SAR Compliance Test Report

Testing Lab: RIM Testing Services
440 Phillip Street
Waterloo, Ontario
Canada N2L 5R9
Phone: 519-888-7465
Fax: 519-746-0189

Applicant: Research In Motion Limited
295 Phillip Street
Waterloo, Ontario
Canada N2L 3W8
Phone: 519-888-7465
Fax: 519-888-6906

Web site: www.rim.com

Statement of Compliance: RIM Testing Services declares under its sole responsibility that the product to which this declaration relates, is in conformity with the appropriate RF exposure standards, recommendations and guidelines. It also declares that the product was tested in accordance with the appropriate measurement standards, guidelines and recommended practices.

Device Category: This BlackBerry® Smartphone is a portable device, designed to be used in direct contact with the user's head, hand and to be carried in approved accessories when carried on the user's body.

RF Exposure Environment: This device has been shown to be in compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in OET Bulletin 65 Supplement C (Edition 01-01), FCC 96-326, IEEE Std. C95.1-2005, Health Canada's Safety Code 6, as reproduced in RSS-102 issue 4-2010 and has been tested in accordance with the measurement procedures specified in latest FCC OET KDB Procedures, OET Bulletin 65 Supplement C (Edition 01-01), ANSI/IEEE Std. C95.3-2002, IEEE 1528-2003, IEC 62209-1-2005, IEC 62209 - 2-2010 and Health Canada's Safety Code 6.

Andrew Becker
SAR & HAC Compliance Specialist
(Author of the Test Report)

Daoud Attayi
Compliance Manager (SAR & HAC)
(Verification and responsible of the Test Report)

Masud S. Attayi
Manager, Regulatory Compliance
(Approval for the Test Report)

RTS is accredited
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EN ISO/IEC 17025 by:

SCC Accredited LAB
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Note: According to the hardware similarity document, BlackBerry model: RFR101LW has a same design/PCB as RFS121LW, except RFR101LW also supports LTE Bands 2,4,5,17 and UMTS Band IV. Due to this similarity, only SAR measurement spot checks were performed on the worst case band and full testing on the new band.

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1.0 OPERATING CONFIGURATIONS AND TEST CONDITIONS

1.1 Picture of Device

Please refer to Appendix E.

Figure 1.1-1 BlackBerry Smartphone

1.2 Antenna description

Type	Internal fixed antenna
Location	Please refer to Figure 1.9-1
Configuration	Internal fixed antenna

Table 1.2-1 Antenna description

1.3 Device description

Device Model	RFS121LW			
FCC ID	L6ARFS120LW			
PIN	Radiated: 2AB02A54 (Rev1), 2AB02A49 (Rev1), 2AB04D29 (Rev2) , 2FFF9A72 (Rev3) Conducted: 2AB02A62 (Rev1), 2AB02A6B (Rev1), 2AB04D16 (Rev2), 2FFF9A91 (Rev3)			
Hardware Rev	Rev1-906-00/01, Rev2-906-00/01, Rev3-x09-01/02			
Software Version	127.0.1.4081, 10.1.0.1666			
Prototype or Production Unit	Production			
Mode(s) of Operation	1-slot GSM 850 GSM 1900	2-slots EDGE/GPRS 850/1900	3-slots EDGE/GPRS 850/1900	4-slots EDGE/GPRS 850/1900
Nominal Maximum conducted RF Output Power (dBm)	33.5 29.0	31.5 28.0	30.5 25.0	28.0 24.5
Tolerance in Power Setting on centre channel (dB)	± 0.5	± 0.5	± 0.5	± 0.5
Duty Cycle	1:8	2:8	3:8	4:8
Transmitting Frequency Range (MHz)	824.2 – 848.8 1850.2 – 1909.8	824.2 – 848.8 1850.2 – 1909.8	824.2 – 848.8 1850.2 – 1909.8	824.2 – 848.8 1850.2 – 1909.8
Mode(s) of Operation	802.11b	802.11g	802.11n	Bluetooth
Nominal Maximum conducted RF Output Power (dBm)	16.5	15.5	12.5	10.5
Tolerance in Power Setting on centre channel (dB)	± 0.5	± 0.5	± 0.5	N/A
Duty Cycle	1:1	1:1	1:1	N/A

Transmitting Frequency Range (MHz)	2412-2462	2412-2462	2412-2462	2402-2483
Mode(s) of Operation	HSPA+/ WCDMA / UMTS FDD V (850)	HSPA+/ WCDMA / UMTS FDD II (1900)	NFC	
Nominal Maximum conducted RF Output Power (dBm)	23.5	22.5	N/A	
Tolerance in Power Setting on centre channel (dB)	± 0.5	± 0.5	N/A	
Duty Cycle	1:1	1:1	N/A	
Transmitting Frequency Range (MHz)	824.6 – 846.6	1852.4 – 1907.6	13.56	

Table 1.3-1 Test device characterization for U.S. wireless operating modes/bands for model RFS121LW

Note 1: The BlackBerry model: RFS121LW also supports GSM/GPRS/EDGE 900/1800 MHz, UMTS band I/VIII, and LTE 3/7/8/20, that are not operational in North America, therefore no data is presented in this report for those bands.

Note 2: SAR measurements on NFC haven't been conducted, since it is very low power and frequency magnetic field transceiver. SAR probes measure higher frequency/power electric field.

Device Model	RFR101LW			
FCC ID	L6ARFR100LW			
PIN	Radiated: 2AB035D0(Rev1), 2AB035B7(Rev1), 2FFFB6AF (Rev2) Conducted: 2AB035BB (Rev1), 2AB035B8 (Rev1)			
Hardware Rev	Rev1-906-00/01, Rev2-x06-01/05			
Software Version	127.0.1.3901/4081, 10.1.0.1411			
Prototype or Production Unit	Production			
Mode(s) of Operation	1-slot GSM 850 GSM 1900	2-slots EDGE/GPRS 850/1900	3-slots EDGE/GPRS 850/1900	4-slots EDGE/GPRS 850/1900
Nominal Maximum conducted RF Output Power (dBm)	33.5 29.0	31.5 28.0	30.5 25.0	28.0 24.5
Tolerance in Power Setting on centre channel (dB)	± 0.5	± 0.5	± 0.5	± 0.5
Duty Cycle	1:8	2:8	3:8	4:8
Transmitting Frequency Range (MHz)	824.2 – 848.8 1850.2 – 1909.8	824.2 – 848.8 1850.2 – 1909.8	824.2 – 848.8 1850.2 – 1909.8	824.2 – 848.8 1850.2 – 1909.8
Mode(s) of Operation	802.11b	802.11g	802.11n	Bluetooth
Nominal Maximum conducted RF Output Power (dBm)	16.5	15.5	12.5	10.5

Tolerance in Power Setting on centre channel (dB)	± 0.5	± 0.5	± 0.5	N/A
Duty Cycle	1:1	1:1	1:1	N/A
Transmitting Frequency Range (MHz)	2412-2462	2412-2462	2412-2462	2402-2483
Mode(s) of Operation	HSPA+/ WCDMA / UMTS FDD V (850)	WCDMA / UMTS FDD IV (1700)	HSPA+/ WCDMA / UMTS FDD II (1900)	NFC
Nominal Maximum conducted RF Output Power (dBm)	23.5	23.0	22.5	N/A
Tolerance in Power Setting on centre channel (dB)	± 0.5	± 0.5	± 0.5	N/A
Duty Cycle	1:1	1:1	1:1	N/A
Transmitting Frequency Range (MHz)	824.6 – 846.6	1712.4-1752.6	1852.4 – 1907.6	13.56

Table 1.3-2 Test device characterization for U.S. wireless operating modes/bands for model RFR101LW

Note 1: The BlackBerry model: RFR101LW also supports GSM/GPRS/EDGE 900/1800 MHz and UMTS band I that are not operational in North America. Therefore, no data is presented in this report for those bands.

Note 2: SAR measurements on NFC haven't been conducted, since it is very low power and frequency magnetic field transceiver. SAR probes measure higher frequency/power electric field.

Device Model	RFR101LW
FCC ID	L6ARFR100LW
PIN	Radiated: 2AB035D0(Rev1), 2AB035B7(Rev1), 2FFFB6AF (Rev2) Conducted: 2AB035BB (Rev1), 2AB035B8 (Rev1)
Hardware Rev	Rev1-906-00/01, Rev2-x06-01/05
Software Version	127.0.1.3901/4081, 10.1.0.1411
Prototype or Production Unit	Production
Transmission channel bandwidth	Band 17: 5 MHz, 10 MHz Band 5: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz Band 4: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15MHz, 20MHz Band 2: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15MHz, 20MHz

Transmission channel number and frequencies				
	LTE band 17		**LTE band 5**	
	Chan.	**f (MHz)**	**Chan.**	**f (MHz)**
L	23780	709.0	20450	829.0
M	23790	710.0	20525	836.5
H	23800	711.0	20600	844.0
	LTE band 4		**LTE band 2**	
	Chan.	**f (MHz)**	**Chan.**	**f (MHz)**
L	20050	1720.0	18700	1860.0
M	20175	1732.5	18900	1880.0
H	20300	1745.0	19100	1900.0

UE Category	Category 3	
Modulation supported in uplink	QPSK, 16QAM	
Description of LTE antenna	1 Tx/Rx Ant, Sharing with GSM/UMTS; 2 Rx Ant, one separate and one sharing with CDMA	
LTE voice available/supported	No	
Hotspot with LTE+WiFi	Yes	
Hotspot with LTE+WiFi active with GSM/WCDMA voice	No	
LTE MPR permanently built-in by design	Yes	
LTE A-MPR	Disabled during SAR testing , by setting NV value to NV_01 on the CMW500	
LTE maximum average power (dBm)	Band 17: 22.89 dBm Band 5: 23.45 dBm Band 4: 22.79 dBm Band 2: 22.83 dBm	
Other non-LTE U.S. wireless operating modes/bands	GSM/WCDMA/HSPA+	835 MHz GSM/UMTS 1700 MHz UMTS 1900 MHz GSM/UMTS
	WiFi and BT	2.4 GHz Wi-Fi 2.4 GHz BT
Simultaneous Tx conditions	Please refer to section 1.9: Highlights of the FCC OET SAR Evaluation Considerations for Handsets with Multiple Transmitters/ Antennas & GSM/GPRS/EDGE Procedure.	
Power reduction applied for SAR compliance	No	

Table 1.3-3 Test device characterization all U.S. wireless operating modes/bands

Note 2: As per 3GPP TS 36.521-1 V10.0.0 (2011-12):

"The channel numbers that designate carrier frequencies so close to the operating band edges that the carrier extends beyond the operating band edge shall not be used. This implies that the first 7, 15, 25, 50, 75 and 100 channel numbers at the lower operating band edge and the last 6, 14, 24, 49, 74 and 99 channel numbers at the upper operating band edge shall not be used for channel bandwidths of 1.4, 3, 5, 10, 15 and 20 MHz respectively."…5.4.4

1.4 Body worn accessories (holsters)

The device has been tested with the holsters listed below. The holster has been designed with the intended device orientation being with the LCD facing the belt clip only. Proper positioning is vital for protection of the LCD display, and to help maximize the battery life of the device. The device can also be placed in the holster with the backside facing the belt clip. Body SAR measurements were carried out with the worst-case configuration front LCD side and backside towards the belt clip.

Number	Holster Type	Part Number	Separation distance (mm)
1	Vertical Holster, Leather	HDW-50678-001	20
2	Vertical Holster, alt Leather	HDW-50677-001	20

Table 1.4-1 Body worn holster

Note: Holsters have identical design, except for different leather material being used.

Please refer to Appendix E.
Figure 1.4-1 Body-worn holster

1.5 Headset

The device was tested with and without the following headset model numbers.

1) HDW-24529-004
2) HDW-15766-005
3) HDW-44306-001

1.6 Battery

The device was tested with the following Lithium Ion Battery packs.

1) BAT-51585-00x

1.7 Procedure used to establish test signal

- The device was put into test mode for SAR measurements by placing a call from a Rohde & Schwarz CMU 200 or CMW 500 Communications Test Instrument. The power control level was set to command the device to transmit at full power at the specified frequency. Other parameters include: Channel type = full rate, discontinuous transmission off, frequency hopping off. For LTE specific bandwidths, number of resource blocks, and resource block offsets were set. In addition, LTE A-MPR was disabled.
- Software Tool was used to set WiFi to transmit at maximum power and duty cycle for each band, channel, and modulation.

1.8 Highlights of the FCC OET SAR Measurement Requirements

1.8.1 SAR Measurement Procedures for 802.11 a/b/g/n as per KDB 248227 D01 v01r02 and SAR Measurements 100 MHz to 6 GHz as per KDB 865664 D0 V01

• Repeat measurements when the measured SAR is ≥ 0.80 W/kg. If the measured SAR values are < 1.45 W/kg with ≤ 20% variation, only one repeated measurement was performed to reaffirm that the results are not expected to have substantial variations. An additional repeated measurement is required only if the measured results are within 10% of the SAR limit and vary by more than 20%, which are often related to device and measurement setup difficulties.
• Maintained dielectric parameter uncertainty to ± 5.0% of the target values, (although it is very challenging to control/maintain both permittivity and conductivity for 5-6 GHz for all test channels within ± 5.0% of the target values, some conductivity values were measured slightly higher which resulted in more conservative SAR values.
• Liquid depth from SAM ERP or flat phantom was kept at 15 cm.
• Probe Requirement: Used SPEAG probe model ET3DV6/ES3DV3 for 2.45 GHz and EX3DV4 for 5-6 GHz SAR testing specs are outlined below:

ET3DV6/ES3DV3	
Probe tip to sensor center	2.7 mm / 2.0 mm
Probe tip diameter is	6.8 mm / 4.0 mm
Probe calibration uncertainty	< 15 % for f = 2.45 GHz
Probe calibration range	± 100 MHz
EX3DV4	
Probe tip to sensor center	1.0 mm
Probe tip diameter is	2.5 mm
Probe calibration uncertainty	< 15 % for f = 2.45 to < 6.0 GHz
Probe calibration range	± 100 MHz

Table 1.8.1-1 Probe specification requirements

• Area scan resolution was maintained at 10mm (5-6 GHz)
• Area scan resolution was maintained at 12mm (2-3 GHz)
• Area scan resolution was maintained at 15mm (</= 2 GHz)
• System accuracy validation was conducted within ± 100 MHz of device mid-band frequency and results were within ± 10 % of the manufacturers target value for each band.
• Zoom Scan: The following settings were used for the validation and measurement.

ET3DV6/ES3DV3	
Closest Measurement Point to Phantom	4.0 mm
Zoom Scan (x,y) Resolution	7.5 mm (≤2 GHz) or 5 mm (2-3 GHz)
Zoom Scan (z) Resolution	5.0 mm
Zoom Scan Volume	Minimum 30 x 30 x 30 mm[1]
EX3DV4	
Closest Measurement Point to Phantom	2.0 mm
Zoom Scan (x,y) Resolution	4.0 mm (5-6 GHz)
Zoom Scan (z) Resolution	2.0 mm (5-6 GHz)
Zoom Scan Volume	Minimum 22 x 22 x 22 mm[1]

Table 1.8.1-2 Zoom Scan requirement

Note 1: “Auto-extend zoom scan when maxima on boundary” is enabled, which can result in the zoom scan dimensions varying between 30x30x30 to 60x60x30 mm and 22x22x22 to 48x40x22 mm.

- Frequency Channel Configuration: 802.11 b/g modes are tested on the highest output power channel.
- 802.11a is tested for UNII operations on the highest output power channel of each sub band (low, mid, upper band I, and upper band II). If the highest output power channel has a SAR level that is not 3dB lower than the limit, then the low, mid, and high channels of each sub band must also be tested.
- For each frequency band, testing at higher rates and higher modulations is not required when the maximum average output power for each of these configurations is less than ¼ dB higher than those measured at the lowest data rate.
- SAR is not required for 802.11g/n channels when the maximum average output power is less than ¼ dB higher than that measured on the corresponding 802.11b channels.
- SAR test was conducted on each “default test channel” and each band with the worst case modulation and highest duty cycle, if the SAR level was within 3dB of the limit.
- Conducted power measurements:

802.11b @ 1Mbps		802.11g @ 6Mbps		802.11n @ 6.5 Mbps	
Chan	Cond. Power (dBm)	Chan	Cond. Power (dBm)	Chan	Cond. Power (dBm)
1	16.61	1	15.41	1	12.84
6	**16.75**	**6**	**15.52**	**6**	**12.96**
11	16.53	11	15.14	11	12.65
13	15.82	13	14.45	13	11.97

		802.11g			802.11b
Data Rate (Mbps)	Mod.	Channel 6 Cond. Power (dBm)	Data Rate (Mbps)	Mod.	Channel 6 Cond. Power (dBm)
6	BPSK	15.52	1	BPSK	16.75
9	BPSK	15.43	2	DQPSK	16.72
12	QPSK	15.42	5.5	CCK	16.70
18	QPSK	15.46	11	CCK	16.71
24	16-QAM	15.47	22	CCK	16.69
36	16-QAM	15.48			
48	64-QAM	15.50			
54	64-QAM	15.49			

		802.11 n
Data Rate (Mbps)	Mod.	Channel 6 Cond. Power (dBm)
6.5	MCS0	12.96
13	MCS1	12.92
19.5	MCS2	12.93
26	MCS3	12.90
39	MCS4	12.89
52	MCS5	12.91
58.5	MCS6	12.92
65	MCS7	12.92

Table 1.8.1-3 802.11 b/g/n modulation type/data rate vs. conducted power

1.8.2 SAR Measurement Requirements for Bluetooth

Channel	Freq (MHz)	Mode	Conducted Transmit Power (dBm)
0	2402	DH5	8.7
39	2441	DH5	10.5
78	2480	DH5	8.6

Table 1.8.2-1 Bluetooth peak conducted power measurements

1.8.3 SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities as per KDB 941225 D06 v01

Standalone personal wireless routers and handsets with hotspot mode capabilities must address hand-held and other near-body exposure conditions to show SAR compliance. The following procedures are applicable when the overall device length and width are ≥ 9 cm x 5 cm respectively. A test separation of 10 mm is required. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25 mm from that surface or edge, for the data modes, wireless technologies and frequency bands supporting hotspot mode. The standalone SAR results in each device test orientation must be analyzed for the applicable hotspot mode simultaneous transmission configurations to determine SAR test exclusion and volume scan requirements.

