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 latest FCC OET KDB Procedures, OET Bulletin 65 Supplement C (Edition 01-01), ANSI/IEEE Std. C95.3-2002, IEEE 1528-2003, IEC 62209-1-2005, IEC 62209 - 2-2010 and Health Canada's Safety Code 6.

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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	RFN81UW			
FCC ID	L6ARFN80UW			
PIN	Radiated: 25CF0BA5 (Rev 2), 2AB01FAD (Rev 3) Conducted: 25CF0B7F (Rev 2), 2AB01F81 (Rev 3)			
Hardware Rev	Rev 2-905-00/01, Rev 3-905-01/02/03			
Software Version	127.0.1.2982/3123/3901/4318, MFI_4_0_11-180/181			
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)	32.0 29.0	30.0 29.0	29.0 26.5	27.0 25.5
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)	14.5	16.5	17.0	11.0
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	5520-5700	5745-5825
Mode(s) of Operation	802.11b	802.11g	802.11n	Bluetooth
Nominal Maximum conducted RF Output Power (dBm)	18.5	18.5	16.5	9.5
Tolerance in Power Setting	± 0.5	± 0.5	± 0.5	N/A

on centre channel (dB)				
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	WCDMA/HSPA+/ UMTS FDD V (850)	WCDMA/HSPA+/ UMTS FDD II (1900)	NFC	
Nominal Maximum conducted RF Output Power (dBm)	24.5	23.0	N/A	
Tolerance in Power Setting on centre channel (dB)	± 0.5	± 0.5	N/A	
Duty Cycle	1:1	1:1	N/A	
Transmitting Frequency Range (MHz)	824.6 – 846.6	1852.4 – 1907.6	13.56	

Table 1.3-1 Test device characterization non-LTE U.S. wireless operating modes/bands

Note 1: The BlackBerry model: RFN81UW also supports GSM/GPRS/EDGE 900/1800 MHz, UMTS Band I/VIII, and LTE Band 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 holsters listed below. The holster has been designed with the intended device orientation being with the LCD facing the belt clip only. Proper positioning is vital for protection of the LCD display, and to help maximize the battery life of the device. The device can also be placed in the holster with the backside facing the belt clip. Body SAR measurements were carried out with the worst-case configuration front LCD side and backside towards the belt clip.

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

Table 1.4-1 Body worn holster

Note: 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 packs.

1)BAT-49702-002 (1800mA)
2)BAT-52961-002 (2100mA)

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. Software Tool was used to set WiFi to transmit at maximum power and duty cycle for each band, channel, and modulation.

1.8 Highlights of the FCC OET SAR Measurement Requirements

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

• Repeat measurements when the measured SAR is ≥ 0.80 W/kg. If the measured SAR values are < 1.45 W/kg with ≤ 20% variation, only one repeated measurement was performed to reaffirm that the results are not expected to have substantial variations. An additional repeated measurement is required only if the measured results are within 10% of the SAR limit and vary by more than 20%, which are often related to device and measurement setup difficulties.

• Maintained dielectric parameter uncertainty to ± 5.0% of the target values, (although it is very challenging to control/maintain both permittivity and conductivity for 5-6 GHz for all test channels within ± 5.0% of the target values, some conductivity values were measured slightly higher which resulted in more conservative SAR values.

• Liquid depth from SAM ERP or flat phantom was kept at 15 cm.

• Probe Requirement: Used SPEAG probe model ET3DV6/ES3DV3 for 2.45 GHz and EX3DV4 for 5-6 GHz SAR testing specs are outlined below:

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

Table 1.8.1-1 Probe specification requirements

• Area scan resolution was maintained at 10mm (5-6 GHz)

• Area scan resolution was maintained at 12mm (2-3 GHz)

• Area scan resolution was maintained at 15mm (</= 2 GHz)

• System accuracy validation was conducted within ± 100 MHz of device mid-band frequency and results were within ± 10 % of the manufacturers target value for each band.

• Zoom Scan: The following settings were used for the validation and measurement.

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

Table 1.8.1-2 Zoom Scan requirement

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

- Frequency Channel Configuration: 802.11 b/g modes are tested on "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	19.11	1	18.41	1	18.37
6	**20.41**	6	19.70	6	19.60
11	20.21	11	19.41	11	19.42

		802.11g			**802.11b**
		Channel 6			**Channel 6**
Data Rate (Mbps)	**Mod.**	**Cond. Power (dBm)**	**Data Rate (Mbps)**	**Mod.**	**Cond. Power (dBm)**
6	BPSK	19.67	1	BPSK	20.41
9	BPSK	19.66	2	DQPSK	20.31
12	QPSK	19.64	5.5	CCK	20.28
18	QPSK	19.68	11	CCK	20.29
24	16-QAM	19.69	22	CCK	20.30
36	16-QAM	19.67			
48	64-QAM	19.69			
54	64-QAM	19.65			

		802.11 n
		Channel 6
Data Rate (Mbps)	**Mod.**	**Cond. Power (dBm)**
6.5	MCS0	17.64
13	MCS1	17.56
19.5	MCS2	17.55
26	MCS3	17.58
39	MCS4	17.54
52	MCS5	17.57
58.5	MCS6	17.52
65	MCS7	17.54

Table 1.8.1-3a 802.11 b/g/n modulation type/data rate vs. conducted power with Hotspot mode enabled and disabled (Rev3-01)

802.11b @ 1Mbps		802.11g @ 6Mbps		802.11n @ 6.5 Mbps	
Chan	Cond. Power (dBm)	Chan	Cond. Power (dBm)	Chan	Cond. Power (dBm)
1	16.50	1	14.45	1	14.24
6	**17.75**	6	15.63	6	15.50
11	17.50	11	12.15	11	12.05

		802.11g			802.11b
Data Rate (Mbps)	Mod.	Channel 6 Cond. Power (dBm)	Data Rate (Mbps)	Mod.	Channel 6 Cond. Power (dBm)
6	BPSK	15.63	1	BPSK	17.75
9	BPSK	15.51	2	DQPSK	17.74
12	QPSK	15.41	5.5	CCK	17.61
18	QPSK	15.32	11	CCK	17.55
24	16-QAM	15.21	22	CCK	17.54
36	16-QAM	15.00			
48	64-QAM	14.79			
54	64-QAM	14.71			

		802.11 n
Data Rate (Mbps)	Mod.	Channel 6 Cond. Power (dBm)
6.5	MCS0	15.50
13	MCS1	15.31
19.5	MCS2	15.20
26	MCS3	15.10
39	MCS4	14.90
52	MCS5	14.71
58.5	MCS6	13.65
65	MCS7	13.53

Table 1.8.1-3b 802.11 b/g/n modulation type/data rate vs. conducted power with Hotspot mode enabled and disabled (Rev3-02)

802.11b @ 1Mbps		802.11g @ 6Mbps		802.11n @ 6.5 Mbps	
Chan	**Cond. Power (dBm)**	**Chan**	**Cond. Power (dBm)**	**Chan**	**Cond. Power (dBm)**
1	17.77	1	15.52	1	15.32
6	**18.95**	6	18.75	6	16.58
11	18.75	11	13.31	11	13.21
13	11.92	13	11.82	13	11.69

		802.11g			802.11b
		Channel 6			**Channel 6**
Data Rate (Mbps)	**Mod.**	**Cond. Power (dBm)**	**Data Rate (Mbps)**	**Mod.**	**Cond. Power (dBm)**
6	BPSK	18.75	1	BPSK	18.95
9	BPSK	18.65	2	DQPSK	18.92
12	QPSK	18.60	5.5	CCK	18.75
18	QPSK	18.47	11	CCK	18.67
24	16-QAM	17.38	22	CCK	18.68
36	16-QAM	17.13			
48	64-QAM	15.97			
54	64-QAM	15.75			

		802.11 n
		Channel 6
Data Rate (Mbps)	**Mod.**	**Cond. Power (dBm)**
6.5	MCS0	16.58
13	MCS1	16.36
19.5	MCS2	16.23
26	MCS3	16.20
39	MCS4	14.92
52	MCS5	14.77
58.5	MCS6	13.62
65	MCS7	13.54

Table 1.8.1-3c 802.11 b/g/n modulation type/data rate vs. conducted power with Hotspot mode enabled and disabled (Rev3-03)

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	17.29	**52**	**5260**	**17.26**	**104**	**5520**	**19.80**
40	5200	17.24	56	5280	17.22	116	5580	19.54
44	**5220**	**17.42**	60	5300	17.15	124	5620	19.39
48	5240	17.26	64	5320	17.12	140	5700	19.01
						802.11a (upper band II) 6Mbps		
						Chan	**f(MHz)**	**Cond. Power (dBm)**
						149	**5745**	**14.25**
						153	5765	14.11
						157	5785	14.00
						161	5805	13.85
						165	5825	13.75

