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SAR EVALUATION REPORT

Applicant Name:
LG Electronics MobileComm U.S.A., Inc.
1000 Sylvan Avenue
Englewood Cliffs, NJ 07632
United States

Date of Testing:
05/05/14 - 05/21/14
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Document Serial No.:
0Y1405070942.ZNF

FCC ID: **ZNFD851**

APPLICANT: **LG ELECTRONICS MOBILECOMM U.S.A., INC.**

DUT Type: Portable Handset
Application Type: Class II Permissive Change
FCC Rule Part(s): CFR §2.1093
Model(s): LG-D851, LGD851, D851
Permissive Change(s): See FCC Change Document
Date of Original Certification: 5/19/2014

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	0.32	0.57	0.57
PCE	GSM/GPRS/EDGE 1900	1850.20 - 1909.80 MHz	0.19	0.52	0.52
PCE	UMTS 850	826.40 - 846.60 MHz	0.25	0.46	0.46
PCE	UMTS 1750	1712.4 - 1752.5 MHz	0.36	1.15	1.15
PCE	UMTS 1900	1852.4 - 1907.6 MHz	0.26	0.88	0.88
PCE	LTE Band 17	706.5 - 713.5 MHz	< 0.1	0.16	0.25
PCE	LTE Band 4 (AWS)	1712.5 - 1752.5 MHz	0.37	0.99	0.99
PCE	LTE Band 2 (PCS)	1852.5 - 1907.5 MHz	0.20	0.68	0.68
PCE	LTE Band 7	2502.5 - 2567.5 MHz	< 0.1	< 0.1	< 0.1
DTS	2.4 GHz WLAN	2412 - 2462 MHz	0.25	0.19	0.19
DTS/NII	5.8 GHz WLAN	5745 - 5825 MHz	0.12	0.14	0.14
NII	5.2 GHz WLAN	5180 - 5240 MHz	< 0.1	< 0.1	
NII	5.3 GHz WLAN	5260 - 5320 MHz	0.11	< 0.1	
NII	5.5 GHz WLAN	5500 - 5700 MHz	0.14	0.12	
DSS/DTS	Bluetooth	2402 - 2480 MHz	N/A		
Simultaneous SAR per KDB 690783 D01v01r02:			0.56	1.38	1.34

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
GSM/GPRS/EDGE 1900	Voice/Data	1850.20 - 1909.80 MHz
UMTS 850	Voice/Data	826.40 - 846.60 MHz
UMTS 1750	Voice/Data	1712.4 - 1752.5 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.

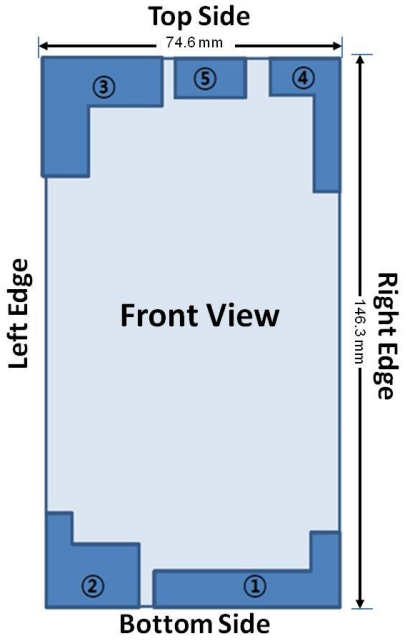
Mode / Band		Voice (dBm)	Burst Average GMSK (dBm)				Burst Average 8-PSK (dBm)			
		1 TX Slot	*1 TX Slots*	*2 TX Slots*	*3 TX Slots*	*4 TX Slots*	*1 TX Slots*	*2 TX Slots*	*3 TX Slots*	*4 TX Slots*
GSM/GPRS/EDGE 850	Maximum	**33.2**	**33.2**	**31.7**	**29.7**	**28.2**	**27.7**	**27.7**	**26.7**	**25.7**
	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 Rel. 99	*3GPP Rel. 5*	*3GPP Rel. 6*	*3GPP Rel. 8*
		RMC	*HSDPA*	*HSUPA*	*DC-HSDPA*
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	**10.5**
	Nominal	**9.0**
Bluetooth LE	Maximum	**6.5**
	Nominal	**4.5**

1.3 DUT Antenna Locations



Antenna Legend

1. Antenna 1
   1. GSM/GPRS/EDGE 850/1900 (Tx/Rx)
   2. UMTS Bands 2/5 (Tx/Rx)
   3. UMTS Band 4 (Rx Only)
   4. LTE Band 2 (Tx/Rx)
   5. LTE Band 4 (Rx Only)
2. Antenna 2
   1. UMTS Band 4 (Tx Only)
   2. LTE Bands 4 (Tx only)
   3. LTE Bands 17/7 (Tx/Rx)
3. Antenna 3
   1. UMTS Band 4 (2nd Rx)
   2. LTE Bands 17/4/7 (2nd Rx)
4. Antenna 4
   1. UMTS Band 2 (2nd Rx)
   2. LTE Band 2 (2nd Rx)
   3. GPS (Rx Only)
5. Antenna 5
   1. 2.4 GHz Bluetooth (Tx/Rx)
   2. 2.4 GHz WiFi (Tx/Rx)
   3. 5 GHz WiFi (Tx/Rx)

Figure 1-1
DUT Antenna Locations

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

Table 1-1
Mobile Hotspot Sides for SAR Testing

Mobile Hotspot Sides for SAR Testing						
Mode	Back	Front	Top	Bottom	Right	Left
GPRS 850	Yes	Yes	No	Yes	Yes	No
GPRS 1900	Yes	Yes	No	Yes	Yes	No
UMTS 850	Yes	Yes	No	Yes	Yes	No
UMTS 1750	Yes	Yes	No	Yes	No	Yes
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: 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 incorperated.

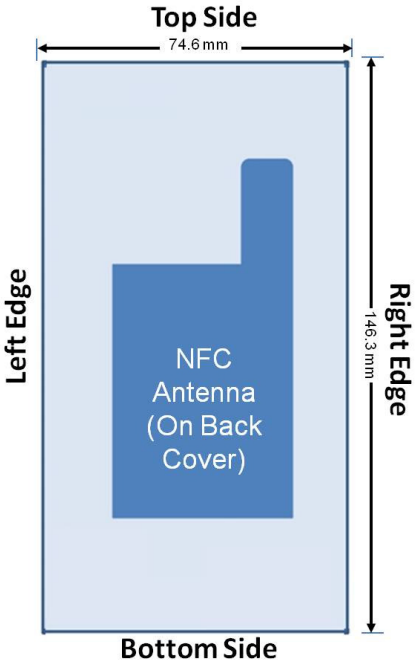


Figure 1-2
NFC Antenna Locations

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; [(11/10)* √2.441] = 1.7< 3.0. Per KDB Publication 447498 D01v05, the maximum power of the channel was rounded to the nearest mW before calculation.

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 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 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

(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)
- FCC KDB Publication 648474 D03-D04 (Wireless Charging Cover & Folio Sleeve Accessory)
- April 2013 TCB Workshop Notes (IEEE 802.11ac)
- October 2013 TCB Workshop Notes (GPRS Testing Considerations)

1.9 Wireless Charging Covers

This DUT may be used with a standard battery cover or with two optional wireless charging accessories: a wireless charging battery cover or a folio sleeve accessory. The wireless charging battery cover is a replacement for the standard back cover. The folio sleeve fits the back of the handset and extends to protect the front side of the device. 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.

Per FCC KDB Publication 648474 D04, SAR was measured using the standard battery cover and then repeated with the wireless charging battery cover and the folio sleeve accessory for the highest reported SAR for each wireless technology, frequency band, operating mode, and exposure condition. Since reported SAR did not exceed 1.2 W/kg, additional testing with the wireless charging accessories was not required.

1.10 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.

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

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:

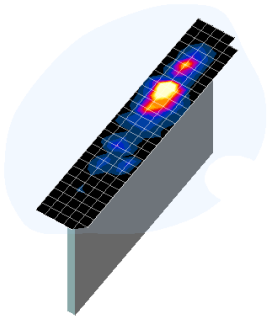


Figure 4-1
Sample SAR Area Scan

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].

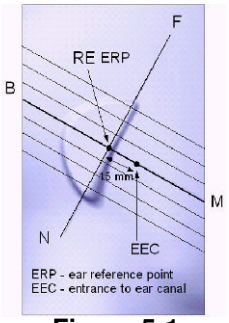


Figure 5-1
Close-Up Side view of ERP

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.

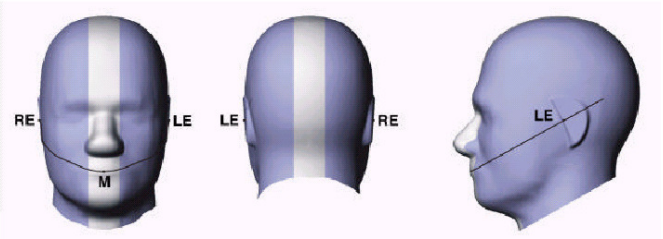


Figure 5-2
Front, back and side view of SAM Twin Phantom

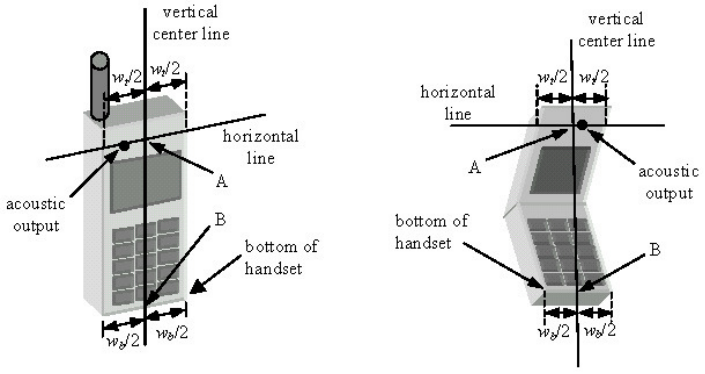


Figure 5-3
Handset Vertical Center & Horizontal Line Reference Points

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.

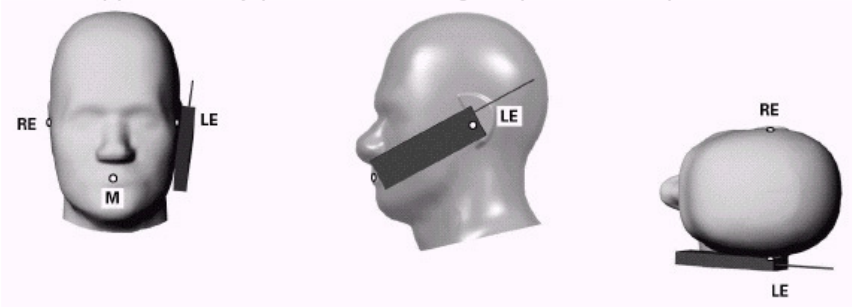


Figure 6-1 Front, Side and Top View of Cheek Position

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).

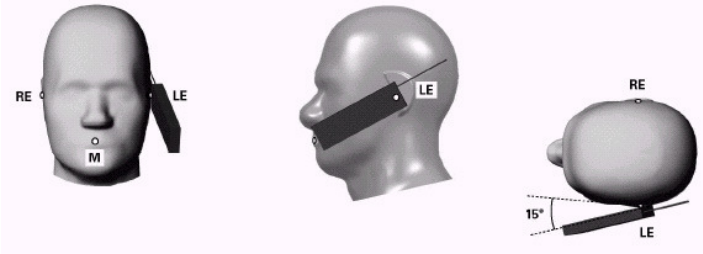


Figure 6-2 Front, Side and Top View of Ear/15º Tilt Position

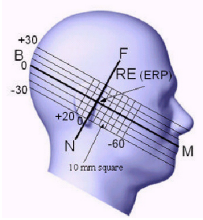


Figure 6-3
Side view w/ relevant markings

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

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

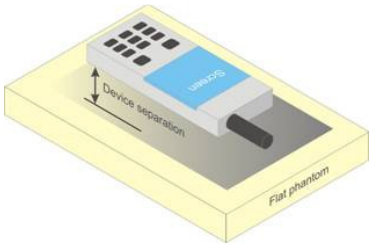


Figure 6-5
Sample Body-Worn Diagram

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

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

6.6 Extremity Exposure Configurations

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

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

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	32.61	32.52	31.13	**29.08**	28.20	27.10	26.92	25.61	24.90
	190	32.67	32.60	31.27	**29.33**	28.20	27.25	27.15	25.85	25.11
	251	32.56	32.49	31.06	**29.18**	28.19	27.24	27.09	25.72	25.01
GSM 1900	512	30.85	30.85	29.39	**27.32**	25.80	26.43	26.28	25.28	24.25
	661	30.79	30.77	29.43	**27.36**	25.80	26.35	26.31	25.25	24.23
	810	30.80	30.86	29.46	**27.27**	25.79	26.42	26.27	25.28	24.27
		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	23.58	23.49	25.11	**24.82**	25.19	18.07	20.90	21.35	21.89
	190	23.64	23.57	25.25	**25.07**	25.19	18.22	21.13	21.59	22.10
	251	23.53	23.46	25.04	**24.92**	25.18	18.21	21.07	21.46	22.00
GSM 1900	512	21.82	21.82	23.37	**23.06**	22.79	17.40	20.26	21.02	21.24
	661	21.76	21.74	23.41	**23.10**	22.79	17.32	20.29	20.99	21.22
	810	21.77	21.83	23.44	**23.01**	22.78	17.39	20.25	21.02	21.26
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 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	23.52	23.46	23.67	24.33	24.32	24.34	23.68	23.45	23.40	-
99		12.2 kbps AMR	23.50	23.47	23.63	24.32	24.29	24.39	23.64	23.43	23.43	-
6	HSDPA	Subtest 1	23.49	23.42	23.55	24.30	24.40	24.43	23.61	23.42	23.44	0
6		Subtest 2	23.38	23.34	23.41	24.21	24.26	24.33	23.46	23.40	23.33	0
6		Subtest 3	23.07	23.02	23.08	23.82	23.84	23.89	22.97	23.03	23.04	0.5
6		Subtest 4	23.01	22.97	23.07	23.77	23.79	23.85	22.93	22.99	22.96	0.5
6	HSUPA	Subtest 1	23.05	22.92	23.38	24.05	24.21	23.80	23.18	23.14	23.41	0
6		Subtest 2	21.69	21.64	21.65	22.56	22.31	22.69	21.70	21.68	21.43	2
6		Subtest 3	22.13	22.27	22.20	23.31	23.20	23.59	22.58	22.42	22.23	1
6		Subtest 4	21.58	21.69	21.59	22.58	22.69	22.70	21.63	21.52	21.40	2
6		Subtest 5	23.53	23.23	23.30	24.35	24.36	24.43	23.29	23.59	23.32	0
8	DC-HSDPA	Subtest 1	23.26	23.21	23.25	23.99	23.97	24.10	23.31	23.55	23.46	0
8		Subtest 2	23.39	23.24	23.30	23.96	23.98	24.06	23.47	23.42	23.24	0
8		Subtest 3	22.93	22.78	22.76	23.37	23.43	23.62	22.91	22.94	23.02	0.5
8		Subtest 4	22.84	22.94	22.74	23.43	23.43	23.56	22.78	22.95	22.98	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	23.92	0	0
	710.0	23790	10	QPSK	1	25	23.95	0	0
	710.0	23790	10	QPSK	1	49	**24.05**	0	0
	710.0	23790	10	QPSK	25	0	**22.66**	0-1	1
	710.0	23790	10	QPSK	25	12	22.60	0-1	1
	710.0	23790	10	QPSK	25	25	22.58	0-1	1
	710.0	23790	10	QPSK	50	0	22.65	0-1	1
	710.0	23790	10	16QAM	1	0	22.48	0-1	1
	710.0	23790	10	16QAM	1	25	22.46	0-1	1
	710.0	23790	10	16QAM	1	49	22.53	0-1	1
	710.0	23790	10	16QAM	25	0	21.42	0-2	2
	710.0	23790	10	16QAM	25	12	21.41	0-2	2
	710.0	23790	10	16QAM	25	25	21.45	0-2	2
	710.0	23790	10	16QAM	50	0	21.52	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	23.93	0	0
	710.0	23790	5	QPSK	1	12	24.00	0	0
	710.0	23790	5	QPSK	1	24	23.93	0	0
	710.0	23790	5	QPSK	12	0	22.64	0-1	1
	710.0	23790	5	QPSK	12	6	22.59	0-1	1
	710.0	23790	5	QPSK	12	13	22.56	0-1	1
	710.0	23790	5	QPSK	25	0	22.56	0-1	1
	710.0	23790	5	16-QAM	1	0	22.43	0-1	1
	710.0	23790	5	16-QAM	1	12	22.44	0-1	1
	710.0	23790	5	16-QAM	1	24	22.45	0-1	1
	710.0	23790	5	16-QAM	12	0	21.44	0-2	2
	710.0	23790	5	16-QAM	12	6	21.43	0-2	2
	710.0	23790	5	16-QAM	12	13	21.41	0-2	2
	710.0	23790	5	16-QAM	25	0	21.43	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	**24.41**	0	0
	1732.5	20175	20	QPSK	1	50	24.30	0	0
	1732.5	20175	20	QPSK	1	99	24.36	0	0
	1732.5	20175	20	QPSK	50	0	**23.12**	0-1	1
	1732.5	20175	20	QPSK	50	25	23.01	0-1	1
	1732.5	20175	20	QPSK	50	50	23.04	0-1	1
	1732.5	20175	20	QPSK	100	0	23.10	0-1	1
	1732.5	20175	20	16QAM	1	0	22.95	0-1	1
	1732.5	20175	20	16QAM	1	50	22.87	0-1	1
	1732.5	20175	20	16QAM	1	99	22.92	0-1	1
	1732.5	20175	20	16QAM	50	0	22.04	0-2	2
	1732.5	20175	20	16QAM	50	25	21.98	0-2	2
	1732.5	20175	20	16QAM	50	50	22.07	0-2	2
	1732.5	20175	20	16QAM	100	0	22.02	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	24.34	0	0
	1717.5	20025	15	QPSK	1	36	24.33	0	0
	1717.5	20025	15	QPSK	1	74	24.35	0	0
	1717.5	20025	15	QPSK	36	0	23.08	0-1	1
	1717.5	20025	15	QPSK	36	18	23.07	0-1	1
	1717.5	20025	15	QPSK	36	37	23.06	0-1	1
	1717.5	20025	15	QPSK	75	0	23.13	0-1	1
	1717.5	20025	15	16QAM	1	0	22.86	0-1	1
	1717.5	20025	15	16QAM	1	36	22.90	0-1	1
	1717.5	20025	15	16QAM	1	74	22.91	0-1	1
	1717.5	20025	15	16QAM	36	0	21.95	0-2	2
	1717.5	20025	15	16QAM	36	18	21.93	0-2	2
	1717.5	20025	15	16QAM	36	37	21.95	0-2	2
	1717.5	20025	15	16QAM	75	0	22.00	0-2	2
Mid	1732.5	20175	15	QPSK	1	0	24.40	0	0
	1732.5	20175	15	QPSK	1	36	24.31	0	0
	1732.5	20175	15	QPSK	1	74	24.33	0	0
	1732.5	20175	15	QPSK	36	0	23.10	0-1	1
	1732.5	20175	15	QPSK	36	18	23.07	0-1	1
	1732.5	20175	15	QPSK	36	37	23.13	0-1	1
	1732.5	20175	15	QPSK	75	0	23.09	0-1	1
	1732.5	20175	15	16QAM	1	0	23.02	0-1	1
	1732.5	20175	15	16QAM	1	36	22.91	0-1	1
	1732.5	20175	15	16QAM	1	74	22.87	0-1	1
	1732.5	20175	15	16QAM	36	0	21.95	0-2	2
	1732.5	20175	15	16QAM	36	18	21.91	0-2	2
	1732.5	20175	15	16QAM	36	37	21.99	0-2	2
	1732.5	20175	15	16QAM	75	0	22.04	0-2	2
High	1747.5	20325	15	QPSK	1	0	24.39	0	0
	1747.5	20325	15	QPSK	1	36	24.38	0	0
	1747.5	20325	15	QPSK	1	74	24.30	0	0
	1747.5	20325	15	QPSK	36	0	23.17	0-1	1
	1747.5	20325	15	QPSK	36	18	23.05	0-1	1
	1747.5	20325	15	QPSK	36	37	23.12	0-1	1
	1747.5	20325	15	QPSK	75	0	23.21	0-1	1
	1747.5	20325	15	16QAM	1	0	22.95	0-1	1
	1747.5	20325	15	16QAM	1	36	22.98	0-1	1
	1747.5	20325	15	16QAM	1	74	22.93	0-1	1
	1747.5	20325	15	16QAM	36	0	21.93	0-2	2
	1747.5	20325	15	16QAM	36	18	21.86	0-2	2
	1747.5	20325	15	16QAM	36	37	21.87	0-2	2
	1747.5	20325	15	16QAM	75	0	22.04	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	24.33	0	0
	1715	20000	10	QPSK	1	25	24.34	0	0
	1715	20000	10	QPSK	1	49	24.36	0	0
	1715	20000	10	QPSK	25	0	23.09	0-1	1
	1715	20000	10	QPSK	25	12	23.10	0-1	1
	1715	20000	10	QPSK	25	25	23.05	0-1	1
	1715	20000	10	QPSK	50	0	23.13	0-1	1
	1715	20000	10	16QAM	1	0	22.85	0-1	1
	1715	20000	10	16QAM	1	25	22.86	0-1	1
	1715	20000	10	16QAM	1	49	22.89	0-1	1
	1715	20000	10	16QAM	25	0	21.96	0-2	2
	1715	20000	10	16QAM	25	12	21.95	0-2	2
	1715	20000	10	16QAM	25	25	21.94	0-2	2
	1715	20000	10	16QAM	50	0	21.99	0-2	2
Mid	1732.5	20175	10	QPSK	1	0	24.39	0	0
	1732.5	20175	10	QPSK	1	25	24.30	0	0
	1732.5	20175	10	QPSK	1	49	24.35	0	0
	1732.5	20175	10	QPSK	25	0	23.12	0-1	1
	1732.5	20175	10	QPSK	25	12	23.06	0-1	1
	1732.5	20175	10	QPSK	25	25	23.11	0-1	1
	1732.5	20175	10	QPSK	50	0	23.10	0-1	1
	1732.5	20175	10	16QAM	1	0	23.00	0-1	1
	1732.5	20175	10	16QAM	1	25	22.92	0-1	1
	1732.5	20175	10	16QAM	1	49	22.90	0-1	1
	1732.5	20175	10	16QAM	25	0	21.96	0-2	2
	1732.5	20175	10	16QAM	25	12	21.92	0-2	2
	1732.5	20175	10	16QAM	25	25	21.95	0-2	2
	1732.5	20175	10	16QAM	50	0	22.01	0-2	2
High	1750	20350	10	QPSK	1	0	24.40	0	0
	1750	20350	10	QPSK	1	25	24.37	0	0
	1750	20350	10	QPSK	1	49	24.31	0	0
	1750	20350	10	QPSK	25	0	23.12	0-1	1
	1750	20350	10	QPSK	25	12	23.04	0-1	1
	1750	20350	10	QPSK	25	25	23.10	0-1	1
	1750	20350	10	QPSK	50	0	23.20	0-1	1
	1750	20350	10	16QAM	1	0	22.92	0-1	1
	1750	20350	10	16QAM	1	25	22.97	0-1	1
	1750	20350	10	16QAM	1	49	22.95	0-1	1
	1750	20350	10	16QAM	25	0	21.94	0-2	2
	1750	20350	10	16QAM	25	12	21.89	0-2	2
	1750	20350	10	16QAM	25	25	21.87	0-2	2
	1750	20350	10	16QAM	50	0	21.99	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	24.32	0	0
	1712.5	19975	5	QPSK	1	12	24.34	0	0
	1712.5	19975	5	QPSK	1	24	24.35	0	0
	1712.5	19975	5	QPSK	12	0	23.10	0-1	1
	1712.5	19975	5	QPSK	12	6	23.08	0-1	1
	1712.5	19975	5	QPSK	12	13	23.04	0-1	1
	1712.5	19975	5	QPSK	25	0	23.09	0-1	1
	1712.5	19975	5	16-QAM	1	0	22.90	0-1	1
	1712.5	19975	5	16-QAM	1	12	22.91	0-1	1
	1712.5	19975	5	16-QAM	1	24	22.94	0-1	1
	1712.5	19975	5	16-QAM	12	0	21.85	0-2	2
	1712.5	19975	5	16-QAM	12	6	21.89	0-2	2
	1712.5	19975	5	16-QAM	12	13	21.90	0-2	2
	1712.5	19975	5	16-QAM	25	0	21.92	0-2	2
Mid	1732.5	20175	5	QPSK	1	0	24.38	0	0
	1732.5	20175	5	QPSK	1	12	24.39	0	0
	1732.5	20175	5	QPSK	1	24	24.36	0	0
	1732.5	20175	5	QPSK	12	0	23.05	0-1	1
	1732.5	20175	5	QPSK	12	6	23.08	0-1	1
	1732.5	20175	5	QPSK	12	13	23.02	0-1	1
	1732.5	20175	5	QPSK	25	0	23.04	0-1	1
	1732.5	20175	5	16-QAM	1	0	22.91	0-1	1
	1732.5	20175	5	16-QAM	1	12	22.95	0-1	1
	1732.5	20175	5	16-QAM	1	24	22.84	0-1	1
	1732.5	20175	5	16-QAM	12	0	21.89	0-2	2
	1732.5	20175	5	16-QAM	12	6	21.90	0-2	2
	1732.5	20175	5	16-QAM	12	13	21.93	0-2	2
	1732.5	20175	5	16-QAM	25	0	21.96	0-2	2
High	1752.5	20375	5	QPSK	1	0	24.40	0	0
	1752.5	20375	5	QPSK	1	12	24.39	0	0
	1752.5	20375	5	QPSK	1	24	24.37	0	0
	1752.5	20375	5	QPSK	12	0	23.06	0-1	1
	1752.5	20375	5	QPSK	12	6	23.10	0-1	1
	1752.5	20375	5	QPSK	12	13	23.05	0-1	1
	1752.5	20375	5	QPSK	25	0	23.07	0-1	1
	1752.5	20375	5	16-QAM	1	0	22.92	0-1	1
	1752.5	20375	5	16-QAM	1	12	22.94	0-1	1
	1752.5	20375	5	16-QAM	1	24	22.89	0-1	1
	1752.5	20375	5	16-QAM	12	0	21.91	0-2	2
	1752.5	20375	5	16-QAM	12	6	21.92	0-2	2
	1752.5	20375	5	16-QAM	12	13	21.94	0-2	2
	1752.5	20375	5	16-QAM	25	0	21.97	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	**23.58**	0	0
	1860	18700	20	QPSK	1	50	23.47	0	0
	1860	18700	20	QPSK	1	99	23.55	0	0
	1860	18700	20	QPSK	50	0	22.31	0-1	1
	1860	18700	20	QPSK	50	25	**22.32**	0-1	1
	1860	18700	20	QPSK	50	50	22.21	0-1	1
	1860	18700	20	QPSK	100	0	22.30	0-1	1
	1860	18700	20	16QAM	1	0	22.23	0-1	1
	1860	18700	20	16QAM	1	50	21.95	0-1	1
	1860	18700	20	16QAM	1	99	22.05	0-1	1
	1860	18700	20	16QAM	50	0	21.21	0-2	2
	1860	18700	20	16QAM	50	25	21.17	0-2	2
	1860	18700	20	16QAM	50	50	21.16	0-2	2
	1860	18700	20	16QAM	100	0	21.13	0-2	2
Mid	1880.0	18900	20	QPSK	1	0	23.51	0	0
	1880.0	18900	20	QPSK	1	50	23.30	0	0
	1880.0	18900	20	QPSK	1	99	23.32	0	0
	1880.0	18900	20	QPSK	50	0	22.12	0-1	1
	1880.0	18900	20	QPSK	50	25	22.09	0-1	1
	1880.0	18900	20	QPSK	50	50	22.00	0-1	1
	1880.0	18900	20	QPSK	100	0	22.08	0-1	1
	1880.0	18900	20	16QAM	1	0	22.03	0-1	1
	1880.0	18900	20	16QAM	1	50	21.81	0-1	1
	1880.0	18900	20	16QAM	1	99	21.83	0-1	1
	1880.0	18900	20	16QAM	50	0	21.03	0-2	2
	1880.0	18900	20	16QAM	50	25	21.04	0-2	2
	1880.0	18900	20	16QAM	50	50	21.02	0-2	2
	1880.0	18900	20	16QAM	100	0	21.03	0-2	2
High	1900	19100	20	QPSK	1	0	23.36	0	0
	1900	19100	20	QPSK	1	50	23.56	0	0
	1900	19100	20	QPSK	1	99	23.42	0	0
	1900	19100	20	QPSK	50	0	22.14	0-1	1
	1900	19100	20	QPSK	50	25	22.20	0-1	1
	1900	19100	20	QPSK	50	50	22.21	0-1	1
	1900	19100	20	QPSK	100	0	22.31	0-1	1
	1900	19100	20	16QAM	1	0	21.86	0-1	1
	1900	19100	20	16QAM	1	50	22.02	0-1	1
	1900	19100	20	16QAM	1	99	21.95	0-1	1
	1900	19100	20	16QAM	50	0	21.19	0-2	2
	1900	19100	20	16QAM	50	25	21.21	0-2	2
	1900	19100	20	16QAM	50	50	21.27	0-2	2
	1900	19100	20	16QAM	100	0	21.16	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	23.52	0	0
	1857.5	18675	15	QPSK	1	36	23.49	0	0
	1857.5	18675	15	QPSK	1	74	23.46	0	0
	1857.5	18675	15	QPSK	36	0	22.31	0-1	1
	1857.5	18675	15	QPSK	36	18	22.29	0-1	1
	1857.5	18675	15	QPSK	36	37	22.25	0-1	1
	1857.5	18675	15	QPSK	75	0	22.26	0-1	1
	1857.5	18675	15	16QAM	1	0	22.01	0-1	1
	1857.5	18675	15	16QAM	1	36	21.86	0-1	1
	1857.5	18675	15	16QAM	1	74	21.94	0-1	1
	1857.5	18675	15	16QAM	36	0	21.19	0-2	2
	1857.5	18675	15	16QAM	36	18	21.26	0-2	2
	1857.5	18675	15	16QAM	36	37	21.15	0-2	2
	1857.5	18675	15	16QAM	75	0	21.14	0-2	2
Mid	1880.0	18900	15	QPSK	1	0	23.32	0	0
	1880.0	18900	15	QPSK	1	36	23.28	0	0
	1880.0	18900	15	QPSK	1	74	23.30	0	0
	1880.0	18900	15	QPSK	36	0	22.05	0-1	1
	1880.0	18900	15	QPSK	36	18	22.03	0-1	1
	1880.0	18900	15	QPSK	36	37	22.06	0-1	1
	1880.0	18900	15	QPSK	75	0	22.01	0-1	1
	1880.0	18900	15	16QAM	1	0	21.87	0-1	1
	1880.0	18900	15	16QAM	1	36	21.86	0-1	1
	1880.0	18900	15	16QAM	1	74	21.84	0-1	1
	1880.0	18900	15	16QAM	36	0	21.06	0-2	2
	1880.0	18900	15	16QAM	36	18	21.05	0-2	2
	1880.0	18900	15	16QAM	36	37	21.04	0-2	2
	1880.0	18900	15	16QAM	75	0	21.10	0-2	2
High	1902.5	19125	15	QPSK	1	0	23.52	0	0
	1902.5	19125	15	QPSK	1	36	23.48	0	0
	1902.5	19125	15	QPSK	1	74	23.51	0	0
	1902.5	19125	15	QPSK	36	0	22.25	0-1	1
	1902.5	19125	15	QPSK	36	18	22.31	0-1	1
	1902.5	19125	15	QPSK	36	37	22.26	0-1	1
	1902.5	19125	15	QPSK	75	0	22.27	0-1	1
	1902.5	19125	15	16QAM	1	0	22.02	0-1	1
	1902.5	19125	15	16QAM	1	36	21.95	0-1	1
	1902.5	19125	15	16QAM	1	74	21.98	0-1	1
	1902.5	19125	15	16QAM	36	0	21.16	0-2	2
	1902.5	19125	15	16QAM	36	18	21.20	0-2	2
	1902.5	19125	15	16QAM	36	37	21.18	0-2	2
	1902.5	19125	15	16QAM	75	0	21.21	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	23.51	0	0
	1855	18650	10	QPSK	1	25	23.50	0	0
	1855	18650	10	QPSK	1	49	23.45	0	0
	1855	18650	10	QPSK	25	0	22.32	0-1	1
	1855	18650	10	QPSK	25	12	22.31	0-1	1
	1855	18650	10	QPSK	25	25	22.26	0-1	1
	1855	18650	10	QPSK	50	0	22.27	0-1	1
	1855	18650	10	16QAM	1	0	22.06	0-1	1
	1855	18650	10	16QAM	1	25	21.87	0-1	1
	1855	18650	10	16QAM	1	49	21.98	0-1	1
	1855	18650	10	16QAM	25	0	21.20	0-2	2
	1855	18650	10	16QAM	25	12	21.24	0-2	2
	1855	18650	10	16QAM	25	25	21.16	0-2	2
	1855	18650	10	16QAM	50	0	21.15	0-2	2
Mid	1880.0	18900	10	QPSK	1	0	23.30	0	0
	1880.0	18900	10	QPSK	1	25	23.29	0	0
	1880.0	18900	10	QPSK	1	49	23.27	0	0
	1880.0	18900	10	QPSK	25	0	22.04	0-1	1
	1880.0	18900	10	QPSK	25	12	22.06	0-1	1
	1880.0	18900	10	QPSK	25	25	22.03	0-1	1
	1880.0	18900	10	QPSK	50	0	22.00	0-1	1
	1880.0	18900	10	16QAM	1	0	21.89	0-1	1
	1880.0	18900	10	16QAM	1	25	21.87	0-1	1
	1880.0	18900	10	16QAM	1	49	21.83	0-1	1
	1880.0	18900	10	16QAM	25	0	21.01	0-2	2
	1880.0	18900	10	16QAM	25	12	21.03	0-2	2
	1880.0	18900	10	16QAM	25	25	21.05	0-2	2
	1880.0	18900	10	16QAM	50	0	21.09	0-2	2
High	1905	19150	10	QPSK	1	0	23.49	0	0
	1905	19150	10	QPSK	1	25	23.46	0	0
	1905	19150	10	QPSK	1	49	23.47	0	0
	1905	19150	10	QPSK	25	0	22.24	0-1	1
	1905	19150	10	QPSK	25	12	22.31	0-1	1
	1905	19150	10	QPSK	25	25	22.28	0-1	1
	1905	19150	10	QPSK	50	0	22.25	0-1	1
	1905	19150	10	16QAM	1	0	22.01	0-1	1
	1905	19150	10	16QAM	1	25	21.94	0-1	1
	1905	19150	10	16QAM	1	49	21.95	0-1	1
	1905	19150	10	16QAM	25	0	21.15	0-2	2
	1905	19150	10	16QAM	25	12	21.18	0-2	2
	1905	19150	10	16QAM	25	25	21.17	0-2	2
	1905	19150	10	16QAM	50	0	21.19	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	23.50	0	0
	1852.5	18625	5	QPSK	1	12	23.48	0	0
	1852.5	18625	5	QPSK	1	24	23.45	0	0
	1852.5	18625	5	QPSK	12	0	22.33	0-1	1
	1852.5	18625	5	QPSK	12	6	22.28	0-1	1
	1852.5	18625	5	QPSK	12	13	22.25	0-1	1
	1852.5	18625	5	QPSK	25	0	22.24	0-1	1
	1852.5	18625	5	16-QAM	1	0	22.04	0-1	1
	1852.5	18625	5	16-QAM	1	12	21.84	0-1	1
	1852.5	18625	5	16-QAM	1	24	21.94	0-1	1
	1852.5	18625	5	16-QAM	12	0	21.17	0-2	2
	1852.5	18625	5	16-QAM	12	6	21.20	0-2	2
	1852.5	18625	5	16-QAM	12	13	21.13	0-2	2
	1852.5	18625	5	16-QAM	25	0	21.16	0-2	2
Mid	1880.0	18900	5	QPSK	1	0	23.33	0	0
	1880.0	18900	5	QPSK	1	12	23.25	0	0
	1880.0	18900	5	QPSK	1	24	23.31	0	0
	1880.0	18900	5	QPSK	12	0	22.09	0-1	1
	1880.0	18900	5	QPSK	12	6	22.04	0-1	1
	1880.0	18900	5	QPSK	12	13	22.07	0-1	1
	1880.0	18900	5	QPSK	25	0	22.01	0-1	1
	1880.0	18900	5	16-QAM	1	0	21.85	0-1	1
	1880.0	18900	5	16-QAM	1	12	21.80	0-1	1
	1880.0	18900	5	16-QAM	1	24	21.81	0-1	1
	1880.0	18900	5	16-QAM	12	0	21.05	0-2	2
	1880.0	18900	5	16-QAM	12	6	21.06	0-2	2
	1880.0	18900	5	16-QAM	12	13	21.07	0-2	2
	1880.0	18900	5	16-QAM	25	0	21.11	0-2	2
High	1907.5	19175	5	QPSK	1	0	23.49	0	0
	1907.5	19175	5	QPSK	1	12	23.45	0	0
	1907.5	19175	5	QPSK	1	24	23.48	0	0
	1907.5	19175	5	QPSK	12	0	22.26	0-1	1
	1907.5	19175	5	QPSK	12	6	22.35	0-1	1
	1907.5	19175	5	QPSK	12	13	22.25	0-1	1
	1907.5	19175	5	QPSK	25	0	22.27	0-1	1
	1907.5	19175	5	16-QAM	1	0	22.00	0-1	1
	1907.5	19175	5	16-QAM	1	12	21.91	0-1	1
	1907.5	19175	5	16-QAM	1	24	21.99	0-1	1
	1907.5	19175	5	16-QAM	12	0	21.18	0-2	2
	1907.5	19175	5	16-QAM	12	6	21.22	0-2	2
	1907.5	19175	5	16-QAM	12	13	21.19	0-2	2
	1907.5	19175	5	16-QAM	25	0	21.19	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	23.58	0	0
	2505	20800	10	QPSK	1	25	**23.62**	0	0
	2505	20800	10	QPSK	1	49	23.52	0	0
	2505	20800	10	QPSK	25	0	22.18	0-1	1
	2505	20800	10	QPSK	25	12	22.24	0-1	1
	2505	20800	10	QPSK	25	25	**22.30**	0-1	1
	2505	20800	10	QPSK	50	0	22.22	0-1	1
	2505	20800	10	16QAM	1	0	21.96	0-1	1
	2505	20800	10	16QAM	1	25	21.84	0-1	1
	2505	20800	10	16QAM	1	49	21.86	0-1	1
	2505	20800	10	16QAM	25	0	21.06	0-2	2
	2505	20800	10	16QAM	25	12	21.10	0-2	2
	2505	20800	10	16QAM	25	25	21.17	0-2	2
	2505	20800	10	16QAM	50	0	21.07	0-2	2
Mid	2535.0	21100	10	QPSK	1	0	23.35	0	0
	2535.0	21100	10	QPSK	1	25	23.42	0	0
	2535.0	21100	10	QPSK	1	49	23.37	0	0
	2535.0	21100	10	QPSK	25	0	22.09	0-1	1
	2535.0	21100	10	QPSK	25	12	22.14	0-1	1
	2535.0	21100	10	QPSK	25	25	22.06	0-1	1
	2535.0	21100	10	QPSK	50	0	22.14	0-1	1
	2535.0	21100	10	16QAM	1	0	21.83	0-1	1
	2535.0	21100	10	16QAM	1	25	21.86	0-1	1
	2535.0	21100	10	16QAM	1	49	21.83	0-1	1
	2535.0	21100	10	16QAM	25	0	21.15	0-2	2
	2535.0	21100	10	16QAM	25	12	21.11	0-2	2
	2535.0	21100	10	16QAM	25	25	21.70	0-2	2
	2535.0	21100	10	16QAM	50	0	21.08	0-2	2
High	2565	21400	10	QPSK	1	0	23.43	0	0
	2565	21400	10	QPSK	1	25	23.47	0	0
	2565	21400	10	QPSK	1	49	23.60	0	0
	2565	21400	10	QPSK	25	0	22.16	0-1	1
	2565	21400	10	QPSK	25	12	22.14	0-1	1
	2565	21400	10	QPSK	25	25	22.22	0-1	1
	2565	21400	10	QPSK	50	0	22.21	0-1	1
	2565	21400	10	16QAM	1	0	21.90	0-1	1
	2565	21400	10	16QAM	1	25	21.86	0-1	1
	2565	21400	10	16QAM	1	49	21.84	0-1	1
	2565	21400	10	16QAM	25	0	21.05	0-2	2
	2565	21400	10	16QAM	25	12	21.08	0-2	2
	2565	21400	10	16QAM	25	25	21.12	0-2	2
	2565	21400	10	16QAM	50	0	21.07	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	23.60	0	0
	2502.5	20775	5	QPSK	1	12	23.58	0	0
	2502.5	20775	5	QPSK	1	24	23.61	0	0
	2502.5	20775	5	QPSK	12	0	22.29	0-1	1
	2502.5	20775	5	QPSK	12	6	22.26	0-1	1
	2502.5	20775	5	QPSK	12	13	22.32	0-1	1
	2502.5	20775	5	QPSK	25	0	22.29	0-1	1
	2502.5	20775	5	16-QAM	1	0	22.12	0-1	1
	2502.5	20775	5	16-QAM	1	12	22.05	0-1	1
	2502.5	20775	5	16-QAM	1	24	22.12	0-1	1
	2502.5	20775	5	16-QAM	12	0	21.13	0-2	2
	2502.5	20775	5	16-QAM	12	6	21.04	0-2	2
	2502.5	20775	5	16-QAM	12	13	21.09	0-2	2
	2502.5	20775	5	16-QAM	25	0	21.16	0-2	2
Mid	2535.0	21100	5	QPSK	1	0	23.57	0	0
	2535.0	21100	5	QPSK	1	12	23.56	0	0
	2535.0	21100	5	QPSK	1	24	23.52	0	0
	2535.0	21100	5	QPSK	12	0	22.24	0-1	1
	2535.0	21100	5	QPSK	12	6	22.22	0-1	1
	2535.0	21100	5	QPSK	12	13	22.25	0-1	1
	2535.0	21100	5	QPSK	25	0	22.24	0-1	1
	2535.0	21100	5	16-QAM	1	0	22.12	0-1	1
	2535.0	21100	5	16-QAM	1	12	22.08	0-1	1
	2535.0	21100	5	16-QAM	1	24	22.10	0-1	1
	2535.0	21100	5	16-QAM	12	0	21.15	0-2	2
	2535.0	21100	5	16-QAM	12	6	21.16	0-2	2
	2535.0	21100	5	16-QAM	12	13	21.17	0-2	2
	2535.0	21100	5	16-QAM	25	0	21.23	0-2	2
High	2567.5	21425	5	QPSK	1	0	23.53	0	0
	2567.5	21425	5	QPSK	1	12	23.59	0	0
	2567.5	21425	5	QPSK	1	24	23.61	0	0
	2567.5	21425	5	QPSK	12	0	22.30	0-1	1
	2567.5	21425	5	QPSK	12	6	22.31	0-1	1
	2567.5	21425	5	QPSK	12	13	22.30	0-1	1
	2567.5	21425	5	QPSK	25	0	22.35	0-1	1
	2567.5	21425	5	16-QAM	1	0	22.04	0-1	1
	2567.5	21425	5	16-QAM	1	12	22.07	0-1	1
	2567.5	21425	5	16-QAM	1	24	22.10	0-1	1
	2567.5	21425	5	16-QAM	12	0	21.14	0-2	2
	2567.5	21425	5	16-QAM	12	6	21.12	0-2	2
	2567.5	21425	5	16-QAM	12	13	21.14	0-2	2
	2567.5	21425	5	16-QAM	25	0	21.19	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 LOW	1855 MHz / ch.18650 + 2132.5 MHz / ch.2175	PCC UL# RB	PCC UL RB Offset	Rel. 8 Tx. Power (dBm)	Rel. 10 Tx. Power (dBm)
		1	0	23.51	23.56

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 HIGH	1750 MHz / ch. 20350 + 1960.0 MHz /ch.900	PCC UL# RB	PCC UL RB Offset	Rel. 8 Tx. Power (dBm)	Rel. 10 Tx. Power (dBm)
		1	0	24.40	24.43

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.

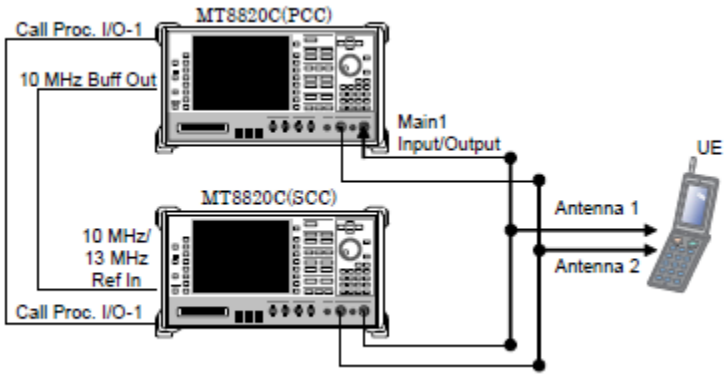


Figure 9-3
Power Measurement Setup

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
802.11n	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.

(*) – 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 9-21
IEEE 802.11n Average RF Power – 40 MHz Bandwidth

Mode	Freq	Channel	40MHz BW 802.11n (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
	[MHz]		13.5	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 [MHz]	Channel	80MHz BW 802.11ac (5GHz) Conducted Power [dBm]									
			Data Rate [Mbps]									
			29.3	58.5	87.8	117	175.5	234	263.3	292.5	351	390
802.11ac	5210	42	**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 20 MHz and 40 MHz) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11a mode.
- 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.

