SAR Compliance Test Report

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

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

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

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RTS is accredited according to EN ISO/IEC 17025 by:

SCC Accredited LAB
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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	Back bottom centre (main licensed transmitters)
Configuration	Internal fixed antenna

Table 1.2.1. Antenna description

1.3 Device description

Device Model	RFH121LW			
FCC ID	L6ARFH120LW			
PIN	Radiated: 2A781058 (Rev 1), 25B217A1 (Rev 2) Conducted: 2A781880 (Rev 1), 25B217A6 (Rev 2), 25B217AC (Rev 3)			
Hardware Rev	Rev 1, Rev 2 , Rev 3			
Software Version	127.0.1.1998, 10.0.9.299/380/542/785/1107			
Prototype or Production Unit	Production			
Mode(s) of Operation	1-slot GSM 850 GSM 1900	2-slots EDGE/GPRS 850/1900	3-slots EDGE/GPRS 850/1900	4-slots EDGE/GPRS 850/1900
Nominal Maximum conducted RF Output Power (dBm)	33.5 28.5	31.5 28.5	30.0 28.5	27.5 28.5
Tolerance in Power Setting on centre channel (dB)	± 0.5	± 0.5	± 0.5	± 0.5
Duty Cycle	1:8	2:8	3:8	4:8
Transmitting Frequency Range (MHz)	824.2 – 848.8 1850.2 – 1909.8	824.2 – 848.8 1850.2 – 1909.8	824.2 – 848.8 1850.2 – 1909.8	824.2 – 848.8 1850.2 – 1909.8
Mode(s) of Operation	802.11a/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)	14.0	14.5	14.0	13.5
Tolerance in Power Setting on centre channel (dB)	± 0.5	± 0.5	± 0.5	± 0.5
Duty Cycle	1:1	1:1	1:1	1:1

Transmitting Frequency Range (MHz)	5180-5240	5260-5320	5500-5700	5749-5825
Mode(s) of Operation	802.11b	802.11g	802.11n	Bluetooth
Nominal Maximum conducted RF Output Power (dBm)	17.0	16.5	16.5	7.71
Tolerance in Power Setting on centre channel (dB)	± 0.5	± 0.5	± 0.5	N/A
Duty Cycle	1:1	1:1	1:1	N/A
Transmitting Frequency Range (MHz)	2412-2462	2412-2462	2412-2462	2402-2483
Mode(s) of Operation	HSPA+ WCDMA/UMTS FDD V (850)	NFC		
Nominal Maximum conducted RF Output Power (dBm)	24.5	N/A		
Tolerance in Power Setting on centre channel (dB)	± 0.5	N/A		
Duty Cycle	1:1	N/A		
Transmitting Frequency Range (MHz)	824.6 – 846.6	13.56		

Table 1.3.1. Test device characterization non-LTE U.S. wireless operating modes/bands

Note 1: The BlackBerry model: RFH121LW also supports GSM/GPRS/EDGE 900/1800 MHz, UMTS/HSPA+ Bands I & VIII, and LTE Bands 3, 7, 8, & 20 that are not operational in North America, therefore no data is presented in this report for those bands.

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

1.4 Body worn accessories (holsters)

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

Number	Holster Type	Part Number	Separation distance (mm)
1	Vertical Holster	HDW-49270-001	19
2	Vertical Holster, Black Leather	HDW-49272-001	19

Table 1.4.1. Body worn holster

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

Please refer to Appendix E.

Figure 1.4.1. Body-worn holster

1.5 Headset

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

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

1.6 Battery

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

1) BAT-47277-001

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 WiFi to transmit at maximum power and duty cycle for each band, channel, and modulation.

1.8 Highlights of the FCC OET SAR Measurement Requirements

1.8.1 SAR Measurement Procedures for 802.11 a/b/g/n Transmitter

• 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. Probe specification requirements

• Area scan resolution was maintained at 10mm (5-6 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
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 or 3 mm
Zoom Scan (z) Resolution	2.5 mm or 2 mm
Zoom Scan Volume	Minimum 24 x 24 x 20 mm[1]

Table 1.8.2. 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 24x24x20 to 48x40x20 mm.
• Frequency Channel Configuration: 802.11 b/g modes are tested on "default test channels" 1, 6 and 11.

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

802.11b @ 1Mbps		802.11g @ 6Mbps		802.11n @ 6.5 Mbps	
Chan	**Cond. Power (dBm)**	**Chan**	**Cond. Power (dBm)**	**Chan**	**Cond. Power (dBm)**
1	17.10	1	16.60	1	16.40
6	16.60	6	16.10	6	16.10
11	**17.20**	11	16.70	11	16.50
13	16.80	13	16.40	13	16.10

		802.11g			802.11b
		Channel 11			**Channel 11**
tx Rate (Mbps)	**Mod.**	**Cond. Power (dBm)**	**Data Rate (Mbps)**	**Mod.**	**Cond. Power (dBm)**
6	BPSK	16.70	1	BPSK	17.20
9	BPSK	16.60	2	DQPSK	17.20
12	QPSK	16.50	5.5	CCK	17.00
18	QPSK	16.40	11	CCK	16.90
24	16-QAM	16.10			
36	16-QAM	15.80			
48	64-QAM	14.50			
54	64-QAM	14.50			

		802.11 n
		Channel 11
Data Rate (Mbps)	**Mod.**	**Cond. Power (dBm)**
6.5	MCS0	16.50
13	MCS1	16.40
19.5	MCS2	16.30
26	MCS3	16.10
39	MCS4	15.80
52	MCS5	14.50
58.5	MCS6	14.40
65	MCS7	12.30

Table 1.8.3. 802.11 b/g/n modulation type/data rate vs. conducted power with Mobile Hot Spot mode enabled and disabled

802.11a (low band)6Mbps			802.11a (mid band) 6Mbps			802.11a (upper band I) 6Mbps		
Chan	f (MHz)	Cond. Power (dBm)	Chan	f (MHz)	Cond. Power (dBm)	Chan	f (MHz)	Cond. Power (dBm)
36	5180	17.1	52	5260	17.5	104	5520	17.2
40	5200	17.1	56	5280	17.6	116	5580	17.2
44	5220	17.2	60	5300	17.6	124	5620	17.0
48	5240	17.1	64	5320	17.6	140	5700	16.9
						802.11a (upper band II)6Mbps		
						Chan	**f (MHz)**	**Cond. Power (dBm)**
						149	5745	16.9
						153	5765	16.9
						157	5785	16.9
						161	5805	16.7
						165	5825	16.6

Table 1.8.4a. Rev 1 802.11 a/n modulation type/data rate vs. conducted power

802.11a (low band) 6Mbps			802.11a (mid band) 6Mbps			802.11a (upper band I) 6Mbps		
Chan	f (MHz)	Cond. Power (dBm)	Chan	f(MHz)	Cond. Power (dBm)	Chan	f (MHz)	Cond. Power (dBm)
36	5180	14.05	52	5260	14.2	104	5520	14.10
40	5200	14.00	56	5280	14.3	**116**	**5580**	**14.20**
44	5220	14.05	60	5300	14.4	124	5620	14.10
48	**5240**	**14.10**	**64**	**5320**	**14.5**	140	5700	13.80
						802.11a (upper band II) 6Mbps		
						Chan	**f (MHz)**	**Cond. Power (dBm)**
						149	**5745**	**13.70**
						153	5765	13.70
						157	5785	13.60
						161	5805	13.50
						165	5825	13.50

		802.11a (lower band)	802.11a (middle band)	802.11a (upper band I)	802.11a (upper band II)
Data Rate (Mbits)	Mod.	Channel 48	Channel 64	Channel 116	Channel 149
		Cond. Power (dBm)	Cond. Power (dBm)	Cond. Power (dBm)	Cond. Power (dBm)
6	BPSK	14.10	14.50	14.20	13.70
9	BPSK	14.00	14.40	14.20	13.60
12	QPSK	13.80	14.40	14.10	13.50