		802.11a (lower band)	802.11a (middle band)	802.11a (upper band I)	802.11a (upper band II)
Data Rate (Mbits)	Mod.	Channel 44	Channel 52	Channel 104	Channel 149
		Cond. Power (dBm)	Cond. Power (dBm)	Cond. Power (dBm)	Cond. Power (dBm)
6	BPSK	17.42	17.26	19.80	14.25
9	BPSK	17.30	17.22	19.75	14.16
12	QPSK	17.32	17.25	19.73	14.15
18	QPSK	17.31	17.21	19.78	14.22
24	16-QAM	17.30	17.23	19.79	14.16
36	16-QAM	17.32	17.22	19.79	14.17
48	64-QAM	17.29	17.20	19.77	14.20
54	64-QAM	17.30	17.24	19.76	14.23

	802.11n (lower band)	802.11n (middle band)	802.11n (upper band I)	802.11n (upper band II)
Mod.	Channel 44	Channel 52	Channel 104	Channel 149
	Cond. Power (dBm)	Cond. Power (dBm)	Cond. Power (dBm)	Cond. Power (dBm)
MCS0	17.31	17.14	19.00	12.94
MCS1	17.30	17.15	18.96	12.95
MCS2	17.40	17.11	18.97	13.00
MCS3	17.40	17.09	18.96	13.01
MCS4	17.28	17.13	18.95	12.98
MCS5	17.37	17.10	18.97	13.01
MCS6	17.40	17.11	18.92	12.97
MCS7	17.39	17.12	18.93	12.99

Table 1.8.1-4a 802.11 a/n modulation type/data rate vs. conducted power (Rev3-01)

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**	**14.71**	52	5260	14.41	**104**	**5520**	**12.03**
40	5200	14.52	56	5280	14.20	116	5580	11.80
44	5220	14.49	60	5300	14.10	124	5620	11.61
48	5240	14.38	**64**	**5320**	**15.10**	140	5700	11.40
						802.11a (upper band II) 6Mbps		
						Chan	f(MHz)	Cond. Power (dBm)
						149	5745	10.52
						153	5765	10.50
						157	5785	10.55
						161	5805	10.51
						165	**5825**	**10.58**

		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 64	Channel 104	Channel 165
		Cond. Power (dBm)	Cond. Power (dBm)	Cond. Power (dBm)	Cond. Power (dBm)
6	BPSK	14.71	15.10	12.03	10.58
9	BPSK	14.70	15.05	11.94	10.51
12	QPSK	14.64	15.00	11.90	10.44
18	QPSK	14.52	14.90	11.75	10.30
24	16-QAM	14.37	14.80	11.57	10.12
36	16-QAM	14.10	14.45	11.30	9.93
48	64-QAM	13.81	14.30	11.13	9.65
54	64-QAM	13.75	14.13	11.10	9.54

	802.11n (lower band)	802.11n (middle band)	802.11n (upper band I)	802.11n (upper band II)
Mod.	Channel 36	Channel 64	Channel 104	Channel 165
	Cond. Power (dBm)	Cond. Power (dBm)	Cond. Power (dBm)	Cond. Power (dBm)
MCS0	14.60	15.00	11.90	10.42
MCS1	14.42	14.81	11.75	10.27
MCS2	14.35	14.71	11.64	10.13
MCS3	14.20	14.65	11.44	10.00
MCS4	13.91	14.44	11.20	9.81
MCS5	13.72	14.15	11.02	9.61
MCS6	13.67	14.10	10.96	9.51
MCS7	13.66	14.11	10.94	9.53

Table 1.8.1-4b 802.11 a/n modulation type/data rate vs. conducted power (Rev3-02)

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**	**14.70**	**52**	**5260**	**16.78**	**104**	**5520**	**17.35**
40	5200	14.68	56	5280	16.66	116	5580	17.00
44	5220	14.54	60	5300	16.62	124	5620	16.87
48	5240	14.50	64	5320	14.12	140	5700	14.23
						802.11a (upper band II) 6Mbps		
						Chan	f(MHz)	Cond. Power (dBm)
						149	**5745**	**11.42**
						153	5765	11.39
						157	5785	11.34
						161	5805	11.32
						165	5825	11.35

		802.11a (lower band)	802.11a (middle band)	802.11a (upper band I)	802.11a (upper band II)
Data Rate (Mbits)	Mod.	Channel 36 Cond. Power (dBm)	Channel 52 Cond. Power (dBm)	Channel 104 Cond. Power (dBm)	Channel 149 Cond. Power (dBm)
6	BPSK	14.70	16.78	17.35	11.42
9	BPSK	14.67	16.74	17.26	11.28
12	QPSK	14.54	16.65	17.21	11.28
18	QPSK	14.44	16.54	17.06	11.10
24	16-QAM	14.32	16.43	15.80	10.86
36	16-QAM	14.03	16.10	15.57	10.68
48	64-QAM	13.87	15.94	14.20	10.47
54	64-QAM	13.80	15.77	14.10	10.46

	802.11n (lower band)	802.11n (middle band)	802.11n (upper band I)	802.11n (upper band II)
Mod.	Channel 36 Cond. Power (dBm)	Channel 52 Cond. Power (dBm)	Channel 104 Cond. Power (dBm)	Channel 149 Cond. Power (dBm)
MCS0	14.45	16.60	17.25	11.15
MCS1	14.36	16.45	17.00	11.07
MCS2	14.28	15.10	15.81	10.90
MCS3	14.19	15.00	15.73	10.80
MCS4	13.90	15.94	14.31	10.63
MCS5	13.73	15.75	14.17	10.36
MCS6	13.60	15.72	13.02	10.24
MCS7	13.53	15.63	12.90	10.23

Table 1.8.1-4c 802.11 a/n modulation type/data rate vs. conducted power (Rev3-03)

1.8.2 SAR Measurement Requirements for Bluetooth

Channel	Freq (MHz)	Mode	Conducted Transmit Power (dBm)
0	2402	DH5	9.30
39	2441	DH5	10.0
78	2480	DH5	9.50

Table 1.8.2-1 Bluetooth peak conducted power measurements

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

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

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:

- EDGE/GPRS 850: back off 3 dB
- UMTS Band V: back off 3.5 dB

When Hotspot mode is enabled or active, all 5 GHz WiFi operations are disabled or not supported.

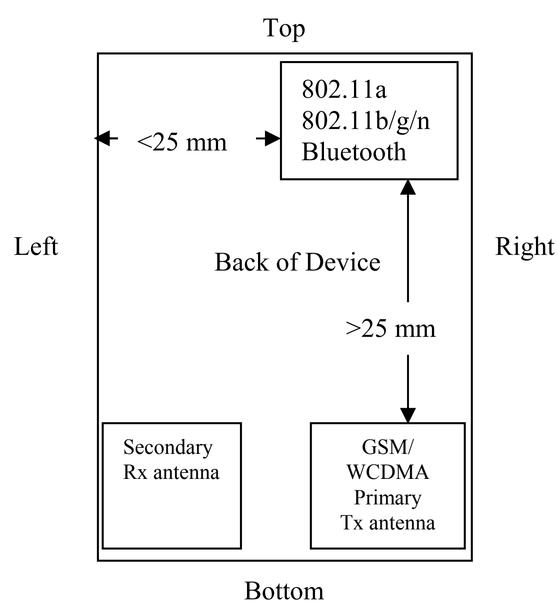

Figure 1.8.3-1 Identification of all sides for SAR Testing

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	Yes	Yes	No	Yes	Yes	Yes
GPRS 1900	Yes	Yes	No	Yes	Yes	Yes
WCDMA/HSPA 850	Yes	Yes	No	Yes	Yes	Yes
WCDMA/HSPA 1900	Yes	Yes	No	Yes	Yes	Yes
Bluetooth 2.4GHz	Yes	Yes	Yes	No	Yes	Yes
802.11b 2.4GHz	Yes	Yes	Yes	No	Yes	Yes

Table 1.8.3-1 Identification of all sides for SAR Testing

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

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

Mode	Freq. (MHz)	Max burst averaged conducted power (dBm) CS1	Max burst averaged conducted power (dBm) MCS1	Max burst averaged conducted power (dBm) MCS5
2-slots GPRS 850 MHz	824.2	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	824.2	30.5	30.4	27.0

EDGE 850 MHz	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

1.8.4-1 GSM/EDGE/GPRS channel vs. conducted power with 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	28.5	N/A	N/A
	1909.8	28.4	N/A	N/A
Mode	**Freq. (MHz)**	**Max burst averaged conducted power (dBm)**		
1-slot GSM (CS) 1900 MHz	1850.2	28.9		
	1880.0	29.1		
	1909.8	28.8		

1.8.4-2 GSM/EDGE/GPRS channel vs. conducted power with Hotspot mode enabled

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

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

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

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

1.8.6 SAR Measurement Procedures for 3G Devices

WCDMA Handsets

Output Power Verification

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

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

Head SAR Measurements

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

Body SAR Measurements

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

Handsets with HSPA

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

	Band	FDD V (850)		
	Channel	4132	4182	4233
	Freq (MHz)	826.4	836.4	846.6
Mode	Subtest	Max burst averaged conducted power (dBm)		
Rel99	12.2 kbps RMC	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 1.8.6-1 WCDMA (Rel99) / HSPA/HSPA+ conducted power measurements with Mobile Hot Spot mode disabled

	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
Rel6 HSUPA	1			
Rel7 HSDPA+	1	20.05	19.95	19.78

Table 1.8.6-2 WCDMA (Rel99) / HSPA/HSPA+ conducted power measurements with Mobile Hot Spot mode enabled

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

Standalone SAR test exclusion guidance:

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

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

Where:

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

.

