SAR Compliance Test Report

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

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

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

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SCC Accredited LAB
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Note: According to the hardware similarity document BlackBerry model: RFQ111LW has the same WiFi/BT design as RFM121LW. Please refer to the Cetecom report SAR_CETE4_023_13001 for RFM121LW WiFi/BT SAR values.

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	RFQ111LW			
FCC ID	L6ARFQ110LW			
PIN	Radiated: 333CB445, 333CB46A, 333CB462 Conducted: 333CB448, 333CB468, 333CB46B			
Hardware Rev	Rev 1-903-00/01			
Software Version	10.1.0.1002/1627			
Prototype or Production Unit	Production			
Mode(s) of Operation	1-slot GSM 850 GSM 1900	2-slots EDGE/GPRS 850/1900	3-slots EDGE/GPRS 850/1900	4-slots EDGE/GPRS 850/1900
Nominal Maximum conducted RF Output Power (dBm)	32.5 29.5	30.0 28.5	29.0 26.0	27.0 25.5
Tolerance in Power Setting on centre channel (dB)	± 0.5	± 0.5	± 0.5	± 0.5
Duty Cycle	1:8	2:8	3:8	4:8
Transmitting Frequency Range (MHz)	824.2 – 848.8 1850.2 – 1909.8	824.2 – 848.8 1850.2 – 1909.8	824.2 – 848.8 1850.2 – 1909.8	824.2 – 848.8 1850.2 – 1909.8
Mode(s) of Operation	HSPA+ WCDMA/UMTS FDD V (850)	HSPA+ WCDMA/UMTS FDD II (1900)	CDMA2000/ 1xEvDO 850	CDMA2000/ 1xEvDO 1900
Nominal Maximum conducted RF Output Power (dBm)	24.0	23.5	23.5	23.5
Tolerance in Power Setting on centre channel (dB)	± 0.5	± 0.5	± 0.50	± 0.50
Duty Cycle	1:1	1:1	1:1	1:1
Transmitting Frequency Range (MHz)	824.6 – 846.6	1852.4 – 1907.6	824.7 – 848.5	1851.2 – 1908.5
Mode(s) of Operation	802.11b	802.11g	802.11n	Bluetooth
Nominal Maximum conducted RF Output Power (dBm)	18.5	18.5	16.0	10.0
Tolerance in Power Setting on centre channel (dB)	± 0.5	± 0.5	± 0.5	N/A
Duty Cycle	1:1	1:1	1:1	N/A
Transmitting Frequency Range (MHz)	2412-2462	2412-2462	2412-2462	2402-2483

Mode(s) of Operation	802.11a/n (low band)	802.11a/n (middle band)	802.11a/n (upper band I)	802.11a/n (upper band II)
Nominal Maximum conducted RF Output Power (dBm)	14.5	15.0	17.0	13.0
Tolerance in Power Setting on centre channel (dB)	± 0.5	± 0.5	± 0.5	± 0.5
Duty Cycle	1:1	1:1	1:1	1:1
Transmitting Frequency Range (MHz)	5180-5240	5260-5320	5500-5700	5745-5825
Mode(s) of Operation	NFC			
Nominal Maximum conducted RF Output Power (dBm)	N/A			
Tolerance in Power Setting on centre channel (dB)	N/A			
Duty Cycle	N/A			
Transmitting Frequency Range (MHz)	13.56			

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

Note 1: 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.

<table>
<tr><td>Device Model</td><td colspan="4">RFQ111LW</td></tr>
<tr><td>FCC ID</td><td colspan="4">L6ARFQ110LW</td></tr>
<tr><td>PIN</td><td colspan="4">Radiated: 333CB445, 333CB46A, 333CB462
Conducted: 333CB448, 333CB468, 333CB46B</td></tr>
<tr><td>Hardware Rev</td><td colspan="4">Rev 1-903-00/01</td></tr>
<tr><td>Software Version</td><td colspan="4">10.1.0.1002/1627</td></tr>
<tr><td>Prototype or Production Unit</td><td colspan="4">Production</td></tr>
<tr><td>Transmission channel bandwidth</td><td colspan="4">Band 25: 5 MHz, 10 MHz, 15MHz, 20MHz</td></tr>
<tr><td colspan="5">Transmission channel number and frequencies</td></tr>
<tr><td></td><td colspan="2">LTE band 25</td><td colspan="2"></td></tr>
<tr><td></td><td>Chan.</td><td>f (MHz)</td><td></td><td></td></tr>
<tr><td>L</td><td>26140</td><td>1860.0</td><td></td><td></td></tr>
<tr><td>M</td><td>26365</td><td>1882.5</td><td></td><td></td></tr>
<tr><td>H</td><td>26590</td><td>1905.0</td><td></td><td></td></tr>
<tr><td colspan="5"></td></tr>
<tr><td>UE Category</td><td colspan="4">Category 3</td></tr>
<tr><td>Modulation supported in uplink</td><td colspan="4">QPSK, 16QAM</td></tr>
<tr><td>Description of LTE antenna</td><td colspan="4">1 Tx/Rx Ant, Sharing with GSM/UMTS; 2 Rx Ant, separate CDMA Tx/Rx antenna</td></tr>
<tr><td>LTE voice available/supported</td><td colspan="4">SVLTE and third party VOIP application might be possible</td></tr>
<tr><td>Hotspot with LTE+WiFi</td><td colspan="4">Yes</td></tr>
<tr><td>Hotspot with LTE+WiFi active with CDMA voice</td><td colspan="4">Yes</td></tr>
<tr><td>LTE MPR permanently built-in by design</td><td colspan="4">Yes</td></tr>
<tr><td>LTE A-MPR</td><td colspan="4">Disabled during SAR testing , by setting NV value to NV_01 on the CMW500</td></tr>
<tr><td>LTE maximum average power (dBm)</td><td colspan="4">Band 25: 22.9 dBm</td></tr>
<tr><td rowspan="2">Other non-LTE U.S. wireless operating modes/bands</td><td colspan="2">GSM/WCDMA/HSPA^{+}</td><td colspan="2">850 MHz GSM/UMTS/CDMA
1900 MHz GSM/UMTS/CDMA</td></tr>
<tr><td colspan="2">WiFi and BT</td><td colspan="2">5.0 GHz Wi-Fi
2.4 GHz Wi-Fi
2.4 GHz BT</td></tr>
<tr><td>Simultaneous Tx conditions</td><td colspan="4">Please refer to section 1.9</td></tr>
<tr><td>Power reduction applied for SAR compliance</td><td colspan="4">Yes, please refer to sections 1.8 and 1.10</td></tr>
</table>

Table 1.3-2 Test device characterization all U.S. wireless operating modes/bands

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

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

1.4 Body worn accessories (holsters)

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

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

Table 1.4-1 Body worn holster

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

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

1.5 Headset

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

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

1.6 Battery

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

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

1.7 Procedure used to establish test signal

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

1.8 Highlights of the FCC OET SAR Measurement Requirements

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

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

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

Table 1.8.1-1 Probe specification requirements

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

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

Table 1.8.1-2 Zoom Scan requirement

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

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

802.11b @ 1Mbps		**802.11g @ 6Mbps**		**802.11n @ 6.5 Mbps**	
Chan	**Cond. Power (dBm)**	**Chan**	**Cond. Power (dBm)**	**Chan**	**Cond. Power (dBm)**
1	18.65	1	16.24	1	16.22
6	**18.75**	**6**	**18.65**	**6**	**16.24**
11	18.52	11	12.63	11	12.70
13	11.64	13	11.67	13	11.62

		802.11g			**802.11b**
Data Rate (Mbps)	**Mod.**	**Channel 6** **Cond. Power (dBm)**	**Data Rate (Mbps)**	**Mod.**	**Channel 6** **Cond. Power (dBm)**
6	BPSK	18.65	1	BPSK	18.75
9	BPSK	18.63	2	DQPSK	18.65
12	QPSK	18.59	5.5	CCK	18.57
18	QPSK	18.41	11	CCK	18.52
24	16-QAM	17.10	22	CCK	18.45
36	16-QAM	16.88			
48	64-QAM	15.47			
54	64-QAM	15.39			

		802.11 n
Data Rate (Mbps)	**Mod.**	**Channel 6** **Cond. Power (dBm)**
6.5	MCS0	16.24
13	MCS1	16.11
19.5	MCS2	16.01
26	MCS3	15.87
39	MCS4	14.55
52	MCS5	14.34
58.5	MCS6	13.12
65	MCS7	13.10

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

Channel	Frequency [MHz]	Average Power [dBm]		
		802.11a	802.11n HT20	802.11n, HT40
36	5180	15.0	15.0	12.7
40	5200	14.9	15.0	
44	5220	14.9	14.8	12.7
48	5240	14.8	14.8	
52	5260	15.3	15.3	12.7
56	5280	15.3	15.2	
60	5300	15.1	15.2	12.7
64	5320	15.1	15.0	
100	5500	17.3	17.3	12.7
104	5520	17.3	17.2	
108	5540	17.2	17.2	12.7
112	5560	17.2	17.2	
116	5580	17.1	17.2	12.7
120	5600	17.1	17.2	
124	5620	17.1	17.2	12.7
128	5640	17.2	17.2	
132	5660	16.6	16.7	12.7
136	5680	16.5	16.6	
140	5700	16.5	16.6	---
149	5745	13.1	13.1	12.7
153	5765	13.1	13.1	
157	5785	13.0	13.0	12.7
161	5805	12.8	12.8	
165	5825	12.6	12.7	---

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

1.8.2 SAR Measurement Requirements for Bluetooth

Channel	Freq (MHz)	Mode	Conducted Transmit Power (dBm)
0	2402	DH5	10.2
39	2441	DH5	10.2
78	2480	DH5	9.0

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:

- LTE Band 25: back off 5 dB

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

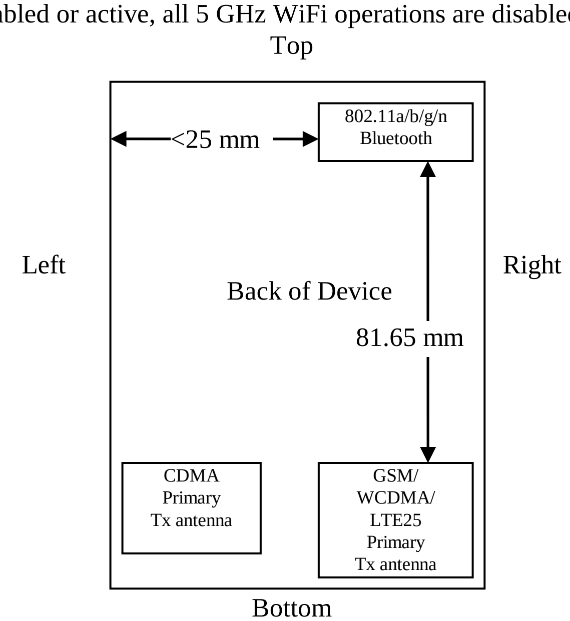

Figure 1.8.3-1 Identification of all sides for SAR Testing

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

Hotspot Sides for SAR Testing						
Mode	**Front**	**Back**	**Top**	**Bottom**	**Left**	**Right**
CDMA/GPRS/WCDMA/HSPA 850	Yes	Yes	No	Yes	Yes	Yes
CDMA/GPRS/WCDMA/HSPA 1900	Yes	Yes	No	Yes	Yes	Yes
Bluetooth 2.4GHz	Yes	Yes	Yes	No	Yes	Yes
802.11b 2.4	Yes	Yes	Yes	No	Yes	Yes

Table 1.8.3-1 Identification of all sides for SAR Testing

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

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

Mode	Freq. (MHz)	Max burst averaged conducted power (dBm) CS1	Max burst averaged conducted power (dBm) MCS1	Max burst averaged conducted power (dBm) MCS5
2-slots GPRS 850 MHz	824.2	30.1	N/A	N/A
	836.8	30.1	N/A	N/A
	848.8	30.0	N/A	N/A
3-slots GPRS 850 MHz	824.2	28.9	N/A	N/A
	836.8	29.1	N/A	N/A
	848.8	28.8	N/A	N/A
4-slots GPRS 850 MHz	824.2	27.1	N/A	N/A
	836.8	26.8	N/A	N/A
	848.8	26.7	N/A	N/A
2-slots EDGE 850 MHz	824.2	30.4	30.2	26.8
	836.8	30.3	30.1	26.6
	848.8	30.2	30.1	26.5
2-slots DTM	824.2	30.0	30.0	30.1
	836.8	29.9	29.9	30.0