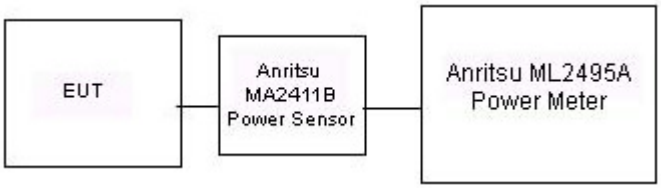


Figure 9-4
Power Measurement Setup for Bandwidths < 50 MHz

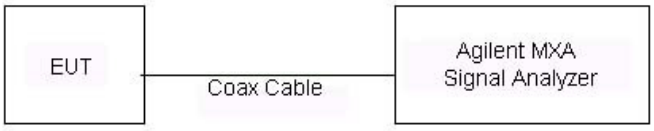


Figure 9-5
Power Measurement Setup for Bandwidths > 50 MHz

10 SYSTEM VERIFICATION

10.1 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
05/16/2014	750H	21.9	710	0.857	41.218	0.890	42.149	-3.71%	-2.21%
			725	0.869	41.015	0.891	42.071	-2.47%	-2.51%
			740	0.882	40.799	0.893	41.994	-1.23%	-2.85%
			755	0.896	40.606	0.894	41.916	0.22%	-3.13%
05/14/2014	835H	21.9	820	0.890	41.136	0.899	41.578	-1.00%	-1.06%
			835	0.905	40.853	0.900	41.500	0.56%	-1.56%
			850	0.919	40.724	0.916	41.500	0.33%	-1.87%
05/14/2014	1750H	22.2	1710	1.369	40.722	1.348	40.142	1.56%	1.44%
			1750	1.413	40.514	1.371	40.079	3.06%	1.09%
			1790	1.456	40.321	1.394	40.016	4.45%	0.76%
05/12/2014	1900H	22.1	1850	1.397	40.176	1.400	40.000	-0.21%	0.44%
			1880	1.429	40.062	1.400	40.000	2.07%	0.15%
			1910	1.463	39.940	1.400	40.000	4.50%	-0.15%
05/19/2014	1900H	22.8	1850	1.397	40.270	1.400	40.000	-0.21%	0.68%
			1880	1.427	40.125	1.400	40.000	1.93%	0.31%
			1910	1.462	40.036	1.400	40.000	4.43%	0.09%
05/05/2014	2450H	21.9	2401	1.763	38.663	1.756	39.287	0.40%	-1.59%
			2450	1.818	38.487	1.800	39.200	1.00%	-1.82%
			2499	1.871	38.296	1.853	39.138	0.97%	-2.15%
05/20/2014	2450H	21.9	2401	1.771	39.180	1.756	39.287	0.85%	-0.27%
			2450	1.824	38.997	1.800	39.200	1.33%	-0.52%
			2499	1.883	38.682	1.853	39.138	1.62%	-1.17%
			2500	1.884	38.687	1.855	39.136	1.56%	-1.15%
			2550	1.943	38.698	1.909	39.073	1.78%	-0.96%
05/14/2014	5200H-5800H	23.9	5200	4.563	36.659	4.655	35.986	-1.98%	1.87%
			5220	4.596	36.629	4.676	35.963	-1.71%	1.85%
			5240	4.626	36.625	4.696	35.940	-1.49%	1.91%
			5280	4.645	36.617	4.737	35.894	-1.94%	2.01%
			5300	4.649	36.515	4.758	35.871	-2.29%	1.80%
			5320	4.673	36.532	4.778	35.849	-2.20%	1.91%
			5500	4.861	36.288	4.963	35.643	-2.06%	1.81%
			5520	4.878	36.257	4.983	35.620	-2.11%	1.79%
			5540	4.888	36.251	5.004	35.597	-2.32%	1.84%
			5765	5.113	35.944	5.234	35.340	-2.31%	1.71%
			5785	5.121	35.971	5.255	35.317	-2.55%	1.85%
			5800	5.130	35.894	5.270	35.300	-2.66%	1.68%

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
05/07/2014	750B	22.7	710	0.944	55.251	0.960	55.687	-1.67%	-0.78%
			725	0.960	55.045	0.961	55.629	-0.10%	-1.05%
			740	0.972	54.935	0.963	55.570	0.93%	-1.14%
			755	0.986	54.765	0.964	55.512	2.28%	-1.35%
05/07/2014	835B	22.7	820	0.998	53.996	0.969	55.258	2.99%	-2.28%
			835	1.012	53.811	0.970	55.200	4.33%	-2.52%
			850	1.027	53.676	0.988	55.154	3.95%	-2.68%
05/08/2014	1750B	22.3	1710	1.429	52.081	1.463	53.537	-2.32%	-2.72%
			1750	1.472	51.877	1.488	53.432	-1.08%	-2.91%
			1790	1.520	51.761	1.514	53.326	0.40%	-2.93%
05/14/2014	1750B	23.1	1710	1.430	52.767	1.463	53.537	-2.26%	-1.44%
			1750	1.473	52.582	1.488	53.432	-1.01%	-1.59%
			1790	1.515	52.463	1.514	53.326	0.07%	-1.62%
05/19/2014	1900B	22.0	1850	1.513	51.993	1.520	53.300	-0.46%	-2.45%
			1880	1.549	51.889	1.520	53.300	1.91%	-2.65%
			1910	1.583	51.772	1.520	53.300	4.14%	-2.87%
05/21/2014	1900B	21.8	1850	1.490	52.830	1.520	53.300	-1.97%	-0.88%
			1880	1.527	52.703	1.520	53.300	0.46%	-1.12%
			1910	1.563	52.598	1.520	53.300	2.83%	-1.32%
05/05/2014	2450B	23.1	2401	1.975	51.293	1.903	52.765	3.78%	-2.79%
			2450	2.045	51.139	1.950	52.700	4.87%	-2.96%
			2499	2.111	50.936	2.019	52.638	4.56%	-3.23%
05/08/2014	2450B	24.3	2401	1.895	51.717	1.903	52.765	-0.42%	-1.99%
			2450	1.960	51.563	1.950	52.700	0.51%	-2.16%
			2499	2.019	51.401	2.019	52.638	0.00%	-2.35%
			2500	2.022	51.398	2.021	52.636	0.05%	-2.35%
			2550	2.091	51.200	2.092	52.573	-0.05%	-2.61%
05/06/2014	5200B-5800B	22.8	5200	5.155	47.532	5.299	49.014	-2.72%	-3.02%
			5220	5.196	47.475	5.323	48.987	-2.39%	-3.09%
			5240	5.222	47.337	5.346	48.960	-2.32%	-3.31%
			5280	5.287	47.108	5.393	48.906	-1.97%	-3.68%
			5300	5.340	46.950	5.416	48.879	-1.40%	-3.95%
			5320	5.395	46.845	5.439	48.851	-0.81%	-4.11%
			5500	5.788	46.207	5.650	48.607	2.44%	-4.94%
			5520	5.831	46.183	5.673	48.580	2.79%	-4.93%
			5540	5.869	46.142	5.696	48.553	3.04%	-4.97%
			5765	6.224	46.405	5.959	48.248	4.45%	-3.82%
			5785	6.230	46.482	5.982	48.220	4.15%	-3.60%
			5800	6.248	46.492	6.000	48.200	4.13%	-3.54%

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 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 (°C)	Liquid Temp (°C)	Input Power (W)	Dipole SN	Probe SN	Measured SAR_{1g} (W/kg)	1 W Target SAR_{1g} (W/kg)	1 W Normalized SAR_{1g} (W/kg)	$Deviation_{1g}$ (%)
K	750	HEAD	05/16/2014	23.8	21.9	0.100	1003	3287	0.796	8.370	7.960	-4.90%
C	835	HEAD	05/14/2014	22.5	21.9	0.100	4d133	3213	0.964	9.620	9.640	0.21%
G	1750	HEAD	05/14/2014	23.0	22.4	0.100	1051	3258	3.460	36.200	34.600	-4.42%
I	1900	HEAD	05/12/2014	23.2	22.1	0.100	5d149	3209	4.100	40.400	41.000	1.49%
G	1900	HEAD	05/19/2014	24.0	22.5	0.100	5d149	3258	3.910	40.400	39.100	-3.22%
H	2450	HEAD	05/05/2014	23.3	22.5	0.100	797	3589	5.080	51.800	50.800	-1.93%
K	2450	HEAD	05/20/2014	24.1	22.2	0.100	797	3287	5.530	51.800	55.300	6.76%
E	5200	HEAD	05/14/2014	24.5	24.2	0.100	1057	3914	7.270	78.000	72.700	-6.79%
E	5300	HEAD	05/14/2014	24.5	24.3	0.100	1057	3914	7.680	83.000	76.800	-7.47%
E	5500	HEAD	05/14/2014	24.2	24.0	0.100	1057	3914	7.670	84.300	76.700	-9.02%
E	5800	HEAD	05/14/2014	24.5	24.1	0.100	1057	3914	7.640	79.300	76.400	-3.66%
K	750	BODY	05/07/2014	23.9	22.7	0.100	1003	3333	0.890	8.770	8.900	1.48%
D	835	BODY	05/07/2014	24.1	22.7	0.100	4d119	3022	0.991	9.340	9.910	6.10%
H	1750	BODY	05/08/2014	23.9	22.8	0.100	1051	3589	4.010	37.400	40.100	7.22%
J	1750	BODY	05/14/2014	21.5	23.1	0.100	1051	3332	3.890	37.400	38.900	4.01%
E	1900	BODY	05/19/2014	24.5	22.1	0.100	5d149	3914	4.190	40.500	41.900	3.46%
J	1900	BODY	05/21/2014	22.4	21.8	0.100	5d149	3332	4.310	40.500	43.100	6.42%
G	2450	BODY	05/05/2014	24.0	23.1	0.100	797	3258	5.090	49.400	50.900	3.04%
G	2450	BODY	05/08/2014	24.3	23.4	0.040	797	3258	2.050	49.400	51.250	3.74%
A	5200	BODY	05/06/2014	23.8	22.5	0.100	1007	3920	7.310	72.600	73.100	0.69%
A	5300	BODY	05/06/2014	23.9	22.5	0.100	1007	3920	7.450	74.700	74.500	-0.27%
A	5500	BODY	05/06/2014	23.9	22.6	0.100	1007	3920	7.680	75.900	76.800	1.19%
A	5800	BODY	05/06/2014	24.0	22.6	0.100	1007	3920	7.320	72.900	73.200	0.41%

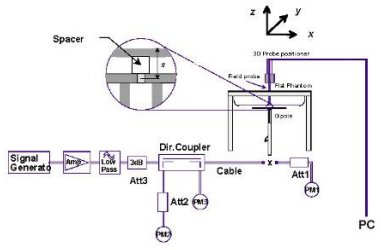


Figure 10-1
System Verification Setup Diagram

Figure 10-2
System Verification Setup Photo

11 SAR DATA SUMMARY

11.1 Standalone Head SAR Data

Table 11-1
GSM/GPRS 850 Head SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Accessory Type	# 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	32.67	-0.08	Right	Cheek	SAR-2	None	1	1:8.3	0.242	1.130	0.273	
836.60	190	GSM 850	GSM	33.2	32.67	-0.01	Right	Cheek	SAR-2	Folio, Closed	1	1:8.3	0.204	1.130	0.231	
836.60	190	GSM 850	GSM	33.2	32.67	-0.08	Right	Cheek	SAR-2	Folio, Open	1	1:8.3	0.217	1.130	0.245	
836.60	190	GSM 850	GSM	33.2	32.67	-0.15	Right	Cheek	SAR-2	Cover	1	1:8.3	0.268	1.130	0.303	
836.60	190	GSM 850	GSM	33.2	32.67	0.02	Right	Tilt	SAR-2	None	1	1:8.3	0.137	1.130	0.155	
836.60	190	GSM 850	GSM	33.2	32.67	0.01	Left	Cheek	SAR-2	None	1	1:8.3	0.193	1.130	0.218	
836.60	190	GSM 850	GSM	33.2	32.67	0.02	Left	Tilt	SAR-2	None	1	1:8.3	0.118	1.130	0.133	
836.60	190	GSM 850	GPRS	29.7	29.33	-0.03	Right	Cheek	SAR-2	None	3	1:2.76	0.277	1.089	0.302	
836.60	190	GSM 850	GPRS	29.7	29.33	-0.18	Right	Cheek	SAR-2	Folio, Closed	3	1:2.76	0.232	1.089	0.253	
836.60	190	GSM 850	GPRS	29.7	29.33	-0.14	Right	Cheek	SAR-2	Folio, Open	3	1:2.76	0.237	1.089	0.258	
836.60	190	GSM 850	GPRS	29.7	29.33	-0.07	Right	Cheek	SAR-2	Cover	3	1:2.76	0.291	1.089	0.317	A1
836.60	190	GSM 850	GPRS	29.7	29.33	0.10	Right	Tilt	SAR-2	None	3	1:2.76	0.152	1.089	0.166	
836.60	190	GSM 850	GPRS	29.7	29.33	-0.07	Left	Cheek	SAR-2	None	3	1:2.76	0.219	1.089	0.238	
836.60	190	GSM 850	GPRS	29.7	29.33	0.04	Left	Tilt	SAR-2	None	3	1:2.76	0.141	1.089	0.154	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Head 1.6 W/kg (mW/g) averaged over 1 gram								

Table 11-2
GSM/GPRS 1900 Head SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Accessory Type	# 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	30.79	0.03	Right	Cheek	SAR-2	None	1	1:8.3	0.105	1.099	0.115	
1880.00	661	GSM 1900	GSM	31.2	30.79	0.07	Right	Tilt	SAR-2	None	1	1:8.3	0.058	1.099	0.064	
1880.00	661	GSM 1900	GSM	31.2	30.79	0.01	Left	Cheek	SAR-2	None	1	1:8.3	0.112	1.099	0.123	
1880.00	661	GSM 1900	GSM	31.2	30.79	0.02	Left	Cheek	SAR-2	Folio, Closed	1	1:8.3	0.095	1.099	0.104	
1880.00	661	GSM 1900	GSM	31.2	30.79	0.12	Left	Cheek	SAR-2	Folio, Open	1	1:8.3	0.139	1.099	0.153	
1880.00	661	GSM 1900	GSM	31.2	30.79	0.03	Left	Cheek	SAR-2	Cover	1	1:8.3	0.126	1.099	0.138	
1880.00	661	GSM 1900	GSM	31.2	30.79	0.09	Left	Tilt	SAR-2	None	1	1:8.3	0.062	1.099	0.068	
1880.00	661	GSM 1900	GPRS	27.7	27.36	0.02	Right	Cheek	SAR-2	None	3	1:2.76	0.147	1.081	0.159	
1880.00	661	GSM 1900	GPRS	27.7	27.36	0.05	Right	Cheek	SAR-2	Folio, Closed	3	1:2.76	0.117	1.081	0.126	
1880.00	661	GSM 1900	GPRS	27.7	27.36	0.06	Right	Cheek	SAR-2	Folio, Open	3	1:2.76	0.130	1.081	0.141	
1880.00	661	GSM 1900	GPRS	27.7	27.36	0.10	Right	Cheek	SAR-2	Cover	3	1:2.76	0.172	1.081	0.186	A2
1880.00	661	GSM 1900	GPRS	27.7	27.36	0.18	Right	Tilt	SAR-2	None	3	1:2.76	0.078	1.081	0.084	
1880.00	661	GSM 1900	GPRS	27.7	27.36	0.15	Left	Cheek	SAR-2	None	3	1:2.76	0.142	1.081	0.154	
1880.00	661	GSM 1900	GPRS	27.7	27.36	-0.10	Left	Tilt	SAR-2	None	3	1:2.76	0.076	1.081	0.082	
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 850 Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Accessory Type	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
836.60	4183	UMTS 850	RMC	23.7	23.46	-0.02	Right	Cheek	SAR-3	None	1:1	0.217	1.057	0.229	
836.60	4183	UMTS 850	RMC	23.7	23.46	0.01	Right	Cheek	SAR-3	Folio, Closed	1:1	0.175	1.057	0.185	
836.60	4183	UMTS 850	RMC	23.7	23.46	-0.01	Right	Cheek	SAR-3	Folio, Open	1:1	0.197	1.057	0.208	
836.60	4183	UMTS 850	RMC	23.7	23.46	0.02	Right	Cheek	SAR-3	Cover	1:1	0.239	1.057	0.253	A3
836.60	4183	UMTS 850	RMC	23.7	23.46	-0.02	Right	Tilt	SAR-3	None	1:1	0.126	1.057	0.133	
836.60	4183	UMTS 850	RMC	23.7	23.46	0.02	Left	Cheek	SAR-3	None	1:1	0.177	1.057	0.187	
836.60	4183	UMTS 850	RMC	23.7	23.46	0.20	Left	Tilt	SAR-3	None	1:1	0.117	1.057	0.124	
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
UMTS 1750 Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Accessory Type	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
1732.40	1412	UMTS 1750	RMC	24.7	24.32	0.21	Right	Cheek	SAR-3	None	1:1	0.230	1.091	0.251	
1732.40	1412	UMTS 1750	RMC	24.7	24.32	-0.07	Right	Cheek	SAR-3	Folio, Closed	1:1	0.243	1.091	0.265	
1732.40	1412	UMTS 1750	RMC	24.7	24.32	-0.01	Right	Cheek	SAR-3	Folio, Open	1:1	0.271	1.091	0.296	
1732.40	1412	UMTS 1750	RMC	24.7	24.32	0.05	Right	Cheek	SAR-3	Cover	1:1	0.334	1.091	0.364	A4
1732.40	1412	UMTS 1750	RMC	24.7	24.32	0.01	Right	Tilt	SAR-3	None	1:1	0.180	1.091	0.196	
1732.40	1412	UMTS 1750	RMC	24.7	24.32	-0.11	Left	Cheek	SAR-3	None	1:1	0.206	1.091	0.225	
1732.40	1412	UMTS 1750	RMC	24.7	24.32	0.00	Left	Tilt	SAR-3	None	1:1	0.139	1.091	0.152	
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	Device Serial Number	Accessory Type	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
1880.00	9400	UMTS 1900	RMC	23.7	23.45	-0.10	Right	Cheek	SAR-3	None	1:1	0.238	1.059	0.252	
1880.00	9400	UMTS 1900	RMC	23.7	23.45	-0.04	Right	Cheek	SAR-3	Folio, Closed	1:1	0.208	1.059	0.220	
1880.00	9400	UMTS 1900	RMC	23.7	23.45	0.05	Right	Cheek	SAR-3	Folio, Open	1:1	0.248	1.059	0.263	A5
1880.00	9400	UMTS 1900	RMC	23.7	23.45	-0.02	Right	Cheek	SAR-3	Cover	1:1	0.232	1.059	0.246	
1880.00	9400	UMTS 1900	RMC	23.7	23.45	0.06	Right	Tilt	SAR-3	None	1:1	0.122	1.059	0.129	
1880.00	9400	UMTS 1900	RMC	23.7	23.45	0.06	Left	Cheek	SAR-3	None	1:1	0.216	1.059	0.229	
1880.00	9400	UMTS 1900	RMC	23.7	23.45	0.05	Left	Tilt	SAR-3	None	1:1	0.145	1.059	0.154	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population															

Table 11-6
LTE Band 17 Head SAR

MEASUREMENT RESULTS																					
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Accessory Type	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
710.00	23790	Mid	LTE Band 17	10	24.2	24.05	-0.02	0	Right	Cheek	QPSK	1	49	SAR-4	None	1:1	0.057	1.035	0.059	
710.00	23790	Mid	LTE Band 17	10	23.2	22.66	0.21	1	Right	Cheek	QPSK	25	0	SAR-4	None	1:1	0.039	1.132	0.044	
710.00	23790	Mid	LTE Band 17	10	24.2	24.05	0.13	0	Right	Tilt	QPSK	1	49	SAR-4	None	1:1	0.044	1.035	0.046	
710.00	23790	Mid	LTE Band 17	10	23.2	22.66	0.06	1	Right	Tilt	QPSK	25	0	SAR-4	None	1:1	0.028	1.132	0.032	
710.00	23790	Mid	LTE Band 17	10	24.2	24.05	-0.19	0	Left	Cheek	QPSK	1	49	SAR-4	None	1:1	0.086	1.035	0.089	A6
710.00	23790	Mid	LTE Band 17	10	24.2	24.05	0.15	0	Left	Cheek	QPSK	1	49	SAR-4	Folio, Closed	1:1	0.072	1.035	0.075	
710.00	23790	Mid	LTE Band 17	10	24.2	24.05	-0.02	0	Left	Cheek	QPSK	1	49	SAR-4	Folio, Open	1:1	0.072	1.035	0.075	
710.00	23790	Mid	LTE Band 17	10	24.2	24.05	0.13	0	Left	Cheek	QPSK	1	49	SAR-4	Cover	1:1	0.081	1.035	0.084	
710.00	23790	Mid	LTE Band 17	10	23.2	22.66	0.21	1	Left	Cheek	QPSK	25	0	SAR-4	None	1:1	0.062	1.132	0.070	
710.00	23790	Mid	LTE Band 17	10	24.2	24.05	0.15	0	Left	Tilt	QPSK	1	49	SAR-4	None	1:1	0.046	1.035	0.048	
710.00	23790	Mid	LTE Band 17	10	23.2	22.66	0.12	1	Left	Tilt	QPSK	25	0	SAR-4	None	1:1	0.037	1.132	0.042	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Head 1.6 W/kg (mW/g) averaged over 1 gram											

Table 11-7
LTE Band 4 Head SAR

MEASUREMENT RESULTS																					
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Accessory Type	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	24.5	24.41	0.13	0	Right	Cheek	QPSK	1	0	SAR-5	None	1:1	0.269	1.021	0.275	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.5	24.41	0.05	0	Right	Cheek	QPSK	1	0	SAR-5	Folio, Closed	1:1	0.206	1.021	0.210	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.5	24.41	-0.01	0	Right	Cheek	QPSK	1	0	SAR-5	Folio, Open	1:1	0.325	1.021	0.332	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.5	24.41	-0.05	0	Right	Cheek	QPSK	1	0	SAR-5	Cover	1:1	0.365	1.021	**0.373**	A7
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	23.12	0.00	1	Right	Cheek	QPSK	50	0	SAR-5	None	1:1	0.208	1.091	0.227	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.5	24.41	0.15	0	Right	Tilt	QPSK	1	0	SAR-5	None	1:1	0.195	1.021	0.199	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	23.12	-0.01	1	Right	Tilt	QPSK	50	0	SAR-5	None	1:1	0.162	1.091	0.177	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.5	24.41	0.13	0	Left	Cheek	QPSK	1	0	SAR-5	None	1:1	0.257	1.021	0.262	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	23.12	-0.02	1	Left	Cheek	QPSK	50	0	SAR-5	None	1:1	0.196	1.091	0.214	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.5	24.41	0.11	0	Left	Tilt	QPSK	1	0	SAR-5	None	1:1	0.163	1.021	0.166	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	23.12	0.00	1	Left	Tilt	QPSK	50	0	SAR-5	None	1:1	0.129	1.091	0.141	
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 Head SAR

MEASUREMENT RESULTS																					
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Accessory Type	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	23.7	23.58	0.13	0	Right	Cheek	QPSK	1	0	SAR-4	None	1:1	0.196	1.028	0.201	A8
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.7	23.58	0.14	0	Right	Cheek	QPSK	1	0	SAR-4	Folio, Closed	1:1	0.136	1.028	0.140	
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.7	23.58	0.06	0	Right	Cheek	QPSK	1	0	SAR-4	Folio, Open	1:1	0.171	1.028	0.176	
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.7	23.58	0.02	0	Right	Cheek	QPSK	1	0	SAR-4	Cover	1:1	0.182	1.028	0.187	
1860.00	18700	Low	LTE Band 2 (PCS)	20	22.7	22.32	-0.06	1	Right	Cheek	QPSK	50	25	SAR-4	None	1:1	0.167	1.091	0.182	
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.7	23.58	0.06	0	Right	Tilt	QPSK	1	0	SAR-4	None	1:1	0.096	1.028	0.099	
1860.00	18700	Low	LTE Band 2 (PCS)	20	22.7	22.32	0.06	1	Right	Tilt	QPSK	50	25	SAR-4	None	1:1	0.081	1.091	0.088	
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.7	23.58	-0.06	0	Left	Cheek	QPSK	1	0	SAR-4	None	1:1	0.183	1.028	0.188	
1860.00	18700	Low	LTE Band 2 (PCS)	20	22.7	22.32	0.10	1	Left	Cheek	QPSK	50	25	SAR-4	None	1:1	0.138	1.091	0.151	
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.7	23.58	0.12	0	Left	Tilt	QPSK	1	0	SAR-4	None	1:1	0.099	1.028	0.102	
1860.00	18700	Low	LTE Band 2 (PCS)	20	22.7	22.32	0.02	1	Left	Tilt	QPSK	50	25	SAR-4	None	1:1	0.074	1.091	0.081	
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]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Accessory Type	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
2505.00	20800	Low	LTE Band 7	10	23.7	23.62	0.13	0	Right	Cheek	QPSK	1	25	SAR-4	None	1:1	0.012	1.019	0.012	
2505.00	20800	Low	LTE Band 7	10	23.7	23.62	0.18	0	Right	Cheek	QPSK	1	25	SAR-4	Folio, Closed	1:1	0.008	1.019	0.008	
2505.00	20800	Low	LTE Band 7	10	23.7	23.62	0.08	0	Right	Cheek	QPSK	1	25	SAR-4	Folio, Open	1:1	0.009	1.019	0.009	
2505.00	20800	Low	LTE Band 7	10	23.7	23.62	0.18	0	Right	Cheek	QPSK	1	25	SAR-4	Cover	1:1	0.012	1.019	0.012	A9
2505.00	20800	Low	LTE Band 7	10	22.7	22.30	0.19	1	Right	Cheek	QPSK	25	25	SAR-4	None	1:1	0.008	1.096	0.009	
2505.00	20800	Low	LTE Band 7	10	23.7	23.62	0.18	0	Right	Tilt	QPSK	1	25	SAR-4	None	1:1	0.006	1.019	0.006	
2505.00	20800	Low	LTE Band 7	10	22.7	22.30	0.16	1	Right	Tilt	QPSK	25	25	SAR-4	None	1:1	0.004	1.096	0.004	
2505.00	20800	Low	LTE Band 7	10	23.7	23.62	0.19	0	Left	Cheek	QPSK	1	25	SAR-4	None	1:1	0.009	1.019	0.009	
2505.00	20800	Low	LTE Band 7	10	22.7	22.30	0.07	1	Left	Cheek	QPSK	25	25	SAR-4	None	1:1	0.007	1.096	0.008	
2505.00	20800	Low	LTE Band 7	10	23.7	23.62	0.16	0	Left	Tilt	QPSK	1	25	SAR-4	None	1:1	0.002	1.019	0.002	
2505.00	20800	Low	LTE Band 7	10	22.7	22.30	0.14	1	Left	Tilt	QPSK	25	25	SAR-4	None	1:1	0.001	1.096	0.001	
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/NII Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Accessory Type	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	-0.06	Right	Cheek	SAR-1	None	1	1:1	0.169	1.081	0.183	
2412	1	IEEE 802.11b	DSSS	17.1	16.76	0.21	Right	Tilt	SAR-1	None	1	1:1	0.148	1.081	0.160	
2412	1	IEEE 802.11b	DSSS	17.1	16.76	0.20	Left	Cheek	SAR-1	None	1	1:1	0.223	1.081	0.241	
2412	1	IEEE 802.11b	DSSS	17.1	16.76	0.13	Left	Cheek	SAR-1	Folio, Closed	1	1:1	0.158	1.081	0.171	
2412	1	IEEE 802.11b	DSSS	17.1	16.76	0.17	Left	Cheek	SAR-1	Folio, Open	1	1:1	0.203	1.081	0.219	
2412	1	IEEE 802.11b	DSSS	17.1	16.76	0.06	Left	Cheek	SAR-1	Cover	1	1:1	0.234	1.081	**0.253**	A10
2412	1	IEEE 802.11b	DSSS	17.1	16.76	0.20	Left	Tilt	SAR-1	None	1	1:1	0.212	1.081	0.229	
5765	153	IEEE 802.11a	OFDM	12.1	11.73	0.05	Right	Cheek	SAR-1	None	6	1:1	0.096	1.089	0.105	
5765	153	IEEE 802.11a	OFDM	12.1	11.73	0.12	Right	Tilt	SAR-1	None	6	1:1	0.111	1.089	0.121	A11
5775	155	IEEE 802.11ac	OFDM	10.1	9.57	0.13	Right	Tilt	SAR-1	None	29.3	1:1	0.050	1.130	0.057	
5765	153	IEEE 802.11a	OFDM	12.1	11.73	0.14	Left	Cheek	SAR-1	None	6	1:1	0.082	1.089	0.089	
5765	153	IEEE 802.11a	OFDM	12.1	11.73	0.18	Left	Tilt	SAR-1	None	6	1:1	0.094	1.089	0.102	
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	Device Serial Number	Accessory Type	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	0.14	Right	Cheek	SAR-1	None	6	1:1	0.058	1.180	0.068	
5240	48	IEEE 802.11a	OFDM	12.1	11.38	0.16	Right	Tilt	SAR-1	None	6	1:1	0.058	1.180	0.068	
5240	48	IEEE 802.11a	OFDM	12.1	11.38	0.13	Left	Cheek	SAR-1	None	6	1:1	0.075	1.180	0.089	
5240	48	IEEE 802.11a	OFDM	12.1	11.38	0.17	Left	Tilt	SAR-1	None	6	1:1	0.078	1.180	0.092	
5210	42	IEEE 802.11ac	OFDM	10.1	8.28	0.21	Left	Tilt	SAR-1	None	29.3	1:1	0.019	1.521	0.029	
5320	64	IEEE 802.11a	OFDM	12.1	10.74	0.15	Right	Cheek	SAR-1	None	6	1:1	0.060	1.368	0.082	
5320	64	IEEE 802.11a	OFDM	12.1	10.74	0.20	Right	Tilt	SAR-1	None	6	1:1	0.068	1.368	0.093	
5320	64	IEEE 802.11a	OFDM	12.1	10.74	0.13	Left	Cheek	SAR-1	None	6	1:1	0.077	1.368	0.105	
5290	58	IEEE 802.11ac	OFDM	10.1	9.22	0.16	Left	Cheek	SAR-1	None	29.3	1:1	0.039	1.225	0.048	
5320	64	IEEE 802.11a	OFDM	12.1	10.74	0.15	Left	Tilt	SAR-1	None	6	1:1	0.073	1.368	0.100	
5540	108	IEEE 802.11a	OFDM	12.1	11.79	-0.07	Right	Cheek	SAR-1	None	6	1:1	0.110	1.074	0.118	
5540	108	IEEE 802.11a	OFDM	12.1	11.79	0.18	Right	Tilt	SAR-1	None	6	1:1	0.117	1.074	0.126	
5540	108	IEEE 802.11a	OFDM	12.1	11.79	0.07	Right	Tilt	SAR-1	Folio, Closed	6	1:1	0.119	1.074	0.128	
5540	108	IEEE 802.11a	OFDM	12.1	11.79	0.14	Right	Tilt	SAR-1	Folio, Open	6	1:1	0.119	1.074	0.128	
5540	108	IEEE 802.11a	OFDM	12.1	11.79	-0.16	Right	Tilt	SAR-1	Cover	6	1:1	0.133	1.074	**0.143**	A12
5530	106	IEEE 802.11ac	OFDM	10.1	9.13	-0.08	Right	Tilt	SAR-1	None	29.3	1:1	0.048	1.250	0.060	
5540	108	IEEE 802.11a	OFDM	12.1	11.79	0.21	Left	Cheek	SAR-1	None	6	1:1	0.116	1.074	0.125	
5540	108	IEEE 802.11a	OFDM	12.1	11.79	0.16	Left	Tilt	SAR-1	None	6	1:1	0.112	1.074	0.120	
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/GPRS Body-Worn SAR Data

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Accessory Type	# 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	32.67	-0.12	10 mm	SAR-2	None	1	1:8.3	back	0.454	1.130	0.513	
836.60	190	GSM 850	GSM	33.2	32.67	0.02	10 mm	SAR-2	Folio, Closed	1	1:8.3	back	0.312	1.130	0.353	
836.60	190	GSM 850	GSM	33.2	32.67	-0.03	10 mm	SAR-2	Cover	1	1:8.3	back	0.370	1.130	0.418	
836.60	190	GSM 850	GPRS	29.7	29.33	-0.08	10 mm	SAR-2	None	3	1:2.76	back	0.524	1.089	0.571	A13
836.60	190	GSM 850	GPRS	29.7	29.33	-0.11	10 mm	SAR-2	Folio, Closed	3	1:2.76	back	0.339	1.089	0.369	
836.60	190	GSM 850	GPRS	29.7	29.33	0.02	10 mm	SAR-2	Cover	3	1:2.76	back	0.420	1.089	0.457	
1880.00	661	GSM 1900	GSM	31.2	30.79	0.08	10 mm	SAR-2	None	1	1:8.3	back	0.396	1.099	0.435	
1880.00	661	GSM 1900	GSM	31.2	30.79	0.05	10 mm	SAR-2	Folio, Closed	1	1:8.3	back	0.384	1.099	0.422	
1880.00	661	GSM 1900	GSM	31.2	30.79	0.06	10 mm	SAR-2	Cover	1	1:8.3	back	0.350	1.099	0.385	
1880.00	661	GSM 1900	GPRS	27.7	27.36	0.04	10 mm	SAR-2	None	3	1:2.76	back	0.481	1.081	0.520	A14
1880.00	661	GSM 1900	GPRS	27.7	27.36	0.07	10 mm	SAR-2	Folio, Closed	3	1:2.76	back	0.444	1.081	0.480	
1880.00	661	GSM 1900	GPRS	27.7	27.36	0.12	10 mm	SAR-2	Cover	3	1:2.76	back	0.468	1.081	0.506	
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
UMTS Body-Worn SAR Data

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Accessory Type	Duty Cycle	Side	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
836.60	4183	UMTS 850	RMC	23.7	23.46	-0.06	10 mm	SAR-3	None	1:1	back	0.434	1.057	0.459	A15
836.60	4183	UMTS 850	RMC	23.7	23.46	-0.04	10 mm	SAR-3	Folio, Closed	1:1	back	0.345	1.057	0.365	
836.60	4183	UMTS 850	RMC	23.7	23.46	0.03	10 mm	SAR-3	Cover	1:1	back	0.384	1.057	0.406	
1712.40	1312	UMTS 1750	RMC	24.7	24.33	-0.05	10 mm	SAR-3	None	1:1	back	1.060	1.089	1.154	A16
1712.40	1312	UMTS 1750	RMC	24.7	24.33	0.02	10 mm	SAR-3	Folio, Closed	1:1	back	1.010	1.089	1.100	
1712.40	1312	UMTS 1750	RMC	24.7	24.33	-0.02	10 mm	SAR-3	Cover	1:1	back	0.994	1.089	1.082	
1732.40	1412	UMTS 1750	RMC	24.7	24.32	-0.08	10 mm	SAR-3	None	1:1	back	0.988	1.091	1.078	
1752.50	1862	UMTS 1750	RMC	24.7	24.34	0.08	10 mm	SAR-3	None	1:1	back	0.898	1.086	0.975	
1712.40	1312	UMTS 1750	RMC	24.7	24.33	0.07	10 mm	SAR-3	None	1:1	back	1.020	1.089	1.111	
1852.40	9262	UMTS 1900	RMC	23.7	23.68	0.05	10 mm	SAR-3	None	1:1	back	0.727	1.005	0.731	
1880.00	9400	UMTS 1900	RMC	23.7	23.45	0.06	10 mm	SAR-3	None	1:1	back	0.820	1.059	0.868	A17
1880.00	9400	UMTS 1900	RMC	23.7	23.45	-0.01	10 mm	SAR-3	Folio, Closed	1:1	back	0.772	1.059	0.818	
1880.00	9400	UMTS 1900	RMC	23.7	23.45	-0.06	10 mm	SAR-3	Cover	1:1	back	0.809	1.059	0.857	
1907.60	9538	UMTS 1900	RMC	23.7	23.40	0.03	10 mm	SAR-3	None	1:1	back	0.819	1.072	0.878	
1880.00	9400	UMTS 1900	RMC	23.7	23.45	-0.01	10 mm	SAR-3	None	1:1	back	0.815	1.059	0.863	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Body 1.6 W/kg (mW/g) averaged over 1 gram						

Note: Blue entries represent variability data.

Table 11-14
LTE Body-Worn SAR Data

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Accessory Type	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	24.2	24.05	0.02	0	SAR-5	None	QPSK	1	49	10 mm	back	1:1	0.157	1.035	0.162	A18
710.00	23790	Mid	LTE Band 17	10	24.2	24.05	0.05	0	SAR-5	Folio, Closed	QPSK	1	49	10 mm	back	1:1	0.123	1.035	0.127	
710.00	23790	Mid	LTE Band 17	10	24.2	24.05	-0.02	0	SAR-5	Cover	QPSK	1	49	10 mm	back	1:1	0.115	1.035	0.119	
710.00	23790	Mid	LTE Band 17	10	23.2	22.66	0.00	1	SAR-5	None	QPSK	25	0	10 mm	back	1:1	0.118	1.132	0.134	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.5	24.41	0.05	0	SAR-4	None	QPSK	1	0	10 mm	back	1:1	0.973	1.021	0.993	A20
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.5	24.41	0.09	0	SAR-4	Folio, Closed	QPSK	1	0	10 mm	back	1:1	0.792	1.021	0.809	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.5	24.41	0.06	0	SAR-4	Cover	QPSK	1	0	10 mm	back	1:1	0.837	1.021	0.855	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	23.12	-0.07	1	SAR-4	None	QPSK	50	0	10 mm	back	1:1	0.718	1.091	0.783	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	23.10	0.10	1	SAR-4	None	QPSK	100	0	10 mm	back	1:1	0.780	1.096	0.855	
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.7	23.58	-0.07	0	SAR-4	None	QPSK	1	0	10 mm	back	1:1	0.662	1.028	0.681	A21
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.7	23.58	-0.02	0	SAR-4	Folio, Closed	QPSK	1	0	10 mm	back	1:1	0.539	1.028	0.554	
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.7	23.58	0.05	0	SAR-4	Cover	QPSK	1	0	10 mm	back	1:1	0.617	1.028	0.634	
1860.00	18700	Low	LTE Band 2 (PCS)	20	22.7	22.32	-0.11	1	SAR-4	None	QPSK	50	25	10 mm	back	1:1	0.515	1.091	0.562	
2505.00	20800	Low	LTE Band 7	10	23.7	23.62	0.09	0	SAR-4	None	QPSK	1	25	10 mm	back	1:1	0.075	1.019	0.076	A22
2505.00	20800	Low	LTE Band 7	10	23.7	23.62	0.07	0	SAR-4	Folio, Closed	QPSK	1	25	10 mm	back	1:1	0.064	1.019	0.065	
2505.00	20800	Low	LTE Band 7	10	23.7	23.62	-0.01	0	SAR-4	Cover	QPSK	1	25	10 mm	back	1:1	0.067	1.019	0.068	
2505.00	20800	Low	LTE Band 7	10	22.7	22.30	0.05	1	SAR-4	None	QPSK	25	25	10 mm	back	1:1	0.056	1.096	0.061	
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
DTS/NII Body-Worn SAR Data

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Accessory Type	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	0.11	10 mm	SAR-1	None	1	back	1:1	0.133	1.081	0.144	
2412	1	IEEE 802.11b	DSSS	17.1	16.76	0.04	10 mm	SAR-1	Folio, Closed	1	back	1:1	0.176	1.081	**0.190**	A23
2412	1	IEEE 802.11b	DSSS	17.1	16.76	0.04	10 mm	SAR-1	Cover	1	back	1:1	0.111	1.081	0.120	
5765	153	IEEE 802.11a	OFDM	12.1	11.73	-0.20	10 mm	SAR-1	None	6	back	1:1	0.132	1.089	**0.144**	A24
5765	153	IEEE 802.11a	OFDM	12.1	11.73	-0.17	10 mm	SAR-1	Folio, Closed	6	back	1:1	0.122	1.089	0.133	
5765	153	IEEE 802.11a	OFDM	12.1	11.73	-0.16	10 mm	SAR-1	Cover	6	back	1:1	0.112	1.089	0.122	
5775	155	IEEE 802.11ac	OFDM	10.1	9.57	0.13	10 mm	SAR-1	None	29.3	back	1:1	0.067	1.130	0.076	
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 11-16
NII Body-Worn SAR Data

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Accessory Type	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	0.19	10 mm	SAR-1	None	6	back	1:1	0.051	1.180	0.060	
5210	42	IEEE 802.11ac	OFDM	10.1	8.28	0.13	10 mm	SAR-1	None	29.3	back	1:1	0.019	1.521	0.029	
5320	64	IEEE 802.11a	OFDM	12.1	10.74	0.14	10 mm	SAR-1	None	6	back	1:1	0.061	1.368	0.083	
5290	58	IEEE 802.11ac	OFDM	10.1	9.22	0.19	10 mm	SAR-1	None	29.3	back	1:1	0.041	1.225	0.050	
5540	108	IEEE 802.11a	OFDM	12.1	11.79	-0.13	10 mm	SAR-1	None	6	back	1:1	0.110	1.074	0.118	A25
5530	106	IEEE 802.11ac	OFDM	10.1	9.13	0.18	10 mm	SAR-1	None	29.3	back	1:1	0.050	1.250	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								

11.3 Standalone Wireless Router SAR Data

Table 11-17
GPRS Hotspot SAR Data

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Accessory Type	# 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	29.33	-0.08	10 mm	SAR-2	None	3	1:2.76	back	0.524	1.089	0.571	A13
836.60	190	GSM 850	GPRS	29.7	29.33	-0.11	10 mm	SAR-2	Folio, Closed	3	1:2.76	back	0.339	1.089	0.369	
836.60	190	GSM 850	GPRS	29.7	29.33	0.02	10 mm	SAR-2	Cover	3	1:2.76	back	0.420	1.089	0.457	
836.60	190	GSM 850	GPRS	29.7	29.33	0.03	10 mm	SAR-2	None	3	1:2.76	front	0.347	1.089	0.378	
836.60	190	GSM 850	GPRS	29.7	29.33	-0.13	10 mm	SAR-2	None	3	1:2.76	bottom	0.254	1.089	0.277	
836.60	190	GSM 850	GPRS	29.7	29.33	-0.11	10 mm	SAR-2	None	3	1:2.76	right	0.439	1.089	0.478	
1880.00	661	GSM 1900	GPRS	27.7	27.36	0.04	10 mm	SAR-2	None	3	1:2.76	back	0.481	1.081	0.520	A14
1880.00	661	GSM 1900	GPRS	27.7	27.36	0.07	10 mm	SAR-2	Folio, Closed	3	1:2.76	back	0.444	1.081	0.480	
1880.00	661	GSM 1900	GPRS	27.7	27.36	0.12	10 mm	SAR-2	Cover	3	1:2.76	back	0.468	1.081	0.506	
1880.00	661	GSM 1900	GPRS	27.7	27.36	-0.06	10 mm	SAR-2	None	3	1:2.76	front	0.285	1.081	0.308	
1880.00	661	GSM 1900	GPRS	27.7	27.36	0.01	10 mm	SAR-2	None	3	1:2.76	bottom	0.441	1.081	0.477	
1880.00	661	GSM 1900	GPRS	27.7	27.36	0.17	10 mm	SAR-2	None	3	1:2.76	right	0.157	1.081	0.170	
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
UMTS Hotspot SAR Data

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Accessory Type	Duty Cycle	Side	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
836.60	4183	UMTS 850	RMC	23.7	23.46	-0.06	10 mm	SAR-3	None	1:1	back	0.434	1.057	0.459	A15
836.60	4183	UMTS 850	RMC	23.7	23.46	-0.04	10 mm	SAR-3	Folio, Closed	1:1	back	0.345	1.057	0.365	
836.60	4183	UMTS 850	RMC	23.7	23.46	0.03	10 mm	SAR-3	Cover	1:1	back	0.384	1.057	0.406	
836.60	4183	UMTS 850	RMC	23.7	23.46	-0.02	10 mm	SAR-3	None	1:1	front	0.315	1.057	0.333	
836.60	4183	UMTS 850	RMC	23.7	23.46	0.02	10 mm	SAR-3	None	1:1	bottom	0.210	1.057	0.222	
836.60	4183	UMTS 850	RMC	23.7	23.46	0.02	10 mm	SAR-3	None	1:1	right	0.381	1.057	0.403	
1712.40	1312	UMTS 1750	RMC	24.7	24.33	-0.05	10 mm	SAR-3	None	1:1	back	1.060	1.089	**1.154**	A16
1712.40	1312	UMTS 1750	RMC	24.7	24.33	0.02	10 mm	SAR-3	Folio, Closed	1:1	back	1.010	1.089	1.100	
1712.40	1312	UMTS 1750	RMC	24.7	24.33	-0.02	10 mm	SAR-3	Cover	1:1	back	0.994	1.089	1.082	
1732.40	1412	UMTS 1750	RMC	24.7	24.32	-0.08	10 mm	SAR-3	None	1:1	back	0.988	1.091	1.078	
1752.50	1862	UMTS 1750	RMC	24.7	24.34	0.08	10 mm	SAR-3	None	1:1	back	0.898	1.086	0.975	
1732.40	1412	UMTS 1750	RMC	24.7	24.32	-0.05	10 mm	SAR-3	None	1:1	front	0.660	1.091	0.720	
1732.40	1412	UMTS 1750	RMC	24.7	24.32	0.01	10 mm	SAR-3	None	1:1	bottom	0.434	1.091	0.473	
1732.40	1412	UMTS 1750	RMC	24.7	24.32	-0.03	10 mm	SAR-3	None	1:1	left	0.486	1.091	0.530	
1712.40	1312	UMTS 1750	RMC	24.7	24.33	0.07	10 mm	SAR-3	None	1:1	back	1.020	1.089	1.111	
1852.40	9262	UMTS 1900	RMC	23.7	23.68	0.05	10 mm	SAR-3	None	1:1	back	0.727	1.005	0.731	
1880.00	9400	UMTS 1900	RMC	23.7	23.45	0.06	10 mm	SAR-3	None	1:1	back	0.820	1.059	0.868	A17
1880.00	9400	UMTS 1900	RMC	23.7	23.45	-0.01	10 mm	SAR-3	Folio, Closed	1:1	back	0.772	1.059	0.818	
1880.00	9400	UMTS 1900	RMC	23.7	23.45	-0.06	10 mm	SAR-3	Cover	1:1	back	0.809	1.059	0.857	
1907.60	9538	UMTS 1900	RMC	23.7	23.40	0.03	10 mm	SAR-3	None	1:1	back	0.819	1.072	0.878	
1880.00	9400	UMTS 1900	RMC	23.7	23.45	-0.03	10 mm	SAR-3	None	1:1	front	0.326	1.059	0.345	
1880.00	9400	UMTS 1900	RMC	23.7	23.45	0.00	10 mm	SAR-3	None	1:1	bottom	0.683	1.059	0.723	
1880.00	9400	UMTS 1900	RMC	23.7	23.45	0.05	10 mm	SAR-3	None	1:1	right	0.254	1.059	0.269	
1880.00	9400	UMTS 1900	RMC	23.7	23.45	-0.01	10 mm	SAR-3	None	1:1	back	0.815	1.059	0.863	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Body 1.6 W/kg (mW/g) averaged over 1 gram						

Note: Blue entries represent variability data.

Table 11-19
LTE Band 17 Hotspot SAR Data

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Accessory Type	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	24.2	24.05	0.02	0	SAR-5	None	QPSK	1	49	10 mm	back	1:1	0.157	1.035	0.162	
710.00	23790	Mid	LTE Band 17	10	23.2	22.66	0.00	1	SAR-5	None	QPSK	25	0	10 mm	back	1:1	0.118	1.132	0.134	
710.00	23790	Mid	LTE Band 17	10	24.2	24.05	0.03	0	SAR-5	None	QPSK	1	49	10 mm	front	1:1	0.106	1.035	0.110	
710.00	23790	Mid	LTE Band 17	10	23.2	22.66	0.07	1	SAR-5	None	QPSK	25	0	10 mm	front	1:1	0.084	1.132	0.095	
710.00	23790	Mid	LTE Band 17	10	24.2	24.05	0.19	0	SAR-5	None	QPSK	1	49	10 mm	bottom	1:1	0.089	1.035	0.092	
710.00	23790	Mid	LTE Band 17	10	23.2	22.66	0.15	1	SAR-5	None	QPSK	25	0	10 mm	bottom	1:1	0.070	1.132	0.079	
710.00	23790	Mid	LTE Band 17	10	24.2	24.05	-0.05	0	SAR-5	None	QPSK	1	49	10 mm	left	1:1	0.242	1.035	0.250	A19
710.00	23790	Mid	LTE Band 17	10	24.2	24.05	0.21	0	SAR-5	Folio, Closed	QPSK	1	49	10 mm	left	1:1	0.181	1.035	0.187	
710.00	23790	Mid	LTE Band 17	10	24.2	24.05	-0.01	0	SAR-5	Cover	QPSK	1	49	10 mm	left	1:1	0.179	1.035	0.185	
710.00	23790	Mid	LTE Band 17	10	23.2	22.66	-0.02	1	SAR-5	None	QPSK	25	0	10 mm	left	1:1	0.173	1.132	0.196	
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 11-20
LTE Band 4 Hotspot SAR Data

MEASUREMENT RESULTS																					
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Accessory Type	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	24.5	24.41	0.05	0	SAR-4	None	QPSK	1	0	10 mm	back	1:1	0.973	1.021	0.993	A20
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.5	24.41	0.09	0	SAR-4	Folio, Closed	QPSK	1	0	10 mm	back	1:1	0.792	1.021	0.809	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.5	24.41	0.06	0	SAR-4	Cover	QPSK	1	0	10 mm	back	1:1	0.837	1.021	0.855	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	23.12	-0.07	1	SAR-4	None	QPSK	50	0	10 mm	back	1:1	0.718	1.091	0.783	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	23.10	0.10	1	SAR-4	None	QPSK	100	0	10 mm	back	1:1	0.780	1.096	0.855	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.5	24.41	0.03	0	SAR-4	None	QPSK	1	0	10 mm	front	1:1	0.610	1.021	0.623	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	23.12	-0.02	1	SAR-4	None	QPSK	50	0	10 mm	front	1:1	0.454	1.091	0.495	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.5	24.41	-0.01	0	SAR-4	None	QPSK	1	0	10 mm	bottom	1:1	0.420	1.021	0.429	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	23.12	-0.05	1	SAR-4	None	QPSK	50	0	10 mm	bottom	1:1	0.339	1.091	0.370	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	24.5	24.41	-0.01	0	SAR-4	None	QPSK	1	0	10 mm	left	1:1	0.418	1.021	0.427	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	23.12	-0.03	1	SAR-4	None	QPSK	50	0	10 mm	left	1:1	0.314	1.091	0.343	
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
LTE Band 2 Hotspot SAR Data

MEASUREMENT RESULTS																					
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Accessory Type	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	23.7	23.58	-0.07	0	SAR-4	None	QPSK	1	0	10 mm	back	1:1	0.662	1.028	0.681	A21
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.7	23.58	-0.02	0	SAR-4	Folio, Closed	QPSK	1	0	10 mm	back	1:1	0.539	1.028	0.554	
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.7	23.58	0.05	0	SAR-4	Cover	QPSK	1	0	10 mm	back	1:1	0.617	1.028	0.634	
1860.00	18700	Low	LTE Band 2 (PCS)	20	22.7	22.32	-0.11	1	SAR-4	None	QPSK	50	25	10 mm	back	1:1	0.515	1.091	0.562	
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.7	23.58	0.03	0	SAR-4	None	QPSK	1	0	10 mm	front	1:1	0.358	1.028	0.368	
1860.00	18700	Low	LTE Band 2 (PCS)	20	22.7	22.32	-0.06	1	SAR-4	None	QPSK	50	25	10 mm	front	1:1	0.291	1.091	0.317	
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.7	23.58	-0.01	0	SAR-4	None	QPSK	1	0	10 mm	bottom	1:1	0.647	1.028	0.665	
1860.00	18700	Low	LTE Band 2 (PCS)	20	22.7	22.32	-0.03	1	SAR-4	None	QPSK	50	25	10 mm	bottom	1:1	0.497	1.091	0.542	
1860.00	18700	Low	LTE Band 2 (PCS)	20	23.7	23.58	-0.06	0	SAR-4	None	QPSK	1	0	10 mm	right	1:1	0.186	1.028	0.191	
1860.00	18700	Low	LTE Band 2 (PCS)	20	22.7	22.32	0.02	1	SAR-4	None	QPSK	50	25	10 mm	right	1:1	0.154	1.091	0.168	
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 11-22
LTE Band 7 Hotspot SAR Data

MEASUREMENT RESULTS																					
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Accessory Type	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
2505.00	20800	Low	LTE Band 7	10	23.7	23.62	0.09	0	SAR-4	None	QPSK	1	25	10 mm	back	1:1	0.075	1.019	0.076	A22
2505.00	20800	Low	LTE Band 7	10	23.7	23.62	0.07	0	SAR-4	Folio, Closed	QPSK	1	25	10 mm	back	1:1	0.064	1.019	0.065	
2505.00	20800	Low	LTE Band 7	10	23.7	23.62	-0.01	0	SAR-4	Cover	QPSK	1	25	10 mm	back	1:1	0.067	1.019	0.068	
2505.00	20800	Low	LTE Band 7	10	22.7	22.30	0.05	1	SAR-4	None	QPSK	25	25	10 mm	back	1:1	0.056	1.096	0.061	
2505.00	20800	Low	LTE Band 7	10	23.7	23.62	0.15	0	SAR-4	None	QPSK	1	25	10 mm	front	1:1	0.030	1.019	0.031	
2505.00	20800	Low	LTE Band 7	10	22.7	22.30	0.13	1	SAR-4	None	QPSK	25	25	10 mm	front	1:1	0.022	1.096	0.024	
2505.00	20800	Low	LTE Band 7	10	23.7	23.62	0.09	0	SAR-4	None	QPSK	1	25	10 mm	bottom	1:1	0.064	1.019	0.065	
2505.00	20800	Low	LTE Band 7	10	22.7	22.30	0.12	1	SAR-4	None	QPSK	25	25	10 mm	bottom	1:1	0.047	1.096	0.052	
2505.00	20800	Low	LTE Band 7	10	23.7	23.62	0.13	0	SAR-4	None	QPSK	1	25	10 mm	left	1:1	0.017	1.019	0.017	
2505.00	20800	Low	LTE Band 7	10	22.7	22.30	0.16	1	SAR-4	None	QPSK	25	25	10 mm	left	1:1	0.012	1.096	0.013	
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 11-23
WLAN Hotspot SAR Data

MEASUREMENT RESULTS																
FREQUENCY		Service	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Accessory Type	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	0.11	10 mm	SAR-1	None	1	back	1:1	0.133	1.081	0.144	
2412	1	IEEE 802.11b	DSSS	17.1	16.76	0.04	10 mm	SAR-1	Folio, Closed	1	back	1:1	0.176	1.081	**0.190**	A23
2412	1	IEEE 802.11b	DSSS	17.1	16.76	0.04	10 mm	SAR-1	Cover	1	back	1:1	0.111	1.081	0.120	
2412	1	IEEE 802.11b	DSSS	17.1	16.76	-0.01	10 mm	SAR-1	None	1	front	1:1	0.071	1.081	0.077	
2412	1	IEEE 802.11b	DSSS	17.1	16.76	0.05	10 mm	SAR-1	None	1	top	1:1	0.072	1.081	0.078	
2412	1	IEEE 802.11b	DSSS	17.1	16.76	0.09	10 mm	SAR-1	None	1	right	1:1	0.032	1.081	0.035	
5765	153	IEEE 802.11a	OFDM	12.1	11.73	-0.20	10 mm	SAR-1	None	6	back	1:1	0.132	1.089	**0.144**	A24
5765	153	IEEE 802.11a	OFDM	12.1	11.73	-0.17	10 mm	SAR-1	Folio, Closed	6	back	1:1	0.122	1.089	0.133	
5765	153	IEEE 802.11a	OFDM	12.1	11.73	-0.16	10 mm	SAR-1	Cover	6	back	1:1	0.112	1.089	0.122	
5775	155	IEEE 802.11ac	OFDM	10.1	9.57	0.13	10 mm	SAR-1	None	29.3	back	1:1	0.067	1.130	0.076	
5765	153	IEEE 802.11a	OFDM	12.1	11.73	0.19	10 mm	SAR-1	None	6	front	1:1	0.024	1.089	0.026	
5765	153	IEEE 802.11a	OFDM	12.1	11.73	0.15	10 mm	SAR-1	None	6	top	1:1	0.075	1.089	0.082	
5765	153	IEEE 802.11a	OFDM	12.1	11.73	0.18	10 mm	SAR-1	None	6	right	1:1	0.012	1.089	0.013	
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, 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).
10. In the above tables, the wireless charging back cover accessory is referred to as “Cover” and the folio sleeve accessory is referred to as “Folio” and is specified to be open or closed. See Section 1.9 for more information.