Simultaneous Transmission SAR Test exclusion considerations:

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

The ratio is determined by:

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

Where:

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

Simultaneous Transmission SAR required:

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

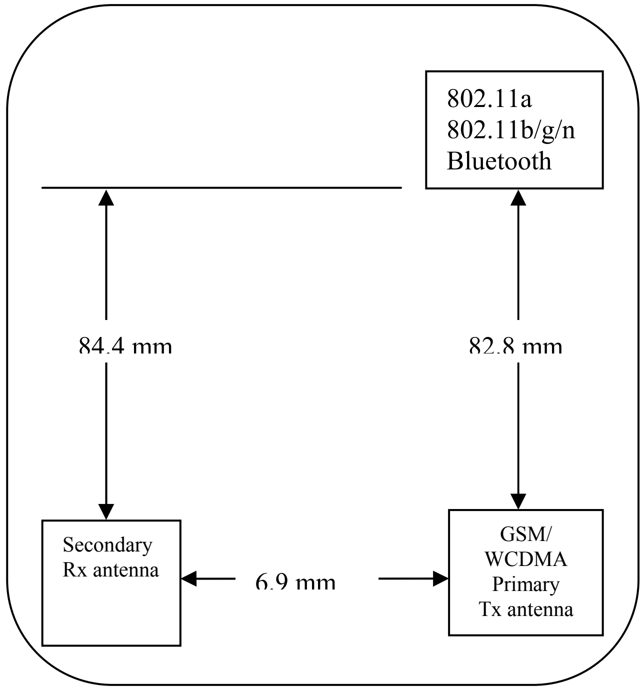

Figure 1.9-1 Back view of device showing closest distance between antenna pairs

1.9.1 Simultaneous Transmission Analysis

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

Table 1.9.1-1 Simultaneous Transmission Scenarios

Test	Configuration	Licensed Transmitters		WiFi 2.4/5.0G 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	0.54	0.40	0.94
	Right Cheek	UMTS Band V	0.63		1.03
	Right Cheek	GSM/GPRS/EDGE 1900	0.59		0.99
	Right Cheek	UMTS Band II	0.58		0.98
	Right Tilt	GSM/GPRS/EDGE 850	0.44	0.40	0.84
	Right Tilt	UMTS Band V	0.45		0.85
	Right Tilt	GSM/GPRS/EDGE 1900	0.42		0.82
	Right Tilt	UMTS Band II	0.44		0.84
	Left Cheek	GSM/GPRS/EDGE 850	0.80	0.19	0.99
	Left Cheek	UMTS Band V	0.90		1.09
	Left Cheek	GSM/GPRS/EDGE 1900	0.94		1.13
	Left Cheek	UMTS Band II	1.09		1.28
	Left Tilt	GSM/GPRS/EDGE 850	0.43	0.22	0.65
	Left Tilt	UMTS Band V	0.40		0.62
	Left Tilt	GSM/GPRS/EDGE 1900	0.45		0.67
	Left Tilt	UMTS Band II	0.45		0.67

Table 1.9.1-2 Highest Head SAR values and summation

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

Test	Configuration	Licensed Transmitters		WiFi 2.4/5.0G 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	GSM/GPRS/EDGE 850	0.62	0.41	1.03
		UMTS Band V	0.65		1.06
		GSM/GPRS/EDGE 1900	0.49		0.90
		UMTS Band II	0.59		1.00
	Holster device back	GSM/GPRS/EDGE 850	0.50	0.29	0.79
		UMTS Band V	0.60		0.89
		GSM/GPRS/EDGE 1900	0.19		0.48
		UMTS Band II	0.36		0.65
	Holster device front	GSM/GPRS/EDGE 850	0.47	0.05	0.52
		UMTS Band V	0.57		0.62
		GSM/GPRS/EDGE 1900	0.28		0.33
		UMTS Band II	0.25		0.30

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

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

Test	Configuration	Licensed Transmitters		WiFi 2.4 G 1 g avg. SAR (W/kg)	Maximum Summation 1 g avg. SAR (W/kg)
		Band	1 g avg. SAR (W/kg)		
Mobile Hotspot SAR	10 mm separation, device back	GSM/GPRS/EDGE 850	0.43	0.49	0.92
		UMTS Band V	0.38		0.87
		GSM/GPRS/EDGE 1900	0.94		1.43
		UMTS Band II	1.30		1.79
	10 mm separation, device front	GSM/GPRS/EDGE 850	0.32	0.10	0.42
		UMTS Band V	0.34		0.44
		GSM/GPRS/EDGE 1900	0.52		0.62
		UMTS Band II	0.52		0.62
	10 mm separation, device left	GSM/GPRS/EDGE 850	0.36	0.27	0.63
		UMTS Band V	0.34		0.61
		GSM/GPRS/EDGE 1900	0.30		0.57
		UMTS Band II	0.36		0.63
	10 mm separation, device right	GSM/GPRS/EDGE 850	0.21	0.08	0.29
		UMTS Band V	0.20		0.28
		GSM/GPRS/EDGE 1900	0.18		0.26
		UMTS Band II	0.16		0.24
	10 mm separation, device top	GSM/GPRS/EDGE 850	0.00	0.23	0.23
		UMTS Band V	0.00		0.23
		GSM/GPRS/EDGE 1900	0.00		0.23
		UMTS Band II	0.00		0.23
	10 mm separation, device top	GSM/GPRS/EDGE 850	0.06	0.00	0.06
		UMTS Band V	0.07		0.07
		GSM/GPRS/EDGE 1900	0.52		0.52
		UMTS Band II	0.23		0.23

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

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

Antenna	Position	SAR 1g	X [mm]	Y [mm]	Z [mm]	
Antenna 1 (802.11 b)	MHS 10 mm back	0.49	-39.2	-45.6	-208.0	
Antenna 2 (UMTS band II)	MHS 10 mm back	1.30	-39.5	45.5	-208.9	
	SAR Sum	1.79				
	[SAR Sum]^1.5	2.39				
	Delta [mm]		0.3	-91.1	0.9	
	closest Distance [mm]					**91.10**
	Ratio	0.03				

Antenna	Position	SAR 1g	X [mm]	Y [mm]	Z [mm]	
Antenna 1 (802.11 b)	MHS 10 mm back,2100 Batt	0.49	-39.2	-42.8	-208.1	
Antenna 2 (UMTS band II)	MHS 10 mm back,2100 Batt	1.30	-39.5	45.5	-208.9	
	SAR Sum	1.79				
	[SAR Sum]^1.5	2.39				
	Delta [mm]		0.3	-88.3	0.8	
	closest Distance [mm]					**88.32**
	Ratio	0.03				

Table 1.9.1-5 Mobile Hotspot configuration ratio of SAR to peak separation distance for pair of transmitters

Note 3: If the ratio of SAR to peak separation distance is ≤ 0.04, Simultaneous SAR measurement is not required.

