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SAR EVALUATION REPORT

Applicant Name:
Samsung Electronics, Co. Ltd.
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Gyeonggi-do, 443-742, Republic of Korea

Date of Testing:
02/20/13 - 03/04/13
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Document Serial No.:
0Y1302190326-R1.A3L

FCC ID: **A3LGTN5100**

APPLICANT: **SAMSUNG ELECTRONICS, CO. LTD.**

DUT Type: Portable Tablet
Application Type: Class II Permissive Change
FCC Rule Part(s): CFR §2.1093
Model(s): GT-N5100
Permissive Change(s): See FCC Change Document
Date of Original Certification: March 12, 2013

Equipment Class	Band & Mode	Tx Frequency	Measured Conducted Power [dBm]	SAR	
				1 gm Head (W/kg)	1 gm Body (W/kg)
PCE	GSM/GPRS/EDGE 850	824.20 - 848.80 MHz	30.49	0.73	1.01
PCE	UMTS 850	826.40 - 846.60 MHz	23.43	0.36	0.86
PCE	GSM/GPRS/EDGE 1900	1850.20 - 1909.80 MHz	29.82	0.20	0.80
PCE	UMTS 1900	1852.4 - 1907.6 MHz	22.45	0.51	0.96
DTS	2.4 GHz WLAN	2412 - 2462 MHz	16.21	0.45	1.08
DTS	Bluetooth LE	2402 - 2480 MHz	7.03	N/A	N/A
DTS	5.8 GHz WLAN	5745 - 5825 MHz	8.67	< 0.1	0.48
UNII	5.2 GHz WLAN	5180 - 5240 MHz	8.23	< 0.1	0.15
UNII	5.3 GHz WLAN	5260 - 5320 MHz	8.31	< 0.1	0.25
UNII	5.5 GHz WLAN	5500 - 5700 MHz	8.76	0.13	1.06
DSS	Bluetooth	2402 - 2480 MHz	11.25	N/A	0.15
Simultaneous SAR per KDB 690783 D01v01r02:				0.84	1.55

Note: Powers in the above table represent output powers for the SAR test configurations and may not represent the highest output powers for all configurations for each mode.

Note: This revised Test Report (S/N: 0Y1302190326-R1.A3L) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE C95.1-1992 and has been tested in accordance with the measurement procedures specified in Section 1.7 of this report; for North American frequency bands only.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them. Test results reported herein relate only to the item(s) tested.

Randy Ortanez
President

ACCREDITED
TESTING LABORATORY
CERTIFICATE #2041.01

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1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
GSM/GPRS/EDGE 850	Voice/Data	824.20 - 848.80 MHz
UMTS 850	Voice/Data	826.40 - 846.60 MHz
GSM/GPRS/EDGE 1900	Voice/Data	1850.20 - 1909.80 MHz
UMTS 1900	Voice/Data	1852.4 - 1907.6 MHz
2.4 GHz WLAN	Data	2412 - 2462 MHz
Bluetooth LE	Data	2402 - 2480 MHz
5.8 GHz WLAN	Data	5745 - 5825 MHz
5.2 GHz WLAN	Data	5180 - 5240 MHz
5.3 GHz WLAN	Data	5260 - 5320 MHz
5.5 GHz WLAN	Data	5500 - 5700 MHz
Bluetooth	Data	2402 - 2480 MHz

1.2 Power Reduction for SAR

This device uses two proximity sensors for SAR compliance. One IR sensor is activated when the device is held to the ear in voice and data operations, while the capacitive grip sensor is activated when used in close proximity to the user's body. Both the proximity sensors trigger power reduction for all voice and data modes. There are no operating conditions or exposure conditions that require the power reduction triggering of both the IR and capacitive sensors. The IR sensor is only applicable for held to ear operations and exposure conditions. The capacitive sensor is only applicable for tablet operations. There are no body worn accessories for this device.

The held-to-ear RF exposure conditions were evaluated at reduced power according to the Head SAR test positions described in IEEE 1528 and Supplement C. Since the device is a full tablet size, the Body SAR was evaluated per FCC KDB Publication 616217 D04v01 for full sized tablets

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1.3 Nominal and Maximum Output Power Specifications

This device operates using the following maximum and nominal output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v05.

With power backoff: either capacitive sensor or IR sensor activated:

Mode / Band	Sensor State		Voice (dBm)	Burst Average GMSK (dBm)				Burst Average 8-PSK (dBm)			
			1 TX Slot	*1 TX Slots*	*2 TX Slots*	*3 TX Slots*	*4 TX Slots*	*1 TX Slots*	*2 TX Slots*	*3 TX Slots*	*4 TX Slots*
GSM/GPRS/EDGE 850	Active	Maximum	**28.5**	**28.5**	**26.0**	**22.5**	**21.0**	**24.0**	**22.0**	**20.5**	**19.0**
		Nominal	**28.0**	**28.0**	**25.5**	**22.0**	**20.5**	**23.5**	**21.5**	**20.0**	**18.5**
GSM/GPRS/EDGE 1900	Active	Maximum	**23.5**	**23.5**	**20.0**	**18.5**	**17.5**	**22.0**	**19.5**	**18.0**	**17.0**
		Nominal	**23.0**	**23.0**	**19.5**	**18.0**	**17.0**	**21.5**	**19.0**	**17.5**	**16.5**

Mode / Band	Sensor State		Modulated Average		
			3GPP RMC	*3GPP HSDPA*	*3GPP HSUPA*
UMTS Band 5 (850 MHz)	Active	Maximum	**17.5**	**17.5**	**17.5**
		Nominal	**17.0**	**17.0**	**17.0**
UMTS Band 2 (1900 MHz)	Active	Maximum	**15.5**	**15.5**	**15.5**
		Nominal	**15.0**	**15.0**	**15.0**

Max power with capacitive sensor or IR sensor inactivated for body SAR testing configurations:

Mode / Band	Sensor State		Voice (dBm)	Burst Average GMSK (dBm)				Burst Average 8-PSK (dBm)			
			1 TX Slot	*1 TX Slots*	*2 TX Slots*	*3 TX Slots*	*4 TX Slots*	*1 TX Slots*	*2 TX Slots*	*3 TX Slots*	*4 TX Slots*
GSM/GPRS/EDGE 850	Inactive	Maximum	**33.0**	**33.0**	**30.5**	**27.0**	**26.0**	**27.5**	**27.0**	**26.0**	**24.0**
		Nominal	**32.5**	**32.5**	**30.0**	**26.5**	**25.5**	**27.0**	**26.5**	**25.5**	**23.5**
GSM/GPRS/EDGE 1900	Inactive	Maximum	**30.0**	**30.0**	**26.0**	**24.5**	**23.0**	**26.5**	**26.5**	**25.5**	**23.5**
		Nominal	**29.5**	**29.5**	**25.5**	**24.0**	**22.5**	**26.0**	**26.0**	**25.0**	**23.0**

Mode / Band	Sensor State		Modulated Average		
			3GPP RMC	*3GPP HSDPA*	*3GPP HSUPA*
UMTS Band 5 (850 MHz)	Inactive	Maximum	**23.5**	**23.5**	**23.5**
		Nominal	**23.0**	**23.0**	**23.0**
UMTS Band 2 (1900 MHz)	Inactive	Maximum	**22.5**	**22.5**	**22.5**
		Nominal	**22.0**	**22.0**	**22.0**

Mode / Band		Modulated Average (dBm)
IEEE 802.11b (2.4 GHz)	Maximum	**16.5**
	Nominal	**16.0**
IEEE 802.11g (2.4 GHz)	Maximum	**12.0**
	Nominal	**11.5**
IEEE 802.11n (2.4 GHz)	Maximum	**11.0**
	Nominal	**10.5**
IEEE 802.11a (5 GHz)	Maximum	**9.0**
	Nominal	**8.5**
IEEE 802.11n (5.2 and 5.3 GHz)	Maximum	**8.5**
	Nominal	**8.0**
IEEE 802.11n (5.5 and 5.8 GHz)	Maximum	**8.0**
	Nominal	**7.5**
Bluetooth	Maximum	**11.5**
	Nominal	**11.0**
Bluetooth LE	Maximum	**7.5**
	Nominal	**7.0**

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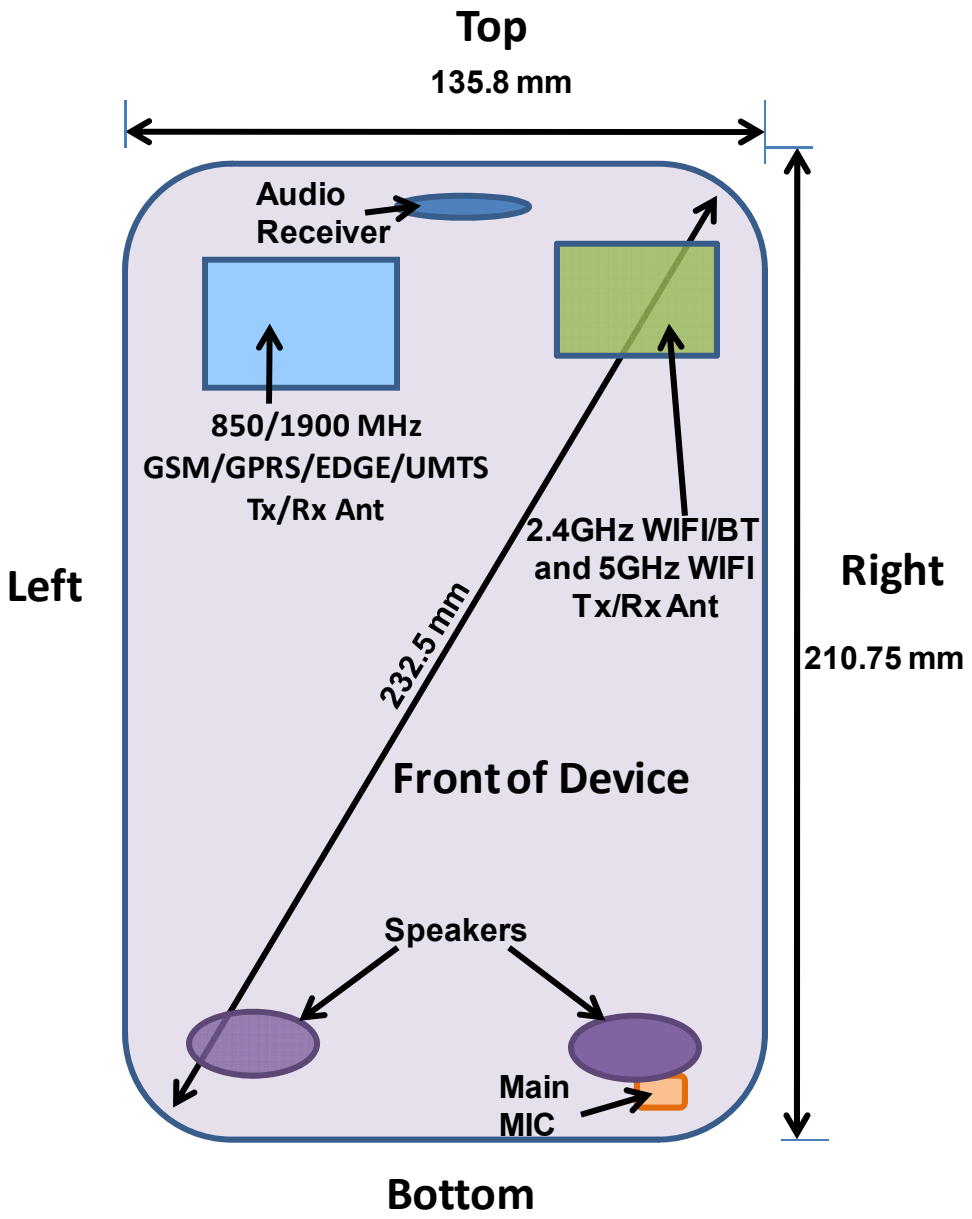
1.4 DUT Antenna Locations



Note: Specific antenna dimensions and separation distances are shown in the antenna distance document.

Figure 1-1
DUT Antenna Locations

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1.5 Simultaneous Transmission Capabilities

According to FCC KDB Publication 447498 D05v01, transmitters are considered to be transmitting simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds. Modes which share the same transmission path cannot transmit simultaneously with one another.

This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis according to FCC KDB Publication 447498 D01v05 3) procedures.

Table 1-1
Simultaneous Transmission Scenarios

Ref.	Simultaneous Transmit Configurations	Head	Body	Note
		IEEE 1528, Supp C	FCC KDB 616217	
1	GSM850 Voice + 2.4 GHz WIFI	Yes		
2	GSM850 Voice + 5 GHz WIFI	Yes		
3	GSM1900 Voice + 2.4 GHz WIFI	Yes		
4	GSM1900 Voice + 5 GHz WIFI	Yes		
5	UMTS 850 Voice + 2.4 GHz WIFI	Yes		
6	UMTS 1900 Voice + 2.4 GHz WIFI	Yes		
7	UMTS 850 Voice + 5 GHz WIFI	Yes		
8	UMTS 1900 Voice + 5 GHz WIFI	Yes		
9	UMTS 850 Data + 2.4 GHz WIFI	Yes	Yes	3G Hotspot
10	UMTS 1900 Data + 2.4 GHz WIFI	Yes	Yes	3G Hotspot
11	GPRS/EDGE 850 Data + 2.4 GHz WIFI		Yes	2G Hotspot
12	GPRS/EDGE 1900 Data + 2.4 GHz WIFI		Yes	2G Hotspot
13	UMTS 850 Data + 5 GHz WIFI	Yes	Yes	5 GHz WIFI Direct
14	UMTS 1900 Data + 5 GHz WIFI	Yes	Yes	5 GHz WIFI Direct
15	GPRS/EDGE 850 Data + 5 GHz WIFI		Yes	5 GHz WIFI Direct
16	GPRS/EDGE 1900 Data + 5 GHz WIFI		Yes	5 GHz WIFI Direct
17	UMTS 850 Voice+ Bluetooth			
18	UMTS 1900 Voice+Bluetooth			
19	GSM 850 Voice+Bluetooth			
20	GSM 1900 Voice +Bluetooth			
21	UMTS 850 Data + Bluetooth		Yes	
22	UMTS 1900 Data + Bluetooth		Yes	
23	GPRS/EDGE 850 Data + Bluetooth		Yes	
24	GPRS/EDGE 1900 Data + Bluetooth		Yes	

Notes:

1. Bluetooth and 2.4 GHz WLAN and 5 GHz share the same antenna path and cannot transmit simultaneously.

Note:

1. Per FCC KDB 616217 D04 4.3, when voice mode is limited to speaker mode or headset operations only, additional SAR testing for tablet voice use is not required. Therefore Voice standalone and simultaneous combinations are not evaluated for body configurations.
2. Per the manufacturer, WIFI Direct is not expected to be used in conjunction with a held-to-ear voice call. Therefore, there are no new simultaneous transmission scenarios involving WIFI direct in held-to-ear configurations.

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1.6 SAR Test Exclusions Applied

(A) WIFI/BT

Per FCC KDB 447498 D01 v05, the SAR exclusion threshold for distances <50mm is defined by the following equation:

$$\frac{Max\ Power\ of\ Channel\ (mW)}{Test\ Separation\ Dist\ (mm)} * \sqrt{Frequency(GHz)} \leq 3.0$$

Based on the maximum conducted power of Bluetooth LE (rounded to the nearest mW) and the antenna to user separation distance, Bluetooth LE SAR was not required; [(6/5)* √2.441] = 1.9< 3.0.

This device supports 20 MHz and 40 MHz Bandwidths for IEEE 802.11n for 5 GHz WIFI only. IEEE 802.11n was not evaluated for SAR since the average output power of 20 MHz and 40 MHz bandwidths was not more than 0.25 dB higher than the average output power of IEEE 802.11a.

(B) Licensed Transmitter(s)

GSM/GPRS/EDGE DTM is not supported for US bands. Therefore, the GSM Voice modes in this report do not transmit simultaneously with GPRS/EDGE Data.

This device is only capable of QPSK HSUPA in the uplink. Therefore, no additional SAR tests are required beyond that described for devices with HSUPA in KDB 941225 D01v02.

When the user utilizes multiple services in UMTS 3G mode it uses multi-Radio Access Bearer or multi-RAB. The power control is based on a physical control channel (Dedicated Physical Control Channel [DPCCH]) and power control will be adjusted to meet the needs of both services. Therefore, the UMTS+WLAN scenario also represents the UMTS Voice/DATA + WLAN Hotspot scenario.

1.7 Guidance Applied

- IEEE 1528-2003
- FCC KDB Publication 941225 D01-D06 (2G/3G)
- FCC KDB Publication 248227 D01v01r02 (SAR Considerations for 802.11 Devices)
- FCC KDB Publication 447498 D01v05 (General SAR Guidance)
- FCC KDB Publication 865664 D01-D02 (SAR Measurements up to 6 GHz)
- FCC KDB Publication 616217 D04v01 (Tablet SAR Consideration)

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1.8 Device Serial Numbers

Several samples were used with identical hardware to support SAR testing. When the device is touching the user, the proximity sensors activate and hence the device is limited to a reduced output power level. Additional samples were used for the SAR Testing that were limited to the reduced levels (via manufacturer proprietary tools) and are indicated in the below table. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics with production units.

Mode/Band	Head Serial Number	Body Max Power Serial Number	Body Reduced Power Serial Number
GSM/GPRS/EDGE 850	R31D20MH5LN	R31D20MH5GL	R31D20MH5LN
UMTS 850	R31D20MH5JY	R31D20MH5GL	R31D20MH5LN
GSM/GPRS/EDGE 1900	R31D20MH5LN	R31D20MH5GL	R31D20MH5LN
UMTS 1900	R31D20MH5LN	R31D20MH5GL	R31D20MH5LN
2.4 GHz Bluetooth	-	R31D20MH56R	-
2.4 GHz WLAN	R31D20MH5GL	R31D20MH56R	-
5 GHz WLAN	R31D20MH56R	R31D20MH56R	-

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2 INTRODUCTION

The FCC and Industry Canada have adopted the guidelines for evaluating the environmental effects of radio frequency (RF) radiation in ET Docket 93-62 on Aug. 6, 1996 and Health Canada Safety Code 6 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices. [1]

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz [3] and Health Canada RF Exposure Guidelines Safety Code 6 [24]. The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave [4] is used for guidance in measuring the Specific Absorption Rate (SAR) due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the International Committee for Non-Ionizing Radiation Protection (ICNIRP) in Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," Report No. Vol 74. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

2.1 SAR Definition

Specific Absorption Rate is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Equation 2-1).

Equation 2-1
SAR Mathematical Equation

$$SAR = \frac{d}{dt}\left(\frac{dU}{dm}\right) = \frac{d}{dt}\left(\frac{dU}{\rho dv}\right)$$

SAR is expressed in units of Watts per Kilogram (W/kg).

$$SAR = \frac{\sigma \cdot E^2}{\rho}$$

where:

σ = conductivity of the tissue-simulating material (S/m)
ρ = mass density of the tissue-simulating material (kg/m^3)
E = Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relation to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.[6]

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3 DOSIMETRIC ASSESSMENT

3.1 Measurement Procedure

The evaluation was performed using the following procedure:

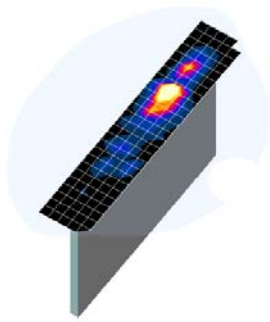

Figure 3-1
Sample SAR Area Scan

1. The SAR distribution at the exposed side of the head or body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head and body interface and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01v01 (See Table 3-1).
2. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during the 1g/10g cube evaluation. SAR at this fixed point was measured and used as a reference value.
3. Based on the area scan data, the peak of the region with maximum SAR was determined by spline interpolation. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB Publication 865664 D01v01 (See Table 3-1). On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual online for more details):

   a. The data was extrapolated to the surface of the outer-shell of the phantom. The combined distance extrapolated was the combined distance from the center of the dipoles 2.7mm away from the tip of the probe housing plus the 1.2 mm distance between the surface and the lowest measuring point. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).

   b. After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were obtained through interpolation, in order to calculate the averaged SAR.

   c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.

Table 3-1
Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01

Frequency	Maximum Area Scan Resolution (mm) (Δx_{area}, Δy_{area})	Maximum Zoom Scan Resolution (mm) (Δx_{zoom}, Δy_{zoom})	Maximum Zoom Scan Spatial Resolution (mm)			Minimum Zoom Scan Volume (mm) (x,y,z)
			Uniform Grid	Graded Grid		
			$\Delta z_{zoom}(n)$	$\Delta z_{zoom}(1)$*	$\Delta z_{zoom}(n>1)$*	
≤ 2 GHz	≤ 15	≤ 8	≤ 5	≤ 4	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 30
2-3 GHz	≤ 12	≤ 5	≤ 5	≤ 4	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 30
3-4 GHz	≤ 12	≤ 5	≤ 4	≤ 3	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 28
4-5 GHz	≤ 10	≤ 4	≤ 3	≤ 2.5	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 25
5-6 GHz	≤ 10	≤ 4	≤ 2	≤ 2	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 22

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4 DEFINITION OF REFERENCE POINTS

4.1 EAR REFERENCE POINT

Figure 4-2 shows the front, back and side views of the SAM Twin Phantom. The point "M" is the reference point for the center of the mouth, "LE" is the left ear reference point (ERP), and "RE" is the right ERP. The ERP is 15mm posterior to the entrance to the ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 4-1. The plane passing through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck-Front) is perpendicular to the reference plane and passing through the RE (or LE) is called the Reference Pivoting Line (see Figure 4-1). Line B-M is perpendicular to the N-F line. Both N-F and B-M lines are marked on the external phantom shell to facilitate handset positioning [5].

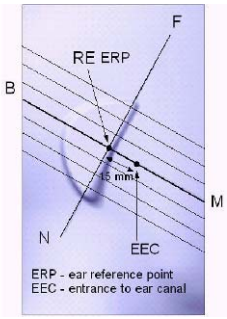

Figure 4-1
Close-Up Side view of ERP

4.2 HANDSET REFERENCE POINTS

Two imaginary lines on the handset were established: the vertical centerline and the horizontal line. The test device was placed in a normal operating position with the "test device reference point" located along the "vertical centerline" on the front of the device aligned to the "ear reference point" (See Figure 4-3). The "test device reference point" was than located at the same level as the center of the ear reference point. The test device was positioned so that the "vertical centerline" was bisecting the front surface of the handset at its top and bottom edges, positioning the "ear reference point" on the outer surface of the both the left and right head phantoms on the ear reference point.

Figure 4-2
Front, back and side view of SAM Twin Phantom

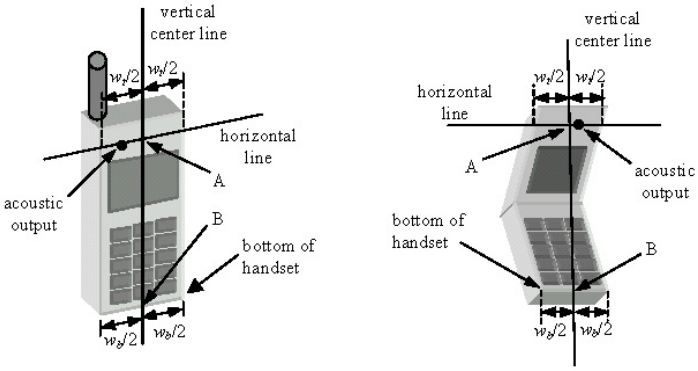

Figure 4-3
Handset Vertical Center & Horizontal Line Reference Points

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5 TEST CONFIGURATION POSITIONS FOR HANDSETS

5.1 Device Holder

The device holder is made out of low-loss POM material having the following dielectric parameters: relative permittivity ε = 3 and loss tangent δ = 0.02.

Due to the width of the grips on the device holder, the DUT could not be gripped using the standard holder grip setup but instead the device was supported by the device holder with the grips supporting the bottom of the device.

5.2 Positioning for Cheek

1. The test device was positioned with the device 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 5-1), such that the plane defined by the vertical center line and the horizontal line of the phone is approximately parallel to the sagittal plane of the phantom.