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 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 20 MHz and 40 MHz bandwidths) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11a mode.
3. 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 except the 5.8 GHz band are disabled. Therefore only 5.8 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.

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	10.50	10	**0.229**

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	0.303	0.183	**0.486**
	Right Tilt	0.155	0.160	0.315
	Left Cheek	0.218	0.253	0.471
	Left Tilt	0.133	0.229	0.362

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.317	0.183	**0.500**
	Right Tilt	0.166	0.160	0.326
	Left Cheek	0.238	0.253	0.491
	Left Tilt	0.154	0.229	0.383

Simult Tx	Configuration	GSM 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.115	0.183	0.298
	Right Tilt	0.064	0.160	0.224
	Left Cheek	0.153	0.253	**0.406**
	Left Tilt	0.068	0.229	0.297

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.186	0.183	0.369
	Right Tilt	0.084	0.160	0.244
	Left Cheek	0.154	0.253	**0.407**
	Left Tilt	0.082	0.229	0.311

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.253	0.183	0.436
	Right Tilt	0.133	0.160	0.293
	Left Cheek	0.187	0.253	**0.440**
	Left Tilt	0.124	0.229	0.353

Simult Tx	Configuration	UMTS 1750 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.364	0.183	**0.547**
	Right Tilt	0.196	0.160	0.356
	Left Cheek	0.225	0.253	0.478
	Left Tilt	0.152	0.229	0.381

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.263	0.183	0.446
	Right Tilt	0.129	0.160	0.289
	Left Cheek	0.229	0.253	**0.482**
	Left Tilt	0.154	0.229	0.383

Simult Tx	Configuration	LTE Band 17 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.059	0.183	0.242
	Right Tilt	0.046	0.160	0.206
	Left Cheek	0.089	0.253	**0.342**
	Left Tilt	0.048	0.229	0.277

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	0.373	0.183	**0.556**
	Right Tilt	0.199	0.160	0.359
	Left Cheek	0.262	0.253	0.515
	Left Tilt	0.166	0.229	0.395

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	0.201	0.183	0.384
	Right Tilt	0.099	0.160	0.259
	Left Cheek	0.188	0.253	**0.441**
	Left Tilt	0.102	0.229	0.331

Simult Tx	Configuration	LTE Band 7 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.012	0.183	0.195
	Right Tilt	0.006	0.160	0.166
	Left Cheek	0.009	0.253	**0.262**
	Left Tilt	0.002	0.229	0.231

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	0.303	0.118	**0.421**
	Right Tilt	0.155	0.143	0.298
	Left Cheek	0.218	0.125	0.343
	Left Tilt	0.133	0.120	0.253

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.317	0.118	**0.435**
	Right Tilt	0.166	0.143	0.309
	Left Cheek	0.238	0.125	0.363
	Left Tilt	0.154	0.120	0.274

Simult Tx	Configuration	GSM 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.115	0.118	0.233
	Right Tilt	0.064	0.143	0.207
	Left Cheek	0.153	0.125	**0.278**
	Left Tilt	0.068	0.120	0.188

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.186	0.118	**0.304**
	Right Tilt	0.084	0.143	0.227
	Left Cheek	0.154	0.125	0.279
	Left Tilt	0.082	0.120	0.202

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.253	0.118	**0.371**
	Right Tilt	0.133	0.143	0.276
	Left Cheek	0.187	0.125	0.312
	Left Tilt	0.124	0.120	0.244

Simult Tx	Configuration	UMTS 1750 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.364	0.118	**0.482**
	Right Tilt	0.196	0.143	0.339
	Left Cheek	0.225	0.125	0.350
	Left Tilt	0.152	0.120	0.272

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.263	0.118	**0.381**
	Right Tilt	0.129	0.143	0.272
	Left Cheek	0.229	0.125	0.354
	Left Tilt	0.154	0.120	0.274

Simult Tx	Configuration	LTE Band 17 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.059	0.118	0.177
	Right Tilt	0.046	0.143	0.189
	Left Cheek	0.089	0.125	**0.214**
	Left Tilt	0.048	0.120	0.168

Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.373	0.118	**0.491**
	Right Tilt	0.199	0.143	0.342
	Left Cheek	0.262	0.125	0.387
	Left Tilt	0.166	0.120	0.286

Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.201	0.118	**0.319**
	Right Tilt	0.099	0.143	0.242
	Left Cheek	0.188	0.125	0.313
	Left Tilt	0.102	0.120	0.222

Simult Tx	Configuration	LTE Band 7 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.012	0.118	0.130
	Right Tilt	0.006	0.143	**0.149**
	Left Cheek	0.009	0.125	0.134
	Left Tilt	0.002	0.120	0.122

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	0.513	0.190	0.703
Back Side	GPRS 850	0.571	0.190	0.761
Back Side	GSM 1900	0.435	0.190	0.625
Back Side	GPRS 1900	0.520	0.190	0.710
Back Side	UMTS 850	0.459	0.190	0.649
Back Side	UMTS 1750	1.154	0.190	**1.344**
Back Side	UMTS 1900	0.878	0.190	1.068
Back Side	LTE Band 17	0.162	0.190	0.352
Back Side	LTE Band 4 (AWS)	0.993	0.190	1.183
Back Side	LTE Band 2 (PCS)	0.681	0.190	0.871
Back Side	LTE Band 7	0.076	0.190	0.266

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	0.513	0.144	0.657
Back Side	GPRS 850	0.571	0.144	0.715
Back Side	GSM 1900	0.435	0.144	0.579
Back Side	GPRS 1900	0.520	0.144	0.664
Back Side	UMTS 850	0.459	0.144	0.603
Back Side	UMTS 1750	1.154	0.144	**1.298**
Back Side	UMTS 1900	0.878	0.144	1.022
Back Side	LTE Band 17	0.162	0.144	0.306
Back Side	LTE Band 4 (AWS)	0.993	0.144	1.137
Back Side	LTE Band 2 (PCS)	0.681	0.144	0.825
Back Side	LTE Band 7	0.076	0.144	0.220

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	0.513	0.229	0.742
Back Side	GPRS 850	0.571	0.229	0.800
Back Side	GSM 1900	0.435	0.229	0.664
Back Side	GPRS 1900	0.520	0.229	0.749
Back Side	UMTS 850	0.459	0.229	0.688
Back Side	UMTS 1750	1.154	0.229	**1.383**
Back Side	UMTS 1900	0.878	0.229	1.107
Back Side	LTE Band 17	0.162	0.229	0.391
Back Side	LTE Band 4 (AWS)	0.993	0.229	1.222
Back Side	LTE Band 2 (PCS)	0.681	0.229	0.910
Back Side	LTE Band 7	0.076	0.229	0.305

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	0.571	0.190	**0.761**
	Front	0.378	0.077	0.455
	Top	-	0.078	0.078
	Bottom	0.277	-	0.277
	Right	0.478	0.035	0.513
	Left	-	-	0.000

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.520	0.190	**0.710**
	Front	0.308	0.077	0.385
	Top	-	0.078	0.078
	Bottom	0.477	-	0.477
	Right	0.170	0.035	0.205
	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	0.459	0.190	**0.649**
	Front	0.333	0.077	0.410
	Top	-	0.078	0.078
	Bottom	0.222	-	0.222
	Right	0.403	0.035	0.438
	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	1.154	0.190	**1.344**
	Front	0.720	0.077	0.797
	Top	-	0.078	0.078
	Bottom	0.473	-	0.473
	Right	-	0.035	0.035
	Left	0.530	-	0.530

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.878	0.190	**1.068**
	Front	0.345	0.077	0.422
	Top	-	0.078	0.078
	Bottom	0.723	-	0.723
	Right	0.269	0.035	0.304
	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	0.162	0.190	**0.352**
	Front	0.110	0.077	0.187
	Top	-	0.078	0.078
	Bottom	0.092	-	0.092
	Right	-	0.035	0.035
	Left	0.250	-	0.250

Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.993	0.190	**1.183**
	Front	0.623	0.077	0.700
	Top	-	0.078	0.078
	Bottom	0.429	-	0.429
	Right	-	0.035	0.035
	Left	0.427	-	0.427

Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.681	0.190	**0.871**
	Front	0.368	0.077	0.445
	Top	-	0.078	0.078
	Bottom	0.665	-	0.665
	Right	0.191	0.035	0.226
	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	0.076	0.190	**0.266**
	Front	0.031	0.077	0.108
	Top	-	0.078	0.078
	Bottom	0.065	-	0.065
	Right	-	0.035	0.035
	Left	0.017	-	0.017

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	0.571	0.144	**0.715**
	Front	0.378	0.026	0.404
	Top	-	0.082	0.082
	Bottom	0.277	-	0.277
	Right	0.478	0.013	0.491
	Left	-	-	0.000

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.520	0.144	**0.664**
	Front	0.308	0.026	0.334
	Top	-	0.082	0.082
	Bottom	0.477	-	0.477
	Right	0.170	0.013	0.183
	Left	-	-	0.000

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.459	0.144	**0.603**
	Front	0.333	0.026	0.359
	Top	-	0.082	0.082
	Bottom	0.222	-	0.222
	Right	0.403	0.013	0.416
	Left	-	-	0.000

Simult Tx	Configuration	UMTS 1750 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	1.154	0.144	**1.298**
	Front	0.720	0.026	0.746
	Top	-	0.082	0.082
	Bottom	0.473	-	0.473
	Right	-	0.013	0.013
	Left	0.530	-	0.530

Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.878	0.144	**1.022**
	Front	0.345	0.026	0.371
	Top	-	0.082	0.082
	Bottom	0.723	-	0.723
	Right	0.269	0.013	0.282
	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	0.162	0.144	**0.306**
	Front	0.110	0.026	0.136
	Top	-	0.082	0.082
	Bottom	0.092	-	0.092
	Right	-	0.013	0.013
	Left	0.250	-	0.250

Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.993	0.144	**1.137**
	Front	0.623	0.026	0.649
	Top	-	0.082	0.082
	Bottom	0.429	-	0.429
	Right	-	0.013	0.013
	Left	0.427	-	0.427

Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.681	0.144	**0.825**
	Front	0.368	0.026	0.394
	Top	-	0.082	0.082
	Bottom	0.665	-	0.665
	Right	0.191	0.013	0.204
	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	0.076	0.144	**0.220**
	Front	0.031	0.026	0.057
	Top	-	0.082	0.082
	Bottom	0.065	-	0.065
	Right	-	0.013	0.013
	Left	0.017	-	0.017

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)	
1750	1712.40	1312	UMTS 1750	RMC	back	10 mm	1.060	1.020	1.04	N/A	N/A	N/A	N/A
1900	1880.00	9400	UMTS 1900	RMC	back	10 mm	0.820	0.815	1.01	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
Agilent	85047A	S-Parameter Test Set	N/A	N/A	N/A	2904A00579
Agilent	8594A	(9kHz-2.9GHz) Spectrum Analyzer	N/A	N/A	N/A	3051A00187
Agilent	8648D	(9kHz-4GHz) Signal Generator	4/15/2014	Annual	4/15/2015	3629U00687
Agilent	8753E	(30kHz-6GHz) Network Analyzer	7/23/2013	Annual	7/23/2014	US37390350
Agilent	8753ES	S-Parameter Network Analyzer	10/29/2013	Annual	10/29/2014	US39170122
Agilent	E4438C	ESG Vector Signal Generator	4/25/2014	Annual	4/25/2015	MY42082385
Agilent	E4438C	ESG Vector Signal Generator	4/15/2014	Annual	4/15/2015	MY45090700
Agilent	E8257D	(250kHz-20GHz) Signal Generator	4/15/2014	Annual	4/15/2015	MY45470194
Agilent	N5182A	MXG Vector Signal Generator	4/15/2014	Annual	4/15/2015	MY47420800
Agilent	N9020A	MXA Signal Analyzer	10/29/2013	Annual	10/29/2014	US46470561
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433972
Anritsu	MA24106A	USB Power Sensor	1/3/2014	Annual	1/3/2015	1344554
Anritsu	MA24106A	USB Power Sensor	1/3/2014	Annual	1/3/2015	1344557
Anritsu	MA2411B	Pulse Power Sensor	3/25/2014	Annual	3/25/2015	1207470
Anritsu	MA2411B	Pulse Power Sensor	2/3/2014	Annual	2/3/2015	1339018
Anritsu	ML2469A	Power Meter	3/14/2014	Annual	3/14/2015	1306009
Anritsu	ML2495A	Power Meter	10/31/2013	Annual	10/31/2014	1039008
Anritsu	MT8820C	Radio Communication Analyzer	12/12/2013	Annual	12/12/2014	6200901190
Anritsu	MT8820C	Radio Communication Analyzer	12/12/2013	Annual	12/12/2014	6201300731
COMTech	AR85729-5	Solid State Amplifier	CBT	N/A	CBT	M15SA00-009
COMTECH	AR85729-5/5759B	Solid State Amplifier	CBT	N/A	CBT	M3W1A00-1002
Control Company	4052	Long Stem Thermometer	9/27/2013	Biennial	9/27/2015	130567447
Control Company	36934-158	Wall-Mounted Thermometer	4/29/2014	Biennial	4/29/2016	122014488
Control Company	61220-416	Long-Stem Thermometer	4/29/2014	Biennial	4/29/2016	111331323
Fisher Scientific	15-077-960	Digital Thermometer	11/6/2012	Biennial	11/6/2014	122640025
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	Power Attenuator	CBT	N/A	CBT	1226
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
Mitutoyo	CD-6"CSX	Digital Caliper	5/8/2014	Biennial	5/8/2016	13264162
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	CMW500	LTE Radio Communication Tester	10/4/2013	Biennial	10/4/2015	103962
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	10/18/2013	Annual	10/18/2014	100976
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	10/4/2013	Annual	10/4/2014	108798
Rohde & Schwarz	NRVD	Dual Channel Power Meter	10/12/2012	Biennial	10/12/2014	101695
Rohde & Schwarz	NRVS	Single Channel Power Meter	10/31/2013	Annual	10/31/2014	835360/0079
Rohde & Schwarz	NRV-Z32	Peak Power Sensor	10/12/2012	Biennial	10/12/2014	836019/013
Rohde & Schwarz	SME06	Signal Generator	10/30/2013	Annual	10/30/2014	832026
Seekonk	NC-100	Torque Wrench	3/18/2014	Biennial	3/18/2016	22313
Seekonk	NC-100	Torque Wrench	3/18/2014	Biennial	3/18/2016	N/A
SPEAG	D750V3	750 MHz Dipole	1/20/2014	Annual	1/20/2015	1003
SPEAG	D835V2	835 MHz SAR Dipole	4/7/2014	Annual	4/7/2015	4d119
SPEAG	D835V2	835 MHz SAR Dipole	7/17/2013	Annual	7/17/2014	4d133
SPEAG	D1750V2	1750 MHz SAR Dipole	4/10/2014	Annual	4/10/2015	1051
SPEAG	D1900V2	1900 MHz SAR Dipole	7/22/2013	Annual	7/22/2014	5d149
SPEAG	D2450V2	2450 MHz SAR Dipole	1/21/2014	Annual	1/21/2015	797
SPEAG	D5GHzV2	5 GHz SAR Dipole	1/27/2014	Annual	1/27/2015	1057
SPEAG	D5GHzV2	5 GHz SAR Dipole	9/23/2013	Annual	9/23/2014	1007
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/17/2014	Annual	3/17/2015	1334
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/26/2014	Annual	2/26/2015	665
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/22/2014	Annual	1/22/2015	1272
SPEAG	DAE4	Dasy Data Acquisition Electronics	12/12/2013	Annual	12/12/2014	649
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	DAE4	Dasy Data Acquisition Electronics	11/18/2013	Annual	11/18/2014	1407
SPEAG	DAE4	Dasy Data Acquisition Electronics	8/21/2013	Annual	8/21/2014	1322
SPEAG	DAK-3.5	Dielectric Assessment Kit	11/13/2013	Annual	11/13/2014	1091
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/14/2013	Annual	5/14/2014	1070
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
SPEAG	ES3DV2	SAR Probe	8/22/2013	Annual	8/22/2014	3022
SPEAG	ES3DV3	SAR Probe	3/19/2014	Annual	3/19/2015	3209
SPEAG	ES3DV3	SAR Probe	4/11/2014	Annual	4/11/2015	3213
SPEAG	ES3DV3	SAR Probe	2/25/2014	Annual	2/25/2015	3258
SPEAG	ES3DV3	SAR Probe	11/25/2013	Annual	11/25/2014	3332
SPEAG	ES3DV3	SAR Probe	11/22/2013	Annual	11/22/2014	3333
SPEAG	ES3DV3	SAR Probe	11/20/2013	Annual	11/20/2014	3287
SPEAG	EX3DV4	SAR Probe	1/29/2014	Annual	1/29/2015	3589
SPEAG	EX3DV4	SAR Probe	12/18/2013	Annual	12/18/2014	3920
SPEAG	EX3DV4	SAR Probe	10/23/2013	Annual	10/23/2014	3914
Tektronix	RSA6114A	Real Time Spectrum Analyzer	4/16/2014	Annual	4/16/2015	B010177
VWR	23226-658	Long Stem Thermometer	7/11/2012	Biennial	7/11/2014	122389330
VWR	36934-158	Wall-Mounted Thermometer	8/8/2013	Biennial	8/8/2015	130477877

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 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-2

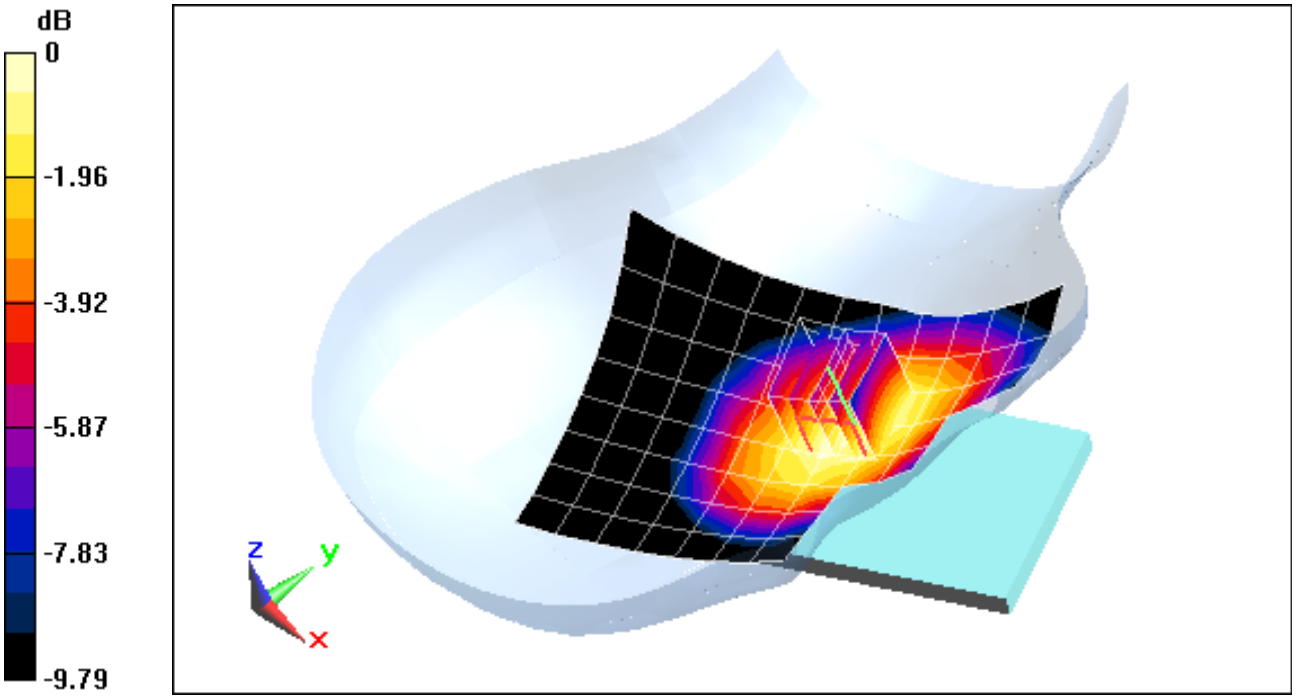
Communication System: UID 0, GSM GPRS; 3 Tx slots; Frequency: 836.6 MHz; Duty Cycle: 1:2.76
Medium: 835 Head, Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.906 S/m; ε_r = 40.839; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 05-14-2014; Ambient Temp: 22.5°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3213; ConvF(6.37, 6.37, 6.37); Calibrated: 4/11/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1364; Calibrated: 3/17/2014
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: GPRS 850, Right Head, Cheek, Mid.ch, 3 Tx Slots with Wireless Charging Back Cover

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.393 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.361 W/kg
SAR(1 g) = 0.291 W/kg



0 dB = 0.307 W/kg = -5.13 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

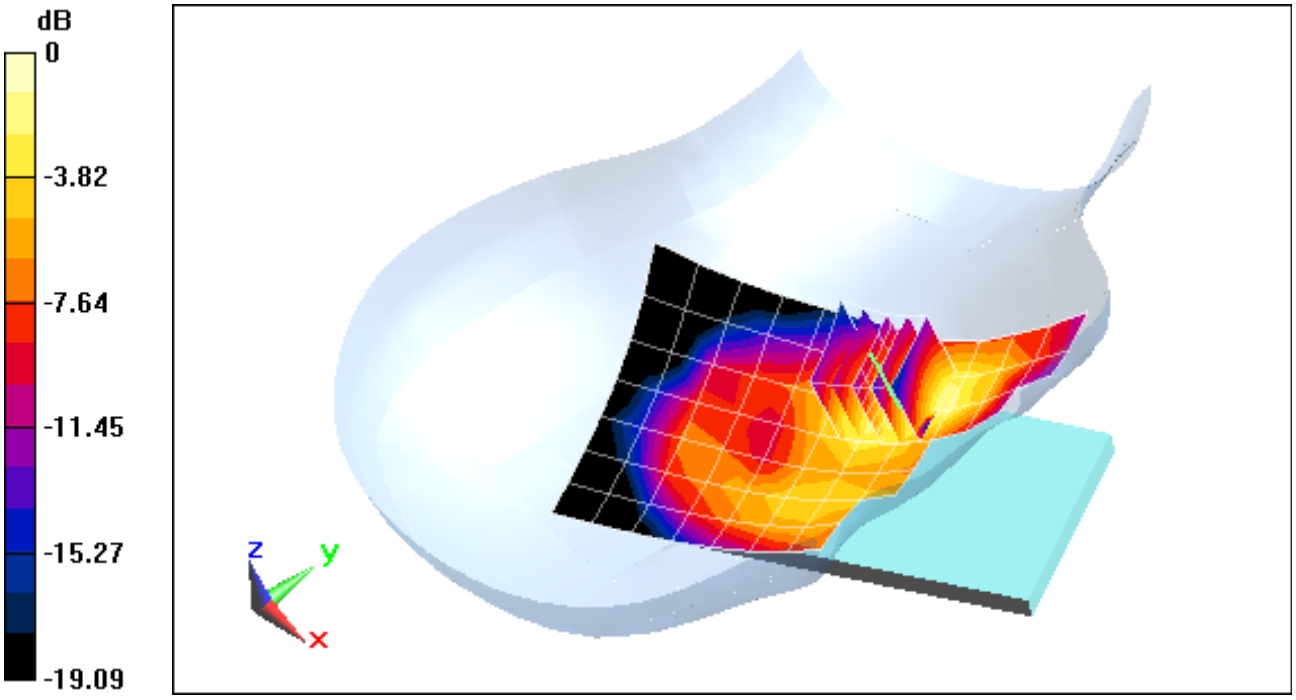
Communication System: UID 0, GSM GPRS; 3 Tx slots; Frequency: 1880 MHz; Duty Cycle: 1:2.76
Medium: 1900 Head, Medium parameters used:
f = 1880 MHz; σ = 1.427 S/m; ε_r = 40.125; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 05-19-2014; Ambient Temp: 24.0°C; Tissue Temp: 22.5°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: GPRS 1900, Right Head, Cheek, Mid.ch, 3 Tx slots
with Wireless Charging Back Cover

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.958 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 0.293 W/kg
SAR(1 g) = 0.172 W/kg



0 dB = 0.180 W/kg = -7.45 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

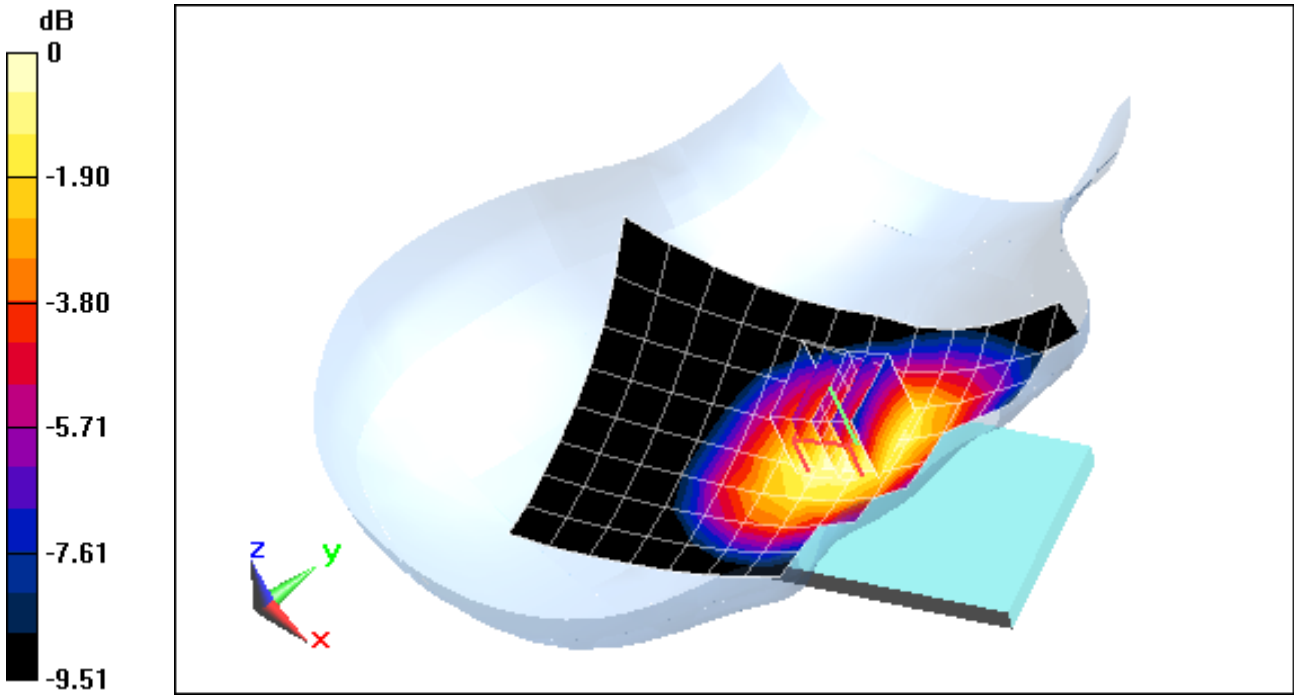
Communication System: UID 0, UMTS; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium: 835 Head, Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.906 S/m; ε_r = 40.839; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 05-14-2014; Ambient Temp: 22.5°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3213; ConvF(6.37, 6.37, 6.37); Calibrated: 4/11/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1364; Calibrated: 3/17/2014
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: UMTS 850, Right Head, Cheek, Mid.ch
with Wireless Charging Back Cover

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.804 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.301 W/kg
SAR(1 g) = 0.239 W/kg



0 dB = 0.252 W/kg = -5.99 dBW/kg

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

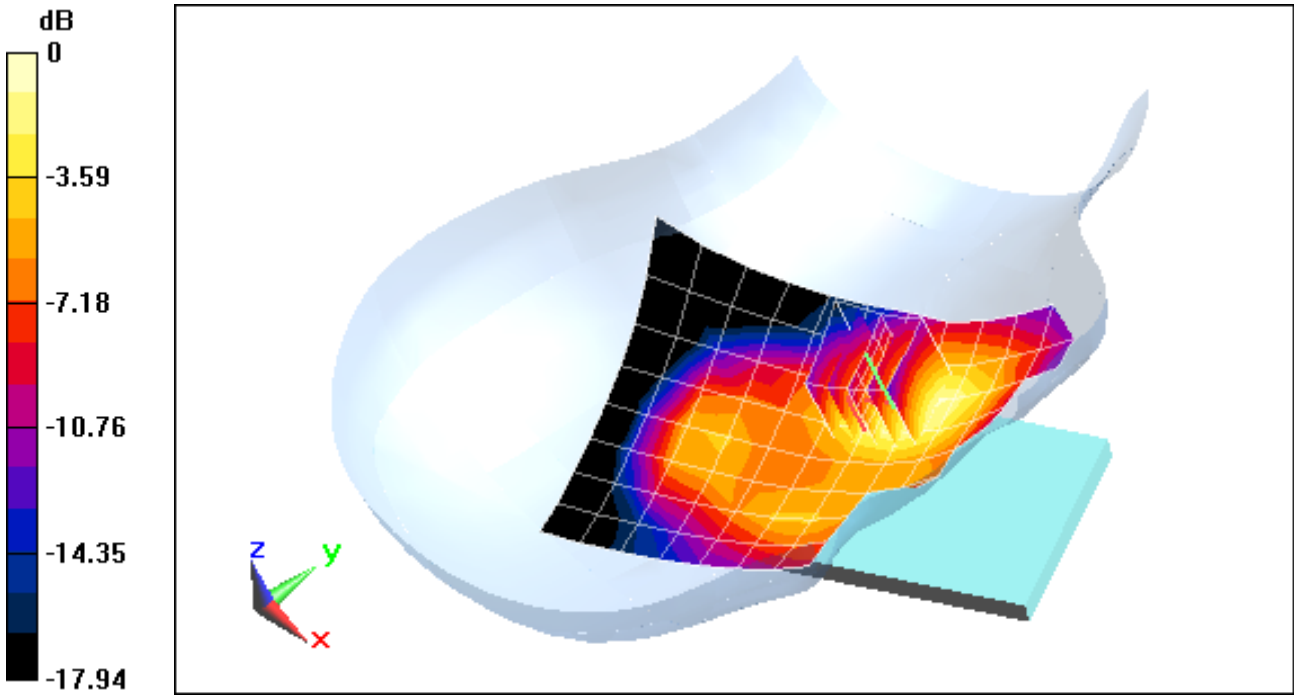
Communication System: UID 0, UMTS; Frequency: 1732.4 MHz; Duty Cycle: 1:1
Medium: 1750 Head, Medium parameters used (interpolated):
f = 1732.4 MHz; σ = 1.394 S/m; ε_r = 40.606; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 05-14-2014; Ambient Temp: 23.0°C; Tissue Temp: 22.4°C

Probe: ES3DV3 - SN3258; ConvF(5.19, 5.19, 5.19); 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: AWS UMTS, Right Head, Cheek, Mid.ch
with Wireless Charging Back Cover

Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.875 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.512 W/kg
SAR(1 g) = 0.334 W/kg



0 dB = 0.358 W/kg = -4.46 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

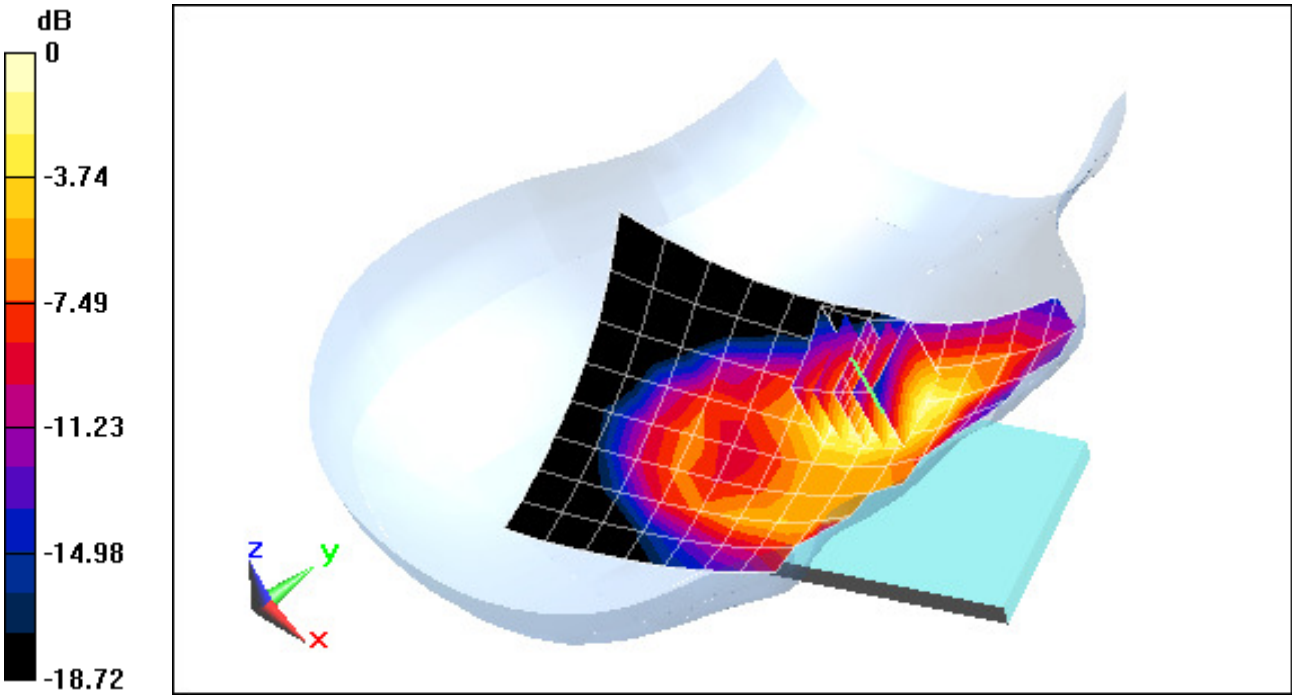
Communication System: UID 0, UMTS; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: 1900 Head, Medium parameters used:
f = 1880 MHz; σ = 1.429 S/m; ε_r = 40.062; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 05-12-2014; Ambient Temp: 23.2°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3209; ConvF(5.13, 5.13, 5.13); Calibrated: 3/19/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 3/17/2014
Phantom: SAM right; Type: QD000P40CD; Serial: TP:1757
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Mode: UMTS 1900, Right Head, Cheek, Mid.ch
with Folio Accessory, Open

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.491 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.385 W/kg
SAR(1 g) = 0.248 W/kg



0 dB = 0.272 W/kg = -5.65 dBW/kg

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

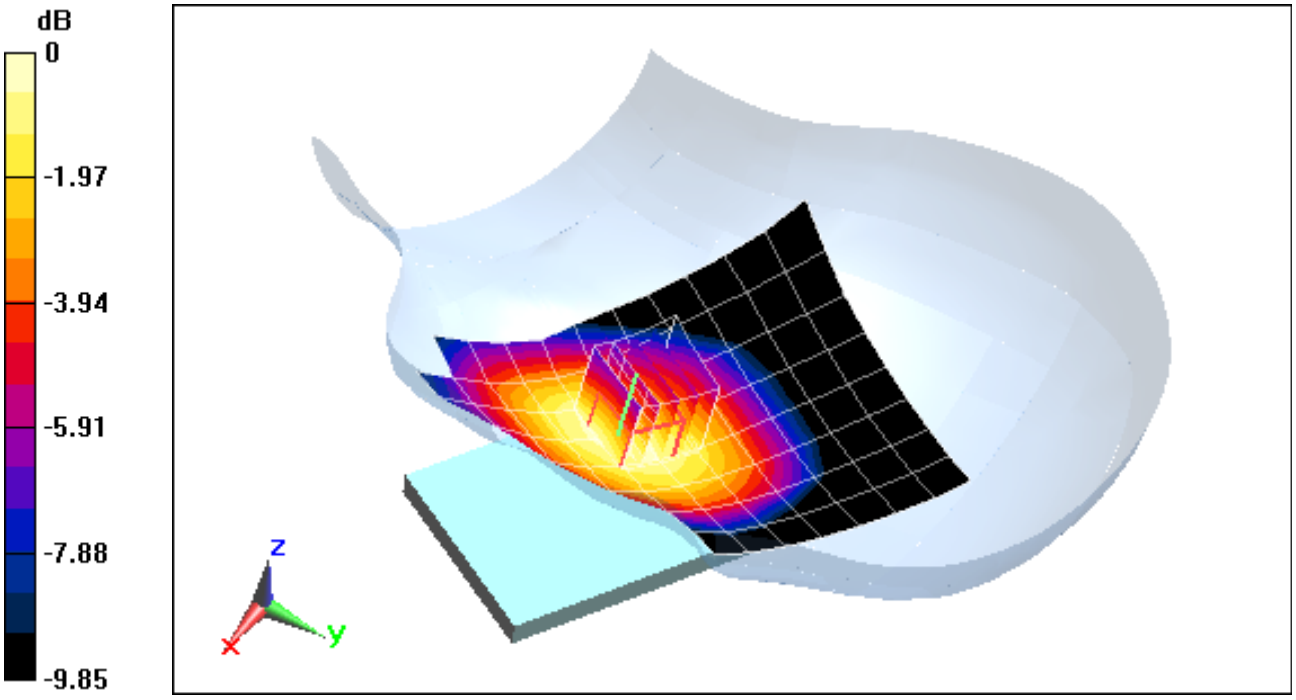
Communication System: UID 0, LTE Band 17; Frequency: 710 MHz; Duty Cycle: 1:1
Medium: 750 Head, Medium parameters used:
f = 710 MHz; σ = 0.857 S/m; ε_r = 41.218; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 05-16-2014; Ambient Temp: 23.8°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3287; ConvF(6.52, 6.52, 6.52); Calibrated: 11/20/2013;
Sensor-Surface: 4mm (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 17, Left Head, Cheek, Mid.ch, 10 MHz Bandwidth, QPSK, 1 RB, 49 RB Offset, with Standard Back Cover

Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.929 V/m; Power Drift = -0.19 dB
Peak SAR (extrapolated) = 0.106 W/kg
SAR(1 g) = 0.086 W/kg



0 dB = 0.0900 W/kg = -10.46 dBW/kg

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

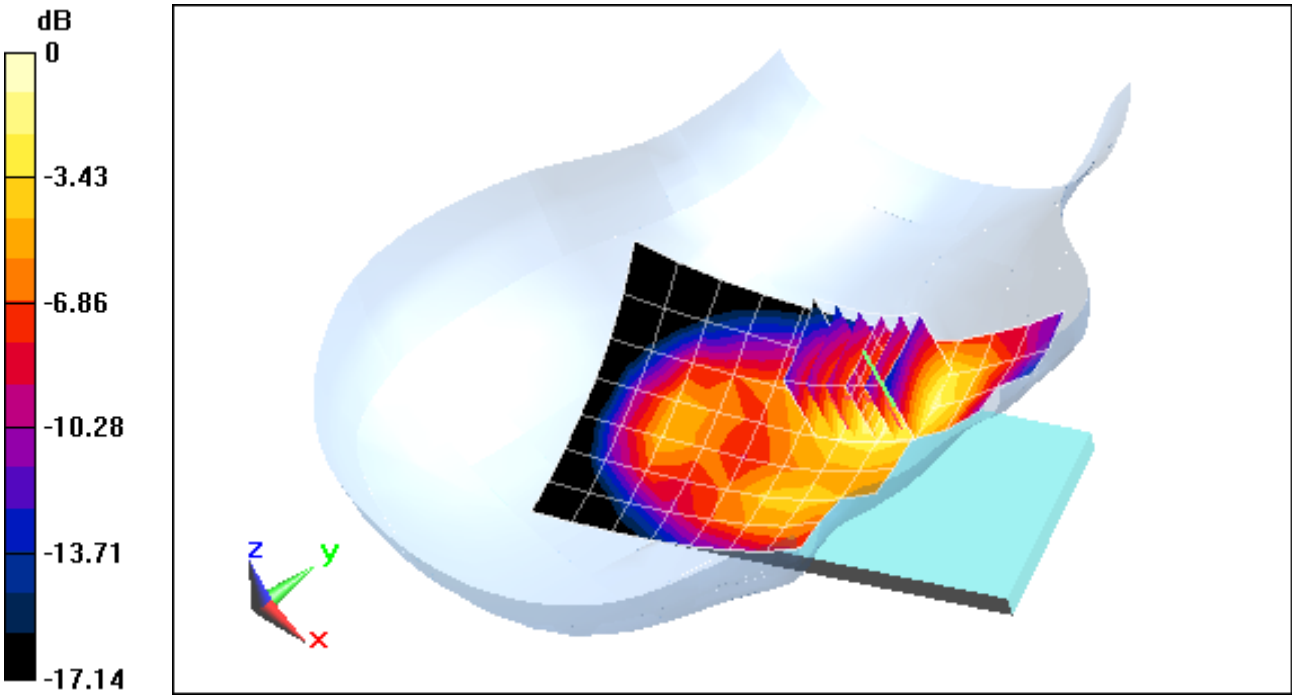
Communication System: UID 0, LTE Band 4 (AWS); Frequency: 1732.5 MHz; Duty Cycle: 1:1
Medium: 1750 Head, Medium parameters used (interpolated):
f = 1732.5 MHz; σ = 1.394 S/m; ε_r = 40.605; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 05-14-2014; Ambient Temp: 23.0°C; Tissue Temp: 22.4°C

Probe: ES3DV3 - SN3258; ConvF(5.19, 5.19, 5.19); 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 4 (AWS), Right Head, Cheek, Mid.ch, 20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset, with Wireless Charging Back Cover

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.664 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.551 W/kg
SAR(1 g) = 0.365 W/kg



0 dB = 0.390 W/kg = -4.09 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

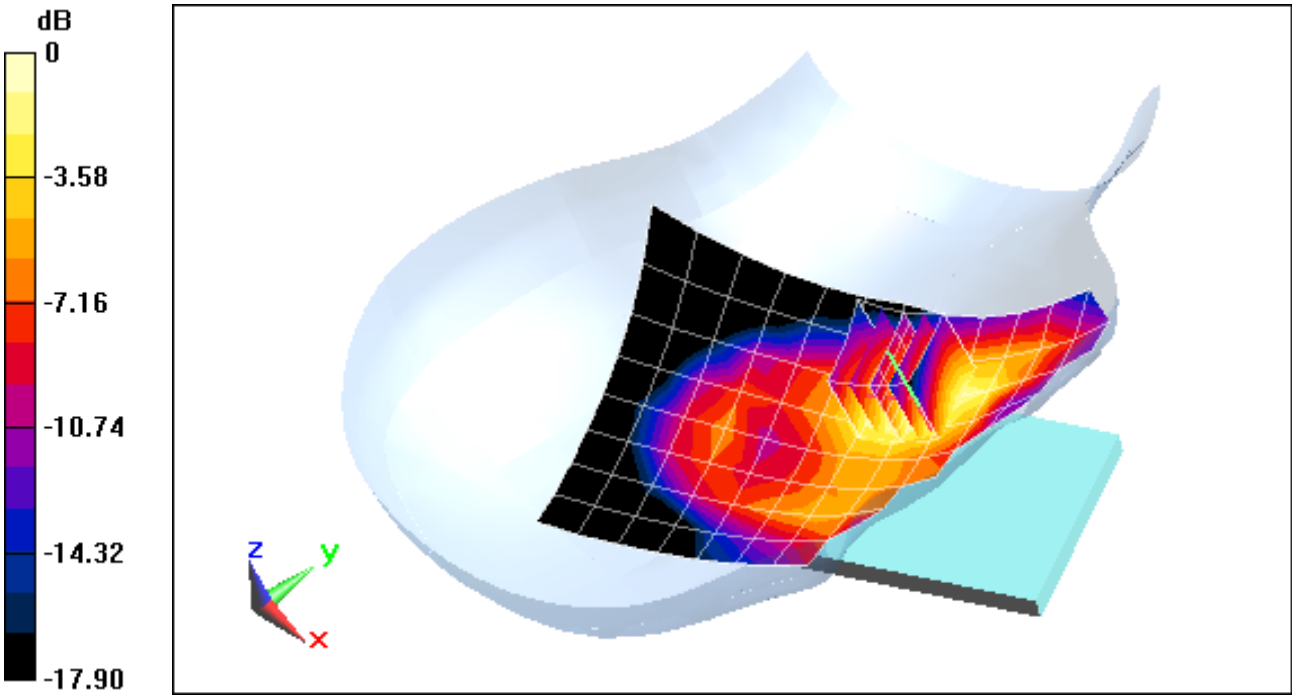
Communication System: UID 0, LTE Band 2 (PCS); Frequency: 1860 MHz; Duty Cycle: 1:1
Medium: 1900 Head, Medium parameters used (interpolated):
f = 1860 MHz; σ = 1.408 S/m; ε_r = 40.138; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 05-12-2014; Ambient Temp: 23.2°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3209; ConvF(5.13, 5.13, 5.13); Calibrated: 3/19/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 3/17/2014
Phantom: SAM right; Type: QD000P40CD; Serial: TP:1757
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, with Standard Back Cover

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.011 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 0.298 W/kg
SAR(1 g) = 0.196 W/kg



0 dB = 0.209 W/kg = -6.80 dBW/kg

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

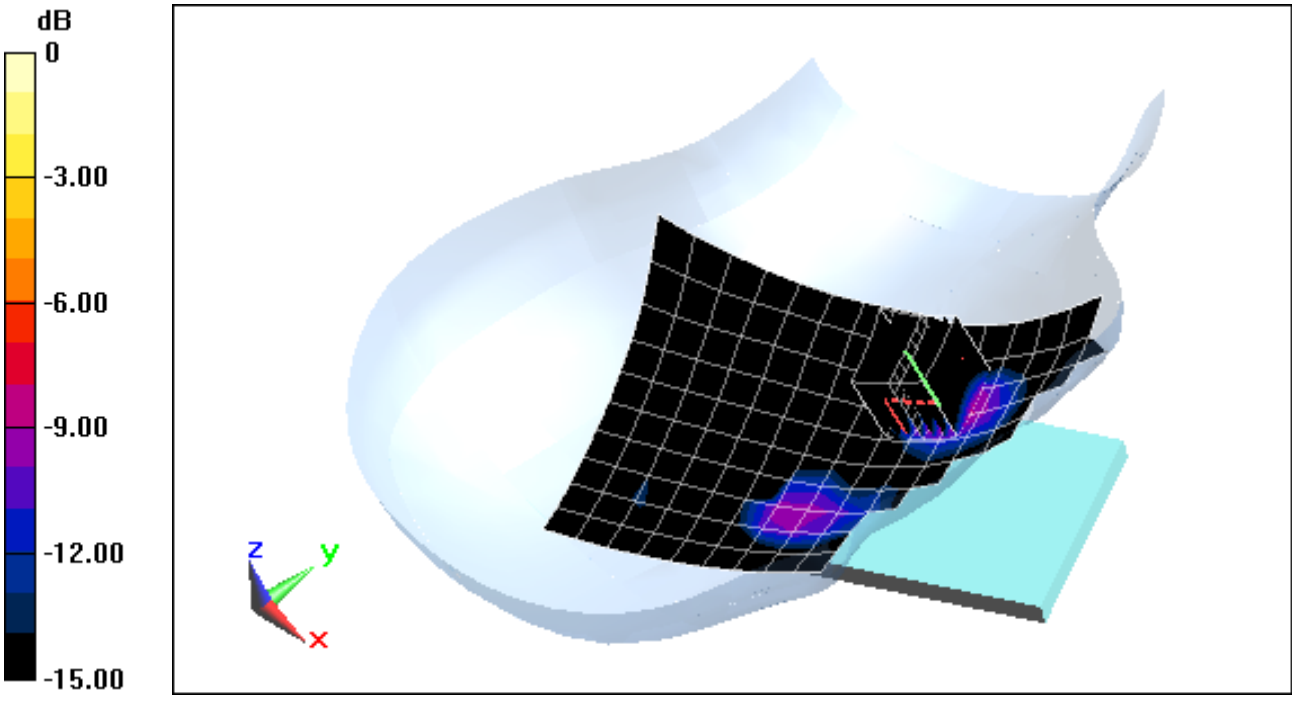
Communication System: UID 0, LTE Band 7; Frequency: 2505 MHz; Duty Cycle: 1:1
Medium: 2600 Head, Medium parameters used (interpolated):
f = 2505 MHz; σ = 1.89 S/m; ε_r = 38.688; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 05-20-2014; Ambient Temp: 24.1°C; Tissue Temp: 22.2°C

