70%.  Scheduled Calibration
Calibration Equipment used (M&	TE critical for calibration)		
Calibration Equipment used (M& Primary Standards Power meter EPM-442A	STE critical for calibration)	Cal Date (Certificate No.) 01-Nov-12 (No. 217-01640) 01-Nov-12 (No. 217-01640)	Scheduled Calibration Oct-13 Oct-13
Calibration Equipment used (M& Primary Standards Power meter EPM-442A Power sensor HP 8481A Reference 20 dB Attenuator	ID #  GB37480704 US37292783 SN: 5058 (20k)	Cal Date (Certificate No.) 01-Nov-12 (No. 217-01640) 01-Nov-12 (No. 217-01640) 27-Mar-12 (No. 217-01530)	Scheduled Calibration Oct-13 Oct-13 Apr-13
Calibration Equipment used (M& Primary Standards Power meter EPM-442A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination	ID #  GB37480704 US37292783 SN: 5058 (20k) SN: 5047.3 / 06327	Cal Date (Certificate No.) 01-Nov-12 (No. 217-01640) 01-Nov-12 (No. 217-01640) 27-Mar-12 (No. 217-01530) 27-Mar-12 (No. 217-01533)	Scheduled Calibration Oct-13 Oct-13 Apr-13 Apr-13
Calibration Equipment used (M& Primary Standards Power meter EPM-442A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ESSDV3	ID #  GB37480704 US37292783 SN: 5058 (20k)	Cal Date (Certificate No.) 01-Nov-12 (No. 217-01640) 01-Nov-12 (No. 217-01640) 27-Mar-12 (No. 217-01530)	Scheduled Calibration Oct-13 Oct-13 Apr-13
	ID #  GB37480704  US37292783  SN: 5058 (20k)  SN: 5047.3 / 06327  SN: 3205	Cal Date (Certificate No.) 01-Nov-12 (No. 217-01640) 01-Nov-12 (No. 217-01640) 27-Mar-12 (No. 217-01530) 27-Mar-12 (No. 217-01533) 28-Dec-12 (No. ES3-3205_Dec12)	Scheduled Calibration Oct-13 Oct-13 Apr-13 Apr-13 Dec-13
Calibration Equipment used (M& Primary Standards Power meter EPM-442A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ESSDV3 DAE4	GB37480704 US37292783 SN: 5058 (20k) SN: 5047.3 / 06327 SN: 5205 SN: 601	Cal Date (Certificate No.) 01-Nov-12 (No. 217-01640) 01-Nov-12 (No. 217-01640) 27-Mar-12 (No. 217-01530) 27-Mar-12 (No. 217-01533) 28-Dec-12 (No. ES3-3205_Dec12) 27-Jun-12 (No. DAE4-601_Jun12)	Scheduled Calibration Oct-13 Oct-13 Apr-13 Apr-13 Dec-13 Jun-13
Calibration Equipment used (M& Primary Standards Power meter EPM-442A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination teference Probe ESSDV3 DAE4 Secondary Standards Power sensor HP 8481A	ID #  GB37480704 US37292783 SN: 5058 (20k) SN: 5047.3 / 06327 SN: 3205 SN: 601  ID #	Cal Date (Certificate No.) 01-Nov-12 (No. 217-01640) 01-Nov-12 (No. 217-01640) 27-Mar-12 (No. 217-01530) 27-Mar-12 (No. 217-01533) 28-Dec-12 (No. ES3-3205_Dec12) 27-Jun-12 (No. DAE4-601_Jun12) Check Dats (in house)	Scheduled Calibration Oct-13 Oct-13 Apr-13 Apr-13 Dec-13 Jun-13 Scheduled Check In house check: Oct-13
Calibration Equipment used (M&Primary Standards Power meter EPM-442A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV3 DAE4 Secondary Standards Power sensor HP 8481A RF generator R&S SMT-06	ID #  GB37480704 US37292783 SN: 5058 (20k) SN: 5047.3 / 06327 SN: 3205 SN: 601  ID #  MY41092317	Cal Date (Certificate No.) 01-Nov-12 (No. 217-01640) 01-Nov-12 (No. 217-01640) 27-Mar-12 (No. 217-01530) 27-Mar-12 (No. 217-01533) 28-Dec-12 (No. ES3-3205_Dec12) 27-Jun-12 (No. DAE4-601_Jun12) Check Date (in house)	Scheduled Calibration Oct-13 Oct-13 Apr-13 Apr-13 Dec-13 Jun-13 Scheduled Check In house check: Oct-13 In house check: Oct-13
Calibration Equipment used (M& Primary Standards Power meter EPM-442A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ESSDV3 DAE4	BTE critical for calibration)  ID #  GB37480704  US37292783  SN: 5058 (20k)  SN: 5047.3 / 06327  SN: 3205  SN: 601  ID #  MY41092317 100005  US37390585 S4206	Cal Date (Certificate No.) 01-Nov-12 (No. 217-01640) 01-Nov-12 (No. 217-01640) 27-Mar-12 (No. 217-01530) 27-Mar-12 (No. 217-01533) 28-Dec-12 (No. ES3-3205_Dec12) 27-Jun-12 (No. DAE4-601_Jun12) Check Date (in house) 18-Oct-02 (in house check Oct-11) 04-Aug-99 (in house check Oct-12)	Scheduled Calibration Oct-13 Oct-13 Apr-13 Apr-13 Dec-13 Jun-13 Scheduled Check In house check: Oct-13 In house check: Oct-13 In house check: Oct-13
Calibration Equipment used (M&Primary Standards Power meter EPM-442A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ESSDV3 DAE4 Secondary Standards Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer HP 8753E	ID #  GB37480704  US37292783  SN: 5058 (20k)  SN: 5047.3 / 06327  SN: 3205  SN: 601  ID #  MY41092317  100005  US37390585 S4206	Cal Date (Certificate No.) 01-Nov-12 (No. 217-01640) 01-Nov-12 (No. 217-01640) 27-Mar-12 (No. 217-01530) 27-Mar-12 (No. 217-01533) 28-Dec-12 (No. ES3-3205_Dec12) 27-Jun-12 (No. DAE4-601_Jun12) Check Date (in house) 18-Oct-02 (in house check Oct-11) 04-Aug-99 (in house check Oct-11) 18-Oct-01 (in house check Oct-12) Function	Scheduled Calibration Oct-13 Oct-13 Apr-13 Apr-13 Dec-13 Jun-13 Scheduled Check In house check: Oct-13 In house check: Oct-13
Calibration Equipment used (M&Primary Standards Power meter EPM-442A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV3 DAE4 Secondary Standards Power sensor HP 8481A RF generator R&S SMT-06	BTE critical for calibration)  ID #  GB37480704  US37292783  SN: 5058 (20k)  SN: 5047.3 / 06327  SN: 3205  SN: 601  ID #  MY41092317 100005  US37390585 S4206	Cal Date (Certificate No.) 01-Nov-12 (No. 217-01640) 01-Nov-12 (No. 217-01640) 27-Mar-12 (No. 217-01530) 27-Mar-12 (No. 217-01533) 28-Dec-12 (No. ES3-3205_Dec12) 27-Jun-12 (No. DAE4-601_Jun12) Check Date (in house) 18-Oct-02 (in house check Oct-11) 04-Aug-99 (in house check Oct-12)	Scheduled Calibration Oct-13 Oct-13 Apr-13 Apr-13 Dec-13 Jun-13 Scheduled Check In house check: Oct-13 In house check: Oct-13 In house check: Oct-13

Certificate No: D835V2-446\_Jan13

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Author Data

**Andrew Becker** 

Dates of Test July 12 – October 16, 2013

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Test Report No RTS-6046-1310-25 Rev 3 FCC ID: L6ARFV120LW

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

#### Glossary:

TSL

tissue simulating liquid

ConvF N/A

sensitivity in TSL / NORM x,y,z not applicable or not measured

#### Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

#### Additional Documentation:

d) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

- · Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Certificate No: D835V2-446\_Jan13

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Appendix D for the BlackBerry® Smartphone Model