850 MHz	848.8	29.8	29.8	29.9
3-slots EDGE 850 MHz	824.2	29.1	29.0	25.2
	836.8	29.2	29.1	25.0
	848.8	29.0	28.9	24.9
3-slots DTM 850 MHz	824.2	29.5	29.4	29.0
	836.8	29.1	29.1	29.1
	848.8	28.9	28.8	28.9
4-slots EDGE 850 MHz	824.2	27.1	27.1	24.2
	836.8	26.8	26.8	23.9
	848.8	26.8	26.9	23.8
2-slots GPRS 1900 MHz	1850.2	28.7	N/A	N/A
	1880.0	28.5	N/A	N/A
	1909.8	28.8	N/A	N/A
3-slots GPRS 1900 MHz	1850.2	26.2	N/A	N/A
	1880.0	26.0	N/A	N/A
	1909.8	26.2	N/A	N/A
4-slots GPRS 1900 MHz	1850.2	25.6	N/A	N/A
	1880.0	25.6	N/A	N/A
	1909.8	25.6	N/A	N/A
2-slots EDGE 1900MHz	1850.2	28.7	28.6	25.3
	1880.0	28.5	28.6	25.2
	1909.8	28.8	28.8	25.4
2-slots DTM 1900MHz	1850.2	28.4	28.4	28.4
	1880.0	28.3	28.3	28.4
	1909.8	28.5	28.5	28.5
3-slots EDGE 1900MHz	1850.2	26.2	26.2	24.3
	1880.0	26.1	26.0	24.3
	1909.8	26.2	26.2	24.4
3-slots DTM 1900MHz	1850.2	25.8	25.8	25.9
	1880.0	25.8	25.7	25.7
	1909.8	25.9	25.9	26.0
4-slots EDGE 1900MHz	1850.2	25.6	25.6	23.3
	1880.0	25.6	25.7	23.3
	1909.8	25.7	25.7	23.4

Mode	Freq. (MHz)	Max burst averaged conducted power (dBm)
1-slot GSM (CS) 850 MHz	824.2	33.0
	836.8	32.3
	848.8	32.3
1-slot GSM (CS) 1900 MHz	1850.2	29.6
	1880.0	29.5
	1909.8	29.7

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

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

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

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

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

1.8.6 SAR Measurement Procedures for 3G Devices

WCDMA Handsets

Output Power Verification

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

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

Head SAR Measurements

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

Body SAR Measurements

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

Handsets with HSPA

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

	Band	**FDD V (850)**		
	Channel	4132	4182	4233
	Freq (MHz)	826.4	836.4	846.6
Mode	**Subtest**	**Max burst averaged conducted power (dBm)**		
Rel99	12.2 kbps RMC	24.22	24.02	23.90
Rel99	12.2 kbps, Voice, AMR, SRB 3.4 kbps	24.35	24.10	24.08
HSUPA	1	22.88	22.57	22.56
HSUPA	2	22.48	22.33	22.45
HSUPA	3	23.28	23.15	23.06
HSUPA	4	23.26	23.03	23.05
HSUPA	5	22.38	22.22	22.22
HSDPA+	1	23.20	22.70	22.80
HSDPA+	2	22.65	22.39	22.60
HSDPA+	3	22.86	22.60	22.58
HSDPA+	4	21.84	21.05	21.45
	Band	**FDD II (1900)**		
	Channel	9262	9400	9538
	Freq (MHz)	1852.4	1880.0	1907.6
Mode	**Subtest**	**Max burst averaged conducted power (dBm)**		
Rel99	12.2 kbps RMC	23.55	23.54	23.67
Rel99	12.2 kbps, Voice, AMR, SRB 3.4 kbps	23.69	23.53	23.51
HSUPA	1	22.16	22.12	22.25
HSUPA	2	22.08	21.80	21.92
HSUPA	3	22.78	22.45	22.69
HSUPA	4	22.60	22.35	22.55
HSUPA	5	21.90	21.68	21.78
HSDPA+	1	22.79	22.60	2.70
HSDPA+	2	22.14	22.02	22.13
HSDPA+	3	22.31	22.11	22.14
HSDPA+	4	21.72	20.85	21.12

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

1.8.7 FCC SAR Measurement Procedures for 3G Devices CDMA 2000

The followings are the **FCC SAR Measurement Procedures for 3G Devices issued in Oct. 2006**, applicable to handsets operating under CDMA 2000, Release 0, with MS Protocol Revision 6 (**P_REV 6**). The default test configuration is to measure SAR in RC3 with an established radio link between the DUT and a communication test set. SAR in RC1 is selectively confirmed according to output power and exposure conditions.

Output Power Verification

Maximum output power is verified on the High, Middle and Low channels according to procedures in section 4.4.5.2 of 3GPP2 C.S0011/TIA-98-E. Results for at least steps 3, 4 and 10 of the power measurement procedures should be tabulated in the SAR report as shown on Table 1.8.3-3 Steps 3 and 4 should be measured using SO55 with power control bits in "All Up" condition. TDSO / SO32 may be used instead of SO55 for step 4. Step 10 should be measured using TDSO / SO32 with power control bits in the "Bits Hold" condition (i.e. alternative Up/Down Bits).

3GPP2 C.S0011/ TIA-98-E, section 4.4.5.2 Method of Measurement

1. If the mobile station supports Reverse Traffic Channel Radio Configuration 1 and 7 Forward Traffic Channel Radio Configuration 1, set up a call using Fundamental 8 Channel Test Mode 1 with 9600 bps data rate only and perform steps 6 through 8.
2. If the mobile station supports the Radio Configuration 3 Reverse Fundamental 11 Channel and demodulation of Radio Configuration 3, 4, or 5, set up a call using 12 Fundamental Channel Test Mode 3 with 9600 bps data rate only and 13 perform steps 6 through 8.
3. Set the test parameters as specified in **Table 1.8.7-1**
4. Send continuously '0' power control bits to the mobile station.
5. Measure the mobile station output power at the mobile station antenna connector.
6. If the mobile station supports the Radio Configuration 3 Reverse Fundamental Channel, Radio Configuration 3 Reverse Supplemental Channel 0 and demodulation of Radio Configuration 3, 4, or 5, set up a call using Supplemental Channel Test Mode 3 with 9600 bps Fundamental Channel and 9600 bps Supplemental Channel 0 data rate, and perform the following:
a) Set the test parameters as specified in **Table 1.8.7-2**
b) Send alternating '0' and '1' power control bits to the mobile station using the smallest supported closed loop power control step size supported by the mobile station.
c) Determine the active channel configuration. If the desired channel configuration is not active, increase by 1 dB and repeat the verification. Repeat this step until the desired channel configuration becomes active.
d) Measure the mobile station output power at the mobile station antenna connector and record reading.

Parameter	Units	Value
$\hat{I}_{or}$	dBm/1.23 MHz	-104
$\frac{\text{Pilot } E_c}{I_{or}}$	dB	-7
$\frac{\text{Traffic } E_c}{I_{or}}$	dB	-7.4

Table 1.8.7-1

Parameter	Units	Value
$\hat{I}_{or}$	dBm/1.23 MHz	-86
$\frac{\text{Pilot } E_c}{I_{or}}$	dB	-7
$\frac{\text{Traffic } E_c}{I_{or}}$	dB	-7.4

Table 1.8.7-2

Test Parameters for Maximum RF Output Power for Spreading Rate 1

Head SAR Measurements

SAR for head exposure configurations is measured in RC3 with the DUT configured to transmit at full rate using Loopback Service Option SO55. SAR for RC1 is not required when the maximum average output of each channel is less than ¼ dB higher than that measured in RC3. Otherwise, SAR is measured on the maximum output channel in RC1 using the exposure configuration that results in the highest SAR for that channel in RC3.

Body SAR Measurements

SAR for body exposure configurations is measured in RC3 with the DUT configured to transmit at full rate on FCH with all other code channels disabled using TDSO / SO32. SAR for multiple code channels (FCH + SCH_n) is not required when the maximum average output of each RF channel is less than ¼ dB higher than that measured with FCH only. Otherwise, SAR is measured on the maximum output channel (FCH + SCH_n) with FCH at full rate and SCH_0 enabled at 9600 bps using the exposure configuration that results in the highest SAR for that channel with FCH only. When multiple code channels are enabled, the DUT output may shift by more than 0.5 dB and lead to higher SAR drifts and SCH dropouts.

Body SAR in RC1 is not required when the maximum average output of each channel is less than ¼ dB higher than that measured in RC3. Otherwise, SAR is measured on the maximum output channel in RC1; with Loopback Service Option SO55, at full rate, using the body exposure configuration that results in the highest SAR for that channel in RC3.

1x Ev-DO

For handsets with Ev-Do capabilities, when the maximum average output of each channel in Rev. 0 is less than ¼ dB higher than that measured in RC3 (1x RTT), body SAR for Ev-Do is not required. Otherwise, SAR for Rev. 0 is measured on the maximum output channel at 153.6 kbps using the body exposure configuration that results in the highest SAR for that channel in RC3. SAR for Rev. A is not required when the maximum average output of each channel is less than that measured in Rev. 0 or less than ¼ dB higher than that measured in RC3. Otherwise, SAR is measured on the maximum output channel for Rev. A using a Reverse Data Channel payload size of 4096 bits and a Termination Target of 16 slots defined for Subtype 2 Physical Layer configurations. A Forward Traffic Channel data rate corresponding to the 2-slot version of 307.2 kbps with the ACK Channel transmitting in all slots should be configured in the downlink for both Rev. 0 and Rev. A.

Band	**Channel**	**1x EvDO (153.6kbps) Rev 0 (dBm)**	**1x EvDO (153.6kbps) Rev A (dBm)**	**CDMA2000 RC**	**SO2 Loopback (dBm)**	**SO55 Loopback (dBm)**	**TDSO SO32 Test Data Service (dBm)**
CDMA 850 BC0	1013	24.0	24.0	**RC1**	24.0	24.0	N/A
				RC3	24.0	24.0	24.0
	384	23.9	23.9	**RC1**	23.9	23.9	N/A
				RC3	23.9	23.9	23.8
	777	23.9	23.9	**RC1**	23.9	23.9	N/A
				RC3	24.0	23.9	23.8
Band	**Channel**	**1x EvDO (153.6kbps) Rev 0 (dBm)**	**1x EvDO (153.6kbps) Rev A (dBm)**	**CDMA2000 RC**	**SO2 Loopback (dBm)**	**SO55 Loopback (dBm)**	**TDSO SO32 Test Data Service (dBm)**
CDMA 1900 BC1	25	23.7	23.6	**RC1**	23.7	23.6	N/A
				RC3	23.6	23.6	23.6
	600	23.6	23.7	**RC1**	23.7	23.7	N/A
				RC3	23.7	23.7	23.7
	1175	23.8	23.8	**RC1**	23.9	23.9	N/A
				RC3	24.0	24.0	24.0

Table 1.8.7-3 Conducted RF output power (dBm) measured for various settings

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.
•LTE Head SAR was evaluated in SVLTE mode at lowered LTE power.