Probe: ES3DV3 - SN3287; ConvF(4.43, 4.43, 4.43); Calibrated: 11/20/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1408; Calibrated: 11/19/2013
Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1797
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Mode: LTE Band 7, Right Head, Cheek, Low.ch, 10 MHz Bandwidth, QPSK, 1 RB, 25 RB Offset, with Wireless Charging Back Cover

Area Scan (11x18x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.704 V/m; Power Drift = 0.18 dB
Peak SAR (extrapolated) = 0.0250 W/kg
SAR(1 g) = 0.012 W/kg



0 dB = 0.0800 W/kg = -10.97 dBW/kg

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

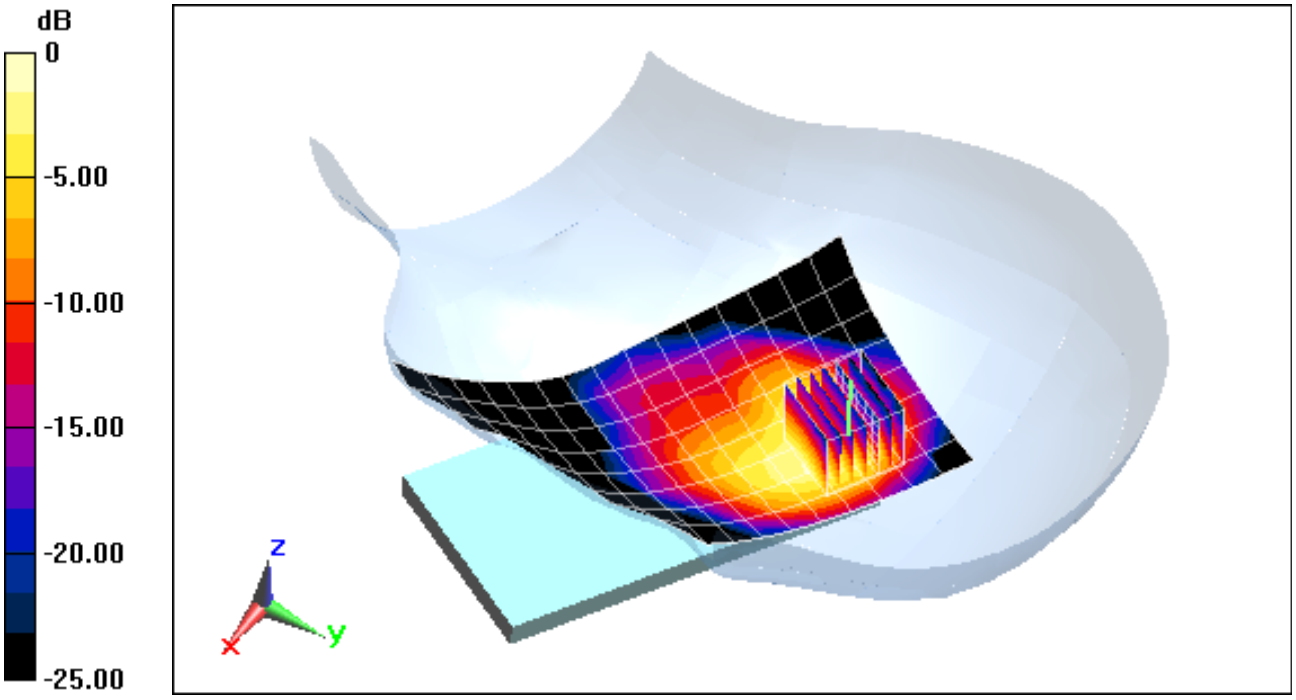
Communication System: UID 0, IEEE 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1
Medium: 2450 Head, Medium parameters used (interpolated):
f = 2412 MHz; σ = 1.775 S/m; ε_r = 38.623; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 05-05-2014; Ambient Temp: 23.3°C; Tissue Temp: 22.5°C

Probe: EX3DV4 - SN3589; ConvF(6.45, 6.45, 6.45); Calibrated: 1/29/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/22/2014
Phantom: SAM; Type: QD000P40CD; Serial: TP:1758
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
with Wireless Charging Back Cover

Area Scan (9x18x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 12.507 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.518 W/kg
SAR(1 g) = 0.234 W/kg



0 dB = 0.302 W/kg = -5.20 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

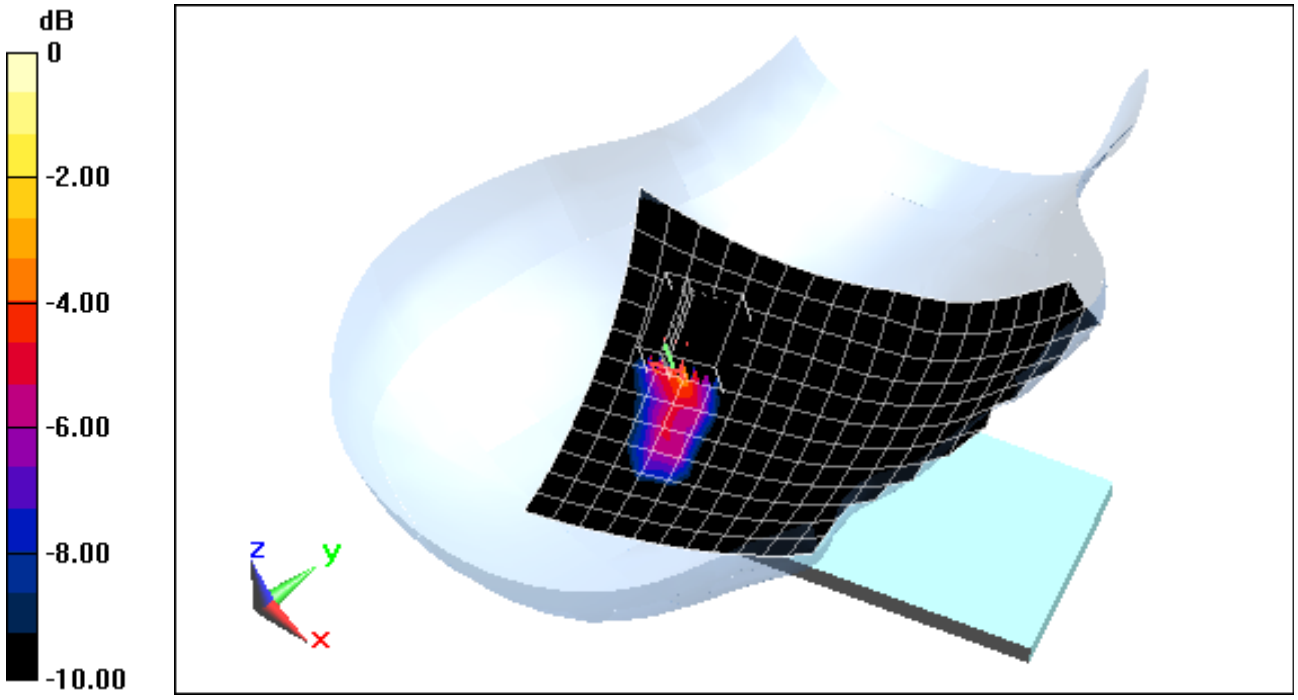
Communication System: UID 0, IEEE 802.11a, Frequency: 5765 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head, Medium parameters used:
f = 5765 MHz; σ = 5.113 S/m; ε_r = 35.944; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 05-14-2014; Ambient Temp: 24.5°C; Tissue Temp: 24.1°C

Probe: EX3DV4 - SN3914; ConvF(4.52, 4.52, 4.52); Calibrated: 10/23/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Mode: IEEE 802.11a, 5.8 GHz, Right Head, Tilt, Ch 153, 6 Mbps with Standard Back Cover

Area Scan (13x22x1): 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 = 2.885 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 0.435 W/kg
SAR(1 g) = 0.111 W/kg



0 dB = 0.272 W/kg = -5.65 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

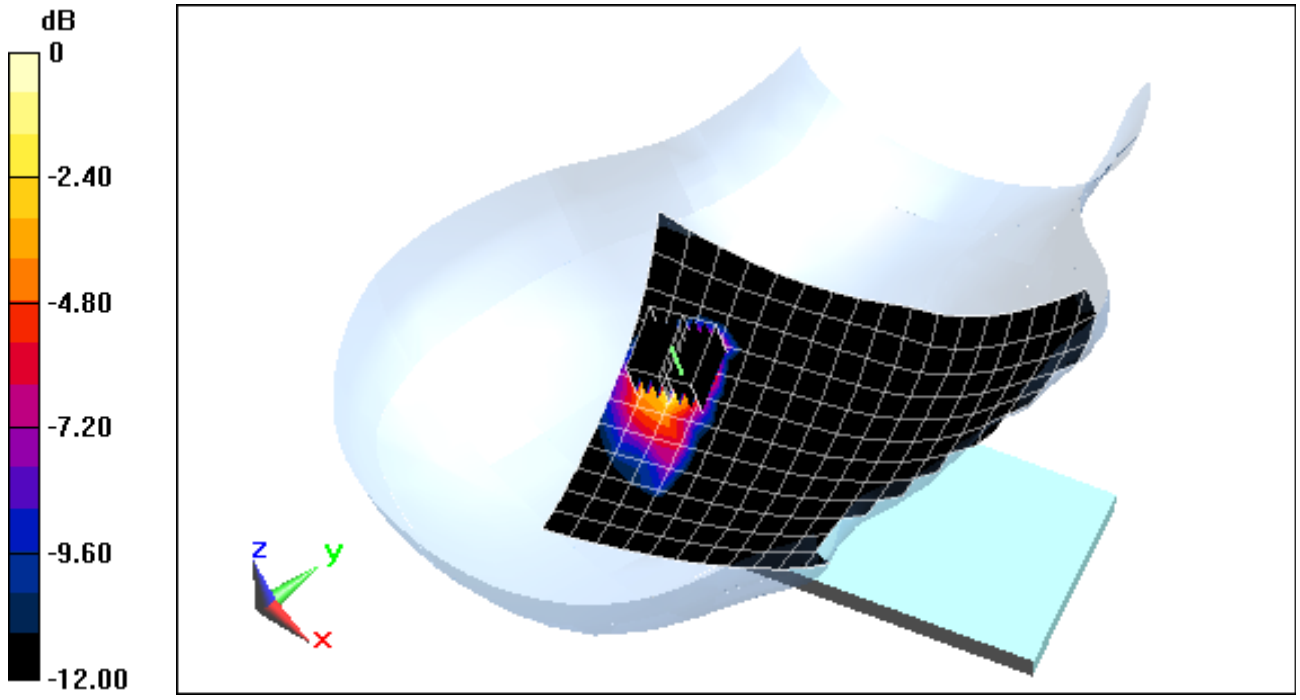
Communication System: UID 0, IEEE 802.11a; Frequency: 5540 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head, Medium parameters used:
f = 5540 MHz; σ = 4.888 S/m; ε_r = 36.251; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 05-14-2014; Ambient Temp: 24.2°C; Tissue Temp: 24.0°C

Probe: EX3DV4 - SN3914; ConvF(4.55, 4.55, 4.55); Calibrated: 10/23/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Mode: IEEE 802.11a, 5.5 GHz, Right Head, Tilt, Ch 108, 6 Mbps with Wireless Charging Back Cover

Area Scan (13x22x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Reference Value = 5.468 V/m; Power Drift = -0.16 dB
Peak SAR (extrapolated) = 0.515 W/kg
SAR(1 g) = 0.133 W/kg



0 dB = 0.317 W/kg = -4.99 dBW/kg

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

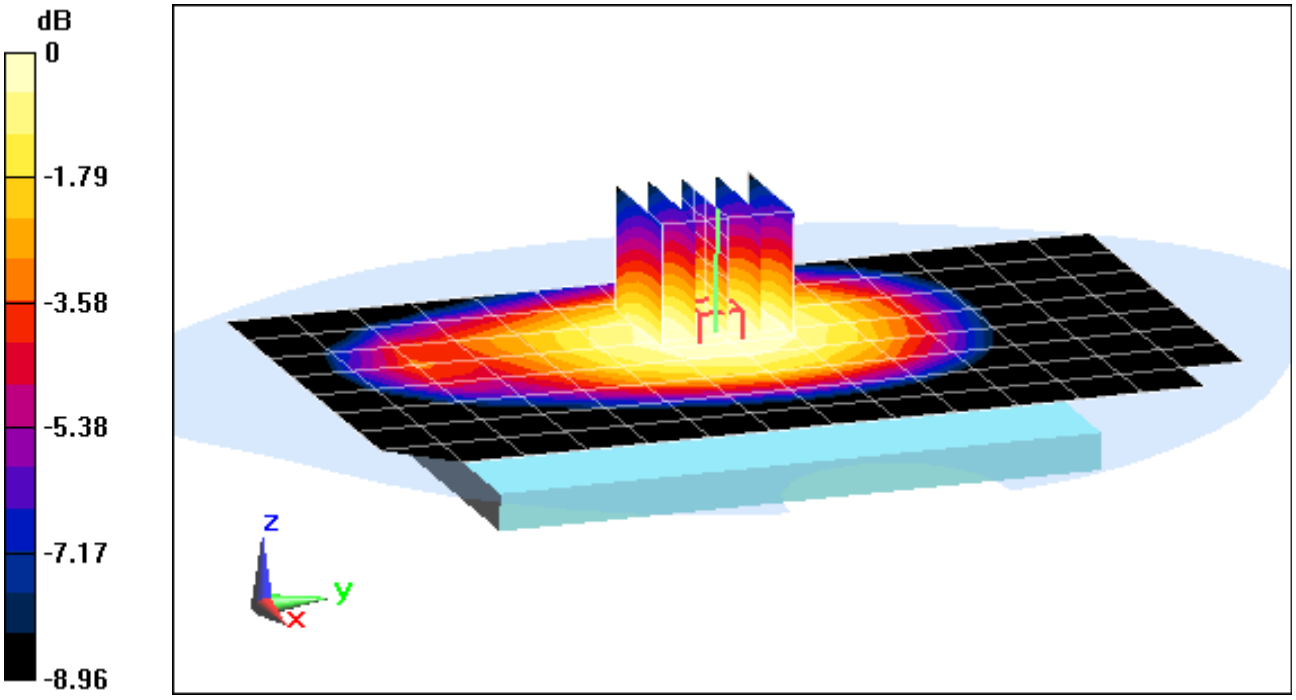
Communication System: UID 0, GSM GPRS; 3 Tx slots; Frequency: 836.6 MHz; Duty Cycle: 1:2.76
Medium: 835 Body, Medium parameters used (interpolated):
f = 836.6 MHz; σ = 1.014 S/m; ε_r = 53.797; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-07-2014; Ambient Temp: 24.1°C; Tissue Temp: 22.7°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 with Standard Back Cover

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.703 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 0.650 W/kg
SAR(1 g) = 0.524 W/kg



0 dB = 0.550 W/kg = -2.60 dBW/kg

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

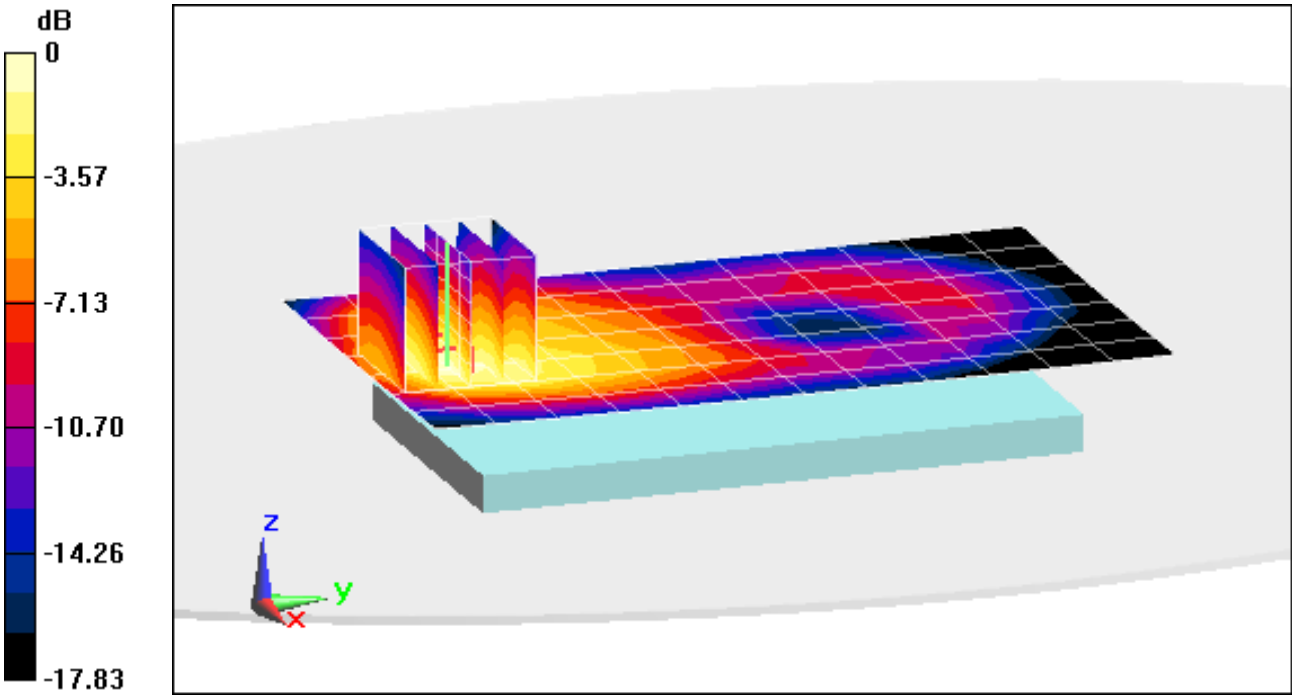
Communication System: UID 0, GSM GPRS; 3 Tx slots; Frequency: 1880 MHz; Duty Cycle: 1:2.76
Medium: 1900 Body, Medium parameters used:
f = 1880 MHz; σ = 1.527 S/m; ε_r = 52.703; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-21-2014; Ambient Temp: 22.4°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3332; ConvF(4.7, 4.7, 4.7); Calibrated: 11/25/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 11/18/2013
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1226
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 with Standard Back Cover

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.263 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.781 W/kg
SAR(1 g) = 0.481 W/kg



0 dB = 0.534 W/kg = -2.72 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

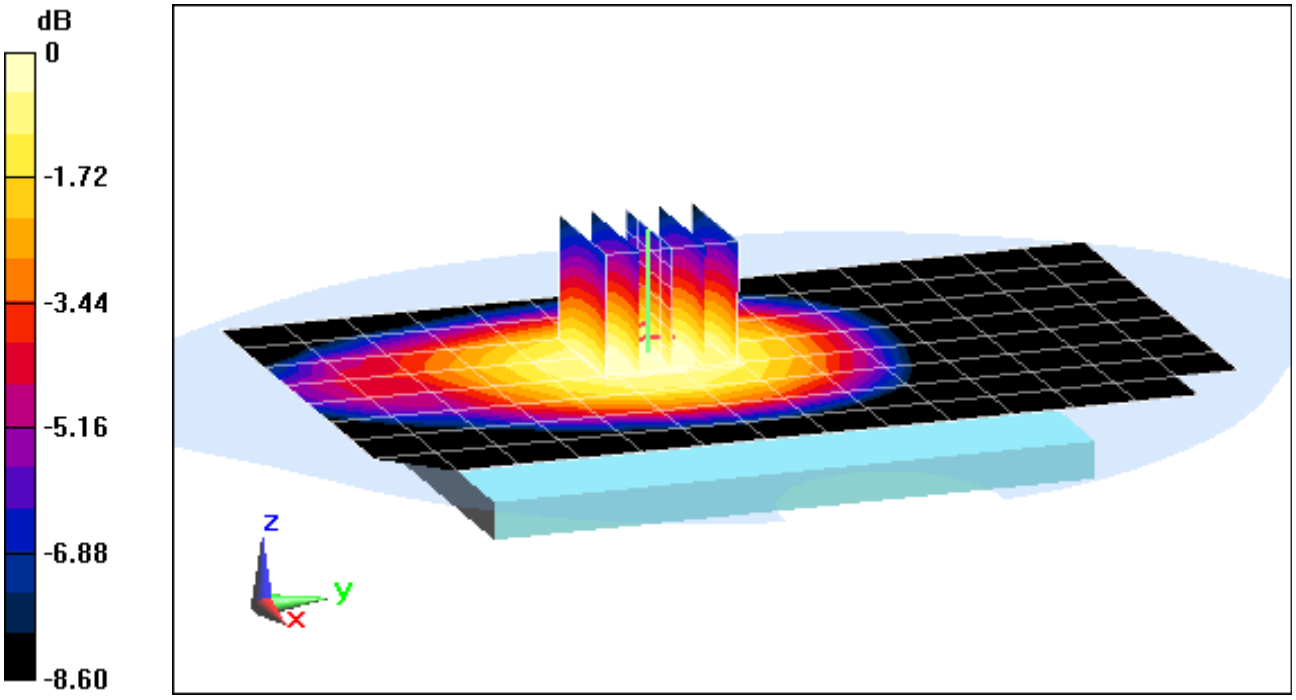
Communication System: UID 0, UMTS; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium: 835 Body, Medium parameters used (interpolated):
f = 836.6 MHz; σ = 1.014 S/m; ε_r = 53.797; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-07-2014; Ambient Temp: 24.1°C; Tissue Temp: 22.7°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
with Standard Back Cover

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 21.366 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 0.538 W/kg
SAR(1 g) = 0.434 W/kg



0 dB = 0.455 W/kg = -3.42 dBW/kg

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

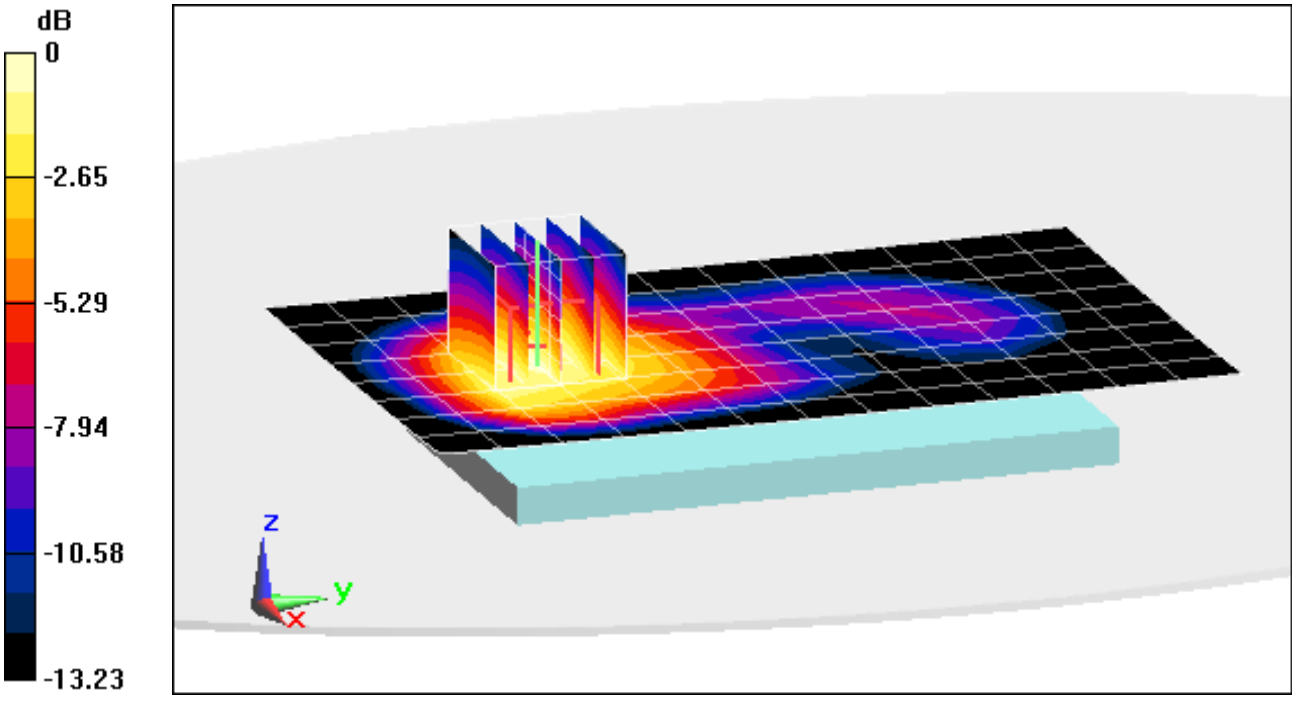
Communication System: UID 0, UMTS; Frequency: 1712.4 MHz; Duty Cycle: 1:1
Medium: 1750 Body, Medium parameters used (interpolated):
f = 1712.4 MHz; σ = 1.432 S/m; ε_r = 52.069; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-08-2014; Ambient Temp: 23.9°C; Tissue Temp: 22.8°C

Probe: EX3DV4 - SN3589; ConvF(6.68, 6.68, 6.68); 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: AWS UMTS, Body SAR, Back Side, Low.ch
with Standard Back Cover

Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 28.192 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 1.57 W/kg
SAR(1 g) = 1.06 W/kg



0 dB = 1.13 W/kg = 0.53 dBW/kg

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

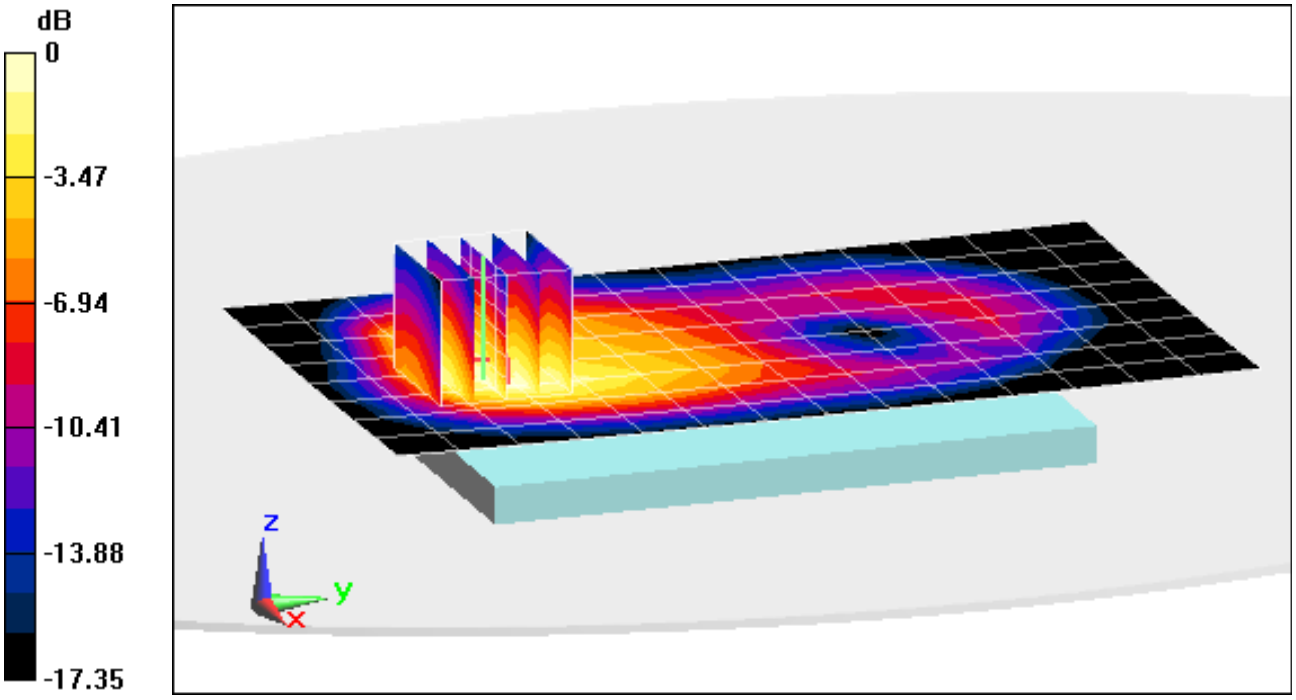
Communication System: UID 0, UMTS; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: 1900 Body, Medium parameters used:
f = 1880 MHz; σ = 1.527 S/m; ε_r = 52.703; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-21-2014; Ambient Temp: 22.4°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3332; ConvF(4.7, 4.7, 4.7); Calibrated: 11/25/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 11/18/2013
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1226
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Mode: UMTS 1900, Body SAR, Back Side, Mid.ch
with Standard Back Cover

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.559 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 1.34 W/kg
SAR(1 g) = 0.820 W/kg



0 dB = 0.909 W/kg = -0.41 dBW/kg

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

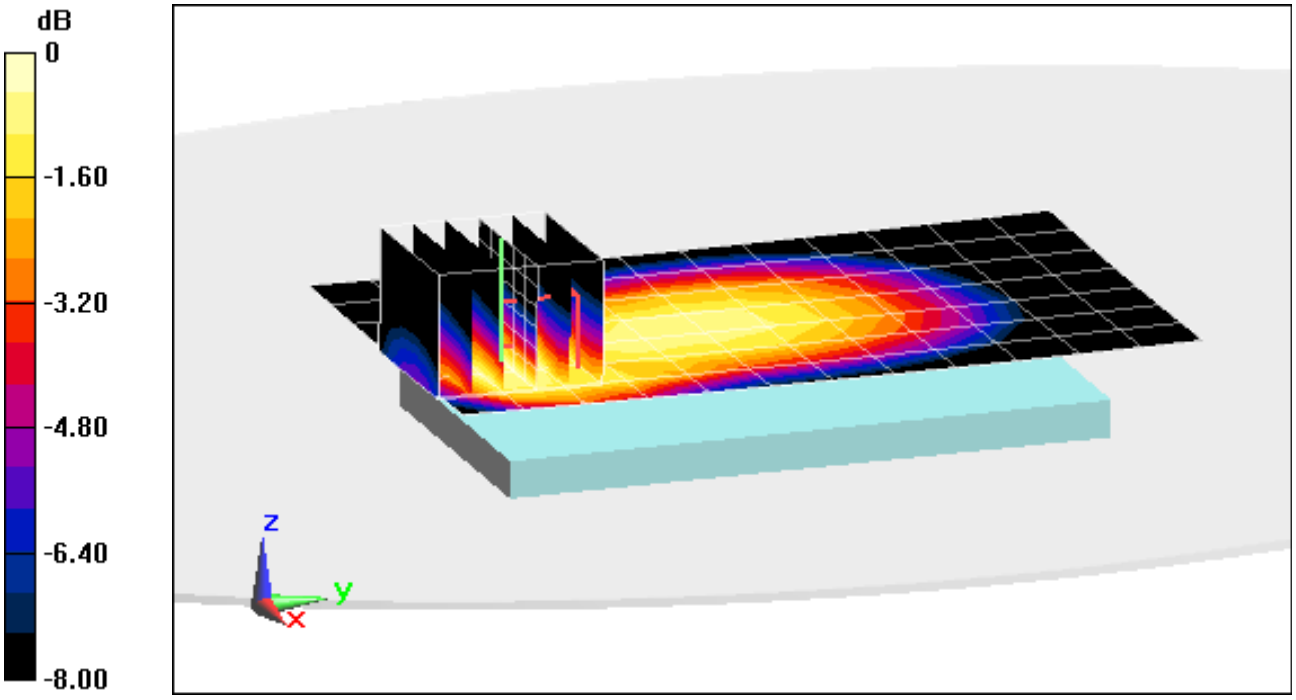
Communication System: UID 0, LTE Band 17; Frequency: 710 MHz; Duty Cycle: 1:1
Medium: 750 Body, Medium parameters used:
f = 710 MHz; σ = 0.944 S/m; ε_r = 55.251; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-07-2014; Ambient Temp: 23.9°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, with Standard Back Cover

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.019 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.262 W/kg
SAR(1 g) = 0.157 W/kg



0 dB = 0.170 W/kg = -7.70 dBW/kg

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

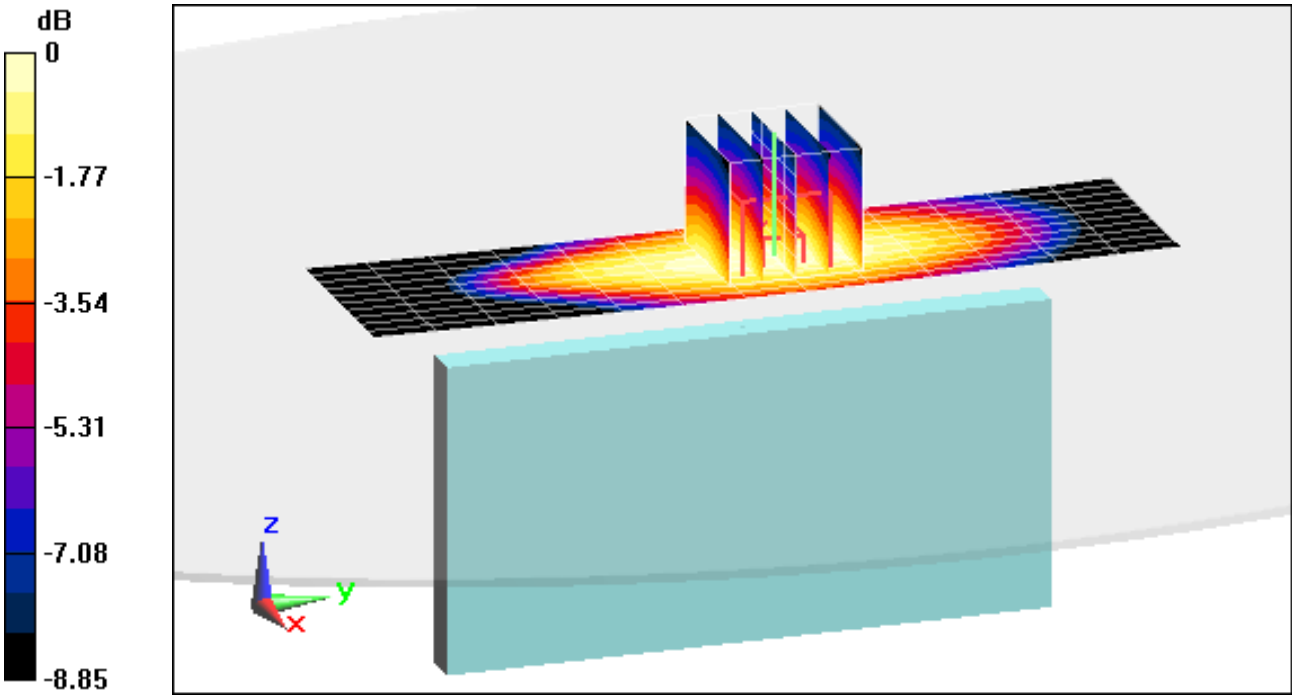
Communication System: UID 0, LTE Band 17; Frequency: 710 MHz; Duty Cycle: 1:1
Medium: 750 Body, Medium parameters used:
f = 710 MHz; σ = 0.944 S/m; ε_r = 55.251; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-07-2014; Ambient Temp: 23.9°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, Left Edge, Mid.ch, 10 MHz Bandwidth, QPSK, 1 RB, 49 RB Offset, with Standard Back Cover

Area Scan (11x14x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.666 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.325 W/kg
SAR(1 g) = 0.242 W/kg



0 dB = 0.252 W/kg = -5.99 dBW/kg

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

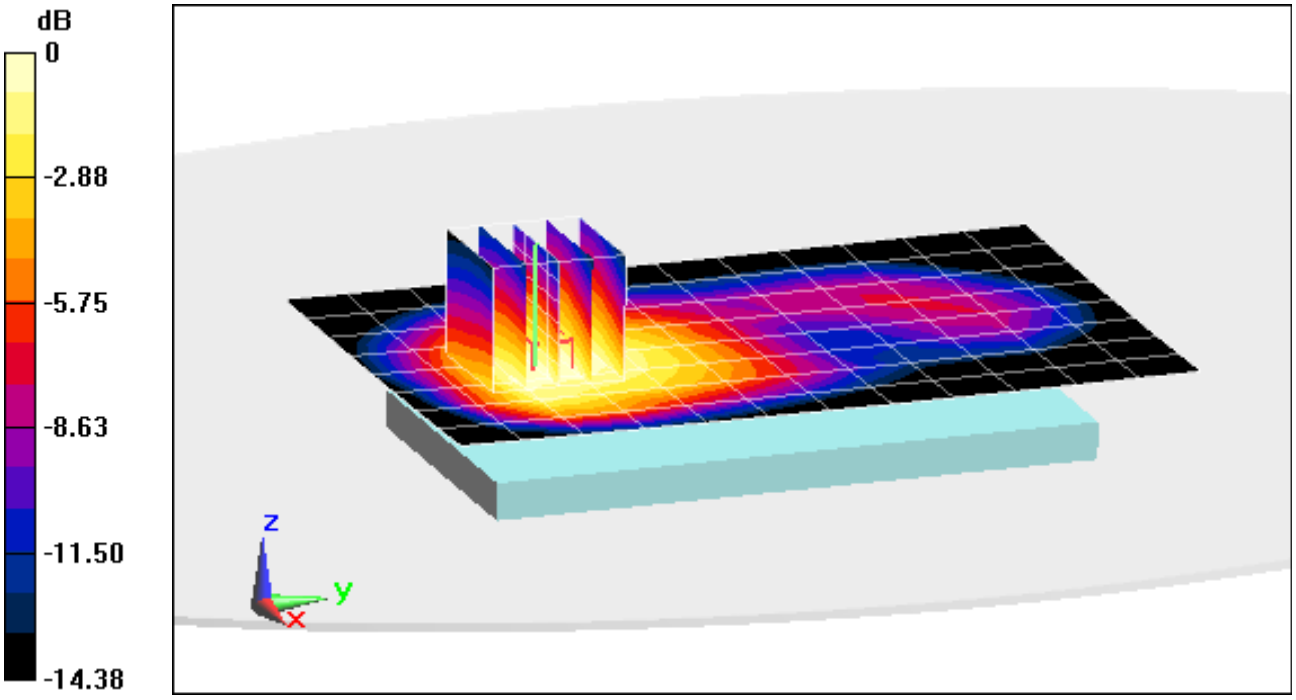
Communication System: UID 0, LTE Band 4 (AWS); Frequency: 1732.5 MHz; Duty Cycle: 1:1
Medium: 1750 Body, Medium parameters used (interpolated):
f = 1732.5 MHz; σ = 1.453 S/m; ε_r = 51.966; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-08-2014; Ambient Temp: 23.9°C; Tissue Temp: 22.8°C

Probe: EX3DV4 - SN3589; ConvF(6.68, 6.68, 6.68); 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 4 (AWS), Body SAR, Back Side, Mid.ch, 20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset, with Standard Back Cover

Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 26.530 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 1.45 W/kg
SAR(1 g) = 0.973 W/kg



0 dB = 1.03 W/kg = 0.13 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

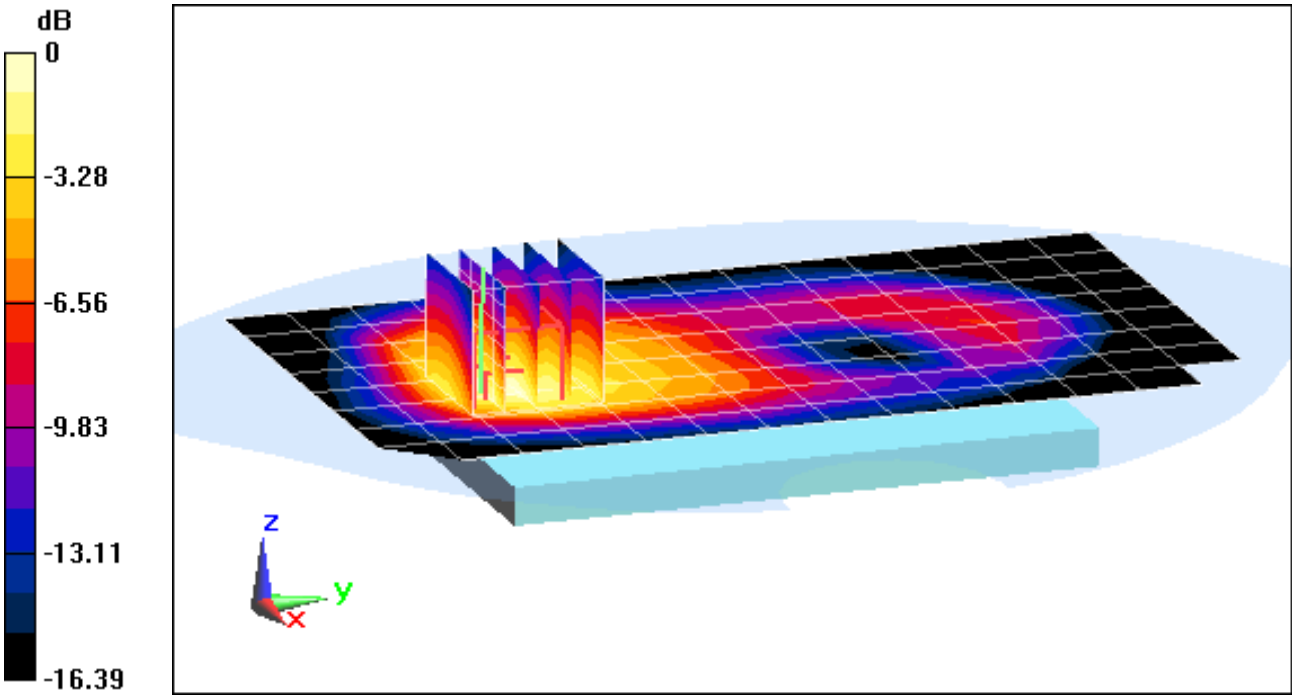
Communication System: UID 0, LTE Band 2 (PCS); Frequency: 1860 MHz; Duty Cycle: 1:1
Medium: 1900 Body, Medium parameters used (interpolated):
f = 1860 MHz; σ = 1.525 S/m; ε_r = 51.958; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-19-2014; Ambient Temp: 24.5°C; Tissue Temp: 22.1°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: LTE Band 2 (PCS), Body SAR, Back Side, Low.ch, 20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset, with Standard Back Cover

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 21.146 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 1.07 W/kg
SAR(1 g) = 0.662 W/kg



0 dB = 0.698 W/kg = -1.56 dBW/kg

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

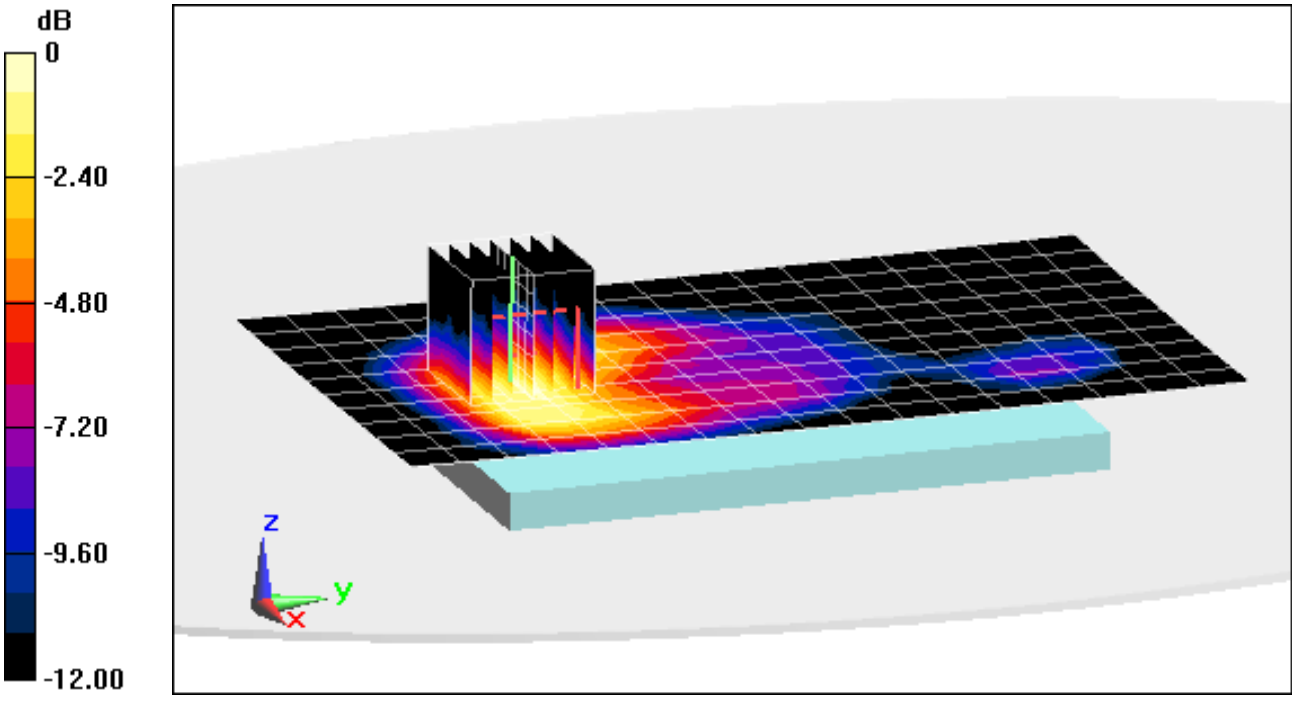
Communication System: UID 0, LTE Band 7; Frequency: 2505 MHz; Duty Cycle: 1:1
Medium: 2450 Body, Medium parameters used (interpolated):
f = 2505 MHz; σ = 2.029 S/m; ε_r = 51.378; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-08-2014; Ambient Temp: 24.3°C; Tissue Temp: 23.4°C

Probe: ES3DV3 - SN3258; ConvF(4.14, 4.14, 4.14); 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, Low.ch, 10 MHz Bandwidth, QPSK, 1 RB, 25 RB Offset, with Standard Back Cover

Area Scan (11x18x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.370 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 0.142 W/kg
SAR(1 g) = 0.075 W/kg



0 dB = 0.0930 W/kg = -10.32 dBW/kg

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

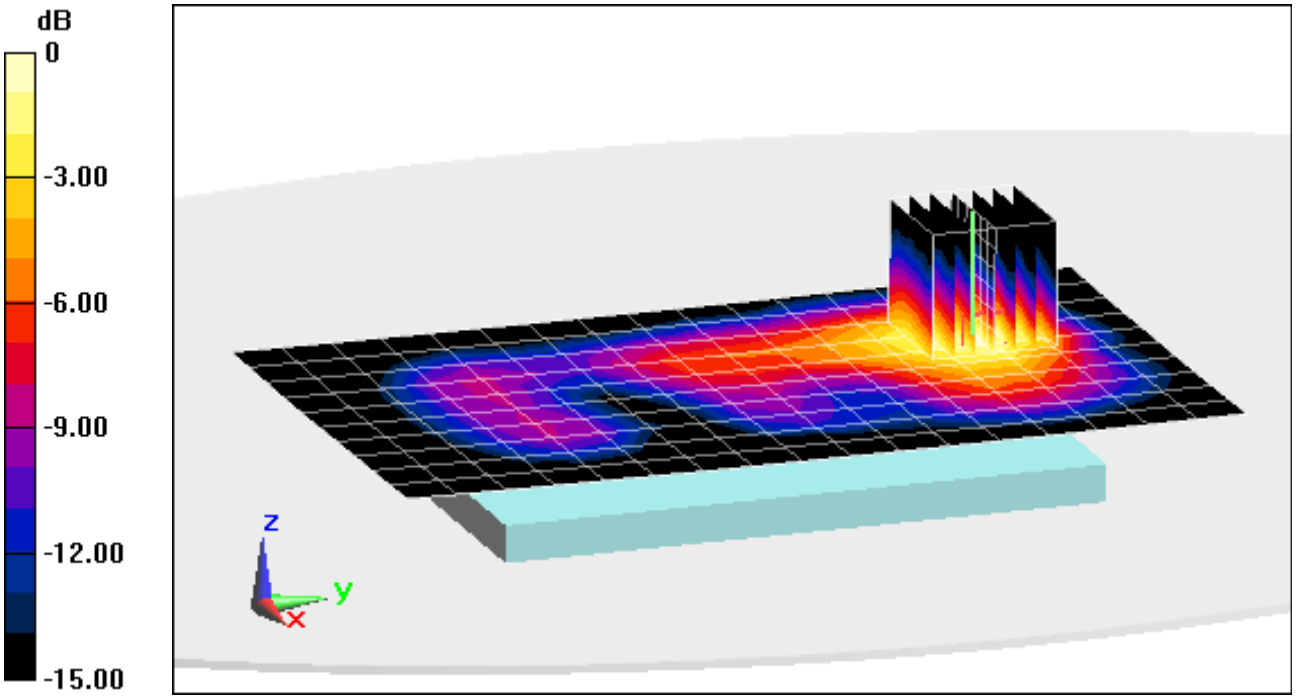
Communication System: UID 0, IEEE 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1
Medium: 2450 Body, Medium parameters used (interpolated):
f = 2412 MHz; σ = 1.991 S/m; ε_r = 51.258; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-05-2014; Ambient Temp: 24.0°C; Tissue Temp: 23.1°C

