SAR EVALUATION REPORT

Applicant Name:
LG Electronics Mobilecomm USA
1000 Sylvan Avenue
Englewood Cliffs, NJ 07632
United States

Date of Testing:
04/07/14 - 04/17/14
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Document Serial No.:
0Y1404070701-R2.ZNF

FCC ID: **ZNFD851**

APPLICANT: **LG ELECTRONICS MOBILECOMM USA**

DUT Type: Portable Handset
Application Type: Certification
FCC Rule Part(s): CFR §2.1093
Model(s): LG-D851, LGD851, D851

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	0.24	0.48	0.48
PCE	UMTS 850	826.40 - 846.60 MHz	0.20	0.37	0.37
PCE	UMTS 1750	1712.4 - 1752.5 MHz	0.25	0.72	0.72
PCE	GSM/GPRS/EDGE 1900	1850.20 - 1909.80 MHz	0.19	0.79	0.79
PCE	UMTS 1900	1852.4 - 1907.6 MHz	0.27	0.95	0.95
PCE	LTE Band 17	706.5 - 713.5 MHz	0.10	0.16	0.19
PCE	LTE Band 4 (AWS)	1712.5 - 1752.5 MHz	0.22	0.61	0.61
PCE	LTE Band 2 (PCS)	1852.5 - 1907.5 MHz	0.19	1.04	1.04
PCE	LTE Band 7	2502.5 - 2567.5 MHz	< 0.1	< 0.1	< 0.1
DTS	2.4 GHz WLAN	2412 - 2462 MHz	0.42	< 0.1	< 0.1
DTS/NII	5.8 GHz WLAN	5745 - 5825 MHz	0.36	0.20	0.20
NII	5.2 GHz WLAN	5180 - 5240 MHz	0.28	0.13	
NII	5.3 GHz WLAN	5260 - 5320 MHz	0.30	0.17	
NII	5.5 GHz WLAN	5500 - 5700 MHz	0.40	0.18	
DSS/DTS	Bluetooth	2402 - 2480 MHz	N/A		
Simultaneous SAR per KDB 690783 D01v01r02:			1.33		

This revised Test Report (S/N: 0Y1404070701-R2.ZNF) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

This wireless portable device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE C95.1-1992 and has been tested in accordance with the measurement procedures specified in Section 1.8 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

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1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
GSM/GPRS/EDGE 850	Voice/Data	824.20 - 848.80 MHz
UMTS 850	Voice/Data	826.40 - 846.60 MHz
UMTS 1750	Voice/Data	1712.4 - 1752.5 MHz
GSM/GPRS/EDGE 1900	Voice/Data	1850.20 - 1909.80 MHz
UMTS 1900	Voice/Data	1852.4 - 1907.6 MHz
LTE Band 17	Data	706.5 - 713.5 MHz
LTE Band 4 (AWS)	Data	1712.5 - 1752.5 MHz
LTE Band 2 (PCS)	Data	1852.5 - 1907.5 MHz
LTE Band 7	Data	2502.5 - 2567.5 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

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.

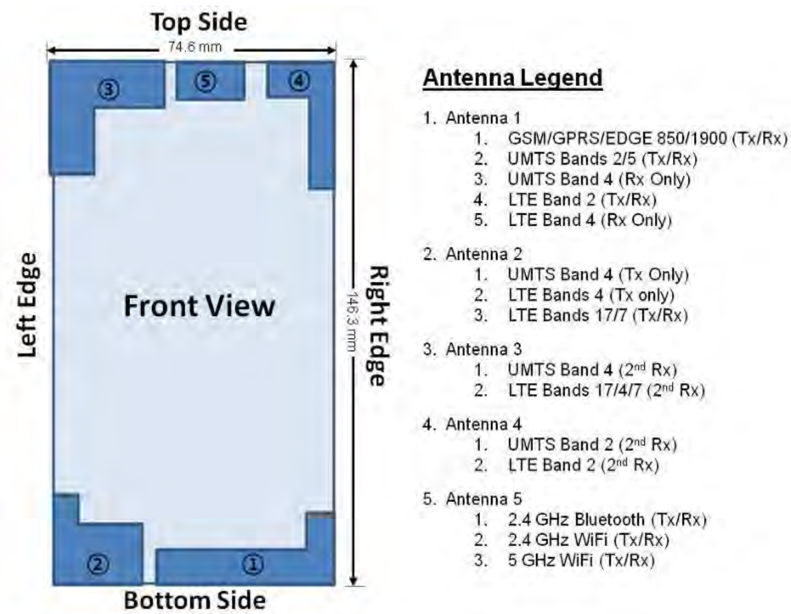
Mode / Band		Voice (dBm)	Burst Average GMSK (dBm)				Burst Average 8-PSK (dBm)			
		1 TX Slot	*1 TX Slots*	*2 TX Slots*	*3 TX Slots*	*4 TX Slots*	*1 TX Slots*	*2 TX Slots*	*3 TX Slots*	*4 TX Slots*
GSM/GPRS/EDGE 850	Maximum	**33.2**	**33.2**	**31.7**	**29.7**	**28.2**	**27.7**	**27.7**	**26.7**	**25.7**
	Nominal	**32.7**	**32.7**	**31.2**	**29.2**	**27.7**	**27.2**	**27.2**	**26.2**	**25.2**
GSM/GPRS/EDGE 1900	Maximum	**31.2**	**31.2**	**29.7**	**27.7**	**26.2**	**26.7**	**26.7**	**25.7**	**24.7**
	Nominal	**30.7**	**30.7**	**29.2**	**27.2**	**25.7**	**26.2**	**26.2**	**25.2**	**24.2**

Mode / Band		Modulated Average (dBm)			
		3GPP WCDMA Rel 99	*3GPP HSDPA Rel 5*	*3GPP HSUPA Rel 6*	*3GPP HSUPA Rel 8*
UMTS Band 5 (850 MHz)	Maximum	**23.7**	**23.7**	**23.7**	**23.7**
	Nominal	**23.2**	**23.2**	**23.2**	**23.2**
UMTS Band 4 (1750 MHz)	Maximum	**24.7**	**24.7**	**24.7**	**24.7**
	Nominal	**24.2**	**24.2**	**24.2**	**24.2**
UMTS Band 2 (1900 MHz)	Maximum	**23.7**	**23.7**	**23.7**	**23.7**
	Nominal	**23.2**	**23.2**	**23.2**	**23.2**

Mode / Band		Modulated Average (dBm)
LTE Band 17	Maximum	**24.2**
	Nominal	**23.7**
LTE Band 4 (AWS)	Maximum	**24.5**
	Nominal	**24.0**
LTE Band 2 (PCS)	Maximum	**23.7**
	Nominal	**23.2**
LTE Band 7	Maximum	**23.7**
	Nominal	**23.2**

Mode / Band		Modulated Average (dBm)
IEEE 802.11b (2.4 GHz)	Maximum	**17.1**
	Nominal	**16.0**
IEEE 802.11g (2.4 GHz)	Maximum	**13.1**
	Nominal	**12.0**
IEEE 802.11n (2.4 GHz)	Maximum	**12.1**
	Nominal	**11.0**
IEEE 802.11ac (2.4 GHz)	Maximum	**10.1**
	Nominal	**9.0**
IEEE 802.11a (5 GHz)	Maximum	**12.1**
	Nominal	**11.0**
IEEE 802.11n (5 GHz) - 20 MHz	Maximum	**11.1**
	Nominal	**10.0**
IEEE 802.11n (5 GHz) - 40 MHz	Maximum	**12.1**
	Nominal	**11.0**
IEEE 802.11ac (5 GHz) - 80 MHz	Maximum	**10.1**
	Nominal	**9.0**
Bluetooth	Maximum	**11.5**
	Nominal	**10.5**
Bluetooth LE	Maximum	**9.1**
	Nominal	**7.5**

1.3 DUT Antenna Locations



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

Sides for SAR Testing						
Mode	Back	Front	Top	Bottom	Right	Left
GPRS 850	Yes	Yes	No	Yes	Yes	No
UMTS 850	Yes	Yes	No	Yes	Yes	No
UMTS 1750	Yes	Yes	No	Yes	No	Yes
GPRS 1900	Yes	Yes	No	Yes	Yes	No
UMTS 1900	Yes	Yes	No	Yes	Yes	No
LTE Band 17	Yes	Yes	No	Yes	No	Yes
LTE Band 4 (AWS)	Yes	Yes	No	Yes	No	Yes
LTE Band 2 (PCS)	Yes	Yes	No	Yes	Yes	No
LTE Band 7	Yes	Yes	No	Yes	No	Yes
2.4 GHz WLAN	Yes	Yes	Yes	No	Yes	No
5.8 GHz WLAN	Yes	Yes	Yes	No	Yes	No

Note:
1) 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. The antenna document shows the distances between the transmit antennas and the edges of the device.

1.4 Near Field Communications (NFC) Antenna

This DUT has NFC operations. The NFC antenna is integrated into the back cover. The SAR tests were performed with the back cover with NFC antenna already incorporated.

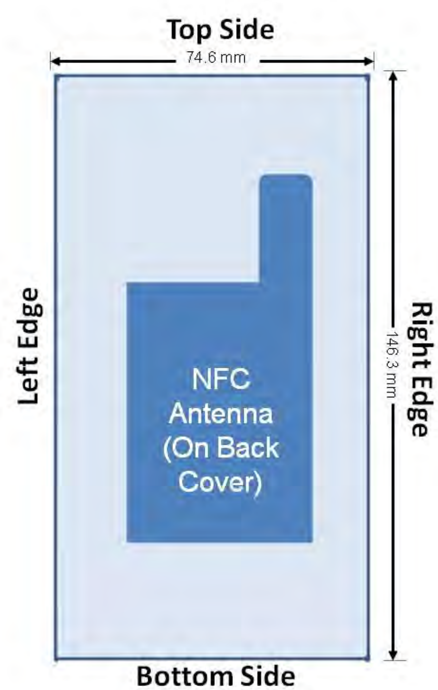


Figure 1-2
NFC Antenna Locations

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.

Figure 1-3
Simultaneous Transmission Paths

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	Yes	
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 + 5 GHz WI-FI	Yes*	Yes*	Yes	*-Pre-installed VOIP applications are considered.
9	LTE + 2.4 GHz Bluetooth	N/A	Yes*	N/A	*-Pre-installed VOIP applications are considered.
10	GPRS/EDGE + 2.4 GHz WI-FI	Yes*	Yes*	Yes	*-Pre-installed VOIP applications are considered.
11	GPRS/EDGE + 5 GHz WI-FI	Yes*	Yes*	Yes	*-Pre-installed VOIP applications are considered.
12	GPRS/EDGE + 2.4 GHz Bluetooth	N/A	Yes*	N/A	*-Pre-installed VOIP applications are considered.

Notes:

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. Per the manufacturer, WIFI Direct is expected to be used in conjunction with a held-to-ear or body-worn accessory voice call. Simultaneous transmission scenarios involving WIFI direct are specified above.

1.6 SAR Test Exclusions Applied

(A) WIFI/BT

Since hotspot operations are not allowed by the chipset firmware using 5 GHz NII WIFI, only 2.4 GHz and 5.8 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; [(14/10)* √2.441] = 2.2< 3.0. Per KDB Publication 447498 D01v05, the maximum power of the channel was rounded to the nearest milliwatt before calculation.

This device supports IEEE 802.11ac for 2.4 GHz WIFI. IEEE 802.11ac was not evaluated for SAR since the average output power was not more than 0.25 dB higher than the average output power of IEEE 802.11b.

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

This device supports IEEE 802.11ac with the following features:

a) Up to 80 MHz Bandwidth only
b) No aggregate channel configurations
c) 1 Tx antenna output
d) 256 QAM is supported
e) No new 5 GHz channels

(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.

This device supports inter-band LTE Carrier Aggregation (CA) in the downlink only. All uplink communications are identical to Release 8 specifications. Per FCC Guidance, LTE CA SAR was not needed for testing since the data sent by uplink on uplink physical channels does not change between Rel 8 and Rel 10.

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)
- FCC KDB Publication 68474 D04 (Folio Sleeve Accessory)

1.9 Wireless Charging Cover

This DUT has wireless charging capabilities. The same wireless charging capability is integrated into the standard back cover and the folio sleeve accessory. The SAR tests were performed with the standard back cover and the folio sleeve accessory was additionally evaluated for worst case SAR for each configuration.

1.10 Folio Sleeve Accessory

This DUT may be used with a folio sleeve accessory. Folio sleeve fits the back of the handset and extends to protect the front side of the device. Per FCC KDB Publication 648474 D04, SAR was measured using the standard battery cover, including NFC antenna and wireless charging cover, and then repeated with the folio sleeve, also including NFC antenna and wireless charging cover, for the highest reported SAR for each wireless technology, frequency band, operating mode, and exposure condition. Head tests were performed with the folio sleeve open and closed. Additional body-worn and hotspot tests were performed with the folio closed only because operations near the body with the folio open are not expected. No other additional test with folio sleeve was required since all reported SAR were less than 1.2 W/kg.

1.11 Device Serial Numbers

Several samples were used with identical hardware 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.

	Head Serial Number	Body-Worn Serial Number	Hotspot Serial Number
GSM/GPRS/EDGE 850	SAR 4	SAR 4	SAR 4
UMTS 850	SAR 4	SAR 4	SAR 4
UMTS 1750	SAR 4	SAR 4	SAR 4
GSM/GPRS/EDGE 1900	SAR 5	SAR 6	SAR 6
UMTS 1900	SAR 5	SAR 6	SAR 6
LTE Band 17	SAR 2	SAR 2	SAR 2
LTE Band 4 (AWS)	SAR 1	SAR 1	SAR 1
LTE Band 2 (PCS)	SAR 1	SAR 1	SAR 1
LTE Band 7	SAR 1	SAR 5	SAR 5
2.4 GHz WLAN	SAR 3	SAR 7	SAR 7
5 GHz WLAN	SAR 3	SAR 3	SAR 3

2 LTE INFORMATION

LTE Information			
FCC ID	**ZNFD851**		
Form Factor	Portable Handset		
Frequency Range of each LTE transmission band	LTE Band 17 (706.5 - 713.5 MHz)		
	LTE Band 4 (AWS) (1712.5 - 1752.5 MHz)		
	LTE Band 2 (PCS) (1852.5 - 1907.5 MHz)		
	LTE Band 7 (2502.5 - 2567.5 MHz)		
Channel Bandwidths	LTE Band 17: 5 MHz, 10 MHz		
	LTE Band 4 (AWS): 5 MHz, 10 MHz, 15 MHz, 20 MHz		
	LTE Band 2 (PCS): 5 MHz, 10 MHz, 15 MHz, 20 MHz		
	LTE Band 7: 5 MHz, 10 MHz		
Channel Numbers and Frequencies (MHz)	Low	Mid	High
LTE Band 17: 5 MHz	706.5 (23755)	710 (23790)	713.5 (23825)
LTE Band 17: 10 MHz	709 (23780)	710 (23790)	711 (23800)
LTE Band 4 (AWS): 5 MHz	1712.5 (19975)	1732.5 (20175)	1752.5 (20375)
LTE Band 4 (AWS): 10 MHz	1715 (20000)	1732.5 (20175)	1750 (20350)
LTE Band 4 (AWS): 15 MHz	1717.5 (20025)	1732.5 (20175)	1747.5 (20325)
LTE Band 4 (AWS): 20 MHz	1720 (20050)	1732.5 (20175)	1745 (20300)
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)
LTE Band 7: 5 MHz	2502.5 (20775)	2535 (21100)	2567.5 (21425)
LTE Band 7: 10 MHz	2505 (20800)	2535 (21100)	2565 (21400)
UE Category	4		
LTE Carrier Aggregation Possible Combinations	B4 (PCC) + B2 (SCC)		B2 (PCC) + B4 (SCC)
	5 MHz B4 (PCC) + 10 MHzB2 (SCC)		5 MHzB2 (PCC) + 10 MHzB4 (SCC)
	15 MHz B4 (PCC) + 10 MHzB2 (SCC)		5 MHzB2 (PCC) + 10 MHzB4 (SCC)
	10 MHz B4 (PCC) + 5 MHzB2 (SCC)		10 MHzB2 (PCC) + 5 MHzB4 (SCC)
	10 MHz B4 (PCC) + 10 MHzB2 (SCC)		10 MHzB2 (PCC) + 10 MHzB4 (SCC)
LTE Carrier Aggregation Additional Information	This device does not support full CA features on 3GPP Release 10. It supports a maximum of 2 carriers in the downlink with a total maximum bandwidth of 10 Mhz of the spectrum. All uplink communications are identical to the Release 8 specifications. Uplink communications are done on the PCC. Due to Carrier Capability, only B4 Band2 (PCC) + Band4 (SCC) and Band4 (PCC) + Band2 (SCC) are supported. The following LTE Release 10 features are not supported: Relay, HetNet, Enhanced MIMO, eICI, WIFI Offloading, MDG, eMBMA, Cross-Carrier Scheduling, SC-FDMA		
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		

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]

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:

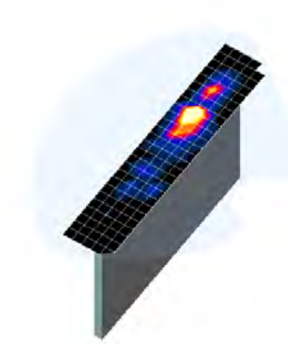


Figure 4-1
Sample SAR Area Scan

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

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].

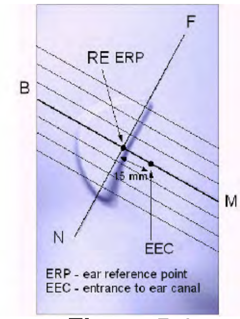


Figure 5-1
Close-Up Side view of ERP

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

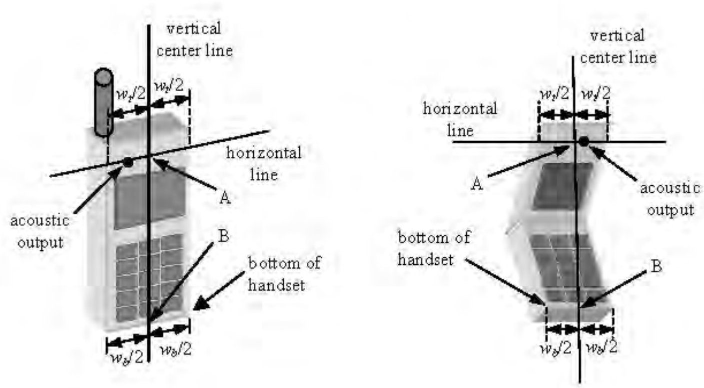


Figure 5-3
Handset Vertical Center & Horizontal Line Reference Points

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).

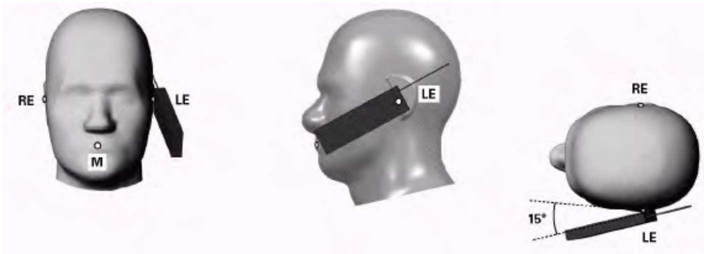


Figure 6-2 Front, Side and Top View of Ear/15º Tilt Position

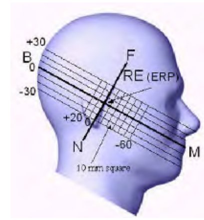


Figure 6-3
Side view w/ relevant markings

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

6.5 Body-Worn Accessory Configurations

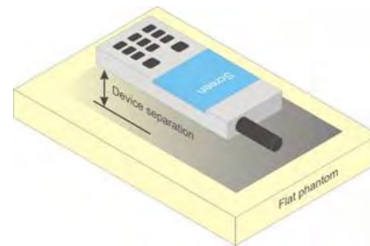


Figure 6-5
Sample Body-Worn Diagram

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.

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.

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.

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.

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.

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.

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.

8.3.6 SAR Measurement Conditions for DC-HSDPA

SAR test exclusion for DC-HSDPA devices is determined by power measurements according to the H-Set 12, Fixed Reference Channel (FRC) configuration in Table C.8.1.12 of 3GPP TS 34.121-1. A primary and a secondary serving HS-DSCH Cell are required to perform the power measurement and for the results to qualify for SAR test exclusion. DC-HSDPA uplink maximum output power measurements using the four Rel. 5 HSDPA subtests in Table C.10.1.4 of TS 234.121-1 is required.

When the maximum average output power of each RF channel with DC-HSDPA active is ≤ ¼ dB higher than that measured using 12.2 kbps RMC, or the maximum reported SAR for 12.2 kbps RMC is ≤ 75% of the SAR limit, SAR evaluation for DC-HSDPA is not required.

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.
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.

8.4.5 Carrier Aggregation

LTE Carrier Aggregation (CA) measurements were made in accordance to 3GPP TS 36.521-1 V10.4.0 (2012-12). The RRC connection is only handled by one cell, the Primary component carrier (PCC) for downlink and uplink communications. After making a data connection to the PCC, the UE device adds the Secondary component carrier (SCC) on the downlink only. All uplink communications and acknowledgements remain identical to release 8 specifications on the PCC. Additional output powers were measured using two carriers in the downlink for the release 8 configurations with the highest output power among all channels, RB configurations and bandwidths for each uplink band. Per FCC Guidance, no SAR measurements were required.

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.

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	32.87	33.10	31.40	**29.68**	28.05	27.60	27.35	26.55	25.54
	190	32.99	33.20	31.66	**29.66**	28.10	27.70	27.45	26.70	25.65
	251	32.95	33.19	31.70	**29.70**	28.15	27.68	27.60	26.69	25.66
GSM 1900	512	31.01	31.17	29.70	**27.60**	26.11	26.68	26.51	25.61	24.69
	661	30.99	31.16	29.60	**27.59**	26.13	26.57	26.60	25.60	24.70
	810	31.07	30.99	29.63	**27.59**	26.10	26.70	26.63	25.63	24.70

		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	23.84	24.07	25.38	**25.42**	25.04	18.57	21.33	22.29	22.53
	190	23.96	24.17	25.64	**25.40**	25.09	18.67	21.43	22.44	22.64
	251	23.92	24.16	25.68	**25.44**	25.14	18.65	21.58	22.43	22.65
GSM 1900	512	21.98	22.14	23.68	**23.34**	23.10	17.65	20.49	21.35	21.68
	661	21.96	22.13	23.58	**23.33**	23.12	17.54	20.58	21.34	21.69
	810	22.04	21.96	23.61	**23.33**	23.09	17.67	20.61	21.37	21.69
GSM 850	Frame Avg.Targets:	23.67	23.67	25.18	**24.94**	24.69	18.17	21.18	21.94	22.19
GSM 1900		21.67	21.67	23.18	**22.94**	22.69	17.17	20.18	20.94	21.19

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. 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: 12 (Max 4 Tx uplink slots)
EDGE Multislot class: 12 (Max 4 Tx uplink slots)
DTM Multislot Class: N/A

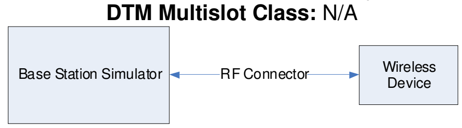


Figure 9-1
Power Measurement Setup

9.2 UMTS Conducted Powers

3GPP Release Version	Mode	3GPP 34.121 Subtest	Cellular Band [dBm]			AWS Band [dBm]			PCS Band [dBm]			3GPP MPR [dB]
			4132	4183	4233	1312	1412	1862	9262	9400	9538	
99	WCDMA	12.2 kbps RMC	23.31	23.38	23.31	24.37	24.30	24.34	23.15	23.19	23.26	-
99		12.2 kbps AMR	23.30	23.29	23.15	24.40	24.31	24.36	23.16	23.27	23.35	-
6	HSDPA	Subtest 1	23.30	23.28	23.18	24.39	24.31	24.30	23.22	23.25	23.38	0
6		Subtest 2	23.34	23.30	23.25	24.41	24.37	24.37	23.19	23.30	23.37	0
6		Subtest 3	22.85	22.82	22.71	23.90	23.77	23.81	22.75	22.83	22.79	0.5
6		Subtest 4	22.88	22.84	22.83	23.94	23.84	23.87	22.68	22.80	22.72	0.5
6	HSUPA	Subtest 1	23.04	23.02	23.17	23.36	23.40	23.72	22.31	22.55	22.96	0
6		Subtest 2	21.46	21.81	21.59	22.46	22.72	22.83	21.47	21.53	21.61	2
6		Subtest 3	22.28	21.95	22.07	23.35	23.18	22.94	22.03	21.90	21.89	1
6		Subtest 4	21.67	21.70	21.78	22.89	22.96	23.16	21.63	21.70	21.96	2
6		Subtest 5	22.61	22.76	22.94	23.56	23.91	24.00	22.63	23.00	22.89	0
8	DC-HSDPA	Subtest 1	22.92	23.26	23.48	24.21	24.18	24.36	23.12	23.25	23.23	0
8		Subtest 2	22.99	23.29	23.50	24.22	24.23	24.34	23.16	23.19	23.33	0
8		Subtest 3	22.55	22.80	23.06	23.67	23.66	23.81	22.76	22.75	22.84	0.5
8		Subtest 4	22.58	22.89	23.04	23.75	23.57	23.77	22.68	22.83	22.77	0.5

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.

DC-HSDPA considerations

- 3GPP Specification 34.121-1 Release 8 Ver 8.10.0 was used for DC-HSDPA guidance
- H-Set 12 (QPSK) was confirmed to be used during DC-HSDPA measurements
- Measured maximum output powers for DC-HSDPA were not greater than 1/4 dB higher than the WCDMA 12.2 kbps RMC maximum output, as a result, SAR is not required for DC-HSDPA
- The DUT supports UE category 24 for HSDPA

It is expected by the manufacturer that MPR for some HSUPA subtests may be up to 1 dB more than specified by 3GPP, but also as low as 0 dB according to the chipset implementation in this model.

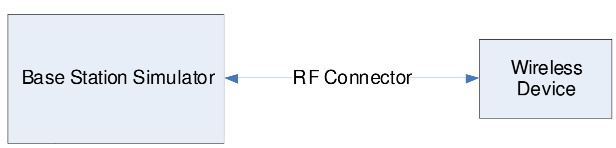


Figure 9-2
Power Measurement Setup

9.3 LTE Conducted Powers

9.3.1 LTE Band 17

Table 9-1
LTE Band 17 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	710.0	23790	10	QPSK	1	0	23.81	0	0
	710.0	23790	10	QPSK	1	25	23.91	0	0
	710.0	23790	10	QPSK	1	49	**23.92**	0	0
	710.0	23790	10	QPSK	25	0	22.70	0-1	1
	710.0	23790	10	QPSK	25	12	22.71	0-1	1
	710.0	23790	10	QPSK	25	25	**22.73**	0-1	1
	710.0	23790	10	QPSK	50	0	22.70	0-1	1
	710.0	23790	10	16QAM	1	0	22.20	0-1	1
	710.0	23790	10	16QAM	1	25	22.34	0-1	1
	710.0	23790	10	16QAM	1	49	22.39	0-1	1
	710.0	23790	10	16QAM	25	0	21.60	0-2	2
	710.0	23790	10	16QAM	25	12	21.61	0-2	2
	710.0	23790	10	16QAM	25	25	21.64	0-2	2
	710.0	23790	10	16QAM	50	0	21.65	0-2	2

Note: LTE Band 17 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.

Table 9-2
LTE Band 17 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]
Mid	710.0	23790	5	QPSK	1	0	23.90	0	0
	710.0	23790	5	QPSK	1	12	23.93	0	0
	710.0	23790	5	QPSK	1	24	24.03	0	0
	710.0	23790	5	QPSK	12	0	22.91	0-1	1
	710.0	23790	5	QPSK	12	6	22.71	0-1	1
	710.0	23790	5	QPSK	12	13	22.72	0-1	1
	710.0	23790	5	QPSK	25	0	22.73	0-1	1
	710.0	23790	5	16-QAM	1	0	22.24	0-1	1
	710.0	23790	5	16-QAM	1	12	22.33	0-1	1
	710.0	23790	5	16-QAM	1	24	22.39	0-1	1
	710.0	23790	5	16-QAM	12	0	21.57	0-2	2
	710.0	23790	5	16-QAM	12	6	21.55	0-2	2
	710.0	23790	5	16-QAM	12	13	21.56	0-2	2
	710.0	23790	5	16-QAM	25	0	21.50	0-2	2

Note: LTE Band 17 at 5 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.

9.3.2 LTE Band 4 (AWS)

Table 9-3
LTE Band 4 (AWS) 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]
Mid	1732.5	20175	20	QPSK	1	0	**24.13**	0	0
	1732.5	20175	20	QPSK	1	50	24.10	0	0
	1732.5	20175	20	QPSK	1	99	24.11	0	0
	1732.5	20175	20	QPSK	50	0	22.90	0-1	1
	1732.5	20175	20	QPSK	50	25	22.95	0-1	1
	1732.5	20175	20	QPSK	50	50	**22.97**	0-1	1
	1732.5	20175	20	QPSK	100	0	22.88	0-1	1
	1732.5	20175	20	16QAM	1	0	22.56	0-1	1
	1732.5	20175	20	16QAM	1	50	22.54	0-1	1
	1732.5	20175	20	16QAM	1	99	22.50	0-1	1
	1732.5	20175	20	16QAM	50	0	21.64	0-2	2
	1732.5	20175	20	16QAM	50	25	21.77	0-2	2
	1732.5	20175	20	16QAM	50	50	21.83	0-2	2
	1732.5	20175	20	16QAM	100	0	21.82	0-2	2

Note: LTE Band 4 (AWS) at 20 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.

Table 9-4
LTE Band 4 (AWS) 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	1717.5	20025	15	QPSK	1	0	24.18	0	0
	1717.5	20025	15	QPSK	1	36	24.08	0	0
	1717.5	20025	15	QPSK	1	74	24.10	0	0
	1717.5	20025	15	QPSK	36	0	22.89	0-1	1
	1717.5	20025	15	QPSK	36	18	22.86	0-1	1
	1717.5	20025	15	QPSK	36	37	22.83	0-1	1
	1717.5	20025	15	QPSK	75	0	22.89	0-1	1
	1717.5	20025	15	16QAM	1	0	22.58	0-1	1
	1717.5	20025	15	16QAM	1	36	22.51	0-1	1
	1717.5	20025	15	16QAM	1	74	22.50	0-1	1
	1717.5	20025	15	16QAM	36	0	21.70	0-2	2
	1717.5	20025	15	16QAM	36	18	21.75	0-2	2
	1717.5	20025	15	16QAM	36	37	21.76	0-2	2
	1717.5	20025	15	16QAM	75	0	21.77	0-2	2
Mid	1732.5	20175	15	QPSK	1	0	24.15	0	0
	1732.5	20175	15	QPSK	1	36	24.07	0	0
	1732.5	20175	15	QPSK	1	74	24.07	0	0
	1732.5	20175	15	QPSK	36	0	22.86	0-1	1
	1732.5	20175	15	QPSK	36	18	22.84	0-1	1
	1732.5	20175	15	QPSK	36	37	22.92	0-1	1
	1732.5	20175	15	QPSK	75	0	22.90	0-1	1
	1732.5	20175	15	16QAM	1	0	22.62	0-1	1
	1732.5	20175	15	16QAM	1	36	22.51	0-1	1
	1732.5	20175	15	16QAM	1	74	22.54	0-1	1
	1732.5	20175	15	16QAM	36	0	21.71	0-2	2
	1732.5	20175	15	16QAM	36	18	21.70	0-2	2
	1732.5	20175	15	16QAM	36	37	21.76	0-2	2
	1732.5	20175	15	16QAM	75	0	21.82	0-2	2
High	1747.5	20325	15	QPSK	1	0	24.17	0	0
	1747.5	20325	15	QPSK	1	36	24.14	0	0
	1747.5	20325	15	QPSK	1	74	24.15	0	0
	1747.5	20325	15	QPSK	36	0	22.90	0-1	1
	1747.5	20325	15	QPSK	36	18	22.95	0-1	1
	1747.5	20325	15	QPSK	36	37	22.91	0-1	1
	1747.5	20325	15	QPSK	75	0	22.91	0-1	1
	1747.5	20325	15	16QAM	1	0	22.61	0-1	1
	1747.5	20325	15	16QAM	1	36	22.52	0-1	1
	1747.5	20325	15	16QAM	1	74	22.57	0-1	1
	1747.5	20325	15	16QAM	36	0	21.75	0-2	2
	1747.5	20325	15	16QAM	36	18	21.77	0-2	2
	1747.5	20325	15	16QAM	36	37	21.75	0-2	2
	1747.5	20325	15	16QAM	75	0	21.80	0-2	2

Table 9-5
LTE Band 4 (AWS) 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	1715	20000	10	QPSK	1	0	24.18	0	0
	1715	20000	10	QPSK	1	25	23.98	0	0
	1715	20000	10	QPSK	1	49	24.30	0	0
	1715	20000	10	QPSK	25	0	22.79	0-1	1
	1715	20000	10	QPSK	25	12	22.86	0-1	1
	1715	20000	10	QPSK	25	25	23.03	0-1	1
	1715	20000	10	QPSK	50	0	23.09	0-1	1
	1715	20000	10	16QAM	1	0	22.68	0-1	1
	1715	20000	10	16QAM	1	25	22.61	0-1	1
	1715	20000	10	16QAM	1	49	22.51	0-1	1
	1715	20000	10	16QAM	25	0	21.80	0-2	2
	1715	20000	10	16QAM	25	12	21.95	0-2	2
	1715	20000	10	16QAM	25	25	21.96	0-2	2
	1715	20000	10	16QAM	50	0	21.67	0-2	2
Mid	1732.5	20175	10	QPSK	1	0	24.05	0	0
	1732.5	20175	10	QPSK	1	25	24.07	0	0
	1732.5	20175	10	QPSK	1	49	23.87	0	0
	1732.5	20175	10	QPSK	25	0	22.76	0-1	1
	1732.5	20175	10	QPSK	25	12	22.74	0-1	1
	1732.5	20175	10	QPSK	25	25	22.92	0-1	1
	1732.5	20175	10	QPSK	50	0	22.90	0-1	1
	1732.5	20175	10	16QAM	1	0	22.52	0-1	1
	1732.5	20175	10	16QAM	1	25	22.61	0-1	1
	1732.5	20175	10	16QAM	1	49	22.54	0-1	1
	1732.5	20175	10	16QAM	25	0	21.81	0-2	2
	1732.5	20175	10	16QAM	25	12	21.80	0-2	2
	1732.5	20175	10	16QAM	25	25	21.66	0-2	2
	1732.5	20175	10	16QAM	50	0	21.62	0-2	2
High	1750	20350	10	QPSK	1	0	24.27	0	0
	1750	20350	10	QPSK	1	25	24.14	0	0
	1750	20350	10	QPSK	1	49	24.05	0	0
	1750	20350	10	QPSK	25	0	22.80	0-1	1
	1750	20350	10	QPSK	25	12	23.05	0-1	1
	1750	20350	10	QPSK	25	25	22.71	0-1	1
	1750	20350	10	QPSK	50	0	22.91	0-1	1
	1750	20350	10	16QAM	1	0	22.71	0-1	1
	1750	20350	10	16QAM	1	25	22.62	0-1	1
	1750	20350	10	16QAM	1	49	22.57	0-1	1
	1750	20350	10	16QAM	25	0	21.55	0-2	2
	1750	20350	10	16QAM	25	12	21.97	0-2	2
	1750	20350	10	16QAM	25	25	21.65	0-2	2
	1750	20350	10	16QAM	50	0	21.60	0-2	2

Table 9-6
LTE Band 4 (AWS) 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	1712.5	19975	5	QPSK	1	0	24.08	0	0
	1712.5	19975	5	QPSK	1	12	24.08	0	0
	1712.5	19975	5	QPSK	1	24	24.10	0	0
	1712.5	19975	5	QPSK	12	0	22.99	0-1	1
	1712.5	19975	5	QPSK	12	6	23.06	0-1	1
	1712.5	19975	5	QPSK	12	13	23.13	0-1	1
	1712.5	19975	5	QPSK	25	0	22.89	0-1	1
	1712.5	19975	5	16-QAM	1	0	22.88	0-1	1
	1712.5	19975	5	16-QAM	1	12	22.71	0-1	1
	1712.5	19975	5	16-QAM	1	24	22.51	0-1	1
	1712.5	19975	5	16-QAM	12	0	21.80	0-2	2
	1712.5	19975	5	16-QAM	12	6	22.15	0-2	2
	1712.5	19975	5	16-QAM	12	13	22.16	0-2	2
	1712.5	19975	5	16-QAM	25	0	22.01	0-2	2
Mid	1732.5	20175	5	QPSK	1	0	24.25	0	0
	1732.5	20175	5	QPSK	1	12	24.17	0	0
	1732.5	20175	5	QPSK	1	24	23.87	0	0
	1732.5	20175	5	QPSK	12	0	22.76	0-1	1
	1732.5	20175	5	QPSK	12	6	22.94	0-1	1
	1732.5	20175	5	QPSK	12	13	22.72	0-1	1
	1732.5	20175	5	QPSK	25	0	22.90	0-1	1
	1732.5	20175	5	16-QAM	1	0	22.52	0-1	1
	1732.5	20175	5	16-QAM	1	12	22.55	0-1	1
	1732.5	20175	5	16-QAM	1	24	22.54	0-1	1
	1732.5	20175	5	16-QAM	12	0	21.71	0-2	2
	1732.5	20175	5	16-QAM	12	6	21.80	0-2	2
	1732.5	20175	5	16-QAM	12	13	21.56	0-2	2
	1732.5	20175	5	16-QAM	25	0	21.62	0-2	2
High	1752.5	20375	5	QPSK	1	0	24.47	0	0
	1752.5	20375	5	QPSK	1	12	24.24	0	0
	1752.5	20375	5	QPSK	1	24	24.05	0	0
	1752.5	20375	5	QPSK	12	0	22.90	0-1	1
	1752.5	20375	5	QPSK	12	6	22.95	0-1	1
	1752.5	20375	5	QPSK	12	13	22.81	0-1	1
	1752.5	20375	5	QPSK	25	0	23.01	0-1	1
	1752.5	20375	5	16-QAM	1	0	22.71	0-1	1
	1752.5	20375	5	16-QAM	1	12	22.62	0-1	1
	1752.5	20375	5	16-QAM	1	24	22.57	0-1	1
	1752.5	20375	5	16-QAM	12	0	21.65	0-2	2
	1752.5	20375	5	16-QAM	12	6	21.97	0-2	2
	1752.5	20375	5	16-QAM	12	13	21.85	0-2	2
	1752.5	20375	5	16-QAM	25	0	21.60	0-2	2

9.3.3 LTE Band 2 (PCS)

Table 9-7
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	**23.40**	0	0
	1860	18700	20	QPSK	1	50	23.28	0	0
	1860	18700	20	QPSK	1	99	23.36	0	0
	1860	18700	20	QPSK	50	0	22.09	0-1	1
	1860	18700	20	QPSK	50	25	22.06	0-1	1
	1860	18700	20	QPSK	50	50	**22.12**	0-1	1
	1860	18700	20	QPSK	100	0	22.11	0-1	1
	1860	18700	20	16QAM	1	0	21.72	0-1	1
	1860	18700	20	16QAM	1	50	21.70	0-1	1
	1860	18700	20	16QAM	1	99	21.76	0-1	1
	1860	18700	20	16QAM	50	0	20.93	0-2	2
	1860	18700	20	16QAM	50	25	20.90	0-2	2
	1860	18700	20	16QAM	50	50	21.00	0-2	2
	1860	18700	20	16QAM	100	0	21.03	0-2	2
Mid	1880.0	18900	20	QPSK	1	0	23.37	0	0
	1880.0	18900	20	QPSK	1	50	23.31	0	0
	1880.0	18900	20	QPSK	1	99	23.24	0	0
	1880.0	18900	20	QPSK	50	0	22.07	0-1	1
	1880.0	18900	20	QPSK	50	25	22.09	0-1	1
	1880.0	18900	20	QPSK	50	50	22.02	0-1	1
	1880.0	18900	20	QPSK	100	0	22.05	0-1	1
	1880.0	18900	20	16QAM	1	0	21.85	0-1	1
	1880.0	18900	20	16QAM	1	50	21.72	0-1	1
	1880.0	18900	20	16QAM	1	99	21.70	0-1	1
	1880.0	18900	20	16QAM	50	0	20.99	0-2	2
	1880.0	18900	20	16QAM	50	25	20.98	0-2	2
	1880.0	18900	20	16QAM	50	50	20.92	0-2	2
	1880.0	18900	20	16QAM	100	0	20.94	0-2	2
High	1900	19100	20	QPSK	1	0	23.27	0	0
	1900	19100	20	QPSK	1	50	23.38	0	0
	1900	19100	20	QPSK	1	99	23.36	0	0
	1900	19100	20	QPSK	50	0	22.03	0-1	1
	1900	19100	20	QPSK	50	25	22.09	0-1	1
	1900	19100	20	QPSK	50	50	22.01	0-1	1
	1900	19100	20	QPSK	100	0	22.07	0-1	1
	1900	19100	20	16QAM	1	0	21.72	0-1	1
	1900	19100	20	16QAM	1	50	21.75	0-1	1
	1900	19100	20	16QAM	1	99	21.76	0-1	1
	1900	19100	20	16QAM	50	0	20.91	0-2	2
	1900	19100	20	16QAM	50	25	21.04	0-2	2
	1900	19100	20	16QAM	50	50	20.90	0-2	2
	1900	19100	20	16QAM	100	0	21.03	0-2	2

Table 9-8
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	23.40	0	0
	1857.5	18675	15	QPSK	1	36	23.38	0	0
	1857.5	18675	15	QPSK	1	74	23.36	0	0
	1857.5	18675	15	QPSK	36	0	22.19	0-1	1
	1857.5	18675	15	QPSK	36	18	22.26	0-1	1
	1857.5	18675	15	QPSK	36	37	22.22	0-1	1
	1857.5	18675	15	QPSK	75	0	22.31	0-1	1
	1857.5	18675	15	16QAM	1	0	21.92	0-1	1
	1857.5	18675	15	16QAM	1	36	21.90	0-1	1
	1857.5	18675	15	16QAM	1	74	21.77	0-1	1
	1857.5	18675	15	16QAM	36	0	21.13	0-2	2
	1857.5	18675	15	16QAM	36	18	20.70	0-2	2
	1857.5	18675	15	16QAM	36	37	21.00	0-2	2
	1857.5	18675	15	16QAM	75	0	21.03	0-2	2
Mid	1880.0	18900	15	QPSK	1	0	23.57	0	0
	1880.0	18900	15	QPSK	1	36	23.21	0	0
	1880.0	18900	15	QPSK	1	74	23.04	0	0
	1880.0	18900	15	QPSK	36	0	21.87	0-1	1
	1880.0	18900	15	QPSK	36	18	21.89	0-1	1
	1880.0	18900	15	QPSK	36	37	22.22	0-1	1
	1880.0	18900	15	QPSK	75	0	22.15	0-1	1
	1880.0	18900	15	16QAM	1	0	21.85	0-1	1
	1880.0	18900	15	16QAM	1	36	21.82	0-1	1
	1880.0	18900	15	16QAM	1	74	21.80	0-1	1
	1880.0	18900	15	16QAM	36	0	20.99	0-2	2
	1880.0	18900	15	16QAM	36	18	20.88	0-2	2
	1880.0	18900	15	16QAM	36	37	20.72	0-2	2
	1880.0	18900	15	16QAM	75	0	20.94	0-2	2
High	1902.5	19125	15	QPSK	1	0	23.27	0	0
	1902.5	19125	15	QPSK	1	36	23.28	0	0
	1902.5	19125	15	QPSK	1	74	23.46	0	0
	1902.5	19125	15	QPSK	36	0	22.03	0-1	1
	1902.5	19125	15	QPSK	36	18	22.29	0-1	1
	1902.5	19125	15	QPSK	36	37	22.01	0-1	1
	1902.5	19125	15	QPSK	75	0	21.97	0-1	1
	1902.5	19125	15	16QAM	1	0	21.82	0-1	1
	1902.5	19125	15	16QAM	1	36	21.72	0-1	1
	1902.5	19125	15	16QAM	1	74	21.86	0-1	1
	1902.5	19125	15	16QAM	36	0	20.71	0-2	2
	1902.5	19125	15	16QAM	36	18	20.84	0-2	2
	1902.5	19125	15	16QAM	36	37	21.00	0-2	2
	1902.5	19125	15	16QAM	75	0	20.93	0-2	2