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

Band	**LTE Band 25 (Full Power)**					
Frequency (MHz)	**Channel**	**BW**	**Modulation**	**RB Size**	**RB Offset**	**Maximum Avg. Power (dBm)**
1860.0	26140	20 MHz	QPSK	1	0	22.82
			QPSK	1	50	22.66
			QPSK	1	99	22.60
			QPSK	50	0	21.87
			QPSK	50	50	21.75
			QPSK	100	0	21.75
			16QAM	1	0	21.62
			16QAM	1	50	21.52
			16QAM	1	99	21.49
			16QAM	75	0	20.83
			16QAM	75	25	20.82
			16QAM	100	0	20.87
1882.5	26365	20 MHz	QPSK	1	0	22.32
			QPSK	1	50	22.86
			QPSK	1	99	22.51
			QPSK	50	0	21.74
			QPSK	50	50	21.52
			QPSK	100	0	21.67
			16QAM	1	0	21.04
			16QAM	1	50	21.60
			16QAM	1	99	21.24
			16QAM	75	0	20.81
			16QAM	75	25	20.90
			16QAM	100	0	20.76
1905.0	26590	20 MHz	QPSK	1	0	22.52
			QPSK	1	50	22.70
			QPSK	1	99	22.93
			QPSK	50	0	21.77
			QPSK	50	50	21.94
			QPSK	100	0	21.86
			16QAM	1	0	21.37
			16QAM	1	50	21.56
			16QAM	1	99	21.72
			16QAM	75	0	20.78
			16QAM	75	25	20.89
			16QAM	100	0	20.84
1882.5	26365	15 MHz	QPSK	1	0	22.31
			QPSK	1	38	22.66
			QPSK	1	74	22.46
			QPSK	36	0	21.65
			QPSK	36	39	21.54

			QPSK	75	0	21.72
			16QAM	1	0	21.30
			16QAM	1	38	21.64
			16QAM	1	74	21.43
			16QAM	16	0	21.54
			16QAM	16	59	21.62
			16QAM	75	0	20.71
1882.5	26365	10 MHz	QPSK	1	0	22.54
			QPSK	1	25	22.82
			QPSK	1	49	22.55
			QPSK	25	0	21.92
			QPSK	25	25	21.69
			QPSK	50	0	21.77
			16QAM	1	0	21.37
			16QAM	1	25	21.69
			16QAM	1	49	21.40
			16QAM	16	0	20.89
			16QAM	50	0	20.79
1882.5	26365	5 MHz	QPSK	1	0	22.87
			QPSK	1	13	22.86
			QPSK	1	24	22.69
			QPSK	15	0	21.84
			QPSK	15	10	21.83
			QPSK	25	0	21.80
			16QAM	1	0	22.07
			16QAM	1	13	22.17
			16QAM	1	24	21.99
			16QAM	8	0	21.77
			16QAM	8	17	21.68
			16QAM	25	0	20.84
1882.5	26365	3 MHz	QPSK	1	0	22.78
			QPSK	1	8	22.82
			QPSK	1	14	22.65
			QPSK	6	0	21.80
			QPSK	6	9	21.78
			QPSK	15	0	21.81
			16QAM	1	0	21.62
			16QAM	1	8	21.66
			16QAM	1	14	21.47
			16QAM	6	0	20.72
			16QAM	6	9	20.74
			16QAM	15	0	20.82
1882.5	26365	1.4 MHz	QPSK	1	0	22.72
			QPSK	1	3	22.74
			QPSK	1	5	22.73
			QPSK	3	0	22.69
			QPSK	3	3	22.72
			QPSK	6	0	21.87
			16QAM	1	0	21.70
			16QAM	1	3	21.61
			16QAM	1	5	21.58
			16QAM	5	0	21.77
			16QAM	5	1	21.82
			16QAM	6	0	20.74

Table 1.8.8-1 LTE band 25 conducted power measurements full power with Hotspot mode disabled

Band	LTE Band 25 (Full Power)					
Frequency (MHz)	**Channel**	**BW**	**Modulation**	**RB Size**	**RB Offset**	**Maximum Avg. Power (dBm)**
1860.0	26140	20 MHz	QPSK	1	0	18.47
			QPSK	1	50	18.03
			QPSK	1	99	18.44
			QPSK	50	0	18.33
			QPSK	50	50	18.07
			QPSK	100	0	18.07
1882.5	26365	20 MHz	QPSK	1	0	18.38
			QPSK	1	50	18.73
			QPSK	1	99	18.10
			QPSK	50	0	18.59
			QPSK	50	50	18.13
			QPSK	100	0	18.12
1905.0	26590	20 MHz	QPSK	1	0	18.53
			QPSK	1	50	18.19
			QPSK	1	99	18.70
			QPSK	50	0	18.48
			QPSK	50	50	18.67
			QPSK	100	0	18.52

Table 1.8.8-2 LTE band 25 conducted power measurements lower power with Hotspot mode enabled

Band	LTE Band 25 (SVLTE Power)					
Frequency (MHz)	**Channel**	**BW**	**Modulation**	**RB Size**	**RB Offset**	**Maximum Avg. Power (dBm)**
1860.0	26140	20 MHz	QPSK	1	0	17.98
			QPSK	1	50	18.03
			QPSK	1	99	17.60
			QPSK	50	0	18.11
			QPSK	50	50	17.89
			QPSK	100	0	17.96
			16QAM	1	0	17.65
			16QAM	1	50	17.72
			16QAM	1	99	17.30
			16QAM	75	0	18.03
			16QAM	75	25	17.89
			16QAM	100	0	17.90
1882.5	26365	20 MHz	QPSK	1	0	17.82
			QPSK	1	50	18.16
			QPSK	1	99	18.12
			QPSK	50	0	18.05
			QPSK	50	50	18.07
			QPSK	100	0	18.05
			16QAM	1	0	17.65
			16QAM	1	50	17.91
			16QAM	1	99	17.88
			16QAM	75	0	17.95
			16QAM	75	25	18.00
			16QAM	100	0	18.00

1905.0	26590	20 MHz	QPSK	1	0	17.96
			QPSK	1	50	18.08
			QPSK	1	99	18.17
			QPSK	50	0	17.95
			QPSK	50	50	18.38
			QPSK	100	0	18.23
			16QAM	1	0	17.93
			16QAM	1	50	18.02
			16QAM	1	99	18.21
			16QAM	75	0	17.90
			16QAM	75	25	18.11
			16QAM	100	0	18.14
1882.5	26365	15 MHz	QPSK	1	0	17.95
			QPSK	1	38	18.15
			QPSK	1	74	18.12
			QPSK	36	0	18.04
			QPSK	36	39	18.17
			QPSK	75	0	18.18
			16QAM	1	0	18.08
			16QAM	1	38	18.35
			16QAM	1	74	18.11
			16QAM	16	0	17.97
			16QAM	16	59	18.15
			16QAM	75	0	18.06
1882.5	26365	10 MHz	QPSK	1	0	17.99
			QPSK	1	25	18.19
			QPSK	1	49	18.20
			QPSK	25	0	18.04
			QPSK	25	25	18.17
			QPSK	50	0	18.21
			16QAM	1	0	17.81
			16QAM	1	25	18.00
			16QAM	1	49	17.91
			16QAM	16	0	18.01
			16QAM	50	0	18.14
1882.5	26365	5 MHz	QPSK	1	0	18.17
			QPSK	1	13	18.22
			QPSK	1	24	18.26
			QPSK	15	0	18.11
			QPSK	15	10	18.18
			QPSK	25	0	18.25
			16QAM	1	0	18.35
			16QAM	1	13	18.41
			16QAM	1	24	18.45
			16QAM	8	0	17.95
			16QAM	8	17	18.10
			16QAM	25	0	18.05
1882.5	26365	3 MHz	QPSK	1	0	18.14
			QPSK	1	8	18.28
			QPSK	1	14	18.32
			QPSK	6	0	18.08
			QPSK	6	9	18.20
			QPSK	15	0	18.20
			16QAM	1	0	17.86
			16QAM	1	8	18.01
			16QAM	1	14	17.96
			16QAM	6	0	17.89
			16QAM	6	9	18.05
			16QAM	15	0	18.02

1882.5	26365	1.4 MHz	QPSK	1	0	18.00
			QPSK	1	3	18.07
			QPSK	1	5	18.13
			QPSK	3	0	18.08
			QPSK	3	3	18.13
			QPSK	6	0	18.11
			16QAM	1	0	17.91
			16QAM	1	3	17.95
			16QAM	1	5	18.07
			16QAM	5	0	18.12
			16QAM	5	1	18.14
			16QAM	6	0	18.14

Table 1.8.8-3 LTE band 25 conducted power measurements SVLTE lower power and Hotspot mode

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

Standalone SAR test exclusion guidance:

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

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

Where:

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

.

Simultaneous Transmission SAR Test exclusion considerations:

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

The ratio is determined by:

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

Where:

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

Simultaneous Transmission SAR required:

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

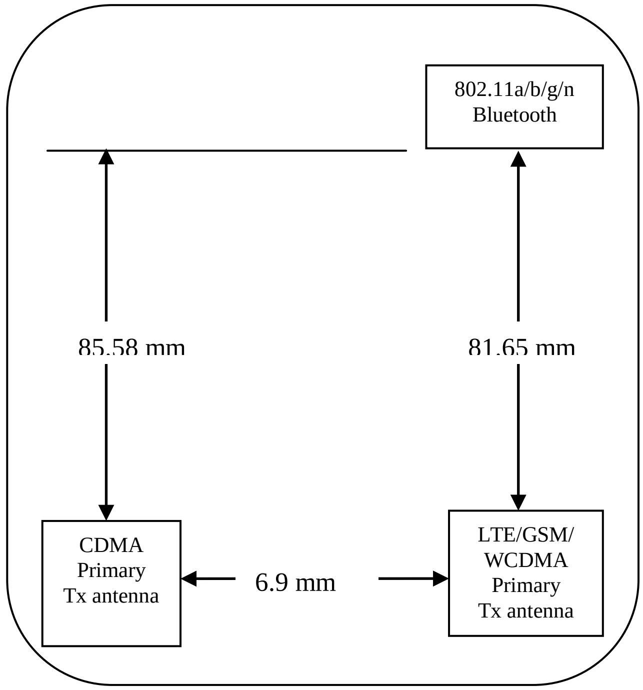

Figure 1.9-1 Back view of device showing closest distance between antenna pairs

1.9.1 Simultaneous Transmission Analysis

Simultaneous Transmission Combination	Head	Body-Worn Accessory	Hotspot
CDMA2000 voice + LTE + WiFi 2.4 GHz/WiFi 5.0 GHz/BT	Yes	Yes	No
WCDMA/GSM/CDMA2000 voice + WiFi 2.4 GHz/WiFi 5.0 GHz/BT	Yes	Yes	No
CDMA2000 data+ LTE + WiFi 2.4 GHz/WiFi 5.0 GHz	Yes	Yes	Yes
CDMA2000 data+ LTE + BT	Yes	Yes	No
LTE/HSPA/EDGE/GPRS/CDMA2000 data + WiFi 2.4 GHz/WiFi 5.0 GHz	Yes	Yes	Yes
LTE/HSPA/EDGE/GPRS/CDMA2000 data + BT	Yes	Yes	No

Table 1.9.1-1 Simultaneous Transmission Scenarios

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

Test	Configuration	Licensed Transmitters		WiFi 2.4G/5.0G 1 g avg. SAR (W/kg)	SVLTE LTE 25 1 g avg. SAR (W/kg)	Maximum Summation 1 g avg. SAR (W/kg)
		Band	**1 g avg. SAR (W/kg)**			
Head SAR	Right Cheek	GSM/DTM/EDGE 850	1.01	0.13	NA	1.14
		UMTS Band V	0.93			1.06
		GSM/DTM/EDGE 1900	0.36			0.49
		UMTS Band II	0.62			0.75
		LTE 25 Full Power	0.45			0.58
		CDMA 850	0.39		0.16	0.68
		CDMA 1900	0.63			0.76
	Right Tilt	GSM/DTM/EDGE 850	0.47	0.16	NA	0.63
		UMTS Band V	0.39			0.55
		GSM/DTM/EDGE 1900	0.26			0.42
		UMTS Band II	0.47			0.63
		LTE 25 Full Power	0.30			0.46
		CDMA 850	0.24		0.10	0.50
		CDMA 1900	0.25			0.51
	Left Cheek	GSM/DTM/EDGE 850	0.64	0.08	NA	0.72
		UMTS Band V	0.55			0.63
		GSM/DTM/EDGE 1900	0.45			0.53
		UMTS Band II	0.69			0.77
		LTE 25 Full Power	0.56			0.64
		CDMA 850	0.66		0.22	0.96
		CDMA 1900	1.00			1.30
	Left Tilt	GSM/DTM/EDGE 850	0.41	0.08	NA	0.49
		UMTS Band V	0.36			0.44
		GSM/DTM/EDGE 1900	0.23			0.31
		UMTS Band II	0.34			0.42
		LTE 25 Full Power	0.29			0.37
		CDMA 850	0.24		0.10	0.42
		CDMA 1900	0.23			0.41