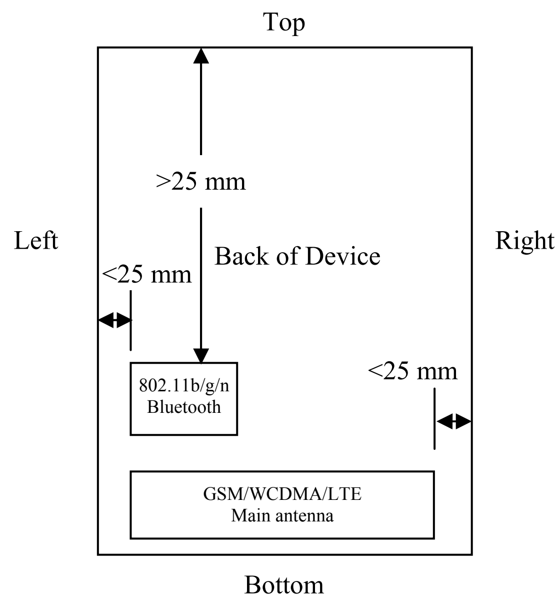

Figure 1.8.3-1 Identification of all sides for SAR Testing

Note: According to FCC guidance, Hotspot SAR testing is not required on any edge that is more than 2.5cm from the transmitting antenna.

Hotspot Sides for SAR Testing						
Mode	**Front**	**Back**	**Top**	**Bottom**	**Left**	**Right**
GSM 850	Yes	Yes	No	Yes	Yes	Yes
GSM 1900	Yes	Yes	No	Yes	Yes	Yes
WCDMA/HSPA 850	Yes	Yes	No	Yes	Yes	Yes
WCDMA/HSPA 1700	Yes	Yes	No	Yes	Yes	Yes
WCDMA/HSPA 1900	Yes	Yes	No	Yes	Yes	Yes
LTE Band 17	Yes	Yes	No	Yes	Yes	Yes
LTE Band 5	Yes	Yes	No	Yes	Yes	Yes
LTE Band 4	Yes	Yes	No	Yes	Yes	Yes
LTE Band 2	Yes	Yes	No	Yes	Yes	Yes
Bluetooth 2.45GHz	Yes	Yes	No	Yes	Yes	No
802.11b 2.45GHz	Yes	Yes	No	Yes	Yes	No

Table 1.8.3-1 Identification of all sides for SAR Testing

1.8.4 SAR Evaluation Procedures for GSM/(E)GPRS Dual Transfer Mode as per KDB 941225 D04 v01 and SAR Test Reduction Procedures GSM GPRS EDGE as per DDB 941225 D03 vo1

- The device supports EGPRS/GPRS Multi-slot Class 12, DTM/GPRS Multi-slot Class11 and DTM/EGPRS Multi-slot Class10.
- CMU200 base station simulator with DTM software option CMU-K44 was used to set device in DTM (CS+PD) mode for testing. However, device could not be connected in DTM 4-slots uplink.
- For each slot addition in multi-slot modes (DTM, GPRS, EDGE), there is software power reduction of ~ 2 dB per slot.
- For head configurations, 1 slot CS, 2/3/4-slots (PD) and DTM (CS+PD) were evaluated.
- For body SAR configurations, 2/3/4-slots GPRS (PD) mode were tested.
- In EDGE/GPRS mode, GMSK Modulation was used using CS1-CS4 or MCSI-MCS4.
- 8-PSK modulation or MCS5-MCS9 code scheme were avoided since maximum burst avg . power was measured lower on those modulation schemes.
- Please refer to the conducted power measurements table below:

Mode	Freq. (MHz)	Max burst averaged conducted power (dBm) CS1	Max burst averaged conducted power (dBm) MCS1	Max burst averaged conducted power (dBm) MCS5
2-slots GPRS 850 MHz	824.2	31.5	N/A	N/A
	836.8	31.6	N/A	N/A
	848.8	31.5	N/A	N/A
3-slots GPRS 850 MHz	824.2	30.5	N/A	N/A
	836.8	30.3	N/A	N/A
	848.8	30.3	N/A	N/A
4-slots GPRS 850 MHz	824.2	28.1	N/A	N/A
	836.8	28.2	N/A	N/A
	848.8	28.2	N/A	N/A
2-slots EDGE 850 MHz	824.2	31.4	31.5	27.5
	836.8	31.5	31.5	27.4
	848.8	31.5	31.5	27.4

2-slots DTM 850 MHz	824.2	31.8	31.7	31.7	27.5
	836.8	31.7	31.7	31.7	27.4
	848.8	31.7	31.7	31.6	27.4
3-slots EDGE 850 MHz	824.2	30.5	30.5	25.7	
	836.8	30.3	30.3	25.7	
	848.8	30.3	30.3	25.6	
3-slots DTM 850 MHz	824.2	30.6	30.6	30.6	25.7
	836.8	30.6	30.6	30.6	25.7
	848.8	30.7	30.6	30.6	25.6
4-slots EDGE 850 MHz	824.2	28.1	28.1	24.5	
	836.8	28.2	28.2	24.5	
	848.8	28.2	28.2	24.5	
2-slots GPRS 1900 MHz	1850.2	28.2	N/A	N/A	
	1880.0	28.3	N/A	N/A	
	1909.8	28.2	N/A	N/A	
3-slots GPRS 1900 MHz	1850.2	25.5	N/A	N/A	
	1880.0	25.4	N/A	N/A	
	1909.8	25.4	N/A	N/A	
4-slots GPRS 1900 MHz	1850.2	24.7	N/A	N/A	
	1880.0	24.8	N/A	N/A	
	1909.8	24.5	N/A	N/A	
2-slots EDGE 1900MHz	1850.2	28.2	28.3	24.5	
	1880.0	28.3	28.2	24.4	
	1909.8	28.2	28.2	24.4	
2-slots DTM 1900MHz	1850.2	28.0	28.0	28.0	24.5
	1880.0	27.9	27.9	27.8	24.4
	1909.8	27.9	27.9	27.9	24.4
3-slots EDGE 1900MHz	1850.2	25.5	25.5	23.3	
	1880.0	25.4	25.4	23.2	
	1909.8	25.4	25.4	23.2	
3-slots DTM 1900MHz	1850.2	25.3	25.3	25.3	23.3
	1880.0	25.3	25.3	25.2	23.2
	1909.8	25.2	25.2	25.2	23.2
4-slots EDGE 1900MHz	1850.2	24.8	24.8	22.3	
	1880.0	24.8	24.8	22.2	
	1909.8	24.6	24.6	22.1	

Mode	Freq. (MHz)	Max burst averaged conducted power (dBm)
1-slot GSM (CS) 850 MHz	824.2	34.0
	836.8	33.9
	848.8	33.7
1-slot GSM (CS) 1900 MHz	1850.2	29.4
	1880.0	29.2
	1909.8	29.4

1.8.4-1 GSM/EDGE/GPRS channel vs. conducted power

1.8.5 SAR Measurement Procedure for Fast SAR Scan as per KDB 447498

- Area scan based 1-g SAR estimation.
  - Very specific implementation of fast SAR methods.
    - Reported in the 29th BEMS meeting in 2009.
    - Using the specific polynomial fit algorithm.
  - Other implementations are not considered.

- When estimated 1-g SAR is ≤ 1.2 W/kg, zoom scan is not required according to the following:
  - Zoom scan is not required for any other purposes.
  - Peaks are distinctively identified in the area scan.
  - No sharp gradients: SAR at 1 cm from peak ≥ 40% of peak value.
  - No measurement warnings or alerts for other measurement issues.

- 1-g SAR for estimated & zoom scan in the system verification (dipole) must be within 3% of each other to utilize Fast SAR.
- 1g Fast SAR values for dipole validation scans are generally more conservative than the standard SAR scans.
- Regardless of the SAR value, a zoom scan is required for the highest SAR configuration in each frequency band and wireless mode.
- Fast SAR Algorithm: The approach is based on the area scan using DASY5 system.

1.8.6 SAR Measurement Procedures for 3G Devices

WCDMA Handsets

Output Power Verification

• Maximum output power is verified on the High, Middle and Low channels using 12.2 kbps RMC, 12.2 kbps AMR with a 3.4 kbps SRB (signal radio bearer) with TPC (transmit power control) set to all "1's" for WCDMA/HSPA or applying the required inner loop.

• For Release 6 HSPA/Release 7 HSDPA^{+}, output power is measured according to requirements for HS-DPCCH Sub-test 1-4/1-5 and 3GPP TS 34.121.

Head SAR Measurements

SAR for head exposure configurations is measured using the 12.2 kbps RMC with TPC bits configured to all "1s". SAR in AMR configurations is not required when the maximum average output of each RF channel for 12.2 kbps AMR is less than ¼ dB higher than that measured in 12.2 kbps RMC. Otherwise, SAR is measured on the maximum output channel in 12.2 AMR with a 3.4 kbps SRB (signalling radio bearer) using the exposure configuration that results in the highest SAR for that RF channel in 12.2 RMC.

Body SAR Measurements

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits configured to all "1s". SAR for other spreading codes and multiple $DPDCH_n$, when supported by the DUT, are not required when the maximum average outputs of each RF channel, for each spreading code and $DPDCH_n$ configuration, are less than ¼ dB higher than those measured in 12.2 RMC. Otherwise, SAR is measured on the maximum output channel with an applicable RMC configuration for the corresponding spreading code or $DPDCH_n$ using the exposure configuration that results in the highest SAR with 12.2 RMC.

Handsets with HSPA

Body SAR is not required for handsets with HSPA/HSPA+ capabilities, when the maximum average output of each RF channel with HSPA active is less than ¼ dB higher than that measured in 12.2 kbps RMC without HSPA/HSPA+. Otherwise, SAR for HSPA is measured using FRC (fixed reference channel) in the body exposure configuration that results in the highest SAR for that RF channel in 12.2kbps RMC.

	Band	**FDD V (850)**		
	Channel	4132	4182	4233
	Freq (MHz)	826.4	836.4	846.6
Mode	**Subtest**	**Max burst averaged conducted power (dBm)**		
Rel99	12.2 kbps RMC	23.94	24.03	23.76
Rel99	12.2 kbps, Voice, AMR, SRB 3.4 kbps	23.90	24.03	23.74
Rel6 HSUPA	1	22.45	22.50	22.19
Rel6 HSUPA	2	22.20	22.28	22.08
Rel6 HSUPA	3	22.92	23.05	22.79
Rel6 HSUPA	4	22.93	22.94	22.72
Rel6 HSUPA	5	22.09	22.25	21.75
Rel7 HSDPA+	1	22.71	22.70	22.50
Rel7 HSDPA+	2	22.73	22.68	22.60
Rel7 HSDPA+	3	22.53	22.76	22.58
Rel7 HSDPA+	4	22.63	22.65	22.58
	Band	**FDD II (1900)**		
	Channel	9262	9400	9538
	Freq (MHz)	1852.4	1880.0	1907.6
Mode	**Subtest**	**Max burst averaged conducted power (dBm)**		
Rel99	12.2 kbps RMC	22.60	22.40	22.47
Rel99	12.2 kbps, Voice, AMR, SRB 3.4 kbps	22.50	22.41	22.42
Rel6 HSUPA	1	21.08	20.97	21.04
Rel6 HSUPA	2	21.67	21.33	21.46
Rel6 HSUPA	3	21.62	21.36	21.42
Rel6 HSUPA	4	21.59	21.39	21.44
Rel6 HSUPA	5	20.72	20.66	20.75
Rel7 HSDPA+	1	21.91	21.54	21.34
Rel7 HSDPA+	2	21.88	21.55	21.32
Rel7 HSDPA+	3	22.20	21.55	21.62
Rel7 HSDPA+	4	21.88	21.97	21.33
Hotspot Mode On FDD II (1900) Model RFR101LW				
Rel99	12.2 kbps RMC	20.55	20.70	20.56
Rel99	12.2 kbps, Voice, AMR, SRB 3.4 kbps	20.58	20.64	20.53

Table 1.8.6-1 WCDMA (Rel99) / HSPA/HSPA+ conducted power measurements

	Band	FDD IV (1700)		
	Channel	1312	1413	1513
	Freq (MHz)	1712.4	1732.6	1752.6
Mode	Subtest	Max burst averaged conducted power (dBm)		
Rel99	12.2 kbps RMC	23.03	23.17	22.98
Rel99	12.2 kbps, Voice, AMR, SRB 3.4 kbps	23.03	23.11	22.92
Rel5 HSDPA	1	22.01	22.08	21.97
Rel5 HSDPA	2	21.56	21.70	21.50
Rel5 HSDPA	3	21.67	21.69	21.45
Rel5 HSDPA	4	20.42	20.51	20.72
Rel6 HSUPA	1	21.63	21.66	21.58
Rel6 HSUPA	2	21.45	21.46	21.34
Rel6 HSUPA	3	22.08	22.14	22.02
Rel6 HSUPA	4	22.00	22.07	21.92
Rel6 HSUPA	5	21.17	21.41	21.20
Hotspot Mode On				
Rel99	12.2 kbps RMC	19.96	20.12	19.88
Rel99	12.2 kbps, Voice, AMR, SRB 3.4 kbps	19.93	20.06	19.90

Table 1.8.6-2 WCDMA (Rel99) / HSPA/HSPA+ conducted power measurements

1.8.7 SAR Evaluation Procedures for LTE as per KDB 941225 D05 v02

"1. QPSK with 1 RB allocation

Start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and *required test channel* combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each *required test channel*. When the *reported* SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and *required test channels* is not required for 1 RB allocation; otherwise, SAR is required for the remaining r*equired test channels* and only for the RB offset configuration with the highest output power for that channel.6 When the *reported* SAR of a *required test channel* is > 1.45 W/kg, SAR is required for all three RB offset configurations for that *required test channel*.

2. QPSK with 50% RB allocation

The procedures required for 1 RB allocation in 1. are applied to measure the SAR for QPSK with 50% RB allocation.

3. QPSK with 100% RB allocation

For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest *reported* SAR for 1 RB and 50% RB allocation in 1. and 2. are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel and if the *reported* SAR is > 1.45 W/kg, the remaining *required test channels* must also be tested.

Higher order modulations

For each modulation besides QPSK; e.g., 16-QAM, 64-QAM, apply the QPSK procedures in sections 1. and 2.and 3. to determine the QAM configurations that may need SAR measurement.

For each configuration

identified as required for testing, SAR is required only when the highest maximum output power for the configuration in the higher order modulation is > ½ dB higher than the same configuration in QPSK or when the *reported* SAR for the QPSK configuration is > 1.45 W/kg.

4. Other channel bandwidth standalone SAR test requirements

For the other channel bandwidths used by the device in a frequency band, apply all the procedures required for the largest channel bandwidth in section 5.2 to determine the channels and RB configurations that need SAR testing and only measure SAR when the highest maximum output power of a configuration requiring testing in the smaller channel bandwidth is > ½ dB higher than the equivalent channel configurations in the largest channel bandwidth configuration or the *reported* SAR of a configuration for the largest channel bandwidth is > 1.45 W/kg.

The equivalent channel configuration for the RB allocation, RB offset and modulation etc. Is determined for the smaller channel bandwidth according to the same number of RB allocated in the largest channel bandwidth. For example, 50 RB in 10 MHz channel bandwidth does not apply to 5 MHz channel bandwidth; therefore, this cannot be tested in the smaller channel bandwidth. However, 50% RB allocation in 10 MHz channel bandwidth is equivalent to 100% RB allocation in 5 MHz channel bandwidth; therefore, these are the equivalent configurations to be compared to determine the specific channel and configuration in the smaller channel bandwidth that need SAR testing."

• MPR has been implemented permanently by the manufacturer as per 3GPP TS36.101
• A-MPR was disabled for all SAR measurements.
•LTE Head SAR was evaluated to cover third-party VoIP applications at full power.