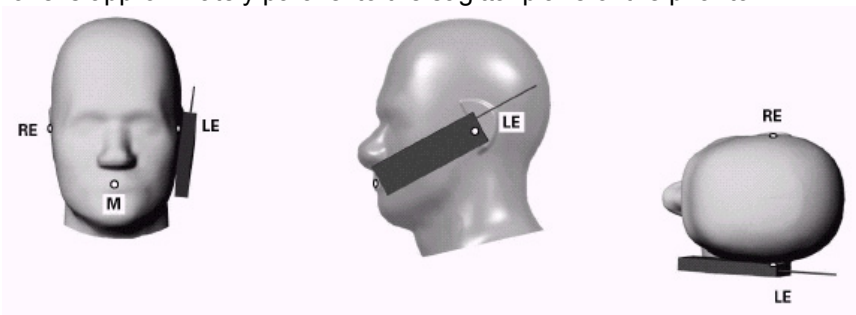

Figure 5-1 Front, Side and Top View of Cheek Position

2. The handset was translated towards the phantom along the line passing through RE & LE until the handset touches the ear.
3. While maintaining the handset in this plane, the handset was rotated around the LE-RE line until the vertical centerline was in the plane normal to MB-NF including the line MB (reference plane).
4. The phone was then rotated around the vertical centerline until the phone (horizontal line) was symmetrical was respect to the line NF.
5. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE, and maintaining the device contact with the ear, the device was rotated about the NF line until any point on the handset made contact with a phantom point below the ear (cheek) (See Figure 5-2).

5.3 Positioning for Ear / 15º Tilt

With the test device aligned in the “Cheek Position”:

1. While maintaining the orientation of the phone, the phone was retracted parallel to the reference plane far enough to enable a rotation of the phone by 15degrees.
2. The phone was then rotated around the horizontal line by 15 degrees.
3. While maintaining the orientation of the phone, the phone was moved parallel to the reference plane until any part of the handset touched the head. (In this position, point A was located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact was at any location other than the pinna, the angle of the phone would then be reduced. The tilted

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position was obtained when any part of the phone was in contact of the ear as well as a second part of the phone was in contact with the head (see Figure 5-2).

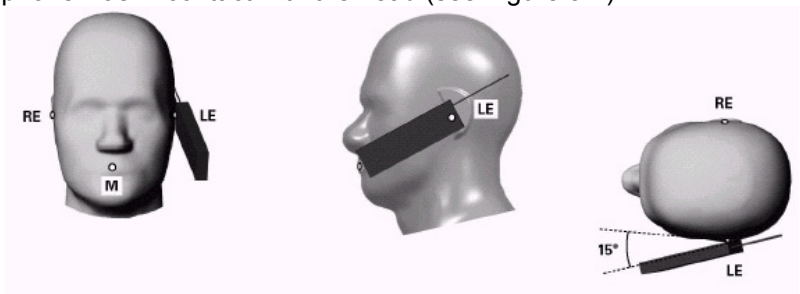

Figure 5-2 Front, Side and Top View of Ear/15º Tilt Position

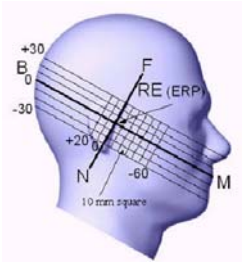

Figure 5-3
Side view w/ relevant markings

5.4 SAR Testing for Tablet per KDB Publication 616217 D04v01

This device can be used also in full sized tablet exposure conditions, due to its size. Per FCC KDB 616217, the back surface and edges of the tablet should be tested for SAR compliance with the tablet touching the phantom. The SAR Exclusion Threshold in KDB 447498 D01v05 can be applied to determine SAR test exclusion for adjacent edge configurations. The closest distance from the antenna to an adjacent tablet edge is used to determine if SAR testing is required for the adjacent edges, with the adjacent edge positioned against the phantom and the edge containing the antenna positioned perpendicular to the phantom.

5.5 Additional Test Positions due to Proximity Sensor Considerations

This device uses a proximity sensor to reduce voice/ data powers in tablet-device use conditions.

While the device is touching the user on the antenna, the proximity sensors activate and thus reduce the maximum output power allowed. However, when the device is moved beyond the sensor triggering distance, the sensors de-activate and thus maximum output power is no longer limited. Therefore, an additional exposure condition is needed in the vicinity of the triggering distance to ensure SAR is compliant when the device is allowed to operate at a non-reduced output power level.

FCC KDB 616217 D04 Section 6 was used as a guideline for selecting SAR test distances for this device at these additional exposure conditions. Since the capacitive proximity sensor activation distance for the back side and top edge of the device is 7 mm, a conservative distance of 6 mm was tested for SAR on the back side and top edge, at maximum power. Sensor triggering distance summary data is included in Appendix G. The capacitive proximity sensor does not trigger power reduction from the front of the device.

The sensor is designed to support sufficient detection range and sensitivity to cover regions of the sensors in all applicable directions since the sensor entirely covers the antenna.

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6 RF EXPOSURE LIMITS

6.1 Uncontrolled Environment

UNCONTROLLED ENVIRONMENTS are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

6.2 Controlled Environment

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). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Table 6-1
SAR Human Exposure Specified in ANSI/IEEE C95.1-1992 and Health Canada Safety Code 6

HUMAN EXPOSURE LIMITS		
	UNCONTROLLED ENVIRONMENT *General Population* (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT *Occupational* (W/kg) or (mW/g)
SPATIAL PEAK SAR Brain	1.6	8.0
SPATIAL AVERAGE SAR Whole Body	0.08	0.4
SPATIAL PEAK SAR Hands, Feet, Ankles, Wrists	4.0	20

1. The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.
2. The Spatial Average value of the SAR averaged over the whole body.
3. The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

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7 FCC MEASUREMENT PROCEDURES

Power measurements were performed using a base station simulator under digital average power.

7.1 Measured and Reported SAR

Per FCC KDB Publication 447498 D01v05, When SAR is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance. For simultaneous transmission, the measured aggregate SAR must be scaled according to the sum of the differences between the maximum tune-up tolerance and actual power used to test each transmitter. When SAR is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as *reported* SAR. The highest *reported* SAR results are identified on the grant of equipment authorization according to procedures in KDB 690783 D01v01r02.

7.2 Procedures Used to Establish RF Signal for SAR

The following procedures are according to FCC KDB Publication 941225 D01 “SAR Measurement Procedures for 3G Devices” v02, October 2007.

The device was placed into a simulated call using a base station simulator in a RF shielded chamber. Establishing connections in this manner ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. Devices under test were evaluated prior to testing, with a fully charged battery and were configured to operate at maximum output power. In order to verify that the device was tested throughout the SAR test at maximum output power, the SAR measurement system measures a “point SAR” at an arbitrary reference point at the start and end of the 1 gram SAR evaluation, to assess for any power drifts during the evaluation. If the power drift deviated by more than 5%, the SAR test and drift measurements were repeated.

7.3 SAR Measurement Conditions for UMTS

7.3.1 Output Power Verification

Maximum output power is measured on the High, Middle and Low channels for each applicable transmission band according to the general descriptions in section 5.2 of 3GPP TS 34.121, using the appropriate RMC or AMR with TPC (transmit power control) set to all “1s”.

Maximum output power is verified on the High, Middle and Low channels according to the general descriptions in section 5.2 of 3GPP TS 34.121 (release 5), using the appropriate RMC with TPC (transmit power control) set to all “1s” or applying the required inner loop power control procedures to maintain maximum output power while HSUPA is active. Results for all applicable physical channel configurations (DPCCH, DPDCHn and spreading codes, HS-DPCCH etc) are tabulated in this test report. All configurations that are not supported by the DUT or cannot be measured due to technical or equipment limitations are identified.

7.3.2 Head SAR Measurements for Handsets

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 0.25 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 (signaling radio bearer) using the exposure configuration that resulted in the highest SAR for that RF channel in the 12.2 kbps RMC mode.

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7.3.3 Body SAR Measurements

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits all "1s".

7.3.4 Procedures Used to Establish RF Signal for SAR HSDPA Data Devices

The following procedures are applicable to HSDPA data devices operating under 3GPP Release 5. Body exposure conditions are typically applicable to these devices, including handsets and data modems operating in various electronic devices. HSDPA operates in conjunction with UMTS and requires an active DPCCH. The default test configuration is to measure SAR in UMTS without HSDPA, with an established radio link between the DUT and a communication test set with 12.2 kbps RMC mode configured in Test Loop Mode 1; and tested with HSDPA with FRC and a 12.2 kbps RMC using the highest SAR configuration in UMTS. SAR is selectively confirmed for other physical channel configurations according to output power, exposure conditions and device operating capabilities. Maximum output power is verified according to 3GPP TS 23.121 (Release 5) and SAR must be measured according to these maximum output conditions.

7.3.5 SAR Measurement Conditions for HSUPA Data Devices

SAR for body exposure configurations are measured according to the 'Body SAR Measurements' procedures in the 'WCDMA Handsets' section of the KDB 941225 D01 FCC 3G document. In addition, Body SAR is also measured for HSPA when the maximum average output of each RF channel with HSPA active is at least ¼ dB higher of that measured without HSPA in 12.2 kbps RMC mode or the maximum SAR for 12.2 kbps RMC is above 75% of the SAR limit. Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 with power control algorithm 2, according to the highest body SAR configuration in 12.2 kbps RMC without HSPA. When VOIP is applicable for head exposure, SAR is not required when the maximum output of each RF channel with HSPA is less than ¼ dB higher than that measured using 12.2 kbps RMC; otherwise, the same HSPA configuration used for body measurements should be used to test for head exposure.

Due to inner loop power control requirements in HSPA, a commercial communication test set should be used for the output power and SAR tests. The 12.2 kbps RMC, FRC H-set 1 and EDCH configurations for HSPA should be configured according to the β values indicated below as well as other applicable procedures described in the 'WCDMA Handset' and 'Release 5 HSDPA Data Devices' sections of the FCC 3G document.

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

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

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7.4 SAR Testing with 802.11 Transmitters

Normal network operating configurations are not suitable for measuring the SAR of 802.11 a/b/g/n transmitters. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable. See KDB Publication 248227 D01v01r02 for more details.

7.4.1 General Device Setup

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

7.4.2 Frequency Channel Configurations [27]

For 2.4 GHz, the highest average RF output power channel between the low, mid and high channel at the lowest data rate was selected for SAR evaluation in 802.11b mode. 802.11g/n modes and higher data rates for 802.11b were additionally evaluated for SAR if the output power of the respective mode was 0.25 dB or higher than the powers of the SAR configurations tested in the 802.11b mode.

For 5 GHz, the highest average RF output power channel across the default test channels at the lowest data rate was selected for SAR evaluation in 802.11a. When the adjacent channels are higher in power then the default channels, these “required channels” were considered instead of the default channels for SAR testing. 802.11n modes and higher data rates for 802.11a/n were evaluated only if the respective mode was 0.25 dB or higher than the 802.11a mode.

If the maximum extrapolated peak SAR of the zoom scan for the highest output channel was less than 1.6 W/kg or if the 1g averaged SAR was less than 0.8 W/kg, SAR testing was not required for the other test channels in the band.

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8 RF CONDUCTED POWERS

8.1 GSM Conducted Powers

Table 8-1
Reduced GSM/GPRS Average RF Conducted Powers
(Representing either Capacitive Sensor or IR Sensor Active)

		Maximum Burst-Averaged Output Power								
		Voice	*GPRS/EDGE Data (GMSK)*				*EDGE Data (8-PSK)*			
Band	**Channel**	**GSM [dBm] CS (1 Slot)**	**GPRS [dBm] 1 Tx Slot**	**GPRS [dBm] 2 Tx Slot**	**GPRS [dBm] 3 Tx Slot**	**GPRS [dBm] 4 Tx Slot**	**EDGE [dBm] 1 Tx Slot**	**EDGE [dBm] 2 Tx Slot**	**EDGE [dBm] 3 Tx Slot**	**EDGE [dBm] 4 Tx Slot**
GSM 850	128	27.78	27.81	**25.35**	21.87	20.35	23.27	21.77	20.16	18.46
	190	27.93	27.94	**25.47**	21.96	20.48	23.47	21.89	20.27	18.60
	251	28.07	28.05	**25.54**	22.11	20.63	23.50	21.98	20.40	18.74
GSM 1900	512	22.84	22.85	19.86	18.33	**17.34**	21.61	19.24	17.81	16.75
	661	22.84	22.84	19.88	18.37	**17.36**	21.60	19.24	17.76	16.72
	810	22.90	22.94	19.96	18.45	**17.44**	21.72	19.33	17.86	16.81
		Calculated Maximum Frame-Averaged Output Power								
		Voice	*GPRS/EDGE Data (GMSK)*				*EDGE Data (8-PSK)*			
Band	**Channel**	**GSM [dBm] CS (1 Slot)**	**GPRS [dBm] 1 Tx Slot**	**GPRS [dBm] 2 Tx Slot**	**GPRS [dBm] 3 Tx Slot**	**GPRS [dBm] 4 Tx Slot**	**EDGE [dBm] 1 Tx Slot**	**EDGE [dBm] 2 Tx Slot**	**EDGE [dBm] 3 Tx Slot**	**EDGE [dBm] 4 Tx Slot**
GSM 850	128	18.75	18.78	**19.33**	17.61	17.34	14.24	15.75	15.90	15.45
	190	18.90	18.91	**19.45**	17.70	17.47	14.44	15.87	16.01	15.59
	251	19.04	19.02	**19.52**	17.85	17.62	14.47	15.96	16.14	15.73
GSM 1900	512	13.81	13.82	13.84	14.07	**14.33**	12.58	13.22	13.55	13.74
	661	13.81	13.81	13.86	14.11	**14.35**	12.57	13.22	13.50	13.71
	810	13.87	13.91	13.94	14.19	**14.43**	12.69	13.31	13.60	13.80

Table 8-2
Maximum GSM/GPRS Average RF Conducted Powers
(Representing both Capacitive Sensor and IR Sensor Inactive)

		Maximum Burst-Averaged Output Power								
		Voice	*GPRS/EDGE Data (GMSK)*				*EDGE Data (8-PSK)*			
Band	**Channel**	**GSM [dBm] CS (1 Slot)**	**GPRS [dBm] 1 Tx Slot**	**GPRS [dBm] 2 Tx Slot**	**GPRS [dBm] 3 Tx Slot**	**GPRS [dBm] 4 Tx Slot**	**EDGE [dBm] 1 Tx Slot**	**EDGE [dBm] 2 Tx Slot**	**EDGE [dBm] 3 Tx Slot**	**EDGE [dBm] 4 Tx Slot**
GSM 850	128	32.96	32.93	**30.49**	26.99	25.56	26.87	26.70	25.65	23.68
	190	32.78	32.77	**30.44**	26.91	25.48	26.82	26.65	25.62	23.61
	251	32.82	32.81	**30.46**	26.94	25.50	26.86	26.75	25.70	23.70
GSM 1900	512	29.73	**29.84**	25.82	24.33	22.84	25.89	25.90	25.05	23.16
	661	29.71	**29.82**	25.81	24.30	22.83	25.92	25.86	25.03	23.17
	810	29.78	**29.92**	25.89	24.40	22.91	25.99	25.97	25.01	23.22

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		Calculated Maximum Frame-Averaged Output Power								
		Voice	*GPRS/EDGE Data (GMSK)*				*EDGE Data (8-PSK)*			
Band	**Channel**	**GSM [dBm] CS (1 Slot)**	**GPRS [dBm] 1 Tx Slot**	**GPRS [dBm] 2 Tx Slot**	**GPRS [dBm] 3 Tx Slot**	**GPRS [dBm] 4 Tx Slot**	**EDGE [dBm] 1 Tx Slot**	**EDGE [dBm] 2 Tx Slot**	**EDGE [dBm] 3 Tx Slot**	**EDGE [dBm] 4 Tx Slot**
GSM 850	128	23.93	23.90	**24.47**	22.73	22.55	17.84	20.68	21.39	20.67
	190	23.75	23.74	**24.42**	22.65	22.47	17.79	20.63	21.36	20.60
	251	23.79	23.78	**24.44**	22.68	22.49	17.83	20.73	21.44	20.69
GSM 1900	512	20.70	**20.81**	19.80	20.07	19.83	16.86	19.88	20.79	20.15
	661	20.68	**20.79**	19.79	20.04	19.82	16.89	19.84	20.77	20.16
	810	20.75	**20.89**	19.87	20.14	19.90	16.96	19.95	20.75	20.21

Note:

1. Both burst-averaged and calculated frame-averaged powers are included. Frame-averaged power was calculated from the measured burst-averaged power by converting the slot powers into linear units and calculating the energy over 8 timeslots.

2. The bolded GPRS modes were selected for SAR testing according to the highest frame-averaged output power table according to KDB 941225 D03v01.

3. GPRS/EDGE (GMSK) output powers were measured with coding scheme setting of 1 (CS1) on the base station simulator. CS1 was configured to measure GPRS output power measurements and SAR to ensure GMSK modulation in the signal. Our Investigation has shown that CS1 - CS4 settings do not have any impact on the output levels or modulation in the GPRS modes.

4. EDGE (8-PSK) output powers were measured with MCS7 on the base station simulator. MCS7 coding scheme was used to measure the output powers for EDGE since investigation has shown that choosing MCS7 coding scheme will ensure 8-PSK modulation. It has been shown that MCS levels that produce 8PSK modulation do not have an impact on output power.

5. This device does not support evolved EDGE (eEDGE)

GSM Class: B
GPRS Multislot class: 33 (Max 4 Tx uplink slots)
EDGE Multislot class: 33 (Max 4 Tx uplink slots)
DTM Multislot Class: N/A

Figure 8-1
Power Measurement Setup

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8.2 UMTS Conducted Powers

Table 8-3
Reduced UMTS Average RF Conducted Powers
(Representing either Capacitive Sensor or IR Sensor Active)

3GPP Release Version	Mode	3GPP 34.121 Subtest	Cellular Band [dBm]			PCS Band [dBm]			3GPP MPR [dB]
			4132	4183	4233	9262	9400	9538	
99	WCDMA	12.2 kbps RMC	17.40	17.24	17.23	15.15	15.06	15.19	-
99		12.2 kbps AMR	17.49	17.26	17.30	15.16	15.12	15.17	-
6	HSDPA	Subtest 1	17.37	17.32	17.19	15.02	15.13	15.01	0
6		Subtest 2	17.17	17.04	16.94	14.82	14.80	14.81	0
6		Subtest 3	16.90	16.73	16.69	14.62	14.65	14.62	0.5
6		Subtest 4	16.60	16.43	16.48	14.50	14.36	14.36	0.5
6	HSUPA	Subtest 1	16.31	16.20	16.19	13.81	13.80	13.98	0
6		Subtest 2	15.50	15.50	15.48	12.37	12.45	12.57	2
6		Subtest 3	16.31	16.28	16.15	13.60	13.52	13.68	1
6		Subtest 4	15.50	15.35	15.39	12.54	12.59	12.60	2
6		Subtest 5	17.36	17.23	17.15	14.82	14.76	14.87	0

Table 8-4
Maximum UMTS Average RF Conducted Powers
(Representing both Capacitive Sensor and IR Sensor Inactive)

3GPP Release Version	Mode	3GPP 34.121 Subtest	Cellular Band [dBm]			PCS Band [dBm]			3GPP MPR [dB]
			4132	4183	4233	9262	9400	9538	
99	WCDMA	12.2 kbps RMC	23.43	23.20	23.16	22.46	22.45	22.42	-
99		12.2 kbps AMR	23.32	23.16	23.12	22.39	22.43	22.37	-
6	HSDPA	Subtest 1	23.44	23.24	23.13	22.27	22.28	22.25	0
6		Subtest 2	22.65	22.50	22.40	22.01	22.00	21.98	0
6		Subtest 3	22.44	22.24	22.15	21.81	21.78	21.77	0.5
6		Subtest 4	22.02	22.00	21.85	21.85	21.88	21.91	0.5
6	HSUPA	Subtest 1	22.42	22.50	22.49	22.25	22.33	21.89	0
6		Subtest 2	20.43	20.16	20.30	20.50	20.47	20.36	2
6		Subtest 3	21.27	21.13	21.19	21.31	21.30	21.39	1
6		Subtest 4	20.72	20.62	20.51	20.94	21.04	21.10	2
6		Subtest 5	22.31	22.50	22.30	22.16	22.20	22.48	0

Note:

1. UMTS SAR was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v02. HSPA SAR was not required since the average output power of the HSPA subtests was not more than 0.25 dB higher than the RMC level and SAR was less than 1.2 W/kg.
2. This device does not support DC-HSDPA.
3. It is expected by the manufacturer that MPR for some HSUPA subtests may be up to 2 dB more than specified by 3GPP, but also as low as 0 dB according to the chipset implementation in this model.

Figure 8-2
Power Measurement Setup

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8.3 BT/WLAN Conducted Powers

Table 8-5
IEEE 802.11b Average RF Power

Mode	Freq	Channel	802.11b (2.4 GHz) Conducted Power [dBm]			
			Data Rate [Mbps]			
	[MHz]		1	2	5.5	11
802.11b	2412	1*	**16.08**	16.07	16.11	16.17
802.11b	2437	6*	**16.17**	16.19	16.27	16.10
802.11b	2462	11*	**16.21**	16.17	16.21	16.17

Table 8-6
IEEE 802.11g Average RF Power

Mode	Freq	Channel	802.11g (2.4 GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
	[MHz]		6	9	12	18	24	36	48	54
802.11g	2412	1	11.63	11.60	11.53	11.58	11.65	11.57	11.57	11.54
802.11g	2437	6	11.67	11.68	11.66	11.63	11.74	11.71	11.69	11.65
802.11g	2462	11	11.75	11.66	11.73	11.75	11.74	11.66	11.71	11.67

Table 8-7
IEEE 802.11n Average RF Power

Mode	Freq	Channel	802.11n (2.4 GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
	[MHz]		6.5	13	20	26	39	52	58	65
802.11n	2412	1	10.42	10.34	10.45	10.37	10.37	10.38	10.42	10.36
802.11n	2437	6	10.44	10.52	10.52	10.45	10.46	10.60	10.41	10.55
802.11n	2462	11	10.57	10.54	10.51	10.51	10.47	10.50	10.52	10.52

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Table 8-8
IEEE 802.11a Average RF Power

Mode	Freq	Channel	802.11a (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
	[MHz]		6	9	12	18	24	36	48	54
802.11a	5180	36*	8.10	8.03	7.98	8.09	7.98	8.01	7.94	7.94
802.11a	5200	40	8.06	7.98	7.92	8.05	7.88	7.95	7.88	7.95
802.11a	5220	44	8.15	7.99	7.96	8.09	7.92	8.00	7.95	8.02
802.11a	5240	48*	**8.23**	8.11	8.07	8.11	8.02	8.07	8.04	8.05
802.11a	5260	52*	8.16	8.15	8.14	8.13	8.14	8.04	7.96	7.93
802.11a	5280	56	8.22	8.21	8.20	8.11	8.13	8.08	8.01	7.98
802.11a	5300	60	8.19	8.18	8.17	8.10	8.15	8.09	7.96	8.03
802.11a	5320	64*	**8.31**	8.28	8.29	8.21	8.17	8.17	8.11	8.15
802.11a	5500	100	8.23	8.24	8.17	8.10	8.04	8.14	8.04	8.02
802.11a	5520	104*	8.31	8.30	8.28	8.30	8.13	8.24	8.15	8.11
802.11a	5540	108	**8.35**	8.33	8.32	8.32	8.22	8.30	8.23	8.15
802.11a	5560	112	8.42	8.36	8.35	8.40	8.32	8.38	8.33	8.26
802.11a	5580	116*	**8.54**	8.46	8.43	8.41	8.33	8.32	8.36	8.31
802.11a	5600	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11a	5620	124	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11a	5640	128	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11a	5660	132	8.65	8.61	8.57	8.48	8.45	8.47	8.51	8.44
802.11a	5680	136*	**8.76**	8.71	8.70	8.67	8.65	8.71	8.68	8.66
802.11a	5700	140	8.75	8.71	8.68	8.71	8.61	8.66	8.65	8.64
802.11a	5745	149*	**8.59**	8.55	8.58	8.56	8.44	8.49	8.42	8.41
802.11a	5765	153	8.57	8.55	8.40	8.45	8.48	8.36	8.42	8.32
802.11a	5785	157*	**8.62**	8.51	8.50	8.44	8.50	8.51	8.53	8.50
802.11a	5805	161*	8.62	8.61	8.56	8.54	8.58	8.48	8.45	8.43
802.11a	5825	165	**8.67**	8.65	8.66	8.64	8.60	8.58	8.56	8.58

Per FCC KDB Publication 443999 and RSS-210 A9.2(3), transmission on channels which overlap the 5600-5650 MHz is prohibited as a client. This device does not transmit any beacons or initiate any transmissions in 5.3 and 5.5 GHz Band.