Table 1.9.1-2 Highest Head SAR values and summation

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

Test	**Configuration**	**Licensed Transmitters**		**WiFi 2.4G/5.0G 1 g avg. SAR (W/kg)**	**SVLTE LTE 25 1 g avg. SAR (W/kg)**	**Maximum Summation 1 g avg. SAR (W/kg)**
		Band	**1 g avg. SAR (W/kg)**			
Body Worn SAR	15 mm separation, device back	GSM/DTM/EDGE 850	0.68	0.34	NA	1.02
		UMTS Band V	0.62			0.96
		GSM/DTM/EDGE 1900	0.36			0.70
		UMTS Band II	0.55			0.89
		LTE 25 Full Power	0.45			0.79
		CDMA 850	0.46		0.14	0.94
		CDMA 1900	0.42			0.90
	Holster device back	GSM/DTM/EDGE 850	0.38	0.09	NA	0.47
		UMTS Band V	0.40			0.49
		GSM/DTM/EDGE 1900	0.20			0.29
		UMTS Band II	0.33			0.42
		LTE 25 Full Power	0.26			0.35
		CDMA 850	0.35		0.09	0.53
		CDMA 1900	0.28			0.46
	Holster device front	GSM/DTM/EDGE 850	0.38	0.02	NA	0.40
		UMTS Band V	0.39			0.41
		GSM/DTM/EDGE 1900	0.15			0.17
		UMTS Band II	0.24			0.26
		LTE 25 Full Power	0.21			0.23
		CDMA 850	0.28		0.07	0.37
		CDMA 1900	0.21			0.30

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

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

Test	**Configuration**	**Licensed Transmitters**		**WiFi 2.4G 1 g avg. SAR (W/kg)**	**SVLTE LTE 25 1 g avg. SAR (W/kg)**	**Maximum Summation 1 g avg. SAR (W/kg)**
		Band	**1 g avg. SAR (W/kg)**			
Hotspot SAR	10 mm separation, device back	GSM/DTM/EDGE 850	1.16	0.47	NA	1.63
		UMTS Band V	0.87			1.34
		GSM/DTM/EDGE 1900	0.61			1.08
		UMTS Band II	0.98			1.45
		LTE 25 Full Power	0.89			1.36
		CDMA 850	1.03		0.31	1.81
		CDMA 1900	1.08			1.86

	10 mm separation, device front	GSM/DTM/EDGE 850	0.89	0.04	NA	0.93
		UMTS Band V	0.69			0.73
		GSM/DTM/EDGE 1900	0.36			0.40
		UMTS Band II	0.67			0.71
		LTE 25 Full Power	0.60			0.64
		CDMA 850	0.44		0.21	0.69
		CDMA 1900	0.48			0.73
	10 mm separation, device left	GSM/DTM/EDGE 850	0.23	0.11	NA	0.34
		UMTS Band V	0.30			0.41
		GSM/DTM/EDGE 1900	0.11			0.22
		UMTS Band II	0.15			0.26
		LTE 25 Full Power	0.12			0.23
		CDMA 850	0.43		0.04	0.58
		CDMA 1900	0.26			0.41
	10 mm separation, device right	GSM/DTM/EDGE 850	0.88	0.04	NA	0.92
		UMTS Band V	0.78			0.82
		GSM/DTM/EDGE 1900	0.21			0.25
		UMTS Band II	0.33			0.37
		LTE 25 Full Power	0.26			0.30
		CDMA 850	0.15		0.08	0.27
		CDMA 1900	0.09			0.21
	10 mm separation, device bottom	GSM/DTM/EDGE 850	0.39	0.02	NA	0.41
		UMTS Band V	0.36			0.38
		GSM/DTM/EDGE 1900	0.68			0.70
		UMTS Band II	1.05			1.07
		LTE 25 Full Power	0.96			0.98
		CDMA 850	0.19		0.30	0.51
		CDMA 1900	0.44			0.76
	10 mm separation, device top	GSM/DTM/EDGE 850	0.00	0.00	NA	0.00
		UMTS Band V	0.00			0.00
		GSM/DTM/EDGE 1900	0.00			0.00
		UMTS Band II	0.00			0.00
		LTE 25 Full Power	0.00			0.00
		CDMA 850	0.00		0.00	0.00
		CDMA 1900	0.00			0.00

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

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

Test	Configuration	Licensed Transmitters		SAR peak location (cm)			Closest Distance (cm)	Pair Sum (W/kg)	Ratio
		Band	1 g avg. SAR (w/kg)	X	Y	Z			
Hotspot SAR	10 mm separation, device back	WiFi 2.4G	0.47	-36.6	-42.4	-208.0	79.8	1.81	0.03
		CDMA 850+SVLTE	1.34	-24.5	36.5	-208.5			
		WiFi 2.4G	0.47	-36.6	-42.4	-208.0	79.0	1.86	0.03
		CDMA 1900+SVLTE	1.39	-41.0	36.5	-208.1			
		WiFi 2.4G	0.47	-36.6	-42.4	-208.0	95.0	1.63	0.02
		GPRS 850 3-slots	1.16	-0.50	45.5	-208.0			

Table 1.9.1-5 Highest Hotspot SAR values and ratio of SAR to peak location

Note 3: Since the sum of 1 g SAR > 1.6 W/kg for the above pairs, the ratio of SAR to peak separation distance for each pair of transmitters is calculated.
Note 4: If the ratio of SAR to peak separation distance is < 0.04, Simultaneous SAR measurement is not required.

1.10 SVLTE Power Reduction Considerations

This device supports Simultaneous Voice and LTE (SVLTE) calls, i.e. voice call is supported by a CDMA 1xRTT transmitter and the data connection supported by a LTE transmitter. Transmitters have separate antenna, match, PA and RF filtering. Dynamic Power Reduction scheme has been implemented on LTE during a SVLTE call with the 1xRTT voice. The dynamic scheme is applied only to the PCS band, but affects from low to high transmitting frequency. Power reduction is applicable to LTE mode only and not on CDMA modes during SVLTE calls. LTE power reduction is triggered when CDMA power is >/= 18.5 dBm.

LTE and EvDO cannot transmit simultaneously in cell and PCS bands.

1.10.1 SVLTE Power Reduction, Test Setup Configuration and Conducted Power Measurements

The LTE power reduction was verified by simultaneously connecting the device to both LTE and CDMA base station simulators. LTE power levels were measured through conducted RF connections by first connecting the device to CWM500 LTE data and CDMA 1xRTT to CMU200 base station simulator.

First, CDMA 1xRTT was set to transmit at maximum transmitting power by setting the following parameters on the CMU200; CDMA and LTE power levels were measured and recorded:

- Power Control Bit was set to: All Bits UP
- BS Signal Level-> CDMA Power was set to: -99 dBm
- Analyzer level was set: 24.0 dBm
- RF Mode was set to: Auto

Then, CDMA 1xRTT power level was lowered by step of 1 dB; CDMA and LTE power levels were measured and recorded by setting the following parameters on the CMU200:

- Power Control Bit was set to: Auto
- BS Signal Level-> CDMA Power was set to: -99 dBm
- Analyzer level was lowered from 24.0 dBm to 17.0 dBm by step of 1 dB.
- RF Mode was set to: Manual

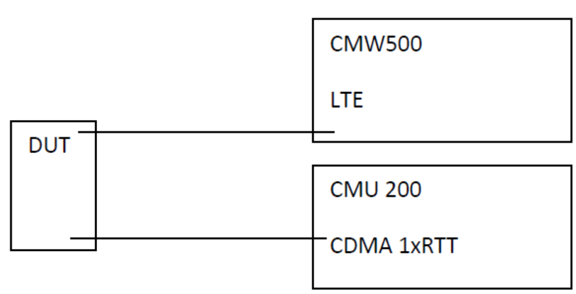

Figure 1.10.1-1 SVLTE Conducted Power Test Setup Diagram

Band	SVLTE_LTE Band 25/CDMA 850 BC0						
Frequency (MHz)	Channel	BW	Modulation	RB Size	RB Offset	LTE	CDMA 850
1905	265590	20 MHz	QPSK	1	99	22.62	23.90
			QPSK	1	99	22.55	22.70
			QPSK	1	99	22.51	22.23
			QPSK	1	99	22.50	21.50
			QPSK	1	99	22.49	20.51
			QPSK	1	99	22.60	18.63
			QPSK	1	99	22.51	17.74
			QPSK	1	99	22.49	16.56

Table 1.10.1-1 SVLTE Conducted Power Data for LTE/CDMA 850
Done on Low Channel (Ch. 1013)

Note 1: CMU200 Analyzer level→RF Max Level varied from 16.6dBm to 23.9dBm
Note 2: RF mode was set to Manual, Power control bit was set to Auto
Note 3: BS Signal Level →CDMA Power set to -99dBm

Band	SVLTE_LTE Band 25/CDMA 1900 BC1						
Frequency (MHz)	Channel	BW	Modulation	RB Size	RB Offset	LTE	CDMA 1900
1905	265590	20 MHz	QPSK	1	99	17.75	23.90
			QPSK	1	99	18.11	23.24
			QPSK	1	99	18.43	22.24
			QPSK	1	99	19.50	21.48
			QPSK	1	99	20.75	20.37
			QPSK	1	99	21.84	19.47
			QPSK	1	99	22.32	18.27
			QPSK	1	99	22.60	17.29

Table 1.10.1-2 SVLTE Conducted Power Data for LTE/CDMA 1900
Done on High channel (Ch. 1175)

Note 1: CMU200 Analyzer level→RF Max Level varied from 17.3dBm to 23.9dBm
Note 2: RF mode was set to Manual, Power control bit was set to Auto
Note 3: BS Signal Level →CDMA Power set to -99dBm

2.0 DESCRIPTION OF THE TEST EQUIPMENT

2.1 SAR measurement system

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

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

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

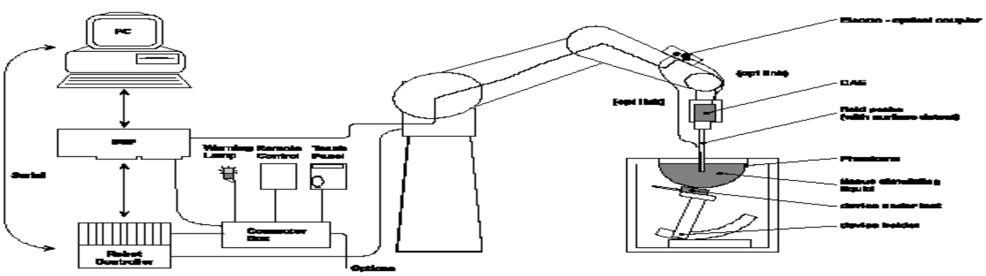

Figure 2.1-1 System Description

2.1.1 Equipment List

Manufacturer	Test Equipment	Model Number	Serial Number	Cal. Due Date (MM/DD/YY)
SCHMID & Partner Engineering AG	E-field probe	ES3DV3	3225	01/10/2014
SCHMID & Partner Engineering AG	Data Acquisition Electronics (DAE3)	DAE4 V1	881	01/14/2014
SCHMID & Partner Engineering AG	Dipole Validation Kit	D835V2	446	01/07/2015
SCHMID & Partner Engineering AG	Dipole Validation Kit	D1900V2	545	01/09/2015
SCHMID & Partner Engineering AG	Dipole Validation Kit	D1900V2	5d075	04/05/2013*
SCHMID & Partner Engineering AG	Dipole Validation Kit	D2450V2	747	11/09/2013
Agilent Technologies	Signal generator	8648C	4037U03155	09/23/2013
Agilent Technologies	Power meter	E4419B	GB40202821	09/23/2013
Agilent Technologies	Power sensor	8481A	MY41095417	09/26/2013
Amplifier Research	Amplifier	5S1G4M3	300986	CNR
Agilent Technologies	Power meter	N1911A	MY45100905	05/17/2013
Agilent Technologies	Power sensor	N1921A	SG45240281	06/12/2013
Agilent Technologies	Power sensor	N1921A	MY45241383	09/11/2013
Weinschel Corp	20dB Attenuator	33-20-34	BMO697	CNR
Agilent Technologies	Network analyzer	8753ES	US39174857	09/20/2013
Rohde & Schwarz	Base Station Simulator	CMU 200	109747	11/19/2013
CPI Wireless Solutions	Amplifier	VZC-6961K4	SK4310E5	CNR
Rohde & Schwarz	Signal generator	SMA 100A	102106	12/02/2013
Rohde & Schwarz	Bluetooth Tester	CBT	100368	12/04/2013
Rohde & Schwarz	Bluetooth Tester	CBT	100678	12/04/2013
Rohde & Schwarz	Wideband Base Station Simulator	CMW 500	109949	12/10/2014
Rohde & Schwarz	Wideband Base Station Simulator	CMW 500	101169	12/10/2014

