SAR Compliance Test Report

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

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

RF Exposure Environment: This device has been shown to be in compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in, FCC 47 CFR Part 2.1093, FCC 96-326, IEEE Std. C95.1-1992, Health Canada's Safety Code 6, as reproduced in RSS-102 issue 4-2010 and has been tested in accordance with the measurement procedures specified in latest FCC OET KDB Procedures, ANSI/IEEE Std. C95.3-2002, IEEE 1528-2013, and RSS 102-issue4-2010

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

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Report was revised to **RTS-6057-1405-01 Rev 2** on July 10, 2014.
Updated Table 4.1-1 (Page 75-76): 1800 MHz and 2450 MHz dipole validation results.
Updated Appendix A and B: validation plots for 1800 MHz and 2450 MHz and head SAR plots for 802.11b.

Contents

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	RGY181LW			
FCC ID	L6ARGY180LW			
PIN	Radiated: 2FFF3D40 (Rev 1), 2FFF3D3C (Rev 1), 2FFF46F9 (Rev 2), 2FFF4703 (Rev 2) Conducted: 2FFF3D32 (Rev 1), 2FFF46F5 (Rev 2)			
Hardware Rev	Rev 1-x04-00/01, Rev 2-x05-02/03/04/05			
Software Version	10.3.0.302/416/590/680			
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)	33.1 30.4	30.2 28.5	29.0 26.0	28.0 25.5
Tolerance in power setting on centre channel (dB)	± 0.6	± 0.5	± 0.5	± 0.5
Duty cycle	1:8	2:8	3:8	4:8
Transmitting frequency range (MHz)	824.2 – 848.8 1850.2 – 1909.8	824.2 – 848.8 1850.2 – 1909.8	824.2 – 848.8 1850.2 – 1909.8	824.2 – 848.8 1850.2 – 1909.8
Mode(s) of Operation	802.11b	802.11g	802.11n	Bluetooth
Nominal maximum conducted RF output power (dBm)	18.0	18.5	17.0	10.0
Tolerance in power setting on centre channel (dB)	+2/-2.5	+2/-2.5	+2/-2.5	± 0.75
Duty cycle	1:1	1:1	1:1	N/A
Transmitting frequency range (MHz)	2412-2462	2412-2462	2412-2462	2402-2483
Mode(s) of Operation	802.11a/n/ac (low band)	802.11a/n/ac (middle band)	802.11a/n/ac (upper band I)	802.11a/n/ac (upper band II)
Nominal maximum conducted RF output power (dBm)	18.0	18.0	18.0	18.0
Tolerance in power setting on centre channel (dB)	+2/-2.5	+2/-2.5	+2/-2.5	+2/-2.5

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	HSPA+/ WCDMA / UMTS FDD V (850)	HSPA+/ WCDMA / UMTS FDD IV (1800)	HSPA+/ WCDMA / UMTS FDD II (1900)	NFC
Nominal maximum conducted RF output power (dBm)	24.2	24.0	24.0	N/A
Tolerance in power setting on centre channel (dB)	± 0.6	± 0.6	± 0.6	N/A
Duty cycle	1:1	1:1	1:1	N/A
Transmitting frequency range (MHz)	824.6 – 846.6	1712.4 – 1752.6	1852.4 – 1907.6	13.56

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

Note 1: The BlackBerry model: RGY181LW also supports GSM/GPRS/EDGE 900/1800 MHz, and UMTS/HSPA+ Bands VIII/I, and LTE bands 1/3/8/20 that are operational outside North America only, therefore no data is presented in this report for those bands. RGY181LW also supports LTE band 7 which is operational in Canada only, therefore no data is presented in this report.

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

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

Device Model	RGY181LW					
FCC ID	L6ARGY180LW					
PIN	Radiated: 2FFF3D40 (Rev 1), 2FFF3D3C (Rev 1), 2FFF46F9 (Rev 2), 2FFF4703 (Rev 2) Conducted: 2FFF3D32 (Rev 1), 2FFF46F5 (Rev 2)					
Hardware Rev	Rev 1-x04-00/01, Rev 2-x05-002/003					
Software Version	10.3.0.302/416/590/680					
Prototype or Production Unit	Production					
Transmission channel bandwidth	Band 2: 1.4 MHz , 3 MHz , 5 MHz, 10 MHz, 15 MHz, 20 MHz Band 4: 1.4 MHz , 3 MHz , 5 MHz, 10 MHz, 15 MHz, 20 MHz Band 5: 1.4 MHz , 3 MHz , 5 MHz, 10 MHz Band 17: 5 MHz, 10 MHz Band 13: 5 MHz, 10 MHz					
Transmission channel number and frequencies						
	LTE band 2		**LTE band 4**		**LTE band 5**	
	f (MHz)	**Chan.**	**f (MHz)**	**Chan.**	**f (MHz)**	**Chan.**
L	1860.0	18700	1720.0	20050	829.0	20450
M	1880.0	18900	1732.5	20175	836.5	20525
H	1900.0	19100	1745.0	20300	844.0	20600
	LTE band 17		**LTE band 13**			
	f (MHz)	**Chan.**	**Chan.**	**f (MHz)**		

L	709.0	23780	23205	779.5	
M	710.0	23790	23230	782.0	
H	711.0	23800	23255	784.5	

UE Category	Category 3	
Modulation supported in uplink	QPSK, 16QAM	
Description of LTE antenna	1 Tx/Rx Ant, Sharing with GSM/UMTS;	
LTE voice available/supported	Possible	
Hotspot with LTE+WiFi	Yes	
Hotspot with LTE+WiFi active with GSM/UMTS voice	No	
LTE MPR permanently built-in by design	Yes	
LTE A-MPR	Disabled during testing , by setting NV value to NV_01 on the CMW500	
Nominal Maximum conducted RF Output Power (dBm) +/- Tolerance in Power Setting on centre channel (dB)	Band 2: 23.4 ± 0.50 Band 4: 23.4 ± 0.50 Band 5: 23.2 ± 0.50 Band 13: 23.4 ± 0.50 Band 17: 23.1 ± 0.50	
Other non-LTE U.S. wireless operating modes/bands	GSM//WCDMA/HSPA^{+}	GSM 850 MHz UMTS/WCDMA 850 MHz UMTS/WCDMA 1800 MHz GSM 1900 MHz UMTS/WCDMA 1900 MHz
	802.11 a/ac/b/g/n	2.4 GHz Wi-Fi 5 GHz Wi-Fi 2.4 GHz BT

Table 1.3-2 Test device characterization all North American wireless operating modes/bands

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

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

Note 2: Open loop antenna tuning is used for all transmitters (GSM/WCDMA/LTE) which is equivalent to the static tuning configurations used in traditional handsets that do not have any specific antenna tuning flexibility or additional hardware.

1.4 Body worn accessories (holsters)

The device has been tested with the holster listed below and/or a 15mm manufacturer recommended separation distance. The holster has been designed with the intended device orientation being with the LCD facing the belt clip only. Proper positioning is vital for protection of the LCD display, and to help maximize the battery life of the device. The device can also be placed in the holster with the backside facing the belt clip. Body SAR measurements were carried out with the worst-case configuration front LCD side and backside towards the belt clip.

Number	Holster Type	Part Number	Separation distance (mm)
NA	NA	NA	NA

Table 1.4.1. Body worn holster

1.5 Headset

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

1)HDW-49299-002
2)HDW-55351-002

1.6 Battery

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

1)BAT-58107-00x

1.7 Procedure used to establish test signal

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

1.8 Highlights of the FCC OET SAR Measurement Requirements

1.8.1 SAR Measurement Procedures for 802.11 a/b/g/n/ac 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 24 x 24 x 22 mm[1]

Table 1.8.1-2 Zoom Scan requirement

Note 1: "Auto-extend zoom scan when maxima on boundary" is enabled, which can result in the zoom scan dimensions varying between 30x30x30 to 60x60x30 mm and 24x24x22 to 48x48x22 mm.

- Frequency Channel Configuration: 802.11 b/g modes are tested on the highest output power channel.
- 802.11a is tested for UNII operations on the highest output power channel of each sub band (low, mid, upper band I, and upper band II). If the highest output power channel has a SAR level that is not 3dB lower than the limit, then the "default test channels" of each sub band must also be tested. The "default channels" for each sub band are [36, 48], [52, 64], [104, 116, 124, and 136], [149, 157, and 165].
- For each frequency band, testing at higher rates and higher modulations is not required when the maximum average output power for each of these configurations is less than ¼ dB higher than those measured at the lowest data rate.
- SAR is not required for 802.11g/n channels when the maximum average output power is less than ¼ dB higher than that measured on the corresponding 802.11b channels.
- SAR test was conducted on each "default test channel" and each band with the worst case modulation and highest duty cycle, if the SAR level was within 3dB of the limit.
- 802.11a does not support channels 52 – 140 in Hotspot and GO/Direct mode.
- 802.11ac was spot checked on each bandwidth on the worst case SAR for 802.11a
- 802.11ac does not support Hotspot and GO/Direct mode

- Conducted power measurements:

802.11b/g/n At Full Power								
802.11b @ 1Mbps			802.11g @ 6Mbps			802.11n @ 6.5 Mbps		
f (MHz)	Chan	Max. average conducted power (dBm)	f (MHz)	Chan	Max. average conducted power (dBm)	f (MHz)	Chan	Max. average conducted power (dBm)
2412	1	17.2	2412	1	16.1	2412	1	16.0
2437	**6**	**18.0**	**2437**	**6**	**18.5**	2437	6	16.8
2462	11	17.4	2462	11	16.7	2462	11	16.5

802.11g			802.11b		
Data Rate (Mbps)	Mod.	Channel 6 Max. average conducted power (dBm)	Data Rate (Mbps)	Mod.	Channel 6 Max. average conducted power (dBm)
6	BPSK	18.5	1	BPSK	17.8
9	BPSK	18.4	2	DQPSK	18.0
12	QPSK	18.5	5.5	CCK	18.0
18	QPSK	18.4	11	CCK	18.0
24	16-QAM	16.1			
36	16-QAM	16.1			
48	64-QAM	16.1			
54	64-QAM	16.0			

802.11 n		
Data Rate (Mbps)	Mod.	Channel 6 Max. average conducted power (dBm)
6.5	MCS0	16.8
13	MCS1	16.7
19.5	MCS2	16.7
26	MCS3	15.1
39	MCS4	15.1
52	MCS5	15.0
58.5	MCS6	14.2
65	MCS7	14.2

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

802.11b/g/n At Reduced Power For Hotspot Mode								
802.11b @ 1Mbps			802.11g @ 6Mbps			802.11n @ 6.5 Mbps		
f (MHz)	Chan	Max. average conducted power (dBm)	f (MHz)	Chan	Max. average conducted power (dBm)	f (MHz)	Chan	Max. average conducted power (dBm)
2412	1	9.6	2412	1	9.6	2412	1	9.5
2437	**6**	**10.2**	2437	6	10.2	2437	6	10.2
2462	11	9.9	2462	11	9.8	2462	11	9.8

802.11g			802.11b		
Data Rate (Mbps)	Mod.	Channel 6 Max. average conducted power (dBm)	Data Rate (Mbps)	Mod.	Channel 6 Max. average conducted power (dBm)
6	BPSK	10.2	1	BPSK	10.2
9	BPSK		2	DQPSK	10.3
12	QPSK	10.1	5.5	CCK	10.3
18	QPSK		11	CCK	10.3
24	16-QAM	10.2			
36	16-QAM				
48	64-QAM	10.2			
54	64-QAM				

802.11 n		
Data Rate (Mbps)	Mod.	Channel 6 Max. average conducted power (dBm)
6.5	MCS0	10.2
13	MCS1	
19.5	MCS2	
26	MCS3	
39	MCS4	10.3
52	MCS5	
58.5	MCS6	
65	MCS7	10.3

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

Note 1: There is fixed power reduction on Wi-Fi in hotspot mode. Power reduction is triggered when device is set to Hotspot mode.

802.11b/g/n GO/Direct Mode								
802.11b @ 1Mbps			802.11g @ 6Mbps			802.11n @ 6.5 Mbps		
f (MHz)	Chan	Max. average conducted power (dBm)	f (MHz)	Chan	Max. average conducted power (dBm)	f (MHz)	Chan	Max. average conducted power (dBm)
2412	1	17.2	2412	1	15.9	2412	1	14.7
2437	6	17.6	2437	6	18.2	2437	6	16.3
2462	11	17.4	2462	11	15.4	2462	11	15.2
2472	13	17.6	2472	13	15.3	2472	13	15.2

802.11g			802.11b		
Data Rate (Mbps)	Mod.	Channel 6 Max. average conducted power (dBm)	Data Rate (Mbps)	Mod.	Channel 6 Max. average conducted power (dBm)
6	BPSK	18.2	1	BPSK	17.6
9	BPSK		2	DQPSK	18.0
12	QPSK	18.3	5.5	CCK	18.0
18	QPSK		11	CCK	17.9
24	16-QAM	15.8			
36	16-QAM				
48	64-QAM				
54	64-QAM	15.7			

802.11 n		
Data Rate (Mbps)	Mod.	Channel 6 Max. average conducted power (dBm)
6.5	MCS0	16.3
13	MCS1	
19.5	MCS2	
26	MCS3	14.7
39	MCS4	
52	MCS5	
58.5	MCS6	
65	MCS7	13.9

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

802.11a/n At Full Power on Rev 1								
802.11a (low band) 6Mbps			802.11a (mid band) 6Mbps			802.11a (upper band I) 6Mbps		
f (MHz)	**Chan**	**Max. average conducted power (dBm)**	**f (MHz)**	**Chan**	**Max. average conducted power (dBm)**	**f (MHz)**	**Chan**	**Max. average conducted power (dBm)**
5180	**36**	**18.2**	**5260**	**52**	**18.2**	5500	100	19.0
5200	40	18.2	5280	56	18.0	**5520**	**104**	**19.1**
5220	44	18.1	5300	60	18.0	5540	108	19.0
5240	48	18.0	5320	64	18.0	5560	112	19.1
						5580	116	19.0
						5600	120	19.0
						5620	124	19.0
						5640	128	19.0
						5660	132	19.0
						5680	136	18.8
						5700	140	18.9
						802.11a (upper band II) 6Mbps		
						f (MHz)	**Chan**	**Max. average conducted power (dBm)**
						5745	**149**	**19.1**
						5765	153	19.0
						5785	157	18.9
						5805	161	18.6
						5825	165	18.5

		802.11a (lower band)	802.11a (middle band)	802.11a (upper band I)	802.11a (upper band II)
Data Rate (Mbits)	**Mod.**	**Channel 36**	**Channel 52**	**Channel 104**	**Channel 149**
		Max. average conducted power (dBm)	**Max. average conducted power (dBm)**	**Max. average conducted power (dBm)**	**Max. average conducted power (dBm)**
6	BPSK	18.3	18.1	18.8	19.0
9	BPSK	18.3	18.1	19.0	19.0
12	QPSK	18.3	18.1	19.0	19.1
18	QPSK	18.5	18.1	19.0	19.1
24	16-QAM	17.7	17.7	18.4	18.7
36	16-QAM	17.2	17.1	18.0	18.1
48	64-QAM	16.4	16.4	16.9	17.5
54	64-QAM	16.2	16.2	16.9	17.2

	802.11n (lower band)	802.11n (middle band)	802.11n (upper band I)	802.11n (upper band II)
Mod.	Channel 36	Channel 52	Channel 104	Channel 149
	Max. average conducted power (dBm)	Max. average conducted power (dBm)	Max. average conducted power (dBm)	Max. average conducted power (dBm)
MCS0	18.2	18.1	19.0	19.1
MCS1	18.6	18.2	18.9	19.5
MCS2	18.5	18.3	19.0	19.1
MCS3	17.9	17.7	18.6	18.7
MCS4	17.4	17.3	18.2	18.2
MCS5	16.5	16.4	17.0	17.6
MCS6	16.3	16.2	17.1	17.4
MCS7	15.3	15.2	16.0	16.4

Table 1.8.1-4a 802.11 a/n modulation type/data rate vs. conducted power at full power on Rev 1

802.11a/n At Full Power On Rev 2 (Spot Check On Band Edge)								
802.11a (low band) 6Mbps			802.11a (mid band) 6Mbps			802.11a (upper band I) 6Mbps		
f (MHz)	Chan	Max. average conducted power (dBm)	f (MHz)	Chan	Max. average conducted power (dBm)	f (MHz)	Chan	Max. average conducted power (dBm)
5180	**36**	**15.9**	**5260**	**52**	**17.9**	5500	100	16.2
5200	40	15.8	5280	56		**5520**	**104**	**18.5**
5220	44	15.7	5300	60		5540	108	
5240	48	15.7	5320	64	17.6	5560	112	
						5580	116	
						5600	120	
						5620	124	
						5640	128	
						5660	132	
						5680	136	
						5700	140	13.6
						802.11a (upper band II) 6Mbps		
						f (MHz)	Chan	Max. average conducted power (dBm)
						5745	149	15.9
						5765	153	
						5785	157	
						5805	161	
						5825	165	18.2

		802.11a (lower band)	**802.11a (middle band)**	**802.11a (upper band I)**	**802.11a (upper band II)**
Data Rate (Mbits)	**Mod.**	**Channel 36**	**Channel 52**	**Channel 104**	**Channel 165**
		Max. average conducted power (dBm)	**Max. average conducted power (dBm)**	**Max. average conducted power (dBm)**	**Max. average conducted power (dBm)**
6	BPSK	15.9	17.9	18.5	18.2
9	BPSK				
12	QPSK				
18	QPSK				
24	16-QAM	15.7	17.2	17.8	17.6
36	16-QAM				
48	64-QAM				
54	64-QAM	15.8	15.8	16.0	16.1

	802.11n (lower band)	**802.11n (middle band)**	**802.11n (upper band I)**	**802.11n (upper band II)**
Mod.	**Channel 36**	**Channel 52**	**Channel 104**	**Channel 165**
	Max. average conducted power (dBm)	**Max. average conducted power (dBm)**	**Max. average conducted power (dBm)**	**Max. average conducted power (dBm)**
MCS0	15.9	17.8	18.3	14.2
MCS1				
MCS2				
MCS3				
MCS4	15.7	16.7	17.2	14.3
MCS5				
MCS6				
MCS7	14.6	14.6	15.0	14.1

Table 1.8.1-4b 802.11 a/n modulation type/data rate vs. conducted power at full power on Rev 2

Note: Rev 2 reduced conducted power on the band edge, so only a spot check on these channels was done.

802.11a/n At Reduced Power For Hotspot Mode					
802.11a (low band) 6Mbps			**802.11a (upper band II) 6Mbps**		
f (MHz)	**Chan**	**Max. average conducted power (dBm)**	**f (MHz)**	**Chan**	**Max. average conducted power (dBm)**
5180	36	**10.5**	5745	149	**11.4**
5200	40	10.4	5765	153	11.1
5220	44	10.2	5785	157	11.0
5240	48	10.1	5805	161	10.8
			5825	165	10.8

	802.11a (lower band)	**802.11 a (upper band II)**
Data Rate (Mbits)	**Channel 36**	**Channel 149**
	Max. average conducted power (dBm)	**Max. average conducted power (dBm)**
6	10.5	11.4
24	10.5	11.3
54	10.4	11.3

	802.11n (lower band)	**802.11n (upper band II)**
Mod.	**Channel 36**	**Channel 149**
	Max. average conducted power (dBm)	**Max. average conducted power (dBm)**
MCS0	10.4	11.3
MCS4	10.3	11.1
MCS7	10.3	11.1

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

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

802.11a/n Full Power GO/Direct Mode					
802.11a (low band) 6Mbps			**802.11a (upper band II) 6Mbps**		
f (MHz)	**Chan**	**Max. average conducted power (dBm)**	**f (MHz)**	**Chan**	**Max. average conducted power (dBm)**
5180	36	**15.9**	5745	149	15.9
5200	40	15.8	5765	153	18.5
5220	44	15.7	5785	157	18.3
5240	48	15.7	5805	161	18.1
			5825	165	18.2

	802.11a (lower band)	**802.11 a (upper band II)**
Data Rate (Mbits)	**Channel 36**	**Channel 153**
	Max. average conducted power (dBm)	**Max. average conducted power (dBm)**
6	15.9	18.5
24	15.7	17.9
54	15.8	16.5

	802.11n (lower band)	**802.11n (upper band II)**
Mod.	**Channel 36**	**Channel 153**
	Max. average conducted power (dBm)	**Max. average conducted power (dBm)**
MCS0	15.9	14.5
MCS4	15.7	14.4
MCS7	14.6	14.3

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

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

802.11ac At Full Power On Rev 1									
BW (MHz)	802.11ac (low band) MCS0			802.11ac (mid band) MCS0			802.11ac (upper band I) MCS0		
	f (MHz)	Chan	Max. average conducted power (dBm)	f (MHz)	Chan	Max. average conducted power (dBm)	f (MHz)	Chan	Max. average conducted power (dBm)
20	**5180**	**36**	**18.1**	**5260**	**52**	**18.0**	5500	100	19.0
	5200	40	18.0	5280	56	18.0	**5520**	**104**	**19.0**
	5220	44	18.0	5300	60	18.0	5540	108	19.0
	5240	48	18.0	5320	64	18.0	5560	112	19.0
							5580	116	19.0
							5600	120	18.9
							5620	124	18.9
							5640	128	18.9
							5660	132	18.8
							5680	136	18.8
							5700	140	18.8
							802.11ac (upper band II) MCS0		
							f (MHz)	**Chan**	**Max. average conducted power (dBm)**
							5745	**149**	**19.0**
							5765	153	18.9
							5785	157	18.6
							5805	161	18.4
							5825	165	18.1