RFV121LW SAR Report Rev 2

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Author Data

**Andrew Becker** 

Dates of Test **July 12 – October 16, 2013** 

March 24-26. 2014 December 8-12, 2014

Test Report No RTS-6046-1310-25 Rev 3

FCC ID: L6ARFV120LW

#### **Measurement Conditions**

DASY Version	DASY5	V52.8.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, $dy$ , $dz = 5  mm$	
Frequency	835 MHz ± 1 MHz	

#### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.0 æ 6 %	0.92 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	nn.	144

#### SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2,38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.39 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.55 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.13 W/kg ± 16.5 % (k=2)

Certificate No: D835V2-446\_Jan13

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Test Report No

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Author Data

**Andrew Becker** 

Dates of Test **July 12 – October 16, 2013** March 24-26. 2014

December 8-12, 2014

RTS-6046-1310-25 Rev 3

FCC ID: L6ARFV120LW

#### Appendix

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.1 Ω - 6.5 jΩ	
Return Loss	-23.7 dB	

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.385 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

#### Additional EUT Data

Manufactured by	SPEAG	
Manufactured on	October 24, 2001	

Certificate No: D835V2-446\_Jan13

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Appendix D for the BlackBerry® Smartphone Model

Test Report No

RFV121LW SAR Report Rev 2

FCC ID:

34(81)

Author Data

**Andrew Becker** 

Dates of Test July 12 – October 16, 2013 March 24-26. 2014 December 8-12, 2014

RTS-6046-1310-25 Rev 3

L6ARFV120LW

#### DASY5 Validation Report for Head TSL

Date: 07.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 446

Communication System: CW; Frequency: 835 MHz

Medium parameters used: f = 835 MHz;  $\sigma = 0.92 \text{ S/m}$ ;  $\varepsilon_r = 42$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

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

#### DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(6.05, 6.05, 6.05); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics; DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.4(1052); SEMCAD X 14.6.8(7028)

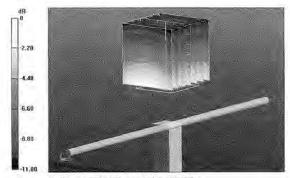
#### Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 56.650 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.61 W/kg

SAR(1 g) = 2.38 W/kg; SAR(10 g) = 1.55 W/kg

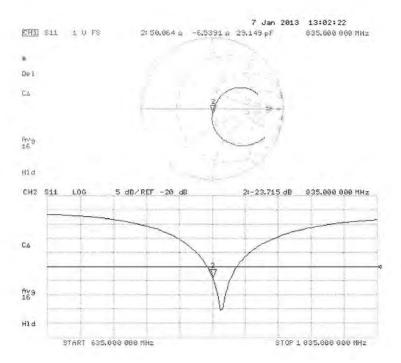
Maximum value of SAR (measured) = 2.79 W/kg



0 dB = 2.79 W/kg = 4.46 dBW/kg

≅ BlackBer	y	Appendix D for the RFV121LW SAR R	BlackBerry® Smartphone Meport Rev 2	<b>Iodel</b>	Page <b>35(81)</b>
Author Data	Dates of Test		Test Report No	FCC ID:	
Andrew Becker	July 12	- October 16, 2013	RTS-6046-1310-25 Rev 3	L6ARFV120LW	
	March	24-26. 2014			
	Decemb	oer 8-12, 2014			

#### Impedance Measurement Plot for Head TSL





Appendix D for the BlackBerry® Smartphone Model

Test Report No

RFV121LW SAR Report Rev 2

FCC ID:

36(81)

Author Data

**Andrew Becker** 

Dates of Test **July 12 – October 16, 2013** March 24-26. 2014 December 8-12, 2014

RTS-6046-1310-25 Rev 3

L6ARFV120LW

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





Schweizerischer Kalibrierdlenst Service suisse d'étalonnage Ċ Servizio svizzero di taratura Swiss Calibration Service

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

RTS (RIM Testing Services)

Accreditation No.: SCS 108

Certificate No: D1800V2-2d020 Jan13

CALIBRATION C			
Object	D1800V2 - SN: 2	2d020	
Calibration procedure(s)	QA CAL-05.v9 Calibration proce	edure for dipole validation kits ab	oove 700 MHz
Calibration date:	January 09, 2013	3	
		ional standards, which realize the physical u robability are given on the following pages a	
Ali cálibrations have been conduc	cled in the closed laborato	ry lacility: environment temperature (22 $\pm$ 3)	°C and humidity < 70%.
All calibrations have been conductation Equipment used (M&		ry lacility: environment temperature (22 $\pm$ 3)	°C and humidity < 70%.
alibration Equipment used (M&		ry facility: environment temperature (22 ±3)  Cal Date (Certificate No.)	°C and humidity < 70%. Scheduled Calibration
Calibration Equipment used (M&	TE critical for calibration)		
allibration Equipment used (M& rimary Standards ower meter EPM-442A ower sensor HP 8481A	TE critical for calibration)	Cal Date (Certificate No.)	Scheduled Calibration
allibration Equipment used (M& rimary Standards ower meter EPM-442A ower sensor HP 8481A eference 20 dB Attenuator	ID # GB37480704 US37292783 SN: 5058 (20k)	Cal Date (Certificate No.) 01-Nov-12 (No. 217-01640) 01-Nov-12 (No. 217-01640) 27-Mar-12 (No. 217-01530)	Scheduled Calibration Oct-13
rimary Standards ower meter EPM-442A ower sensor HP 8481A teference 20 dB Attenuator ype-N mismatch combination	ID # GB37480704 US37292783 SN: 5058 (20k) SN: 5047.3 / 06327	Cal Date (Certificate No.) 01-Nov-12 (No. 217-01640) 01-Nov-12 (No. 217-01640) 27-Mar-12 (No. 217-01530) 27-Mar-12 (No. 217-01533)	Scheduled Calibration Oct-13 Oct-13 Apr-13 Apr-13
rimary Standards Tower meter EPM-142A Tower sensor HP 8481A Teference 20 dB Attenuator Type-N mismatch combination Teference Probe ES3DV3	ID # GB37480704 US37292783 SN: 5058 (20k) SN: 5047.3 / 06327 SN: 3205	Cal Date (Certificate No.) 01-Nov-12 (No. 217-01640) 01-Nov-12 (No. 217-01640) 27-Mar-12 (No. 217-01530) 27-Mar-12 (No. 217-01533) 28-Dec-12 (No. ES3-3205_Dec12)	Scheduled Calibration Oct-13 Oct-13 Apr-13 Apr-13 Dec-13
rimary Standards Tower meter EPM-142A Tower sensor HP 8481A Teference 20 dB Attenuator Type-N mismatch combination Teference Probe ES3DV3	ID # GB37480704 US37292783 SN: 5058 (20k) SN: 5047.3 / 06327	Cal Date (Certificate No.) 01-Nov-12 (No. 217-01640) 01-Nov-12 (No. 217-01640) 27-Mar-12 (No. 217-01530) 27-Mar-12 (No. 217-01533)	Scheduled Calibration Oct-13 Oct-13 Apr-13 Apr-13
calibration Equipment used (M& frimary Standards fower meter EPM-442A fower sensor HP 8481A teference 20 dB Attenuator ype-N mismatch combination teference Probe ES3DV3	ID # GB37480704 US37292783 SN: 5058 (20k) SN: 5047.3 / 06327 SN: 3205	Cal Date (Certificate No.) 01-Nov-12 (No. 217-01640) 01-Nov-12 (No. 217-01640) 27-Mar-12 (No. 217-01530) 27-Mar-12 (No. 217-01533) 28-Dec-12 (No. ES3-3205_Dec12)	Scheduled Calibration Oct-13 Oct-13 Apr-13 Apr-13 Dec-13
Calibration Equipment used (M& Calibration Equipment used (M& Calibration Standards) Cower sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV3 DAE4 Recondary Standards	ID # GB37480704 US37292783 SN: 5058 (20k) SN: 5047.3 / 06327 SN: 3205 SN: 601	Cal Date (Certificate No.) 01-Nov-12 (No. 217-01640) 01-Nov-12 (No. 217-01640) 27-Mar-12 (No. 217-01530) 27-Mar-12 (No. 217-01533) 28-Dec-12 (No. ES3-3205_Dec12) 27-Jun-12 (No. DAE4-601_Jun12)	Scheduled Calibration Oct-13 Oct-13 Apr-13 Apr-13 Dec-13 Jun-13
calibration Equipment used (M& rimary Standards rower meter EPM-042A rower sensor HP 8481A teference 20 dB Attenuator ype-N mismatch combination teference Probe ES3DV3 0AE4 secondary Standards rower sensor HP 8481A	ID #  GB37480704 US37292783 SN: 5058 (20k) SN: 5047.3 / 06327 SN: 3205 SN: 601	Cal Date (Certificate No.) 01-Nov-12 (No. 217-01640) 01-Nov-12 (No. 217-01640) 27-Mar-12 (No. 217-01530) 27-Mar-12 (No. 217-01533) 28-Dac-12 (No. ES3-3205_Dec12) 27-Jun-12 (No. DAE4-601_Jun12) Check Date (in house)	Scheduled Calibration Oct-13 Oct-13 Apr-13 Apr-13 Dec-13 Jun-13
	ID #  GB37480704 US37292783 SN: 5058 (20k) SN: 5047.3 / 06327 SN: 3205 SN: 601  ID #  MY41092317	Cal Date (Certificate No.) 01-Nov-12 (No. 217-01640) 01-Nov-12 (No. 217-01640) 27-Mar-12 (No. 217-01530) 27-Mar-12 (No. 217-01533) 28-Dec-12 (No. ES3-3205_Dec12) 27-Jun-12 (No. DAE4-601_Jun12) Check Date (in house) 18-Oct-02 (in house check Oct-11)	Scheduled Calibration Oct-13 Oct-13 Apr-13 Apr-13 Dec-13 Jun-13 Scheduled Check In house check: Oct-13
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Calibration Equipment used (M&Calibration Equipment used (M&Calibration Equipment used (M&Calibration Equipment used (M&Calibration Equipment Equi	ID # GB37480704 US37292783 SN: 5058 (20k) SN: 5047.3 / 06327 SN: 3205 SN: 601 ID # MY41092317 100005 US37390585 S4206	Cal Date (Certificate No.) 01-Nov-12 (No. 217-01640) 01-Nov-12 (No. 217-01640) 27-Mar-12 (No. 217-01530) 27-Mar-12 (No. 217-01533) 28-Dec-12 (No. ES3-3205_Dec12) 27-Jun-12 (No. DAE4-601_Jun12) Check Date (in house) 18-Oct-02 (in house check Oct-11) 04-Aug-99 (in house check Oct-11) 18-Oct-01 (in house check Oct-12)	Scheduled Calibration Oct-13 Oct-13 Apr-13 Apr-13 Dec-13 Jun-13 Scheduled Check In house check: Oct-13 In house check: Oct-13 In house check: Oct-13