Table 9-9
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	23.50	0	0
	1855	18650	10	QPSK	1	25	23.48	0	0
	1855	18650	10	QPSK	1	49	23.56	0	0
	1855	18650	10	QPSK	25	0	21.99	0-1	1
	1855	18650	10	QPSK	25	12	22.26	0-1	1
	1855	18650	10	QPSK	25	25	22.12	0-1	1
	1855	18650	10	QPSK	50	0	22.11	0-1	1
	1855	18650	10	16QAM	1	0	22.02	0-1	1
	1855	18650	10	16QAM	1	25	22.00	0-1	1
	1855	18650	10	16QAM	1	49	21.79	0-1	1
	1855	18650	10	16QAM	25	0	21.13	0-2	2
	1855	18650	10	16QAM	25	12	20.70	0-2	2
	1855	18650	10	16QAM	25	25	21.20	0-2	2
	1855	18650	10	16QAM	50	0	21.03	0-2	2
Mid	1880.0	18900	10	QPSK	1	0	23.57	0	0
	1880.0	18900	10	QPSK	1	25	23.21	0	0
	1880.0	18900	10	QPSK	1	49	23.04	0	0
	1880.0	18900	10	QPSK	25	0	21.77	0-1	1
	1880.0	18900	10	QPSK	25	12	22.09	0-1	1
	1880.0	18900	10	QPSK	25	25	22.12	0-1	1
	1880.0	18900	10	QPSK	50	0	22.05	0-1	1
	1880.0	18900	10	16QAM	1	0	21.75	0-1	1
	1880.0	18900	10	16QAM	1	25	21.92	0-1	1
	1880.0	18900	10	16QAM	1	49	21.90	0-1	1
	1880.0	18900	10	16QAM	25	0	21.19	0-2	2
	1880.0	18900	10	16QAM	25	12	20.78	0-2	2
	1880.0	18900	10	16QAM	25	25	20.82	0-2	2
	1880.0	18900	10	16QAM	50	0	20.94	0-2	2
High	1905	19150	10	QPSK	1	0	23.07	0	0
	1905	19150	10	QPSK	1	25	23.48	0	0
	1905	19150	10	QPSK	1	49	23.26	0	0
	1905	19150	10	QPSK	25	0	21.93	0-1	1
	1905	19150	10	QPSK	25	12	22.29	0-1	1
	1905	19150	10	QPSK	25	25	22.11	0-1	1
	1905	19150	10	QPSK	50	0	22.17	0-1	1
	1905	19150	10	16QAM	1	0	21.72	0-1	1
	1905	19150	10	16QAM	1	25	21.79	0-1	1
	1905	19150	10	16QAM	1	49	21.74	0-1	1
	1905	19150	10	16QAM	25	0	20.78	0-2	2
	1905	19150	10	16QAM	25	12	21.04	0-2	2
	1905	19150	10	16QAM	25	25	21.00	0-2	2
	1905	19150	10	16QAM	50	0	21.13	0-2	2

Table 9-10
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	23.60	0	0
	1852.5	18625	5	QPSK	1	12	23.48	0	0
	1852.5	18625	5	QPSK	1	24	23.26	0	0
	1852.5	18625	5	QPSK	12	0	21.89	0-1	1
	1852.5	18625	5	QPSK	12	6	22.06	0-1	1
	1852.5	18625	5	QPSK	12	13	21.92	0-1	1
	1852.5	18625	5	QPSK	25	0	22.11	0-1	1
	1852.5	18625	5	16-QAM	1	0	21.82	0-1	1
	1852.5	18625	5	16-QAM	1	12	22.10	0-1	1
	1852.5	18625	5	16-QAM	1	24	21.79	0-1	1
	1852.5	18625	5	16-QAM	12	0	21.23	0-2	2
	1852.5	18625	5	16-QAM	12	6	20.70	0-2	2
	1852.5	18625	5	16-QAM	12	13	21.00	0-2	2
	1852.5	18625	5	16-QAM	25	0	20.83	0-2	2
Mid	1880.0	18900	5	QPSK	1	0	23.57	0	0
	1880.0	18900	5	QPSK	1	12	23.01	0	0
	1880.0	18900	5	QPSK	1	24	23.14	0	0
	1880.0	18900	5	QPSK	12	0	21.77	0-1	1
	1880.0	18900	5	QPSK	12	6	22.19	0-1	1
	1880.0	18900	5	QPSK	12	13	21.92	0-1	1
	1880.0	18900	5	QPSK	25	0	22.05	0-1	1
	1880.0	18900	5	16-QAM	1	0	21.75	0-1	1
	1880.0	18900	5	16-QAM	1	12	21.82	0-1	1
	1880.0	18900	5	16-QAM	1	24	21.80	0-1	1
	1880.0	18900	5	16-QAM	12	0	21.29	0-2	2
	1880.0	18900	5	16-QAM	12	6	20.77	0-2	2
	1880.0	18900	5	16-QAM	12	13	21.02	0-2	2
	1880.0	18900	5	16-QAM	25	0	20.74	0-2	2
High	1907.5	19175	5	QPSK	1	0	23.27	0	0
	1907.5	19175	5	QPSK	1	12	23.28	0	0
	1907.5	19175	5	QPSK	1	24	23.06	0	0
	1907.5	19175	5	QPSK	12	0	21.83	0-1	1
	1907.5	19175	5	QPSK	12	6	22.29	0-1	1
	1907.5	19175	5	QPSK	12	13	22.21	0-1	1
	1907.5	19175	5	QPSK	25	0	22.07	0-1	1
	1907.5	19175	5	16-QAM	1	0	21.72	0-1	1
	1907.5	19175	5	16-QAM	1	12	21.75	0-1	1
	1907.5	19175	5	16-QAM	1	24	21.76	0-1	1
	1907.5	19175	5	16-QAM	12	0	20.71	0-2	2
	1907.5	19175	5	16-QAM	12	6	21.24	0-2	2
	1907.5	19175	5	16-QAM	12	13	21.00	0-2	2
	1907.5	19175	5	16-QAM	25	0	21.13	0-2	2

9.3.4 LTE Band 7

Table 9-11
LTE Band 7 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	2505	20800	10	QPSK	1	0	23.24	0	0
	2505	20800	10	QPSK	1	25	23.30	0	0
	2505	20800	10	QPSK	1	49	23.38	0	0
	2505	20800	10	QPSK	25	0	22.00	0-1	1
	2505	20800	10	QPSK	25	12	22.02	0-1	1
	2505	20800	10	QPSK	25	25	22.14	0-1	1
	2505	20800	10	QPSK	50	0	22.10	0-1	1
	2505	20800	10	16QAM	1	0	21.90	0-1	1
	2505	20800	10	16QAM	1	25	21.82	0-1	1
	2505	20800	10	16QAM	1	49	21.88	0-1	1
	2505	20800	10	16QAM	25	0	20.91	0-2	2
	2505	20800	10	16QAM	25	12	20.95	0-2	2
	2505	20800	10	16QAM	25	25	21.05	0-2	2
	2505	20800	10	16QAM	50	0	20.95	0-2	2
Mid	2535.0	21100	10	QPSK	1	0	23.44	0	0
	2535.0	21100	10	QPSK	1	25	23.45	0	0
	2535.0	21100	10	QPSK	1	49	23.40	0	0
	2535.0	21100	10	QPSK	25	0	21.97	0-1	1
	2535.0	21100	10	QPSK	25	12	21.99	0-1	1
	2535.0	21100	10	QPSK	25	25	22.12	0-1	1
	2535.0	21100	10	QPSK	50	0	21.94	0-1	1
	2535.0	21100	10	16QAM	1	0	21.96	0-1	1
	2535.0	21100	10	16QAM	1	25	21.92	0-1	1
	2535.0	21100	10	16QAM	1	49	21.87	0-1	1
	2535.0	21100	10	16QAM	25	0	21.09	0-2	2
	2535.0	21100	10	16QAM	25	12	21.06	0-2	2
	2535.0	21100	10	16QAM	25	25	21.00	0-2	2
	2535.0	21100	10	16QAM	50	0	20.94	0-2	2
High	2565	21400	10	QPSK	1	0	23.43	0	0
	2565	21400	10	QPSK	1	25	23.45	0	0
	2565	21400	10	QPSK	1	49	**23.58**	0	0
	2565	21400	10	QPSK	25	0	22.13	0-1	1
	2565	21400	10	QPSK	25	12	22.10	0-1	1
	2565	21400	10	QPSK	25	25	**22.16**	0-1	1
	2565	21400	10	QPSK	50	0	22.06	0-1	1
	2565	21400	10	16QAM	1	0	22.01	0-1	1
	2565	21400	10	16QAM	1	25	21.97	0-1	1
	2565	21400	10	16QAM	1	49	21.96	0-1	1
	2565	21400	10	16QAM	25	0	21.01	0-2	2
	2565	21400	10	16QAM	25	12	21.03	0-2	2
	2565	21400	10	16QAM	25	25	21.05	0-2	2
	2565	21400	10	16QAM	50	0	21.02	0-2	2

Table 9-12
LTE Band 7 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	2502.5	20775	5	QPSK	1	0	23.22	0	0
	2502.5	20775	5	QPSK	1	12	23.21	0	0
	2502.5	20775	5	QPSK	1	24	23.36	0	0
	2502.5	20775	5	QPSK	12	0	22.00	0-1	1
	2502.5	20775	5	QPSK	12	6	22.02	0-1	1
	2502.5	20775	5	QPSK	12	13	22.13	0-1	1
	2502.5	20775	5	QPSK	25	0	22.08	0-1	1
	2502.5	20775	5	16-QAM	1	0	21.88	0-1	1
	2502.5	20775	5	16-QAM	1	12	21.85	0-1	1
	2502.5	20775	5	16-QAM	1	24	21.86	0-1	1
	2502.5	20775	5	16-QAM	12	0	20.89	0-2	2
	2502.5	20775	5	16-QAM	12	6	20.94	0-2	2
	2502.5	20775	5	16-QAM	12	13	21.03	0-2	2
	2502.5	20775	5	16-QAM	25	0	20.94	0-2	2
Mid	2535.0	21100	5	QPSK	1	0	23.36	0	0
	2535.0	21100	5	QPSK	1	12	23.43	0	0
	2535.0	21100	5	QPSK	1	24	23.35	0	0
	2535.0	21100	5	QPSK	12	0	21.93	0-1	1
	2535.0	21100	5	QPSK	12	6	21.97	0-1	1
	2535.0	21100	5	QPSK	12	13	21.98	0-1	1
	2535.0	21100	5	QPSK	25	0	21.92	0-1	1
	2535.0	21100	5	16-QAM	1	0	21.94	0-1	1
	2535.0	21100	5	16-QAM	1	12	21.92	0-1	1
	2535.0	21100	5	16-QAM	1	24	21.85	0-1	1
	2535.0	21100	5	16-QAM	12	0	21.07	0-2	2
	2535.0	21100	5	16-QAM	12	6	21.04	0-2	2
	2535.0	21100	5	16-QAM	12	13	20.93	0-2	2
	2535.0	21100	5	16-QAM	25	0	20.92	0-2	2
High	2567.5	21425	5	QPSK	1	0	23.41	0	0
	2567.5	21425	5	QPSK	1	12	23.45	0	0
	2567.5	21425	5	QPSK	1	24	23.55	0	0
	2567.5	21425	5	QPSK	12	0	22.11	0-1	1
	2567.5	21425	5	QPSK	12	6	22.08	0-1	1
	2567.5	21425	5	QPSK	12	13	22.14	0-1	1
	2567.5	21425	5	QPSK	25	0	22.04	0-1	1
	2567.5	21425	5	16-QAM	1	0	21.81	0-1	1
	2567.5	21425	5	16-QAM	1	12	21.95	0-1	1
	2567.5	21425	5	16-QAM	1	24	21.94	0-1	1
	2567.5	21425	5	16-QAM	12	0	20.99	0-2	2
	2567.5	21425	5	16-QAM	12	6	21.01	0-2	2
	2567.5	21425	5	16-QAM	12	13	21.03	0-2	2
	2567.5	21425	5	16-QAM	25	0	21.00	0-2	2

9.4 LTE Carrier Aggregation Conducted Powers

Table 9-13
LTE Carrier Aggregation Conducted Powers - Band 2 (PCC) + Band 4 (SCC) 10 MHz BW

Band 2 (PCC) + Band 4 (SCC), 10 MHz					
PCC MID	1880 MHz / ch.18900 + 2132.5 MHz / ch.2175	PCC UL# RB	PCC UL RB Offset	Rel 8 Tx. Power (dBm)	Rel 10 Tx. Power (dBm)
		1	0	23.4	23.26

Table 9-14
LTE Carrier Aggregation Conducted Powers - Band 4 (PCC) + Band 2 (SCC) 10 MHz BW

Band 4 (PCC) + Band 2 (SCC), 10MHz					
PCC LOW	1715 MHz / ch. 20000 + 1960.0 MHz /ch.900	PCC UL# RB	PCC UL RB Offset	Rel 8 Tx. Power (dBm)	Rel 10 Tx. Power (dBm)
		1	49	24.13	24.22

Notes:

1. The device does not support all Rel. 10 Carrier Aggregation features due to modem chipset limitation.
2. The device only supports downlink Carrier Aggregation. Uplink Carrier Aggregation is not supported. Power measurements were performed with two DL carriers for the Release 8 configuration that had the highest output power (across all bandwidths, channels and RB Configurations) for each band
3. This device only supports inter-band CA with 2 carriers (B2+B4, B4+B2) with a maximum of 10 MHz of spectrum.
4. All control and acknowledge data is sent on uplink channels that operate identical to release 8 specifications.

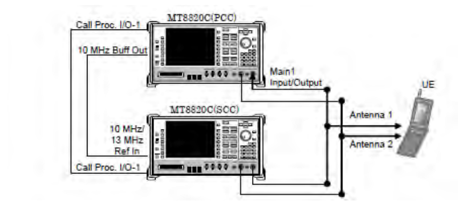


Figure 9-3
Power Measurement Setup

9.5 WLAN Conducted Powers

Table 9-15
IEEE 802.11b Average RF Power

Mode	Freq	Channel	802.11b (2.4 GHz) Conducted Power [dBm]			
			Data Rate [Mbps]			
	[MHz]		1	2	5.5	11
802.11b	2412	1*	**16.76**	16.87	16.96	16.98
802.11b	2437	6*	16.36	16.78	16.74	16.84
802.11b	2462	11*	15.74	15.88	16.01	16.02

Table 9-16
IEEE 802.11g Average RF Power

Mode	Freq	Channel	802.11g (2.4 GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
	[MHz]		6	9	12	18	24	36	48	54
802.11g	2412	1	12.57	12.58	12.55	12.46	12.74	12.51	12.81	12.32
802.11g	2437	6	12.73	12.79	12.77	12.78	12.99	12.94	13.06	12.84
802.11g	2462	11	11.84	11.83	11.81	11.71	12.01	11.92	12.16	11.84

Table 9-17
IEEE 802.11n Average RF Power

Mode	Freq	Channel	802.11n (2.4 GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
	[MHz]		6.5	13	20	26	39	52	58	65
802.11n	2412	1	11.13	11.21	11.18	11.39	11.36	11.45	11.37	11.33
802.11n	2437	6	11.52	11.46	11.56	11.67	11.76	11.68	11.65	11.77
802.11n	2462	11	11.66	11.68	11.37	11.77	11.73	11.84	11.78	11.87

Table 9-18
IEEE 802.11ac Average RF Power

802.11ac (2.4GHz) Conducted Power [dBm]			
Mode	**Freq [MHz]**	**Channel**	**Data Rate**
			6.5 Mbps
802.11ac	2412	1	9.26
802.11ac	2437	6	9.48
802.11ac	2462	11	9.62

Table 9-19
IEEE 802.11a Average RF Power

Mode	Freq	Channel	802.11a (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
	[MHz]		6	9	12	18	24	36	48	54
802.11a	5180	36*	11.33	11.32	11.30	11.28	11.31	11.42	11.35	11.29
802.11a	5200	40	11.35	11.27	11.37	11.20	11.52	11.37	11.61	11.29
802.11a	5220	44	11.31	11.32	11.23	11.27	11.54	11.44	11.35	11.50
802.11a	5240	48*	**11.38**	11.34	11.29	11.28	11.51	11.36	11.36	11.44
802.11a	5260	52*	10.51	10.38	10.33	10.31	10.64	10.61	10.76	10.60
802.11a	5280	56	10.53	10.54	10.70	10.59	10.82	10.82	10.91	10.63
802.11a	5300	60	10.61	10.59	10.64	10.57	10.84	10.71	10.64	10.68
802.11a	5320	64*	**10.74**	10.64	10.71	10.60	10.93	10.85	10.51	10.82
802.11a	5500	100	11.69	11.60	11.57	11.49	11.83	11.70	12.00	11.67
802.11a	5520	104*	11.73	11.60	11.64	11.53	11.90	11.88	12.01	11.76
802.11a	5540	108	**11.79**	11.72	11.76	11.72	11.89	11.78	12.02	11.76
802.11a	5560	112	11.65	11.70	11.66	11.66	11.89	11.80	11.63	11.77
802.11a	5580	116*	11.66	11.58	11.55	11.52	11.80	11.73	11.98	11.63
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	11.68	11.53	11.62	11.48	11.91	11.78	12.00	11.68
802.11a	5680	136*	11.67	11.72	11.62	11.56	11.95	11.87	11.98	11.67
802.11a	5700	140	11.59	11.57	11.47	11.50	11.73	11.63	11.87	11.66
802.11a	5720	144	11.70	11.52	11.54	11.55	11.68	11.53	11.82	11.67
802.11a	5745	149*	11.63	11.56	11.60	11.63	11.86	11.73	11.96	11.62
802.11a	5765	153	**11.73**	11.73	11.68	11.68	11.59	11.93	11.75	11.73
802.11a	5785	157*	11.61	11.57	11.52	11.46	11.80	11.59	11.95	11.63
802.11a	5805	161	11.56	11.60	11.66	11.57	11.88	11.81	11.60	11.75
802.11a	5825	165*	11.43	11.42	11.35	11.42	11.74	11.53	11.85	11.51

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.

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

Mode	Freq	Channel	20MHz BW 802.11n (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
	[MHz]		6.5	13	19.5	26	39	52	58.5	65
802.11n	5180	36	10.06	9.96	10.05	10.25	10.32	10.28	10.36	10.35
802.11n	5200	40	10.09	10.12	10.07	10.46	10.33	10.46	10.52	10.37
802.11n	5220	44	10.07	10.12	10.13	10.44	10.51	10.51	10.31	10.56
802.11n	5240	48	10.13	10.20	10.09	10.61	10.61	10.55	10.58	10.47
802.11n	5260	52	9.40	9.50	9.54	9.90	9.85	9.92	9.82	9.87
802.11n	5280	56	9.36	9.41	9.54	9.66	9.73	9.71	9.65	9.79
802.11n	5300	60	9.39	9.37	9.29	9.71	9.76	9.72	9.68	9.62
802.11n	5320	64	9.42	9.59	9.43	9.87	9.89	9.80	9.84	9.84
802.11n	5500	100	10.51	10.66	10.62	10.91	10.92	10.98	10.99	10.89
802.11n	5520	104	10.48	10.63	10.52	10.90	10.84	10.79	10.74	10.89
802.11n	5540	108	10.42	10.37	10.32	10.77	10.78	10.71	10.77	10.66
802.11n	5560	112	10.44	10.52	10.54	10.89	10.98	10.92	10.89	10.88
802.11n	5580	116	10.51	10.52	10.47	10.89	10.89	10.87	10.82	10.87
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	10.38	10.36	10.39	10.74	10.90	10.86	10.73	10.78
802.11n	5680	136	10.45	10.40	10.53	10.87	10.82	10.77	10.80	10.83
802.11n	5700	140	10.54	10.67	10.50	10.89	11.07	11.00	10.96	11.05
802.11a	5720	144	10.51	10.68	10.71	10.76	10.75	10.83	10.89	10.82
802.11n	5745	149	10.42	10.42	10.42	10.98	10.84	10.70	10.80	10.80
802.11n	5765	153	10.31	10.48	10.40	10.75	10.76	10.83	10.67	10.66
802.11n	5785	157	10.41	10.43	10.33	10.74	10.84	10.85	10.65	10.80
802.11n	5805	161	10.35	10.46	10.50	10.82	10.62	10.73	10.64	10.71
802.11n	5825	165	10.29	10.35	10.23	10.68	10.50	10.53	10.56	10.65

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 9-21
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	9.95	10.06	9.93	10.06	10.02	10.05	9.92	10.06
802.11n	5230	46	10.95	10.74	10.77	10.85	10.93	10.89	10.95	10.86
802.11n	5270	54	10.82	10.69	10.77	10.97	10.91	10.93	10.78	10.87
802.11n	5310	62	10.97	10.83	10.77	10.97	10.96	10.98	10.96	10.96
802.11n	5510	102	10.41	10.43	10.38	10.65	10.63	10.61	10.68	10.54
802.11n	5550	110	11.24	11.18	11.11	11.40	11.35	11.35	11.34	11.25
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	11.34	11.37	11.30	11.57	11.55	11.52	11.49	11.43
802.11n	5710	142	11.36	11.34	11.43	11.70	11.53	11.71	11.56	11.65
802.11n	5755	151	11.02	10.99	11.09	11.19	11.27	11.18	11.22	11.18
802.11n	5795	159	10.85	10.77	10.85	11.12	11.00	11.10	11.11	10.96

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 9-22
IEEE 802.11ac Average RF Power – 80 MHz Bandwidth

Mode	Freq	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	**8.28**	8.08	8.06	8.48	8.51	8.40	8.49	8.45	8.50	8.50
802.11ac	5290	58	**9.22**	8.94	8.96	9.26	9.44	9.36	9.40	9.25	9.45	9.28
802.11ac	5530	106	**9.13**	9.01	9.03	9.25	9.21	9.37	9.33	9.28	9.28	9.22
802.11ac	5690	138	**9.01**	9.02	9.00	9.21	9.23	9.28	9.26	9.22	9.26	9.28
802.11ac	5775	155	**9.57**	9.36	9.25	9.76	9.70	9.68	9.72	9.73	9.67	9.66

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

- For 2.4 GHz, highest average RF output power channel for the lowest data rate for IEEE 802.11b were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11g/n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode.
- For 5 GHz, highest average RF output power channel for the lowest data rate for IEEE 802.11a were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11n) 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.
- Full SAR tests for all IEEE 802.11ac configurations were not required because the average output power was not more than 0.25 dB higher than IEEE 802.11a mode. IEEE 802.11ac was evaluated for the highest IEEE 802.11a position in each 5 GHz band and exposure condition.
- 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.

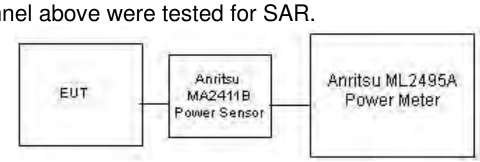


Figure 9-4
Power Measurement Setup for Bandwidths < 50 MHz

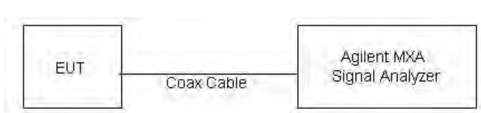


Figure 9-5
Power Measurement Setup for Bandwidths > 50 MHz

10 SYSTEM VERIFICATION

10.1 Head Tissue Verification

Table 10-1
Measured Head 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
4/16/2014	750H	23.0	680	0.860	42.594	0.888	42.305	-3.15%	0.68%
			695	0.871	42.333	0.889	42.227	-2.02%	0.25%
			710	0.884	42.247	0.890	42.149	-0.67%	0.23%
			725	0.901	42.170	0.891	42.071	1.12%	0.24%
			740	0.915	41.995	0.893	41.994	2.46%	0.00%
			755	0.927	41.845	0.894	41.916	3.69%	-0.17%
4/17/2014	835H	23.2	820	0.894	40.846	0.899	41.578	-0.56%	-1.76%
			835	0.906	40.624	0.900	41.500	0.67%	-2.11%
			850	0.920	40.469	0.916	41.500	0.44%	-2.48%
4/15/2014	1750H	21.1	1710	1.378	39.701	1.348	40.142	2.23%	-1.10%
			1750	1.413	39.525	1.371	40.079	3.06%	-1.38%
			1790	1.456	39.386	1.394	40.016	4.45%	-1.57%
4/8/2014	1900H	23.4	1850	1.349	41.533	1.400	40.000	-3.64%	3.83%
			1880	1.382	41.430	1.400	40.000	-1.29%	3.58%
			1910	1.411	41.316	1.400	40.000	0.79%	3.29%
4/10/2014	2450H	23.5	2401	1.701	38.388	1.756	39.287	-3.13%	-2.29%
			2450	1.756	38.206	1.800	39.200	-2.44%	-2.54%
			2499	1.808	38.046	1.853	39.138	-2.43%	-2.79%
4/8/2014	2600H	23.5	2500	1.809	38.056	1.855	39.136	-2.48%	-2.76%
			2550	1.867	37.862	1.909	39.073	-2.20%	-3.10%
			2600	1.921	37.696	1.964	39.009	-2.19%	-3.37%
4/8/2014	5200H-5800H	22.5	5200	4.529	36.808	4.655	35.986	-2.71%	2.28%
			5220	4.563	36.728	4.676	35.963	-2.42%	2.13%
			5240	4.557	36.727	4.696	35.940	-2.96%	2.19%
			5280	4.606	36.629	4.737	35.894	-2.77%	2.05%
			5300	4.621	36.611	4.758	35.871	-2.88%	2.06%
			5320	4.656	36.562	4.778	35.849	-2.55%	1.99%
			5500	4.869	36.261	4.963	35.643	-1.89%	1.73%
			5520	4.894	36.225	4.983	35.620	-1.79%	1.70%
			5540	4.915	36.192	5.004	35.597	-1.78%	1.67%
			5580	4.972	36.123	5.045	35.551	-1.45%	1.61%
			5765	5.189	35.902	5.234	35.340	-0.86%	1.59%
			5785	5.209	35.886	5.255	35.317	-0.88%	1.61%
			5800	5.216	35.886	5.270	35.300	-1.02%	1.66%

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.

10.2 Body Tissue Verification

Table 10-2
Measured Body 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
4/8/2014	740B	22.7	680	0.921	56.559	0.958	55.804	-3.86%	1.35%
			695	0.934	56.389	0.959	55.745	-2.61%	1.16%
			710	0.949	56.254	0.960	55.687	-1.15%	1.02%
			725	0.964	56.102	0.961	55.629	0.31%	0.85%
			740	0.977	55.948	0.963	55.570	1.45%	0.68%
			755	0.992	55.804	0.964	55.512	2.90%	0.53%
4/14/2014	835B	22.2	820	0.985	53.948	0.969	55.258	1.65%	-2.37%
			835	0.999	53.799	0.970	55.200	2.99%	-2.54%
			850	1.013	53.647	0.988	55.154	2.53%	-2.73%
4/17/2014	1750B	20.1	1710	1.490	51.025	1.463	53.537	1.85%	-4.69%
			1750	1.529	50.952	1.488	53.432	2.76%	-4.64%
			1790	1.565	50.819	1.514	53.326	3.37%	-4.70%
4/8/2014	1900B	22.8	1850	1.519	53.148	1.520	53.300	-0.07%	-0.29%
			1880	1.549	53.054	1.520	53.300	1.91%	-0.46%
			1910	1.578	52.949	1.520	53.300	3.82%	-0.66%
4/11/2014	1900B	24.2	1850	1.463	52.325	1.520	53.300	-3.75%	-1.83%
			1880	1.494	52.229	1.520	53.300	-1.71%	-2.01%
			1910	1.529	52.125	1.520	53.300	0.59%	-2.20%
4/7/2014	2450B	21.7	2401	1.945	51.500	1.903	52.765	2.21%	-2.40%
			2450	2.000	51.276	1.950	52.700	2.56%	-2.70%
			2499	2.040	51.096	2.019	52.638	1.04%	-2.93%
4/10/2014	2600B	24.3	2500	2.087	51.639	2.021	52.636	3.27%	-1.89%
			2550	2.155	51.432	2.092	52.573	3.01%	-2.17%
			2600	2.222	51.269	2.163	52.509	2.73%	-2.36%
04/09/2014	5200B-5800B	23.7	5200	5.462	46.941	5.299	49.014	3.08%	-4.23%
			5220	5.482	46.917	5.323	48.987	2.99%	-4.23%
			5240	5.489	46.842	5.346	48.960	2.67%	-4.33%
			5280	5.552	46.771	5.393	48.906	2.95%	-4.37%
			5300	5.586	46.756	5.416	48.879	3.14%	-4.34%
			5320	5.606	46.678	5.439	48.851	3.07%	-4.45%
			5500	5.845	46.348	5.650	48.607	3.45%	-4.65%
			5520	5.868	46.309	5.673	48.580	3.44%	-4.67%
			5540	5.897	46.253	5.696	48.553	3.53%	-4.74%
			5580	5.963	46.171	5.743	48.499	3.83%	-4.80%
			5765	6.207	45.896	5.959	48.248	4.16%	-4.87%
			5785	6.233	45.880	5.982	48.220	4.20%	-4.85%
			5800	6.257	45.808	6.000	48.200	4.28%	-4.96%

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.

10.3 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 10-3
System Verification Results

System Verification TARGET & MEASURED											
SAR System #	Tissue Frequency (MHz)	Tissue Type	Date:	Amb. Temp (℃)	Liquid Temp (℃)	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$_{1g}$ (%)
G	750	HEAD	04/16/2014	24.1	23.2	0.100	1003	3258	0.813	8.370	8.130	-2.87%
E	835	HEAD	04/17/2014	24.5	23.5	0.100	4d132	3914	0.976	9.200	9.760	6.09%
C	1750	HEAD	04/15/2014	23.9	21.1	0.100	1008	3263	3.640	36.800	36.400	-1.09%
G	1900	HEAD	04/08/2014	24.2	22.2	0.100	5d149	3258	4.040	40.400	40.400	0.00%
K	2450	HEAD	04/08/2014	24.5	23.4	0.040	797	3333	1.970	51.800	49.250	-4.92%
K	2600	HEAD	04/08/2014	24.5	23.2	0.040	1071	3333	2.280	56.600	57.000	0.71%
A	5200	HEAD	04/08/2014	23.8	22.3	0.100	1007	3920	7.690	77.500	76.900	-0.77%
A	5300	HEAD	04/08/2014	23.8	22.3	0.100	1007	3920	7.840	80.200	78.400	-2.24%
A	5500	HEAD	04/08/2014	23.8	22.3	0.100	1007	3920	8.160	81.400	81.600	0.25%
A	5800	HEAD	04/08/2014	23.8	22.3	0.100	1007	3920	7.710	77.500	77.100	-0.52%
K	750	BODY	04/08/2014	24.1	22.7	0.100	1003	3333	0.840	8.770	8.400	-4.22%
D	835	BODY	04/14/2014	23.0	22.1	0.100	4d132	3022	0.979	9.310	9.790	5.16%
C	1750	BODY	04/17/2014	22.0	20.1	0.100	1008	3263	3.920	38.200	39.200	2.62%
H	1900	BODY	04/08/2014	22.6	22.8	0.100	5d149	3589	4.190	40.500	41.900	3.46%
E	1900	BODY	04/11/2014	24.5	24.3	0.100	5d149	3914	4.060	40.500	40.600	0.25%
C	2450	BODY	04/07/2014	23.3	21.7	0.100	719	3263	5.150	51.700	51.500	-0.39%
G	2600	BODY	04/10/2014	24.4	23.4	0.100	1071	3258	5.270	55.700	52.700	-5.39%
A	5200	BODY	04/09/2014	23.5	23.7	0.100	1007	3920	7.040	72.600	70.400	-3.03%
A	5300	BODY	04/09/2014	23.5	23.7	0.100	1007	3920	7.410	74.700	74.100	-0.80%
A	5500	BODY	04/09/2014	23.4	23.6	0.100	1007	3920	8.040	75.900	80.400	5.93%
A	5800	BODY	04/09/2014	23.4	23.6	0.100	1007	3920	7.320	72.900	73.200	0.41%

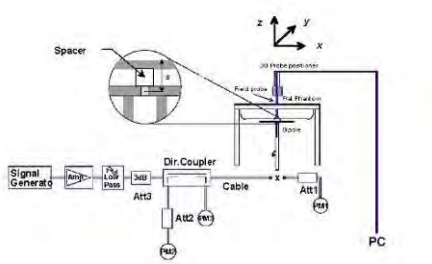


Figure 10-1
System Verification Setup Diagram

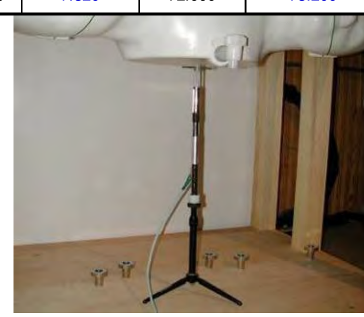


Figure 10-2
System Verification Setup Photo

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	Cover Type	Device Serial Number	# of Time Slots	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
836.60	190	GSM 850	GSM	33.2	32.99	-0.02	Right	Cheek	Standard	SAR 4	1	1:8.3	0.216	1.050	0.227	
836.60	190	GSM 850	GSM	33.2	32.99	0.14	Right	Cheek	Wireless Charging Open	SAR 4	1	1:8.3	0.112	1.050	0.118	
836.60	190	GSM 850	GSM	33.2	32.99	0.01	Right	Cheek	Wireless Charging Closed	SAR 4	1	1:8.3	0.094	1.050	0.099	
836.60	190	GSM 850	GSM	33.2	32.99	-0.01	Right	Tilt	Standard	SAR 4	1	1:8.3	0.148	1.050	0.155	
836.60	190	GSM 850	GSM	33.2	32.99	0.09	Left	Cheek	Standard	SAR 4	1	1:8.3	0.149	1.050	0.156	
836.60	190	GSM 850	GSM	33.2	32.99	0.09	Left	Tilt	Standard	SAR 4	1	1:8.3	0.099	1.050	0.104	
836.60	190	GSM 850	GPRS	29.7	29.66	0.03	Right	Cheek	Standard	SAR 4	3	1:2.76	0.242	1.009	0.244	A1
836.60	190	GSM 850	GPRS	29.7	29.66	-0.13	Right	Cheek	Wireless Charging Open	SAR 4	3	1:2.76	0.148	1.009	0.149	
836.60	190	GSM 850	GPRS	29.7	29.66	-0.02	Right	Cheek	Wireless Charging Closed	SAR 4	3	1:2.76	0.132	1.009	0.133	
836.60	190	GSM 850	GPRS	29.7	29.66	0.20	Right	Tilt	Standard	SAR 4	3	1:2.76	0.165	1.009	0.166	
836.60	190	GSM 850	GPRS	29.7	29.66	-0.15	Left	Cheek	Standard	SAR 4	3	1:2.76	0.200	1.009	0.202	
836.60	190	GSM 850	GPRS	29.7	29.66	-0.13	Left	Tilt	Standard	SAR 4	3	1:2.76	0.124	1.009	0.125	
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
UMTS 850 Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Cover Type	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	23.7	23.38	-0.17	Right	Cheek	Standard	SAR 4	1:1	0.168	1.076	0.181	
836.60	4183	UMTS 850	RMC	23.7	23.38	0.12	Right	Cheek	Wireless Charging Open	SAR 4	1:1	0.190	1.076	0.204	A2
836.60	4183	UMTS 850	RMC	23.7	23.38	0.07	Right	Cheek	Wireless Charging Closed	SAR 4	1:1	0.170	1.076	0.183	
836.60	4183	UMTS 850	RMC	23.7	23.38	0.01	Right	Tilt	Standard	SAR 4	1:1	0.104	1.076	0.112	
836.60	4183	UMTS 850	RMC	23.7	23.38	0.02	Left	Cheek	Standard	SAR 4	1:1	0.140	1.076	0.151	
836.60	4183	UMTS 850	RMC	23.7	23.38	0.10	Left	Tilt	Standard	SAR 4	1:1	0.094	1.076	0.101	
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
UMTS 1750 Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Cover Type	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
1732.40	1412	UMTS 1750	RMC	24.7	24.30	0.07	Right	Cheek	Standard	SAR 4	1:1	0.195	1.096	0.214	
1732.40	1412	UMTS 1750	RMC	24.7	24.30	0.08	Right	Cheek	Wireless Charging Open	SAR 4	1:1	0.197	1.096	0.216	
1732.40	1412	UMTS 1750	RMC	24.7	24.30	-0.11	Right	Cheek	Wireless Charging Closed	SAR 4	1:1	0.226	1.096	0.248	A3
1732.40	1412	UMTS 1750	RMC	24.7	24.30	-0.03	Right	Tilt	Standard	SAR 4	1:1	0.166	1.096	0.182	
1732.40	1412	UMTS 1750	RMC	24.7	24.30	-0.11	Left	Cheek	Standard	SAR 4	1:1	0.166	1.096	0.182	
1732.40	1412	UMTS 1750	RMC	24.7	24.30	0.09	Left	Tilt	Standard	SAR 4	1:1	0.130	1.096	0.142	
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 11-4
GSM 1900 Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Cover Type	Device Serial Number	# of Time Slots	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
1880.00	661	GSM 1900	GSM	31.2	30.99	0.14	Right	Cheek	Standard	SAR 5	1	1:8.3	0.156	1.050	0.164	
1880.00	661	GSM 1900	GSM	31.2	30.99	-0.12	Right	Cheek	Wireless Charging Open	SAR 5	1	1:8.3	0.150	1.050	0.158	
1880.00	661	GSM 1900	GSM	31.2	30.99	0.05	Right	Cheek	Wireless Charging Closed	SAR 5	1	1:8.3	0.132	1.050	0.139	
1880.00	661	GSM 1900	GSM	31.2	30.99	0.17	Right	Tilt	Standard	SAR 5	1	1:8.3	0.052	1.050	0.055	
1880.00	661	GSM 1900	GSM	31.2	30.99	0.09	Left	Cheek	Standard	SAR 5	1	1:8.3	0.120	1.050	0.126	
1880.00	661	GSM 1900	GSM	31.2	30.99	-0.12	Left	Tilt	Standard	SAR 5	1	1:8.3	0.060	1.050	0.063	
1880.00	661	GSM 1900	GPRS	27.7	27.59	0.07	Right	Cheek	Standard	SAR 5	3	1:2.76	0.162	1.026	0.166	
1880.00	661	GSM 1900	GPRS	27.7	27.59	-0.13	Right	Tilt	Standard	SAR 5	3	1:2.76	0.067	1.026	0.069	
1880.00	661	GSM 1900	GPRS	27.7	27.59	0.13	Left	Cheek	Standard	SAR 5	3	1:2.76	0.166	1.026	0.170	
1880.00	661	GSM 1900	GPRS	27.7	27.59	0.16	Left	Cheek	Wireless Charging Open	SAR 5	3	1:2.76	0.180	1.026	0.185	A4
1880.00	661	GSM 1900	GPRS	27.7	27.59	0.05	Left	Cheek	Wireless Charging Closed	SAR 5	3	1:2.76	0.149	1.026	0.153	
1880.00	661	GSM 1900	GPRS	27.7	27.59	-0.13	Left	Tilt	Standard	SAR 5	3	1:2.76	0.071	1.026	0.073	
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
UMTS 1900 Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Cover Type	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	23.7	23.19	-0.05	Right	Cheek	Standard	SAR 5	1:1	0.217	1.125	0.244	
1880.00	9400	UMTS 1900	RMC	23.7	23.19	0.09	Right	Tilt	Standard	SAR 5	1:1	0.083	1.125	0.093	
1880.00	9400	UMTS 1900	RMC	23.7	23.19	0.06	Left	Cheek	Standard	SAR 5	1:1	0.218	1.125	0.245	
1880.00	9400	UMTS 1900	RMC	23.7	23.19	0.19	Left	Cheek	Wireless Charging Open	SAR 5	1:1	0.237	1.125	0.267	A5
1880.00	9400	UMTS 1900	RMC	23.7	23.19	0.09	Left	Cheek	Wireless Charging Closed	SAR 5	1:1	0.230	1.125	0.259	
1880.00	9400	UMTS 1900	RMC	23.7	23.19	0.13	Left	Tilt	Standard	SAR 5	1:1	0.080	1.125	0.090	
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 17 Head SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Cover Type	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)	
710.00	23790	Mid	LTE Band 17	10	Standard	24.2	23.92	0.13	0	Right	Cheek	QPSK	1	49	SAR 2	1:1	0.073	1.067	0.078	
710.00	23790	Mid	LTE Band 17	10	Standard	23.2	22.73	0.19	1	Right	Cheek	QPSK	25	25	SAR 2	1:1	0.058	1.114	0.065	
710.00	23790	Mid	LTE Band 17	10	Standard	24.2	23.92	-0.18	0	Right	Tilt	QPSK	1	49	SAR 2	1:1	0.048	1.067	0.051	
710.00	23790	Mid	LTE Band 17	10	Standard	23.2	22.73	0.18	1	Right	Tilt	QPSK	25	25	SAR 2	1:1	0.038	1.114	0.042	
710.00	23790	Mid	LTE Band 17	10	Standard	24.2	23.92	0.03	0	Left	Cheek	QPSK	1	49	SAR 2	1:1	0.097	1.067	0.103	A6
710.00	23790	Mid	LTE Band 17	10	Wireless Charging Open	24.2	23.92	0.14	0	Left	Cheek	QPSK	1	49	SAR 2	1:1	0.089	1.067	0.095	
710.00	23790	Mid	LTE Band 17	10	Wireless Charging Closed	24.2	23.92	0.07	0	Left	Cheek	QPSK	1	49	SAR 2	1:1	0.085	1.067	0.091	
710.00	23790	Mid	LTE Band 17	10	Standard	23.2	22.73	0.13	1	Left	Cheek	QPSK	25	25	SAR 2	1:1	0.072	1.114	0.080	
710.00	23790	Mid	LTE Band 17	10	Standard	24.2	23.92	-0.13	0	Left	Tilt	QPSK	1	49	SAR 2	1:1	0.057	1.067	0.061	
710.00	23790	Mid	LTE Band 17	10	Standard	23.2	22.73	0.20	1	Left	Tilt	QPSK	25	25	SAR 2	1:1	0.040	1.114	0.045	
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 11-7
LTE Band 4 (AWS) Head SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Cover Type	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)	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	24.5	24.13	-0.02	0	Right	Cheek	QPSK	1	0	SAR 1	1:1	0.182	1.089	0.198	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Wireless Charging Open	24.5	24.13	-0.05	0	Right	Cheek	QPSK	1	0	SAR 1	1:1	0.200	1.089	0.218	A7
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Wireless Charging Closed	24.5	24.13	0.02	0	Right	Cheek	QPSK	1	0	SAR 1	1:1	0.155	1.089	0.169	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.5	22.97	0.02	1	Right	Cheek	QPSK	50	50	SAR 1	1:1	0.160	1.130	0.181	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	24.5	24.13	0.03	0	Right	Tilt	QPSK	1	0	SAR 1	1:1	0.138	1.089	0.150	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.5	22.97	-0.14	1	Right	Tilt	QPSK	50	50	SAR 1	1:1	0.114	1.130	0.129	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	24.5	24.13	0.07	0	Left	Cheek	QPSK	1	0	SAR 1	1:1	0.173	1.089	0.188	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.5	22.97	0.04	1	Left	Cheek	QPSK	50	50	SAR 1	1:1	0.150	1.130	0.170	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	24.5	24.13	-0.03	0	Left	Tilt	QPSK	1	0	SAR 1	1:1	0.120	1.089	0.131	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.5	22.97	0.11	1	Left	Tilt	QPSK	50	50	SAR 1	1:1	0.107	1.130	0.121	
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 11-8
LTE Band 2 (PCS) Head SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Cover Type	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)	
1860.00	18700	Low	LTE Band 2 (PCS)	20	Standard	23.7	23.40	0.02	0	Right	Cheek	QPSK	1	0	SAR 1	1:1	0.181	1.072	0.194	A8
1860.00	18700	Low	LTE Band 2 (PCS)	20	Wireless Charging Open	23.7	23.40	-0.01	0	Right	Cheek	QPSK	1	0	SAR 1	1:1	0.178	1.072	0.191	
1860.00	18700	Low	LTE Band 2 (PCS)	20	Wireless Charging Closed	23.7	23.40	0.05	0	Right	Cheek	QPSK	1	0	SAR 1	1:1	0.125	1.072	0.134	
1860.00	18700	Low	LTE Band 2 (PCS)	20	Standard	22.7	22.12	0.11	1	Right	Cheek	QPSK	50	50	SAR 1	1:1	0.149	1.143	0.170	
1860.00	18700	Low	LTE Band 2 (PCS)	20	Standard	23.7	23.40	0.13	0	Right	Tilt	QPSK	1	0	SAR 1	1:1	0.109	1.072	0.117	
1860.00	18700	Low	LTE Band 2 (PCS)	20	Standard	22.7	22.12	0.02	1	Right	Tilt	QPSK	50	50	SAR 1	1:1	0.069	1.143	0.079	
1860.00	18700	Low	LTE Band 2 (PCS)	20	Standard	23.7	23.40	0.14	0	Left	Cheek	QPSK	1	0	SAR 1	1:1	0.152	1.072	0.163	
1860.00	18700	Low	LTE Band 2 (PCS)	20	Standard	22.7	22.12	-0.03	1	Left	Cheek	QPSK	50	50	SAR 1	1:1	0.153	1.143	0.175	
1860.00	18700	Low	LTE Band 2 (PCS)	20	Standard	23.7	23.40	0.13	0	Left	Tilt	QPSK	1	0	SAR 1	1:1	0.077	1.072	0.083	
1860.00	18700	Low	LTE Band 2 (PCS)	20	Standard	22.7	22.12	0.18	1	Left	Tilt	QPSK	50	50	SAR 1	1:1	0.068	1.143	0.078	
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 11-9
LTE Band 7 Head SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Cover Type	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)	
2565.00	21400	High	LTE Band 7	10	Standard	23.7	23.58	0.14	0	Right	Cheek	QPSK	1	49	SAR 1	1:1	0.013	1.028	0.013	
2565.00	21400	High	LTE Band 7	10	Standard	22.7	22.16	0.12	1	Right	Cheek	QPSK	25	25	SAR 1	1:1	0.005	1.132	0.006	
2565.00	21400	High	LTE Band 7	10	Standard	23.7	23.58	0.17	0	Right	Tilt	QPSK	1	49	SAR 1	1:1	0.015	1.028	0.015	A9
2565.00	21400	High	LTE Band 7	10	Wireless Charging Open	23.7	23.58	0.18	0	Right	Tilt	QPSK	1	49	SAR 1	1:1	0.005	1.028	0.005	
2565.00	21400	High	LTE Band 7	10	Wireless Charging Closed	23.7	23.58	0.12	0	Right	Tilt	QPSK	1	49	SAR 1	1:1	0.004	1.028	0.004	
2565.00	21400	High	LTE Band 7	10	Standard	22.7	22.16	0.11	1	Right	Tilt	QPSK	25	25	SAR 1	1:1	0.010	1.132	0.011	
2565.00	21400	High	LTE Band 7	10	Standard	23.7	23.58	0.14	0	Left	Cheek	QPSK	1	49	SAR 1	1:1	0.004	1.028	0.004	
2565.00	21400	High	LTE Band 7	10	Standard	22.7	22.16	0.11	1	Left	Cheek	QPSK	25	25	SAR 1	1:1	0.003	1.132	0.003	
2565.00	21400	High	LTE Band 7	10	Standard	23.7	23.58	0.12	0	Left	Tilt	QPSK	1	49	SAR 1	1:1	0.000	1.028	0.000	
2565.00	21400	High	LTE Band 7	10	Standard	22.7	22.16	0.20	1	Left	Tilt	QPSK	25	25	SAR 1	1:1	0.000	1.132	0.000	
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 11-10
DTS Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Cover Type	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	17.1	16.76	-0.04	Right	Cheek	Standard	SAR 3	1	1:1	0.214	1.081	0.231	
2412	1	IEEE 802.11b	DSSS	17.1	16.76	-0.02	Right	Tilt	Standard	SAR 3	1	1:1	0.233	1.081	0.252	
2412	1	IEEE 802.11b	DSSS	17.1	16.76	-0.12	Left	Cheek	Standard	SAR 3	1	1:1	0.388	1.081	0.419	A10
2412	1	IEEE 802.11b	DSSS	17.1	16.76	-0.18	Left	Cheek	Wireless Charging Open	SAR 3	1	1:1	0.379	1.081	0.410	
2412	1	IEEE 802.11b	DSSS	17.1	16.76	0.02	Left	Cheek	Wireless Charging Closed	SAR 3	1	1:1	0.241	1.081	0.261	
2412	1	IEEE 802.11b	DSSS	17.1	16.76	0.17	Left	Tilt	Standard	SAR 3	1	1:1	0.386	1.081	0.417	
5765	153	IEEE 802.11a	OFDM	12.1	11.73	0.13	Right	Cheek	Standard	SAR 3	6	1:1	0.234	1.089	0.255	
5765	153	IEEE 802.11a	OFDM	12.1	11.73	0.13	Right	Tilt	Standard	SAR 3	6	1:1	0.280	1.089	0.305	
5765	153	IEEE 802.11a	OFDM	12.1	11.73	0.01	Left	Cheek	Standard	SAR 3	6	1:1	0.274	1.089	0.298	
5765	153	IEEE 802.11a	OFDM	12.1	11.73	0.09	Left	Tilt	Standard	SAR 3	6	1:1	0.327	1.089	0.356	A11
5775	155	IEEE 802.11ac	OFDM	10.1	9.57	0.14	Left	Tilt	Standard	SAR 3	29.3	1:1	0.181	1.130	0.205	
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 11-11
NII Head SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Cover Type	Device Serial Number	Data Rate (Mbps)	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
5240	48	IEEE 802.11a	OFDM	12.1	11.38	0.04	Right	Cheek	Standard	SAR 3	6	1:1	0.157	1.180	0.185	
5240	48	IEEE 802.11a	OFDM	12.1	11.38	0.16	Right	Tilt	Standard	SAR 3	6	1:1	0.191	1.180	0.225	
5240	48	IEEE 802.11a	OFDM	12.1	11.38	0.15	Left	Cheek	Standard	SAR 3	6	1:1	0.238	1.180	0.281	
5210	42	IEEE 802.11ac	OFDM	10.1	8.28	0.18	Left	Cheek	Standard	SAR 3	29.3	1:1	0.154	1.521	0.234	
5240	48	IEEE 802.11a	OFDM	12.1	11.38	-0.01	Left	Tilt	Standard	SAR 3	6	1:1	0.200	1.180	0.236	
5320	64	IEEE 802.11a	OFDM	12.1	10.74	0.13	Right	Cheek	Standard	SAR 3	6	1:1	0.154	1.368	0.211	
5320	64	IEEE 802.11a	OFDM	12.1	10.74	0.19	Right	Tilt	Standard	SAR 3	6	1:1	0.176	1.368	0.241	
5320	64	IEEE 802.11a	OFDM	12.1	10.74	0.09	Left	Cheek	Standard	SAR 3	6	1:1	0.200	1.368	0.274	
5320	64	IEEE 802.11a	OFDM	12.1	10.74	0.14	Left	Tilt	Standard	SAR 3	6	1:1	0.217	1.368	0.297	
5290	58	IEEE 802.11ac	OFDM	10.1	9.22	0.16	Left	Tilt	Standard	SAR 3	29.3	1:1	0.158	1.225	0.194	
5540	108	IEEE 802.11a	OFDM	12.1	11.79	0.17	Right	Cheek	Standard	SAR 3	6	1:1	0.262	1.074	0.281	
5540	108	IEEE 802.11a	OFDM	12.1	11.79	0.14	Right	Tilt	Standard	SAR 3	6	1:1	0.318	1.074	0.342	
5540	108	IEEE 802.11a	OFDM	12.1	11.79	0.04	Left	Cheek	Standard	SAR 3	6	1:1	0.319	1.074	0.343	
5540	108	IEEE 802.11a	OFDM	12.1	11.79	0.17	Left	Tilt	Standard	SAR 3	6	1:1	0.375	1.074	0.403	A12
5530	106	IEEE 802.11ac	OFDM	10.1	9.13	0.15	Left	Tilt	Standard	SAR 3	29.3	1:1	0.193	1.250	0.241	
5540	108	IEEE 802.11a	OFDM	12.1	11.79	0.21	Left	Tilt	Wireless Charging Open	SAR 3	6	1:1	0.206	1.074	0.221	
5540	108	IEEE 802.11a	OFDM	12.1	11.79	0.13	Left	Tilt	Wireless Charging Closed	SAR 3	6	1:1	0.175	1.074	0.188	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram									