2.0 DESCRIPTION OF THE TEST EQUIPMENT

2.1 SAR measurement system

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

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

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

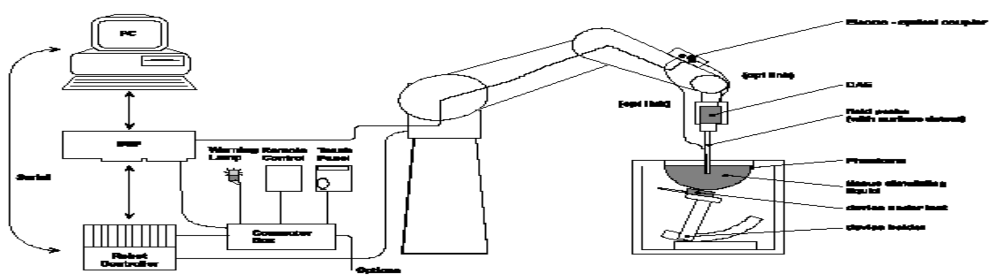

Figure 2.1-1 System Description

2.1.1 Equipment List

Manufacturer	Test Equipment	Model Number	Serial Number	Cal. Due Date (MM/DD/YY)
SCHMID & Partner Engineering AG	E-field probe	ES3DV3	3225	01/10/2014
SCHMID & Partner Engineering AG	E-field probe	EX3DV4	3592	11/14/2013
SCHMID & Partner Engineering AG	E-field probe	ET3DV6	1644	11/13/2013
SCHMID & Partner Engineering AG	Data Acquisition Electronics (DAE3)	DAE3 V1	473	01/15/2014
SCHMID & Partner Engineering AG	Data Acquisition Electronics (DAE3)	DAE3 V1	472	03/07/2013
SCHMID & Partner Engineering AG	Dipole Validation Kit	D835V2	446	01/07/2015
SCHMID & Partner Engineering AG	Dipole Validation Kit	D835V2	4d043	04/07/2013
SCHMID & Partner Engineering AG	Dipole Validation Kit	D1900V2	545	01/09/2015
SCHMID & Partner Engineering AG	Dipole Validation Kit	D1900V2	5d075	04/05/2013
SCHMID & Partner Engineering AG	Dipole Validation Kit	D2450V2	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	11/19/2013
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	12/10/2014
Rohde & Schwarz	Wideband Base Station Simulator	CMW 500	101169	12/10/2014

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.

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

Table 3.1-1 Probe specifications

3.2 Probe calibration and measurement uncertainty

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

Calibration Parameter Determined in Head Tissue Simulating Media

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

Calibration Parameter Determined in Body Tissue Simulating Media

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

Table 3.2-1 Probe ES3DV3 SN: 3225

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	6.57	6.57	6.57	0.44	2.25	± 12.0 %
900	41.5	0.97	6.24	6.24	6.24	0.38	2.52	± 12.0 %
1810	40.0	1.40	5.21	5.21	5.21	0.80	2.10	± 12.0 %
1950	40.0	1.40	5.16	5.16	5.16	0.60	2.09	± 12.0 %
2450	39.2	1.80	4.60	4.60	4.60	0.65	2.00	± 12.0 %

Calibration Parameter Determined in Body Tissue Simulating Media

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

Table 3.2-2 Probe ET3DV6 SN: 1644

Calibration Parameter Determined in Head Tissue Simulating Media

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

Calibration Parameter Determined in Body Tissue Simulating Media

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

Table 3.2-3 Probe EX3DV4 SN: 3592

Calibration Parameter Determined in Head Tissue Simulating Media

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

Calibration Parameter Determined in Body Tissue Simulating Media

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

Table 3.2-4 Probe EX3DV4 SN: 3548

C The validity of ± 100 MHz only applies for DASY v4.4 and higher.

DASY 52 has been used for measurements, therefore ± 100 MHz tolerance is valid.

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

4.0 SAR MEASUREMENT SYSTEM VERIFICATION

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

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

4.1 System accuracy verification for head adjacent use

f (MHz)	Limits / Measured (MM/DD/YYYY)	Scan Type	SAR 1 g/10 g (W/kg)	Dielectric Parameters		Liquid Temp. (°C)
				ε_r	σ [S/m]	
835	Measured (12/09/2012)	Area/Fast Scan	9.44/6.40	40.1	0.89	22.5
	Measured (12/09/2012)	Zoom Scan	9.37/6.15	40.1	0.89	22.5
	Measured (02/04/2013)	Area/Fast Scan	9.15/6.24	40.0	0.90	22.6
	Measured (02/04/2013)	Zoom Scan	9.20/6.05	40.0	0.90	22.6
	Recommended Limits (Dipole: 446)		9.63/6.27	41.5	0.90	N/A
	Recommended Limits (Dipole: 4d043)		9.43/6.14	41.5	0.90	N/A
1900	Measured (11/26/2012)	Area/Fast Scan	38.8/20.5	38.9	1.36	22.6
	Measured (11/26/2012)	Zoom Scan	38.3/20.0	38.9	1.36	22.6
	Measured (11/30/2012)	Area/Fast Scan	39.6/21.0	39.4	1.38	22.8
	Measured (11/30/2012)	Zoom Scan	39.3/20.5	39.4	1.38	22.8
	Measured (12/02/2012)	Area/Fast Scan	40.2/21.3	40.8	1.40	22.7
	Measured (12/02/2012)	Zoom Scan	40.1/20.9	40.8	1.40	22.7
	Measured (01/24/2013)	Area/Fast Scan	38.3/20.3	38.2	1.44	22.7
	Measured (01/24/2013)	Zoom Scan	36.9/19.6	38.2	1.44	22.7
	Measured (01/28/2013)	Area/Fast Scan	38.2/20.4	38.3	1.38	22.9
	Measured (01/28/2013)	Zoom Scan	36.9/19.9	38.3	1.38	22.9
	Recommended Limits (Dipole: 545)		40.0/20.8	40.0	1.40	N/A
	Recommended Limits (Dipole: 5d075)		40.4/21.0	40.0	1.40	N/A
2450	Measured (01/18/2013)	Area/Fast Scan	53.5/25.4	37.6	1.79	22.8
	Measured (01/18/2013)	Zoom Scan	52.6/24.6	37.6	1.79	22.8
	Measured (01/21/2013)	Area/Fast Scan	52.1/24.7	37.4	1.76	22.5
	Measured (01/21/2013)	Zoom Scan	50.9/24.1	37.4	1.76	22.5
	Measured (02/27/2013)	Area/Fast Scan	50.4/22.4	37.7	1.78	20.5
	Measured (02/27/2013)	Zoom Scan	49.6/23.2	37.7	1.78	20.5
	Recommended Limits		54.1/25.3	39.2	1.80	N/A
5200	Measured (01/14/2013)	Zoom Scan	83.5/24.2	34.4	4.66	21.5
	Measured (01/17/2013)	Zoom Scan	83.21/24	34.8	4.88	22.5
	Measured (02/25/2013)	Zoom Scan	77.5/22.4	34.7	4.75	21.7
	Recommended Limits		80.8/23.0	36.0	4.66	N/A
5500	Measured (01/14/2013)	Zoom Scan	93.9/26.7	34.2	5.10	21.5
	Measured (01/17/2013)	Zoom Scan	86.1/24.5	34.0	4.97	22.5
	Measured (02/25/2013)	Zoom Scan	85.8/24.5	34.6	5.13	21.7
	Recommended Limits		87.3/24.7	35.6	4.96	N/A

5800	Measured (01/10/2013)	Zoom Scan	86.1/24.4	34.7	5.52	21.1
	Measured (01/17/2013)	Zoom Scan	82/23.2	34.2	5.40	22.5
	Measured (02/25/2013)	Zoom Scan	85.8/24.4	34.0	5.45	21.7
	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 6.1.1-1 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 ε_r	Dielectric Parameters σ [S/m]	Liquid Temp (°C)
835	Head	Measured (12/09/2012)	815	40.4	0.87	22.5
			825	40.3	0.88	
			835	40.1	0.89	
			850	40.0	0.90	
		Measured (02/04/2013)	815	40.3	0.88	22.6
			825	40.2	0.89	
			835	40.0	0.90	
			850	39.8	0.91	
			865	39.6	0.93	
		Recommended Limits	835	41.5	0.90	N/A
	Muscle	Measured (12/09/2012)	815	54.6	0.95	22.5
			825	54.5	0.96	
			835	54.4	0.97	
			850	54.2	0.98	
		Measured (02/04/2013)	815	53.3	0.96	22.6

			825	53.2	0.97	
			835	53.0	0.98	
			850	52.8	1.00	
		Recommended Limits	835	55.2	0.97	N/A
1900	Head	Measured (11/26/2012)	1850	39.1	1.33	22.6
			1900	38.9	1.36	
			1910	38.8	1.37	
			1980	38.8	1.46	
		Measured (11/28/2012)	1850	38.7	1.34	22.6
			1900	38.5	1.39	
			1910	38.4	1.40	
			1980	38.1	1.47	
		Measured (11/30/2012)	1850	39.6	1.33	22.8
			1900	39.4	1.38	
			1910	39.4	1.39	
			1980	39.2	1.46	
		Measured (12/02/2012)	1850	41.2	1.36	22.7
			1900	40.8	1.40	
			1910	40.8	1.41	
			1980	40.5	1.46	
		Measured (01/24/2013)	1850	38.8	1.34	20.4
			1900	38.6	1.39	
			1910	38.6	1.40	
			1980	38.4	1.48	
		Measured (01/24/2013)	1850	38.3	1.40	22.7
			1900	38.2	1.44	
			1910	38.1	1.45	
		Measured (01/28/2013)	1850	38.5	1.33	22.5
			1900	38.3	1.38	
			1910	38.3	1.39	
			1980	38.0	1.47	
		Recommended Limits	1900	40.0	1.40	N/A
	Muscle	Measured (11/26/2012)	1850	50.9	1.47	22.6
			1900	50.7	1.51	
			1910	50.6	1.53	
		Measured (11/28/2012)	1850	51.2	1.51	22.6
			1900	50.9	1.57	
			1910	50.9	1.58	
		Measured (11/30/2012)	1850	51.3	1.49	22.8
			1900	51.2	1.55	
			1910	51.2	1.56	
		Measured (12/02/2012)	1850	52.4	1.45	22.7
			1900	52.0	1.51	
			1910	51.9	1.53	
		Recommended Limits	1900	53.3	1.52	N/A
2450	Head	Measured (01/18/13)	2410	37.8	1.75	22.8
			2450	37.6	1.79	