(*) – indicates default channels per KDB Publication 248227 D01v01r02. When the adjacent channels are higher in power then the default channels, these “required channels” are considered for SAR testing instead of the default channels.

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Table 8-9
IEEE 802.11n Average RF Power – 20 MHz Bandwidth

Mode	Freq	Channel	20MHz BW 802.11n (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
	[MHz]		6.5	13	20	26	39	52	58	65
802.11n	5180	36	8.05	8.02	8.04	7.98	8.00	8.04	7.92	7.86
802.11n	5200	40	8.04	8.01	7.98	8.03	7.98	7.95	8.00	7.94
802.11n	5220	44	7.92	7.87	7.89	7.78	7.91	7.81	7.79	7.78
802.11n	5240	48	7.97	7.95	7.93	7.91	7.90	7.88	7.82	7.81
802.11n	5260	52	7.99	7.97	7.98	7.96	7.95	7.91	7.93	7.90
802.11n	5280	56	8.02	8.01	8.00	7.96	7.98	7.92	7.91	8.01
802.11n	5300	60	8.04	8.00	7.96	7.93	8.02	7.99	7.97	7.96
802.11n	5320	64	8.05	8.03	8.01	7.98	7.94	8.00	8.01	8.02
802.11n	5500	100	7.55	7.54	7.51	7.49	7.50	7.48	7.45	7.49
802.11n	5520	104	7.50	7.49	7.45	7.40	7.39	7.35	7.33	7.30
802.11n	5540	108	7.57	7.55	7.52	7.56	7.52	7.50	7.52	7.49
802.11n	5560	112	7.61	7.59	7.48	7.54	7.50	7.55	7.53	7.52
802.11n	5580	116	7.63	7.58	7.62	7.61	7.58	7.61	7.58	7.59
802.11n	5600	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5620	124	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5640	128	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5660	132	7.83	7.81	7.78	7.73	7.69	7.67	7.67	7.66
802.11n	5680	136	7.90	7.89	7.86	7.85	7.81	7.80	7.74	7.72
802.11n	5700	140	7.92	7.91	7.89	7.86	7.82	7.80	7.71	7.70
802.11n	5745	149	7.78	7.75	7.68	7.77	7.68	7.69	7.76	7.64
802.11n	5765	153	7.76	7.71	7.74	7.74	7.69	7.70	7.68	7.65
802.11n	5785	157	7.86	7.83	7.84	7.85	7.84	7.82	7.82	7.81
802.11n	5805	161	7.84	7.83	7.81	7.80	7.79	7.82	7.78	7.83
802.11n	5825	165	7.93	7.91	7.89	7.87	7.87	7.86	7.81	7.73

Table 8-10
IEEE 802.11n Average RF Power – 40 MHz Bandwidth

Mode	Freq	Channel	40MHz BW 802.11n (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
	[MHz]		13.5/15	27/30	40.5/45	54/60	81/90	108/120	121.5/135	135/150
802.11n	5190	38	8.17	8.15	8.13	8.11	8.05	8.09	8.08	7.96
802.11n	5230	46	8.02	8.00	8.01	7.96	7.98	8.00	7.99	8.00
802.11n	5270	54	8.02	8.00	7.97	7.86	7.91	7.88	7.84	7.82
802.11n	5310	62	8.04	7.97	7.98	7.90	7.92	7.89	7.88	7.87
802.11n	5510	102	7.51	7.50	7.49	7.42	7.43	7.42	7.36	7.30
802.11n	5550	110	7.61	7.58	7.57	7.54	7.52	7.48	7.40	7.38
802.11n	5590	118	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5630	126	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5670	134	7.92	7.87	7.86	7.81	7.73	7.74	7.74	7.73
802.11n	5755	151	7.86	7.84	7.81	7.80	7.74	7.68	7.57	7.54
802.11n	5795	159	7.97	7.95	7.94	7.89	7.82	7.81	7.74	7.72

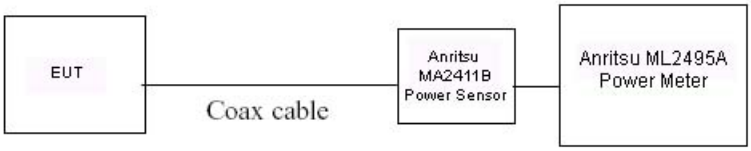

Figure 8-3
Power Measurement Setup

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Table 8-11
Bluetooth RF Conducted Powers

Frequency [MHz]	Data Rate [Mbps]	Channel No.	Peak Conducted Power		Avg Conducted Power	
			[dBm]	[mW]	[dBm]	[mW]
2402	1.0	0	11.34	13.614	**11.25**	**13.323**
2441	1.0	39	11.08	12.832	10.97	12.515
2480	1.0	78	10.80	12.020	10.66	11.644
2402	2.0	0	11.05	12.732	9.10	8.124
2441	2.0	39	11.08	12.826	8.96	7.876
2480	2.0	78	10.67	11.663	8.28	6.730
2402	3.0	0	11.45	13.967	9.17	8.264
2441	3.0	39	11.32	13.558	9.04	8.017
2480	3.0	78	10.99	12.572	8.42	6.945

Table 8-12
Bluetooth LE RF Conducted Powers

Frequency [MHz]	Channel No.	Bluetooth Mode	Peak Conducted Power		Average Conducted Power	
			[dBm]	[mW]	[dBm]	[mW]
2402	0	LE	8.59	7.224	6.58	4.548
2440	19	LE	9.04	8.019	7.03	5.048
2480	39	LE	8.76	7.523	6.75	4.736

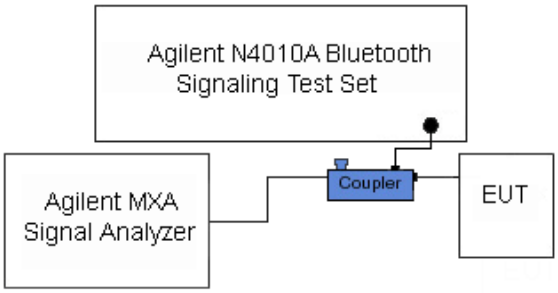

Figure 8-4
Power Measurement Setup

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Justification for reduced test configurations for BT/WIFI channels per KDB Publication 248227 D01v01r02 and October 2012 FCC/TCB Meeting Notes:

- For 2.4 GHz, highest average RF output power channel for the lowest data rate for IEEE 802.11b were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11g/n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode.
- For 5 GHz, highest average RF output power channel for the lowest data rate for IEEE 802.11a were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11n 20 MHz and 40 MHz) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11a mode.
- When the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is <1.6 W/kg and the reported 1g averaged SAR is <0.8 W/kg, SAR testing on other channels is not required. Otherwise, the other default (or corresponding required) test channels were additionally tested using the lowest data rate.
- The bolded data rate and channel above were tested for SAR.
- Previous Conducted Powers data from the device of FCC ID: A3LGTN5100 (S/N: 0Y1212201834-R1.A3L) with respect to 2.4 GHz WLAN, 5 GHz WLAN and Bluetooth modes remain unchanged, and therefore they were reused for current application.

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9 SYSTEM VERIFICATION

9.1 Tissue Verification

Table 9-1
Measured Tissue Properties

Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (C˚)	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ε	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ε	% dev σ	% dev ε
02/25/2013	835H	20.9	820	0.905	41.527	0.898	41.571	0.78%	-0.11%
			835	0.919	41.356	0.900	41.500	2.11%	-0.35%
			850	0.930	41.202	0.916	41.500	1.53%	-0.72%
02/20/2013	1900H	23.8	1850	1.395	40.628	1.400	40.000	-0.36%	1.57%
			1880	1.425	40.521	1.400	40.000	1.79%	1.30%
			1910	1.454	40.398	1.400	40.000	3.86%	1.00%
02/20/2013	2450H	23.7	2401	1.812	38.296	1.758	39.298	3.07%	-2.55%
			2450	1.862	38.106	1.800	39.200	3.44%	-2.79%
			2499	1.927	37.910	1.852	39.135	4.05%	-3.13%
02/26/2013	5200 - 5800H	24.1	5200	4.660	37.213	4.660	36.000	0.00%	3.37%
			5240	4.711	37.102	4.700	35.960	0.23%	3.18%
			5300	4.792	36.891	4.760	35.900	0.67%	2.76%
			5320	4.810	36.902	4.780	35.880	0.63%	2.85%
			5500	5.037	36.499	4.965	35.650	1.45%	2.38%
			5600	5.166	36.191	5.070	35.500	1.89%	1.95%
			5680	5.257	35.974	5.150	35.420	2.08%	1.56%
			5800	5.403	35.682	5.270	35.300	2.52%	1.08%
			5825	5.431	35.637	5.296	35.275	2.55%	1.03%
02/22/2013	835B	23.1	820	0.979	55.567	0.969	55.258	1.03%	0.56%
			835	1.001	55.060	0.970	55.200	3.20%	-0.25%
			850	1.020	54.659	0.988	55.154	3.24%	-0.90%
02/27/2013	835B	23.9	820	0.991	53.360	0.969	55.258	2.27%	-3.43%
			835	1.005	53.209	0.970	55.200	3.61%	-3.61%
			850	1.019	53.080	0.988	55.154	3.14%	-3.76%
02/21/2013	1900B	23.8	1850	1.511	51.060	1.520	53.300	-0.59%	-4.20%
			1880	1.535	50.992	1.520	53.300	0.99%	-4.33%
			1910	1.575	50.849	1.520	53.300	3.62%	-4.60%
02/25/2013	1900B	20.3	1850	1.491	51.176	1.520	53.300	-1.91%	-3.98%
			1880	1.519	51.175	1.520	53.300	-0.07%	-3.99%
			1910	1.544	50.923	1.520	53.300	1.58%	-4.46%
02/20/2013	2450B	24.5	2401	1.923	51.233	1.903	52.765	1.05%	-2.90%
			2450	1.982	51.037	1.950	52.700	1.64%	-3.16%
			2499	2.055	50.823	2.019	52.638	1.78%	-3.45%
03/04/2013	2450B	23.0	2401	1.915	51.521	1.903	52.765	0.63%	-2.36%
			2450	1.977	51.362	1.950	52.700	1.38%	-2.54%
			2499	2.042	51.164	2.019	52.638	1.14%	-2.80%
02/27/2013	5200 - 5800B	22.5	5200	5.346	47.630	5.299	49.014	0.89%	-2.82%
			5240	5.396	47.567	5.346	48.933	0.94%	-2.79%
			5300	5.472	47.464	5.416	48.851	1.03%	-2.84%
			5320	5.494	47.426	5.439	48.607	1.01%	-2.43%
			5500	5.732	47.135	5.650	48.580	1.45%	-2.97%
			5540	5.784	47.129	5.696	48.526	1.54%	-2.88%
			5580	5.854	47.031	5.743	48.471	1.93%	-2.97%
			5600	5.848	46.974	5.766	48.444	1.42%	-3.03%
			5680	5.977	46.895	5.860	48.336	2.00%	-2.98%
			5745	6.069	46.775	5.936	48.248	2.24%	-3.05%
			5785	6.111	46.589	5.982	48.242	2.16%	-3.43%
			5800	6.147	46.555	6.000	48.200	2.45%	-3.41%
			5825	6.192	46.611	6.029	48.132	2.70%	-3.16%

The above measured tissue parameters were used in the DASY software. The DASY software was used to perform interpolation to determine the dielectric parameters at the SAR test device frequencies (per IEEE 1528 6.6.1.2). The tissue parameters listed in the SAR test plots may slightly differ from the table above due to significant digit rounding in the software.

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9.2 Test System Verification

Prior to SAR assessment, the system is verified to ±10% of the SAR measurement on the reference dipole at the time of calibration by the calibration facility. Full system validation status and result summary can be found in Appendix E.

Table 9-2
System Verification Results

System Verification TARGET & MEASURED											
Tissue Frequency (MHz)	Tissue Type	Date:	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Dipole SN	Probe SN	Measured SAR_{1g} (W/kg)	1 W Target SAR_{1g} (W/kg)	1 W Normalized SAR_{1g} (W/kg)	Deviation (%)
835	HEAD	02/25/2013	20.8	21.2	0.100	4d132	3213	1.010	9.660	10.100	4.55%
1900	HEAD	02/20/2013	23.9	23.5	0.100	5d149	3288	3.940	39.300	39.400	0.25%
2450	HEAD	02/20/2013	24.5	23.5	0.100	719	3022	5.380	52.700	53.800	2.09%
5200	HEAD	02/26/2013	24.2	23.4	0.100	1057	3589	7.400	75.900	74.000	-2.50%
5300	HEAD	02/26/2013	24.2	23.5	0.100	1057	3589	7.160	76.900	71.600	-6.89%
5500	HEAD	02/26/2013	24.2	23.5	0.100	1057	3589	7.430	80.100	74.300	-7.24%
5600	HEAD	02/26/2013	24.3	23.6	0.100	1057	3589	7.930	80.400	79.300	-1.37%
5800	HEAD	02/26/2013	24.3	23.6	0.100	1057	3589	7.330	76.100	73.300	-3.68%
835	BODY	02/22/2013	24.8	23.2	0.100	4d026	3287	1.010	9.580	10.100	5.43%
835	BODY	02/27/2013	24.6	23.9	0.100	4d119	3287	1.000	9.560	10.000	4.60%
1900	BODY	02/21/2013	24.1	22.3	0.100	5d149	3288	3.920	39.300	39.200	-0.25%
1900	BODY	02/25/2013	22.3	20.3	0.100	5d148	3288	3.930	40.800	39.300	-3.68%
2450	BODY	02/20/2013	24.2	22.9	0.040	797	3263	1.980	49.600	49.500	-0.20%
2450	BODY	03/04/2013	23.8	22.1	0.100	719	3287	4.910	51.600	49.100	-4.84%
5200	BODY	02/27/2013	23.9	22.7	0.100	1057	3589	7.140	75.500	71.400	-5.43%
5300	BODY	02/27/2013	23.7	22.6	0.100	1057	3589	7.340	75.300	73.400	-2.52%
5500	BODY	02/27/2013	23.8	22.6	0.100	1057	3589	7.770	80.800	77.700	-3.84%
5600	BODY	02/27/2013	24.1	22.8	0.100	1057	3589	8.370	80.300	83.700	4.23%
5800	BODY	02/27/2013	24.2	22.8	0.100	1057	3589	7.300	75.100	73.000	-2.80%

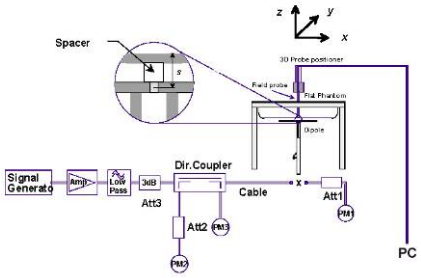

Figure 9-1
System Verification Setup Diagram

Figure 9-2
System Verification Setup Photo

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10 SAR DATA SUMMARY

10.1 Standalone Head SAR Data

Table 10-1
GSM 850 Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
836.60	190	GSM 850	GSM	28.5	27.93	0.10	Right	Cheek	R31D20MH5LN	1:8.3	0.644	1.140	**0.734**	A1
836.60	190	GSM 850	GSM	28.5	27.93	0.14	Right	Tilt	R31D20MH5LN	1:8.3	0.579	1.140	0.660	
836.60	190	GSM 850	GSM	28.5	27.93	0.07	Left	Cheek	R31D20MH5LN	1:8.3	0.232	1.140	0.265	
836.60	190	GSM 850	GSM	28.5	27.93	-0.05	Left	Tilt	R31D20MH5LN	1:8.3	0.258	1.140	0.294	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							**Head 1.6 W/kg (mW/g)** averaged over 1 gram							

Table 10-2
UMTS 850 Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
836.60	4183	UMTS 850	RMC	17.5	17.24	0.08	Right	Cheek	R31D20MH5JY	1:1	0.341	1.062	0.362	A2
836.60	4183	UMTS 850	RMC	17.5	17.24	0.05	Right	Tilt	R31D20MH5JY	1:1	0.335	1.062	0.356	
836.60	4183	UMTS 850	RMC	17.5	17.24	0.03	Left	Cheek	R31D20MH5JY	1:1	0.115	1.062	0.122	
836.60	4183	UMTS 850	RMC	17.5	17.24	0.05	Left	Tilt	R31D20MH5JY	1:1	0.120	1.062	0.127	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							**Head 1.6 W/kg (mW/g)** averaged over 1 gram							

Table 10-3
GSM 1900 Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
1880.00	661	GSM 1900	GSM	23.5	22.84	0.02	Right	Cheek	R31D20MH5LN	1:8.3	0.175	1.164	0.204	A3
1880.00	661	GSM 1900	GSM	23.5	22.84	0.05	Right	Tilt	R31D20MH5LN	1:8.3	0.120	1.164	0.140	
1880.00	661	GSM 1900	GSM	23.5	22.84	0.11	Left	Cheek	R31D20MH5LN	1:8.3	0.052	1.164	0.060	
1880.00	661	GSM 1900	GSM	23.5	22.84	-0.04	Left	Tilt	R31D20MH5LN	1:8.3	0.046	1.164	0.053	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							**Head 1.6 W/kg (mW/g)** averaged over 1 gram							

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Table 10-4
UMTS 1900 Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
1880.00	9400	UMTS 1900	RMC	15.5	15.06	-0.03	Right	Cheek	R31D20MH5LN	1:1	0.452	1.107	0.500	
1880.00	9400	UMTS 1900	RMC	15.5	15.06	-0.04	Right	Tilt	R31D20MH5LN	1:1	0.456	1.107	0.505	A4
1880.00	9400	UMTS 1900	RMC	15.5	15.06	0.11	Left	Cheek	R31D20MH5LN	1:1	0.120	1.107	0.133	
1880.00	9400	UMTS 1900	RMC	15.5	15.06	0.04	Left	Tilt	R31D20MH5LN	1:1	0.115	1.107	0.127	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram							

Table 10-5
DTS Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Data Rate (Mbps)	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
2462	11	IEEE 802.11b	DSSS	16.5	16.21	0.15	Right	Cheek	R31D20MH5GL	1	1:1	0.098	1.069	0.105	
2462	11	IEEE 802.11b	DSSS	16.5	16.21	-0.06	Right	Tilt	R31D20MH5GL	1	1:1	0.134	1.069	0.143	
2462	11	IEEE 802.11b	DSSS	16.5	16.21	0.11	Left	Cheek	R31D20MH5GL	1	1:1	0.414	1.069	0.443	
2462	11	IEEE 802.11b	DSSS	16.5	16.21	0.12	Left	Tilt	R31D20MH5GL	1	1:1	0.420	1.069	**0.449**	A5
5825	165	IEEE 802.11a	OFDM	9.0	8.67	0.21	Right	Cheek	R31D20MH56R	6	1:1	0.025	1.079	0.027	
5825	165	IEEE 802.11a	OFDM	9.0	8.67	-0.02	Right	Tilt	R31D20MH56R	6	1:1	0.007	1.079	0.008	
5825	165	IEEE 802.11a	OFDM	9.0	8.67	0.18	Left	Cheek	R31D20MH56R	6	1:1	0.068	1.079	0.074	A6
5825	165	IEEE 802.11a	OFDM	9.0	8.67	0.20	Left	Tilt	R31D20MH56R	6	1:1	0.039	1.079	0.042	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram								

Table 10-6
NII Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Data Rate (Mbps)	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
5240	48	IEEE 802.11a	OFDM	9.0	8.23	0.08	Right	Cheek	R31D20MH56R	6	1:1	0.028	1.194	0.034	
5240	48	IEEE 802.11a	OFDM	9.0	8.23	0.06	Right	Tilt	R31D20MH56R	6	1:1	0.002	1.194	0.002	
5240	48	IEEE 802.11a	OFDM	9.0	8.23	0.12	Left	Cheek	R31D20MH56R	6	1:1	0.045	1.194	0.054	
5240	48	IEEE 802.11a	OFDM	9.0	8.23	0.02	Left	Tilt	R31D20MH56R	6	1:1	0.022	1.194	0.027	
5320	64	IEEE 802.11a	OFDM	9.0	8.31	0.06	Right	Cheek	R31D20MH56R	6	1:1	0.033	1.172	0.039	
5320	64	IEEE 802.11a	OFDM	9.0	8.31	0.04	Right	Tilt	R31D20MH56R	6	1:1	0.001	1.172	0.001	
5320	64	IEEE 802.11a	OFDM	9.0	8.31	0.15	Left	Cheek	R31D20MH56R	6	1:1	0.051	1.172	0.060	
5320	64	IEEE 802.11a	OFDM	9.0	8.31	0.16	Left	Tilt	R31D20MH56R	6	1:1	0.038	1.172	0.044	
5680	136	IEEE 802.11a	OFDM	9.0	8.76	0.12	Right	Cheek	R31D20MH56R	6	1:1	0.051	1.057	0.054	
5680	136	IEEE 802.11a	OFDM	9.0	8.76	0.02	Right	Tilt	R31D20MH56R	6	1:1	0.017	1.057	0.018	
5680	136	IEEE 802.11a	OFDM	9.0	8.76	0.10	Left	Cheek	R31D20MH56R	6	1:1	0.126	1.057	**0.133**	A7
5680	136	IEEE 802.11a	OFDM	9.0	8.76	0.02	Left	Tilt	R31D20MH56R	6	1:1	0.065	1.057	0.069	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram								

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10.2 Standalone Body SAR Data