Probe: ES3DV3 - SN3258; ConvF(4.14, 4.14, 4.14); 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: IEEE 802.11b, Body SAR, Ch 01, 1 Mbps, Back Side with Folio Accessory, Closed

Area Scan (11x18x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.218 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.392 W/kg
SAR(1 g) = 0.176 W/kg



0 dB = 0.225 W/kg = -6.48 dBW/kg

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

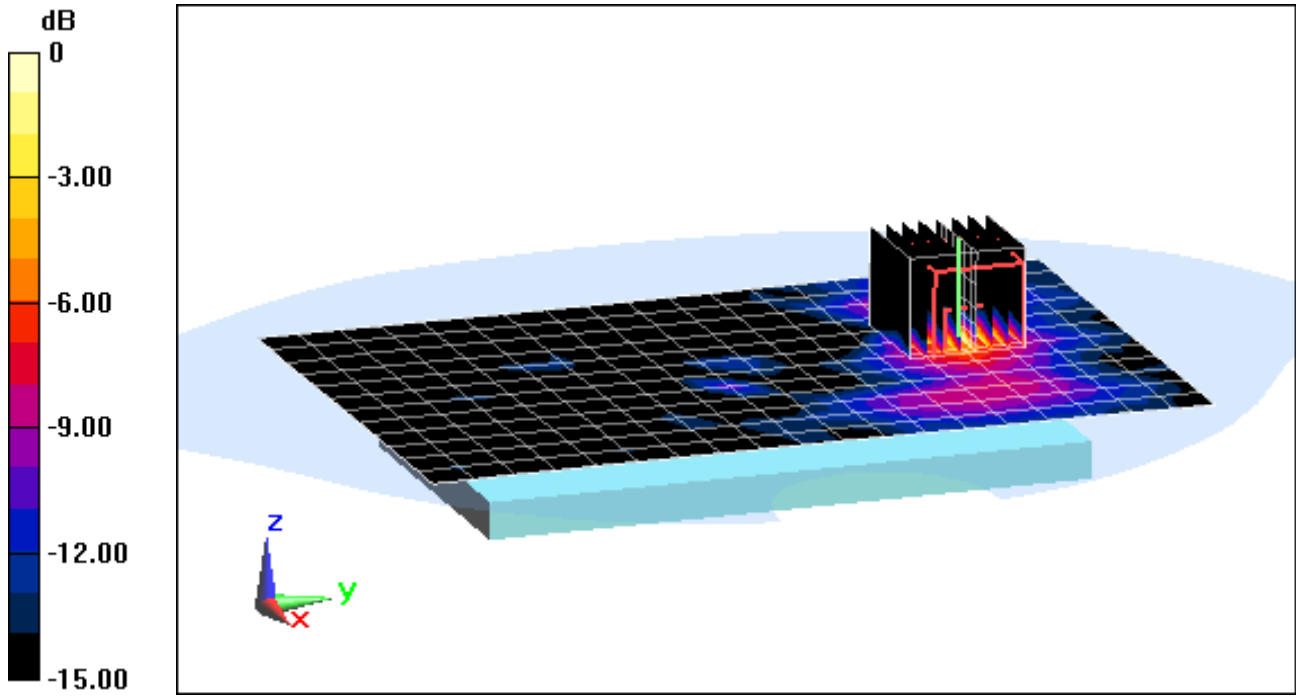
Communication System: UID 0, IEEE 802.11a; Frequency: 5765 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body, Medium parameters used:
f = 5765 MHz; σ = 6.224 S/m; ε_r = 46.405; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-06-2014; Ambient Temp: 24.0°C; Tissue Temp: 22.6°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 with Standard Back Cover

Area Scan (13x20x1): 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 = 4.719 V/m; Power Drift = -0.20 dB
Peak SAR (extrapolated) = 0.516 W/kg
SAR(1 g) = 0.132 W/kg



0 dB = 0.288 W/kg = -5.41 dBW/kg

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

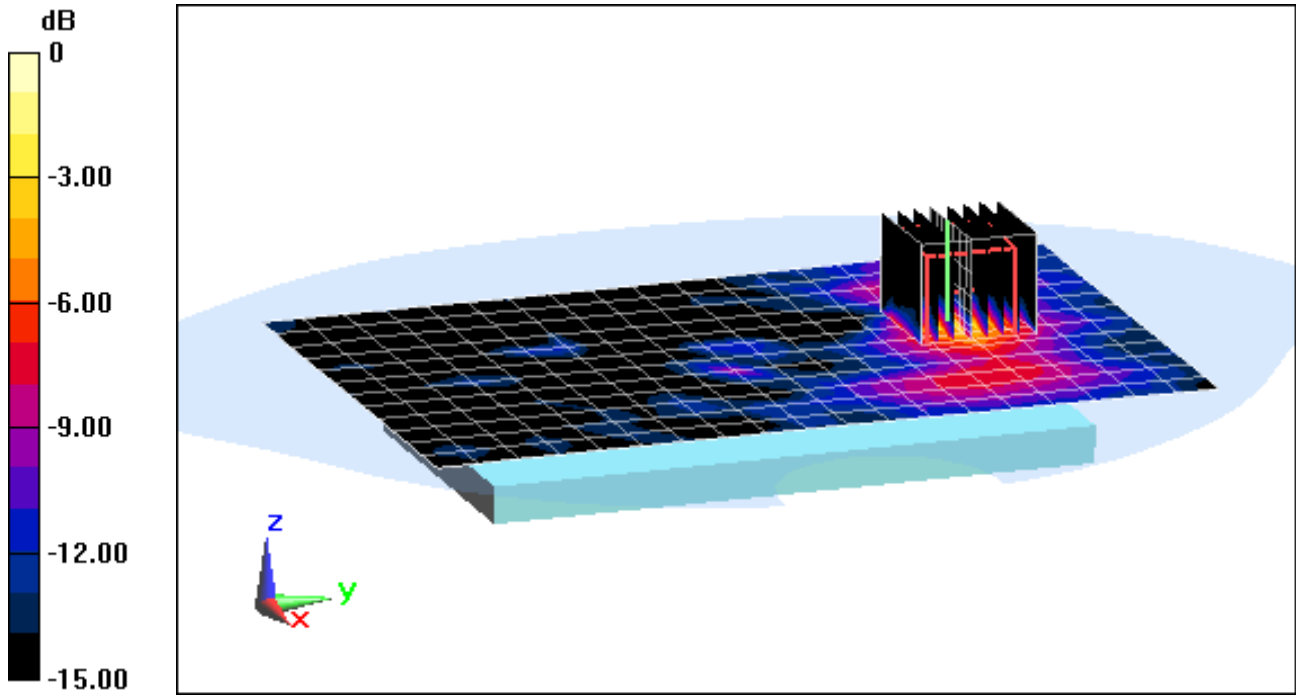
Communication System: UID 0, IEEE 802.11a; Frequency: 5540 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body, Medium parameters used:
f = 5540 MHz; σ = 5.869 S/m; ε_r = 46.142; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-06-2014; Ambient Temp: 23.9°C; Tissue Temp: 22.6°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 with Standard Back Cover

Area Scan (13x20x1): 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 = 4.738 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 0.391 W/kg
SAR(1 g) = 0.110 W/kg



0 dB = 0.231 W/kg = -6.36 dBW/kg

APPENDIX B: SYSTEM VERIFICATION

PCTEST ENGINEERING LABORATORY, INC.

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

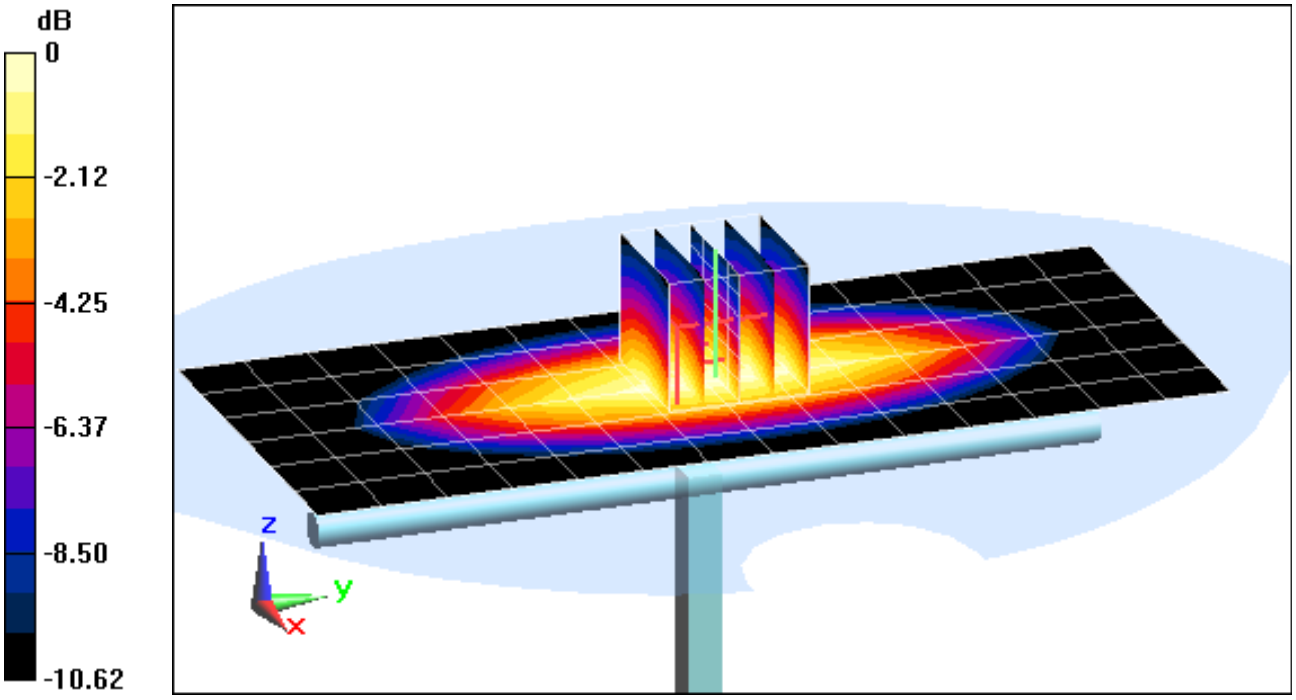
Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1
Medium: 750 Head, Medium parameters used (interpolated):
f = 750 MHz; σ = 0.891 S/m; ε_r = 40.67; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 05-16-2014; Ambient Temp: 23.8°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3287; ConvF(6.52, 6.52, 6.52); Calibrated: 11/20/2013;
Sensor-Surface: 4mm (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)

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) = 1.19 W/kg
SAR(1 g) = 0.796 W/kg
Deviation = -4.90%



0 dB = 0.860 W/kg = -0.66 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d133

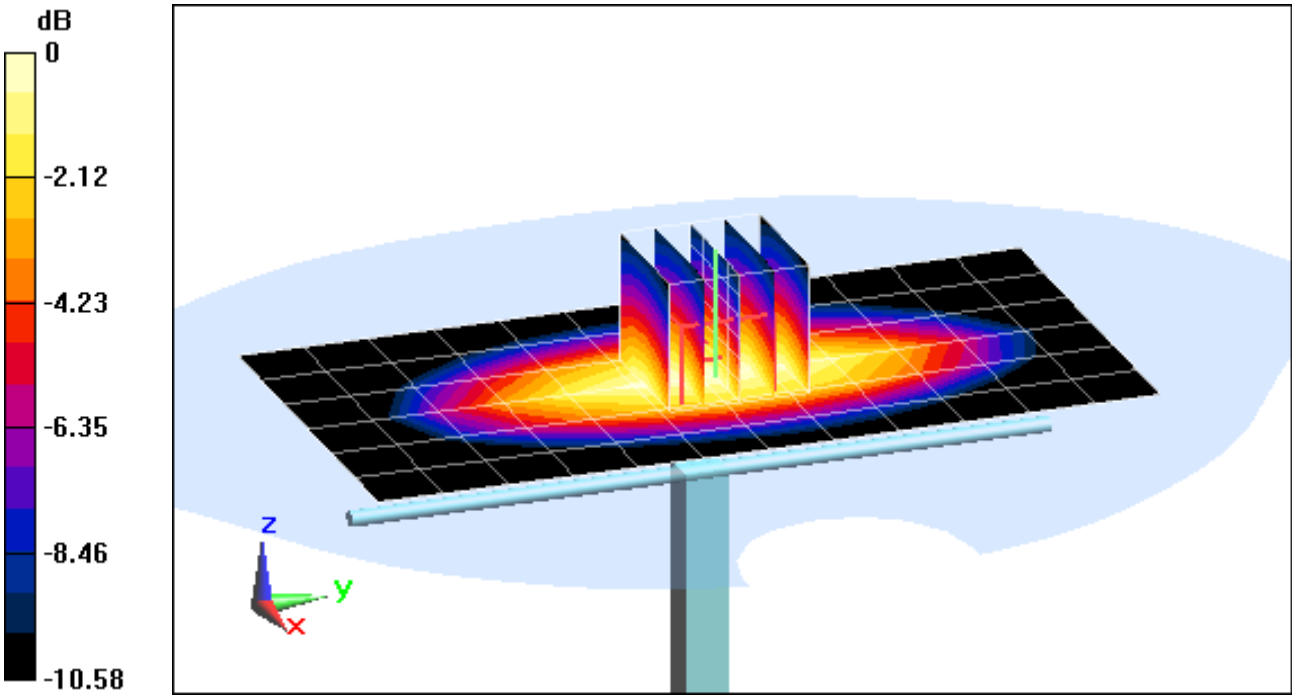
Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: 835 Head, Medium parameters used:
f = 835 MHz; σ = 0.905 S/m; ε_r = 40.853; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 05-14-2014; Ambient Temp: 22.5°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3213; ConvF(6.37, 6.37, 6.37); Calibrated: 4/11/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1364; Calibrated: 3/17/2014
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7164)

835 MHz System Verification

Area Scan (7x13x1): 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) = 1.40 W/kg
SAR(1 g) = 0.964 W/kg
Deviation = 0.21%



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

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: 1051

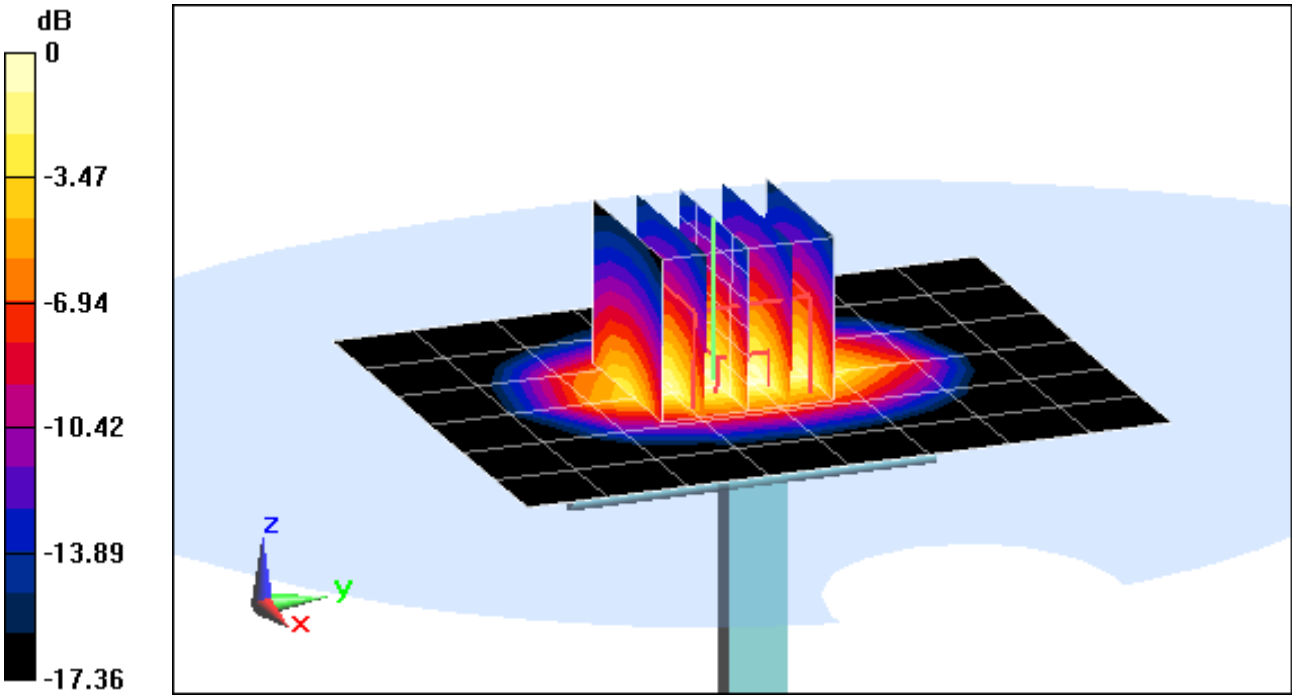
Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1
Medium: 1750 Head, Medium parameters used:
f = 1750 MHz; σ = 1.413 S/m; ε_r = 40.514; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-14-2014; Ambient Temp: 23.0°C; Tissue Temp: 22.4°C

Probe: ES3DV3 - SN3258; ConvF(5.19, 5.19, 5.19); 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)

1750 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 6.39 W/kg
SAR(1 g) = 3.46 W/kg
Deviation = -4.42%



0 dB = 3.82 W/kg = 5.82 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

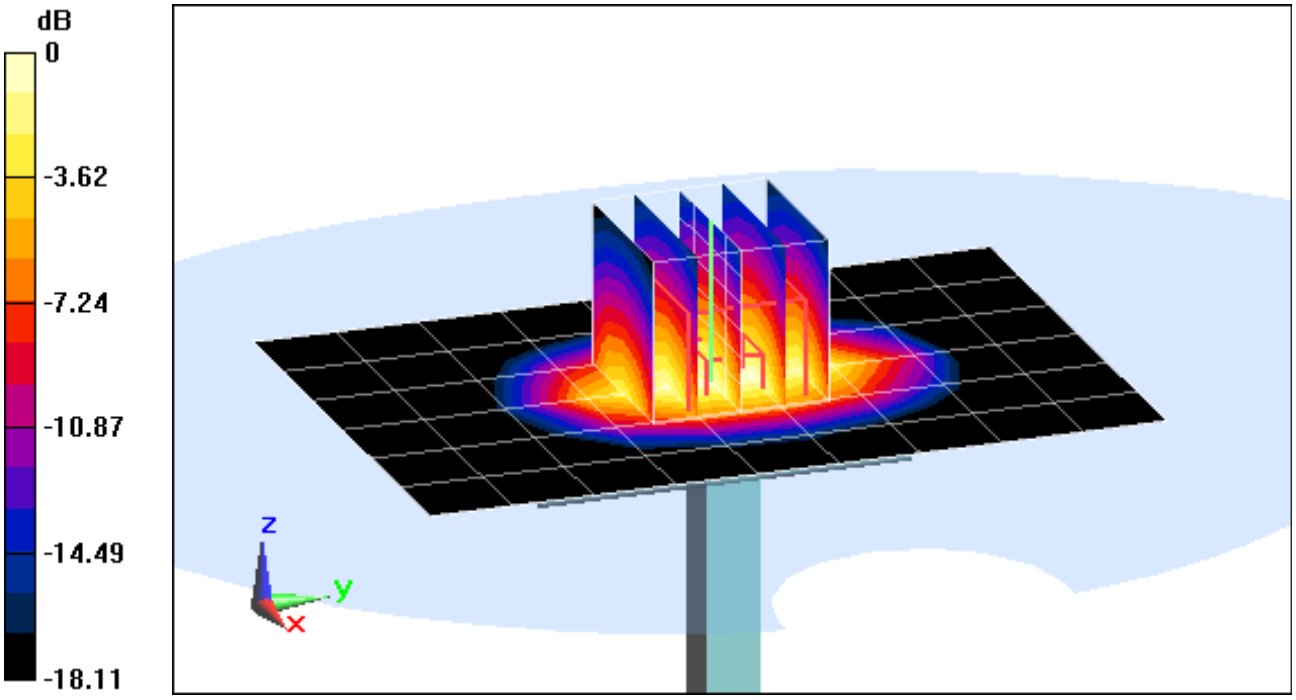
Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Head, Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.452 S/m; ε_r = 39.981; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-12-2014; Ambient Temp: 23.2°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3209; ConvF(5.13, 5.13, 5.13); Calibrated: 3/19/2014;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 3/17/2014
Phantom: SAM right; Type: QD000P40CD; Serial: TP:1757
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) = 7.60 W/kg
SAR(1 g) = 4.10 W/kg
Deviation = 1.49%



0 dB = 4.57 W/kg = 6.60 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

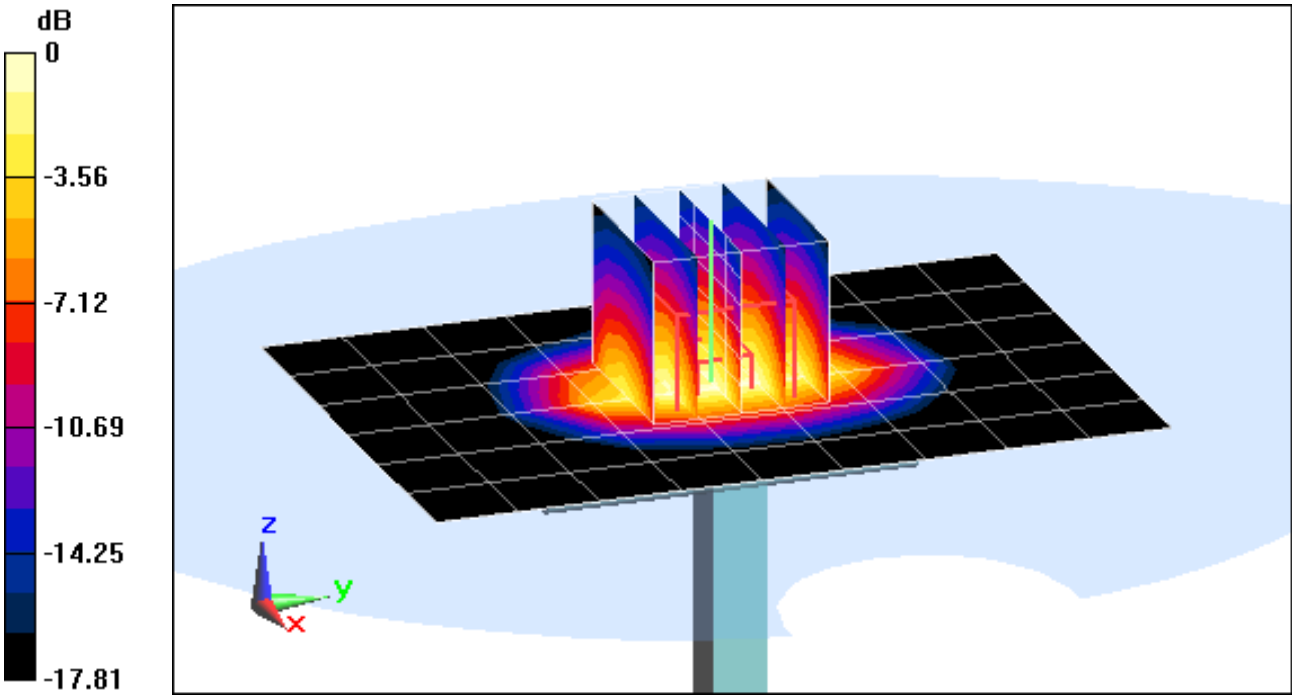
Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Head, Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.45 S/m; ε_r = 40.066; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-19-2014; Ambient Temp: 24.0°C; Tissue Temp: 22.5°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) = 7.27 W/kg
SAR(1 g) = 3.91 W/kg
Deviation = -3.22%



0 dB = 4.40 W/kg = 6.43 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

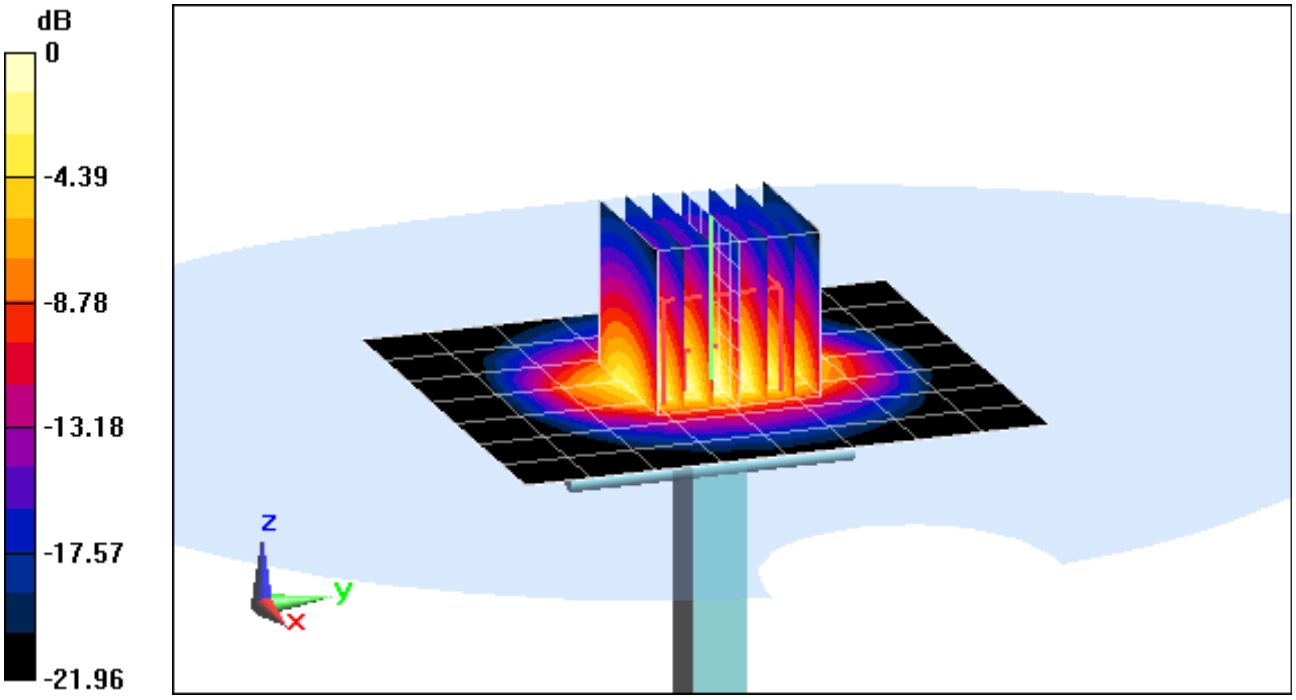
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 Head, Medium parameters used:
f = 2450 MHz; σ = 1.818 S/m; ε_r = 38.487; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-05-2014; Ambient Temp: 23.3°C; Tissue Temp: 22.5°C

Probe: EX3DV4 - SN3589; ConvF(6.45, 6.45, 6.45); Calibrated: 1/29/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/22/2014
Phantom: SAM; Type: QD000P40CD; Serial: TP:1758
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 = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 10.4 W/kg
SAR(1 g) = 5.08 W/kg
Deviation = -1.93%



0 dB = 6.60 W/kg = 8.20 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

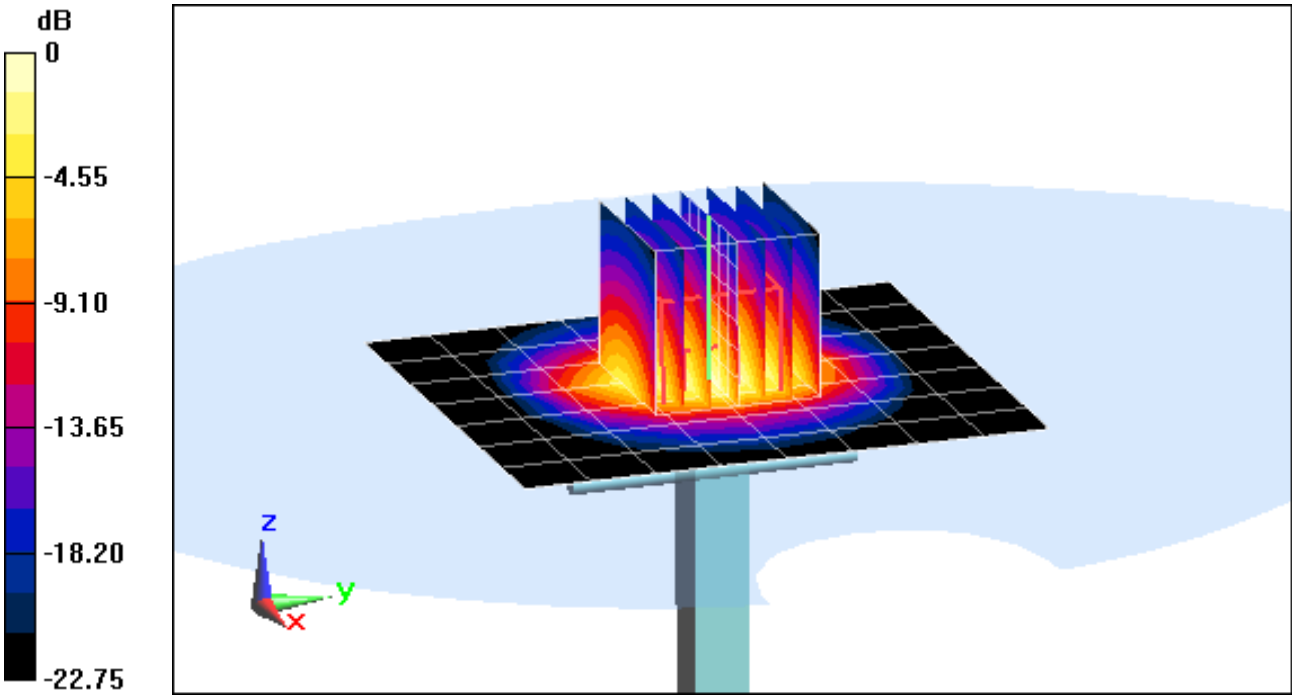
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 Head, Medium parameters used:
f = 2450 MHz; σ = 1.824 S/m; ε_r = 38.997; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-20-2014; Ambient Temp: 24.1°C; Tissue Temp: 22.2°C

Probe: ES3DV3 - SN3287; ConvF(4.43, 4.43, 4.43); Calibrated: 11/20/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1408; Calibrated: 11/19/2013
Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1797
Measurement SW: DASY52, Version 52.8 (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 = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 11.5 W/kg
SAR(1 g) = 5.53 W/kg
Deviation = 6.76%



0 dB = 7.27 W/kg = 8.62 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

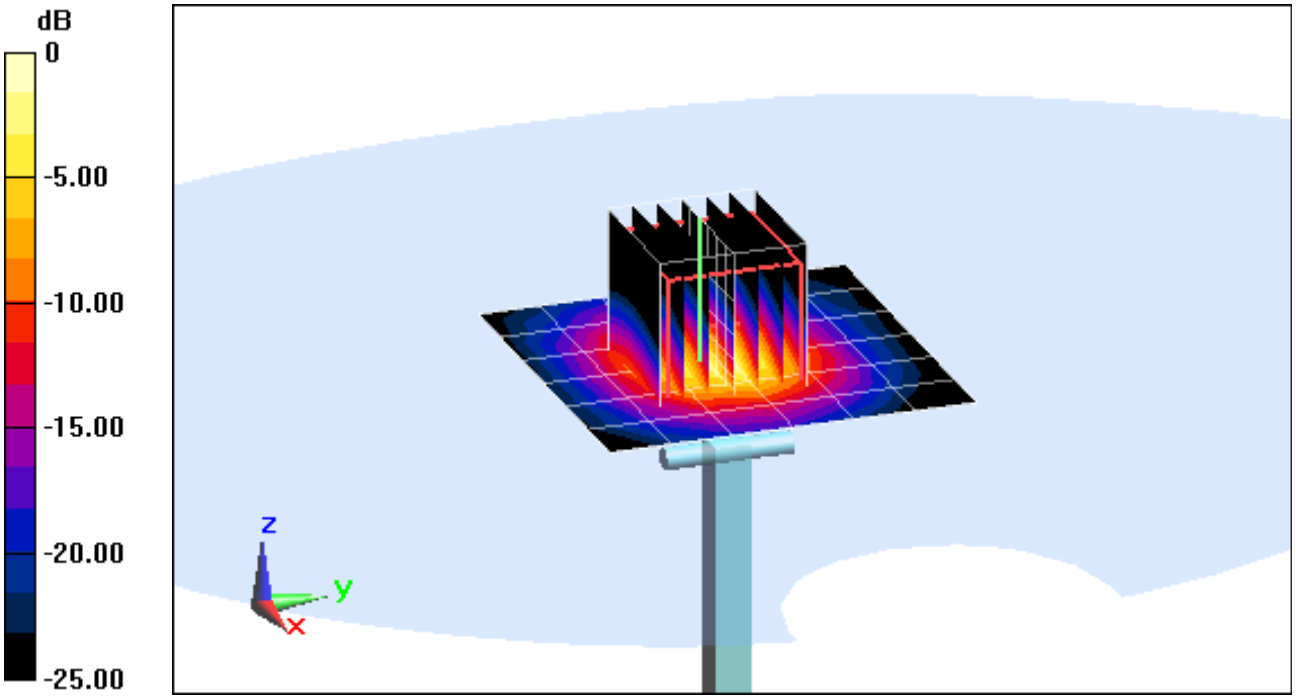
Communication System: UID 0, CW; Frequency: 5200 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head, Medium parameters used:
f = 5200 MHz; σ = 4.563 S/m; ε_r = 36.659; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-14-2014; Ambient Temp: 24.5°C; Tissue Temp: 24.2°C

Probe: EX3DV4 - SN3914; ConvF(4.99, 4.99, 4.99); Calibrated: 10/23/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

5200 MHz System Verification

Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 30.0 W/kg
SAR(1 g) = 7.27 W/kg
Deviation = -6.79%



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

PCTEST ENGINEERING LABORATORY, INC.

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

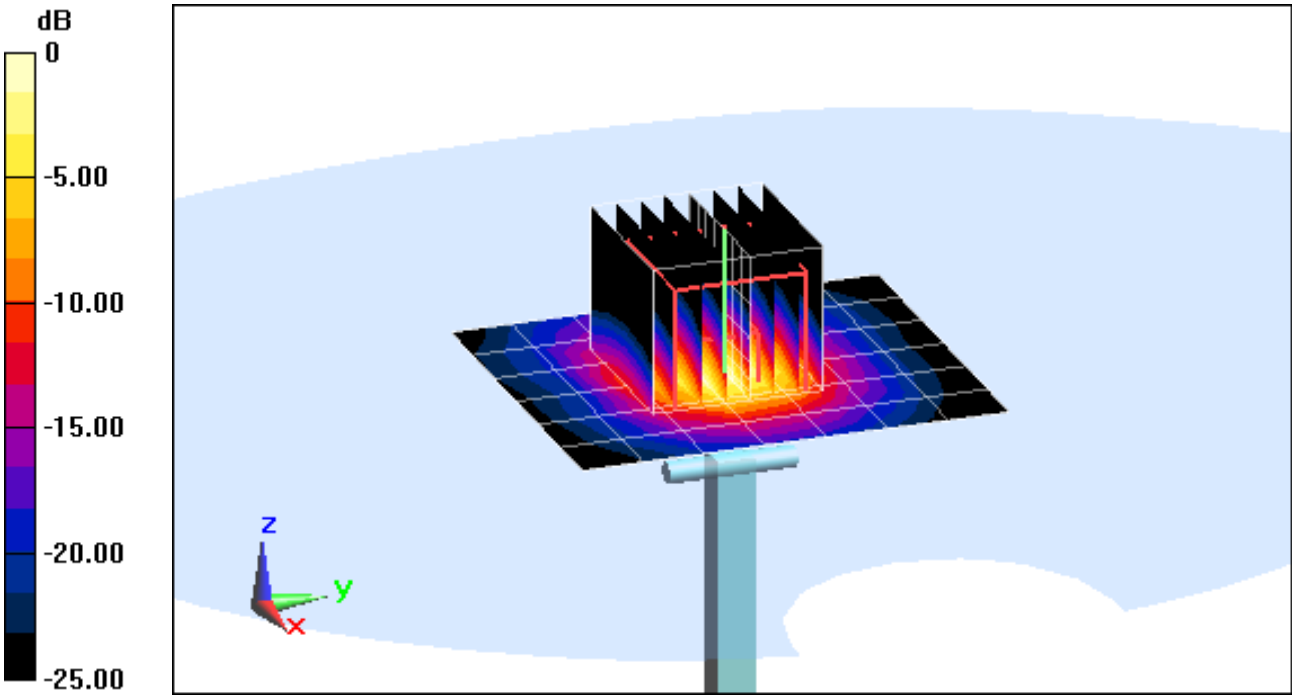
Communication System: UID 0, CW; Frequency: 5300 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head, Medium parameters used:
f = 5300 MHz; σ = 4.649 S/m; ε_r = 36.515; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-14-2014; Ambient Temp: 24.5°C; Tissue Temp: 24.3°C

Probe: EX3DV4 - SN3914; ConvF(4.82, 4.82, 4.82); Calibrated: 10/23/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

5300 MHz System Verification

Area Scan (7x8x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 32.5 W/kg
SAR(1 g) = 7.68 W/kg
Deviation = -7.47%



0 dB = 15.9 W/kg = 12.01 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

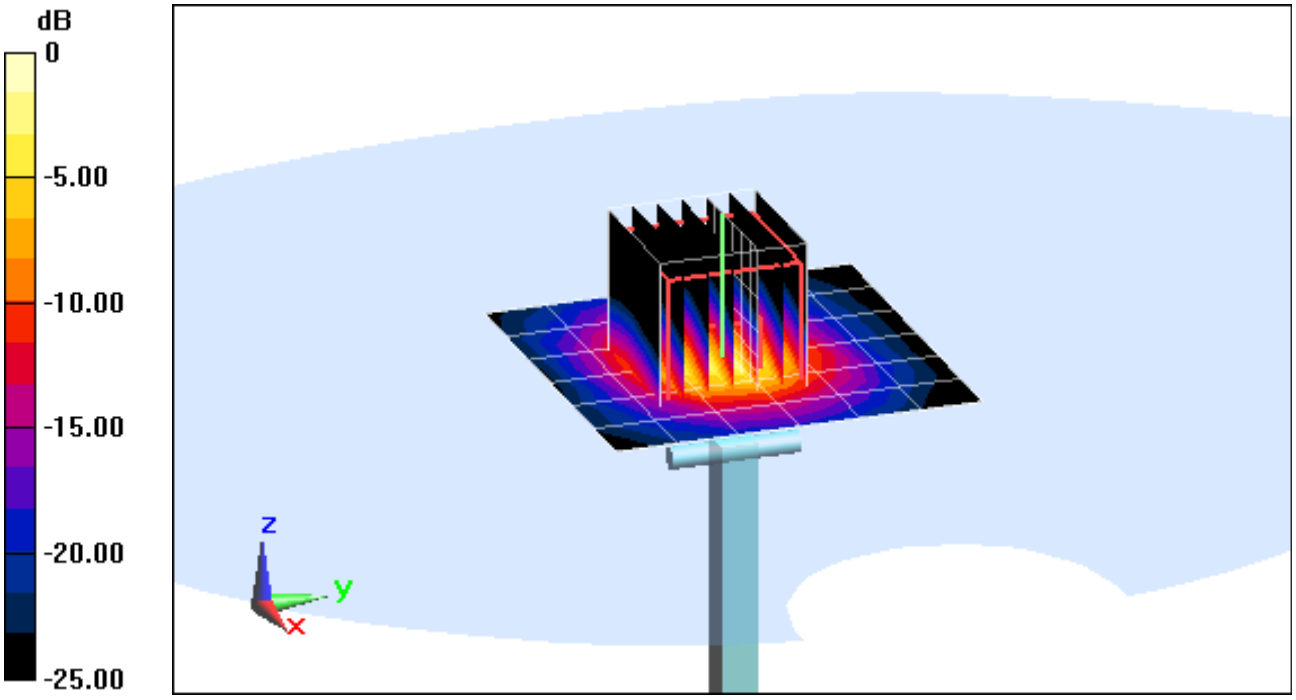
Communication System: UID 0, CW; Frequency: 5500 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head, Medium parameters used:
f = 5500 MHz; σ = 4.861 S/m; ε_r = 36.288; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-14-2014; Ambient Temp: 24.2°C; Tissue Temp: 24.0°C

Probe: EX3DV4 - SN3914; ConvF(4.55, 4.55, 4.55); Calibrated: 10/23/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

5500 MHz System Verification

Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 33.6 W/kg
SAR(1 g) = 7.67 W/kg
Deviation = -9.02%



0 dB = 18.4 W/kg = 12.65 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

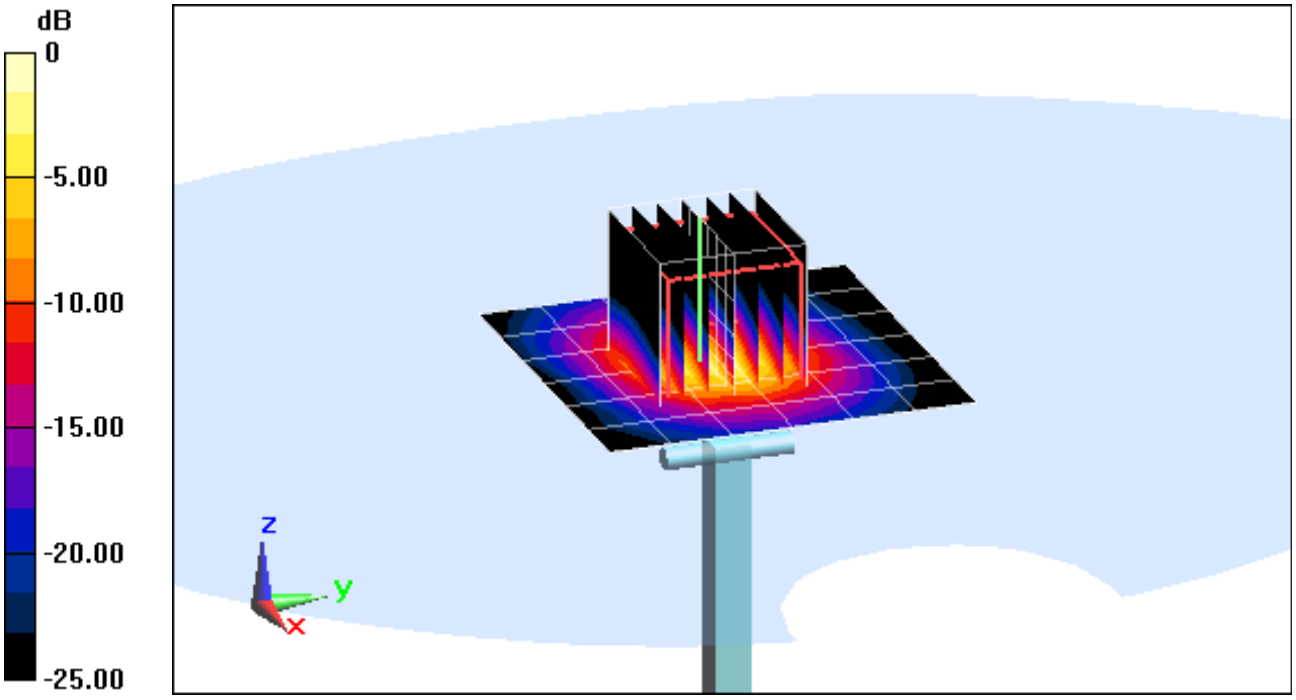
Communication System: UID 0, CW; Frequency: 5800 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head, Medium parameters used:
f = 5800 MHz; σ = 5.13 S/m; ε_r = 35.894; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-14-2014; Ambient Temp: 24.5°C; Tissue Temp: 24.1°C

Probe: EX3DV4 - SN3914; ConvF(4.52, 4.52, 4.52); Calibrated: 10/23/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

5800 MHz System Verification

Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 35.3 W/kg
SAR(1 g) = 7.64 W/kg
Deviation = -3.66%



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

PCTEST ENGINEERING LABORATORY, INC.