BW (MHz)	Data Rate (Mbits)	802.11ac (lower band)	802.11ac (middle band)	802.11ac (upper band I)	802.11ac (upper band II)
		Channel 36	**Channel 52**	**Channel 104**	**Channel 149**
		Max. average conducted power (dBm)	**Max. average conducted power (dBm)**	**Max. average conducted power (dBm)**	**Max. average conducted power (dBm)**
20	MCS0	18.1	18.0	19.0	19.0
	MCS5	15.8	15.8	16.6	16.8
	MCS9	7.2	7.1	7.8	8.0
BW (MHz)	**Data Rate (Mbits)**	**802.11ac (lower band)**	**802.11ac (middle band)**	**802.11ac (upper band I)**	**802.11ac (upper band II)**
		Channel 36	**Channel 52**	**Channel 104**	**Channel 149**
		Max. average conducted power (dBm)	**Max. average conducted power (dBm)**	**Max. average conducted power (dBm)**	**Max. average conducted power (dBm)**
40	MCS0	17.1	16.8	17.7	17.7
	MCS5	15.8	15.6	16.2	16.8
	MCS9	12.0	11.7	12.4	12.7

BW (MHz)	Data Rate (Mbits)	802.11ac (lower band)	802.11ac (middle band)	802.11ac (upper band I)	802.11ac (upper band II)
		Channel 36	Channel 52	Channel 104	Channel 149
		Max. average conducted power (dBm)	Max. average conducted power (dBm)	Max. average conducted power (dBm)	Max. average conducted power (dBm)
80	MCS0	16.7	16.3	17.6	17.3
	MCS5	14.6	14.2	15.3	15.3
	MCS9	10.9	10.9	11.6	11.6

Table 1.8.1-5a 802.11 ac modulation type/data rate vs. conducted power per bandwidth at full power on Rev 1

802.11ac At Full Power On Rev 2 (Spot Check On Band Edge)

BW (MHz)	802.11ac (low band) MCS0			802.11ac (mid band) MCS0			802.11ac (upper band I) MCS0		
	f (MHz)	Chan	Max. average conducted power (dBm)	f (MHz)	Chan	Max. average conducted power (dBm)	f (MHz)	Chan	Max. average conducted power (dBm)
20	**5180**	**36**	**15.9**	**5260**	**52**	**18.0**	5500	100	17.0
	5200	40	15.8	5280	56		**5520**	**104**	**18.4**
	5220	44	15.8	5300	60		5540	108	
	5240	48	15.7	5320	64	17.1	5560	112	
							5580	116	
							5600	120	
							5620	124	
							5640	128	
							5660	132	
							5680	136	
							5700	140	13.4
							802.11ac (upper band II) MCS0		
							f (MHz)	**Chan**	**Max. average conducted power (dBm)**
							5745	**149**	**14.9**
							5765	153	
							5785	157	
							5805	161	
							5825	165	14.6

BW (MHz)	Data Rate (Mbits)	802.11ac (lower band)	802.11ac (middle band)	802.11ac (upper band I)	802.11ac (upper band II)
		Channel 36	Channel 52	Channel 104	Channel 149
		Max. average conducted power (dBm)	Max. average conducted power (dBm)	Max. average conducted power (dBm)	Max. average conducted power (dBm)
20	MCS0	15.9	18.0	18.4	14.9
	MCS5	15.7	15.7	16.2	14.8
	MCS9	7.2	7.5	7.7	8.0
BW (MHz)	**Data Rate (Mbits)**	**802.11ac (lower band)**	**802.11ac (middle band)**	**802.11ac (upper band I)**	**802.11ac (upper band II)**
		Channel 36	**Channel 52**	**Channel 104**	**Channel 149**
		Max. average conducted power (dBm)	**Max. average conducted power (dBm)**	**Max. average conducted power (dBm)**	**Max. average conducted power (dBm)**
40	MCS0	15.8	17.9	18.4	15.0
	MCS5	15.6	15.7	16.2	14.8
	MCS9	7.5	7.5	7.7	8.3
BW (MHz)	**Data Rate (Mbits)**	**802.11ac (lower band)**	**802.11ac (middle band)**	**802.11ac (upper band I)**	**802.11ac (upper band II)**
		Channel 36	**Channel 52**	**Channel 104**	**Channel 149**
		Max. average conducted power (dBm)	**Max. average conducted power (dBm)**	**Max. average conducted power (dBm)**	**Max. average conducted power (dBm)**
80	MCS0	15.9	18.0	18.4	15.0
	MCS5	15.7	15.7	16.2	14.8
	MCS9	7.3	7.5	7.5	8.1

Table 1.8.1-5b 802.11 ac modulation type/data rate vs. conducted power per bandwidth at full power on Rev 2

Note: Rev 2 reduced conducted power on the band edge, so only a spot check on these channels was done.

1.8.2 SAR Measurement Requirements for Bluetooth

Channel	Freq (MHz)	Mode	Conducted Avg. Transmit Power (dBm)
0	2402	DH5	8.6
39	2441	DH5	10.4
78	2480	DH5	6.7

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:

- 802.11a/b/g/n: back off 6/8 dB

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

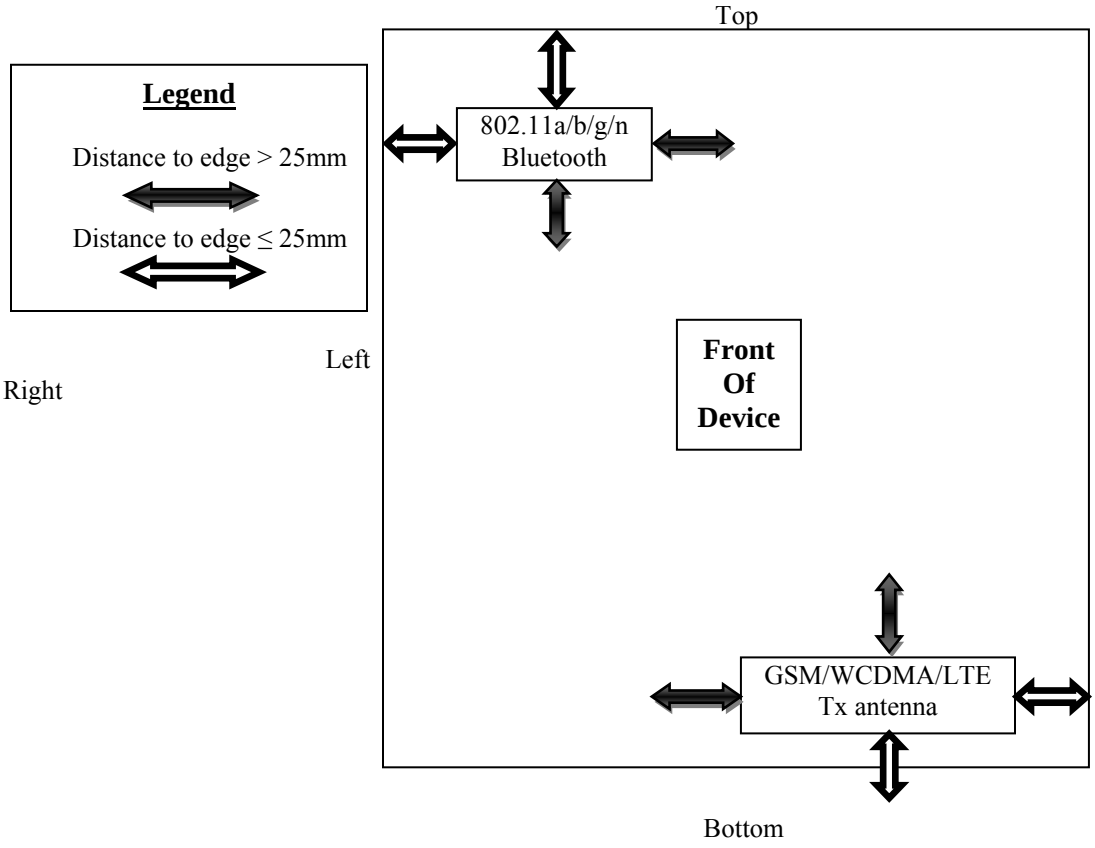

Figure 1.8.3-1 Identification of all sides for SAR Testing

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

Hotspot Sides for SAR Testing						
Mode	**Front**	**Back**	**Top**	**Bottom**	**Left**	**Right**
GPRS 850/1900, WCDMA/HSPA II/IV/V, LTE band 2/4/5/7/13/17	Yes	Yes	No	Yes	No	Yes
Bluetooth 2.4GHz/802.11 a/b/g/n/ac (2.4 GHz/5.0 GHz)	Yes	Yes	Yes	No	Yes	No

Table 1.8.3-1 Identification of all sides for SAR Testing

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

- The device supports EGPRS/GPRS Multi-slot Class 12, DTM/GPRS Multi-slot Class11 and DTM/EGPRS Multi-slot Class10.
- CMU200 base station simulator with DTM software option CMU-K44 was used to set device in DTM (CS+PD) mode for testing. However, device could not be connected in DTM 4-slots uplink.
- For each slot addition in multi-slot modes (DTM, GPRS, EDGE), there is software power reduction of ≈ 3/1/1 dB per slot respectively for GSM 850 and 2/2.5/0.5 dB per slot respectively for GSM 1900.
- For head configurations, 1 slot CS, 2/3-slots (PD) and DTM (CS+PD) were evaluated.
- For body SAR configurations, 1 slot CS, 2/3/4-slots GPRS (PD) mode were tested.
- In EDGE/GPRS mode, GMSK Modulation was used using CS1-CS4 or MCSI-MCS4.
- 8-PSK modulation or MCS5-MCS9 code scheme were avoided since maximum burst avg . power was measured lower on those modulation schemes.
- Please refer to the conducted power measurements table below:

Mode	Freq. (MHz)	Ch.	Max burst averaged conducted power (dBm) CS1 (GMSK)	Max burst averaged conducted power (dBm) MCS1 (GMSK)	Max burst averaged conducted power (dBm) MCS5 (8-QPSK)
1-slot GPRS/EDGE 850 MHz	824.2	128	33.6		
	836.8	190	33.3		
	848.8	251	33.3		
2-slots GPRS 850 MHz	824.2	128	30.7		
	836.8	190	30.2		
	848.8	251	30.2		
3-slots GPRS 850 MHz	824.2	128	29.2		
	836.8	190	28.9		
	848.8	251	28.7		
4-slots GPRS 850 MHz	824.2	128	27.1		
	836.8	190	26.8		
	848.8	251	26.6		
2-slots EDGE 850 MHz	824.2	128	30.7	30.6	25.6
	836.8	190	30.2	30.2	25.3
	848.8	251	30.2	30.2	25.0
2-slots DTM 850 MHz	824.2	128	30.6	30.6	30.6
	836.8	190	30.4	30.4	30.4
	848.8	251	30.1	30.1	30.1
3-slots	824.2	128	29.3	29.3	24.5

EDGE 850 MHz	836.8	190	29.0	29.0	24.1
	848.8	251	28.8	28.7	23.8
3-slots DTM 850 MHz	824.2	128	29.3	29.4	29.3
	836.8	190	29.0	29.0	28.9
	848.8	251	28.8	28.7	28.7
4-slots EDGE 850 MHz	824.2	128	27.1	27.1	23.2
	836.8	190	26.9	26.9	22.9
	848.8	251	26.6	26.6	22.6
1-slot GPRS/EDGE 1900 MHz	1850.2	512	31.0		
	1880.0	661	31.0		
	1909.8	810	30.8		
2-slots GPRS 1900 MHz	1850.2	512	29.4		
	1880.0	661	29.5		
	1909.8	810	29.4		
3-slots GPRS 1900 MHz	1850.2	512	26.5		
	1880.0	661	26.5		
	1909.8	810	26.3		
4-slots GPRS 1900 MHz	1850.2	512	25.9		
	1880.0	661	25.7		
	1909.8	810	25.7		
2-slots EDGE 1900MHz	1850.2	512	29.4	29.4	25.1
	1880.0	661	29.4	29.4	25.1
	1909.8	810	29.4	29.3	25.1
2-slots DTM 1900MHz	1850.2	512	29.4	29.4	29.4
	1880.0	661	29.5	29.4	29.4
	1909.8	810	29.4	29.3	29.3
3-slots EDGE 1900MHz	1850.2	512	26.6	26.6	23.8
	1880.0	661	26.5	26.5	23.9
	1909.8	810	26.4	26.5	24.0
3-slots DTM 1900MHz	1850.2	512	26.5	26.5	26.5
	1880.0	661	26.5	26.4	26.4
	1909.8	810	26.2	26.2	26.3
4-slots EDGE 1900MHz	1850.2	512	25.9	25.9	22.9
	1880.0	661	25.8	25.8	22.8
	1909.8	810	25.7	25.7	22.7

Mode	**Freq. (MHz)**	**Ch.**	**Max burst averaged conducted power (dBm)**
1-slot GSM (CS) 850 MHz	824.2	128	33.6
	836.8	190	33.3
	848.8	251	33.3
1-slot GSM (CS) 1900 MHz	1850.2	512	30.9
	1880.0	661	31.0
	1909.8	810	30.8

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

Mode	Freq. (MHz)	Channel	Max burst averaged conducted power (dBm) CS1 (GMSK)	Max burst averaged conducted power (dBm) MCS1 (GMSK)	Max burst averaged conducted power (dBm) MCS5 (8-QPSK)
1-slot GPRS/EDGE 850 MHz	824.2	128	32.8		
	836.8	190	32.8		
	848.8	251	32.7		
2-slots GPRS 850 MHz	824.2	128	29.7		
	836.8	190	29.5		
	848.8	251	29.6		
3-slots GPRS 850 MHz	824.2	128	28.5		
	836.8	190	28.3		
	848.8	251	28.3		
4-slots GPRS 850 MHz	824.2	128	26.5		
	836.8	190	26.3		
	848.8	251	26.1		
2-slots EDGE 850 MHz	824.2	128	29.7		
	836.8	190	29.5		
	848.8	251	29.5		
2-slots DTM 850 MHz	824.2	128	29.7		
	836.8	190	29.5		
	848.8	251	29.5		
3-slots EDGE 850 MHz	824.2	128	28.5		
	836.8	190	28.3		
	848.8	251	28.3		
3-slots DTM 850 MHz	824.2	128	28.5		
	836.8	190	28.3		
	848.8	251	28.3		
4-slots EDGE 850 MHz	824.2	128	26.5		
	836.8	190	26.3		
	848.8	251	26.1		
1-slot GPRS/EDGE 1900 MHz	1850.2	512	29.8		
	1880.0	661	29.8		
	1909.8	810	29.8		
2-slots GPRS 1900 MHz	1850.2	512	28.4		
	1880.0	661	28.5		
	1909.8	810	28.4		
3-slots GPRS 1900 MHz	1850.2	512	25.5		
	1880.0	661	25.5		
	1909.8	810	25.5		
4-slots GPRS 1900 MHz	1850.2	512	25.0		
	1880.0	661	25.0		
	1909.8	810	25.0		

2-slots EDGE 1900MHz	1850.2	512	28.5		
	1880.0	661	28.4		
	1909.8	810	28.4		
2-slots DTM 1900MHz	1850.2	512	28.5		
	1880.0	661	28.4		
	1909.8	810	28.4		
3-slots EDGE 1900MHz	1850.2	512	25.5		
	1880.0	661	25.5		
	1909.8	810	25.6		
3-slots DTM 1900MHz	1850.2	512	25.5		
	1880.0	661	25.5		
	1909.8	810	25.6		
4-slots EDGE 1900MHz	1850.2	512	25.0		
	1880.0	661	25.0		
	1909.8	810	25.0		

Mode	**Freq. (MHz)**	**Channel**	**Max burst averaged conducted power (dBm)**
1-slot GSM (CS) 850 MHz	824.2	128	32.8
	836.8	190	32.8
	848.8	251	32.7
1-slot GSM (CS) 1900 MHz	1850.2	512	29.8
	1880.0	661	29.8
	1909.8	810	29.8

1.8.4-1b GSM/EDGE/GPRS channel vs. conducted power on Rev 2

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

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

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

1.8.6 SAR Measurement Procedures for 3G Devices

WCDMA Handsets

Output Power Verification

- Maximum output power is verified on the High, Middle and Low channels using 12.2 kbps RMC, 12.2 kbps AMR with a 3.4 kbps SRB (signal radio bearer) with TPC (transmit power control) set to all "1's" for WCDMA/HSPA or applying the required inner loop.
- For Release 6 HSPA/Release 7 HSDPA^{+}, output power is measured according to requirements for HS-DPCCH Sub-test 1-4/1-5 and 3GPP TS 34.121.

Head SAR Measurements

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

Body SAR Measurements

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

Handsets with HSPA

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

1.8.7 Test Seup information for WCDMA / HSPDA / HSUPA

a) WCDMA RMC

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

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

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

b) HSDPA

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

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

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

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

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

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

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

c) DC-HSDPA (3GPP Release 8)

Dual Cell – HSDPA has been signalized using the following settings for connection setup:

Parameter During Connection Setup	Value
P-CPICH_Ec/Ior	-10 dB
P-CCPCH	-12
SCH_Ec/Ior	-12
PICH_Ec/Ior	-15
HS-PDSCH	off
HS-SCCH_1	off
DPCH_Ec/Ior	-5
OCNS_Ec/Ior	-3.1

Table 1.8.7-3 Downlink Physical Channels according to 3GPP 34.121 Table E.5.0

The fixed reference channel has been set to H-set 12 according to 3GPP TS 34.121 Table C.8.1.12:

Parameter	Unit	Value
Nominal Average Inf. Bit Rate	kbit/s	60
Inter-TTI Distance	TTI's	1
Information Bit Payload (N_{INF})	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Process	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codecs	Codecs	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table. Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		

Table 1.8.7-4 H-Set 12 QPSK configuration

The same Sub-test settings as for Release 5 HSDPA were used for the tests.

d) HSUPA

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

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

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

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

Table 1.8.7-5 Subtests for UMTS Release 6 HSUPA

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

WCDMA/UMTS/HSPA/HSPA+ At Full Power				
	Band	**FDD V (850)**		
	Freq (MHz)	826.4	836.4	846.6
	Channel	4132	4182	4233
Mode	**Subtest**	**Max burst averaged conducted power (dBm)**		
Rel99	12.2 kbps RMC	24.34	24.36	24.31
Rel99	12.2kbps, Voice, AMR, SRB 3.4 kbps	24.40	24.36	24.30
HSUPA	1	23.38	23.32	22.99
HSUPA	2	22.44	22.42	22.38
HSUPA	3	21.97	22.01	21.97
HSUPA	4	22.92	22.87	22.86
HSUPA	5	22.54	23.22	22.96
HSDPA+	1	23.40	23.47	23.33
HSDPA+	2	23.42	23.44	23.30
HSDPA+	3	23.00	22.95	22.81
HSDPA+	4	23.01	22.95	22.87
DC-HSDPA	1	23.02	23.03	23.24
DC-HSDPA	2	23.03	23.12	23.24
DC-HSDPA	3	22.64	22.64	22.84
DC-HSDPA	4	22.64	22.66	22.77
	Band	**FDD IV (1700)**		
	Freq (MHz)	1712.4	1732.6	1752.6
	Channel	1312	1413	1513
Mode	**Subtest**	**Max burst averaged conducted power (dBm)**		
Rel99	12.2 kbps RMC	24.02	24.26	24.25
Rel99	12.2 kbps, Voice, AMR, SRB 3.4 kbps	24.04	24.24	24.25
HSUPA	1	23.11	22.94	22.65
HSUPA	2	22.05	22.26	22.32
HSUPA	3	21.94	21.58	21.80
HSUPA	4	22.54	22.76	22.83
HSUPA	5	22.55	22.45	22.38
HSDPA+	1	23.10	23.38	23.36
HSDPA+	2	23.12	23.31	23.39
HSDPA+	3	22.60	22.86	22.89
HSDPA+	4	22.61	22.83	22.90
DC-HSDPA	1	22.71	23.05	22.84
DC-HSDPA	2	22.61	22.99	23.00
DC-HSDPA	3	22.26	22.71	22.57
DC-HSDPA	4	22.30	22.63	22.58
	Band	**FDD II (1900)**		

	Freq (MHz)	1852.4	1880.0	1907.6
	Channel	9262	9400	9538
Mode	Subtest	Max burst averaged conducted power (dBm)		
Rel99	12.2 kbps RMC	24.24	24.28	24.06
Rel99	12.2 kbps, Voice, AMR, SRB 3.4 kbps	24.26	24.28	24.02
HSUPA	1	23.08	23.21	22.78
HSUPA	2	22.31	22.45	22.25
HSUPA	3	22.34	21.94	21.77
HSUPA	4	22.75	22.90	22.66
HSUPA	5	23.11	23.01	22.74
HSDPA+	1	23.44	23.42	23.17
HSDPA+	2	23.47	23.43	23.23
HSDPA+	3	22.95	22.96	22.77
HSDPA+	4	22.87	22.96	22.76
DC-HSDPA	1	23.22	22.92	22.97
DC-HSDPA	2	23.26	23.05	22.92
DC-HSDPA	3	22.62	22.45	22.45
DC-HSDPA	4	22.63	22.43	22.41

Table 1.8.7-6a WCDMA (Rel99) / HSPA/HSPA+ conducted power measurements at full power

WCDMA/UMTS/HSPA/HSPA+ At Reduced Power For Hotspot Mode				
	Band	FDD II (1900)		
	Freq (MHz)	1852.4	1880.0	1907.6
	Channel	9262	9400	9538
Mode	Subtest	Max burst averaged conducted power (dBm)		
Rel99	12.2 kbps RMC	23.37	23.37	23.03
Rel99	12.2kbps, Voice, AMR, SRB 3.4 kbps	23.38	23.38	23.02
HSUPA	1	22.37	22.36	21.98
HSDPA+	1	22.40	22.60	22.26

Table 1.8.7-6b WCDMA (Rel99) / HSPA/HSPA+ conducted power measurements on Hotspot mode

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

"1. QPSK with 1 RB allocation

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

2. QPSK with 50% RB allocation

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

3. QPSK with 100% RB allocation

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

Higher order modulations

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

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

4. Other channel bandwidth standalone SAR test requirements

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

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

the smaller channel bandwidth that need SAR testing."