18	QPSK	13.70	14.20	13.90	13.20
24	16-QAM	13.50	14.00	13.70	13.10
36	16-QAM	13.30	13.70	13.40	12.80
48	64-QAM	13.00	13.40	13.20	12.50
54	64-QAM	13.00	13.30	13.00	12.40
		802.11n (lower band)	**802.11n (middle band)**	**802.11n (upper band I)**	**802.11n (upper band II)**
Mod.		**Channel 48**	**Channel 64**	**Channel 116**	**Channel 149**
		Cond. Power (dBm)	**Cond. Power (dBm)**	**Cond. Power (dBm)**	**Cond. Power (dBm)**
MCS0		14.00	14.40	14.20	13.60
MCS1		13.80	14.20	13.90	13.40
MCS2		13.70	14.00	13.70	13.20
MCS3		13.50	14.00	13.70	13.00
MCS4		13.20	13.70	13.40	12.80
MCS5		13.00	13.30	13.00	12.60
MCS6		12.80	13.20	13.00	12.40
MCS7		12.00	12.30	12.00	11.60

Table 1.8.4b. Rev 2 802.11 a/n modulation type/data rate vs. conducted power

1.8.2 SAR Measurement Requirements for Bluetooth

Channel	Freq (MHz)	Mode	Conducted Transmit Power (dBm)
0	2402	DH5	6.03
39	2441	DH5	7.71
78	2480	DH5	4.91

Table 1.8.5. Bluetooth peak conducted power measurements with Mobile Hot Spot mode enabled and disabled

1.8.3 SAR Measurement Procedures for 3G Devices

WCDMA Handsets

Output Power Verification

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

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

Head SAR Measurements

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

Body SAR Measurements

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

Handsets with HSPA

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

	Band	**FDD V (850)**		
	Channel	4132	4182	4233
	Freq (MHz)	826.4	836.4	846.6
Mode	**Subtest**	**Max burst averaged conducted power (dBm)**		
Rel99	12.2 kbps RMC	24.5	24.3	24.2
Rel99	12.2 kbps, Voice, AMR, SRB 3.4 kbps	24.6	24.4	24.2
Rel6 HSUPA	1	23.6	23.4	23.3
Rel6 HSUPA	2	22.2	22.0	21.7
Rel6 HSUPA	3	23.1	23.0	22.7
Rel6 HSUPA	4	23.4	23.3	23.0
Rel6 HSUPA	5	21.2	21.3	21.1
Rel7 HSDPA+	1	23.7	23.4	23.2
Rel7 HSDPA+	2	23.3	23.1	22.9
Rel7 HSDPA+	3	23.3	23.1	22.9
Rel7 HSDPA+	4	21.9	21.7	21.9

Table 1.8.6. WCDMA (Rel99) / HSPA/HSPA+ conducted power measurements with Mobile Hot Spot mode enabled and disabled

1.8.4 SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities

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

1.9 Highlights of the FCC OET SAR Evaluation Considerations for Handsets with Multiple Transmitters/ Antennas & GSM/GPRS/EDGE Procedure

Unlicensed Transmitters

When there is simultaneous transmission –
Stand-alone SAR not required when
- output ≤ 2·PRef and antenna is > 5.0 cm from other antennas
- output ≤ PRef and antenna is > 2.5 cm from other antennas
- the other antenna(s), which are < 2.5 cm away, has an output ≤ PRef OR max 1g SAR < 1.2 W/kg

Otherwise stand-alone SAR is required
- test SAR on highest output channel for each wireless mode and exposure condition
- if SAR for highest output channel is > 50% of SAR limit, evaluate all channels according to normal procedure

Simultaneous Transmission SAR not required:

Unlicensed only
- when stand-alone 1-g SAR is not required and antenna is > 5 cm from other antennas
- when the other antenna(s), which are < 2.5 cm away, has an output ≤ PRef OR max 1g SAR < 1.2 W/kg

Licensed & Unlicensed
- when the sum of the 1-g SAR is < 1.6 W/kg for each pair of simultaneous transmitting antennas.

or
- when the ratio of SAR to peak SAR separation distance of simultaneous transmitting antenna pair is < 0.3

Simultaneous Transmission SAR required:

Licensed & Unlicensed
- antenna pairs with SAR to antenna separation ratio ≥ 0.3; test is only required for the configuration that results in the highest SAR in standalone configuration for each wireless mode and exposure condition.

	2.45	5.15 – 5.35	5.47 – 5.85	GHz
P_{Ref}	12	6	5	mW
P_{Ref}	10.8	7.8	7.0	dBm
$2 \cdot P_{Ref}$	13.8	10.8	10.0	dBm
Device output power should be rounded to the nearest mW to compare with values in this table.				

Table 1.9.1. Output Power Thresholds for Unlicensed Transmitters

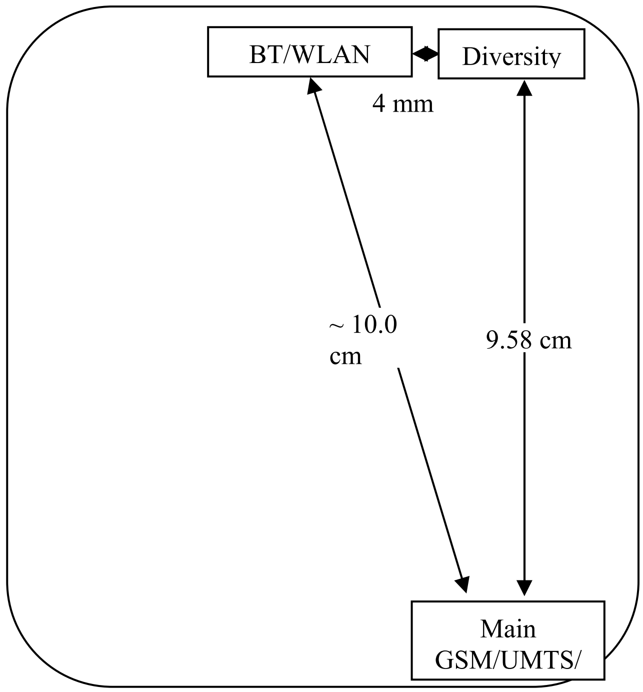

Figure 1.9.1. Back view of device showing closest distance between antenna pairs

1.9.1 Simultaneous Transmission Analysis

Simultaneous Transmission Combination	Head	Body-Worn Accessory	Mobile Hotspot
WCDMA/GSM voice + WiFi 2.4 GHz	Yes	Yes	Yes
WCDMA/GSM voice + WiFi 5.0 GHz	Yes	Yes	No
WCDMA/GSM voice + BT	Yes	Yes	Yes
HSPA/EDGE/GPRS data + WiFi 2.4 GHz	Yes	Yes	Yes
HSPA/EDGE/GPRS data + WiFi 5.0 GHz	Yes	Yes	No
HSPA/EDGE/GPRS data + BT	Yes	Yes	Yes

Table 1.9.2. Simultaneous Transmission Scenarios

Note 1: WCDMA/HSPA/GSM share the same transmitting antenna and cannot transmit simultaneously.
Note 2: WLAN 2.4 GHz/5.0 GHz/BT share the same transmitting antenna and cannot transmit simultaneously.
Note 3: BT Stand-alone SAR test is not required and value of zero is considered for SAR summation.

Test	**Configuration**	**Licensed Transmitters**		**WiFi 2.4 G 1 g avg. SAR (W/kg)**	**Maximum Summation 1 g avg. SAR (W/kg)**
		Band	**1 g avg. SAR (w/kg)**		
Head SAR	Right Cheek	GSM/GPRS/EDGE 850	0.51	0.85	1.36
	Right Cheek	WCDMA band V	0.46		1.31
	Right Cheek	GSM/GPRS/EDGE 1900	0.27		1.12
	Right Tilt	GSM/GPRS/EDGE 850	0.22	1.07	1.29
	Right Tilt	WCDMA band V	0.25		1.32
	Right Tilt	GSM/GPRS/EDGE 1900	0.10		1.17
	Left Cheek	GSM/GPRS/EDGE 850	0.60	0.99	1.59
	Left Cheek	WCDMA band V	0.50		1.49
	Left Cheek	GSM/GPRS/EDGE 1900	0.39		1.38
	Left Tilt	GSM/GPRS/EDGE 850	0.25	0.98	1.23
	Left Tilt	WCDMA band V	0.28		1.26
	Left Tilt	GSM/GPRS/EDGE 1900	0.15		1.13

Table 1.9.3. Highest Head SAR values and summation

Note 1: If sum of 1 g SAR < 1.6 W/kg, Simultaneous SAR measurement is not required.
Note 2: If sum of 1 g SAR > 1.6 W/kg, ratio of SAR to peak separation distance for pair of transmitters calculated.
Note 3: If the ratio of SAR to peak separation distance is < 0.3, Simultaneous SAR measurement is not required.