• According to “3GPP TS 36.521-1 V10.0.0 (2011-12)”:

•“The channel numbers that designate carrier frequencies so close to the operating band edges that the carrier extends beyond the operating band edge shall not be used. This implies that the first 7, 15, 25, 50, 75 and 100 channel numbers at the lower operating band edge and the last 6, 14, 24, 49, 74 and 99 channel numbers at the upper operating band edge shall not be used for channel bandwidths of 1.4, 3, 5, 10, 15 and 20 MHz respectively.”…

Band	**LTE Band 17**					
Frequency (MHz)	**Channel**	**BW**	**Modulation**	**RB Size**	**RB Offset**	**Maximum Avg. Power (dBm)**
709.0	23780	10 MHz	QPSK	1	0	22.89
			QPSK	1	49	22.69
			QPSK	25	0	21.66
			QPSK	50	0	21.61
			16QAM	1	0	21.69
			16QAM	1	49	21.59
			16QAM	16	0	20.85
			16QAM	50	0	20.52
710	23790	10 MHz	QPSK	1	0	22.80
			QPSK	1	49	22.63
			QPSK	25	0	21.76
			QPSK	50	0	21.56
			16QAM	1	0	21.48
			16QAM	1	49	21.39
			16QAM	16	0	20.85
			16QAM	50	0	20.52
711	23800	10 MHz	QPSK	1	0	22.68
			QPSK	1	49	22.73
			QPSK	25	0	21.72
			QPSK	50	0	21.50
			16QAM	1	0	22.30
			16QAM	1	49	22.35
			16QAM	16	0	20.94
			16QAM	50	0	20.48
709.0	23780	5 MHz	QPSK	1	0	22.80
			QPSK	1	24	22.74
			QPSK	10	15	21.74
			QPSK	25	0	21.65
			16QAM	1	0	21.85
			16QAM	1	24	21.79
			16QAM	8	17	21.68
			16QAM	25	0	20.62
		5 MHz	QPSK	1	0	23.05
			QPSK	1	24	22.79
			QPSK	10	15	21.70
			QPSK	25	0	21.59

710	23790		16QAM	1	0	22.23
			16QAM	1	24	22.05
			16QAM	8	17	21.70
			16QAM	25	0	20.60
711	23800	5 MHz	QPSK	1	0	22.95
			QPSK	1	24	22.86
			QPSK	10	15	21.75
			QPSK	25	0	21.61
			16QAM	1	0	22.19
			16QAM	1	24	22.11
			16QAM	8	17	21.68
			16QAM	25	0	20.54

Table 1.8.7-1 LTE band 17 conducted RF output power (dBm)

Band	**LTE Band 5**					
Frequency (MHz)	**Channel**	**BW**	**Modulation**	**RB Size**	**RB Offset**	**Maximum Avg. Power (dBm)**
829	20450	10 MHz	QPSK	1	0	23.33
			QPSK	1	49	23.45
			QPSK	25	0	22.14
			QPSK	50	0	22.10
			16QAM	1	0	22.82
			16QAM	1	49	22.99
			16QAM	30	20	21.22
			16QAM	50	0	21.03
836.5	20525	10 MHz	QPSK	1	0	23.20
			QPSK	1	49	23.11
			QPSK	25	0	22.23
			QPSK	50	0	22.03
			16QAM	1	0	22.09
			16QAM	1	49	22.00
			16QAM	30	20	21.04
			16QAM	50	0	21.00
844.0	20600	10 MHz	QPSK	1	0	23.25
			QPSK	1	49	22.95
			QPSK	25	0	21.96
			QPSK	50	0	21.89
			16QAM	1	0	21.90
			16QAM	1	49	21.75
			16QAM	30	20	21.00
			16QAM	50	0	20.85
829	20450	5 MHz	QPSK	1	0	23.27
			QPSK	1	24	23.25
			QPSK	15	0	22.21
			QPSK	25	0	22.07
			16QAM	1	0	22.34
			16QAM	1	24	22.42
			16QAM	8	17	22.09
			16QAM	25	0	21.03
836.5	20525	5 MHz	QPSK	1	0	23.51
			QPSK	1	24	23.48
			QPSK	15	0	22.35
			QPSK	25	0	22.20
			16QAM	1	0	22.69
			16QAM	1	24	22.65
			16QAM	8	17	22.18
			16QAM	25	0	21.11

844.0	20600	5 MHz	QPSK	1	0	22.99
			QPSK	1	24	23.18
			QPSK	15	0	22.00
			QPSK	25	0	21.90
			16QAM	1	0	22.10
			16QAM	1	24	22.16
			16QAM	8	17	22.07
			16QAM	25	0	20.83
829	20450	3 MHz	QPSK	1	0	23.19
			QPSK	1	14	23.24
			QPSK	6	9	22.35
			QPSK	15	0	22.25
			16QAM	1	0	22.00
			16QAM	1	14	21.98
			16QAM	4	11	22.36
			16QAM	15	0	21.17
836.5	20525	3 MHz	QPSK	1	0	23.45
			QPSK	1	14	23.28
			QPSK	6	9	22.21
			QPSK	15	0	22.30
			16QAM	1	0	22.23
			16QAM	1	14	22.12
			16QAM	4	11	22.32
			16QAM	15	0	21.13
844.0	20600	3 MHz	QPSK	1	0	23.03
			QPSK	1	14	23.20
			QPSK	6	9	22.13
			QPSK	15	0	21.98
			16QAM	1	0	21.90
			16QAM	1	14	22.05
			16QAM	4	11	22.13
			16QAM	15	0	20.99
829	20450	1.4 MHz	QPSK	1	0	23.31
			QPSK	1	5	23.35
			QPSK	6	0	22.23
			16QAM	1	0	22.18
			16QAM	1	5	22.09
			16QAM	6	0	21.18
836.5	20525	1.4 MHz	QPSK	1	0	23.25
			QPSK	1	5	23.12
			QPSK	6	0	22.25
			16QAM	1	0	22.04
			16QAM	1	5	21.98
			16QAM	6	0	21.20
844.0	20600	1.4 MHz	QPSK	1	0	22.97
			QPSK	1	5	23.02
			QPSK	6	0	22.99
			16QAM	1	0	21.81
			16QAM	1	5	21.75
			16QAM	6	0	20.99

Table 1.8.7-2 LTE band 5 conducted RF output power (dBm)

Band	**LTE Band 4**					
Frequency (MHz)	**Channel**	**BW**	**Modulation**	**RB Size**	**RB Offset**	**Maximum Avg. Power (dBm)**
			QPSK	1	0	22.69

1720	20050	20 MHz	QPSK	1	50	22.60
			QPSK	1	99	22.79
			QPSK	50	0	21.33
			QPSK	50	50	21.49
			QPSK	100	0	21.44
			16QAM	1	0	21.35
			16QAM	1	50	21.20
			16QAM	1	99	21.38
			16QAM	75	0	20.38
			16QAM	75	25	20.43
			16QAM	100	0	20.44
1732.5	20175	20 MHz	QPSK	1	0	22.73
			QPSK	1	50	22.59
			QPSK	1	99	22.71
			QPSK	50	0	21.64
			QPSK	50	50	21.51
			QPSK	100	0	21.49
			16QAM	1	0	21.44
			16QAM	1	50	21.48
			16QAM	1	99	21.44
			16QAM	75	0	20.48
			16QAM	75	25	20.43
			16QAM	100	0	20.43
1745.0	20300	20 MHz	QPSK	1	0	22.64
			QPSK	1	50	22.69
			QPSK	1	99	22.71
			QPSK	50	0	21.51
			QPSK	50	50	21.40
			QPSK	100	0	21.46
			16QAM	1	0	21.32
			16QAM	1	50	21.35
			16QAM	1	99	21.30
			16QAM	75	0	20.39
			16QAM	75	25	20.45
			16QAM	100	0	20.43
1732.5	20175	15 MHz	QPSK	1	0	22.55
			QPSK	1	74	22.49
			QPSK	36	39	21.30
			QPSK	75	0	21.30
			16QAM	1	0	21.36
			16QAM	1	74	21.35
			16QAM	16	59	21.52
			16QAM	75	0	20.29
1732.5	20175	10 MHz	QPSK	1	0	22.65
			QPSK	1	49	22.45
			QPSK	25	0	21.40
			QPSK	50	0	21.28
			16QAM	1	0	21.47
			16QAM	1	49	21.34
			16QAM	16	0	20.50
			16QAM	50	0	20.31
1732.5	20175	5 MHz	QPSK	1	0	22.62
			QPSK	1	24	22.50
			QPSK	25	0	21.44
			16QAM	1	0	21.79
			16QAM	1	24	21.76
			16QAM	25	0	20.39
1745.0	20300	3 MHz	QPSK	1	0	22.52
			QPSK	1	14	22.47

			QPSK	15	0	21.46
			16QAM	1	0	21.43
			16QAM	1	14	21.43
			16QAM	15	0	21.39
1745.0	20300	1.4 MHz	QPSK	1	0	22.55
			QPSK	1	5	22.49
			QPSK	6	0	21.62
			16QAM	1	0	21.46
			16QAM	1	5	21.41
			16QAM	6	0	20.53
Hotspot Mode ON						
1720.0	20050	20 MHz	QPSK	1	99	19.67
1732.5	20175	20 MHz	QPSK	50	0	19.56

Table 1.8.7-3 LTE band 4 conducted RF output power (dBm)

Band	**LTE Band 2**					
Frequency (MHz)	**Channel**	**BW**	**Modulation**	**RB Size**	**RB Offset**	**Maximum Avg. Power (dBm)**
1860	18700	20 MHz	QPSK	1	0	22.77
			QPSK	1	50	22.70
			QPSK	1	99	22.68
			QPSK	50	0	21.56
			QPSK	50	50	21.59
			QPSK	100	0	21.60
			16QAM	1	0	22.23
			16QAM	1	50	21.62
			16QAM	1	99	21.51
			16QAM	75	0	20.49
			16QAM	75	25	20.54
			16QAM	100	0	20.58
1880	18900	20 MHz	QPSK	1	0	22.75
			QPSK	1	50	22.80
			QPSK	1	99	22.83
			QPSK	50	0	21.49
			QPSK	50	50	21.70
			QPSK	100	0	21.67
			16QAM	1	0	21.45
			16QAM	1	50	21.32
			16QAM	1	99	21.43
			16QAM	75	0	20.55
			16QAM	75	25	20.65
			16QAM	100	0	20.73
1900	19100	20 MHz	QPSK	1	0	22.80
			QPSK	1	50	22.71
			QPSK	1	99	22.67
			QPSK	50	0	21.60
			QPSK	50	50	21.68
			QPSK	100	0	21.60
			16QAM	1	0	21.67
			16QAM	1	50	21.53
			16QAM	1	99	21.54
			16QAM	75	0	20.55
			16QAM	75	25	20.53
			16QAM	100	0	20.58
1880	18900	15 MHz	QPSK	1	0	22.70
			QPSK	1	74	22.82
			QPSK	36	39	21.61

			QPSK	75	0	21.56
			16QAM	1	0	21.51
			16QAM	1	74	21.75
			16QAM	16	59	21.88
			16QAM	75	0	21.43
1880	18900	10 MHz	QPSK	1	0	22.77
			QPSK	1	49	22.70
			QPSK	25	0	21.71
			QPSK	50	0	21.64
			16QAM	1	0	21.46
			16QAM	1	49	21.57
			16QAM	16	0	20.96
			16QAM	50	0	20.68
1880	18900	5 MHz	QPSK	1	0	22.79
			QPSK	1	24	22.82
			QPSK	25	0	21.81
			16QAM	1	0	22.13
			16QAM	1	24	22.08
			16QAM	25	0	20.74
1880	18900	3 MHz	QPSK	1	0	22.75
			QPSK	1	14	22.83
			QPSK	15	0	21.78
			16QAM	1	0	21.62
			16QAM	1	14	21.72
			16QAM	15	0	20.84
1880	18900	1.4 MHz	QPSK	1	0	22.80
			QPSK	1	5	22.83
			QPSK	6	0	21.81
			16QAM	1	0	21.60
			16QAM	1	5	21.73
			16QAM	6	0	20.67
Hotspot Mode ON						
1880	18900	20 MHz	QPSK	1	99	19.72
1880	18900	20 MHz	QPSK	50	50	19.56

Table 1.8.7-4 LTE band 2 conducted RF output power (dBm)

1.9 General SAR Test Reduction and Exclusion procedure as per KDB 447498 D01 V05 and SAR Handsets Multi Xmiter and Ant procedure as per 648474 D04 v01

Standalone SAR test exclusion guidance:

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances*

$$\left(\frac{\text{max. power of channel, including tune-up tolerance (mW)}}{\text{min. test separation distance (mm)}} \times \sqrt{f_{(GHz)}}\right) \leq 3.0$$, For 1g SAR

Where:

- $f_{(GHz)}$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation[17]
- If *distance* is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion
- The result is rounded to one decimal place for comparison

.

Simultaneous Transmission SAR Test exclusion considerations:

When the sum of 1-g of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration. When the sum is greater than the SAR limit, the SAR to peak location separation ratio procedures described below may be applied to determine if simultaneous transmission SAR test exclusion applies.

The ratio is determined by:

$$\left([SAR1 + SAR2]^{\frac{1.5}{R_i}}\right) \leq 0.04$$

Where:

- R_i = the separation distance between the peak SAR locations for the antenna pair (mm)

Simultaneous Transmission SAR required:

• antenna pairs with SAR to antenna separation ratio > 0.04; test is only required for the configuration that results in the highest SAR in standalone configuration for each wireless mode and exposure condition.

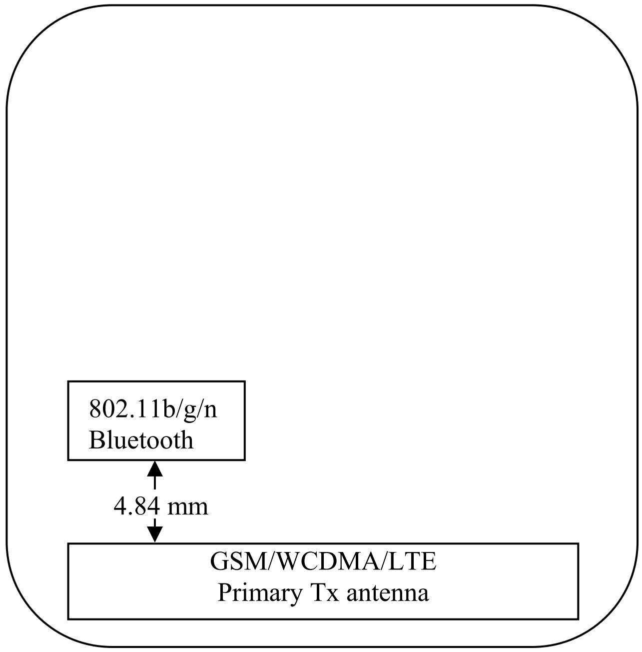

Figure 1.9-1 Back view of device showing closest distance between antenna pairs

1.9.1 Simultaneous Transmission Analysis

Simultaneous Transmission Combination	Head	Body-Worn Accessory	Mobile Hotspot
LTE/WCDMA/GSM voice + WiFi 2.4 GHz/BT	Yes	Yes	No
LTE/HSPA/EDGE/GPRS data + WiFi 2.4 GHz	Yes	Yes	Yes
LTE/HSPA/EDGE/GPRS data + BT	Yes	Yes	No

Table 1.9.1-1 Simultaneous Transmission Scenarios

Note 1: BT and WiFi cannot transmit simultaneously since the design doesn't allow it and they use the same antenna.
Note 2: GSM/WCDMA and LTE cannot transmit simultaneously since the design doesn't allow it and they use the same antenna

Test	Configuration	Licensed Transmitters Band	Licensed Transmitters 1 g avg. SAR (W/kg)	WiFi 2.4 GHz 1 g avg. SAR (W/kg)	Maximum Summation 1 g avg. SAR (W/kg)
Head SAR	Right Cheek	GSM/DTM/EDGE 850	0.82	0.32	1.14
		UMTS Band V	0.53		0.85
		GSM/DTM/EDGE 1900	0.91		1.23
		UMTS Band II	1.05		1.37
		LTE Band 17	0.14		0.46
		LTE Band 5	0.30		0.62
		LTE Band 4	0.71		1.03
		UMTS Band IV	0.88		1.20
		LTE Band 2	1.19		1.51
	Right Tilt	GSM/DTM/EDGE 850	0.43	0.06	0.49
		UMTS Band V	0.31		0.37
		GSM/DTM/EDGE 1900	0.24		0.30
		UMTS Band II	0.26		0.32
		LTE Band 17	0.07		0.13
		LTE Band 5	0.17		0.23
		LTE Band 4	0.19		0.25
		UMTS Band IV	0.25		0.31
		LTE Band 2	0.28		0.34
	Left Cheek	GSM/DTM/EDGE 850	0.67	0.21	0.88
		UMTS Band V	0.50		0.71
		GSM/DTM/EDGE 1900	1.12		1.33
		UMTS Band II	1.33		1.54
		LTE Band 17	0.17		0.38
		LTE Band 5	0.31		0.52
		LTE Band 4	1.08		1.29
		UMTS Band IV	1.12		1.33
		LTE Band 2	1.38		1.59
	Left Tilt	GSM/DTM/EDGE 850	0.41	0.09	0.50
		UMTS Band V	0.30		0.39
		GSM/DTM/EDGE 1900	0.41		0.50
		UMTS Band II	0.36		0.45
		LTE Band 17	0.10		0.19
		LTE Band 5	0.18		0.27
		LTE Band 4	0.30		0.39
		UMTS Band IV	0.32		0.41
		LTE Band 2	0.46		0.55

Table 1.9.1-2 Highest Head SAR values and summation

Note 1: If sum of 1 g SAR < 1.6 W/kg, Simultaneous SAR measurement is not required.
Note 2: If sum of 1 g SAR > 1.6 W/kg, ratio of SAR to peak separation distance for pair of transmitters calculated.

Test	Configuration	Licensed Transmitters		WiFi 2.4 GHz 1 g avg. SAR (W/kg)	Maximum Summation 1 g avg. SAR (W/kg)
		Band	1 g avg. SAR (W/kg)		
Body Worn SAR	15 mm separation, device back	GSM/GPRS/EDGE 850	0.71	0.15	0.86
		UMTS Band V	0.63		0.78
		GSM/GPRS/EDGE 1900	0.36		0.51
		UMTS Band II	0.53		0.68
		LTE Band 17	0.16		0.31
		LTE Band 5	0.34		0.49
		LTE Band 4	0.44		0.59
		UMTS Band IV	0.54		0.69
		LTE Band 2	0.45		0.60
	Holster device back	GSM/GPRS/EDGE 850	0.85	0.08	0.93
		UMTS Band V	0.53		0.61
		GSM/GPRS/EDGE 1900	0.22		0.30
		UMTS Band II	0.32		0.40
		LTE Band 17	0.17		0.25
		LTE Band 5	0.24		0.32
		LTE Band 4	0.28		0.36
		UMTS Band IV	0.35		0.43
		LTE Band 2	0.24		0.32
	Holster device front	GSM/GPRS/EDGE 850	0.68	0.06	0.74
		UMTS Band V	0.41		0.47
		GSM/GPRS/EDGE 1900	0.27		0.33
		UMTS Band II	0.39		0.45
		LTE Band 17	0.12		0.18
		LTE Band 5	0.23		0.29
		LTE Band 4	0.35		0.41
		UMTS Band IV	0.43		0.49
		LTE Band 2	0.32		0.38

Table 1.9.1-3 Highest Body-worn SAR values for the same configuration

Note 1: If sum of 1 g SAR < 1.6 W/kg, Simultaneous SAR measurement is not required.
Note 2: If sum of 1 g SAR > 1.6 W/kg, ratio of SAR to peak separation distance for pair of transmitters is required.

