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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:
11/16/15 - 11/27/15
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Document Serial No.:
0Y1511161949-R2.ZNF

FCC ID: **ZNFLS675**

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

DUT Type: Portable Handset
Application Type: Certification
FCC Rule Part(s): CFR §2.1093
Model(s): LG-LS675, LGLS675, LS675

Equipment Class	Band & Mode	Tx Frequency	SAR		
			1 gm Head (W/kg)	1 gm Body-Worn (W/kg)	1 gm Hotspot (W/kg)
PCE	GSM/GPRS/EDGE 850	824.20 - 848.80 MHz	0.37	0.52	0.52
PCE	GSM/GPRS/EDGE 1900	1850.20 - 1909.80 MHz	0.31	0.36	0.36
PCE	UMTS 850	826.40 - 846.60 MHz	0.45	0.61	0.61
PCE	UMTS 1900	1852.4 - 1907.6 MHz	0.57	0.64	0.64
PCE	CDMA/EVDO BC10 (§90S)	817.90 - 823.10 MHz	0.35	0.48	0.51
PCE	CDMA/EVDO BC0 (§22H)	824.70 - 848.31 MHz	0.53	0.72	0.74
PCE	PCS CDMA/EVDO	1851.25 - 1908.75 MHz	0.66	0.73	0.82
PCE	LTE Band 26 (Cell)	814.7 - 848.3 MHz	0.38	0.59	0.59
PCE	LTE Band 25 (PCS)	1850.7 - 1914.3 MHz	0.62	0.78	0.78
PCE	LTE Band 41	2498.5 - 2687.5 MHz	0.15	0.37	0.39
DTS	2.4 GHz WLAN	2412 - 2462 MHz	0.38	< 0.1	< 0.1
DSS/DTS	Bluetooth	2402 - 2480 MHz	N/A		
Simultaneous SAR per KDB 690783 D01v01r03:			1.04	1.06	0.89

Note: This revised Test Report (S/N: 0Y1511161949-R2.ZNF) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

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

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

Randy Ortanez
President

TESTING CERT#2041.01

The SAR Tick is an initiative of the Mobile Manufacturers Forum (MMF). While a product may be considered eligible, use of the SAR Tick logo requires an agreement with the MMF. Further details can be obtained by emailing: sartick@mmfai.info.

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1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
GSM/GPRS/EDGE 850	Voice/Data	824.20 - 848.80 MHz
GSM/GPRS/EDGE 1900	Voice/Data	1850.20 - 1909.80 MHz
UMTS 850	Voice/Data	826.40 - 846.60 MHz
UMTS 1900	Voice/Data	1852.4 - 1907.6 MHz
CDMA/EVDO BC10 (§90S)	Voice/Data	817.90 - 823.10 MHz
CDMA/EVDO BC0 (§22H)	Voice/Data	824.70 - 848.31 MHz
PCS CDMA/EVDO	Voice/Data	1851.25 - 1908.75 MHz
LTE Band 26 (Cell)	Data	814.7 - 848.3 MHz
LTE Band 25 (PCS)	Data	1850.7 - 1914.3 MHz
LTE Band 41	Data	2498.5 - 2687.5 MHz
2.4 GHz WLAN	Data	2412 - 2462 MHz
Bluetooth	Data	2402 - 2480 MHz

1.2 Nominal and Maximum Output Power Specifications

This device operates using the following maximum and nominal output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01.

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**	**26.7**
	Nominal	**33.2**	**33.2**	**31.2**	**27.2**	**26.2**
GSM/GPRS/EDGE 1900	Maximum	**29.7**	**29.7**	**27.7**	**26.7**	**25.7**
	Nominal	**29.2**	**29.2**	**27.2**	**26.2**	**25.2**

Mode / Band		Modulated Average (dBm)		
		3GPP WCDMA	*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)
CDMA/EVDO BC10 (§90S)	Maximum	**24.7**
	Nominal	**24.2**
CDMA/EVDO BC0 (§22H)	Maximum	**24.7**
	Nominal	**24.2**
PCS CDMA/EVDO	Maximum	**24.7**
	Nominal	**24.2**

Mode / Band		Modulated Average (dBm)
LTE Band 26 (Cell)	Maximum	**23.7**
	Nominal	**23.2**
LTE Band 25 (PCS)	Maximum	**23.7**
	Nominal	**23.2**
LTE Band 41	Maximum	**23.5**
	Nominal	**23.0**

Mode / Band		Modulated Average (dBm)
IEEE 802.11b (2.4 GHz)	Maximum	**17.5**
	Nominal	**16.5**
IEEE 802.11g (2.4 GHz) Channels 1 and 11	Maximum	**11.5**
	Nominal	**10.5**
IEEE 802.11g (2.4 GHz) Channels 2-10	Maximum	**13.5**
	Nominal	**12.5**
IEEE 802.11n (2.4 GHz)	Maximum	**10.5**
	Nominal	**9.5**
Bluetooth	Maximum	**11.0**
	Nominal	**7.0**
Bluetooth LE	Maximum	**3.0**
	Nominal	**-1.0**

1.3 DUT Antenna Locations

The overall dimensions of this device are ≥9 x 5 cm. The overall diagonal dimension of the device is ≤160 mm and the diagonal display is ≤150 mm. A diagram showing the location of the device antennas can be found in Appendix F.

Table 1-1
Device Edges/Sides for SAR Testing

Mode	Back	Front	Top	Bottom	Right	Left
GPRS 850	Yes	Yes	No	Yes	Yes	Yes
GPRS 1900	Yes	Yes	No	Yes	No	Yes
UMTS 850	Yes	Yes	No	Yes	Yes	Yes
UMTS 1900	Yes	Yes	No	Yes	No	Yes
CDMA/EVDO BC10 (§90S)	Yes	Yes	No	Yes	Yes	Yes
CDMA/EVDO BC0 (§22H)	Yes	Yes	No	Yes	Yes	Yes
PCS CDMA/EVDO	Yes	Yes	No	Yes	No	Yes
LTE Band 26 (Cell)	Yes	Yes	No	Yes	Yes	Yes
LTE Band 25 (PCS)	Yes	Yes	No	Yes	No	Yes
LTE Band 41	Yes	Yes	No	Yes	Yes	Yes
2.4 GHz WLAN	Yes	Yes	Yes	No	Yes	No

Note: Particular DUT edges were not required to be evaluated for wireless router SAR if the edges were greater than 2.5 cm from the transmitting antenna according to FCC KDB Publication 941225 D06 guidance, page 2. The distances between the transmit antennas and the edges of the device are included in the filing.

1.4 Simultaneous Transmission Capabilities

According to FCC KDB Publication 447498 D01, 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 1-1 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 1-1
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 D01 3) procedures.

Table 1-2
Simultaneous Transmission Scenarios

No.	Capable Transmit Configuration	Head	Body-Worn Accessory	Wireless Router	Notes
1	1x CDMA voice + 2.4 GHz WI-FI	Yes	Yes	N/A	
2	1x CDMA voice + 2.4 GHz Bluetooth	N/A	Yes	N/A	
3	GSM voice + 2.4 GHz WI-FI	Yes	Yes	N/A	
4	GSM voice + 2.4 GHz Bluetooth	N/A	Yes	N/A	
5	UMTS + 2.4 GHz WI-FI	Yes	Yes	Yes	
6	UMTS + 2.4 GHz Bluetooth	N/A	Yes	N/A	
7	LTE + 2.4 GHz WI-FI	Yes*	Yes*	Yes	*-Pre-installed VOIP applications are considered.
8	LTE + 2.4 GHz Bluetooth	N/A	Yes*	N/A	*-Pre-installed VOIP applications are considered.
9	CDMA/EVDO data + 2.4 GHz WI-FI	Yes*	Yes*	Yes	*-Pre-installed VOIP applications are considered.
10	CDMA/EVDO data + 2.4 GHz Bluetooth	N/A	Yes*	N/A	*-Pre-installed VOIP applications are considered.
11	GPRS/EDGE + 2.4 GHz WI-FI	Yes*	Yes*	Yes	*-Pre-installed VOIP applications are considered.
12	GPRS/EDGE + 2.4 GHz Bluetooth	N/A	Yes*	N/A	*-Pre-installed VOIP applications are considered.

1. 2.4 GHz WLAN and 2.4 GHz Bluetooth share the same antenna path and cannot transmit simultaneously.
2. All licensed modes share the same antenna path and cannot transmit simultaneously.
3. 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.
4. Per the manufacturer, WIFI Direct is expected to be used in conjunction with a held-to-ear or body-worn accessory voice call. Simultaneous transmission scenarios involving WIFI direct are specified above.

1.5 Miscellaneous SAR Test Considerations

(A) BT

Per FCC KDB 447498 D01, the 1g 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, body-worn Bluetooth SAR was not required; $[(13/10)* \sqrt{2.480}] = 2.0 \leq 3.0$. Per KDB Publication 447498 D01, the maximum power of the channel was rounded to the nearest mW before calculation.

(B) Licensed Transmitter(s)

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

This device is only capable of QPSK HSUPA in the uplink. Therefore, no additional SAR tests are required beyond that described for devices with HSUPA in KDB 941225 D01.

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 D05.

CDMA 1X Advanced technology was not required for SAR since the maximum allowed output powers for 1x Advanced was not more than 0.25 dB higher than the maximum powers for 1x and the measured SAR in any 1x mode exposure conditions was not greater than 1.2 W/kg per FCC KDB Publication 941225 D01.

1.6 Power Reduction for SAR

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

1.7 Guidance Applied

- IEEE 1528-2003
- FCC KDB Publication 941225 D01, D05, D06 (2G/3G/4G, Hotspot and CDMA 2000 1x Advanced)
- FCC KDB Publication 248227 D01 (SAR Considerations for 802.11 Devices)
- FCC KDB Publication 447498 D01 (General SAR Guidance)
- FCC KDB Publication 865664 D01, D02 (SAR Measurements up to 6 GHz)
- October 2013 TCB Workshop Notes (GPRS Testing Considerations)

1.8 Device Serial Numbers

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

	Head Serial Number	Body-Worn Serial Number	Hotspot Serial Number
GSM/GPRS/EDGE 850	01890	01891	01891
GSM/GPRS/EDGE 1900	01890	01890	01890
UMTS 850	01890	01891	01891
UMTS 1900	01890	01890	01890
CDMA/EVDO BC10 (§90S)	01890	01891	01891
CDMA/EVDO BC0 (§22H)	01890	01891	01891
PCS CDMA/EVDO	01890	01890	01890
LTE Band 26 (Cell)	01891	01891	01891
LTE Band 25 (PCS)	01890	01890	01890
LTE Band 41	01891	01891	01891
2.4 GHz WLAN	01892	01892	01892

2 LTE INFORMATION

LTE Information					
FCC ID	**ZNFLS675**				
Form Factor	Portable Handset				
Frequency Range of each LTE transmission band	LTE Band 26 (Cell) (814.7 - 848.3 MHz)				
	LTE Band 25 (PCS) (1850.7 - 1914.3 MHz)				
	LTE Band 41 (2498.5 - 2687.5 MHz)				
Channel Bandwidths	LTE Band 26 (Cell): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz				
	LTE Band 25 (PCS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz				
	LTE Band 41: 5 MHz, 10 MHz, 15 MHz, 20 MHz				
Channel Numbers and Frequencies (MHz)	Low	Low-Mid	Mid	Mid-High	High
LTE Band 26 (Cell): 1.4 MHz	814.7 (26697)		831.5 (26865)	848.3 (27033)	
LTE Band 26 (Cell): 3 MHz	815.5 (26705)		831.5 (26865)	847.5 (27025)	
LTE Band 26 (Cell): 5 MHz	816.5 (26715)		831.5 (26865)	846.5 (27015)	
LTE Band 26 (Cell): 10 MHz	819 (26740)		831.5 (26865)	844 (26990)	
LTE Band 26 (Cell): 15 MHz	831.5 (26865)		836.5 (26915)	841.5 (26965)	
LTE Band 25 (PCS): 1.4 MHz	1850.7 (26047)		1882.5 (26365)	1914.3 (26683)	
LTE Band 25 (PCS): 3 MHz	1851.5 (26055)		1882.5 (26365)	1913.5 (26675)	
LTE Band 25 (PCS): 5 MHz	1852.5 (26065)		1882.5 (26365)	1912.5 (26665)	
LTE Band 25 (PCS): 10 MHz	1855 (26090)		1882.5 (26365)	1910 (26640)	
LTE Band 25 (PCS): 15 MHz	1857.5 (26115)		1882.5 (26365)	1907.5 (26615)	
LTE Band 25 (PCS): 20 MHz	1860 (26140)		1882.5 (26365)	1905 (26590)	
LTE Band 41: 5 MHz	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
LTE Band 41: 10 MHz	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
LTE Band 41: 15 MHz	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
LTE Band 41: 20 MHz	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055)	2680 (41490)
UE Category	4				
Modulations Supported in UL	QPSK, 16QAM				
LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3~6.2.5? (manufacturer attestation to be provided)	YES				
A-MPR (Additional MPR) disabled for SAR Testing?	YES				

3 INTRODUCTION

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

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz [3] and Health Canada RF Exposure Guidelines Safety Code 6 [22]. The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave [4] is used for guidance in measuring the Specific Absorption Rate (SAR) due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the International Committee for Non-Ionizing Radiation Protection (ICNIRP) in Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," Report No. Vol 74. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

3.1 SAR Definition

Specific Absorption Rate is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Equation 3-1).

Equation 3-1
SAR Mathematical Equation

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

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

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

where:

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

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

4 DOSIMETRIC ASSESSMENT

4.1 Measurement Procedure

The evaluation was performed using the following procedure compliant to FCC KDB Publication 865664 D01 and IEEE 1528-2013:

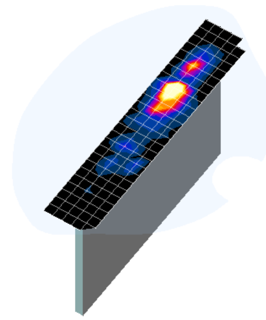

Figure 4-1
Sample SAR Area Scan

1. The SAR distribution at the exposed side of the head or body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head and body interface and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01 (See Table 4-1) and IEEE 1528-2013.
2. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during the 1g/10g cube evaluation. SAR at this fixed point was measured and used as a reference value.
3. Based on the area scan data, the peak of the region with maximum SAR was determined by spline interpolation. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB Publication 865664 D01 (See Table 4-1) and IEEE 1528-2013. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual online for more details):
   a. SAR values at the inner surface of the phantom are extrapolated from the measured values along the line away from the surface with spacing no greater than that in Table 4-1. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).
   b. After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were obtained through interpolation, in order to calculate the averaged SAR.
   c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.

Table 4-1
Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01*

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

*Also compliant to IEEE 1528-2013 Table 6

5 DEFINITION OF REFERENCE POINTS

5.1 EAR REFERENCE POINT

Figure 5-2 shows the front, back and side views of the SAM Twin Phantom. The point "M" is the reference point for the center of the mouth, "LE" is the left ear reference point (ERP), and "RE" is the right ERP. The ERP is 15mm posterior to the entrance to the ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 5-1. The plane passing through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck-Front), also called the Reference Pivoting Line, is not perpendicular to the reference plane (see Figure 5-1). Line B-M is perpendicular to the N-F line. Both N-F and B-M lines are marked on the external phantom shell to facilitate handset positioning [5].

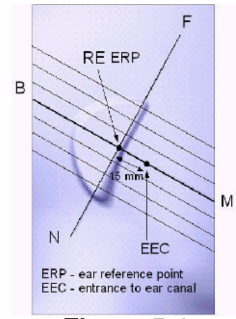

Figure 5-1
Close-Up Side view of ERP

5.2 HANDSET REFERENCE POINTS

Two imaginary lines on the handset were established: the vertical centerline and the horizontal line. The test device was placed in a normal operating position with the acoustic output located along the "vertical centerline" on the front of the device aligned to the "ear reference point" (See Figure 5-3). The acoustic output was than located at the same level as the center of the ear reference point. The test device was positioned so that the "vertical centerline" was bisecting the front surface of the handset at its top and bottom edges, positioning the "ear reference point" on the outer surface of the both the left and right head phantoms on the ear reference point.

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

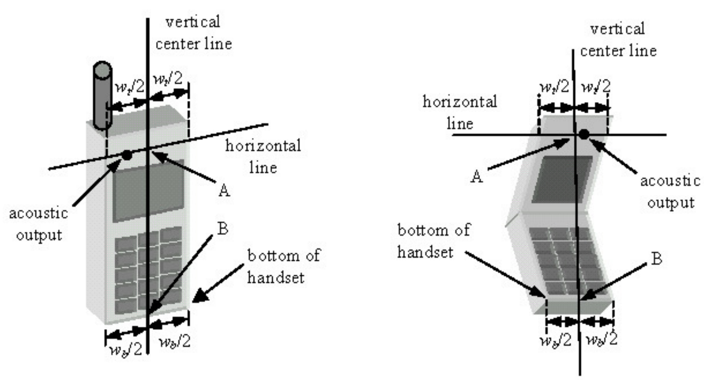

Figure 5-3
Handset Vertical Center & Horizontal Line Reference Points

6 TEST CONFIGURATION POSITIONS FOR HANDSETS

6.1 Device Holder

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

6.2 Positioning for Cheek

1. The test device was positioned with the device close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 6-1), such that the plane defined by the vertical center line and the horizontal line of the phone is approximately parallel to the sagittal plane of the phantom.

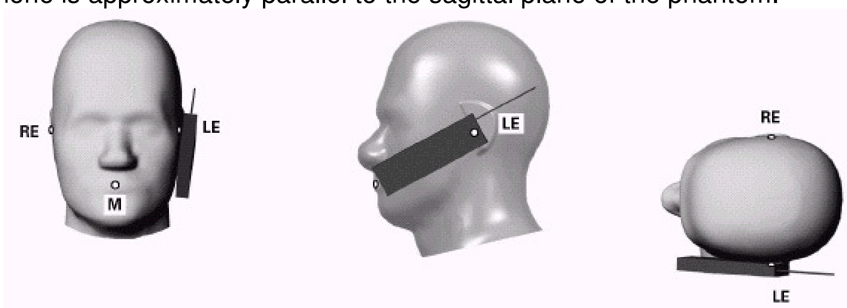

Figure 6-1 Front, Side and Top View of Cheek Position

2. The handset was translated towards the phantom along the line passing through RE & LE until the handset touches the pinna.
3. While maintaining the handset in this plane, the handset was rotated around the LE-RE line until the vertical centerline was in the reference plane.
4. The phone was then rotated around the vertical centerline until the phone (horizontal line) was symmetrical was respect to the line NF.
5. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE, and maintaining the device contact with the ear, the device was rotated about the NF line until any point on the handset made contact with a phantom point below the ear (cheek) (See Figure 6-2).

6.3 Positioning for Ear / 15º Tilt

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

1. While maintaining the orientation of the phone, the phone was retracted parallel to the reference plane far enough to enable a rotation of the phone by 15degrees.
2. The phone was then rotated around the horizontal line by 15 degrees.
3. While maintaining the orientation of the phone, the phone was moved parallel to the reference plane until any part of the handset touched the head. (In this position, point A was located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact was at any location other than the pinna, the angle of the phone would then be reduced. In this situation, the tilted position was obtained when any part of the phone was in contact of the ear as well as a second part of the phone was in contact with the head (see Figure 6-2).

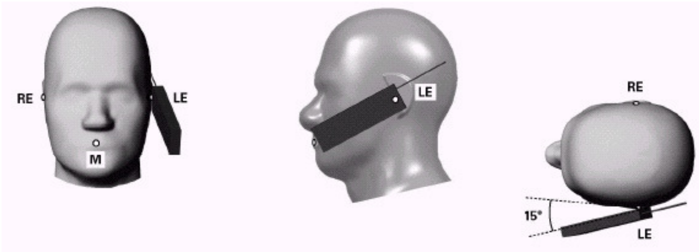

Figure 6-2 Front, Side and Top View of Ear/15º Tilt Position

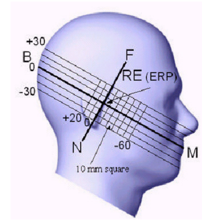

Figure 6-3
Side view w/ relevant markings

6.4 Body-Worn Accessory Configurations

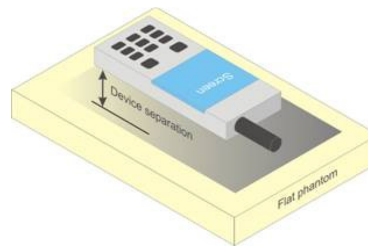

Figure 6-4
Sample Body-Worn Diagram

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 6-4). Per FCC KDB Publication 648474 D04, 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 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.

6.5 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 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 D01 procedures. The "Portable Hotspot" feature on the handset was NOT activated during SAR assessments, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal at a time.

7 RF EXPOSURE LIMITS

7.1 Uncontrolled Environment

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

7.2 Controlled Environment

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

Table 7-1
SAR Human Exposure Specified in ANSI/IEEE C95.1-1992 and Health Canada Safety Code 6

HUMAN EXPOSURE LIMITS		
	UNCONTROLLED ENVIRONMENT *General Population* (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT *Occupational* (W/kg) or (mW/g)
Peak Spatial Average SAR Head	1.6	8.0
Whole Body SAR	0.08	0.4
Peak Spatial Average SAR Hands, Feet, Ankle, Wrists, etc.	4.0	20

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

8 FCC MEASUREMENT PROCEDURES

Power measurements for licensed transmitters are performed using a base station simulator under digital average power.

8.1 Measured and Reported SAR

Per FCC KDB Publication 447498 D01, 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 D01.

8.2 3G SAR Test Reduction Procedure

In FCC KDB Publication 941225 D01, certain transmission modes within a frequency band and wireless mode evaluated for SAR are defined as primary modes. The equivalent modes considered for SAR test reduction are denoted as secondary modes. When the maximum output power including tune-up tolerance specified for production units in a secondary mode is ≤ 0.25 dB higher than the primary mode or when the highest reported SAR of the primary mode, scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode, is ≤ 1.2 W/kg, SAR measurements are not required for the secondary mode. These criteria are referred to as the 3G SAR test reduction procedure. When the 3G SAR test reduction procedure is not satisfied, SAR measurements are additionally required for the secondary mode.

8.3 Procedures Used to Establish RF Signal for SAR

The following procedures are according to FCC KDB Publication 941225 D01 “3G SAR Measurement Procedures.”

The device is 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 are 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 is 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 deviates by more than 5%, the SAR test and drift measurements are repeated.

8.4 SAR Measurement Conditions for CDMA2000

The following procedures were performed according to FCC KDB Publication 941225 D01 “3G SAR Measurement Procedures.”

8.4.1 Output Power Verification

See 3GPP2 C.S0011/TIA-98-E as recommended by FCC KDB Publication 941225 D01 “3G SAR Measurement Procedures.” Maximum output power is verified on the High, Middle and Low channels according to procedures in section 4.4.5.2 of 3GPP2 C.S0011/TIA-98-E. SO55 tests were measured with power control bits in the "All Up" condition.

1. If the mobile station (MS) supports Reverse TCH RC 1 and Forward TCH RC 1, set up a call using Fundamental Channel Test Mode 1 (RC=1/1) with 9600 bps data rate only.
2. Under RC1, C.S0011 Table 4.4.5.2-1, Table 8-1 parameters were applied.
3. If the MS supports the RC 3 Reverse FCH, RC3 Reverse SCH_0 and demodulation of RC 3,4, or 5, set up a call using Supplemental Channel Test Mode 3 (RC 3/3) with 9600 bps Fundamental Channel and 9600 bps SCH0 data rate.
4. Under RC3, C.S0011 Table 4.4.5.2-2, Table 8-2 was applied.

Table 8-1
Parameters for Max. Power for RC1

Parameter	Units	Value
I_{or}	dBm/1.23 MHz	-104
$\frac{\text{Pilot } E_c}{I_{or}}$	dB	-7
$\frac{\text{Traffic } E_c}{I_{or}}$	dB	-7.4

Table 8-2
Parameters for Max. Power for RC3

Parameter	Units	Value
I_{or}	dBm/1.23 MHz	-86
$\frac{\text{Pilot } E_c}{I_{or}}$	dB	-7
$\frac{\text{Traffic } E_c}{I_{or}}$	dB	-7.4

5. FCHs were configured at full rate for maximum SAR with "All Up" power control bits.

8.4.2 Head SAR Measurements

SAR for next to the ear head exposure is measured in RC3 with the handset configured to transmit at fullrate in SO55. The 3G SAR test reduction procedure is applied to RC1 with RC3 as the primary mode; otherwise, SAR is required for the channel with maximum measured output in RC1 using the head exposure configuration that results in the highest reported SAR in RC3.

Head SAR is additionally evaluated using EVDO Rev. A to support compliance for VoIP operations. See Section 8.4.5 for EVDO Rev. A configuration parameters.

8.4.3 Body-worn SAR Measurements

SAR for body-worn exposure configurations is measured in RC3 with the DUT configured to transmit at full rate on FCH with all other code channels disabled using TDSO / SO32. The 3G SAR test reduction procedure is applied to the multiple code channel configuration (FCH+SCHn), with FCH only as the primary mode. Otherwise, SAR is required for multiple code channel configuration (FCH + SCHn), with FCH at full rate and SCH0 enabled at 9600 bps, using the highest reported SAR configuration for FCH only. When multiple code channels are enabled, the transmitter output can shift by more than 0.5 dB and may lead to higher SAR drifts and SCH dropouts.

The 3G SAR test reduction procedure is applied to body-worn accessory SAR in RC1 with RC3 as the primary mode. Otherwise, SAR is required for RC1, with SO55 and full rate, using the highest reported SAR configuration for body-worn accessory exposure in RC3.

8.4.4 Body-worn SAR Measurements for EVDO Devices

For handsets with Ev-Do capabilities, the 3G SAR test reduction procedure is applied to Ev-Do Rev. 0 with 1x RTT RC3 as the primary mode to determine body-worn accessory test requirements. Otherwise, body-worn accessory SAR is required for Rev. 0, at 153.6 kbps, using the highest reported SAR configuration for body-worn accessory exposure in RC3.

The 3G SAR test reduction procedure is applied to Rev. A, with Rev. 0 as the primary mode to determine body-worn accessory SAR test requirements. When SAR is not required for Rev. 0, the 3G SAR test reduction is applied with 1x RTT RC3 as the primary mode.

When SAR is required for EVDO Rev. A, SAR is measured with a Reverse Data Channel payload size of 4096 bits and a Termination Target of 16 slots defined for Subtype 2 Physical Layer configurations, using the highest reported SAR configuration for body-worn accessory exposure in Rev. 0 or 1x RTT RC3, as appropriate.

8.4.5 Body SAR Measurements for EVDO Hotspot

Hotspot Body SAR is measured using Subtype 0/1 Physical Layer configurations for Rev. 0. The 3G SAR test reduction procedure is applied to Rev. A, Subtype 2 Physical layer configuration, with Rev. 0 as the primary mode; otherwise, SAR is measured for Rev. A using the highest reported SAR configuration for body-worn accessory exposure in Rev. 0. The AT is tested with a Reverse Data Channel rate of 153.6 kbps in Subtype 0/1 Physical Layer configurations; and a Reverse Data Channel payload size of 4096 bits and Termination Target of 16 slots in Subtype 2 Physical Layer configurations.

For Ev-Do data devices that also support 1x RTT voice and/or data operations, the 3G SAR test reduction procedure is applied to 1x RTT RC3 and RC1 with Ev-Do Rev. 0 and Rev. A as the respective primary modes. Otherwise, the ‘Body-Worn Accessory SAR’ procedures in the ‘3GPP2 CDMA 2000 1x Handsets’ section are applied.

8.4.6 CDMA2000 1x Advanced

This device additionally supports 1x Advanced. Conducted powers are measured using SO75 with RC8 on the uplink and RC11 on the downlink per FCC KDB Publication 941225 D01. Smart blanking is disabled for all measurements. The EUT is configured with forward power control Mode 000 and reverse power control at 400 bps. Conducted powers are measured on an Agilent 8960 Series 10 Wireless Communications Test Set, Model E5515C using the CDMA2000 1x Advanced application, Option E1962B-410.

The 3G SAR test reduction procedure is applied to the 1x-Advanced transmission mode with 1x RTT RC3 as the primary mode. When SAR measurement is required, the 1x-Advanced power measurement configurations are used. The 1x Advanced SAR procedures are applied separately to head, body-worn accessory and other exposure conditions.

8.5 SAR Measurement Conditions for UMTS

8.5.1 Output Power Verification

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, 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.

8.5.2 Head SAR Measurements

SAR for next to the ear head exposure is measured using a 12.2 kbps RMC with TPC bits configured to all “1’s”. The 3G SAR test reduction procedure is applied to AMR configurations with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured for 12.2 kbps AMR in 3.4 kbps SRB (signaling radio bearer) using the highest reported SAR configuration in 12.2 kbps RMC for head exposure.

8.5.3 Body SAR Measurements

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits all “1s”. The 3G SAR test reduction procedure is applied to other spreading codes and multiple $DPDCH_n$ configurations supported by the handset with 12.2 kbps RMC as the primary mode. Otherwise, SAR is measured using an applicable RMC configuration with the corresponding spreading code or $DPDCH_n$, for the highest reported SAR configuration in 12.2 kbps RMC.

8.5.4 SAR Measurements with Rel 5 HSDPA

The 3G SAR test reduction procedure is applied to HSDPA body configurations with 12.2 kbps RMC as the primary mode. Otherwise, Body SAR for HSDPA is measured using an FRC with H-Set 1 in Sub-test 1 and a 12.2 kbps RMC configured in Test Loop Mode 1, for the highest reported SAR configuration in 12.2 kbps RMC without HSDPA. Handsets with both HSDPA and HSUPA are tested according to Release 6 HSPA test procedures.

8.5.5 SAR Measurements with Rel 6 HSUPA

The 3G SAR test reduction procedure is applied to HSPA (HSUPA/HSDPA with RMC) body configurations with 12.2 kbps RMC as the primary mode. Otherwise, Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 and power control algorithm 2, according to the highest reported body SAR configuration in 12.2 kbps RMC without HSPA.

When VOIP applies to head exposure, the 3G SAR test reduction procedure is applied with 12.2 kbps RMC as the primary mode; otherwise, the same HSPA configuration used for body SAR measurements are applied to head exposure testing.

8.6 SAR Measurement Conditions for LTE

LTE modes are tested according to FCC KDB 941225 D05 publication. Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. The R&S CMW500 or Anritsu MT8820C simulators are used for LTE output power measurements and SAR testing. Closed loop power control was used so the UE transmits with maximum output power during SAR testing. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).

8.6.1 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.

8.6.2 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.

8.6.3 A-MPR

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

8.6.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05:

a. Per Section 4.2.1, 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 4.2.2, SAR is required for 50% RB allocation using the largest bandwidth following the same procedures outlined in Section 4.2.1.
c. Per Section 4.2.3, 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 4.2.4 and 4.3, 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 4.2.1 through 4.2.3 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.

8.6.5 TDD

LTE TDD is tested at the highest duty factor using UL-DL configuration 0 with special subframe configuration 6 and applying the FDD LTE procedures in KDB 941225. SAR testing was performed using the normal cyclic prefix and then scaling up the measured SAR result to the extended cyclic prefix listed in 3GPP TS 36.211 Section 4.

8.7 SAR Testing with 802.11 Transmitters

The normal network operating configurations of 802.11 transmitters are not suitable for SAR measurements. 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 D01 for more details.

8.7.1 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.

A periodic duty factor is required for current generation SAR systems to measure SAR. When 802.11 frame gaps are accounted for in the transmission, a maximum transmission duty factor of 92 - 96% is typically achievable in most test mode configurations. A minimum transmission duty factor of 85% is required to avoid certain hardware and device implementation issues related to wide range SAR scaling. The reported SAR is scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit.

8.7.2 Initial Test Position Procedure

For exposure conditions with multiple test positions, such as handset operating next to the ear, devices with hotspot mode or UMPC mini-tablet, procedures for initial test position can be applied. Using the transmission mode determined by the DSSS procedure or initial test configuration, area scans are measured for all positions in an exposure condition. The test position with the highest extrapolated (peak) SAR is used as the initial test position. When reported SAR for the initial test position is ≤ 0.4 W/kg, no additional testing for the remaining test positions is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is ≤ 0.8 W/kg or all test positions are measured.

8.7.3 2.4 GHz SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either the fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

1) When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.

2) When the reported SAR is > 0.8 W/kg, SAR is required for that position using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

2.4 GHz 802.11 g/n OFDM are additionally evaluated for SAR if the highest reported SAR for 802.11b, adjusted by the ratio of the OFDM to DSSS specified maximum output power, is > 1.2 W/kg. When SAR is required for OFDM modes in 2.4 GHz band, the Initial Test Configuration Procedures should be followed.

8.7.4 OFDM Transmission Mode and SAR Test Channel Selection

For the 2.4 GHz bands, when the same maximum output power was specified for multiple OFDM transmission mode configurations in a frequency band or aggregated band, SAR is measured using the configuration with the largest channel bandwidth, lowest order modulation and lowest data rate. When the maximum output power of a channel is the same for equivalent OFDM configurations; for example, 802.11g and 802.11n with the same channel bandwidth, modulation and data rate etc., the lower order 802.11 mode i.e., 802.11g then 802.11n, is used for SAR measurement. When the maximum output power are the same for multiple test channels, either according to the default or additional power measurement requirements, SAR is measured using the channel closest to the middle of the frequency band or aggregated band. When there are multiple channels with the same maximum output power, SAR is measured using the higher number channel.

8.7.5 Initial Test Configuration Procedure

For OFDM in 2.4 GHz bands, an initial test configuration is determined for each frequency band and aggregated band, according to the transmission mode with the highest maximum output power specified for SAR measurements. When the same maximum output power is specified for multiple transmission modes configurations in a frequency band or aggregated band, SAR is measured using the configuration(s) with the largest channel bandwidth, lowest order modulation, and lowest data rate. The channel of the transmission mode with the highest average RF output conducted power will be the initial test configuration.

When the reported SAR is ≤ 0.8 W/kg, no additional measurements on other test channels are required. Otherwise, SAR is evaluated using the subsequent highest average RF output channel until the reported SAR result is ≤ 1.2 W/kg or all channels are measured. When there are multiple untested channels having the same subsequent highest average RF output power, the channel with higher frequency from the lowest 802.11 mode is considered for SAR measurements (See Section 8.7.4).

9 RF CONDUCTED POWERS

9.1 CDMA Conducted Powers

Band	Channel	Rule Part	Frequency	SO55 [dBm]	SO55 [dBm]	SO75 [dBm]	TDSO SO32 [dBm]	TDSO SO32 [dBm]	1x EvDO Rev. 0 [dBm]	1x EvDO Rev. A [dBm]
	F-RC		MHz	RC1	RC3	RC11	FCH+SCH	FCH	(RTAP)	(RETAP)
Cellular	564	90S	820.1	24.55	24.60	24.55	24.55	24.60	24.40	24.42
Cellular	1013	22H	824.7	24.50	24.50	24.50	24.50	24.54	24.60	24.55
	384	22H	836.52	24.41	24.46	24.45	24.43	24.46	24.55	24.50
	777	22H	848.31	24.50	24.52	24.55	24.52	24.58	24.59	24.55
PCS	25	24E	1851.25	24.40	24.43	24.30	24.43	24.44	24.50	24.40
	600	24E	1880	24.52	24.62	24.40	24.50	24.61	24.55	24.51
	1175	24E	1908.75	24.40	24.41	24.40	24.42	24.41	24.50	24.53

Note: RC1 is only applicable for IS-95 compatibility. For FCC Rule Part 90S, Per FCC KDB Publication 447498 D01 4.1.6, only one channel is required since the device operates within the transmission range of 817.90 – 823.10 MHz.

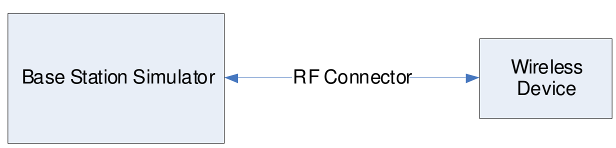

Figure 9-1
Power Measurement Setup

9.2 GSM Conducted Powers

		Maximum Burst-Averaged Output Power				
		Voice	GPRS/EDGE Data (GMSK)		EDGE Data (8-PSK)	
Band	Channel	GSM [dBm] CS (1 Slot)	GPRS [dBm] 1 Tx Slot	GPRS [dBm] 2 Tx Slot	EDGE [dBm] 1 Tx Slot	EDGE [dBm] 2 Tx Slot
GSM 850	128	33.60	33.60	**31.10**	27.02	26.21
	190	33.62	33.63	**31.21**	27.25	26.35
	251	33.65	33.65	**31.52**	27.50	26.65
GSM 1900	512	29.50	29.55	**27.50**	26.64	25.65
	661	29.61	29.66	**27.46**	26.65	25.65
	810	29.45	29.52	**27.42**	26.60	25.63
		Calculated Maximum Frame-Averaged Output Power				
		Voice	GPRS/EDGE Data (GMSK)		EDGE Data (8-PSK)	
Band	Channel	GSM [dBm] CS (1 Slot)	GPRS [dBm] 1 Tx Slot	GPRS [dBm] 2 Tx Slot	EDGE [dBm] 1 Tx Slot	EDGE [dBm] 2 Tx Slot
GSM 850	128	24.57	24.57	**25.08**	17.99	20.19
	190	24.59	24.60	**25.19**	18.22	20.33
	251	24.62	24.62	**25.50**	18.47	20.63
GSM 1900	512	20.47	20.52	**21.48**	17.61	19.63
	661	20.58	20.63	**21.44**	17.62	19.63
	810	20.42	20.49	**21.40**	17.57	19.61
GSM 850	Frame Avg.Targets:	24.17	24.17	**25.18**	18.17	20.18
GSM 1900		20.17	20.17	**21.18**	17.17	19.18

Note:

1. Both burst-averaged and calculated frame-averaged powers are included. Frame-averaged power was calculated from the measured burst-averaged power by converting the slot powers into linear units and calculating the energy over 8 timeslots.
2. The source-based frame-averaged output power was evaluated for all GPRS/EDGE slot configurations. The configuration with the highest target frame averaged output power was evaluated for VoIP SAR. When the maximum frame-averaged powers are equivalent across two or more slots (within 0.25 dBm), the configuration with the most number of time slots was tested.
3. GPRS/EDGE (GMSK) output powers were measured with coding scheme setting of 1 (CS1) on the base station simulator. CS1 was configured to measure GPRS output power measurements and SAR to ensure GMSK modulation in the signal. Our Investigation has shown that CS1 - CS4 settings do not have any impact on the output levels or modulation in the GPRS modes.
4. EDGE (8-PSK) output powers were measured with MCS7 on the base station simulator. MCS7 coding scheme was used to measure the output powers for EDGE since investigation has shown that choosing MCS7 coding scheme will ensure 8-PSK modulation. It has been shown that MCS levels that produce 8PSK modulation do not have an impact on output power.

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

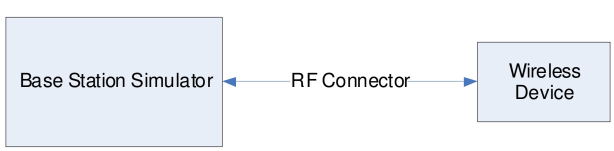

Figure 9-2
Power Measurement Setup

9.3 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	23.43	23.45	23.33	23.61	23.57	23.46	-
99		12.2 kbps AMR	23.51	23.63	23.64	23.64	23.56	23.50	-
6	HSDPA	Subtest 1	23.41	23.59	23.50	23.56	23.50	23.33	0
6		Subtest 2	23.47	23.41	23.46	23.52	23.41	23.35	0
6		Subtest 3	22.97	23.01	22.95	22.99	22.98	22.89	0.5
6		Subtest 4	23.05	23.02	22.99	23.05	23.03	22.87	0.5
6	HSUPA	Subtest 1	22.84	22.96	22.99	23.04	23.29	23.03	0
6		Subtest 2	21.55	21.72	21.71	21.68	21.57	21.53	2
6		Subtest 3	22.40	22.32	22.05	22.13	22.07	22.10	1
6		Subtest 4	21.73	21.85	21.75	21.84	21.88	21.79	2
6		Subtest 5	23.52	23.56	23.62	23.40	23.55	23.28	0

This device does not support DC-HSDPA.

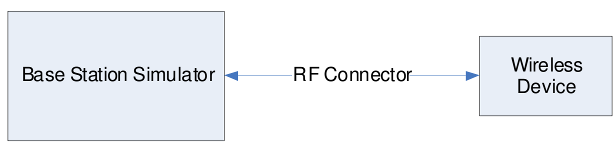

Figure 9-3
Power Measurement Setup

9.4 LTE Conducted Powers

9.4.1 LTE Band 26 (Cell)

Table 9-1
LTE Band 26 (Cell) Conducted Powers - 15 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	836.5	26915	15	QPSK	1	0	**23.48**	0	0
	836.5	26915	15	QPSK	1	36	23.30	0	0
	836.5	26915	15	QPSK	1	74	23.37	0	0
	836.5	26915	15	QPSK	36	0	22.48	0-1	1
	836.5	26915	15	QPSK	36	18	22.41	0-1	1
	836.5	26915	15	QPSK	36	37	**22.51**	0-1	1
	836.5	26915	15	QPSK	75	0	22.43	0-1	1
	836.5	26915	15	16QAM	1	0	22.53	0-1	1
	836.5	26915	15	16QAM	1	36	22.51	0-1	1
	836.5	26915	15	16QAM	1	74	22.59	0-1	1
	836.5	26915	15	16QAM	36	0	21.50	0-2	2
	836.5	26915	15	16QAM	36	18	21.38	0-2	2
	836.5	26915	15	16QAM	36	37	21.32	0-2	2
	836.5	26915	15	16QAM	75	0	21.39	0-2	2

Note: LTE Band 26 (Cell) at 15 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

Table 9-2
LTE Band 26 (Cell) Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	819	26740	10	QPSK	1	0	23.37	0	0
	819	26740	10	QPSK	1	25	23.43	0	0
	819	26740	10	QPSK	1	49	23.37	0	0
	819	26740	10	QPSK	25	0	22.40	0-1	1
	819	26740	10	QPSK	25	12	22.31	0-1	1
	819	26740	10	QPSK	25	25	22.36	0-1	1
	819	26740	10	QPSK	50	0	22.50	0-1	1
	819	26740	10	16QAM	1	0	22.47	0-1	1
	819	26740	10	16QAM	1	25	22.51	0-1	1
	819	26740	10	16QAM	1	49	22.43	0-1	1
	819	26740	10	16QAM	25	0	21.38	0-2	2
	819	26740	10	16QAM	25	12	21.33	0-2	2
	819	26740	10	16QAM	25	25	21.25	0-2	2
	819	26740	10	16QAM	50	0	21.30	0-2	2
Mid	831.5	26865	10	QPSK	1	0	23.54	0	0
	831.5	26865	10	QPSK	1	25	23.43	0	0
	831.5	26865	10	QPSK	1	49	23.36	0	0
	831.5	26865	10	QPSK	25	0	22.57	0-1	1
	831.5	26865	10	QPSK	25	12	22.39	0-1	1
	831.5	26865	10	QPSK	25	25	22.34	0-1	1
	831.5	26865	10	QPSK	50	0	22.48	0-1	1
	831.5	26865	10	16QAM	1	0	22.39	0-1	1
	831.5	26865	10	16QAM	1	25	22.43	0-1	1
	831.5	26865	10	16QAM	1	49	22.63	0-1	1
	831.5	26865	10	16QAM	25	0	21.47	0-2	2
	831.5	26865	10	16QAM	25	12	21.44	0-2	2
	831.5	26865	10	16QAM	25	25	21.31	0-2	2
	831.5	26865	10	16QAM	50	0	21.46	0-2	2
High	844	26990	10	QPSK	1	0	23.56	0	0
	844	26990	10	QPSK	1	25	23.33	0	0
	844	26990	10	QPSK	1	49	23.07	0	0
	844	26990	10	QPSK	25	0	22.39	0-1	1
	844	26990	10	QPSK	25	12	22.34	0-1	1
	844	26990	10	QPSK	25	25	22.08	0-1	1
	844	26990	10	QPSK	50	0	22.34	0-1	1
	844	26990	10	16QAM	1	0	22.15	0-1	1
	844	26990	10	16QAM	1	25	22.12	0-1	1
	844	26990	10	16QAM	1	49	22.18	0-1	1
	844	26990	10	16QAM	25	0	21.55	0-2	2
	844	26990	10	16QAM	25	12	21.41	0-2	2
	844	26990	10	16QAM	25	25	21.24	0-2	2
	844	26990	10	16QAM	50	0	21.34	0-2	2

Table 9-3
LTE Band 26 (Cell) Conducted Powers - 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	816.5	26715	5	QPSK	1	0	23.47	0	0
	816.5	26715	5	QPSK	1	12	23.41	0	0
	816.5	26715	5	QPSK	1	24	23.18	0	0
	816.5	26715	5	QPSK	12	0	22.30	0-1	1
	816.5	26715	5	QPSK	12	6	22.44	0-1	1
	816.5	26715	5	QPSK	12	13	22.33	0-1	1
	816.5	26715	5	QPSK	25	0	22.30	0-1	1
	816.5	26715	5	16-QAM	1	0	22.65	0-1	1
	816.5	26715	5	16-QAM	1	12	22.54	0-1	1
	816.5	26715	5	16-QAM	1	24	22.62	0-1	1
	816.5	26715	5	16-QAM	12	0	21.08	0-2	2
	816.5	26715	5	16-QAM	12	6	21.23	0-2	2
	816.5	26715	5	16-QAM	12	13	21.22	0-2	2
	816.5	26715	5	16-QAM	25	0	21.34	0-2	2
Mid	831.5	26865	5	QPSK	1	0	23.25	0	0
	831.5	26865	5	QPSK	1	12	23.36	0	0
	831.5	26865	5	QPSK	1	24	23.14	0	0
	831.5	26865	5	QPSK	12	0	22.53	0-1	1
	831.5	26865	5	QPSK	12	6	22.38	0-1	1
	831.5	26865	5	QPSK	12	13	22.46	0-1	1
	831.5	26865	5	QPSK	25	0	22.35	0-1	1
	831.5	26865	5	16-QAM	1	0	21.93	0-1	1
	831.5	26865	5	16-QAM	1	12	21.92	0-1	1
	831.5	26865	5	16-QAM	1	24	21.85	0-1	1
	831.5	26865	5	16-QAM	12	0	21.26	0-2	2
	831.5	26865	5	16-QAM	12	6	21.29	0-2	2
	831.5	26865	5	16-QAM	12	13	21.29	0-2	2
	831.5	26865	5	16-QAM	25	0	21.39	0-2	2
High	846.5	27015	5	QPSK	1	0	23.03	0	0
	846.5	27015	5	QPSK	1	12	23.28	0	0
	846.5	27015	5	QPSK	1	24	22.94	0	0
	846.5	27015	5	QPSK	12	0	22.14	0-1	1
	846.5	27015	5	QPSK	12	6	22.09	0-1	1
	846.5	27015	5	QPSK	12	13	22.09	0-1	1
	846.5	27015	5	QPSK	25	0	22.16	0-1	1
	846.5	27015	5	16-QAM	1	0	22.24	0-1	1
	846.5	27015	5	16-QAM	1	12	22.48	0-1	1
	846.5	27015	5	16-QAM	1	24	22.22	0-1	1
	846.5	27015	5	16-QAM	12	0	21.43	0-2	2
	846.5	27015	5	16-QAM	12	6	21.18	0-2	2
	846.5	27015	5	16-QAM	12	13	21.09	0-2	2
	846.5	27015	5	16-QAM	25	0	21.11	0-2	2

Table 9-4
LTE Band 26 (Cell) Conducted Powers - 3 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	815.5	26705	3	QPSK	1	0	23.27	0	0
	815.5	26705	3	QPSK	1	7	23.59	0	0
	815.5	26705	3	QPSK	1	14	23.39	0	0
	815.5	26705	3	QPSK	8	0	22.43	0-1	1
	815.5	26705	3	QPSK	8	4	22.37	0-1	1
	815.5	26705	3	QPSK	8	7	22.39	0-1	1
	815.5	26705	3	QPSK	15	0	22.37	0-1	1
	815.5	26705	3	16-QAM	1	0	22.21	0-1	1
	815.5	26705	3	16-QAM	1	7	22.64	0-1	1
	815.5	26705	3	16-QAM	1	14	22.67	0-1	1
	815.5	26705	3	16-QAM	8	0	21.18	0-2	2
	815.5	26705	3	16-QAM	8	4	21.33	0-2	2
	815.5	26705	3	16-QAM	8	7	21.15	0-2	2
	815.5	26705	3	16-QAM	15	0	21.11	0-2	2
Mid	831.5	26865	3	QPSK	1	0	23.45	0	0
	831.5	26865	3	QPSK	1	7	23.48	0	0
	831.5	26865	3	QPSK	1	14	23.26	0	0
	831.5	26865	3	QPSK	8	0	22.57	0-1	1
	831.5	26865	3	QPSK	8	4	22.38	0-1	1
	831.5	26865	3	QPSK	8	7	22.49	0-1	1
	831.5	26865	3	QPSK	15	0	22.40	0-1	1
	831.5	26865	3	16-QAM	1	0	22.51	0-1	1
	831.5	26865	3	16-QAM	1	7	22.46	0-1	1
	831.5	26865	3	16-QAM	1	14	22.45	0-1	1
	831.5	26865	3	16-QAM	8	0	21.61	0-2	2
	831.5	26865	3	16-QAM	8	4	21.28	0-2	2
	831.5	26865	3	16-QAM	8	7	21.62	0-2	2
	831.5	26865	3	16-QAM	15	0	21.59	0-2	2
High	847.5	27025	3	QPSK	1	0	23.20	0	0
	847.5	27025	3	QPSK	1	7	23.20	0	0
	847.5	27025	3	QPSK	1	14	22.96	0	0
	847.5	27025	3	QPSK	8	0	22.19	0-1	1
	847.5	27025	3	QPSK	8	4	22.15	0-1	1
	847.5	27025	3	QPSK	8	7	22.10	0-1	1
	847.5	27025	3	QPSK	15	0	22.06	0-1	1
	847.5	27025	3	16-QAM	1	0	22.06	0-1	1
	847.5	27025	3	16-QAM	1	7	21.80	0-1	1
	847.5	27025	3	16-QAM	1	14	21.73	0-1	1
	847.5	27025	3	16-QAM	8	0	21.34	0-2	2
	847.5	27025	3	16-QAM	8	4	21.22	0-2	2
	847.5	27025	3	16-QAM	8	7	20.87	0-2	2
	847.5	27025	3	16-QAM	15	0	21.14	0-2	2

Table 9-5
LTE Band 26 (Cell) Conducted Powers - 1.4 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	814.7	26697	1.4	QPSK	1	0	23.11	0	0
	814.7	26697	1.4	QPSK	1	2	23.37	0	0
	814.7	26697	1.4	QPSK	1	5	23.24	0	0
	814.7	26697	1.4	QPSK	3	0	23.26	0	0
	814.7	26697	1.4	QPSK	3	2	23.29	0	0
	814.7	26697	1.4	QPSK	3	3	23.25	0	0
	814.7	26697	1.4	QPSK	6	0	22.40	0-1	1
	814.7	26697	1.4	16-QAM	1	0	22.47	0-1	1
	814.7	26697	1.4	16-QAM	1	2	22.61	0-1	1
	814.7	26697	1.4	16-QAM	1	5	22.57	0-1	1
	814.7	26697	1.4	16-QAM	3	0	22.47	0-1	1
	814.7	26697	1.4	16-QAM	3	2	22.39	0-1	1
	814.7	26697	1.4	16-QAM	3	3	22.36	0-1	1
	814.7	26697	1.4	16-QAM	6	0	21.46	0-2	2
Mid	831.5	26865	1.4	QPSK	1	0	23.40	0	0
	831.5	26865	1.4	QPSK	1	2	23.67	0	0
	831.5	26865	1.4	QPSK	1	5	23.62	0	0
	831.5	26865	1.4	QPSK	3	0	23.39	0	0
	831.5	26865	1.4	QPSK	3	2	23.45	0	0
	831.5	26865	1.4	QPSK	3	3	23.37	0	0
	831.5	26865	1.4	QPSK	6	0	22.47	0-1	1
	831.5	26865	1.4	16-QAM	1	0	22.69	0-1	1
	831.5	26865	1.4	16-QAM	1	2	22.69	0-1	1
	831.5	26865	1.4	16-QAM	1	5	22.60	0-1	1
	831.5	26865	1.4	16-QAM	3	0	22.62	0-1	1
	831.5	26865	1.4	16-QAM	3	2	22.70	0-1	1
	831.5	26865	1.4	16-QAM	3	3	22.54	0-1	1
	831.5	26865	1.4	16-QAM	6	0	21.70	0-2	2
High	848.3	27033	1.4	QPSK	1	0	22.97	0	0
	848.3	27033	1.4	QPSK	1	2	23.17	0	0
	848.3	27033	1.4	QPSK	1	5	23.00	0	0
	848.3	27033	1.4	QPSK	3	0	22.92	0	0
	848.3	27033	1.4	QPSK	3	2	22.95	0	0
	848.3	27033	1.4	QPSK	3	3	22.94	0	0
	848.3	27033	1.4	QPSK	6	0	22.07	0-1	1
	848.3	27033	1.4	16-QAM	1	0	22.16	0-1	1
	848.3	27033	1.4	16-QAM	1	2	22.10	0-1	1
	848.3	27033	1.4	16-QAM	1	5	22.15	0-1	1
	848.3	27033	1.4	16-QAM	3	0	22.06	0-1	1
	848.3	27033	1.4	16-QAM	3	2	22.12	0-1	1
	848.3	27033	1.4	16-QAM	3	3	22.22	0-1	1
	848.3	27033	1.4	16-QAM	6	0	21.32	0-2	2

9.4.2 LTE Band 25 (PCS)

Table 9-6
LTE Band 25 (PCS) Conducted Powers - 20 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1860	26140	20	QPSK	1	0	23.60	0	0
	1860	26140	20	QPSK	1	50	23.46	0	0
	1860	26140	20	QPSK	1	99	23.47	0	0
	1860	26140	20	QPSK	50	0	22.44	0-1	1
	1860	26140	20	QPSK	50	25	22.29	0-1	1
	1860	26140	20	QPSK	50	50	22.26	0-1	1
	1860	26140	20	QPSK	100	0	22.30	0-1	1
	1860	26140	20	16QAM	1	0	21.74	0-1	1
	1860	26140	20	16QAM	1	50	21.74	0-1	1
	1860	26140	20	16QAM	1	99	21.76	0-1	1
	1860	26140	20	16QAM	50	0	21.39	0-2	2
	1860	26140	20	16QAM	50	25	21.25	0-2	2
	1860	26140	20	16QAM	50	50	21.31	0-2	2
	1860	26140	20	16QAM	100	0	21.27	0-2	2
Mid	1882.5	26365	20	QPSK	1	0	23.58	0	0
	1882.5	26365	20	QPSK	1	50	**23.62**	0	0
	1882.5	26365	20	QPSK	1	99	23.29	0	0
	1882.5	26365	20	QPSK	50	0	**22.48**	0-1	1
	1882.5	26365	20	QPSK	50	25	22.38	0-1	1
	1882.5	26365	20	QPSK	50	50	22.29	0-1	1
	1882.5	26365	20	QPSK	100	0	22.43	0-1	1
	1882.5	26365	20	16QAM	1	0	22.56	0-1	1
	1882.5	26365	20	16QAM	1	50	22.33	0-1	1
	1882.5	26365	20	16QAM	1	99	22.18	0-1	1
	1882.5	26365	20	16QAM	50	0	21.33	0-2	2
	1882.5	26365	20	16QAM	50	25	21.34	0-2	2
	1882.5	26365	20	16QAM	50	50	21.15	0-2	2
	1882.5	26365	20	16QAM	100	0	21.37	0-2	2
High	1905	26590	20	QPSK	1	0	23.20	0	0
	1905	26590	20	QPSK	1	50	23.22	0	0
	1905	26590	20	QPSK	1	99	23.22	0	0
	1905	26590	20	QPSK	50	0	22.26	0-1	1
	1905	26590	20	QPSK	50	25	22.28	0-1	1
	1905	26590	20	QPSK	50	50	22.25	0-1	1
	1905	26590	20	QPSK	100	0	22.25	0-1	1
	1905	26590	20	16QAM	1	0	22.33	0-1	1
	1905	26590	20	16QAM	1	50	22.37	0-1	1
	1905	26590	20	16QAM	1	99	22.32	0-1	1
	1905	26590	20	16QAM	50	0	21.40	0-2	2
	1905	26590	20	16QAM	50	25	21.31	0-2	2
	1905	26590	20	16QAM	50	50	21.29	0-2	2
	1905	26590	20	16QAM	100	0	21.22	0-2	2