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

• According to "3GPP TS 36.521-1 V10.0.0 (2011-12)":
  •"The channel numbers that designate carrier frequencies so close to the operating band edges that the carrier extends beyond the operating band edge shall not be used. This implies that the first 7, 15, 25, 50, 75 and 100 channel numbers at the lower operating band edge and the last 6, 14, 24, 49, 74 and 99 channel numbers at the upper operating band edge shall not be used for channel bandwidths of 1.4, 3, 5, 10, 15 and 20 MHz respectively."…

LTE Band 2 At Full Power						
Band	**BW**	**Mod.**	**Channel**	**RB**	**Offset**	**Max. avg. conducted power (dBm)**
2	20	QPSK	18700	1	LOW	23.53
2	20	QPSK	18700	1	MID	23.60
2	20	QPSK	18700	1	HIGH	23.54
2	20	QPSK	18700	50	LOW	22.53
2	20	QPSK	18700	50	HIGH	22.50
2	20	QPSK	18700	100	LOW	22.56
2	20	Q16	18700	1	LOW	22.51
2	20	Q16	18700	1	MID	22.55
2	20	Q16	18700	1	HIGH	22.56
2	20	Q16	18700	75	LOW	21.67
2	20	Q16	18700	75	HIGH	21.56
2	20	Q16	18700	100	LOW	21.64
2	20	QPSK	18900	1	LOW	23.65
2	**20**	**QPSK**	**18900**	**1**	**MID**	**23.65**
2	20	QPSK	18900	1	HIGH	23.64
2	**20**	**QPSK**	**18900**	**50**	**LOW**	**22.63**
2	20	QPSK	18900	50	HIGH	22.60
2	**20**	**QPSK**	**18900**	**100**	**LOW**	**22.57**
2	20	Q16	18900	1	LOW	23.03
2	20	Q16	18900	1	MID	23.07
2	20	Q16	18900	1	HIGH	23.05

2	20	Q16	18900	75	LOW	21.69
2	20	Q16	18900	75	HIGH	21.59
2	20	Q16	18900	100	LOW	21.60
2	20	QPSK	19100	1	LOW	23.55
2	20	QPSK	19100	1	MID	23.33
2	20	QPSK	19100	1	HIGH	23.42
2	20	QPSK	19100	50	LOW	22.44
2	20	QPSK	19100	50	HIGH	22.25
2	20	QPSK	19100	100	LOW	22.36
2	20	Q16	19100	1	LOW	22.63
2	20	Q16	19100	1	MID	22.44
2	20	Q16	19100	1	HIGH	22.48
2	20	Q16	19100	75	LOW	21.49
2	20	Q16	19100	75	HIGH	21.43
2	20	Q16	19100	100	LOW	21.38
2	15	QPSK	18900	1	LOW	23.58
2	15	QPSK	18900	1	MID	23.52
2	15	QPSK	18900	1	HIGH	23.49
2	15	QPSK	18900	36	LOW	22.66
2	15	QPSK	18900	36	HIGH	22.60
2	15	QPSK	18900	75	LOW	22.78
2	15	Q16	18900	1	LOW	22.92
2	15	Q16	18900	1	MID	22.88
2	15	Q16	18900	1	HIGH	22.89
2	15	Q16	18900	16	LOW	22.61
2	15	Q16	18900	16	HIGH	22.64
2	15	Q16	18900	75	LOW	21.74
2	10	QPSK	18900	1	LOW	23.53
2	10	QPSK	18900	1	MID	23.51
2	10	QPSK	18900	1	HIGH	23.56
2	10	QPSK	18900	25	LOW	22.63
2	10	QPSK	18900	25	HIGH	22.58
2	10	QPSK	18900	50	LOW	22.63
2	10	Q16	18900	1	LOW	22.94
2	10	Q16	18900	1	MID	22.89
2	10	Q16	18900	1	HIGH	22.95
2	10	Q16	18900	30	LOW	21.59
2	10	Q16	18900	30	HIGH	21.56

2	10	Q16	18900	50	LOW	21.57
2	5	QPSK	18900	1	LOW	23.49
2	5	QPSK	18900	1	MID	23.50
2	5	QPSK	18900	1	HIGH	23.55
2	5	QPSK	18900	10	LOW	22.53
2	5	QPSK	18900	10	HIGH	22.59
2	5	QPSK	18900	25	LOW	22.58
2	5	Q16	18900	1	LOW	22.46
2	5	Q16	18900	1	MID	22.45
2	5	Q16	18900	1	HIGH	22.52
2	5	Q16	18900	8	LOW	22.68
2	5	Q16	18900	8	HIGH	22.71
2	5	Q16	18900	25	LOW	21.64
2	3	QPSK	18900	1	LOW	23.55
2	3	QPSK	18900	1	MID	23.47
2	3	QPSK	18900	1	HIGH	23.52
2	3	QPSK	18900	6	LOW	22.57
2	3	QPSK	18900	6	HIGH	22.56
2	3	QPSK	18900	15	LOW	22.60
2	3	Q16	18900	1	LOW	22.92
2	3	Q16	18900	1	MID	22.87
2	3	Q16	18900	1	HIGH	22.95
2	3	Q16	18900	4	LOW	22.74
2	3	Q16	18900	4	HIGH	22.77
2	3	Q16	18900	15	LOW	21.66
2	1.4	QPSK	18900	1	LOW	23.54
2	1.4	QPSK	18900	1	MID	23.52
2	1.4	QPSK	18900	1	HIGH	23.54
2	1.4	QPSK	18900	3	LOW	23.62
2	1.4	QPSK	18900	3	HIGH	23.61
2	1.4	QPSK	18900	6	LOW	22.67
2	1.4	Q16	18900	1	LOW	22.73
2	1.4	Q16	18900	1	MID	22.66
2	1.4	Q16	18900	1	HIGH	22.73
2	1.4	Q16	18900	5	LOW	22.53
2	1.4	Q16	18900	5	HIGH	22.55
2	1.4	Q16	18900	6	LOW	21.57

Table 1.8.8-1a LTE band 2 conducted power measurements at full power

LTE Band 2 At Reduced Power On Hotspot Mode						
Band	**BW**	**Mod.**	**Channel**	**RB**	**Offset**	**Max. avg. conducted power (dBm)**
2	20	QPSK	18700	1	LOW	22.71
2	20	QPSK	18700	1	MID	22.79
2	20	QPSK	18700	1	HIGH	22.74
2	20	QPSK	18700	50	LOW	22.53
2	20	QPSK	18700	50	HIGH	22.52
2	20	QPSK	18700	100	LOW	22.62
2	20	Q16	18700	1	LOW	22.53
2	20	Q16	18700	1	MID	22.56
2	20	Q16	18700	1	HIGH	22.56
2	20	Q16	18700	75	LOW	21.67
2	20	Q16	18700	75	HIGH	21.59
2	20	Q16	18700	100	LOW	21.64
2	20	QPSK	18900	1	LOW	22.83
2	**20**	**QPSK**	**18900**	**1**	**MID**	**22.90**
2	20	QPSK	18900	1	HIGH	22.89
2	**20**	**QPSK**	**18900**	**50**	**LOW**	**22.71**
2	20	QPSK	18900	50	HIGH	22.65
2	**20**	**QPSK**	**18900**	**100**	**LOW**	**22.65**
2	20	Q16	18900	1	LOW	23.08
2	20	Q16	18900	1	MID	23.14
2	20	Q16	18900	1	HIGH	23.14
2	20	Q16	18900	75	LOW	21.70
2	20	Q16	18900	75	HIGH	21.72
2	20	Q16	18900	100	LOW	21.60
2	20	QPSK	19100	1	LOW	22.80
2	20	QPSK	19100	1	MID	22.66
2	20	QPSK	19100	1	HIGH	22.70
2	20	QPSK	19100	50	LOW	22.52
2	20	QPSK	19100	50	HIGH	22.38
2	20	QPSK	19100	100	LOW	22.43
2	20	Q16	19100	1	LOW	22.67
2	20	Q16	19100	1	MID	22.48

2	20	Q16	19100	1	HIGH	22.55
2	20	Q16	19100	75	LOW	21.56
2	20	Q16	19100	75	HIGH	21.50
2	20	Q16	19100	100	LOW	21.44
2	15	QPSK	18900	1	LOW	22.77
2	15	QPSK	18900	1	MID	22.76
2	15	QPSK	18900	1	HIGH	22.73
2	15	QPSK	18900	36	LOW	22.72
2	15	QPSK	18900	36	HIGH	22.65
2	15	QPSK	18900	75	LOW	22.79
2	15	Q16	18900	1	LOW	22.97
2	15	Q16	18900	1	MID	22.96
2	15	Q16	18900	1	HIGH	22.98
2	15	Q16	18900	16	LOW	22.66
2	15	Q16	18900	16	HIGH	22.69
2	15	Q16	18900	75	LOW	21.79
2	10	QPSK	18900	1	LOW	22.74
2	10	QPSK	18900	1	MID	22.67
2	10	QPSK	18900	1	HIGH	22.72
2	10	QPSK	18900	25	LOW	22.70
2	10	QPSK	18900	25	HIGH	22.68
2	10	QPSK	18900	50	LOW	22.66
2	10	Q16	18900	1	LOW	23.00
2	10	Q16	18900	1	MID	22.95
2	10	Q16	18900	1	HIGH	23.02
2	10	Q16	18900	30	LOW	21.70
2	10	Q16	18900	30	HIGH	21.60
2	10	Q16	18900	50	LOW	21.65
2	5	QPSK	18900	1	LOW	22.73
2	5	QPSK	18900	1	MID	22.73
2	5	QPSK	18900	1	HIGH	22.79
2	5	QPSK	18900	10	LOW	22.60
2	5	QPSK	18900	10	HIGH	22.62
2	5	QPSK	18900	25	LOW	22.59
2	5	Q16	18900	1	LOW	22.50
2	5	Q16	18900	1	MID	22.53
2	5	Q16	18900	1	HIGH	22.60
2	5	Q16	18900	8	LOW	22.74

2	5	Q16	18900	8	HIGH	22.80
2	5	Q16	18900	25	LOW	21.74
2	3	QPSK	18900	1	LOW	22.75
2	3	QPSK	18900	1	MID	22.67
2	3	QPSK	18900	1	HIGH	22.75
2	3	QPSK	18900	6	LOW	22.70
2	3	QPSK	18900	6	HIGH	22.68
2	3	QPSK	18900	15	LOW	22.65
2	3	Q16	18900	1	LOW	22.99
2	3	Q16	18900	1	MID	22.92
2	3	Q16	18900	1	HIGH	22.99
2	3	Q16	18900	4	LOW	22.84
2	3	Q16	18900	4	HIGH	22.87
2	3	Q16	18900	15	LOW	21.71
2	14	QPSK	18900	1	LOW	22.81
2	14	QPSK	18900	1	MID	22.71
2	14	QPSK	18900	1	HIGH	22.79
2	14	QPSK	18900	3	LOW	22.91
2	14	QPSK	18900	3	HIGH	22.91
2	14	QPSK	18900	6	LOW	22.70
2	14	Q16	18900	1	LOW	22.79
2	14	Q16	18900	1	MID	22.75
2	14	Q16	18900	1	HIGH	22.81
2	14	Q16	18900	5	LOW	22.57
2	14	Q16	18900	5	HIGH	22.57
2	14	Q16	18900	6	LOW	21.67

Table 1.8.8-1b LTE band 2 conducted power measurements on Hotspot mode

Band	BW	Mod.	Channel	RB	Offset	Max. avg. conducted power (dBm)
4	20	QPSK	20050	1	LOW	23.27
4	20	QPSK	20050	1	MID	23.48
4	20	QPSK	20050	1	HIGH	23.39
4	20	QPSK	20050	50	LOW	22.33
4	20	QPSK	20050	50	HIGH	22.44
4	20	QPSK	20050	100	LOW	22.44
4	20	Q16	20050	1	LOW	22.25
4	20	Q16	20050	1	MID	22.45
4	20	Q16	20050	1	HIGH	22.40
4	20	Q16	20050	75	LOW	21.53
4	20	Q16	20050	75	HIGH	21.49
4	20	Q16	20050	100	LOW	21.38
4	**20**	**QPSK**	**20175**	**1**	**LOW**	**23.59**
4	20	QPSK	20175	1	MID	23.51
4	20	QPSK	20175	1	HIGH	23.34
4	**20**	**QPSK**	**20175**	**50**	**LOW**	**22.48**
4	20	QPSK	20175	50	HIGH	22.44
4	**20**	**QPSK**	**20175**	**100**	**LOW**	**22.48**
4	20	Q16	20175	1	LOW	23.03
4	20	Q16	20175	1	MID	22.94
4	20	Q16	20175	1	HIGH	22.81
4	20	Q16	20175	75	LOW	21.55
4	20	Q16	20175	75	HIGH	21.60
4	20	Q16	20175	100	LOW	21.52
4	20	QPSK	20300	1	LOW	23.47
4	20	QPSK	20300	1	MID	23.18
4	20	QPSK	20300	1	HIGH	23.40
4	20	QPSK	20300	50	LOW	22.30
4	20	QPSK	20300	50	HIGH	22.30
4	20	QPSK	20300	100	LOW	22.32
4	20	Q16	20300	1	LOW	22.54
4	20	Q16	20300	1	MID	22.29
4	20	Q16	20300	1	HIGH	22.51

4	20	Q16	20300	75	LOW	21.40
4	20	Q16	20300	75	HIGH	21.38
4	20	Q16	20300	100	LOW	21.38
4	15	QPSK	20175	1	LOW	23.37
4	15	QPSK	20175	1	MID	23.36
4	15	QPSK	20175	1	HIGH	23.26
4	15	QPSK	20175	36	LOW	22.48
4	15	QPSK	20175	36	HIGH	22.57
4	15	QPSK	20175	75	LOW	22.61
4	15	Q16	20175	1	LOW	22.77
4	15	Q16	20175	1	MID	22.75
4	15	Q16	20175	1	HIGH	22.69
4	15	Q16	20175	16	LOW	22.39
4	15	Q16	20175	16	HIGH	22.47
4	15	Q16	20175	75	LOW	21.60
4	10	QPSK	20175	1	LOW	23.28
4	10	QPSK	20175	1	MID	23.31
4	10	QPSK	20175	1	HIGH	23.34
4	10	QPSK	20175	25	LOW	22.40
4	10	QPSK	20175	25	HIGH	22.45
4	10	QPSK	20175	50	LOW	22.51
4	10	Q16	20175	1	LOW	22.68
4	10	Q16	20175	1	MID	22.74
4	10	Q16	20175	1	HIGH	22.74
4	10	Q16	20175	30	LOW	21.39
4	10	Q16	20175	30	HIGH	21.43
4	10	Q16	20175	50	LOW	21.47
4	5	QPSK	20175	1	LOW	23.33
4	5	QPSK	20175	1	MID	23.34
4	5	QPSK	20175	1	HIGH	23.41
4	5	QPSK	20175	10	LOW	22.43
4	5	QPSK	20175	10	HIGH	22.45
4	5	QPSK	20175	25	LOW	22.45
4	5	Q16	20175	1	LOW	22.32
4	5	Q16	20175	1	MID	22.33
4	5	Q16	20175	1	HIGH	22.42
4	5	Q16	20175	8	LOW	22.55
4	5	Q16	20175	8	HIGH	22.61

4	5	Q16	20175	25	LOW	21.54
4	3	QPSK	20175	1	LOW	23.35
4	3	QPSK	20175	1	MID	23.33
4	3	QPSK	20175	1	HIGH	23.35
4	3	QPSK	20175	6	LOW	22.49
4	3	QPSK	20175	6	HIGH	22.50
4	3	QPSK	20175	15	LOW	22.51
4	3	Q16	20175	1	LOW	22.79
4	3	Q16	20175	1	MID	22.74
4	3	Q16	20175	1	HIGH	22.78
4	3	Q16	20175	4	LOW	22.59
4	3	Q16	20175	4	HIGH	22.65
4	3	Q16	20175	15	LOW	21.53
4	1.4	QPSK	20175	1	LOW	23.41
4	1.4	QPSK	20175	1	MID	23.31
4	1.4	QPSK	20175	1	HIGH	23.39
4	1.4	QPSK	20175	3	LOW	23.48
4	1.4	QPSK	20175	3	HIGH	23.47
4	1.4	QPSK	20175	6	LOW	22.54
4	1.4	Q16	20175	1	LOW	22.59
4	1.4	Q16	20175	1	MID	22.53
4	1.4	Q16	20175	1	HIGH	22.61
4	1.4	Q16	20175	5	LOW	22.42
4	1.4	Q16	20175	5	HIGH	22.41
4	1.4	Q16	20175	6	LOW	21.51

Table 1.8.8-2 LTE band 4 conducted power measurements

Band	BW	Mod.	Channel	RB	Offset	Max. avg. conducted power (dBm)
5	10	QPSK	20450	1	LOW	22.94
5	**10**	**QPSK**	**20450**	**1**	**MID**	**23.62**
5	10	QPSK	20450	1	HIGH	23.39
5	10	QPSK	20450	25	LOW	22.47
5	**10**	**QPSK**	**20450**	**25**	**HIGH**	**22.51**
5	**10**	**QPSK**	**20450**	**50**	**LOW**	**22.50**
5	10	Q16	20450	1	LOW	22.20
5	10	Q16	20450	1	MID	22.98
5	10	Q16	20450	1	HIGH	22.81
5	10	Q16	20450	30	LOW	21.51
5	10	Q16	20450	30	HIGH	21.50
5	10	Q16	20450	50	LOW	21.49
5	10	QPSK	20525	1	LOW	23.34
5	10	QPSK	20525	1	MID	23.17
5	10	QPSK	20525	1	HIGH	23.21
5	10	QPSK	20525	25	LOW	22.30
5	10	QPSK	20525	25	HIGH	22.28
5	10	QPSK	20525	50	LOW	22.37
5	10	Q16	20525	1	LOW	22.35
5	10	Q16	20525	1	MID	22.22
5	10	Q16	20525	1	HIGH	22.18
5	10	Q16	20525	30	LOW	21.38
5	10	Q16	20525	30	HIGH	21.36
5	10	Q16	20525	50	LOW	21.33
5	10	QPSK	20600	1	LOW	23.27
5	10	QPSK	20600	1	MID	23.23
5	10	QPSK	20600	1	HIGH	23.06
5	10	QPSK	20600	25	LOW	22.32
5	10	QPSK	20600	25	HIGH	22.28
5	10	QPSK	20600	50	LOW	22.29
5	10	Q16	20600	1	LOW	22.70
5	10	Q16	20600	1	MID	22.69
5	10	Q16	20600	1	HIGH	22.55
5	10	Q16	20600	30	LOW	21.24
5	10	Q16	20600	30	HIGH	21.29
5	10	Q16	20600	50	LOW	21.30

5	5	QPSK	20525	1	LOW	23.39
5	5	QPSK	20525	1	MID	23.30
5	5	QPSK	20525	1	HIGH	23.40
5	5	QPSK	20525	10	LOW	22.30
5	5	QPSK	20525	10	HIGH	22.39
5	5	QPSK	20525	25	LOW	22.30
5	5	Q16	20525	1	LOW	22.90
5	5	Q16	20525	1	MID	22.88
5	5	Q16	20525	1	HIGH	22.97
5	5	Q16	20525	8	LOW	22.30
5	5	Q16	20525	8	HIGH	22.39
5	5	Q16	20525	25	LOW	21.27
5	3	QPSK	20525	1	LOW	23.22
5	3	QPSK	20525	1	MID	23.15
5	3	QPSK	20525	1	HIGH	23.26
5	3	QPSK	20525	6	LOW	22.34
5	3	QPSK	20525	6	HIGH	22.39
5	3	QPSK	20525	15	LOW	22.34
5	3	Q16	20525	1	LOW	22.64
5	3	Q16	20525	1	MID	22.57
5	3	Q16	20525	1	HIGH	22.72
5	3	Q16	20525	4	LOW	22.47
5	3	Q16	20525	4	HIGH	22.60
5	3	Q16	20525	15	LOW	21.41
5	1.4	QPSK	20525	1	LOW	23.21
5	1.4	QPSK	20525	1	MID	23.17
5	1.4	QPSK	20525	1	HIGH	23.35
5	1.4	QPSK	20525	3	LOW	23.30
5	1.4	QPSK	20525	3	HIGH	23.27
5	1.4	QPSK	20525	6	LOW	22.36
5	1.4	Q16	20525	1	LOW	22.46
5	1.4	Q16	20525	1	MID	22.38
5	1.4	Q16	20525	1	HIGH	22.54
5	1.4	Q16	20525	5	LOW	22.25
5	1.4	Q16	20525	5	HIGH	22.25
5	1.4	Q16	20525	6	LOW	21.37