Test	**Configuration**	**Licensed Transmitters**		**WiFi 5.0G 1 g avg. SAR (W/kg)**	**Maximum Summation 1 g avg. SAR (W/kg)**
		Band	**1 g avg. SAR (w/kg)**		
Body-Worn SAR	15 mm separation, device back	GPRS/EDGE 850	0.40	0.28	0.68
		WCDMA band V	0.41		0.69
		GPRS/EDGE 1900	1.07		1.35
	15 mm separation, device front	GPRS/EDGE 850	0.38	0.15	0.53
		WCDMA band V	0.42		0.57
		GPRS/EDGE 1900	0.55		0.70
	Holster, device back	GPRS/EDGE 850	0.36	0.18	0.54
		GPRS/EDGE 1900	0.47		0.65

Table 1.9.4. Highest Body-worn SAR values for the same configuration

Note 1: If sum of 1 g SAR < 1.6 W/kg, Simultaneous SAR measurement is not required.
Note 2: If sum of 1 g SAR > 1.6 W/kg, ratio of SAR to peak separation distance for pair of transmitters calculated.
Note 3: If the ratio of SAR to peak separation distance is < 0.3, Simultaneous SAR measurement is not required.

Test	Configuration	Licensed Transmitters		WiFi 2.4 G 1 g avg. SAR (W/kg)	Max Sum 1 g avg. SAR (W/kg)
		Band	1 g avg. SAR (w/kg)		
Mobile Hotspot SAR	10 mm separation, device back	GSM/GPRS/EDGE 850	0.96	0.30	1.26
		WCDMA band V	0.56		0.86
		GSM/GPRS/EDGE 1900	0.93		1.23
	10 mm separation, device front	GSM/GPRS/EDGE 850	0.64	0.17	0.81
		WCDMA band V	0.55		0.72
		GSM/GPRS/EDGE 1900	0.75		0.92
	10 mm separation, device left	GSM/GPRS/EDGE 850	0.30	0.04	0.34
		WCDMA band V	0.37		0.41
		GSM/GPRS/EDGE 1900	0.10		0.14
	10 mm separation, device right	GSM/GPRS/EDGE 850	0.34	0.00	0.34
		WCDMA band V	0.44		0.44
		GSM/GPRS/EDGE 1900	0.06		0.06
	10 mm separation, device bottom	GSM/GPRS/EDGE 850	0.08	0.00	0.08
		WCDMA band V	0.08		0.08
		GSM/GPRS/EDGE 1900	1.26		1.26

Table 1.9.5. Highest Mobile Hotspot SAR values for the same configuration

Note 1: If sum of 1 g SAR < 1.6 W/kg, Simultaneous SAR measurement is not required.
Note 2: If sum of 1 g SAR > 1.6 W/kg, ratio of SAR to peak separation distance for pair of transmitters calculated.
Note 3: If the ratio of SAR to peak separation distance is < 0.3, Simultaneous SAR measurement is not required.

BT & GSM/WCDMA:

- BT Stand-alone SAR is not required because the output ≤ 2·PRef and the antenna is > 5.0 cm from other antennas
- BT Simultaneous Transmission SAR is not required because BT Stand-alone SAR is not required.

GSM/WCDMA & WiFi:

- Head Configuration:
  - GSM/EDGE/GPRS & WCDMA Stand-alone SAR is required because they are licensed antennas.
  - Wifi Stand-alone SAR is required because the antenna is > 5.0 cm from other antennas, but the output power > 2·PRef.
  - Simultaneous Transmission is not required as the sum of the 1-g SAR is < 1.6 W/kg.
- Body Configuration:
  - GSM/EDGE/GPRS & WCDMA Stand-alone SAR is required because they are licensed antennas.
  - Wifi Stand-alone SAR is required because the antenna is > 5.0 cm from other antennas, but the output power > 2·PRef.
  - Simultaneous Transmission is not required as the sum of the 1-g SAR is < 1.6 W/kg

- The device supports DTM, GPRS Category Class A/B, and Multi-Slot Class 11/12 with maximum 5-slots
(2/3/4-slots uplink and 3/2/1-slot downlink).
- For body SAR configurations, 2/3/4-slots GPRS (PD) mode was 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.
- Each slot is set to maximum power, but there is software power reduction of ~ 2 dB in multislot modes.
- Please refer to the conducted power measurements table below:

Mode	Freq. (MHz)	Max burst averaged conducted power (dBm) CS1	Max burst averaged conducted power (dBm) MCS1	Max burst averaged conducted power (dBm) MCS5
2-slots GPRS 850 MHz	824.2	31.6	N/A	N/A
	836.8	31.2	N/A	N/A
	848.8	31.0	N/A	N/A
3-slots GPRS 850 MHz	824.2	29.8	N/A	N/A
	836.8	29.7	N/A	N/A
	848.8	29.3	N/A	N/A
4-slots GPRS 850 MHz	824.2	27.7	N/A	N/A
	836.8	27.2	N/A	N/A
	848.8	27.2	N/A	N/A
2-slots EDGE 850 MHz	824.2	31.7	31.7	27.1
	836.8	31.2	31.3	26.8
	848.8	31.0	30.9	26.6
2-slots DTM	824.2	31.4	31.4	31.0/27.0
	836.8	30.9	30.9	31.0/26.7

850 MHz	**848.8**	30.7	30.7	30.7/26.6
3-slots EDGE 850 MHz	**824.2**	30.2	30.1	25.4
	836.8	29.8	29.7	25.2
	848.8	29.2	29.3	25.0
3-slots DTM 850 MHz	**824.2**	30.1	30.1	30.1/25.5
	836.8	29.6	29.7	29.7/25.2
	848.8	29.1	29.2	29.2/25.0
4-slots EDGE 850 MHz	**824.2**	27.7	27.7	23.4
	836.8	27.2	27.2	23.1
	848.8	27.1	27.2	22.9
2-slots GPRS 1900 MHz	**1850.2**	28.1	N/A	N/A
	1880.0	28.0	N/A	N/A
	1909.8	28.1	N/A	N/A
3-slots GPRS 1900 MHz	**1850.2**	26.1	N/A	N/A
	1880.0	25.9	N/A	N/A
	1909.8	25.8	N/A	N/A
4-slots GPRS 1900 MHz	**1850.2**	24.1	N/A	N/A
	1880.0	24.0	N/A	N/A
	1909.8	24.1	N/A	N/A
2-slots EDGE 1900MHz	**1850.2**	28.0	28.1	25.3
	1880.0	27.9	27.9	25.3
	1909.8	27.8	28.1	25.2
2-slots DTM 1900MHz	**1850.2**	27.7	27.8	27.7/25.0
	1880.0	27.6	27.7	27.5/24.9
	1909.8	27.5	27.6	27.5/24.8
3-slots EDGE 1900MHz	**1850.2**	25.4	25.5	23.8
	1880.0	25.4	25.4	23.8
	1909.8	25.4	25.4	23.7
3-slots DTM 1900MHz	**1850.2**	25.6	NA	NA
	1880.0	25.4	NA	NA
	1909.8	25.5	NA	NA
4-slots EDGE 1900MHz	**1850.2**	24.1	24.1	23.4
	1880.0	24.0	23.9	23.4
	1909.8	24.1	24.2	23.3