Test	Configuration	Licensed Transmitters		WiFi 2.4 G 1 g avg. SAR (W/kg)	Maximum Summation 1 g avg. SAR (W/kg)
		Band	1 g avg. SAR (W/kg)		
Mobile Hotspot SAR	10 mm separation, device back	GSM/GPRS/EDGE 850	1.15	0.28	1.43
		UMTS Band V	0.83		1.11
		GSM/GPRS/EDGE 1900	0.61		0.89
		UMTS Band II	0.65		0.93
		LTE Band 17	0.14		0.42
		LTE Band 5	0.47		0.75
		LTE Band 4	0.47		0.75
		UMTS Band IV	0.52		0.80
		LTE Band 2	0.43		0.71
	10 mm separation, device front	GSM/GPRS/EDGE 850	0.92	0.20	1.12
		UMTS Band V	0.56		0.76
		GSM/GPRS/EDGE 1900	0.70		0.90
		UMTS Band II	0.93		1.13
		LTE Band 17	0.09		0.29
		LTE Band 5	0.39		0.59
		LTE Band 4	0.44		0.64
		UMTS Band IV	0.52		0.72
		LTE Band 2	0.52		0.72
	10 mm separation, device left	GSM/GPRS/EDGE 850	0.54	0.05	0.59
		UMTS Band V	0.44		0.49
		GSM/GPRS/EDGE 1900	0.24		0.29
		UMTS Band II	0.31		0.36
		LTE Band 17	0.05		0.10
		LTE Band 5	0.22		0.27
		LTE Band 4	0.13		0.18
		UMTS Band IV	0.15		0.20
		LTE Band 2	0.17		0.23
	10 mm separation, device right	GSM/GPRS/EDGE 850	0.58	0.13	0.71
		UMTS Band V	0.42		0.55
		GSM/GPRS/EDGE 1900	0.24		0.37
		UMTS Band II	0.24		0.37
		LTE Band 17	0.03		0.16
		LTE Band 5	0.28		0.41
		LTE Band 4	0.06		0.19
		UMTS Band IV	0.07		0.20
		LTE Band 2	0.15		0.28
	10 mm separation, device bottom	GSM/GPRS/EDGE 850	0.12	0.10	0.22
		UMTS Band V	0.10		0.20
		GSM/GPRS/EDGE 1900	0.44		0.54
		UMTS Band II	0.49		0.59
		LTE Band 17	0.02		0.12
		LTE Band 5	0.05		0.15

		LTE Band 4	0.23		0.33
		UMTS Band IV	0.28		0.38
		LTE Band 2	0.29		0.39
	10 mm separation, device top	GSM/GPRS/EDGE 850	0.00	0.00	0.00
		UMTS Band V	0.00		0.00
		GSM/GPRS/EDGE 1900	0.00		0.00
		UMTS Band II	0.00		0.00
		LTE Band 17	0.00		0.00
		LTE Band 5	0.00		0.00
		LTE Band 4	0.00		0.00
		UMTS Band IV	0.00		0.00
		LTE Band 2	0.00		0.00

Table 1.9.1-4 Highest Mobile Hotspot SAR values for the same configuration

Note 1: If sum of 1 g SAR < 1.6 W/kg, Simultaneous SAR measurement is not required.
Note 2: If sum of 1 g SAR > 1.6 W/kg, ratio of SAR to peak separation distance for pair of transmitters calculated.

2.0 DESCRIPTION OF THE TEST EQUIPMENT

2.1 SAR measurement system

SAR measurements were performed using a Dosimetric Assessment System (DASY52), an automated SAR measurement system manufactured by Schmid & Partner Engineering AG (SPEAG), of Zurich, Switzerland.

The DASY 52 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (Stäubli RX family) with controller and software.
- An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A DAE module that performs the signal amplification, signal multiplexing, A/D conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the Electro-optical coupler (EOC).
- A unit to operate the optical surface detector that is connected to the EOC.
- The EOC performs the conversion from an optical signal into the digital electric signal of the DAE. The EOC is connected to the PC plug-in card.
- The functions of the PC plug-in card based on a DSP are to perform the time critical tasks such as signal filtering, surveillance of the robot operation fast movement interrupts.
- A computer operating Windows.
- DASY52 software version 52.8.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM Twin Phantom enabling testing left-hand and right-hand usage.
- The device holder for mobile phones.
- Tissue simulating liquid mixed according to the given recipes (see section 6.1).
- System validation dipoles allowing for the validation of proper functioning of the system.

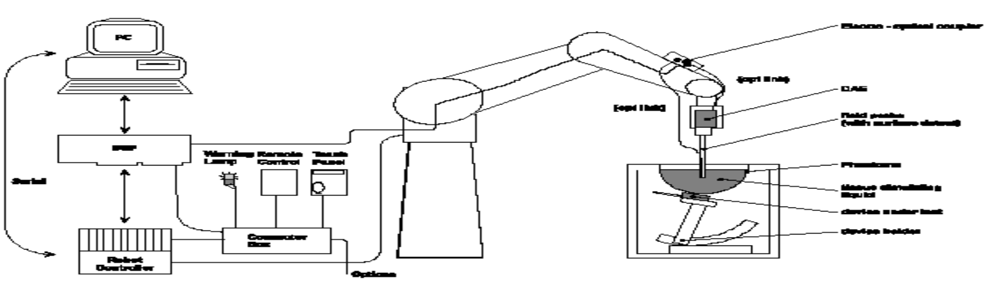

Figure 2.1-1 System Description

2.1.1 Equipment List

Manufacturer	Test Equipment	Model Number	Serial Number	Cal. Due Date (MM/DD/YY)
SCHMID & Partner Engineering AG	E-field probe	ES3DV3	3225	01/10/2014
SCHMID & Partner Engineering AG	Data Acquisition Electronics (DAE3)	DAE4 V1	881	01/14/2014
SCHMID & Partner Engineering AG	Dipole Validation Kit	D750V3	1021	01/07/2015
SCHMID & Partner Engineering AG	Dipole Validation Kit	D835V2	4d043	04/07/2013*
SCHMID & Partner Engineering AG	Dipole Validation Kit	D835V2	446	01/07/2015
SCHMID & Partner Engineering AG	Dipole Validation Kit	D1900V2	545	01/09/2015
SCHMID & Partner Engineering AG	Dipole Validation Kit	D1900V2	5d075	04/05/2013*
SCHMID & Partner Engineering AG	Dipole Validation Kit	D2450V2	791	04/05/2013*
Agilent Technologies	Signal generator	8648C	4037U03155	09/23/2013
Agilent Technologies	Power meter	E4419B	GB40202821	09/23/2013
Agilent Technologies	Power sensor	8481A	MY41095417	09/26/2013
Amplifier Research	Amplifier	5S1G4M3	300986	CNR
Agilent Technologies	Power meter	N1911A	MY45100905	05/17/2013*
Agilent Technologies	Power sensor	N1921A	SG45240281	06/12/2013
Agilent Technologies	Power sensor	N1921A	MY45241383	09/11/2013
Weinschel Corp	20dB Attenuator	33-20-34	BMO697	CNR
Agilent Technologies	Network analyzer	8753ES	US39174857	09/20/2013
Rohde & Schwarz	Base Station Simulator	CMU 200	109747	11/19/2013
CPI Wireless Solutions	Amplifier	VZC-6961K4	SK4310E5	CNR
Rohde & Schwarz	Signal generator	SMA 100A	102106	12/02/2013
Rohde & Schwarz	Bluetooth Tester	CBT	100368	12/04/2013
Rohde & Schwarz	Bluetooth Tester	CBT	100678	12/04/2013
Rohde & Schwarz	Wideband Base Station Simulator	CMW 500	109949	12/10/2014
Rohde & Schwarz	Wideband Base Station Simulator	CMW 500	101169	12/10/2014

Table 2.1.1-1 Equipment list

* This equipment was sent out for calibration before due date.

2.2 Description of the test setup

Before SAR measurements are conducted, the device and the DASY equipment are setup as follows:

2.2.1 Device and base station simulator setup

- Power up the device.
- Turn on the base station simulator and set the radio channel and power to the appropriate values.
- Connect an antenna to the RF IN/OUT of the communication test set and place it close to the device.

2.2.2 DASY setup

- Turn the computer on and log on to Windows.
- Start the DASY software by clicking on the icon located on the Windows desktop.
- Mount the DAE unit and the probe. Turn on the DAE unit.
- Turn the Robot Controller on by turning the main power switch to the horizontal position
- Align the probe by clicking the ‘Align probe in light beam’ button.
- Open a file and configure the proper parameters - probe, medium, communications system etc.
- Establish a connection between the Device and the communications test instrument. Place the Device on the stand and adjust it under the phantom.
- Start SAR measurements.

3.0 ELECTRIC FIELD PROBE CALIBRATION

3.1 Probe Specifications

SAR measurements were conducted using the dosimetric probes ES3DV3/ET3DV6 and EX3DV4, designed by Schmid & Partner Engineering AG for the measurement of SAR. The probe is constructed using the thin film technique, with printed resistive lines on ceramic substrates. It has a symmetrical design with triangular core, built-in optical fibre for the surface detection system and built-in shielding against static discharge. The probe is sensitive to E-fields and thus incorporates three small dipoles arranged so that the overall response is close to isotropic. The table below summarizes the technical data for the probe.

Property	Data
Frequency range	30 MHz – 3 GHz
Linearity	±0.1 dB
Directivity (rotation around probe axis)	≤ ±0.2 dB
Directivity (rotation normal to probe axis)	±0.4 dB
Dynamic Range	5 mW/kg – 100 W/kg
Probe positioning repeatability	±0.2 mm
Spatial resolution	< 0.125 mm ³
Probe model EX3DV4 for 2.4 – 6 GHz	
Probe tip to sensor center	1.0 mm
Probe tip diameter is	2.5 mm
Probe calibration uncertainty	< 15 % for f = 2.45 to < 6.0 GHz
Probe calibration range	± 100 MHz

Table 3.1-1 Probe specifications

3.2 Probe calibration and measurement uncertainty

The probe had been calibrated with accuracy better than ±12% . The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe were tested. The probe calibration parameters are shown on Appendix D and below:

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	6.42	6.42	6.42	0.27	2.04	± 12.0 %
900	41.5	0.97	6.06	6.06	6.06	0.35	1.74	± 12.0 %
1810	40.0	1.40	5.23	5.23	5.23	0.73	1.21	± 12.0 %
1950	40.0	1.40	4.98	4.98	4.98	0.58	1.41	± 12.0 %
2450	39.2	1.80	4.50	4.50	4.50	0.79	1.26	± 12.0 %
2600	39.0	1.96	4.32	4.32	4.32	0.77	1.32	± 12.0 %

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	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	0.36	1.74	± 12.0 %
900	55.0	1.05	6.07	6.07	6.07	0.29	2.02	± 12.0 %
1810	53.3	1.52	4.92	4.92	4.92	0.50	1.57	± 12.0 %
1950	53.3	1.52	4.87	4.87	4.87	0.59	1.49	± 12.0 %
2450	52.7	1.95	4.30	4.30	4.30	0.68	1.16	± 12.0 %
2600	52.5	2.16	4.12	4.12	4.12	0.80	0.99	± 12.0 %

Table 3.2-1 Probe ES3DV3 SN: 3225

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	6.57	6.57	6.57	0.44	2.25	± 12.0 %
900	41.5	0.97	6.24	6.24	6.24	0.38	2.52	± 12.0 %
1810	40.0	1.40	5.21	5.21	5.21	0.80	2.10	± 12.0 %
1950	40.0	1.40	5.16	5.16	5.16	0.80	2.09	± 12.0 %
2450	39.2	1.80	4.60	4.60	4.60	0.65	2.00	± 12.0 %

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	6.30	6.30	6.30	0.33	2.61	± 12.0 %
900	55.0	1.05	6.06	6.06	6.06	0.31	2.99	± 12.0 %
1810	53.3	1.52	4.75	4.75	4.75	0.80	2.40	± 12.0 %
1950	53.3	1.52	4.75	4.75	4.75	0.80	2.28	± 12.0 %
2450	52.7	1.95	4.11	4.11	4.11	0.50	2.15	± 12.0 %

Table 3.2-2 Probe ET3DV6 SN: 1644

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz] [C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth	Unc (k=2)
5200	± 50 / ± 100	36.0 ± 5%	4.66 ± 5%	4.50	4.50	4.50	0.45	1.90	± 13.1%
5500	± 50 / ± 100	35.6 ± 5%	4.96 ± 5%	4.25	4.25	4.25	0.50	1.90	± 13.1%
5800	± 50 / ± 100	35.3 ± 5%	5.27 ± 5%	3.98	3.98	3.98	0.52	1.90	± 13.1%

Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
5200	± 50 / ± 100	49.0 ± 5%	5.30 ± 5%	3.95	3.95	3.95	0.52	1.95 ± 13.1%
5500	± 50 / ± 100	48.6 ± 5%	5.65 ± 5%	3.73	3.73	3.73	0.55	1.95 ± 13.1%
5800	± 50 / ± 100	48.2 ± 5%	6.00 ± 5%	3.40	3.40	3.40	0.63	1.95 ± 13.1%

Table 3.2-3 Probe EX3DV4 SN: 3592

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
2600	± 50 / ± 100	39.0 ± 5%	1.96 ± 5%	7.08	7.08	7.08	0.23	1.34 ± 11.0%
5200	± 50 / ± 100	36.0 ± 5%	4.66 ± 5%	5.01	5.01	5.01	0.40	1.80 ± 13.1%
5500	± 50 / ± 100	35.6 ± 5%	4.96 ± 5%	4.63	4.63	4.63	0.50	1.80 ± 13.1%
5800	± 50 / ± 100	35.3 ± 5%	5.27 ± 5%	4.42	4.42	4.42	0.50	1.80 ± 13.1%

Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
2600	± 50 / ± 100	52.5 ± 5%	2.16 ± 5%	7.12	7.12	7.12	0.67	0.71 ± 11.0%
5200	± 50 / ± 100	49.0 ± 5%	5.30 ± 5%	4.79	4.79	4.79	0.45	1.90 ± 13.1%
5500	± 50 / ± 100	48.6 ± 5%	5.65 ± 5%	4.29	4.29	4.29	0.50	1.90 ± 13.1%
5800	± 50 / ± 100	48.2 ± 5%	6.00 ± 5%	4.08	4.08	4.08	0.60	1.90 ± 13.1%

Table 3.2-4 Probe EX3DV4 SN: 3548

C The validity of ± 100 MHz only applies for DASY v4.4 and higher.
DASY 52 has been used for measurements, therefore ± 100 MHz tolerance is valid.
Measured dielectric parameters are within +/- 5% of the probe calibration values and target values.
Expanded probe calibration uncertainty (k=2) is < 15 %

4.0 SAR MEASUREMENT SYSTEM VERIFICATION

Prior to conducting SAR measurements, the system was validated using the dipole validation kit and the flat section of the SAM phantom. A power level of 1.0W was applied to the dipole antenna. The verification results are in the table below with a comparison to reference values. Printouts are shown in Appendix A. All the measured parameters are within the allowed tolerances.

At above 1.5 – 2 GHz, dipoles maintain good return loss of -15 dB to -20 dB, therefore SAR measurements are limited to approximately +/- 100 MHz of the probe/dipole calibration frequency.