			2480	37.6	1.82	
		Measured (01/21/13)	2410	37.5	1.72	22.5
			2450	37.4	1.76	
			2480	37.2	1.79	
		Measured (02/27/2013)	2410	37.8	1.74	20.5
			2450	37.7	1.78	
			2480	37.6	1.82	
		Recommended Limits	2450	39.2	1.80	N/A
	Muscle	Measured (01/18/13)	2410	51.3	1.91	22.8
			2450	51.2	1.96	
			2480	51.1	2.00	
		Measured (01/21/13)	2410	51.2	1.85	22.5
			2450	51.1	1.91	
			2480	51.0	1.95	
		Measured (02/27/2013)	2410	50.3	1.89	20.5
			2450	50.2	1.94	
			2480	50.1	1.98	
		Recommended Limits	2450	52.7	1.95	N/A
5200	Head	Measured (01/14/13)	5180	34.4	4.65	21.5
			5200	34.4	4.66	
			5280	34.2	4.77	
		Measured (01/17/13)	5180	34.8	4.87	22.5
			5200	34.8	4.88	
			5280	34.6	4.99	
		Measured (02/25/2013)	5180	34.7	4.72	21.7
			5200	34.7	4.75	
			5280	34.4	4.83	
		Recommended Limits	5200	36.0	4.66	N/A
	Muscle	Measured (01/14/13)	5180	46.8	5.06	21.5
			5200	46.7	5.09	
			5280	46.6	5.19	
		Measured (01/17/13)	5180	46.9	5.17	22.5
			5200	46.9	5.19	
			5280	46.8	5.32	
		Measured (02/25/2013)	5180	47.0	5.12	22.1
			5200	47.0	5.14	
			5320	46.7	5.32	
		Recommended Limits	5200	49.0	5.30	N/A
5500	Head	Measured (01/14/13)	5500	34.2	5.10	21.5
			5620	33.9	5.25	
		Measured (01/17/13)	5500	34.0	4.97	22.5
			5620	33.8	5.10	
		Measured (02/25/2013)	5500	34.6	5.13	21.7
			5620	34.3	5.27	
		Recommended Limits	5500	35.6	4.96	N/A
	Muscle	Measured (01/14/13)	5500	46.4	5.54	21.5
			5620	46.2	5.72	

		Measured (01/17/13)	5500	46.4	5.37	22.5
			5620	46.2	5.53	
		Measured (02/25/2013)	5500	47.9	5.64	22.1
			5620	47.7	5.81	
		Recommended Limits	5500	48.6	5.65	N/A
5800	Head	Measured (01/10/13)	5745	34.9	5.43	21.1
			5800	34.7	5.52	
		Measured (01/17/13)	5745	34.5	5.40	22.5
			5800	34.2	5.48	
		Measured (02/25/2013)	5745	34.0	5.33	21.7
			5800	34.0	5.45	
		Recommended Limits	5800	35.3	5.27	N/A
	Muscle	Measured (01/10/13)	5745	46.0	5.98	21.0
			5800	45.9	6.06	
		Measured (01/17/13)	5745	46.6	5.80	22.5
			5800	46.4	5.90	
		Measured (02/25/2013)	5745	45.8	5.72	22.1
			5800	45.8	5.85	
		Recommended Limits	5800	48.2	6.00	N/A

Table 6.2-1 Electrical parameters of tissue simulating liquid

6.2.2 Test Configuration

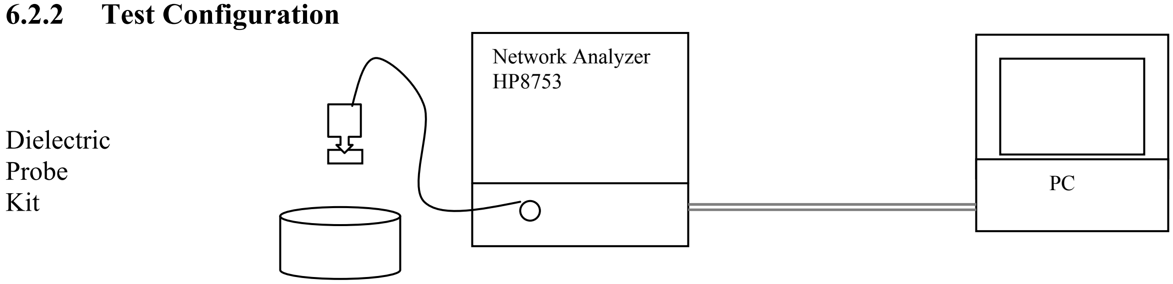

Figure 6.2.2-1 Test configuration

6.2.3 Procedure

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

7.0 SAR SAFETY LIMITS

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

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

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

Table 7.0-2 SAR safety limits

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

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

8.0 DEVICE POSITIONING

8.1 Device holder for SAM Twin Phantom

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

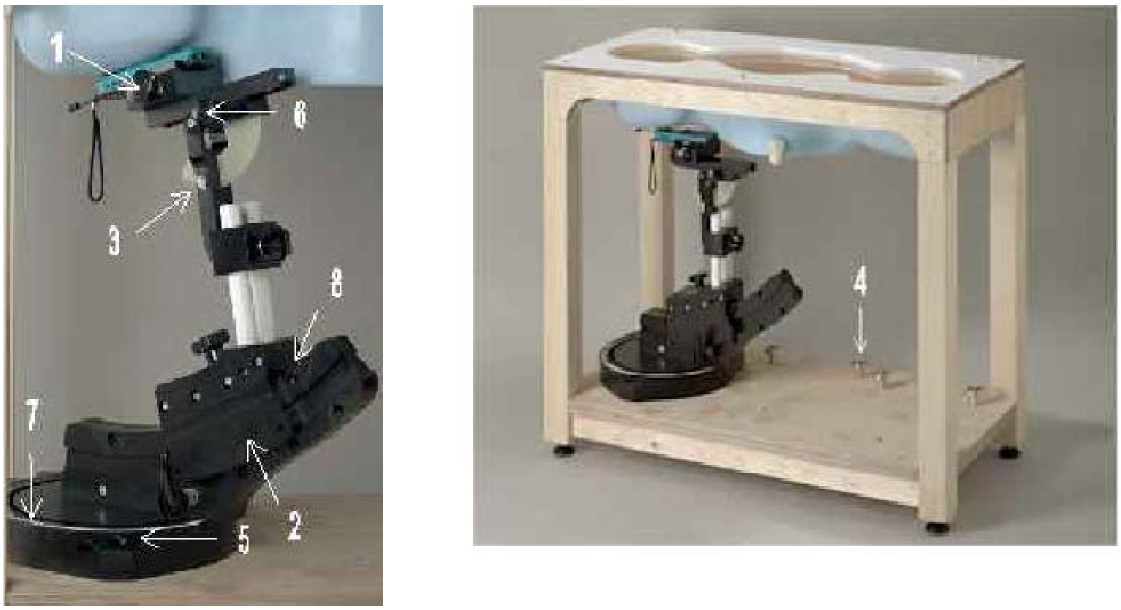

Figure 8.1-1 Device Holder

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

8.2 Description of the test positioning

8.2.1 Test Positions of Device Relative to Head

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

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

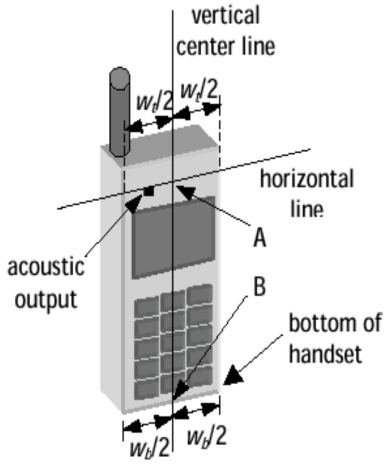

Figure 8.2.1-1 Handset vertical and horizontal reference lines – fixed case

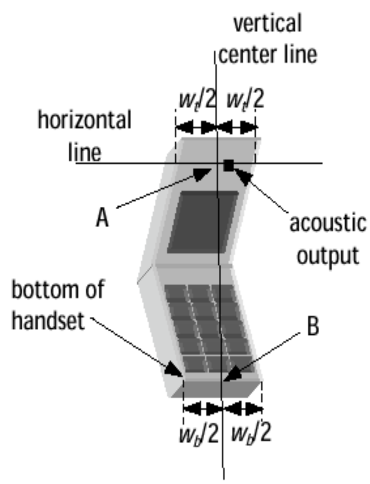

Figure 8.2.1-2 Handset vertical and horizontal reference lines – “clam-shell”