Table 2.1.1-1 Equipment list

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

2.2 Description of the test setup

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

2.2.1 Device and base station simulator setup

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

2.2.2 DASY setup

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

3.0 ELECTRIC FIELD PROBE CALIBRATION

3.1 Probe Specifications

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

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

Table 3.1-1 Probe specifications

3.2 Probe calibration and measurement uncertainty

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

Calibration Parameter Determined in Head Tissue Simulating Media

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

Calibration Parameter Determined in Body Tissue Simulating Media

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

Table 3.2-1 Probe ES3DV3 SN: 3225

Calibration Parameter Determined in Head Tissue Simulating Media

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

Calibration Parameter Determined in Body Tissue Simulating Media

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

Table 3.2-2 Probe ET3DV6 SN: 1644

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz] C	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth	Unc (k=2)
5200	± 50 / ± 100	36.0 ± 5%	4.66 ± 5%	4.50	4.50	4.50	0.45	1.90	± 13.1%
5500	± 50 / ± 100	35.6 ± 5%	4 96 ± 5%	4.25	4.25	4.25	0.50	1.90	± 13.1%
5800	± 50 / ± 100	35.3 ± 5%	5.27 ± 5%	3.98	3.98	3.98	0.52	1.90	± 13.1%

Calibration Parameter Determined in Body Tissue Simulating Media

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

Table 3.2-3 Probe EX3DV4 SN: 3592

Calibration Parameter Determined in Head Tissue Simulating Media

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

Calibration Parameter Determined in Body Tissue Simulating Media

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

Table 3.2-4 Probe EX3DV4 SN: 3548

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

4.0 SAR MEASUREMENT SYSTEM VERIFICATION

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

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

4.1 System accuracy verification for head adjacent use

f (MHz)	Limits / Measured (MM/DD/YYYY)	Scan Type	SAR 1 g/10 g (W/kg)	Dielectric Parameters		Liquid Temp. (°C)
				ε_r	σ [S/m]	
835	Measured (04/15/2013)	Area Scan/Fast SAR	8.80/5.86	41.5	0.89	21.4
	Measured (04/15/2013)	Zoom Scan	8.84/5.78	41.5	0.89	21.4
	Measured (04/18/2013)	Area Scan/Fast SAR	8.68/5.76	41.0	0.90	21.3
	Measured (04/18/2013)	Zoom Scan	8.52/5.58	41.0	0.90	21.3
	Recommended Limits (Dipole: 446)		9.36/6.13	41.5	0.90	N/A
1900	Measured (04/02/2013)	Area Scan/Fast SAR	38.2/20.4	38.4	1.46	22.4
	Measured (04/02/2013)	Zoom Scan	37.3/19.4	38.4	1.46	22.4
	Measured (04/08/2013)	Area Scan/Fast SAR	37.3/19.9	38.3	1.38	21.9
	Measured (04/08/2013)	Zoom Scan	36.8/19.3	38.3	1.38	21.9
	Measured (04/10/2013)	Area Scan/Fast SAR	39.3/20.9	39.5	1.42	20.9
	Measured (04/10/2013)	Zoom Scan	38.3/20.0	39.5	1.42	20.9
	Measured (04/14/2013)	Area Scan/Fast SAR	37.3/19.7	38.5	1.39	22.7
	Measured (04/14/2013)	Zoom Scan	36.8/19.2	38.5	1.39	22.7
	Measured (04/25/2013)	Area Scan/Fast SAR	36.9/19.5	38.7	1.37	22.2
	Measured (04/25/2013)	Zoom Scan	36.4/19.1	38.7	1.37	22.2
	Measured (05/13/2013)	Area Scan/Fast SAR	37.3/19.7	39.2	1.38	21.8
	Measured (05/13/2013)	Zoom Scan	36.7/19.3	39.2	1.38	21.8
	Recommended Limits (Dipole: 5d075)		40.4/21.0	40.0	1.40	N/A
	Recommended Limits (Dipole: 545)		40.2/21.1	40.0	1.40	N/A
2450	Measured (04/29/2013)	Area Scan/Fast SAR	51.9/23.1	37.6	1.80	21.3
	Measured (04/29/2013)	Zoom Scan	52.0/24.5	37.6	1.80	21.3
	Recommended Limits (Dipole: 747)		54.1/25.3	39.2	1.80	N/A

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

5.0 PHANTOM DESCRIPTION

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

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

Left side head
Right side head
Flat phantom

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

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

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

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

Figure 5.0-1 SAM Twin Phantom

6.0 TISSUE DIELECTRIC PROPERTIES

6.1 Composition of tissue simulant

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

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

Table 6.1-1 Tissue simulant recipe

6.1.1 Equipment

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

Table 6.1.1-1 Tissue simulant preparation equipment

6.1.2 Preparation procedure

800-900 MHz liquids

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

1800-2450 MHz liquid

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

6.2 Electrical parameters of the tissue simulating liquid

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

Band (MHz)	Tissue Type	Limits / Measured (MM/DD/YYYY)	f (MHz)	Dielectric Parameters		Liquid Temp (°C)
				ε_r	σ [S/m]	
835	Head	Measured (04/15/2013)	815	41.7	0.87	21.4
			825	41.6	0.88	
			835	41.5	0.89	
			850	41.3	0.91	
		Measured (04/18/2013)	815	41.2	0.88	21.3
			825	41.1	0.89	
			835	41.0	0.90	
			850	40.6	0.92	
		Recommended Limits	835	41.5	0.90	N/A
	Muscle	Measured (04/15/2013)	815	53.2	0.94	21.5
			825	53.1	0.95	
			835	53.0	0.96	
		Recommended Limits	850	52.9	0.98	N/A
1900	Head	Measured (04/02/2013)	1850	38.6	1.39	22.4
			1900	38.4	1.46	
			1910	38.4	1.47	

		Measured (04/08/2013)	1850	38.5	1.33	21.9
			1900	38.3	1.38	
			1910	38.2	1.39	
		Measured (04/10/2013)	1850	39.8	1.37	20.9
			1900	39.5	1.42	
			1910	39.4	1.43	
		Measured (04/14/2013)	1850	38.7	1.34	22.6
			1900	38.5	1.39	
			1910	38.5	1.40	
		Measured (04/25/2013)	1850	38.9	1.33	22.2
			1900	38.7	1.37	
			1910	38.8	1.38	
		Measured (05/13/2013)	1850	39.3	1.33	21.8
			1900	39.2	1.38	
			1910	39.1	1.39	
		Recommended Limits	1900	40.0	1.40	N/A
	Muscle	Measured (04/02/2013)	1850	50.7	1.51	22.5
			1900	50.7	1.58	
			1910	50.7	1.59	
		Measured (04/08/2013)	1850	51.0	1.48	22.5
			1900	50.9	1.53	
			1910	50.8	1.55	
		Measured (04/10/2013)	1850	50.9	1.51	22.5
			1900	50.8	1.57	
			1910	50.7	1.58	
		Measured (04/14/2013)	1850	51.1	1.51	22.5
			1900	50.9	1.56	
			1910	50.9	1.57	
		Measured (04/25/2013)	1850	50.8	1.50	22.7
			1900	50.7	1.54	
			1910	50.7	1.55	
		Measured (05/13/2013)	1850	51.2	1.48	22.8
			1900	51.0	1.54	
			1910	51.0	1.55	
		Recommended Limits	1900	53.3	1.52	N/A
2450	Head	Measured (04/29/2013)	2410	37.64	1.76	21.3
			2450	37.56	1.80	
			2480	37.35	1.82	
		Recommended Limits	2450	39.2	1.80	N/A
	Muscle	Measured (04/29/2013)	2410	50.59	1.89	21.3
			2450	50.50	1.94	
			2480	50.29	1.97	
		Recommended Limits	2450	52.7	1.95	N/A

Table 6.2-1 Electrical parameters of tissue simulating liquid

6.2.2 Test Configuration

Dielectric
Probe
Kit

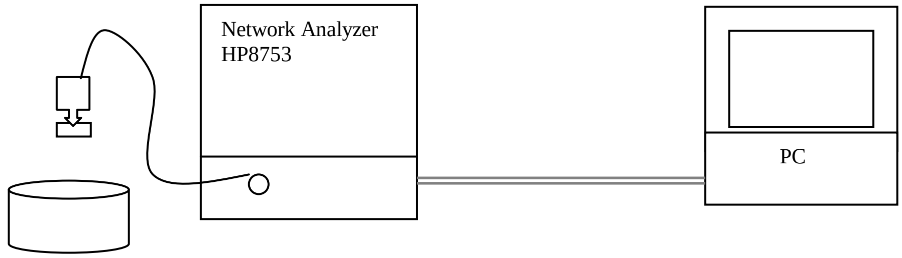

Figure 6.2.2-1 Test configuration

6.2.3 Procedure

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

7.0 SAR SAFETY LIMITS

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

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

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

Table 7.0-2 SAR safety limits

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

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

8.0 DEVICE POSITIONING

8.1 Device holder for SAM Twin Phantom

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

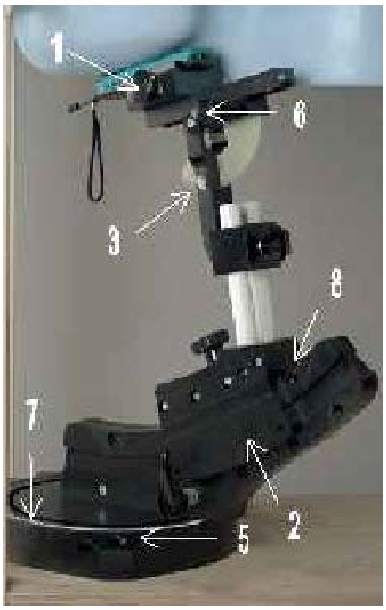

Figure 8.1-1 Device Holder

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

8.2 Description of the test positioning

8.2.1 Test Positions of Device Relative to Head

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

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

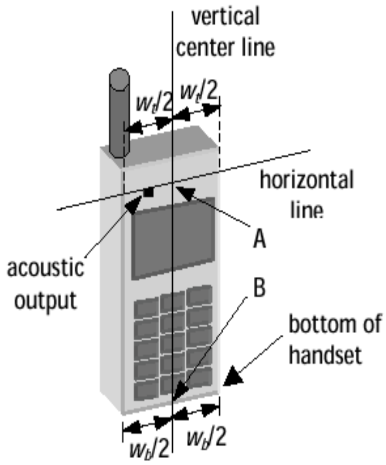

Figure 8.2.1-1 Handset vertical and horizontal reference lines – fixed case

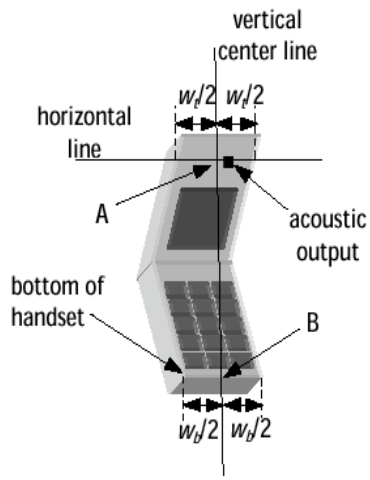

Figure 8.2.1-2 Handset vertical and horizontal reference lines – "clam-shell"

Definition of the "cheek" position

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

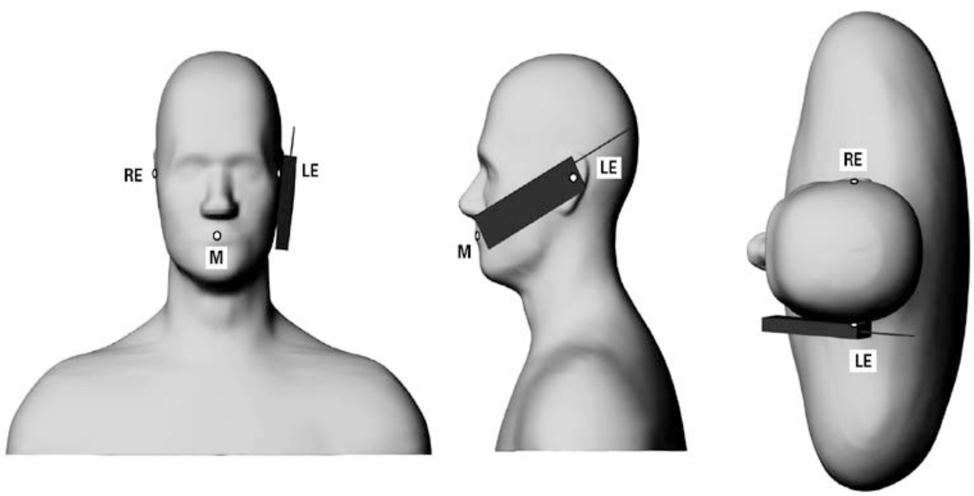

Figure 8.2.1-3 Phone position 1, "cheek" or "touch" position. The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only.

