PCTEST ENGINEERING LABORATORY, INC.
7185 Oakland Mills Road, Columbia, MD 21046 USA
Tel. +1.410.290.6652 / Fax +1.410.290.6654
http://www.pctestlab.com

SAR EVALUATION REPORT

Applicant Name:
Samsung Electronics, Co. Ltd.
129, Samsung-ro, Maetan dong,
Yeongtong-gu, Suwon-si
Gyeonggi-do 443-742, Korea

Date of Testing:
07/07/14 – 08/04/14
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Document Serial No.:
0Y1407071344.A3L

FCC ID: **A3LSMG901F**

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

DUT Type: Portable Handset
Application Type: Certification
FCC Rule Part(s): CFR §2.1093
Model(s): SM-G901F

Equipment Class	Band & Mode	Tx Frequency	SAR		
			1 gm Head (W/kg)	1 gm Body-Worn (W/kg)	1 gm Hotspot (W/kg)
PCE	GSM/GPRS/EDGE 850	824.20 - 848.80 MHz	0.30	0.40	0.48
PCE	GSM/GPRS/EDGE 1900	1850.20 - 1909.80	0.18	0.33	0.90
PCE	UMTS 850	826.40 - 846.60 MHz	0.56	0.77	0.77
PCE	UMTS 1900	1852.4 - 1907.6 MHz	0.26	0.59	0.92
PCE	LTE Band 5 (Cell)	824.7 - 848.3 MHz	0.58	0.69	0.69
PCE	LTE Band 2 (PCS)	1850.7 - 1909.3 MHz	0.30	0.68	1.10
DTS	2.4 GHz WLAN	2412 - 2462 MHz	0.66	0.23	0.23
DTS	5.8 GHz WLAN	5745 - 5825 MHz	0.58	0.16	
NII	5.2 GHz WLAN	5180 - 5240 MHz	0.35	0.23	
NII	5.3 GHz WLAN	5260 - 5320 MHz	0.21	0.24	
NII	5.5 GHz WLAN	5500 - 5700 MHz	0.59	0.23	
DSS/DTS	Bluetooth	2402 - 2480 MHz	N/A		
Simultaneous SAR per KDB 690783 D01v01r03:			1.09	1.01	1.29

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 1.8 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 CERT#2041.01

© 2014 PCTEST Engineering Laboratory, Inc.

TABLE OF CONTENTS

1 DEVICE UNDER TEST 3

2 LTE INFORMATION 9

3 INTRODUCTION 10

4 DOSIMETRIC ASSESSMENT 11

5 DEFINITION OF REFERENCE POINTS 12

6 TEST CONFIGURATION POSITIONS FOR HANDSETS 13

7 RF EXPOSURE LIMITS 17

8 FCC MEASUREMENT PROCEDURES 18

9 RF CONDUCTED POWERS 22

10 SYSTEM VERIFICATION 44

11 SAR DATA SUMMARY 46

12 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS 56

13 SAR MEASUREMENT VARIABILITY 65

14 EQUIPMENT LIST 66

15 MEASUREMENT UNCERTAINTIES 67

16 CONCLUSION 69

17 REFERENCES 70

APPENDIX A: SAR TEST PLOTS

APPENDIX B: SAR DIPOLE VERIFICATION PLOTS

APPENDIX C: PROBE AND DIPOLE CALIBRATION CERTIFICATES

APPENDIX D: SAR TISSUE SPECIFICATIONS

APPENDIX E: SAR SYSTEM VALIDATION

APPENDIX F: SAR TEST SETUP PHOTOGRAPHS

© 2014 PCTEST Engineering Laboratory, Inc.

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
GSM/GPRS/EDGE 1900	Voice/Data	1850.20 - 1909.80 MHz
UMTS 850	Voice/Data	826.40 - 846.60 MHz
UMTS 1900	Voice/Data	1852.4 - 1907.6 MHz
LTE Band 5 (Cell)	Voice/Data	824.7 - 848.3 MHz
LTE Band 2 (PCS)	Voice/Data	1850.7 - 1909.3 MHz
2.4 GHz WLAN	Data	2412 - 2462 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
NFC	Data	13.56 MHz
ANT+	Data	2402 - 2480 MHz

1.2 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.

Mode / Band		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	Maximum	**33.5**	**33.5**	**31.5**	**27.5**	**27.0**	**27.5**	**26.5**	**26.5**	**26.5**
	Nominal	**33.0**	**33.0**	**31.0**	**27.0**	**26.5**	**27.0**	**26.0**	**26.0**	**26.0**
GSM/GPRS/EDGE 1900	Maximum	**29.5**	**29.5**	**29.0**	**26.0**	**25.0**	**25.5**	**25.5**	**25.0**	**25.0**
	Nominal	**29.0**	**29.0**	**28.5**	**25.5**	**24.5**	**25.0**	**25.0**	**24.5**	**24.5**

Mode / Band		Modulated Average (dBm)		
		3GPP WCDMA Rel. 99	*3GPP HSDPA Rel. 5*	*3GPP HSUPA Rel. 6*
UMTS Band 5 (850 MHz)	Maximum	**23.5**	**22.5**	**21.0**
	Nominal	**23.0**	**22.0**	**20.5**
UMTS Band 2 (1900 MHz)	Maximum	**21.5**	**21.5**	**20.5**
	Nominal	**21.0**	**21.0**	**20.0**

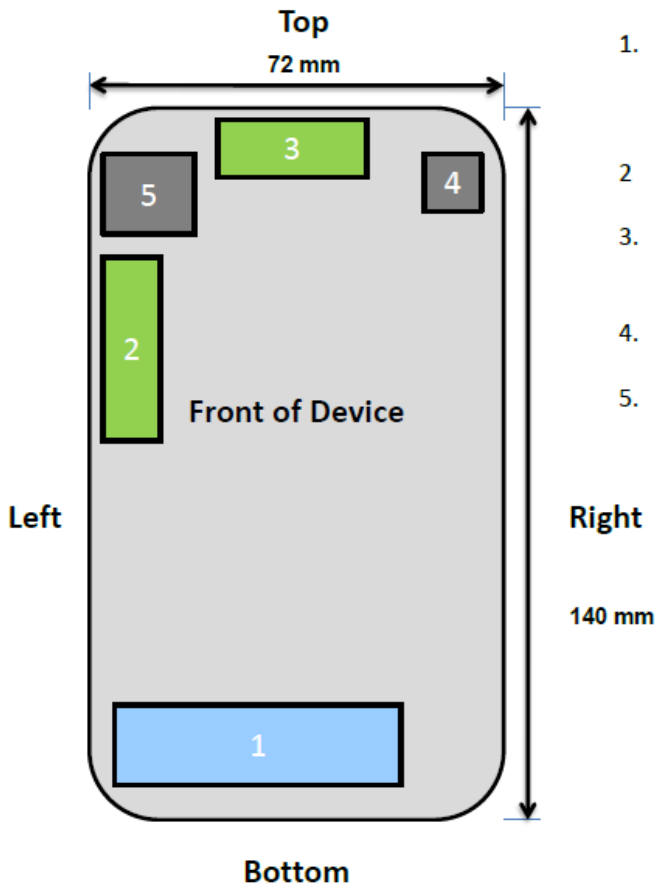
Mode / Band		Modulated Average (dBm)
LTE Band 5 (Cell)	Maximum	**23.7**
	Nominal	**23.2**
LTE Band 2 (PCS)	Maximum	**23.0**
	Nominal	**22.5**

© 2014 PCTEST Engineering Laboratory, Inc.

Mode / Band		Modulated Average (dBm)
SISO Ant 1 IEEE 802.11b (2.4 GHz)	Maximum	**13.5**
	Nominal	**13.0**
SISO Ant 1 IEEE 802.11g (2.4 GHz)	Maximum	**13.5**
	Nominal	**13.0**
SISO Ant 1 IEEE 802.11n (2.4 GHz)	Maximum	**12.5**
	Nominal	**12.0**
SISO Ant 2 IEEE 802.11b (2.4 GHz)	Maximum	**16.5**
	Nominal	**16.0**
SISO Ant 2 IEEE 802.11g (2.4 GHz)	Maximum	**14.5**
	Nominal	**14.0**
SISO Ant 2 IEEE 802.11n (2.4 GHz)	Maximum	**13.5**
	Nominal	**13.0**
MIMO IEEE 802.11n (2.4 GHz)	Maximum	**16.0**
	Nominal	**15.5**
SISO Ant 1 IEEE 802.11a (5 GHz)	Maximum	**9.5**
	Nominal	**9.0**
SISO Ant 1 IEEE 802.11n (5 GHz) 20 MHz Bandwidth	Maximum	**9.5**
	Nominal	**9.0**
SISO Ant 1 IEEE 802.11n (5 GHz) 40 MHz Bandwidth	Maximum	**8.5**
	Nominal	**8.0**
SISO Ant 1 IEEE 802.11ac (5 GHz) 80 MHz Bandwidth	Maximum	**7.5**
	Nominal	**7.0**
SISO Ant 2 IEEE 802.11a (5 GHz)	Maximum	**6.5**
	Nominal	**6.0**
SISO Ant 2 IEEE 802.11n (5 GHz) 20 MHz Bandwidth	Maximum	**6.5**
	Nominal	**6.0**
SISO Ant 2 IEEE 802.11n (5 GHz) 40 MHz Bandwidth	Maximum	**5.5**
	Nominal	**5.0**
SISO Ant 2 IEEE 802.11ac (5 GHz) 80 MHz Bandwidth	Maximum	**6.5**
	Nominal	**6.0**
MIMO IEEE 802.11n (5 GHz) 20 MHz Bandwidth	Maximum	**11.5**
	Nominal	**11.0**
MIMO IEEE 802.11n (5 GHz) 40 MHz Bandwidth	Maximum	**10.5**
	Nominal	**10.0**
MIMO IEEE 802.11ac (5 GHz) 80 MHz Bandwidth	Maximum	**9.5**
	Nominal	**9.0**
Bluetooth	Maximum	**10.0**
	Nominal	**9.5**
Bluetooth LE	Maximum	**2.0**
	Nominal	**1.5**

© 2014 PCTEST Engineering Laboratory, Inc.

1.3 DUT Antenna Locations



1. Main Antenna
   - 850/1900 MHz GSM/GPRS/EDGE (Tx/Rx)
   - 850/1900 MHz UMTS (Tx/Rx)
   - LTE B5/B2 (Tx/Rx)
2. WIFI Antenna 2
   - 2.4/5 GHz WIFI (Tx/Rx)
3. BT/WIFI Antenna 1
   - 2.4/5 GHz WIFI (Tx/Rx)
   - 2.4 GHz BT (Tx/Rx)
4. Antenna 4
   - GPS (Rx only)
5. Antenna 5
   - 850/1900 MHz GSM/ UMTS/LTE Diversity (Rx only)

Note: Exact antenna dimensions and separation distances are shown in the Technical Descriptions in the FCC Filing.

Figure 1-1
DUT Antenna Locations

Table 1-1
Mobile Hotspot Sides for SAR Testing

Mode	Back	Front	Top	Bottom	Right	Left
GPRS 850	Yes	Yes	No	Yes	No	Yes
GPRS 1900	Yes	Yes	No	Yes	No	Yes
UMTS 850	Yes	Yes	No	Yes	No	Yes
UMTS 1900	Yes	Yes	No	Yes	No	Yes
LTE Band 5 (Cell)	Yes	Yes	No	Yes	No	Yes
LTE Band 2 (PCS)	Yes	Yes	No	Yes	No	Yes
2.4 GHz Antenna 1 WLAN	Yes	Yes	Yes	No	No	Yes
2.4 GHz Antenna 2 WLAN	Yes	Yes	No	No	No	Yes
2.4 GHz MIMO WLAN	Yes	Yes	Yes	No	No	Yes

Note: Particular DUT edges were not required to be evaluated for Wireless Router SAR if the edges were greater than 2.5 cm from the transmitting antenna according to FCC KDB Publication 941225 D06v01 guidance, page 2. When the wireless router mode is enabled, all 5 GHz bands are disabled. Therefore 5 GHz WIFI is not considered in this section.

© 2014 PCTEST Engineering Laboratory, Inc.

1.4 Near Field Communications (NFC) Antenna

This DUT has NFC operations. The NFC antenna is integrated into the specialized battery. The SAR tests were performed with the specialized battery (model: EB-BG900BBE).

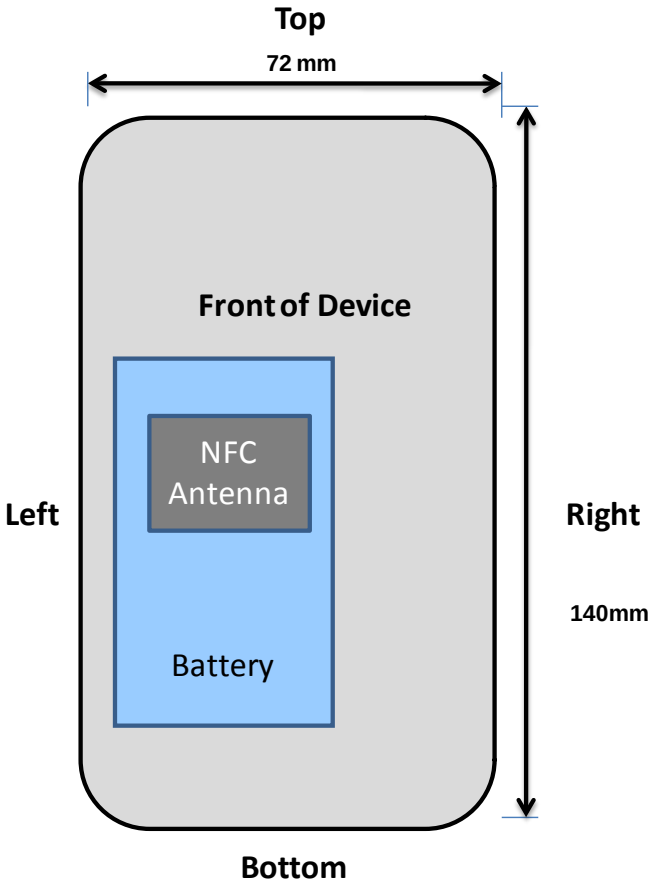


Figure 1-2
NFC Antenna Locations

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. Possible transmission paths for the DUT are shown in Figure 1-3 and are color-coded to indicate communication modes which share the same path. Modes which share the same transmission path cannot transmit simultaneously with one another. This device supports MIMO Tx for WLAN 802.11n/ac. Each WLAN antenna can transmit independently or together when operating with MIMO.

Figure 1-3
Simultaneous Transmission Paths

© 2014 PCTEST Engineering Laboratory, Inc.

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 1-2
Simultaneous Transmission Scenarios

No.	Capable Transmit Configuration	Head	Body-Worn Accessory	Wireless Router	Notes
1	GSM voice + 2.4 GHz WI-FI	Yes	Yes	N/A	
2	GSM voice + 5 GHz WI-FI	Yes	Yes	N/A	
3	GSM voice + 2.4 GHz Bluetooth	N/A	Yes	N/A	
4	UMTS + 2.4 GHz WI-FI	Yes	Yes	Yes	
5	UMTS + 5 GHz WI-FI	Yes	Yes	N/A	
6	UMTS + 2.4 GHz Bluetooth	N/A	Yes	N/A	
7	LTE + 2.4 GHz WI-FI	Yes*	Yes*	Yes	*-Pre-installed VOIP applications are considered.
8	LTE + 2.4 GHz Bluetooth	N/A	Yes*	N/A	*-Pre-installed VOIP applications are considered.
9	GPRS/EDGE + 2.4 GHz WI-FI	N/A	N/A	Yes	
10	LTE + 5 GHz WI-FI	Yes*	Yes*	N/A	
11	GPRS/EDGE + 5 GHz WI-FI	N/A	N/A	N/A	Not supported by SW

Note:

1. 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.
2. This device supports 2×2 MIMO Tx for WLAN 802.11n/ac. Each WLAN antenna can transmit independently or together when operating with MIMO.
3. Per the manufacturer, WIFI Direct is not expected to be used in conjunction with a held-to-ear or body-worn accessory voice call. Therefore, there is no simultaneous transmission scenarios involving WIFI direct beyond that listed in the above table.
4. When the wireless router mode is enabled, all 5 GHz bands are disabled.

1.6 SAR Test Exclusions Applied

(A) WIFI/BT

Since Wireless Router operations are not allowed by the chipset firmware using 5 GHz WIFI, only 2.4 GHz WIFI Hotspot SAR tests and combinations are considered for SAR with respect to Wireless Router configurations according to FCC KDB 941225 D06v01.

Per FCC KDB 447498 D01v05, 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 (rounded to the nearest mW) and the antenna to user separation distance, Bluetooth SAR was not required; [(10/10)* √2.480] = 1.6< 3.0. Per KDB Publication 447498 D01v05, the maximum power of the channel was rounded to the nearest mW before calculation.

Per April 2013 TCB Workshop notes, full SAR tests for all SISO IEEE 802.11ac configurations were not required because the average output power was not more than 0.25 dB higher than SISO IEEE 802.11a mode. SISO IEEE 802.11ac was evaluated for the highest SISO IEEE 802.11a position in each 5 GHz band and exposure condition.

This device supports IEEE 802.11ac with the following features:
a) Up to 80 MHz Bandwidth only
b) No aggregate channel configurations
c) 2 Tx antenna output
d) 256 QAM is supported
e) No new 5 GHz channels

© 2014 PCTEST Engineering Laboratory, Inc.

(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.

LTE SAR for the higher modulations and lower bandwidths were not tested since the maximum average output power of all required channels and configurations was not more than 0.5 dB higher than the highest bandwidth; and the reported LTE SAR for the highest bandwidth was less than 1.45 W/kg for all configurations according to FCC KDB 941225 D05v02.

1.7 Power Reduction for SAR

There is no power reduction used for any band/mode implemented in this device for SAR purposes.

1.8 Guidance Applied

- IEEE 1528-2003
- FCC KDB Publication 941225 D01-D06 (2G/3G/4G and Hotspot)
- 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)
- April 2013 TCB Workshop Notes (IEEE 802.11ac)
- October 2013 TCB Workshop Notes (GPRS Testing Considerations)

1.9 Device Serial Numbers

Several samples with identical hardware were used to support SAR testing. 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.

Mode	Head Serial Number	Body-Worn Serial Number	Hotspot Serial Number
GSM/GPRS/EDGE 850	7-03	7-01	7-01
GSM/GPRS/EDGE 1900	7-01	7-03	7-03
UMTS 850	7-03	7-01	7-01
UMTS 1900	7-01	7-03	7-03
LTE Band 5 (Cell)	22-08	22-08	22-08
LTE Band 2 (PCS)	28-01	28-01	28-01
2.4 GHz WLAN	7-02	7-02	7-02
5 GHz WLAN	7-02	7-02	7-02

© 2014 PCTEST Engineering Laboratory, Inc.

2 LTE INFORMATION

LTE Information			
FCC ID	**A3LSMG901F**		
Form Factor	Portable Handset		
Frequency Range of each LTE transmission band	LTE Band 5 (Cell) (824.7 - 848.3 MHz)		
	LTE Band 2 (PCS) (1850.7 - 1909.3 MHz)		
Channel Bandwidths	LTE Band 5 (Cell): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz		
	LTE Band 2 (PCS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz		
Channel Numbers and Frequencies (MHz)	Low	Mid	High
LTE Band 5 (Cell): 1.4 MHz	824.7 (20407)	836.5 (20525)	848.3 (20643)
LTE Band 5 (Cell): 3 MHz	825.5 (20415)	836.5 (20525)	847.5 (20635)
LTE Band 5 (Cell): 5 MHz	826.5 (20425)	836.5 (20525)	846.5 (20625)
LTE Band 5 (Cell): 10 MHz	829 (20450)	836.5 (20525)	844 (20600)
LTE Band 2 (PCS): 1.4 MHz	1850.7 (18607)	1880 (18900)	1909.3 (19193)
LTE Band 2 (PCS): 3 MHz	1851.5 (18615)	1880 (18900)	1908.5 (19185)
LTE Band 2 (PCS): 5 MHz	1852.5 (18625)	1880 (18900)	1907.5 (19175)
LTE Band 2 (PCS): 10 MHz	1855 (18650)	1880 (18900)	1905 (19150)
LTE Band 2 (PCS): 15 MHz	1857.5 (18675)	1880 (18900)	1902.5 (19125)
LTE Band 2 (PCS): 20 MHz	1860 (18700)	1880 (18900)	1900 (19100)
UE Category	4		
Modulations Supported in UL	QPSK, 16QAM		
LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3~6.2.5? (manufacturer attestation to be provided)	YES		
A-MPR (Additional MPR) disabled for SAR Testing?	YES		

© 2014 PCTEST Engineering Laboratory, Inc.

3 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 [22]. 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.

3.1 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 3-1).

Equation 3-1
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]

© 2014 PCTEST Engineering Laboratory, Inc.

4 DOSIMETRIC ASSESSMENT

4.1 Measurement Procedure

The evaluation was performed using the following procedure compliant to FCC KDB Publication 865664 D01v01 and IEEE 1528-2013:

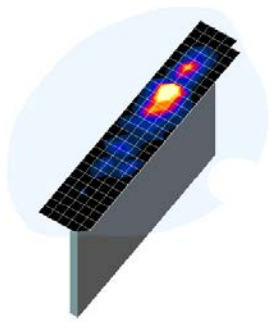


Figure 4-1
Sample SAR Area Scan

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 4-1) and IEEE 1528-2013.
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 4-1) and IEEE 1528-2013. 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. SAR values at the inner surface of the phantom are extrapolated from the measured values along the line away from the surface with spacing no greater than that in Table 4-1. 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 4-1
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

*Also compliant to IEEE 1528-2013 Table 6

© 2014 PCTEST Engineering Laboratory, Inc.

5 DEFINITION OF REFERENCE POINTS

5.1 EAR REFERENCE POINT

Figure 5-2 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 5-1. The plane passing through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck-Front), also called the Reference Pivoting Line, is not perpendicular to the reference plane (see Figure 5-1). 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].

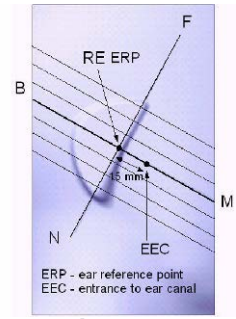


Figure 5-1
Close-Up Side view of ERP

5.2 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 acoustic output located along the "vertical centerline" on the front of the device aligned to the "ear reference point" (See Figure 5-3). The acoustic output 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 5-2
Front, back and side view of SAM Twin Phantom

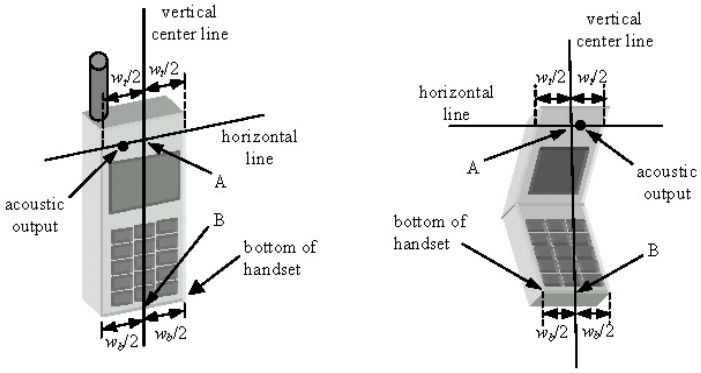


Figure 5-3
Handset Vertical Center & Horizontal Line Reference Points

© 2014 PCTEST Engineering Laboratory, Inc.

6 TEST CONFIGURATION POSITIONS FOR HANDSETS

6.1 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.

6.2 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 6-1), 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 6-1 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 pinna.
3. While maintaining the handset in this plane, the handset was rotated around the LE-RE line until the vertical centerline was in the 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 6-2).

6.3 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. In this situation, the tilted 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 6-2).

© 2014 PCTEST Engineering Laboratory, Inc.

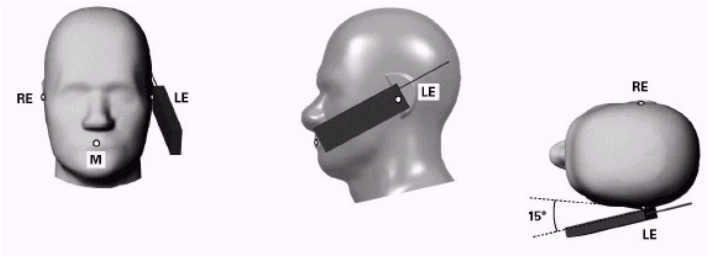


Figure 6-2 Front, Side and Top View of Ear/15º Tilt Position

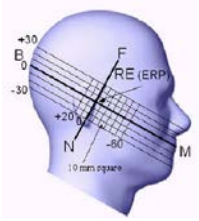


Figure 6-3
Side view w/ relevant markings

6.4 SAR Evaluations near the Mouth/Jaw Regions of the SAM Phantom

Antennas located near the bottom of a phone may require SAR measurements around the mouth and jaw regions of the SAM head phantom. This typically applies to clam-shell style phones that are generally longer in the unfolded normal use positions or to certain older style long rectangular phones. Per IEEE 1528-2013, a rotated SAM phantom is necessary to allow probe access to such regions. Both SAM heads of the TwinSAM-Chin20 are rotated 20 degrees around the NF line. Each head can be removed from the table for emptying and cleaning.

Under these circumstances, the following procedures apply, adopted from the FCC guidance on SAR handsets document FCC KDB Publication 648474 D04_v01. The SAR required in these regions of SAM should be measured using a flat phantom. The phone should be positioned with a separation distance of 4 mm between the ear reference point (ERP) and the outer surface of the flat phantom shell. While maintaining this distance at the ERP location, the low (bottom) edge of the phone should be lowered from the phantom to establish the same separation distance between the peak SAR location identified by the truncated partial SAR distribution measured with the SAM phantom. The distance from the peak SAR location to the phone is determined by the straight line passing perpendicularly through the phantom surface. When it is not feasible to maintain 4 mm separation at the ERP while also establishing the required separation at the peak SAR location, the top edge of the phone will be allowed to touch the phantom with a separation < 4 mm at the ERP. The phone should not be tilted to the left or right while placed in this inclined position to the flat phantom.

Figure 6-4 Twin SAM Chin20

© 2014 PCTEST Engineering Laboratory, Inc.

6.5 Body-Worn Accessory Configurations

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 6-5). Per FCC KDB Publication 648474 D04v01, Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB Publication 447498 D01v05 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

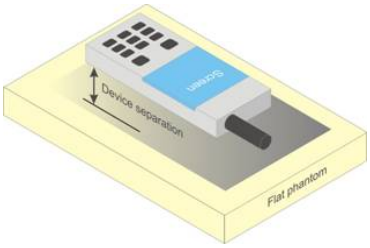


Figure 6-5
Sample Body-Worn Diagram

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are tested with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

Body-worn accessories may not always be supplied or available as options for some devices intended to be authorized for body-worn use. In this case, a test configuration with a separation distance between the back of the device and the flat phantom is used. Test position spacing was documented. Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom in head fluid. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessories, including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

6.6 Extremity Exposure Configurations

Devices that are designed or intended for use on extremities or mainly operated in extremity only exposure conditions; i.e., hands, wrists, feet and ankles, may require extremity SAR evaluation. When the device also operates in close proximity to the user's body, SAR compliance for the body is also required. The 1-g body and 10-g extremity SAR Exclusion Thresholds found in KDB Publication 44798 D01v05 should be applied to determine SAR test requirements.

Per KDB Publication 447498 D01v05, Cell phones (handsets) are not normally designed to be used on extremities or operated in extremity only exposure conditions. The maximum output power levels of handsets generally do not require extremity SAR testing to show compliance. Therefore, extremity SAR was not evaluated for this device.

© 2014 PCTEST Engineering Laboratory, Inc.

6.7 Wireless Router Configurations

Some battery-operated handsets have the capability to transmit and receive user data through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication 941225 D06 v01 where SAR test considerations for handsets (L x W ≥ 9 cm x 5 cm) are based on a composite test separation distance of 10 mm from the front, back and edges of the device containing transmitting antennas within 2.5 cm of their edges, determined from general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WIFI transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions due to the limitations of the SAR assessment probes. Therefore, SAR must be evaluated for each frequency transmission and mode separately and spatially summed with the WIFI transmitter according to FCC KDB Publication 447498 D01v05 publication procedures. The "Portable Hotspot" feature on the handset was NOT activated during SAR assessments, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal at a time.

© 2014 PCTEST Engineering Laboratory, Inc.

7 RF EXPOSURE LIMITS

7.1 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.

7.2 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 7-1
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)
Peak Spatial Average SAR Head	1.6	8.0
Whole Body SAR	0.08	0.4
Peak Spatial Average SAR Hands, Feet, Ankle, Wrists, etc.	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.

© 2014 PCTEST Engineering Laboratory, Inc.

8 FCC MEASUREMENT PROCEDURES

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

8.1 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.

8.2 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.

8.3 SAR Measurement Conditions for UMTS

8.3.1 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.

8.3.2 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.

© 2014 PCTEST Engineering Laboratory, Inc.

8.3.3 Body SAR Measurements

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

8.3.4 SAR Measurements for Handsets with Rel 5 HSDPA

Body SAR for HSDPA is not required for handsets with HSDPA capabilities when the maximum average output power of each RF channel with HSDPA active is less than 0.25 dB higher than that measured without HSDPA using 12.2 kbps RMC and the maximum SAR for 12.2 kbps RMC is ≤ 75% of the SAR limit. Otherwise, SAR is measured for HSDPA, using an FRC with H-Set 1 in Sub-test 1 and a 12.2 kbps RMC configured in Test Loop Mode 1, using the highest body SAR configuration measured in 12.2 kbps RMC without HSDPA, on the maximum output channel with the body exposure configuration that resulted in the highest SAR in 12.2 kbps RMC mode for that RF channel.

The H-set used in FRC for HSDPA should be configured according to the UE category of a test device. The number of HS-DSCH/HSPDSCHs, HARQ processes, minimum inter-TTI interval, transport block sizes and RV coding sequence are defined by the applicable H-set. To maintain a consistent test configuration and stable transmission conditions, QPSK is used in the FRC for SAR testing. HS-DPCCH should be configured with a CQI feedback cycle of 2 ms to maintain a constant rate of active CQI slots. DPCCH and DPDCH gain factors of βc=9 and βd=15, and power offset parameters of ΔACK= ΔNACK =5 and ΔCQI=2 is used. The CQI value is determined by the UE category, transport block size, number of HS-PDSCHs and modulation used in the FRC.

Sub-Test	β_c	β_d	β_d *(SF)*	β_c/β_d	β_{HS} *(Note1, Note 2)*	CM (dB) *(Note 3)*	MPR (dB) *(Note 3)*
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 *(Note 4)*	15/15 *(Note 4)*	64	12/15 *(Note 4)*	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

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: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA, Δ_{ACK} and $\Delta_{NACK} = 8$ ($A_{hs} = 30/15$) with $\beta_{hs} = 30/15 * \beta_c$, and $\Delta_{CQI} = 7$ ($A_{hs} = 24/15$) with $\beta_{hs} = 24/15 * \beta_c$.

Note 3: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Figure 8-1
Table C.10.1.4 of TS 234.121-1

8.3.5 SAR Measurements for Handsets with Rel 6 HSUPA

Body SAR for HSUPA is not required when the maximum average output of each RF channel with HSUPA/HSDPA active is less than 0.25 dB higher than as measured without HSUPA/HSDPA using 12.2 kbps RMC and maximum SAR for 12.2 kbps RMC is ≤ 75 % of the SAR limit. Otherwise SAR is measured on the maximum output channel for the body exposure configuration produced highest SAR in 12.2 kbps RMC for that RF channel, using the additional procedures under "Release 6 HSPA data devices"

Head SAR for VOIP operations under HSPA is not required when maximum average output of each RF channel with HSPA is less than 0.25 dB higher than as measured using 12.2 kbps RMC. Otherwise SAR is measured using same HSPA configuration as used for body SAR.

© 2014 PCTEST Engineering Laboratory, Inc.

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.

8.4 SAR Measurement Conditions for LTE

LTE modes were tested according to FCC KDB 941225 D05v02 publication. Please see notes after the tabulated SAR data for required test configurations. Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. The R&S CMW500 was used for LTE output power measurements and SAR testing. Closed loop power control was used so the UE transmits with maximum output power during SAR testing. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).

8.4.1 Spectrum Plots for RB Configurations

A properly configured base station simulator was used for SAR tests and power measurements. Therefore, spectrum plots for RB configurations were not required to be included in this report.

8.4.2 MPR

MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.

8.4.3 A-MPR

A-MPR (Additional MPR) has been disabled for all SAR tests by setting NS=01 on the base station simulator.

8.4.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05v02r01:

a. Per Section 5.2.1, SAR is required for QPSK 1 RB Allocation for the largest bandwidth
   i. The required channel and offset combination with the highest maximum output power is required for SAR.
   ii. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required. Otherwise, SAR is required for the remaining required test channels using the RB offset configuration with highest output power for that channel.
   iii. When the reported SAR for a required test channel is > 1.45 W/kg, SAR is required for all RB offset configurations for that channel.
b. Per Section 5.2.2, SAR is required for 50% RB allocation using the largest bandwidth following the same procedures outlined in Section 5.2.1.

© 2014 PCTEST Engineering Laboratory, Inc.

c. Per Section 5.2.3, QPSK SAR is not required for the 100% allocation when the highest maximum output power for the 100% allocation is less than the highest maximum output power of the 1 RB and 50% RB allocations and the reported SAR for the 1 RB and 50% RB allocations is < 0.8 W/kg.
d. Per Section 5.2.4 and 5.3, SAR tests for higher order modulations and lower bandwidths configurations are not required when the conducted power of the required test configurations determined by Sections 5.2.1 through 5.2.3 is less than or equal to ½ dB higher than the equivalent configuration using QPSK modulation and when the QPSK SAR for those configurations is <1.45 W/kg.

8.5 SAR Testing with 802.11 Transmitters

Normal network operating configurations are not suitable for measuring the SAR of 802.11 a/b/g/n/ac 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.

8.5.1 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.

8.5.2 Frequency Channel Configurations [24]

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 higher than 0.25 dB or more than the 802.11a mode. 802.11ac SAR was evaluated for highest 802.11a configuration in each 5 GHz band and each exposure condition. 802.11ac modes were additionally evaluated for SAR if the output power for the respective mode was more than 0.25 dB higher than powers of 802.11a modes.

If the maximum extrapolated peak SAR of the zoom scan for the highest output channel was less than 1.6 W/kg and 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.

8.5.3 MIMO SAR Considerations

Per KDB 248227, SAR for MIMO was measured with both transmitting simultaneously and was evaluated independently of SISO operation. For 2.4 GHz MIMO, 802.11n was evaluated. For 5 GHz MIMO, 20 MHz BW 802.11n was evaluated. Additional evaluations for 40 MHz bandwidth 802.11n and 802.11ac were not required since the maximum allowed output power was not higher than 802.11n 20 MHz Bandwidth.

© 2014 PCTEST Engineering Laboratory, Inc.

9 RF CONDUCTED POWERS

9.1 GSM Conducted Powers

		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	32.12	32.05	**29.69**	27.38	26.41	26.40	26.27	26.09	25.89
	190	32.19	32.14	**29.79**	27.48	26.12	26.44	26.27	26.06	25.91
	251	32.32	32.31	**30.00**	27.50	26.77	26.66	26.49	26.25	26.14
GSM 1900	512	29.50	29.49	**27.16**	24.61	24.07	24.80	24.91	24.76	24.57
	661	29.30	29.24	**27.03**	24.50	24.15	24.81	24.85	24.69	24.55
	810	29.11	29.11	**27.24**	24.66	24.04	24.74	24.76	24.59	24.50

		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	23.09	23.02	**23.67**	23.12	23.40	17.37	20.25	21.83	22.88
	190	23.16	23.11	**23.77**	23.22	23.11	17.41	20.25	21.80	22.90
	251	23.29	23.28	**23.98**	23.24	23.76	17.63	20.47	21.99	23.13
GSM 1900	512	20.47	20.46	**21.14**	20.35	21.06	15.77	18.89	20.50	21.56
	661	20.27	20.21	**21.01**	20.24	21.14	15.78	18.83	20.43	21.54
	810	20.08	20.08	**21.22**	20.40	21.03	15.71	18.74	20.33	21.49
GSM 850	**Frame Avg.Targets:**	23.97	23.97	**24.98**	22.74	23.49	17.97	19.98	21.74	22.99
GSM 1900		19.97	19.97	**22.48**	21.24	21.49	15.97	18.98	20.24	21.49

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 source-based frame-averaged output power was evaluated for all GPRS/EDGE slot configurations. Per October 2013 TCB Workshop Notes, the configuration with the highest target frame averaged output power was evaluated for hotspot SAR. When the maximum frame-averaged powers are equivalent across two or more slots (within 0.25 dB), the configuration with the most number of time slots was tested.
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.

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 9-1
Power Measurement Setup

© 2014 PCTEST Engineering Laboratory, Inc.

9.2 UMTS Conducted Powers

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	22.01	22.47	22.01	21.23	21.31	20.25	-
99		12.2 kbps AMR	21.99	22.48	22.02	21.19	21.23	20.19	-
6	HSDPA	Subtest 1	21.20	21.94	20.88	21.18	21.27	20.24	0
6		Subtest 2	21.24	22.03	20.95	21.18	21.30	20.25	0
6		Subtest 3	20.71	21.45	20.41	21.28	21.17	20.45	0.5
6		Subtest 4	20.74	21.58	20.54	21.36	21.26	20.47	0.5
6	HSUPA	Subtest 1	20.39	20.35	20.54	19.58	19.83	18.51	0
6		Subtest 2	19.77	20.49	19.40	20.14	20.14	19.42	2
6		Subtest 3	20.22	20.77	19.76	19.73	20.10	18.77	1
6		Subtest 4	19.88	20.57	18.94	20.28	20.25	19.22	2
6		Subtest 5	20.26	20.00	19.90	19.28	19.42	18.50	0

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.

This deceive does not support DC-HSDPA.

It is expected by the manufacturer that MPR for some HSPA 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 9-2
Power Measurement Setup

© 2014 PCTEST Engineering Laboratory, Inc.

9.3 LTE Conducted Powers

9.3.1 LTE Band 5 (Cell)

Table 9-1
LTE Band 5 (Cell) Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	836.5	20525	10	QPSK	1	0	23.36	0	0
	836.5	20525	10	QPSK	1	25	23.49	0	0
	836.5	20525	10	QPSK	1	49	**23.51**	0	0
	836.5	20525	10	QPSK	25	0	21.72	0-1	1
	836.5	20525	10	QPSK	25	12	21.71	0-1	1
	836.5	20525	10	QPSK	25	25	**21.74**	0-1	1
	836.5	20525	10	QPSK	50	0	21.70	0-1	1
	836.5	20525	10	16QAM	1	0	21.99	0-1	1
	836.5	20525	10	16QAM	1	25	22.70	0-1	1
	836.5	20525	10	16QAM	1	49	22.65	0-1	1
	836.5	20525	10	16QAM	25	0	20.76	0-2	2
	836.5	20525	10	16QAM	25	12	20.77	0-2	2
	836.5	20525	10	16QAM	25	25	20.76	0-2	2
	836.5	20525	10	16QAM	50	0	20.70	0-2	2

Note: LTE Band 5 (Cell) at 10 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

© 2014 PCTEST Engineering Laboratory, Inc.