Table 10-7
GPRS/UMTS Body SAR Data

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	# of GPRS Slots	Duty Cycle	Side	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
824.20	128	GSM 850	GPRS	30.5	30.49	0.03	6 mm	R31D20MH5GL	2	1:4.15	back	0.704	1.002	0.706	
836.60	190	GSM 850	GPRS	30.5	30.44	-0.01	6 mm	R31D20MH5GL	2	1:4.15	back	0.857	1.014	0.869	
848.80	251	GSM 850	GPRS	30.5	30.46	0.03	6 mm	R31D20MH5GL	2	1:4.15	back	1.000	1.009	**1.009**	A8
824.20	128	GSM 850	GPRS	26.0	25.35	0.01	0 mm	R31D20MH5LN	2	1:4.15	back	0.804	1.161	0.934	
836.60	190	GSM 850	GPRS	26.0	25.47	0.00	0 mm	R31D20MH5LN	2	1:4.15	back	0.841	1.130	0.950	
848.80	251	GSM 850	GPRS	26.0	25.54	0.01	0 mm	R31D20MH5LN	2	1:4.15	back	0.818	1.112	0.909	
836.60	190	GSM 850	GPRS	30.5	30.44	0.10	6 mm	R31D20MH5GL	2	1:4.15	top	0.705	1.014	0.715	
836.60	190	GSM 850	GPRS	26.0	25.47	0.01	0 mm	R31D20MH5LN	2	1:4.15	top	0.511	1.130	0.577	
836.60	190	GSM 850	GPRS	30.5	30.44	0.10	0 mm	R31D20MH5GL	2	1:4.15	left	0.316	1.014	0.320	
848.80	251	GSM 850	GPRS	30.5	30.46	0.03	6 mm	R31D20MH5GL	2	1:4.15	back	0.944	1.009	0.953	
826.40	4132	UMTS 850	RMC	23.5	23.43	0.01	6 mm	R31D20MH5GL	N/A	1:1	back	0.649	1.016	0.660	
836.60	4183	UMTS 850	RMC	23.5	23.20	0.00	6 mm	R31D20MH5GL	N/A	1:1	back	0.760	1.072	0.814	
846.60	4233	UMTS 850	RMC	23.5	23.16	0.02	6 mm	R31D20MH5GL	N/A	1:1	back	0.792	1.081	0.856	A9
836.60	4183	UMTS 850	RMC	17.5	17.24	-0.01	0 mm	R31D20MH5LN	N/A	1:1	back	0.537	1.062	0.570	
836.60	4183	UMTS 850	RMC	23.5	23.20	-0.16	6 mm	R31D20MH5GL	N/A	1:1	top	0.639	1.072	0.685	
836.60	4183	UMTS 850	RMC	17.5	17.24	-0.02	0 mm	R31D20MH5LN	N/A	1:1	top	0.376	1.062	0.399	
836.60	4183	UMTS 850	RMC	23.5	23.20	-0.09	0 mm	R31D20MH5GL	N/A	1:1	left	0.369	1.072	0.395	
1880.00	661	GSM 1900	GPRS	30.0	29.82	-0.08	6 mm	R31D20MH5GL	1	1:8.3	back	0.764	1.042	0.796	A10
1880.00	661	GSM 1900	GPRS	17.5	17.36	-0.02	0 mm	R31D20MH5LN	4	1:2.076	back	0.546	1.033	0.564	
1880.00	661	GSM 1900	GPRS	30.0	29.82	0.02	6 mm	R31D20MH5GL	1	1:8.3	top	0.583	1.042	0.608	
1880.00	661	GSM 1900	GPRS	17.5	17.36	-0.04	0 mm	R31D20MH5LN	4	1:2.076	top	0.382	1.033	0.395	
1880.00	661	GSM 1900	GPRS	30.0	29.82	-0.10	0 mm	R31D20MH5GL	1	1:8.3	left	0.259	1.042	0.270	
1880.00	9400	UMTS 1900	RMC	22.5	22.45	-0.01	6 mm	R31D20MH5GL	N/A	1:1	back	0.699	1.012	0.707	
1852.40	9262	UMTS 1900	RMC	15.5	15.15	-0.03	0 mm	R31D20MH5LN	N/A	1:1	back	0.737	1.084	0.799	
1880.00	9400	UMTS 1900	RMC	15.5	15.06	0.02	0 mm	R31D20MH5LN	N/A	1:1	back	0.772	1.107	0.854	
1907.60	9538	UMTS 1900	RMC	15.5	15.19	-0.11	0 mm	R31D20MH5LN	N/A	1:1	back	0.893	1.074	0.959	A11
1880.00	9400	UMTS 1900	RMC	22.5	22.45	-0.01	6 mm	R31D20MH5GL	N/A	1:1	top	0.471	1.012	0.476	
1880.00	9400	UMTS 1900	RMC	15.5	15.06	0.10	0 mm	R31D20MH5LN	N/A	1:1	top	0.657	1.107	0.727	
1880.00	9400	UMTS 1900	RMC	22.5	22.45	-0.05	0 mm	R31D20MH5GL	N/A	1:1	left	0.214	1.012	0.216	
1907.60	9538	UMTS 1900	RMC	15.5	15.19	-0.04	0 mm	R31D20MH5LN	N/A	1:1	back	0.884	1.074	0.949	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							**Body 1.6 W/kg (mW/g) averaged over 1 gram**								

Note:

1. Blue entries represent variability measurements.

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Table 10-8
DTS Body SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
2412	1	IEEE 802.11b	DSSS	16.5	16.08	0.06	0 mm	R31D20MH56R	1	back	1:1	0.982	1.102	**1.082**	A12
2437	6	IEEE 802.11b	DSSS	16.5	16.17	-0.01	0 mm	R31D20MH56R	1	back	1:1	0.928	1.079	1.001	
2462	11	IEEE 802.11b	DSSS	16.5	16.21	0.02	0 mm	R31D20MH56R	1	back	1:1	0.961	1.069	1.027	
2412	1	IEEE 802.11b	DSSS	16.5	16.08	-0.02	0 mm	R31D20MH56R	1	top	1:1	0.978	1.102	1.077	
2437	6	IEEE 802.11b	DSSS	16.5	16.17	-0.02	0 mm	R31D20MH56R	1	top	1:1	0.888	1.079	0.958	
2462	11	IEEE 802.11b	DSSS	16.5	16.21	0.04	0 mm	R31D20MH56R	1	top	1:1	0.768	1.069	0.821	
2462	11	IEEE 802.11b	DSSS	16.5	16.21	-0.04	0 mm	R31D20MH56R	1	right	1:1	0.389	1.069	0.416	
2412	1	IEEE 802.11b	DSSS	16.5	16.08	-0.05	0 mm	R31D20MH56R	1	back	1:1	0.902	1.102	0.994	
5745	149	IEEE 802.11a	OFDM	9.0	8.59	0.19	0 mm	R31D20MH56R	6	back	1:1	0.432	1.099	0.475	A13
5785	157	IEEE 802.11a	OFDM	9.0	8.62	0.02	0 mm	R31D20MH56R	6	back	1:1	0.393	1.091	0.429	
5825	165	IEEE 802.11a	OFDM	9.0	8.67	0.01	0 mm	R31D20MH56R	6	back	1:1	0.409	1.079	0.441	
5825	165	IEEE 802.11a	OFDM	9.0	8.67	-0.14	0 mm	R31D20MH56R	6	top	1:1	0.136	1.079	0.147	
5825	165	IEEE 802.11a	OFDM	9.0	8.67	0.00	0 mm	R31D20MH56R	6	right	1:1	0.000	1.079	0.000	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**Body 1.6 W/kg (mW/g) averaged over 1 gram**										

Note: Blue entries represent variability measurements.

Table 10-9
NII Body SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
5240	48	IEEE 802.11a	OFDM	9.0	8.23	0.12	0 mm	R31D20MH56R	6	back	1:1	0.128	1.194	0.153	
5240	48	IEEE 802.11a	OFDM	9.0	8.23	-0.03	0 mm	R31D20MH56R	6	top	1:1	0.085	1.194	0.101	
5240	48	IEEE 802.11a	OFDM	9.0	8.23	0.17	0 mm	R31D20MH56R	6	right	1:1	0.034	1.194	0.041	
5320	64	IEEE 802.11a	OFDM	9.0	8.31	0.03	0 mm	R31D20MH56R	6	back	1:1	0.214	1.172	0.251	
5320	64	IEEE 802.11a	OFDM	9.0	8.31	-0.21	0 mm	R31D20MH56R	6	top	1:1	0.099	1.172	0.115	
5320	64	IEEE 802.11a	OFDM	9.0	8.31	-0.03	0 mm	R31D20MH56R	6	right	1:1	0.052	1.172	0.061	
5540	108	IEEE 802.11a	OFDM	9.0	8.35	0.05	0 mm	R31D20MH56R	6	back	1:1	0.915	1.161	**1.062**	A14
5580	116	IEEE 802.11a	OFDM	9.0	8.54	-0.06	0 mm	R31D20MH56R	6	back	1:1	0.808	1.112	0.898	
5680	136	IEEE 802.11a	OFDM	9.0	8.76	0.14	0 mm	R31D20MH56R	6	back	1:1	0.608	1.057	0.643	
5680	136	IEEE 802.11a	OFDM	9.0	8.76	-0.02	0 mm	R31D20MH56R	6	top	1:1	0.309	1.057	0.327	
5680	136	IEEE 802.11a	OFDM	9.0	8.76	0.10	0 mm	R31D20MH56R	6	right	1:1	0.003	1.057	0.003	
5540	108	IEEE 802.11a	OFDM	9.0	8.35	0.06	0 mm	R31D20MH56R	6	back	1:1	0.777	1.161	0.902	
5580	116	IEEE 802.11a	OFDM	9.0	8.54	0.00	0 mm	R31D20MH56R	6	back	1:1	0.703	1.112	0.782	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**Body 1.6 W/kg (mW/g) averaged over 1 gram**										

Note: Blue entries represent variability measurements.

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Table 10-10
DSS Body SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
2402	0	IEEE 802.11b	FHSS	11.5	11.25	-0.05	0 mm	R31D20MH56R	1	back	1:1	0.143	1.059	**0.151**	A15
2402	0	IEEE 802.11b	FHSS	11.5	11.25	-0.01	0 mm	R31D20MH56R	1	top	1:1	0.130	1.059	0.138	
2402	0	IEEE 802.11b	FHSS	11.5	11.25	0.16	0 mm	R31D20MH56R	1	right	1:1	0.059	1.059	0.063	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							**Body 1.6 W/kg (mW/g) averaged over 1 gram**								

10.3 SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2003, FCC KDB Publication 616217 D04v01, and FCC KDB Publication 447498 D01v05.
2. Batteries are fully charged at the beginning of the SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v05.
6. Per FCC KDB 865664 D01 v01, variability SAR tests were performed when the measured SAR results for a frequency band were greater than 0.8 W/kg. Repeated SAR measurements are highlighted in the tables above for clarity. Please see Section 12 for variability analysis.
7. Per FCC KDB 616217 D04 Section 4.3, SAR tests are required for the back surface and edges of the tablet with the tablet touching the phantom. The SAR Exclusion Threshold in FCC KDB 447498 D01v05 was applied to determine SAR test exclusion for adjacent edge configurations. SAR tests were required for top and left edge for the main antenna and top and right edge for the BT/WLAN antenna.
8. Head SAR testing was required for this tablet because it has a speaker/ receiver and microphone positioning that allows for a held-to-ear configuration usage. This device uses a proximity sensor to reduce powers of voice/data modes in held-to-ear configurations. Therefore, all head SAR tests were performed at reduced power levels for GSM/UMTS.

GSM Test Notes:

1. Justification for reduced test configurations per KDB Publication 941225 D03v01: The source-based time-averaged output power was evaluated for all multi-slot operations. The multi-slot configuration with the highest frame averaged output power was evaluated for SAR.
2. Per FCC KDB Publication 447498 D01v05, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel must be used.

UMTS Notes:

1. UMTS mode in Body SAR was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v02. HSPA SAR was not required since the average output power of the HSPA subtests was not more than 0.25 dB higher than the RMC level and SAR was less than 1.2 W/kg.

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2. Per FCC KDB Publication 447498 D01v05, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel must be used.

BT/WLAN Notes:

1. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and October 2012 FCC/TCB Meeting Notes for 2.4 GHz WIFI: Highest average RF output power channel for the lowest data rate was selected for SAR evaluation in 802.11b. Other IEEE 802.11 modes (including 802.11g/n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode.
2. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and October 2012 FCC/TCB Meeting Notes for 5 GHz WIFI: Highest average RF output power channel for the lowest data rate was selected for SAR evaluation in 802.11a. Other IEEE 802.11 modes (including 802.11n 20 MHz and 40 MHz bandwidths) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11a mode.
3. WIFI transmission was verified using an uncalibrated spectrum analyzer.
4. Since the maximum extrapolated peak SAR of the zoom scan for the maximum output channel was greater 1.6 W/kg or the reported 1g averaged SAR was greater than 0.8 W/kg, SAR testing on other default (or corresponding) channels was required.
5. There is no proximity sensor power reduction mechanism applied for WIFI/BT modes.

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11 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

11.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D01v05 are applicable to handsets with built-in unlicensed transmitters such as 802.11a/b/g/n and Bluetooth devices which may simultaneously transmit with the licensed transmitter.

11.2 Simultaneous Transmission Procedures

This device contains transmitters that may operate simultaneously. Therefore simultaneous transmission analysis is required. Per FCC KDB 447498 D01v05 IV.C.1.iii, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is ≤1.6 W/kg. When standalone SAR is not required to be measured, per FCC KDB 447498 D01v05 4.3.2 2), the following equation must be used to estimate the standalone 1g SAR for simultaneous transmission assessment involving that transmitter.

$$\text{Estimated SAR} = \frac{\sqrt{f(GHz)}}{7.5} * \frac{(\text{Max Power of channel, mW})}{\text{Min. Separation Distance, mm}}$$

Table 11-1
Estimated SAR for Bluetooth LE at Min. Separation Distances

Mode	Configurations	Frequency	Maximum Allowed Power	Separation Distance (Body)	Estimated SAR (Body)
		[MHz]	[dBm]	[mm]	[W/kg]
Bluetooth LE	Touching *	2441	7.50	5	**0.250**
Bluetooth LE	Top and Back	2441	7.50	6	**0.208**

Note:

- For configurations excluded per 447498 D01v05, an estimated SAR of 0.4 W/kg was used to determine simultaneous transmission SAR exclusion since the test separation distance was >50 mm.
- (*) – Per FCC KDB Publication 447498, when the test separation distance is < 5 mm, a distance of 5 mm is applied to determine estimated SAR.

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11.3 Head SAR Simultaneous Transmission Analysis

Table 11-2
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Held to Ear)

Simult Tx	Configuration	GSM 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.734	0.105	0.839	Head SAR	Right Cheek	0.362	0.105	0.467
	Right Tilt	0.660	0.143	0.803		Right Tilt	0.356	0.143	0.499
	Left Cheek	0.265	0.443	0.708		Left Cheek	0.122	0.443	0.565
	Left Tilt	0.294	0.449	0.743		Left Tilt	0.127	0.449	0.576
Simult Tx	Configuration	GSM 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.204	0.105	0.309	Head SAR	Right Cheek	0.500	0.105	0.605
	Right Tilt	0.140	0.143	0.283		Right Tilt	0.505	0.143	0.648
	Left Cheek	0.060	0.443	0.503		Left Cheek	0.133	0.443	0.576
	Left Tilt	0.053	0.449	0.502		Left Tilt	0.127	0.449	0.576

Table 11-3
Simultaneous Transmission Scenario with 5 GHz WLAN (Held to Ear)

Simult Tx	Configuration	GSM 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	UMTS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.734	0.054	0.788	Head SAR	Right Cheek	0.362	0.054	0.416
	Right Tilt	0.660	0.018	0.678		Right Tilt	0.356	0.018	0.374
	Left Cheek	0.265	0.133	0.398		Left Cheek	0.122	0.133	0.255
	Left Tilt	0.294	0.069	0.363		Left Tilt	0.127	0.069	0.196
Simult Tx	Configuration	GSM 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.204	0.054	0.258	Head SAR	Right Cheek	0.500	0.054	0.554
	Right Tilt	0.140	0.018	0.158		Right Tilt	0.505	0.018	0.523
	Left Cheek	0.060	0.133	0.193		Left Cheek	0.133	0.133	0.266
	Left Tilt	0.053	0.069	0.122		Left Tilt	0.127	0.069	0.196

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11.4 Body Simultaneous Transmission Analysis

Table 11-4
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body at 0 mm)

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.950	1.082	See Note 1	0.04
	Top	0.577	1.077	See Note 1	0.04
	Bottom	0.400	0.400	0.800	N/A
	Right	0.400	0.416	0.816	N/A
	Left	0.320	0.400	0.720	N/A
Simult Tx	**Configuration**	**UMTS 850 SAR (W/kg)**	**2.4 GHz WLAN SAR (W/kg)**	**Σ SAR (W/kg)**	**SPLSR**
Body SAR	Back	0.570	1.082	See Note 1	0.03
	Top	0.399	1.077	1.476	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.400	0.416	0.816	N/A
	Left	0.395	0.400	0.795	N/A
Simult Tx	**Configuration**	**GPRS 1900 SAR (W/kg)**	**2.4 GHz WLAN SAR (W/kg)**	**Σ SAR (W/kg)**	**SPLSR**
Body SAR	Back	0.564	1.082	See Note 1	0.03
	Top	0.395	1.077	1.472	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.400	0.416	0.816	N/A
	Left	0.270	0.400	0.670	N/A
Simult Tx	**Configuration**	**UMTS 1900 SAR (W/kg)**	**2.4 GHz WLAN SAR (W/kg)**	**Σ SAR (W/kg)**	**SPLSR**
Body SAR	Back	0.959	1.082	See Note 1	0.04
	Top	0.727	1.077	See Note 1	0.03
	Bottom	0.400	0.400	0.800	N/A
	Right	0.400	0.416	0.816	N/A
	Left	0.216	0.400	0.616	N/A

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Table 11-5
Simultaneous Transmission Scenario with 5 GHz WLAN (Body at 0 mm)

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Body SAR	Back	0.950	1.062	See Note 1	0.04
	Top	0.577	0.327	0.904	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.400	0.061	0.461	N/A
	Left	0.320	0.400	0.720	N/A
Simult Tx	**Configuration**	**UMTS 850 SAR (W/kg)**	**5 GHz WLAN SAR (W/kg)**	**Σ SAR (W/kg)**	**SPLSR**
Body SAR	Back	0.570	1.062	See Note 1	0.03
	Top	0.399	0.327	0.726	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.400	0.061	0.461	N/A
	Left	0.395	0.400	0.795	N/A
Simult Tx	**Configuration**	**GPRS 1900 SAR (W/kg)**	**5 GHz WLAN SAR (W/kg)**	**Σ SAR (W/kg)**	**SPLSR**
Body SAR	Back	0.564	1.062	See Note 1	0.03
	Top	0.395	0.327	0.722	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.400	0.061	0.461	N/A
	Left	0.270	0.400	0.670	N/A
Simult Tx	**Configuration**	**UMTS 1900 SAR (W/kg)**	**5 GHz WLAN SAR (W/kg)**	**Σ SAR (W/kg)**	**SPLSR**
Body SAR	Back	0.959	1.062	See Note 1	0.04
	Top	0.727	0.327	1.054	N/A
	Bottom	0.400	0.400	0.800	N/A
	Right	0.400	0.061	0.461	N/A
	Left	0.216	0.400	0.616	N/A

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Table 11-6
Simultaneous Transmission Scenario with Bluetooth (Body at 0 mm)

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	UMTS 850 SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.950	0.250	1.200	Body SAR	Back	0.570	0.250	0.820
	Top	0.577	0.250	0.827		Top	0.399	0.250	0.649
	Bottom	0.400	0.400	0.800		Bottom	0.400	0.400	0.800
	Right	0.400	0.250	0.650		Right	0.400	0.250	0.650
	Left	0.320	0.400	0.720		Left	0.395	0.400	0.795
Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.564	0.250	0.814	Body SAR	Back	0.959	0.250	1.209
	Top	0.395	0.250	0.645		Top	0.727	0.250	0.977
	Bottom	0.400	0.400	0.800		Bottom	0.400	0.400	0.800
	Right	0.400	0.250	0.650		Right	0.400	0.250	0.650
	Left	0.270	0.400	0.670		Left	0.216	0.400	0.616

Table 11-7
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body at 6 mm)

Configuration	Mode	2G/3G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Back Side	GPRS 850	1.009	<1.082	See Note 1	<0.04
Back Side	UMTS 850	0.856	<1.082	See Note 1	<0.03
Back Side	GPRS 1900	0.796	<1.082	See Note 1	<0.03
Back Side	UMTS 1900	0.707	<1.082	See Note 1	<0.03
Top Edge	GPRS 850	0.715	<1.077	See Note 1	<0.04
Top Edge	UMTS 850	0.685	<1.077	See Note 1	<0.04
Top Edge	GPRS 1900	0.608	<1.077	See Note 1	<0.03
Top Edge	UMTS 1900	0.476	<1.077	**<1.553**	N/A

Table 11-8
Simultaneous Transmission Scenario with 5 GHz WLAN (Body at 6 mm)

Configuration	Mode	2G/3G SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	SPLSR
Back Side	GPRS 850	1.009	<1.062	See Note 1	<0.04
Back Side	UMTS 850	0.856	<1.062	See Note 1	<0.03
Back Side	GPRS 1900	0.796	<1.062	See Note 1	<0.03
Back Side	UMTS 1900	0.707	<1.062	See Note 1	<0.03
Top Edge	GPRS 850	0.715	<0.327	<1.042	N/A
Top Edge	UMTS 850	0.685	<0.327	<1.012	N/A
Top Edge	GPRS 1900	0.608	<0.327	<0.935	N/A
Top Edge	UMTS 1900	0.476	<0.327	<0.803	N/A

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Table 11-9
Simultaneous Transmission Scenario with Bluetooth (Body at 6 mm)

Configuration	Mode	2G/3G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Back Side	GPRS 850	1.009	0.208	1.217
Back Side	UMTS 850	0.856	0.208	1.064
Back Side	GPRS 1900	0.796	0.208	1.004
Back Side	UMTS 1900	0.707	0.208	0.915
Top Edge	GPRS 850	0.715	0.208	0.923
Top Edge	UMTS 850	0.685	0.208	0.893
Top Edge	GPRS 1900	0.608	0.208	0.816
Top Edge	UMTS 1900	0.476	0.208	0.684

Note:

1. No evaluation was performed to determine the aggregate 1g SAR for these configurations as the SPLS ratio between the antenna pairs was not higher than 0.04 per FCC KDB 447498 D01v05. See Section 11.5 for detailed SPLS ratio analysis.
2. For configurations excluded per 447498 D01v05, an estimated SAR of 0.4 W/kg was used to determine simultaneous transmission SAR exclusion since the test separation distance was >50 mm.
3. For SAR summations for body 6 mm, WLAN SAR values for 0.0 cm were used since the 0.0 cm test distance for WLAN was more conservative. "<" denotes that the 0.0 cm WLAN SAR values were used for summation purposes.
4. Estimated SAR at 5 mm for Bluetooth LE was used in Table 11-6, instead of measured Bluetooth SAR, since estimated SAR for Bluetooth LE represent the worst case scenarios during simultaneous transmission. See Table 11-1.
5. Estimated Bluetooth LE SAR at 6 mm for back side and top edge were used to evaluate the simultaneous sums in Table 11-9, see table 11-1.
6. Per FCC KDB 616217 D04 4.3, when voice mode is limited to speaker mode or headset operations only, additional SAR testing for tablet voice use is not required. Therefore voice standalone and simultaneous combinations with Bluetooth are not evaluated for body configurations.
7. The worst case 5 GHz WLAN reported SAR for each configuration was used for SAR summation, regardless of whether the WLAN channel has WIFI Direct capability. Therefore, the summations above represent the absolute worst cases for simultaneous transmission with 5 GHz WLAN.

11.5 SPLSR Evaluation and Analysis

Per FCC KDB Publication 447498 D01v05, when the sum of the standalone transmitters is more than 1.6 W/kg, the SAR sum to peak locations can be analyzed to determine SAR distribution overlaps. When the SAR peak to location ratio (shown below) for each pair of antennas is ≤ 0.04, simultaneous SAR evaluation is not required. The distance between the transmitters was calculated using the following formula.

$$\text{Distance}_{Tx1-Tx2} = R_i = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2}$$

$$\text{SPLS Ratio} = \frac{(SAR_1 + SAR_2)^{1.5}}{R_i}$$

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The sum of the standalone SAR values was above 1.6 W/kg for the Body Back side configuration at a separation distance of 6 mm with GPRS 850 antenna operating at maximum output power with 2.4 GHz WIFI.