Definition of the "Tilted" Position

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

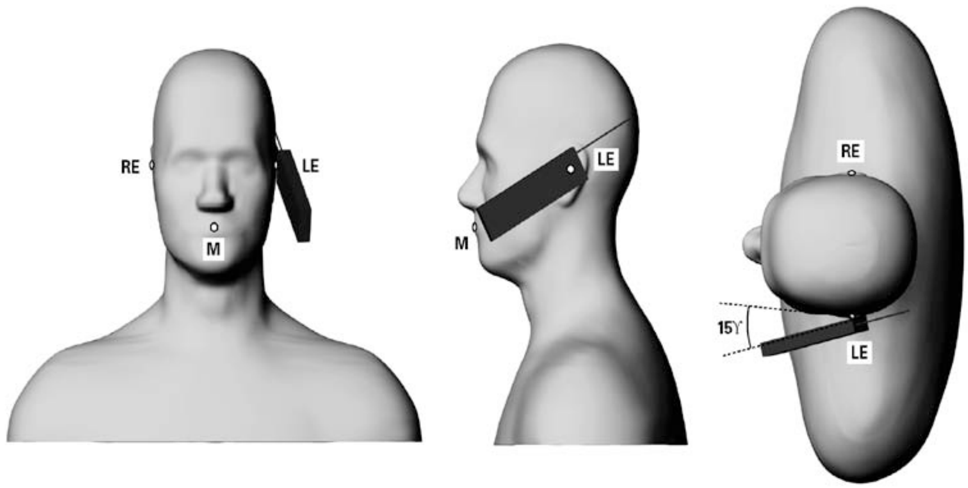

Figure 8.2.1-4 Phone position 2, "tilted position." The reference points for the right ear (RE), left ear (LE) and mouth (M), which define the reference plane for phone positioning, are indicated. The shoulders are shown for illustration purposes only.

8.2.2 Body-worn Configuration

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

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

8.2.3 Limb/Hand Configuration

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

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

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

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

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

9.0 HIGH LEVEL EVALUATION

9.1 Maximum search

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

9.2 Extrapolation

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

9.3 Boundary correction

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

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

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

10.0 MEASUREMENT UNCERTAINTY

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

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

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

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

Relative DASY5 Uncertainty Budget for Fast SAR Tests
According to IEEE 1528/2011 and IEC 62209-1/2011
(0.3 - 3 GHz range)

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

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

DASY5 Uncertainty Budget for the 3 - 6 GHz range								
Error Description	Uncert. value	Prob. Dist.	Div.	(c_i) 1g	(c_i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v_i) v_{eff}
Measurement System								
Probe Calibration	±6.55 %	N	1	1	1	±6.55 %	±6.55 %	∞
Axial Isotropy	±4.7 %	R	$\sqrt{3}$	0.7	0.7	±1.9 %	±1.9 %	∞
Hemispherical Isotropy	±9.6 %	R	$\sqrt{3}$	0.7	0.7	±3.9 %	±3.9 %	∞
Boundary Effects	±2.0 %	R	$\sqrt{3}$	1	1	±1.2 %	±1.2 %	∞
Linearity	±4.7 %	R	$\sqrt{3}$	1	1	±2.7 %	±2.7 %	∞
System Detection Limits	±1.0 %	R	$\sqrt{3}$	1	1	±0.6 %	±0.6 %	∞
Readout Electronics	±0.3 %	N	1	1	1	±0.3 %	±0.3 %	∞
Response Time	±0.8 %	R	$\sqrt{3}$	1	1	±0.5 %	±0.5 %	∞
Integration Time	±2.6 %	R	$\sqrt{3}$	1	1	±1.5 %	±1.5 %	∞
RF Ambient Noise	±3.0 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
RF Ambient Reflections	±3.0 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
Probe Positioner	±0.8 %	R	$\sqrt{3}$	1	1	±0.5 %	±0.5 %	∞
Probe Positioning	±9.9 %	R	$\sqrt{3}$	1	1	±5.7 %	±5.7 %	∞
Max. SAR Eval.	±4.0 %	R	$\sqrt{3}$	1	1	±2.3 %	±2.3 %	∞
Test Sample Related								
Device Positioning	±2.9 %	N	1	1	1	±2.9 %	±2.9 %	145
Device Holder	±3.6 %	N	1	1	1	±3.6 %	±3.6 %	5
Power Drift	±5.0 %	R	$\sqrt{3}$	1	1	±2.9 %	±2.9 %	∞
Phantom and Setup								
Phantom Uncertainty	±4.0 %	R	$\sqrt{3}$	1	1	±2.3 %	±2.3 %	∞
Liquid Conductivity (target)	±5.0 %	R	$\sqrt{3}$	0.64	0.43	±1.8 %	±1.2 %	∞
Liquid Conductivity (meas.)	±2.5 %	N	1	0.64	0.43	±1.6 %	±1.1 %	∞
Liquid Permittivity (target)	±5.0 %	R	$\sqrt{3}$	0.6	0.49	±1.7 %	±1.4 %	∞
Liquid Permittivity (meas.)	±2.5 %	N	1	0.6	0.49	±1.5 %	±1.2 %	∞
Combined Std. Uncertainty						±12.8 %	±12.6 %	330
Expanded STD Uncertainty						**±25.6 %**	**±25.2 %**	

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

11.0 TEST RESULTS

11.1 SAR Measurement results at highest power measured against the head

Test Position	Mode	f (MHz)	Channel	Modulation	# of Resource Blocks	RB Offset	Conducted Output Power (dBm)	SAR, averaged over 1 g		
								Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Right Head Cheek	LTE Band 25	1860.0	26140	QPSK	1	0				
		1882.5	26365	QPSK	1	50				
		1905.0	26590	QPSK	1	99	22.9	0.45	-0.01	0.45
		1905.0	26590	QPSK	50	50	21.9	0.41	-0.03	0.41
Right Head 15° Tilt	LTE Band 25	1905.0	26590	QPSK	1	99	22.9	0.30	0.37	0.30
Left Head Cheek	LTE Band 25	1860.0	26140	QPSK	1	0				
		1882.5	26365	QPSK	1	50				
		1905.0	26590	QPSK	1	99	22.9	0.55	0.34	0.55
		1905.0	26590	QPSK	50	50	21.9	0.48	-0.02	0.48
Left Head 15° Tilt	LTE Band 25	1905.0	26590	QPSK	1	99	22.9	0.29	0.08	0.29

Table 11.1-1a SAR results for LTE Band 25 (20MHz BW) head configuration full power

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

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

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

Note 3: 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 4: 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 5: For LTE if SAR > 1.45, then SAR tests for the smaller bandwidths are required

Note 6: Tested only the highest bandwidth since conducted power on other bandwidths is about the same.

Note 7: Did not test 16 QAM as conducted power was lower than QPSK.

Test Position	Mode	f (MHz)	Channel	Modulation	# of Resource Blocks	RB Offset	Conducted Output Power (dBm)	SAR, averaged over 1 g		
								Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Left Head Cheek	LTE Band 25	1860.0	26140	QPSK	1	0				
		1882.5	26365	QPSK	1	50				
		1905.0	26590	QPSK	1	99	22.9	0.56	0.03	0.56
		1905.0	26590	QPSK	50	50				

Table 11.1-1b SAR results for LTE Band 25 (20MHz BW) head configuration full power 2100mA battery

Test Position	Mode	f (MHz)	Channel	Modulation	# of Resource Blocks	RB Offset	Conducted Output Power (dBm)	SAR, averaged over 1 g		
								Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Right Head Cheek	SVLTE Band 25	1860.0	26140	QPSK	1	0				
		1882.5	26365	QPSK	1	50				
		1905.0	26590	QPSK	1	99	18.2	0.16	0.10	0.16
		1905.0	26590	QPSK	50	50	18.4	0.15	0.00	0.15
		1905.0	26590	QPSK	100	0	18.2	0.15	0.05	0.15
Right Head 15° Tilt	SVLTE Band 25	1905.0	26590	QPSK	100	0	18.2	0.10	0.06	0.10
Left Head Cheek	SVLTE Band 25	1860.0	26140	QPSK	1	0				
		1882.5	26365	QPSK	1	50				
		1905.0	26590	QPSK	1	99	18.2	0.18	0.00	0.18
		1905.0	26590	QPSK	50	50	18.4	0.18	0.07	0.18
		1905.0	26590	QPSK	100	0	18.2	0.18	-0.16	0.18
Left Head 15° Tilt	SVLTE Band 25	1905.0	26590	QPSK	100	0	18.2	0.10	0.04	0.10

Table 11.1-1c SAR results for SVLTE Band 25 (20MHz BW) lower power head configuration

Test Position	Mode	f (MHz)	Channel	Modulation	# of Resource Blocks	RB Offset	Conducted Output Power (dBm)	SAR, averaged over 1 g		
								Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Left Head Cheek	SVLTE Band 25	1860.0	26140	QPSK	1	0				
		1882.5	26365	QPSK	1	50				
		1905.0	26590	QPSK	1	99				
		1905.0	26590	QPSK	50	50				
		1905.0	26590	QPSK	100	0	18.2	0.22	0.04	0.22

Table 11.1-1d SAR results for SVLTE Band 25 (20MHz BW) head configuration lower power 2100mA battery

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	SAR, averaged over 1 g		
					Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Right Head Cheek	2-slots DTM 850 MHz	824.2	128				
		836.8	190	29.9	0.74	0.10	0.74
		848.8	251				
Right Head Cheek	3-slots DTM 850 MHz	824.2	128	29.5	0.85	0.19	0.85
		836.8	190	29.1	0.99	-0.14	0.99
		848.8	251	28.9	0.78	0.00	0.78
Right Head Cheek	4-slots EDGE 850 MHz	824.2	128				
		836.8	190	26.8	0.79	-0.11	0.79
		848.8	251				
Right Head 15° Tilt	3-slots DTM 850 MHz	824.2	128				
		836.8	190	29.1	0.47	0.01	0.47
		848.8	251				
Right Head Cheek	1-slot GSM 850 MHz	824.2	128				
		836.8	190	32.3	0.62	-0.18	0.62
		848.8	251				
Left Head Cheek	2-slots DTM 850 MHz	824.2	128				
		836.8	190	29.9	0.49	0.00	0.49
		848.8	251				
Left Head Cheek	3-slots DTM 850 MHz	824.2	128				
		836.8	190	29.1	0.64	0.16	0.64
		848.8	251				
Left Head Cheek	4-slots GSM/EDGE 850 MHz	824.2	128				
		836.8	190	26.8	0.50	0.13	0.50
		848.8	251				
Left Head 15° Tilt	3-slots DTM 850 MHz	824.2	128				
		836.8	190	29.1	0.41	-0.11	0.41
		848.8	251				
Left Head Cheek	1-slot GSM 850 MHz	824.2	128				
		836.8	190	32.3	0.38	0.02	0.38
		848.8	251				

Table 11.1-2a SAR results for GSM/EDGE/DTM 850 head configuration

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

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

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

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	SAR, averaged over 1 g Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)	Scan Type
Right Head Cheek	3-slots DTM 850 MHz	824.2	128					
		836.8	190	29.1	**1.01**	**-0.18**	**1.01**	
		836.8	190	29.1	0.99	0.05	0.99	2nd scan
		848.8	251					

Table 11.1-2b SAR results for GSM/EDGE/DTM 850 head configuration 2100mA battery

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	SAR, averaged over 1 g Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)	Scan Type
Right Head Cheek	WCDMA FDD V 850 MHz	826.4	4132	24.2	0.73	-0.02	0.73	
		836.4	4182	24.0	0.91	-0.14	0.91	
		836.4	4182	24.0	0.86	0.03	0.86	2nd scan
		846.6	4233	23.9	0.85	0.02	0.85	
Right Head 15° Tilt	WCDMA FDD V 850 MHz	826.4						
		836.4	4182	24.0	0.39	0.05	0.39	
		846.6						
Left Head Cheek	WCDMA FDD V 850 MHz	826.4						
		836.4	4182	24.0	0.55	0.02	0.55	
		846.6						
Left Head 15° Tilt	WCDMA FDD V 850 MHz	826.4						
		836.4	4182	24.0	0.36	0.07	0.36	
		846.6						