11.2 Standalone Body-Worn SAR Data

Table 11-12
GSM/UMTS Body-Worn SAR Data

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Cover Type	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	33.2	32.99	-0.02	10 mm	Standard	SAR 4	1	1:8.3	back	0.393	1.050	0.413	
836.60	190	GSM 850	GSM	33.2	32.99	0.02	10 mm	Wireless Charging Closed	SAR 4	1	1:8.3	back	0.341	1.050	0.358	
836.60	190	GSM 850	GPRS	29.7	29.66	-0.05	10 mm	Standard	SAR 4	3	1:2.76	back	0.474	1.009	0.478	A13
836.60	190	GSM 850	GPRS	29.7	29.66	-0.09	10 mm	Wireless Charging Closed	SAR 4	3	1:2.76	back	0.408	1.009	0.412	
836.60	4183	UMTS 850	RMC	23.7	23.38	-0.07	10 mm	Standard	SAR 4	N/A	1:1	back	0.347	1.076	0.373	A14
836.60	4183	UMTS 850	RMC	23.7	23.38	0.02	10 mm	Wireless Charging Closed	SAR 4	N/A	1:1	back	0.299	1.076	0.322	
1732.40	1412	UMTS 1750	RMC	24.7	24.30	0.11	10 mm	Standard	SAR 4	N/A	1:1	back	0.596	1.096	0.653	
1732.40	1412	UMTS 1750	RMC	24.7	24.30	0.02	10 mm	Wireless Charging Closed	SAR 4	N/A	1:1	back	0.661	1.096	0.724	A15
1880.00	661	GSM 1900	GSM	31.2	30.99	-0.02	10 mm	Standard	SAR 6	1	1:8.3	back	0.450	1.050	0.473	
1880.00	661	GSM 1900	GSM	31.2	30.99	0.06	10 mm	Wireless Charging Closed	SAR 6	1	1:8.3	back	0.429	1.050	0.450	
1880.00	661	GSM 1900	GPRS	27.7	27.59	-0.01	10 mm	Standard	SAR 6	3	1:2.76	back	0.772	1.026	0.792	A16
1880.00	661	GSM 1900	GPRS	27.7	27.59	-0.01	10 mm	Wireless Charging Closed	SAR 6	3	1:2.76	back	0.578	1.026	0.607	
1852.40	9262	UMTS 1900	RMC	23.7	23.15	0.04	10 mm	Standard	SAR 6	N/A	1:1	back	0.760	1.135	0.863	
1880.00	9400	UMTS 1900	RMC	23.7	23.19	-0.01	10 mm	Standard	SAR 6	N/A	1:1	back	0.840	1.125	0.945	A17
1907.60	9538	UMTS 1900	RMC	23.7	23.26	0.05	10 mm	Standard	SAR 6	N/A	1:1	back	0.836	1.107	0.925	
1880.00	9400	UMTS 1900	RMC	23.7	23.19	0.00	10 mm	Wireless Charging Closed	SAR 6	N/A	1:1	back	0.733	1.125	0.811	
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 11-13
LTE Body-Worn SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Cover Type	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)	
710.00	23790	Mid	LTE Band 17	10	Standard	24.2	23.92	0.04	0	SAR 2	QPSK	1	49	10 mm	back	1:1	0.149	1.067	0.159	A18
710.00	23790	Mid	LTE Band 17	10	Wireless Charging Closed	24.2	23.92	0.09	0	SAR 2	QPSK	1	49	10 mm	back	1:1	0.132	1.067	0.141	
710.00	23790	Mid	LTE Band 17	10	Standard	23.2	22.73	0.02	1	SAR 2	QPSK	25	25	10 mm	back	1:1	0.112	1.114	0.125	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	24.5	24.13	-0.09	0	SAR 1	QPSK	1	0	10 mm	back	1:1	0.537	1.089	0.585	A20
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Wireless Charging Closed	24.5	24.13	-0.11	0	SAR 1	QPSK	1	0	10 mm	back	1:1	0.518	1.089	0.564	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.5	22.97	0.00	1	SAR 1	QPSK	50	50	10 mm	back	1:1	0.535	1.130	0.605	
1860.00	18700	Low	LTE Band 2 (PCS)	20	Standard	23.7	23.40	-0.01	0	SAR 1	QPSK	1	0	10 mm	back	1:1	0.872	1.072	0.935	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	Standard	23.7	23.37	0.00	0	SAR 1	QPSK	1	0	10 mm	back	1:1	0.945	1.079	1.020	
1900.00	19100	High	LTE Band 2 (PCS)	20	Standard	23.7	23.38	-0.01	0	SAR 1	QPSK	1	50	10 mm	back	1:1	0.968	1.076	1.042	A22
1900.00	19100	High	LTE Band 2 (PCS)	20	Wireless Charging Closed	23.7	23.38	0.09	0	SAR 1	QPSK	1	50	10 mm	back	1:1	0.763	1.076	0.763	
1860.00	18700	Low	LTE Band 2 (PCS)	20	Standard	22.7	22.12	0.05	1	SAR 1	QPSK	50	50	10 mm	back	1:1	0.653	1.143	0.746	
1860.00	18700	Low	LTE Band 2 (PCS)	20	Standard	22.7	22.11	0.07	1	SAR 1	QPSK	100	0	10 mm	back	1:1	0.623	1.146	0.714	
1900.00	19100	High	LTE Band 2 (PCS)	20	Standard	23.7	23.38	-0.04	0	SAR 1	QPSK	1	50	10 mm	back	1:1	0.934	1.076	1.005	
2565.00	21400	High	LTE Band 7	10	Standard	23.7	23.58	0.16	0	SAR 5	QPSK	1	49	10 mm	back	1:1	0.076	1.028	0.078	A23
2565.00	21400	High	LTE Band 7	10	Wireless Charging Closed	23.7	23.58	0.07	1	SAR 5	QPSK	1	49	10 mm	back	1:1	0.037	1.028	0.038	
2565.00	21400	High	LTE Band 7	10	Standard	22.7	22.16	0.00	1	SAR 5	QPSK	25	25	10 mm	back	1:1	0.056	1.132	0.063	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Body 1.6 W/kg (mW/g) averaged over 1 gram										

Note: Measurements in blue represent variability data

Table 11-14
DTS Body-Worn SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Cover Type	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	17.1	16.76	-0.04	10 mm	Standard	SAR 7	1	back	1:1	0.076	1.081	0.082	A24
2412	1	IEEE 802.11b	DSSS	17.1	16.76	0.06	10 mm	Wireless Charging	SAR 7	1	back	1:1	0.042	1.081	0.045	
5765	153	IEEE 802.11a	OFDM	12.1	11.73	-0.18	10 mm	Standard	SAR 3	6	back	1:1	0.181	1.089	0.197	A25
5775	155	IEEE 802.11ac	OFDM	10.1	9.57	0.19	10 mm	Standard	SAR 3	29.3	back	1:1	0.095	1.130	0.107	
5765	153	IEEE 802.11a	OFDM	12.1	11.73	-0.11	10 mm	Wireless Charging Closed	SAR 3	6	back	1:1	0.144	1.089	0.157	
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 11-15
NII Body-Worn SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Cover Type	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
5240	48	IEEE 802.11a	OFDM	12.1	11.38	-0.12	10 mm	Standard	SAR 3	6	back	1:1	0.113	1.180	0.133	
5210	42	IEEE 802.11ac	OFDM	10.1	8.28	0.14	10 mm	Standard	SAR 3	29.3	back	1:1	0.035	1.521	0.053	
5320	64	IEEE 802.11a	OFDM	12.1	10.74	0.03	10 mm	Standard	SAR 3	6	back	1:1	0.123	1.368	0.168	
5290	58	IEEE 802.11ac	OFDM	10.1	9.22	0.13	10 mm	Standard	SAR 3	29.3	back	1:1	0.045	1.225	0.055	
5540	108	IEEE 802.11a	OFDM	12.1	11.79	-0.15	10 mm	Standard	SAR 3	6	back	1:1	0.170	1.074	0.183	A26
5530	106	IEEE 802.11ac	OFDM	10.1	9.13	-0.14	10 mm	Standard	SAR 3	29.3	back	1:1	0.078	1.250	0.098	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram									

11.3 Standalone Wireless Router SAR Data

Table 11-16
GPRS/UMTS Hotspot SAR Data

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Cover Type	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	29.7	29.66	-0.05	10 mm	Standard	SAR 4	3	1:2.76	back	0.474	1.009	0.478	A13
836.60	190	GSM 850	GPRS	29.7	29.66	-0.09	10 mm	Wireless Charging Closed	SAR 4	3	1:2.76	back	0.408	1.009	0.412	
836.60	190	GSM 850	GPRS	29.7	29.66	-0.07	10 mm	Standard	SAR 4	3	1:2.76	front	0.337	1.009	0.340	
836.60	190	GSM 850	GPRS	29.7	29.66	-0.03	10 mm	Standard	SAR 4	3	1:2.76	bottom	0.231	1.009	0.233	
836.60	190	GSM 850	GPRS	29.7	29.66	0.01	10 mm	Standard	SAR 4	3	1:2.76	right	0.443	1.009	0.447	
836.60	4183	UMTS 850	RMC	23.7	23.38	-0.07	10 mm	Standard	SAR 4	N/A	1:1	back	0.347	1.076	0.373	A14
836.60	4183	UMTS 850	RMC	23.7	23.38	0.02	10 mm	Wireless Charging Closed	SAR 4	N/A	1:1	back	0.299	1.076	0.322	
836.60	4183	UMTS 850	RMC	23.7	23.38	-0.02	10 mm	Standard	SAR 4	N/A	1:1	front	0.256	1.076	0.275	
836.60	4183	UMTS 850	RMC	23.7	23.38	-0.14	10 mm	Standard	SAR 4	N/A	1:1	bottom	0.169	1.076	0.182	
836.60	4183	UMTS 850	RMC	23.7	23.38	0.07	10 mm	Standard	SAR 4	N/A	1:1	right	0.313	1.076	0.337	
1732.40	1412	UMTS 1750	RMC	24.7	24.30	0.11	10 mm	Standard	SAR 4	N/A	1:1	back	0.596	1.096	0.653	
1732.40	1412	UMTS 1750	RMC	24.7	24.30	0.02	10 mm	Wireless Charging Closed	SAR 4	N/A	1:1	back	0.661	1.096	0.724	A15
1732.40	1412	UMTS 1750	RMC	24.7	24.30	-0.01	10 mm	Standard	SAR 4	N/A	1:1	front	0.400	1.096	0.438	
1732.40	1412	UMTS 1750	RMC	24.7	24.30	-0.06	10 mm	Standard	SAR 4	N/A	1:1	bottom	0.417	1.096	0.457	
1732.40	1412	UMTS 1750	RMC	24.7	24.30	-0.01	10 mm	Standard	SAR 4	N/A	1:1	left	0.391	1.096	0.429	
1880.00	661	GSM 1900	GPRS	27.7	27.59	-0.01	10 mm	Standard	SAR 6	3	1:2.76	back	0.772	1.026	0.792	A16
1880.00	661	GSM 1900	GPRS	27.7	27.59	-0.06	10 mm	Wireless Charging Closed	SAR 6	3	1:2.76	back	0.578	1.026	0.593	
1880.00	661	GSM 1900	GPRS	27.7	27.59	-0.04	10 mm	Standard	SAR 6	3	1:2.76	front	0.326	1.026	0.334	
1880.00	661	GSM 1900	GPRS	27.7	27.59	-0.07	10 mm	Standard	SAR 6	3	1:2.76	bottom	0.630	1.026	0.646	
1880.00	661	GSM 1900	GPRS	27.7	27.59	-0.07	10 mm	Standard	SAR 6	3	1:2.76	right	0.162	1.026	0.166	
1852.40	9262	UMTS 1900	RMC	23.7	23.15	0.04	10 mm	Standard	SAR 6	N/A	1:1	back	0.760	1.135	0.863	
1880.00	9400	UMTS 1900	RMC	23.7	23.19	-0.01	10 mm	Standard	SAR 6	N/A	1:1	back	0.840	1.125	0.945	A17
1907.60	9538	UMTS 1900	RMC	23.7	23.26	0.05	10 mm	Standard	SAR 6	N/A	1:1	back	0.836	1.107	0.925	
1880.00	9400	UMTS 1900	RMC	23.7	23.19	0.00	10 mm	Wireless Charging Closed	SAR 6	N/A	1:1	back	0.733	1.125	0.825	
1880.00	9400	UMTS 1900	RMC	23.7	23.19	0.00	10 mm	Standard	SAR 6	N/A	1:1	front	0.430	1.125	0.484	
1852.40	9262	UMTS 1900	RMC	23.7	23.15	0.04	10 mm	Standard	SAR 6	N/A	1:1	bottom	0.755	1.135	0.857	
1880.00	9400	UMTS 1900	RMC	23.7	23.19	-0.02	10 mm	Standard	SAR 6	N/A	1:1	bottom	0.744	1.125	0.837	
1907.60	9538	UMTS 1900	RMC	23.7	23.26	0.01	10 mm	Standard	SAR 6	N/A	1:1	bottom	0.798	1.107	0.883	
1880.00	9400	UMTS 1900	RMC	23.7	23.19	-0.03	10 mm	Standard	SAR 6	N/A	1:1	right	0.205	1.125	0.231	
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 11-17
LTE Band 17 Hotspot SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Cover Type	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)	
710.00	23790	Mid	LTE Band 17	10	Standard	24.2	23.92	0.04	0	SAR 2	QPSK	1	49	10 mm	back	1:1	0.149	1.067	0.159	
710.00	23790	Mid	LTE Band 17	10	Standard	23.2	22.73	0.02	1	SAR 2	QPSK	25	25	10 mm	back	1:1	0.112	1.114	0.125	
710.00	23790	Mid	LTE Band 17	10	Standard	24.2	23.92	0.05	0	SAR 2	QPSK	1	49	10 mm	front	1:1	0.087	1.067	0.093	
710.00	23790	Mid	LTE Band 17	10	Standard	23.2	22.73	0.07	1	SAR 2	QPSK	25	25	10 mm	front	1:1	0.065	1.114	0.072	
710.00	23790	Mid	LTE Band 17	10	Standard	24.2	23.92	0.01	0	SAR 2	QPSK	1	49	10 mm	bottom	1:1	0.061	1.067	0.065	
710.00	23790	Mid	LTE Band 17	10	Standard	23.2	22.73	0.01	1	SAR 2	QPSK	25	25	10 mm	bottom	1:1	0.049	1.114	0.055	
710.00	23790	Mid	LTE Band 17	10	Standard	24.2	23.92	0.01	0	SAR 2	QPSK	1	49	10 mm	left	1:1	0.176	1.067	0.188	
710.00	23790	Mid	LTE Band 17	10	Wireless Charging Closed	24.2	23.92	0.10	0	SAR 2	QPSK	1	49	10 mm	left	1:1	0.180	1.067	0.192	A19
710.00	23790	Mid	LTE Band 17	10	Standard	23.2	22.73	-0.08	1	SAR 2	QPSK	25	25	10 mm	left	1:1	0.129	1.114	0.144	
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 11-18
LTE Band 4 (AWS) Hotspot SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Cover Type	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)	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	24.5	24.13	-0.09	0	SAR 1	QPSK	1	0	10 mm	back	1:1	0.537	1.089	0.585	A20
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Wireless Charging Closed	24.5	24.13	-0.11	0	SAR 1	QPSK	1	0	10 mm	back	1:1	0.518	1.089	0.564	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.5	22.97	0.00	1	SAR 1	QPSK	50	50	10 mm	back	1:1	0.535	1.130	0.605	A21
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	24.5	24.13	0.02	0	SAR 1	QPSK	1	0	10 mm	front	1:1	0.317	1.089	0.345	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.5	22.97	-0.03	1	SAR 1	QPSK	50	50	10 mm	front	1:1	0.246	1.130	0.278	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	24.5	24.13	0.16	0	SAR 1	QPSK	1	0	10 mm	bottom	1:1	0.366	1.089	0.399	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.5	22.97	0.06	1	SAR 1	QPSK	50	50	10 mm	bottom	1:1	0.338	1.130	0.382	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	24.5	24.13	0.13	0	SAR 1	QPSK	1	0	10 mm	left	1:1	0.302	1.089	0.329	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.5	22.97	-0.02	1	SAR 1	QPSK	50	50	10 mm	left	1:1	0.274	1.130	0.310	
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 11-19
LTE Band 2 (PCS) Hotspot SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Cover Type	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)	
1860.00	18700	Low	LTE Band 2 (PCS)	20	Standard	23.7	23.40	-0.01	0	SAR 1	QPSK	1	0	10 mm	back	1:1	0.872	1.072	0.935	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	Standard	23.7	23.37	0.00	0	SAR 1	QPSK	1	0	10 mm	back	1:1	0.945	1.079	1.020	
1900.00	19100	High	LTE Band 2 (PCS)	20	Standard	23.7	23.38	-0.01	0	SAR 1	QPSK	1	50	10 mm	back	1:1	0.968	1.076	1.042	A22
1900.00	19100	High	LTE Band 2 (PCS)	20	Wireless Charging Closed	23.7	23.38	0.09	0	SAR 1	QPSK	1	50	10 mm	back	1:1	0.763	1.076	0.763	
1860.00	18700	Low	LTE Band 2 (PCS)	20	Standard	22.7	22.12	0.05	1	SAR 1	QPSK	50	50	10 mm	back	1:1	0.653	1.143	0.746	
1860.00	18700	Low	LTE Band 2 (PCS)	20	Standard	22.7	22.11	0.07	1	SAR 1	QPSK	100	0	10 mm	back	1:1	0.623	1.146	0.714	
1860.00	18700	Low	LTE Band 2 (PCS)	20	Standard	23.7	23.40	0.01	0	SAR 1	QPSK	1	0	10 mm	front	1:1	0.483	1.072	0.518	
1860.00	18700	Low	LTE Band 2 (PCS)	20	Standard	22.7	22.12	-0.03	1	SAR 1	QPSK	50	50	10 mm	front	1:1	0.371	1.143	0.424	
1860.00	18700	Low	LTE Band 2 (PCS)	20	Standard	23.7	23.40	0.01	0	SAR 1	QPSK	1	0	10 mm	bottom	1:1	0.829	1.072	0.889	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	Standard	23.7	23.37	0.00	0	SAR 1	QPSK	1	0	10 mm	bottom	1:1	0.825	1.079	0.890	
1900.00	19100	High	LTE Band 2 (PCS)	20	Standard	23.7	23.38	-0.01	0	SAR 1	QPSK	1	50	10 mm	bottom	1:1	0.830	1.076	0.893	
1860.00	18700	Low	LTE Band 2 (PCS)	20	Standard	22.7	22.12	0.01	1	SAR 1	QPSK	50	50	10 mm	bottom	1:1	0.602	1.143	0.688	
1860.00	18700	Low	LTE Band 2 (PCS)	20	Standard	22.7	22.11	0.00	1	SAR 1	QPSK	100	0	10 mm	bottom	1:1	0.607	1.146	0.696	
1860.00	18700	Low	LTE Band 2 (PCS)	20	Standard	23.7	23.40	0.05	0	SAR 1	QPSK	1	0	10 mm	right	1:1	0.235	1.072	0.252	
1860.00	18700	Low	LTE Band 2 (PCS)	20	Standard	22.7	22.12	0.04	1	SAR 1	QPSK	50	50	10 mm	right	1:1	0.176	1.143	0.201	
1900.00	19100	High	LTE Band 2 (PCS)	20	Standard	23.7	23.38	-0.04	0	SAR 1	QPSK	1	50	10 mm	back	1:1	0.934	1.076	1.005	
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: Measurements in blue represent variability data

Table 11-20
LTE Band 7 Hotspot SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Cover Type	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)	
2565.00	21400	High	LTE Band 7	10	Standard	23.7	23.58	0.16	0	SAR 5	QPSK	1	49	10 mm	back	1:1	0.076	1.028	0.078	A23
2565.00	21400	High	LTE Band 7	10	Wireless Charging Closed	23.7	23.58	0.07	0	SAR 5	QPSK	1	49	10 mm	back	1:1	0.037	1.028	0.038	
2565.00	21400	High	LTE Band 7	10	Standard	22.7	22.16	0.00	1	SAR 5	QPSK	25	25	10 mm	back	1:1	0.056	1.132	0.063	
2565.00	21400	High	LTE Band 7	10	Standard	23.7	23.58	-0.21	0	SAR 5	QPSK	1	49	10 mm	front	1:1	0.016	1.028	0.016	
2565.00	21400	High	LTE Band 7	10	Standard	22.7	22.16	0.01	1	SAR 5	QPSK	25	25	10 mm	front	1:1	0.011	1.132	0.012	
2565.00	21400	High	LTE Band 7	10	Standard	23.7	23.58	0.06	0	SAR 5	QPSK	1	49	10 mm	bottom	1:1	0.040	1.028	0.041	
2565.00	21400	High	LTE Band 7	10	Standard	22.7	22.16	0.16	1	SAR 5	QPSK	25	25	10 mm	bottom	1:1	0.031	1.132	0.035	
2565.00	21400	High	LTE Band 7	10	Standard	23.7	23.58	0.14	0	SAR 5	QPSK	1	49	10 mm	left	1:1	0.026	1.028	0.027	
2565.00	21400	High	LTE Band 7	10	Standard	22.7	22.16	0.17	1	SAR 5	QPSK	25	25	10 mm	left	1:1	0.019	1.132	0.022	
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 11-21
WLAN Hotspot SAR

MEASUREMENT RESULTS																	
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Cover Type	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	17.1	16.76	-0.04	10 mm	Standard	SAR 7	1	back	1:1	0.076	1.081	**0.082**	A24
2412	1	IEEE 802.11b	DSSS	17.1	16.76	0.06	10 mm	Wireless Charging Closed	SAR 7	1	back	1:1	0.042	1.081	0.045	
2412	1	IEEE 802.11b	DSSS	17.1	16.76	-0.10	10 mm	Standard	SAR 7	1	front	1:1	0.034	1.081	0.037	
2412	1	IEEE 802.11b	DSSS	17.1	16.76	-0.01	10 mm	Standard	SAR 7	1	top	1:1	0.037	1.081	0.040	
2412	1	IEEE 802.11b	DSSS	17.1	16.76	-0.01	10 mm	Standard	SAR 7	1	right	1:1	0.027	1.081	0.029	
5765	153	IEEE 802.11a	OFDM	12.1	11.73	-0.18	10 mm	Standard	SAR 3	6	back	1:1	0.181	1.089	**0.197**	A25
5775	155	IEEE 802.11ac	OFDM	10.1	9.57	0.19	10 mm	Standard	SAR 3	29.3	back	1:1	0.095	1.130	0.107	
5765	153	IEEE 802.11a	OFDM	12.1	11.73	-0.11	10 mm	Wireless Charging Closed	SAR 3	6	back	1:1	0.144	1.089	0.157	
5765	153	IEEE 802.11a	OFDM	12.1	11.73	-0.13	10 mm	Standard	SAR 3	6	front	1:1	0.054	1.089	0.059	
5765	153	IEEE 802.11a	OFDM	12.1	11.73	0.14	10 mm	Standard	SAR 3	6	top	1:1	0.143	1.089	0.156	
5765	153	IEEE 802.11a	OFDM	12.1	11.73	-0.17	10 mm	Standard	SAR 3	6	right	1:1	0.022	1.089	0.024	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram									

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 standard 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.
4. This device supports GSM VOIP in the head and body-worn configurations; therefore GPRS was additionally evaluated for head and body-worn compliance.

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.

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).
4. Per FCC Guidance, LTE CA SAR was not needed for testing since the data sent by uplink on uplink physical channels does not change between Rel 8 and Rel 10.

WLAN Notes:

1. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and October 2012 FCC/TCB Meeting Notes for 2.4 GHz WIFI: Highest average RF output power channel for the lowest data rate was selected for SAR evaluation in 802.11b. Other IEEE 802.11 modes (including 802.11g/n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode.
2. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and October 2012 FCC/TCB Meeting Notes for 5 GHz WIFI: Highest average RF output power channel for the lowest data rate was selected for SAR evaluation in 802.11a. Other IEEE 802.11 modes (including 802.11n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11a mode.
3. Per April 2013 TCB Workshop notes, full SAR tests for all IEEE 802.11ac configurations were not required because the average output power was not more than 0.25 dB higher than IEEE 802.11a mode. IEEE 802.11ac was evaluated for the highest 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. Since 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 default channels was not required.
7. 5 GHz WIFI Direct GO is supported in the 5.8 GHz band only. The manufacturer expects 5.8 GHz WIFI Direct GO may be used similar to wireless router usage. Therefore, 5.8 GHz WIFI Direct GO was evaluated for SAR similar to wireless router SAR procedures in FCC KDB Publication 941225.

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	2441	11.50	10	**0.292**

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.

12.3 Head SAR Simultaneous Transmission Analysis

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

Simult Tx	Configuration	GSM 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.227	0.231	0.458
	Right Tilt	0.155	0.252	0.407
	Left Cheek	0.156	0.419	**0.575**
	Left Tilt	0.104	0.417	0.521

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.244	0.231	0.475
	Right Tilt	0.166	0.252	0.418
	Left Cheek	0.202	0.419	**0.621**
	Left Tilt	0.125	0.417	0.542

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.204	0.231	0.435
	Right Tilt	0.112	0.252	0.364
	Left Cheek	0.151	0.419	**0.570**
	Left Tilt	0.101	0.417	0.518

Simult Tx	Configuration	UMTS 1750 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.248	0.231	0.479
	Right Tilt	0.182	0.252	0.434
	Left Cheek	0.182	0.419	**0.601**
	Left Tilt	0.142	0.417	0.559

Simult Tx	Configuration	GSM 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.164	0.231	0.395
	Right Tilt	0.055	0.252	0.307
	Left Cheek	0.126	0.419	**0.545**
	Left Tilt	0.063	0.417	0.480

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.166	0.231	0.397
	Right Tilt	0.069	0.252	0.321
	Left Cheek	0.185	0.419	**0.604**
	Left Tilt	0.073	0.417	0.490

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.244	0.231	0.475
	Right Tilt	0.093	0.252	0.345
	Left Cheek	0.267	0.419	**0.686**
	Left Tilt	0.090	0.417	0.507

Simult Tx	Configuration	LTE Band 17 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.078	0.231	0.309
	Right Tilt	0.051	0.252	0.303
	Left Cheek	0.103	0.419	**0.522**
	Left Tilt	0.061	0.417	0.478

Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.218	0.231	0.449
	Right Tilt	0.150	0.252	0.402
	Left Cheek	0.188	0.419	**0.607**
	Left Tilt	0.131	0.417	0.548

Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.194	0.231	0.425
	Right Tilt	0.117	0.252	0.369
	Left Cheek	0.175	0.419	**0.594**
	Left Tilt	0.083	0.417	0.500

Simult Tx	Configuration	LTE Band 7 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.013	0.231	0.244
	Right Tilt	0.015	0.252	0.267
	Left Cheek	0.004	0.419	**0.423**
	Left Tilt	0.000	0.417	0.417

Table 12-3
Simultaneous Transmission Scenario with 5 GHz WLAN (Held to Ear)

Simult Tx	Configuration	GSM 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.227	0.281	**0.508**
	Right Tilt	0.155	0.342	0.497
	Left Cheek	0.156	0.343	0.499
	Left Tilt	0.104	0.403	0.507

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.244	0.281	0.525
	Right Tilt	0.166	0.342	0.508
	Left Cheek	0.202	0.343	**0.545**
	Left Tilt	0.125	0.403	0.528

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.204	0.281	0.485
	Right Tilt	0.112	0.342	0.454
	Left Cheek	0.151	0.343	0.494
	Left Tilt	0.101	0.403	**0.504**

Simult Tx	Configuration	UMTS 1750 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.248	0.281	0.529
	Right Tilt	0.182	0.342	0.524
	Left Cheek	0.182	0.343	0.525
	Left Tilt	0.142	0.403	**0.545**

Simult Tx	Configuration	GSM 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.164	0.281	0.445
	Right Tilt	0.055	0.342	0.397
	Left Cheek	0.126	0.343	**0.469**
	Left Tilt	0.063	0.403	0.466

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.166	0.281	0.447
	Right Tilt	0.069	0.342	0.411
	Left Cheek	0.185	0.343	**0.528**
	Left Tilt	0.073	0.403	0.476

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.244	0.281	0.525
	Right Tilt	0.093	0.342	0.435
	Left Cheek	0.267	0.343	**0.610**
	Left Tilt	0.090	0.403	0.493

Simult Tx	Configuration	LTE Band 17 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.078	0.281	0.359
	Right Tilt	0.051	0.342	0.393
	Left Cheek	0.103	0.343	0.446
	Left Tilt	0.061	0.403	**0.464**

Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.218	0.281	0.499
	Right Tilt	0.150	0.342	0.492
	Left Cheek	0.188	0.343	0.531
	Left Tilt	0.131	0.403	**0.534**

Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.194	0.281	0.475
	Right Tilt	0.117	0.342	0.459
	Left Cheek	0.175	0.343	**0.518**
	Left Tilt	0.083	0.403	0.486

Simult Tx	Configuration	LTE Band 7 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.013	0.281	0.294
	Right Tilt	0.015	0.342	0.357
	Left Cheek	0.004	0.343	0.347
	Left Tilt	0.000	0.403	**0.403**

The worst case 5 GHz WIFI reported SAR for each head configuration was considered for simultaneous SAR exclusion via summation of standalone SAR, regardless of whether the WIFI channel has WIFI Hotspot capability, for simplicity to determine compliance. Please note that the actual simultaneous transmission SAR will not exceed the summed levels indicated.

12.4 Body-Worn Simultaneous Transmission Analysis

Table 12-4
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body-Worn at 1.0 cm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	GSM 850	0.413	0.082	0.495
Back Side	GPRS 850	0.478	0.082	0.560
Back Side	UMTS 850	0.373	0.082	0.455
Back Side	UMTS 1750	0.724	0.082	0.806
Back Side	GSM 1900	0.473	0.082	0.555
Back Side	GPRS 1900	0.792	0.082	0.874
Back Side	UMTS 1900	0.945	0.082	1.027
Back Side	LTE Band 17	0.159	0.082	0.241
Back Side	LTE Band 4 (AWS)	0.605	0.082	0.687
Back Side	LTE Band 2 (PCS)	1.042	0.082	1.124
Back Side	LTE Band 7	0.078	0.082	0.160

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

Configuration	Mode	2G/3G/4G SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	GSM 850	0.413	0.197	0.610
Back Side	GPRS 850	0.478	0.197	0.675
Back Side	UMTS 850	0.373	0.197	0.570
Back Side	UMTS 1750	0.724	0.197	0.921
Back Side	GSM 1900	0.473	0.197	0.670
Back Side	GPRS 1900	0.792	0.197	0.989
Back Side	UMTS 1900	0.945	0.197	1.142
Back Side	LTE Band 17	0.159	0.197	0.356
Back Side	LTE Band 4 (AWS)	0.605	0.197	0.802
Back Side	LTE Band 2 (PCS)	1.042	0.197	1.239
Back Side	LTE Band 7	0.078	0.197	0.275

The worst case 5 GHz WIFI reported SAR for each body-worn configuration was considered for simultaneous SAR exclusion via summation of standalone SAR, regardless of whether the WIFI channel has WIFI Hotspot capability, for simplicity to determine compliance. Please note that the actual simultaneous transmission SAR will not exceed the summed levels indicated.

Table 12-6
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	0.413	0.292	0.705
Back Side	GPRS 850	0.478	0.292	0.770
Back Side	UMTS 850	0.373	0.292	0.665
Back Side	UMTS 1750	0.724	0.292	1.016
Back Side	GSM 1900	0.473	0.292	0.765
Back Side	GPRS 1900	0.792	0.292	1.084
Back Side	UMTS 1900	0.945	0.292	1.237
Back Side	LTE Band 17	0.159	0.292	0.451
Back Side	LTE Band 4 (AWS)	0.605	0.292	0.897
Back Side	LTE Band 2 (PCS)	1.042	0.292	1.334
Back Side	LTE Band 7	0.078	0.292	0.370

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.

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 12-7
Simultaneous Transmission Scenario (2.4 GHz Hotspot at 1.0 cm)

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.478	0.082	**0.560**
	Front	0.340	0.037	0.377
	Top	-	0.040	0.040
	Bottom	0.233	-	0.233
	Right	0.447	0.029	0.476
	Left	-	-	0.000

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.373	0.082	**0.455**
	Front	0.275	0.037	0.312
	Top	-	0.040	0.040
	Bottom	0.182	-	0.182
	Right	0.337	0.029	0.366
	Left	-	-	0.000

Simult Tx	Configuration	UMTS 1750 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.724	0.082	**0.806**
	Front	0.438	0.037	0.475
	Top	-	0.040	0.040
	Bottom	0.457	-	0.457
	Right	-	0.029	0.029
	Left	0.429	-	0.429

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.792	0.082	**0.874**
	Front	0.334	0.037	0.371
	Top	-	0.040	0.040
	Bottom	0.646	-	0.646
	Right	0.166	0.029	0.195
	Left	-	-	0.000

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.945	0.082	**1.027**
	Front	0.484	0.037	0.521
	Top	-	0.040	0.040
	Bottom	0.883	-	0.883
	Right	0.231	0.029	0.260
	Left	-	-	0.000

Simult Tx	Configuration	LTE Band 17 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.160	0.082	**0.242**
	Front	0.093	0.037	0.130
	Top	-	0.040	0.040
	Bottom	0.065	-	0.065
	Right	-	0.029	0.029
	Left	0.193	-	0.193

Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.605	0.082	**0.687**
	Front	0.345	0.037	0.382
	Top	-	0.040	0.040
	Bottom	0.399	-	0.399
	Right	-	0.029	0.029
	Left	0.329	-	0.329

Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	1.042	0.082	**1.124**
	Front	0.518	0.037	0.555
	Top	-	0.040	0.040
	Bottom	0.893	-	0.893
	Right	0.252	0.029	0.281
	Left	-	-	0.000

Simult Tx	Configuration	LTE Band 7 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.078	0.082	**0.160**
	Front	0.016	0.037	0.053
	Top	-	0.040	0.040
	Bottom	0.041	-	0.041
	Right	-	0.029	0.029
	Left	0.027	-	0.027

Table 12-8
Simultaneous Transmission Scenario (5 GHz Hotspot at 1.0 cm)

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.478	0.197	**0.675**
	Front	0.340	0.059	0.399
	Top	-	0.156	0.156
	Bottom	0.233	-	0.233
	Right	0.447	0.024	0.471
	Left	-	-	0.000

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.373	0.197	**0.570**
	Front	0.275	0.059	0.334
	Top	-	0.156	0.156
	Bottom	0.182	-	0.182
	Right	0.337	0.024	0.361
	Left	-	-	0.000

Simult Tx	Configuration	UMTS 1750 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.724	0.197	**0.921**
	Front	0.438	0.059	0.497
	Top	-	0.156	0.156
	Bottom	0.457	-	0.457
	Right	-	0.024	0.024
	Left	0.429	-	0.429

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.792	0.197	**0.989**
	Front	0.334	0.059	0.393
	Top	-	0.156	0.156
	Bottom	0.646	-	0.646
	Right	0.166	0.024	0.190
	Left	-	-	0.000

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.945	0.197	**1.142**
	Front	0.484	0.059	0.543
	Top	-	0.156	0.156
	Bottom	0.883	-	0.883
	Right	0.231	0.024	0.255
	Left	-	-	0.000

Simult Tx	Configuration	LTE Band 17 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.160	0.197	**0.357**
	Front	0.093	0.059	0.152
	Top	-	0.156	0.156
	Bottom	0.065	-	0.065
	Right	-	0.024	0.024
	Left	0.193	-	0.193

Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.605	0.197	**0.802**
	Front	0.345	0.059	0.404
	Top	-	0.156	0.156
	Bottom	0.399	-	0.399
	Right	-	0.024	0.024
	Left	0.329	-	0.329

Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	1.042	0.197	**1.239**
	Front	0.518	0.059	0.577
	Top	-	0.156	0.156
	Bottom	0.893	-	0.893
	Right	0.252	0.024	0.276
	Left	-	-	0.000

Simult Tx	Configuration	LTE Band 7 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.078	0.197	**0.275**
	Front	0.016	0.059	0.075
	Top	-	0.156	0.156
	Bottom	0.041	-	0.041
	Right	-	0.024	0.024
	Left	0.027	-	0.027

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.

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	1900.00	19100	LTE Band 2 (PCS)	QPSK, 1 RB, 50 RB Offset	back	10 mm	0.968	0.934	1.04	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.

14 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
SPEAG	DAE4	Dasy Data Acquisition Electronics	12/12/2013	Annual	12/12/2014	649
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/26/2014	Annual	2/26/2015	665
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/13/2013	Annual	5/13/2014	859
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/22/2014	Annual	1/22/2015	1272
SPEAG	DAE4	Dasy Data Acquisition Electronics	8/21/2013	Annual	8/21/2014	1322
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/19/2013	Annual	11/19/2014	1333
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/17/2014	Annual	3/17/2015	1364
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/19/2013	Annual	11/19/2014	1408
SPEAG	D1765V2	1765 MHz SAR Dipole	5/14/2013	Annual	5/14/2014	1008
SPEAG	D1900V2	1900 MHz SAR Dipole	7/22/2013	Annual	7/22/2014	5d149
SPEAG	D2450V2	2450 MHz SAR Dipole	8/23/2013	Annual	8/23/2014	719
SPEAG	D2450V2	2450 MHz SAR Dipole	1/21/2014	Annual	1/21/2015	797
SPEAG	D2600V2	2600 MHz SAR Dipole	11/15/2013	Annual	11/15/2014	1071
SPEAG	D5GHzV2	5 GHz SAR Dipole	9/23/2013	Annual	9/23/2014	1007
SPEAG	D750V3	750 MHz Dipole	1/20/2014	Annual	1/20/2015	1003
SPEAG	D835V2	835 MHz SAR Dipole	1/22/2014	Annual	1/22/2015	4d132
SPEAG	ES3DV2	SAR Probe	8/22/2013	Annual	8/22/2014	3022
SPEAG	ES3DV3	SAR Probe	2/25/2014	Annual	2/25/2015	3258
SPEAG	ES3DV3	SAR Probe	5/16/2013	Annual	5/16/2014	3263
SPEAG	EXDV4	SAR Probe	1/29/2014	Annual	1/29/2015	3589
SPEAG	ES3DV3	SAR Probe	11/22/2013	Annual	11/22/2014	3333
SPEAG	EX3DV4	SAR Probe	10/23/2013	Annual	10/23/2014	3914
SPEAG	EX3DV4	SAR Probe	12/18/2013	Annual	12/18/2014	3920
Agilent	8753E	(30kHz-6GHz) Network Analyzer	7/23/2013	Annual	7/23/2014	US37390350
Agilent	8594A	(9kHz-2.9GHz) Spectrum Analyzer	N/A	N/A	N/A	3051A00187
Agilent	N9020A	MXA Signal Analyzer	10/29/2013	Annual	10/29/2014	US46470561
Agilent	8753ES	S-Parameter Network Analyzer	10/29/2013	Annual	10/29/2014	US39170122
Agilent	85047A	S-Parameter Test Set	N/A	N/A	N/A	2904A00579
Agilent	E5515C	Wireless Communications Test Set	3/19/2014	Annual	3/19/2015	GB45360985
Agilent	E5515C	Wireless Communications Test Set	3/18/2014	Annual	3/18/2015	GB46110872
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433972
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433974
Anritsu	MT8820C	Radio Communication Analyzer	12/12/2013	Annual	12/12/2014	6200901190
Anritsu	MT8820C	Radio Communication Analyzer	12/12/2013	Annual	12/12/2014	6201300731
Anritsu	MA24106A	USB Power Sensor	12/18/2013	Annual	12/18/2014	1344545
Anritsu	MA24106A	USB Power Sensor	1/3/2014	Annual	1/3/2015	1349509
Anritsu	MA24106A	USB Power Sensor	1/3/2014	Annual	1/3/2015	1349514
COMTech	AR85729-5	Solid State Amplifier	CBT	N/A	CBT	M1S5A00-009
COMTECH	AR85729-5/5759B	Solid State Amplifier	CBT	N/A	CBT	M3W1A00-1002
Fisher Scientific	15-077-960	Digital Thermometer	12/4/2013	Biennial	12/4/2015	130764558
Fisher Scientific	S407993	Long Stem Thermometer	11/4/2013	Biennial	11/4/2015	130671826
Gigatronics	80701A	(0.05-18GHz) Power Sensor	10/30/2013	Annual	10/30/2014	1833460
Gigatronics	8651A	Universal Power Meter	10/30/2013	Annual	10/30/2014	8650319
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
MiniCircuits	SLP-2400+	Low Pass Filter	CBT	N/A	CBT	R8979500903
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
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-1200+	Low Pass Filter DC to 1000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Narda	BW-S3W2	Attenuator (3dB)	CBT	N/A	CBT	120
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Rohde & Schwarz	CMU200	Base Station Simulator	9/23/2013	Annual	9/23/2014	109892
Rohde & Schwarz	CMU200	Base Station Simulator	5/3/2013	Annual	5/3/2014	836371/0079
Rohde & Schwarz	NRVD	Dual Channel Power Meter	10/12/2012	Biennial	10/12/2014	101695
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	10/18/2013	Annual	10/18/2014	100976
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	2/20/2014	Annual	2/20/2015	128633
Rohde & Schwarz	NRV-Z32	Peak Power Sensor	10/12/2012	Biennial	10/12/2014	836019/013
Rohde & Schwarz	SME06	Signal Generator	10/30/2013	Annual	10/30/2014	832026
Rohde & Schwarz	NRVS	Single Channel Power Meter	10/31/2013	Annual	10/31/2014	835360/0079
Seekonk	NC-100	Torque Wrench 5/16", 8" lbs	3/18/2014	Biennial	3/18/2016	N/A
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/14/2013	Annual	5/14/2014	1070
SPEAG	DAK-3.5	Dielectric Assessment Kit	11/13/2013	Annual	11/13/2014	1091
SPEAG	DAKS-3.5	Portable Dielectric Assessment Kit	8/18/2013	Annual	8/18/2014	1008
SPEAG	DAKS-3.5	Portable Dielectric Assessment Kit	8/18/2013	Annual	8/18/2014	1009
VWR	23226-658	Long Stem Thermometer	5/16/2012	Biennial	5/16/2014	122295544
VWR	36934-158	Wall-Mounted Thermometer	8/8/2013	Biennial	8/8/2015	130477866
Anritsu	MA2411B	Pulse Sensor	4/8/2014	Annual	4/8/2015	846215
Anritsu	ML2495A	Power Meter	10/31/2013	Annual	10/31/2014	941001

Note:

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

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

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

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]

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APPENDIX A: SAR TEST DATA

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 4

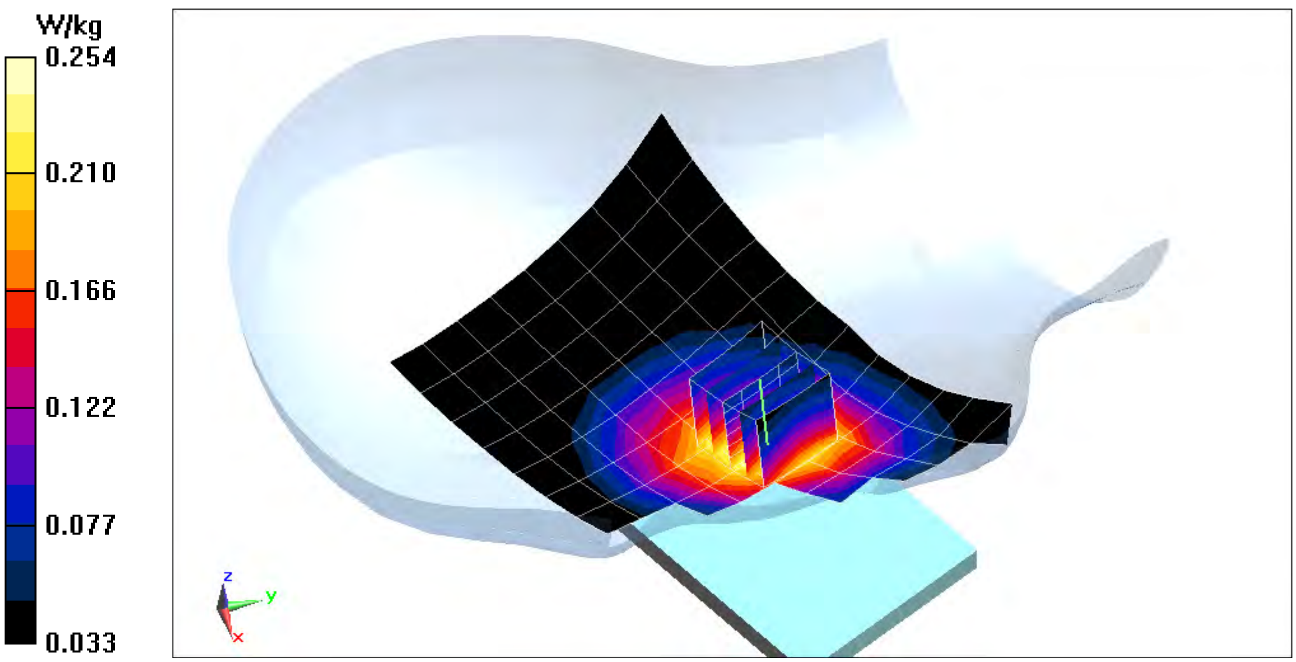
Communication System: UID 0, GSM GPRS; 3 Tx slots (0); Frequency: 836.6 MHz;Duty Cycle: 1:2.76
Medium: 835 Head Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.907 S/m; ε_r = 40.607; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 04-17-2014; Ambient Temp: 24.5°C; Tissue Temp: 23.5°C

Probe: EX3DV4 - SN3914; ConvF(9.34, 9.34, 9.34); Calibrated: 10/23/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648
Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

Mode: GPRS 850, Right Head, Cheek, Mid.ch, 3 Tx slots

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.584 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.305 W/kg
SAR(1 g) = 0.242 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 4

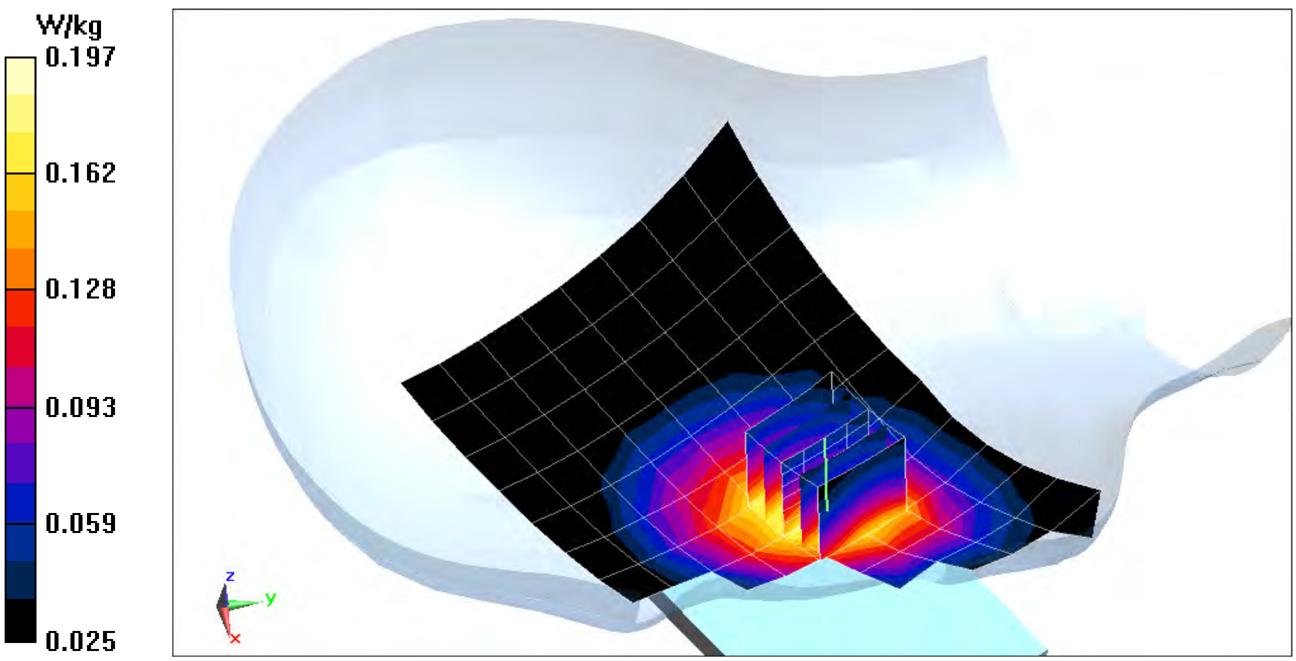
Communication System: UID 0, UMTS; Frequency: 836.6 MHz;Duty Cycle: 1:1
Medium: 835 Head Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.907 S/m; ε_r = 40.607; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 04-17-2014; Ambient Temp: 24.5°C; Tissue Temp: 23.5°C

Probe: EX3DV4 - SN3914; ConvF(9.34, 9.34, 9.34); Calibrated: 10/23/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648
Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

Mode: Wireless Charging Cover Open, UMTS 850, Right 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 = 14.618 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 0.246 W/kg
SAR(1 g) = 0.190 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 4

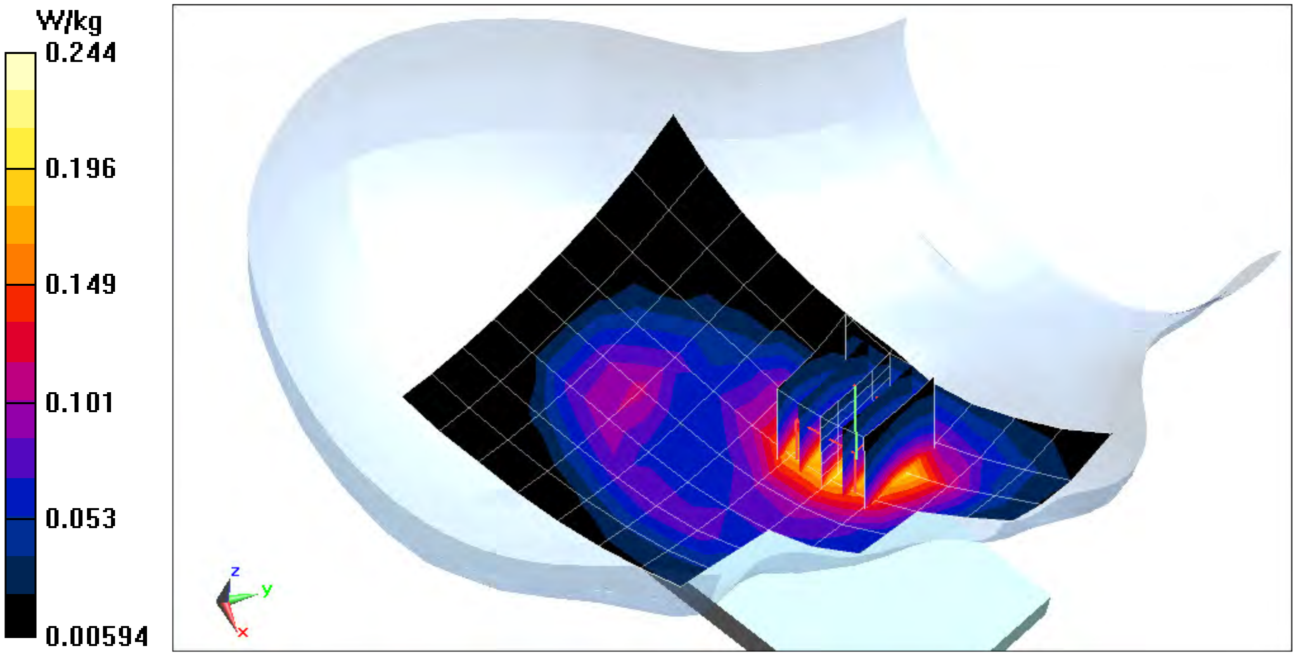
Communication System: UID 0, AWS UMTS; Frequency: 1732.4 MHz;Duty Cycle: 1:1
Medium: 1750 Head Medium parameters used (interpolated):
f = 1732.4 MHz; σ = 1.398 S/m; ε_r = 39.602; ρ = 1000 kg/m^3
Phantom section: Right Section ; Space: 1.0 cm

Test Date: 04-15-2014; Ambient Temp: 23.9°C; Tissue Temp: 21.1°C

Probe: ES3DV3 - SN3263; ConvF(5.3, 5.3, 5.3); Calibrated: 5/16/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 5/13/2013
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: Wireless Charging Cover Open, AWS UMTS, Right Head, Cheek, Mid.ch

Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.499 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 0.329 W/kg
SAR(1 g) = 0.226 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 5

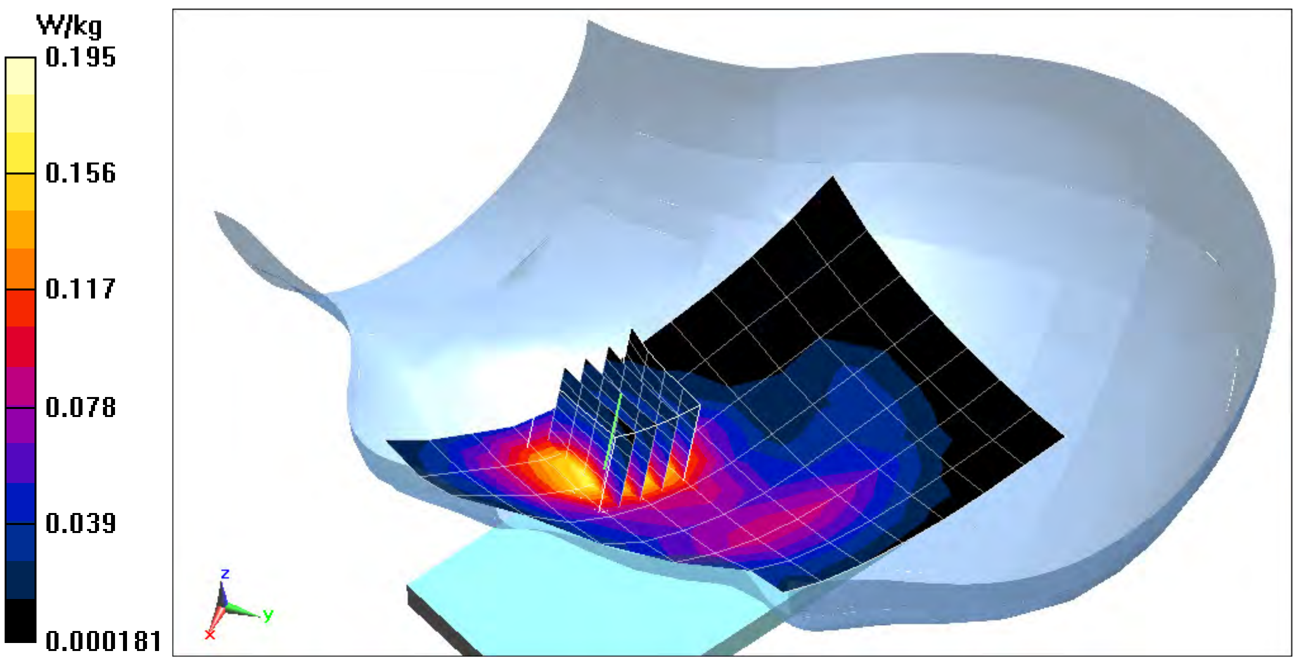
Communication System: UID 0, GSM GPRS; 3 Tx slots (0); Frequency: 1880 MHz;Duty Cycle: 1:2.76
Medium: 1900 Head Medium parameters used:
f = 1880 MHz; σ = 1.382 S/m; ε_r = 41.43; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 04-08-2014; Ambient Temp: 24.2°C; Tissue Temp: 22.2°C

Probe: ES3DV3 - SN3258; ConvF(5.04, 5.04, 5.04); Calibrated: 2/25/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 2/26/2014
Phantom: SAM Front; Type: SAM; Serial: 1686
Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

Mode: Wireless Charging Cover Open, GPRS 1900, Left Head, Cheek, Mid.ch, 3 Tx slots

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.293 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 0.327 W/kg
SAR(1 g) = 0.180 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 5

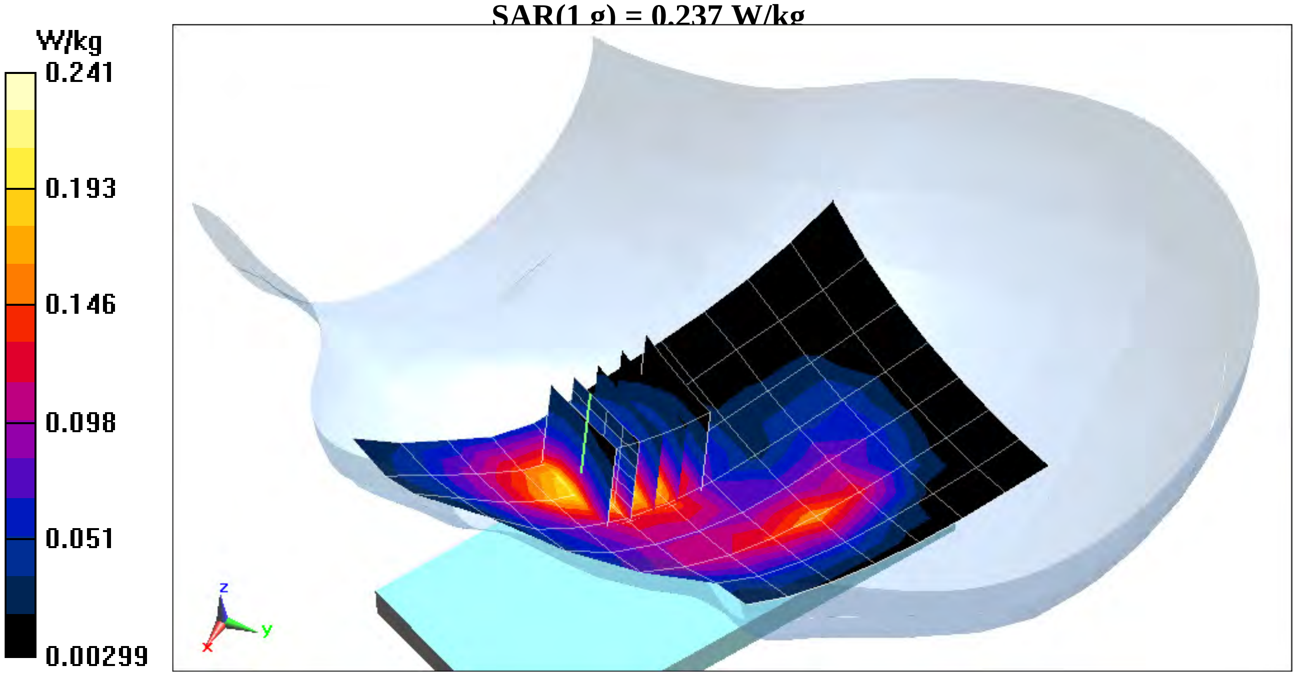
Communication System: UID 0, UMTS; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: 1900 Head Medium parameters used:
f = 1880 MHz; σ = 1.382 S/m; ε_r = 41.43; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 04-08-2014; Ambient Temp: 24.2°C; Tissue Temp: 22.2°C

Probe: ES3DV3 - SN3258; ConvF(5.04, 5.04, 5.04); Calibrated: 2/25/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 2/26/2014
Phantom: SAM Front; Type: SAM; Serial: 1686
Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

Mode: Wireless Charging Cover Open, 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 = 12.645 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 0.375 W/kg
SAR(1 g) = 0.237 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 2

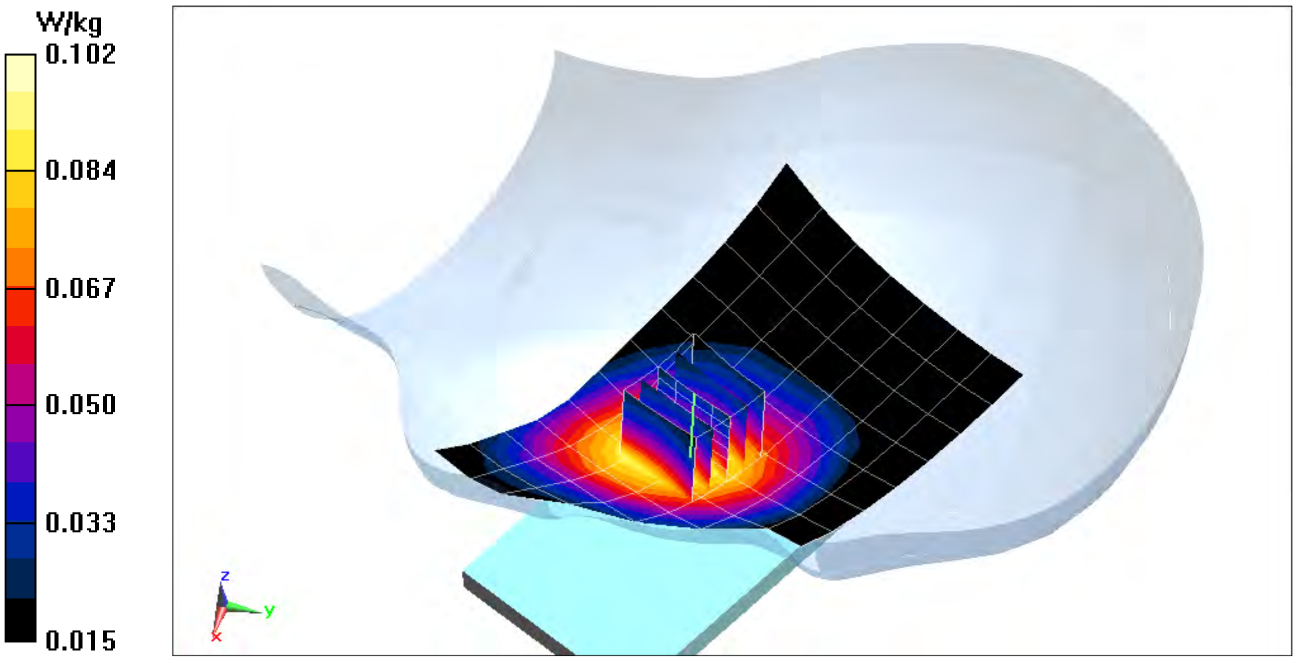
Communication System: UID 0, LTE Band 17; Frequency: 710 MHz;Duty Cycle: 1:1
Medium: 740 Head Medium parameters used:
f = 710 MHz; σ = 0.884 S/m; ε_r = 42.247; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 04-16-2014; Ambient Temp: 24.1°C; Tissue Temp: 23.2°C

Probe: ES3DV3 - SN3258; ConvF(6.53, 6.53, 6.53); Calibrated: 2/25/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 2/26/2014
Phantom: SAM Front; Type: SAM; Serial: 1686
Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

Mode: LTE Band 17, 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 (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 11.322 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.119 W/kg
SAR(1 g) = 0.097 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 1

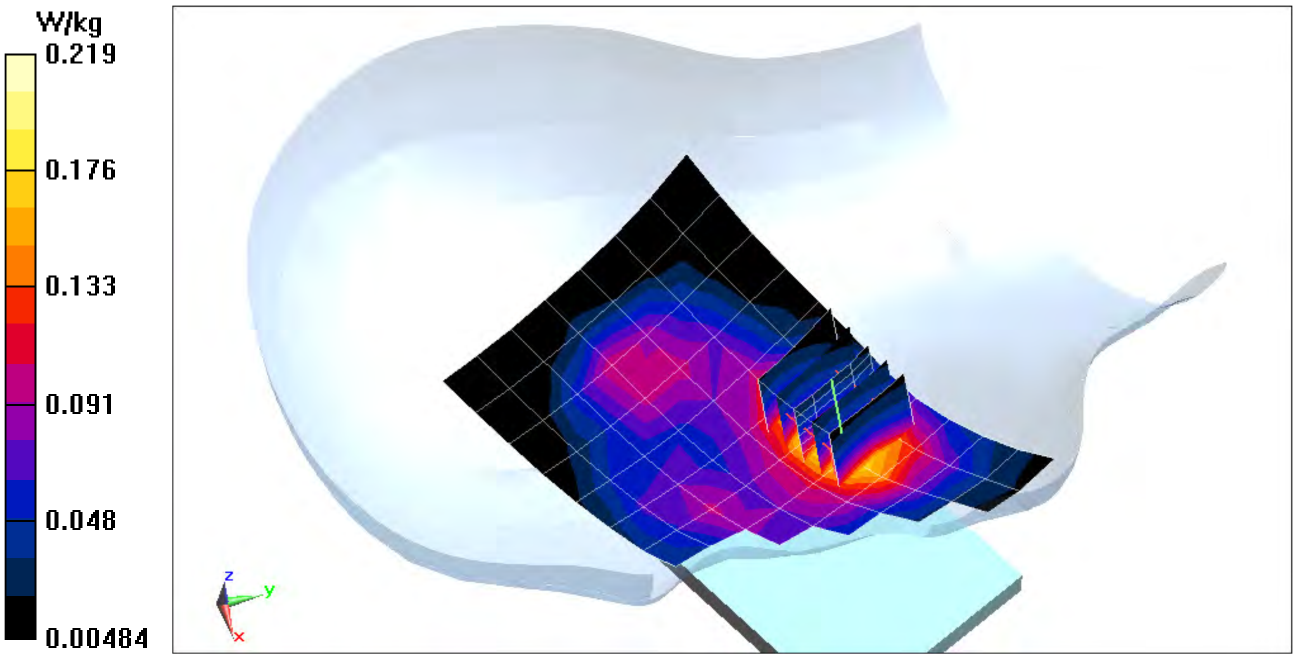
Communication System: UID 0, LTE RF; Frequency: 1732.5 MHz;Duty Cycle: 1:1
Medium: 1750 Head Medium parameters used (interpolated):
f = 1732.5 MHz; σ = 1.398 S/m; ε_r = 39.602; ρ = 1000 kg/m^3
Phantom section: Right Section ; Space: 1.0 cm

Test Date: 04-15-2014; Ambient Temp: 23.9°C; Tissue Temp: 21.1°C

Probe: ES3DV3 - SN3263; ConvF(5.3, 5.3, 5.3); Calibrated: 5/16/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 5/13/2013
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: Wireless Charging Cover Open, LTE Band 4 (AWS), Right Head, Cheek, Mid.ch, 20 MHz Bandwidth, QPSK, 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 = 12.741 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.293 W/kg
SAR(1 g) = 0.200 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 1

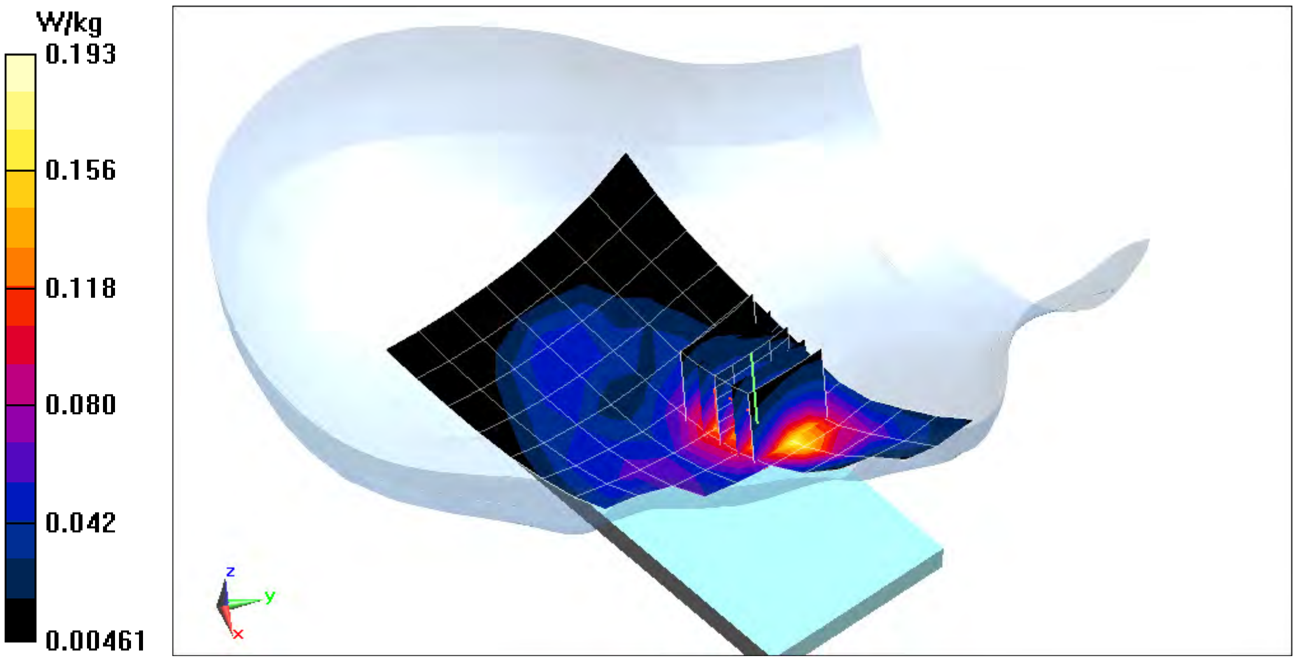
Communication System: UID 0, LTE Band 2 (PCS) (0); Frequency: 1860 MHz;Duty Cycle: 1:1
Medium: 1900 Head Medium parameters used (interpolated):
f = 1860 MHz; σ = 1.36 S/m; ε_r = 41.499; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 04-08-2014; Ambient Temp: 24.2°C; Tissue Temp: 22.2°C

Probe: ES3DV3 - SN3258; ConvF(5.04, 5.04, 5.04); Calibrated: 2/25/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 2/26/2014
Phantom: SAM Front; Type: SAM; Serial: 1686
Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

Mode: LTE Band 2 (PCS), Right Head, Cheek, Low.ch,
20 MHz Bandwidth, QPSK, 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 = 12.504 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.276 W/kg
SAR(1 g) = 0.181 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 1

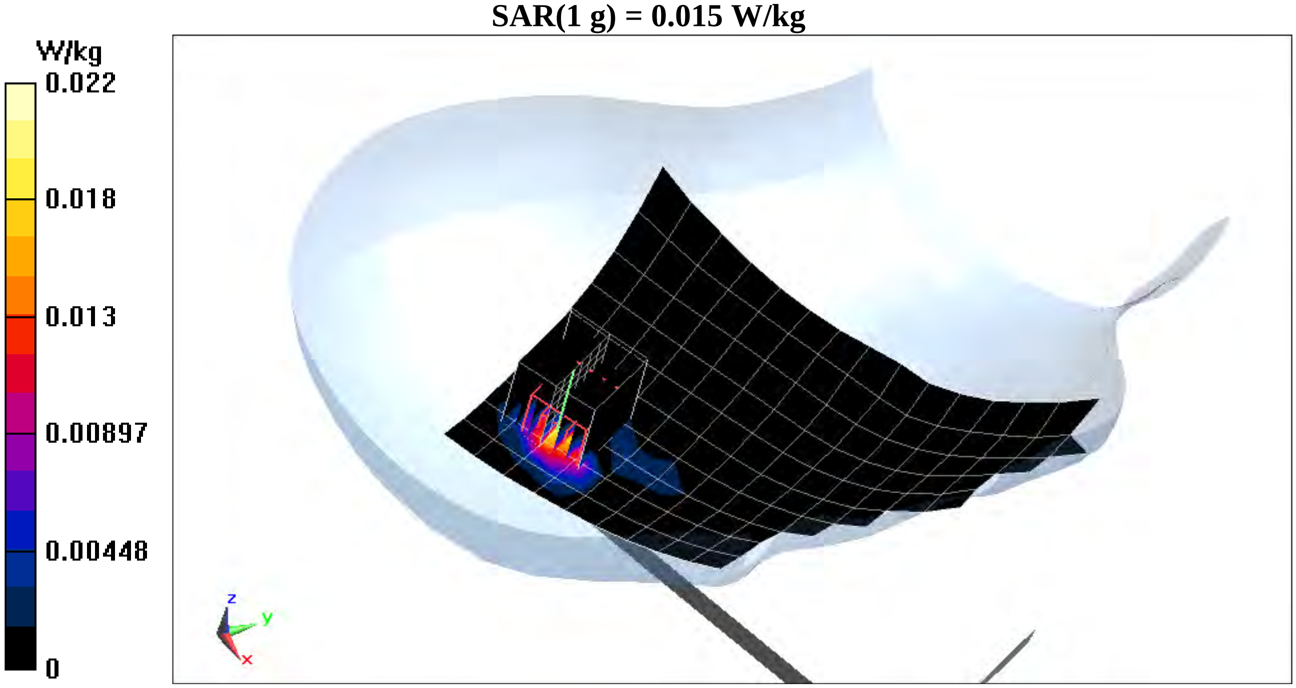
Communication System: UID 0, LTE Band 7 (0); Frequency: 2565 MHz;Duty Cycle: 1:1
Medium: 2600 Head Medium parameters used (interpolated):
f = 2565 MHz; σ = 1.877 S/m; ε_r = 38.819; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 04-10-2014; Ambient Temp: 24.5°C; Tissue Temp: 23.2°C

Probe: ES3DV3 - SN3333; ConvF(4.28, 4.28, 4.28); Calibrated: 11/22/2013;
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 (7);SEMCAD X Version 14.6.10 (7164)

Mode: LTE Band 7, Right Head, Tilt, High.ch,
10 MHz Bandwidth, QPSK, 1 RB, 49 RB Offset

Area Scan (11x18x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.608 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 0.0810 W/kg
SAR(1 g) = 0.015 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 3

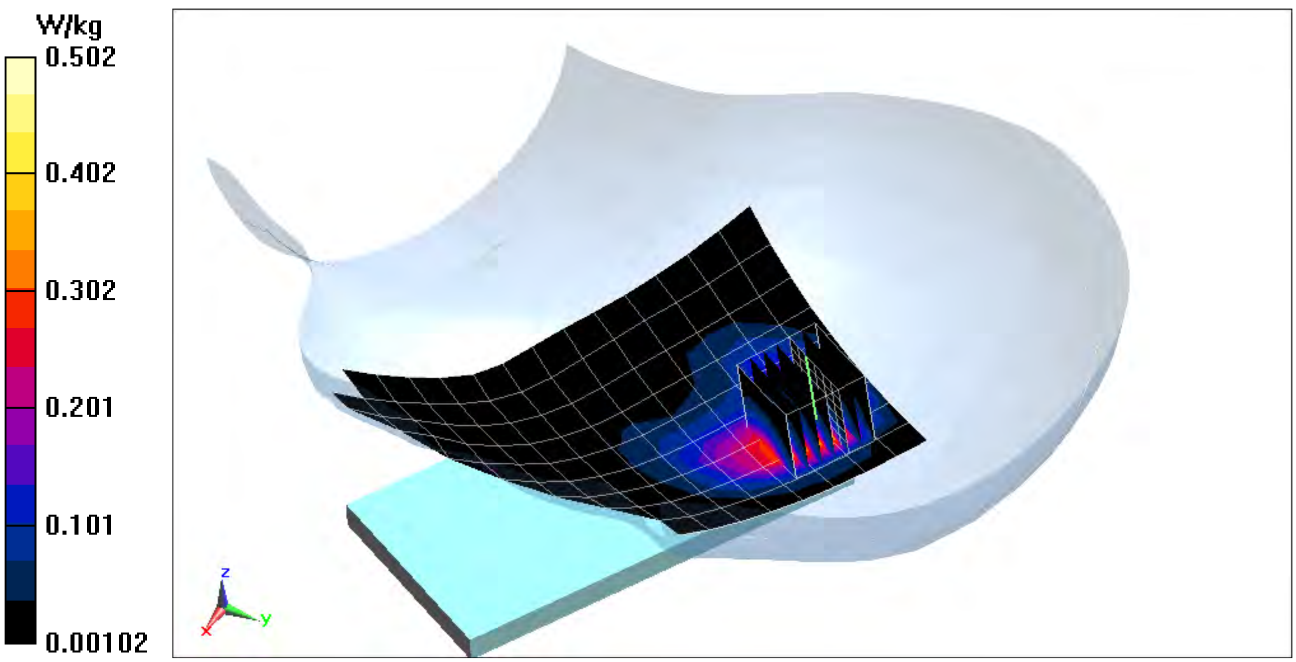
Communication System: UID 0, IEEE 802.11b; Frequency: 2412 MHz;Duty Cycle: 1:1
Medium: 2450 Head Medium parameters used (interpolated):
f = 2412 MHz; σ = 1.713 S/m; ε_r = 38.347; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 04-08-2014; Ambient Temp: 24.5°C; Tissue Temp: 23.4°C

Probe: ES3DV3 - SN3333; ConvF(4.42, 4.42, 4.42); Calibrated: 11/22/2013;
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 (7);SEMCAD X Version 14.6.10 (7164)

Mode: IEEE 802.11b, Left Head, Cheek, Ch 01, 1 Mbps

Area Scan (10x16x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 16.036 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 0.828 W/kg
SAR(1 g) = 0.388 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 3

Communication System: UID 0, IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5765 MHz;Duty Cycle: 1:1
Medium: 5 GHz Head Medium parameters used:
f = 5765 MHz; σ = 5.189 S/m; ε_r = 35.902; ρ = 1000 kg/m^3
Phantom section: Left Section

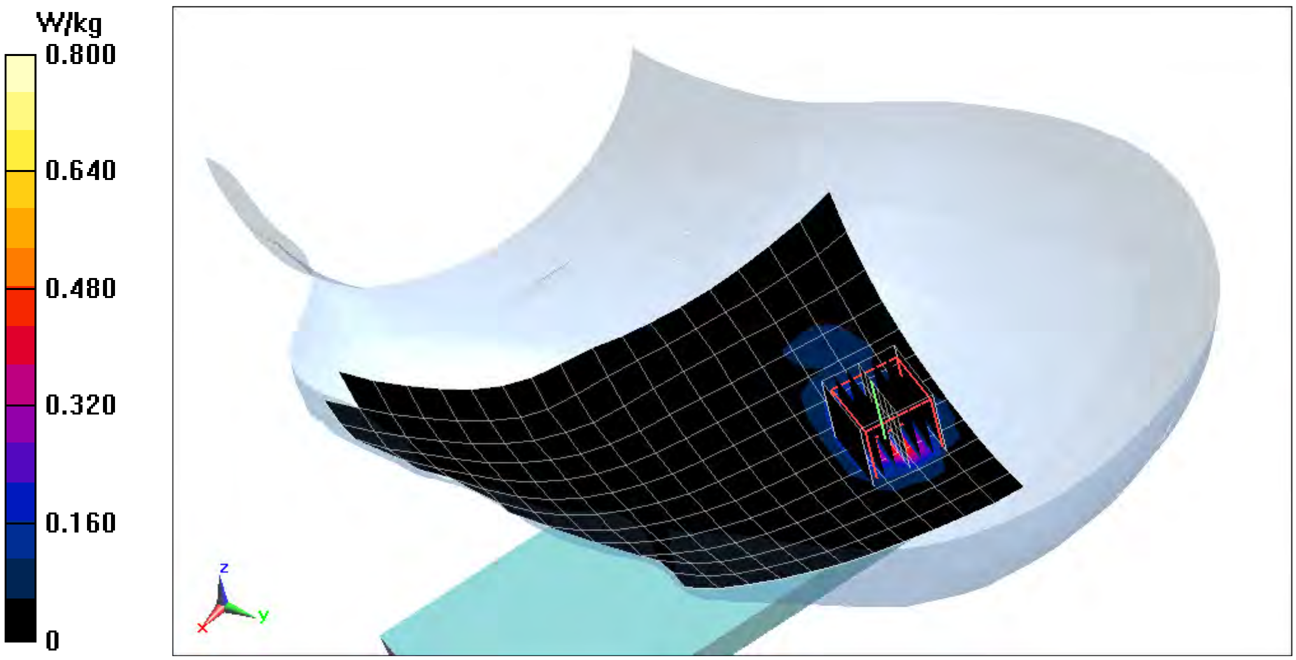
Test Date: 04-08-2014; Ambient Temp: 23.8°C; Tissue Temp: 22.3°C

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 Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

Mode: IEEE 802.11a, 5.8 GHz Left Head, Tilt, Ch 153, 6 Mbps

Area Scan (13x18x1): 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 = 8.507 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 1.25 W/kg
SAR(1 g) = 0.327 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 3

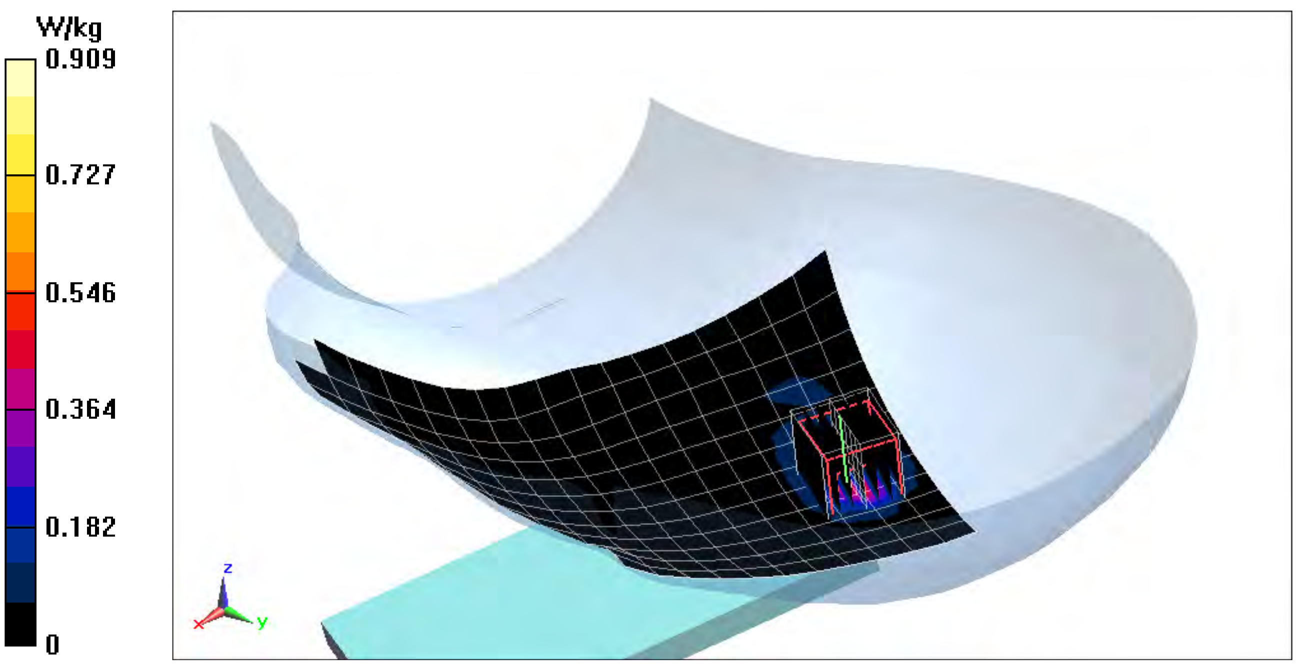
Communication System: UID 0, IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5540 MHz;Duty Cycle: 1:1
Medium: 5 GHz Head Medium parameters used:
f = 5540 MHz; σ = 4.915 S/m; ε_r = 36.192; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 04-08-2014; Ambient Temp: 23.8°C; Tissue Temp: 22.3°C

Probe: EX3DV4 - SN3920; ConvF(4.54, 4.54, 4.54); Calibrated: 12/18/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 12/12/2013
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

Mode: IEEE 802.11a, 5.5 GHz Left Head, Tilt, Ch 108, 6 Mbps

Area Scan (13x18x1): 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 = 9.067 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 1.47 W/kg
SAR(1 g) = 0.375 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 4

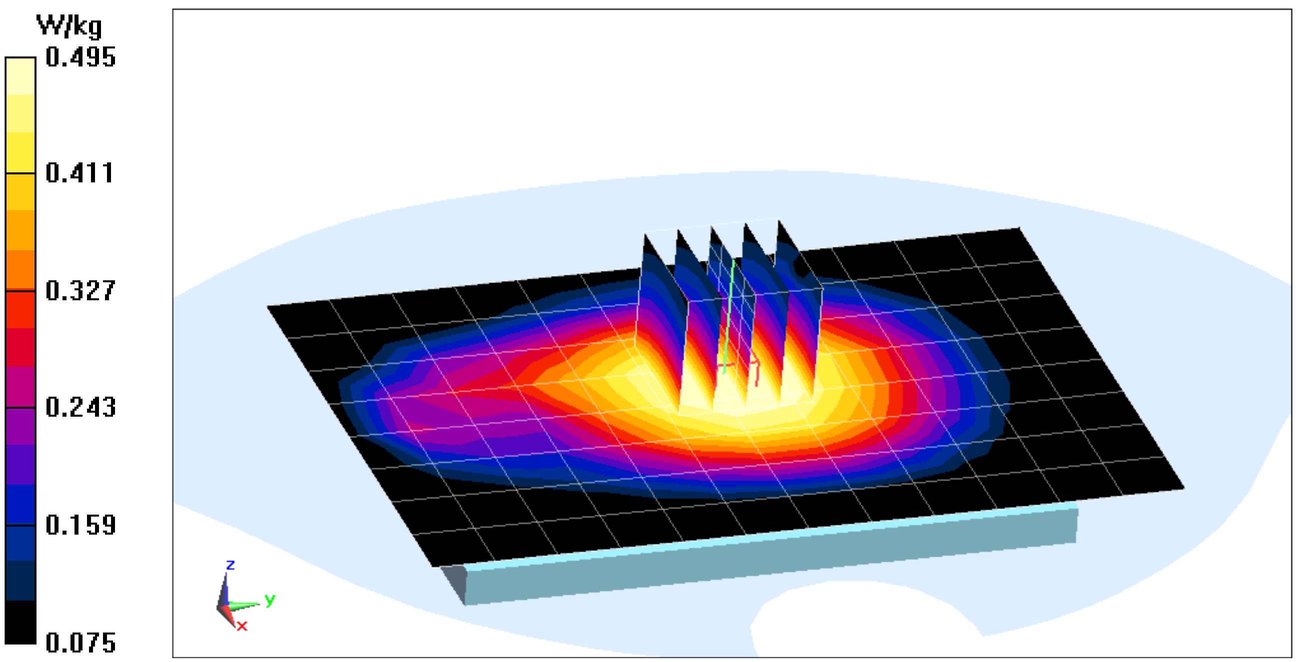
Communication System: UID 0, GSM GPRS; 3 Tx slots; Frequency: 836.6 MHz;Duty Cycle: 1:2.76
Medium: 835 Body Medium parameters used (interpolated):
f = 836.6 MHz; σ = 1 S/m; ε_r = 53.783; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-14-2014; Ambient Temp: 23.0°C; Tissue Temp: 22.1°C

Probe: ES3DV2 - SN3022; ConvF(5.91, 5.91, 5.91); Calibrated: 8/22/2013;
Sensor-Surface: 4mm (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 (7);SEMCAD X Version 14.6.10 (7164)

Mode: GPRS 850, Body SAR, Back side, Mid.ch, 3 Tx Slots

Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.673 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.586 W/kg
SAR(1 g) = 0.474 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 4

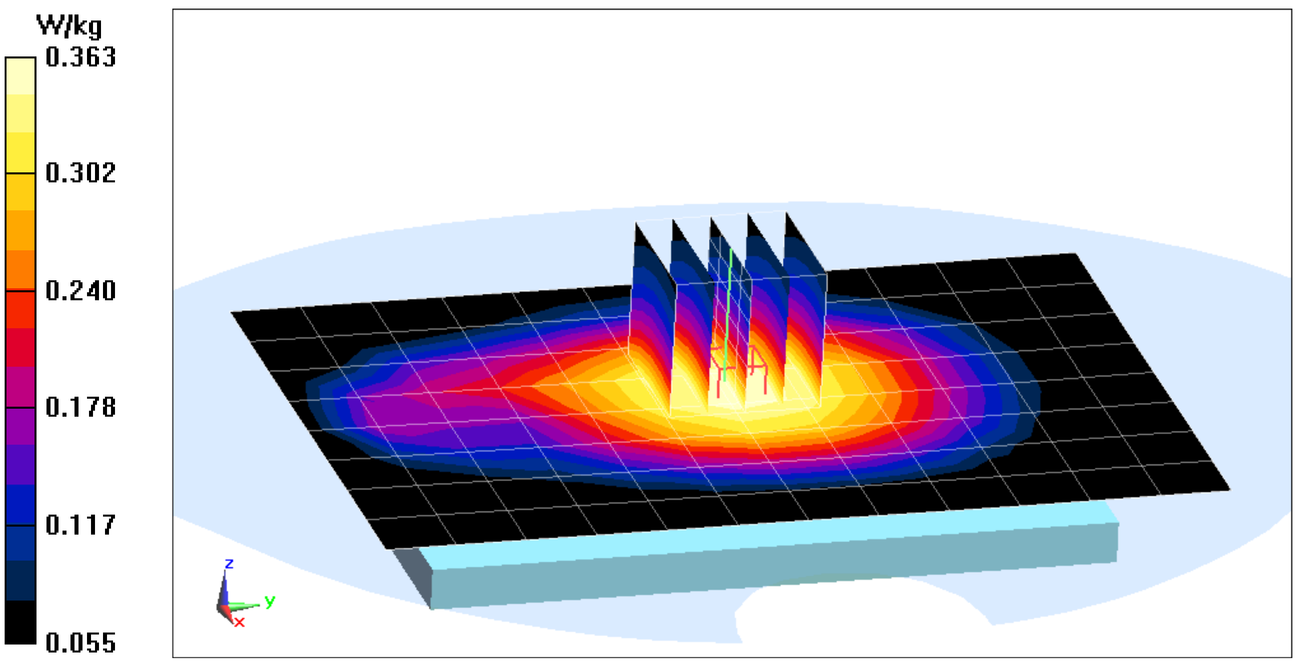
Communication System: UID 0, UMTS; Frequency: 836.6 MHz;Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 836.6 MHz; σ = 1 S/m; ε_r = 53.783; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-14-2014; Ambient Temp: 23.0°C; Tissue Temp: 22.1°C

Probe: ES3DV2 - SN3022; ConvF(5.91, 5.91, 5.91); Calibrated: 8/22/2013;
Sensor-Surface: 4mm (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 (7);SEMCAD X Version 14.6.10 (7164)

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

Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.312 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.429 W/kg
SAR(1 g) = 0.347 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 4

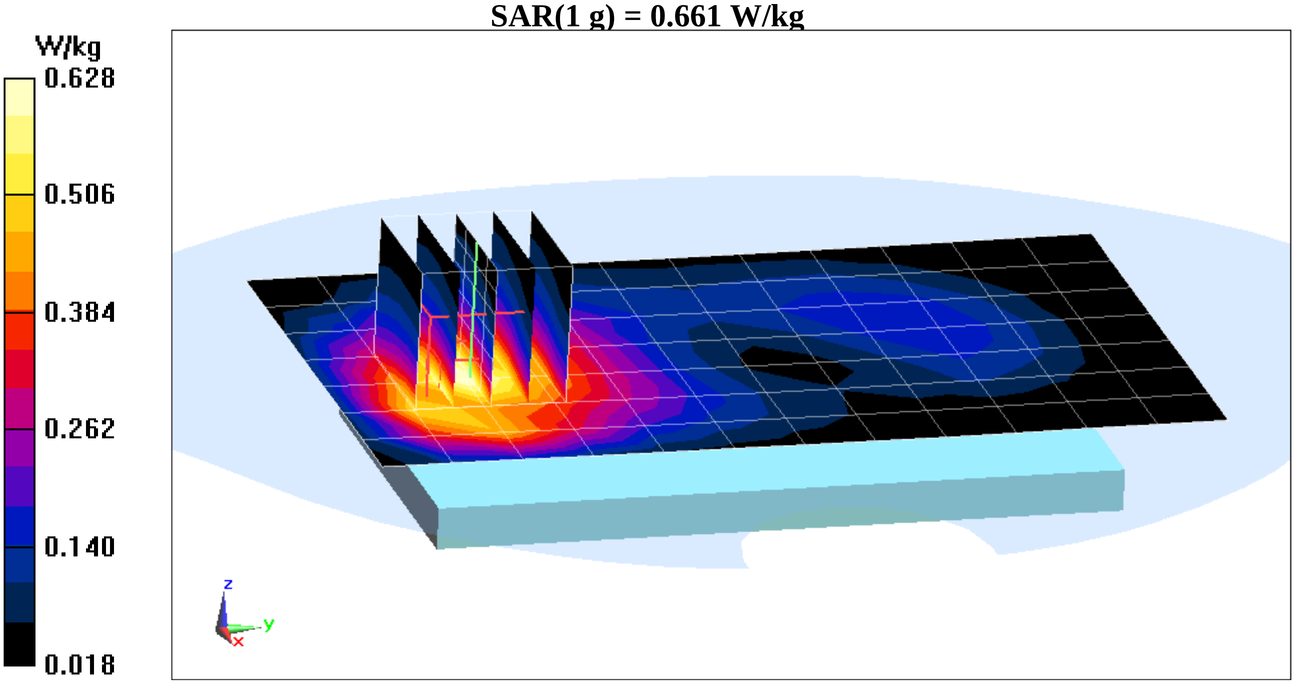
Communication System: UID 0, AWS UMTS; Frequency: 1732.4 MHz;Duty Cycle: 1:1
Medium: 1750 Body Medium parameters used (interpolated):
f = 1732.4 MHz; σ = 1.512 S/m; ε_r = 50.984; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-17-2014; Ambient Temp: 22.0°C; Tissue Temp: 20.1°C

Probe: ES3DV3 - SN3263; ConvF(5.01, 5.01, 5.01); Calibrated: 5/16/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 5/13/2013
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

Mode: Wireless Charging Cover Closed AWS UMTS, 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 = 21.384 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 1.05 W/kg
SAR(1 g) = 0.661 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 6

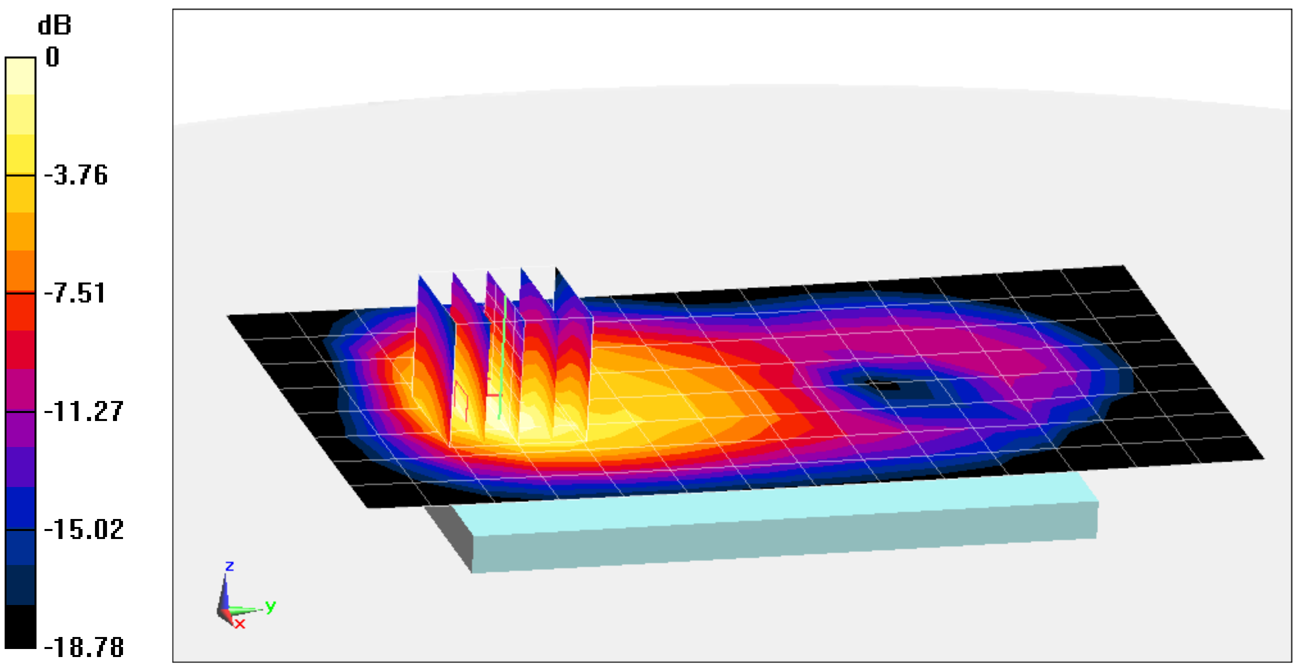
Communication System: UID 0, GSM GPRS; 3 Tx slots; Frequency: 1880 MHz;Duty Cycle: 1:2.76
Medium: 1900 Body Medium parameters used:
f = 1880 MHz; σ = 1.549 S/m; ε_r = 53.054; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-11-2014; Ambient Temp: 24.5°C; Tissue Temp: 24.3°C

Probe: EX3DV4 - SN3589; ConvF(6.54, 6.54, 6.54); Calibrated: 1/29/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/22/2014
Phantom: ELI left; Type: QDOVA002AA; Serial: TP:1202
Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

Mode: GPRS 1900, Body SAR, Back side, Mid.ch, 3 Tx Slots

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.146 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.32 W/kg
SAR(1 g) = 0.772 W/kg



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

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 6

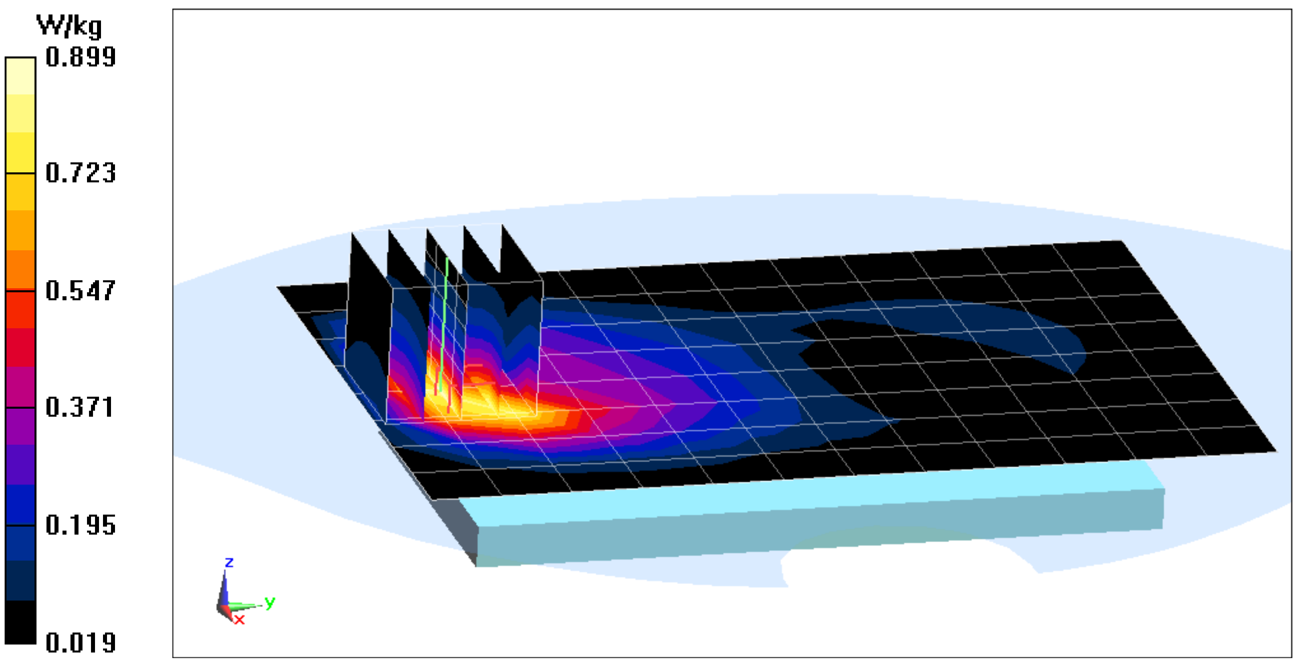
Communication System: UID 0, UMTS; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used:
f = 1880 MHz; σ = 1.494 S/m; ε_r = 52.229; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-11-2014; Ambient Temp: 24.5°C; Tissue Temp: 24.3°C

Probe: EX3DV4 - SN3914; ConvF(7.51, 7.51, 7.51); Calibrated: 10/23/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648
Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

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

Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.893 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.40 W/kg
SAR(1 g) = 0.840 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 2

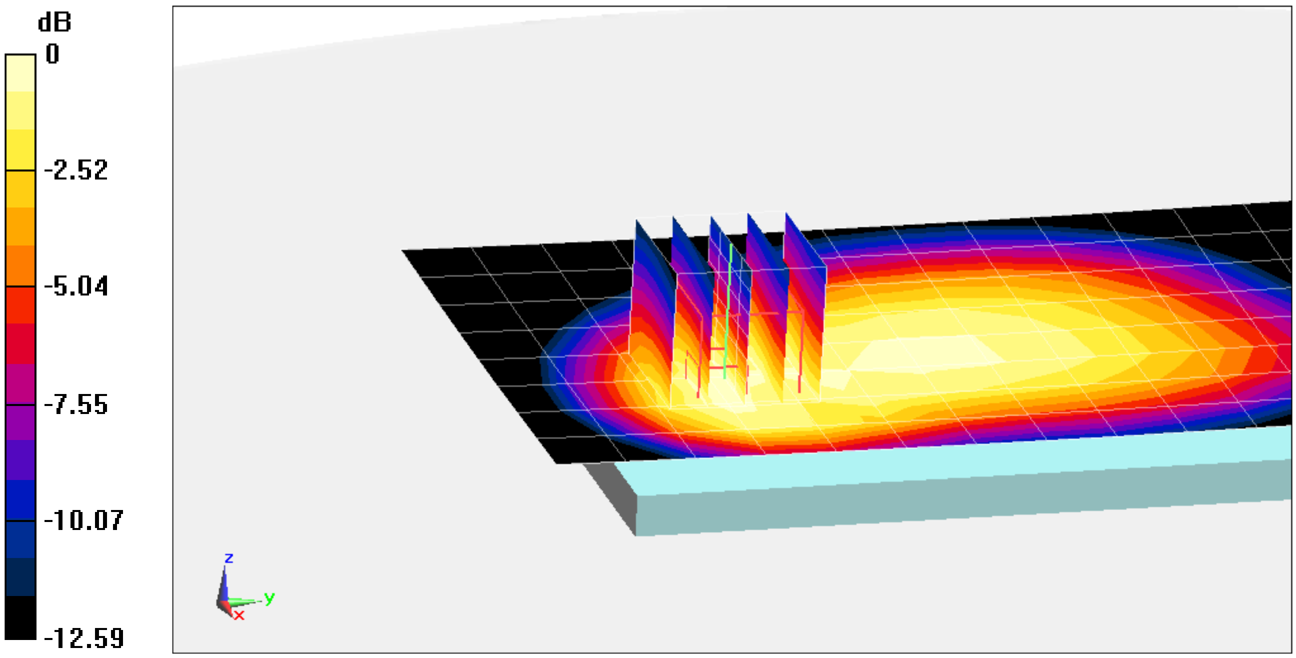
Communication System: UID 0, LTE Band 17; Frequency: 710 MHz;Duty Cycle: 1:1
Medium: 740 Body Medium parameters used:
f = 710 MHz; σ = 0.949 S/m; ε_r = 56.254; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-08-2014; Ambient Temp: 24.1°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3333; ConvF(6.11, 6.11, 6.11); Calibrated: 11/22/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1408; Calibrated: 11/19/2013
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1229
Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

Mode: LTE Band 17, Body SAR, Back side, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 49 RB Offset

Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.072 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.259 W/kg
SAR(1 g) = 0.149 W/kg



0 dB = 0.161 W/kg = -7.93 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 2

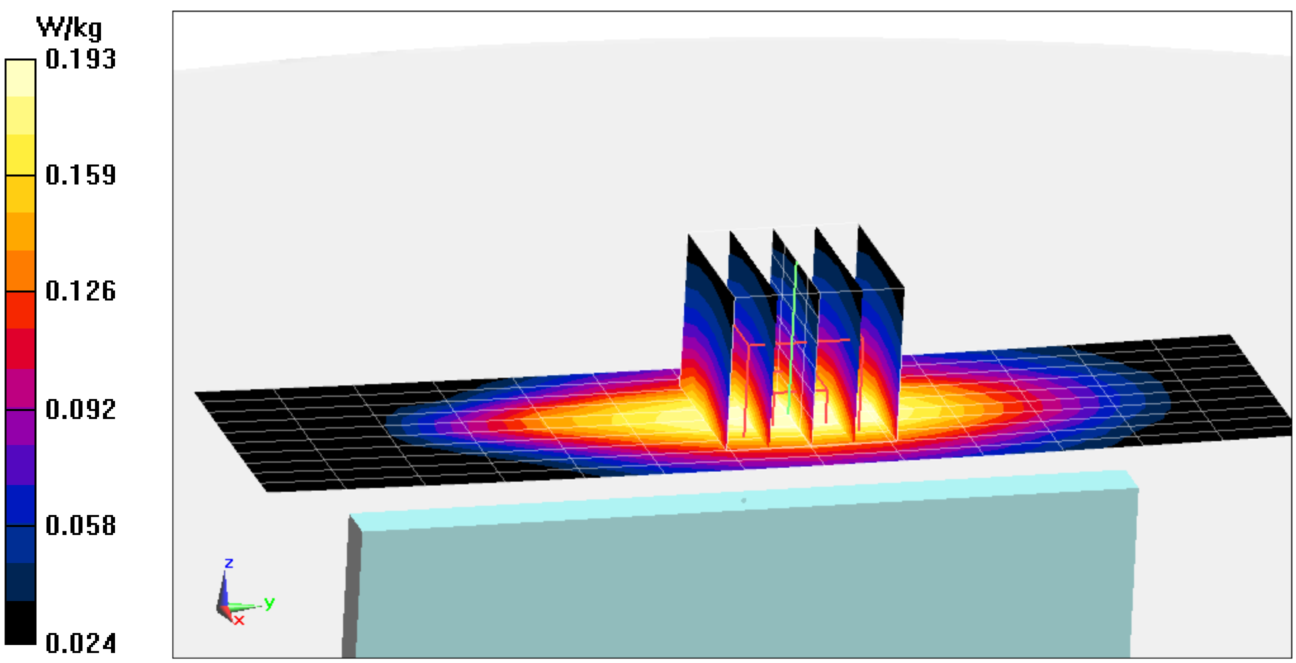
Communication System: UID 0, LTE Band 17; Frequency: 710 MHz;Duty Cycle: 1:1
Medium: 740 Body Medium parameters used:
f = 710 MHz; σ = 0.949 S/m; ε_r = 56.254; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-08-2014; Ambient Temp: 24.1°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3333; ConvF(6.11, 6.11, 6.11); Calibrated: 11/22/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1408; Calibrated: 11/19/2013
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1229
Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

Mode: Wireless Charging Cover Closed, LTE Band 17, Body SAR, Left Edge, Mid.ch, 10 MHz Bandwidth, QPSK, 1 RB, 49 RB Offset

Area Scan (11x14x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.300 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 0.240 W/kg
SAR(1 g) = 0.180 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 1

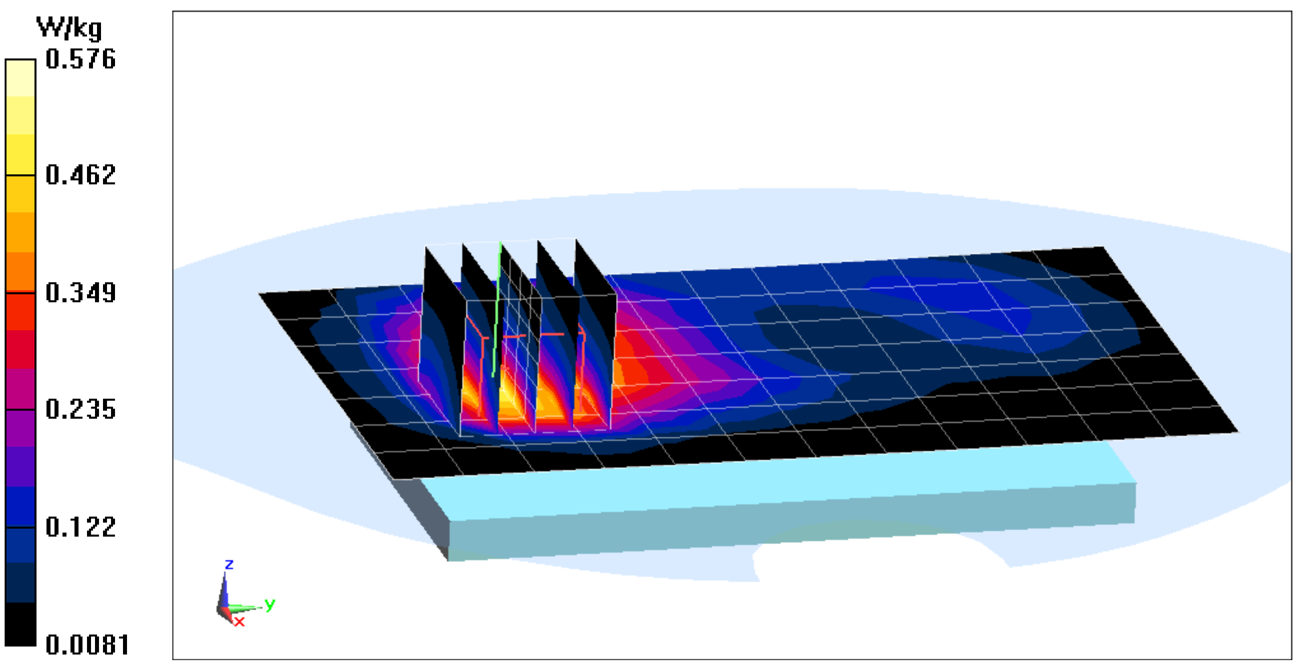
Communication System: UID 0, LTE RF; Frequency: 1732.5 MHz;Duty Cycle: 1:1
Medium: 1750 Body Medium parameters used (interpolated):
f = 1732.5 MHz; σ = 1.512 S/m; ε_r = 50.984; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-17-2014; Ambient Temp: 22.0°C; Tissue Temp: 20.1°C

Probe: ES3DV3 - SN3263; ConvF(5.01, 5.01, 5.01); Calibrated: 5/16/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 5/13/2013
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

Mode: LTE Band 4 (AWS), Body SAR, Back side, Mid.ch,
20 MHz Bandwidth, QPSK, 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 = 19.532 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 0.873 W/kg
SAR(1 g) = 0.537 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 1

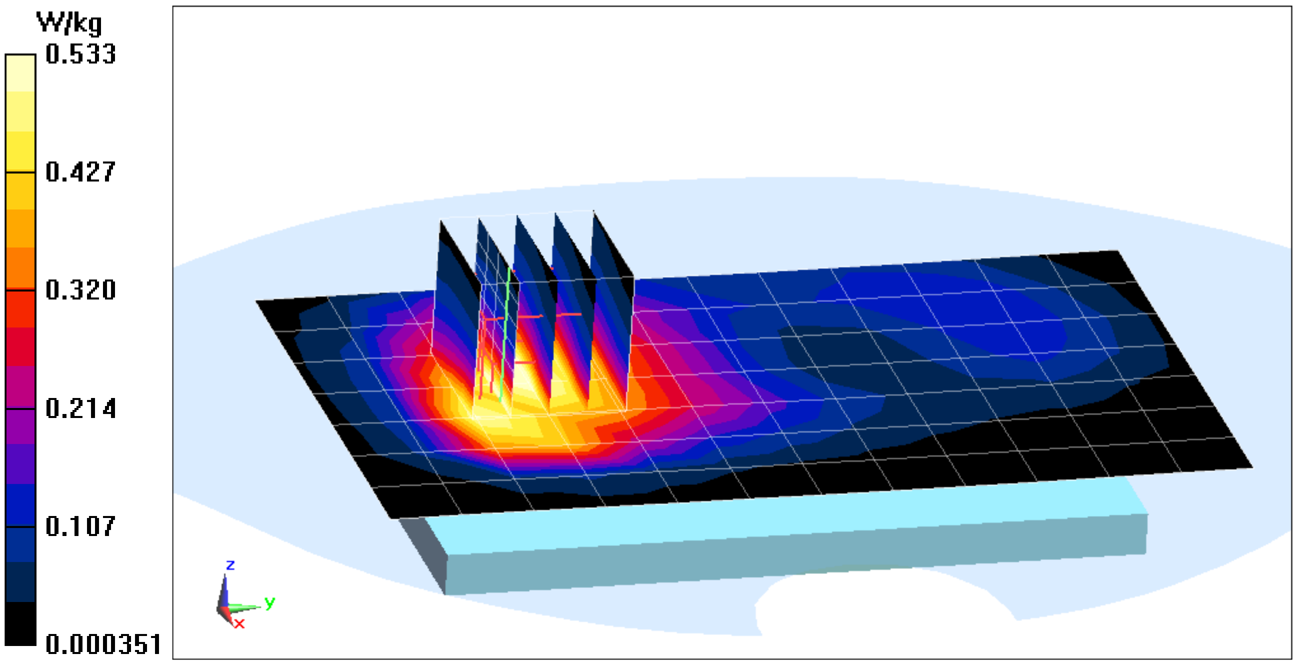
Communication System: UID 0, LTE RF; Frequency: 1732.5 MHz;Duty Cycle: 1:1
Medium: 1750 Body Medium parameters used (interpolated):
f = 1732.5 MHz; σ = 1.512 S/m; ε_r = 50.984; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-17-2014; Ambient Temp: 22.0°C; Tissue Temp: 20.1°C

Probe: ES3DV3 - SN3263; ConvF(5.01, 5.01, 5.01); Calibrated: 5/16/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 5/13/2013
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

Mode: LTE Band 4 (AWS), Body SAR, Back side, Mid.ch,
20 MHz Bandwidth, QPSK, 50 RB, 50 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 = 19.384 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.854 W/kg
SAR(1 g) = 0.535 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 1

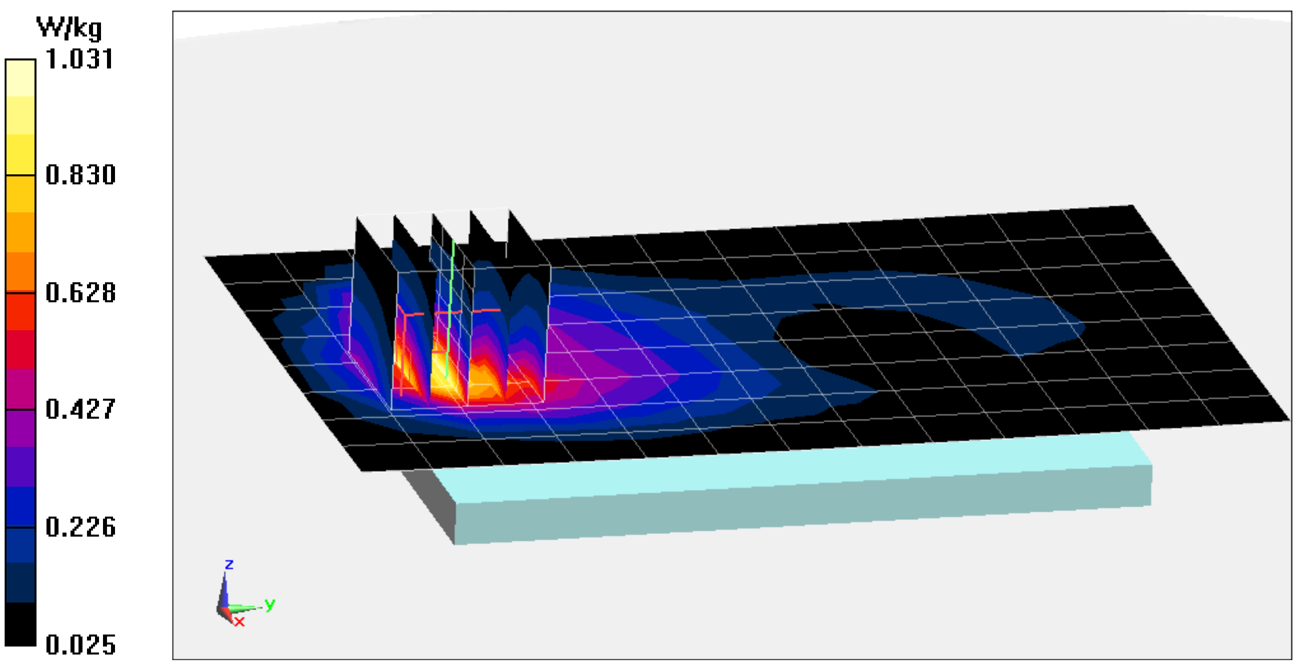
Communication System: UID 0, LTE Band 2 (PCS) (0); Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.568 S/m; ε_r = 52.984; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-08-2014; Ambient Temp: 22.6°C; Tissue Temp: 22.8°C

Probe: EX3DV4 - SN3589; ConvF(6.54, 6.54, 6.54); Calibrated: 1/29/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/22/2014
Phantom: ELI left; Type: QDOVA002AA; Serial: TP:1202
Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

Mode: LTE Band 2 (PCS), Body SAR, Back side, High.ch,
20 MHz Bandwidth, QPSK, 1 RB, 50 RB Offset

Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.698 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.65 W/kg
SAR(1 g) = 0.968 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 5

Communication System: UID 0, LTE Band 7 (0); Frequency: 2565 MHz;Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used (interpolated):
f = 2565 MHz; σ = 2.175 S/m; ε_r = 51.383; ρ = 1000 kg/m^3

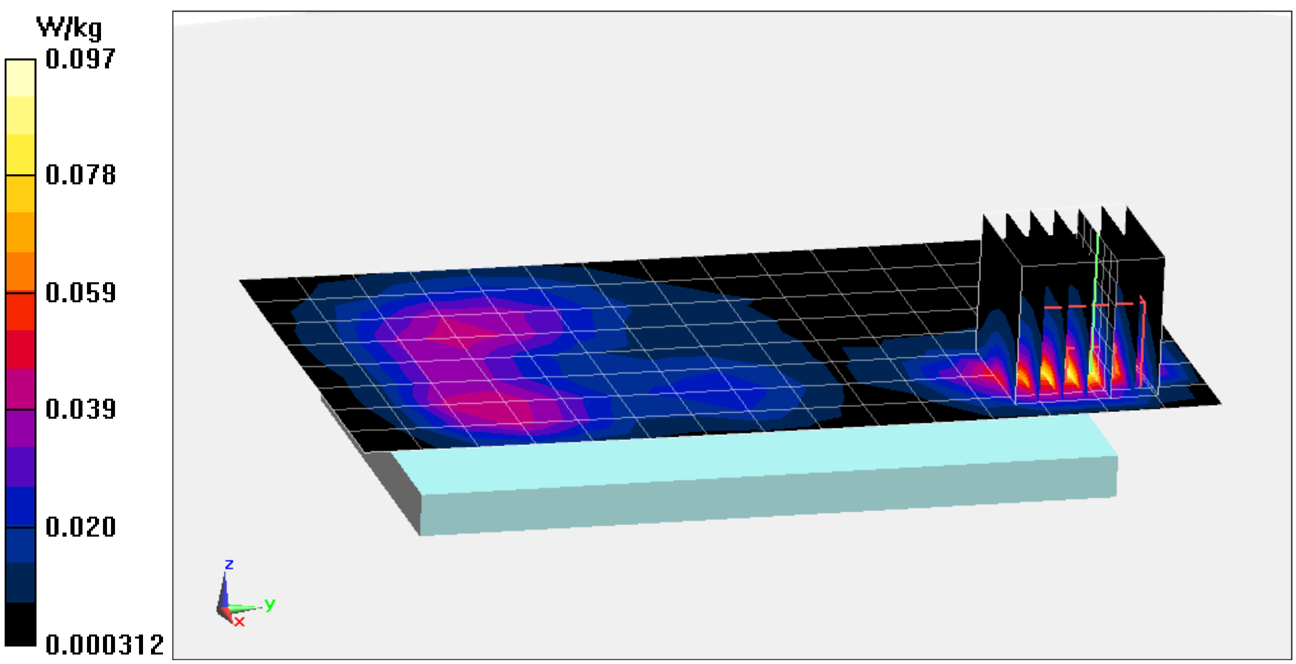
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-10-2014; Ambient Temp: 24.4°C; Tissue Temp: 23.4°C

Probe: ES3DV3 - SN3258; ConvF(3.91, 3.91, 3.91); Calibrated: 2/25/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 2/26/2014
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

Mode: LTE Band 7, Body SAR, Back side, High.ch,
10 MHz Bandwidth, QPSK, 1 RB, 49 RB Offset

Area Scan (9x16x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.215 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 0.166 W/kg
SAR(1 g) = 0.076 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 7

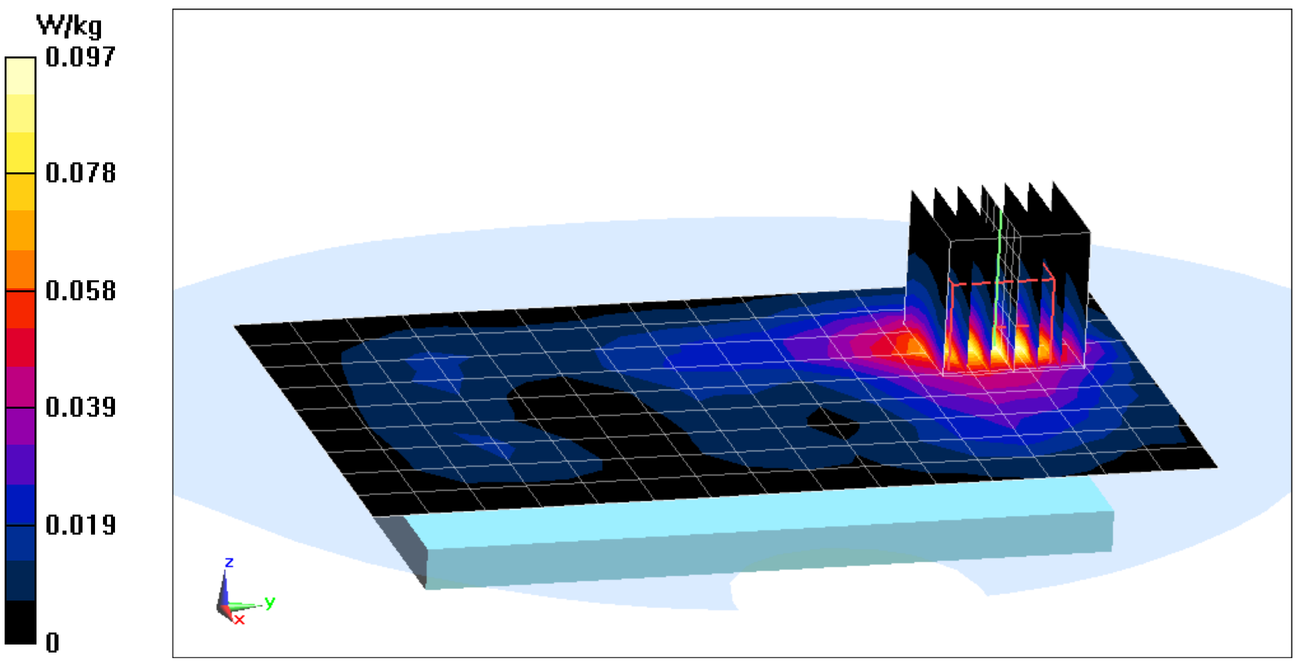
Communication System: UID 0, IEEE 802.11b; Frequency: 2412 MHz;Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used (interpolated):
f = 2412 MHz; σ = 1.957 S/m; ε_r = 51.45; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-07-2014; Ambient Temp: 23.3°C; Tissue Temp: 21.7°C

Probe: ES3DV3 - SN3263; ConvF(4.33, 4.33, 4.33); Calibrated: 5/16/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 5/13/2013
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 802.11b, Body SAR, Ch 01, 1 Mbps, Back Side

Area Scan (10x16x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.593 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.172 W/kg
SAR(1 g) = 0.076 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 3

Communication System: UID 0, IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5765 MHz;Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5765 MHz; σ = 6.207 S/m; ε_r = 45.896; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

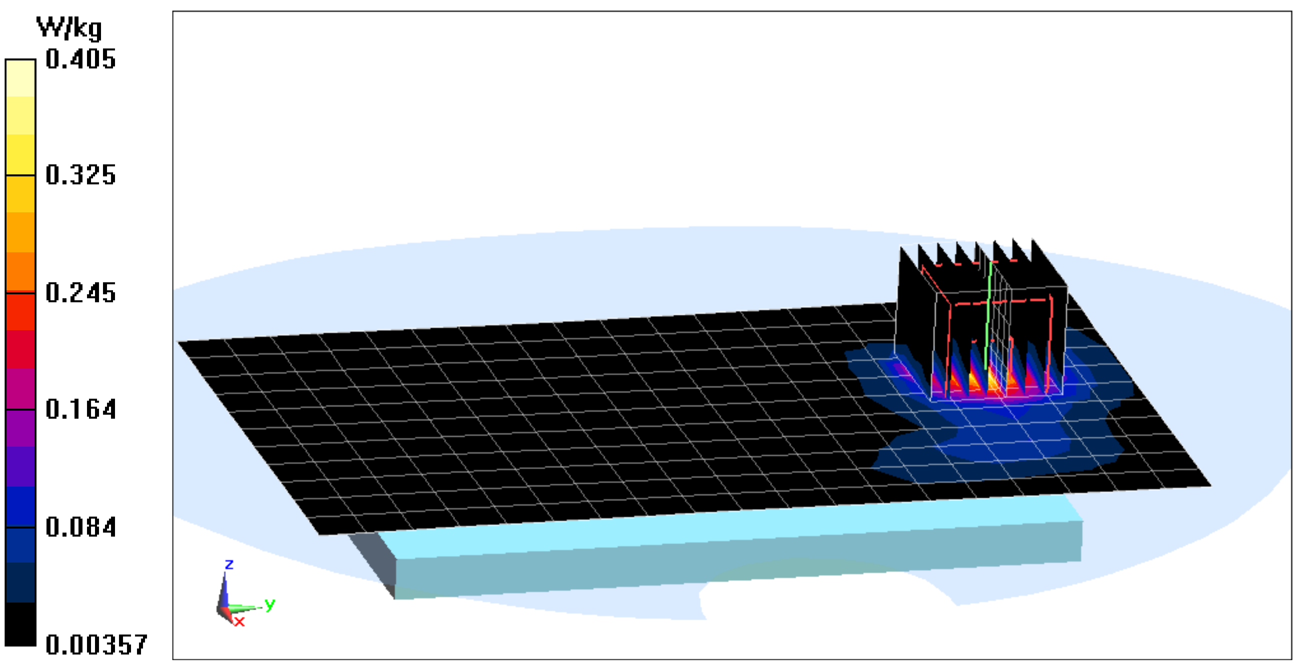
Test Date: 04-09-2014; Ambient Temp: 23.4°C; Tissue Temp: 23.6°C

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 153, 6 Mbps, Back Side

Area Scan (12x20x1): 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 = 5.820 V/m; Power Drift = -0.18 dB
Peak SAR (extrapolated) = 0.730 W/kg
SAR(1 g) = 0.181 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFD851; Type: Portable Handset; Serial: SAR 3

Communication System: UID 0, IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5540 MHz;Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5540 MHz; σ = 5.897 S/m; ε_r = 46.253; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

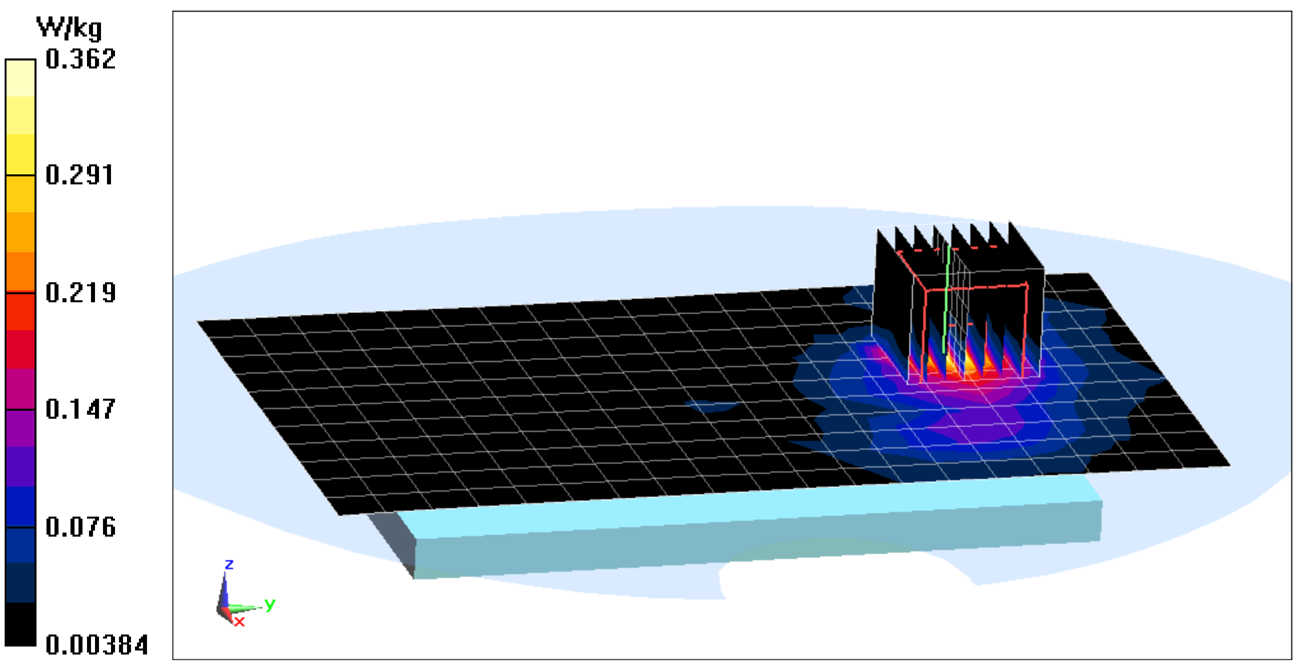
Test Date: 04-09-2014; Ambient Temp: 23.4°C; Tissue Temp: 23.6°C

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)

Mode: IEEE 802.11a, 5.5 GHz, Body SAR, Ch 108, 6 Mbps, Back Side

Area Scan (12x20x1): 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 = 5.759 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 0.643 W/kg
SAR(1 g) = 0.170 W/kg



APPENDIX B: SYSTEM VERIFICATION

PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 750 MHz; Type: D750V3; Serial: 1003

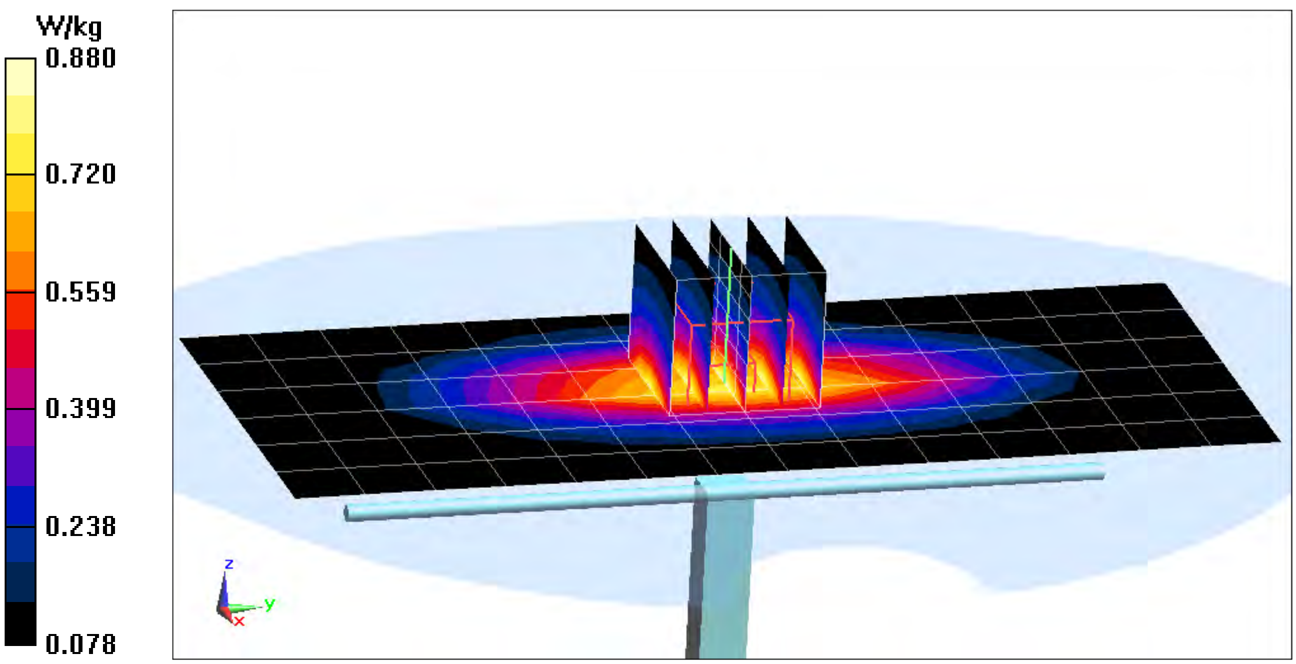
Communication System: UID 0, CW; Frequency: 750 MHz;Duty Cycle: 1:1
Medium: 740 Head Medium parameters used (interpolated):
f = 750 MHz; σ = 0.923 S/m; ε_r = 41.895; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.5 cm

Test Date: 04-16-2014; Ambient Temp: 24.1°C; Tissue Temp: 23.2°C

Probe: ES3DV3 - SN3258; ConvF(6.53, 6.53, 6.53); Calibrated: 2/25/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 2/26/2014
Phantom: SAM Front; Type: SAM; Serial: 1686
Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

750 MHz System Verification

Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 1.21 W/kg
SAR(1 g) = 0.813 W/kg
Deviation = -2.87 %



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d132

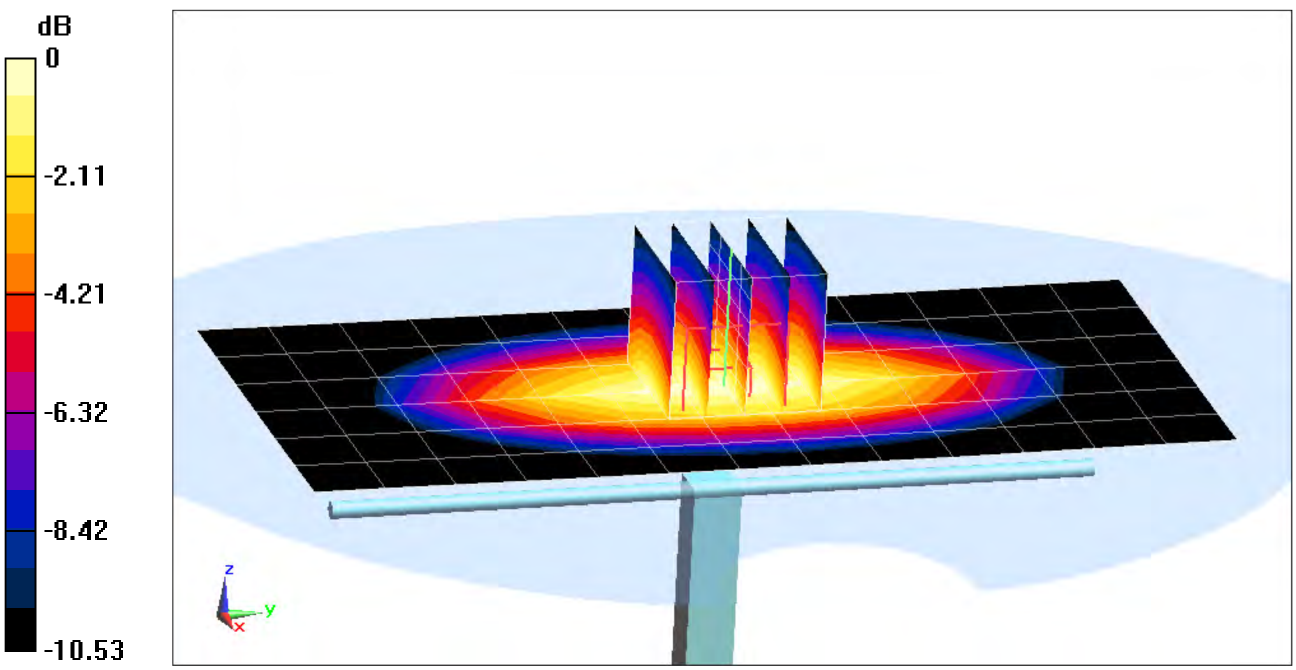
Communication System: UID 0, CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: 835 Head Medium parameters used:
f = 835 MHz; σ = 0.906 S/m; ε_r = 40.624; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.5 cm

Test Date: 04-17-2014; Ambient Temp: 24.5°C; Tissue Temp: 23.5°C

Probe: EX3DV4 - SN3914; ConvF(9.34, 9.34, 9.34); Calibrated: 10/23/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648
Measurement SW: DASY52, Version 52.8 (7);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 = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 1.45 W/kg
SAR(1 g) = 0.976 W/kg
Deviation = 6.09 %



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

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1750 MHz; Type: D1765V2; Serial: 1008

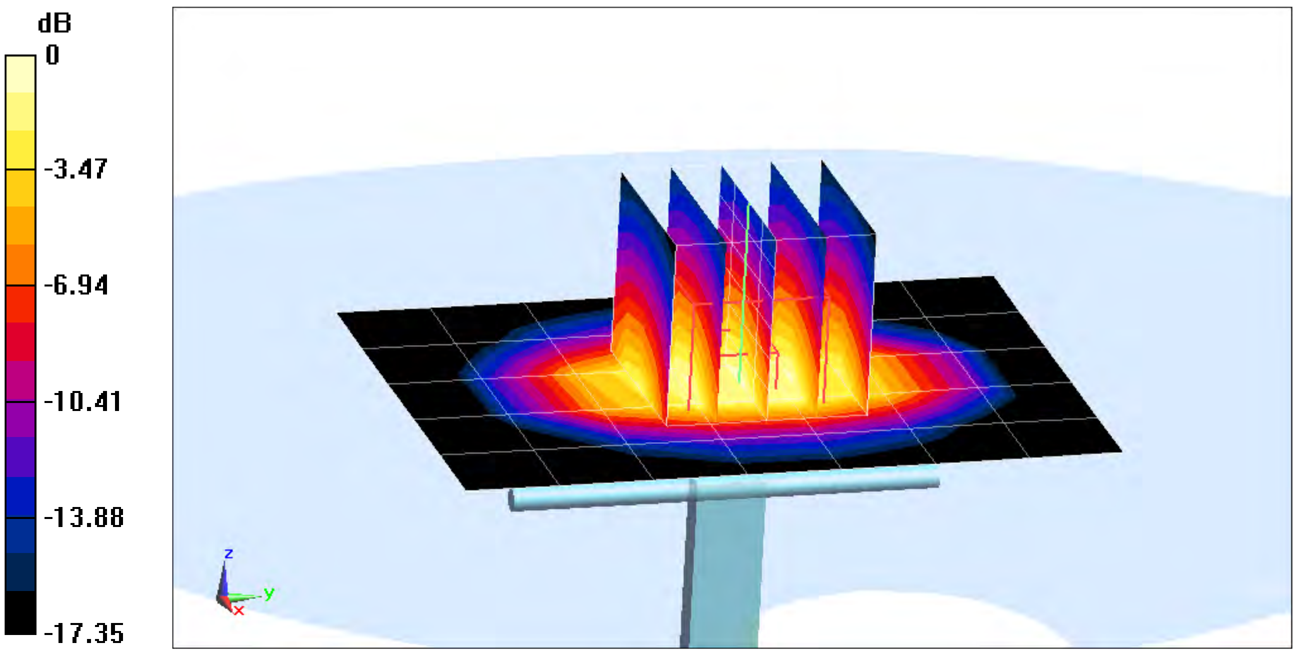
Communication System: UID 0, CW; Frequency: 1750 MHz;Duty Cycle: 1:1
Medium: 1750 Head Medium parameters used:
f = 1750 MHz; σ = 1.413 S/m; ε_r = 39.525; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-15-2014; Ambient Temp: 23.9°C; Tissue Temp: 21.1°C

Probe: ES3DV3 - SN3263; ConvF(5.3, 5.3, 5.3); Calibrated: 5/16/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 5/13/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

1750 MHz System Verification

Area Scan (6x8x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 6.64 W/kg
SAR(1 g) = 3.64 W/kg
Deviation = -1.09 %



0 dB = 4.08 W/kg = 6.11 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

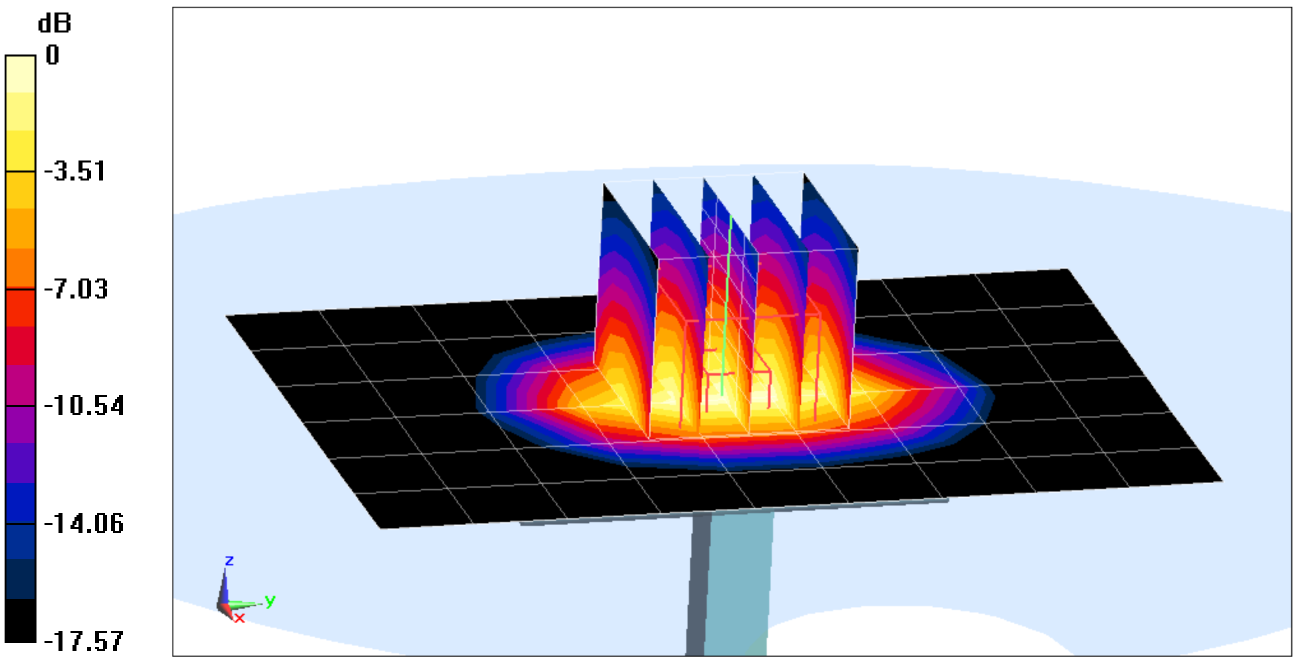
Communication System: UID 0, CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: 1900 Head Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.401 S/m; ε_r = 41.354; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-08-2014; Ambient Temp: 24.2°C; Tissue Temp: 22.2°C

Probe: ES3DV3 - SN3258; ConvF(5.04, 5.04, 5.04); Calibrated: 2/25/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 2/26/2014
Phantom: SAM Front; Type: SAM; Serial: 1686
Measurement SW: DASY52, Version 52.8 (7);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 = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 7.42 W/kg
SAR(1 g) = 4.04 W/kg
Deviation = 0.00 %



0 dB = 4.53 W/kg = 6.56 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

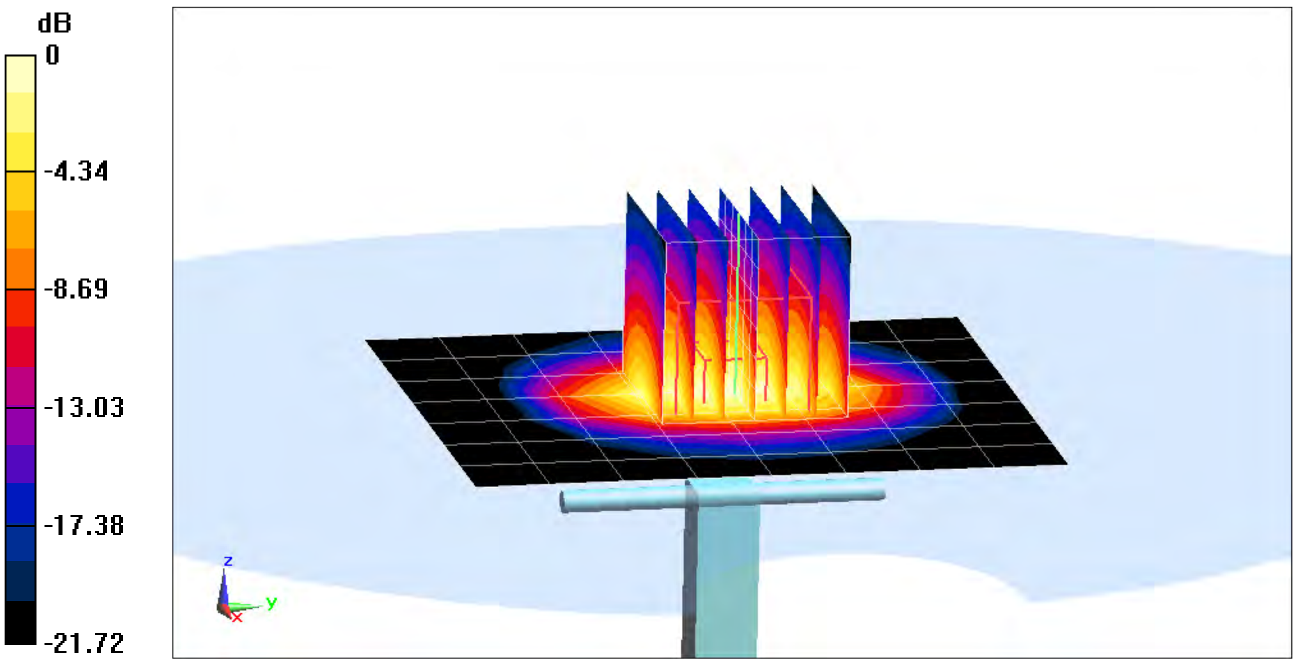
Communication System: UID 0, CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: 2450 Head Medium parameters used:
f = 2450 MHz; σ = 1.756 S/m; ε_r = 38.206; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-08-2014; Ambient Temp: 24.5°C; Tissue Temp: 23.4°C

Probe: ES3DV3 - SN3333; ConvF(4.42, 4.42, 4.42); Calibrated: 11/22/2013;
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 (7);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 = 16.0 dBm (40 mW)
Peak SAR (extrapolated) = 4.02 W/kg
SAR(1 g) = 1.97 W/kg
Deviation = -4.92 %



0 dB = 2.58 W/kg = 4.12 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: 1071

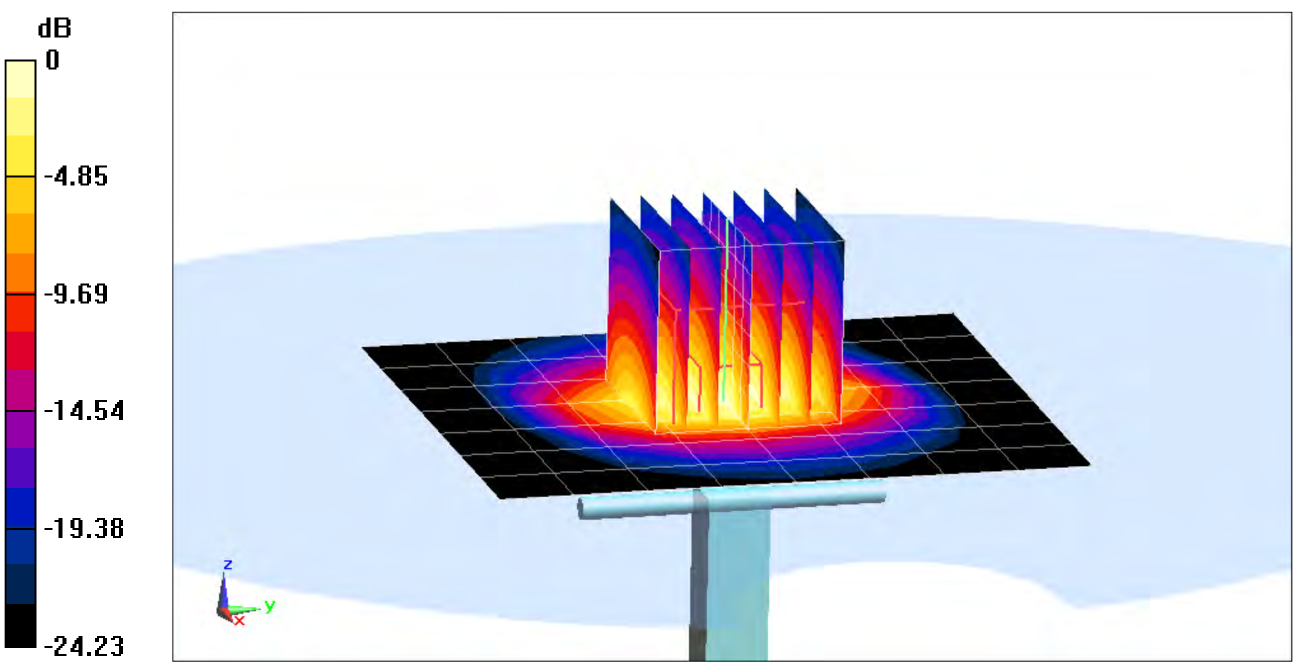
Communication System: UID 0, CW; Frequency: 2600 MHz;Duty Cycle: 1:1
Medium: 2600 Head Medium parameters used:
f = 2600 MHz; σ = 1.915 S/m; ε_r = 38.709; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-10-2014; Ambient Temp: 24.5°C; Tissue Temp: 23.2°C

Probe: ES3DV3 - SN3333; ConvF(4.28, 4.28, 4.28); Calibrated: 11/22/2013;
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 (7);SEMCAD X Version 14.6.10 (7164)

2600 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 = 16.0 dBm (40 mW)
Peak SAR (extrapolated) = 4.85 W/kg
SAR(1 g) = 2.28 W/kg
Deviation = 0.71 %



0 dB = 3.03 W/kg = 4.81 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

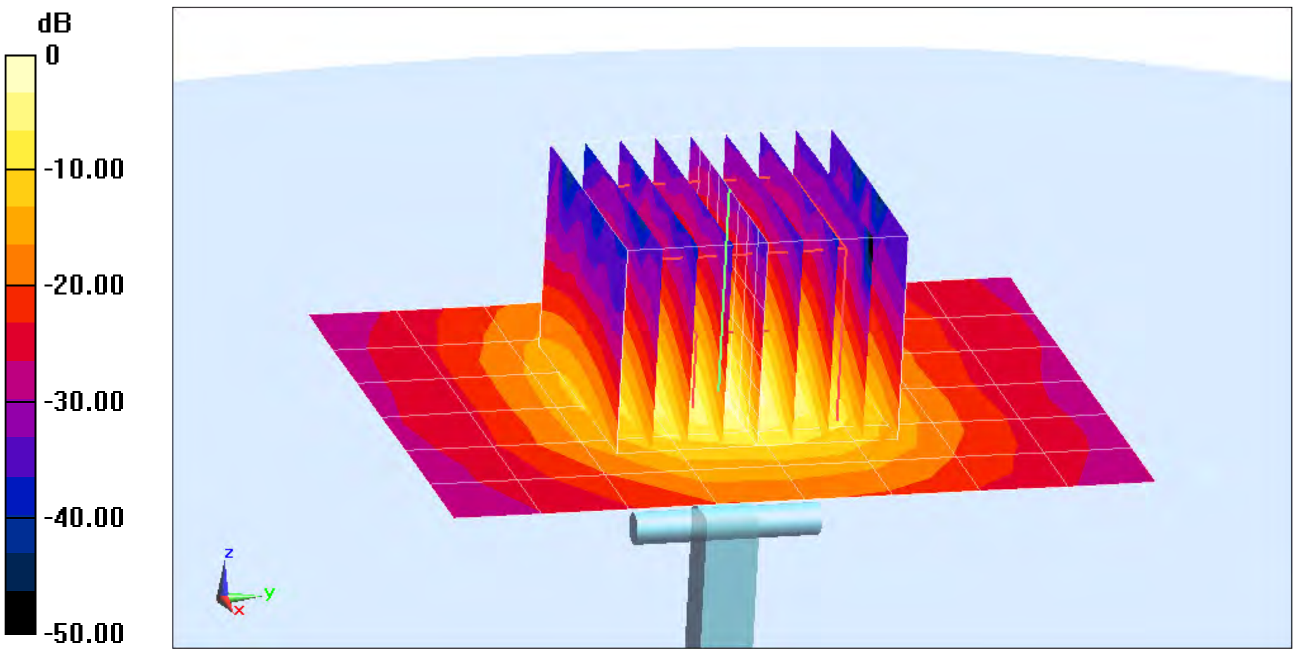
Communication System: UID 0, CW; Frequency: 5200 MHz;Duty Cycle: 1:1
Medium: 5 GHz Head Medium parameters used:
f = 5200 MHz; σ = 4.529 S/m; ε_r = 36.808; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-08-2014; Ambient Temp: 23.8°C; Tissue Temp: 22.3°C

Probe: EX3DV4 - SN3920; ConvF(4.87, 4.87, 4.87); Calibrated: 12/18/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 12/12/2013
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
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 = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 31.2 W/kg
SAR(1 g) = 7.69 W/kg
Deviation = -0.77 %



0 dB = 19.3 W/kg = 12.86 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

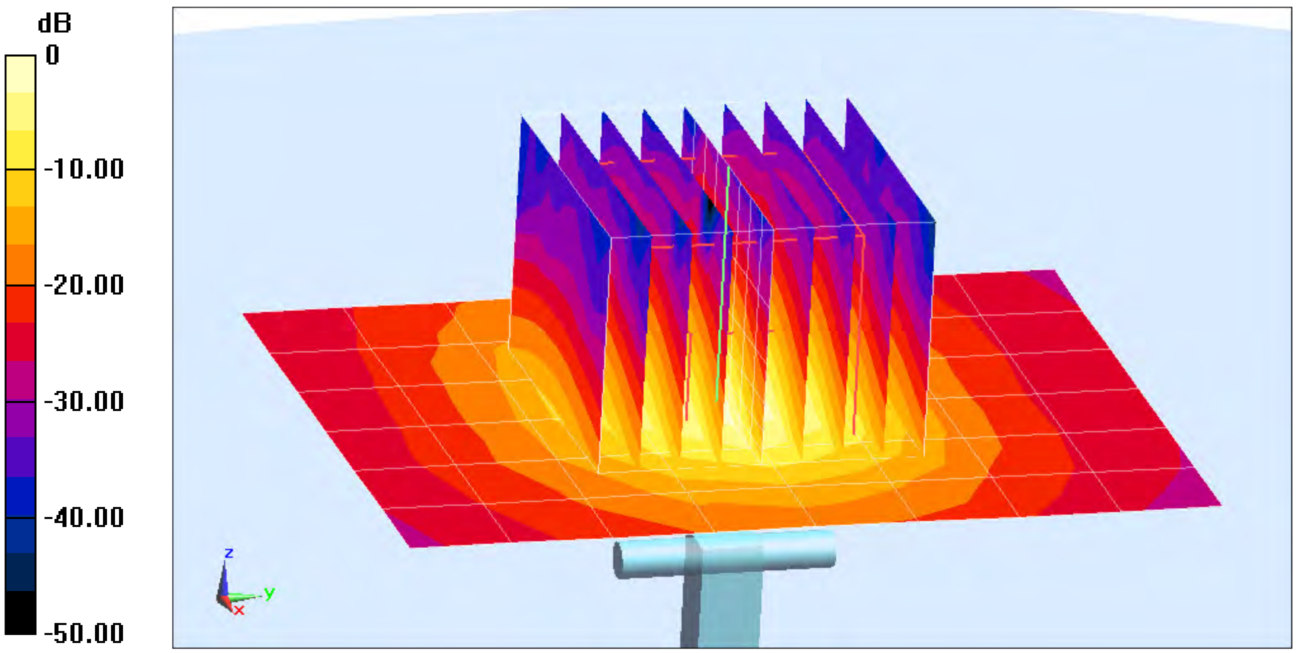
Communication System: UID 0, CW; Frequency: 5300 MHz;Duty Cycle: 1:1
Medium: 5 GHz Head Medium parameters used:
f = 5300 MHz; $\sigma = 4.621$ S/m; $\varepsilon_r = 36.611$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-08-2014; Ambient Temp: 23.8°C; Tissue Temp: 22.3°C

Probe: EX3DV4 - SN3920; ConvF(4.66, 4.66, 4.66); Calibrated: 12/18/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 12/12/2013
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

5300MHz 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 = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 31.8 W/kg
SAR(1 g) = 7.84 W/kg
Deviation = -2.24 %



0 dB = 19.9 W/kg = 12.99 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

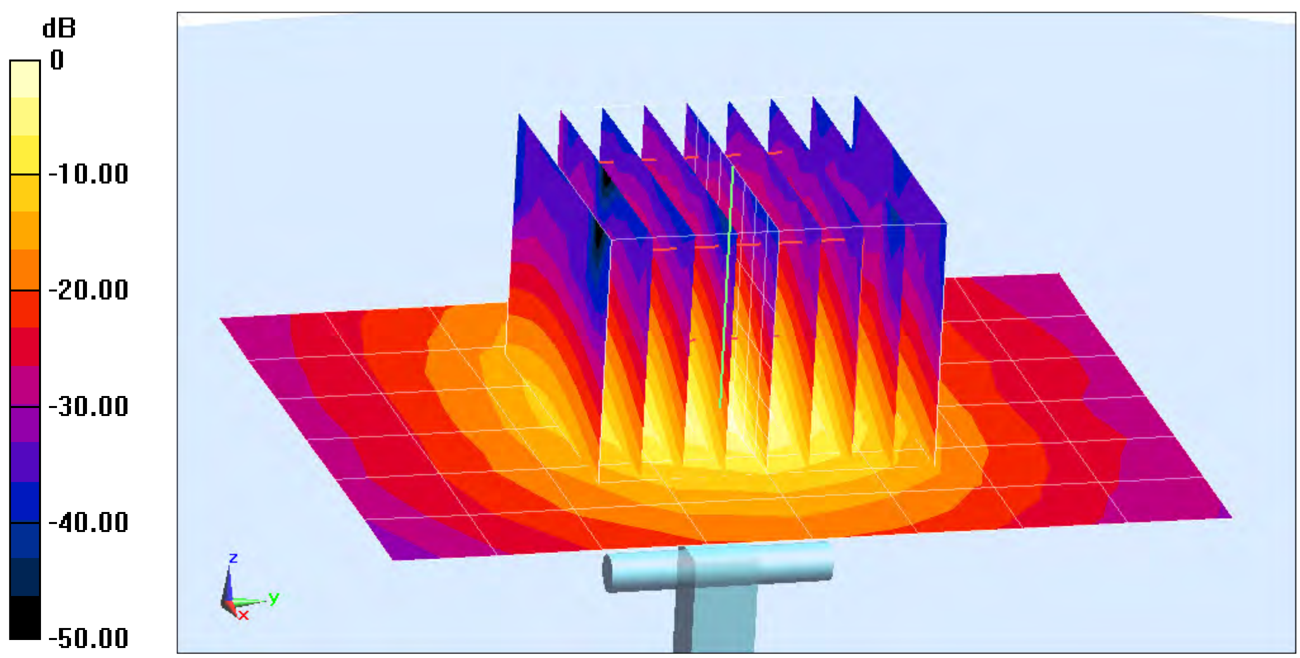
Communication System: UID 0, CW; Frequency: 5500 MHz;Duty Cycle: 1:1
Medium: 5 GHz Head Medium parameters used:
f = 5500 MHz; σ = 4.869 S/m; ε_r = 36.261; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-08-2014; Ambient Temp: 23.8°C; Tissue Temp: 22.3°C

Probe: EX3DV4 - SN3920; ConvF(4.54, 4.54, 4.54); Calibrated: 12/18/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 12/12/2013
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

5500MHz 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 = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 35.2 W/kg
SAR(1 g) = 8.16 W/kg
Deviation = 0.25 %



0 dB = 20.8 W/kg = 13.18 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

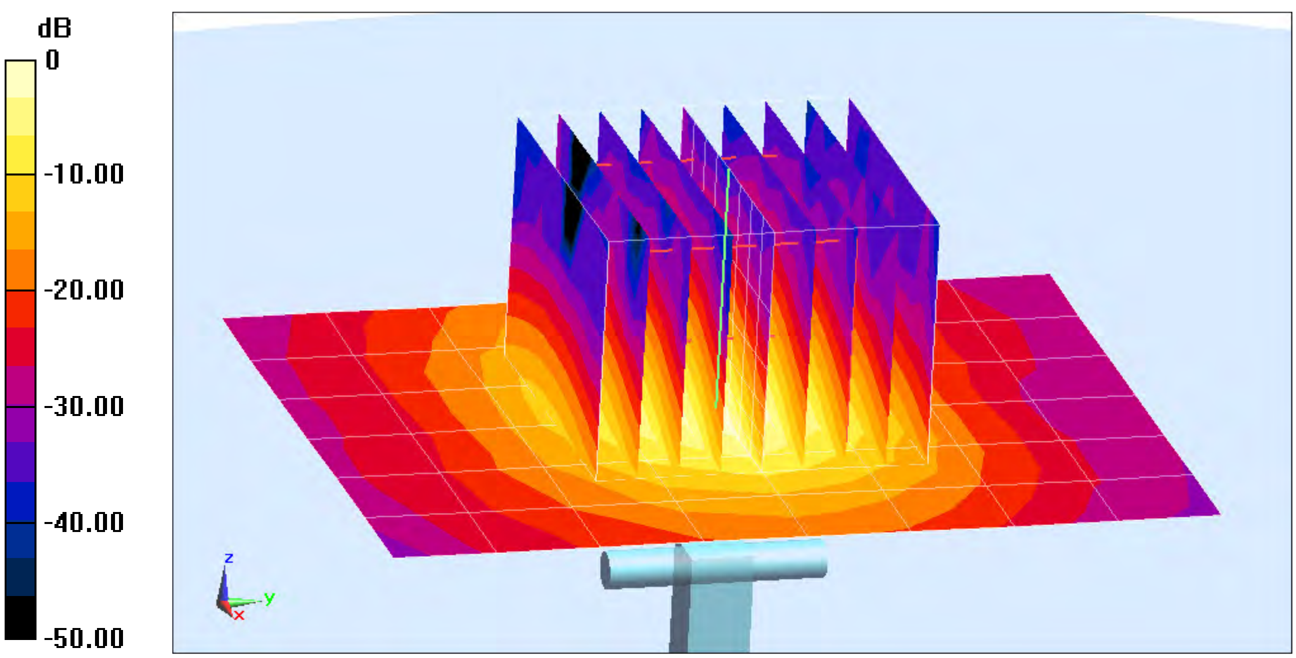
Communication System: UID 0, CW; Frequency: 5800 MHz;Duty Cycle: 1:1
Medium: 5 GHz Head Medium parameters used:
f = 5800 MHz; σ = 5.216 S/m; ε_r = 35.886; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-08-2014; Ambient Temp: 23.8°C; Tissue Temp: 22.3°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 Main; Type: SAM 4.0; Serial: TP-1114
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 = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 32.5 W/kg
SAR(1 g) = 7.71 W/kg
Deviation = -0.52 %



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

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 750 MHz; Type: D750V3; Serial: 1003

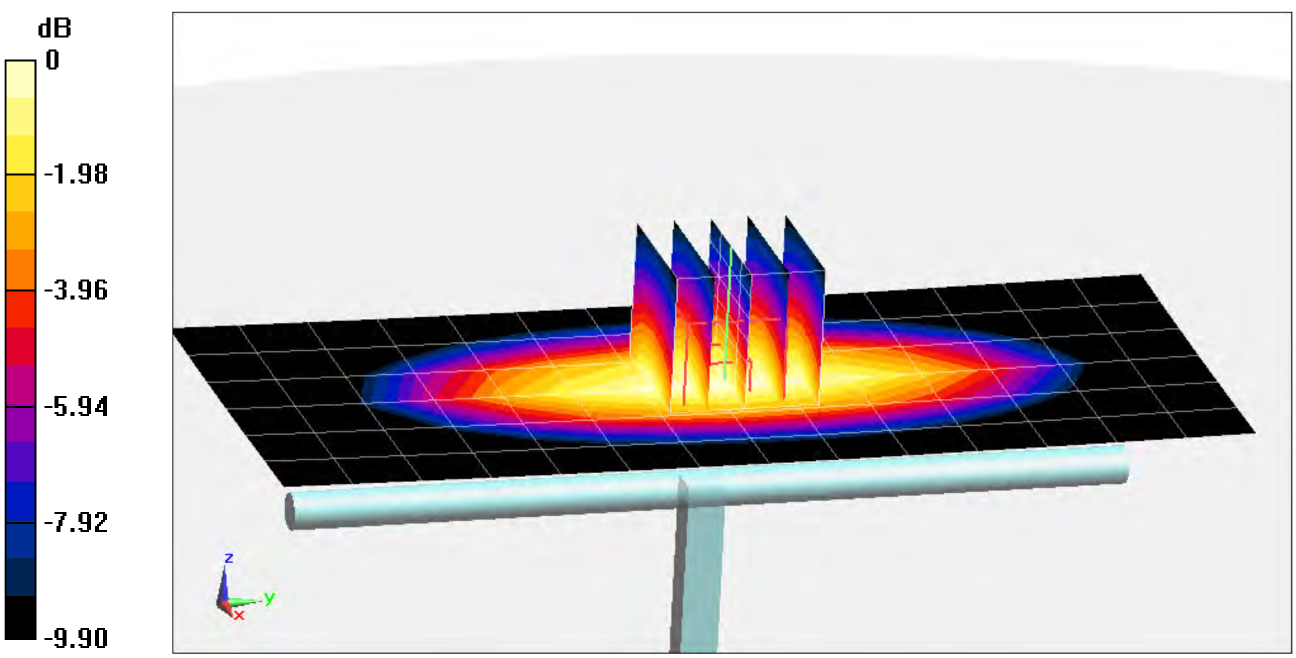
Communication System: UID 0, CW; Frequency: 750 MHz;Duty Cycle: 1:1
Medium: 740 Body Medium parameters used (interpolated):
f = 750 MHz; σ = 0.987 S/m; ε_r = 55.852; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.5 cm

Test Date: 04-08-2014; Ambient Temp: 24.1°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3333; ConvF(6.11, 6.11, 6.11); Calibrated: 11/22/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1408; Calibrated: 11/19/2013
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1229
Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

750 MHz System Verification

Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 1.20 W/kg
SAR(1 g) = 0.840 W/kg
Deviation = -4.22 %



0 dB = 0.910 W/kg = -0.41 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: 835MHz Dipole; Type: D835V2; Serial: 4d132

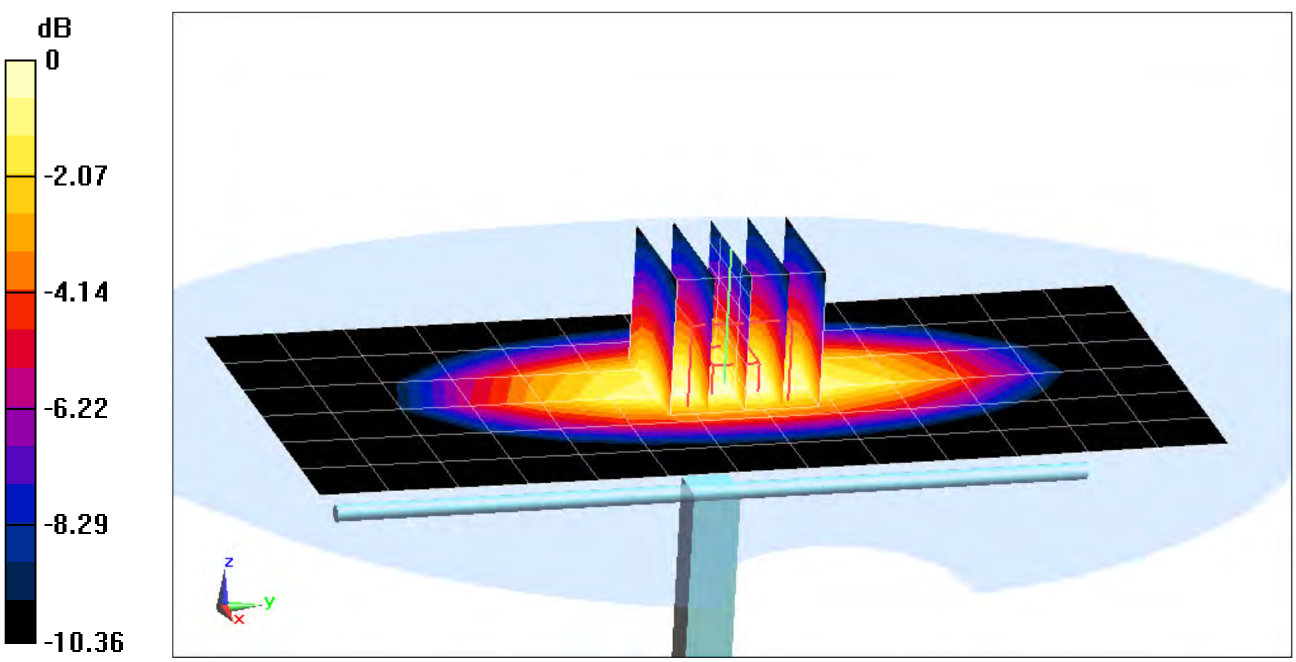
Communication System: UID 0, CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: 835 Body Medium parameters used:
f = 835 MHz; σ = 0.999 S/m; ε_r = 53.799; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.5 cm

Test Date: 04-14-2014; Ambient Temp: 23.0°C; Tissue Temp: 22.1°C

Probe: ES3DV2 - SN3022; ConvF(5.91, 5.91, 5.91); Calibrated: 8/22/2013;
Sensor-Surface: 4mm (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 (7);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 = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 1.41 W/kg
SAR(1 g) = 0.979 W/kg
Deviation = 5.16 %



0 dB = 1.06 W/kg = 0.25 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1750 MHz; Type: D1765V2; Serial: 1008

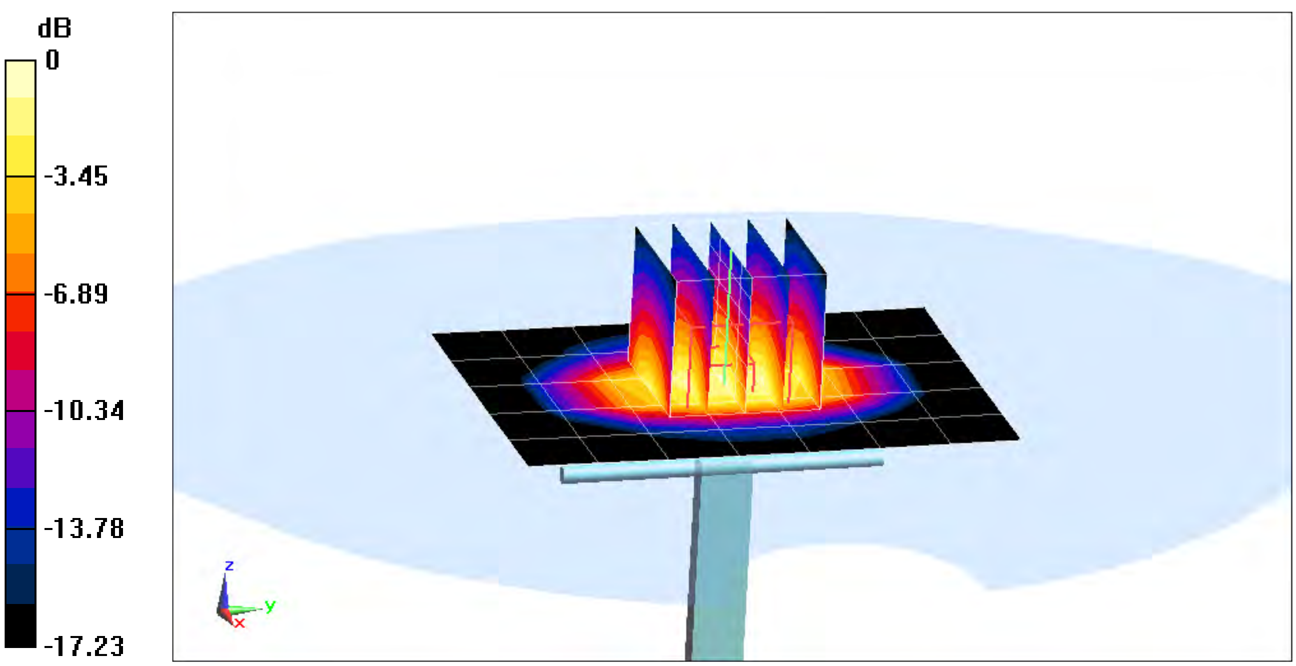
Communication System: UID 0, CW; Frequency: 1750 MHz;Duty Cycle: 1:1
Medium: 1750 Body Medium parameters used:
f = 1750 MHz; σ = 1.529 S/m; ε_r = 50.952; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-17-2014; Ambient Temp: 22.0°C; Tissue Temp: 20.1°C

Probe: ES3DV3 - SN3263; ConvF(5.01, 5.01, 5.01); Calibrated: 5/16/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 5/13/2013
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

1750 MHz System Verification

Area Scan (6x8x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 7.14 W/kg
SAR(1 g) = 3.92 W/kg
Deviation = 2.62 %



0 dB = 4.41 W/kg = 6.44 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

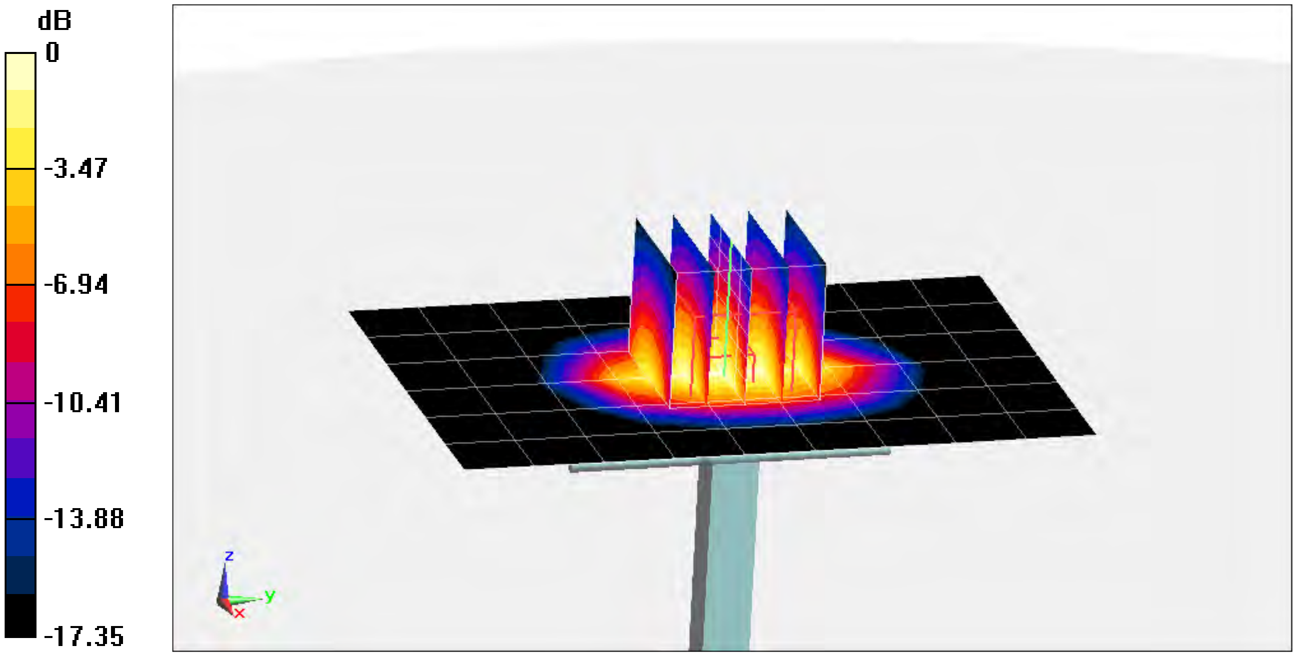
Communication System: UID 0, CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.568 S/m; ε_r = 52.984; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-08-2014; Ambient Temp: 22.6°C; Tissue Temp: 22.8°C