Table 11-10
Peak SAR Locations for Body Back Side at 6 mm GPRS 850 and 2.4 GHz WLAN

Mode/Band	x (mm)	y (mm)	z (mm)
GPRS 850	8.50	80.50	-202.00
802.11b	-61.00	100.00	-206.00

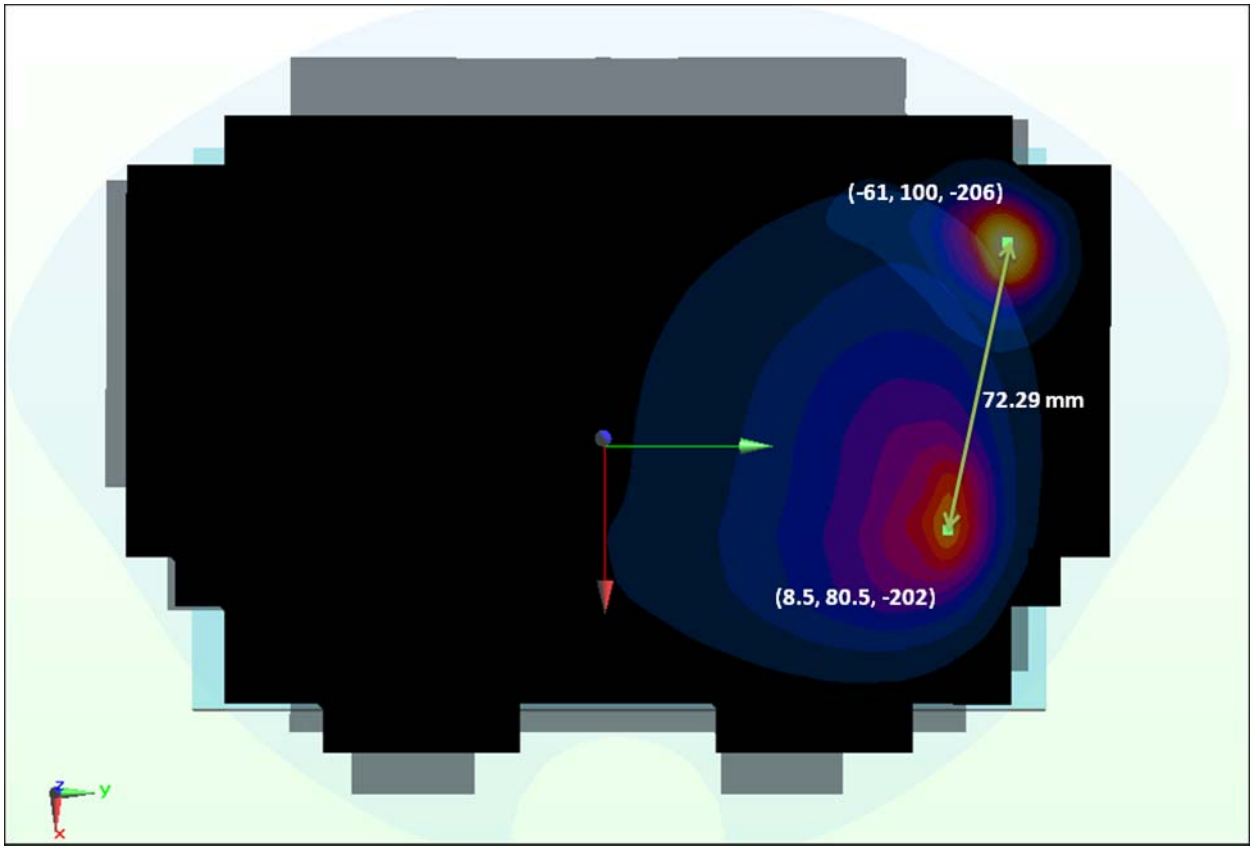

Figure 11-1
Peak SAR Locations of 2.4 GHz WLAN and GPRS 850

Table 11-11
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
GPRS 850	802.11b	1.009	<1.082	<2.091	72.29	<0.04

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The sum of the standalone SAR values was above 1.6 W/kg for the Body Back side configuration at a separation distance of 6 mm with UMTS 850 antenna operating at maximum output power with 2.4 GHz WIFI.

Table 11-12
Peak SAR Locations for Body Back Side at 6 mm UMTS 850 and 2.4 GHz WLAN

Mode/Band	x (mm)	y (mm)	z (mm)
UMTS 850	14.50	70.50	-202.00
802.11b	-61.00	100.00	-206.00

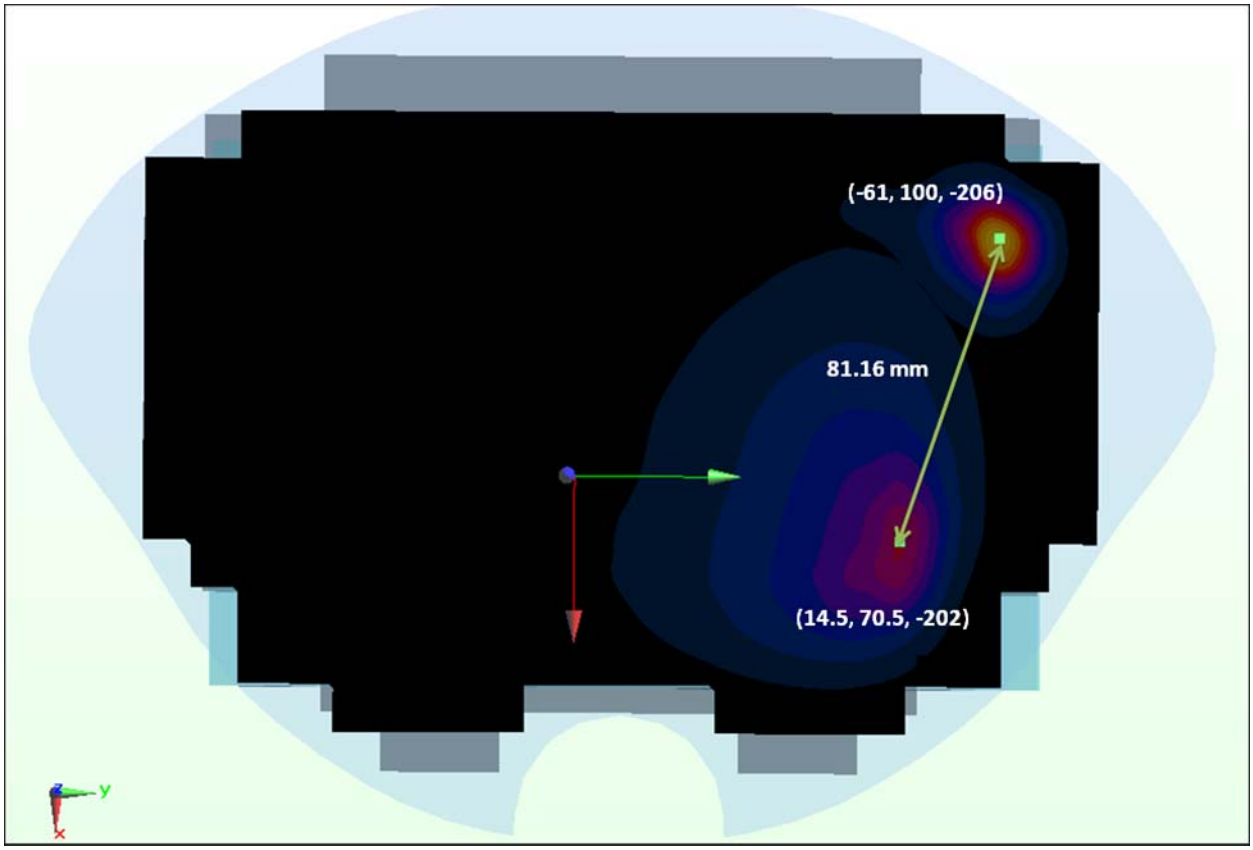

Figure 11-2
Peak SAR Locations of 2.4 GHz WLAN and UMTS 850

Table 11-13
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
UMTS 850	802.11b	0.856	<1.082	<1.938	81.16	<0.03

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The sum of the standalone SAR values was above 1.6 W/kg for the Body Back side configuration at a separation distance of 6 mm with GPRS 1900 antenna operating at maximum output power with 2.4 GHz WIFI.

Table 11-14
Peak SAR Locations for Body Back Side at 6 mm GPRS 1900 and 2.4 GHz WLAN

Mode/Band	x (mm)	y (mm)	z (mm)
GPRS 1900	22.00	99.00	-203.00
802.11b	-61.00	100.00	-206.00

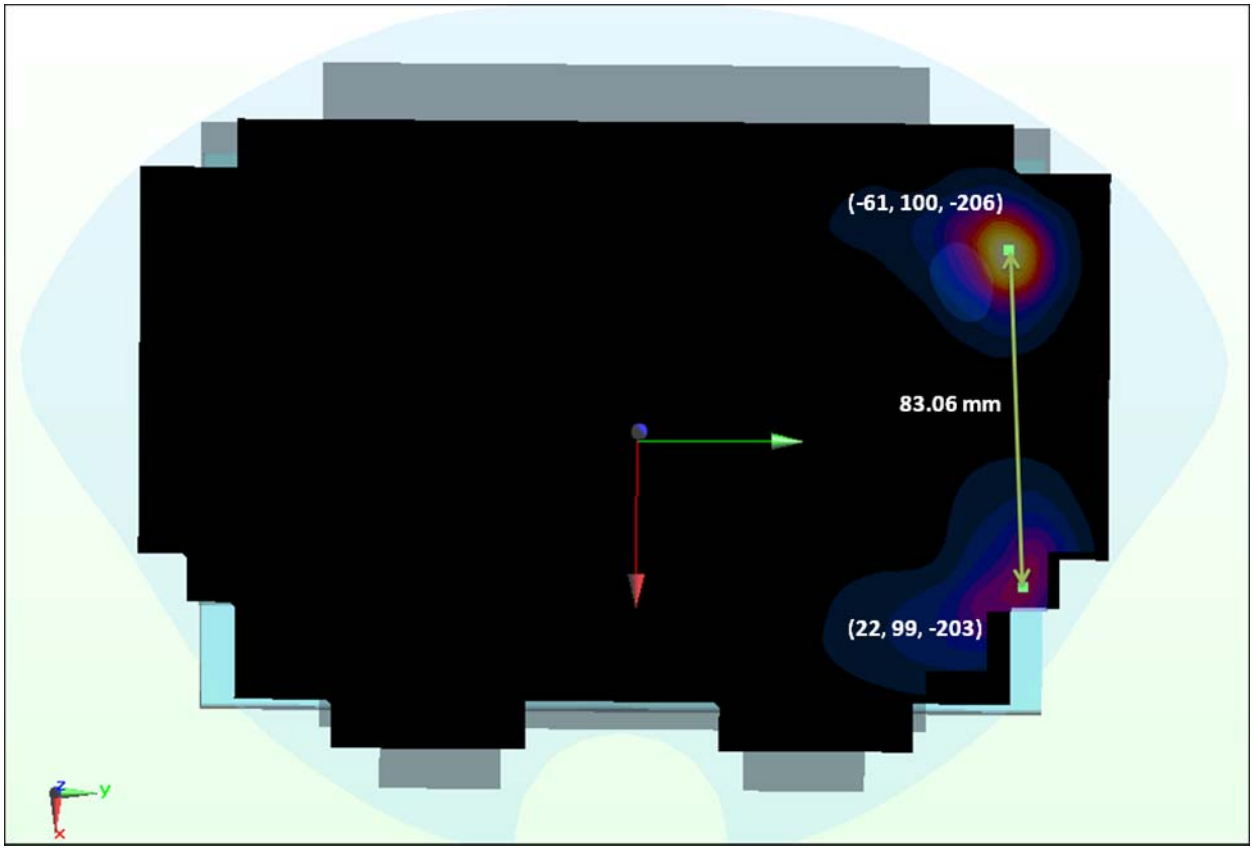

Figure 11-3
Peak SAR Locations of 2.4 GHz WLAN and GPRS 1900

Table 11-15
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
GPRS 1900	802.11b	0.796	<1.082	<1.878	83.06	<0.03

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The sum of the standalone SAR values was above 1.6 W/kg for the Body Back side configuration at a separation distance of 6 mm with UMTS 1900 antenna operating at maximum output power with 2.4 GHz WIFI.

Table 11-16
Peak SAR Locations for Body Back Side at 6 mm UMTS 1900 and 2.4 GHz WLAN

Mode/Band	x (mm)	y (mm)	z (mm)
UMTS1900	16.00	101.00	-204.00
802.11b	-61.00	100.00	-206.00

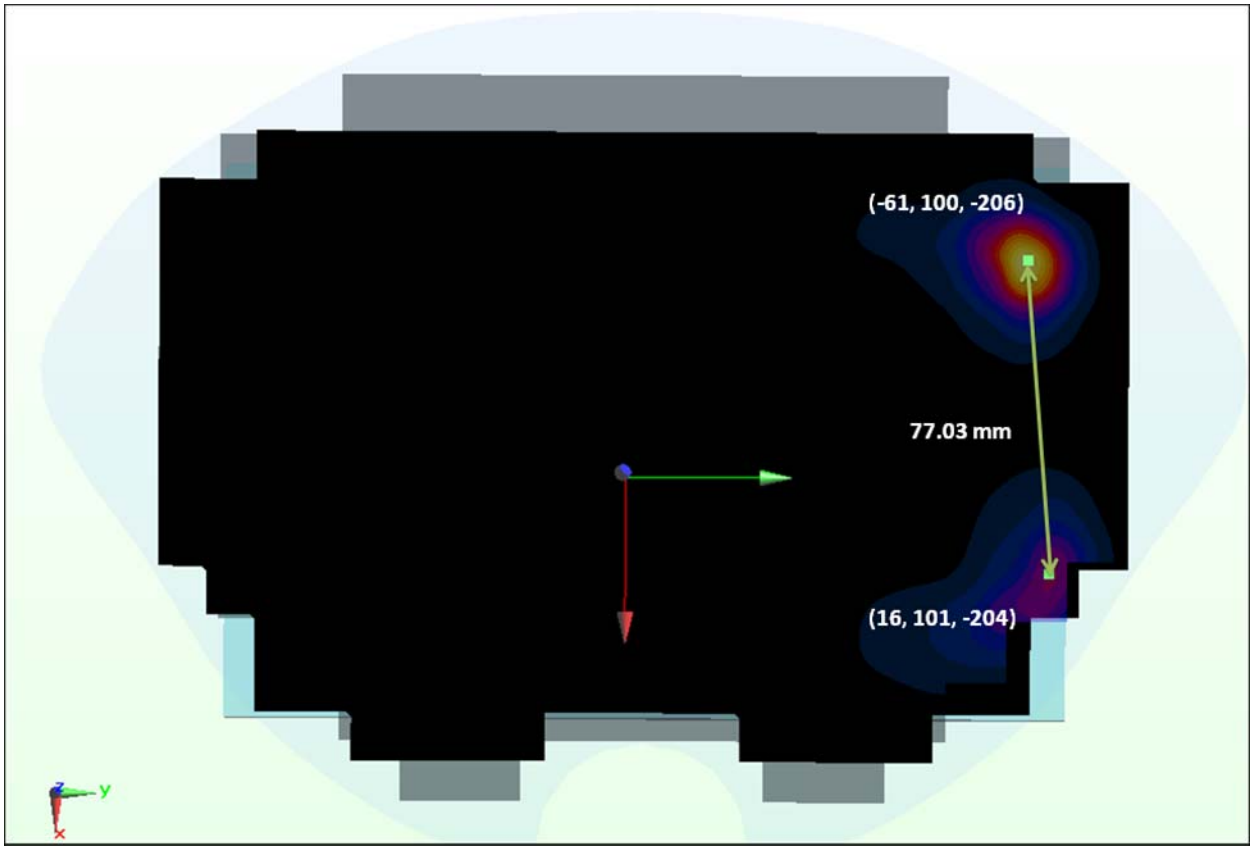

Figure 11-4
Peak SAR Locations of 2.4 GHz WLAN and UMTS 1900

Table 11-17
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
UMTS1900	802.11b	0.707	<1.082	<1.789	77.03	<0.03

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The sum of the standalone SAR values was above 1.6 W/kg for the Body Back side configuration at a separation distance of 0 mm with GPRS 850 antenna operating at limited output power with 2.4 GHz WIFI.

Table 11-18
Peak SAR Locations for Body Back Side at 0 mm GPRS 850 and 2.4 GHz WLAN

Mode/Band	x (mm)	y (mm)	z (mm)
GPRS 850	16.00	93.00	-202.00
802.11b	-61.00	100.00	-206.00

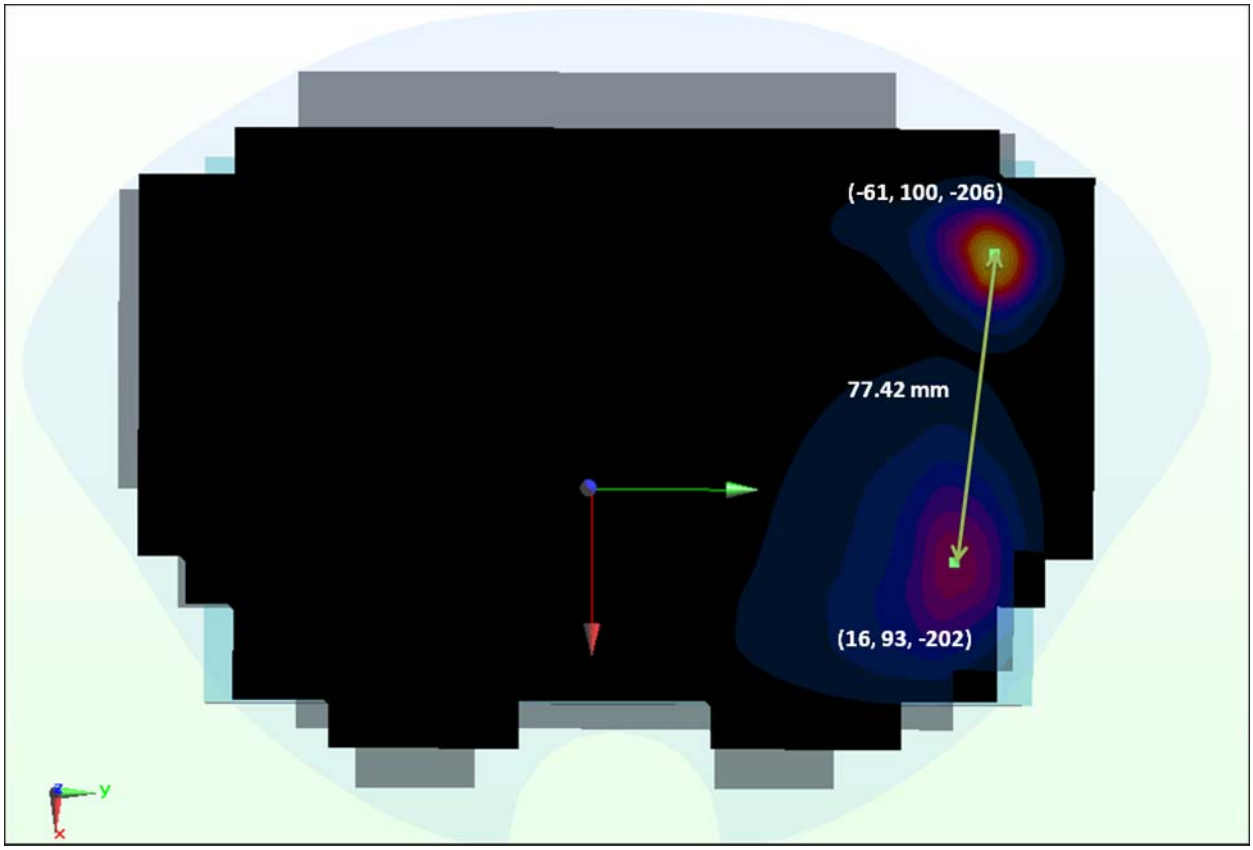

Figure 11-5
Peak SAR Locations of 2.4 GHz WLAN and GPRS 850

Table 11-19
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
GPRS 850	802.11b	0.95	1.082	2.032	77.42	0.04

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The sum of the standalone SAR values was above 1.6 W/kg for the Body Back side configuration at a separation distance of 0 mm with UMTS 850 antenna operating at limited output power with 2.4 GHz WIFI.

Table 11-20
Peak SAR Locations for Body Back Side at 0 mm UMTS 850 and 2.4 GHz WLAN

Mode/Band	x (mm)	y (mm)	z (mm)
UMTS850	14.40	92.00	-202.00
802.11b	-61.00	100.00	-206.00

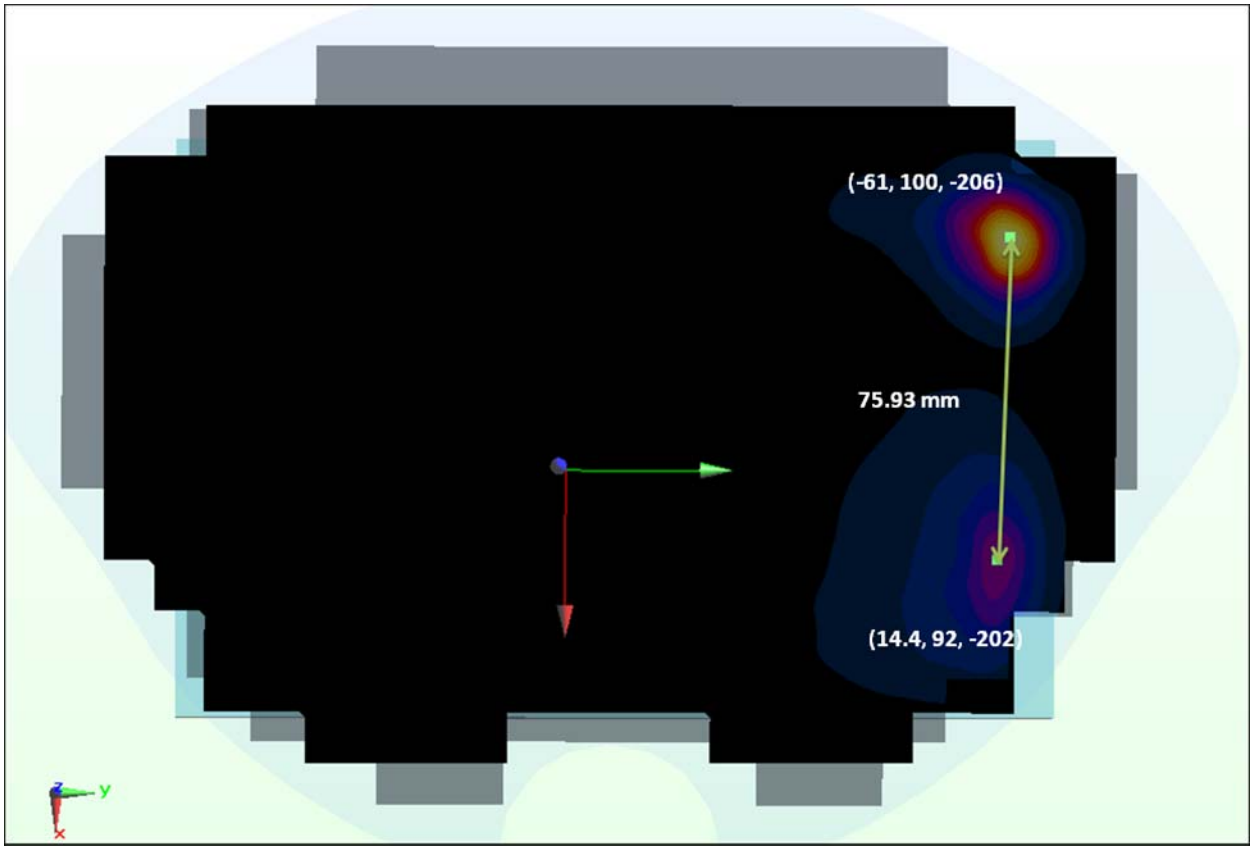

Figure 11-6
Peak SAR Locations of 2.4 GHz WLAN and UMTS 850

Table 11-21
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
UMTS850	802.11b	0.57	1.082	1.652	75.93	0.03

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The sum of the standalone SAR values was above 1.6 W/kg for the Body Back side configuration at a separation distance of 0 mm with GPRS 1900 antenna operating at limited output power with 2.4 GHz WIFI.

