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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:
02/13/13 - 03/13/13
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Document Serial No.:
0Y1302130270-R1.ZNF

FCC ID: **ZNFE980**

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-E980, E980, LGE980
Permissive Change(s): See FCC Change Document
Date of Original Certification: 03/21/2013

Equipment Class	Band & Mode	Tx Frequency	Measured Conducted Power [dBm]	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	33.24	0.26	0.39	0.53
PCE	UMTS 850	826.40 - 846.60 MHz	23.68	0.17	0.30	0.35
PCE	GSM/GPRS/EDGE 1900	1850.20 - 1909.80 MHz	30.67	0.23	0.76	0.76
PCE	UMTS 1900	1852.4 - 1907.6 MHz	23.68	0.27	1.08	1.08
PCE	LTE Band 17	706.5 - 713.5 MHz	23.70	0.12	0.24	0.24
PCE	LTE Band 5 (Cell)	826.5 - 846.5 MHz	23.70	0.17	0.28	0.28
PCE	LTE Band 4 (AWS)	1712.5 - 1752.5 MHz	23.70	0.64	0.70	0.70
PCE	LTE Band 2 (PCS)	1852.5 - 1907.5 MHz	23.70	0.26	1.18	1.18
DTS	2.4 GHz WLAN	2412 - 2462 MHz	16.85	< 0.1	0.32	0.32
DTS	5.8 GHz WLAN	5745 - 5825 MHz	14.89	< 0.1	0.16	
UNII	5.2 GHz WLAN	5180 - 5240 MHz	14.86	< 0.1	0.30	
UNII	5.3 GHz WLAN	5260 - 5320 MHz	14.80	< 0.1	0.42	
UNII	5.5 GHz WLAN	5500 - 5700 MHz	14.26	< 0.1	0.28	
DSS/DTS	Bluetooth	2402 - 2480 MHz	11.12	N/A		
Simultaneous SAR per KDB 690783 D01v01r02:				0.68	1.60	1.50

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

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 1.10 of this report; for North American frequency bands only.

Note: This revised Test Report (S/N: 0Y1302130270-R1.ZNF) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly

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

ilac-MRA
ACCREDITED
TESTING LABORATORY
CERTIFICATE #2041.01

T A B L E   O F   C O N T E N T S

1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
GSM/GPRS/EDGE 850	Voice/Data	824.20 - 848.80 MHz
UMTS 850	Voice/Data	826.40 - 846.60 MHz
GSM/GPRS/EDGE 1900	Voice/Data	1850.20 - 1909.80 MHz
UMTS 1900	Voice/Data	1852.4 - 1907.6 MHz
LTE Band 17	Data	706.5 - 713.5 MHz
LTE Band 5 (Cell)	Data	826.5 - 846.5 MHz
LTE Band 4 (AWS)	Data	1712.5 - 1752.5 MHz
LTE Band 2 (PCS)	Data	1852.5 - 1907.5 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.

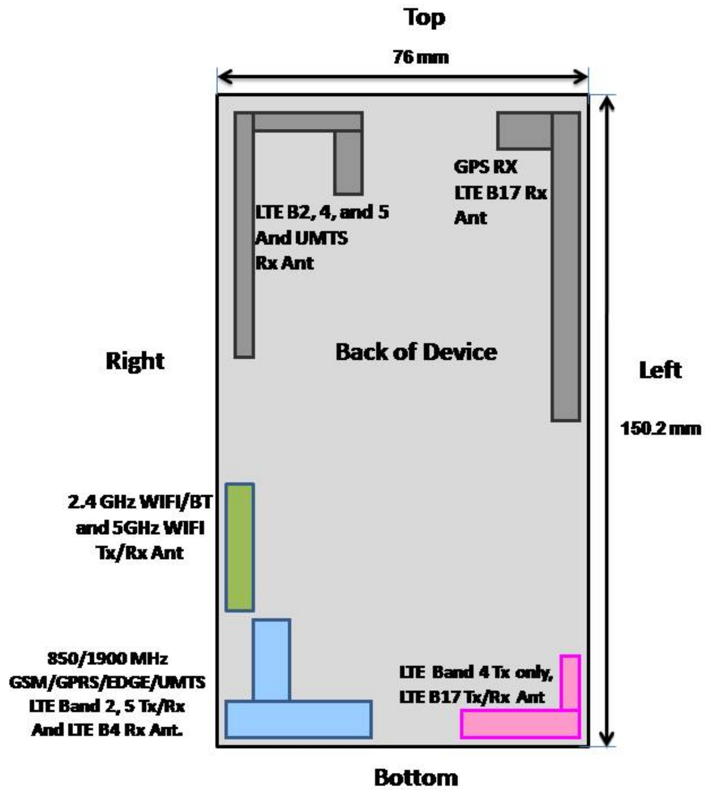
Mode / Band		Voice (dBm)	Burst Average GMSK (dBm)		Burst Average 8-PSK (dBm)	
		1 TX Slot	*1 TX Slots*	*2 TX Slots*	*1 TX Slots*	*2 TX Slots*
GSM/GPRS/EDGE 850	Maximum	**33.7**	**33.7**	**31.7**	**27.7**	**27.7**
	Nominal	**33.2**	**33.2**	**31.2**	**27.2**	**27.2**
GSM/GPRS/EDGE 1900	Maximum	**30.7**	**30.7**	**28.7**	**26.7**	**26.7**
	Nominal	**30.2**	**30.2**	**28.2**	**26.2**	**26.2**

Mode / Band		Modulated Average		
		3GPP RMC	*3GPP HSDPA*	*3GPP HSUPA*
UMTS Band 5 (850 MHz)	Maximum	**23.7**	**23.7**	**23.7**
	Nominal	**23.2**	**23.2**	**23.2**
UMTS Band 2 (1900 MHz)	Maximum	**23.7**	**23.7**	**23.7**
	Nominal	**23.2**	**23.2**	**23.2**

Mode / Band		Modulated Average (dBm)
LTE Band 17	Maximum	**23.7**
	Nominal	**23.2**
LTE Band 5 (Cell)	Maximum	**23.7**
	Nominal	**23.2**
LTE Band 4 (AWS)	Maximum	**23.7**
	Nominal	**23.2**
LTE Band 2 (PCS)	Maximum	**23.7**
	Nominal	**23.2**

Mode / Band		Modulated Average (dBm)
IEEE 802.11b (2.4 GHz)	Maximum	**18.1**
	Nominal	**17.0**
IEEE 802.11g (2.4 GHz)	Maximum	**14.1**
	Nominal	**13.0**
IEEE 802.11n (2.4 GHz)	Maximum	**13.1**
	Nominal	**12.0**
IEEE 802.11a (5 GHz)	Maximum	**15.1**
	Nominal	**14.0**
IEEE 802.11n (5GHz 20 MHz) UNII - 1/2/3	Maximum	**14.1**
	Nominal	**13.0**
IEEE 802.11n (5GHz 20 MHz) ISM (Ch149 - Ch165)	Maximum	**13.1**
	Nominal	**12.0**
IEEE 802.11n (5 GHz 40 MHz) UNII - 1/2/3	Maximum	**14.1**
	Nominal	**13.0**
IEEE 802.11n (5GHz 40 MHz) ISM (Ch151 - Ch159)	Maximum	**13.4**
	Nominal	**12.3**
Bluetooth	Maximum	**11.5**
	Nominal	**10.5**
Bluetooth LE	Maximum	**9.1**
	Nominal	**7.5**

1.3 DUT Antenna Locations



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

Figure 1-1
DUT Antenna Locations

Table 1-1
Mobile Hotspot Sides for SAR Testing

Mobile Hotspot Sides for SAR Testing						
Mode	Back	Front	Top	Bottom	Right	Left
GPRS 850	Yes	Yes	No	Yes	Yes	No
UMTS 850	Yes	Yes	No	Yes	Yes	No
GPRS 1900	Yes	Yes	No	Yes	Yes	No
UMTS 1900	Yes	Yes	No	Yes	Yes	No
LTE Band 17	Yes	Yes	No	Yes	No	Yes
LTE Band 5 (Cell)	Yes	Yes	No	Yes	Yes	No
LTE Band 4 (AWS)	Yes	Yes	No	Yes	No	Yes
LTE Band 2 (PCS)	Yes	Yes	No	Yes	Yes	No
2.4 GHz WLAN	Yes	Yes	No	Yes	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. When the wireless router mode is enabled, all 5 GHz bands are disabled. Therefore 5 GHz WIFI is not considered in this section.

1.4 Near Field Communications (NFC) Antenna

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

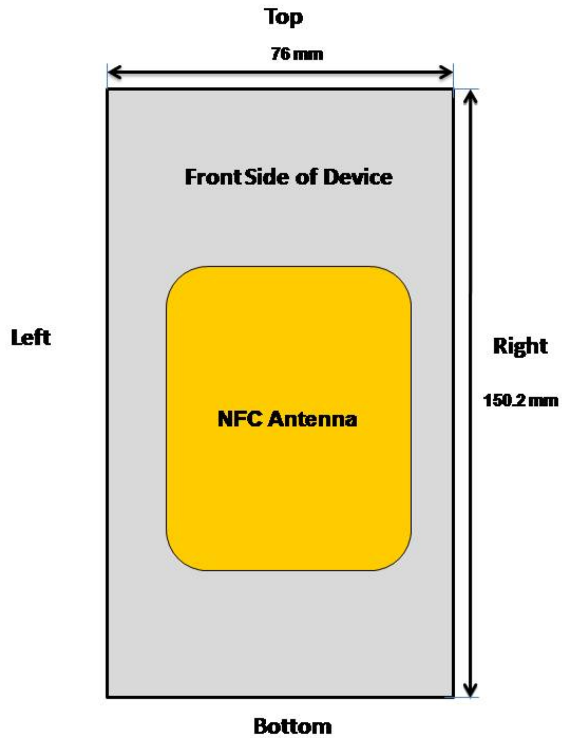


Figure 1-2
NFC Antenna Locations

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.

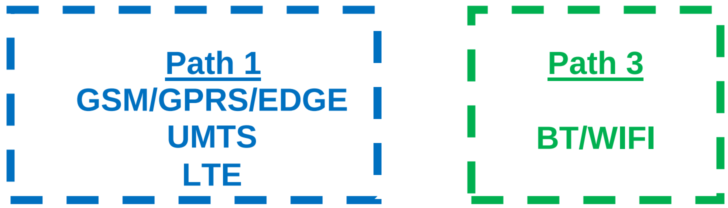


Figure 1-3
Simultaneous Transmission Paths

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 TX Configration	Head SAR	Body Worn SAR	Hotspot SAR	Note
1	GSM 850 Voice + WiFi 2.4Ghz	yes	yes	N/A	GSM voice + WiFi 2.4Ghz
2	GSM 1900 Voice + WiFi 2.4Ghz	yes	yes	N/A	
3	GSM 850 Voice + WiFi 5Ghz	yes	yes	N/A	GSM voice + WiFi 5Ghz
4	GSM 1900 Voice + WiFi 5Ghz	yes	yes	N/A	
5	GSM 850 GPRS/EDGE + WiFi 2.4Ghz	yes	yes	yes	GPRS/EDGE + WiFi 2.4Ghz
6	GSM 1900 GPRS/EDGE + WiFi 2.4Ghz	yes	yes	yes	
7	GSM 850 GPRS/EDGE + WiFi 5Ghz	yes	yes	no	GPRS/EDGE + WiFi 5Ghz (WIFI Direct)
8	GSM 1900 GPRS/EDGE + WiFi 5Ghz	yes	yes	no	
9	UMTS 850 + WiFi 2.4Ghz	yes	yes	yes	UMTS + WiFi 2.4Ghz
10	UMTS 1900 + WiFi 2.4Ghz	yes	yes	yes	
11	UMTS 850 + WiFi 5Ghz	yes	yes	no	UMTS + WiFi 5Ghz
12	UMTS 1900 + WiFi 5Ghz	yes	yes	no	
13	GSM 850 Voice + 2.4 GHz Bluetooth	no	yes	no	2G/3G + 2.4 GHz Bluetooth
14	GSM 1900 Voice + 2.4 GHz Bluetooth	no	yes	no	
15	UMTS 850 + 2.4 GHz Bluetooth	no	yes	no	
16	UMTS 1900 + 2.4 GHz Bluetooth	no	yes	no	
17	LTE B2 + 2.4 GHz Bluetooth	no	yes	no	LTE + 2.4 GHz Bluetooth
18	LTE B4 + 2.4 GHz Bluetooth	no	yes	no	
19	LTE B5 + 2.4 GHz Bluetooth	no	yes	no	
20	LTE B6 + 2.4 GHz Bluetooth	no	yes	no	
21	LTE B2 + WiFi 2.4Ghz	yes	yes	yes	LTE + WiFi 2.4Ghz
22	LTE B4 + WiFi 2.4Ghz	yes	yes	yes	
23	LTE B5 + WiFi 2.4Ghz	yes	yes	yes	
24	LTE B17 + WiFi 2.4Ghz	yes	yes	yes	
25	LTE B2 + WiFi 5Ghz	yes	yes	no	LTE + WiFi 5Ghz (WIFI Direct)
26	LTE B4 + WiFi 5Ghz	yes	yes	no	
27	LTE B5 + WiFi 5Ghz	yes	yes	no	
28	LTE B17 + WiFi 5Ghz	yes	yes	no	

1. LTE, UMTS data, GPRS/EDGE is supported Hotspot.
2. VoIP is supported in LTE, WCDMA, GSM (e.g. 3rd part VoIP and VoLTE)
3. Bluetooth and WiFi can not transmit simultaneously since they share the same chip.
4. GSM, UMTS and LTE can not transmit simultaneously since they share the same chip.
5. Per the manufacturer, WIFI Direct Group Owner capabilities are only available in the 2.4 GHz Band.

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

1.6 SAR Test Exclusions Applied

(A) WIFI/BT

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

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

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

Based on the maximum conducted power of Bluetooth (rounded to the nearest mW) and the antenna to user separation distance, Bluetooth SAR was not required; [(14/10)* √2.441] = 2.2< 3.0.

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

(B) Licensed Transmitter(s)

This model does not support Simultaneous Voice and Data for the licensed transmitter in any modes except in UMTS that allows Multi-RAB transmissions that share voice and data operations on a single physical channel.

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

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

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

1.7 Power Reduction for SAR

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

1.8 Wireless Charging Cover

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

1.9 Folio Sleeve Accessory

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

1.10 Guidance Applied

- FCC OET Bulletin 65 Supplement C [June 2001]
- 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 D04 (Folio Sleeve Accessory)

1.11 Device Serial Numbers

Several samples were used with identical hardware to support SAR testing. The manufacturer has confirmed that the devices tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.

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

2 LTE INFORMATION

LTE Information			
FCC ID	**ZNFE980**		
Form Factor	Portable Handset		
Frequency Range of each LTE transmission band	LTE Band 17 (706.5 - 713.5 MHz)		
	LTE Band 5 (Cell) (826.5 - 846.5 MHz)		
	LTE Band 4 (AWS) (1712.5 - 1752.5 MHz)		
	LTE Band 2 (PCS) (1852.5 - 1907.5 MHz)		
Channel Bandwidths	LTE Band 17: 5 MHz, 10 MHz		
	LTE Band 5 (Cell): 5 MHz, 10 MHz		
	LTE Band 4 (AWS): 5 MHz, 10 MHz		
	LTE Band 2 (PCS): 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 5 (Cell): 5 MHz	826.5 (20425)	836.5 (20525)	846.5 (20625)
LTE Band 5 (Cell): 10 MHz	829 (20450)	836.5 (20525)	844 (20600)
LTE Band 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 2 (PCS): 5 MHz	1852.5 (18625)	1880 (18900)	1907.5 (19175)
LTE Band 2 (PCS): 10 MHz	1855 (18650)	1880 (18900)	1905 (19150)
UE Category	3		
Modulations Supported in UL	QPSK, 16QAM		
LTE Transmitter and Antenna Implementation	2Tx/Rx antennas and 2 Rx only antennas for LTE		
Description of LTE Tx and Ant. Implementation	GSM/UMTS/LTE share the same transmitter		
Hotspot with LTE+WIFI	YES		
Hotspot with LTE+WIFI active with 1XVoice sessions?	NO		
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		
Conducted power Table provided for 1RB (low, mid and high offset), 50% RB (low, mid, and high offset), and 100% RB	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 [24]. The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave [4] is used for guidance in measuring the Specific Absorption Rate (SAR) due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the International Committee for Non-Ionizing Radiation Protection (ICNIRP) in Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," Report No. Vol 74. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

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:

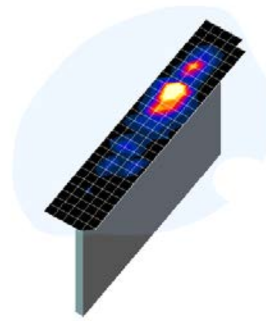


Figure 4-1
Sample SAR Area Scan

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).
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). On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual online for more details):

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

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

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

Table 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

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) is perpendicular to the reference plane and passing through the RE (or LE) is called the Reference Pivoting Line (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].

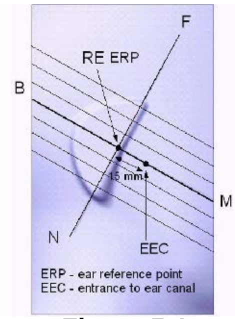


Figure 5-1
Close-Up Side view of ERP

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 “test device reference point” located along the “vertical centerline” on the front of the device aligned to the “ear reference point” (See Figure 5-3). The “test device reference point” was than located at the same level as the center of the ear reference point. The test device was positioned so that the “vertical centerline” was bisecting the front surface of the handset at its top and bottom edges, positioning the “ear reference point” on the outer surface of the both the left and right head phantoms on the ear reference point.

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

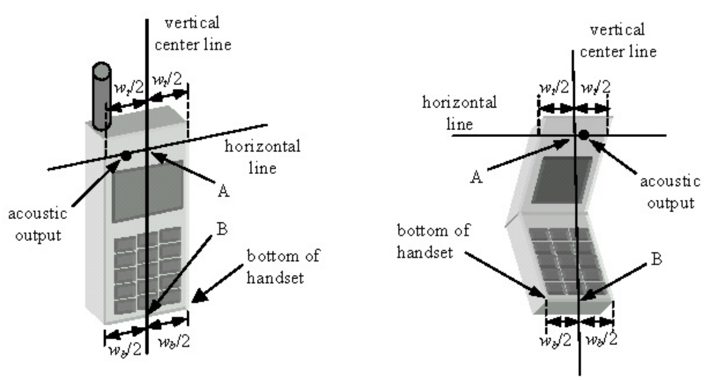


Figure 5-3
Handset Vertical Center & Horizontal Line Reference Points

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.

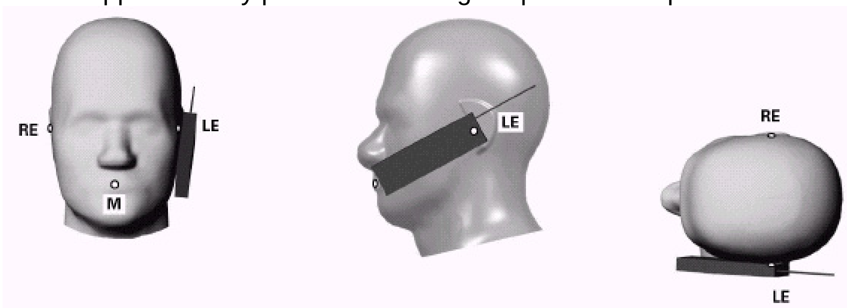


Figure 6-1 Front, Side and Top View of Cheek Position

2. The handset was translated towards the phantom along the line passing through RE & LE until the handset touches the ear.
3. While maintaining the handset in this plane, the handset was rotated around the LE-RE line until the vertical centerline was in the plane normal to MB-NF including the line MB (reference plane).
4. The phone was then rotated around the vertical centerline until the phone (horizontal line) was symmetrical was respect to the line NF.
5. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE, and maintaining the device contact with the ear, the device was rotated about the NF line until any point on the handset made contact with a phantom point below the ear (cheek) (See Figure 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 15 degrees.
2. The phone was then rotated around the horizontal line by 15 degrees.
3. While maintaining the orientation of the phone, the phone was moved parallel to the reference plane until any part of the handset touched the head. (In this position, point A was located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact was at any location other than the pinna, the angle of the phone would then be reduced. The tilted 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).

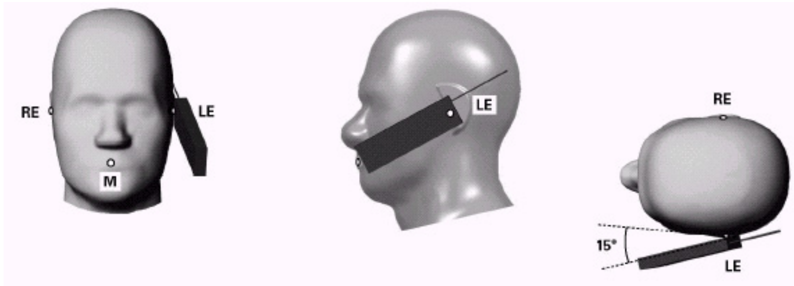


Figure 6-2 Front, Side and Top View of Ear/15º Tilt Position

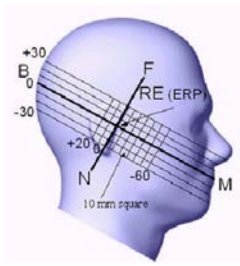


Figure 6-3
Side view w/ relevant markings

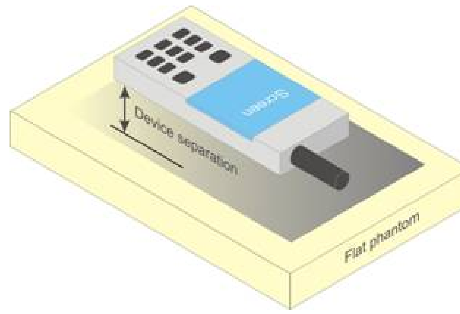


Figure 6-4
Sample Body-Worn Diagram

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.

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.

The latest IEEE 1528 committee developments propose the usage of a tilted phantom when the antenna of the phone is mounted at the bottom or in all cases the peak absorption is in the chin region. Both SAM heads of the TwinSAM-Chin20 are rotated 20 degrees around the NF line. Each head can be removed individually from the table for emptying and cleaning.

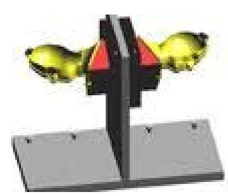


Figure 6-5 Twin SAM Chin20

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 6-4). Per FCC KDB Publication 648474 D04_v01, 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 D01_v05 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

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

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

6.6 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)
SPATIAL PEAK SAR Brain	1.6	8.0
SPATIAL AVERAGE SAR Whole Body	0.08	0.4
SPATIAL PEAK SAR Hands, Feet, Ankles, Wrists	4.0	20

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

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.

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.

8.4 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.

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.

8.5 SAR Testing with 802.11 Transmitters

Normal network operating configurations are not suitable for measuring the SAR of 802.11 a/b/g/n 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 [27]

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

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

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

9 RF CONDUCTED POWERS

9.1 GSM Conducted Powers

Band	Channel	Maximum Burst-Averaged Output Power: Voice – GSM [dBm] CS (1 Slot)	GPRS/EDGE Data (GMSK) – GPRS [dBm] 1 Tx Slot	GPRS/EDGE Data (GMSK) – GPRS [dBm] 2 Tx Slot	EDGE Data (8-PSK) – EDGE [dBm] 1 Tx Slot	EDGE Data (8-PSK) – EDGE [dBm] 2 Tx Slot
GSM 850	128	33.51	33.59	**31.30**	27.49	27.43
	190	33.24	33.36	**31.48**	27.43	27.36
	251	33.42	33.50	**31.27**	27.39	27.38
GSM 1900	512	30.15	30.19	**28.02**	26.47	26.31
	661	30.67	30.69	**28.20**	26.68	26.45
	810	30.65	30.68	**28.37**	26.61	26.49

Band	Channel	Calculated Maximum Frame-Averaged Output Power: Voice – GSM [dBm] CS (1 Slot)	GPRS/EDGE Data (GMSK) – GPRS [dBm] 1 Tx Slot	GPRS/EDGE Data (GMSK) – GPRS [dBm] 2 Tx Slot	EDGE Data (8-PSK) – EDGE [dBm] 1 Tx Slot	EDGE Data (8-PSK) – EDGE [dBm] 2 Tx Slot
GSM 850	128	24.48	24.56	**25.28**	18.46	21.41
	190	24.21	24.33	**25.46**	18.40	21.34
	251	24.39	24.47	**25.25**	18.36	21.36
GSM 1900	512	21.12	21.16	**22.00**	17.44	20.29
	661	21.64	21.66	**22.18**	17.65	20.43
	810	21.62	21.65	**22.35**	17.58	20.47

Note: 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.

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

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.

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.

This device does not support evolved EDGE (eEDGE)

GSM Class: B
GPRS Multislot class: 10 (Max 2 Tx uplink slots)
EDGE Multislot class: 10 (Max 2 Tx uplink slots)
DTM Multislot Class: N/A

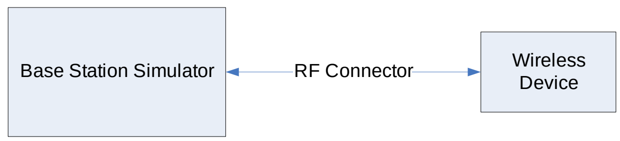


Figure 9-1
Power Measurement Setup

9.2 UMTS Conducted Powers

3GPP Release Version	Mode	3GPP 34.121 Subtest	Cellular Band [dBm]			PCS Band [dBm]			3GPP MPR [dB]
			4132	4183	4233	9262	9400	9538	
99	WCDMA	12.2 kbps RMC	23.61	23.68	23.51	23.68	23.64	23.58	-
99		12.2 kbps AMR	23.57	23.61	23.51	23.61	23.66	23.60	-
6	HSDPA	Subtest 1	23.49	23.63	23.60	23.50	23.37	23.30	0
6		Subtest 2	23.50	23.70	23.61	23.47	23.57	23.13	0
6		Subtest 3	23.14	23.20	23.20	23.15	23.00	22.95	0.5
6		Subtest 4	23.15	23.19	23.19	23.17	23.15	23.01	0.5
6	HSUPA	Subtest 1	22.70	22.93	22.89	23.30	23.24	23.16	0
6		Subtest 2	21.14	21.23	21.17	21.51	21.54	21.85	2
6		Subtest 3	22.39	22.43	22.36	21.70	21.80	21.77	1
6		Subtest 4	21.73	21.99	21.87	21.86	21.90	21.87	2
6		Subtest 5	22.70	23.09	22.79	22.55	22.95	22.82	0

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

This device does not support DC-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.

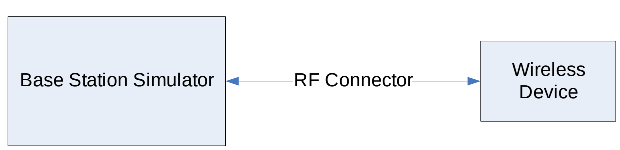


Figure 9-2
Power Measurement Setup

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]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Mid	710.0	23790	10	QPSK	1	0	23.65	0	0
	710.0	23790	10	QPSK	1	25	**23.70**	0	0
	710.0	23790	10	QPSK	1	49	23.69	0	0
	710.0	23790	10	QPSK	25	0	22.53	1	0-1
	710.0	23790	10	QPSK	25	12	22.56	1	0-1
	710.0	23790	10	QPSK	25	25	**22.58**	1	0-1
	710.0	23790	10	QPSK	50	0	22.40	1	0-1
	710.0	23790	10	16QAM	1	0	22.55	1	0-1
	710.0	23790	10	16QAM	1	25	22.63	1	0-1
	710.0	23790	10	16QAM	1	49	22.54	1	0-1
	710.0	23790	10	16QAM	25	0	21.55	2	0-2
	710.0	23790	10	16QAM	25	12	21.58	2	0-2
	710.0	23790	10	16QAM	25	25	21.56	2	0-2
	710.0	23790	10	16QAM	50	0	21.31	2	0-2

Note: LTE Band 17 at 10 MHz Bandwidth does not support three non-overlapping channels. Per KDB 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the mid 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]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Mid	710.0	23790	5	QPSK	1	0	23.68	0	0
	710.0	23790	5	QPSK	1	12	23.70	0	0
	710.0	23790	5	QPSK	1	24	23.70	0	0
	710.0	23790	5	QPSK	12	0	22.68	1	0-1
	710.0	23790	5	QPSK	12	6	22.69	1	0-1
	710.0	23790	5	QPSK	12	13	22.70	1	0-1
	710.0	23790	5	QPSK	25	0	22.55	1	0-1
	710.0	23790	5	16-QAM	1	0	22.27	1	0-1
	710.0	23790	5	16-QAM	1	12	22.28	1	0-1
	710.0	23790	5	16-QAM	1	24	22.39	1	0-1
	710.0	23790	5	16-QAM	12	0	21.70	2	0-2
	710.0	23790	5	16-QAM	12	6	21.68	2	0-2
	710.0	23790	5	16-QAM	12	13	21.70	2	0-2
	710.0	23790	5	16-QAM	25	0	21.54	2	0-2

Note: LTE Band 17 at 5 MHz Bandwidth does not support three non-overlapping channels. Per KDB 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the mid channel of the group of overlapping channels should be selected for testing.

9.3.2 LTE Band 5 (Cell)

Table 9-3
LTE Band 5 (Cell) Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Mid	836.5	20525	10	QPSK	1	0	23.40	0	0
	836.5	20525	10	QPSK	1	25	**23.70**	0	0
	836.5	20525	10	QPSK	1	49	23.68	0	0
	836.5	20525	10	QPSK	25	0	22.44	1	0-1
	836.5	20525	10	QPSK	25	12	22.45	1	0-1
	836.5	20525	10	QPSK	25	25	**22.60**	1	0-1
	836.5	20525	10	QPSK	50	0	22.36	1	0-1
	836.5	20525	10	16QAM	1	0	22.15	1	0-1
	836.5	20525	10	16QAM	1	25	22.55	1	0-1
	836.5	20525	10	16QAM	1	49	22.45	1	0-1
	836.5	20525	10	16QAM	25	0	21.40	2	0-2
	836.5	20525	10	16QAM	25	12	21.48	2	0-2
	836.5	20525	10	16QAM	25	25	21.62	2	0-2
	836.5	20525	10	16QAM	50	0	21.44	2	0-2

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

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

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Low	826.5	20425	5	QPSK	1	0	23.68	0	0
	826.5	20425	5	QPSK	1	12	23.66	0	0
	826.5	20425	5	QPSK	1	24	23.56	0	0
	826.5	20425	5	QPSK	12	0	22.63	1	0-1
	826.5	20425	5	QPSK	12	6	22.56	1	0-1
	826.5	20425	5	QPSK	12	13	22.54	1	0-1
	826.5	20425	5	QPSK	25	0	22.49	1	0-1
	826.5	20425	5	16-QAM	1	0	22.37	1	0-1
	826.5	20425	5	16-QAM	1	12	22.27	1	0-1
	826.5	20425	5	16-QAM	1	24	22.20	1	0-1
	826.5	20425	5	16-QAM	12	0	21.70	2	0-2
	826.5	20425	5	16-QAM	12	6	21.63	2	0-2
	826.5	20425	5	16-QAM	12	13	21.50	2	0-2
	826.5	20425	5	16-QAM	25	0	21.42	2	0-2
Mid	836.5	20525	5	QPSK	1	0	23.58	0	0
	836.5	20525	5	QPSK	1	12	23.70	0	0
	836.5	20525	5	QPSK	1	24	23.69	0	0
	836.5	20525	5	QPSK	12	0	22.62	1	0-1
	836.5	20525	5	QPSK	12	6	22.66	1	0-1
	836.5	20525	5	QPSK	12	13	22.69	1	0-1
	836.5	20525	5	QPSK	25	0	22.45	1	0-1
	836.5	20525	5	16-QAM	1	0	22.24	1	0-1
	836.5	20525	5	16-QAM	1	12	22.41	1	0-1
	836.5	20525	5	16-QAM	1	24	22.51	1	0-1
	836.5	20525	5	16-QAM	12	0	21.70	2	0-2
	836.5	20525	5	16-QAM	12	6	21.70	2	0-2
	836.5	20525	5	16-QAM	12	13	21.69	2	0-2
	836.5	20525	5	16-QAM	25	0	21.46	2	0-2
High	846.5	20625	5	QPSK	1	0	23.53	0	0
	846.5	20625	5	QPSK	1	12	23.48	0	0
	846.5	20625	5	QPSK	1	24	23.52	0	0
	846.5	20625	5	QPSK	12	0	22.45	1	0-1
	846.5	20625	5	QPSK	12	6	22.42	1	0-1
	846.5	20625	5	QPSK	12	13	22.55	1	0-1
	846.5	20625	5	QPSK	25	0	22.37	1	0-1
	846.5	20625	5	16-QAM	1	0	22.15	1	0-1
	846.5	20625	5	16-QAM	1	12	22.10	1	0-1
	846.5	20625	5	16-QAM	1	24	22.15	1	0-1
	846.5	20625	5	16-QAM	12	0	21.54	2	0-2
	846.5	20625	5	16-QAM	12	6	21.50	2	0-2
	846.5	20625	5	16-QAM	12	13	21.56	2	0-2
	846.5	20625	5	16-QAM	25	0	21.33	2	0-2

9.3.3 LTE Band 4 (AWS)

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]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Low	1715	20000	10	QPSK	1	0	23.57	0	0
	1715	20000	10	QPSK	1	25	23.68	0	0
	1715	20000	10	QPSK	1	49	23.69	0	0
	1715	20000	10	QPSK	25	0	22.56	1	0-1
	1715	20000	10	QPSK	25	12	22.53	1	0-1
	1715	20000	10	QPSK	25	25	22.53	1	0-1
	1715	20000	10	QPSK	50	0	22.38	1	0-1
	1715	20000	10	16QAM	1	0	22.32	1	0-1
	1715	20000	10	16QAM	1	25	22.38	1	0-1
	1715	20000	10	16QAM	1	49	22.45	1	0-1
	1715	20000	10	16QAM	25	0	21.56	2	0-2
	1715	20000	10	16QAM	25	12	21.49	2	0-2
	1715	20000	10	16QAM	25	25	21.51	2	0-2
	1715	20000	10	16QAM	50	0	21.34	2	0-2
Mid	1732.5	20175	10	QPSK	1	0	23.69	0	0
	1732.5	20175	10	QPSK	1	25	23.69	0	0
	1732.5	20175	10	QPSK	1	49	**23.70**	0	0
	1732.5	20175	10	QPSK	25	0	22.61	1	0-1
	1732.5	20175	10	QPSK	25	12	**22.63**	1	0-1
	1732.5	20175	10	QPSK	25	25	22.59	1	0-1
	1732.5	20175	10	QPSK	50	0	22.51	1	0-1
	1732.5	20175	10	16QAM	1	0	22.49	1	0-1
	1732.5	20175	10	16QAM	1	25	22.40	1	0-1
	1732.5	20175	10	16QAM	1	49	22.48	1	0-1
	1732.5	20175	10	16QAM	25	0	21.65	2	0-2
	1732.5	20175	10	16QAM	25	12	21.63	2	0-2
	1732.5	20175	10	16QAM	25	25	21.48	2	0-2
	1732.5	20175	10	16QAM	50	0	21.51	2	0-2
High	1750	20350	10	QPSK	1	0	23.58	0	0
	1750	20350	10	QPSK	1	25	23.63	0	0
	1750	20350	10	QPSK	1	49	23.65	0	0
	1750	20350	10	QPSK	25	0	22.51	1	0-1
	1750	20350	10	QPSK	25	12	22.55	1	0-1
	1750	20350	10	QPSK	25	25	22.48	1	0-1
	1750	20350	10	QPSK	50	0	22.38	1	0-1
	1750	20350	10	16QAM	1	0	22.33	1	0-1
	1750	20350	10	16QAM	1	25	22.39	1	0-1
	1750	20350	10	16QAM	1	49	22.34	1	0-1
	1750	20350	10	16QAM	25	0	21.61	2	0-2
	1750	20350	10	16QAM	25	12	21.62	2	0-2
	1750	20350	10	16QAM	25	25	21.54	2	0-2
	1750	20350	10	16QAM	50	0	21.37	2	0-2

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]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Low	1712.5	19975	5	QPSK	1	0	23.70	0	0
	1712.5	19975	5	QPSK	1	12	23.69	0	0
	1712.5	19975	5	QPSK	1	24	23.68	0	0
	1712.5	19975	5	QPSK	12	0	22.63	1	0-1
	1712.5	19975	5	QPSK	12	6	22.65	1	0-1
	1712.5	19975	5	QPSK	12	13	22.62	1	0-1
	1712.5	19975	5	QPSK	25	0	22.53	1	0-1
	1712.5	19975	5	16-QAM	1	0	22.33	1	0-1
	1712.5	19975	5	16-QAM	1	12	22.32	1	0-1
	1712.5	19975	5	16-QAM	1	24	22.30	1	0-1
	1712.5	19975	5	16-QAM	12	0	21.65	2	0-2
	1712.5	19975	5	16-QAM	12	6	21.67	2	0-2
	1712.5	19975	5	16-QAM	12	13	21.70	2	0-2
	1712.5	19975	5	16-QAM	25	0	21.42	2	0-2
Mid	1732.5	20175	5	QPSK	1	0	23.70	0	0
	1732.5	20175	5	QPSK	1	12	23.68	0	0
	1732.5	20175	5	QPSK	1	24	23.69	0	0
	1732.5	20175	5	QPSK	12	0	22.69	1	0-1
	1732.5	20175	5	QPSK	12	6	22.70	1	0-1
	1732.5	20175	5	QPSK	12	13	22.66	1	0-1
	1732.5	20175	5	QPSK	25	0	22.56	1	0-1
	1732.5	20175	5	16-QAM	1	0	22.42	1	0-1
	1732.5	20175	5	16-QAM	1	12	22.26	1	0-1
	1732.5	20175	5	16-QAM	1	24	22.28	1	0-1
	1732.5	20175	5	16-QAM	12	0	21.69	2	0-2
	1732.5	20175	5	16-QAM	12	6	21.70	2	0-2
	1732.5	20175	5	16-QAM	12	13	21.69	2	0-2
	1732.5	20175	5	16-QAM	25	0	21.39	2	0-2
High	1752.5	20375	5	QPSK	1	0	23.68	0	0
	1752.5	20375	5	QPSK	1	12	23.69	0	0
	1752.5	20375	5	QPSK	1	24	23.65	0	0
	1752.5	20375	5	QPSK	12	0	22.70	1	0-1
	1752.5	20375	5	QPSK	12	6	22.57	1	0-1
	1752.5	20375	5	QPSK	12	13	22.60	1	0-1
	1752.5	20375	5	QPSK	25	0	22.49	1	0-1
	1752.5	20375	5	16-QAM	1	0	22.34	1	0-1
	1752.5	20375	5	16-QAM	1	12	22.26	1	0-1
	1752.5	20375	5	16-QAM	1	24	22.30	1	0-1
	1752.5	20375	5	16-QAM	12	0	21.70	2	0-2
	1752.5	20375	5	16-QAM	12	6	21.66	2	0-2
	1752.5	20375	5	16-QAM	12	13	21.68	2	0-2
	1752.5	20375	5	16-QAM	25	0	21.42	2	0-2

9.3.4 LTE Band 2 (PCS)

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

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Low	1855	18650	10	QPSK	1	0	23.28	0	0
	1855	18650	10	QPSK	1	25	23.45	0	0
	1855	18650	10	QPSK	1	49	23.34	0	0
	1855	18650	10	QPSK	25	0	22.26	1	0-1
	1855	18650	10	QPSK	25	12	22.23	1	0-1
	1855	18650	10	QPSK	25	25	22.30	1	0-1
	1855	18650	10	QPSK	50	0	22.24	1	0-1
	1855	18650	10	16QAM	1	0	22.19	1	0-1
	1855	18650	10	16QAM	1	25	22.33	1	0-1
	1855	18650	10	16QAM	1	49	22.31	1	0-1
	1855	18650	10	16QAM	25	0	21.22	2	0-2
	1855	18650	10	16QAM	25	12	21.23	2	0-2
	1855	18650	10	16QAM	25	25	21.33	2	0-2
	1855	18650	10	16QAM	50	0	21.22	2	0-2
Mid	1880.0	18900	10	QPSK	1	0	23.64	0	0
	1880.0	18900	10	QPSK	1	25	**23.70**	0	0
	1880.0	18900	10	QPSK	1	49	23.68	0	0
	1880.0	18900	10	QPSK	25	0	**22.58**	1	0-1
	1880.0	18900	10	QPSK	25	12	22.50	1	0-1
	1880.0	18900	10	QPSK	25	25	22.55	1	0-1
	1880.0	18900	10	QPSK	50	0	22.37	1	0-1
	1880.0	18900	10	16QAM	1	0	22.59	1	0-1
	1880.0	18900	10	16QAM	1	25	22.59	1	0-1
	1880.0	18900	10	16QAM	1	49	22.58	1	0-1
	1880.0	18900	10	16QAM	25	0	21.68	2	0-2
	1880.0	18900	10	16QAM	25	12	21.57	2	0-2
	1880.0	18900	10	16QAM	25	25	21.62	2	0-2
	1880.0	18900	10	16QAM	50	0	21.38	2	0-2
High	1905	19150	10	QPSK	1	0	23.27	0	0
	1905	19150	10	QPSK	1	25	23.24	0	0
	1905	19150	10	QPSK	1	49	23.07	0	0
	1905	19150	10	QPSK	25	0	22.08	1	0-1
	1905	19150	10	QPSK	25	12	22.08	1	0-1
	1905	19150	10	QPSK	25	25	22.06	1	0-1
	1905	19150	10	QPSK	50	0	21.90	1	0-1
	1905	19150	10	16QAM	1	0	22.09	1	0-1
	1905	19150	10	16QAM	1	25	21.99	1	0-1
	1905	19150	10	16QAM	1	49	21.99	1	0-1
	1905	19150	10	16QAM	25	0	21.04	2	0-2
	1905	19150	10	16QAM	25	12	21.05	2	0-2
	1905	19150	10	16QAM	25	25	21.05	2	0-2
	1905	19150	10	16QAM	50	0	20.91	2	0-2

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

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Low	1852.5	18625	5	QPSK	1	0	23.17	0	0
	1852.5	18625	5	QPSK	1	12	23.29	0	0
	1852.5	18625	5	QPSK	1	24	23.44	0	0
	1852.5	18625	5	QPSK	12	0	22.40	1	0-1
	1852.5	18625	5	QPSK	12	6	22.37	1	0-1
	1852.5	18625	5	QPSK	12	13	22.35	1	0-1
	1852.5	18625	5	QPSK	25	0	22.25	1	0-1
	1852.5	18625	5	16-QAM	1	0	22.07	1	0-1
	1852.5	18625	5	16-QAM	1	12	22.07	1	0-1
	1852.5	18625	5	16-QAM	1	24	22.18	1	0-1
	1852.5	18625	5	16-QAM	12	0	21.38	2	0-2
	1852.5	18625	5	16-QAM	12	6	21.39	2	0-2
	1852.5	18625	5	16-QAM	12	13	21.38	2	0-2
	1852.5	18625	5	16-QAM	25	0	21.14	2	0-2
Mid	1880.0	18900	5	QPSK	1	0	23.70	0	0
	1880.0	18900	5	QPSK	1	12	23.67	0	0
	1880.0	18900	5	QPSK	1	24	23.69	0	0
	1880.0	18900	5	QPSK	12	0	22.70	1	0-1
	1880.0	18900	5	QPSK	12	6	22.68	1	0-1
	1880.0	18900	5	QPSK	12	13	22.69	1	0-1
	1880.0	18900	5	QPSK	25	0	22.53	1	0-1
	1880.0	18900	5	16-QAM	1	0	22.39	1	0-1
	1880.0	18900	5	16-QAM	1	12	22.32	1	0-1
	1880.0	18900	5	16-QAM	1	24	22.48	1	0-1
	1880.0	18900	5	16-QAM	12	0	21.55	2	0-2
	1880.0	18900	5	16-QAM	12	6	21.66	2	0-2
	1880.0	18900	5	16-QAM	12	13	21.68	2	0-2
	1880.0	18900	5	16-QAM	25	0	21.48	2	0-2
High	1907.5	19175	5	QPSK	1	0	23.31	0	0
	1907.5	19175	5	QPSK	1	12	23.15	0	0
	1907.5	19175	5	QPSK	1	24	23.05	0	0
	1907.5	19175	5	QPSK	12	0	22.25	1	0-1
	1907.5	19175	5	QPSK	12	6	22.24	1	0-1
	1907.5	19175	5	QPSK	12	13	22.21	1	0-1
	1907.5	19175	5	QPSK	25	0	22.06	1	0-1
	1907.5	19175	5	16-QAM	1	0	21.96	1	0-1
	1907.5	19175	5	16-QAM	1	12	21.89	1	0-1
	1907.5	19175	5	16-QAM	1	24	21.77	1	0-1
	1907.5	19175	5	16-QAM	12	0	21.32	2	0-2
	1907.5	19175	5	16-QAM	12	6	21.26	2	0-2
	1907.5	19175	5	16-QAM	12	13	21.27	2	0-2
	1907.5	19175	5	16-QAM	25	0	20.95	2	0-2

9.4 WLAN Conducted Powers

Per the FCC change document for this device, the 2.4GHz WLAN/5GHz WLAN/2.4GHz Bluetooth chipset remains the same as the original certified device. Therefore, conducted powers for IEEE 802.11b/g/n/a - FCC Rule Part 15C and Bluetooth - FCC Rule Part 15C remain the same as the original certification.

Table 9-9
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	16.57	16.64	16.66	16.67
802.11b	2437	6	**16.85**	16.91	16.98	16.96
802.11b	2462	11	16.33	16.19	16.29	16.34

Table 9-10
IEEE 802.11g Average RF Power

Mode	Freq [MHz]	Channel	802.11g (2.4 GHz) Conducted Power [dBm] Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
802.11g	2412	1	13.62	13.62	13.18	13.19	13.60	13.55	13.18	13.55
802.11g	2437	6	13.97	13.87	13.87	13.77	13.70	13.82	13.75	13.81
802.11g	2462	11	13.23	13.16	13.22	13.19	13.12	13.32	13.19	13.17

Table 9-11
IEEE 802.11n Average RF Power

Mode	Freq [MHz]	Channel	802.11n (2.4 GHz) Conducted Power [dBm] Data Rate [Mbps]							
			6.5	13	20	26	39	52	58	65
802.11n	2412	1	12.65	12.60	12.65	12.07	12.65	12.55	12.52	12.57
802.11n	2437	6	12.85	12.71	12.74	12.70	12.67	12.66	12.72	12.54
802.11n	2462	11	12.12	12.16	12.17	12.16	12.14	12.09	12.07	12.09

Table 9-12
IEEE 802.11a Average RF Power

Mode	Freq [MHz]	Channel	802.11a (5GHz) Conducted Power [dBm] Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
802.11a	5180	36*	14.69	14.78	14.79	14.76	14.72	14.72	14.64	14.65
802.11a	5200	40	14.70	14.69	14.65	14.68	14.68	14.67	14.46	14.74
802.11a	5220	44	**14.86**	14.84	14.85	14.87	14.86	14.78	14.85	14.71
802.11a	5240	48*	14.80	14.77	14.83	14.90	14.87	14.81	14.60	14.91
802.11a	5260	52*	**14.80**	14.86	14.82	14.93	14.94	14.85	14.71	14.83
802.11a	5280	56	14.80	14.94	14.89	14.95	15.01	14.92	14.79	14.86
802.11a	5300	60	13.97	13.91	13.97	13.92	13.88	13.82	13.81	13.81
802.11a	5320	64*	13.93	13.87	13.83	13.96	13.92	13.97	13.94	13.91
802.11a	5500	100	13.99	13.91	13.98	14.00	13.90	14.02	13.87	13.82
802.11a	5520	104*	14.06	14.09	14.12	14.03	14.06	14.08	14.02	14.05
802.11a	5540	108	13.98	14.07	13.89	14.01	14.02	13.96	13.66	13.85
802.11a	5560	112	14.07	14.02	13.90	14.04	14.06	13.85	13.58	13.91
802.11a	5580	116*	14.08	14.10	14.07	14.07	14.07	13.87	13.94	13.97
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	14.21	14.24	14.25	14.25	14.26	13.95	14.04	14.12
802.11a	5680	136*	**14.26**	14.32	14.25	14.24	14.28	14.05	14.07	14.11
802.11a	5700	140	13.18	13.27	13.24	13.22	13.27	13.12	13.05	13.09
802.11a	5745	149*	12.63	12.68	12.75	12.65	12.68	12.61	12.52	12.51
802.11a	5765	153	13.73	13.70	13.68	13.72	13.75	13.74	13.67	13.59
802.11a	5785	157*	14.82	14.86	14.75	14.83	14.74	14.73	14.82	14.67
802.11a	5805	161*	**14.89**	14.42	14.84	14.83	14.82	14.76	14.66	14.70
802.11a	5825	165	14.84	14.92	14.91	14.88	14.94	14.81	14.81	14.75

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 9-13
IEEE 802.11n Average RF Power – 20 MHz Bandwidth

Mode	Freq [MHz]	Channel	20MHz BW 802.11n (5GHz) Conducted Power [dBm] Data Rate [Mbps]							
			6.5	13	20	26	39	52	58	65
802.11n	5180	36	12.70	13.52	13.39	13.34	13.39	13.61	13.46	13.39
802.11n	5200	40	12.67	13.51	13.41	13.42	13.45	13.41	13.33	13.42
802.11n	5220	44	12.90	13.53	13.40	13.51	13.56	13.52	13.39	13.39
802.11n	5240	48	12.75	13.54	13.37	13.55	13.59	13.44	13.49	13.47
802.11n	5260	52	12.90	13.59	13.56	13.56	13.65	13.52	13.47	13.54
802.11n	5280	56	13.73	13.68	13.72	13.67	13.57	13.48	13.70	13.55
802.11n	5300	60	13.81	13.78	13.79	13.65	13.52	13.69	13.62	13.39
802.11n	5320	64	13.84	13.82	13.75	13.79	13.63	13.65	13.73	13.44
802.11n	5500	100	12.67	12.64	12.61	12.59	12.63	12.53	12.54	12.09
802.11n	5520	104	12.81	12.73	12.64	12.47	12.59	12.54	12.45	12.20
802.11n	5540	108	13.54	13.76	13.72	13.56	13.69	13.61	13.58	13.31
802.11n	5560	112	13.75	13.90	13.77	13.61	13.51	13.54	13.64	13.16
802.11n	5580	116	12.35	13.84	13.89	13.72	13.58	13.57	13.63	13.28
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	12.83	12.85	12.75	12.75	12.44	12.60	12.71	12.12
802.11n	5680	136	12.85	12.90	12.81	12.67	12.45	12.67	12.83	12.20
802.11n	5700	140	11.92	11.74	11.82	11.62	11.48	11.64	11.64	11.17
802.11n	5745	149	11.45	11.25	11.23	11.11	11.01	11.16	11.11	10.69
802.11n	5765	153	12.53	12.39	12.38	12.47	12.15	12.29	12.25	11.84
802.11n	5785	157	12.61	12.39	12.41	12.67	12.08	12.23	12.26	11.95
802.11n	5805	161	12.59	12.45	12.37	12.48	12.12	12.29	12.45	11.71
802.11n	5825	165	12.67	12.46	12.45	12.40	12.25	12.27	12.31	11.73

Table 9-14
IEEE 802.11n Average RF Power – 40 MHz Bandwidth

Mode	Freq [MHz]	Channel	40MHz BW 802.11n (5GHz) Conducted Power [dBm] Data Rate [Mbps]							
			13.5/15	27/30	40.5/45	54/60	81/90	108/120	121.5/135	135/150
802.11n	5190	38	13.22	13.22	12.71	13.03	13.02	12.97	12.45	11.73
802.11n	5230	46	13.35	12.96	12.76	13.13	13.15	13.07	12.54	12.02
802.11n	5270	54	13.72	13.67	13.53	13.58	13.56	13.45	13.57	13.61
802.11n	5310	62	12.77	12.70	12.67	12.64	12.63	12.67	12.54	12.68
802.11n	5510	102	13.41	12.95	12.84	13.29	13.21	13.16	12.42	11.98
802.11n	5550	110	13.49	12.94	12.91	13.28	13.30	13.32	12.68	12.03
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	13.62	13.28	13.31	13.52	13.44	13.44	12.87	12.22
802.11n	5755	151	13.23	12.83	12.60	13.26	12.93	12.92	12.55	11.76
802.11n	5795	159	13.33	12.92	12.65	12.83	13.11	13.01	12.43	11.90

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

- For 2.4 GHz, highest average RF output power channel for the lowest data rate for IEEE 802.11b were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11g/n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode.
- For 5 GHz, highest average RF output power channel for the lowest data rate for IEEE 802.11a were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11n 20 MHz and 40 MHz) were not investigated since the average output powers over all channels and data rates

were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11a mode.

- When the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is <1.6 W/kg and the reported 1g averaged SAR is <0.8 W/kg, SAR testing on other channels is not required. Otherwise, the other default (or corresponding required) test channels were additionally tested using the lowest data rate.
- The bolded data rate and channel above were tested for SAR.

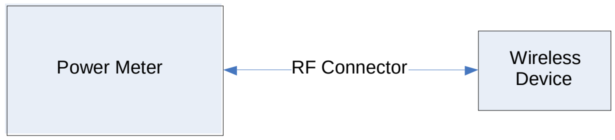


Figure 9-3
Power Measurement Setup

10 SYSTEM VERIFICATION

10.1 Tissue Verification

Table 10-1
Measured Tissue Properties

Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (C°)	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ε	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ε	% dev σ	% dev ε
03/13/2013	740H	23.4	710	0.862	42.357	0.887	42.113	-2.82%	0.58%
			725	0.885	42.049	0.888	42.033	-0.34%	0.04%
			740	0.892	41.758	0.889	41.953	0.34%	-0.46%
			755	0.902	41.733	0.891	41.876	1.23%	-0.34%
02/16/2013	835H	22.8	820	0.915	42.513	0.898	41.571	1.89%	2.27%
			835	0.931	42.408	0.900	41.500	3.44%	2.19%
			850	0.949	42.127	0.916	41.500	3.60%	1.51%
03/07/2013	835H	23.5	820	0.917	42.236	0.898	41.571	2.12%	1.60%
			835	0.934	42.102	0.900	41.500	3.78%	1.45%
			850	0.950	41.861	0.916	41.500	3.71%	0.87%
03/11/2013	1750H	24.6	1710	1.381	39.951	1.348	40.136	2.45%	-0.46%
			1750	1.417	39.823	1.370	40.100	3.43%	-0.69%
			1790	1.456	39.625	1.394	40.020	4.45%	-0.99%
02/14/2013	1900H	23.0	1850	1.355	39.452	1.400	40.000	-3.21%	-1.37%
			1880	1.385	39.316	1.400	40.000	-1.07%	-1.71%
			1910	1.416	39.151	1.400	40.000	1.14%	-2.12%
03/07/2013	1900H	22.7	1850	1.388	39.898	1.400	40.000	-0.86%	-0.25%
			1880	1.418	39.846	1.400	40.000	1.29%	-0.39%
			1910	1.452	39.647	1.400	40.000	3.71%	-0.88%
02/20/2013	2450H	23.7	2401	1.812	38.296	1.758	39.298	3.07%	-2.55%
			2450	1.862	38.106	1.800	39.200	3.44%	-2.79%
			2499	1.927	37.910	1.852	39.135	4.05%	-3.13%
02/18/2013	5200H-5800H	23.9	5200	4.618	37.176	4.660	36.000	-0.90%	3.27%
			5220	4.645	37.117	4.680	35.980	-0.75%	3.16%
			5260	4.689	36.691	4.720	35.940	-0.66%	2.09%
			5300	4.815	36.609	4.760	35.900	1.16%	1.97%
			5600	5.133	36.190	5.070	35.500	1.24%	1.94%
			5680	5.263	35.609	5.150	35.420	2.19%	0.53%
			5800	5.390	35.299	5.270	35.300	2.28%	0.00%
			5805	5.398	35.295	5.275	35.295	2.33%	0.00%
02/14/2013	740B	24.1	710	0.959	53.294	0.960	55.687	-0.10%	-4.30%
			725	0.975	53.163	0.961	55.629	1.46%	-4.43%
			740	0.990	53.014	0.963	55.570	2.80%	-4.60%
			755	1.005	52.865	0.964	55.512	4.25%	-4.77%
02/15/2013	835B	22.6	820	1.001	53.916	0.969	55.258	3.30%	-2.43%
			835	1.013	53.806	0.970	55.200	4.43%	-2.53%
			850	1.030	53.685	0.988	55.154	4.25%	-2.66%
02/16/2013	835B	23.3	820	0.975	54.154	0.969	55.258	0.62%	-2.00%
			835	0.988	53.996	0.970	55.200	1.86%	-2.18%
			850	1.004	53.897	0.988	55.154	1.62%	-2.28%
03/11/2013	1750B	22.2	1710	1.465	52.825	1.460	53.540	0.34%	-1.34%
			1750	1.503	52.718	1.490	53.430	0.87%	-1.33%
			1790	1.550	52.559	1.510	53.330	2.65%	-1.45%
02/13/2013	1900B	23.8	1850	1.472	52.178	1.520	53.300	-3.16%	-2.11%
			1880	1.507	52.045	1.520	53.300	-0.86%	-2.35%
			1910	1.540	51.917	1.520	53.300	1.32%	-2.59%
02/18/2013	1900B	22.1	1850	1.502	51.954	1.520	53.300	-1.18%	-2.53%
			1880	1.536	51.841	1.520	53.300	1.05%	-2.74%
			1910	1.568	51.711	1.520	53.300	3.16%	-2.98%
03/11/2013	1900B	23.9	1850	1.483	53.209	1.520	53.300	-2.43%	-0.17%
			1880	1.497	53.229	1.520	53.300	-1.51%	-0.13%
			1910	1.554	53.234	1.520	53.300	2.24%	-0.12%
02/14/2013	2450B	23.2	2401	1.872	50.829	1.903	52.765	-1.63%	-3.67%
			2450	1.932	50.597	1.950	52.700	-0.92%	-3.99%
			2499	1.998	50.442	2.019	52.638	-1.04%	-4.17%
02/27/2013	5200B-5800B	22.5	5200	5.346	47.630	5.299	49.014	0.89%	-2.82%
			5220	5.362	47.591	5.323	48.987	0.73%	-2.85%
			5260	5.416	47.528	5.369	48.906	0.88%	-2.82%
			5300	5.472	47.464	5.416	48.851	1.03%	-2.84%
			5600	5.848	46.974	5.766	48.444	1.42%	-3.03%
			5680	5.977	46.895	5.860	48.336	2.00%	-2.98%
			5800	6.147	46.555	6.000	48.200	2.45%	-3.41%
			5805	6.146	46.596	6.005	48.166	2.35%	-3.26%
03/05/2013	5200B-5800B	22.0	5260	5.519	47.672	5.369	48.906	2.79%	-2.52%
			5300	5.562	47.610	5.416	48.851	2.70%	-2.54%

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 IEEE 1528 6.6.1.2). The tissue parameters listed in the SAR test plots may slightly differ from the table above due to significant digit rounding in the software.

10.2 Test System Verification

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

Table 10-2
System Verification Results

System Verification TARGET & MEASURED											
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 (%)
750	HEAD	03/13/2013	24.2	23.3	0.100	1046	3287	0.813	8.500	8.130	-4.35%
835	HEAD	02/16/2013	23.7	22.9	0.100	4d119	3022	0.970	9.420	9.700	2.97%
835	HEAD	03/07/2013	24.4	23.5	0.100	4d026	3022	0.996	9.390	9.960	6.07%
1750	HEAD	03/11/2013	24.8	23.1	0.100	1008	3287	3.810	36.400	38.100	4.67%
1900	HEAD	02/14/2013	24.2	22.8	0.100	5d149	3263	4.030	39.300	40.300	2.54%
1900	HEAD	03/07/2013	24.3	23.2	0.100	5d148	3920	4.070	39.700	40.700	2.52%
2450	HEAD	02/20/2013	24.5	23.5	0.100	719	3022	5.380	52.700	53.800	2.09%
5200	HEAD	02/18/2013	23.4	22.0	0.100	1057	3589	7.010	75.900	70.100	-7.64%
5300	HEAD	02/18/2013	23.3	22.1	0.100	1057	3589	7.320	76.900	73.200	-4.81%
5600	HEAD	02/18/2013	23.6	22.4	0.100	1057	3589	8.300	80.400	83.000	3.23%
5800	HEAD	02/18/2013	23.7	22.5	0.100	1057	3589	7.750	76.100	77.500	1.84%
750	BODY	02/14/2013	23.8	22.5	0.100	1003	3287	0.913	8.830	9.130	3.40%
835	BODY	02/15/2013	24.6	22.1	0.100	4d133	3213	1.010	9.600	10.100	5.21%
835	BODY	02/16/2013	23.3	21.9	0.100	4d026	3287	1.010	9.580	10.100	5.43%
1750	BODY	03/11/2013	24.6	22.9	0.100	1008	3287	3.950	37.400	39.500	5.61%
1900	BODY	02/13/2013	24.1	22.1	0.100	5d149	3263	4.040	39.300	40.400	2.80%
1900	BODY	02/18/2013	24.3	21.8	0.100	5d149	3263	4.000	39.300	40.000	1.78%
1900	BODY	03/11/2013	24.3	23.3	0.100	5d148	3213	4.280	40.800	42.800	4.90%
2450	BODY	02/14/2013	24.3	22.7	0.100	797	3288	4.790	49.600	47.900	-3.43%
5200	BODY	02/27/2013	23.9	22.7	0.100	1057	3589	7.140	75.500	71.400	-5.43%
5300	BODY	02/27/2013	23.9	22.7	0.100	1057	3589	7.340	75.300	73.400	-2.52%
5300	BODY	03/05/2013	23.7	21.6	0.100	1057	3589	7.440	75.300	74.400	-1.20%
5600	BODY	02/27/2013	23.9	22.7	0.100	1057	3589	8.370	80.300	83.700	4.23%
5800	BODY	02/27/2013	23.9	22.7	0.100	1057	3589	7.300	75.100	73.000	-2.80%

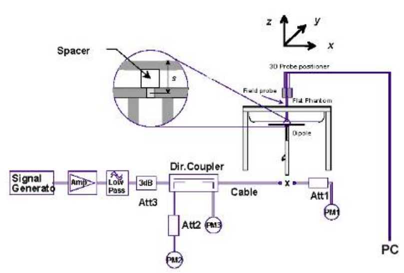


Figure 10-1
System Verification Setup Diagram

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	Back Cover Type	Device Serial Number	# of Time Slots	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
836.60	190	GSM 850	GSM	33.7	33.24	-0.07	Right	Cheek	Standard	SAR#1	1	1:8.3	0.165	1.112	0.183	
836.60	190	GSM 850	GSM	33.7	33.24	-0.01	Right	Cheek	Folio Closed	SAR#1	1	1:8.3	0.204	1.112	0.227	
836.60	190	GSM 850	GSM	33.7	33.24	-0.04	Right	Cheek	Folio Open	SAR#1	1	1:8.3	0.212	1.112	0.236	
836.60	190	GSM 850	GSM	33.7	33.24	0.01	Right	Tilt	Standard	SAR#1	1	1:8.3	0.095	1.112	0.105	
836.60	190	GSM 850	GSM	33.7	33.24	-0.07	Left	Cheek	Standard	SAR#1	1	1:8.3	0.152	1.112	0.169	
836.60	190	GSM 850	GSM	33.7	33.24	0.03	Left	Tilt	Standard	SAR#1	1	1:8.3	0.084	1.112	0.093	
836.60	190	GSM 850	GPRS	31.7	31.48	-0.07	Right	Cheek	Standard	SAR#1	2	1:4.15	0.247	1.052	0.260	A2
836.60	190	GSM 850	GPRS	31.7	31.48	0.12	Right	Cheek	Folio Closed	SAR#1	2	1:4.15	0.238	1.052	0.250	
836.60	190	GSM 850	GPRS	31.7	31.48	0.03	Right	Cheek	Folio Open	SAR#1	2	1:4.15	0.239	1.052	0.251	
836.60	190	GSM 850	GPRS	31.7	31.48	-0.05	Right	Tilt	Standard	SAR#1	2	1:4.15	0.145	1.052	0.153	
836.60	190	GSM 850	GPRS	31.7	31.48	-0.13	Left	Cheek	Standard	SAR#1	2	1:4.15	0.221	1.052	0.232	
836.60	190	GSM 850	GPRS	31.7	31.48	-0.04	Left	Tilt	Standard	SAR#1	2	1:4.15	0.129	1.052	0.136	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram								

Table 11-2
UMTS 850 Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Back Cover Type	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
836.60	4183	UMTS 850	RMC	23.7	23.68	0.07	Right	Cheek	Standard	SAR#1	1:1	0.143	1.005	0.144	
836.60	4183	UMTS 850	RMC	23.7	23.68	0.11	Right	Cheek	Folio Closed	SAR#1	1:1	0.167	1.005	0.168	
836.60	4183	UMTS 850	RMC	23.7	23.68	0.12	Right	Cheek	Folio Open	SAR#1	1:1	0.168	1.005	0.169	A3
836.60	4183	UMTS 850	RMC	23.7	23.68	0.04	Right	Tilt	Standard	SAR#1	1:1	0.079	1.005	0.079	
836.60	4183	UMTS 850	RMC	23.7	23.68	-0.03	Left	Cheek	Standard	SAR#1	1:1	0.118	1.005	0.119	
836.60	4183	UMTS 850	RMC	23.7	23.68	-0.02	Left	Tilt	Standard	SAR#1	1:1	0.066	1.005	0.066	
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
GSM/GPRS 1900 Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Back Cover Type	Device Serial Number	# of Time Slots	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
1880.00	661	GSM 1900	GSM	30.7	30.67	0.09	Right	Cheek	Standard	SAR#1	1	1:8.3	0.190	1.007	0.191	
1880.00	661	GSM 1900	GSM	30.7	30.67	0.05	Right	Cheek	Folio Closed	SAR#1	1	1:8.3	0.143	1.007	0.144	
1880.00	661	GSM 1900	GSM	30.7	30.67	-0.07	Right	Cheek	Folio Open	SAR#1	1	1:8.3	0.169	1.007	0.170	
1880.00	661	GSM 1900	GSM	30.7	30.67	0.10	Right	Tilt	Standard	SAR#1	1	1:8.3	0.078	1.007	0.078	
1880.00	661	GSM 1900	GSM	30.7	30.67	-0.01	Left	Cheek	Standard	SAR#1	1	1:8.3	0.082	1.007	0.082	
1880.00	661	GSM 1900	GSM	30.7	30.67	-0.01	Left	Tilt	Standard	SAR#1	1	1:8.3	0.079	1.007	0.079	
1880.00	661	GSM 1900	GPRS	28.7	28.20	-0.01	Right	Cheek	Standard	SAR#1	2	1:4.15	0.204	1.122	0.229	A6
1880.00	661	GSM 1900	GPRS	28.7	28.20	0.05	Right	Cheek	Folio Closed	SAR#1	2	1:4.15	0.163	1.122	0.183	
1880.00	661	GSM 1900	GPRS	28.7	28.20	0.19	Right	Cheek	Folio Open	SAR#1	2	1:4.15	0.180	1.122	0.202	
1880.00	661	GSM 1900	GPRS	28.7	28.20	-0.12	Right	Tilt	Standard	SAR#1	2	1:4.15	0.083	1.122	0.093	
1880.00	661	GSM 1900	GPRS	28.7	28.20	0.05	Left	Cheek	Standard	SAR#1	2	1:4.15	0.075	1.122	0.084	
1880.00	661	GSM 1900	GPRS	28.7	28.20	0.12	Left	Tilt	Standard	SAR#1	2	1:4.15	0.076	1.122	0.085	
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 1900 Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Back Cover Type	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
1880.00	9400	UMTS 1900	RMC	23.7	23.64	0.04	Right	Cheek	Standard	SAR#1	1:1	0.257	1.014	0.261	
1880.00	9400	UMTS 1900	RMC	23.7	23.64	-0.07	Right	Cheek	Folio Closed	SAR#1	1:1	0.218	1.014	0.221	
1880.00	9400	UMTS 1900	RMC	23.7	23.64	0.00	Right	Cheek	Folio Open	SAR#1	1:1	0.261	1.014	0.265	A7
1880.00	9400	UMTS 1900	RMC	23.7	23.64	-0.01	Right	Tilt	Standard	SAR#1	1:1	0.107	1.014	0.108	
1880.00	9400	UMTS 1900	RMC	23.7	23.64	0.09	Left	Cheek	Standard	SAR#1	1:1	0.122	1.014	0.124	
1880.00	9400	UMTS 1900	RMC	23.7	23.64	0.07	Left	Tilt	Standard	SAR#1	1:1	0.101	1.014	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 11-5
LTE Band 17 Head SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Back Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
710.00	23790	Mid	LTE Band 17	10	Standard	23.7	23.70	0.07	0	Right	Cheek	QPSK	1	25	SAR#3	1:1	0.073	1.000	0.073	
710.00	23790	Mid	LTE Band 17	10	Standard	22.7	22.58	0.09	1	Right	Cheek	QPSK	25	25	SAR#3	1:1	0.058	1.028	0.060	
710.00	23790	Mid	LTE Band 17	10	Standard	23.7	23.70	0.06	0	Right	Tilt	QPSK	1	25	SAR#3	1:1	0.035	1.000	0.035	
710.00	23790	Mid	LTE Band 17	10	Standard	22.7	22.58	-0.05	1	Right	Tilt	QPSK	25	25	SAR#3	1:1	0.029	1.028	0.030	
710.00	23790	Mid	LTE Band 17	10	Standard	23.7	23.70	0.00	0	Left	Cheek	QPSK	1	25	SAR#3	1:1	0.093	1.000	0.093	
710.00	23790	Mid	LTE Band 17	10	Folio Closed	23.7	23.70	0.07	0	Left	Cheek	QPSK	1	25	SAR#3	1:1	0.120	1.000	0.120	
710.00	23790	Mid	LTE Band 17	10	Folio Open	23.7	23.70	0.09	0	Left	Cheek	QPSK	1	25	SAR#3	1:1	0.122	1.000	0.122	A1
710.00	23790	Mid	LTE Band 17	10	Standard	22.7	22.58	0.02	1	Left	Cheek	QPSK	25	25	SAR#3	1:1	0.073	1.028	0.075	
710.00	23790	Mid	LTE Band 17	10	Standard	23.7	23.70	0.02	0	Left	Tilt	QPSK	1	25	SAR#3	1:1	0.044	1.000	0.044	
710.00	23790	Mid	LTE Band 17	10	Standard	22.7	22.58	0.21	1	Left	Tilt	QPSK	25	25	SAR#3	1:1	0.034	1.028	0.035	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population											Head 1.6 W/kg (mW/g) averaged over 1 gram									

Table 11-6
LTE Band 5 (Cell) Head SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Back Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	23.7	23.70	-0.05	0	Right	Cheek	QPSK	1	25	SAR#3	1:1	0.119	1.000	0.119	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Folio Closed	23.7	23.70	0.07	0	Right	Cheek	QPSK	1	25	SAR#3	1:1	0.160	1.000	0.160	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Folio Open	23.7	23.70	0.06	0	Right	Cheek	QPSK	1	25	SAR#3	1:1	0.169	1.000	0.169	A4
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	22.7	22.60	0.02	1	Right	Cheek	QPSK	25	25	SAR#3	1:1	0.094	1.023	0.096	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	23.7	23.70	0.09	0	Right	Tilt	QPSK	1	25	SAR#3	1:1	0.071	1.000	0.071	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	22.7	22.60	-0.13	1	Right	Tilt	QPSK	25	25	SAR#3	1:1	0.056	1.023	0.058	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	23.7	23.70	0.01	0	Left	Cheek	QPSK	1	25	SAR#3	1:1	0.118	1.000	0.118	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	22.7	22.60	0.15	1	Left	Cheek	QPSK	25	25	SAR#3	1:1	0.091	1.023	0.093	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	23.7	23.70	0.05	0	Left	Tilt	QPSK	1	25	SAR#3	1:1	0.068	1.000	0.068	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	22.7	22.60	0.13	1	Left	Tilt	QPSK	25	25	SAR#3	1:1	0.054	1.023	0.055	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population											Head 1.6 W/kg (mW/g) averaged over 1 gram									

Table 11-7
LTE Band 4 (AWS) Head SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Back Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
1732.50	20175	Mid	LTE Band 4 (AWS)	10	Standard	23.7	23.70	-0.04	0	Right	Cheek	QPSK	1	49	SAR#2	1:1	0.305	1.000	0.305	
1732.50	20175	Mid	LTE Band 4 (AWS)	10	Standard	22.7	22.63	0.00	1	Right	Cheek	QPSK	25	12	SAR#2	1:1	0.226	1.016	0.230	
1732.50	20175	Mid	LTE Band 4 (AWS)	10	Standard	23.7	23.70	-0.03	0	Right	Tilt	QPSK	1	49	SAR#2	1:1	0.327	1.000	0.327	
1732.50	20175	Mid	LTE Band 4 (AWS)	10	Standard	22.7	22.63	0.04	1	Right	Tilt	QPSK	25	12	SAR#2	1:1	0.237	1.016	0.241	
1732.50	20175	Mid	LTE Band 4 (AWS)	10	Standard	23.7	23.70	0.04	0	Left	Cheek	QPSK	1	49	SAR#2	1:1	0.609	1.000	0.609	
1732.50	20175	Mid	LTE Band 4 (AWS)	10	Folio Closed	23.7	23.70	0.00	0	Left	Cheek	QPSK	1	49	SAR#2	1:1	0.586	1.000	0.586	
1732.50	20175	Mid	LTE Band 4 (AWS)	10	Folio Open	23.7	23.70	-0.05	0	Left	Cheek	QPSK	1	49	SAR#2	1:1	0.642	1.000	**0.642**	A5
1732.50	20175	Mid	LTE Band 4 (AWS)	10	Standard	22.7	22.63	0.06	1	Left	Cheek	QPSK	25	12	SAR#2	1:1	0.461	1.016	0.468	
1732.50	20175	Mid	LTE Band 4 (AWS)	10	Standard	23.7	23.70	0.06	0	Left	Tilt	QPSK	1	49	SAR#2	1:1	0.298	1.000	0.298	
1732.50	20175	Mid	LTE Band 4 (AWS)	10	Standard	22.7	22.63	0.05	1	Left	Tilt	QPSK	25	12	SAR#2	1:1	0.239	1.016	0.243	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Head 1.6 W/kg (mW/g) averaged over 1 gram										

Table 11-8
LTE Band 2 (PCS) Head SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Back Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
1880.00	18900	Mid	LTE Band 2 (PCS)	10	Standard	23.7	23.70	-0.01	0	Right	Cheek	QPSK	1	25	SAR#3	1:1	0.256	1.000	0.256	
1880.00	18900	Mid	LTE Band 2 (PCS)	10	Folio Closed	23.7	23.70	-0.14	0	Right	Cheek	QPSK	1	25	SAR#3	1:1	0.258	1.000	0.258	
1880.00	18900	Mid	LTE Band 2 (PCS)	10	Folio Open	23.7	23.70	0.12	0	Right	Cheek	QPSK	1	25	SAR#3	1:1	0.263	1.000	0.263	A8
1880.00	18900	Mid	LTE Band 2 (PCS)	10	Standard	22.7	22.58	0.07	1	Right	Cheek	QPSK	25	0	SAR#3	1:1	0.200	1.028	0.206	
1880.00	18900	Mid	LTE Band 2 (PCS)	10	Standard	23.7	23.70	-0.13	0	Right	Tilt	QPSK	1	25	SAR#3	1:1	0.104	1.000	0.104	
1880.00	18900	Mid	LTE Band 2 (PCS)	10	Standard	22.7	22.58	0.03	1	Right	Tilt	QPSK	25	0	SAR#3	1:1	0.084	1.028	0.087	
1880.00	18900	Mid	LTE Band 2 (PCS)	10	Standard	23.7	23.70	0.17	0	Left	Cheek	QPSK	1	25	SAR#3	1:1	0.112	1.000	0.112	
1880.00	18900	Mid	LTE Band 2 (PCS)	10	Standard	22.7	22.58	0.13	1	Left	Cheek	QPSK	25	0	SAR#3	1:1	0.092	1.028	0.094	
1880.00	18900	Mid	LTE Band 2 (PCS)	10	Standard	23.7	23.70	0.15	0	Left	Tilt	QPSK	1	25	SAR#3	1:1	0.106	1.000	0.106	
1880.00	18900	Mid	LTE Band 2 (PCS)	10	Standard	22.7	22.58	0.05	1	Left	Tilt	QPSK	25	0	SAR#3	1:1	0.077	1.028	0.079	
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
DTS Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Back Cover Type	Device Serial Number	Data Rate (Mbps)	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
2437	6	IEEE 802.11b	DSSS	18.1	16.85	0.09	Right	Cheek	Standard	SAR#5	1	1:1	0.038	1.334	**0.050**	A9
2437	6	IEEE 802.11b	DSSS	18.1	16.85	-0.02	Right	Cheek	Folio Closed	SAR#5	1	1:1	0.029	1.334	0.038	
2437	6	IEEE 802.11b	DSSS	18.1	16.85	0.13	Right	Cheek	Folio Open	SAR#5	1	1:1	0.024	1.334	0.032	
2437	6	IEEE 802.11b	DSSS	18.1	16.85	0.13	Right	Tilt	Standard	SAR#5	1	1:1	0.021	1.334	0.027	
2437	6	IEEE 802.11b	DSSS	18.1	16.85	0.07	Left	Cheek	Standard	SAR#5	1	1:1	0.032	1.334	0.042	
2437	6	IEEE 802.11b	DSSS	18.1	16.85	0.00	Left	Tilt	Standard	SAR#5	1	1:1	0.029	1.334	0.038	
5805	161	IEEE 802.11a	OFDM	15.1	14.89	-0.03	Right	Cheek	Standard	SAR#4	6	1:1	0.008	1.050	0.009	A10
5805	161	IEEE 802.11a	OFDM	15.1	14.89	0.08	Right	Tilt	Standard	SAR#4	6	1:1	0.000	1.050	0.000	
5805	161	IEEE 802.11a	OFDM	15.1	14.89	-0.01	Left	Cheek	Standard	SAR#4	6	1:1	0.003	1.050	0.004	
5805	161	IEEE 802.11a	OFDM	15.1	14.89	0.00	Left	Tilt	Standard	SAR#4	6	1:1	0.000	1.050	0.000	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram									

Table 11-10
NII Head SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Back Cover Type	Device Serial Number	Data Rate (Mbps)	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
5220	44	IEEE 802.11a	OFDM	15.1	14.86	0.14	Right	Cheek	Standard	SAR#4	6	1:1	0.012	1.057	0.013	
5220	44	IEEE 802.11a	OFDM	15.1	14.86	0.15	Right	Tilt	Standard	SAR#4	6	1:1	0.000	1.057	0.000	
5220	44	IEEE 802.11a	OFDM	15.1	14.86	0.18	Left	Cheek	Standard	SAR#4	6	1:1	0.007	1.057	0.008	
5220	44	IEEE 802.11a	OFDM	15.1	14.86	0.00	Left	Tilt	Standard	SAR#4	6	1:1	0.000	1.057	0.000	
5260	52	IEEE 802.11a	OFDM	15.1	14.80	0.11	Right	Cheek	Standard	SAR#4	6	1:1	0.010	1.072	0.010	
5260	52	IEEE 802.11a	OFDM	15.1	14.80	-0.07	Right	Tilt	Standard	SAR#4	6	1:1	0.001	1.072	0.002	
5260	52	IEEE 802.11a	OFDM	15.1	14.80	0.20	Left	Cheek	Standard	SAR#4	6	1:1	0.004	1.072	0.004	
5260	52	IEEE 802.11a	OFDM	15.1	14.80	0.00	Left	Tilt	Standard	SAR#4	6	1:1	0.000	1.072	0.000	
5680	136	IEEE 802.11a	OFDM	15.1	14.26	-0.06	Right	Cheek	Standard	SAR#4	6	1:1	0.017	1.213	**0.021**	A11
5680	136	IEEE 802.11a	OFDM	15.1	14.26	0.00	Right	Cheek	Folio Closed	SAR#4	6	1:1	0.000	1.213	0.000	
5680	136	IEEE 802.11a	OFDM	15.1	14.26	0.19	Right	Cheek	Folio Open	SAR#4	6	1:1	0.000	1.213	0.000	
5680	136	IEEE 802.11a	OFDM	15.1	14.26	-0.01	Right	Tilt	Standard	SAR#4	6	1:1	0.008	1.213	0.009	
5680	136	IEEE 802.11a	OFDM	15.1	14.26	0.12	Left	Cheek	Standard	SAR#4	6	1:1	0.005	1.213	0.006	
5680	136	IEEE 802.11a	OFDM	15.1	14.26	0.00	Left	Tilt	Standard	SAR#4	6	1:1	0.000	1.213	0.000	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram									

11.2 Standalone Body-Worn SAR Data

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

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Back Cover Type	Device Serial Number	# of Time Slots	Duty Cycle	Side	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
836.60	190	GSM 850	GSM	33.7	33.24	-0.05	10 mm	Standard	SAR#1	1	1:8.3	back	0.291	1.112	0.324	
836.60	190	GSM 850	GSM	33.7	33.24	-0.05	10 mm	Folio Closed	SAR#1	1	1:8.3	back	0.317	1.112	0.353	
836.60	190	GSM 850	GPRS	31.7	31.48	-0.04	10 mm	Standard	SAR#1	2	1:4.15	back	0.366	1.052	0.385	A13
836.60	190	GSM 850	GPRS	31.7	31.48	-0.16	10 mm	Folio Closed	SAR#1	2	1:4.15	back	0.329	1.052	0.346	
836.60	4183	UMTS 850	RMC	23.7	23.68	-0.11	10 mm	Standard	SAR#1	N/A	1:1	back	0.297	1.005	0.298	A15
836.60	4183	UMTS 850	RMC	23.7	23.68	-0.01	10 mm	Folio Closed	SAR#1	N/A	1:1	back	0.290	1.005	0.291	
1880.00	661	GSM 1900	GSM	30.7	30.67	0.00	10 mm	Standard	SAR#1	1	1:8.3	back	0.602	1.007	0.606	
1880.00	661	GSM 1900	GSM	30.7	30.67	-0.12	10 mm	Folio Closed	SAR#1	1	1:8.3	back	0.611	1.007	0.615	
1880.00	661	GSM 1900	GPRS	28.7	28.20	0.03	10 mm	Standard	SAR#1	2	1:4.15	back	0.679	1.122	0.762	A19
1880.00	661	GSM 1900	GPRS	28.7	28.20	-0.04	10 mm	Folio Closed	SAR#1	2	1:4.15	back	0.551	1.122	0.618	
1852.40	9262	UMTS 1900	RMC	23.7	23.68	0.00	10 mm	Standard	SAR#1	N/A	1:1	back	0.946	1.005	0.951	
1880.00	9400	UMTS 1900	RMC	23.7	23.64	0.02	10 mm	Standard	SAR#1	N/A	1:1	back	0.979	1.014	0.993	
1907.60	9538	UMTS 1900	RMC	23.7	23.58	0.01	10 mm	Standard	SAR#1	N/A	1:1	back	1.050	1.028	1.079	A20
1907.60	9538	UMTS 1900	RMC	23.7	23.58	0.14	10 mm	Folio Closed	SAR#1	N/A	1:1	back	0.958	1.028	0.985	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak								Body 1.6 W/kg (mW/g)								

Table 11-12
LTE Body-Worn SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Back Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
710.00	23790	Mid	LTE Band 17	10	Standard	23.7	23.70	0.12	0	SAR#3	QPSK	1	25	10 mm	back	1:1	0.240	1.000	0.240	A12
710.00	23790	Mid	LTE Band 17	10	Folio Closed	23.7	23.70	-0.02	0	SAR#3	QPSK	1	25	10 mm	back	1:1	0.219	1.000	0.219	
710.00	23790	Mid	LTE Band 17	10	Standard	22.7	22.58	0.04	1	SAR#3	QPSK	25	25	10 mm	back	1:1	0.190	1.028	0.195	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	23.7	23.70	-0.06	0	SAR#2	QPSK	1	25	10 mm	back	1:1	0.278	1.000	0.278	A17
836.50	20525	Mid	LTE Band 5 (Cell)	10	Folio Closed	23.7	23.70	-0.01	0	SAR#2	QPSK	1	25	10 mm	back	1:1	0.217	1.000	0.217	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	22.7	22.60	-0.06	1	SAR#2	QPSK	25	25	10 mm	back	1:1	0.209	1.023	0.214	
1732.50	20175	Mid	LTE Band 4 (AWS)	10	Standard	23.7	23.70	0.03	0	SAR#2	QPSK	1	49	10 mm	back	1:1	0.601	1.000	0.601	
1732.50	20175	Mid	LTE Band 4 (AWS)	10	Folio Closed	23.7	23.70	-0.06	0	SAR#2	QPSK	1	49	10 mm	back	1:1	0.701	1.000	0.701	A18
1732.50	20175	Mid	LTE Band 4 (AWS)	10	Standard	22.7	22.63	-0.02	1	SAR#2	QPSK	25	12	10 mm	back	1:1	0.465	1.016	0.472	
1855.00	18650	Low	LTE Band 2 (PCS)	10	Standard	23.7	23.45	0.01	0	SAR#2	QPSK	1	25	10 mm	back	1:1	0.922	1.059	0.976	
1880.00	18900	Mid	LTE Band 2 (PCS)	10	Standard	23.7	23.70	0.01	0	SAR#2	QPSK	1	25	10 mm	back	1:1	0.966	1.000	0.966	
1905.00	19150	High	LTE Band 2 (PCS)	10	Standard	23.7	23.27	0.01	0	SAR#2	QPSK	1	0	10 mm	back	1:1	1.070	1.104	**1.181**	A21
1905.00	19150	High	LTE Band 2 (PCS)	10	Folio Closed	23.7	23.27	0.00	0	SAR#2	QPSK	1	0	10 mm	back	1:1	0.898	1.104	0.991	
1880.00	18900	Mid	LTE Band 2 (PCS)	10	Standard	22.7	22.58	0.02	1	SAR#2	QPSK	25	0	10 mm	back	1:1	0.743	1.028	0.764	
1880.00	18900	Mid	LTE Band 2 (PCS)	10	Standard	22.7	22.37	-0.03	1	SAR#2	QPSK	50	0	10 mm	back	1:1	0.700	1.079	0.755	
1905.00	19150	High	LTE Band 2 (PCS)	10	Standard	23.7	23.27	0.01	0	SAR#2	QPSK	1	0	10 mm	back	1:1	0.929	1.104	1.026	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Body 1.6 W/kg (mW/g) averaged over 1 gram										

Note: Variability test data was highlighted as a blue entry.

Table 11-13
DTS Body-Worn SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Back Cover Type	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
2437	6	IEEE 802.11b	DSSS	18.1	16.85	0.07	10 mm	Standard	SAR#2	1	back	1:1	0.241	1.334	**0.321**	A22
2437	6	IEEE 802.11b	DSSS	18.1	16.85	-0.04	10 mm	Folio Closed	SAR#2	1	back	1:1	0.128	1.334	0.171	
5805	161	IEEE 802.11a	OFDM	15.1	14.89	0.19	10 mm	Standard	SAR#5	6	back	1:1	0.156	1.050	0.164	A23
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram								

Table 11-14
NII Body-Worn SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Back Cover Type	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
5220	44	IEEE 802.11a	OFDM	15.1	14.86	-0.07	10 mm	Standard	SAR#5	6	back	1:1	0.282	1.057	0.298	
5260	52	IEEE 802.11a	OFDM	15.1	14.80	0.04	10 mm	Standard	SAR#5	6	back	1:1	0.350	1.072	0.375	
5260	52	IEEE 802.11a	OFDM	15.1	14.80	-0.04	10 mm	Folio Closed	SAR#5	6	back	1:1	0.390	1.072	**0.418**	A24
5680	136	IEEE 802.11a	OFDM	15.1	14.26	0.03	10 mm	Standard	SAR#5	6	back	1:1	0.234	1.213	0.284	
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 11-15
GPRS/UMTS Hotspot SAR Data

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Back Cover Type	Device Serial Number	# of GPRS Slots	Duty Cycle	Side	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
836.60	190	GSM 850	GPRS	31.7	31.48	-0.04	10 mm	Standard	SAR#1	2	1:4.15	back	0.366	1.052	0.385	
836.60	190	GSM 850	GPRS	31.7	31.48	0.12	10 mm	Standard	SAR#1	2	1:4.15	front	0.299	1.052	0.315	
836.60	190	GSM 850	GPRS	31.7	31.48	-0.01	10 mm	Standard	SAR#1	2	1:4.15	bottom	0.280	1.052	0.295	
836.60	190	GSM 850	GPRS	31.7	31.48	0.06	10 mm	Standard	SAR#1	2	1:4.15	right	0.507	1.052	0.533	A14
836.60	190	GSM 850	GPRS	31.7	31.48	-0.19	10 mm	Folio Closed	SAR#1	2	1:4.15	right	0.350	1.052	0.368	
836.60	4183	UMTS 850	RMC	23.7	23.68	-0.11	10 mm	Standard	SAR#1	N/A	1:1	back	0.297	1.005	0.298	
836.60	4183	UMTS 850	RMC	23.7	23.68	-0.03	10 mm	Standard	SAR#1	N/A	1:1	front	0.198	1.005	0.199	
836.60	4183	UMTS 850	RMC	23.7	23.68	-0.01	10 mm	Standard	SAR#1	N/A	1:1	bottom	0.188	1.005	0.189	
836.60	4183	UMTS 850	RMC	23.7	23.68	0.04	10 mm	Standard	SAR#1	N/A	1:1	right	0.346	1.005	0.348	A16
836.60	4183	UMTS 850	RMC	23.7	23.68	0.01	10 mm	Folio Closed	SAR#1	N/A	1:1	right	0.294	1.005	0.295	
1880.00	661	GSM 1900	GPRS	28.7	28.20	0.03	10 mm	Standard	SAR#1	2	1:4.15	back	0.679	1.122	0.762	A19
1880.00	661	GSM 1900	GPRS	28.7	28.20	-0.04	10 mm	Folio Closed	SAR#1	2	1:4.15	back	0.551	1.122	0.618	
1880.00	661	GSM 1900	GPRS	28.7	28.20	-0.01	10 mm	Standard	SAR#1	2	1:4.15	front	0.289	1.122	0.324	
1880.00	661	GSM 1900	GPRS	28.7	28.20	-0.01	10 mm	Standard	SAR#1	2	1:4.15	bottom	0.493	1.122	0.553	
1880.00	661	GSM 1900	GPRS	28.7	28.20	0.11	10 mm	Standard	SAR#1	2	1:4.15	right	0.166	1.122	0.186	
1852.40	9262	UMTS 1900	RMC	23.7	23.68	0.00	10 mm	Standard	SAR#1	N/A	1:1	back	0.946	1.005	0.951	
1880.00	9400	UMTS 1900	RMC	23.7	23.64	0.02	10 mm	Standard	SAR#1	N/A	1:1	back	0.979	1.014	0.993	
1907.60	9538	UMTS 1900	RMC	23.7	23.58	0.01	10 mm	Standard	SAR#1	N/A	1:1	back	1.050	1.028	1.079	A20
1907.60	9538	UMTS 1900	RMC	23.7	23.58	0.14	10 mm	Folio Closed	SAR#1	N/A	1:1	back	0.958	1.028	0.985	
1880.00	9400	UMTS 1900	RMC	23.7	23.64	0.10	10 mm	Standard	SAR#1	N/A	1:1	front	0.408	1.014	0.414	
1880.00	9400	UMTS 1900	RMC	23.7	23.64	0.00	10 mm	Standard	SAR#1	N/A	1:1	bottom	0.710	1.014	0.720	
1880.00	9400	UMTS 1900	RMC	23.7	23.64	-0.01	10 mm	Standard	SAR#1	N/A	1:1	right	0.243	1.014	0.246	
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
LTE Band 17 Hotspot SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Back Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
710.00	23790	Mid	LTE Band 17	10	Standard	23.7	23.70	0.12	0	SAR#3	QPSK	1	25	10 mm	back	1:1	0.240	1.000	0.240	A12
710.00	23790	Mid	LTE Band 17	10	Folio Closed	23.7	23.70	-0.02	0	SAR#3	QPSK	1	25	10 mm	back	1:1	0.219	1.000	0.219	
710.00	23790	Mid	LTE Band 17	10	Standard	22.7	22.58	0.04	1	SAR#3	QPSK	25	25	10 mm	back	1:1	0.190	1.028	0.195	
710.00	23790	Mid	LTE Band 17	10	Standard	23.7	23.70	0.01	0	SAR#3	QPSK	1	25	10 mm	front	1:1	0.159	1.000	0.159	
710.00	23790	Mid	LTE Band 17	10	Standard	22.7	22.58	-0.03	1	SAR#3	QPSK	25	25	10 mm	front	1:1	0.121	1.028	0.124	
710.00	23790	Mid	LTE Band 17	10	Standard	23.7	23.70	0.02	0	SAR#3	QPSK	1	25	10 mm	bottom	1:1	0.154	1.000	0.154	
710.00	23790	Mid	LTE Band 17	10	Standard	22.7	22.58	0.03	1	SAR#3	QPSK	25	25	10 mm	bottom	1:1	0.123	1.028	0.126	
710.00	23790	Mid	LTE Band 17	10	Standard	23.7	23.70	-0.17	0	SAR#3	QPSK	1	25	10 mm	left	1:1	0.201	1.000	0.201	
710.00	23790	Mid	LTE Band 17	10	Standard	22.7	22.58	-0.05	1	SAR#3	QPSK	25	25	10 mm	left	1:1	0.164	1.028	0.169	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Body 1.6 W/kg (mW/g) averaged over 1 gram											

Table 11-17
LTE Band 5 (Cell) Hotspot SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Back Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	23.7	23.70	-0.06	0	SAR#2	QPSK	1	25	10 mm	back	1:1	0.278	1.000	0.278	A17
836.50	20525	Mid	LTE Band 5 (Cell)	10	Folio Closed	23.7	23.70	-0.01	0	SAR#2	QPSK	1	25	10 mm	back	1:1	0.217	1.000	0.217	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	22.7	22.60	-0.06	1	SAR#2	QPSK	25	25	10 mm	back	1:1	0.209	1.023	0.214	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	23.7	23.70	-0.01	0	SAR#2	QPSK	1	25	10 mm	front	1:1	0.189	1.000	0.189	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	22.7	22.60	0.03	1	SAR#2	QPSK	25	25	10 mm	front	1:1	0.143	1.023	0.146	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	23.7	23.70	0.03	0	SAR#2	QPSK	1	25	10 mm	bottom	1:1	0.207	1.000	0.207	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	22.7	22.60	0.04	1	SAR#2	QPSK	25	25	10 mm	bottom	1:1	0.154	1.023	0.158	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	23.7	23.70	-0.01	0	SAR#2	QPSK	1	25	10 mm	right	1:1	0.264	1.000	0.264	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	22.7	22.60	-0.09	1	SAR#2	QPSK	25	25	10 mm	right	1:1	0.245	1.023	0.251	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Body 1.6 W/kg (mW/g) averaged over 1 gram										

Table 11-18
LTE Band 4 (AWS) Hotspot SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Back Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
1732.50	20175	Mid	LTE Band 4 (AWS)	10	Standard	23.7	23.70	0.03	0	SAR#2	QPSK	1	49	10 mm	back	1:1	0.601	1.000	0.601	
1732.50	20175	Mid	LTE Band 4 (AWS)	10	Folio Closed	23.7	23.70	-0.06	0	SAR#2	QPSK	1	49	10 mm	back	1:1	0.701	1.000	0.701	A18
1732.50	20175	Mid	LTE Band 4 (AWS)	10	Standard	22.7	22.63	-0.02	1	SAR#2	QPSK	25	12	10 mm	back	1:1	0.465	1.016	0.472	
1732.50	20175	Mid	LTE Band 4 (AWS)	10	Standard	23.7	23.70	-0.01	0	SAR#2	QPSK	1	49	10 mm	front	1:1	0.466	1.000	0.466	
1732.50	20175	Mid	LTE Band 4 (AWS)	10	Standard	22.7	22.63	-0.01	1	SAR#2	QPSK	25	12	10 mm	front	1:1	0.366	1.016	0.372	
1732.50	20175	Mid	LTE Band 4 (AWS)	10	Standard	23.7	23.70	0.02	0	SAR#2	QPSK	1	49	10 mm	bottom	1:1	0.142	1.000	0.142	
1732.50	20175	Mid	LTE Band 4 (AWS)	10	Standard	22.7	22.63	0.00	1	SAR#2	QPSK	25	12	10 mm	bottom	1:1	0.122	1.016	0.124	
1732.50	20175	Mid	LTE Band 4 (AWS)	10	Standard	23.7	23.70	-0.06	0	SAR#2	QPSK	1	49	10 mm	left	1:1	0.563	1.000	0.563	
1732.50	20175	Mid	LTE Band 4 (AWS)	10	Standard	22.7	22.63	-0.01	1	SAR#2	QPSK	25	12	10 mm	left	1:1	0.421	1.016	0.428	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Body 1.6 W/kg (mW/g) averaged over 1 gram										

Table 11-19
LTE Band 2 (PCS) Hotspot SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Back Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
1855.00	18650	Low	LTE Band 2 (PCS)	10	Standard	23.7	23.45	0.01	0	SAR#2	QPSK	1	25	10 mm	back	1:1	0.922	1.059	0.976	
1880.00	18900	Mid	LTE Band 2 (PCS)	10	Standard	23.7	23.70	0.01	0	SAR#2	QPSK	1	25	10 mm	back	1:1	0.966	1.000	0.966	
1905.00	19150	High	LTE Band 2 (PCS)	10	Standard	23.7	23.27	0.01	0	SAR#2	QPSK	1	0	10 mm	back	1:1	1.070	1.104	**1.181**	A21
1905.00	19150	High	LTE Band 2 (PCS)	10	Folio Closed	23.7	23.27	0.00	0	SAR#2	QPSK	1	0	10 mm	back	1:1	0.898	1.104	0.991	
1880.00	18900	Mid	LTE Band 2 (PCS)	10	Standard	22.7	22.58	0.02	1	SAR#2	QPSK	25	0	10 mm	back	1:1	0.743	1.028	0.764	
1880.00	18900	Mid	LTE Band 2 (PCS)	10	Standard	22.7	22.37	-0.03	1	SAR#2	QPSK	50	0	10 mm	back	1:1	0.700	1.079	0.755	
1880.00	18900	Mid	LTE Band 2 (PCS)	10	Standard	23.7	23.70	-0.03	0	SAR#2	QPSK	1	25	10 mm	front	1:1	0.479	1.000	0.479	
1880.00	18900	Mid	LTE Band 2 (PCS)	10	Standard	22.7	22.58	0.06	1	SAR#2	QPSK	25	0	10 mm	front	1:1	0.372	1.028	0.382	
1880.00	18900	Mid	LTE Band 2 (PCS)	10	Standard	23.7	23.70	-0.05	0	SAR#2	QPSK	1	25	10 mm	bottom	1:1	0.736	1.000	0.736	
1880.00	18900	Mid	LTE Band 2 (PCS)	10	Standard	22.7	22.58	-0.02	1	SAR#2	QPSK	25	0	10 mm	bottom	1:1	0.570	1.028	0.586	
1880.00	18900	Mid	LTE Band 2 (PCS)	10	Standard	23.7	23.70	0.00	0	SAR#2	QPSK	1	25	10 mm	right	1:1	0.268	1.000	0.268	
1880.00	18900	Mid	LTE Band 2 (PCS)	10	Standard	22.7	22.58	0.07	1	SAR#2	QPSK	25	0	10 mm	right	1:1	0.203	1.028	0.209	
1905.00	19150	High	LTE Band 2 (PCS)	10	Standard	23.7	23.27	0.01	0	SAR#2	QPSK	1	0	10 mm	back	1:1	0.929	1.104	1.026	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Body 1.6 W/kg (mW/g) averaged over 1 gram										

Note: Variability test data was highlighted as a blue entry.

Table 11-20
WLAN Hotspot SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Back Cover Type	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
2437	6	IEEE 802.11b	DSSS	18.1	16.85	0.07	10 mm	Standard	SAR#2	1	back	1:1	0.241	1.334	**0.321**	A22
2437	6	IEEE 802.11b	DSSS	18.1	16.85	-0.04	10 mm	Folio Closed	SAR#2	1	back	1:1	0.128	1.334	0.171	
2437	6	IEEE 802.11b	DSSS	18.1	16.85	0.19	10 mm	Standard	SAR#2	1	front	1:1	0.036	1.334	0.048	
2437	6	IEEE 802.11b	DSSS	18.1	16.85	0.18	10 mm	Standard	SAR#2	1	bottom	1:1	0.017	1.334	0.023	
2437	6	IEEE 802.11b	DSSS	18.1	16.85	0.01	10 mm	Standard	SAR#2	1	right	1:1	0.091	1.334	0.121	
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, FCC/OET Bulletin 65, Supplement C [June 2001] 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 because 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 6.6 for more details).
10. This DUT has NFC operations. The same NFC antenna is integrated into the standard back cover and the folio sleeve accessory. The SAR tests were performed with the standard back cover and the folio sleeve accessory was additionally evaluated for worst case SAR for each configuration.
11. This DUT may be used with a folio sleeve accessory. Folio sleeve fits the back of the handset and extends to protect the front side of the device. Per FCC KDB Publication 648474 D04, SAR was measured using the standard battery cover, including NFC antenna and wireless charging cover, and then repeated with the folio sleeve, also including NFC antenna and wireless charging cover, for the highest reported SAR for each wireless technology, frequency band, operating mode, and exposure condition. Head tests were performed with the folio sleeve open and closed. Additional body-worn and hotspot tests were performed with the folio closed only because operations near the body with the folio open are not expected. No other additional test with folio sleeve was required since all reported SAR were less than 1.2 W/kg.

GSM Test Notes:

1. This device supports GSM VOIP in the head and the body-worn configurations therefore GPRS was additionally evaluated for head and body-worn compliance.
2. Body-Worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn SAR.
3. Justification for reduced test configurations per KDB Publication 941225 D03v01: The source-based time-averaged output power was evaluated for all multi-slot operations. The multi-slot configuration with the highest frame averaged output power was evaluated for SAR.
4. Per FCC KDB Publication 447498 D01v05, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel must be used.

UMTS Notes:

1. UMTS mode in Body SAR was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v02. HSPA SAR was not required since the average output power of the HSPA subtests was not more than 0.25 dB higher than the RMC level and SAR was less than 1.2 W/kg.
2. Per FCC KDB Publication 447498 D01v05, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel must be used.

LTE Notes:

1. LTE Considerations: LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05v02r01. Implementation of the general test procedures 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.

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. When Hotspot is enabled, all 5 GHz bands are disabled. Therefore no 5 GHz WIFI Wireless Router SAR Data was required.
4. WIFI transmission was verified using an uncalibrated spectrum analyzer.
5. 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 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, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is ≤1.6 W/kg. When standalone SAR is not required to be measured, per FCC KDB 447498 D01v05 4.3.2 2), the following equation must be used to estimate the standalone 1g SAR for simultaneous transmission assessment involving that transmitter.

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

Table 12-1
Estimated SAR

Mode	Frequency	Maximum Allowed Power	Separation Distance (Body)	Estimated SAR (Body)
	[MHz]	[dBm]	[mm]	[W/kg]
Bluetooth	2441	11.50	10	**0.292**

Note: Held-to ear configurations are not applicable to Bluetooth operations and therefore were not considered for simultaneous transmission.

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)	Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.236	0.050	0.286	Head SAR	Right Cheek	0.169	0.050	0.219
	Right Tilt	0.105	0.027	0.132		Right Tilt	0.079	0.027	0.106
	Left Cheek	0.169	0.042	0.211		Left Cheek	0.119	0.042	0.161
	Left Tilt	0.093	0.038	0.131		Left Tilt	0.066	0.038	0.104
Simult Tx	**Configuration**	**GSM 1900 SAR (W/kg)**	**2.4 GHz WLAN SAR (W/kg)**	**Σ SAR (W/kg)**	**Simult Tx**	**Configuration**	**UMTS 1900 SAR (W/kg)**	**2.4 GHz WLAN SAR (W/kg)**	**Σ SAR (W/kg)**
Head SAR	Right Cheek	0.191	0.050	0.241	Head SAR	Right Cheek	0.265	0.050	**0.315**
	Right Tilt	0.078	0.027	0.105		Right Tilt	0.108	0.027	0.135
	Left Cheek	0.082	0.042	0.124		Left Cheek	0.124	0.042	0.166
	Left Tilt	0.079	0.038	0.117		Left Tilt	0.102	0.038	0.140
Simult Tx	**Configuration**	**GPRS 850 SAR (W/kg)**	**2.4 GHz WLAN SAR (W/kg)**	**Σ SAR (W/kg)**	**Simult Tx**	**Configuration**	**GPRS 1900 SAR (W/kg)**	**2.4 GHz WLAN SAR (W/kg)**	**Σ SAR (W/kg)**
Head SAR	Right Cheek	0.260	0.050	**0.310**	Head SAR	Right Cheek	0.229	0.050	0.279
	Right Tilt	0.153	0.027	0.180		Right Tilt	0.093	0.027	0.120
	Left Cheek	0.232	0.042	0.274		Left Cheek	0.084	0.042	0.126
	Left Tilt	0.136	0.038	0.174		Left Tilt	0.085	0.038	0.123
Simult Tx	**Configuration**	**LTE Band 17 SAR (W/kg)**	**2.4 GHz WLAN SAR (W/kg)**	**Σ SAR (W/kg)**	**Simult Tx**	**Configuration**	**LTE Band 5 (Cell) SAR (W/kg)**	**2.4 GHz WLAN SAR (W/kg)**	**Σ SAR (W/kg)**
Head SAR	Right Cheek	0.073	0.050	0.123	Head SAR	Right Cheek	0.169	0.050	**0.219**
	Right Tilt	0.035	0.027	0.062		Right Tilt	0.071	0.027	0.098
	Left Cheek	0.122	0.042	**0.164**		Left Cheek	0.118	0.042	0.160
	Left Tilt	0.044	0.038	0.082		Left Tilt	0.068	0.038	0.106
Simult Tx	**Configuration**	**LTE Band 4 (AWS) SAR (W/kg)**	**2.4 GHz WLAN SAR (W/kg)**	**Σ SAR (W/kg)**	**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	0.305	0.050	0.355	Head SAR	Right Cheek	0.263	0.050	**0.313**
	Right Tilt	0.327	0.027	0.354		Right Tilt	0.104	0.027	0.131
	Left Cheek	0.642	0.042	**0.684**		Left Cheek	0.112	0.042	0.154
	Left Tilt	0.298	0.038	0.336		Left Tilt	0.106	0.038	0.144

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	0.236	0.021	**0.257**
	Right Tilt	0.105	0.009	0.114
	Left Cheek	0.169	0.008	0.177
	Left Tilt	0.093	0.000	0.093
Simult Tx	Configuration	GSM 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.191	0.021	**0.212**
	Right Tilt	0.078	0.009	0.087
	Left Cheek	0.082	0.008	0.090
	Left Tilt	0.079	0.000	0.079
Simult Tx	Configuration	GPRS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.260	0.021	**0.281**
	Right Tilt	0.153	0.009	0.162
	Left Cheek	0.232	0.008	0.240
	Left Tilt	0.136	0.000	0.136
Simult Tx	Configuration	LTE Band 17 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.073	0.021	0.094
	Right Tilt	0.035	0.009	0.044
	Left Cheek	0.122	0.008	**0.130**
	Left Tilt	0.044	0.000	0.044
Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.305	0.021	0.326
	Right Tilt	0.327	0.009	0.336
	Left Cheek	0.642	0.008	**0.650**
	Left Tilt	0.298	0.000	0.298

Simult Tx	Configuration	UMTS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.169	0.021	**0.190**
	Right Tilt	0.079	0.009	0.088
	Left Cheek	0.119	0.008	0.127
	Left Tilt	0.066	0.000	0.066
Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.265	0.021	**0.286**
	Right Tilt	0.108	0.009	0.117
	Left Cheek	0.124	0.008	0.132
	Left Tilt	0.102	0.000	0.102
Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.229	0.021	**0.250**
	Right Tilt	0.093	0.009	0.102
	Left Cheek	0.084	0.008	0.092
	Left Tilt	0.085	0.000	0.085
Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.169	0.021	**0.190**
	Right Tilt	0.071	0.009	0.080
	Left Cheek	0.118	0.008	0.126
	Left Tilt	0.068	0.000	0.068
Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.263	0.021	**0.284**
	Right Tilt	0.104	0.009	0.113
	Left Cheek	0.112	0.008	0.120
	Left Tilt	0.106	0.000	0.106

The worst case 5 GHz SAR value was used to evaluate potential combinations using WIFI direct in group client mode only.

12.4 Body-Worn Simultaneous Transmission Analysis

Table 12-4
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body-Worn at 10 mm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	GSM 850	0.353	0.321	0.674
Back Side	UMTS 850	0.298	0.321	0.619
Back Side	GSM 1900	0.615	0.321	0.936
Back Side	UMTS 1900	1.079	0.321	1.400
Back Side	GPRS 850	0.385	0.321	0.706
Back Side	GPRS 1900	0.762	0.321	1.083
Back Side	LTE Band 17	0.240	0.321	0.561
Back Side	LTE Band 5 (Cell)	0.278	0.321	0.599
Back Side	LTE Band 4 (AWS)	0.701	0.321	1.022
Back Side	LTE Band 2 (PCS)	1.181	0.321	1.502

Table 12-5
Simultaneous Transmission Scenario with 5 GHz WLAN (Body-Worn at 10 mm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	GSM 850	0.353	0.418	0.771
Back Side	UMTS 850	0.298	0.418	0.716
Back Side	GSM 1900	0.615	0.418	1.033
Back Side	UMTS 1900	1.079	0.418	1.497
Back Side	GPRS 850	0.385	0.418	0.803
Back Side	GPRS 1900	0.762	0.418	1.180
Back Side	LTE Band 17	0.240	0.418	0.658
Back Side	LTE Band 5 (Cell)	0.278	0.418	0.696
Back Side	LTE Band 4 (AWS)	0.701	0.418	1.119
Back Side	LTE Band 2 (PCS)	1.181	0.418	**1.599**

The worst case 5 GHz SAR value was used to evaluate potential combinations using WIFI direct in group client mode only.

Table 12-6
Simultaneous Transmission Scenario with Bluetooth (Body-Worn at 10 mm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Back Side	GSM 850	0.353	0.292	0.645
Back Side	UMTS 850	0.298	0.292	0.590
Back Side	GSM 1900	0.615	0.292	0.907
Back Side	UMTS 1900	1.079	0.292	1.371
Back Side	GPRS 850	0.385	0.292	0.677
Back Side	GPRS 1900	0.762	0.292	1.054
Back Side	LTE Band 17	0.240	0.292	0.532
Back Side	LTE Band 5 (Cell)	0.278	0.292	0.570
Back Side	LTE Band 4 (AWS)	0.701	0.292	0.993
Back Side	LTE Band 2 (PCS)	1.181	0.292	1.473

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 (Hotspot at 1.0 cm)

Simult Tx	Configuration	GPRS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.385	0.321	0.706	Body SAR	Back	0.298	0.321	0.619
	Front	0.315	0.048	0.363		Front	0.199	0.048	0.247
	Top	-	-	0.000		Top	-	-	0.000
	Bottom	0.295	0.023	0.318		Bottom	0.189	0.023	0.212
	Right	0.533	0.121	0.654		Right	0.348	0.121	0.469
	Left	-	-	0.000		Left	-	-	0.000

Simult Tx	Configuration	GPRS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.762	0.321	1.083	Body SAR	Back	1.079	0.321	1.400
	Front	0.324	0.048	0.372		Front	0.414	0.048	0.462
	Top	-	-	0.000		Top	-	-	0.000
	Bottom	0.553	0.023	0.576		Bottom	0.720	0.023	0.743
	Right	0.186	0.121	0.307		Right	0.246	0.121	0.367
	Left	-	-	0.000		Left	-	-	0.000

Simult Tx	Configuration	LTE Band 17 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.240	0.321	0.561	Body SAR	Back	0.278	0.321	0.599
	Front	0.159	0.048	0.207		Front	0.189	0.048	0.237
	Top	-	-	0.000		Top	-	-	0.000
	Bottom	0.154	0.023	0.177		Bottom	0.207	0.023	0.230
	Right	-	0.121	0.121		Right	0.264	0.121	0.385
	Left	0.201	-	0.201		Left	-	-	0.000

Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 2 (PCS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.701	0.321	1.022	Body SAR	Back	1.181	0.321	1.502
	Front	0.466	0.048	0.514		Front	0.479	0.048	0.527
	Top	-	-	0.000		Top	-	-	0.000
	Bottom	0.142	0.023	0.165		Bottom	0.736	0.023	0.759
	Right	-	0.121	0.121		Right	0.268	0.121	0.389
	Left	0.563	-	0.563		Left	-	-	0.000

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.

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	# of Time Slots	Data Rate (Mbps)	Side	Spacing	Measured SAR (1g)	1st Repeated SAR (1g)	Ratio	2nd Repeated SAR (1g)	Ratio	3rd Repeated SAR (1g)	Ratio
	MHz	Ch.							(W/kg)	(W/kg)		(W/kg)		(W/kg)	
1900	1905.00	19150	LTE Band 2 (PCS)	QPSK, 1 RB, 0 RB Offset	N/A	N/A	back	10 mm	1.070	0.929	1.15	N/A	N/A	N/A	N/A
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram							

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	10/10/2012	Annual	10/10/2013	3613A00315
Agilent	8648D	Signal Generator	4/3/2012	Annual	4/3/2013	3629U00687
Agilent	8753E	(30kHz-6GHz) Network Analyzer	4/4/2012	Annual	4/4/2013	JP38020182
Agilent	8753E	(30kHz-6GHz) Network Analyzer	4/3/2012	Annual	4/3/2013	US37390350
Agilent	E5515C	Wireless Communications Test Set	9/24/2012	Annual	9/24/2013	GB43163447
Agilent	E5515C	Wireless Communications Test Set	10/18/2012	Biennial	10/18/2014	GB43193563
Agilent	E8257D	(250kHz-20GHz) Signal Generator	4/5/2012	Annual	4/5/2013	MY45470194
Agilent	MA24106A	USB Power Sensor	12/7/2012	Annual	12/7/2013	1244524
Agilent	MA24106A	USB Power Sensor	12/6/2012	Annual	12/6/2013	1248508
Amplifier Research	5S1G4	5W, 800MHz-4.2GHz	CBT	N/A	CBT	21910
Anritsu	MA24106A	USB Power Sensor	8/22/2012	Annual	8/22/2013	1231538
Anritsu	MA24106A	USB Power Sensor	8/22/2012	Annual	8/22/2013	1231535
Anritsu	MA2411B	Power Sensor	3/5/2012	Annual	3/5/2013	846215
Anritsu	MA2411B	Pulse Sensor	9/19/2012	Annual	9/19/2013	1027293
Anritsu	MA2411B	Pulse Power Sensor	12/4/2012	Annual	12/4/2013	1207364
Anritsu	MA2481A	Power Sensor	4/5/2012	Annual	4/5/2013	5605
Anritsu	MA2481D	Universal Sensor	12/17/2012	Annual	12/17/2013	1204419
Anritsu	ML2496A	Power Meter	11/28/2012	Annual	11/28/2013	1138001
Anritsu	MT8820C	Radio Communication Tester	11/6/2012	Annual	11/6/2013	6200901190
COMTech	AR85729-5	Solid State Amplifier	CBT	N/A	CBT	M1S5A00-009
Control Company	4353	Long Stem Thermometer	9/25/2012	Biennial	9/25/2014	122539615
Control Company	36934-158	Wall-Mounted Thermometer	1/4/2012	Biennial	1/4/2014	122014488
Control Company	61220-416	Long-Stem Thermometer	7/1/2011	Biennial	7/1/2013	111642834
Gigatronics	80701A	(0.05-18GHz) Power Sensor	10/10/2012	Annual	10/10/2013	1833460
Gigatronics	8651A	Universal Power Meter	10/10/2012	Annual	10/10/2013	8650319
Intelligent Weighing	PD-3000	Electronic Balance	6/29/2012	Annual	6/29/2013	120405017
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
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
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Narda	BW-S3W2	Attenuator (3dB)	CBT	N/A	CBT	120
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Rohde & Schwarz	CMU200	Base Station Simulator	5/22/2012	Annual	5/22/2013	109892
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	10/7/2011	Biennial	10/7/2013	103962
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	2/8/2013	Annual	2/8/2014	101699
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	3/5/2012	Annual	3/5/2013	102060
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	9/26/2012	Annual	9/26/2013	108798
Rohde & Schwarz	NRVD	Dual Channel Power Meter	10/12/2012	Biennial	10/12/2014	101695
Rohde & Schwarz	NRV-Z32	Peak Power Sensor	10/12/2012	Biennial	10/12/2014	836019/013
Rohde & Schwarz	SME06	Signal Generator	10/11/2012	Annual	10/11/2013	832026
Rohde & Schwarz	SMIQ03B	Signal Generator	4/5/2012	Annual	4/5/2013	DE27259
Seekonk	NC-100	Torque Wrench (8" lb)	3/5/2012	Triennial	3/5/2015	N/A
SPEAG	D1765V2	1765 MHz SAR Dipole	5/18/2012	Annual	5/18/2013	1008
SPEAG	D1900V2	1900 MHz SAR Dipole	2/22/2012	Annual	2/22/2013	5d149
SPEAG	D1900V2	1900 MHz SAR Dipole	2/6/2013	Annual	2/6/2014	5d148
SPEAG	D2450V2	2450 MHz SAR Dipole	8/23/2012	Annual	8/23/2013	719
SPEAG	D2450V2	2450 MHz SAR Dipole	1/8/2013	Annual	1/8/2014	797
SPEAG	D5GHzV2	5 GHz SAR Dipole	1/11/2013	Annual	1/11/2014	1057
SPEAG	D750V3	750 MHz Dipole	1/7/2013	Annual	1/7/2014	1003
SPEAG	D750V3	750 MHz Dipole	2/13/2013	Annual	2/13/2014	1046
SPEAG	D835V2	835 MHz SAR Dipole	8/23/2012	Annual	8/23/2013	4d026
SPEAG	D835V2	835 MHz SAR Dipole	4/20/2012	Annual	4/20/2013	4d119
SPEAG	D835V2	835 MHz SAR Dipole	2/17/2012	Annual	2/17/2013	4d133
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/19/2012	Annual	4/19/2013	665
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/6/2013	Annual	2/6/2014	649
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/17/2013	Annual	1/17/2014	1272
SPEAG	DAE4	Dasy Data Acquisition Electronics	9/19/2012	Annual	9/19/2013	1323
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/13/2012	Annual	11/13/2013	1333
SPEAG	DAE4	Dasy Data Acquisition Electronics	8/24/2012	Annual	8/24/2013	1322
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/7/2012	Annual	5/7/2013	1334
SPEAG	DAK-3.5	Dielectric Assessment Kit	6/19/2012	Annual	6/19/2013	1070
SPEAG	ES3DV2	SAR Probe	8/28/2012	Annual	8/28/2013	3022
SPEAG	ES3DV3	SAR Probe	4/24/2012	Annual	4/24/2013	3213
SPEAG	ES3DV3	SAR Probe	5/18/2012	Annual	5/18/2013	3263
SPEAG	ES3DV3	SAR Probe	9/20/2012	Annual	9/20/2013	3288
SPEAG	ES3DV3	SAR Probe	11/15/2012	Annual	11/15/2013	3287
SPEAG	EX3DV4	SAR Probe	1/17/2013	Annual	1/17/2014	3589
SPEAG	EX3DV4	SAR Probe	2/27/2013	Annual	2/27/2014	3920
Tektronix	RSA-6114A	Real Time Spectrum Analyzer	4/5/2012	Annual	4/5/2013	B010177
VWR	23226-658	Long Stem Thermometer	5/16/2012	Biennial	5/16/2014	122295544
VWR	36934-158	Wall-Mounted Thermometer	9/30/2011	Biennial	9/30/2013	111859323
VWR	62344-925	Mini-Thermometer	10/24/2011	Biennial	10/24/2013	111886441

Notes:

1. CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path. The power meter offset was then adjusted to compensate for the measurement system losses. This level offset is stored within the power meter before measurements are made. This calibration verification procedure applies to the system verification and output power measurements. The calibrated reading is then taken directly from the power meter after compensation of the losses for all final power measurements.
2. All equipment was used within its calibration period. 5d149 and 4d133 dipoles were used before 02/22/2013 and 02/17/2013 respectively.

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: ZNFE980; Type: Portable Handset; Serial: SAR#3

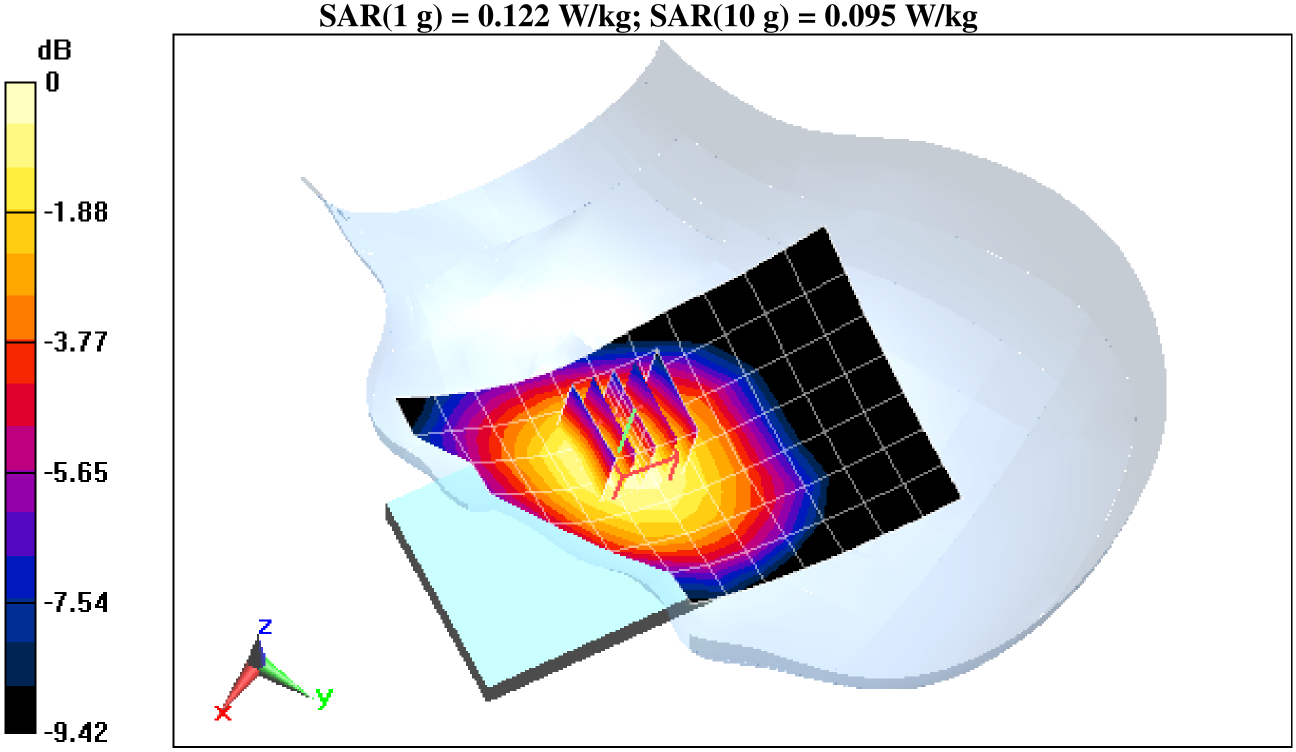
Communication System: LTE BAND 17; Frequency: 750 MHz;Duty Cycle: 1:1
Medium: 750 Head Medium parameters used:
$f = 710$ MHz; $\sigma = 0.862$ S/m; $\varepsilon_r = 42.357$; $\rho = 1000$ kg/m^3
Phantom section: Left Section

Test Date: 03-13-2013; Ambient Temp: 24.2°C; Tissue Temp: 23.3°C

Probe: ES3DV3 - SN3287; ConvF(6.4, 6.4, 6.4); Calibrated: 11/15/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM with CRP; Type: SAM 4.0; Serial: TP1375
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

Mode: LTE Band 17, Left Head, Cheek, Mid.ch
10 MHz Bandwidth, QPSK, 1 RB, 25 RB Offset Folio Open

Area Scan (8x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.690 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 0.147 W/kg
SAR(1 g) = 0.122 W/kg; SAR(10 g) = 0.095 W/kg



0 dB = 0.128 W/kg = -8.93 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFE980; Type: Portable Handset; Serial: SAR#1

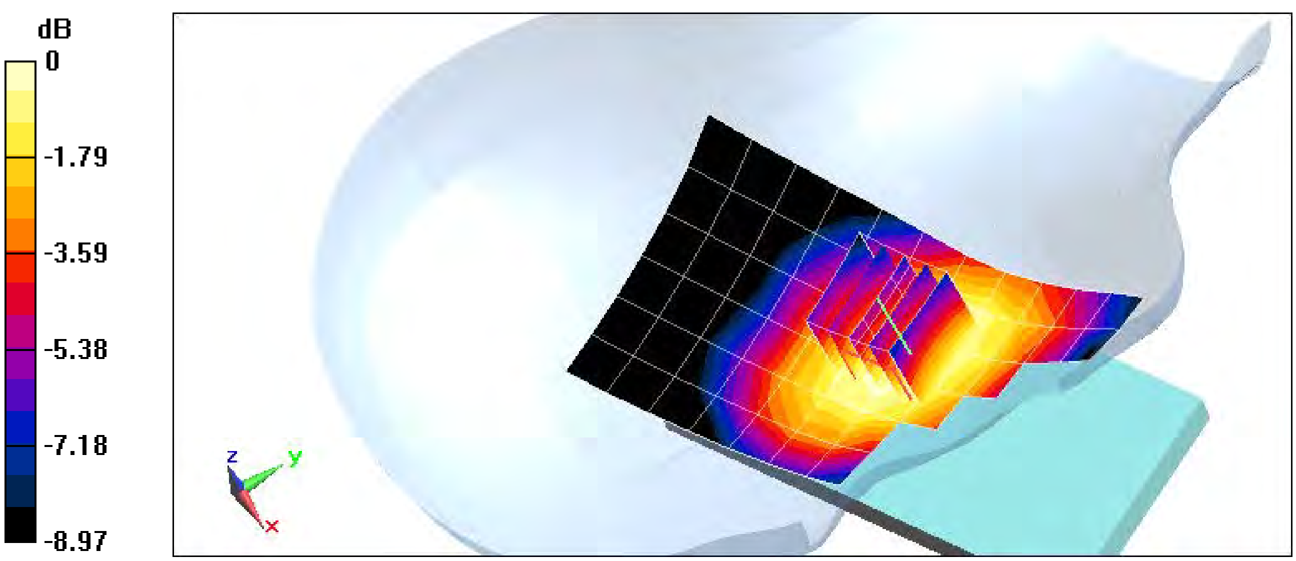
Communication System: GSM850 GPRS; 2 Tx slots; Frequency: 836.6 MHz; Duty Cycle: 1:4.15
Medium: 835 Head Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.933 mho/m; ε_r = 42.378; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 02-16-2013; Ambient Temp: 23.7°C; Tissue Temp: 22.9°C

Probe: ES3DV2 - SN3022; ConvF(6.03, 6.03, 6.03); Calibrated: 8/28/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/24/2012
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

Mode: GPRS 850, Right Head, Cheek, Mid.ch, 2 Tx Slots

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.864 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.301 W/kg
SAR(1 g) = 0.247 W/kg; SAR(10 g) = 0.193 W/kg



0 dB = 0.257 W/kg = -5.90 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFE980; Type: Portable Handset; Serial: SAR#1

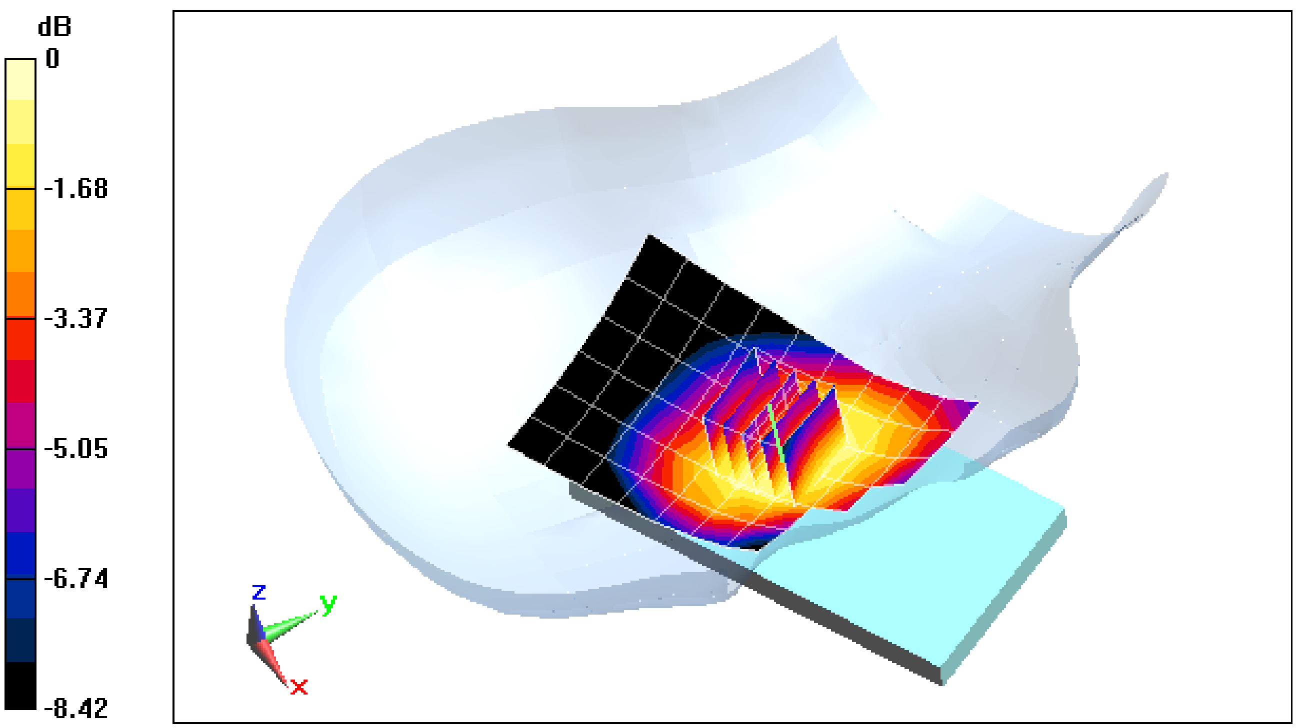
Communication System: WCDMA850; Frequency: 836.6 MHz;Duty Cycle: 1:1
Medium: 835 Head Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.936 S/m; ε_r = 42.076; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 03-07-2013; Ambient Temp: 24.4°C; Tissue Temp: 23.5°C

Probe: ES3DV2 - SN3022; ConvF(6.03, 6.03, 6.03); Calibrated: 8/28/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/24/2012
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

Mode: UMTS 850, Right Head, Cheek, Mid.ch FolioOpen

Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 13.576 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 0.202 W/kg
SAR(1 g) = 0.168 W/kg; SAR(10 g) = 0.132 W/kg



0 dB = 0.177 W/kg = -7.52 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFE980; Type: Portable Handset; Serial: SAR#3

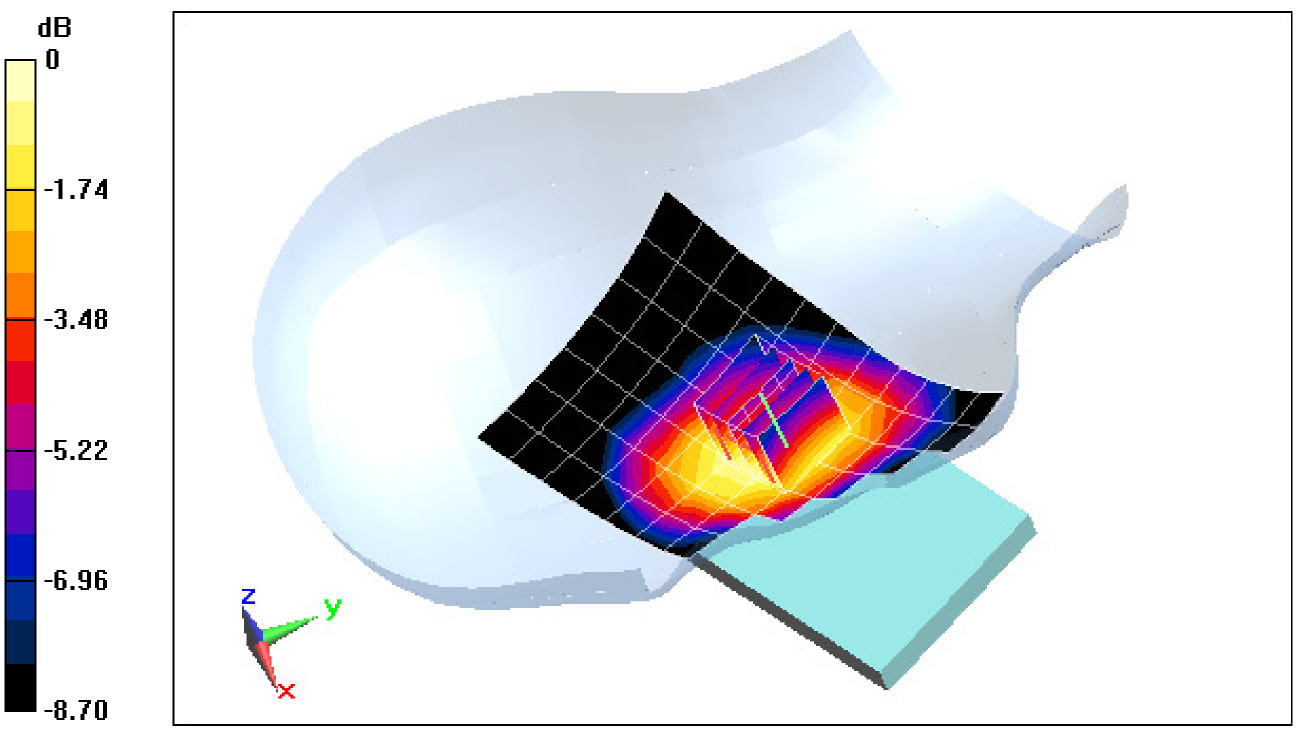
Communication System: LTE BAND 5; Frequency: 836.5 MHz;Duty Cycle: 1:1
Medium: 835 Head Medium parameters used (interpolated):
f = 836.5 MHz; σ = 0.936 S/m; ε_r = 42.078; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 03-07-2013; Ambient Temp: 24.4°C; Tissue Temp: 23.5°C

Probe: ES3DV2 - SN3022; ConvF(6.03, 6.03, 6.03); Calibrated: 8/28/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/24/2012
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

Mode: LTE Band 5 (Cell), Right Head, Cheek, Mid.ch
10 MHz Bandwidth, QPSK, 1 RB, 25 RB Offset, Folio Open

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.389 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.203 W/kg
SAR(1 g) = 0.169 W/kg; SAR(10 g) = 0.131 W/kg



0 dB = 0.177 W/kg = -7.52 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFE980; Type: Portable Handset; Serial: SAR#2

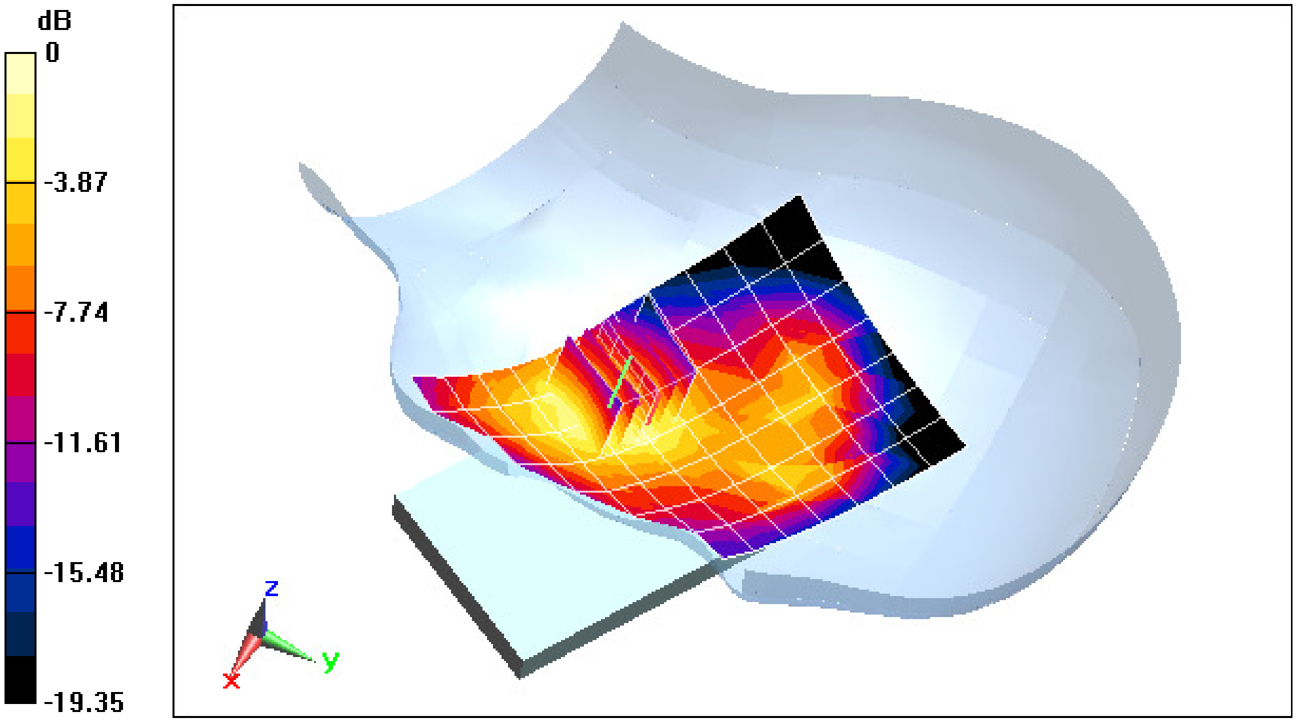
Communication System: LTE RF; Frequency: 1732.5 MHz;Duty Cycle: 1:1
Medium: 1750 Head Medium parameters used (interpolated):
f = 1732.5 MHz; σ = 1.401 S/m; ε_r = 39.879; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 03-11-2013; Ambient Temp: 24.8°C; Tissue Temp: 23.1°C

Probe: ES3DV3 - SN3287; ConvF(5.16, 5.16, 5.16); Calibrated: 11/15/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM with CRP; Type: SAM 4.0; Serial: TP1375
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

Mode: LTE Band 4 (AWS), Left Head, Cheek, Mid.ch
10 MHz Bandwidth, QPSK, 1 RB, 49 RB Offset, Folio Open

Area Scan (8x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.002 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.980 W/kg
SAR(1 g) = 0.642 W/kg; SAR(10 g) = 0.399 W/kg



0 dB = 0.694 W/kg = -1.59 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFE980; Type: Portable Handset; Serial: SAR#1

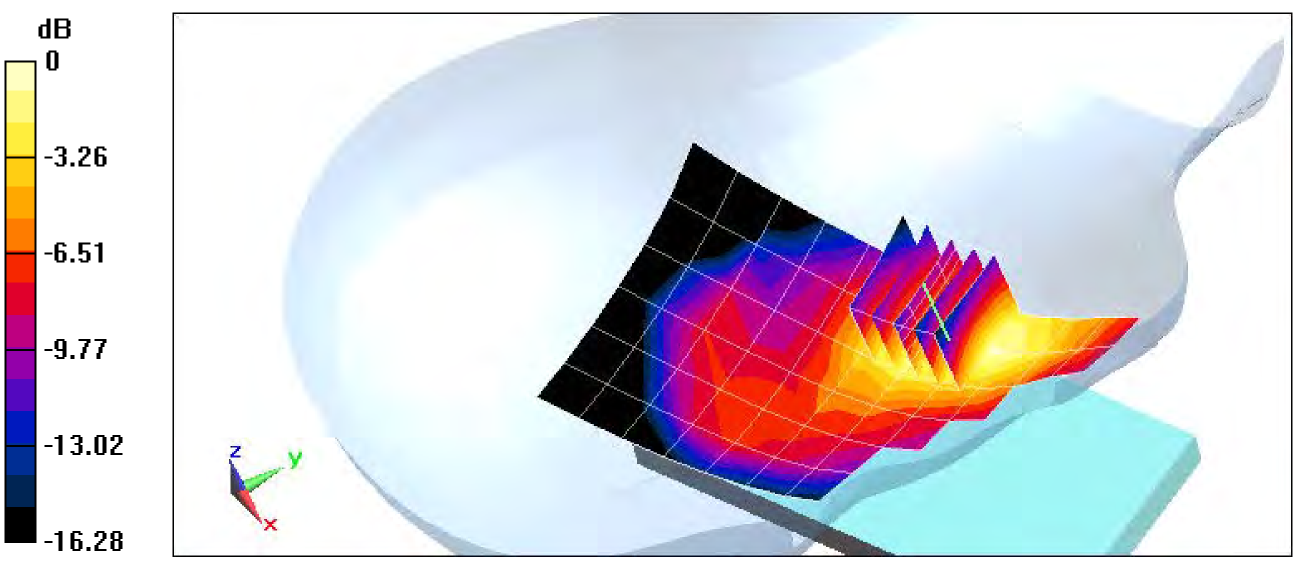
Communication System: GSM GPRS; 2 Tx slots; Frequency: 1880 MHz; Duty Cycle: 1:4.15
Medium: 1900 Head Medium parameters used:
f = 1880 MHz; σ = 1.385 mho/m; ε_r = 39.316; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 02-14-2013; Ambient Temp: 24.2°C; Tissue Temp: 22.8°C

Probe: ES3DV3 - SN3263; ConvF(5.09, 5.09, 5.09); Calibrated: 5/18/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 5/7/2012
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.7 (6848)

Mode:GPRS 1900, Right Head, Cheek , Mid.ch, 2 Tx slots

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.606 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.318 W/kg
SAR(1 g) = 0.204 W/kg



0 dB = 0.219 W/kg = -6.60 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFE980; Type: Portable Handset; Serial: SAR#1

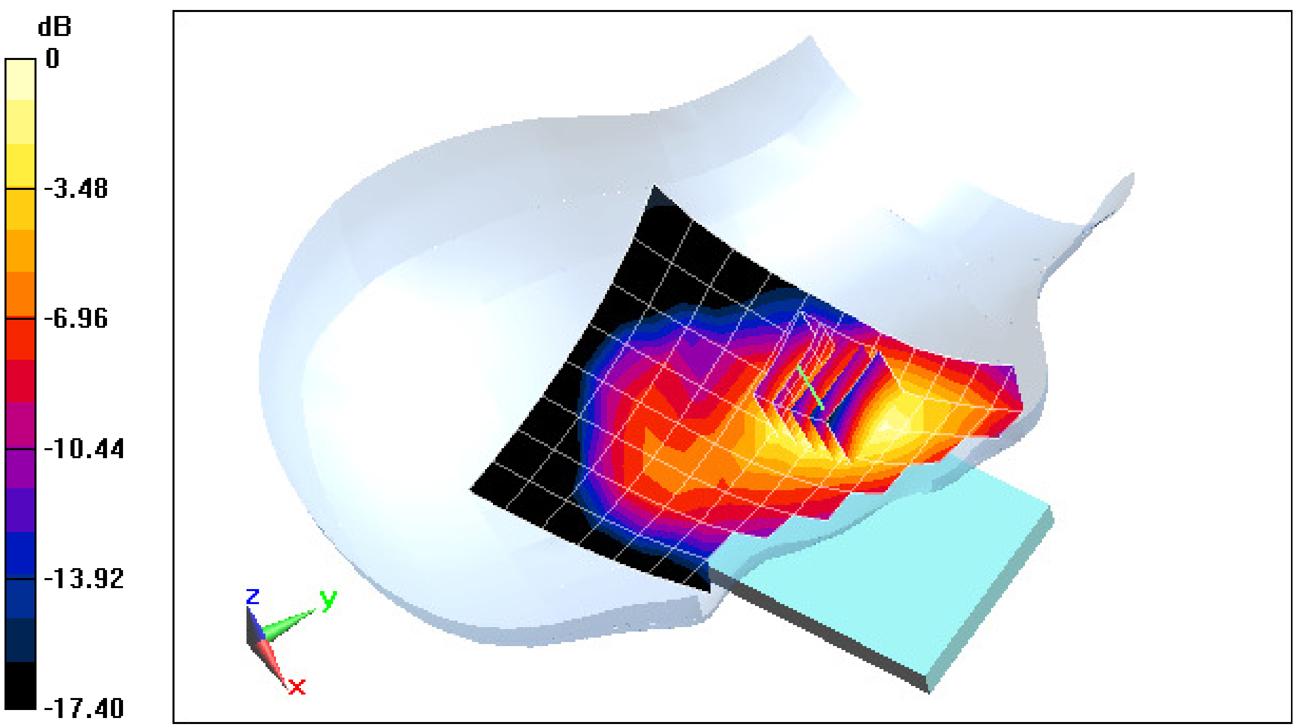
Communication System: UMTS; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: 1900 Head Medium parameters used:
f = 1880 MHz; σ = 1.418 S/m; ε_r = 39.846; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 03-07-2013; Ambient Temp: 24.3°C; Tissue Temp: 23.2°C

Probe: EX3DV4 - SN3920; ConvF(7.73, 7.73, 7.73); Calibrated: 2/27/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/6/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.8 (7028)

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

Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.280 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.404 W/kg
SAR(1 g) = 0.261 W/kg



0 dB = 0.273 W/kg = -5.64 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFE980; Type: Portable Handset; Serial: SAR#3

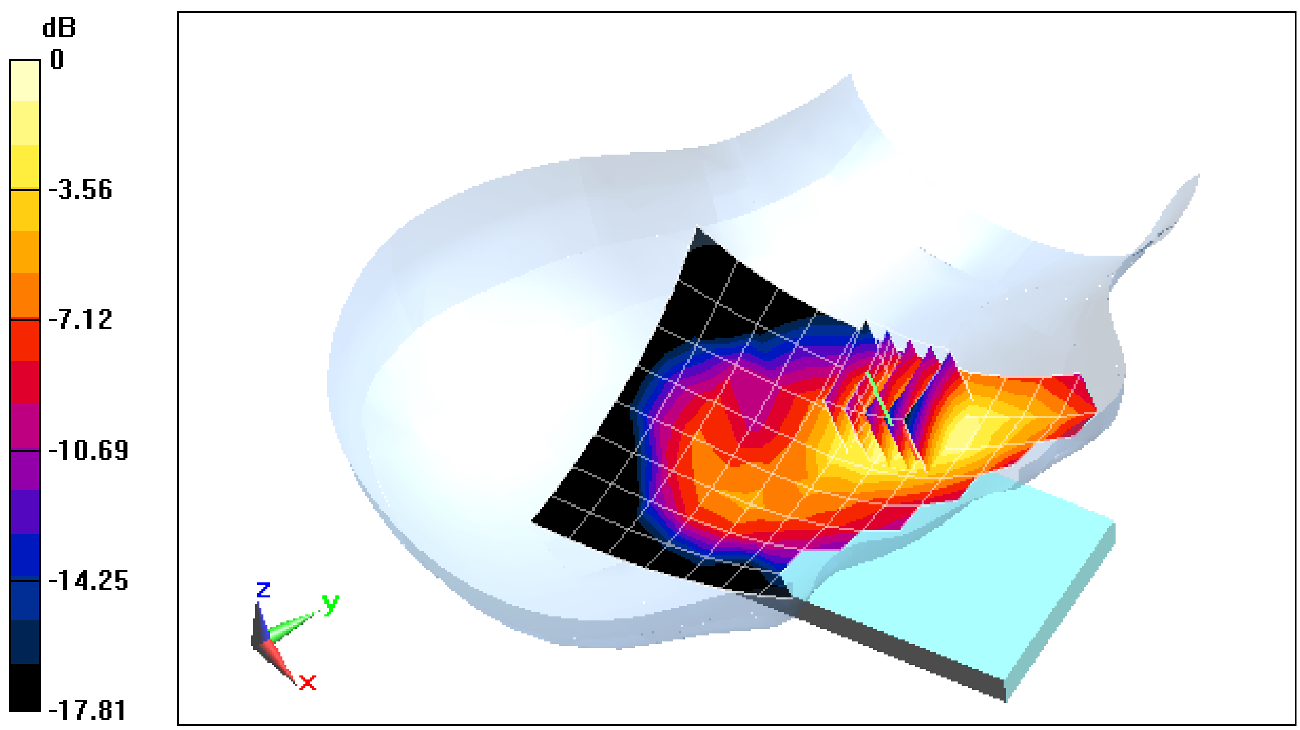
Communication System: LTE Band 2; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: 1900 Head Medium parameters used:
f = 1880 MHz; σ = 1.418 S/m; ε_r = 39.846; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 03-07-2013; Ambient Temp: 24.3°C; Tissue Temp: 23.2°C

Probe: EX3DV4 - SN3920; ConvF(7.73, 7.73, 7.73); Calibrated: 2/27/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/6/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.8 (7028)

Mode: LTE Band 2 (PCS), Right Head, Cheek, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 25 RB Offset, Folio Open

Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.469 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 0.391 W/kg
SAR(1 g) = 0.263 W/kg; SAR(10 g) = 0.162 W/kg



0 dB = 0.280 W/kg = -5.53 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFE980; Type: Portable Handset; Serial: SAR#5

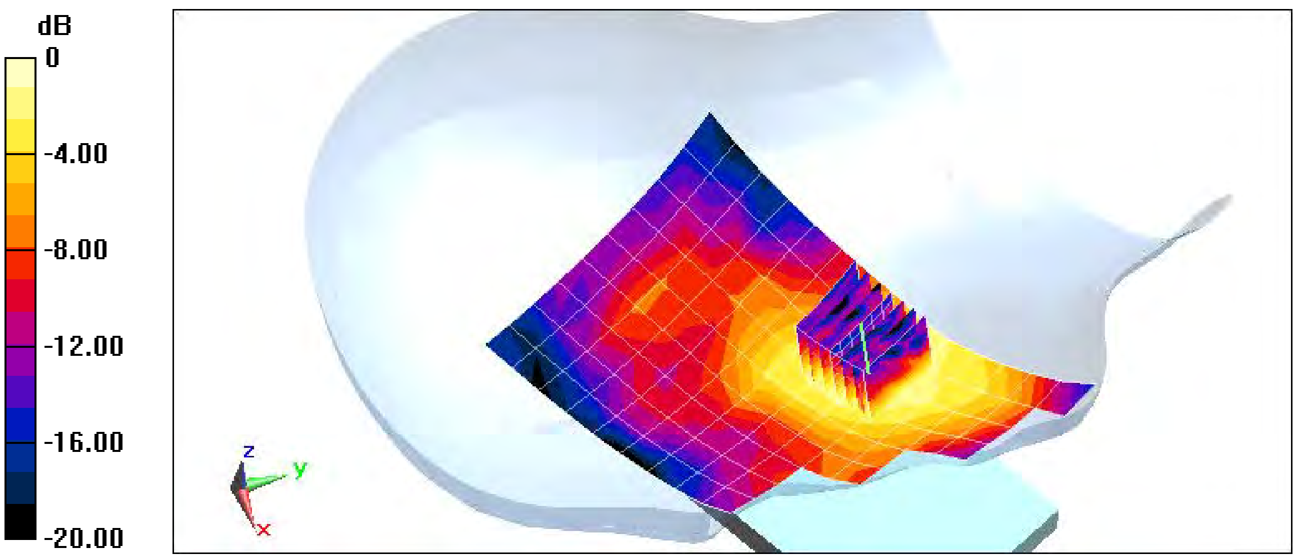
Communication System: IEEE 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1
Medium: 2450 Head Medium parameters used (interpolated):
f = 2437 MHz; $\sigma = 1.849$ mho/m; $\varepsilon_r = 38.156$; $\rho = 1000$ kg/m^3
Phantom section: Right Section

Test Date: 02-20-2013; Ambient Temp: 24.5°C; Tissue Temp: 23.5°C

Probe: ES3DV2 - SN3022; ConvF(4.23, 4.23, 4.23); Calibrated: 8/28/2012;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/24/2012
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

Mode: IEEE 802.11b, Right Head, Cheek, Ch 06, 1 Mbps

Area Scan (10x17x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.868 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 0.0670 W/kg
SAR(1 g) = 0.038 W/kg; SAR(10 g) = 0.020 W/kg



0 dB = 0.0467 W/kg = -13.31 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFE980; Type: Portable Handset; Serial: SAR#4

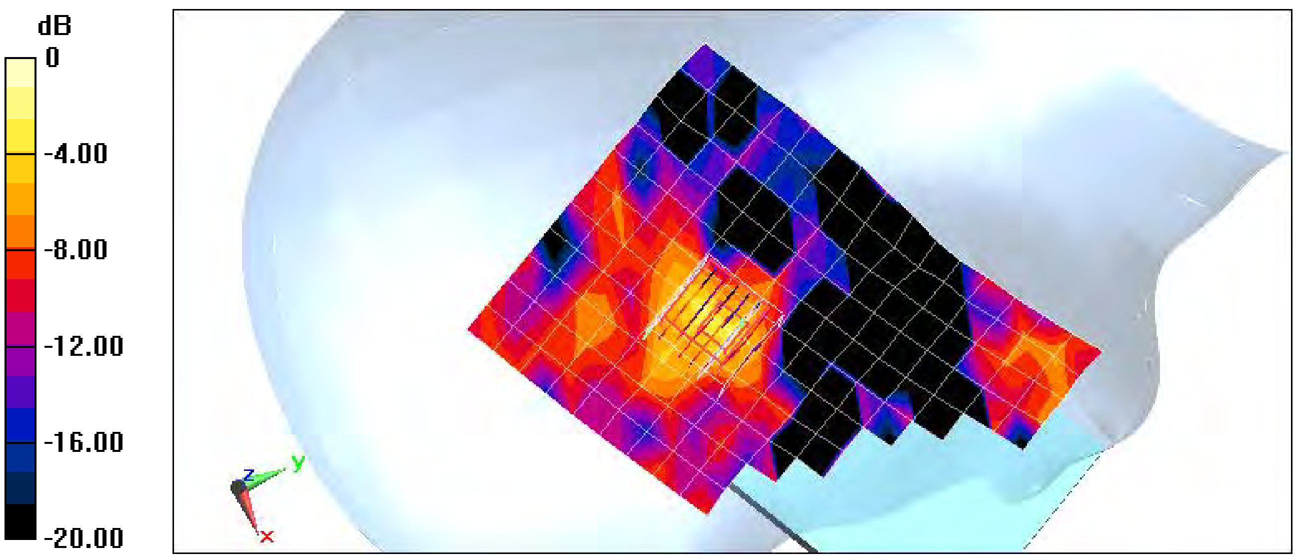
Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5805 MHz, Duty Cycle: 1:1
Medium: 5 GHz Head Medium parameters used:
f = 5805 MHz; σ = 5.398 mho/m; ε_r = 35.295; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 02-18-2013; Ambient Temp: 23.7°C; Tissue Temp: 22.5°C

Probe: EX3DV4 - SN3589; ConvF(3.85, 3.85, 3.85); Calibrated: 1/17/2013
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/17/2013
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

Mode: IEEE 802.11a 5.8 GHz, Right Head, Cheek, Ch 161, 6 Mbps

Area Scan (14x19x1): 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 = 2.512 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.282 W/kg
SAR(1 g) = 0.008 W/kg; SAR(10 g) = 0.00193 W/kg



0 dB = 0.0600 W/kg = -12.22 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFE980; Type: Portable Handset; Serial: SAR#4

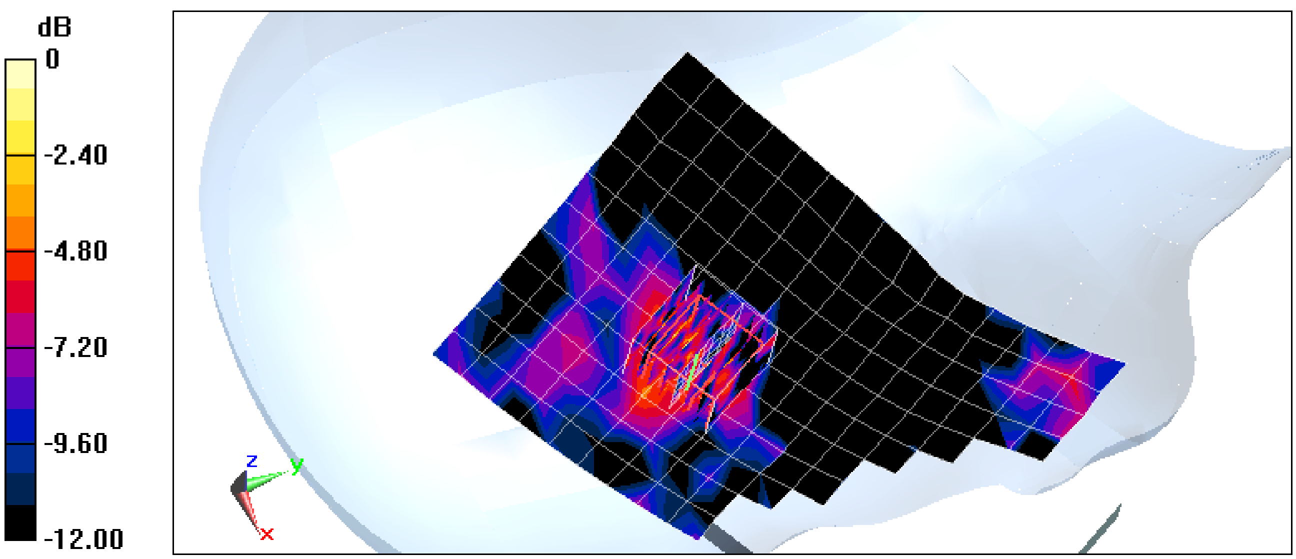
Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5680 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head Medium parameters used:
f = 5680 MHz; σ = 5.263 mho/m; ε_r = 35.609; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 02-18-2013; Ambient Temp: 23.6°C; Tissue Temp: 22.4°C

Probe: EX3DV4 - SN3589; ConvF(3.81, 3.81, 3.81); Calibrated: 1/17/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/17/2013
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

Mode: IEEE 802.11a 5.5 - 5.7 GHz, Right Head, Cheek, Ch 136, 6 Mbps

Area Scan (12x16x1): 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 = 2.723 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 0.246 W/kg
SAR(1 g) = 0.017 W/kg; SAR(10 g) = 0.0054 W/kg



0 dB = 0.0540 W/kg = -12.68 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFE980; Type: Portable Handset; Serial: SAR#3

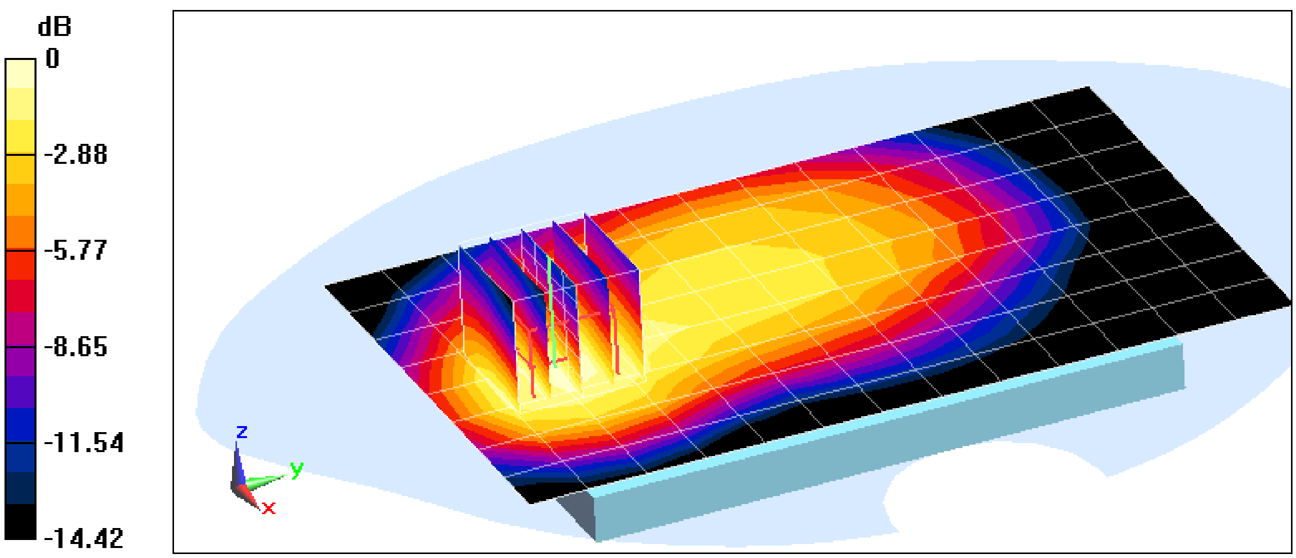
Communication System: LTE BAND 17; Frequency: 710 MHz; Duty Cycle: 1:1
Medium: 740 Body Medium parameters used:
f = 710 MHz; σ = 0.959 mho/m; ε_r = 53.294; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-14-2013; Ambient Temp: 23.8°C; Tissue Temp: 22.5°C

Probe: ES3DV3 - SN3287; ConvF(6.14, 6.14, 6.14); Calibrated: 11/15/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM with CRP; Type: SAM 4.0; Serial: TP1375
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

Mode: LTE Band 17, Body SAR, Back side, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 25 RB Offset

Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.638 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 0.425 W/kg
SAR(1 g) = 0.240 W/kg; SAR(10 g) = 0.146 W/kg



0 dB = 0.256 W/kg = -5.92 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFE980; Type: Portable Handset; Serial: SAR#1

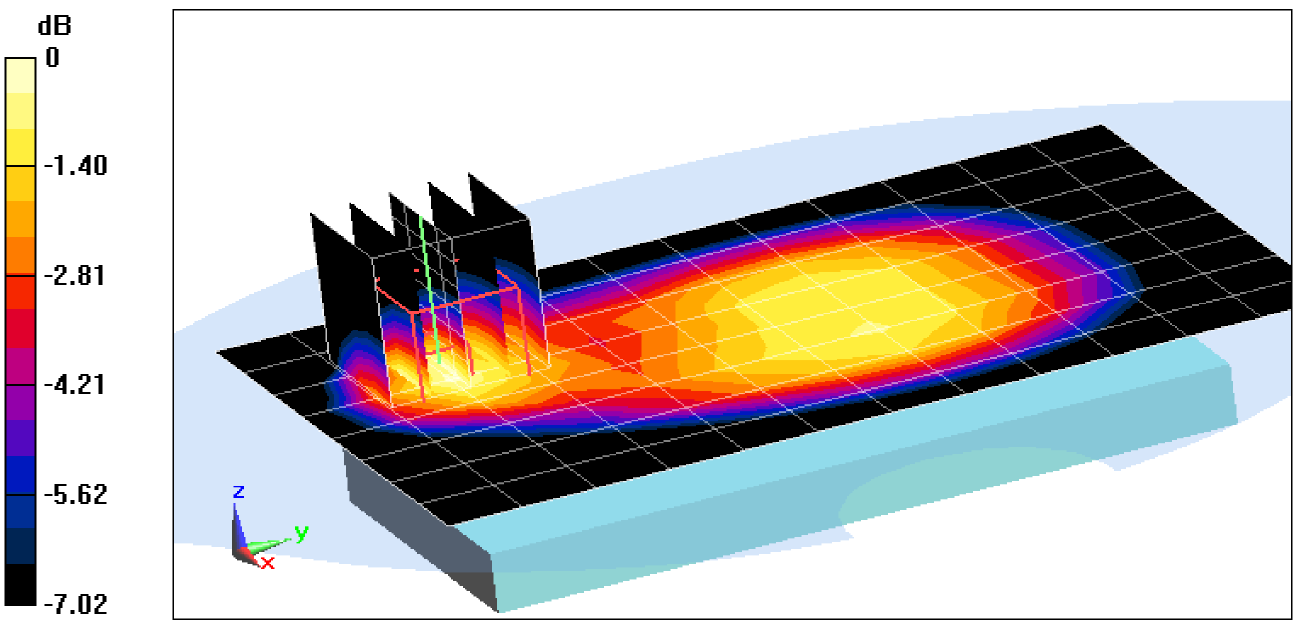
Communication System: GSM850 GPRS; 2 Tx slots; Frequency: 836.6 MHz; Duty Cycle: 1:4.15
Medium: 835 Body Medium parameters used (interpolated):
$f = 836.6$ MHz; $\sigma = 0.99$ mho/m; $\varepsilon_r = 53.985$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-16-2013; Ambient Temp: 23.3°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3287; ConvF(6.06, 6.06, 6.06); Calibrated: 11/15/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM with CRP; Type: SAM 4.0; Serial: TP1375
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

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

Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.854 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.629 W/kg
SAR(1 g) = 0.366 W/kg; SAR(10 g) = 0.222 W/kg



0 dB = 0.391 W/kg = -4.08 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFE980; Type: Portable Handset; Serial: SAR#1

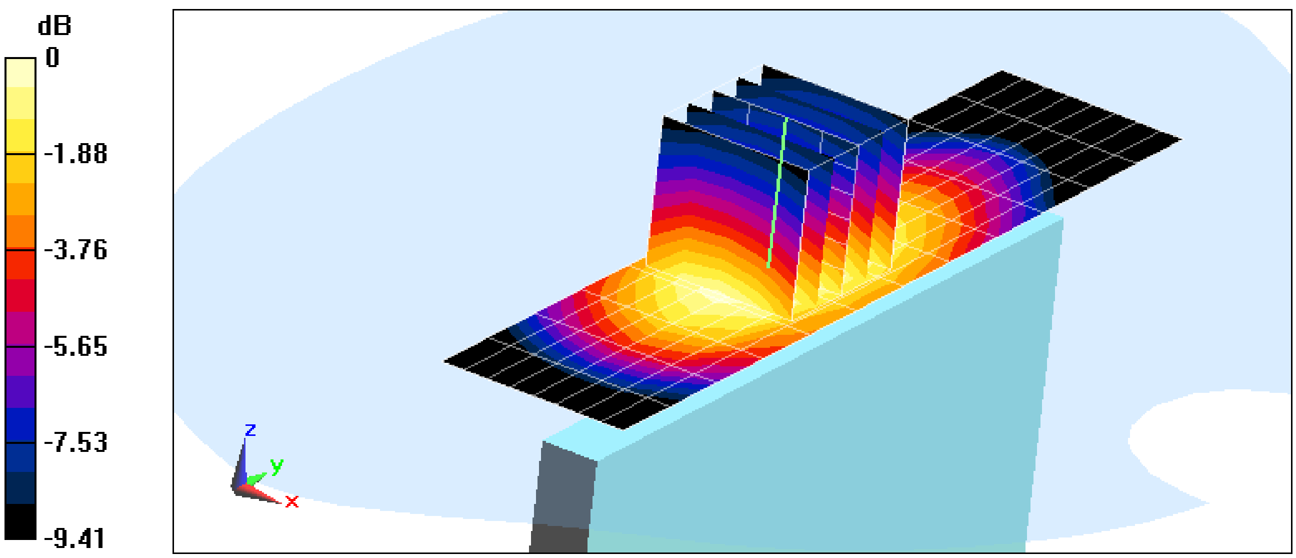
Communication System: GSM 850 GPRS; 2 Tx slots; Frequency: 836.6 MHz; Duty Cycle: 1:4.15
Medium: 835 Body Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.99 mho/m; ε_r = 53.985; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-16-2013; Ambient Temp: 23.3°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3287; ConvF(6.06, 6.06, 6.06); Calibrated: 11/15/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM with CRP; Type: SAM 4.0; Serial: TP1375
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

Mode: GPRS 850, Body SAR, Right Edge, Mid.ch, 2 Tx Slots

Area Scan (9x13x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.565 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.699 W/kg
SAR(1 g) = 0.507 W/kg; SAR(10 g) = 0.350 W/kg



0 dB = 0.543 W/kg = -2.65 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFE980; Type: Portable Handset; Serial: SAR#1

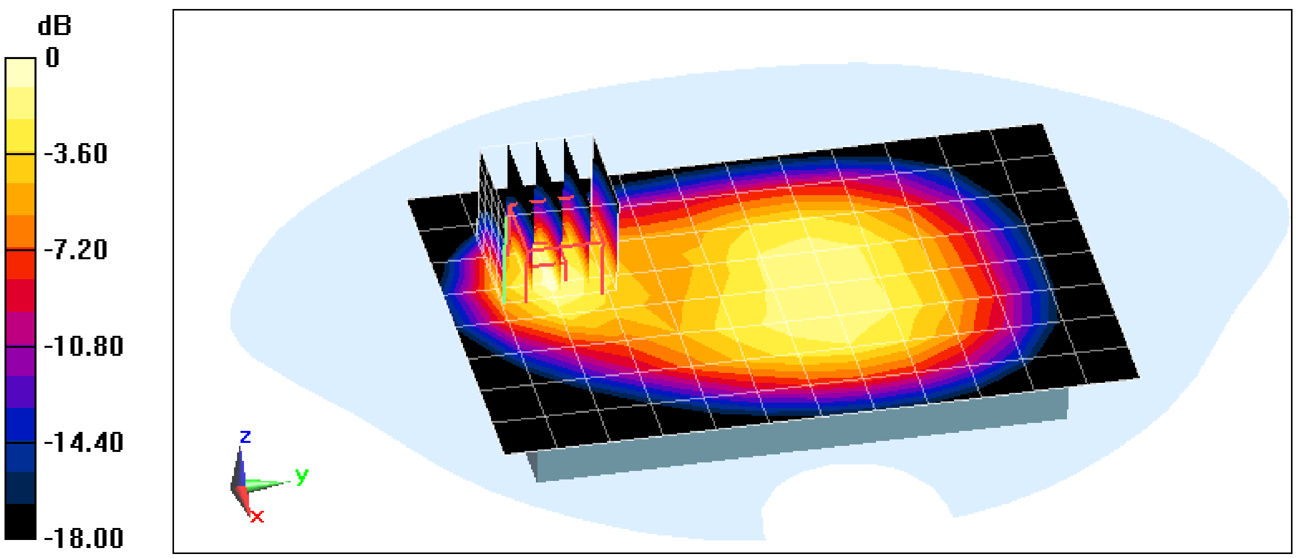
Communication System: WCDMA850; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.99 mho/m; ε_r = 53.985; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-16-2013; Ambient Temp: 23.3°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3287; ConvF(6.06, 6.06, 6.06); Calibrated: 11/15/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM with CRP; Type: SAM 4.0; Serial: TP1375
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

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

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.691 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 0.503 W/kg
SAR(1 g) = 0.297 W/kg; SAR(10 g) = 0.183 W/kg



0 dB = 0.323 W/kg = -4.91 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFE980; Type: Portable Handset; Serial: SAR#1

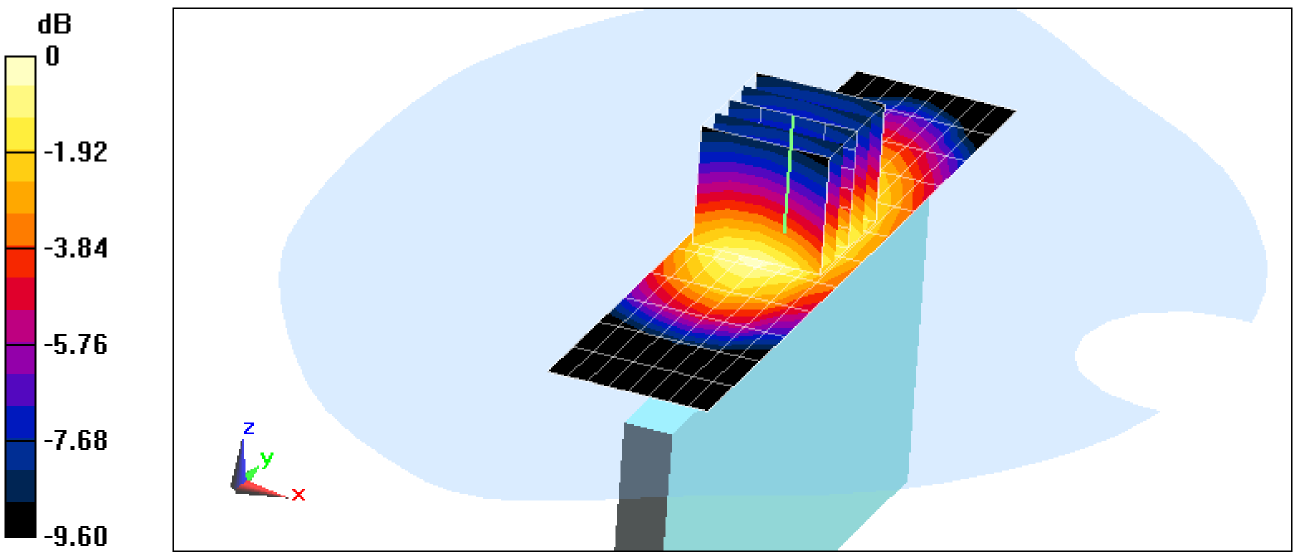
Communication System: WCDMA850; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.99 mho/m; ε_r = 53.985; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-16-2013; Ambient Temp: 23.3°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3287; ConvF(6.06, 6.06, 6.06); Calibrated: 11/15/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM with CRP; Type: SAM 4.0; Serial: TP1375
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

Mode: UMTS 850, Body SAR, Right Edge, Mid.ch

Area Scan (9x13x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.617 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.479 W/kg
SAR(1 g) = 0.346 W/kg; SAR(10 g) = 0.239 W/kg



0 dB = 0.373 W/kg = -4.28 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFE980; Type: Portable Handset; Serial: SAR#2

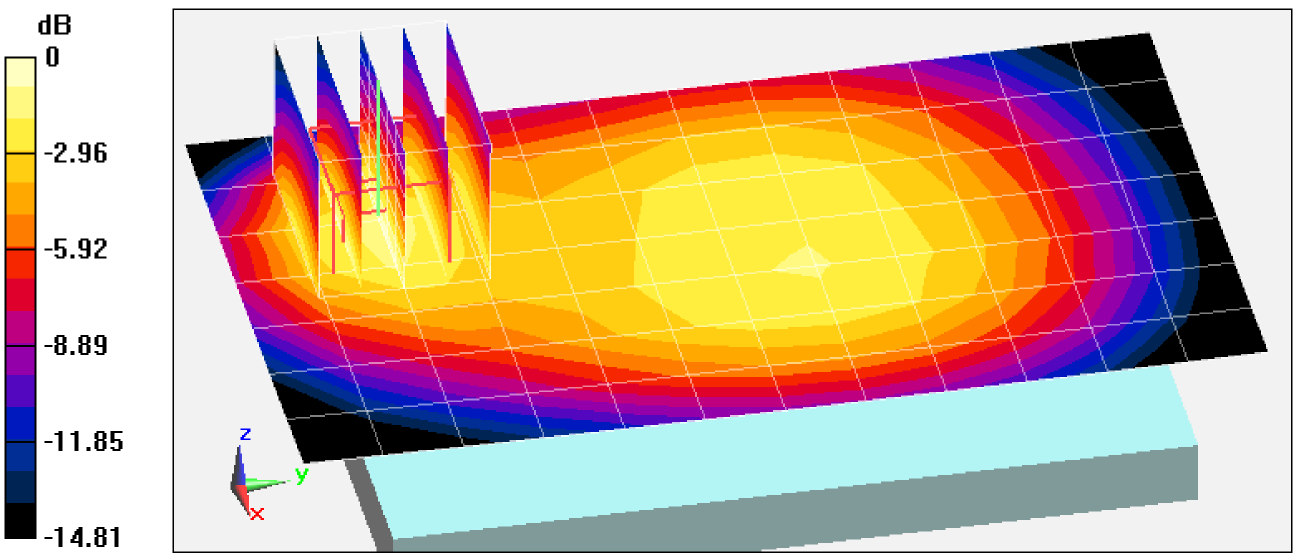
Communication System: LTE Band 5 (Cell.); Frequency: 836.5 MHz; Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 836.5 MHz; σ = 1.015 mho/m; ε_r = 53.794; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-15-2013; Ambient Temp: 24.6°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3213; ConvF(6.07, 6.07, 6.07); Calibrated: 4/24/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 4/19/2012
Phantom: ELI v5.0 Door; Type: QDOVA002BB; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.7 (6848)

**Mode: LTE Band 5 (Cell.), Body SAR, Back side, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 25 RB Offset**

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.284 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 0.456 W/kg
SAR(1 g) = 0.278 W/kg; SAR(10 g) = 0.174 W/kg



0 dB = 0.290 W/kg = -5.38 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFE980; Type: Portable Handset; Serial: SAR#2

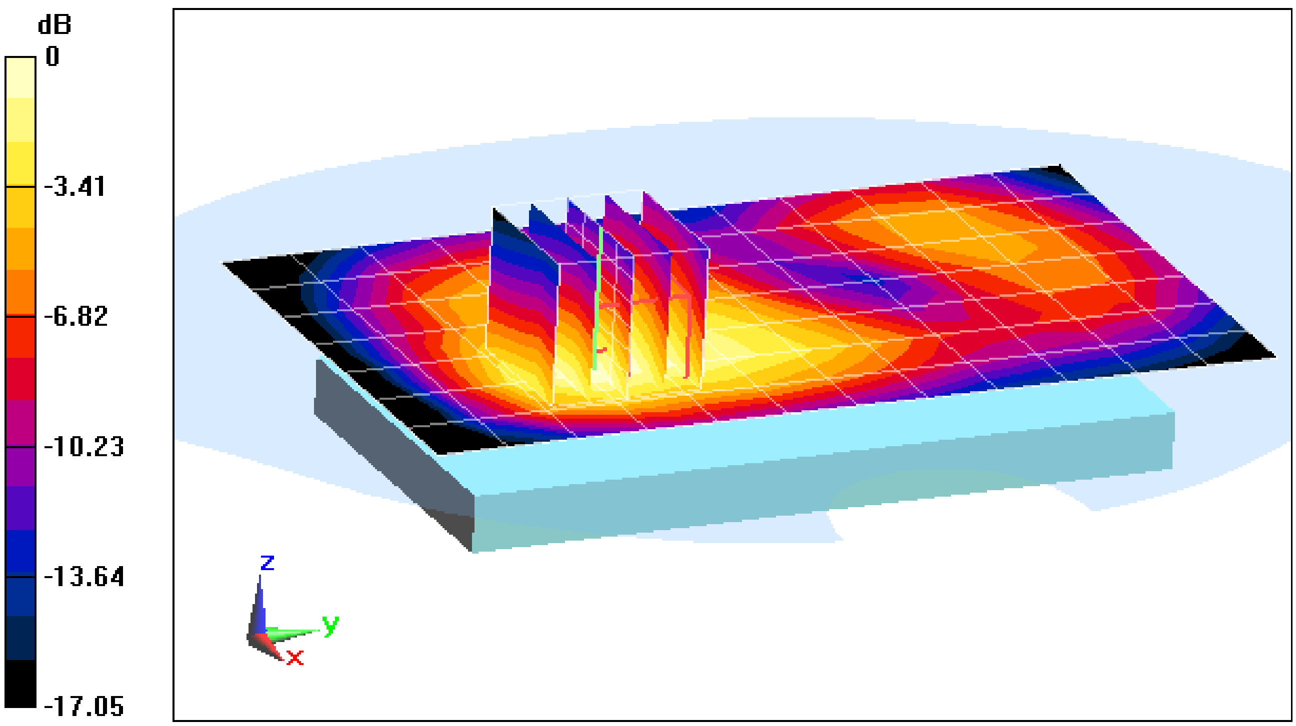
Communication System: LTE RF; Frequency: 1732.5 MHz;Duty Cycle: 1:1
Medium: 1750 Body Medium parameters used (interpolated):
f = 1732.5 MHz; σ = 1.486 S/m; ε_r = 52.765; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-11-2013; Ambient Temp: 24.6°C; Tissue Temp: 22.9°C

Probe: ES3DV3 - SN3287; ConvF(4.86, 4.86, 4.86); Calibrated: 11/15/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

Mode: LTE Band 4 (AWS), Body SAR, Back side, Mid.ch
10 MHz Bandwidth, QPSK, 1 RB, 49 RB Offset, Folio Closed

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.369 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 1.13 W/kg
SAR(1 g) = 0.701 W/kg; SAR(10 g) = 0.435 W/kg



0 dB = 0.764 W/kg = -1.17 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFE980; Type: Portable Handset; Serial: SAR#1

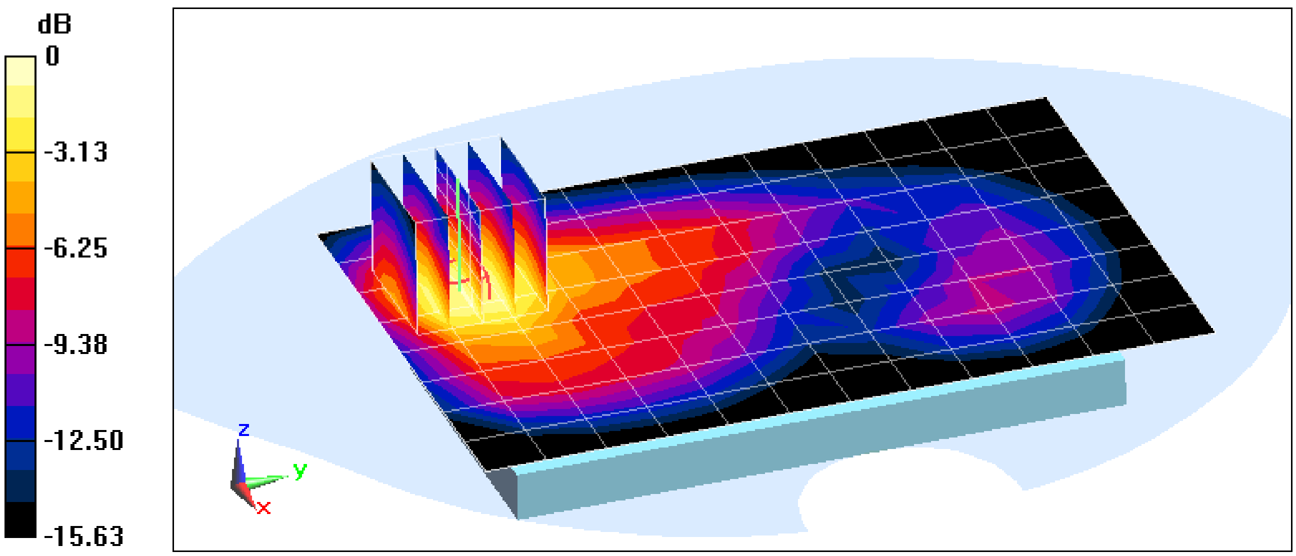
Communication System: GSM GPRS; 2 Tx slots; Frequency: 1880 MHz; Duty Cycle: 1:4.15
Medium: 1900 Body Medium parameters used:
f = 1880 MHz; σ = 1.536 mho/m; ε_r = 51.841; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-18-2013; Ambient Temp: 24.3°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3263; ConvF(4.76, 4.76, 4.76); Calibrated: 5/18/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 5/7/2012
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648
Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.7 (6848)

Mode: GPRS 1900, Body SAR, Back side, Mid.ch, 2 Tx Slots

Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.778 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 1.18 W/kg
SAR(1 g) = 0.679 W/kg



0 dB = 0.745 W/kg = -1.28 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFE980; Type: Portable Handset; Serial: SAR#1

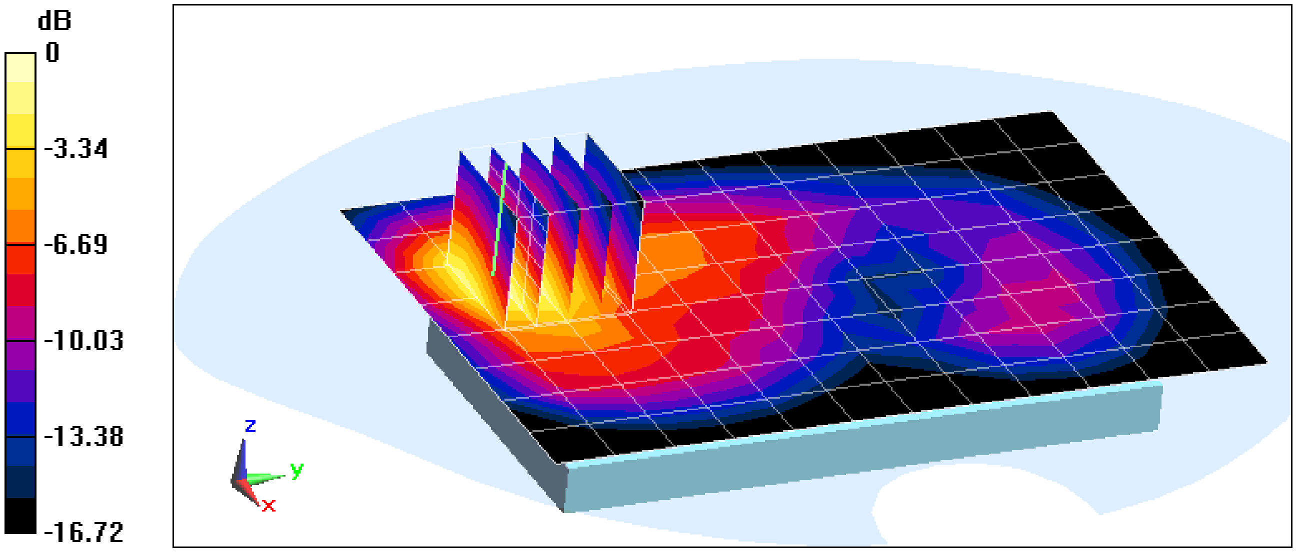
Communication System: UMTS; Frequency: 1907.6 MHz; Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1907.6 MHz; σ = 1.565 mho/m; ε_r = 51.721; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-18-2013; Ambient Temp: 24.3°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3263; ConvF(4.76, 4.76, 4.76); Calibrated: 5/18/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 5/7/2012
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648
Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.7 (6848)

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

Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.461 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 1.80 W/kg
SAR(1 g) = 1.050 W/kg



0 dB = 1.15 W/kg = 0.61 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFE980; Type: Portable Handset; Serial: SAR#2

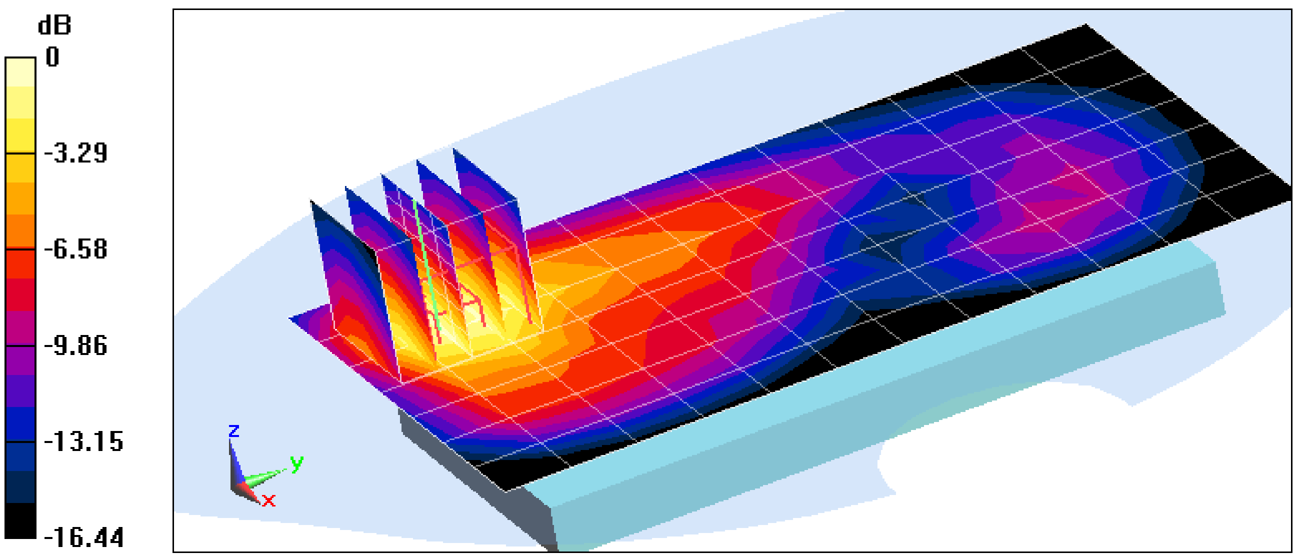
Communication System: LTE Band 2 (PCS); Frequency: 1905 MHz; Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1905 MHz; σ = 1.535 mho/m; ε_r = 51.938; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-13-2013; Ambient Temp: 24.1°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3263; ConvF(4.76, 4.76, 4.76); Calibrated: 5/18/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 5/7/2012
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648
Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.7 (6848)

Mode: LTE Band 2 (PCS), Body SAR, Back side, High.ch, 10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 27.985 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 1.82 W/kg
SAR(1 g) = 1.070 W/kg; SAR(10 g) = 0.605 W/kg



0 dB = 1.15 W/kg = 0.61 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFE980; Type: Portable Handset; Serial: SAR#2

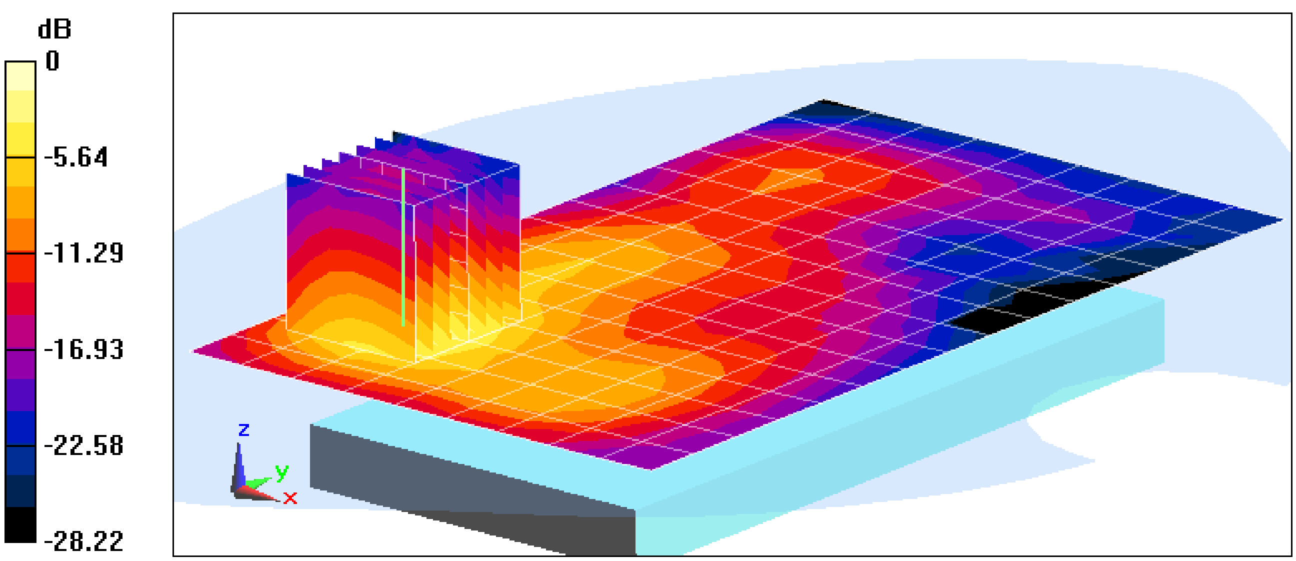
Communication System: IEEE 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used (interpolated):
f = 2437 MHz; σ = 1.916 mho/m; ε_r = 50.659; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-14-2013; Ambient Temp: 24.3°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3288; ConvF(4.35, 4.35, 4.35); Calibrated: 9/20/2012;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/19/2012
Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646
Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.7 (6848)

Mode: IEEE 802.11b, Body SAR, Ch 06, 1 Mbps, Back Side

Area Scan (10x16x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 11.669 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.528 W/kg
SAR(1 g) = 0.241 W/kg



0 dB = 0.308 W/kg = -5.11 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFE980; Type: Portable Handset; Serial: SAR#5

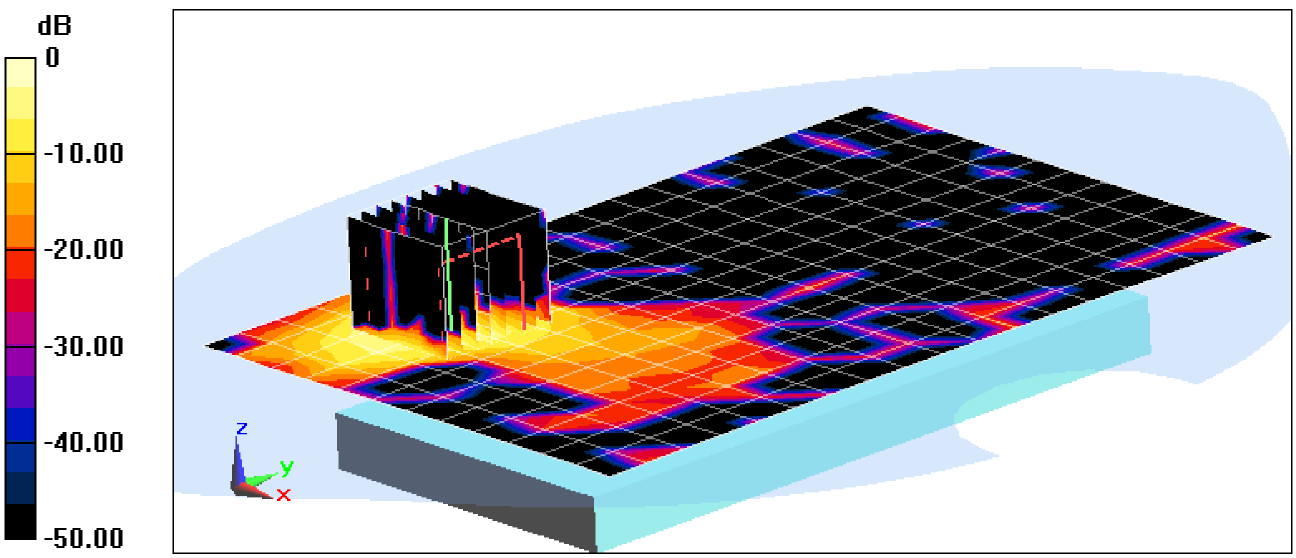
Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5805 MHz; Duty Cycle: 1:1
Medium: 5 GHz Medium parameters used:
f = 5805 MHz; σ = 6.146 mho/m; ε_r = 46.596; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-27-2013; Ambient Temp: 23.9°C; Tissue Temp: 22.7°C

Probe: EX3DV4 - SN3589; ConvF(3.66, 3.66, 3.66); Calibrated: 1/17/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/17/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

Mode: IEEE 802.11a, 5.8 GHz, Body SAR, Ch 161, 6 Mbps, Back Side

Area Scan (13x19x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Reference Value = 5.645 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 0.794 W/kg
SAR(1 g) = 0.156 W/kg; SAR(10 g) = 0.039 W/kg



0 dB = 0.481 W/kg = -3.18 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFE980; Type: Portable Handset; Serial: SAR#5

Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5260 MHz;Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5260 MHz; σ = 5.519 S/m; ε_r = 47.672; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

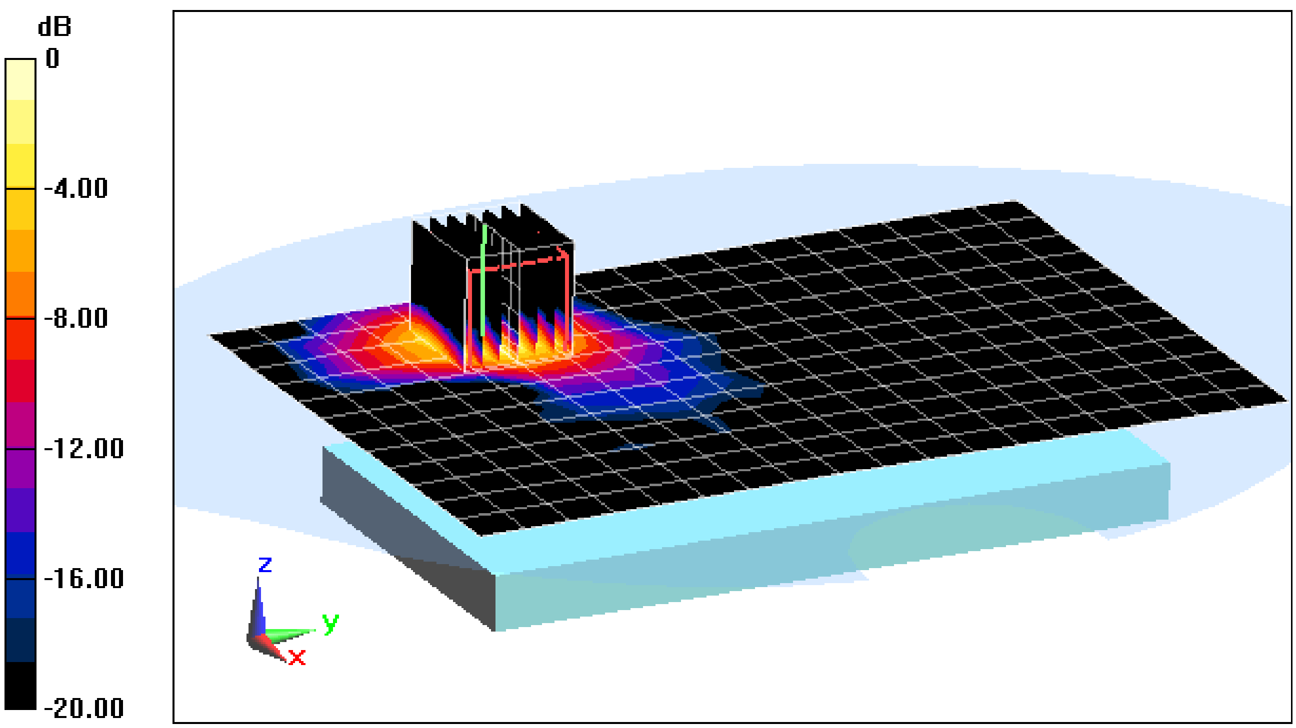
Test Date: 03-05-2013; Ambient Temp: 23.7°C; Tissue Temp: 21.6°C

Probe: EX3DV4 - SN3589; ConvF(3.81, 3.81, 3.81); Calibrated: 1/17/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/17/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

Mode: IEEE 802.11a, 5.3 GHz, Body SAR, Ch 52, 6 Mbps, Back Side, Folio Closed

Area Scan (13x19x1): Measurement grid: dx=10mm, dy=10mm

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Reference Value = 8.430 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 1.55 W/kg
SAR(1 g) = 0.390 W/kg; SAR(10 g) = 0.127 W/kg



0 dB = 0.951 W/kg = -0.22 dBW/kg

APPENDIX B: SYSTEM VERIFICATION

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 750 MHz; Type: D750V3; Serial: 1046

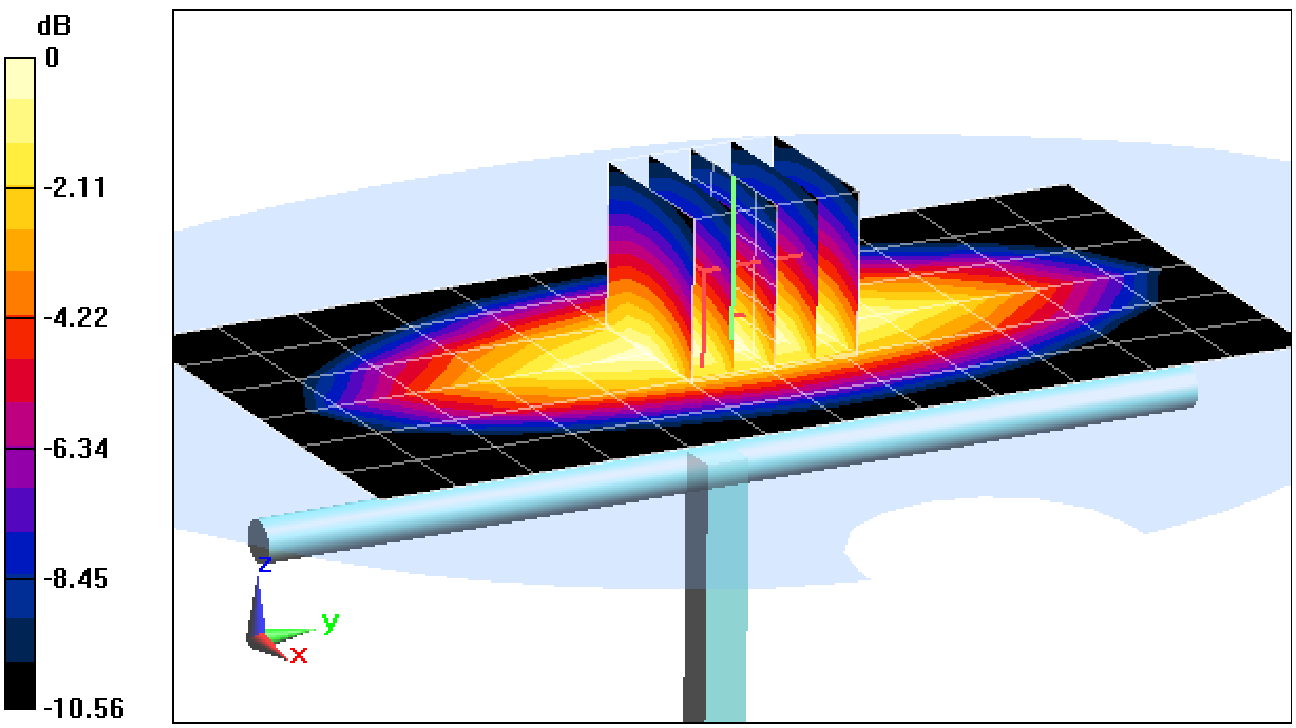
Communication System: CW; Frequency: 750 MHz;Duty Cycle: 1:1
Medium: 750 Head Medium parameters used (interpolated):
f = 750 MHz; σ = 0.899 S/m; ε_r = 41.741; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 03-13-2013; Ambient Temp: 24.2°C; Tissue Temp: 23.3°C

Probe: ES3DV3 - SN3287; ConvF(6.4, 6.4, 6.4); Calibrated: 11/15/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM with CRP; Type: SAM 4.0; Serial: TP1375
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

750MHz 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 dBm (100 mW)
Peak SAR (extrapolated) = 1.18 W/kg
SAR(1 g) = 0.813 W/kg; SAR(10 g) = 0.534 W/kg
Deviation = -4.35%



0 dB = 0.877 W/kg = -0.57 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

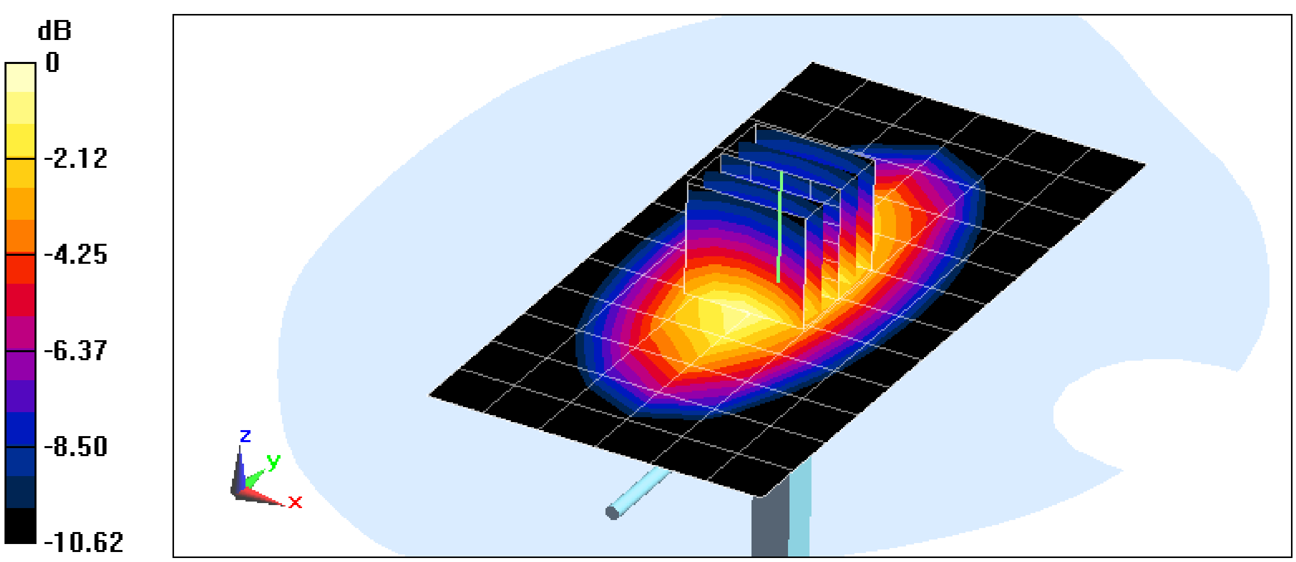
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: 835 Head Medium parameters used:
f = 835 MHz; σ = 0.931 mho/m; ε_r = 42.408; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 02-16-2013; Ambient Temp: 23.7°C; Tissue Temp: 22.9°C

Probe: ES3DV2 - SN3022; ConvF(6.03, 6.03, 6.03); Calibrated: 8/28/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/24/2012
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

835MHz 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 dBm (100 mW)
Peak SAR (extrapolated) = 1.42 W/kg
SAR(1 g) = 0.970 W/kg; SAR(10 g) = 0.636 W/kg
Deviation: 2.97%



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

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 835 MHz; Type: D835V2; Serial: 4d026

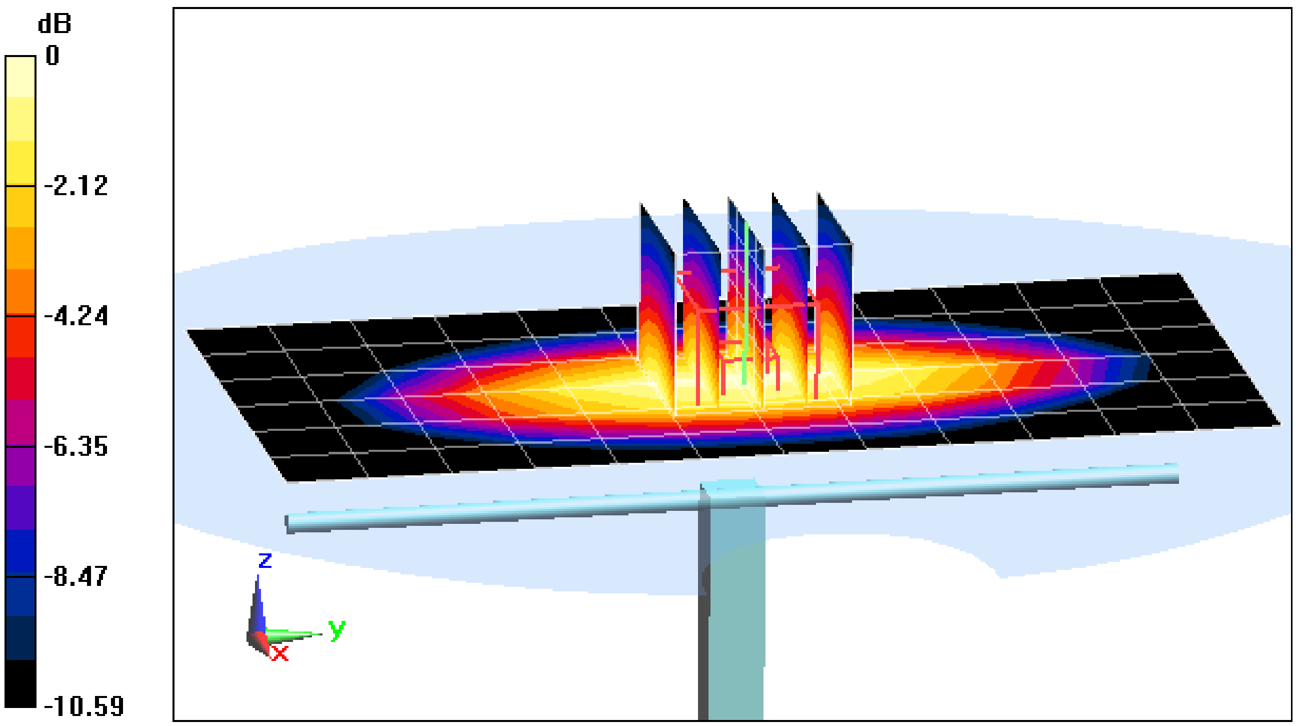
Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: 835 Head Medium parameters used:
f = 835 MHz; σ = 0.934 S/m; ε_r = 42.102; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 03-07-2013; Ambient Temp: 24.4°C; Tissue Temp: 23.5°C

Probe: ES3DV2 - SN3022; ConvF(6.03, 6.03, 6.03); Calibrated: 8/28/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/24/2012
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

835MHz 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 dBm (100 mW)
Peak SAR (extrapolated) = 1.47 W/kg
SAR(1 g) = 0.996 W/kg; SAR(10 g) = 0.652 W/kg
Deviation = 6.07%



0 dB = 1.08 W/kg = 0.33 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

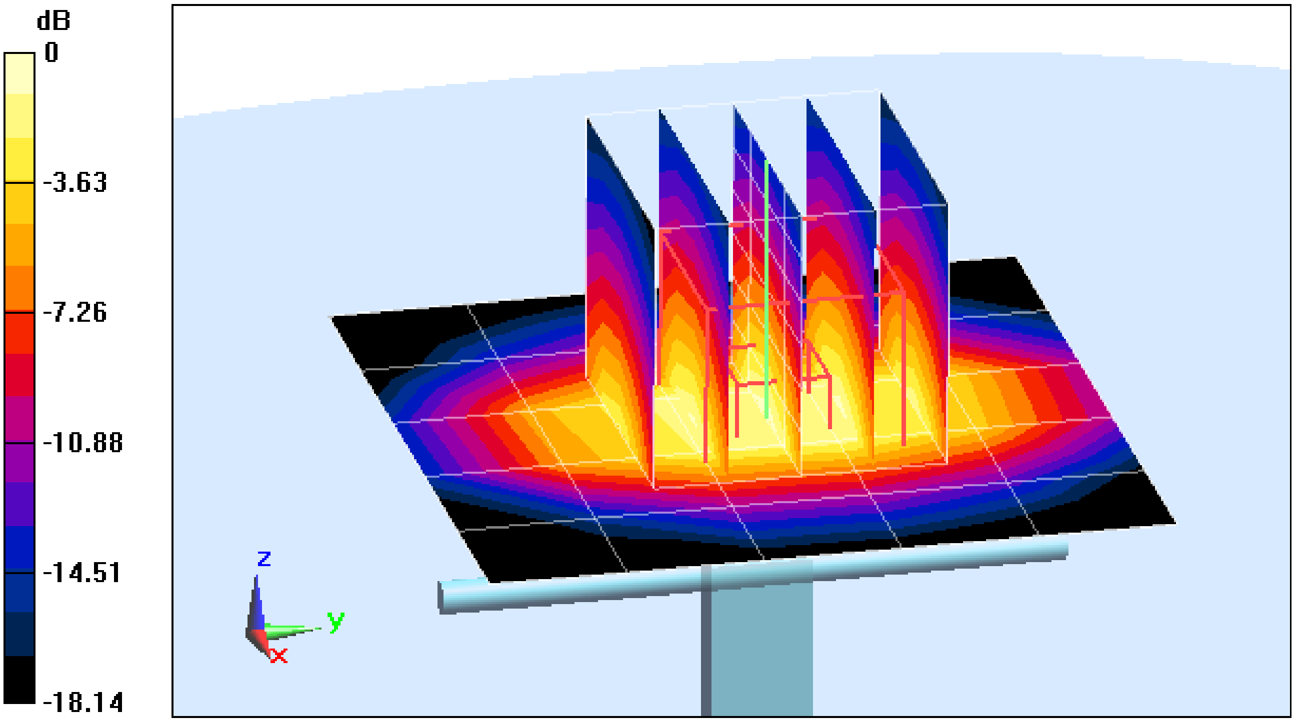
Communication System: CW; Frequency: 1750 MHz;Duty Cycle: 1:1
Medium: 1750 Head Medium parameters used:
f = 1750 MHz; σ = 1.417 S/m; ε_r = 39.823; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-11-2013; Ambient Temp: 24.8°C; Tissue Temp: 23.1°C

Probe: ES3DV3 - SN3287; ConvF(5.16, 5.16, 5.16); Calibrated: 11/15/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM with CRP; Type: SAM 4.0; Serial: TP1375
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

1750 MHz System Verification

Area Scan (6x6x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20 dBm (100 mW)
Peak SAR (extrapolated) = 7.08 W/kg
SAR(1 g) = 3.81 W/kg; SAR(10 g) = 1.99 W/kg
Deviation = 4.67%



0 dB = 4.27 W/kg = 6.30 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

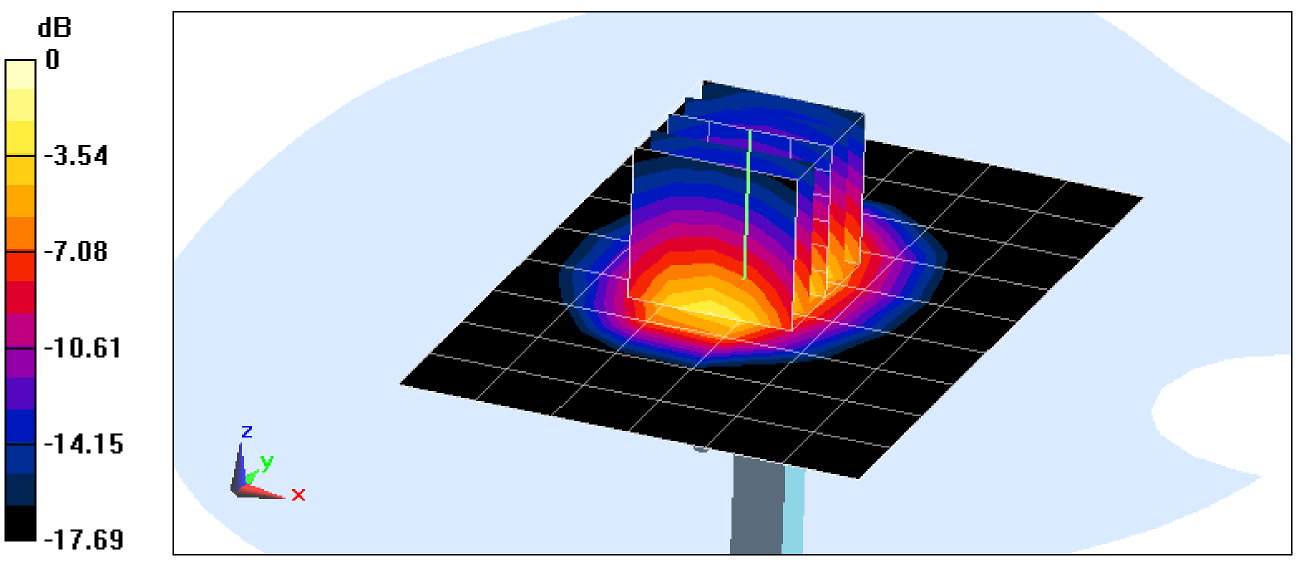
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Head Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.406 mho/m; ε_r = 39.206; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-14-2013; Ambient Temp: 24.2°C; Tissue Temp: 22.8°C

Probe: ES3DV3 - SN3263; ConvF(5.09, 5.09, 5.09); Calibrated: 5/18/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 5/7/2012
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.7 (6848)

1900 MHz System Verification

Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 7.46 W/kg
SAR(1 g) = 4.030 W/kg; SAR(10 g) = 2.1 W/kg
Deviation: 2.54%



0 dB = 4.50 W/kg = 6.53 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 5d148

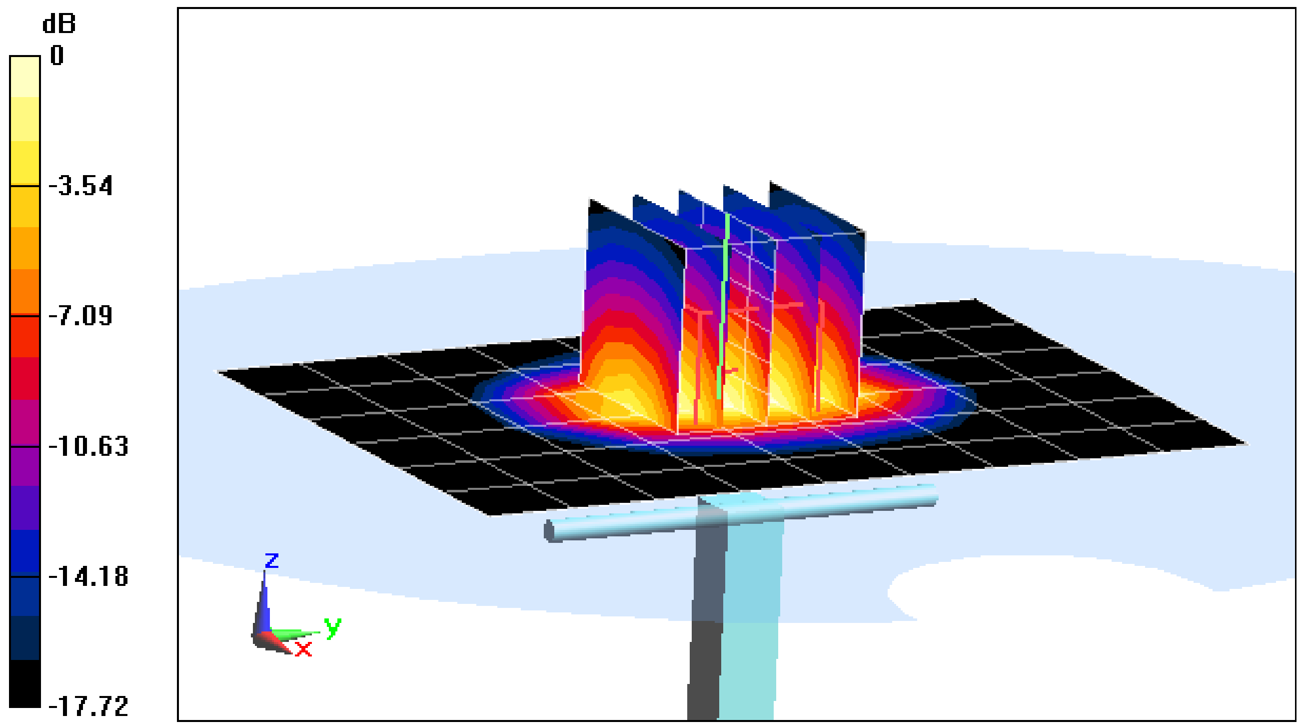
Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: 1900 Head Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.441 S/m; ε_r = 39.713; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-07-2013; Ambient Temp: 24.3°C; Tissue Temp: 23.2°C

Probe: EX3DV4 - SN3920; ConvF(7.73, 7.73, 7.73); Calibrated: 2/27/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/6/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.8 (7028)

1900 MHz System Verification

Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20 dBm (100 mW)
Peak SAR (extrapolated) = 7.51 W/kg
SAR(1 g) = 4.07 W/kg; SAR(10 g) = 2.12 W/kg
Deviation = 2.52%



0 dB = 4.56 W/kg = 6.59 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

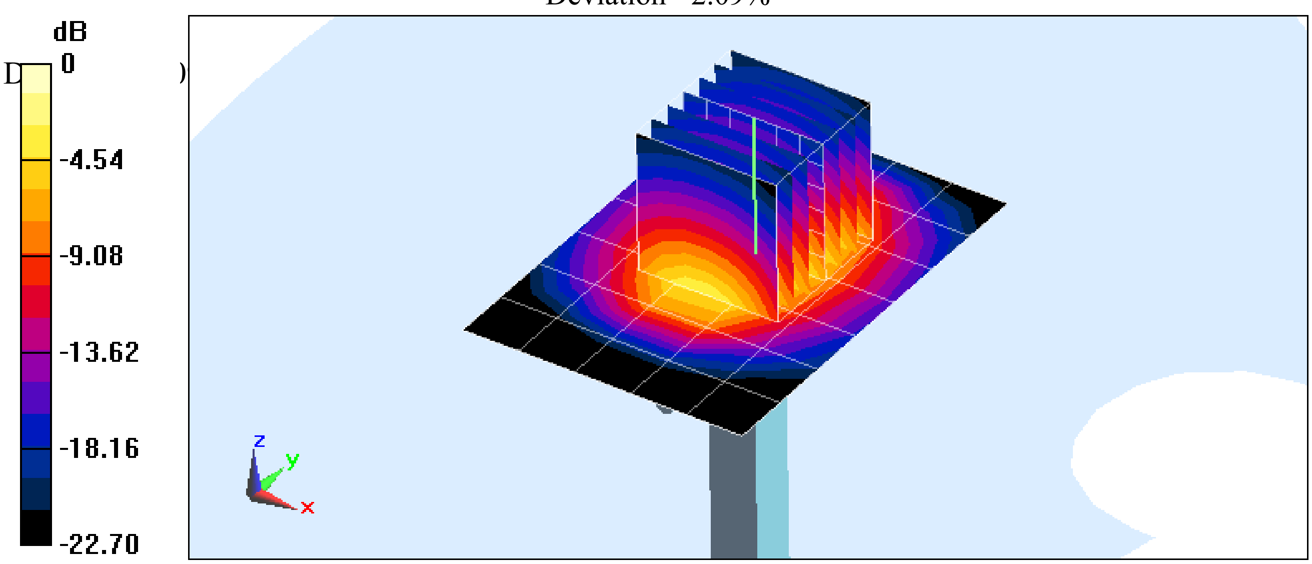
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 Head Medium parameters used:
f = 2450 MHz; σ = 1.862 mho/m; ε_r = 38.106; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-20-2013; Ambient Temp: 24.5°C; Tissue Temp: 23.5°C

Probe: ES3DV2 - SN3022; ConvF(4.23, 4.23, 4.23); Calibrated: 8/28/2012;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/24/2012
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

2450 MHz System Verification

Area Scan (6x8x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 11.1 W/kg
SAR(1 g) = 5.380 W/kg; SAR(10 g) = 2.49 W/kg
Deviation= 2.09%



0 dB = 7.08 W/kg = 8.50 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

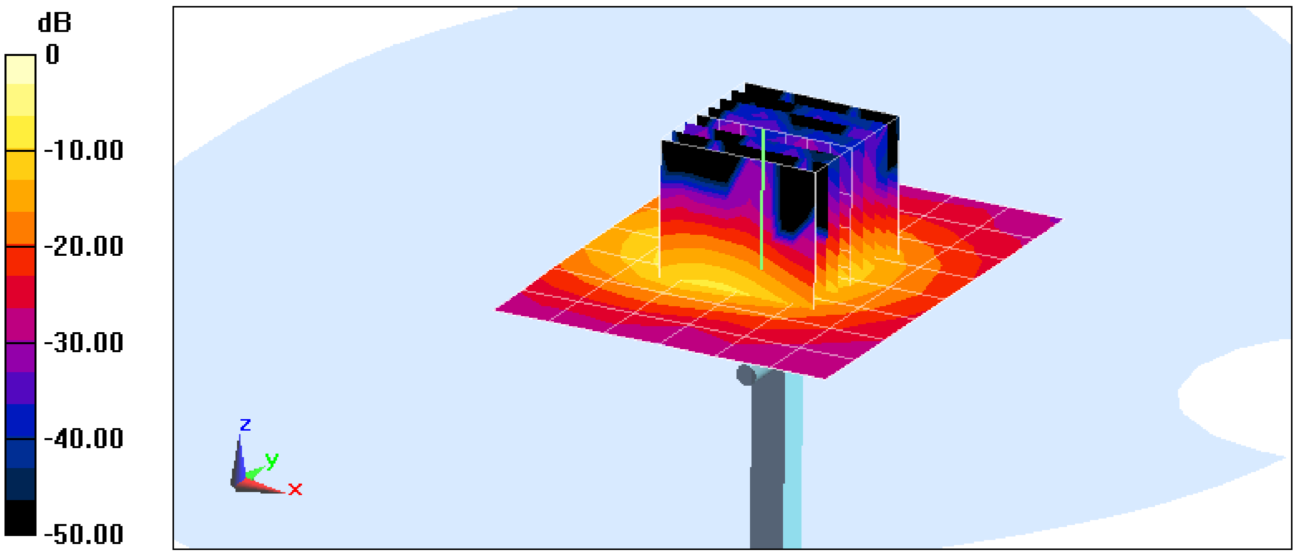
Communication System: CW; Frequency: 5200 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head Medium parameters used:
f = 5200 MHz; σ = 4.618 mho/m; ε_r = 37.176; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-18-2013; Ambient Temp: 23.4°C; Tissue Temp: 22.0°C

Probe: EX3DV4 - SN3589; ConvF(4.48, 4.48, 4.48); Calibrated: 1/17/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/17/2013
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

5200MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 32.1 W/kg
SAR(1 g) = 7.010 W/kg; SAR(10 g) = 1.96 W/kg
Deviation: -7.64%



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

PCTEST ENGINEERING LABORATORY, INC.

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

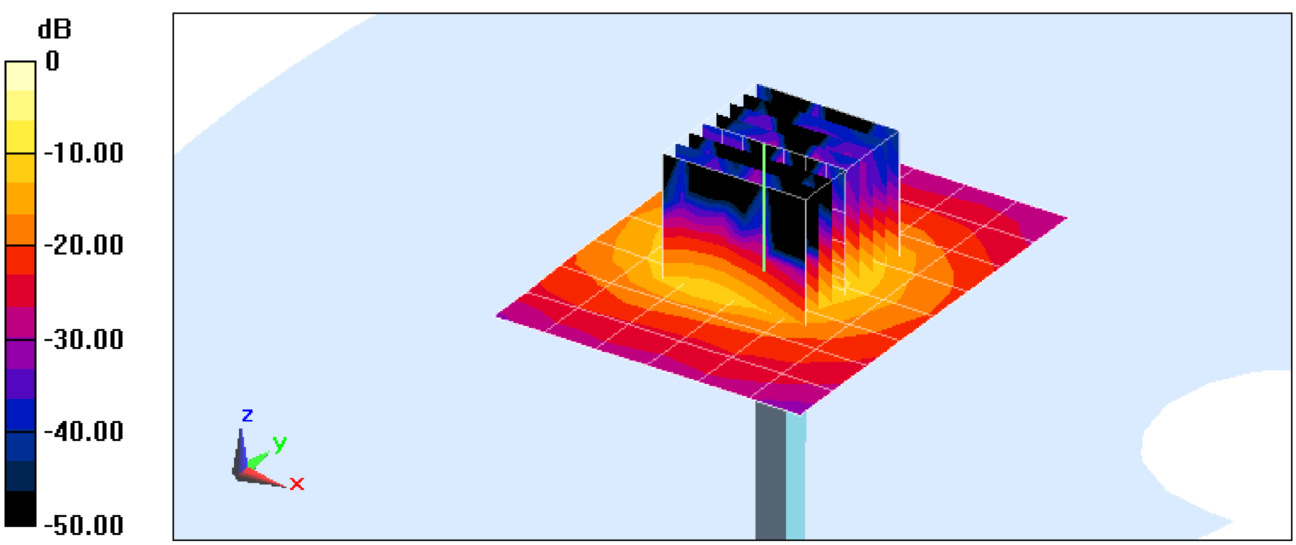
Communication System: CW; Frequency: 5300 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head Medium parameters used:
f = 5300 MHz; σ = 4.815 mho/m; ε_r = 36.609; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-18-2013; Ambient Temp: 23.3°C; Tissue Temp: 22.1°C

Probe: EX3DV4 - SN3589; ConvF(4.27, 4.27, 4.27); Calibrated: 1/17/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/17/2013
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

5300MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 34.1 W/kg
SAR(1 g) = 7.320 W/kg; SAR(10 g) = 2.02 W/kg
Deviation: -4.81%



0 dB = 19.2 W/kg = 12.83 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

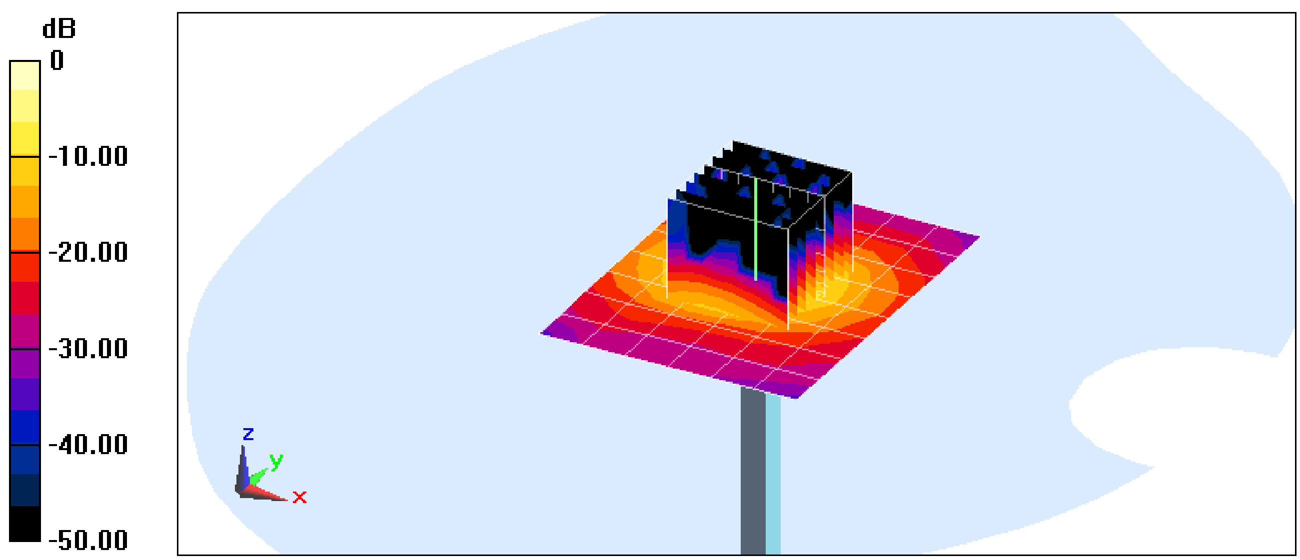
Communication System: CW; Frequency: 5600 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head Medium parameters used:
f = 5600 MHz; σ = 5.133 mho/m; ε_r = 36.19; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-18-2013; Ambient Temp: 23.6°C; Tissue Temp: 22.4°C

Probe: EX3DV4 - SN3589; ConvF(3.81, 3.81, 3.81); Calibrated: 1/17/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/17/2013
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

5600MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 35.4 W/kg
SAR(1 g) = 8.300 W/kg; SAR(10 g) = 2.28 W/kg
Deviation: 3.23%



0 dB = 21.4 W/kg = 13.30 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

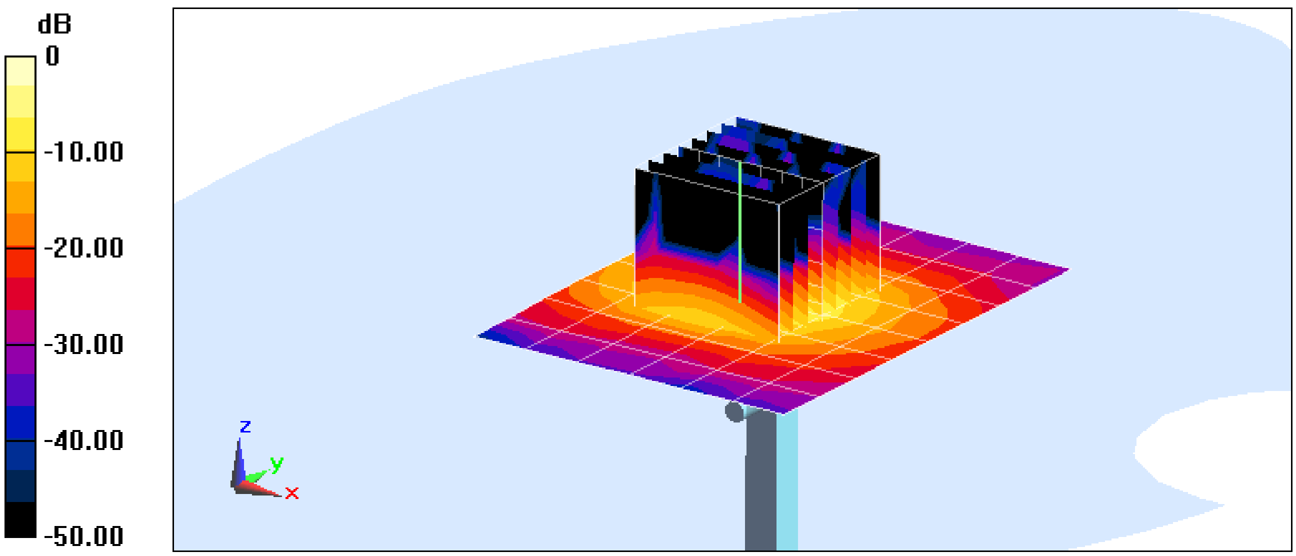
Communication System: CW; Frequency: 5800 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head Medium parameters used:
$f = 5800$ MHz; $\sigma = 5.39$ mho/m; $\varepsilon_r = 35.299$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-18-2013; Ambient Temp: 23.7°C; Tissue Temp: 22.5°C

Probe: EX3DV4 - SN3589; ConvF(3.85, 3.85, 3.85); Calibrated: 1/17/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/17/2013
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

5800MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 37.3 W/kg
SAR(1 g) = 7.750 W/kg; SAR(10 g) = 2.14 W/kg
Deviation: 1.84%



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

PCTEST ENGINEERING LABORATORY, INC.

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

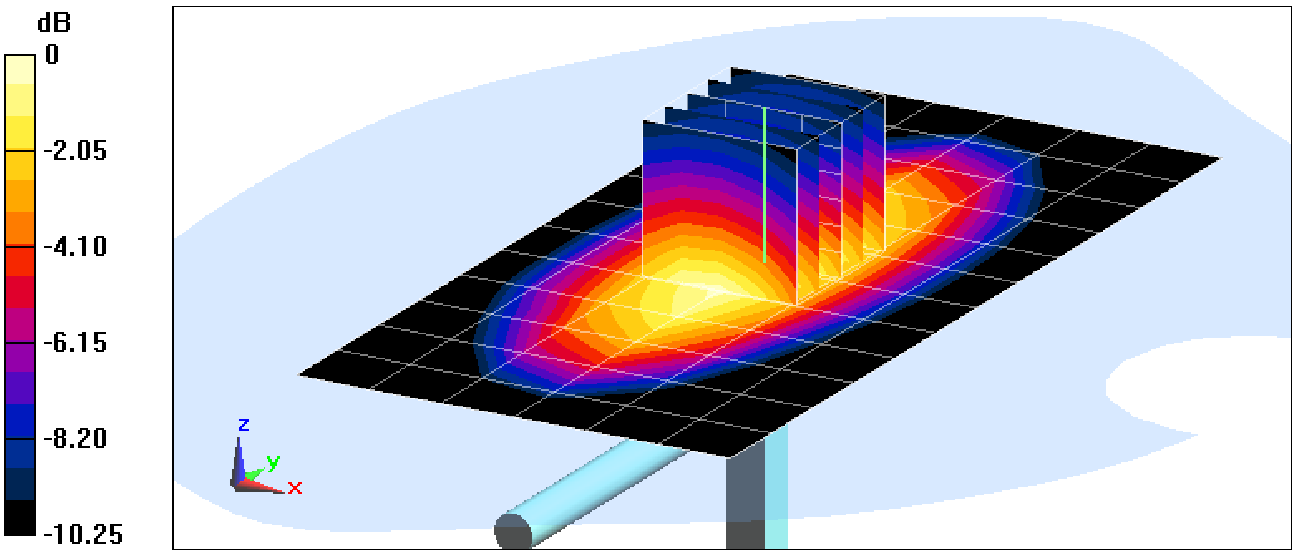
Communication System: CW; Frequency: 750 MHz; Duty Cycle: 1:1
Medium: 740 Body Medium parameters used (interpolated):
f = 750 MHz; σ = 1 mho/m; ε_r = 52.915; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 02-14-2013; Ambient Temp: 23.8°C; Tissue Temp: 22.5°C

Probe: ES3DV3 - SN3287; ConvF(6.14, 6.14, 6.14); Calibrated: 11/15/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM with CRP; Type: SAM 4.0; Serial: TP1375
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

750MHz 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 dBm (100 mW)
Peak SAR (extrapolated) = 1.30 W/kg
SAR(1 g) = 0.913 W/kg; SAR(10 g) = 0.608 W/kg
Deviation: 3.40%



0 dB = 0.985 W/kg = -0.07 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

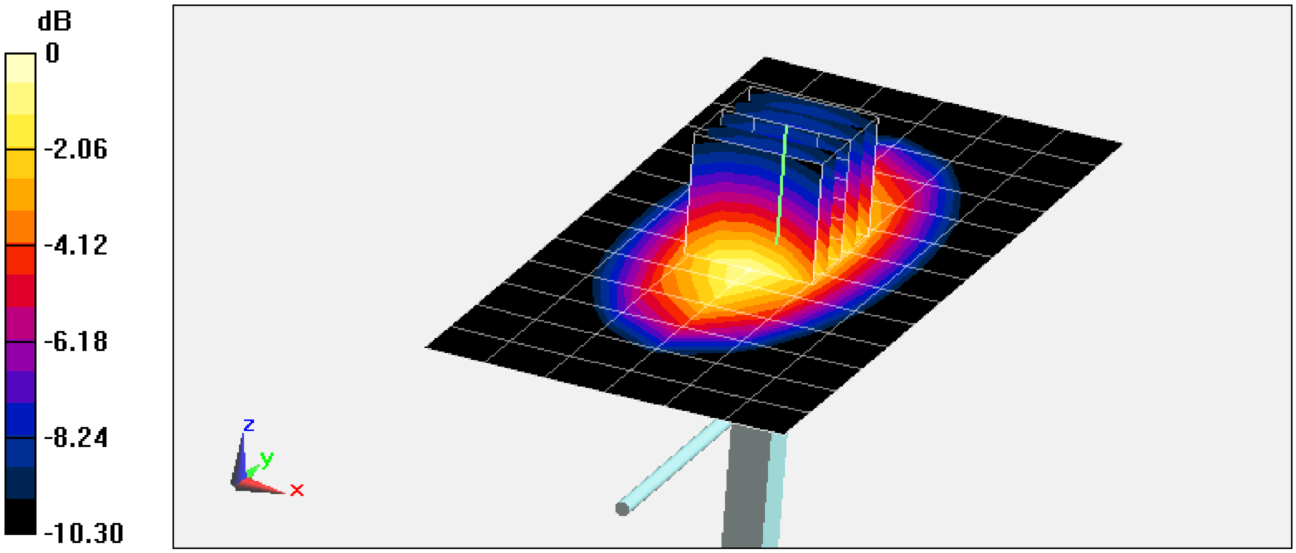
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: 835 Body Medium parameters used:
f = 835 MHz; σ = 1.013 mho/m; ε_r = 53.806; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 02-15-2013; Ambient Temp: 24.6°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3213; ConvF(6.07, 6.07, 6.07); Calibrated: 4/24/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 4/19/2012
Phantom: ELI v5.0 Door; Type: QDOVA002BB; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (5);SEMCAD X Version 14.6.7 (6848)

835 MHz System Verification

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 1.47 W/kg
SAR(1 g) = 1.01 W/kg; SAR(10 g) = 0.664 W/kg
Deviation: 5.21%



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

PCTEST ENGINEERING LABORATORY, INC.

DUT: 835MHz SAR Validation Dipole; Type: D835V2; Serial: 4d026

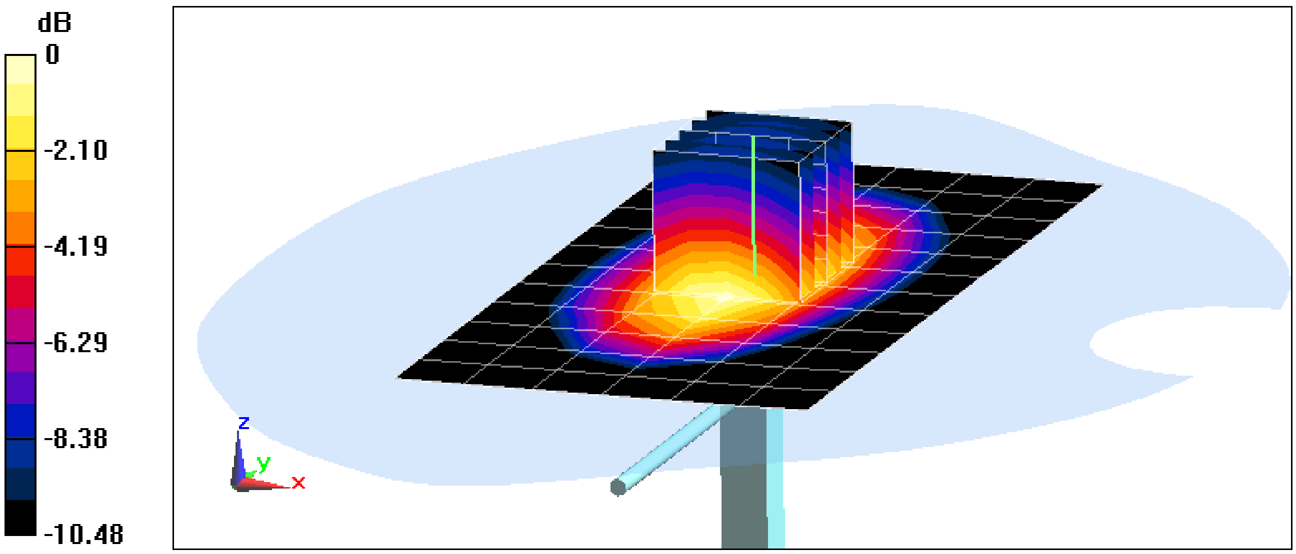
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: 835 Body Medium parameters used:
f = 835 MHz; σ = 0.988 mho/m; ε_r = 53.996; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 02-16-2013; Ambient Temp: 23.3°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3287; ConvF(6.06, 6.06, 6.06); Calibrated: 11/15/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM with CRP; Type: SAM 4.0; Serial: TP1375
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

835MHz 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 dBm (100 mW)
Peak SAR (extrapolated) = 1.47 W/kg
SAR(1 g) = 1.01 W/kg; SAR(10 g) = 0.666 W/kg
Deviation: 5.43%



0 dB = 1.10 W/kg = 0.41 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

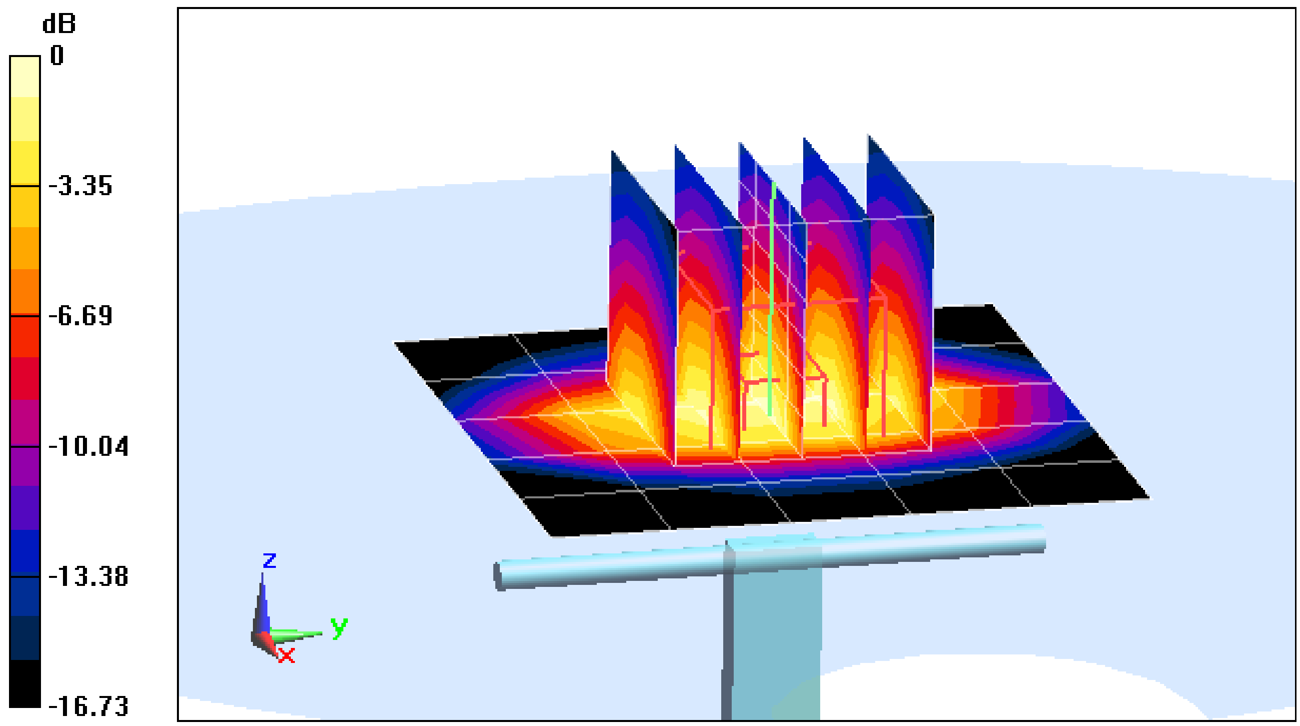
Communication System: CW; Frequency: 1750 MHz;Duty Cycle: 1:1
Medium: 1750 Body Medium parameters used:
f = 1750 MHz; σ = 1.503 S/m; ε_r = 52.718; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-11-2013; Ambient Temp: 24.6°C; Tissue Temp: 22.9°C

Probe: ES3DV3 - SN3287; ConvF(4.86, 4.86, 4.86); Calibrated: 11/15/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

1750 MHz System Verification

Area Scan (6x6x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20 dBm (100 mW)
Peak SAR (extrapolated) = 6.92 W/kg
SAR(1 g) = 3.95 W/kg; SAR(10 g) = 2.12 W/kg
Deviation = 5.61%



0 dB = 4.38 W/kg = 6.41 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

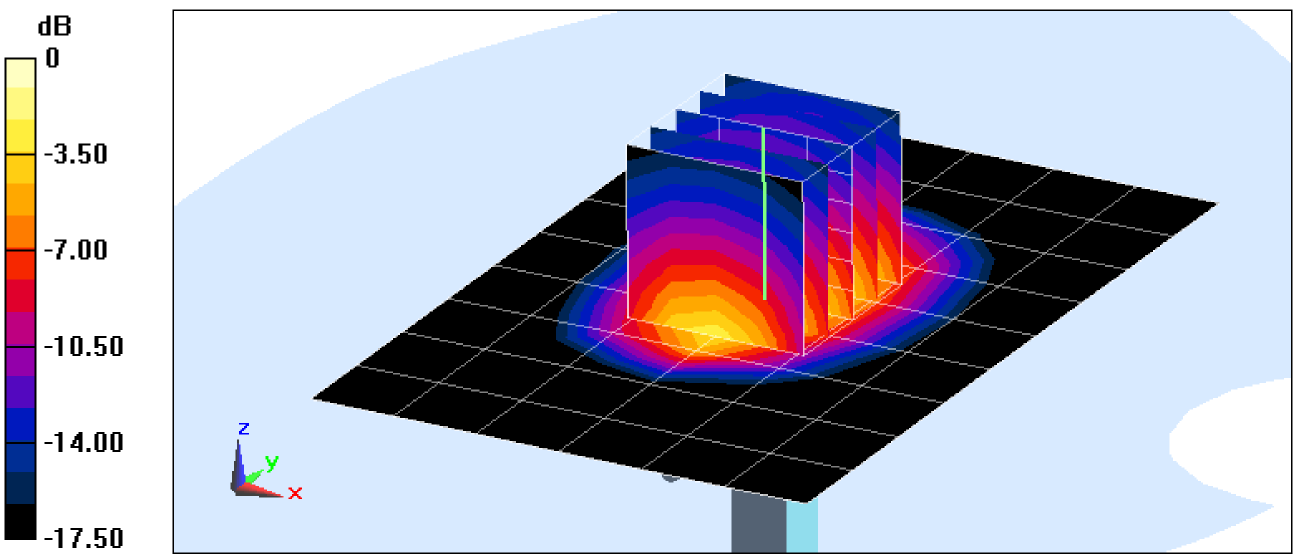
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.529 mho/m; ε_r = 51.96; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-13-2013; Ambient Temp: 24.1°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3263; ConvF(4.76, 4.76, 4.76); Calibrated: 5/18/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 5/7/2012
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648
Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.7 (6848)

1900 MHz System Verification

Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 7.33 W/kg
SAR(1 g) = 4.040 W/kg; SAR(10 g) = 2.11 W/kg
Deviation: 2.80%



0 dB = 4.49 W/kg = 6.52 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 5d148

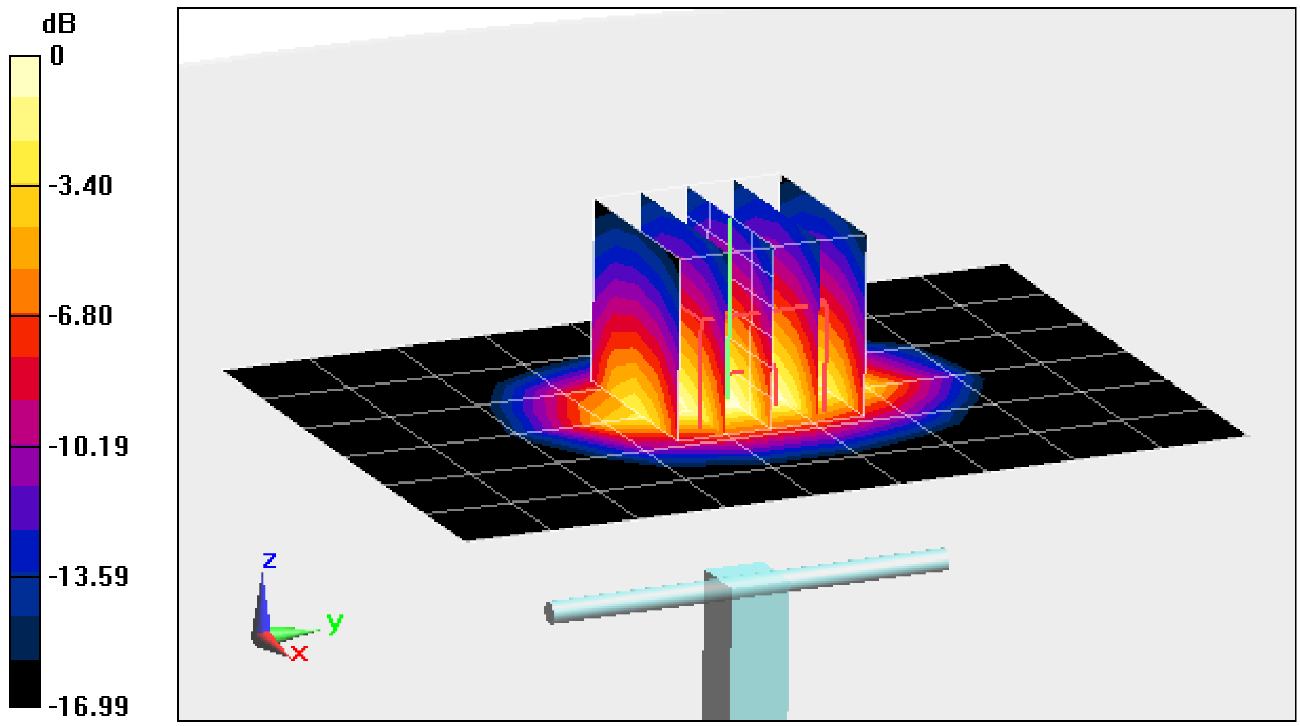
Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.535 S/m; ε_r = 53.232; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-11-2013; Ambient Temp: 24.3°C; Tissue Temp: 23.3°C

Probe: ES3DV3 - SN3213; ConvF(4.5, 4.5, 4.5); Calibrated: 4/24/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 4/19/2012
Phantom: ELI v5.0 Door; Type: QDOVA002BB; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.8 (7028)

1900 MHz System Verification

Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20 dBm (100 mW)
Peak SAR (extrapolated) = 7.66 W/kg
SAR(1 g) = 4.28 W/kg; SAR(10 g) = 2.25 W/kg
Deviation = 4.90%



0 dB = 4.80 W/kg = 6.81 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

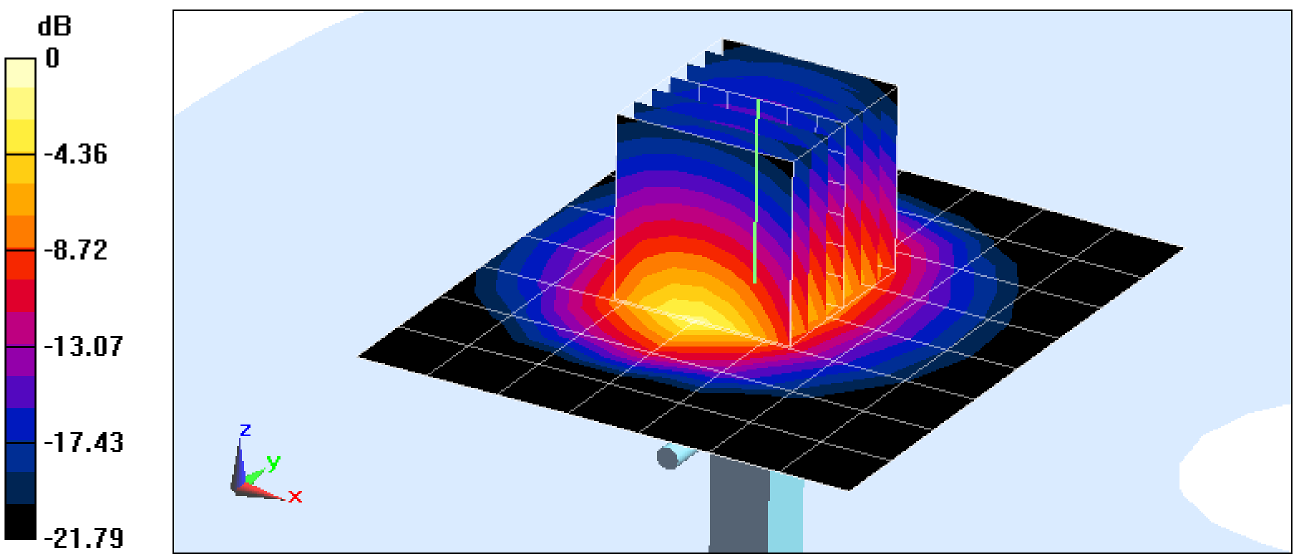
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used:
f = 2450 MHz; σ = 1.932 mho/m; ε_r = 50.597; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-14-2013; Ambient Temp: 24.3°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3288; ConvF(4.35, 4.35, 4.35); Calibrated: 9/20/2012;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/19/2012
Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646
Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.7 (6848)

2450 MHz System Verification

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 10.0 W/kg
SAR(1 g) = 4.790 W/kg; SAR(10 g) = 2.21 W/kg
Deviation: -3.43%



0 dB = 6.28 W/kg = 7.98 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

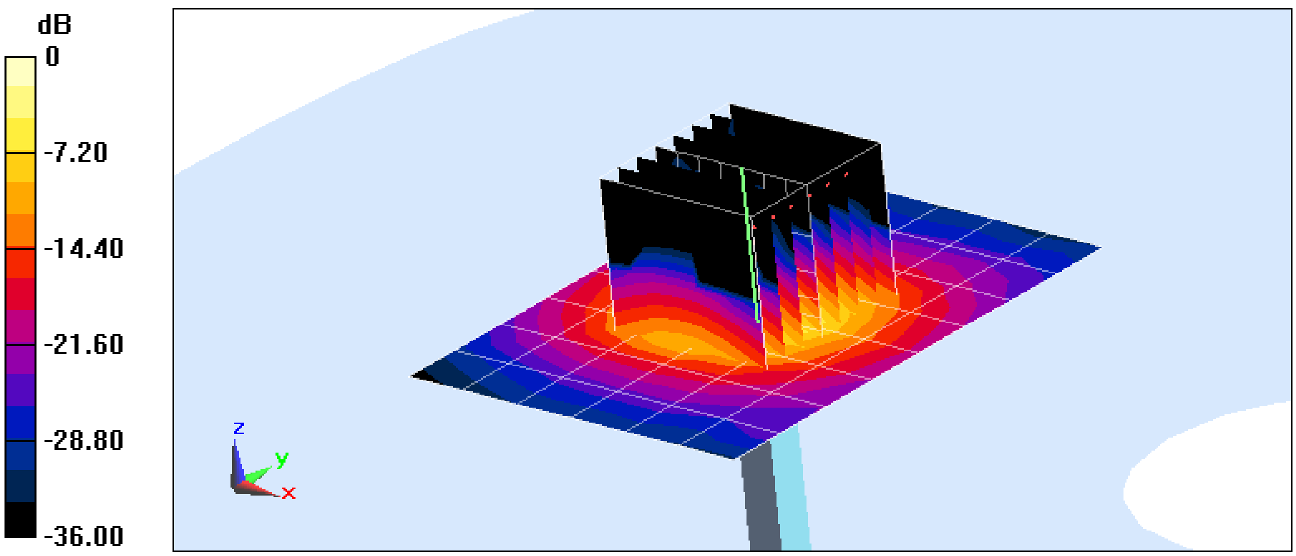
Communication System: CW; Frequency: 5200 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5200 MHz; σ = 5.346 mho/m; ε_r = 47.63; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-27-2013; Ambient Temp: 23.9°C; Tissue Temp: 22.7°C

Probe: EX3DV4 - SN3589; ConvF(3.99, 3.99, 3.99); Calibrated: 1/17/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/17/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

5200MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 32.1 W/kg
SAR(1 g) = 7.140 W/kg; SAR(10 g) = 1.99 W/kg
Deviation: -5.43%



0 dB = 16.3 W/kg = 12.12 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

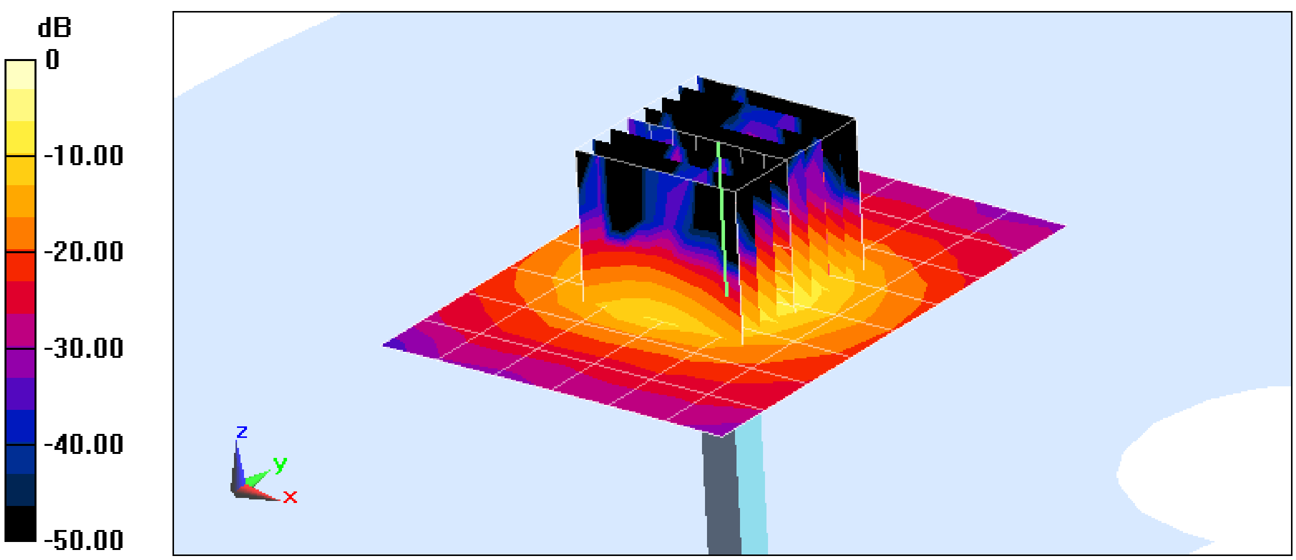
Communication System: CW; Frequency: 5300 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5300 MHz; σ = 5.472 mho/m; ε_r = 47.46; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-27-2013; Ambient Temp: 23.9°C; Tissue Temp: 22.7°C

Probe: EX3DV4 - SN3589; ConvF(3.81, 3.81, 3.81); Calibrated: 1/17/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/17/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

5300MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 34.0 W/kg
SAR(1 g) = 7.340 W/kg; SAR(10 g) = 2.02 W/kg
Deviation: -2.52%



0 dB = 17.3 W/kg = 12.38 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

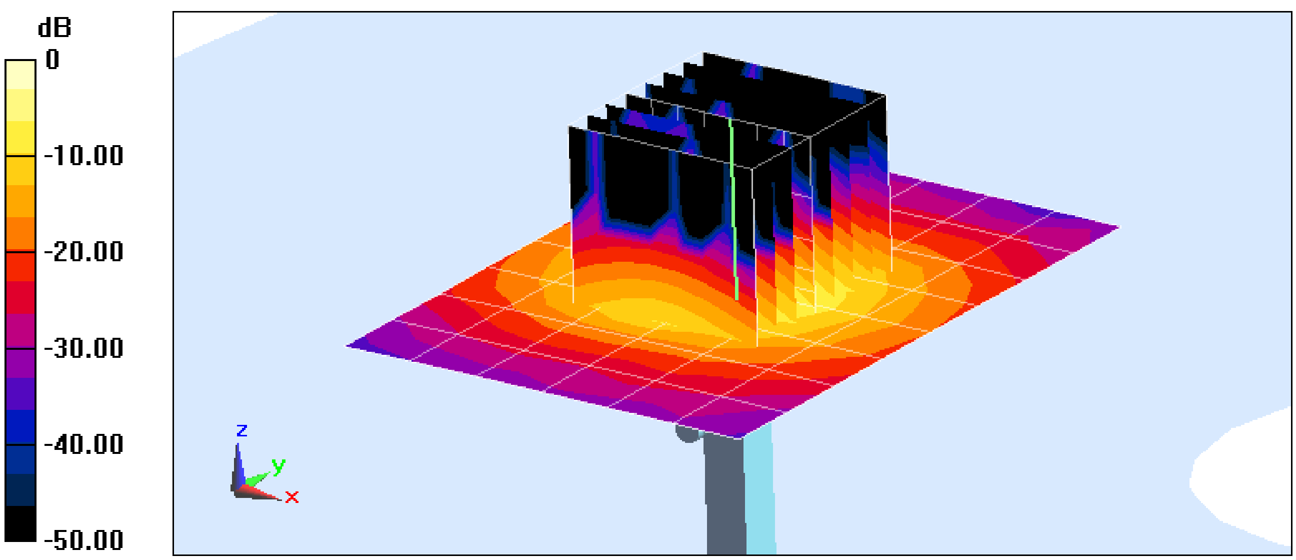
Communication System: CW; Frequency: 5600 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5600 MHz; σ = 5.848 mho/m; ε_r = 46.974; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-27-2013; Ambient Temp: 23.9°C; Tissue Temp: 22.7°C

Probe: EX3DV4 - SN3589; ConvF(3.32, 3.32, 3.32); Calibrated: 1/17/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/17/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

5600MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 38.4 W/kg
SAR(1 g) = 8.370 W/kg; SAR(10 g) = 2.29 W/kg
Deviation: 4.23%



0 dB = 20.9 W/kg = 13.20 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

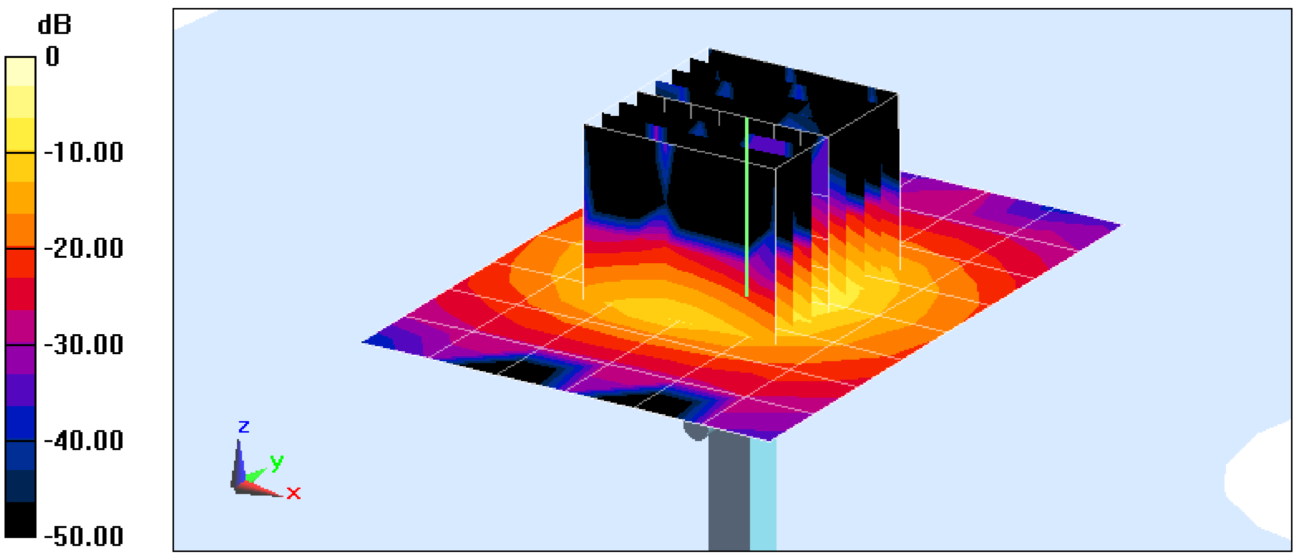
Communication System: CW; Frequency: 5800 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body Medium parameters used:
f = 5800 MHz; σ = 6.147 mho/m; ε_r = 46.555; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 02-27-2013; Ambient Temp: 23.9°C; Tissue Temp: 22.7°C

Probe: EX3DV4 - SN3589; ConvF(3.66, 3.66, 3.66); Calibrated: 1/17/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1272; Calibrated: 1/17/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

5800MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio: 1.4
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 36.9 W/kg
SAR(1 g) = 7.300 W/kg; SAR(10 g) = 1.99 W/kg
Deviation: -2.80%



0 dB = 18.4 W/kg = 12.65 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**
Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
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Accreditation No.: SCS 108

Client **PC Test**

Certificate No: D1765V2-1008_May12

CALIBRATION CERTIFICATE

Object	D1765V2 - SN 1008
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	May 18, 2012

✓ KOK 6/11/12

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12

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

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

Issued: May 18, 2012

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.1
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.1	1.38 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.5 ± 6 %	1.34 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	8.92 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**36.4 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.77 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**19.3 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.4	1.50 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.9 ± 6 %	1.46 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.22 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**37.4 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	4.95 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**20.0 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	47.7 Ω - 5.9 jΩ
Return Loss	- 23.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	43.4 Ω - 6.0 jΩ
Return Loss	- 20.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.212 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	October 06, 2005

DASY5 Validation Report for Head TSL

Date: 18.05.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

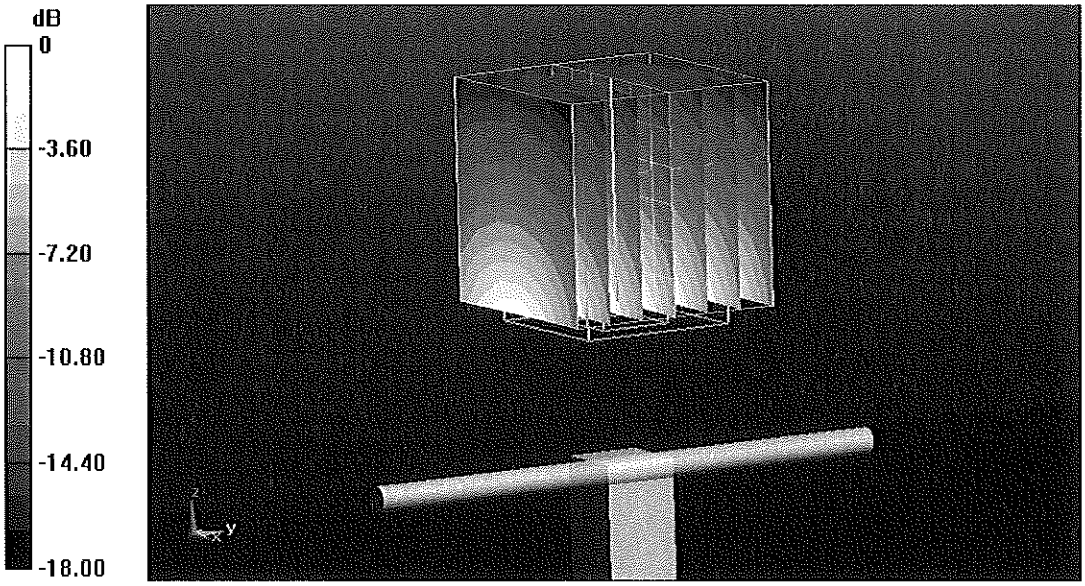
Communication System: CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.34 mho/m; ε_r = 40.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.22, 5.22, 5.22); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

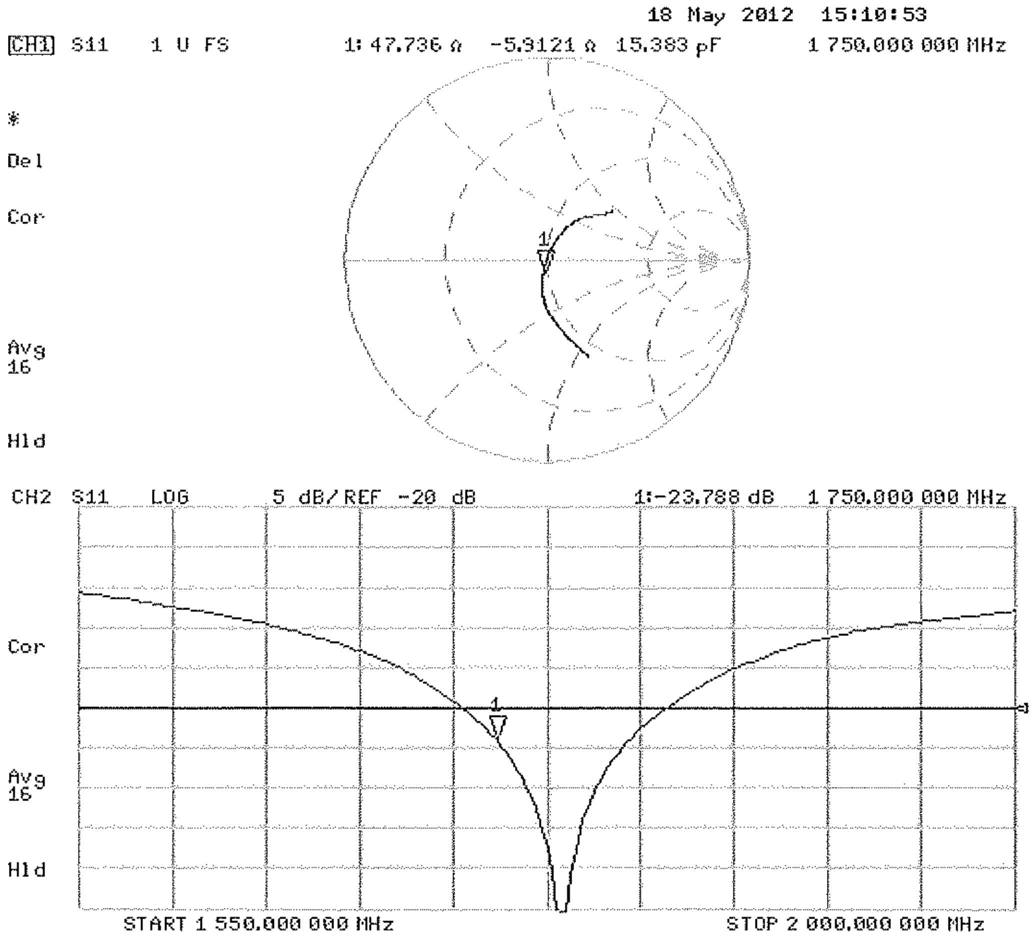
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.890 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 15.761 mW/g
SAR(1 g) = 8.92 mW/g; SAR(10 g) = 4.77 mW/g
Maximum value of SAR (measured) = 11.0 mW/g



0 dB = 11.0 mW/g = 20.83 dB mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 18.05.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

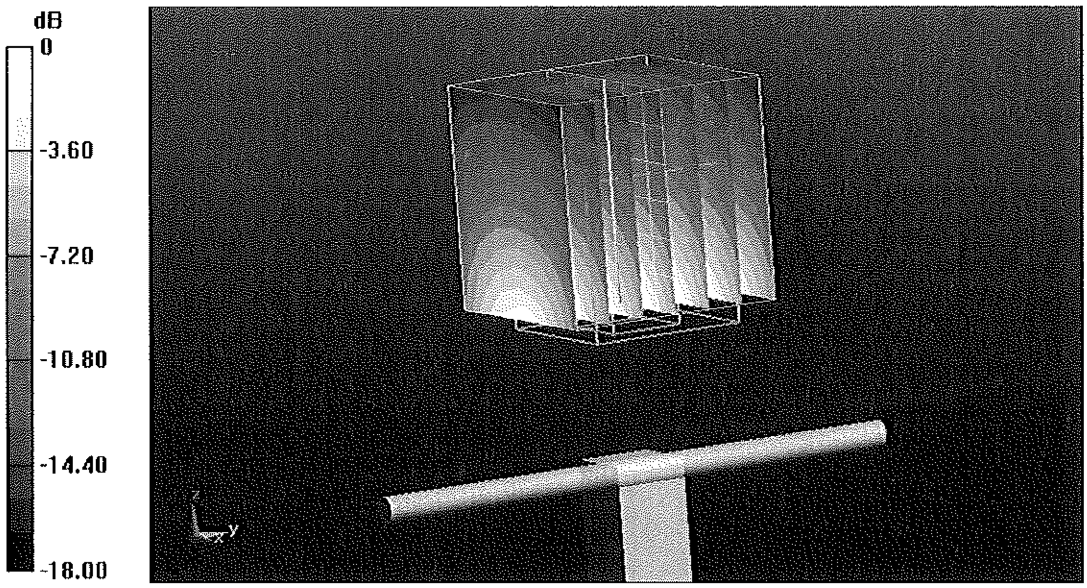
Communication System: CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.46 mho/m; ε_r = 52.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.85, 4.85, 4.85); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

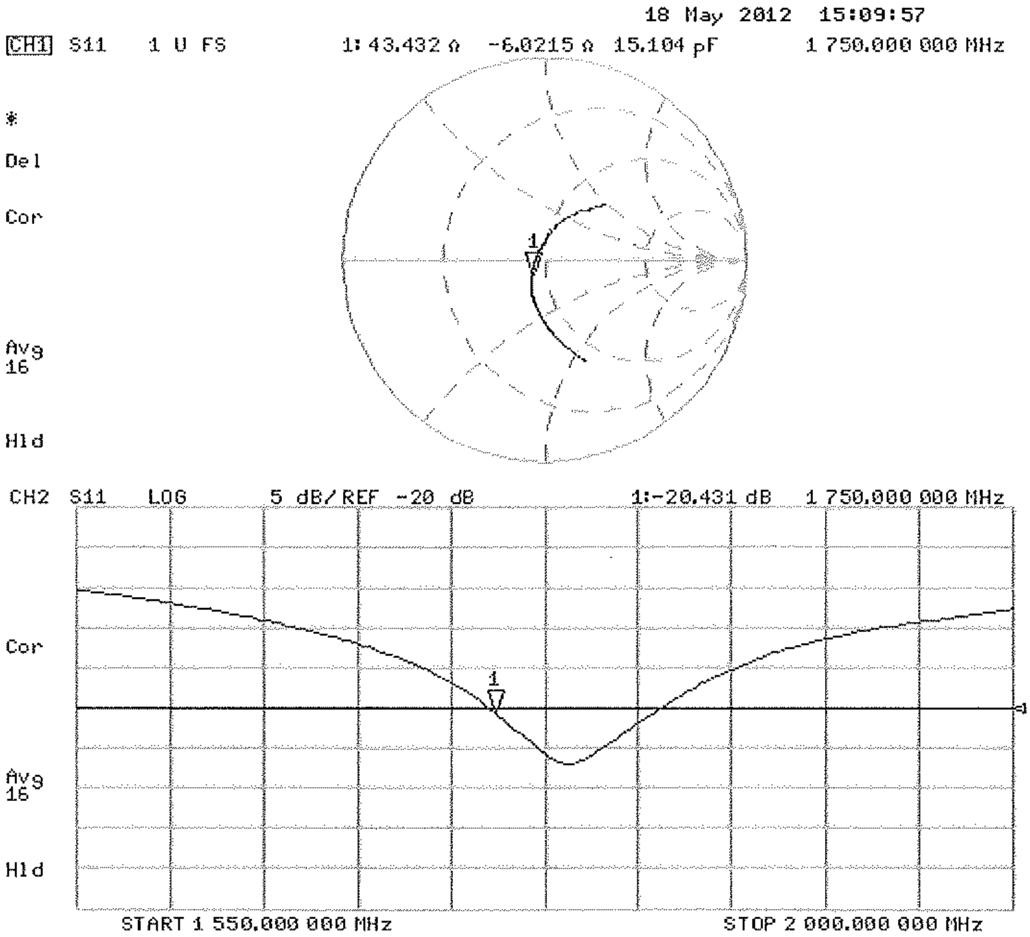
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.032 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 15.840 mW/g
SAR(1 g) = 9.22 mW/g; SAR(10 g) = 4.95 mW/g
Maximum value of SAR (measured) = 11.6 mW/g



0 dB = 11.6 mW/g = 21.29 dB mW/g

Impedance Measurement Plot for Body TSL



Calibration Laboratory of
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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: D1900V2-5d148_Feb13

CALIBRATION CERTIFICATE

Object: D1900V2 - SN: 5d148

Calibration procedure(s): QA CAL-05.v9
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: February 06, 2013

✓ KOK 2/21/13

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

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

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	*(signature)*
Approved by:	Katja Pokovic	Technical Manager	*(signature)*

Issued: February 6, 2013

Calibration Laboratory of
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Zeughausstrasse 43, 8004 Zurich, Switzerland

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.5
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.4 ± 6 %	1.38 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.87 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**39.7 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.18 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**20.8 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.9 ± 6 %	1.53 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.3 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**40.8 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.45 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.7 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.1 Ω + 5.9 jΩ
Return Loss	- 24.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.3 Ω + 6.3 jΩ
Return Loss	- 23.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 11, 2011

DASY5 Validation Report for Head TSL

Date: 06.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d148

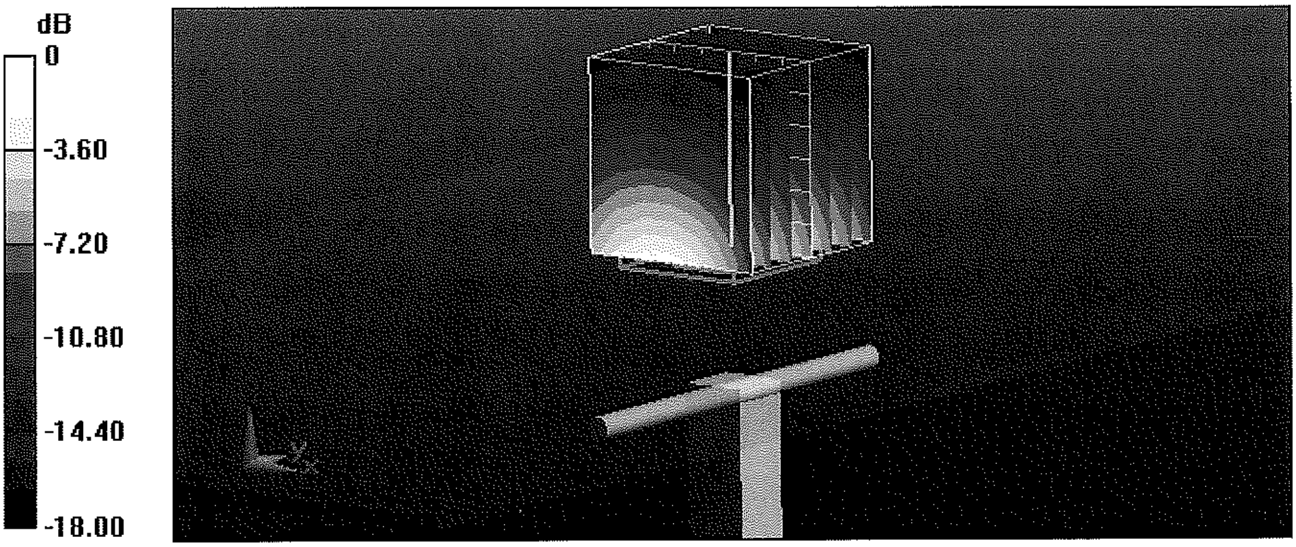
Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; $\sigma = 1.38$ S/m; $\varepsilon_r = 39.4$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.98, 4.98, 4.98); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

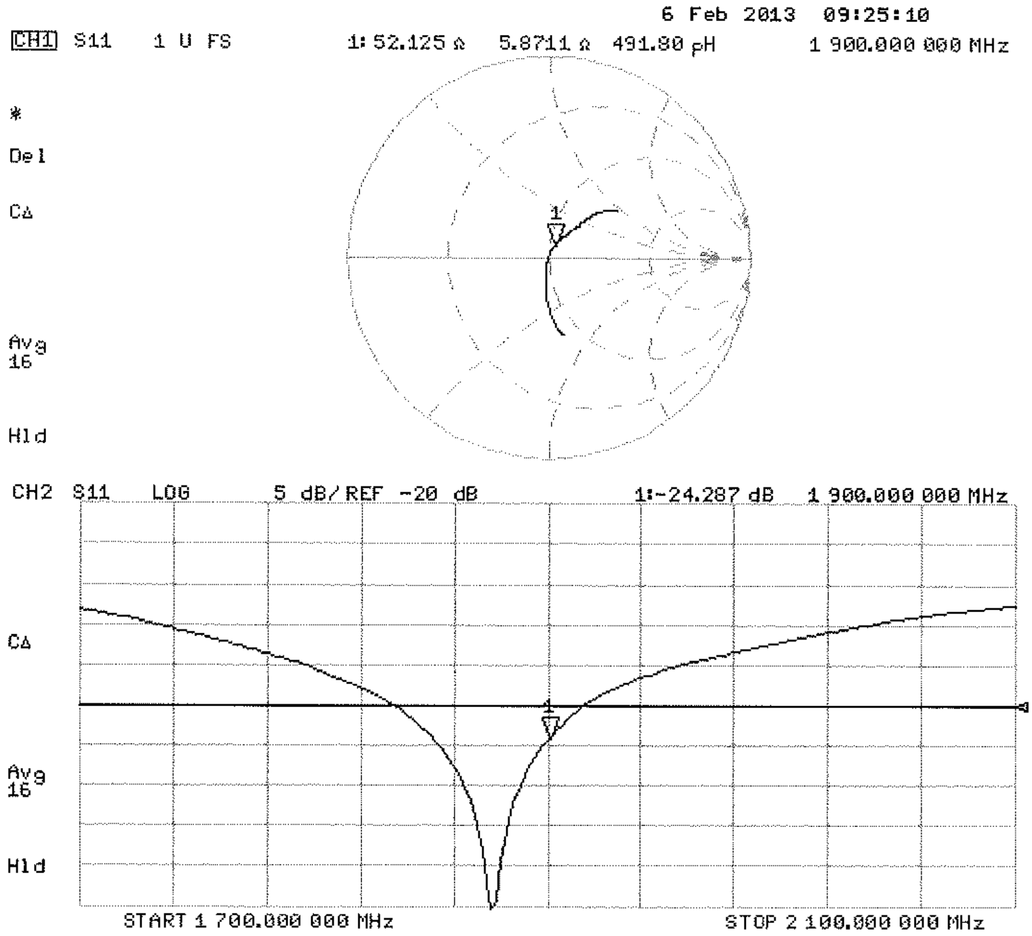
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.534 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 17.8 W/kg
SAR(1 g) = 9.87 W/kg; SAR(10 g) = 5.18 W/kg
Maximum value of SAR (measured) = 12.1 W/kg



0 dB = 12.1 W/kg = 10.83 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 06.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d148

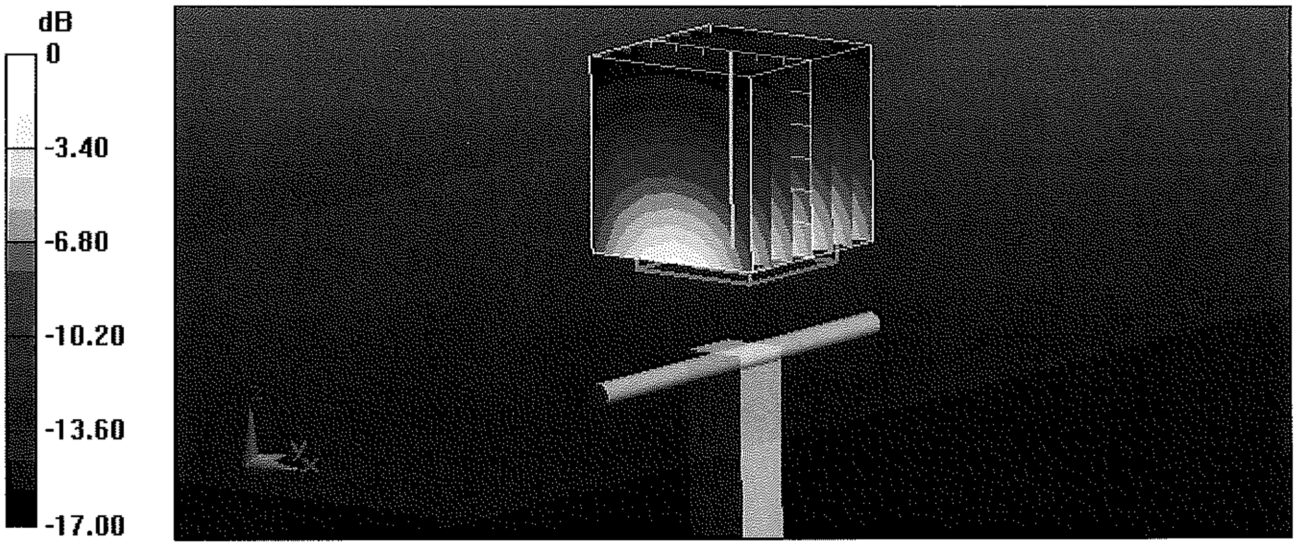
Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; $\sigma = 1.53$ S/m; $\varepsilon_r = 51.9$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.6, 4.6, 4.6); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

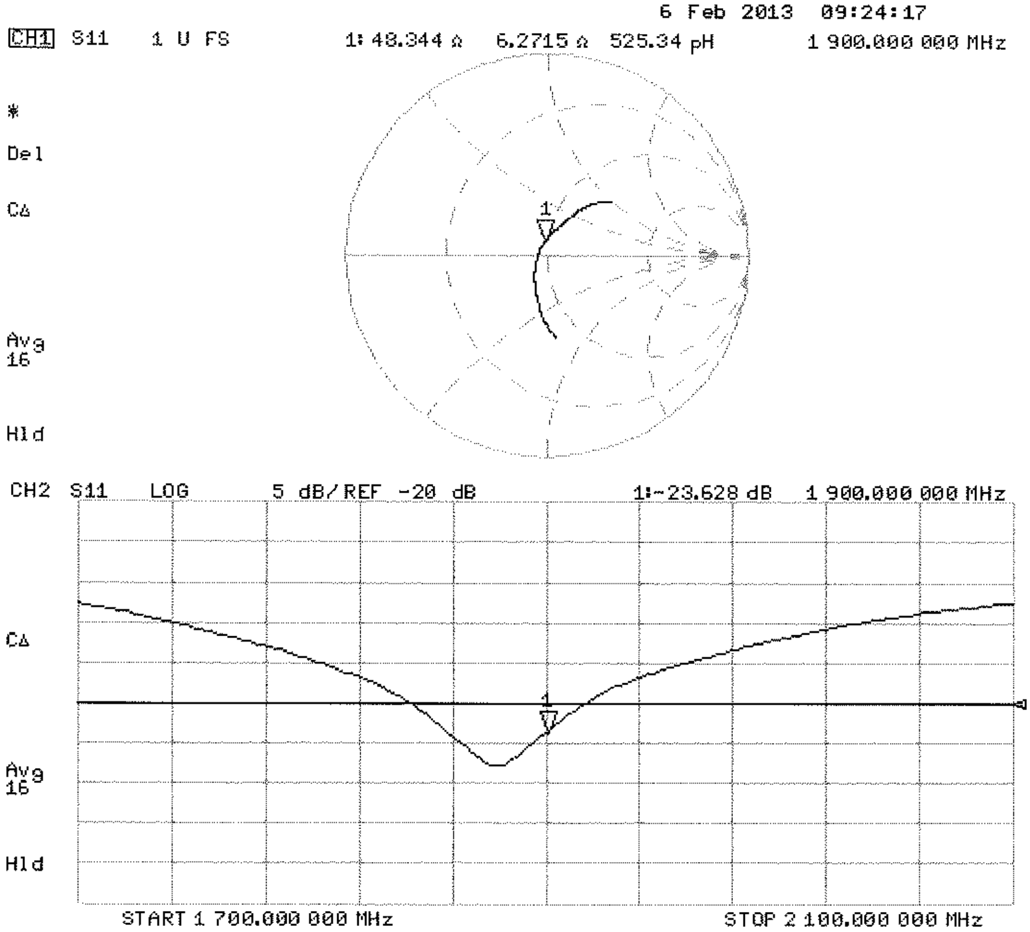
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.534 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 17.9 W/kg
SAR(1 g) = 10.3 W/kg; SAR(10 g) = 5.45 W/kg
Maximum value of SAR (measured) = 13.1 W/kg



0 dB = 13.1 W/kg = 11.17 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client PC Test

Certificate No: **D1900V2-5d149_Feb12**

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d149
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	February 22, 2012

✓ KOK 4/11/12

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5086 (20g)	29-Mar-11 (No. 217-01368)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12

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

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

Issued: February 23, 2012

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

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.4 ± 6 %	1.40 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.80 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**39.3 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.18 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**20.7 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.0 ± 6 %	1.56 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.99 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**39.3 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.23 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**20.7 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.4 Ω + 5.5 jΩ
Return Loss	- 24.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.0 Ω + 6.7 jΩ
Return Loss	- 23.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 11, 2011

DASY5 Validation Report for Head TSL

Date: 22.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

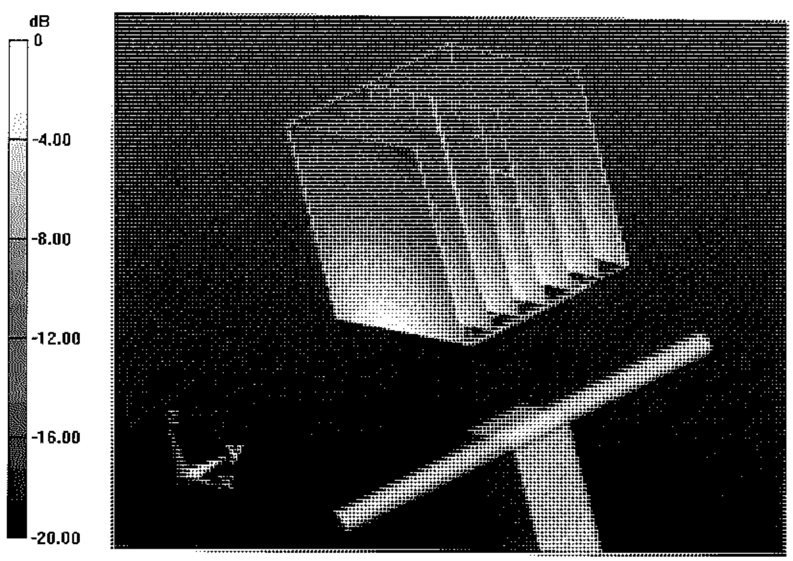
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d149

Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.4 mho/m; ε_r = 40.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

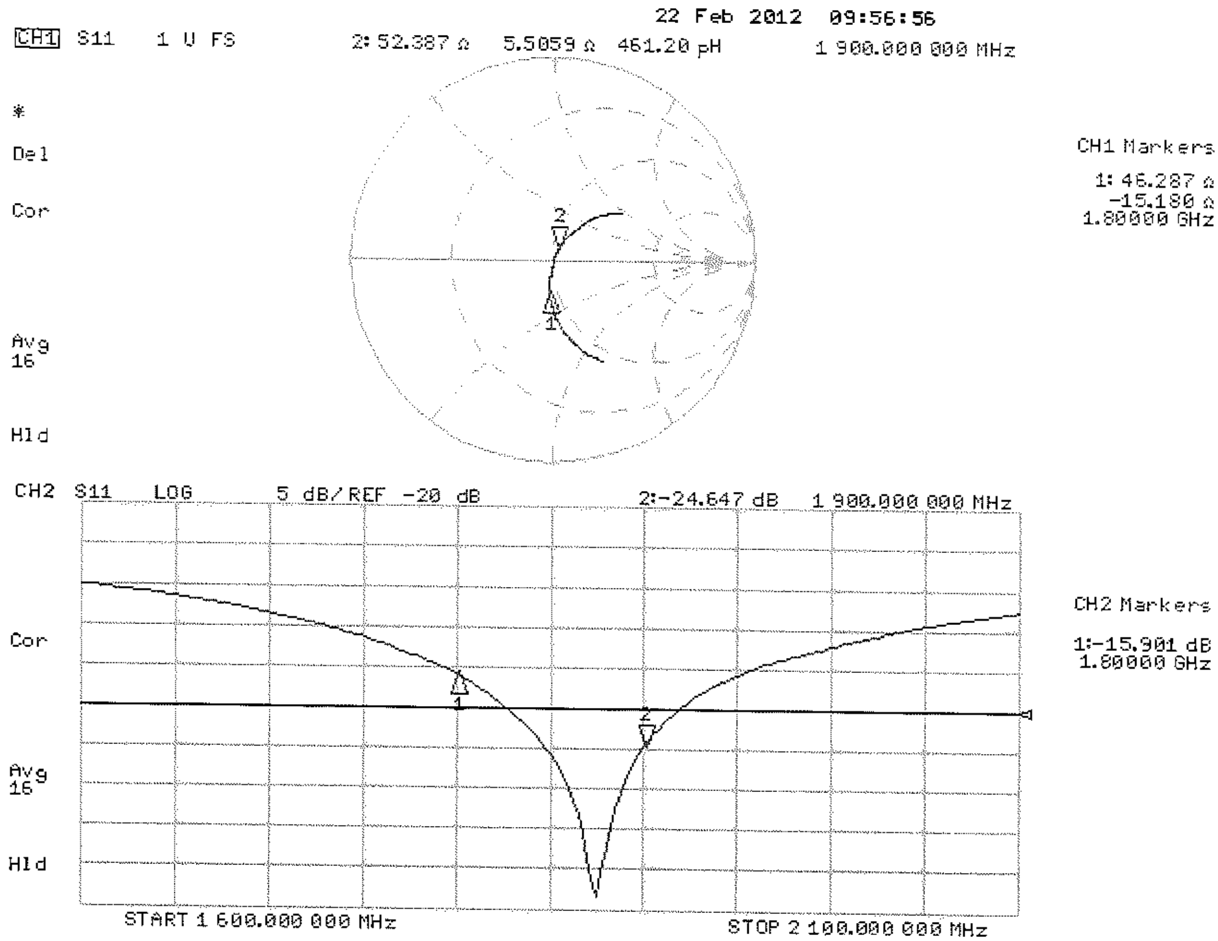
- Probe: ES3DV3 - SN3205; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.685 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 17.4710
SAR(1 g) = 9.8 mW/g; SAR(10 g) = 5.18 mW/g
Maximum value of SAR (measured) = 12.114 mW/g



0 dB = 12.110mW/g = 21.66 dB mW/g

Impedance Measurement Plot for Head TSL



Date: 06.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

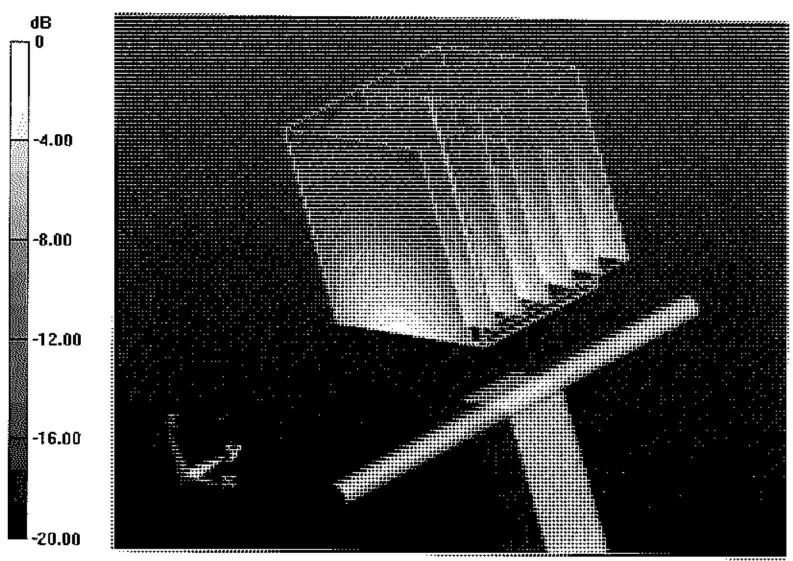
Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.56 mho/m; ε_r = 53; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.62, 4.62, 4.62); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

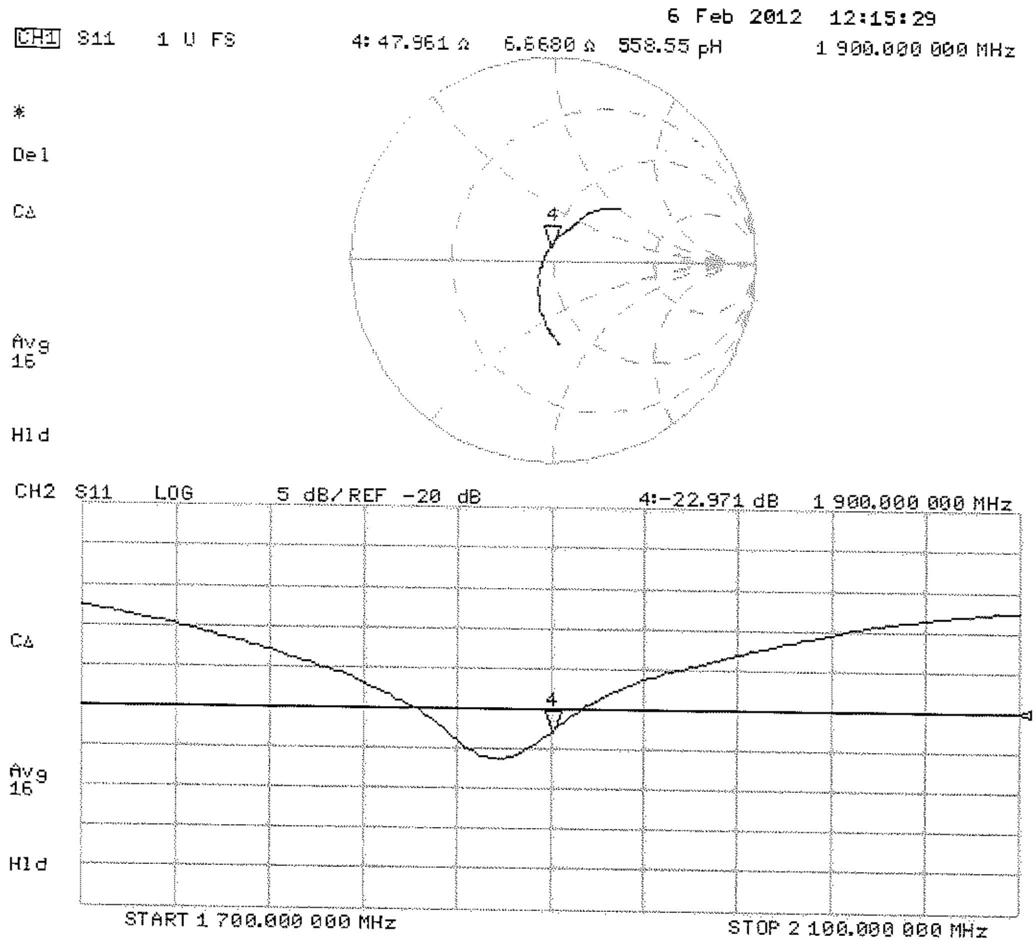
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.047 V/m; Power Drift = 0.0017 dB
Peak SAR (extrapolated) = 18.1310
SAR(1 g) = 9.99 mW/g; SAR(10 g) = 5.23 mW/g
Maximum value of SAR (measured) = 12.672 mW/g



0 dB = 12.670mW/g = 22.06 dB mW/g

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client PC Test

Certificate No: D2450V2-719_Aug12

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 719
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	August 23, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

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

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

Issued: August 23, 2012

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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.2 ± 6 %	1.81 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.2 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**52.7 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.19 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**24.7 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.3 ± 6 %	1.99 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.1 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**51.6 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.16 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**24.4 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.4 Ω + 3.8 jΩ
Return Loss	- 25.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.7 Ω + 5.9 jΩ
Return Loss	- 24.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.150 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 10, 2002

DASY5 Validation Report for Head TSL

Date: 23.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

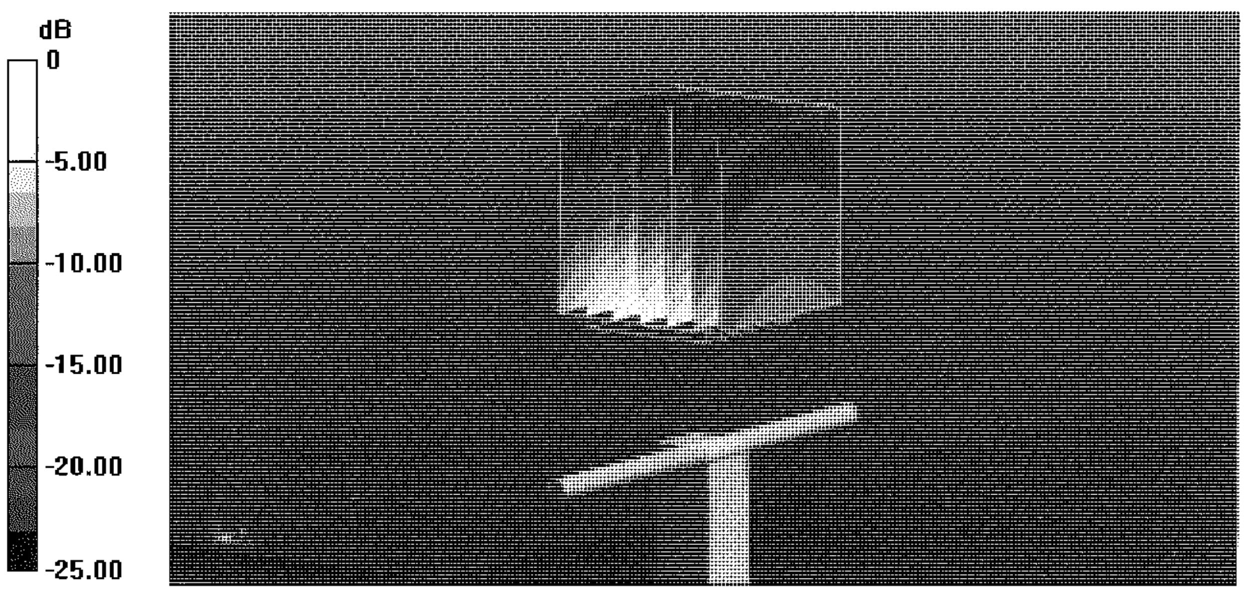
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.81 mho/m; ε_r = 39.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

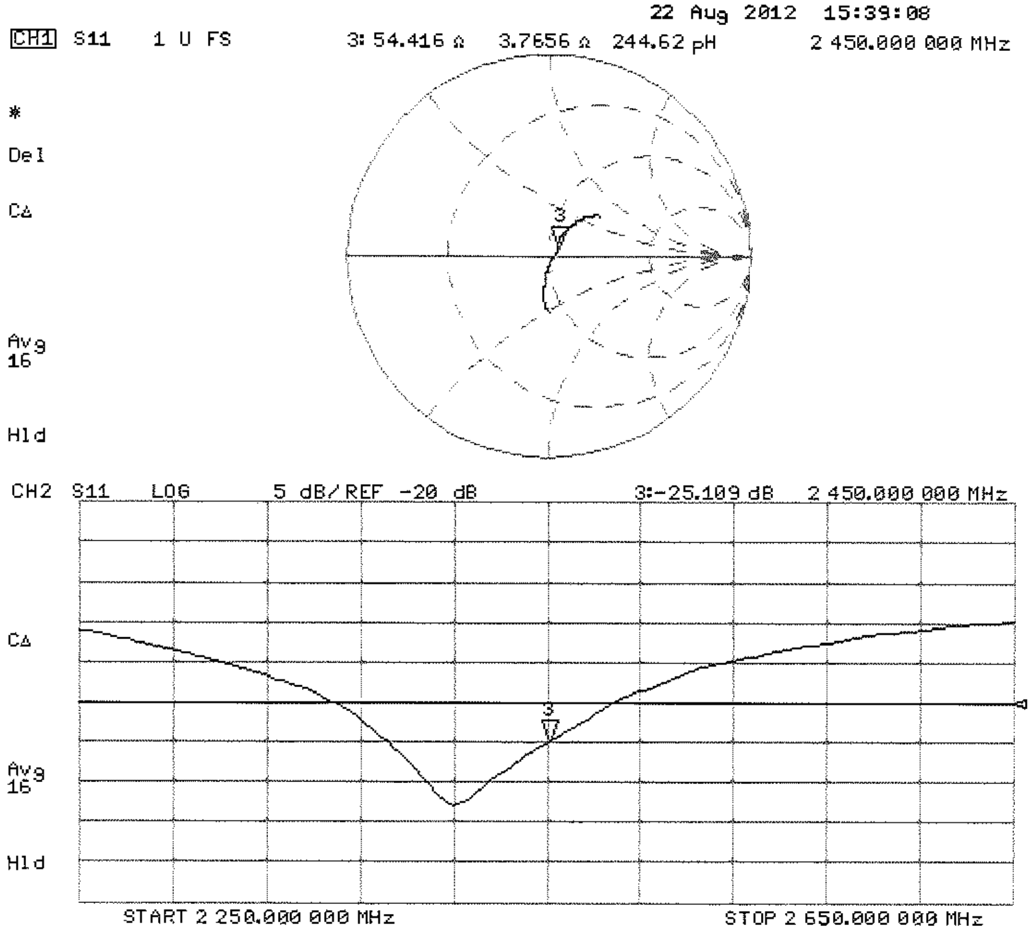
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.219 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 26.633 mW/g
SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.19 mW/g
Maximum value of SAR (measured) = 16.5 W/kg



0 dB = 16.5 W/kg = 24.35 dB W/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 22.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

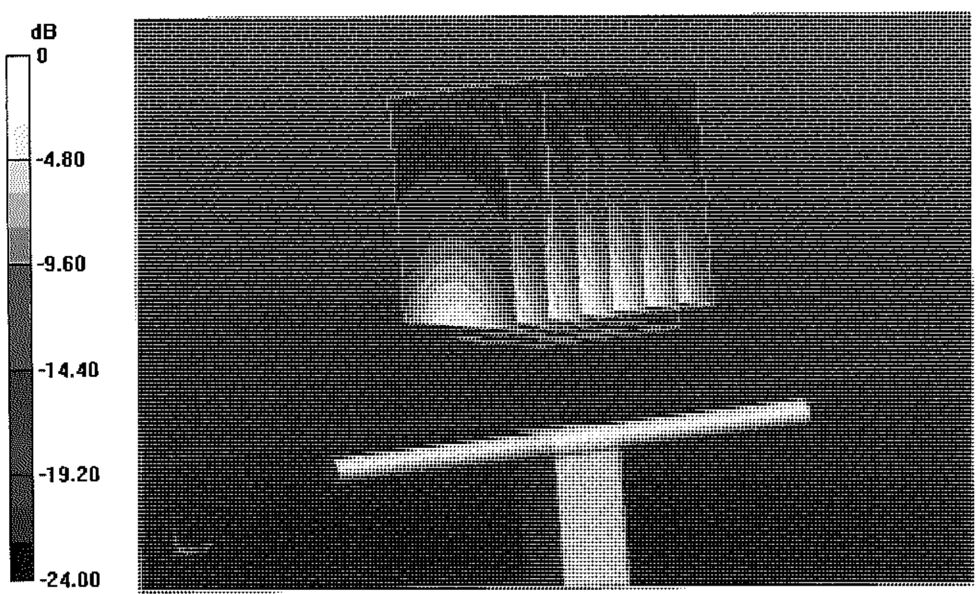
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.99 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

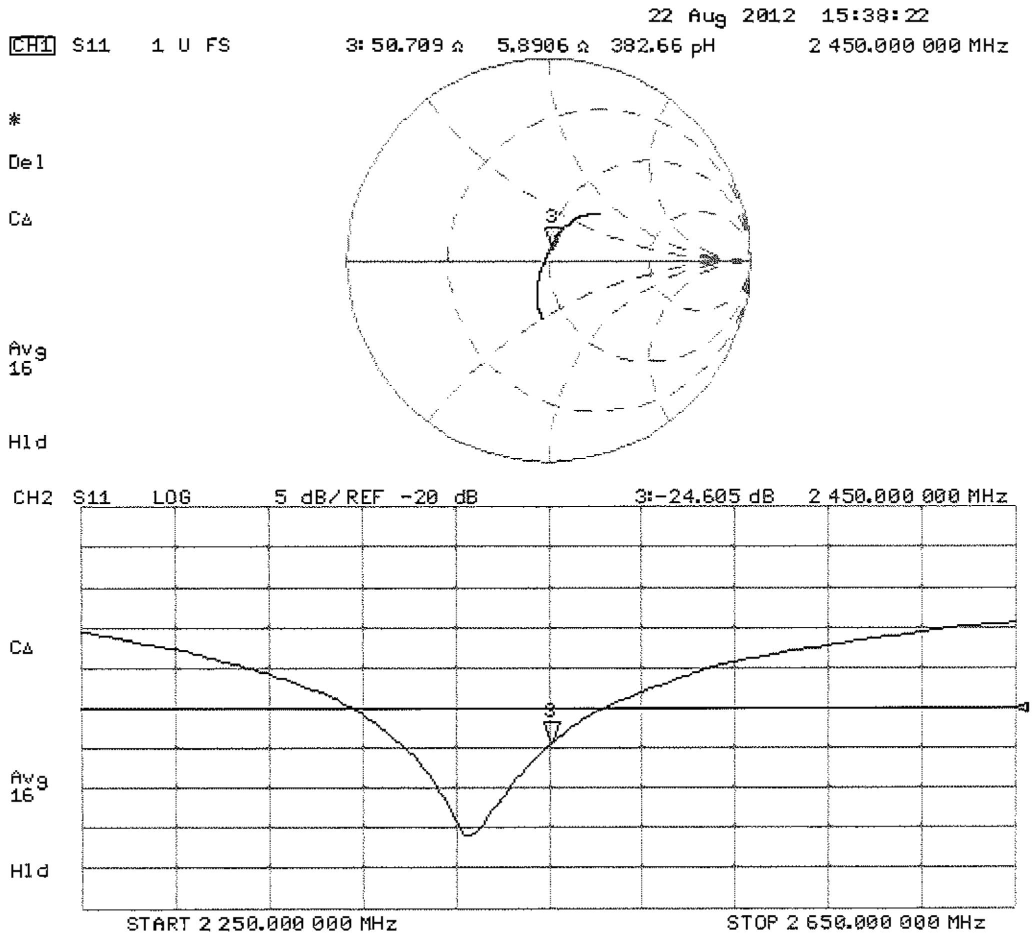
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.970 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 26.692 mW/g
SAR(1 g) = 13.1 mW/g; SAR(10 g) = 6.16 mW/g
Maximum value of SAR (measured) = 17.1 W/kg



0 dB = 17.1 W/kg = 24.66 dB W/kg

Impedance Measurement Plot for Body TSL



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Client **PC Test**

Certificate No: D2450V2-797_Jan13

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 797
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	January 08, 2013

✓ KOK 1/28/13

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

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

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

Issued: January 8, 2013

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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.9 ± 6 %	1.85 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.4 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.5 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.5 ± 6 %	2.01 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.7 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**49.6 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.88 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.2 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.3 Ω + 3.1 jΩ
Return Loss	- 27.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.1 Ω + 4.9 jΩ
Return Loss	- 26.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.152 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	January 24, 2006

DASY5 Validation Report for Head TSL

Date: 08.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

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

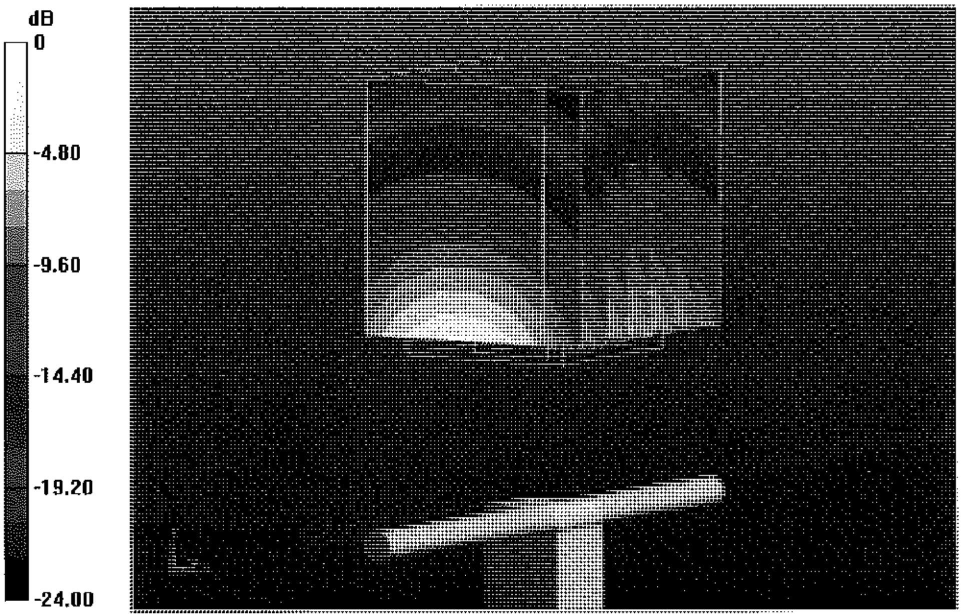
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.85 S/m; ε_r = 37.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.52, 4.52, 4.52); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.4(1052); SEMCAD X 14.6.8(7028)

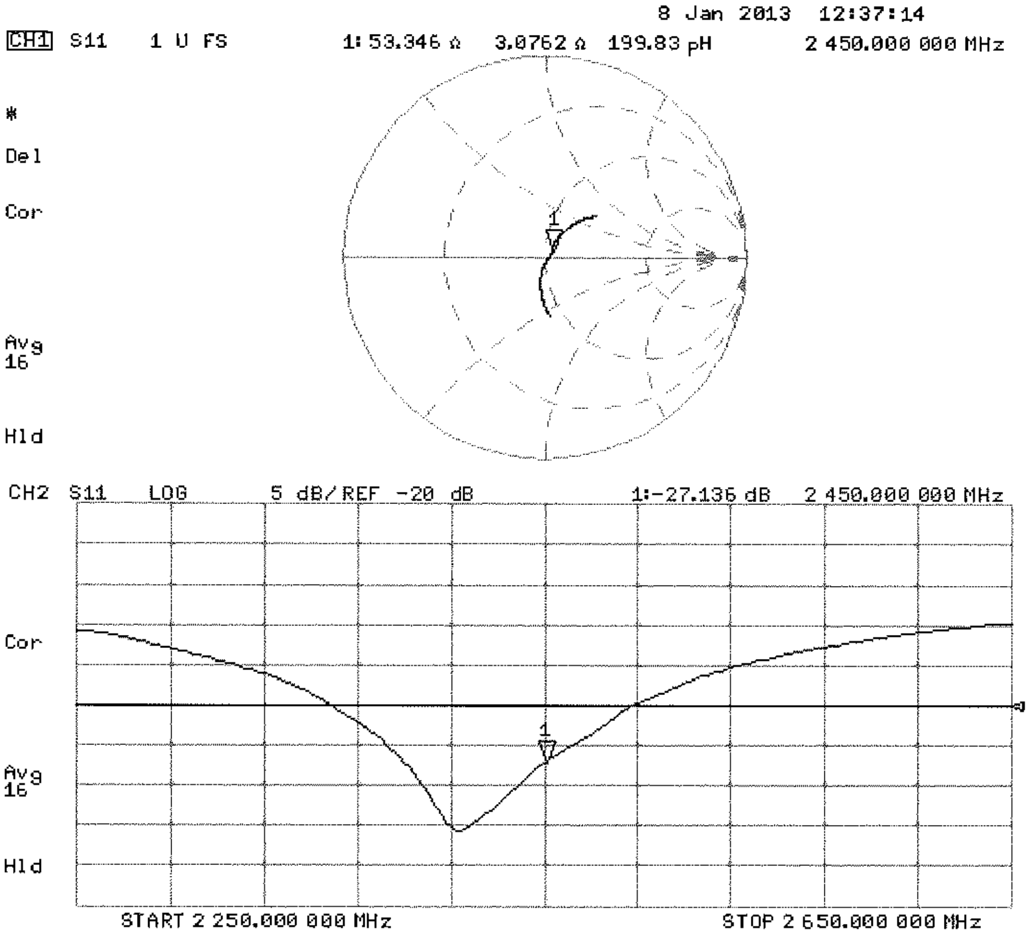
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.154 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 27.8 W/kg
SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.2 W/kg
Maximum value of SAR (measured) = 17.0 W/kg



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

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 08.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

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

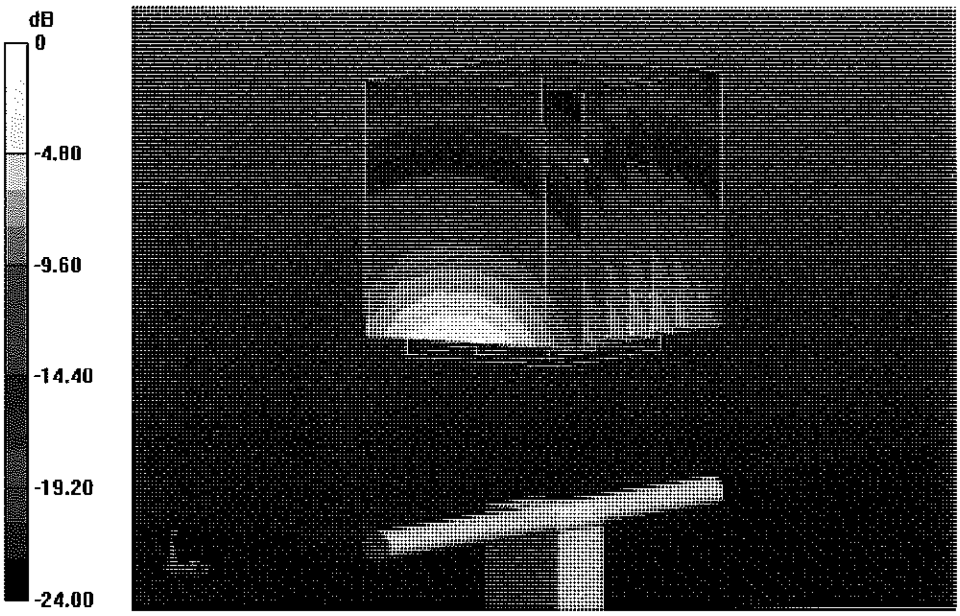
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.01 S/m; ε_r = 50.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.42, 4.42, 4.42); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.4(1052); SEMCAD X 14.6.8(7028)

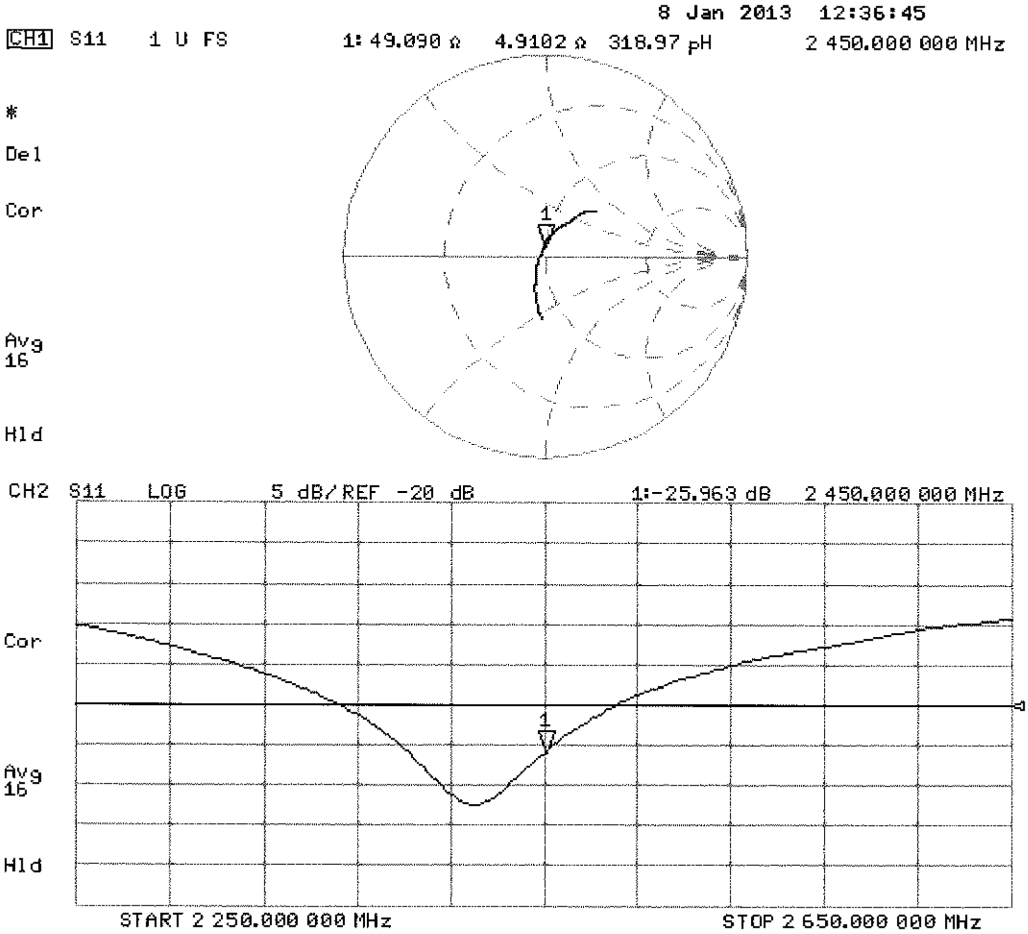
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.935 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 26.7 W/kg
SAR(1 g) = 12.7 W/kg; SAR(10 g) = 5.88 W/kg
Maximum value of SAR (measured) = 16.7 W/kg



0 dB = 16.7 W/kg = 12.23 dBW/kg

Impedance Measurement Plot for Body TSL



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

S **Schweizerischer Kalibrierdienst**
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Accreditation No.: SCS 108

Client **PC Test**

Certificate No: D5GHzV2-1057_Jan13

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN: 1057
Calibration procedure(s)	QA CAL-22.v2 Calibration procedure for dipole validation kits between 3-6 GHz
Calibration date:	January 11, 2013

✓ KOK 1/28/13

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe EX3DV4	SN: 3503	28-Dec-12 (No. EX3-3503_Dec12)	Dec-13
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

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

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

Issued: January 11, 2013

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEC 62209-2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", March 2010

b) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

c) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.5
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5500 MHz ± 1 MHz 5600 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.6 ± 6 %	4.50 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.66 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**75.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.4 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.5 ± 6 %	4.60 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.76 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**76.9 W / kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.9 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.2 ± 6 %	4.79 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.09 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.5 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.1 ± 6 %	4.88 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.12 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.7 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	33.8 ± 6 %	5.09 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.69 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**76.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.4 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.0 ± 6 %	5.42 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.61 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.13 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.1 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.8 ± 6 %	5.55 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.59 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.3 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.13 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.1 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.5 ± 6 %	5.81 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**80.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.26 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.4 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.3 ± 6 %	5.94 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**80.3 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.25 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.3 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.0 ± 6 %	6.21 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.57 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.09 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.7 W/kg ± 19.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	50.5 Ω - 9.8 jΩ
Return Loss	- 20.3 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	48.5 Ω - 4.5 jΩ
Return Loss	- 26.4 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	50.6 Ω - 5.8 jΩ
Return Loss	- 24.8 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	53.9 Ω - 3.8 jΩ
Return Loss	- 25.6 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	52.5 Ω - 4.4 jΩ
Return Loss	- 26.1 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	49.3 Ω - 7.9 jΩ
Return Loss	- 22.0 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	48.7 Ω - 3.2 jΩ
Return Loss	- 29.2 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	51.2 Ω - 4.8 jΩ
Return Loss	- 26.2 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	53.6 Ω - 2.1 jΩ
Return Loss	- 27.9 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	53.3 Ω - 2.9 jΩ
Return Loss	- 27.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.202 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	November 27, 2006

DASY5 Validation Report for Head TSL

Date: 11.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1057

Communication System: CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 4.5 S/m; ε_r = 34.6; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 4.6 S/m; ε_r = 34.5; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 4.79 S/m; ε_r = 34.2; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 4.88 S/m; ε_r = 34.1; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 5.09 S/m; ε_r = 33.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.41, 5.41, 5.41); Calibrated: 28.12.2012, ConvF(5.1, 5.1, 5.1); Calibrated: 28.12.2012, ConvF(4.91, 4.91, 4.91); Calibrated: 28.12.2012, ConvF(4.76, 4.76, 4.76); Calibrated: 28.12.2012, ConvF(4.81, 4.81, 4.81); Calibrated: 28.12.2012;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

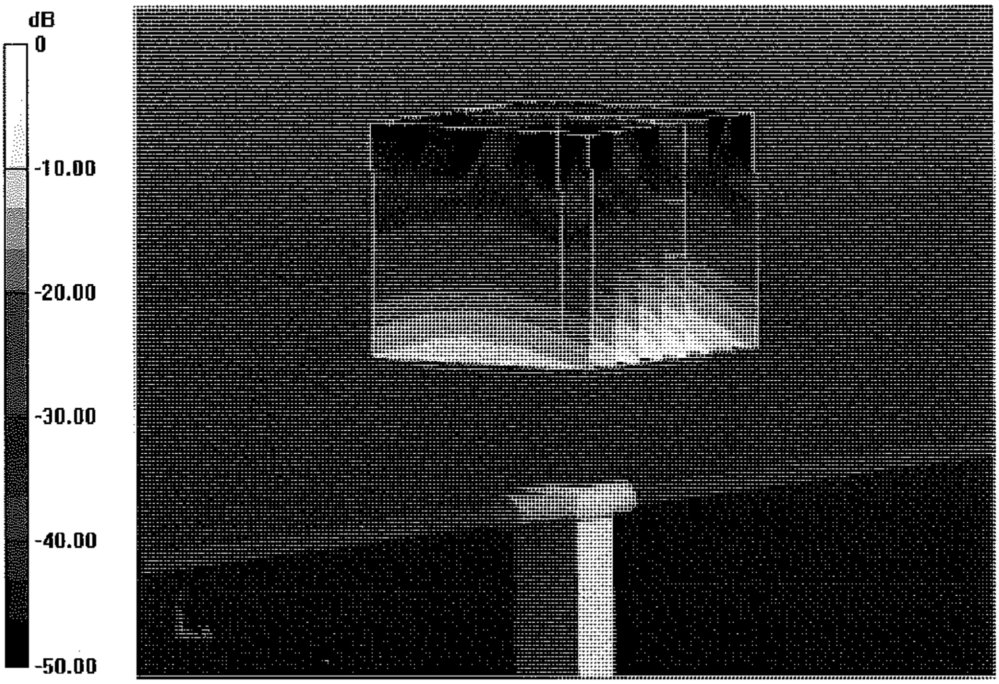
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.671 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 29.4 W/kg
SAR(1 g) = 7.66 W/kg; SAR(10 g) = 2.17 W/kg
Maximum value of SAR (measured) = 18.5 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.473 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 30.3 W/kg
SAR(1 g) = 7.76 W/kg; SAR(10 g) = 2.22 W/kg
Maximum value of SAR (measured) = 18.8 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.735 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 33.2 W/kg
SAR(1 g) = 8.09 W/kg; SAR(10 g) = 2.28 W/kg
Maximum value of SAR (measured) = 20.1 W/kg

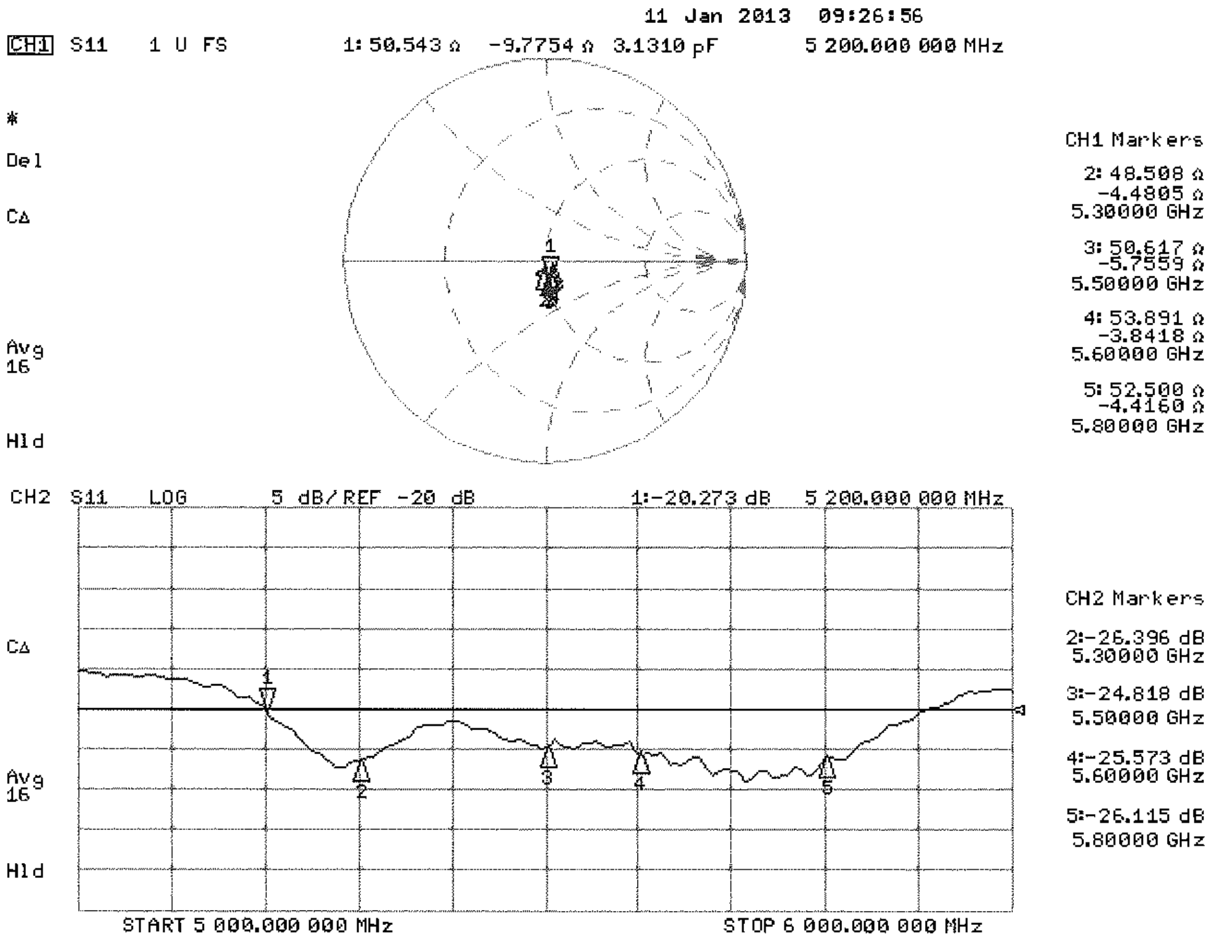
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.848 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 33.5 W/kg
SAR(1 g) = 8.12 W/kg; SAR(10 g) = 2.3 W/kg
Maximum value of SAR (measured) = 20.2 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 60.467 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 33.3 W/kg
SAR(1 g) = 7.69 W/kg; SAR(10 g) = 2.17 W/kg
Maximum value of SAR (measured) = 19.4 W/kg



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

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 10.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1057

Communication System: CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 5.42 S/m; ε_r = 47; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 5.55 S/m; ε_r = 46.8; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 5.81 S/m; ε_r = 46.5; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 5.94 S/m; ε_r = 46.3; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 6.21 S/m; ε_r = 46; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.91, 4.91, 4.91); Calibrated: 28.12.2012, ConvF(4.67, 4.67, 4.67); Calibrated: 28.12.2012, ConvF(4.43, 4.43, 4.43); Calibrated: 28.12.2012, ConvF(4.22, 4.22, 4.22); Calibrated: 28.12.2012, ConvF(4.38, 4.38, 4.38); Calibrated: 28.12.2012;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

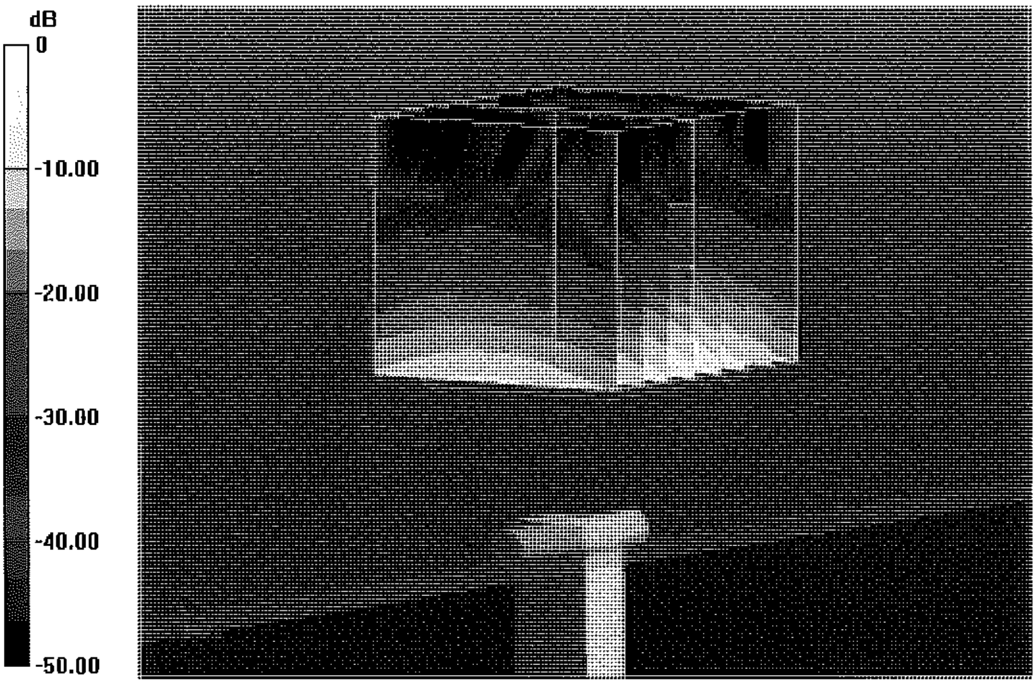
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 59.074 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 30.4 W/kg
SAR(1 g) = 7.61 W/kg; SAR(10 g) = 2.13 W/kg
Maximum value of SAR (measured) = 18.0 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 58.924 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 30.9 W/kg
SAR(1 g) = 7.59 W/kg; SAR(10 g) = 2.13 W/kg
Maximum value of SAR (measured) = 17.9 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 59.561 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 35.3 W/kg
SAR(1 g) = 8.14 W/kg; SAR(10 g) = 2.26 W/kg
Maximum value of SAR (measured) = 19.7 W/kg

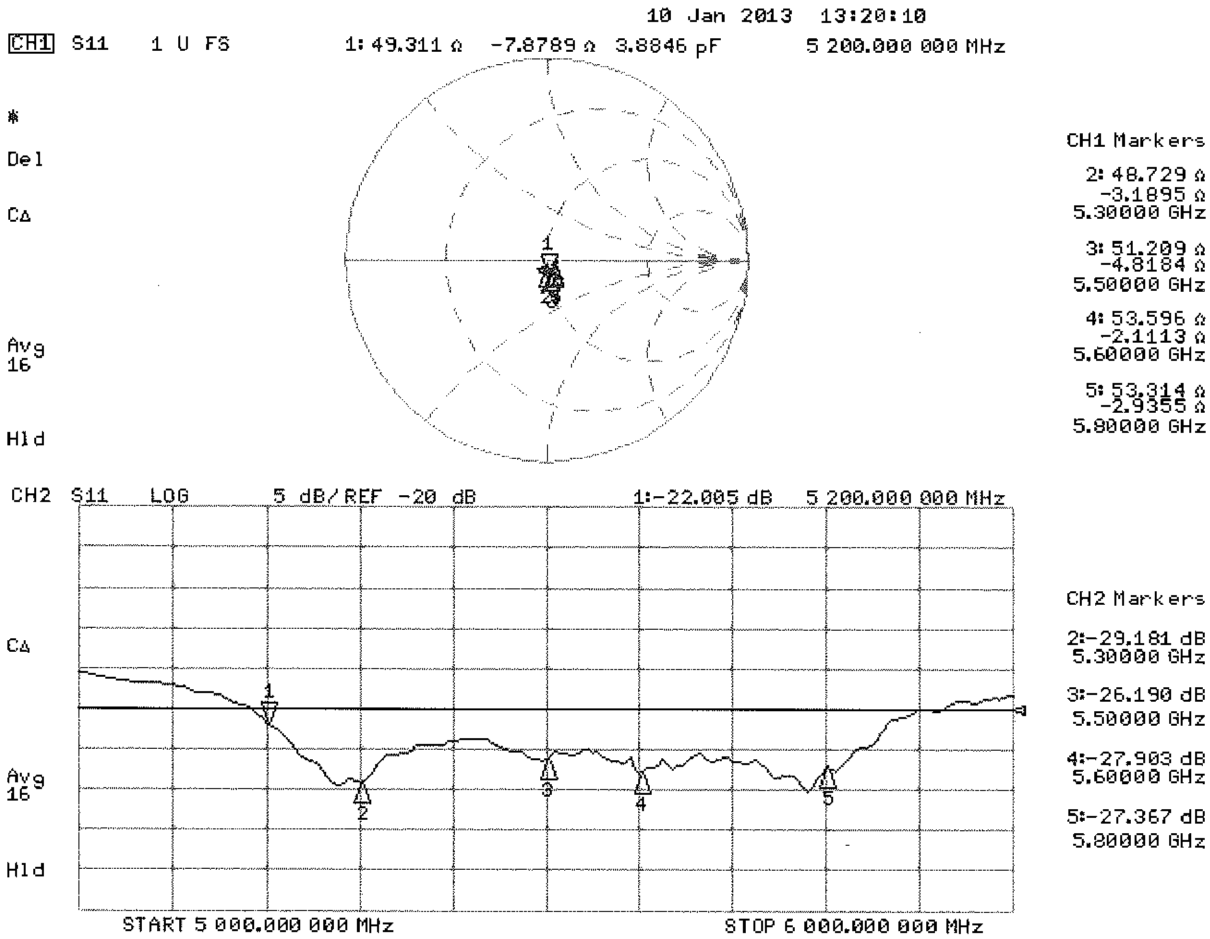
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 58.884 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 36.3 W/kg
SAR(1 g) = 8.1 W/kg; SAR(10 g) = 2.25 W/kg
Maximum value of SAR (measured) = 20.0 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 55.753 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 35.6 W/kg
SAR(1 g) = 7.57 W/kg; SAR(10 g) = 2.09 W/kg
Maximum value of SAR (measured) = 18.9 W/kg



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

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client **PC Test**

Certificate No: D750V3-1046_Feb13

CALIBRATION CERTIFICATE

Object	D750V3 - SN: 1046
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	February 13, 2013

√ KOK 2/21/13

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

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

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

Issued: February 13, 2013

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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.5
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.2 ± 6 %	0.91 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.50 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.55 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.8 ± 6 %	0.99 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.25 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**8.77 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.49 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**5.84 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	56.3 Ω + 1.4 jΩ
Return Loss	- 24.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	52.0 Ω - 1.1 jΩ
Return Loss	- 32.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.038 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 02, 2011

DASY5 Validation Report for Head TSL

Date: 13.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1046

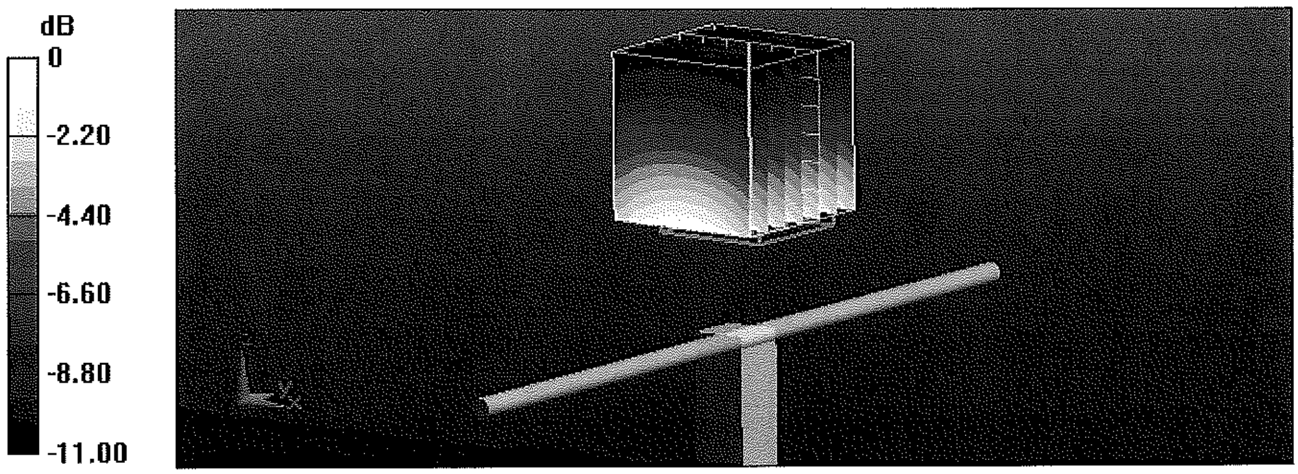
Communication System: CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; $\sigma = 0.91$ S/m; $\varepsilon_r = 41.2$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.28, 6.28, 6.28); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

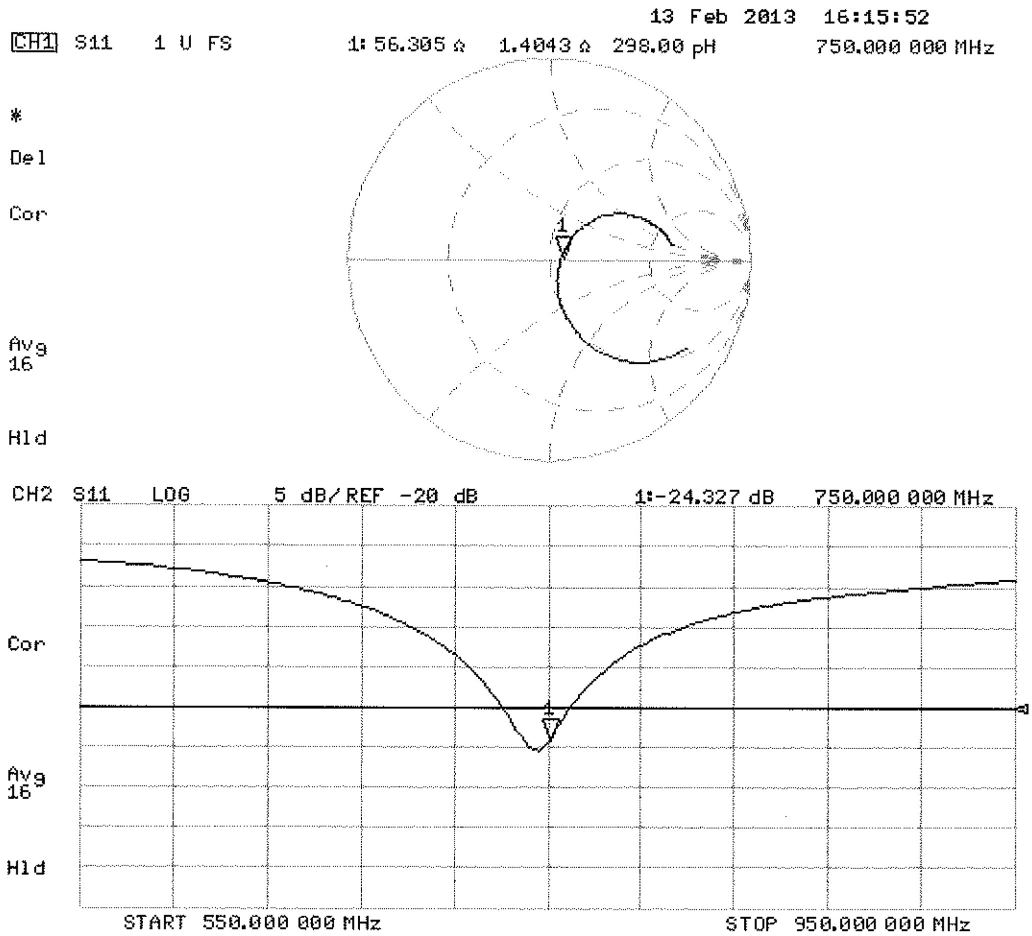
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.942 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.32 W/kg
SAR(1 g) = 2.17 W/kg; SAR(10 g) = 1.41 W/kg
Maximum value of SAR (measured) = 2.55 W/kg



0 dB = 2.55 W/kg = 4.07 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 13.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1046

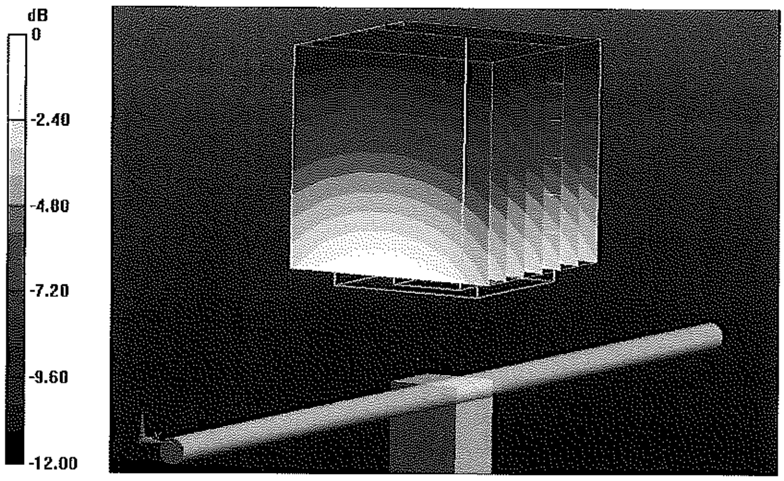
Communication System: CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; $\sigma = 0.99$ S/m; $\varepsilon_r = 54.8$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.11, 6.11, 6.11); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

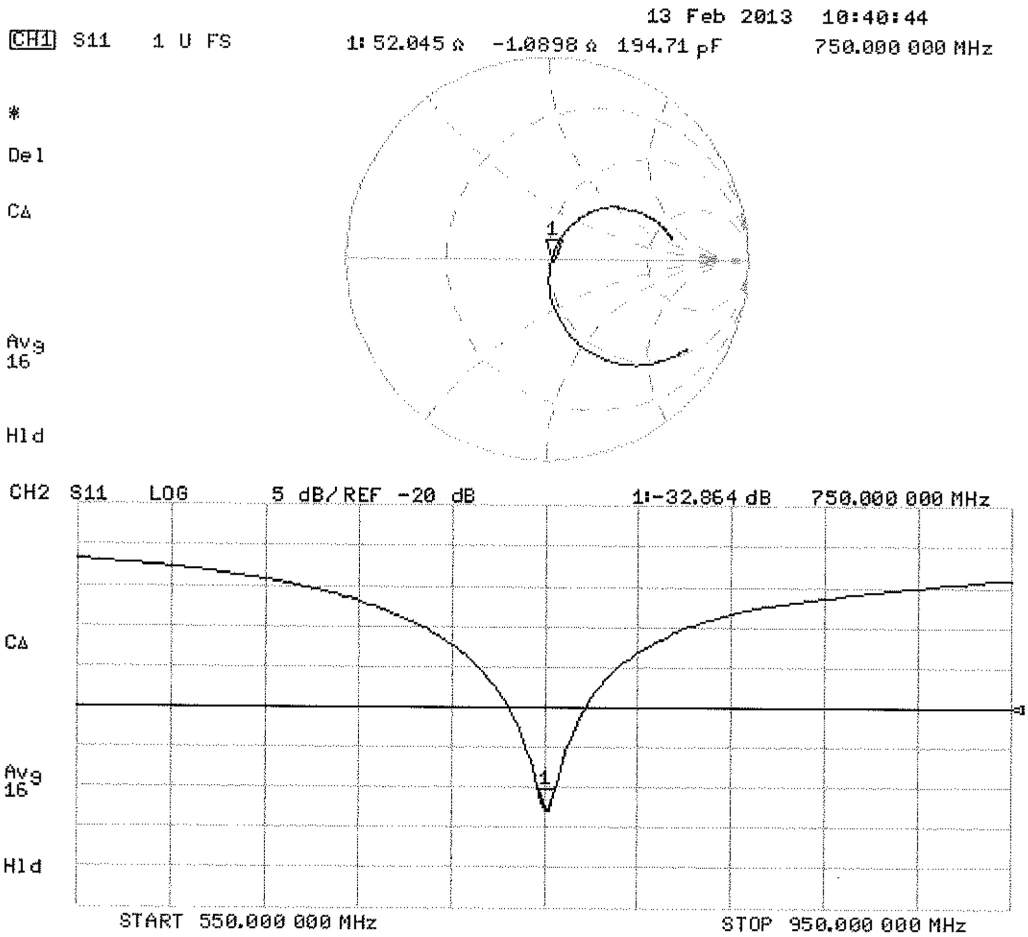
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.942 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.29 W/kg
SAR(1 g) = 2.25 W/kg; SAR(10 g) = 1.49 W/kg
Maximum value of SAR (measured) = 2.61 W/kg



0 dB = 2.61 W/kg = 4.17 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client **PC Test**

Certificate No: D750V3-1003_Jan13

CALIBRATION CERTIFICATE

Object	D750V3 - SN: 1003
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	January 07, 2013

✓ KOK 1/28/13

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

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

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	*(signature)*
Approved by:	Katja Pokovic	Technical Manager	*(signature)*

Issued: January 8, 2013

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.4 ± 6 %	0.89 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.12 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.46 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.51 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.8 ± 6 %	0.97 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.23 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**8.83 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.48 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**5.87 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	56.1 Ω - 0.2 jΩ
Return Loss	- 24.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.6 Ω - 3.5 jΩ
Return Loss	- 29.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.043 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	January 21, 2009

DASY5 Validation Report for Head TSL

Date: 07.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

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

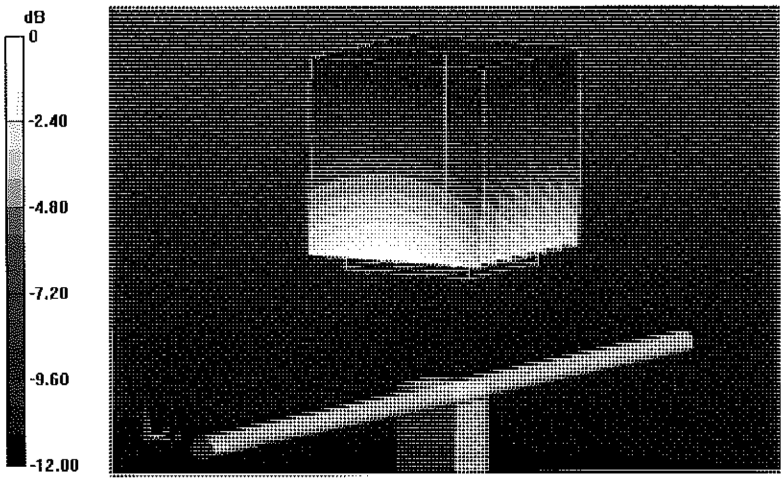
Communication System: CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; $\sigma = 0.89$ S/m; $\varepsilon_r = 41.4$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.28, 6.28, 6.28); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.4(1052); SEMCAD X 14.6.8(7028)

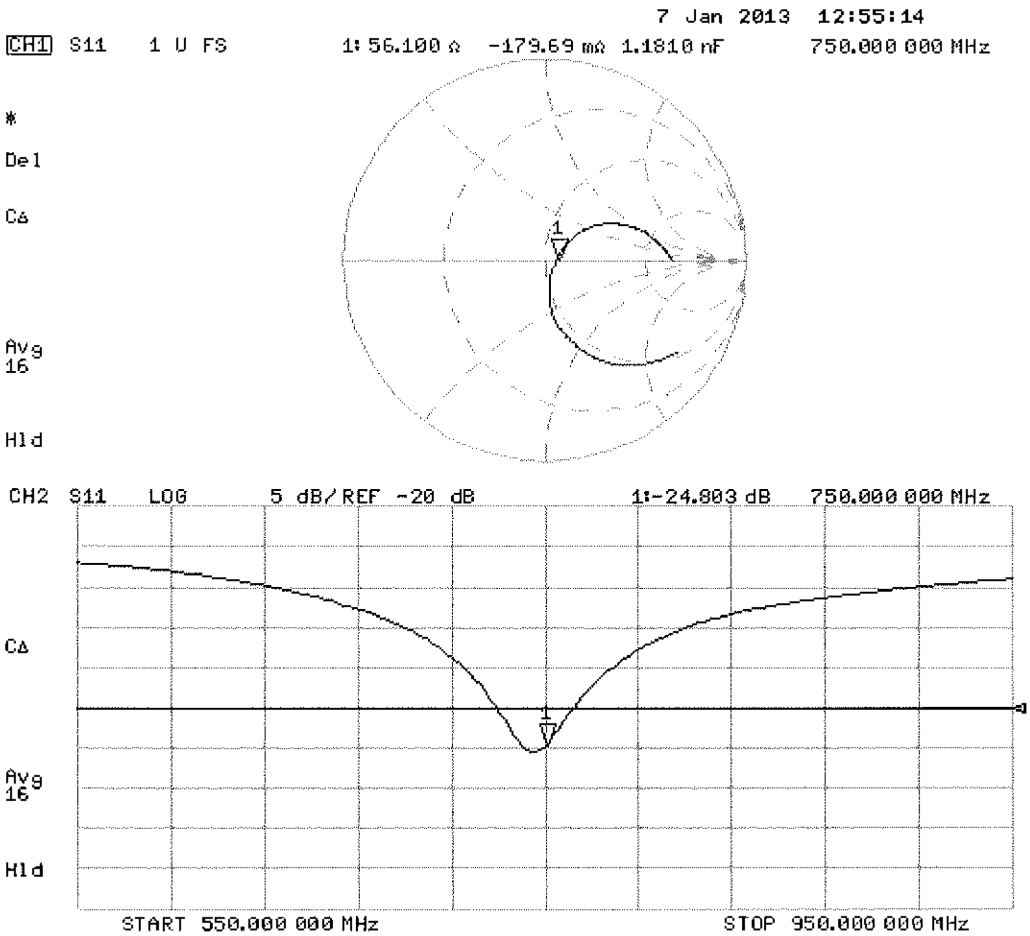
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.114 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.24 W/kg
SAR(1 g) = 2.12 W/kg; SAR(10 g) = 1.38 W/kg
Maximum value of SAR (measured) = 2.47 W/kg



0 dB = 2.47 W/kg = 3.93 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 07.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

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

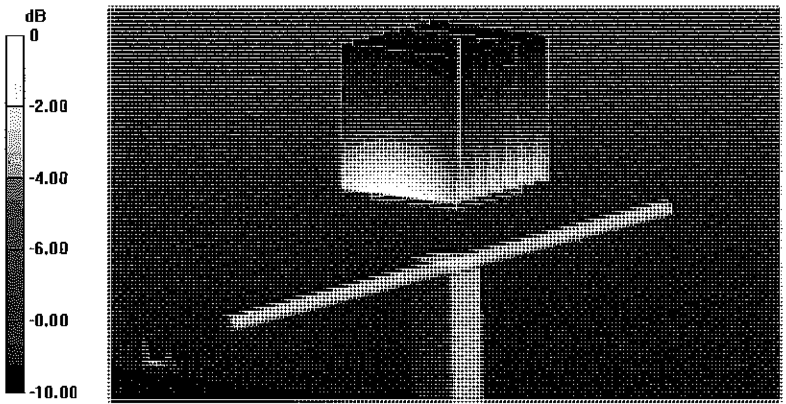
Communication System: CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.97 S/m; ε_r = 54.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.11, 6.11, 6.11); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.4(1052); SEMCAD X 14.6.8(7028)

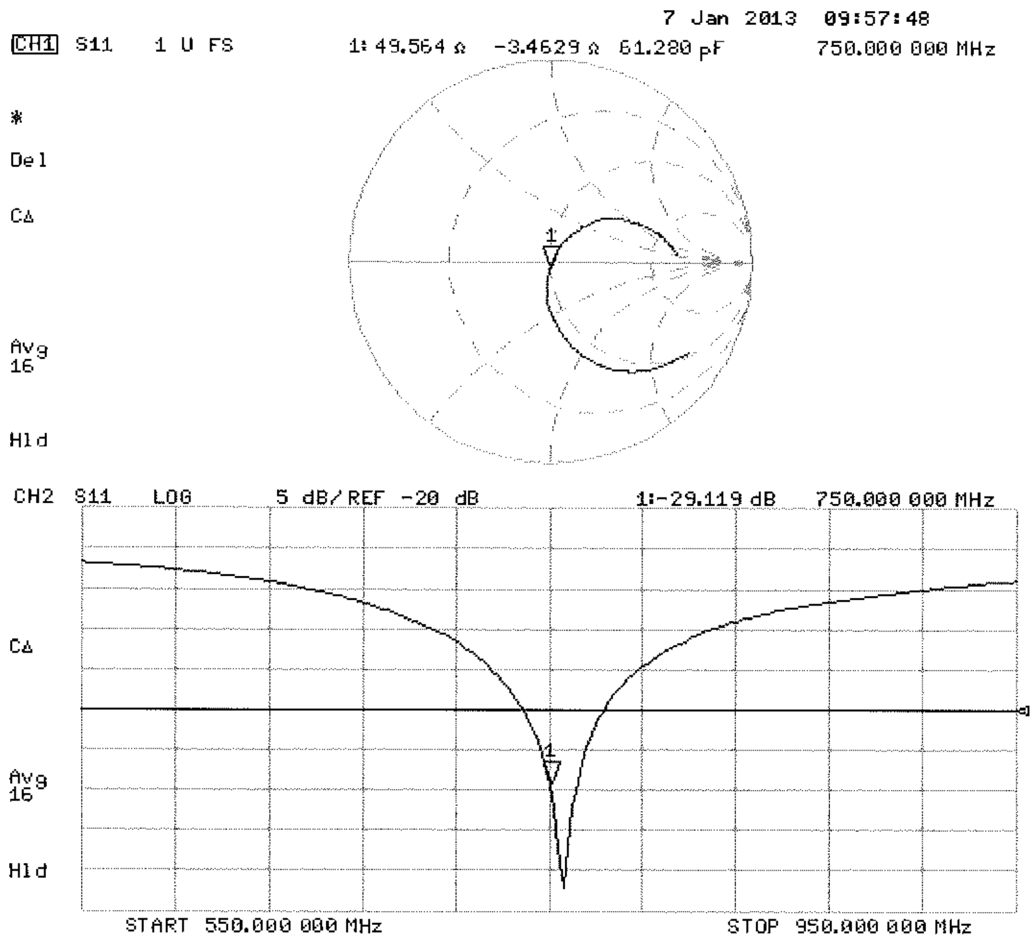
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.114 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.25 W/kg
SAR(1 g) = 2.23 W/kg; SAR(10 g) = 1.48 W/kg
Maximum value of SAR (measured) = 2.57 W/kg



0 dB = 2.57 W/kg = 4.10 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: **SCS 108**

Client PC Test

Certificate No: **D835V2-4d119_Apr12**

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d119
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	April 20, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12

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

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

Issued: April 20, 2012

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.1
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.1 ± 6 %	0.90 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.36 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**9.42 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.55 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**6.19 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.5 ± 6 %	1.01 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.47 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**9.56 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.62 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**6.31 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.3 Ω - 2.2 jΩ
Return Loss	- 32.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.8 Ω - 4.3 jΩ
Return Loss	- 25.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.386 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	June 29, 2010

DASY5 Validation Report for Head TSL

Date: 20.04.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

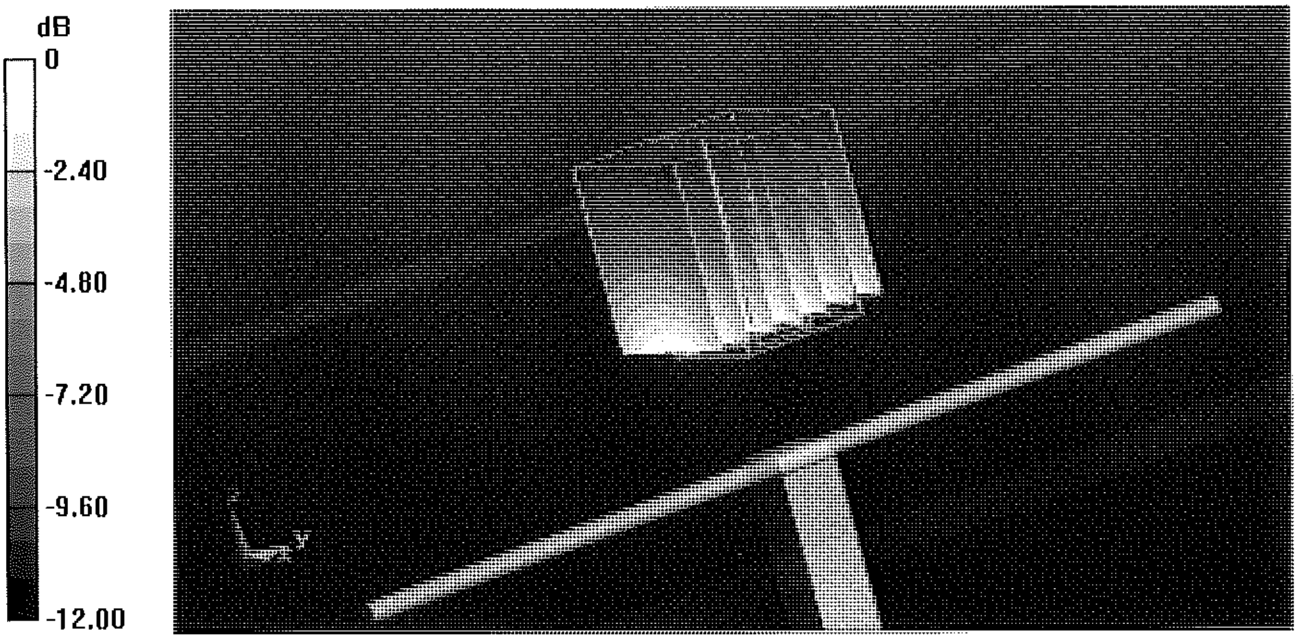
Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.9 mho/m; ε_r = 41.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.07, 6.07, 6.07); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

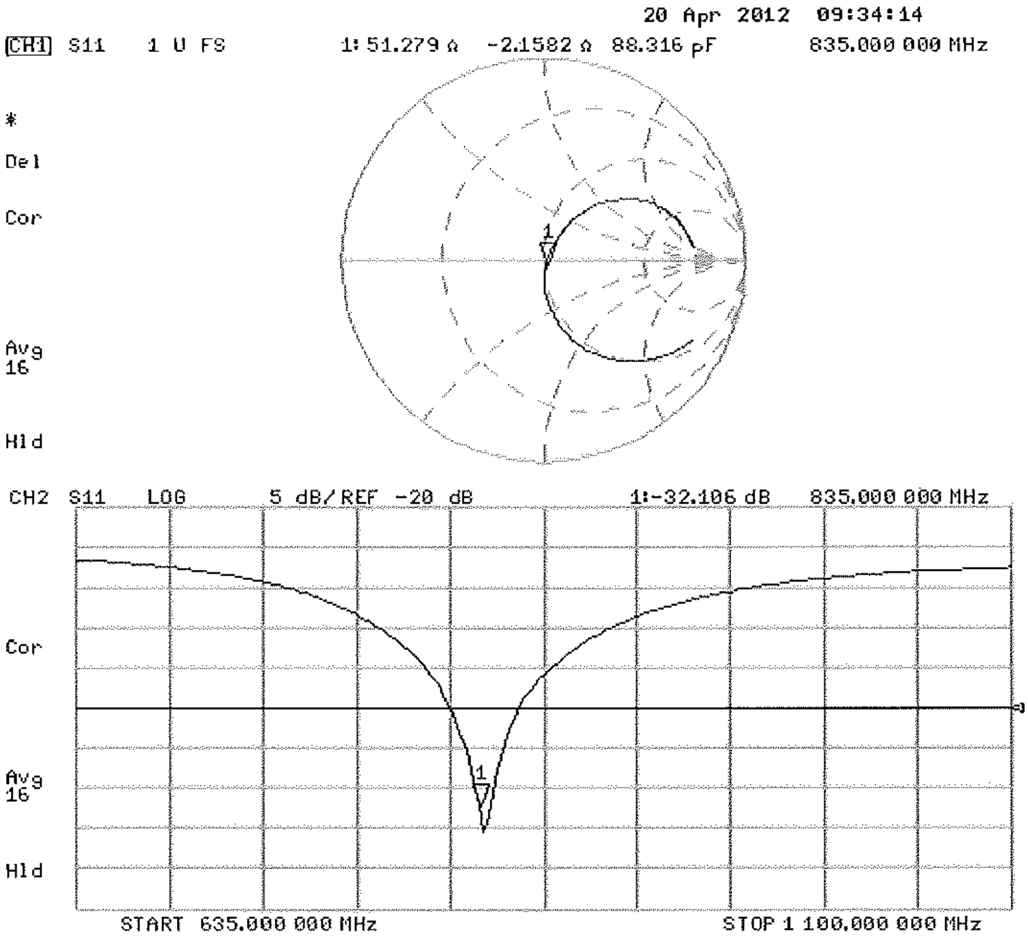
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.041 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 3.480 mW/g
SAR(1 g) = 2.36 mW/g; SAR(10 g) = 1.55 mW/g
Maximum value of SAR (measured) = 2.75 mW/g



0 dB = 2.75 mW/g = 8.79 dB mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 19.04.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

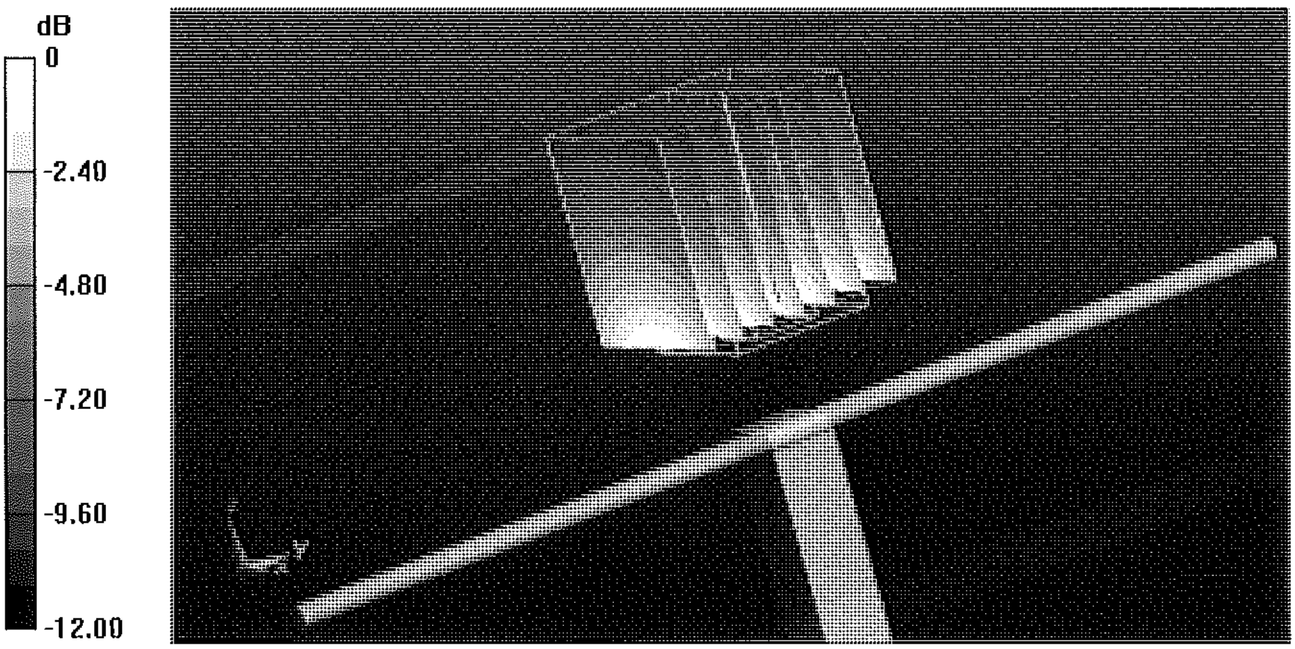
Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1.01 mho/m; ε_r = 54.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

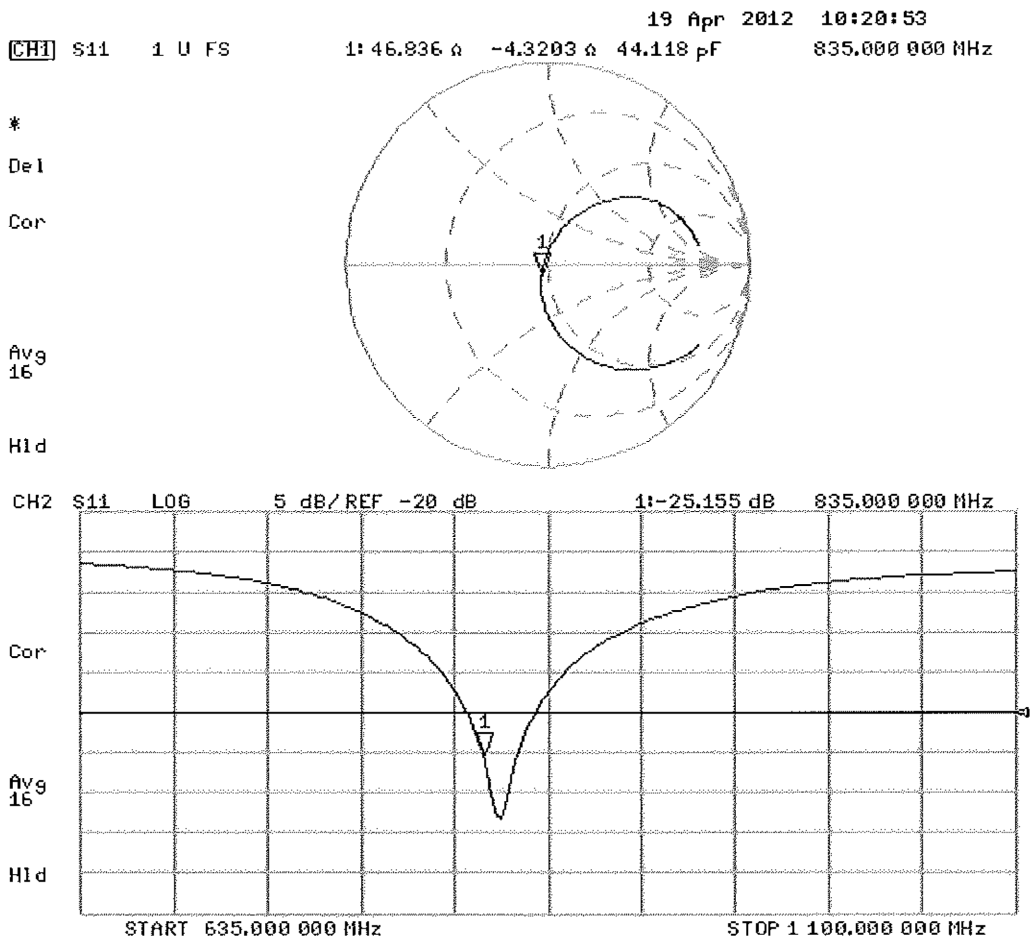
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.253 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.571 mW/g
SAR(1 g) = 2.47 mW/g; SAR(10 g) = 1.62 mW/g
Maximum value of SAR (measured) = 2.87 mW/g



0 dB = 2.87 mW/g = 9.16 dB mW/g

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client PC Test

Certificate No: D835V2-4d133_Feb12/2

CALIBRATION CERTIFICATE (Replacement of No:D835V2-4d133_Feb12)

Object	D835V2 - SN: 4d133
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	February 17, 2012

✓KOK 4/23/12

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5086 (20g)	29-Mar-11 (No. 217-01368)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12

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

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

Issued: April 16, 2012

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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.8 ± 6 %	0.89 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.34 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**9.45 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.53 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**6.17 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.7 ± 6 %	1.01 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.47 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**9.60 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.62 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**6.33 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.5 Ω - 2.9 jΩ
Return Loss	- 28.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.3 Ω - 5.1 jΩ
Return Loss	- 24.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.396 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 22, 2011

Date: 03.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

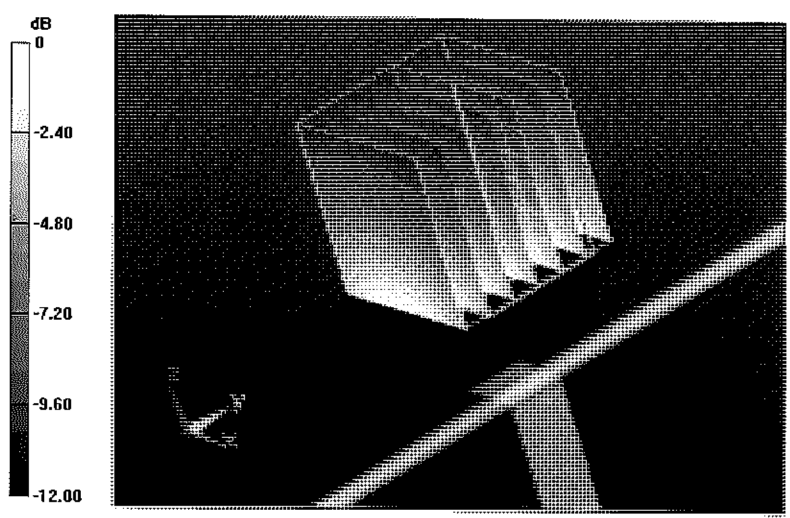
Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.89 mho/m; ε_r = 41.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.07, 6.07, 6.07); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

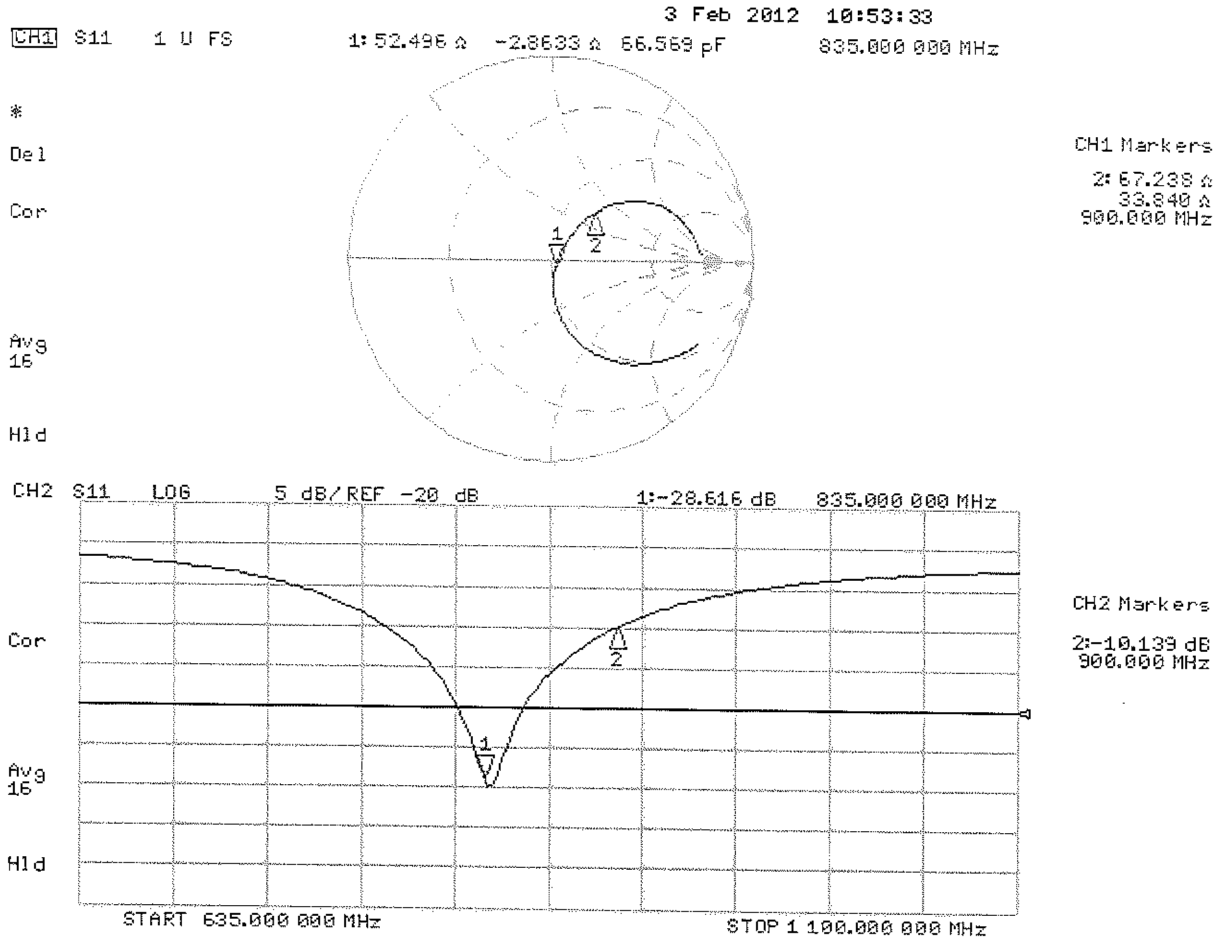
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.046 V/m; Power Drift = -0.0089 dB
Peak SAR (extrapolated) = 3.4450
SAR(1 g) = 2.34 mW/g; SAR(10 g) = 1.53 mW/g
Maximum value of SAR (measured) = 2.713 mW/g



0 dB = 2.710mW/g = 8.66 dB mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 17.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

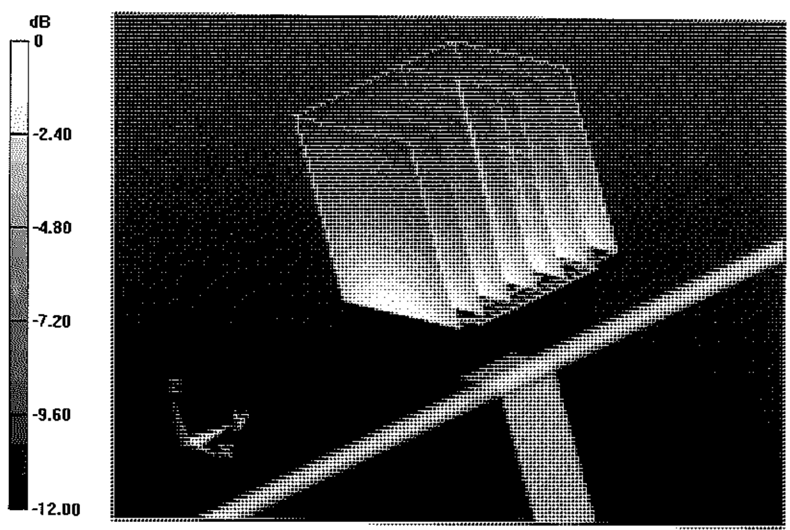
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d133

Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1.01 mho/m; ε_r = 55.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

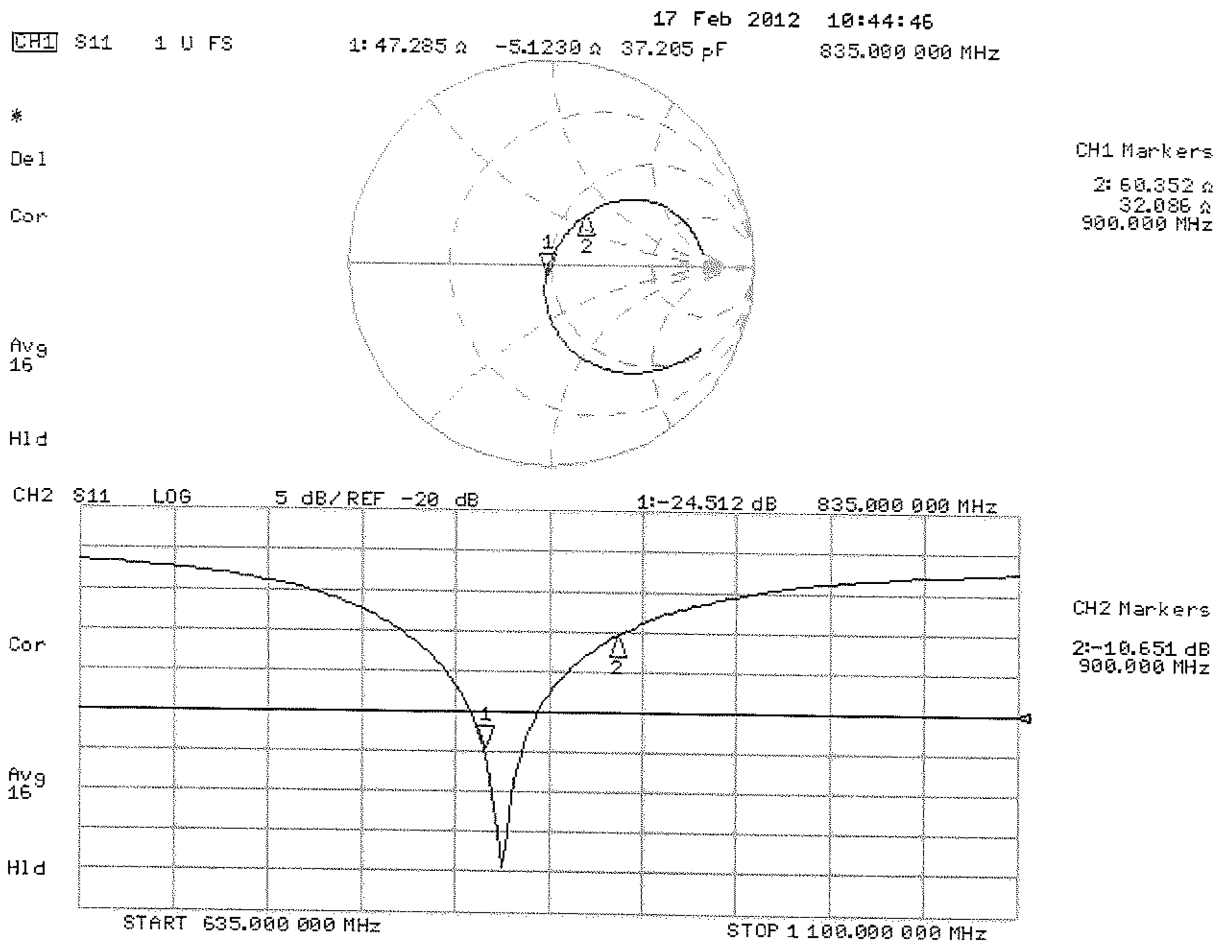
- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.163 V/m; Power Drift = 0.0044 dB
Peak SAR (extrapolated) = 3.5620
SAR(1 g) = 2.47 mW/g; SAR(10 g) = 1.62 mW/g
Maximum value of SAR (measured) = 2.866 mW/g



0 dB = 2.870mW/g = 9.16 dB mW/g

Impedance Measurement Plot for Body TSL



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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D835V2-4d026_Aug12**

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d026
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	August 23, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

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

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

Issued: August 23, 2012

Calibration Laboratory of
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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.3 ± 6 %	0.90 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.35 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**9.39 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.53 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**6.12 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.2 ± 6 %	1.00 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.47 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**9.58 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.62 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**6.33 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.7 Ω - 3.4 jΩ
Return Loss	- 26.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.6 Ω - 4.8 jΩ
Return Loss	- 26.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.389 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 17, 2004

DASY5 Validation Report for Head TSL

Date: 23.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

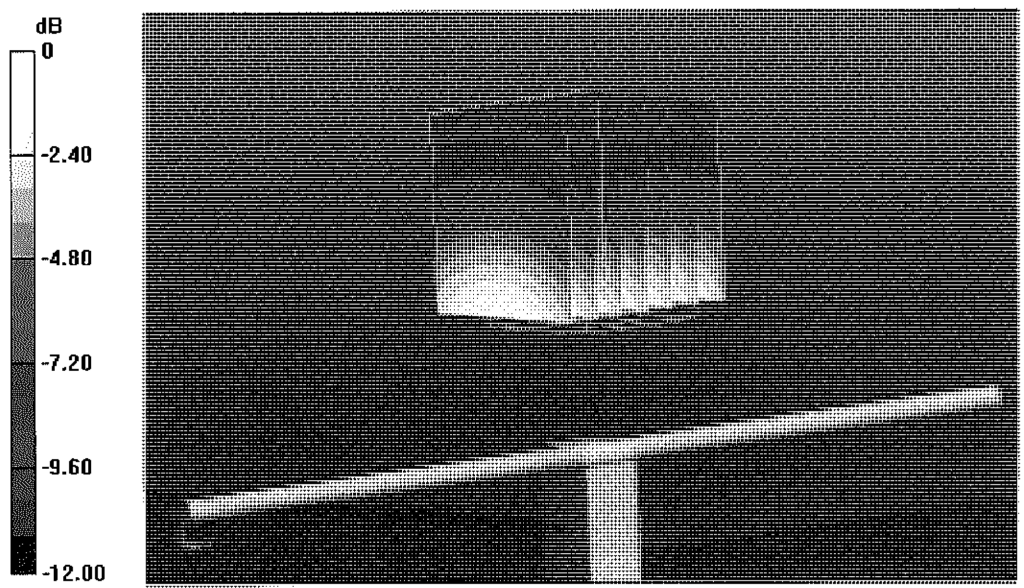
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d026

Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.9 mho/m; ε_r = 41.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

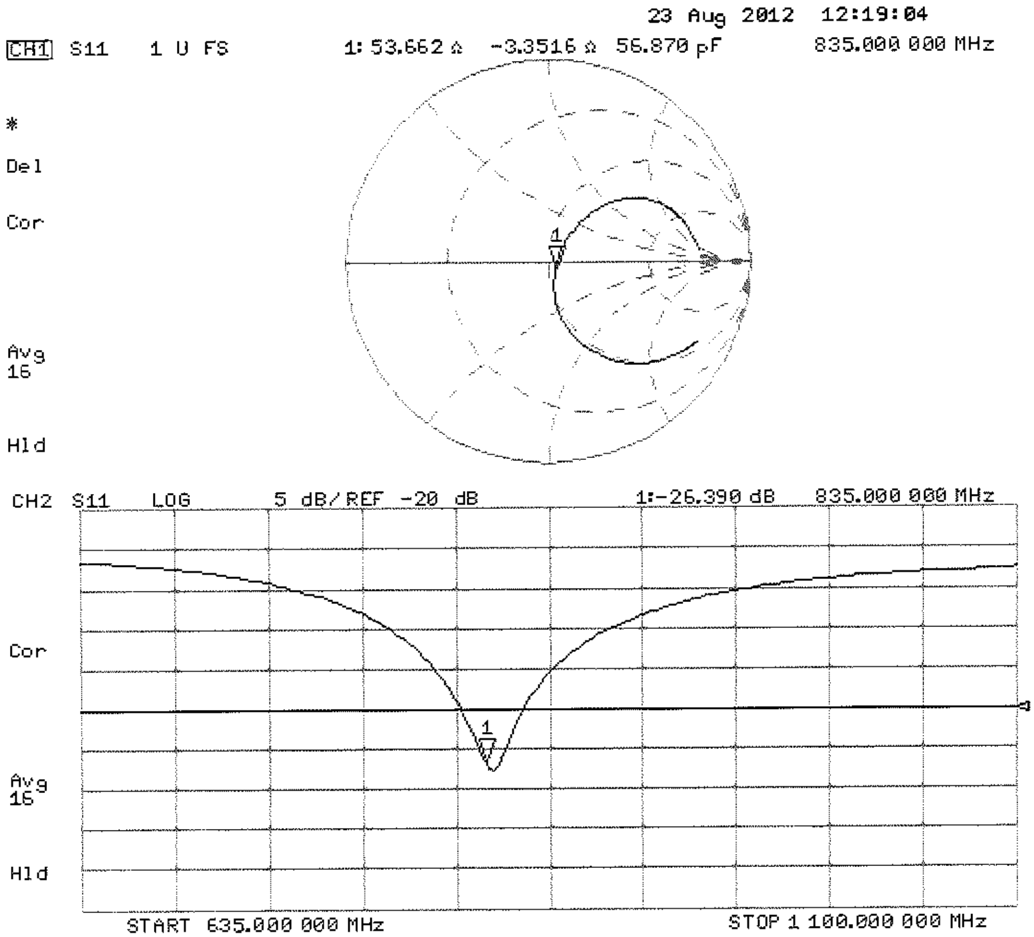
- Probe: ES3DV3 - SN3205; ConvF(6.07, 6.07, 6.07); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm 2/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.824 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.482 mW/g
SAR(1 g) = 2.35 mW/g; SAR(10 g) = 1.53 mW/g
Maximum value of SAR (measured) = 2.72 W/kg



0 dB = 2.72 W/kg = 8.69 dB W/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 23.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

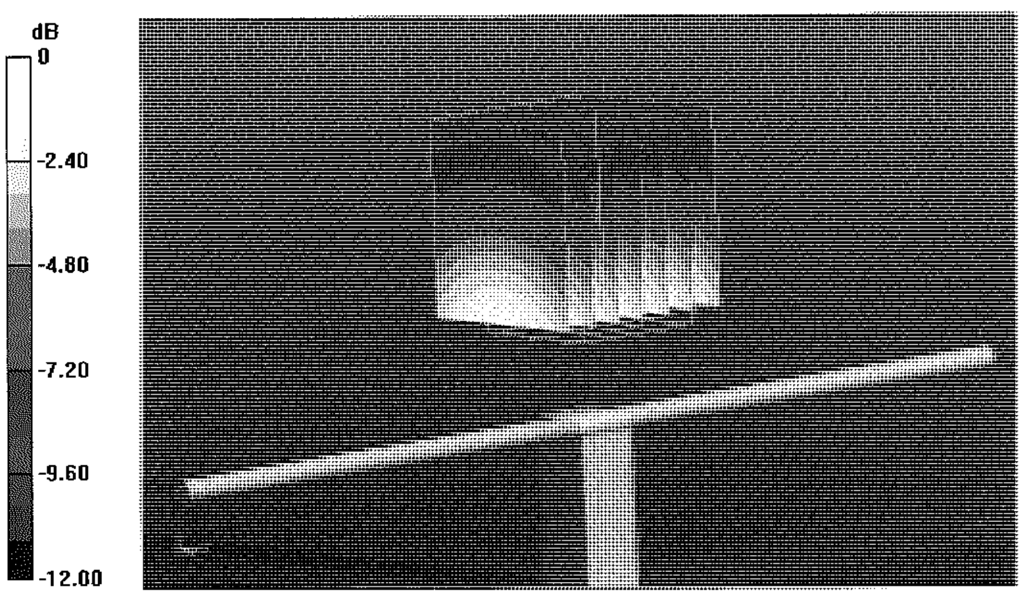
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d026

Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1 mho/m; ε_r = 53.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

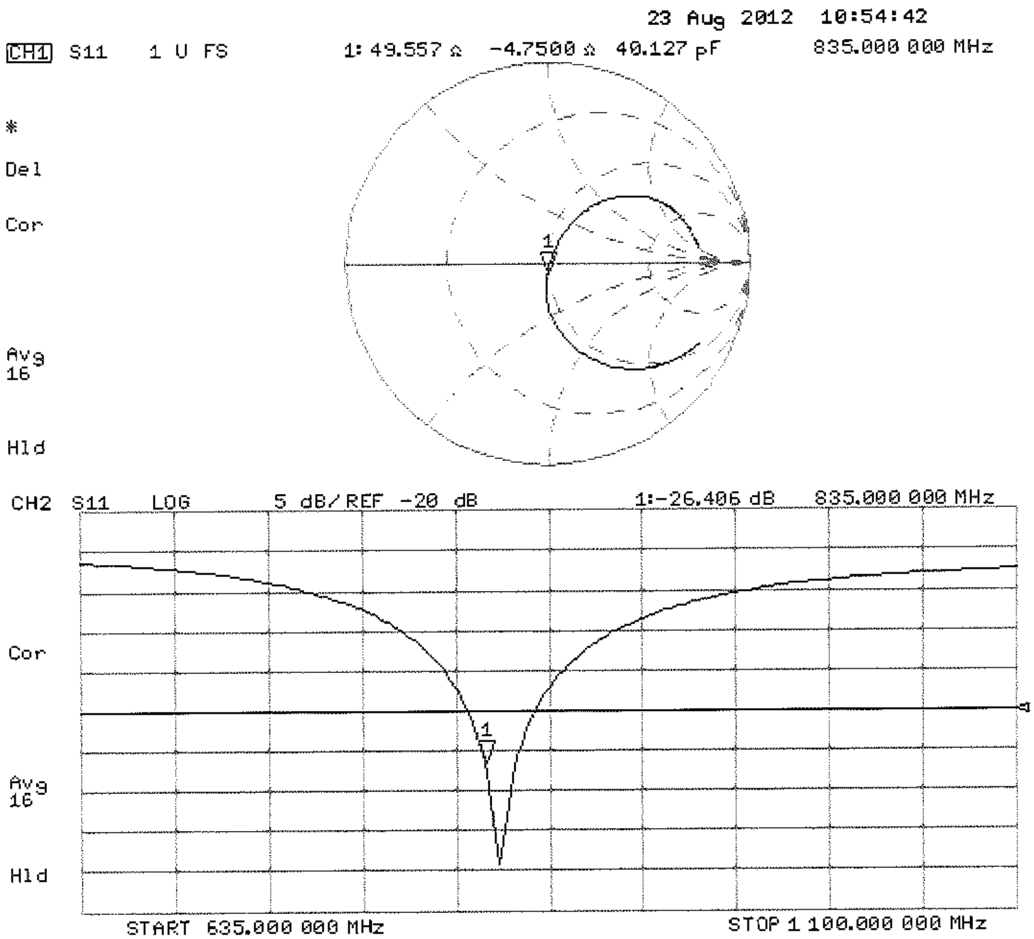
- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.339 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 3.592 mW/g
SAR(1 g) = 2.47 mW/g; SAR(10 g) = 1.62 mW/g
Maximum value of SAR (measured) = 2.87 W/kg



0 dB = 2.87 W/kg = 9.16 dB W/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client **PC Test**

Certificate No: ES3-3022_Aug12

CALIBRATION CERTIFICATE

Object: ES3DV2 - SN:3022

Calibration procedure(s): QA CAL-01.v8, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes

Calibration date: August 28, 2012

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	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 660	20-Jun-12 (No. DAE4-660_Jun12)	Jun-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Issued: August 28, 2012

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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	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

Calibration is Performed According to the Following Standards:

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

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, VRx,y,z: A, B, C* 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.

Probe ES3DV2

SN:3022

Manufactured: April 15, 2003
Calibrated: August 28, 2012

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

DASY/EASY - Parameters of Probe: ES3DV2 - SN:3022

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.00	1.04	0.99	± 10.1 %
DCP (mV)[B]	98.3	99.5	101.3	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
0	CW	0.00	X	0.00	0.00	1.00	133.3	±2.7 %
			Y	0.00	0.00	1.00	140.3	
			Z	0.00	0.00	1.00	178.9	

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 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV2 - SN:3022

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	6.30	6.30	6.30	0.30	1.72	± 12.0 %
835	41.5	0.90	6.03	6.03	6.03	0.35	1.63	± 12.0 %
1750	40.1	1.37	5.07	5.07	5.07	0.32	1.89	± 12.0 %
1900	40.0	1.40	4.86	4.86	4.86	0.40	1.57	± 12.0 %
2450	39.2	1.80	4.23	4.23	4.23	0.59	1.44	± 12.0 %
2600	39.0	1.96	4.10	4.10	4.10	0.67	1.37	± 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.

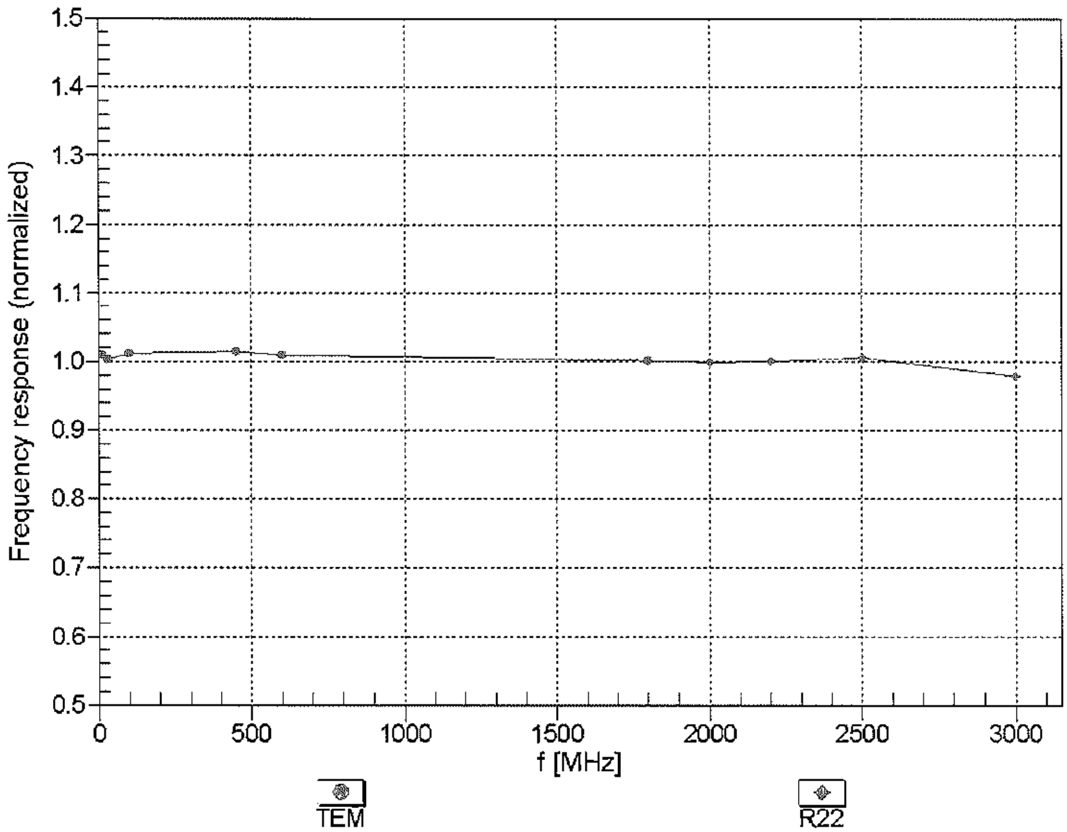
DASY/EASY - Parameters of Probe: ES3DV2 - SN:3022

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	6.07	6.07	6.07	0.23	2.09	± 12.0 %
835	55.2	0.97	6.02	6.02	6.02	0.47	1.44	± 12.0 %
1750	53.4	1.49	4.70	4.70	4.70	0.46	1.55	± 12.0 %
1900	53.3	1.52	4.43	4.43	4.43	0.36	1.87	± 12.0 %
2450	52.7	1.95	3.97	3.97	3.97	0.65	1.06	± 12.0 %
2600	52.5	2.16	3.80	3.80	3.80	0.54	0.75	± 12.0 %

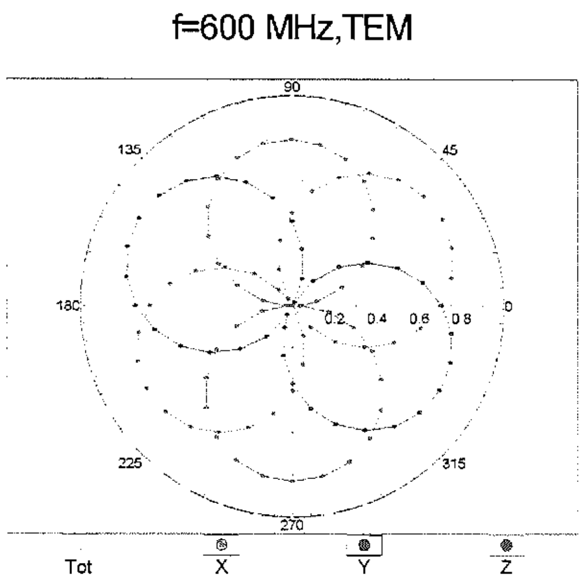
[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of 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.

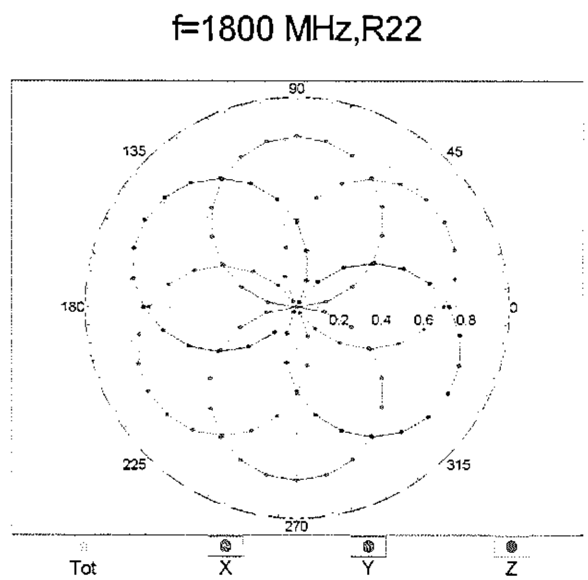
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)

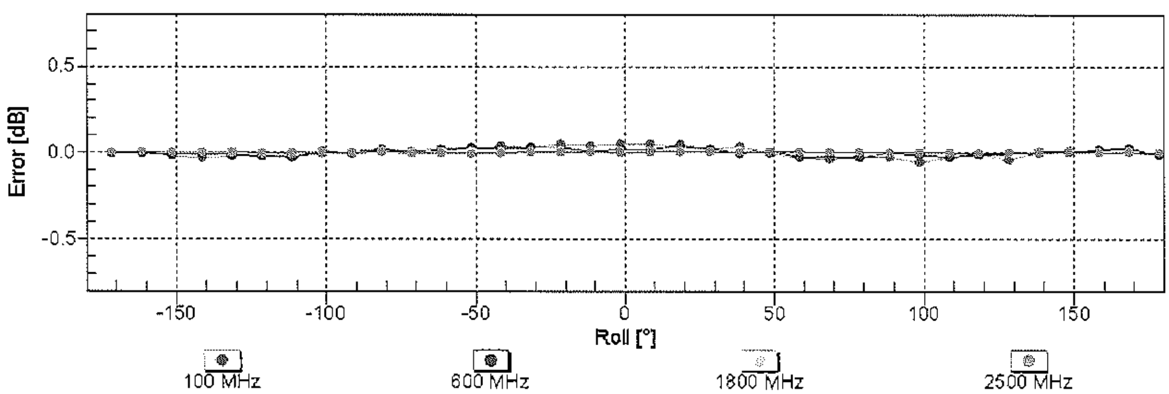


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°

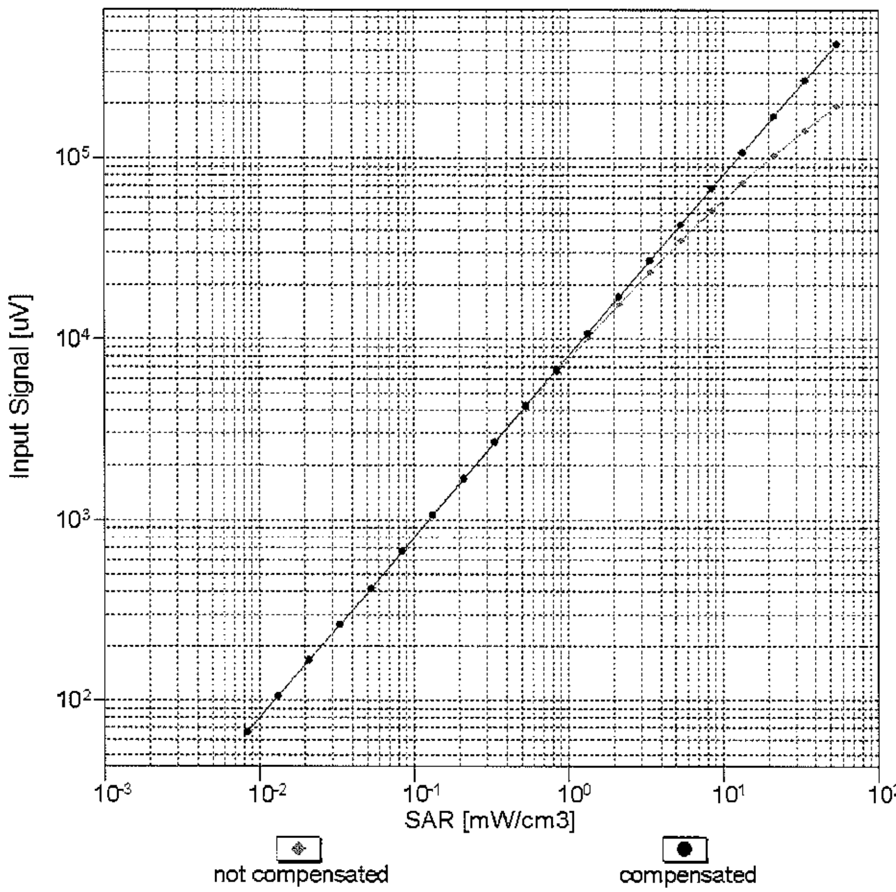


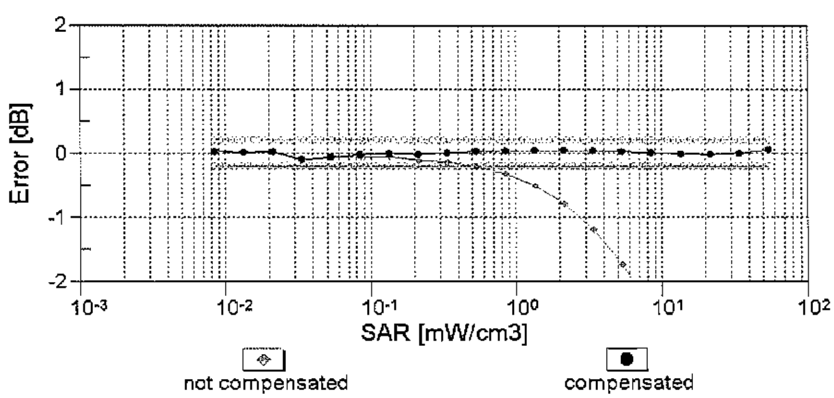




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

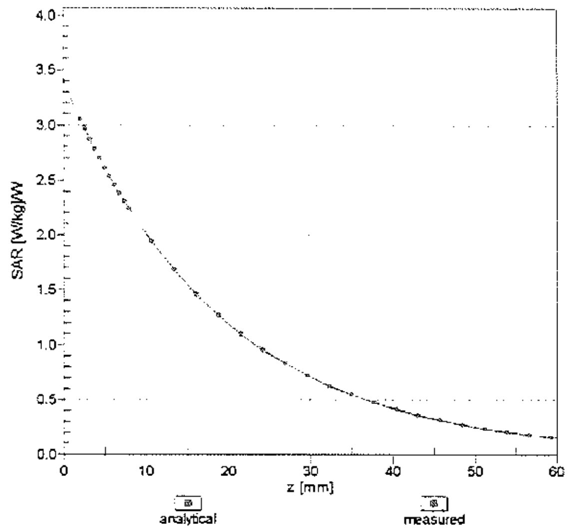




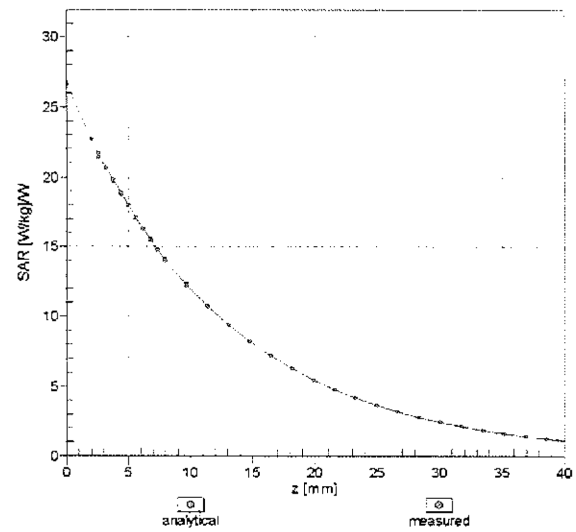
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

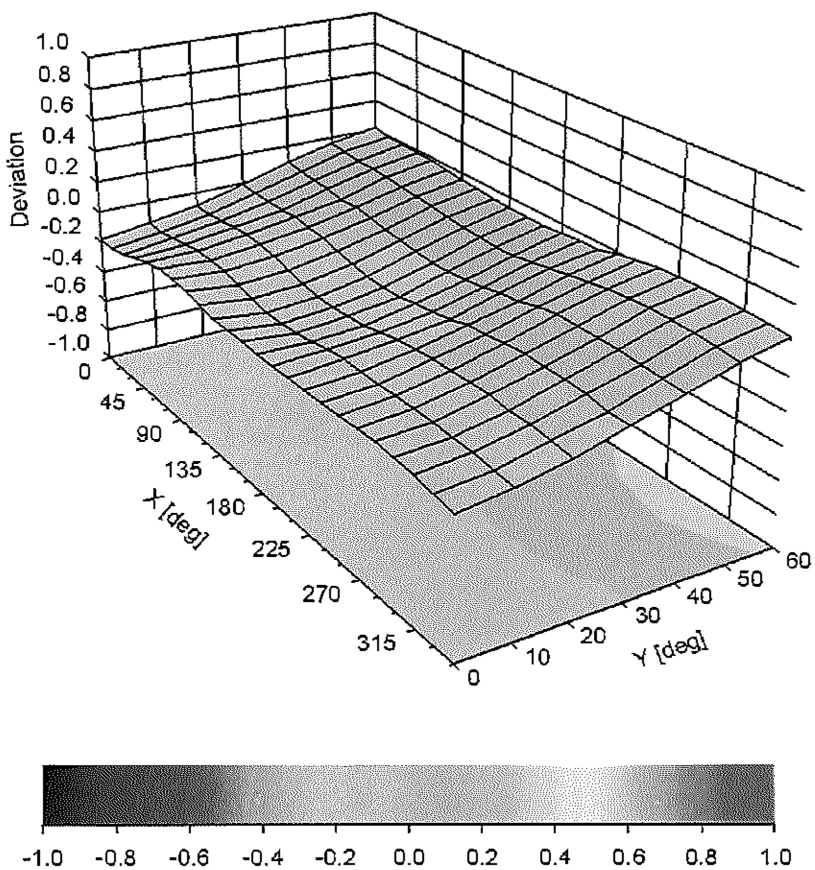


f = 1750 MHz,WGLS R22 (H_convF)



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: ES3DV2 - SN:3022

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	98.5
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **ES3-3213_Apr12**

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3213

Calibration procedure(s): QA CAL-01.v8, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes

Calibration date: April 24, 2012

KOK 5/2/12

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	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 660	10-Jan-12 (No. DAE4-660_Jan12)	Jan-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

	Name	Function	Signature
Calibrated by:	Dimce Iliev	Laboratory Technician	D. Iliev
Approved by:	Katja Pokovic	Technical Manager	

Issued: April 25, 2012

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	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

Calibration is Performed According to the Following Standards:

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

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, VRx,y,z: A, B, C* 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.

Probe ES3DV3

SN:3213

Manufactured: October 14, 2008
Calibrated: April 24, 2012

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]	1.48	1.36	1.33	± 10.1 %
DCP (mV)[B]	97.8	101.0	99.1	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
0	CW	0.00	X	0.00	0.00	1.00	125.2	±2.5 %
			Y	0.00	0.00	1.00	127.5	
			Z	0.00	0.00	1.00	169.0	

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

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN: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	Depth (mm)	Unct. (k=2)
750	41.9	0.89	6.32	6.32	6.32	0.50	1.38	± 12.0 %
835	41.5	0.90	6.07	6.07	6.07	0.41	1.57	± 12.0 %
1640	40.3	1.29	5.36	5.36	5.36	0.64	1.24	± 12.0 %
1750	40.1	1.37	5.22	5.22	5.22	0.57	1.39	± 12.0 %
1900	40.0	1.40	5.02	5.02	5.02	0.63	1.32	± 12.0 %
2450	39.2	1.80	4.43	4.43	4.43	0.80	1.22	± 12.0 %
2600	39.0	1.96	4.26	4.26	4.26	0.72	1.36	± 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.

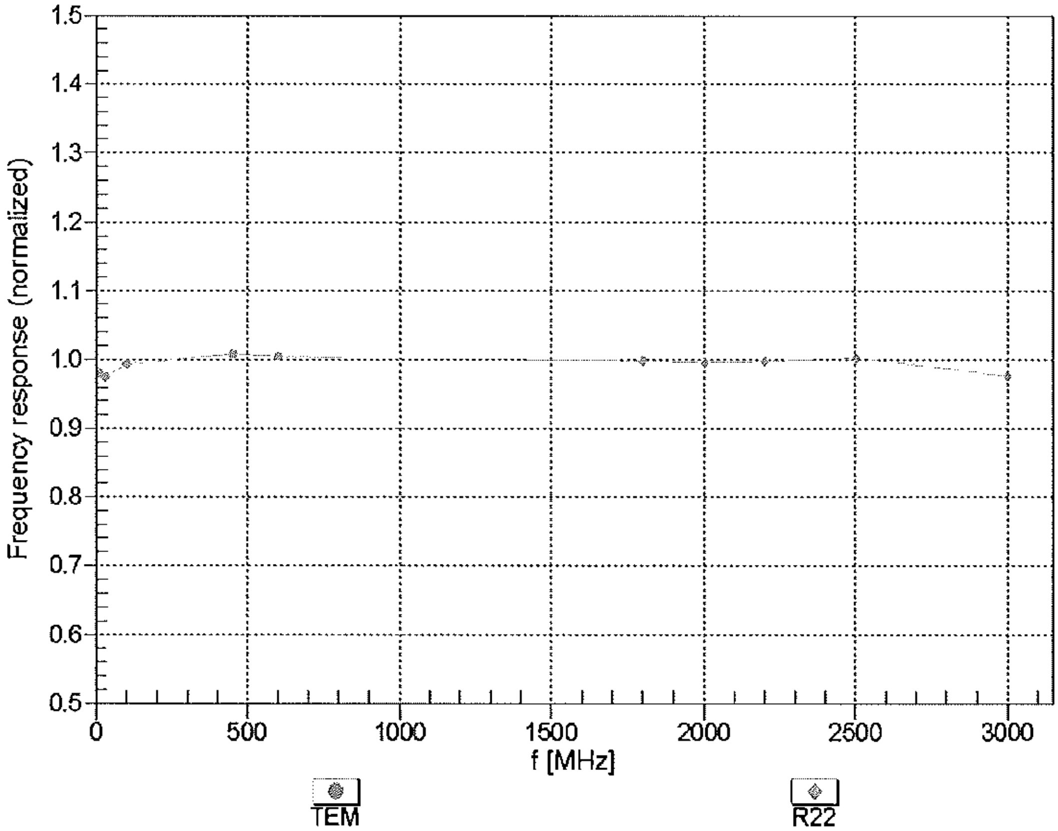
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3213

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	Depth (mm)	Unct. (k=2)
750	55.5	0.96	6.19	6.19	6.19	0.31	1.96	± 12.0 %
835	55.2	0.97	6.07	6.07	6.07	0.38	1.73	± 12.0 %
1640	53.8	1.40	5.13	5.13	5.13	0.35	2.07	± 12.0 %
1750	53.4	1.49	4.68	4.68	4.68	0.54	1.56	± 12.0 %
1900	53.3	1.52	4.50	4.50	4.50	0.69	1.37	± 12.0 %
2450	52.7	1.95	4.11	4.11	4.11	0.80	1.04	± 12.0 %
2600	52.5	2.16	3.91	3.91	3.91	0.63	0.92	± 12.0 %

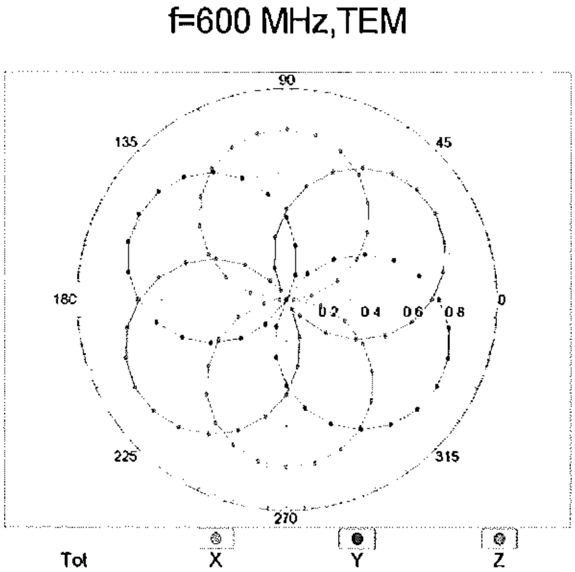
[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of 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.

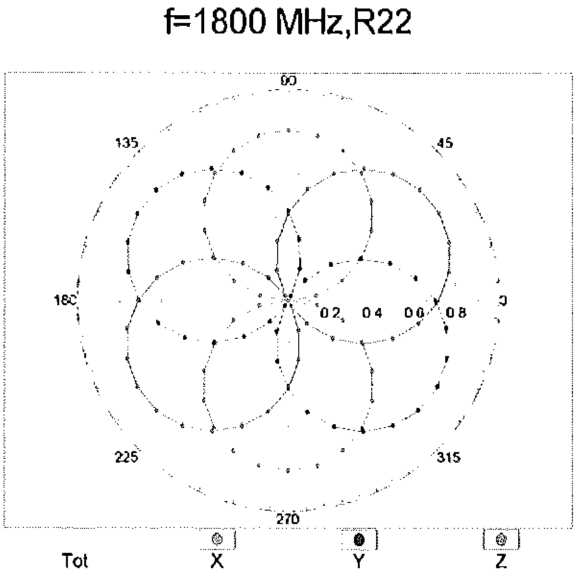
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)

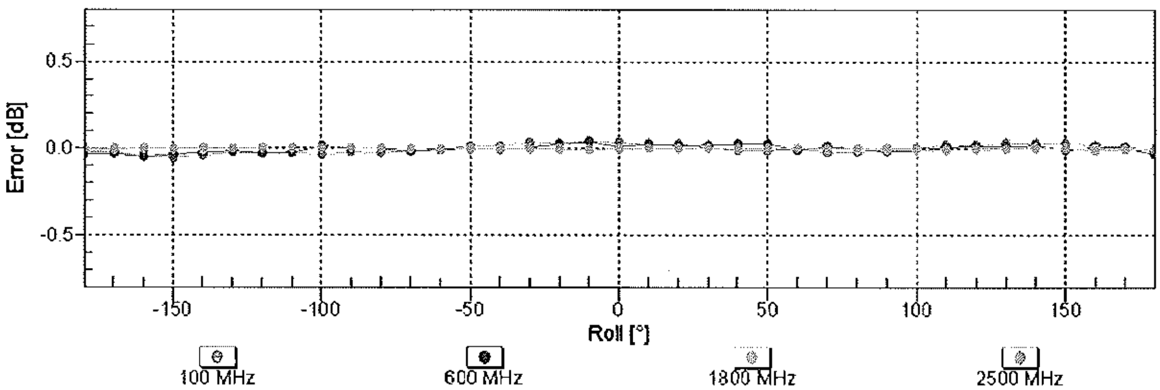


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°

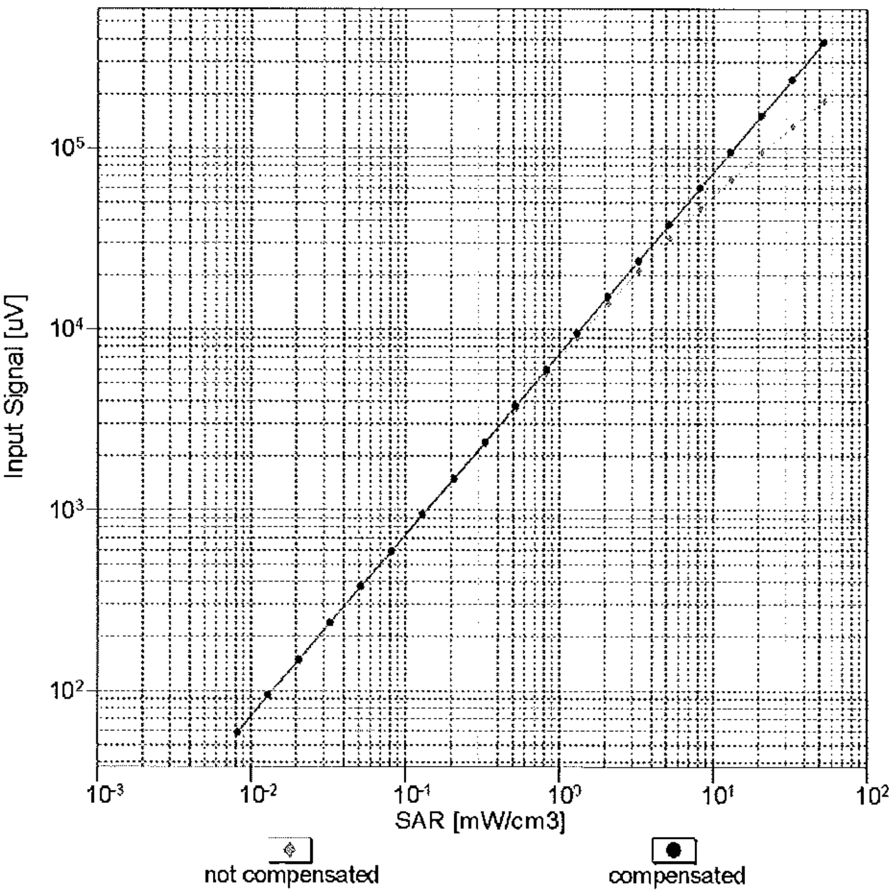


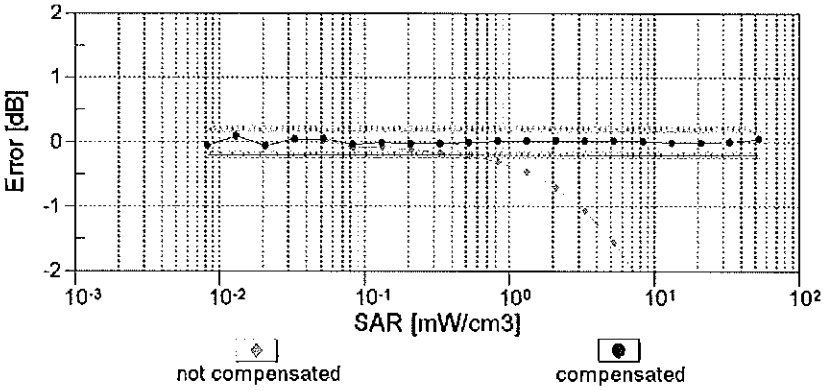




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

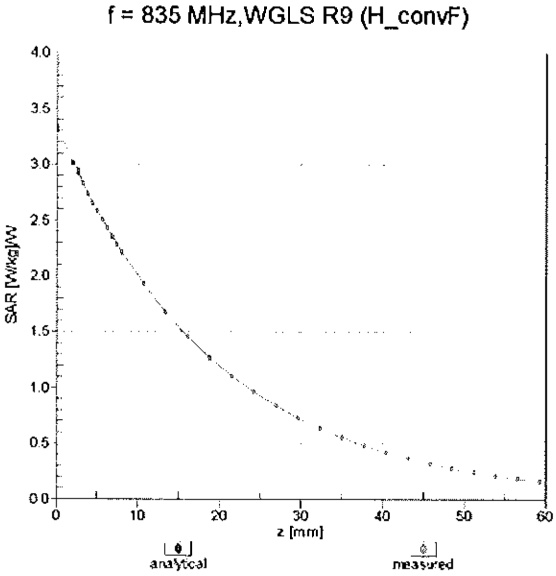
Dynamic Range f(SAR_{head})
(TEM cell , f = 900 MHz)

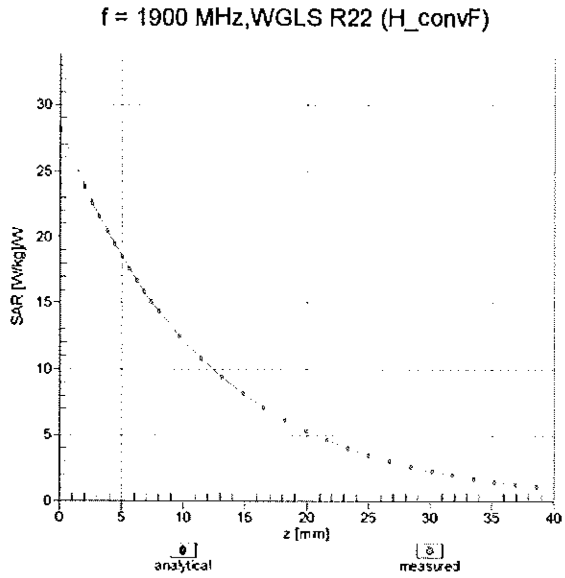




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

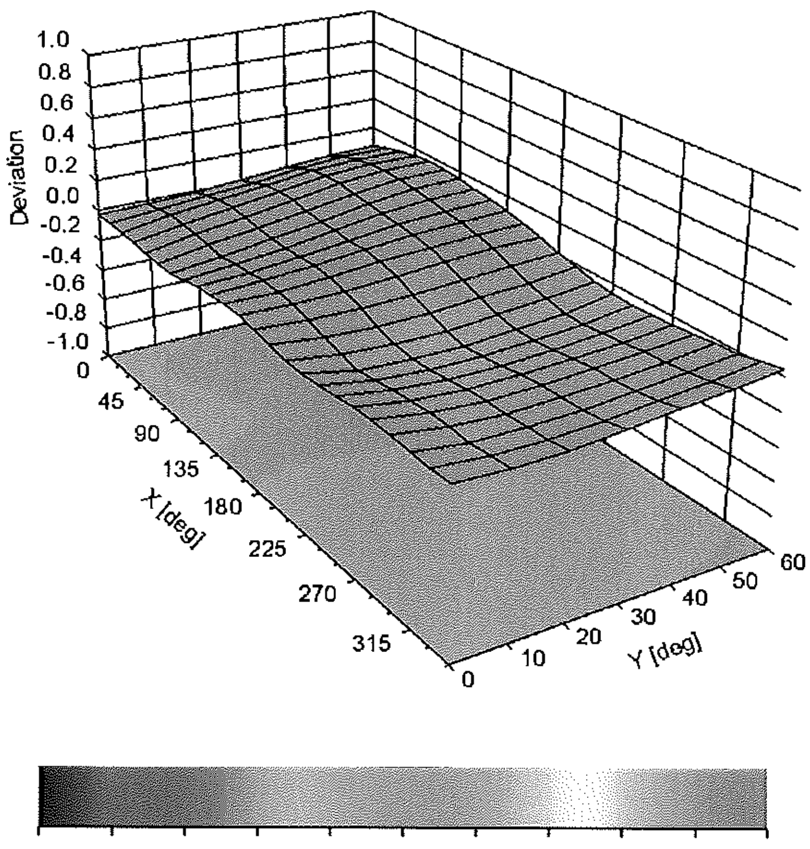
Conversion Factor Assessment





Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	140.1
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