Definition of the "cheek" position

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

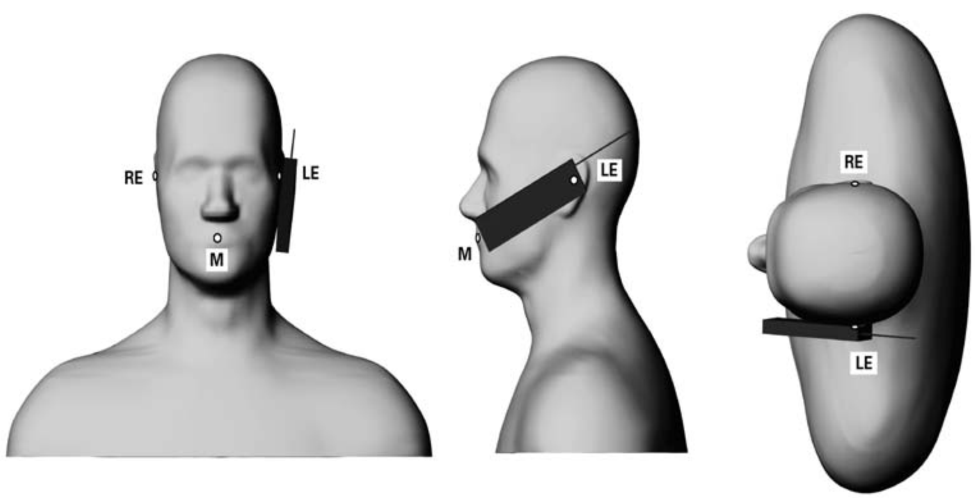

Figure 8.2.1-3 Phone position 1, "cheek" or "touch" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only.

Definition of the "Tilted" Position

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

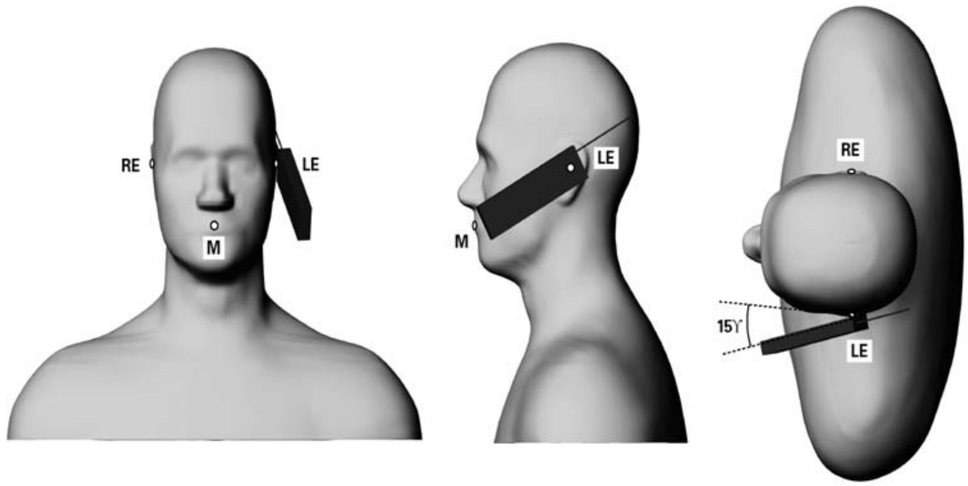

Figure 8.2.1-4 Phone position 2, "tilted position." The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only.

8.2.2 Body-worn Configuration

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

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

8.2.3 Limb/Hand Configuration

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

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

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

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

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

9.0 HIGH LEVEL EVALUATION

9.1 Maximum search

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

9.2 Extrapolation

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

9.3 Boundary correction

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

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

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

10.0 MEASUREMENT UNCERTAINTY

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

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

Table 10.0-1 Worst-Case uncertainty budget for 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.

Relative DASY5 Uncertainty Budget for Fast SAR Tests

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

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

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

DASY5 Uncertainty Budget
for the 3 - 6 GHz range

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

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

11.0 TEST RESULTS

11.1 SAR Measurement results at highest power measured against the head

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm	SAR, averaged over 1 g Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Right Head Cheek	2-slots GSM/EDGE 850 MHz	824.2	128				
		836.8	190	30.1	0.54	-0.14	0.54
		848.8	251				
Right Head 15° Tilt	2-slots GSM/EDGE 850 MHz	824.2	128				
		836.8	190	30.1	0.44	0.40	0.44
		848.8	251				
Right Head Cheek	1-slot GSM 850 MHz	824.2	128				
		836.8	190	31.9	0.49	0.03	0.49
		848.8	251				
Left Head Cheek	2-slots GSM/EDGE 850 MHz	824.2	128	30.5	0.75	-0.12	0.75
		836.8	190	30.1	0.80	0.11	0.80
		848.8	251	30.1	0.68	-0.05	0.68
Left Head Cheek	3-slots GSM/EDGE 850 MHz	824.2	128				
		836.8	190	29.3	0.76	-0.17	0.76
		848.8	251				
Left Head Cheek	4-slots GSM/EDGE 850 MHz	824.2	128				
		836.8	190	27.5	0.69	-0.10	0.69
		848.8	251				
Left Head 15° Tilt	2-slots GSM/EDGE 850 MHz	824.2	128				
		836.8	190	30.1	0.43	-0.04	0.43
		848.8	251				
Left Head Cheek	1-slot GSM 850 MHz	824.2	128				
		836.8	190	31.9	0.66	0.11	0.66
		848.8	251				

Table 11.1-1a SAR results for GSM/DTM 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	2-slots GSM/EDGE 850 MHz	824.2	128				
		836.8	190	30.1	0.72	-0.14	0.72
		848.8	251				

Table 11.1-1b SAR results for GSM/DTM 850 head configuration
2100mA Battery

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	Scan Type	SAR, averaged over 1 g Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Right Head Cheek	WCDMA FDD V 850 MHz	826.4	4132					
		836.4	4182	24.4		0.63	0.01	0.63
		846.6	4233					
Right Head 15° Tilt	WCDMA FDD V 850 MHz	826.4	4132					
		836.4	4182	24.4		0.45	-0.07	0.45
		846.6	4233					
Left Head Cheek	WCDMA FDD V 850 MHz	826.4	4132	24.6		0.78	-0.13	0.78
		836.4	4182	24.4		0.83	-0.13	0.83
		846.6	4233	24.3		0.90	0.00	0.90
		846.6	4233	24.3	2nd Scan	0.85	-0.03	0.85
Left Head 15° Tilt	WCDMA FDD V 850 MHz	826.4	4132					
		836.4	4182	24.4		0.40	0.04	0.40
		846.6	4233					

Table 11.1-2a 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)
Left Head Cheek	WCDMA FDD V 850 MHz	826.4	4132				
		836.4	4182				
		846.6	4233	24.3	0.84	-0.01	0.84

Table 11.1-2b SAR results for WCDMA FDD V head configuration
2100mA Battery

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	Scan Type	SAR, averaged over 1 g		
						Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Right Head Cheek	2-slots GSM/EDGE 1900 MHz	1850.2	512					
		1880.0	661	29.1		0.59	0.09	0.59
		1909.8	810					
Right Head 15° Tilt	2-slots GSM/EDGE 1900 MHz	1850.2	512					
		1880.0	661	29.1		0.42	-0.01	0.42
		1909.8	810					
Right Head Cheek	1-slot GSM 1900 MHz	1850.2	512					
		1880.0	661	29.2		0.37	-0.11	0.37
		1909.8	810					
Left Head Cheek	2-slots GSM/EDGE 1900 MHz	1850.2	512	29.2		0.93	-0.06	0.93
		1850.2	512	29.2	2nd Scan	0.91	0.17	0.91
		1880.0	661	29.1		0.83	-0.06	0.83
		1909.8	810	29.0		0.69	-0.08	0.69
Left Head Cheek	3-slots GSM/EDGE 1900 MHz	1850.2	512	26.6		0.70	-0.06	0.70
		1880.0	661	26.6				
		1909.8	810	26.4				
Left Head Cheek	4-slots GSM/EDGE 1900 MHz	1850.2	512	26.0		0.77	-0.09	0.77
		1880.0	661					
		1909.8	810					
Left Head 15° Tilt	2-slots GSM/EDGE 1900 MHz	1850.2	512					
		1880.0	661	29.1		0.45	0.05	0.45
		1909.8	810					
Left Head Cheek	1-slot GSM 1900 MHz	1850.2	512					
		1880.0	661	29.2		0.54	0.20	0.54
		1909.8	810					