Table 11-22
Peak SAR Locations for Body Back Side at 0 mm GPRS 1900 and 2.4 GHz WLAN

Mode/Band	x (mm)	y (mm)	z (mm)
GPRS 1900	13.00	99.00	-204.00
802.11b	-61.00	100.00	-206.00

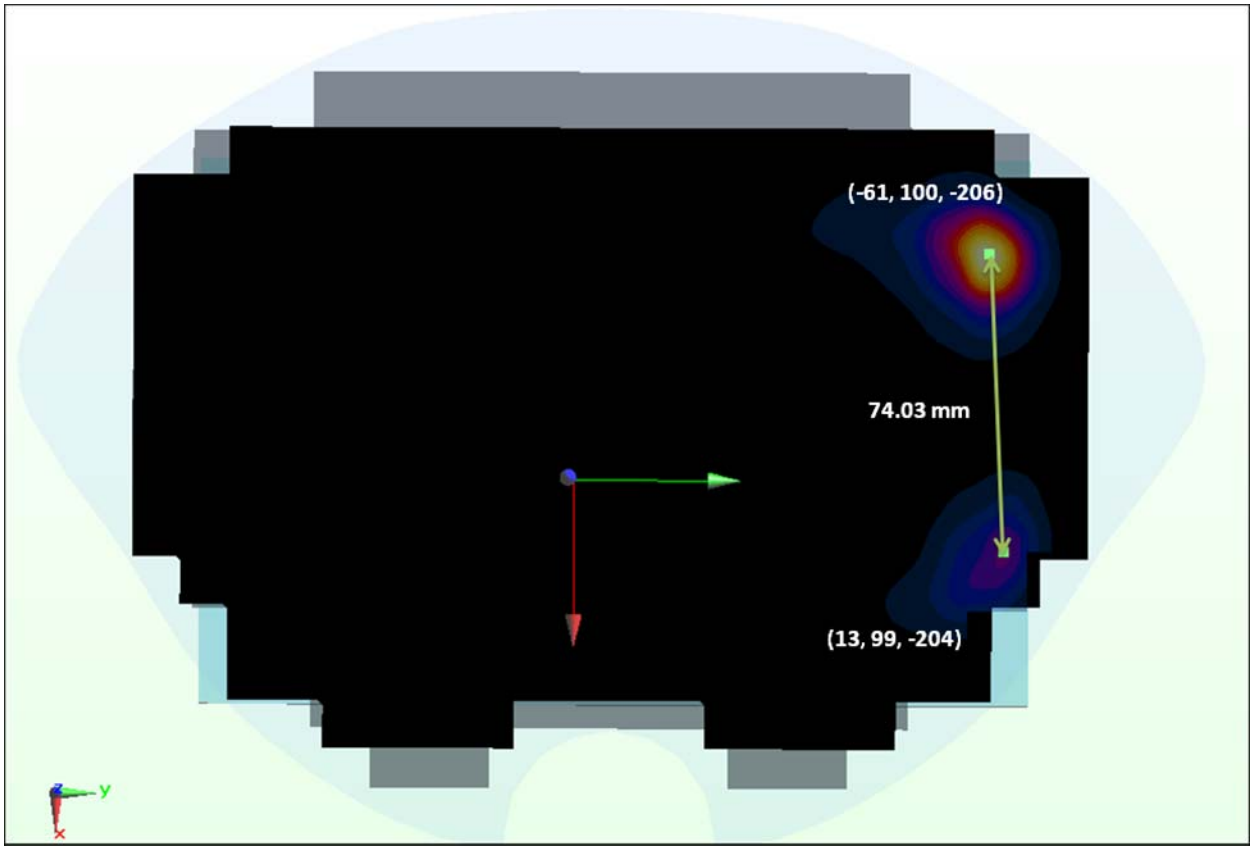

Figure 11-7
Peak SAR Locations of 2.4 GHz WLAN and GPRS 1900

Table 11-23
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
GPRS 1900	802.11b	0.564	1.082	1.646	74.03	0.03

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The sum of the standalone SAR values was above 1.6 W/kg for the Body Back side configuration at a separation distance of 0 mm with UMTS 1900 antenna operating at limited output power with 2.4 GHz WIFI.

Table 11-24
Peak SAR Locations for Body Back Side at 0 mm UMTS 1900 and 2.4 GHz WLAN

Mode/Band	x (mm)	y (mm)	z (mm)
UMTS 1900	12.00	98.00	-204.00
802.11b	-61.00	100.00	-206.00

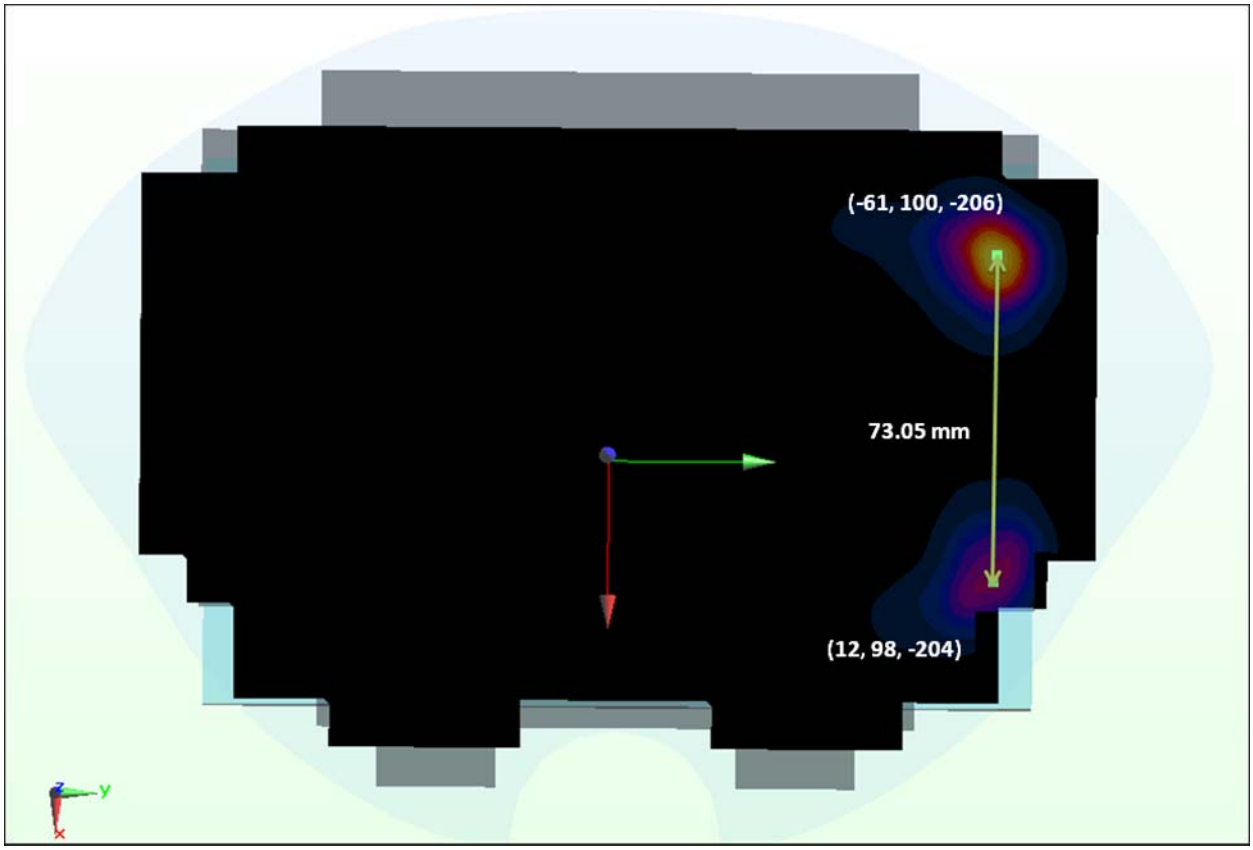

Figure 11-8
Peak SAR Locations of 2.4 GHz WLAN and UMTS 1900

Table 11-25
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
UMTS 1900	802.11b	0.959	1.082	2.041	73.05	0.04

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The sum of the standalone SAR values was above 1.6 W/kg for the Body Top Edge configuration at a separation distance of 6 mm with GPRS 850 antenna operating at maximum output power with 2.4 GHz WIFI.

Table 11-26
Peak SAR Locations for Body Top Edge at 6 mm GPRS 850 and 2.4 GHz WLAN

Mode/Band	x (mm)	y (mm)	z (mm)
GPRS 850	-23.00	-12.00	-202.00
802.11b	-16.00	41.00	-205.00

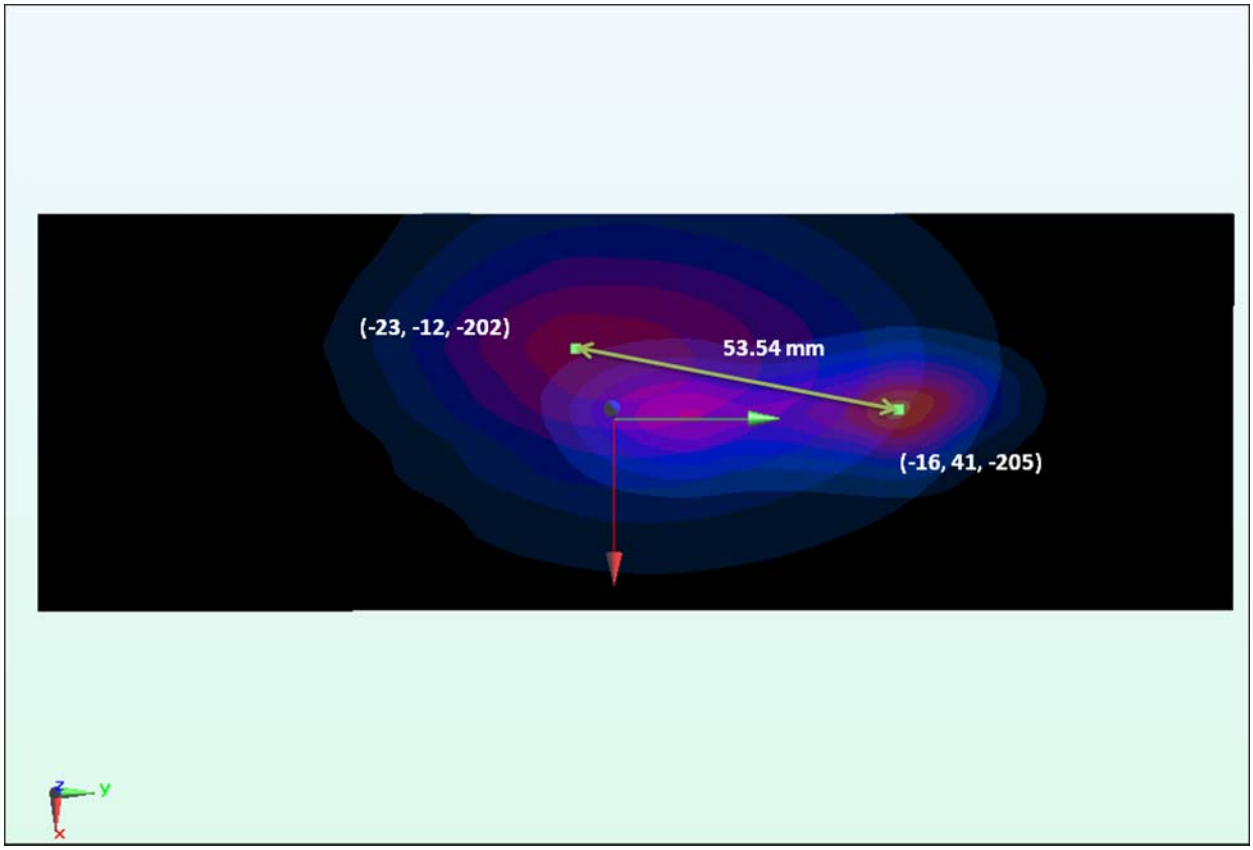

Figure 11-9
Peak SAR Locations of 2.4 GHz WLAN and GPRS 850

Table 11-27
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
GPRS 850	802.11b	0.715	<1.077	<1.792	53.54	<0.04

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The sum of the standalone SAR values was above 1.6 W/kg for the Body Top Edge configuration at a separation distance of 6 mm with UMTS 850 antenna operating at maximum output power with 2.4 GHz WIFI.

Table 11-28
Peak SAR Locations for Body Top Edge at 6 mm UMTS 850 and 2.4 GHz WLAN

Mode/Band	x (mm)	y (mm)	z (mm)
UMTS 850	-22.50	-16.50	-202.00
802.11b	-16.00	41.00	-205.00

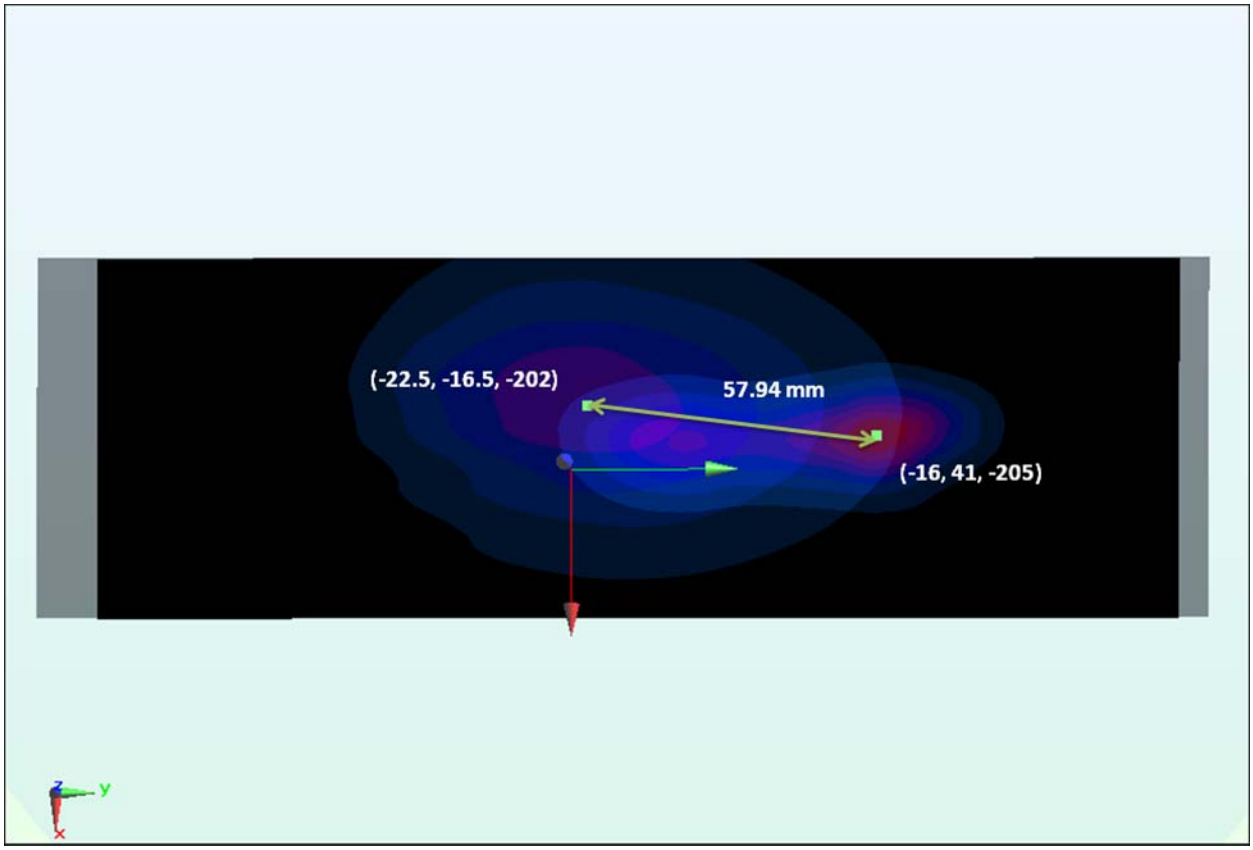

Figure 11-10
Peak SAR Locations of 2.4 GHz WLAN and UMTS 850

Table 11-29
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
UMTS 850	802.11b	0.685	<1.077	<1.762	57.94	<0.04

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The sum of the standalone SAR values was above 1.6 W/kg for the Body Top Edge configuration at a separation distance of 6 mm with GPRS 1900 antenna operating at maximum output power with 2.4 GHz WIFI.

Table 11-30
Peak SAR Locations for Body Top Edge at 6 mm GPRS 1900 and 2.4 GHz WLAN

Mode/Band	x (mm)	y (mm)	z (mm)
GPRS 1900	-24.00	-36.00	-204.00
802.11b	-16.00	41.00	-205.00

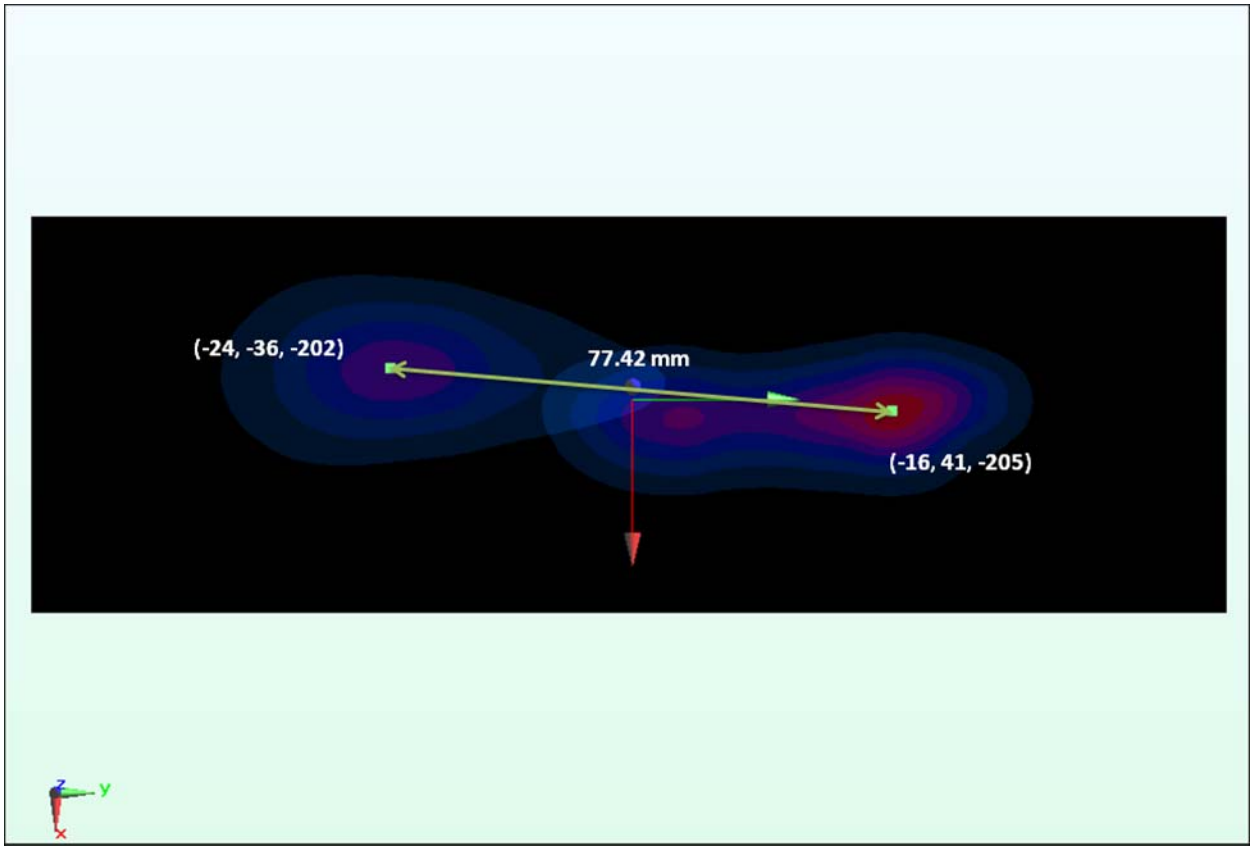

Figure 11-11
Peak SAR Locations of 2.4 GHz WLAN and GPRS 1900

Table 11-31
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
GPRS 1900	802.11b	0.608	1.077	<1.685	77.42	<0.03

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The sum of the standalone SAR values was above 1.6 W/kg for the Body Top Edge configuration at a separation distance of 0 mm with GPRS 850 antenna operating at limited output power with 2.4 GHz WIFI.

Table 11-32
Peak SAR Locations for Body Top Edge at 0 mm GPRS 850 and 2.4 GHz WLAN

Mode/Band	x (mm)	y (mm)	z (mm)
GPRS850	-14.10	-16.50	-201.00
802.11b	-16.00	41.00	-205.00

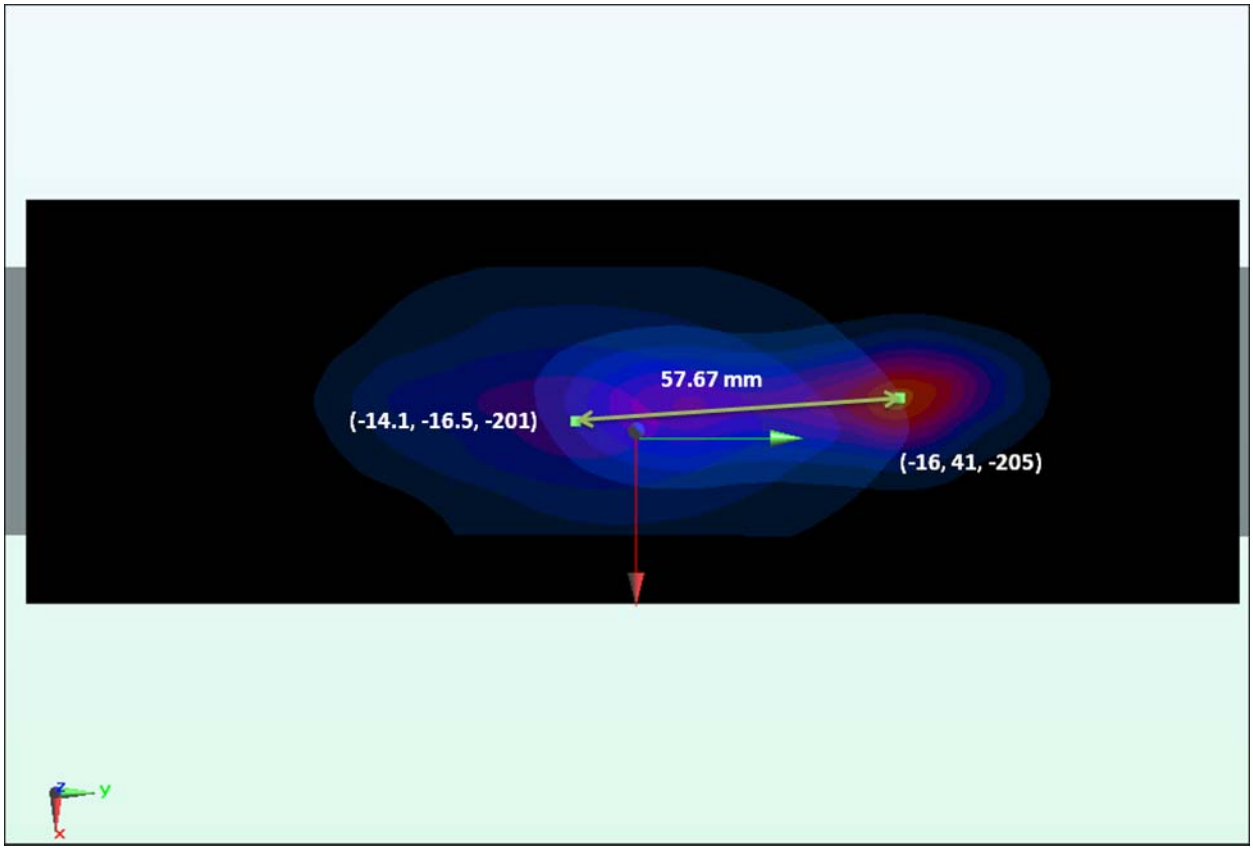

Figure 11-12
Peak SAR Locations of 2.4 GHz WLAN and GPRS 850

Table 11-33
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
GPRS850	802.11b	0.577	1.077	1.654	57.67	0.04

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The sum of the standalone SAR values was above 1.6 W/kg for the Body Top Edge configuration at a separation distance of 0 mm with UMTS 1900 antenna operating at limited output power with 2.4 GHz WIFI.