Mode	Freq. (MHz)	Max burst averaged conducted power (dBm)
1-slot GSM (CS) 850 MHz	**824.2**	33.8
	836.8	33.5
	848.8	33.4
1-slot GSM (CS) 1900 MHz	**1850.2**	29.5
	1880.0	29.6
	1909.8	29.6

1.9.6a. Rev1, GSM/EDGE/GPRS channel vs. conducted power with Mobile Hot Spot mode disabled

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 1900 MHz	1850.2	27.3	N/A	N/A
	1880.0	27.3	N/A	N/A
	1909.8	27.2	N/A	N/A
3-slots GPRS 1900 MHz	1850.2	25.8	N/A	N/A
	1880.0	25.8	N/A	N/A
	1909.8	25.8	N/A	N/A
4-slots GPRS 1900 MHz	1850.2	24.2	N/A	N/A
	1880.0	24.4	N/A	N/A
	1909.8	24.3	N/A	N/A
2-slots EDGE 1900MHz	1850.2	27.2	27.2	24.8
	1880.0	27.3	27.3	24.9
	1909.8	27.2	27.2	24.8
2-slots DTM 1900MHz	1850.2	27.1	27.1	27.1/24.8
	1880.0	27.1	27.1	27.1/24.9
	1909.8	27.1	27.1	27.1/24.8
3-slots EDGE 1900MHz	1850.2	25.8	25.8	23.9
	1880.0	25.8	25.8	23.9
	1909.8	25.8	25.8	23.9
4-slots EDGE 1900MHz	1850.2	24.1	24.1	23.4
	1880.0	24.5	24.5	23.4
	1909.8	24.2	24.2	23.3

1.9.6b. Rev2, GSM/EDGE/GPRS channel vs. conducted power with Mobile Hotspot mode enabled

2-slots GPRS 1900 MHz	1850.2	29.6	N/A	N/A
	1880.0	29.7	N/A	N/A
	1909.8	29.9	N/A	N/A
3-slots GPRS 1900 MHz	1850.2	29.6	N/A	N/A
	1880.0	29.7	N/A	N/A
	1909.8	29.7	N/A	N/A
4-slots GPRS 1900 MHz	1850.2	29.0	N/A	N/A
	1880.0	29.1	N/A	N/A
	1909.8	29.1	N/A	N/A
2-slots	1850.2	29.6	29.6	26.3

EDGE 1900MHz	1880.0	29.7	29.7	26.4
	1909.8	29.9	29.9	26.3
2-slots DTM 1900MHz	1850.2	29.6	29.6	29.6/26.3
	1880.0	29.7	29.7	29.7/26.4
	1909.8	29.9	29.9	29.9/26.3
3-slots EDGE 1900MHz	1850.2	29.6	29.6	26.3
	1880.0	29.7	29.7	26.4
	1909.8	29.9	29.9	26.3
3-slots DTM 1900MHz	1850.2	29.6	NA	NA
	1880.0	29.7	NA	NA
	1909.8	29.9	NA	NA
4-slots EDGE 1900MHz	1850.2	29.0	29.0	25.9
	1880.0	29.1	29.1	25.9
	1909.8	29.1	29.1	25.7
1-slot GSM (CS) 1900 MHz	1850.2	29.6		
	1880.0	29.7		
	1909.8	29.9		

1.9.6c. Rev2, GSM/EDGE/GPRS channel vs. conducted power with Mobile Hotspot mode disabled

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 1900 MHz	1850.2	28.4	N/A	N/A
	1880.0	28.4	N/A	N/A
	1909.8	28.1	N/A	N/A
3-slots GPRS 1900 MHz	1850.2	28.4	N/A	N/A
	1880.0	28.4	N/A	N/A
	1909.8	28.1	N/A	N/A
4-slots GPRS 1900 MHz	1850.2	28.4	N/A	N/A
	1880.0	28.4	N/A	N/A
	1909.8	28.1	N/A	N/A
2-slots EDGE 1900MHz	1850.2	28.4	28.4	24.7
	1880.0	28.4	28.4	24.6
	1909.8	28.1	28.1	24.2
2-slots DTM 1900MHz	1850.2	28.4	28.4	28.4/24.7
	1880.0	28.4	28.4	28.4/24.6
	1909.8	28.1	28.1	28.1/24.2
3-slots	1850.2	28.4	28.4	24.7

EDGE 1900MHz	1880.0	28.4	28.4	24.6
	1909.8	28.1	28.1	24.2
3-slots DTM 1900MHz	1850.2	28.4	NA	NA
	1880.0	28.4	NA	NA
	1909.8	28.1	NA	NA
4-slots EDGE 1900MHz	1850.2	28.4	28.4	24.7
	1880.0	28.4	28.4	24.6
	1909.8	28.1	28.1	24.2

Mode	**Freq. (MHz)**	**Max burst averaged conducted power (dBm)**
1-slot GSM (CS) 1900 MHz	1850.2	28.3
	1880.0	28.4
	1909.8	28.2

1.9.6d. Rev3, GSM/EDGE/GPRS channel vs. conducted power with Mobile Hotspot mode disabled

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 is 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 52.6(2).
· 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.

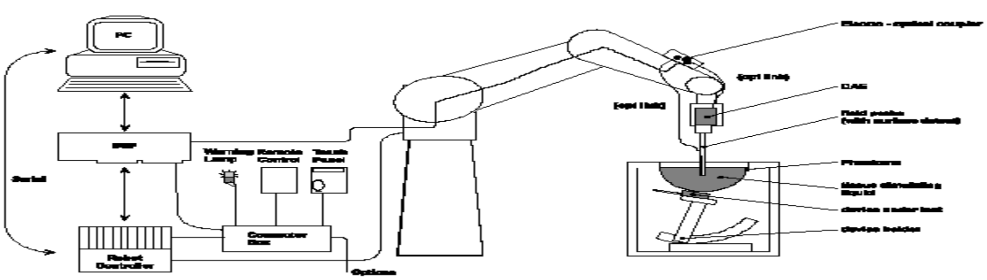

Figure 2.1.1. System Description

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	01/11/2013
SCHMID & Partner Engineering AG	E-field probe	EX3DV4	3592	11/16/2012
SCHMID & Partner Engineering AG	E-field probe	EX3DV4	3548	01/14/2013
SCHMID & Partner Engineering AG	Data Acquisition Electronics (DAE3)	DAE3 V1	473	01/13/2013
SCHMID & Partner Engineering AG	Dipole Validation Kit	D835V2	446	01/21/2013
SCHMID & Partner Engineering AG	Dipole Validation Kit	D1900V2	545	01/13/2013
SCHMID & Partner Engineering AG	Dipole Validation Kit	D2450V2	747	11/09/2013
SCHMID & Partner Engineering AG	Dipole Validation Kit	D5000V2	1033	11/15/2013
Agilent Technologies	Signal generator	8648C	4037U03155	09/23/2013
Agilent Technologies	Power meter	E4419B	GB40202821	09/23/2013
Agilent Technologies	Power sensor	8481A	MY41095417	09/26/2013
Amplifier Research	Amplifier	5S1G4M3	300986	CNR
Agilent Technologies	Power meter	N1911A	MY45100905	05/17/2013
Agilent Technologies	Power sensor	N1921A	SG45240281	06/12/2013
Agilent Technologies	Power sensor	N1921A	MY45241383	09/11/2013
Weinschel Corp	20dB Attenuator	33-20-34	BMO697	CNR
Agilent Technologies	Network analyzer	8753ES	US39174857	09/20/2013
Rohde & Schwarz	Base Station Simulator	CMU 200	109747	11/20/2012
Rohde & Schwarz	Base Station Simulator	CMU 200	118277	11/30/2012
Rohde & Schwarz	Base Station Simulator	CMU 200	112394	11/21/2012
CPI Wireless Solutions	Amplifier	VZC-6961K4	SK4310E5	CNR
Rohde & Schwarz	Signal generator	SMA 100A	102106	12/02/2013
Rohde & Schwarz	Wideband Base Station Simulator	CMW 500	109949	01/12/2013
Rohde & Schwarz	Wideband Base Station Simulator	CMW 500	101169	01/12/2013

Table 2.1.1. 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.