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

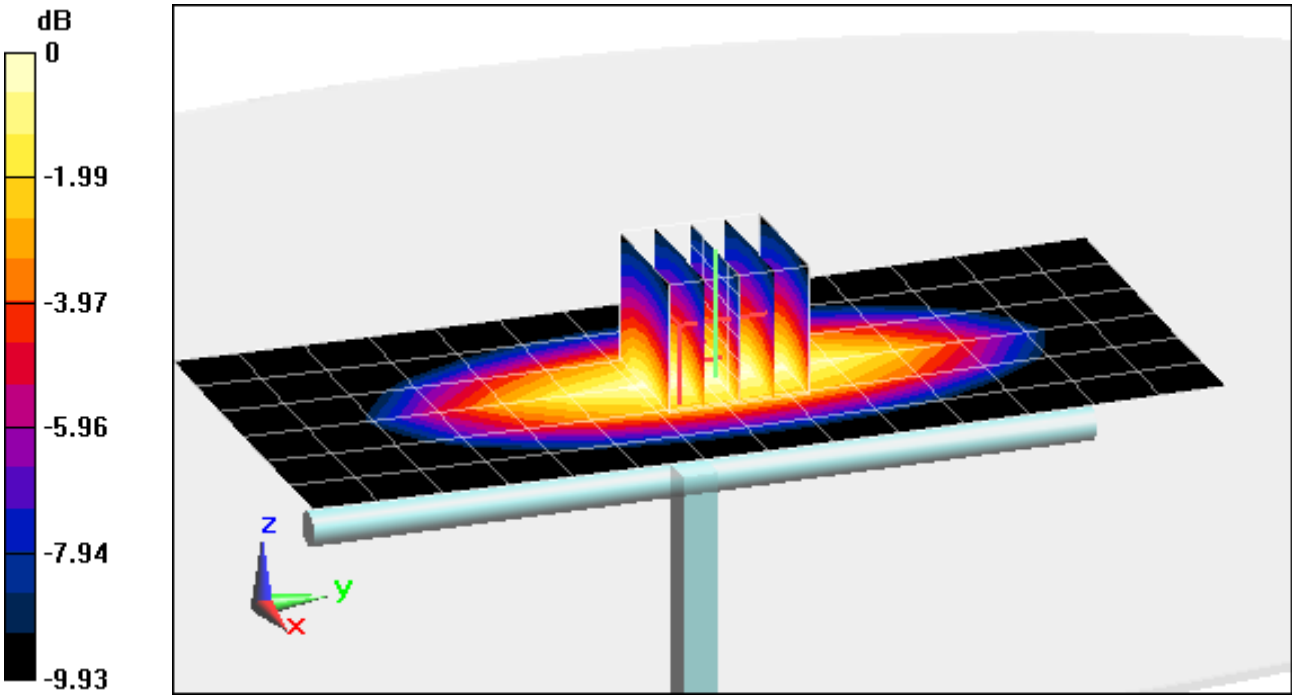
Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1
Medium: 750 Body, Medium parameters used (interpolated):
f = 750 MHz; σ = 0.981 S/m; ε_r = 54.822; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 05-07-2014; Ambient Temp: 23.9°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) = 1.26 W/kg
SAR(1 g) = 0.890 W/kg
Deviation = 1.48%



0 dB = 0.961 W/kg = -0.17 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

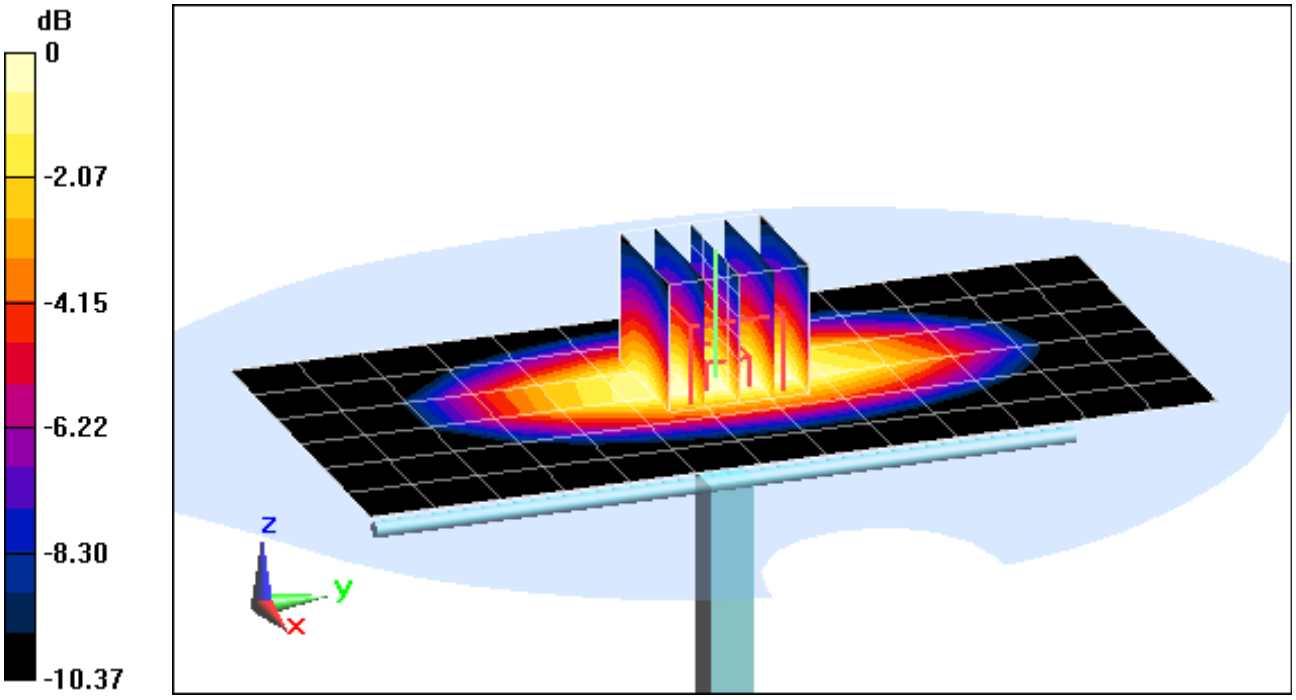
Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: 835 Body, Medium parameters used:
f = 835 MHz; σ = 1.012 S/m; ε_r = 53.811; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 05-07-2014; Ambient Temp: 24.1°C; Tissue Temp: 22.7°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) = 1.43 W/kg
SAR(1 g) = 0.991 W/kg
Deviation = 6.10%



0 dB = 1.07 W/kg = 0.29 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: 1051

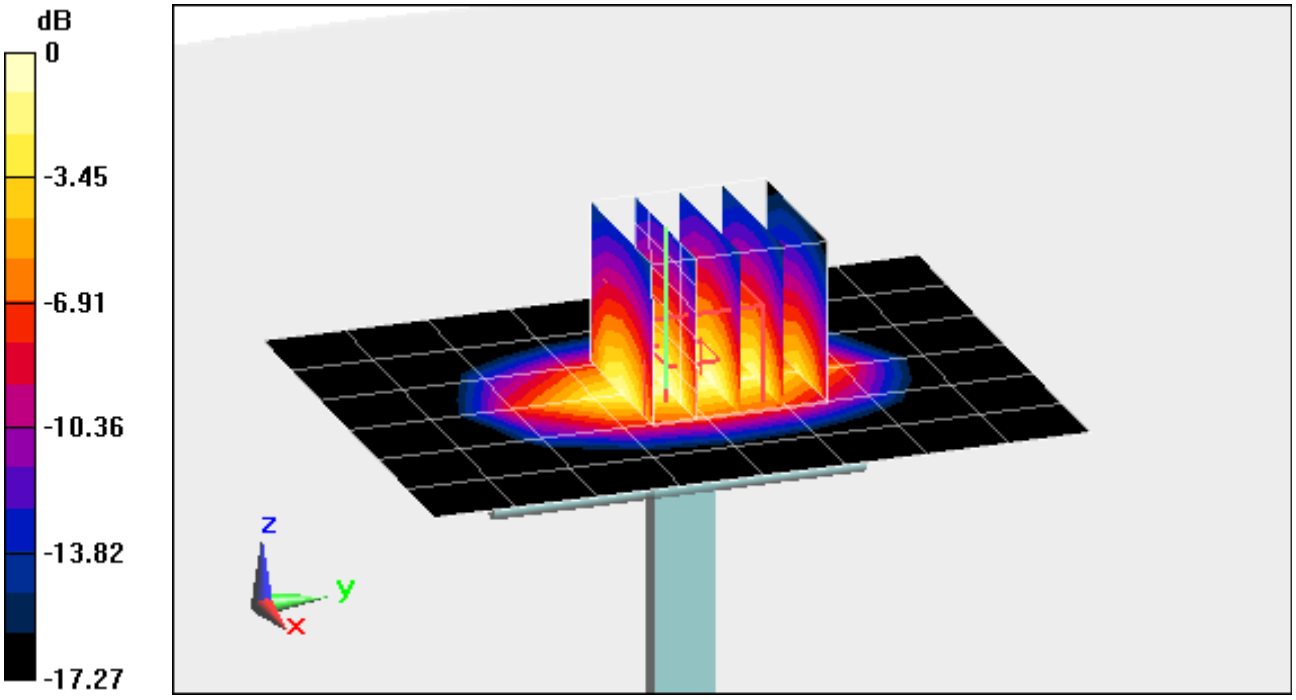
Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1
Medium: 1750 Body, Medium parameters used:
f = 1750 MHz; σ = 1.472 S/m; ε_r = 51.877; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-08-2014; Ambient Temp: 23.9°C; Tissue Temp: 22.8°C

Probe: EX3DV4 - SN3589; ConvF(6.68, 6.68, 6.68); 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)

1750 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 7.22 W/kg
SAR(1 g) = 4.01 W/kg
Deviation = 7.22%



0 dB = 4.44 W/kg = 6.47 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: 1051

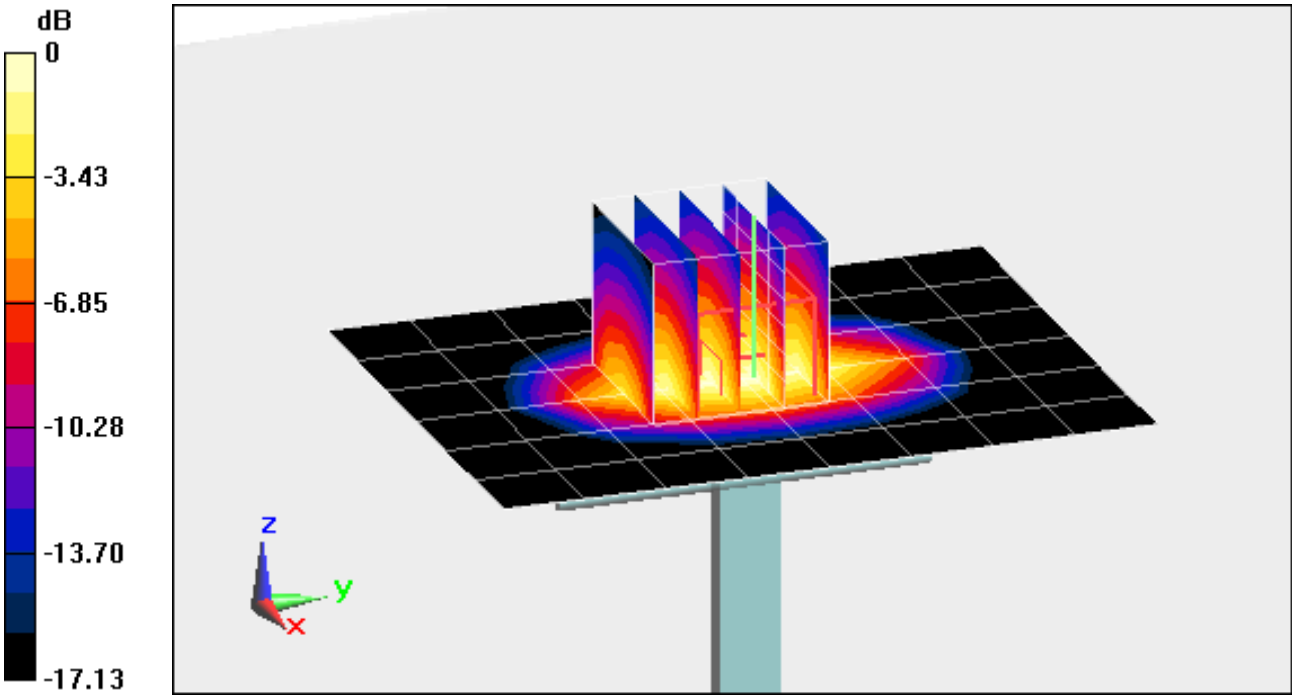
Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1
Medium: 1750 Body, Medium parameters used:
f = 1750 MHz; σ = 1.473 S/m; ε_r = 52.582; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-14-2014; Ambient Temp: 21.5°C; Tissue Temp: 23.1°C

Probe: ES3DV3 - SN3332; ConvF(4.93, 4.93, 4.93); Calibrated: 11/25/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 11/18/2013
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1226
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

1750 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 6.82 W/kg
SAR(1 g) = 3.89 W/kg
Deviation = 4.01%



0 dB = 4.32 W/kg = 6.35 dBW/kg

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

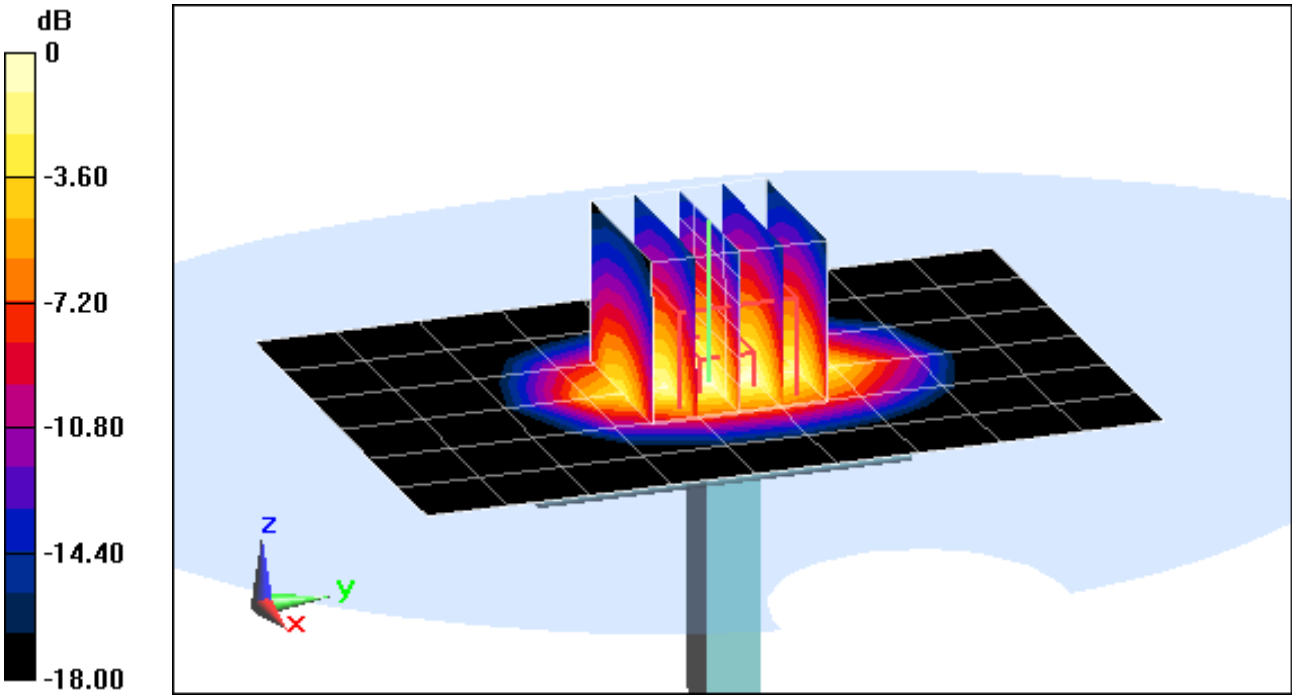
Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Body, Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.572 S/m; ε_r = 51.811; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-19-2014; Ambient Temp: 24.5°C; Tissue Temp: 22.1°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) = 7.67 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: Dipole 1900 MHz; Type: D1900V2; Serial: 5d149

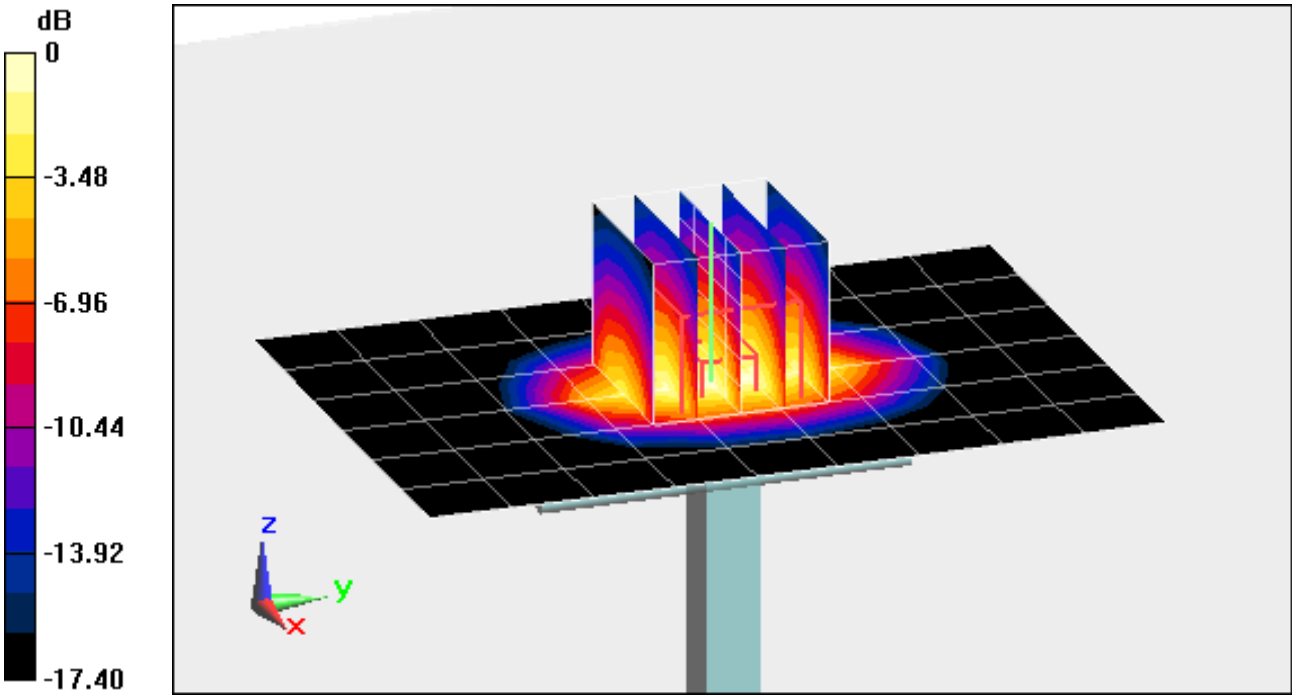
Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Body, Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.551 S/m; ε_r = 52.633; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-21-2014; Ambient Temp: 22.4°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3332; ConvF(4.7, 4.7, 4.7); Calibrated: 11/25/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 11/18/2013
Phantom: ELI v5.0; Type: QDOVA001BB; Serial: 1226
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) = 7.77 W/kg
SAR(1 g) = 4.31 W/kg
Deviation = 6.42%



0 dB = 4.83 W/kg = 6.84 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

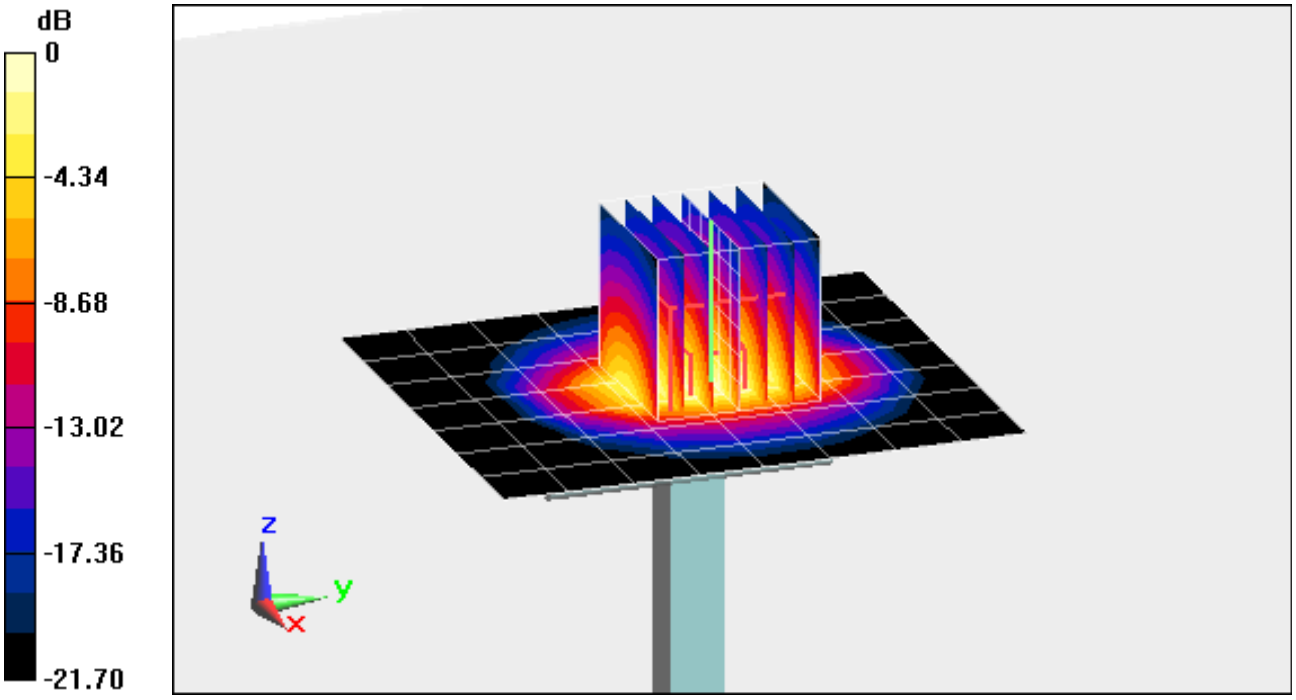
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 Body, Medium parameters used:
f = 2450 MHz; σ = 1.96 S/m; ε_r = 51.563; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-08-2014; Ambient Temp: 24.3°C; Tissue Temp: 23.4°C

Probe: ES3DV3 - SN3258; ConvF(4.14, 4.14, 4.14); 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)

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) = 4.29 W/kg
SAR(1 g) = 2.05 W/kg
Deviation = 3.74%



0 dB = 2.68 W/kg = 4.28 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

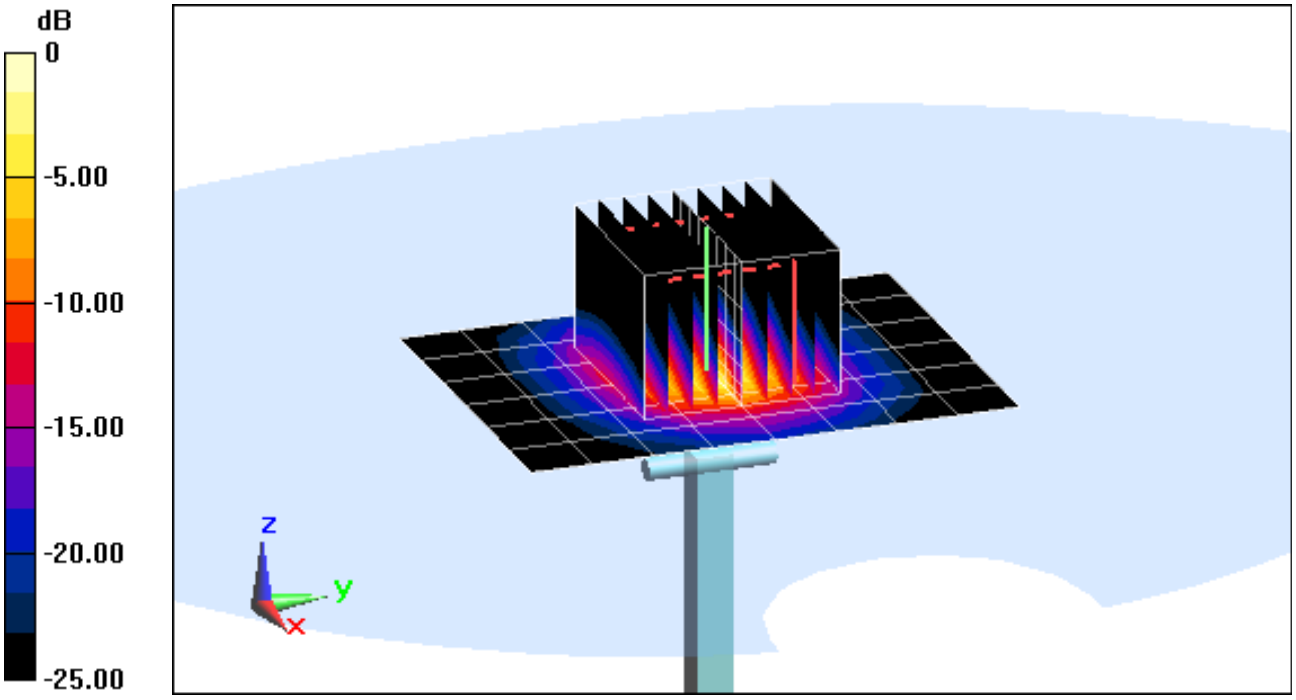
Communication System: UID 0, CW; Frequency: 5200 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body, Medium parameters used:
f = 5200 MHz; σ = 5.155 S/m; ε_r = 47.532; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-06-2014; Ambient Temp: 23.8°C; Tissue Temp: 22.5°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)

5200 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 29.1 W/kg
SAR(1 g) = 7.31 W/kg
Deviation = 0.69%



0 dB = 18.6 W/kg = 12.70 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

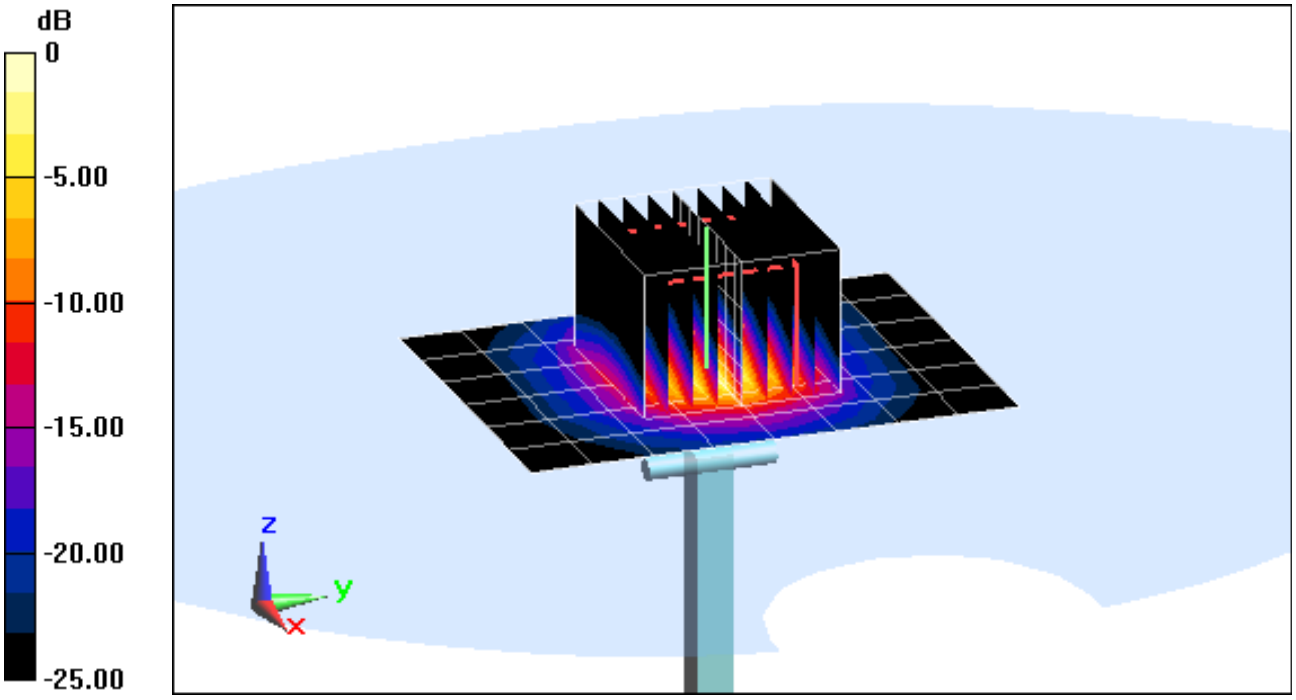
Communication System: UID 0, CW; Frequency: 5300 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body, Medium parameters used:
f = 5300 MHz; σ = 5.34 S/m; ε_r = 46.95; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-06-2014; Ambient Temp: 23.9°C; Tissue Temp: 22.5°C

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

5300 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 29.7 W/kg
SAR(1 g) = 7.45 W/kg
Deviation = -0.27%



0 dB = 18.8 W/kg = 12.74 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

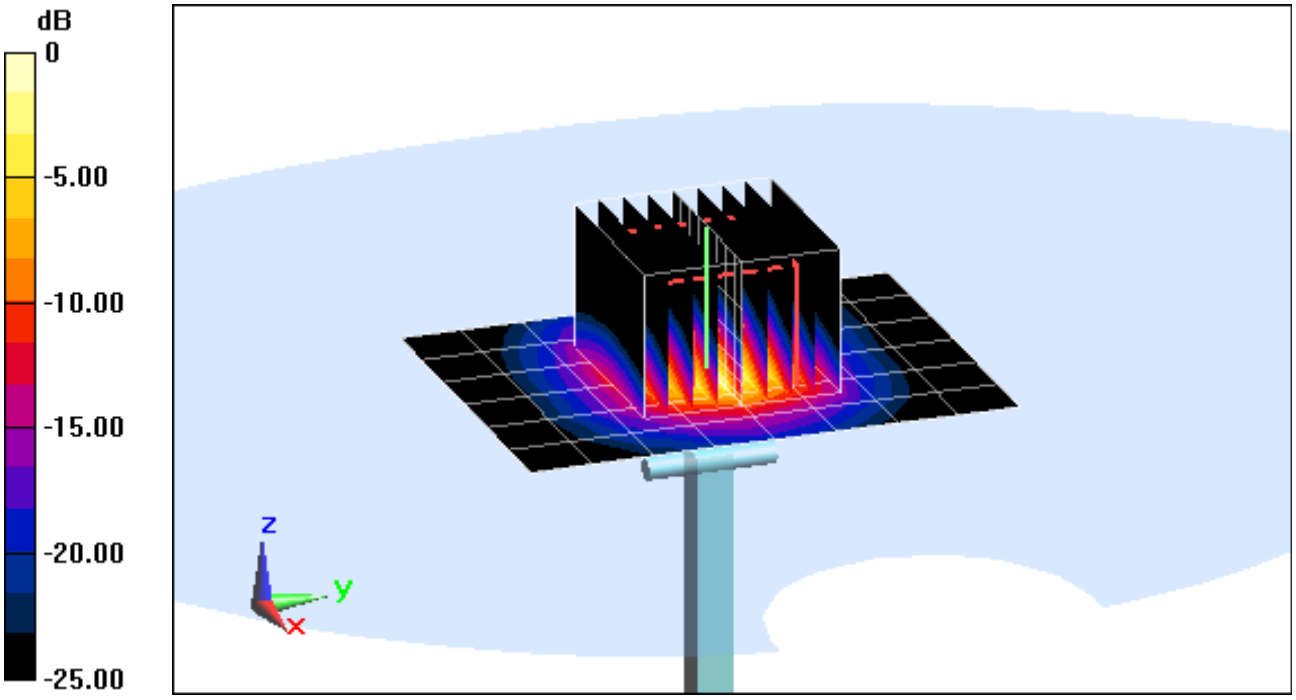
Communication System: UID 0, CW; Frequency: 5500 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body, Medium parameters used:
f = 5500 MHz; σ = 5.788 S/m; ε_r = 46.207; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-06-2014; Ambient Temp: 23.9°C; Tissue Temp: 22.6°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)

5500 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 33.5 W/kg
SAR(1 g) = 7.68 W/kg
Deviation = 1.19%



0 dB = 18.9 W/kg = 12.76 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

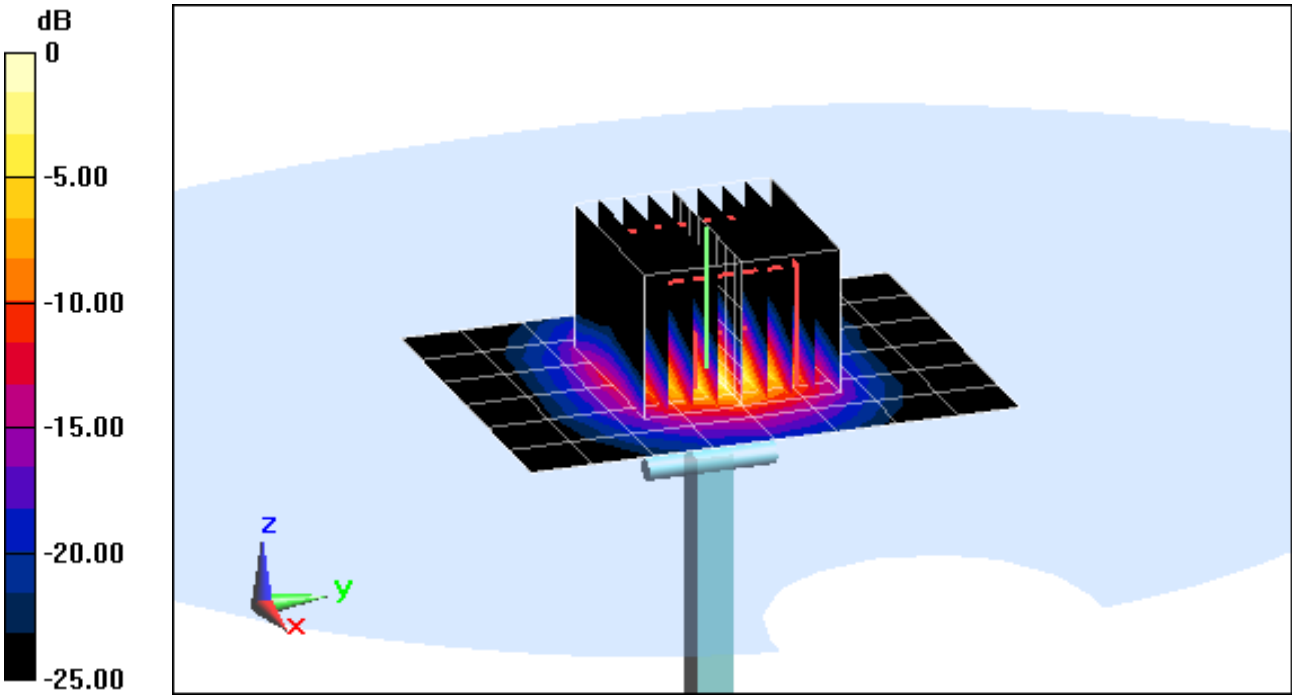
Communication System: UID 0, CW; Frequency: 5800 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body, Medium parameters used:
f = 5800 MHz; σ = 6.248 S/m; ε_r = 46.492; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 05-06-2014; Ambient Temp: 24.0°C; Tissue Temp: 22.6°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)

5800 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 36.4 W/kg
SAR(1 g) = 7.32 W/kg
Deviation = 0.41%



0 dB = 18.6 W/kg = 12.70 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
S 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: ES3-3287_Nov13

CALIBRATION CERTIFICATE

Object ES3DV3 - SN:3287

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 20, 2013

CC ✓ 11/26/2013

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:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: November 20, 2013

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

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., $\vartheta = 0$ 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 $\vartheta = 0$ ($f \leq 900$ 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 $f \leq 800$ 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:3287

Manufactured: June 7, 2010
Calibrated: November 20, 2013

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3287

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.31	1.25	1.25	± 10.1 %
DCP (mV)[B]	102.6	102.5	100.4	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	157.3	±2.7 %
		Y	0.0	0.0	1.0		159.9	
		Z	0.0	0.0	1.0		152.5	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	2.23	57.9	9.9	10.00	45.7	±1.4 %
		Y	2.13	57.6	9.8		46.6	
		Z	3.31	61.1	11.8		47.6	
10011-CAA	UMTS-FDD (WCDMA)	X	3.25	66.3	17.9	2.91	124.8	±0.5 %
		Y	3.16	65.7	17.4		127.4	
		Z	3.15	65.5	17.4		122.8	
10012-CAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	3.08	68.7	18.3	1.87	127.2	±0.7 %
		Y	3.03	68.2	17.9		129.4	
		Z	2.87	67.0	17.3		126.5	
10021-DAA	GSM-FDD (TDMA, GMSK)	X	15.99	90.6	25.0	9.39	99.9	±1.2 %
		Y	12.41	86.6	23.6		101.5	
		Z	29.18	99.9	28.5		109.2	
10023-DAA	GPRS-FDD (TDMA, GMSK, TN 0)	X	25.67	98.9	27.8	9.57	97.9	±1.7 %
		Y	14.20	88.5	24.3		100.6	
		Z	27.68	99.8	28.8		107.7	
10024-DAA	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	42.95	99.6	24.9	6.56	124.4	±1.4 %
		Y	45.27	99.9	24.8		128.8	
		Z	42.64	99.6	25.5		135.7	
10027-DAA	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	27.78	91.3	21.1	4.80	136.0	±1.4 %
		Y	32.74	93.9	21.9		146.6	
		Z	23.93	89.5	21.1		144.8	
10028-DAA	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	59.17	99.6	22.4	3.55	142.5	±1.2 %
		Y	78.76	99.7	21.7		104.9	
		Z	38.06	94.2	21.4		148.8	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	93.35	99.7	19.5	1.16	108.1	±0.9 %
		Y	96.67	94.0	16.9		114.7	
		Z	98.17	96.2	18.2		108.9	
10039-CAA	CDMA2000 (1xRTT, RC1)	X	4.84	66.7	18.8	4.57	126.5	±0.9 %
		Y	4.83	66.6	18.6		134.4	
		Z	4.76	66.0	18.3		125.9	
10081-CAA	CDMA2000 (1xRTT, RC3)	X	4.00	66.2	18.5	3.97	121.9	±0.7 %
		Y	3.91	65.5	17.9		128.9	
		Z	3.88	65.2	17.8		120.7	

10098-CAA	UMTS-FDD (HSUPA, Subtest 2)	X	4.66	66.6	18.4	3.98	132.5	±0.7 %
		Y	4.66	66.5	18.2		141.3	
		Z	4.54	65.9	17.9		130.7	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.65	68.3	20.1	5.67	139.5	±1.4 %
		Y	6.69	68.3	19.9		148.9	
		Z	6.60	67.9	19.8		137.5	
10108-CAB	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.52	67.8	20.0	5.80	137.3	±1.4 %
		Y	6.53	67.6	19.7		147.5	
		Z	6.51	67.6	19.8		135.3	
10110-CAB	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	6.19	67.2	19.7	5.75	134.3	±1.2 %
		Y	6.24	67.3	19.6		142.9	
		Z	6.23	67.1	19.6		132.3	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	11.56	79.1	27.9	9.28	130.1	±3.0 %
		Y	11.01	76.8	26.2		141.9	
		Z	12.98	81.2	28.7		135.7	
10154-CAB	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	6.25	67.4	19.8	5.75	135.1	±1.2 %
		Y	6.17	66.9	19.3		143.6	
		Z	6.16	66.8	19.4		132.8	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.66	67.8	20.0	5.82	140.3	±1.4 %
		Y	6.72	67.9	19.9		148.8	
		Z	6.66	67.6	19.8		137.4	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.05	66.7	19.5	5.73	117.8	±0.9 %
		Y	4.93	66.0	18.9		125.0	
		Z	5.08	66.3	19.3		116.3	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	8.47	76.8	26.9	9.21	100.3	±2.2 %
		Y	8.06	74.6	25.3		107.5	
		Z	9.43	78.2	27.4		102.5	
10175-CAB	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.98	66.3	19.3	5.72	118.2	±0.9 %
		Y	4.96	66.1	19.0		119.9	
		Z	5.03	66.1	19.1		116.1	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	5.06	66.7	19.6	5.72	118.7	±0.9 %
		Y	4.97	66.2	19.1		120.0	
		Z	5.03	66.1	19.1		116.3	
10225-CAA	UMTS-FDD (HSPA+)	X	6.78	66.1	18.9	5.97	105.3	±1.2 %
		Y	6.68	65.7	18.6		106.8	
		Z	7.32	67.6	19.7		148.0	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	8.56	77.1	27.1	9.21	100.8	±1.9 %
		Y	8.33	75.8	26.1		103.8	
		Z	9.39	78.0	27.3		101.9	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	10.58	77.8	27.4	9.24	123.3	±2.5 %
		Y	10.48	76.9	26.5		128.1	
		Z	11.79	79.6	28.0		127.0	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	11.52	79.1	27.9	9.30	130.1	±2.7 %
		Y	11.24	77.7	26.9		136.0	
		Z	12.96	81.2	28.8		134.8	

10274-CAA	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	X	6.14	67.4	19.0	4.87	145.5	±1.2 %
		Y	6.19	67.4	19.0		149.2	
		Z	6.10	66.9	18.8		142.3	
10275-CAA	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.41	66.4	18.3	3.96	126.4	±0.7 %
		Y	4.43	66.3	18.2		130.4	
		Z	4.36	65.9	18.0		123.8	
10291-AAA	CDMA2000, RC3, SO55, Full Rate	X	3.57	65.9	17.9	3.46	120.0	±0.5 %
		Y	3.55	65.6	17.6		121.7	
		Z	3.50	65.1	17.5		117.2	
10292-AAA	CDMA2000, RC3, SO32, Full Rate	X	3.55	66.1	18.0	3.39	121.3	±0.5 %
		Y	3.54	66.0	17.8		123.6	
		Z	3.45	65.2	17.4		118.9	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.53	67.8	20.0	5.81	136.2	±1.2 %
		Y	6.48	67.5	19.6		139.3	
		Z	6.52	67.6	19.8		134.1	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	7.12	68.4	20.4	6.06	141.7	±1.4 %
		Y	7.11	68.3	20.1		145.3	
		Z	7.14	68.4	20.3		139.8	
10315-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc duty cycle)	X	2.79	67.6	18.0	1.71	125.5	±0.5 %
		Y	2.71	66.9	17.3		128.2	
		Z	2.64	66.2	17.0		123.5	
10403-AAA	CDMA2000 (1xEV-DO, Rev. 0)	X	4.78	67.5	18.3	3.76	130.6	±0.5 %
		Y	4.77	67.5	18.2		133.8	
		Z	4.65	66.5	17.8		130.0	
10404-AAA	CDMA2000 (1xEV-DO, Rev. A)	X	4.83	68.2	18.6	3.77	129.2	±0.7 %
		Y	4.68	67.4	18.0		131.9	
		Z	4.52	66.3	17.7		128.7	

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 7 and 8).
[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:3287

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	6.52	6.52	6.52	0.47	1.46	± 12.0 %
835	41.5	0.90	6.30	6.30	6.30	0.40	1.59	± 12.0 %
1750	40.1	1.37	5.27	5.27	5.27	0.63	1.34	± 12.0 %
1900	40.0	1.40	5.08	5.08	5.08	0.62	1.37	± 12.0 %
2450	39.2	1.80	4.43	4.43	4.43	0.79	1.28	± 12.0 %
2600	39.0	1.96	4.29	4.29	4.29	0.77	1.38	± 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:3287

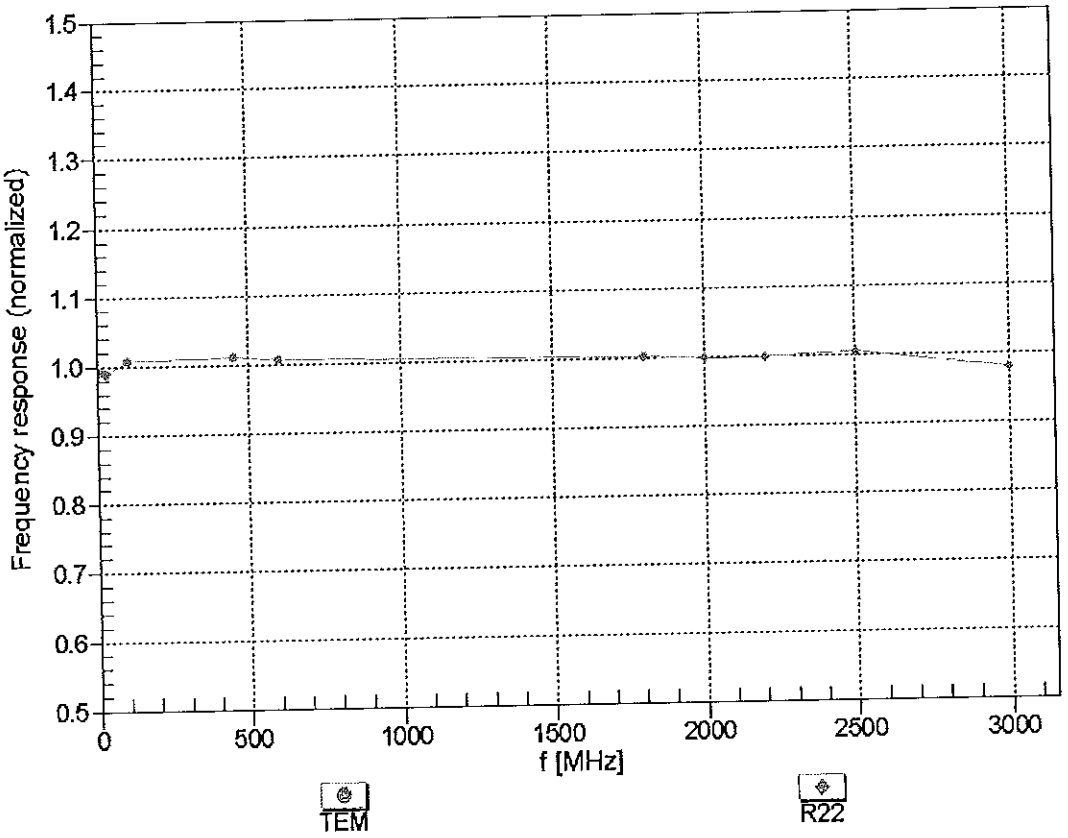
Calibration Parameter Determined in Body Tissue Simulating Media

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	6.09	6.09	6.09	0.55	1.37	± 12.0 %
835	55.2	0.97	6.04	6.04	6.04	0.55	1.39	± 12.0 %
1750	53.4	1.49	4.93	4.93	4.93	0.39	1.73	± 12.0 %
1900	53.3	1.52	4.67	4.67	4.67	0.38	1.75	± 12.0 %
2450	52.7	1.95	4.17	4.17	4.17	0.60	1.20	± 12.0 %
2600	52.5	2.16	4.00	4.00	4.00	0.60	1.10	± 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

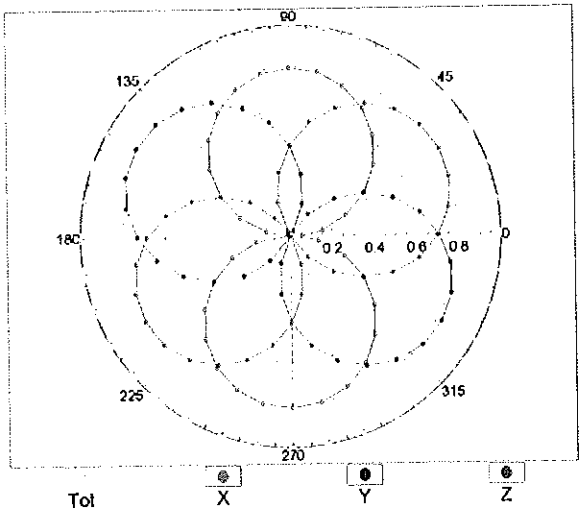
(TEM-Cell:ifi110 EXX, Waveguide: R22)



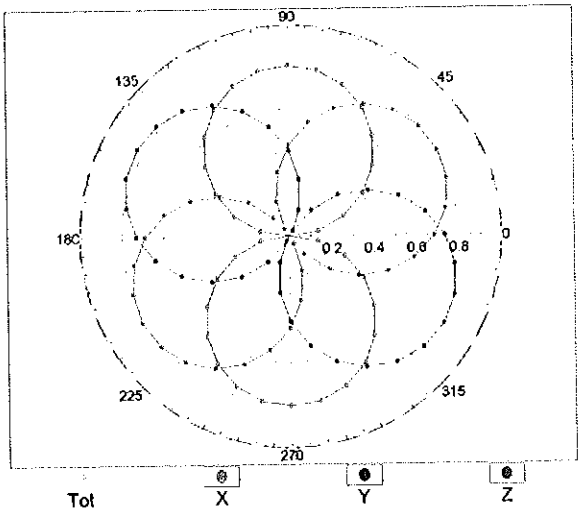
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

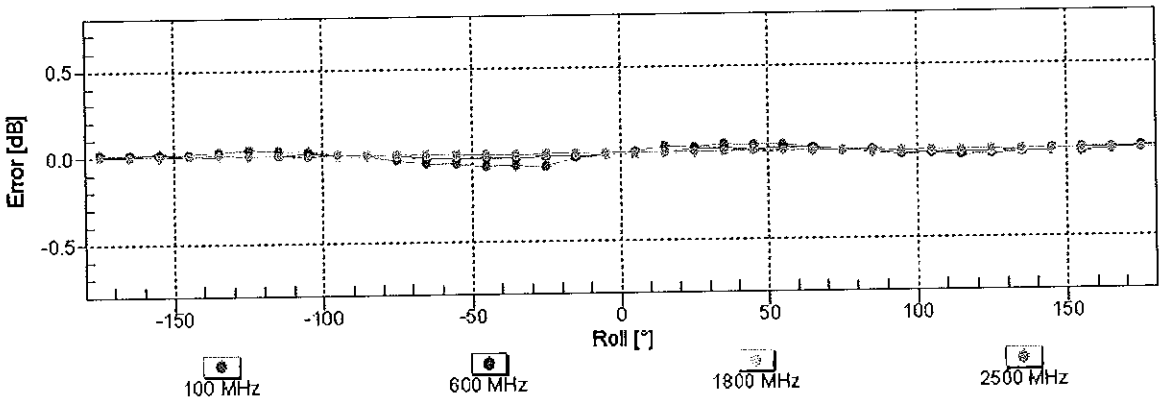
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



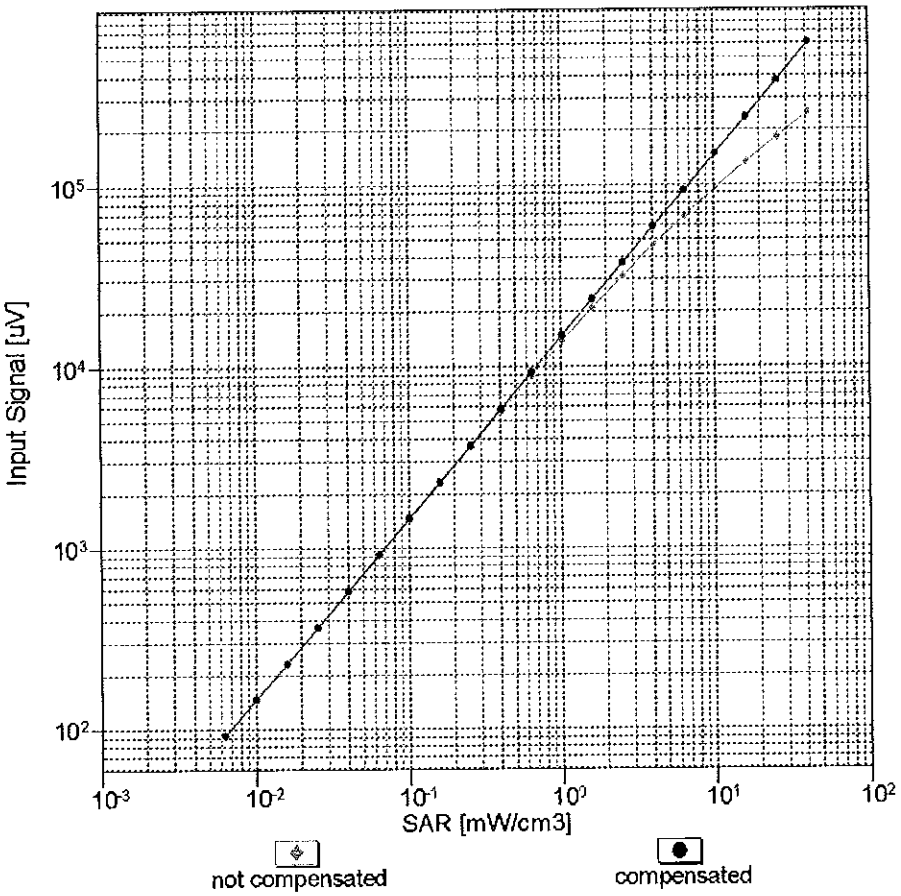
f=1800 MHz,R22

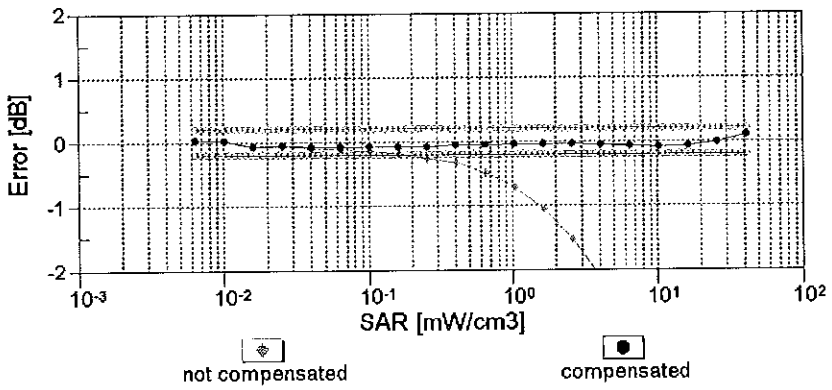




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

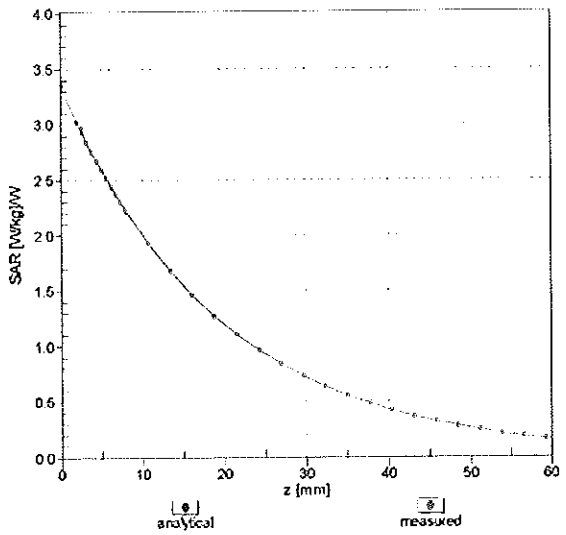




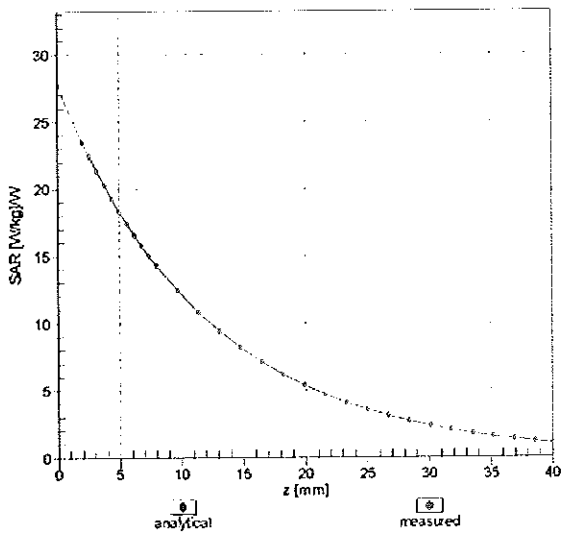
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