Table 1.8.8-3 LTE band 5 conducted power measurements

Band	BW	Mod.	Channel	RB	Offset	Max. avg. conducted power (dBm)
13	10	QPSK	23230	1	LOW	23.62
13	10	QPSK	23230	1	MID	23.69
13	**10**	**QPSK**	**23230**	**1**	**HIGH**	**23.77**
13	10	QPSK	23230	25	LOW	22.83
13	10	QPSK	23230	25	HIGH	22.78
13	**10**	**QPSK**	**23230**	**50**	**LOW**	**22.83**
13	10	Q16	23230	1	LOW	23.04
13	10	Q16	23230	1	MID	23.10
13	10	Q16	23230	1	HIGH	23.12
13	10	Q16	23230	30	LOW	21.71
13	10	Q16	23230	30	HIGH	21.72
13	10	Q16	23230	50	LOW	21.79
13	10	QPSK	23230	1	LOW	23.62
13	10	QPSK	23230	1	MID	23.68
13	10	QPSK	23230	1	HIGH	23.76
13	10	QPSK	23230	25	LOW	22.82
13	**10**	**QPSK**	**23230**	**25**	**HIGH**	**22.84**
13	10	QPSK	23230	50	LOW	22.82
13	10	Q16	23230	1	LOW	23.04
13	10	Q16	23230	1	MID	23.09
13	10	Q16	23230	1	HIGH	23.13
13	10	Q16	23230	30	LOW	21.73
13	10	Q16	23230	30	HIGH	21.72
13	10	Q16	23230	50	LOW	21.78
13	10	QPSK	23230	1	LOW	23.64
13	10	QPSK	23230	1	MID	23.69
13	10	QPSK	23230	1	HIGH	23.71
13	10	QPSK	23230	25	LOW	22.83
13	10	QPSK	23230	25	HIGH	22.77
13	10	QPSK	23230	50	LOW	22.82
13	10	Q16	23230	1	LOW	23.02
13	10	Q16	23230	1	MID	23.09
13	10	Q16	23230	1	HIGH	23.13
13	10	Q16	23230	30	LOW	21.71
13	10	Q16	23230	30	HIGH	21.72
13	10	Q16	23230	50	LOW	21.77

13	5	QPSK	23205	1	LOW	23.47
13	5	QPSK	23205	1	MID	23.40
13	5	QPSK	23205	1	HIGH	23.57
13	5	QPSK	23205	10	LOW	22.41
13	5	QPSK	23205	10	HIGH	22.49
13	5	QPSK	23205	25	LOW	22.55
13	5	Q16	23205	1	LOW	23.01
13	5	Q16	23205	1	MID	22.91
13	5	Q16	23205	1	HIGH	23.02
13	5	Q16	23205	25	LOW	21.39
13	5	QPSK	23230	1	LOW	23.42
13	5	QPSK	23230	1	MID	23.53
13	5	QPSK	23230	1	HIGH	23.46
13	5	QPSK	23230	10	LOW	22.49
13	5	QPSK	23230	10	HIGH	22.43
13	5	QPSK	23230	25	LOW	22.51
13	5	Q16	23230	1	LOW	22.26
13	5	Q16	23230	1	MID	22.34
13	5	Q16	23230	1	HIGH	22.27
13	5	Q16	23230	25	LOW	22.45
13	5	QPSK	23255	1	LOW	23.41
13	5	QPSK	23255	1	MID	23.30
13	5	QPSK	23255	1	HIGH	23.23
13	5	QPSK	23255	10	LOW	22.38
13	5	QPSK	23255	10	HIGH	22.35
13	5	QPSK	23255	25	LOW	22.39
13	5	Q16	23230	1	LOW	22.26
13	5	Q16	23230	1	MID	22.34
13	5	Q16	23230	1	HIGH	22.27
13	5	Q16	23255	25	LOW	21.45

Table 1.8.8-4 LTE band 13 conducted power measurements

Band	BW	Mod.	Channel	RB	Offset	Max. avg. conducted power (dBm)
17	10	QPSK	23780	1	LOW	22.85
17	10	QPSK	23780	1	MID	22.95
17	10	QPSK	23780	1	HIGH	22.98
17	10	QPSK	23780	25	LOW	21.95
17	**10**	**QPSK**	**23780**	**25**	**HIGH**	**22.03**
17	10	QPSK	23780	50	LOW	21.95
17	10	Q16	23780	1	LOW	22.21
17	10	Q16	23780	1	MID	22.28
17	10	Q16	23780	1	HIGH	22.30
17	10	Q16	23780	30	LOW	20.96
17	10	Q16	23780	30	HIGH	21.02
17	10	Q16	23780	50	LOW	20.97
17	10	QPSK	23790	1	LOW	22.70
17	10	QPSK	23790	1	MID	22.90
17	10	QPSK	23790	1	HIGH	23.04
17	10	QPSK	23790	25	LOW	21.95
17	10	QPSK	23790	25	HIGH	22.01
17	**10**	**QPSK**	**23790**	**50**	**LOW**	**21.95**
17	10	Q16	23790	1	LOW	21.74
17	10	Q16	23790	1	MID	21.86
17	10	Q16	23790	1	HIGH	21.92
17	10	Q16	23790	30	LOW	21.01
17	10	Q16	23790	30	HIGH	21.03
17	10	Q16	23790	50	LOW	20.93
17	10	QPSK	23800	1	LOW	22.69
17	10	QPSK	23800	1	MID	22.90
17	**10**	**QPSK**	**23800**	**1**	**HIGH**	**23.08**
17	10	QPSK	23800	25	LOW	21.95
17	10	QPSK	23800	25	HIGH	21.99
17	10	QPSK	23800	50	LOW	21.95
17	10	Q16	23800	1	LOW	22.13
17	10	Q16	23800	1	MID	22.25
17	10	Q16	23800	1	HIGH	22.45

17	10	Q16	23800	30	LOW	20.95
17	10	Q16	23800	30	HIGH	20.95
17	10	Q16	23800	50	LOW	20.97
17	5	QPSK	23790	1	LOW	23.01
17	5	QPSK	23790	1	MID	22.99
17	5	QPSK	23790	1	HIGH	23.07
17	5	QPSK	23790	10	LOW	21.98
17	5	QPSK	23790	10	HIGH	21.98
17	5	QPSK	23790	25	LOW	21.94
17	5	Q16	23790	1	LOW	22.46
17	5	Q16	23790	1	MID	22.49
17	5	Q16	23790	1	HIGH	22.48
17	5	Q16	23790	8	LOW	21.94
17	5	Q16	23790	8	HIGH	21.97
17	5	Q16	23790	25	LOW	20.94

Table 1.8.8-5 LTE band 17 conducted power measurements

1.9 General SAR Test Reduction and Exclusion procedure as per KDB 447498 D01 V05 and SAR Handsets Multi transmitters 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*

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

	802.11a/b/g/n Bluetooth

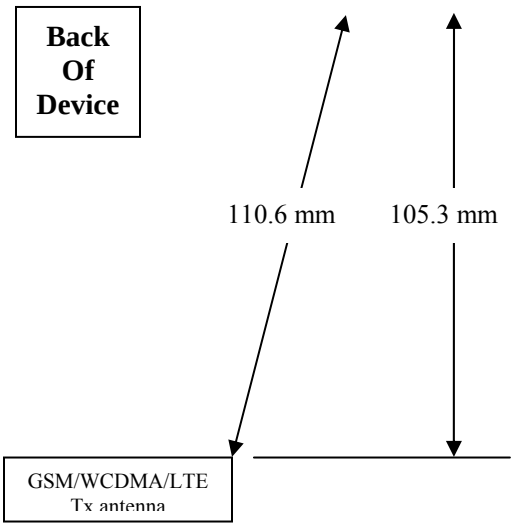

Figure 1.9-1 Back view of device showing closest distance between antenna pairs

1.9.1 Simultaneous Transmission Analysis

Separate Transmitting Antenna		
Separate Antenna	**Technologies Utilized By Each Antenna**	
Antenna 1	GSM, WCDMA, LTE	
Antenna 2	Wi-Fi 2.4 GHz, Wi-Fi 5.0 GHz, Bluetooth	
Simultaneous Transmission Combinations		
Configuration	**Simultaneous Transmission (by Antenna)**	**Simultaneous Transmission (by Technology)**
Head	Antenna 1 + Antenna 2	GSM/WCDMA/LTE + Wi-Fi/BT
Body-Worn	Antenna 1 + Antenna 2	GSM/WCDMA/LTE + Wi-Fi/BT
Hotspot	Antenna 1 + Antenna 2	GSM/WCDMA/LTE + Wi-Fi/BT

Table 1.9.1-1 Simultaneous Transmission Scenarios

Note 1: BT and Wi-Fi cannot transmit simultaneously since the design doesn't allow it and they use the same antenna.
Note 2: 802.11b and 802.11a cannot transmit simultaneously since the design doesn't allow it and they use the same antenna.
Note 3: LTE and GSM/WCDMA cannot transmit simultaneously since it shares the same antenna.

Test	Configuration	Licensed Transmitters		WiFi 2.4/5.0GHz 1g avg. SAR (W/kg)	Max Sum 1g avg. SAR (W/kg)
		Band	1g avg. SAR (W/kg)		
Head SAR	Right Cheek	LTE Band 17	0.08	0.41	0.49
	Right Cheek	LTE Band 13	0.21	0.41	0.62
	Right Cheek	LTE Band 5	0.30	0.41	0.71
	Right Cheek	GSM/DTM/EDGE 850	0.55	0.41	0.96
	Right Cheek	UMTS Band V	0.40	0.41	0.81
	Right Cheek	LTE Band 4	0.28	0.41	0.69
	Right Cheek	UMTS Band IV	0.26	0.41	0.67
	Right Cheek	LTE Band 2	0.18	0.41	0.59
	Right Cheek	GSM/DTM/EDGE 1900	0.13	0.41	0.54
	Right Cheek	UMTS Band II	0.16	0.41	0.57
	Right Tilt	LTE Band 17	0.02	0.58	0.60
	Right Tilt	LTE Band 13	0.08	0.58	0.66
	Right Tilt	LTE Band 5	0.08	0.58	0.66
	Right Tilt	GSM/DTM/EDGE 850	0.11	0.58	0.69
	Right Tilt	UMTS Band V	0.14	0.58	0.72
	Right Tilt	LTE Band 4	0.09	0.58	0.67
	Right Tilt	UMTS Band IV	0.12	0.58	0.70
	Right Tilt	LTE Band 2	0.05	0.58	0.63
	Right Tilt	GSM/DTM/EDGE 1900	0.03	0.58	0.61
	Right Tilt	UMTS Band II	0.05	0.58	0.63
	Left Cheek	LTE Band 17	0.05	0.51	0.56
	Left Cheek	LTE Band 13	0.15	0.51	0.66
	Left Cheek	LTE Band 5	0.15	0.51	0.66
	Left Cheek	GSM/DTM/EDGE 850	0.28	0.51	0.79
	Left Cheek	UMTS Band V	0.26	0.51	0.77
	Left Cheek	LTE Band 4	0.33	0.51	0.84
	Left Cheek	UMTS Band IV	0.27	0.51	0.78
	Left Cheek	LTE Band 2	0.21	0.51	0.72
	Left Cheek	GSM/DTM/EDGE 1900	0.21	0.51	0.72
	Left Cheek	UMTS Band II	0.28	0.51	0.79
	Left Tilt	LTE Band 17	0.02	0.50	0.52
	Left Tilt	LTE Band 13	0.07	0.50	0.57
	Left Tilt	LTE Band 5	0.07	0.50	0.57
	Left Tilt	GSM/DTM/EDGE 850	0.09	0.50	0.59
	Left Tilt	UMTS Band V	0.11	0.50	0.61
	Left Tilt	LTE Band 4	0.10	0.50	0.60
	Left Tilt	UMTS Band IV	0.11	0.50	0.61
	Left Tilt	LTE Band 2	0.05	0.50	0.55
	Left Tilt	GSM/DTM/EDGE 1900	0.05	0.50	0.55
	Left Tilt	UMTS Band II	0.06	0.50	0.56

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

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

Test	Configuration	Licensed Transmitters		WiFi 2.4/5.0GHz 1g avg. SAR (W/kg)	Max Sum 1g avg. SAR (W/kg)
		Band	1g avg. SAR (W/kg)		
Body Worn SAR	15mm separation device back	LTE Band 17	0.11	1.45	1.56
	15mm separation device back	LTE Band 13	0.39	1.45	1.84
	15mm separation device back	LTE Band 5	0.40	1.45	1.85
	15mm separation device back	GSM/DTM/EDGE 850	0.67	1.45	2.12
	15mm separation device back	UMTS Band V	0.58	1.45	2.03
	15mm separation device back	LTE Band 4	0.45	1.45	1.90
	15mm separation device back	UMTS Band IV	0.62	1.45	2.07
	15mm separation device back	LTE Band 2	0.61	1.45	2.06
	15mm separation device back	GSM/DTM/EDGE 1900	0.45	1.45	1.90
	15mm separation device back	UMTS Band II	0.70	1.45	2.15
	15mm separation device front	LTE Band 17	0.10	0.06	0.16
	15mm separation device front	LTE Band 13	0.34	0.06	0.40
	15mm separation device front	LTE Band 5	0.31	0.06	0.37
	15mm separation device front	GSM/DTM/EDGE 850	0.40	0.06	0.46
	15mm separation device front	UMTS Band V	0.51	0.06	0.57
	15mm separation device front	LTE Band 4	0.17	0.06	0.23
	15mm separation device front	UMTS Band IV	0.26	0.06	0.32
	15mm separation device front	LTE Band 2	0.14	0.06	0.20
	15mm separation device front	GSM/DTM/EDGE 1900	0.14	0.06	0.20
	15mm separation device front	UMTS Band II	0.18	0.06	0.24

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

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

Antenna 1 (802.11 a)	15mm, back	1.45	-58.0	-53.0	-206.5	
Antenna 2 (LTE 13) RB1	15mm, back	0.39	11.5	27.5	-207.7	
	SAR Sum	1.84				
	SAR Sum to the power of 1.5	2.50				
	Delta [mm]		-69.5	-80.5	1.2	
	closest Distance [mm]					**106.38**
	Ratio	0.02				
Antenna 1 (802.11 a)	15mm, back	1.45	-58.0	-53.0	-206.5	
Antenna 2 (LTE 5) RB1	15mm, back	0.40	1.0	27.5	-209.4	
	SAR Sum	1.85				
	SAR Sum to the power of 1.5	2.52				
	Delta [mm]		-59.0	-80.5	2.9	
	closest Distance [mm]					**99.86**
	Ratio	0.03				
Antenna 1 (802.11 a)	15mm, back	1.45	-58.0	-53.0	-206.5	
Antenna 2 (GPRS 850)	15mm, back	0.67	10.0	30.5	-208.3	
	SAR Sum	2.12				
	SAR Sum to the power of 1.5	3.09				
	Delta [mm]		-68.0	-83.5	1.8	
	closest Distance [mm]					**107.71**
	Ratio	0.03				
Antenna 1 (802.11 a)	15mm, back	1.45	-58.0	-53.0	-206.5	
Antenna 2 (UMTS V)	15mm, back	0.58	5.5	29.0	-209.3	
	SAR Sum	2.03				
	SAR Sum to the power of 1.5	2.89				
	Delta [mm]		-63.5	-82.0	2.8	
	closest Distance [mm]					**103.77**
	Ratio	0.03				

Antenna 1 (802.11 a)	15mm, back	1.45	-58.0	-53.0	-206.5	
Antenna 2 (LTE 4)	15mm, back	0.45	5.5	59.0	-208.7	
RB1						
	SAR Sum	1.90				
	SAR Sum to the power of 1.5	2.62				
	Delta [mm]		-63.5	-112.0	2.2	
	closest Distance [mm]					**128.78**
	Ratio	0.02				
Antenna 1 (802.11 a)	15mm, back	1.45	-58.0	-53.0	-206.5	
Antenna 2 (UMTS IV)	15mm, back	0.62	13.0	51.5	-207.3	
	SAR Sum	2.07				
	SAR Sum to the power of 1.5	2.98				
	Delta [mm]		-71.0	-104.5	0.8	
	closest Distance [mm]					**126.34**
	Ratio	0.02				
Antenna 1 (802.11 a)	15mm, back	1.45	-58.0	-53.0	-206.5	
Antenna 2 (LTE 2)	15mm, back	0.61	11.5	57.5	-209.3	
RB1						
	SAR Sum	2.06				
	SAR Sum to the power of 1.5	2.96				
	Delta [mm]		-69.5	-110.5	2.8	
	closest Distance [mm]					**130.58**
	Ratio	0.02				
Antenna 1 (802.11 a)	15mm, back	1.45	-58.0	-53.0	-206.5	
Antenna 2	15mm, back	0.45	14.5	56.0	-207.6	
(GPRS1900)						
	SAR Sum	1.90				
	SAR Sum to the power of 1.5	2.62				
	Delta [mm]		-72.5	-109.0	1.1	
	closest Distance [mm]					**130.93**
	Ratio	0.02				

Antenna 1 (802.11 a)	15mm, back	1.45	-58.0	-53.0	-206.5	
Antenna 2 (UMTS II)	15mm, back	0.70	13.0	60.5	-207.1	
	SAR Sum	2.15				
	SAR Sum to the power of 1.5	3.15				
	Delta [mm]		-71.0	-113.5	0.6	
	closest Distance [mm]					**133.90**
	Ratio	0.02				

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

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

Hotspot SAR Values Summation On The Same Test Position Table 1/2					
Test	Configuration	Licensed Transmitters		WiFi 2.4GHz 1g avg. SAR (W/kg)	Max Sum 1g avg. SAR (W/kg)
		Band	1g avg. SAR (W/kg)		
Hotspot Mode SAR	10mm separation device back	LTE Band 17	0.19	0.42	0.61
	10mm separation device back	LTE Band 13	0.50	0.42	0.92
	10mm separation device back	LTE Band 5	0.62	0.42	1.04
	10mm separation device back	GSM/DTM/EDGE 850	0.95	0.42	1.37
	10mm separation device back	UMTS Band V	0.78	0.42	1.20
	10mm separation device back	LTE Band 4	0.84	0.42	1.26
	10mm separation device back	UMTS Band IV	1.23	0.42	1.65
	10mm separation device back	LTE Band 2	1.21	0.42	1.63
	10mm separation device back	GSM/DTM/EDGE 1900	0.82	0.42	1.24
	10mm separation device back	UMTS Band II	1.40	0.42	1.82
	10mm separation device front	LTE Band 17	0.12	0.09	0.21
	10mm separation device front	LTE Band 13	0.43	0.09	0.52
	10mm separation device front	LTE Band 5	0.51	0.09	0.60
	10mm separation device front	GSM/DTM/EDGE 850	0.49	0.09	0.58
	10mm separation device front	UMTS Band V	0.63	0.09	0.72
	10mm separation device front	LTE Band 4	0.24	0.09	0.33
	10mm separation device front	UMTS Band IV	0.45	0.09	0.54
	10mm separation device front	LTE Band 2	0.25	0.09	0.34
	10mm separation device front	GSM/DTM/EDGE 1900	0.16	0.09	0.25
	10mm separation device front	UMTS Band II	0.28	0.09	0.37
	10mm separation device left	LTE Band 17	0.02	0.12	0.14
	10mm separation device left	LTE Band 13	0.10	0.12	0.22
	10mm separation device left	LTE Band 5	0.21	0.12	0.33
	10mm separation device left	GSM/DTM/EDGE 850	0.24	0.12	0.36
	10mm separation device left	UMTS Band V	0.31	0.12	0.43
	10mm separation device left	LTE Band 4	0.08	0.12	0.20
	10mm separation device left	UMTS Band IV	0.09	0.12	0.21
	10mm separation device left	LTE Band 2	0.04	0.12	0.16
	10mm separation device left	GSM/DTM/EDGE 1900	0.04	0.12	0.16
	10mm separation device left	UMTS Band II	0.06	0.12	0.18
	10mm separation device right	LTE Band 17	0.13	0.00	0.13
	10mm separation device right	LTE Band 13	0.26	0.00	0.26
	10mm separation device right	LTE Band 5	0.20	0.00	0.20
	10mm separation device right	GSM/DTM/EDGE 850	0.17	0.00	0.17
	10mm separation device right	UMTS Band V	0.25	0.00	0.25
	10mm separation device right	LTE Band 4	0.11	0.00	0.11
	10mm separation device right	UMTS Band IV	0.13	0.00	0.13
	10mm separation device right	LTE Band 2	0.12	0.00	0.12
	10mm separation device right	GSM/DTM/EDGE 1900	0.14	0.00	0.14
	10mm separation device right	UMTS Band II	0.15	0.00	0.15

Hotspot SAR Values Summation On The Same Test Position Table 2/2					
Test	**Configuration**	**Licensed Transmitters**		**WiFi 2.4GHz 1g avg. SAR (W/kg)**	**Max Sum 1g avg. SAR (W/kg)**
		Band	**1g avg. SAR (W/kg)**		
Hotspot Mode SAR	10mm separation device bottom	LTE Band 17	0.17	0.00	0.17
	10mm separation device bottom	LTE Band 13	0.21	0.00	0.21
	10mm separation device bottom	LTE Band 5	0.30	0.00	0.30
	10mm separation device bottom	GSM/DTM/EDGE 850	0.30	0.00	0.30
	10mm separation device bottom	UMTS Band V	0.44	0.00	0.44
	10mm separation device bottom	LTE Band 4	0.33	0.00	0.33
	10mm separation device bottom	UMTS Band IV	0.42	0.00	0.42
	10mm separation device bottom	LTE Band 2	0.41	0.00	0.41
	10mm separation device bottom	GSM/DTM/EDGE 1900	0.36	0.00	0.36
	10mm separation device bottom	UMTS Band II	0.47	0.00	0.47
	10mm separation device top	LTE Band 17	0.00	0.18	0.18
	10mm separation device top	LTE Band 13	0.00	0.18	0.18
	10mm separation device top	LTE Band 5	0.00	0.18	0.18
	10mm separation device top	GSM/DTM/EDGE 850	0.00	0.18	0.18
	10mm separation device top	UMTS Band V	0.00	0.18	0.18
	10mm separation device top	LTE Band 4	0.00	0.18	0.18
	10mm separation device top	UMTS Band IV	0.00	0.18	0.18
	10mm separation device top	LTE Band 2	0.00	0.18	0.18
	10mm separation device top	GSM/DTM/EDGE 1900	0.00	0.18	0.18
	10mm separation device top	UMTS Band II	0.00	0.18	0.18