Certificate No: D1800V2-2d020\_Jan13

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Author Data

**Andrew Becker** 

Dates of Test July 12 – October 16, 2013

March 24-26. 2014 December 8-12, 2014

Test Report No RTS-6046-1310-25 Rev 3 FCC ID: L6ARFV120LW

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

#### Glossary:

tissue simulating liquid TSL ConvF sensitivity in TSL / NORM x,y,z N/A not applicable or not measured

# Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

#### Additional Documentation:

d) DASY4/5 System Handbook

# Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- · Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Certificate No: D1800V2-2d020\_Jan13

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Author Data

**Andrew Becker** 

Dates of Test **July 12 – October 16, 2013** 

March 24-26. 2014 December 8-12, 2014

Test Report No RTS-6046-1310-25 Rev 3

FCC ID: L6ARFV120LW

#### Measurement Conditions

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

DASY Version	DASY5	V52.8.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1800 MHz ± 1 MHz	

# Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.9 ± 6 %	1,38 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	-	

#### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.61 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	38.5 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.06 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.3 W/kg ± 16.5 % (k=2)



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Author Data

**Andrew Becker** 

Dates of Test **July 12 – October 16, 2013** 

March 24-26. 2014 December 8-12, 2014

Test Report No RTS-6046-1310-25 Rev 3 FCC ID: L6ARFV120LW

#### Appendix

# Antenna Parameters with Head TSL

Impedance, transformed to feed point	46.2 Ω - 8.3 jΩ	
Return Loss	= 20.5 dB	

# General Antenna Parameters and Design

Electrical Delay (one direction)	1,216 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change, The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

#### Additional EUT Data

Manufactured by	SPEAG	
Manufactured on	September 07, 2001	

Certificate No: D1800V2-2d020\_Jan13

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Appendix D for the BlackBerry® Smartphone Model

RFV121LW SAR Report Rev 2

Test Report No

FCC ID:

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RTS-6046-1310-25 Rev 3

Author Data **Andrew Becker** 

Dates of Test July 12 – October 16, 2013 March 24-26. 2014 December 8-12, 2014

L6ARFV120LW

Date: 09.01.2013

# **DASY5 Validation Report for Head TSL**

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN: 2d020

Communication System; CW; Frequency: 1800 MHz

Medium parameters used: f = 1800 MHz;  $\sigma = 1.38 \text{ S/m}$ ;  $\varepsilon_r = 38.9$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

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

#### DASY52 Configuration:

Probe: ES3DV3 - SN3205; ConvF(5.04, 5.04, 5.04); Calibrated: 28.12.2012;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn601; Calibrated: 27.06.2012

Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001

DASY52 52.8.4(1052); SEMCAD X 14.6.8(7028)

# Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

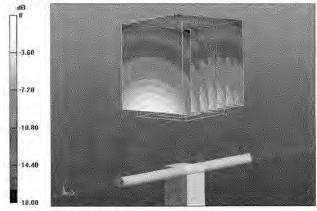
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.870 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 17.5 W/kg

SAR(1 g) = 9.61 W/kg; SAR(10 g) = 5.06 W/kg

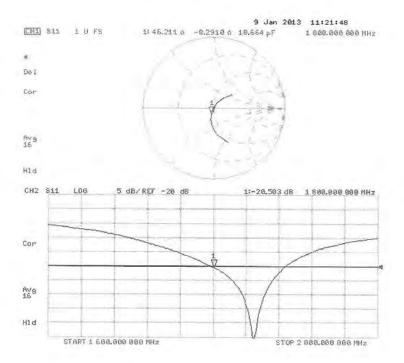
Maximum value of SAR (measured) = 11.8 W/kg



0 dB = 11.8 W/kg = 10.72 dBW/kg

RFV121LW SAR R		BlackBerry® Smartphone Meport Rev 2	Page <b>41(81)</b>		
Author Data	Dates of Test	:	Test Report No	FCC ID:	
Andrew Becker	July 12	- October 16, 2013	RTS-6046-1310-25 Rev 3	L6ARFV120LW	
	March	24-26. 2014			
	Decemb	oer 8-12, 2014			

# Impedance Measurement Plot for Head TSL





Appendix D for the BlackBerry® Smartphone Model

RFV121LW SAR Report Rev 2

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Author Data Dates of Test

**Andrew Becker** 

July 12 – October 16, 2013 March 24-26. 2014 December 8-12, 2014

Test Report No RTS-6046-1310-25 Rev 3 FCC ID: L6ARFV120LW

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





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The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

RTS (RIM Testing Services)

Accreditation No.: SCS 108

Certificate No: D1900V2-545\_Jan13

#### CALIBRATION CERTIFICATE D1900V2 - SN: 545 Object Calibration procedure(s) QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz Calibration date: January 09, 2013 This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (St). 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) Cal Date (Certificate No.) Scheduled Calibration Primary Standards Power meter EPM-442A GB37480704 01-Nov-12 (No. 217-01640) Oct-13 01-Nov-12 (No. 217-01640) Oct-13 Power sensor HP 8481A US37292783 Reference 20 dB Attenuator SN: 5058 (20k) 27-Mar-12 (No. 217-01530) Apr-13 SN: 5047.3 / 06327 27-Mar-12 (No. 217-01533) Apr-13 Type-N mismatch combination 28-Dec-12 (No. ES3-3205 Dec12) Dec-13 Reference Probe ES3DV3 SN: 3205 DAE4 SN: 601 27-Jun-12 (No. DAE4-601\_Jun12) Jun-13 Secondary Standards Check Date (in house) Scheduled Check ID# In house check: Oct-13 18-Oct-02 (in house check Oct-11) Power sensor HP 8481A MY41092317 RF generator R&S SMT-06 100005 04-Aug-99 (in house check Oct-11) In house check: Oct-13 US37390585 S4206 18-Oct-01 (in house check Oct-12) In house check: Oct-13 Network Analyzer HP 8753E Function Laboratory Technician Calibrated by: Israe El-Naoug Katja Pokovic Technical Manager Approved by: Issued: January 9, 2013 This calibration certificate shall not be reproduced except in full without written approval of the laboratory

Certificate No: D1900V2-545\_Jan13

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Author Data

**Andrew Becker** 

Dates of Test July 12 – October 16, 2013 March 24-26. 2014

December 8-12, 2014

Test Report No RTS-6046-1310-25 Rev 3 FCC ID: L6ARFV120LW

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





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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

#### Glossary:

TSL

tissue simulating liquid

ConvF N/A

sensitivity in TSL / NORM x,y,z not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

#### Additional Documentation:

d) DASY4/5 System Handbook

# Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Certificate No: D1900V2-545 Jan13

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Author Data

**Andrew Becker** 

Dates of Test

July 12 – October 16, 2013

March 24-26. 2014 December 8-12, 2014 Test Report No

RTS-6046-1310-25 Rev 3

FCC ID:

L6ARFV120LW

# **Measurement Conditions**

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

DASY Version	DASY5	V52.8.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, $dy$ , $dz = 5 mm$	
Frequency	1900 MHz ± 1 MHz	
(104)mono)	7.9 4.4 3.50 (M-34.7 1.15) ···	

# Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22,0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.4 ± 6 %	1.38 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	****	

# SAR result with Head TSL

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.2 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.26 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.1 W/kg ± 16.5 % (k=2)



### Appendix

#### Antenna Parameters with Head TSL

December 8-12, 2014

Impedance, transformed to feed point	$51.0 \Omega + 1.7 \Omega$	
Return Loss	- 34.3 dB	

#### General Antenna Parameters and Design

	100000000000000000000000000000000000000
Electrical Delay (one direction)	1.198 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

# **Additional EUT Data**

Manufactured by	SPEAG	
Manufactured on	November 15, 2001	

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Author Data

**Andrew Becker** 

Dates of Test July 12 – October 16, 2013 March 24-26. 2014 December 8-12, 2014

Test Report No RTS-6046-1310-25 Rev 3 FCC ID: L6ARFV120LW

# **DASY5 Validation Report for Head TSL**

Date: 09.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

#### DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 545

Communication System; CW; Frequency: 1900 MHz

Medium parameters used: f = 1900 MHz;  $\sigma = 1.38 \text{ S/m}$ ;  $\varepsilon_t = 39.4$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

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

#### DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(4.98, 4.98, 4.98); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.4(1052); SEMCAD X 14.6.8(7028)

#### Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

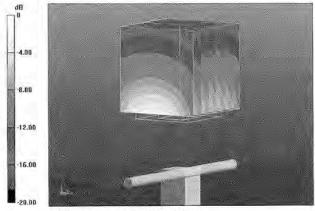
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.493 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 18.1 W/kg

SAR(1 g) = 10 W/kg; SAR(10 g) = 5.26 W/kg

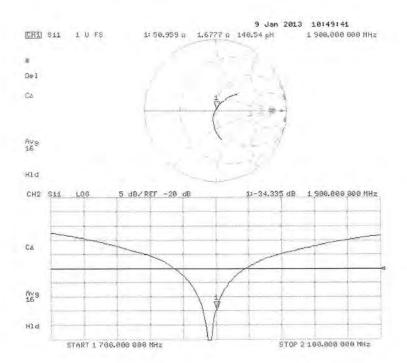
Maximum value of SAR (measured) = 12.2 W/kg



0 dB = 12.2 W/kg = 10.86 dBW/kg

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# Impedance Measurement Plot for Head TSL





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Author Data

**Andrew Becker** 

Dates of Test July 12 – October 16, 2013 March 24-26. 2014

December 8-12, 2014

Test Report No RTS-6046-1310-25 Rev 3 FCC ID: L6ARFV120LW

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





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Accreditation No.: SCS 108

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Certificate No: D2450V2-747\_Nov11 CALIBRATION CERTIFICATE Object D2450V2 - SN: 747 QA CAL-05.v8 Calibration procedure(s) Calibration procedure for dipole validation kits above 700 MHz November 09, 2011 Calibration date: 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) Cal Date (Certificate No.) Scheduled Calibration **Primary Standards** ID# 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 Reference 20 dB Attenuator SN: 5086 (20g) 29-Mar-11 (No. 217-01368) Apr-12 Type-N mismatch combination SN: 5047.2 / 06327 29-Mar-11 (No. 217-01371) Apr-12 Reference Probe ES3DV3 SN: 3205 29-Apr-11 (No. ES3-3205\_Apr11) Apr-12 DAE4 SN: 601 04-Jul-11 (No. DAE4-601\_Jul11) Jul-12 Secondary Standards ID# Check Date (in house) Scheduled Check Power sensor HP 8481A MY41092317 18-Oct-02 (in house check Oct-11) In house check: Oct-13 RF generator R&S SMT-06 100005 04-Aug-99 (in house check Oct-11) In house check: Oct-13 US37390585 S4206 Network Analyzer HP 8753E 18-Oct-01 (In house check Oct-11) In house check: Oct-12 Name Function Calibrated by: Approved by: Issued: November 9, 2011 This calibration certificate shall not be reproduced except in full without written approval of the laboratory

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Author Data

**Andrew Becker** 

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Calibration Laboratory of

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





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Accreditation No.: SCS 108

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#### Glossary:

TSL. ConvF

N/A

tissue simulating liquid

sensitivity in TSL / NORM x,y,z not applicable or not measured

# Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

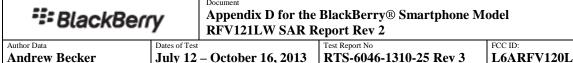
#### Additional Documentation:

d) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

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#### **Measurement Conditions**

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

Extrapolation Advanced Extrapolation  Phantom Modular Flat Phantom  Distance Dipole Center - TSL 10 mm	
Distance Dipole Center - TSL 10 mm	
	with Spacer
Zoom Scan Resolution dx, dy, dz = 5 mm	
Frequency 2450 MHz ± 1 MHz	

Head TSL parameters
The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22,0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.7 ± 6 %	1,84 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	14944	

# SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.8 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	54.1 mW /g ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.39 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	25.3 mW /g ± 16.5 % (k=2)

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# Appendix

### Antenna Parameters with Head TSL

December 8-12, 2014

Impedance, transformed to feed point	$52.5 \Omega + 1.3 j\Omega$
Return Loss	- 31.2 dB

# General Antenna Parameters and Design

A	
Electrical Delay (one direction)	1.161 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

#### **Additional EUT Data**

Manufactured by	SPEAG		
Manufactured on	December 01, 2003		

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Author Data

**Andrew Becker** 

Dates of Test July 12 – October 16, 2013 March 24-26. 2014 December 8-12, 2014

Test Report No RTS-6046-1310-25 Rev 3 FCC ID: L6ARFV120LW

#### **DASY5 Validation Report for Head TSL**

Date: 09,11.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 747

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: f = 2450 MHz;  $\sigma = 1.84 \text{ mho/m}$ ;  $\varepsilon_t = 37.7$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

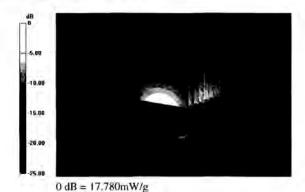
Measurement Standard; DASY5 (IEEE/IEC/ANSI C63.19-2007)

#### DASY52 Configuration:

- Probe: ES3DV3 SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

# Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 102.1 V/m; Power Drift = 0.04 dB Peak SAR (extrapolated) = 28.853 W/kg SAR(1 g) = 13.8 mW/g; SAR(10 g) = 6.39 mW/gMaximum value of SAR (measured) = 17.782 mW/g

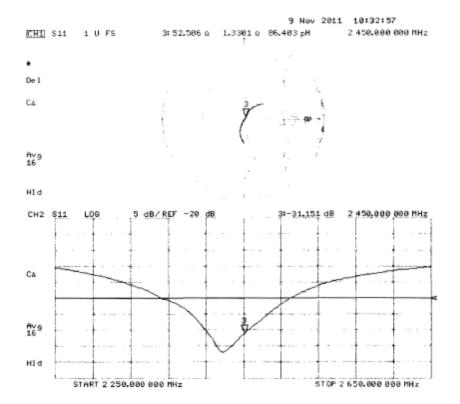


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# Impedance Measurement Plot for Head TSL



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Dates of Test **Andrew Becker** 

July 12 – October 16, 2013 March 24-26. 2014 December 8-12, 2014

Test Report No RTS-6046-1310-25 Rev 3 FCC ID: L6ARFV120LW

Calibration Laboratory of

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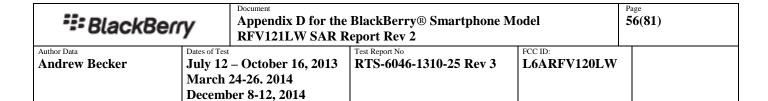
Certificate No: D5GHzV2-1033\_Nov11

Accreditation No.: SCS 108

#### **CALIBRATION CERTIFICATE** D5GHzV2 - SN: 1033 Object QA CAL-22.v1 Calibration procedure(s) Calibration procedure for dipole validation kits between 3-6 GHz A CONTRACTOR OF THE PERSON OF November 15, 2011 Calibration date 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 Cal Date (Certificate No.) Scheduled Calibration Power meter EPM-442A GB37480704 05-Oct-11 (No. 217-01451) Oct-12 US37292783 Power sensor HP B481A 05-Oct-11 (No. 217-01451) Oct-12 Reference 20 dB Attenuator SN: 5086 (20g) 29-Mar-11 (No. 217-01368) Apr-12 Type-N mismatch combination SN: 5047.2 / 06327 29-Mar-11 (No. 217-01371) Apr-12 Reference Probe EX3DV4 SN: 3503 04-Mar-11 (No. EX3-3503\_Mar11) Mar-12 DAE4 SN: 601 04-Jul-11 (No. DAE4-601\_Jul11) Secondary Standards ID# Check Date (in house) Scheduled Check MY41092317 Power sensor HP 8481A 18-Oct-02 (in house check Oct-11) In house check: Oct-13 RF generator R&S SMT-06 100005 04-Aug-99 (in house check Oct-11) In house check: Oct-13 Network Analyzer HP 8753E US37390585 S4206 18-Oct-01 (in house check Oct-11) In house check: Oct-12 Function Dimce Iliev Calibrated by: Laboratory Technician Technical Manager Katja Pokovic Approved by: Issued: November 16, 2011 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

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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

#### Glossary:

TSL tissue simulating liquid
ConvF sensitivity in TSL / NORM x,y,z
N/A not applicable or not measured

#### Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- EC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

### Additional Documentation:

d) DASY4/5 System Handbook

#### Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end
  of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed
  point exactly below the center marking of the flat phantom section, with the arms oriented
  parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole
  positioned under the liquid filled phantom. The impedance stated is transformed from the
  measurement at the SMA connector to the feed point. The Return Loss ensures low
  reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point.
   No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

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# **Measurement Conditions**

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

DASY Version	DASY5	V52.6.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5500 MHz ± 1 MHz 5800 MHz ± 1 MHz	

#### Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.6 ± 6 %	4.46 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

# SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.16 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	80.8 mW /g ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.33 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	23.0 mW /g ± 16.5 % (k=2)

# Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.2 ± 6 %	4.75 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

# SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.82 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	87.3 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.50 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	24.7 mW / g ± 16.5 % (k=2)

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	March	24-26. 2014			
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# Head TSL parameters at 5800 MHz The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	33.7 ± 6 %	5.03 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		

# SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.03 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	79.4 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2,28 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	22.5 mW / g ± 16.5 % (k=2)

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	March	24-26. 2014			
	Decemb	oer 8-12, 2014			

# **Appendix**

# Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	51.1 Ω - 8.7 jΩ
Return Loss	- 21.2 dB

#### Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	52.3 Ω - 2.7 jΩ	
Return Loss	- 29.2 dB	

#### Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	56.7 Ω - 4.3 jΩ	
Return Loss	- 22.6 dB	

# General Antenna Parameters and Design

Electrical Delay (one direction)	1.202 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

# Additional EUT Data

Manufactured by	SPEAG		
Manufactured on	July 09, 2004		

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≅ BlackBerry		Appendix D for the BlackBerry® Smartphone Model RFV121LW SAR Report Rev 2			Page <b>60(81)</b>
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Andrew Becker	July 12	- October 16, 2013	RTS-6046-1310-25 Rev 3	L6ARFV120LW	
	March	24-26. 2014			
	Decemb	oer 8-12, 2014			

#### **DASY5 Validation Report for Head TSL**

Date: 15.11.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1033

Communication System: CW; Frequency: 5200 MHz, Frequency: 5500 MHz, Frequency: 5800 MHz Medium parameters used: f = 5200 MHz;  $\sigma = 4.46$  mho/m;  $\epsilon_r = 34.6$ ;  $\rho = 1000$  kg/m³, Medium parameters used: f = 5500 MHz;  $\sigma = 4.75$  mho/m;  $\epsilon_r = 34.2$ ;  $\rho = 1000$  kg/m³, Medium parameters used: f = 5800 MHz;  $\sigma = 5.03$  mho/m;  $\epsilon_r = 33.7$ ;  $\rho = 1000$  kg/m³

Phantom section: Flat Section

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

#### DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5.41, 5.41, 5.41), ConvF(4.91, 4.91, 4.91), ConvF(4.81, 4.81, 4.81); Calibrated: 04.03.2011
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

# Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.595 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 30.134 W/kg

SAR(1 g) = 8.16 mW/g; SAR(10 g) = 2.33 mW/gMaximum value of SAR (measured) = 18.725 mW/g

# Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 66.819 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 35.056 W/kg

SAR(1 g) = 8.82 mW/g; SAR(10 g) = 2.5 mW/gMaximum value of SAR (measured) = 21.019 mW/g

# Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 62.220 V/m; Power Drift = 0.04 dB

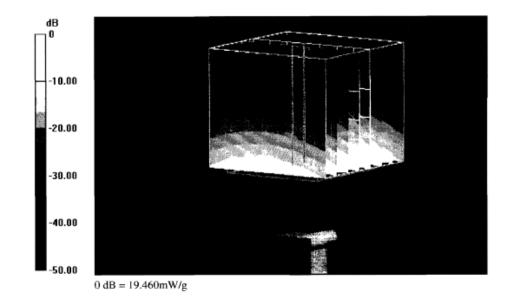
Peak SAR (extrapolated) = 33.743 W/kg

SAR(1 g) = 8.03 mW/g; SAR(10 g) = 2.28 mW/gMaximum value of SAR (measured) = 19.463 mW/g

Certificate No: D5GHzV2-1033\_Nov11

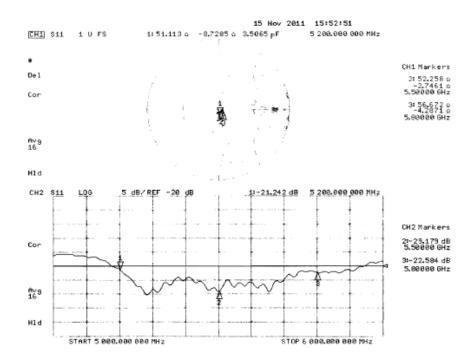
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	March	24-26. 2014			
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*** BlackBerry Appendix D RFV121LW		Appendix D for the RFV121LW SAR R	BlackBerry® Smartphone Meport Rev 2	Page <b>62(81)</b>	
Author Data	Dates of Test	:	Test Report No	FCC ID:	
Andrew Becker	July 12	- October 16, 2013	RTS-6046-1310-25 Rev 3	L6ARFV120LW	
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	Decemb	oer 8-12, 2014			

# Impedance Measurement Plot for Head TSL





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RFV121LW SAR Report Rev 2

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Author Data

**Andrew Becker** 

July 12 – October 16, 2013

March 24-26. 2014 December 8-12, 2014 Test Report No

RTS-6046-1310-25 Rev 3

FCC ID: L6ARFV120LW

# **Probe 3592**

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





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

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

Blackberry Waterloo

Accreditation No.: SCS 108

S

C

Certificate No: EX3-3592\_Nov14

# CALIBRATION CERTIFICATE

Object

EX3DV4-SN:3592

Calibration procedure(s)

QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6

Calibration procedure for dosimetric E-field probes

Calibration date:

November 10, 2014

This calibration cartificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncortainties 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 E4419B	GB412938Y4	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03 Apr-14 (No. 217-01915)	Apr-16
Reference 20 dB Attenuator	SN: S5277 (20x)	(33-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN; S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	5N: 3013	30-Dec-13 (No. ES3-3013, Dec13)	Dec-14
DAE4	SN: 860	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	(1)	Gheck Date (in house)	Scheduled Check
RI- generator HP 8648C	US3642U01700	4-Aug-89 (in house check Apr. 13)	In house check: Apr-16
Network Analyzer HP 8753F	US37390585	18-Oct-01 (in house check Oct-14)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	Seef My
Approved by:	Kalja Pokovic	Technical Manager	Reas-
			Issued: November 10, 2014

Certificate No. EX3-3592\_Nov14

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Author Data

**Andrew Becker** 

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RFV121LW SAR Report Rev 2

Test Report No

RTS-6046-1310-25 Rev 3

FCC ID:

L6ARFV120LW

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Calibration Laboratory of

Dates of Test

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





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

Accreditation No.: SCS 108

Accredited by the Swiss Accreditation Service (SAS)

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July 12 – October 16, 2013

March 24-26. 2014 December 8-12, 2014

Glossary:

tissue simulating liquid sensitivity in free space NORMX, Y, Z sensitivity in TSL / NORMx,y,z ConvF DCP diode compression point

crest factor (1/duty\_cycle) of the RF signal CF A, B, C, D modulation dependent linearization parameters

Polarization of corotation around probe axis

Polarization 9 9 rotation around an axis that is in the plane normal to probe axis (at measurement center),

i.e., 8 = 0 is normal to probe axis

Connector Angle information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

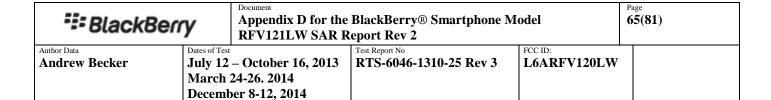
- a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques\*, June 2013
- b) IEC 62209-1. \*Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

### Methods Applied and Interpretation of Parameters:

- NORMx,y,z: Assessed for E-field polarization 9 = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz; R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E2-field uncertainty inside TSL (see below ConvF).
- NORM(f)x,y,z = NORMx,y,z \* frequency response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF
- DCPx,y,z: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media
- PAR: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal
- Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z; A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for f < 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx,y,z \* ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100
- Spherical isotropy (3D deviation from isotropy): in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset. The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle: The angle is assessed using the information gained by determining the NORMx (no uncertainty required).

Cortificate No. EX3-3592 Nov14

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EX3DV4 - SN:3592

November 10, 2014

# Probe EX3DV4

SN:3592

Manufactured: Calibrated: September 18, 2006 November 10, 2014

Calibrated for DASY/EASY Systems (Note: non-compatible with DASY2 system!)

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Author Data

**Andrew Becker** 

Dates of Test **July 12 – October 16, 2013** March 24-26. 2014

December 8-12, 2014

Test Report No RTS-6046-1310-25 Rev 3 FCC ID: L6ARFV120LW

EX3DV4-SN:3592

November 10, 2014

# DASY/EASY - Parameters of Probe: EX3DV4 - SN:3592

# **Basic Calibration Parameters**

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (µV/(V/m) <sup>2</sup> ) <sup>A</sup>	0.48	0.47	0.40	±10.1 %
DCP (mV)	95,2	98.0	98.8	-

#### Modulation Calibration Parameters

מוט	Communication System Name		A dB	B dBõV	C	dB	VR mV	Unc* (k=2)
0	CW	×	0.0	0.0	1.0	0.00	145.9	±3.3 %
	10-27	Y	0.0	0,0	1.0		156.9	
		Z	0.0	0.0	1.0		149.1	

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

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<sup>\*</sup> The uncertainties of NormX,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Pages 5 and 6).

<sup>&</sup>lt;sup>12</sup> Numerical linearization parameter; uncertainty not required.
<sup>15</sup> Uncertainty is determined using the max, deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

*** BlackBerry Appendix D for RFV121LW SA		Appendix D for the RFV121LW SAR R	BlackBerry® Smartphone Meport Rev 2	Page <b>67(81)</b>	
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	March	24-26. 2014			
	Decemb	oer 8-12, 2014			

EX3DV4-SN:3592

November 10, 2014

# DASY/EASY - Parameters of Probe: EX3DV4 - SN:3592

# Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) F	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
2600	39.0	1.96	6.80	6.80	6.80	0.36	0.93	± 12.0 %
5250	35.9	4.71	4.63	4.63	4.63	0.35	1.80	± 13.1 %
5600	35.5	5.07	4.20	4.20	4.20	0.40	1.80	± 13.1 %
5750	35.4	5.22	4.34	4.34	4.34	0.40	1.80	± 13.1 %

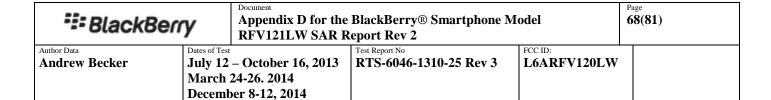
Frequency validity above 350 MHz of ± 100 MHz only applies for DASY v1.4 and higher (ace Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvE uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvE assossments at 30, 84, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

At frequencies below 3 GHz, the validity of tissue parameters (a and in) can be relaxed to ± 10% if liquid compensation formula is applied to investigate the second of the ConvE uncertainty for indicated target tissue parameters.

AppliaDepth are determined during calibration. SEPAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-8 GHz at any distance larger than half the probe to diemeter from the boundary.

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EX3DV4 8N:3592

November 10, 2014

# DASY/EASY - Parameters of Probe: EX3DV4 - SN:3592

### Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) C	Relative Permittivity	Conductivity (S/m)	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>C</sup> (mm)	Unct. (k=2)
2600	52.5	2.16	6.84	6.84	6,84	0.78	0.62	± 12.0 %
5250	48,9	5.36	4.06	4.06	4.06	0.45	1.90	± 13.1 %
5600	48.5	5.77	3.78	3.78	3.78	0.45	1.90	± 13.1 %
5750	48,3	5.94	3.81	3.81	3.81	0.50	1.90	± 13.1 %

Frequency validity above 300 MHz of ± 103 MHz only applies for DASY V4.4 and higher (see Page 7), else if its restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

\*At frequencies below 3 GHz, the validity of tissue parameters (cland of can be released to ± 10% if liquid companion formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (cland of can be released to ± 10%. The uncertainty is the RSS of the ConvF numeritainty for indicated larget tissue parameters.

\*Alpha/Depth are determined during calibration. SPEAG warronts that the remaining deviation due to the boundary effect after componsation is a subscribe for frequencies below 3.6 Hz, and halow a 2% for frequencies below 3.6 Hz and halow a 10% for frequencies below 3.6 Hz and halow at 20% for frequencies below 3.6 Hz and halow a 10% for frequencies below 3.6 Hz and halow a 20% for frequencies below 3.6 Hz as any distance larger than 1.0 MHz.

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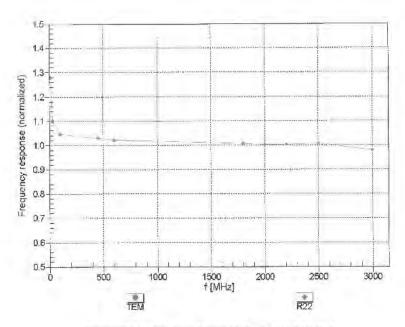
always loss than ± 1% for frequencies below 3 GHz and helow ± 2% for frequencies between 3.6 GHz at any distance larger than half the probe tip claimater from the boundary.

*** BlackBerry App			Appendix D for the BlackBerry® Smartphone Model RFV121LW SAR Report Rev 2			
Author Data	Dates of Test	:	Test Report No	FCC ID:		
Andrew Becker	July 12	- October 16, 2013	RTS-6046-1310-25 Rev 3	L6ARFV120LW		
	March	24-26. 2014				
	Decemb	oer 8-12, 2014				

EX3DV4- SN:3592

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# Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)

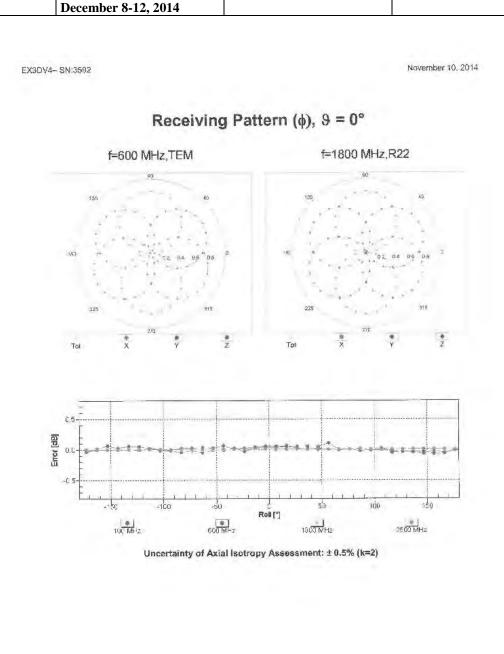


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

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Author Data

**Andrew Becker July 12 – October 16, 2013** 

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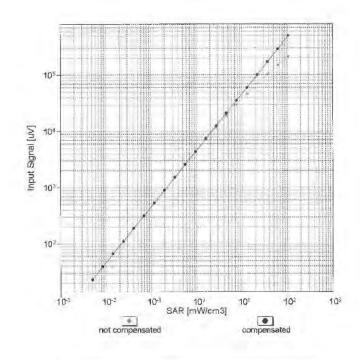
Test Report No RTS-6046-1310-25 Rev 3

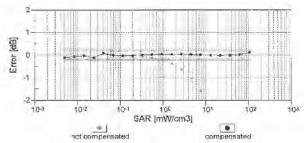
FCC ID: L6ARFV120LW

EX3DV4 SN:3592

November 10, 2014

# Dynamic Range f(SAR<sub>head</sub>) (TEM cell , feval= 1900 MHz)





Uncertainty of Linearity Assessment: ± 0.6% (k=2)

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Author Data

**Andrew Becker** 

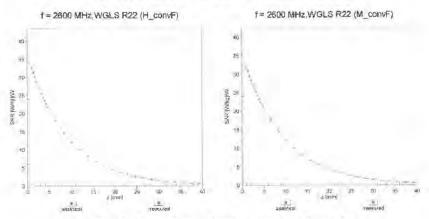
Dates of Test **July 12 – October 16, 2013** March 24-26. 2014 December 8-12, 2014

Test Report No RTS-6046-1310-25 Rev 3 FCC ID: L6ARFV120LW

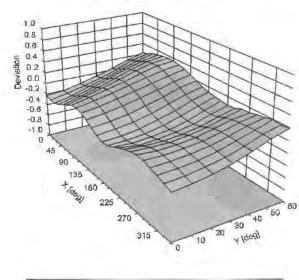
EX3DV4- SN:3592

November 10, 2014

# **Conversion Factor Assessment**



# Deviation from Isotropy in Liquid Error (φ, θ), f = 900 MHz



-1.0 -0.8 -0.6 -0.4 -0.2 0.0 0.2 0.4 0.6 Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

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Andrew Becker	July 12	- October 16, 2013	RTS-6046-1310-25 Rev 3	L6ARFV120LW			
	March	24-26. 2014					
	Decemb	oer 8-12, 2014					

EX3DV4-SN:3592

November 10, 2014

# DASY/EASY - Parameters of Probe: EX3DV4 - SN:3592

# Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (*)	-13.3
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1,4 mm

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Test Report No

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Author Data **Andrew Becker** 

Dates of Test July 12 - October 16, 2013 March 24-26. 2014 December 8-12, 2014

RTS-6046-1310-25 Rev 3

5000 Dipole

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





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Blackberry Waterloo

Certificate No: D5GHzV2-1033\_Nov13

Accreditation No.: SCS 108

Object	D5GHzV2 - SN: 1033		
	DOG TETE OF THOSE		
Calibration procedure(s)	QA CAL-22.v2 Calibration procedure for dipole validation kits between 3-6 GHz		
Calibration date:	November 08, 20	13	
		onal standards, which realize the physical un obability are given on the following pages an	
All calibrations have been conduc	cred in the closed laborator	y facility: environment temperature (22 ± 3)°C	and humidity < 70%.
Calibration Equipment used (M&	TE critical for calibration)		
Calibration Equipment used (M&	TE critical for calibration)	Cal Date (Certificate No.)	Scheduled Calibration
Primary Standards Power meter EPM-442A	ID # GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Primary Standards Power meter EPM-442A Power sensor HP 8481A	ID # GB37480704 US37292783	09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01827)	Oct-14 Oct-14
Primary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A	ID # GB37480704 US37292783 MY41092317	09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01828)	Oct-14 Oct-14 Oct-14
Primary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A Reference 20 dB Attenuator	ID # GB37480704 US37292783 MY41092317 SN: 5058 (20k)	09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01828) 04-Apr-13 (No. 217-01738)	Oct-14 Oct-14 Oct-14 Apr-14
Primary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A Reference 20 dB Attanuator Type-N mismatch combination	ID # GB37480704 US37292783 MY41092317 SN: 5058 (20k) SN: 5047.3 / 06327	09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01826) 04-Apr-13 (No. 217-01736) 04-Apr-13 (No. 217-01739)	Oct-14 Oct-14 Oct-14 Apr-14 Apr-14
Primary Standards Power meter EPM-442A Power sensor HP 8481A Power sensor HP 8481A Reference 20 dB Attenuator	ID # GB37480704 US37292783 MY41092317 SN: 5058 (20k)	09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01828) 04-Apr-13 (No. 217-01738)	Oct-14 Oct-14 Oct-14 Apr-14
Primary Standards Power meter EPM-442A Power sensor HP 9481A Power sensor HP 9481A Reference 20 dB Attanuator Type-N mismatch combination Reference Probe ESSDV3 DAE4	ID III GB37480704 US37292783 MY41092317 SN: 5058 (20k) SN: 5047 3 / 06927 SN: 3205	09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01826) 04-Apr-13 (No. 217-01736) 04-Apr-13 (No. 217-01739) 28-Dec-12 (No. ES3-3205_Dec12)	Oct-14 Oct-14 Oct-14 Apr-14 Apr-14 Dec-13
Primary Standards Power meter EPM-442A Power sensor HP 9481A Power sensor HP 9481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ESSDV3	ID # GB37480704 US37292783 MY41092317 SN: 5058 (20k) SN: 5047.3 / 06927 SN: 3205 SN: 801	09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01828) 04-Apr-13 (No. 217-01738) 04-Apr-13 (No. 217-01739) 28-Dac-12 (No. E35-3205_Dec12) 25-Apr-13 (No. DAE4-601_Apr13)	Oct-14 Oct-14 Oct-14 Apr-14 Apr-14 Dec-13 Apr-14
Primary Standards Power meter EPM-442A Power sensor HP 9481A Power sensor HP 9481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ESSDV3 DAE4 Secondary Standards	ID # GB37480704 US37292783 MY41092317 SN: 5058 (20k) SN: 5047.3 / 06327 SN: 3205 SN: 601	08-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01828) 04-Apr-13 (No. 217-01738) 04-Apr-13 (No. 217-01739) 28-Dec-12 (No. ES3-3205_Dec12) 25-Apr-13 (No. DAE4-601_Apri3) Check Date (in house)	Oct-14 Oct-14 Oct-14 Apr-14 Apr-14 Dec-13 Apr-14 Scheduled Check
Primary Standards Power mater EPM-442A Power sensor HP 8481A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ESSDV3 DAE4 Secondary Standards HF generator R&S SMT-06	ID # GBS7480704 US37292783 MY41092317 SN: 5058 (20k) SN: 5047 9 / 06927 SN: 3205 SN: 801 ID # 100005 US37390585 S4206	09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01828) 04-Apr-13 (No. 217-01738) 04-Apr-13 (No. 217-01739) 24-Dac-12 (No. ES3-3205_Dec12) 25-Apr-13 (No. DAE4-601_Apr13) Check Date (in house) 04-Aug-99 (in house check Oct-13) 18-Oct-01 (in house chack Oct-13)	Oct-14 Oct-14 Oct-14 Apr-14 Apr-14 Dec-13 Apr-14 Scheduled Check In house check, Oct-15 In house check, Oct-14
Primary Standards Power meter EPM-442A Power sensor HP 9481A Power sensor HP 9481A Power sensor HP 3481A Reference 20 dB Attanuator Type-N mismatch combination Reference Probe ES3DV3 DAE4 Secondary Standards HF generator R&S SMT-06 Network Analyzer HP 8753E	ID # GBS7480704 US37292783 MY41092317 SN: 5058 (20k) SN: 5047 3 / 06327 SN: 3206 SN: 801 ID # 100005 US37390585 S4206	09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01828) 04-Apr-13 (No. 217-01736) 04-Apr-13 (No. 217-01739) 28-Dac-12 (No. ES3-3205_Dec12) 25-Apr-13 (No. DAE4-601_Apr13) Check Date (in house) 04-Aug-99 (in house check Oct-13) 18-Oct-01 (in house check Oct-13)	Oct-14 Oct-14 Oct-14 Apr-14 Apr-14 Apr-14 Dec-13 Apr-14 Scheduled Check In house check, Oct-15
Primary Standards Power mater EPM-442A Power sensor HP 8481A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ESSDV3 DAE4 Secondary Standards HF generator R&S SMT-06	ID # GBS7480704 US37292783 MY41092317 SN: 5058 (20k) SN: 5047 9 / 06927 SN: 3205 SN: 801 ID # 100005 US37390585 S4206	09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01828) 04-Apr-13 (No. 217-01738) 04-Apr-13 (No. 217-01739) 24-Dac-12 (No. ES3-3205_Dec12) 25-Apr-13 (No. DAE4-601_Apr13) Check Date (in house) 04-Aug-99 (in house check Oct-13) 18-Oct-01 (in house chack Oct-13)	Oct-14 Oct-14 Oct-14 Apr-14 Apr-14 Dec-13 Apr-14 Scheduled Check In house check, Oct-15 In house check, Oct-14
Primary Standards Power meter EPM-442A Power sensor HP 9481A Power sensor HP 9481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV3 DAE4 Secondary Standards HF generator R&S SMT-06 Network Analyzer HP 8753E	ID # GBS7480704 US37292783 MY41092317 SN: 5058 (20k) SN: 5047 3 / 06327 SN: 3206 SN: 801 ID # 100005 US37390585 S4206	09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01827) 09-Oct-13 (No. 217-01828) 04-Apr-13 (No. 217-01736) 04-Apr-13 (No. 217-01739) 28-Dac-12 (No. ES3-3205_Dec12) 25-Apr-13 (No. DAE4-601_Apr13) Check Date (in house) 04-Aug-99 (in house check Oct-13) 18-Oct-01 (in house check Oct-13)	Oct-14 Oct-14 Oct-14 Apr-14 Apr-14 Apr-14 Dac-13 Apr-14 Scheduled Check In house check, Oct-15 In house check, Oct-11

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





Schweizerischer Kallbrierdienst Service suisse d'étalonnage C

Servizio svizzero di taratura Swiss Calibration Service

Accreditation No.: SCS 108

Accrediters by the Swass Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL ConvF N/A

tissue simulating liquid

sensitivity in TSL / NORM x,y,z not applicable or not measured

Calibration is Performed According to the Following Standards:

- a) IEC 62209-2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", March 2010
- b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"
- c) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

#### Additional Documentation:

d) DASY4/5 System Handbook

# Methods Applied and Interpretation of Parameters:

- · Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- · Antenna Parameters with TSL: The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1 W at the antenna
- SAR for nominal TSL parameters: The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

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# Measurement Conditions

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5500 MHz ± 1 MHz 5800 MHz ± 1 MHz	

# Head TSL parameters at 5200 MHz

ng parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.0 ± 6 %	4.46 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	-	-

# SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.99 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.4 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.6 W/kg ± 19.5 % (k=2)

# Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mhq/m
Measured Head TSL parameters	(22.0 ± 0.2) "C	34.6 ± 6 %	4.75 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	-	

#### SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.51 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	84.4 W / kg ± 19.9 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.9 W/kg ± 19.5 % (k=2)

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Head TSL parameters at 5800 MHz

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The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22,0 °C	35,3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) "C	34.2 ± 6 %	5.06 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C		-

# SAR result with Head TSL at 5800 MHz

Condition	
100 mW input power	8.01 W/kg
normalized to 1W	79.4 W/kg ± 19.9 % (k=2)
	100 mW input power

SAR averaged over 10 cm3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.6 W/kg ± 19.5 % (k=2)



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#### Appendix

#### Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	49.1 Ω - 9.6  Ω
Return Loss	- 20.3 dB

#### Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	50.3 Ω - 4.1 JΩ		
Return Loss	- 27.7 dB		

#### Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	57.8 Ω - 4.0 jΩ	
Return Loss	- 21.8 dB	

# General Antenna Parameters and Design

Electrical Delay (one direction)	1.213 ns
The state of the s	1,270 110

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

# Additional EUT Data

Manufactured by	SPEAG		
Manufactured on	July 09, 2004		

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# DASY5 Validation Report for Head TSL

Date: 08.11.2013

Test Laboratory: SPEAG, Zurich, Switzerland

# DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1033

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5500 MHz, Frequency: 5800

Medium parameters used: f = 5200 MHz;  $\sigma = 4.46$  S/m;  $\epsilon_r = 35$ ;  $\rho = 1000$  kg/m<sup>3</sup>, Medium parameters used: f = 5500 MHz;  $\sigma = 4.75$  S/m;  $\epsilon_r = 34.6$ ;  $\rho = 1000$  kg/m<sup>1</sup> Medium parameters used: f = 5800 MHz;  $\sigma = 5.06$  S/m;  $\varepsilon_r = 34.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

# DASY52 Configuration:

- Probe: EX3DV4 SN3503; ConvF(5.41, 5.41, 5.41); Calibrated: 28.12.2012, ConvF(4.91, 4.91. 4.91); Calibrated: 28.12.2012, ConvF(4.81, 4.81, 4.81); Calibrated: 28.12.2012;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA, Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

# Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 64.635 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 29.5 W/kg

SAR(1 g) = 7.99 W/kg; SAR(10 g) = 2.28 W/kg

Maximum value of SAR (measured) = 18.4 W/kg

# Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 64.397 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 33.8 W/kg

SAR(1 g) = 8.51 W/kg; SAR(10 g) = 2.41 W/kg

Maximum value of SAR (measured) = 20.3 W/kg

# Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan,

dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 61.128 V/m; Power Drift = 0.08 dB

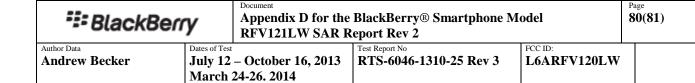
Peak SAR (extrapolated) = 33.0 W/kg

SAR(1 g) = 8.01 W/kg; SAR(10 g) = 2.28 W/kg

Maximum value of SAR (measured) = 19.2 W/kg

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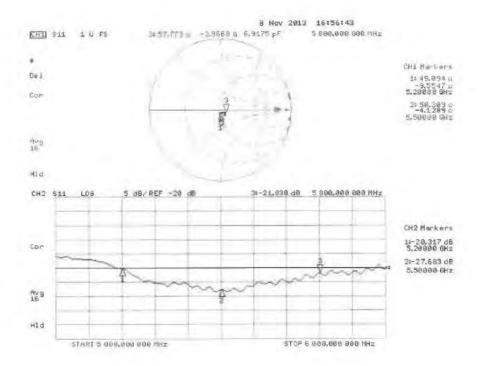


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	Decemb	oer 8-12, 2014			

# Impedance Measurement Plot for Head TSL



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