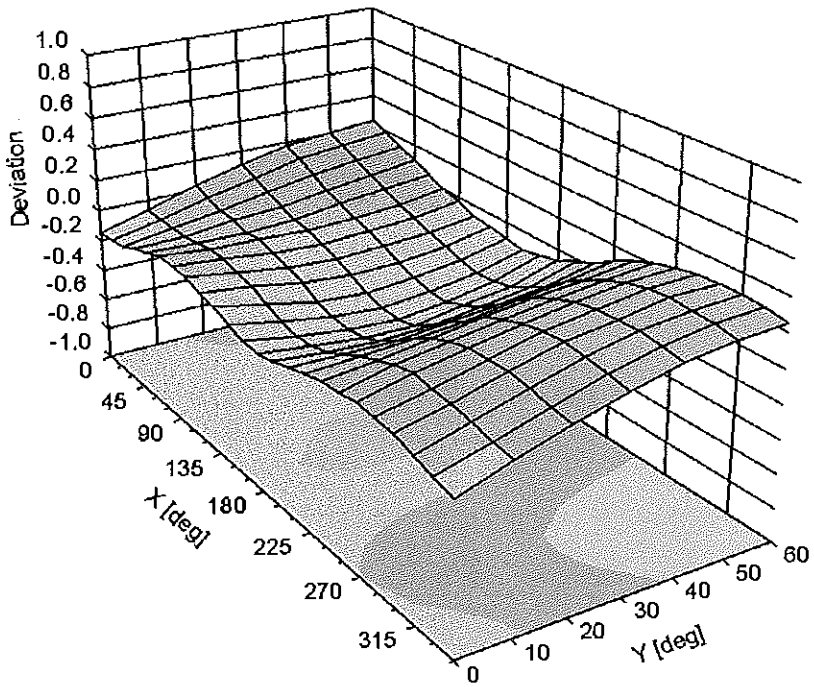


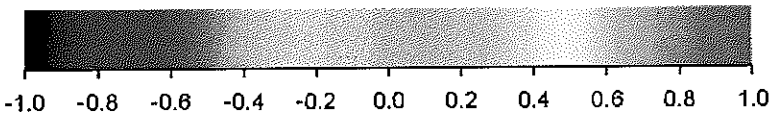
f = 1900 MHz,WGLS R22 (H_convF)



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:3287

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-15
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

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: ES3-3213_Apr14

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3213

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

CCV 5/7/14

Calibration date: April 11, 2014

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	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-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-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: April 14, 2014

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:3213

Manufactured: October 14, 2008
Calibrated: April 11, 2014

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3213

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.47	1.36	1.32	± 10.1 %
DCP (mV)[B]	102.9	101.6	102.7	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	197.4	±3.8 %
		Y	0.0	0.0	1.0		219.1	
		Z	0.0	0.0	1.0		195.3	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	5.05	68.5	14.4	10.00	41.4	±0.9 %
		Y	9.83	75.4	16.6		39.8	
		Z	10.63	76.7	17.0		40.3	
10011-CAB	UMTS-FDD (WCDMA)	X	3.25	67.1	18.8	2.91	135.4	±0.5 %
		Y	3.21	66.6	18.4		131.4	
		Z	3.43	68.3	19.4		133.5	
10012-CAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	3.39	71.8	20.4	1.87	137.8	±0.7 %
		Y	2.98	69.1	19.1		133.1	
		Z	3.26	71.3	20.3		133.8	
10021-DAB	GSM-FDD (TDMA, GMSK)	X	22.08	99.1	27.6	9.39	143.1	±2.2 %
		Y	21.57	99.6	28.2		141.4	
		Z	13.61	90.9	24.9		137.1	
10023-DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	16.13	94.0	26.2	9.57	133.8	±1.9 %
		Y	22.39	99.7	28.1		137.8	
		Z	18.99	97.5	27.4		129.2	
10024-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	21.23	93.4	23.4	6.56	148.9	±1.9 %
		Y	33.62	99.9	25.4		148.5	
		Z	32.72	99.7	25.1		141.6	
10027-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	49.20	99.7	23.0	4.80	138.6	±2.5 %
		Y	40.22	99.8	23.9		134.7	
		Z	43.82	99.8	23.4		131.9	
10028-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	50.05	99.8	22.4	3.55	146.5	±2.2 %
		Y	51.41	99.6	22.3		144.4	
		Z	46.36	99.5	22.4		140.0	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	40.43	99.5	20.4	1.16	135.1	±1.7 %
		Y	24.55	99.5	21.7		133.5	
		Z	32.87	99.9	21.0		131.0	
10039-CAB	CDMA2000 (1xRTT, RC1)	X	4.69	66.6	19.0	4.57	133.4	±0.9 %
		Y	4.76	66.9	19.3		133.2	
		Z	4.71	66.8	19.2		130.1	

10081-CAB	CDMA2000 (1xRTT, RC3)	X	3.87	66.1	18.6	3.97	129.0	±0.7 %
		Y	3.89	66.1	18.7		129.6	
		Z	3.97	66.6	19.0		146.7	
10098-CAB	UMTS-FDD (HSUPA, Subtest 2)	X	4.59	66.8	18.8	3.98	141.1	±0.7 %
		Y	4.64	67.0	19.0		140.0	
		Z	4.67	67.2	19.1		138.5	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.52	68.0	20.1	5.67	147.5	±1.4 %
		Y	6.61	68.3	20.4		148.5	
		Z	6.51	68.0	20.1		145.4	
10108-CAB	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.39	67.5	19.9	5.80	145.2	±1.4 %
		Y	6.44	67.8	20.2		145.8	
		Z	6.41	67.7	20.1		145.5	
10110-CAB	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	6.02	66.7	19.5	5.75	141.3	±1.4 %
		Y	6.10	67.2	20.0		141.0	
		Z	6.05	67.0	19.8		141.2	
10114-CAA	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	X	10.19	68.9	21.4	8.10	135.6	±2.2 %
		Y	10.43	69.6	21.9		135.7	
		Z	10.21	69.0	21.5		134.5	
10117-CAA	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.17	68.9	21.3	8.07	137.7	±2.5 %
		Y	10.45	69.6	21.9		137.2	
		Z	10.22	69.1	21.5		136.9	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	9.70	74.8	25.8	9.28	133.6	±3.0 %
		Y	9.81	75.7	26.7		130.1	
		Z	9.49	74.4	25.7		131.6	
10154-CAB	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	6.07	67.0	19.7	5.75	142.9	±1.4 %
		Y	6.19	67.6	20.2		145.4	
		Z	6.06	67.0	19.8		141.7	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.50	67.5	19.9	5.82	148.5	±1.4 %
		Y	6.35	67.0	19.7		127.0	
		Z	6.52	67.6	20.0		147.9	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.00	66.8	19.8	5.73	145.4	±1.4 %
		Y	5.13	67.5	20.4		148.9	
		Z	5.06	67.3	20.2		144.8	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	9.02	79.7	28.5	9.21	148.9	±3.0 %
		Y	8.14	77.1	27.6		125.0	
		Z	8.82	79.5	28.6		147.1	
10175-CAB	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	5.05	67.2	20.0	5.72	146.2	±1.4 %
		Y	5.14	67.6	20.4		145.9	
		Z	5.00	67.1	20.1		140.8	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	5.07	67.2	20.0	5.72	149.7	±1.4 %
		Y	5.15	67.6	20.4		146.0	
		Z	5.00	67.0	20.0		141.0	

10193-CAA	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	X	9.92	68.8	21.4	8.09	135.2	±2.2 %
		Y	10.06	69.3	21.8		130.6	
		Z	9.78	68.4	21.2		126.9	
10196-CAA	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.93	68.9	21.4	8.10	136.4	±2.2 %
		Y	10.06	69.3	21.9		131.1	
		Z	9.84	68.7	21.4		128.8	
10219-CAA	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	X	9.81	68.8	21.4	8.03	135.3	±2.2 %
		Y	9.95	69.3	21.8		130.1	
		Z	9.71	68.5	21.2		127.4	
10222-CAA	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	X	10.24	69.1	21.5	8.06	141.2	±2.2 %
		Y	10.45	69.7	22.0		136.8	
		Z	10.13	68.9	21.4		133.6	
10225-CAB	UMTS-FDD (HSPA+)	X	6.95	66.9	19.5	5.97	137.9	±1.4 %
		Y	7.03	67.2	19.8		133.2	
		Z	6.92	66.9	19.5		130.6	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	8.08	76.6	27.0	9.21	127.8	±3.0 %
		Y	10.15	84.0	31.2		149.6	
		Z	8.67	79.0	28.3		145.4	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	8.92	73.6	25.3	9.24	126.0	±3.5 %
		Y	9.19	75.1	26.5		124.0	
		Z	9.66	76.2	26.8		149.1	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	9.59	74.5	25.7	9.30	131.9	±3.0 %
		Y	9.87	75.8	26.8		130.6	
		Z	9.36	73.9	25.5		127.8	
10274-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	X	5.84	66.6	18.8	4.87	128.6	±0.9 %
		Y	5.87	66.7	19.0		128.8	
		Z	6.08	67.6	19.4		149.9	
10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.35	66.6	18.8	3.96	134.0	±0.9 %
		Y	4.46	67.0	19.1		138.5	
		Z	4.39	66.8	19.0		129.4	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.72	67.5	19.2	3.46	149.2	±0.7 %
		Y	3.66	67.1	19.1		129.6	
		Z	3.72	67.6	19.3		143.2	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.54	66.9	18.8	3.39	128.3	±0.5 %
		Y	3.61	67.2	19.1		130.4	
		Z	3.69	67.8	19.4		146.2	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.38	67.4	19.9	5.81	145.8	±1.4 %
		Y	6.50	68.0	20.4		148.6	
		Z	6.35	67.4	19.9		140.8	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.70	67.2	19.7	6.06	127.8	±1.4 %
		Y	6.85	67.7	20.3		130.2	
		Z	6.98	68.2	20.4		147.9	

10315-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc duty cycle)	X	2.82	69.1	19.2	1.71	135.1	±0.7 %
		Y	2.92	69.5	19.6		136.9	
		Z	3.22	71.8	20.6		130.9	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.77	68.3	18.9	3.76	140.0	±0.5 %
		Y	4.80	68.4	19.1		141.4	
		Z	4.86	68.9	19.3		134.8	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.61	68.0	18.8	3.77	138.2	±0.7 %
		Y	4.67	68.2	19.0		139.3	
		Z	4.69	68.5	19.1		133.9	

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 8 and 9).
[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:3213

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	6.58	6.58	6.58	0.34	1.79	± 12.0 %
835	41.5	0.90	6.37	6.37	6.37	0.29	1.94	± 12.0 %
1750	40.1	1.37	5.18	5.18	5.18	0.79	1.17	± 12.0 %
1900	40.0	1.40	4.99	4.99	4.99	0.57	1.36	± 12.0 %
2450	39.2	1.80	4.40	4.40	4.40	0.78	1.28	± 12.0 %
2600	39.0	1.96	4.25	4.25	4.25	0.77	1.23	± 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.

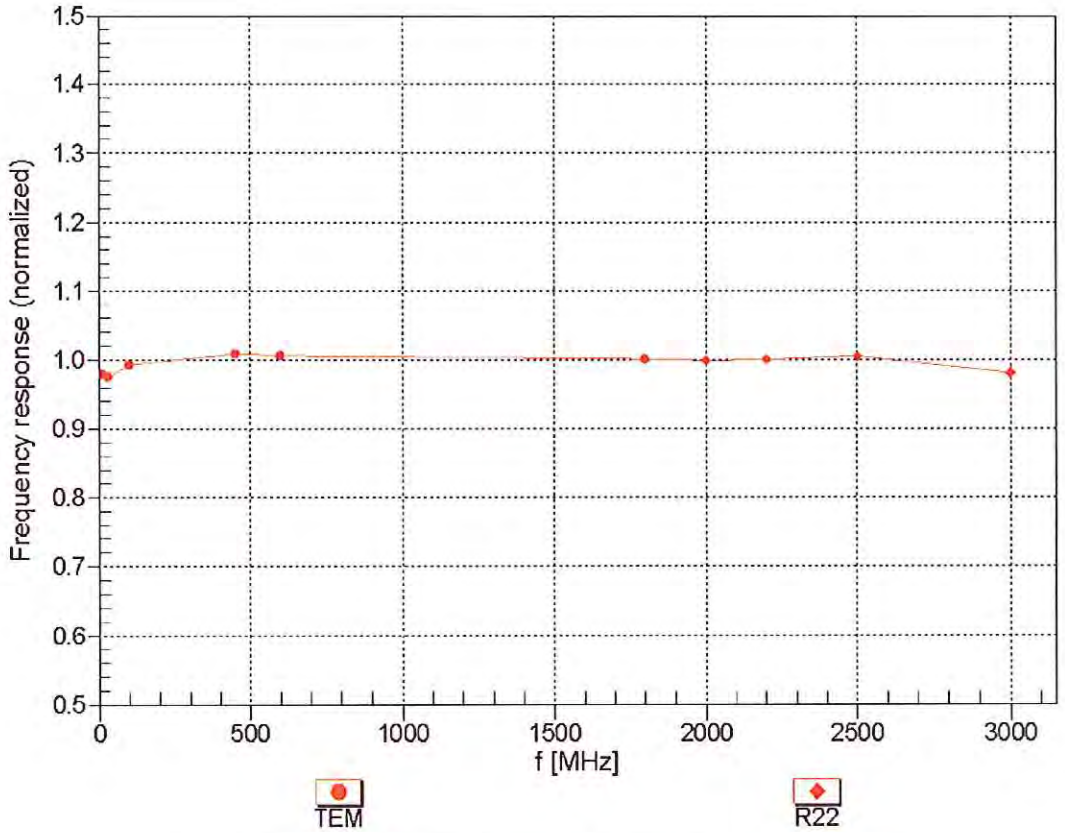
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3213

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	6.21	6.21	6.21	0.77	1.19	± 12.0 %
835	55.2	0.97	6.18	6.18	6.18	0.54	1.37	± 12.0 %
1750	53.4	1.49	4.89	4.89	4.89	0.73	1.27	± 12.0 %
1900	53.3	1.52	4.68	4.68	4.68	0.47	1.70	± 12.0 %
2450	52.7	1.95	4.26	4.26	4.26	0.70	1.16	± 12.0 %
2600	52.5	2.16	4.05	4.05	4.05	0.67	1.00	± 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.

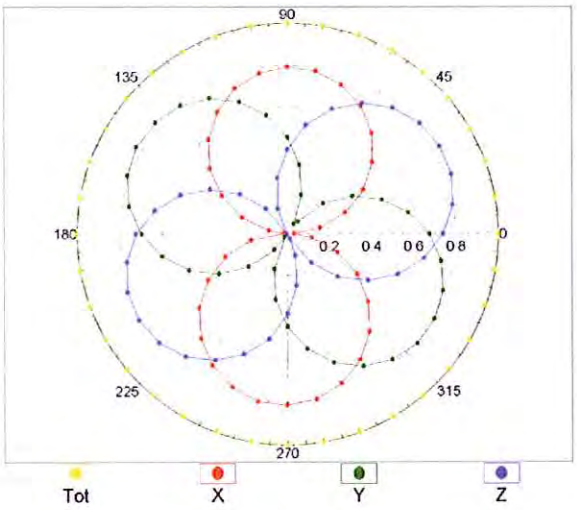
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



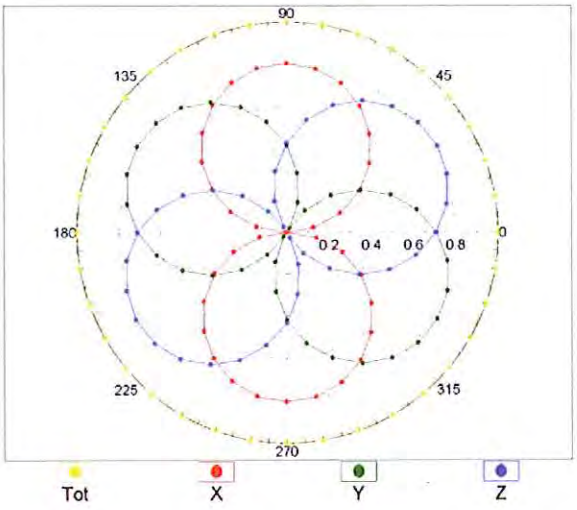
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

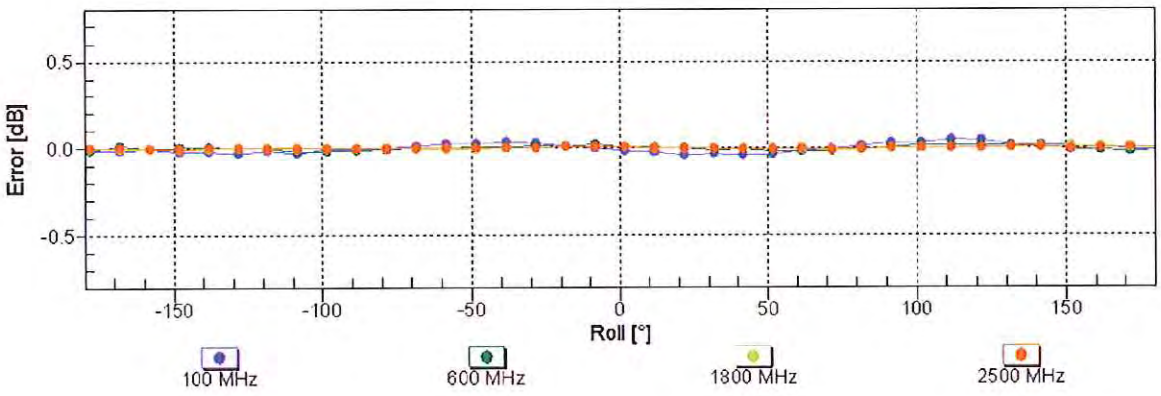
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



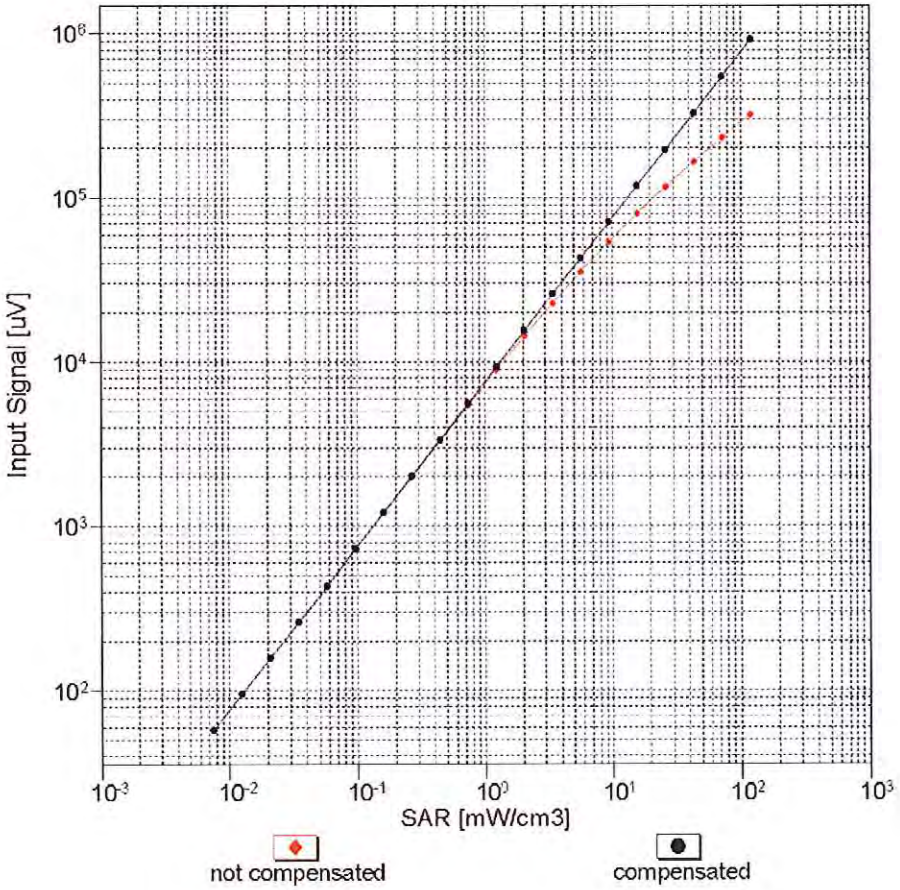
f=1800 MHz,R22

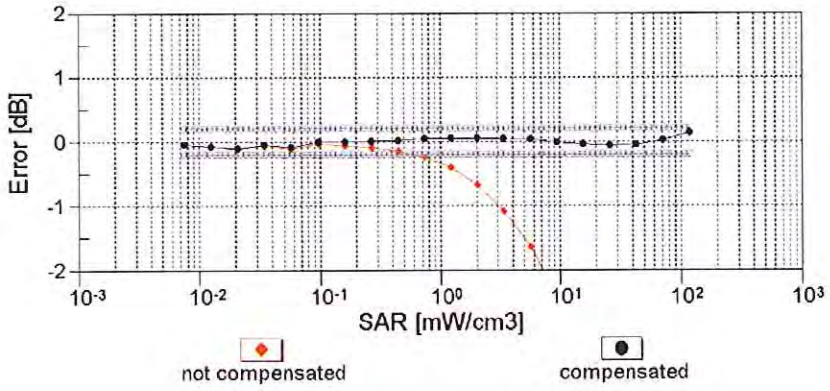




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})
(TEM cell , f_{eval}= 1900 MHz)

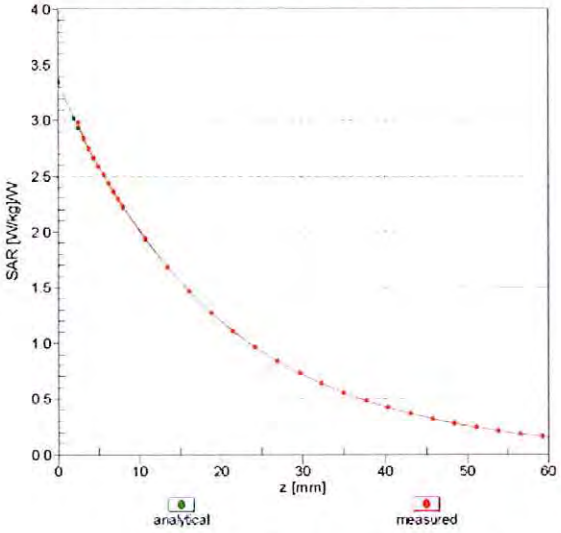




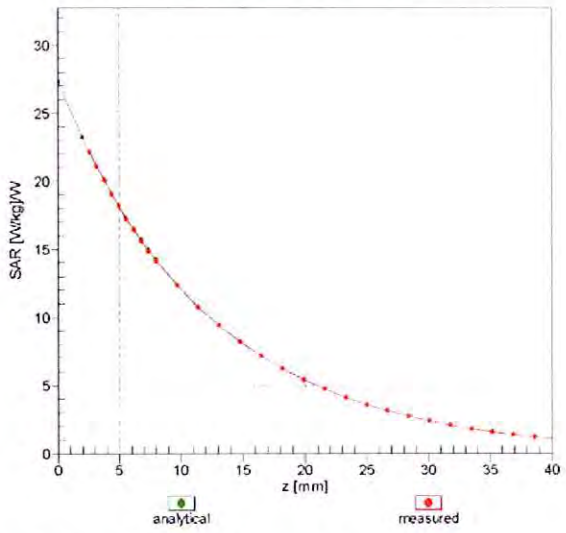
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

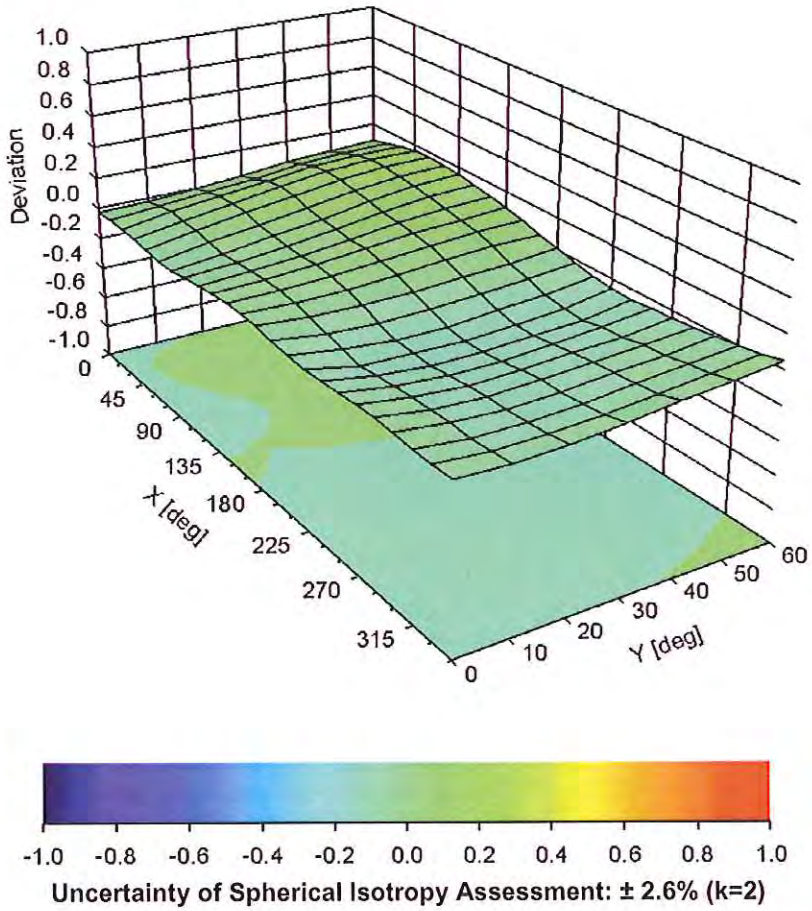


f = 1900 MHz,WGLS R22 (H_convF)



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:3213

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-68.3
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

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: ES3-3258_Feb14

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3258

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

CCV 3/6/14

Calibration date: February 25, 2014

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	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-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-16
Network Analyzer HP 8753E	US37390585	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: February 27, 2014

PCT# 80615

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) **Accreditation No.: SCS 108**
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

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:3258

Manufactured: January 25, 2010
Calibrated: February 25, 2014

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3258

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.29	1.19	1.23	± 10.1 %
DCP (mV)[B]	104.5	107.0	103.0	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	222.4	±3.8 %
		Y	0.0	0.0	1.0		202.2	
		Z	0.0	0.0	1.0		207.1	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	5.09	65.6	14.1	10.00	44.8	±1.9 %
		Y	1.68	57.4	9.3		40.7	
		Z	4.01	62.4	13.0		51.1	
10011-CAB	UMTS-FDD (WCDMA)	X	3.34	67.5	18.9	2.91	131.2	±0.5 %
		Y	3.43	67.9	18.7		137.1	
		Z	3.42	67.8	19.0		146.0	
10012-CAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	3.40	70.9	19.8	1.87	134.2	±0.7 %
		Y	3.19	70.2	19.2		137.9	
		Z	3.46	70.8	19.6		149.6	
10021-DAB	GSM-FDD (TDMA, GMSK)	X	30.24	99.7	28.7	9.39	131.2	±1.4 %
		Y	12.91	88.5	23.9		147.5	
		Z	30.37	99.5	28.9		128.0	
10023-DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	29.88	100.0	29.0	9.57	123.0	±1.9 %
		Y	16.02	92.5	25.4		140.7	
		Z	30.01	100.0	29.4		125.8	
10024-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	44.57	99.7	25.9	6.56	119.6	±1.7 %
		Y	28.97	95.3	23.2		127.6	
		Z	43.72	99.8	26.3		120.1	
10027-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	53.52	99.7	24.4	4.80	129.4	±2.2 %
		Y	54.55	99.9	22.9		143.3	
		Z	51.63	99.7	24.8		127.5	
10028-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	58.93	99.8	23.4	3.55	133.4	±2.2 %
		Y	77.54	99.7	21.3		125.3	
		Z	56.64	99.8	23.8		130.8	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	47.03	99.5	21.3	1.16	136.3	±1.7 %
		Y	95.86	95.2	17.1		138.2	
		Z	39.68	100.0	22.2		132.3	
10039-CAB	CDMA2000 (1xRTT, RC1)	X	4.84	66.8	19.1	4.57	131.3	±0.9 %
		Y	4.75	67.0	18.9		135.2	
		Z	4.86	66.7	19.0		127.2	

10081-CAB	CDMA2000 (1xRTT, RC3)	X	4.06	66.8	19.0	3.97	148.4	±0.7 %
		Y	3.96	66.6	18.6		134.7	
		Z	4.13	66.9	19.1		143.4	
10098-CAB	UMTS-FDD (HSUPA, Subtest 2)	X	4.63	66.8	18.7	3.98	137.3	±0.7 %
		Y	4.75	67.5	18.8		148.4	
		Z	4.65	66.7	18.7		133.2	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.66	68.5	20.3	5.67	144.0	±1.2 %
		Y	6.27	67.1	19.3		130.6	
		Z	6.62	68.2	20.1		140.5	
10108-CAB	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.53	68.0	20.2	5.80	142.6	±1.4 %
		Y	6.17	66.8	19.3		129.2	
		Z	6.52	67.8	20.1		139.0	
10110-CAB	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	6.19	67.3	19.9	5.75	137.9	±1.4 %
		Y	6.12	67.3	19.6		149.5	
		Z	6.19	67.1	19.8		136.1	
10114-CAA	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	X	10.49	69.5	21.7	8.10	132.4	±2.5 %
		Y	10.23	69.1	21.3		144.3	
		Z	10.45	69.3	21.6		129.5	
10117-CAA	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.46	69.5	21.7	8.07	133.9	±2.5 %
		Y	10.26	69.2	21.3		147.4	
		Z	10.47	69.4	21.7		130.5	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	11.61	77.4	26.8	9.28	118.8	±3.0 %
		Y	9.89	75.2	25.7		144.9	
		Z	12.01	77.8	26.9		119.6	
10154-CAB	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	6.20	67.3	19.9	5.75	139.2	±1.2 %
		Y	5.86	66.2	19.0		128.5	
		Z	6.22	67.3	19.9		136.3	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.63	67.8	20.1	5.82	144.1	±1.4 %
		Y	6.31	66.8	19.3		133.1	
		Z	6.66	67.7	20.0		140.9	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.25	67.5	20.2	5.73	143.6	±1.2 %
		Y	4.92	66.7	19.5		131.0	
		Z	5.29	67.4	20.2		140.7	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	13.49	87.5	31.6	9.21	139.0	±2.7 %
		Y	7.83	75.5	26.0		124.9	
		Z	13.47	86.5	31.1		137.8	
10175-CAB	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	5.22	67.4	20.1	5.72	144.3	±1.4 %
		Y	5.08	67.5	19.9		147.9	
		Z	5.26	67.2	20.0		139.6	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	5.24	67.5	20.1	5.72	144.5	±1.2 %
		Y	5.06	67.4	19.8		147.0	
		Z	5.29	67.3	20.1		139.2	

10193-CAA	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	X	10.12	69.1	21.6	8.09	128.8	±2.2 %
		Y	9.76	68.4	21.0		132.8	
		Z	10.08	68.9	21.5		123.4	
10196-CAA	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	10.15	69.2	21.7	8.10	130.2	±2.2 %
		Y	9.77	68.5	21.0		134.1	
		Z	10.10	69.0	21.5		124.0	
10219-CAA	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	X	10.02	69.0	21.5	8.03	128.7	±2.2 %
		Y	9.67	68.5	21.0		133.3	
		Z	10.02	68.9	21.5		123.9	
10222-CAA	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	X	10.46	69.6	21.7	8.06	134.0	±2.2 %
		Y	10.09	68.8	21.1		139.7	
		Z	10.40	69.3	21.6		128.7	
10225-CAB	UMTS-FDD (HSPA+)	X	7.09	67.1	19.6	5.97	131.2	±1.4 %
		Y	6.98	67.2	19.4		138.0	
		Z	7.06	66.8	19.4		127.2	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	13.63	87.8	31.7	9.21	141.6	±3.0 %
		Y	7.85	75.5	26.0		126.5	
		Z	13.99	87.7	31.6		141.4	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	12.86	81.4	28.9	9.24	142.1	±3.0 %
		Y	8.91	73.4	24.8		129.9	
		Z	13.15	81.4	28.8		142.0	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	11.63	77.5	26.8	9.30	118.7	±3.0 %
		Y	9.62	74.3	25.2		138.4	
		Z	11.96	77.7	26.9		119.3	
10274-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	X	6.14	67.4	19.3	4.87	149.9	±0.9 %
		Y	5.90	66.9	18.7		132.8	
		Z	6.20	67.5	19.3		146.6	
10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.45	66.9	18.9	3.96	130.1	±0.7 %
		Y	4.50	67.2	18.8		137.9	
		Z	4.64	67.6	19.3		149.2	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.79	67.5	19.2	3.46	145.3	±0.7 %
		Y	3.74	67.5	18.9		128.2	
		Z	3.78	67.3	19.1		139.1	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.77	67.8	19.3	3.39	147.0	±0.5 %
		Y	3.69	67.7	18.9		130.1	
		Z	3.73	67.3	19.0		141.3	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.52	67.9	20.1	5.81	141.4	±1.4 %
		Y	6.41	67.6	19.7		147.4	
		Z	6.51	67.7	20.1		135.4	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	7.17	68.7	20.7	6.06	147.7	±1.4 %
		Y	6.69	67.2	19.6		128.6	
		Z	7.12	68.4	20.5		142.0	

10315-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc duty cycle)	X	3.04	70.0	19.6	1.71	129.8	±0.5 %
		Y	3.25	71.3	19.7		136.9	
		Z	3.09	69.9	19.5		148.7	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.73	67.3	18.6	3.76	135.7	±0.5 %
		Y	4.93	69.1	19.0		141.5	
		Z	4.73	67.1	18.4		132.7	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.67	67.5	18.6	3.77	134.0	±0.5 %
		Y	4.92	69.4	19.1		139.8	
		Z	4.65	67.1	18.5		130.7	

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 8 and 9).
[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:3258

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	6.53	6.53	6.53	0.40	1.60	± 12.0 %
835	41.5	0.90	6.27	6.27	6.27	0.80	1.17	± 12.0 %
1750	40.1	1.37	5.19	5.19	5.19	0.80	1.10	± 12.0 %
1900	40.0	1.40	5.04	5.04	5.04	0.68	1.27	± 12.0 %
2450	39.2	1.80	4.52	4.52	4.52	0.78	1.23	± 12.0 %
2600	39.0	1.96	4.34	4.34	4.34	0.76	1.33	± 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.

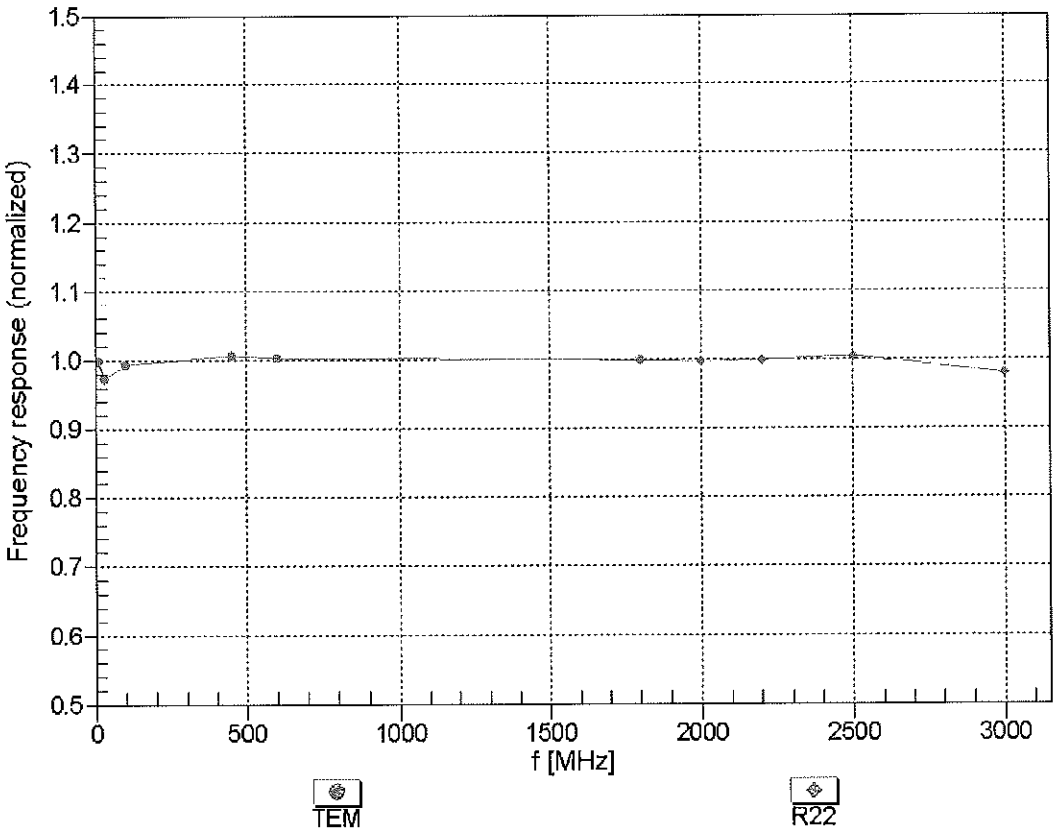
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3258

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	6.15	6.15	6.15	0.61	1.32	± 12.0 %
835	55.2	0.97	6.11	6.11	6.11	0.80	1.15	± 12.0 %
1750	53.4	1.49	4.83	4.83	4.83	0.47	1.74	± 12.0 %
1900	53.3	1.52	4.61	4.61	4.61	0.55	1.59	± 12.0 %
2450	52.7	1.95	4.14	4.14	4.14	0.80	1.11	± 12.0 %
2600	52.5	2.16	3.91	3.91	3.91	0.80	1.00	± 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.

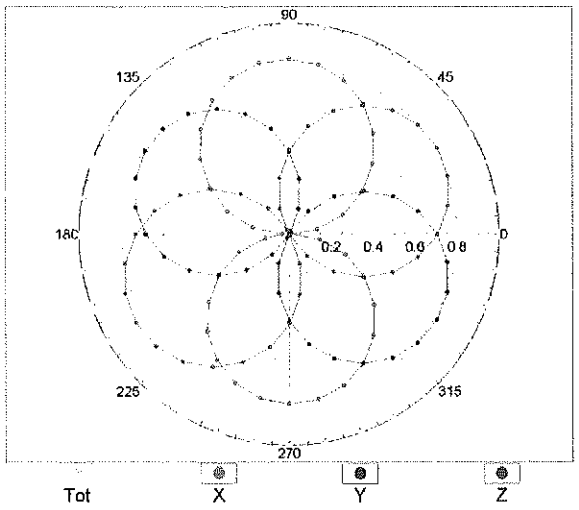
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



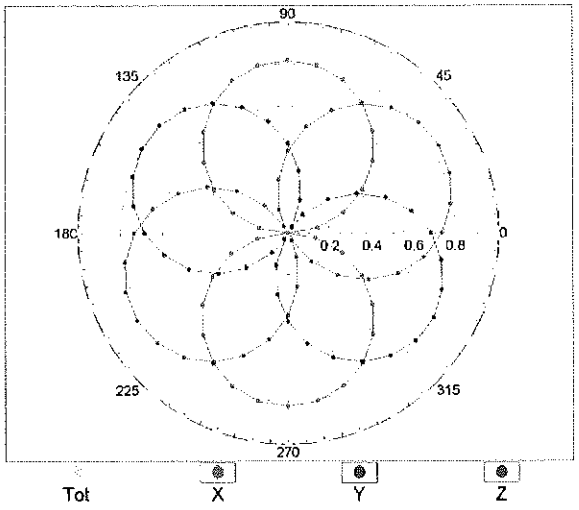
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

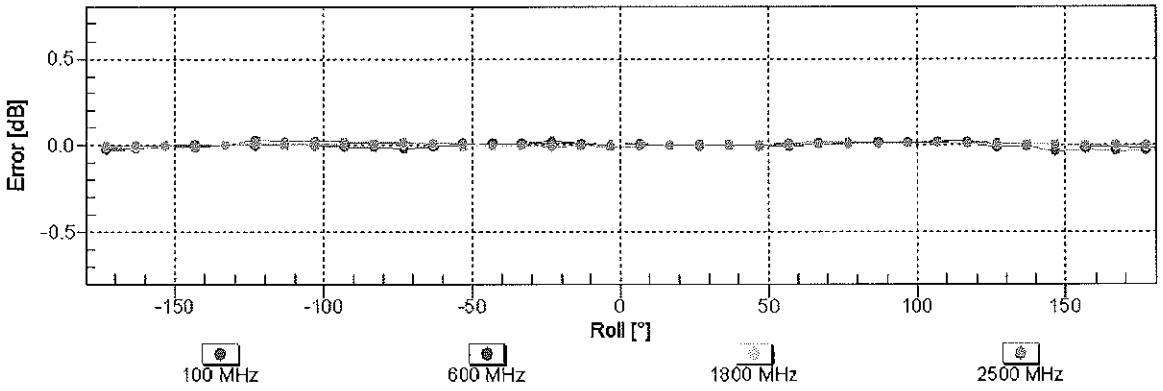
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



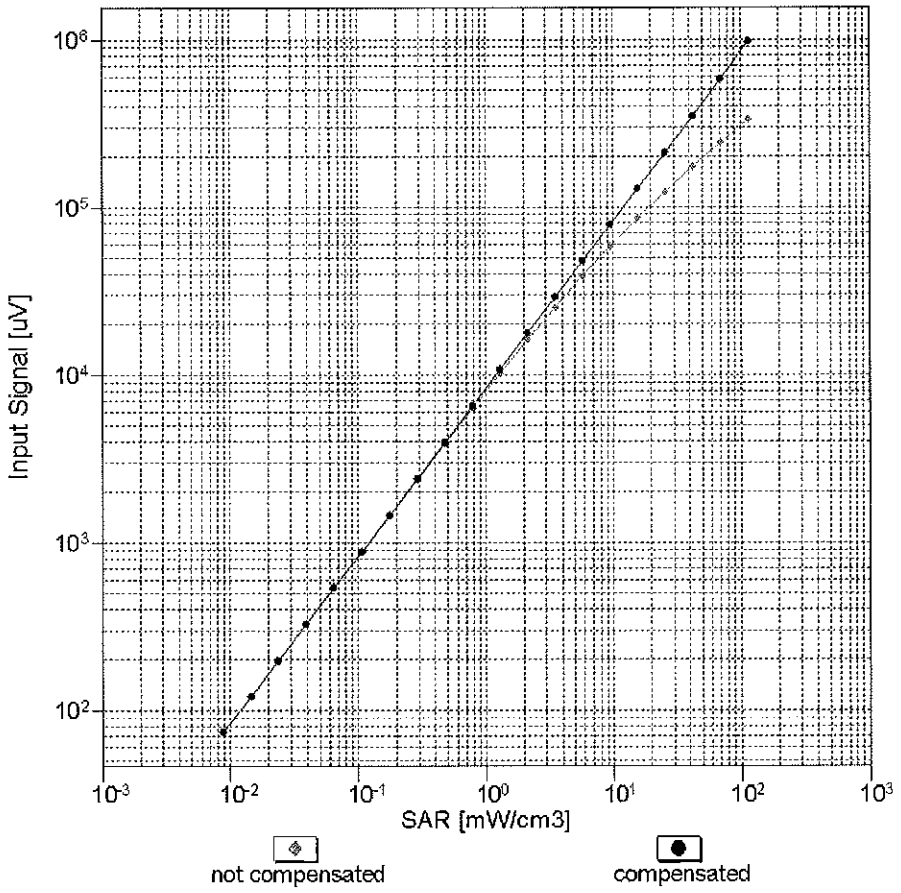
f=1800 MHz,R22

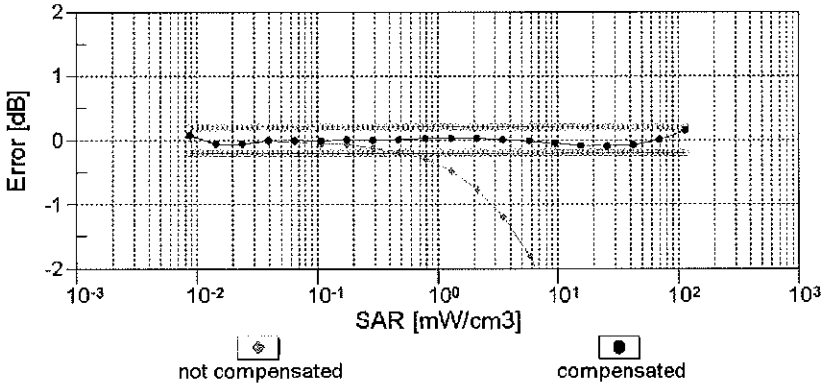




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})
(TEM cell , f_{eval}= 1900 MHz)

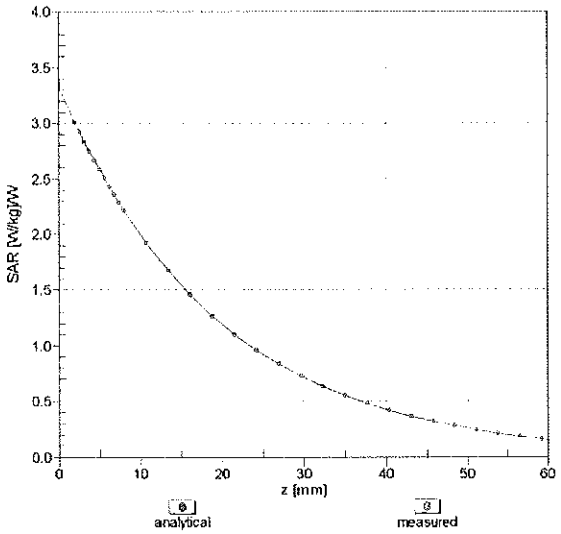




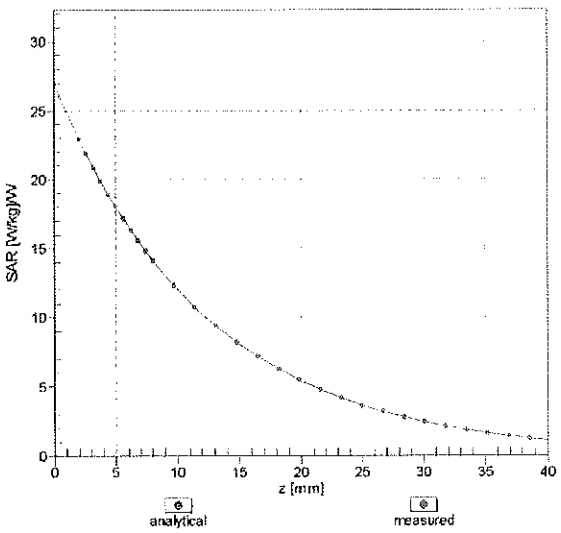
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

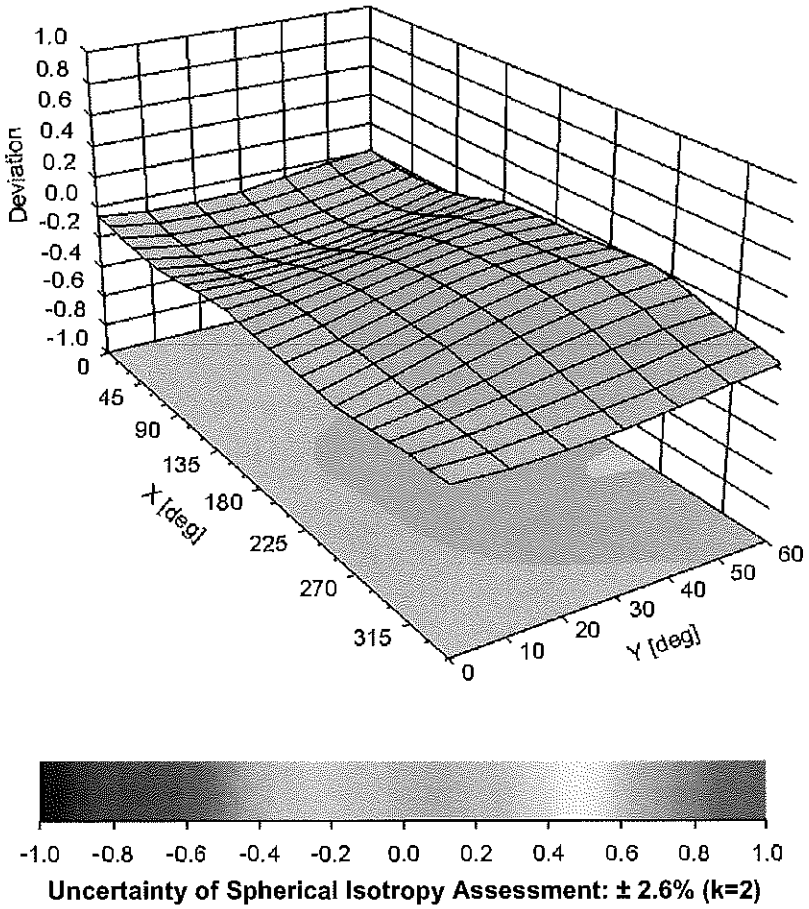


f = 1750 MHz,WGLS R22 (H_convF)