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

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

Antenna 1 (802.11 b)	10mm, back	0.42	-47.0	-57.6	-207.3	
Antenna 2 (UMTS IV) Low Ch.	10mm, back	1.23	7.0	59.0	-208.7	
	SAR Sum	1.65				
	SAR Sum to the power of 1.5	2.12				
	Delta [mm]		-54.0	-116.6	1.4	
	closest Distance [mm]					**128.52**
	Ratio	0.02				
Antenna 1 (802.11 b)	10mm, back	0.42	-47.0	-57.6	-207.3	
Antenna 2 (LTE 2)	10mm, back	1.21	13.0	50.0	-207.3	
	SAR Sum	1.63				
	SAR Sum to the power of 1.5	2.08				
	Delta [mm]		-60.0	-107.6	0.0	
	closest Distance [mm]					**123.21**
	Ratio	0.02				
Antenna 1 (802.11 b)	10mm, back	0.42	-47.0	-57.6	-207.3	
Antenna 2 (UMTS II)	10mm, back	1.40	14.5	50.0	-207.3	
	SAR Sum	1.82				
	SAR Sum to the power of 1.5	2.46				
	Delta [mm]		-61.5	-107.6	0.0	
	closest Distance [mm]					**123.95**
	Ratio	0.02				

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

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

1.10 Wi-Fi and Hotspot Mode Power Reductions

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

- LTE band 2
- UMTS band II
- 802.11 a/b/g/n/ac

2.0 DESCRIPTION OF THE TEST EQUIPMENT

2.1 SAR measurement system

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

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

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

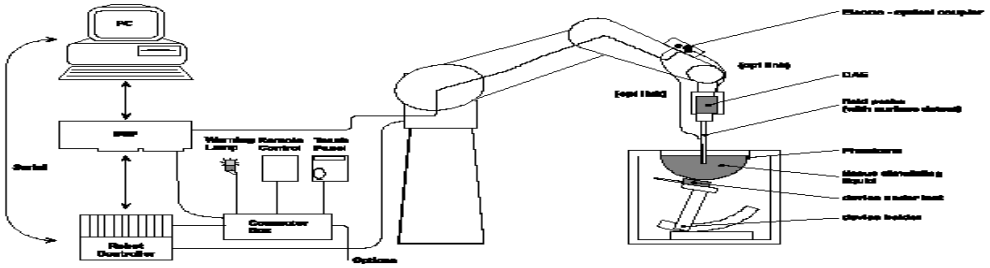

Figure 2.1-1 System Description

2.1.1 Equipment List

Manufacturer	Test Equipment	Model Number	Serial Number	Cal. Due Date (MM/DD/YY)
SCHMID & Partner Engineering AG	E-field probe	ES3DV3	3225	01/22/2015
SCHMID & Partner Engineering AG	E-field probe	ET3DV6	1643	03/10/2015
SCHMID & Partner Engineering AG	E-field probe	EX3DV4	3548	01/17/2015
SCHMID & Partner Engineering AG	Data Acquisition Electronics (DAE3)	DAE3	472	03/18/2015
SCHMID & Partner Engineering AG	Dipole Validation Kit	D750V2	1021	01/07/2015
SCHMID & Partner Engineering AG	Dipole Validation Kit	D835V2	446	01/07/2015
SCHMID & Partner Engineering AG	Dipole Validation Kit	D1800V2	2d020	01/09/2015
SCHMID & Partner Engineering AG	Dipole Validation Kit	D1900V2	545	01/09/2015
SCHMID & Partner Engineering AG	Dipole Validation Kit	D2450V2	791	09/10/2015
SCHMID & Partner Engineering AG	Dipole Validation Kit	D2600V2	1033	03/11/2015
SCHMID & Partner Engineering AG	Dipole Validation Kit	D5000V2	1033	11/08/2015
Agilent Technologies	Signal generator	8648C	4037U03155	09/25/2015
Agilent Technologies	Power meter	E4419B	GB40202821	09/25/2015
Agilent Technologies	Power sensor	8481A	MY41095233	09/27/2014
Agilent Technologies	Power sensor	8481A	MY41095417	09/26/2014
Amplifier Research	Amplifier	5S1G4M3	300986	CNR
Rohde & Schwarz	Signal generator	SMA 100A	102106	11/28/2014
Amplifier Research	Coupler	DC7144	300993	CNR
CPI Wireless Solutions	Amplifier	VZC-6961K4	SK4310E5	CNR
Agilent Technologies	Network analyzer	8753ES	US39174857	09/27/2014
Agilent Technologies	Power meter	N1911A	MY45100905	05/29/2015
Agilent Technologies	Power sensor	N1921A	SG45240281	12/04/2014
Rohde & Schwarz	Wideband Base Station Simulator	CMW 500	136298	04/22/2015
Rohde & Schwarz	Base Station Simulator	CMU 200	109747	11/28/2015
Rohde & Schwarz	Bluetooth Tester	CBT	100368	11/28/2014
Weinschel Corp	20dB Attenuator	33-20-34	BMO697	CNR

Table 2.1.1-1 Equipment list

2.2 Description of the test setup

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

2.2.1 Device and base station simulator setup

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

2.2.2 DASY setup

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

3.0 ELECTRIC FIELD PROBE CALIBRATION

3.1 Probe Specifications

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

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 [G]	Depth [G] (mm)	Unct. (k=2)
750	41.9	0.89	6.55	6.55	6.55	0.41	2.30	± 12.0 %
900	41.5	0.97	6.15	6.15	6.15	0.38	2.41	± 12.0 %
1810	40.0	1.40	5.17	5.17	5.17	0.80	2.07	± 12.0 %
1950	40.0	1.40	4.92	4.92	4.92	0.80	2.04	± 12.0 %
2450	39.2	1.80	4.46	4.46	4.46	0.80	1.83	± 12.0 %

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	6.24	6.24	6.24	0.43	2.19	± 12.0 %
900	55.0	1.05	6.03	6.03	6.03	0.38	2.61	± 12.0 %
1810	53.3	1.52	4.59	4.59	4.59	0.80	2.41	± 12.0 %
1950	53.3	1.52	4.64	4.64	4.64	0.80	2.33	± 12.0 %
2450	52.7	1.95	4.07	4.07	4.07	0.70	1.23	± 12.0 %

Table 3.2-1 Probe ET3DV6 SN: 1643 (cal: 3/10/2014)

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	41.9	0.89	6.36	6.36	6.36	0.28	1.91	± 12.0 %
900	41.5	0.97	6.05	6.05	6.05	0.49	1.38	± 12.0 %
1810	40.0	1.40	5.24	5.24	5.24	0.69	1.23	± 12.0 %
1950	40.0	1.40	4.97	4.97	4.97	0.73	1.21	± 12.0 %
2450	39.2	1.80	4.64	4.64	4.64	0.80	1.23	± 12.0 %
2600	39.0	1.96	4.33	4.33	4.33	0.75	1.34	± 12.0 %

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	6.28	6.28	6.28	0.34	1.84	± 12.0 %
900	55.0	1.05	6.09	6.09	6.09	0.62	1.32	± 12.0 %
1810	53.3	1.52	4.93	4.93	4.93	0.48	1.57	± 12.0 %
1950	53.3	1.52	4.84	4.84	4.84	0.50	1.59	± 12.0 %
2450	52.7	1.95	4.28	4.28	4.28	0.77	1.23	± 12.0 %
2600	52.5	2.16	4.03	4.03	4.03	0.80	1.01	± 12.0 %

Table 3.2-2 Probe ES3DV3 SN: 3225 (cal: 1/22/2014)

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
2600	39.0	1.96	7.03	7.03	7.03	0.50	0.77	± 12.0 %
5200	36.0	4.66	5.37	5.37	5.37	0.35	1.80	± 13.1 %
5500	35.6	4.96	4.94	4.94	4.94	0.35	1.80	± 13.1 %
5800	35.3	5.27	4.76	4.76	4.76	0.40	1.80	± 13.1 %

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
2600	52.5	2.16	6.91	6.91	6.91	0.80	0.50	± 12.0 %
5200	49.0	5.30	4.83	4.83	4.83	0.40	1.90	± 13.1 %
5500	48.6	5.65	4.33	4.33	4.33	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.36	4.36	4.36	0.50	1.90	± 13.1 %

Table 3.2-3 Probe EX3DV4 SN: 3548 (cal: 1/17/2014)

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

4.0 SAR MEASUREMENT SYSTEM VERIFICATION

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

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

4.1 System accuracy verification for head adjacent use

f (MHz)	Limits / Measured (MM/DD/YYYY)	Scan Type	SAR 1g/10g (W/kg)	Dielectric Parameters		Liquid Temp. (°C)
				ε_r	σ [S/m]	
750	Measured (05/08/2014)	Area Scan/Fast SAR	8.31/5.56	40.5	0.89	22.1
	Measured (05/08/2014)	Zoom Scan	8.25/5.42	40.5	0.89	22.1
	Measured (05/12/2014)	Area Scan/Fast SAR	8.13/5.44	40.9	0.90	22.3
	Measured (05/12/2014)	Zoom Scan	8.03/5.26	40.9	0.90	22.3
	Recommended Limits (Dipole:1021)		8.46/5.51	41.9	0.89	N/A
835	Measured (05/01/2014)	Area Scan/Fast SAR	9.52/6.31	40.0	0.87	22.0
	Measured (05/01/2014)	Zoom Scan	9.48/6.27	40.0	0.87	22.0
	Measured (05/05/2014)	Area Scan/Fast SAR	9.74/6.46	40.0	0.89	22.9
	Measured (05/05/2014)	Zoom Scan	9.55/6.33	40.0	0.89	22.9
	Measured (06/09/2014)	Area Scan/Fast SAR	9.42/6.25	41.3	0.89	22.9
	Measured (06/09/2014)	Zoom Scan	9.48/6.23	41.3	0.89	22.9
	Recommended Limits (Dipole: 446)		9.39/6.13	41.5	0.90	N/A
1800	Measured (05/12/2014)	Area Scan/Fast SAR	35.7/19.2	40.4	1.47	22.5
	Measured (05/12/2014)	Zoom Scan	34.8/18.6	40.4	1.47	22.5
	Measured (05/15/2014)	Area Scan/Fast SAR	35.7/19.2	40.1	1.44	23.0
	Measured (05/15/2014)	Zoom Scan	35.3/18.8	40.1	1.44	23.0
	Measured (06/04/2014)	Area Scan/Fast SAR	36.0/19.4	40.0	1.46	22.4
	Measured (06/04/2014)	Zoom Scan	35.5/19.0	40.0	1.46	22.4
	Recommended Limits (Dipole:2d020)		38.5/20.3	40.0	1.40	N/A
1900	Measured (04/24/2014)	Area Scan/Fast SAR	40.9/21.9	39.2	1.43	21.1
	Measured (04/24/2014)	Zoom Scan	39.9/21.4	39.2	1.43	21.1
	Measured (04/28/2014)	Area Scan/Fast SAR	38.0/20.1	40.9	1.37	22.4
	Measured (04/28/2014)	Zoom Scan	37.6/20.1	40.9	1.37	22.4
	Measured (05/30/2014)	Area Scan/Fast SAR	38.3/20.2	40.3	1.41	22.2
	Measured (05/30/2014)	Zoom Scan	37.2/20.1	40.3	1.41	22.2
	Measured (06/03/2014)	Area Scan/Fast SAR	37.3/19.8	39.8	1.38	22.7
	Measured (06/03/2014)	Zoom Scan	36.3/19.5	39.8	1.38	22.7
	Recommended Limits (Dipole: 545)		40.2/21.1	40.0	1.40	N/A
2450	Measured (05/16/2014)	Area Scan/Fast SAR	56.2/24.7	37.7	1.86	22.0
	Measured (05/16/2014)	Zoom Scan	56.6/26.2	37.7	1.86	22.0
	Measured (05/20/2014)	Area Scan/Fast SAR	56.6/24.7	37.7	1.84	22.1
	Measured (05/20/2014)	Zoom Scan	56.7/26.3	37.7	1.84	22.1
	Recommended Limits (Dipole: 791)		51.6/24.0	39.2	1.80	N/A

2600	Measured (05/21/2014)	Area Scan/Fast SAR	64.0/28.9	37.1	1.99	21.9
	Measured (05/21/2014)	Zoom Scan	62.8/27.9	37.1	1.99	21.9
	Measured (06/05/2014)	Area Scan/Fast SAR	63.8/28.5	37.3	1.99	22.4
	Measured (06/05/2014)	Zoom Scan	62.2/27.9	37.3	1.99	22.4
	Measured (06/12/2014)	Area Scan/Fast SAR	63.6/28.4	37.3	2.01	22.8
	Measured (06/12/2014)	Zoom Scan	62.9/28.2	37.3	2.01	22.8
	Recommended Limits (Dipole: 1033)		58.6/26.2	39.0	1.96	N/A
5200	Measured (05/26/2014)	Area Scan/Fast SAR	77.3/21.5	34.7	4.71	21.4
	Measured (05/26/2014)	Zoom Scan	80.6/23.4	34.7	4.71	21.4
	Recommended Limits (Dipole: 1033)		80.8/23.0	36.0	4.66	N/A
5500	Measured (05/26/2014)	Area Scan/Fast SAR	88.2/24.4	34.2	5.08	21.4
	Measured (05/26/2014)	Zoom Scan	94.5/26.9	34.2	5.08	21.4
	Recommended Limits (Dipole: 1033)		87.3/24.7	35.6	4.96	N/A
5800	Measured (05/26/2014)	Area Scan/Fast SAR	80.4/22.1	33.6	5.39	21.4
	Measured (05/26/2014)	Zoom Scan	85.4/24.3	33.6	5.39	21.4
	Recommended Limits (Dipole: 1033)		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	09/27/2014
Control Company	Digital Thermometer	23609-234	21352860	09/30/2014
Control Company	Digital Thermometer	15-077-21	51129471	05/30/2014*

Table 6.1.1-1 Tissue simulant preparation equipment

Note 1: "*" equipment was sent out for calibration before it's due date.

6.1.2 Preparation procedure

800-900 MHz liquids

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

1800-2450 MHz liquid

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

6.2 Electrical parameters of the tissue simulating liquid

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

Band (MHz)	Tissue Type	Limits / Measured (MM/DD/YYYY)	f (MHz)	Dielectric Parameters		Liquid Temp (°C)
				ε_r	σ [S/m]	
750	Head	Measured (05/09/2014)	705	41.1	0.85	22.1
			715	40.9	0.86	
			750	40.5	0.89	
			775	40.2	0.91	
			790	39.9	0.93	
		Measured (05/12/2014)	705	41.6	0.86	22.3
			715	41.5	0.87	
			750	40.9	0.90	
			775	40.6	0.92	
			790	40.4	0.93	
		Recommended Limits	750	41.9	0.89	N/A

	Muscle	Measured (05/09/2014)	705	54.8	0.91	22.1
			715	54.7	0.92	
			750	54.4	0.96	
			775	54.3	0.98	
			790	53.9	0.99	
		Measured (05/12/2014)	705	54.6	0.91	21.9
			715	54.6	0.92	
			750	54.2	0.96	
			775	53.9	0.98	
			790	53.8	1.00	
		Recommended Limits	750	55.5	0.96	N/A
835	Head	Measured (05/01/2014)	815	41.6	0.86	22.0
			825	41.5	0.87	
			835	40.0	0.87	
			850	39.8	0.88	
			865	39.7	0.89	
		Measured (05/05/2014)	815	41.7	0.88	22.9
			825	41.6	0.89	
			835	40.0	0.89	
			850	39.8	0.90	
			865	39.6	0.91	
		Measured (06/09/2014)	815	41.6	0.86	22.9
			825	41.5	0.87	
			835	41.3	0.89	
			850	41.1	0.90	
			865	41.0	0.91	
		Recommended Limits	835	41.5	0.90	N/A
	Muscle	Measured (05/01/2014)	815	53.7	0.96	22.1
			825	53.6	0.97	
			835	53.4	0.98	
			850	53.3	1.00	
		Measured (05/05/2014)	815	55.2	0.99	22.8
			825	54.0	0.98	
			835	53.9	0.99	
			850	53.7	1.01	
		Measured (06/09/2014)	815	53.8	0.95	22.7
			825	53.7	0.96	
			835	53.6	0.97	
			850	53.4	0.99	
		Recommended Limits	835	55.2	0.97	N/A
1800	Head	Measured (05/12/2014)	1710	40.8	1.37	22.5
			1750	40.7	1.42	
			1800	40.4	1.47	
		Measured (05/15/2014)	1710	40.5	1.35	23.0
			1750	40.3	1.39	
			1800	40.1	1.44	

		Measured (06/04/2014)	1710	40.3	1.37	22.4
			1750	40.2	1.41	
			1800	40.0	1.46	
		Recommended Limits	1800	40.0	1.40	N/A
	Muscle	Measured (05/12/2014)	1710	51.5	1.49	22.5
			1750	51.4	1.54	
			1800	51.2	1.59	
		Recommended Limits	1800	53.3	1.52	N/A
1900	Head	Measured (04/24/2014)	1850	39.4	1.38	21.1
			1900	39.2	1.43	
			1910	39.2	1.45	
			1980	NA	NA	
		Measured (04/28/2014)	1850	41.1	1.32	22.4
			1900	40.9	1.37	
			1910	40.5	1.46	
			1980	40.5	1.46	
		Measured (05/30/2014)	1850	40.4	1.37	22.4
			1900	40.3	1.41	
			1910	40.3	1.42	
			1980	NA	NA	
		Measured (06/03/2014)	1850	40.0	1.33	22.7
			1900	39.8	1.38	
			1910	39.8	1.38	
			1980	39.6	1.46	
		Recommended Limits	1900	40.0	1.40	N/A
	Muscle	Measured (04/24/2014)	1850	51.7	1.45	21.7
			1900	51.5	1.52	
			1910	51.5	1.54	
		Measured (04/28/2014)	1850	51.6	1.47	22.4
			1900	51.4	1.53	
			1910	51.4	1.54	
		Measured (05/30/2014)	1850	52.7	1.53	22.4
			1900	52.7	1.57	
			1910	52.6	1.58	
		Measured (06/03/2014)	1850	50.8	1.46	22.6
			1900	50.7	1.51	
			1910	50.7	1.52	
		Recommended Limits	1900	53.3	1.52	N/A
2450	Head	Measured (05/16/2014)	2410	37.9	1.80	22.0
			2450	37.7	1.86	
			2480	37.6	1.89	
		Measured (05/20/2014)	2410	37.8	1.79	22.1
			2450	37.7	1.84	
			2480	37.5	1.87	
		Recommended Limits	2450	39.2	1.80	N/A
	Muscle	Measured (05/20/2014)	2410	51.0	1.96	22.7

			2450	50.9	2.01	
			2480	50.7	2.04	
		Recommended Limits	2450	52.7	1.95	N/A
2600	Head	Measured (05/20/2014)	2500	37.4	1.89	21.9
			2570	37.2	1.96	
			2600	37.1	1.99	
		Measured (06/05/2014)	2500	37.6	1.88	22.4
			2570	37.4	1.96	
			2600	37.3	1.99	
		Measured (06/12/2014)	2500	37.6	1.90	22.8
			2570	37.4	1.97	
			2600	37.3	2.01	
		Recommended Limits	2600	39.0	1.96	N/A
	Muscle	Measured (05/20/2014)	2500	50.7	2.08	22.1
			2570	50.4	2.16	
			2600	50.3	2.20	
		Measured (06/05/2014)	2500	51.0	2.07	22.5
			2570	50.7	2.15	
			2600	50.7	2.20	
		Measured (06/05/2014)	2500	50.5	2.06	22.6
			2570	50.3	2.15	
			2600	50.2	2.19	
		Recommended Limits	2600	52.5	2.16	N/A
5200	Head	Measured (05/26/2014)	5180	34.7	4.70	21.4
			5200	34.7	4.71	
			5280	34.6	4.82	
		Recommended Limits	5200	36.0	4.66	N/A
	Muscle	Measured (05/26/2014)	5180	47.1	5.47	21.4
			5200	47.0	5.50	
			5280	46.9	5.60	
		Recommended Limits	5200	49.0	5.30	N/A
5500	Head	Measured (05/26/2014)	5500	34.2	5.08	21.4
			5600	34.1	5.19	
		Recommended Limits	5500	35.6	4.96	N/A
	Muscle	Measured (05/26/2014)	5500	46.4	5.92	21.4
			5600	46.3	6.06	
		Recommended Limits	5500	48.6	5.65	N/A
5800	Head	Measured (05/26/2014)	5745	33.8	5.35	21.4
			5800	33.6	5.39	
		Recommended Limits	5800	35.3	5.27	N/A
	Muscle	Measured (05/26/2014)	5745	45.9	6.27	21.4
			5800	45.8	6.34	
		Recommended Limits	5800	48.2	6.00	N/A

Table 6.2-1 Electrical parameters of tissue simulating liquid

6.2.2 Test Configuration

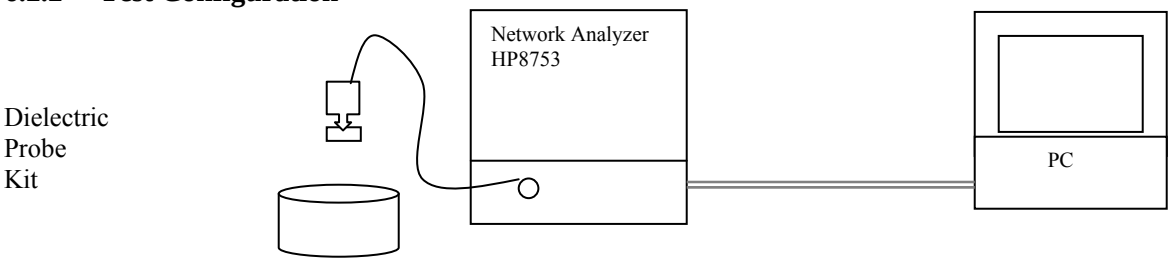

Figure 6.2.2-1 Test configuration

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).