Table 11.1-3a SAR results for WCDMA FDD V head configuration

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	SAR, averaged over 1 g Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)	Scan Type
Right Head Cheek	WCDMA FDD V 850 MHz	836.4	4182	24.0	0.90	0.04	0.90	
		836.4	4182	24.0	0.93	0.04	0.93	2nd Scan

Table 11.1-3b SAR results for WCDMA FDD V head configuration 2100mA battery

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	SAR, averaged over 1 g		
					Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Right Head Cheek	CDMA 850 MHz BC 0	824.70	1013				
		836.52	384	23.9	0.39	-0.06	0.39
		848.52	777				
Right Head 15° Tilt	CDMA 850 MHz BC 0	824.70	1013				
		836.52	384	23.9	0.24	0.07	0.24
		848.52	777				
Left Head Cheek	CDMA 850 MHz BC 0	824.70	1013	24.0	0.61	0.08	0.61
		836.52	384	23.9	0.55	-0.06	0.55
		848.52	777	23.9	0.66	-0.15	0.66
Left Head 15° Tilt	CDMA 850 MHz BC 0	824.70	1013				
		836.52	384	23.9	0.24	-0.04	0.24
		848.52	777				

Table 11.1-4a SAR results for CDMA 850 BC0 head configuration

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	SAR, averaged over 1 g		
					Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Left Head Cheek	CDMA 850 MHz BC 0	824.70	1013				
		836.52	384				
		848.52	777	23.9	0.66	-0.16	0.66

Table 11.1-4b SAR results for CDMA 850 BC0 head configuration 2100mA battery

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	SAR, averaged over 1 g		
					Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Right Head Cheek	2-slots DTM 1900 MHz	1850.2	512				
		1880.0	661	28.3	0.36	-0.04	0.36
		1909.8	810				
Right Head 15° Tilt	2-slots DTM 1900 MHz	1850.2	512				
		1880.0	661	28.3	0.26	0.00	0.26
		1909.8	810				
Right Head Cheek	1-slot GSM 1900 MHz	1850.2	512				
		1880.0	661	29.5	0.35	0.06	0.35
		1909.8	810				
Left Head Cheek	2-slots DTM 1900 MHz	1850.2	512				
		1880.0	661	28.3	0.42	0.23	0.42
		1909.8	810				
Left Head Cheek	3-slots DTM 1900 MHz	1850.2	512				
		1880.0	661	25.8	0.33	0.17	0.33
		1909.8	810				
Left Head Cheek	4-slots GSM/EDGE 1900 MHz	1850.2	512				
		1880.0	661	25.6	0.38	-0.06	0.38
		1909.8	810				
Left Head 15° Tilt	2-slots DTM 1900 MHz	1850.2	512				
		1880.0	661	28.3	0.23	0.04	0.23
		1909.8	810				
Left Head Cheek	1-slot GSM 1900 MHz	1850.2	512				
		1880.0	661	29.5	0.29	0.25	0.29
		1909.8	810				

Table 11.1-5a SAR results for GSM/EDGE/DTM 1900 head configuration

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	SAR, averaged over 1 g		
					Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Left Head Cheek	2-slots DTM 1900 MHz	1850.2	512				
		1880.0	661	28.3	0.45	0.05	0.45
		1909.8	810				

Table 11.1-5b SAR results for GSM/EDGE/DTM 1900 head configuration 2100mA battery

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	SAR, averaged over 1 g		
					Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Right Head Cheek	WCDMA FDD II 1900 MHz	1852.4	9262				
		1880.0	9400	23.5	0.62	-0.17	0.62
		1907.6	9538				
Right Head 15° Tilt	WCDMA FDD II 1900 MHz	1852.4	9262				
		1880.0	9400	23.5	0.47	0.23	0.47
		1907.6	9538				
Left Head Cheek	WCDMA FDD II 1900 MHz	1852.4	9262				
		1880.0	9400	23.5	0.69	-0.12	0.69
		1907.6	9538				
Left Head 15° Tilt	WCDMA FDD II 1900 MHz	1852.4	9262				
		1880.0	9400	23.5	0.34	0.07	0.34
		1907.6	9538				

Table 11.1-6a SAR results for WCDMA FDD II head configuration

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	SAR, averaged over 1 g		
					Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Left Head Cheek	WCDMA FDD II 1900 MHz	1852.4	9262				
		1880.0	9400	23.5	0.62	-0.08	0.62
		1907.6	9538				

Table 11.1-6b SAR results for WCDMA FDD II head configuration 2100mA battery

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	SAR, averaged over 1 g			Scan Type
					Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)	
Right Head Cheek	CDMA 1900 MHz BC 1	1851.25	25					
		1880.00	600	23.7	0.63	0.02	0.63	
		1908.50	1175					
Right Head 15° Tilt	CDMA 1900 MHz BC 1	1851.25	25					
		1880.00	600	23.7	0.25	0.05	0.25	
		1908.50	1175					
Left Head Cheek	CDMA 1900 MHz BC 1	1851.25	25	23.7	0.64	-0.12	0.64	
		1880.00	600	23.7	0.73	-0.08	0.73	
		1908.50	1175	23.9	1.00	0.38	1.00	
		1908.50	1175	23.9	0.98	0.04	0.98	2nd Scan
Left Head 15° Tilt	CDMA 1900 MHz BC 1	1851.25	25					
		1880.00	600	23.7	0.23	0.15	0.23	
		1908.50	1175					

Table 11.1-7a SAR results for CDMA 1900 BC1 head configuration

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	SAR, averaged over 1 g		
					Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
Left Head Cheek	CDMA 1900 MHz BC 1	1851.25	25				
		1880.00	600	23.7	0.54	0.16	0.54
		1908.50	1175	23.9	0.97	-0.15	0.97

Table 11.1-7b SAR results for CDMA 1900 BC1head configuration 2100mA battery

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	Measured SAR (W/kg)		
					Power Drift (dB)	Averaged over 1 g	Averaged over 10 g
Right Head Cheek	802.11 b 2450 MHz	2412	1				
		2437	6	18.8	-0.14	0.13	0.06
		2462	11				
Right Head 15° Tilt	802.11 b 2450 MHz	2412	1				
		2437	6	18.8	0.02	0.16	0.08
		2462	11				
Left Head Cheek	802.11 b 2450 MHz	2412	1				
		2437	6	18.8	0.06	0.08	0.04
		2462	11				
Left Head 15° Tilt	802.11 b 2450 MHz	2412	1				
		2437	6	18.8	-0.14	0.08	0.05
		2462	11				

Table 11.1-8a SAR results for WiFi/WLAN/802.11b head configuration

Note: Only the highest output power channel was tested

Test Position	Mode	f (MHz)	Channel	Cond. Output Power (dBm)	Measured SAR (W/kg)		
					Power Drift (dB)	Averaged over 1 g	Averaged over 10 g
Right Head Cheek	802.11 b 2450 MHz	2412	1				
		2437	6	18.8	0.06	0.13	0.06
		2462	11				

Table 11.1-8b SAR results for WiFi/WLAN/802.11b head configuration 2100mA battery

Note: Only the highest output power channel was tested

Band	Operation Mode	Channel	Frequency (MHz)	Battery	Position	SAR 1g (W/kg)	Extrapolated SAR 1g (W/kg)[1]	Results (Appendix A)
WLAN 802.11a	OFDM, 6 Mbit/s	36	5180	Standard	Right Touch	0.057	N/A[2]	Plot 103
					Right Tilt	0.076		Plot 104
					Left Touch	0.037		Plot 105
					Left Tilt	0.062		Plot 106
		64	5320		Right Touch	0.114		Plot 107
					Right Tilt	0.125		Plot 108
					Left Touch	0.048		Plot 109
					Left Tilt	0.070		Plot 110
		100	5500		Right Touch	0.068		Plot 111
					Right Tilt	0.054		Plot 112
					Left Touch	0.043		Plot 113
					Left Tilt	0.065		Plot 114
		149	5745		Right Touch	0.064		Plot 115
					Right Tilt	0.056		Plot 116
					Left Touch	0.061		Plot 117
					Left Tilt	0.079		Plot 118
		64	5320	High Cap.	Right Tilt	0.113		Plot 119

NOTES:
1. Measured 1g SAR extrapolated to manufacturer stated output power upper tolerance limit.
2. Bluetooth and WLAN tested at highest output power. No extrapolation required.

Table 11.1-9 SAR results for WiFi/WLAN/802.11a head configuration from SAR_CETE4_023_13001

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

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Configuration	Modulation	# of Resource Blocks	RB Offset	Conducted Output Power (dBm)	SAR, averaged over 1 g		
										Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
LTE Band 25	1860.0	26140	Body Hotspot Mode	1.0	Back	QPSK	1	0	22.8	0.84	-0.14	0.84
	1882.5	26365		1.0	Back	QPSK	1	50	22.9	0.89	0.03	0.89
	1905.0	26590		1.0	Back	QPSK	1	99	22.9	0.87	-0.03	0.87
	1905.0	26590		1.0	Back	QPSK	50	50	21.9	0.68	-0.08	0.68
	1905.0	26590		1.0	Back	QPSK	100	0	21.9	0.76	0.51	0.76
	1882.5	26365		1.0	Front	QPSK	1	50	22.9	0.60	-0.04	0.60
	1882.5	26365		1.0	Left	QPSK	1	50	22.9	0.12	0.06	0.12
	1882.5	26365		1.0	Right	QPSK	1	50	22.9	0.26	-0.03	0.26
	1860.0	26140		1.0	Bottom	QPSK	1	0	22.8	0.91	-0.02	0.91
	1882.5	26365		1.0	Bottom	QPSK	1	50	22.9	0.91	-0.06	0.91
	1905.0	26590		1.0	Bottom	QPSK	1	99	22.9	0.90	-0.02	0.90
	1860.0	26140		1.0	Bottom+HS	QPSK	1	0	22.8	0.92	-0.04	0.92
	1860.0	26140		1.0	Bottom+HS +2100mA	QPSK	1	0	22.8	0.90	-0.16	0.90
	1860.0	26140		1.0	Bottom+HS 2nd Scan	QPSK	1	0	22.8	0.96	0.00	0.96
LTE Band 25	1882.5	26365	Body-worn	1.5	Back	QPSK	1	50	22.9	0.45	-0.02	0.45
	1882.5	26365		Holster	Back	QPSK	1	50	22.9	0.26	-0.04	0.26
	1882.5	26365		Holster	Front	QPSK	1	50	22.9	0.21	0.07	0.21

Table 11.2-1a SAR results for LTE Band 25 (20 MHz BW) body-worn and Hotspot configurations full power

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

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

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

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

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

Note 5: 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 6: 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 7: For LTE if SAR > 1.45, then SAR tests for the smaller bandwidths are required

Note 8: Tested only the highest bandwidth since conducted power on other bandwidths is about the same.

Note 9: Did not test 16 QAM as conducted power was lower than QPSK.