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

Table 3.1.1. Probe specifications

3.2 Probe calibration and measurement uncertainty

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

Calibration Parameter Determined in Head Tissue Simulating Media

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

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) C	Relative Permittivity F	Conductivity (S/m) F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	6.27	6.27	6.27	0.36	1.74	± 12.0 %
900	55.0	1.05	6.07	6.07	6.07	0.29	2.02	± 12.0 %
1810	53.3	1.52	4.92	4.92	4.92	0.50	1.57	± 12.0 %
1950	53.3	1.52	4.87	4.87	4.87	0.59	1.49	± 12.0 %
2450	52.7	1.95	4.30	4.30	4.30	0.68	1.16	± 12.0 %
2600	52.5	2.16	4.12	4.12	4.12	0.80	0.99	± 12.0 %

Table 3.2.1. Probe ES3DV3 SN: 3225

Calibration Parameter Determined in Head Tissue Simulating Media

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

Calibration Parameter Determined in Body Tissue Simulating Media

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

Table 3.2.2. Probe EX3DV4 SN: 3592

Calibration Parameter Determined in Head Tissue Simulating Media

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

Calibration Parameter Determined in Body Tissue Simulating Media

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

Table 3.2.3. Probe EX3DV4 SN: 3548

C The validity of ± 100 MHz only applies for DASY v4.4 and higher.
DASY 52 has been used for measurements, therefore ± 100 MHz tolerance is valid.

Measured dielectric parameters are within +/- 5% of the probe calibration values and target values.
Expanded probe calibration uncertainty (k=2) is < 15 %

4.0 SAR MEASUREMENT SYSTEM VERIFICATION

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

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

4.1 System accuracy verification for head adjacent use

f (MHz)	Limits / Measured (MM/DD/YYYY)	SAR 1 g/10 g (W/kg)	Dielectric Parameters		Liquid Temp. (°C)
			ε_r	σ [S/m]	
835	Measured (09/21/2012)	9.66/6.35	40.1	0.91	22.6
	Measured (09/24/2012)	9.54/6.26	42.1	0.89	22.0
	Measured (10/30/2012)	9.09/5.98	40.8	0.88	21.9
	Recommended Limits	9.63/6.27	41.5	0.90	N/A
1900	Measured (09/18/2012)	38.8/20.3	38.4	1.40	22.6
	Measured (11/01/2012)	38.5/20.1	39.7	1.39	22.6
	Recommended Limits	40.0/20.8	40.0	1.40	N/A
2450	Measured (11/05/2012)	54.7/25.7	38.2	1.82	22.5
	Recommended Limits	54.1/25.3	39.2	1.80	N/A
5200	Measured (10/09/2012)	79.3/23.0	34.5	4.70	21.6
	Measured (10/12/2012)	84.9/24.7	34.5	4.64	22.5
	Measured (10/15/2012)	85.4/24.7	34.6	4.76	22.7
	Measured (11/06/2012)	86.3/25.1	35.6	4.68	22.8
	Recommended Limits	80.8/23.0	36.0	4.66	N/A
5500	Measured (10/09/2012)	87.6/25.4	34.7	4.94	21.6
	Measured (10/12/2012)	94.6/27.1	34.2	5.11	22.5
	Measured (10/15/2012)	90.3/25.8	34.4	5.07	22.7
	Recommended Limits	87.3/24.7	35.6	4.96	N/A
5800	Measured (10/09/2012)	85.4/24.6	33.7	5.40	21.6
	Measured (10/15/2012)	82.9/23.9	34.5	5.52	22.6
	Recommended Limits	79.4/22.5	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	09/20/2013
Control Company	Digital Thermometer	23609-234	21352860	09/26/2013

Table 6.1.2. 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 (09/21/12)	825	40.3	0.90	22.6
			835	40.1	0.91	
			850	39.9	0.92	
		Measured (09/24/2012)	825	42.2	0.88	22.0
			835	42.1	0.89	
			850	41.9	0.91	
			865	41.8	0.92	
		Measured (10/30/2012)	825	40.8	0.87	21.9
			835	40.8	0.88	
			850	40.8	0.89	
		Recommended Limits	835	41.5	0.90	N/A
	Muscle	Measured (09/21/12)	825	54.3	0.96	22.6
			835	54.2	0.97	
			850	54.1	0.99	

		Measured (09/24/12)	825	53.0	0.94.	22.0
			835	53.0	0.95	
			850	52.9	0.96	
		Measured (10/30/2012)	825	53.6	0.94	21.9
			835	53.5	0.95	
			850	53.4	0.97	
		Recommended Limits	835	55.2	0.97	N/A
1900	Head	Measured (09/18/2012)	1850	38.7	1.35	22.6
			1900	38.4	1.40	
			1910	38.4	1.41	
			1980	38.1	1.48	
		Measured (11/01/2012)	1850	39.9	1.34	22.7
			1900	39.7	1.39	
			1910	39.7	1.40	
			1980	39.4	1.47	
		Recommended Limits	1900	40.0	1.40	N/A
	Muscle	Measured (09/18/2012)	1850	50.9	1.52	22.5
			1900	50.7	1.58	
			1910	50.7	1.60	
		Measured (11/01/2012)	1850	52.4	1.49	22.7
			1900	52.2	1.55	
			1910	52.1	156	
		Recommended Limits	1900	53.3	1.52	N/A
2450	Head	Measured (11/05/2012)	2410	38.3	1.78	22.5
			2450	38.2	1.82	
			2480	38.0	1.83	
		Recommended Limits	2450	39.2	1.80	N/A
		Measured (11/05/2012)	2410	52.3	1.86	22.5
			2450	52.2	1.91	
			2480	52.2	1.95	
		Recommended Limits	2450	52.7	1.95	N/A
5200	Head	Measured (10/09/2012)	5180	34.5	4.68	21.6
			5200	34.5	4.70	
			5280	34.4	4.79	
		Measured (10/11/2012)	5180	34.5	4.64	22.5
			5200	34.5	4.64	
			5280	34.4	4.76	
		Measured (10/15/2012)	5180	34.6	4.74	22.7
			5200	34.6	4.76	
			5280	34.4	4.85	
		Measured (11/06/2012)	5180	35.6	4.66	22.8
			5200	35.6	4.68	
			5280	35.4	4.78	
		Recommended Limits	5200	36.0	4.66	N/A
	Muscle	Measured (10/16/2012)	5180	46.8	5.11	22.6
			5200	46.8	5.13	
			5280	46.7	5.25	

		Measured (11/06/2012)	5180	49.1	5.22	22.6
			5200	49.0	5.26	
			5280	49.0	5.39	
		Recommended Limits	5200	49.0	5.30	N/A
5500	Head	Measured (10/09/2012)	5500	34.7	4.94	21.6
			5620	34.3	5.04	
		Measured (10/12/2012)	5500	34.2	5.11	22.7
			5620	34.0	5.25	
		Measured (10/15/2012)	5500	34.4	5.07	22.7
			5620	34.1	5.20	
		Recommended Limits	5500	35.6	4.96	N/A
	Muscle	Measured (10/16/2012)	5500	47.0	5.66	22.6
			5620	46.8	5.84	
		Recommended Limits	5500	48.6	5.65	N/A
5800	Head	Measured (10/09/2012)	5745	33.8	5.34	21.6
			5800	33.7	5.40	
		Measured (10/15/2012)	5745	34.6	5.49	22.6
			5800	34.5	5.52	
		Recommended Limits	5800	35.3	5.27	N/A
	Muscle	Measured (10/16/2012)	5745	46.3	5.95	22.6
			5800	46.2	6.02	
		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

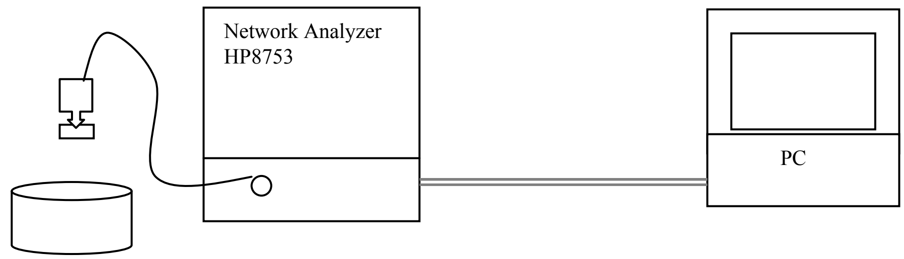

Figure 6.2.1. Test configuration

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).