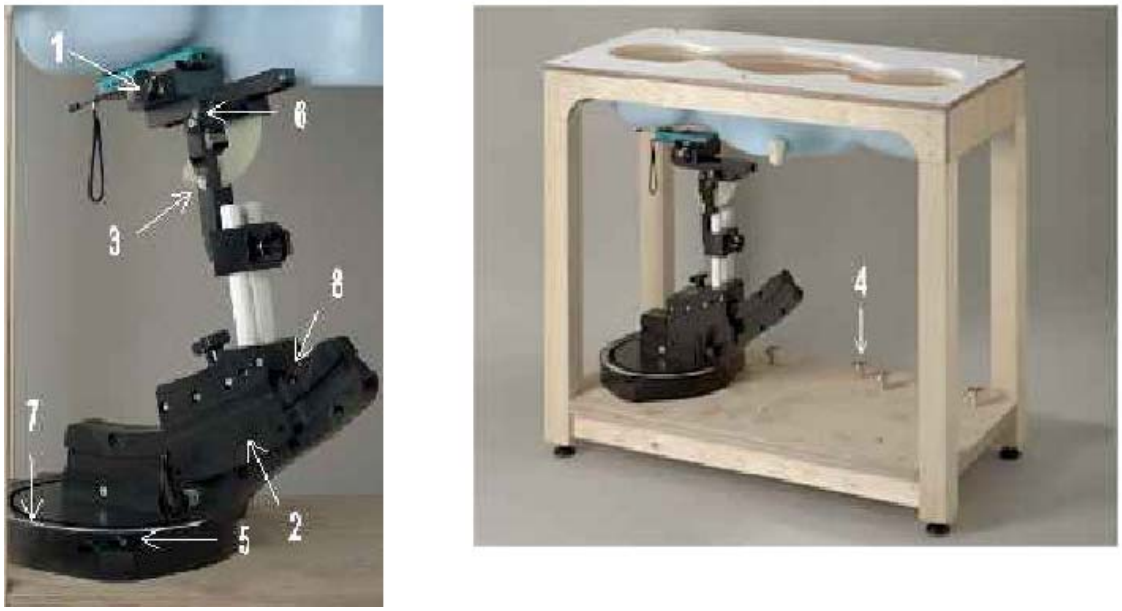

Figure 8.1-1 Device Holder

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".

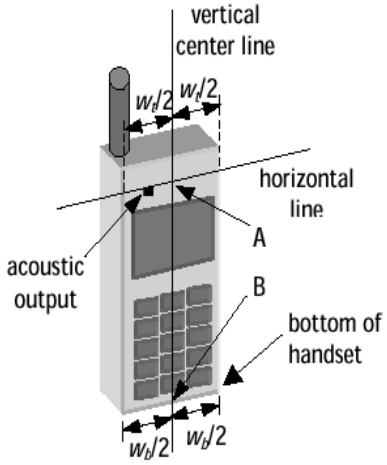

Figure 8.2.1-1 Handset vertical and horizontal reference lines – fixed case

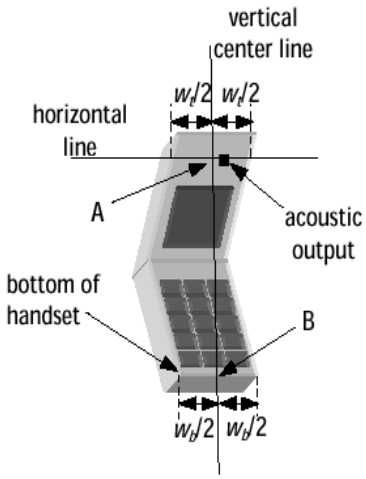

Figure 8.2.1-2 Handset vertical and horizontal reference lines – "clam-shell"

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).

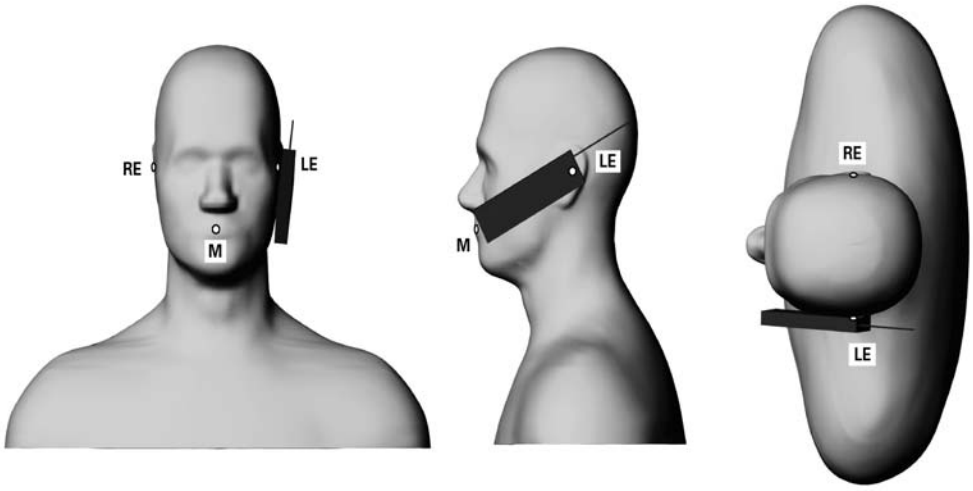

Figure 8.2.1-3 Phone position 1, "cheek" or "touch" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only.

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**.**

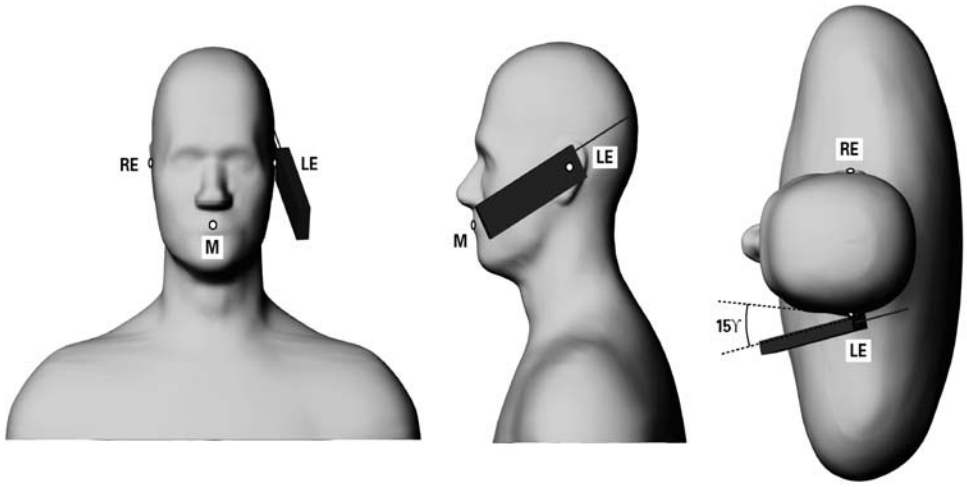

Figure 8.2.1-4 Phone position 2, "tilted position." The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only.

8.2.2 Body-worn Configuration

Body-worn configurations, as shown in appendix E, have been test with the device for RF exposure compliance. The device was tested with a holster and/or a minimum separation distance. The device was tested with 15 mm BLACKBERRY recommended separation distance to allow typical after-market holster to be used. For holster testing the holster case and the belt clip was placed against the flat section of the phantom. A headset was then connected to the device to simulate hands-free operation in a body worn holster configuration. BLACKBERRY body-worn holsters with belt-clip have been designed to maintain ~ 19-20 mm separation distance from body.

8.2.3 Limb/Hand Configuration

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

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

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

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

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

9.0 HIGH LEVEL EVALUATION

9.1 Maximum search

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

9.2 Extrapolation

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

9.3 Boundary correction

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

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

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

10.0 MEASUREMENT UNCERTAINTY

DASY5 Uncertainty Budget
(0.3 - 3 GHz range)

Error Description	Uncert. value	Prob. Dist.	Div.	(c_i) 1g	(c_i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v_i) v_{eff}
Measurement System								
Probe Calibration	±6.0%	N	1	1	1	±6.0%	±6.0%	∞
Axial Isotropy	±4.7%	R	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%	∞
Hemispherical Isotropy	±9.6%	R	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%	∞
Boundary Effects	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Linearity	±4.7%	R	$\sqrt{3}$	1	1	±2.7%	±2.7%	∞
System Detection Limits	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Modulation Response[m]	±2.4%	R	$\sqrt{3}$	1	1	±1.4%	±1.4%	∞
Readout Electronics	±0.3%	N	1	1	1	±0.3%	±0.3%	∞
Response Time	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
Integration Time	±2.6%	R	$\sqrt{3}$	1	1	±1.5%	±1.5%	∞
RF Ambient Noise	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
RF Ambient Reflections	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Probe Positioner	±0.4%	R	$\sqrt{3}$	1	1	±0.2%	±0.2%	∞
Probe Positioning	±2.9%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Max. SAR Eval.	±2.0%	R	$\sqrt{3}$	1	1	±1.2%	±1.2%	∞
Test Sample Related								
Device Positioning	±2.9%	N	1	1	1	±2.9%	±2.9%	145
Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%	5
Power Drift	±5.0%	R	$\sqrt{3}$	1	1	±2.9%	±2.9%	∞
Power Scaling[p]	±0%	R	$\sqrt{3}$	1	1	±0.0%	±0.0%	∞
Phantom and Setup								
Phantom Uncertainty	±6.1%	R	$\sqrt{3}$	1	1	±3.5%	±3.5%	∞
SAR correction	±1.9%	R	$\sqrt{3}$	1	0.84	±1.1%	±0.9%	∞
Liquid Conductivity (mea.)[DAK]	±2.5%	R	$\sqrt{3}$	0.78	0.71	±1.1%	±1.0%	∞
Liquid Permittivity (mea.) [DAK]	±2.5%	R	$\sqrt{3}$	0.26	0.26	±0.3%	±0.4%	∞
Temp. unc. - Conductivity [BB]	±3.4%	R	$\sqrt{3}$	0.78	0.71	±1.5%	±1.4%	∞
Temp. unc. - Permittivity [BB]	±0.4%	R	$\sqrt{3}$	0.23	0.26	±0.1%	±0.1%	∞
Combined Std. Uncertainty						±11.2%	±11.1%	361
Expanded STD Uncertainty						**±22.3%**	**±22.2%**	

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

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

Relative DASY5 Uncertainty Budget for Fast SAR Tests
(0.3 - 3 GHz range)

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

Table 10.0-2 Worst-Case uncertainty budget for DASY5 assessed according to IEEE P1528-2013
Source: Schmid & Partner Engineering AG.

DASY5 Uncertainty Budget
(3 - 6 GHz range)

Error Description	Uncert. value	Prob. Dist.	Div.	(c_i) 1g	(c_i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v_i) v_{eff}
Measurement System								
Probe Calibration	±6.55 %	N	1	1	1	±6.55 %	±6.55 %	∞
Axial Isotropy	±4.7 %	R	$\sqrt{3}$	0.7	0.7	±1.9 %	±1.9 %	∞
Hemispherical Isotropy	±9.6 %	R	$\sqrt{3}$	0.7	0.7	±3.9 %	±3.9 %	∞
Boundary Effects	±2.0 %	R	$\sqrt{3}$	1	1	±1.2 %	±1.2 %	∞
Linearity	±4.7 %	R	$\sqrt{3}$	1	1	±2.7 %	±2.7 %	∞
System Detection Limits	±1.0 %	R	$\sqrt{3}$	1	1	±0.6 %	±0.6 %	∞
Modulation Response[m]	±2.4 %	R	$\sqrt{3}$	1	1	±1.4 %	±1.4 %	∞
Readout Electronics	±0.3 %	N	1	1	1	±0.3 %	±0.3 %	∞
Response Time	±0.8 %	R	$\sqrt{3}$	1	1	±0.5 %	±0.5 %	∞
Integration Time	±2.6 %	R	$\sqrt{3}$	1	1	±1.5 %	±1.5 %	∞
RF Ambient Noise	±3.0 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
RF Ambient Reflections	±3.0 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
Probe Positioner	±0.8 %	R	$\sqrt{3}$	1	1	±0.5 %	±0.5 %	∞
Probe Positioning	±6.7 %	R	$\sqrt{3}$	1	1	±3.9 %	±3.9 %	∞
Max. SAR Eval.	±4.0 %	R	$\sqrt{3}$	1	1	±2.3 %	±2.3 %	∞
Test Sample Related								
Device Positioning	±2.9 %	N	1	1	1	±2.9 %	±2.9 %	145
Device Holder	±3.6 %	N	1	1	1	±3.6 %	±3.6 %	5
Power Drift	±5.0 %	R	$\sqrt{3}$	1	1	±2.9 %	±2.9 %	∞
Power Scaling[p]	±0 %	R	$\sqrt{3}$	1	1	±0.0 %	±0.0 %	∞
Phantom and Setup								
Phantom Uncertainty	±6.6 %	R	$\sqrt{3}$	1	1	±3.8 %	±3.8 %	∞
SAR correction	±1.9 %	R	$\sqrt{3}$	1	0.84	±1.1 %	±0.9 %	∞
Liquid Conductivity (mea.)[DAK]	±2.5 %	R	$\sqrt{3}$	0.78	0.71	±1.1 %	±1.0 %	∞
Liquid Permittivity (mea.) [DAK]	±2.5 %	R	$\sqrt{3}$	0.26	0.26	±0.3 %	±0.4 %	∞
Temp. unc. - Conductivity [BB]	±3.4 %	R	$\sqrt{3}$	0.78	0.71	±1.5 %	±1.4 %	∞
Temp. unc. - Permittivity [BB]	±0.4 %	R	$\sqrt{3}$	0.23	0.26	±0.1 %	±0.1 %	∞
Combined Std. Uncertainty						±12.3 %	±12.2 %	748
Expanded STD Uncertainty						**±24.6 %**	**±24.5 %**	

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

11.0 TEST RESULTS

11.1 SAR Measurement results at highest power measured against the head

Measured/Extrapolated SAR Values - Head - LTE Band 17 700 MHz (BW 10MHz)										
Channel	Freq. (MHz)	Mod.	RB #	RB Offset	Position	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
						Declared	Measured		Extrapolated	Reported
23780	709.0	QPSK	1	49	Right Cheek	23.6	22.98	0.05	0.07	0.08
23790	710.0	QPSK	1	49	Right Cheek	23.6	23.04	0.14	0.07	0.08
23800	711.0	QPSK	1	49	Right Cheek	23.6	23.08	-0.11	0.05	0.06
23780	709.0	QPSK	25	25	Right Cheek	22.6	22.03	-0.13	0.05	0.06
		QPSK	50	0	Right Cheek	22.6				0.00
23800	711.0	QPSK	1	49	Right 15° Tilt	23.6	23.08	0.08	0.02	0.02
23780	709.0	QPSK	1		Left Cheek	23.6				0.00
23790	710.0	QPSK	1		Left Cheek	23.6				0.00
23800	711.0	QPSK	1	49	Left Cheek	23.6	23.08	0.17	0.04	0.05
23780	709.0	QPSK	25	25	Left Cheek	22.6	22.03	0.01	0.03	0.03
		QPSK	50	0	Left Cheek	22.6				0.00
23800	711.0	QPSK	1	49	Left 15° Tilt	23.6	23.08	-0.14	0.02	0.02

Table 11.1-1 SAR results for LTE Band 17 (10MHz BW) 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 reported SAR ≤ 0.8 W/Kg or 3dB lower than the limit.

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

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

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

Note 5a: For LTE it is only required to test the configuration (channel and offset) yielding the highest conducted power for RB 1 and RB 50% when combined 1g avg. SAR < 0.8 W/Kg or 3dB lower than the limit for both cases. Also, when the highest conducted power for RB 1 and RB 50% are both greater than RB 100%, then SAR testing for RB 100% can be excluded.

Note 5b: For LTE if 1g avg. SAR > 0.8 W/Kg or not at least 3dB lower than the limit, than the remaining channels for that RB number must be tested and one additional scan must be done with RB 100%. For all additional scans the highest conducted power configuration (channel and offset) must be used.

Note 5c: For LTE if SAR ≤ 1.45, then SAR tests for the smaller bandwidths are not required

Note 5d: For LTE the lower bandwidths are only tested on the cases where the conducted power is 0.5 dB greater than those found on the highest bandwidth or when the reported 1g SAR > 1.45 for the highest bandwidth.

Note 5e: For LTE 16 QAM is only tested on the cases where its conducted power is 0.5 dB greater than QPSK or when the reported 1g SAR > 1.45 for QPSK.

Measured/Extrapolated SAR Values - Head - LTE Band 13 750 MHz (BW 10MHz)										
Channel	Freq. (MHz)	Mod.	RB #	RB Offset	Position	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
						Declared	Measured		Extrapolated	Reported
23230	782.0	QPSK	1	49	Right Cheek	23.9	23.77	-0.08	0.20	0.21
23230	782.0	QPSK	25	25	Right Cheek	22.9	22.84	0.02	0.17	0.17
23230	782.0	QPSK	50	0	Right Cheek					0.00
23230	782.0	QPSK	1	49	Right 15° Tilt	23.9	23.77	0.16	0.08	0.08
23230	782.0	QPSK	1	49	Left Cheek	23.9	23.77	-0.02	0.15	0.15
23230	782.0	QPSK	25	25	Left Cheek	22.9	22.84	-0.04	0.12	0.12
23230	782.0	QPSK	50	0	Left Cheek					0.00
23230	782.0	QPSK	1	49	Left 15° Tilt	23.9	23.77	0.03	0.07	0.07

Table 11.1-2 SAR results for LTE Band 13 (10MHz BW) head configuration

Measured/Extrapolated SAR Values - Head - LTE Band 5 850 MHz (BW 10MHz)										
Channel	Freq. (MHz)	Mod.	RB #	RB Offset	Position	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
						Declared	Measured		Extrapolated	Reported
20450	829.0	QPSK	1	25	Right Cheek	23.7	23.62	0.02	0.25	0.26
20525	836.5	QPSK	1	0	Right Cheek	23.7	23.34	0.01	0.27	0.30
20600	844.0	QPSK	1	0	Right Cheek	23.5	23.27	-0.01	0.27	0.28
20450	829.0	QPSK	25	25	Right Cheek	22.7	22.51	0.03	0.21	0.22
		QPSK	50	0	Right Cheek					0.00
20450	829.0	QPSK	1	25	Right 15° Tilt	23.7	23.62	0.04	0.08	0.08
20450	829.0	QPSK	1	25	Left Cheek	23.7	23.62	-0.01	0.14	0.15
20525	836.5	QPSK	1	0	Left Cheek					0.00
20600	844.0	QPSK	1	0	Left Cheek					0.00
20450	829.0	QPSK	25	25	Left Cheek	22.7	22.51	0.05	0.12	0.13
		QPSK	50	0	Left Cheek					0.00
20450	829.0	QPSK	1	25	Left 15° Tilt	23.7	23.62	-0.01	0.07	0.07

Table 11.1-3 SAR results for LTE Band 5 (10MHz BW) head configuration

Measured/Extrapolated SAR Values - Head - GSM/GMSK/DTM 850 MHz								
Channel	Freq. (MHz)	Time Slots	Position	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
				Declared	Measured		Extrapolated	Reported
128	824.2	1	Right Cheek					0.00
190	836.6	1	Right Cheek	33.6	33.3	0.05	0.31	0.33
251	848.8	1	Right Cheek					0.00
128	824.2	2	Right Cheek	30.7	30.6	0.33	0.40	0.41
190	836.6	2	Right Cheek	30.5	30.4	-0.08	0.32	0.33
251	848.8	2	Right Cheek	30.5	30.1	-0.15	0.29	0.32
190	836.6	3	Right Cheek	29.5	29.0	0.05	0.30	0.34
190	836.6	2	Right 15° Tilt	30.5	30.4	0.04	0.11	0.11
128	824.2	1	Left Cheek					0.00
190	836.6	1	Left Cheek	33.6	33.3	0.01	0.16	0.17
251	848.8	1	Left Cheek					0.00
190	836.6	2	Left Cheek	30.5	30.4	-0.01	0.17	0.17
190	836.6	3	Left Cheek					0.00
190	836.6	2	Left 15° Tilt	30.5	30.4	-0.08	0.09	0.09

Table 11.1-4a SAR results for GSM/EDGE/DTM 850 head configuration on Rev 1

Measured/Extrapolated SAR Values - Head - GSM/GMSK/DTM 850 MHz								
Channel	Freq. (MHz)	Time Slots	Position	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
				Declared	Measured		Extrapolated	Reported
128	824.2	1	Right Cheek	33.6	32.8			0.00
190	836.6	1	Right Cheek	33.6	32.8	0.00	0.38	0.46
251	848.8	1	Right Cheek	33.7	32.7			0.00
128	824.2	2	Right Cheek	30.5	29.7	0.07	0.40	0.48
128	824.2	3	Right Cheek	29.5	28.5	0.02	0.44	**0.55**
190	836.6	3	Right Cheek	29.5	28.3	-0.06	0.38	0.50
251	848.8	3	Right Cheek	29.5	28.3	0.15	0.33	0.44
128	824.2	1	Left Cheek					0.00
190	836.6	1	Left Cheek					0.00
251	848.8	1	Left Cheek					0.00
190	836.6	2	Left Cheek					0.00
128	824.2	3	Left Cheek	29.5	28.5	0.00	0.22	0.28

Table 11.1-4b SAR results for GSM/EDGE/DTM 850 head configuration on Rev 2

Note: Antenna tuning and conducted power changed on Rev 2 therefore spot check measurements were performed on the highest conducted power channel for the worst case position. Please refer to the hardware declaration HWD_CER-59665-001 - Rev2-x05-04.