Table 9-7
LTE Band 25 (PCS) Conducted Powers - 15 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1857.5	26115	15	QPSK	1	0	23.20	0	0
	1857.5	26115	15	QPSK	1	36	23.32	0	0
	1857.5	26115	15	QPSK	1	74	23.31	0	0
	1857.5	26115	15	QPSK	36	0	22.46	0-1	1
	1857.5	26115	15	QPSK	36	18	22.37	0-1	1
	1857.5	26115	15	QPSK	36	37	22.27	0-1	1
	1857.5	26115	15	QPSK	75	0	22.36	0-1	1
	1857.5	26115	15	16QAM	1	0	22.67	0-1	1
	1857.5	26115	15	16QAM	1	36	22.64	0-1	1
	1857.5	26115	15	16QAM	1	74	22.58	0-1	1
	1857.5	26115	15	16QAM	36	0	21.25	0-2	2
	1857.5	26115	15	16QAM	36	18	21.33	0-2	2
	1857.5	26115	15	16QAM	36	37	21.24	0-2	2
	1857.5	26115	15	16QAM	75	0	21.24	0-2	2
Mid	1882.5	26365	15	QPSK	1	0	23.40	0	0
	1882.5	26365	15	QPSK	1	36	23.35	0	0
	1882.5	26365	15	QPSK	1	74	23.13	0	0
	1882.5	26365	15	QPSK	36	0	22.44	0-1	1
	1882.5	26365	15	QPSK	36	18	22.32	0-1	1
	1882.5	26365	15	QPSK	36	37	22.27	0-1	1
	1882.5	26365	15	QPSK	75	0	22.30	0-1	1
	1882.5	26365	15	16QAM	1	0	22.30	0-1	1
	1882.5	26365	15	16QAM	1	36	22.31	0-1	1
	1882.5	26365	15	16QAM	1	74	22.17	0-1	1
	1882.5	26365	15	16QAM	36	0	21.46	0-2	2
	1882.5	26365	15	16QAM	36	18	21.34	0-2	2
	1882.5	26365	15	16QAM	36	37	21.23	0-2	2
	1882.5	26365	15	16QAM	75	0	21.34	0-2	2
High	1907.5	26615	15	QPSK	1	0	23.36	0	0
	1907.5	26615	15	QPSK	1	36	23.22	0	0
	1907.5	26615	15	QPSK	1	74	23.51	0	0
	1907.5	26615	15	QPSK	36	0	22.27	0-1	1
	1907.5	26615	15	QPSK	36	18	22.34	0-1	1
	1907.5	26615	15	QPSK	36	37	22.35	0-1	1
	1907.5	26615	15	QPSK	75	0	22.38	0-1	1
	1907.5	26615	15	16QAM	1	0	22.14	0-1	1
	1907.5	26615	15	16QAM	1	36	21.86	0-1	1
	1907.5	26615	15	16QAM	1	74	21.75	0-1	1
	1907.5	26615	15	16QAM	36	0	21.18	0-2	2
	1907.5	26615	15	16QAM	36	18	21.29	0-2	2
	1907.5	26615	15	16QAM	36	37	21.24	0-2	2
	1907.5	26615	15	16QAM	75	0	21.28	0-2	2

Table 9-8
LTE Band 25 (PCS) Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1855	26090	10	QPSK	1	0	23.38	0	0
	1855	26090	10	QPSK	1	25	23.42	0	0
	1855	26090	10	QPSK	1	49	23.12	0	0
	1855	26090	10	QPSK	25	0	22.32	0-1	1
	1855	26090	10	QPSK	25	12	22.39	0-1	1
	1855	26090	10	QPSK	25	25	22.40	0-1	1
	1855	26090	10	QPSK	50	0	22.42	0-1	1
	1855	26090	10	16QAM	1	0	22.69	0-1	1
	1855	26090	10	16QAM	1	25	22.61	0-1	1
	1855	26090	10	16QAM	1	49	22.60	0-1	1
	1855	26090	10	16QAM	25	0	21.27	0-2	2
	1855	26090	10	16QAM	25	12	21.35	0-2	2
	1855	26090	10	16QAM	25	25	21.16	0-2	2
	1855	26090	10	16QAM	50	0	21.38	0-2	2
Mid	1882.5	26365	10	QPSK	1	0	23.46	0	0
	1882.5	26365	10	QPSK	1	25	23.50	0	0
	1882.5	26365	10	QPSK	1	49	23.30	0	0
	1882.5	26365	10	QPSK	25	0	22.52	0-1	1
	1882.5	26365	10	QPSK	25	12	22.40	0-1	1
	1882.5	26365	10	QPSK	25	25	22.35	0-1	1
	1882.5	26365	10	QPSK	50	0	22.39	0-1	1
	1882.5	26365	10	16QAM	1	0	21.76	0-1	1
	1882.5	26365	10	16QAM	1	25	21.89	0-1	1
	1882.5	26365	10	16QAM	1	49	22.70	0-1	1
	1882.5	26365	10	16QAM	25	0	21.30	0-2	2
	1882.5	26365	10	16QAM	25	12	21.19	0-2	2
	1882.5	26365	10	16QAM	25	25	21.25	0-2	2
	1882.5	26365	10	16QAM	50	0	21.30	0-2	2
High	1910	26640	10	QPSK	1	0	23.25	0	0
	1910	26640	10	QPSK	1	25	23.26	0	0
	1910	26640	10	QPSK	1	49	23.45	0	0
	1910	26640	10	QPSK	25	0	22.28	0-1	1
	1910	26640	10	QPSK	25	12	22.36	0-1	1
	1910	26640	10	QPSK	25	25	22.32	0-1	1
	1910	26640	10	QPSK	50	0	22.37	0-1	1
	1910	26640	10	16QAM	1	0	22.18	0-1	1
	1910	26640	10	16QAM	1	25	22.17	0-1	1
	1910	26640	10	16QAM	1	49	22.07	0-1	1
	1910	26640	10	16QAM	25	0	21.37	0-2	2
	1910	26640	10	16QAM	25	12	21.57	0-2	2
	1910	26640	10	16QAM	25	25	21.55	0-2	2
	1910	26640	10	16QAM	50	0	21.52	0-2	2

Table 9-9
LTE Band 25 (PCS) Conducted Powers - 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1852.5	26065	5	QPSK	1	0	23.34	0	0
	1852.5	26065	5	QPSK	1	12	23.55	0	0
	1852.5	26065	5	QPSK	1	24	23.43	0	0
	1852.5	26065	5	QPSK	12	0	22.40	0-1	1
	1852.5	26065	5	QPSK	12	6	22.36	0-1	1
	1852.5	26065	5	QPSK	12	13	22.45	0-1	1
	1852.5	26065	5	QPSK	25	0	22.42	0-1	1
	1852.5	26065	5	16-QAM	1	0	22.35	0-1	1
	1852.5	26065	5	16-QAM	1	12	22.35	0-1	1
	1852.5	26065	5	16-QAM	1	24	22.64	0-1	1
	1852.5	26065	5	16-QAM	12	0	21.58	0-2	2
	1852.5	26065	5	16-QAM	12	6	21.56	0-2	2
	1852.5	26065	5	16-QAM	12	13	21.43	0-2	2
	1852.5	26065	5	16-QAM	25	0	21.52	0-2	2
Mid	1882.5	26365	5	QPSK	1	0	23.38	0	0
	1882.5	26365	5	QPSK	1	12	23.55	0	0
	1882.5	26365	5	QPSK	1	24	23.29	0	0
	1882.5	26365	5	QPSK	12	0	22.41	0-1	1
	1882.5	26365	5	QPSK	12	6	22.33	0-1	1
	1882.5	26365	5	QPSK	12	13	22.37	0-1	1
	1882.5	26365	5	QPSK	25	0	22.39	0-1	1
	1882.5	26365	5	16-QAM	1	0	22.52	0-1	1
	1882.5	26365	5	16-QAM	1	12	22.45	0-1	1
	1882.5	26365	5	16-QAM	1	24	22.20	0-1	1
	1882.5	26365	5	16-QAM	12	0	21.46	0-2	2
	1882.5	26365	5	16-QAM	12	6	21.18	0-2	2
	1882.5	26365	5	16-QAM	12	13	21.13	0-2	2
	1882.5	26365	5	16-QAM	25	0	21.24	0-2	2
High	1912.5	26665	5	QPSK	1	0	23.21	0	0
	1912.5	26665	5	QPSK	1	12	23.26	0	0
	1912.5	26665	5	QPSK	1	24	23.18	0	0
	1912.5	26665	5	QPSK	12	0	22.43	0-1	1
	1912.5	26665	5	QPSK	12	6	22.36	0-1	1
	1912.5	26665	5	QPSK	12	13	22.36	0-1	1
	1912.5	26665	5	QPSK	25	0	22.36	0-1	1
	1912.5	26665	5	16-QAM	1	0	21.88	0-1	1
	1912.5	26665	5	16-QAM	1	12	21.78	0-1	1
	1912.5	26665	5	16-QAM	1	24	22.01	0-1	1
	1912.5	26665	5	16-QAM	12	0	21.40	0-2	2
	1912.5	26665	5	16-QAM	12	6	21.44	0-2	2
	1912.5	26665	5	16-QAM	12	13	21.37	0-2	2
	1912.5	26665	5	16-QAM	25	0	21.51	0-2	2

Table 9-10
LTE Band 25 (PCS) Conducted Powers - 3 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1851.5	26055	3	QPSK	1	0	23.35	0	0
	1851.5	26055	3	QPSK	1	7	23.50	0	0
	1851.5	26055	3	QPSK	1	14	23.37	0	0
	1851.5	26055	3	QPSK	8	0	22.31	0-1	1
	1851.5	26055	3	QPSK	8	4	22.23	0-1	1
	1851.5	26055	3	QPSK	8	7	22.26	0-1	1
	1851.5	26055	3	QPSK	15	0	22.31	0-1	1
	1851.5	26055	3	16-QAM	1	0	22.66	0-1	1
	1851.5	26055	3	16-QAM	1	7	22.45	0-1	1
	1851.5	26055	3	16-QAM	1	14	22.58	0-1	1
	1851.5	26055	3	16-QAM	8	0	21.54	0-2	2
	1851.5	26055	3	16-QAM	8	4	21.43	0-2	2
	1851.5	26055	3	16-QAM	8	7	21.48	0-2	2
	1851.5	26055	3	16-QAM	15	0	21.27	0-2	2
Mid	1882.5	26365	3	QPSK	1	0	23.27	0	0
	1882.5	26365	3	QPSK	1	7	23.42	0	0
	1882.5	26365	3	QPSK	1	14	23.25	0	0
	1882.5	26365	3	QPSK	8	0	22.54	0-1	1
	1882.5	26365	3	QPSK	8	4	22.40	0-1	1
	1882.5	26365	3	QPSK	8	7	22.53	0-1	1
	1882.5	26365	3	QPSK	15	0	22.44	0-1	1
	1882.5	26365	3	16-QAM	1	0	21.81	0-1	1
	1882.5	26365	3	16-QAM	1	7	21.84	0-1	1
	1882.5	26365	3	16-QAM	1	14	21.77	0-1	1
	1882.5	26365	3	16-QAM	8	0	21.26	0-2	2
	1882.5	26365	3	16-QAM	8	4	21.52	0-2	2
	1882.5	26365	3	16-QAM	8	7	21.37	0-2	2
	1882.5	26365	3	16-QAM	15	0	21.32	0-2	2
High	1913.5	26675	3	QPSK	1	0	23.22	0	0
	1913.5	26675	3	QPSK	1	7	23.53	0	0
	1913.5	26675	3	QPSK	1	14	23.44	0	0
	1913.5	26675	3	QPSK	8	0	22.46	0-1	1
	1913.5	26675	3	QPSK	8	4	22.54	0-1	1
	1913.5	26675	3	QPSK	8	7	22.33	0-1	1
	1913.5	26675	3	QPSK	15	0	22.42	0-1	1
	1913.5	26675	3	16-QAM	1	0	22.05	0-1	1
	1913.5	26675	3	16-QAM	1	7	22.37	0-1	1
	1913.5	26675	3	16-QAM	1	14	22.17	0-1	1
	1913.5	26675	3	16-QAM	8	0	21.55	0-2	2
	1913.5	26675	3	16-QAM	8	4	21.53	0-2	2
	1913.5	26675	3	16-QAM	8	7	21.48	0-2	2
	1913.5	26675	3	16-QAM	15	0	21.53	0-2	2

Table 9-11
LTE Band 25 (PCS) Conducted Powers -1.4 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1850.7	26047	1.4	QPSK	1	0	23.25	0	0
	1850.7	26047	1.4	QPSK	1	2	23.33	0	0
	1850.7	26047	1.4	QPSK	1	5	23.25	0	0
	1850.7	26047	1.4	QPSK	3	0	23.34	0	0
	1850.7	26047	1.4	QPSK	3	2	23.42	0	0
	1850.7	26047	1.4	QPSK	3	3	23.25	0	0
	1850.7	26047	1.4	QPSK	6	0	22.28	0-1	1
	1850.7	26047	1.4	16-QAM	1	0	22.50	0-1	1
	1850.7	26047	1.4	16-QAM	1	2	22.61	0-1	1
	1850.7	26047	1.4	16-QAM	1	5	22.50	0-1	1
	1850.7	26047	1.4	16-QAM	3	0	22.36	0-1	1
	1850.7	26047	1.4	16-QAM	3	2	22.34	0-1	1
	1850.7	26047	1.4	16-QAM	3	3	22.43	0-1	1
	1850.7	26047	1.4	16-QAM	6	0	20.92	0-2	2
Mid	1882.5	26365	1.4	QPSK	1	0	23.36	0	0
	1882.5	26365	1.4	QPSK	1	2	23.39	0	0
	1882.5	26365	1.4	QPSK	1	5	23.24	0	0
	1882.5	26365	1.4	QPSK	3	0	23.28	0	0
	1882.5	26365	1.4	QPSK	3	2	23.15	0	0
	1882.5	26365	1.4	QPSK	3	3	23.09	0	0
	1882.5	26365	1.4	QPSK	6	0	22.39	0-1	1
	1882.5	26365	1.4	16-QAM	1	0	21.78	0-1	1
	1882.5	26365	1.4	16-QAM	1	2	21.90	0-1	1
	1882.5	26365	1.4	16-QAM	1	5	21.86	0-1	1
	1882.5	26365	1.4	16-QAM	3	0	22.10	0-1	1
	1882.5	26365	1.4	16-QAM	3	2	22.46	0-1	1
	1882.5	26365	1.4	16-QAM	3	3	22.11	0-1	1
	1882.5	26365	1.4	16-QAM	6	0	21.34	0-2	2
High	1914.3	26683	1.4	QPSK	1	0	23.42	0	0
	1914.3	26683	1.4	QPSK	1	2	23.62	0	0
	1914.3	26683	1.4	QPSK	1	5	23.47	0	0
	1914.3	26683	1.4	QPSK	3	0	23.39	0	0
	1914.3	26683	1.4	QPSK	3	2	23.26	0	0
	1914.3	26683	1.4	QPSK	3	3	23.27	0	0
	1914.3	26683	1.4	QPSK	6	0	22.31	0-1	1
	1914.3	26683	1.4	16-QAM	1	0	22.15	0-1	1
	1914.3	26683	1.4	16-QAM	1	2	22.24	0-1	1
	1914.3	26683	1.4	16-QAM	1	5	22.16	0-1	1
	1914.3	26683	1.4	16-QAM	3	0	21.77	0-1	1
	1914.3	26683	1.4	16-QAM	3	2	22.09	0-1	1
	1914.3	26683	1.4	16-QAM	3	3	21.93	0-1	1
	1914.3	26683	1.4	16-QAM	6	0	21.28	0-2	2

9.4.3 LTE Band 41

Table 9-12
LTE Band 41 Conducted Powers - 20 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]	Deviation [dB]
Low	2506.0	39750	20	QPSK	1	0	**23.49**	0	0	0.49
	2506.0	39750	20	QPSK	1	50	23.49	0	0	0.49
	2506.0	39750	20	QPSK	1	99	23.06	0	0	0.06
	2506.0	39750	20	QPSK	50	0	22.36	0-1	1	0.36
	2506.0	39750	20	QPSK	50	25	**22.44**	0-1	1	0.44
	2506.0	39750	20	QPSK	50	50	22.27	0-1	1	0.27
	2506.0	39750	20	QPSK	100	0	**22.46**	0-1	1	0.46
	2506.0	39750	20	16QAM	1	0	22.27	0-1	1	0.27
	2506.0	39750	20	16QAM	1	50	22.45	0-1	1	0.45
	2506.0	39750	20	16QAM	1	99	21.81	0-1	1	-0.19
	2506.0	39750	20	16QAM	50	0	21.47	0-2	2	0.47
	2506.0	39750	20	16QAM	50	25	21.42	0-2	2	0.42
	2506.0	39750	20	16QAM	50	50	21.35	0-2	2	0.35
	2506.0	39750	20	16QAM	100	0	21.38	0-2	2	0.38
Low Mid	2549.5	40185	20	QPSK	1	0	23.20	0	0	0.20
	2549.5	40185	20	QPSK	1	50	23.17	0	0	0.17
	2549.5	40185	20	QPSK	1	99	22.97	0	0	-0.03
	2549.5	40185	20	QPSK	50	0	22.04	0-1	1	0.04
	2549.5	40185	20	QPSK	50	25	21.91	0-1	1	-0.09
	2549.5	40185	20	QPSK	50	50	21.84	0-1	1	-0.16
	2549.5	40185	20	QPSK	100	0	21.94	0-1	1	-0.06
	2549.5	40185	20	16-QAM	1	0	22.10	0-1	1	0.10
	2549.5	40185	20	16-QAM	1	50	22.05	0-1	1	0.05
	2549.5	40185	20	16-QAM	1	99	21.80	0-1	1	-0.20
	2549.5	40185	20	16-QAM	50	0	21.17	0-2	2	0.17
	2549.5	40185	20	16-QAM	50	25	21.04	0-2	2	0.04
	2549.5	40185	20	16-QAM	50	50	20.88	0-2	2	-0.12
	2549.5	40185	20	16-QAM	100	0	20.99	0-2	2	-0.01
Mid	2593.0	40620	20	QPSK	1	0	23.21	0	0	0.21
	2593.0	40620	20	QPSK	1	50	23.12	0	0	0.12
	2593.0	40620	20	QPSK	1	99	22.78	0	0	-0.22
	2593.0	40620	20	QPSK	50	0	21.97	0-1	1	-0.03
	2593.0	40620	20	QPSK	50	25	21.88	0-1	1	-0.12
	2593.0	40620	20	QPSK	50	50	21.80	0-1	1	-0.20
	2593.0	40620	20	QPSK	100	0	21.92	0-1	1	-0.08
	2593.0	40620	20	16-QAM	1	0	22.43	0-1	1	0.43
	2593.0	40620	20	16-QAM	1	50	22.45	0-1	1	0.45
	2593.0	40620	20	16-QAM	1	99	22.26	0-1	1	0.26
	2593.0	40620	20	16-QAM	50	0	21.05	0-2	2	0.05
	2593.0	40620	20	16-QAM	50	25	20.98	0-2	2	-0.02
	2593.0	40620	20	16-QAM	50	50	20.95	0-2	2	-0.05
	2593.0	40620	20	16-QAM	100	0	20.96	0-2	2	-0.04
Mid High	2636.5	41055	20	QPSK	1	0	22.89	0	0	-0.11
	2636.5	41055	20	QPSK	1	50	22.81	0	0	-0.19
	2636.5	41055	20	QPSK	1	99	23.01	0	0	0.01
	2636.5	41055	20	QPSK	50	0	21.96	0-1	1	-0.04
	2636.5	41055	20	QPSK	50	25	21.88	0-1	1	-0.12
	2636.5	41055	20	QPSK	50	50	21.82	0-1	1	-0.18
	2636.5	41055	20	QPSK	100	0	21.87	0-1	1	-0.13
	2636.5	41055	20	16-QAM	1	0	21.65	0-1	1	-0.35
	2636.5	41055	20	16-QAM	1	50	21.86	0-1	1	-0.14
	2636.5	41055	20	16-QAM	1	99	22.03	0-1	1	0.03
	2636.5	41055	20	16-QAM	50	0	21.00	0-2	2	0.00
	2636.5	41055	20	16-QAM	50	25	20.83	0-2	2	-0.17
	2636.5	41055	20	16-QAM	50	50	20.84	0-2	2	-0.16
	2636.5	41055	20	16-QAM	100	0	20.79	0-2	2	-0.21
High	2680.0	41490	20	QPSK	1	0	23.30	0	0	0.30
	2680.0	41490	20	QPSK	1	50	23.49	0	0	0.49
	2680.0	41490	20	QPSK	1	99	23.35	0	0	0.35
	2680.0	41490	20	QPSK	50	0	22.07	0-1	1	0.07
	2680.0	41490	20	QPSK	50	25	21.95	0-1	1	-0.05
	2680.0	41490	20	QPSK	50	50	22.01	0-1	1	0.01
	2680.0	41490	20	QPSK	100	0	22.07	0-1	1	0.07
	2680.0	41490	20	16-QAM	1	0	22.12	0-1	1	0.12
	2680.0	41490	20	16-QAM	1	50	22.24	0-1	1	0.24
	2680.0	41490	20	16-QAM	1	99	22.19	0-1	1	0.19
	2680.0	41490	20	16-QAM	50	0	21.23	0-2	2	0.23
	2680.0	41490	20	16-QAM	50	25	21.04	0-2	2	0.04
	2680.0	41490	20	16-QAM	50	50	21.03	0-2	2	0.03
	2680.0	41490	20	16-QAM	100	0	21.17	0-2	2	0.17

Table 9-13
LTE Band 41 Conducted Powers - 15 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	2506.0	39750	15	QPSK	1	0	23.49	0	0
	2506.0	39750	15	QPSK	1	36	23.44	0	0
	2506.0	39750	15	QPSK	1	74	23.48	0	0
	2506.0	39750	15	QPSK	36	0	22.33	0-1	1
	2506.0	39750	15	QPSK	36	18	22.39	0-1	1
	2506.0	39750	15	QPSK	36	37	22.38	0-1	1
	2506.0	39750	15	QPSK	75	0	22.35	0-1	1
	2506.0	39750	15	16QAM	1	0	22.44	0-1	1
	2506.0	39750	15	16QAM	1	36	22.45	0-1	1
	2506.0	39750	15	16QAM	1	74	22.04	0-1	1
	2506.0	39750	15	16QAM	36	0	21.44	0-2	2
	2506.0	39750	15	16QAM	36	18	21.40	0-2	2
	2506.0	39750	15	16QAM	36	37	21.39	0-2	2
	2506.0	39750	15	16QAM	75	0	21.43	0-2	2
Low Mid	2549.5	40185	15	QPSK	1	0	23.00	0	0
	2549.5	40185	15	QPSK	1	36	22.79	0	0
	2549.5	40185	15	QPSK	1	74	22.82	0	0
	2549.5	40185	15	QPSK	36	0	21.98	0-1	1
	2549.5	40185	15	QPSK	36	18	21.87	0-1	1
	2549.5	40185	15	QPSK	36	37	21.83	0-1	1
	2549.5	40185	15	QPSK	75	0	21.89	0-1	1
	2549.5	40185	15	16-QAM	1	0	21.86	0-1	1
	2549.5	40185	15	16-QAM	1	36	21.55	0-1	1
	2549.5	40185	15	16-QAM	1	74	21.98	0-1	1
	2549.5	40185	15	16-QAM	36	0	21.06	0-2	2
	2549.5	40185	15	16-QAM	36	18	20.87	0-2	2
	2549.5	40185	15	16-QAM	36	37	20.82	0-2	2
	2549.5	40185	15	16-QAM	75	0	20.91	0-2	2
Mid	2593.0	40620	15	QPSK	1	0	23.13	0	0
	2593.0	40620	15	QPSK	1	36	22.93	0	0
	2593.0	40620	15	QPSK	1	74	22.87	0	0
	2593.0	40620	15	QPSK	36	0	21.85	0-1	1
	2593.0	40620	15	QPSK	36	18	21.78	0-1	1
	2593.0	40620	15	QPSK	36	37	21.74	0-1	1
	2593.0	40620	15	QPSK	75	0	21.83	0-1	1
	2593.0	40620	15	16-QAM	1	0	22.15	0-1	1
	2593.0	40620	15	16-QAM	1	36	21.95	0-1	1
	2593.0	40620	15	16-QAM	1	74	21.86	0-1	1
	2593.0	40620	15	16-QAM	36	0	21.02	0-2	2
	2593.0	40620	15	16-QAM	36	18	20.91	0-2	2
	2593.0	40620	15	16-QAM	36	37	20.83	0-2	2
	2593.0	40620	15	16-QAM	75	0	20.95	0-2	2
Mid High	2636.5	41055	15	QPSK	1	0	22.74	0	0
	2636.5	41055	15	QPSK	1	36	22.56	0	0
	2636.5	41055	15	QPSK	1	74	22.81	0	0
	2636.5	41055	15	QPSK	36	0	21.92	0-1	1
	2636.5	41055	15	QPSK	36	18	21.80	0-1	1
	2636.5	41055	15	QPSK	36	37	21.82	0-1	1
	2636.5	41055	15	QPSK	75	0	21.87	0-1	1
	2636.5	41055	15	16-QAM	1	0	21.91	0-1	1
	2636.5	41055	15	16-QAM	1	36	21.55	0-1	1
	2636.5	41055	15	16-QAM	1	74	22.15	0-1	1
	2636.5	41055	15	16-QAM	36	0	20.84	0-2	2
	2636.5	41055	15	16-QAM	36	18	20.73	0-2	2
	2636.5	41055	15	16-QAM	36	37	20.87	0-2	2
	2636.5	41055	15	16-QAM	75	0	20.80	0-2	2
High	2680.0	41490	15	QPSK	1	0	23.12	0	0
	2680.0	41490	15	QPSK	1	36	22.87	0	0
	2680.0	41490	15	QPSK	1	74	23.15	0	0
	2680.0	41490	15	QPSK	36	0	22.16	0-1	1
	2680.0	41490	15	QPSK	36	18	22.08	0-1	1
	2680.0	41490	15	QPSK	36	37	22.04	0-1	1
	2680.0	41490	15	QPSK	75	0	22.09	0-1	1
	2680.0	41490	15	16-QAM	1	0	22.20	0-1	1
	2680.0	41490	15	16-QAM	1	36	22.09	0-1	1
	2680.0	41490	15	16-QAM	1	74	22.23	0-1	1
	2680.0	41490	15	16-QAM	36	0	21.10	0-2	2
	2680.0	41490	15	16-QAM	36	18	21.10	0-2	2
	2680.0	41490	15	16-QAM	36	37	20.99	0-2	2
	2680.0	41490	15	16-QAM	75	0	21.17	0-2	2

Table 9-14
LTE Band 41 Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	2506.0	39750	10	QPSK	1	0	23.27	0	0
	2506.0	39750	10	QPSK	1	25	23.23	0	0
	2506.0	39750	10	QPSK	1	49	23.32	0	0
	2506.0	39750	10	QPSK	25	0	22.29	0-1	1
	2506.0	39750	10	QPSK	25	12	22.22	0-1	1
	2506.0	39750	10	QPSK	25	25	22.26	0-1	1
	2506.0	39750	10	QPSK	50	0	22.27	0-1	1
	2506.0	39750	10	16QAM	1	0	22.19	0-1	1
	2506.0	39750	10	16QAM	1	25	22.31	0-1	1
	2506.0	39750	10	16QAM	1	49	22.19	0-1	1
	2506.0	39750	10	16QAM	25	0	21.30	0-2	2
	2506.0	39750	10	16QAM	25	12	21.34	0-2	2
	2506.0	39750	10	16QAM	25	25	21.39	0-2	2
	2506.0	39750	10	16QAM	50	0	21.40	0-2	2
Low Mid	2549.5	40185	10	QPSK	1	0	23.00	0	0
	2549.5	40185	10	QPSK	1	25	22.82	0	0
	2549.5	40185	10	QPSK	1	49	22.69	0	0
	2549.5	40185	10	QPSK	25	0	21.93	0-1	1
	2549.5	40185	10	QPSK	25	12	21.89	0-1	1
	2549.5	40185	10	QPSK	25	25	21.84	0-1	1
	2549.5	40185	10	QPSK	50	0	21.97	0-1	1
	2549.5	40185	10	16-QAM	1	0	21.98	0-1	1
	2549.5	40185	10	16-QAM	1	25	21.77	0-1	1
	2549.5	40185	10	16-QAM	1	49	21.74	0-1	1
	2549.5	40185	10	16-QAM	25	0	20.96	0-2	2
	2549.5	40185	10	16-QAM	25	12	20.71	0-2	2
	2549.5	40185	10	16-QAM	25	25	20.85	0-2	2
	2549.5	40185	10	16-QAM	50	0	20.83	0-2	2
Mid	2593.0	40620	10	QPSK	1	0	23.10	0	0
	2593.0	40620	10	QPSK	1	25	23.08	0	0
	2593.0	40620	10	QPSK	1	49	22.87	0	0
	2593.0	40620	10	QPSK	25	0	21.96	0-1	1
	2593.0	40620	10	QPSK	25	12	21.90	0-1	1
	2593.0	40620	10	QPSK	25	25	21.81	0-1	1
	2593.0	40620	10	QPSK	50	0	22.00	0-1	1
	2593.0	40620	10	16-QAM	1	0	22.15	0-1	1
	2593.0	40620	10	16-QAM	1	25	22.11	0-1	1
	2593.0	40620	10	16-QAM	1	49	21.95	0-1	1
	2593.0	40620	10	16-QAM	25	0	21.08	0-2	2
	2593.0	40620	10	16-QAM	25	12	20.97	0-2	2
	2593.0	40620	10	16-QAM	25	25	20.94	0-2	2
	2593.0	40620	10	16-QAM	50	0	20.99	0-2	2
Mid High	2636.5	41055	10	QPSK	1	0	22.80	0	0
	2636.5	41055	10	QPSK	1	25	22.84	0	0
	2636.5	41055	10	QPSK	1	49	22.88	0	0
	2636.5	41055	10	QPSK	25	0	21.83	0-1	1
	2636.5	41055	10	QPSK	25	12	21.92	0-1	1
	2636.5	41055	10	QPSK	25	25	21.78	0-1	1
	2636.5	41055	10	QPSK	50	0	21.85	0-1	1
	2636.5	41055	10	16-QAM	1	0	21.91	0-1	1
	2636.5	41055	10	16-QAM	1	25	21.92	0-1	1
	2636.5	41055	10	16-QAM	1	49	21.75	0-1	1
	2636.5	41055	10	16-QAM	25	0	20.89	0-2	2
	2636.5	41055	10	16-QAM	25	12	20.91	0-2	2
	2636.5	41055	10	16-QAM	25	25	20.85	0-2	2
	2636.5	41055	10	16-QAM	50	0	20.85	0-2	2
High	2680.0	41490	10	QPSK	1	0	23.18	0	0
	2680.0	41490	10	QPSK	1	25	22.89	0	0
	2680.0	41490	10	QPSK	1	49	23.18	0	0
	2680.0	41490	10	QPSK	25	0	22.01	0-1	1
	2680.0	41490	10	QPSK	25	12	22.05	0-1	1
	2680.0	41490	10	QPSK	25	25	21.99	0-1	1
	2680.0	41490	10	QPSK	50	0	22.04	0-1	1
	2680.0	41490	10	16-QAM	1	0	21.98	0-1	1
	2680.0	41490	10	16-QAM	1	25	22.07	0-1	1
	2680.0	41490	10	16-QAM	1	49	22.10	0-1	1
	2680.0	41490	10	16-QAM	25	0	21.07	0-2	2
	2680.0	41490	10	16-QAM	25	12	21.11	0-2	2
	2680.0	41490	10	16-QAM	25	25	21.01	0-2	2
	2680.0	41490	10	16-QAM	50	0	21.07	0-2	2

Table 9-15
LTE Band 41 Conducted Powers - 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	2506.0	39750	5	QPSK	1	0	23.15	0	0
	2506.0	39750	5	QPSK	1	12	23.25	0	0
	2506.0	39750	5	QPSK	1	24	23.17	0	0
	2506.0	39750	5	QPSK	12	0	22.24	0-1	1
	2506.0	39750	5	QPSK	12	6	22.31	0-1	1
	2506.0	39750	5	QPSK	12	13	22.30	0-1	1
	2506.0	39750	5	QPSK	25	0	22.25	0-1	1
	2506.0	39750	5	16-QAM	1	0	22.12	0-1	1
	2506.0	39750	5	16-QAM	1	12	22.10	0-1	1
	2506.0	39750	5	16-QAM	1	24	22.21	0-1	1
	2506.0	39750	5	16-QAM	12	0	21.26	0-2	2
	2506.0	39750	5	16-QAM	12	6	21.32	0-2	2
	2506.0	39750	5	16-QAM	12	13	21.22	0-2	2
	2506.0	39750	5	16-QAM	25	0	21.43	0-2	2
Low Mid	2549.5	40185	5	QPSK	1	0	22.91	0	0
	2549.5	40185	5	QPSK	1	12	23.49	0	0
	2549.5	40185	5	QPSK	1	24	22.60	0	0
	2549.5	40185	5	QPSK	12	0	21.93	0-1	1
	2549.5	40185	5	QPSK	12	6	21.85	0-1	1
	2549.5	40185	5	QPSK	12	13	21.79	0-1	1
	2549.5	40185	5	QPSK	25	0	21.90	0-1	1
	2549.5	40185	5	16-QAM	1	0	22.29	0-1	1
	2549.5	40185	5	16-QAM	1	12	22.34	0-1	1
	2549.5	40185	5	16-QAM	1	24	22.20	0-1	1
	2549.5	40185	5	16-QAM	12	0	20.79	0-2	2
	2549.5	40185	5	16-QAM	12	6	20.79	0-2	2
	2549.5	40185	5	16-QAM	12	13	20.75	0-2	2
	2549.5	40185	5	16-QAM	25	0	21.12	0-2	2
Mid	2593.0	40620	5	QPSK	1	0	22.92	0	0
	2593.0	40620	5	QPSK	1	12	22.92	0	0
	2593.0	40620	5	QPSK	1	24	22.76	0	0
	2593.0	40620	5	QPSK	12	0	21.86	0-1	1
	2593.0	40620	5	QPSK	12	6	21.85	0-1	1
	2593.0	40620	5	QPSK	12	13	21.89	0-1	1
	2593.0	40620	5	QPSK	25	0	21.93	0-1	1
	2593.0	40620	5	16-QAM	1	0	22.03	0-1	1
	2593.0	40620	5	16-QAM	1	12	21.69	0-1	1
	2593.0	40620	5	16-QAM	1	24	21.73	0-1	1
	2593.0	40620	5	16-QAM	12	0	20.91	0-2	2
	2593.0	40620	5	16-QAM	12	6	20.91	0-2	2
	2593.0	40620	5	16-QAM	12	13	20.94	0-2	2
	2593.0	40620	5	16-QAM	25	0	20.90	0-2	2
Mid High	2636.5	41055	5	QPSK	1	0	22.62	0	0
	2636.5	41055	5	QPSK	1	12	22.76	0	0
	2636.5	41055	5	QPSK	1	24	22.78	0	0
	2636.5	41055	5	QPSK	12	0	21.84	0-1	1
	2636.5	41055	5	QPSK	12	6	21.82	0-1	1
	2636.5	41055	5	QPSK	12	13	21.81	0-1	1
	2636.5	41055	5	QPSK	25	0	21.80	0-1	1
	2636.5	41055	5	16-QAM	1	0	21.69	0-1	1
	2636.5	41055	5	16-QAM	1	12	21.85	0-1	1
	2636.5	41055	5	16-QAM	1	24	21.55	0-1	1
	2636.5	41055	5	16-QAM	12	0	20.76	0-2	2
	2636.5	41055	5	16-QAM	12	6	20.75	0-2	2
	2636.5	41055	5	16-QAM	12	13	20.63	0-2	2
	2636.5	41055	5	16-QAM	25	0	20.78	0-2	2
High	2680.0	41490	5	QPSK	1	0	23.15	0	0
	2680.0	41490	5	QPSK	1	12	23.30	0	0
	2680.0	41490	5	QPSK	1	24	23.10	0	0
	2680.0	41490	5	QPSK	12	0	22.05	0-1	1
	2680.0	41490	5	QPSK	12	6	21.92	0-1	1
	2680.0	41490	5	QPSK	12	13	21.98	0-1	1
	2680.0	41490	5	QPSK	25	0	22.00	0-1	1
	2680.0	41490	5	16-QAM	1	0	21.95	0-1	1
	2680.0	41490	5	16-QAM	1	12	21.95	0-1	1
	2680.0	41490	5	16-QAM	1	24	22.20	0-1	1
	2680.0	41490	5	16-QAM	12	0	21.07	0-2	2
	2680.0	41490	5	16-QAM	12	6	20.94	0-2	2
	2680.0	41490	5	16-QAM	12	13	21.00	0-2	2
	2680.0	41490	5	16-QAM	25	0	21.05	0-2	2

9.5 WLAN Conducted Powers

Table 9-16
2.4 GHz IEEE 802.11b Average RF Power

Freq [MHz]	Channel	2.4GHz Conducted Power [dBm]
		IEEE Transmission Mode
		802.11b
2412	1	17.05
2437	6	17.36
2462	11	**17.37**

Table 9-17
2.4 GHz IEEE 802.11g Average RF Power

Freq [MHz]	Channel	2.4GHz Conducted Power [dBm]
		IEEE Transmission Mode
		802.11g
2412	1	11.39
2417	2	13.20
2437	6	12.99
2457	10	13.18
2462	11	11.48

Justification for test configurations for WLAN per KDB Publication 248227 D01:

- Power measurements were performed for the transmission mode configuration with the highest maximum output power specified for production units.
- For transmission modes with the same maximum output power specification, powers were measured for the largest channel bandwidth, lowest order modulation and lowest data rate.
- For transmission modes with identical maximum specified output power, channel bandwidth, modulation and data rates, power measurements were required for all identical configurations.
- For each transmission mode configuration, powers were measured for the highest and lowest channels; and at the mid-band channel(s) when there were at least 3 channels supported. For configurations with multiple mid-band channels, due to an even number of channels, both channels were measured.
- The bolded data rate and channel above were tested for SAR.

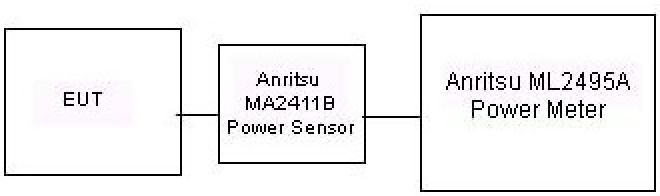

Figure 9-4
Power Measurement Setup

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
11/17/2015	835H	21.4	820	0.909	41.007	0.899	41.578	1.11%	-1.37%
			835	0.925	40.806	0.900	41.500	2.78%	-1.67%
			850	0.940	40.605	0.916	41.500	2.62%	-2.16%
11/19/2015	1900H	22.1	1850	1.394	39.014	1.400	40.000	-0.43%	-2.46%
			1880	1.433	38.928	1.400	40.000	2.36%	-2.68%
			1910	1.458	38.770	1.400	40.000	4.14%	-3.07%
11/16/2015	2450H	24.2	2450	1.862	39.522	1.800	39.200	3.44%	0.82%
			2500	1.915	39.358	1.855	39.136	3.23%	0.57%
			2550	1.970	39.130	1.909	39.073	3.20%	0.15%
			2600	2.040	39.015	1.964	39.009	3.87%	0.02%
11/27/2015	2450H	21.6	2400	1.833	38.832	1.756	39.289	4.38%	-1.16%
			2450	1.888	38.637	1.800	39.200	4.89%	-1.44%
			2500	1.946	38.447	1.855	39.136	4.91%	-1.76%
11/17/2015	835B	21.4	820	0.991	54.647	0.969	55.258	2.27%	-1.11%
			835	1.005	54.494	0.970	55.200	3.61%	-1.28%
			850	1.019	54.344	0.988	55.154	3.14%	-1.47%
11/17/2015	1900B	22.7	1850	1.480	51.046	1.520	53.300	-2.63%	-4.23%
			1880	1.513	50.946	1.520	53.300	-0.46%	-4.42%
			1910	1.546	50.836	1.520	53.300	1.71%	-4.62%
11/19/2015	2450B	23.5	2450	1.976	51.091	1.950	52.700	1.33%	-3.05%
			2500	2.033	50.881	2.021	52.636	0.59%	-3.33%
			2550	2.105	50.714	2.092	52.573	0.62%	-3.54%
			2600	2.167	50.536	2.163	52.509	0.18%	-3.76%
11/27/2015	2450B	22.2	2400	1.938	52.083	1.902	52.767	1.89%	-1.30%
			2450	2.007	51.881	1.950	52.700	2.92%	-1.55%
			2500	2.076	51.674	2.021	52.636	2.72%	-1.83%

The above measured tissue parameters were used in the DASY software. The DASY software was used to perform interpolation to determine the dielectric parameters at the SAR test device frequencies (per KDB Publication 865664 D01 and IEEE 1528-2013 6.6.1.2). The tissue parameters listed in the SAR test plots may slightly differ from the table above due to significant digit rounding in the software.

10.2 Test System Verification

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

Table 10-2
System Verification Results

System Verification TARGET & MEASURED												
SAR System #	Tissue Frequency (MHz)	Tissue Type	Date:	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Dipole SN	Probe SN	Measured SAR_{1g} (W/kg)	1 W Target SAR_{1g} (W/kg)	1 W Normalized SAR_{1g} (W/kg)	$Deviation_{1g}$ (%)
A	835	HEAD	11/17/2015	22.3	21.4	0.200	4d132	3332	1.970	9.250	9.850	6.49%
I	1900	HEAD	11/19/2015	22.8	22.1	0.100	5d149	3333	4.220	40.700	42.200	3.69%
I	2450	HEAD	11/16/2015	24.1	23.9	0.100	719	3333	5.390	54.200	53.900	-0.55%
H	2450	HEAD	11/27/2015	20.7	21.6	0.100	797	3263	5.520	52.700	55.200	4.74%
H	835	BODY	11/17/2015	22.5	21.6	0.200	4d133	3263	1.990	9.250	9.950	7.57%
C	1900	BODY	11/17/2015	23.1	22.7	0.100	5d148	3288	3.970	40.200	39.700	-1.24%
C	2450	BODY	11/19/2015	23.8	23.5	0.100	882	3288	5.310	50.700	53.100	4.73%
D	2450	BODY	11/27/2015	21.7	20.5	0.100	719	3209	5.570	51.900	55.700	7.32%

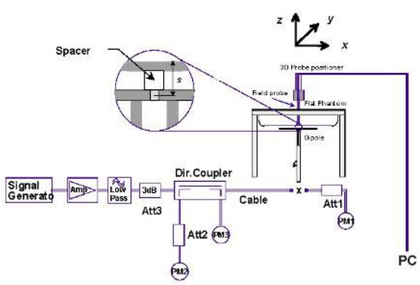

Figure 10-1
System Verification Setup Diagram

Figure 10-2
System Verification Setup Photo

11 SAR DATA SUMMARY

11.1 Standalone Head SAR Data

Table 11-1
GSM/GPRS 850 Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	# of Time Slots	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
836.60	190	GSM 850	GSM	33.7	33.62	0.08	Right	Cheek	01890	1	1:8.3	0.305	1.019	0.311	
836.60	190	GSM 850	GSM	33.7	33.62	-0.12	Right	Tilt	01890	1	1:8.3	0.126	1.019	0.128	
836.60	190	GSM 850	GSM	33.7	33.62	-0.11	Left	Cheek	01890	1	1:8.3	0.273	1.019	0.278	
836.60	190	GSM 850	GSM	33.7	33.62	0.00	Left	Tilt	01890	1	1:8.3	0.127	1.019	0.129	
836.60	190	GSM 850	GPRS	31.7	31.21	0.11	Right	Cheek	01890	2	1:4.15	0.326	1.119	0.365	A1
836.60	190	GSM 850	GPRS	31.7	31.21	-0.01	Right	Tilt	01890	2	1:4.15	0.154	1.119	0.172	
836.60	190	GSM 850	GPRS	31.7	31.21	0.09	Left	Cheek	01890	2	1:4.15	0.284	1.119	0.318	
836.60	190	GSM 850	GPRS	31.7	31.21	-0.04	Left	Tilt	01890	2	1:4.15	0.124	1.119	0.139	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram								

Table 11-2
GSM/GPRS 1900 Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	# of Time Slots	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
1880.00	661	GSM 1900	GSM	29.7	29.61	0.04	Right	Cheek	01890	1	1:8.3	0.131	1.021	0.134	
1880.00	661	GSM 1900	GSM	29.7	29.61	0.01	Right	Tilt	01890	1	1:8.3	0.099	1.021	0.101	
1880.00	661	GSM 1900	GSM	29.7	29.61	-0.09	Left	Cheek	01890	1	1:8.3	0.230	1.021	0.235	
1880.00	661	GSM 1900	GSM	29.7	29.61	0.05	Left	Tilt	01890	1	1:8.3	0.136	1.021	0.139	
1880.00	661	GSM 1900	GPRS	27.7	27.46	0.18	Right	Cheek	01890	2	1:4.15	0.190	1.057	0.201	
1880.00	661	GSM 1900	GPRS	27.7	27.46	-0.02	Right	Tilt	01890	2	1:4.15	0.138	1.057	0.146	
1880.00	661	GSM 1900	GPRS	27.7	27.46	0.12	Left	Cheek	01890	2	1:4.15	0.295	1.057	0.312	A2
1880.00	661	GSM 1900	GPRS	27.7	27.46	0.07	Left	Tilt	01890	2	1:4.15	0.177	1.057	0.187	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram								

Table 11-3
UMTS 850 Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
836.60	4183	UMTS 850	RMC	23.7	23.45	0.06	Right	Cheek	01890	1:1	0.424	1.059	0.449	A3
836.60	4183	UMTS 850	RMC	23.7	23.45	0.20	Right	Tilt	01890	1:1	0.180	1.059	0.191	
836.60	4183	UMTS 850	RMC	23.7	23.45	-0.10	Left	Cheek	01890	1:1	0.365	1.059	0.387	
836.60	4183	UMTS 850	RMC	23.7	23.45	0.02	Left	Tilt	01890	1:1	0.167	1.059	0.177	
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	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
1880.00	9400	UMTS 1900	RMC	23.7	23.57	-0.09	Right	Cheek	01890	1:1	0.368	1.030	0.379	
1880.00	9400	UMTS 1900	RMC	23.7	23.57	0.04	Right	Tilt	01890	1:1	0.253	1.030	0.261	
1880.00	9400	UMTS 1900	RMC	23.7	23.57	-0.07	Left	Cheek	01890	1:1	0.550	1.030	0.567	A4
1880.00	9400	UMTS 1900	RMC	23.7	23.57	-0.01	Left	Tilt	01890	1:1	0.339	1.030	0.349	
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
CDMA BC10 (§90S) Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
820.10	564	CDMA BC10 (§90S)	RC3 / SO55	24.7	24.60	-0.06	Right	Cheek	01890	1:1	0.341	1.023	0.349	A5
820.10	564	CDMA BC10 (§90S)	RC3 / SO55	24.7	24.60	-0.01	Right	Tilt	01890	1:1	0.138	1.023	0.141	
820.10	564	CDMA BC10 (§90S)	RC3 / SO55	24.7	24.60	0.15	Left	Cheek	01890	1:1	0.287	1.023	0.294	
820.10	564	CDMA BC10 (§90S)	RC3 / SO55	24.7	24.60	0.19	Left	Tilt	01890	1:1	0.140	1.023	0.143	
820.10	564	CDMA BC10 (§90S)	EVDO Rev. A	24.7	24.42	0.10	Right	Cheek	01890	1:1	0.324	1.067	0.346	
820.10	564	CDMA BC10 (§90S)	EVDO Rev. A	24.7	24.42	-0.12	Right	Tilt	01890	1:1	0.137	1.067	0.146	
820.10	564	CDMA BC10 (§90S)	EVDO Rev. A	24.7	24.42	0.15	Left	Cheek	01890	1:1	0.294	1.067	0.314	
820.10	564	CDMA BC10 (§90S)	EVDO Rev. A	24.7	24.42	-0.11	Left	Tilt	01890	1:1	0.158	1.067	0.169	
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
CDMA BC0 (§22H) Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
836.52	384	CDMA BC0 (§22H)	RC3 / SO55	24.7	24.46	0.06	Right	Cheek	01890	1:1	0.504	1.057	0.533	A6
836.52	384	CDMA BC0 (§22H)	RC3 / SO55	24.7	24.46	-0.11	Right	Tilt	01890	1:1	0.202	1.057	0.214	
836.52	384	CDMA BC0 (§22H)	RC3 / SO55	24.7	24.46	-0.13	Left	Cheek	01890	1:1	0.481	1.057	0.508	
836.52	384	CDMA BC0 (§22H)	RC3 / SO55	24.7	24.46	-0.12	Left	Tilt	01890	1:1	0.203	1.057	0.215	
836.52	384	CDMA BC0 (§22H)	EVDO Rev. A	24.7	24.50	0.15	Right	Cheek	01890	1:1	0.480	1.047	0.503	
836.52	384	CDMA BC0 (§22H)	EVDO Rev. A	24.7	24.50	0.07	Right	Tilt	01890	1:1	0.222	1.047	0.232	
836.52	384	CDMA BC0 (§22H)	EVDO Rev. A	24.7	24.50	0.17	Left	Cheek	01890	1:1	0.431	1.047	0.451	
836.52	384	CDMA BC0 (§22H)	EVDO Rev. A	24.7	24.50	0.16	Left	Tilt	01890	1:1	0.195	1.047	0.204	
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
PCS CDMA Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
1880.00	600	PCS CDMA	RC3 / SO55	24.7	24.62	0.05	Right	Cheek	01890	1:1	0.362	1.019	0.369	
1880.00	600	PCS CDMA	RC3 / SO55	24.7	24.62	-0.06	Right	Tilt	01890	1:1	0.309	1.019	0.315	
1880.00	600	PCS CDMA	RC3 / SO55	24.7	24.62	-0.01	Left	Cheek	01890	1:1	0.650	1.019	0.662	A7
1880.00	600	PCS CDMA	RC3 / SO55	24.7	24.62	0.10	Left	Tilt	01890	1:1	0.421	1.019	0.429	
1880.00	600	PCS CDMA	EVDO Rev. A	24.7	24.51	0.20	Right	Cheek	01890	1:1	0.410	1.045	0.428	
1880.00	600	PCS CDMA	EVDO Rev. A	24.7	24.51	0.07	Right	Tilt	01890	1:1	0.308	1.045	0.322	
1880.00	600	PCS CDMA	EVDO Rev. A	24.7	24.51	-0.04	Left	Cheek	01890	1:1	0.635	1.045	**0.664**	
1880.00	600	PCS CDMA	EVDO Rev. A	24.7	24.51	-0.01	Left	Tilt	01890	1:1	0.420	1.045	0.439	
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 26 (Cell) Head SAR

MEASUREMENT RESULTS																			
FREQUENCY MHz	Ch.		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g) (W/kg)	Scaling Factor	Reported SAR (1g) (W/kg)	Plot #
836.50	26915	Mid	LTE Band 26 (Cell)	15	23.7	23.48	0.14	0	Right	Cheek	QPSK	1	0	01891	1:1	0.357	1.052	0.376	
836.50	26915	Mid	LTE Band 26 (Cell)	15	22.7	22.51	-0.08	1	Right	Cheek	QPSK	36	37	01891	1:1	0.335	1.045	0.350	
836.50	26915	Mid	LTE Band 26 (Cell)	15	23.7	23.48	0.09	0	Right	Tilt	QPSK	1	0	01891	1:1	0.150	1.052	0.158	
836.50	26915	Mid	LTE Band 26 (Cell)	15	22.7	22.51	0.14	1	Right	Tilt	QPSK	36	37	01891	1:1	0.140	1.045	0.146	
836.50	26915	Mid	LTE Band 26 (Cell)	15	23.7	23.48	0.18	0	Left	Cheek	QPSK	1	0	01891	1:1	0.358	1.052	0.377	A8
836.50	26915	Mid	LTE Band 26 (Cell)	15	22.7	22.51	0.05	1	Left	Cheek	QPSK	36	37	01891	1:1	0.354	1.045	0.370	
836.50	26915	Mid	LTE Band 26 (Cell)	15	23.7	23.48	0.11	0	Left	Tilt	QPSK	1	0	01891	1:1	0.168	1.052	0.177	
836.50	26915	Mid	LTE Band 26 (Cell)	15	22.7	22.51	-0.06	1	Left	Tilt	QPSK	36	37	01891	1:1	0.164	1.045	0.171	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Head 1.6 W/kg (mW/g) averaged over 1 gram										

Table 11-9
LTE Band 25 (PCS) Head SAR

MEASUREMENT RESULTS																			
FREQUENCY MHz	Ch.		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g) (W/kg)	Scaling Factor	Reported SAR (1g) (W/kg)	Plot #
1882.50	26365	Mid	LTE Band 25 (PCS)	20	23.7	23.62	0.00	0	Right	Cheek	QPSK	1	50	01890	1:1	0.385	1.019	0.392	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	22.7	22.48	0.12	1	Right	Cheek	QPSK	50	0	01890	1:1	0.314	1.052	0.330	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	23.7	23.62	-0.11	0	Right	Tilt	QPSK	1	50	01890	1:1	0.268	1.019	0.273	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	22.7	22.48	-0.04	1	Right	Tilt	QPSK	50	0	01890	1:1	0.218	1.052	0.229	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	23.7	23.62	-0.13	0	Left	Cheek	QPSK	1	50	01890	1:1	0.611	1.019	0.623	A9
1882.50	26365	Mid	LTE Band 25 (PCS)	20	22.7	22.48	-0.01	1	Left	Cheek	QPSK	50	0	01890	1:1	0.476	1.052	0.501	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	23.7	23.62	0.07	0	Left	Tilt	QPSK	1	50	01890	1:1	0.352	1.019	0.359	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	22.7	22.48	0.06	1	Left	Tilt	QPSK	50	0	01890	1:1	0.296	1.052	0.311	
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
LTE Band 41 Head SAR

MEASUREMENT RESULTS																				
FREQUENCY MHz	Ch.		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g) (W/kg)	Scaling Factor (Cond. Power)	Scaling Factor (CP Duty)	Reported SAR (1g) (W/kg)	Plot #
2506.00	39750	Low	LTE Band 41	20	23.5	23.49	0.07	0	Right	Cheek	QPSK	1	0	01891	1:1.59	0.146	1.002	1.010	0.148	
2506.00	39750	Low	LTE Band 41	20	22.5	22.44	-0.03	1	Right	Cheek	QPSK	50	25	01891	1:1.59	0.122	1.014	1.010	0.125	
2506.00	39750	Low	LTE Band 41	20	22.5	22.46	0.03	1	Right	Cheek	QPSK	100	0	01891	1:1.59	0.125	1.009	1.010	0.127	
2506.00	39750	Low	LTE Band 41	20	23.5	23.49	-0.05	0	Right	Tilt	QPSK	1	0	01891	1:1.59	0.063	1.002	1.010	0.064	
2506.00	39750	Low	LTE Band 41	20	22.5	22.44	0.09	1	Right	Tilt	QPSK	50	25	01891	1:1.59	0.052	1.014	1.010	0.053	
2506.00	39750	Low	LTE Band 41	20	22.5	22.46	0.10	1	Right	Tilt	QPSK	100	0	01891	1:1.59	0.053	1.009	1.010	0.054	
2506.00	39750	Low	LTE Band 41	20	23.5	23.49	-0.07	0	Left	Cheek	QPSK	1	0	01891	1:1.59	0.152	1.002	1.010	0.154	A10
2506.00	39750	Low	LTE Band 41	20	22.5	22.44	-0.01	1	Left	Cheek	QPSK	50	25	01891	1:1.59	0.130	1.014	1.010	0.133	
2506.00	39750	Low	LTE Band 41	20	22.5	22.46	0.05	1	Left	Cheek	QPSK	100	0	01891	1:1.59	0.131	1.009	1.010	0.134	
2506.00	39750	Low	LTE Band 41	20	23.5	23.49	0.16	0	Left	Tilt	QPSK	1	0	01891	1:1.59	0.080	1.002	1.010	0.081	
2506.00	39750	Low	LTE Band 41	20	22.5	22.44	-0.09	1	Left	Tilt	QPSK	50	25	01891	1:1.59	0.069	1.014	1.010	0.071	
2506.00	39750	Low	LTE Band 41	20	22.5	22.46	0.05	1	Left	Tilt	QPSK	100	0	01891	1:1.59	0.068	1.009	1.010	0.070	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Head 1.6 W/kg (mW/g) averaged over 1 gram											

Table 11-11
DTS Head SAR

MEASUREMENT RESULTS																	
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Data Rate (Mbps)	Duty Cycle (%)	Peak SAR of Area Scan	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.												W/kg	(W/kg)			(W/kg)	
2462	11	802.11b	DSSS	22	17.5	17.37	-	Right	Cheek	01892	1	99.4	0.161	-	1.030	1.007	-	
2462	11	802.11b	DSSS	22	17.5	17.37	-	Right	Tilt	01892	1	99.4	0.099	-	1.030	1.007	-	
2462	11	802.11b	DSSS	22	17.5	17.37	0.07	Left	Cheek	01892	1	99.4	0.445	0.362	1.030	1.007	**0.376**	A11
2462	11	802.11b	DSSS	22	17.5	17.37	-	Left	Tilt	01892	1	99.4	0.211	-	1.030	1.007	-	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Head 1.6 W/kg (mW/g) averaged over 1 gram										

11.1 Standalone Body-Worn SAR Data

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

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	# of Time Slots	Duty Cycle	Side	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
836.60	190	GSM 850	GSM	33.7	33.62	-0.01	10 mm	01891	1	1:8.3	back	0.439	1.019	0.447	
836.60	190	GSM 850	GPRS	31.7	31.21	-0.12	10 mm	01891	2	1:4.15	back	0.463	1.119	0.518	A12
1880.00	661	GSM 1900	GSM	29.7	29.61	-0.02	10 mm	01890	1	1:8.3	back	0.292	1.021	0.298	
1880.00	661	GSM 1900	GPRS	27.7	27.46	0.01	10 mm	01890	2	1:4.15	back	0.340	1.057	0.359	A13
836.60	4183	UMTS 850	RMC	23.7	23.45	-0.01	10 mm	01891	N/A	1:1	back	0.580	1.059	0.614	A14
1880.00	9400	UMTS 1900	RMC	23.7	23.57	0.09	10 mm	01890	N/A	1:1	back	0.620	1.030	0.639	A15
820.10	564	CDMA BC10 (§90S)	TDSO / SO32	24.7	24.60	-0.04	10 mm	01891	N/A	1:1	back	0.472	1.023	0.483	A16
836.52	384	CDMA BC0 (§22H)	TDSO / SO32	24.7	24.46	0.11	10 mm	01891	N/A	1:1	back	0.678	1.057	0.717	A18
1880.00	600	PCS CDMA	TDSO / SO32	24.7	24.61	0.01	10 mm	01890	N/A	1:1	back	0.717	1.021	0.732	A20
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram								

Table 11-13
LTE Body-Worn SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	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 (Cond. Power)	Scaling Factor (CP Duty)	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)			(W/kg)	
836.50	26915	Mid	LTE Band 26 (Cell)	15	23.7	23.48	-0.02	0	01891	QPSK	1	0	10 mm	back	1:1	0.556	1.052	N/A	0.585	A22
836.50	26915	Mid	LTE Band 26 (Cell)	15	22.7	22.51	-0.05	1	01891	QPSK	36	37	10 mm	back	1:1	0.526	1.045	N/A	0.550	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	23.7	23.62	0.08	0	01890	QPSK	1	50	10 mm	back	1:1	0.769	1.019	N/A	**0.784**	A23
1882.50	26365	Mid	LTE Band 25 (PCS)	20	22.7	22.48	0.05	1	01890	QPSK	50	0	10 mm	back	1:1	0.570	1.052	N/A	0.600	
2506.00	39750	Low	LTE Band 41	20	23.5	23.49	0.11	0	01891	QPSK	1	0	10 mm	back	1:1.59	0.370	1.002	1.010	0.374	A24
2506.00	39750	Low	LTE Band 41	20	22.5	22.44	0.12	1	01891	QPSK	50	25	10 mm	back	1:1.59	0.218	1.014	1.010	0.223	
2506.00	39750	Low	LTE Band 41	20	22.5	22.46	0.04	1	01891	QPSK	100	0	10 mm	back	1:1.59	0.227	1.009	1.010	0.231	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Body 1.6 W/kg (mW/g) averaged over 1 gram											

Table 11-14
DTS Body-Worn SAR

MEASUREMENT RESULTS																		
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	Peak SAR of Area Scan	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.												W/kg	(W/kg)			(W/kg)	
2462	11	802.11b	DSSS	22	17.5	17.37	0.16	10 mm	01892	1	back	99.4	0.081	0.068	1.030	1.007	0.070	A26
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram										

11.2 Standalone Wireless Router SAR Data

Table 11-15
GPRS/UMTS/CDMA Hotspot SAR Data

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	# of GPRS Slots	Duty Cycle	Side	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
836.60	190	GSM850	GPRS	31.7	31.21	-0.12	10 mm	01891	2	1:4.15	back	0.463	1.119	0.518	A12
836.60	190	GSM850	GPRS	31.7	31.21	0.01	10 mm	01891	2	1:4.15	front	0.384	1.119	0.430	
836.60	190	GSM850	GPRS	31.7	31.21	-0.06	10 mm	01891	2	1:4.15	bottom	0.105	1.119	0.117	
836.60	190	GSM850	GPRS	31.7	31.21	-0.15	10 mm	01891	2	1:4.15	right	0.294	1.119	0.329	
836.60	190	GSM850	GPRS	31.7	31.21	0.01	10 mm	01891	2	1:4.15	left	0.230	1.119	0.257	
1880.00	661	GSM1900	GPRS	27.7	27.46	0.01	10 mm	01890	2	1:4.15	back	0.340	1.057	0.359	A13
1880.00	661	GSM1900	GPRS	27.7	27.46	-0.03	10 mm	01890	2	1:4.15	front	0.321	1.057	0.339	
1880.00	661	GSM1900	GPRS	27.7	27.46	0.01	10 mm	01890	2	1:4.15	bottom	0.176	1.057	0.186	
1880.00	661	GSM1900	GPRS	27.7	27.46	0.15	10 mm	01890	2	1:4.15	left	0.254	1.057	0.268	
836.60	4183	UMTS 850	RMC	23.7	23.45	-0.01	10 mm	01891	N/A	1:1	back	0.580	1.059	0.614	A14
836.60	4183	UMTS 850	RMC	23.7	23.45	-0.01	10 mm	01891	N/A	1:1	front	0.480	1.059	0.508	
836.60	4183	UMTS 850	RMC	23.7	23.45	-0.10	10 mm	01891	N/A	1:1	bottom	0.177	1.059	0.187	
836.60	4183	UMTS 850	RMC	23.7	23.45	-0.04	10 mm	01891	N/A	1:1	right	0.414	1.059	0.438	
836.60	4183	UMTS 850	RMC	23.7	23.45	0.03	10 mm	01891	N/A	1:1	left	0.312	1.059	0.330	
1880.00	9400	UMTS 1900	RMC	23.7	23.57	0.09	10 mm	01890	N/A	1:1	back	0.620	1.030	0.639	A15
1880.00	9400	UMTS 1900	RMC	23.7	23.57	-0.01	10 mm	01890	N/A	1:1	front	0.583	1.030	0.600	
1880.00	9400	UMTS 1900	RMC	23.7	23.57	-0.08	10 mm	01890	N/A	1:1	bottom	0.349	1.030	0.359	
1880.00	9400	UMTS 1900	RMC	23.7	23.57	0.02	10 mm	01890	N/A	1:1	left	0.481	1.030	0.495	
820.10	564	CDMA BC10 (§90S)	EVDO Rev. 0	24.7	24.40	0.01	10 mm	01891	N/A	1:1	back	0.473	1.072	0.507	A17
820.10	564	CDMA BC10 (§90S)	EVDO Rev. 0	24.7	24.40	-0.17	10 mm	01891	N/A	1:1	front	0.407	1.072	0.436	
820.10	564	CDMA BC10 (§90S)	EVDO Rev. 0	24.7	24.40	0.02	10 mm	01891	N/A	1:1	bottom	0.153	1.072	0.164	
820.10	564	CDMA BC10 (§90S)	EVDO Rev. 0	24.7	24.40	0.06	10 mm	01891	N/A	1:1	right	0.343	1.072	0.368	
820.10	564	CDMA BC10 (§90S)	EVDO Rev. 0	24.7	24.40	-0.08	10 mm	01891	N/A	1:1	left	0.246	1.072	0.264	
836.52	384	CDMA BC0 (§22H)	EVDO Rev. 0	24.7	24.55	-0.15	10 mm	01891	N/A	1:1	back	0.713	1.035	0.738	A19
836.52	384	CDMA BC0 (§22H)	EVDO Rev. 0	24.7	24.55	0.15	10 mm	01891	N/A	1:1	front	0.573	1.035	0.593	
836.52	384	CDMA BC0 (§22H)	EVDO Rev. 0	24.7	24.55	-0.07	10 mm	01891	N/A	1:1	bottom	0.225	1.035	0.233	
836.52	384	CDMA BC0 (§22H)	EVDO Rev. 0	24.7	24.55	-0.02	10 mm	01891	N/A	1:1	right	0.503	1.035	0.521	
836.52	384	CDMA BC0 (§22H)	EVDO Rev. 0	24.7	24.55	-0.04	10 mm	01891	N/A	1:1	left	0.394	1.035	0.408	
1851.25	25	PCS CDMA	EVDO Rev. 0	24.7	24.50	-0.01	10 mm	01890	N/A	1:1	back	0.787	1.047	0.824	A21
1880.00	600	PCS CDMA	EVDO Rev. 0	24.7	24.55	-0.06	10 mm	01890	N/A	1:1	back	0.779	1.035	0.806	
1908.75	1175	PCS CDMA	EVDO Rev. 0	24.7	24.50	-0.04	10 mm	01890	N/A	1:1	back	0.745	1.047	0.780	
1880.00	600	PCS CDMA	EVDO Rev. 0	24.7	24.55	0.01	10 mm	01890	N/A	1:1	front	0.701	1.035	0.726	
1880.00	600	PCS CDMA	EVDO Rev. 0	24.7	24.55	-0.06	10 mm	01890	N/A	1:1	bottom	0.401	1.035	0.415	
1880.00	600	PCS CDMA	EVDO Rev. 0	24.7	24.55	0.00	10 mm	01890	N/A	1:1	left	0.614	1.035	0.635	
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 26 (Cell) Hotspot SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
836.50	26915	Mid	LTE Band 26 (Cell)	15	23.7	23.48	-0.02	0	01891	QPSK	1	0	10 mm	back	1:1	0.556	1.052	0.585	A22
836.50	26915	Mid	LTE Band 26 (Cell)	15	22.7	22.51	-0.05	1	01891	QPSK	36	37	10 mm	back	1:1	0.526	1.045	0.550	
836.50	26915	Mid	LTE Band 26 (Cell)	15	23.7	23.48	0.11	0	01891	QPSK	1	0	10 mm	front	1:1	0.465	1.052	0.489	
836.50	26915	Mid	LTE Band 26 (Cell)	15	22.7	22.51	0.16	1	01891	QPSK	36	37	10 mm	front	1:1	0.439	1.045	0.459	
836.50	26915	Mid	LTE Band 26 (Cell)	15	23.7	23.48	-0.02	0	01891	QPSK	1	0	10 mm	bottom	1:1	0.173	1.052	0.182	
836.50	26915	Mid	LTE Band 26 (Cell)	15	22.7	22.51	0.15	1	01891	QPSK	36	37	10 mm	bottom	1:1	0.166	1.045	0.173	
836.50	26915	Mid	LTE Band 26 (Cell)	15	23.7	23.48	-0.08	0	01891	QPSK	1	0	10 mm	right	1:1	0.364	1.052	0.383	
836.50	26915	Mid	LTE Band 26 (Cell)	15	22.7	22.51	-0.01	1	01891	QPSK	36	37	10 mm	right	1:1	0.351	1.045	0.367	
836.50	26915	Mid	LTE Band 26 (Cell)	15	23.7	23.48	0.11	0	01891	QPSK	1	0	10 mm	left	1:1	0.267	1.052	0.281	
836.50	26915	Mid	LTE Band 26 (Cell)	15	22.7	22.51	0.04	1	01891	QPSK	36	37	10 mm	left	1:1	0.282	1.045	0.295	
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 25 (PCS) Hotspot SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	23.7	23.62	0.08	0	01890	QPSK	1	50	10 mm	back	1:1	0.769	1.019	0.784	A23
1882.50	26365	Mid	LTE Band 25 (PCS)	20	22.7	22.48	0.05	1	01890	QPSK	50	0	10 mm	back	1:1	0.570	1.052	0.600	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	23.7	23.62	-0.15	0	01890	QPSK	1	50	10 mm	front	1:1	0.674	1.019	0.687	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	22.7	22.48	-0.04	1	01890	QPSK	50	0	10 mm	front	1:1	0.573	1.052	0.603	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	23.7	23.62	-0.14	0	01890	QPSK	1	50	10 mm	bottom	1:1	0.379	1.019	0.386	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	22.7	22.48	0.13	1	01890	QPSK	50	0	10 mm	bottom	1:1	0.312	1.052	0.328	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	23.7	23.62	-0.12	0	01890	QPSK	1	50	10 mm	left	1:1	0.555	1.019	0.566	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	22.7	22.48	-0.04	1	01890	QPSK	50	0	10 mm	left	1:1	0.443	1.052	0.466	
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 41 Hotspot SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor (Cond. Power)	Scaling Factor (CP Duty)	Reported SAR (1g)	Plot #
MHz	Ch.															(W/kg)			(W/kg)	
2506.00	39750	Low	LTE Band 41	20	23.5	23.49	0.11	0	01891	QPSK	1	0	10 mm	back	1:1.59	0.370	1.002	1.010	0.374	
2506.00	39750	Low	LTE Band 41	20	22.5	22.44	0.12	1	01891	QPSK	50	25	10 mm	back	1:1.59	0.218	1.014	1.010	0.223	
2506.00	39750	Low	LTE Band 41	20	22.5	22.46	0.04	1	01891	QPSK	100	0	10 mm	back	1:1.59	0.227	1.009	1.010	0.231	
2506.00	39750	Low	LTE Band 41	20	23.5	23.49	0.11	0	01891	QPSK	1	0	10 mm	front	1:1.59	0.300	1.002	1.010	0.304	
2506.00	39750	Low	LTE Band 41	20	22.5	22.44	-0.16	1	01891	QPSK	50	25	10 mm	front	1:1.59	0.234	1.014	1.010	0.240	
2506.00	39750	Low	LTE Band 41	20	22.5	22.46	0.04	1	01891	QPSK	100	0	10 mm	front	1:1.59	0.248	1.009	1.010	0.253	
2506.00	39750	Low	LTE Band 41	20	23.5	23.49	-0.01	0	01891	QPSK	1	0	10 mm	bottom	1:1.59	0.381	1.002	1.010	0.386	A25
2506.00	39750	Low	LTE Band 41	20	22.5	22.44	-0.02	1	01891	QPSK	50	25	10 mm	bottom	1:1.59	0.304	1.014	1.010	0.311	
2506.00	39750	Low	LTE Band 41	20	22.5	22.46	-0.03	1	01891	QPSK	100	0	10 mm	bottom	1:1.59	0.304	1.009	1.010	0.310	
2506.00	39750	Low	LTE Band 41	20	23.5	23.49	-0.19	0	01891	QPSK	1	0	10 mm	right	1:1.59	0.082	1.002	1.010	0.083	
2506.00	39750	Low	LTE Band 41	20	22.5	22.44	-0.02	1	01891	QPSK	50	25	10 mm	right	1:1.59	0.071	1.014	1.010	0.073	
2506.00	39750	Low	LTE Band 41	20	22.5	22.46	0.05	1	01891	QPSK	100	0	10 mm	right	1:1.59	0.071	1.009	1.010	0.072	
2506.00	39750	Low	LTE Band 41	20	23.5	23.49	-0.07	0	01891	QPSK	1	0	10 mm	left	1:1.59	0.099	1.002	1.010	0.100	
2506.00	39750	Low	LTE Band 41	20	22.5	22.44	-0.02	1	01891	QPSK	50	25	10 mm	left	1:1.59	0.089	1.014	1.010	0.092	
2506.00	39750	Low	LTE Band 41	20	22.5	22.46	-0.12	1	01891	QPSK	100	0	10 mm	left	1:1.59	0.089	1.009	1.010	0.091	
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
WLAN Hotspot SAR

MEASUREMENT RESULTS																		
FREQUENCY		Mode	Service	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle (%)	Peak SAR of Area Scan	SAR (1g)	Scaling Factor (Power)	Scaling Factor (Duty Cycle)	Reported SAR (1g)	Plot #
MHz	Ch.												W/kg	(W/kg)			(W/kg)	
2462	11	802.11b	DSSS	22	17.5	17.37	0.16	10 mm	01892	1	back	99.4	0.081	0.068	1.030	1.007	0.070	A26
2462	11	802.11b	DSSS	22	17.5	17.37	-	10 mm	01892	1	front	99.4	0.069	-	1.030	1.007	-	
2462	11	802.11b	DSSS	22	17.5	17.37	-	10 mm	01892	1	top	99.4	0.039	-	1.030	1.007	-	
2462	11	802.11b	DSSS	22	17.5	17.37	-	10 mm	01892	1	right	99.4	0.057	-	1.030	1.007	-	
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 SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2003, and FCC KDB Publication 447498 D01.
2. Batteries are fully charged at the beginning of the SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01.
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 D04, body-worn SAR was evaluated without a headset connected to the device. Since the standalone reported body-worn SAR was ≤ 1.2 W/kg, no additional body-worn SAR evaluations using a headset cable were required

8. Per FCC KDB 865664 D01, variability SAR tests were not performed since the measured SAR results for all frequency bands were less than 0.8 W/kg. Please see Section 13 for more information.
9. During SAR Testing for the Wireless Router conditions per FCC KDB Publication 941225 D06, the actual Portable Hotspot operation (with actual simultaneous transmission of a transmitter with WIFI) was not activated (See Section 0 for more details).

GSM Test Notes:

1. Body-Worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn SAR.
2. Justification for reduced test configurations per KDB Publication 941225 D01 and October 2013 TCB Workshop Notes: The source-based frame-averaged output power was evaluated for all GPRS/EDGE slot configurations. The configuration with the highest target frame averaged output power was evaluated for hotspot SAR. When the maximum frame-averaged powers are equivalent across two or more slots (within 0.25 dB), the configuration with the most number of time slots was tested.
3. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel was used.
4. GPRS was additionally evaluated for head and body-worn exposure conditions to address possible VoIP scenarios.

CDMA Notes:

1. Head SAR for CDMA2000 mode was tested under RC3/SO55 per FCC KDB Publication 941225 D01.
2. Body-Worn SAR was tested with 1x RTT with TDSO / SO32 FCH Only. EVDO Rev0 and RevA and TDSO / SO32 FCH+SCH SAR tests were not required per the 3G SAR Test Reduction Procedure in FCC KDB Publication 941225 D01.
3. CDMA Wireless Router SAR is measured using Subtype 0/1 Physical Layer configurations for Rev. 0 according to KDB 941225 D01 procedures for data devices. Wireless Router SAR tests for Subtype 2 of Rev.A and 1x RTT configurations were not required per the 3G SAR Test Reduction Policy in KDB Publication 941225 D01.
4. Head SAR was additionally evaluated using EVDO Rev. A to determine compliance for VoIP operations.
5. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel was used.

UMTS Notes:

1. UMTS mode in was tested under RMC 12.2 kbps with HSPA inactive per KDB Publication 941225 D01. AMR and HSPA SAR was not required per the 3G Test Reduction Procedure in KDB Publication 941225 D01.
2. Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel was used.

LTE Notes:

1. LTE Considerations: LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05. The general test procedures used for testing can be found in Section 8.6.4.
2. MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.
3. A-MPR was disabled for all SAR tests by setting NS=01 on the base station simulator. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).
4. Per FCC KDB Publication 447498 D01, when the reported (scaled) for LTE Band 41 SAR measured at the highest output power channel in a given a test configuration was > 0.6 W/kg, testing at the other channels was required for such test configurations.
5. TDD LTE was tested using UL-DL configuration 0 with 6 UL subframes and 2 S subframes using normal cyclic prefix only and special subframe configuration 6. Due to equipment setup issues with extended cyclic prefix as a result of test samples configured for normal cyclic prefix, SAR tests were performed at maximum output power and worst-case transmission duty factor in normal cyclic prefix. Results were then scaled to the duty factor required for extended cyclic prefix listed in 3GPP TS 36.211 Section 4. The cyclic prefix scaling factor for LTE Band 41 was calculated by dividing the extended cyclic prefix duty factor by the normal cyclic prefix duty factor. Per 3GPP 36.211 Section 4, the duty factor for special subframe configuration 6 using normal cyclic prefix is 0.629. The duty factor for special subframe configuration 6 using extended cyclic prefix is 0.633.

WLAN Notes:

1. For held-to-ear and hotspot operations, the initial test position procedures were applied. The test position with the highest extrapolated peak SAR will be used as the initial test position. When reported SAR for the initial test position is ≤ 0.4 W/kg, no additional testing for the remaining test positions was required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is ≤ 0.8 W/kg or all test positions are measured.
2. Justification for test configurations for WLAN per KDB Publication 248227 D01 for 2.4 GHz WIFI single transmission chain operations, the highest measured maximum output power channel for DSSS was selected for SAR measurement. SAR for OFDM modes (2.4 GHz 802.11g/n) was not required due to the maximum allowed powers and the highest reported DSSS SAR. See Section 8.7.3 for more information.
3. When the maximum reported 1g averaged SAR is ≤0.8 W/kg, SAR testing on additional channels was not required. Otherwise, SAR for the next highest output power channel was required until the reported SAR result was ≤ 1.20 W/kg or all test channels were measured.
4. The device was configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools. The reported SAR was scaled to the 100% transmission duty factor to determine compliance. Procedures used to measure the duty factor are identical to that in the associated EMC test reports.

12 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

12.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D01 are applicable to devices with built-in unlicensed transmitters such as 802.11 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 D01 IV.C.1.iii and IEEE 1528-2013 Section 6.3.4.1.2, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is ≤1.6 W/kg. The different test positions in an exposure condition may be considered collectively to determine SAR test exclusion according to the sum of 1-g.

When standalone SAR is not required to be measured, per FCC KDB 447498 D01 4.3.2 2), the following equation must be used to estimate the standalone 1g SAR for simultaneous transmission assessment involving that transmitter.

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

Table 12-1
Estimated SAR

Mode	Frequency	Maximum Allowed Power	Separation Distance (Body)	Estimated SAR (Body)
	[MHz]	[dBm]	[mm]	[W/kg]
Bluetooth	2480	11.00	10	0.273

Note: Held-to ear configurations are not applicable to Bluetooth operations and therefore were not considered for simultaneous transmission. Per KDB Publication 447498 D01, the maximum power of the channel was rounded to the nearest mW before calculation.

12.3 Head SAR Simultaneous Transmission Analysis

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

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	GSM/GPRS 850	0.365	0.376	0.741
	GSM/GPRS 1900	0.312	0.376	0.688
	UMTS 850	0.449	0.376	0.825
	UMTS 1900	0.567	0.376	0.943
	CDMA/EVDO BC10	0.349	0.376	0.725
	CDMA/EVDO BC0	0.533	0.376	0.909
	PCS CDMA/EVDO	0.664	0.376	**1.040**
	LTE Band 26 (Cell)	0.377	0.376	0.753
	LTE Band 25 (PCS)	0.623	0.376	0.999
	LTE Band 41	0.154	0.376	0.530

12.4 Body-Worn Simultaneous Transmission Analysis

Table 12-3
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body-Worn at 1.0 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body-Worn	GSM/GPRS 850	0.518	0.070	0.588
	GSM/GPRS 1900	0.359	0.070	0.429
	UMTS 850	0.614	0.070	0.684
	UMTS 1900	0.639	0.070	0.709
	CDMA BC10 (§90S)	0.483	0.070	0.553
	CDMA BC0 (§22H)	0.717	0.070	0.787
	PCS CDMA	0.732	0.070	0.802
	LTE Band 26 (Cell)	0.585	0.070	0.655
	LTE Band 25 (PCS)	0.784	0.070	**0.854**
	LTE Band 41	0.374	0.070	0.444

Table 12-4
Simultaneous Transmission Scenario with Bluetooth (Body-Worn at 1.0 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Body-Worn	GSM/GPRS 850	0.518	0.273	0.791
	GSM/GPRS 1900	0.359	0.273	0.632
	UMTS 850	0.614	0.273	0.887
	UMTS 1900	0.639	0.273	0.912
	CDMA BC10 (§90S)	0.483	0.273	0.756
	CDMA BC0 (§22H)	0.717	0.273	0.990
	PCS CDMA	0.732	0.273	1.005
	LTE Band 26 (Cell)	0.585	0.273	0.858
	LTE Band 25 (PCS)	0.784	0.273	**1.057**
	LTE Band 41	0.374	0.273	0.647

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

Table 12-5
Simultaneous Transmission Scenario (2.4 GHz Hotspot at 1.0 cm)

Exposure Condition	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Hotspot SAR	GPRS 850	0.518	0.070	0.588
	GPRS 1900	0.359	0.070	0.429
	UMTS 850	0.614	0.070	0.684
	UMTS 1900	0.639	0.070	0.709
	EVDO BC10 (§90S)	0.507	0.070	0.577
	EVDO BC0 (§22H)	0.738	0.070	0.808
	PCS EVDO	0.824	0.070	**0.894**
	LTE Band 26 (Cell)	0.585	0.070	0.655
	LTE Band 25 (PCS)	0.784	0.070	0.854
	LTE Band 41	0.386	0.070	0.456

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 D01 and IEEE 1528-2013 Section 6.3.4.1.2.

13 SAR MEASUREMENT VARIABILITY

13.1 Measurement Variability

Per FCC KDB Publication 865664 D01, SAR measurement variability was not assessed for any frequency band since all measured SAR values were less than 0.80 W/kg.

13.2 Measurement Uncertainty

The measured SAR was <1.5 W/kg for all frequency bands. Therefore, per KDB Publication 865664 D01, 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	E8257D	(250kHz-20GHz) Signal Generator	3/15/2015	Annual	3/15/2016	MY45470194
Agilent	8753E	(30kHz-6GHz) Network Analyzer	12/30/2014	Annual	12/30/2015	JP38020182
Agilent	8594A	(9kHz-2.9GHz) Spectrum Analyzer	N/A	N/A	N/A	3051A00187
Agilent	8648D	(9kHz-4GHz) Signal Generator	3/15/2015	Annual	3/15/2016	3629U00687
Agilent	E4438C	ESG Vector Signal Generator	3/13/2015	Annual	3/13/2016	MY42082659
Agilent	N5182A	MXG Vector Signal Generator	3/16/2015	Annual	3/16/2016	MY47420651
Agilent	8753ES	Network Analyzer	3/20/2015	Annual	3/20/2016	MY40001472
Agilent	8753ES	S-Parameter Network Analyzer	3/12/2015	Annual	3/12/2016	MY40000670
Agilent	E5515C	Wireless Communications Test Set	5/16/2015	Biennial	5/16/2017	GB43304447
Agilent	N4010A	Wireless Connectivity Test Set	N/A	N/A	N/A	GB46170464
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433971
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433972
Anritsu	ML2438A	Power Meter	3/13/2015	Annual	3/13/2016	01190013
Anritsu	ML2438A	Power Meter	3/13/2015	Annual	3/13/2016	01070030
Anritsu	ML2495A	Power Meter	10/16/2015	Biennial	10/16/2017	1039008
Anritsu	MA2481A	Power Sensor	3/10/2015	Annual	3/10/2016	N/A
Anritsu	MA2481A	Power Sensor	3/10/2015	Annual	3/10/2016	N/A
Anritsu	MA2411B	Pulse Power Sensor	3/13/2015	Annual	3/13/2016	1207470
Anritsu	MA2411B	Pulse Power Sensor	8/3/2015	Annual	8/3/2016	1126066
Anritsu	MT8820C	Radio Communication Analyzer	7/24/2015	Annual	7/24/2016	6200901190
Anritsu	MA24106A	USB Power Sensor	5/29/2015	Annual	5/29/2016	1244512
Anritsu	MA24106A	USB Power Sensor	5/29/2015	Annual	5/29/2016	1248508
Control Company	4040	Digital Thermometer	3/15/2015	Biennial	3/15/2017	150194929
Control Company	4353	Long Stem Thermometer	3/5/2015	Biennial	3/5/2017	150149534
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-1200+	Low Pass Filter DC to 1000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Mitutoyo	CD-6"CSX	Digital Caliper	5/8/2014	Biennial	5/8/2016	13264162
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	12/4/2014	Annual	12/4/2015	833855/0010
Rohde & Schwarz	CMW500	Radio Communication Tester	7/9/2015	Annual	7/9/2016	106578
Rohde & Schwarz	CMW500	Radio Communication Tester	7/21/2015	Annual	7/21/2016	116743
Seekonk	NC-100	Torque Wrench	3/18/2014	Biennial	3/18/2016	022313
Seekonk	NC-100	Torque Wrench	1/22/2015	Biennial	1/22/2017	022847
SPEAG	D835V2	835 MHz SAR Dipole	1/16/2015	Annual	1/16/2016	4d132
SPEAG	D835V2	835 MHz SAR Dipole	7/23/2015	Annual	7/23/2016	4d133
SPEAG	D1900V2	1900 MHz SAR Dipole	7/14/2015	Annual	7/14/2016	5d149
SPEAG	D1900V2	1900 MHz SAR Dipole	2/18/2015	Annual	2/18/2016	5d148
SPEAG	D2450V2	2450 MHz SAR Dipole	8/20/2015	Annual	8/20/2016	719
SPEAG	D2450V2	2450 MHz SAR Dipole	10/21/2015	Annual	10/21/2016	797
SPEAG	D2450V2	2450 MHz SAR Dipole	2/18/2015	Annual	2/18/2016	882
SPEAG	DAE4	Dasy Data Acquisition Electronics	9/16/2015	Annual	9/16/2016	1323
SPEAG	DAE4	Dasy Data Acquisition Electronics	10/27/2015	Annual	10/27/2016	1333
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/17/2015	Annual	6/17/2016	859
SPEAG	DAE4	Dasy Data Acquisition Electronics	9/18/2015	Annual	9/18/2016	1364
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/20/2015	Annual	4/20/2016	1407
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/12/2015	Annual	5/12/2016	1070
SPEAG	DAK-3.5	Dielectric Assessment Kit	10/20/2015	Annual	10/20/2016	1091
SPEAG	ES3DV3	SAR Probe	9/18/2015	Annual	9/18/2016	3332
SPEAG	ES3DV3	SAR Probe	10/29/2015	Annual	10/29/2016	3333
SPEAG	ES3DV3	SAR Probe	5/30/2015	Annual	5/30/2016	3263
SPEAG	ES3DV3	SAR Probe	9/18/2015	Annual	9/18/2016	3288
SPEAG	ES3DV3	SAR Probe	3/19/2015	Annual	3/19/2016	3209

Note: 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.

15 MEASUREMENT UNCERTAINTIES

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

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: ZNFLS675; Type: Portable Handset; Serial: 01890

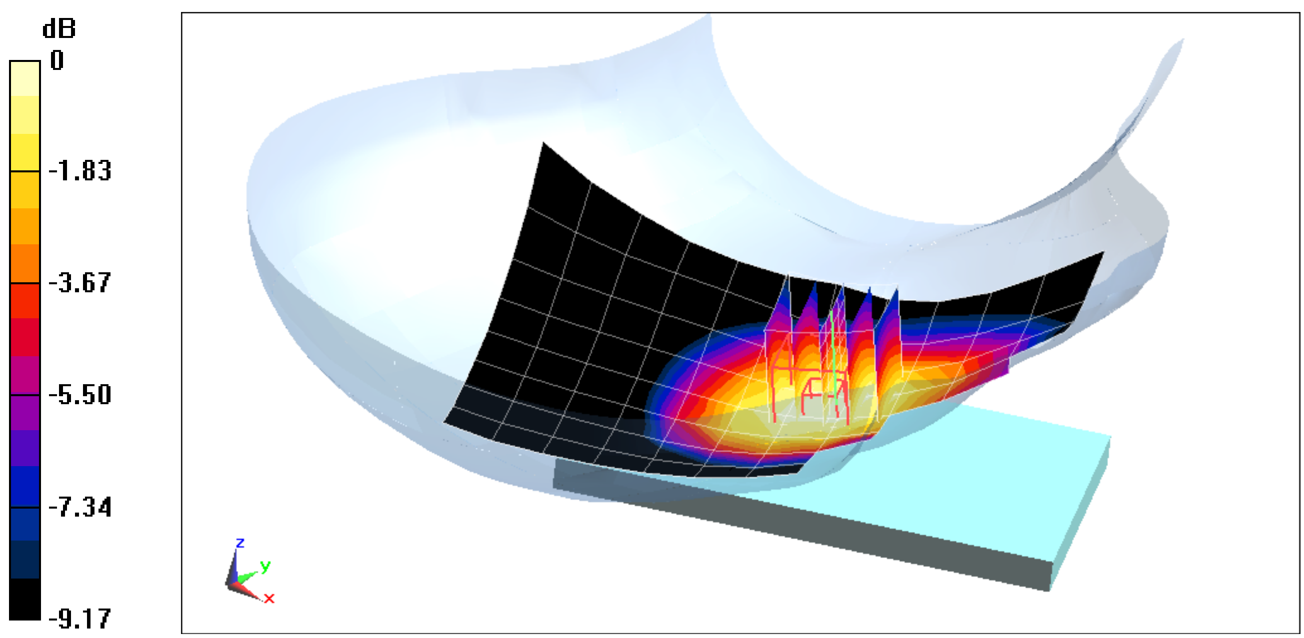
Communication System: UID 0, GSM GPRS; 2 Tx slots; Frequency: 836.6 MHz; Duty Cycle: 1:4.15
Medium: 835 Head Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.927 S/m; ε_r = 40.785; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 11-17-2015; Ambient Temp: 22.3°C; Tissue Temp: 21.4°C

Probe: ES3DV3 - SN3332; ConvF(6.23, 6.23, 6.23); Calibrated: 9/18/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/16/2015
Phantom: SAM Main ; Type: QD000P40CC; Serial: TP 1114
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.92 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 0.402 W/kg
SAR(1 g) = 0.326 W/kg



0 dB = 0.355 W/kg = -4.50 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01890

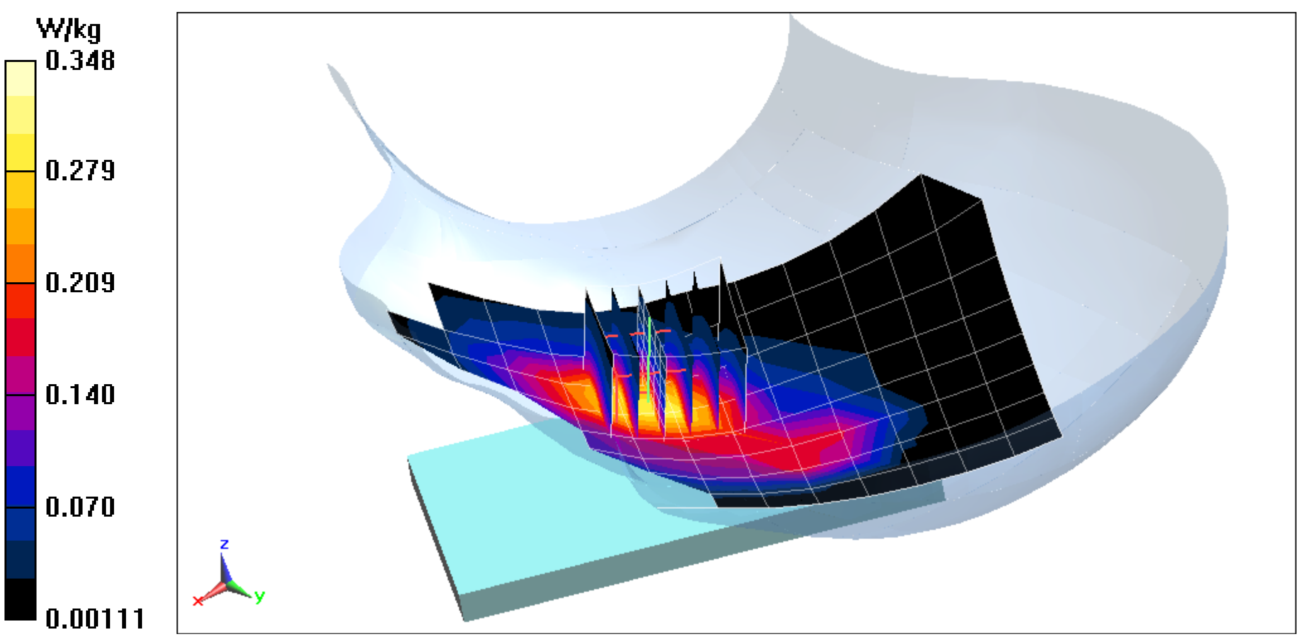
Communication System: UID 0, GSM GPRS; 2 Tx slots; Frequency: 1880 MHz; Duty Cycle: 1:4.15
Medium: 1900 Head Medium parameters used:
f = 1880 MHz; σ = 1.433 S/m; ε_r = 38.928; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 11-19-2015; Ambient Temp: 22.8°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3333; ConvF(5.03, 5.03, 5.03); Calibrated: 10/29/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 10/27/2015
Phantom: SAM Right; Type: QD000P40CD; Serial: 1757
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.10 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 0.453 W/kg
SAR(1 g) = 0.295 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01890

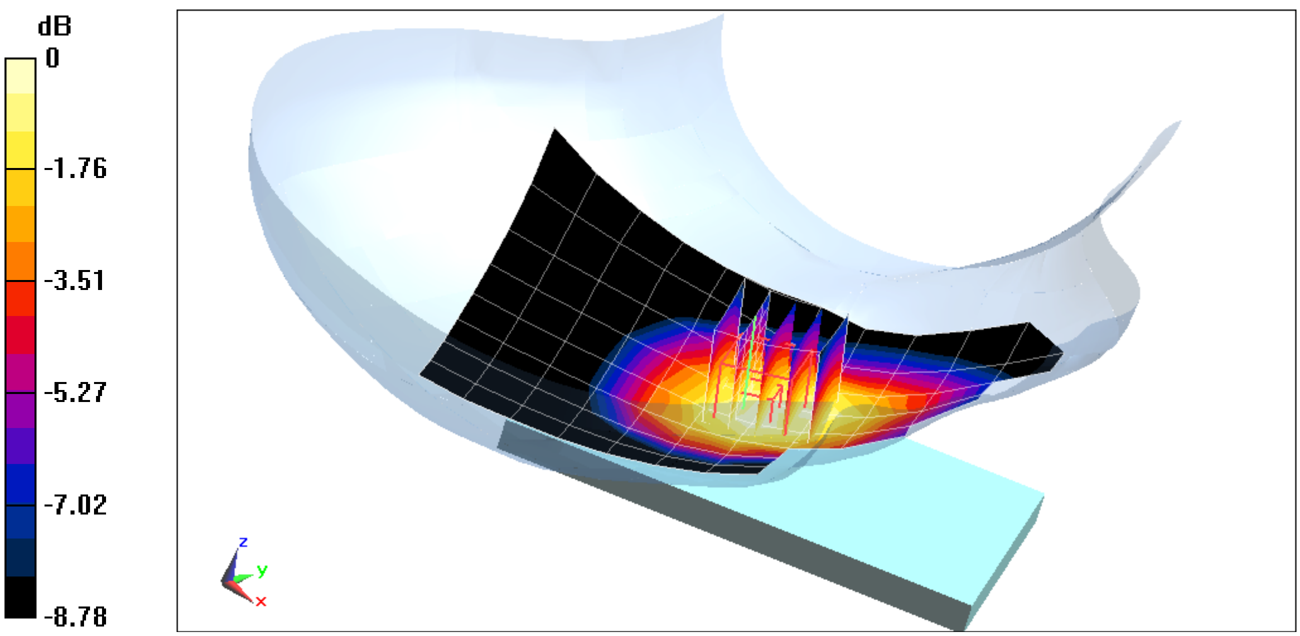
Communication System: UID 0, UMTS; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium: 835 Head Medium parameters used (interpolated):
f = 836.6 MHz; σ = 0.927 S/m; ε_r = 40.785; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 11-17-2015; Ambient Temp: 22.3°C; Tissue Temp: 21.4°C

Probe: ES3DV3 - SN3332; ConvF(6.23, 6.23, 6.23); Calibrated: 9/18/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/16/2015
Phantom: SAM Main ; Type: QD000P40CC; Serial: TP 1114
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 21.50 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.525 W/kg
SAR(1 g) = 0.424 W/kg



0 dB = 0.462 W/kg = -3.35 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01890

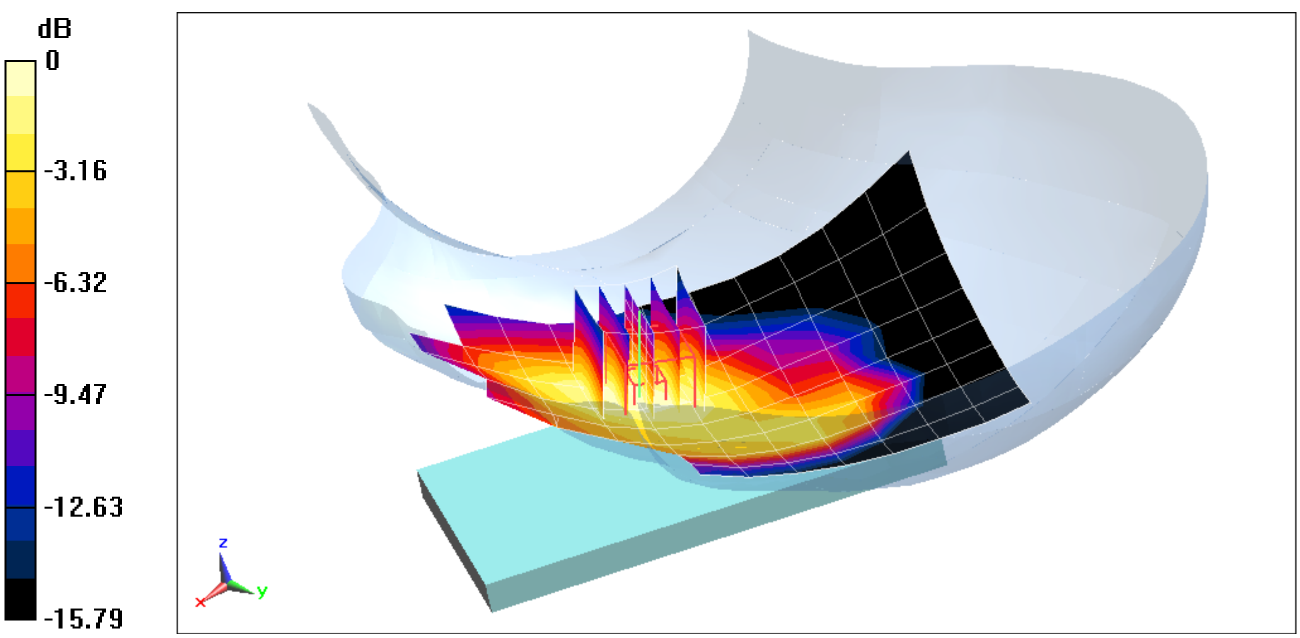
Communication System: UID 0, UMTS; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: 1900 Head Medium parameters used:
f = 1880 MHz; σ = 1.433 S/m; ε_r = 38.928; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 11-19-2015; Ambient Temp: 22.8°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3333; ConvF(5.03, 5.03, 5.03); Calibrated: 10/29/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 10/27/2015
Phantom: SAM Right; Type: QD000P40CD; Serial: 1757
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.90 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.845 W/kg
SAR(1 g) = 0.550 W/kg



0 dB = 0.648 W/kg = -1.88 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01890

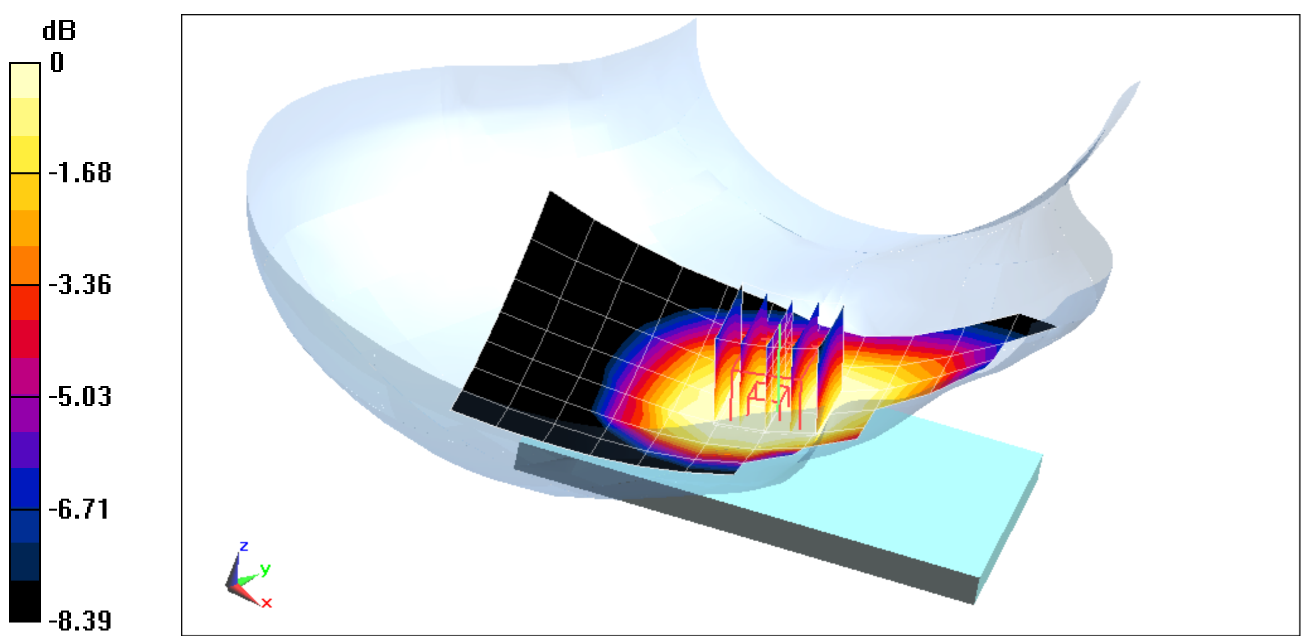
Communication System: UID 0, CDMA; Frequency: 820.1 MHz; Duty Cycle: 1:1
Medium: 835 Head Medium parameters used (interpolated):
f = 820.1 MHz; σ = 0.909 S/m; ε_r = 41.006; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 11-17-2015; Ambient Temp: 22.3°C; Tissue Temp: 21.4°C

Probe: ES3DV3 - SN3332; ConvF(6.23, 6.23, 6.23); Calibrated: 9/18/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/16/2015
Phantom: SAM Main ; Type: QD000P40CC; Serial: TP 1114
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: Cellular CDMA, Rule Part 90S, Right Head, Cheek, Mid.ch

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.24 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 0.410 W/kg
SAR(1 g) = 0.341 W/kg



0 dB = 0.369 W/kg = -4.33 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01890

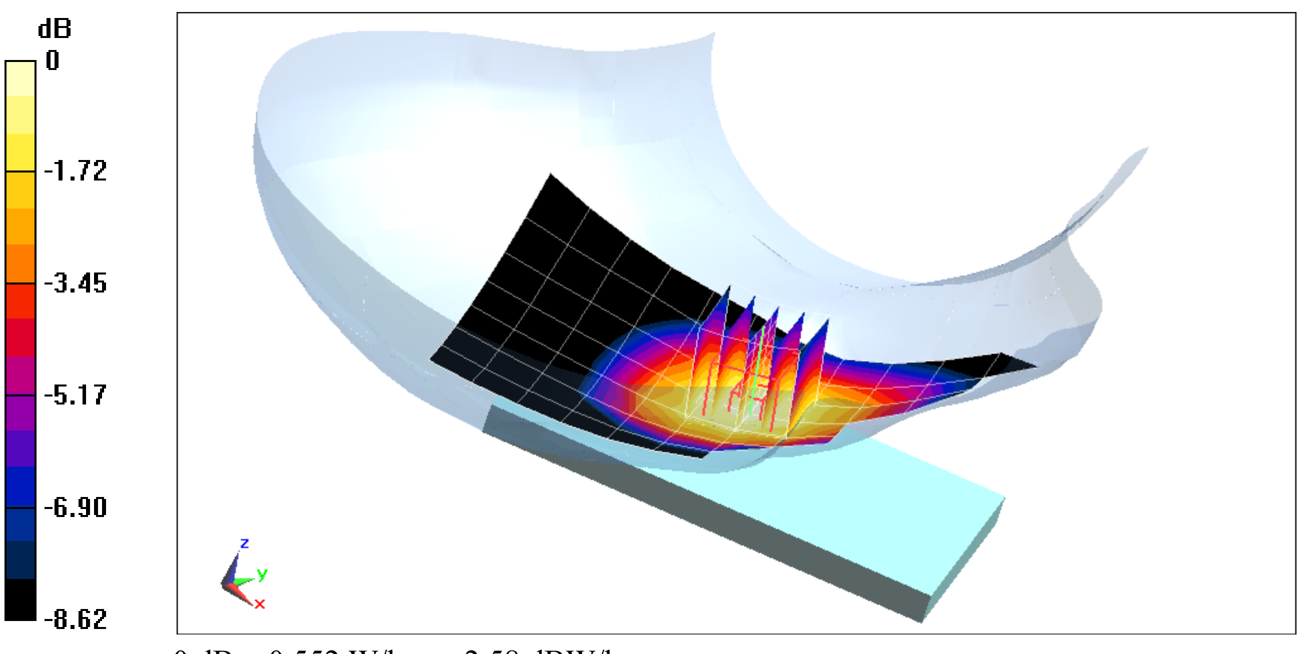
Communication System: UID 0, CDMA; Frequency: 836.52 MHz; Duty Cycle: 1:1
Medium: 835 Head Medium parameters used (interpolated):
$f = 836.52$ MHz; $\sigma = 0.927$ S/m; $\varepsilon_r = 40.786$; $\rho = 1000$ kg/m^3
Phantom section: Right Section

Test Date: 11-17-2015; Ambient Temp: 22.3°C; Tissue Temp: 21.4°C

Probe: ES3DV3 - SN3332; ConvF(6.23, 6.23, 6.23); Calibrated: 9/18/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/16/2015
Phantom: SAM Main ; Type: QD000P40CC; Serial: TP 1114
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: Cellular CDMA, Rule Part 22H, Right Head, Cheek, Mid.ch

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.20 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.618 W/kg
SAR(1 g) = 0.504 W/kg



0 dB = 0.552 W/kg = -2.58 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01890

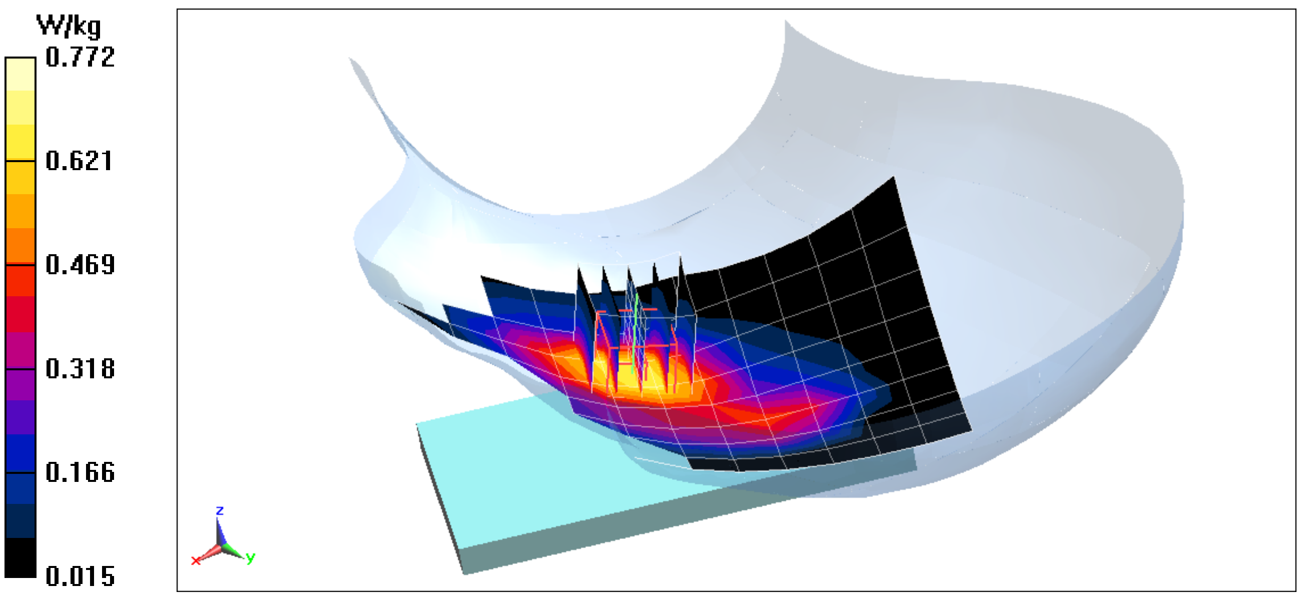
Communication System: UID 0, CDMA; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: 1900 Head Medium parameters used:
f = 1880 MHz; σ = 1.433 S/m; ε_r = 38.928; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 11-19-2015; Ambient Temp: 22.8°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3333; ConvF(5.03, 5.03, 5.03); Calibrated: 10/29/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 10/27/2015
Phantom: SAM Right; Type: QD000P40CD; Serial: 1757
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: PCS CDMA, Left Head, Cheek, Mid.ch

Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 21.06 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.01 W/kg
SAR(1 g) = 0.650 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01891

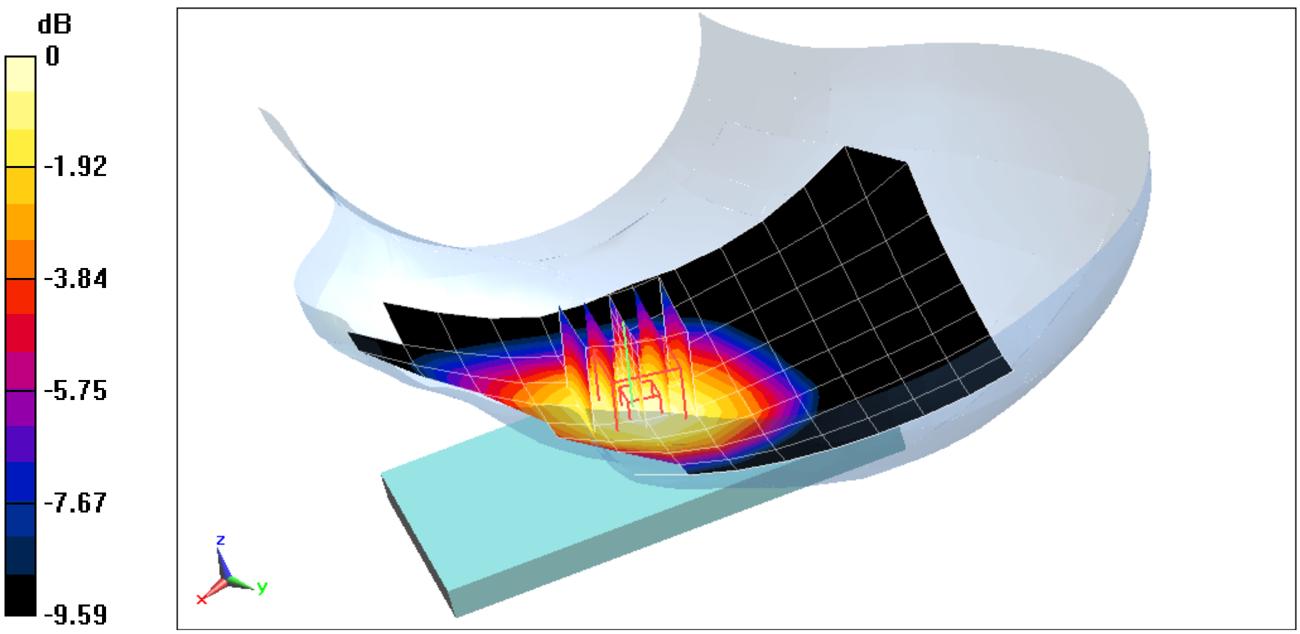
Communication System: UID 0, LTE Band 26; Frequency: 836.5 MHz; Duty Cycle: 1:1
Medium: 835 Head Medium parameters used (interpolated):
f = 836.5 MHz; σ = 0.927 S/m; ε_r = 40.786; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 11-17-2015; Ambient Temp: 22.3°C; Tissue Temp: 21.4°C

Probe: ES3DV3 - SN3332; ConvF(6.23, 6.23, 6.23); Calibrated: 9/18/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/16/2015
Phantom: SAM Main ; Type: QD000P40CC; Serial: TP 1114
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 26 (Cellular), Left Head, Cheek, Mid.ch
15 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.28 V/m; Power Drift = 0.18 dB
Peak SAR (extrapolated) = 0.434 W/kg
SAR(1 g) = 0.358 W/kg



0 dB = 0.389 W/kg = -4.10 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01890

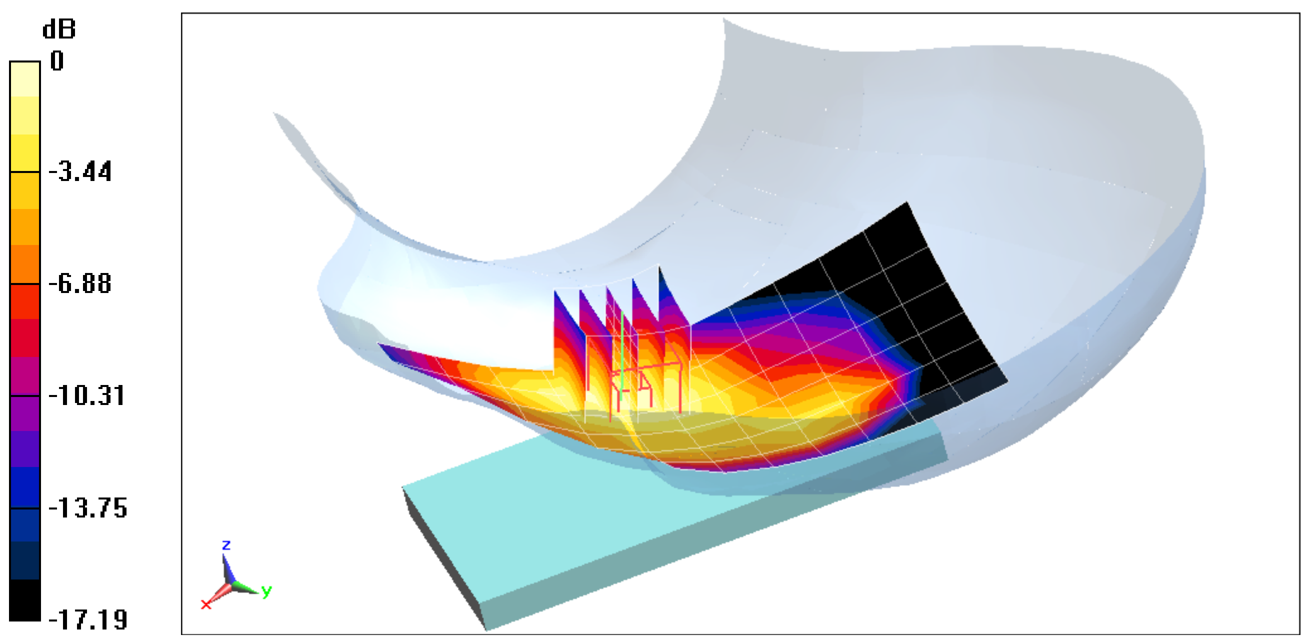
Communication System: UID 0, LTE Band 25 (PCS); Frequency: 1882.5 MHz; Duty Cycle: 1:1
Medium: 1900 Head Medium parameters used (interpolated):
f = 1882.5 MHz; σ = 1.435 S/m; ε_r = 38.915; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 11-19-2015; Ambient Temp: 22.8°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3333; ConvF(5.03, 5.03, 5.03); Calibrated: 10/29/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 10/27/2015
Phantom: SAM Right; Type: QD000P40CD; Serial: 1757
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 25 (PCS), Left Head, Cheek, Mid.ch
20 MHz Bandwidth, QPSK, 1 RB, 50 RB Offset

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.26 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 0.935 W/kg
SAR(1 g) = 0.611 W/kg



0 dB = 0.720 W/kg = -1.43 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01891

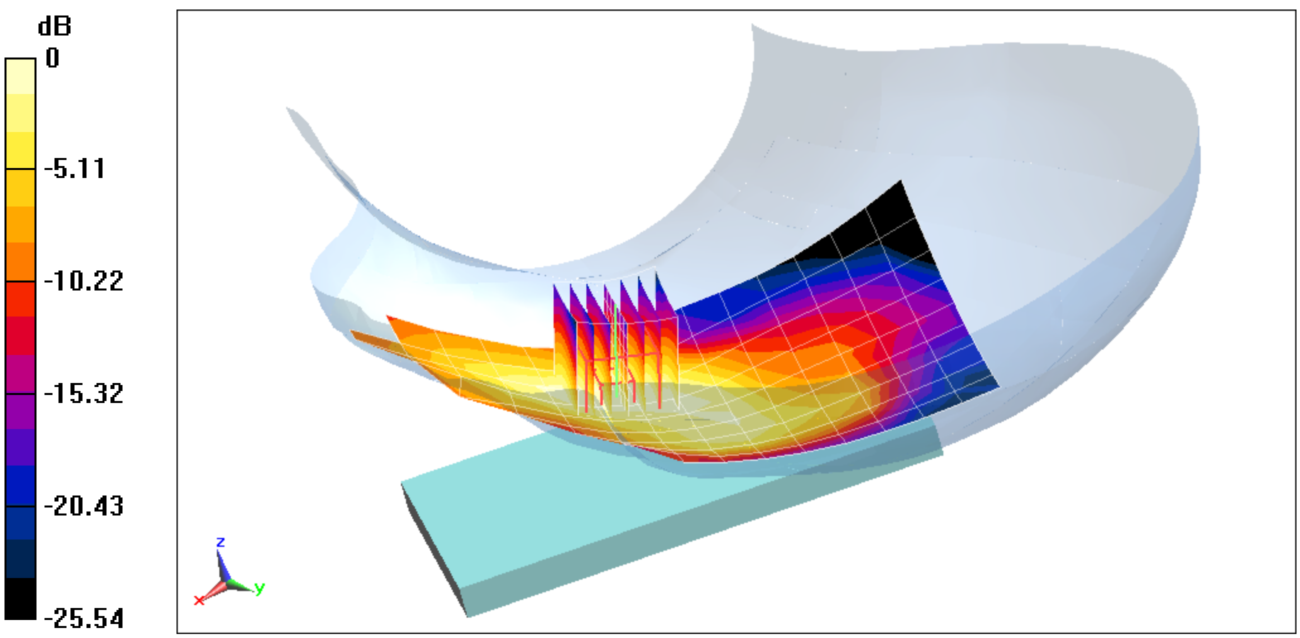
Communication System: UID 0, LTE Band 41; Frequency: 2506 MHz; Duty Cycle: 1:1.59
Medium: 2450 Head Medium parameters used (interpolated):
$f = 2506$ MHz; $\sigma = 1.922$ S/m; $\varepsilon_r = 39.331$; $\rho = 1000$ kg/m^3
Phantom section: Left Section

Test Date: 11-16-2015; Ambient Temp: 24.1°C; Tissue Temp: 23.9°C

Probe: ES3DV3 - SN3333; ConvF(4.53, 4.53, 4.53); Calibrated: 10/29/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 10/27/2015
Phantom: SAM Front; Type: QD000P40CD; Serial: TP:1758
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 41, Left Head, Cheek, Low.ch
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (10x17x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.42 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.282 W/kg
SAR(1 g) = 0.152 W/kg



0 dB = 0.190 W/kg = -7.21 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01892

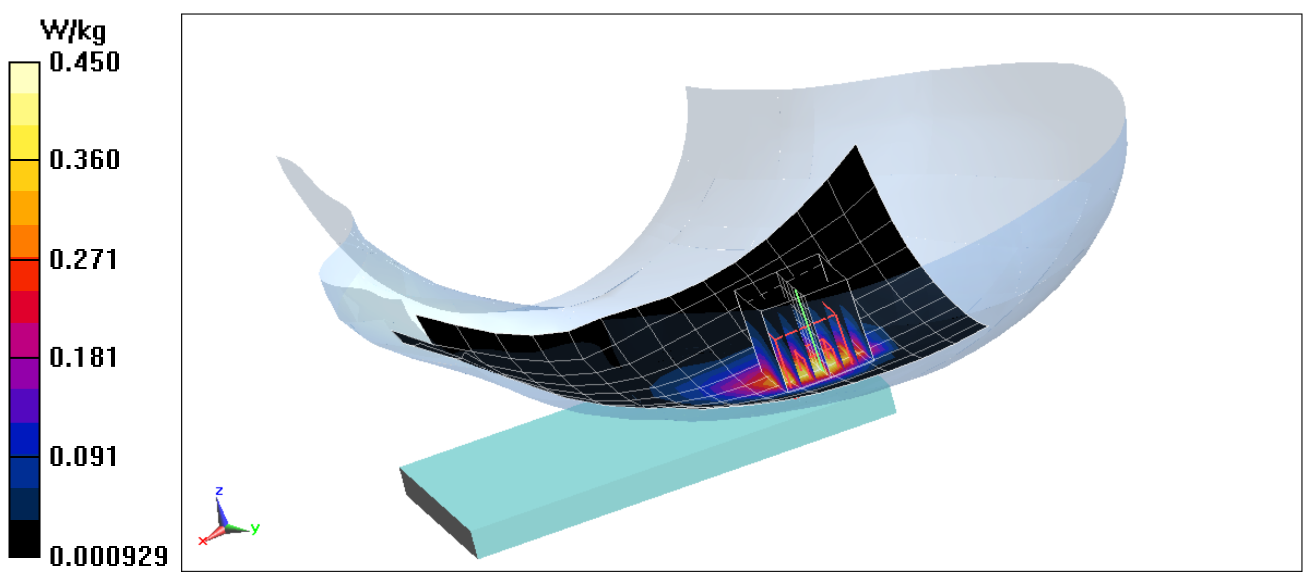
Communication System: UID 0, IEEE 802.11b; Frequency: 2462 MHz; Duty Cycle: 1:1
Medium: 2450 Head Medium parameters used (interpolated):
f = 2462 MHz; σ = 1.902 S/m; ε_r = 38.591; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 11-27-2015; Ambient Temp: 20.7°C; Tissue Temp: 21.6°C

Probe: ES3DV3 - SN3263; ConvF(4.4, 4.4, 4.4); Calibrated: 5/20/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 6/17/2015
Phantom: SAM with CRP v5.0 (Right); Type: QD000P40CD; Serial: TP:1759
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: IEEE 802.11b, 22 MHz Bandwidth, Left Head, Cheek, Ch 11, 1 Mbps

Area Scan (11x18x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 14.74 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.745 W/kg
SAR(1 g) = 0.362 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01891

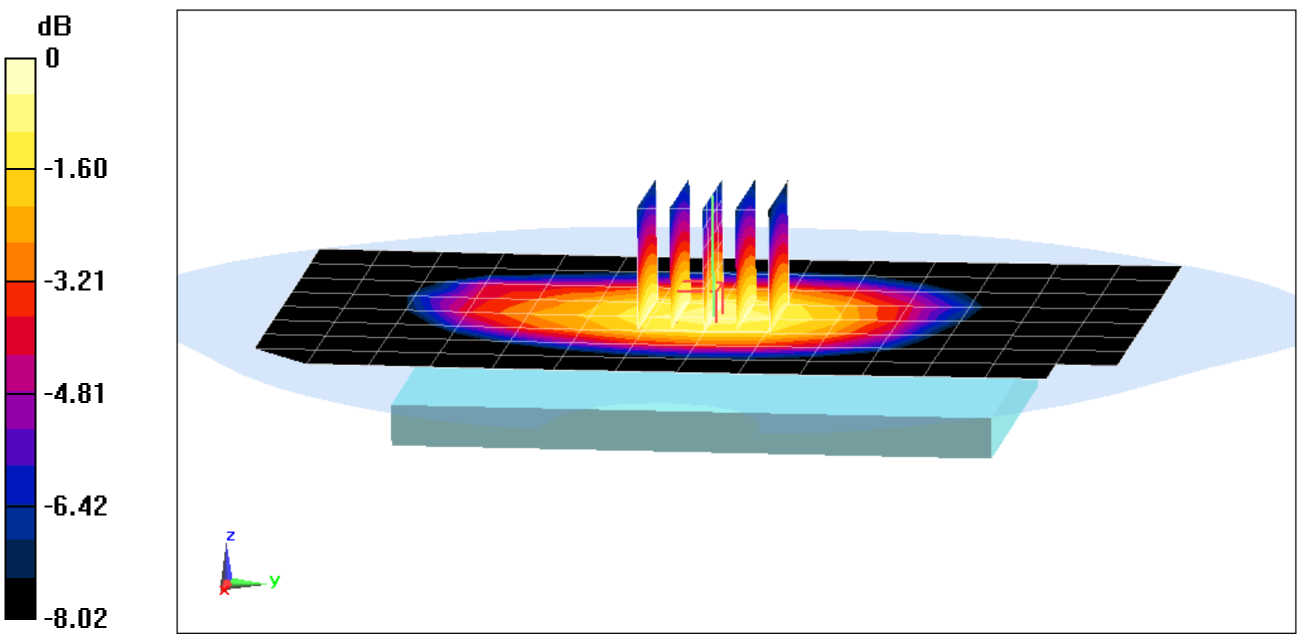
Communication System: UID 0, GSM GPRS; 2 Tx slots; Frequency: 836.6 MHz; Duty Cycle: 1:4.15
Medium: 835 Body Medium parameters used (interpolated):
f = 836.6 MHz; σ = 1.006 S/m; ε_r = 54.478; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-17-2015; Ambient Temp: 22.5°C; Tissue Temp: 21.6°C

Probe: ES3DV3 - SN3263; ConvF(6.08, 6.08, 6.08); Calibrated: 5/20/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 6/17/2015
Phantom: SAM with CRP v5.0 (Right); Type: QD000P40CD; Serial: TP:1759
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.80 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 0.580 W/kg
SAR(1 g) = 0.463 W/kg



0 dB = 0.508 W/kg = -2.94 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01890

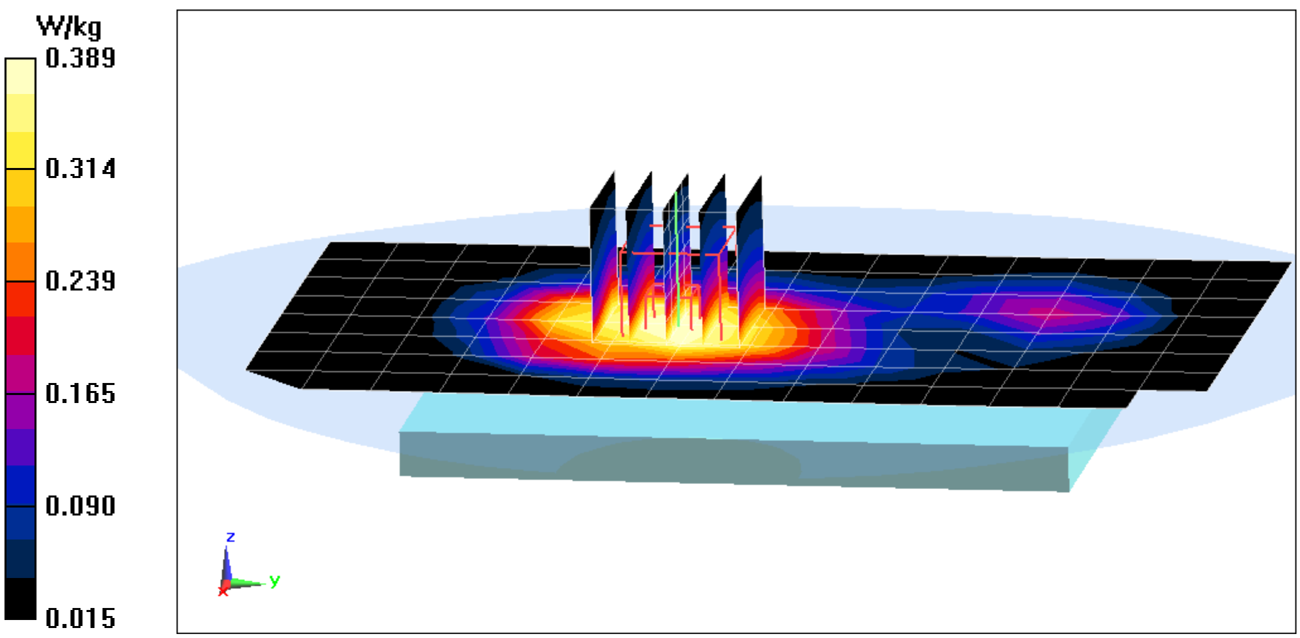
Communication System: UID 0, GSM GPRS; 2 Tx slots; Frequency: 1880 MHz; Duty Cycle: 1:4.15
Medium: 1900 Body Medium parameters used:
f = 1880 MHz; σ = 1.513 S/m; ε_r = 50.946; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-17-2015; Ambient Temp: 23.1°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3288; ConvF(4.81, 4.81, 4.81); Calibrated: 9/18/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1364; Calibrated: 9/18/2015
Phantom: Main TWIN SAM; Type: QD000P40CC; Serial: TP-1406
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.61 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.504 W/kg
SAR(1 g) = 0.340 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01891

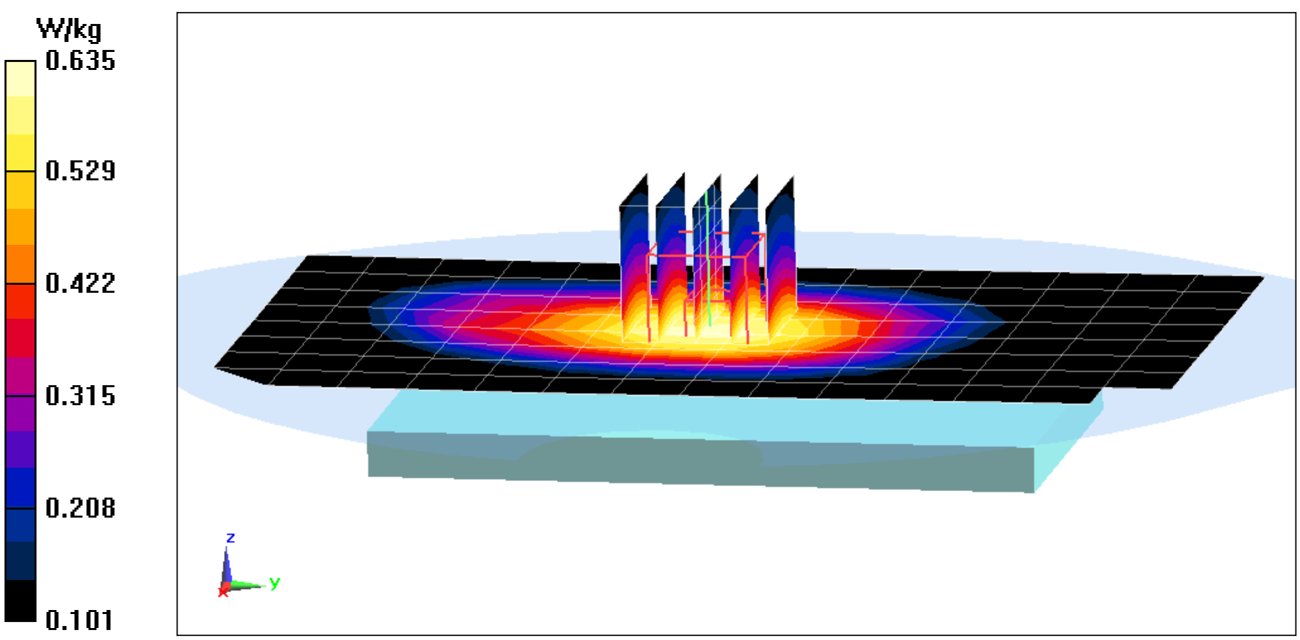
Communication System: UID 0, UMTS; Frequency: 836.6 MHz; Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 836.6 MHz; σ = 1.006 S/m; ε_r = 54.478; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-17-2015; Ambient Temp: 22.5°C; Tissue Temp: 21.6°C

Probe: ES3DV3 - SN3263; ConvF(6.08, 6.08, 6.08); Calibrated: 5/20/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 6/17/2015
Phantom: SAM with CRP v5.0 (Right); Type: QD000P40CD; Serial: TP:1759
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.69 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.723 W/kg
SAR(1 g) = 0.580 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01890

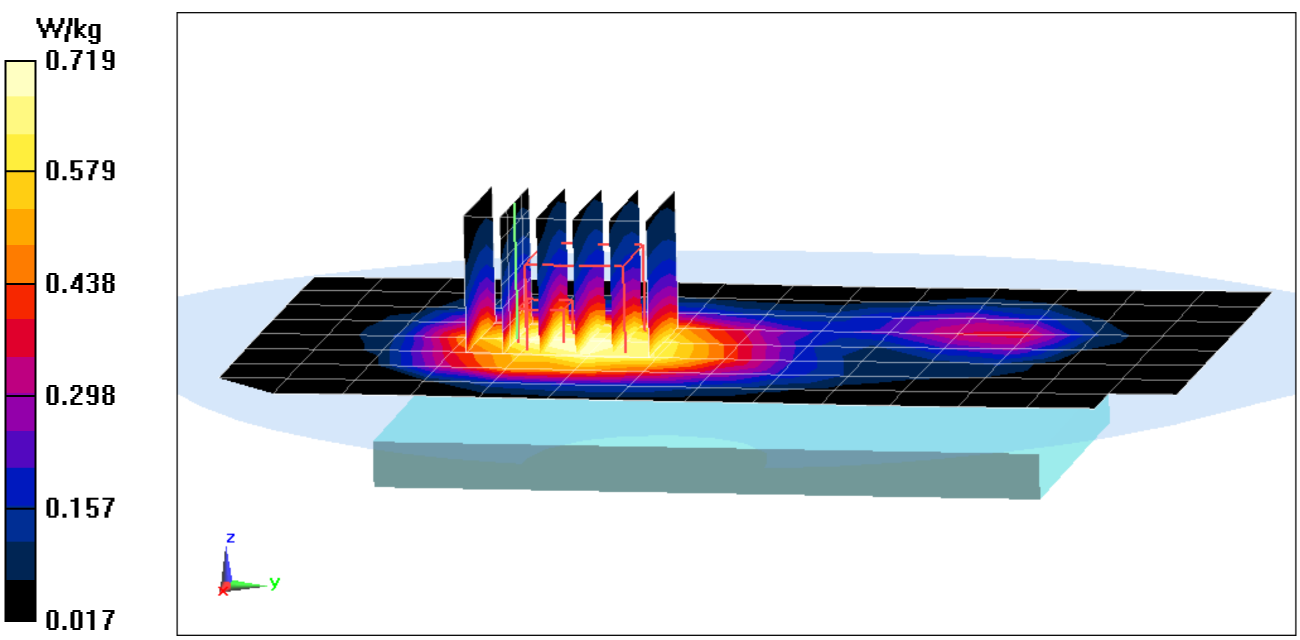
Communication System: UID 0, UMTS; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used:
f = 1880 MHz; σ = 1.513 S/m; ε_r = 50.946; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-17-2015; Ambient Temp: 23.1°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3288; ConvF(4.81, 4.81, 4.81); Calibrated: 9/18/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1364; Calibrated: 9/18/2015
Phantom: Main TWIN SAM; Type: QD000P40CC; Serial: TP-1406
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.95 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 0.958 W/kg
SAR(1 g) = 0.620 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01891

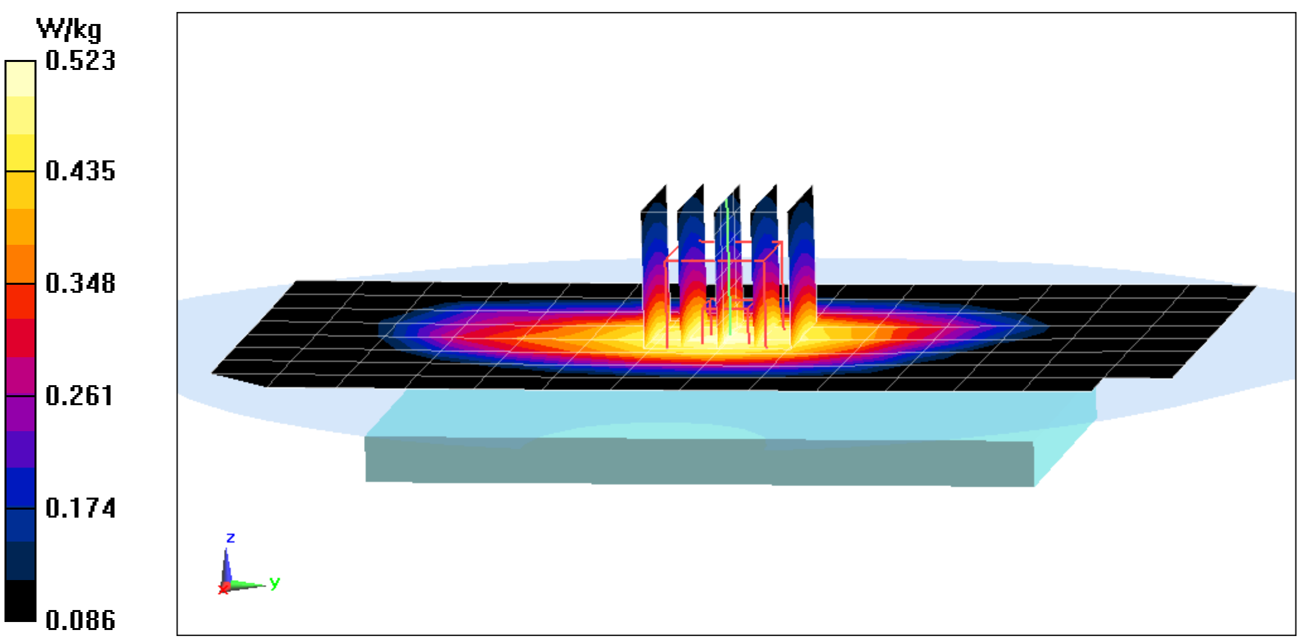
Communication System: UID 0, CDMA; Frequency: 820.1 MHz; Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 820.1 MHz; σ = 0.991 S/m; ε_r = 54.646; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-17-2015; Ambient Temp: 22.5°C; Tissue Temp: 21.6°C

Probe: ES3DV3 - SN3263; ConvF(6.08, 6.08, 6.08); Calibrated: 5/20/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 6/17/2015
Phantom: SAM with CRP v5.0 (Right); Type: QD000P40CD; Serial: TP:1759
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: Cellular CDMA, Rule Part 90S , Body SAR, Back side, Mid.ch

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.62 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.600 W/kg
SAR(1 g) = 0.472 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01891

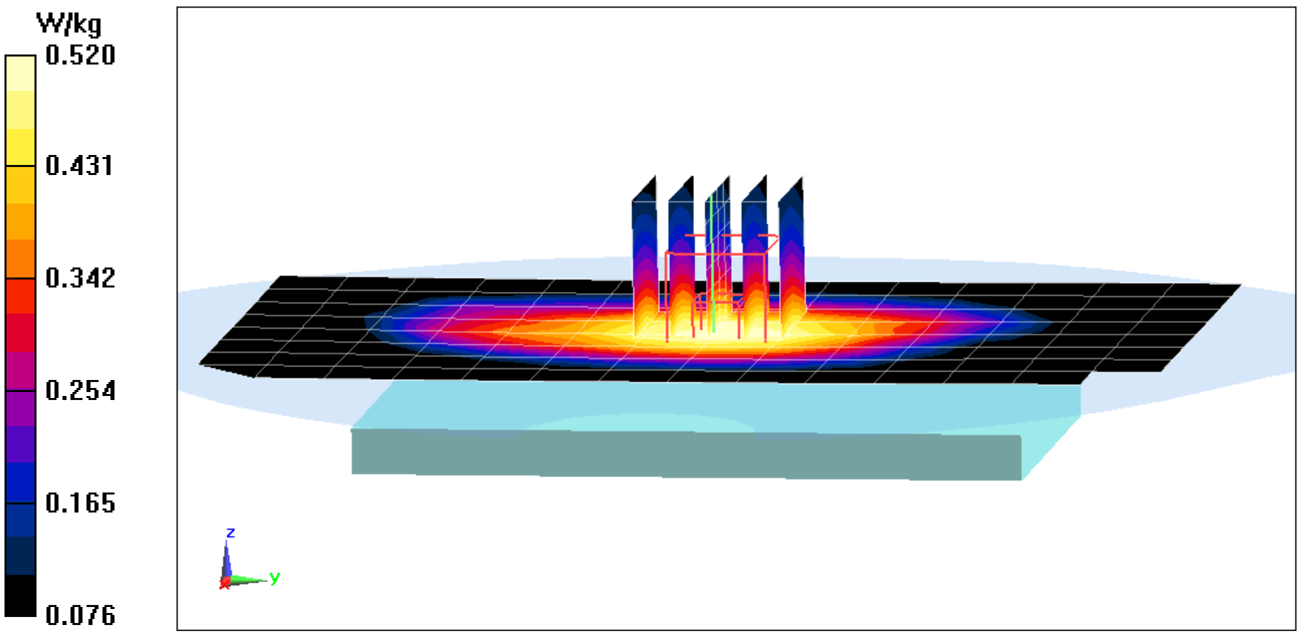
Communication System: UID 0, CDMA; Frequency: 820.1 MHz; Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 820.1 MHz; σ = 0.991 S/m; ε_r = 54.646; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-17-2015; Ambient Temp: 22.5°C; Tissue Temp: 21.6°C

Probe: ES3DV3 - SN3263; ConvF(6.08, 6.08, 6.08); Calibrated: 5/20/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 6/17/2015
Phantom: SAM with CRP v5.0 (Right); Type: QD000P40CD; Serial: TP:1759
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: Cellular EVDO, Rule Part 90S, Body SAR, Back side, Mid.ch

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.49 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.589 W/kg
SAR(1 g) = 0.473 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01891

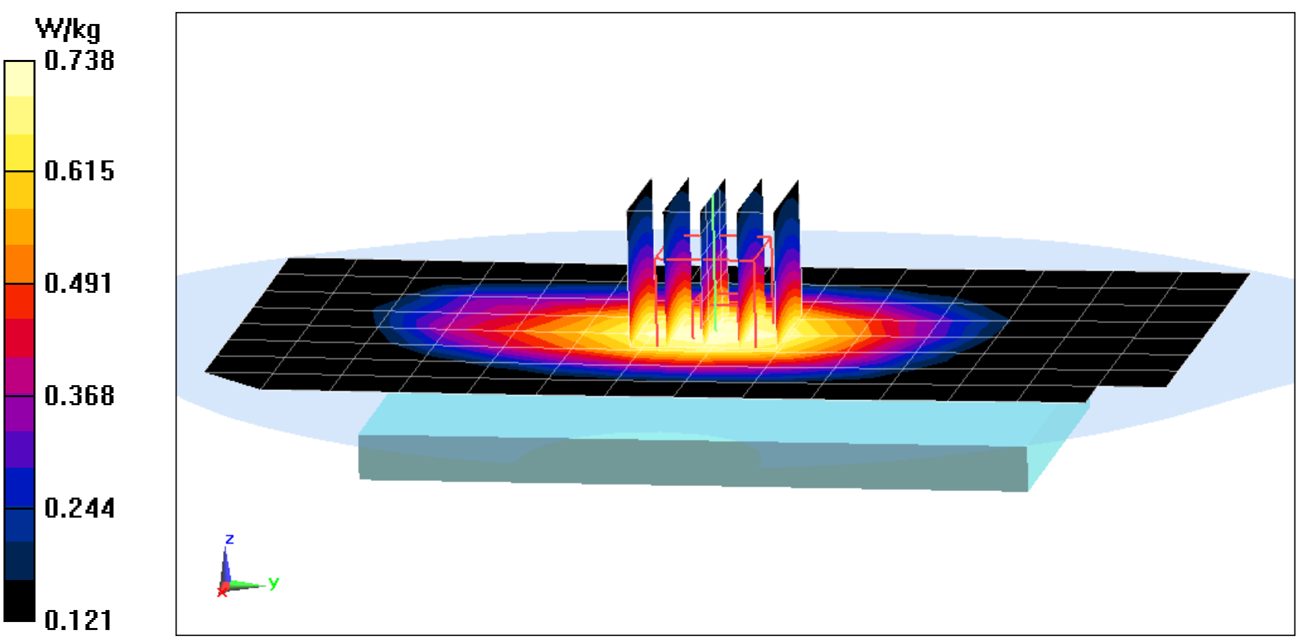
Communication System: UID 0, CDMA; Frequency: 836.52 MHz; Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 836.52 MHz; σ = 1.006 S/m; ε_r = 54.479; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-17-2015; Ambient Temp: 22.5°C; Tissue Temp: 21.6°C

Probe: ES3DV3 - SN3263; ConvF(6.08, 6.08, 6.08); Calibrated: 5/20/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 6/17/2015
Phantom: SAM with CRP v5.0 (Right); Type: QD000P40CD; Serial: TP:1759
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: Cellular CDMA, Rule Part 22H, Body SAR, Back side, Mid.ch

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 26.97 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 0.838 W/kg
SAR(1 g) = 0.678 W/kg



DUT: ZNFLS675; Type: Portable Handset; Serial: 01891

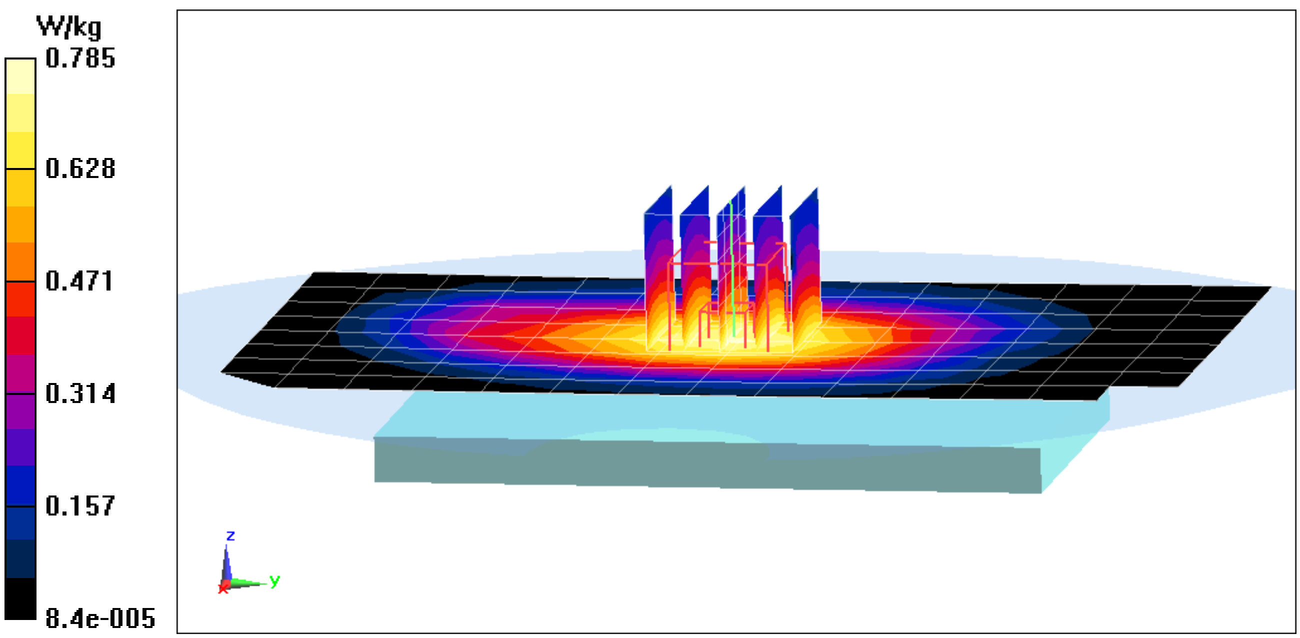
Communication System: UID 0, CDMA; Frequency: 836.52 MHz; Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 836.52 MHz; σ = 1.006 S/m; ε_r = 54.479; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-17-2015; Ambient Temp: 22.5°C; Tissue Temp: 21.6°C

Probe: ES3DV3 - SN3263; ConvF(6.08, 6.08, 6.08); Calibrated: 5/20/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 6/17/2015
Phantom: SAM with CRP v5.0 (Right); Type: QD000P40CD; Serial: TP:1759
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: Cellular EVDO, Rule Part 22H, Body SAR, Back side, Mid.ch

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 27.94 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 0.936 W/kg
SAR(1 g) = 0.713 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01890

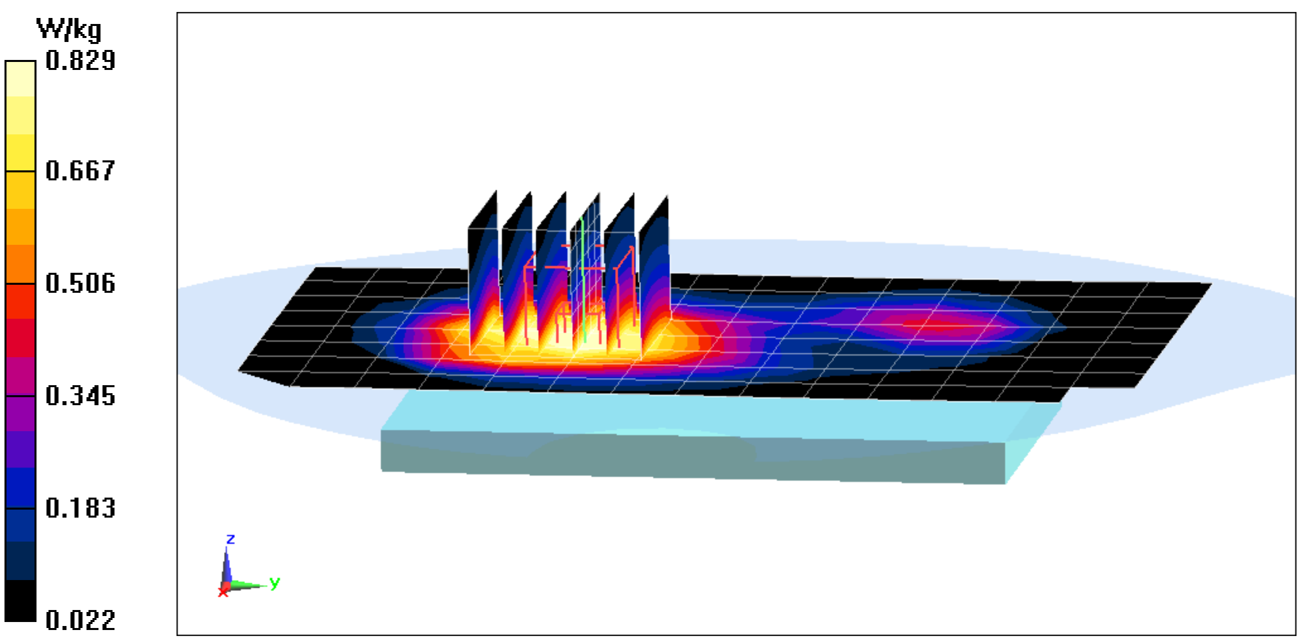
Communication System: UID 0, CDMA; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used:
f = 1880 MHz; σ = 1.513 S/m; ε_r = 50.946; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-17-2015; Ambient Temp: 23.1°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3288; ConvF(4.81, 4.81, 4.81); Calibrated: 9/18/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1364; Calibrated: 9/18/2015
Phantom: Main TWIN SAM; Type: QD000P40CC; Serial: TP-1406
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: PCS CDMA, Body SAR, Back side, Mid.ch

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.62 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 1.07 W/kg
SAR(1 g) = 0.717 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01890

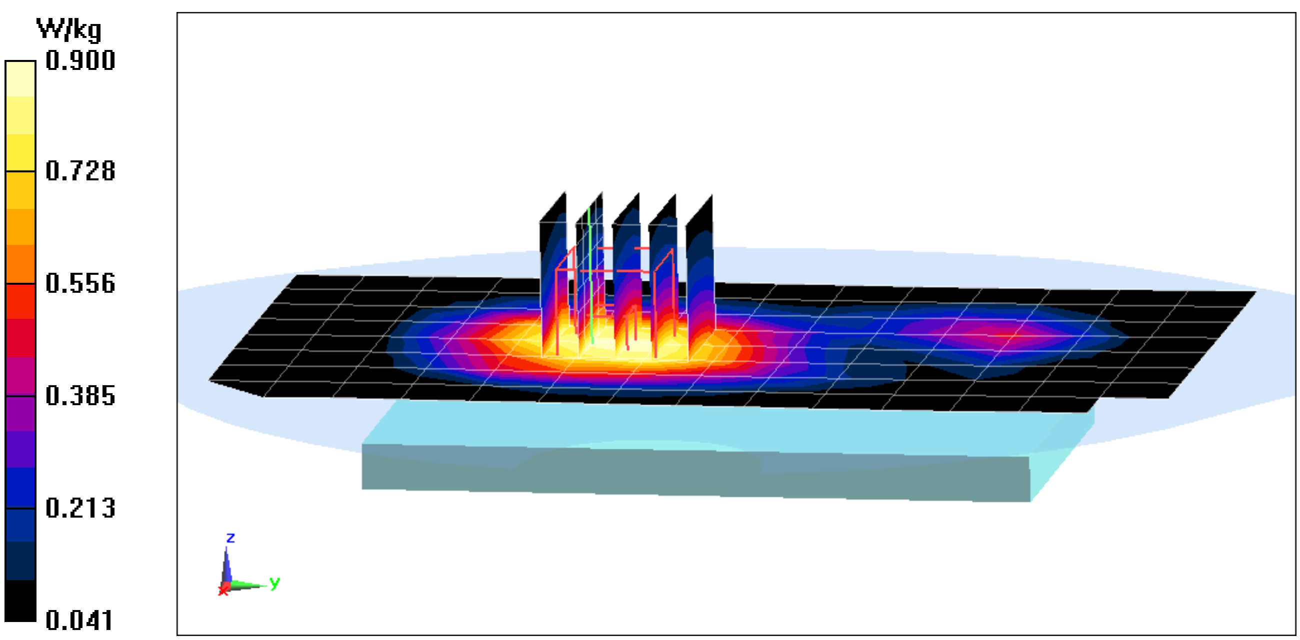
Communication System: UID 0, CDMA; Frequency: 1851.25 MHz; Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1851.25 MHz; σ = 1.481 S/m; ε_r = 51.042; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-17-2015; Ambient Temp: 23.1°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3288; ConvF(4.81, 4.81, 4.81); Calibrated: 9/18/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1364; Calibrated: 9/18/2015
Phantom: Main TWIN SAM; Type: QD000P40CC; Serial: TP-1406
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: PCS EVDO, Body SAR, Back side, Low.ch

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.39 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.16 W/kg
SAR(1 g) = 0.787 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01891

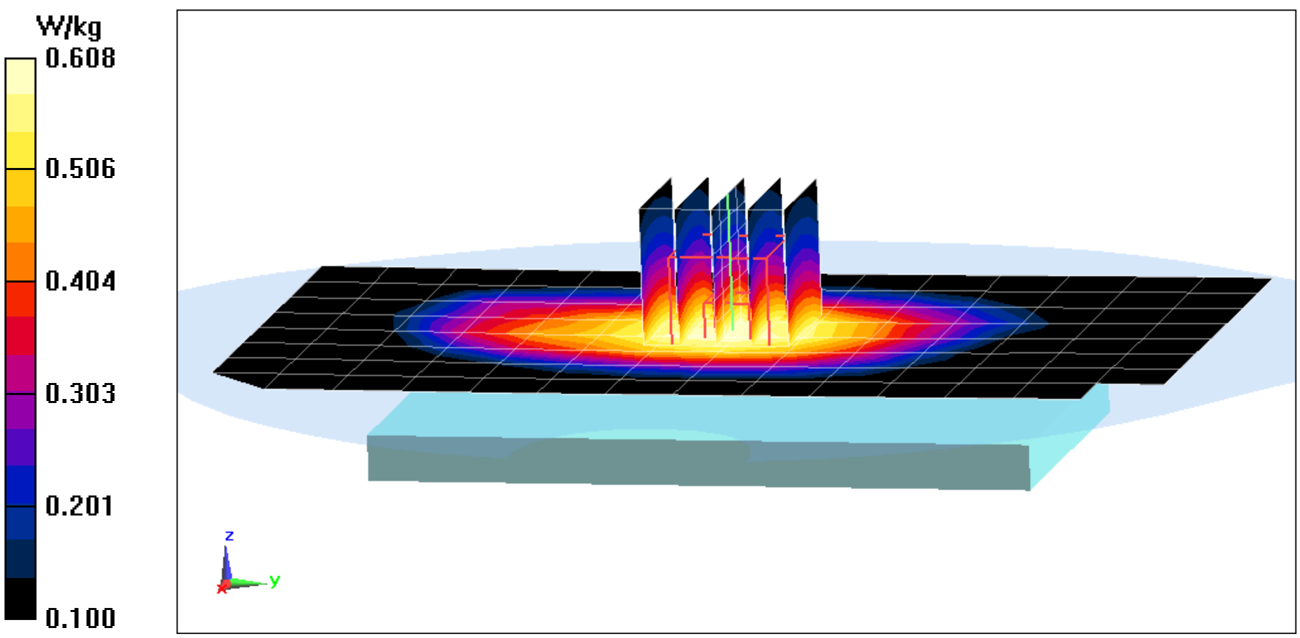
Communication System: UID 0, LTE Band 26; Frequency: 836.5 MHz; Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 836.5 MHz; σ = 1.006 S/m; ε_r = 54.479; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-17-2015; Ambient Temp: 22.5°C; Tissue Temp: 21.6°C

Probe: ES3DV3 - SN3263; ConvF(6.08, 6.08, 6.08); Calibrated: 5/20/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 6/17/2015
Phantom: SAM with CRP v5.0 (Right); Type: QD000P40CD; Serial: TP:1759
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 26 (Cellular), Body SAR, Back side, Mid.ch
15 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.55 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.690 W/kg
SAR(1 g) = 0.556 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01890

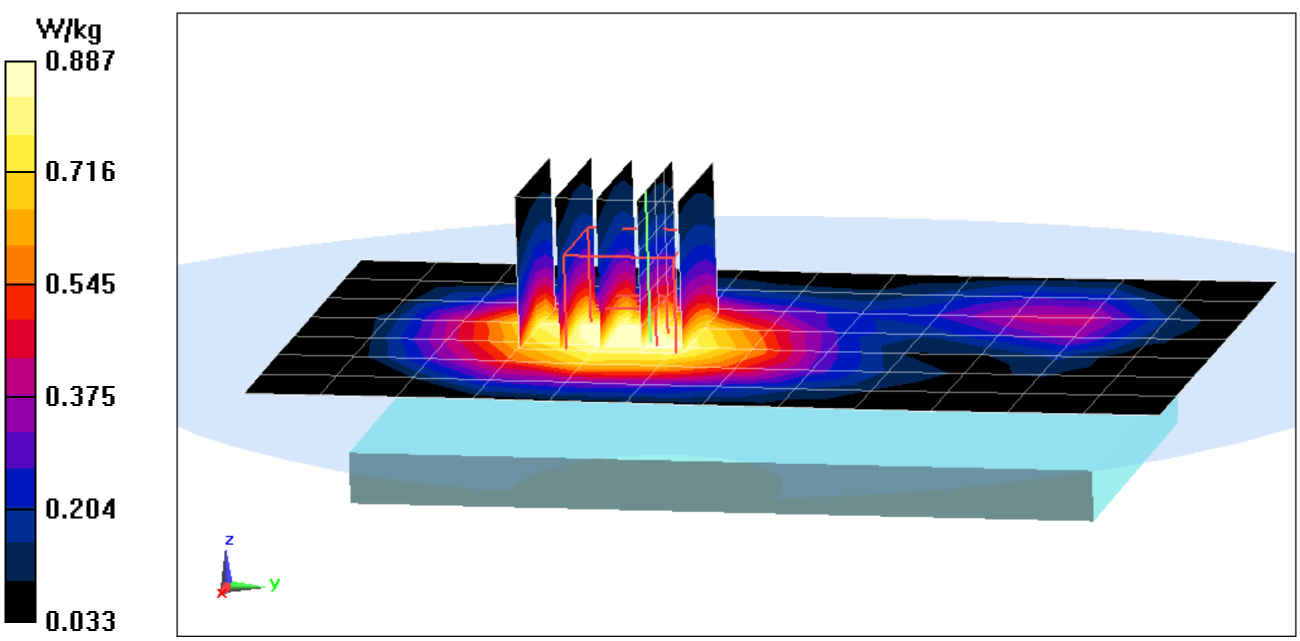
Communication System: UID 0, LTE Band 25 (PCS); Frequency: 1882.5 MHz; Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1882.5 MHz; σ = 1.516 S/m; ε_r = 50.937; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-17-2015; Ambient Temp: 23.1°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3288; ConvF(4.81, 4.81, 4.81); Calibrated: 9/18/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1364; Calibrated: 9/18/2015
Phantom: Main TWIN SAM; Type: QD000P40CC; Serial: TP-1406
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 25 (PCS), Body SAR, Back side, Mid.ch
20 MHz Bandwidth, QPSK, 1 RB, 50 RB Offset

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.03 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 1.14 W/kg
SAR(1 g) = 0.769 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01891

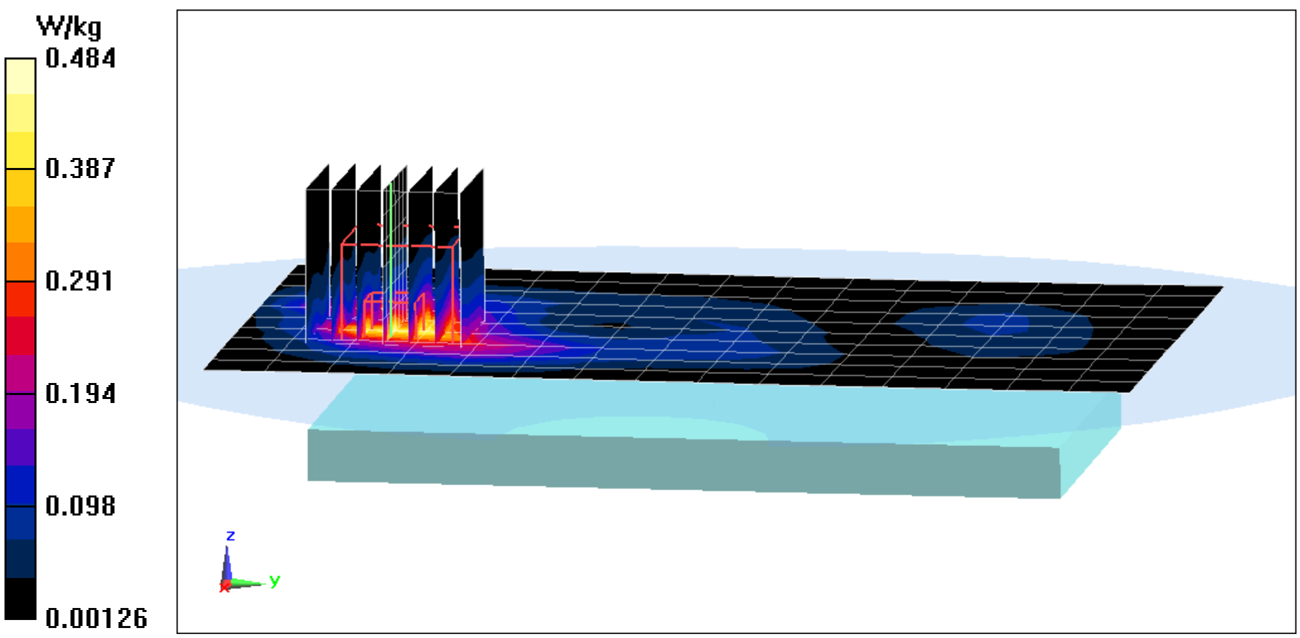
Communication System: UID 0, LTE Band 41; Frequency: 2506 MHz; Duty Cycle: 1:1.59
Medium: 2450 Body Medium parameters used (interpolated):
f = 2506 MHz; $\sigma = 2.042$ S/m; $\varepsilon_r = 50.861$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-19-2015; Ambient Temp: 23.8°C; Tissue Temp: 23.5°C

Probe: ES3DV3 - SN3288; ConvF(4.37, 4.37, 4.37); Calibrated: 9/18/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1364; Calibrated: 9/18/2015
Phantom: Main TWIN SAM; Type: QD000P40CC; Serial: TP-1406
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 41, Body SAR, Back side, Low.ch
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (11x16x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 14.34 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 0.944 W/kg
SAR(1 g) = 0.370 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01891

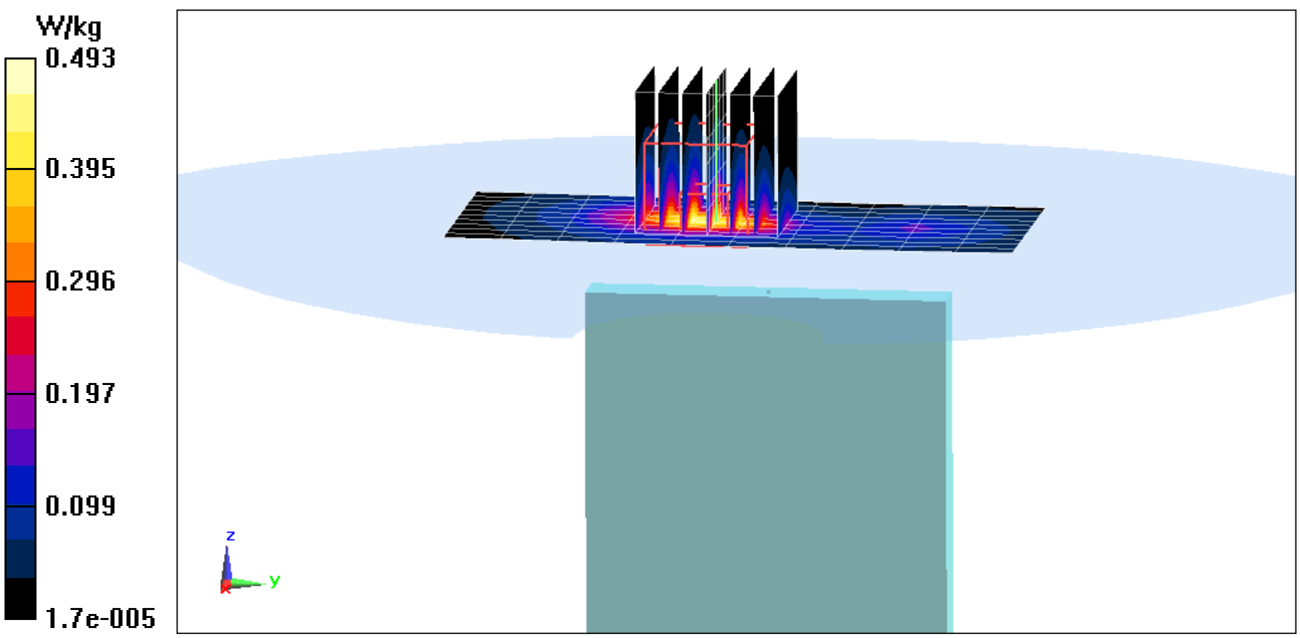
Communication System: UID 0, LTE Band 41; Frequency: 2506 MHz; Duty Cycle: 1:1.59
Medium: 2450 Body Medium parameters used (interpolated):
f = 2506 MHz; σ = 2.042 S/m; ε_r = 50.861; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-19-2015; Ambient Temp: 23.8°C; Tissue Temp: 23.5°C

Probe: ES3DV3 - SN3288; ConvF(4.37, 4.37, 4.37); Calibrated: 9/18/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1364; Calibrated: 9/18/2015
Phantom: Main TWIN SAM; Type: QD000P40CC; Serial: TP-1406
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 41, Body SAR, Bottom Edge, Low.ch
20 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (11x11x1): Measurement grid: dx=5mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 14.49 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.783 W/kg
SAR(1 g) = 0.381 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS675; Type: Portable Handset; Serial: 01892

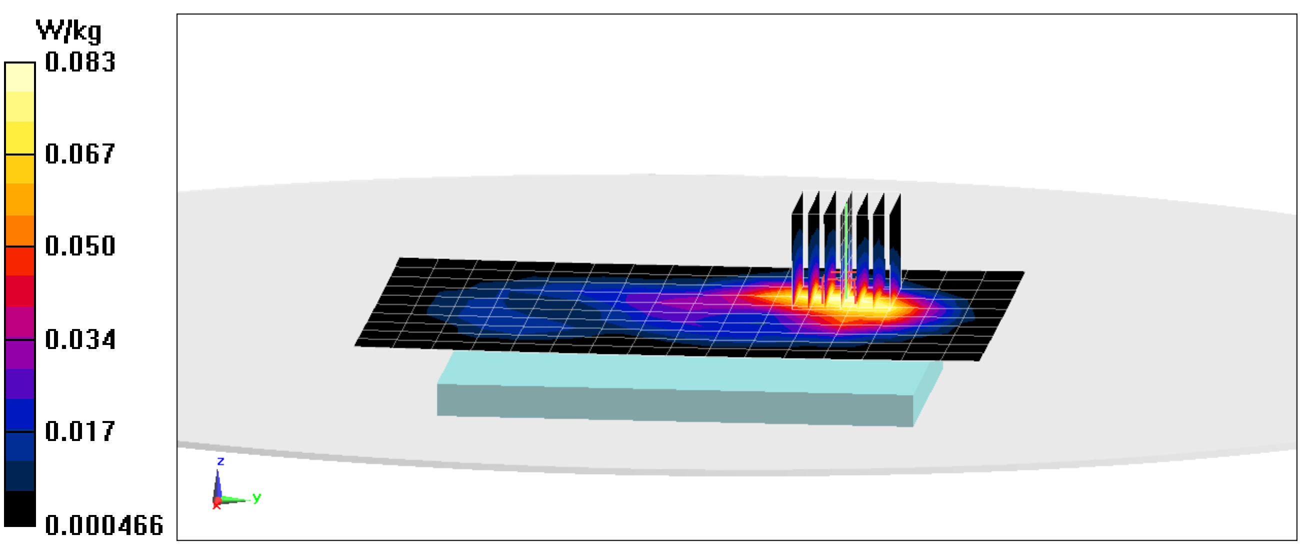
Communication System: UID 0, IEEE 802.11b; Frequency: 2462 MHz; Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used (interpolated):
f = 2462 MHz; σ = 2.024 S/m; ε_r = 51.831; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-27-2015; Ambient Temp: 21.7°C; Tissue Temp: 20.5°C

Probe: ES3DV3 - SN3209; ConvF(4.12, 4.12, 4.12); Calibrated: 3/19/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/20/2015
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1202
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: IEEE 802.11b, 22 MHz Bandwidth, Body SAR, Ch 11, 1 Mbps, Back Side

Area Scan (11x17x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.106 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 0.133 W/kg
SAR(1 g) = 0.068 W/kg



APPENDIX B: SYSTEM VERIFICATION

PCTEST ENGINEERING LABORATORY, INC.

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

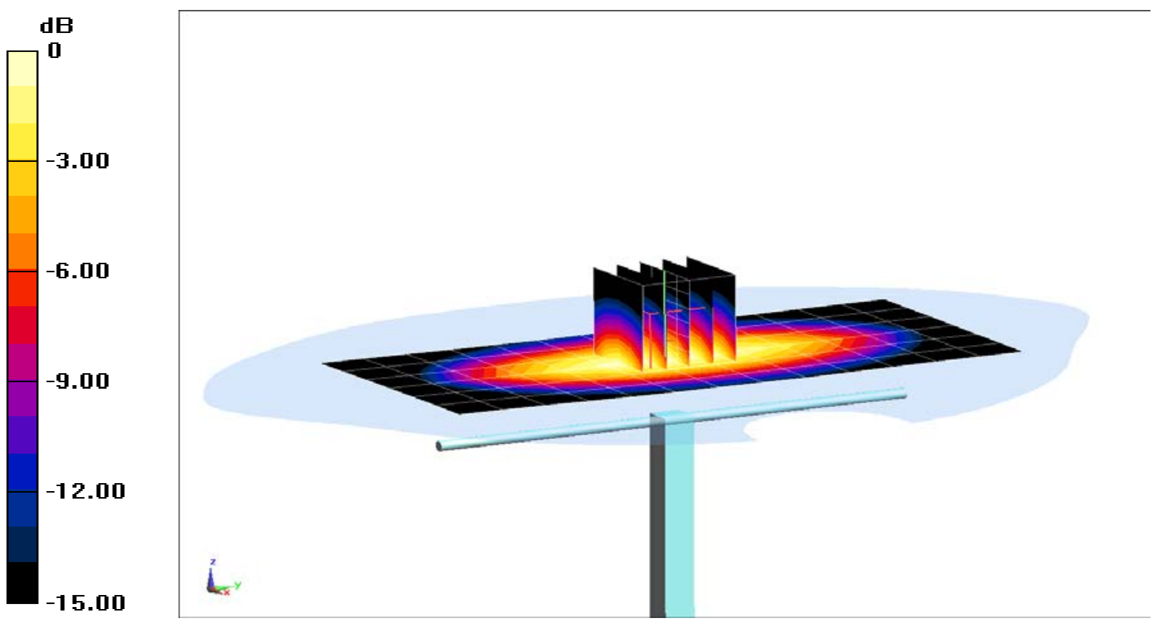
Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: 835 Head Medium parameters used:
f = 835 MHz; σ = 0.925 S/m; ε_r = 40.806; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 11-17-2015; Ambient Temp: 22.3°C; Tissue Temp: 21.4°C

Probe: ES3DV3 - SN3332; ConvF(6.23, 6.23, 6.23); Calibrated: 9/18/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/16/2015
Phantom: SAM Main ; Type: QD000P40CC; Serial: TP 1114
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

835 MHz System Verification at 23.0 dBm (200 mW)

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 2.93 W/kg
SAR(1 g) = 1.97 W/kg
Deviation(1 g) = 6.49 %



PCTEST ENGINEERING LABORATORY, INC.

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

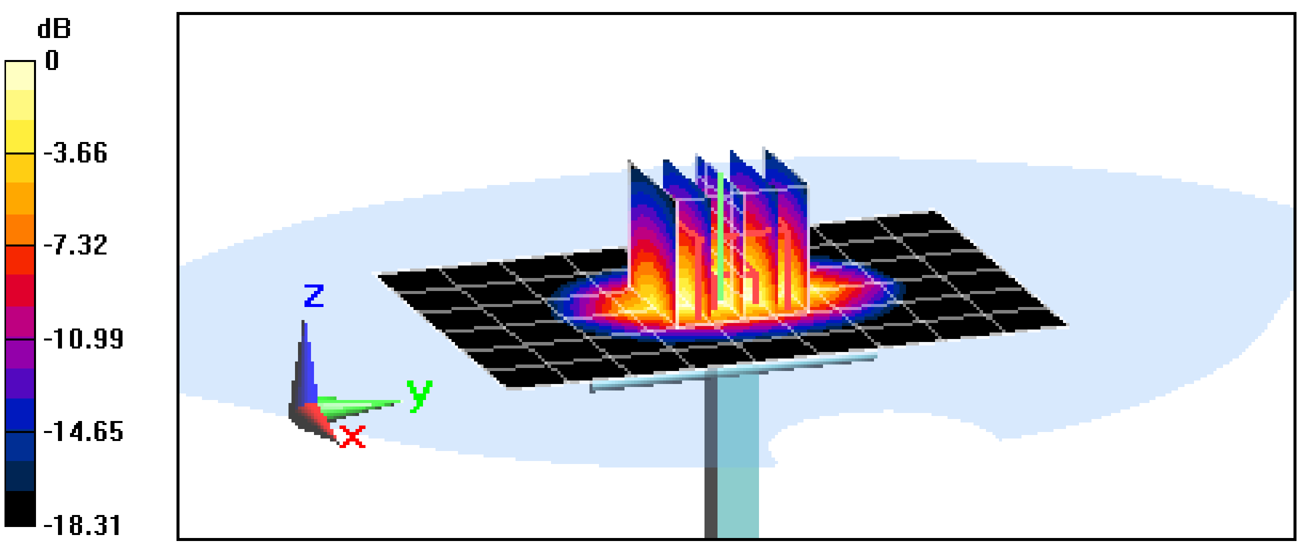
Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Head Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.45 S/m; ε_r = 38.823; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-19-2015; Ambient Temp: 22.8°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3333; ConvF(5.03, 5.03, 5.03); Calibrated: 10/29/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 10/27/2015
Phantom: SAM Right; Type: QD000P40CD; Serial: 1757
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

1900 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 7.72 W/kg
SAR(1 g) = 4.22 W/kg
Deviation(1 g) = 3.69 %



PCTEST ENGINEERING LABORATORY, INC.

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

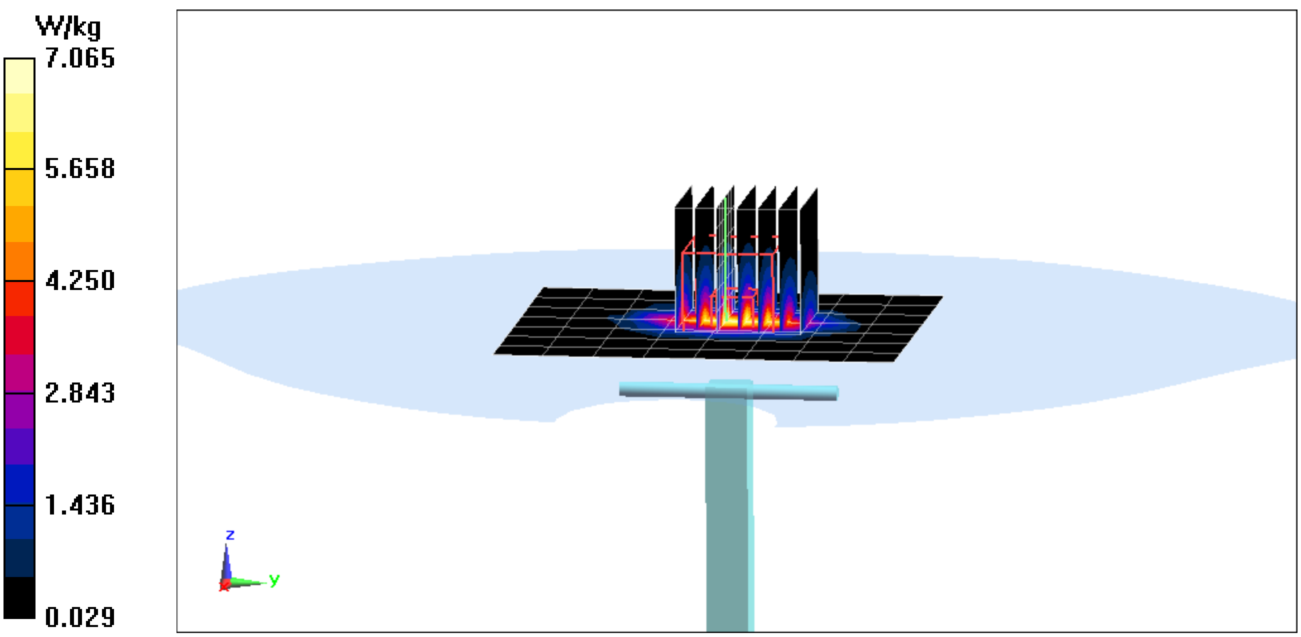
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 Head Medium parameters used:
f = 2450 MHz; σ = 1.862 S/m; ε_r = 39.522; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-16-2015; Ambient Temp: 24.1°C; Tissue Temp: 23.9°C

Probe: ES3DV3 - SN3333; ConvF(4.53, 4.53, 4.53); Calibrated: 10/29/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 10/27/2015
Phantom: SAM Front; Type: QD000P40CD; Serial: TP:1758
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

2450 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 11.4 W/kg
SAR(1 g) = 5.39 W/kg
Deviation(1 g) = -0.55 %



PCTEST ENGINEERING LABORATORY, INC.

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

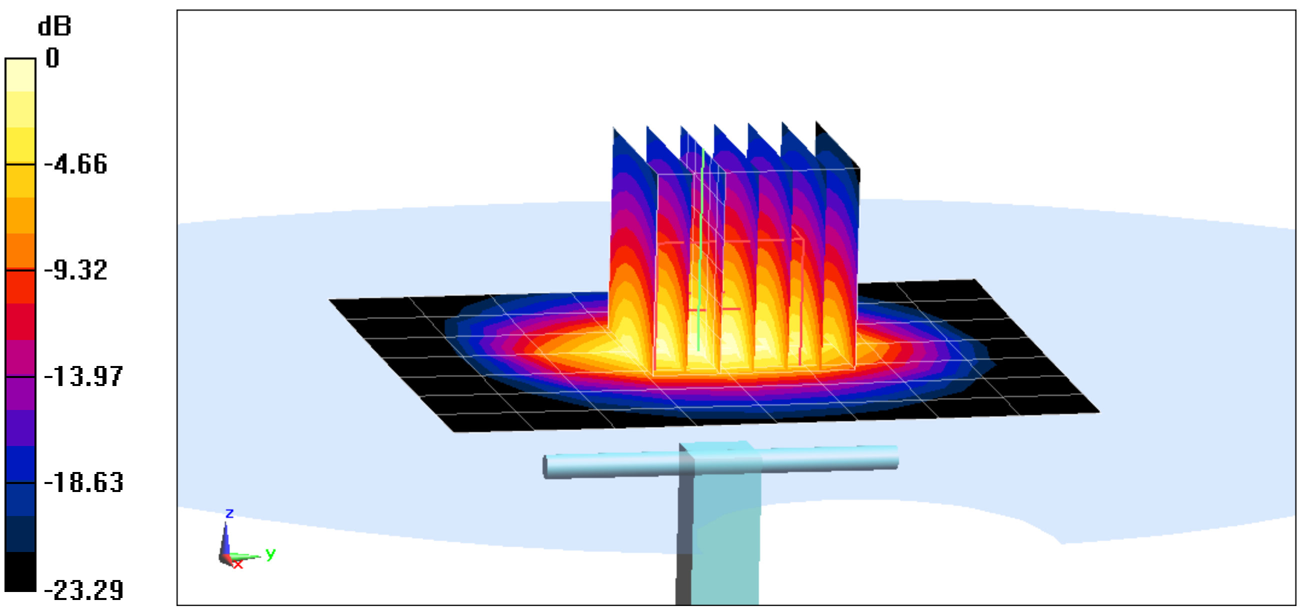
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 Head Medium parameters used:
f = 2450 MHz; σ = 1.888 S/m; ε_r = 38.637; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-27-2015; Ambient Temp: 20.7°C; Tissue Temp: 21.6°C

Probe: ES3DV3 - SN3263; ConvF(4.4, 4.4, 4.4); Calibrated: 5/20/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 6/17/2015
Phantom: SAM with CRP v5.0 (Right); Type: QD000P40CD; Serial: TP:1759
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

2450 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 11.6 W/kg
SAR(1 g) = 5.52 W/kg
Deviation(1 g) = 4.74%



0 dB = 7.26 W/kg = 8.61 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

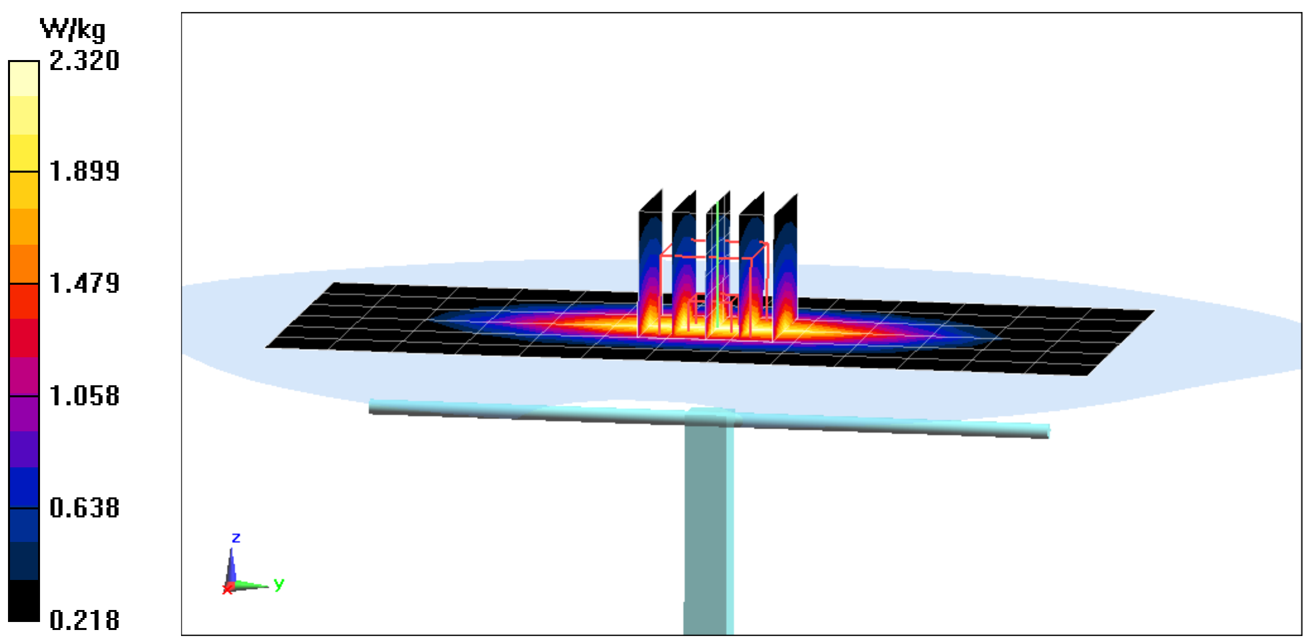
Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: 835 Body Medium parameters used:
f = 835 MHz; σ = 1.005 S/m; ε_r = 54.494; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 11-17-2015; Ambient Temp: 22.5°C; Tissue Temp: 21.6°C

Probe: ES3DV3 - SN3263; ConvF(6.08, 6.08, 6.08); Calibrated: 5/20/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn859; Calibrated: 6/17/2015
Phantom: SAM with CRP v5.0 (Right); Type: QD000P40CD; Serial: TP:1759
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

835 MHz System Verification at 23.0 dBm (200 mW)

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 2.90 W/kg
SAR(1 g) = 1.99 W/kg
Deviation(1 g) = 7.57 %



PCTEST ENGINEERING LABORATORY, INC.

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

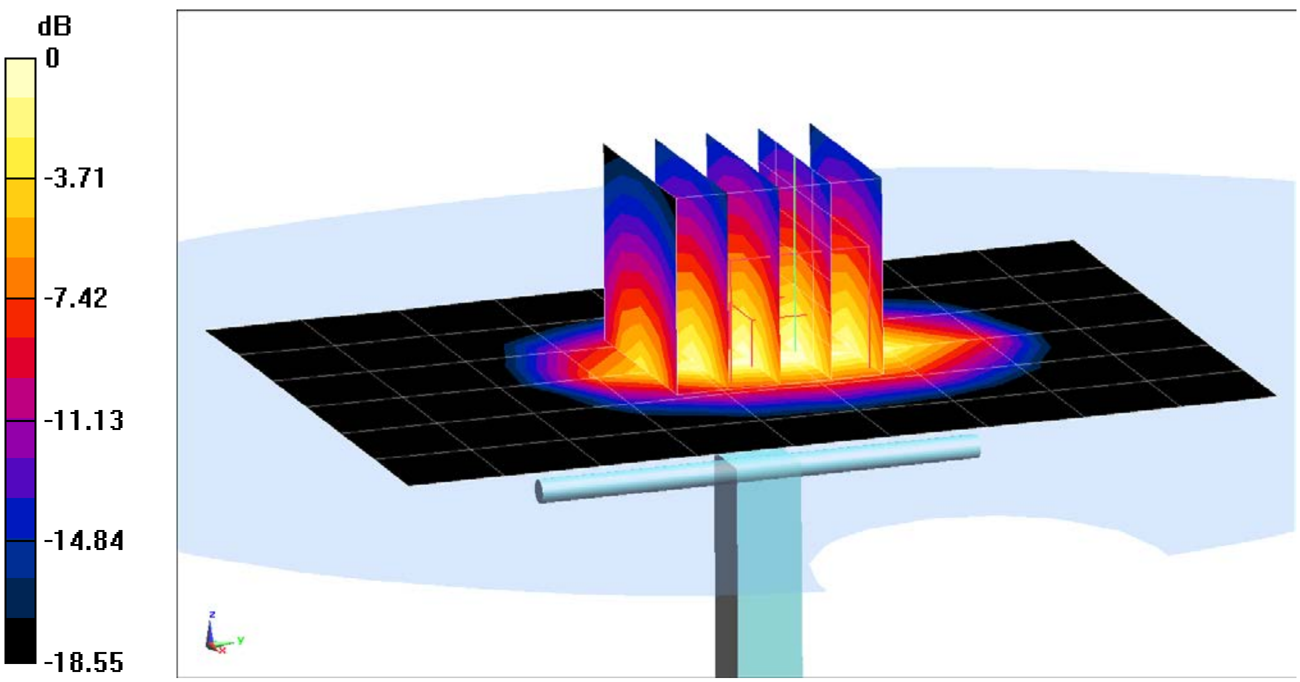
Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.535 S/m; ε_r = 50.873; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-17-2015; Ambient Temp: 23.1°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3288; ConvF(4.81, 4.81, 4.81); Calibrated: 9/18/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1364; Calibrated: 9/18/2015
Phantom: Main TWIN SAM; Type: QD000P40CC; Serial: TP-1406
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

1900 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 6.99 W/kg
SAR(1 g) = 3.97 W/kg
Deviation (1 g) = -1.24 %



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 882

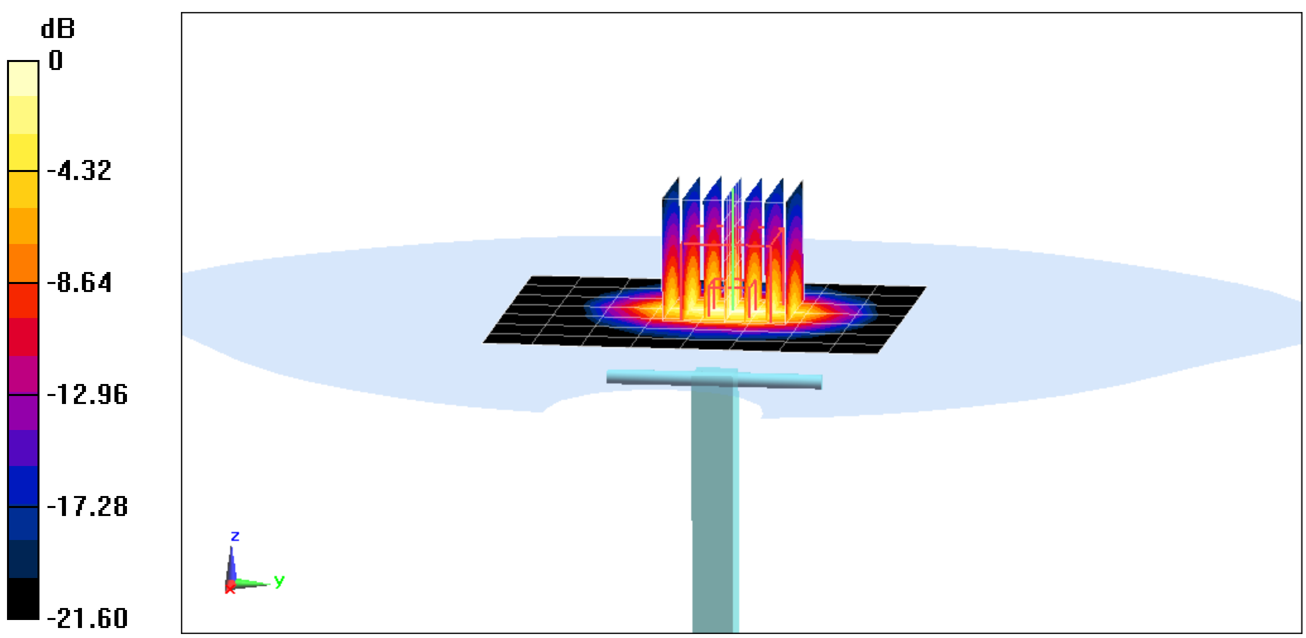
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used:
f = 2450 MHz; σ = 1.976 S/m; ε_r = 51.091; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-19-2015; Ambient Temp: 23.8°C; Tissue Temp: 23.5°C

Probe: ES3DV3 - SN3288; ConvF(4.37, 4.37, 4.37); Calibrated: 9/18/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1364; Calibrated: 9/18/2015
Phantom: Main TWIN SAM; Type: QD000P40CC; Serial: TP-1406
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

2450 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 12.1 W/kg
SAR(1 g) = 5.31 W/kg
Deviation(1 g) = 4.73 %



PCTEST ENGINEERING LABORATORY, INC.

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

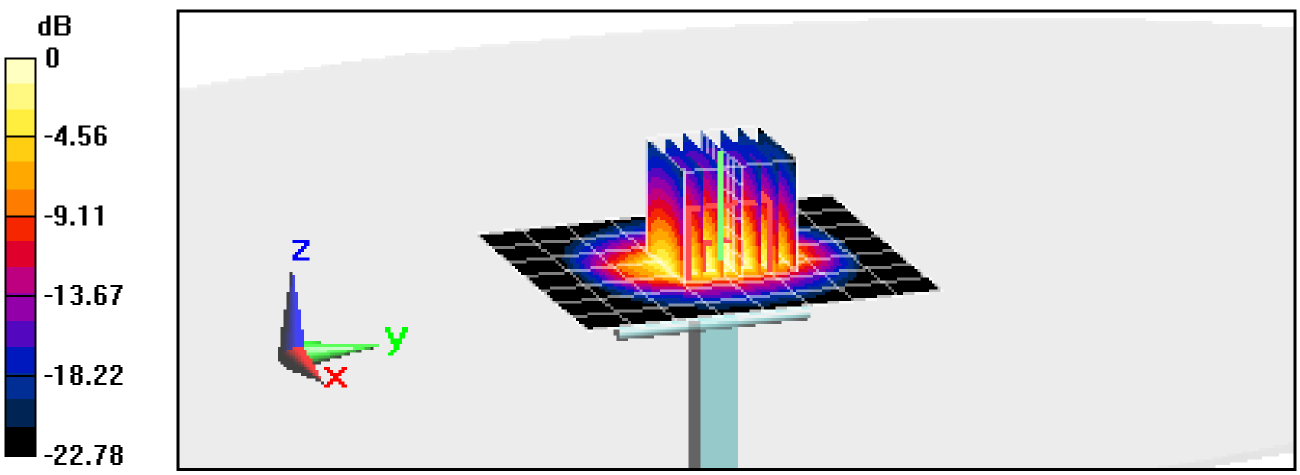
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used:
f = 2450 MHz; σ = 2.007 S/m; ε_r = 51.881; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-27-2015; Ambient Temp: 21.7°C; Tissue Temp: 20.5°C

Probe: ES3DV3 - SN3209; ConvF(4.12, 4.12, 4.12); Calibrated: 3/19/2015;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 4/20/2015
Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP:1202
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

2450 MHz System Verification at 20.0 dBm (100 mW)

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 12.0 W/kg
SAR(1 g) = 5.57 W/kg
Deviation(1 g) = 7.32 %



0 dB = 7.35 W/kg = 8.66 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)
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **ES3-3332_Sep15**

CALIBRATION CERTIFICATE

Object ES3DV3 - SN:3332

BN ✓ 10/02/15

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

Calibration date: September 18, 2015

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	01-Apr-15 (No. 217-02128)	Mar-16
Power sensor E4412A	MY41498087	01-Apr-15 (No. 217-02128)	Mar-16
Reference 3 dB Attenuator	SN: S5054 (3c)	01-Apr-15 (No. 217-02129)	Mar-16
Reference 20 dB Attenuator	SN: S5277 (20x)	01-Apr-15 (No. 217-02132)	Mar-16
Reference 30 dB Attenuator	SN: S5129 (30b)	01-Apr-15 (No. 217-02133)	Mar-16
Reference Probe ES3DV2	SN: 3013	30-Dec-14 (No. ES3-3013_Dec14)	Dec-15
DAE4	SN: 660	14-Jan-15 (No. DAE4-660_Jan15)	Jan-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 19, 2015

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3332

Manufactured:	January 24, 2012
Calibrated:	September 18, 2015

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3332

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.93	1.15	0.99	± 10.1 %
DCP (mV)[B]	108.2	105.6	111.7	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB$\sqrt{\mu V}$	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	180.2	±3.3 %
		Y	0.0	0.0	1.0		198.1	
		Z	0.0	0.0	1.0		187.7	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	2.96	64.5	11.8	10.00	35.0	±1.2 %
		Y	2.25	60.5	10.6		40.1	
		Z	2.62	65.4	12.1		36.6	
10011-CAB	UMTS-FDD (WCDMA)	X	3.44	68.4	19.2	2.91	147.3	±0.5 %
		Y	3.37	67.7	18.7		139.1	
		Z	3.45	69.0	19.4		149.1	
10012-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	3.28	71.7	20.1	1.87	148.2	±0.9 %
		Y	3.30	71.1	19.7		137.5	
		Z	4.01	76.3	22.2		149.5	
10013-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	10.53	69.8	22.7	9.46	139.2	±2.5 %
		Y	10.78	69.9	22.7		131.2	
		Z	10.35	69.9	22.9		138.0	
10021-DAB	GSM-FDD (TDMA, GMSK)	X	5.49	76.7	19.0	9.39	136.0	±1.7 %
		Y	10.71	86.8	23.3		136.5	
		Z	4.51	77.8	20.5		131.7	
10023-DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	6.10	78.4	19.8	9.57	129.5	±2.5 %
		Y	10.58	86.6	23.3		129.0	
		Z	4.53	77.3	20.2		146.7	
10024-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	6.33	78.5	17.8	6.56	140.5	±1.9 %
		Y	37.44	99.7	24.4		145.2	
		Z	24.95	99.6	24.7		141.3	
10027-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	54.77	99.9	21.9	4.80	140.5	±2.5 %
		Y	45.73	99.6	22.9		135.1	
		Z	16.63	92.9	21.5		136.4	
10028-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	93.62	99.9	20.2	3.55	127.4	±1.9 %
		Y	67.21	100.0	21.5		144.3	
		Z	46.91	99.9	21.3		149.2	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	97.19	90.7	14.6	1.16	145.1	±1.9 %
		Y	96.34	95.4	17.0		135.4	
		Z	96.75	90.9	14.5		146.6	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.19	67.1	19.4	5.67	135.5	±1.4 %
		Y	6.42	67.7	19.7		146.7	
		Z	6.28	67.8	19.9		135.8	

10103-CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	8.89	72.8	24.6	9.29	142.1	±2.7 %
		Y	9.60	73.9	24.9		135.4	
		Z	8.51	72.3	24.5		138.8	
10108-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.05	66.7	19.3	5.80	134.0	±1.4 %
		Y	6.32	67.4	19.7		145.7	
		Z	6.03	67.1	19.6		133.7	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	9.80	68.3	20.9	8.07	123.8	±2.2 %
		Y	10.05	68.7	21.1		136.1	
		Z	9.72	68.4	21.0		123.8	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	8.37	72.1	24.4	9.28	136.9	±2.7 %
		Y	9.10	73.2	24.8		131.4	
		Z	7.92	71.3	24.2		133.2	
10154-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	5.75	66.3	19.1	5.75	130.7	±1.4 %
		Y	6.00	66.8	19.4		142.7	
		Z	5.71	66.6	19.4		131.5	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.17	66.7	19.3	5.82	136.2	±1.4 %
		Y	6.44	67.3	19.6		147.2	
		Z	6.16	67.2	19.7		135.7	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	4.74	66.7	19.6	5.73	133.7	±1.2 %
		Y	5.01	67.4	19.9		145.0	
		Z	4.65	67.0	19.9		133.6	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	6.67	73.1	25.1	9.21	126.3	±2.5 %
		Y	8.06	76.9	26.9		144.3	
		Z	6.29	72.8	25.4		129.2	
10175-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.87	67.3	19.9	5.72	149.0	±1.2 %
		Y	4.98	67.2	19.8		144.1	
		Z	4.63	66.9	19.9		131.7	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.68	66.4	19.4	5.72	127.1	±1.2 %
		Y	4.98	67.2	19.8		144.1	
		Z	4.63	66.9	19.9		131.9	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.73	68.9	21.4	8.10	141.6	±2.2 %
		Y	9.66	68.3	21.0		128.4	
		Z	9.56	69.0	21.4		139.9	
10225-CAB	UMTS-FDD (HSPA+)	X	6.84	67.3	19.5	5.97	145.4	±1.4 %
		Y	6.90	66.9	19.3		134.3	
		Z	6.82	68.0	20.1		144.5	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	6.71	73.3	25.2	9.21	127.4	±2.5 %
		Y	8.21	77.5	27.2		147.1	
		Z	6.58	74.2	26.2		146.3	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	8.26	73.2	25.2	9.24	147.4	±2.5 %
		Y	9.17	74.7	25.7		148.9	
		Z	7.77	72.2	24.9		149.4	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	8.34	72.0	24.4	9.30	130.4	±2.2 %
		Y	9.09	73.2	24.8		130.6	
		Z	8.00	71.6	24.4		132.7	

10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.39	67.2	18.8	3.96	143.6	±0.7 %
		Y	4.42	66.9	18.7		137.9	
		Z	4.44	68.0	19.3		149.9	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.61	67.5	18.9	3.46	134.1	±0.7 %
		Y	3.62	68.1	19.3		149.7	
		Z	3.86	69.8	20.3		136.7	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.55	67.5	18.8	3.39	135.0	±0.7 %
		Y	3.64	67.5	18.9		128.2	
		Z	3.70	69.2	19.9		140.6	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.00	66.5	19.2	5.81	127.3	±1.7 %
		Y	6.31	67.3	19.7		143.5	
		Z	6.10	67.3	19.8		133.1	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.58	67.1	19.6	6.06	132.3	±1.7 %
		Y	6.89	67.9	20.0		150.0	
		Z	6.66	67.9	20.1		139.0	
10400-AAC	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	9.89	68.9	21.5	8.37	137.7	±2.5 %
		Y	9.99	68.7	21.4		131.9	
		Z	9.84	69.3	21.8		142.0	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.79	69.6	19.3	3.76	144.7	±0.5 %
		Y	4.91	69.1	19.1		139.1	
		Z	5.14	72.5	20.9		148.7	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	5.05	70.9	19.9	3.77	143.6	±0.9 %
		Y	4.92	69.5	19.3		137.0	
		Z	5.15	72.8	21.0		146.1	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.75	69.3	19.0	1.54	143.9	±0.7 %
		Y	2.86	69.9	19.3		134.9	
		Z	3.83	76.3	22.3		149.9	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	9.83	69.0	21.5	8.23	142.4	±2.2 %
		Y	9.78	68.4	21.1		130.2	
		Z	9.68	69.0	21.6		141.2	

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 Norm X,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 7 and 8).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3332

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	41.9	0.89	6.44	6.44	6.44	0.46	1.55	± 12.0 %
835	41.5	0.90	6.23	6.23	6.23	0.25	2.20	± 12.0 %
1750	40.1	1.37	5.25	5.25	5.25	0.46	1.48	± 12.0 %
1900	40.0	1.40	5.06	5.06	5.06	0.61	1.30	± 12.0 %
2300	39.5	1.67	4.78	4.78	4.78	0.61	1.43	± 12.0 %
2450	39.2	1.80	4.44	4.44	4.44	0.80	1.26	± 12.0 %
2600	39.0	1.96	4.31	4.31	4.31	0.80	1.27	± 12.0 %

[C] Frequency validity above 300 MHz 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. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3332

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	55.5	0.96	6.36	6.36	6.36	0.80	1.16	± 12.0 %
835	55.2	0.97	6.21	6.21	6.21	0.53	1.43	± 12.0 %
1750	53.4	1.49	4.85	4.85	4.85	0.40	1.67	± 12.0 %
1900	53.3	1.52	4.70	4.70	4.70	0.55	1.55	± 12.0 %
2300	52.9	1.81	4.46	4.46	4.46	0.80	1.25	± 12.0 %
2450	52.7	1.95	4.30	4.30	4.30	0.80	1.25	± 12.0 %
2600	52.5	2.16	4.06	4.06	4.06	0.80	1.20	± 12.0 %

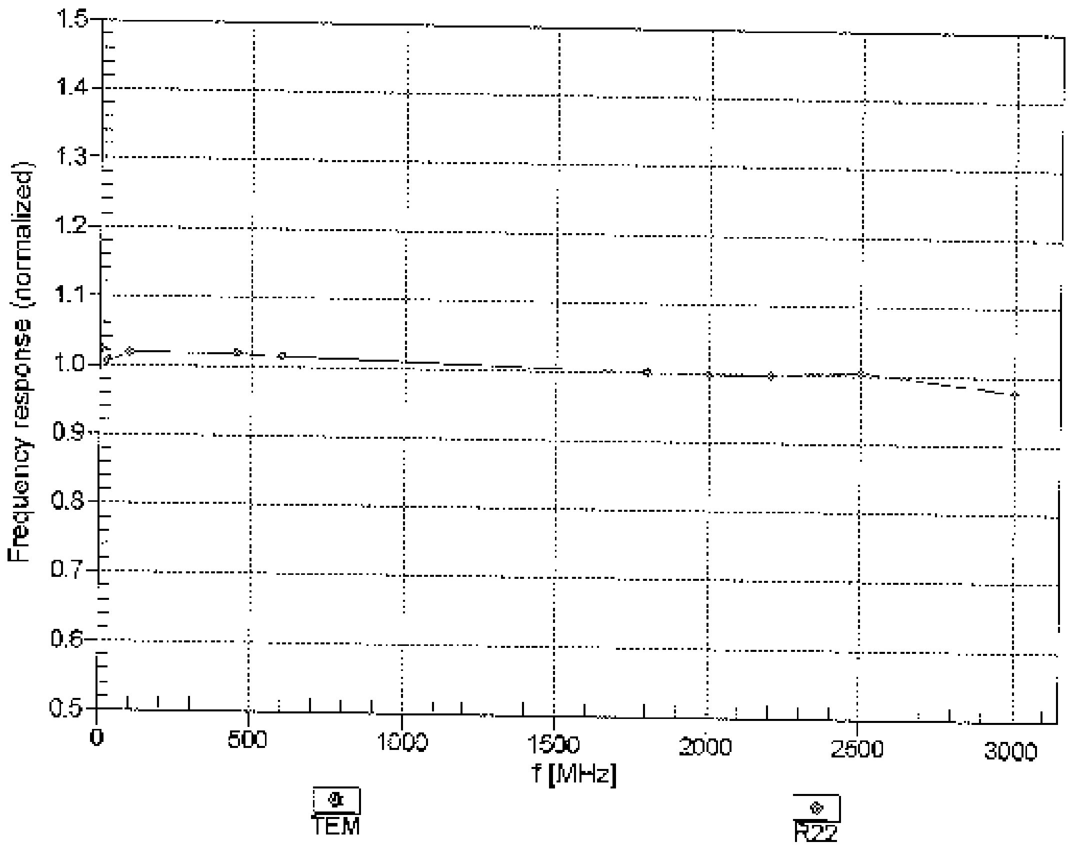
[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

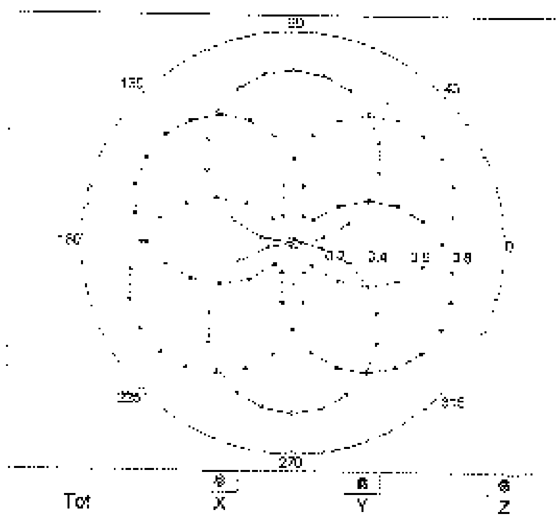
Frequency Response of E-Field

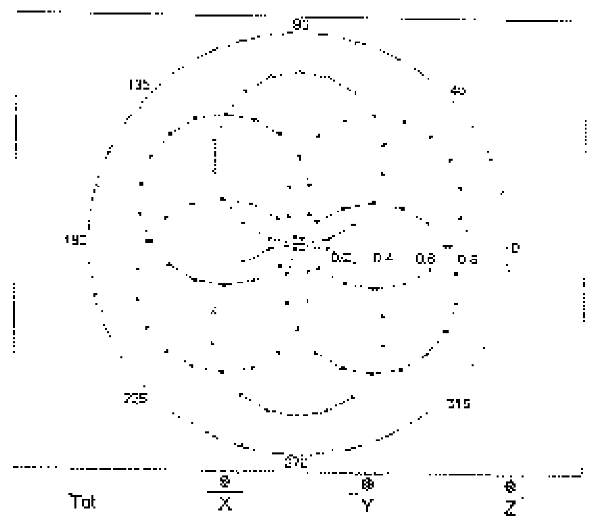
(TEM-Cell:ifi110 EXX, Waveguide: R22)

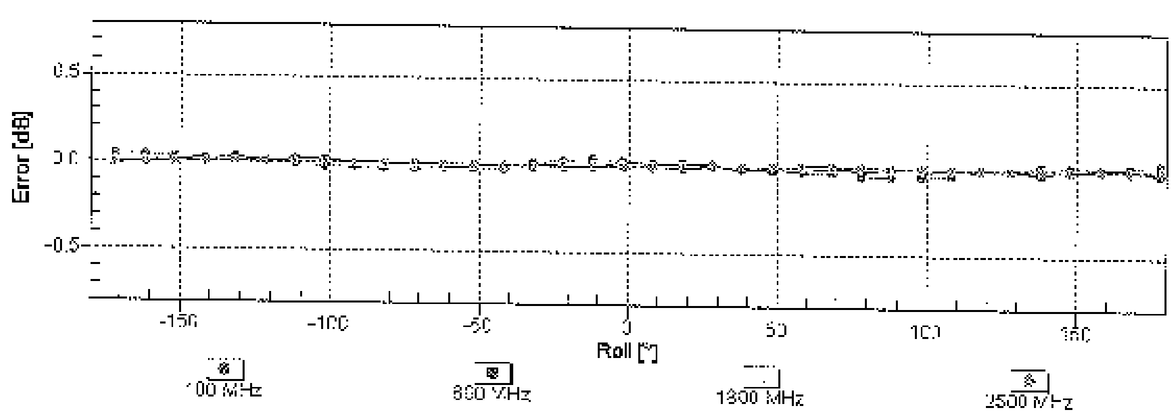


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



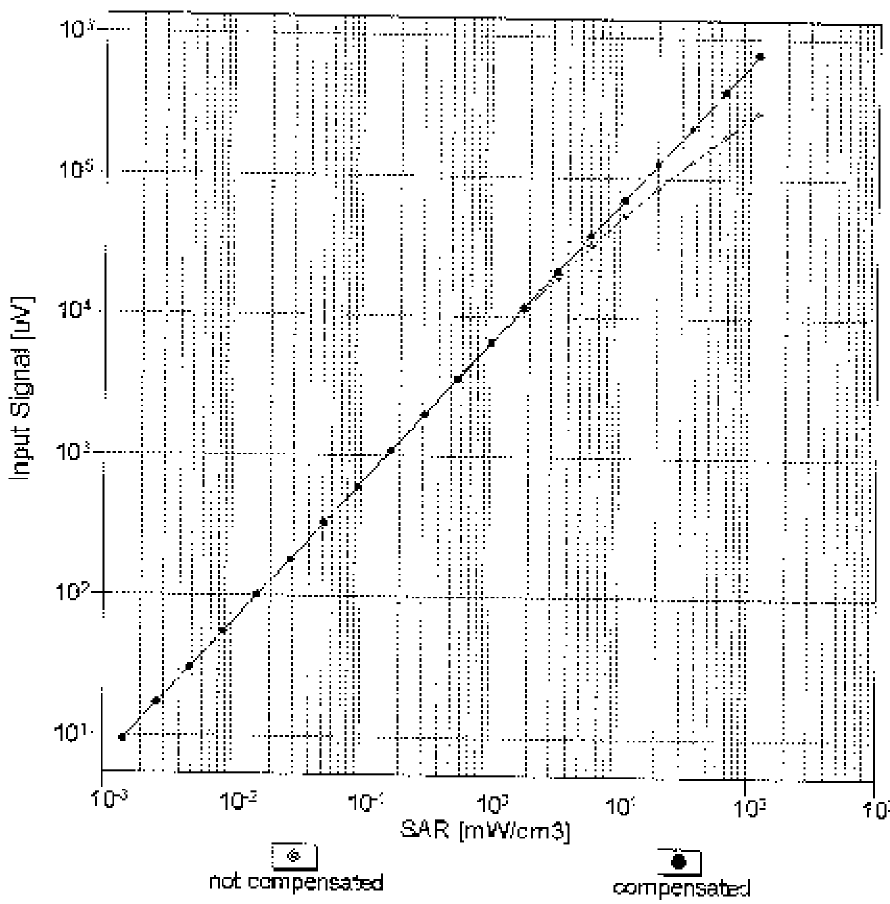


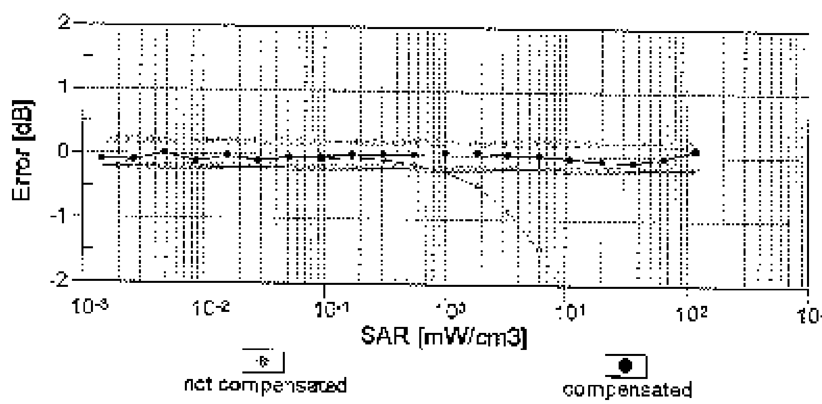


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR$_{head}$)

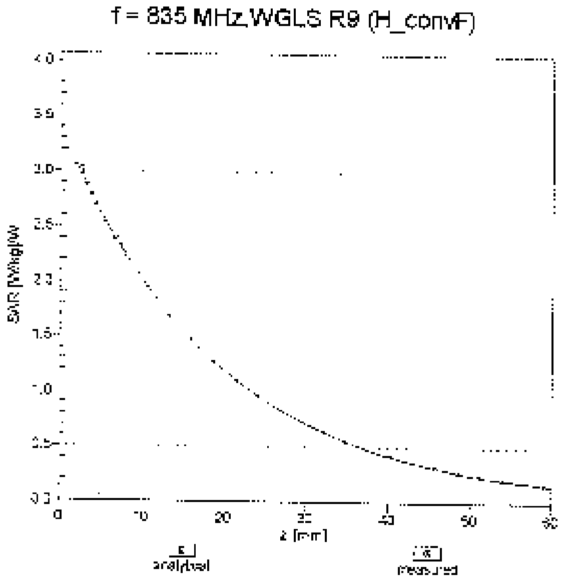
(TEM cell , f_{eval}= 1900 MHz)

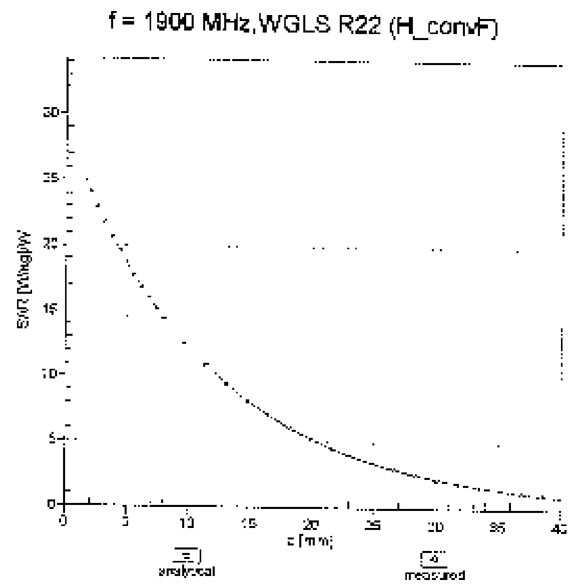




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

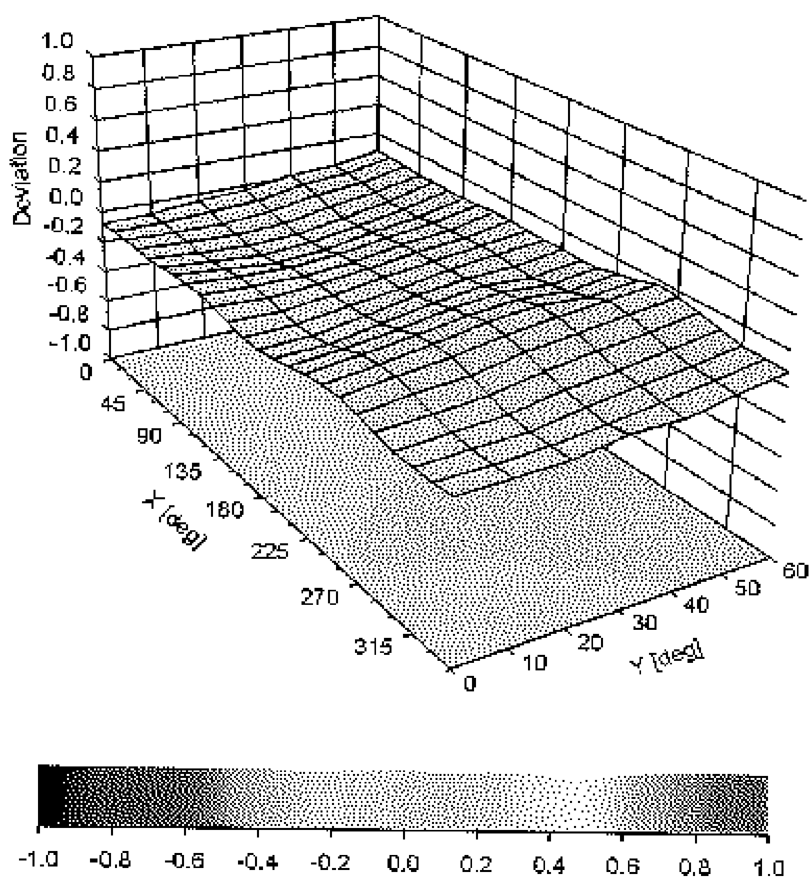
Conversion Factor Assessment





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:3332

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-1.9
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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

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

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

Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **ES3-3333_Oct15**

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3333

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

BN 11/03/15

Calibration date: October 29, 2015

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	01-Apr-15 (No. 217-02128)	Mar-16
Power sensor E4412A	MY41498087	01-Apr-15 (No. 217-02128)	Mar-16
Reference 3 dB Attenuator	SN: S5054 (3c)	01-Apr-15 (No. 217-02129)	Mar-16
Reference 20 dB Attenuator	SN: S5277 (20x)	01-Apr-15 (No. 217-02132)	Mar-16
Reference 30 dB Attenuator	SN: S5129 (30b)	01-Apr-15 (No. 217-02133)	Mar-16
Reference Probe ES3DV2	SN: 3013	30-Dec-14 (No. ES3-3013_Dec14)	Dec-15
DAE4	SN: 660	14-Jan-15 (No. DAE4-660_Jan15)	Jan-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

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

Issued: October 29, 2015

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

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3333

Manufactured: January 24, 2012
Calibrated: October 29, 2015

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

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.07	0.90	0.88	± 10.1 %
DCP (mV)[B]	106.8	108.5	106.8	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	201.0	±3.5 %
		Y	0.0	0.0	1.0		187.1	
		Z	0.0	0.0	1.0		184.8	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	2.43	60.7	11.4	10.00	41.6	±2.2 %
		Y	4.35	67.4	13.2		35.6	
		Z	1.46	57.0	8.7		36.2	
10011-CAB	UMTS-FDD (WCDMA)	X	3.35	67.9	19.1	2.91	138.2	±0.5 %
		Y	3.48	68.6	19.2		127.5	
		Z	3.37	67.6	18.6		149.0	
10012-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	3.60	72.8	20.8	1.87	141.0	±0.7 %
		Y	3.68	73.3	20.8		128.0	
		Z	3.01	69.3	18.8		128.2	
10013-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	11.52	71.7	23.9	9.46	139.3	±3.0 %
		Y	10.94	70.4	22.9		147.1	
		Z	10.95	70.8	23.4		144.5	
10021-DAB	GSM-FDD (TDMA, GMSK)	X	21.45	95.2	26.5	9.39	139.9	±2.5 %
		Y	9.12	82.9	21.9		142.0	
		Z	11.47	88.1	23.9		127.6	
10023-DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	20.81	95.6	27.0	9.57	135.8	±2.2 %
		Y	9.78	84.4	22.7		135.3	
		Z	9.12	83.5	22.1		144.6	
10024-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	39.84	99.8	25.2	6.56	140.9	±1.9 %
		Y	35.07	100.0	25.0		128.4	
		Z	35.20	99.8	24.7		131.9	
10027-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	47.16	99.8	23.9	4.80	124.9	±2.5 %
		Y	49.75	99.6	22.8		145.4	
		Z	45.37	99.9	23.1		148.5	
10028-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	56.24	99.6	22.6	3.55	140.4	±2.7 %
		Y	56.95	99.7	21.9		129.1	
		Z	48.45	99.6	22.1		133.2	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	18.03	99.1	22.8	1.16	127.5	±1.9 %
		Y	35.17	99.6	20.7		141.1	
		Z	21.08	99.9	21.9		127.5	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.36	67.6	19.8	5.67	137.5	±1.2 %
		Y	6.29	67.4	19.6		129.9	
		Z	6.35	67.5	19.7		139.5	

10103-CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	10.65	76.6	26.4	9.29	130.6	±2.7 %
		Y	9.58	73.7	24.8		143.0	
		Z	9.94	75.6	26.2		149.3	
10108-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.21	67.0	19.7	5.80	126.9	±1.2 %
		Y	6.16	66.9	19.5		129.2	
		Z	6.22	67.2	19.7		138.0	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.05	68.7	21.2	8.07	126.1	±2.5 %
		Y	10.13	69.0	21.3		146.1	
		Z	9.97	68.7	21.1		126.2	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	10.11	75.5	26.0	9.28	125.8	±3.3 %
		Y	9.06	73.2	24.7		138.2	
		Z	9.32	74.8	26.0		143.1	
10154-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	5.97	66.8	19.6	5.75	133.4	±1.2 %
		Y	5.92	66.7	19.5		127.0	
		Z	5.91	66.7	19.5		134.2	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.40	67.3	19.9	5.82	137.8	±1.2 %
		Y	6.31	67.1	19.6		130.7	
		Z	6.32	67.1	19.6		139.8	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.05	67.3	20.1	5.73	136.8	±1.2 %
		Y	4.89	67.0	19.9		131.1	
		Z	4.93	67.2	20.0		137.4	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	10.74	83.9	30.3	9.21	136.8	±2.7 %
		Y	7.34	74.3	25.5		125.9	
		Z	7.74	76.6	27.1		131.2	
10175-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.97	66.9	19.9	5.72	130.8	±1.2 %
		Y	4.66	66.9	19.8		128.5	
		Z	4.97	67.3	20.1		137.0	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.99	67.0	19.9	5.72	130.1	±1.2 %
		Y	4.88	67.0	19.9		127.6	
		Z	4.95	67.2	20.0		136.2	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	10.00	69.2	21.7	8.10	137.9	±2.2 %
		Y	9.75	68.7	21.2		137.5	
		Z	9.94	69.4	21.7		145.3	
10225-CAB	UMTS-FDD (HSPA+)	X	7.08	67.5	19.8	5.97	147.1	±1.4 %
		Y	7.06	67.7	19.8		142.3	
		Z	7.04	67.7	19.9		148.8	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	10.66	83.5	30.1	9.21	144.0	±3.0 %
		Y	7.43	74.7	25.7		127.6	
		Z	7.86	77.1	27.4		132.3	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	10.81	78.7	27.9	9.24	139.7	±3.0 %
		Y	8.48	72.4	24.4		130.1	
		Z	8.71	74.1	25.8		135.2	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	11.73	79.9	28.3	9.30	148.6	±3.3 %
		Y	9.11	73.2	24.8		139.0	
		Z	9.38	74.9	26.1		142.7	

10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.52	67.6	19.3	3.96	144.5	±0.7 %
		Y	4.67	68.3	19.6		146.0	
		Z	4.41	67.0	18.9		130.0	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.66	67.2	19.0	3.46	134.5	±0.5 %
		Y	3.91	68.9	19.9		133.2	
		Z	3.86	68.5	19.6		146.9	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.63	67.5	19.1	3.39	134.9	±0.5 %
		Y	3.93	69.3	20.0		136.0	
		Z	3.81	68.5	19.6		148.6	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.20	67.1	19.7	5.81	129.0	±1.2 %
		Y	6.20	67.0	19.6		128.0	
		Z	6.32	67.5	19.9		142.7	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.76	67.6	20.0	6.06	134.7	±1.4 %
		Y	6.75	67.5	19.9		133.5	
		Z	6.90	68.1	20.3		149.2	
10400-AAC	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	10.30	69.7	22.1	8.37	140.1	±2.5 %
		Y	10.05	69.0	21.5		141.2	
		Z	9.94	69.0	21.7		126.3	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.80	68.5	19.0	3.76	129.3	±0.5 %
		Y	5.30	71.1	20.2		148.4	
		Z	5.10	70.4	19.9		135.2	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.77	68.8	19.2	3.77	127.3	±0.7 %
		Y	5.35	71.7	20.5		145.4	
		Z	5.03	70.6	20.1		133.3	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.77	69.7	19.7	1.54	147.0	±0.7 %
		Y	3.73	75.4	22.2		143.7	
		Z	3.25	72.2	20.7		133.9	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	10.11	69.4	21.8	8.23	144.7	±2.5 %
		Y	9.86	68.8	21.4		139.3	
		Z	9.72	68.6	21.3		126.0	

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 Norm X,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 7 and 8).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	41.9	0.89	6.46	6.46	6.46	0.75	1.22	± 12.0 %
835	41.5	0.90	6.16	6.16	6.16	0.36	1.67	± 12.0 %
1750	40.1	1.37	5.21	5.21	5.21	0.80	1.19	± 12.0 %
1900	40.0	1.40	5.03	5.03	5.03	0.73	1.25	± 12.0 %
2300	39.5	1.67	4.73	4.73	4.73	0.60	1.43	± 12.0 %
2450	39.2	1.80	4.53	4.53	4.53	0.80	1.28	± 12.0 %
2600	39.0	1.96	4.39	4.39	4.39	0.80	1.29	± 12.0 %

[C] Frequency validity above 300 MHz 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. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

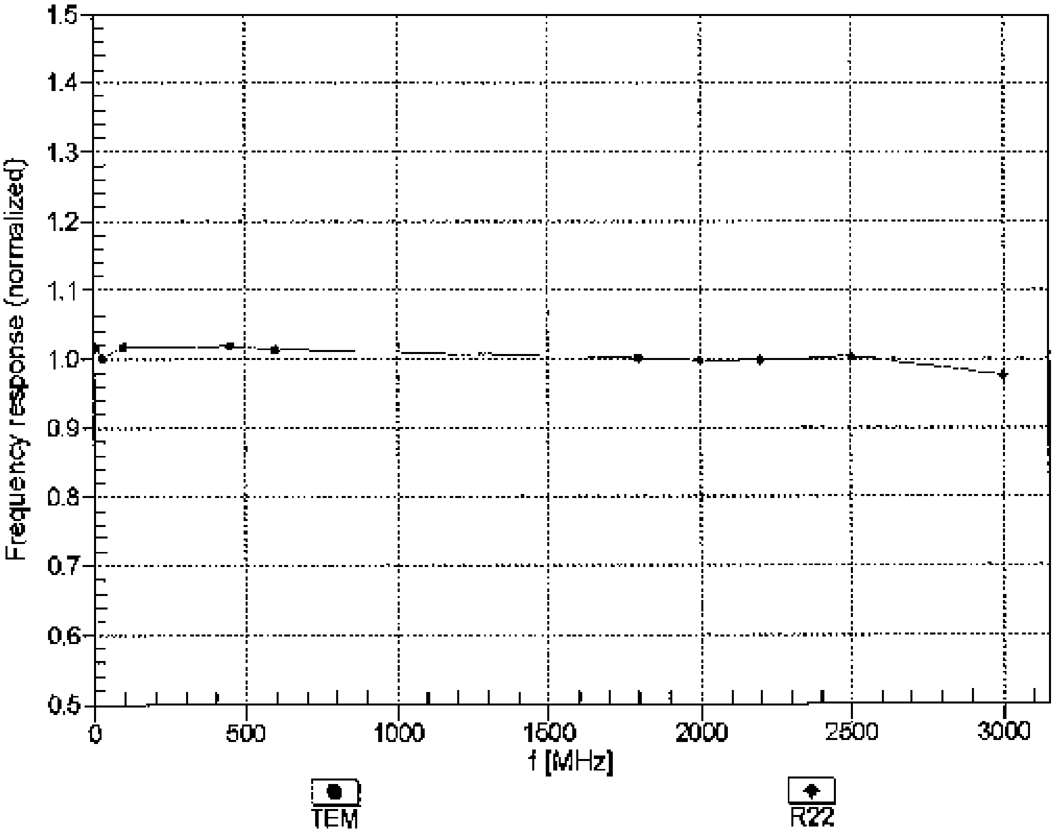
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3333

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	55.5	0.96	6.31	6.31	6.31	0.70	1.26	± 12.0 %
835	55.2	0.97	6.25	6.25	6.25	0.47	1.54	± 12.0 %
1750	53.4	1.49	4.90	4.90	4.90	0.49	1.63	± 12.0 %
1900	53.3	1.52	4.70	4.70	4.70	0.54	1.49	± 12.0 %
2300	52.9	1.81	4.51	4.51	4.51	0.80	1.15	± 12.0 %
2450	52.7	1.95	4.34	4.34	4.34	0.80	1.15	± 12.0 %
2600	52.5	2.16	4.23	4.23	4.23	0.80	1.03	± 12.0 %

[C] Frequency validity above 300 MHz 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. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

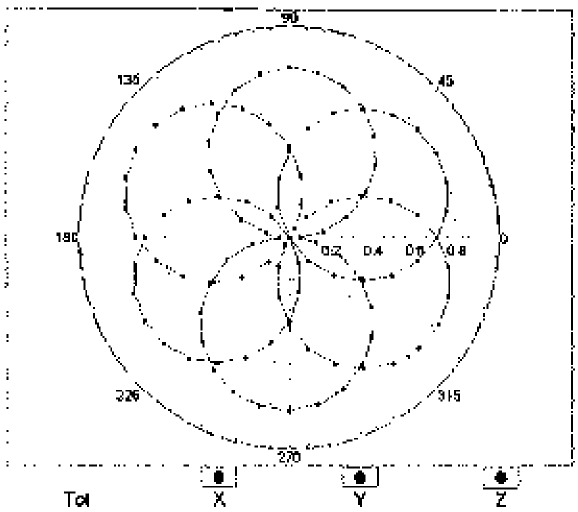
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



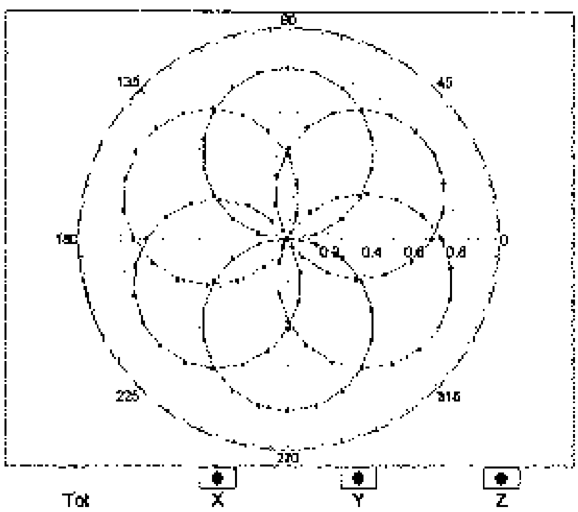
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

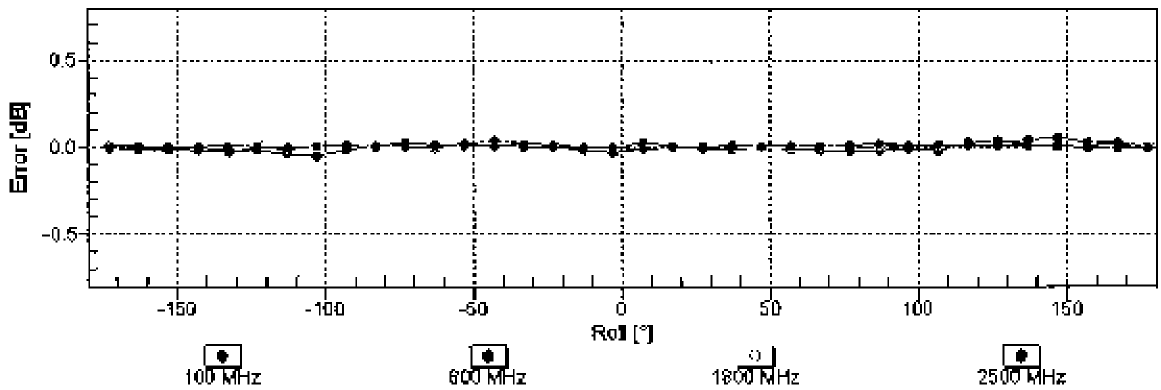
Receiving Pattern (ϕ), $\vartheta = 0°$

f=600 MHz,TEM



f=1800 MHz,R22

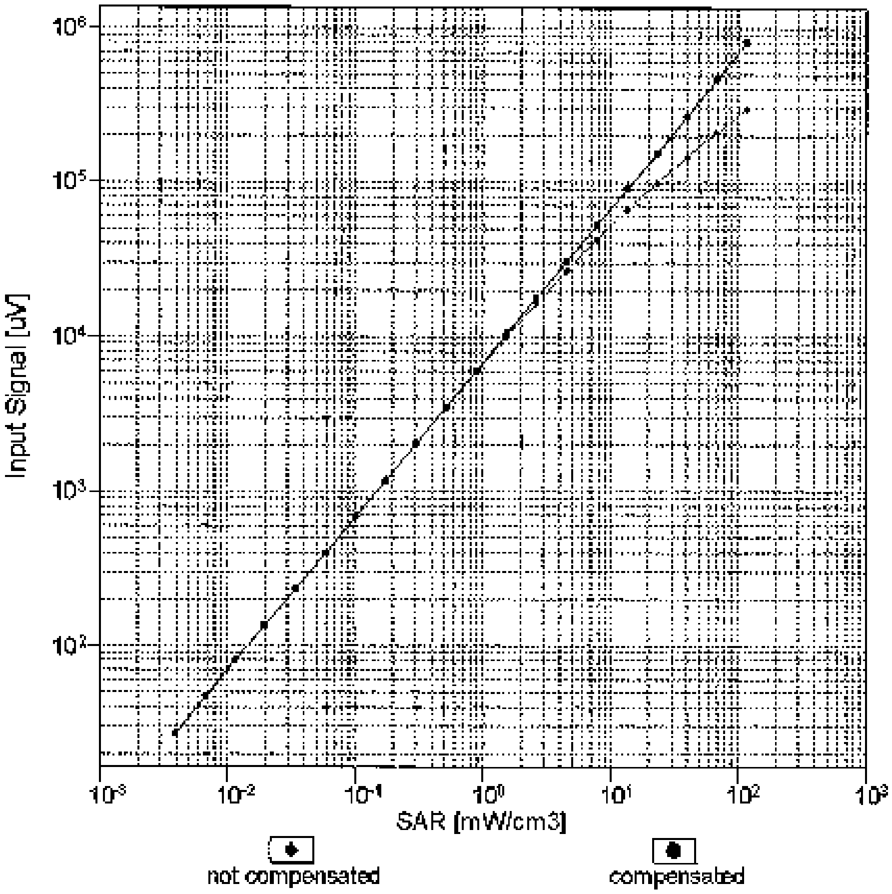


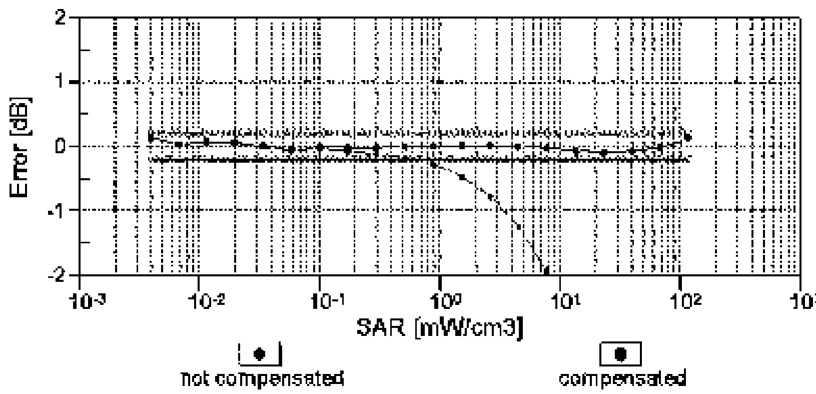


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

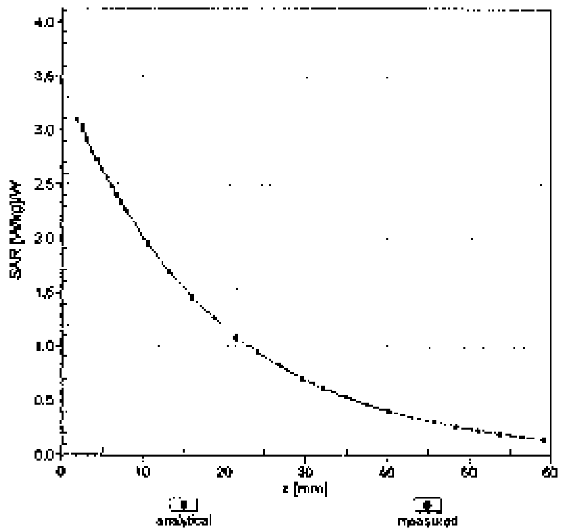
(TEM cell , f_{eval}= 1900 MHz)

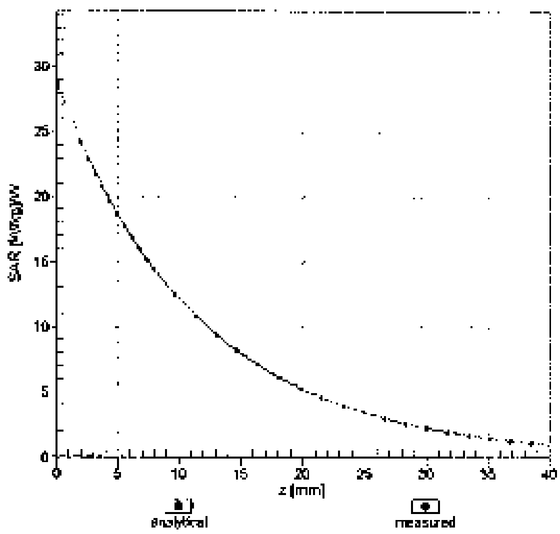




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

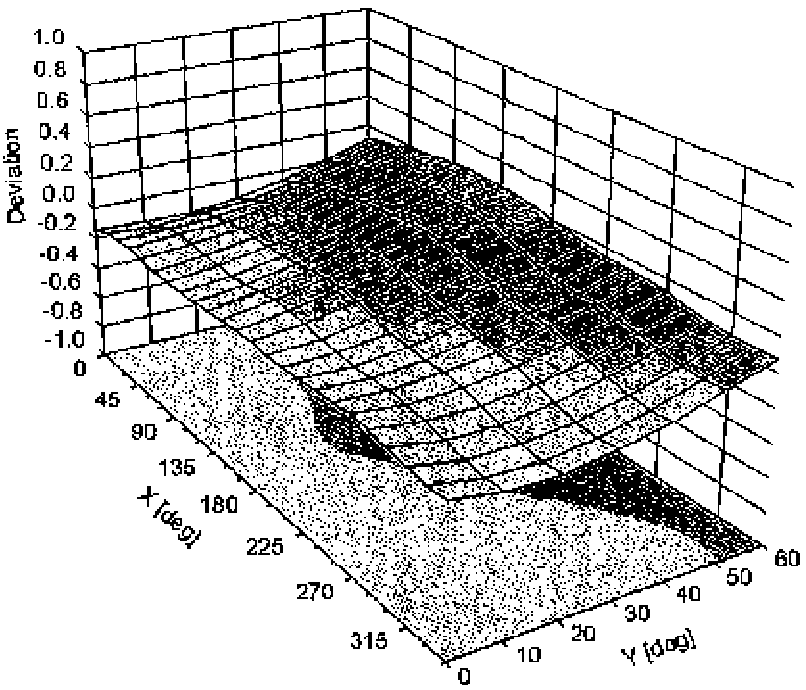
Conversion Factor Assessment





Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-32.8
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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

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

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

Accreditation No.: SCS 0108

Client **PC Test**

Certificate No: ES3-3263_May15

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3263
Calibration procedure(s)	QA CAL-01.v9, QA CAL-23.v5, QA CAL-25.v6 Calibration procedure for dosimetric E-field probes
Calibration date:	May 20, 2015

BN ✓
5/28/15

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	01-Apr-15 (No. 217-02128)	Mar-16
Power sensor E4412A	MY41498087	01-Apr-15 (No. 217-02128)	Mar-16
Reference 3 dB Attenuator	SN: S5054 (3c)	01-Apr-15 (No. 217-02129)	Mar-16
Reference 20 dB Attenuator	SN: S5277 (20x)	01-Apr-15 (No. 217-02132)	Mar-16
Reference 30 dB Attenuator	SN: S5129 (30b)	01-Apr-15 (No. 217-02133)	Mar-16
Reference Probe ES3DV2	SN: 3013	30-Dec-14 (No. ES3-3013_Dec14)	Dec-15
DAE4	SN: 660	14-Jan-15 (No. DAE4-660_Jan15)	Jan-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

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

Issued: May 19, 2015

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3263

Manufactured: January 25, 2010
Calibrated: May 20, 2015

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3263

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.21	1.25	1.13	± 10.1 %
DCP (mV)[B]	106.1	103.6	108.3	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB$\sqrt{\mu V}$	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	205.3	±3.3 %
		Y	0.0	0.0	1.0		207.3	
		Z	0.0	0.0	1.0		199.5	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	1.83	58.4	9.4	10.00	41.2	±1.4 %
		Y	3.88	63.3	12.9		47.5	
		Z	1.42	56.8	8.7		39.5	
10011-CAB	UMTS-FDD (WCDMA)	X	3.27	67.4	18.6	2.91	140.1	±0.7 %
		Y	3.39	67.5	18.7		142.7	
		Z	3.32	67.6	18.6		136.9	
10012-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	2.85	68.8	18.8	1.87	142.2	±0.7 %
		Y	3.38	70.7	19.5		144.8	
		Z	3.07	70.0	19.1		138.1	
10013-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	10.99	70.8	23.4	9.46	135.9	±2.5 %
		Y	11.36	70.3	22.8		124.7	
		Z	10.57	70.0	22.9		129.4	
10021-DAB	GSM-FDD (TDMA, GMSK)	X	9.38	84.7	22.1	9.39	139.8	±1.9 %
		Y	27.79	100.0	28.7		129.4	
		Z	9.29	86.8	23.8		134.5	
10023-DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	9.63	84.9	22.1	9.57	134.1	±2.5 %
		Y	25.29	98.2	28.2		124.0	
		Z	9.65	87.7	24.3		128.2	
10024-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	16.20	88.9	21.0	6.56	145.2	±1.4 %
		Y	41.82	99.7	25.6		128.5	
		Z	24.57	96.8	24.1		142.0	
10027-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	55.77	99.6	22.1	4.80	138.5	±2.2 %
		Y	53.39	99.7	23.9		140.5	
		Z	40.28	99.6	23.2		134.3	
10028-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	81.43	99.8	20.7	3.55	148.6	±1.7 %
		Y	60.49	99.7	22.9		146.0	
		Z	62.69	99.6	21.2		145.0	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	96.06	93.7	16.0	1.16	140.3	±1.9 %
		Y	77.08	99.9	20.1		149.0	
		Z	99.64	99.9	18.6		138.0	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.24	67.2	19.6	5.67	131.7	±1.4 %
		Y	6.39	67.3	19.5		133.8	
		Z	6.19	67.2	19.6		126.8	

10103-CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	10.13	76.3	26.6	9.29	142.6	±2.7 %
		Y	12.07	77.9	26.6		138.9	
		Z	9.41	74.3	25.6		134.1	
10108-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.13	66.9	19.5	5.80	129.6	±1.4 %
		Y	6.35	67.1	19.5		133.7	
		Z	6.39	68.0	20.1		150.0	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.34	69.6	21.7	8.07	147.0	±1.9 %
		Y	10.05	68.3	20.9		123.4	
		Z	10.08	69.1	21.3		138.2	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	9.44	75.3	26.3	9.28	137.0	±3.5 %
		Y	11.36	76.9	26.3		134.5	
		Z	8.85	73.5	25.3		130.3	
10154-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	5.79	66.2	19.2	5.75	126.9	±1.2 %
		Y	6.05	66.5	19.3		130.9	
		Z	5.92	66.9	19.5		145.5	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.25	66.9	19.5	5.82	131.8	±1.4 %
		Y	6.47	67.0	19.5		135.4	
		Z	6.09	66.5	19.3		127.5	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	4.78	66.7	19.7	5.73	130.0	±1.2 %
		Y	5.14	66.7	19.5		135.0	
		Z	4.83	67.1	19.9		147.9	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	8.63	80.4	29.1	9.21	147.7	±2.7 %
		Y	9.72	78.5	27.2		123.9	
		Z	7.63	76.7	27.2		142.5	
10175-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.75	66.6	19.6	5.72	128.2	±1.2 %
		Y	5.12	66.6	19.5		134.3	
		Z	4.87	67.1	19.9		148.0	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.76	66.6	19.6	5.72	127.9	±1.2 %
		Y	5.12	66.6	19.5		134.5	
		Z	4.87	67.3	20.0		147.0	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.87	69.1	21.6	8.10	135.8	±2.2 %
		Y	10.19	69.1	21.4		145.3	
		Z	9.65	68.8	21.3		130.5	
10225-CAB	UMTS-FDD (HSPA+)	X	6.90	67.2	19.5	5.97	139.2	±1.7 %
		Y	7.22	67.3	19.6		148.0	
		Z	6.75	67.0	19.4		134.1	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	8.68	80.6	29.2	9.21	148.0	±3.0 %
		Y	9.82	78.8	27.3		125.0	
		Z	7.85	77.6	27.7		143.5	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	8.56	73.7	25.6	9.24	126.6	±3.5 %
		Y	10.58	76.0	25.9		126.3	
		Z	8.84	74.8	26.1		146.7	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	9.24	74.6	25.9	9.30	133.6	±3.3 %
		Y	11.38	76.9	26.2		134.3	
		Z	8.79	73.2	25.1		128.6	

10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.39	67.0	18.9	3.96	143.8	±0.9 %
		Y	4.55	67.1	18.8		147.3	
		Z	4.42	67.4	19.0		139.9	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.59	67.2	18.9	3.46	132.2	±0.5 %
		Y	3.68	66.7	18.5		136.0	
		Z	3.57	67.1	18.6		128.5	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.50	67.0	18.7	3.39	134.0	±0.7 %
		Y	3.62	66.6	18.4		138.6	
		Z	3.50	67.2	18.7		129.8	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.11	66.8	19.4	5.81	127.7	±1.4 %
		Y	6.33	67.0	19.5		132.1	
		Z	6.28	67.6	19.9		146.6	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.71	67.5	19.9	6.06	134.2	±1.7 %
		Y	6.93	67.7	19.9		138.0	
		Z	6.57	67.2	19.6		128.0	
10400-AAC	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	10.17	69.5	21.9	8.37	138.5	±2.5 %
		Y	10.55	69.5	21.8		148.0	
		Z	9.92	69.0	21.6		132.5	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.79	69.2	19.1	3.76	144.1	±0.7 %
		Y	4.71	67.0	18.2		129.2	
		Z	4.72	69.3	19.2		139.3	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.69	69.2	19.2	3.77	142.1	±0.7 %
		Y	4.71	67.5	18.5		126.7	
		Z	4.51	68.6	18.8		137.3	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.55	68.0	18.5	1.54	141.7	±0.7 %
		Y	2.67	68.4	18.6		144.0	
		Z	2.98	70.8	19.5		138.0	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	10.01	69.3	21.8	8.23	137.3	±2.5 %
		Y	10.31	69.3	21.6		146.0	
		Z	9.69	68.8	21.4		129.9	

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 7 and 8).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3263

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	41.9	0.89	6.27	6.27	6.27	0.29	1.87	± 12.0 %
835	41.5	0.90	6.18	6.18	6.18	0.49	1.42	± 12.0 %
1750	40.1	1.37	5.27	5.27	5.27	0.49	1.46	± 12.0 %
1900	40.0	1.40	4.96	4.96	4.96	0.66	1.28	± 12.0 %
2300	39.5	1.67	4.63	4.63	4.63	0.58	1.41	± 12.0 %
2450	39.2	1.80	4.40	4.40	4.40	0.71	1.34	± 12.0 %
2600	39.0	1.96	4.25	4.25	4.25	0.80	1.25	± 12.0 %

[C] Frequency validity above 300 MHz 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. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

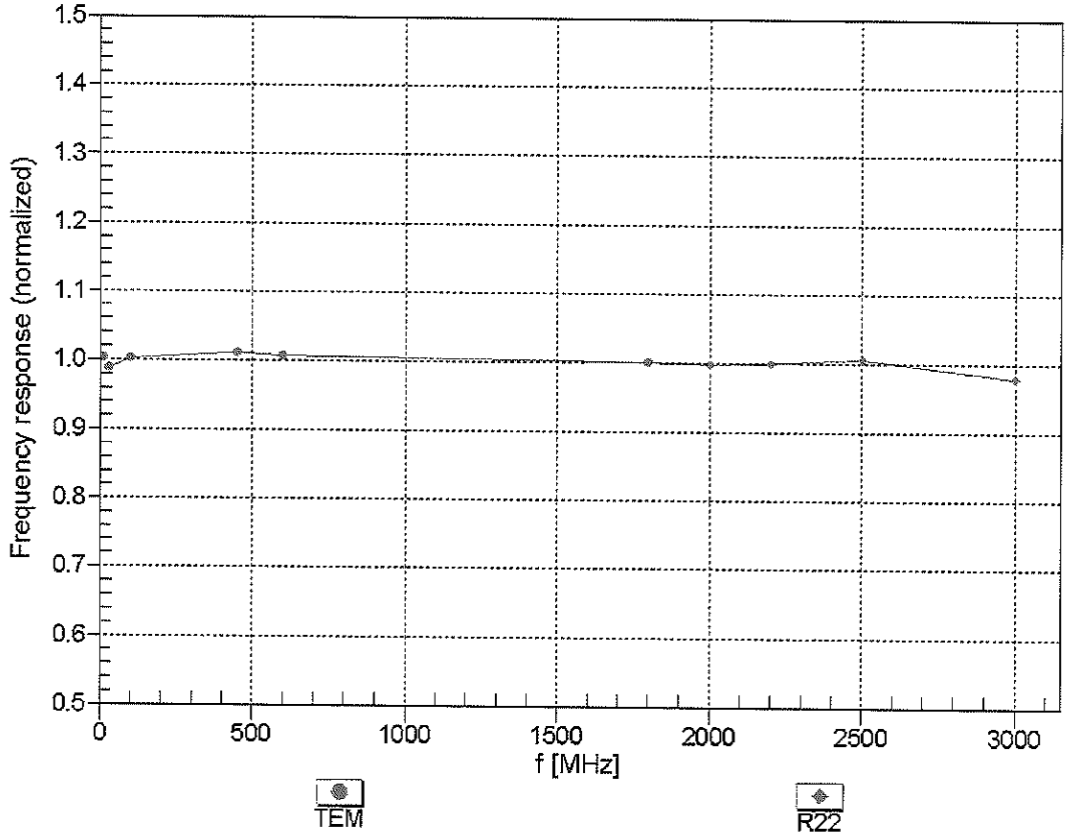
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3263

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	6.07	6.07	6.07	0.53	1.42	± 12.0 %
835	55.2	0.97	6.08	6.08	6.08	0.57	1.36	± 12.0 %
1750	53.4	1.49	4.88	4.88	4.88	0.54	1.50	± 12.0 %
1900	53.3	1.52	4.66	4.66	4.66	0.56	1.51	± 12.0 %
2300	52.9	1.81	4.42	4.42	4.42	0.69	1.33	± 12.0 %
2450	52.7	1.95	4.28	4.28	4.28	0.80	1.08	± 12.0 %
2600	52.5	2.16	4.11	4.11	4.11	0.80	1.09	± 12.0 %

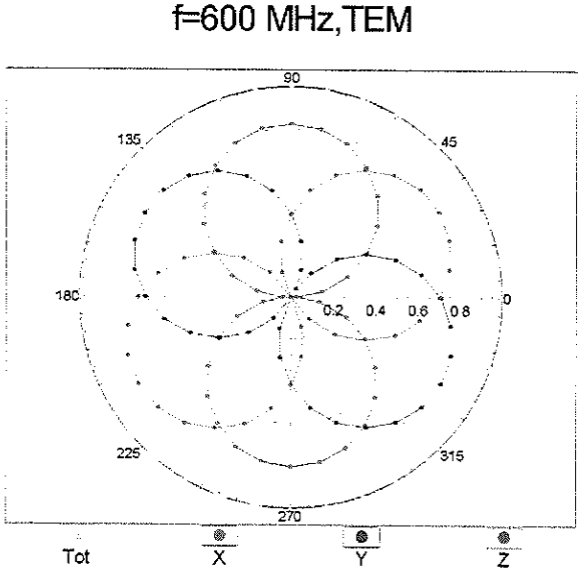
[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

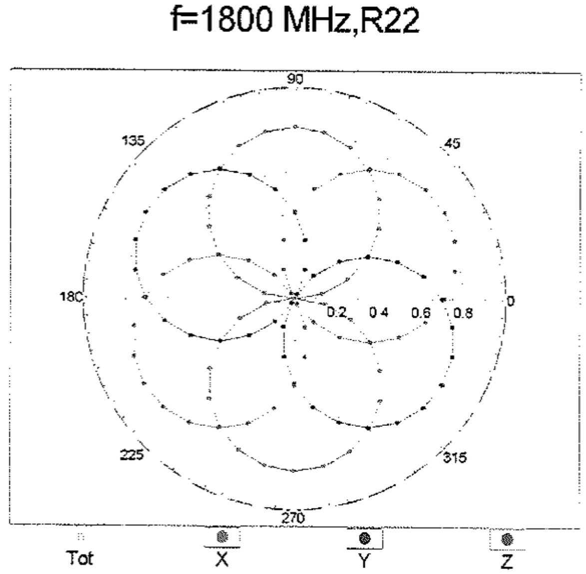
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)

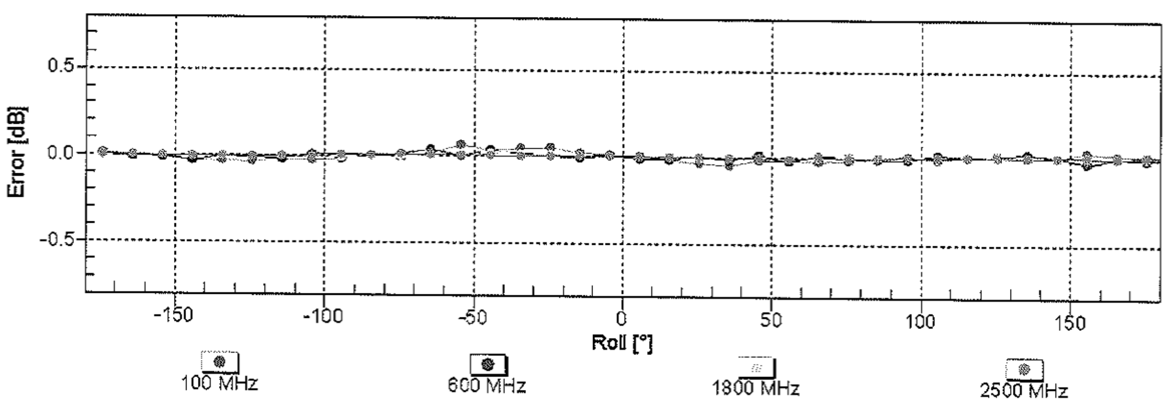


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°

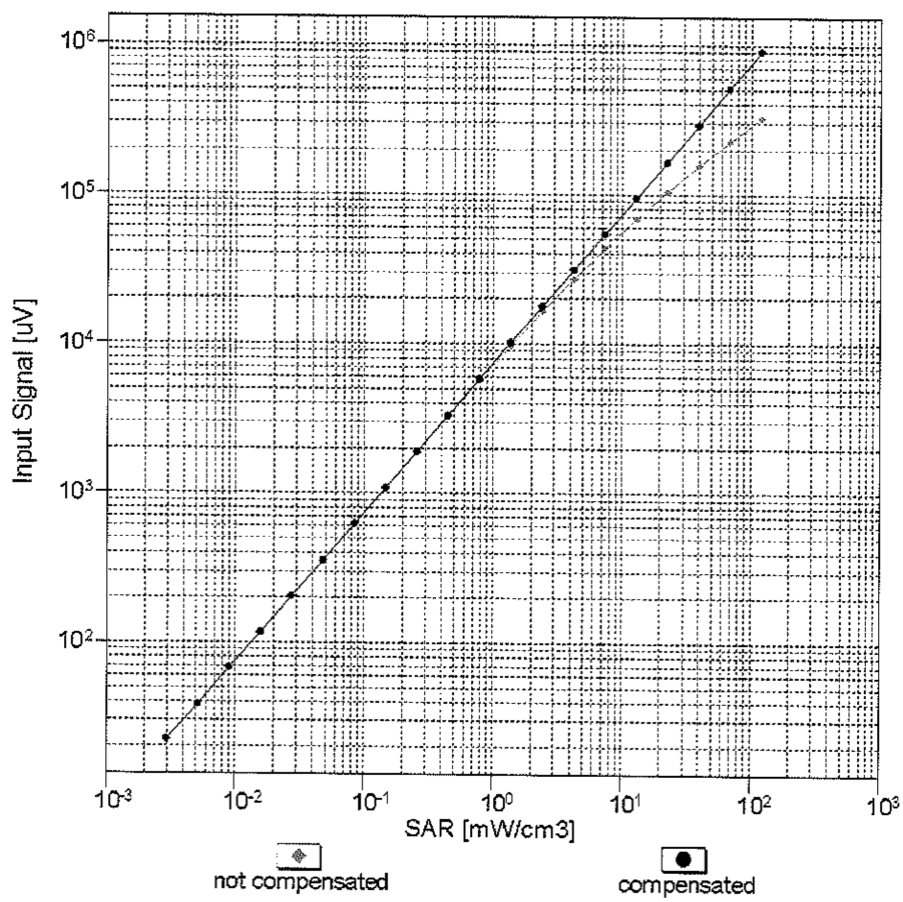


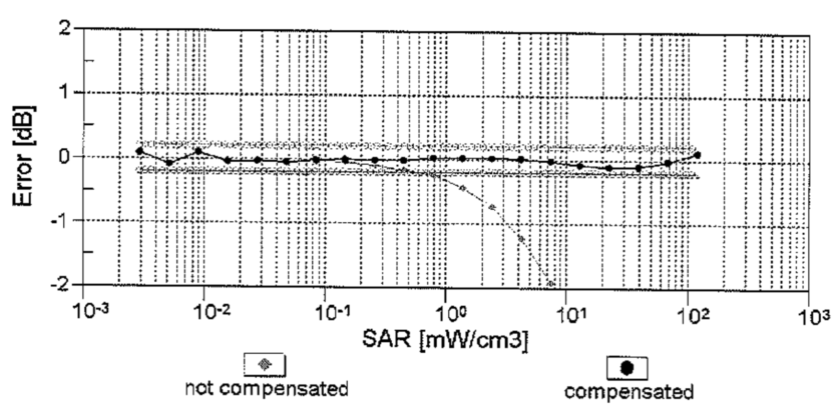




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

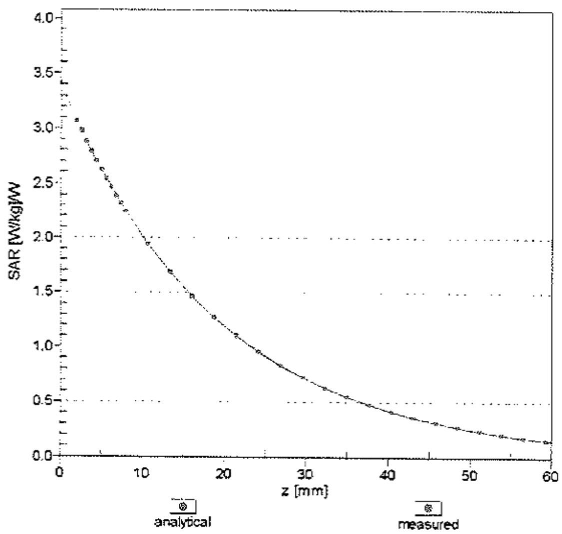




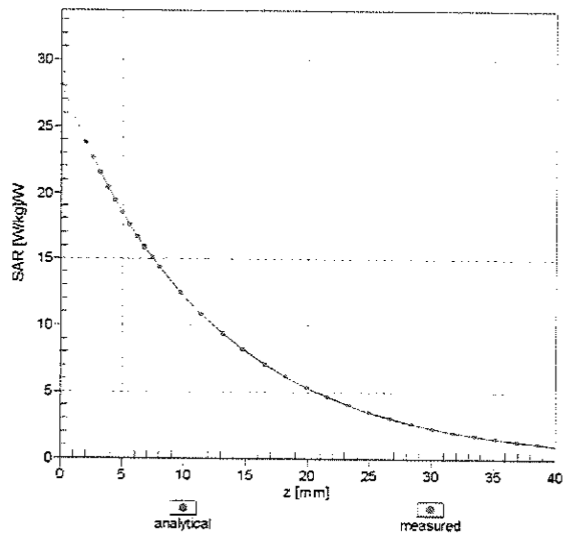
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

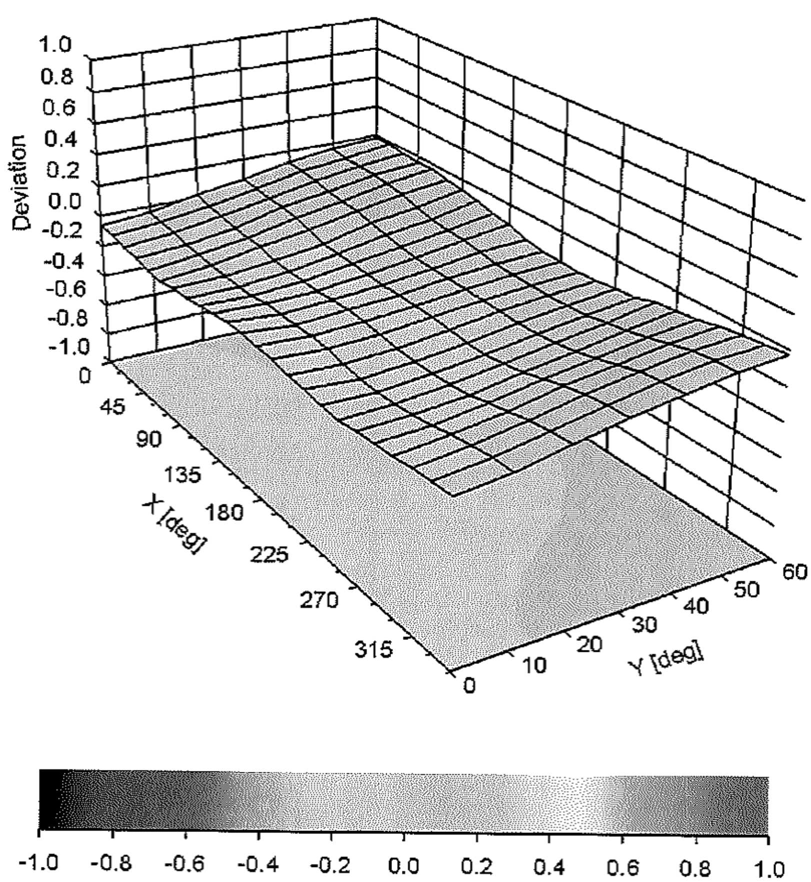


f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3263

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	65.6
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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

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

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

Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **ES3-3288_Sep15**

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3288

B.N. ✓ 10/02/15

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

Calibration date: September 18, 2015

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	01-Apr-15 (No. 217-02128)	Mar-16
Power sensor E4412A	MY41498087	01-Apr-15 (No. 217-02128)	Mar-16
Reference 3 dB Attenuator	SN: S5054 (3c)	01-Apr-15 (No. 217-02129)	Mar-16
Reference 20 dB Attenuator	SN: S5277 (20x)	01-Apr-15 (No. 217-02132)	Mar-16
Reference 30 dB Attenuator	SN: S5129 (30b)	01-Apr-15 (No. 217-02133)	Mar-16
Reference Probe ES3DV2	SN: 3013	30-Dec-14 (No. ES3-3013_Dec14)	Dec-15
DAE4	SN: 660	14-Jan-15 (No. DAE4-660_Jan15)	Jan-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M. Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 19, 2015

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

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3288

Manufactured: July 6, 2010
Calibrated: September 18, 2015

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3288

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)^A	1.05	1.16	0.92	± 10.1 %
DCP (mV)^B	106.9	106.9	107.4	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB$\sqrt{\mu V}$	C	D dB	VR mV	Unc^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	190.7	±3.0 %
		Y	0.0	0.0	1.0		181.4	
		Z	0.0	0.0	1.0		179.1	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	2.55	61.8	10.9	10.00	38.0	±1.2 %
		Y	99.34	97.0	21.5		36.6	
		Z	6.26	70.5	13.9		35.2	
10011-CAB	UMTS-FDD (WCDMA)	X	3.28	67.4	18.7	2.91	129.4	±0.5 %
		Y	3.60	69.3	19.8		143.8	
		Z	3.38	67.9	18.8		143.0	
10012-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	3.07	70.1	19.4	1.87	131.0	±0.7 %
		Y	3.79	74.2	21.4		145.4	
		Z	3.15	70.5	19.4		144.5	
10013-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	10.64	69.8	22.8	9.46	122.7	±2.7 %
		Y	10.89	70.2	22.9		140.0	
		Z	10.70	70.2	23.0		136.7	
10021-DAB	GSM-FDD (TDMA, GMSK)	X	10.49	86.3	22.8	9.39	138.5	±2.2 %
		Y	13.76	90.7	24.6		145.7	
		Z	7.99	82.4	21.3		141.8	
10023-DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	9.73	85.3	22.7	9.57	149.4	±2.7 %
		Y	9.12	84.3	22.7		131.8	
		Z	8.21	83.4	22.1		134.8	
10024-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	34.75	99.7	24.5	6.56	135.8	±2.5 %
		Y	22.21	94.5	23.5		146.5	
		Z	8.93	81.8	18.8		148.3	
10027-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	51.22	100.0	22.6	4.80	132.9	±1.9 %
		Y	45.95	99.6	23.0		139.7	
		Z	14.90	87.0	19.2		138.0	
10028-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	56.25	99.8	21.6	3.55	141.8	±1.9 %
		Y	61.05	99.6	21.6		149.8	
		Z	70.48	99.7	20.8		126.6	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	98.24	98.4	18.0	1.16	135.4	±1.9 %
		Y	71.59	99.7	19.3		144.2	
		Z	98.96	91.6	15.1		146.2	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.44	67.9	19.9	5.67	148.9	±1.4 %
		Y	6.27	67.2	19.6		131.4	
		Z	6.28	67.3	19.5		137.9	

10103-CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	9.52	74.2	25.3	9.29	134.3	±2.5 %
		Y	9.97	75.1	25.7		146.8	
		Z	9.47	74.4	25.4		147.4	
10108-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.31	67.5	19.8	5.80	147.4	±1.4 %
		Y	6.21	67.1	19.6		131.0	
		Z	6.16	67.0	19.5		136.4	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.11	68.9	21.2	8.07	137.9	±2.2 %
		Y	10.26	69.3	21.5		147.7	
		Z	9.85	68.3	20.9		126.0	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	8.90	73.2	25.0	9.28	129.8	±3.3 %
		Y	9.32	74.0	25.2		142.5	
		Z	8.86	73.4	25.1		142.1	
10154-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	5.98	66.9	19.6	5.75	143.7	±1.2 %
		Y	5.91	66.6	19.4		128.0	
		Z	5.84	66.5	19.3		133.4	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.43	67.5	19.8	5.82	148.9	±1.4 %
		Y	6.31	67.0	19.6		132.2	
		Z	6.30	67.1	19.5		138.0	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	4.93	67.3	20.0	5.73	145.7	±1.2 %
		Y	4.89	66.9	19.8		131.7	
		Z	4.82	66.9	19.7		134.9	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	7.96	77.5	27.4	9.21	143.6	±2.7 %
		Y	7.61	75.5	26.3		129.2	
		Z	7.10	74.5	25.9		129.7	
10175-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.89	67.1	19.9	5.72	138.9	±1.2 %
		Y	5.02	67.5	20.1		148.1	
		Z	4.77	66.7	19.6		129.3	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.93	67.3	20.0	5.72	143.8	±1.2 %
		Y	5.08	67.8	20.3		149.0	
		Z	4.73	66.5	19.5		129.4	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.73	68.7	21.3	8.10	130.0	±1.9 %
		Y	9.74	68.6	21.2		132.7	
		Z	9.78	69.0	21.4		136.2	
10225-CAB	UMTS-FDD (HSPA+)	X	6.83	66.9	19.4	5.97	134.3	±1.4 %
		Y	6.98	67.3	19.6		139.3	
		Z	6.92	67.4	19.6		142.7	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	7.94	77.5	27.4	9.21	143.5	±2.7 %
		Y	7.44	74.8	25.9		125.0	
		Z	7.14	74.7	26.0		131.4	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	8.95	74.9	26.1	9.24	140.8	±2.7 %
		Y	8.53	72.8	24.7		127.2	
		Z	8.14	72.3	24.6		127.1	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	9.66	75.7	26.4	9.30	149.7	±3.0 %
		Y	9.20	73.6	25.1		135.1	
		Z	8.81	73.3	25.1		134.3	

10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.39	67.0	18.8	3.96	138.0	±0.7 %
		Y	4.51	67.5	19.2		141.4	
		Z	4.46	67.3	18.9		146.2	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.59	67.1	18.7	3.46	128.3	±0.5 %
		Y	3.80	68.2	19.5		130.9	
		Z	3.74	68.1	19.2		135.6	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.55	67.3	18.9	3.39	129.6	±0.5 %
		Y	3.73	68.2	19.4		132.7	
		Z	3.63	67.8	19.0		137.7	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.30	67.4	19.8	5.81	145.6	±1.4 %
		Y	6.38	67.7	19.9		148.2	
		Z	6.12	66.8	19.4		129.8	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.56	66.9	19.5	6.06	126.9	±1.2 %
		Y	6.71	67.4	19.8		129.7	
		Z	6.71	67.5	19.8		136.5	
10400-AAC	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	9.96	68.8	21.5	8.37	132.0	±2.2 %
		Y	10.06	69.0	21.6		137.4	
		Z	10.06	69.3	21.7		140.2	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.89	69.6	19.3	3.76	139.4	±0.5 %
		Y	5.05	70.0	19.6		143.9	
		Z	4.98	70.0	19.5		146.8	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.81	69.6	19.4	3.77	136.6	±0.7 %
		Y	5.07	70.4	19.9		146.8	
		Z	4.90	70.2	19.6		144.5	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.82	69.8	19.4	1.54	136.4	±0.7 %
		Y	3.19	72.3	20.7		145.1	
		Z	2.84	69.7	19.1		145.5	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	9.77	68.6	21.3	8.23	130.4	±2.2 %
		Y	9.95	69.0	21.5		140.4	
		Z	9.88	69.0	21.5		138.1	

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 Norm X,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 7 and 8).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3288

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	41.9	0.89	6.69	6.69	6.69	0.80	1.17	± 12.0 %
835	41.5	0.90	6.41	6.41	6.41	0.68	1.22	± 12.0 %
1750	40.1	1.37	5.40	5.40	5.40	0.57	1.39	± 12.0 %
1900	40.0	1.40	5.17	5.17	5.17	0.76	1.14	± 12.0 %
2300	39.5	1.67	4.85	4.85	4.85	0.64	1.32	± 12.0 %
2450	39.2	1.80	4.57	4.57	4.57	0.75	1.34	± 12.0 %
2600	39.0	1.96	4.44	4.44	4.44	0.68	1.38	± 12.0 %

[C] Frequency validity above 300 MHz 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. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3288

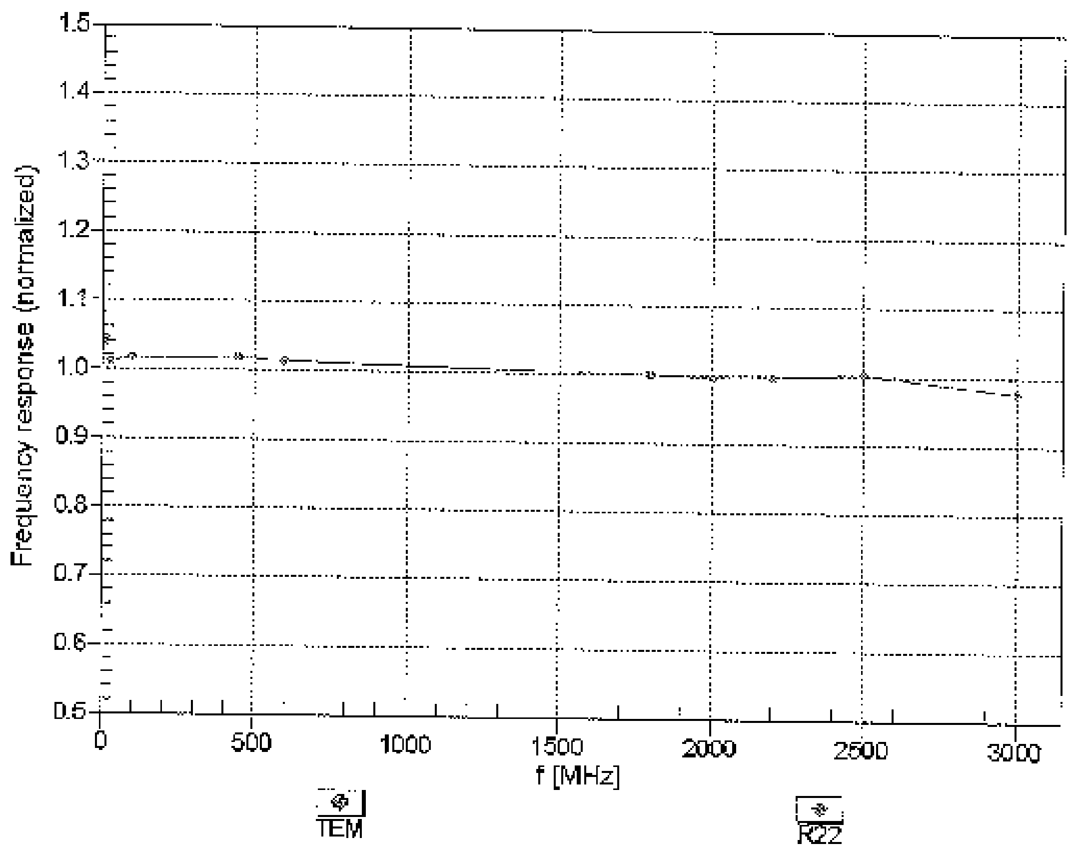
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	55.5	0.96	6.57	6.57	6.57	0.80	1.13	± 12.0 %
835	55.2	0.97	6.40	6.40	6.40	0.53	1.45	± 12.0 %
1750	53.4	1.49	4.99	4.99	4.99	0.37	1.82	± 12.0 %
1900	53.3	1.52	4.81	4.81	4.81	0.42	1.72	± 12.0 %
2300	52.9	1.81	4.54	4.54	4.54	0.80	1.24	± 12.0 %
2450	52.7	1.95	4.37	4.37	4.37	0.80	1.20	± 12.0 %
2600	52.5	2.16	4.23	4.23	4.23	0.80	1.18	± 12.0 %

[C] Frequency validity above 300 MHz 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. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

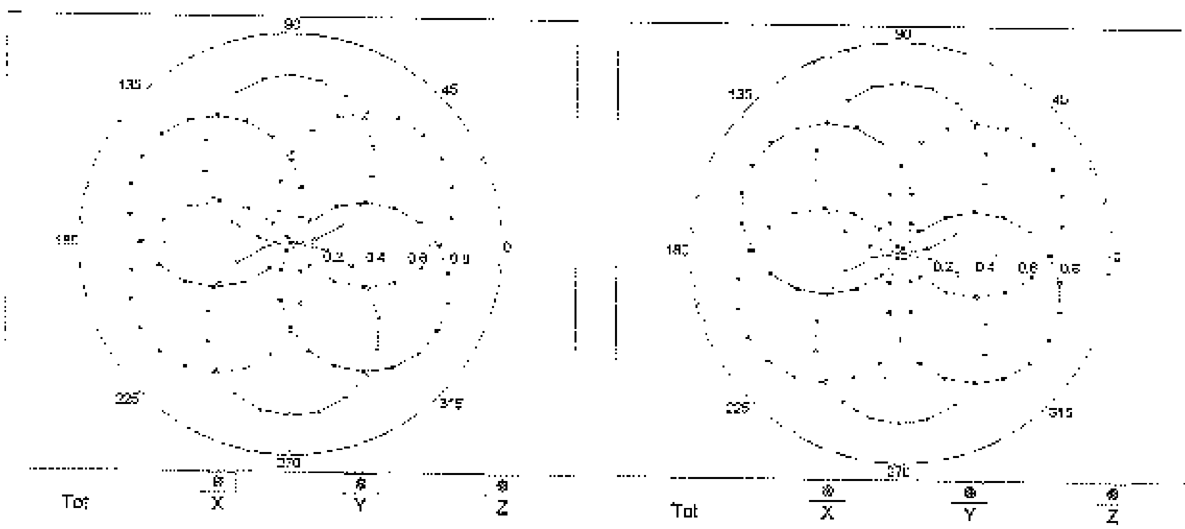
Frequency Response of E-Field

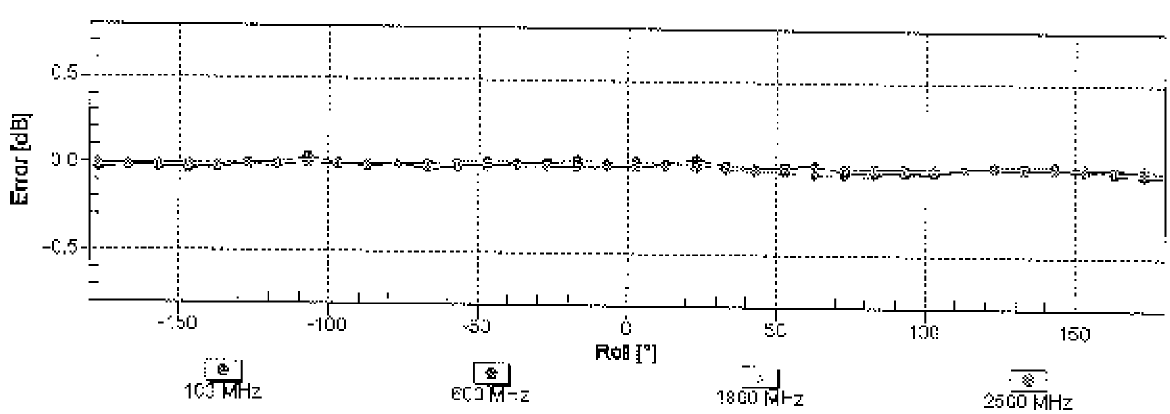
(TEM-Cell:ifi110 EXX, Waveguide: R22)



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

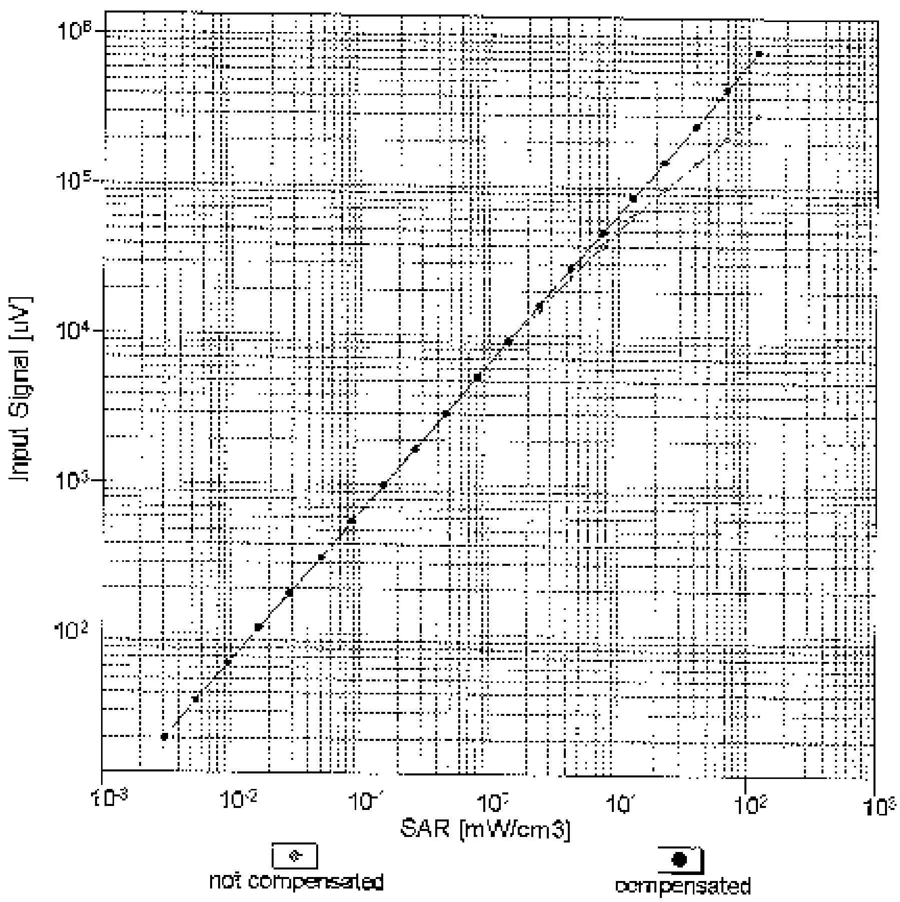
Receiving Pattern (ϕ), $\vartheta = 0°$

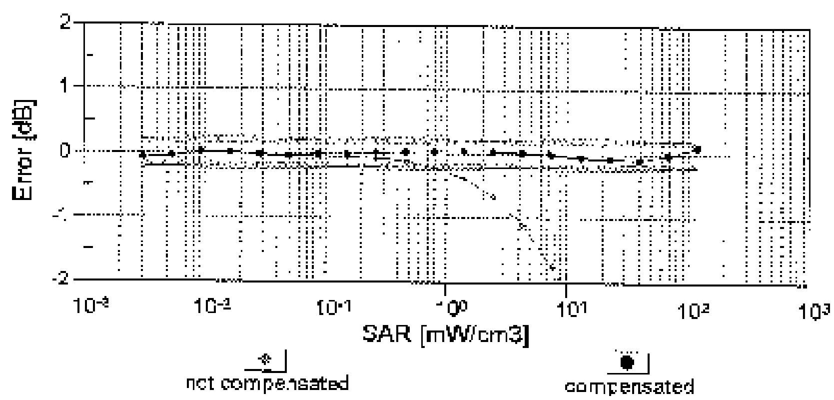




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

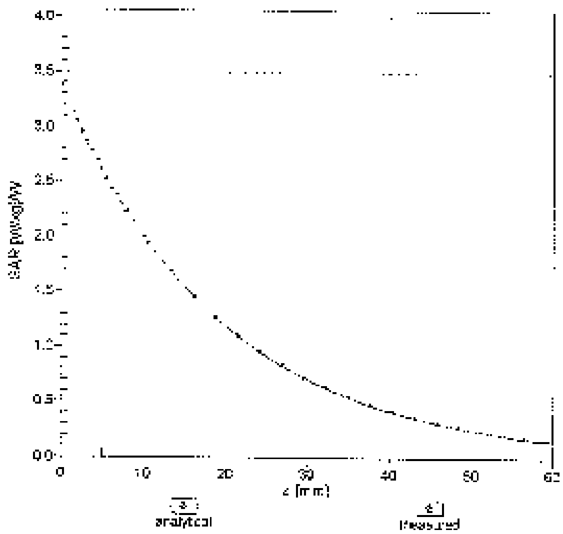




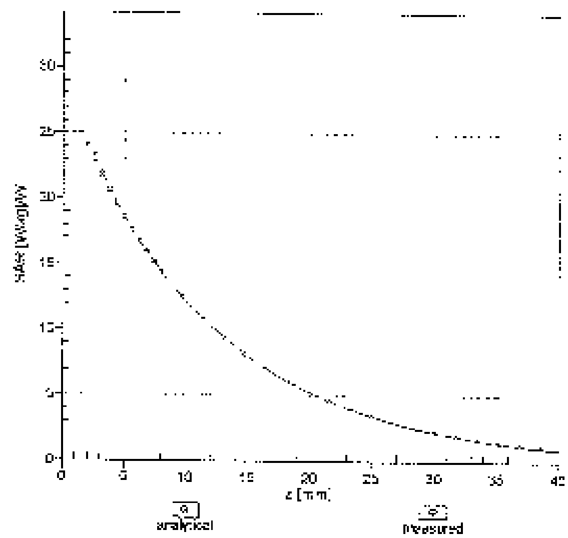
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

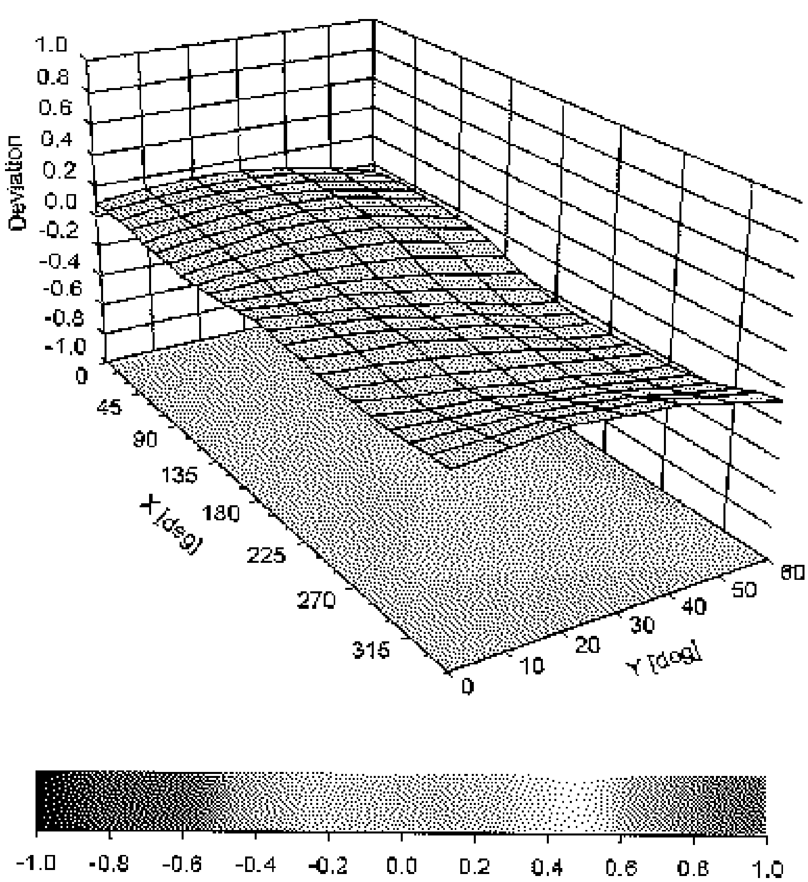


f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3288

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	73.1
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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

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

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

Accreditation No.: SCS 0108

Client **PC Test**

Certificate No: ES3-3209_Mar15

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3209

BN ✓ 3/26

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

Calibration date: March 19, 2015

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-14 (No. ES3-3013_Dec14)	Dec-15
DAE4	SN: 660	14-Jan-15 (No. DAE4-660_Jan15)	Jan-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Israe Elnaouq	Laboratory Technician	Israe Elnaouq
Approved by:	Katja Pokovic	Technical Manager	

Issued: March 19, 2015

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3209

Manufactured: October 14, 2008
Calibrated: March 19, 2015

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

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.35	1.33	1.14	± 10.1 %
DCP (mV)[B]	102.0	100.9	103.3	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	214.5	±3.5 %
		Y	0.0	0.0	1.0		192.6	
		Z	0.0	0.0	1.0		199.1	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	2.61	65.1	12.2	10.00	42.3	±1.7 %
		Y	1.39	57.8	8.9		42.7	
		Z	4.57	70.3	14.0		38.3	
10011-CAB	UMTS-FDD (WCDMA)	X	3.12	66.3	18.1	2.91	130.3	±0.7 %
		Y	3.08	65.6	17.5		132.2	
		Z	3.32	67.7	19.0		137.6	
10012-CAB	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	2.54	66.8	17.8	1.87	131.1	±0.7 %
		Y	2.67	67.1	17.7		131.6	
		Z	2.85	69.2	19.1		138.0	
10013-CAB	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	10.78	70.5	23.4	9.46	146.9	±2.7 %
		Y	10.39	69.2	22.5		123.5	
		Z	10.50	69.9	23.1		128.4	
10021-DAB	GSM-FDD (TDMA, GMSK)	X	3.65	74.2	17.7	9.39	130.0	±1.9 %
		Y	6.62	83.5	22.0		149.4	
		Z	4.25	76.8	19.2		136.2	
10023-DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	3.95	75.3	18.4	9.57	138.8	±2.5 %
		Y	4.99	78.2	19.8		143.3	
		Z	4.11	75.8	18.9		129.3	
10024-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	6.44	80.3	17.7	6.56	135.0	±1.7 %
		Y	3.76	73.7	16.0		144.2	
		Z	11.61	88.5	20.7		148.0	
10027-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	43.77	99.9	21.8	4.80	131.8	±1.7 %
		Y	13.95	87.5	19.0		142.7	
		Z	39.96	99.9	22.1		145.6	
10028-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	62.88	99.8	20.4	3.55	144.5	±2.2 %
		Y	2.45	70.4	12.9		130.3	
		Z	80.83	99.9	19.9		135.1	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	0.32	58.4	4.3	1.16	144.1	±1.9 %
		Y	16.25	79.9	12.1		129.5	
		Z	95.90	91.1	14.4		134.6	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.32	67.4	19.8	5.67	138.3	±1.4 %
		Y	6.35	67.3	19.5		144.4	
		Z	6.20	67.1	19.6		127.7	

10103-CAB	LTE-TDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	8.72	73.1	25.3	9.29	138.6	±2.7 %
		Y	8.88	72.9	24.9		147.9	
		Z	8.48	72.3	24.9		127.4	
10108-CAC	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.14	66.9	19.6	5.80	136.2	±1.7 %
		Y	6.20	66.8	19.4		142.8	
		Z	6.10	66.8	19.6		126.2	
10117-CAB	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.05	68.9	21.4	8.07	126.8	±2.2 %
		Y	9.98	68.5	21.1		132.4	
		Z	10.23	69.4	21.7		140.4	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	8.16	72.2	25.0	9.28	133.6	±2.7 %
		Y	8.33	72.0	24.5		142.6	
		Z	8.40	73.1	25.6		147.5	
10154-CAC	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	5.83	66.5	19.4	5.75	133.1	±1.4 %
		Y	5.89	66.3	19.2		139.3	
		Z	6.00	67.2	19.9		146.5	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.26	66.9	19.6	5.82	138.8	±1.7 %
		Y	6.34	67.0	19.5		145.1	
		Z	6.22	66.9	19.7		128.8	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	4.77	66.7	19.8	5.73	135.9	±1.4 %
		Y	4.89	66.6	19.5		141.8	
		Z	4.85	66.8	19.9		128.3	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	6.77	75.0	26.9	9.21	144.2	±2.5 %
		Y	6.56	72.6	25.2		131.1	
		Z	6.68	74.0	26.4		137.1	
10175-CAC	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.80	66.9	19.9	5.72	135.2	±1.4 %
		Y	4.87	66.5	19.5		140.6	
		Z	5.03	67.7	20.4		149.4	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.77	66.7	19.8	5.72	134.7	±1.2 %
		Y	4.88	66.5	19.5		140.6	
		Z	4.84	66.8	19.9		127.8	
10196-CAB	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.97	69.5	21.9	8.10	145.2	±2.2 %
		Y	9.60	68.2	21.0		125.1	
		Z	9.80	69.1	21.7		133.9	
10225-CAB	UMTS-FDD (HSPA+)	X	6.95	67.5	19.8	5.97	147.3	±1.4 %
		Y	6.73	66.4	19.1		128.7	
		Z	6.89	67.4	19.8		137.2	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	6.85	75.4	27.2	9.21	146.0	±2.5 %
		Y	6.54	72.5	25.1		131.6	
		Z	6.76	74.4	26.6		138.2	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	7.58	71.3	24.6	9.24	126.6	±2.5 %
		Y	7.73	71.1	24.2		133.3	
		Z	7.82	72.4	25.3		139.0	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	8.18	72.2	25.1	9.30	133.6	±2.7 %
		Y	8.35	72.0	24.6		141.1	
		Z	8.42	73.2	25.6		147.0	

10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.22	66.1	18.4	3.96	128.8	±0.9 %
		Y	4.24	65.9	18.1		133.8	
		Z	4.39	67.1	19.0		141.7	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.51	66.7	18.6	3.46	140.9	±0.7 %
		Y	3.52	66.2	18.1		143.4	
		Z	3.58	67.2	19.0		131.7	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.45	66.7	18.5	3.39	142.0	±0.7 %
		Y	3.50	66.4	18.2		146.9	
		Z	3.61	67.8	19.3		132.2	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.15	66.9	19.6	5.81	136.3	±1.4 %
		Y	6.20	66.8	19.4		140.3	
		Z	6.11	66.8	19.6		126.6	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.80	67.8	20.1	6.06	143.2	±1.7 %
		Y	6.80	67.5	19.9		147.4	
		Z	6.71	67.6	20.1		131.9	
10400-AAB	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	10.31	70.0	22.4	8.37	147.9	±3.0 %
		Y	9.88	68.5	21.3		127.2	
		Z	10.13	69.5	22.1		135.8	
10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.60	68.6	18.9	3.76	128.2	±0.5 %
		Y	4.58	67.9	18.4		134.2	
		Z	4.86	69.6	19.5		142.6	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.57	68.9	19.1	3.77	149.7	±0.5 %
		Y	4.51	68.0	18.5		132.3	
		Z	4.78	69.6	19.5		140.3	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.47	67.0	17.9	1.54	128.1	±0.7 %
		Y	2.46	66.4	17.4		132.5	
		Z	2.72	69.1	19.2		140.6	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	10.12	69.7	22.1	8.23	146.8	±2.7 %
		Y	9.66	68.2	21.1		125.0	
		Z	9.91	69.2	21.8		134.3	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 7 and 8).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	41.9	0.89	6.34	6.34	6.34	0.29	2.02	± 12.0 %
835	41.5	0.90	6.04	6.04	6.04	0.23	2.57	± 12.0 %
1750	40.1	1.37	5.23	5.23	5.23	0.80	1.08	± 12.0 %
1900	40.0	1.40	5.05	5.05	5.05	0.10	2.40	± 12.0 %
2300	39.5	1.67	4.76	4.76	4.76	0.70	1.27	± 12.0 %
2450	39.2	1.80	4.53	4.53	4.53	0.80	1.22	± 12.0 %
2600	39.0	1.96	4.36	4.36	4.36	0.75	1.31	± 12.0 %

[C] Frequency validity above 300 MHz 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. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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

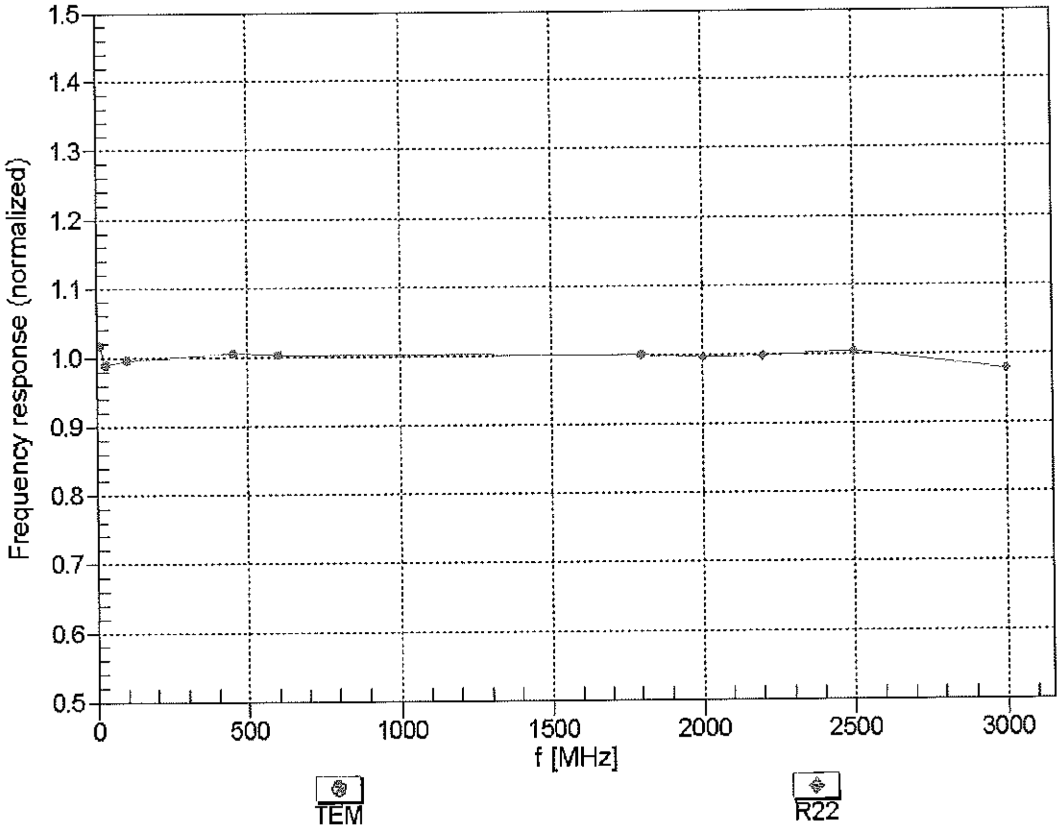
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	6.12	6.12	6.12	0.34	1.81	± 12.0 %
835	55.2	0.97	6.07	6.07	6.07	0.37	1.79	± 12.0 %
1750	53.4	1.49	4.86	4.86	4.86	0.67	1.43	± 12.0 %
1900	53.3	1.52	4.57	4.57	4.57	0.57	1.53	± 12.0 %
2300	52.9	1.81	4.28	4.28	4.28	0.80	1.19	± 12.0 %
2450	52.7	1.95	4.12	4.12	4.12	0.72	1.15	± 12.0 %
2600	52.5	2.16	3.92	3.92	3.92	0.80	1.10	± 12.0 %

[C] Frequency validity above 300 MHz 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. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

Frequency Response of E-Field

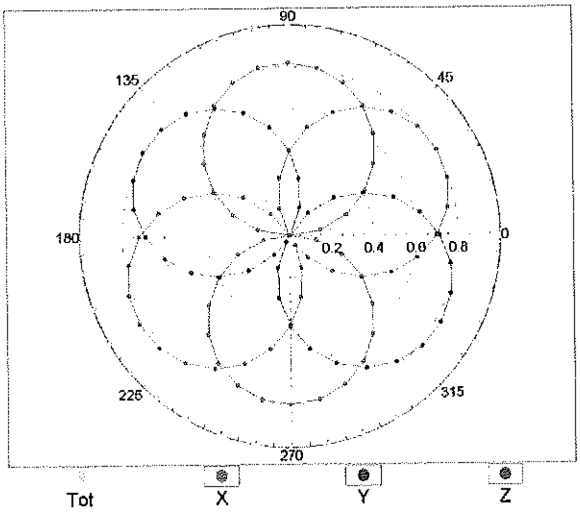
(TEM-Cell:ifi110 EXX, Waveguide: R22)



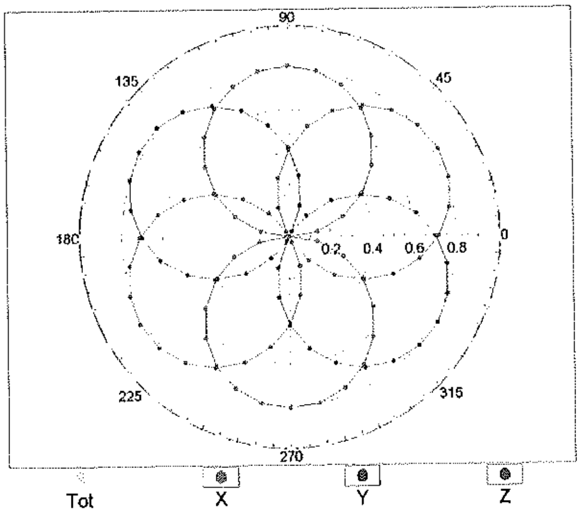
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

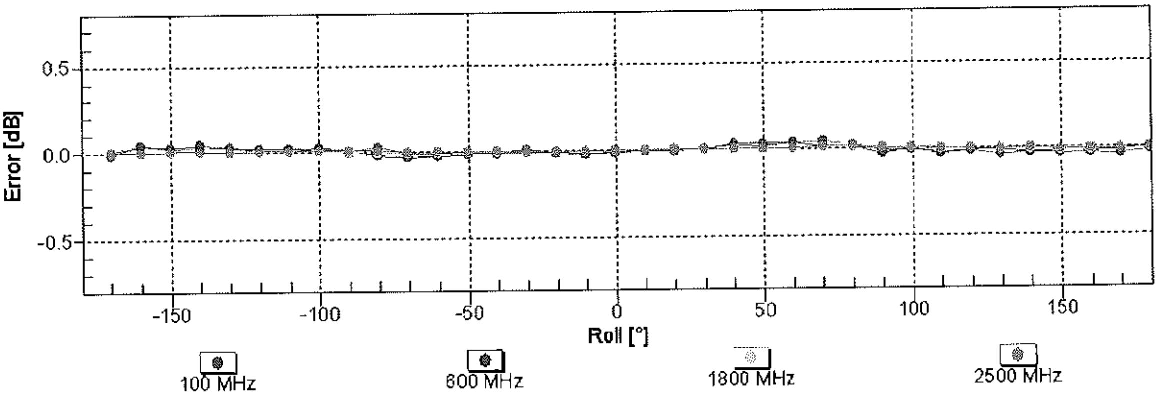
Receiving Pattern (ϕ), $\vartheta = 0°$

f=600 MHz,TEM



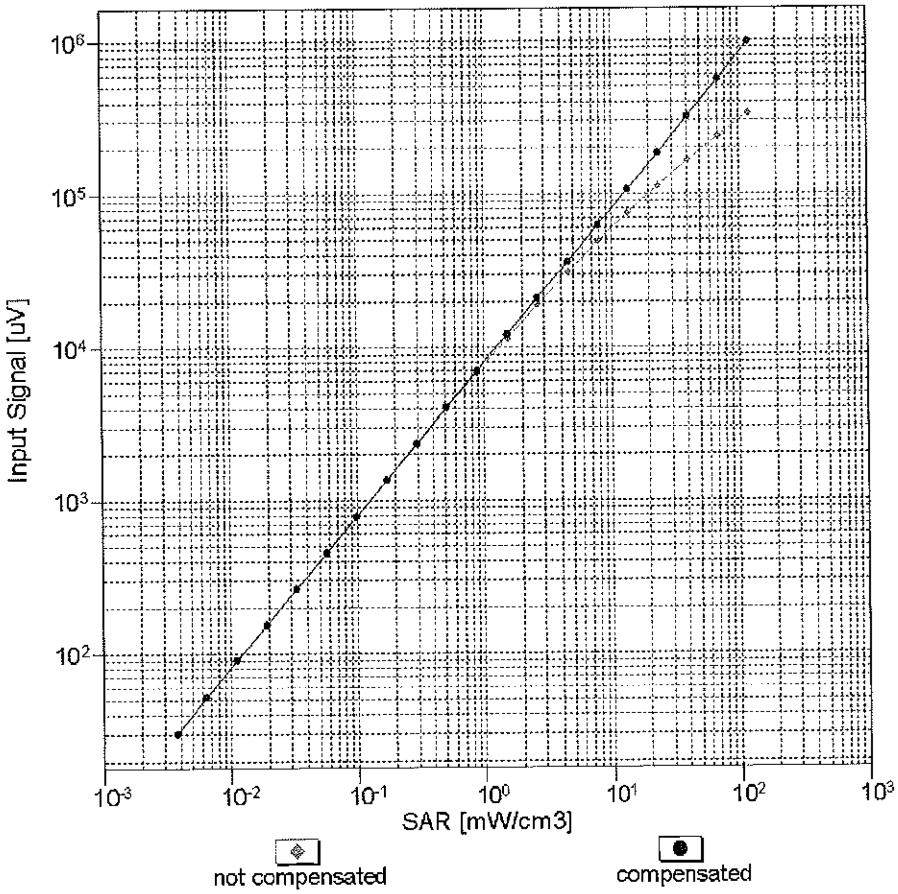
f=1800 MHz,R22

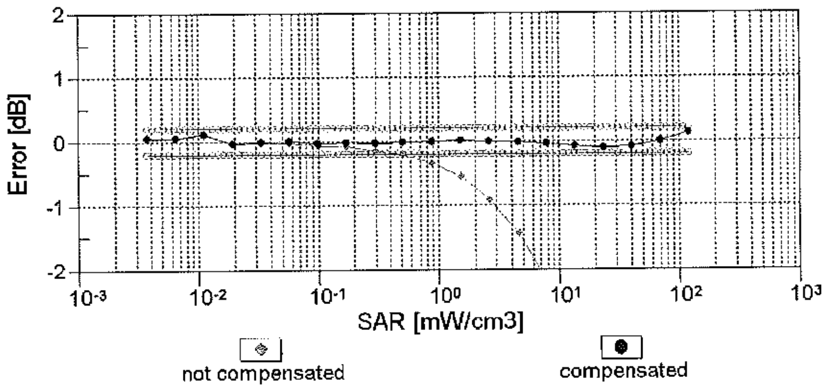




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

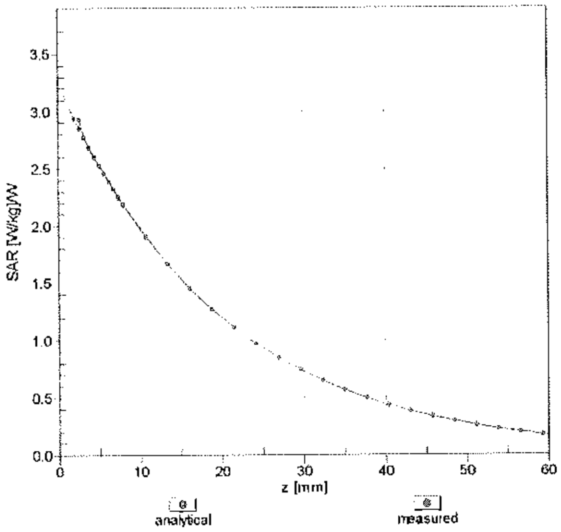




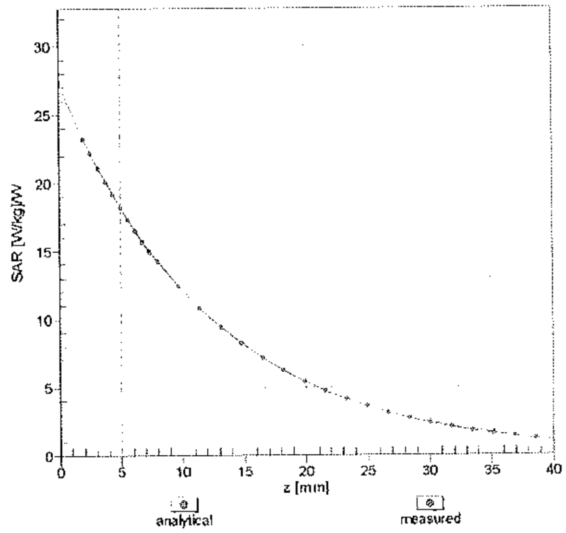
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

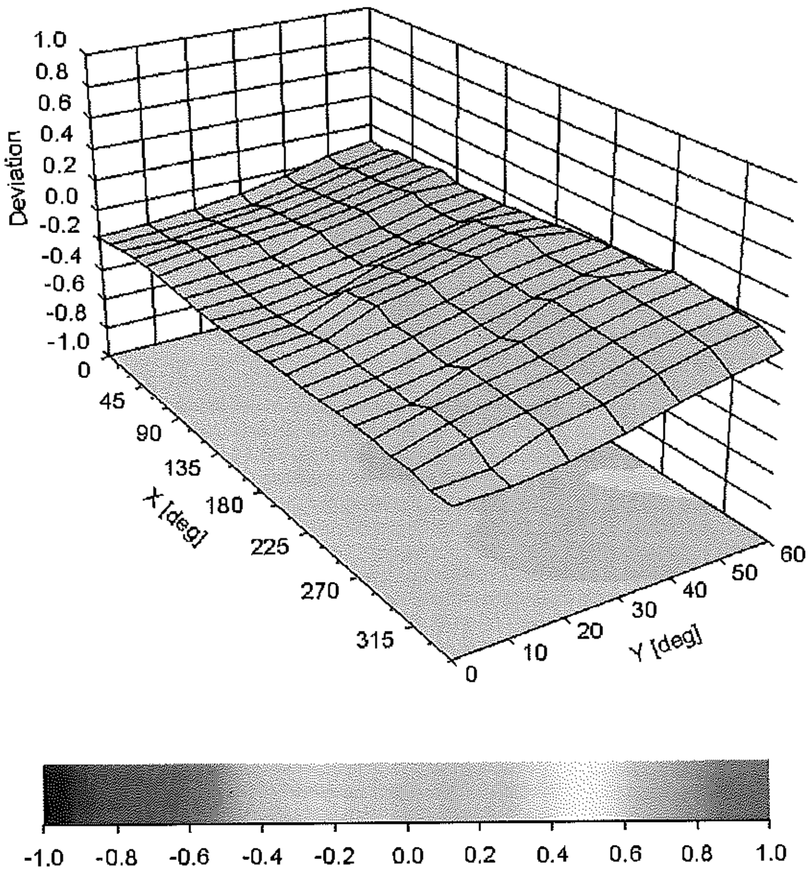


f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-40.3
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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

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

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

Accreditation No.: SCS 0108

Client **PC Test**

Certificate No: D835V2-4d132_Jan15

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d132
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	January 16, 2015

CC
2/3/15

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	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 19, 2015

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
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	41.5 ± 6 %	0.93 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	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.25 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.54 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.04 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	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.8 ± 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	2.35 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.14 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.53 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**5.98 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.8 Ω - 2.3 jΩ
Return Loss	- 30.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.5 Ω - 4.3 jΩ
Return Loss	- 25.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.385 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

DASY5 Validation Report for Head TSL

Date: 16.01.2015

Test Laboratory: SPEAG, Zurich, Switzerland

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

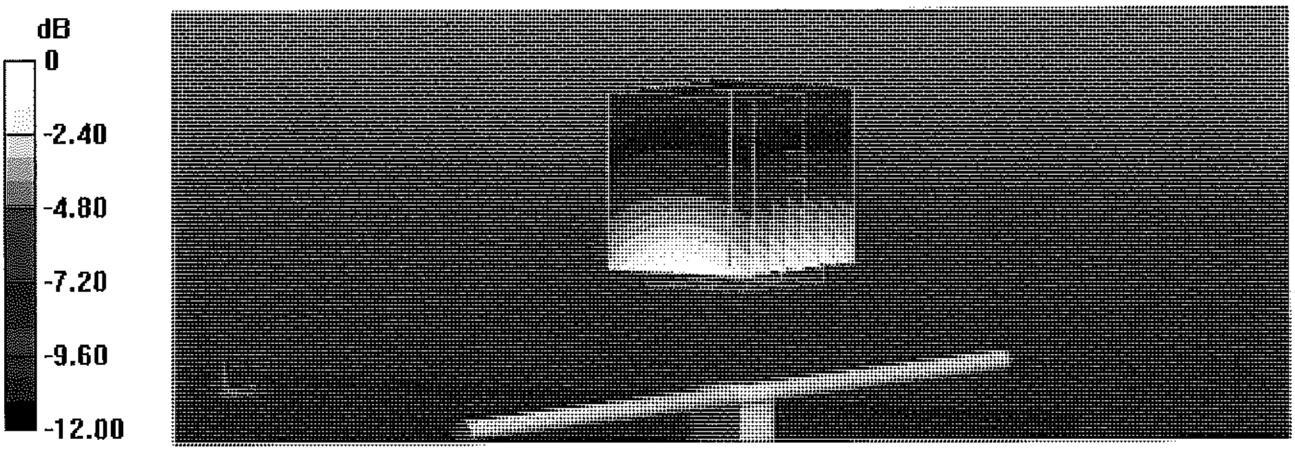
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.93 S/m; ε_r = 41.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.2, 6.2, 6.2); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

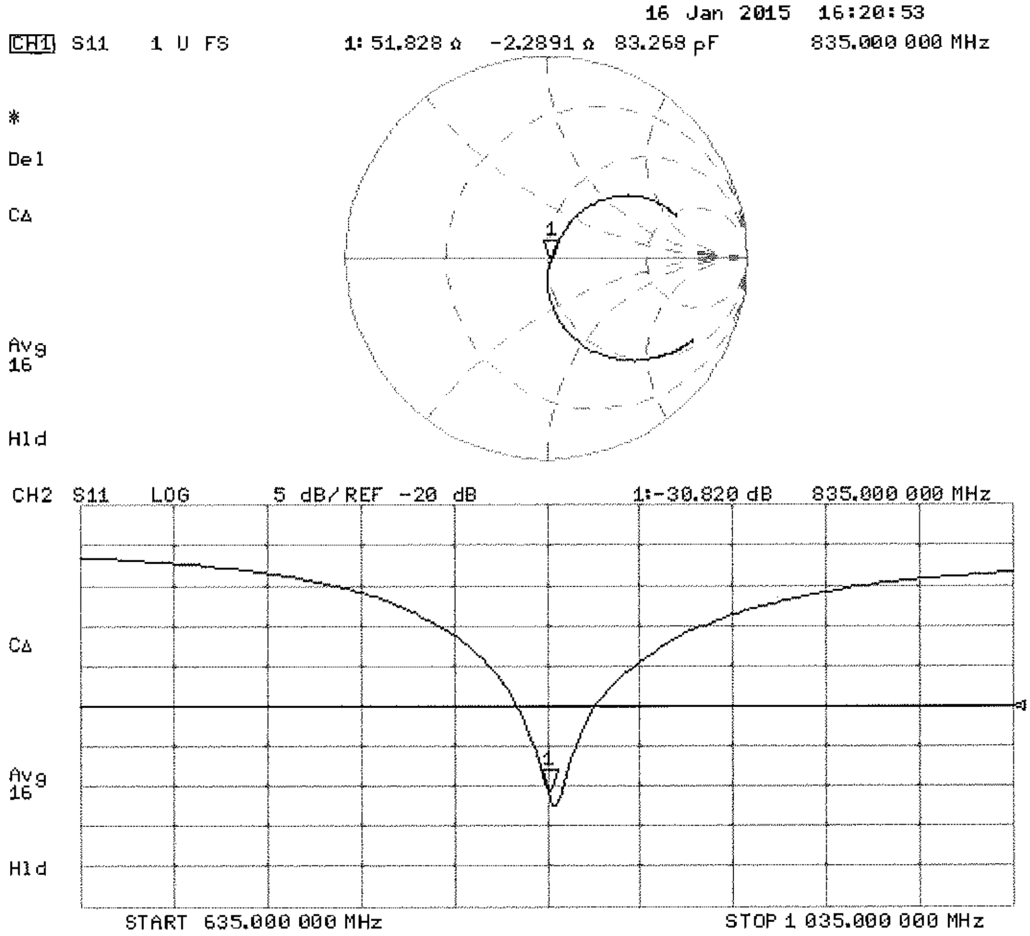
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.27 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 3.51 W/kg
SAR(1 g) = 2.37 W/kg; SAR(10 g) = 1.54 W/kg
Maximum value of SAR (measured) = 2.77 W/kg



0 dB = 2.77 W/kg = 4.42 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 16.01.2015

Test Laboratory: SPEAG, Zurich, Switzerland

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

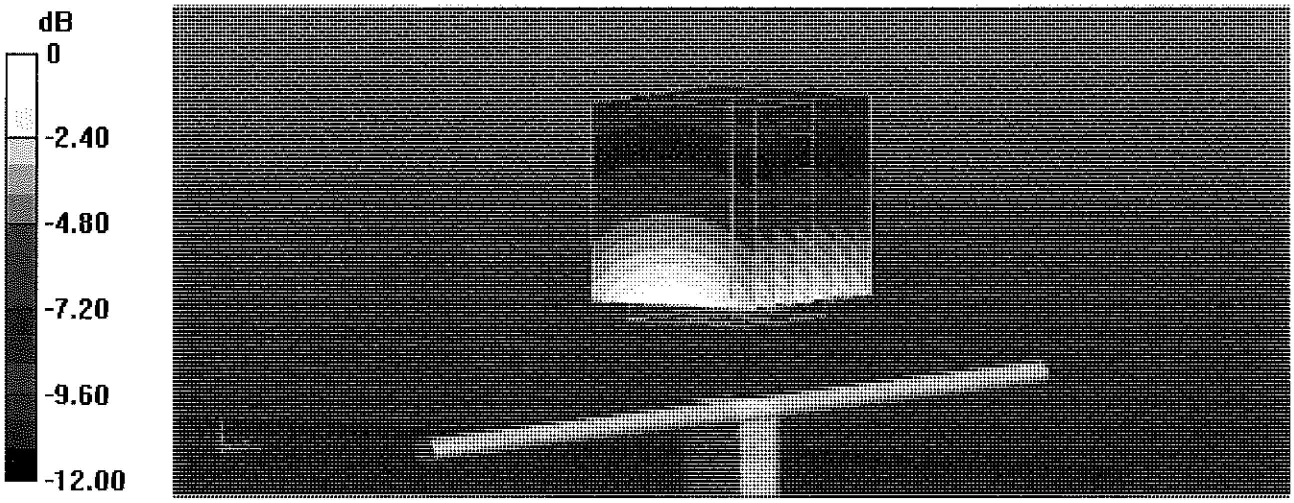
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; $\sigma = 1.01$ S/m; $\varepsilon_r = 55.8$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.17, 6.17, 6.17); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

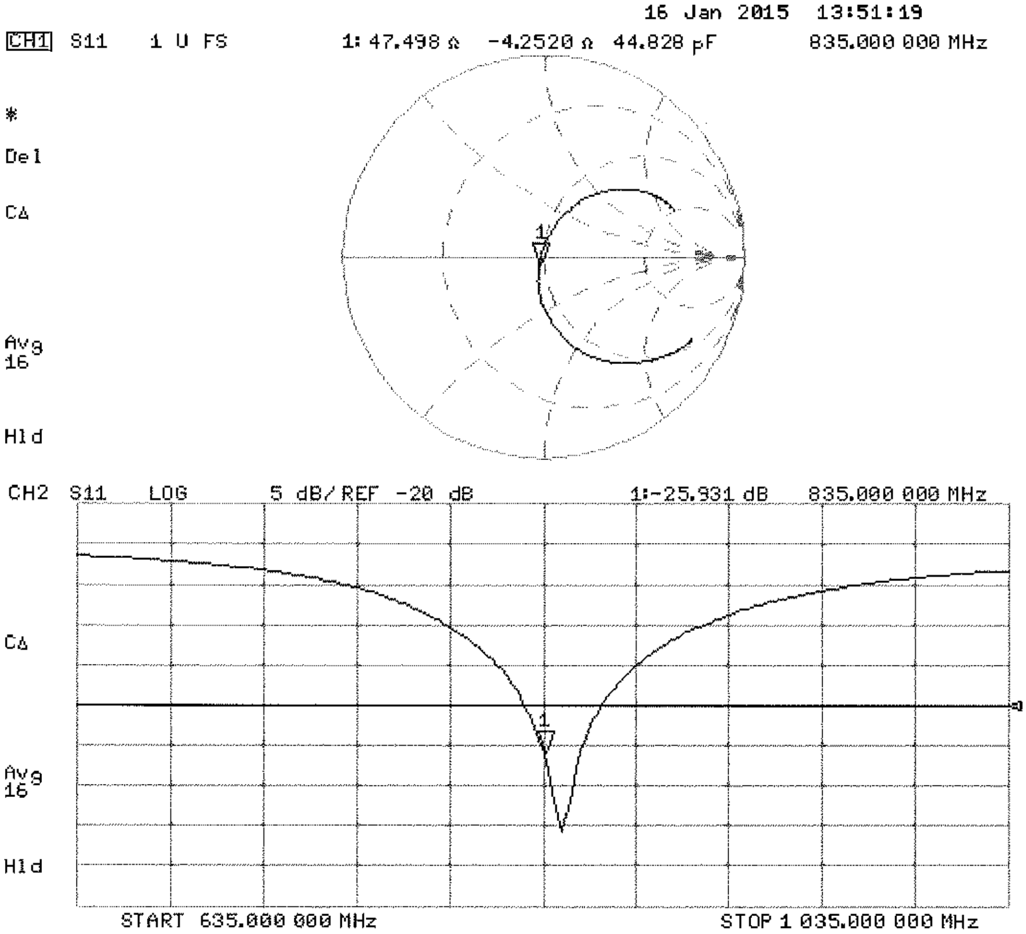
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.27 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 3.47 W/kg
SAR(1 g) = 2.35 W/kg; SAR(10 g) = 1.53 W/kg
Maximum value of SAR (measured) = 2.75 W/kg



0 dB = 2.75 W/kg = 4.39 dBW/kg

Impedance Measurement Plot for Body TSL



Calibration Laboratory of
Schmid & Partner
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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 0108

Client **PC Test**

Certificate No: D835V2-4d133_Jul15

CALIBRATION CERTIFICATE

Object D835V2 - SN: 4d133

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

PN ✓
8/4/15

Calibration date: July 23, 2015

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	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: July 23, 2015

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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	V52.8.8
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	42.4 ± 6 %	0.92 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	2.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.13 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.50 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.94 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	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.9 ± 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	2.37 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.25 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.55 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.08 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.6 Ω - 1.6 jΩ
Return Loss	- 33.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.0 Ω - 3.7 jΩ
Return Loss	- 27.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.395 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

DASY5 Validation Report for Head TSL

Date: 22.07.2015

Test Laboratory: SPEAG, Zurich, Switzerland

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

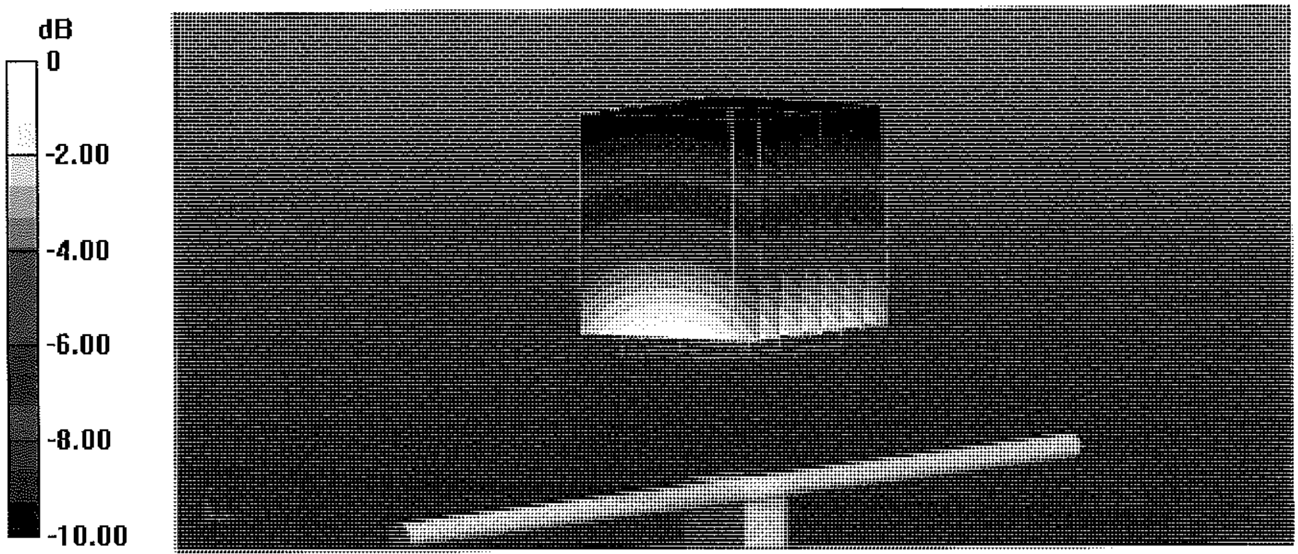
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.92 S/m; ε_r = 42.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.2, 6.2, 6.2); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

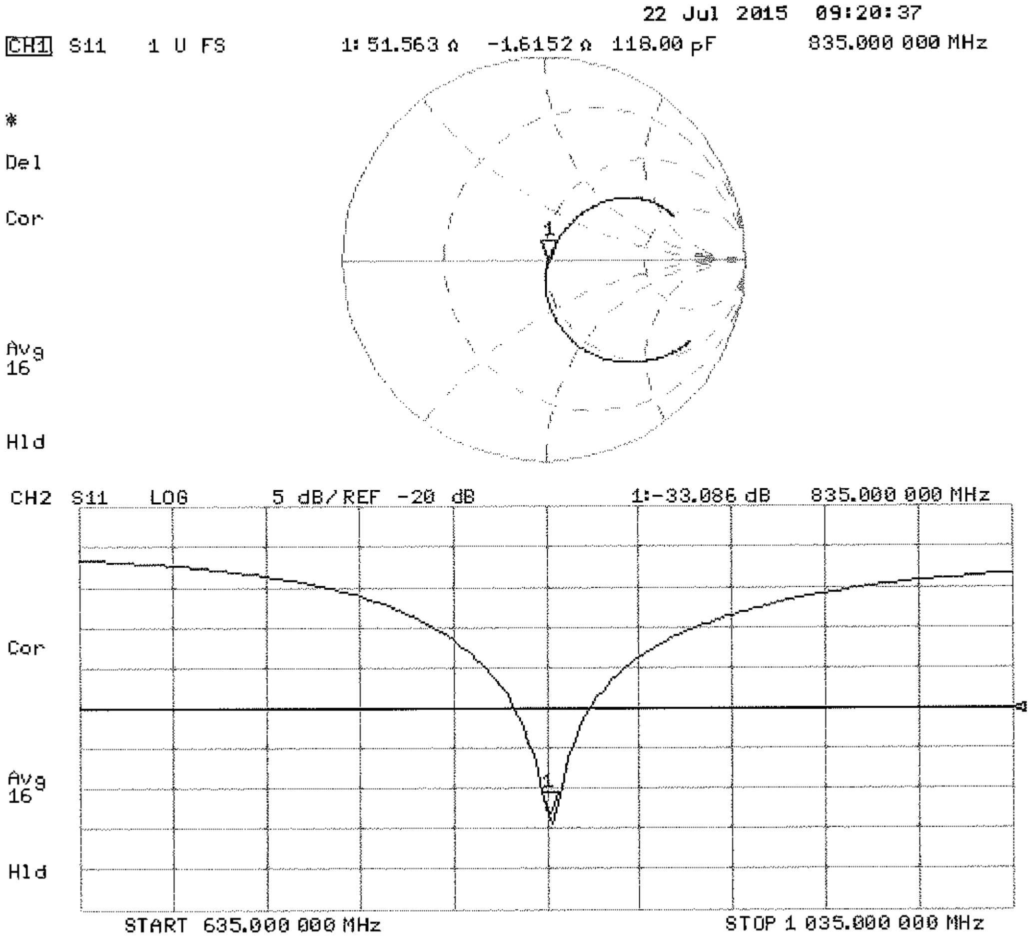
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.11 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 3.44 W/kg
SAR(1 g) = 2.31 W/kg; SAR(10 g) = 1.5 W/kg
Maximum value of SAR (measured) = 2.70 W/kg



0 dB = 2.70 W/kg = 4.31 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 23.07.2015

Test Laboratory: SPEAG, Zurich, Switzerland

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

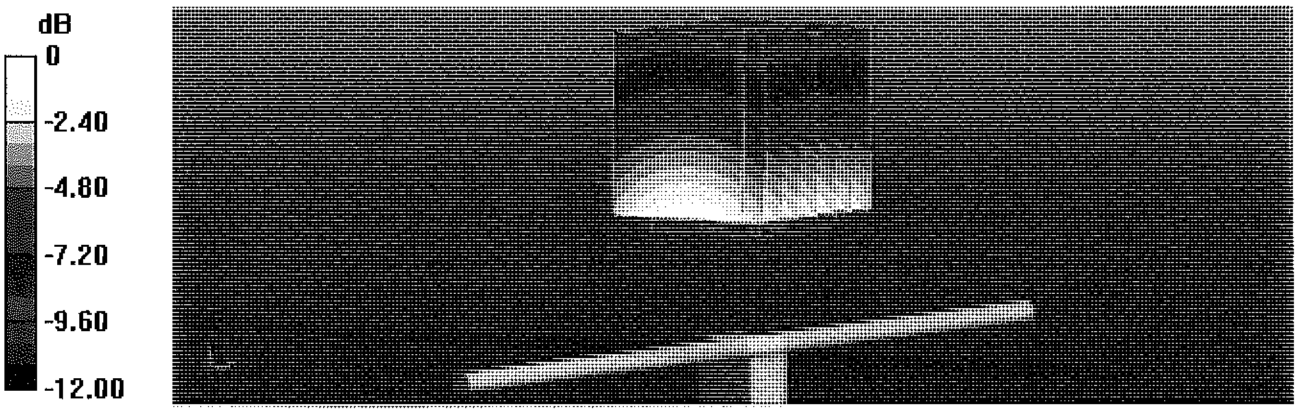
Communication System: UID 0 - CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1 S/m; ε_r = 54.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.17, 6.17, 6.17); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

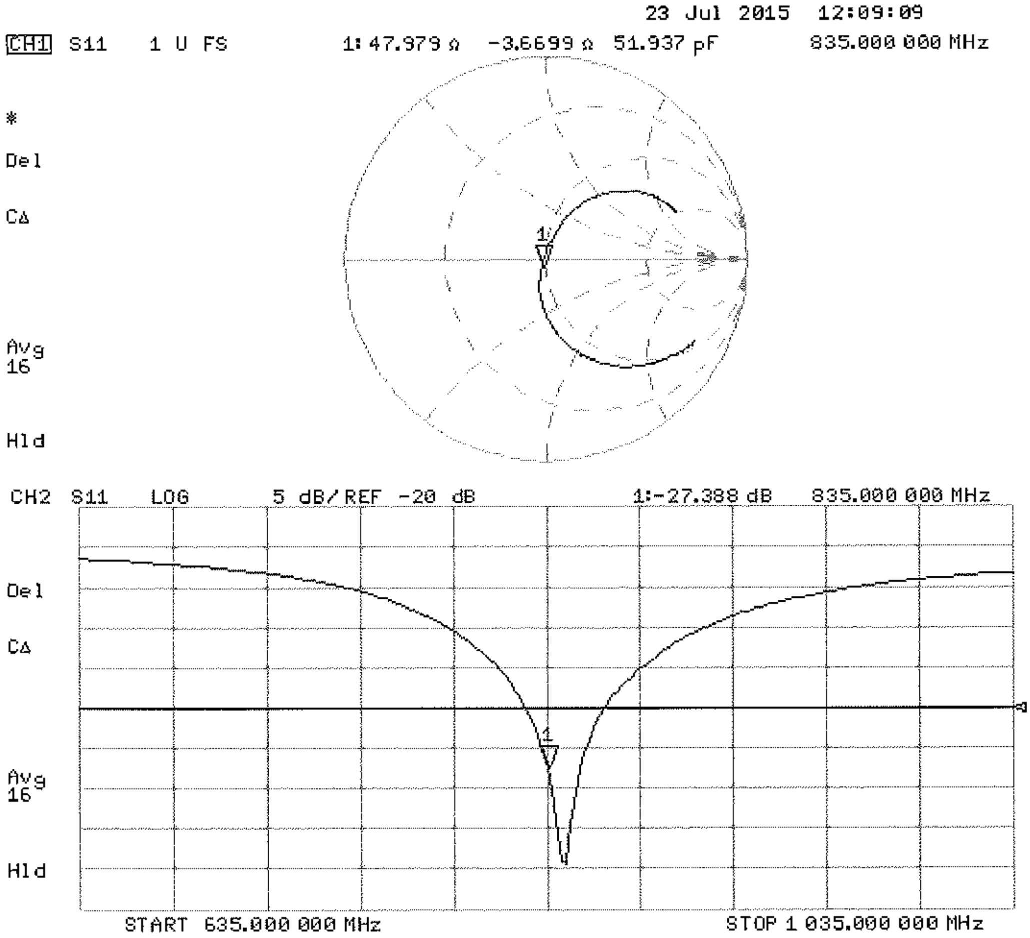
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.56 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.50 W/kg
SAR(1 g) = 2.37 W/kg; SAR(10 g) = 1.55 W/kg
Maximum value of SAR (measured) = 2.77 W/kg



0 dB = 2.77 W/kg = 4.42 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 0108

Client **PC Test**

Certificate No: D1900V2-5d149_Jul15

CALIBRATION CERTIFICATE

Object	D1900V2 - SN:5d149
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	July 14, 2015

CC✓
8/4/15

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	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

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

Issued: July 14, 2015

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

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Accreditation No.: SCS 0108

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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	V52.8.8
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	39.7 ± 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	10.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**40.7 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.5 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	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.7 ± 6 %	1.54 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	10.2 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**40.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.49 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.8 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.4 Ω + 5.6 jΩ
Return Loss	- 24.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.7 Ω + 6.1 jΩ
Return Loss	- 23.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.197 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: 14.07.2015

Test Laboratory: SPEAG, Zurich, Switzerland

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

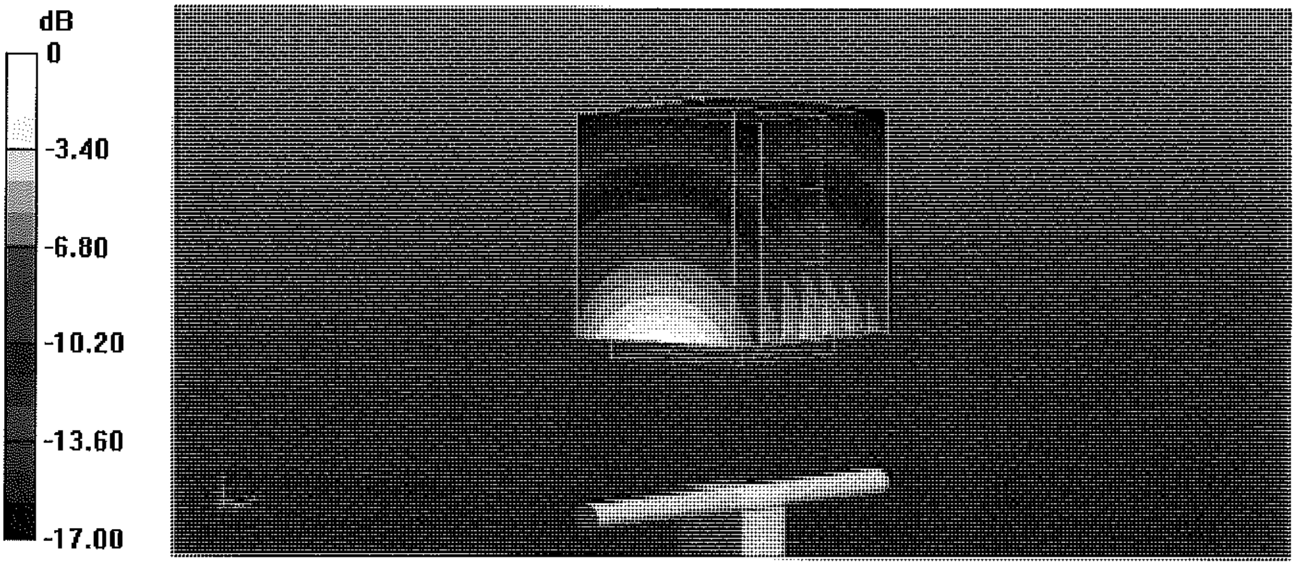
Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.38 S/m; ε_r = 39.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5, 5, 5); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

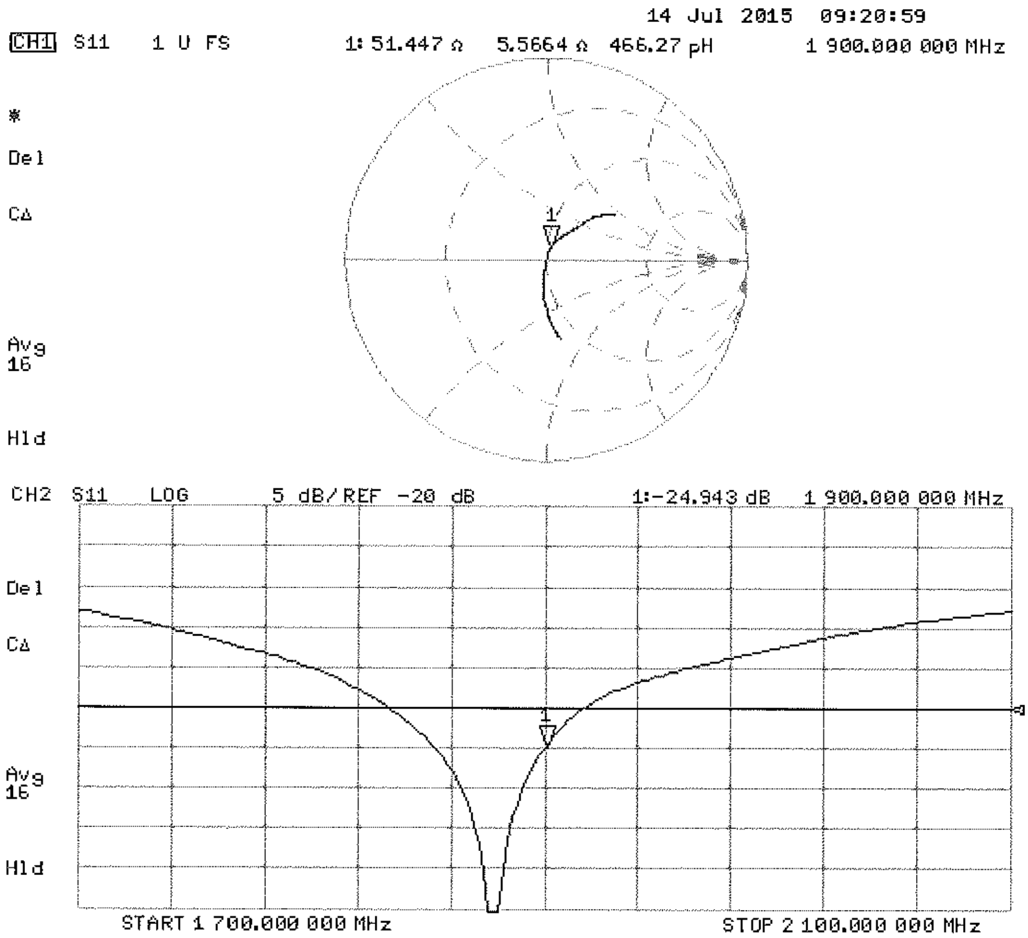
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.22 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 18.3 W/kg
SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.34 W/kg
Maximum value of SAR (measured) = 12.9 W/kg



0 dB = 12.9 W/kg = 11.11 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 14.07.2015

Test Laboratory: SPEAG, Zurich, Switzerland

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

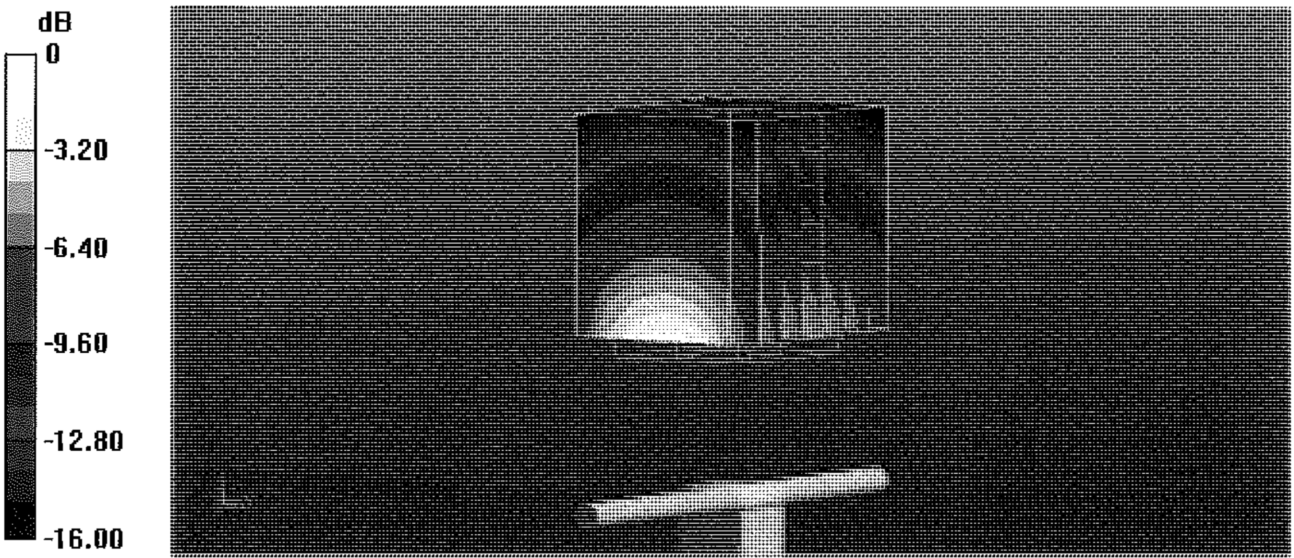
Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; $\sigma = 1.54$ S/m; $\varepsilon_r = 52.7$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.65, 4.65, 4.65); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

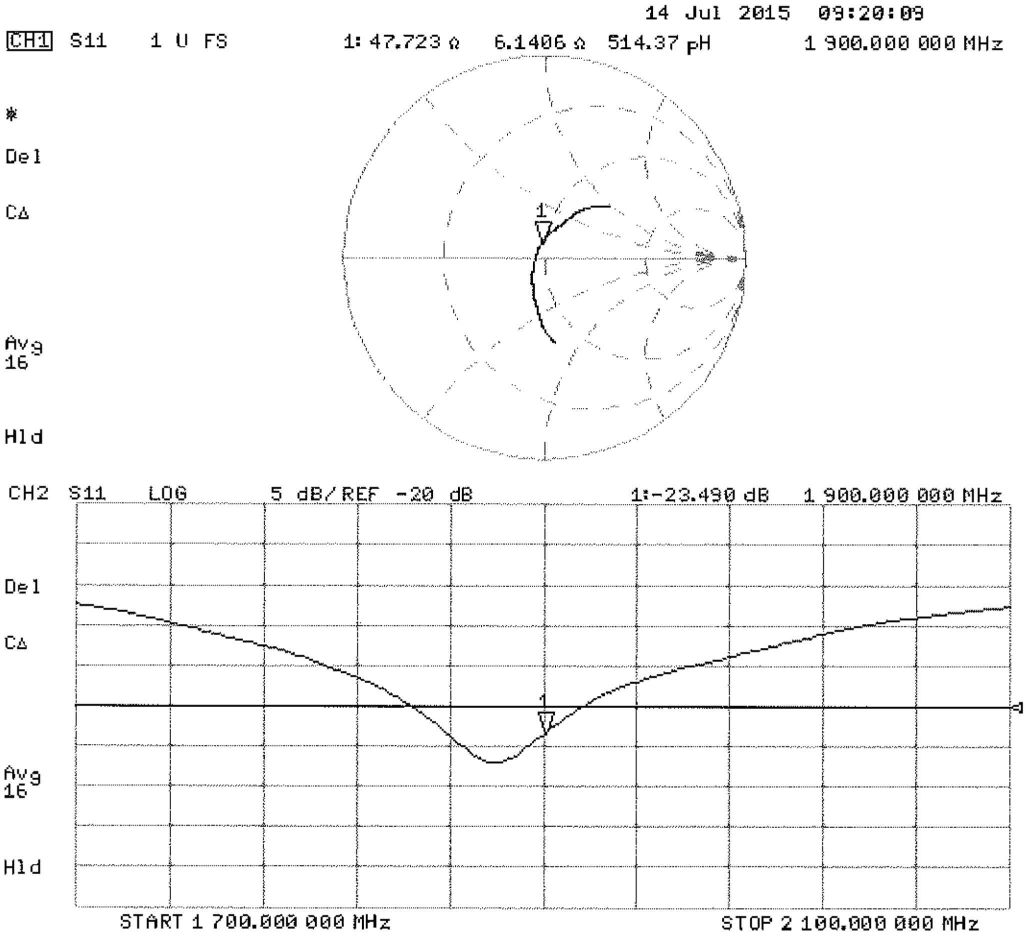
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.96 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 17.2 W/kg
SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.49 W/kg
Maximum value of SAR (measured) = 12.9 W/kg



0 dB = 12.9 W/kg = 11.11 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 0108

Client PC Test

Certificate No: D1900V2-5d148_Feb15

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 18, 2015

QC ✓
3/6/15

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	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 18, 2015

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Accreditation No.: SCS 0108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
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	39.1 ± 6 %	1.42 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	10.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**40.6 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.3 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.1 ± 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	10.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**40.2 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.40 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.5 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.4 Ω + 6.2 jΩ
Return Loss	- 23.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.2 Ω + 6.6 jΩ
Return Loss	- 23.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.198 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: 18.02.2015

Test Laboratory: SPEAG, Zurich, Switzerland

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

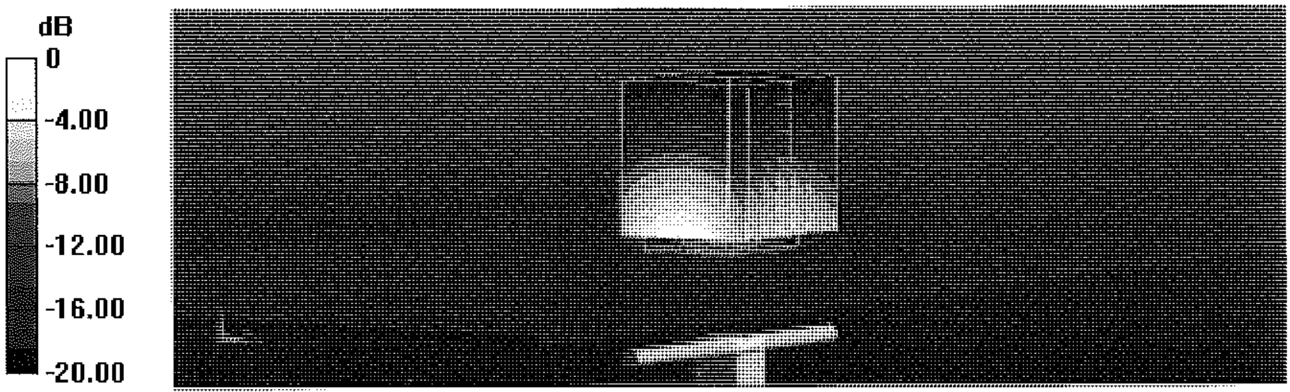
Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.42 S/m; ε_r = 39.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5, 5, 5); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

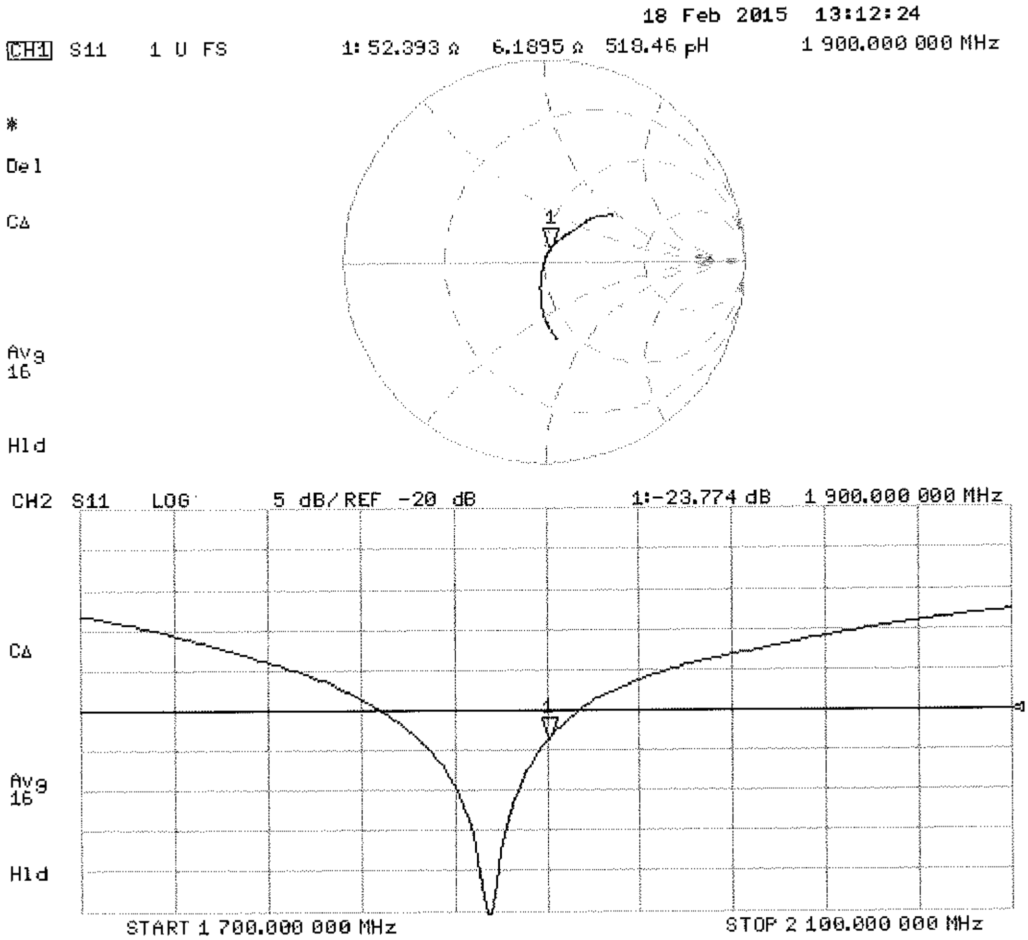
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 98.30 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 18.8 W/kg
SAR(1 g) = 10.3 W/kg; SAR(10 g) = 5.37 W/kg
Maximum value of SAR (measured) = 13.0 W/kg

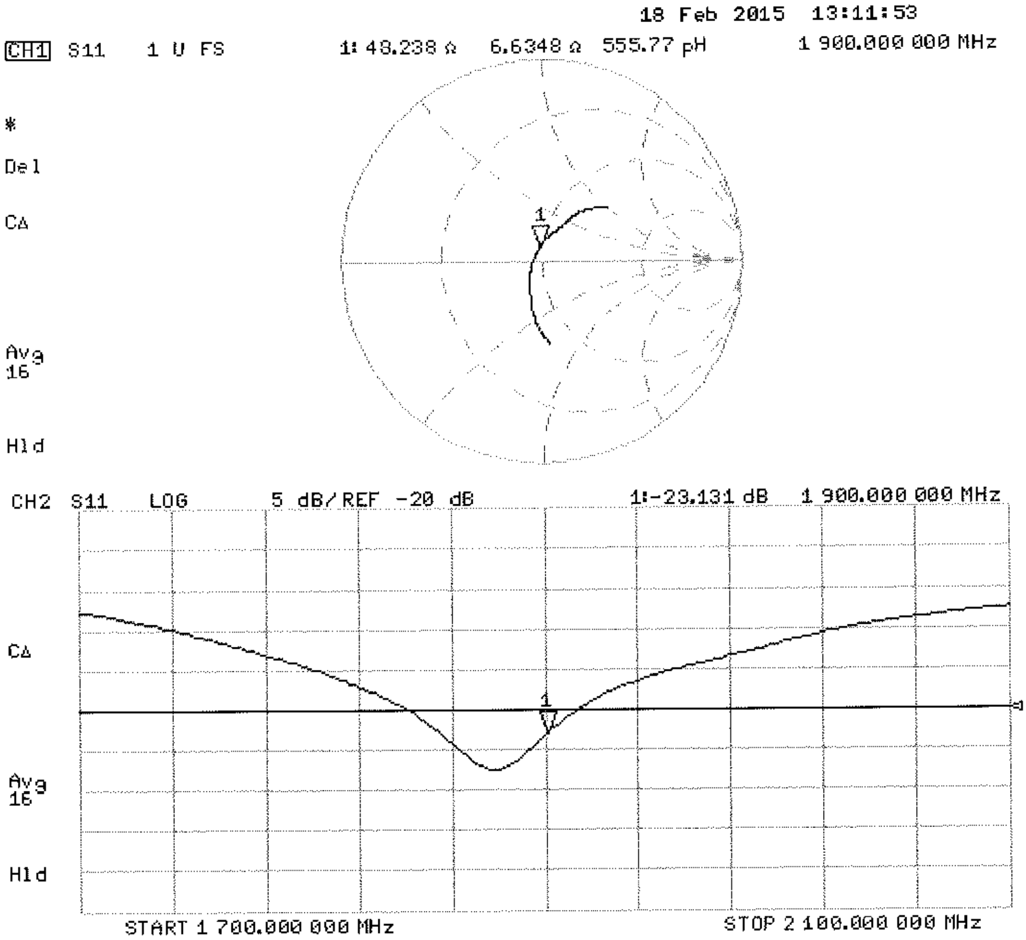


0 dB = 13.0 W/kg = 11.14 dBW/kg

Impedance Measurement Plot for Head TSL



Impedance Measurement Plot for Body TSL



DASY5 Validation Report for Body TSL

Date: 18.02.2015

Test Laboratory: SPEAG, Zurich, Switzerland

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

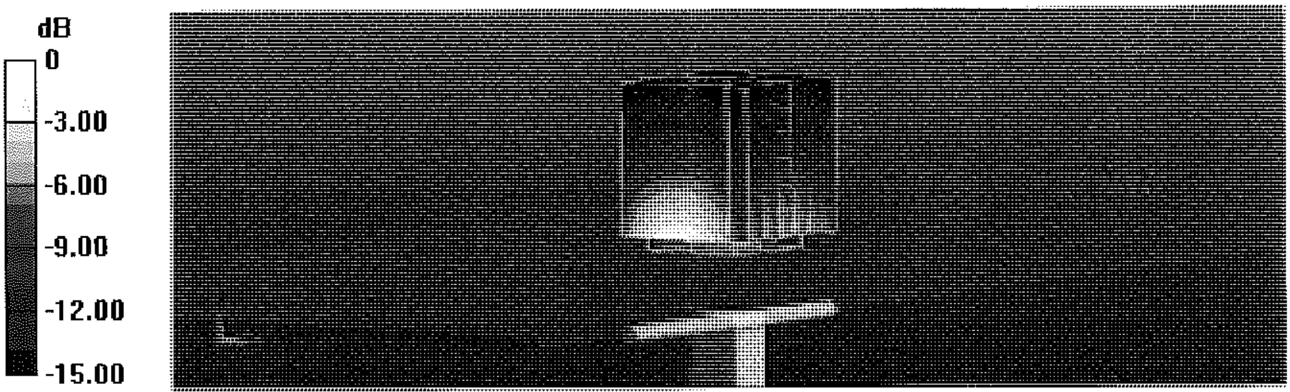
Communication System: UID 0 - CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.53 S/m; ε_r = 53.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.65, 4.65, 4.65); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 95.79 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 17.2 W/kg
SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.4 W/kg
Maximum value of SAR (measured) = 12.7 W/kg



0 dB = 12.7 W/kg = 11.04 dBW/kg

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

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

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Accreditation No.: **SCS 0108**

Client **PC Test**

Certificate No: **D2450V2-719_Aug15**

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 719
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	August 20, 2015

BN ✓
9/3/15

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	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	17-Aug-15 (No. DAE4-601_Aug15)	Aug-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: August 21, 2015

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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	V52.8.8
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 %	1.87 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.8 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**54.2 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.48 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**25.7 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	53.2 ± 6 %	2.00 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**51.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.11 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.3 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.5 Ω + 5.3 jΩ
Return Loss	- 23.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.1 Ω + 6.5 jΩ
Return Loss	- 23.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.149 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 10, 2002

DASY5 Validation Report for Head TSL

Date: 20.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

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

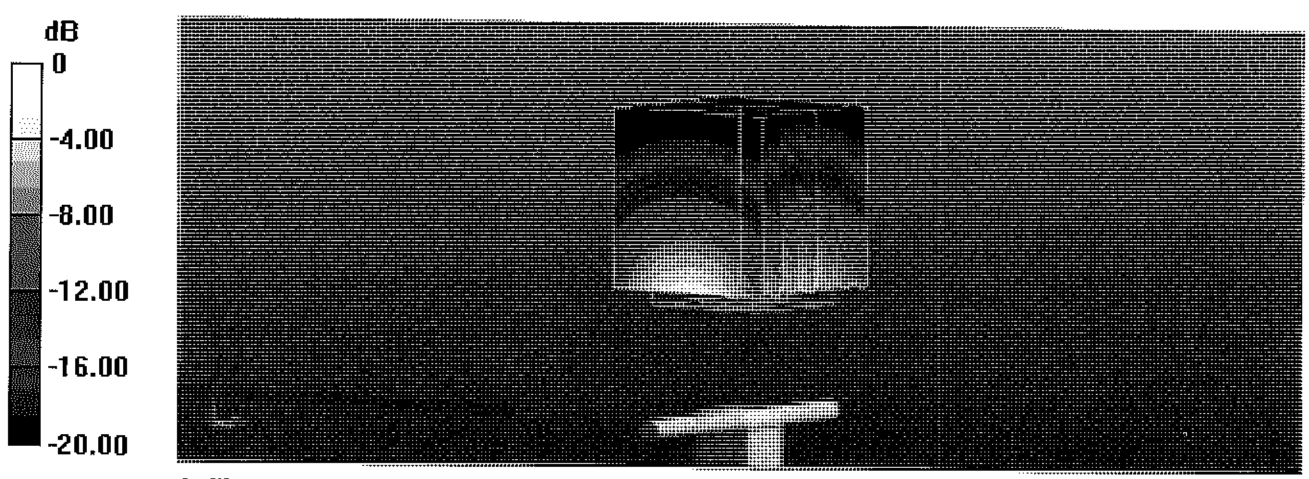
Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.87 S/m; ε_r = 39.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.54, 4.54, 4.54); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 17.08.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

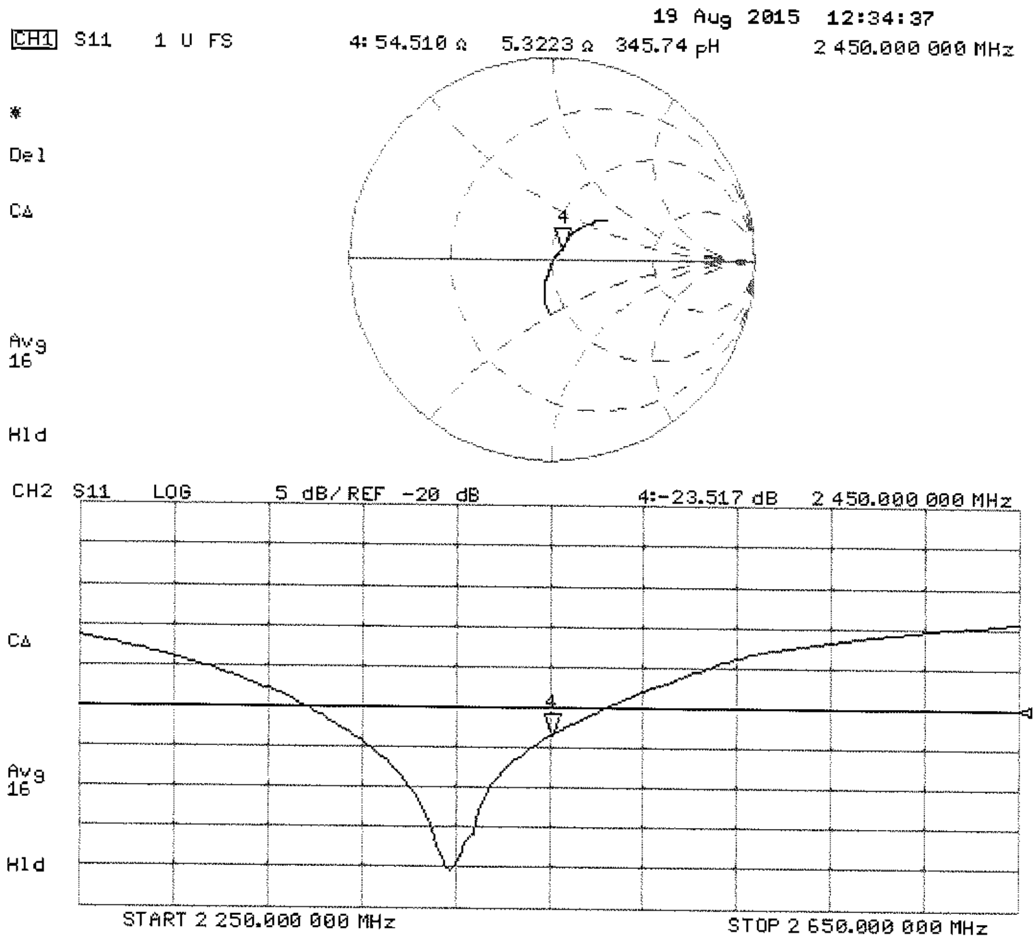
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 102.2 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 28.1 W/kg
SAR(1 g) = 13.8 W/kg; SAR(10 g) = 6.48 W/kg
Maximum value of SAR (measured) = 18.2 W/kg



0 dB = 18.2 W/kg = 12.60 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 19.08.2015

Test Laboratory: SPEAG, Zurich, Switzerland

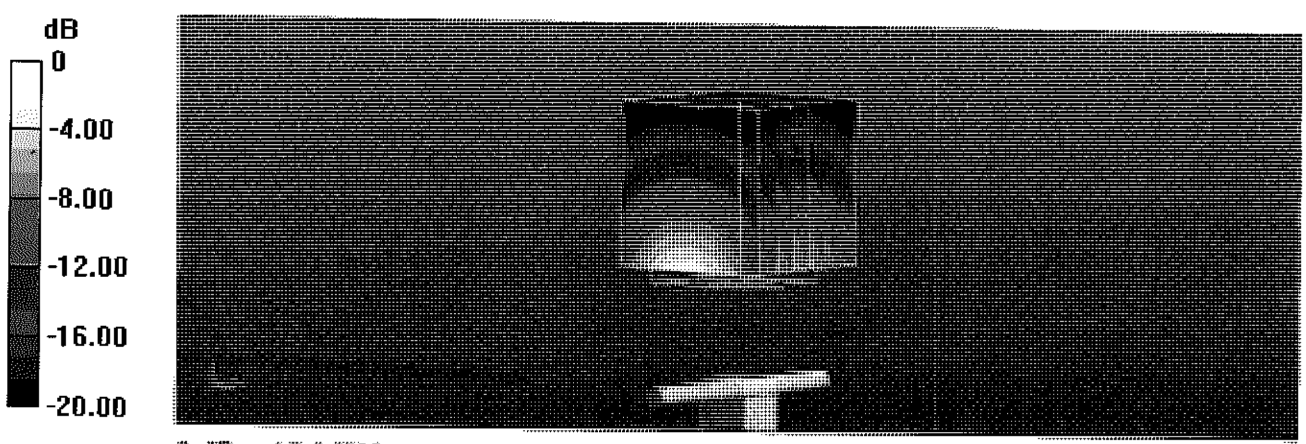
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 719

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2 S/m; ε_r = 53.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

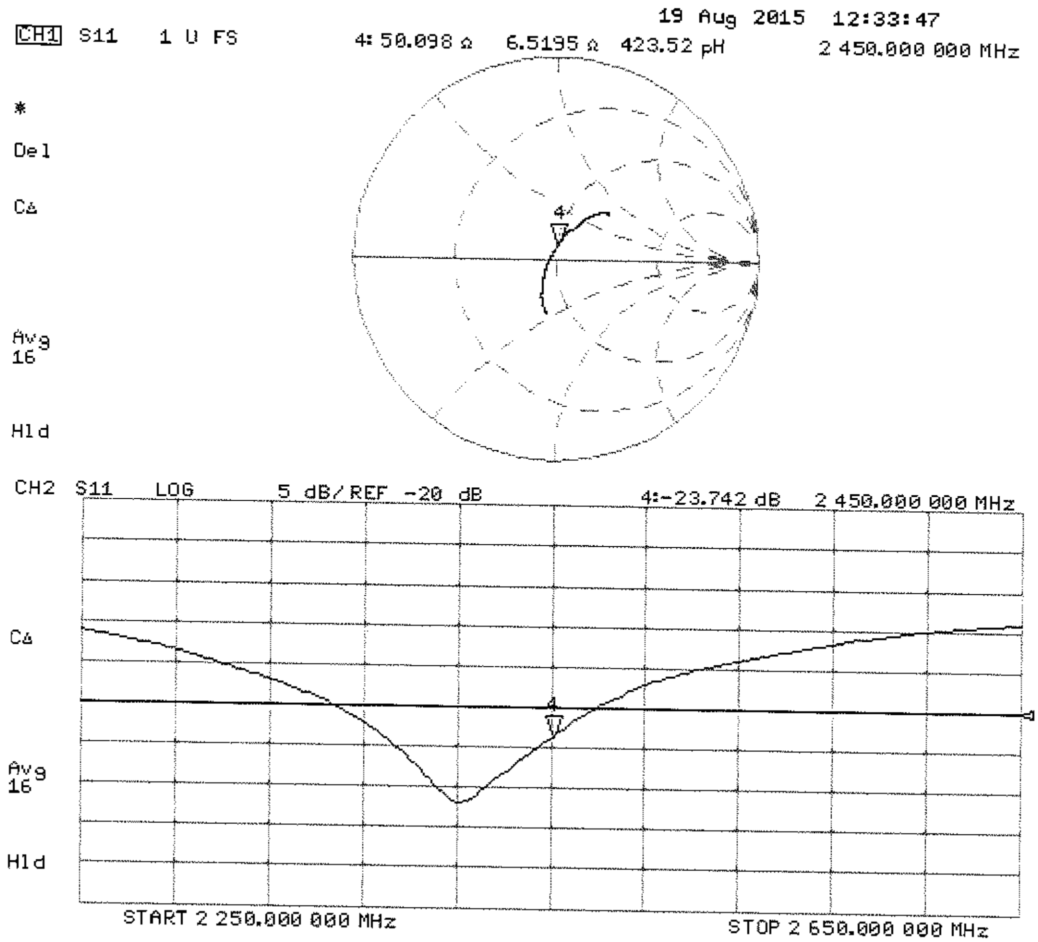
- Probe: ES3DV3 - SN3205; ConvF(4.32, 4.32, 4.32); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 17.08.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 95.73 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 26.9 W/kg
SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.11 W/kg
Maximum value of SAR (measured) = 17.3 W/kg



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

Impedance Measurement Plot for Body TSL



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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 0108**

Client **PC Test**

Certificate No: **D2450V2-797_Oct15**

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 797
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	October 21, 2015

BN ✓
11/03/15

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	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	US37292783	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	MY41092317	07-Oct-15 (No. 217-02223)	Oct-16
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe EX3DV4	SN: 7349	30-Dec-14 (No. EX3-7349_Dec14)	Dec-15
DAE4	SN: 601	17-Aug-15 (No. DAE4-601_Aug15)	Aug-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100972	15-Jun-15 (in house check Jun-15)	In house check: Jun-18
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

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

Issued: October 22, 2015

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.0 ± 6 %	1.84 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	**52.7 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.4 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	52.8 ± 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	13.0 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**51.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.08 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**24.2 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.1 Ω + 6.0 jΩ
Return Loss	- 21.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.8 Ω + 9.3 jΩ
Return Loss	- 20.7 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: 21.10.2015

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.84 S/m; ε_r = 38; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

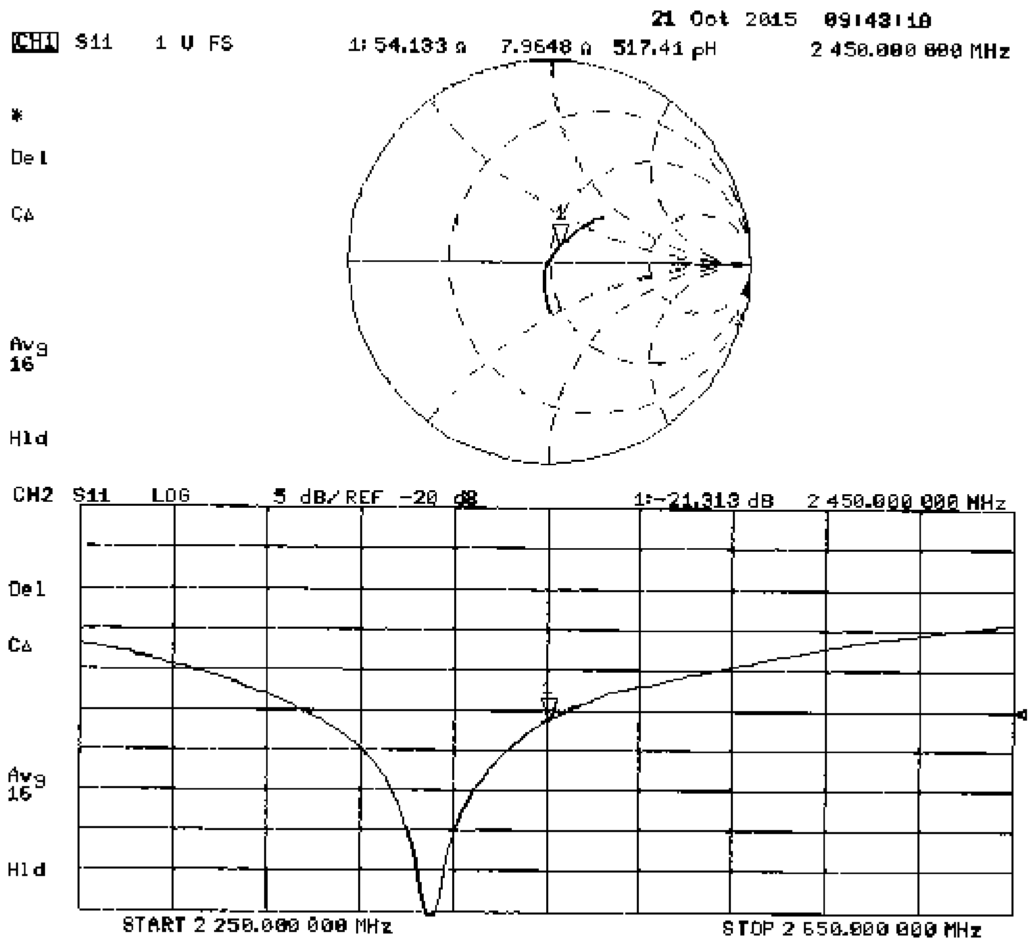
- Probe: EX3DV4 - SN7349; ConvF(7.67, 7.67, 7.67); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 17.08.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 114.6 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 27.8 W/kg
SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.17 W/kg
Maximum value of SAR (measured) = 22.3 W/kg

0 dB = 22.3 W/kg = 13.48 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 21.10.2015

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.99 S/m; ε_r = 52.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

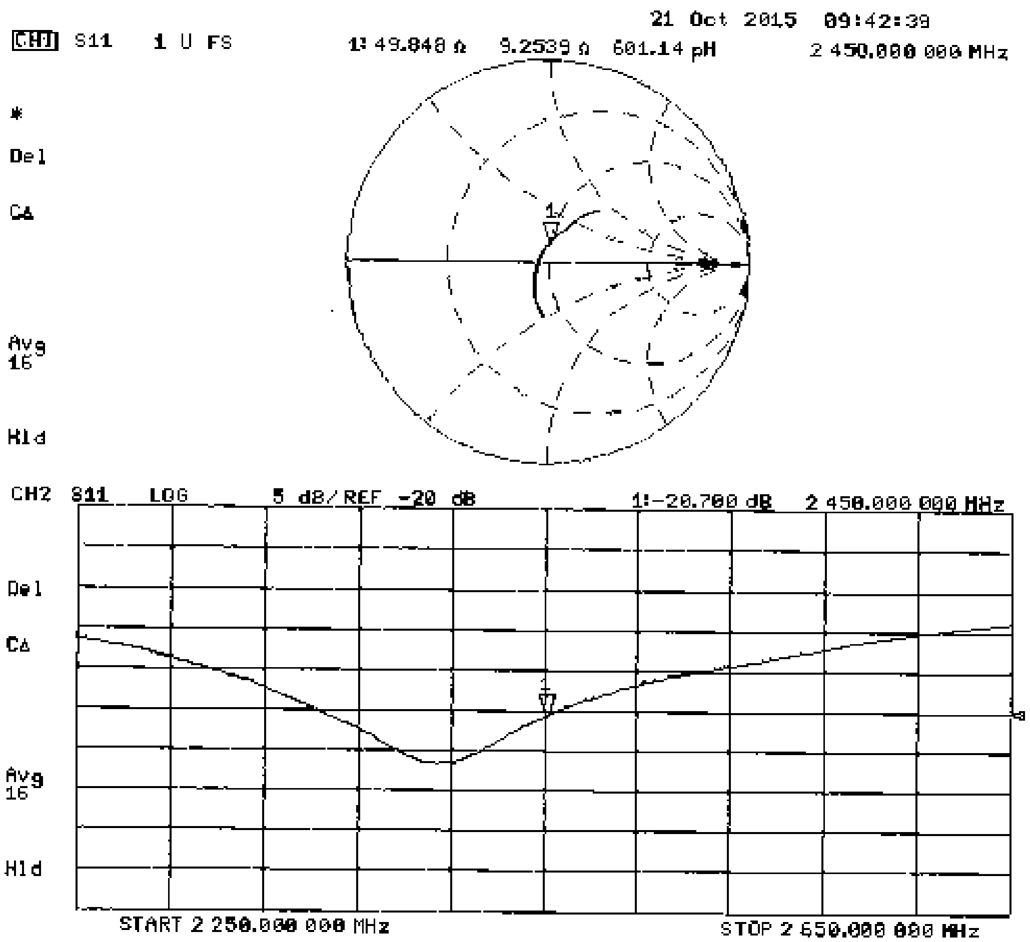
DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(7.53, 7.53, 7.53); Calibrated: 30.12.2014;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 17.08.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

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 = 108.1 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 25.8 W/kg
SAR(1 g) = 13 W/kg; SAR(10 g) = 6.08 W/kg
Maximum value of SAR (measured) = 21.2 W/kg

0 dB = 21.2 W/kg = 13.26 dBW/kg

Impedance Measurement Plot for Body TSL



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S Swiss Calibration Service

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

Accreditation No.: SCS 0108

Client **PC Test**

Certificate No: D2450V2-882_Feb15

CALIBRATION CERTIFICATE

Object	D2450V2 - SN:882
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	February 18, 2015

PM √
3/6/15

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	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	US37292783	07-Oct-14 (No. 217-02020)	Oct-15
Power sensor HP 8481A	MY41092317	07-Oct-14 (No. 217-02021)	Oct-15
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-14 (No. ES3-3205_Dec14)	Dec-15
DAE4	SN: 601	18-Aug-14 (No. DAE4-601_Aug14)	Aug-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-14)	In house check: Oct-15

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 18, 2015

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.2 ± 6 %	1.87 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	**52.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.16 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.3 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.7 ± 6 %	2.04 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.0 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**50.7 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.97 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.5 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.8 Ω - 0.2 jΩ
Return Loss	- 31.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.4 Ω + 1.9 jΩ
Return Loss	- 34.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.156 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, 2011

DASY5 Validation Report for Head TSL

Date: 18.02.2015

Test Laboratory: SPEAG, Zurich, Switzerland

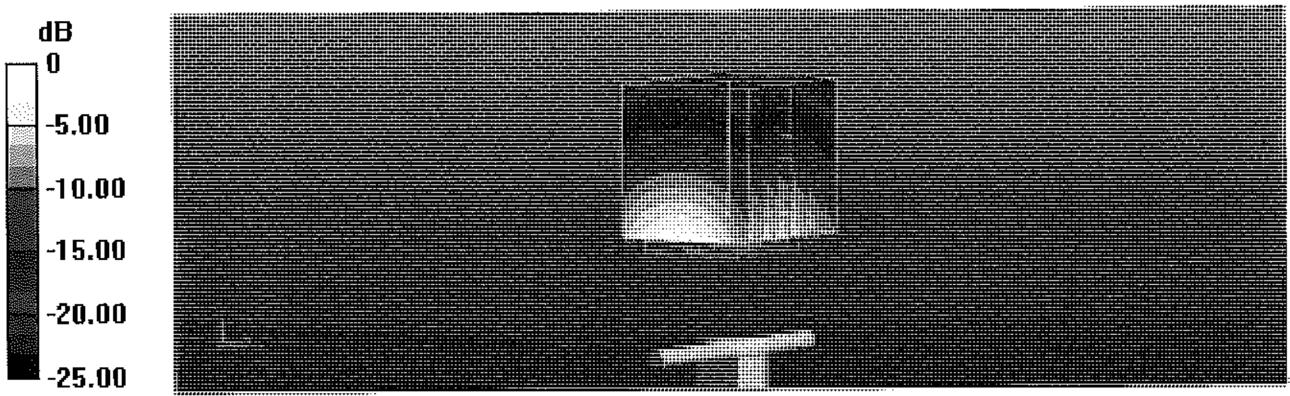
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:882

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.87 S/m; ε_r = 38.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

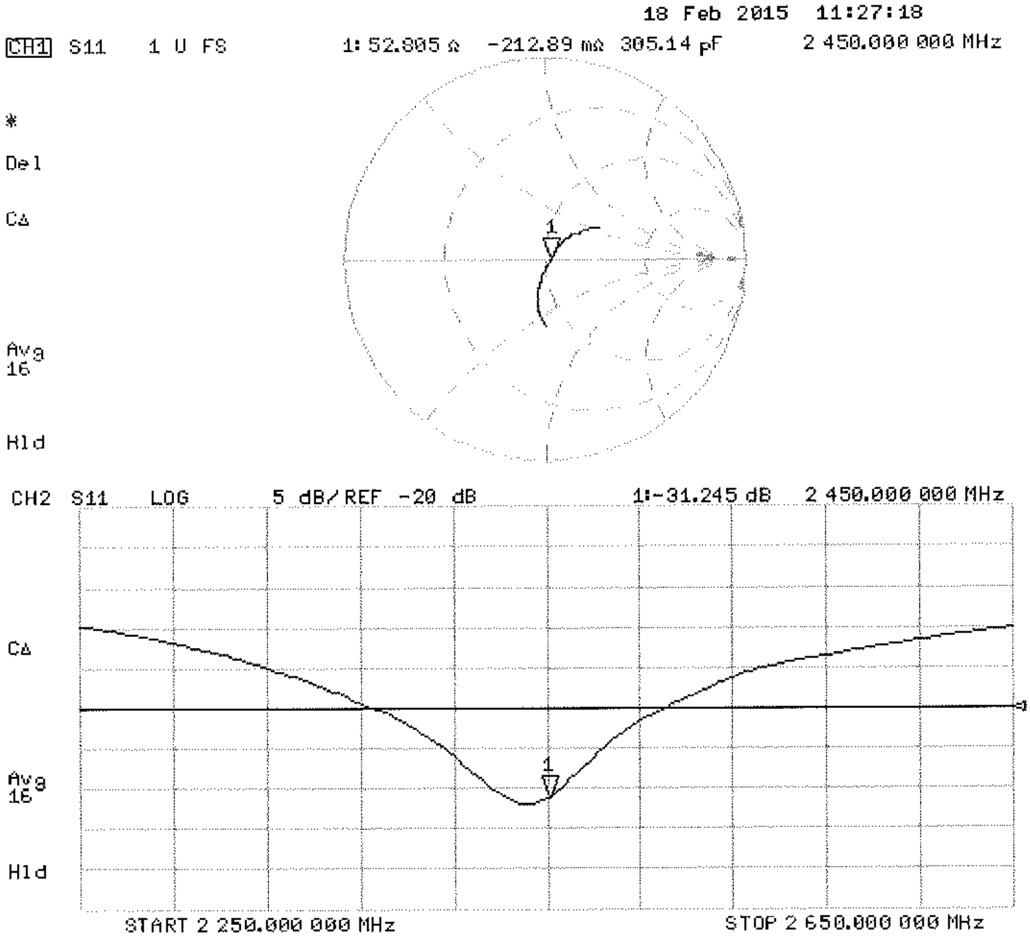
- Probe: ES3DV3 - SN3205; ConvF(4.54, 4.54, 4.54); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Head Tissue - ES Probe/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.95 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 27.9 W/kg
SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.16 W/kg
Maximum value of SAR (measured) = 17.3 W/kg



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

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 18.02.2015

Test Laboratory: SPEAG, Zurich, Switzerland

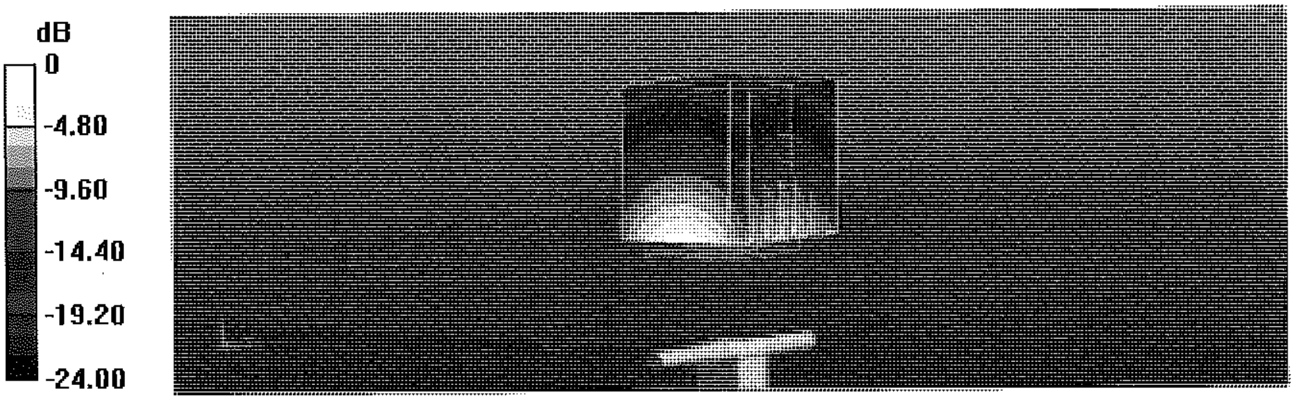
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:882

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.04 S/m; ε_r = 51.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

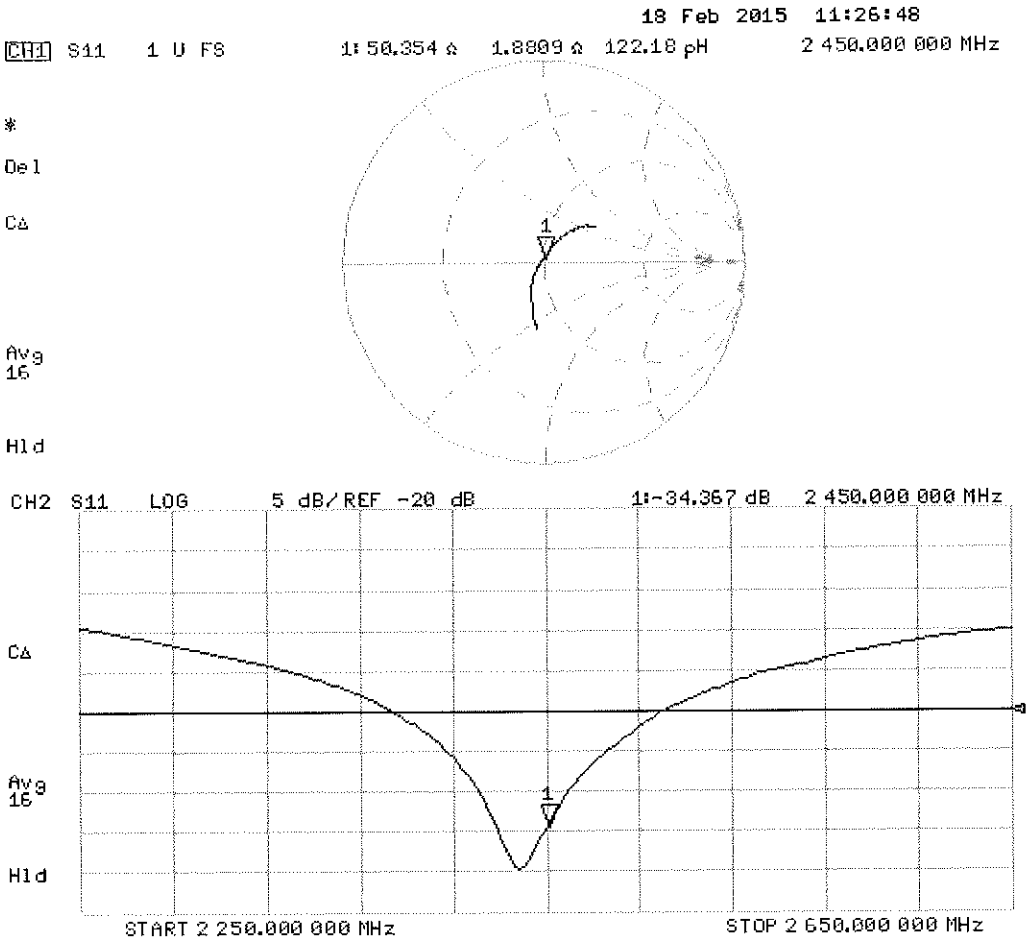
- Probe: ES3DV3 - SN3205; ConvF(4.32, 4.32, 4.32); Calibrated: 30.12.2014;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 18.08.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Dipole Calibration for Body Tissue - ES Probe/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.16 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 27.2 W/kg
SAR(1 g) = 13 W/kg; SAR(10 g) = 5.97 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 Body TSL



APPENDIX D: SAR TISSUE SPECIFICATIONS

Measurement Procedure for Tissue Verification:

1) The network analyzer and probe system was configured and calibrated.
2) The probe was immersed in the tissue. The tissue was placed in a nonmetallic container. Trapped air bubbles beneath the flange were minimized by placing the probe at a slight angle.
3) The complex admittance with respect to the probe aperture was measured
4) The complex relative permittivity ε' can be calculated from the below equation (Pournaropoulos and Misra):

$$Y = \frac{j2\omega\varepsilon_r\varepsilon_0}{[\ln(b/a)]^2}\int_a^b\int_a^b\int_0^\pi \cos\phi' \frac{\exp\left[-j\omega r(\mu_0\varepsilon_r'\varepsilon_0)^{1/2}\right]}{r}\, d\phi' d\rho' d\rho$$

where Y is the admittance of the probe in contact with the sample, the primed and unprimed coordinates refer to source and observation points, respectively, $r^2 = \rho^2 + \rho'^2 - 2\rho\rho'\cos\phi'$, ω is the angular frequency, and $j = \sqrt{-1}$.

Table D- 1
Composition of the Tissue Equivalent Matter

Frequency (MHz)	835	835	1900	1900	2450	2450
Tissue	Head	Body	Head	Body	Head	Body
Ingredients (% by weight)						
Bactericide	0.1	0.1			See page 2	
DGBE			44.92	29.44		26.7
HEC	1	1				
NaCl	1.45	0.94	0.18	0.39		0.1
Sucrose	57	44.9				
Water	40.45	53.06	54.9	70.17		73.2

2 Composition / Information on ingredients

The Item is composed of the following ingredients:

H2O	Water, 52 – 75%
C8H18O3	Diethylene glycol monobutyl ether (DGBE), 25 – 48% (CAS-No. 112-34-5, EC-No. 203-961-6, EC-index-No. 603-096-00-8) Relevant for safety; Refer to the respective Safety Data Sheet*.
NaCl	Sodium Chloride, <1.0%

Figure D-1
Composition of 2.4 GHz Head Tissue Equivalent Matter

Note: 2.4 GHz head liquid recipes are proprietary SPEAG. Since the composition is approximate to the actual liquids utilized, the manufacturer tissue-equivalent liquid data sheets are provided below.

Measurement Certificate / Material Test

Item Name	**Head Tissue Simulating Liquid (HSL2450V2)**
Product No.	SL AAH 245 BA (Charge: 150206-3)
Manufacturer	SPEAG

Measurement Method
TSL dielectric parameters measured using calibrated OCP probe.

Setup Validation
Validation results were within ± 2.5% towards the target values of Methanol.

Target Parameters
Target parameters as defined in the IEEE 1528 and IEC 62209 compliance standards.

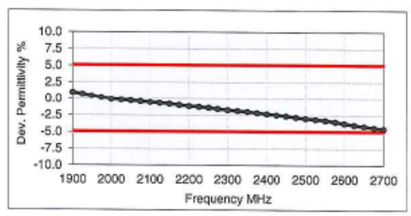
Test Condition

Ambient	Environment temperatur (22 ± 3)°C and humidity < 70%.
TSL Temperature	23°C
Test Date	11-Feb-15
Operator	IEN

Additional Information

TSL Density	0.988 g/cm^3
TSL Heat-capacity	3.680 kJ/(kg*K)

	Measured			Target		Diff.to Target [%]	
f [MHz]	HP-e'	HP-e"	sigma	eps	sigma	Δ-eps	Δ-sigma
1900	40.4	11.89	1.26	40.0	1.40	1.0	-10.2
1925	40.3	11.98	1.28	40.0	1.40	0.7	-8.3
1950	40.2	12.07	1.31	40.0	1.40	0.4	-6.4
1975	40.1	12.15	1.34	40.0	1.40	0.2	-4.6
2000	40.0	12.23	1.36	40.0	1.40	-0.1	-2.8
2025	39.9	12.32	1.39	40.0	1.42	-0.2	-2.4
2050	39.8	12.41	1.42	39.9	1.44	-0.3	-2.0
2075	39.7	12.50	1.44	39.9	1.47	-0.4	-1.6
2100	39.6	12.59	1.47	39.8	1.49	-0.5	-1.2
2125	39.5	12.66	1.50	39.8	1.51	-0.7	-0.9
2150	39.4	12.73	1.52	39.7	1.53	-0.8	-0.7
2175	39.3	12.83	1.55	39.7	1.56	-0.9	-0.2
2200	39.2	12.92	1.58	39.6	1.58	-1.1	0.2
2225	39.1	13.00	1.61	39.6	1.60	-1.2	0.6
2250	39.0	13.08	1.64	39.6	1.62	-1.3	0.9
2275	38.9	13.17	1.67	39.5	1.64	-1.5	1.4
2300	38.8	13.26	1.70	39.5	1.67	-1.7	1.8
2325	38.7	13.34	1.73	39.4	1.69	-1.8	2.2
2350	38.6	13.42	1.75	39.4	1.71	-2.0	2.5
2375	38.5	13.50	1.78	39.3	1.73	-2.1	2.9
2400	38.4	13.58	1.81	39.3	1.76	-2.3	3.3
2425	38.3	13.65	1.84	39.2	1.78	-2.4	3.6
2450	38.2	13.73	1.87	39.2	1.80	-2.6	3.9
2475	38.1	13.80	1.90	39.2	1.83	-2.8	4.0
2500	38.0	13.87	1.93	39.1	1.85	-3.0	4.0
2525	37.9	13.90	1.95	39.1	1.88	-3.1	3.8
2550	37.8	13.93	1.98	39.1	1.91	-3.2	3.5
2575	37.7	14.05	2.01	39.0	1.94	-3.5	4.0
2600	37.6	14.17	2.05	39.0	1.96	-3.7	4.4
2625	37.4	14.23	2.08	39.0	1.99	-3.9	4.4
2650	37.3	14.29	2.11	38.9	2.02	-4.1	4.4
2675	37.2	14.37	2.14	38.9	2.05	-4.3	4.6
2700	37.1	14.45	2.17	38.9	2.07	-4.5	4.7



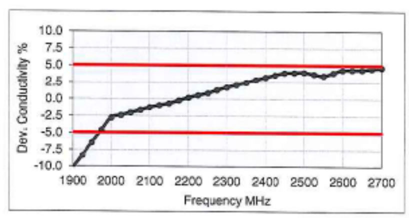


Figure D-2
2.4 GHz Head Tissue Equivalent Matter

APPENDIX E: SAR SYSTEM VALIDATION

Per FCC KDB 865664 D02, SAR system validation status should be documented to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue- equivalent media for system validation, according to the procedures outlined in FCC KDB 865664 D01 and IEEE 1528-2013. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

A tabulated summary of the system validation status including the validation date(s), measurement frequencies, SAR probes and tissue dielectric parameters has been included.

Table E- 1
SAR System Validation Summary

SAR SYSTEM #	FREQ. [MHz]	DATE	PROBE SN	PROBE TYPE	PROBE CAL. POINT		COND.	PERM.	CW VALIDATION			MOD. VALIDATION		
							(σ)	(εr)	SENSITIVITY	PROBE LINEARITY	PROBE ISOTROPY	MOD. TYPE	DUTY FACTOR	PAR
A	835	10/21/2015	3332	ES3DV3	835	Head	0.932	41.247	PASS	PASS	PASS	GMSK	PASS	N/A
I	1900	11/4/2015	3333	ES3DV3	1900	Head	1.440	39.391	PASS	PASS	PASS	GMSK	PASS	N/A
I	2450	11/16/2015	3333	ES3DV3	2450	Head	1.862	39.522	PASS	PASS	PASS	OFDM/TDD	PASS	PASS
H	2450	7/20/2015	3263	ES3DV3	2450	Head	1.845	38.994	PASS	PASS	PASS	OFDM/TDD	PASS	PASS
H	835	7/22/2015	3263	ES3DV3	835	Body	0.992	53.114	PASS	PASS	PASS	GMSK	PASS	N/A
C	1900	10/6/2015	3288	ES3DV3	1900	Body	1.555	51.090	PASS	PASS	PASS	GMSK	PASS	N/A
C	2450	10/7/2015	3288	ES3DV3	2450	Body	2.047	50.488	PASS	PASS	PASS	OFDM/TDD	PASS	PASS
D	2450	11/25/2015	3209	ES3DV3	2450	Body	1.974	50.939	PASS	PASS	PASS	OFDM/TDD	PASS	PASS

NOTE: While the probes have been calibrated for both CW and modulated signals, all measurements were performed using communication systems calibrated for CW signals only. Modulations in the table above represent test configurations for which the measurement system has been validated per FCC KDB Publication 865664 D01 for scenarios when CW probe calibrations are used with other signal types. SAR systems were validated for modulated signals with a periodic duty cycle, such as GMSK, or with a high peak to average ratio (>5 dB), such as OFDM according to FCC KDB Publication 865664 D01.