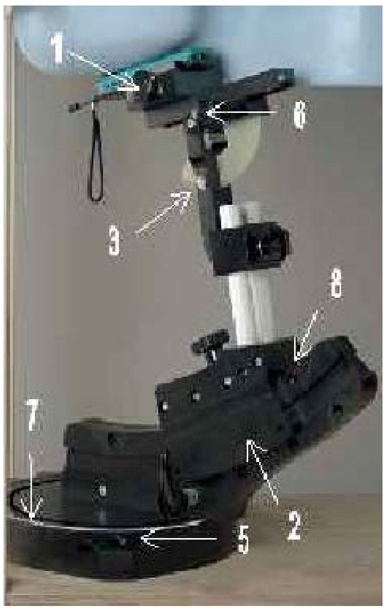

Figure 8.1.1. Device Holder

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”.

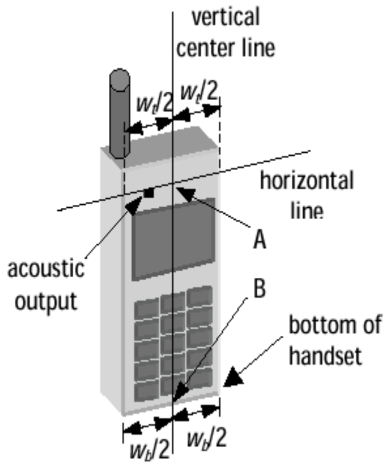

Figure 8.2.1a. Handset vertical and horizontal reference lines – fixed case

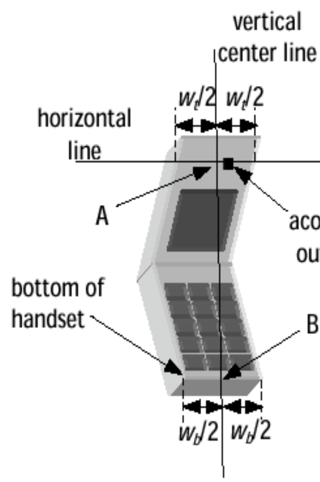

Figure 8.2.1b. Handset vertical and horizontal reference lines – “clam-shell”

8.2.1.1 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 8.2.1a and 8.2.1b), 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 8.2.1a). 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 8.2.1b), 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), 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).

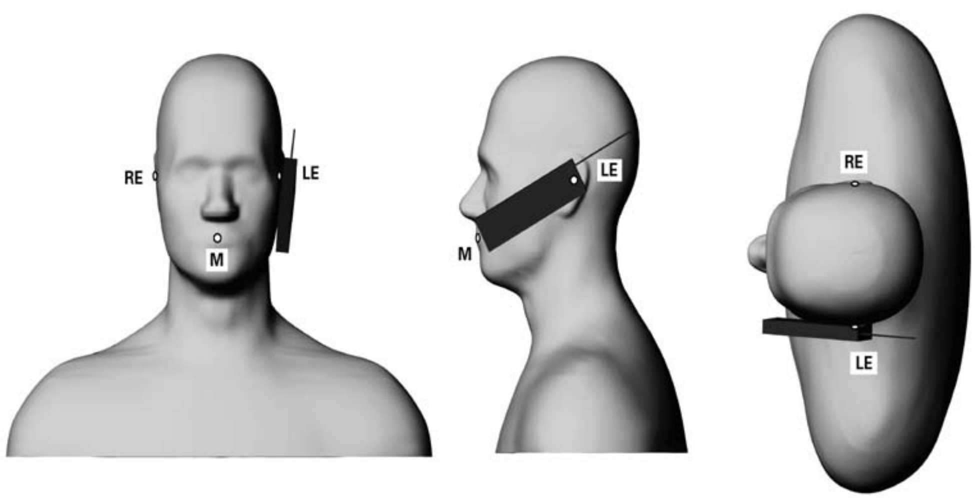

Figure 8.2.2. Phone position 1, "cheek" or "touch" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only.

8.2.1.2 Definition of the "Tilted" Position

1) Repeat steps 1 to 7 of 5.4.1 (in this report 8.2.1.1) to replace the device in the "cheek position."
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**.**

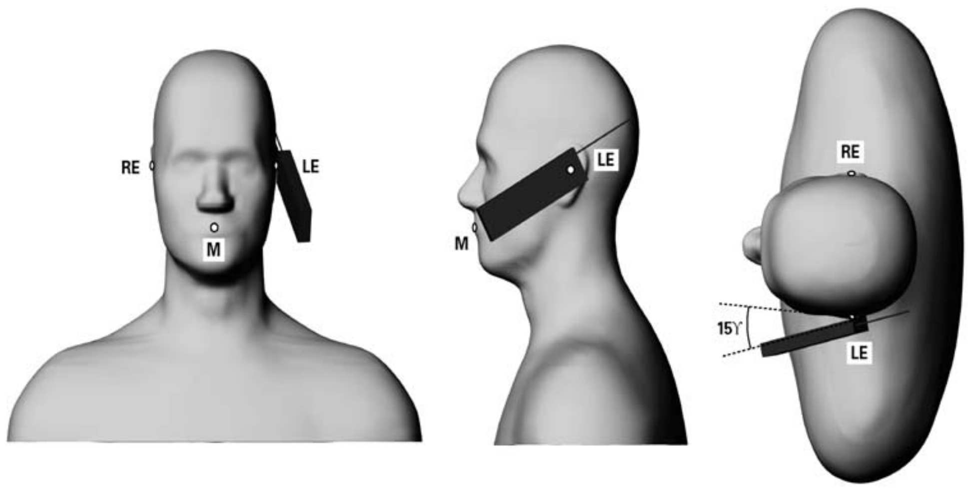

Figure 8.2.3. Phone position 2, "tilted position." The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only.

8.2.2 Body-worn Configuration

Body-worn holsters, as shown on Figure 1.4.1, have been test with the device for FCC RF exposure compliance. The EUT was positioned in each holster case and the belt clip was placed against the flat section of the phantom. A headset was then connected to the device to simulate hands-free operation in a body worn holster configuration.

In addition, device was tested with 15 mm RIM recommended separation distance to allow typical after-market holster to be used. RIM body-worn holsters with belt-clip have been designed to maintain ~ 19 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 / 24x24x20 with 7.5mm / 4.0 resolution in (x,y) and 5mm / 2.5mm resolution in z axis amounts to 175 / 693 measurement points. The first procedure is an extrapolation (incl. Boundary correction) to get the points between the lowest measured plane and the surface. The next step uses 3D interpolation to get all points within the measured volume in a 1mm grid. In the last step, a 1g cube is placed numerically into the volume and its averaged SAR is calculated. This cube is then moved around until the highest averaged SAR is found. This last procedure is repeated for a 10 g cube. If the highest SAR is found at the edge of the measured volume, the system will issue a warning: higher SAR values might be found outside of the measured volume. In that case the cube measurement can be repeated, using the new interpolated maximum as the center.

10.0 MEASUREMENT UNCERTAINTY

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

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

Table 10.0.1. Worst-Case uncertainty budget for DASY52 assessed according to IEEE P1528.
Source: Schmid & Partner Engineering AG.

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

DASY5 Uncertainty Budget
for the 3 - 6 GHz range

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

Table 10.0.2. Worst-Case uncertainty budget for DASY52 assessed according to IEEE P1528.
Source: Schmid & Partner Engineering AG.