Measured/Extrapolated SAR Values - Head - WCDMA FDD V 850 MHz							
Channel	Freq. (MHz)	Position	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
			Declared	Measured		Extrapolated	Reported
4132	826.4	Right Cheek	24.8	24.34	-0.03	0.32	0.36
4182	836.4	Right Cheek	24.8	24.36	0.00	0.34	0.38
4233	846.6	Right Cheek	24.8	24.31	-0.01	0.36	0.40
4182	836.4	Right 15° Tilt	24.8	24.36	0.00	0.12	0.14
4132	826.4	Left Cheek					0.00
4182	836.4	Left Cheek	24.8	24.36	0.02	0.24	0.26
4233	846.6	Left Cheek					0.00
4182	836.4	Left 15° Tilt	24.8	24.36	-0.02	0.10	0.11

Table 11.1-5 SAR results for WCDMA FDD V head configuration

Measured/Extrapolated SAR Values - Head - LTE Band 4 1800 MHz (BW 20MHz)										
Channel	Freq. (MHz)	Mod.	RB #	RB Offset	Position	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
						Declared	Measured		Extrapolated	Reported
20050	1720.0	QPSK	1		Right Cheek					0.00
20175	1732.5	QPSK	1	0	Right Cheek	23.9	23.59	-0.17	0.26	0.28
20300	1745.0	QPSK	1		Right Cheek					0.00
20175	1732.5	QPSK	50	0	Right Cheek	22.9	22.48	-0.16	0.21	0.23
		QPSK	100	0	Right Cheek					0.00
20175	1732.5	QPSK	1	0	Right 15° Tilt	23.9	23.59	0.04	0.08	0.09
20050	1720.0	QPSK	1	50	Left Cheek	23.9	23.48	-0.19	0.30	0.33
20175	1732.5	QPSK	1	0	Left Cheek	23.9	23.59	-0.17	0.31	0.33
20300	1745.0	QPSK	1	0	Left Cheek	23.9	23.47	-0.19	0.30	0.33
20175	1732.5	QPSK	50	0	Left Cheek	22.9	22.48	0.03	0.25	0.28
		QPSK	100	0	Left Cheek					0.00
20175	1732.5	QPSK	1	0	Left 15° Tilt	23.9	23.60	0.09	0.09	0.10

Table 11.1-6 SAR results for LTE Band 4 (20MHz BW) head configuration

Measured/Extrapolated SAR Values - Head - WCDMA FDD IV 1800 MHz							
Channel	Freq. (MHz)	Position	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
			Declared	Measured		Extrapolated	Reported
1312	1712.4	Right Cheek					0.00
1413	1732.6	Right Cheek	24.6	24.26	-0.14	0.24	0.26
1513	1752.6	Right Cheek					0.00
1413	1732.6	Right 15° Tilt	24.6	24.26	0.13	0.11	0.12
1312	1712.4	Left Cheek	24.6	24.02	0.04	0.22	0.25
1413	1732.6	Left Cheek	24.6	24.26	-0.10	0.25	0.27
1513	1752.6	Left Cheek	24.6	24.25	-0.09	0.23	0.25
1413	1732.6	Left 15° Tilt	24.6	24.26	-0.19	0.10	0.11

Table 11.1-7 SAR results for WCDMA FDD IV head configuration

Measured/Extrapolated SAR Values - Head - LTE Band 2 1900 MHz (BW 20MHz)										
Channel	Freq. (MHz)	Mod.	RB #	RB Offset	Position	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
						Declared	Measured		Extrapolated	Reported
18700	1860.0	QPSK	1		Right Cheek					0.00
18900	1880.0	QPSK	1	50	Right Cheek	23.9	23.65	-0.07	0.17	0.18
19100	1900.0	QPSK	1		Right Cheek					0.00
18900	1880.0	QPSK	50	0	Right Cheek	22.9	22.63	0.06	0.14	0.14
		QPSK	100	0	Right Cheek					0.00
18900	1880.0	QPSK	1	50	Right 15° Tilt	23.9	23.65	-0.05	0.05	0.05
18700	1860.0	QPSK	1	50	Left Cheek	23.9	23.60	0.19	0.18	0.19
18900	1880.0	QPSK	1	50	Left Cheek	23.9	23.65	-0.04	0.20	0.21
19100	1900.0	QPSK	1	0	Left Cheek	23.9	23.55	-0.11	0.16	0.17
18900	1880.0	QPSK	50	0	Left Cheek	22.9	22.63	-0.01	0.16	0.17
		QPSK	100	0	Left Cheek					0.00
18900	1880.0	QPSK	1	50	Left 15° Tilt	23.9	23.65	0.04	0.05	0.05

Table 11.1-8 SAR results for LTE Band 2 (20MHz BW) head configuration

Measured/Extrapolated SAR Values - Head - GSM/EDGE/DTM 1900 MHz								
Channel	Freq. (MHz)	Time Slots	Position	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
				Declared	Measured		Extrapolated	Reported
512	1850.2	1	Right Cheek	31.0				0.00
661	1880.0	1	Right Cheek	31.0	29.8	-0.08	0.09	0.12
810	1909.8	1	Right Cheek	30.8				0.00
661	1880.0	2	Right Cheek	29.0	28.4	0.20	0.11	0.13
661	1880.0	3	Right Cheek	26.5	25.5	-0.11	0.09	0.11
661	1880.0	2	Right 15° Tilt	29.0	28.4	-0.18	0.03	0.03
661	1880.0	1	Left Cheek	31.0	29.7	0.16	0.13	0.18
512	1850.2	2	Left Cheek	29.0	28.5	0.02	0.17	0.19
661	1880.0	2	Left Cheek	29.0	28.4	-0.01	0.18	0.21
810	1909.8	2	Left Cheek	29.0	28.4	-0.06	0.14	0.16
661	1880.0	3	Left Cheek	26.5	25.5	0.05	0.13	0.16
661	1880.0	2	Left 15° Tilt	29.0	28.4	-0.14	0.04	0.05

Table 11.1-9 SAR results for GSM/EDGE/DTM 1900 head configuration

Measured/Extrapolated SAR Values - Head - WCDMA FDD II 1900 MHz							
Channel	Freq. (MHz)	Position	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
			Declared	Measured		Extrapolated	Reported
9262	1852.4	Right Cheek					0.00
9400	1880.0	Right Cheek	24.6	24.28	-0.03	0.15	0.16
9538	1907.6	Right Cheek					0.00
9400	1880.0	Right 15° Tilt	24.6	24.28	0.01	0.05	0.05
9262	1852.4	Left Cheek	24.6	24.24	-0.13	0.26	0.28
9400	1880.0	Left Cheek	24.6	24.28	-0.04	0.24	0.26
9538	1907.6	Left Cheek	24.6	24.06	-0.08	0.20	0.23
9400	1880.0	Left 15° Tilt	24.6	24.28	0.08	0.06	0.06

Table 11.1-10 SAR results for WCDMA FDD II head configuration

Measured/Extrapolated SAR Values - Head Full - 802.11b/g 2450 MHz							
Channel	Freq. (MHz)	Position	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
			Declared	Measured		Extrapolated	Reported
1	2412.0	Right Cheek					0.00
6	2437.0	Right Cheek	20.0	18.0	0.01	0.24	0.38
11	2462.0	Right Cheek					0.00
6	2437.0	Right Cheek(g)	20.5	18.5	0.17	0.24	0.38
6	2437.0	Right 15° Tilt	20.0	18.0	0.02	0.20	0.32
1	2412.0	Left Cheek					0.00
6	2437.0	Left Cheek	20.0	18.0	0.16	0.09	0.14
11	2462.0	Left Cheek					0.00
6	2437.0	Left 15° Tilt	20.0	18.0	0.28	0.10	0.16

Table 11.1-11 results for Wi-Fi/WLAN/802.11b head configuration

Note 1: SAR measurements were performed on the highest output power channel
Note 2: Spot check measurements were performed on 802.11g as its conducted power is ¼ dB higher than 802.11b

Measured/Extrapolated SAR Values - Head - Bluetooth 2450 MHz							
Channel	Freq. (MHz)	Position	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
			Declared	Measured		Extrapolated	Reported
0	2402.0	Right Cheek					0.00
39	2441.0	Right Cheek	10.75	10.40	0.19	0.03	0.03
78	2480.0	Right Cheek					0.00
39	2441.0	Right 15° Tilt	10.75	10.40	0.18	0.03	0.03
0	2402.0	Left Cheek					0.00
39	2441.0	Left Cheek	10.75	10.40	0.02	0.01	0.01
78	2480.0	Left Cheek					0.00
39	2441.0	Left 15° Tilt	10.75	10.40	0.18	0.00	0.00

Table 11.1-12 SAR results for Bluetooth head configuration

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

Measured/Extrapolated SAR Values - Head - 802.11a 5000 MHz Full Power Mode							
Channel	Freq. (MHz)	Position	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
			Declared	Measured		Extrapolated	Reported
36*	5180.0	Right Cheek	20.0	18.2	-0.01	0.08	0.12
48*	5240.0	Right Cheek					0.00
52*	5260.0	Right Cheek	20.0	18.2	0.15	0.27	0.41
64*	5320.0	Right Cheek					0.00
104*	5520.0	Right Cheek	20.0	19.1	-0.03	0.26	0.32
116*	5580.0	Right Cheek					0.00
124*	5620.0	Right Cheek					0.00
136*	5680.0	Right Cheek					0.00
149*	5745.0	Right Cheek	20.0	19.1	0.06	0.33	0.41
157*	5785.0	Right Cheek					0.00
165*	5825.0	Right Cheek					0.00
149*	5745.0	Right 15° Tilt	20.0	19.1	0.18	0.47	0.58
36*	5180.0	Left Cheek	20.0	18.2	-0.18	0.19	0.29
48*	5240.0	Left Cheek					0.00
52*	5260.0	Left Cheek	20.0	18.2	-0.11	0.34	0.51
64*	5320.0	Left Cheek					0.00
104*	5520.0	Left Cheek	20.0	19.1	-0.13	0.37	0.46
116*	5580.0	Left Cheek					0.00
124*	5620.0	Left Cheek					0.00
136*	5680.0	Left Cheek					0.00
104*	5520.0	Left Cheek(ac, 20)	20.0	19.0	0.00	0.27	0.34
104*	5520.0	Left Cheek(ac, 40)	19.0	17.7	0.30	0.16	0.22
104*	5520.0	Left Cheek(ac, 80)	19.0	17.6	-0.48	0.11	0.15
149*	5745.0	Left Cheek	20.0	19.1	0.09	0.25	0.31
157*	5785.0	Left Cheek					0.00
165*	5825.0	Left Cheek					0.00
104*	5520.0	Left 15° Tilt	20.0	19.1	0.28	0.41	0.50

Table 11.1-13 SAR results for 802.11a head configuration

Note 1: "*" marks default test channels of each sub band which need to be tested if SAR is more than half of the limit.
Note 2: Spot check measurements were performed on 802.11ac for each bandwidth on the worst case SAR from 802.11a.
Note 3: Tests were conducted on Rev 1. Spot check measurements were not performed on Rev 2 as the only change was a decrease in conducted power.

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

Measured/Extrapolated SAR Values - Hotspot/Body-Worn - LTE Band 17 700 MHz (BW 10MHz)											
Channel	Freq. (MHz)	Spacing (cm)/ Holster	Mod.	RB #	RB Offset	Side facing phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
							Declared	Measured		Extrapolated	Reported
Hotspot Configuration											
23780	709	1.0	QPSK	1	49	Back	23.6	22.98	0.06	0.16	0.19
23790	710	1.0	QPSK	1	49	Back	23.6	23.04	-0.02	0.16	0.19
23800	711	1.0	QPSK	1	49	Back	23.6	23.08	-0.04	0.17	0.19
23780	709	1.0	QPSK	25	25	Back	22.6	22.03	0.04	0.13	0.15
		1.0	QPSK	50	0	Back					0.00
23800	711	1.0	QPSK	1	49	Front	23.6	23.08	0.03	0.11	0.12
23800	711	1.0	QPSK	1	49	Left	23.6	23.08	-0.16	0.01	0.02
23800	711	1.0	QPSK	1	49	Right	23.6	23.08	-0.04	0.12	0.13
23800	711	1.0	QPSK	1	49	Bottom	23.6	23.08	0.02	0.15	0.17
Body-Worn Configuration											
23780	709	1.5	QPSK	1	49	Back	23.6	22.98	-0.01	0.08	0.09
23790	710	1.5	QPSK	1	49	Back	23.6	23.04	0.00	0.09	0.11
23800	711	1.5	QPSK	1	49	Back	23.6	23.08	-0.04	0.10	0.11
23780	709	1.5	QPSK	25	25	Back	22.6	22.03	-0.04	0.07	0.08
		1.5	QPSK	50	0	Back					0.00
23800	711	1.5	QPSK	1	49	Front	23.6	23.08	0.03	0.09	0.10

Table 11.2-1 SAR results for LTE Band 17 (10MHz BW) 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 reported SAR ≤ 0.8 W/Kg or 3dB lower than the limit.
Note 3a: For Fast SAR a zoom scan is required for each head position with 1g measured SAR ≥ 0.8 W/Kg and one additional zoom scan to cover all the remaining head positions. The scan is done on the worst case for the position(s)
Note 3b: For Fast SAR the technique cannot be utilized when 1g measured SAR ≥ 1.2 W/Kg, an error message occurs, or difference between the zoom and area scan 1g SAR ≥ 0.1 W/kg for that configuration.
Note 4: A 2nd scan is required when 1g measured SAR ≥ 0.8 W/Kg. A 3rd scan is required when the 1g measured SAR ≥ 1.45 W/Kg or the 2nd scan SAR differs more than 20%. A 4th scan is required when the 1g measured SAR ≥ 1.50 W/Kg or the previous measurements differ more than 20%.
Note 5: Device was tested with 15 mm BLACKBERRY recommended separation distance to allow typical after-market holster to be used.
Note 6: For Hot Spot mode any side of the phone that is further than 2.5 cm away from the transmitting antenna can be exempted from testing.
Note 7a: For LTE it is only required to test the configuration (channel and offset) yielding the highest conducted power for RB 1 and RB 50% when combined 1g avg. SAR < 0.8 W/Kg or 3dB lower than the limit for both cases. Also, when the highest conducted power for RB 1 and RB 50% are both greater than RB 100%, then SAR testing for RB 100% can be excluded.
Note 7b: For LTE if 1g avg. SAR > 0.8 W/Kg or not at least 3dB lower than the limit, than the remaining channels for that RB number must be tested and one additional scan must be done with RB 100%. For all additional scans the highest conducted power configuration (channel and offset) must be used.
Note 7c: For LTE if SAR ≤ 1.45, then SAR tests for the smaller bandwidths are not required
Note 7d: For LTE the lower bandwidths are only tested on the cases where the conducted power is 0.5 dB greater than those found on the highest bandwidth or when the reported 1g SAR > 1.45 for the highest bandwidth.
Note 7e: For LTE 16 QAM is only tested on the cases where its conducted power is 0.5 dB greater than QPSK or when the reported 1g SAR > 1.45 for QPSK.

Measured/Extrapolated SAR Values - Hotspot/Body-Worn - LTE Band 13 750 MHz (BW 10MHz)											
Channel	Freq. (MHz)	Spacing (cm)/ Holster	Mod.	RB #	RB Offset	Side facing phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
							Declared	Measured		Extrapolated	Reported
Hotspot Configuration											
23180	777.0	1.0	QPSK	1		Back					0.00
23230	782.0	1.0	QPSK	1	49	Back	23.9	23.77	-0.02	0.49	0.50
23279	786.9	1.0	QPSK	1		Back					0.00
23230	782.0	1.0	QPSK	25	25	Back	22.9	22.84	0.03	0.39	0.40
		1.0	QPSK	50	0	Back					0.00
23230	782.0	1.0	QPSK	1	49	Front	23.9	23.77	-0.08	0.42	0.43
23230	782.0	1.0	QPSK	1	49	Left	23.9	23.77	0.02	0.10	0.10
23230	782.0	1.0	QPSK	1	49	Right	23.9	23.77	-0.04	0.25	0.26
23230	782.0	1.0	QPSK	1	49	Bottom	23.9	23.77	0.01	0.20	0.21
		1.0	QPSK			+HS					0.00
Body-Worn Configuration											
23180	777.0	1.5	QPSK	1		Back					0.00
23230	782.0	1.5	QPSK	1	49	Back	23.9	23.77	-0.01	0.38	0.39
23279	786.9	1.5	QPSK	1		Back					0.00
23230	782.0	1.5	QPSK	25	25	Back	22.9	22.84	-0.01	0.28	0.29
		1.5	QPSK	50	0	Back					0.00
23230	782.0	1.5	QPSK	1	49	Front	23.9	23.77	0.04	0.33	0.34
		Holster	QPSK								0.00

Table 11.2-2 SAR results for LTE Band 13 (10MHz BW) body-worn and Hotspot configurations

Measured/Extrapolated SAR Values - Hotspot/Body-Worn - LTE Band 5 850 MHz (BW 10MHz)											
Channel	Freq. (MHz)	Spacing (cm)/ Holster	Mod.	RB #	RB Offset	Side facing phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
							Declared	Measured		Extrapolated	Reported
Hotspot Configuration											
20450	829.0	1.0	QPSK	1	25	Back	23.7	23.62	-0.14	0.60	0.61
20525	836.5	1.0	QPSK	1	0	Back	23.7	23.34	0.03	0.57	0.62
20600	844.0	1.0	QPSK	1	0	Back	23.5	23.27	0.02	0.55	0.58
20450	829.0	1.0	QPSK	25	25	Back	22.7	22.51	0.00	0.46	0.48
		1.0	QPSK	50	0	Back					0.00
20450	829.0	1.0	QPSK	1	25	Front	23.7	23.62	0.05	0.50	0.51
20450	829.0	1.0	QPSK	1	25	Left	23.7	23.62	-0.13	0.21	0.21
20450	829.0	1.0	QPSK	1	25	Right	23.7	23.62	-0.11	0.20	0.20
20450	829.0	1.0	QPSK	1	25	Bottom	23.7	23.62	-0.06	0.29	0.30
		1.0	QPSK			+HS					0.00
Body-Worn Configuration											
20450	829.0	1.5	QPSK	1	25	Back	23.7	23.62	-0.01	0.36	0.37
20525	836.5	1.5	QPSK	1	0	Back	23.7	23.34	-0.01	0.36	0.39
20600	844.0	1.5	QPSK	1	0	Back	23.7	23.27	-0.02	0.36	0.40
20450	829.0	1.5	QPSK	25	25	Back	22.7	22.51	0.00	0.29	0.31
		1.5	QPSK	50		Back					0.00
20450	829.0	1.5	QPSK	1	25	Front	23.7	23.62	0.02	0.30	0.31
		Holster	QPSK								0.00

Table 11.2-3 SAR results for LTE Band 5 (10MHz BW) body-worn and Hotspot configurations

Measured/Extrapolated SAR Values - Hotspot/Body-Worn - GSM/EDGE/GPRS 850 MHz									
Ch.	Freq. (MHz)	Time Slots	spacing (cm)/ holster	Side Facing Phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
					Declared	Measured		Extrapolated	Reported
Hotspot Configuration									
128	824.2	1	1.0	Back	33.6	33.6	-0.01	0.63	0.63
190	836.6	1	1.0	Back	33.6	33.3	-0.13	0.60	0.64
251	848.8	1	1.0	Back	33.7	33.3	0.00	0.54	0.59
190	836.6	2	1.0	Back	30.5	30.2	-0.19	0.50	0.54
190	836.6	3	1.0	Back	29.5	28.9	0.06	0.57	0.65
190	836.6	4	1.0	Back	28.5	26.8	-0.03	0.46	0.68
190	836.6	1	1.0	Front	33.6	33.3	0.00	0.46	0.49
190	836.6	1	1.0	Left	33.6	33.3	0.03	0.23	0.24
190	836.6	1	1.0	Right	33.6	33.3	0.07	0.16	0.17
190	836.6	1	1.0	Bottom	33.6	33.3	-0.01	0.28	0.30
			1.0	+HS					0.00
Body-Worn Configuration									
190	836.6	1	1.5	Back	33.6	33.3	0.00	0.36	0.39
190	836.6	2	1.5	Back	30.5	30.2	-0.02	0.35	0.37
128	824.2	3	1.5	Back	29.5	29.2	0.00	0.45	0.49
190	836.6	3	1.5	Back	29.5	28.9	0.08	0.38	0.44
251	848.8	3	1.5	Back	29.5	28.7	-0.01	0.33	0.39
190	836.6	4	1.5	Back	28.5	26.8	0.04	0.31	0.46
190	836.6	3	1.5	Front	29.5	28.9	0.02	0.35	0.40
			Holster						0.00

Table 11.2-4a SAR results for GSM/EDGE/GPRS 850 body-worn and Hotspot configurations on Rev1

Measured/Extrapolated SAR Values - Hotspot/Body-Worn - GSM/EDGE/GPRS 850 MHz									
Ch.	Freq. (MHz)	Time Slots	spacing (cm)/ holster	Side Facing Phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
					Declared	Measured		Extrapolated	Reported
Hotspot Configuration									
190	836.6	1	1.0	Back	33.6	32.8	0.01	0.61	0.73
128	824.2	2	1.0	Back	30.7	29.7	-0.02	0.67	0.84
128	824.2	3	1.0	Back	29.5	28.5	-0.01	0.72	0.91
190	836.6	3	1.0	Back	29.5	28.3	0.02	0.65	0.86
251	848.8	3	1.0	Back	29.5	28.3	0.02	0.50	0.66
128	824.2	4	1.0	Back	28.5	26.5	0.02	0.60	0.95
128	824.2	3	1.0	Back (2nd)	29.5	28.5	0.02	0.73	0.92
Body-Worn Configuration									
190	836.6	1	1.5	Back	33.6	32.8	0.03	0.39	0.47
128	824.2	2	1.5	Back	30.7	29.7	0.00	0.46	0.58
128	824.2	3	1.5	Back	29.5	28.5	0.04	0.52	0.65
190	836.6	3	1.5	Back	29.5	28.3	-0.01	0.43	0.57
251	848.8	3	1.5	Back	29.5	28.3	-0.04	0.40	0.53
128	824.2	4	1.5	Back	28.5	26.5	-0.01	0.42	0.67
190	836.6	3	1.5	Front					0.00
			Holster						0.00

Table 11.2-4b SAR results for GSM/EDGE/GPRS 850 body-worn and Hotspot configurations on Rev2

Note: Antenna tuning and conducted power changed on Rev 2 therefore spot check measurements were performed on the highest conducted power channel for the worst case position. Please refer to the hardware declaration HWD_CER-59665-001 - Rev2-x05-04.