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Configuration	Modulation	# of Resource Blocks	RB Offset	Conducted Output Power (dBm)	SAR, averaged over 1 g		
										Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
SV-LTE Band 25	1860.0	26140	Body Hotspot Mode	1.0	Back	QPSK	1	0				
	1882.5	26365		1.0	Back	QPSK	1	50				
	1905.0	26590		1.0	Back	QPSK	1	99	18.2	0.27	0.17	0.27
	1905.0	26590		1.0	Back	QPSK	50	50	18.4	0.28	-0.10	0.28
	1905.0	26590		1.0	Back	QPSK	100	0	18.2	0.31	0.10	0.31
	1905.0	26590		1.0	Front	QPSK	100	0	18.2	0.21	0.10	0.21
	1905.0	26590		1.0	Left	QPSK	100	0	18.2	0.04	-0.06	0.04
	1905.0	26590		1.0	Right	QPSK	100	0	18.2	0.08	-0.01	0.08
	1905.0	26590		1.0	Bottom	QPSK	100	0	18.2	0.30	0.02	0.30
	1905.0	26590		1.0	Back+HS	QPSK	100	0	18.2	0.29	-0.12	0.29
	1905.0	26590		1.0	Back+ 2100mA	QPSK	100	0	18.2	0.27	-0.11	0.27
SV-LTE Band 25	1905.0	26590	Body-worn	1.5	Back	QPSK	100	0	18.2	0.14	-0.12	0.14
	1905.0	26590		Holster	Back	QPSK	100	0	18.2	0.09	-0.04	0.09
	1905.0	26590		Holster	Front	QPSK	100	0	18.2	0.07	0.01	0.07

Table 11.2-1b SAR results for SVLTE Band 25 (20 MHz BW) lower power body-worn and Hotspot configurations

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Configuration	Modulation	# of Resource Blocks	RB Offset	Conducted Output Power (dBm)	SAR, averaged over 1 g		
										Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
LTE Band 25	1882.5	26365	Body Hotspot Mode	1.0	Bottom+HS	QPSK	1	50	18.7	0.26	0.10	0.26
	1905.0	26590		1.0	Bottom+HS	QPSK	50	50	18.7	0.27	0.01	0.27
	1905.0	26590		1.0	Bottom+HS	QPSK	100	0	18.5	0.28	-0.06	0.28

Table 11.2-1c SAR results for LTE Band 25 (20 MHz BW) body-worn and Hotspot configurations Hotspot mode ON lower power

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Configuration	Conducted Output Power (dBm)	SAR, averaged over 1 g		
							Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
2-slots GPRS 850MHz	824.2	128	Body Hotspot Mode	1.0	Back				
	836.8	190		1.0	Back	30.1	0.68	0.04	0.68
	848.8	251		1.0	Back				
3-slots GPRS 850MHz	824.2	128		1.0	Back	28.9	0.98	-0.02	0.98
	836.8	190		1.0	Back	29.1	0.89	-0.08	0.89
	848.8	251		1.0	Back	28.8	0.73	0.05	0.73
	824.2	128		1.0	Front	28.9	0.89	0.02	0.89
	836.8	190		1.0	Front	29.1	0.82	0.36	0.82
	848.8	251		1.0	Front	28.8	0.57	-0.12	0.57
	836.8	190		1.0	Left	29.1	0.23	-0.16	0.23
	824.2	128		1.0	Right	28.9	0.88	-0.07	0.88
	836.8	190		1.0	Right	29.1	0.82	-0.14	0.82
	848.8	251		1.0	Right	28.8	0.60	-0.09	0.60
	836.8	190		1.0	Bottom	29.1	0.39	0.13	0.39

	824.2	128		1.0	Back+HS	28.9	1.03	0.08	1.03
	824.2	128		1.0	Back+HS +2100mA	28.9	**1.16**	**-0.11**	**1.16**
	824.2	128		1.0	Back+HS +2100mA 2nd scan	28.9	1.14	-0.11	1.14
4-slots GPRS 850MHz	824.2	128		1.0	Back				
	836.8	190		1.0	Back	26.8	0.75	-0.02	0.75
	848.8	251		1.0	Back				
3-slots GPRS 850MHz	836.8	190	Body-worn	1.5	Back	29.1	**0.68**	**0.18**	**0.68**
	836.8	190		Holster	Back	29.1	0.38	0.06	0.38
	836.8	190		Holster	Front	29.1	0.38	0.16	0.38

Table 11.2-2 SAR results for EDGE/EGPRS 850 body-worn and Hotspot configurations

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

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

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

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

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

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Configuration	Conducted Output Power (dBm)	SAR, averaged over 1 g		
							Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
WCDMA FDD V 850 MHz	826.4	4132	Body Hotspot Mode	1.0	Back	24.2	0.82	0.00	0.82
	836.4	4182		1.0	Back	24.0	0.86	-0.05	0.86
	846.6	4233		1.0	Back	23.9	0.83	-0.06	0.83
	836.4	4182		1.0	Front	24.0	0.69	-0.02	0.69
	836.4	4182		1.0	Left	24.0	0.30	0.05	0.30
	836.4	4182		1.0	Right	24.0	0.78	0.00	0.78
	836.4	4182		1.0	Bottom	24.0	0.36	0.02	0.36
	836.4	4182		1.0	Back+HS	24.0	0.84	0.03	0.84
	836.4	4182		1.0	Back+2100	24.0	0.87	0.01	0.87
	836.4	4182		1.0	Back+2100 2nd Scan	24.0	0.85	0.07	0.85
WCDMA FDD V 850 MHz	836.4	4182	Body-worn	1.5	Back	24.0	0.62	0.00	0.62
	836.4	4182		Holster	Back	24.0	0.40	-0.04	0.40
	836.4	4182		Holster	Front	24.0	0.39	-0.02	0.39

Table 11.2-3 SAR results for WCDMA FDD V body-worn and Hotspot configurations

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Configuration	Conducted Output Power (dBm)	SAR, averaged over 1 g		
							Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
CDMA 850 MHz BC 0	824.70	1013	Body Hotspot Mode	1.0	Back	24.0	1.03	0.05	1.03
	824.70	1013		1.0	Back 2nd Scan	24.0	1.03	-0.10	1.03
	836.52	384		1.0	Back	23.9	0.69	-0.10	0.69
	848.52	777		1.0	Back	23.9	0.76	-0.12	0.76
	836.52	384		1.0	Front	23.9	0.44	0.02	0.44
	836.52	384		1.0	Left	23.9	0.43	0.02	0.43
	836.52	384		1.0	Right	23.9	0.15	-0.03	0.15
	836.52	384		1.0	Bottom	23.9	0.19	0.05	0.19
	824.70	1013		1.0	Back+HS	24.0	0.72	-0.04	0.72
	824.70	1013		1.0	Back+2100	24.0	0.96	-0.02	0.96
CDMA 850 MHz BC 0	836.52	384	Body-worn	1.5	Back	23.9	0.46	-0.04	0.46
	836.52	384		Holster	Back	23.9	0.35	0.10	0.35
	836.52	384		Holster	Front	23.9	0.28	-0.08	0.28

Table 11.2-4 SAR results for CDMA 850 BC0 body-worn and Hotspot configurations

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Configuration	Conducted Output Power (dBm)	SAR, averaged over 1 g		
							Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
2-slots GPRS 1900 MHz	1850.2	512	Body Hotspot Mode	1.0	Back				
	1880.0	661		1.0	Back	28.5	0.61	0.07	0.61
	1909.8	810		1.0	Back				
	1880.0	661		1.0	Front	28.5	0.36	-0.05	0.36
	1880.0	661		1.0	Left	28.5	0.11	-0.04	0.11
	1880.0	661		1.0	Right	28.5	0.21	0.04	0.21
	1880.0	661		1.0	Bottom	28.5	0.64	-0.05	0.64
	1880.0	661		1.0	Bottom+HS	28.5	0.68	-0.09	0.68
	1880.0	661		1.0	Bottom+HS +2100mA	28.5	0.65	0.02	0.65
3-slots GPRS 1900 MHz	1880.0	661		1.0	Back	26.0	0.56	-0.09	0.56
4-slots GPRS 1900 MHz	1880.0	661		1.0	Back	25.6	0.59	-0.09	0.59
2-slots GPRS 1900 MHz	1880.0	661	Body-worn	1.5	Back	28.5	0.36	0.00	0.36
	1880.0	661		Holster	Back	28.5	0.20	0.03	0.20
	1880.0	661		Holster	Front	28.5	0.15	0.03	0.15

Table 11.2-5 SAR results for GPRS/EDGE 1900 body-worn and Hotspot configurations

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Configuration	Conducted Output Power (dBm)	SAR, averaged over 1 g		
							Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
WCDMA FDD II 1900 MHz	1852.4	9262	Body Hotspot Mode	1.0	Back	23.6	0.98	-0.10	0.98
	1880.0	9400		1.0	Back	23.5	0.96	0.02	0.96
	1907.6	9538		1.0	Back	23.7	0.92	-0.03	0.92
	1852.4	9262		1.0	Front	23.6	0.67	-0.08	0.67
	1852.4	9262		1.0	Left	23.6	0.15	-0.01	0.15
	1852.4	9262		1.0	Right	23.6	0.33	0.20	0.33
	1852.4	9262		1.0	Bottom	23.6	1.04	-0.05	1.04
	1852.4	9262		1.0	Bottom 2nd scan	23.6	1.05	0.10	1.05
	1880.0	9400		1.0	Bottom	23.5	1.03	0.06	1.03
	1907.6	9538		1.0	Bottom	23.7	0.93	-0.07	0.93
	1852.4	9262		1.0	Bottom+HS	23.6	1.00	-0.05	1.00
	1852.4	9262		1.0	Bottom+ 2100mA	23.6	1.04	0.00	1.04
WCDMA FDD II 1900 MHz	1880.0	9400	Body-worn	1.5	Back	23.5	0.55	0.02	0.55
	1880.0	9400		Holster	Back	23.5	0.33	0.09	0.33
	1880.0	9400		Holster	Front	23.5	0.24	-0.04	0.24

Table 11.2-6 SAR results for WCDMA FDD II body-worn and Hotspot configurations

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Configuration	Conducted Output Power (dBm)	SAR, averaged over 1 g		
							Measured (W/kg)	Power Drift (dB)	*Extrapolated (W/kg)
CDMA 1900 MHz BC 1	1850.2	25	Body Hotspot Mode	1.0	Back	23.7	0.70	-0.01	0.70
	1880.0	600		1.0	Back	23.7	0.77	0.09	0.77
	1909.8	1175		1.0	Back	23.9	1.08	-0.04	1.08
	1909.8	1175		1.0	Back 2nd scan	23.9	1.07	-0.02	1.07
	1880.0	600		1.0	Front	23.7	0.48	0.13	0.48
	1880.0	600		1.0	Left	23.7	0.26	0.17	0.26
	1880.0	600		1.0	Right	23.7	0.09	-0.01	0.09
	1880.0	600		1.0	Bottom	23.7	0.44	-0.09	0.44
	1909.8	1175		1.0	Back+HS	23.9	0.89	-0.07	0.89
	1909.8	1175		1.0	Back+2100	23.9	1.05	0.10	1.05
CDMA 1900 MHz BC 1	1880.0	600	Body-worn	1.5	Back	23.7	0.42	0.00	0.42
	1880.0	600		Holster	Back	23.7	0.28	-0.14	0.28
	1880.0	600		Holster	Front	23.7	0.21	-0.04	0.21

Table 11.2-7 SAR results for CDMA 1900 BC1 body-worn and Hotspot configurations

Mode	f (MHz)	Channel	Test Position	Spacing (cm)/ Holster	Configuration	Conducted Output Power (dBm)	Measured SAR (W/kg)		
							Power Drift (dB)	Averaged over 1 g	Averaged over 10 g
802.11b/ WLAN 2450 MHz	2437	6	Body Mobile Hotspot Mode	1.0	Back	18.8	-0.01	0.43	0.19
	2437	6		1.0	Front	18.8	0.10	0.04	0.02
	2437	6		1.0	Left	18.8	0.16	0.11	0.06
	2437	6		1.0	Right	18.8	-0.09	0.04	0.02
	2437	6		1.0	Bottom	18.8	-0.18	0.02	0.01
	2437	6		1.0	Back+ HS	18.8	0.14	0.30	0.14
	2437	6		1.0	Back+ 2100mA	18.8	0.01	0.47	0.21
802.11b/ WLAN 2450 MHz	2437	6	Body-worn	1.5	Back	18.8	-0.06	0.18	0.09
	2437	6		Holster	Back	18.8	-0.06	0.09	0.05
	2437	6		Holster	Front	18.8	0.08	0.02	0.01

Table 11.2-8 SAR results for WiFi/WLAN/802.11b body-worn and Hotspot configurations

Note: Only the highest output power channel was tested

Band	Operation Mode	Channel	Frequency (MHz)	Position	Accessory	Distance (mm)	SAR 1g (W/kg)	Extrapolated SAR 1g (W/kg)[1]	Results (Appendix A)
WLAN 802.11a	OFDM, 6 Mbit/s	36	5180	Back	None	15	0.310	N/A[3]	Plot 208
		64	5320	Back	None	15	0.154		Plot 209
		100	5500	Back	None	15	0.072		Plot 210
		149	5745	Back	None	15	0.252		Plot 211
		36	5180	Back	Holster	0	0.065		Plot 212
				Back	High Cap. Battery	15	0.342		Plot 213

NOTES:
1. Measured 1g SAR extrapolated to manufacturer stated output power upper tolerance limit.
2. Measurements with more than one SAR value have a secondary peak that is within 2 dB of the primary peak.
3. Bluetooth and WLAN tested at highest output power. No extrapolation required.

Table 11.2-9 SAR results for WiFi/WLAN/802.11a body-worn configurations from SAR_CETE4_023_13001

12.0 REFERENCES

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

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

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

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

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

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[26] IEEE 1528-2011: Draft "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques."

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