Probe: EX3DV4 - SN3589; ConvF(6.54, 6.54, 6.54); Calibrated: 1/29/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/22/2014
Phantom: ELI left; Type: QDOVA002AA; Serial: TP:1202
Measurement SW: DASY52, Version 52.8 (7);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 = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 7.66 W/kg
SAR(1 g) = 4.19 W/kg
Deviation = 3.46 %



0 dB = 4.69 W/kg = 6.71 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

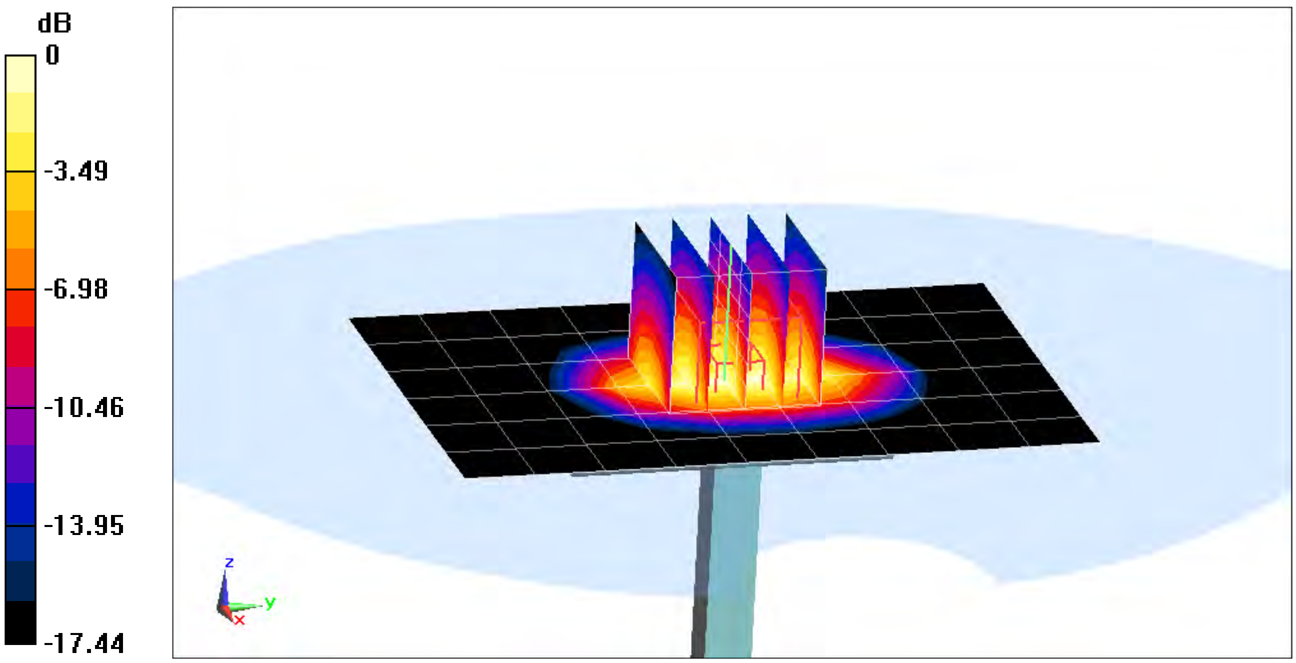
Communication System: UID 0, CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.517 S/m; ε_r = 52.16; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-11-2014; Ambient Temp: 24.5°C; Tissue Temp: 24.3°C

Probe: EX3DV4 - SN3914; ConvF(7.51, 7.51, 7.51); Calibrated: 10/23/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648
Measurement SW: DASY52, Version 52.8 (7);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 = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 7.35 W/kg
SAR(1 g) = 4.06 W/kg
Deviation = 0.25 %



0 dB = 4.55 W/kg = 6.58 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 2450 MHz; Type: D2450V2; Serial: 719

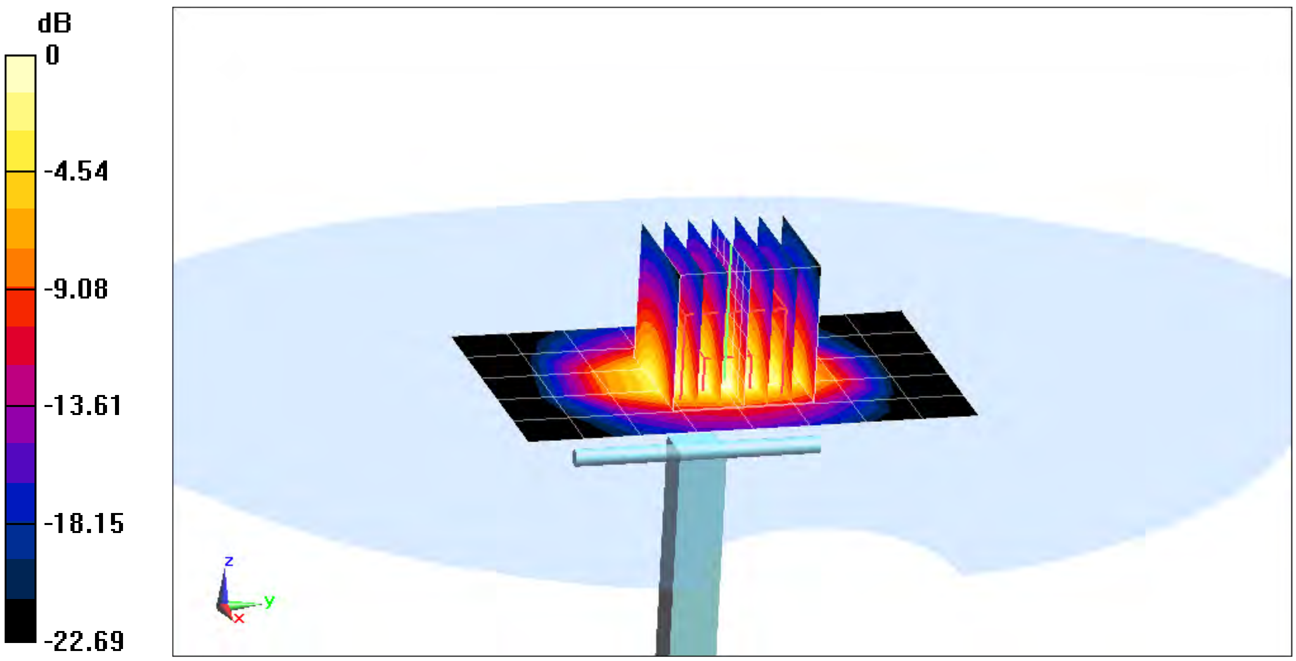
Communication System: UID 0, CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used:
f = 2450 MHz; σ = 2 S/m; ε_r = 51.276; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-07-2014; Ambient Temp: 23.3°C; Tissue Temp: 21.7°C

Probe: ES3DV3 - SN3263; ConvF(4.33, 4.33, 4.33); Calibrated: 5/16/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 5/13/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80);SEMCAD X Version 14.6.10 (7164)

2450MHz System Verification

Area Scan (6x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 11.1 W/kg
SAR(1 g) = 5.15 W/kg
Deviation = -0.39 %



0 dB = 6.68 W/kg = 8.25 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: 1071

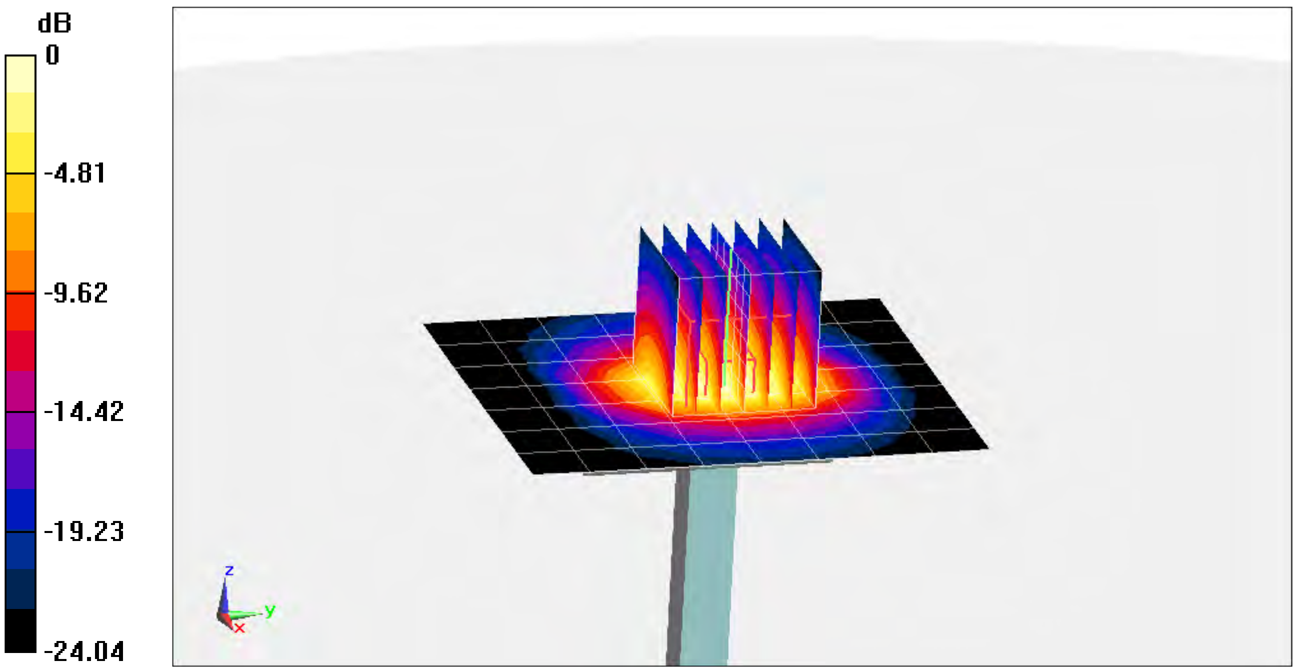
Communication System: UID 0, CW (0); Frequency: 2600 MHz;Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used:
f = 2600 MHz; σ = 2.222 S/m; ε_r = 51.269; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-10-2014; Ambient Temp: 24.4°C; Tissue Temp: 23.4°C

Probe: ES3DV3 - SN3258; ConvF(3.91, 3.91, 3.91); Calibrated: 2/25/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 2/26/2014
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (7);SEMCAD X Version 14.6.10 (7164)

2600 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 = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 12.2 W/kg
SAR(1 g) = 5.27 W/kg
Deviation = -5.39 %



0 dB = 7.05 W/kg = 8.48 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

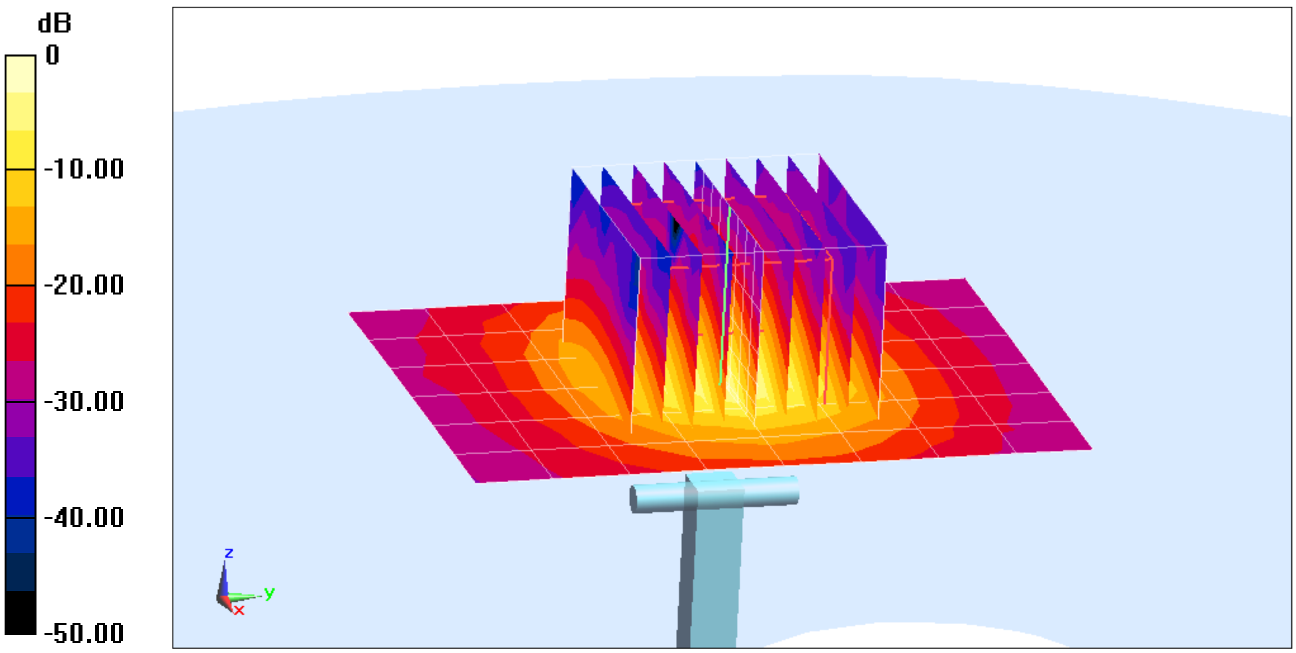
Communication System: UID 0, CW; Frequency: 5200 MHz;Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5200 MHz; σ = 5.462 S/m; ε_r = 46.941; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-09-2014; Ambient Temp: 23.5°C; Tissue Temp: 23.7°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 = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 29.7 W/kg
SAR(1 g) = 7.04 W/kg
Deviation = -3.03 %



0 dB = 18.0 W/kg = 12.55 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

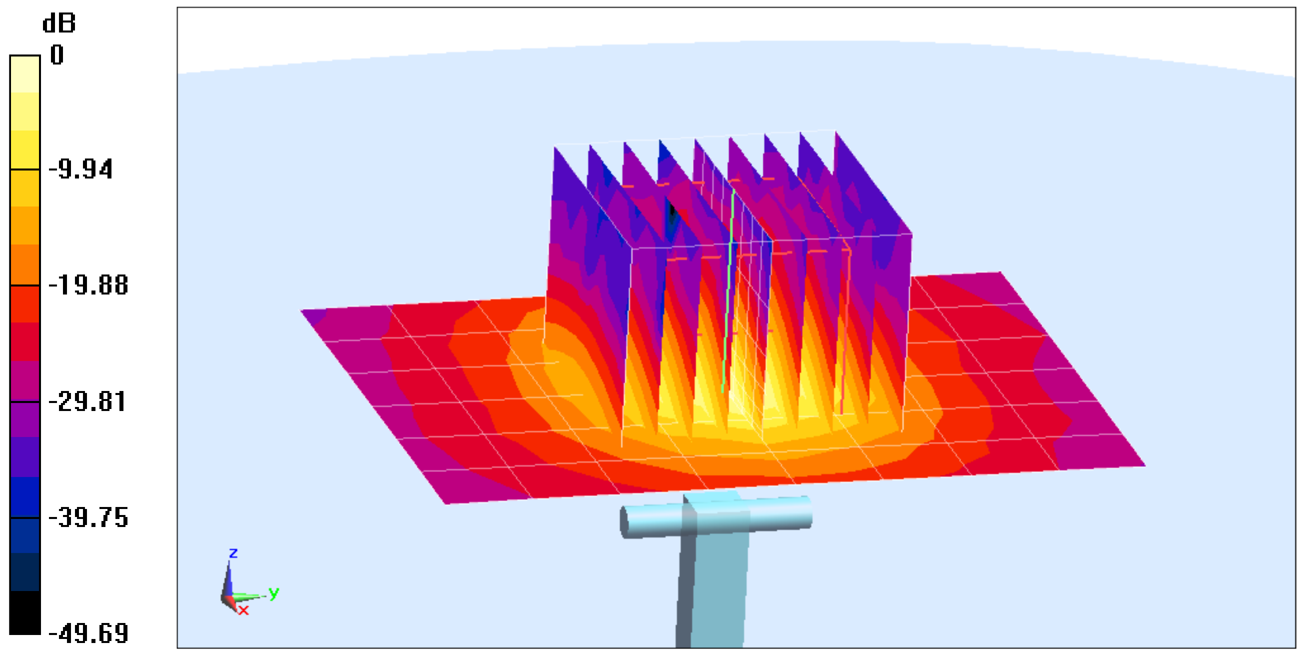
Communication System: UID 0, CW; Frequency: 5300 MHz;Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5300 MHz; σ = 5.586 S/m; ε_r = 46.756; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-09-2014; Ambient Temp: 23.5°C; Tissue Temp: 23.7°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)

5300MHz 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 = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 31.4 W/kg
SAR(1 g) = 7.41 W/kg
Deviation = -0.80 %



0 dB = 19.0 W/kg = 12.79 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

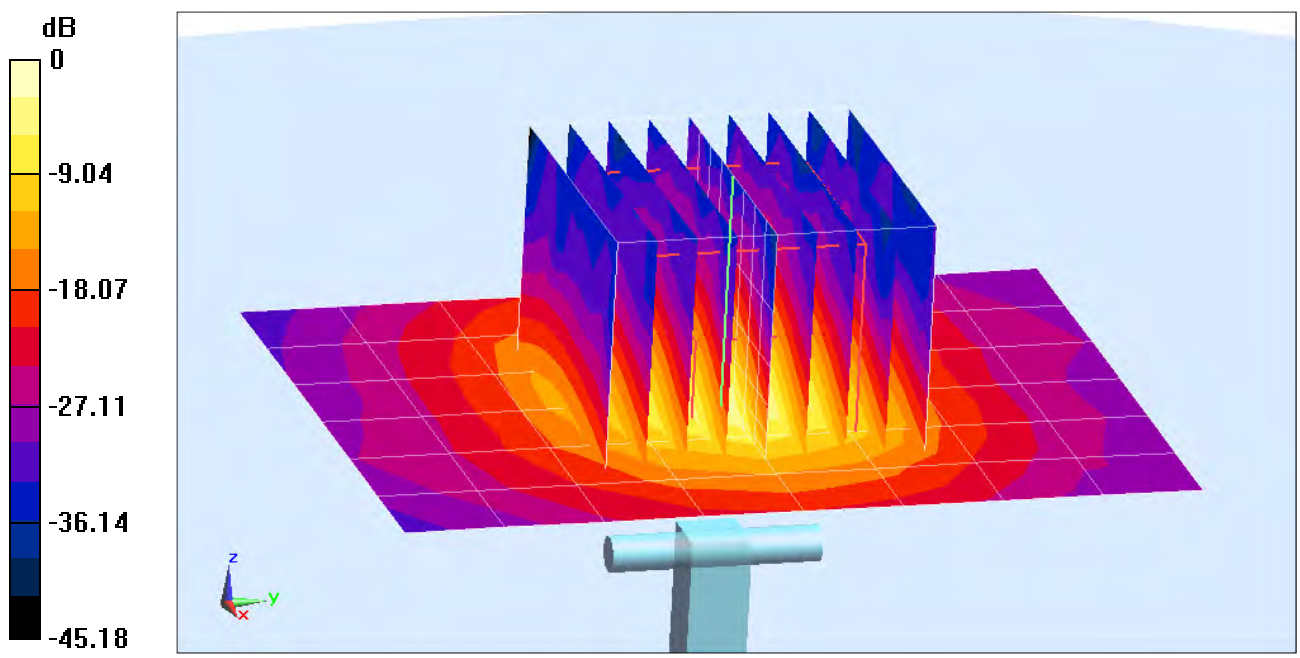
Communication System: UID 0, CW; Frequency: 5500 MHz;Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5500 MHz; σ = 5.845 S/m; ε_r = 46.348; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-09-2014; Ambient Temp: 23.4°C; Tissue Temp: 23.6°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)

5500MHz 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 = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 36.1 W/kg
SAR(1 g) = 8.04 W/kg
Deviation = 5.93 %



0 dB = 21.3 W/kg = 13.28 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

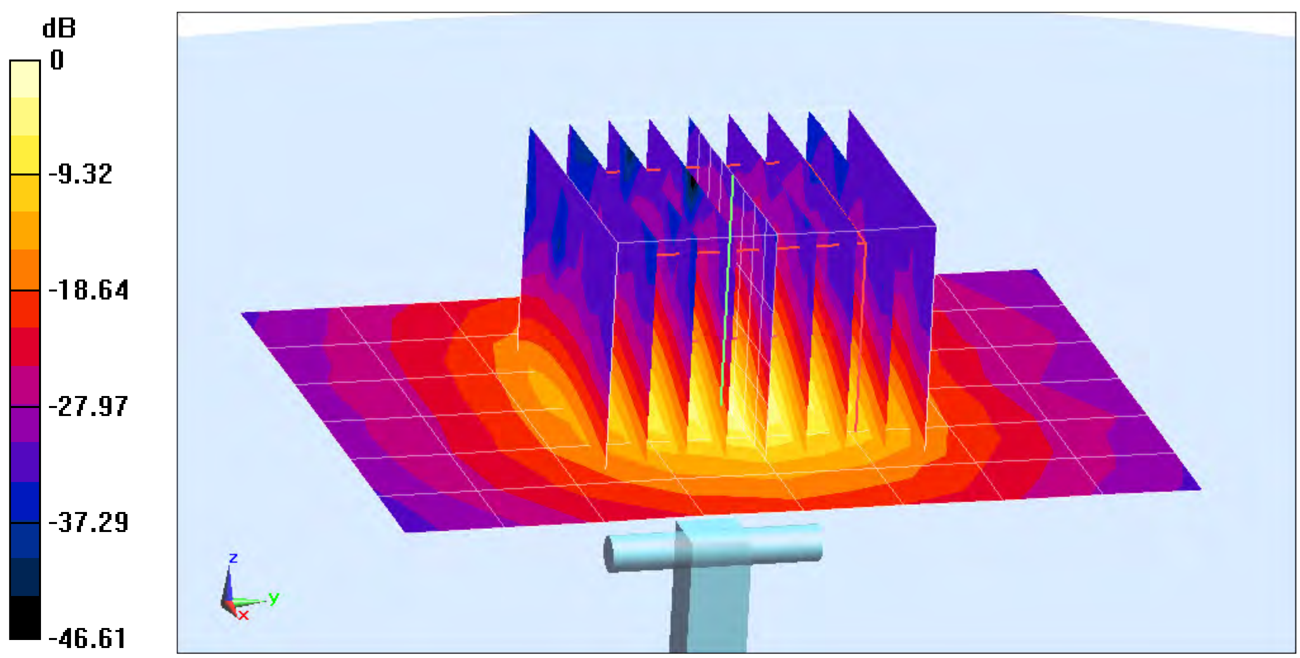
Communication System: UID 0, CW; Frequency: 5800 MHz;Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5800 MHz; σ = 6.257 S/m; ε_r = 45.808; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 04-09-2014; Ambient Temp: 23.4°C; Tissue Temp: 23.6°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 = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 34.6 W/kg
SAR(1 g) = 7.32 W/kg
Deviation = 0.41 %



0 dB = 19.5 W/kg = 12.90 dBW/kg

APPENDIX C: PROBE CALIBRATION

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **PC Test**

Certificate No: D2600V2-1071_Nov13

CALIBRATION CERTIFICATE

Object	D2600V2 - SN: 1071
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	November 15, 2013

VCC
1/12/14

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-15
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Israe El-Naouq	Laboratory Technician	Israe El-Naouq
Approved by:	Katja Pokovic	Technical Manager	

Issued: November 15, 2013

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.1 ± 6 %	2.01 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**56.6 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.35 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**25.3 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.7 ± 6 %	2.20 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	14.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**55.7 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.23 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.8 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.1 Ω - 4.7 jΩ
Return Loss	- 26.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.4 Ω - 3.8 jΩ
Return Loss	- 24.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.153 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 17, 2013

DASY5 Validation Report for Head TSL

Date: 15.11.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1071

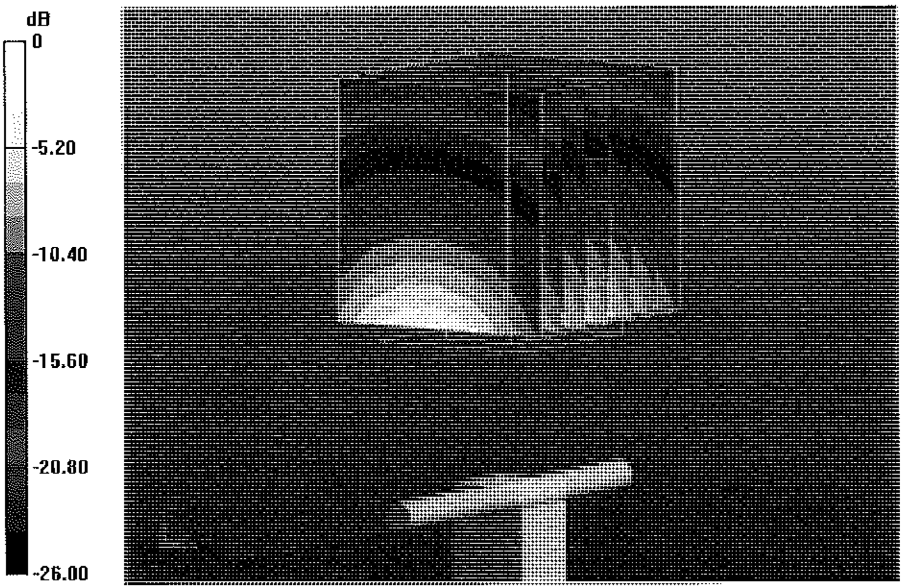
Communication System: UID 0 - CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2.01 S/m; ε_r = 39.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

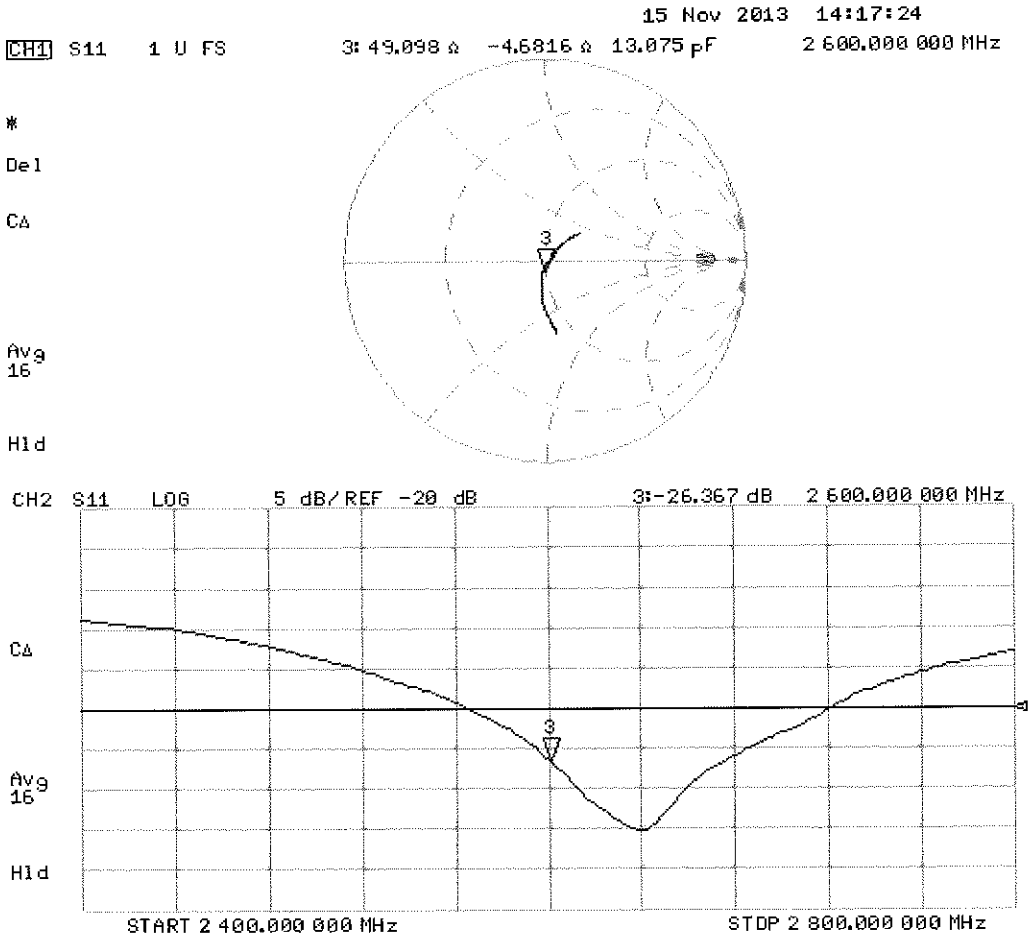
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.749 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 31.1 W/kg
SAR(1 g) = 14.3 W/kg; SAR(10 g) = 6.35 W/kg
Maximum value of SAR (measured) = 18.5 W/kg



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

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 15.11.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1071

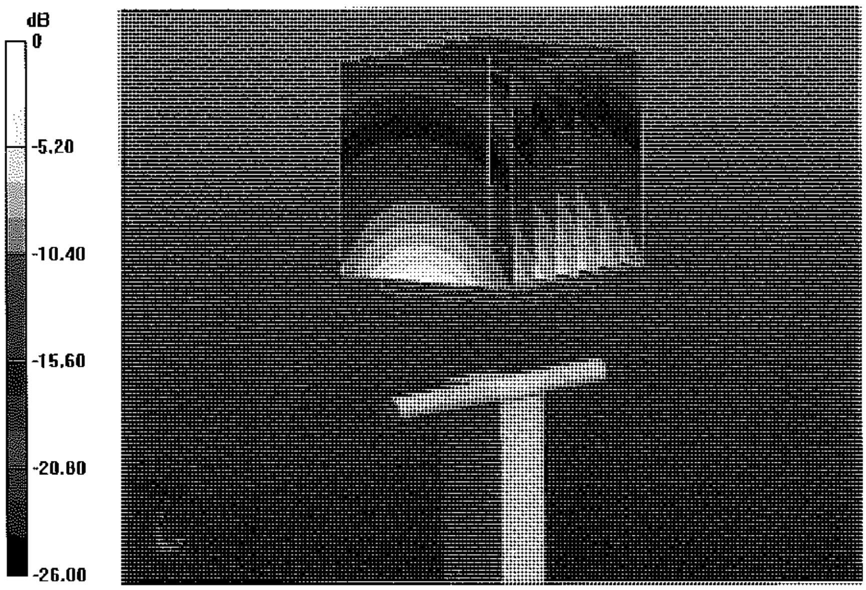
Communication System: UID 0 - CW; Frequency: 2600 MHz
Medium parameters used: f = 2600 MHz; σ = 2.2 S/m; ε_r = 51.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.32, 4.32, 4.32); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

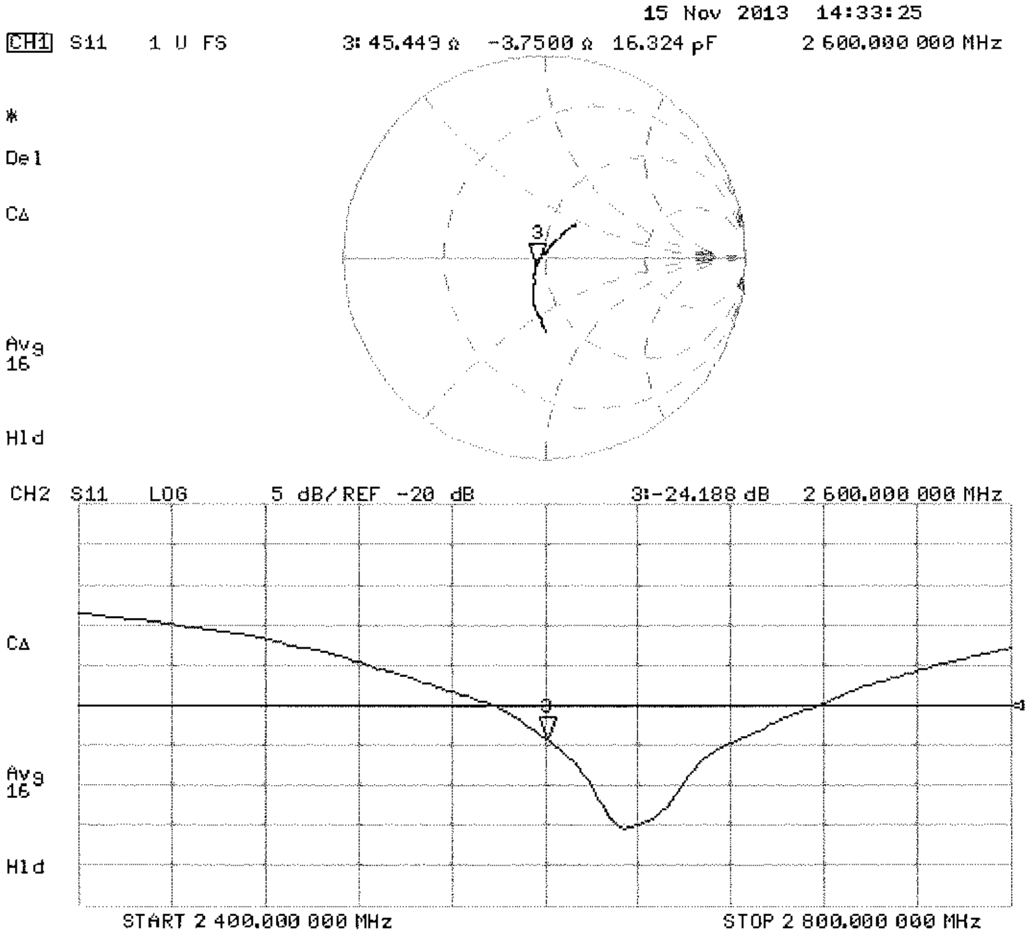
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.915 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 30.8 W/kg
SAR(1 g) = 14.1 W/kg; SAR(10 g) = 6.23 W/kg
Maximum value of SAR (measured) = 18.7 W/kg



0 dB = 18.7 W/kg = 12.72 dBW/kg

Impedance Measurement Plot for Body TSL



Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **PC Test**

Certificate No: ES3-3333_Nov13

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3333

Calibration procedure(s): QA CAL-01.v9, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: November 22, 2013

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	4-Sep-13 (No. DAE4-660_Sep13)	Sep-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-15
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: November 25, 2013

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Probe ES3DV3

SN:3333

Manufactured: January 24, 2012
Calibrated: November 22, 2013

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3333

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.08	0.90	0.88	± 10.1 %
DCP (mV)[B]	104.9	103.3	101.7	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB$\sqrt{\mu V}$	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	140.9	±2.2 %
		Y	0.0	0.0	1.0		132.0	
		Z	0.0	0.0	1.0		170.3	

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3333

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	41.9	0.89	6.56	6.56	6.56	0.44	1.54	± 12.0 %
850	41.5	0.92	6.30	6.30	6.30	0.46	1.48	± 12.0 %
1750	40.1	1.37	5.23	5.23	5.23	0.77	1.17	± 12.0 %
1900	40.0	1.40	5.05	5.05	5.05	0.80	1.19	± 12.0 %
2450	39.2	1.80	4.42	4.42	4.42	0.74	1.31	± 12.0 %
2600	39.0	1.96	4.28	4.28	4.28	0.80	1.30	± 12.0 %

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

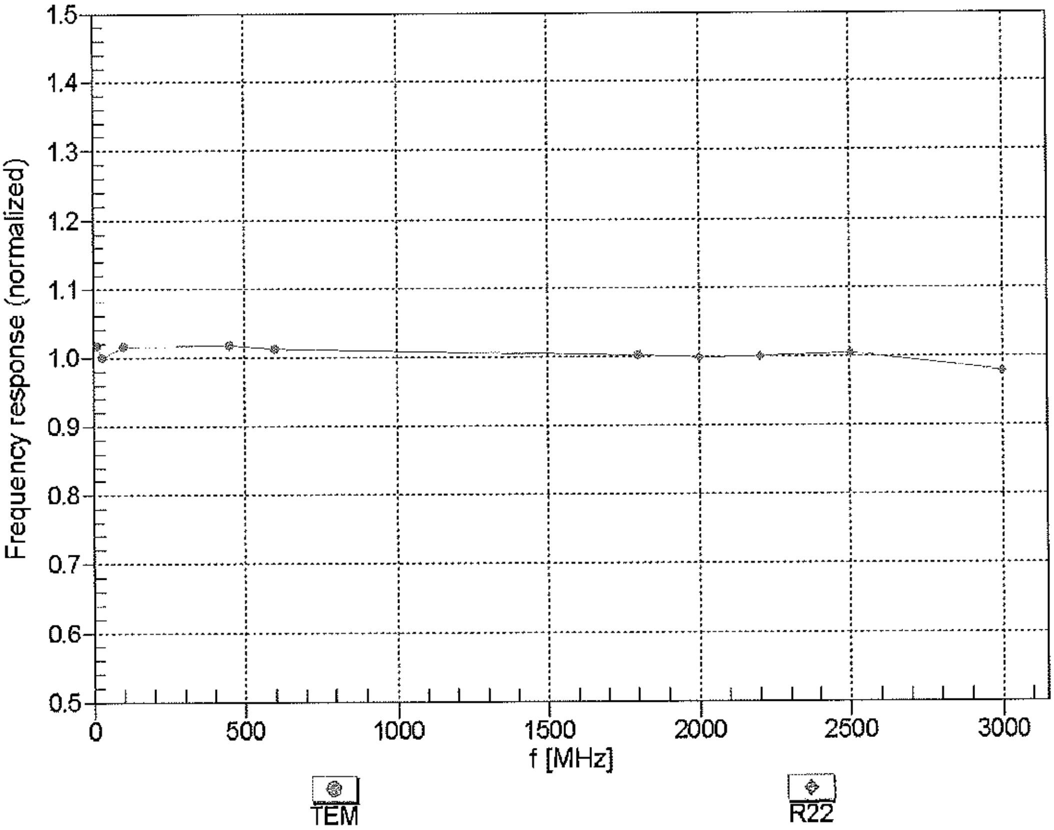
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3333

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	6.11	6.11	6.11	0.33	1.90	± 12.0 %
850	55.2	0.99	6.07	6.07	6.07	0.80	1.19	± 12.0 %
1750	53.4	1.49	4.95	4.95	4.95	0.80	1.26	± 12.0 %
1900	53.3	1.52	4.71	4.71	4.71	0.49	1.54	± 12.0 %
2450	52.7	1.95	4.22	4.22	4.22	0.80	0.95	± 12.0 %
2600	52.5	2.16	4.16	4.16	4.16	0.80	1.07	± 12.0 %

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

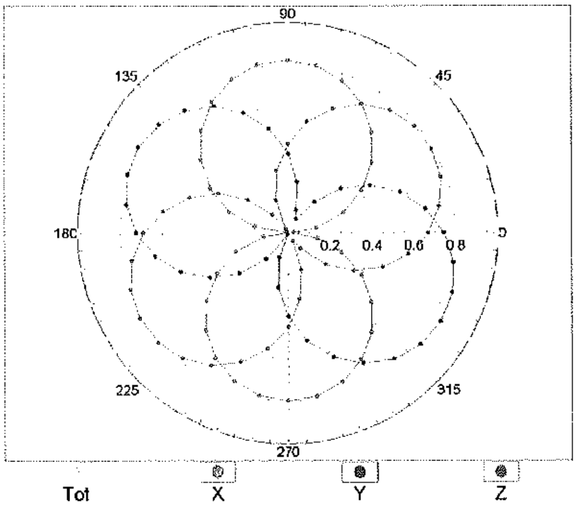
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



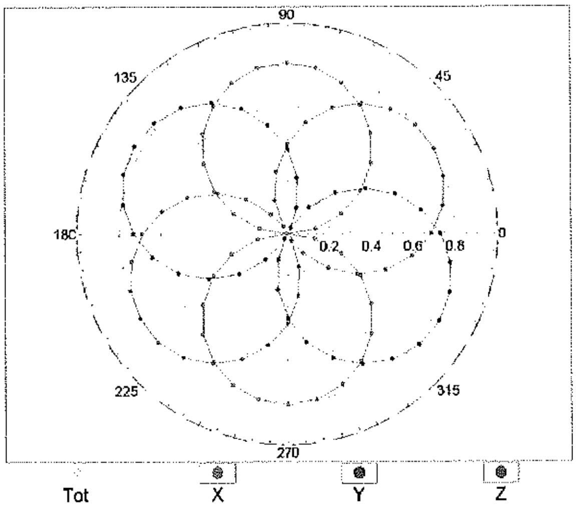
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

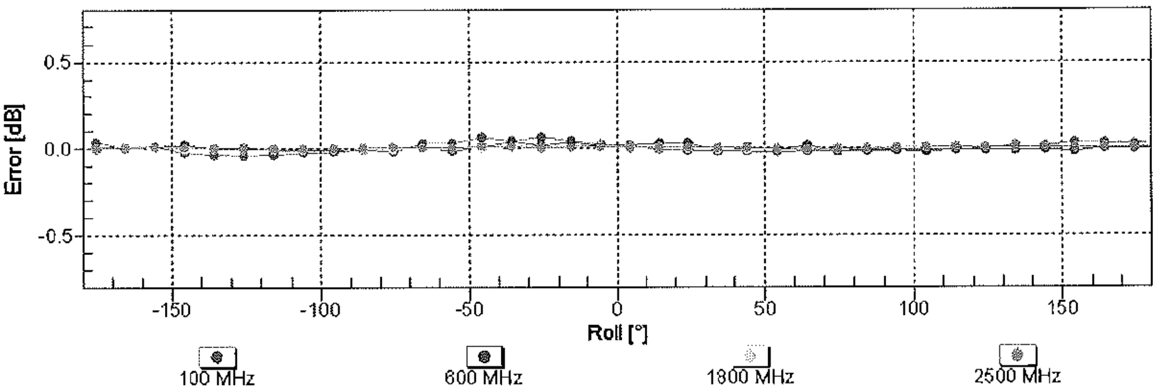
Receiving Pattern (ϕ), $\vartheta = 0°$

f=600 MHz,TEM



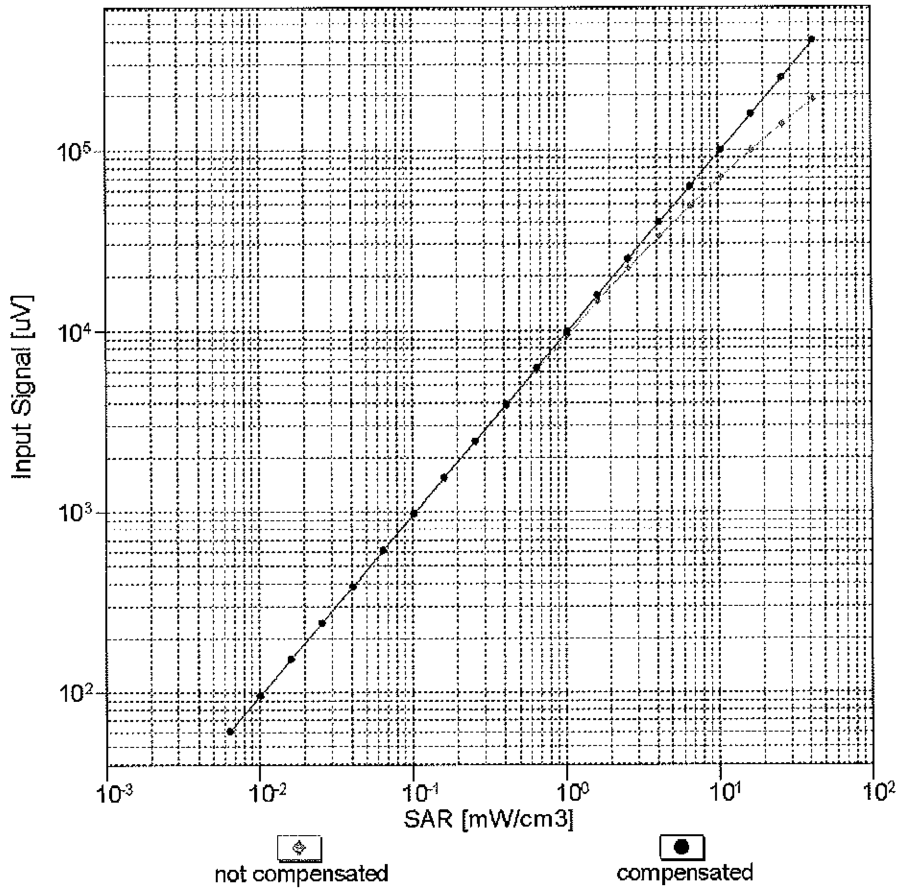
f=1800 MHz,R22

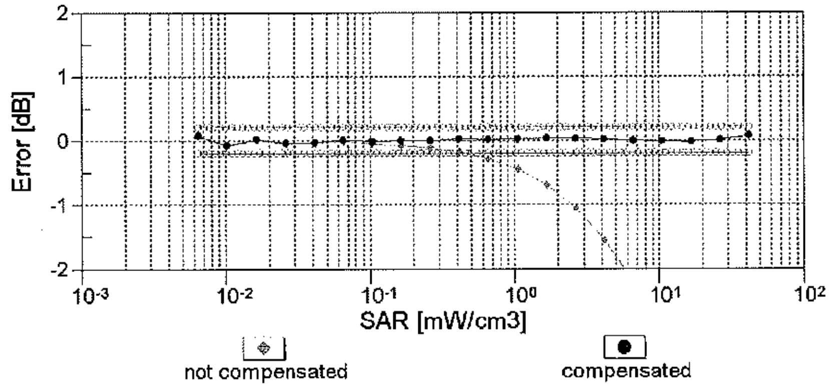




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

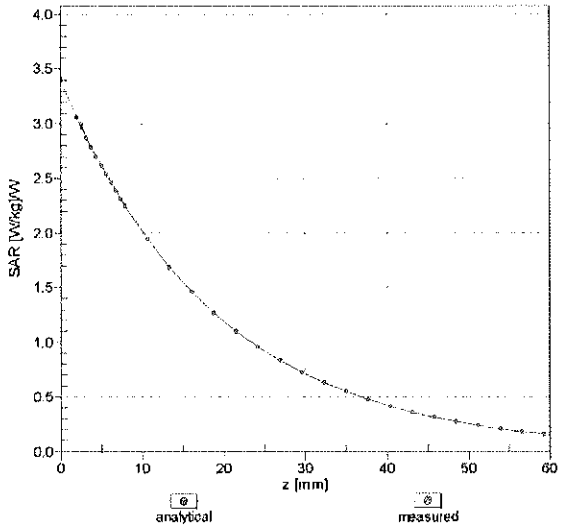
Dynamic Range f(SAR_{head})
(TEM cell , f = 900 MHz)

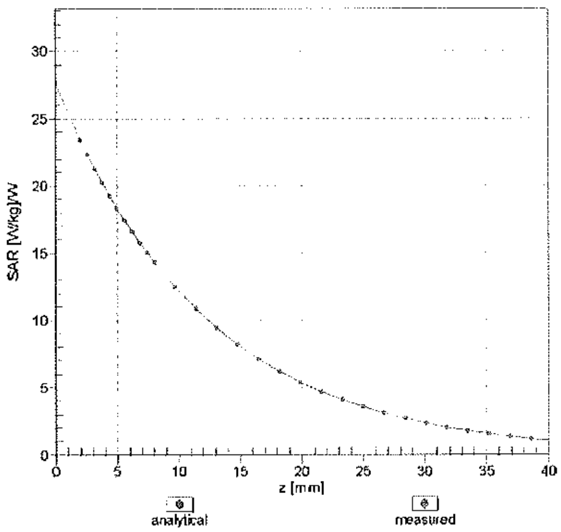




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

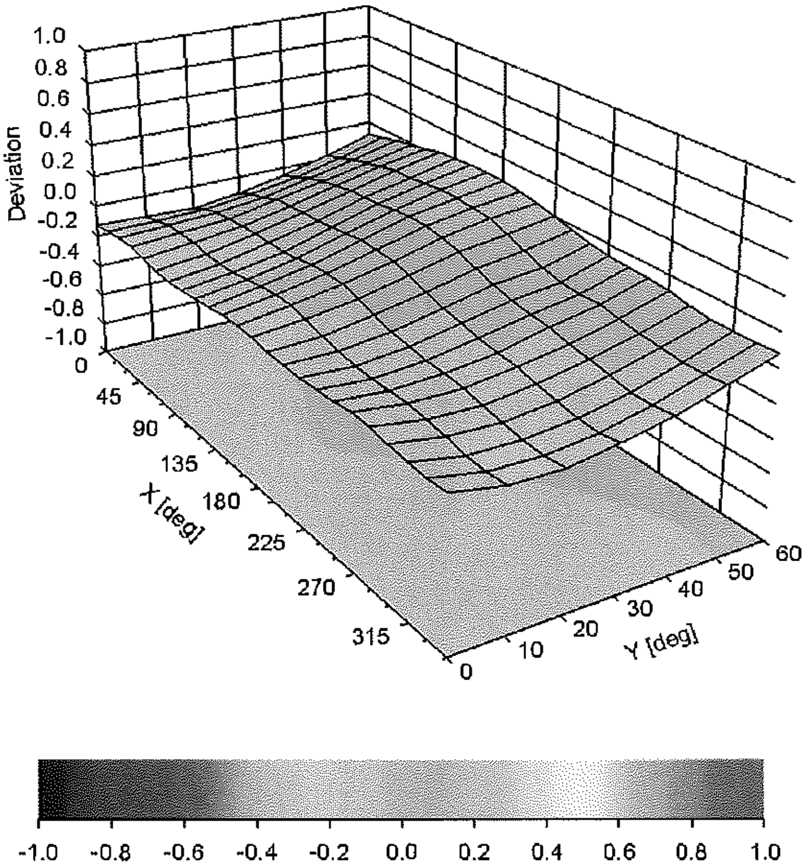
Conversion Factor Assessment





Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3333

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-35.7
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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Accreditation No.: SCS 108

Client **PC Test**

Certificate No: D1765V2-1008_May13

CALIBRATION CERTIFICATE

Object	D1765V2 - SN: 1008
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	May 14, 2013

✓ KOK 5/23/13

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Jeton Kastrat	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: May 15, 2013

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.6
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.1 ± 6 %	1.33 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.09 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**36.8 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.85 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.6 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.7 ± 6 %	1.47 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.53 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**38.2 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.4 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.3 Ω - 6.4 jΩ
Return Loss	- 23.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	43.8 Ω - 6.1 jΩ
Return Loss	- 20.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.211 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	October 06, 2005

DASY5 Validation Report for Head TSL

Date: 14.05.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1765 MHz; Type: D1765V2; Serial: D1765V2 - SN: 1008

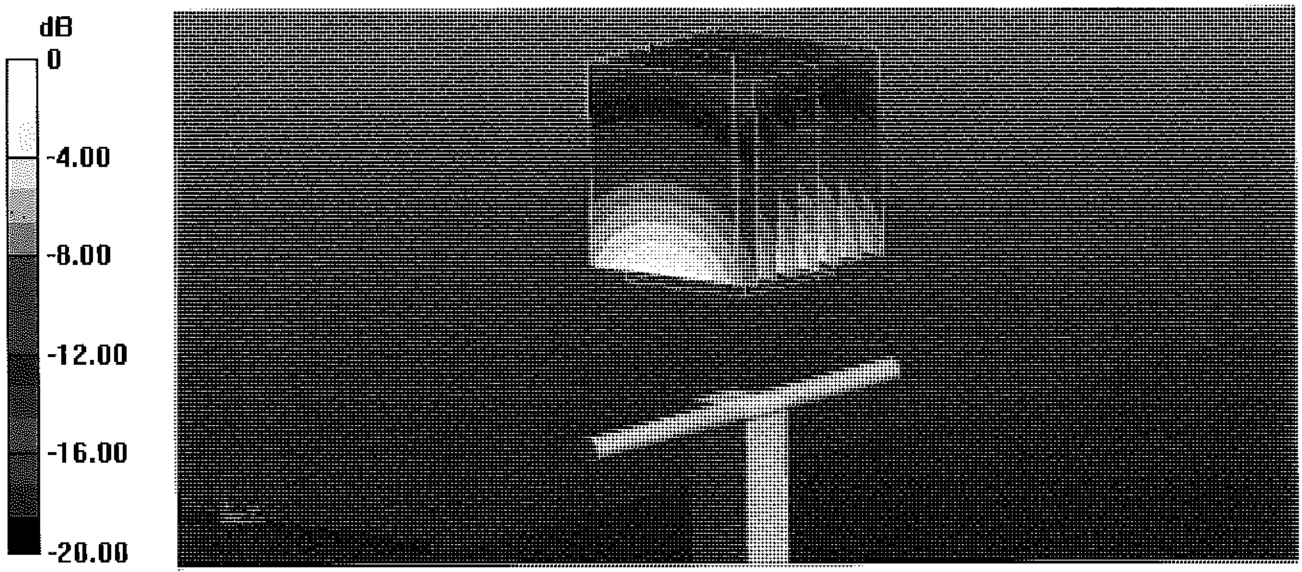
Communication System: UID 0 - CW ; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.33 S/m; ε_r = 39.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.18, 5.18, 5.18); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.6(1115); SEMCAD X 14.6.9(7117)

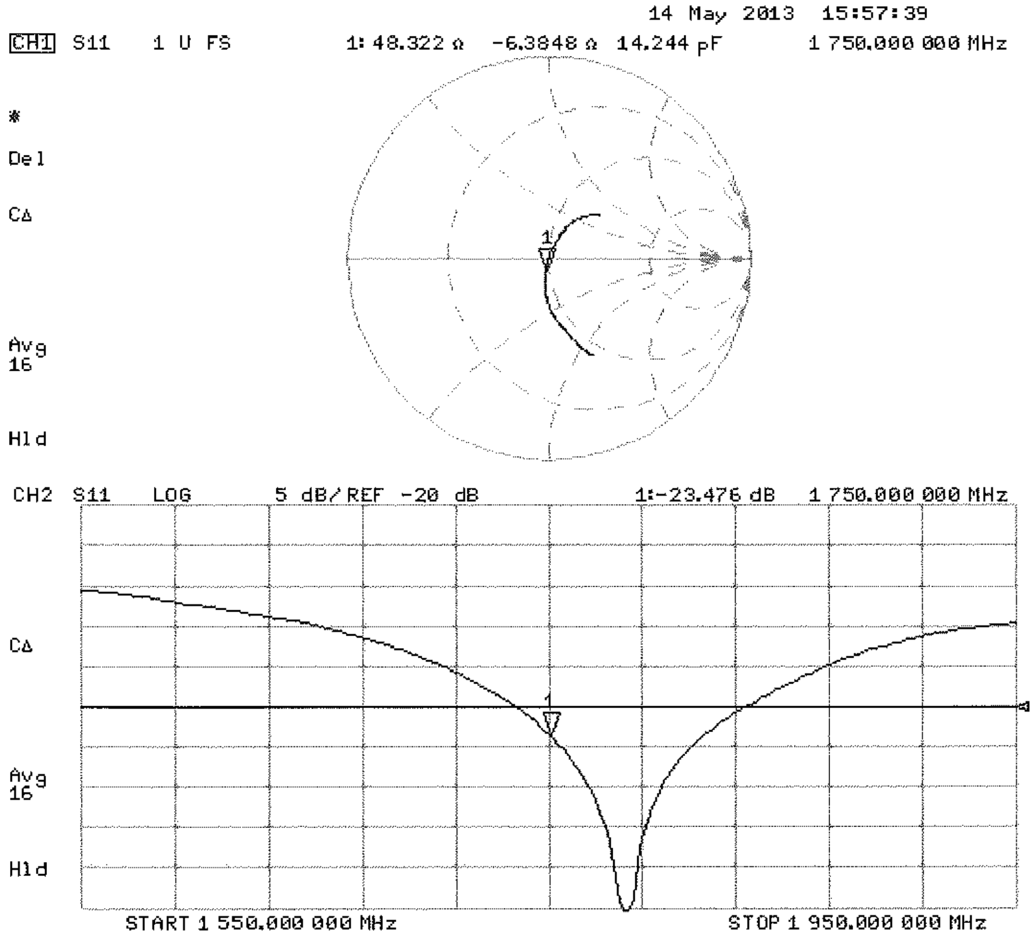
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.430 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 16.3 W/kg
SAR(1 g) = 9.09 W/kg; SAR(10 g) = 4.85 W/kg
Maximum value of SAR (measured) = 11.3 W/kg



0 dB = 11.3 W/kg = 10.53 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 13.05.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1765 MHz; Type: D1765V2; Serial: D1765V2 - SN: 1008

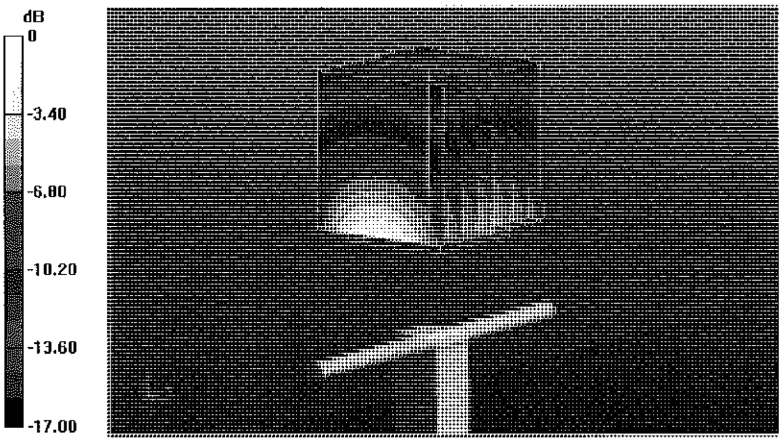
Communication System: UID 0 - CW ; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.47 S/m; ε_r = 51.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.83, 4.83, 4.83); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.6(1115); SEMCAD X 14.6.9(7117)

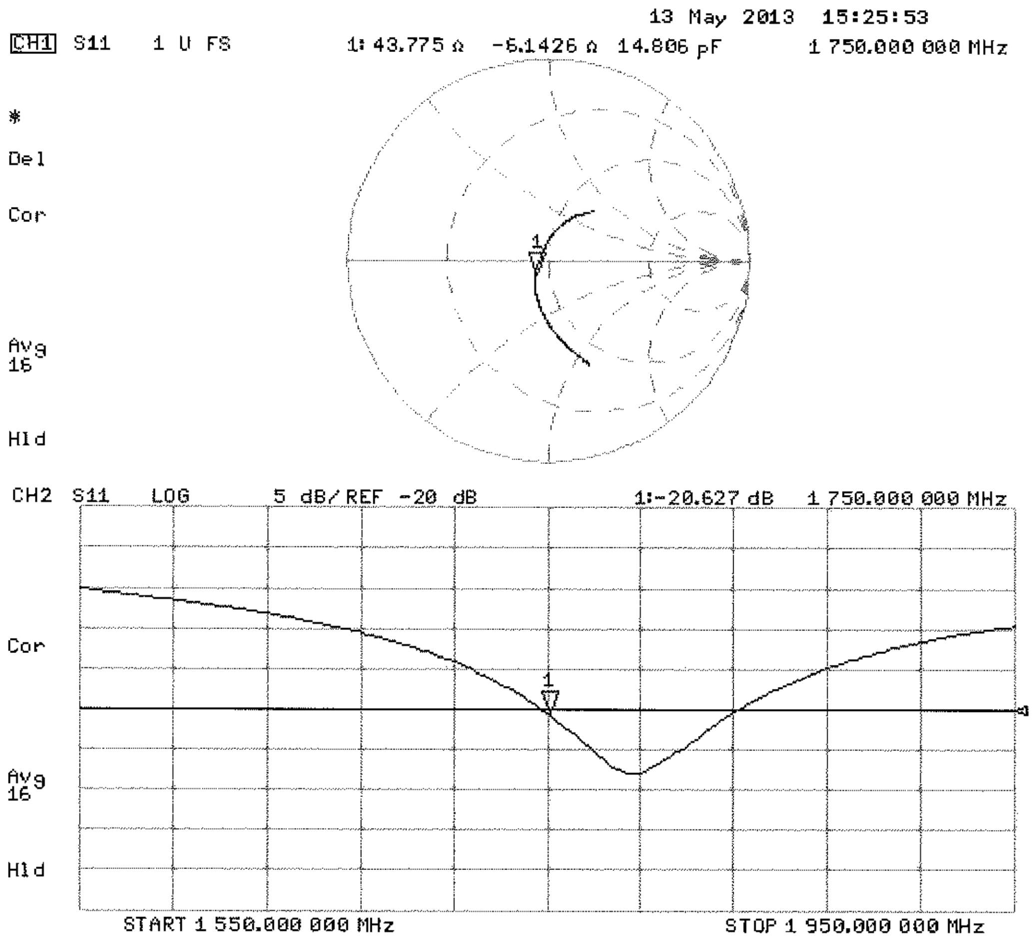
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.430 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 16.4 W/kg
SAR(1 g) = 9.53 W/kg; SAR(10 g) = 5.1 W/kg
Maximum value of SAR (measured) = 12.0 W/kg



0 dB = 12.0 W/kg = 10.79 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client **PC Test**

Certificate No: D1900V2-5d149_Jul13

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d149
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	July 22, 2013

KOK 8/19/13

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 22, 2013

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Accreditation No.: SCS 108

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.9 ± 6 %	1.36 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.99 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**40.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.3 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.4 ± 6 %	1.49 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.0 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**40.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.36 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.6 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.9 Ω + 6.0 jΩ
Return Loss	- 23.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.5 Ω + 6.4 jΩ
Return Loss	- 23.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.196 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 11, 2011

DASY5 Validation Report for Head TSL

Date: 22.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

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

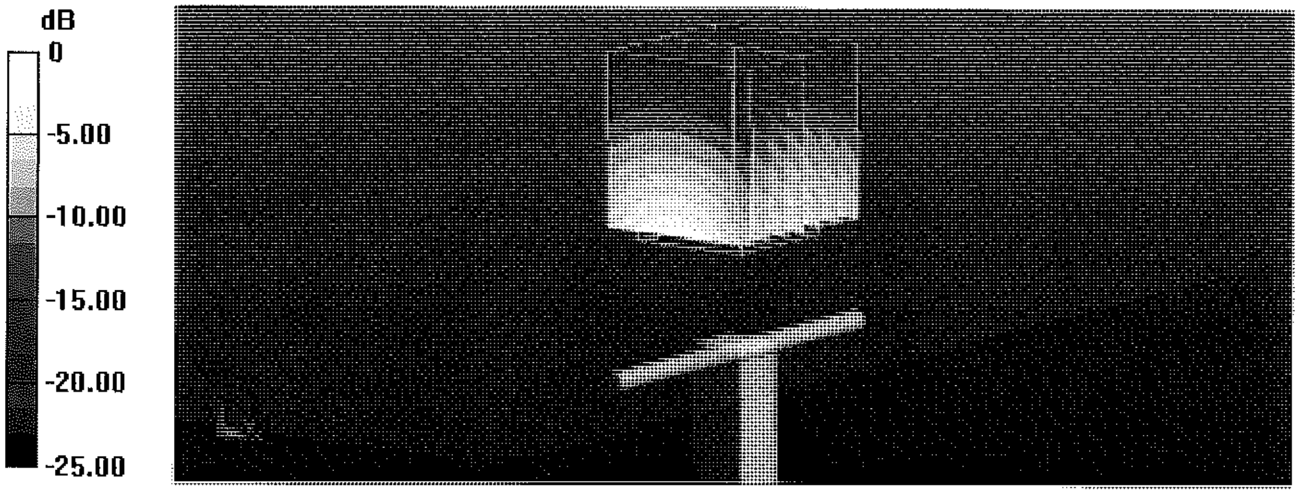
Communication System: UID 0 - CW ; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; $\sigma = 1.36$ S/m; $\varepsilon_r = 38.9$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.98, 4.98, 4.98); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

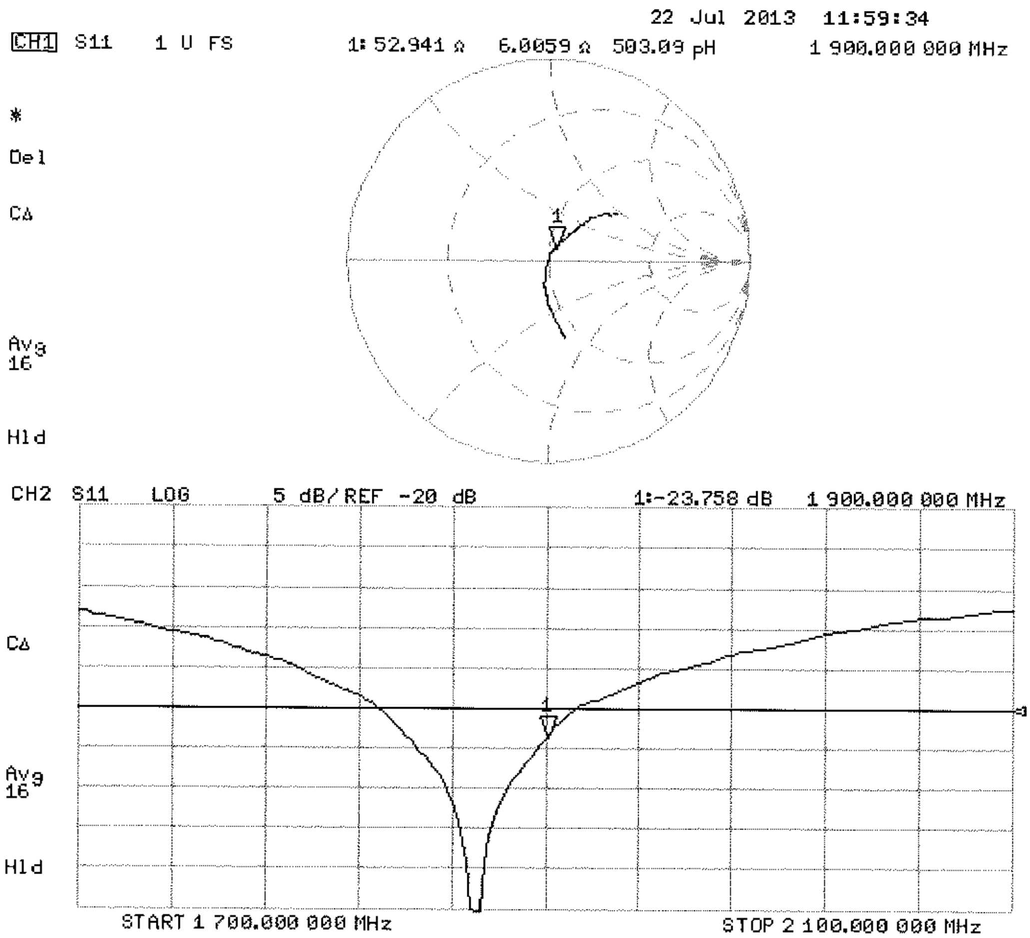
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.173 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 18.0 W/kg
SAR(1 g) = 9.99 W/kg; SAR(10 g) = 5.28 W/kg
Maximum value of SAR (measured) = 12.4 W/kg



0 dB = 12.4 W/kg = 10.93 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 22.07.2013

Test Laboratory: SPEAG, Zurich, Switzerland

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

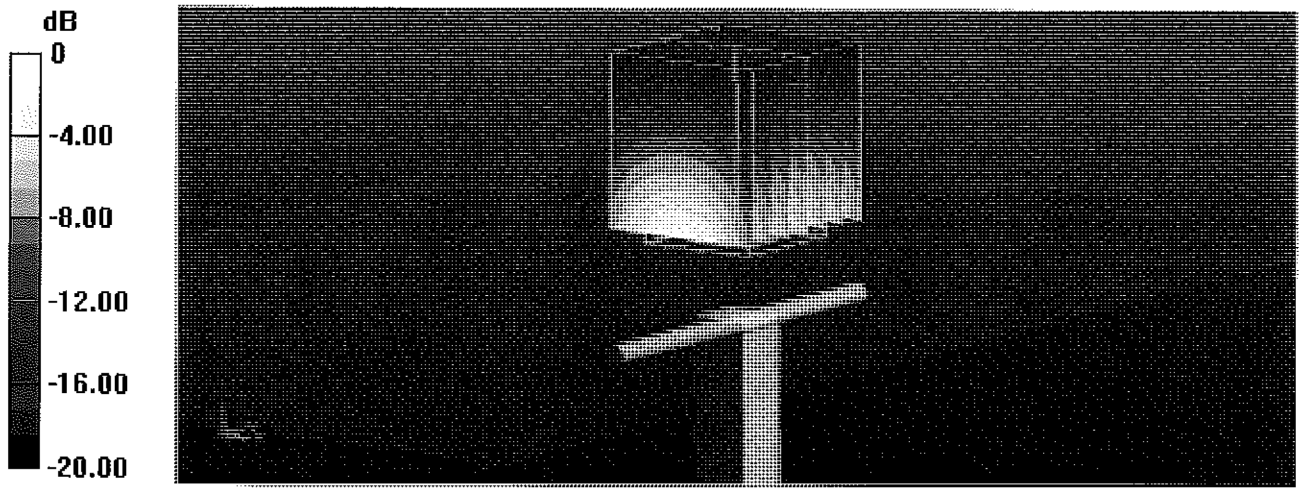
Communication System: UID 0 - CW ; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.49 S/m; ε_r = 53.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.6, 4.6, 4.6); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

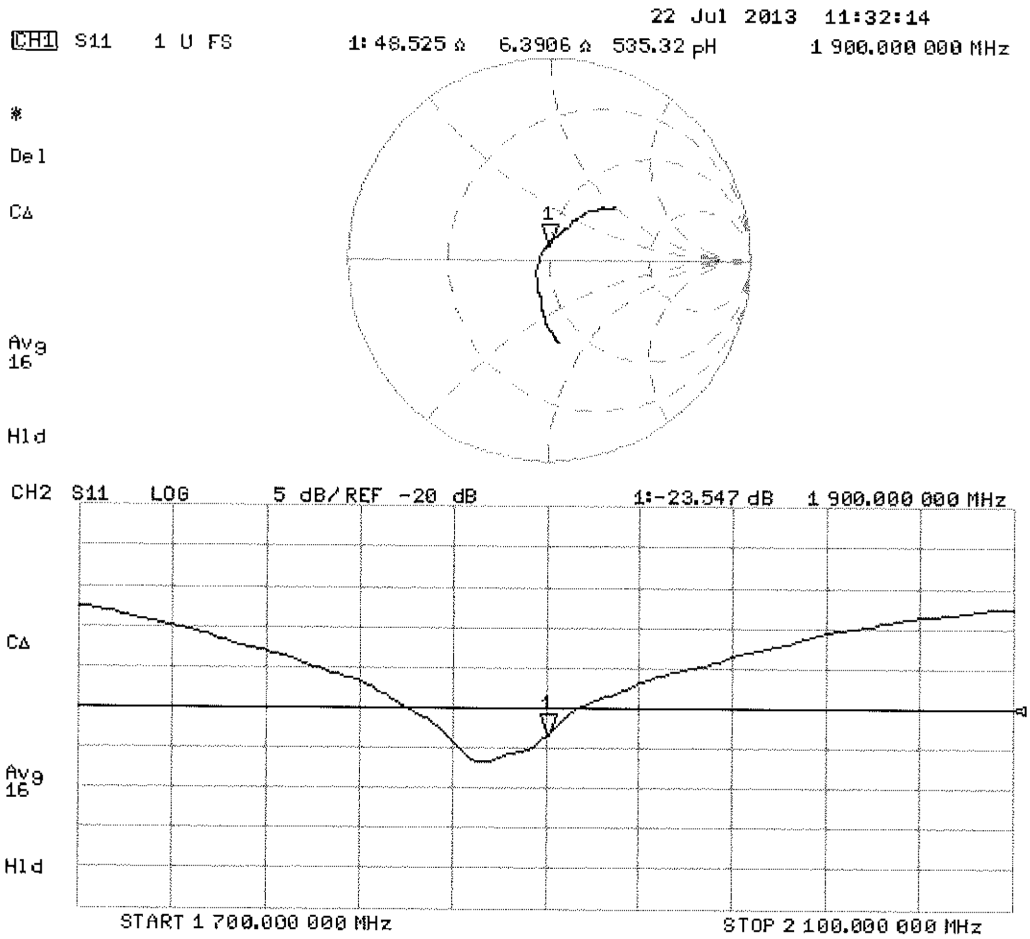
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.173 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 17.0 W/kg
SAR(1 g) = 10 W/kg; SAR(10 g) = 5.36 W/kg
Maximum value of SAR (measured) = 12.6 W/kg



0 dB = 12.6 W/kg = 11.00 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client PC Test

Certificate No: D2450V2-719_Aug13

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 719
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	August 23, 2013

✓CC 9/13/13

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: August 23, 2013

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Accreditation No.: SCS 108

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.8 ± 6 %	1.80 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.4 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**53.2 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.8 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.6 ± 6 %	2.03 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.3 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**51.7 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.1 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.6 Ω + 3.5 jΩ
Return Loss	- 25.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	51.1 Ω + 5.4 jΩ
Return Loss	- 25.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.149 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 10, 2002

DASY5 Validation Report for Head TSL

Date: 22.08.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 719

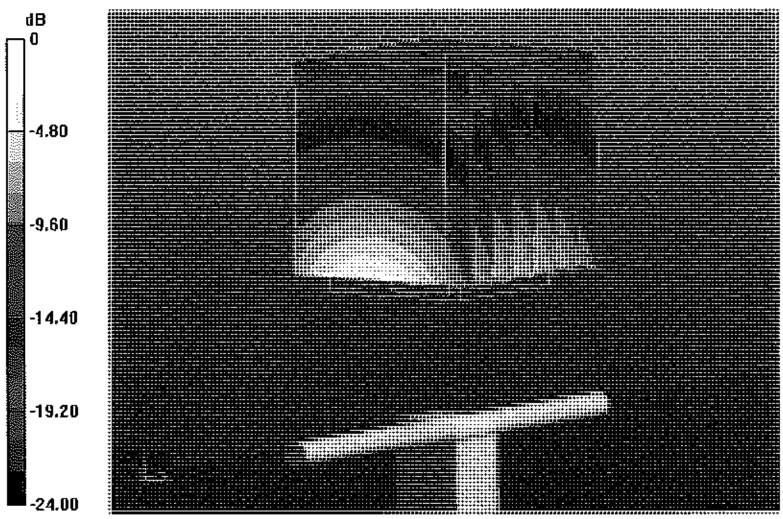
Communication System: UID 0 - CW ; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; $\sigma = 1.8$ S/m; $\varepsilon_r = 37.8$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.52, 4.52, 4.52); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

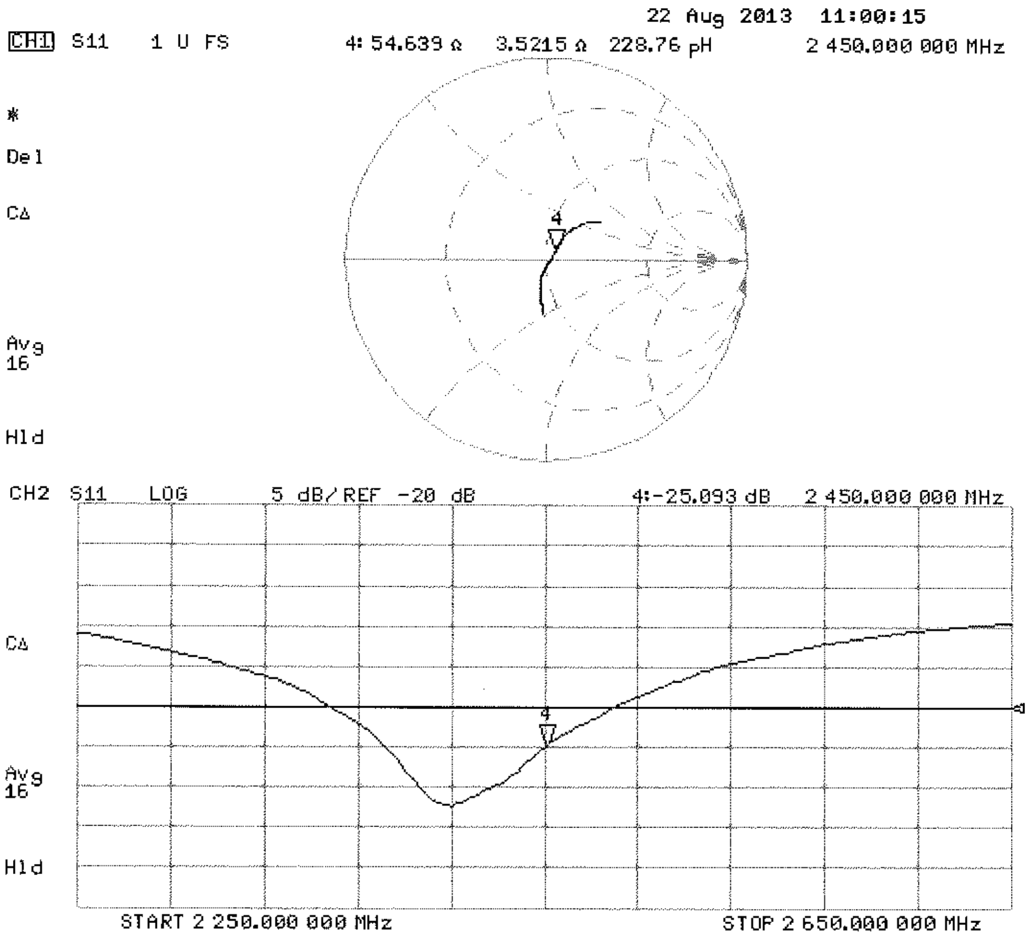
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 100.7 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 27.9 W/kg
SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.23 W/kg
Maximum value of SAR (measured) = 17.0 W/kg



0 dB = 17.0 W/kg = 12.30 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 23.08.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 719

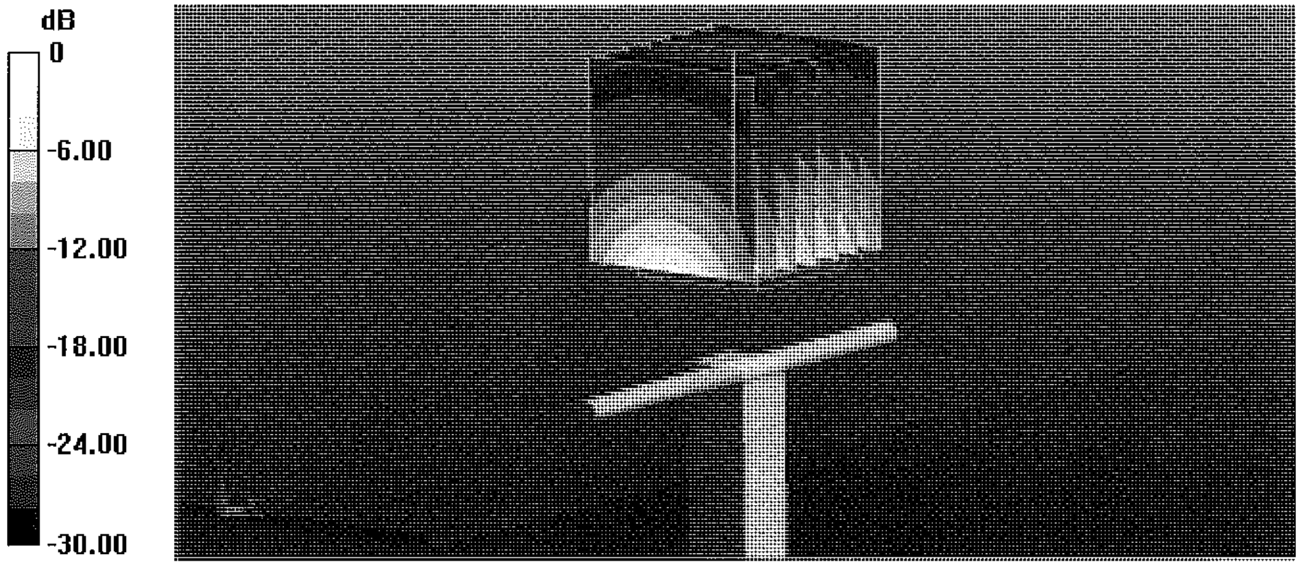
Communication System: UID 0 - CW ; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.03 S/m; ε_r = 50.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.42, 4.42, 4.42); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

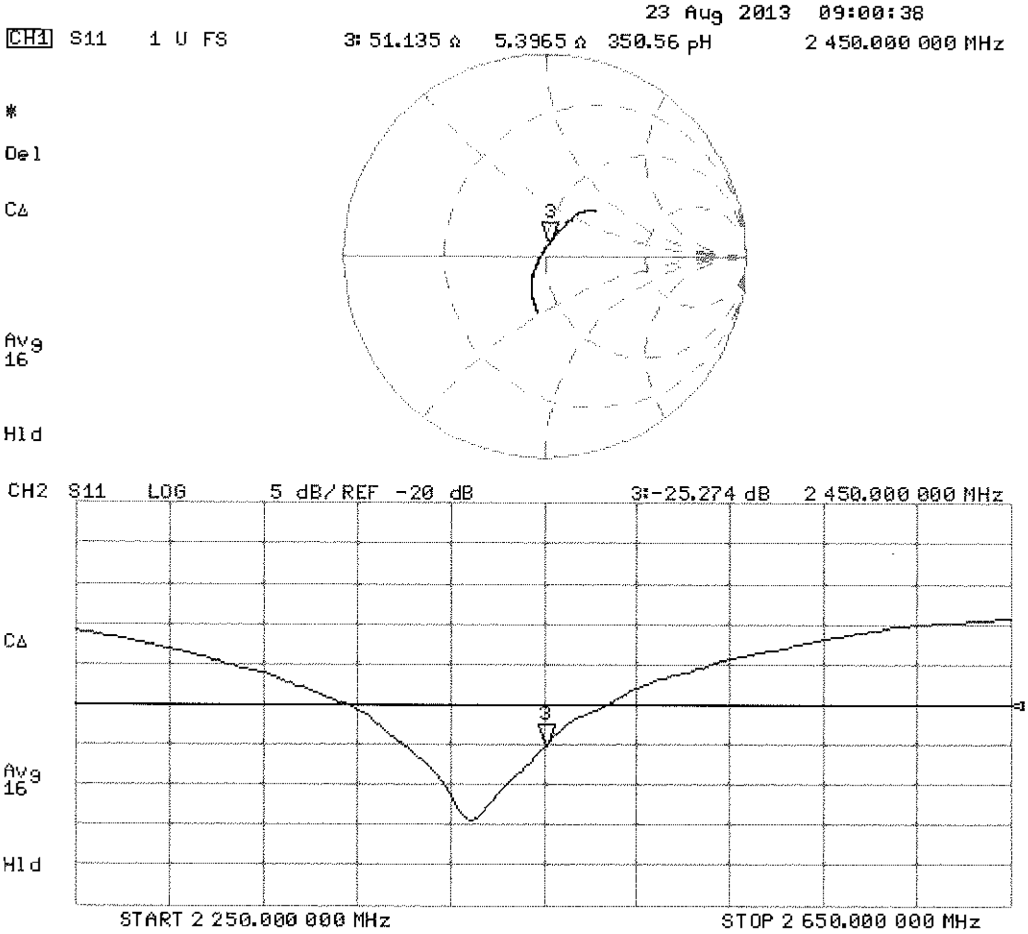
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.688 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 27.9 W/kg
SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.14 W/kg
Maximum value of SAR (measured) = 17.2 W/kg



0 dB = 17.2 W/kg = 12.36 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client PC Test

Certificate No: D2450V2-797_Jan14

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 797
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	January 21, 2014

CC ✓ 2/5/14

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Israe El-Naouq	Laboratory Technician	Israe El-Naouq
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 21, 2014

PCT# 751

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Accreditation No.: SCS 108

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.7 ± 6 %	1.86 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**51.8 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.13 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.3 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.3 ± 6 %	2.04 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.7 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**49.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.86 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.1 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.5 Ω + 3.2 jΩ
Return Loss	- 26.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.0 Ω + 4.9 jΩ
Return Loss	- 26.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.151 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	January 24, 2006

DASY5 Validation Report for Head TSL

Date: 21.01.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

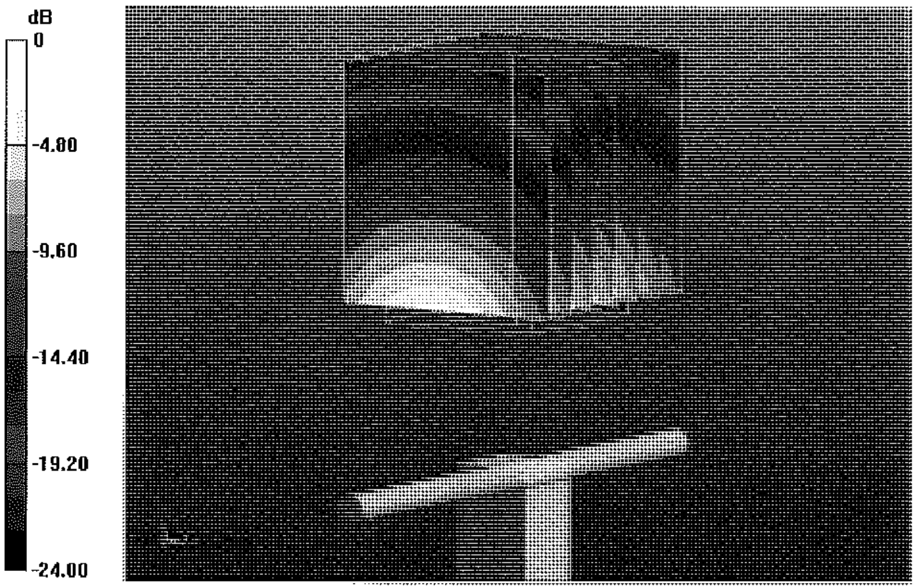
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.86 S/m; ε_r = 38.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

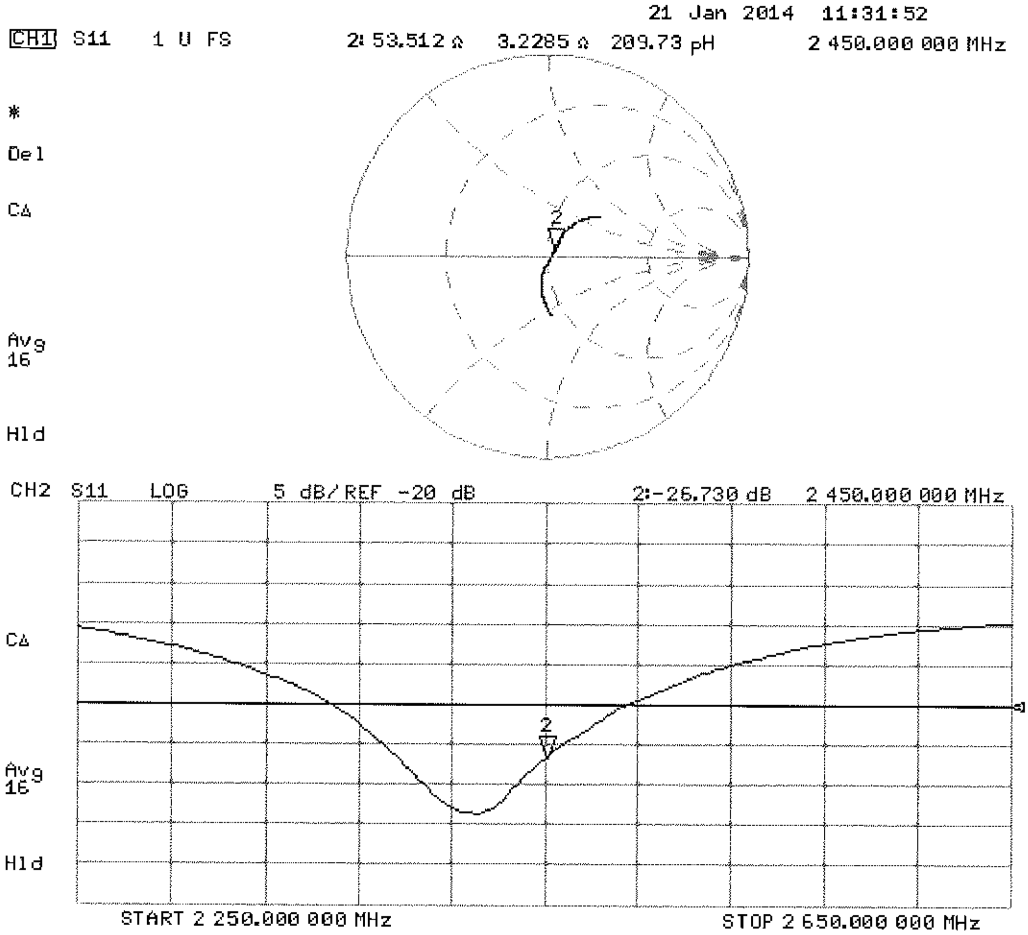
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.151 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 27.5 W/kg
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.13 W/kg
Maximum value of SAR (measured) = 16.9 W/kg



0 dB = 16.9 W/kg = 12.28 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 21.01.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

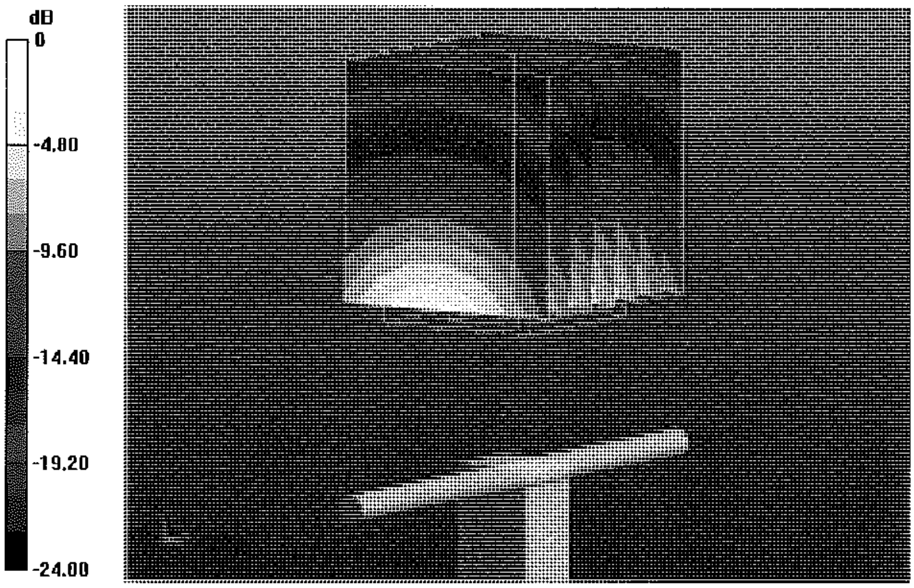
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.04 S/m; ε_r = 51.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.709 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 26.4 W/kg
SAR(1 g) = 12.7 W/kg; SAR(10 g) = 5.86 W/kg
Maximum value of SAR (measured) = 16.8 W/kg



0 dB = 16.8 W/kg = 12.25 dBW/kg

Impedance Measurement Plot for Body TSL