Measured/Extrapolated SAR Values - Hotspot/Body-Worn - WCDMA FDD V 850 MHz								
Ch.	Freq. (MHz)	spacing (cm)/ holster	Side Facing Phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
				Declared	Measured		Extrapolated	Reported
Hotspot Configuration								
4132	826.4	1.0	Back	24.8	24.34	0.00	0.70	0.78
4182	836.4	1.0	Back	24.8	24.36	-0.01	0.67	0.74
4233	846.6	1.0	Back	24.8	24.31	-0.01	0.62	0.69
4182	836.4	1.0	Front	24.8	24.36	0.00	0.57	0.63
4182	836.4	1.0	Left	24.8	24.36	0.01	0.28	0.31
4182	836.4	1.0	Right	24.8	24.36	0.00	0.23	0.25
4182	836.4	1.0	Bottom	24.8	24.36	0.02	0.40	0.44
		1.0	+HS					0.00
Body-Worn Configuration								
4132	826.4	1.5	Back	24.8	24.34	-0.02	0.52	0.58
4182	836.4	1.5	Back	24.8	24.36	-0.07	0.51	0.57
4233	846.6	1.5	Back	24.8	24.31	0.01	0.47	0.52
4182	836.4	1.5	Front	24.8	24.36	-0.01	0.47	0.51
4182	836.4	Holster						0.00

Table 11.2-5 SAR results for WCDMA FDD V body-worn and Hotspot configurations

Measured/Extrapolated SAR Values - Hotspot/Body-Worn - LTE Band 4 1700 MHz (BW 20MHz)											
Channel	Freq. (MHz)	Spacing (cm)/ Holster	Mod.	RB #	RB Offset	Side facing phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
							Declared	Measured		Extrapolated	Reported
Hotspot Configuration											
20050	1720.0	1.0	QPSK	1	50	Back	23.9	23.48	-0.02	0.70	0.77
20175	1732.5	1.0	QPSK	1	0	Back	23.9	23.59	0.06	0.79	0.84
20300	1745.0	1.0	QPSK	1	0	Back	23.9	23.47	-0.01	0.69	0.76
20175	1732.5	1.0	QPSK	50	0	Back	22.9	22.48	-0.13	0.59	0.65
		1.0	QPSK	100	0	Back					0.00
20175	1732.5	1.0	QPSK		0	Front	23.9	23.59	0.08	0.22	0.24
20175	1732.5	1.0	QPSK		0	Left	23.9	23.59	0.00	0.07	0.08
20175	1732.5	1.0	QPSK		0	Right	23.9	23.59	-0.06	0.10	0.11
20175	1732.5	1.0	QPSK		0	Bottom	23.9	23.59	0.01	0.31	0.33
		1.0	QPSK			+HS					0.00
Body-Worn Configuration											
20050	1720.0	1.5	QPSK	1	50	Back	23.9	23.48	-0.02	0.37	0.41
20175	1732.5	1.5	QPSK	1	0	Back	23.9	23.59	-0.12	0.42	0.45
20300	1745.0	1.5	QPSK	1	0	Back	23.9	23.47	-0.06	0.37	0.41
20175	1732.5	1.5	QPSK	50	0	Back	22.9	22.48	-0.05	0.31	0.34
		1.5	QPSK	100	0	Back					0.00
20175	1732.5	1.5	QPSK		0	Front	23.9	23.59	-0.04	0.16	0.17
		Holster	QPSK								0.00

Table 11.2-6 SAR results for LTE Band 4 (20 MHz BW) body-worn and Hotspot configurations

Measured/Extrapolated SAR Values - Hotspot/Body-Worn - WCDMA FDD IV 1700 MHz								
Ch.	Freq. (MHz)	spacing (cm)/ holster	Side Facing Phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
				Declared	Measured		Extrapolated	Reported
Hotspot Configuration								
1312	1712.4	1.0	Back	24.6	24.02	-0.02	1.08	1.23
1413	1732.6	1.0	Back	24.6	24.26	0.01	1.11	1.20
1513	1752.6	1.0	Back	24.6	24.25	-0.01	1.02	1.11
1413	1732.6	1.0	Front	24.6	24.26	0.08	0.41	0.45
1413	1732.6	1.0	Left	24.6	24.26	-0.02	0.08	0.09
1413	1732.6	1.0	Right	24.6	24.26	-0.04	0.12	0.13
1413	1732.6	1.0	Bottom	24.6	24.26	-0.04	0.39	0.42
1413	1732.6	1.0	2nd Scan Back	24.6	24.26	0.03	1.02	1.10
Body-Worn Configuration								
1312	1712.4	1.5	Back	24.6	24.02	0.06	0.54	0.62
1413	1732.6	1.5	Back	24.6	24.26	-0.09	0.57	0.62
1513	1752.6	1.5	Back	24.6	24.25	0.05	0.46	0.50
1413	1732.6	1.5	Front	24.6	24.26	0.01	0.24	0.26

Table 11.2-7 SAR results for WCDMA FDD IV body-worn and Hotspot configurations

Measured/Extrapolated SAR Values - Hotspot/Body-Worn - LTE Band 2 1900 MHz (BW 20MHz)											
Channel	Freq. (MHz)	Spacing (cm)/ Holster	Mod.	RB #	RB Offset	Side facing phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
							Declared	Measured		Extrapolated	Reported
Hotspot Configuration											
18700	1860.0	1.0	QPSK	1	50	Back	23.0	22.79	0.03	1.03	1.08
18900	1880.0	1.0	QPSK	1	50	Back	23.0	22.90	-0.01	1.02	1.04
19100	1900.0	1.0	QPSK	1	0	Back	23.0	22.80	0.07	1.16	1.21
18700	1860.0	1.0	QPSK	50	0	Back	23.0	22.53	0.12	1.02	1.14
18900	1880.0	1.0	QPSK	50	0	Back	23.0	22.71	-0.06	1.03	1.10
19100	1900.0	1.0	QPSK	50	0	Back	23.0	22.52	0.03	1.00	1.12
18900	1880.0	1.0	QPSK	100	0	Back	23.0	22.62	-0.18	1.02	1.11
19100	1900.0	1.0	QPSK	100	0	Back	23.0	22.65	0.10	1.04	1.13
19100	1900.0	1.0	QPSK	100	0	Back	23.0	22.43	-0.15	0.98	1.12
18900	1880.0	1.0	QPSK	1	50	Front	23.0	22.90	-0.05	0.24	0.25
18900	1880.0	1.0	QPSK	1	50	Left	23.0	22.90	-0.03	0.04	0.04
18900	1880.0	1.0	QPSK	1	50	Right	23.0	22.90	-0.04	0.12	0.12
18900	1880.0	1.0	QPSK	1	50	Bottom	23.0	22.90	-0.14	0.40	0.41
19100	1900.0	1.0	QPSK	1	0	Back+HS	23.0	22.90	0.08	0.79	0.81
19100	1900.0	1.0	QPSK	1	0	Back 2nd Scan	23.0	22.90	-0.16	1.04	1.06
Body-Worn Configuration											
18700	1860.0	1.5	QPSK	1	50	Back	23.9	23.60	0.03	0.57	0.61
18900	1880.0	1.5	QPSK	1	50	Back	23.9	23.65	-0.01	0.51	0.53
19100	1900.0	1.5	QPSK	1	0	Back	23.9	23.55	-0.02	0.44	0.48
18900	1880.0	1.5	QPSK	1	50	Front	23.9	23.65	-0.04	0.13	0.14
		Holster	QPSK								0.00

Table 11.2-8 SAR results for LTE Band 2 (20 MHz BW) body-worn and Hotspot configurations

Measured/Extrapolated SAR Values - Hotspot/Body-Worn - GSM/EDGE/GPRS 1900 MHz									
Ch.	Freq. (MHz)	Time Slots	spacing (cm)/ holster	Side Facing Phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
					Declared	Measured		Extrapolated	Reported
Hotspot Configuration									
661	1880.0	1	1.0	Back	31.0	29.8	0.13	0.51	0.67
512	1850.2	2	1.0	Back	29.0	28.4	-0.03	0.64	0.73
661	1880.0	2	1.0	Back	29.0	28.5	-0.10	0.69	0.77
810	1909.8	2	1.0	Back	29.0	28.4	0.00	0.71	0.82
661	1880.0	3	1.0	Back	26.5	25.5	0.03	0.51	0.64
661	1880.0	4	1.0	Back	26.0	25.0	0.05	0.57	0.72
661	1880.0	2	1.0	Front	28.5	28.4	0.07	0.16	0.16
661	1880.0	2	1.0	Left	28.5	28.4	0.01	0.04	0.04
661	1880.0	2	1.0	Right	28.5	28.4	0.08	0.14	0.14
661	1880.0	2	1.0	Bottom	28.5	28.4	0.00	0.35	0.36
			1.0	+HS					0.00
810	1909.8	2	1.0	Back (2nd)	28.5	28.4	-0.19	0.68	0.70
Body-Worn Configuration									
661	1880.0	1	1.5	Back	31.0	29.8	-0.07	0.24	0.32
512	1850.2	2	1.5	Back	29.0	28.4	-0.03	0.31	0.36
661	1880.0	2	1.5	Back	29.0	28.5	-0.16	0.34	0.38
810	1909.8	2	1.5	Back	29.0	28.4	0.19	0.39	0.45
661	1880.0	3	1.5	Back	26.5	25.5	-0.07	0.26	0.33
661	1880.0	4	1.5	Back	26.0	25.0	0.14	0.29	0.37
661	1880.0	2	1.5	Front	29.0	28.4	-0.10	0.12	0.14
			Holster						0.00

Table 11.2-9 SAR results for GSM/EDGE/GPRS 1900 body-worn and Hotspot configurations

Measured/Extrapolated SAR Values - Hotspot/Body-Worn - WCDMA FDD II 1900 MHz								
Ch.	Freq. (MHz)	spacing (cm)/ holster	Side Facing Phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
				Declared	Measured		Extrapolated	Reported
Hotspot Configuration								
9262	1852.4	1.0	Back	23.60	23.37	0.20	1.33	1.40
9400	1880.0	1.0	Back	23.60	23.37	0.01	1.25	1.32
9538	1907.6	1.0	Back	23.60	23.03	0.03	1.05	1.20
9400	1880.0	1.0	Front	23.60	23.37	-0.01	0.27	0.28
9400	1880.0	1.0	Left	23.60	23.37	-0.03	0.06	0.06
9400	1880.0	1.0	Right	23.60	23.37	-0.01	0.15	0.15
9400	1880.0	1.0	Bottom	23.60	23.37	0.09	0.44	0.47
9262	1852.4	1.0	Back+HS	23.60	23.37	0.01	1.22	1.29
9262	1852.4	1.0	Back HSUPA	22.60	22.37	0.01	1.08	1.14
9262	1852.4	1.0	Back HSDPA	22.60	22.40	0.11	1.06	1.11
9262	1852.4	1.0	Back 2nd	23.60	23.37	-0.01	1.20	1.27
Body-Worn Configuration								
9262	1852.4	1.5	Back	24.60	24.24	-0.03	0.40	0.44
9400	1880.0	1.5	Back	24.60	24.28	-0.03	0.65	0.70
9538	1907.6	1.5	Back	24.60	24.06	-0.03	0.37	0.42
9400	1880.0	1.5	Front	24.60	24.28	-0.03	0.16	0.18
9400	1880.0	Holster						0.00

Table 11.2-10 SAR results for WCDMA FDD II body-worn and Hotspot configurations

Measured/Extrapolated SAR Values - Hotspot/Body-Worn - 802.11b/g 2450 MHz								
Ch.	Freq. (MHz)	spacing (cm)/ holster	Side Facing Phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
				Declared	Measured		Extrapolated	Reported
Hotspot Configuration								
1	2412	1.0	Back					0.00
6	2437	1.0	Back	12.00	10.20	-0.07	0.28	0.42
11	2462	1.0	Back					0.00
6	2437	1.0	Front	12.00	10.20	0.18	0.06	0.09
6	2437	1.0	Left	12.00	10.20	-0.03	0.08	0.12
6	2437	1.0	Right	12.00	10.20			0.00
6	2437	1.0	Top	12.00	10.20	-0.02	0.12	0.18
		1.0	Bottom					0.00
		1.0	+HS					0.00
Body-Worn Configuration								
6	2437	1.5	Back	20.00	18.00	0.08	0.11	0.17
6	2437	1.5	Back (g)	20.50	18.50	-0.04	0.15	0.24
6	2437	1.5	Front	20.00	18.00	-0.12	0.02	0.03
		Holster	Back					0.00

Table 11.2-11 SAR results for Wi-Fi/WLAN/802.11b body-worn and Hotspot configurations

Note 1: SAR measurements were performed on the highest output power channel
Note 2: Spot check measurements were performed on 802.11g as its conducted power is ¼ dB higher than 802.11b

Measured/Extrapolated SAR Values - Hotspot/Body-Worn - Bluetooth 2450 MHz								
Ch.	Freq. (MHz)	spacing (cm)/ holster	Side Facing Phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
				Declared	Measured		Extrapolated	Reported
Hotspot Configuration								
0	2402	1.0	Back					0.00
39	2441	1.0	Back	10.75	10.4	0.14	0.04	0.04
78	2480	1.0	Back					0.00
39	2441	1.0	Front	10.75	10.4	-0.08	0.01	0.01
		1.0	Left					0.00
		1.0	Right					0.00
39	2441	1.0	Top	10.75	10.4	0.02	0.02	0.02
		1.0	Bottom					0.00
		1.0	+HS					0.00
Body-Worn Configuration								
39	2441	1.5	Back	10.75	10.4	0.01	0.01	0.01
39	2441	1.5	Front	10.75	10.4	-0.11	0.00	0.00
		Holster						0.00

Table 11.2-12 SAR results for Bluetooth body-worn and Hotspot configurations

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

Measured/Extrapolated SAR Values - Hotspot - 802.11a 5000 MHz									
Ch.	Freq. (MHz)	spacing (cm)/ holster	Side Facing Phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)		10g SAR (W/Kg)
				Declared	Measured		Extrapolated	Reported	Extrapolated
36*	5180	1.0	Back	12.0	10.5	-0.09	0.11	0.16	0.03
40	5200	1.0	Back					0.00	
44	5220	1.0	Back					0.00	
48*	5240	1.0	Back					0.00	
149*	5745	1.0	Back	12.0	11.4	-0.09	0.32	0.37	0.11
153	5765	1.0	Back					0.00	
157*	5785	1.0	Back					0.00	
161	5805	1.0	Back					0.00	
165*	5825	1.0	Back					0.00	
149*	5745	1.0	Front	12.0	11.4	0.18	0.01	0.01	0.00
149*	5745	1.0	Left	12.0	11.4	-0.04	0.09	0.10	0.04
149*	5745	1.0	Right					0.00	
149*	5745	1.0	Top	12.0	11.4	-0.01	0.11	0.13	0.04

Table 11.2-13a SAR results for 802.11a Hotspot configuration

Note 1: "*" marks default test channels of each sub band which need to be tested if SAR is more than half of the limit.
Note 2: Spot check measurements were performed on 802.11ac for each bandwidth on the worst case SAR from 802.11a.
Note 3: Tests were conducted on Rev 1. Spot check measurements were not performed on Rev 2 as the only change was a decrease in conducted power.

Measured/Extrapolated SAR Values - Body-Worn - 802.11a 5000 MHz								
Ch.	Freq. (MHz)	spacing (cm)/ holster	Side Facing Phantom	Cond. Output Power (dBm)		Power Drift (dB)	1g SAR (W/Kg)	
				Declared	Measured		Extrapolated	Reported
36*	5180	1.5	Back	20.0	18.2	-0.32	0.54	0.82
48*	5240	1.5	Back	20.0	18.0	-0.45	0.68	1.08
52*	5260	1.5	Back	20.0	18.2	0.09	0.85	1.29
64*	5320	1.5	Back	20.0	18.0	0.13	0.87	1.38
104*	5520	1.5	Back	20.0	19.1	-0.44	0.92	1.13
116*	5580	1.5	Back	20.0	19.0	0.09	0.98	1.23
124*	5620	1.5	Back	20.0	19.0	-0.02	1.11	1.40
136*	5680	1.5	Back	20.0	18.8	0.46	1.10	1.45
149*	5745	1.5	Back	20.0	19.1	0.22	**1.18**	**1.45**
157*	5785	1.5	Back	20.0	18.9	0.27	1.06	1.37
165*	5825	1.5	Back	20.0	18.5	0.06	1.02	1.44
149*	5745	1.5	Back+HS	20.0	19.1	-0.09	0.57	0.70
149*	5745	1.5	Back(2nd)	20.0	19.1	-0.09	1.18	1.45
149*	5745	1.5	Back(ac,20)	20.0	19.0	-0.41	1.01	1.27
149*	5745	1.5	Back(ac,40)	19.0	17.7	0.15	0.59	0.80
149*	5745	1.5	Back(ac,80)	19.0	17.3	0.23	0.41	0.61
149*	5745	1.5	Front	20.0	19.1	0.19	0.05	0.06
		Holster	Back					0.00

Table 11.2-13b SAR results for 802.11a body-worn configuration

Note 1: "*" marks default test channels of each sub band which need to be tested if SAR is more than half of the limit.

Note 2: Spot check measurements were performed on 802.11ac for each bandwidth on the worst case SAR from 802.11a.

Note 3: Tests were conducted on Rev 1. Spot check measurements were not performed on Rev 2 as the only change was a decrease in conducted power.

12.0 REFERENCES

[1] IEEE 1528-2013: Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques.

[2] EN 50360: 2001, Product standard to demonstrate the compliance of mobile phones with the basic restrictions related to human exposure to electromagnetic fields (300 MHz – 3 GHz)

[3] ICNIRP, International Commission on Non-Ionizing Radiation Protection (2009), Guidelines for limiting exposure in time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz).

[4] Council Recommendation 1999/519/EC of July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz)

[5] IEEE C95.3-2002, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave.

[6] IEEE C95.1-1992, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

[7] FCC 96-326, Guidelines for Evaluating the Environmental Effects of Radio-Frequency Radiation.

[8] DASY 5 DOSIMETRIC ASSESSMENT SYSTEM SOFTWARE MANUAL, Schmid & Partner Engineering AG.

[9] Health Canada, Safety Code 6, 2009: Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency range from 3 kHz to 300 GHz.

[10] RSS-102, issue 4-2010: Evaluation Procedure for Mobile and Portable Radio Transmitters with respect to Health Canada's Safety Code 6 for Exposure of Humans to Radio Frequency Fields.

[11] IEC 62209-1, First Edition-2005: Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures –Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz).

[12] IEC 62209-2, Edition 1.0-2010: Human exposure to radio frequency fields from hand-held and body-mount wireless communication devices – Human Models, instrumentation, and procedures - part 2 - procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz).

[13] IEC/EN 62311-2008: Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz – 300 GHz).

[14] 3GPP TS 36.521-1 V10.0.0 (2011-12): Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Conformance testing

[15] FCC OET SAR measurement 100 MHz to 6 GHz, KDB 865664 D01 v01, October 24, 2012.

[16] FCC OET SAR Measurement Procedures for 802.11 a/b/g Transmitters, KDB 248227 D01 v01r02, May, 2007.

[17] FCC OET SAR Evaluation Considerations for Handsets with Multiple Transmitters & Antennas, KDB 648474 D04 v01, October 24, 2012.

[18] FCC OET SAR Test Reduction Procedure for GSM/GPRS/EDGE, KDB 941225 D03 vo1, December, 2008.

[19] FCC OET SAR Test Procedure for Evaluating SAR for GSM/(E)GPRS Dual Transfer Mode, KDB 941225 D04 v01, January 27, 2010.

[20] FCC OET RF Exposure Procedures for Mobile and Portable Devices, and Equipment Authorization Policies, KDB 447498 D01 v05, October 24, 2012.

[21] FCC OET SAR Measurements Procedures for 3G Devices, KDB 941225 D01 v02, October, 2007.

[22] FCC OET SAR Evaluation Procedure for Portable Devices with Wireless Router capability, KDB 941225 D06 Hot Spot SAR v01, April 04, 2011.

[23] FCC OET SAR Evaluation Considerations for LTE Devices, KDB 941225 D05 v02, October 24, 2012.

[24] FCC OET RF Exposure Compliance Reporting and Documentation Considerations, KDB 865664 D02 v01, October 24, 2012.

[25] FCC 47 CRF Part 2.1093, Radiofrequency radiation exposure evaluation: portable devices. June 18, 2014.