Table 11-34
Peak SAR Locations for Body Top Edge at 0 mm UMTS 1900 and 2.4 GHz WLAN

Mode/Band	x (mm)	y (mm)	z (mm)
UMTS1900	-29.00	-34.00	-204.00
802.11b	-16.00	41.00	-205.00

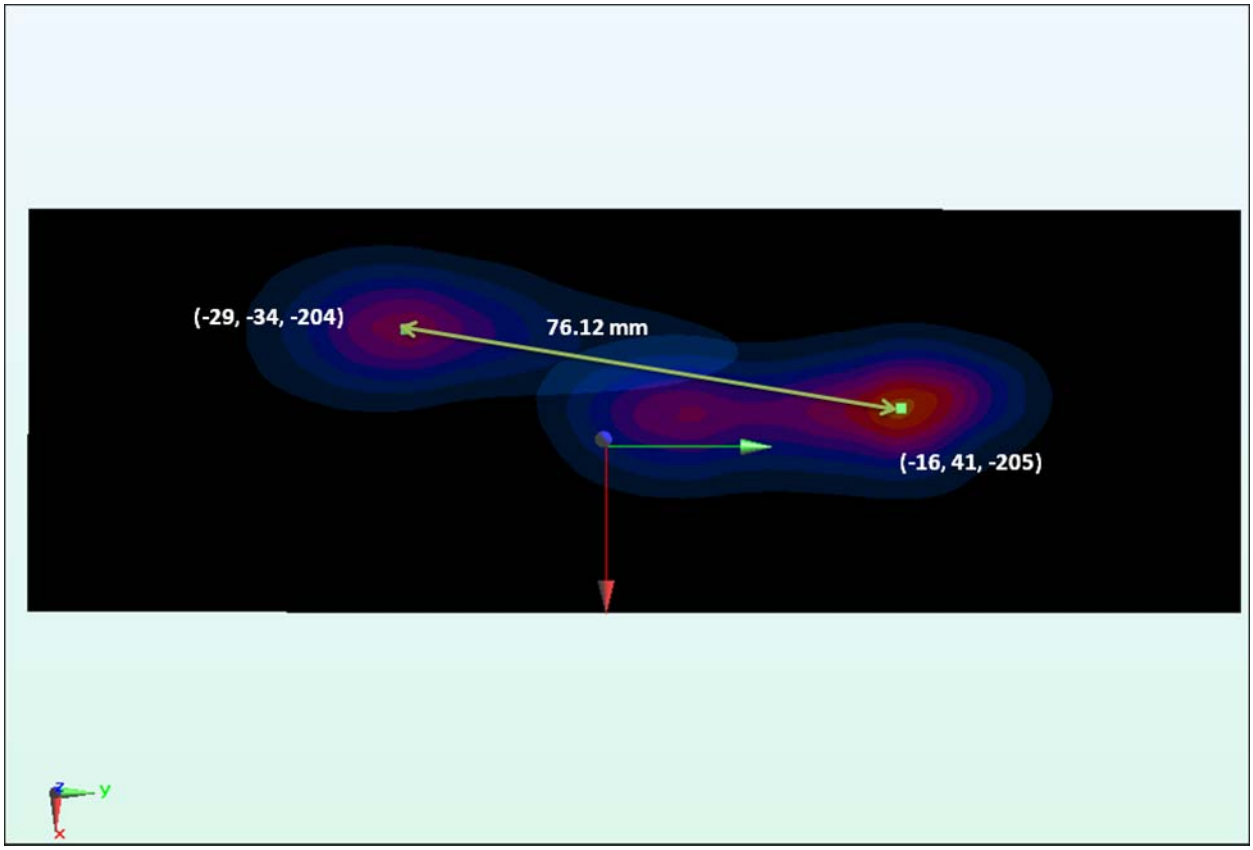

Figure 11-13
Peak SAR Locations of 2.4 GHz WLAN and UMTS 1900

Table 11-35
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
UMTS1900	802.11b	0.727	1.077	1.804	76.12	0.03

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The sum of the standalone SAR values was above 1.6 W/kg for the Body Back side configuration at a separation distance of 6 mm with GPRS 850 antenna operating at maximum output power with 5 GHz WIFI.

Table 11-36
Peak SAR Locations for Body Back Side at 6 mm GPRS 850 and 5 GHz WLAN

Mode/Band	x (mm)	y (mm)	z (mm)
GPRS 850	8.50	80.50	-202.00
802.11a	-61.70	106.00	-200.00

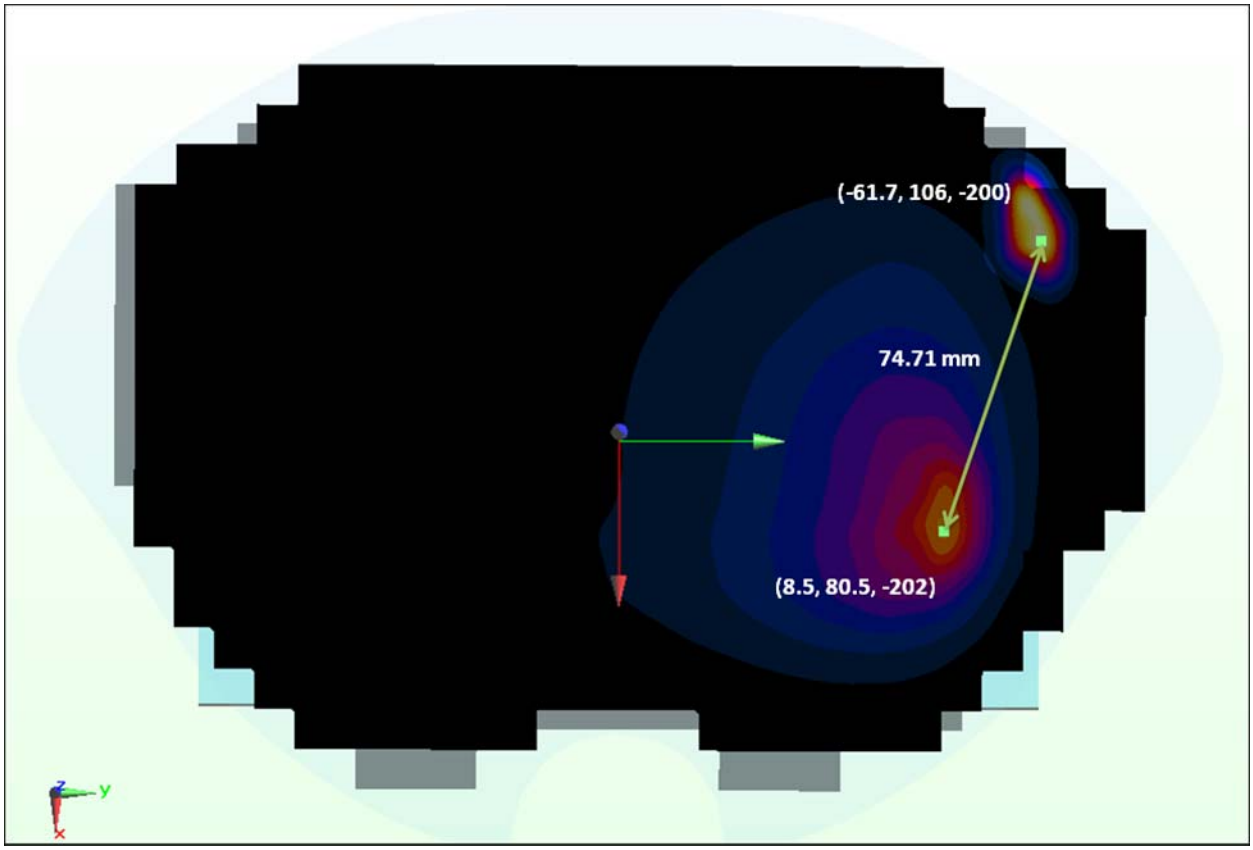

Figure 11-14
Peak SAR Locations of 5 GHz WLAN and GPRS 850

Table 11-37
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
GPRS 850	802.11a	1.009	<1.062	<2.071	74.71	<0.04

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The sum of the standalone SAR values was above 1.6 W/kg for the Body Back side configuration at a separation distance of 6 mm with UMTS 850 antenna operating at maximum output power with 5 GHz WIFI.

Table 11-38
Peak SAR Locations for Body Back Side at 6 mm UMTS 850 and 5 GHz WLAN

Mode/Band	x (mm)	y (mm)	z (mm)
UMTS 850	14.50	70.50	-202.00
802.11a	-61.70	106.00	-200.00

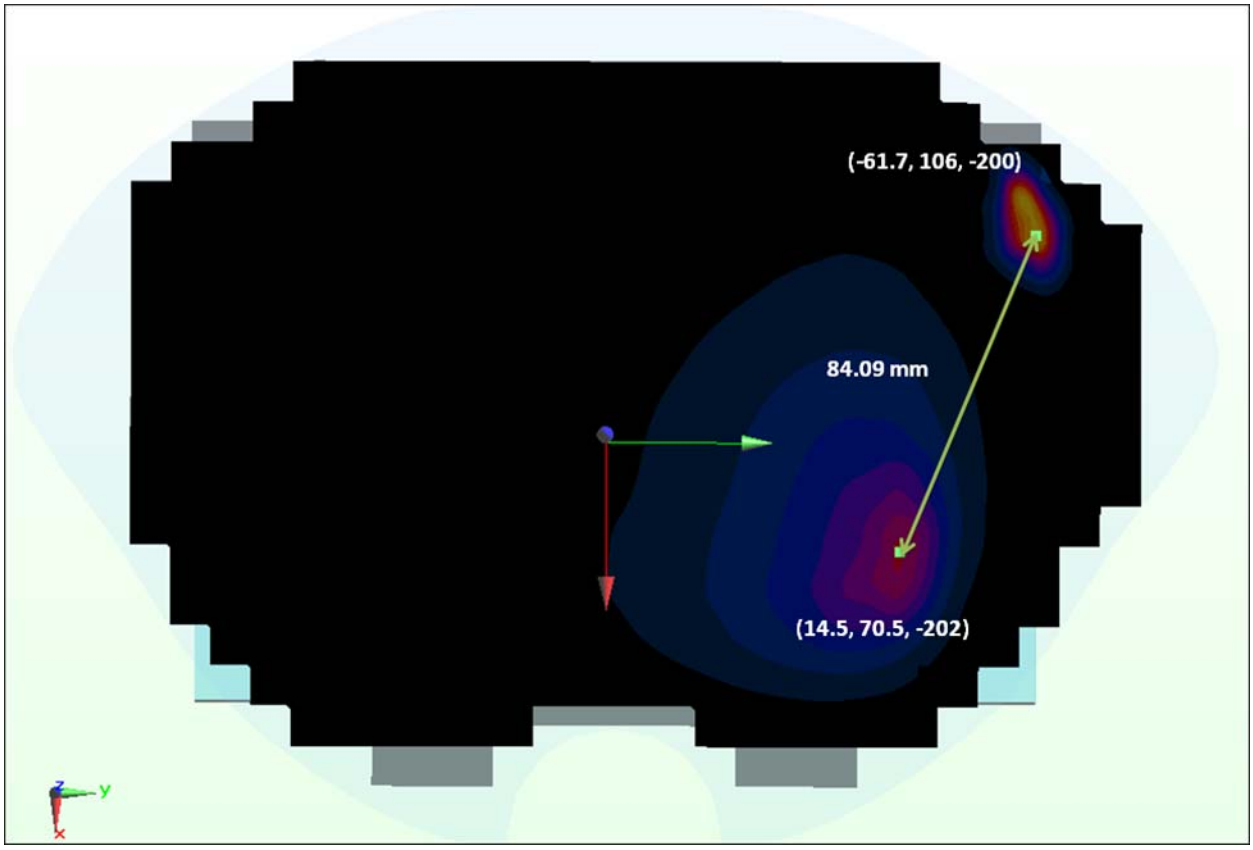

Figure 11-15
Peak SAR Locations of 5 GHz WLAN and UMTS 850

Table 11-39
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
UMTS 850	802.11a	0.856	<1.062	<1.918	84.09	<0.03

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The sum of the standalone SAR values was above 1.6 W/kg for the Body Back side configuration at a separation distance of 6 mm with GPRS 1900 antenna operating at maximum output power with 5 GHz WIFI.

Table 11-40
Peak SAR Locations for Body Back Side at 6 mm GPRS 1900 and 5 GHz WLAN

Mode/Band	x (mm)	y (mm)	z (mm)
GPRS 1900	22.00	99.00	-203.00
802.11a	-61.70	106.00	-200.00

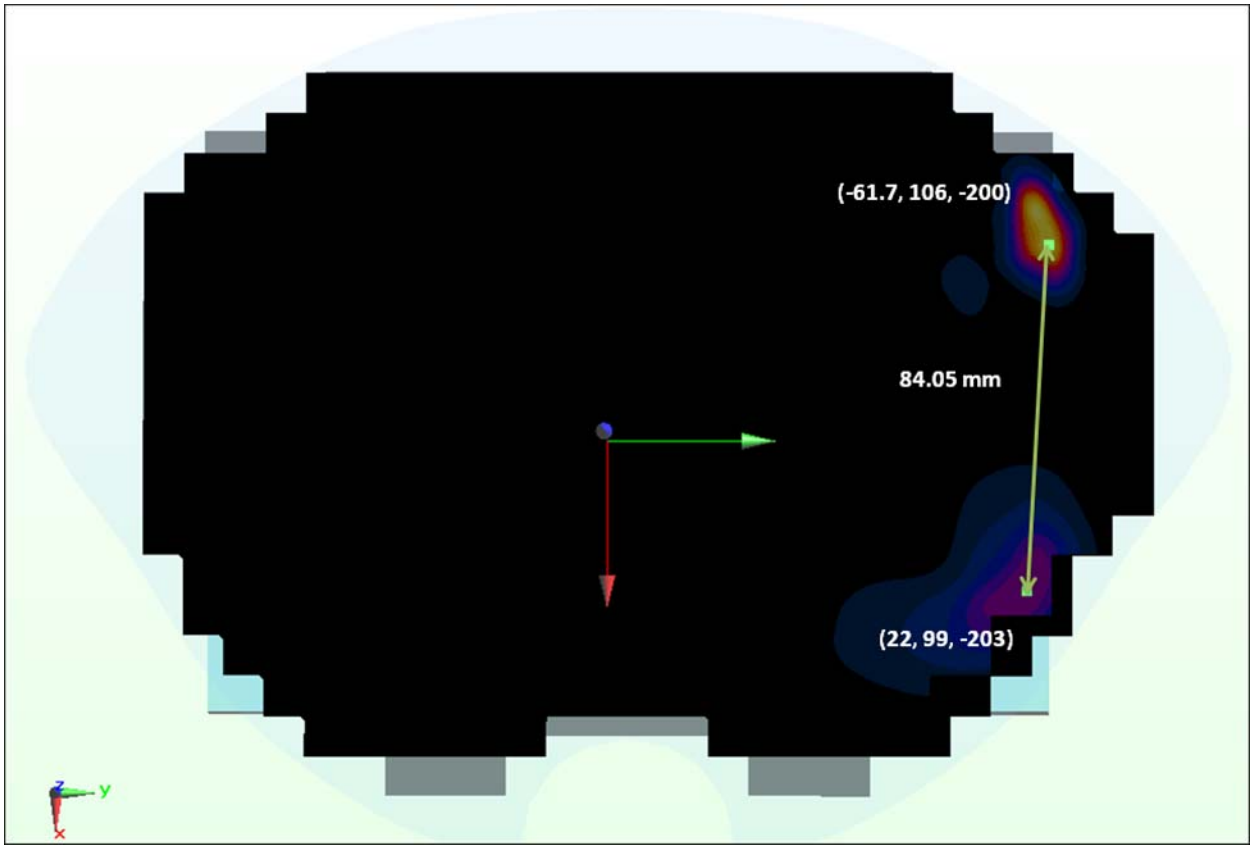

Figure 11-16
Peak SAR Locations of 5 GHz WLAN and GPRS 1900

Table 11-41
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
GPRS 1900	802.11a	0.796	<1.062	<1.858	84.05	<0.03

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The sum of the standalone SAR values was above 1.6 W/kg for the Body Back side configuration at a separation distance of 6 mm with UMTS 1900 antenna operating at maximum output power with 5 GHz WIFI.

Table 11-42
Peak SAR Locations for Body Back Side at 6 mm UMTS 1900 and 5 GHz WLAN

Mode/Band	x (mm)	y (mm)	z (mm)
UMTS1900	16.00	101.00	-204.00
802.11a	-61.70	106.00	-200.00

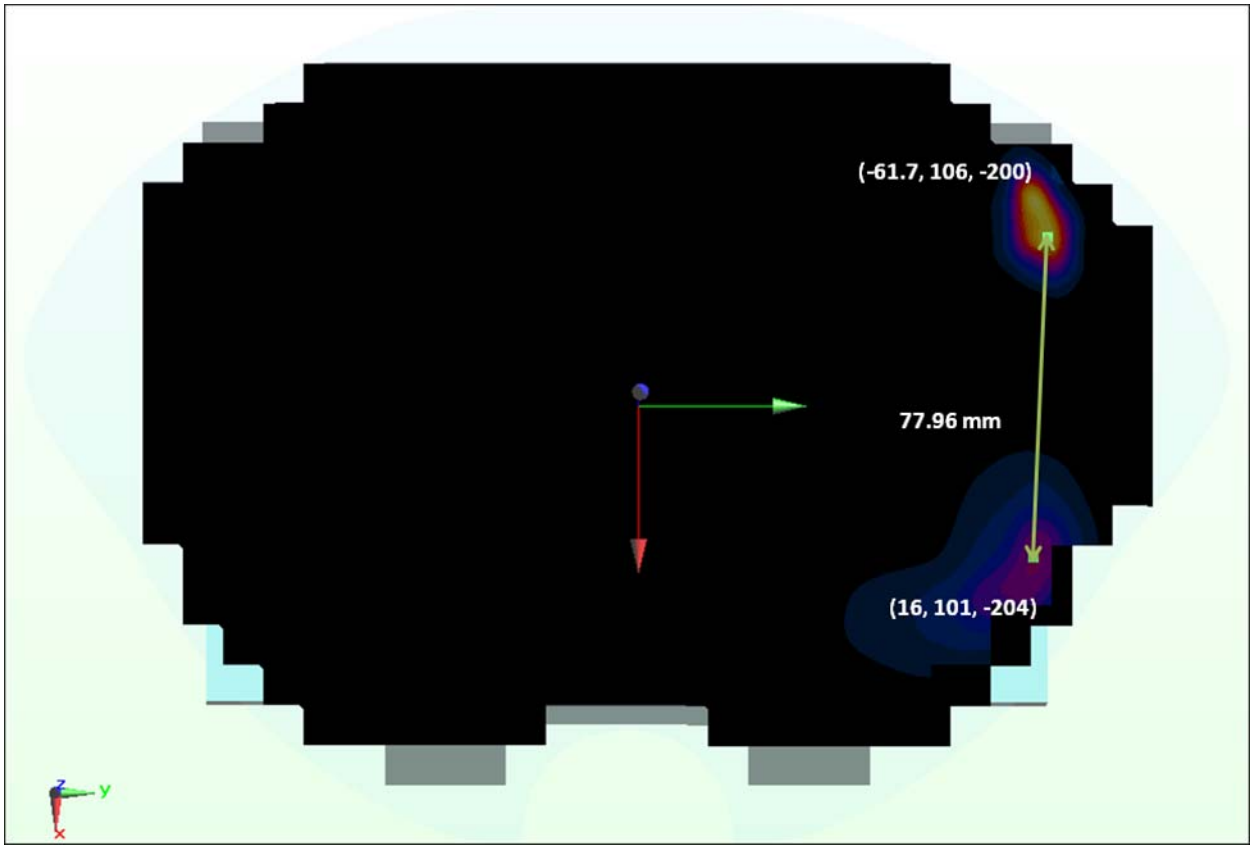

Figure 11-17
Peak SAR Locations of 5 GHz WLAN and UMTS 1900

Table 11-43
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
UMTS1900	802.11a	0.707	<1.062	<1.769	77.96	<0.03

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The sum of the standalone SAR values was above 1.6 W/kg for the Body Back side configuration at a separation distance of 0 mm with GPRS 850 antenna operating at limited output power with 5 GHz WIFI.

Table 11-44
Peak SAR Locations for Body Back Side at 0 mm GPRS 850 and 5 GHz WLAN

Mode/Band	x (mm)	y (mm)	z (mm)
GPRS 850	16.00	93.00	-202.00
802.11a	-61.70	106.00	-200.00

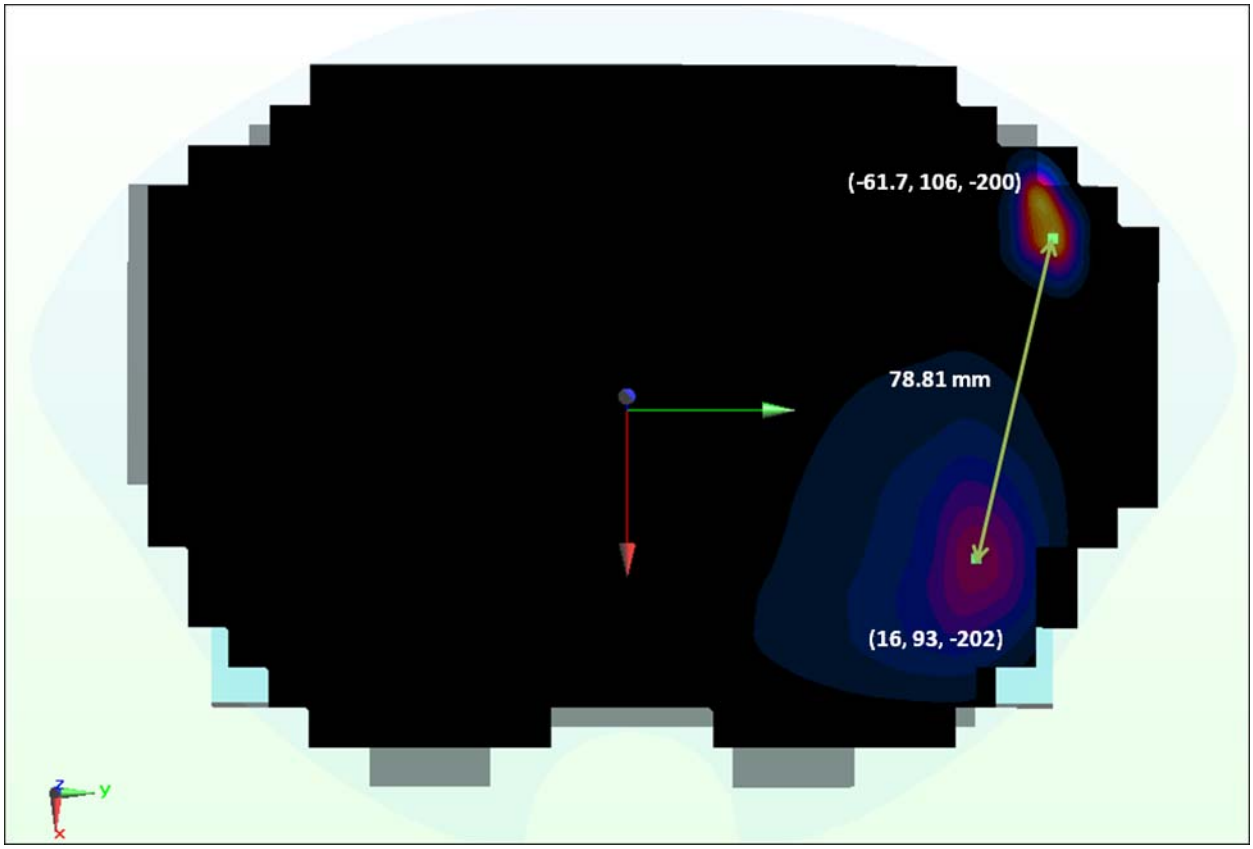

Figure 11-18
Peak SAR Locations of 5 GHz WLAN and GPRS 850

Table 11-45
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
GPRS 850	802.11a	0.95	1.062	2.012	78.81	0.04

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The sum of the standalone SAR values was above 1.6 W/kg for the Body Back side configuration at a separation distance of 0 mm with UMTS 850 antenna operating at limited output power with 5 GHz WIFI.