Table 9-2
LTE Band 5 (Cell) Conducted Powers - 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	826.5	20425	5	QPSK	1	0	23.39	0	0
	826.5	20425	5	QPSK	1	12	23.52	0	0
	826.5	20425	5	QPSK	1	24	23.54	0	0
	826.5	20425	5	QPSK	12	0	21.75	0-1	1
	826.5	20425	5	QPSK	12	6	21.70	0-1	1
	826.5	20425	5	QPSK	12	13	21.77	0-1	1
	826.5	20425	5	QPSK	25	0	21.73	0-1	1
	826.5	20425	5	16-QAM	1	0	22.65	0-1	1
	826.5	20425	5	16-QAM	1	12	22.51	0-1	1
	826.5	20425	5	16-QAM	1	24	22.68	0-1	1
	826.5	20425	5	16-QAM	12	0	20.79	0-2	2
	826.5	20425	5	16-QAM	12	6	20.80	0-2	2
	826.5	20425	5	16-QAM	12	13	20.81	0-2	2
	826.5	20425	5	16-QAM	25	0	20.73	0-2	2
Mid	836.5	20525	5	QPSK	1	0	23.38	0	0
	836.5	20525	5	QPSK	1	12	23.51	0	0
	836.5	20525	5	QPSK	1	24	23.45	0	0
	836.5	20525	5	QPSK	12	0	21.74	0-1	1
	836.5	20525	5	QPSK	12	6	21.73	0-1	1
	836.5	20525	5	QPSK	12	13	21.76	0-1	1
	836.5	20525	5	QPSK	25	0	21.72	0-1	1
	836.5	20525	5	16-QAM	1	0	22.64	0-1	1
	836.5	20525	5	16-QAM	1	12	22.68	0-1	1
	836.5	20525	5	16-QAM	1	24	22.65	0-1	1
	836.5	20525	5	16-QAM	12	0	20.78	0-2	2
	836.5	20525	5	16-QAM	12	6	20.79	0-2	2
	836.5	20525	5	16-QAM	12	13	20.78	0-2	2
	836.5	20525	5	16-QAM	25	0	20.70	0-2	2
High	846.5	20625	5	QPSK	1	0	23.40	0	0
	846.5	20625	5	QPSK	1	12	23.53	0	0
	846.5	20625	5	QPSK	1	24	23.41	0	0
	846.5	20625	5	QPSK	12	0	21.76	0-1	1
	846.5	20625	5	QPSK	12	6	21.75	0-1	1
	846.5	20625	5	QPSK	12	13	21.71	0-1	1
	846.5	20625	5	QPSK	25	0	21.74	0-1	1
	846.5	20625	5	16-QAM	1	0	22.67	0-1	1
	846.5	20625	5	16-QAM	1	12	22.63	0-1	1
	846.5	20625	5	16-QAM	1	24	22.69	0-1	1
	846.5	20625	5	16-QAM	12	0	20.80	0-2	2
	846.5	20625	5	16-QAM	12	6	20.81	0-2	2
	846.5	20625	5	16-QAM	12	13	20.84	0-2	2
	846.5	20625	5	16-QAM	25	0	20.74	0-2	2

© 2014 PCTEST Engineering Laboratory, Inc.

Table 9-3
LTE Band 5 (Cell) Conducted Powers - 3 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	825.5	20415	3	QPSK	1	0	23.42	0	0
	825.5	20415	3	QPSK	1	7	23.51	0	0
	825.5	20415	3	QPSK	1	14	23.39	0	0
	825.5	20415	3	QPSK	8	0	21.74	0-1	1
	825.5	20415	3	QPSK	8	4	21.73	0-1	1
	825.5	20415	3	QPSK	8	7	21.70	0-1	1
	825.5	20415	3	QPSK	15	0	21.72	0-1	1
	825.5	20415	3	16-QAM	1	0	22.63	0-1	1
	825.5	20415	3	16-QAM	1	7	22.61	0-1	1
	825.5	20415	3	16-QAM	1	14	22.64	0-1	1
	825.5	20415	3	16-QAM	8	0	20.78	0-2	2
	825.5	20415	3	16-QAM	8	4	20.80	0-2	2
	825.5	20415	3	16-QAM	8	7	20.86	0-2	2
	825.5	20415	3	16-QAM	15	0	20.72	0-2	2
Mid	836.5	20525	3	QPSK	1	0	23.37	0	0
	836.5	20525	3	QPSK	1	7	23.50	0	0
	836.5	20525	3	QPSK	1	14	23.52	0	0
	836.5	20525	3	QPSK	8	0	21.73	0-1	1
	836.5	20525	3	QPSK	8	4	21.88	0-1	1
	836.5	20525	3	QPSK	8	7	21.75	0-1	1
	836.5	20525	3	QPSK	15	0	21.71	0-1	1
	836.5	20525	3	16-QAM	1	0	22.63	0-1	1
	836.5	20525	3	16-QAM	1	7	22.49	0-1	1
	836.5	20525	3	16-QAM	1	14	22.66	0-1	1
	836.5	20525	3	16-QAM	8	0	20.77	0-2	2
	836.5	20525	3	16-QAM	8	4	20.78	0-2	2
	836.5	20525	3	16-QAM	8	7	20.79	0-2	2
	836.5	20525	3	16-QAM	15	0	20.71	0-2	2
High	847.5	20635	3	QPSK	1	0	23.36	0	0
	847.5	20635	3	QPSK	1	7	23.49	0	0
	847.5	20635	3	QPSK	1	14	23.43	0	0
	847.5	20635	3	QPSK	8	0	21.76	0-1	1
	847.5	20635	3	QPSK	8	4	21.71	0-1	1
	847.5	20635	3	QPSK	8	7	21.74	0-1	1
	847.5	20635	3	QPSK	15	0	21.70	0-1	1
	847.5	20635	3	16-QAM	1	0	22.62	0-1	1
	847.5	20635	3	16-QAM	1	7	22.66	0-1	1
	847.5	20635	3	16-QAM	1	14	22.63	0-1	1
	847.5	20635	3	16-QAM	8	0	20.76	0-2	2
	847.5	20635	3	16-QAM	8	4	20.77	0-2	2
	847.5	20635	3	16-QAM	8	7	20.76	0-2	2
	847.5	20635	3	16-QAM	15	0	20.74	0-2	2

© 2014 PCTEST Engineering Laboratory, Inc.

Table 9-4
LTE Band 5 (Cell) Conducted Powers -1.4 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	824.7	20407	1.4	QPSK	1	0	23.44	0	0
	824.7	20407	1.4	QPSK	1	2	23.53	0	0
	824.7	20407	1.4	QPSK	1	5	23.41	0	0
	824.7	20407	1.4	QPSK	3	0	23.13	0	0
	824.7	20407	1.4	QPSK	3	2	22.71	0	0
	824.7	20407	1.4	QPSK	3	3	22.89	0	0
	824.7	20407	1.4	QPSK	6	0	21.74	0-1	1
	824.7	20407	1.4	16-QAM	1	0	22.65	0-1	1
	824.7	20407	1.4	16-QAM	1	2	22.63	0-1	1
	824.7	20407	1.4	16-QAM	1	5	22.66	0-1	1
	824.7	20407	1.4	16-QAM	3	0	21.70	0-1	1
	824.7	20407	1.4	16-QAM	3	2	22.00	0-1	1
	824.7	20407	1.4	16-QAM	3	3	21.84	0-1	1
	824.7	20407	1.4	16-QAM	6	0	20.74	0-2	2
Mid	836.5	20525	1.4	QPSK	1	0	23.43	0	0
	836.5	20525	1.4	QPSK	1	2	23.50	0	0
	836.5	20525	1.4	QPSK	1	5	23.41	0	0
	836.5	20525	1.4	QPSK	3	0	23.12	0	0
	836.5	20525	1.4	QPSK	3	2	22.73	0	0
	836.5	20525	1.4	QPSK	3	3	22.88	0	0
	836.5	20525	1.4	QPSK	6	0	21.74	0-1	1
	836.5	20525	1.4	16-QAM	1	0	22.65	0-1	1
	836.5	20525	1.4	16-QAM	1	2	22.63	0-1	1
	836.5	20525	1.4	16-QAM	1	5	22.69	0-1	1
	836.5	20525	1.4	16-QAM	3	0	21.76	0-1	1
	836.5	20525	1.4	16-QAM	3	2	21.99	0-1	1
	836.5	20525	1.4	16-QAM	3	3	21.90	0-1	1
	836.5	20525	1.4	16-QAM	6	0	20.70	0-2	2
High	848.3	20643	1.4	QPSK	1	0	23.41	0	0
	848.3	20643	1.4	QPSK	1	2	23.48	0	0
	848.3	20643	1.4	QPSK	1	5	23.36	0	0
	848.3	20643	1.4	QPSK	3	0	23.10	0	0
	848.3	20643	1.4	QPSK	3	2	22.71	0	0
	848.3	20643	1.4	QPSK	3	3	22.86	0	0
	848.3	20643	1.4	QPSK	6	0	21.72	0-1	1
	848.3	20643	1.4	16-QAM	1	0	22.63	0-1	1
	848.3	20643	1.4	16-QAM	1	2	22.61	0-1	1
	848.3	20643	1.4	16-QAM	1	5	22.63	0-1	1
	848.3	20643	1.4	16-QAM	3	0	21.76	0-1	1
	848.3	20643	1.4	16-QAM	3	2	21.97	0-1	1
	848.3	20643	1.4	16-QAM	3	3	21.88	0-1	1
	848.3	20643	1.4	16-QAM	6	0	20.71	0-2	2

© 2014 PCTEST Engineering Laboratory, Inc.

9.3.2 LTE Band 2 (PCS)

Table 9-5
LTE Band 2 (PCS) Conducted Powers - 20 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1860	18700	20	QPSK	1	0	22.67	0	0
	1860	18700	20	QPSK	1	50	22.50	0	0
	1860	18700	20	QPSK	1	99	22.63	0	0
	1860	18700	20	QPSK	50	0	21.70	0-1	1
	1860	18700	20	QPSK	50	25	21.78	0-1	1
	1860	18700	20	QPSK	50	50	21.79	0-1	1
	1860	18700	20	QPSK	100	0	21.71	0-1	1
	1860	18700	20	16QAM	1	0	21.72	0-1	1
	1860	18700	20	16QAM	1	50	21.41	0-1	1
	1860	18700	20	16QAM	1	99	21.59	0-1	1
	1860	18700	20	16QAM	50	0	21.76	0-2	1
	1860	18700	20	16QAM	50	25	21.81	0-2	1
	1860	18700	20	16QAM	50	50	21.82	0-2	1
	1860	18700	20	16QAM	100	0	21.73	0-2	1
Mid	1880.0	18900	20	QPSK	1	0	**22.89**	0	0
	1880.0	18900	20	QPSK	1	50	22.85	0	0
	1880.0	18900	20	QPSK	1	99	22.74	0	0
	1880.0	18900	20	QPSK	50	0	21.85	0-1	1
	1880.0	18900	20	QPSK	50	25	21.87	0-1	1
	1880.0	18900	20	QPSK	50	50	**21.88**	0-1	1
	1880.0	18900	20	QPSK	100	0	21.84	0-1	1
	1880.0	18900	20	16QAM	1	0	21.70	0-1	1
	1880.0	18900	20	16QAM	1	50	21.64	0-1	1
	1880.0	18900	20	16QAM	1	99	21.62	0-1	1
	1880.0	18900	20	16QAM	50	0	21.77	0-2	1
	1880.0	18900	20	16QAM	50	25	21.79	0-2	1
	1880.0	18900	20	16QAM	50	50	21.82	0-2	1
	1880.0	18900	20	16QAM	100	0	21.84	0-2	1
High	1900	19100	20	QPSK	1	0	22.64	0	0
	1900	19100	20	QPSK	1	50	22.38	0	0
	1900	19100	20	QPSK	1	99	22.56	0	0
	1900	19100	20	QPSK	50	0	21.61	0-1	1
	1900	19100	20	QPSK	50	25	21.49	0-1	1
	1900	19100	20	QPSK	50	50	21.43	0-1	1
	1900	19100	20	QPSK	100	0	21.55	0-1	1
	1900	19100	20	16QAM	1	0	21.37	0-1	1
	1900	19100	20	16QAM	1	50	21.15	0-1	1
	1900	19100	20	16QAM	1	99	21.12	0-1	1
	1900	19100	20	16QAM	50	0	21.50	0-2	1
	1900	19100	20	16QAM	50	25	21.52	0-2	1
	1900	19100	20	16QAM	50	50	21.49	0-2	1
	1900	19100	20	16QAM	100	0	21.56	0-2	1

© 2014 PCTEST Engineering Laboratory, Inc.

Table 9-6
LTE Band 2 (PCS) Conducted Powers - 15 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1857.5	18675	15	QPSK	1	0	22.78	0	0
	1857.5	18675	15	QPSK	1	36	22.62	0	0
	1857.5	18675	15	QPSK	1	74	22.76	0	0
	1857.5	18675	15	QPSK	36	0	21.73	0-1	1
	1857.5	18675	15	QPSK	36	18	21.66	0-1	1
	1857.5	18675	15	QPSK	36	37	21.72	0-1	1
	1857.5	18675	15	QPSK	75	0	21.73	0-1	1
	1857.5	18675	15	16QAM	1	0	21.34	0-1	1
	1857.5	18675	15	16QAM	1	36	21.29	0-1	1
	1857.5	18675	15	16QAM	1	74	21.27	0-1	1
	1857.5	18675	15	16QAM	36	0	21.72	0-2	1
	1857.5	18675	15	16QAM	36	18	21.68	0-2	1
	1857.5	18675	15	16QAM	36	37	21.73	0-2	1
	1857.5	18675	15	16QAM	75	0	21.80	0-2	1
Mid	1880.0	18900	15	QPSK	1	0	22.76	0	0
	1880.0	18900	15	QPSK	1	36	22.75	0	0
	1880.0	18900	15	QPSK	1	74	22.74	0	0
	1880.0	18900	15	QPSK	36	0	21.93	0-1	1
	1880.0	18900	15	QPSK	36	18	21.90	0-1	1
	1880.0	18900	15	QPSK	36	37	21.93	0-1	1
	1880.0	18900	15	QPSK	75	0	21.84	0-1	1
	1880.0	18900	15	16QAM	1	0	21.59	0-1	1
	1880.0	18900	15	16QAM	1	36	21.57	0-1	1
	1880.0	18900	15	16QAM	1	74	21.68	0-1	1
	1880.0	18900	15	16QAM	36	0	21.83	0-2	1
	1880.0	18900	15	16QAM	36	18	21.80	0-2	1
	1880.0	18900	15	16QAM	36	37	21.86	0-2	1
	1880.0	18900	15	16QAM	75	0	21.78	0-2	1
High	1902.5	19125	15	QPSK	1	0	22.62	0	0
	1902.5	19125	15	QPSK	1	36	22.48	0	0
	1902.5	19125	15	QPSK	1	74	22.78	0	0
	1902.5	19125	15	QPSK	36	0	21.46	0-1	1
	1902.5	19125	15	QPSK	36	18	21.42	0-1	1
	1902.5	19125	15	QPSK	36	37	21.44	0-1	1
	1902.5	19125	15	QPSK	75	0	21.44	0-1	1
	1902.5	19125	15	16QAM	1	0	21.39	0-1	1
	1902.5	19125	15	16QAM	1	36	21.19	0-1	1
	1902.5	19125	15	16QAM	1	74	21.18	0-1	1
	1902.5	19125	15	16QAM	36	0	21.54	0-2	1
	1902.5	19125	15	16QAM	36	18	21.52	0-2	1
	1902.5	19125	15	16QAM	36	37	21.56	0-2	1
	1902.5	19125	15	16QAM	75	0	21.45	0-2	1

© 2014 PCTEST Engineering Laboratory, Inc.

Table 9-7
LTE Band 2 (PCS) Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1855	18650	10	QPSK	1	0	22.52	0	0
	1855	18650	10	QPSK	1	25	22.67	0	0
	1855	18650	10	QPSK	1	49	22.53	0	0
	1855	18650	10	QPSK	25	0	21.59	0-1	1
	1855	18650	10	QPSK	25	12	21.67	0-1	1
	1855	18650	10	QPSK	25	25	21.78	0-1	1
	1855	18650	10	QPSK	50	0	21.65	0-1	1
	1855	18650	10	16QAM	1	0	21.19	0-1	1
	1855	18650	10	16QAM	1	25	21.24	0-1	1
	1855	18650	10	16QAM	1	49	21.20	0-1	1
	1855	18650	10	16QAM	25	0	21.67	0-2	1
	1855	18650	10	16QAM	25	12	21.65	0-2	1
	1855	18650	10	16QAM	25	25	21.74	0-2	1
	1855	18650	10	16QAM	50	0	21.70	0-2	1
Mid	1880.0	18900	10	QPSK	1	0	22.60	0	0
	1880.0	18900	10	QPSK	1	25	22.66	0	0
	1880.0	18900	10	QPSK	1	49	22.65	0	0
	1880.0	18900	10	QPSK	25	0	21.81	0-1	1
	1880.0	18900	10	QPSK	25	12	21.84	0-1	1
	1880.0	18900	10	QPSK	25	25	21.89	0-1	1
	1880.0	18900	10	QPSK	50	0	21.85	0-1	1
	1880.0	18900	10	16QAM	1	0	21.52	0-1	1
	1880.0	18900	10	16QAM	1	25	21.60	0-1	1
	1880.0	18900	10	16QAM	1	49	21.49	0-1	1
	1880.0	18900	10	16QAM	25	0	21.74	0-2	1
	1880.0	18900	10	16QAM	25	12	21.78	0-2	1
	1880.0	18900	10	16QAM	25	25	21.80	0-2	1
	1880.0	18900	10	16QAM	50	0	21.75	0-2	1
High	1905	19150	10	QPSK	1	0	22.20	0	0
	1905	19150	10	QPSK	1	25	22.29	0	0
	1905	19150	10	QPSK	1	49	22.31	0	0
	1905	19150	10	QPSK	25	0	21.51	0-1	1
	1905	19150	10	QPSK	25	12	21.52	0-1	1
	1905	19150	10	QPSK	25	25	21.32	0-1	1
	1905	19150	10	QPSK	50	0	21.33	0-1	1
	1905	19150	10	16QAM	1	0	21.03	0-1	1
	1905	19150	10	16QAM	1	25	21.05	0-1	1
	1905	19150	10	16QAM	1	49	21.10	0-1	1
	1905	19150	10	16QAM	25	0	21.36	0-2	1
	1905	19150	10	16QAM	25	12	21.37	0-2	1
	1905	19150	10	16QAM	25	25	21.35	0-2	1
	1905	19150	10	16QAM	50	0	21.35	0-2	1

© 2014 PCTEST Engineering Laboratory, Inc.

Table 9-8
LTE Band 2 (PCS) Conducted Powers - 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1852.5	18625	5	QPSK	1	0	22.52	0	0
	1852.5	18625	5	QPSK	1	12	22.67	0	0
	1852.5	18625	5	QPSK	1	24	22.53	0	0
	1852.5	18625	5	QPSK	12	0	21.59	0-1	1
	1852.5	18625	5	QPSK	12	6	21.67	0-1	1
	1852.5	18625	5	QPSK	12	13	21.78	0-1	1
	1852.5	18625	5	QPSK	25	0	21.65	0-1	1
	1852.5	18625	5	16-QAM	1	0	21.19	0-1	1
	1852.5	18625	5	16-QAM	1	12	21.24	0-1	1
	1852.5	18625	5	16-QAM	1	24	21.20	0-1	1
	1852.5	18625	5	16-QAM	12	0	21.67	0-2	1
	1852.5	18625	5	16-QAM	12	6	21.65	0-2	1
	1852.5	18625	5	16-QAM	12	13	21.74	0-2	1
	1852.5	18625	5	16-QAM	25	0	21.70	0-2	1
Mid	1880.0	18900	5	QPSK	1	0	22.60	0	0
	1880.0	18900	5	QPSK	1	12	22.66	0	0
	1880.0	18900	5	QPSK	1	24	22.65	0	0
	1880.0	18900	5	QPSK	12	0	21.81	0-1	1
	1880.0	18900	5	QPSK	12	6	21.84	0-1	1
	1880.0	18900	5	QPSK	12	13	21.89	0-1	1
	1880.0	18900	5	QPSK	25	0	21.85	0-1	1
	1880.0	18900	5	16-QAM	1	0	21.52	0-1	1
	1880.0	18900	5	16-QAM	1	12	21.60	0-1	1
	1880.0	18900	5	16-QAM	1	24	21.49	0-1	1
	1880.0	18900	5	16-QAM	12	0	21.74	0-2	1
	1880.0	18900	5	16-QAM	12	6	21.78	0-2	1
	1880.0	18900	5	16-QAM	12	13	21.80	0-2	1
	1880.0	18900	5	16-QAM	25	0	21.75	0-2	1
High	1907.5	19175	5	QPSK	1	0	22.20	0	0
	1907.5	19175	5	QPSK	1	12	22.29	0	0
	1907.5	19175	5	QPSK	1	24	22.31	0	0
	1907.5	19175	5	QPSK	12	0	21.51	0-1	1
	1907.5	19175	5	QPSK	12	6	21.52	0-1	1
	1907.5	19175	5	QPSK	12	13	21.32	0-1	1
	1907.5	19175	5	QPSK	25	0	21.33	0-1	1
	1907.5	19175	5	16-QAM	1	0	21.03	0-1	1
	1907.5	19175	5	16-QAM	1	12	21.05	0-1	1
	1907.5	19175	5	16-QAM	1	24	21.10	0-1	1
	1907.5	19175	5	16-QAM	12	0	21.36	0-2	1
	1907.5	19175	5	16-QAM	12	6	21.37	0-2	1
	1907.5	19175	5	16-QAM	12	13	21.35	0-2	1
	1907.5	19175	5	16-QAM	25	0	21.35	0-2	1

© 2014 PCTEST Engineering Laboratory, Inc.

Table 9-9
LTE Band 2 (PCS) Conducted Powers - 3 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1851.5	18615	3	QPSK	1	0	22.52	0	0
	1851.5	18615	3	QPSK	1	7	22.67	0	0
	1851.5	18615	3	QPSK	1	14	22.53	0	0
	1851.5	18615	3	QPSK	8	0	21.59	0-1	1
	1851.5	18615	3	QPSK	8	4	21.67	0-1	1
	1851.5	18615	3	QPSK	8	7	21.78	0-1	1
	1851.5	18615	3	QPSK	15	0	21.65	0-1	1
	1851.5	18615	3	16-QAM	1	0	21.19	0-1	1
	1851.5	18615	3	16-QAM	1	7	21.24	0-1	1
	1851.5	18615	3	16-QAM	1	14	21.20	0-1	1
	1851.5	18615	3	16-QAM	8	0	21.67	0-2	1
	1851.5	18615	3	16-QAM	8	4	21.65	0-2	1
	1851.5	18615	3	16-QAM	8	7	21.74	0-2	1
	1851.5	18615	3	16-QAM	15	0	21.70	0-2	1
Mid	1880.0	18900	3	QPSK	1	0	22.60	0	0
	1880.0	18900	3	QPSK	1	7	22.66	0	0
	1880.0	18900	3	QPSK	1	14	22.65	0	0
	1880.0	18900	3	QPSK	8	0	21.81	0-1	1
	1880.0	18900	3	QPSK	8	4	21.84	0-1	1
	1880.0	18900	3	QPSK	8	7	21.89	0-1	1
	1880.0	18900	3	QPSK	15	0	21.85	0-1	1
	1880.0	18900	3	16-QAM	1	0	21.52	0-1	1
	1880.0	18900	3	16-QAM	1	7	21.60	0-1	1
	1880.0	18900	3	16-QAM	1	14	21.49	0-1	1
	1880.0	18900	3	16-QAM	8	0	21.74	0-2	1
	1880.0	18900	3	16-QAM	8	4	21.78	0-2	1
	1880.0	18900	3	16-QAM	8	7	21.80	0-2	1
	1880.0	18900	3	16-QAM	15	0	21.75	0-2	1
High	1908.5	19185	3	QPSK	1	0	22.20	0	0
	1908.5	19185	3	QPSK	1	7	22.29	0	0
	1908.5	19185	3	QPSK	1	14	22.31	0	0
	1908.5	19185	3	QPSK	8	0	21.51	0-1	1
	1908.5	19185	3	QPSK	8	4	21.52	0-1	1
	1908.5	19185	3	QPSK	8	7	21.32	0-1	1
	1908.5	19185	3	QPSK	15	0	21.33	0-1	1
	1908.5	19185	3	16-QAM	1	0	21.03	0-1	1
	1908.5	19185	3	16-QAM	1	7	21.05	0-1	1
	1908.5	19185	3	16-QAM	1	14	21.10	0-1	1
	1908.5	19185	3	16-QAM	8	0	21.36	0-2	1
	1908.5	19185	3	16-QAM	8	4	21.37	0-2	1
	1908.5	19185	3	16-QAM	8	7	21.35	0-2	1
	1908.5	19185	3	16-QAM	15	0	21.35	0-2	1

© 2014 PCTEST Engineering Laboratory, Inc.

Table 9-10
LTE Band 2 (PCS) Conducted Powers – 1.4 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	Target MPR [dB]
Low	1850.7	18607	1.4	QPSK	1	0	22.52	0	0
	1850.7	18607	1.4	QPSK	1	2	22.67	0	0
	1850.7	18607	1.4	QPSK	1	5	22.53	0	0
	1850.7	18607	1.4	QPSK	3	0	22.67	0	0
	1850.7	18607	1.4	QPSK	3	2	22.73	0	0
	1850.7	18607	1.4	QPSK	3	3	22.58	0	0
	1850.7	18607	1.4	QPSK	6	0	21.65	0-1	1
	1850.7	18607	1.4	16-QAM	1	0	21.19	0-1	1
	1850.7	18607	1.4	16-QAM	1	2	21.24	0-1	1
	1850.7	18607	1.4	16-QAM	1	5	21.20	0-1	1
	1850.7	18607	1.4	16-QAM	3	0	21.67	0-1	1
	1850.7	18607	1.4	16-QAM	3	2	21.65	0-1	1
	1850.7	18607	1.4	16-QAM	3	3	21.74	0-1	1
	1850.7	18607	1.4	16-QAM	6	0	21.70	0-2	1
Mid	1880.0	18900	1.4	QPSK	1	0	22.60	0	0
	1880.0	18900	1.4	QPSK	1	2	22.66	0	0
	1880.0	18900	1.4	QPSK	1	5	22.65	0	0
	1880.0	18900	1.4	QPSK	3	0	22.63	0	0
	1880.0	18900	1.4	QPSK	3	2	22.70	0	0
	1880.0	18900	1.4	QPSK	3	3	22.66	0	0
	1880.0	18900	1.4	QPSK	6	0	21.85	0-1	1
	1880.0	18900	1.4	16-QAM	1	0	21.52	0-1	1
	1880.0	18900	1.4	16-QAM	1	2	21.60	0-1	1
	1880.0	18900	1.4	16-QAM	1	5	21.49	0-1	1
	1880.0	18900	1.4	16-QAM	3	0	21.74	0-1	1
	1880.0	18900	1.4	16-QAM	3	2	21.78	0-1	1
	1880.0	18900	1.4	16-QAM	3	3	21.80	0-1	1
	1880.0	18900	1.4	16-QAM	6	0	21.75	0-2	1
High	1909.3	19193	1.4	QPSK	1	0	22.20	0	0
	1909.3	19193	1.4	QPSK	1	2	22.29	0	0
	1909.3	19193	1.4	QPSK	1	5	22.31	0	0
	1909.3	19193	1.4	QPSK	3	0	22.33	0	0
	1909.3	19193	1.4	QPSK	3	2	22.35	0	0
	1909.3	19193	1.4	QPSK	3	3	22.30	0	0
	1909.3	19193	1.4	QPSK	6	0	21.33	0-1	1
	1909.3	19193	1.4	16-QAM	1	0	21.03	0-1	1
	1909.3	19193	1.4	16-QAM	1	2	21.05	0-1	1
	1909.3	19193	1.4	16-QAM	1	5	21.10	0-1	1
	1909.3	19193	1.4	16-QAM	3	0	21.36	0-1	1
	1909.3	19193	1.4	16-QAM	3	2	21.37	0-1	1
	1909.3	19193	1.4	16-QAM	3	3	21.35	0-1	1
	1909.3	19193	1.4	16-QAM	6	0	21.35	0-2	1

© 2014 PCTEST Engineering Laboratory, Inc.

9.4 WLAN Antenna 1 Conducted Powers

Table 9-11
IEEE 802.11b Average RF Power

Mode	Freq [MHz]	Channel	802.11b Conducted Power [dBm]			
			Data Rate [Mbps]			
			1	2	5.5	11
802.11b	2412	1*	**13.20**	13.43	13.42	13.43
802.11b	2437	6*	12.96	13.27	13.25	13.27
802.11b	2462	11*	12.77	12.08	12.08	12.08

Table 9-12
IEEE 802.11g Average RF Power

Mode	Freq [MHz]	Channel	802.11g Conducted Power [dBm]							
			Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
802.11g	2412	1	13.10	13.07	13.07	13.11	13.40	13.40	13.43	13.36
802.11g	2437	6	13.09	13.06	13.06	13.10	13.39	13.39	13.42	13.35
802.11g	2462	11	12.89	12.86	12.86	12.90	13.19	13.19	13.22	13.15

Table 9-13
IEEE 802.11n Average RF Power

Mode	Freq [MHz]	Channel	802.11n (2.4GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
			6.5	13	19.5	26	39	52	58.5	65
802.11n	2412	1	11.96	11.97	11.84	12.16	12.18	12.19	12.22	12.15
802.11n	2437	6	11.97	11.98	11.85	12.17	12.19	12.20	12.23	12.16
802.11n	2462	11	11.70	11.71	11.58	11.90	11.92	11.93	11.96	11.89

© 2014 PCTEST Engineering Laboratory, Inc.

Table 9-14
IEEE 802.11a Average RF Power

Mode	Freq [MHz]	Channel	802.11a Conducted Power [dBm]							
			Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
802.11a	5180	36*	9.01	8.97	8.97	8.99	9.21	9.23	9.22	9.22
802.11a	5200	40	8.57	8.53	8.53	8.55	8.77	8.79	8.78	8.78
802.11a	5220	44	**9.25**	9.21	9.21	9.23	9.45	9.47	9.46	9.46
802.11a	5240	48*	8.80	8.76	8.76	8.78	9.00	9.02	9.01	9.01
802.11a	5260	52*	9.03	9.00	8.97	9.00	9.23	9.26	9.24	9.21
802.11a	5280	56	8.92	8.89	8.86	8.89	9.12	9.15	9.13	9.10
802.11a	5300	60	**9.11**	9.08	9.05	9.08	9.31	9.34	9.32	9.29
802.11a	5320	64*	8.64	8.61	8.58	8.61	8.84	8.87	8.85	8.82
802.11a	5500	100	8.90	8.83	8.83	8.88	9.07	9.08	9.13	9.09
802.11a	5520	104*	8.79	8.72	8.72	8.77	8.96	8.97	9.02	8.98
802.11a	5540	108	8.58	8.51	8.51	8.56	8.75	8.76	8.81	8.77
802.11a	5560	112	8.88	8.81	8.81	8.86	9.05	9.06	9.11	9.07
802.11a	5580	116*	9.02	8.95	8.95	9.00	9.19	9.20	9.25	9.21
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	8.94	8.87	8.87	8.92	9.11	9.12	9.17	9.13
802.11a	5680	136*	9.01	8.94	8.94	8.99	9.18	9.19	9.24	9.20
802.11a	5700	140	**9.15**	9.08	9.08	9.13	9.32	9.33	9.38	9.34
802.11a	5745	149*	9.04	8.98	9.04	9.03	9.01	8.84	8.81	8.78
802.11a	5765	153	8.99	8.93	8.99	8.98	8.96	8.79	8.76	8.73
802.11a	5785	157*	**9.09**	9.03	9.09	9.08	9.06	8.89	8.86	8.83
802.11a	5805	161	8.30	8.24	8.30	8.29	8.27	8.10	8.07	8.04
802.11a	5825	165*	8.55	8.49	8.55	8.54	8.52	8.35	8.32	8.29

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.

© 2014 PCTEST Engineering Laboratory, Inc.

Table 9-15
IEEE 802.11n Average RF Power – 20 MHz Bandwidth

Mode	Freq [MHz]	Channel	20MHz BW 802.11n (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
			6.5	13	19.5	26	39	52	58.5	65
802.11n	5180	36	9.03	9.05	8.93	9.21	9.28	9.24	9.29	9.26
802.11n	5200	40	9.49	9.49	9.39	8.67	8.74	8.70	8.75	8.72
802.11n	5220	44	9.18	9.20	9.08	9.36	9.43	9.39	9.44	9.41
802.11n	5240	48	8.75	8.77	8.65	8.93	9.00	8.96	9.01	8.98
802.11n	5260	52	8.94	8.96	8.84	9.12	9.19	9.15	9.20	9.17
802.11n	5280	56	8.86	8.88	8.76	9.04	9.11	9.07	9.12	9.09
802.11n	5300	60	8.94	8.96	8.84	9.12	9.19	9.15	9.20	9.17
802.11n	5320	64	8.55	8.57	8.45	8.73	8.80	8.76	8.81	8.78
802.11n	5500	100	9.09	9.11	8.99	9.27	9.34	9.30	9.35	9.32
802.11n	5520	104	9.01	9.03	8.91	9.19	9.26	9.22	9.27	9.24
802.11n	5540	108	8.76	8.78	8.66	8.94	9.01	8.97	9.02	8.99
802.11n	5560	112	9.09	9.11	8.99	9.27	9.34	9.30	9.35	9.32
802.11n	5580	116	9.33	9.35	9.23	8.51	8.58	8.54	8.59	8.56
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	9.10	9.12	9.00	9.28	9.35	9.31	9.36	9.33
802.11n	5680	136	9.05	9.07	8.95	9.23	9.30	9.26	9.31	9.28
802.11n	5700	140	9.14	9.16	9.04	9.32	9.39	9.35	9.39	9.37
802.11n	5745	149	8.95	8.97	8.85	9.13	9.20	9.16	9.21	9.18
802.11n	5765	153	8.99	9.01	8.89	9.17	9.24	9.20	9.25	9.22
802.11n	5785	157	9.14	9.16	9.04	9.32	9.32	9.30	9.33	9.30
802.11n	5805	161	8.37	8.39	8.27	8.55	8.62	8.58	8.63	8.60
802.11n	5825	165	8.58	8.60	8.48	8.76	8.83	8.79	8.84	8.81

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.

© 2014 PCTEST Engineering Laboratory, Inc.

Table 9-16
IEEE 802.11n Average RF Power – 40 MHz Bandwidth

Mode	Freq [MHz]	Channel	40MHz BW 802.11n (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
			13.5	27	40.5	54	81	108	121.5	135
802.11n	5190	38	8.35	8.40	8.36	8.49	8.48	8.47	8.46	8.49
802.11n	5230	46	8.33	8.38	8.34	8.49	8.46	8.48	8.48	8.47
802.11n	5270	54	8.25	8.30	8.26	8.44	8.38	8.40	8.40	8.39
802.11n	5310	62	8.23	8.28	8.24	8.42	8.36	8.38	8.38	8.37
802.11n	5510	102	8.28	8.33	8.29	8.47	8.41	8.43	8.43	8.42
802.11n	5550	110	8.15	8.20	8.16	8.34	8.28	8.30	8.30	8.29
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	8.18	8.23	8.19	8.37	8.31	8.33	8.33	8.32
802.11n	5755	151	8.49	7.54	7.50	7.68	7.62	7.64	7.64	7.63
802.11n	5795	159	8.49	7.55	7.52	7.71	7.61	7.68	7.65	7.63

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.

Table 9-17
IEEE 802.11ac Average RF Power – 80 MHz Bandwidth

Mode	Freq [MHz]	Channel	80MHz BW 802.11ac (5GHz) Conducted Power [dBm]									
			Data Rate [Mbps]									
			29.3	58.5	87.8	117	175.5	234	263.3	292.5	351	390
802.11ac	5210	42	**6.60**	6.57	6.77	6.81	6.78	6.74	6.51	6.56	6.07	6.30
802.11ac	5290	58	**6.58**	6.55	6.75	6.79	6.76	6.72	6.49	6.54	6.05	6.28
802.11ac	5530	106	**6.41**	6.38	6.58	6.62	6.59	6.55	6.32	6.37	5.88	6.11
802.11ac	5775	155	**6.71**	6.68	6.88	6.92	6.89	6.85	6.62	6.67	6.18	6.41

Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and October 2012/April 2013 FCC/TCB Meeting Notes:

- For SISO 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 SISO 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.

© 2014 PCTEST Engineering Laboratory, Inc.

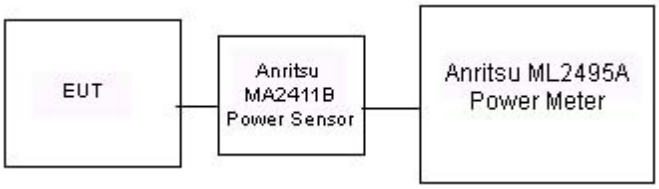


Figure 9-3
Power Measurement Setup for Bandwidths < 50 MHz

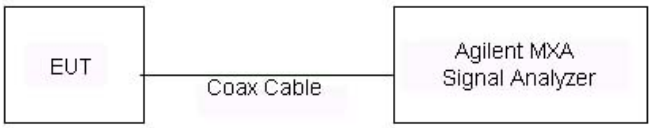


Figure 9-4
Power Measurement Setup for Bandwidths > 50 MHz

9.5 WLAN Antenna 2 Conducted Powers

Table 9-18
IEEE 802.11b Average RF Power

Mode	Freq [MHz]	Channel	802.11b Conducted Power [dBm]			
			Data Rate [Mbps]			
			1	2	5.5	11
802.11b	2412	1*	**16.16**	16.39	16.38	16.39
802.11b	2437	6*	15.87	16.18	16.16	16.18
802.11b	2462	11*	15.81	16.12	16.12	16.12

Table 9-19
IEEE 802.11g Average RF Power

Mode	Freq [MHz]	Channel	802.11g Conducted Power [dBm]							
			Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
802.11g	2412	1	14.00	13.97	13.97	14.01	14.30	14.30	14.35	14.26
802.11g	2437	6	13.83	13.79	13.80	13.90	14.21	14.21	14.20	14.19
802.11g	2462	11	13.71	13.69	13.69	13.73	13.99	14.08	14.00	14.04

© 2014 PCTEST Engineering Laboratory, Inc.