Table 11.1-3a SAR results for GSM/DTM 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	29.2	0.94	-0.03	0.94
		1880.0	661				
		1909.8	810				

Table 11.1-3b SAR results for GSM/DTM 1900 head configuration
2100mA Battery

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	Scan Type	SAR, averaged over 1 g		
						Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Right Head Cheek	WCDMA FDD II 1900 MHz	1852.4	9262					
		1880.0	9400	23.0		0.58	0.05	0.58
		1907.6	9538					
Right Head 15° Tilt	WCDMA FDD II 1900 MHz	1852.4	9262					
		1880.0	9400	23.0		0.44	0.00	0.44
		1907.6	9538					
Left Head Cheek	WCDMA FDD II 1900 MHz	1852.4	9262	23.1		0.87	0.08	0.87
		1880.0	9400	23.0		0.96	0.02	0.96
		1907.6	9538	23.0		**1.09**	-0.07	**1.09**
		1907.6	9538	23.0	2nd Scan	1.02	0.04	1.02
Left Head 15° Tilt	WCDMA FDD II 1900 MHz	1852.4	9262					
		1880.0	9400	23.0		0.45	0.07	0.45
		1907.6	9538					

Table 11.1-4a SAR results for WCDMA FDD II 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	WCDMA FDD II 1900 MHz	1852.4	9262				
		1880.0	9400				
		1907.6	9538	23.0	1.08	-0.12	1.08

Table 11.1-4b SAR results for WCDMA FDD II head configuration
2100mA Battery

Test Position	Mode	f (MHz)	Channel	Volume Scan	Cond. Output Power (dBm)	Measured SAR (W/kg)		
						Power Drift (dB)	Averaged over 1 g	Averaged over 10 g
Right Head Cheek	802.11 b 2450 MHz	2412	1					
		2437	6		20.4	-0.04	0.40	0.19
		2462	11					
Right Head 15° Tilt	802.11 b 2450 MHz	2412	1					
		2437	6		20.4	-0.06	0.40	0.19
		2462	11					
Left Head Cheek	802.11 b 2450 MHz	2412	1					
		2437	6		20.4	0.08	0.19	0.11
		2462	11					
Left Head 15° Tilt	802.11 b 2450 MHz	2412	1					
		2437	6		20.4	0.07	0.22	0.12
		2462	11					

Table 11.1-5a SAR results for WiFi/WLAN/802.11b head configuration (Rev3-01/03)

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	SAR, averaged over 1 g		
					Power Drift (dB)	Averaged over 1 g	Averaged over 10 g
Right Head Cheek	802.11 b 2450 MHz	2412	1				
		2437	6	20.4	0.06	0.39	0.19
		2462	11				

Table 11.1-5b SAR results for WiFi/WLAN/802.11b head configuration 2100mA Battery (Rev3-01/03)

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	Measured SAR (W/kg)		
					Power Drift (dB)	Averaged over 1 g	Averaged over 10 g
Right Head Cheek	802.11 b 2450 MHz	2412	1				
		2437	6	17.8	0.45	0.12	0.06
		2462	11				

Table 11.1-5c SAR results for WiFi/WLAN/802.11b head configuration (Rev3-02)

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	Measured SAR (W/kg)		
					Power Drift (dB)	Averaged over 1 g	Averaged over 10 g
Right Head Cheek	Bluetooth 2450 MHz	2402	0				
		2441	39	10.0	0.55	0.00	0.00
		2480	78				
Right Head 15° Tilt	Bluetooth 2450 MHz	2402	0				
		2441	39	10.0	0.46	0.00	0.00
		2480	78				
Left Head Cheek	Bluetooth 2450 MHz	2402	0				
		2441	39	10.0	0.23	0.00	0.00
		2480	78				
Left Head 15° Tilt	Bluetooth 2450 MHz	2402	0				
		2441	39	10.0	0.44	0.00	0.00
		2480	78				

Table 11.1-6a SAR results for Bluetooth 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	Bluetooth 2450 MHz	2402	0				
		2441	39	10.0	-0.05	0.00	0.00
		2480	78				

**Table 11.1-6b SAR results for Bluetooth head configuration
2100mA Battery**

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	5220	44	17.4	0.14	0.21	0.08
		5260	52	17.3	0.23	0.23	0.09
		5520	104	19.8	0.14	0.24	0.07
		5745	149	14.2	0.15	0.10	0.04
Right Head 15° Tilt	802.11 a 5180-5805 MHz	5220	44				
		5260	52				
		5520	104	19.8	0.45	0.19	0.06
		5745	149				
Left Head Cheek	802.11 a 5180-5805 MHz	5220	44	17.4	-0.04	0.12	0.05
		5260	52	17.3	0.31	0.15	0.06
		5520	104	19.8	-0.06	0.12	0.04
		5745	149	14.2	1.03	0.05	0.02
Left Head 15° Tilt	802.11 a 5180-5805 MHz	5220	44				
		5260	52	17.3	0.18	0.18	0.07
		5520	104				
		5745	149				

Table 11.1-7a SAR results for 802.11a head configuration (Rev3-01/03)

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	5220	44				
		5260	52				
		5520	104	19.8	0.21	0.23	0.07
		5745	149				

Table 11.1-7b SAR results for 802.11a head configuration 2100mA Battery (Rev3-01/03)

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	5220	44				
		5260	52				
		5520	104	12.0	0.25	0.04	0.01
		5745	149				

Table 11.1-7c SAR results for 802.11a head configuration (Rev3-02)

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 Hotspot Mode	1.0	Back				
	836.8	190		1.0	Back	27.4	0.43	0.08	0.43
	848.8	251		1.0	Back				
	836.8	190		1.0	Front	27.4	0.32	0.19	0.32
	836.8	190		1.0	Left	27.4	0.36	0.03	0.36
	836.8	190		1.0	Right	27.4	0.21	-0.05	0.21
	836.8	190		1.0	Bottom	27.4	0.06	-0.07	0.06
	836.8	190		1.0	Back+HS	27.4	0.39	-0.05	0.39
	836.8	190		1.0	Back+ 2100mA	27.4	0.43	-0.02	0.43
3-slots GPRS 850 MHz	836.8	190		1.0	Back	26.1	0.41	-0.19	0.41
4-slots GPRS 850 MHz	836.8	190		1.0	Back	24.3	0.41	0.05	0.41
2-slots GPRS 850 MHz	836.8	190	Body-worn	1.5	Back	30.2	0.62	0.27	0.62
	836.8	190		Holster	Back	30.2	0.50	0.38	0.50
	836.8	190		Holster	Front	30.2	0.47	-0.09	0.47

Table 11.2-1 SAR results for EDGE/EGPRS 850 body-worn and Hotspot 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 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)
WCDMA FDD V 850 MHz	826.4	4132	Body Hotspot Mode	1.0	Back				
	836.4	4182		1.0	Back	21.0	0.38	0.00	0.38
	846.6	4233		1.0	Back				
	836.4	4182		1.0	Front	21.0	0.34	-0.03	0.34
	836.4	4182		1.0	Left	21.0	0.34	0.05	0.34
	836.4	4182		1.0	Right	21.0	0.20	0.04	0.20
	836.4	4182		1.0	Bottom	21.0	0.07	-0.09	0.07
	836.4	4182		1.0	Back+HS	21.0	0.36	-0.05	0.36
	836.4	4182		1.0	Back+ 2100mA	21.0	0.38	0.04	0.38
WCDMA FDD V 850 MHz	836.4	4182	Body-worn	1.5	Back	24.4	**0.65**	-0.10	**0.65**
	836.4	4182		Holster	Back	24.4	0.60	0.03	0.60
	836.4	4182		Holster	Front	24.4	0.57	-0.09	0.57

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

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Conducted Output Power (dBm)	Scan Type	SAR, averaged over 1 g		
								Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
2-slots GPRS 1900MHz	1850.2	512	Body Hotspot Mode	1.0	Back	29.1		0.91	-0.01	0.91
	1850.2	512		1.0	Back	29.1	2nd Scan	0.92	-0.11	0.92
	1880.0	661		1.0	Back	29.1		0.86	-0.02	0.86
	1909.8	810		1.0	Back	28.8		0.83	-0.08	0.83
	1880.0	661		1.0	Front	29.1		0.49	-0.26	0.52
	1880.0	661		1.0	Left	29.1		0.30	-0.08	0.30
	1880.0	661		1.0	Right	29.1		0.18	-0.01	0.18
	1880.0	661		1.0	Bottom	29.1		0.52	-0.07	0.52
	1909.8	512		1.0	Back+HS	29.1		0.89	-0.06	0.89
3-slots GPRS 1900MHz	1850.2	512		1.0	Back	26.4		0.74	0.11	0.74
4-slots GPRS 1900MHz	1850.2	512		1.0	Back	25.8		0.85	0.04	0.85
2-slots GPRS 1900 MHz	1880.0	661	Body-worn	1.5	Back	29.1		0.47	0.01	0.47
	1880.0	661		Holster	Front	29.1		0.19	-0.06	0.19
	1880.0	661		Holster	Back	29.1		0.28	-0.12	0.28

Table 11.2-3a SAR results for GPRS/EDGE 1900 body-worn and Hotspot 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/ EDGE 1900MHz	1850.2	512	Body Hotspot Mode	1.0	Back	29.1	0.94	0.00	0.94
	1880.0	661		1.0	Back				
	1909.8	810		1.0	Back				
2-slots GPRS/ EDGE 1900MHz	1850.2	512	Body-worn	1.5	Back				
	1880.0	661		1.5	Back	29.1	0.49	-0.01	0.49
	1909.8	810		1.5	Back				

Table 11.2-3b SAR results for GPRS/EDGE 1900 body-worn and Hotspot configurations 2100mA Battery

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Conducted Output Power (dBm)	Scan Type	SAR, averaged over 1 g		
								Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
WCDMA FDD II 1900 MHz	1852.4	9262	Body Hotspot Mode	1.0	Back	23.1		1.10	0.17	1.10
	1880.0	9400		1.0	Back	23.0		1.10	0.10	1.10
	1907.6	9538		1.0	Back	23.0		1.20	0.03	1.20
	1907.6	9538		1.0	Back	23.0	2nd scan	**1.30**	0.09	**1.30**
	1880.0	9400		1.0	Front	23.0		0.52	-0.11	0.52
	1880.0	9400		1.0	Left	23.0		0.36	0.11	0.36
	1880.0	9400		1.0	Right	23.0		0.16	0.04	0.16
	1880.0	9400		1.0	Bottom	23.0		0.56	0.06	0.56
	1907.6	9400		1.0	Back+HS	23.0		1.03	-0.06	1.03
WCDMA FDD II 1900 MHz	1880.0	9400	Body-worn	1.5	Back	23.0		0.59	0.05	0.59
	1880.0	9400		Holster	Back	23.0		0.36	0.04	0.36
	1880.0	9400		Holster	Front	23.0		0.25	0.05	0.25

Table 11.2-4a SAR results for WCDMA FDD II body-worn and Hotspot 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 II 1900 MHz	1852.4	9262	Body Hotspot Mode	1.0	Back				
	1880.0	9400		1.0	Back				
	1907.6	9538		1.0	Back	23.0	1.13	0.10	1.13
WCDMA FDD II 1900 MHz	1852.4	9262	Body-worn	1.5	Back				
	1880.0	9400		1.5	Back	23.0	0.58	0.03	0.58
	1907.6	9538		1.5	Back				

Table 11.2-4b SAR results for WCDMA FDD II body-worn and Hotspot configurations 2100mA Battery

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Conducted Output Power (dBm)	Measured SAR (W/kg)		
							Power Drift (dB)	Averaged over 1 g	Averaged over 10 g
802.11b/ WLAN 2450 MHz	2437	6	Body Hotspot Mode	1.0	Front	20.4	0.32	0.10	0.06
	2437	6		1.0	Left	20.4	-0.08	0.27	0.14
	2437	6		1.0	Right	20.4	-0.08	0.08	0.04
	2437	6		1.0	Top	20.4	0.03	0.23	0.12
802.11b/ WLAN 2450 MHz	2437	6	Body-worn	1.5	Back	20.4	-0.02	0.32	0.17
	2437	6		Holster	Front	20.4	0.02	0.05	0.03
	2437	6		Holster	Back	20.4	-0.02	0.26	0.14

Table 11.2-5a SAR results for WiFi/WLAN/802.11b body-worn and Hotspot configurations (Rev3-01)

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Conducted Output Power (dBm)	Measured SAR (W/kg)		
							Power Drift (dB)	Averaged over 1 g	Averaged over 10 g
802.11b/ WLAN 2450 MHz	2437	6	Body Hotspot Mode	1.0	Back	17.8	-0.04	0.37	0.18
	2437	6		1.0	Back+HS	17.8	0.02	0.27	0.13
	2437	6		1.0	Back 2100mA batt	17.8	0.07	0.37	0.18

Table 11.2-5b SAR results for WiFi/WLAN/802.11b body-worn and Hotspot configurations (Rev3-02)

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Conducted Output Power (dBm)	Extrapolated SAR (W/kg)		
							Power Drift (dB)	Averaged over 1 g	Averaged over 10 g
802.11b/ WLAN 2450 MHz	2437	6	Body Hotspot Mode	1.0	Back	18.9	-0.04	0.49	0.24
	2437	6		1.0	Back+HS	18.9	0.02	0.36	0.17
	2437	6		1.0	Back 2100mA batt	18.9	0.07	0.49	0.24

Table 11.2-5c SAR results for WiFi/WLAN/802.11b body-worn and Hotspot configurations (Rev3-03)

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Side	Conducted Output Power (dBm)	Measured SAR (W/kg)		
							Power Drift (dB)	Averaged over 1 g	Averaged over 10 g
Bluetooth 2450 MHz	2437	39	Body Hotspot Mode	1.0	Back	10.0	-0.01	0.00	0.00
	2437	39		1.0	Front				
	2437	39		1.0	Left				
	2437	39		1.0	Right				
	2437	39		1.0	Top	10.0	0.14	0.00	0.00
Bluetooth 2450 MHz	2437	39	Body-worn	1.5	Back	10.0	-0.25	0.00	0.00
	2437	39		Holster	Front				
	2437	39		Holster	Back				

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

Mode	Freq. (MHz)	Channel	Holster type / device configuration	Conducted Output Power (dBm	Measured SAR (W/kg) Power Drift (dBm)	Averaged over 1 g	Averaged over 10 g
802.11a 5180 - 5805 MHz	**5180**	**36**	No Holster, back side 15 mm away	14.7	0.04	0.31	0.12
	5320	**64**	No Holster, back side 15 mm away	15.1	0.17	0.23	0.08
	5520	**104**	No Holster, back side 15 mm away	12.0	-0.15	0.05	0.02
	5825	**165**	No Holster, back side 15 mm away	10.6	-0.12	0.25	0.09
	5180	**36**	Leather Holster, back side facing	14.7	-0.17	0.10	0.04
	5180	**36**	Leather Holster, front side facing	14.7	-0.02	0.01	0.01
	5180	**36**	No Holster, Headset, back side 15mm away	14.7	-0.13	0.31	0.12

Table 11.2-7a SAR results for 802.11a body-worn configurations (Rev3-02)

Mode	Freq. (MHz)	Channel	Holster type / device configuration	Conducted Output Power (dBm	Measured SAR (W/kg) Power Drift (dBm)	Averaged over 1 g	Averaged over 10 g
802.11a 5180 - 5805 MHz	**5180**	**36**	No Holster, back side 15 mm away	14.7	-0.19	0.31	0.12

Table 11.2-7b SAR results for 802.11a body-worn configurations 2100mA Battery (Rev3-02)

Mode	Freq. (MHz)	Channel	Holster type / device configuration	Conducted Output Power (dBm	Extrapolated SAR (W/kg)		
					Power Drift (dBm)	Averaged over 1 g	Averaged over 10 g
802.11a 5180 - 5805 MHz	**5180**	**36**	No Holster, back side 15 mm away	14.7	0.04	0.31	0.12
	5320	**60**	No Holster, back side 15 mm away	16.7	0.17	0.41	0.14
	5520	**104**	No Holster, back side 15 mm away	17.3	-0.15	0.17	0.07
	5825	**165**	No Holster, back side 15 mm away	11.3	-0.12	0.30	0.11
	5180	**36**	Leather Holster, back side facing	14.7	-0.17	0.10	0.04
	5180	**36**	Leather Holster, front side facing	14.7	-0.02	0.01	0.01
	5180	**36**	No Holster, Headset, back side 15mm away	14.7	-0.13	0.31	0.12

Table 11.2-7c SAR results for 802.11a body-worn configurations (Rev3-03)

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