Table 11-46
Peak SAR Locations for Body Back Side at 0 mm UMTS 850 and 5 GHz WLAN

Mode/Band	x (mm)	y (mm)	z (mm)
UMTS850	14.40	92.00	-202.00
802.11a	-61.70	106.00	-200.00

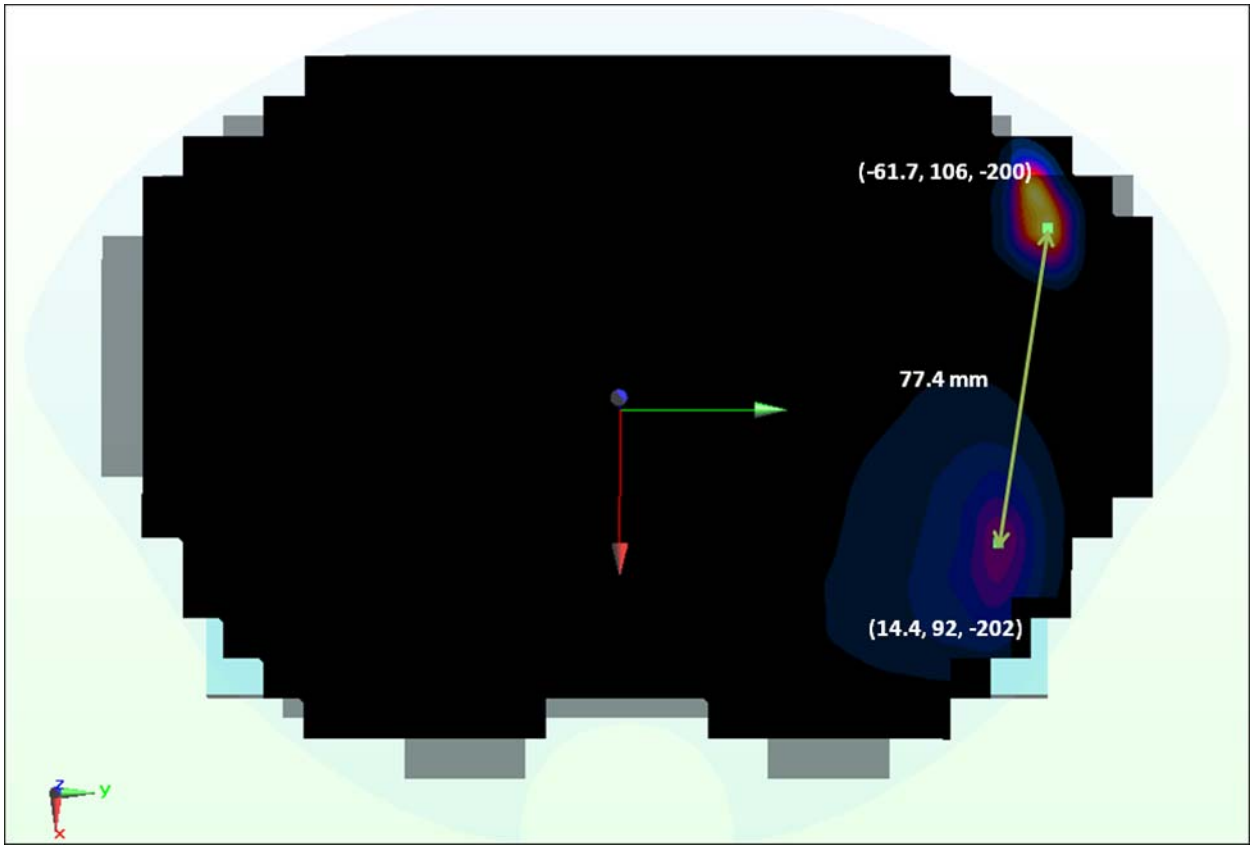

Figure 11-19
Peak SAR Locations of 5 GHz WLAN and UMTS 850

Table 11-47
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
UMTS850	802.11a	0.57	1.062	1.632	77.4	0.03

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The sum of the standalone SAR values was above 1.6 W/kg for the Body Back side configuration at a separation distance of 0 mm with GPRS 1900 antenna operating at limited output power with 5 GHz WIFI.

Table 11-48
Peak SAR Locations for Body Back Side at 0 mm GPRS 1900 and 5 GHz WLAN

Mode/Band	x (mm)	y (mm)	z (mm)
GPRS 1900	13.00	99.00	-204.00
802.11a	-61.70	106.00	-200.00

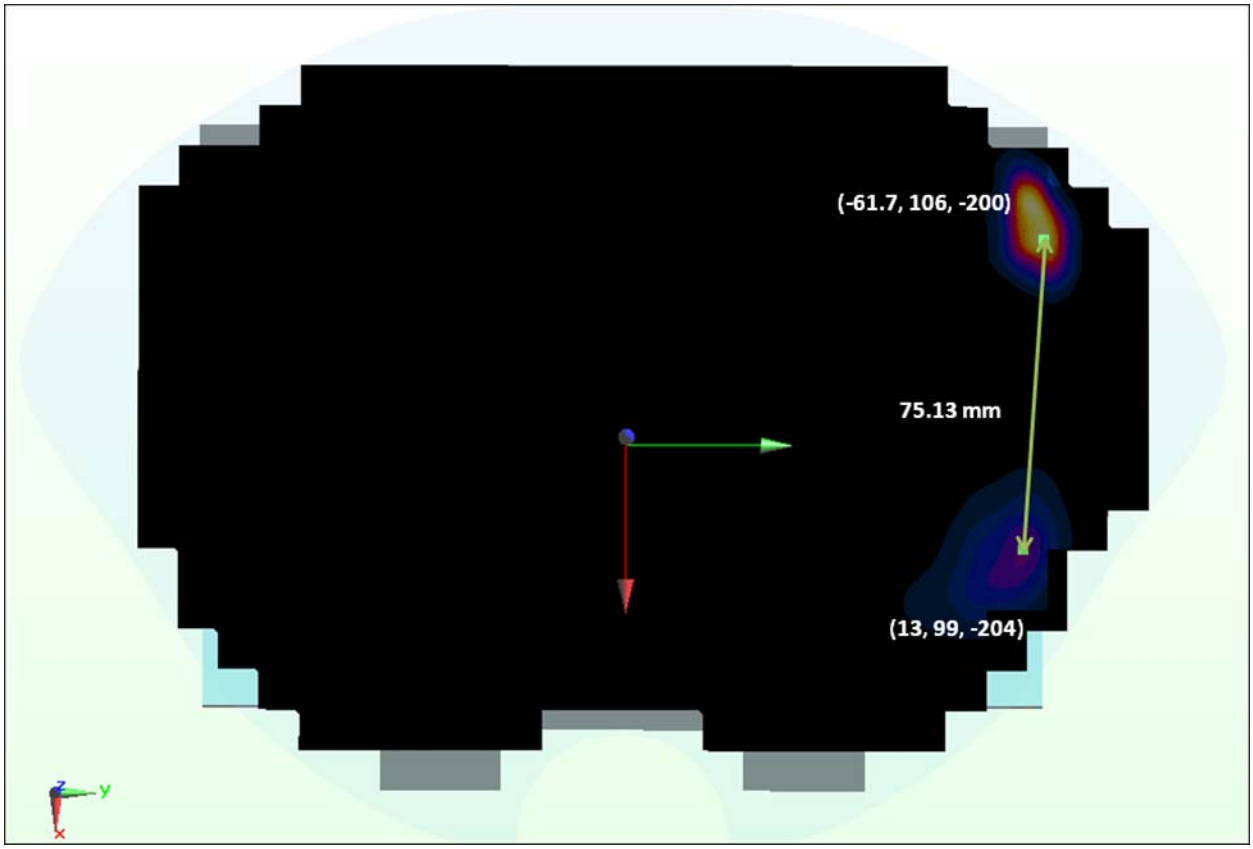

Figure 11-20
Peak SAR Locations of 5 GHz WLAN and GPRS 1900

Table 11-49
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
GPRS 1900	802.11a	0.564	1.062	1.626	75.13	0.03

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The sum of the standalone SAR values was above 1.6 W/kg for the Body Back side configuration at a separation distance of 0 mm with UMTS 1900 antenna operating at limited output power with 5 GHz WIFI.

Table 11-50
Peak SAR Locations for Body Back Side at 0 mm UMTS 1900 and 5 GHz WLAN

Mode/Band	x (mm)	y (mm)	z (mm)
UMTS 1900	12.00	98.00	-204.00
802.11a	-61.70	106.00	-200.00

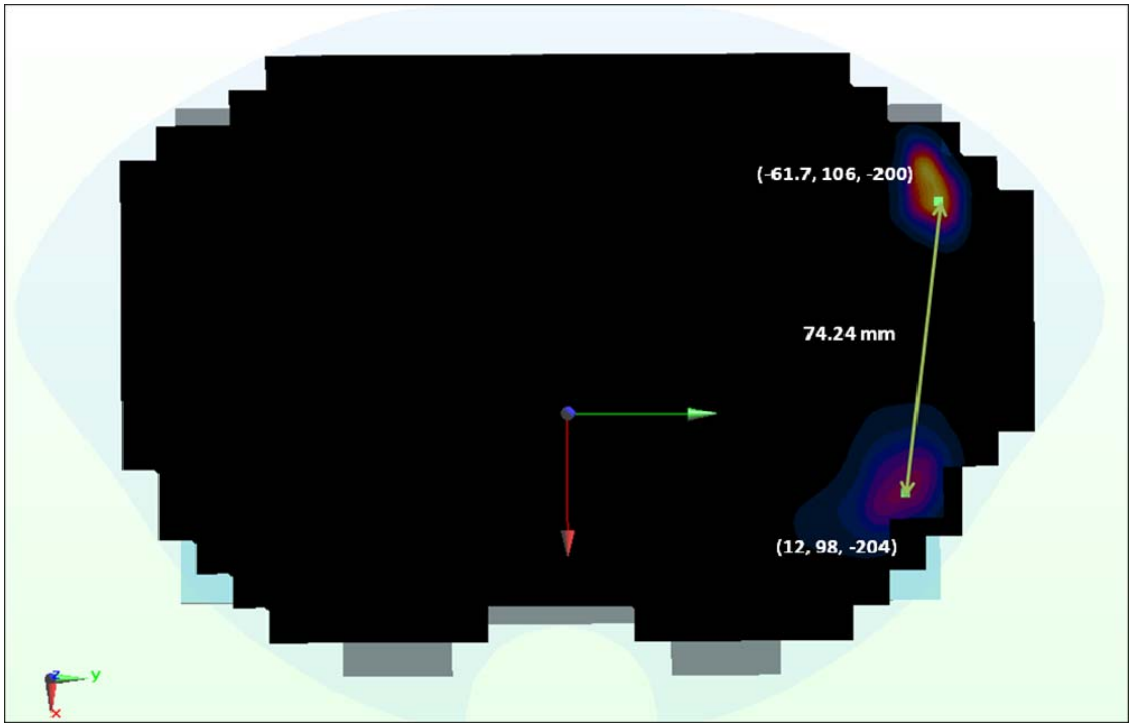

Figure 11-21
Peak SAR Locations of 5 GHz WLAN and UMTS 1900

Table 11-51
SAR Sum to Peak Location Separation Ratio Calculation

Antenna Pair		Standalone 1g SAR (W/kg)		Standalone SAR Sum (W/kg)	Peak SAR Separation Distance (mm)	SPLS Ratio
Ant "a"	Ant "b"	a	b	a+b	D_{a-b}	$(a+b)^{1.5}/D_{a-b}$
UMTS 1900	802.11a	0.959	1.062	2.021	74.24	0.04

11.6 Simultaneous Transmission Conclusion

The above numerical summed SAR results for all the worst-case simultaneous transmission conditions were below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore no measured volumetric simultaneous SAR summation is required per FCC KDB Publication 447498 D01v05.

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12 SAR MEASUREMENT VARIABILITY

12.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR Measurement Variability was assessed using the following procedures for each frequency band:

1) When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.
2) A second repeated measurement was preformed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
3) A third repeated measurement was performed only if the original, first or second repeated measurement was ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.
4) Repeated measurements are not required when the original highest measured SAR is < 0.80 W/kg

Table 12-1
Body SAR Measurement Variability Results

BODY VARIABILITY RESULTS															
Band	FREQUENCY		Mode	Service	# of Time Slots	Data Rate (Mbps)	Side	Spacing	Measured SAR (1g)	1st Repeated SAR (1g)	Ratio	2nd Repeated SAR (1g)	Ratio	3rd Repeated SAR (1g)	Ratio
	MHz	Ch.							(W/kg)	(W/kg)		(W/kg)		(W/kg)	
835	848.80	251	GSM 850	GPRS	2	N/A	back	6 mm	1.000	0.944	1.06	N/A	N/A	N/A	N/A
1900	1907.60	9538	UMTS 1900	RMC	N/A	N/A	back	0 mm	0.893	0.884	1.01	N/A	N/A	N/A	N/A
2450	2412.00	1	IEEE 802.11b	DSSS	N/A	1	back	0 mm	0.982	0.902	1.09	N/A	N/A	N/A	N/A
5500	5540.00	108	IEEE 802.11a	OFDM	N/A	6	back	0 mm	0.915	0.777	1.18	N/A	N/A	N/A	N/A
5600	5580.00	116	IEEE 802.11a	OFDM	N/A	6	back	0 mm	0.808	0.703	1.15	N/A	N/A	N/A	N/A
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram							

12.2 Measurement Uncertainty

The measured SAR was <1.5 W/kg for all frequency bands. Therefore, per KDB Publication 865664 D01v01, the extended measurement uncertainty analysis per IEEE 1528-2003 was not required.

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13 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	E8257D	(250kHz-20GHz) Signal Generator	4/5/2012	Annual	4/5/2013	MY45470194
Agilent	8753E	(30kHz-6GHz) Network Analyzer	4/3/2012	Annual	4/3/2013	US37390350
Agilent	8753E	(30kHz-6GHz) Network Analyzer	4/4/2012	Annual	4/4/2013	JP38020182
Agilent	8594A	(9kHz-2.9GHz) Spectrum Analyzer	N/A	N/A	N/A	3051A00187
Agilent	8648D	(9kHz-4GHz) Signal Generator	10/10/2012	Annual	10/10/2013	3613A00315
Agilent	85070E	Dielectric Probe Kit	2/14/2013	Annual	2/14/2014	MY44300633
Agilent	8648D	Signal Generator	4/3/2012	Annual	4/3/2013	3629U00687
Agilent	85047A	S-Parameter Test Set	N/A	N/A	N/A	2904A00579
Agilent	MA24106A	USB Power Sensor	12/7/2012	Annual	12/7/2013	1244515
Agilent	MA24106A	USB Power Sensor	12/7/2012	Annual	12/7/2013	1244512
Agilent	E5515C	Wireless Communications Test Set	9/24/2012	Annual	9/24/2013	GB43163447
Agilent	E5515C	Wireless Communications Test Set	10/18/2012	Biennial	10/18/2014	GB43193563
Amplifier Research	5S1G4	5W, 800MHz-4.2GHz	CBT	N/A	CBT	21910
Anritsu	ML2438A	Power Meter	2/14/2013	Annual	2/14/2014	1190013
Anritsu	ML2438A	Power Meter	2/14/2013	Annual	2/14/2014	98150041
Anritsu	MA2481A	Power Sensor	2/14/2013	Annual	2/14/2014	5821
Anritsu	MA2481A	Power Sensor	2/14/2013	Annual	2/14/2014	2400
Anritsu	MA2411B	Pulse Power Sensor	12/4/2012	Annual	12/4/2013	1207364
Anritsu	MA2411B	Pulse Power Sensor	12/5/2012	Annual	12/5/2013	1126066
Anritsu	MT8820C	Radio Communication Tester	11/6/2012	Annual	11/6/2013	6200901190
COMTECH	AR85729-5/5759B	Solid State Amplifier	CBT	N/A	CBT	M3W1A00-1002
COMTech	AR85729-5	Solid State Amplifier	CBT	N/A	CBT	M1S5A00-009
Gigatronics	80701A	(0.05-18GHz) Power Sensor	10/10/2012	Annual	10/10/2013	1833460
Gigatronics	8651A	Universal Power Meter	10/10/2012	Annual	10/10/2013	8650319
Intelligent Weigh	PD-3000	Electronic Balance	3/27/2012	Annual	3/27/2013	11081534
Intelligent Weighing	PD-3000	Electronic Balance	6/29/2012	Annual	6/29/2013	120405017
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
MiniCircuits	SLP-2400+	Low Pass Filter	CBT	N/A	CBT	R8979500903
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-1200+	Low Pass Filter DC to 1000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Narda	BW-S3W2	Attenuator (3dB)	CBT	N/A	CBT	120
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Rohde & Schwarz	CMU200	Base Station Simulator	5/22/2012	Annual	5/22/2013	109892
Rohde & Schwarz	NRVD	Dual Channel Power Meter	10/12/2012	Biennial	10/12/2014	101695
Rohde & Schwarz	NRV-Z32	Peak Power Sensor	10/12/2012	Biennial	10/12/2014	836019/013
Rohde & Schwarz	SMIQ03B	Signal Generator	4/5/2012	Annual	4/5/2013	DE27259
Rohde & Schwarz	SME06	Signal Generator	10/11/2012	Annual	10/11/2013	832026
Seekonk	NC-100	Torque Wrench (8" lb)	3/5/2012	Triennial	3/5/2015	N/A
Seekonk	NC-100	Torque Wrench (8" lb)	3/5/2012	Triennial	3/5/2015	N/A
SPEAG	D1900V2	1900 MHz SAR Dipole	2/22/2012	Annual	2/22/2013	5d149
SPEAG	D1900V2	1900 MHz SAR Dipole	2/6/2013	Annual	2/6/2014	5d148
SPEAG	D2450V2	2450 MHz SAR Dipole	8/23/2012	Annual	8/23/2013	719
SPEAG	D2450V2	2450 MHz SAR Dipole	1/8/2013	Annual	1/8/2014	797
SPEAG	D5GHzV2	5 GHz SAR Dipole	1/11/2013	Annual	1/11/2014	1057
SPEAG	D835V2	835 MHz SAR Dipole	8/23/2012	Annual	8/23/2013	4d026
SPEAG	D835V2	835 MHz SAR Dipole	1/7/2013	Annual	1/7/2014	4d132
SPEAG	D835V2	836 MHz SAR Dipole	4/20/2012	Annual	4/20/2013	4d119
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/19/2012	Annual	4/19/2013	665
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/7/2012	Annual	5/7/2013	1334
SPEAG	DAE4	Dasy Data Acquisition Electronics	8/24/2012	Annual	8/24/2013	1322
SPEAG	DAE4	Dasy Data Acquisition Electronics	9/19/2012	Annual	9/19/2013	1323
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/13/2012	Annual	11/13/2013	1333
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/17/2013	Annual	1/17/2014	1272
SPEAG	DAK-3.5	Dielectic Assessment Kit	6/19/2012	Annual	6/19/2013	1070
SPEAG	DAK-3.5	Dielectric Assessment Kit	12/11/2012	Annual	12/11/2013	1091
SPEAG	ES3DV3	SAR Probe	4/24/2012	Annual	4/24/2013	3213
SPEAG	ES3DV3	SAR Probe	5/18/2012	Annual	5/18/2013	3263
SPEAG	ES3DV2	SAR Probe	8/28/2012	Annual	8/28/2013	3022
SPEAG	ES3DV3	SAR Probe	9/20/2012	Annual	9/20/2013	3288
SPEAG	ES3DV3	SAR Probe	11/15/2012	Annual	11/15/2013	3287
SPEAG	EX3DV4	SAR Probe	1/17/2013	Annual	1/17/2014	3589
Tektronix	RSA-6114A	Real Time Spectrum Analyzer	4/5/2012	Annual	4/5/2013	B010177
VWR	23226-658	Long Stem Thermometer	3/30/2012	Biennial	3/30/2014	122179874
VWR	23226-658	Long Stem Thermometer	5/16/2012	Biennial	5/16/2014	122295544
VWR	62344-925	Mini-Thermometer	10/24/2011	Biennial	10/24/2013	111886441
VWR	36934-158	Wall-Mounted Thermometer	9/30/2011	Biennial	9/30/2013	111859323
VWR	36934-158	Wall-Mounted Thermometer	9/30/2011	Biennial	9/30/2013	111859332

Note:

1. CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path. The power meter offset was then adjusted to compensate for the measurement system losses. This level offset is stored within the power meter before measurements are made. This calibration verification procedure applies to the system verification and output power measurements. The calibrated reading is then taken directly from the power meter after compensation of the losses for all final power measurements.
2. All Calibrated Equipments were used within their calibration period.

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14 MEASUREMENT UNCERTAINTIES

Applicable for frequencies less than 3000 MHz.

a	b	c	d	e= f(d,k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component	**IEEE 1528 Sec.**	**Tol. (± %)**	**Prob. Dist.**	**Div.**	**c_i 1gm**	**c_i 10 gms**	**1gm u_i (± %)**	**10gms u_i (± %)**	**v_i**
Measurement System									
Probe Calibration	E.2.1	6.0	N	1	1.0	1.0	6.0	6.0	∞
Axial Isotropy	E.2.2	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	E.2.2	1.3	N	1	1.0	1.0	1.3	1.3	∞
Boundary Effect	E.2.3	0.4	N	1	1.0	1.0	0.4	0.4	∞
Linearity	E.2.4	0.3	N	1	1.0	1.0	0.3	0.3	∞
System Detection Limits	E.2.5	5.1	N	1	1.0	1.0	5.1	5.1	∞
Readout Electronics	E.2.6	1.0	N	1	1.0	1.0	1.0	1.0	∞
Response Time	E.2.7	0.8	R	1.73	1.0	1.0	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.73	1.0	1.0	1.5	1.5	∞
RF Ambient Conditions	E.6.1	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1.0	1.0	0.2	0.2	∞
Probe Positioning w/ respect to Phantom	E.6.3	2.9	R	1.73	1.0	1.0	1.7	1.7	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	E.5	1.0	R	1.73	1.0	1.0	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	E.4.2	6.0	N	1	1.0	1.0	6.0	6.0	287
Device Holder Uncertainty	E.4.1	3.32	R	1.73	1.0	1.0	1.9	1.9	∞
Output Power Variation - SAR drift measurement	6.6.2	5.0	R	1.73	1.0	1.0	2.9	2.9	∞
Phantom & Tissue Parameters									
Phantom Uncertainty (Shape & Thickness tolerances)	E.3.1	4.0	R	1.73	1.0	1.0	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	3.8	N	1	0.64	0.43	2.4	1.6	6
Liquid Permittivity - deviation from target values	E.3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Liquid Permittivity - measurement uncertainty	E.3.3	4.5	N	1	0.60	0.49	2.7	2.2	6
Combined Standard Uncertainty (k=1)			RSS				12.1	11.7	299
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				24.2	23.5	

The above measurement uncertainties are according to IEEE Std. 1528-2003

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Applicable for frequencies up to 6 GHz.

a	b	c	d	e= f(d,k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component	**IEEE 1528 Sec.**	**Tol. (± %)**	**Prob. Dist.**	**Div.**	**c_i 1gm**	**c_i 10 gms**	**1gm u_i (± %)**	**10gms u_i (± %)**	**v_i**
Measurement System									
Probe Calibration	E.2.1	6.55	N	1	1.0	1.0	6.6	6.6	∞
Axial Isotropy	E.2.2	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	E.2.2	1.3	N	1	1.0	1.0	1.3	1.3	∞
Boundary Effect	E.2.3	0.4	N	1	1.0	1.0	0.4	0.4	∞
Linearity	E.2.4	0.3	N	1	1.0	1.0	0.3	0.3	∞
System Detection Limits	E.2.5	5.1	N	1	1.0	1.0	5.1	5.1	∞
Readout Electronics	E.2.6	1.0	N	1	1.0	1.0	1.0	1.0	∞
Response Time	E.2.7	0.8	R	1.73	1.0	1.0	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.73	1.0	1.0	1.5	1.5	∞
RF Ambient Conditions	E.6.1	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1.0	1.0	0.2	0.2	∞
Probe Positioning w/ respect to Phantom	E.6.3	2.9	R	1.73	1.0	1.0	1.7	1.7	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	E.5	1.0	R	1.73	1.0	1.0	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	E.4.2	6.0	N	1	1.0	1.0	6.0	6.0	287
Device Holder Uncertainty	E.4.1	3.32	R	1.73	1.0	1.0	1.9	1.9	∞
Output Power Variation - SAR drift measurement	6.6.2	5.0	R	1.73	1.0	1.0	2.9	2.9	∞
Phantom & Tissue Parameters									
Phantom Uncertainty (Shape & Thickness tolerances)	E.3.1	4.0	R	1.73	1.0	1.0	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	3.8	N	1	0.64	0.43	2.4	1.6	6
Liquid Permittivity - deviation from target values	E.3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Liquid Permittivity - measurement uncertainty	E.3.3	4.5	N	1	0.60	0.49	2.7	2.2	6
Combined Standard Uncertainty (k=1)			RSS				12.4	12.0	299
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				24.7	24.0	

The above measurement uncertainties are according to IEEE Std. 1528-2003

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15 CONCLUSION

15.1 Measurement Conclusion

The SAR evaluation indicates that the EUT complies with the RF radiation exposure limits of the FCC and Industry Canada, with respect to all parameters subject to this test. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because various factors may interact with one another to vary the specific biological outcome of an exposure to electromagnetic fields, any protection guide should consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables. [3]

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