4.1 System accuracy verification for head adjacent use

f (MHz)	Limits / Measured (MM/DD/YYYY)	Scan Type	SAR 1 g/10 g (W/kg)	Dielectric Parameters ε_r	Dielectric Parameters σ [S/m]	Liquid Temp. (°C)
750	Measured (05/08/2013)	Area Scan/Fast SAR	8.10/5.56	40.8	0.90	21.5
	Measured (05/08/2013)	Zoom Scan	8.06/5.28	40.8	0.90	21.5
	Measured (05/28/2013)	Area Scan/Fast SAR	7.63/5.23	41.6	0.90	21.2
	Measured (05/28/2013)	Zoom Scan	7.62/4.99	41.6	0.90	21.2
	Recommended Limits (Dipole: 1021)		8.46/5.51	41.9	0.89	N/A
835	Measured (03/13/2013)	Area Scan/Fast SAR	8.98/6.10	40.5	0.89	21.8
	Measured (03/13/2013)	Zoom Scan	8.91/5.85	40.5	0.89	21.8
	Measured (03/15/2013)	Area Scan/Fast SAR	9.27/6.30	41.0	0.90	21.2
	Measured (03/15/2013)	Zoom Scan	9.17/6.03	41.0	0.90	21.2
	Measured (03/19/2013)	Area Scan/Fast SAR	8.72/5.92	43.2	0.93	21.4
	Measured (03/19/2013)	Zoom Scan	8.64/5.68	43.2	0.93	21.4
	Measured (05/06/2013)	Area Scan/Fast SAR	8.96/5.94	41.3	0.90	21.5
	Measured (05/06/2013)	Zoom Scan	8.96/5.86	41.3	0.90	21.5
	Recommended Limits (Dipole: 4d043)		9.43/6.14	41.5	0.90	N/A
	Recommended Limits (Dipole: 446)		9.39/6.13	41.5	0.90	N/A
1800	Measured (04/01/2013)	Area Scan/Fast SAR	35.6/19.4	38.0	1.46	21.8
	Measured (04/01/2013)	Zoom Scan	34.9/18.3	38.0	1.46	21.8
	Measured (05/24/2013)	Area Scan/Fast SAR	35.6/19.4	38.2	1.42	22.1
	Measured (05/24/2013)	Zoom Scan	35.2/18.3	38.2	1.42	22.1
	Measured (05/27/2013)	Area Scan/Fast SAR	35.9/19.6	38.5	1.44	21.5
	Measured (05/27/2013)	Zoom Scan	35.5/18.5	38.5	1.44	21.5
	Recommended Limits (Dipole: 2d020)		38.5/20.3	40.0	1.40	N/A
1900	Measured (03/11/2013)	Area Scan/Fast SAR	38.8/20.7	38.5	1.39	22.0
	Measured (03/11/2013)	Zoom Scan	38.3/20.1	38.5	1.39	22.0
	Measured (03/24/2013)	Area Scan/Fast SAR	38.4/20.5	38.3	1.42	21.8
	Measured (03/24/2013)	Zoom Scan	38.2/19.8	38.3	1.42	21.8
	Measured (04/02/2013)	Area Scan/Fast SAR	38.2/20.4	38.4	1.46	22.4
	Measured (04/02/2013)	Zoom Scan	37.3/19.4	38.4	1.46	22.4
	Measured (04/08/2013)	Area Scan/Fast SAR	37.3/19.9	38.3	1.38	21.9
	Measured (04/08/2013)	Zoom Scan	36.8/19.3	38.3	1.38	21.9
	Measured (04/14/2013)	Area Scan/Fast SAR	37.3/19.7	38.5	1.39	22.7
	Measured (04/14/2013)	Zoom Scan	36.8/19.2	38.5	1.39	22.7
	Measured (04/19/2013)	Area Scan/Fast SAR	37.5/19.8	38.8	1.38	22.1
	Measured (04/19/2013)	Zoom Scan	36.8/19.1	38.8	1.38	22.1

	Measured (04/25/2013)	Area Scan/Fast SAR	36.9/19.5	38.7	1.37	22.2
	Measured (04/25/2013)	Zoom Scan	36.4/19.1	38.7	1.37	22.2
	Measured (05/10/2013)	Area Scan/Fast SAR	37.6/19.8	38.8	1.38	22.0
	Measured (05/10/2013)	Zoom Scan	37.1/19.4	38.8	1.38	22.0
	Measured (05/13/2013)	Area Scan/Fast SAR	37.3/19.7	39.2	1.38	21.8
	Measured (05/13/2013)	Zoom Scan	36.7/19.3	39.2	1.38	21.8
	Measured (05/29/2013)	Area Scan/Fast SAR	37.7/20.0	38.9	1.41	21.5
	Measured (05/29/2013)	Zoom Scan	36.8/19.3	38.9	1.41	21.5
	Recommended Limits (Dipole: 5d075)		40.4/21.0	40.0	1.40	N/A
	Recommended Limits (Dipole: 545)		40.2/21.1	40.0	1.40	N/A
2450	Measured (03/21/2013)	Area Scan/Fast SAR	51.9/23.1	37.7	1.84	21.6
	Measured (03/21/2013)	Zoom Scan	51.3/24.2	37.7	1.84	21.6
	Recommended Limits (Dipole: 791)		54.1/25.0	39.2	1.80	N/A

Table 4.1-1 System accuracy (validation for head adjacent use)

5.0 PHANTOM DESCRIPTION

The SAM Twin Phantom, manufactured by SPEAG, was used during the SAR measurements. The phantom is made of a fibreglass shell integrated with a wooden table.

The SAM Twin Phantom is a fibreglass shell phantom with 2 mm shell thickness. It has three measurement areas:

Left side head
Right side head
Flat phantom

The phantom table dimensions are: 100x50x85 cm (LxWxH). The table is intended for use with freestanding robots.

The bottom shelf contains three pair of bolts for locking the device holder in place. The device holder positions are adjusted to the standard measurement positions in the three sections. Only one device holder is
necessary if two phantoms are used (e.g., for different solutions).

A white cover is provided to top the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. Free space scans of devices on the cover are possible; however the optical surface detector does not work properly at the cover surface. Place a sheet of white paper on the cover when using optical surface detection.

Liquid depth of ≥ 15 cm is maintained in the phantom for all the measurements.

Figure 5.0-1 SAM Twin Phantom

6.0 TISSUE DIELECTRIC PROPERTIES

6.1 Composition of tissue simulant

The composition of the brain and muscle simulating liquids are shown in the table below.

INGREDIENT	MIXTURE 800–900MHz		MIXTURE 1800–1900MHz		MIXTURE 2450 MHz		MIXTURE 5 – 6 GHz	
	Brain %	Muscle %	Brain %	Muscle %	Brain %	Muscle %	Brain %	Muscle %
Water	40.29	65.45	55.24	69.91	55.0	68.75	64	64-78
Sugar	57.90	34.31	0	0	0	0	0	0
Salt	1.38	0.62	0.31	0.13	0	0	0	0
HEC	0.24	0	0	0	0	0	0	0
Bactericide	0.18	0.10	0	0	0	0	0	0
DGBE	0	0	44.45	29.96	40.0	31.25	0	0
Triton X-100	0	0	0	0	5.0	0	0	0
Additives and Salt	0	0	0	0	0	0	3	2-3
Emulsifiers	0	0	0	0	0	0	15	9-15
Mineral Oil	0	0	0	0	0	0	18	11-18

Table 6.1-1 Tissue simulant recipe

6.1.1 Equipment

Manufacturer	Test Equipment	Model Number	Serial Number	Cal. Due Date (MM/DD/YY)
Pyrex, England	Graduated Cylinder	N/A	N/A	N/A
Pyrex, USA	Beaker	N/A	N/A	N/A
Acculab	Weight Scale	V1-1200	018WB2003	N/A
IKA Works Inc.	Hot Plate	RC Basic	3.107433	N/A
Dell	PC using GPIB card	GX110	347	N/A
Agilent Technologies	Dielectric probe kit	HP 85070C	US9936135	CNR
Agilent Technologies	Network Analyzer	8753ES	US39174857	09/20/2013
Control Company	Digital Thermometer	23609-234	21352860	09/26/2013

Table 6.1.1-1 Tissue simulant preparation equipment

6.1.2 Preparation procedure

800-900 MHz liquids

- Fill the container with **water**. Begin heating and stirring.
- Add the **Cellulose,** the **preservative substance** and the **salt**. After several hours, the liquid will become more transparent again. The container must be covered to prevent evaporation.
- Add **Sugar**. Stir it well until the sugar is sufficiently dissolved.
- Keep the liquid hot but below the boiling point for at least an hour. The container must be covered to prevent evaporation.
- Remove the container from, and turn the hotplate off and allow the liquid to cool off to room temperature prior to performing dielectric measurements.

1800-2450 MHz liquid

- Fill the container with water and place it on hotplate. Begin heating and stirring.
- Add the salt, Glycol/Triton X-100. The container must be covered to prevent evaporation.
- Keep the liquid hot enough to dissolve sugar for at least an hour. The container must be covered to prevent evaporation.
- Remove the container from, and turn the hotplate off and allow the liquid to cool off to room temperature prior to performing dielectric measurements.

6.2 Electrical parameters of the tissue simulating liquid

The tissue dielectric parameters shall be measured before a batch can be used for SAR measurements to ensure that the simulated tissue was properly made and will simulate the desired human characteristic. Limits and measured electrical parameters are shown in the table below.
Recommended limits are adopted from IEEE P1528-2003:
" Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", DASY manual and from FCC Tissue Dielectric Properties web page at http://www.fcc.gov/fcc-bin/dielec.sh

Band (MHz)	Tissue Type	Limits / Measured (MM/DD/YYYY)	f (MHz)	Dielectric Parameters		Liquid Temp (°C)
				ε_r	σ [S/m]	
750	Head	Measured (05/08/2013)	705	41.4	0.86	21.5
			715	41.3	0.86	
			750	40.8	0.90	
		Measured (05/28/2013)	705	42.3	0.86	21.0
			715	42.1	0.87	
			750	41.6	0.90	
		Recommended Limits	750	41.9	0.89	N/A
	Muscle	Measured (05/08/2013)	705	54.0	0.91	21.4
			715	53.9	0.92	
			750	53.5	0.96	
		Measured (05/28/2013)	705	56.2	0.92	21.0
			715	56.2	0.92	
			750	55.7	0.96	
		Recommended Limits	750	55.5	0.96	N/A

835	Head	Measured (03/13/2013)	815	40.7	0.87	21.8
			825	40.6	0.88	
			835	40.5	0.89	
			850	40.4	0.90	
			865	40.2	0.92	
		Measured (03/15/2013)	815	41.2	0.89	21.2
			825	41.1	0.89	
			835	41.0	0.90	
			850	40.8	0.92	
			865	40.6	0.93	
		Measured (03/18/2013)	815	43.5	0.91	21.5
			825	43.4	0.92	
			835	43.2	0.93	
			850	43.0	0.95	
			865	42.8	0.96	
		Measured (05/06/2013)	815	41.6	0.88	21.5
			825	41.4	0.89	
			835	41.3	0.90	
			850	41.2	0.91	
			865	41.0	0.93	
		Recommended Limits	835	41.5	0.90	N/A
	Muscle	Measured (03/13/2013)	815	54.8	0.95	20.3
			825	54.7	0.96	
			835	54.6	0.98	
			850	54.5	0.99	
		Measured (03/15/2013)	815	53.2	0.95	20.9
			825	53.1	0.96	
			835	53.0	0.97	
			850	52.8	0.99	
		Measured (03/18/2013)	815	53.2	0.95	21.3
			825	53.1	0.96	
			835	53.0	0.97	
			850	52.8	0.99	
		Measured (05/06/2013)	815	53.3	0.94	21.5
			825	53.3	0.95	
			835	53.1	0.96	
			850	53.0	0.98	
		Recommended Limits	835	55.2	0.97	N/A
1800	Head	Measured (04/01/2013)	1710	38.6	1.38	21.8
			1750	38.3	1.42	
			1800	38.0	1.46	
		Measured (05/24/2013)	1710	38.9	1.34	22.1
			1750	38.6	1.38	
			1800	38.2	1.42	
		Measured (05/27/2013)	1710	38.8	1.35	21.3
			1750	38.5	1.39	
			1800	38.5	1.44	
		Recommended Limits	1800	40.0	1.40	N/A

	Muscle	Measured (04/01/2013)	1710	51.1	1.50	22.0
			1750	50.9	1.54	
			1800	50.7	1.60	
		Measured (05/24/2013)	1710	51.4	1.48	22.1
			1750	51.3	1.53	
			1800	51.1	1.58	
		Measured (05/27/2013)	1710	50.8	1.50	22.3
			1750	50.7	1.54	
			1800	50.6	1.60	
		Recommended Limits	1800	53.3	1.52	N/A
1900	Head	Measured (03/11/2013)	1850	38.8	1.34	22.0
			1900	38.5	1.39	
			1910	38.5	1.40	
			1980	38.2	1.46	
		Measured (03/24/2013)	1850	38.5	1.37	21.8
			1900	38.3	1.42	
			1910	38.3	1.43	
			1980	38.1	1.51	
		Measured (04/02/2013)	1850	38.6	1.39	22.4
			1900	38.4	1.46	
			1910	38.4	1.47	
		Measured (04/08/2013)	1850	38.5	1.33	21.9
			1900	38.3	1.38	
			1910	38.2	1.39	
		Measured (04/14/2013)	1850	38.7	1.34	22.6
			1900	38.5	1.39	
			1910	38.5	1.40	
		Measured (04/19/2013)	1850	39.0	1.33	22.1
			1900	38.8	1.38	
			1910	38.8	1.39	
		Measured (04/25/2013)	1850	38.9	1.33	22.2
			1900	38.7	1.37	
			1910	38.8	1.38	
		Measured (05/10/2013)	1850	39.0	1.33	22.0
			1900	38.8	1.38	
			1910	38.7	1.39	
		Measured (05/13/2013)	1850	39.3	1.33	21.8
			1900	39.2	1.38	
			1910	39.1	1.39	
		Measured (05/28/2013)	1850	39.1	1.36	21.8
			1900	38.9	1.41	
			1910	38.8	1.42	
		Recommended Limits	1900	40.0	1.40	N/A
	Muscle	Measured (03/12/2013)	1850	51.8	1.51	22.4
			1900	51.5	1.56	
			1910	51.5	1.57	
		Measured (03/24/2013)	1850	50.9	1.48	22.4
			1900	50.8	1.53	

			1910	50.7	1.58	
		Measured (04/02/2013)	1850	50.7	1.51	22.5
			1900	50.7	1.58	
			1910	50.7	1.59	
		Measured (04/08/2013)	1850	51.0	1.48	22.5
			1900	50.9	1.53	
			1910	50.8	1.55	
		Measured (04/14/2013)	1850	51.1	1.51	22.5
			1900	50.9	1.56	
			1910	50.9	1.57	
		Measured (04/19/2013)	1850	50.8	1.50	21.6
			1900	50.7	1.55	
			1910	50.6	1.57	
		Measured (04/25/2013)	1850	50.8	1.50	22.7
			1900	50.7	1.54	
			1910	50.7	1.55	
		Measured (05/10/2013)	1850	50.9	1.50	22.1
			1900	50.7	1.55	
			1910	50.7	1.56	
		Measured (05/13/2013)	1850	51.2	1.48	22.8
			1900	51.0	1.54	
			1910	51.0	1.55	
		Measured (05/28/2013)	1850	51.3	1.52	21.1
			1900	51.2	1.57	
			1910	51.1	1.58	
		Recommended Limits	1900	53.3	1.52	N/A
2450	Head	Measured (03/20/2013)	2410	37.8	1.80	21.6
			2450	37.7	1.84	
			2480	37.6	1.87	
		Recommended Limits	2450	39.2	1.80	N/A
	Muscle	Measured (03/20/2013)	2410	50.5	1.92	20.8
			2450	50.4	1.97	
			2480	50.2	2.01	
		Recommended Limits	2450	52.7	1.95	N/A

Table 6.2-1 Electrical parameters of tissue simulating liquid

6.2.2 Test Configuration

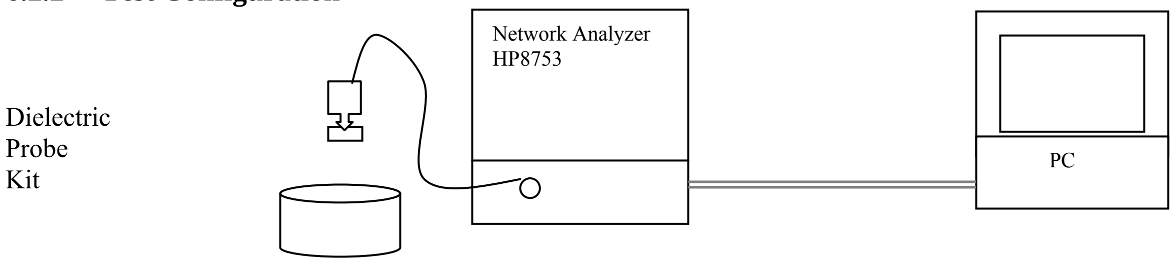

Figure 6.2.2-1 Test configuration

6.2.3 Procedure

1. Turn NWA on and allow at least 30 minutes for warm up.
2. Mount dielectric probe kit so that interconnecting cable to NWA will not be moved during measurements or calibration.
3. Pour de-ionized water and measure water temperature (±1°).
4. Set water temperature in HP-Software (Calibration Setup).
5. Perform calibration.
6. Relative permittivity $\varepsilon r = \varepsilon'$ and conductivity can be calculated from ε'' ($\sigma = \omega\, \varepsilon_0\, \varepsilon''$)
7. Measure liquid shortly after calibration.
8. Stir the liquid to be measured. Take a sample (~50ml) with a syringe from the center of the liquid container.
9. Pour the liquid into a small glass flask. Hold the syringe at the bottom of the flask to avoid air bubbles.
10. Put the dielectric probe in the glass flask. Check that there are no air bubbles in front of the opening in the dielectric probe kit.
11. Perform measurements.
12. Adjust medium parameters in DASY software for the frequencies necessary for the measurements (‘Setup Config’, select medium (e.g. Head 835 MHz) and press ‘Option’-button.
13. Select the current medium for the frequency of the validation (e.g. Setup Medium Brain 835 MHz).

7.0 SAR SAFETY LIMITS

Standards/Guideline	Localized SAR Limit (W/kg) General public (uncontrolled)	Localized SAR Limits (W/kg) Workers (controlled)
ICNIRP Standard	2.0 (10g)	10.0 (10g)
IEEE C95.1 Standard	1.6 (1g)	8.0 (1g)

Table 7.0-1 SAR safety limits for Controlled / Uncontrolled environment

Human Exposure	Localized SAR Limits (W/kg) 10g, ICNIRP Standard	Localized SAR Limits (W/kg) 1g, IEEE C95.1 Standard
Spatial Average (averaged over the whole body)	0.08	0.08
Spatial Peak (averaged over any X g of tissue)	2.00	1.60
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)	4.00	4.00 (10g)

Table 7.0-2 SAR safety limits

Uncontrolled Environments are defined as locations where there is exposure of individuals who have no knowledge or control of their exposure.

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation).