11.0 TEST RESULTS

11.1 SAR Measurement results at highest power measured against the head

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	SAR, averaged over 1 g Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Right Head Cheek	3-slots GSM/EDGE 850 MHz	824.2	128				
		836.8	190	29.8	0.51	0.22	0.51
		848.8	251				
Right Head 15° Tilt	3-slots GSM/EDGE 850 MHz	824.2	128				
		836.8	190	29.8	0.22	0.05	0.22
		848.8	251				
Right Head Cheek	1-slot GSM 850 MHz	824.2	128				
		836.8	190	33.5	0.42	-0.27	0.45
		848.8	251				
Left Head Cheek	2-slots GSM/EDGE 850 MHz	824.2	128				
		836.8	190	31.2	0.52	0.13	0.52
		848.8	251				
Left Head Cheek	3-slots GSM/EDGE 850 MHz	824.2	128				
		836.8	190	29.8	0.60	-0.15	0.60
		848.8	251				
Left Head Cheek	4-slots GSM/EDGE 850 MHz	824.2	128				
		836.8	190	27.2	0.45	-0.08	0.45
		848.8	251				
Left Head 15° Tilt	3-slots GSM/EDGE 850 MHz	824.2	128				
		836.8	190	29.8	0.24	-0.25	0.25
		848.8	251				
Left Head Cheek	1-slot GSM 850 MHz	824.2	128				
		836.8	190	33.5	0.47	0.11	0.47
		848.8	251				

Table 11.1.1a. Rev 1 SAR results for GSM/EDGE 850 head configuration

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

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

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

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	SAR, averaged over 1 g Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Left Head Cheek	3-slots GSM/EDGE 850 MHz	824.2	128				
		836.8	190	29.8	0.47	-0.18	0.47
		848.8	251				

Table 11.1.1b. Rev 2 SAR results for GSM/EDGE 850 head configuration

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	SAR, averaged over 1 g Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Right Head Cheek	WCDMA FDD V 850 MHz	826.4					
		836.4	4182	24.3	0.46	-0.02	0.46
		846.6					
Right Head 15° Tilt	WCDMA FDD V 850 MHz	826.4					
		836.4	4182	24.3	0.25	-0.02	0.25
		846.6					
Left Head Cheek	WCDMA FDD V 850 MHz	826.4					
		836.4	4182	24.3	0.50	-0.02	0.50
		846.6					
Left Head 15° Tilt	WCDMA FDD V 850 MHz	826.4					
		836.4	4182	24.3	0.28	0.19	0.28
		846.6					

Table 11.1.2. SAR results for WCDMA FDD V head configuration

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	SAR, averaged over 1 g Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Right Head Cheek	3-slots GSM/EDGE 1900 MHz	1850.2	512				
		1880.0	661	25.4	0.27	-0.07	0.27
		1909.8	810				
Right Head 15° Tilt	3-slots GSM/EDGE 1900 MHz	1850.2	512				
		1880.0	661	25.4	0.10	-0.03	0.10
		1909.8	810				
Right Head Cheek	1-slot GSM 1900 MHz	1850.2	512				
		1880.0	661	29.6	0.22	-0.19	0.22
		1909.8	810				
Left Head Cheek	2-slots GSM/EDGE 1900 MHz	1850.2	512				
		1880.0	661	27.9	0.28	0.08	0.28
		1909.8	810				
Left Head Cheek	3-slots GSM/EDGE 1900 MHz	1850.2	512				
		1880.0	661	25.4	0.28	-0.04	0.28
		1909.8	810				
Left Head Cheek	4-slots GSM/EDGE 1900 MHz	1850.2	512				
		1880.0	661	24.0	0.24	-0.10	0.24
		1909.8	810				
Left Head 15° Tilt	2-slots GSM/EDGE 1900 MHz	1850.2	512				
		1880.0	661	27.9	0.14	-0.27	0.15
		1909.8	810				
Left Head Cheek	1-slot GSM 1900 MHz	1850.2	512				
		1880.0	661	29.6	0.23	0.18	0.23
		1909.8	810				

Table 11.1.3a. Rev 1 SAR results for GSM/EDGE 1900 head configuration

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	SAR, averaged over 1 g		
					Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Left Head Cheek	2-slots GSM/EDGE 1900 MHz	1850.2	512				
		1880.0	661	29.7	0.39	-0.08	0.39
		1909.8	810				

Table 11.1.3b. Rev 2 SAR results for GSM/EDGE 1900 head configuration

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	Measured SAR (W/kg)		
					Power Drift (dB)	Averaged over 1 g	Averaged over 10 g
Right Head Cheek	802.11 b 2450 MHz	2412	1	17.1	0.02	0.81	0.37
		2437	6	16.6	0.38	0.85	0.34
		2462	11	17.2	-0.17	0.83	0.36
Right Head 15° Tilt	802.11 b 2450 MHz	2412	1	17.1	-0.17	0.96	0.45
		2437	6	16.6	-0.19	0.97	0.43
		2462	11	17.2	0.01	**1.07**	**0.44**
Left Head Cheek	802.11 b 2450 MHz	2412	1	17.1	-0.07	0.99	0.44
		2437	6	16.6	0.26	0.90	0.38
		2462	11	17.2	0.74	0.90	0.38
Left Head 15° Tilt	802.11 b 2450 MHz	2412	1	17.1	-0.04	0.93	0.42
		2437	6	16.6	-0.18	0.97	0.43
		2462	11	17.2	-0.02	0.98	0.43

Table 11.2.4. SAR results for WiFi/WLAN/802.11b head configuration

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	Measured SAR (W/kg) Power Drift (dB)	Averaged over 1 g	Averaged over 10 g
Right Head Cheek	802.11 a 5180-5805 MHz	5180	36	17.2	-0.31	0.66	0.20
		5240	**48**	17.2	0.23	0.84	0.24
		5260	52				
		5320	**64**	16.7	0.09	0.79	0.21
		5520	104				
		5580	116				
		5620	**124**	17.3	0.21	0.50	0.13
		5680	136				
		5745	**149**	16.9	0.38	0.45	0.15
		5785	157				
		5825	165				
Right Head 15° Tilt	802.11 a 5180-5805 MHz	5180	36	17.2	-0.13	0.72	0.24
		5240	**48**	17.2	-0.03	0.98	0.32
		5260	52				
		5320	**64**	16.7	0.01	0.76	0.24
		5520	104				
		5580	116				
		5620	**124**	17.3	0.01	0.57	0.17
		5680	136				
		5745	**149**	16.9	-0.41	0.60	0.23
		5785	157				
		5825	165				
Left Head Cheek	802.11 a 5180-5805 MHz	5180	36	17.2	-0.06	0.98	0.29
		5260	52	16.6	-0.01	0.96	0.30
		5320	**64**	16.7	-0.10	0.92	0.28
		5520	104				
		5580	116				
		5620	**124**	17.3	0.06	0.53	0.17
		5680	136				
		5745	**149**	16.9	0.12	0.46	0.17
		5785	157				
		5825	165				
Left Head 15° Tilt	802.11 a 5180-5805 MHz	**5620**	**124**	17.3	0.25	0.58	0.17
		5680	136				
		5745	**149**	16.9	0.06	0.64	0.22
		5785	157				
		5825	165				

Table 11.2.5a. Rev 1 SAR results for 802.11a head configuration

Note 4: Only the highest output power channel per sub band was tested.

