SAR Compliance Test Report

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Statement of Compliance: BlackBerry RTS 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, FCC 47 CFR Part 2.1093, FCC 96-326, IEEE Std. C95.1-1992, 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, ANSI/IEEE Std. C95.3-2002, IEEE 1528-2013, and RSS 102-issue4-2010.

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RTS is accredited
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EN ISO/IEC 17025 by:

SCC Accredited LAB
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Report was revised to **RTS-6058-1408-05 Rev 2** on September 04, 2014.
Updated and referenced to the latest FCC KDB released publication date.

Note 1: According to the hardware similarity document, BlackBerry model: RHB121LW has the same conducted power for GSM and WCDMA as RFN81UW. Therefore, RFN81UW conducted power results are used for the bands in common and all the other bands were measured on RHB121LW.

Note 2: According to the hardware similarity document, BlackBerry model: RHB121LW has the same RF hardware for 802.11a/n as RHA111LW, however Hotspot mode has different conducted power levels. In addition, 802.11b/g/n & Bluetooth has the same conducted power on both models, but RHB121LW has a modified band pass filter due to supported LTE band 7. Therefore, RHA111LW radiated SAR and conducted power results are used for 802.11a/b/g/n (except 802.11a Hotspot mode) and 802.11a Hotspot mode (conducted/radiated SAR) and 802.11b radiated SAR spot checks were done on RHB121LW. Bluetooth was not spot checked due to extremely low SAR values.

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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	RHB121LW			
FCC ID	L6ARHB120LW			
PIN	Radiated: 2FFEB30D (Rev 1), 2FFEC317 (Rev 2) Conducted: 2FFEB2E0 (Rev 1)			
Hardware Rev	Rev1-905-00, Rev2-905-01			
Software Version	10.3.0.686/890/1034			
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)	31.6 28.9	30.0 28.7	29.0 26.2	27.0 25.5
Tolerance in power setting on centre channel (dB)	± 0.6	± 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)	20.0	19.0	17.0	10.2
Tolerance in power setting on centre channel (dB)	± 2.0	± 2.0	± 2.0	± 0.75
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	802.11a/n (low band)	802.11a/n (middle band)	802.11a/n (upper band I)	802.11a/n (upper band II)
Nominal maximum conducted RF output power (dBm)	19.0	19.0	19.0	16.6
Tolerance in power setting on centre channel (dB)	± 2.0	± 2.0	± 2.0	± 2.0

Duty cycle	1:1	1:1	1:1	1:1
Transmitting frequency range (MHz)	5180-5240	5260-5320	5520-5700	5745-5825
Mode(s) of Operation	$HSPA^+$/ WCDMA / UMTS FDD V (850)	$HSPA^+$/ WCDMA / UMTS FDD II (1900)	NFC	
Nominal maximum conducted RF output power (dBm)	24.2	23.0	N/A	
Tolerance in power setting on centre channel (dB)	± 0.5	± 0.6	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

Note 1: The BlackBerry model: RHB121LW also supports GSM/GPRS/EDGE 900/1800 MHz, and UMTS/$HSPA^+$ Bands I/VIII, and LTE bands 3/7/8/20 that are operational outside North America only, 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.

Note 3: Open loop antenna tuning is used for all transmitters (GSM/WCDMA/LTE) which is equivalent to the static tuning configurations used in traditional handsets that do not have any specific antenna tuning flexibility or additional hardware.

1.4 Body worn accessories (holsters)

The device has been tested with the holsters listed below and/or a 15mm manufacturer recommended separation distance. 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

1.5 Headset

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

1)HDW-49299-005

1.6 Battery

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

1)BAT-52961-00x

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.
- Software Tool was used to set Wi-Fi to transmit at maximum power and duty cycle for each band, channel, and modulation.
- A Rohde & Schwarz CBT Bluetooth Tester was used to establish a connection with the DUT's Bluetooth radio.

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 v01r03

• 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 24 x 24 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 24x24x22 to 48x48x22 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 “default test channels” of each sub band must also be tested. The “default channels” for each sub band are [36, 48], [52, 64], [104, 116, 124, and 136], [149, 157, and 165].
- 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.
- 802.11a does not support channels 52 – 140 in Hotspot and GO/Direct mode.

- Conducted power measurements:

802.11b/g/n With Full Power For North America								
802.11b @ 1Mbps			802.11g @ 6Mbps			802.11n @ 6.5 Mbps		
f (MHz)	**Chan**	**Max. average conducted power (dBm)**	**f (MHz)**	**Chan**	**Max. average conducted power (dBm)**	**f (MHz)**	**Chan**	**Max. average conducted power (dBm)**
2412	1	19.4	2412	1	16.6	2412	1	16.4
2437	**6**	**20.0**	**2437**	**6**	**19.4**	2437	6	16.6
2462	11	19.3	2462	11	13.2	2462	11	13.1
2472	13	12.3	2472	13	12.3	2472	13	12.0

802.11g			802.11b		
Data Rate (Mbps)	**Mod.**	**Channel 6** **Max. average conducted power (dBm)**	**Data Rate (Mbps)**	**Mod.**	**Channel 6** **Max. average conducted power (dBm)**
6	BPSK	19.4	1	BPSK	19.9
9	BPSK	19.4	2	DQPSK	19.7
12	QPSK	18.2	5.5	CCK	19.8
18	QPSK	18.1	11	CCK	19.8
24	16-QAM	17.0			
36	16-QAM	17.0			
48	64-QAM	15.9			
54	64-QAM	15.7			

802.11 n		
Data Rate (Mbps)	**Mod.**	**Channel 6** **Max. average conducted power (dBm)**
6.5	MCS0	16.6
13	MCS1	16.5
19.5	MCS2	15.6
26	MCS3	15.7
39	MCS4	14.7
52	MCS5	14.5
58.5	MCS6	13.6
65	MCS7	13.6

Table 1.8.1-3a 802.11 b/g/n modulation type/data rate vs. conducted power at full/maximum power for North America (measured on RHA111LW)

802.11b/g/n With Full Power For Outside North America								
802.11b @ 1Mbps			802.11g @ 6Mbps			802.11n @ 6.5 Mbps		
f (MHz)	Chan	Max. average conducted power (dBm)	f (MHz)	Chan	Max. average conducted power (dBm)	f (MHz)	Chan	Max. average conducted power (dBm)
2412	1	19.7	2412	1	19.2	2412	1	16.6
2437	**6**	**20.0**	**2437**	**6**	**19.4**	2437	6	16.8
2462	11	19.7	2462	11	19.2	2462	11	16.5
2472	13	19.6	2472	13	19.1	2472	13	16.4

802.11g			802.11b		
Data Rate (Mbps)	Mod.	Channel 6 Max. average conducted power (dBm)	Data Rate (Mbps)	Mod.	Channel 6 Max. average conducted power (dBm)
6	BPSK	19.4	1	BPSK	19.8
9	BPSK	19.2	2	DQPSK	19.4
12	QPSK	19.2	5.5	CCK	19.3
18	QPSK	19.2	11	CCK	19.2
24	16-QAM	19.2			
36	16-QAM	19.3			
48	64-QAM	19.2			
54	64-QAM	19.2			

802.11 n		
Data Rate (Mbps)	Mod.	Channel 6 Max. average conducted power (dBm)
6.5	MCS0	19.3
13	MCS1	19.3
19.5	MCS2	19.4
26	MCS3	19.4
39	MCS4	19.3
52	MCS5	19.4
58.5	MCS6	19.3
65	MCS7	19.4

Table 1.8.1-3b 802.11 b/g/n modulation type/data rate vs. conducted power at full/maximum power for outside North America (measured on RHA111LW)

Note: 802.11b/g/n has different power levels within and outside of North America due to additional requirements for band edge in North America. Due to this SAR testing was done using these higher conducted values as they will result in more conservative SAR measurements. However, the phone officially operates at the 802.11b power levels listed in table 1.8.1-3a

802.11b/g/n With Reduced Power For GO/Direct Mode								
802.11b @ 1Mbps			**802.11g @ 6Mbps**			**802.11n @ 6.5 Mbps**		
f (MHz)	**Chan**	**Max. average conducted power (dBm)**	**f (MHz)**	**Chan**	**Max. average conducted power (dBm)**	**f (MHz)**	**Chan**	**Max. average conducted power (dBm)**
2412	1	13.3	2412	1	13.6	2412	1	13.5
2437	**6**	**13.8**	**2437**	**6**	**13.8**	**2437**	**6**	**13.8**
2462	11	13.5	2462	11	13.6	2462	11	13.5
2472	13	NA	2472	13	NA	2472	13	NA

802.11g			802.11b		
Data Rate (Mbps)	**Mod.**	**Channel 6 Max. average conducted power (dBm)**	**Data Rate (Mbps)**	**Mod.**	**Channel 6 Max. average conducted power (dBm)**
6	BPSK	13.8	1	BPSK	13.8
9	BPSK	13.7	2	DQPSK	13.8
12	QPSK	13.8	5.5	CCK	13.8
18	QPSK	13.8	11	CCK	13.8
24	16-QAM	13.8			
36	16-QAM	13.7			
48	64-QAM	13.7			
54	64-QAM	13.8			

802.11 n		
Data Rate (Mbps)	**Mod.**	**Channel 6 Max. average conducted power (dBm)**
6.5	MCS0	13.8
13	MCS1	13.8
19.5	MCS2	13.8
26	MCS3	13.8
39	MCS4	13.8
52	MCS5	13.8
58.5	MCS6	13.8
65	MCS7	13.8

Table 1.8.1-3c 802.11 b/g/n modulation type/data rate vs. maximum average conducted power for Wi-Fi Direct/GO mode (measured on RHA111LW)

802.11a/n With Full Power For North America

802.11a (low band) 6Mbps			802.11a (mid band) 6Mbps			802.11a (upper band I) 6Mbps		
f (MHz)	**Chan**	**Max. average conducted power (dBm)**	**f (MHz)**	**Chan**	**Max. average conducted power (dBm)**	**f (MHz)**	**Chan**	**Max. average conducted power (dBm)**
5180	**36**	**13.7**	**5260**	**52**	**15.7**	5500	100	13.5
5200	40	13.7	5280	56	15.7	**5520**	**104**	**19.5**
5220	44	13.6	5300	60	15.6	5540	108	19.4
5240	48	13.5	5320	64	13.3	5560	112	19.3
						5580	116	19.1
						5600	120	19.0
						5620	124	19.1
						5640	128	18.9
						5660	132	18.9
						5680	136	18.8
						5700	140	14.9

802.11a (upper band II) 6Mbps		
f (MHz)	**Chan**	**Max. average conducted power (dBm)**
5745	149	12.2
5765	**153**	**16.5**
5785	157	16.4
5805	161	16.5
5825	165	12.0

		802.11a (lower band)	**802.11a (middle band)**	**802.11a (upper band I)**	**802.11a (upper band II)**
Data Rate (Mbits)	**Mod.**	**Channel 36**	**Channel 52**	**Channel 104**	**Channel 153**
		Max. average conducted power (dBm)	**Max. average conducted power (dBm)**	**Max. average conducted power (dBm)**	**Max. average conducted power (dBm)**
6	BPSK	13.7	15.7	19.5	16.5
9	BPSK	13.7	15.7	19.6	16.4
12	QPSK	13.7	15.8	19.5	16.4
18	QPSK	13.8	15.8	19.5	16.4
24	16-QAM	13.9	15.8	17.7	15.8
36	16-QAM	13.8	15.8	17.6	15.9
48	64-QAM	13.8	15.7	17.8	15.7
54	64-QAM	13.9	15.6	16.8	15.4

	802.11n (lower band)	802.11n (middle band)	802.11n (upper band I)	802.11n (upper band II)
Mod.	Channel 36	Channel 52	Channel 104	Channel 153
	Max. average conducted power (dBm)	Max. average conducted power (dBm)	Max. average conducted power (dBm)	Max. average conducted power (dBm)
MCS0	13.9	16.0	15.6	12.0
MCS1	13.6	15.7	15.6	12.0
MCS2	13.6	15.8	15.4	12.0
MCS3	13.6	15.9	15.4	11.9
MCS4	13.6	15.8	15.5	11.9
MCS5	13.7	15.8	15.4	12.0
MCS6	13.7	15.8	15.6	12.0
MCS7	13.9	15.8	15.6	12.0