Table 9-20
IEEE 802.11n Average RF Power

Mode	Freq [MHz]	Channel	802.11n (2.4GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
			6.5	13	19.5	26	39	52	58.5	65
802.11n	2412	1	13.04	13.05	12.92	13.24	13.26	13.27	13.30	13.23
802.11n	2437	6	12.92	12.96	12.86	13.22	13.25	13.22	13.30	13.21
802.11n	2462	11	12.83	12.81	12.75	13.09	13.09	13.04	13.11	13.05

Table 9-21
IEEE 802.11a Average RF Power

Mode	Freq [MHz]	Channel	802.11a Conducted Power [dBm]							
			Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
802.11a	5180	36*	6.03	5.98	5.99	6.01	6.23	6.24	6.24	6.23
802.11a	5200	40	5.82	5.87	5.70	5.88	5.93	5.79	5.77	5.77
802.11a	5220	44	5.50	5.58	5.56	5.55	5.57	5.43	5.43	5.58
802.11a	5240	48*	**6.19**	6.20	6.08	6.13	6.13	6.08	6.31	6.29
802.11a	5260	52*	5.80	5.76	5.74	5.77	6.00	6.04	6.01	5.97
802.11a	5280	56	5.80	5.70	5.69	5.84	5.70	5.78	5.68	5.92
802.11a	5300	60	**5.89**	5.84	6.02	5.99	5.92	5.93	5.96	5.78
802.11a	5320	64*	5.60	5.62	5.65	5.57	5.53	5.53	5.56	5.58
802.11a	5500	100	5.68	5.62	5.61	5.66	5.86	5.86	5.91	5.87
802.11a	5520	104*	5.62	5.59	5.72	5.75	5.61	5.58	5.63	5.67
802.11a	5540	108	5.60	5.61	5.65	5.56	5.60	5.50	5.71	5.57
802.11a	5560	112	5.66	5.63	5.79	5.76	5.66	5.75	5.77	5.74
802.11a	5580	116*	5.81	5.74	5.68	5.71	5.93	5.84	5.87	5.80
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	5.80	5.80	5.80	5.77	5.75	5.77	5.79	5.84
802.11a	5680	136*	**5.89**	5.87	5.82	5.92	5.96	5.82	5.79	6.01
802.11a	5700	140	5.67	5.70	5.72	5.67	5.69	5.72	5.61	5.55
802.11a	5745	149*	**5.60**	5.54	5.54	5.57	5.74	5.77	5.80	5.79
802.11a	5765	153	5.37	5.43	5.45	5.32	5.44	5.40	5.38	5.42
802.11a	5785	157*	5.54	5.46	5.55	5.55	5.54	5.45	5.60	5.63
802.11a	5805	161	5.52	5.53	5.63	5.63	5.40	5.61	5.56	5.50
802.11a	5825	165*	5.40	5.37	5.47	5.27	5.47	5.38	5.48	5.37

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.

© 2014 PCTEST Engineering Laboratory, Inc.

Table 9-22
IEEE 802.11n Average RF Power – 20 MHz Bandwidth

Mode	Freq [MHz]	Channel	20MHz BW 802.11n (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
			6.5	13	19.5	26	39	52	58.5	65
802.11n	5180	36	5.91	5.93	5.81	6.09	6.16	6.12	6.17	6.14
802.11n	5200	40	5.73	6.05	5.82	5.80	5.93	6.02	5.76	5.86
802.11n	5220	44	5.86	5.78	5.58	5.63	5.81	5.63	5.70	5.60
802.11n	5240	48	6.08	5.69	5.93	5.81	6.03	5.93	5.95	5.96
802.11n	5260	52	5.65	5.71	5.58	5.91	5.92	5.90	5.95	5.89
802.11n	5280	56	5.69	5.65	5.79	5.76	5.67	5.77	5.71	5.51
802.11n	5300	60	5.79	5.79	5.61	5.73	5.92	5.77	5.72	5.84
802.11n	5320	64	5.50	5.54	5.67	5.50	5.66	5.39	5.45	5.42
802.11n	5500	100	5.56	5.59	5.48	5.76	5.79	5.77	5.81	5.78
802.11n	5520	104	5.50	5.52	5.59	5.56	5.44	5.60	5.43	5.32
802.11n	5540	108	5.50	5.41	5.60	5.50	5.50	5.60	5.44	5.61
802.11n	5560	112	5.56	5.47	5.62	5.57	5.42	5.48	5.56	5.51
802.11n	5580	116	5.68	5.82	5.77	5.78	5.58	5.51	5.59	5.65
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	5.68	5.57	5.80	5.57	5.59	5.77	5.53	5.76
802.11n	5680	136	5.54	5.37	5.60	5.55	5.58	5.59	5.51	5.48
802.11n	5700	140	5.54	5.54	5.37	5.64	5.41	5.71	5.52	5.52
802.11n	5745	149	5.50	5.50	5.39	5.67	5.67	5.71	5.65	5.68
802.11n	5765	153	5.27	5.17	5.27	5.12	5.23	5.32	5.42	5.42
802.11n	5785	157	5.41	5.35	5.50	5.41	5.32	5.27	5.43	5.50
802.11n	5805	161	5.44	5.35	5.41	5.47	5.37	5.49	5.26	5.56
802.11n	5825	165	5.30	5.39	5.42	5.37	5.46	5.36	5.16	5.43

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.

Table 9-23
IEEE 802.11n Average RF Power – 40 MHz Bandwidth

Mode	Freq [MHz]	Channel	40MHz BW 802.11n (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
			13.5	27	40.5	54	81	108	121.5	135
802.11n	5190	38	5.39	5.44	5.40	5.48	5.42	5.44	5.44	5.43
802.11n	5230	46	5.22	5.23	5.16	5.28	5.28	5.22	5.31	5.26
802.11n	5270	54	5.08	5.18	5.11	5.28	5.29	5.27	5.33	5.30
802.11n	5310	62	5.23	5.28	5.31	5.23	5.26	5.30	5.20	5.16
802.11n	5510	102	5.02	5.01	5.00	5.19	5.21	5.13	5.22	5.16
802.11n	5550	110	4.93	4.89	4.93	5.02	5.02	4.84	4.84	4.96
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	5.28	5.28	5.34	5.22	5.29	5.22	5.32	5.26
802.11n	5755	151	4.98	5.05	5.01	5.14	5.20	5.12	5.20	5.21
802.11n	5795	159	4.85	4.76	4.79	4.91	4.93	4.81	4.79	4.85

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.

© 2014 PCTEST Engineering Laboratory, Inc.

Table 9-24
IEEE 802.11ac Average RF Power – 80 MHz Bandwidth

Mode	Freq [MHz]	Channel	80MHz BW 802.11ac (5GHz) Conducted Power [dBm]									
			Data Rate [Mbps]									
			29.3	58.5	87.8	117	175.5	234	263.3	292.5	351	390
802.11ac	5210	42	**5.75**	5.72	5.92	5.96	5.93	5.89	5.66	5.71	5.22	5.45
802.11ac	5290	58	**5.66**	5.65	5.86	5.67	5.75	5.76	5.69	5.71	5.42	5.49
802.11ac	5530	106	**5.50**	5.67	5.74	5.60	5.72	5.51	5.70	5.65	5.45	5.49
802.11ac	5775	155	**5.27**	5.47	5.49	5.50	5.50	5.45	5.47	5.25	5.44	5.49

Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and October 2012/April 2013 FCC/TCB Meeting Notes:

- For SISO 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 SISO 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.

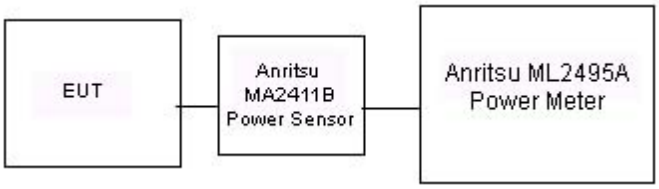


Figure 9-5
Power Measurement Setup for Bandwidths < 50 MHz

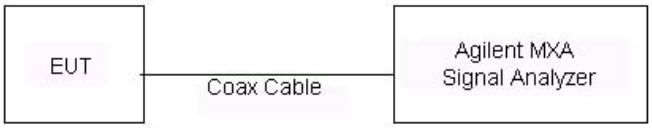


Figure 9-6
Power Measurement Setup for Bandwidths > 50 MHz

© 2014 PCTEST Engineering Laboratory, Inc.

9.6 WLAN MIMO Conducted Powers

Per KDB 662911 D01v02r01, the individual spectra for each 2×2 MIMO WIFI antenna were summed mathematically in linear power units for the MIMO output power measurements.

Table 9-25
IEEE 802.11n Average RF Power

Mode	Freq [MHz]	Channel	Data Rate [Mbps]
			13
802.11n	2412	1	**15.54**
802.11n	2437	6	15.48
802.11n	2462	11	15.31

Table 9-26
IEEE 802.11n Average RF Power – 20 MHz Bandwidth

Mode	Freq [MHz]	Channel	Data Rate [Mbps]
			13
802.11n	5180	36	10.75
802.11n	5200	40	**11.01**
802.11n	5220	44	10.84
802.11n	5240	48	10.63
802.11n	5260	52	10.61
802.11n	5280	56	10.57
802.11n	5300	60	**10.65**
802.11n	5320	64	10.30
802.11n	5500	100	10.68
802.11n	5520	104	10.61
802.11n	5540	108	10.44
802.11n	5560	112	10.68
802.11n	5580	116	**10.89**
802.11n	5600	120	N/A
802.11n	5620	124	N/A
802.11n	5640	128	N/A
802.11n	5660	132	10.73
802.11n	5680	136	10.65
802.11n	5700	140	10.71
802.11n	5745	149	10.57
802.11n	5765	153	10.53
802.11n	5785	157	**10.68**
802.11n	5805	161	10.16
802.11n	5825	165	10.25

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.

© 2014 PCTEST Engineering Laboratory, Inc.

Table 9-27
IEEE 802.11n Average RF Power – 40 MHz Bandwidth

Mode	Freq [MHz]	Channel	Data Rate [Mbps]
			27
802.11n	5190	38	10.13
802.11n	5230	46	10.06
802.11n	5270	54	9.96
802.11n	5310	62	9.99
802.11n	5510	102	9.96
802.11n	5550	110	9.84
802.11n	5590	118	N/A
802.11n	5630	126	N/A
802.11n	5670	134	9.98
802.11n	5755	151	10.09
802.11n	5795	159	10.05

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.

Table 9-28
IEEE 802.11ac Average RF Power – 80 MHz Bandwidth

Mode	Freq [MHz]	Channel	Data Rate [Mbps]
			58.5
802.11ac	5210	42	9.21
802.11ac	5290	58	9.15
802.11ac	5530	106	8.99
802.11ac	5775	155	9.06

Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and October 2012/April 2013 FCC/TCB Meeting Notes:

- Per KDB 662911 D01v02r01, the individual spectra for each 2x2 MIMO WIFI Antenna were summed mathematically in linear power units for the MIMO output power measurements.
- For MIMO 2.4 GHz, highest average RF output power channel for the lowest data rate for IEEE 802.11n were selected for SAR evaluation.
- For MIMO 5 GHz, highest average RF output power channel for the lowest data rate for IEEE 802.11n 20 MHz Bandwidth were selected for SAR evaluation.
- 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.

© 2014 PCTEST Engineering Laboratory, Inc.

10 SYSTEM VERIFICATION

10.1 Tissue Verification

Table 10-1
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
07/09/2014	835H	23.6	820	0.913	43.478	0.899	41.578	1.56%	4.57%
			835	0.926	43.263	0.900	41.500	2.89%	4.25%
			850	0.944	43.050	0.916	41.500	3.06%	3.73%
07/23/2014	835H	22.9	820	0.920	42.818	0.899	41.578	2.34%	2.98%
			835	0.934	42.634	0.900	41.500	3.78%	2.73%
			850	0.945	42.468	0.916	41.500	3.17%	2.33%
07/07/2014	1900H	24.2	1850	1.337	40.244	1.400	40.000	-4.50%	0.61%
			1880	1.368	40.137	1.400	40.000	-2.29%	0.34%
			1910	1.400	40.009	1.400	40.000	0.00%	0.02%
08/04/2014	1900H	22.9	1850	1.353	39.481	1.400	40.000	-3.36%	-1.30%
			1880	1.382	39.348	1.400	40.000	-1.29%	-1.63%
			1910	1.416	39.218	1.400	40.000	1.14%	-1.95%
07/15/2014	2450H	23.2	2401	1.689	38.730	1.756	39.287	-3.82%	-1.42%
			2450	1.744	38.576	1.800	39.200	-3.11%	-1.59%
			2499	1.796	38.430	1.853	39.138	-3.08%	-1.81%
07/14/2014	5200H-5800H	23.2	5200	4.649	36.923	4.655	35.986	-0.13%	2.60%
			5220	4.671	36.848	4.676	35.963	-0.11%	2.46%
			5240	4.707	36.834	4.696	35.940	0.23%	2.49%
			5280	4.742	36.833	4.737	35.894	0.11%	2.62%
			5300	4.746	36.754	4.758	35.871	-0.25%	2.46%
			5500	4.958	36.509	4.963	35.643	-0.10%	2.43%
			5580	5.031	36.380	5.045	35.551	-0.28%	2.33%
			5600	5.056	36.352	5.065	35.529	-0.18%	2.32%
			5660	5.123	36.346	5.127	35.460	-0.08%	2.50%
			5680	5.137	36.279	5.147	35.437	-0.19%	2.38%
			5700	5.160	36.229	5.168	35.414	-0.15%	2.30%
			5745	5.218	36.192	5.214	35.363	0.08%	2.34%
			5765	5.236	36.202	5.234	35.340	0.04%	2.44%
			5785	5.243	36.160	5.255	35.317	-0.23%	2.39%
			5800	5.255	36.098	5.270	35.300	-0.28%	2.26%
			5825	5.283	36.031	5.296	35.271	-0.25%	2.15%
07/08/2014	835B	24.0	820	0.996	54.424	0.969	55.258	2.79%	-1.51%
			835	1.010	54.281	0.970	55.200	4.12%	-1.66%
			850	1.025	54.110	0.988	55.154	3.74%	-1.89%
07/21/2014	835B	23.2	820	0.992	53.366	0.969	55.258	2.37%	-3.42%
			835	1.007	53.195	0.970	55.200	3.81%	-3.63%
			850	1.021	53.049	0.988	55.154	3.34%	-3.82%
07/08/2014	1900B	23.9	1850	1.520	51.394	1.520	53.300	0.00%	-3.58%
			1880	1.555	51.320	1.520	53.300	2.30%	-3.71%
			1910	1.592	51.205	1.520	53.300	4.74%	-3.93%
07/31/2014	1900B	22.9	1850	1.467	53.578	1.520	53.300	-3.49%	0.52%
			1880	1.501	53.483	1.520	53.300	-1.25%	0.34%
			1910	1.538	53.387	1.520	53.300	1.18%	0.16%
08/04/2014	1900B	22.3	1850	1.453	53.366	1.520	53.300	-4.41%	0.12%
			1880	1.485	53.252	1.520	53.300	-2.30%	-0.09%
			1910	1.520	53.133	1.520	53.300	0.00%	-0.31%
07/08/2014	2450B	23.1	2401	1.884	51.060	1.903	52.765	-1.00%	-3.23%
			2450	1.949	50.892	1.950	52.700	-0.05%	-3.43%
			2499	2.014	50.716	2.019	52.638	-0.25%	-3.65%
07/08/2014	5200B-5800B	21.7	5200	5.358	47.305	5.299	49.014	1.11%	-3.49%
			5220	5.381	47.276	5.323	48.987	1.09%	-3.49%
			5240	5.405	47.239	5.346	48.960	1.10%	-3.52%
			5280	5.460	47.160	5.393	48.906	1.24%	-3.57%
			5300	5.505	47.133	5.416	48.879	1.64%	-3.57%
			5320	5.529	47.145	5.439	48.851	1.65%	-3.49%
			5500	5.799	46.887	5.650	48.607	2.64%	-3.54%
			5520	5.827	46.838	5.673	48.580	2.71%	-3.59%
			5540	5.859	46.825	5.696	48.553	2.86%	-3.56%
			5580	5.919	46.806	5.743	48.499	3.06%	-3.49%
			5600	5.953	46.751	5.766	48.471	3.24%	-3.55%
			5660	6.020	46.633	5.837	48.390	3.14%	-3.63%
			5680	6.053	46.590	5.860	48.363	3.29%	-3.67%
			5700	6.073	46.554	5.883	48.336	3.23%	-3.69%
			5745	6.122	46.451	5.936	48.275	3.13%	-3.78%
			5785	6.167	46.343	5.982	48.220	3.09%	-3.89%
			5800	6.188	46.321	6.000	48.200	3.13%	-3.90%
			5825	6.224	46.347	6.029	48.166	3.23%	-3.78%

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 KDB Publication 865664 and IEEE 1528-2013 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.

© 2014 PCTEST Engineering Laboratory, Inc.

10.2 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 10-2
System Verification Results

System Verification TARGET & MEASURED												
SAR System #	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)	$Deviation_{1g}$ (%)
K	835	HEAD	07/09/2014	24.4	23.6	0.100	4d119	3287	0.897	9.220	8.970	-2.71%
H	835	HEAD	07/23/2014	23.3	22.9	0.100	4d119	3319	0.931	9.220	9.310	0.98%
D	1900	HEAD	07/07/2014	24.4	24.2	0.100	5d149	3022	3.770	40.400	37.700	-6.68%
K	1900	HEAD	08/04/2014	24.0	22.9	0.100	5d141	3287	3.910	40.100	39.100	-2.49%
H	2450	HEAD	07/15/2014	22.7	22.5	0.100	797	3319	5.270	51.800	52.700	1.74%
E	5200	HEAD	07/14/2014	24.4	23.3	0.100	1057	3914	7.580	78.000	75.800	-2.82%
E	5300	HEAD	07/14/2014	24.4	23.3	0.100	1057	3914	7.680	83.000	76.800	-7.47%
E	5500	HEAD	07/14/2014	24.5	23.4	0.100	1057	3914	7.810	84.300	78.100	-7.35%
E	5600	HEAD	07/14/2014	24.5	23.4	0.100	1057	3914	8.250	83.500	82.500	-1.20%
E	5800	HEAD	07/14/2014	24.5	24.4	0.100	1057	3914	7.730	79.300	77.300	-2.52%
D	835	BODY	07/08/2014	24.5	24.0	0.100	4d119	3022	0.858	9.340	8.580	-8.14%
D	835	BODY	07/21/2014	24.5	23.2	0.100	4d119	3022	0.972	9.340	9.720	4.07%
J	1900	BODY	07/08/2014	23.6	23.6	0.100	5d149	3332	4.360	40.500	43.600	7.65%
K	1900	BODY	07/31/2014	24.5	23.2	0.100	5d141	3287	4.160	40.600	41.600	2.46%
K	1900	BODY	08/04/2014	24.0	22.6	0.100	5d141	3287	4.100	40.600	41.000	0.99%
E	2450	BODY	07/08/2014	24.2	23.0	0.100	797	3914	5.330	49.400	53.300	7.89%
A	5200	BODY	07/08/2014	23.9	21.8	0.100	1007	3920	7.390	72.600	73.900	1.79%
A	5300	BODY	07/08/2014	23.9	21.8	0.100	1007	3920	7.590	74.700	75.900	1.61%
A	5500	BODY	07/08/2014	23.9	21.8	0.100	1007	3920	7.880	75.900	78.800	3.82%
A	5600	BODY	07/08/2014	23.9	21.8	0.100	1007	3920	7.840	77.300	78.400	1.42%
A	5800	BODY	07/08/2014	23.9	21.8	0.100	1007	3920	7.540	72.900	75.400	3.43%

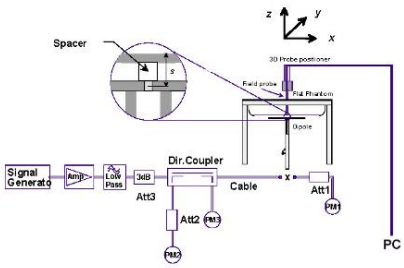


Figure 10-1
System Verification Setup Diagram

Figure 10-2
System Verification Setup Photo

© 2014 PCTEST Engineering Laboratory, Inc.

11 SAR DATA SUMMARY

11.1 Standalone Head SAR Data

Table 11-1
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	33.5	32.19	0.05	Right	Cheek	7-03	1:8.3	0.165	1.352	0.223	
836.60	190	GSM 850	GSM	33.5	32.19	0.12	Right	Tilt	7-03	1:8.3	0.094	1.352	0.127	
836.60	190	GSM 850	GSM	33.5	32.19	-0.06	Left	Cheek	7-03	1:8.3	0.225	1.352	0.304	A1
836.60	190	GSM 850	GSM	33.5	32.19	-0.09	Left	Tilt	7-03	1:8.3	0.106	1.352	0.143	
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 11-2
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	29.5	29.30	0.01	Right	Cheek	7-01	1:8.3	0.108	1.047	0.113	
1880.00	661	GSM 1900	GSM	29.5	29.30	0.09	Right	Tilt	7-01	1:8.3	0.072	1.047	0.075	
1880.00	661	GSM 1900	GSM	29.5	29.30	0.05	Left	Cheek	7-01	1:8.3	0.169	1.047	0.177	A2
1880.00	661	GSM 1900	GSM	29.5	29.30	-0.07	Left	Tilt	7-01	1:8.3	0.047	1.047	0.049	
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 11-3
UTMS 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	23.5	22.47	0.01	Right	Cheek	7-03	1:1	0.338	1.268	0.429	
836.60	4183	UMTS 850	RMC	23.5	22.47	-0.02	Right	Tilt	7-03	1:1	0.228	1.268	0.289	
836.60	4183	UMTS 850	RMC	23.5	22.47	-0.06	Left	Cheek	7-03	1:1	0.442	1.268	0.560	A3
836.60	4183	UMTS 850	RMC	23.5	22.47	-0.09	Left	Tilt	7-03	1:1	0.262	1.268	0.332	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram							

© 2014 PCTEST Engineering Laboratory, Inc.

Table 11-4
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	21.5	21.31	0.07	Right	Cheek	7-01	1:1	0.167	1.045	0.175	
1880.00	9400	UMTS 1900	RMC	21.5	21.31	-0.01	Right	Tilt	7-01	1:1	0.097	1.045	0.101	
1880.00	9400	UMTS 1900	RMC	21.5	21.31	0.06	Left	Cheek	7-01	1:1	0.246	1.045	0.257	A4
1880.00	9400	UMTS 1900	RMC	21.5	21.31	0.05	Left	Tilt	7-01	1:1	0.069	1.045	0.072	
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 11-5
LTE Band 5 (Cell) Head SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.7	23.51	0.02	0	Right	Cheek	QPSK	1	49	22-08	1:1	0.381	1.045	0.398	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.7	21.74	0.02	1	Right	Cheek	QPSK	25	25	22-08	1:1	0.253	1.247	0.315	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.7	23.51	0.08	0	Right	Tilt	QPSK	1	49	22-08	1:1	0.282	1.045	0.295	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.7	21.74	0.03	1	Right	Tilt	QPSK	25	25	22-08	1:1	0.202	1.247	0.252	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.7	23.51	-0.01	0	Left	Cheek	QPSK	1	49	22-08	1:1	0.553	1.045	**0.578**	A5
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.7	21.74	-0.10	1	Left	Cheek	QPSK	25	25	22-08	1:1	0.322	1.247	0.402	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.7	23.51	0.01	0	Left	Tilt	QPSK	1	49	22-08	1:1	0.340	1.045	0.355	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.7	21.74	-0.10	1	Left	Tilt	QPSK	25	25	22-08	1:1	0.204	1.247	0.254	
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 11-6
LTE Band 2 (PCS) Head SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.0	22.89	-0.20	0	Right	Cheek	QPSK	1	0	28-01	1:1	0.201	1.026	0.206	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	22.0	21.88	-0.02	1	Right	Cheek	QPSK	50	50	28-01	1:1	0.147	1.028	0.151	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.0	22.89	-0.04	0	Right	Tilt	QPSK	1	0	28-01	1:1	0.130	1.026	0.133	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	22.0	21.88	-0.03	1	Right	Tilt	QPSK	50	50	28-01	1:1	0.104	1.028	0.107	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.0	22.89	-0.03	0	Left	Cheek	QPSK	1	0	28-01	1:1	0.294	1.026	0.302	A6
1880.00	18900	Mid	LTE Band 2 (PCS)	20	22.0	21.88	0.02	1	Left	Cheek	QPSK	50	50	28-01	1:1	0.245	1.028	0.252	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.0	22.89	-0.03	0	Left	Tilt	QPSK	1	0	28-01	1:1	0.080	1.026	0.082	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	22.0	21.88	0.09	1	Left	Tilt	QPSK	50	50	28-01	1:1	0.073	1.028	0.075	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Head 1.6 W/kg (mW/g) averaged over 1 gram										

© 2014 PCTEST Engineering Laboratory, Inc.

Table 11-7
DTS Head SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Antenna Config.	Device Serial Number	Data Rate (Mbps)	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
2412	1	IEEE 802.11b	DSSS	13.5	13.20	0.02	Right	Cheek	1	7-02	1	1:1	0.616	1.072	**0.660**	A7
2412	1	IEEE 802.11b	DSSS	13.5	13.20	0.14	Right	Tilt	1	7-02	1	1:1	0.531	1.072	0.569	
2412	1	IEEE 802.11b	DSSS	13.5	13.20	0.14	Left	Cheek	1	7-02	1	1:1	0.351	1.072	0.376	
2412	1	IEEE 802.11b	DSSS	13.5	13.20	0.02	Left	Tilt	1	7-02	1	1:1	0.358	1.072	0.384	
2412	1	IEEE 802.11b	DSSS	16.5	16.16	0.03	Right	Cheek	2	7-02	1	1:1	0.230	1.081	0.249	
2412	1	IEEE 802.11b	DSSS	16.5	16.16	0.08	Right	Tilt	2	7-02	1	1:1	0.068	1.081	0.074	
2412	1	IEEE 802.11b	DSSS	16.5	16.16	0.04	Left	Cheek	2	7-02	1	1:1	0.076	1.081	0.082	
2412	1	IEEE 802.11b	DSSS	16.5	16.16	0.08	Left	Tilt	2	7-02	1	1:1	0.042	1.081	0.045	
2412	1	IEEE 802.11n	OFDM	16.0	15.54	-0.03	Right	Cheek	MIMO	7-02	13	1:1	0.285	1.112	0.317	
2412	1	IEEE 802.11n	OFDM	16.0	15.54	-0.04	Right	Tilt	MIMO	7-02	13	1:1	0.257	1.112	0.286	
2412	1	IEEE 802.11n	OFDM	16.0	15.54	-0.01	Left	Cheek	MIMO	7-02	13	1:1	0.177	1.112	0.197	
2412	1	IEEE 802.11n	OFDM	16.0	15.54	0.08	Left	Tilt	MIMO	7-02	13	1:1	0.170	1.112	0.189	
5745	149	IEEE 802.11a	OFDM	9.5	9.04	0.01	Right	Cheek	1	7-02	6	1:1	0.448	1.112	0.498	
5785	157	IEEE 802.11a	OFDM	9.5	9.09	0.01	Right	Cheek	1	7-02	6	1:1	0.418	1.099	0.459	
5825	165	IEEE 802.11a	OFDM	9.5	8.55	0.11	Right	Cheek	1	7-02	6	1:1	0.438	1.245	0.545	
5745	149	IEEE 802.11a	OFDM	9.5	9.04	0.00	Right	Tilt	1	7-02	6	1:1	0.485	1.112	0.539	A8
5785	157	IEEE 802.11a	OFDM	9.5	9.09	-0.03	Right	Tilt	1	7-02	6	1:1	0.473	1.099	0.520	
5825	165	IEEE 802.11a	OFDM	9.5	8.55	-0.10	Right	Tilt	1	7-02	6	1:1	0.468	1.245	0.583	
5775	155	IEEE 802.11ac	OFDM	7.5	6.71	0.21	Right	Tilt	1	7-02	29.3	1:1	0.269	1.199	0.323	
5745	149	IEEE 802.11a	OFDM	9.5	9.04	-0.03	Left	Cheek	1	7-02	6	1:1	0.361	1.112	0.401	
5785	157	IEEE 802.11a	OFDM	9.5	9.09	-0.05	Left	Cheek	1	7-02	6	1:1	0.352	1.099	0.387	
5825	165	IEEE 802.11a	OFDM	9.5	8.55	-0.05	Left	Cheek	1	7-02	6	1:1	0.367	1.245	0.457	
5745	149	IEEE 802.11a	OFDM	9.5	9.04	0.10	Left	Tilt	1	7-02	6	1:1	0.379	1.112	0.421	
5785	157	IEEE 802.11a	OFDM	9.5	9.09	-0.03	Left	Tilt	1	7-02	6	1:1	0.407	1.099	0.447	
5825	165	IEEE 802.11a	OFDM	9.5	8.55	0.00	Left	Tilt	1	7-02	6	1:1	0.396	1.245	0.493	
5745	149	IEEE 802.11a	OFDM	6.5	5.60	-0.08	Right	Cheek	2	7-02	6	1:1	0.024	1.230	0.030	
5775	155	IEEE 802.11ac	OFDM	6.5	5.27	-0.10	Right	Cheek	2	7-02	29.3	1:1	0.013	1.327	0.017	
5745	149	IEEE 802.11a	OFDM	6.5	5.60	0.03	Right	Tilt	2	7-02	6	1:1	0.013	1.230	0.016	
5745	149	IEEE 802.11a	OFDM	6.5	5.60	0.03	Left	Cheek	2	7-02	6	1:1	0.007	1.230	0.009	
5745	149	IEEE 802.11a	OFDM	6.5	5.60	0.00	Left	Tilt	2	7-02	6	1:1	0.006	1.230	0.007	
5785	157	IEEE 802.11n	OFDM	11.5	10.68	0.13	Right	Cheek	MIMO	7-02	13	1:1	0.236	1.208	0.285	
5785	157	IEEE 802.11n	OFDM	11.5	10.68	0.05	Right	Tilt	MIMO	7-02	13	1:1	0.243	1.208	0.294	
5785	157	IEEE 802.11n	OFDM	11.5	10.68	0.10	Left	Cheek	MIMO	7-02	13	1:1	0.186	1.208	0.225	
5785	157	IEEE 802.11n	OFDM	11.5	10.68	0.11	Left	Tilt	MIMO	7-02	13	1:1	0.219	1.208	0.265	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							**Head 1.6 W/kg (mW/g)** averaged over 1 gram									

© 2014 PCTEST Engineering Laboratory, Inc.

Table 11-8
NII Head SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Antenna Config.	Device Serial Number	Data Rate (Mbps)	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
5220	44	IEEE 802.11a	OFDM	9.5	9.25	-0.02	Right	Cheek	1	7-02	6	1:1	0.244	1.059	0.258	
5220	44	IEEE 802.11a	OFDM	9.5	9.25	0.03	Right	Tilt	1	7-02	6	1:1	0.328	1.059	0.347	
5210	42	IEEE 802.11ac	OFDM	7.5	6.60	-0.05	Right	Tilt	1	7-02	29.3	1:1	0.175	1.230	0.215	
5220	44	IEEE 802.11a	OFDM	9.5	9.25	0.13	Left	Cheek	1	7-02	6	1:1	0.258	1.059	0.273	
5220	44	IEEE 802.11a	OFDM	9.5	9.25	0.05	Left	Tilt	1	7-02	6	1:1	0.306	1.059	0.324	
5300	60	IEEE 802.11a	OFDM	9.5	9.11	-0.18	Right	Cheek	1	7-02	6	1:1	0.176	1.094	0.193	
5300	60	IEEE 802.11a	OFDM	9.5	9.11	-0.03	Right	Tilt	1	7-02	6	1:1	0.187	1.094	0.205	
5290	58	IEEE 802.11ac	OFDM	7.5	6.58	0.10	Right	Tilt	1	7-02	29.3	1:01	0.107	1.236	0.132	
5300	60	IEEE 802.11a	OFDM	9.5	9.11	-0.12	Left	Cheek	1	7-02	6	1:1	0.168	1.094	0.184	
5300	60	IEEE 802.11a	OFDM	9.5	9.11	-0.11	Left	Tilt	1	7-02	6	1:1	0.184	1.094	0.201	
5500	100	IEEE 802.11a	OFDM	9.5	8.90	0.08	Right	Cheek	1	7-02	6	1:1	0.310	1.148	0.356	
5580	116	IEEE 802.11a	OFDM	9.5	9.02	-0.04	Right	Cheek	1	7-02	6	1:1	0.515	1.117	0.575	
5700	140	IEEE 802.11a	OFDM	9.5	9.15	-0.07	Right	Cheek	1	7-02	6	1:1	0.405	1.084	0.439	
5500	100	IEEE 802.11a	OFDM	9.5	8.90	0.03	Right	Tilt	1	7-02	6	1:1	0.373	1.148	0.428	
5580	116	IEEE 802.11a	OFDM	9.5	9.02	0.04	Right	Tilt	1	7-02	6	1:1	0.516	1.117	0.576	
5700	140	IEEE 802.11a	OFDM	9.5	9.15	0.13	Right	Tilt	1	7-02	6	1:1	0.542	1.084	**0.588**	A9
5530	106	IEEE 802.11ac	OFDM	7.5	6.41	0.02	Right	Tilt	1	7-02	29.3	1:1	0.250	1.285	0.321	
5500	100	IEEE 802.11a	OFDM	9.5	8.90	-0.02	Left	Cheek	1	7-02	6	1:1	0.290	1.148	0.333	
5580	116	IEEE 802.11a	OFDM	9.5	9.02	-0.11	Left	Cheek	1	7-02	6	1:1	0.372	1.117	0.416	
5700	140	IEEE 802.11a	OFDM	9.5	9.15	-0.10	Left	Cheek	1	7-02	6	1:1	0.387	1.084	0.420	
5500	100	IEEE 802.11a	OFDM	9.5	8.90	0.02	Left	Tilt	1	7-02	6	1:1	0.327	1.148	0.375	
5580	116	IEEE 802.11a	OFDM	9.5	9.02	0.04	Left	Tilt	1	7-02	6	1:1	0.430	1.117	0.480	
5700	140	IEEE 802.11a	OFDM	9.5	9.15	0.12	Left	Tilt	1	7-02	6	1:1	0.452	1.084	0.490	
5240	48	IEEE 802.11a	OFDM	6.5	6.19	0.06	Right	Cheek	2	7-02	6	1:1	0.043	1.074	0.046	
5210	42	IEEE 802.11ac	OFDM	6.5	5.75	0.14	Right	Cheek	2	7-02	29.3	1:1	0.022	1.189	0.026	
5240	48	IEEE 802.11a	OFDM	6.5	6.19	0.09	Right	Tilt	2	7-02	6	1:1	0.002	1.074	0.002	
5240	48	IEEE 802.11a	OFDM	6.5	6.19	0.08	Left	Cheek	2	7-02	6	1:1	0.008	1.074	0.009	
5240	48	IEEE 802.11a	OFDM	6.5	6.19	-0.02	Left	Tilt	2	7-02	6	1:1	0.010	1.074	0.011	
5300	60	IEEE 802.11a	OFDM	6.5	5.89	0.09	Right	Cheek	2	7-02	6	1:1	0.040	1.151	0.046	
5290	58	IEEE 802.11ac	OFDM	6.5	5.66	-0.08	Right	Cheek	2	7-02	29.3	1:1	0.019	1.213	0.023	
5300	60	IEEE 802.11a	OFDM	6.5	5.89	0.05	Right	Tilt	2	7-02	6	1:1	0.008	1.151	0.009	
5300	60	IEEE 802.11a	OFDM	6.5	5.89	0.04	Left	Cheek	2	7-02	6	1:1	0.010	1.151	0.012	
5300	60	IEEE 802.11a	OFDM	6.5	5.89	-0.05	Left	Tilt	2	7-02	6	1:1	0.013	1.151	0.015	
5680	136	IEEE 802.11a	OFDM	6.5	5.89	0.06	Right	Cheek	2	7-02	6	1:1	0.029	1.151	0.033	
5530	106	IEEE 802.11ac	OFDM	6.5	5.50	-0.06	Right	Cheek	2	7-02	29.3	1:1	0.017	1.259	0.021	
5680	136	IEEE 802.11a	OFDM	6.5	5.89	0.07	Right	Tilt	2	7-02	6	1:1	0.014	1.151	0.016	
5680	136	IEEE 802.11a	OFDM	6.5	5.89	-0.10	Left	Cheek	2	7-02	6	1:1	0.007	1.151	0.008	
5680	136	IEEE 802.11a	OFDM	6.5	5.89	0.00	Left	Tilt	2	7-02	6	1:1	0.001	1.151	0.001	
5200	40	IEEE 802.11n	OFDM	11.5	11.01	0.20	Right	Cheek	MIMO	7-02	13	1:1	0.158	1.119	0.177	
5200	40	IEEE 802.11n	OFDM	11.5	11.01	0.03	Right	Tilt	MIMO	7-02	13	1:1	0.186	1.119	0.208	
5200	40	IEEE 802.11n	OFDM	11.5	11.01	0.19	Left	Cheek	MIMO	7-02	13	1:1	0.141	1.119	0.158	
5200	40	IEEE 802.11n	OFDM	11.5	11.01	0.15	Left	Tilt	MIMO	7-02	13	1:1	0.173	1.119	0.194	
5300	60	IEEE 802.11n	OFDM	11.5	10.65	0.08	Right	Cheek	MIMO	7-02	13	1:1	0.096	1.216	0.117	
5300	60	IEEE 802.11n	OFDM	11.5	10.65	-0.07	Right	Tilt	MIMO	7-02	13	1:1	0.109	1.216	0.133	
5300	60	IEEE 802.11n	OFDM	11.5	10.65	0.03	Left	Cheek	MIMO	7-02	13	1:1	0.102	1.216	0.124	
5300	60	IEEE 802.11n	OFDM	11.5	10.65	0.05	Left	Tilt	MIMO	7-02	13	1:1	0.128	1.216	0.156	
5500	100	IEEE 802.11n	OFDM	11.5	10.68	0.15	Right	Cheek	MIMO	7-02	13	1:1	0.195	1.208	0.236	
5580	116	IEEE 802.11n	OFDM	11.5	10.89	0.04	Right	Cheek	MIMO	7-02	13	1:1	0.262	1.151	0.302	
5660	132	IEEE 802.11n	OFDM	11.5	10.73	-0.14	Right	Cheek	MIMO	7-02	13	1:1	0.308	1.194	0.368	
5500	100	IEEE 802.11n	OFDM	11.5	10.68	-0.09	Right	Tilt	MIMO	7-02	13	1:1	0.196	1.208	0.237	
5580	116	IEEE 802.11n	OFDM	11.5	10.89	-0.05	Right	Tilt	MIMO	7-02	13	1:1	0.259	1.151	0.298	
5660	132	IEEE 802.11n	OFDM	11.5	10.73	0.19	Right	Tilt	MIMO	7-02	13	1:1	0.282	1.194	0.337	
5580	116	IEEE 802.11n	OFDM	11.5	10.89	0.04	Left	Cheek	MIMO	7-02	13	1:1	0.211	1.151	0.243	
5500	100	IEEE 802.11n	OFDM	11.5	10.68	0.03	Left	Tilt	MIMO	7-02	13	1:1	0.190	1.208	0.230	
5580	116	IEEE 802.11n	OFDM	11.5	10.89	-0.12	Left	Tilt	MIMO	7-02	13	1:1	0.239	1.151	0.275	
5660	132	IEEE 802.11n	OFDM	11.5	10.73	0.04	Left	Tilt	MIMO	7-02	13	1:1	0.244	1.194	0.291	

ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population	Head 1.6 W/kg (mW/g) averaged over 1 gram

© 2014 PCTEST Engineering Laboratory, Inc.

11.2 Standalone Body-Worn SAR Data

Table 11-9
GSM/UMTS Body-Worn SAR Data

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	# of Time Slots	Duty Cycle	Side	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
836.60	190	GSM 850	GSM	33.5	32.19	-0.03	10 mm	7-01	1	1:8.3	back	0.295	1.352	0.399	A10
1880.00	661	GSM 1900	GSM	29.5	29.30	0.01	10 mm	7-03	1	1:8.3	back	0.317	1.047	0.332	A12
836.60	4183	UMTS 850	RMC	23.5	22.47	-0.01	10 mm	7-01	N/A	1:1	back	0.610	1.268	0.773	A14
1880.00	9400	UMTS 1900	RMC	21.5	21.31	-0.20	10 mm	7-03	N/A	1:1	back	0.568	1.045	0.594	A15
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram							

Table 11-10
LTE Body-Worn SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.7	23.51	-0.02	0	22-08	QPSK	1	49	10 mm	back	1:1	0.658	1.045	0.688	A17
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.7	21.74	0.15	1	22-08	QPSK	25	25	10 mm	back	1:1	0.418	1.247	0.521	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.0	22.89	-0.08	0	28-01	QPSK	1	0	10 mm	back	1:1	0.660	1.026	0.677	A18
1880.00	18900	Mid	LTE Band 2 (PCS)	20	22.0	21.88	-0.05	1	28-01	QPSK	50	50	10 mm	back	1:1	0.594	1.028	0.611	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Body 1.6 W/kg (mW/g) averaged over 1 gram										

Table 11-11
DTS Body-Worn SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	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	13.5	13.20	-0.04	10 mm	1	7-02	1	back	1:1	0.212	1.072	0.227	A20
2412	1	IEEE 802.11b	DSSS	16.5	16.16	0.17	10 mm	2	7-02	1	back	1:1	0.110	1.081	0.119	
2412	1	IEEE 802.11n	OFDM	16.0	15.54	-0.02	10 mm	MIMO	7-02	13	back	1:1	0.097	1.112	0.108	
5785	157	IEEE 802.11a	OFDM	9.5	9.09	-0.07	10 mm	1	7-02	6	back	1:1	0.148	1.099	0.163	A21
5775	155	IEEE 802.11ac	OFDM	7.5	6.71	-0.04	10 mm	1	7-02	29.3	back	1:1	0.116	1.199	0.139	
5745	149	IEEE 802.11a	OFDM	6.5	5.60	0.19	10 mm	2	7-02	6	back	1:1	0.091	1.230	0.112	
5775	155	IEEE 802.11ac	OFDM	6.5	5.27	0.07	10 mm	2	7-02	29.3	back	1:1	0.073	1.327	0.097	
5785	157	IEEE 802.11n	OFDM	11.5	10.68	-0.14	10 mm	MIMO	7-02	13	back	1:1	0.077	1.208	0.093	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram								

© 2014 PCTEST Engineering Laboratory, Inc.

Table 11-12
NII Body-Worn SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
5220	44	IEEE 802.11a	OFDM	9.5	9.25	-0.20	10 mm	1	7-02	6	back	1:1	0.021	1.059	0.022	
5210	42	IEEE 802.11ac	OFDM	7.5	6.60	-0.06	10 mm	1	7-02	29.3	back	1:1	0.098	1.230	0.121	
5300	60	IEEE 802.11a	OFDM	9.5	9.11	-0.11	10 mm	1	7-02	6	back	1:1	0.168	1.094	0.184	
5290	58	IEEE 802.11ac	OFDM	7.5	6.58	-0.05	10 mm	1	7-02	29.3	back	1:1	0.106	1.236	0.131	
5700	140	IEEE 802.11a	OFDM	9.5	9.15	-0.01	10 mm	1	7-02	6	back	1:1	0.212	1.084	0.230	A22
5530	106	IEEE 802.11ac	OFDM	7.5	6.41	0.04	10 mm	1	7-02	29.3	back	1:1	0.124	1.285	0.159	
5240	48	IEEE 802.11a	OFDM	6.5	6.19	0.02	10 mm	2	7-02	6	back	1:1	0.212	1.074	0.228	
5210	42	IEEE 802.11ac	OFDM	6.5	5.75	0.14	10 mm	2	7-02	29.3	back	1:1	0.163	1.189	0.194	
5300	60	IEEE 802.11a	OFDM	6.5	5.89	-0.18	10 mm	2	7-02	6	back	1:1	0.208	1.151	**0.239**	
5290	58	IEEE 802.11ac	OFDM	6.5	5.66	-0.08	10 mm	2	7-02	29.3	back	1:1	0.155	1.213	0.188	
5680	136	IEEE 802.11a	OFDM	6.5	5.89	0.03	10 mm	2	7-02	6	back	1:1	0.111	1.151	0.128	
5530	106	IEEE 802.11ac	OFDM	6.5	5.50	0.03	10 mm	2	7-02	29.3	back	1:1	0.114	1.259	0.144	
5200	40	IEEE 802.11n	OFDM	11.5	11.01	0.06	10 mm	MIMO	7-02	13	back	1:1	0.174	1.119	0.195	
5300	60	IEEE 802.11n	OFDM	11.5	10.65	0.15	10 mm	MIMO	7-02	13	back	1:1	0.171	1.216	0.208	
5580	116	IEEE 802.11n	OFDM	11.5	10.89	0.02	10 mm	MIMO	7-02	13	back	1:1	0.124	1.151	0.143	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							**Body 1.6 W/kg (mW/g)** averaged over 1 gram									

© 2014 PCTEST Engineering Laboratory, Inc.

11.3 Standalone Wireless Router SAR Data

Table 11-13
GPRS/UMTS Hotspot 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)	
836.60	190	GSM 850	GPRS	31.5	29.79	-0.04	10 mm	7-01	2	1:4.15	back	0.321	1.483	0.476	A11
836.60	190	GSM 850	GPRS	31.5	29.79	-0.02	10 mm	7-01	2	1:4.15	front	0.268	1.483	0.397	
836.60	190	GSM 850	GPRS	31.5	29.79	0.01	10 mm	7-01	2	1:4.15	bottom	0.089	1.483	0.132	
836.60	190	GSM 850	GPRS	31.5	29.79	0.05	10 mm	7-01	2	1:4.15	left	0.262	1.483	0.389	
1880.00	661	GSM 1900	GPRS	29.0	27.03	0.04	10 mm	7-03	2	1:4.15	back	0.373	1.574	0.587	
1850.20	512	GSM 1900	GPRS	29.0	27.16	-0.01	10 mm	7-03	2	1:4.15	front	0.537	1.528	0.821	
1880.00	661	GSM 1900	GPRS	29.0	27.03	-0.02	10 mm	7-03	2	1:4.15	front	0.567	1.574	0.892	
1909.80	810	GSM 1900	GPRS	29.0	27.24	-0.08	10 mm	7-03	2	1:4.15	front	0.599	1.500	0.899	A13
1880.00	661	GSM 1900	GPRS	29.0	27.03	-0.18	10 mm	7-03	2	1:4.15	bottom	0.427	1.574	0.672	
1880.00	661	GSM 1900	GPRS	29.0	27.03	0.05	10 mm	7-03	2	1:4.15	left	0.175	1.574	0.275	
836.60	4183	UMTS 850	RMC	23.5	22.47	-0.01	10 mm	7-01	N/A	1:1	back	0.610	1.268	0.773	A14
836.60	4183	UMTS 850	RMC	23.5	22.47	0.00	10 mm	7-01	N/A	1:1	front	0.533	1.268	0.676	
836.60	4183	UMTS 850	RMC	23.5	22.47	0.00	10 mm	7-01	N/A	1:1	bottom	0.198	1.268	0.251	
836.60	4183	UMTS 850	RMC	23.5	22.47	-0.02	10 mm	7-01	N/A	1:1	left	0.575	1.268	0.729	
1880.00	9400	UMTS 1900	RMC	21.5	21.31	-0.20	10 mm	7-03	N/A	1:1	back	0.568	1.045	0.594	
1852.40	9262	UMTS 1900	RMC	21.5	21.23	-0.02	10 mm	7-03	N/A	1:1	front	0.797	1.064	0.848	
1880.00	9400	UMTS 1900	RMC	21.5	21.31	0.01	10 mm	7-03	N/A	1:1	front	0.877	1.045	0.916	A16
1907.60	9538	UMTS 1900	RMC	21.5	20.25	-0.01	10 mm	7-03	N/A	1:1	front	0.659	1.334	0.879	
1880.00	9400	UMTS 1900	RMC	21.5	21.31	-0.08	10 mm	7-03	N/A	1:1	bottom	0.647	1.045	0.676	
1880.00	9400	UMTS 1900	RMC	21.5	21.31	-0.01	10 mm	7-03	N/A	1:1	left	0.329	1.045	0.344	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram								

Table 11-14
LTE Band 5 (Cell) Hotspot SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.7	23.51	-0.02	0	22-08	QPSK	1	49	10 mm	back	1:1	0.658	1.045	0.688	A17
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.7	21.74	0.15	1	22-08	QPSK	25	25	10 mm	back	1:1	0.418	1.247	0.521	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.7	23.51	-0.01	0	22-08	QPSK	1	49	10 mm	front	1:1	0.603	1.045	0.630	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.7	21.74	-0.15	1	22-08	QPSK	25	25	10 mm	front	1:1	0.378	1.247	0.471	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.7	23.51	-0.02	0	22-08	QPSK	1	49	10 mm	bottom	1:1	0.236	1.045	0.247	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.7	21.74	0.02	1	22-08	QPSK	25	25	10 mm	bottom	1:1	0.141	1.247	0.176	
836.50	20525	Mid	LTE Band 5 (Cell)	10	23.7	23.51	0.00	0	22-08	QPSK	1	49	10 mm	left	1:1	0.579	1.045	0.605	
836.50	20525	Mid	LTE Band 5 (Cell)	10	22.7	21.74	0.02	1	22-08	QPSK	25	25	10 mm	left	1:1	0.403	1.247	0.503	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram												

© 2014 PCTEST Engineering Laboratory, Inc.

Table 11-15
LTE Band 2 (PCS) Hotspot SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.0	22.89	-0.08	0	28-01	QPSK	1	0	10 mm	back	1:1	0.660	1.026	0.677	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	22.0	21.88	-0.05	1	28-01	QPSK	50	50	10 mm	back	1:1	0.594	1.028	0.611	
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.0	22.67	0.00	0	28-01	QPSK	1	0	10 mm	front	1:1	0.929	1.079	1.002	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.0	22.89	-0.04	0	28-01	QPSK	1	0	10 mm	front	1:1	1.070	1.026	**1.098**	A19
1900.00	19100	High	LTE Band 2 (PCS)	20	23.0	22.64	0.01	0	28-01	QPSK	1	0	10 mm	front	1:1	0.970	1.086	1.053	
1860.00	18700	Low	LTE Band 2 (PCS)	20	22.0	21.79	-0.02	1	28-01	QPSK	50	50	10 mm	front	1:1	0.764	1.050	0.802	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	22.0	21.88	-0.02	1	28-01	QPSK	50	50	10 mm	front	1:1	0.833	1.028	0.856	
1900.00	19100	High	LTE Band 2 (PCS)	20	22.0	21.61	-0.03	1	28-01	QPSK	50	0	10 mm	front	1:1	0.753	1.094	0.824	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	22.0	21.84	-0.02	1	28-01	QPSK	100	0	10 mm	front	1:1	0.779	1.038	0.809	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.0	22.89	0.03	0	28-01	QPSK	1	0	10 mm	bottom	1:1	0.758	1.026	0.778	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	22.0	21.88	0.00	1	28-01	QPSK	50	50	10 mm	bottom	1:1	0.685	1.028	0.704	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.0	22.89	0.01	0	28-01	QPSK	1	0	10 mm	left	1:1	0.313	1.026	0.321	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	22.0	21.88	0.02	1	28-01	QPSK	50	50	10 mm	left	1:1	0.259	1.028	0.266	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.0	22.89	-0.03	0	28-01	QPSK	1	0	10 mm	front	1:1	1.020	1.026	1.047	
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: Variability data is highlighted in blue

Table 11-16
WLAN Hotspot SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Antenna Config.	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	13.5	13.20	-0.04	10 mm	1	7-02	1	back	1:1	0.212	1.072	**0.227**	A20
2412	1	IEEE 802.11b	DSSS	13.5	13.20	-0.08	10 mm	1	7-02	1	front	1:1	0.183	1.072	0.196	
2412	1	IEEE 802.11b	DSSS	13.5	13.20	0.15	10 mm	1	7-02	1	top	1:1	0.164	1.072	0.176	
2412	1	IEEE 802.11b	DSSS	13.5	13.20	-0.16	10 mm	1	7-02	1	left	1:1	0.107	1.072	0.115	
2412	1	IEEE 802.11b	DSSS	16.5	16.16	0.17	10 mm	2	7-02	1	back	1:1	0.110	1.081	0.119	
2412	1	IEEE 802.11b	DSSS	16.5	16.16	-0.02	10 mm	2	7-02	1	front	1:1	0.039	1.081	0.042	
2412	1	IEEE 802.11b	DSSS	16.5	16.16	0.14	10 mm	2	7-02	1	left	1:1	0.050	1.081	0.054	
2412	1	IEEE 802.11n	OFDM	16.0	15.54	-0.02	10 mm	MIMO	7-02	13	back	1:1	0.097	1.112	0.108	
2412	1	IEEE 802.11n	OFDM	16.0	15.54	-0.01	10 mm	MIMO	7-02	13	front	1:1	0.057	1.112	0.063	
2412	1	IEEE 802.11n	OFDM	16.0	15.54	-0.03	10 mm	MIMO	7-02	13	top	1:1	0.041	1.112	0.046	
2412	1	IEEE 802.11n	OFDM	16.0	15.54	0.02	10 mm	MIMO	7-02	13	left	1:1	0.038	1.112	0.042	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram									

© 2014 PCTEST Engineering Laboratory, Inc.

11.4 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, and FCC KDB Publication 447498 D01v05.
2. Batteries are fully charged at the beginning of the SAR measurements. A specialized battery was used for all 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. Device was tested using a fixed spacing for body-worn accessory testing. A separation distance of 10 mm was considered because the manufacturer has determined that there will be body-worn accessories available in the marketplace for users to support this separation distance.
7. Per FCC KDB Publication 648474 D04v01, body-worn SAR was evaluated without a headset connected to the device. Since the standalone reported SAR was ≤ 1.2 W/kg, no additional SAR evaluations using a headset cable were required.
8. 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 13 for variability analysis.
9. During SAR Testing for the Wireless Router conditions per FCC KDB Publication 941225 D06v01, the actual Portable Hotspot operation (with actual simultaneous transmission of a transmitter with WIFI) was not activated (See Section 6.7 for more details).

GSM Test Notes:

1. Body-Worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn SAR.
2. Justification for reduced test configurations per KDB Publication 941225 D03v01 and October 2013 TCB Workshop Notes: The source-based frame-averaged output power was evaluated for all GPRS/EDGE slot configurations. The configuration with the highest target frame averaged output power was evaluated for hotspot SAR. When the maximum frame-averaged powers are equivalent across two or more slots (within 0.25 dB), the configuration with the most number of time slots was tested.
3. 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 was used.

UMTS Notes:

1. UMTS mode in 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. 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 was used.

© 2014 PCTEST Engineering Laboratory, Inc.

LTE Notes:

1. LTE Considerations: LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05v02r01. The general test procedures used for testing can be found in Section 8.4.4.
2. MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.
3. A-MPR was disabled for all SAR tests by setting NS=01 on the base station simulator. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).

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 SISO 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 SISO 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 SISO IEEE 802.11 modes (including 802.11n) 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 SISO IEEE 802.11a mode.
3. Per April 2013 TCB Workshop notes, full SAR tests for all SISO IEEE 802.11ac configurations were not required because the average output power was not more than 0.25 dB higher than SISO IEEE 802.11a mode. SISO IEEE 802.11ac was evaluated for the highest SISO IEEE 802.11a position in each 5 GHz band and exposure condition.
4. When Hotspot is enabled, all 5 GHz bands are disabled. Therefore no 5 GHz WIFI Wireless Router SAR Data was required.
5. WIFI transmission was verified using an uncalibrated spectrum analyzer.
6. When the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is >1.6 W/kg or the reported 1g averaged SAR is >0.8 W/kg, SAR testing on other default channels was required.
7. Per KDB 248227, SAR for MIMO was measured with both transmitting simultaneously and was evaluated independently of SISO operation. For 2.4 GHz MIMO, 802.11n was evaluated. For 5 GHz MIMO, 20 MHz Bandwidth 802.11n was evaluated. Additional evaluations for 40 MHz bandwidth 802.11n and 802.11ac were not required since the maximum allowed output power was not higher than 802.11n 20 MHz Bandwidth.
8.

© 2014 PCTEST Engineering Laboratory, Inc.

12 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

12.1 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/ac and Bluetooth devices which may simultaneously transmit with the licensed transmitter.

12.2 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 and IEEE 1528-2013 Section 6.3.4.1.2, 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 12-1
Estimated SAR

Mode	Frequency	Maximum Allowed Power	Separation Distance (Body)	Estimated SAR (Body)
	[MHz]	[dBm]	[mm]	[W/kg]
Bluetooth	2480	10.00	10	0.210

Note: Held-to ear configurations are not applicable to Bluetooth operations and therefore were not considered for simultaneous transmission. Per KDB Publication 447498 D01v05, the maximum power of the channel was rounded to the nearest mW before calculation.

© 2014 PCTEST Engineering Laboratory, Inc.

12.3 Head SAR Simultaneous Transmission Analysis

Table 12-2
Simultaneous Transmission Scenario with 2.4 GHz WLAN Antenna 1 (Held to Ear)

Simult Tx	Configuration	GSM 850 SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.223	0.660	**0.883**
	Right Tilt	0.127	0.569	0.696
	Left Cheek	0.304	0.376	0.680
	Left Tilt	0.143	0.384	0.527

Simult Tx	Configuration	GSM 1900 SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.113	0.660	**0.773**
	Right Tilt	0.075	0.569	0.644
	Left Cheek	0.177	0.376	0.553
	Left Tilt	0.049	0.384	0.433

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.429	0.660	**1.089**
	Right Tilt	0.289	0.569	0.858
	Left Cheek	0.560	0.376	0.936
	Left Tilt	0.332	0.384	0.716

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.175	0.660	**0.835**
	Right Tilt	0.101	0.569	0.670
	Left Cheek	0.257	0.376	0.633
	Left Tilt	0.072	0.384	0.456

Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.398	0.660	**1.058**
	Right Tilt	0.295	0.569	0.864
	Left Cheek	0.578	0.376	0.954
	Left Tilt	0.355	0.384	0.739

Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.206	0.660	**0.866**
	Right Tilt	0.133	0.569	0.702
	Left Cheek	0.302	0.376	0.678
	Left Tilt	0.082	0.384	0.466

Table 12-3
Simultaneous Transmission Scenario with 2.4 GHz WLAN Antenna 2 (Held to Ear)

Simult Tx	Configuration	GSM 850 SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.223	0.249	**0.472**
	Right Tilt	0.127	0.074	0.201
	Left Cheek	0.304	0.082	0.386
	Left Tilt	0.143	0.045	0.188

Simult Tx	Configuration	GSM 1900 SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.113	0.249	**0.362**
	Right Tilt	0.075	0.074	0.149
	Left Cheek	0.177	0.082	0.259
	Left Tilt	0.049	0.045	0.094

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.429	0.249	**0.678**
	Right Tilt	0.289	0.074	0.363
	Left Cheek	0.560	0.082	0.642
	Left Tilt	0.332	0.045	0.377

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.175	0.249	**0.424**
	Right Tilt	0.101	0.074	0.175
	Left Cheek	0.257	0.082	0.339
	Left Tilt	0.072	0.045	0.117

Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.398	0.249	0.647
	Right Tilt	0.295	0.074	0.369
	Left Cheek	0.578	0.082	**0.660**
	Left Tilt	0.355	0.045	0.400

Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.206	0.249	**0.455**
	Right Tilt	0.133	0.074	0.207
	Left Cheek	0.302	0.082	0.384
	Left Tilt	0.082	0.045	0.127

© 2014 PCTEST Engineering Laboratory, Inc.

Table 12-4
Simultaneous Transmission Scenario with 2.4 GHz WLAN MIMO (Held to Ear)

Simult Tx	Configuration	GSM 850 SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.223	0.317	**0.540**
	Right Tilt	0.127	0.286	0.413
	Left Cheek	0.304	0.197	0.501
	Left Tilt	0.143	0.189	0.332

Simult Tx	Configuration	GSM 1900 SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.113	0.317	**0.430**
	Right Tilt	0.075	0.286	0.361
	Left Cheek	0.177	0.197	0.374
	Left Tilt	0.049	0.189	0.238

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.429	0.317	0.746
	Right Tilt	0.289	0.286	0.575
	Left Cheek	0.560	0.197	**0.757**
	Left Tilt	0.332	0.189	0.521

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.175	0.317	**0.492**
	Right Tilt	0.101	0.286	0.387
	Left Cheek	0.257	0.197	0.454
	Left Tilt	0.072	0.189	0.261

Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.398	0.317	0.715
	Right Tilt	0.295	0.286	0.581
	Left Cheek	0.578	0.197	**0.775**
	Left Tilt	0.355	0.189	0.544

Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.206	0.317	**0.523**
	Right Tilt	0.133	0.286	0.419
	Left Cheek	0.302	0.197	0.499
	Left Tilt	0.082	0.189	0.271

Table 12-5
Simultaneous Transmission Scenario with 5 GHz WLAN Antenna 1 (Held to Ear)

Simult Tx	Configuration	GSM 850 SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.223	0.575	**0.798**
	Right Tilt	0.127	0.588	0.715
	Left Cheek	0.304	0.457	0.761
	Left Tilt	0.143	0.493	0.636

Simult Tx	Configuration	GSM 1900 SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.113	0.575	**0.688**
	Right Tilt	0.075	0.588	0.663
	Left Cheek	0.177	0.457	0.634
	Left Tilt	0.049	0.493	0.542

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.429	0.575	1.004
	Right Tilt	0.289	0.588	0.877
	Left Cheek	0.560	0.457	**1.017**
	Left Tilt	0.332	0.493	0.825

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.175	0.575	**0.750**
	Right Tilt	0.101	0.588	0.689
	Left Cheek	0.257	0.457	0.714
	Left Tilt	0.072	0.493	0.565

Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.398	0.575	0.973
	Right Tilt	0.295	0.588	0.883
	Left Cheek	0.578	0.457	**1.035**
	Left Tilt	0.355	0.493	0.848

Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.206	0.575	**0.781**
	Right Tilt	0.133	0.588	0.721
	Left Cheek	0.302	0.457	0.759
	Left Tilt	0.082	0.493	0.575

© 2014 PCTEST Engineering Laboratory, Inc.

Table 12-6
Simultaneous Transmission Scenario with 5 GHz WLAN Antenna 2 (Held to Ear)

Simult Tx	Configuration	GSM 850 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.223	0.046	0.269
	Right Tilt	0.127	0.016	0.143
	Left Cheek	0.304	0.012	**0.316**
	Left Tilt	0.143	0.015	0.158

Simult Tx	Configuration	GSM 1900 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.113	0.046	0.159
	Right Tilt	0.075	0.016	0.091
	Left Cheek	0.177	0.012	**0.189**
	Left Tilt	0.049	0.015	0.064

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.429	0.046	0.475
	Right Tilt	0.289	0.016	0.305
	Left Cheek	0.560	0.012	**0.572**
	Left Tilt	0.332	0.015	0.347

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.175	0.046	0.221
	Right Tilt	0.101	0.016	0.117
	Left Cheek	0.257	0.012	**0.269**
	Left Tilt	0.072	0.015	0.087

Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.398	0.046	0.444
	Right Tilt	0.295	0.016	0.311
	Left Cheek	0.578	0.012	**0.590**
	Left Tilt	0.355	0.015	0.370

Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.206	0.046	0.252
	Right Tilt	0.133	0.016	0.149
	Left Cheek	0.302	0.012	**0.314**
	Left Tilt	0.082	0.015	0.097

Table 12-7
Simultaneous Transmission Scenario with 5 GHz WLAN MIMO (Held to Ear)

Simult Tx	Configuration	GSM 850 SAR (W/kg)	5 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.223	0.368	**0.591**
	Right Tilt	0.127	0.337	0.464
	Left Cheek	0.304	0.243	0.547
	Left Tilt	0.143	0.291	0.434

Simult Tx	Configuration	GSM 1900 SAR (W/kg)	5 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.113	0.368	**0.481**
	Right Tilt	0.075	0.337	0.412
	Left Cheek	0.177	0.243	0.420
	Left Tilt	0.049	0.291	0.340

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	5 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.429	0.368	0.797
	Right Tilt	0.289	0.337	0.626
	Left Cheek	0.560	0.243	**0.803**
	Left Tilt	0.332	0.291	0.623

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	5 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.175	0.368	**0.543**
	Right Tilt	0.101	0.337	0.438
	Left Cheek	0.257	0.243	0.500
	Left Tilt	0.072	0.291	0.363

Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	5 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.398	0.368	0.766
	Right Tilt	0.295	0.337	0.632
	Left Cheek	0.578	0.243	**0.821**
	Left Tilt	0.355	0.291	0.646

Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	5 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.206	0.368	**0.574**
	Right Tilt	0.133	0.337	0.470
	Left Cheek	0.302	0.243	0.545
	Left Tilt	0.082	0.291	0.373

© 2014 PCTEST Engineering Laboratory, Inc.

12.4 Body-Worn Simultaneous Transmission Analysis

Table 12-8
Simultaneous Transmission Scenario with 2.4 GHz WLAN Antenna 1 (Body-Worn at 1.0 cm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
Back Side	GSM 850	0.399	0.227	0.626
Back Side	GSM 1900	0.332	0.227	0.559
Back Side	UMTS 850	0.773	0.227	**1.000**
Back Side	UMTS 1900	0.594	0.227	0.821
Back Side	LTE Band 5 (Cell)	0.688	0.227	0.915
Back Side	LTE Band 2 (PCS)	0.677	0.227	0.904

Table 12-9
Simultaneous Transmission Scenario with 2.4 GHz WLAN Antenna 2 (Body-Worn at 1.0 cm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Back Side	GSM 850	0.399	0.119	0.518
Back Side	GSM 1900	0.332	0.119	0.451
Back Side	UMTS 850	0.773	0.119	**0.892**
Back Side	UMTS 1900	0.594	0.119	0.713
Back Side	LTE Band 5 (Cell)	0.688	0.119	0.807
Back Side	LTE Band 2 (PCS)	0.677	0.119	0.796

Table 12-10
Simultaneous Transmission Scenario with 2.4 GHz WLAN MIMO (Body-Worn at 1.0 cm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
Back Side	GSM 850	0.399	0.108	0.507
Back Side	GSM 1900	0.332	0.108	0.440
Back Side	UMTS 850	0.773	0.108	**0.881**
Back Side	UMTS 1900	0.594	0.108	0.702
Back Side	LTE Band 5 (Cell)	0.688	0.108	0.796
Back Side	LTE Band 2 (PCS)	0.677	0.108	0.785

Table 12-11
Simultaneous Transmission Scenario with 5 GHz WLAN Antenna 1 (Body-Worn at 1.0 cm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	5 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
Back Side	GSM 850	0.399	0.230	0.629
Back Side	GSM 1900	0.332	0.230	0.562
Back Side	UMTS 850	0.773	0.230	**1.003**
Back Side	UMTS 1900	0.594	0.230	0.824
Back Side	LTE Band 5 (Cell)	0.688	0.230	0.918
Back Side	LTE Band 2 (PCS)	0.677	0.230	0.907

© 2014 PCTEST Engineering Laboratory, Inc.

Table 12-12
Simultaneous Transmission Scenario with 5 GHz WLAN Antenna 2 (Body-Worn at 1.0 cm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	5 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Back Side	GSM 850	0.399	0.239	0.638
Back Side	GSM 1900	0.332	0.239	0.571
Back Side	UMTS 850	0.773	0.239	**1.012**
Back Side	UMTS 1900	0.594	0.239	0.833
Back Side	LTE Band 5 (Cell)	0.688	0.239	0.927
Back Side	LTE Band 2 (PCS)	0.677	0.239	0.916

Table 12-13
Simultaneous Transmission Scenario with 5 GHz WLAN MIMO (Body-Worn at 1.0 cm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	5 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
Back Side	GSM 850	0.399	0.208	0.607
Back Side	GSM 1900	0.332	0.208	0.540
Back Side	UMTS 850	0.773	0.208	**0.981**
Back Side	UMTS 1900	0.594	0.208	0.802
Back Side	LTE Band 5 (Cell)	0.688	0.208	0.896
Back Side	LTE Band 2 (PCS)	0.677	0.208	0.885

Table 12-14
Simultaneous Transmission Scenario with Bluetooth (Body-Worn at 1.0 cm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Back Side	GSM 850	0.399	0.210	0.609
Back Side	GSM 1900	0.332	0.210	0.542
Back Side	UMTS 850	0.773	0.210	**0.983**
Back Side	UMTS 1900	0.594	0.210	0.804
Back Side	LTE Band 5 (Cell)	0.688	0.210	0.898
Back Side	LTE Band 2 (PCS)	0.677	0.210	0.887

Note: Bluetooth SAR was not required to be measured per FCC KDB 447498. Estimated SAR results were used in the above table to determine simultaneous transmission SAR test exclusion.

© 2014 PCTEST Engineering Laboratory, Inc.

12.5 Hotspot SAR Simultaneous Transmission Analysis

Per FCC KDB Publication 941225 D06v01, the devices edges with antennas more than 2.5 cm from edge are not required to be evaluated for SAR ("-").

Table 12-15
Simultaneous Transmission Scenario (2.4 GHz Antenna 1 Hotspot at 1.0 cm)

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.476	0.227	**0.703**
	Front	0.397	0.196	0.593
	Top	-	0.176	0.176
	Bottom	0.132	-	0.132
	Right	-	-	0.000
	Left	0.389	0.115	0.504

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.587	0.227	0.814
	Front	0.899	0.196	**1.095**
	Top	-	0.176	0.176
	Bottom	0.672	-	0.672
	Right	-	-	0.000
	Left	0.275	0.115	0.390

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.773	0.227	**1.000**
	Front	0.676	0.196	0.872
	Top	-	0.176	0.176
	Bottom	0.251	-	0.251
	Right	-	-	0.000
	Left	0.729	0.115	0.844

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.594	0.227	0.821
	Front	0.916	0.196	**1.112**
	Top	-	0.176	0.176
	Bottom	0.676	-	0.676
	Right	-	-	0.000
	Left	0.344	0.115	0.459

Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.688	0.227	**0.915**
	Front	0.630	0.196	0.826
	Top	-	0.176	0.176
	Bottom	0.247	-	0.247
	Right	-	-	0.000
	Left	0.605	0.115	0.720

Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	2.4 GHz WLAN Ant 1 SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.677	0.227	0.904
	Front	1.098	0.196	**1.294**
	Top	-	0.176	0.176
	Bottom	0.778	-	0.778
	Right	-	-	0.000
	Left	0.321	0.115	0.436

© 2014 PCTEST Engineering Laboratory, Inc.

Table 12-16
Simultaneous Transmission Scenario (2.4 GHz Antenna 2 Hotspot at 1.0 cm)

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.476	0.119	**0.595**
	Front	0.397	0.042	0.439
	Top	-	-	0.000
	Bottom	0.132	-	0.132
	Right	-	-	0.000
	Left	0.389	0.054	0.443

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.587	0.119	0.706
	Front	0.899	0.042	**0.941**
	Top	-	-	0.000
	Bottom	0.672	-	0.672
	Right	-	-	0.000
	Left	0.275	0.054	0.329

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.773	0.119	**0.892**
	Front	0.676	0.042	0.718
	Top	-	-	0.000
	Bottom	0.251	-	0.251
	Right	-	-	0.000
	Left	0.729	0.054	0.783

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.594	0.119	0.713
	Front	0.916	0.042	**0.958**
	Top	-	-	0.000
	Bottom	0.676	-	0.676
	Right	-	-	0.000
	Left	0.344	0.054	0.398

Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.688	0.119	**0.807**
	Front	0.630	0.042	0.672
	Top	-	-	0.000
	Bottom	0.247	-	0.247
	Right	-	-	0.000
	Left	0.605	0.054	0.659

Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	2.4 GHz WLAN Ant 2 SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.677	0.119	0.796
	Front	1.098	0.042	**1.140**
	Top	-	-	0.000
	Bottom	0.778	-	0.778
	Right	-	-	0.000
	Left	0.321	0.054	0.375

© 2014 PCTEST Engineering Laboratory, Inc.

Table 12-17
Simultaneous Transmission Scenario (2.4 GHz MIMO Hotspot at 1.0 cm)

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.476	0.108	**0.584**
	Front	0.397	0.063	0.460
	Top	-	0.046	0.046
	Bottom	0.132	-	0.132
	Right	-	-	0.000
	Left	0.389	0.042	0.431

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.587	0.108	0.695
	Front	0.899	0.063	**0.962**
	Top	-	0.046	0.046
	Bottom	0.672	-	0.672
	Right	-	-	0.000
	Left	0.275	0.042	0.317

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.773	0.108	**0.881**
	Front	0.676	0.063	0.739
	Top	-	0.046	0.046
	Bottom	0.251	-	0.251
	Right	-	-	0.000
	Left	0.729	0.042	0.771

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.594	0.108	0.702
	Front	0.916	0.063	**0.979**
	Top	-	0.046	0.046
	Bottom	0.676	-	0.676
	Right	-	-	0.000
	Left	0.344	0.042	0.386

Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.688	0.108	**0.796**
	Front	0.630	0.063	0.693
	Top	-	0.046	0.046
	Bottom	0.247	-	0.247
	Right	-	-	0.000
	Left	0.605	0.042	0.647

Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	2.4 GHz WLAN MIMO SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.677	0.108	0.785
	Front	1.098	0.063	**1.161**
	Top	-	0.046	0.046
	Bottom	0.778	-	0.778
	Right	-	-	0.000
	Left	0.321	0.042	0.363

12.6 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 and IEEE 1528-2013 Section 6.3.4.1.2.

© 2014 PCTEST Engineering Laboratory, Inc.

13 SAR MEASUREMENT VARIABILITY

13.1 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 13-1
Body SAR Measurement Variability Results

BODY VARIABILITY RESULTS													
Band	FREQUENCY		Mode	Service	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)	
1900	1880.00	18900	LTE Band 2 (PCS)	QPSK, 1 RB, 0 RB Offset	front	10 mm	1.070	1.020	1.05	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							

13.2 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.

© 2014 PCTEST Engineering Laboratory, Inc.

14 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	E5515C	Wireless Communications Test Set	3/18/2014	Annual	3/18/2015	GB46110872
Agilent	E8257D	(250kHz-20GHz) Signal Generator	4/15/2014	Annual	4/15/2015	MY45470194
Agilent	N9020A	MXA Signal Analyzer	10/29/2013	Annual	10/29/2014	US46470561
Agilent	8648D	(9kHz-4GHz) Signal Generator	4/15/2014	Annual	4/15/2015	3629U00687
Agilent	8753ES	S-Parameter Network Analyzer	10/29/2013	Annual	10/29/2014	US39170122
Agilent	N5182A	MXG Vector Signal Generator	4/15/2014	Annual	4/15/2015	MY47420800
Agilent	N5182A	MXG Vector Signal Generator	4/15/2014	Annual	4/15/2015	MY47420651
Agilent	E4438C	ESG Vector Signal Generator	4/25/2014	Annual	4/25/2015	MY42082385
Agilent	E4438C	ESG Vector Signal Generator	4/1/2014	Annual	4/1/2015	MY47270002
Agilent	8753ES	S-Parameter Network Analyzer	5/22/2014	Annual	5/22/2015	US39170118
Agilent	E5515C	Wireless Communications Test Set	3/28/2014	Annual	3/28/2015	GB42230325
Agilent	E5515C	Wireless Communications Test Set	3/28/2014	Annual	3/28/2015	GB44400860
Anritsu	ML2495A	Power Meter	10/31/2013	Annual	10/31/2014	1039008
Anritsu	MT8820C	Radio Communication Analyzer	12/12/2013	Annual	12/12/2014	6200901190
Anritsu	MA24106A	USB Power Sensor	5/14/2014	Annual	5/14/2015	1231538
Anritsu	MA24106A	USB Power Sensor	5/14/2014	Annual	5/14/2015	1231535
Anritsu	MA24106A	USB Power Sensor	5/15/2014	Annual	5/15/2015	1244524
Anritsu	MA24106A	USB Power Sensor	5/14/2014	Annual	5/14/2015	1244515
Anritsu	MA24106A	USB Power Sensor	5/15/2014	Annual	5/15/2015	1244512
Anritsu	MA24106A	USB Power Sensor	5/14/2014	Annual	5/14/2015	1248508
Anritsu	MA2411B	Pulse Power Sensor	11/14/2013	Annual	11/14/2014	1126066
Anritsu	MT8820C	Radio Communication Analyzer	12/12/2013	Annual	12/12/2014	6201300731
Anritsu	ML2469A	Power Meter	3/14/2014	Annual	3/14/2015	1306009
Anritsu	MA2411B	Pulse Power Sensor	3/25/2014	Annual	3/25/2015	1207470
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
Control Company	61220-416	Long-Stem Thermometer	4/29/2014	Biennial	4/29/2016	111331323
Control Company	4353	Long Stem Thermometer	9/25/2012	Biennial	9/25/2014	122541139
Control Company	4052	Long Stem Thermometer	9/27/2013	Biennial	9/27/2015	130567447
Fisher Scientific	15-077-960	Digital Thermometer	11/6/2012	Biennial	11/6/2014	122640025
Gigatronics	8651A	Universal Power Meter	10/30/2013	Annual	10/30/2014	8650319
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	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	NLP-1200+	Low Pass Filter DC to 1000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	CBT	N/A	CBT	N/A
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	6/6/2014	Annual	6/6/2015	109892
Rohde & Schwarz	NRVD	Dual Channel Power Meter	10/12/2012	Biennial	10/12/2014	101695
Rohde & Schwarz	NRVS	Single Channel Power Meter	10/31/2013	Annual	10/31/2014	835360/0079
Rohde & Schwarz	NRV-Z32	Peak Power Sensor	10/12/2012	Biennial	10/12/2014	836019/013
Rohde & Schwarz	CMW500	Radio Communication Tester	10/18/2013	Annual	10/18/2014	100976
Rohde & Schwarz	CMW500	Radio Communication Tester	10/4/2013	Biennial	10/4/2015	103962
Rohde & Schwarz	CMW500	Radio Communication Tester	4/23/2014	Annual	4/23/2015	112347
Rohde & Schwarz	CMW500	Radio Communication Tester	4/18/2014	Annual	4/18/2015	101699
Rohde & Schwarz	CMW500	Radio Communication Tester	4/15/2014	Annual	4/15/2015	102060
Rohde & Schwarz	SME06	Signal Generator	10/30/2013	Annual	10/30/2014	832026
Seekonk	NC-100	Torque Wrench 5/16", 8" lbs	3/18/2014	Biennial	3/18/2016	N/A
SPEAG	D2450V2	2450 MHz SAR Dipole	1/21/2014	Annual	1/21/2015	797
SPEAG	D5GHzV2	5 GHz SAR Dipole	9/23/2013	Annual	9/23/2014	1007
SPEAG	D5GHzV2	5 GHz SAR Dipole	1/27/2014	Annual	1/27/2015	1057
SPEAG	DAE4	Dasy Data Acquisition Electronics	12/12/2013	Annual	12/12/2014	649
SPEAG	ES3DV2	SAR Probe	8/22/2013	Annual	8/22/2014	3022
SPEAG	D1900V2	1900 MHz SAR Dipole	4/9/2014	Annual	4/9/2015	5d141
SPEAG	D835V2	835 MHz SAR Dipole	4/7/2014	Annual	4/7/2015	4d119
SPEAG	D1900V2	1900 MHz SAR Dipole	7/22/2013	Annual	7/22/2014	5d149
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/19/2013	Annual	11/19/2014	1333
SPEAG	DAE4	Dasy Data Acquisition Electronics	8/21/2013	Annual	8/21/2014	1322
SPEAG	ES3DV3	SAR Probe	11/20/2013	Annual	11/20/2014	3287
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/6/2014	Annual	5/6/2015	1070
SPEAG	EX3DV4	SAR Probe	12/18/2013	Annual	12/18/2014	3920
SPEAG	EX3DV4	SAR Probe	10/23/2013	Annual	10/23/2014	3914
SPEAG	ES3DV3	SAR Probe	4/17/2014	Annual	4/17/2015	3319
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/19/2013	Annual	11/19/2014	1408
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/11/2014	Annual	4/11/2015	1368
SPEAG	ES3DV3	SAR Probe	11/25/2013	Annual	11/25/2014	3332
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/18/2013	Annual	11/18/2014	1407
Tektronix	RSA6114A	Real Time Spectrum Analyzer	4/16/2014	Annual	4/16/2015	B010177
VWR	36934-158	Wall-Mounted Thermometer	4/29/2014	Biennial	4/29/2016	111859323
VWR	36934-158	Wall-Mounted Thermometer	4/29/2014	Biennial	4/29/2016	111859332
VWR	36934-158	Wall-Mounted Thermometer	8/8/2013	Biennial	8/8/2015	130477877
VWR	36934-158	Wall-Mounted Thermometer	8/8/2013	Biennial	8/8/2015	130477866

Notes:

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. Each equipment item was used solely within its respective calibration period.

© 2014 PCTEST Engineering Laboratory, Inc.

15 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

© 2014 PCTEST Engineering Laboratory, Inc.

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

© 2014 PCTEST Engineering Laboratory, Inc.

16 CONCLUSION

16.1 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]

© 2014 PCTEST Engineering Laboratory, Inc.

17 REFERENCES

[1] Federal Communications Commission, ET Docket 93-62, Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation, Aug. 1996.

[2] ANSI/IEEE C95.1-2005, American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 3kHz to 300GHz, New York: IEEE, 2006.

[3] ANSI/IEEE C95.1-1992, American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 3kHz to 300GHz, New York: IEEE, Sept. 1992.

[4] ANSI/IEEE C95.3-2002, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave, New York: IEEE, December 2002.

[5] IEEE Standards Coordinating Committee 39 –Standards Coordinating Committee 34 – IEEE Std. 1528-2003, Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices.

[6] NCRP, National Council on Radiation Protection and Measurements, Biological Effects and Exposure Criteria for RadioFrequency Electromagnetic Fields, NCRP Report No. 86, 1986. Reprinted Feb. 1995.

[7] T. Schmid, O. Egger, N. Kuster, Automated E-field scanning system for dosimetric assessments, IEEE Transaction on Microwave Theory and Techniques, vol. 44, Jan. 1996, pp. 105-113.

[8] K. Pokovic, T. Schmid, N. Kuster, Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies, ICECOM97, Oct. 1997, pp. -124.

[9] K. Pokovic, T. Schmid, and N. Kuster, E-field Probe with improved isotropy in brain simulating liquids, Proceedings of the ELMAR, Zadar, Croatia, June 23-25, 1996, pp. 172-175.

[10] Schmid & Partner Engineering AG, Application Note: Data Storage and Evaluation, June 1998, p2.

[11] V. Hombach, K. Meier, M. Burkhardt, E. Kuhn, N. Kuster, The Dependence of EM Energy Absorption upon Human Modeling at 900 MHz, IEEE Transaction on Microwave Theory and Techniques, vol. 44 no. 10, Oct. 1996, pp. 1865-1873.

[12] N. Kuster and Q. Balzano, Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300MHz, IEEE Transaction on Vehicular Technology, vol. 41, no. 1, Feb. 1992, pp. 17-23.

[13] G. Hartsgrove, A. Kraszewski, A. Surowiec, Simulated Biological Materials for Electromagnetic Radiation Absorption Studies, University of Ottawa, Bioelectromagnetics, Canada: 1987, pp. 29-36.

[14] Q. Balzano, O. Garay, T. Manning Jr., Electromagnetic Energy Exposure of Simulated Users of Portable Cellular Telephones, IEEE Transactions on Vehicular Technology, vol. 44, no.3, Aug. 1995.

[15] W. Gander, Computermathematick, Birkhaeuser, Basel, 1992.

[16] W.H. Press, S.A. Teukolsky, W.T. Vetterling, and B.P. Flannery, Numerical Recipes in C, The Art of Scientific Computing, Second edition, Cambridge University Press, 1992.

[17] N. Kuster, R. Kastle, T. Schmid, Dosimetric evaluation of mobile communications equipment with known precision, IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp. 645-652.

[18] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), Human Exposure to Electromagnetic Fields High-frequency: 10kHz-300GHz, Jan. 1995.

© 2014 PCTEST Engineering Laboratory, Inc.

[19] Prof. Dr. Niels Kuster, ETH, Eidgenössische Technische Hoschschule Zürich, Dosimetric Evaluation of the Cellular Phone.

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

[21] Industry Canada RSS-102 Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) Issue 4, March 2010.

[22] Health Canada Safety Code 6 Limits of Human Exposure to Radio Frequency Electromagnetic Fields in the Frequency Range from 3 kHz – 300 GHz, 2009

[23] FCC SAR Test Procedures for 2G-3G Devices, Mobile Hotspot and UMPC Devices KDB Publications 941225, D01-D07

[24] SAR Measurement procedures for IEEE 802.11a/b/g KDB Publication 248227 D01v01r02

[25] FCC SAR Considerations for Handsets with Multiple Transmitters and Antennas, KDB Publications 648474 D02-D04

[26] FCC SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers, FCC KDB Publication 616217 D04

[27] FCC SAR Measurement and Reporting Requirements for 100MHz – 6 GHz, KDB Publications 865664 D01-D02

[28] FCC General RF Exposure Guidance and SAR Procedures for Dongles, KDB Publication 447498, D01-D02

[29] Anexo à Resolução No. 533, de 10 de Septembro de 2009.

[30] IEC 62209-2, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz), Mar. 2010.

© 2014 PCTEST Engineering Laboratory, Inc.

APPENDIX A: SAR TEST DATA

© 2014 PCTEST Engineering Laboratory, Inc.

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG901F; Type: Portable Handset; Serial: 7-03

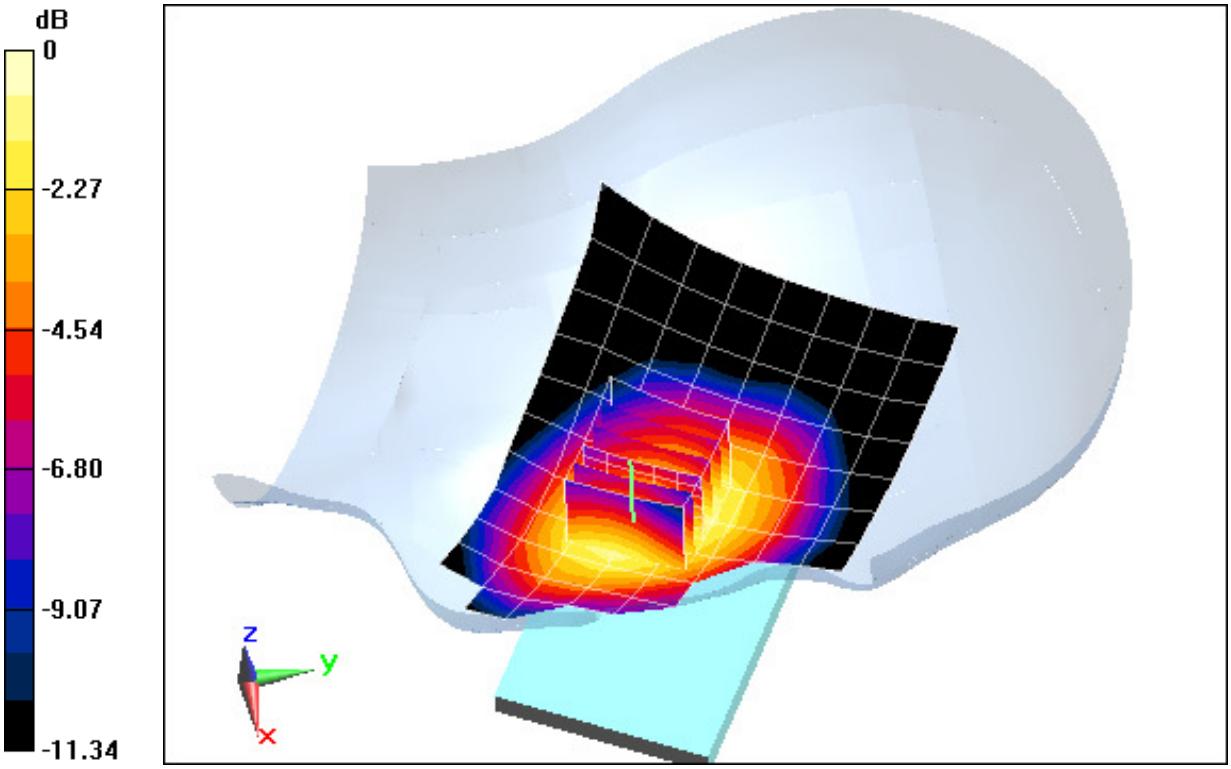
Communication System: UID 0, GSM; Frequency: 836.6 MHz;Duty Cycle: 1:8.3
Medium: 835 Head Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.928 S/m; ε_r = 43.24; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 07-09-2014; Ambient Temp: 24.4°C; Tissue Temp: 23.6°C

Probe: ES3DV3 - SN3287; ConvF(6.3, 6.3, 6.3); Calibrated: 11/20/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1408; Calibrated: 11/19/2013
Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1797
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

Mode: GSM 850, Left Head, Cheek, Mid.ch

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.020 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 0.287 W/kg
SAR(1 g) = 0.225 W/kg



0 dB = 0.245 W/kg = -6.11 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG901F; Type: Portable Handset; Serial: 7-01

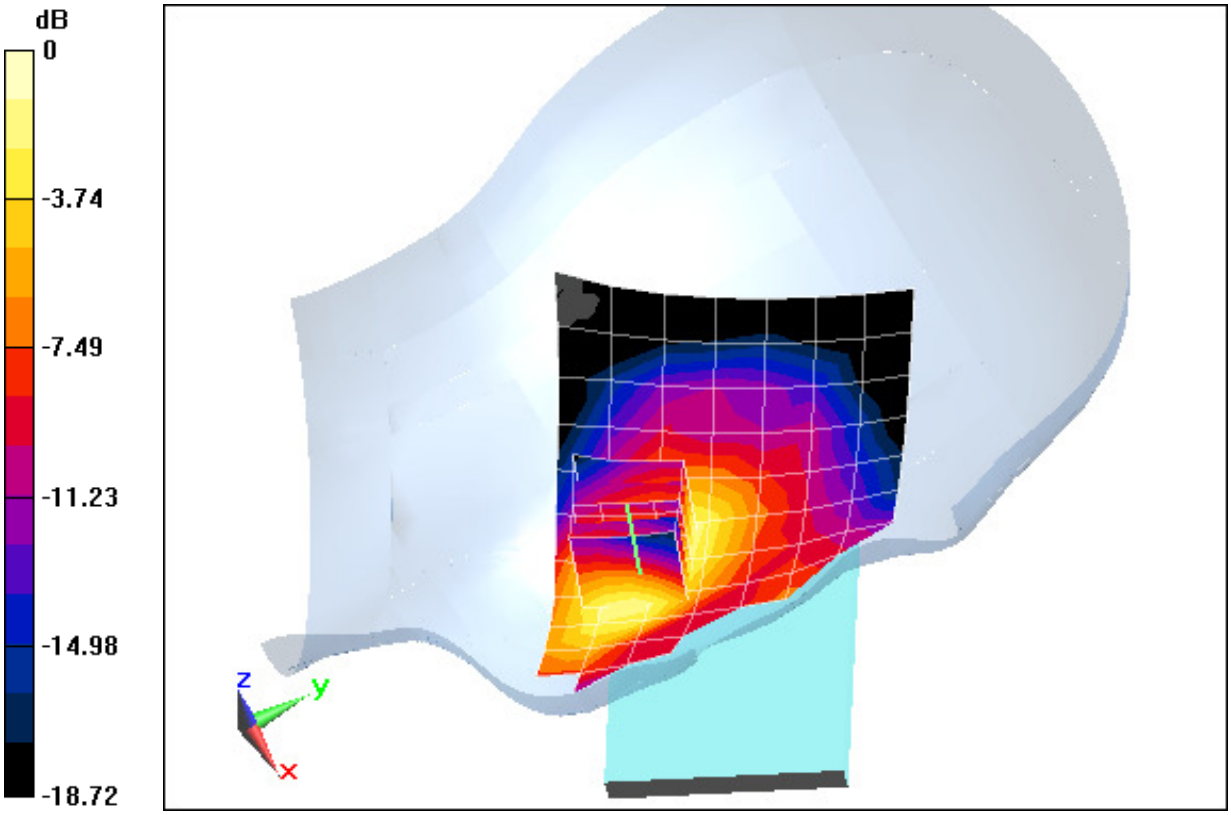
Communication System: UID 0, GSM1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium: 1900 Head Medium parameters used:
f = 1880 MHz; σ = 1.368 S/m; ε_r = 40.137; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 07-07-2014; Ambient Temp: 24.4°C; Tissue Temp: 24.2°C

Probe: ES3DV2 - SN3022; ConvF(5.03, 5.03, 5.03); Calibrated: 8/22/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/21/2013
Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

Mode: GSM 1900, Left Head, Cheek, Mid.ch

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.367 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.254 W/kg
SAR(1 g) = 0.169 W/kg



0 dB = 0.195 W/kg = -7.10 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG901F; Type: Portable Handset; Serial: 7-03

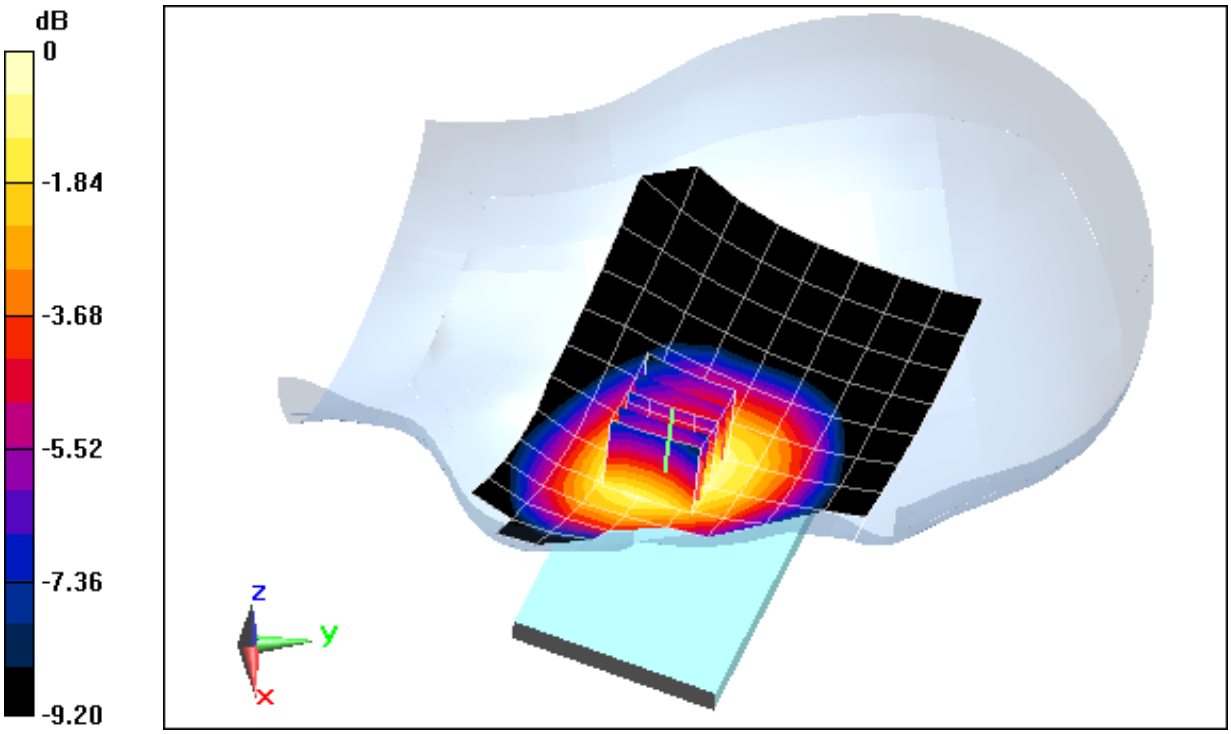
Communication System: UID 0, UMTS; Frequency: 836.6 MHz;Duty Cycle: 1:1
Medium: 835 Head Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.928 S/m; ε_r = 43.24; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 07-09-2014; Ambient Temp: 24.4°C; Tissue Temp: 23.6°C

Probe: ES3DV3 - SN3287; ConvF(6.3, 6.3, 6.3); Calibrated: 11/20/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1408; Calibrated: 11/19/2013
Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1797
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

Mode: UMTS 850, Left Head, Cheek, Mid.ch

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.554 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 0.558 W/kg
SAR(1 g) = 0.442 W/kg



0 dB = 0.486 W/kg = -3.13 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG901F; Type: Portable Handset; Serial: 7-01

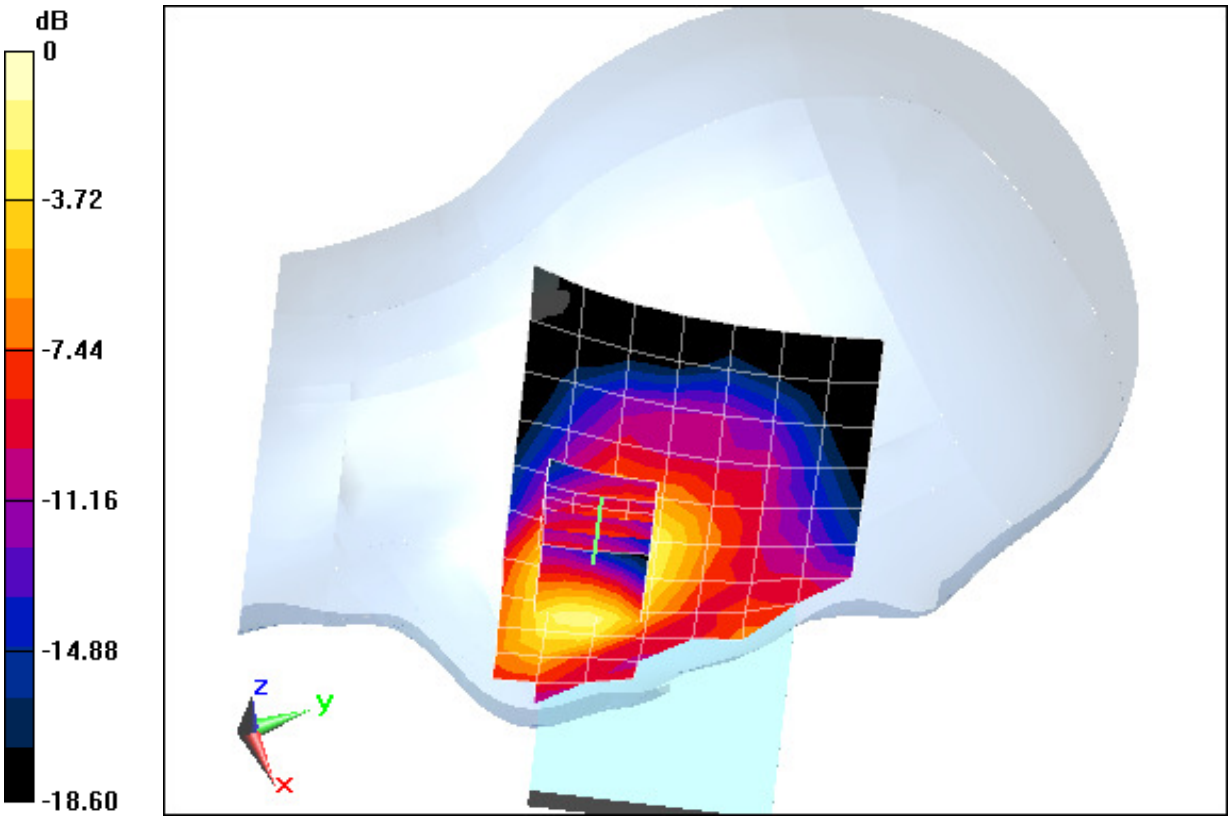
Communication System: UID 0, UMTS; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: 1900 Head Medium parameters used:
f = 1880 MHz; σ = 1.368 S/m; ε_r = 40.137; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 07-07-2014; Ambient Temp: 24.4°C; Tissue Temp: 24.2°C

Probe: ES3DV2 - SN3022; ConvF(5.03, 5.03, 5.03); Calibrated: 8/22/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/21/2013
Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

Mode:UMTS 1900, Left Head, Cheek, Mid.ch

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.015 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.368 W/kg
SAR(1 g) = 0.246 W/kg



0 dB = 0.283 W/kg = -5.48 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG901F; Type: Portable Handset; Serial: 22-08

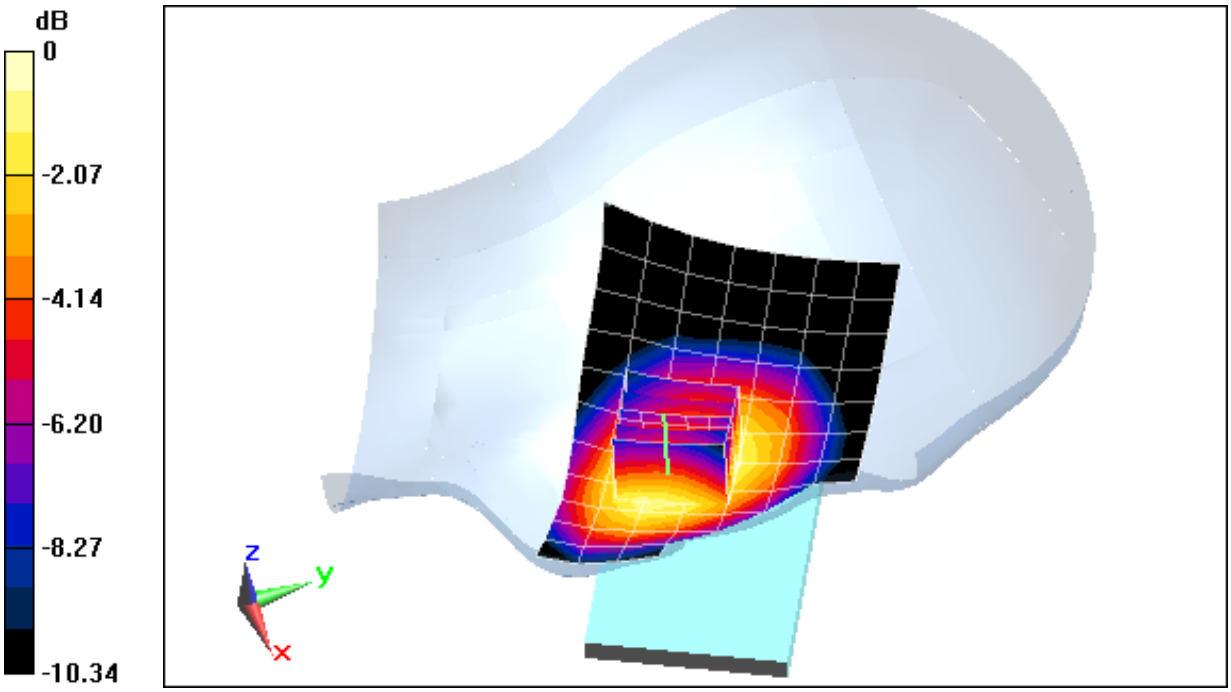
Communication System: UID 0, LTE Band 5 (Cell.); Frequency: 836.5 MHz;Duty Cycle: 1:1
Medium: 835 Head Medium parameters used (interpolated):
f = 836.5 MHz; σ = 0.935 S/m; ε_r = 42.617; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 07-23-2014; Ambient Temp: 23.3°C; Tissue Temp: 22.9°C

Probe: ES3DV3 - SN3319; ConvF(6.27, 6.27, 6.27); Calibrated: 4/17/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1368; Calibrated: 4/11/2014
Phantom: SAM; Type: QD000P40CD; Serial: TP:1758
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

Mode: LTE Band 5 (Cell), Left Head, Cheek, Mid.ch,
QPSK, 10 MHz Bandwidth, 1 RB, 49 RB Offset

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.832 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.714 W/kg
SAR(1 g) = 0.553 W/kg



0 dB = 0.613 W/kg = -2.13 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG901F; Type: Portable Handset; Serial: 28-01

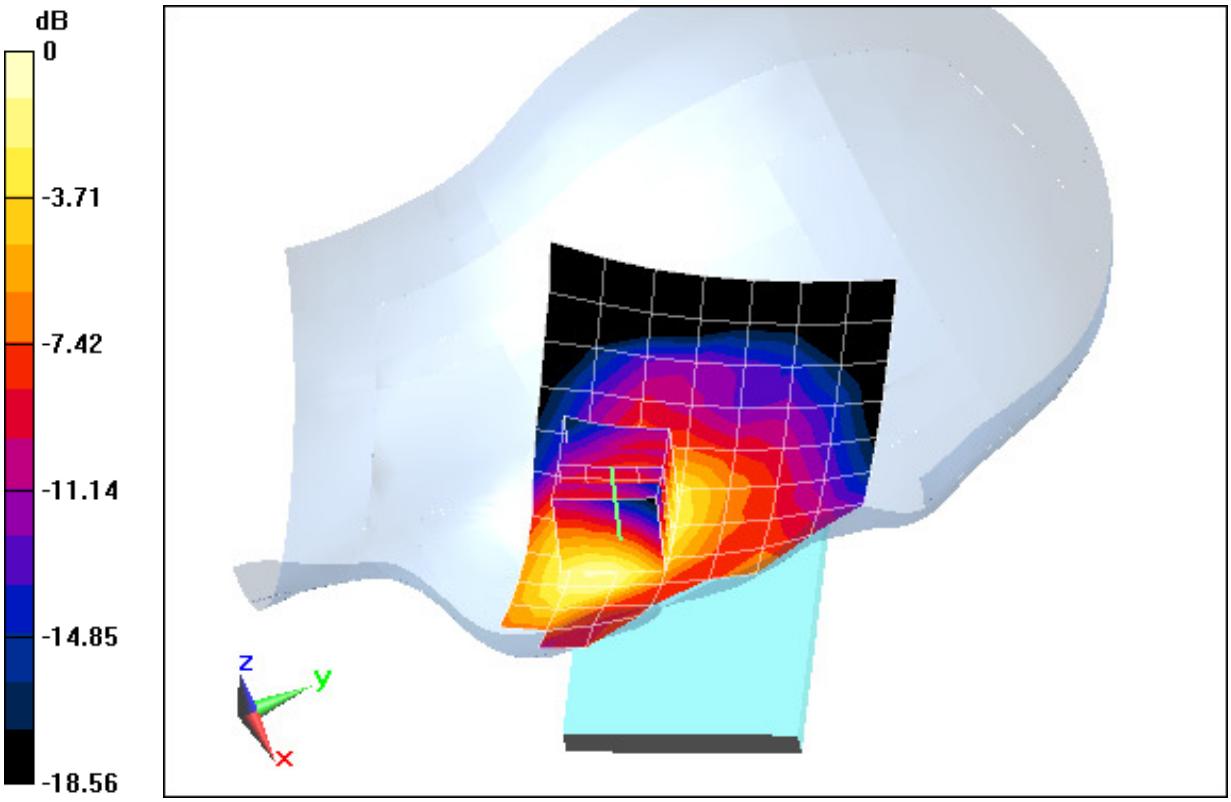
Communication System: UID 0, LTE Band 2 (PCS); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: 1900 Head Medium parameters used:
f = 1880 MHz; σ = 1.382 S/m; ε_r = 39.348; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 08-04-2014; Ambient Temp: 24.0°C; Tissue Temp: 22.9°C

Probe: ES3DV3 - SN3287; ConvF(5.08, 5.08, 5.08); Calibrated: 11/20/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1408; Calibrated: 11/19/2013
Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1797
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

Mode: LTE Band 2 (PCS), Left Head, Cheek, Mid.ch,
QPSK, 20 MHz Bandwidth, 1 RB, 0 RB Offset

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.136 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.431 W/kg
SAR(1 g) = 0.294 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG901F; Type: Portable Handset; Serial: 7-02

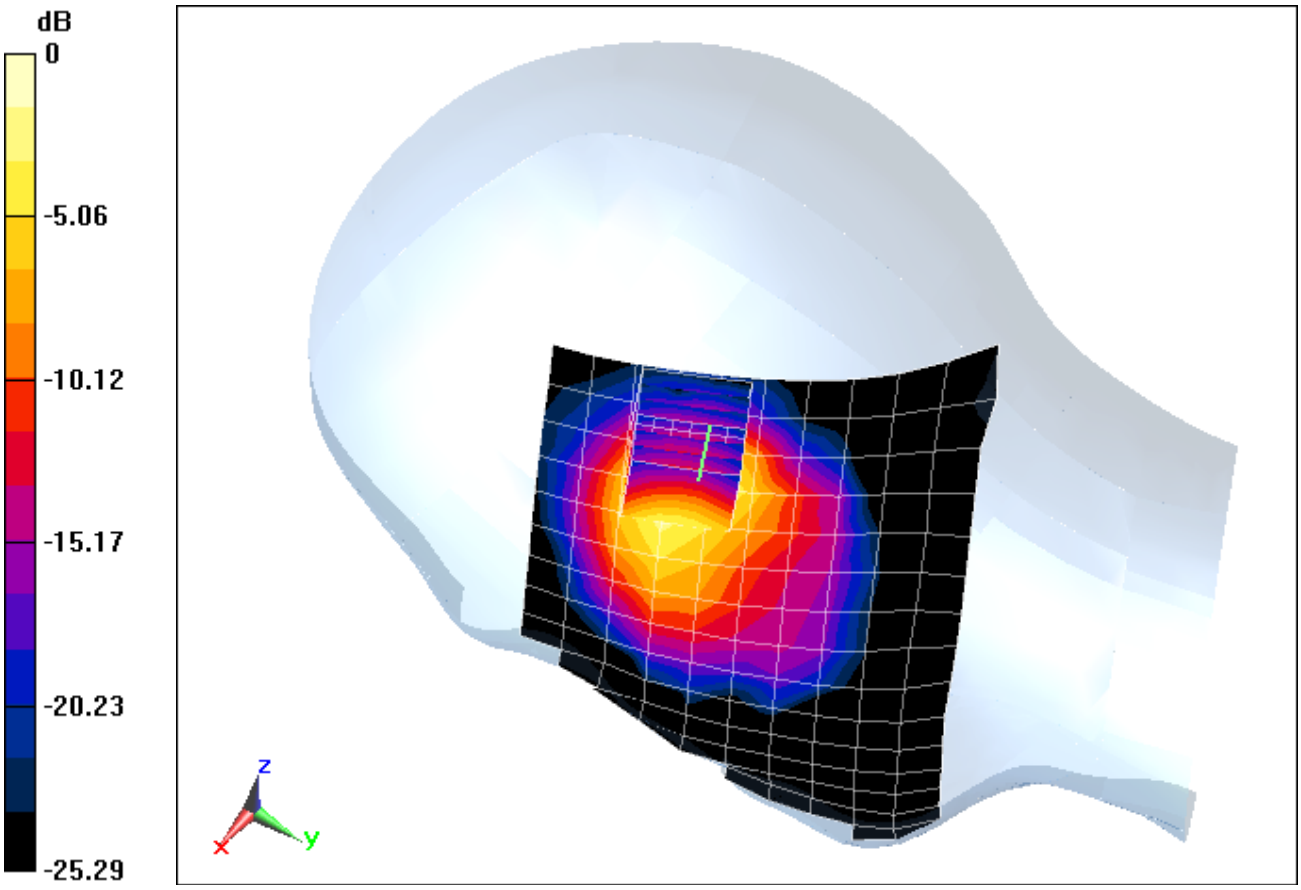
Communication System: UID 0, IEEE 802.11b; Frequency: 2412 MHz;Duty Cycle: 1:1
Medium: 2450 Head Medium parameters used (interpolated):
f = 2412 MHz; σ = 1.701 S/m; ε_r = 38.695; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 07-15-2014; Ambient Temp: 22.7°C; Tissue Temp: 22.5°C

Probe: ES3DV3 - SN3319; ConvF(4.45, 4.45, 4.45); Calibrated: 4/17/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1368; Calibrated: 4/11/2014
Phantom: SAM; Type: QD000P40CD; Serial: TP:1758
Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7164)

Mode: IEEE 802.11b, Right Head, Cheek, Ch 01, 1 Mbps; Ant 1

Area Scan (11x18x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 17.85 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 1.39 W/kg
SAR(1 g) = 0.616 W/kg



0 dB = 0.833 W/kg = -0.79 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG901F; Type: Portable Handset; Serial: 7-02

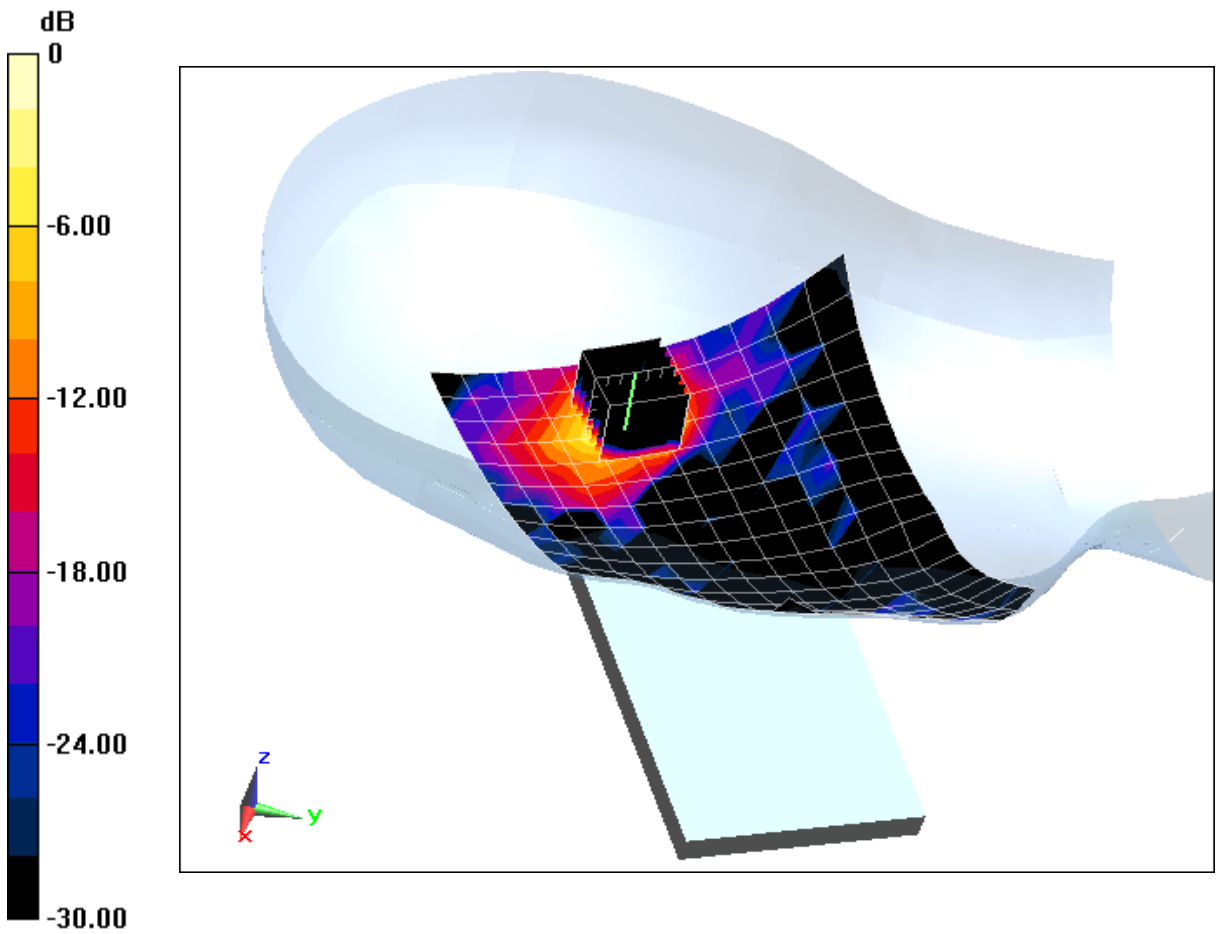
Communication System: UID 0, IEEE 802.11a; Frequency: 5745 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head Medium parameters used:
f = 5745 MHz; σ = 5.218 S/m; ε_r = 36.192; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 07-14-2014; Ambient Temp: 24.5°C; Tissue Temp: 24.4°C

Probe: EX3DV4 - SN3914; ConvF(4.52, 4.52, 4.52); Calibrated: 10/23/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7164)

Mode: IEEE 802.11a, 5.8 GHz, Right Head, Tilt, Ch 149, 6 Mbps; Ant 1

Area Scan (13x22x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Reference Value = 9.929 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 2.28 W/kg
SAR(1 g) = 0.485 W/kg



0 dB = 1.26 W/kg = 1.00 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG901F; Type: Portable Handset; Serial: 7-02

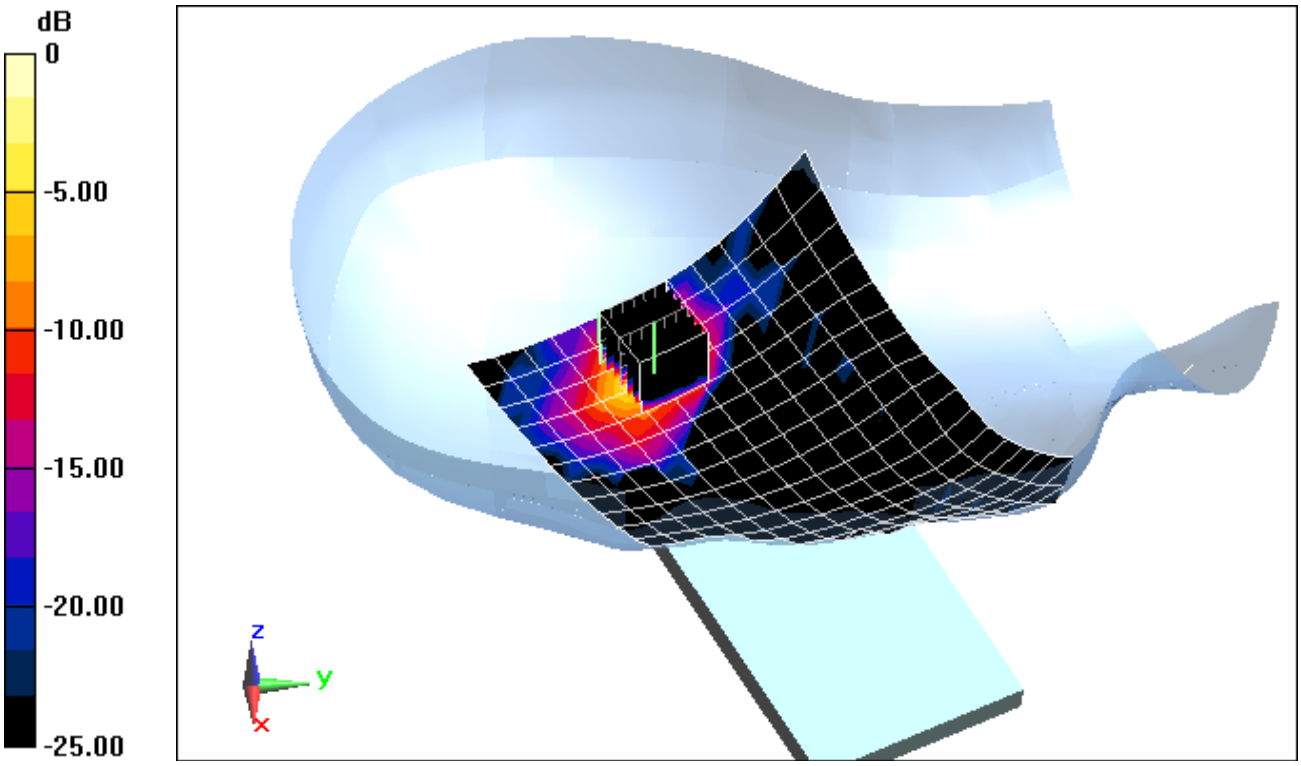
Communication System: UID 0, IEEE 802.11a; Frequency: 5700 MHz ;Duty Cycle: 1:1
Medium: 5 GHz Head Medium parameters used:
f = 5700 MHz; σ = 5.16 S/m; ε_r = 36.229; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 07-14-2014; Ambient Temp: 24.5°C; Tissue Temp: 23.4°C

Probe: EX3DV4 - SN3914; ConvF(4.37, 4.37, 4.37); Calibrated: 10/23/2013
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7164)

Mode: IEEE 802.11a, 5.5 GHz, Right Head, Tilt, Ch 140, 6 Mbps; Ant 1

Area Scan (13x22x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan(7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm;Graded Ratio:1.4
Reference Value = 10.48 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 2.42 W/kg
SAR(1 g) = 0.542 W/kg



0 dB = 1.41 W/kg = 1.49 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG901F; Type: Portable Handset; Serial: 7-01

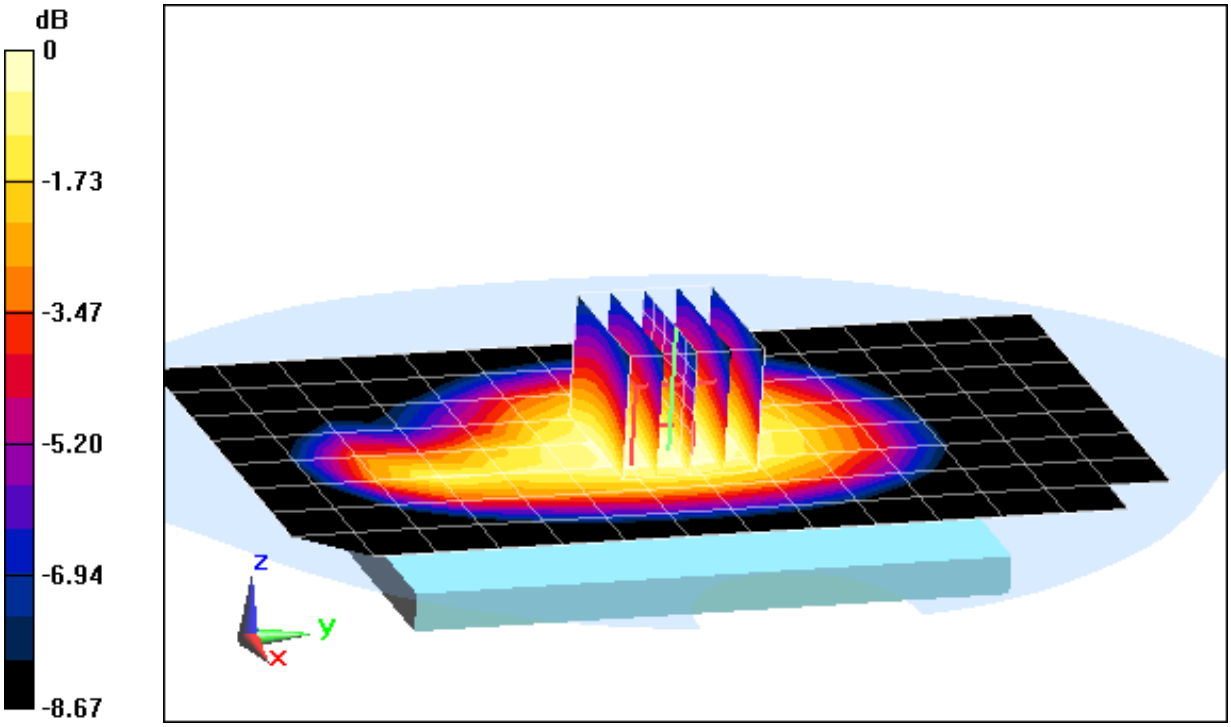
Communication System: UID 0, GSM; Frequency: 836.6 MHz;Duty Cycle: 1:8.3
Medium: 835 Body Medium parameters used (interpolated):
f = 836.6 MHz; σ = 1.012 S/m; ε_r = 54.263; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-08-2014; Ambient Temp: 24.5°C; Tissue Temp: 24.0°C

Probe: ES3DV2 - SN3022; ConvF(5.91, 5.91, 5.91); Calibrated: 8/22/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/21/2013
Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

Mode: GSM 850, Body SAR, Back side, Mid.ch

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.665 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.371 W/kg
SAR(1 g) = 0.295 W/kg



0 dB = 0.324 W/kg = -4.89 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG901F; Type: Portable Handset; Serial: 7-01

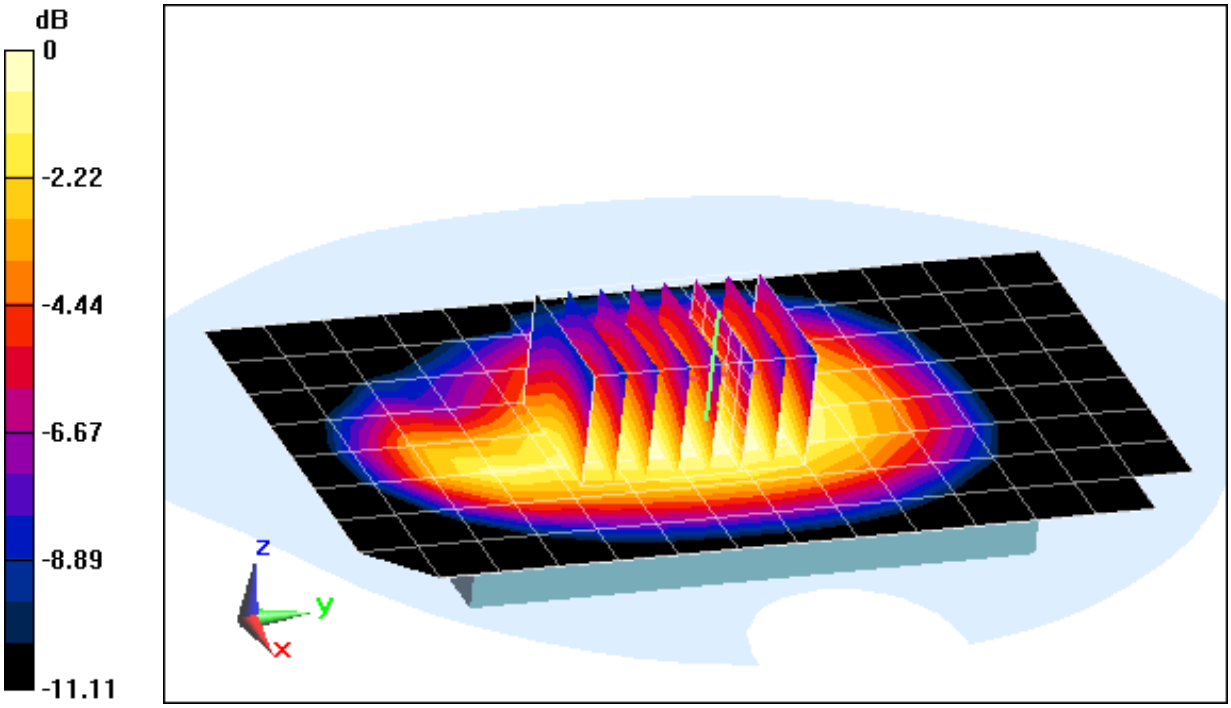
Communication System: UID 0, GSM GPRS; 2 Tx slots; Frequency: 836.6 MHz;Duty Cycle: 1:4.15
Medium: 835 Body Medium parameters used (interpolated):
f = 836.6 MHz; σ = 1.012 S/m; ε_r = 54.263; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-08-2014; Ambient Temp: 24.5°C; Tissue Temp: 24.0°C

Probe: ES3DV2 - SN3022; ConvF(5.91, 5.91, 5.91); Calibrated: 8/22/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/21/2013
Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

Mode: GPRS 850, Body SAR, Back side, Mid.ch, 2 Tx Slots

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x8x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.430 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.408 W/kg
SAR(1 g) = 0.321 W/kg



0 dB = 0.353 W/kg = -4.52 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG901F; Type: Portable Handset; Serial: 7-03

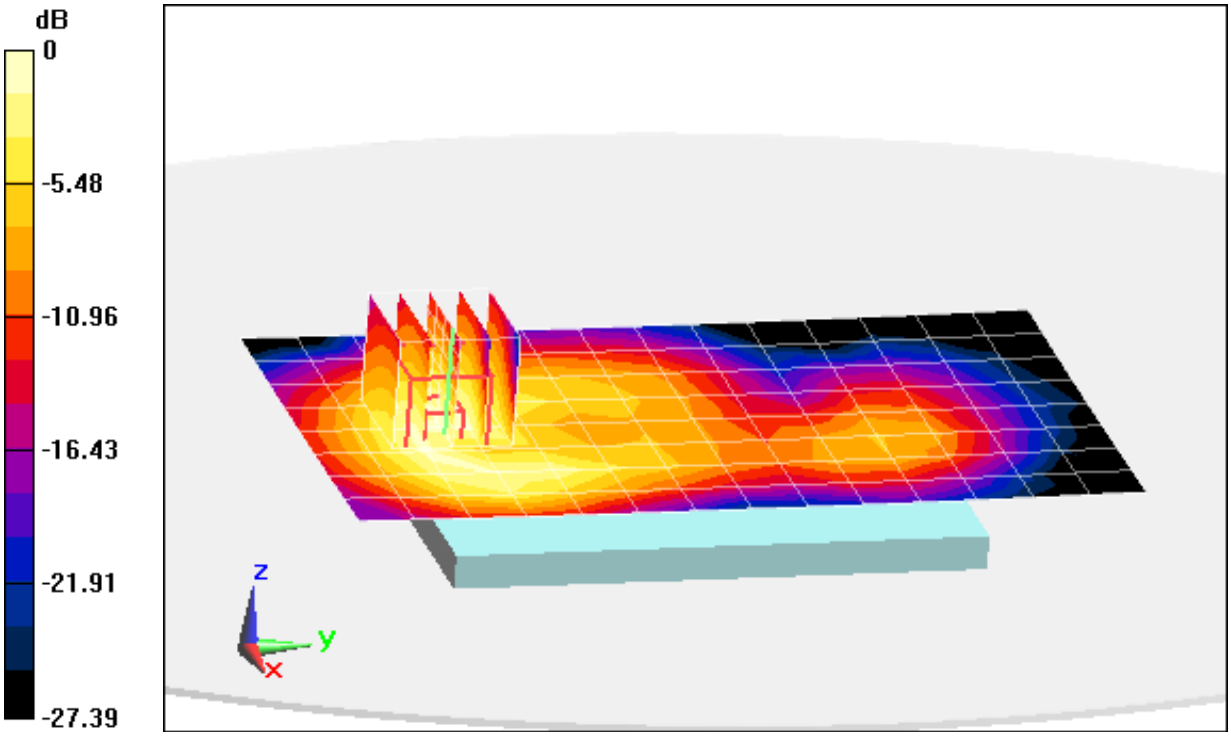
Communication System: UID 0, GSM; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium: 1900 Body Medium parameters used:
f = 1880 MHz; σ = 1.555 S/m; ε_r = 51.32; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-08-2014; Ambient Temp: 23.6°C; Tissue Temp: 23.6°C

Probe: ES3DV3 - SN3332; ConvF(4.7, 4.7, 4.7); Calibrated: 11/25/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 11/18/2013
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1226
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

Mode: GSM 1900, Body SAR, Back side, Mid.ch

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.731 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.525 W/kg
SAR(1 g) = 0.317 W/kg



0 dB = 0.376 W/kg = -4.25 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG901F; Type: Portable Handset; Serial: 7-03

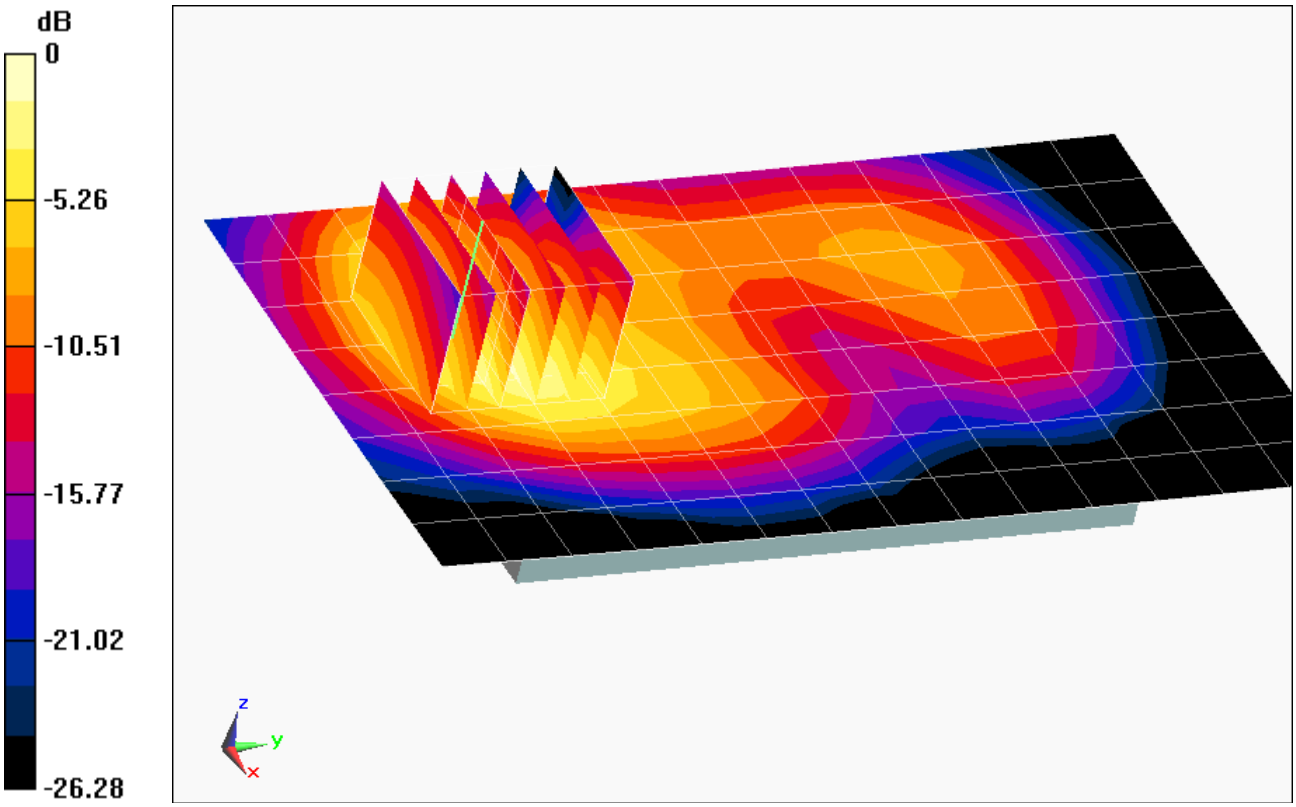
Communication System: UID 0, GSM GPRS; 2 Tx slots; Frequency: 1909.8 MHz;Duty Cycle: 1:4.15
Medium: 1900 Body Medium parameters used (interpolated):
f = 1910 MHz; σ = 1.592 S/m; ε_r = 51.205; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-08-2014; Ambient Temp: 23.6°C; Tissue Temp: 23.6°C

Probe: ES3DV3 - SN3332; ConvF(4.7, 4.7, 4.7); Calibrated: 11/25/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 11/18/2013
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1226
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

Mode: GPRS 1900, Body SAR, Front side, High ch, 2 Tx Slots

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.21 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 1.01 W/kg
SAR(1 g) = 0.599 W/kg



0 dB = 0.713 W/kg = -1.47 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG901F; Type: Portable Handset; Serial: 7-01

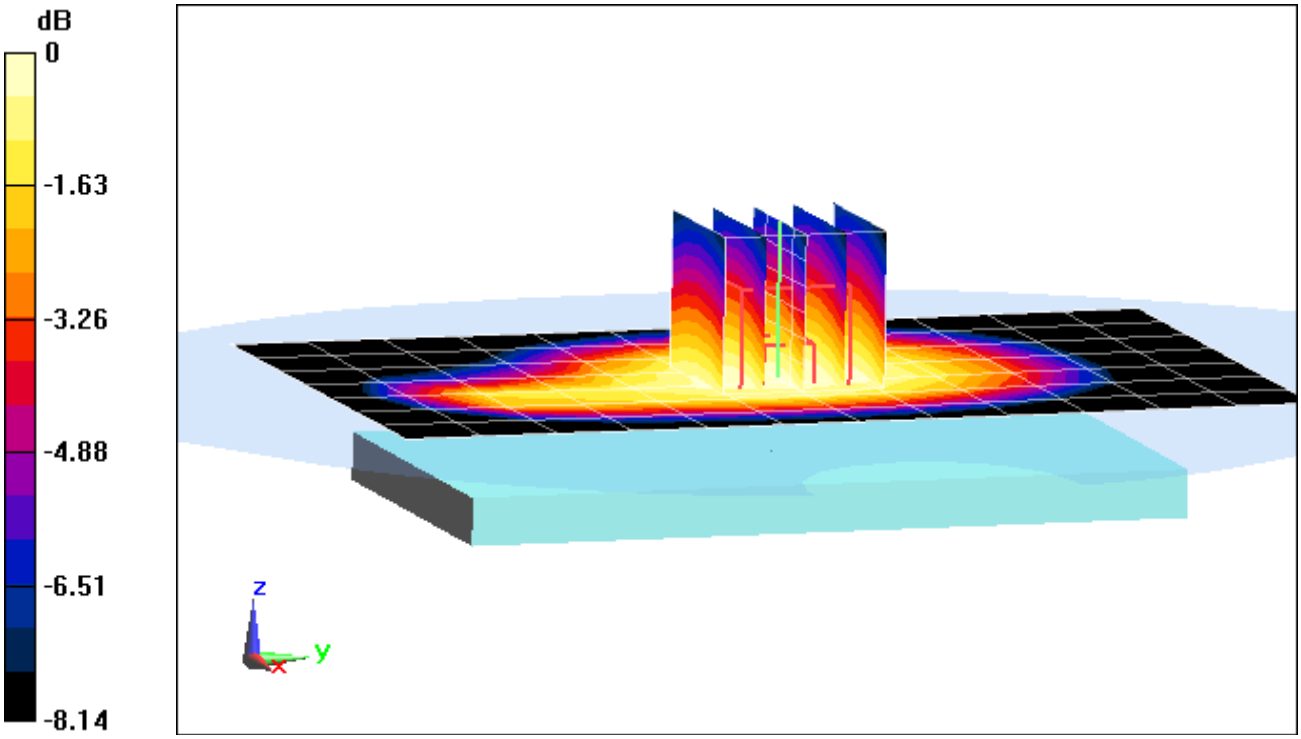
Communication System: UID 0, UMTS; Frequency: 836.6 MHz;Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 836.6 MHz; σ = 1.012 S/m; ε_r = 54.263; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 07-08-2014; Ambient Temp: 24.5°C; Tissue Temp: 24.0°C

Probe: ES3DV2 - SN3022; ConvF(5.91, 5.91, 5.91); Calibrated: 8/22/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/21/2013
Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646
Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7164)

Mode: UMTS 850, Body SAR, Back side, Mid.ch

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.38 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.765 W/kg
SAR(1 g) = 0.610 W/kg



0 dB = 0.670 W/kg = -1.74 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG901F; Type: Portable Handset; Serial: 7-03

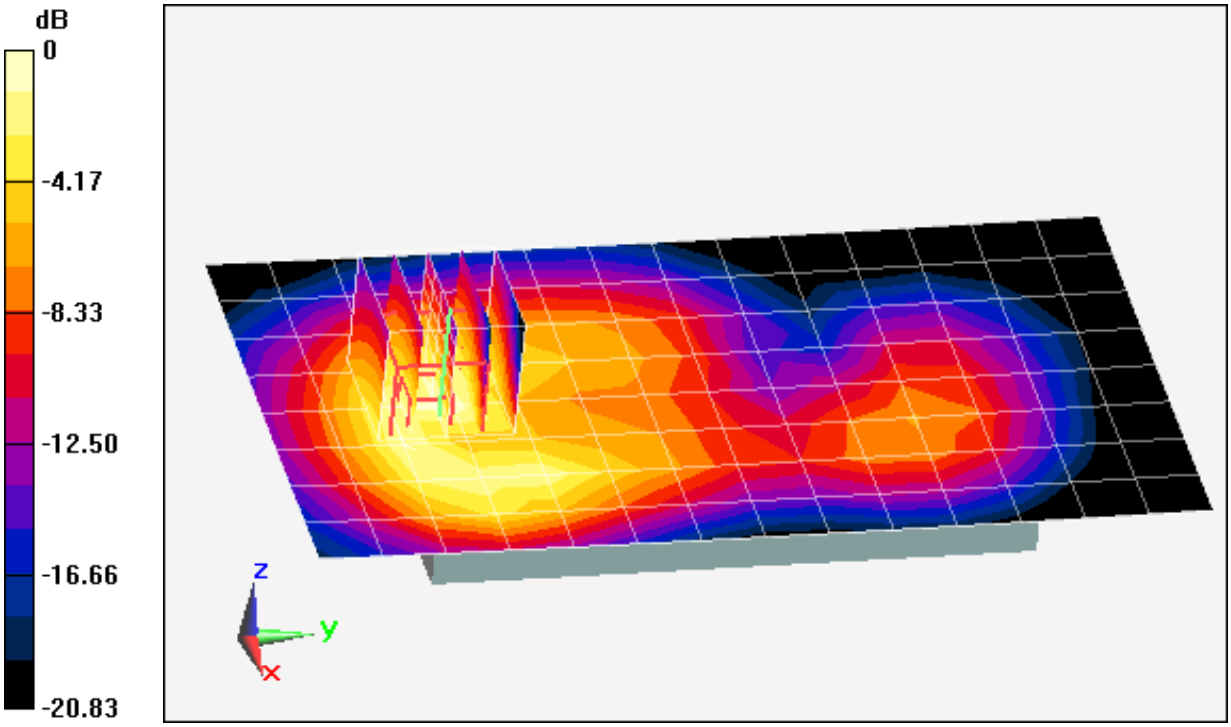
Communication System: UID 0, UMTS; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used:
f = 1880 MHz; σ = 1.555 S/m; ε_r = 51.32; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-08-2014; Ambient Temp: 23.6°C; Tissue Temp: 23.6°C

Probe: ES3DV3 - SN3332; ConvF(4.7, 4.7, 4.7); Calibrated: 11/25/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 11/18/2013
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1226
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

Mode: UMTS 1900, Body SAR, Back side, Mid.ch

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.969 V/m; Power Drift = -0.20 dB
Peak SAR (extrapolated) = 0.940 W/kg
SAR(1 g) = 0.568 W/kg



0 dB = 0.660 W/kg = -1.80 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG901F; Type: Portable Handset; Serial: 7-03

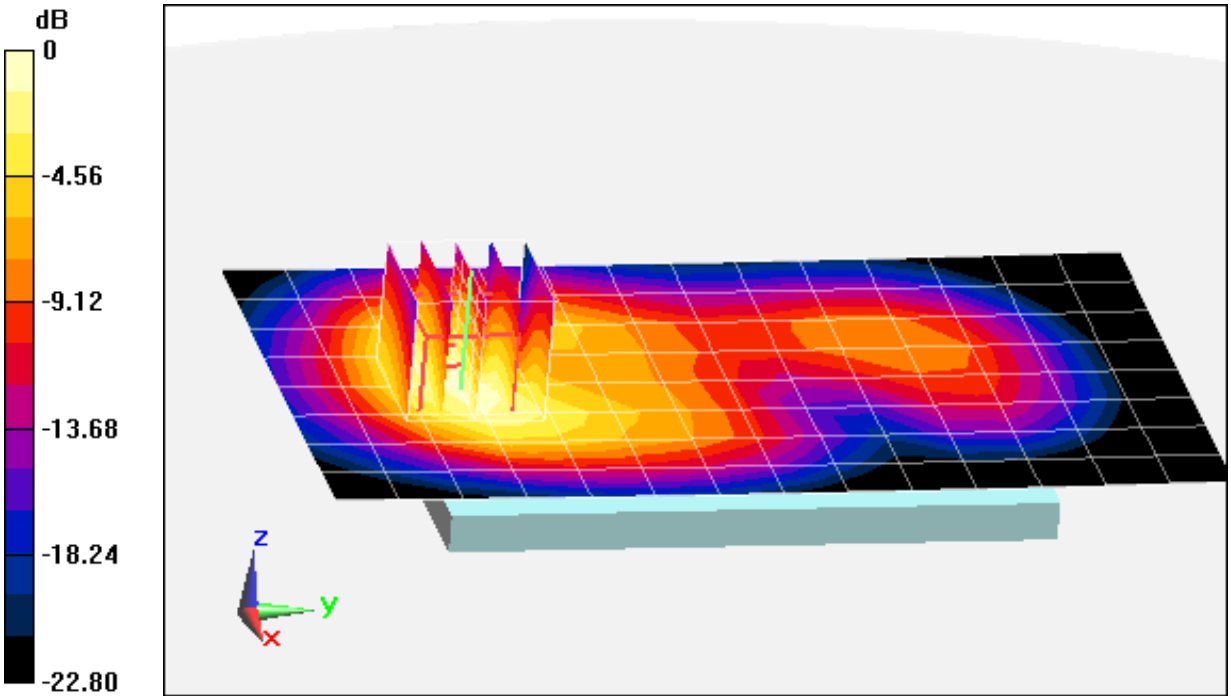
Communication System: UID 0, UMTS; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used:
f = 1880 MHz; σ = 1.555 S/m; ε_r = 51.32; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-08-2014; Ambient Temp: 23.6°C; Tissue Temp: 23.6°C

Probe: ES3DV3 - SN3332; ConvF(4.7, 4.7, 4.7); Calibrated: 11/25/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 11/18/2013
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1226
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

Mode: UMTS 1900, Body SAR, Front side, Mid.ch

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.364 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 1.45 W/kg
SAR(1 g) = 0.877 W/kg



0 dB = 1.04 W/kg = 0.17 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG901F; Type: Portable Handset; Serial: 22-08

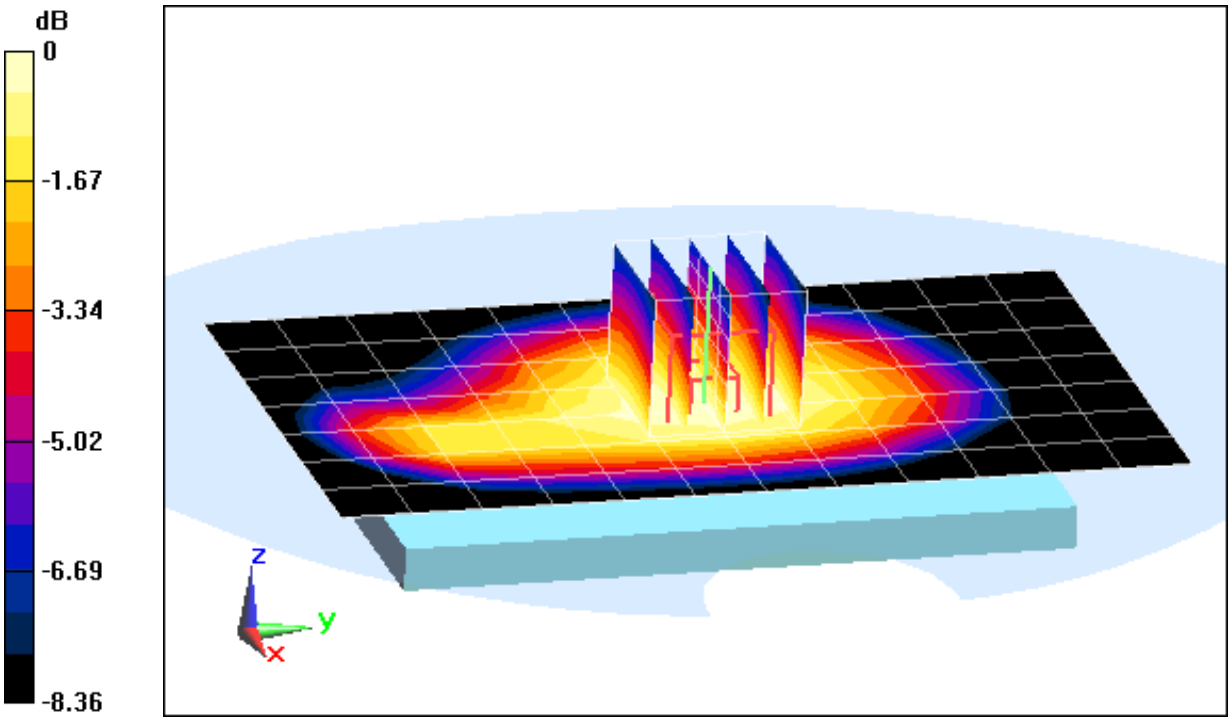
Communication System: UID 0, LTE Band 5; Frequency: 836.5 MHz;Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 836.5 MHz; σ = 1.008 S/m; ε_r = 53.18; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-21-2014; Ambient Temp: 24.5°C; Tissue Temp: 23.2°C

Probe: ES3DV2 - SN3022; ConvF(5.91, 5.91, 5.91); Calibrated: 8/22/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/21/2013
Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

Mode:LTE Band 5 (Cell.), Body SAR, Back side, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 49 RB Offset

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 26.519 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.827 W/kg
SAR(1 g) = 0.658 W/kg



0 dB = 0.723 W/kg = -1.41 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG901F; Type: Portable Handset; Serial: 28-01

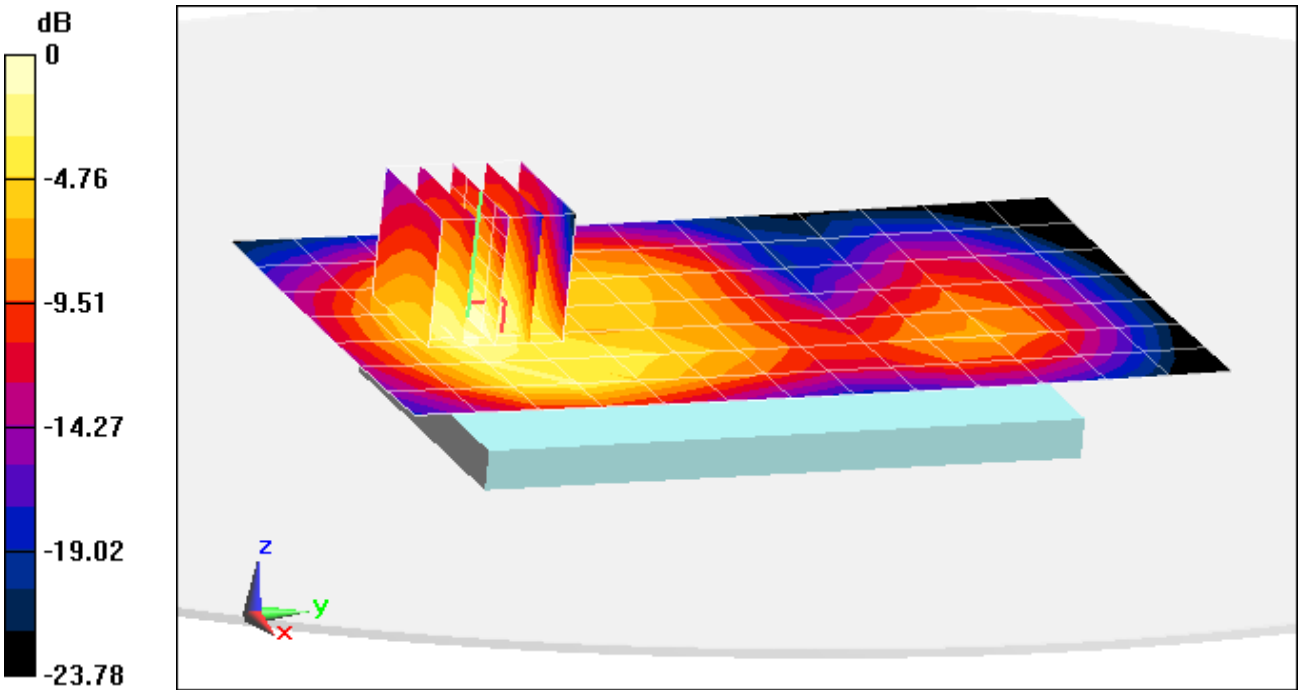
Communication System: UID 0, LTE Band 2; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used:
f = 1880 MHz; σ = 1.501 S/m; ε_r = 53.483; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 07-31-2014; Ambient Temp: 24.5°C; Tissue Temp: 23.2°C

Probe: ES3DV3 - SN3287; ConvF(4.67, 4.67, 4.67); Calibrated: 11/20/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1408; Calibrated: 11/19/2013
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1229
Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7164)

Mode: LTE Band 2 (PCS), Body SAR, Back Side, Mid.ch,
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (8x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.41 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 1.08 W/kg
SAR(1 g) = 0.660 W/kg



0 dB = 0.783 W/kg = -1.06 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG901F; Type: Portable Handset; Serial: 28-01

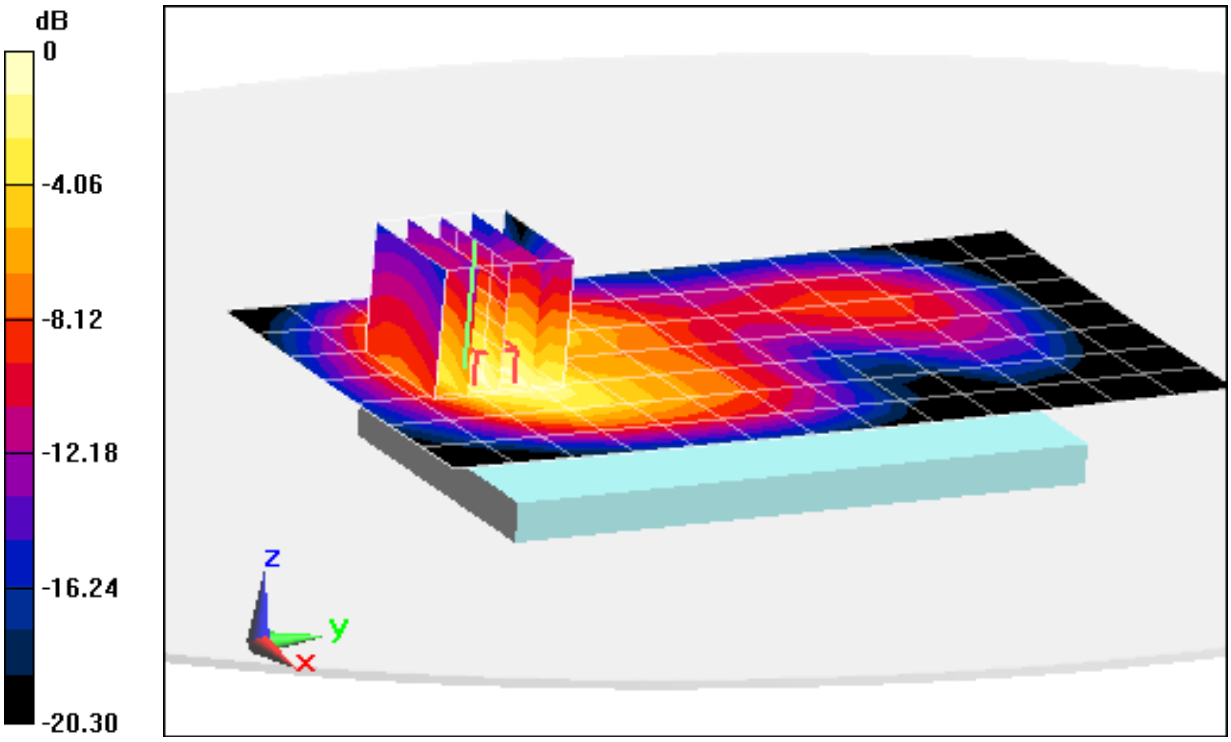
Communication System: UID 0, LTE Band 2; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used:
f = 1880 MHz; σ = 1.501 S/m; ε_r = 53.483; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-31-2014; Ambient Temp: 24.5°C; Tissue Temp: 23.2°C

Probe: ES3DV3 - SN3287; ConvF(4.67, 4.67, 4.67); Calibrated: 11/20/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1408; Calibrated: 11/19/2013
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1229
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

Mode: LTE Band 2 (PCS), Body SAR, Front Side, Mid.ch,
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (8x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 28.505 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 1.80 W/kg
SAR(1 g) = 1.07 W/kg



0 dB = 1.29 W/kg = 1.11 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG901F; Type: Portable Handset; Serial: 7-02

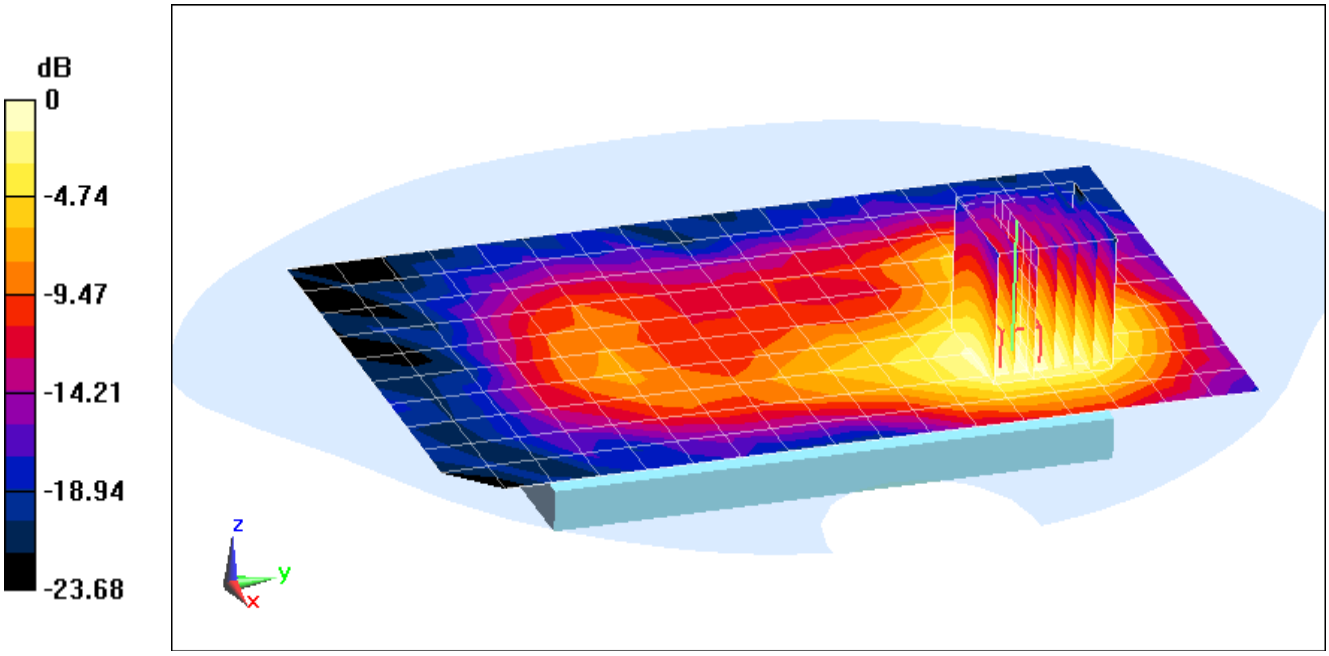
Communication System: UID 0, IEEE 802.11b; Frequency: 2412 MHz;Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used (interpolated):
f = 2412 MHz; σ = 1.899 S/m; ε_r = 51.022; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-08-2014; Ambient Temp: 24.2°C; Tissue Temp: 23.0°C

Probe: EX3DV4 - SN3914; ConvF(7.02, 7.02, 7.02); Calibrated: 10/23/2013;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

Mode: IEEE 802.11b, Body SAR, Ch 01, 1 Mbps, Back Side; Ant 1

Area Scan (11x18x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.86 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.370 W/kg
SAR(1 g) = 0.212 W/kg



0 dB = 0.289 W/kg = -5.39 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG901F; Type: Portable Handset; Serial: 7-02

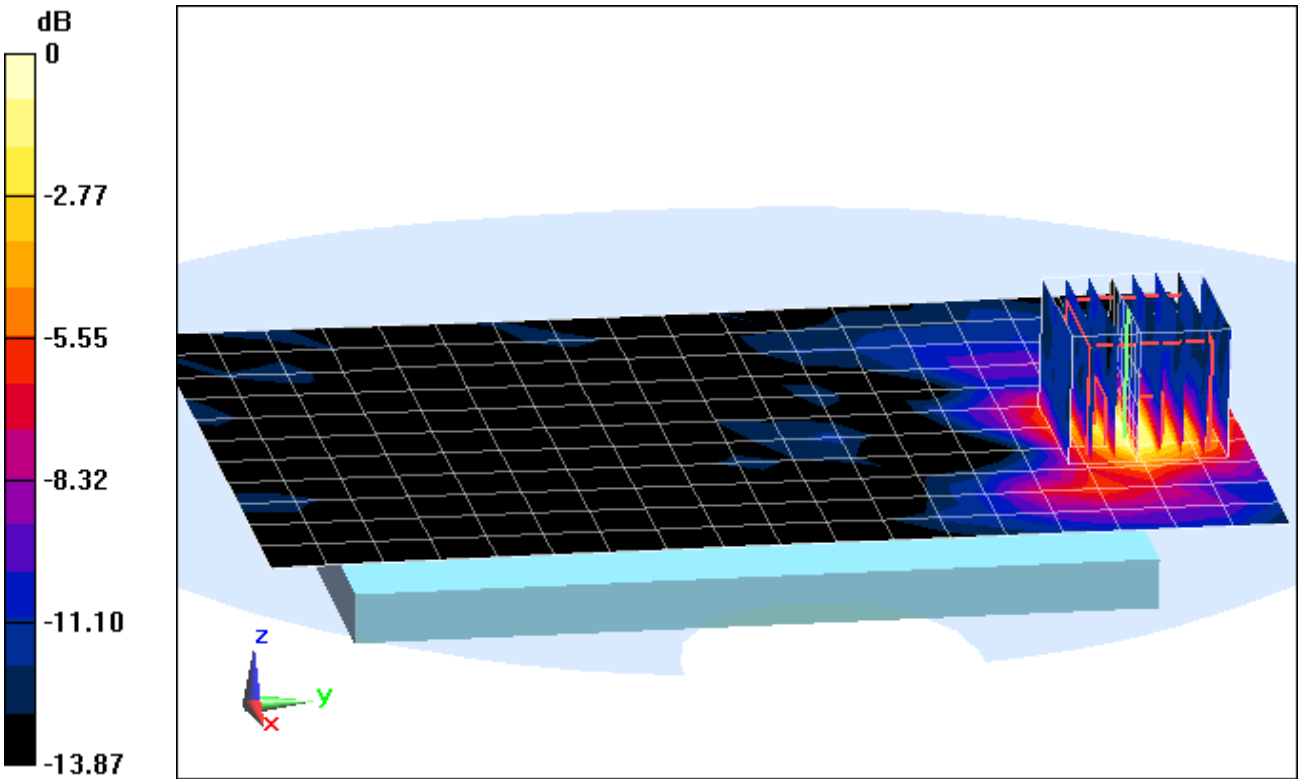
Communication System: UID 0, IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5785 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5785 MHz; σ = 6.167 S/m; ε_r = 46.343; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-08-2014; Ambient Temp: 23.9°C; Tissue Temp: 21.8°C

Probe: EX3DV4 - SN3920; ConvF(4, 4, 4); Calibrated: 12/18/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 12/12/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

Mode: IEEE 802.11a, 5.8 GHz, Body SAR, Ch 157; 6 Mbps, Back Side, Ant 1

Area Scan (12x19x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Reference Value = 5.093 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.659 W/kg
SAR(1 g) = 0.148 W/kg



0 dB = 0.329 W/kg = -4.83 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG901F; Type: Portable Handset; Serial: 7-02

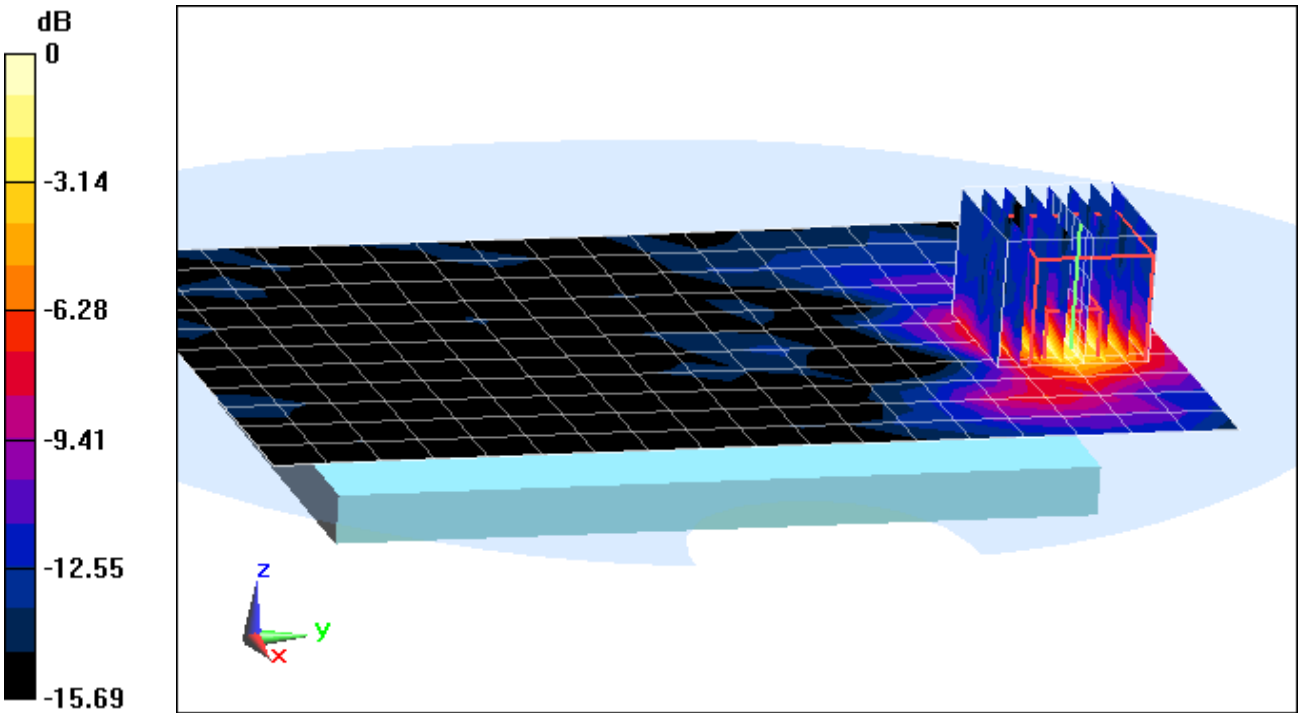
Communication System: UID 0, IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5700 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5700 MHz; σ = 6.073 S/m; ε_r = 46.554; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-08-2014; Ambient Temp: 23.9°C; Tissue Temp: 21.8°C

Probe: EX3DV4 - SN3920; ConvF(3.62, 3.62, 3.62); Calibrated: 12/18/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 12/12/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

Mode: IEEE 802.11a, 5.5 GHz, Body SAR, Ch 140; 6 Mbps, Back Side, Ant 1

Area Scan (12x19x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan(8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio:1.4
Reference Value = 6.295 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.822 W/kg
SAR(1 g) = 0.212 W/kg



0 dB = 0.467 W/kg = -3.31 dBW/kg

APPENDIX B: SYSTEM VERIFICATION

© 2014 PCTEST Engineering Laboratory, Inc.

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d119

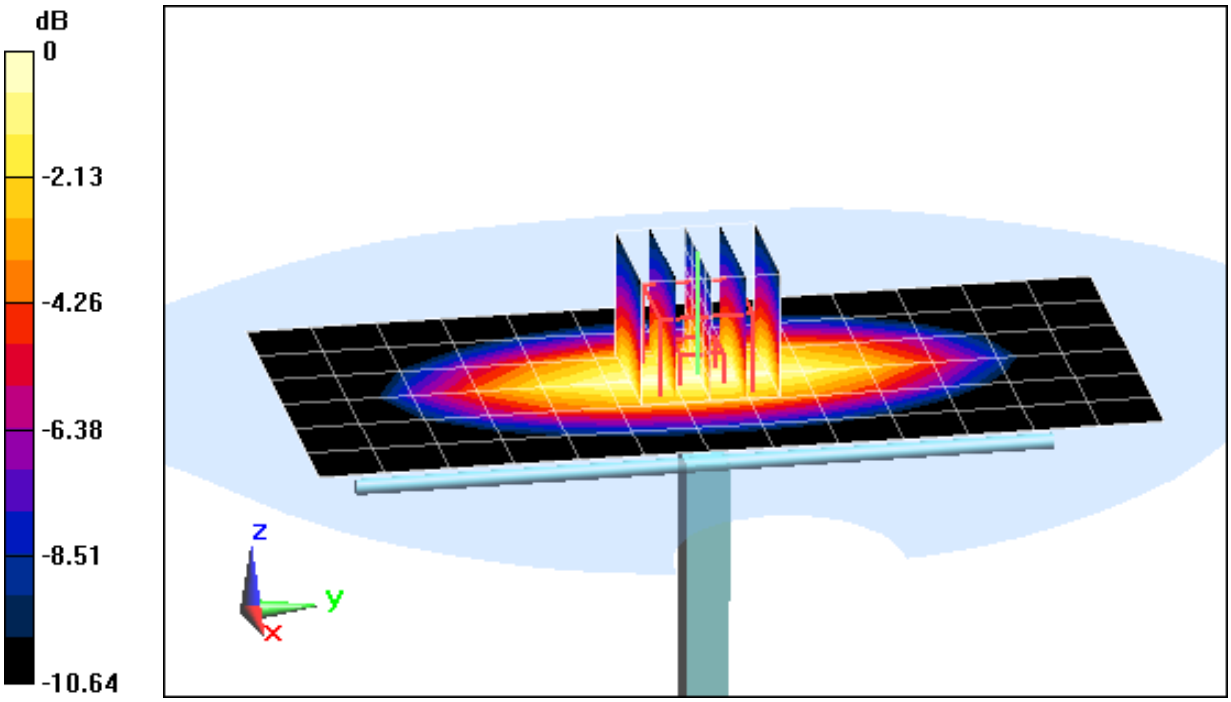
Communication System: UID 0, CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: 835 Head Medium parameters used:
f = 835 MHz; σ = 0.926 S/m; ε_r = 43.263; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space : 1.5 cm

Test Date: 07-09-2014; Ambient Temp: 24.4°C; Tissue Temp: 23.6°C

Probe: ES3DV3 - SN3287; ConvF(6.3, 6.3, 6.3); Calibrated: 11/20/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1408; Calibrated: 11/19/2013
Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1797
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

835 MHz System Verification

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 1.34 W/kg
SAR(1 g) = 0.897 W/kg
Deviation: -2.71%



0 dB = 1.05 W/kg = 0.21 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d119

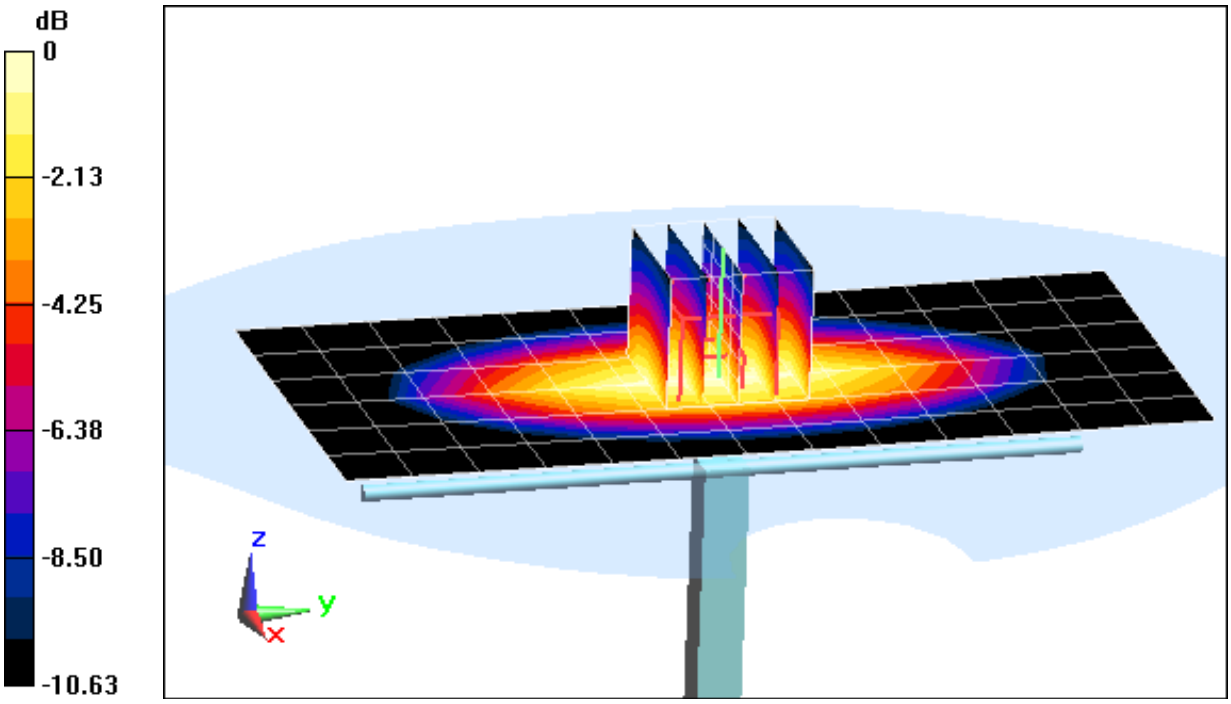
Communication System: UID 0, CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: 835 Head Medium parameters used:
f = 835 MHz; σ = 0.934 S/m; ε_r = 42.634; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-23-2014; Ambient Temp: 23.3°C; Tissue Temp: 22.9°C

Probe: ES3DV3 - SN3319; ConvF(6.27, 6.27, 6.27); Calibrated: 4/17/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1368; Calibrated: 4/11/2014
Phantom: SAM; Type: QD000P40CD; Serial: TP:1758
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

835 MHz System Verification

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 1.39 W/kg
SAR(1 g) = 0.931 W/kg
Deviation: 0.98%



0 dB = 1.09 W/kg = 0.37 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d149

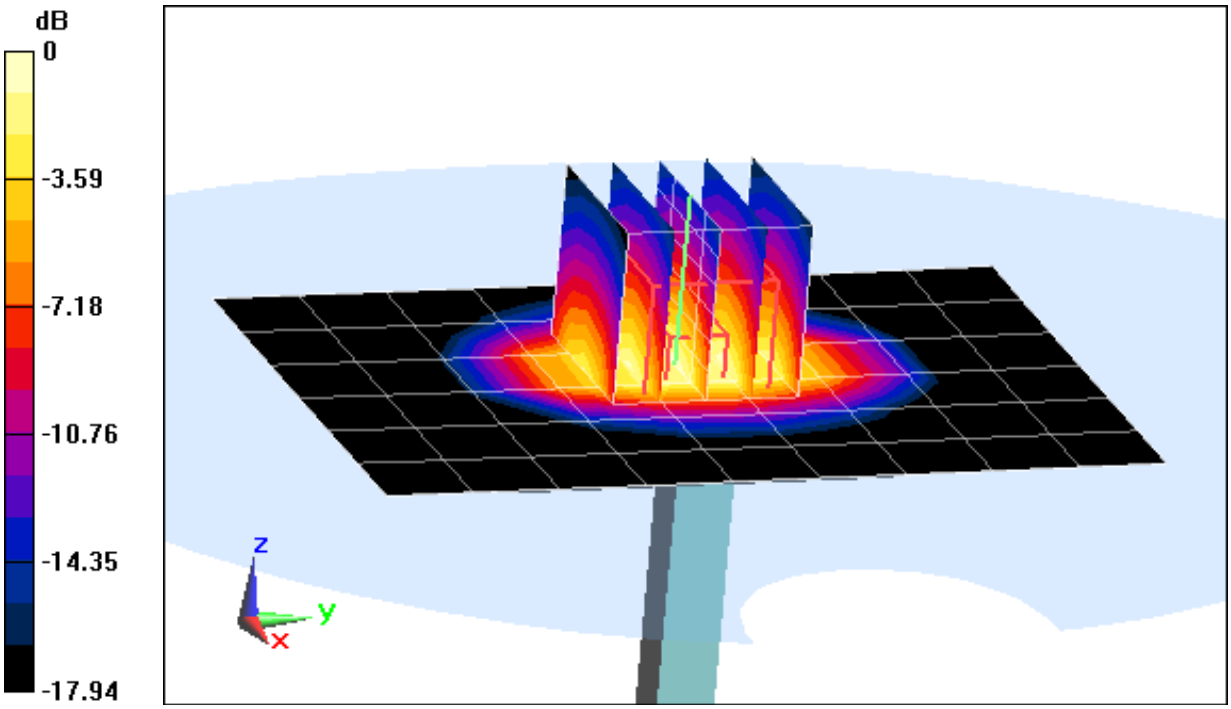
Communication System: UID 0, CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: 1900 Head Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.389 S/m; ε_r = 40.052; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-07-2014; Ambient Temp: 24.4°C; Tissue Temp: 24.2°C

Probe: ES3DV2 - SN3022; ConvF(5.03, 5.03, 5.03); Calibrated: 8/22/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/21/2013
Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

1900 MHz System Verification

Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 6.77 W/kg
SAR(1 g) = 3.77 W/kg
Deviation: -6.68%



0 dB = 4.76 W/kg = 6.78 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d141

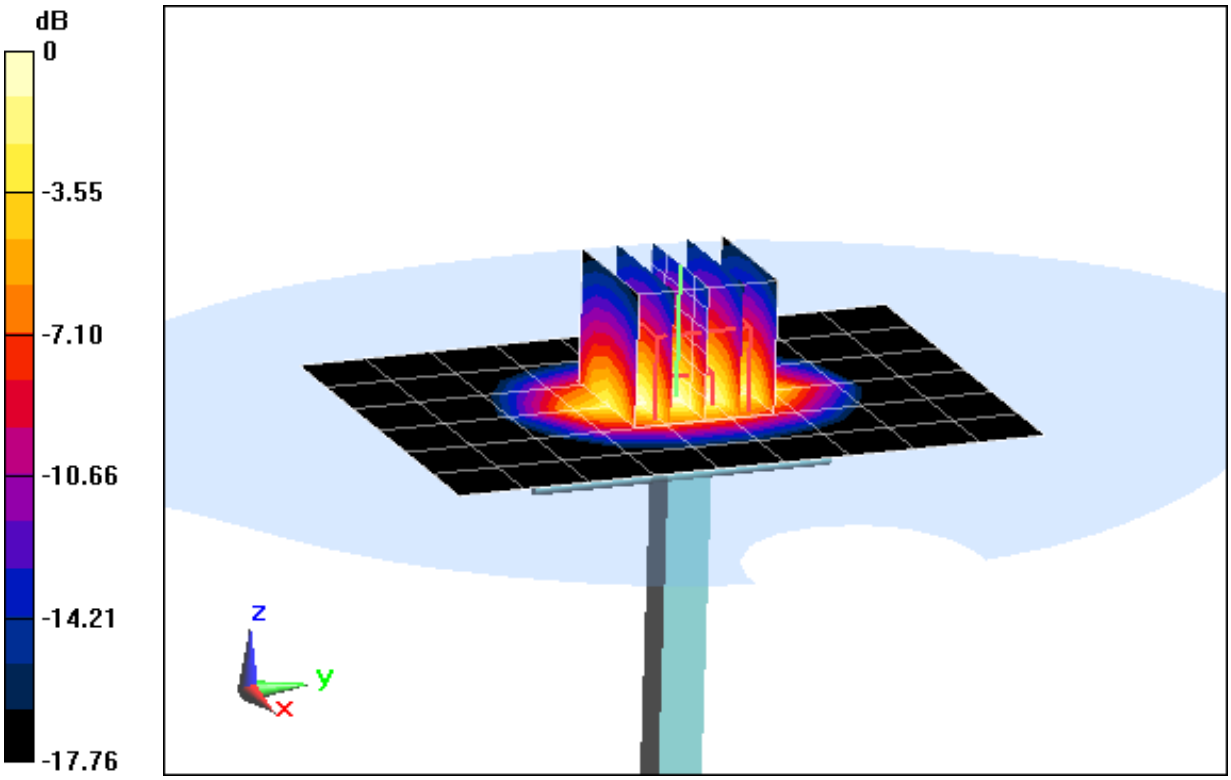
Communication System: UID 0, CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: 1900 Head Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.405 S/m; ε_r = 39.261; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 08-04-2014; Ambient Temp: 24.0°C; Tissue Temp: 22.9°C

Probe: ES3DV3 - SN3287; ConvF(5.08, 5.08, 5.08); Calibrated: 11/20/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1408; Calibrated: 11/19/2013
Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1797
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

1900 MHz System Verification

Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 7.04 W/kg
SAR(1 g) = 3.91 W/kg
Deviation: -2.49%



0 dB = 4.96 W/kg = 6.95 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 797

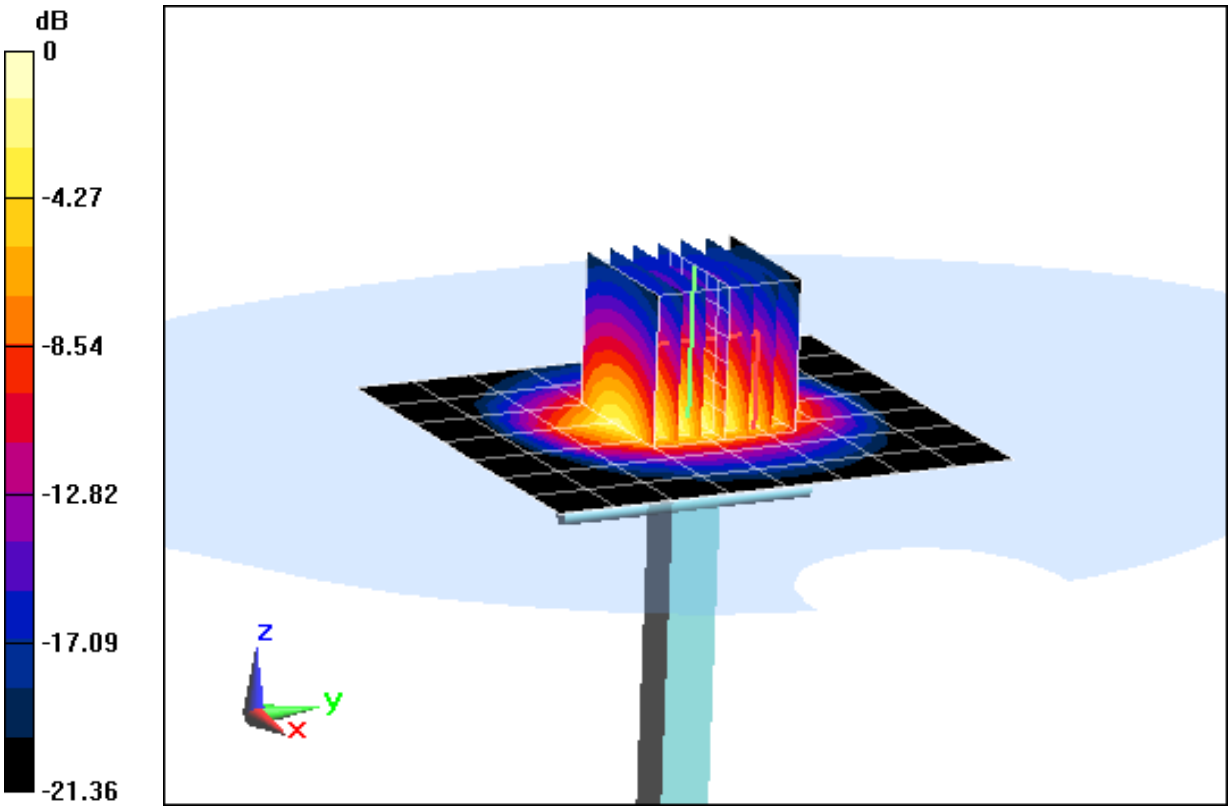
Communication System: UID 0, CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: 2450 Head Medium parameters used:
f = 2450 MHz; σ = 1.744 S/m; ε_r = 38.576; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-15-2014; Ambient Temp: 22.7°C; Tissue Temp: 22.5°C

Probe: ES3DV3 - SN3319; ConvF(4.45, 4.45, 4.45); Calibrated: 4/17/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1368; Calibrated: 4/11/2014
Phantom: SAM; Type: QD000P40CD; Serial: TP:1758
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

2450 MHz System Verification

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 10.6 W/kg
SAR(1 g) = 5.27 W/kg
Deviation: 1.74%



0 dB = 6.85 W/kg = 8.36 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5200 MHz; Type: D5GHzV2; Serial: 1057

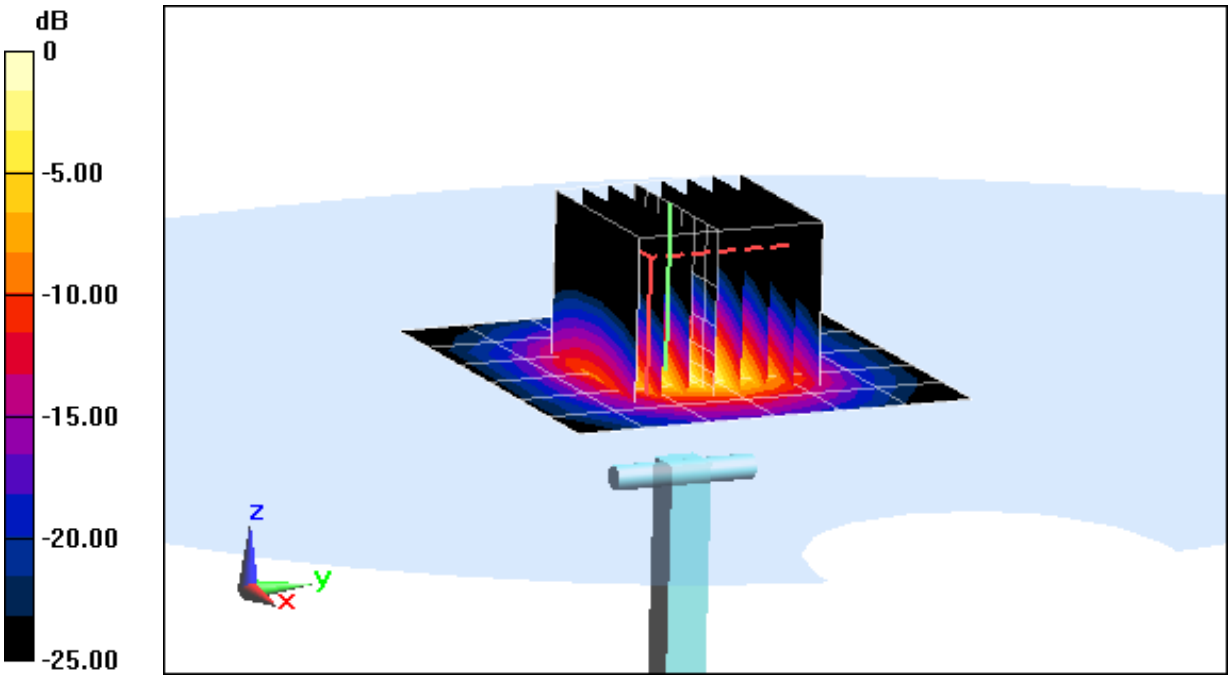
Communication System: UID 0, CW; Frequency: 5200 MHz;Duty Cycle: 1:1
Medium: 5 GHz Head Medium parameters used:
f = 5200 MHz; σ = 4.649 S/m; ε_r = 36.923; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-14-2014; Ambient Temp: 24.4°C; Tissue Temp: 23.3°C

Probe: EX3DV4 - SN3914; ConvF(4.99, 4.99, 4.99); Calibrated: 10/23/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

5200 MHz System Verification

Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 31.7 W/kg
SAR(1 g) = 7.58 W/kg
Deviation: -2.82%



0 dB = 17.5 W/kg = 12.43 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5300 MHz; Type: D5GHzV2; Serial: 1057

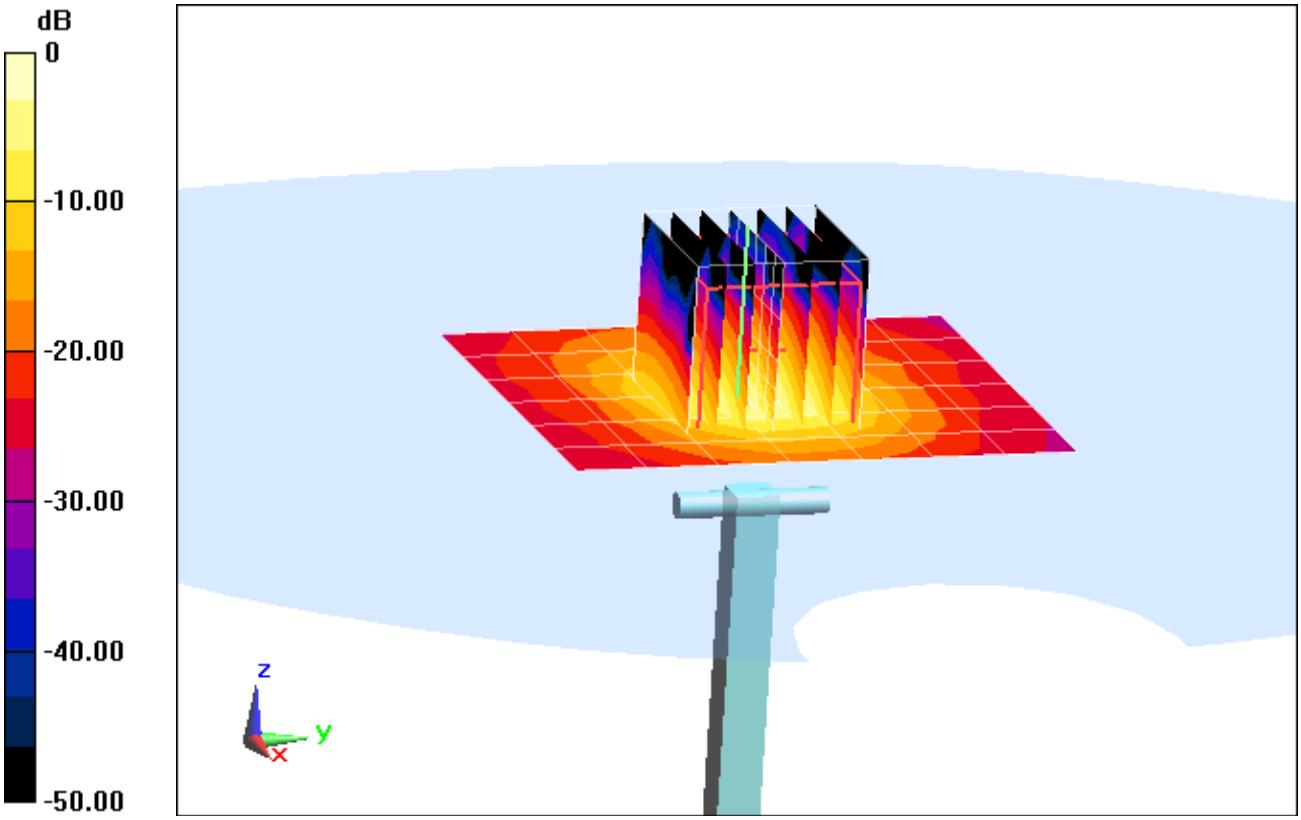
Communication System: UID 0, CW; Frequency: 5300 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head Medium parameters used:
f = 5300 MHz; σ = 4.746 S/m; ε_r = 36.754; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 07-14-2014; Ambient Temp: 24.4°C; Tissue Temp: 23.3°C

Probe: EX3DV4 - SN3914; ConvF(4.82, 4.82, 4.82); Calibrated: 10/23/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7164)

5300 MHz System Verification

Area Scan (7x8x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 33.3 W/kg
SAR(1 g) = 7.68 W/kg
Deviation: -7.47%



0 dB = 18.5 W/kg = 12.67 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5500 MHz; Type: D5GHzV2; Serial: 1057

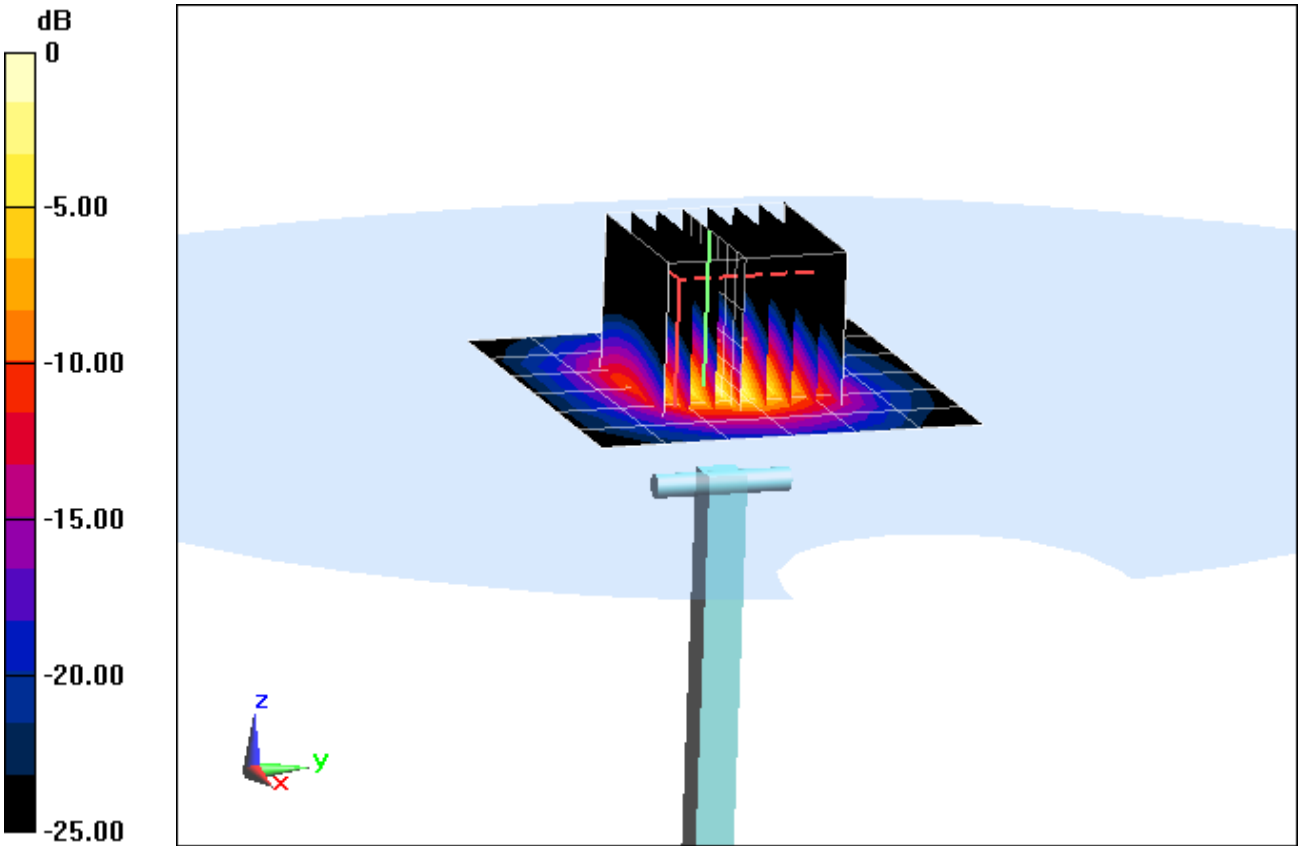
Communication System: UID 0, CW; Frequency: 5500 MHz;Duty Cycle: 1:1
Medium: 5 GHz Head Medium parameters used:
f = 5500 MHz; σ = 4.958 S/m; ε_r = 36.509; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 07-14-2014; Ambient Temp: 24.5°C; Tissue Temp: 23.4°C

Probe: EX3DV4 - SN3914; ConvF(4.55, 4.55, 4.55); Calibrated: 10/23/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7164)

5500 MHz System Verification

Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 34.4 W/kg
SAR(1 g) = 7.81 W/kg
Deviation: -7.35%



0 dB = 19.1 W/kg = 12.81 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5600 MHz; Type: D5GHzV2; Serial: 1057

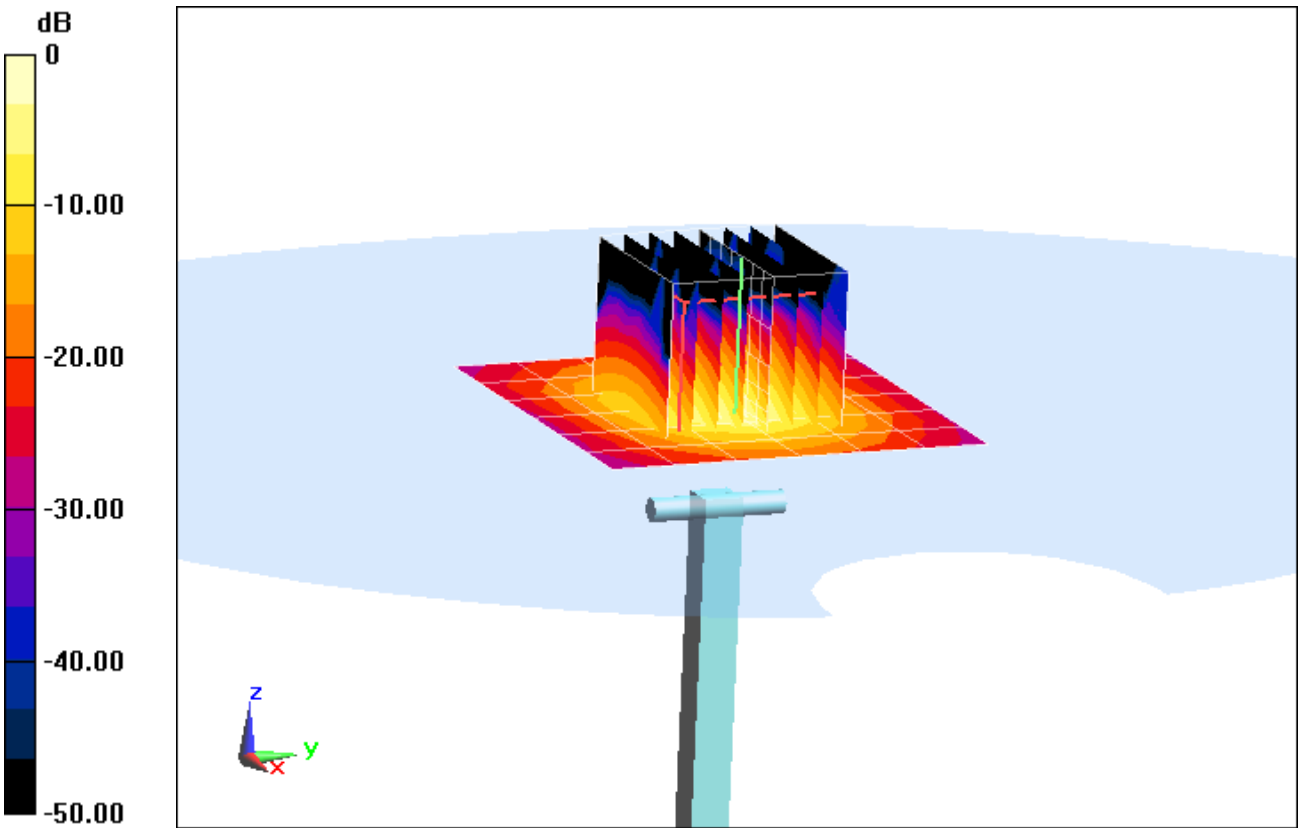
Communication System: UID 0, CW; Frequency: 5600 MHz;Duty Cycle: 1:1
Medium: 5 GHz Head Medium parameters used:
f = 5600 MHz; σ = 5.056 S/m; ε_r = 36.352; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-14-2014; Ambient Temp: 24.5°C; Tissue Temp: 23.4°C

Probe: EX3DV4 - SN3914; ConvF(4.37, 4.37, 4.37); Calibrated: 10/23/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7164)

5600 MHz System Verification

Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 37.1 W/kg
SAR(1 g) = 8.25 W/kg
Deviation: -1.20%



0 dB = 19.8 W/kg = 12.97 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5800 MHz; Type: D5GHzV2; Serial: 1057

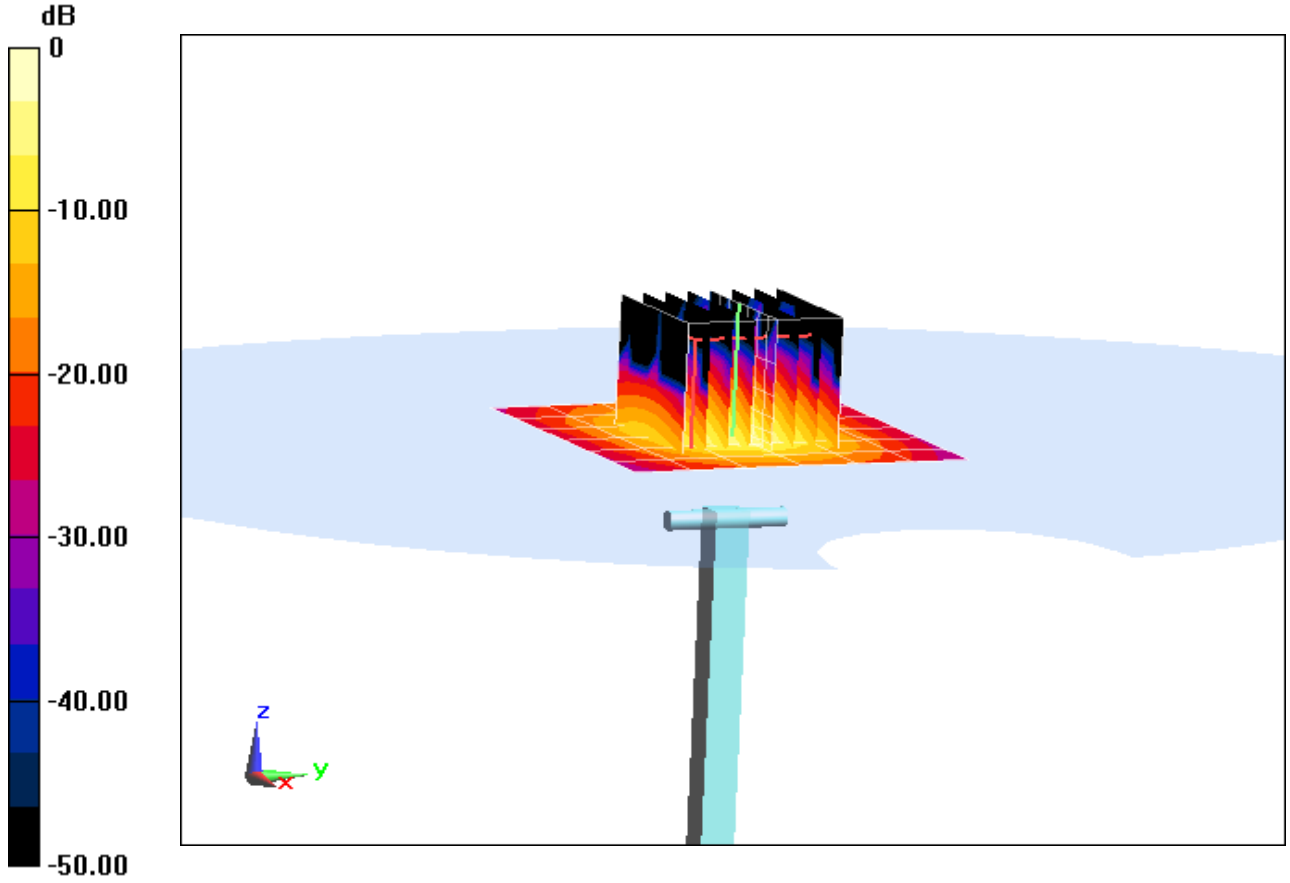
Communication System: UID 0, CW; Frequency: 5800 MHz;Duty Cycle: 1:1
Medium: 5 GHz Head Medium parameters used:
f = 5800 MHz; σ = 5.255 S/m; ε_r = 36.098; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-14-2014; Ambient Temp: 24.5°C; Tissue Temp: 24.4°C

Probe: EX3DV4 - SN3914; ConvF(4.52, 4.52, 4.52); Calibrated: 10/23/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7164)

5800 MHz System Verification

Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 36.4 W/kg
SAR(1 g) = 7.73 W/kg
Deviation: -2.52%



0 dB = 19.4 W/kg = 12.88 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d119

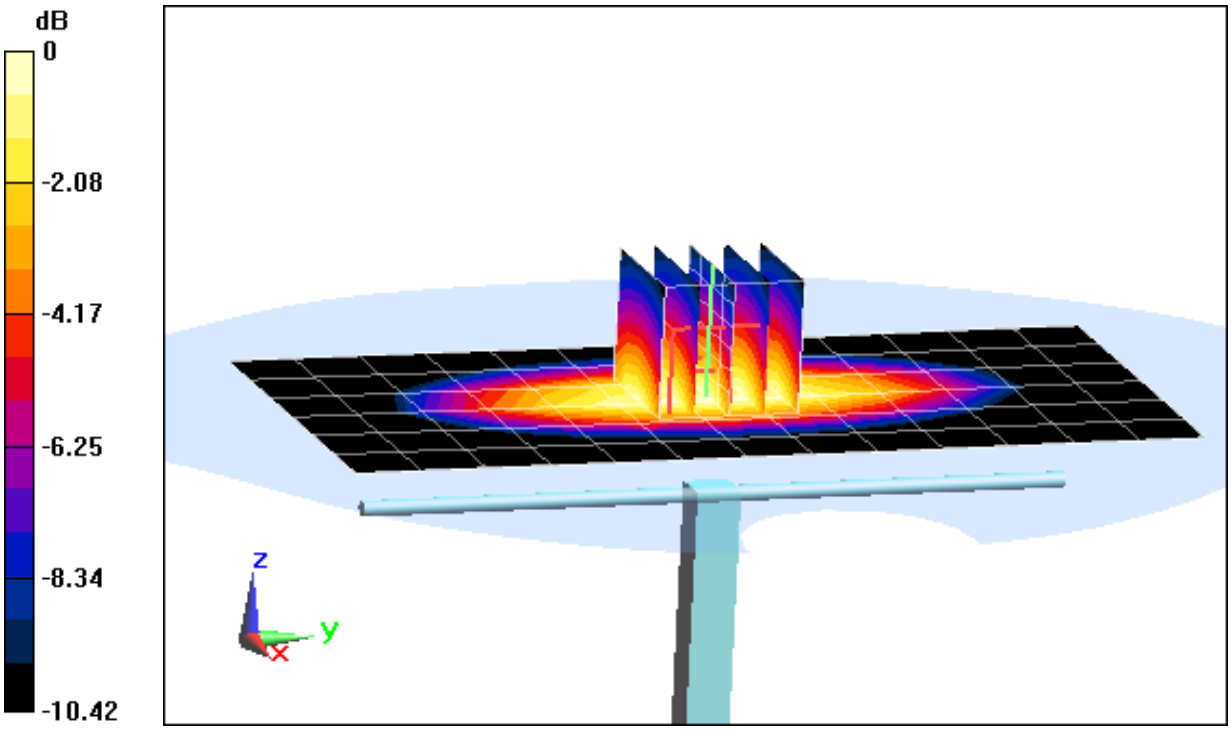
Communication System: UID 0, CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: 835 Body Medium parameters used:
f = 835 MHz; σ = 1.01 S/m; ε_r = 54.281; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 07-08-2014; Ambient Temp: 24.5°C; Tissue Temp: 24.0°C

Probe: ES3DV2 - SN3022; ConvF(5.91, 5.91, 5.91); Calibrated: 8/22/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/21/2013
Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

835 MHz System Verification

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 1.26 W/kg
SAR(1 g) = 0.858 W/kg
Deviation: -8.14%



0 dB = 0.999 W/kg = -0.00 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d149

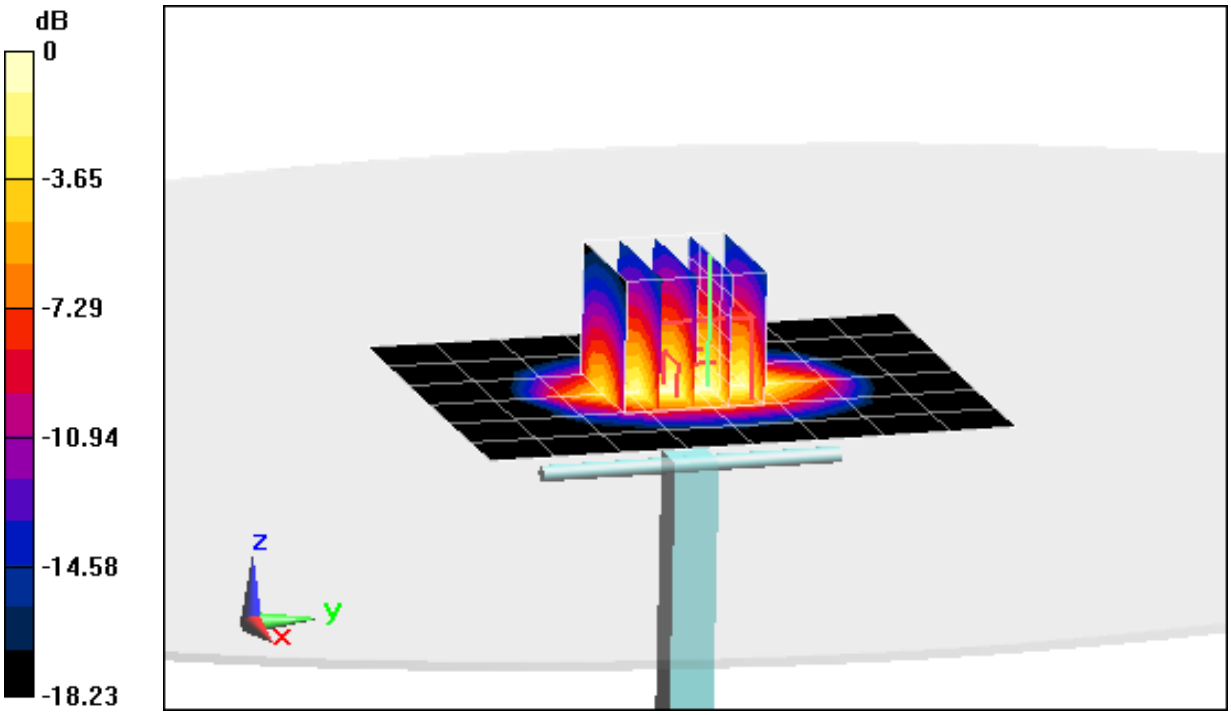
Communication System: UID 0, CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.58 S/m; ε_r = 51.243; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-08-2014; Ambient Temp: 23.6°C; Tissue Temp: 23.6°C

Probe: ES3DV3 - SN3332; ConvF(4.7, 4.7, 4.7); Calibrated: 11/25/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 11/18/2013
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1226
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

1900 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 7.78 W/kg
SAR(1 g) = 4.36 W/kg
Deviation: 7.65%



0 dB = 5.42 W/kg = 7.34 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d141

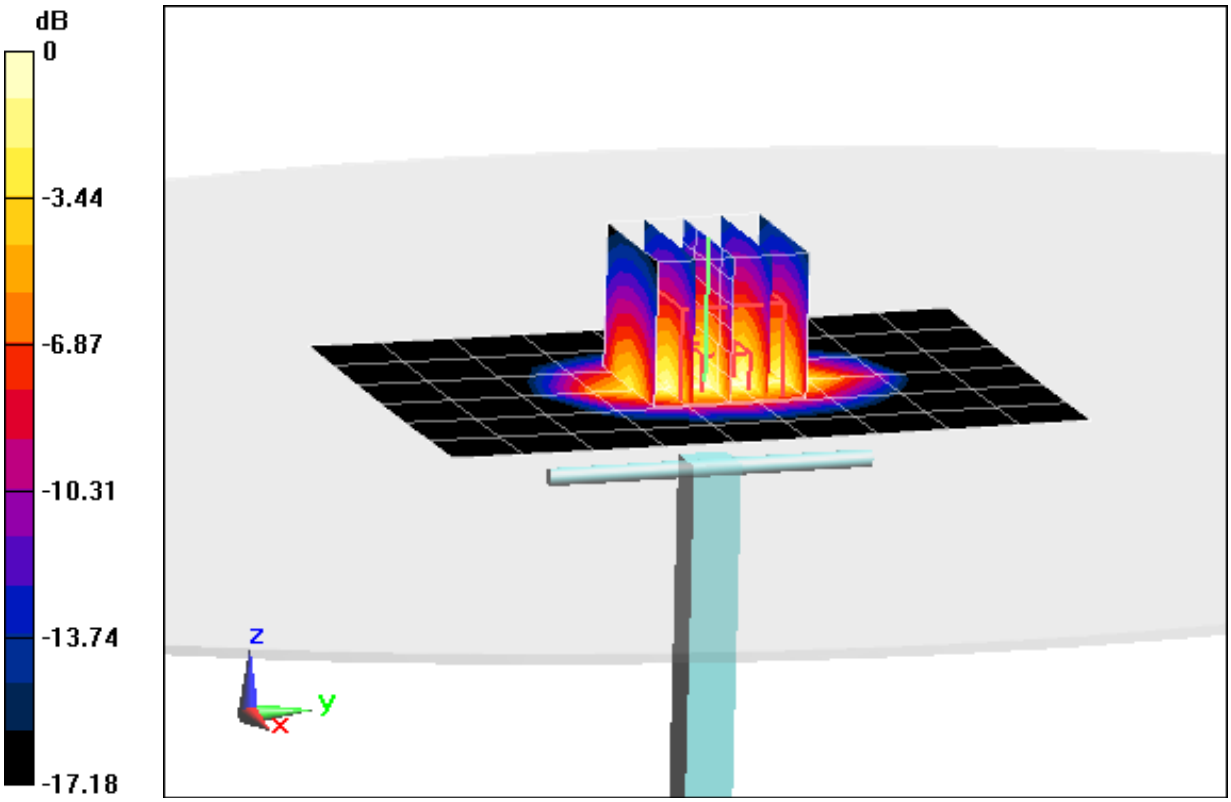
Communication System: UID 0, CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.526 S/m; ε_r = 53.419; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-31-2014; Ambient Temp: 24.5°C; Tissue Temp: 23.2°C

Probe: ES3DV3 - SN3287; ConvF(4.67, 4.67, 4.67); Calibrated: 11/20/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1408; Calibrated: 11/19/2013
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1229
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7164)

1900 MHz System Verification

Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 7.28 W/kg
SAR(1 g) = 4.16 W/kg
Deviation: 2.46%



0 dB = 5.20 W/kg = 7.16 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 797

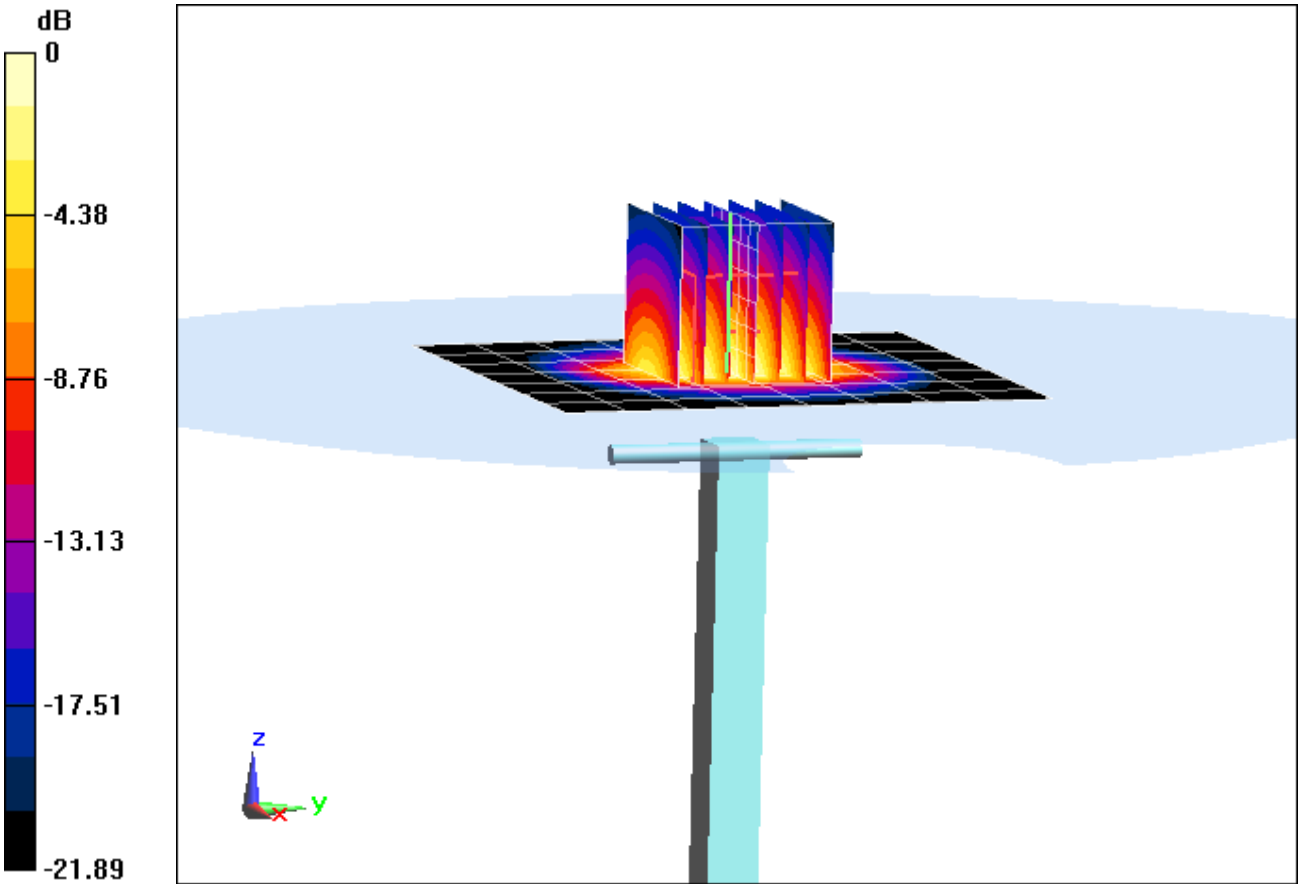
Communication System: UID 0, CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used:
f = 2450 MHz; σ = 1.949 S/m; ε_r = 50.892; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 07-08-2014; Ambient Temp: 24.2°C; Tissue Temp: 23.0°C

Probe: EX3DV4 - SN3914; ConvF(7.02, 7.02, 7.02); Calibrated: 10/23/2013;
Sensor-Surface: 2mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7164)

2450 MHz System Verification

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 13.3 W/kg
SAR(1 g) = 5.33 W/kg
Deviation: 7.89%



0 dB = 9.44 W/kg = 9.75 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5200 MHz; Type: D5GHzV2; Serial: 1007

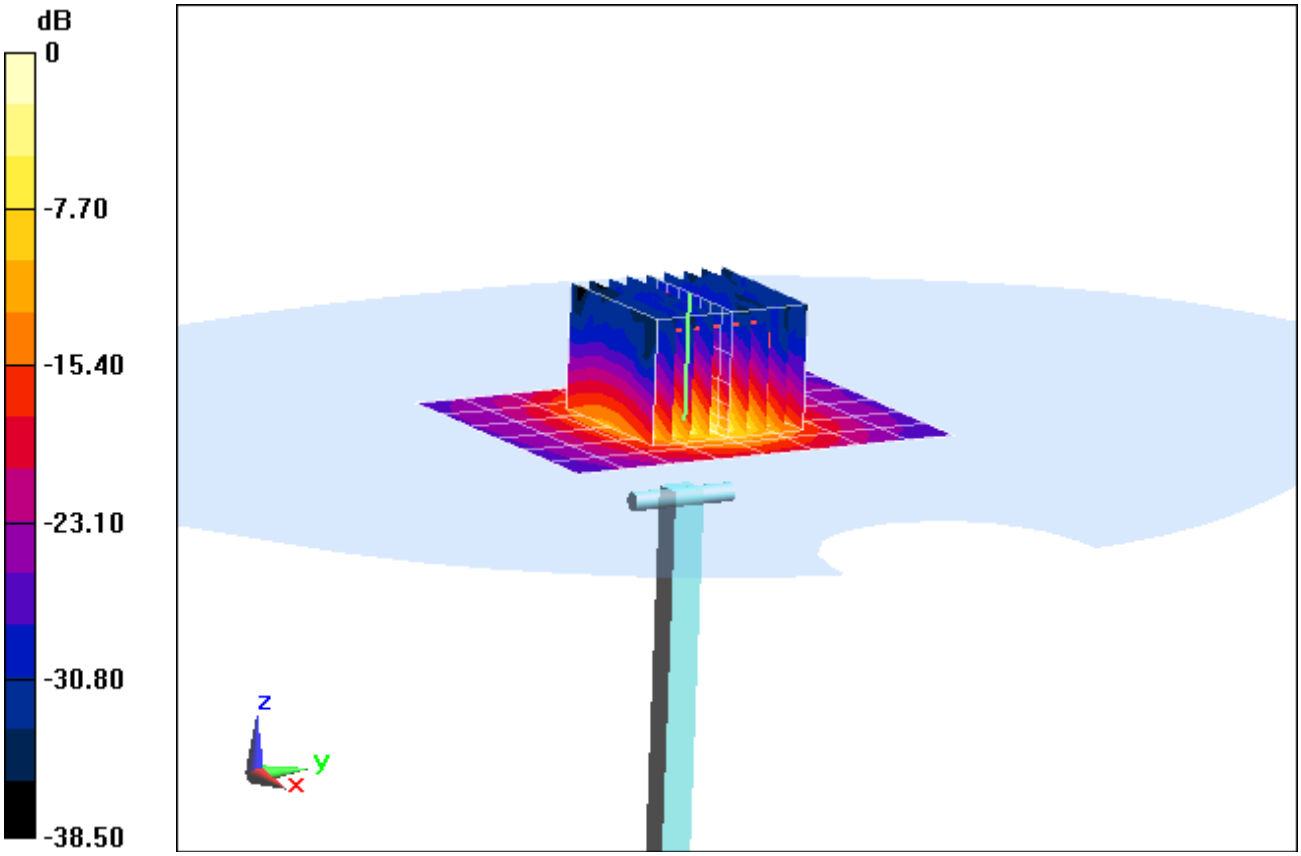
Communication System: UID 0, CW; Frequency: 5200 MHz;Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5200 MHz; σ = 5.358 S/m; ε_r = 47.305; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 07-08-2014; Ambient Temp: 23.9°C; Tissue Temp: 21.8°C

Probe: EX3DV4 - SN3920; ConvF(4.23, 4.23, 4.23); Calibrated: 12/18/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 12/12/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

5200MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 26.4 W/kg
SAR(1 g) = 7.39 W/kg
Deviation: 1.79%



0 dB = 18.1 W/kg = 12.58 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5300 MHz; Type: D5GHzV2; Serial: 1007

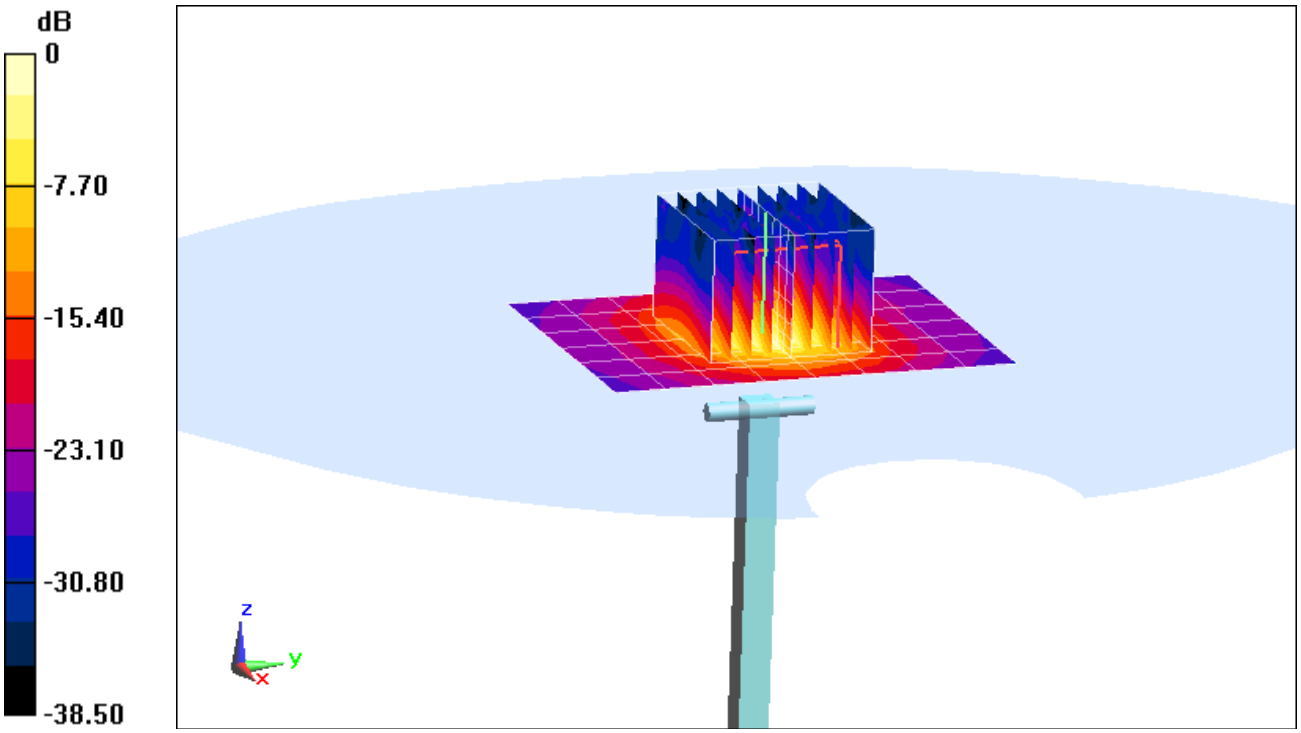
Communication System: UID 0, CW; Frequency: 5300 MHz;Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5300 MHz; σ = 5.505 S/m; ε_r = 47.133; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 10 mm

Test Date: 07-08-2014; Ambient Temp: 23.9°C; Tissue Temp: 21.8°C

Probe: EX3DV4 - SN3920; ConvF(4.11, 4.11, 4.11); Calibrated: 12/18/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 12/12/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

5300 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 32.5 W/kg
SAR(1 g) = 7.59 W/kg
Deviation: 1.61%



0 dB = 17.5 W/kg = 12.43 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5500 MHz; Type: D5GHzV2; Serial: 1007

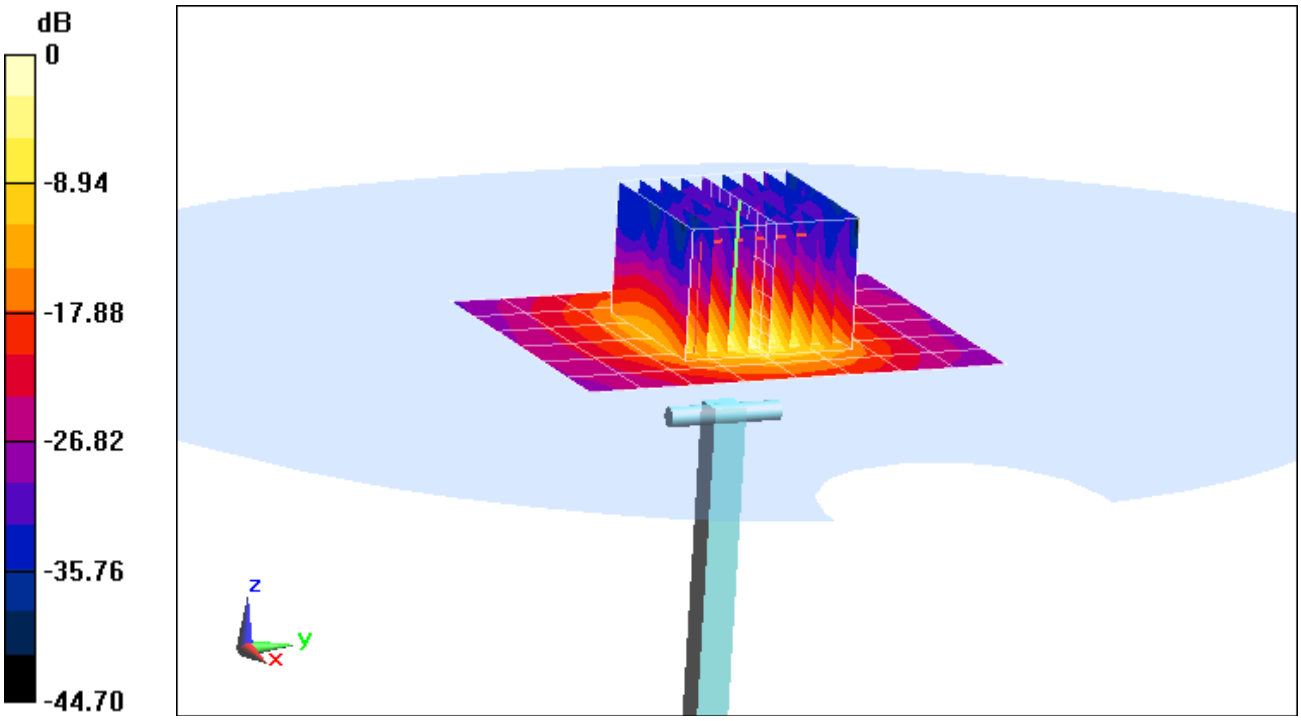
Communication System: UID 0, CW; Frequency: 5500 MHz;Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5500 MHz; σ = 5.799 S/m; ε_r = 46.887; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 07-08-2014; Ambient Temp: 23.9°C; Tissue Temp: 21.8°C

Probe: EX3DV4 - SN3920; ConvF(3.8, 3.8, 3.8); Calibrated: 12/18/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 12/12/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

5500 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 35.2 W/kg
SAR(1 g) = 7.88 W/kg
Deviation: 3.82%



0 dB = 20.0 W/kg = 13.01 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5600 MHz; Type: D5GHzV2; Serial: 1007

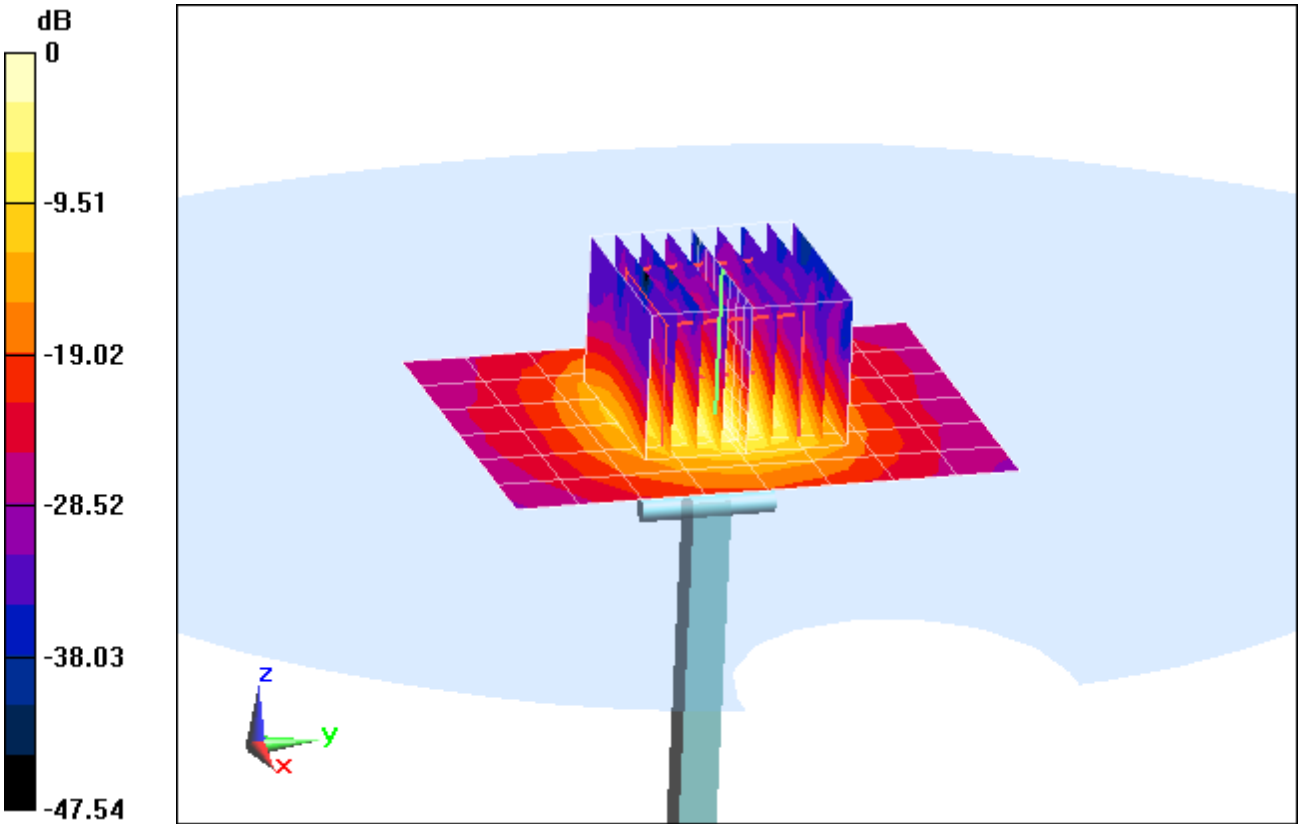
Communication System: UID 0, CW; Frequency: 5600 MHz;Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5600 MHz; σ = 5.953 S/m; ε_r = 46.751; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 07-08-2014; Ambient Temp: 23.9°C; Tissue Temp: 21.8°C

Probe: EX3DV4 - SN3920; ConvF(3.62, 3.62, 3.62); Calibrated: 12/18/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 12/12/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

5600MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 34.9 W/kg
SAR(1 g) = 7.84 W/kg
Deviation: 1.42%



0 dB = 20.1 W/kg = 13.03 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5800 MHz; Type: D5GHzV2; Serial: 1007

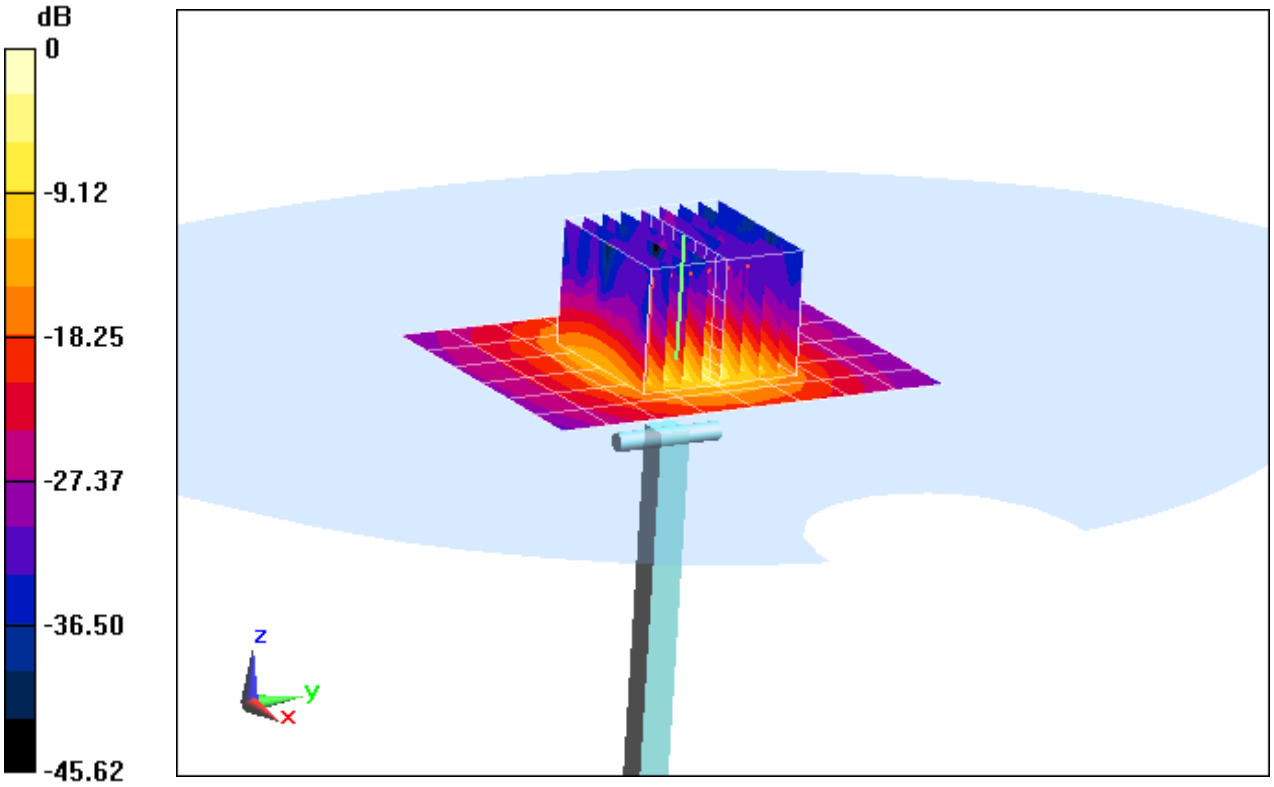
Communication System: UID 0, CW; Frequency: 5800 MHz;Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5800 MHz; σ = 6.188 S/m; ε_r = 46.321; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 07-08-2014; Ambient Temp: 23.9°C; Tissue Temp: 21.8°C

Probe: EX3DV4 - SN3920; ConvF(4, 4, 4); Calibrated: 12/18/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 12/12/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

5800MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 34.4 W/kg
SAR(1 g) = 7.54 W/kg
Deviation: 3.43%



0 dB = 20.2 W/kg = 13.05 dBW/kg