8.0 DEVICE POSITIONING

8.1 Device holder for SAM Twin Phantom

The Device was positioned for all test configurations using the DASY5 holder. The device holder facilitates the rotation of the mounted transmitter in spherical coordinates whereby the rotation point is the ear opening. The devices can be easily, accurately and with repeatability positioned according to FCC and CENELEC specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

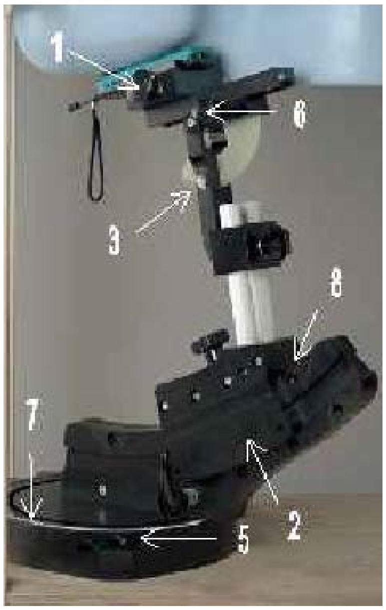

Figure 8.1-1 Device Holder

1. Put the phone in the clamp mechanism (1) and hold it straight while tightening. (Curved phones or phones with asymmetrical ear pieces should be positioned so that the earpiece is in the symmetry plane of the clamp).
2. Adjust the sliding carriage (2) to 90°. Then adjust the phone holder angle (3) until the reference line of the phone is horizontal (parallel to the flat phantom bottom). The phone reference line is defined as the front tangential line between the earpiece and the center of the device bottom (or the center of the flip hinge). For devices with parallel front and backsides, the phone holder angle (3) is 0°.
3. Place the device holder at the desired phantom section and move it securely against the positioning pins (4). The screw in front of the turning plate can be applied for correct positioning (5). (Do not tighten it too strongly).
4. Shift the phone clamp (6) so that the earpiece is exactly below the ear marking of the phantom. The phone is now correctly positioned in the holder for all standard phantom measurements, even after changing the phantom or phantom section.
5. Adjust the device position angles to the desired measurement position.
6. After fixing the device angles, move the phone fixture up until the phone touches the ear marking. (The point of contact depends on the design of the device and the positioning angle).

8.2 Description of the test positioning

8.2.1 Test Positions of Device Relative to Head

The handset was tested in two test positions against the head phantom, the "cheek" position and the "tilted" position, on both left and right sides of the phantom.

The handset was tested in the above positions according to IEEE 1528- 2003 "Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques".

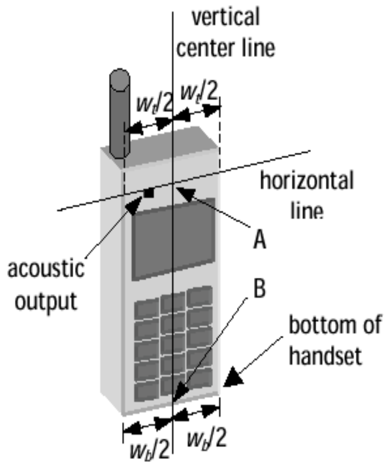

Figure 8.2.1-1 Handset vertical and horizontal reference lines – fixed case

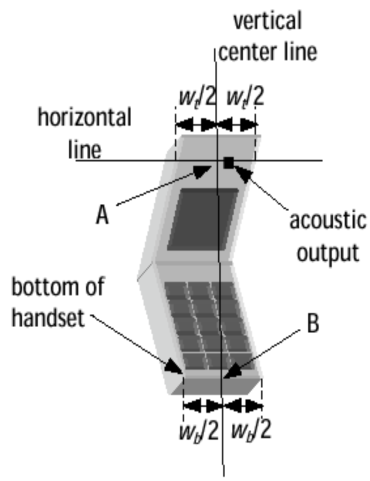

Figure 8.2.1-2 Handset vertical and horizontal reference lines – "clam-shell"

Definition of the "cheek" position

1) Ready the handset for talk operation, if necessary. For example, for handsets with a cover piece, open the cover.
2) Define two imaginary lines on the handset: the vertical centerline and the horizontal line. The vertical centerline passes through two points on the front side of the handset: the midpoint of the width *wt* of the handset at the level of the acoustic output (point A on Figures 8.2.1-1 and 8.2.1-2), and the midpoint of the width *wb* of the bottom of the handset (point B). The horizontal line is perpendicular to the vertical centerline and passes through the center of the acoustic output (see Figure 8.2.1-1). The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output. However, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centerline is not necessarily parallel to the front face of the handset (see Figure 8.2.1-2), especially for clamshell handsets, handsets with flip pieces, and other irregularly shaped handsets.
3) Position the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 8.2.1-3), such that the plane defined by the vertical center line and the horizontal center line is in a plane approximately parallel to the sagittal plane of the phantom.
4) Translate the handset towards the phantom along the line passing through RE and LE until the handset touches the ear.
5) While maintaining the handset in this plane, rotate it around the LE-RE line until the vertical centerline is the plane normal to MB ("*mouth-back*") - NF ("*neck-front*") including the line MB (reference plane).
6) Rotate the phone around the vertical centerline until the phone (horizontal line) is symmetrical with respect to the line NF.
7) While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE, and maintaining the phone contact with the ear, rotate the handset about the line NF until any point on the handset is in contact with a phantom point below the ear (cheek).

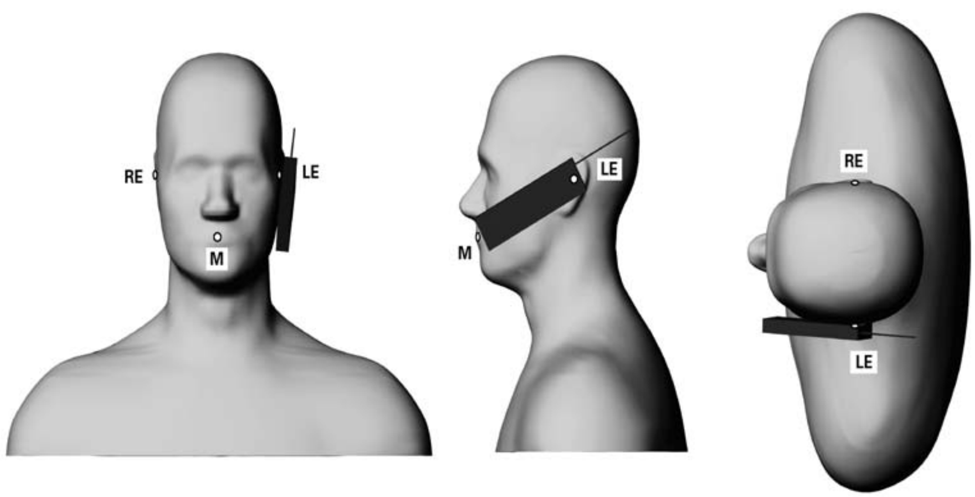

Figure 8.2.1-3 Phone position 1, "cheek" or "touch" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only.

Definition of the “Tilted” Position

1) Repeat steps 1 to 7 from above.
2) While maintaining the device in the reference plane (described above) and pivoting against the ear, move the device outward away from the mouth by an angle of 15 degrees, or until the antenna touches the phantom**.**

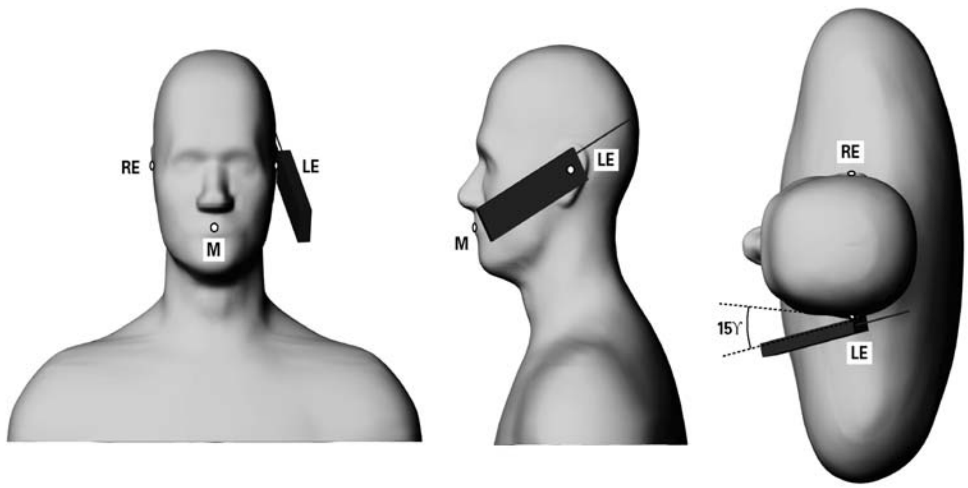

Figure 8.2.1-4 Phone position 2, “tilted position.” The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only.

8.2.2 Body-worn Configuration

Body-worn holsters, as shown on Figure 1.4-1, have been test with the device for RF exposure compliance. The device was positioned in each holster case and the belt clip was placed against the flat section of the phantom. A headset was then connected to the device to simulate hands-free operation in a body worn holster configuration.

In addition, device was tested with 15 mm RIM recommended separation distance to allow typical after-market holster to be used. RIM body-worn holsters with belt-clip have been designed to maintain ~ 19-20 mm separation distance from body.

8.2.3 Limb/Hand Configuration

BlackBerry device is not a limb-worn device and hasn’t been tested for such a configuration.

As per Clause 6.1.4.9 in the IEC/EN 62209-2 standard:

"Additional studies remain needed for devising a representative method for evaluating SAR in the hand of hand-held devices. Future versions of this standard are intended to contain a test method based on scientific data and rationale. Annex J presents the currently available test procedure."

Clause J.2 of the IEC/EN 62209-2 states that testing for compliance for the exposure of the hand is not applicable for devices that are intended to being hand-held to enable use at the ear (see EN 62209-1) or worn on the body when transmitting.

In addition, BlackBerry device is not intended to be held in hand at a distance of larger than 200 mm from the head and body during normal use.

9.0 HIGH LEVEL EVALUATION

9.1 Maximum search

The maximum search is automatically performed after each coarse scan measurement. It is based on splines in two or three dimensions. The procedure can find the maximum for most SAR distributions even with relatively large grid spacing. After the coarse scan measurement, the probe is automatically moved to a position at the interpolated maximum. The following scan can directly use this position for reference, e.g., for a finer resolution grid or the cube evaluations.

9.2 Extrapolation

The extrapolation can be used in z-axis scans with automatic surface detection. The SAR values can be extrapolated to the inner phantom surface. The extrapolation distance is the sum of the probe sensor offset, the surface detection distance and the grid offset. The extrapolation is based on fourth order polynomial functions. The extrapolation is only available for SAR values.

9.3 Boundary correction

The correction of the probe boundary effect in the vicinity of the phantom surface is done in the standard (worst case) evaluation; the boundary effect is reduced by different weights for the lowest measured points in the extrapolation routine. The result is a slight overestimation of the extrapolated SAR values (2% to 8%) depending on the SAR distribution and gradient. The advanced evaluation makes a full compensation of the boundary effect before doing the extrapolation. This is only possible for probes with specifications on the boundary effect.

9.4 Peak search for 1g and 10g cube averaged SAR

The 1g and 10g peak evaluations are only available for the predefined cube 5x5x7 / 7x7x9 scan. The routines are verified and optimized for the grid dimensions used in these cube measurements.
The measured volume of 30x30x30mm / 22x22x22 with 7.5 / 5 / 4.0 mm resolution in (x,y) and 5mm / 2.mm resolution in z axis amounts to 175 / 693 measurement points. The first procedure is an extrapolation (incl. Boundary correction) to get the points between the lowest measured plane and the surface. The next step uses 3D interpolation to get all points within the measured volume in a 1mm grid. In the last step, a 1g cube is placed numerically into the volume and its averaged SAR is calculated. This cube is then moved around until the highest averaged SAR is found. This last procedure is repeated for a 10 g cube. If the highest SAR is found at the edge of the measured volume, the system will issue a warning: higher SAR values might be found outside of the measured volume. In that case the cube measurement can be repeated, using the new interpolated maximum as the center.

10.0 MEASUREMENT UNCERTAINTY

DASY5 Uncertainty Budget
According to IEEE 1528/2003 [1]

Error Description	Uncert. value	Prob. Dist.	Div.	(c_i) 1g	(c_i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v_i) v_{eff}
Measurement System								
Probe Calibration	±5.5 %	N	1	1	1	±5.5 %	±5.5 %	∞
Axial Isotropy	±4.7 %	R	$\sqrt{3}$	0.7	0.7	±1.9 %	±1.9 %	∞
Hemispherical Isotropy	±9.6 %	R	$\sqrt{3}$	0.7	0.7	±3.9 %	±3.9 %	∞
Boundary Effects	±1.0 %	R	$\sqrt{3}$	1	1	±0.6 %	±0.6 %	∞
Linearity	±4.7 %	R	$\sqrt{3}$	1	1	±2.7 %	±2.7 %	∞
System Detection Limits	±1.0 %	R	$\sqrt{3}$	1	1	±0.6 %	±0.6 %	∞
Readout Electronics	±0.3 %	N	1	1	1	±0.3 %	±0.3 %	∞
Response Time	±0.8 %	R	$\sqrt{3}$	1	1	±0.5 %	±0.5 %	∞
Integration Time	±2.6 %	R	$\sqrt{3}$	1	1	±1.5 %	±1.5 %	∞
RF Ambient Noise	±3.0 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
RF Ambient Reflections	±3.0 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
Probe Positioner	±0.4 %	R	$\sqrt{3}$	1	1	±0.2 %	±0.2 %	∞
Probe Positioning	±2.9 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
Max. SAR Eval.	±1.0 %	R	$\sqrt{3}$	1	1	±0.6 %	±0.6 %	∞
Test Sample Related								
Device Positioning	±2.9 %	N	1	1	1	±2.9 %	±2.9 %	145
Device Holder	±3.6 %	N	1	1	1	±3.6 %	±3.6 %	5
Power Drift	±5.0 %	R	$\sqrt{3}$	1	1	±2.9 %	±2.9 %	∞
Phantom and Setup								
Phantom Uncertainty	±4.0 %	R	$\sqrt{3}$	1	1	±2.3 %	±2.3 %	∞
Liquid Conductivity (target)	±5.0 %	R	$\sqrt{3}$	0.64	0.43	±1.8 %	±1.2 %	∞
Liquid Conductivity (meas.)	±2.5 %	N	1	0.64	0.43	±1.6 %	±1.1 %	∞
Liquid Permittivity (target)	±5.0 %	R	$\sqrt{3}$	0.6	0.49	±1.7 %	±1.4 %	∞
Liquid Permittivity (meas.)	±2.5 %	N	1	0.6	0.49	±1.5 %	±1.2 %	∞
Combined Std. Uncertainty						±10.7 %	±10.5 %	387
Expanded STD Uncertainty						**±21.4 %**	**±21.0 %**	

Table 10.0-1 Worst-Case uncertainty budget for DASY5 assessed according to IEEE P1528.
Source: Schmid & Partner Engineering AG.

[1] The budget is valid for the frequency range 300MHz - 3 GHz and represents a worst-case analysis. For specific tests and configurations, the uncertainty could be considerably smaller.

Relative DASY5 Uncertainty Budget for Fast SAR Tests

According to IEEE 1528/2011 and IEC 62209-1/2011
(0.3 - 3 GHz range)

Error Description	Uncert. value	Prob. Dist.	Div.	(c_i) 1g	(c_i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v_i) v_{eff}
Measurement System								
Probe Calibration	±6.0 %	N	1	0	0			
Axial Isotropy	±4.7 %	R	$\sqrt{3}$	0.7	0.7	±1.9 %	±1.9 %	∞
Hemispherical Isotropy	±9.6 %	R	$\sqrt{3}$	0.7	0.7	±3.9 %	±3.9 %	∞
Boundary Effects	±1.0 %	R	$\sqrt{3}$	1	1	±0.6 %	±0.6 %	∞
Linearity	±4.7 %	R	$\sqrt{3}$	1	1	±2.7 %	±2.7 %	∞
System Detection Limits	±1.0 %	R	$\sqrt{3}$	1	1	±0.6 %	±0.6 %	∞
Modulation Response	±2.4 %	R	$\sqrt{3}$	1	1	±1.4 %	±1.4 %	∞
Readout Electronics	±0.3 %	N	1	0	0			
Response Time	±0.8 %	R	$\sqrt{3}$	0	0			
Integration Time	±2.6 %	R	$\sqrt{3}$	1	1	±1.5 %	±1.5 %	∞
RF Ambient Noise	±3.0 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
RF Ambient Reflections	±3.0 %	R	$\sqrt{3}$	0	0			
Probe Positioner	±0.4 %	R	$\sqrt{3}$	1	1	±0.2 %	±0.2 %	∞
Probe Positioning	±2.9 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
Spatial x-y-Resolution	±10.0 %	R	$\sqrt{3}$	1	1	±5.8 %	±5.8 %	∞
Fast SAR z-Approximation	±7.0 %	R	$\sqrt{3}$	1	1	±4.0 %	±4.0 %	∞
Test Sample Related								
Device Positioning	±2.9 %	N	1	1	1	±2.9 %	±2.9 %	145
Device Holder	±3.6 %	N	1	1	1	±3.6 %	±3.6 %	5
Power Drift	±5.0 %	R	$\sqrt{3}$	1	1	±2.9 %	±2.9 %	∞
Power Scaling	±0 %	R	$\sqrt{3}$	0	0			
Phantom and Setup								
Phantom Uncertainty	±6.1 %	R	$\sqrt{3}$	1	1	±3.5 %	±3.5 %	∞
SAR correction	±1.9 %	R	$\sqrt{3}$	0	0			
Liquid Conductivity (mea.)	±2.5 %	R	$\sqrt{3}$	0	0			
Liquid Permittivity (mea.)	±2.5 %	R	$\sqrt{3}$	0	0			
Temp. unc. - Conductivity	±3.4 %	R	$\sqrt{3}$	0	0			
Temp. unc. - Permittivity	±0.4 %	R	$\sqrt{3}$	0	0			
Combined Std. Uncertainty						±11.4 %	±11.4 %	748
Expanded STD Uncertainty						**±22.7 %**	**±22.7 %**	

Table 10.0-2 Worst-Case uncertainty budget for DASY5 assessed according to IEEE P1528/2011 and IEC 62209-1/2011
Source: Schmid & Partner Engineering AG.

DASY5 Uncertainty Budget
for the 3 - 6 GHz range

Error Description	Uncert. value	Prob. Dist.	Div.	(c_i) 1g	(c_i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v_i) v_{eff}
Measurement System								
Probe Calibration	±6.55 %	N	1	1	1	±6.55 %	±6.55 %	∞
Axial Isotropy	±4.7 %	R	$\sqrt{3}$	0.7	0.7	±1.9 %	±1.9 %	∞
Hemispherical Isotropy	±9.6 %	R	$\sqrt{3}$	0.7	0.7	±3.9 %	±3.9 %	∞
Boundary Effects	±2.0 %	R	$\sqrt{3}$	1	1	±1.2 %	±1.2 %	∞
Linearity	±4.7 %	R	$\sqrt{3}$	1	1	±2.7 %	±2.7 %	∞
System Detection Limits	±1.0 %	R	$\sqrt{3}$	1	1	±0.6 %	±0.6 %	∞
Readout Electronics	±0.3 %	N	1	1	1	±0.3 %	±0.3 %	∞
Response Time	±0.8 %	R	$\sqrt{3}$	1	1	±0.5 %	±0.5 %	∞
Integration Time	±2.6 %	R	$\sqrt{3}$	1	1	±1.5 %	±1.5 %	∞
RF Ambient Noise	±3.0 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
RF Ambient Reflections	±3.0 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
Probe Positioner	±0.8 %	R	$\sqrt{3}$	1	1	±0.5 %	±0.5 %	∞
Probe Positioning	±9.9 %	R	$\sqrt{3}$	1	1	±5.7 %	±5.7 %	∞
Max. SAR Eval.	±4.0 %	R	$\sqrt{3}$	1	1	±2.3 %	±2.3 %	∞
Test Sample Related								
Device Positioning	±2.9 %	N	1	1	1	±2.9 %	±2.9 %	145
Device Holder	±3.6 %	N	1	1	1	±3.6 %	±3.6 %	5
Power Drift	±5.0 %	R	$\sqrt{3}$	1	1	±2.9 %	±2.9 %	∞
Phantom and Setup								
Phantom Uncertainty	±4.0 %	R	$\sqrt{3}$	1	1	±2.3 %	±2.3 %	∞
Liquid Conductivity (target)	±5.0 %	R	$\sqrt{3}$	0.64	0.43	±1.8 %	±1.2 %	∞
Liquid Conductivity (meas.)	±2.5 %	N	1	0.64	0.43	±1.6 %	±1.1 %	∞
Liquid Permittivity (target)	±5.0 %	R	$\sqrt{3}$	0.6	0.49	±1.7 %	±1.4 %	∞
Liquid Permittivity (meas.)	±2.5 %	N	1	0.6	0.49	±1.5 %	±1.2 %	∞
Combined Std. Uncertainty						±12.8 %	±12.6 %	330
Expanded STD Uncertainty						**±25.6 %**	**±25.2 %**	

Table 10.0-3 Worst-Case uncertainty budget for DASY52 assessed according to IEEE P1528.
Source: Schmid & Partner Engineering AG.

11.0 TEST RESULTS

11.1 SAR Measurement results at highest power measured against the head

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm	SAR, averaged over 1 g			Scan Type
					Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)	
Right Head Cheek	2-slots DTM 850 MHz	824.2	128					
		836.8	190	31.7	0.67	-0.07	0.67	
		848.8	251					
Right Head Cheek	3-slots DTM 850 MHz	824.2	128	30.6	0.68	-0.15	0.68	
		836.8	190	30.6	0.82	-0.11	0.82	
		836.8	190	30.6	0.72	-0.22	0.76	2nd Scan
		848.8	251	30.7	0.73	0.05	0.73	
Right Head Cheek	4-slots GSM/EDGE 850 MHz	824.2	128					
		836.8	190	28.2	0.58	0.05	0.58	
		848.8	251					
Right Head 15° Tilt	2-slots DTM 850 MHz	824.2	128					
		836.8	190	31.7	0.40	-0.29	0.43	
		848.8	251					
Right Head Cheek	1-slot GSM 850 MHz	824.2	128					
		836.8	190	33.9	0.58	-0.13	0.58	
		848.8	251					
Left Head Cheek	2-slots DTM 850 MHz	824.2	128					
		836.8	190	31.7	0.62	-0.35	0.67	
		848.8	251					
Left Head 15° Tilt	2-slots DTM 850 MHz	824.2	128					
		836.8	190	31.7	0.41	0.18	0.41	
		848.8	251					
Left Head Cheek	1-slot GSM 850 MHz	824.2	128					
		836.8	190	33.9	0.52	-0.01	0.52	
		848.8	251					

Table 11.1-1 SAR results for GSM/DTM 850 head configuration model RFS121LW

Note 1: If the power drift is ≤ – 0.200 dB, the extrapolated SAR is calculated using the formula:

Extrapolated SAR = (Measured SAR) * 10^(|Power Drift (dB)| / 10)

Note 2: Only Middle channel was tested when 1g Average SAR <0.8 W/Kg or 3dB lower than the limit.

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm	SAR, averaged over 1 g		
					Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Right Head Cheek	WCDMA FDD V 850 MHz	826.4	4132				
		836.4	4182	24.0	0.53	-0.08	0.53
		846.6	4233				
Right Head 15° Tilt	WCDMA FDD V 850 MHz	826.4	4132				
		836.4	4182	24.0	0.31	-0.02	0.31
		846.6	4233				
Left Head Cheek	WCDMA FDD V 850 MHz	826.4	4132				
		836.4	4182	24.0	0.50	0.10	0.50
		846.6	4233				
Left Head 15° Tilt	WCDMA FDD V 850 MHz	826.4	4132				
		836.4	4182	24.0	0.30	0.02	0.30
		846.6	4233				

Table 11.1-2 SAR results for WCDMA FDD V head configuration model RFS121LW

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm	SAR, averaged over 1 g			Scan Type
					Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)	
Right Head Cheek	2-slots DTM 1900 MHz	1850.2	512	28.0	0.91	-0.16	0.91	
		1880.0	661	27.9	0.85	-0.13	0.85	
		1909.8	810	27.9	0.91	-0.02	0.91	
Right Head 15° Tilt	2-slots DTM 1900 MHz	1850.2	512					
		1880.0	661	27.9	0.24	0.18	0.24	
		1909.8	810					
Right Head Cheek	1-slot GSM 1900 MHz	1850.2	512	29.2	0.78	0.01	0.78	
		1880.0	661					
		1909.8	810					
Left Head Cheek	2-slots DTM 1900 MHz	1850.2	512	28.0	1.08	-0.11	1.08	
		1880.0	661	27.9	1.12	0.10	1.12	
		1880.0	661	27.9	1.07	-0.14	1.07	2nd Scan
		1909.8	810	27.9	1.06	0.05	1.06	
Left Head Cheek	3-slots DTM 1900 MHz	1850.2	512					
		1880.0	661	25.3	0.99	0.11	0.99	
		1909.8	810					
Left Head Cheek	4-slots EDGE 1900 MHz	1850.2	512					
		1880.0	661	24.8	0.88	0.00	0.88	
		1909.8	810					
Left Head 15° Tilt	2-slots DTM 1900 MHz	1850.2	512					
		1880.0	661	27.9	0.41	0.06	0.41	
		1909.8	810					
Left Head Cheek	1-slot GSM 1900 MHz	1850.2	512					
		1880.0	661	29.2	1.06	0.06	1.06	
		1909.8	810					

Table 11.1-3 SAR results for GSM/DTM 1900 head configuration model RFS121LW

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	SAR, averaged over 1 g			Scan Type
					Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)	
Right Head Cheek	WCDMA FDD II 1900 MHz	1852.4	9262	22.6	1.04	0.04	1.04	
		1880.0	9400	22.4	1.03	0.09	1.03	
		1907.6	9538	22.5	1.05	0.09	1.05	
Right Head 15° Tilt	WCDMA FDD II 1900 MHz	1852.4	9262					
		1880.0	9400	22.4	0.26	-0.11	0.26	
		1907.6	9538					
Left Head Cheek	WCDMA FDD II 1900 MHz	1852.4	9262	22.6	1.20	0.02	1.20	
		1880.0	9400	22.4	1.18	0.00	1.18	
		1907.6	9538	22.5	1.22	0.07	1.22	
		1907.6	9538	22.5	1.33	0.09	1.33	2nd scan
Left Head 15° Tilt	WCDMA FDD II 1900 MHz	1852.4	9262					
		1880.0	9400	22.4	0.36	-0.08	0.36	
		1907.6	9538					

Table 11.1-4 SAR results for WCDMA FDD II head configuration model RFS121LW

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	Measured SAR (W/kg)		
					Power Drift (dB)	Averaged over 1 g	Averaged over 10 g
Right Head Cheek	802.11 b 2450 MHz	2412	1				
		2437	6	16.8	0.16	0.32	0.15
		2462	11				
Right Head 15° Tilt	802.11 b 2450 MHz	2412	1				
		2437	6	16.8	0.01	0.06	0.03
		2462	11				
Left Head Cheek	802.11 b 2450 MHz	2412	1				
		2437	6	16.8	-0.07	0.21	0.12
		2462	11				
Left Head 15° Tilt	802.11 b 2450 MHz	2412	1				
		2437	6	16.8	0.12	0.09	0.05
		2462	11				

Table 11.1-5 SAR results for WiFi/WLAN/802.11b head configuration model RFS121LW

Note: Only the highest output power channel was tested

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	Measured SAR (W/kg)		
					Power Drift (dB)	Averaged over 1 g	Averaged over 10 g
Right Head Cheek	Bluetooth 2450 MHz	2402	0				
		2441	39	10.5	0.02	0.03	0.02
		2480	78				
Right Head 15° Tilt	Bluetooth 2450 MHz	2402	0				
		2441	39	10.5	-0.08	0.00	0.00
		2480	78				
Left Head Cheek	Bluetooth 2450 MHz	2402	0				
		2441	39	10.5	0.19	0.02	0.01
		2480	78				

Table 11.1-6 SAR results for Bluetooth head configuration model RFS121LW

Note: Only the highest output power channel was tested

Test Position	Mode	f (MHz)	Channel	Modulation	# of Resource Blocks	RB Offset	Conducted Output Power (dBm)	SAR, averaged over 1 g		
								Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Right Head Cheek	LTE Band 17	709	23780	QPSK	1	0	22.9	0.14	0.09	0.14
		710	23790	QPSK	25	0	21.8	0.10	0.01	0.10
Right Head 15° Tilt	LTE Band 17	709	23780	QPSK	1	0	22.9	0.07	0.07	0.07
Left Head Cheek	LTE Band 17	709	23780	QPSK	1	0	22.9	0.17	-0.03	0.17
		710	23790	QPSK	25	0	21.8	0.12	0.07	0.12
Left Head 15° Tilt	LTE Band 17	709	23780	QPSK	1	0	22.9	0.10	0.04	0.10

Table 11.1-7 SAR results for LTE Band 17 (10MHz BW) head configuration model RFR101LW

Note 1: Only required to test the configuration (channel and offset) yielding the highest conducted power for RB 1 and RB 50% when combined 1g avg. SAR <0.8 W/Kg or 3dB lower than the limit for both cases. Also, when the highest conducted power for RB 1 and RB 50% are both greater than RB 100%, then SAR testing for RB 100% can be excluded.
Note 2: If 1g avg. SAR >0.8 W/Kg or not at least 3dB lower than the limit, than the remaining channels for that RB number must be tested and one additional scan must be done with RB 100%. For all additional scans the highest conducted power configuration (channel and offset) must be used.
Note 3: For LTE if SAR > 1.45, then SAR tests for the smaller bandwidths are required
Note 4: Tested only the highest bandwidth since conducted power on other bandwidths is about the same.
Note 5: Did not test 16 QAM as conducted power was lower than QPSK.

Test Position	Mode	f (MHz)	Channel	Modulation	# of Resource Blocks	RB Offset	Conducted Output Power (dBm)	SAR, averaged over 1 g		
								Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Right Head Cheek	LTE Band 5	829.0	20450	QPSK	1	49	23.4	0.30	-0.14	0.30
		836.5	20525	QPSK	25	0	22.2	0.22	-0.01	0.22
Right Head 15° Tilt	LTE Band 5	829.0	20450	QPSK	1	49	23.4	0.17	0.06	0.17
Left Head Cheek	LTE Band 5	829.0	20450	QPSK	1	49	23.4	0.31	0.06	0.31
		836.5	20525	QPSK	25	0	22.2	0.22	0.12	0.22
Left Head 15° Tilt	LTE Band 5	836.5	20525	QPSK	1	0	23.4	0.18	0.07	0.18

Table 11.1-8 SAR results for LTE Band 5 (10MHz BW) head configuration model RFR101LW

Test Position	Mode	f (MHz)	Channel	Modulation	# of Resource Blocks	RB Offset	Conducted Output Power (dBm)	SAR, averaged over 1 g			Scan Type
								Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)	
Right Head Cheek	LTE Band 4	1720.0	20050	QPSK	1	99	22.8	0.71	0.00	0.71	
		1732.5	20175	QPSK	50	0	21.6	0.57	0.07	0.57	
Right Head 15° Tilt	LTE Band 4	1720.0	20050	QPSK	1	99	22.8	0.19	0.04	0.19	
Left Head Cheek	LTE Band 4	1720.0	20050	QPSK	1	99	22.8	0.82	-0.14	0.82	
		1732.5	20175	QPSK	1	0	22.7	0.81	0.09	0.81	
		1745.0	20300	QPSK	1	99	22.7	1.04	0.05	1.04	
		1745.0	20300	QPSK	1	99	2nd Scan	1.08	0.03	1.08	2nd Scan
		1732.5	20175	QPSK	50	0	21.6	0.64	0.12	0.64	
Left Head 15° Tilt	LTE Band 4	1720.0	20050	QPSK	1	99	22.8	0.30	-0.02	0.30	

Table 11.1-9 SAR results for LTE Band 4 (20MHz BW) head configuration model RFR101LW

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	SAR, averaged over 1 g		
					Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Right Head Cheek	WCDMA FDD IV 1700 MHz	1712.4	1312	23.0	0.69	0.03	0.69
		1732.6	1413	23.2	0.82	0.02	0.82
		1752.6	1513	23.0	0.88	-0.04	0.88
Right Head 15° Tilt	WCDMA FDD IV 1700 MHz	1712.4	1312				
		1732.6	1413	23.2	0.25	0.05	0.25
		1752.6	1513				
Left Head Cheek	WCDMA FDD IV 1700 MHz	1712.4	1312	23.0	0.86	-0.07	0.86
		1732.6	1413	23.2	1.08	-0.08	1.08
		1752.6	1513	23.0	1.12	-0.04	1.12
Left Head 15° Tilt	WCDMA FDD IV 1700 MHz	1712.4	1312				
		1732.6	1413	23.2	0.32	-0.15	0.32
		1752.6	1513				

Table 11.1-10 SAR results for WCDMA FDD IV head configuration model RFR101LW

Test Position	Mode	f (MHz)	Channel	Modulation	# of Resource Blocks	RB Offset	Conducted Output Power (dBm)	SAR, averaged over 1 g			Scan Type
								Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)	
Right Head Cheek	LTE Band 2	1860	18700	QPSK	1	0	22.8	1.08	-0.03	1.08	
		1880	18900	QPSK	1	99	22.8	1.16	-0.17	1.16	
		1900	19100	QPSK	1	0	22.8	1.19	-0.05	1.19	
		1880	18900	QPSK	50	50	21.7	0.93	0.02	0.93	
		1880	18900	QPSK	100	0	21.7	0.97	0.01	0.97	
Right Head 15° Tilt	LTE Band 2	1880	18900	QPSK	1	99	22.8	0.28	-0.12	0.28	
Left Head Cheek	LTE Band 2	1860	18700	QPSK	1	0	22.8	1.25	0.05	1.25	
		1880	18900	QPSK	1	99	22.8	1.37	0.05	1.37	
		1880	18900	QPSK	1	99	22.8	**1.38**	**0.05**	**1.38**	**2nd Scan**
		1900	19100	QPSK	1	0	22.8	1.32	-0.03	1.32	
		1880	18900	QPSK	50	50	21.7	1.18	0.02	1.18	
		1880	18900	QPSK	100	0	21.7	1.22	0.05	1.22	
Left Head 15° Tilt	LTE Band 2	1880	18900	QPSK	1	99	22.8	0.46	-0.07	0.46	

Table 11.1-11 SAR results for LTE Band 2 (20MHz BW) head configuration model RFR101LW

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm	SAR, averaged over 1 g		
					Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Right Head Cheek	2-slots DTM 1900 MHz	1850.2	512				
		1880.0	661	27.9	0.59	-0.14	0.59
		1909.8	810				
Left Head Cheek	2-slots DTM 1900 MHz	1850.2	512				
		1880.0	661	27.9	0.61	0.17	0.61
		1909.8	810				

Table 11.1-12 SAR results for GSM/DTM 1900 head configuration model RFR101LW

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	SAR, averaged over 1 g			Scan Type
					Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)	
Left Head Cheek	WCDMA FDD II 1900 MHz	1852.4	9262	22.6	1.22	0.01	1.22	
		1880.0	9400	22.4	1.28	-0.08	1.28	
		1880.0	9400	22.4	1.29	0.00	1.29	2nd scan
		1907.6	9538	22.5	1.22	0.00	1.22	

Table 11.1-13 SAR results for WCDMA II head configuration model RFR101LW

11.2 SAR measurement results at highest power measured against the body using accessories

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Conducted Output Power (dBm)	SAR, averaged over 1 g Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)	Scan Type
2-slots GPRS 850 MHz	836.8	190	Body Hotspot Mode	1.0	Back	31.6	0.78	0.28	0.78	
3-slots GPRS 850 MHz	824.2	128		1.0	Back	30.5	1.14	-0.02	1.14	
	824.2	128		1.0	Back	30.5	**1.15**	**-0.01**	**1.15**	2nd scan
	836.8	190		1.0	Back	30.3	0.96	0.09	0.96	
	848.8	251		1.0	Back	30.3	0.85	-0.04	0.85	
	824.2	128		1.0	Front	30.5	0.87	0.00	0.87	
	836.8	190		1.0	Front	30.3	0.92	0.08	0.92	
	848.8	251		1.0	Front	30.3	0.84	0.01	0.84	
	824.2	128		1.0	Left	30.5	0.54	-0.02	0.54	
	824.2	128		1.0	Right	30.5	0.58	-0.01	0.58	
	824.2	128		1.0	Bottom	30.5	0.12	-0.03	0.12	
	824.2	128		1.0	Back+HS	30.5	0.84	0.04	0.84	
4-slots GPRS 850 MHz	836.8	190		1.0	Back	28.2	0.70	-0.08	0.70	
3-slots GPRS 850 MHz	836.8	190	Body-worn	1.5	Back	30.3	0.71	0.02	0.71	
	824.2	128		Holster	Back	30.5	0.81	0.01	0.81	
	836.8	190		Holster	Back	30.3	0.81	-0.06	0.81	
	836.8	190		Holster	Back	30.3	**0.85**	**0.23**	**0.85**	2nd scan
	848.8	251		Holster	Back	30.3	0.62	-0.01	0.62	
	836.8	190		Holster	Front	30.3	0.68	-0.09	0.68	

Table 11.2-1 SAR results for EDGE/EGPRS 850 body-worn and Hotspot configurations model RFS121LW

Note 1: If the power drift is ≤ – 0.200 dB, the extrapolated SAR is calculated using the formula:

Extrapolated SAR = (Measured SAR) * 10^(|Power Drift (dB)| / 10)

Note 2: Only Middle channel was tested when 1g Average SAR <0.8 W/Kg or 3dB lower than the limit.

Note 3: Device was tested with 15 mm RIM recommended separation distance to allow typical after-market holster to be used. RIM body-worn holsters with belt-clip have been designed to maintain ~ 20 mm separation distance from body.

Note 4: For Hot Spot mode any side of the phone that is further than 2.5 cm away from the transmitting antenna can be exempted from testing.

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Conducted Output Power (dBm)	SAR, averaged over 1 g			Scan Type
							Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)	
WCDMA FDD V 850 MHz	826.4	4132	Body Hotspot Mode	1.0	Back	23.9	0.76	-0.02	0.76	
	836.4	4182		1.0	Back	24.0	0.80	-0.02	0.80	
	836.4	4182		1.0	Back	24.0	0.83	-0.07	0.83	2nd Scan
	846.6	4233		1.0	Back	23.8	0.73	-0.02	0.73	
	836.4	4182		1.0	Front	24.0	0.56	0.00	0.56	
	836.4	4182		1.0	Left	24.0	0.44	-0.07	0.44	
	836.4	4182		1.0	Right	24.0	0.42	0.05	0.42	
	836.4	4182		1.0	Bottom	24.0	0.10	-0.02	0.10	
	836.4	4182		1.0	Back+HS	24.0	0.61	0.08	0.61	
WCDMA FDD V 850 MHz	836.4	4182	Body-worn	1.5	Back	24.0	0.63	-0.19	0.63	
	836.4	4182		Holster	Back	24.0	0.53	-0.10	0.53	
	836.4	4182		Holster	Front	24.0	0.41	-0.01	0.41	

Table 11.2-2 SAR results for WCDMA FDD V body-worn and Hotspot configurations model RFS121LW

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Conducted Output Power (dBm)	SAR, averaged over 1 g		
							Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
2-slots GPRS 1900MHz	1880.0	661	Body Hotspot Mode	1.0	Back	28.3	0.61	0.08	0.61
	1880.0	661		1.0	Front	28.3	0.70	-0.12	0.70
	1880.0	661		1.0	Right	28.3	0.24	-0.11	0.24
	1880.0	661		1.0	Left	28.3	0.24	-0.08	0.24
	1880.0	661		1.0	Bottom	28.3	0.44	0.02	0.44
	1880.0	661		1.0	Back+HS	28.3	0.60	0.00	0.60
3-slots GPRS 1900MHz	1880.0	661		1.0	Back	25.4	0.56	0.01	0.56
4-slots GPRS 1900MHz	1880.0	661		1.0	Back	24.8	0.52	0.03	0.52
2-slots GPRS 1900 MHz	1880.0	661	Body-worn	1.5	Back	28.3	0.36	-0.05	0.36
	1880.0	661		Holster	Back	28.3	0.22	-0.14	0.22
	1880.0	661		Holster	Front	28.3	0.27	0.10	0.27

Table 11.2-3 SAR results for GPRS/EDGE 1900 body-worn and Hotspot configurations model RFS121LW

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Conducted Output Power (dBm)	SAR, averaged over 1 g			Scan Type
							Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)	
WCDMA FDD II 1900 MHz	1852.4	9262	Body Hotspot Mode	1.0	Back					
	1880.0	9400		1.0	Back	22.4	0.65	-0.08	0.65	
	1907.6	9538		1.0	Back					
	1852.4	9262		1.0	Front	22.6	0.93	0.01	0.93	
	1880.0	9400		1.0	Front	22.4	0.88	-0.02	0.88	
	1907.6	9538		1.0	Front	22.5	0.93	0.08	0.93	
	1907.6	9538		1.0	Front	22.5	0.92	-0.02	0.92	2nd scan
	1880.0	9400		1.0	Left	22.4	0.31	-0.03	0.31	
	1880.0	9400		1.0	Right	22.4	0.24	-0.10	0.24	
	1880.0	9400		1.0	Bottom	22.4	0.49	0.06	0.49	
	1880.0	9400		1.0	Back+HS	22.4	0.64	0.08	0.64	
WCDMA FDD II 1900 MHz	1880.0	9400	Body-worn	1.5	Back	22.4	0.53	0.00	0.53	
	1880.0	9400		Holster	Back	22.4	0.32	-0.08	0.32	
	1880.0	9400		Holster	Front	22.4	0.39	-0.04	0.39	

Table 11.2-4 SAR results for WCDMA FDD II body-worn and Hotspot configurations model RFS121LW

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Conducted Output Power (dBm)	Measured SAR (W/kg)		
							Power Drift (dB)	Averaged over 1 g	Averaged over 10 g
802.11b/ WLAN 2450 MHz	2437	6	Body Hotspot Mode	1.0	Back	16.8	0.07	0.27	0.14
	2437	6		1.0	Front	16.8	0.10	0.20	0.11
	2437	6		1.0	Right	16.8	0.08	0.13	0.07
	2437	6		1.0	Left	16.8	0.13	0.05	0.03
	2437	6		1.0	Bottom	16.8	-0.01	0.10	0.06
	2437	6		1.0	Back+HS	16.8	0.02	0.28	0.15
802.11b/ WLAN 2450 MHz	2437	6	Body-worn	1.5	Back	16.8	-0.10	0.15	0.09
	2437	6		1.5	Back+HS	16.8	0.12	0.15	0.08
	2437	6		Holster	Back	16.8	-0.03	0.08	0.05
	2437	6		Holster	Front	16.8	0.10	0.06	0.03

Table 11.2-5 SAR results for WiFi/WLAN/802.11b body-worn and Hotspot configurations model RFS121LW

Note: Only the highest output power channel was tested

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Conducted Output Power (dBm)	Measured SAR (W/kg)		
							Power Drift (dB)	Averaged over 1 g	Averaged over 10 g
Bluetooth 2450 MHz	2441	39	Body Hotspot Mode	1.0	Back	10.5	0.05	0.03	0.01
Bluetooth 2450 MHz	2441	39	Body-worn	1.5	Back	10.5	-0.05	0.01	0.01

Table 11.2-6 SAR results for Bluetooth body-worn and Hotspot configurations model RFS121LW

Note: Only the highest output power channel was tested

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Modulation	# of Resource Blocks	RB Offset	Conducted Output Power (dBm)	SAR, averaged over 1 g		
										Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
LTE Band 17	709	23780	Body Hotspot Mode	1.0	Back	QPSK	1	0	22.9	0.14	0.00	0.14
	710	23790		1.0	Back	QPSK	25	0	21.8	0.14	0.00	0.14
	709	23780		1.0	Front	QPSK	1	0	22.9	0.09	-0.03	0.09
	709	23780		1.0	Left	QPSK	1	0	22.9	0.05	0.06	0.05
	709	23780		1.0	Right	QPSK	1	0	22.9	0.03	0.01	0.03
	709	23780		1.0	Bottom	QPSK	1	0	22.9	0.02	0.08	0.02
	709	23780		1.0	Back+HS	QPSK	1	0	22.9	0.13	-0.03	0.13
LTE Band 17	709	23780	Body-worn	1.5	Back	QPSK	1	0	22.9	0.16	-0.01	0.16
	709	23780		Holster	Back	QPSK	1	0	22.9	0.17	0.02	0.17
	709	23780		Holster	Front	QPSK	1	0	22.9	0.12	0.01	0.12

Table 11.2-7 SAR results for LTE Band 17 (10MHz BW) body-worn and Hotspot configurations model RFR101LW

Note 1: Only required to test the configuration (channel and offset) yielding the highest conducted power for RB 1 and RB 50% when combined 1g avg. SAR <0.8 W/Kg or 3dB lower than the limit for both cases. Also, when the highest conducted power for RB 1 and RB 50% are both greater than RB 100%, then SAR testing for RB 100% can be excluded.
Note 2: If 1g avg. SAR >0.8 W/Kg or not at least 3dB lower than the limit, than the remaining channels for that RB number must be tested and one additional scan must be done with RB 100%. For all additional scans the highest conducted power configuration (channel and offset) must be used.
Note 3: For LTE if SAR > 1.45, then SAR tests for the smaller bandwidths are required
Note 4: Tested only the highest bandwidth since conducted power on other bandwidths is about the same.
Note 5: Did not test 16 QAM as conducted power was lower than QPSK.

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Modulation	# of Resource Blocks	RB Offset	Conducted Output Power (dBm)	SAR, averaged over 1 g		
										Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
LTE Band 5	829.0	20450	Body Hotspot Mode	1.0	Back	QPSK	1	49	23.4	0.47	0.02	0.47
	836.5	20525		1.0	Back	QPSK	25	0	22.2	0.33	-0.10	0.33
	829.0	20450		1.0	Front	QPSK	1	49	23.4	0.39	-0.13	0.39
	829.0	20450		1.0	Left	QPSK	1	49	23.4	0.22	-0.04	0.22
	829.0	20450		1.0	Right	QPSK	1	49	23.4	0.28	-0.01	0.28
	829.0	20450		1.0	Bottom	QPSK	1	49	23.4	0.05	0.10	0.05
	829.0	20450		1.0	Back+HS	QPSK	1	49	23.4	0.45	-0.16	0.45
LTE Band 5	829.0	20450	Body-worn	1.5	Back	QPSK	1	49	23.4	0.34	0.02	0.34
	829.0	20450		Holster	Front	QPSK	1	49	23.4	0.24	0.06	0.24
	829.0	20450		Holster	Back	QPSK	1	49	23.4	0.23	0.07	0.23

Table 11.2-8 SAR results for LTE Band 5 (10MHz BW) body-worn and Hotspot configurations model RFR101LW

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Modulation	# of Resource Blocks	RB Offset	Conducted Output Power (dBm)	SAR, averaged over 1 g		
										Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
LTE Band 4	1720.0	20050	Body Hotspot Mode	1.0	Back	QPSK	1	99	19.7	0.46	0.06	0.46
	1732.5	20175		1.0	Back	QPSK	1	0				
	1745.0	20300		1.0	Back	QPSK	1	99				
	1732.5	20175		1.0	Back	QPSK	50	0	19.6	0.47	0.02	0.47
	1732.5	20175		1.0	Front	QPSK	50	0	19.6	0.44	0.07	0.44
	1732.5	20175		1.0	Left	QPSK	50	0	19.6	0.13	-0.02	0.13
	1732.5	20175		1.0	Right	QPSK	50	0	19.6	0.06	0.05	0.06
	1732.5	20175		1.0	Bottom	QPSK	50	0	19.6	0.23	0.19	0.23
	1732.5	20175		1.0	Back+HS	QPSK	50	0	19.6	0.41	-0.17	0.41
LTE Band 4	1720.0	20050	Body-worn	1.5	Back	QPSK	1	99	22.8	0.44	-0.04	0.44
	1732.5	20175		1.5	Back	QPSK	50	0	21.6	0.35	-0.11	0.35
	1720.0	20050		Holster	Back	QPSK	1	99	22.8	0.28	0.01	0.28
	1720.0	20050		Holster	Front	QPSK	1	99	22.8	0.35	0.01	0.35

Table 11.2-9 SAR results for LTE Band 4 (20MHz BW) body-worn and Hotspot configurations model RFR101LW

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Conducted Output Power (dBm)	SAR, averaged over 1 g		
							Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
WCDMA FDD IV 1700 MHz	1732.6	1413	Body Hotspot Mode	1.0	Back	20.1	0.52	-0.04	0.52
	1732.6	1413		1.0	Front	20.1	0.52	0.01	0.52
	1732.6	1413		1.0	Left	20.1	0.15	0.12	0.15
	1732.6	1413		1.0	Right	20.1	0.07	0.08	0.07
	1732.6	1413		1.0	Bottom	20.1	0.28	0.13	0.28
	1732.6	1413		1.0	Front+HS	20.1	0.51	-0.02	0.51
WCDMA FDD IV 1700 MHz	1732.6	1413	Body-worn	1.5	Back	23.2	0.54	-0.02	0.54
	1732.6	1413		Holster	Back	23.2	0.35	-0.11	0.35
	1732.6	1413		Holster	Front	23.2	0.43	-0.04	0.43

Table 11.2-10 SAR results for WCDMA FDD IV body-worn and Hotspot configurations model RFR101LW

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Modulation	# of Resource Blocks	RB Offset	Conducted Output Power (dBm)	SAR, averaged over 1 g		
										Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
LTE Band 2	1880	18900	Body Hotspot Mode	1.0	Back	QPSK	1	99	19.7	0.42	0.06	0.42
	1880	18900		1.0	Back	QPSK	50	50	19.6	0.43	0.12	0.43
	1880	18900		1.0	Front	QPSK	50	50	19.7	0.51	0.02	0.51
	1880	18900		1.0	Left	QPSK	50	50	19.7	0.17	0.08	0.17
	1880	18900		1.0	Right	QPSK	50	50	19.7	0.15	-0.01	0.15
	1880	18900		1.0	Bottom	QPSK	50	50	19.7	0.29	-0.04	0.29
	1880	18900		1.0	Back+HS	QPSK	50	50	19.7	0.43	0.02	0.43
	1880	18900		1.0	Front+HS	QPSK	50	50	19.7	0.52	0.03	0.52
LTE Band 2	1880	18900	Body-worn	1.5	Back	QPSK	1	99	22.8	0.45	0.03	0.45
	1880	18900		1.5	Back	QPSK	50	50	21.7	0.37	-0.01	0.37
	1880	18900		1.5	Back	QPSK	1	99	22.8	0.59	0.01	0.59
	1880	18900		Holster	Back	QPSK	1	99	22.8	0.24	-0.10	0.24
	1880	18900		Holster	Front	QPSK	1	99	22.8	0.32	-0.14	0.32

Table 11.2-11 SAR results for LTE Band 2 (20 MHz BW) body-worn and Hotspot configurations model RFR101LW

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Conducted Output Power (dBm)	SAR, averaged over 1 g		
							Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
2-slots GPRS 1900MHz	1880.0	661	Body Hotspot Mode	1.0	Back	28.3	0.33	-0.14	0.33
	1880.0	661		1.0	Front	28.3	0.37	-0.09	0.37
	1880.0	661		1.0	Right				
	1880.0	661		1.0	Left				
	1880.0	661		1.0	Back+HS				
2-slots GPRS 1900 MHz	1880.0	661	Body-worn	1.5	Back	28.3	0.21	-0.01	0.21
	1880.0	661		Holster	Back				
	1880.0	661		Holster	Front				

Table 11.2-12 SAR results for GPRS/EDGE 1900 body-worn and Hotspot configurations model RFR101LW

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Conducted Output Power (dBm)	SAR, averaged over 1 g		
							Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
WCDMA FDD II 1900 MHz	1880.0	9400	Body Hotspot Mode	1.0	Back	20.7	0.65	0.00	0.65
	1880.0	9400		1.0	Front	20.7	0.79	0.06	0.79
WCDMA FDD II 1900 MHz	1880.0	9400	Body-worn	1.5	Back	22.4	0.47	-0.02	0.47
	1880.0	9400		Holster	Back				
	1880.0	9400		Holster	Front				

Table 11.2-13 SAR results for WCDMA FDD II body-worn and Hotspot configurations model RFR101LW

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