Table 1.8.1-4a 802.11 a/n modulation type/data rate vs. conducted power at full power for North America (measured on RHA111LW)

802.11a/n With Full Power For Outside North America								
802.11a (low band) 6Mbps			802.11a (mid band) 6Mbps			802.11a (upper band I) 6Mbps		
f (MHz)	Chan	Max. average conducted power (dBm)	f (MHz)	Chan	Max. average conducted power (dBm)	f (MHz)	Chan	Max. average conducted power (dBm)
5180	**36**	**20.2**	**5260**	**52**	**20.1**	5500	100	19.5
5200	40	20.2	5280	56	20.0	**5520**	**104**	**19.6**
5220	44	20.2	5300	60	20.0	5540	108	19.4
5240	48	20.0	5320	64	20.0	5560	112	19.3
						5580	116	19.3
						5600	120	19.0
						5620	124	18.9
						5640	128	18.8
						5660	132	18.7
						5680	136	18.6
						5700	140	18.4
						802.11a (upper band II) 6Mbps		
						f (MHz)	Chan	Max. average conducted power (dBm)
						5745	149	16.6
						5765	**153**	**16.6**
						5785	157	16.6
						5805	161	16.3
						5825	165	16.4

		802.11a (lower band)	**802.11a (middle band)**	**802.11a (upper band I)**	**802.11a (upper band II)**
Data Rate (Mbits)	**Mod.**	**Channel 36**	**Channel 52**	**Channel 104**	**Channel 153**
		Max. average conducted power (dBm)	**Max. average conducted power (dBm)**	**Max. average conducted power (dBm)**	**Max. average conducted power (dBm)**
6	BPSK	20.2	20.1	19.6	16.6
9	BPSK	20.2	20.0	19.5	16.6
12	QPSK	19.5	19.2	18.6	16.5
18	QPSK	19.5	19.1	18.6	16.5
24	16-QAM	18.5	18.1	17.6	16.5
36	16-QAM	18.4	18.1	17.6	16.5
48	64-QAM	17.0	17.0	16.7	15.4
54	64-QAM	17.0	16.9	16.6	15.5

	802.11n (lower band)	**802.11n (middle band)**	**802.11n (upper band I)**	**802.11n (upper band II)**
Mod.	**Channel 36**	**Channel 52**	**Channel 104**	**Channel 153**
	Max. average conducted power (dBm)	**Max. average conducted power (dBm)**	**Max. average conducted power (dBm)**	**Max. average conducted power (dBm)**
MCS0	17.0	16.9	18.4	16.4
MCS1	17.0	16.7	18.4	16.2
MCS2	16.0	15.7	17.5	16.3
MCS3	16.0	16.0	17.3	16.3
MCS4	19.3	19.1	16.7	15.5
MCS5	19.3	19.2	16.6	15.4
MCS6	18.5	18.1	15.5	14.2
MCS7	18.2	17.9	15.5	14.3

Table 1.8.1-4b 802.11 a/n modulation type/data rate vs. conducted power at full power for outside North America (measured on RHA111LW)

Note: 802.11a/n has different power levels within and outside of North America due to additional requirements for band edge in North America. Due to this SAR testing was done using these higher conducted values as they will result in more conservative SAR measurements. However, the phone officially operates at the 802.11a power levels listed in table 1.8.1-4a

802.11a/n With Reduced Power For Hotspot Mode					
802.11a (low band) 6Mbps			802.11a (upper band II) 6Mbps		
f (MHz)	Chan	Max. average conducted power (dBm)	f (MHz)	Chan	Max. average conducted power (dBm)
5180	36	15.7	5745	149	13.7
5200	40	15.6	5765	153	13.7
5220	44	15.7	5785	157	13.7
5240	48	15.7	5805	161	13.8
			5825	165	13.8

	802.11a (lower band)	802.11 a (upper band II)
Data Rate (Mbits)	Channel 36	Channel 161
	Max. average conducted power (dBm)	Max. average conducted power (dBm)
6	15.7	13.8
24	15.8	13.6
54	15.8	13.7

	802.11n (lower band)	802.11n (upper band II)
Mod.	Channel 36	Channel 161
	Max. average conducted power (dBm)	Max. average conducted power (dBm)
MCS0	15.8	13.7
MCS4	15.8	13.6
MCS7	15.7	13.6

Table 1.8.1-4c 802.11 a/n modulation type/data rate vs. conducted power for Hotspot mode (measured on RHB121LW)

Note 1: 802.11a/n Hotspot mode does not support channels 52-140.

802.11a/n With Reduced Power For GO/Direct Mode					
802.11a (low band) 6Mbps			**802.11a (upper band II) 6Mbps**		
f (MHz)	**Chan**	**Max. average conducted power (dBm)**	**f (MHz)**	**Chan**	**Max. average conducted power (dBm)**
5180	36	12.5	5745	149	11.8
5200	40	12.4	5765	153	16.0
5220	44	12.3	5785	157	16.0
5240	48	12.2	5805	161	15.9
			5825	165	11.7

	802.11a (lower band)	**802.11 a (upper band II)**
Data Rate (Mbits)	**Channel 36**	**Channel 153**
	Max. average conducted power (dBm)	**Max. average conducted power (dBm)**
6	12.5	16.0
24	12.5	15.9
54	12.5	15.9

	802.11n (lower band)	**802.11n (upper band II)**
Mod.	**Channel 36**	**Channel 153**
	Max. average conducted power (dBm)	**Max. average conducted power (dBm)**
MCS0	12.5	16.0
MCS4	12.4	16.0
MCS7	12.4	16.0

Table 1.8.1-4d 802.11 a/n modulation type/data rate vs. conducted power for Wi-Fi GO/Direct mode (measured on RHA111LW)

Note: 802.11a/n GO/Direct mode does not support channels 52-140.

1.8.2 SAR Measurement Requirements for Bluetooth

Channel	Freq (MHz)	Mode	Conducted Avg. Transmit Power (dBm)
0	2402	DH5	10.8
39	2441	DH5	10.9
78	2480	DH5	9.8

Table 1.8.2-1 Bluetooth peak conducted power measurements (measured on RHA111LW)

1.8.3 SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities as per KDB 941225 D06 v01r01

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.

Static/fixed power reduction scheme on the following modes/bands have been implemented when Hotspot Mode is enabled or active to comply with body SAR with 10 mm test separation from flat phantom on standalone transmitter and multi-band simultaneous transmission conditions:

- 802.11a/b/g/n: back off 6 dB

When Hotspot mode is enabled or active, 802.11a channels 52 – 140 are disabled or not supported.

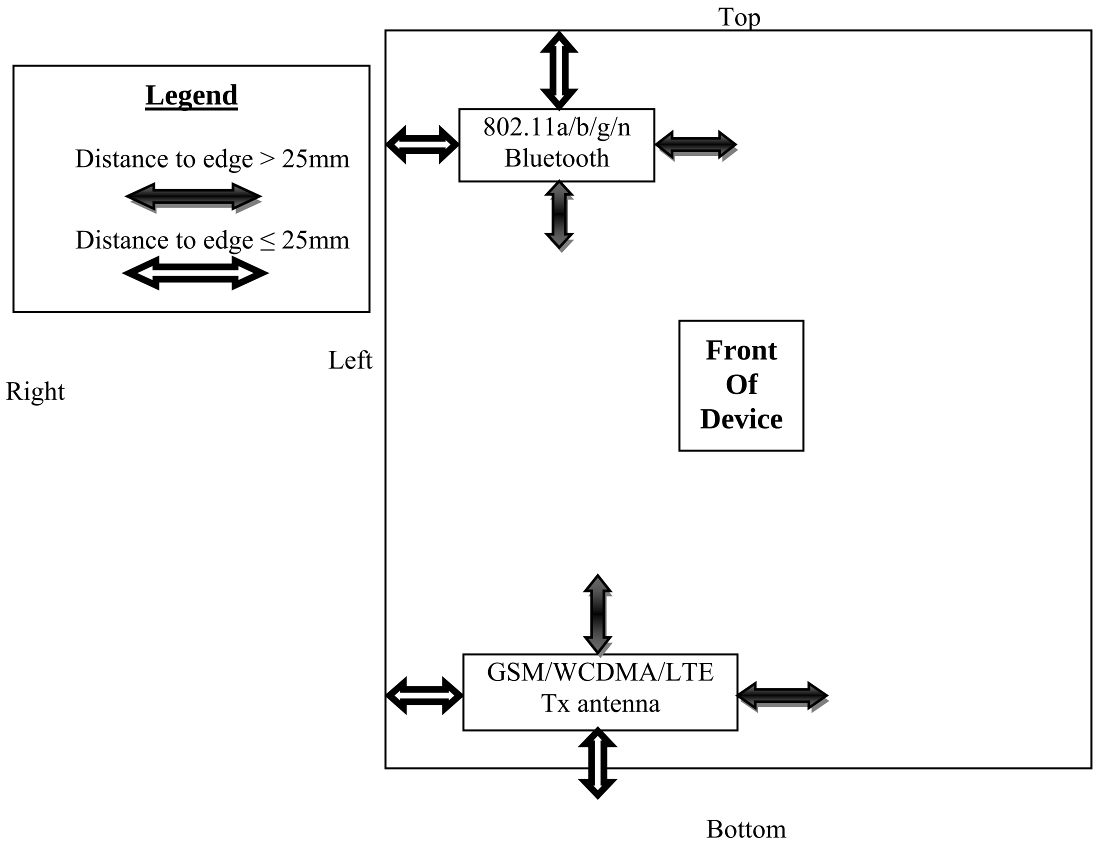

Figure 1.8.3-1 Identification of all sides for SAR Testing

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
GPRS 850/1900, WCDMA/HSPA II/V	Yes	Yes	No	Yes	No	Yes
Bluetooth 2.4GHz/802.11 a/b/g/n (2.4 GHz/5.0 GHz)	Yes	Yes	Yes	No	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 ≈ 3/1/1 dB per slot respectively for GSM 850 and 2/2.5/0.5 dB per slot respectively for GSM 1900.
- For head configurations, 1 slot CS, 2/3-slots (PD) and DTM (CS+PD) were evaluated.
- For body SAR configurations, 1 slot CS, 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:

GSM/EDGE/GPRS/DTM With Full Power				
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	30.5	N/A	N/A
	836.8	30.2	N/A	N/A
	848.8	30.3	N/A	N/A
3-slots GPRS 850 MHz	824.2	29.2	N/A	N/A
	836.8	29.4	N/A	N/A
	848.8	28.9	N/A	N/A
4-slots GPRS 850 MHz	824.2	27.2	N/A	N/A
	836.8	27.4	N/A	N/A
	848.8	26.9	N/A	N/A
2-slots EDGE 850 MHz	824.2	30.5	30.4	27.0
	836.8	30.1	30.2	27.0
	848.8	30.1	30.2	27.1
2-slots DTM 850 MHz	824.2	30.3	30.2	30.3
	836.8	29.9	30.3	29.8
	848.8	29.9	29.8	29.9
3-slots EDGE 850 MHz	824.2	29.2	29.0	25.1
	836.8	29.3	29.1	25.2
	848.8	29.0	29.0	25.1

3-slots DTM 850 MHz	824.2	29.1	29.0	29.1
	836.8	29.2	29.1	29.2
	848.8	28.8	28.6	28.8
4-slots EDGE 850 MHz	824.2	27.2	27.1	24.1
	836.8	27.5	27.2	24.0
	848.8	26.9	26.7	23.9
2-slots GPRS 1900 MHz	1850.2	29.1	N/A	N/A
	1880.0	29.1	N/A	N/A
	1909.8	28.8	N/A	N/A
3-slots GPRS 1900 MHz	1850.2	26.4	N/A	N/A
	1880.0	26.4	N/A	N/A
	1909.8	26.2	N/A	N/A
4-slots GPRS 1900 MHz	1850.2	25.8	N/A	N/A
	1880.0	25.8	N/A	N/A
	1909.8	25.4	N/A	N/A
2-slots EDGE 1900MHz	1850.2	29.2	28.8	25.5
	1880.0	29.1	28.7	25.5
	1909.8	29.0	28.5	25.4
2-slots DTM 1900MHz	1850.2	29.1	29.0	28.8
	1880.0	29.1	28.9	28.8
	1909.8	28.8	28.8	28.6
3-slots EDGE 1900MHz	1850.2	26.6	26.7	24.4
	1880.0	26.6	26.7	24.4
	1909.8	26.4	26.5	24.3
3-slots DTM 1900MHz	1850.2	26.4	26.3	26.3
	1880.0	26.4	26.3	26.1
	1909.8	26.2	26.1	26.1
4-slots EDGE 1900MHz	1850.2	26.0	26.0	23.3
	1880.0	26.0	26.0	23.3
	1909.8	25.6	25.7	23.1

Mode	Freq. (MHz)	Max burst averaged conducted power (dBm)
1-slot GSM (CS) 850 MHz	824.2	32.2
	836.8	31.9
	848.8	32.0
1-slot GSM (CS) 1900 MHz	1850.2	29.3
	1880.0	29.2
	1909.8	29.0

1.8.4-1a GSM/EDGE/GPRS channel vs. conducted power with full/maximum power (measured on RFN81UW)

GSM/EDGE/GPRS/DTM With Reduced Power For Hotspot Mode on Rev 1				
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	27.5	N/A	N/A
	836.8	27.4	N/A	N/A
	848.8	27.6	N/A	N/A
3-slots GPRS 850 MHz	824.2	26.0	N/A	N/A
	836.8	26.1	N/A	N/A
	848.8	25.6	N/A	N/A
4-slots GPRS 850 MHz	824.2	24.5	N/A	N/A
	836.8	24.3	N/A	N/A
	848.8	24.3	N/A	N/A
2-slots EDGE 850 MHz	824.2	27.4	27.4	26.3
	836.8	27.3	27.4	26.3
	848.8	27.5	27.5	26.2
2-slots DTM 850 MHz	824.2	27.4	27.4	26.3
	836.8	27.7	27.3	26.3
	848.8	27.5	27.5	26.2

Mode	**Freq. (MHz)**	**Max burst averaged conducted power (dBm)**
1-slot GSM (CS) 850 MHz	824.2	30.3
	836.8	30.5
	848.8	30.0

1.8.4-1b GSM/EDGE/GPRS channel vs. conducted power for hotspot mode power on Rev 1 (measured on RFN81UW)

Note: For Rev 2 Hotspot mode transmits at full power as seen in table 1.8.4-1a

1.8.5 SAR Measurement Procedure for Fast SAR Scan as per KDB 447498 D01 General RF Exposure Guidance v05r02

Fast SAR or area scan based 1-g SAR estimation can be used instead of full SAR measurements as long as the following conditions are fulfilled:

- For dipole validation the 1g SAR for the area and zoom scan must be with ±3%
- 1g Measured SAR ≤ 1.2 W/kg
- The difference between the zoom and area scan 1g SAR ≤ 0.1 W/kg
- A zoom scan is required on the worst case for each configuration of a frequency band.
  - For head configuration: A zoom scan is required for **each** position with 1g SAR ≥ 0.8 and 1 additional zoom scan to cover all the remaining positions. The scan is done on the worst case for the position(s)
- Polynomial fit algorithm is utilized. Set in DASY by double clicking the area scan procedure
- Area scan is measure at a distance ≤ 4 mm from the phantom surface
- A zoom scan is not required for any other purpose
  - For simultaneous transmission the coordinates for the maxima can be found using the area scan
- DASY must not show any error, warning, or alert messages during the scan.
  - Example: noise in measurement, peak to close to the scan boundary. Peaks are too sharp, etc.
- The frequency band being tested is ≤ 3 GHz

1.8.6 SAR Measurement Procedures for 3G Devices as per KDB 941225 D01 v02

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.

1.8.7 Test Seup information for WCDMA / HSPDA / HSUPA

a) WCDMA RMC

In RMC (reference measurement channel) mode the conducted power at 4 different bit rates were measured. They correspond with the used spreading factors as follows:

Bit rate	*12.2 kbit/s*	*64 kbit/s*	*144 kbit/s*	*384 kbit/s*
Spreading factor (SF)	64	16	8	4

In RMC mode only DPCCH and DPDCH are active. As bit rate changes do not influence the relative power of any code channel the measured RMS output power remains on the same level which is set to maximum by TPC (Transmit power control) pattern type 'All 1'.

b) HSDPA

HSDPA adds the HS-DPCCH in uplink as a control channel for high speed data transfer in downlink.
In HSDPA mode 4 sub-tests are defined by 3GPP 34.121 according to the following table:

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs} (1)	CM(dB) (2)
1	2/15	15/15	64	2/15	4/15	0.0
2	12/15 (3)	15/15 (3)	64	12/15 (3)	24/15	1.0
3	15/15	8/15	64	15/8	30/15	1.5
4	15/15	4/15	64	15/4	30/15	1.5

Note 1: Δ_{ACK}, Δ_{NACK}, Δ_{CQI} = 8 $\Longleftrightarrow$ $A_{hs} = \beta_{hs}/\beta_c = 30/15$ $\Longleftrightarrow$ $\beta_{hs} = 30/15 * \beta_c$
Note 2 : CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$
Note 3 : For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1,TF1) to β_c = 11/15 and β_d = 15/15

Table 1.8.7-1 Sub-tests for UMTS Release 5 HSDPA

The β_c and β_d gain factors for DPCCH and DPDCH were set according to the values in the above table, β_{hs} for HS-DPCCH is set automatically to the correct value when Δ_{ACK}, Δ_{NACK}, Δ_{CQI} = 8. The variation of the β_c/β_d ratio causes a power reduction at sub-tests 2 - 4.
The measurements were performed with a Fixed Reference Channel (FRC) and H-Set 1 QPSK.

Parameter	*Value*
Nominal average inf. bit rate	534 kbit/s
Inter-TTI Distance	3 TTI's
Number of HARQ Processes	2 Processes
Information Bit Payload	3202 Bits
MAC-d PDU size	336 Bits
Number Code Blocks	1 Block
Binary Channel Bits Per TTI	4800 Bits
Total Available SMLs in UE	19200 SMLs
Number of SMLs per HARQ Process	9600 SMLs
Coding Rate	0.67
Number of Physical Channel Codes	5

Table 1.8.7-2 Settings of required H-Set 1 QPSK acc. to 3GPP 34.121

c) HSUPA

In HSUPA mode additional code channels (E-DPCCH, E-DPDCHn) are added for data transfer in uplink at higher bit rates.

5 sub-tests are defined by 3GPP 34.121 according to the following table :

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{hs} (1)	β_{ec}	β_{ed}	β_{ec} (SF)	β_{ed} (code)	CM(2) (dB)	MPR (dB)	AG(4) Index	E-TFCI
1	11/15(3)	15/15(3)	64	11/15(3)	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1}:47/15 β_{ed2}:47/15	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15(4)	15/15(4)	64	15/15(4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK}, Δ_{CQI} = 8 $\Longleftrightarrow$ $A_{hs} = \beta_{hs}/\beta_c = 30/15$ $\Longleftrightarrow$ $\beta_{hs} = 30/15 * \beta_c$
Note 2 : CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference
Note 3 : For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1,TF1) to β_c = 10/15 and β_d = 15/15
Note 4 : For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1,TF1) to β_c = 14/15 and β_d = 15/15
Note 5 : Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g
Note 6 : β_{ed} can not be set directly; it is set by Absolute Grant Value

Table 1.8.7-3 Subtests for UMTS Release 6 HSUPA

To achieve the settings above some additional procedures were defined by 3GPP 34.121. Those have been included in an application note for the CMU200 and were exactly followed :

- Test mode connection (BS signal tab) :
RMC 12.2 kbit/s + HSPA 34.108 with loop mode 1
- HS-DSCH settings (BS signal tab):
- FRC with H-set 1 QPSK
- ACK-NACK repetition factor = 3
- CQI feedback cycle = 4ms
- CQI repetition factor = 2
- HSUPA-specific signalling settings (UE signal tab) :
- E-TFCI table index = 0
- E-DCH minimum set E-TFCI = 9
- Puncturing limit non-max = 0.84
- max. number of channelisation codes = 2x SF4
- Initial Serving Grant Value = Off
- HSDPA and HSUPA Gain factors (UE signal tab)

Sub-test	β_c	β_d	Δ_{ACK}, Δ_{NACK}, Δ_{CQI}	ΔE–DPCCH *
1	10	15	8	6
2	6	15	8	8
3	15	9	8	8
4	2	15	8	5
5	14	15	8	7

*** β_{ec} and β_{ed} ratios (relative to β_c and β_d) are set by ΔE–DPCCH**

- HSUPA Reference E-TFCIs (UE signal tab > HSUPA gain factors) :

Sub-test	**1, 2, 4, 5**				
Number of E-TFCIs	5				
Reference E-TFCI	11	67	71	75	81
Reference E-TFCI power offset	4	18	23	26	27

Sub-test	**3**	
Number of E-TFCIs	2	
Reference E-TFCI	11	92
Reference E-TFCI power offset	4	18

- HSUPA-specific generator parameters (BS Signal tab > HSUPA > E-AGCH > AG Pattern)

Sub-test	***Absolute Grant Value (AG Index)***
1	20
2	12
3	15
4	17
5	21

- Power Level settings (BS Signal tab > Node B-settings):
- Level reference : Output Channel Power (lor)
- Output Channel Power (lor) : -86 dBm

- Downlink Physical Channel Settings (BS signal tab)
- P-CPICH : -10 dB
- S-CPICH : Off
- P-SCH : -15 dB
- S-SCH : -15 dB
- P-CCPCH : -12 dB
- S-CCPCH : -12 dB
- PICH : -15 dB
- AICH : -12 dB
- DPDCH : -10 dB
- HS-SCCH : -8 dB

- HS-PDSCH : -3 dB
- E-AGCH : -20 dB
- E-RGCH/E-HICH - 20 dB
- E-RGCH Active : Off

The settings above were stored once for each sub-test and recalled before the measurement.

To reach maximum output power in HSUPA mode the following procedures were followed:

3 different TPC patterns were defined:
Set 1: Closed loop with target power 10 dBm
Set 2: Single Pattern + Alternating with binary pattern '11111' for 1 dB steps 'up'
Set 3: Single Pattern + Alternating with binary pattern '00000' for 1 dB steps 'down'

After recalling a certain HSUPA sub-test the HSUPA E-AGCH graph with E-TFCI event counter is displayed. First, the closed loop command is executed and then the power is increased in 1 dB steps by activating pattern set 2 until the UE decreases the transmitted E-TFCI. At this point set 3 is activated once to reduce the output power to the value at which the original E-TFCI, which is required for the sub-test, appears again.

For conducted power measurements the same steps are repeated in the power menu to read out the corresponding maximum RMS output power with the target E-TFCI. For SAR measurements it is useful to switch to Code Domain Power vs. Time display. Here the CMU200 shows relative power values (max. and min.) of each code channel which should roughly correspond to the numerators of the gain factors e.g.:

Sub-test	β_c	β_d	β_{hs}	β_{ec}	β_{ed}
5	15	15	30	24	134

WCDMA/UMTS With Full Power				
	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	24.63	24.42	24.27
Rel99	12.2 kbps, Voice, AMR, SRB 3.4 kbps	24.69	24.37	24.33
Rel6 HSUPA	1	23.22	23.00	22.80
Rel6 HSUPA	2	22.80	22.48	22.33
Rel6 HSUPA	3	23.70	23.38	23.26
Rel6 HSUPA	4	23.55	23.30	23.15
Rel6 HSUPA	5	21.65	21.55	21.30
Rel7 HSDPA+	1	22.90	22.92	22.91
Rel7 HSDPA+	2	22.16	22.11	22.15
Rel7 HSDPA+	3	21.80	21.72	22.05
Rel7 HSDPA+	4	21.41	21.60	22.01
	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	23.10	22.95	22.98
Rel99	12.2 kbps, Voice, AMR, SRB 3.4 kbps	23.10	22.94	22.96
Rel6 HSUPA	1	22.71	22.51	22.54
Rel6 HSUPA	2	22.41	22.20	22.11
Rel6 HSUPA	3	23.09	22.92	22.95
Rel6 HSUPA	4	23.00	22.85	22.83
Rel6 HSUPA	5	21.20	21.00	20.95
Rel7 HSDPA+	1	22.60	22.81	22.81
Rel7 HSDPA+	2	22.05	22.04	22.10
Rel7 HSDPA+	3	22.48	22.41	22.32
Rel7 HSDPA+	4	21.25	21.10	21.20

Table 1.8.7-4a WCDMA (Rel99) / HSPA/HSPA+ conducted power measurements at full power (measured on RFN81UW)

WCDMA/UMTS With Reduced Power For Hotspot Mode On Rev 1				
	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	21.15	21.00	20.80
Rel99	12.2 kbps, Voice, AMR, SRB 3.4 kbps	21.08	20.95	20.80
Rel7 HSDPA+	1	20.05	19.95	19.78

Table 1.8.7-4b WCDMA (Rel99) / HSPA/HSPA+ conducted power measurements on Hotspot mode (measured on RFN81UW)

Note: For Rev 2 Hotspot mode transmits at full power as seen in table 1.8.7-4a

1.9 General SAR Test Reduction and Exclusion procedure as per KDB 447498 D01 v05r02 and SAR Evaluation Considerations for Wireless Handsets as per 648474 D04 v01r02

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.

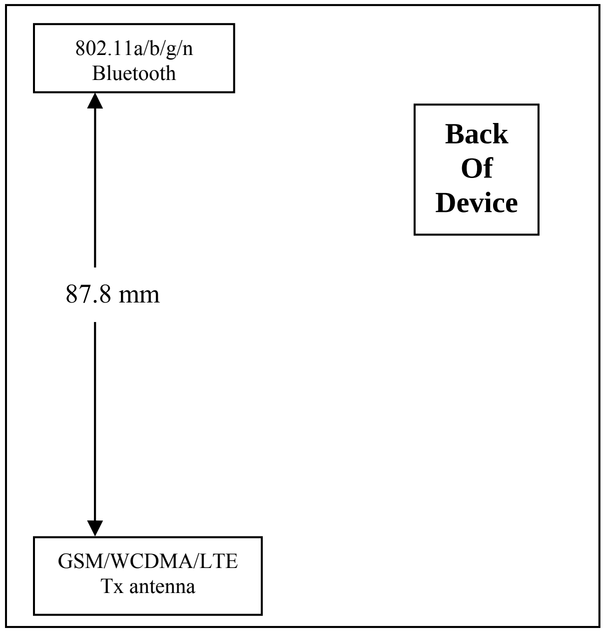

Figure 1.9-1 Back view of device showing closest distance between antenna pairs

1.9.1 Simultaneous Transmission Analysis

Separate Transmitting Antenna	
Separate Antenna	**Technologies Utilized By Each Antenna**
Antenna 1	GSM, WCDMA
Antenna 2	Wi-Fi 2.4 GHz, Wi-Fi 5.0 GHz, Bluetooth

Simultaneous Transmission Combinations		
Configuration	**Simultaneous Transmission (by Antenna)**	**Simultaneous Transmission (by Technology)**
Head	Antenna 1 + Antenna 2	GSM/WCDMA + Wi-Fi/BT
Body-Worn	Antenna 1 + Antenna 2	GSM/WCDMA + Wi-Fi/BT
Hotspot	Antenna 1 + Antenna 2	GSM/WCDMA + Wi-Fi/BT

Table 1.9.1-1 Simultaneous Transmission Scenarios

Note 1: BT and Wi-Fi cannot transmit simultaneously since the design doesn't allow it and they use the same antenna.
Note 2: 802.11b and 802.11a cannot transmit simultaneously since the design doesn't allow it and they use the same antenna.

Head SAR Values Summation On The Same Test Position					
Test	Configuration	Licensed Transmitters		WiFi 2.4/5.0GHz 1g avg. SAR (W/kg)	Max Sum 1g avg. SAR (W/kg)
		Band	1g avg. SAR (W/kg)		
Head SAR	Right Cheek	GSM/DTM/EDGE 850	0.38	0.71	1.09
		UMTS Band V	0.46	0.71	1.17
		GSM/DTM/EDGE 1900	0.50	0.71	1.21
		UMTS Band II	0.60	0.71	1.31
	Right Tilt	GSM/DTM/EDGE 850	0.30	0.98	1.28
		UMTS Band V	0.38	0.98	1.36
		GSM/DTM/EDGE 1900	0.20	0.98	1.18
		UMTS Band II	0.39	0.98	1.37
	Left Cheek	GSM/DTM/EDGE 850	0.52	0.63	1.15
		UMTS Band V	0.67	0.63	1.30
		GSM/DTM/EDGE 1900	0.65	0.63	1.28
		UMTS Band II	1.06	0.63	**1.69**
	Left Tilt	GSM/DTM/EDGE 850	0.27	0.58	0.85
		UMTS Band V	0.37	0.58	0.95
		GSM/DTM/EDGE 1900	0.24	0.58	0.82
		UMTS Band II	0.32	0.58	0.90

Table 1.9.1-2a Highest Head SAR values and summation on the same test position

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.

Antenna 1 (802.11 a)	Left Head Touch	0.63	-3.3	307	-168.1	
Antenna 2 (UMTS II)	Left Head Touch	1.06	63.6	251.4	-172.9	
	SAR Sum	1.69				
	SAR Sum to the power of 1.5	2.20				
	Delta [mm]		-66.8	55.6	4.8	
	closest Distance [mm]					**87.05**
	Ratio	0.03				

Table 1.9.1-2b Head configuration ratio of SAR to peak separation distance for pair of transmitters

Note: If the ratio of SAR to peak separation distance is ≤ 0.04, Simultaneous SAR measurement is not required.

Body-Worn SAR Values Summation On The Same Test Position					
Test	**Configuration**	**Licensed Transmitters**		**WiFi 2.4/5.0GHz 1g avg. SAR (W/kg)**	**Max Sum 1g avg. SAR (W/kg)**
		Band	**1g avg. SAR (W/kg)**		
Body Worn SAR	15mm separation device back	GSM/DTM/EDGE 850	0.68	1.05	**1.73**
		UMTS Band V	0.63	1.05	**1.68**
		GSM/DTM/EDGE 1900	0.45	1.05	1.50
		UMTS Band II	0.74	1.05	**1.79**
	15mm separation device front	GSM/DTM/EDGE 850	0.54	0.06	0.60
		UMTS Band V	0.51	0.06	0.57
		GSM/DTM/EDGE 1900	0.26	0.06	0.32
		UMTS Band II	0.50	0.06	0.56
	Holster device back	GSM/DTM/EDGE 850	0.57	0.73	1.30
		UMTS Band V	0.54	0.73	1.27
		GSM/DTM/EDGE 1900	0.24	0.73	0.97
		UMTS Band II	0.33	0.73	1.06

Table 1.9.1-3a Highest Body-worn SAR values and summation on the same test position

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.

Antenna 1 (802.11 a)	15mm, back	1.05	-35.0	-43.0	-207	
Antenna 2 (GPRS 850)	15mm, back	0.68	-20.0	23.0	-207.3	
	SAR Sum	1.73				
	SAR Sum to the power of 1.5	2.28				
	Delta [mm]		-15.0	-66.0	0.3	
	closest Distance [mm]					**67.69**
	Ratio	0.03				
Antenna 1 (802.11 a)	15mm, back	1.05	-35.0	-43.0	-207	
Antenna 2 (UMTS V)	15mm, back	0.63	-24.5	20.0	-208.8	
	SAR Sum	1.68				
	SAR Sum to the power of 1.5	2.18				
	Delta [mm]		-10.5	-63.0	1.8	
	closest Distance [mm]					**63.90**
	Ratio	0.03				
Antenna 1 (802.11 a)	15mm, back	1.05	-35.0	-43.0	-207	
Antenna 2 (UMTS II)	15mm, back	0.74	-38.0	45.5	-206.9	
	SAR Sum	1.79				
	SAR Sum to the power of 1.5	2.39				
	Delta [mm]		3.0	-88.5	-0.1	
	closest Distance [mm]					**88.56**
	Ratio	0.03				

Table 1.9.1-3b Body-worn configuration ratio of SAR to peak separation distance for pair of transmitters

Note: If the ratio of SAR to peak separation distance is ≤ 0.04, Simultaneous SAR measurement is not required.

Hotspot SAR Values Summation On The Same Test Position					
Test	Configuration	Licensed Transmitters		WiFi 2.4/5.0GHz 1g avg. SAR (W/kg)	Max Sum 1g avg. SAR (W/kg)
		Band	1g avg. SAR (W/kg)		
Hotspot Mode SAR	10mm separation device back	GSM/DTM/EDGE 850	0.47	0.78	1.25
		UMTS Band V	0.89	0.78	**1.67**
		GSM/DTM/EDGE 1900	0.94	0.78	**1.72**
		UMTS Band II	1.32	0.78	**2.10**
	10mm separation device front	GSM/DTM/EDGE 850	0.30	0.14	0.44
		UMTS Band V	0.29	0.14	0.43
		GSM/DTM/EDGE 1900	0.45	0.14	0.59
		UMTS Band II	1.01	0.14	1.15
	10mm separation device left	GSM/DTM/EDGE 850	0.45	0.27	0.72
		UMTS Band V	0.41	0.27	0.68
		GSM/DTM/EDGE 1900	0.23	0.27	0.50
		UMTS Band II	0.34	0.27	0.61
	10mm separation device right	GSM/DTM/EDGE 850	0.22	0.03	0.25
		UMTS Band V	0.17	0.03	0.20
		GSM/DTM/EDGE 1900	0.04	0.03	0.07
		UMTS Band II	0.09	0.03	0.12
	10mm separation device bottom	GSM/DTM/EDGE 850	0.07	0.00	0.07
		UMTS Band V	0.15	0.00	0.15
		GSM/DTM/EDGE 1900	0.28	0.00	0.28
		UMTS Band II	0.58	0.00	0.58
	10mm separation device top	ALL BANDS	0.00	0.23	0.23

Table 1.9.1-4a Highest Hotspot SAR values and summation on the same test position

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.

Antenna 1 (802.11 a)	10mm, back	0.78	-41.0	-41.0	-207	
Antenna 2 (UMTS V)	10mm, back	0.89	-29.0	33.5	-209.4	
	SAR Sum	1.67				
	SAR Sum to the power of 1.5	2.16				
	Delta [mm]		-12.0	-74.5	2.4	
	closest Distance [mm]					**75.51**
	Ratio	0.03				
Antenna 1 (802.11 a)	10mm, back	0.78	-41.0	-41.0	-207	
Antenna 2 (GPRS 1900)	10mm, back	0.94	-32.0	45.5	-206.9	
	SAR Sum	1.72				
	SAR Sum to the power of 1.5	2.26				
	Delta [mm]		-9.0	-86.5	-0.1	
	closest Distance [mm]					**86.97**
	Ratio	0.03				
Antenna 1 (802.11 a)	10mm, back	0.78	-41.0	-41.0	-207	
Antenna 2 (UMTS II)	10mm, back	1.32	-35.0	45.5	-206.9	
	SAR Sum	2.10				
	SAR Sum to the power of 1.5	3.04				
	Delta [mm]		-6.0	-86.5	-0.1	
	closest Distance [mm]					**86.72**
	Ratio	0.04				

Table 1.9.1-4b Hotspot configuration ratio of SAR to peak separation distance for pair of transmitters

Note: If the ratio of SAR to peak separation distance is ≤ 0.04, Simultaneous SAR measurement is not required.

1.10 Wi-Fi and Hotspot Mode Power Reductions

There can be a fixed power reduction in hotspot mode for certain bands when the mode is enabled. The following bands have a reduced power in Hotspot mode; all other bands continue to transmit at full power.

- GSM 850 (Rev 1)
- UMTS band V (Rev 1)
- 802.11 a/b/g/n

Note: GSM 850 and UMTS band V no longer have power reduction for hotspot mode on Rev 2

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.

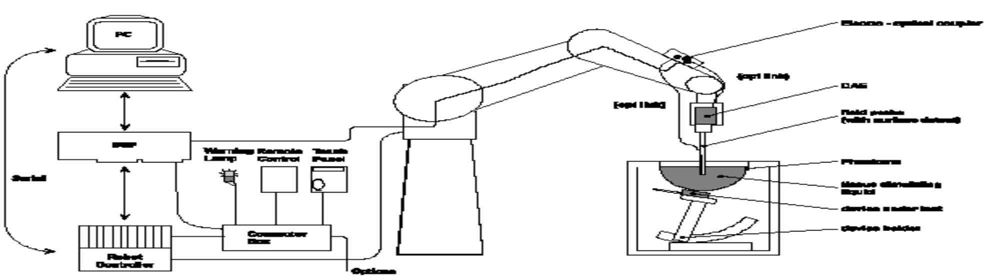

Figure 2.1-1 System Description

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	01/22/2015
SCHMID & Partner Engineering AG	E-field probe	EX3DV4	3548	01/17/2015
SCHMID & Partner Engineering AG	Data Acquisition Electronics (DAE3)	DAE3	472	03/18/2015
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	D2450V2	791	09/10/2015
SCHMID & Partner Engineering AG	Dipole Validation Kit	D5000V2	1033	11/08/2015
Agilent Technologies	Signal generator	8648C	4037U03155	09/25/2015
Agilent Technologies	Power meter	E4419B	GB40202821	09/25/2015
Agilent Technologies	Power sensor	8481A	MY41095233	09/27/2014
Agilent Technologies	Power sensor	8481A	MY41095417	09/26/2014
Amplifier Research	Amplifier	5S1G4M3	300986	CNR
Rohde & Schwarz	Signal generator	SMA 100A	102106	11/28/2014
Amplifier Research	Coupler	DC7144	300993	CNR
CPI Wireless Solutions	Amplifier	VZC-6961K4	SK4310E5	CNR
Agilent Technologies	Network analyzer	8753ES	US39174857	09/27/2014
Agilent Technologies	Power meter	N1911A	MY45100905	05/29/2015
Agilent Technologies	Power sensor	N1921A	SG45240281	12/04/2014
Rohde & Schwarz	Wideband Base Station Simulator	CMW 500	136298	04/22/2015
Rohde & Schwarz	Base Station Simulator	CMU 200	109747	11/28/2015
Rohde & Schwarz	Bluetooth Tester	CBT	100368	11/28/2014
Weinschel Corp	20dB Attenuator	33-20-34	BMO697	CNR

Table 2.1.1-1 Equipment list

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.

	Probe model ES3DV3	**Probe model EX3DV4**
Property	**Data**	**Data**
Frequency range	10 MHz – 4 GHz	10 MHz – 6 GHz
Linearity	±0.2 dB	±0.2 dB
Directivity (rotation around probe axis)	±0.2 dB	±0.3 dB
Directivity (rotation normal to probe axis)	±0.3 dB	±0.5 dB
Dynamic Range	5 μW/kg – 100 mW/kg	10 μW/kg – 100 mW/kg
Probe positioning repeatability	±0.2 mm	±0.2 mm
Probe tip to sensor center	2.0 mm	1.0 mm
Probe tip diameter is	3.9 mm	2.5 mm
Probe calibration uncertainty	12.0 % < 3 GHz	12.0% < 3 GHz 13.1% < 6 GHz
Probe calibration range	± 100 MHz	± 100 MHz

Table 3.1-1 Probe specifications

3.2 Probe calibration and measurement uncertainty

The probe had been calibrated with accuracy of ±12.0% (< 3 GHz) and 13.1% (5-6 GHz). 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 [G]	Depth [G] (mm)	Unct. (k=2)
750	41.9	0.89	6.36	6.36	6.36	0.28	1.91	± 12.0 %
900	41.5	0.97	6.05	6.05	6.05	0.49	1.38	± 12.0 %
1810	40.0	1.40	5.24	5.24	5.24	0.69	1.23	± 12.0 %
1950	40.0	1.40	4.97	4.97	4.97	0.73	1.21	± 12.0 %
2450	39.2	1.80	4.64	4.64	4.64	0.80	1.23	± 12.0 %
2600	39.0	1.96	4.33	4.33	4.33	0.75	1.34	± 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 [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	6.28	6.28	6.28	0.34	1.84	± 12.0 %
900	55.0	1.05	6.09	6.09	6.09	0.62	1.32	± 12.0 %
1810	53.3	1.52	4.93	4.93	4.93	0.48	1.57	± 12.0 %
1950	53.3	1.52	4.84	4.84	4.84	0.50	1.59	± 12.0 %
2450	52.7	1.95	4.28	4.28	4.28	0.77	1.23	± 12.0 %
2600	52.5	2.16	4.03	4.03	4.03	0.80	1.01	± 12.0 %

Table 3.2-1 Probe ES3DV3 SN: 3225 (cal: 1/22/2014)

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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 [G]	Depth [G] (mm)	Unct. (k=2)
2600	39.0	1.96	7.03	7.03	7.03	0.50	0.77	± 12.0 %
5200	36.0	4.66	5.37	5.37	5.37	0.35	1.80	± 13.1 %
5500	35.6	4.96	4.94	4.94	4.94	0.35	1.80	± 13.1 %
5800	35.3	5.27	4.76	4.76	4.76	0.40	1.80	± 13.1 %

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 [G]	Depth [G] (mm)	Unct. (k=2)
2600	52.5	2.16	6.91	6.91	6.91	0.80	0.50	± 12.0 %
5200	49.0	5.30	4.83	4.83	4.83	0.40	1.90	± 13.1 %
5500	48.6	5.65	4.33	4.33	4.33	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.36	4.36	4.36	0.50	1.90	± 13.1 %

Table 3.2-2 Probe EX3DV4 SN: 3548 (cal: 1/17/2014)

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

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

[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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 1g/10g (W/kg)	Dielectric Parameters		Liquid Temp. (°C)
				ε_r	σ [S/m]	
835	Measured (07/03/2014)	Area Scan/Fast SAR	10.1/6.67	40.9	0.91	22.0
	Measured (07/03/2014)	Zoom Scan	10.0/6.56	40.9	0.91	22.0
	Measured (07/07/2014)	Area Scan/Fast SAR	9.62/6.31	41.5	0.88	22.8
	Measured (07/07/2014)	Zoom Scan	9.51/6.26	41.5	0.88	22.8
	Measured (07/25/2014)	Area Scan/Fast SAR	9.89/6.52	40.1	0.89	22.0
	Measured (07/25/2014)	Zoom Scan	9.81/6.43	40.1	0.89	22.0
	Recommended Limits (Dipole: 446)		9.39/6.13	41.5	0.90	N/A
1900	Measured (07/08/2014)	Area Scan/Fast SAR	40.7/21.2	38.6	1.39	22.7
	Measured (07/08/2014)	Zoom Scan	40.1/21.0	38.6	1.39	22.7
	Measured (07/28/2014)	Area Scan/Fast SAR	42.1/21.6	39.8	1.38	22.3
	Measured (07/28/2014)	Zoom Scan	41.2/21.4	39.8	1.38	22.3
	Recommended Limits (Dipole: 545)		40.2/21.1	40.0	1.40	N/A
2450	Measured (07/17/2014)	Area Scan/Fast SAR	55.5/26.1	38.4	1.88	22.0
	Measured (07/17/2014)	Zoom Scan	54.8/25.6	38.4	1.88	22.0
	Recommended Limits (Dipole: 791)		51.6/24.0	39.2	1.80	N/A
5200	Measured (07/30/2014)	Area Scan/Fast SAR	81.5/23.1	35.1	4.76	22.3
	Measured (07/30/2014)	Zoom Scan	85.4/24.8	35.1	4.76	22.3
	Recommended Limits (Dipole: 1033)		79.4/22.6	36.0	4.66	N/A
5500	Measured (07/30/2014)	Area Scan/Fast SAR	88.2/24.4	34.5	5.11	22.3
	Measured (07/30/2014)	Zoom Scan	88.6/25.5	34.5	5.11	22.3
	Recommended Limits (Dipole: 1033)		84.4/23.9	35.6	4.96	N/A
5800	Measured (07/30/2014)	Area Scan/Fast SAR	79.6/22.0	34.0	5.47	22.3
	Measured (07/30/2014)	Zoom Scan	82.6/23.8	34.0	5.47	22.3
	Recommended Limits (Dipole: 1033)		79.4/22.6	35.3	5.27	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	09/27/2014
Control Company	Digital Thermometer	23609-234	21352860	09/30/2014

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]	
835	Head	Measured (07/02/2014)	815	41.2	0.88	22.0
			825	41.1	0.90	
			835	40.9	0.91	
			850	40.7	0.91	
			865	40.6	0.93	
		Measured (07/07/2014)	815	41.7	0.86	22.8
			825	41.6	0.87	
			835	41.5	0.88	
			850	41.3	0.90	
			865	41.1	0.91	
		Measured (07/25/2014)	815	40.4	0.87	22.0
			825	40.2	0.88	
			835	40.1	0.89	
			850	39.9	0.90	
			865	39.7	0.91	
		Recommended Limits	835	41.5	0.90	N/A

	Muscle	Measured (07/02/2014)	815	57.8	0.97	21.8
			825	57.6	0.99	
			835	57.5	1.00	
			850	57.3	1.01	
		Measured (07/25/2014)	815	53.8	0.96	21.4
			825	53.7	0.97	
			835	53.6	0.98	
			850	53.4	1.00	
		Recommended Limits	835	55.2	0.97	N/A
1900	Head	Measured (07/08/2014)	1850	38.8	1.35	22.7
			1900	38.6	1.39	
			1910	38.6	1.40	
			1980	38.4	1.47	
		Measured (07/28/2014)	1850	40.0	1.33	22.3
			1900	39.8	1.38	
			1910	39.8	1.39	
			1980	39.6	1.47	
		Recommended Limits	1900	40.0	1.40	N/A
	Muscle	Measured (07/08/2014)	1850	50.9	1.47	22.7
			1900	50.7	1.51	
			1910	50.7	1.53	
		Measured (07/28/2014)	1850	50.9	1.47	22.2
			1900	50.8	1.53	
			1910	50.8	1.54	
		Recommended Limits	1900	53.3	1.52	N/A
2450	Head	Measured (07/17/2014)	2410	38.5	1.84	22.0
			2450	38.4	1.88	
			2480	38.3	1.91	
		Recommended Limits	2450	39.2	1.80	N/A
	Muscle	Measured (07/17/2014)	2410	50.5	1.95	22.0
			2450	50.4	2.00	
			2480	50.3	2.04	
		Recommended Limits	2450	52.7	1.95	N/A
5200	Head	Measured (07/30/2014)	5180	35.1	4.75	22.3
			5200	35.1	4.76	
			5280	34.9	4.86	
		Recommended Limits	5200	36.0	4.66	N/A
	Muscle	Measured (07/30/2014)	5180	47.3	5.35	21.5
			5200	47.3	5.37	
			5280	47.0	5.51	
		Recommended Limits	5200	49.0	5.30	N/A
5500	Head	Measured (07/30/2014)	5500	34.5	5.11	22.3
			5600	34.4	5.22	
		Recommended Limits	5500	35.6	4.96	N/A
	Muscle	Measured (07/30/2014)	5500	47.4	5.70	21.5
			5600	47.2	5.83	
		Recommended Limits	5500	48.6	5.65	N/A
5800	Head	Measured (07/30/2014)	5745	34.0	5.39	22.3

			5800	34.0	5.47	
		Recommended Limits	5800	35.3	5.27	N/A
	Muscle	Measured (07/30/2014)	5745	47.0	6.06	21.5
			5800	46.9	6.12	
		Recommended Limits	5800	48.2	6.00	N/A

Table 6.2-1 Electrical parameters of tissue simulating liquid

6.2.2 Test Configuration

Dielectric
Probe
Kit

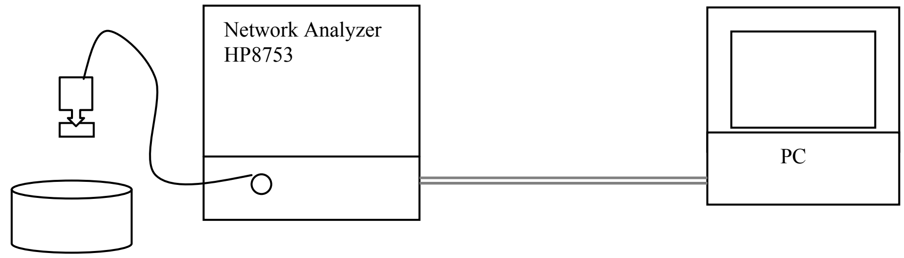

Figure 6.2.2-1 Test configuration

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).

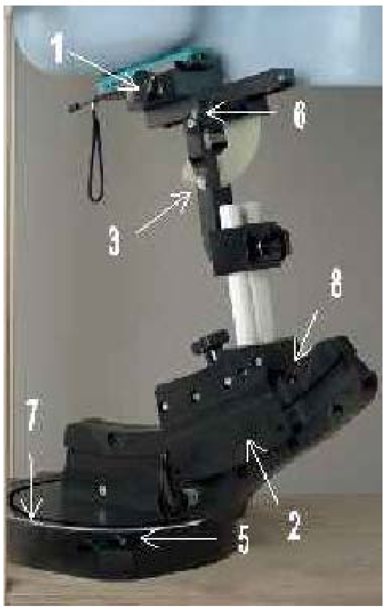

Figure 8.1-1 Device Holder

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”.

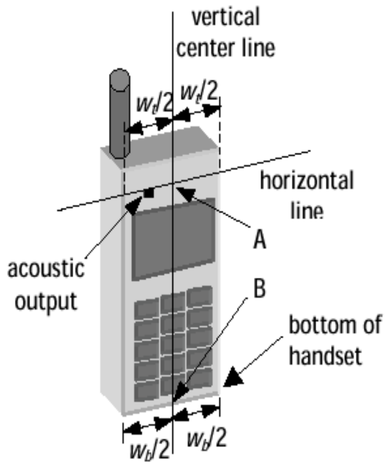

Figure 8.2.1-1 Handset vertical and horizontal reference lines – fixed case

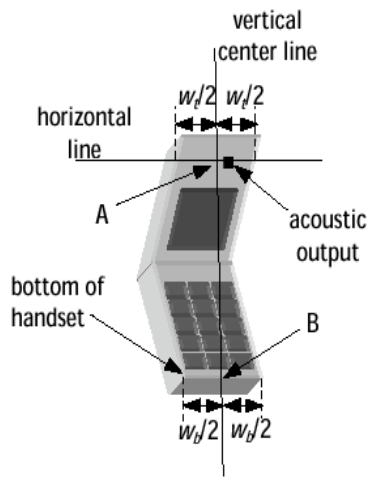

Figure 8.2.1-2 Handset vertical and horizontal reference lines – “clam-shell”

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).

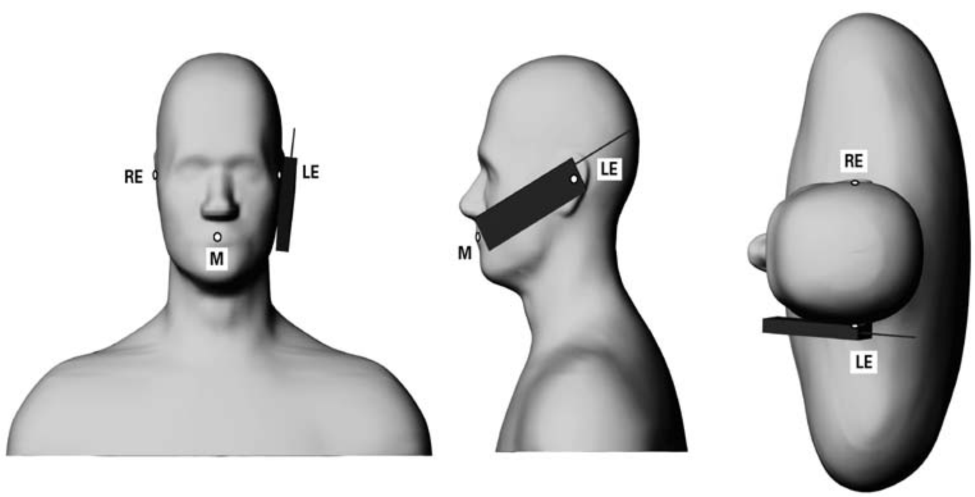

Figure 8.2.1-3 Phone position 1, "cheek" or "touch" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only.

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**.**

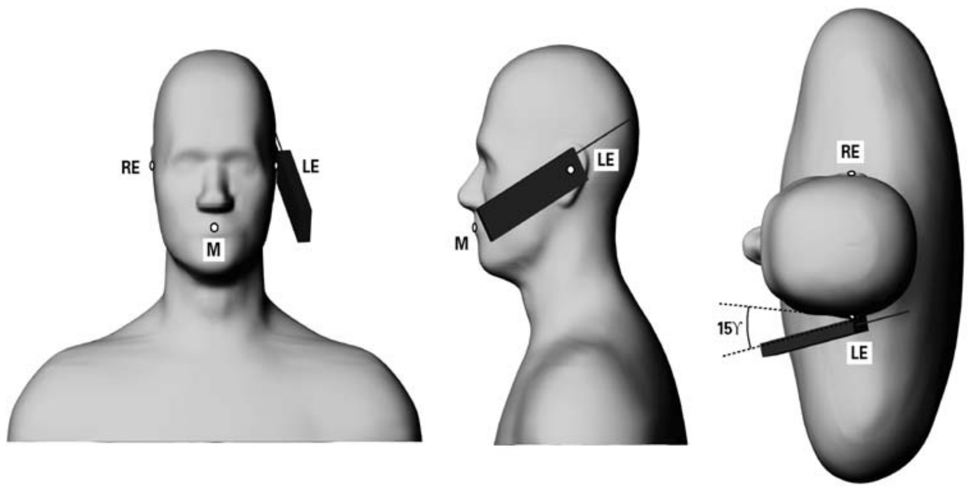

Figure 8.2.1-4 Phone position 2, "tilted position." The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only.

8.2.2 Body-worn Configuration

Body-worn configurations, as shown in appendix E, have been test with the device for RF exposure compliance. The device was tested with a holster and/or a minimum separation distance. The device was tested with 15 mm BLACKBERRY recommended separation distance to allow typical after-market holster to be used. For holster testing the 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. BLACKBERRY 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
(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	1	1	±6.0 %	±6.0 %	∞
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^m	±2.4 %	R	$\sqrt{3}$	1	1	±1.4 %	±1.4 %	∞
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.	±2.0 %	R	$\sqrt{3}$	1	1	±1.2 %	±1.2 %	∞
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^p	±0 %	R	$\sqrt{3}$	1	1	±0.0 %	±0.0 %	∞
Phantom and Setup								
Phantom Uncertainty	±6.1 %	R	$\sqrt{3}$	1	1	±3.5 %	±3.5 %	∞
SAR correction	±1.9 %	R	$\sqrt{3}$	1	0.84	±1.1 %	±0.9 %	∞
Liquid Conductivity (mea.)^{DAK}	±2.5 %	R	$\sqrt{3}$	0.78	0.71	±1.1 %	±1.0 %	∞
Liquid Permittivity (mea.) ^{DAK}	±2.5 %	R	$\sqrt{3}$	0.26	0.26	±0.3 %	±0.4 %	∞
Temp. unc. - Conductivity ^{BB}	±3.4 %	R	$\sqrt{3}$	0.78	0.71	±1.5 %	±1.4 %	∞
Temp. unc. - Permittivity ^{BB}	±0.4 %	R	$\sqrt{3}$	0.23	0.26	±0.1 %	±0.1 %	∞
Combined Std. Uncertainty						±11.2 %	±11.1 %	361
Expanded STD Uncertainty						**±22.3 %**	**±22.2 %**	

Table 10.0-1 Worst-Case uncertainty budget for DASY5 assessed according to IEEE P1528-2013.
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
(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 P1528-2013 Source: Schmid & Partner Engineering AG.

DASY5 Uncertainty Budget

(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 %	∞
Modulation Response^m	±2.4 %	R	$\sqrt{3}$	1	1	±1.4 %	±1.4 %	∞
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	±6.7 %	R	$\sqrt{3}$	1	1	±3.9 %	±3.9 %	∞
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 %	∞
Power Scaling^p	±0 %	R	$\sqrt{3}$	1	1	±0.0 %	±0.0 %	∞
Phantom and Setup								
Phantom Uncertainty	±6.6 %	R	$\sqrt{3}$	1	1	±3.8 %	±3.8 %	∞
SAR correction	±1.9 %	R	$\sqrt{3}$	1	0.84	±1.1 %	±0.9 %	∞
Liquid Conductivity (mea.)^{DAK}	±2.5 %	R	$\sqrt{3}$	0.78	0.71	±1.1 %	±1.0 %	∞
Liquid Permittivity (mea.) ^{DAK}	±2.5 %	R	$\sqrt{3}$	0.26	0.26	±0.3 %	±0.4 %	∞
Temp. unc. - Conductivity ^{BB}	±3.4 %	R	$\sqrt{3}$	0.78	0.71	±1.5 %	±1.4 %	∞
Temp. unc. - Permittivity ^{BB}	±0.4 %	R	$\sqrt{3}$	0.23	0.26	±0.1 %	±0.1 %	∞
Combined Std. Uncertainty						±12.3 %	±12.2 %	748
Expanded STD Uncertainty						**±24.6 %**	**±24.5 %**	

Table 10.0-3 Worst-Case uncertainty budget for DASY52 assessed according to IEEE P1528-2013.
Source: Schmid & Partner Engineering AG.

11.0 TEST RESULTS

11.1 SAR Measurement results at highest power measured against the head

Measured/Extrapolated SAR Values - Head - GSM/EDGE/DTM 850 MHz								
Channel	Freq. (MHz)	Time Slots	Position	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
				Declared	Measured		Extrapolated	Reported
128	824.2	1	Right Cheek					
190	836.6	1	Right Cheek	32.2	31.9	0.09	0.23	0.25
251	848.8	1	Right Cheek					
190	836.6	2	Right Cheek					
190	836.6	3	Right Cheek	29.5	29.2	-0.26	0.35	0.38
190	836.6	3	Right 15° Tilt	29.5	29.2	-0.20	0.28	0.30
190	836.6	1	Left Cheek	32.2	31.9	0.07	0.39	0.42
190	836.6	2	Left Cheek	30.5	29.9	-0.02	0.44	0.51
128	824.2	3	Left Cheek	29.5	29.1	-0.06	0.47	0.52
190	836.6	3	Left Cheek	29.5	29.2	0.33	0.45	0.48
251	848.8	3	Left Cheek	29.5	28.8	-0.04	0.41	0.48
190	836.6	3	Left 15° Tilt	29.5	29.2	0.09	0.25	0.27

Table 11.1-1 SAR results for GSM/EDGE/DTM 850 head configuration (measured on RHB121LW)

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 reported SAR ≤ 0.8 W/Kg or 3dB lower than the limit.

Note 3a: For Fast SAR a zoom scan is required for each head position with 1g measured SAR ≥ 0.8 W/Kg and one additional zoom scan to cover all the remaining head positions. The scan is done on the worst case for the position(s)

Note 3b: For Fast SAR the technique cannot be utilized when 1g measured SAR ≥ 1.2 W/Kg, an error message occurs, or difference between the zoom and area scan 1g SAR ≥ 0.1 W/kg for that configuration.

Note 4: A 2nd scan is required when 1g measured SAR ≥ 0.8 W/Kg. A 3rd scan is required when the 1g measured SAR ≥ 1.45 W/Kg or the 2nd scan SAR differs more than 20%. A 4th scan is required when the 1g measured SAR ≥ 1.50 W/Kg or the previous measurements differ more than 20%.

Measured/Extrapolated SAR Values - Head - WCDMA FDD V 850 MHz							
Channel	Freq. (MHz)	Position	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
			Declared	Measured		Extrapolated	Reported
4132	826.4	Right Cheek					
4182	836.4	Right Cheek	24.6	24.4	-0.03	0.44	0.46
4233	846.6	Right Cheek					
4182	836.4	Right 15° Tilt	24.6	24.4	-0.01	0.36	0.38
4132	826.4	Left Cheek	24.7	24.6	0.11	0.56	0.57
4182	836.4	Left Cheek	24.6	24.4	-0.04	0.62	0.65
4233	846.6	Left Cheek	24.5	24.3	0.04	0.64	0.67
4182	836.4	Left 15° Tilt	24.6	24.4	-0.01	0.35	0.37

Table 11.1-2 SAR results for WCDMA FDD V head configuration (measured on RHB121LW)

Measured/Extrapolated SAR Values - Head - GSM/EDGE/DTM 1900 MHz								
Channel	Freq. (MHz)	Time Slots	Position	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
				Declared	Measured		Extrapolated	Reported
661	1880.0	1	Right Cheek	29.5	29.2	-0.01	0.27	0.29
661	1880.0	2	Right Cheek	29.2	29.1	-0.16	0.49	0.50
661	1880.0	3	Right Cheek	26.7	26.4	-0.01	0.35	0.38
661	1880.0	2	Right 15° Tilt	29.2	29.1	-0.05	0.20	0.20
661	1880.0	1	Left Cheek	29.5	29.2	0.20	0.40	0.43
512	1850.2	2	Left Cheek	29.2	29.1	-0.01	0.64	0.65
661	1880.0	2	Left Cheek	29.2	29.1	0.13	0.58	0.59
810	1909.8	2	Left Cheek	29.2	28.8	-0.04	0.41	0.45
661	1880.0	3	Left Cheek	26.7	26.4	-0.14	0.48	0.51
661	1880.0	2	Left 15° Tilt	29.1	29.1	-0.06	0.24	0.24

Table 11.1-3 SAR results for GSM/EDGE/DTM 1900 head configuration (measured on RHB121LW)

Measured/Extrapolated SAR Values - Head - WCDMA FDD II 1900 MHz							
Channel	Freq. (MHz)	Position	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
			Declared	Measured		Extrapolated	Reported
9262	1852.4	Right Cheek					
9400	1880.0	Right Cheek	23.5	22.95	0.05	0.53	0.60
9538	1907.6	Right Cheek					
9400	1880.0	Right 15° Tilt	23.5	22.95	0.00	0.34	0.39
9262	1852.4	Left Cheek	23.6	23.10	0.05	0.88	0.99
9400	1880.0	Left Cheek	23.5	23.95	-0.10	0.84	0.76
9538	1907.6	Left Cheek	23.5	22.98	0.09	0.94	**1.06**
9400	1880.0	Left 15° Tilt	23.5	23.95	-0.11	0.35	0.32
9538	1907.6	Left Cheek 2nd	23.5	22.98	0.15	0.91	1.03

Table 11.1-4 SAR results for WCDMA FDD II head configuration (measured on RHB121LW)

Measured/Extrapolated SAR Values - Head - 802.11b 2450 MHz							
Channel	Freq. (MHz)	Position	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
			Declared	Measured		Extrapolated	Reported
1	2412.0	Right Cheek	21.7	19.7	0.04	0.33	0.52
6	2437.0	Right Cheek	22.0	20.0	-0.01	0.36	0.57
11	2462.0	Right Cheek	21.7	19.7	0.04	0.34	0.54
6	2437.0	Right 15° Tilt	22.0	20.0	0.04	0.32	0.51
1	2412.0	Left Cheek					
6	2437.0	Left Cheek	22.0	20.0	0.01	0.23	0.36
11	2462.0	Left Cheek					
6	2437.0	Left 15° Tilt	22.0	20.0	0.02	0.29	0.46

Table 11.1-5a results for Wi-Fi/WLAN/802.11b head configuration (measured on RHA111LW)

Note: SAR measurements were performed on the highest output power channel

Measured/Extrapolated SAR Values - Head Spot Check - 802.11b 2450 MHz							
Channel	Freq. (MHz)	Position	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
			Declared	Measured		Extrapolated	Reported
1	2412.0	Right Cheek					
6	2437.0	Right Cheek	22.0	20.0	-0.03	0.42	0.67
11	2462.0	Right Cheek					
6	2437.0	Right 15° Tilt					
1	2412.0	Left Cheek					
6	2437.0	Left Cheek	22.0	20.0	0.12	0.28	0.44
11	2462.0	Left Cheek					
6	2437.0	Left 15° Tilt	22.0	20.0	0.08	0.32	0.51

Table 11.1-5b Spot check results for Wi-Fi/WLAN/802.11b head configuration (measured on RHB121LW)

Note: RHB121LW has a modified band pass filter due to LTE band 7 so a spot check was done on the worst case SAR from RHA111LW

Measured/Extrapolated SAR Values - Head - Bluetooth 2450 MHz							
Channel	Freq. (MHz)	Position	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
			Declared	Measured		Extrapolated	Reported
0	2402.0	Right Cheek					
39	2441.0	Right Cheek	10.95	10.9	0.17	0.03	0.03
78	2480.0	Right Cheek					
39	2441.0	Right 15° Tilt	10.95	10.9	0.18	0.03	0.03
0	2402.0	Left Cheek					
39	2441.0	Left Cheek	10.95	10.9	0.72	0.02	0.02
78	2480.0	Left Cheek					
		Left 15° Tilt					

Table 11.1-6 SAR results for Bluetooth head configuration (measured on RHA111LW)

Note 1: SAR measurements were performed on the highest output power channel
Note 2: Spot checks were not done on RHB121LW due to the extremely low SAR of Bluetooth

Measured/Extrapolated SAR Values - Head - 802.11a 5000 MHz							
Channel	Freq. (MHz)	Position	Cond. Output Power (dBm)		Power	1g SAR (W/Kg)	
			Declared	Measured	Drift (dB)	Extrapolated	Reported
36*	5180.0	Right Cheek	21.0	20.2	0.05	0.48	0.58
48*	5240.0	Right Cheek					
52*	5260.0	Right Cheek	21.0	20.1	0.29	0.58	0.71
56	5280.0	Right Cheek	21.0	20.0	0.04	0.19	0.24
60	5300.0	Right Cheek					
64*	5320.0	Right Cheek	21.0	20.0	-0.19	0.11	0.14
104*	5520.0	Right Cheek	21.0	19.6	-0.12	0.46	0.63
116*	5580.0	Right Cheek					
124*	5620.0	Right Cheek					
136*	5680.0	Right Cheek					
149*	5745.0	Right Cheek					
153	5765.0	Right Cheek	18.6	16.6	0.08	0.28	0.44
157*	5785.0	Right Cheek					
165*	5825.0	Right Cheek					
52*	5260.0	Right 15° Tilt	21.0	20.1	0.03	0.80	0.98
64*	5320.0	Right 15° Tilt	21.0	20.0	0.02	0.13	0.16
104*	5520.0	Right 15° Tilt	21.0	19.6	-0.05	0.56	0.77
36*	5180.0	Left Cheek	21.0	20.2	-0.33	0.52	0.63
48*	5240.0	Left Cheek					
52*	5260.0	Left Cheek	21.0	20.1	0.36	0.50	0.62
56	5280.0	Left Cheek					
64*	5320.0	Left Cheek					
104*	5520.0	Left Cheek	21.0	19.6	0.28	0.44	0.61
116*	5580.0	Left Cheek					
124*	5620.0	Left Cheek					
136*	5680.0	Left Cheek					
149*	5745.0	Left Cheek					
153	5765.0	Left Cheek	18.6	16.6	0.11	0.40	0.63
157*	5785.0	Left Cheek					
165*	5825.0	Left Cheek					
52*	5260.0	Left 15° Tilt	21.0	20.1	0.24	0.47	0.58

Table 11.1-7 SAR results for 802.11a head configuration (measured on RHA111LW)

Note 1: SAR measurements were performed on the highest output power channel for each sub band.
Note 2: "*" marks default test channels of each sub band which need to be tested if SAR is more than half of the limit. The default channels were tested on the sub band with the highest measured SAR on the worst case position even if SAR is less than half the limit.

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

Measured/Extrapolated SAR Values - Hotspot/Body-Worn Rev 1 - GSM/EDGE/GPRS 850 MHz									
Ch.	Freq. (MHz)	Time Slots	spacing (cm)/ holster	Side Facing Phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
					Declared	Measured		Extrapolated	Reported
Hotspot Configuration									
128	824.2	1	1.0	Back	30.9	30.3	-0.06	0.39	0.45
190	836.6	1	1.0	Back	30.9	30.5	-0.03	0.37	0.41
251	848.8	1	1.0	Back	30.9	30.0	0.00	0.35	0.43
190	836.6	2	1.0	Back	27.8	27.4	0.01	0.27	0.30
190	836.6	3	1.0	Back	26.1	26.1	0.02	0.29	0.29
190	836.6	4	1.0	Back	24.8	24.3	0.04	0.26	0.29
128	824.2	1	1.0	Front	30.9	30.3	-0.06	0.26	0.30
128	824.2	1	1.0	Left	30.9	30.3	0.00	0.39	0.45
128	824.2	1	1.0	Right	30.9	30.3	-0.01	0.19	0.22
128	824.2	1	1.0	Bottom	30.9	30.3	0.02	0.06	0.07
			1.0	+HS					
Body-Worn Configuration									
128	824.2	1	1.5	Back	32.2	32.2	-0.05	0.64	0.64
190	836.6	1	1.5	Back	32.2	31.9	-0.17	0.63	0.68
251	848.8	1	1.5	Back	32.2	32.0	-0.03	0.55	0.58
190	836.6	2	1.5	Back	30.5	30.2	-0.07	0.54	0.58
190	836.6	3	1.5	Back	29.5	29.4	-0.03	0.65	0.67
190	836.6	4	1.5	Back	27.5	27.4	0.01	0.51	0.52
190	836.6	1	1.5	Front	32.2	31.9	0.05	0.50	0.54
190	836.6	1	Holster	Back	32.2	31.9	-0.01	0.53	0.57

Table 11.2-1a SAR results for GSM/EDGE/GPRS 850 body-worn and Hotspot configurations on Rev 1 (measured on RHB121LW)

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 reported SAR ≤ 0.8 W/Kg or 3dB lower than the limit.
Note 3a: For Fast SAR a zoom scan is required for each head position with 1g measured SAR ≥ 0.8 W/Kg and one additional zoom scan to cover all the remaining head positions. The scan is done on the worst case for the position(s)
Note 3b: For Fast SAR the technique cannot be utilized when 1g measured SAR ≥ 1.2 W/Kg, an error message occurs, or difference between the zoom and area scan 1g SAR ≥ 0.1 W/kg for that configuration.
Note 4: A 2nd scan is required when 1g measured SAR ≥ 0.8 W/Kg. A 3rd scan is required when the 1g measured SAR ≥ 1.45 W/Kg or the 2nd scan SAR differs more than 20%. A 4th scan is required when the 1g measured SAR ≥ 1.50 W/Kg or the previous measurements differ more than 20%.
Note 5: Device was tested with 15 mm BLACKBERRY recommended separation distance to allow typical after-market holster to be used.
Note 6: 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.

Measured/Extrapolated SAR Values - Hotspot/Body-Worn Rev 2 - GSM/EDGE/GPRS 850 MHz									
Ch.	Freq. (MHz)	Time Slots	spacing (cm)/ holster	Side Facing Phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
					Declared	Measured		Extrapolated	Reported
Hotspot Configuration									
128	824.2	1	1.0	Back	32.2	32.2	-0.03	0.41	0.41
190	836.6	1	1.0	Back	32.2	31.9	0.01	0.44	0.47
251	848.8	1	1.0	Back	32.2	32.0	0.00	0.38	0.40

Table 11.2-1b SAR results for GSM/EDGE/GPRS 850 body-worn and Hotspot configurations on Rev2 (measured on RHB121LW)

Note: There is no longer power reduction on Hotspot mode for Rev 2, so a spot check was done on the worst case position from Rev 1 to find the highest SAR measurements.

Measured/Extrapolated SAR Values - Hotspot/Body-Worn Rev 1 - WCDMA FDD V 850 MHz								
Ch.	Freq. (MHz)	spacing (cm)/ holster	Side Facing Phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
				Declared	Measured		Extrapolated	Reported
Hotspot Configuration								
4132	826.4	1.0	Back	21.7	21.2	-0.01	0.33	0.37
4182	836.4	1.0	Back	21.6	21.0	0.06	0.33	0.38
4233	846.6	1.0	Back	21.5	20.8	0.03	0.32	0.38
4182	836.4	1.0	Front	21.6	21.0	0.06	0.25	0.29
4182	836.4	1.0	Left	21.6	21.0	0.08	0.36	0.41
4182	836.4	1.0	Right	21.6	21.0	0.01	0.15	0.17
4182	836.4	1.0	Bottom	21.6	21.0	0.03	0.13	0.15
		1.0	+HS					0.00
Body-Worn Configuration								
4132	826.4	1.5	Back	24.7	24.6	0.00	0.59	0.60
4182	836.4	1.5	Back	24.6	24.4	0.04	0.60	0.63
4233	846.6	1.5	Back	24.5	24.3	-0.10	0.58	0.61
4182	836.4	1.5	Front	24.6	24.4	-0.07	0.49	0.51
4182	836.4	Holster	Back	24.6	24.4	-0.16	0.52	0.54

Table 11.2-2a SAR results for WCDMA FDD V body-worn and Hotspot configurations on Rev 1 (measured on RHB121LW)

Measured/Extrapolated SAR Values - Hotspot/Body-Worn Rev 2 - WCDMA FDD V 850 MHz								
Ch.	Freq. (MHz)	spacing (cm)/ holster	Side Facing Phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
				Declared	Measured		Extrapolated	Reported
Hotspot Configuration								
4132	826.4	1.0	Back	24.7	24.6	0.01	0.86	0.88
4182	836.4	1.0	Back	24.6	24.4	-0.01	0.85	0.89
4233	846.6	1.0	Back	24.5	24.3	0.00	0.81	0.85
4182	836.4	1.0	Front					0.00
4182	836.4	1.0	Left					0.00
4182	836.4	1.0	Right					0.00
4182	836.4	1.0	Bottom					0.00
4132	826.4	1.0	Back 2nd	24.7	24.6	0.00	0.83	0.85

Table 11.2-2b SAR results for WCDMA FDD V body-worn and Hotspot configurations on Rev 2 (measured on RHB121LW)

Note: There is no longer power reduction on Hotspot mode for Rev 2, so a spot check was done on the worst case position from Rev 1 to find the highest SAR measurements.

Measured/Extrapolated SAR Values - Hotspot/Body-Worn - GSM/EDGE/GPRS 1900 MHz									
Ch.	Freq. (MHz)	Time Slots	spacing (cm)/ holster	Side Facing Phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
					Declared	Measured		Extrapolated	Reported
Hotspot Configuration									
661	1880.0	1	1.0	Back	29.5	29.2	-0.08	0.43	0.46
512	1850.2	2	1.0	Back	29.2	29.1	0.04	0.84	0.86
661	1880.0	2	1.0	Back	29.2	29.1	-0.24	0.83	0.85
810	1909.8	2	1.0	Back	29.2	28.8	-0.05	0.86	0.94
661	1880.0	3	1.0	Back	26.7	26.4	-0.19	0.59	0.63
661	1880.0	4	1.0	Back	26.0	25.8	0.10	0.63	0.66
661	1880.0	2	1.0	Front	29.0	29.1	0.12	0.46	0.45
661	1880.0	2	1.0	Left	29.0	29.1	0.00	0.24	0.23
661	1880.0	2	1.0	Right	29.0	29.1	-0.12	0.04	0.04
661	1880.0	2	1.0	Bottom	29.0	29.1	0.00	0.29	0.28
810	1909.8	2	1.0	Back 2nd	29.0	28.8	-0.13	0.85	0.89
			1.0	+HS					
Body-Worn Configuration									
661	1880.0	1	1.5	Back	29.5	29.2	0.25	0.22	0.24
512	1850.2	2	1.5	Back	29.2	29.1	-0.07	0.39	0.40
661	1880.0	2	1.5	Back	29.2	29.1	-0.04	0.40	0.41
810	1909.8	2	1.5	Back	29.2	28.8	0.00	0.41	0.45
661	1880.0	3	1.5	Back	26.7	26.4	-0.15	0.32	0.34
661	1880.0	4	1.5	Back	26.0	25.8	-0.13	0.35	0.37
661	1880.0	2	1.5	Front	29.2	29.1	0.12	0.25	0.26
661	1880.0	2	Holster	Back	29.2	29.1	0.05	0.23	0.24

Table 11.2-3 SAR results for GSM/EDGE/GPRS 1900 body-worn and Hotspot configurations (measured on RHB121LW)

Measured/Extrapolated SAR Values - Hotspot/Body-Worn - WCDMA FDD II 1900 MHz								
Ch.	Freq. (MHz)	spacing (cm)/ holster	Side Facing Phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
				Declared	Measured		Extrapolated	Reported
Hotspot Configuration								
9262	1852.4	1.0	Back	23.6	23.10	0.08	1.18	**1.32**
9400	1880.0	1.0	Back	23.5	22.95	0.02	1.09	1.24
9538	1907.6	1.0	Back	23.5	22.98	0.09	1.16	1.31
9400	1880.0	1.0	Front	23.5	22.95	0.01	0.89	1.01
9400	1880.0	1.0	Left	23.5	22.95	-0.02	0.30	0.34
9400	1880.0	1.0	Right	23.5	22.95	0.02	0.08	0.09
9400	1880.0	1.0	Bottom	23.5	22.95	0.17	0.51	0.58
9262	1852.4	1.0	Back 2nd	23.6	23.10	0.06	1.16	1.30
9262	1852.4	1.0	Front	23.6	23.10	0.13	0.77	0.86
9538	1907.6	1.0	Front	23.5	22.98	0.14	0.74	0.83
Body-Worn Configuration								
9262	1852.4	1.5	Back	23.6	23.10	0.04	0.64	0.72
9400	1880.0	1.5	Back	23.5	22.95	-0.06	0.59	0.67
9538	1907.6	1.5	Back	23.5	22.98	0.04	0.66	0.74
9400	1880.0	1.5	Front	23.5	22.95	0.05	0.44	0.50
9400	1880.0	Holster	Back	23.5	22.82	0.03	0.28	0.33

Table 11.2-4 SAR results for WCDMA FDD II body-worn and Hotspot configurations (measured on RHB121LW)

Measured/Extrapolated SAR Values - Hotspot/Body-Worn - 802.11b 2450 MHz								
Ch.	Freq. (MHz)	spacing (cm)/ holster	Side Facing Phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
				Declared	Measured		Extrapolated	Reported
Hotspot Configuration								
1	2412	1.0	Back	21.7	19.7	0.03	0.31	0.49
6	2437	1.0	Back	22.0	20.0	0.06	0.38	0.60
11	2462	1.0	Back	21.7	19.7	0.01	0.36	0.57
6	2437	1.0	Front	22.0	20.0	0.12	0.09	0.14
6	2437	1.0	Left	22.0	20.0	0.00	0.15	0.24
6	2437	1.0	Right	22.0	20.0	0.07	0.02	0.03
6	2437	1.0	Top	22.0	20.0	0.03	0.14	0.22
6	2437	1.0	Bottom					
		1.0	+HS					
Body-Worn Configuration								
1	2412	1.5	Back	21.7	19.7	0.01	0.14	0.22
6	2437	1.5	Back	22.0	20.0	0.06	0.16	0.25
11	2462	1.5	Back	21.7	19.7	0.07	0.16	0.25
6	2437	1.5	Front	22.0	20.0	0.01	0.04	0.06
6	2437	Holster	Back	22.0	20.0	0.06	0.09	0.14

Table 11.2-5a SAR results for Wi-Fi/WLAN/802.11b body-worn and Hotspot configurations (measured on RHA111LW)

Note: SAR measurements were performed on the highest output power channel

easured/Extrapolated SAR Values - Hotspot/Body-Worn Spot Check - 802.11b 2450 MH								
Ch.	Freq. (MHz)	spacing (cm)/ holster	Side Facing Phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
				Declared	Measured		Extrapolated	Reported
Hotspot Configuration								
1	2412	1.0	Back					
6	2437	1.0	Back	22.0	20.0	-0.09	0.40	0.63
11	2462	1.0	Back					
Body-Worn Configuration								
1	2412	1.5	Back					
6	2437	1.5	Back	22.0	20.0	-0.04	0.18	0.29
11	2462	1.5	Back					

Table 11.2-5b SAR spot check results for Wi-Fi/WLAN/802.11b body-worn and Hotspot configurations (measured on RHB121LW)

Note: RHB121LW has a modified band pass filter due to LTE band 7 so a spot check was done on the worst case SAR from RHA111LW

Measured/Extrapolated SAR Values - Hotspot/Body-Worn - Bluetooth 2450 MHz								
Ch.	Freq. (MHz)	spacing (cm)/ holster	Side Facing Phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
				Declared	Measured		Extrapolated	Reported
Hotspot Configuration								
0	2402	1.0	Back					
39	2441	1.0	Back	10.95	10.9	-0.12	0.03	0.03
78	2480	1.0	Back					
Body-Worn Configuration								
39	2441	1.5	Back	10.95	10.9	-0.19	0.01	0.01

Table 11.2-6 SAR results for Bluetooth body-worn and Hotspot configurations (measured on RHA111LW)

Note 1: SAR measurements were performed on the highest output power channel
Note 2: Spot checks were not done on RHB121LW due to the extremely low SAR of Bluetooth

Measured/Extrapolated SAR Values - Hotspot - 802.11a 5000 MHz								
Ch.	Freq. (MHz)	spacing (cm)/ holster	Side Facing Phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
				Declared	Measured		Extrapolated	Reported
36*	5180	1.0	Back	16.0	15.7	0.13	0.39	0.42
40	5200	1.0	Back					
44	5220	1.0	Back					
48*	5240	1.0	Back					
149*	5745	1.0	Back	15.7	13.7	0.18	0.28	0.44
153	5765	1.0	Back					
157*	5785	1.0	Back	15.7	13.7	0.03	0.49	0.78
161	5805	1.0	Back					
165*	5825	1.0	Back	15.7	13.8	0.15	0.30	0.46
157*	5785	1.0	Front	15.7	13.7	-0.11	0.02	0.03
157*	5785	1.0	Left	15.7	13.7	-0.11	0.13	0.21
157*	5785	1.0	Right					
157*	5785	1.0	Top	15.7	13.7	0.36	0.23	0.36
????	????	1.0	+HS					

Table 11.2-7 SAR results for 802.11a Hotspot configuration (measured on RHB121LW)

Note 1: Testing was done on RHB121LW instead of RHA111LW because RHB1211LW has different power reduction levels in hotspot mode.
Note 2: SAR measurements were performed on the highest output power channel for each sub band.
Note 3: "*" marks default test channels of each sub band which need to be tested if SAR is more than half of the limit. The default channels were tested on the sub band with the highest measured SAR on the worst case position even if SAR is less than half the limit.

Measured/Extrapolated SAR Values - Body-Worn - 802.11a 5000 MHz								
Ch.	Freq. (MHz)	spacing (cm)/ holster	Side Facing Phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
				Declared	Measured		Extrapolated	Reported
36*	5180	1.5	Back	21.0	20.2	-0.05	0.82	0.99
40	5200	1.5	Back					
44	5220	1.5	Back					
48*	5240	1.5	Back	21.0	20.0	0.10	0.14	0.18
52*	5260	1.5	Back	21.0	20.1	0.09	0.63	0.78
56	5280	1.5	Back					
60	5300	1.5	Back					
64*	5320	1.5	Back					
104*	5520	1.5	Back	21.0	19.6	0.20	0.50	0.69
116*	5580	1.5	Back					
124*	5620	1.5	Back					
136*	5680	1.5	Back					
149*	5745	1.5	Back	18.6	16.6	0.22	0.23	0.36
153	5765	1.5	Back	18.6	16.6	-0.01	0.66	**1.05**
157*	5785	1.5	Back	18.6	16.6	-0.17	0.65	1.03
161	5805	1.5	Back					
165*	5825	1.5	Back	18.4	16.4	0.55	0.25	0.40
153	5765	1.5	Front	18.6	16.6	-0.21	0.03	0.05
153	5765	Holster	Back	18.6	16.6	0.00	0.46	0.73

Table 11.2-8 SAR results for 802.11a body-worn configuration (measured on RHA111LW)

Note 1: SAR measurements were performed on the highest output power channel for each sub band.
Note 2: "*" marks default test channels of each sub band which need to be tested if SAR is more than half of the limit. The default channels were tested on the sub band with the highest measured SAR on the worst case position even if SAR is less than half the limit.

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