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:3258

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-123.1
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

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: ES3-3209_Mar14

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3209

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

CCV 3/27/14

Calibration date: March 19, 2014

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	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-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-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: March 20, 2014

PCT # 80249

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
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS) **Accreditation No.: SCS 108**
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

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:3209

Manufactured: October 14, 2008
Calibrated: March 19, 2014

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3209

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.35	1.32	1.13	± 10.1 %
DCP (mV)[B]	101.5	101.0	102.5	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	188.4	±3.8 %
		Y	0.0	0.0	1.0		180.7	
		Z	0.0	0.0	1.0		200.1	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	2.80	64.7	12.3	10.00	43.2	±1.4 %
		Y	3.12	65.6	13.1		41.9	
		Z	2.67	64.0	11.7		39.4	
10011-CAB	UMTS-FDD (WCDMA)	X	3.39	67.7	19.0	2.91	149.2	±0.5 %
		Y	3.38	67.7	19.0		146.1	
		Z	3.35	67.6	18.7		136.1	
10012-CAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	3.01	69.8	19.4	1.87	149.4	±0.7 %
		Y	3.06	70.1	19.6		147.1	
		Z	2.98	69.7	19.2		136.4	
10021-DAB	GSM-FDD (TDMA, GMSK)	X	5.47	79.6	20.4	9.39	146.9	±1.7 %
		Y	7.76	84.9	22.9		134.2	
		Z	4.34	75.3	18.5		134.2	
10023-DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	6.66	82.9	21.6	9.57	139.8	±2.5 %
		Y	9.36	88.2	24.2		131.5	
		Z	4.67	76.1	18.8		144.8	
10024-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	5.89	79.1	17.9	6.56	141.2	±1.9 %
		Y	27.58	99.6	24.8		145.8	
		Z	5.42	77.8	17.4		129.3	
10027-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	9.68	85.3	19.0	4.80	136.9	±2.2 %
		Y	36.47	100.0	23.3		139.2	
		Z	31.63	96.5	21.4		149.2	
10028-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	40.09	99.7	21.7	3.55	125.9	±1.9 %
		Y	47.92	99.6	21.7		127.6	
		Z	61.98	99.9	20.8		136.2	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	99.32	95.7	16.5	1.16	145.1	±1.7 %
		Y	55.30	99.5	19.3		145.6	
		Z	0.54	60.4	5.7		132.7	
10039-CAB	CDMA2000 (1xRTT, RC1)	X	4.77	67.1	19.2	4.57	145.6	±0.9 %
		Y	4.85	67.5	19.5		147.8	
		Z	4.67	66.7	18.9		133.4	

10081-CAB	CDMA2000 (1xRTT, RC3)	X	3.93	66.4	18.8	3.97	140.9	±0.7 %
		Y	4.02	66.9	19.1		146.0	
		Z	3.86	66.1	18.5		129.1	
10098-CAB	UMTS-FDD (HSUPA, Subtest 2)	X	4.56	66.6	18.6	3.98	132.8	±0.7 %
		Y	4.58	66.7	18.7		135.9	
		Z	4.63	67.0	18.7		143.0	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.42	67.5	19.8	5.67	139.3	±1.4 %
		Y	6.49	67.9	20.1		143.0	
		Z	6.18	66.7	19.3		126.9	
10108-CAB	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.28	67.1	19.7	5.80	136.9	±1.4 %
		Y	6.35	67.5	20.0		140.4	
		Z	6.36	67.5	19.8		147.1	
10110-CAB	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	5.94	66.5	19.4	5.75	134.0	±1.4 %
		Y	6.01	66.9	19.8		136.4	
		Z	5.99	66.8	19.5		143.6	
10114-CAA	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	X	10.02	68.5	21.1	8.10	127.2	±2.2 %
		Y	10.31	69.3	21.8		130.2	
		Z	10.12	68.8	21.2		139.0	
10117-CAA	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.03	68.5	21.1	8.07	129.2	±2.2 %
		Y	10.31	69.3	21.7		131.2	
		Z	10.15	68.9	21.3		141.0	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	8.54	72.4	24.8	9.28	139.6	±3.0 %
		Y	9.29	75.2	26.7		144.1	
		Z	8.55	72.5	24.7		149.7	
10154-CAB	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	5.94	66.5	19.4	5.75	134.7	±1.4 %
		Y	6.00	66.9	19.7		136.7	
		Z	6.01	66.9	19.5		143.3	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.40	67.1	19.7	5.82	139.9	±1.7 %
		Y	6.48	67.5	20.0		142.9	
		Z	6.43	67.3	19.7		148.7	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	4.90	66.8	19.8	5.73	136.1	±1.4 %
		Y	5.03	67.2	20.2		141.1	
		Z	5.08	67.3	20.0		148.1	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	6.56	72.5	25.2	9.21	125.7	±2.5 %
		Y	7.28	75.4	27.1		128.8	
		Z	6.78	73.0	25.2		138.3	
10175-CAB	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.86	66.6	19.7	5.72	133.7	±1.4 %
		Y	4.97	66.9	20.0		136.3	
		Z	5.04	67.2	19.9		145.7	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.88	66.7	19.7	5.72	133.3	±1.4 %
		Y	4.99	67.0	20.0		136.5	
		Z	5.06	67.3	19.9		145.7	

10193-CAA	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	X	10.05	69.2	21.7	8.09	146.7	±2.5 %
		Y	10.20	69.8	22.1		146.9	
		Z	9.76	68.5	21.1		132.1	
10196-CAA	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	10.05	69.2	21.7	8.10	148.5	±2.2 %
		Y	10.21	69.9	22.2		148.0	
		Z	9.75	68.5	21.2		133.6	
10219-CAA	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	X	9.96	69.2	21.6	8.03	148.9	±2.5 %
		Y	10.09	69.7	22.1		147.4	
		Z	9.67	68.5	21.1		133.4	
10222-CAA	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	X	10.00	68.5	21.1	8.06	127.8	±2.2 %
		Y	10.21	69.1	21.6		127.3	
		Z	10.11	68.9	21.2		140.4	
10225-CAB	UMTS-FDD (HSPA+)	X	6.81	66.5	19.3	5.97	125.8	±1.4 %
		Y	7.07	67.5	19.9		149.0	
		Z	6.92	67.0	19.4		136.8	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	6.62	72.8	25.3	9.21	128.5	±2.2 %
		Y	7.33	75.7	27.2		129.5	
		Z	6.87	73.4	25.5		141.8	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	7.92	71.5	24.4	9.24	131.3	±3.0 %
		Y	8.35	73.3	25.7		131.3	
		Z	7.94	71.6	24.3		140.2	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	8.52	72.3	24.8	9.30	138.8	±3.0 %
		Y	9.10	74.5	26.3		139.5	
		Z	8.53	72.3	24.6		149.4	
10274-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	X	5.98	67.1	19.1	4.87	144.4	±0.9 %
		Y	5.99	67.3	19.2		144.0	
		Z	5.80	66.6	18.7		131.0	
10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.51	67.2	19.0	3.96	148.6	±0.7 %
		Y	4.30	66.3	18.6		127.3	
		Z	4.40	66.9	18.7		135.9	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.61	66.9	18.8	3.46	138.3	±0.7 %
		Y	3.67	67.2	19.0		140.5	
		Z	3.62	67.0	18.7		128.8	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.59	67.1	18.9	3.39	141.5	±0.7 %
		Y	3.59	67.1	18.9		142.0	
		Z	3.59	67.2	18.8		130.8	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.27	67.0	19.7	5.81	135.3	±1.7 %
		Y	6.31	67.3	19.9		136.0	
		Z	6.36	67.4	19.8		147.2	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.91	67.9	20.2	6.06	141.9	±1.7 %
		Y	6.94	68.1	20.4		142.7	
		Z	6.68	67.1	19.7		130.3	

10315-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc duty cycle)	X	2.94	69.9	19.6	1.71	148.6	±0.5 %
		Y	2.81	68.8	19.0		148.8	
		Z	2.92	69.7	19.2		138.1	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.76	68.7	19.1	3.76	128.0	±0.5 %
		Y	4.71	68.2	18.9		129.2	
		Z	4.85	68.8	19.0		141.9	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.64	68.5	19.0	3.77	126.3	±0.7 %
		Y	4.60	68.2	18.9		127.9	
		Z	4.74	68.8	19.0		140.6	

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 8 and 9).
[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:3209

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	6.43	6.43	6.43	0.29	2.01	± 12.0 %
835	41.5	0.90	6.23	6.23	6.23	0.34	1.70	± 12.0 %
1750	40.1	1.37	5.24	5.24	5.24	0.80	1.13	± 12.0 %
1900	40.0	1.40	5.13	5.13	5.13	0.46	1.49	± 12.0 %
2450	39.2	1.80	4.54	4.54	4.54	0.63	1.38	± 12.0 %
2600	39.0	1.96	4.38	4.38	4.38	0.76	1.28	± 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.

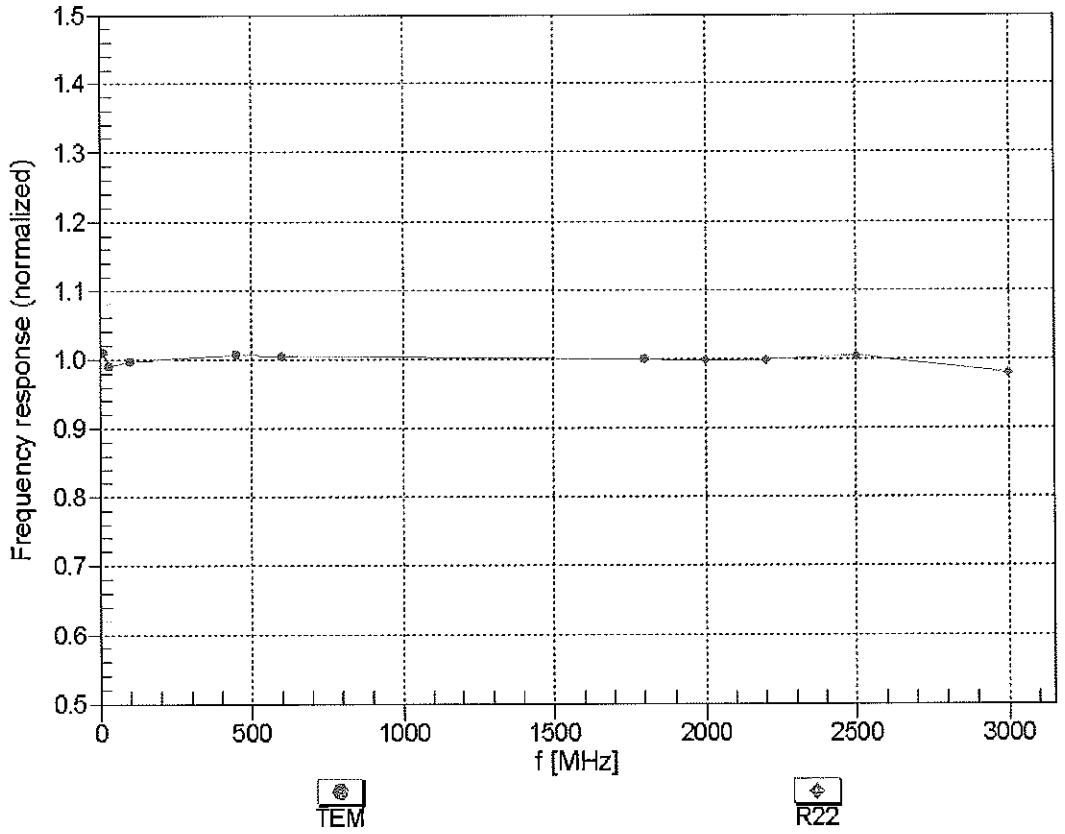
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3209

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	6.16	6.16	6.16	0.26	2.23	± 12.0 %
835	55.2	0.97	6.14	6.14	6.14	0.80	1.13	± 12.0 %
1750	53.4	1.49	4.85	4.85	4.85	0.59	1.42	± 12.0 %
1900	53.3	1.52	4.68	4.68	4.68	0.52	1.59	± 12.0 %
2450	52.7	1.95	4.20	4.20	4.20	0.73	1.08	± 12.0 %
2600	52.5	2.16	4.04	4.04	4.04	0.80	1.00	± 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.

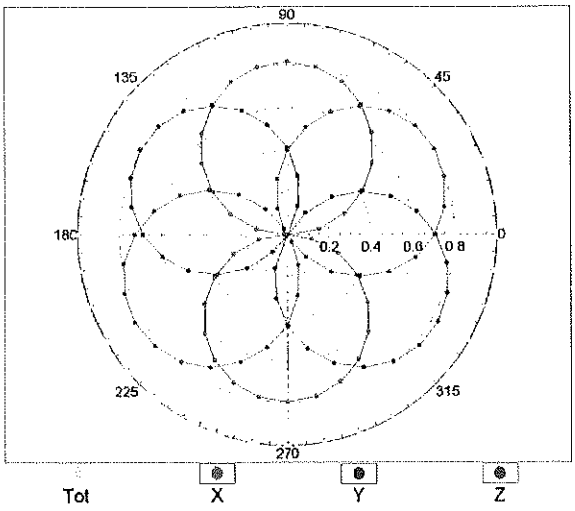
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



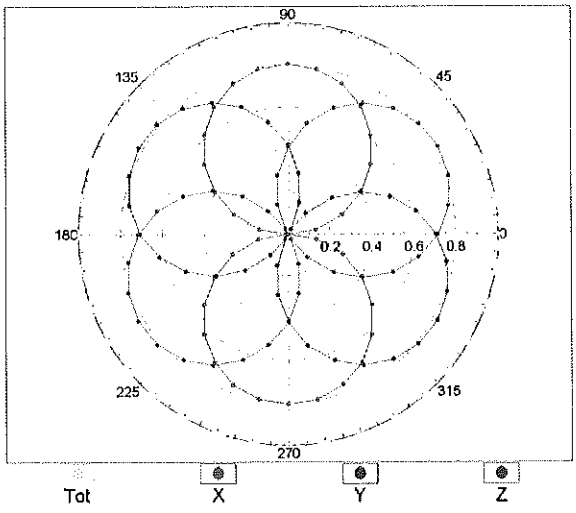
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

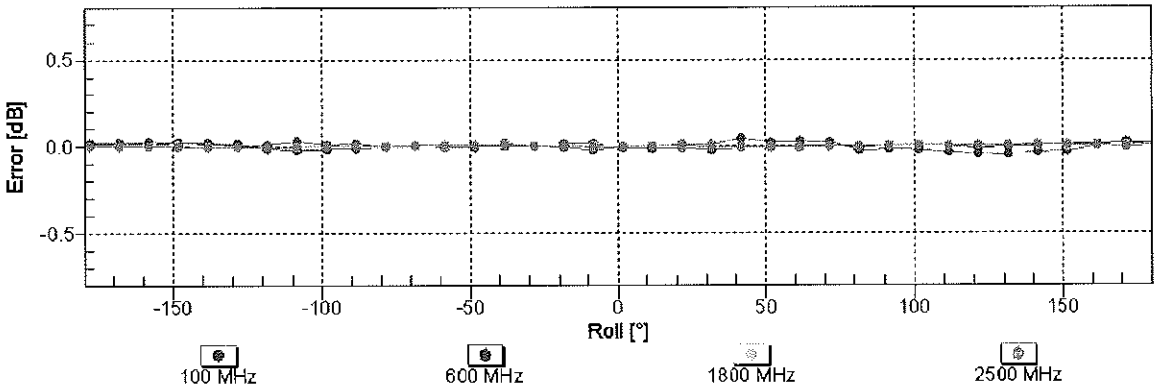
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



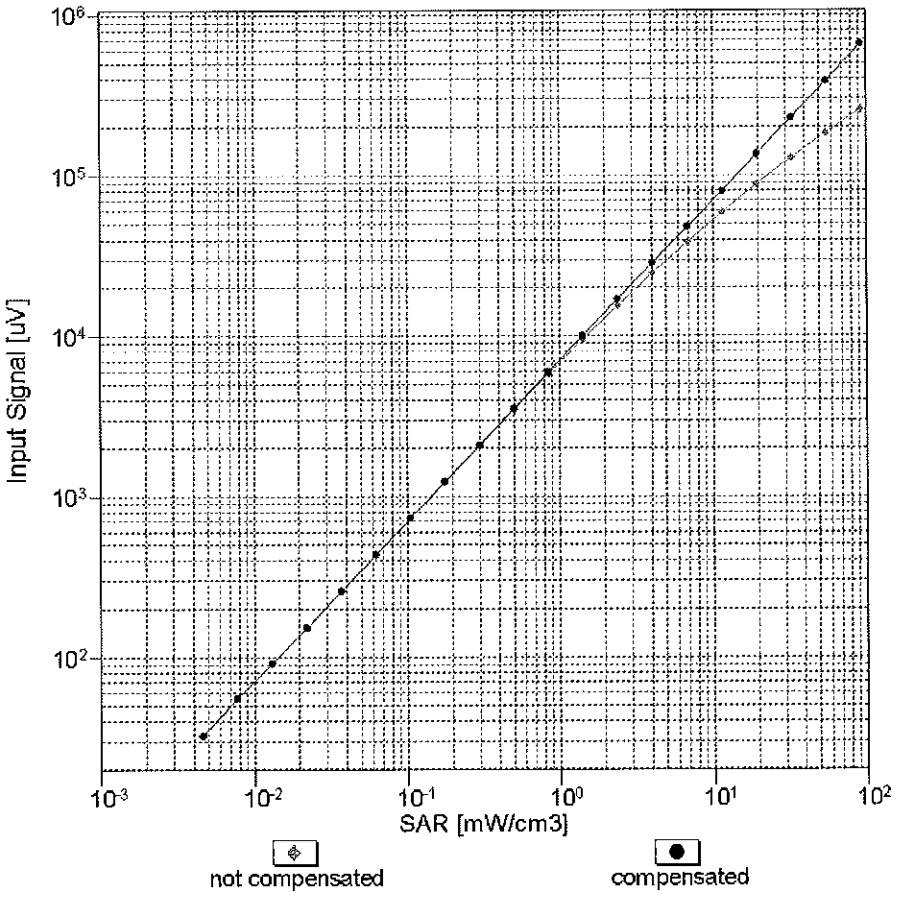
f=1800 MHz,R22

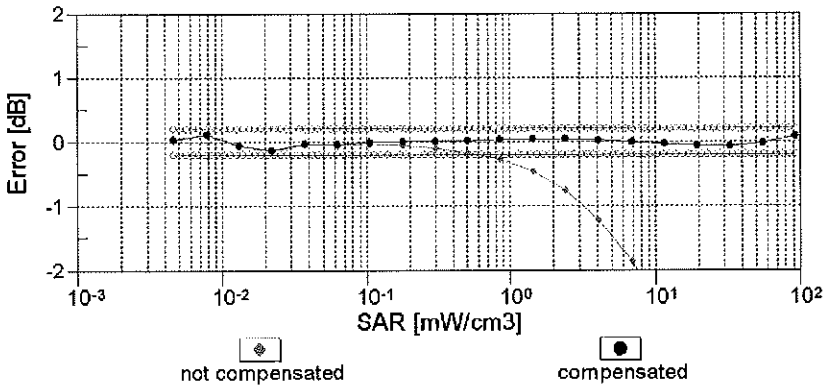




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})
(TEM cell , f_{eval}= 1900 MHz)

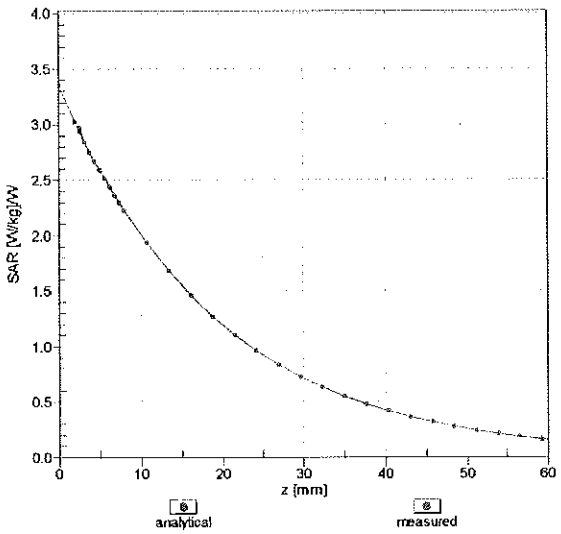




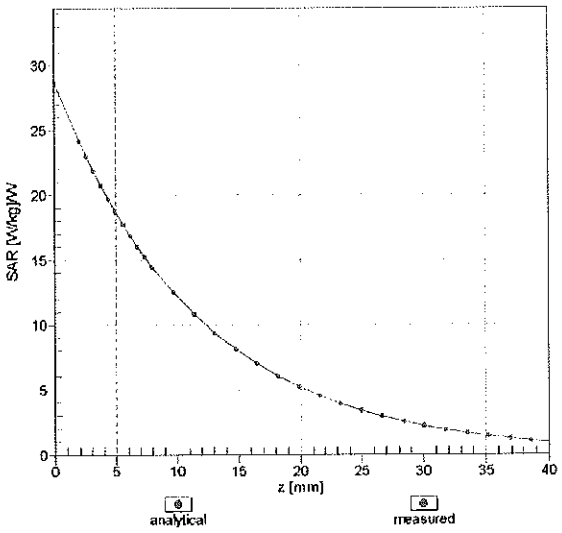
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

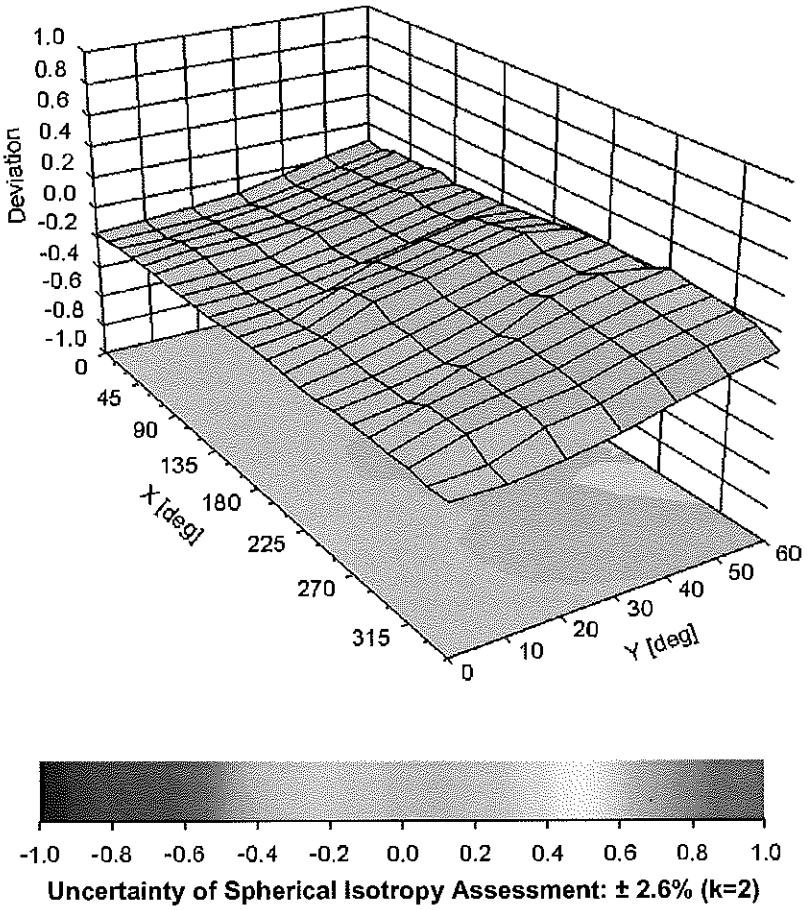


f = 1900 MHz,WGLS R22 (H_convF)



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:3209

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-38.3
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

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) **Accreditation No.: SCS 108**
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Client PC Test **Certificate No: EX3-3589_Jan14**

CALIBRATION CERTIFICATE

Object EX3DV4 - SN:3589

Calibration procedure(s) QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

CC 25/14

Calibration date: January 29, 2014

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	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-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-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 30, 2014

PCT-A 783

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) **Accreditation No.: SCS 108**

The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

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 EX3DV4

SN:3589

Manufactured: March 30, 2006
Calibrated: January 29, 2014

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3589

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.46	0.40	0.40	± 10.1 %
DCP (mV)[B]	101.2	100.8	98.0	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	150.4	±3.8 %
		Y	0.0	0.0	1.0		142.3	
		Z	0.0	0.0	1.0		171.7	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	6.00	69.5	14.2	10.00	42.1	±0.9 %
		Y	7.03	71.8	15.0		40.3	
		Z	3.33	64.6	12.1		44.6	
10011-CAA	UMTS-FDD (WCDMA)	X	3.26	66.2	17.8	2.91	117.6	±0.9 %
		Y	3.38	66.8	18.2		113.0	
		Z	2.79	62.4	14.7		133.2	
10012-CAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	2.77	66.8	17.4	1.87	117.4	±0.7 %
		Y	3.22	69.6	18.8		113.5	
		Z	2.22	62.0	13.8		135.2	
10021-DAA	GSM-FDD (TDMA, GMSK)	X	3.61	69.7	16.6	9.39	91.2	±1.7 %
		Y	5.48	77.1	19.6		125.1	
		Z	2.18	62.5	12.6		75.3	
10023-DAA	GPRS-FDD (TDMA, GMSK, TN 0)	X	3.01	66.4	14.9	9.57	86.1	±2.7 %
		Y	7.02	82.0	22.0		120.5	
		Z	2.13	62.9	12.7		71.4	
10024-DAA	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	18.01	91.8	22.6	6.56	132.3	±1.7 %
		Y	8.55	83.0	19.9		134.3	
		Z	4.04	72.4	15.7		139.6	
10027-DAA	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	4.70	74.7	15.9	4.80	107.5	±1.7 %
		Y	4.94	76.1	16.4		107.8	
		Z	2.97	68.7	12.8		127.1	
10028-DAA	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	67.89	99.9	21.4	3.55	114.7	±2.7 %
		Y	48.02	99.7	21.9		116.6	
		Z	1.36	61.4	7.8		134.4	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	97.41	97.0	17.7	1.16	129.2	±3.0 %
		Y	71.47	99.8	19.3		130.9	
		Z	0.29	53.5	0.9		109.2	
10039-CAA	CDMA2000 (1xRTT, RC1)	X	4.62	65.4	18.0	4.57	113.0	±1.7 %
		Y	4.74	66.1	18.4		111.5	
		Z	4.22	63.3	15.9		133.6	
10062-CAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	X	10.10	67.8	20.8	8.68	108.0	±2.7 %
		Y	10.07	68.1	21.1		108.1	
		Z	10.03	67.6	20.2		130.3	

10098-CAA	UMTS-FDD (HSUPA, Subtest 2)	X	4.53	65.7	17.8	3.98	122.5	±0.9 %
		Y	4.72	66.6	18.4		123.1	
		Z	4.38	64.5	16.7		147.3	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.32	66.5	18.8	5.67	126.9	±1.2 %
		Y	6.50	67.2	19.4		128.9	
		Z	5.80	64.3	17.3		107.2	
10108-CAB	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.22	66.1	18.8	5.80	124.2	±1.7 %
		Y	6.39	66.9	19.4		126.7	
		Z	6.10	65.2	17.7		149.4	
10110-CAB	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	5.94	65.8	18.7	5.75	121.3	±1.7 %
		Y	6.05	66.3	19.1		123.1	
		Z	5.80	65.0	17.7		144.5	
10114-CAA	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	X	10.01	67.7	20.3	8.10	113.9	±2.5 %
		Y	10.16	68.3	20.8		117.0	
		Z	9.96	67.5	19.8		135.3	
10117-CAA	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.07	67.9	20.4	8.07	115.2	±2.5 %
		Y	10.16	68.2	20.7		118.4	
		Z	10.02	67.7	19.9		138.0	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	7.89	68.4	21.8	9.28	108.1	±1.9 %
		Y	8.15	69.7	22.8		109.4	
		Z	7.38	66.5	20.4		123.2	
10154-CAB	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	5.94	65.7	18.6	5.75	122.1	±1.7 %
		Y	6.03	66.3	19.0		122.5	
		Z	5.79	65.0	17.7		144.0	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.38	66.3	18.9	5.82	126.0	±1.7 %
		Y	6.54	67.0	19.4		128.2	
		Z	6.16	65.3	17.8		146.9	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.17	66.5	19.2	5.73	149.7	±1.2 %
		Y	4.95	65.8	19.0		108.3	
		Z	4.64	63.9	17.1		125.3	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	6.79	70.4	23.0	9.21	120.6	±3.0 %
		Y	6.96	72.0	24.2		122.8	
		Z	6.43	69.3	22.0		136.7	
10175-CAB	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	5.15	66.4	19.1	5.72	143.0	±1.4 %
		Y	5.23	67.1	19.6		145.8	
		Z	4.60	63.7	17.0		121.1	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	5.11	66.2	19.0	5.72	141.0	±1.4 %
		Y	5.27	67.3	19.7		144.9	
		Z	4.54	63.4	16.8		119.2	
10193-CAA	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	X	9.57	67.1	20.1	8.09	102.2	±2.2 %
		Y	9.59	67.4	20.4		105.3	
		Z	9.73	67.6	20.0		129.6	
10196-CAA	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.61	67.3	20.2	8.10	104.6	±2.5 %
		Y	9.63	67.6	20.5		107.8	
		Z	9.63	67.3	19.8		130.9	

10219-CAA	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	X	9.61	67.5	20.3	8.03	109.2	±2.7 %
		Y	9.54	67.5	20.4		107.4	
		Z	9.53	67.2	19.7		130.7	
10222-CAA	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	X	10.00	67.8	20.4	8.06	114.1	±2.7 %
		Y	10.01	68.0	20.6		112.3	
		Z	9.96	67.6	19.9		137.1	
10225-CAA	UMTS-FDD (HSPA+)	X	7.18	66.9	19.2	5.97	137.5	±1.4 %
		Y	7.25	67.4	19.5		134.4	
		Z	6.48	64.4	17.3		114.6	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	6.93	71.0	23.5	9.21	123.5	±3.0 %
		Y	6.88	71.6	24.0		119.3	
		Z	6.63	70.1	22.4		141.3	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	8.19	70.5	23.1	9.24	142.9	±2.5 %
		Y	8.46	72.0	24.2		143.3	
		Z	7.10	67.0	20.8		119.9	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	7.83	68.1	21.6	9.30	104.2	±2.2 %
		Y	8.07	69.4	22.7		103.0	
		Z	7.49	67.2	20.9		125.2	
10274-CAA	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	X	5.96	66.2	18.3	4.87	128.1	±1.7 %
		Y	6.12	67.0	18.8		126.0	
		Z	5.31	63.8	16.4		110.2	
10275-CAA	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.30	65.5	17.8	3.96	110.5	±1.2 %
		Y	4.47	66.4	18.4		110.3	
		Z	3.92	63.1	15.6		135.7	
10291-AAA	CDMA2000, RC3, SO55, Full Rate	X	3.59	65.7	17.7	3.46	138.1	±1.2 %
		Y	3.85	67.2	18.6		146.7	
		Z	3.08	61.7	14.7		123.3	
10292-AAA	CDMA2000, RC3, SO32, Full Rate	X	3.59	66.0	17.8	3.39	144.2	±0.9 %
		Y	3.83	67.5	18.7		148.4	
		Z	3.18	63.1	15.7		128.6	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.13	65.8	18.7	5.81	116.5	±1.7 %
		Y	6.30	66.6	19.2		119.4	
		Z	6.20	65.9	18.4		145.6	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.70	66.4	19.0	6.06	122.5	±1.4 %
		Y	6.92	67.3	19.6		124.5	
		Z	6.28	65.0	17.9		103.7	
10315-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc duty cycle)	X	2.66	66.7	17.4	1.71	109.5	±0.7 %
		Y	3.18	70.0	19.2		111.5	
		Z	2.08	61.6	13.4		134.4	
10317-AAA	IEEE 802.11a WiFi 5 GHz (OFDM, 6 Mbps, 96pc duty cycle)	X	9.78	67.4	20.4	8.36	103.5	±2.5 %
		Y	9.81	67.7	20.7		107.1	
		Z	9.86	67.6	20.3		129.5	
10400-AAA	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	9.86	67.5	20.4	8.37	104.9	±2.7 %
		Y	9.93	67.9	20.8		107.9	
		Z	9.97	67.7	20.2		134.3	

10402-AAA	IEEE 802.11ac WiFi (80MHz, 64-QAM, 99pc duty cycle)	X	10.47	67.9	20.5	8.53	109.9	±3.0 %
		Y	10.86	68.8	21.1		116.0	
		Z	10.68	68.2	20.4		142.5	
10403-AAA	CDMA2000 (1xEV-DO, Rev. 0)	X	4.74	67.0	17.9	3.76	114.9	±0.9 %
		Y	5.02	68.5	18.7		116.6	
		Z	4.23	64.4	15.8		145.1	
10404-AAA	CDMA2000 (1xEV-DO, Rev. A)	X	4.71	67.1	17.9	3.77	112.3	±1.4 %
		Y	4.95	68.5	18.7		115.0	
		Z	4.01	63.4	15.1		138.9	

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 8 and 9).
[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: EX3DV4 - SN:3589

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	8.86	8.86	8.86	0.80	0.62	± 12.0 %
835	41.5	0.90	8.49	8.49	8.49	0.45	0.82	± 12.0 %
1750	40.1	1.37	7.31	7.31	7.31	0.80	0.60	± 12.0 %
1900	40.0	1.40	7.05	7.05	7.05	0.52	0.73	± 12.0 %
2450	39.2	1.80	6.45	6.45	6.45	0.29	1.08	± 12.0 %
2600	39.0	1.96	6.24	6.24	6.24	0.76	0.62	± 12.0 %
5200	36.0	4.66	4.78	4.78	4.78	0.30	1.80	± 13.1 %
5300	35.9	4.76	4.58	4.58	4.58	0.30	1.80	± 13.1 %
5500	35.6	4.96	4.44	4.44	4.44	0.31	1.80	± 13.1 %
5600	35.5	5.07	4.20	4.20	4.20	0.35	1.80	± 13.1 %
5800	35.3	5.27	4.39	4.39	4.39	0.32	1.80	± 13.1 %

[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.

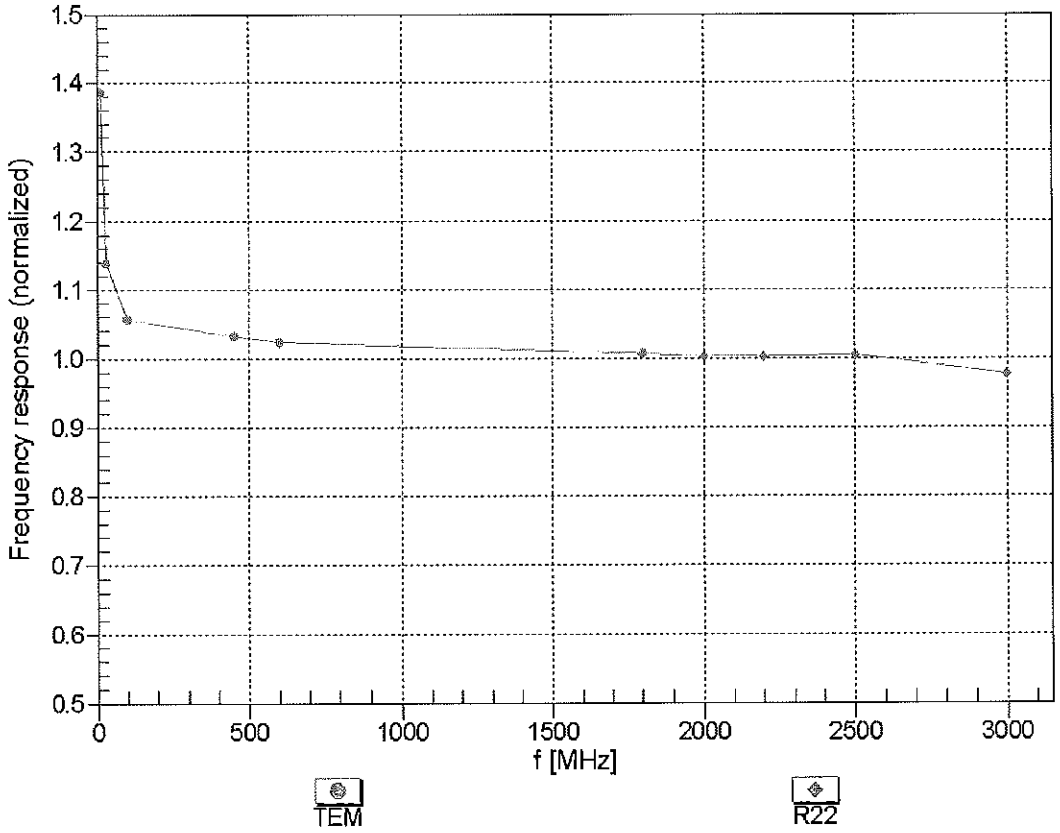
DASY/EASY - Parameters of Probe: EX3DV4 - SN:3589

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	8.34	8.34	8.34	0.66	0.72	± 12.0 %
835	55.2	0.97	8.29	8.29	8.29	0.31	1.11	± 12.0 %
1750	53.4	1.49	6.68	6.68	6.68	0.80	0.61	± 12.0 %
1900	53.3	1.52	6.54	6.54	6.54	0.72	0.64	± 12.0 %
2450	52.7	1.95	6.26	6.26	6.26	0.80	0.57	± 12.0 %
2600	52.5	2.16	6.08	6.08	6.08	0.68	0.50	± 12.0 %
5200	49.0	5.30	4.19	4.19	4.19	0.38	1.90	± 13.1 %
5300	48.9	5.42	3.98	3.98	3.98	0.38	1.90	± 13.1 %
5500	48.6	5.65	3.76	3.76	3.76	0.42	1.90	± 13.1 %
5600	48.5	5.77	3.81	3.81	3.81	0.30	1.90	± 13.1 %
5800	48.2	6.00	3.97	3.97	3.97	0.43	1.90	± 13.1 %

[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.

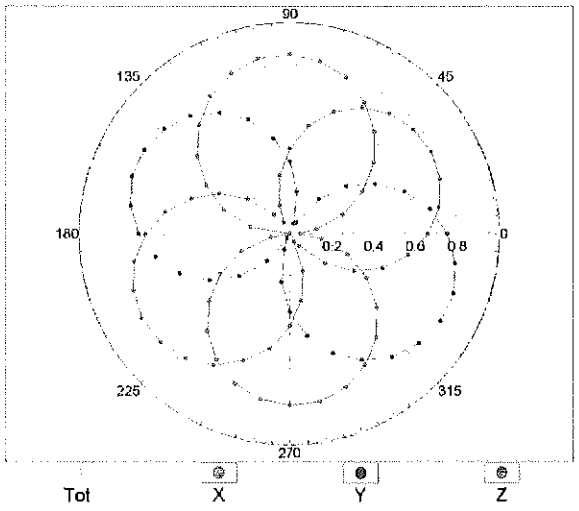
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



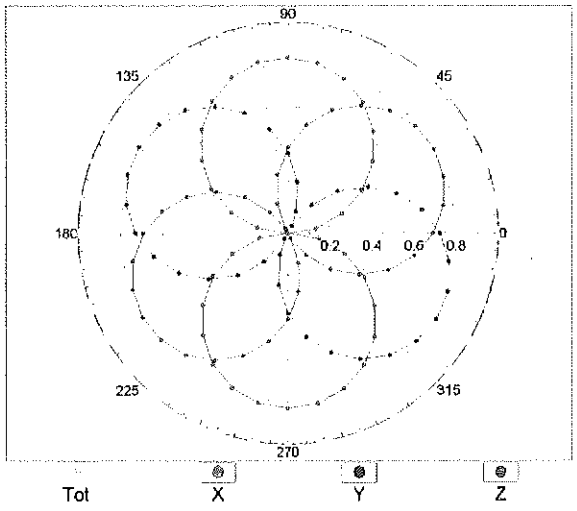
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

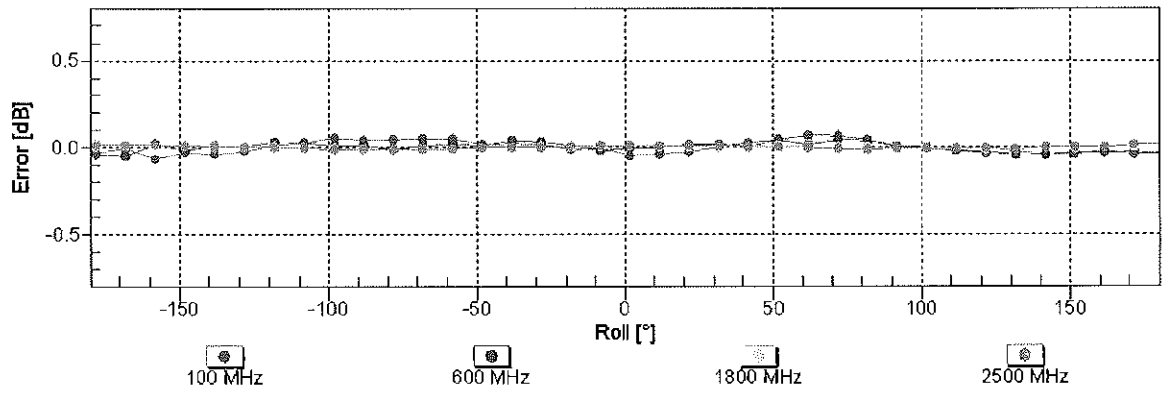
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



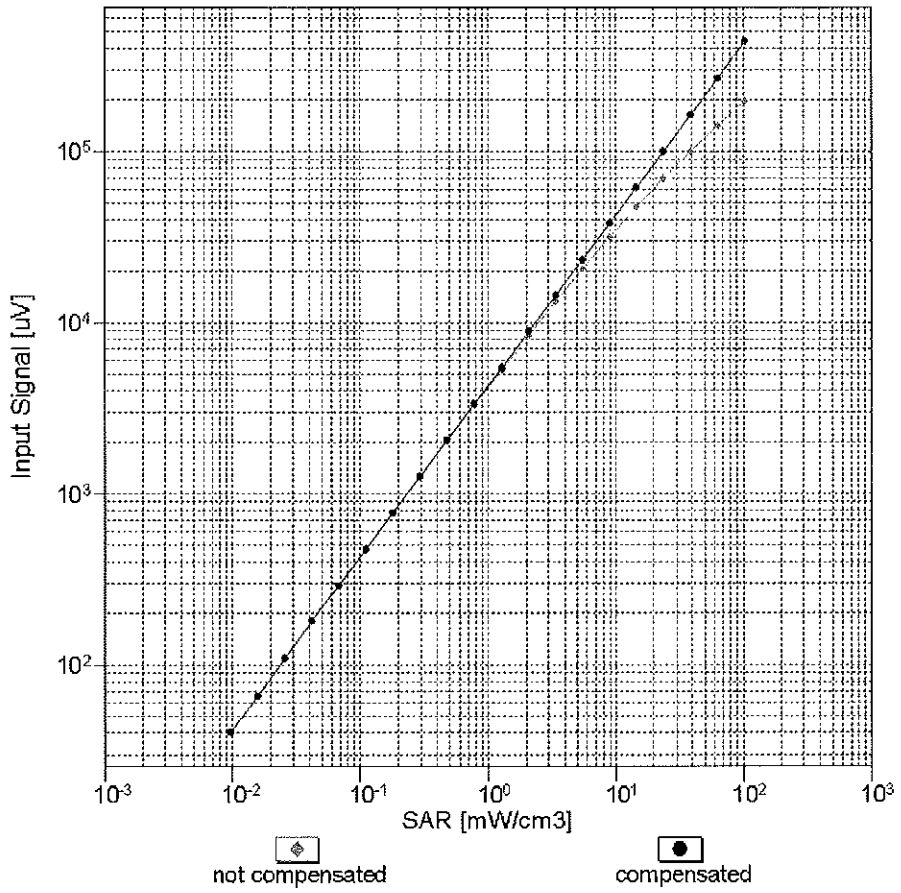
f=1800 MHz,R22

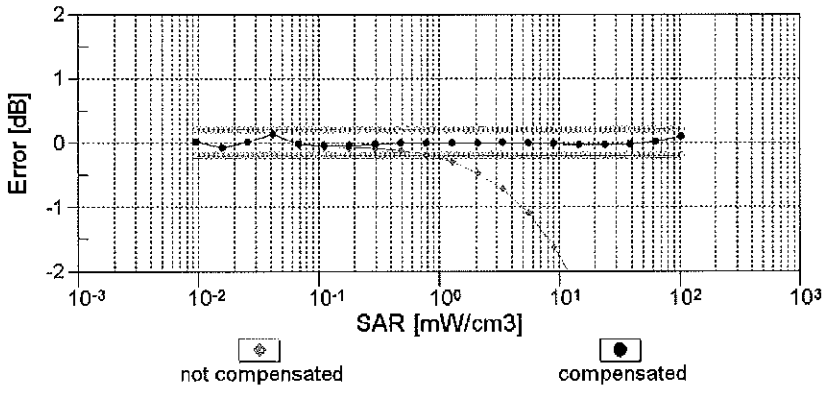




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

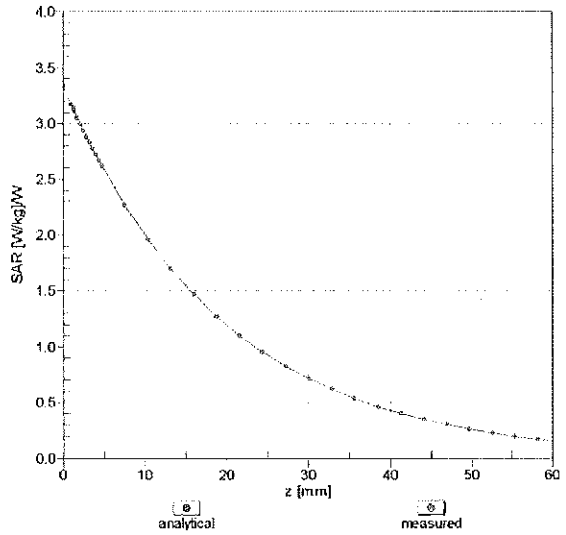




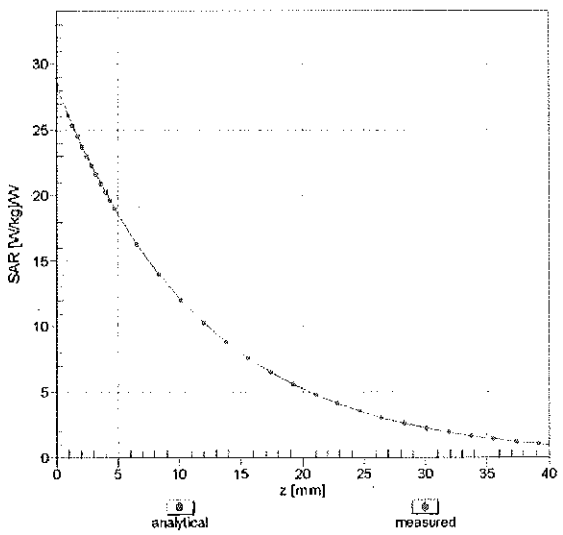
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

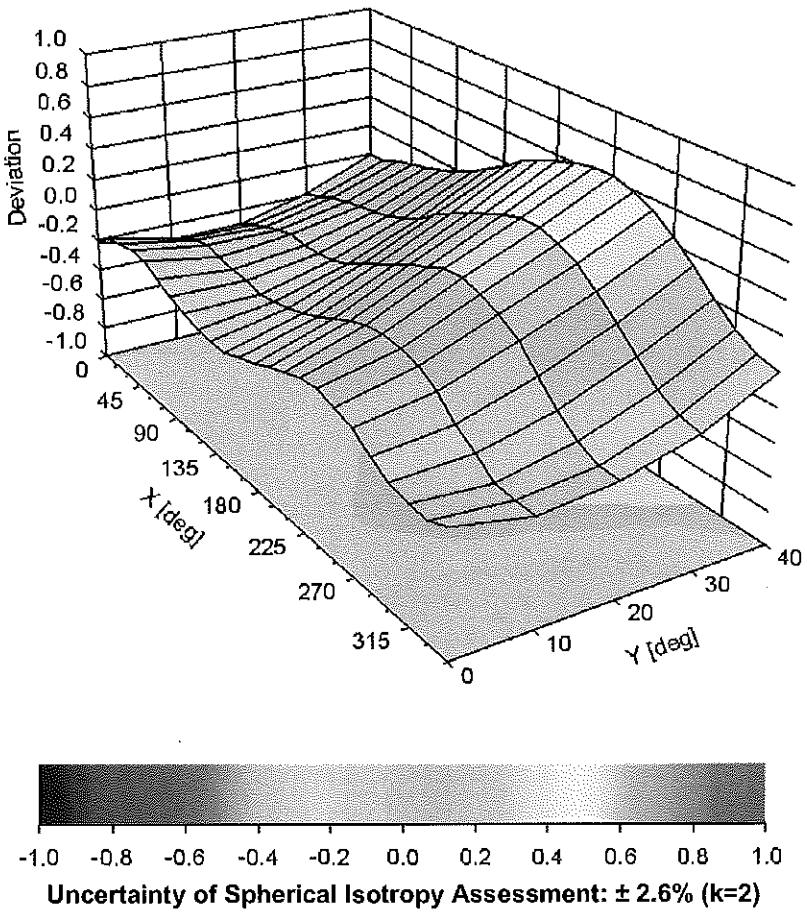


f = 1900 MHz,WGLS R22 (H_convF)



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: EX3DV4 - SN:3589

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-38.2
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm