

RTS RIM Testing Services	Document Appendix for the BlackBerry® Smartphone Model RBZ41GW SAR Report		Page 1(13)
Author Data Shahriar Ninad	Dates of Test July 16-29, 2008	Test Report No RTS-1115-0807-21	FCC ID: L6ARBZ40GW

APPENDIX D2: PROBE & DIPOLE CALIBRATION DATA

RTS RIM Testing Services	Document	Appendix for the BlackBerry® Smartphone Model RBZ41GW SAR Report		Page 2(13)
	Author Data Shahriar Ninad	Dates of Test July 16-29, 2008	Test Report No RTS-1115-0807-21	FCC ID: L6ARBZ40GW

Calibration Laboratory of
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client RIM

Certificate No: D1900V2-545_Jan07

CALIBRATION CERTIFICATE

Object: D1900V2 - SN: 545

Calibration procedure(s): QA CAL-05.v6
Calibration procedure for dipole validation kits

Calibration date: January 9, 2007

Condition of the calibrated item: In Tolerance

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&E critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	03-Oct-06 (METAS, No. 217-06008)	Oct-07
Power sensor HP 8481A	US37292783	03-Oct-06 (METAS, No. 217-06008)	Oct-07
Reference 20 dB Attenuator	SN: 5086 (20g)	10-Aug-06 (METAS, No. 217-00591)	Aug-07
Reference 10 dB Attenuator	SN: 5047.2 (10r)	10-Aug-06 (METAS, No. 217-00591)	Aug-07
Reference Probe ET3DV6	SN: 1507	19-Oct-06 (SPEAG, No. ET3-1607_Oct06)	Oct-07
Reference Probe ES3DV3	SN: 3025	19-Oct-06 (SPEAG, No. ES3-3025_Oct06)	Oct-07
DAE4	SN 907	20-Jul-06 (SPEAG, No. DAE4-907_Jul06)	Jul-07
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (SPEAG, in house check Oct-05)	In house check: Oct-07
RF generator Agilent E4421B	MY41000675	11-May-05 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (SPEAG, in house check Oct-06)	In house check: Oct-07

Calibrated by: Name: Mike Meil, Function: Laboratory Technician, Signature: *M. Meil*

Approved by: Name: Katja Pokovic, Function: Technical Manager, Signature: *Katja Pokovic*

Issued: January 16, 2007

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

Certificate No: D1900V2-545_Jan07

Page 1 of 6

RTS RIM Testing Services	Document Appendix for the BlackBerry® Smartphone Model RBZ41GW SAR Report		Page 3(13)
	Author Data Shahriar Ninad	Dates of Test July 16-29, 2008	Test Report No RTS-1115-0807-21

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Accreditation No.: **SCS 108**

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
- CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001
- 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:

- DASY4 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.

RTS RIM Testing Services	Document Appendix for the BlackBerry® Smartphone Model RBZ41GW SAR Report		Page 4(13)
	Author Data Shahriar Ninad	Dates of Test July 16-29, 2008	Test Report No RTS-1115-0807-21

Measurement Conditions

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

DASY Version	DASY4	V4.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Area Scan Resolution	dx, dy = 15 mm	
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 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	38.8 ± 6 %	1.43 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 0.2) °C	—	—

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	condition	
SAR measured	250 mW input power	9.49 mW / g
SAR normalized	normalized to 1W	38.0 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	37.0 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	4.98 mW / g
SAR normalized	normalized to 1W	19.9 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	19.6 mW / g ± 16.5 % (k=2)

¹ Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

RTS RIM Testing Services	Document Appendix for the BlackBerry® Smartphone Model RBZ41GW SAR Report		Page 5(13)
	Author Data Shahriar Ninad	Dates of Test July 16-29, 2008	Test Report No RTS-1115-0807-21

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.0 Ω + 0.2 j Ω
Return Loss	-34.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.197 ns
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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	November 15, 2001

RTS RIM Testing Services	Document Appendix for the BlackBerry® Smartphone Model RBZ41GW SAR Report		Page 6(13)
	Author Data Shahriar Ninad	Dates of Test July 16-29, 2008	Test Report No RTS-1115-0807-21

DASY4 Validation Report for Head TSL

Date/Time: 09.01.2007 12:59:52

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: HSL U10 BB;

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.43$ mho/m; $\epsilon_r = 38.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507 (HF); ConvF(4.97, 4.97, 4.97); Calibrated: 19.10.2006
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn907; Calibrated: 20.07.2006
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:

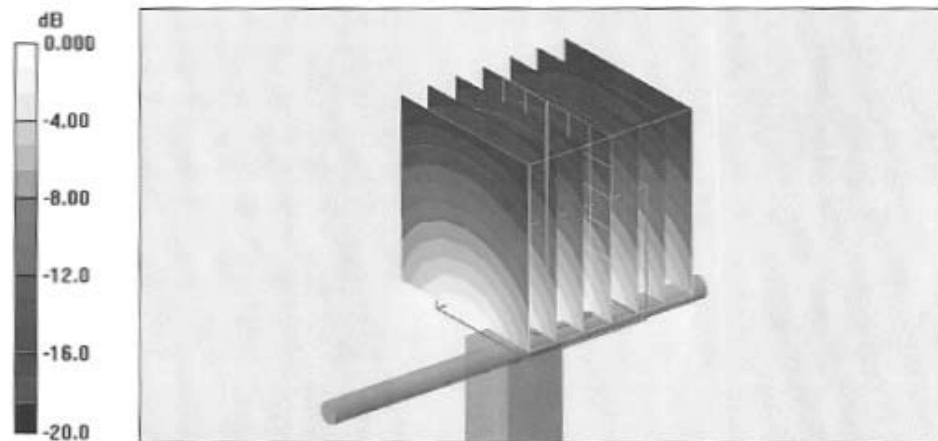
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 90.8 V/m; Power Drift = 0.018 dB

Peak SAR (extrapolated) = 16.5 W/kg

SAR(1 g) = 9.49 mW/g; SAR(10 g) = 4.98 mW/g

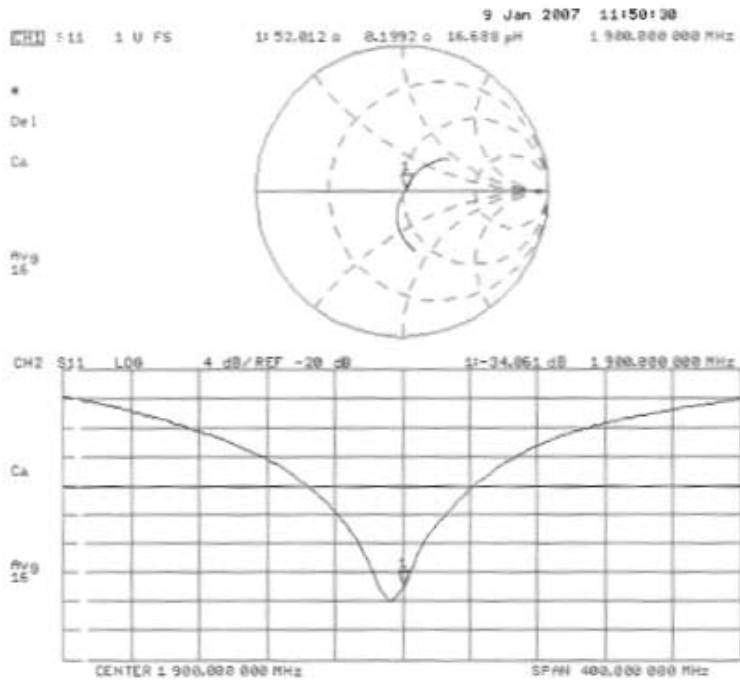
Maximum value of SAR (measured) = 10.7 mW/g



0 dB = 10.7mW/g

RTS RIM Testing Services	Document Appendix for the BlackBerry® Smartphone Model RBZ41GW SAR Report		Page 7(13)
	Author Data Shahriar Ninad	Dates of Test July 16-29, 2008	Test Report No RTS-1115-0807-21

Impedance Measurement Plot for Head TSL



RTS RIM Testing Services	Document	Appendix for the BlackBerry® Smartphone Model RBZ41GW SAR Report		Page 8(13)
	Author Data Shahriar Ninad	Dates of Test July 16-29, 2008	Test Report No RTS-1115-0807-21	FCC ID: L6ARBZ40GW

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Accreditation No.: SCS 108

Client RIM

Certificate No: D2450V2-747_Nov07

CALIBRATION CERTIFICATE

Object: D2450V2 - SN: 747

Calibration procedure(s): QA CAL-05.v6
Calibration procedure for dipole validation kits

Calibration date: November 06, 2007

Condition of the calibrated item: In Tolerance

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 (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	04-Oct-07 (METAS, No. 217-00736)	Oct-08
Power sensor HP 8481A	US37292783	04-Oct-07 (METAS, No. 217-00736)	Oct-08
Reference 20 dB Attenuator	SN: 5086 (20g)	07-Aug-07 (METAS, No 217-00718)	Aug-08
Reference 10 dB Attenuator	SN: 5047.2 (10r)	07-Aug-07 (METAS, No 217-00718)	Aug-08
Reference Probe ES3DV2	SN: 3025	26-Oct-07 (SPEAG, No. ES3-3025_Oct07)	Oct-08
DAE4	SN: 601	30-Jan-07 (SPEAG, No. DAE4-601_Jan07)	Jan-08

Secondary Standards	ID #	Check Date (In house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (SPEAG, in house check Oct-07)	In house check: Oct-08
RF generator R&S SMT-06	100005	4-Aug-98 (SPEAG, in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (SPEAG, in house check Oct-07)	In house check: Oct-08

Calibrated by: Claudio Leubler, Laboratory Technician

Approved by: Kača Poković, Technical Manager

Issued: November 15, 2007

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Certificate No: D2450V2-747_Nov07

Page 1 of 6

RTS RIM Testing Services	Document Appendix for the BlackBerry® Smartphone Model RBZ41GW SAR Report		Page 9(13)
	Author Data Shahriar Ninad	Dates of Test July 16-29, 2008	Test Report No RTS-1115-0807-21
		FCC ID: L6ARBZ40GW	

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Accreditation No.: **SCS 108**

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
- 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:

- DASY4 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.

RTS RIM Testing Services	Document Appendix for the BlackBerry® Smartphone Model RBZ41GW SAR Report		Page 10(13)
	Author Data Shahriar Ninad	Dates of Test July 16-29, 2008	Test Report No RTS-1115-0807-21
		FCC ID: L6ARBZ40GW	

Measurement Conditions

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

DASY Version	DASY4	V4.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
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	38.4 ± 6 %	1.85 mho/m ± 6 %
Head TSL temperature during test	(21.5 ± 0.2) °C	-----	-----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	condition	
SAR measured	250 mW input power	13.6 mW / g
SAR normalized	normalized to 1W	54.4 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	53.2 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.27 mW / g
SAR normalized	normalized to 1W	25.1 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	24.8 mW / g ± 16.5 % (k=2)

¹ Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

RTS RIM Testing Services	Document Appendix for the BlackBerry® Smartphone Model RBZ41GW SAR Report		Page 11(13)
	Author Data Shahriar Ninad	Dates of Test July 16-29, 2008	Test Report No RTS-1115-0807-21

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.2 Ω + 2.1 j Ω
Return Loss	- 32.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.160 ns
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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

RTS RIM Testing Services	Document Appendix for the BlackBerry® Smartphone Model RBZ41GW SAR Report		Page 12(13)
	Author Data Shahriar Ninad	Dates of Test July 16-29, 2008	Test Report No RTS-1115-0807-21

DASY4 Validation Report for Head TSL

Date/Time: 06.11.2007 15:01:41

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN747

Communication System: CW-2450; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: HSL U10 BB;

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.79$ mho/m; $\epsilon_r = 38$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3025 (HF); ConvF(4.41, 4.41, 4.41); Calibrated: 26.10.2007
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2007
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; ;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 172

Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:

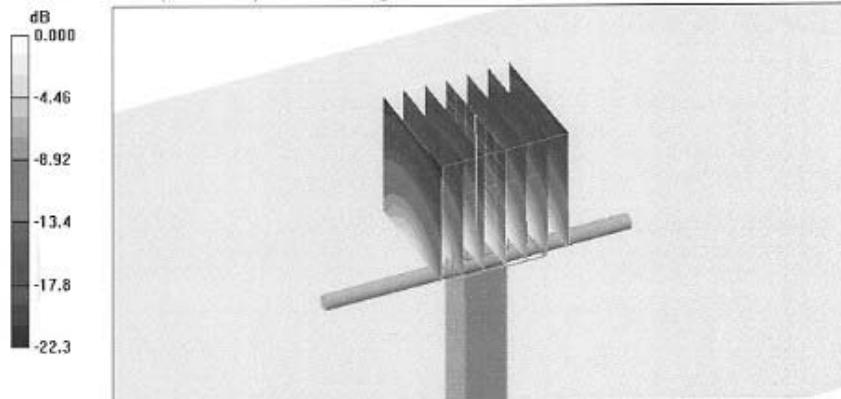
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.4 V/m; Power Drift = 0.016 dB

Peak SAR (extrapolated) = 29.4 W/kg

SAR(1 g) = 13.6 mW/g; SAR(10 g) = 6.27 mW/g

Maximum value of SAR (measured) = 15.4 mW/g



0 dB = 15.4mW/g

RTS RIM Testing Services	Document Appendix for the BlackBerry® Smartphone Model RBZ41GW SAR Report		Page 13(13)
	Author Data Shahriar Ninad	Dates of Test July 16-29, 2008	Test Report No RTS-1115-0807-21

Impedance Measurement Plot for Head TSL