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	Measured SAR (W/kg)		
					Power Drift (dB)	Averaged over 1 g	Averaged over 10 g
Right Head Cheek	802.11 a 5180-5805 MHz	5320	64	14.5	-0.07	0.37	0.12
Right Head 15° Tilt	802.11 a 5180-5805 MHz	5320	64	14.5	0.46	0.44	0.13
Left Head Cheek	802.11 a 5180-5805 MHz	5240	48	14.1	-0.02	0.56	0.15
Left Head 15° Tilt	802.11 a 5180-5805 MHz	5240	48	14.1	0.01	0.66	0.18
		5320	64	14.5	-0.18	0.71	0.18

Table 11.2.5b. Rev 2 SAR results for 802.11a head configuration

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

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Conducted Output Power (dBm)	SAR, averaged over 1 g		
							Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
2-slots GPRS 850 MHz	824.2	128	Body Mobile Hotspot Mode	1.0	Back				
	836.8	190		1.0	Back	31.2	0.73	-0.04	0.73
	848.8	251		1.0	Back				
	836.8	190		1.0	Front	31.2	0.64	-0.03	0.64
	836.8	190		1.0	Left	31.2	0.30	-0.08	0.30
	836.8	190		1.0	Right	31.2	0.34	0.03	0.34
	836.8	190		1.0	Bottom	31.2	0.08	-0.03	0.08
	836.8	190		1.0	Back+HS	31.2	0.78	-0.13	0.78
3-slots GPRS 850 MHz	824.2	128		1.0	Back+HS	29.8	0.90	-0.02	0.90
	836.8	190		1.0	Back+HS	29.7	0.91	0.26	0.91
	848.8	251		1.0	Back+HS	29.3	0.91	-0.22	0.96
4-slots GPRS 850 MHz	836.8	190		1.0	Back+HS	27.2	0.70	-0.16	0.70
2-slots GPRS 850 MHz	836.8	190	Body-worn	1.5	Back	31.2	0.40	0.01	0.40
	836.8	190		1.5	Front	31.2	0.36	-0.23	0.38
	836.8	190		Holster	Back	31.2	0.36	-0.02	0.36

Table 11.2.1a. Rev 1 SAR results for GSM/EDGE 850 body-worn and Mobile Hot Spot configurations

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

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

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

Note 3: Device was tested with 15 mm RIM recommended separation distance to allow typical after-market holster to be used. RIM body-worn holsters with belt-clip have been designed to maintain ~ 19 mm separation distance from body.

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

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Conducted Output Power (dBm)	SAR, averaged over 1 g		
							Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
3-slots GPRS 850 MHz	824.2	128	Body Mobile Hotspot Mode	1.0	Back+HS				
	836.8	190		1.0	Back+HS				
	848.8	251		1.0	Back+HS	29.3	0.81	-0.05	0.81

Table 11.2.1b. Rev 2 SAR results for GSM/EDGE 850 body-worn and Mobile Hot Spot configurations

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Conducted Output Power (dBm)	SAR, averaged over 1 g		
							Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
WCDMA FDD V 850 MHz	826.4	4132	Body Mobile Hotspot Mode	1.0	Back				
	836.4	4182		1.0	Back	24.3	0.56	0.01	0.56
	846.6	4233		1.0	Back				
	836.4	4182		1.0	Front	24.3	0.55	0.05	0.55
	836.4	4182		1.0	Left	24.3	0.37	-0.02	0.37
	836.4	4182		1.0	Right	24.3	0.44	0.06	0.44
	836.4	4182		1.0	Bottom	24.3	0.08	-0.06	0.08
	836.4	4182		1.0	Back+HS	24.3	0.55	0.22	0.55
WCDMA FDD V 850 MHz	836.4	4182	Body-worn	1.5	Back	24.3	0.41	0.09	0.41
	836.4	4182		1.5	Front	24.3	0.42	-0.07	0.42
	836.4	4182		Holster	Front	24.3	0.39	0.14	0.39

Table 11.2.2. SAR results for WCDMA FDD V body-worn and Mobile Hot Spot configurations

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Conducted Output Power (dBm)	SAR, averaged over 1 g		
							Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
2-slots GPRS 1900 MHz	1880.0	661	Body-worn	1.5	Back	28.1	0.62	-0.02	0.62
	1880.0	661		1.5	Front	28.1	0.55	-0.06	0.55
	1880.0	661		Holster	Back	28.1	0.45	-0.20	0.47

Table 11.2.3a. Rev 1 SAR results for GSM/EDGE 1900 body-worn configurations

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Conducted Output Power (dBm)	SAR, averaged over 1 g		
							Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
2-slots GPRS 1900MHz	1850.2	512	Body Mobile Hotspot Mode	1.0	Back	27.3	0.76	0.00	0.76
	1880.0	661		1.0	Back	27.3	0.91	-0.13	0.91
	1909.8	810		1.0	Back	27.2	0.93	-0.13	0.93
	1880.0	661		1.0	Front	27.3	0.75	-0.07	0.75
	1880.0	661		1.0	Left	27.3	0.10	0.09	0.10
	1880.0	661		1.0	Right	27.3	0.06	-0.06	0.06
	1850.2	512		1.0	Bottom	27.3	0.91	-0.03	0.91
	1880.0	661		1.0	Bottom	27.3	1.15	-0.05	1.15
	1909.8	810		1.0	Bottom	27.2	1.21	-0.03	1.21
3-slots GPRS 1900MHz	1909.8	810		1.0	Bottom	25.8	**1.26**	**0.01**	**1.26**
	1909.8	810		1.0	Bottom+ HS	25.8	1.19	0.00	1.19
4-slots GPRS 1900MHz	1909.8	810		1.0	Bottom	24.4	1.20	0.03	1.20
3-slots GPRS 1900MHz	1850.2	512	Body-worn	1.5	Back	29.6	1.03	0.06	1.03
	1880.0	661		1.5	Back	29.7	**1.07**	**0.04**	**1.07**
	1909.8	810		1.5	Back	29.9	1.05	0.05	1.05

Table 11.2.3b. Rev 2 SAR results for GSM/EDGE 1900 body-worn and Mobile Hot Spot configurations

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Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Conducted Output Power (dBm)	Measured SAR (W/kg)		
							Power Drift (dB)	Averaged over 1 g	Averaged over 10 g
802.11b/ WLAN 2450MHz	2462	11	Body Mobile Hotspot Mode	1.0	Back	17.2	0.99	0.30	0.14
	2462	11		1.0	Front	17.2	-0.03	0.17	0.08
	2462	11		1.0	Left	17.2	0.16	0.04	0.02
	2462	11		1.0	Right	17.2	0.32	0.00	0.00
	2462	11		1.0	Top	17.2	0.02	0.23	0.12
	2462	11		1.0	Back+HS	17.2	-0.19	0.23	0.12
802.11b/ WLAN 2450MHz	2462	11	Body-worn	1.5	Back	17.2	0.10	0.15	0.07
	2462	11		1.5	Front	17.2	0.48	0.06	0.03
	2462	11		Holster	Back	17.2	0.07	0.08	0.05

Table 11.2.4. SAR results for WiFi/WLAN/802.11b body-worn and Mobile Hot Spot configurations

Note 5: Only the highest output power channel was tested.

Mode	Freq. (MHz)	Channel	Holster type / device configuration	Conducted Output Power (dBm)	Measured SAR (W/kg)		
					Power Drift (dB)	Averaged over 1 g	Averaged over 10 g
802.11a 5180 - 5805 MHz	5240	48	No Holster, back side 15 mm away	17.2	0.18	0.28	0.11
	5320	64	No Holster, back side 15 mm away	16.7	-0.27	0.23	0.10
	5620	124	No Holster, back side 15 mm away	17.3	0.01	0.20	0.08
	5745	149	No Holster, back side 15 mm away	16.9	0.10	0.23	0.10
	5240	48	No Holster, front side 15mm away	17.2	-0.19	0.15	0.06
	5240	48	Leather Holster, back side facing	17.2	-0.04	0.18	0.08
	5240	48	No Holster, HS, back side 15mm away	17.2	0.41	0.20	0.08

Table 11.2.5a. Rev 1 SAR results for 802.11a body-worn configurations

Note 5: Only the highest output power channel per sub band was tested.

Mode	Freq. (MHz)	Channel	Holster type / device configuration	Conducted Output Power (dBm)	Measured SAR (W/kg)		
					Power Drift (dB)	Averaged over 1 g	Averaged over 10 g
802.11a 5180 - 5805 MHz	5320	64	No Holster, back side 15 mm away	14.5	0.55	0.14	0.05

Table 11.2.5b. Rev 2 SAR results for 802.11a body-worn configurations

Note 5: Only the highest output power channel was tested.

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