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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:
06/16/14 - 06/26/14
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Document Serial No.:
0Y1406171285-R3.ZNF

FCC ID: **ZNFUS990**

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-US990, LGUS990, US990, LG-AS990, AS990, LGAS990

Equipment Class	Band & Mode	Tx Frequency	SAR		
			1 gm Head (W/kg)	1 gm Body-Worn (W/kg)	1 gm Wireless Router (W/kg)
PCE	Cell. CDMA/EVDO	824.70 - 848.31 MHz	0.43	0.46	0.62
PCE	PCS CDMA/EVDO	1851.25 - 1908.75 MHz	0.37	0.82	0.85
PCE	LTE Band 12	699.7 - 715.3 MHz	0.30	0.46	0.66
PCE	LTE Band 5 (Cell)	824.7 - 848.3 MHz	0.32	0.50	0.53
PCE	LTE Band 4 (AWS)	1710.7 - 1754.3 MHz	0.28	0.71	0.71
PCE	LTE Band 25 (PCS)	1850.7 - 1914.3 MHz	0.24	0.66	0.66
DTS	2.4 GHz WLAN	2412 - 2462 MHz	0.18	0.11	0.11
DTS/NII	5.8 GHz WLAN	5745 - 5825 MHz	0.18	0.18	0.18
NII	5.2 GHz WLAN	5180 - 5240 MHz	0.40	0.21	
NII	5.3 GHz WLAN	5260 - 5320 MHz	0.36	0.19	
NII	5.5 GHz WLAN	5500 - 5700 MHz	0.22	0.14	
DSS/DTS	Bluetooth	2402 - 2480 MHz	N/A		
Simultaneous SAR per KDB 690783 D01v01r02:			0.78	1.03	1.01

This revised Test Report (S/N: 0Y1406171285-R3.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 0 of this report; for North American frequency bands only.

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

Randy Ortanez
President

ACCREDITED
TESTING CERT#2041.01

TABLE OF CONTENTS

1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
Cell. CDMA/EVDO	Voice/Data	824.70 - 848.31 MHz
PCS CDMA/EVDO	Voice/Data	1851.25 - 1908.75 MHz
LTE Band 17	Data	706.5 - 713.5 MHz
LTE Band 12	Data	699.7 - 715.3 MHz
LTE Band 5 (Cell)	Data	824.7 - 848.3 MHz
LTE Band 4 (AWS)	Data	1710.7 - 1754.3 MHz
LTE Band 25 (PCS)	Data	1850.7 - 1914.3 MHz
LTE Band 2 (PCS)	Data	1850.7 - 1909.3 MHz
2.4 GHz WLAN	Data	2412 - 2462 MHz
5.8 GHz WLAN	Data	5745 - 5825 MHz
5.2 GHz WLAN	Data	5180 - 5240 MHz
5.3 GHz WLAN	Data	5260 - 5320 MHz
5.5 GHz WLAN	Data	5500 - 5700 MHz
Bluetooth	Data	2402 - 2480 MHz
NFC	Data	13.56 MHz

1.2 Nominal and Maximum Output Power Specifications

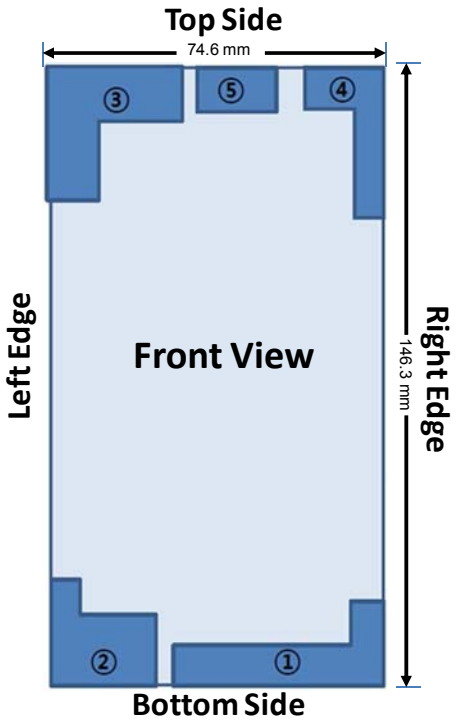
This device operates using the following maximum and nominal output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB Publication 447498 D01v05.

Mode / Band		Modulated Average (dBm)
Cell. CDMA/EVDO	Maximum	**25.7**
	Nominal	**25.2**
PCS CDMA/EVDO	Maximum	**25.2**
	Nominal	**24.7**

Mode / Band		Modulated Average (dBm)
LTE Band 12	Maximum	**24.7**
	Nominal	**24.2**
LTE Band 5 (Cell)	Maximum	**24.7**
	Nominal	**24.2**
LTE Band 4 (AWS)	Maximum	**24.7**
	Nominal	**24.2**
LTE Band 25 (PCS)	Maximum	**24.2**
	Nominal	**23.7**

Mode / Band		Modulated Average (dBm)
IEEE 802.11b (2.4 GHz)	Maximum	**16.0**
	Nominal	**15.0**
IEEE 802.11g (2.4 GHz)	Maximum	**13.0**
	Nominal	**12.0**
IEEE 802.11n (2.4 GHz)	Maximum	**12.0**
	Nominal	**11.0**
IEEE 802.11ac (2.4 GHz)	Maximum	**11.0**
	Nominal	**10.0**
IEEE 802.11a (5 GHz)	Maximum	**13.0**
	Nominal	**12.0**
IEEE 802.11n (5 GHz HT20)	Maximum	**12.0**
	Nominal	**11.0**
IEEE 802.11n (5 GHz HT40)	Maximum	**10.0**
	Nominal	**9.0**
IEEE 802.11ac (5 GHz)	Maximum	**10.0**
	Nominal	**9.0**
Bluetooth	Maximum	**9.5**
	Nominal	**8.5**
Bluetooth LE	Maximum	**7.0**
	Nominal	**6.0**

1.3 DUT Antenna Locations



Antenna Legend

1. Antenna 1
    1. CDMA BC0/BC1 (Tx/Rx)
    2. LTE Band 2/25/5 (Tx/Rx)
    3. LTE Band 4 (Rx Only)
2. Antenna 2
    1. LTE Bands 4 (Tx only)
    2. LTE Bands 12/17 (Tx/Rx)
3. Antenna 3
    1. LTE Bands 5/2/25/4/12/17 (2nd Rx)
4. Antenna 4
    1. GPS (Rx Only)
5. Antenna 5
    1. 2.4 GHz Bluetooth (Tx/Rx)
    2. 2.4 GHz WiFi (Tx/Rx)
    3. 5 GHz WiFi (Tx/Rx)

Figure 1-1
DUT Antenna Locations

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

1.4 Near Field Communications (NFC) Antenna

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

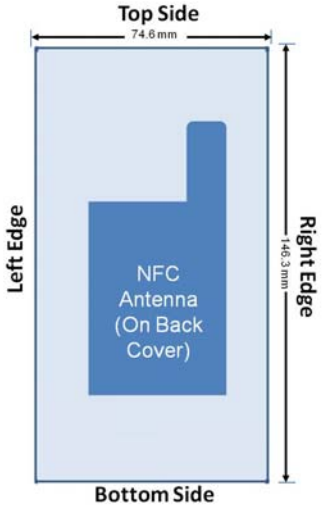


Figure 1-2
NFC Antenna Locations

Table 1-1
Wireless Router Sides for SAR Testing

Mode	Back	Front	Top	Bottom	Right	Left
Cell. EVDO	Yes	Yes	No	Yes	Yes	No
PCS EVDO	Yes	Yes	No	Yes	Yes	No
LTE Band 12	Yes	Yes	No	Yes	No	Yes
LTE Band 5 (Cell)	Yes	Yes	No	Yes	Yes	No
LTE Band 4 (AWS)	Yes	Yes	No	Yes	No	Yes
LTE Band 25 (PCS)	Yes	Yes	No	Yes	Yes	No
2.4 GHz WLAN	Yes	Yes	Yes	No	Yes	No
5 GHz WLAN	Yes	Yes	Yes	No	Yes	No

Note:

1. Particular DUT edges were not required to be evaluated for Wireless Router SAR if the edges were greater than 2.5 cm from the transmitting antenna according to FCC KDB Publication 941225 D06v01 guidance, page 2.
2. 5 GHz WIFI Direct GO is supported in the 5 GHz DTS band only. The manufacturer expects 5 GHz DTS Wifi Direct GO may be used similar to wireless router usage. Therefore, 5 GHz DTS Wifi Direct GO was evaluated for SAR similar to wireless router SAR procedures in FCC KDB Publication 941225.

1.5 Simultaneous Transmission Capabilities

According to FCC KDB Publication 447498 D05v01, transmitters are considered to be transmitting simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds. Possible transmission paths for the DUT are shown in Figure 1-3 and are color-coded to indicate communication modes which share the same path. Modes which share the same transmission path cannot transmit simultaneously with one another.

Figure 1-3
Simultaneous Transmission Paths

This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis according to FCC KDB Publication 447498 D01v05 3) procedures.

Table 1-2
Simultaneous Transmission Scenarios

No.	Capable Transmit Configuration	Head	Body-Worn Accessory	Wireless Router
1	1x CDMA voice + 2.4 GHz WI-FI	Yes	Yes	N/A
2	1x CDMA voice + 5 GHz WI-FI	Yes	Yes	N/A
3	1x CDMA voice + 2.4 GHz Bluetooth	N/A	Yes	N/A
4	LTE + 2.4 GHz WI-FI	Yes*	Yes*	Yes
5	LTE + 5 GHz WI-FI	Yes*	Yes*	Yes
6	LTE + 2.4 GHz Bluetooth	N/A	Yes*	N/A
7	CDMA/EVDO data + 2.4 GHz WI-FI	Yes*	Yes*	Yes
8	CDMA/EVDO data + 5 GHz WI-FI	Yes*	Yes*	Yes
9	CDMA/EVDO data + 2.4 GHz Bluetooth	N/A	Yes*	N/A

1. (*) = for VOIP 3rd party applications possibly installed and used by the end-user.
2. UNII-1 support WIFI Direct GC only.
3. UNII-2A and UNII-2C does not support Hotspot and WIFI Direct.
4. UNII-3 support WIFI Direct GO/GC and Hotspot. (165channel does not support WIFI Direct GO/GC and WIFI Hotspot).
5. Per the manufacturer, WIFI Direct is expected to be used in conjunction with a held-to-ear or body-worn accessory voice call. Simultaneous transmission scenarios involving WIFI direct are specified above.

1.6 SAR Test Exclusions Applied

(A) WIFI/BT

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

5 GHz WIFI Direct GO is supported in the 5.8 GHz band only. The manufacturer expects 5.8 GHz WIFI Direct GO may be used similar to wireless router usage. Therefore, 5.8 GHz WIFI Direct GO was evaluated for SAR similar to wireless router SAR procedures in FCC KDB Publication 941225.

Per FCC KDB 447498 D01v05, the SAR exclusion threshold for distances <50mm is defined by the following equation:

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

Based on the maximum conducted power of Bluetooth (rounded to the nearest mW) and the antenna to user separation distance, Bluetooth SAR was not required; [(9/10)* √2.441] = 1.4< 3.0. Per KDB Publication 447498 D01v05, the maximum power of the channel was rounded to the nearest mW before calculation.

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

This device supports IEEE 802.11ac with the following features:

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

(B) Licensed Transmitter(s)

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

This Device additionally supports LTE B2. LTE Band 25 and LTE Band 2 share the same transmission path. LTE Band 2 was not evaluated for SAR since the supported frequency range falls within the LTE Band 25 supported frequency range.

This Device additionally supports LTE B17. LTE Band 12 and LTE Band 17 share the same transmission path. LTE Band 17 was not evaluated for SAR since the supported frequency range falls within the LTE Band 12 supported frequency range.

1.7 Power Reduction for SAR

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

Guidance Applied

- IEEE 1528-2003
- FCC KDB Publication 941225 D01-D06 (2G/3G/4G and Hotspot)
- FCC KDB Publication 248227 D01v01r02 (SAR Considerations for 802.11 Devices)
- FCC KDB Publication 447498 D01v05 (General SAR Guidance)
- FCC KDB Publication 865664 D01-D02 (SAR Measurements up to 6 GHz)
- FCC KDB Publication 648474 D03-D04 (Wireless Charging Cover)
- April 2013 TCB Workshop Notes (IEEE 802.11ac)

1.8 Wireless Charging Covers

This DUT may be used with a standard battery cover or with an optional wireless charging accessory: a folio sleeve accessory. The folio sleeve fits the back of the handset and extends to protect the front side of the device. Head tests were performed with the folio sleeve open and closed. Additional body-worn and hotspot tests were performed with the folio closed only because operations near the body with the folio open are not expected.

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

1.9 Device Serial Numbers

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

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	Head Serial Number	Body-Worn Serial Number	Wireless Router Serial Number
Cell. CDMA/EVDO	0699-0232	0699-0232	0699-0232
PCS CDMA/EVDO	0699-0232	0699-0232	0699-0232
LTE Band 12	0699-0233	0699-0233	0699-0233
LTE Band 5 (Cell)	0699-0233	0699-0233	0699-0233
LTE Band 4 (AWS)	0699-0233	0699-0233	0699-0233
LTE Band 25 (PCS)	0699-0233	0699-0233	0699-0233
2.4 GHz WLAN	0699-0234	0699-0234	0699-0234
5 GHz WLAN	0699-0234	0699-0234	0699-0234

2 LTE INFORMATION

LTE Information			
FCC ID	**ZNFUS990**		
Form Factor	Portable Handset		
Frequency Range of each LTE transmission band	LTE Band 17 (706.5 - 713.5 MHz)		
	LTE Band 12 (699.7 - 715.3 MHz)		
	LTE Band 5 (Cell) (824.7 - 848.3 MHz)		
	LTE Band 4 (AWS) (1710.7 - 1754.3 MHz)		
	LTE Band 2 (PCS) (1850.7 - 1909.3 MHz)		
	LTE Band 25 (PCS) (1850.7 - 1914.3 MHz)		
Channel Bandwidths	LTE Band 17: 5 MHz, 10 MHz		
	LTE Band 12: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz		
	LTE Band 5 (Cell): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz		
	LTE Band 4 (AWS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz		
	LTE Band 2 (PCS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz		
	LTE Band 25 (PCS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz		
Channel Numbers and Frequencies (MHz)	Low	Mid	High
LTE Band 17: 5 MHz	706.5 (23755)	710 (23790)	713.5 (23825)
LTE Band 17: 10 MHz	709 (23780)	710 (23790)	711 (23800)
LTE Band 12: 1.4 MHz	699.7 (23017)	707.5 (23095)	715.3 (23173)
LTE Band 12: 3 MHz	700.5 (23025)	707.5 (23095)	714.5 (23165)
LTE Band 12: 5 MHz	701.5 (23035)	707.5 (23095)	713.5 (23155)
LTE Band 12: 10 MHz	704 (23060)	707.5 (23095)	711 (23130)
LTE Band 5 (Cell): 1.4 MHz	824.7 (20407)	836.5 (20525)	848.3 (20643)
LTE Band 5 (Cell): 3 MHz	825.5 (20415)	836.5 (20525)	847.5 (20635)
LTE Band 5 (Cell): 5 MHz	826.5 (20425)	836.5 (20525)	846.5 (20625)
LTE Band 5 (Cell): 10 MHz	829 (20450)	836.5 (20525)	844 (20600)
LTE Band 4 (AWS): 1.4 MHz	1710.7 (19957)	1732.5 (20175)	1754.3 (20393)
LTE Band 4 (AWS): 3 MHz	1711.5 (19965)	1732.5 (20175)	1753.5 (20385)
LTE Band 4 (AWS): 5 MHz	1712.5 (19975)	1732.5 (20175)	1752.5 (20375)
LTE Band 4 (AWS): 10 MHz	1715 (20000)	1732.5 (20175)	1750 (20350)
LTE Band 4 (AWS): 15 MHz	1717.5 (20025)	1732.5 (20175)	1747.5 (20325)
LTE Band 4 (AWS): 20 MHz	1720 (20050)	1732.5 (20175)	1745 (20300)
LTE Band 2 (PCS): 1.4 MHz	1850.7 (18607)	1880 (18900)	1909.3 (19193)
LTE Band 2 (PCS): 3 MHz	1851.5 (18615)	1880 (18900)	1908.5 (19185)
LTE Band 2 (PCS): 5 MHz	1852.5 (18625)	1880 (18900)	1907.5 (19175)
LTE Band 2 (PCS): 10 MHz	1855 (18650)	1880 (18900)	1905 (19150)
LTE Band 2 (PCS): 15 MHz	1857.5 (18675)	1880 (18900)	1902.5 (19125)
LTE Band 2 (PCS): 20 MHz	1860 (18700)	1880 (18900)	1900 (19100)
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)
UE Category	3		
Modulations Supported in UL	QPSK, 16QAM		
LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3~6.2.5? (manufacturer attestation to be provided)	YES		
A-MPR (Additional MPR) disabled for SAR Testing?	YES		

3 INTRODUCTION

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

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

3.1 SAR Definition

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

Equation 3-1
SAR Mathematical Equation

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

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

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

where:

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

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

4 DOSIMETRIC ASSESSMENT

4.1 Measurement Procedure

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

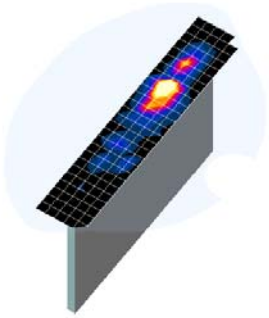

Figure 4-1
Sample SAR Area Scan

1. The SAR distribution at the exposed side of the head or body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head and body interface and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01v01 (See Table 4-1) and IEEE 1528-2013.
2. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during the 1g/10g cube evaluation. SAR at this fixed point was measured and used as a reference value.
3. Based on the area scan data, the peak of the region with maximum SAR was determined by spline interpolation. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB Publication 865664 D01v01 (See Table 4-1) and IEEE 1528-2013. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual online for more details):

   a. SAR values at the inner surface of the phantom are extrapolated from the measured values along the line away from the surface with spacing no greater than that in Table 4-1. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).

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

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

Table 4-1
Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01*

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

*Also compliant to IEEE 1528-2013 Table 6

5 DEFINITION OF REFERENCE POINTS

5.1 EAR REFERENCE POINT

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

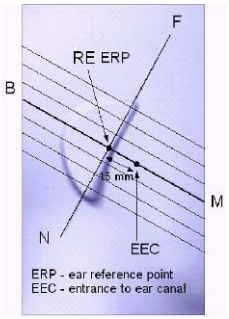

Figure 5-1
Close-Up Side view of ERP

5.2 HANDSET REFERENCE POINTS

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

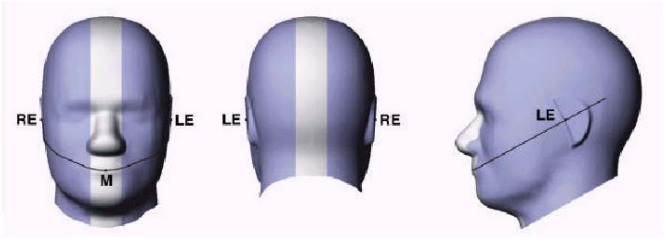

Figure 5-2
Front, back and side view of SAM Twin Phantom

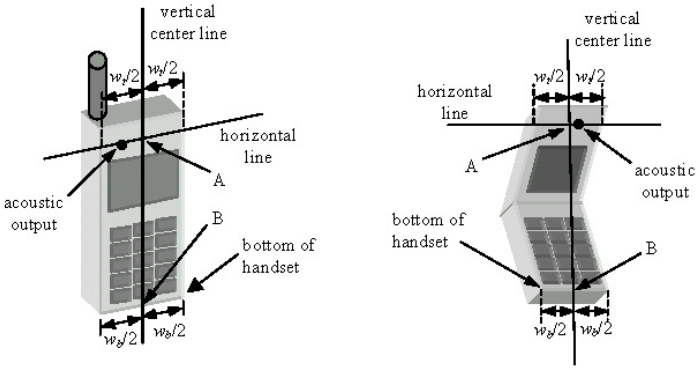

Figure 5-3
Handset Vertical Center & Horizontal Line Reference Points

6 TEST CONFIGURATION POSITIONS FOR HANDSETS

6.1 Device Holder

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

6.2 Positioning for Cheek

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

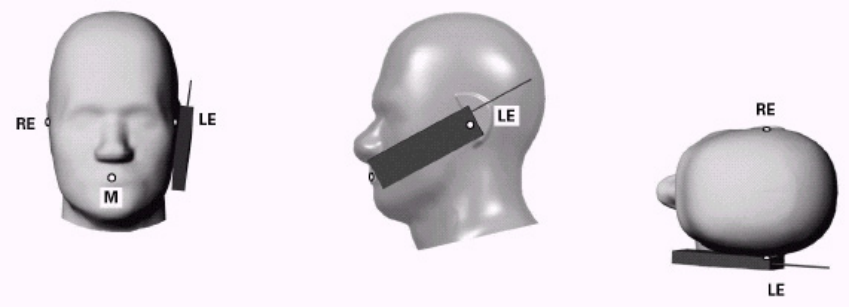

Figure 6-1 Front, Side and Top View of Cheek Position

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

6.3 Positioning for Ear / 15º Tilt

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

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

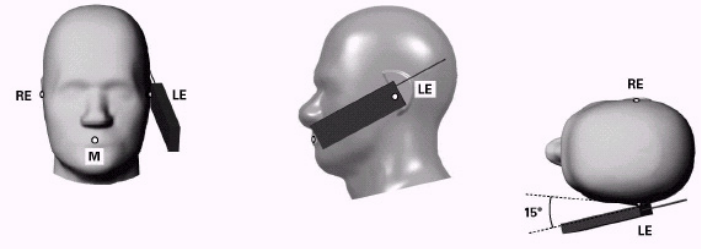

Figure 6-2 Front, Side and Top View of Ear/15º Tilt Position

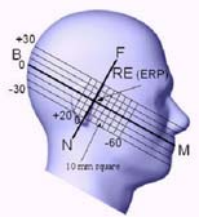

Figure 6-3
Side view w/ relevant markings

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

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

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

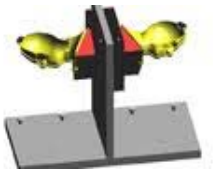

Figure 6-4 Twin SAM Chin20

6.5 Body-Worn Accessory Configurations

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

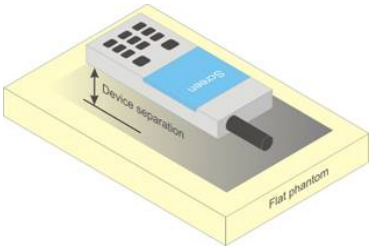

Figure 6-5
Sample Body-Worn Diagram

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

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

6.6 Extremity Exposure Configurations

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

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

6.7 Wireless Router Configurations

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

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

7 RF EXPOSURE LIMITS

7.1 Uncontrolled Environment

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

7.2 Controlled Environment

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

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

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

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

8 FCC MEASUREMENT PROCEDURES

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

8.1 Measured and Reported SAR

Per FCC KDB Publication 447498 D01v05, When SAR is not measured at the maximum power level allowed for production units, the results must be scaled to the maximum tune-up tolerance limit according to the power applied to the individual channels tested to determine compliance. For simultaneous transmission, the measured aggregate SAR must be scaled according to the sum of the differences between the maximum tune-up tolerance and actual power used to test each transmitter. When SAR is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as *reported* SAR. The highest *reported* SAR results are identified on the grant of equipment authorization according to procedures in KDB 690783 D01v01r02.

8.2 Procedures Used to Establish RF Signal for SAR

The following procedures are according to FCC KDB Publication 941225 D01 "SAR Measurement Procedures for 3G Devices" v02, October 2007.

The device was placed into a simulated call using a base station simulator in a RF shielded chamber. Establishing connections in this manner ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. Devices under test were evaluated prior to testing, with a fully charged battery and were configured to operate at maximum output power. In order to verify that the device was tested throughout the SAR test at maximum output power, the SAR measurement system measures a "point SAR" at an arbitrary reference point at the start and end of the 1 gram SAR evaluation, to assess for any power drifts during the evaluation. If the power drift deviated by more than 5%, the SAR test and drift measurements were repeated.

8.3 SAR Measurement Conditions for CDMA2000

The following procedures were performed according to FCC KDB Publication 941225 D01 "SAR Measurement Procedures for 3G Devices" v02, October 2007.

8.3.1 Output Power Verification

See 3GPP2 C.S0011/TIA-98-E as recommended by "SAR Measurement Procedures for 3G Devices" v02, October 2007. 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.

8.3.2 Head SAR Measurements

SAR for head exposure configurations is measured in RC3 with the DUT configured to transmit at full rate using Loopback Service Option SO55. SAR for RC1 is not required when the maximum average output of each channel is less than ¼ dB higher than that measured in RC3. Otherwise, SAR is measured on the maximum output channel in RC1 using the exposure configuration that results in the highest SAR for that channel in RC3.

Head SAR was additionally evaluated using EVDO Rev. A to support compliance for VoIP operations. See Section 8.3.4 for EVDO Rev. A configuration parameters.

8.3.3 Body SAR Measurements

SAR for body 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. SAR for multiple code channels (FCH + SCH_n) is not required when the maximum average output of each RF channel is less than ¼ dB higher than that measured with FCH only. Otherwise, SAR is measured on the maximum output channel (FCH + SCH_n) with FCH at full rate and SCH_0 enabled at 9600 bps using the exposure configuration that results in the highest SAR for that channel with FCH only. When multiple code channels are enabled, the DUT output may shift by more than 0.5 dB and lead to higher SAR drifts and SCH dropouts. Body SAR was measured using TDSO / SO32 with power control bits in the "All Up"

Body SAR in RC1 is not required when the maximum average output of each channel is less than ¼ dB higher than that measured in RC3. Otherwise, SAR is measured on the maximum output channel in RC1; with Loopback Service Option SO55, at full rate, using the body exposure configuration that results in the highest SAR for that channel in RC3.

8.3.4 Handsets with EVDO

For handsets with Ev-Do capabilities, when the maximum average output of each channel in Rev. 0 is less than ¼ dB higher than that measured in RC3 (1x RTT), body SAR for EV-DO is not required. Otherwise, SAR for Rev. 0 is measured on the maximum output channel at 153.6 kbps using the body exposure configuration that results in the highest SAR for that channel in RC3. SAR for Rev. A is not required when the maximum average output of each channel is less than that measured in Rev. 0 or less than ¼ dB higher than that measured in RC3. Otherwise, SAR is measured on the maximum output channel for Rev. A using a Reverse Data Channel payload size of 4096 bits and a Termination Target of 16 slots defined for Subtype 2 Physical Layer configurations. A Forward Traffic Channel data rate corresponding to the 2-slot version of 307.2 kbps with the ACK Channel transmitting in all slots would be configured in the downlink for both Rev. 0 and Rev. A.

8.3.5 Body SAR Measurements for EVDO Hotspot

Hotspot Body SAR is measured using Subtype 0/1 Physical Layer configurations for Rev. 0 per KDB Publication 941225 D01 procedures for "1x Ev-Do data Devices". SAR for Subtype 2 Physical layer configurations is not required for Rev. A when the maximum average output of each RF channels is less than that measured in Subtype 0/1 Physical layer configurations. Otherwise, SAR is measured on the maximum output channel for Rev. A using the exposure configuration that results in the highest SAR for the RF channels 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.

SAR is not required for 1x RTT for Ev-Do devices that also support 1x RTT voice and/or data operations, when the maximum average output of each channel is less than 1⁄4 dB higher than that measured in Subtype 0/1 Physical Layer configurations for Rev. 0. Otherwise, CDMA "Body-SAR Measurement" procedures for "CDMA 2000 1x Handsets" were applied.

8.4 SAR Measurement Conditions for LTE

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

8.4.1 Spectrum Plots for RB Configurations

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

8.4.2 MPR

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

8.4.3 A-MPR

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

8.4.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05v02r01:

a. Per Section 5.2.1, SAR is required for QPSK 1 RB Allocation for the largest bandwidth
   i. The required channel and offset combination with the highest maximum output power is required for SAR.
   ii. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required. Otherwise, SAR is required for the remaining required test channels using the RB offset configuration with highest output power for that channel.

iii. When the reported SAR for a required test channel is > 1.45 W/kg, SAR is required for all RB offset configurations for that channel.

b. Per Section 5.2.2, SAR is required for 50% RB allocation using the largest bandwidth following the same procedures outlined in Section 5.2.1.

c. Per Section 5.2.3, QPSK SAR is not required for the 100% allocation when the highest maximum output power for the 100% allocation is less than the highest maximum output power of the 1 RB and 50% RB allocations and the reported SAR for the 1 RB and 50% RB allocations is < 0.8 W/kg.

d. Per Section 5.2.4 and 5.3, SAR tests for higher order modulations and lower bandwidths configurations are not required when the conducted power of the required test configurations determined by Sections 5.2.1 through 5.2.3 is less than or equal to ½ dB higher than the equivalent configuration using QPSK modulation and when the QPSK SAR for those configurations is <1.45 W/kg.

8.5 SAR Testing with 802.11 Transmitters

Normal network operating configurations are not suitable for measuring the SAR of 802.11 a/b/g/n /ac transmitters. Unpredictable fluctuations in network traffic and antenna diversity conditions can introduce undesirable variations in SAR results. The SAR for these devices should be measured using chipset based test mode software to ensure the results are consistent and reliable. See KDB Publication 248227 D01v01r02 for more details.

8.5.1 General Device Setup

Chipset based test mode software is hardware dependent and generally varies among manufacturers. The device operating parameters established in test mode for SAR measurements must be identical to those programmed in production units, including output power levels, amplifier gain settings and other RF performance tuning parameters. The test frequencies should correspond to actual channel frequencies defined for domestic use. SAR for devices with switched diversity should be measured with only one antenna transmitting at a time during each SAR measurement, according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

8.5.2 Frequency Channel Configurations [24]

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

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

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

9 RF CONDUCTED POWERS

9.1 CDMA Conducted Powers

Band	Channel	Frequency	SO55 [dBm]	SO55 [dBm]	TDSO SO32 [dBm]	TDSO SO32 [dBm]	1x EvDO Rev. 0 [dBm]	1x EvDO Rev. A [dBm]
	F-RC	MHz	RC1	RC3	FCH+SCH	FCH	(RTAP)	(RETAP)
Cellular	1013	824.7	25.48	25.47	25.42	25.48	25.47	25.38
	384	836.52	25.49	25.46	25.47	25.55	25.52	25.44
	777	848.31	25.47	25.48	25.51	25.54	25.50	25.42
PCS	25	1851.25	25.13	25.16	25.12	25.15	25.19	25.13
	600	1880	25.10	25.17	25.13	25.16	25.20	25.18
	1175	1908.75	25.20	25.20	25.18	25.20	25.18	25.14

Note: RC1 is only applicable for IS-95 compatibility.

Per KDB Publication 941225 D01v02:

1. Head SAR was tested with SO55 RC3. SO55 RC1 was not required since the average output power was not more than 0.25 dB than the SO55 RC3 powers. Head SAR was additionally evaluated with EVDO Rev. A to determine compliance for held-to-ear VOIP operations.
2. Body-Worn SAR was tested with 1x RTT with TDSO / SO32 FCH Only. Ev-Do and TDSO / SO32 FCH+SCH SAR tests were not required since the average output power was not more than 0.25 dB higher than the TDSO / SO32 FCH only powers.
3. Hotspot SAR is measured using Subtype 0/1 Physical Layer configurations for Rev. 0. If the average output power of Subtype 2 for Rev. A is less than the Rev. 0 power levels, then Rev. A SAR is not required. Otherwise, SAR is measured on the maximum output channel for Rev. A using the exposure configuration that results in the highest SAR for that RF channel in Rev. 0. SAR is not required for 1x RTT for Ev-Do hotspot devices when the maximum average output of each channel is less than ¼ dB higher than that measured in Subtype 0/1 Physical Layer configurations for Rev. 0

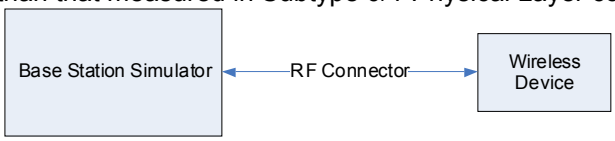

Figure 9-1
Power Measurement Setup

9.2 LTE Conducted Powers

9.2.1 LTE Band 12

Table 9-1
LTE Band 12 Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	707.5	23095	10	QPSK	1	0	24.51	0	0
	707.5	23095	10	QPSK	1	25	24.54	0	0
	707.5	23095	10	QPSK	1	49	**24.57**	0	0
	707.5	23095	10	QPSK	25	0	23.41	0-1	1
	707.5	23095	10	QPSK	25	12	23.35	0-1	1
	707.5	23095	10	QPSK	25	25	**23.47**	0-1	1
	707.5	23095	10	QPSK	50	0	23.44	0-1	1
	707.5	23095	10	16QAM	1	0	23.57	0-1	1
	707.5	23095	10	16QAM	1	25	23.61	0-1	1
	707.5	23095	10	16QAM	1	49	23.65	0-1	1
	707.5	23095	10	16QAM	25	0	22.35	0-2	2
	707.5	23095	10	16QAM	25	12	22.35	0-2	2
	707.5	23095	10	16QAM	25	25	22.39	0-2	2
	707.5	23095	10	16QAM	50	0	22.37	0-2	2

Note: LTE Band 12 at 10 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

Table 9-2
LTE Band 12 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	701.5	23035	5	QPSK	1	0	24.32	0	0
	701.5	23035	5	QPSK	1	12	24.41	0	0
	701.5	23035	5	QPSK	1	24	24.34	0	0
	701.5	23035	5	QPSK	12	0	23.50	0-1	1
	701.5	23035	5	QPSK	12	6	23.54	0-1	1
	701.5	23035	5	QPSK	12	13	23.54	0-1	1
	701.5	23035	5	QPSK	25	0	23.50	0-1	1
	701.5	23035	5	16-QAM	1	0	23.40	0-1	1
	701.5	23035	5	16-QAM	1	12	23.48	0-1	1
	701.5	23035	5	16-QAM	1	24	23.44	0-1	1
	701.5	23035	5	16-QAM	12	0	22.42	0-2	2
	701.5	23035	5	16-QAM	12	6	22.33	0-2	2
	701.5	23035	5	16-QAM	12	13	22.35	0-2	2
	701.5	23035	5	16-QAM	25	0	22.32	0-2	2
Mid	707.5	23095	5	QPSK	1	0	24.41	0	0
	707.5	23095	5	QPSK	1	12	24.45	0	0
	707.5	23095	5	QPSK	1	24	24.41	0	0
	707.5	23095	5	QPSK	12	0	23.39	0-1	1
	707.5	23095	5	QPSK	12	6	23.45	0-1	1
	707.5	23095	5	QPSK	12	13	23.49	0-1	1
	707.5	23095	5	QPSK	25	0	23.38	0-1	1
	707.5	23095	5	16-QAM	1	0	23.31	0-1	1
	707.5	23095	5	16-QAM	1	12	23.33	0-1	1
	707.5	23095	5	16-QAM	1	24	23.39	0-1	1
	707.5	23095	5	16-QAM	12	0	22.33	0-2	2
	707.5	23095	5	16-QAM	12	6	22.40	0-2	2
	707.5	23095	5	16-QAM	12	13	22.41	0-2	2
	707.5	23095	5	16-QAM	25	0	22.32	0-2	2
High	713.5	23155	5	QPSK	1	0	24.15	0	0
	713.5	23155	5	QPSK	1	12	24.11	0	0
	713.5	23155	5	QPSK	1	24	24.16	0	0
	713.5	23155	5	QPSK	12	0	23.47	0-1	1
	713.5	23155	5	QPSK	12	6	23.33	0-1	1
	713.5	23155	5	QPSK	12	13	23.50	0-1	1
	713.5	23155	5	QPSK	25	0	23.49	0-1	1
	713.5	23155	5	16-QAM	1	0	23.32	0-1	1
	713.5	23155	5	16-QAM	1	12	23.23	0-1	1
	713.5	23155	5	16-QAM	1	24	23.26	0-1	1
	713.5	23155	5	16-QAM	12	0	22.34	0-2	2
	713.5	23155	5	16-QAM	12	6	22.23	0-2	2
	713.5	23155	5	16-QAM	12	13	22.30	0-2	2
	713.5	23155	5	16-QAM	25	0	22.33	0-2	2

Table 9-3
LTE Band 12 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	700.5	23025	3	QPSK	1	0	24.27	0	0
	700.5	23025	3	QPSK	1	7	24.45	0	0
	700.5	23025	3	QPSK	1	14	24.40	0	0
	700.5	23025	3	QPSK	8	0	23.51	0-1	1
	700.5	23025	3	QPSK	8	4	23.53	0-1	1
	700.5	23025	3	QPSK	8	7	23.55	0-1	1
	700.5	23025	3	QPSK	15	0	23.52	0-1	1
	700.5	23025	3	16-QAM	1	0	23.58	0-1	1
	700.5	23025	3	16-QAM	1	7	23.69	0-1	1
	700.5	23025	3	16-QAM	1	14	23.65	0-1	1
	700.5	23025	3	16-QAM	8	0	22.29	0-2	2
	700.5	23025	3	16-QAM	8	4	22.30	0-2	2
	700.5	23025	3	16-QAM	8	7	22.32	0-2	2
	700.5	23025	3	16-QAM	15	0	22.40	0-2	2
Mid	707.5	23095	3	QPSK	1	0	24.47	0	0
	707.5	23095	3	QPSK	1	7	24.50	0	0
	707.5	23095	3	QPSK	1	14	24.44	0	0
	707.5	23095	3	QPSK	8	0	23.38	0-1	1
	707.5	23095	3	QPSK	8	4	23.46	0-1	1
	707.5	23095	3	QPSK	8	7	23.49	0-1	1
	707.5	23095	3	QPSK	15	0	23.44	0-1	1
	707.5	23095	3	16-QAM	1	0	23.60	0-1	1
	707.5	23095	3	16-QAM	1	7	23.63	0-1	1
	707.5	23095	3	16-QAM	1	14	23.55	0-1	1
	707.5	23095	3	16-QAM	8	0	22.22	0-2	2
	707.5	23095	3	16-QAM	8	4	22.27	0-2	2
	707.5	23095	3	16-QAM	8	7	22.30	0-2	2
	707.5	23095	3	16-QAM	15	0	22.37	0-2	2
High	714.5	23165	3	QPSK	1	0	24.43	0	0
	714.5	23165	3	QPSK	1	7	24.49	0	0
	714.5	23165	3	QPSK	1	14	24.44	0	0
	714.5	23165	3	QPSK	8	0	23.45	0-1	1
	714.5	23165	3	QPSK	8	4	23.53	0-1	1
	714.5	23165	3	QPSK	8	7	23.44	0-1	1
	714.5	23165	3	QPSK	15	0	23.42	0-1	1
	714.5	23165	3	16-QAM	1	0	23.42	0-1	1
	714.5	23165	3	16-QAM	1	7	23.43	0-1	1
	714.5	23165	3	16-QAM	1	14	23.48	0-1	1
	714.5	23165	3	16-QAM	8	0	22.27	0-2	2
	714.5	23165	3	16-QAM	8	4	22.24	0-2	2
	714.5	23165	3	16-QAM	8	7	22.22	0-2	2
	714.5	23165	3	16-QAM	15	0	22.28	0-2	2

Table 9-4
LTE Band 12 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	699.7	23017	1.4	QPSK	1	0	24.57	0	0
	699.7	23017	1.4	QPSK	1	2	24.62	0	0
	699.7	23017	1.4	QPSK	1	5	24.69	0	0
	699.7	23017	1.4	QPSK	3	0	24.43	0	0
	699.7	23017	1.4	QPSK	3	2	24.45	0	0
	699.7	23017	1.4	QPSK	3	3	24.52	0	0
	699.7	23017	1.4	QPSK	6	0	23.58	0-1	1
	699.7	23017	1.4	16-QAM	1	0	23.23	0-1	1
	699.7	23017	1.4	16-QAM	1	2	23.20	0-1	1
	699.7	23017	1.4	16-QAM	1	5	23.21	0-1	1
	699.7	23017	1.4	16-QAM	3	0	23.40	0-1	1
	699.7	23017	1.4	16-QAM	3	2	23.39	0-1	1
	699.7	23017	1.4	16-QAM	3	3	23.41	0-1	1
	699.7	23017	1.4	16-QAM	6	0	22.50	0-2	2
Mid	707.5	23095	1.4	QPSK	1	0	24.45	0	0
	707.5	23095	1.4	QPSK	1	2	24.42	0	0
	707.5	23095	1.4	QPSK	1	5	24.49	0	0
	707.5	23095	1.4	QPSK	3	0	24.33	0	0
	707.5	23095	1.4	QPSK	3	2	24.39	0	0
	707.5	23095	1.4	QPSK	3	3	24.51	0	0
	707.5	23095	1.4	QPSK	6	0	23.53	0-1	1
	707.5	23095	1.4	16-QAM	1	0	23.39	0-1	1
	707.5	23095	1.4	16-QAM	1	2	23.42	0-1	1
	707.5	23095	1.4	16-QAM	1	5	23.49	0-1	1
	707.5	23095	1.4	16-QAM	3	0	23.29	0-1	1
	707.5	23095	1.4	16-QAM	3	2	23.34	0-1	1
	707.5	23095	1.4	16-QAM	3	3	23.35	0-1	1
	707.5	23095	1.4	16-QAM	6	0	22.34	0-2	2
High	715.3	23173	1.4	QPSK	1	0	24.42	0	0
	715.3	23173	1.4	QPSK	1	2	24.37	0	0
	715.3	23173	1.4	QPSK	1	5	24.38	0	0
	715.3	23173	1.4	QPSK	3	0	24.42	0	0
	715.3	23173	1.4	QPSK	3	2	24.39	0	0
	715.3	23173	1.4	QPSK	3	3	24.38	0	0
	715.3	23173	1.4	QPSK	6	0	23.50	0-1	1
	715.3	23173	1.4	16-QAM	1	0	23.29	0-1	1
	715.3	23173	1.4	16-QAM	1	2	23.27	0-1	1
	715.3	23173	1.4	16-QAM	1	5	23.32	0-1	1
	715.3	23173	1.4	16-QAM	3	0	23.31	0-1	1
	715.3	23173	1.4	16-QAM	3	2	23.28	0-1	1
	715.3	23173	1.4	16-QAM	3	3	23.35	0-1	1
	715.3	23173	1.4	16-QAM	6	0	22.25	0-2	2

9.2.2 LTE Band 5 (Cell)

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

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	836.5	20525	10	QPSK	1	0	**24.69**	0	0
	836.5	20525	10	QPSK	1	25	24.68	0	0
	836.5	20525	10	QPSK	1	49	24.62	0	0
	836.5	20525	10	QPSK	25	0	23.69	0-1	1
	836.5	20525	10	QPSK	25	12	23.68	0-1	1
	836.5	20525	10	QPSK	25	25	**23.70**	0-1	1
	836.5	20525	10	QPSK	50	0	23.69	0-1	1
	836.5	20525	10	16QAM	1	0	23.64	0-1	1
	836.5	20525	10	16QAM	1	25	23.67	0-1	1
	836.5	20525	10	16QAM	1	49	23.64	0-1	1
	836.5	20525	10	16QAM	25	0	22.54	0-2	2
	836.5	20525	10	16QAM	25	12	22.47	0-2	2
	836.5	20525	10	16QAM	25	25	22.51	0-2	2
	836.5	20525	10	16QAM	50	0	22.55	0-2	2

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

Table 9-6
LTE Band 5 (Cell) Conducted Powers - 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	826.5	20425	5	QPSK	1	0	24.45	0	0
	826.5	20425	5	QPSK	1	12	24.57	0	0
	826.5	20425	5	QPSK	1	24	24.53	0	0
	826.5	20425	5	QPSK	12	0	23.44	0-1	1
	826.5	20425	5	QPSK	12	6	23.49	0-1	1
	826.5	20425	5	QPSK	12	13	23.51	0-1	1
	826.5	20425	5	QPSK	25	0	23.42	0-1	1
	826.5	20425	5	16-QAM	1	0	23.35	0-1	1
	826.5	20425	5	16-QAM	1	12	23.44	0-1	1
	826.5	20425	5	16-QAM	1	24	23.41	0-1	1
	826.5	20425	5	16-QAM	12	0	22.41	0-2	2
	826.5	20425	5	16-QAM	12	6	22.43	0-2	2
	826.5	20425	5	16-QAM	12	13	22.49	0-2	2
	826.5	20425	5	16-QAM	25	0	22.33	0-2	2
Mid	836.5	20525	5	QPSK	1	0	24.35	0	0
	836.5	20525	5	QPSK	1	12	24.37	0	0
	836.5	20525	5	QPSK	1	24	24.43	0	0
	836.5	20525	5	QPSK	12	0	23.70	0-1	1
	836.5	20525	5	QPSK	12	6	23.59	0-1	1
	836.5	20525	5	QPSK	12	13	23.61	0-1	1
	836.5	20525	5	QPSK	25	0	23.62	0-1	1
	836.5	20525	5	16-QAM	1	0	23.38	0-1	1
	836.5	20525	5	16-QAM	1	12	23.45	0-1	1
	836.5	20525	5	16-QAM	1	24	23.43	0-1	1
	836.5	20525	5	16-QAM	12	0	22.41	0-2	2
	836.5	20525	5	16-QAM	12	6	22.43	0-2	2
	836.5	20525	5	16-QAM	12	13	22.41	0-2	2
	836.5	20525	5	16-QAM	25	0	22.44	0-2	2
High	846.5	20625	5	QPSK	1	0	24.51	0	0
	846.5	20625	5	QPSK	1	12	24.45	0	0
	846.5	20625	5	QPSK	1	24	24.44	0	0
	846.5	20625	5	QPSK	12	0	23.67	0-1	1
	846.5	20625	5	QPSK	12	6	23.49	0-1	1
	846.5	20625	5	QPSK	12	13	23.47	0-1	1
	846.5	20625	5	QPSK	25	0	23.47	0-1	1
	846.5	20625	5	16-QAM	1	0	23.61	0-1	1
	846.5	20625	5	16-QAM	1	12	23.54	0-1	1
	846.5	20625	5	16-QAM	1	24	23.55	0-1	1
	846.5	20625	5	16-QAM	12	0	22.43	0-2	2
	846.5	20625	5	16-QAM	12	6	22.37	0-2	2
	846.5	20625	5	16-QAM	12	13	22.35	0-2	2
	846.5	20625	5	16-QAM	25	0	22.33	0-2	2

Table 9-7
LTE Band 5 (Cell) Conducted Powers - 3 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	825.5	20415	3	QPSK	1	0	24.43	0	0
	825.5	20415	3	QPSK	1	7	24.39	0	0
	825.5	20415	3	QPSK	1	14	24.52	0	0
	825.5	20415	3	QPSK	8	0	23.43	0-1	1
	825.5	20415	3	QPSK	8	4	23.40	0-1	1
	825.5	20415	3	QPSK	8	7	23.41	0-1	1
	825.5	20415	3	QPSK	15	0	23.44	0-1	1
	825.5	20415	3	16-QAM	1	0	23.61	0-1	1
	825.5	20415	3	16-QAM	1	7	23.61	0-1	1
	825.5	20415	3	16-QAM	1	14	23.70	0-1	1
	825.5	20415	3	16-QAM	8	0	22.24	0-2	2
	825.5	20415	3	16-QAM	8	4	22.23	0-2	2
	825.5	20415	3	16-QAM	8	7	22.25	0-2	2
	825.5	20415	3	16-QAM	15	0	22.34	0-2	2
Mid	836.5	20525	3	QPSK	1	0	24.64	0	0
	836.5	20525	3	QPSK	1	7	24.62	0	0
	836.5	20525	3	QPSK	1	14	24.62	0	0
	836.5	20525	3	QPSK	8	0	23.62	0-1	1
	836.5	20525	3	QPSK	8	4	23.60	0-1	1
	836.5	20525	3	QPSK	8	7	23.56	0-1	1
	836.5	20525	3	QPSK	15	0	23.60	0-1	1
	836.5	20525	3	16-QAM	1	0	23.60	0-1	1
	836.5	20525	3	16-QAM	1	7	23.61	0-1	1
	836.5	20525	3	16-QAM	1	14	23.63	0-1	1
	836.5	20525	3	16-QAM	8	0	22.42	0-2	2
	836.5	20525	3	16-QAM	8	4	22.40	0-2	2
	836.5	20525	3	16-QAM	8	7	22.41	0-2	2
	836.5	20525	3	16-QAM	15	0	22.42	0-2	2
High	847.5	20635	3	QPSK	1	0	24.54	0	0
	847.5	20635	3	QPSK	1	7	24.54	0	0
	847.5	20635	3	QPSK	1	14	24.53	0	0
	847.5	20635	3	QPSK	8	0	23.53	0-1	1
	847.5	20635	3	QPSK	8	4	23.45	0-1	1
	847.5	20635	3	QPSK	8	7	23.43	0-1	1
	847.5	20635	3	QPSK	15	0	23.47	0-1	1
	847.5	20635	3	16-QAM	1	0	23.43	0-1	1
	847.5	20635	3	16-QAM	1	7	23.40	0-1	1
	847.5	20635	3	16-QAM	1	14	23.38	0-1	1
	847.5	20635	3	16-QAM	8	0	22.33	0-2	2
	847.5	20635	3	16-QAM	8	4	22.29	0-2	2
	847.5	20635	3	16-QAM	8	7	22.30	0-2	2
	847.5	20635	3	16-QAM	15	0	22.34	0-2	2

Table 9-8
LTE Band 5 (Cell) Conducted Powers -1.4 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	824.7	20407	1.4	QPSK	1	0	24.63	0	0
	824.7	20407	1.4	QPSK	1	2	24.58	0	0
	824.7	20407	1.4	QPSK	1	5	24.64	0	0
	824.7	20407	1.4	QPSK	3	0	24.41	0	0
	824.7	20407	1.4	QPSK	3	2	24.46	0	0
	824.7	20407	1.4	QPSK	3	3	24.48	0	0
	824.7	20407	1.4	QPSK	6	0	23.40	0-1	1
	824.7	20407	1.4	16-QAM	1	0	23.21	0-1	1
	824.7	20407	1.4	16-QAM	1	2	23.22	0-1	1
	824.7	20407	1.4	16-QAM	1	5	23.20	0-1	1
	824.7	20407	1.4	16-QAM	3	0	23.26	0-1	1
	824.7	20407	1.4	16-QAM	3	2	23.26	0-1	1
	824.7	20407	1.4	16-QAM	3	3	23.30	0-1	1
	824.7	20407	1.4	16-QAM	6	0	22.52	0-2	2
Mid	836.5	20525	1.4	QPSK	1	0	24.63	0	0
	836.5	20525	1.4	QPSK	1	2	24.53	0	0
	836.5	20525	1.4	QPSK	1	5	24.59	0	0
	836.5	20525	1.4	QPSK	3	0	24.63	0	0
	836.5	20525	1.4	QPSK	3	2	24.60	0	0
	836.5	20525	1.4	QPSK	3	3	24.61	0	0
	836.5	20525	1.4	QPSK	6	0	23.59	0-1	1
	836.5	20525	1.4	16-QAM	1	0	23.48	0-1	1
	836.5	20525	1.4	16-QAM	1	2	23.46	0-1	1
	836.5	20525	1.4	16-QAM	1	5	23.51	0-1	1
	836.5	20525	1.4	16-QAM	3	0	23.53	0-1	1
	836.5	20525	1.4	16-QAM	3	2	23.58	0-1	1
	836.5	20525	1.4	16-QAM	3	3	23.58	0-1	1
	836.5	20525	1.4	16-QAM	6	0	22.44	0-2	2
High	848.3	20643	1.4	QPSK	1	0	24.68	0	0
	848.3	20643	1.4	QPSK	1	2	24.62	0	0
	848.3	20643	1.4	QPSK	1	5	24.67	0	0
	848.3	20643	1.4	QPSK	3	0	24.47	0	0
	848.3	20643	1.4	QPSK	3	2	24.50	0	0
	848.3	20643	1.4	QPSK	3	3	24.47	0	0
	848.3	20643	1.4	QPSK	6	0	23.54	0-1	1
	848.3	20643	1.4	16-QAM	1	0	23.34	0-1	1
	848.3	20643	1.4	16-QAM	1	2	23.20	0-1	1
	848.3	20643	1.4	16-QAM	1	5	23.22	0-1	1
	848.3	20643	1.4	16-QAM	3	0	23.31	0-1	1
	848.3	20643	1.4	16-QAM	3	2	23.12	0-1	1
	848.3	20643	1.4	16-QAM	3	3	23.28	0-1	1
	848.3	20643	1.4	16-QAM	6	0	22.51	0-2	2

9.2.3 LTE Band 4 (AWS)

Table 9-9
LTE Band 4 (AWS) Conducted Powers - 20 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Mid	1732.5	20175	20	QPSK	1	0	24.25	0	0
	1732.5	20175	20	QPSK	1	50	**24.28**	0	0
	1732.5	20175	20	QPSK	1	99	24.20	0	0
	1732.5	20175	20	QPSK	50	0	**23.23**	0-1	1
	1732.5	20175	20	QPSK	50	25	23.21	0-1	1
	1732.5	20175	20	QPSK	50	50	23.20	0-1	1
	1732.5	20175	20	QPSK	100	0	23.22	0-1	1
	1732.5	20175	20	16QAM	1	0	23.41	0-1	1
	1732.5	20175	20	16QAM	1	50	23.44	0-1	1
	1732.5	20175	20	16QAM	1	99	23.31	0-1	1
	1732.5	20175	20	16QAM	50	0	22.22	0-2	2
	1732.5	20175	20	16QAM	50	25	22.21	0-2	2
	1732.5	20175	20	16QAM	50	50	22.25	0-2	2
	1732.5	20175	20	16QAM	100	0	22.15	0-2	2

Note: LTE Band 4 (AWS) at 20 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

Table 9-10
LTE Band 4 (AWS) Conducted Powers - 15 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1717.5	20025	15	QPSK	1	0	24.59	0	0
	1717.5	20025	15	QPSK	1	36	24.55	0	0
	1717.5	20025	15	QPSK	1	74	24.46	0	0
	1717.5	20025	15	QPSK	36	0	23.46	0-1	1
	1717.5	20025	15	QPSK	36	18	23.43	0-1	1
	1717.5	20025	15	QPSK	36	37	23.34	0-1	1
	1717.5	20025	15	QPSK	75	0	23.47	0-1	1
	1717.5	20025	15	16QAM	1	0	23.20	0-1	1
	1717.5	20025	15	16QAM	1	36	23.50	0-1	1
	1717.5	20025	15	16QAM	1	74	23.34	0-1	1
	1717.5	20025	15	16QAM	36	0	22.25	0-2	2
	1717.5	20025	15	16QAM	36	18	22.27	0-2	2
	1717.5	20025	15	16QAM	36	37	22.27	0-2	2
	1717.5	20025	15	16QAM	75	0	22.35	0-2	2
Mid	1732.5	20175	15	QPSK	1	0	24.43	0	0
	1732.5	20175	15	QPSK	1	36	24.54	0	0
	1732.5	20175	15	QPSK	1	74	24.21	0	0
	1732.5	20175	15	QPSK	36	0	23.30	0-1	1
	1732.5	20175	15	QPSK	36	18	23.13	0-1	1
	1732.5	20175	15	QPSK	36	37	23.09	0-1	1
	1732.5	20175	15	QPSK	75	0	23.20	0-1	1
	1732.5	20175	15	16QAM	1	0	23.66	0-1	1
	1732.5	20175	15	16QAM	1	36	23.40	0-1	1
	1732.5	20175	15	16QAM	1	74	23.48	0-1	1
	1732.5	20175	15	16QAM	36	0	22.00	0-2	2
	1732.5	20175	15	16QAM	36	18	22.05	0-2	2
	1732.5	20175	15	16QAM	36	37	21.97	0-2	2
	1732.5	20175	15	16QAM	75	0	22.21	0-2	2
High	1747.5	20325	15	QPSK	1	0	24.30	0	0
	1747.5	20325	15	QPSK	1	36	24.26	0	0
	1747.5	20325	15	QPSK	1	74	24.06	0	0
	1747.5	20325	15	QPSK	36	0	22.95	0-1	1
	1747.5	20325	15	QPSK	36	18	22.94	0-1	1
	1747.5	20325	15	QPSK	36	37	22.75	0-1	1
	1747.5	20325	15	QPSK	75	0	23.13	0-1	1
	1747.5	20325	15	16QAM	1	0	23.17	0-1	1
	1747.5	20325	15	16QAM	1	36	23.10	0-1	1
	1747.5	20325	15	16QAM	1	74	22.94	0-1	1
	1747.5	20325	15	16QAM	36	0	21.89	0-2	2
	1747.5	20325	15	16QAM	36	18	21.78	0-2	2
	1747.5	20325	15	16QAM	36	37	21.74	0-2	2
	1747.5	20325	15	16QAM	75	0	21.94	0-2	2

Table 9-11
LTE Band 4 (AWS) Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1715	20000	10	QPSK	1	0	24.20	0	0
	1715	20000	10	QPSK	1	25	24.51	0	0
	1715	20000	10	QPSK	1	49	24.49	0	0
	1715	20000	10	QPSK	25	0	23.45	0-1	1
	1715	20000	10	QPSK	25	12	23.46	0-1	1
	1715	20000	10	QPSK	25	25	23.50	0-1	1
	1715	20000	10	QPSK	50	0	23.51	0-1	1
	1715	20000	10	16QAM	1	0	23.47	0-1	1
	1715	20000	10	16QAM	1	25	23.46	0-1	1
	1715	20000	10	16QAM	1	49	23.48	0-1	1
	1715	20000	10	16QAM	25	0	22.51	0-2	2
	1715	20000	10	16QAM	25	12	22.44	0-2	2
	1715	20000	10	16QAM	25	25	22.45	0-2	2
	1715	20000	10	16QAM	50	0	22.49	0-2	2
Mid	1732.5	20175	10	QPSK	1	0	24.43	0	0
	1732.5	20175	10	QPSK	1	25	24.45	0	0
	1732.5	20175	10	QPSK	1	49	24.52	0	0
	1732.5	20175	10	QPSK	25	0	23.61	0-1	1
	1732.5	20175	10	QPSK	25	12	23.57	0-1	1
	1732.5	20175	10	QPSK	25	25	23.53	0-1	1
	1732.5	20175	10	QPSK	50	0	23.61	0-1	1
	1732.5	20175	10	16QAM	1	0	23.57	0-1	1
	1732.5	20175	10	16QAM	1	25	23.69	0-1	1
	1732.5	20175	10	16QAM	1	49	23.69	0-1	1
	1732.5	20175	10	16QAM	25	0	22.57	0-2	2
	1732.5	20175	10	16QAM	25	12	22.57	0-2	2
	1732.5	20175	10	16QAM	25	25	22.48	0-2	2
	1732.5	20175	10	16QAM	50	0	22.55	0-2	2
High	1750	20350	10	QPSK	1	0	24.29	0	0
	1750	20350	10	QPSK	1	25	24.45	0	0
	1750	20350	10	QPSK	1	49	24.47	0	0
	1750	20350	10	QPSK	25	0	23.43	0-1	1
	1750	20350	10	QPSK	25	12	23.37	0-1	1
	1750	20350	10	QPSK	25	25	23.40	0-1	1
	1750	20350	10	QPSK	50	0	23.42	0-1	1
	1750	20350	10	16QAM	1	0	23.39	0-1	1
	1750	20350	10	16QAM	1	25	23.40	0-1	1
	1750	20350	10	16QAM	1	49	23.40	0-1	1
	1750	20350	10	16QAM	25	0	22.65	0-2	2
	1750	20350	10	16QAM	25	12	22.31	0-2	2
	1750	20350	10	16QAM	25	25	22.35	0-2	2
	1750	20350	10	16QAM	50	0	22.34	0-2	2

Table 9-12
LTE Band 4 (AWS) Conducted Powers - 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1712.5	19975	5	QPSK	1	0	24.45	0	0
	1712.5	19975	5	QPSK	1	12	24.42	0	0
	1712.5	19975	5	QPSK	1	24	24.47	0	0
	1712.5	19975	5	QPSK	12	0	23.44	0-1	1
	1712.5	19975	5	QPSK	12	6	23.45	0-1	1
	1712.5	19975	5	QPSK	12	13	23.48	0-1	1
	1712.5	19975	5	QPSK	25	0	23.48	0-1	1
	1712.5	19975	5	16-QAM	1	0	23.35	0-1	1
	1712.5	19975	5	16-QAM	1	12	23.42	0-1	1
	1712.5	19975	5	16-QAM	1	24	23.48	0-1	1
	1712.5	19975	5	16-QAM	12	0	22.50	0-2	2
	1712.5	19975	5	16-QAM	12	6	22.43	0-2	2
	1712.5	19975	5	16-QAM	12	13	22.44	0-2	2
	1712.5	19975	5	16-QAM	25	0	22.45	0-2	2
Mid	1732.5	20175	5	QPSK	1	0	24.38	0	0
	1732.5	20175	5	QPSK	1	12	24.20	0	0
	1732.5	20175	5	QPSK	1	24	24.27	0	0
	1732.5	20175	5	QPSK	12	0	23.57	0-1	1
	1732.5	20175	5	QPSK	12	6	23.56	0-1	1
	1732.5	20175	5	QPSK	12	13	23.54	0-1	1
	1732.5	20175	5	QPSK	25	0	23.53	0-1	1
	1732.5	20175	5	16-QAM	1	0	23.45	0-1	1
	1732.5	20175	5	16-QAM	1	12	23.34	0-1	1
	1732.5	20175	5	16-QAM	1	24	23.33	0-1	1
	1732.5	20175	5	16-QAM	12	0	22.46	0-2	2
	1732.5	20175	5	16-QAM	12	6	22.45	0-2	2
	1732.5	20175	5	16-QAM	12	13	22.38	0-2	2
	1732.5	20175	5	16-QAM	25	0	22.43	0-2	2
High	1752.5	20375	5	QPSK	1	0	24.49	0	0
	1752.5	20375	5	QPSK	1	12	24.41	0	0
	1752.5	20375	5	QPSK	1	24	24.46	0	0
	1752.5	20375	5	QPSK	12	0	23.47	0-1	1
	1752.5	20375	5	QPSK	12	6	23.44	0-1	1
	1752.5	20375	5	QPSK	12	13	23.47	0-1	1
	1752.5	20375	5	QPSK	25	0	23.46	0-1	1
	1752.5	20375	5	16-QAM	1	0	23.57	0-1	1
	1752.5	20375	5	16-QAM	1	12	23.52	0-1	1
	1752.5	20375	5	16-QAM	1	24	23.55	0-1	1
	1752.5	20375	5	16-QAM	12	0	22.40	0-2	2
	1752.5	20375	5	16-QAM	12	6	22.33	0-2	2
	1752.5	20375	5	16-QAM	12	13	22.36	0-2	2
	1752.5	20375	5	16-QAM	25	0	22.36	0-2	2

Table 9-13

LTE Band 4 (AWS) 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	1711.5	19965	3	QPSK	1	0	24.48	0	0
	1711.5	19965	3	QPSK	1	7	24.45	0	0
	1711.5	19965	3	QPSK	1	14	24.48	0	0
	1711.5	19965	3	QPSK	8	0	23.47	0-1	1
	1711.5	19965	3	QPSK	8	4	23.45	0-1	1
	1711.5	19965	3	QPSK	8	7	23.47	0-1	1
	1711.5	19965	3	QPSK	15	0	23.50	0-1	1
	1711.5	19965	3	16-QAM	1	0	23.66	0-1	1
	1711.5	19965	3	16-QAM	1	7	23.68	0-1	1
	1711.5	19965	3	16-QAM	1	14	23.65	0-1	1
	1711.5	19965	3	16-QAM	8	0	22.36	0-2	2
	1711.5	19965	3	16-QAM	8	4	22.33	0-2	2
	1711.5	19965	3	16-QAM	8	7	22.34	0-2	2
	1711.5	19965	3	16-QAM	15	0	22.39	0-2	2
Mid	1732.5	20175	3	QPSK	1	0	24.66	0	0
	1732.5	20175	3	QPSK	1	7	24.53	0	0
	1732.5	20175	3	QPSK	1	14	24.52	0	0
	1732.5	20175	3	QPSK	8	0	23.52	0-1	1
	1732.5	20175	3	QPSK	8	4	23.51	0-1	1
	1732.5	20175	3	QPSK	8	7	23.51	0-1	1
	1732.5	20175	3	QPSK	15	0	23.59	0-1	1
	1732.5	20175	3	16-QAM	1	0	23.61	0-1	1
	1732.5	20175	3	16-QAM	1	7	23.48	0-1	1
	1732.5	20175	3	16-QAM	1	14	23.47	0-1	1
	1732.5	20175	3	16-QAM	8	0	22.45	0-2	2
	1732.5	20175	3	16-QAM	8	4	22.46	0-2	2
	1732.5	20175	3	16-QAM	8	7	22.40	0-2	2
	1732.5	20175	3	16-QAM	15	0	22.44	0-2	2
High	1753.5	20385	3	QPSK	1	0	24.46	0	0
	1753.5	20385	3	QPSK	1	7	24.45	0	0
	1753.5	20385	3	QPSK	1	14	24.50	0	0
	1753.5	20385	3	QPSK	8	0	23.50	0-1	1
	1753.5	20385	3	QPSK	8	4	23.42	0-1	1
	1753.5	20385	3	QPSK	8	7	23.40	0-1	1
	1753.5	20385	3	QPSK	15	0	23.40	0-1	1
	1753.5	20385	3	16-QAM	1	0	23.42	0-1	1
	1753.5	20385	3	16-QAM	1	7	23.45	0-1	1
	1753.5	20385	3	16-QAM	1	14	23.44	0-1	1
	1753.5	20385	3	16-QAM	8	0	22.38	0-2	2
	1753.5	20385	3	16-QAM	8	4	22.29	0-2	2
	1753.5	20385	3	16-QAM	8	7	22.31	0-2	2
	1753.5	20385	3	16-QAM	15	0	22.41	0-2	2

Table 9-14
LTE Band 4 (AWS) 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	1710.7	19957	1.4	QPSK	1	0	24.63	0	0
	1710.7	19957	1.4	QPSK	1	2	24.58	0	0
	1710.7	19957	1.4	QPSK	1	5	24.64	0	0
	1710.7	19957	1.4	QPSK	3	0	24.48	0	0
	1710.7	19957	1.4	QPSK	3	2	24.44	0	0
	1710.7	19957	1.4	QPSK	3	3	24.52	0	0
	1710.7	19957	1.4	QPSK	6	0	23.50	0-1	1
	1710.7	19957	1.4	16-QAM	1	0	23.21	0-1	1
	1710.7	19957	1.4	16-QAM	1	2	23.25	0-1	1
	1710.7	19957	1.4	16-QAM	1	5	23.20	0-1	1
	1710.7	19957	1.4	16-QAM	3	0	23.30	0-1	1
	1710.7	19957	1.4	16-QAM	3	2	23.27	0-1	1
	1710.7	19957	1.4	16-QAM	3	3	23.27	0-1	1
	1710.7	19957	1.4	16-QAM	6	0	22.50	0-2	2
Mid	1732.5	20175	1.4	QPSK	1	0	24.64	0	0
	1732.5	20175	1.4	QPSK	1	2	24.54	0	0
	1732.5	20175	1.4	QPSK	1	5	24.54	0	0
	1732.5	20175	1.4	QPSK	3	0	24.49	0	0
	1732.5	20175	1.4	QPSK	3	2	24.51	0	0
	1732.5	20175	1.4	QPSK	3	3	24.49	0	0
	1732.5	20175	1.4	QPSK	6	0	23.62	0-1	1
	1732.5	20175	1.4	16-QAM	1	0	23.60	0-1	1
	1732.5	20175	1.4	16-QAM	1	2	23.61	0-1	1
	1732.5	20175	1.4	16-QAM	1	5	23.51	0-1	1
	1732.5	20175	1.4	16-QAM	3	0	23.38	0-1	1
	1732.5	20175	1.4	16-QAM	3	2	23.42	0-1	1
	1732.5	20175	1.4	16-QAM	3	3	23.38	0-1	1
	1732.5	20175	1.4	16-QAM	6	0	22.54	0-2	2
High	1754.3	20393	1.4	QPSK	1	0	24.63	0	0
	1754.3	20393	1.4	QPSK	1	2	24.63	0	0
	1754.3	20393	1.4	QPSK	1	5	24.68	0	0
	1754.3	20393	1.4	QPSK	3	0	24.52	0	0
	1754.3	20393	1.4	QPSK	3	2	24.51	0	0
	1754.3	20393	1.4	QPSK	3	3	24.51	0	0
	1754.3	20393	1.4	QPSK	6	0	23.54	0-1	1
	1754.3	20393	1.4	16-QAM	1	0	23.20	0-1	1
	1754.3	20393	1.4	16-QAM	1	2	23.20	0-1	1
	1754.3	20393	1.4	16-QAM	1	5	23.23	0-1	1
	1754.3	20393	1.4	16-QAM	3	0	23.33	0-1	1
	1754.3	20393	1.4	16-QAM	3	2	23.32	0-1	1
	1754.3	20393	1.4	16-QAM	3	3	23.34	0-1	1
	1754.3	20393	1.4	16-QAM	6	0	22.55	0-2	2

9.2.4 LTE Band 25 (PCS)

Table 9-15
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	23.98	0	0
	1860	26140	20	QPSK	1	50	24.07	0	0
	1860	26140	20	QPSK	1	99	**24.18**	0	0
	1860	26140	20	QPSK	50	0	23.00	0-1	1
	1860	26140	20	QPSK	50	25	22.98	0-1	1
	1860	26140	20	QPSK	50	50	22.97	0-1	1
	1860	26140	20	QPSK	100	0	22.94	0-1	1
	1860	26140	20	16QAM	1	0	23.01	0-1	1
	1860	26140	20	16QAM	1	50	23.19	0-1	1
	1860	26140	20	16QAM	1	99	22.88	0-1	1
	1860	26140	20	16QAM	50	0	21.95	0-2	2
	1860	26140	20	16QAM	50	25	21.88	0-2	2
	1860	26140	20	16QAM	50	50	21.87	0-2	2
	1860	26140	20	16QAM	100	0	21.95	0-2	2
Mid	1882.5	26365	20	QPSK	1	0	23.89	0	0
	1882.5	26365	20	QPSK	1	50	23.93	0	0
	1882.5	26365	20	QPSK	1	99	23.91	0	0
	1882.5	26365	20	QPSK	50	0	22.94	0-1	1
	1882.5	26365	20	QPSK	50	25	22.86	0-1	1
	1882.5	26365	20	QPSK	50	50	23.08	0-1	1
	1882.5	26365	20	QPSK	100	0	22.94	0-1	1
	1882.5	26365	20	16QAM	1	0	23.11	0-1	1
	1882.5	26365	20	16QAM	1	50	23.08	0-1	1
	1882.5	26365	20	16QAM	1	99	22.89	0-1	1
	1882.5	26365	20	16QAM	50	0	21.78	0-2	2
	1882.5	26365	20	16QAM	50	25	21.78	0-2	2
	1882.5	26365	20	16QAM	50	50	21.91	0-2	2
	1882.5	26365	20	16QAM	100	0	21.79	0-2	2
High	1905	26590	20	QPSK	1	0	24.01	0	0
	1905	26590	20	QPSK	1	50	24.00	0	0
	1905	26590	20	QPSK	1	99	23.99	0	0
	1905	26590	20	QPSK	50	0	23.04	0-1	1
	1905	26590	20	QPSK	50	25	**23.17**	0-1	1
	1905	26590	20	QPSK	50	50	22.97	0-1	1
	1905	26590	20	QPSK	100	0	22.88	0-1	1
	1905	26590	20	16QAM	1	0	23.13	0-1	1
	1905	26590	20	16QAM	1	50	23.03	0-1	1
	1905	26590	20	16QAM	1	99	23.07	0-1	1
	1905	26590	20	16QAM	50	0	21.86	0-2	2
	1905	26590	20	16QAM	50	25	21.96	0-2	2
	1905	26590	20	16QAM	50	50	21.75	0-2	2
	1905	26590	20	16QAM	100	0	21.85	0-2	2

Table 9-16
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	23.87	0	0
	1857.5	26115	15	QPSK	1	36	24.20	0	0
	1857.5	26115	15	QPSK	1	74	24.02	0	0
	1857.5	26115	15	QPSK	36	0	23.11	0-1	1
	1857.5	26115	15	QPSK	36	18	23.14	0-1	1
	1857.5	26115	15	QPSK	36	37	23.03	0-1	1
	1857.5	26115	15	QPSK	75	0	23.20	0-1	1
	1857.5	26115	15	16QAM	1	0	23.12	0-1	1
	1857.5	26115	15	16QAM	1	36	23.20	0-1	1
	1857.5	26115	15	16QAM	1	74	22.84	0-1	1
	1857.5	26115	15	16QAM	36	0	22.06	0-2	2
	1857.5	26115	15	16QAM	36	18	22.13	0-2	2
	1857.5	26115	15	16QAM	36	37	22.16	0-2	2
	1857.5	26115	15	16QAM	75	0	22.13	0-2	2
Mid	1882.5	26365	15	QPSK	1	0	24.18	0	0
	1882.5	26365	15	QPSK	1	36	23.98	0	0
	1882.5	26365	15	QPSK	1	74	23.98	0	0
	1882.5	26365	15	QPSK	36	0	23.15	0-1	1
	1882.5	26365	15	QPSK	36	18	23.16	0-1	1
	1882.5	26365	15	QPSK	36	37	23.15	0-1	1
	1882.5	26365	15	QPSK	75	0	23.17	0-1	1
	1882.5	26365	15	16QAM	1	0	23.20	0-1	1
	1882.5	26365	15	16QAM	1	36	23.16	0-1	1
	1882.5	26365	15	16QAM	1	74	23.19	0-1	1
	1882.5	26365	15	16QAM	36	0	21.94	0-2	2
	1882.5	26365	15	16QAM	36	18	21.97	0-2	2
	1882.5	26365	15	16QAM	36	37	22.04	0-2	2
	1882.5	26365	15	16QAM	75	0	22.15	0-2	2
High	1907.5	26615	15	QPSK	1	0	24.16	0	0
	1907.5	26615	15	QPSK	1	36	24.02	0	0
	1907.5	26615	15	QPSK	1	74	24.07	0	0
	1907.5	26615	15	QPSK	36	0	23.11	0-1	1
	1907.5	26615	15	QPSK	36	18	22.61	0-1	1
	1907.5	26615	15	QPSK	36	37	22.96	0-1	1
	1907.5	26615	15	QPSK	75	0	23.08	0-1	1
	1907.5	26615	15	16QAM	1	0	22.82	0-1	1
	1907.5	26615	15	16QAM	1	36	22.77	0-1	1
	1907.5	26615	15	16QAM	1	74	22.93	0-1	1
	1907.5	26615	15	16QAM	36	0	21.83	0-2	2
	1907.5	26615	15	16QAM	36	18	21.73	0-2	2
	1907.5	26615	15	16QAM	36	37	21.81	0-2	2
	1907.5	26615	15	16QAM	75	0	21.85	0-2	2

Table 9-17
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	23.86	0	0
	1855	26090	10	QPSK	1	25	23.99	0	0
	1855	26090	10	QPSK	1	49	23.99	0	0
	1855	26090	10	QPSK	25	0	22.99	0-1	1
	1855	26090	10	QPSK	25	12	22.97	0-1	1
	1855	26090	10	QPSK	25	25	22.98	0-1	1
	1855	26090	10	QPSK	50	0	22.97	0-1	1
	1855	26090	10	16QAM	1	0	22.90	0-1	1
	1855	26090	10	16QAM	1	25	22.96	0-1	1
	1855	26090	10	16QAM	1	49	23.00	0-1	1
	1855	26090	10	16QAM	25	0	22.00	0-2	2
	1855	26090	10	16QAM	25	12	21.92	0-2	2
	1855	26090	10	16QAM	25	25	21.94	0-2	2
	1855	26090	10	16QAM	50	0	21.93	0-2	2
Mid	1882.5	26365	10	QPSK	1	0	24.00	0	0
	1882.5	26365	10	QPSK	1	25	23.98	0	0
	1882.5	26365	10	QPSK	1	49	23.99	0	0
	1882.5	26365	10	QPSK	25	0	23.00	0-1	1
	1882.5	26365	10	QPSK	25	12	22.98	0-1	1
	1882.5	26365	10	QPSK	25	25	22.96	0-1	1
	1882.5	26365	10	QPSK	50	0	22.97	0-1	1
	1882.5	26365	10	16QAM	1	0	22.98	0-1	1
	1882.5	26365	10	16QAM	1	25	22.99	0-1	1
	1882.5	26365	10	16QAM	1	49	23.00	0-1	1
	1882.5	26365	10	16QAM	25	0	22.00	0-2	2
	1882.5	26365	10	16QAM	25	12	21.94	0-2	2
	1882.5	26365	10	16QAM	25	25	21.83	0-2	2
	1882.5	26365	10	16QAM	50	0	21.89	0-2	2
High	1910	26640	10	QPSK	1	0	23.99	0	0
	1910	26640	10	QPSK	1	25	23.98	0	0
	1910	26640	10	QPSK	1	49	23.97	0	0
	1910	26640	10	QPSK	25	0	22.94	0-1	1
	1910	26640	10	QPSK	25	12	22.99	0-1	1
	1910	26640	10	QPSK	25	25	22.93	0-1	1
	1910	26640	10	QPSK	50	0	22.97	0-1	1
	1910	26640	10	16QAM	1	0	22.99	0-1	1
	1910	26640	10	16QAM	1	25	23.00	0-1	1
	1910	26640	10	16QAM	1	49	22.94	0-1	1
	1910	26640	10	16QAM	25	0	21.94	0-2	2
	1910	26640	10	16QAM	25	12	21.83	0-2	2
	1910	26640	10	16QAM	25	25	21.80	0-2	2
	1910	26640	10	16QAM	50	0	21.91	0-2	2

Table 9-18
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	23.85	0	0
	1852.5	26065	5	QPSK	1	12	23.90	0	0
	1852.5	26065	5	QPSK	1	24	24.00	0	0
	1852.5	26065	5	QPSK	12	0	22.99	0-1	1
	1852.5	26065	5	QPSK	12	6	22.82	0-1	1
	1852.5	26065	5	QPSK	12	13	22.94	0-1	1
	1852.5	26065	5	QPSK	25	0	22.95	0-1	1
	1852.5	26065	5	16-QAM	1	0	22.70	0-1	1
	1852.5	26065	5	16-QAM	1	12	22.84	0-1	1
	1852.5	26065	5	16-QAM	1	24	22.92	0-1	1
	1852.5	26065	5	16-QAM	12	0	21.87	0-2	2
	1852.5	26065	5	16-QAM	12	6	21.80	0-2	2
	1852.5	26065	5	16-QAM	12	13	21.90	0-2	2
	1852.5	26065	5	16-QAM	25	0	21.89	0-2	2
Mid	1882.5	26365	5	QPSK	1	0	23.85	0	0
	1882.5	26365	5	QPSK	1	12	23.77	0	0
	1882.5	26365	5	QPSK	1	24	23.73	0	0
	1882.5	26365	5	QPSK	12	0	23.00	0-1	1
	1882.5	26365	5	QPSK	12	6	22.91	0-1	1
	1882.5	26365	5	QPSK	12	13	22.85	0-1	1
	1882.5	26365	5	QPSK	25	0	22.90	0-1	1
	1882.5	26365	5	16-QAM	1	0	22.94	0-1	1
	1882.5	26365	5	16-QAM	1	12	22.91	0-1	1
	1882.5	26365	5	16-QAM	1	24	22.88	0-1	1
	1882.5	26365	5	16-QAM	12	0	21.98	0-2	2
	1882.5	26365	5	16-QAM	12	6	21.94	0-2	2
	1882.5	26365	5	16-QAM	12	13	21.78	0-2	2
	1882.5	26365	5	16-QAM	25	0	21.85	0-2	2
High	1912.5	26665	5	QPSK	1	0	23.78	0	0
	1912.5	26665	5	QPSK	1	12	23.74	0	0
	1912.5	26665	5	QPSK	1	24	23.79	0	0
	1912.5	26665	5	QPSK	12	0	22.98	0-1	1
	1912.5	26665	5	QPSK	12	6	22.90	0-1	1
	1912.5	26665	5	QPSK	12	13	22.95	0-1	1
	1912.5	26665	5	QPSK	25	0	22.96	0-1	1
	1912.5	26665	5	16-QAM	1	0	22.82	0-1	1
	1912.5	26665	5	16-QAM	1	12	22.76	0-1	1
	1912.5	26665	5	16-QAM	1	24	22.82	0-1	1
	1912.5	26665	5	16-QAM	12	0	21.80	0-2	2
	1912.5	26665	5	16-QAM	12	6	21.76	0-2	2
	1912.5	26665	5	16-QAM	12	13	21.74	0-2	2
	1912.5	26665	5	16-QAM	25	0	21.75	0-2	2

Table 9-19
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	23.83	0	0
	1851.5	26055	3	QPSK	1	7	23.86	0	0
	1851.5	26055	3	QPSK	1	14	23.92	0	0
	1851.5	26055	3	QPSK	8	0	22.70	0-1	1
	1851.5	26055	3	QPSK	8	4	22.80	0-1	1
	1851.5	26055	3	QPSK	8	7	22.80	0-1	1
	1851.5	26055	3	QPSK	15	0	22.83	0-1	1
	1851.5	26055	3	16-QAM	1	0	22.90	0-1	1
	1851.5	26055	3	16-QAM	1	7	23.00	0-1	1
	1851.5	26055	3	16-QAM	1	14	23.00	0-1	1
	1851.5	26055	3	16-QAM	8	0	21.87	0-2	2
	1851.5	26055	3	16-QAM	8	4	21.70	0-2	2
	1851.5	26055	3	16-QAM	8	7	21.75	0-2	2
	1851.5	26055	3	16-QAM	15	0	21.73	0-2	2
Mid	1882.5	26365	3	QPSK	1	0	23.97	0	0
	1882.5	26365	3	QPSK	1	7	24.00	0	0
	1882.5	26365	3	QPSK	1	14	24.00	0	0
	1882.5	26365	3	QPSK	8	0	22.98	0-1	1
	1882.5	26365	3	QPSK	8	4	22.90	0-1	1
	1882.5	26365	3	QPSK	8	7	22.94	0-1	1
	1882.5	26365	3	QPSK	15	0	22.99	0-1	1
	1882.5	26365	3	16-QAM	1	0	23.00	0-1	1
	1882.5	26365	3	16-QAM	1	7	22.98	0-1	1
	1882.5	26365	3	16-QAM	1	14	22.91	0-1	1
	1882.5	26365	3	16-QAM	8	0	21.77	0-2	2
	1882.5	26365	3	16-QAM	8	4	21.80	0-2	2
	1882.5	26365	3	16-QAM	8	7	21.80	0-2	2
	1882.5	26365	3	16-QAM	15	0	21.84	0-2	2
High	1913.5	26675	3	QPSK	1	0	24.00	0	0
	1913.5	26675	3	QPSK	1	7	23.97	0	0
	1913.5	26675	3	QPSK	1	14	23.99	0	0
	1913.5	26675	3	QPSK	8	0	22.92	0-1	1
	1913.5	26675	3	QPSK	8	4	22.93	0-1	1
	1913.5	26675	3	QPSK	8	7	22.95	0-1	1
	1913.5	26675	3	QPSK	15	0	22.90	0-1	1
	1913.5	26675	3	16-QAM	1	0	22.99	0-1	1
	1913.5	26675	3	16-QAM	1	7	22.87	0-1	1
	1913.5	26675	3	16-QAM	1	14	22.92	0-1	1
	1913.5	26675	3	16-QAM	8	0	21.72	0-2	2
	1913.5	26675	3	16-QAM	8	4	21.70	0-2	2
	1913.5	26675	3	16-QAM	8	7	21.70	0-2	2
	1913.5	26675	3	16-QAM	15	0	21.76	0-2	2

Table 9-20
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	23.84	0	0
	1850.7	26047	1.4	QPSK	1	2	23.81	0	0
	1850.7	26047	1.4	QPSK	1	5	23.97	0	0
	1850.7	26047	1.4	QPSK	3	0	23.75	0	0
	1850.7	26047	1.4	QPSK	3	2	23.74	0	0
	1850.7	26047	1.4	QPSK	3	3	23.77	0	0
	1850.7	26047	1.4	QPSK	6	0	22.72	0-1	1
	1850.7	26047	1.4	16-QAM	1	0	22.81	0-1	1
	1850.7	26047	1.4	16-QAM	1	2	22.73	0-1	1
	1850.7	26047	1.4	16-QAM	1	5	22.84	0-1	1
	1850.7	26047	1.4	16-QAM	3	0	22.71	0-1	1
	1850.7	26047	1.4	16-QAM	3	2	22.72	0-1	1
	1850.7	26047	1.4	16-QAM	3	3	22.70	0-1	1
	1850.7	26047	1.4	16-QAM	6	0	21.75	0-2	2
Mid	1882.5	26365	1.4	QPSK	1	0	24.00	0	0
	1882.5	26365	1.4	QPSK	1	2	23.99	0	0
	1882.5	26365	1.4	QPSK	1	5	24.00	0	0
	1882.5	26365	1.4	QPSK	3	0	23.98	0	0
	1882.5	26365	1.4	QPSK	3	2	23.98	0	0
	1882.5	26365	1.4	QPSK	3	3	24.00	0	0
	1882.5	26365	1.4	QPSK	6	0	23.00	0-1	1
	1882.5	26365	1.4	16-QAM	1	0	22.73	0-1	1
	1882.5	26365	1.4	16-QAM	1	2	22.70	0-1	1
	1882.5	26365	1.4	16-QAM	1	5	22.72	0-1	1
	1882.5	26365	1.4	16-QAM	3	0	22.86	0-1	1
	1882.5	26365	1.4	16-QAM	3	2	22.84	0-1	1
	1882.5	26365	1.4	16-QAM	3	3	22.81	0-1	1
	1882.5	26365	1.4	16-QAM	6	0	22.00	0-2	2
High	1914.3	26683	1.4	QPSK	1	0	23.94	0	0
	1914.3	26683	1.4	QPSK	1	2	23.92	0	0
	1914.3	26683	1.4	QPSK	1	5	23.94	0	0
	1914.3	26683	1.4	QPSK	3	0	24.00	0	0
	1914.3	26683	1.4	QPSK	3	2	23.99	0	0
	1914.3	26683	1.4	QPSK	3	3	23.98	0	0
	1914.3	26683	1.4	QPSK	6	0	22.97	0-1	1
	1914.3	26683	1.4	16-QAM	1	0	22.86	0-1	1
	1914.3	26683	1.4	16-QAM	1	2	22.79	0-1	1
	1914.3	26683	1.4	16-QAM	1	5	22.90	0-1	1
	1914.3	26683	1.4	16-QAM	3	0	22.85	0-1	1
	1914.3	26683	1.4	16-QAM	3	2	22.89	0-1	1
	1914.3	26683	1.4	16-QAM	3	3	22.88	0-1	1
	1914.3	26683	1.4	16-QAM	6	0	21.78	0-2	2

9.3 WLAN Conducted Powers

Table 9-21
IEEE 802.11b Average RF Power

Mode	Freq [MHz]	Channel	802.11b Conducted Power [dBm]			
			Data Rate [Mbps]			
			1	2	5.5	11
802.11b	2412	1*	14.86	15.05	15.15	15.19
802.11b	2437	6*	**15.16**	15.19	15.17	15.17
802.11b	2462	11*	15.04	15.22	15.32	15.39

Table 9-22
IEEE 802.11g Average RF Power

Mode	Freq [MHz]	Channel	802.11g Conducted Power [dBm]							
			Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
802.11g	2412	1	11.62	11.80	11.98	11.76	12.27	12.08	12.20	12.06
802.11g	2437	6	11.82	11.97	12.18	11.97	12.45	12.30	12.42	12.32
802.11g	2462	11	11.99	12.22	12.36	12.09	12.10	12.43	12.41	12.47

Table 9-23
IEEE 802.11n Average RF Power

Mode	Freq [MHz]	Channel	802.11n (2.4GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
			6.5	13	19.5	26	39	52	58.5	65
802.11n	2412	1	10.43	10.45	10.78	10.87	10.63	10.83	10.83	10.68
802.11n	2437	6	10.66	10.76	10.97	11.03	10.89	11.14	11.15	10.94
802.11n	2462	11	10.76	10.81	11.06	11.15	10.96	11.19	11.22	11.05

Table 9-24
IEEE 802.11ac Average RF Power

802.11ac (2.4GHz) Conducted Power [dBm]			
Mode	Freq [MHz]	Channel	Data Rate
			6.5 Mbps
802.11ac	2412	1	9.45
802.11ac	2437	6	10.12
802.11ac	2462	11	9.67

Table 9-25
IEEE 802.11a Average RF Power

Mode	Freq [MHz]	Channel	802.11a Conducted Power [dBm]							
			Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
802.11a	5180	36*	11.98	12.04	12.06	11.67	11.71	11.64	11.96	11.60
802.11a	5200	40	11.95	12.01	12.09	12.18	11.94	11.89	12.06	11.85
802.11a	5220	44	**12.08**	12.14	12.19	12.29	12.17	12.15	12.25	11.84
802.11a	5240	48*	11.97	12.08	12.03	12.11	12.12	12.12	12.07	12.16
802.11a	5260	52*	**12.18**	12.31	12.30	12.26	12.30	12.15	12.10	11.93
802.11a	5280	56	12.09	12.22	12.17	12.14	12.32	12.02	12.29	12.13
802.11a	5300	60	12.14	12.23	12.23	12.21	12.31	12.13	12.03	12.28
802.11a	5320	64*	12.14	12.29	12.34	12.14	12.31	12.11	12.07	12.17
802.11a	5500	100	**12.82**	12.49	12.45	12.39	11.96	12.72	11.81	11.76
802.11a	5520	104*	12.34	12.46	12.45	12.40	12.04	12.67	11.81	12.74
802.11a	5540	108	12.42	12.49	12.46	12.44	12.03	12.73	11.87	11.89
802.11a	5560	112	12.45	12.62	12.62	12.58	12.07	11.80	11.92	11.86
802.11a	5580	116*	12.49	12.58	12.66	12.52	12.14	11.83	11.95	11.90
802.11a	5600	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11a	5620	124	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11a	5640	128	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11a	5660	132	12.44	12.62	12.45	12.47	12.08	11.82	11.90	11.87
802.11a	5680	136*	12.37	12.43	12.41	12.45	11.99	12.71	11.82	11.78
802.11a	5700	140	12.51	12.60	12.63	12.65	12.16	11.94	12.04	11.93
802.11a	5720	144	12.12	12.04	12.07	11.89	11.88	11.93	12.01	12.00
802.11a	5745	149*	11.81	11.80	11.81	11.88	11.63	12.02	12.07	12.05
802.11a	5765	153	11.85	11.85	11.85	11.99	11.90	11.65	12.08	12.10
802.11a	5785	157*	11.86	11.88	11.80	11.90	11.94	11.62	11.81	11.89
802.11a	5805	161	11.87	11.83	11.84	11.97	11.87	11.70	11.95	11.97
802.11a	5825	165*	**11.90**	11.93	11.90	11.94	11.87	11.88	11.99	12.01

Per FCC KDB Publication 443999 and RSS-210 A9.2(3), transmission on channels which overlap the 5600-5650 MHz is prohibited as a client. This device does not transmit any beacons or initiate any transmissions in 5.3 and 5.5 GHz Band.

(*) – indicates default channels per KDB Publication 248227 D01v01r02. When the adjacent channels are higher in power then the default channels, these "required channels" are considered for SAR testing instead of the default channels.

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

Mode	Freq [MHz]	Channel	20MHz BW 802.11n (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
			6.5	13	19.5	26	39	52	58.5	65
802.11n	5180	36	10.56	10.54	10.56	10.83	10.84	10.85	10.80	10.95
802.11n	5200	40	10.40	10.41	10.40	10.67	10.62	10.72	10.59	10.76
802.11n	5220	44	10.60	10.60	10.59	10.83	10.91	10.82	10.84	11.08
802.11n	5240	48	10.63	10.60	10.64	10.86	10.90	10.94	10.80	10.99
802.11n	5260	52	11.19	11.39	11.27	11.57	11.60	11.54	11.56	11.58
802.11n	5280	56	11.44	11.47	11.37	10.65	10.72	11.62	10.72	10.67
802.11n	5300	60	11.44	11.45	11.37	11.63	11.79	11.56	11.73	11.62
802.11n	5320	64	11.46	11.56	11.35	11.72	11.74	11.63	11.68	11.76
802.11n	5500	100	11.67	11.40	10.56	10.60	10.76	10.69	10.62	10.69
802.11n	5520	104	11.36	11.24	11.46	11.47	10.68	10.68	11.50	10.57
802.11n	5540	108	11.40	11.36	10.56	10.58	10.76	10.58	10.55	10.65
802.11n	5560	112	11.40	11.34	11.50	10.53	10.66	10.63	10.61	10.68
802.11n	5580	116	11.42	11.37	10.58	10.53	10.71	10.66	10.55	10.68
802.11n	5600	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5620	124	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5640	128	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5660	132	11.39	11.36	11.35	11.49	10.67	10.56	10.58	10.60
802.11n	5680	136	11.41	11.34	11.33	10.55	10.76	10.64	10.63	10.61
802.11n	5700	140	11.36	11.24	11.46	11.40	10.65	10.58	10.54	10.63
802.11n	5720	144	11.72	11.69	11.71	11.68	11.65	11.60	11.55	11.56
802.11n	5745	149	10.62	10.59	10.78	10.91	10.90	10.97	10.95	10.88
802.11n	5765	153	10.61	10.58	10.76	10.92	10.85	10.97	10.88	10.89
802.11n	5785	157	10.74	10.73	10.87	10.99	11.00	11.14	11.01	11.03
802.11n	5805	161	10.71	10.67	10.90	11.03	10.94	10.98	11.12	11.00
802.11n	5825	165	10.61	10.62	10.74	10.87	10.86	10.92	10.93	10.88

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

Mode	Freq [MHz]	Channel	40MHz BW 802.11n (5GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
			13.5	27	40.5	54	81	108	121.5	135
802.11n	5190	38	8.69	8.61	8.35	8.64	8.40	8.50	8.61	8.59
802.11n	5230	46	8.68	9.09	8.73	9.06	8.85	8.91	9.00	8.98
802.11n	5270	54	8.77	8.94	8.87	9.04	9.00	9.02	8.96	8.99
802.11n	5310	62	8.92	9.35	9.22	9.41	9.33	9.40	9.33	9.37
802.11n	5510	102	8.88	8.87	8.74	9.01	9.06	9.04	9.03	9.00
802.11n	5550	110	9.18	9.34	9.35	9.24	9.25	9.47	9.42	9.48
802.11n	5590	118	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5630	126	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5670	134	9.22	9.21	9.26	9.25	9.14	9.33	9.22	9.20
802.11n	5710	142	8.85	8.87	8.62	8.91	8.73	8.77	8.89	8.85
802.11n	5755	151	9.11	9.08	9.07	9.15	9.11	9.07	9.09	9.20
802.11n	5795	159	9.11	9.08	9.07	9.19	9.05	9.03	9.05	9.26

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

Mode	Freq [MHz]	Channel	80MHz BW 802.11ac (5GHz) Conducted Power [dBm]									
			Data Rate [Mbps]									
			29.3	58.5	87.8	117	175.5	234	263.3	292.5	351	390
802.11ac	5210	42	**8.75**	8.83	8.81	8.84	8.78	8.74	8.78	8.84	8.73	8.74
802.11ac	5290	58	**8.56**	8.65	8.53	8.52	8.53	8.81	8.80	8.79	8.78	8.46
802.11ac	5530	106	8.51	8.36	8.39	8.69	8.80	8.73	8.72	8.71	8.73	8.27
802.11ac	5690	138	**8.83**	8.95	9.06	8.78	8.74	8.73	8.69	9.01	9.02	8.82
802.11ac	5775	155	**8.99**	8.92	8.87	8.87	8.88	8.87	8.94	8.99	8.92	8.87

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

- For 2.4 GHz, highest average RF output power channel for the lowest data rate for IEEE 802.11b were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11g/n/ac) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode.
- For 5 GHz, highest average RF output power channel for the lowest data rate for IEEE 802.11a were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11a mode.
- Full SAR tests for all IEEE 802.11ac configurations were not required because the average output power was not more than 0.25 dB higher than IEEE 802.11a mode. IEEE 802.11ac was evaluated for the highest IEEE 802.11a position in each 5 GHz band and exposure condition.
- When the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is <1.6 W/kg and the reported 1g averaged SAR is <0.8 W/kg, SAR testing on other channels is not required. Otherwise, the other default (or corresponding required) test channels were additionally tested using the lowest data rate.
- The bolded data rate and channel above were tested for SAR.

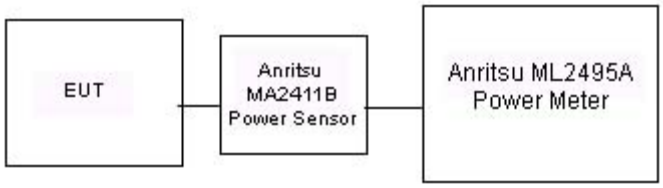

Figure 9-2
Power Measurement Setup for Bandwidths < 50 MHz

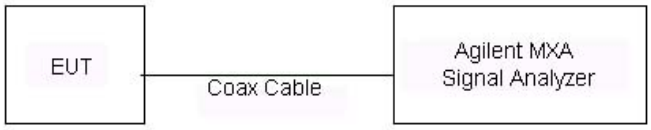

Figure 9-3
Power Measurement Setup for Bandwidths > 50 MHz

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
6/24/2014	750H	22.6	695	0.876	42.625	0.889	42.227	-1.46%	0.94%
			710	0.891	42.437	0.890	42.149	0.11%	0.68%
			725	0.906	42.209	0.891	42.071	1.68%	0.33%
			740	0.920	42.029	0.893	41.994	3.02%	0.08%
			755	0.935	41.839	0.894	41.916	4.59%	-0.18%
6/17/2014	835H	22.7	820	0.879	40.190	0.899	41.578	-2.22%	-3.34%
			835	0.893	40.006	0.900	41.500	-0.78%	-3.60%
			850	0.908	39.847	0.916	41.500	-0.87%	-3.98%
6/18/2014	1750H	22.3	1710	1.337	38.618	1.348	40.142	-0.82%	-3.80%
			1750	1.380	38.440	1.371	40.079	0.66%	-4.09%
			1790	1.418	38.290	1.394	40.016	1.72%	-4.31%
6/17/2014	1900H	23.1	1850	1.348	39.999	1.400	40.000	-3.71%	0.00%
			1880	1.383	39.843	1.400	40.000	-1.21%	-0.39%
			1910	1.419	39.776	1.400	40.000	1.36%	-0.56%
06/23/2014	1900H	22.0	1850	1.392	40.311	1.400	40.000	-0.57%	0.78%
			1880	1.421	40.159	1.400	40.000	1.50%	0.40%
			1910	1.453	40.016	1.400	40.000	3.79%	0.04%
06/17/2014	2450H	22.4	2401	1.692	40.138	1.756	39.287	-3.64%	2.17%
			2450	1.743	39.937	1.800	39.200	-3.17%	1.88%
			2499	1.795	39.764	1.853	39.138	-3.13%	1.60%
06/23/2014	5200H-5800H	23.1	5200	4.698	37.195	4.655	35.986	0.92%	3.36%
			5220	4.734	37.152	4.676	35.963	1.24%	3.31%
			5260	4.780	37.159	4.717	35.917	1.34%	3.46%
			5280	4.791	37.142	4.737	35.894	1.14%	3.48%
			5300	4.799	37.064	4.758	35.871	0.86%	3.33%
			5500	5.014	36.791	4.963	35.643	1.03%	3.22%
			5600	5.122	36.629	5.065	35.529	1.13%	3.10%
			5680	5.199	36.531	5.147	35.437	1.01%	3.09%
			5700	5.218	36.487	5.168	35.414	0.97%	3.03%
			5765	5.309	36.439	5.234	35.340	1.43%	3.11%
			5785	5.312	36.416	5.255	35.317	1.08%	3.11%
			5800	5.320	36.363	5.270	35.300	0.95%	3.01%
			5825	5.360	36.313	5.296	35.271	1.21%	2.95%
6/18/2014	750B	23.0	695	0.920	54.359	0.959	55.745	-4.07%	-2.49%
			710	0.936	54.201	0.960	55.687	-2.50%	-2.67%
			725	0.949	54.068	0.961	55.629	-1.25%	-2.81%
			740	0.963	53.923	0.963	55.570	0.00%	-2.96%
			755	0.977	53.784	0.964	55.512	1.35%	-3.11%
6/23/2014	835B	22.1	820	0.929	55.350	0.969	55.258	-4.13%	0.17%
			835	0.942	55.193	0.970	55.200	-2.89%	-0.01%
			850	0.956	55.074	0.988	55.154	-3.24%	-0.15%
6/18/2014	1750B	22.6	1710	1.486	51.537	1.463	53.537	1.57%	-3.74%
			1750	1.531	51.364	1.488	53.432	2.89%	-3.87%
			1790	1.573	51.242	1.514	53.326	3.90%	-3.91%
6/19/2014	1900B	21.3	1850	1.449	53.626	1.520	53.300	-4.67%	0.61%
			1880	1.481	53.465	1.520	53.300	-2.57%	0.31%
			1910	1.514	53.360	1.520	53.300	-0.39%	0.11%
6/26/2014	1900B	20.1	1850	1.507	52.867	1.520	53.300	-0.86%	-0.81%
			1880	1.540	52.768	1.520	53.300	1.32%	-1.00%
			1910	1.578	52.674	1.520	53.300	3.82%	-1.17%
6/16/2014	2450B	22.8	2401	1.952	52.243	1.903	52.765	2.57%	-0.99%
			2450	2.019	52.059	1.950	52.700	3.54%	-1.22%
			2499	2.086	51.895	2.019	52.638	3.32%	-1.41%
06/16/2014	5200B-5800B	22.2	5200	5.454	47.504	5.299	49.014	2.93%	-3.08%
			5220	5.484	47.539	5.323	48.987	3.02%	-2.96%
			5260	5.511	47.457	5.369	48.933	2.64%	-3.02%
			5280	5.565	47.387	5.393	48.906	3.19%	-3.11%
			5300	5.592	47.351	5.416	48.879	3.25%	-3.13%
			5500	5.881	47.322	5.650	48.607	4.09%	-2.64%
			5520	5.907	47.268	5.673	48.580	4.12%	-2.70%
			5540	5.931	47.226	5.696	48.553	4.13%	-2.73%
			5600	6.014	47.230	5.766	48.471	4.30%	-2.56%
			5680	6.090	47.014	5.860	48.363	3.92%	-2.79%
			5700	6.125	46.970	5.883	48.336	4.11%	-2.83%
			5765	6.158	46.770	5.959	48.248	3.34%	-3.06%
			5785	6.188	46.692	5.982	48.220	3.44%	-3.17%
			5800	6.210	46.638	6.000	48.200	3.50%	-3.24%
			5825	6.233	46.688	6.029	48.166	3.38%	-3.07%

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

10.2 Test System Verification

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

Table 10-2
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)	$Deviation_{1g}$ (%)
J	750	HEAD	06/24/2014	22.4	22.6	0.100	1003	3332	0.876	8.370	8.760	4.66%
I	835	HEAD	06/17/2014	23.8	23.5	0.100	4d119	3209	1.000	9.220	10.000	8.46%
C	1750	HEAD	06/18/2014	19.0	22.3	0.100	1051	3213	3.730	36.200	37.300	3.04%
K	1900	HEAD	06/17/2014	23.9	23.0	0.100	5d149	3287	3.930	40.400	39.300	-2.72%
C	1900	HEAD	06/23/2014	20.9	22.0	0.100	5d148	3213	3.780	40.700	37.800	-7.13%
G	2450	HEAD	06/17/2014	22.5	21.8	0.100	797	3258	4.990	51.800	49.900	-3.67%
E	5200	HEAD	06/23/2014	24.3	23.3	0.100	1057	3914	7.630	78.000	76.300	-2.18%
E	5300	HEAD	06/23/2014	24.4	23.3	0.100	1057	3914	7.810	83.000	78.100	-5.90%
E	5500	HEAD	06/23/2014	24.4	23.3	0.100	1057	3914	8.080	84.300	80.800	-4.15%
E	5600	HEAD	06/23/2014	24.4	23.4	0.100	1057	3914	8.280	83.500	82.800	-0.84%
E	5800	HEAD	06/23/2014	24.4	23.4	0.100	1057	3914	7.350	79.300	73.500	-7.31%
D	750	BODY	06/18/2014	24.9	23.0	0.100	1003	3022	0.859	8.770	8.590	-2.05%
B	835	BODY	06/23/2014	22.6	22.1	0.100	4d133	3288	0.977	9.610	9.770	1.66%
C	1750	BODY	06/18/2014	19.9	22.8	0.100	1051	3213	3.740	37.400	37.400	0.00%
B	1900	BODY	06/19/2014	23.2	21.3	0.100	5d148	3288	4.070	39.300	40.700	3.56%
B	1900	BODY	06/26/2014	21.9	20.1	0.100	5d148	3288	3.890	39.300	38.900	-1.02%
H	2450	BODY	06/16/2014	23.2	22.9	0.100	719	3319	5.550	51.700	55.500	7.35%
A	5200	BODY	06/16/2014	24.4	22.4	0.100	1007	3920	7.400	72.600	74.000	1.93%
A	5300	BODY	06/16/2014	24.4	22.4	0.100	1007	3920	7.530	74.700	75.300	0.80%
A	5500	BODY	06/16/2014	24.5	22.5	0.100	1007	3920	7.620	75.900	76.200	0.40%
A	5600	BODY	06/16/2014	24.5	22.5	0.100	1007	3920	7.650	77.300	76.500	-1.03%
A	5800	BODY	06/16/2014	24.5	22.5	0.100	1007	3920	6.920	72.900	69.200	-5.08%

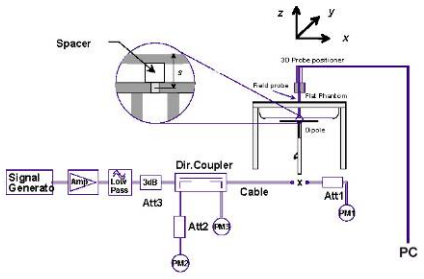

Figure 10-1
System Verification Setup Diagram

Figure 10-2
System Verification Setup Photo

11 SAR DATA SUMMARY

11.1 Standalone Head SAR Data

Table 11-1
Cell. CDMA Head SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Cover Type	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
836.52	384	Cell. CDMA	RC3 / SO55	25.7	25.46	-0.03	Right	Cheek	Standard	0699-0232	1:1	0.395	1.057	0.418	
836.52	384	Cell. CDMA	RC3 / SO55	25.7	25.46	0.05	Right	Cheek	WCC Open	0699-0232	1:1	0.368	1.057	0.389	
836.52	384	Cell. CDMA	RC3 / SO55	25.7	25.46	-0.05	Right	Cheek	WCC Closed	0699-0232	1:1	0.352	1.057	0.372	
836.52	384	Cell. CDMA	RC3 / SO55	25.7	25.46	-0.03	Right	Tilt	Standard	0699-0232	1:1	0.319	1.057	0.337	
836.52	384	Cell. CDMA	RC3 / SO55	25.7	25.46	0.06	Left	Cheek	Standard	0699-0232	1:1	0.321	1.057	0.339	
836.52	384	Cell. CDMA	RC3 / SO55	25.7	25.46	-0.06	Left	Tilt	Standard	0699-0232	1:1	0.280	1.057	0.296	
836.52	384	Cell. CDMA	EVDO Rev. A	25.7	25.44	0.00	Right	Cheek	Standard	0699-0232	1:1	0.407	1.062	0.432	A1
836.52	384	Cell. CDMA	EVDO Rev. A	25.7	25.44	-0.01	Right	Cheek	WCC Open	0699-0232	1:1	0.349	1.062	0.371	
836.52	384	Cell. CDMA	EVDO Rev. A	25.7	25.44	0.00	Right	Cheek	WCC Closed	0699-0232	1:1	0.370	1.062	0.393	
836.52	384	Cell. CDMA	EVDO Rev. A	25.7	25.44	0.01	Right	Tilt	Standard	0699-0232	1:1	0.226	1.062	0.240	
836.52	384	Cell. CDMA	EVDO Rev. A	25.7	25.44	0.02	Left	Cheek	Standard	0699-0232	1:1	0.333	1.062	0.354	
836.52	384	Cell. CDMA	EVDO Rev. A	25.7	25.44	0.17	Left	Tilt	Standard	0699-0232	1:1	0.211	1.062	0.224	
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
PCS CDMA Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Cover Type	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
1880.00	600	PCS CDMA	RC3 / SO55	25.2	25.17	-0.03	Right	Cheek	Standard	0699-0232	1:1	0.367	1.007	0.370	A2
1880.00	600	PCS CDMA	RC3 / SO55	25.2	25.17	0.02	Right	Cheek	WCC Open	0699-0232	1:1	0.354	1.007	0.356	
1880.00	600	PCS CDMA	RC3 / SO55	25.2	25.17	-0.16	Right	Cheek	WCC Closed	0699-0232	1:1	0.269	1.007	0.271	
1880.00	600	PCS CDMA	RC3 / SO55	25.2	25.17	0.04	Right	Tilt	Standard	0699-0232	1:1	0.088	1.007	0.089	
1880.00	600	PCS CDMA	RC3 / SO55	25.2	25.17	-0.02	Left	Cheek	Standard	0699-0232	1:1	0.264	1.007	0.266	
1880.00	600	PCS CDMA	RC3 / SO55	25.2	25.17	0.03	Left	Tilt	Standard	0699-0232	1:1	0.129	1.007	0.130	
1880.00	600	PCS CDMA	EVDO Rev. A	25.2	25.18	-0.03	Right	Cheek	Standard	0699-0232	1:1	0.346	1.005	0.348	
1880.00	600	PCS CDMA	EVDO Rev. A	25.2	25.18	-0.14	Right	Cheek	WCC Open	0699-0232	1:1	0.248	1.005	0.249	
1880.00	600	PCS CDMA	EVDO Rev. A	25.2	25.18	-0.02	Right	Cheek	WCC Closed	0699-0232	1:1	0.254	1.005	0.255	
1880.00	600	PCS CDMA	EVDO Rev. A	25.2	25.18	0.03	Right	Tilt	Standard	0699-0232	1:1	0.111	1.005	0.112	
1880.00	600	PCS CDMA	EVDO Rev. A	25.2	25.18	-0.04	Left	Cheek	Standard	0699-0232	1:1	0.272	1.005	0.273	
1880.00	600	PCS CDMA	EVDO Rev. A	25.2	25.18	0.06	Left	Tilt	Standard	0699-0232	1:1	0.162	1.005	0.163	
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
LTE Band 12 Head SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
707.50	23095	Mid	LTE Band 12	10	Standard	24.7	24.57	0.06	0	Right	Cheek	QPSK	1	49	0699-0233	1:1	0.207	1.030	0.213	
707.50	23095	Mid	LTE Band 12	10	Standard	23.7	23.47	0.00	1	Right	Cheek	QPSK	25	25	0699-0233	1:1	0.176	1.054	0.186	
707.50	23095	Mid	LTE Band 12	10	Standard	24.7	24.57	-0.07	0	Right	Tilt	QPSK	1	49	0699-0233	1:1	0.121	1.030	0.125	
707.50	23095	Mid	LTE Band 12	10	Standard	23.7	23.47	0.07	1	Right	Tilt	QPSK	25	25	0699-0233	1:1	0.103	1.054	0.109	
707.50	23095	Mid	LTE Band 12	10	Standard	24.7	24.57	-0.11	0	Left	Cheek	QPSK	1	49	0699-0233	1:1	0.272	1.030	0.280	
707.50	23095	Mid	LTE Band 12	10	WCC Open	24.7	24.57	0.20	0	Left	Cheek	QPSK	1	49	0699-0233	1:1	0.289	1.030	0.298	A3
707.50	23095	Mid	LTE Band 12	10	WCC Closed	24.7	24.57	0.16	0	Left	Cheek	QPSK	1	49	0699-0233	1:1	0.252	1.030	0.260	
707.50	23095	Mid	LTE Band 12	10	Standard	23.7	23.47	0.05	1	Left	Cheek	QPSK	25	25	0699-0233	1:1	0.219	1.054	0.231	
707.50	23095	Mid	LTE Band 12	10	Standard	24.7	24.57	-0.16	0	Left	Tilt	QPSK	1	49	0699-0233	1:1	0.157	1.030	0.162	
707.50	23095	Mid	LTE Band 12	10	Standard	23.7	23.47	-0.02	1	Left	Tilt	QPSK	25	25	0699-0233	1:1	0.129	1.054	0.136	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population															Head 1.6 W/kg (mW/g) averaged over 1 gram					

Table 11-4
LTE Band 5 (Cell) Head SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	24.7	24.69	0.02	0	Right	Cheek	QPSK	1	0	0699-0233	1:1	0.321	1.002	0.322	A4
836.50	20525	Mid	LTE Band 5 (Cell)	10	WCC Open	24.7	24.69	-0.04	0	Right	Cheek	QPSK	1	0	0699-0233	1:1	0.275	1.002	0.276	
836.50	20525	Mid	LTE Band 5 (Cell)	10	WCC Closed	24.7	24.69	0.00	0	Right	Cheek	QPSK	1	0	0699-0233	1:1	0.261	1.002	0.262	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	23.7	23.70	0.04	1	Right	Cheek	QPSK	25	25	0699-0233	1:1	0.286	1.000	0.286	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	24.7	24.69	0.06	0	Right	Tilt	QPSK	1	0	0699-0233	1:1	0.183	1.002	0.183	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	23.7	23.70	0.00	1	Right	Tilt	QPSK	25	25	0699-0233	1:1	0.157	1.000	0.157	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	24.7	24.69	0.02	0	Left	Cheek	QPSK	1	0	0699-0233	1:1	0.261	1.002	0.262	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	23.7	23.70	-0.02	1	Left	Cheek	QPSK	25	25	0699-0233	1:1	0.217	1.000	0.217	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	24.7	24.69	0.07	0	Left	Tilt	QPSK	1	0	0699-0233	1:1	0.179	1.002	0.179	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	23.7	23.70	-0.02	1	Left	Tilt	QPSK	25	25	0699-0233	1:1	0.139	1.000	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 11-5
LTE Band 4 (AWS) Head SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	24.7	24.28	-0.01	0	Right	Cheek	QPSK	1	50	0699-0233	1:1	0.250	1.102	0.276	A5
1732.50	20175	Mid	LTE Band 4 (AWS)	20	WCC Open	24.7	24.28	-0.01	0	Right	Cheek	QPSK	1	50	0699-0233	1:1	0.211	1.102	0.233	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	WCC Closed	24.7	24.28	-0.02	0	Right	Cheek	QPSK	1	50	0699-0233	1:1	0.171	1.102	0.188	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.7	23.23	0.18	1	Right	Cheek	QPSK	50	0	0699-0233	1:1	0.202	1.114	0.225	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	24.7	24.28	0.04	0	Right	Tilt	QPSK	1	50	0699-0233	1:1	0.178	1.102	0.196	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.7	23.23	0.03	1	Right	Tilt	QPSK	50	0	0699-0233	1:1	0.142	1.114	0.158	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	24.7	24.28	-0.03	0	Left	Cheek	QPSK	1	50	0699-0233	1:1	0.187	1.102	0.206	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.7	23.23	-0.01	1	Left	Cheek	QPSK	50	0	0699-0233	1:1	0.149	1.114	0.166	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	24.7	24.28	-0.01	0	Left	Tilt	QPSK	1	50	0699-0233	1:1	0.140	1.102	0.154	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.7	23.23	0.06	1	Left	Tilt	QPSK	50	0	0699-0233	1:1	0.103	1.114	0.115	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population															Head 1.6 W/kg (mW/g) averaged over 1 gram					

Table 11-6
LTE Band 25 (PCS) Head SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
1860.00	26140	Low	LTE Band 25 (PCS)	20	Standard	24.2	24.18	-0.05	0	Right	Cheek	QPSK	1	99	0699-0233	1:1	0.243	1.005	0.244	A6
1860.00	26140	Low	LTE Band 25 (PCS)	20	WCC Open	24.2	24.18	-0.04	0	Right	Cheek	QPSK	1	99	0699-0233	1:1	0.240	1.005	0.241	
1860.00	26140	Low	LTE Band 25 (PCS)	20	WCC Closed	24.2	24.18	0.01	0	Right	Cheek	QPSK	1	99	0699-0233	1:1	0.230	1.005	0.231	
1905.00	26590	High	LTE Band 25 (PCS)	20	Standard	23.2	23.17	-0.04	1	Right	Cheek	QPSK	50	25	0699-0233	1:1	0.197	1.007	0.198	
1860.00	26140	Low	LTE Band 25 (PCS)	20	Standard	24.2	24.18	0.01	0	Right	Tilt	QPSK	1	99	0699-0233	1:1	0.103	1.005	0.104	
1905.00	26590	High	LTE Band 25 (PCS)	20	Standard	23.2	23.17	0.16	1	Right	Tilt	QPSK	50	25	0699-0233	1:1	0.083	1.007	0.084	
1860.00	26140	Low	LTE Band 25 (PCS)	20	Standard	24.2	24.18	0.01	0	Left	Cheek	QPSK	1	99	0699-0233	1:1	0.227	1.005	0.228	
1905.00	26590	High	LTE Band 25 (PCS)	20	Standard	23.2	23.17	0.01	1	Left	Cheek	QPSK	50	25	0699-0233	1:1	0.180	1.007	0.181	
1860.00	26140	Low	LTE Band 25 (PCS)	20	Standard	24.2	24.18	-0.20	0	Left	Tilt	QPSK	1	99	0699-0233	1:1	0.132	1.005	0.133	
1905.00	26590	High	LTE Band 25 (PCS)	20	Standard	23.2	23.17	-0.01	1	Left	Tilt	QPSK	50	25	0699-0233	1:1	0.101	1.007	0.102	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population																	Head 1.6 W/kg (mW/g) averaged over 1 gram			

Table 11-7
DTS Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Cover Type	Device Serial Number	Data Rate (Mbps)	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
2437	6	IEEE 802.11b	DSSS	16.0	15.16	0.03	Right	Cheek	Standard	0699-0234	1	1:1	0.096	1.213	0.116	
2437	6	IEEE 802.11b	DSSS	16.0	15.16	0.19	Right	Tilt	Standard	0699-0234	1	1:1	0.093	1.213	0.113	
2437	6	IEEE 802.11b	DSSS	16.0	15.16	0.07	Left	Cheek	Standard	0699-0234	1	1:1	0.152	1.213	**0.184**	A7
2437	6	IEEE 802.11b	DSSS	16.0	15.16	0.01	Left	Cheek	WCC Open	0699-0234	1	1:1	0.138	1.213	0.167	
2437	6	IEEE 802.11b	DSSS	16.0	15.16	0.06	Left	Cheek	WCC Closed	0699-0234	1	1:1	0.091	1.213	0.110	
2437	6	IEEE 802.11b	DSSS	16.0	15.16	0.03	Left	Tilt	Standard	0699-0234	1	1:1	0.151	1.213	0.183	
5825	165	IEEE 802.11a	OFDM	13.0	11.90	0.02	Right	Cheek	Standard	0699-0234	6	1:1	0.127	1.288	0.164	
5825	165	IEEE 802.11a	OFDM	13.0	11.90	0.06	Right	Tilt	Standard	0699-0234	6	1:1	0.141	1.288	0.182	A8
5775	155	IEEE 802.11ac	OFDM	10.0	8.99	0.03	Right	Tilt	Standard	0699-0234	29.3	1:1	0.079	1.262	0.100	
5825	165	IEEE 802.11a	OFDM	13.0	11.90	0.11	Left	Cheek	Standard	0699-0234	6	1:1	0.137	1.288	0.176	
5825	165	IEEE 802.11a	OFDM	13.0	11.90	-0.03	Left	Tilt	Standard	0699-0234	6	1:1	0.139	1.288	0.179	
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
NII Head SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Cover Type	Device Serial Number	Data Rate (Mbps)	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
5220	44	IEEE 802.11a	OFDM	13.0	12.08	-0.01	Right	Cheek	Standard	0699-0234	6	1:1	0.281	1.236	0.347	
5220	44	IEEE 802.11a	OFDM	13.0	12.08	-0.01	Right	Tilt	Standard	0699-0234	6	1:1	0.325	1.236	**0.402**	A9
5220	44	IEEE 802.11a	OFDM	13.0	12.08	0.03	Right	Tilt	WCC Open	0699-0234	6	1:1	0.258	1.236	0.319	
5220	44	IEEE 802.11a	OFDM	13.0	12.08	0.10	Right	Tilt	WCC Closed	0699-0234	6	1:1	0.272	1.236	0.336	
5210	42	IEEE 802.11ac	OFDM	10.0	8.75	0.10	Right	Tilt	Standard	0699-0234	29.3	1:1	0.183	1.334	0.244	
5220	44	IEEE 802.11a	OFDM	13.0	12.08	-0.01	Left	Cheek	Standard	0699-0234	6	1:1	0.256	1.236	0.316	
5220	44	IEEE 802.11a	OFDM	13.0	12.08	0.11	Left	Tilt	Standard	0699-0234	6	1:1	0.262	1.236	0.324	
5260	52	IEEE 802.11a	OFDM	13.0	12.18	-0.03	Right	Cheek	Standard	0699-0234	6	1:1	0.258	1.208	0.312	
5260	52	IEEE 802.11a	OFDM	13.0	12.18	0.06	Right	Tilt	Standard	0699-0234	6	1:1	0.294	1.208	0.355	
5290	58	IEEE 802.11ac	OFDM	10.0	8.56	-0.12	Right	Tilt	Standard	0699-0234	29.3	1:1	0.144	1.393	0.201	
5260	52	IEEE 802.11a	OFDM	13.0	12.18	0.06	Left	Cheek	Standard	0699-0234	6	1:1	0.225	1.208	0.272	
5260	52	IEEE 802.11a	OFDM	13.0	12.18	0.03	Left	Tilt	Standard	0699-0234	6	1:1	0.237	1.208	0.286	
5500	100	IEEE 802.11a	OFDM	13.0	12.82	-0.17	Right	Cheek	Standard	0699-0234	6	1:1	0.080	1.042	0.083	
5500	100	IEEE 802.11a	OFDM	13.0	12.82	0.21	Right	Tilt	Standard	0699-0234	6	1:1	0.208	1.042	0.217	
5690	138	IEEE 802.11ac	OFDM	10.0	8.83	0.03	Right	Tilt	Standard	0699-0234	29.3	1:1	0.083	1.309	0.109	
5500	100	IEEE 802.11a	OFDM	13.0	12.82	0.10	Left	Cheek	Standard	0699-0234	6	1:1	0.125	1.042	0.130	
5500	100	IEEE 802.11a	OFDM	13.0	12.82	-0.20	Left	Tilt	Standard	0699-0234	6	1:1	0.143	1.042	0.149	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**							**Head** **1.6 W/kg (mW/g)** averaged over 1 gram									

11.2 Standalone Body-Worn SAR Data

Table 11-9
Body-Worn SAR Data

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Cover Type	Device Serial Number	Duty Cycle	Side	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
836.52	384	Cell. CDMA	TDSO / SO32	25.7	25.55	-0.02	10 mm	Standard	0699-0232	1:1	back	0.443	1.035	0.459	A10
836.52	384	Cell. CDMA	TDSO / SO32	25.7	25.55	0.03	10 mm	WCC Closed	0699-0232	1:1	back	0.367	1.035	0.380	
1851.25	25	PCS CDMA	TDSO / SO32	25.2	25.15	-0.13	10 mm	Standard	0699-0232	1:1	back	0.780	1.012	0.789	
1880.00	600	PCS CDMA	TDSO / SO32	25.2	25.16	0.00	10 mm	Standard	0699-0232	1:1	back	0.812	1.009	**0.819**	A12
1908.75	1175	PCS CDMA	TDSO / SO32	25.2	25.20	0.01	10 mm	Standard	0699-0232	1:1	back	0.736	1.000	0.736	
1880.00	600	PCS CDMA	TDSO / SO32	25.2	25.16	0.00	10 mm	WCC Closed	0699-0232	1:1	back	0.726	1.009	0.733	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**							**Body** **1.6 W/kg (mW/g)** averaged over 1 gram								

Table 11-10
LTE Body-Worn SAR

MEASUREMENT RESULTS																					
FREQUENCY			Mode	Bandwidth [MHz]	Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
707.50	23095	Mid	LTE Band 12	10	Standard	24.7	24.57	-0.01	0	0699-0233	QPSK	1	49	10 mm	back	1:1	0.443	1.030	0.456	A14
707.50	23095	Mid	LTE Band 12	10	WCC Closed	24.7	24.57	-0.01	0	0699-0233	QPSK	1	49	10 mm	back	1:1	0.401	1.030	0.413	
707.50	23095	Mid	LTE Band 12	10	Standard	23.7	23.47	0.02	1	0699-0233	QPSK	25	25	10 mm	back	1:1	0.367	1.054	0.387	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	24.7	24.69	0.00	0	0699-0233	QPSK	1	0	10 mm	back	1:1	0.503	1.002	0.504	A16
836.50	20525	Mid	LTE Band 5 (Cell)	10	WCC Closed	24.7	24.69	0.07	0	0699-0233	QPSK	1	0	10 mm	back	1:1	0.406	1.002	0.407	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	23.7	23.70	0.07	1	0699-0233	QPSK	25	25	10 mm	back	1:1	0.418	1.000	0.418	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	24.7	24.28	-0.01	0	0699-0233	QPSK	1	50	10 mm	back	1:1	0.647	1.102	0.713	A18
1732.50	20175	Mid	LTE Band 4 (AWS)	20	WCC Closed	24.7	24.28	0.04	0	0699-0233	QPSK	1	50	10 mm	back	1:1	0.566	1.102	0.624	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.7	23.23	-0.07	1	0699-0233	QPSK	50	0	10 mm	back	1:1	0.510	1.114	0.568	
1860.00	26140	Low	LTE Band 25 (PCS)	20	Standard	24.2	24.18	0.01	0	0699-0233	QPSK	1	99	10 mm	back	1:1	0.653	1.005	0.656	A19
1860.00	26140	Low	LTE Band 25 (PCS)	20	WCC Closed	24.2	24.18	0.03	0	0699-0233	QPSK	1	99	10 mm	back	1:1	0.608	1.005	0.611	
1905.00	26590	High	LTE Band 25 (PCS)	20	Standard	23.2	23.17	-0.11	1	0699-0233	QPSK	50	25	10 mm	back	1:1	0.503	1.007	0.507	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Body 1.6 W/kg (mW/g) averaged over 1 gram										

Table 11-11
DTS Body-Worn SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Cover Type	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
2437	6	IEEE 802.11b	DSSS	16.0	15.16	0.12	10 mm	Standard	0699-0234	1	back	1:1	0.092	1.213	0.112	A20
2437	6	IEEE 802.11b	DSSS	16.0	15.16	0.04	10 mm	WCC Closed	0699-0234	1	back	1:1	0.077	1.213	0.093	
5825	165	IEEE 802.11a	OFDM	13.0	11.90	0.08	10 mm	Standard	0699-0234	6	back	1:1	0.142	1.288	**0.183**	A21
5775	155	IEEE 802.11ac	OFDM	10.0	8.99	0.03	10 mm	Standard	0699-0234	29.3	back	1:1	0.100	1.262	0.126	
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 11-12
NII Body-Worn SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Cover Type	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
5220	44	IEEE 802.11a	OFDM	13.0	12.08	0.04	10 mm	Standard	0699-0234	6	back	1:1	0.170	1.236	**0.210**	A22
5220	44	IEEE 802.11a	OFDM	13.0	12.08	0.05	10 mm	WCC Closed	0699-0234	6	back	1:1	0.142	1.236	0.176	
5210	42	IEEE 802.11ac	OFDM	10.0	8.75	-0.09	10 mm	Standard	0699-0234	29.3	back	1:1	0.085	1.334	0.113	
5260	52	IEEE 802.11a	OFDM	13.0	12.18	0.06	10 mm	Standard	0699-0234	6	back	1:1	0.153	1.208	0.185	
5290	58	IEEE 802.11ac	OFDM	10.0	8.56	-0.04	10 mm	Standard	0699-0234	29.3	back	1:1	0.087	1.393	0.121	
5500	100	IEEE 802.11a	OFDM	13.0	12.82	0.02	10 mm	Standard	0699-0234	6	back	1:1	0.138	1.042	0.144	
5690	138	IEEE 802.11ac	OFDM	10.0	8.83	-0.05	10 mm	Standard	0699-0234	29.3	back	1:1	0.108	1.309	0.141	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Body 1.6 W/kg (mW/g) averaged over 1 gram							

11.3 Standalone Wireless Router SAR Data

Table 11-13
CDMA Hotspot SAR Data

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Cover Type	Device Serial Number	Duty Cycle	Side	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
836.52	384	Cell. CDMA	EVDO Rev. 0	25.7	25.52	-0.02	10 mm	Standard	0699-0232	1:1	back	0.594	1.042	0.619	A11
836.52	384	Cell. CDMA	EVDO Rev. 0	25.7	25.52	0.05	10 mm	WCC Closed	0699-0232	1:1	back	0.440	1.042	0.458	
836.52	384	Cell. CDMA	EVDO Rev. 0	25.7	25.52	0.18	10 mm	Standard	0699-0232	1:1	front	0.444	1.042	0.463	
836.52	384	Cell. CDMA	EVDO Rev. 0	25.7	25.52	-0.04	10 mm	Standard	0699-0232	1:1	bottom	0.238	1.042	0.248	
836.52	384	Cell. CDMA	EVDO Rev. 0	25.7	25.52	0.13	10 mm	Standard	0699-0232	1:1	right	0.360	1.042	0.375	
1851.25	25	PCS CDMA	EVDO Rev. 0	25.2	25.19	-0.03	10 mm	Standard	0699-0232	1:1	back	0.563	1.002	0.564	
1880.00	600	PCS CDMA	EVDO Rev. 0	25.2	25.20	-0.04	10 mm	Standard	0699-0232	1:1	back	0.828	1.000	0.828	
1908.75	1175	PCS CDMA	EVDO Rev. 0	25.2	25.18	0.02	10 mm	Standard	0699-0232	1:1	back	0.773	1.005	0.777	
1880.00	600	PCS CDMA	EVDO Rev. 0	25.2	25.20	0.02	10 mm	Standard	0699-0232	1:1	front	0.741	1.000	0.741	
1851.25	25	PCS CDMA	EVDO Rev. 0	25.2	25.19	-0.18	10 mm	Standard	0699-0232	1:1	bottom	0.559	1.002	0.560	
1880.00	600	PCS CDMA	EVDO Rev. 0	25.2	25.20	-0.16	10 mm	Standard	0699-0232	1:1	bottom	0.846	1.000	**0.846**	A13
1908.75	1175	PCS CDMA	EVDO Rev. 0	25.2	25.18	-0.09	10 mm	Standard	0699-0232	1:1	bottom	0.803	1.005	0.807	
1880.00	600	PCS CDMA	EVDO Rev. 0	25.2	25.20	-0.12	10 mm	WCC Closed	0699-0232	1:1	bottom	0.787	1.000	0.787	
1880.00	600	PCS CDMA	EVDO Rev. 0	25.2	25.20	-0.02	10 mm	Standard	0699-0232	1:1	right	0.283	1.000	0.283	
1880.00	600	PCS CDMA	EVDO Rev. 0	25.2	25.20	-0.02	10 mm	Standard	0699-0232	1:1	bottom	0.826	1.000	0.826	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram								

Note: Variability is highlighted in blue.

Table 11-14
LTE Band 12 Hotspot SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
707.50	23095	Mid	LTE Band 12	10	Standard	24.7	24.57	-0.01	0	0699-0233	QPSK	1	49	10 mm	back	1:1	0.443	1.030	0.456	
707.50	23095	Mid	LTE Band 12	10	Standard	23.7	23.47	0.02	1	0699-0233	QPSK	25	25	10 mm	back	1:1	0.367	1.054	0.387	
707.50	23095	Mid	LTE Band 12	10	Standard	24.7	24.57	-0.02	0	0699-0233	QPSK	1	49	10 mm	front	1:1	0.325	1.030	0.335	
707.50	23095	Mid	LTE Band 12	10	Standard	23.7	23.47	0.01	1	0699-0233	QPSK	25	25	10 mm	front	1:1	0.251	1.054	0.265	
707.50	23095	Mid	LTE Band 12	10	Standard	24.7	24.57	-0.04	0	0699-0233	QPSK	1	49	10 mm	bottom	1:1	0.288	1.030	0.297	
707.50	23095	Mid	LTE Band 12	10	Standard	23.7	23.47	0.07	1	0699-0233	QPSK	25	25	10 mm	bottom	1:1	0.229	1.054	0.241	
707.50	23095	Mid	LTE Band 12	10	Standard	24.7	24.57	0.01	0	0699-0233	QPSK	1	49	10 mm	left	1:1	0.639	1.030	0.658	A15
707.50	23095	Mid	LTE Band 12	10	WCC Closed	24.7	24.57	-0.11	0	0699-0233	QPSK	1	49	10 mm	left	1:1	0.535	1.030	0.551	
707.50	23095	Mid	LTE Band 12	10	Standard	23.7	23.47	-0.02	1	0699-0233	QPSK	25	25	10 mm	left	1:1	0.544	1.054	0.573	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Body 1.6 W/kg (mW/g) averaged over 1 gram											

Table 11-15
LTE Band 5 (Cell) Hotspot SAR

MEASUREMENT RESULTS																					
FREQUENCY			Mode	Bandwidth [MHz]	Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g) (W/kg)	Scaling Factor	Scaled SAR (1g) (W/kg)	Plot #
MHz	Ch.																			
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	24.7	24.69	0.00	0	0699-0233	QPSK	1	0	10 mm	back	1:1	0.503	1.002	0.504	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	23.7	23.70	0.07	1	0699-0233	QPSK	25	25	10 mm	back	1:1	0.418	1.000	0.418	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	24.7	24.69	-0.01	0	0699-0233	QPSK	1	0	10 mm	front	1:1	0.386	1.002	0.387	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	23.7	23.70	0.11	1	0699-0233	QPSK	25	25	10 mm	front	1:1	0.318	1.000	0.318	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	24.7	24.69	-0.13	0	0699-0233	QPSK	1	0	10 mm	bottom	1:1	0.239	1.002	0.239	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	23.7	23.70	-0.10	1	0699-0233	QPSK	25	25	10 mm	bottom	1:1	0.205	1.000	0.205	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	24.7	24.69	0.17	0	0699-0233	QPSK	1	0	10 mm	right	1:1	0.526	1.002	0.527	A17
836.50	20525	Mid	LTE Band 5 (Cell)	10	WCC Closed	24.7	24.69	0.07	0	0699-0233	QPSK	1	0	10 mm	right	1:1	0.390	1.002	0.391	
836.50	20525	Mid	LTE Band 5 (Cell)	10	Standard	23.7	23.70	0.06	1	0699-0233	QPSK	25	25	10 mm	right	1:1	0.463	1.000	0.463	
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 4 (AWS) Hotspot SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g) (W/kg)	Scaling Factor	Scaled SAR (1g) (W/kg)	Plot #
MHz	Ch.																			
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	24.7	24.28	-0.01	0	0699-0233	QPSK	1	50	10 mm	back	1:1	0.647	1.102	0.713	A18
1732.50	20175	Mid	LTE Band 4 (AWS)	20	WCC Closed	24.7	24.28	0.04	0	0699-0233	QPSK	1	50	10 mm	back	1:1	0.566	1.102	0.624	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.7	23.23	-0.07	1	0699-0233	QPSK	50	0	10 mm	back	1:1	0.510	1.114	0.568	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	24.7	24.28	0.00	0	0699-0233	QPSK	1	50	10 mm	front	1:1	0.365	1.102	0.402	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.7	23.23	-0.09	1	0699-0233	QPSK	50	0	10 mm	front	1:1	0.338	1.114	0.377	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	24.7	24.28	-0.04	0	0699-0233	QPSK	1	50	10 mm	bottom	1:1	0.443	1.102	0.488	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.7	23.23	0.03	1	0699-0233	QPSK	50	0	10 mm	bottom	1:1	0.350	1.114	0.390	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	24.7	24.28	-0.04	0	0699-0233	QPSK	1	50	10 mm	left	1:1	0.421	1.102	0.464	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.7	23.23	-0.01	1	0699-0233	QPSK	50	0	10 mm	left	1:1	0.330	1.114	0.368	
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]	Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g) (W/kg)	Scaling Factor	Scaled SAR (1g) (W/kg)	Plot #
MHz	Ch.																			
1860.00	26140	Low	LTE Band 25 (PCS)	20	Standard	24.2	24.18	0.01	0	0699-0233	QPSK	1	99	10 mm	back	1:1	0.653	1.005	0.656	A19
1860.00	26140	Low	LTE Band 25 (PCS)	20	WCC Closed	24.2	24.18	0.03	0	0699-0233	QPSK	1	99	10 mm	back	1:1	0.608	1.005	0.611	
1905.00	26590	High	LTE Band 25 (PCS)	20	Standard	23.2	23.17	-0.11	1	0699-0233	QPSK	50	25	10 mm	back	1:1	0.503	1.007	0.507	
1860.00	26140	Low	LTE Band 25 (PCS)	20	Standard	24.2	24.18	0.01	0	0699-0233	QPSK	1	99	10 mm	front	1:1	0.579	1.005	0.582	
1905.00	26590	High	LTE Band 25 (PCS)	20	Standard	23.2	23.17	0.00	1	0699-0233	QPSK	50	25	10 mm	front	1:1	0.479	1.007	0.482	
1860.00	26140	Low	LTE Band 25 (PCS)	20	Standard	24.2	24.18	-0.02	0	0699-0233	QPSK	1	99	10 mm	bottom	1:1	0.628	1.005	0.631	
1905.00	26590	High	LTE Band 25 (PCS)	20	Standard	23.2	23.17	0.09	1	0699-0233	QPSK	50	25	10 mm	bottom	1:1	0.523	1.007	0.527	
1860.00	26140	Low	LTE Band 25 (PCS)	20	Standard	24.2	24.18	-0.01	0	0699-0233	QPSK	1	99	10 mm	right	1:1	0.220	1.005	0.221	
1905.00	26590	High	LTE Band 25 (PCS)	20	Standard	23.2	23.17	0.01	1	0699-0233	QPSK	50	25	10 mm	right	1:1	0.187	1.007	0.188	
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
WLAN Wireless Router SAR

MEASUREMENT RESULTS																
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Cover Type	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.												(W/kg)		(W/kg)	
2437	6	IEEE 802.11b	DSSS	16.0	15.16	0.12	10 mm	Standard	0699-0234	1	back	1:1	0.092	1.213	**0.112**	A20
2437	6	IEEE 802.11b	DSSS	16.0	15.16	0.04	10 mm	WCC Closed	0699-0234	1	back	1:1	0.077	1.213	0.093	
2437	6	IEEE 802.11b	DSSS	16.0	15.16	0.07	10 mm	Standard	0699-0234	1	front	1:1	0.041	1.213	0.050	
2437	6	IEEE 802.11b	DSSS	16.0	15.16	0.12	10 mm	Standard	0699-0234	1	top	1:1	0.048	1.213	0.058	
2437	6	IEEE 802.11b	DSSS	16.0	15.16	0.19	10 mm	Standard	0699-0234	1	right	1:1	0.021	1.213	0.025	
5825	165	IEEE 802.11a	OFDM	13.0	11.90	0.08	10 mm	Standard	0699-0234	6	back	1:1	0.142	1.288	0.183	A21
5825	165	IEEE 802.11a	OFDM	13.0	11.90	0.05	10 mm	WCC Closed	0699-0234	6	back	1:1	0.140	1.288	0.180	
5775	155	IEEE 802.11ac	OFDM	10.0	8.99	0.03	10 mm	Standard	0699-0234	29.3	back	1:1	0.100	1.262	0.126	
5825	165	IEEE 802.11a	OFDM	13.0	11.90	0.04	10 mm	Standard	0699-0234	6	front	1:1	0.020	1.288	0.026	
5825	165	IEEE 802.11a	OFDM	13.0	11.90	-0.10	10 mm	Standard	0699-0234	6	top	1:1	0.114	1.288	0.147	
5825	165	IEEE 802.11a	OFDM	13.0	11.90	-0.03	10 mm	Standard	0699-0234	6	right	1:1	0.012	1.288	0.015	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram									

11.4 SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2003, and FCC KDB Publication 447498 D01v05.
2. Batteries are fully charged at the beginning of the SAR measurements. A standard battery was used for all SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v05.
6. Device was tested using a fixed spacing for body-worn accessory testing. A separation distance of 10 mm was considered because the manufacturer has determined that there will be body-worn accessories available in the marketplace for users to support this separation distance.
7. Per FCC KDB Publication 648474 D04v01, SAR was evaluated without a headset connected to the device. Since the standalone reported SAR was ≤ 1.2 W/kg, no additional SAR evaluations using a headset cable were required.
8. Per FCC KDB 865664 D01 v01, variability SAR tests were performed when the measured SAR results for a frequency band were greater than 0.8 W/kg. Repeated SAR measurements are highlighted in the tables above for clarity. Please see Section 13 for variability analysis.
9. During SAR Testing for the Wireless Router conditions per FCC KDB Publication 941225 D06v01, the actual Portable Hotspot operation (with actual simultaneous transmission of a transmitter with WIFI) was not activated (See Section 6.7 for more details).
10. Per FCC KDB Publication 648474 D04, SAR was measured using the standard battery cover and then repeated with the folio sleeve accessory for the highest reported SAR for each wireless technology, frequency band, operating mode, and exposure condition. Since reported SAR did not exceed 1.2 W/kg, additional testing with the wireless charging accessory was not required. . Head tests were performed with the folio sleeve open and closed. Additional body-worn and hotspot tests were performed with the folio closed only because operations near the body with the folio open are not expected. See Section 1.9 for more information.

CDMA Notes:

1. Head SAR for CDMA2000 mode was tested under RC3/SO55 per FCC KDB Publication 941225 D01v02.
2. Body-Worn SAR was tested with 1x RTT with TDSO / SO32 FCH Only. EVDO and TDSO / SO32 FCH+SCH SAR tests were not required since the average output power was not more than 0.25 dB higher than the TDSO / SO32 FCH only powers, per FCC KDB Publication 941225 D01v02.
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. Since the average output power of Subtype 2 for Rev. A is less than the Rev. 0 power levels, EVDO Rev. A SAR is not required. SAR is not required for 1x RTT for Ev-Do hotspot devices when the maximum average output of each channel is less than ¼ dB higher than that measured in Subtype 0/1 Physical Layer configurations for Rev. 0.
4. Head SAR was additionally evaluated using EVDO Rev. A to determine compliance for VoIP operations.
5. Per FCC KDB Publication 447498 D01v05, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is > ½ dB, instead of the middle channel, the highest output power channel was used.

LTE Notes:

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

WLAN Notes:

1. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and October 2012 FCC/TCB Meeting Notes for 2.4 GHz WIFI: Highest average RF output power channel for the lowest data rate was selected for SAR evaluation in 802.11b. Other IEEE 802.11 modes (including 802.11g/n/ac) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode.
2. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and October 2012 FCC/TCB Meeting Notes for 5 GHz WIFI: Highest average RF output power channel for the lowest data rate was selected for SAR evaluation in 802.11a. Other IEEE 802.11 modes (including 802.11n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11a mode.
3. Per April 2013 TCB Workshop notes, full SAR tests for all IEEE 802.11ac configurations were not required because the average output power was not more than 0.25 dB higher than IEEE 802.11a mode. IEEE 802.11ac was evaluated for the highest IEEE 802.11a position in each 5 GHz band and exposure condition.
4. When Hotspot is enabled, all 5 GHz bands are disabled. Therefore no 5 GHz WIFI Wireless Router SAR Data was required.
5. The applicant expects that WIFI Direct may be used in conjunction with a held-to-ear or bodyworn voice call.

6. 5 GHz WIFI Direct GO is supported in the 5.8 GHz band only. The manufacturer expects 5.8 GHz WIFI Direct GO may be used similarly to wireless router usage. Therefore, 5.8 GHz WIFI Direct GO was evaluated for SAR similar to wireless router SAR procedures in FCC KDB Publication 941225.
7. WIFI transmission was verified using an uncalibrated spectrum analyzer.
8. Since the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is <1.6 W/kg and the reported 1g averaged SAR is <0.8 W/kg, SAR testing on other default channels was not required.

12 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

12.1 Introduction

The following procedures adopted from FCC KDB Publication 447498 D01v05 are applicable to handsets with built-in unlicensed transmitters such as 802.11a/b/g/n/ac and Bluetooth devices which may simultaneously transmit with the licensed transmitter.

12.2 Simultaneous Transmission Procedures

This device contains transmitters that may operate simultaneously. Therefore simultaneous transmission analysis is required. Per FCC KDB 447498 D01v05 IV.C.1.iii and IEEE 1528-2013 Section 6.3.4.1.2, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is ≤1.6 W/kg. When standalone SAR is not required to be measured, per FCC KDB 447498 D01v05 4.3.2 2), the following equation must be used to estimate the standalone 1g SAR for simultaneous transmission assessment involving that transmitter.

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

Table 12-1
Estimated SAR

Mode	Frequency	Maximum Allowed Power	Separation Distance (Body)	Estimated SAR (Body)
	[MHz]	[dBm]	[mm]	[W/kg]
Bluetooth	2441	9.50	10	**0.187**

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

12.3 Head SAR Simultaneous Transmission Analysis

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

Simult Tx	Configuration	Cell. CDMA SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	Cell. EVDO SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.418	0.116	**0.534**	Head SAR	Right Cheek	0.432	0.116	**0.548**
	Right Tilt	0.337	0.113	0.450		Right Tilt	0.240	0.113	0.353
	Left Cheek	0.339	0.184	0.523		Left Cheek	0.354	0.184	0.538
	Left Tilt	0.296	0.183	0.479		Left Tilt	0.224	0.183	0.407

Simult Tx	Configuration	PCS CDMA SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.370	0.116	**0.486**
	Right Tilt	0.089	0.113	0.202
	Left Cheek	0.266	0.184	0.450
	Left Tilt	0.130	0.183	0.313

Simult Tx	Configuration	PCS EVDO SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.348	0.116	**0.464**
	Right Tilt	0.112	0.113	0.225
	Left Cheek	0.273	0.184	0.457
	Left Tilt	0.163	0.183	0.346

Simult Tx	Configuration	LTE Band 12 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.213	0.116	0.329
	Right Tilt	0.125	0.113	0.238
	Left Cheek	0.298	0.184	**0.482**
	Left Tilt	0.162	0.183	0.345

Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.322	0.116	0.438
	Right Tilt	0.183	0.113	0.296
	Left Cheek	0.262	0.184	**0.446**
	Left Tilt	0.179	0.183	0.362

Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.276	0.116	**0.392**
	Right Tilt	0.196	0.113	0.309
	Left Cheek	0.206	0.184	0.390
	Left Tilt	0.154	0.183	0.337

Simult Tx	Configuration	LTE Band 25 (PCS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.244	0.116	0.360
	Right Tilt	0.104	0.113	0.217
	Left Cheek	0.228	0.184	**0.412**
	Left Tilt	0.133	0.183	0.316

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

Simult Tx	Configuration	Cell. CDMA SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.418	0.347	**0.765**
	Right Tilt	0.337	0.402	0.739
	Left Cheek	0.339	0.316	0.655
	Left Tilt	0.296	0.324	0.620

Simult Tx	Configuration	Cell. EVDO SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.432	0.347	**0.779**
	Right Tilt	0.240	0.402	0.642
	Left Cheek	0.354	0.316	0.670
	Left Tilt	0.224	0.324	0.548

Simult Tx	Configuration	PCS CDMA SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.370	0.347	**0.717**
	Right Tilt	0.089	0.402	0.491
	Left Cheek	0.266	0.316	0.582
	Left Tilt	0.130	0.324	0.454

Simult Tx	Configuration	PCS EVDO SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.348	0.347	**0.695**
	Right Tilt	0.112	0.402	0.514
	Left Cheek	0.273	0.316	0.589
	Left Tilt	0.163	0.324	0.487

Simult Tx	Configuration	LTE Band 12 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.213	0.347	0.560
	Right Tilt	0.125	0.402	0.527
	Left Cheek	0.298	0.316	**0.614**
	Left Tilt	0.162	0.324	0.486

Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.322	0.347	**0.669**
	Right Tilt	0.183	0.402	0.585
	Left Cheek	0.262	0.316	0.578
	Left Tilt	0.179	0.324	0.503

Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.276	0.347	**0.623**
	Right Tilt	0.196	0.402	0.598
	Left Cheek	0.206	0.316	0.522
	Left Tilt	0.154	0.324	0.478

Simult Tx	Configuration	LTE Band 25 (PCS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.244	0.347	**0.591**
	Right Tilt	0.104	0.402	0.506
	Left Cheek	0.228	0.316	0.544
	Left Tilt	0.133	0.324	0.457

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

12.4 Body-Worn Simultaneous Transmission Analysis

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

Configuration	Mode	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	Cell. CDMA	0.459	0.112	0.571
Back Side	PCS CDMA	0.819	0.112	0.931
Back Side	LTE Band 12	0.456	0.112	0.568
Back Side	LTE Band 5 (Cell)	0.504	0.112	0.616
Back Side	LTE Band 4 (AWS)	0.713	0.112	0.825
Back Side	LTE Band 25 (PCS)	0.656	0.112	0.768

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

Configuration	Mode	2G/3G/4G SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	Cell. CDMA	0.459	0.210	0.669
Back Side	PCS CDMA	0.819	0.210	**1.029**
Back Side	LTE Band 12	0.456	0.210	0.666
Back Side	LTE Band 5 (Cell)	0.504	0.210	0.714
Back Side	LTE Band 4 (AWS)	0.713	0.210	0.923
Back Side	LTE Band 25 (PCS)	0.656	0.210	0.866

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

Table 12-6
Simultaneous Transmission Scenario with Bluetooth (Body-Worn at 1.0 cm)

Configuration	Mode	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Back Side	Cell. CDMA	0.459	0.187	0.646
Back Side	PCS CDMA	0.819	0.187	1.006
Back Side	LTE Band 12	0.456	0.187	0.643
Back Side	LTE Band 5 (Cell)	0.504	0.187	0.691
Back Side	LTE Band 4 (AWS)	0.713	0.187	0.900
Back Side	LTE Band 25 (PCS)	0.656	0.187	0.843

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

12.5 Hotspot SAR Simultaneous Transmission Analysis

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

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

Simult Tx	Configuration	Cell. EVDO SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	PCS EVDO SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.619	0.112	**0.731**	Body SAR	Back	0.828	0.112	**0.940**
	Front	0.463	0.050	0.513		Front	0.741	0.050	0.791
	Top	-	0.058	0.058		Top	-	0.058	0.058
	Bottom	0.248	-	0.248		Bottom	0.846	-	0.846
	Right	0.375	0.025	0.400		Right	0.283	0.025	0.308
	Left	-	-	0.000		Left	-	-	0.000
Simult Tx	Configuration	LTE Band 12 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.456	0.112	0.568	Body SAR	Back	0.504	0.112	**0.616**
	Front	0.335	0.050	0.385		Front	0.387	0.050	0.437
	Top	-	0.058	0.058		Top	-	0.058	0.058
	Bottom	0.297	-	0.297		Bottom	0.239	-	0.239
	Right	-	0.025	0.025		Right	0.527	0.025	0.552
	Left	0.658	-	**0.658**		Left	-	-	0.000
Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 25 (PCS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.713	0.112	**0.825**	Body SAR	Back	0.656	0.112	**0.768**
	Front	0.402	0.050	0.452		Front	0.582	0.050	0.632
	Top	-	0.058	0.058		Top	-	0.058	0.058
	Bottom	0.488	-	0.488		Bottom	0.631	-	0.631
	Right	-	0.025	0.025		Right	0.221	0.025	0.246
	Left	0.464	-	0.464		Left	-	-	0.000

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

Simult Tx	Configuration	Cell. EVDO SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.619	0.183	**0.802**
	Front	0.463	0.026	0.489
	Top	-	0.147	0.147
	Bottom	0.248	-	0.248
	Right	0.375	0.015	0.390
	Left	-	-	0.000

Simult Tx	Configuration	PCS EVDO SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.828	0.183	**1.011**
	Front	0.741	0.026	0.767
	Top	-	0.147	0.147
	Bottom	0.846	-	0.846
	Right	0.283	0.015	0.298
	Left	-	-	0.000

Simult Tx	Configuration	LTE Band 12 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.456	0.183	0.639
	Front	0.335	0.026	0.361
	Top	-	0.147	0.147
	Bottom	0.297	-	0.297
	Right	-	0.015	0.015
	Left	0.658	-	**0.658**

Simult Tx	Configuration	LTE Band 5 (Cell) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.504	0.183	**0.687**
	Front	0.387	0.026	0.413
	Top	-	0.147	0.147
	Bottom	0.239	-	0.239
	Right	0.527	0.015	0.542
	Left	-	-	0.000

Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.713	0.183	**0.896**
	Front	0.402	0.026	0.428
	Top	-	0.147	0.147
	Bottom	0.488	-	0.488
	Right	-	0.015	0.015
	Left	0.464	-	0.464

Simult Tx	Configuration	LTE Band 25 (PCS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.656	0.183	**0.839**
	Front	0.582	0.026	0.608
	Top	-	0.147	0.147
	Bottom	0.631	-	0.631
	Right	0.221	0.015	0.236
	Left	-	-	0.000

12.6 Simultaneous Transmission Conclusion

The above numerical summed SAR results for all the worst-case simultaneous transmission conditions were below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore no measured volumetric simultaneous SAR summation is required per FCC KDB Publication 447498 D01v05 and IEEE 1528-2013 Section 6.3.4.1.2.

13 SAR MEASUREMENT VARIABILITY

13.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR Measurement Variability was assessed using the following procedures for each frequency band:

1) When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.
2) A second repeated measurement was preformed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
3) A third repeated measurement was performed only if the original, first or second repeated measurement was ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.
4) Repeated measurements are not required when the original highest measured SAR is < 0.80 W/kg

Table 13-1
Body SAR Measurement Variability Results

BODY VARIABILITY RESULTS														
Band	FREQUENCY		Mode	Service	Side	Spacing	Measured SAR (1g)	1st Repeated SAR (1g)	Ratio	2nd Repeated SAR (1g)	Ratio	3rd Repeated SAR (1g)	Ratio
	MHz	Ch.					(W/kg)	(W/kg)		(W/kg)		(W/kg)	
1900	1880.00	600	PCS CDMA	EVDO Rev. 0	bottom	10 mm	0.846	0.826	1.02	N/A	N/A	N/A	N/A
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram						

13.2 Measurement Uncertainty

The measured SAR was <1.5 W/kg for all frequency bands. Therefore, per KDB Publication 865664 D01v01, the extended measurement uncertainty analysis per IEEE 1528-2003 was not required.

14 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8753E	(30kHz-6GHz) Network Analyzer	7/23/2013	Annual	7/23/2014	US37390350
Agilent	8594A	(9kHz-2.9GHz) Spectrum Analyzer	N/A	N/A	N/A	3051A00187
Agilent	N9020A	MXA Signal Analyzer	10/29/2013	Annual	10/29/2014	US46470561
Agilent	8753ES	S-Parameter Network Analyzer	10/29/2013	Annual	10/29/2014	US39170122
Agilent	E5515C	Wireless Communications Test Set	3/19/2014	Annual	3/19/2015	GB45360985
Agilent	E5515C	Wireless Communications Test Set	3/18/2014	Annual	3/18/2015	GB46110872
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433972
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433974
Anritsu	MT8820C	Radio Communication Analyzer	12/12/2013	Annual	12/12/2014	6200901190
Anritsu	MT8820C	Radio Communication Analyzer	12/12/2013	Annual	12/12/2014	6201300731
Anritsu	MA24106A	USB Power Sensor	12/18/2013	Annual	12/18/2014	1344545
Anritsu	MA24106A	USB Power Sensor	1/3/2014	Annual	1/3/2015	1349509
Anritsu	MA24106A	USB Power Sensor	1/3/2014	Annual	1/3/2015	1349514
Anritsu	MA2411B	Pulse Sensor	4/8/2014	Annual	4/8/2015	846215
Anritsu	ML2495A	Power Meter	10/31/2013	Annual	10/31/2014	941001
COMTech	AR85729-5	Solid State Amplifier	CBT	N/A	CBT	M1S5A00-009
COMTECH	AR85729-5/5759B	Solid State Amplifier	CBT	N/A	CBT	M3W1A00-1002
Fisher Scientific	15-077-960	Digital Thermometer	12/4/2013	Biennial	12/4/2015	130764558
Fisher Scientific	S407993	Long Stem Thermometer	11/4/2013	Biennial	11/4/2015	130671826
Gigatronics	80701A	(0.05-18GHz) Power Sensor	10/30/2013	Annual	10/30/2014	1833460
Gigatronics	8651A	Universal Power Meter	10/30/2013	Annual	10/30/2014	8650319
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
MiniCircuits	SLP-2400+	Low Pass Filter	CBT	N/A	CBT	R8979500903
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-1200+	Low Pass Filter DC to 1000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Narda	BW-S3W2	Attenuator (3dB)	CBT	N/A	CBT	120
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	10/4/2013	Annual	10/4/2014	108798
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	12/9/2013	Annual	12/9/2014	109366
Rohde & Schwarz	CMU200	Base Station Simulator	9/23/2013	Annual	9/23/2014	109892
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	10/18/2013	Annual	10/18/2014	100976
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	2/20/2014	Annual	2/20/2015	128633
Rohde & Schwarz	NRV-Z32	Peak Power Sensor	10/12/2012	Biennial	10/12/2014	836019/013
Rohde & Schwarz	SME06	Signal Generator	10/30/2013	Annual	10/30/2014	832026
Rohde & Schwarz	NRV5	Single Channel Power Meter	10/31/2013	Annual	10/31/2014	835360/0079
Seekonk	NC-100	Torque Wrench	3/18/2014	Biennial	3/18/2016	N/A
Seekonk	NC-100	Torque Wrench	3/18/2014	Biennial	3/18/2016	N/A
Seekonk	NC-100	Torque Wrench 5/16", 8" lbs	3/18/2014	Biennial	3/18/2016	N/A
SPEAG	DAK-3.5	Dielectric Assessment Kit	11/13/2013	Annual	11/13/2014	1091
SPEAG	DAKS-3.5	Portable Dielectric Assessment Kit	8/18/2013	Annual	8/18/2014	1008
SPEAG	DAKS-3.5	Portable Dielectric Assessment Kit	8/18/2013	Annual	8/18/2014	1009
SPEAG	ES3DV3	SAR Probe	3/19/2014	Annual	3/19/2015	3209
SPEAG	ES3DV3	SAR Probe	11/20/2013	Annual	11/20/2014	3287
SPEAG	ES3DV3	SAR Probe	11/25/2013	Annual	11/25/2014	3332
SPEAG	ES3DV3	SAR Probe	4/17/2014	Annual	4/17/2015	3319
SPEAG	ES3DV3	SAR Probe	4/11/2014	Annual	4/11/2015	3213
SPEAG	ES3DV3	SAR Probe	2/25/2014	Annual	2/25/2015	3258
SPEAG	EX3DV4	SAR Probe	10/23/2013	Annual	10/23/2014	3914
SPEAG	ES3DV2	SAR Probe	8/22/2013	Annual	8/22/2014	3022
SPEAG	ES3DV3	SAR Probe	9/23/2013	Annual	9/23/2014	3288
SPEAG	EX3DV4	SAR Probe	12/18/2013	Annual	12/18/2014	3920
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/17/2014	Annual	3/17/2015	1334
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/18/2013	Annual	11/18/2014	1407
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/11/2014	Annual	4/11/2015	1368
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/19/2013	Annual	11/19/2014	1408
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/26/2014	Annual	2/26/2015	665
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/19/2013	Annual	11/19/2014	1333
SPEAG	DAE4	Dasy Data Acquisition Electronics	8/21/2013	Annual	8/21/2014	1322
SPEAG	DAE4	Dasy Data Acquisition Electronics	9/17/2013	Annual	9/17/2014	1323
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/17/2014	Annual	3/17/2015	1364
SPEAG	DAE4	Dasy Data Acquisition Electronics	12/12/2013	Annual	12/12/2014	649
SPEAG	D750V3	750 MHz Dipole	1/20/2014	Annual	1/20/2015	1003
SPEAG	D835V2	835 MHz SAR Dipole	4/7/2014	Annual	4/7/2015	4d119
SPEAG	D1750V2	1750 MHz SAR Dipole	4/10/2014	Annual	4/10/2015	1051
SPEAG	D1900V2	1900 MHz SAR Dipole	7/22/2013	Annual	7/22/2014	5d149
SPEAG	D1900V2	1900 MHz SAR Dipole	2/27/2014	Annual	2/27/2015	5d148
SPEAG	D2450V2	2450 MHz SAR Dipole	1/21/2014	Annual	1/21/2015	797
SPEAG	D5GHzV2	5 GHz SAR Dipole	1/27/2014	Annual	1/27/2015	1057
SPEAG	D835V2	835 MHz SAR Dipole	7/17/2013	Annual	7/17/2014	4d133
SPEAG	D2450V2	2450 MHz SAR Dipole	8/23/2013	Annual	8/23/2014	719
SPEAG	D5GHzV2	5 GHz SAR Dipole	9/23/2013	Annual	9/23/2014	1007
VWR	23226-658	Long Stem Thermometer	7/11/2012	Biennial	7/11/2014	122389330
VWR	23226-658	Long Stem Thermometer	7/11/2012	Biennial	7/11/2014	122389334
VWR	36934-158	Wall-Mounted Thermometer	8/8/2013	Biennial	8/8/2015	130477866
VWR	36934-158	Wall-Mounted Thermometer	8/8/2013	Biennial	8/8/2015	130477877

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

Applicable for frequencies less than 3000 MHz.

a	b	c	d	e= f(d,k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component	**IEEE 1528 Sec.**	**Tol. (± %)**	**Prob. Dist.**	**Div.**	**c_i 1gm**	**c_i 10 gms**	**1gm u_i (± %)**	**10gms u_i (± %)**	**v_i**
Measurement System									
Probe Calibration	E.2.1	6.0	N	1	1.0	1.0	6.0	6.0	∞
Axial Isotropy	E.2.2	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	E.2.2	1.3	N	1	1.0	1.0	1.3	1.3	∞
Boundary Effect	E.2.3	0.4	N	1	1.0	1.0	0.4	0.4	∞
Linearity	E.2.4	0.3	N	1	1.0	1.0	0.3	0.3	∞
System Detection Limits	E.2.5	5.1	N	1	1.0	1.0	5.1	5.1	∞
Readout Electronics	E.2.6	1.0	N	1	1.0	1.0	1.0	1.0	∞
Response Time	E.2.7	0.8	R	1.73	1.0	1.0	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.73	1.0	1.0	1.5	1.5	∞
RF Ambient Conditions	E.6.1	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1.0	1.0	0.2	0.2	∞
Probe Positioning w/ respect to Phantom	E.6.3	2.9	R	1.73	1.0	1.0	1.7	1.7	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	E.5	1.0	R	1.73	1.0	1.0	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	E.4.2	6.0	N	1	1.0	1.0	6.0	6.0	287
Device Holder Uncertainty	E.4.1	3.32	R	1.73	1.0	1.0	1.9	1.9	∞
Output Power Variation - SAR drift measurement	6.6.2	5.0	R	1.73	1.0	1.0	2.9	2.9	∞
Phantom & Tissue Parameters									
Phantom Uncertainty (Shape & Thickness tolerances)	E.3.1	4.0	R	1.73	1.0	1.0	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	3.8	N	1	0.64	0.43	2.4	1.6	6
Liquid Permittivity - deviation from target values	E.3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Liquid Permittivity - measurement uncertainty	E.3.3	4.5	N	1	0.60	0.49	2.7	2.2	6
Combined Standard Uncertainty (k=1)			RSS				12.1	11.7	299
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				24.2	23.5	

The above measurement uncertainties are according to IEEE Std. 1528-2003

Applicable for frequencies up to 6 GHz.

a	b	c	d	e=	f	g	h =	i =	k
Uncertainty Component	IEEE 1528 Sec.	Tol. (± %)	Prob. Dist.	f(d,k) Div.	c_i 1gm	c_i 10 gms	1gm u_i (± %)	10gms u_i (± %)	v_i
Measurement System									
Probe Calibration	E.2.1	6.55	N	1	1.0	1.0	6.6	6.6	∞
Axial Isotropy	E.2.2	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	E.2.2	1.3	N	1	1.0	1.0	1.3	1.3	∞
Boundary Effect	E.2.3	0.4	N	1	1.0	1.0	0.4	0.4	∞
Linearity	E.2.4	0.3	N	1	1.0	1.0	0.3	0.3	∞
System Detection Limits	E.2.5	5.1	N	1	1.0	1.0	5.1	5.1	∞
Readout Electronics	E.2.6	1.0	N	1	1.0	1.0	1.0	1.0	∞
Response Time	E.2.7	0.8	R	1.73	1.0	1.0	0.5	0.5	∞
Integration Time	E.2.8	2.6	R	1.73	1.0	1.0	1.5	1.5	∞
RF Ambient Conditions	E.6.1	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	E.6.2	0.4	R	1.73	1.0	1.0	0.2	0.2	∞
Probe Positioning w/ respect to Phantom	E.6.3	2.9	R	1.73	1.0	1.0	1.7	1.7	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	E.5	1.0	R	1.73	1.0	1.0	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	E.4.2	6.0	N	1	1.0	1.0	6.0	6.0	287
Device Holder Uncertainty	E.4.1	3.32	R	1.73	1.0	1.0	1.9	1.9	∞
Output Power Variation - SAR drift measurement	6.6.2	5.0	R	1.73	1.0	1.0	2.9	2.9	∞
Phantom & Tissue Parameters									
Phantom Uncertainty (Shape & Thickness tolerances)	E.3.1	4.0	R	1.73	1.0	1.0	2.3	2.3	∞
Liquid Conductivity - deviation from target values	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity - measurement uncertainty	E.3.3	3.8	N	1	0.64	0.43	2.4	1.6	6
Liquid Permittivity - deviation from target values	E.3.2	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Liquid Permittivity - measurement uncertainty	E.3.3	4.5	N	1	0.60	0.49	2.7	2.2	6
Combined Standard Uncertainty (k=1)			RSS				12.4	12.0	299
Expanded Uncertainty (95% CONFIDENCE LEVEL)			k=2				24.7	24.0	

The above measurement uncertainties are according to IEEE Std. 1528-2003

16 CONCLUSION

16.1 Measurement Conclusion

The SAR evaluation indicates that the EUT complies with the RF radiation exposure limits of the FCC and Industry Canada, with respect to all parameters subject to this test. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested.

Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because various factors may interact with one another to vary the specific biological outcome of an exposure to electromagnetic fields, any protection guide should consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables. [3]

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APPENDIX A: SAR TEST DATA

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFUS990; Type: Portable Handset; Serial: 0699-0232

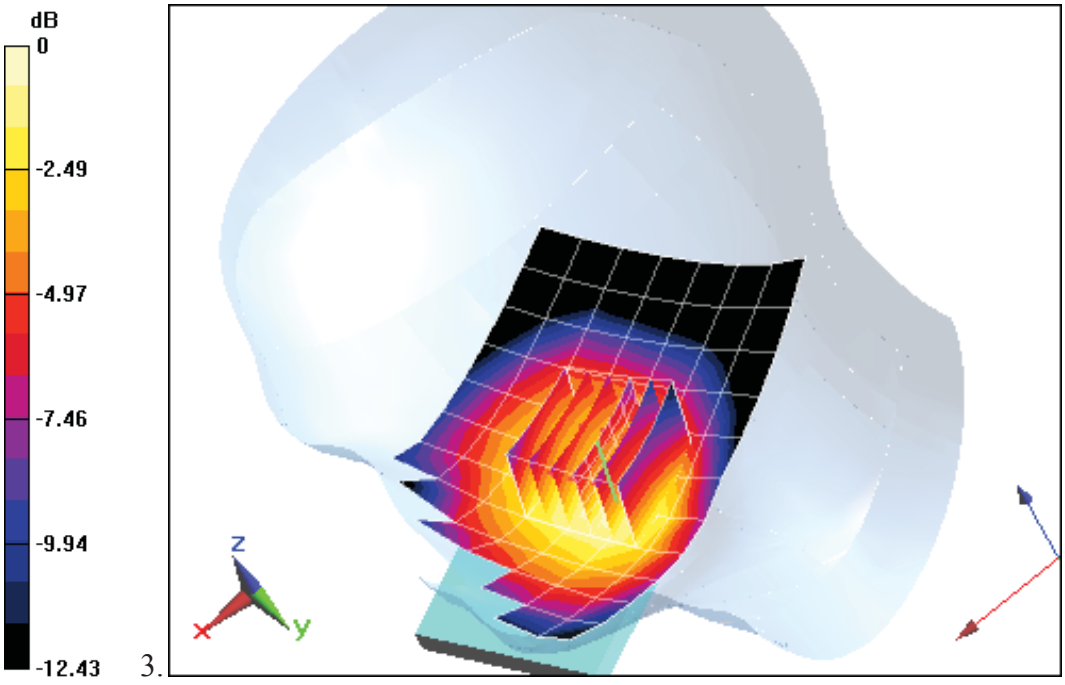
Communication System: UID 0, CDMA; Frequency: 836.52 MHz; Duty Cycle: 1:1
Medium: 835 Head, Medium parameters used (interpolated):
f = 836.52 MHz; σ = 0.895 S/m; ε_r = 39.99; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 06-17-2014; Ambient Temp: 23.8°C; Tissue Temp: 23.5°C

Probe: ES3DV3 - SN3209; ConvF(6.23, 6.23, 6.23); Calibrated: 3/19/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 3/17/2014
Phantom: SAM front; Type: QD000P40CD; Serial: TP:1759
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: Cell EVDO BC0, Right Head, Cheek, Mid.ch, Standard Back Cover

Area Scan (8x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.44 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.517 W/kg
SAR(1 g) = 0.407 W/kg



3.

0 dB = 0.443 W/kg = -3.54 dBW/kg

DUT: ZNFUS990; Type: Portable Handset; Serial: 0699-0232

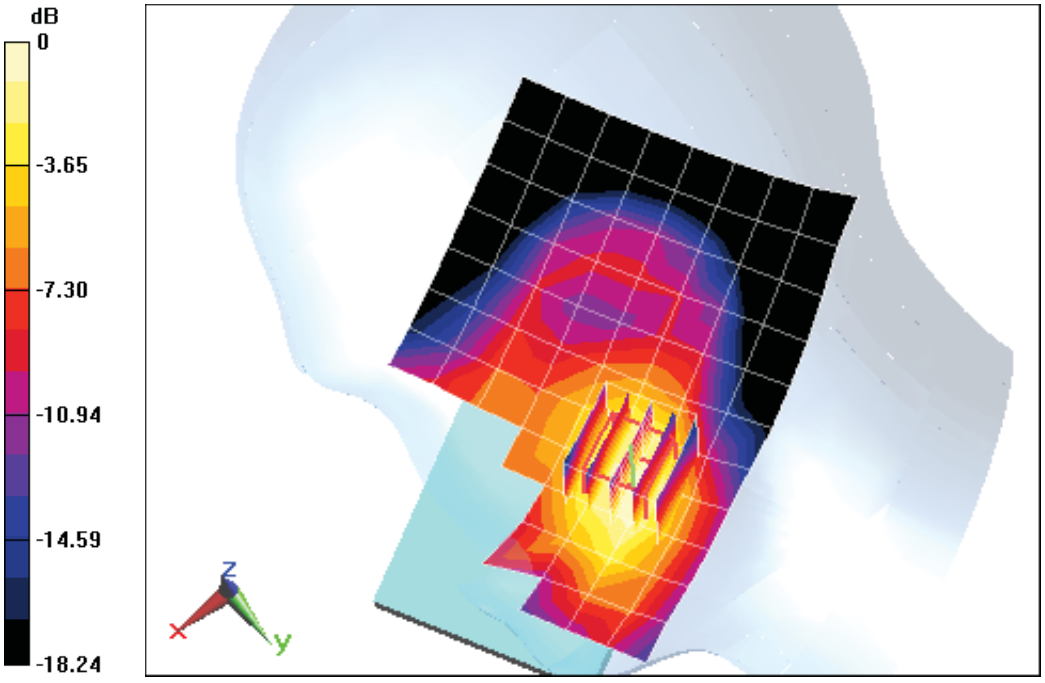
Communication System: UID 0, CDMA; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: 1900 Head, Medium parameters used:
f = 1880 MHz; σ = 1.383 S/m; ε_r = 39.843; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 06-17-2014; Ambient Temp: 23.9°C; Tissue Temp: 23.0°C

Probe: ES3DV3 - SN3287; ConvF(5.08, 5.08, 5.08); Calibrated: 11/20/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1408; Calibrated: 11/19/2013
Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1797
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: PCS CDMA, Right Head, Cheek, Mid.ch, Standard Back Cover

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.25 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.554 W/kg
SAR(1 g) = 0.367 W/kg



0 dB = 0.432 W/kg = -3.65 dBW/kg

DUT: ZNFUS990; Type: Portable Handset; Serial: 0699-0233

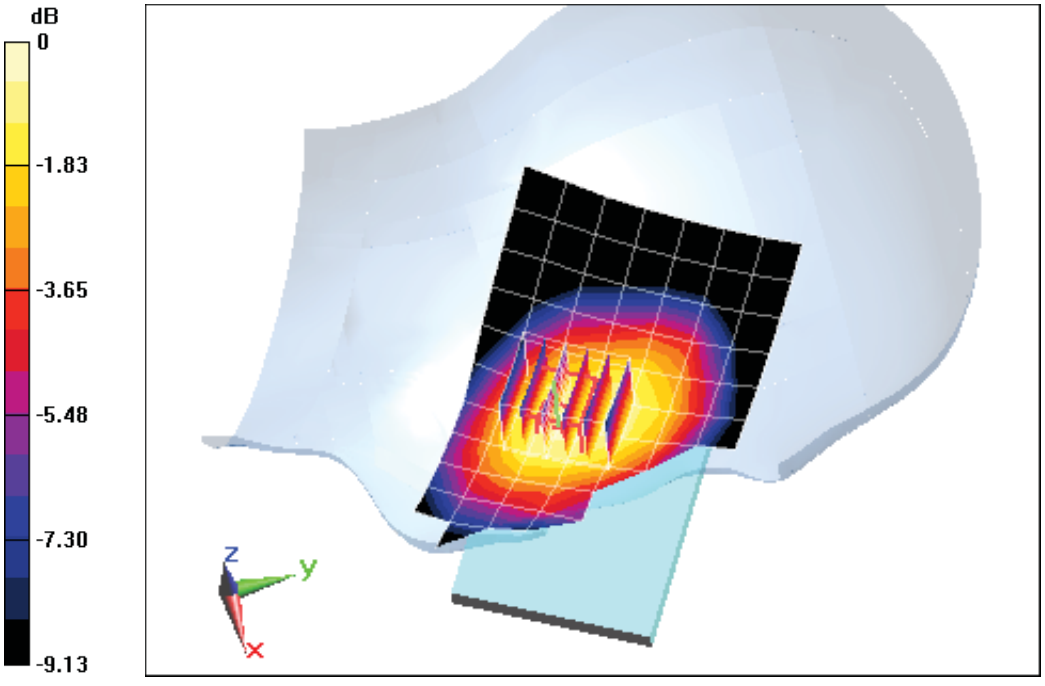
Communication System: UID 0, LTE Band 12 (0); Frequency: 707.5 MHz; Duty Cycle: 1:1
Medium: 695 Head, Medium parameters used (interpolated):
f = 707.5 MHz; σ = 0.888 S/m; ε_r = 42.468; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 06-24-2014; Ambient Temp: 22.4°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3332; ConvF(6.46, 6.46, 6.46); Calibrated: 11/25/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 11/18/2013
Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1800
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 12, Left Head, Cheek, Mid.ch, QPSK, 10 MHz Bandwidth, 1 RB, 49 RB Offset, Wireless Charging Cover Open

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 18.61 V/m; Power Drift = 0.20 dB
Peak SAR (extrapolated) = 0.377 W/kg
SAR(1 g) = 0.289 W/kg



0 dB = 0.319 W/kg = -4.96 dBW/kg

DUT: ZNFUS990; Type: Portable Handset; Serial: 0699-0233

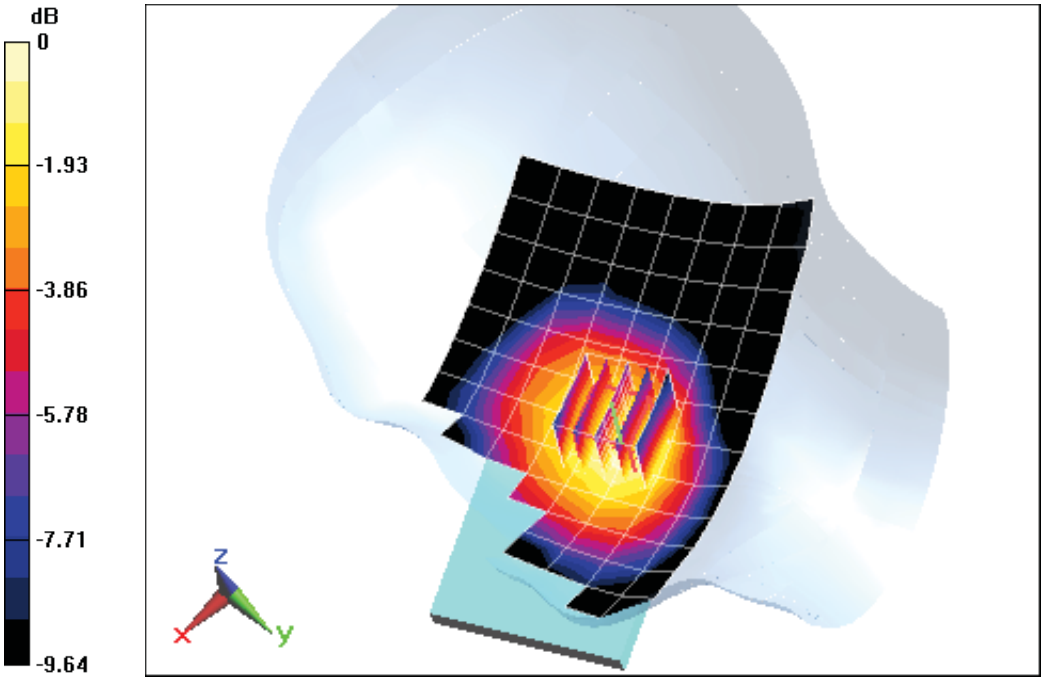
Communication System: UID 0, LTE Band 5 (Cell.); Frequency: 836.5 MHz; Duty Cycle: 1:1
Medium: 835 Head, Medium parameters used (interpolated):
f = 836.5 MHz; σ = 0.895 S/m; ε_r = 39.99; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 06-17-2014; Ambient Temp: 23.8°C; Tissue Temp: 23.5°C

Probe: ES3DV3 - SN3209; ConvF(6.23, 6.23, 6.23); Calibrated: 3/19/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 3/17/2014
Phantom: SAM front; Type: QD000P40CD; Serial: TP:1759
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 5 (Cell.), Right Head, Cheek, Mid.ch, 10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset, Standard Back Cover

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.94 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.417 W/kg
SAR(1 g) = 0.321 W/kg



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

DUT: ZNFUS990; Type: Portable Handset; Serial: 0699-0233

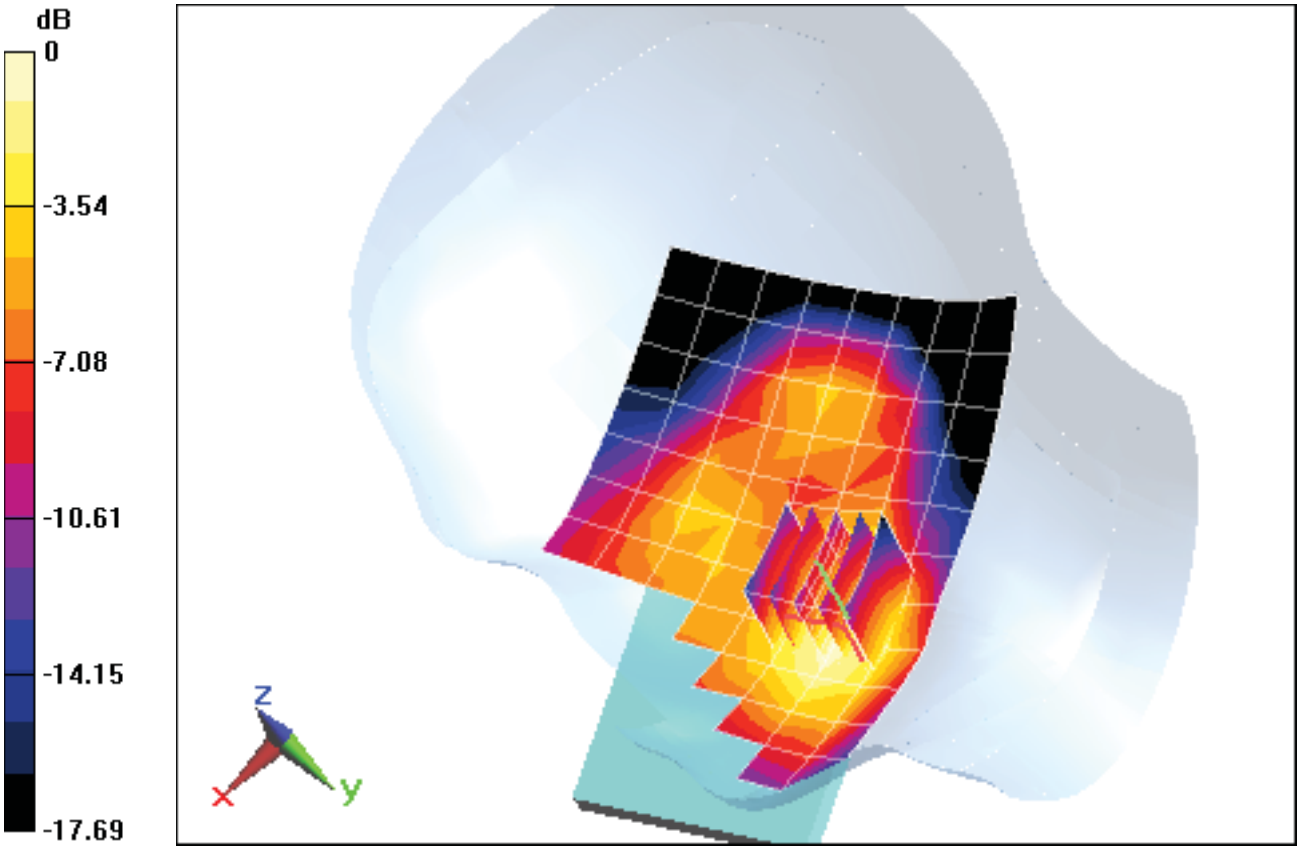
Communication System: UID 0, LTE RF; Frequency: 1732.5 MHz; Duty Cycle: 1:1
Medium: 1750 Head, Medium parameters used (interpolated):
f = 1732.5 MHz; σ = 1.361 S/m; ε_r = 38.518; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 06-18-2014; Ambient Temp: 19.0°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3213; ConvF(5.18, 5.18, 5.18); Calibrated: 4/11/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1364; Calibrated: 3/17/2014
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 4 (AWS), Right Head, Cheek, Mid.ch, 20 MHz Bandwidth, QPSK, 1 RB, 50 RB Offset, Standard Back Cover

Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.87 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.370 W/kg
SAR(1 g) = 0.250 W/kg



0 dB = 0.286 W/kg = -5.44 dBW/kg

DUT: ZNFUS990; Type: Portable Handset; Serial: 0699-0233

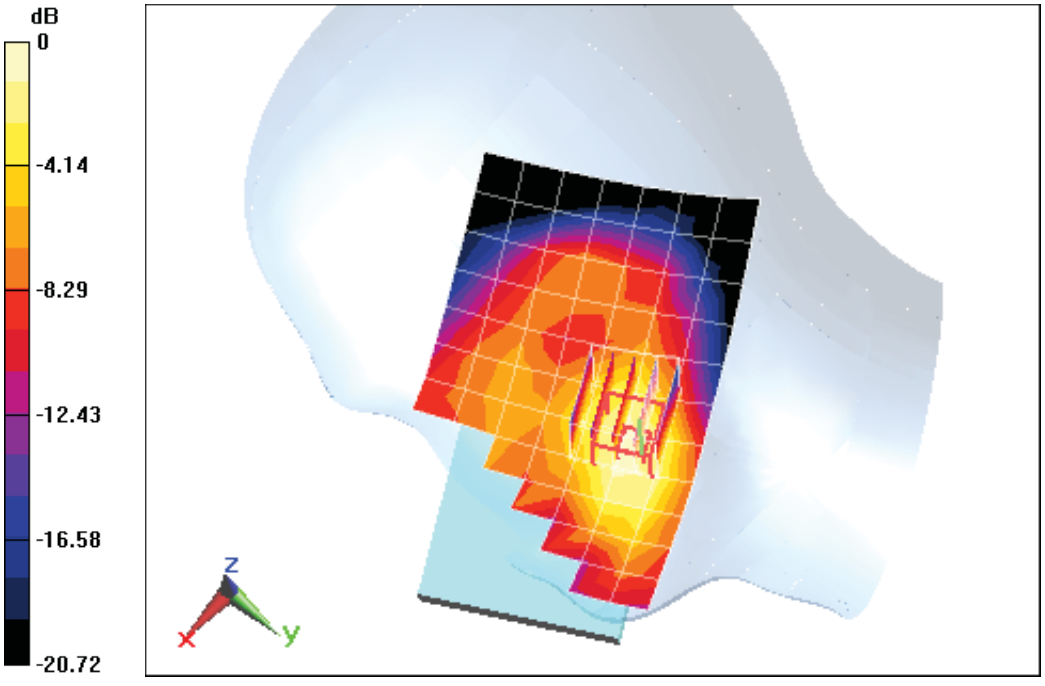
Communication System: UID 0, LTE BAND 25; Frequency: 1860 MHz; Duty Cycle: 1:1
Medium: 1900 Head, Medium parameters used (interpolated):
f = 1860 MHz; σ = 1.402 S/m; ε_r = 40.26; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 06-23-2014; Ambient Temp: 20.9°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3213; ConvF(4.99, 4.99, 4.99); Calibrated: 4/11/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1364; Calibrated: 3/17/2014
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 25 (PCS), Right Head, Cheek, Low.ch, 20 MHz Bandwidth, QPSK, 1 RB, 99 RB Offset, Standard Back Cover

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 14.01 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.382 W/kg
SAR(1 g) = 0.243 W/kg



0 dB = 0.285 W/kg = -5.45 dBW/kg

DUT: ZNFUS990; Type: Portable Handset; Serial: 0699-0234

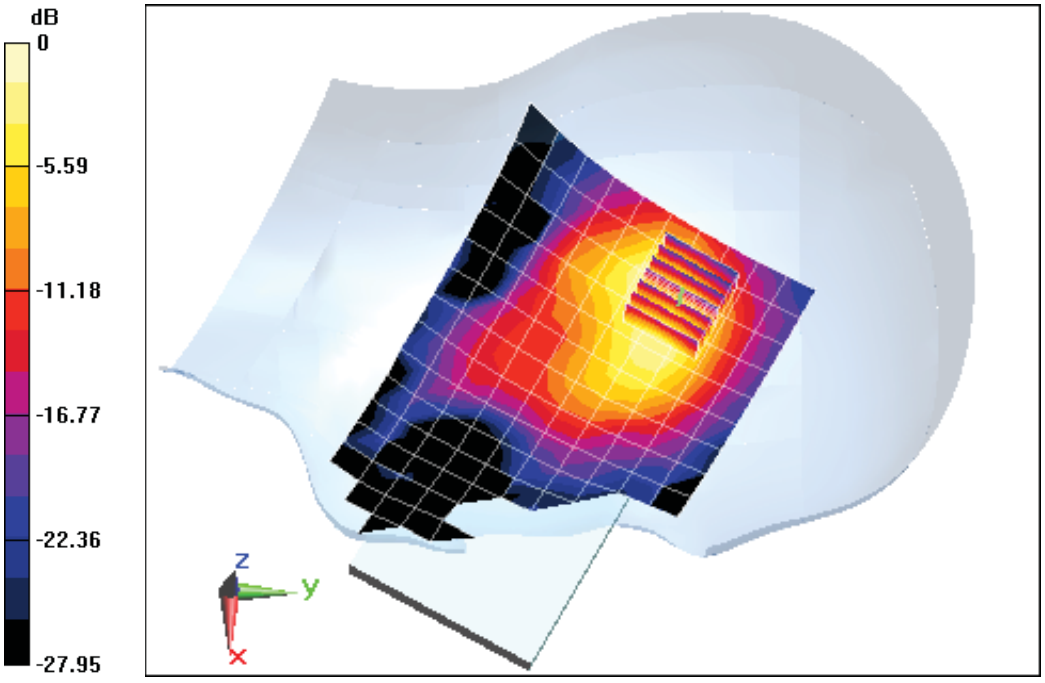
Communication System: UID 0, IEEE 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1
Medium: 2450 Head, Medium parameters used (interpolated):
f = 2437 MHz; σ = 1.729 S/m; ε_r = 39.99; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 06-17-2014; Ambient Temp: 22.5°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3258; ConvF(4.52, 4.52, 4.52); Calibrated: 2/25/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 2/26/2014
Phantom: SAM Front; Type: SAM; Serial: 1686
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: IEEE 802.11b, Left Head, Cheek, Ch 06, 1 Mbps, Standard Back Cover

Area Scan (11x18x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.571 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.346 W/kg
SAR(1 g) = 0.152 W/kg



0 dB = 0.199 W/kg = -7.01 dBW/kg

DUT: ZNFUS990; Type: Portable Handset; Serial: 0699-0234

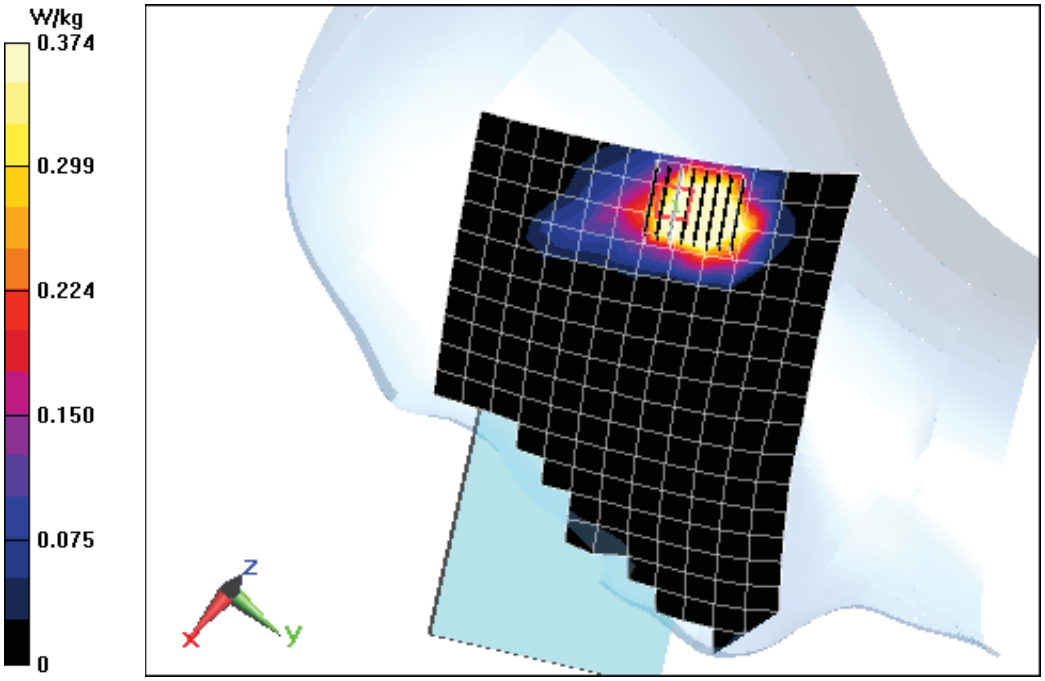
Communication System: UID 0, IEEE 802.11a (0); Frequency: 5825 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head, Medium parameters used:
f = 5825 MHz; σ = 5.36 S/m; ε_r = 36.313; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 06-23-2014; Ambient Temp: 24.4°C; Tissue Temp: 23.4°C

Probe: EX3DV4 - SN3914; ConvF(4.52, 4.52, 4.52); Calibrated: 10/23/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: IEEE 802.11a, 5.8 GHz, Right Head, Tilt, Ch 165, 6 Mbps, Standard Back Cover

Area Scan (13x22x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm, Graded Ratio = 1.4
Reference Value = 2.143 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.613 W/kg
SAR(1 g) = 0.141 W/kg



DUT: ZNFUS990; Type: Portable Handset; Serial: 0699-0234

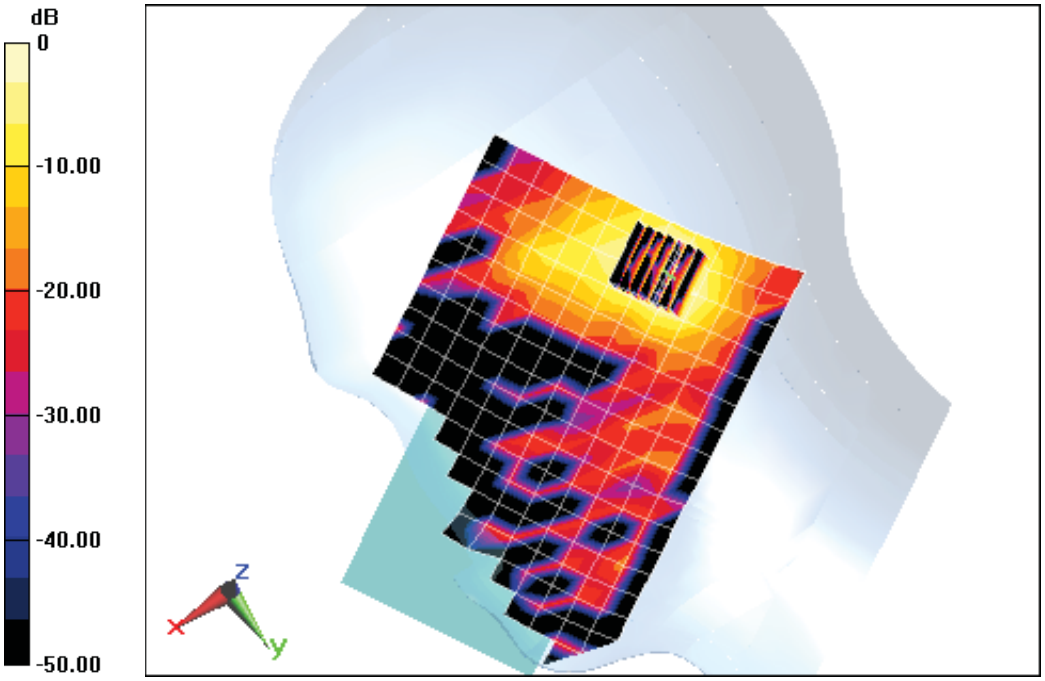
Communication System: UID 0, IEEE 802.11a (0); Frequency: 5220 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head, Medium parameters used:
f = 5220 MHz; σ = 4.734 S/m; ε_r = 37.152; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 06-23-2014; Ambient Temp: 24.3°C; Tissue Temp: 23.3°C

Probe: EX3DV4 - SN3914; ConvF(4.99, 4.99, 4.99); Calibrated: 10/23/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: IEEE 802.11a, 5.2 GHz, Right Head, Tilt, Ch 44, 6 Mbps, Standard Back Cover

Area Scan (13x22x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm, Graded Ratio = 1.4
Reference Value = 8.459 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.16 W/kg
SAR(1 g) = 0.325 W/kg



0 dB = 0.724 W/kg = -1.40 dBW/kg

DUT: ZNFUS990; Type: Portable Handset; Serial: 0699-0232

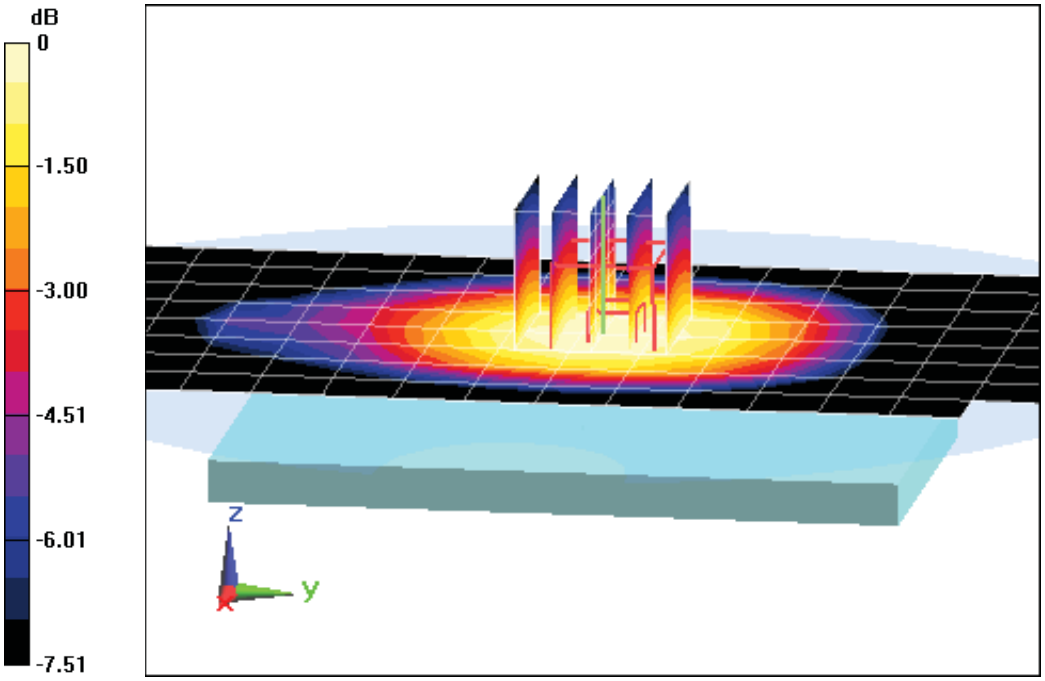
Communication System: UID 0, Cellular CDMA; Frequency: 836.52 MHz; Duty Cycle: 1:1
Medium: 835 Body, Medium parameters used (interpolated):
f = 836.52 MHz; σ = 0.943 S/m; ε_r = 55.181; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-23-2014; Ambient Temp: 22.6°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3288; ConvF(6.27, 6.27, 6.27); Calibrated: 9/23/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/17/2013
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

Mode: Cellular CDMA, Body SAR, Back side, Mid.ch, Standard Back Cover

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.31 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.547 W/kg
SAR(1 g) = 0.443 W/kg



0 dB = 0.464 W/kg = -3.33 dBW/kg

DUT: ZNFUS990; Type: Portable Handset; Serial: 0699-0232

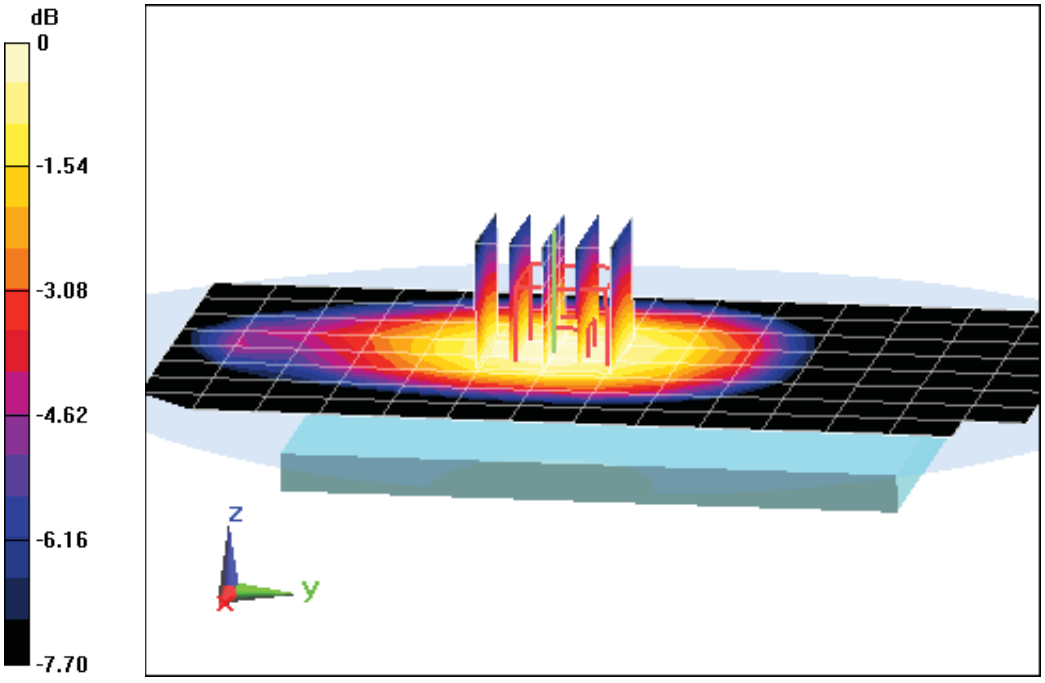
Communication System: UID 0, Cellular CDMA; Frequency: 836.52 MHz; Duty Cycle: 1:1
Medium: 835 Body, Medium parameters used (interpolated):
f = 836.52 MHz; σ = 0.943 S/m; ε_r = 55.181; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-23-2014; Ambient Temp: 22.6°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3288; ConvF(6.27, 6.27, 6.27); Calibrated: 9/23/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/17/2013
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

Mode: Cellular EVDO, Body SAR, Back side, Mid.ch, Standard Back Cover

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 27.36 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.749 W/kg
SAR(1 g) = 0.594 W/kg



0 dB = 0.626 W/kg = -2.03 dBW/kg

DUT: ZNFUS990; Type: Portable Handset; Serial: 0699-0232

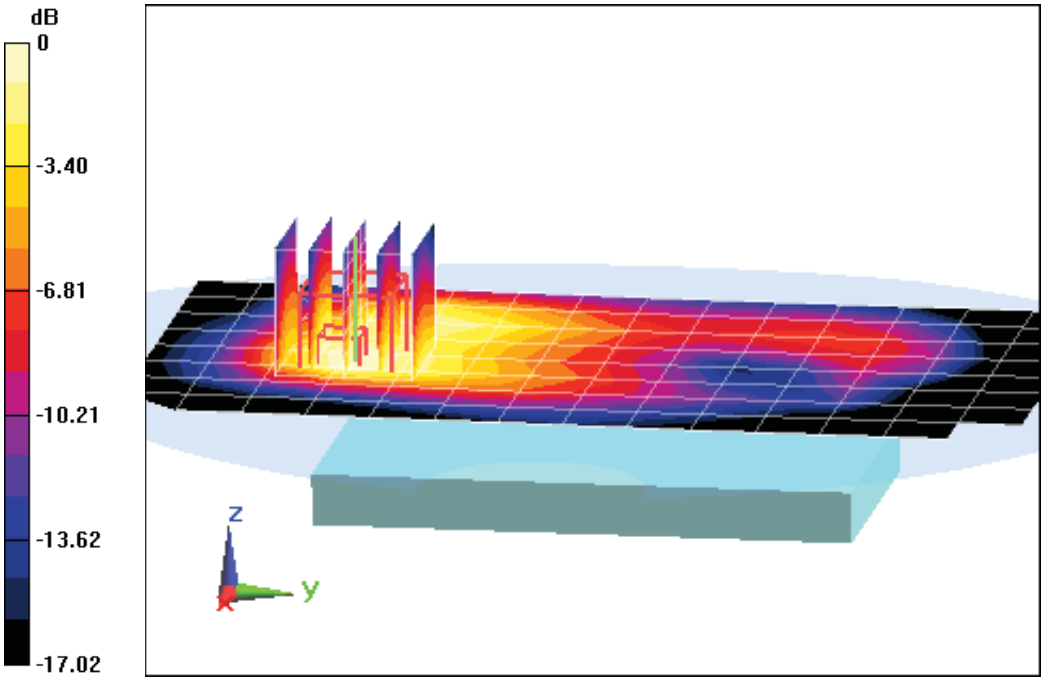
Communication System: UID 0, PCS CDMA; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: 1900 Body, Medium parameters used:
f = 1880 MHz; σ = 1.481 S/m; ε_r = 53.465; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-19-2014; Ambient Temp: 23.2°C; Tissue Temp: 21.3°C

Probe: ES3DV3 - SN3288; ConvF(4.82, 4.82, 4.82); Calibrated: 9/23/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/17/2013
Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

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

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 26.27 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 1.28 W/kg
SAR(1 g) = 0.812 W/kg



0 dB = 0.832 W/kg = -0.80 dBW/kg

DUT: ZNFUS990; Type: Portable Handset; Serial: 0699-0232

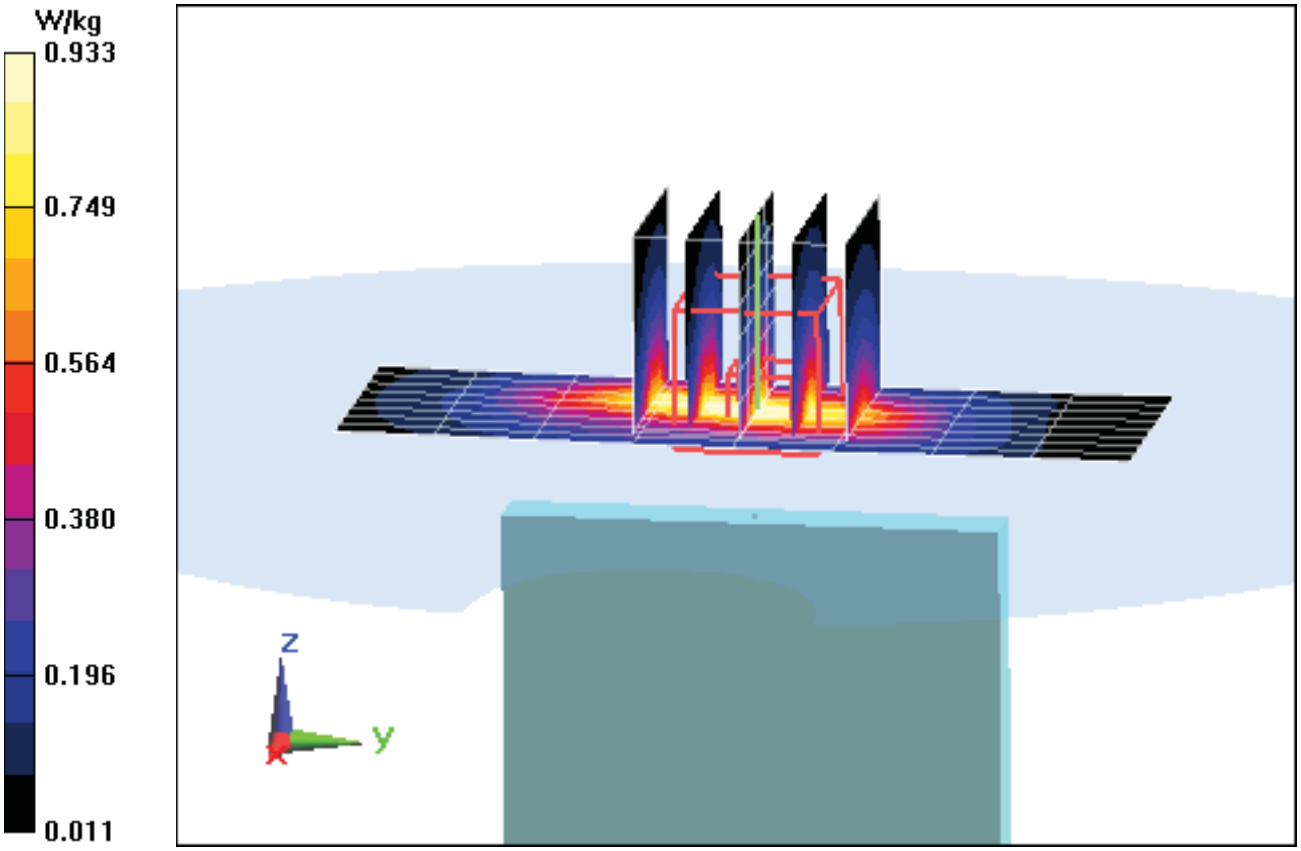
Communication System: UID 0, PCS CDMA; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: 1900 Body, Medium parameters used:
f = 1880 MHz; σ = 1.481 S/m; ε_r = 53.465; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-19-2014; Ambient Temp: 23.2°C; Tissue Temp: 21.3°C

Probe: ES3DV3 - SN3288; ConvF(4.82, 4.82, 4.82); Calibrated: 9/23/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/17/2013
Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

Mode: PCS EVDO, Body SAR, Bottom Edge, Mid.ch, Standard Back Cover

Area Scan (9x9x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 27.55 V/m; Power Drift = -0.16 dB
Peak SAR (extrapolated) = 1.36 W/kg
SAR(1 g) = 0.846 W/kg



DUT: ZNFUS990; Type: Portable Handset; Serial: 0699-0233

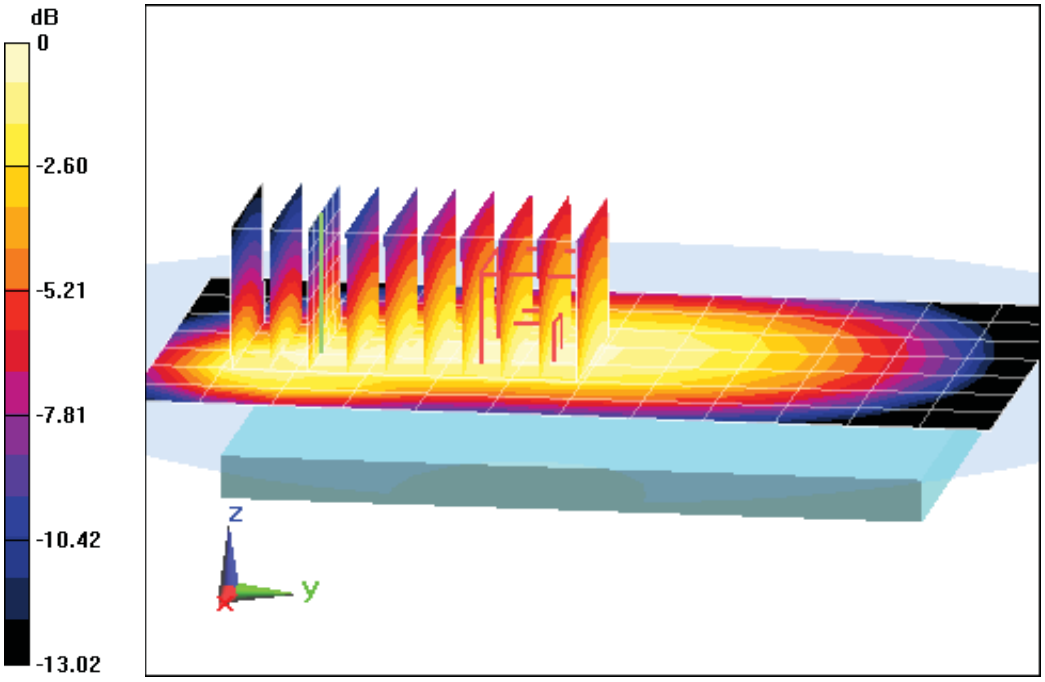
Communication System: UID 0, LTE Band 12 (0); Frequency: 707.5 MHz; Duty Cycle: 1:1
Medium: 750 Body, Medium parameters used (interpolated):
f = 707.5 MHz; σ = 0.933 S/m; ε_r = 54.227; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-18-2014; Ambient Temp: 24.9°C; Tissue Temp: 23.0°C

Probe: ES3DV2 - SN3022; ConvF(5.92, 5.92, 5.92); Calibrated: 8/22/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/21/2013
Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 12, Body SAR, Back side, Mid.ch, 10 MHz Bandwidth, QPSK, 1 RB, 49 RB Offset, Standard Back Cover

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x10x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 22.91 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.811 W/kg
SAR(1 g) = 0.443 W/kg



0 dB = 0.541 W/kg = -2.67 dBW/kg

DUT: ZNFUS990; Type: Portable Handset; Serial: 0699-0233

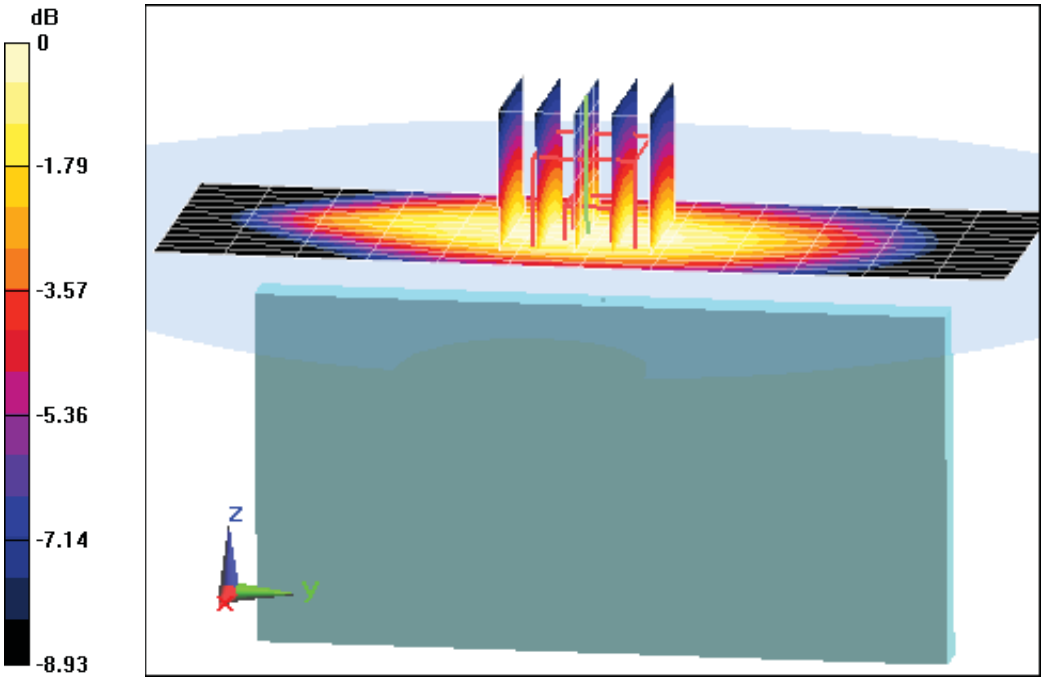
Communication System: UID 0, LTE Band 12 (0); Frequency: 707.5 MHz; Duty Cycle: 1:1
Medium: 750 Body, Medium parameters used (interpolated):
f = 707.5 MHz; σ = 0.933 S/m; ε_r = 54.227; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-18-2014; Ambient Temp: 24.9°C; Tissue Temp: 23.0°C

Probe: ES3DV2 - SN3022; ConvF(5.92, 5.92, 5.92); Calibrated: 8/22/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/21/2013
Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 12, Body SAR, Left Edge, Mid.ch, 10 MHz Bandwidth, QPSK, 1 RB, 49 RB Offset, Standard Back Cover

Area Scan (13x13x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 27.12 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.883 W/kg
SAR(1 g) = 0.639 W/kg



0 dB = 0.725 W/kg = -1.40 dBW/kg

DUT: ZNFUS990; Type: Portable Handset; Serial: 0699-0233

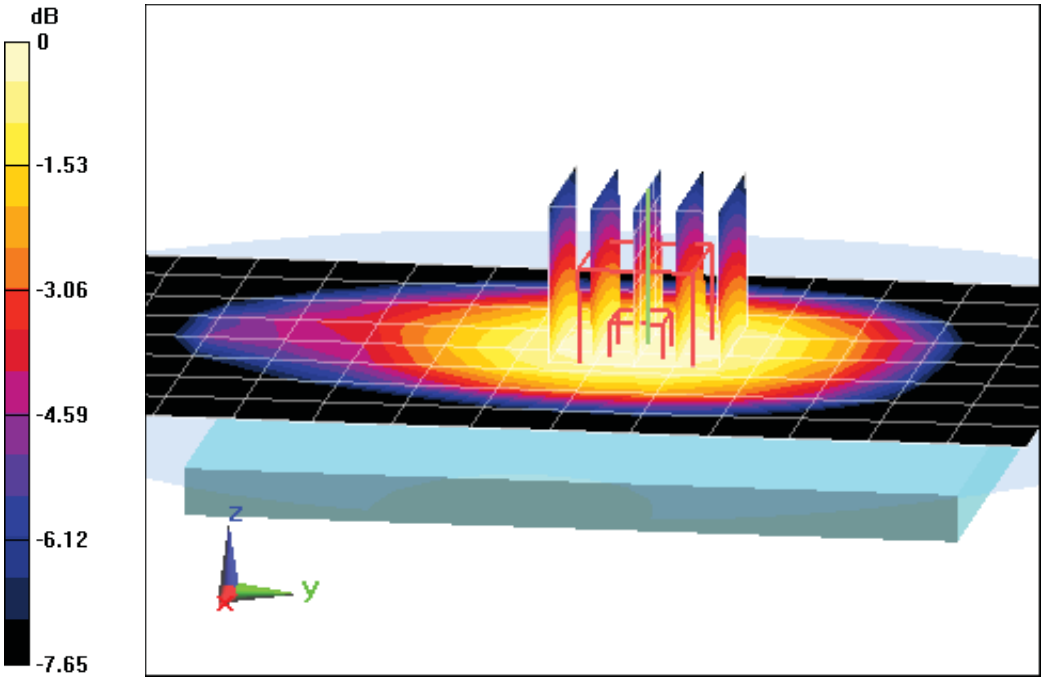
Communication System: UID 0, LTE BAND 5; Frequency: 836.5 MHz; Duty Cycle: 1:1
Medium: 835 Body, Medium parameters used (interpolated):
$f = 836.5$ MHz; $\sigma = 0.943$ S/m; $\varepsilon_r = 55.181$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-23-2014; Ambient Temp: 22.6°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3288; ConvF(6.27, 6.27, 6.27); Calibrated: 9/23/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/17/2013
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 5 (Cell), Body SAR, Back side, Mid.ch, 10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset, Standard Back Cover

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.68 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.618 W/kg
SAR(1 g) = 0.503 W/kg



0 dB = 0.525 W/kg = -2.80 dBW/kg

DUT: ZNFUS990; Type: Portable Handset; Serial: 0699-0233

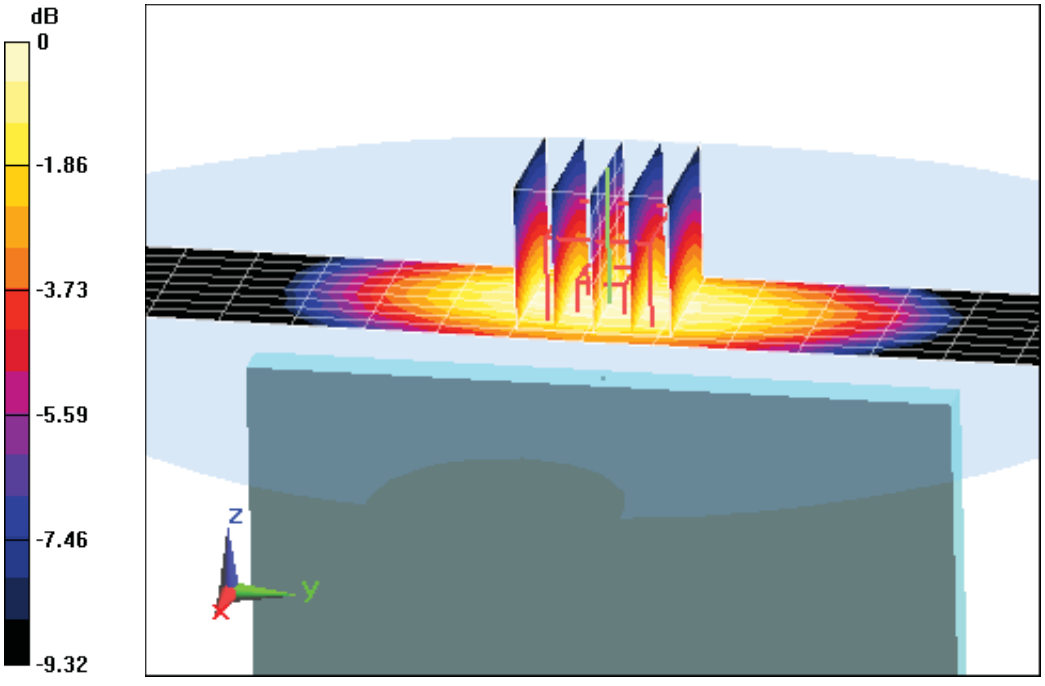
Communication System: UID 0, LTE BAND 5; Frequency: 836.5 MHz; Duty Cycle: 1:1
Medium: 835 Body, Medium parameters used (interpolated):
$f = 836.5$ MHz; $\sigma = 0.943$ S/m; $\varepsilon_r = 55.181$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-23-2014; Ambient Temp: 22.6°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3288; ConvF(6.27, 6.27, 6.27); Calibrated: 9/23/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/17/2013
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 5 (Cell), Body SAR, Right Edge, mid.ch, 10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset, Standard Back Cover

Area Scan (9x15x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.20 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 0.731 W/kg
SAR(1 g) = 0.526 W/kg



0 dB = 0.562 W/kg = -2.50 dBW/kg

DUT: ZNFUS990; Type: Portable Handset; Serial: 0699-0233

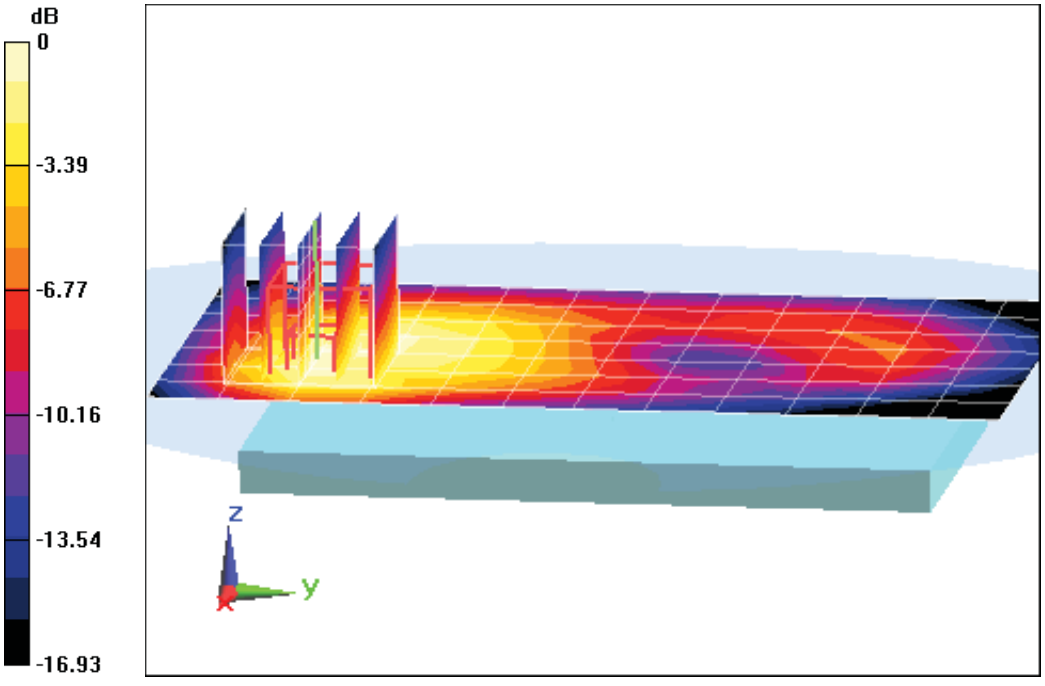
Communication System: UID 0, LTE RF; Frequency: 1732.5 MHz; Duty Cycle: 1:1
Medium: 1750 Body, Medium parameters used (interpolated):
$f = 1732.5$ MHz; $\sigma = 1.511$ S/m; $\varepsilon_r = 51.44$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-18-2014; Ambient Temp: 19.9°C; Tissue Temp: 22.8°C

Probe: ES3DV3 - SN3213; ConvF(4.89, 4.89, 4.89); Calibrated: 4/11/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1364; Calibrated: 3/17/2014
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 4 (AWS), Body SAR, Back side, Mid.ch, 20 MHz Bandwidth, QPSK, 1 RB, 50 RB Offset, Standard Back Cover

Area Scan (8x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 21.40 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 1.08 W/kg
SAR(1 g) = 0.647 W/kg



0 dB = 0.795 W/kg = -1.00 dBW/kg

DUT: ZNFUS990; Type: Portable Handset; Serial: 0699-0233

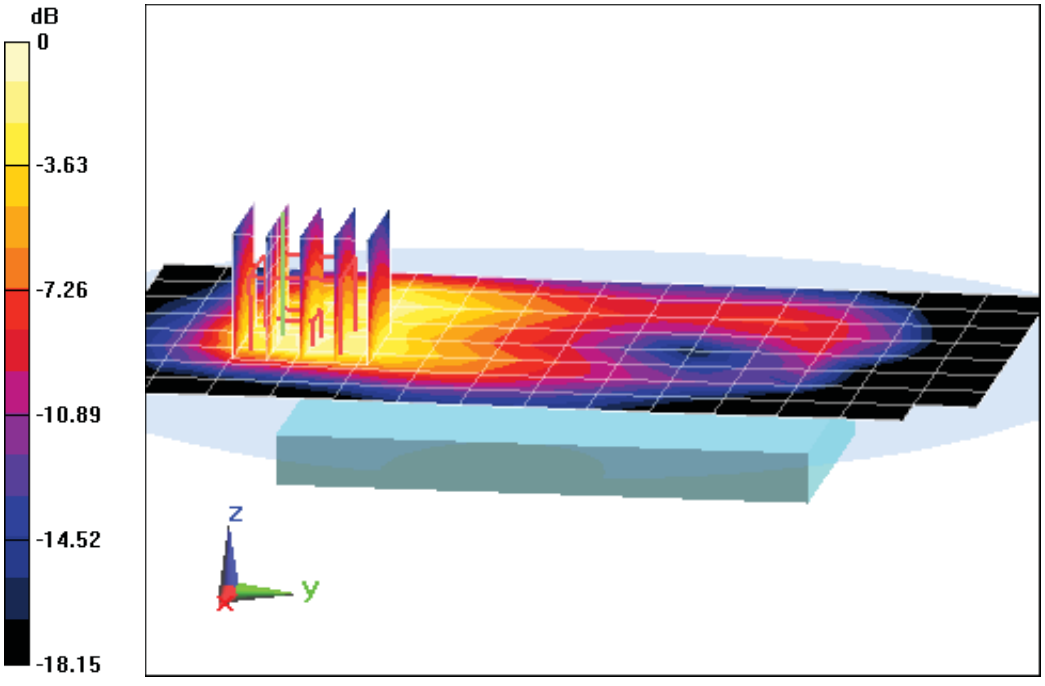
Communication System: UID 0, LTE BAND 25; Frequency: 1860 MHz; Duty Cycle: 1:1
Medium: 1900 Body, Medium parameters used (interpolated):
f = 1860 MHz; σ = 1.46 S/m; ε_r = 53.572; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-19-2014; Ambient Temp: 23.2°C; Tissue Temp: 21.3°C

Probe: ES3DV3 - SN3288; ConvF(4.82, 4.82, 4.82); Calibrated: 9/23/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/17/2013
Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

Mode: LTE Band 25 (PCS), Body SAR, Back side, Low.ch, 20 MHz Bandwidth, QPSK, 1 RB, 99 RB Offset, Standard Back Cover

Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 21.19 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 1.05 W/kg
SAR(1 g) = 0.653 W/kg



0 dB = 0.700 W/kg = -1.55 dBW/kg

DUT: ZNFUS990; Type: Portable Handset; Serial: 0699-0234

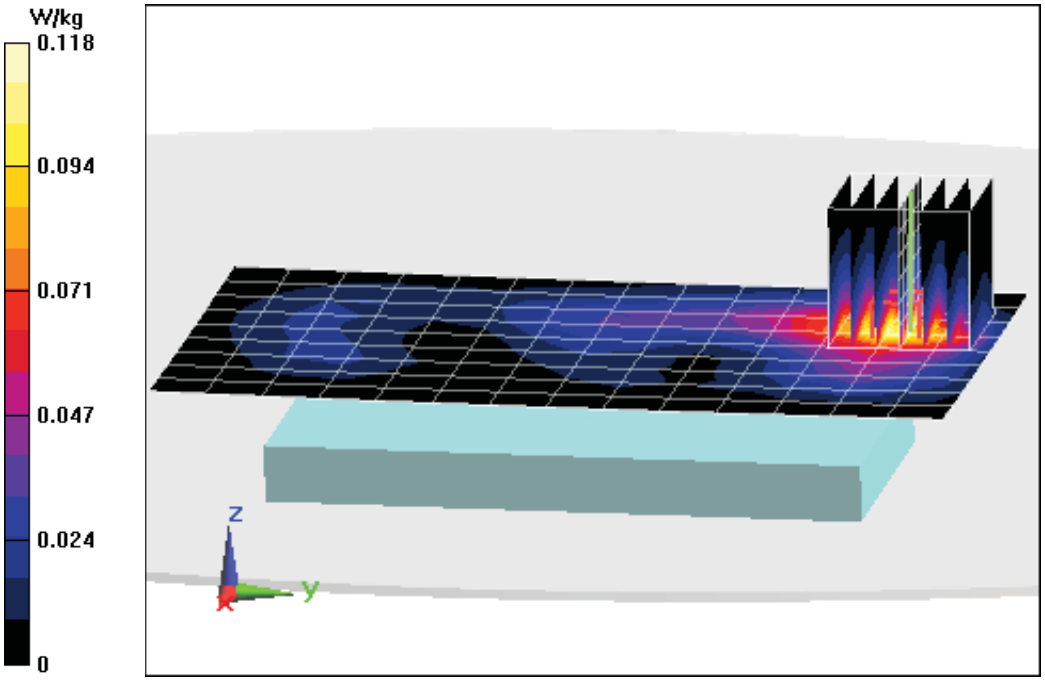
Communication System: UID 0, IEEE 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1
Medium: 2450 Body, Medium parameters used (interpolated):
f = 2437 MHz; σ = 2.001 S/m; ε_r = 52.108; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-16-2014; Ambient Temp: 23.2°C; Tissue Temp: 22.9°C

Probe: ES3DV3 - SN3319; ConvF(4.24, 4.24, 4.24); Calibrated: 4/17/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1368; Calibrated: 4/11/2014
Phantom: ELI left; Type: QDOVA002AA; Serial: TP:1202
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

Area Scan (10x15x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.982 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 0.191 W/kg
SAR(1 g) = 0.092 W/kg



DUT: ZNFUS990; Type: Portable Handset; Serial: 0699-0234

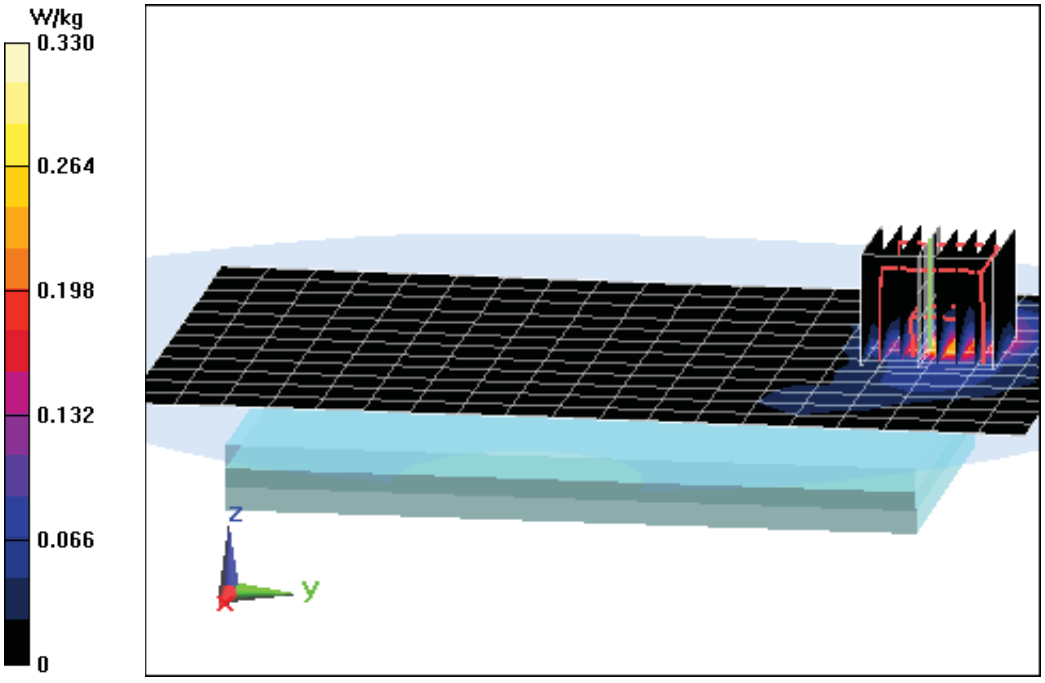
Communication System: UID 0, IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5825 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body, Medium parameters used:
f = 5825 MHz; σ = 6.233 S/m; ε_r = 46.688; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-16-2014; Ambient Temp: 24.5°C; Tissue Temp: 22.5°C

Probe: EX3DV4 - SN3920; ConvF(4, 4, 4); Calibrated: 12/18/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 12/12/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

Mode: IEEE 802.11a, 5.8 GHz, Body SAR, Ch 165, 6 Mbps, Back Side, Standard Back Cover

Area Scan (13x20x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm, Graded Ratio = 1.4
Reference Value = 4.883 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 0.669 W/kg
SAR(1 g) = 0.142 W/kg



DUT: ZNFUS990; Type: Portable Handset; Serial: 0699-0234

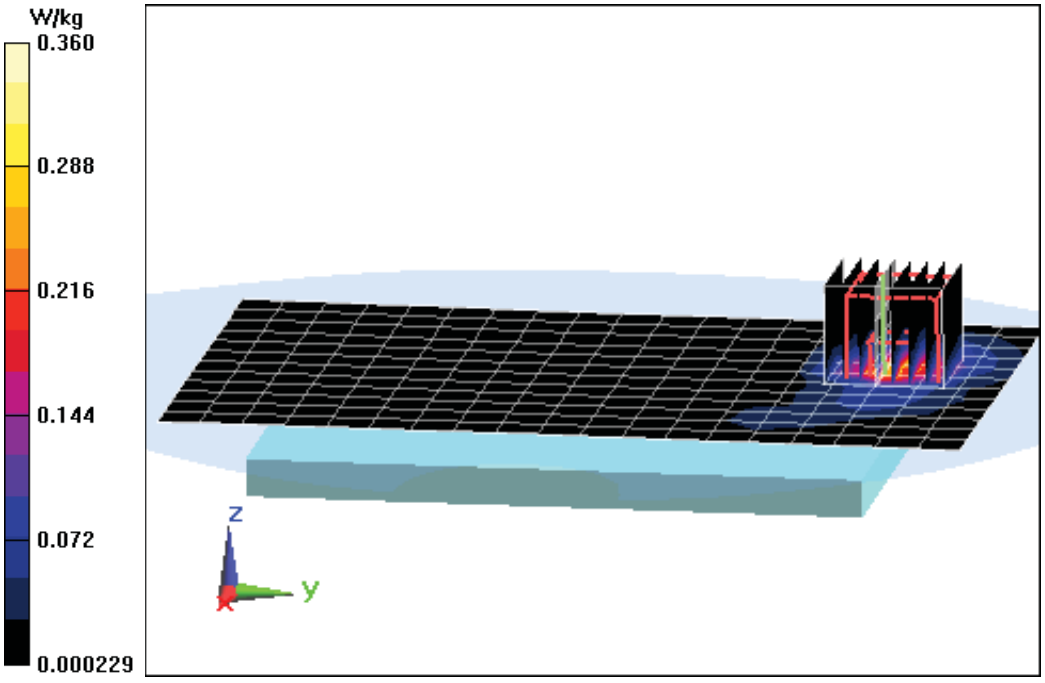
Communication System: UID 0, IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5220 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body, Medium parameters used:
f = 5220 MHz; σ = 5.484 S/m; ε_r = 47.539; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 06-16-2014; Ambient Temp: 24.4°C; Tissue Temp: 22.4°C

Probe: EX3DV4 - SN3920; ConvF(4.23, 4.23, 4.23); Calibrated: 12/18/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 12/12/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

Mode: IEEE 802.11a, 5.2 GHz, Body SAR, Ch 44, 6 Mbps, Back Side, Standard Back Cover

Area Scan (13x20x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm, Graded Ratio = 1.4
Reference Value = 5.636 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.636 W/kg
SAR(1 g) = 0.170 W/kg



APPENDIX B: SYSTEM VERIFICATION

PCTEST ENGINEERING LABORATORY, INC.

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

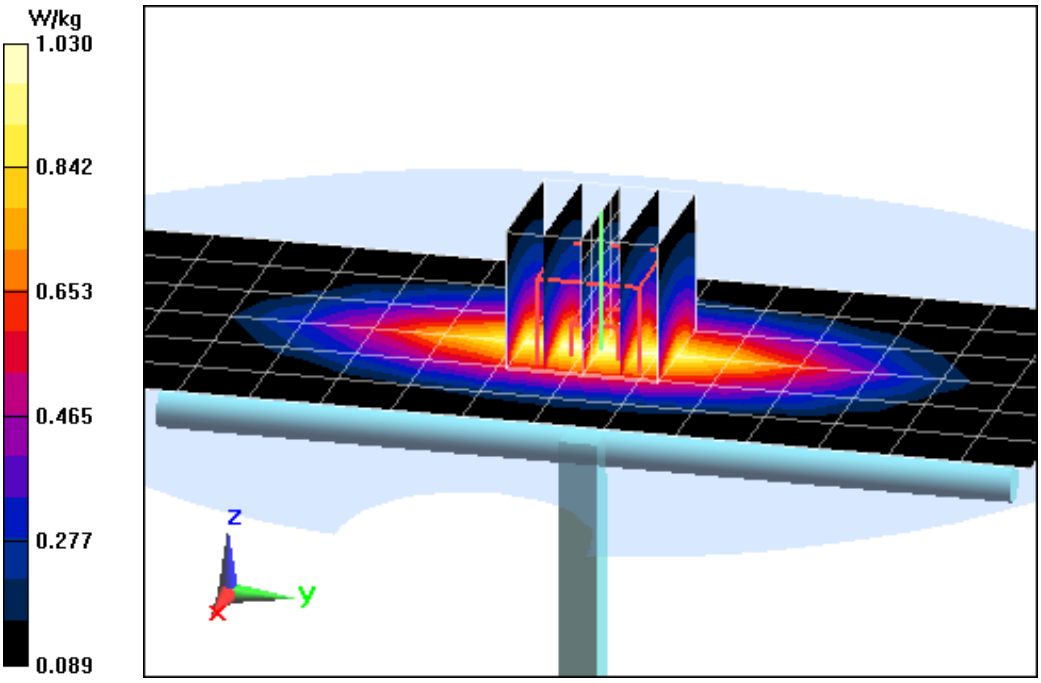
Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1
Medium: 740 Head, Medium parameters used (interpolated):
f = 750 MHz; σ = 0.93 S/m; ε_r = 41.902; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.5 cm

Test Date: 06-24-2014; Ambient Temp: 22.4°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3332; ConvF(6.46, 6.46, 6.46); Calibrated: 11/25/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1407; Calibrated: 11/18/2013
Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1800
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

750 MHz System Verification

Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 1.31 W/kg
SAR(1 g) = 0.876 W/kg
Deviation = 4.66%



PCTEST ENGINEERING LABORATORY, INC.

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

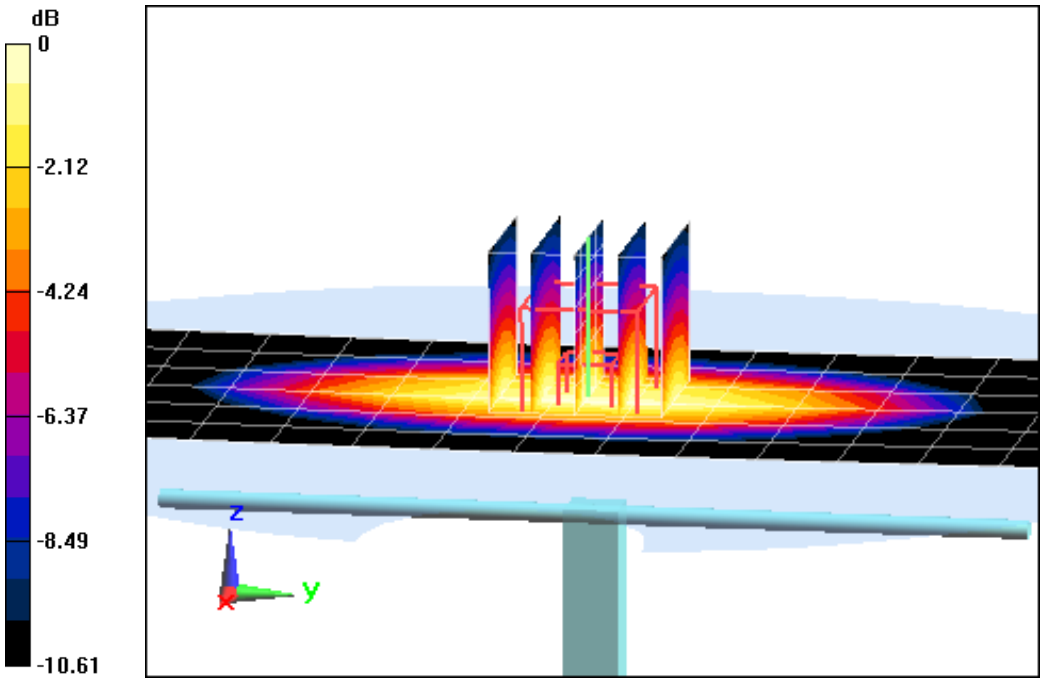
Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: 835 Head, Medium parameters used:
f = 835 MHz; σ = 0.893 S/m; ε_r = 40.006; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.5 cm

Test Date: 06-17-2014; Ambient Temp: 23.8°C; Tissue Temp: 23.5°C

Probe: ES3DV3 - SN3209; ConvF(6.23, 6.23, 6.23); Calibrated: 3/19/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 3/17/2014
Phantom: SAM front; Type: QD000P40CD; Serial: TP:1759
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

835 MHz System Verification

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 1.50 W/kg
SAR(1 g) = 1 W/kg
Deviation = 8.46%



0 dB = 1.17 W/kg = 0.68 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

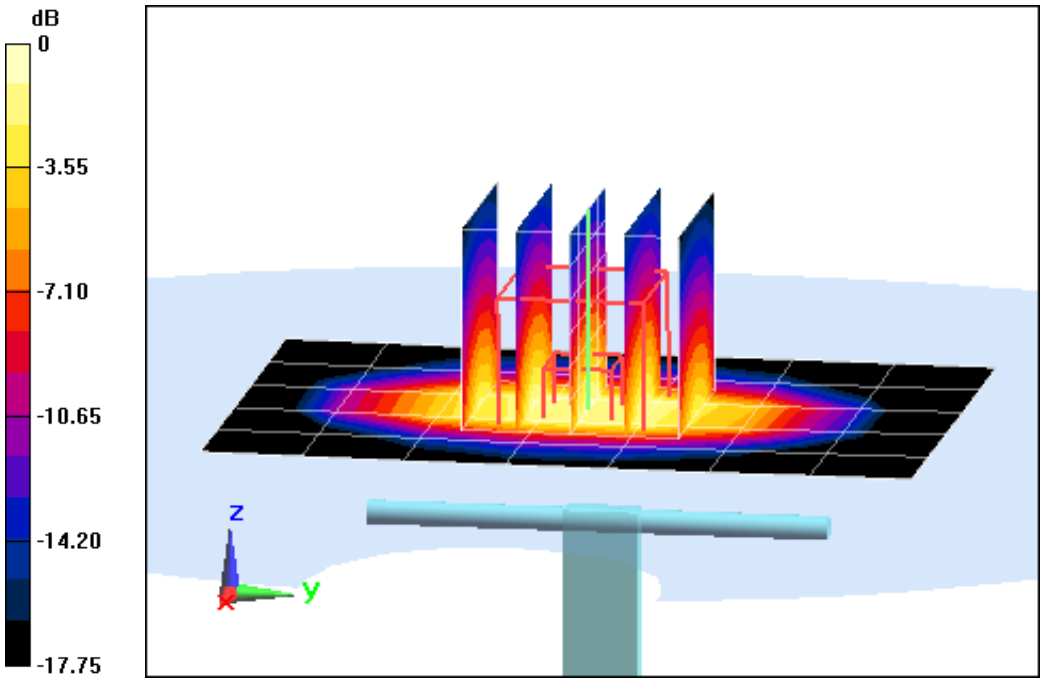
Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1
Medium: 1750 Head, Medium parameters used:
f = 1750 MHz; σ = 1.38 S/m; ε_r = 38.44; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 06-18-2014; Ambient Temp: 19.0°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3213; ConvF(5.18, 5.18, 5.18); Calibrated: 4/11/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1364; Calibrated: 3/17/2014
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

1750 MHz System Verification

Area Scan (6x8x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 6.94 W/kg
SAR(1 g) = 3.73 W/kg
Deviation = 3.04%



0 dB = 4.78 W/kg = 6.79 dBW/kg

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

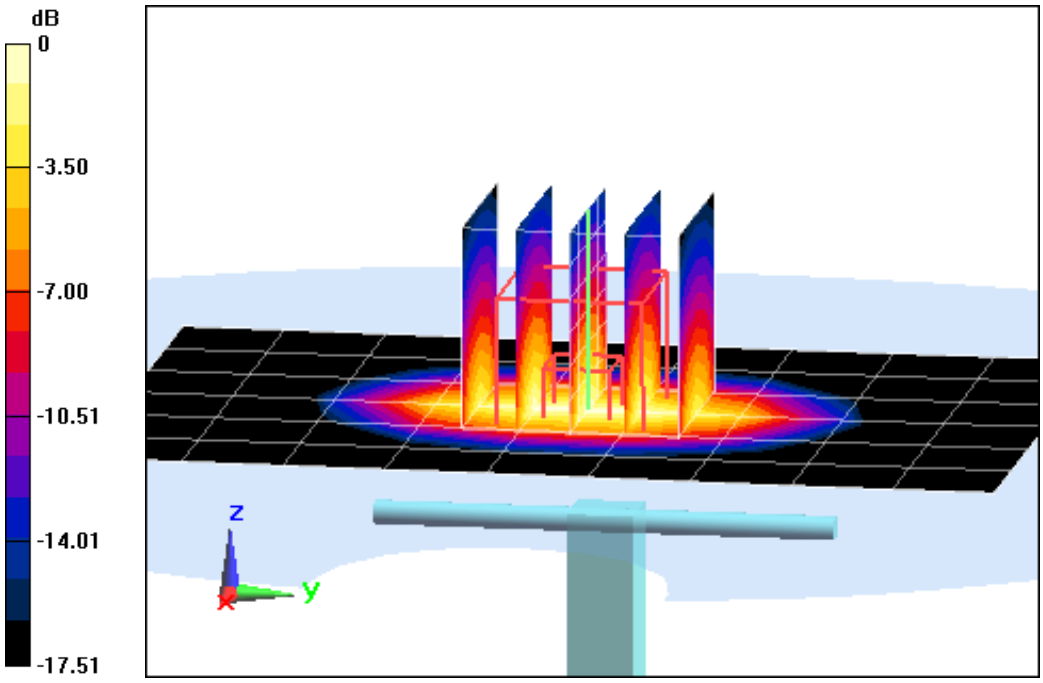
Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Head, Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.407 S/m; ε_r = 39.798; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 06-17-2014; Ambient Temp: 23.9°C; Tissue Temp: 23.0°C

Probe: ES3DV3 - SN3287; ConvF(5.08, 5.08, 5.08); Calibrated: 11/20/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1408; Calibrated: 11/19/2013
Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1797
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

1900 MHz System Verification

Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 7.16 W/kg
SAR(1 g) = 3.93 W/kg
Deviation = -2.72%



0 dB = 5.00 W/kg = 6.99 dBW/kg

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

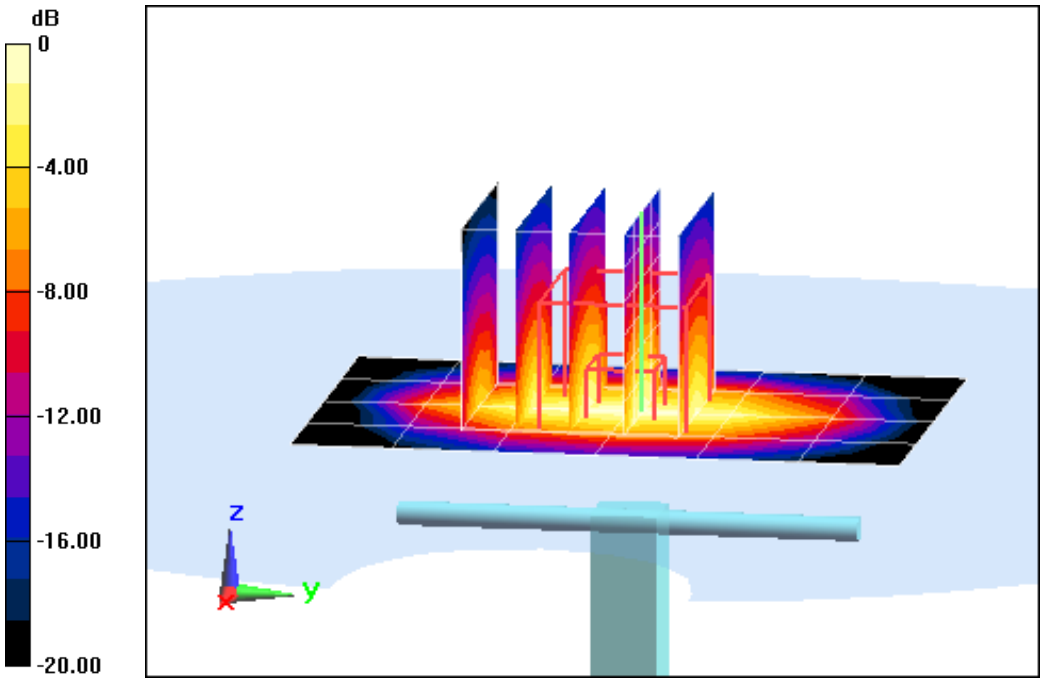
Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Head, Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.442 S/m; ε_r = 40.064; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 06-23-2014; Ambient Temp: 20.9°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3213; ConvF(4.99, 4.99, 4.99); Calibrated: 4/11/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1364; Calibrated: 3/17/2014
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

1900MHz System Verification

Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 6.91 W/kg
SAR(1 g) = 3.78 W/kg
Deviation = -7.13%



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

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

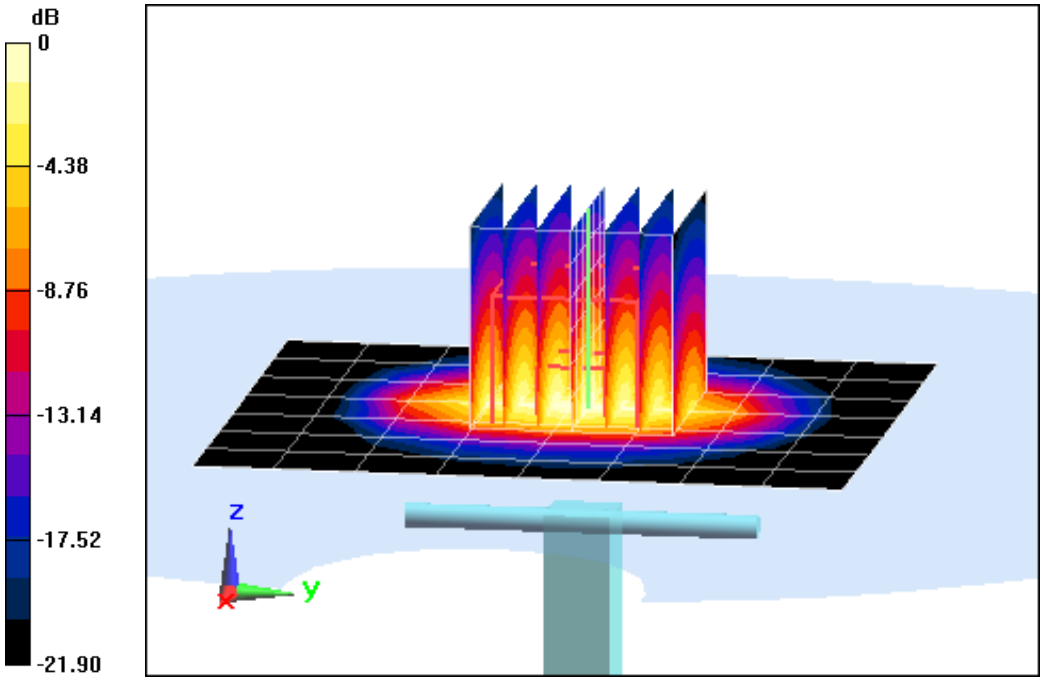
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 Head, Medium parameters used:
f = 2450 MHz; σ = 1.743 S/m; ε_r = 39.937; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 06-17-2014; Ambient Temp: 22.5°C; Tissue Temp: 21.8°C

Probe: ES3DV3 - SN3258; ConvF(4.52, 4.52, 4.52); Calibrated: 2/25/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn665; Calibrated: 2/26/2014
Phantom: SAM Front; Type: SAM; Serial: 1686
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

2450 MHz System Verification

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 10.2 W/kg
SAR(1 g) = 4.99 W/kg
Deviation = -3.67%



0 dB = 6.53 W/kg = 8.15 dBW/kg

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

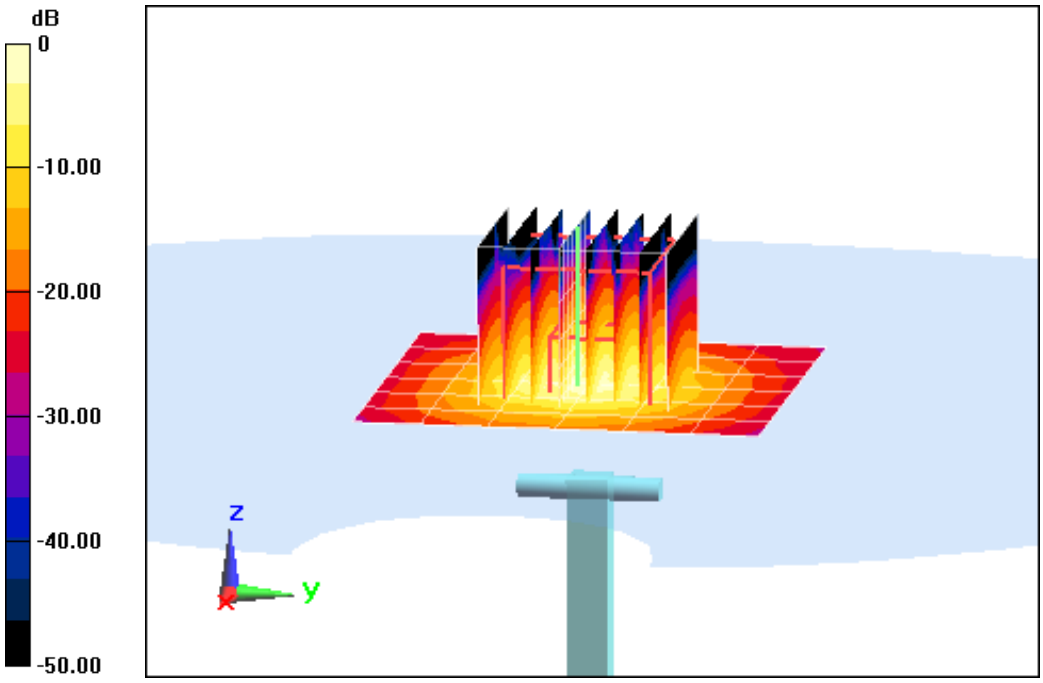
Communication System: UID 0, CW; Frequency: 5200 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head, Medium parameters used:
f = 5200 MHz; σ = 4.698 S/m; ε_r = 37.195; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 06-23-2014; Ambient Temp: 24.3°C; Tissue Temp: 23.3°C

Probe: EX3DV4 - SN3914; ConvF(4.99, 4.99, 4.99); Calibrated: 10/23/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

5200 MHz System Verification

Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio = 1.4
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 32.3 W/kg
SAR(1 g) = 7.63 W/kg
Deviation = -2.18%



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

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

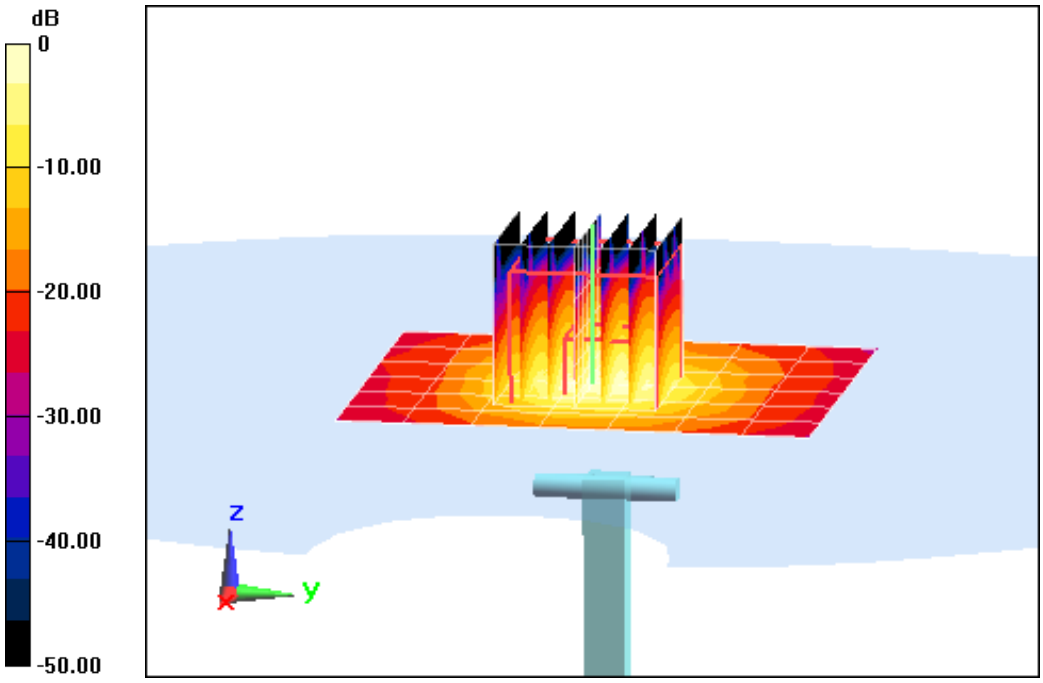
Communication System: UID 0, CW; Frequency: 5300 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head, Medium parameters used:
f = 5300 MHz; σ = 4.799 S/m; ε_r = 37.064; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 06-23-2014; Ambient Temp: 24.4°C; Tissue Temp: 23.3°C

Probe: EX3DV4 - SN3914; ConvF(4.82, 4.82, 4.82); Calibrated: 10/23/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

5300 MHz System Verification

Area Scan (7x8x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio = 1.4
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 33.3 W/kg
SAR(1 g) = 7.81 W/kg
Deviation = -5.90%



0 dB = 15.4 W/kg = 11.88 dBW/kg

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

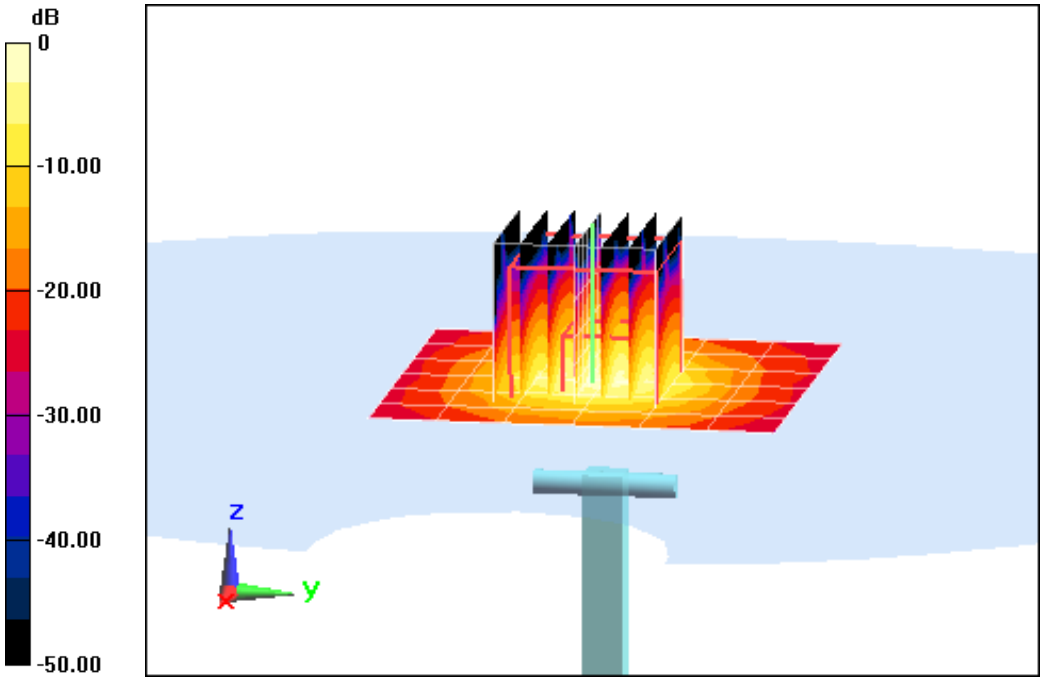
Communication System: UID 0, CW; Frequency: 5500 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head, Medium parameters used:
f = 5500 MHz; σ = 5.014 S/m; ε_r = 36.791; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 06-23-2014; Ambient Temp: 24.4°C; Tissue Temp: 23.3°C

Probe: EX3DV4 - SN3914; ConvF(4.55, 4.55, 4.55); Calibrated: 10/23/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

5500 MHz System Verification

Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio = 1.4
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 36.0 W/kg
SAR(1 g) = 8.08 W/kg
Deviation = -4.15%



0 dB = 19.6 W/kg = 12.92 dBW/kg

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

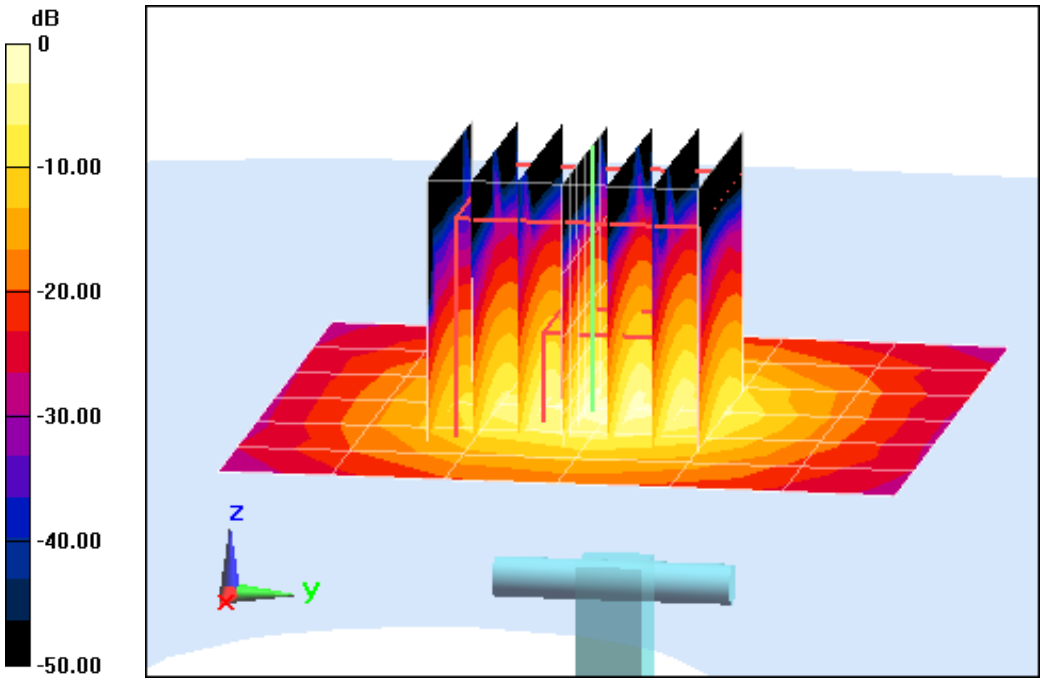
Communication System: UID 0, CW; Frequency: 5600 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head, Medium parameters used:
f = 5600 MHz; σ = 5.122 S/m; ε_r = 36.629; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 06-23-2014; Ambient Temp: 24.4°C; Tissue Temp: 23.4°C

Probe: EX3DV4 - SN3914; ConvF(4.37, 4.37, 4.37); Calibrated: 10/23/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

5600 MHz System Verification

Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio = 1.4
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 37.1 W/kg
SAR(1 g) = 8.28 W/kg
Deviation = -0.84%



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

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

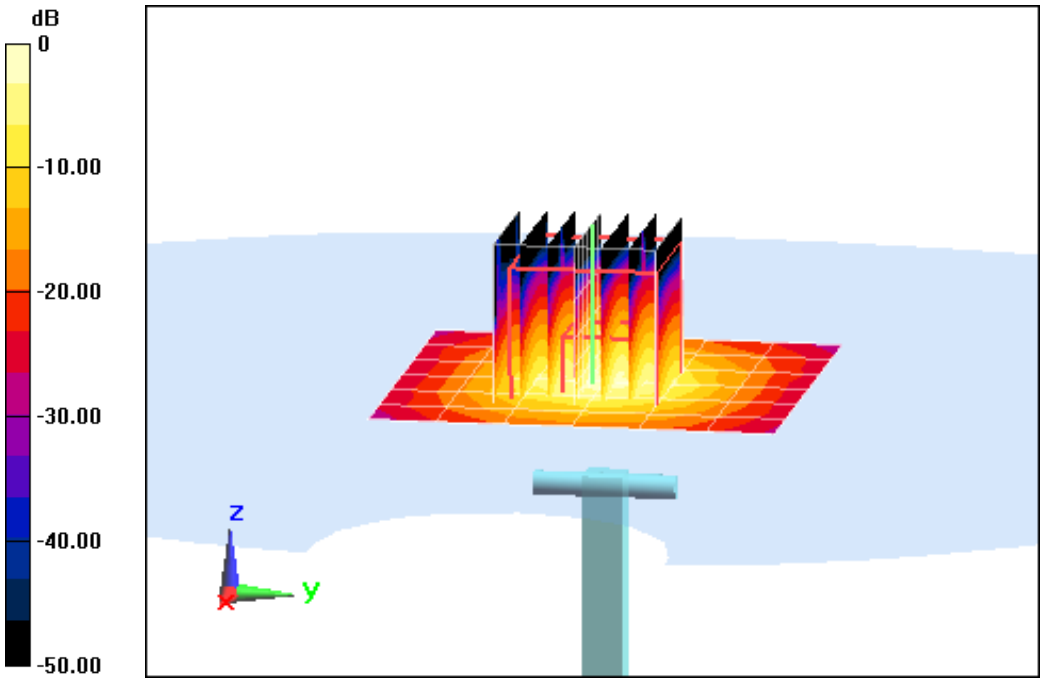
Communication System: UID 0, CW; Frequency: 5800 MHz; Duty Cycle: 1:1
Medium: 5 GHz Head, Medium parameters used:
f = 5800 MHz; σ = 5.32 S/m; ε_r = 36.363; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 06-23-2014; Ambient Temp: 24.4°C; Tissue Temp: 23.4°C

Probe: EX3DV4 - SN3914; ConvF(4.52, 4.52, 4.52); Calibrated: 10/23/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/19/2013
Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

5800 MHz System Verification

Area Scan (7x7x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio = 1.4
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 34.6 W/kg
SAR(1 g) = 7.35 W/kg
Deviation = -7.31%



0 dB = 17.9 W/kg = 12.53 dBW/kg

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

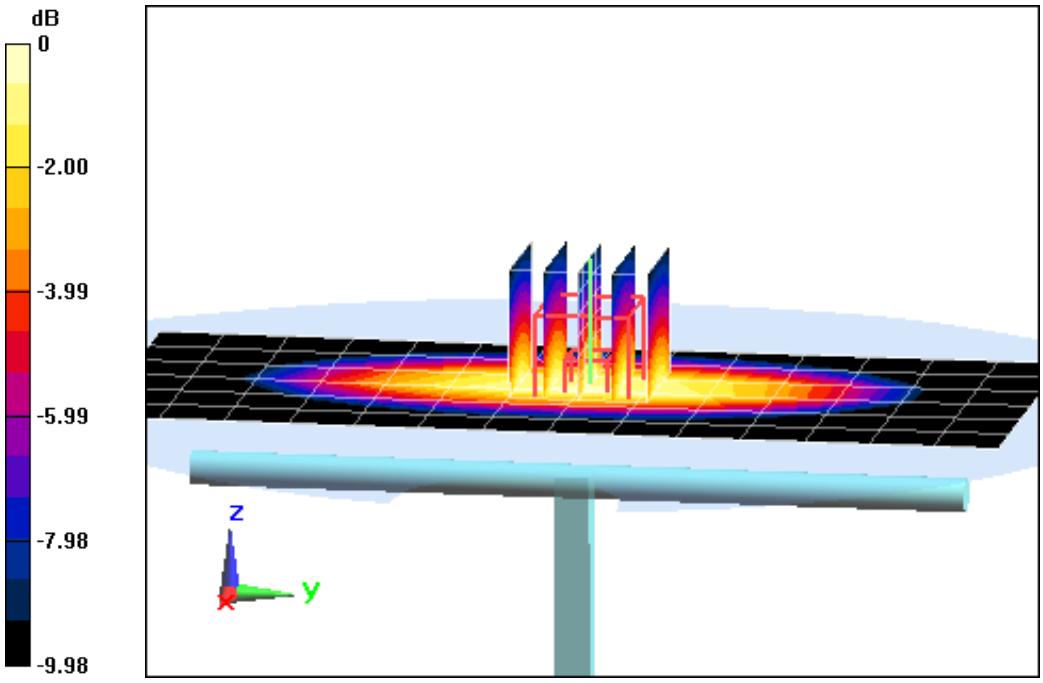
Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1
Medium: 740 Body, Medium parameters used (interpolated):
f = 750 MHz; σ = 0.972 S/m; ε_r = 53.83; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.5 cm

Test Date: 06-18-2014; Ambient Temp: 25.0°C; Tissue Temp: 23.0°C

Probe: ES3DV2 - SN3022; ConvF(5.92, 5.92, 5.92); Calibrated: 8/22/2013;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/21/2013
Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

750 MHz System Verification

Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 1.24 W/kg
SAR(1 g) = 0.859 W/kg
Deviation = -2.05%



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

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

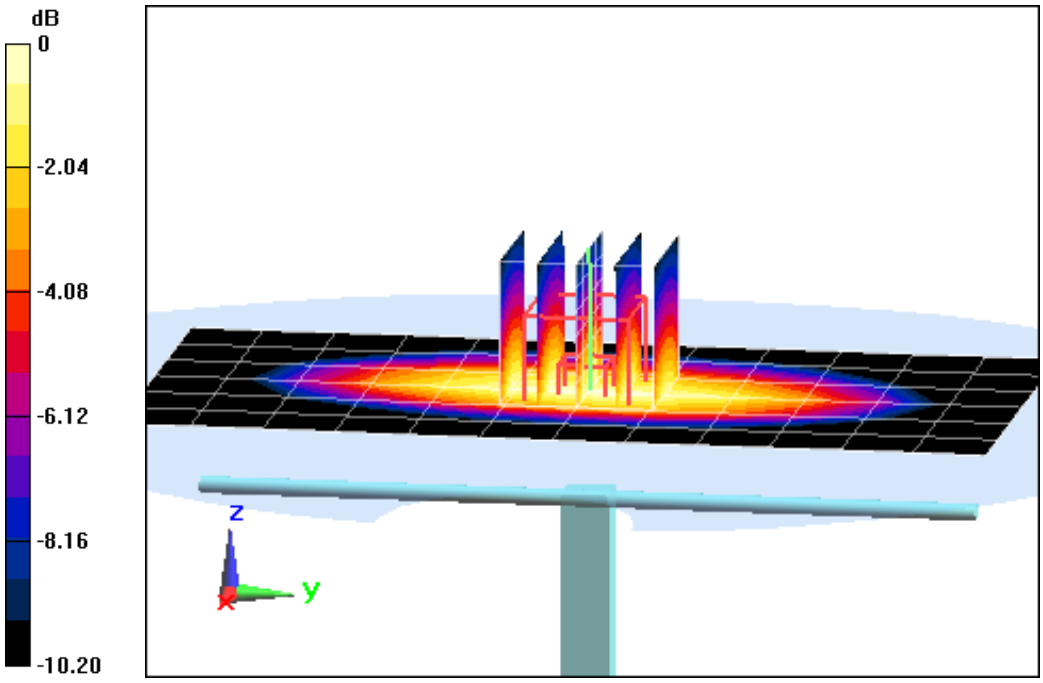
Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: 835 Body, Medium parameters used:
f = 835 MHz; σ = 0.942 S/m; ε_r = 55.193; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.5 cm

Test Date: 06-23-2014; Ambient Temp: 22.6°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3288; ConvF(6.27, 6.27, 6.27); Calibrated: 9/23/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/17/2013
Phantom: SAM with CRP; Type: SAM; Serial: TP1375
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

835MHz System Verification

Area Scan (7x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 1.42 W/kg
SAR(1 g) = 0.977 W/kg
Deviation = 1.66%



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

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

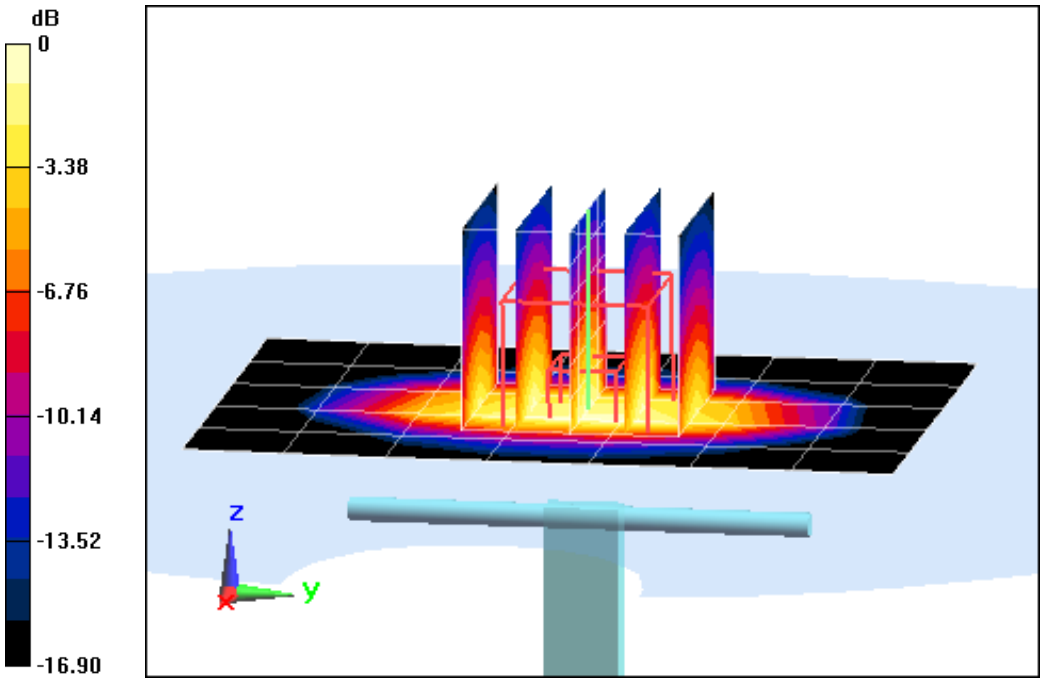
Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1
Medium: 1750 Body, Medium parameters used:
f = 1750 MHz; σ = 1.531 S/m; ε_r = 51.364; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 06-18-2014; Ambient Temp: 19.9°C; Tissue Temp: 22.8°C

Probe: ES3DV3 - SN3213; ConvF(4.89, 4.89, 4.89); Calibrated: 4/11/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1364; Calibrated: 3/17/2014
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

1750 MHz System Verification

Area Scan (6x8x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 6.50 W/kg
SAR(1 g) = 3.74 W/kg
Deviation = 0.00%



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

PCTEST ENGINEERING LABORATORY, INC.

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

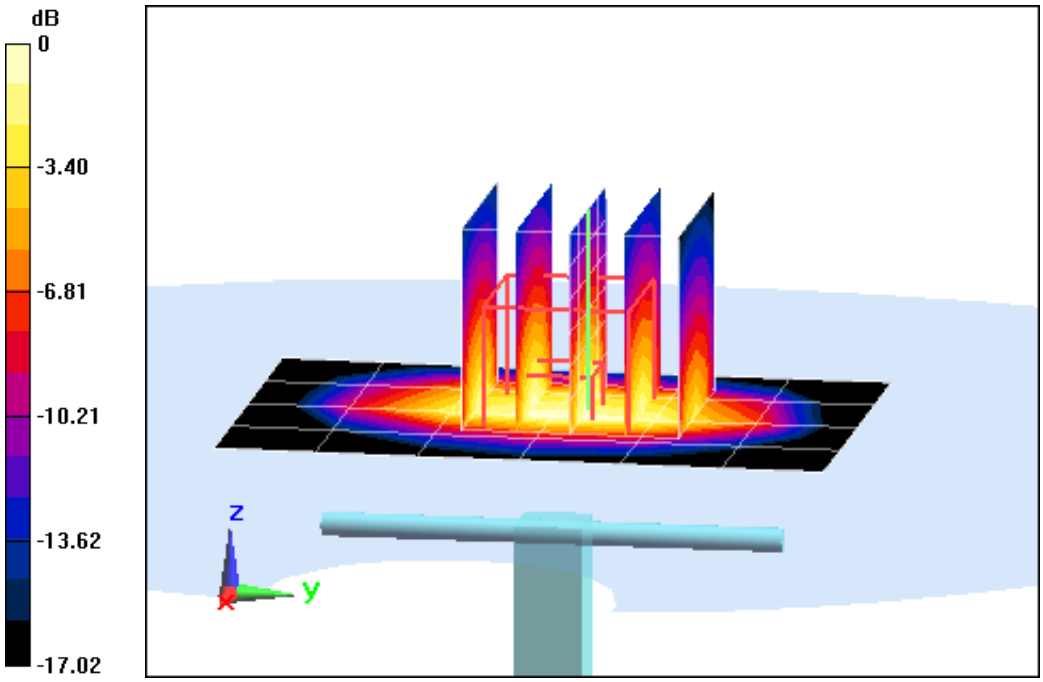
Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Body, Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.503 S/m; ε_r = 53.395; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 06-19-2014; Ambient Temp: 23.2°C; Tissue Temp: 21.3°C

Probe: ES3DV3 - SN3288; ConvF(4.82, 4.82, 4.82); Calibrated: 9/23/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/17/2013
Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

1900MHz System Verification

Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 6.99 W/kg
SAR(1 g) = 4.07 W/kg
Deviation = 3.56%



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

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

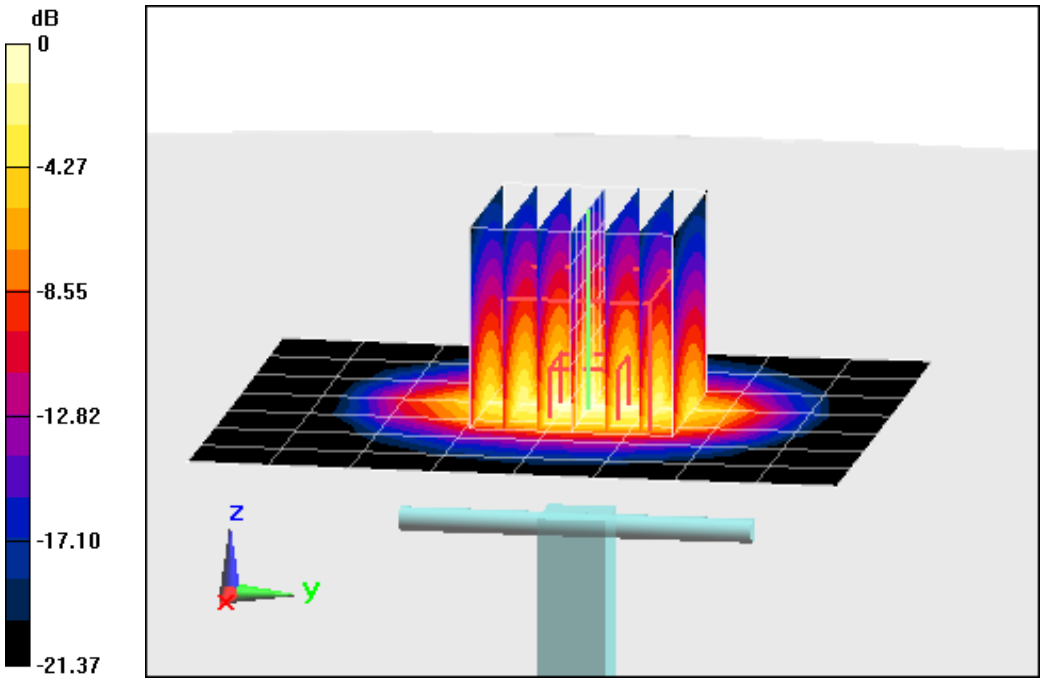
Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: 2450 Body, Medium parameters used:
f = 2450 MHz; σ = 2.019 S/m; ε_r = 52.059; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 06-16-2014; Ambient Temp: 23.2°C; Tissue Temp: 22.9°C

Probe: ES3DV3 - SN3319; ConvF(4.24, 4.24, 4.24); Calibrated: 4/17/2014;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1368; Calibrated: 4/11/2014
Phantom: ELI left; Type: QDOVA002AA; Serial: TP:1202
Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

2450 MHz System Verification

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 11.6 W/kg
SAR(1 g) = 5.55 W/kg
Deviation = 7.35%



0 dB = 7.29 W/kg = 8.63 dBW/kg

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

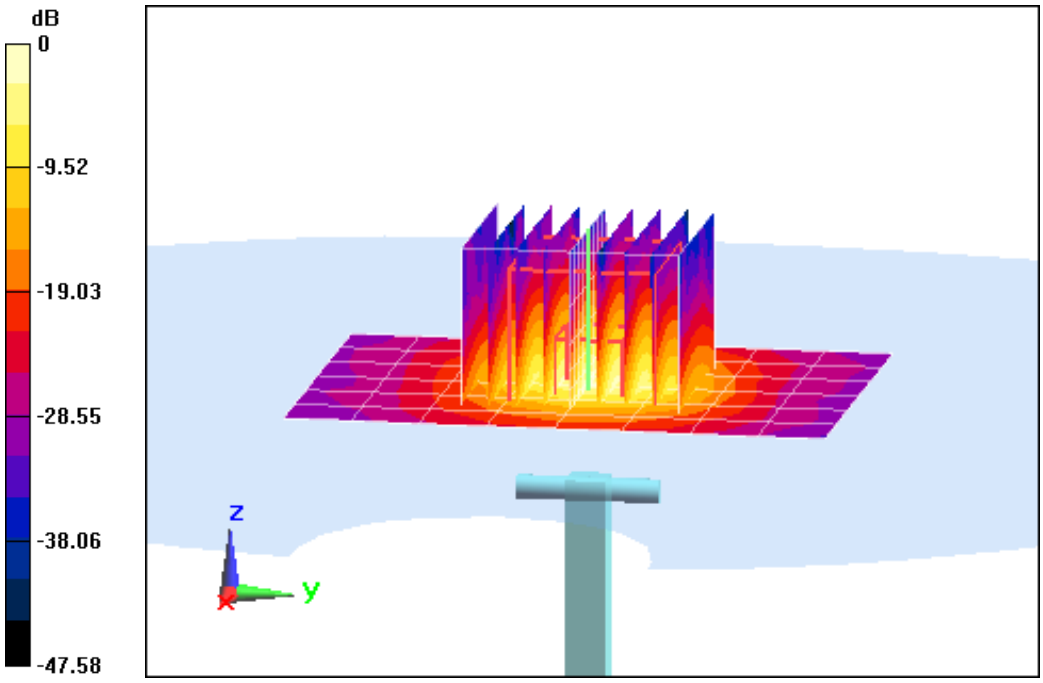
Communication System: UID 0, CW; Frequency: 5200 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body, Medium parameters used:
f = 5200 MHz; σ = 5.454 S/m; ε_r = 47.504; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 06-16-2014; Ambient Temp: 24.4°C; Tissue Temp: 22.4°C

Probe: EX3DV4 - SN3920; ConvF(4.23, 4.23, 4.23); Calibrated: 12/18/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 12/12/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

5200MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio = 1.4
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 28.3 W/kg
SAR(1 g) = 7.4 W/kg
Deviation = 1.93%



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

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

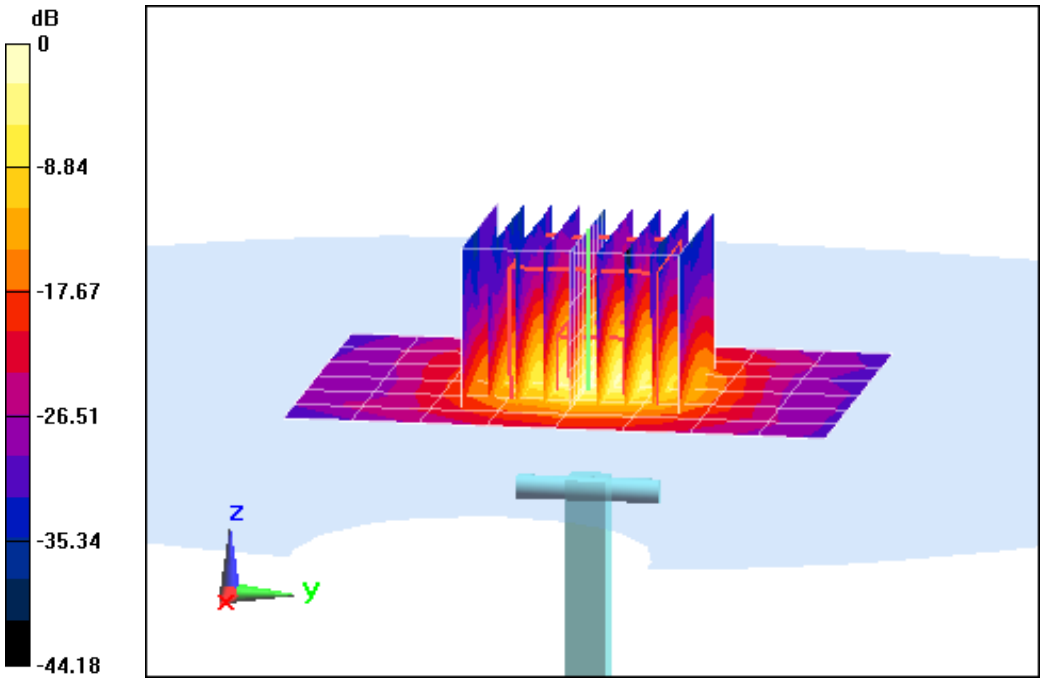
Communication System: UID 0, CW; Frequency: 5300 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body, Medium parameters used:
f = 5300 MHz; σ = 5.592 S/m; ε_r = 47.351; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 06-16-2014; Ambient Temp: 24.4°C; Tissue Temp: 22.4°C

Probe: EX3DV4 - SN3920; ConvF(4.11, 4.11, 4.11); Calibrated: 12/18/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 12/12/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

5300MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio = 1.4
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 33.0 W/kg
SAR(1 g) = 7.53 W/kg
Deviation = 0.80%



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

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

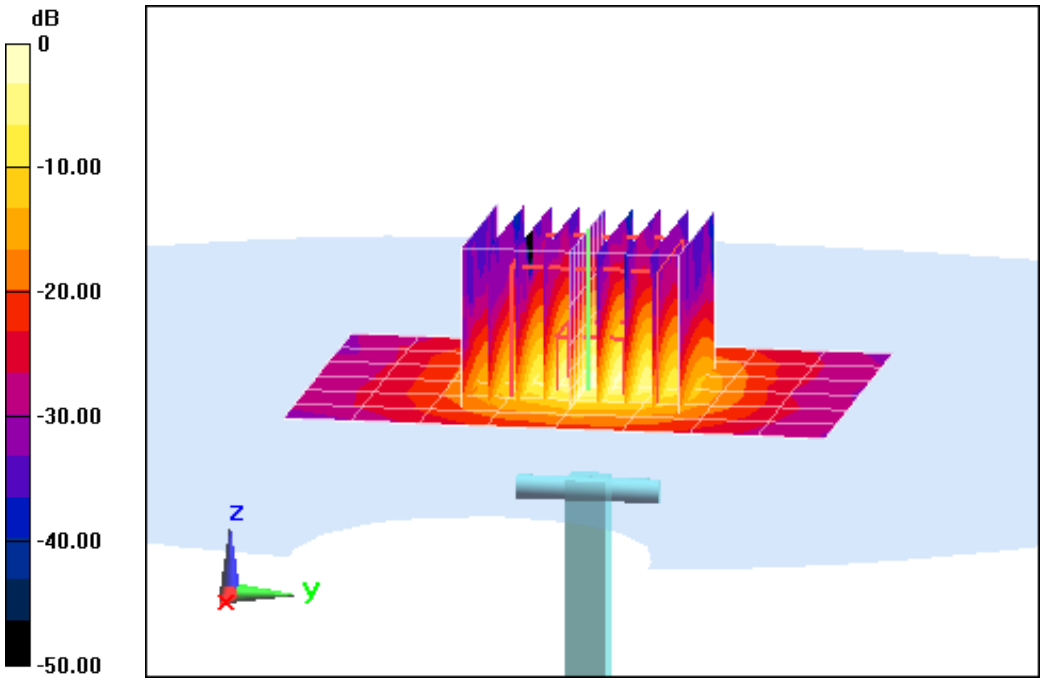
Communication System: UID 0, CW; Frequency: 5500 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body, Medium parameters used:
f = 5500 MHz; σ = 5.881 S/m; ε_r = 47.322; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 06-16-2014; Ambient Temp: 24.5°C; Tissue Temp: 22.5°C

Probe: EX3DV4 - SN3920; ConvF(3.8, 3.8, 3.8); Calibrated: 12/18/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 12/12/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

5500MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio = 1.4
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 35.7 W/kg
SAR(1 g) = 7.62 W/kg
Deviation = 0.40%



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

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

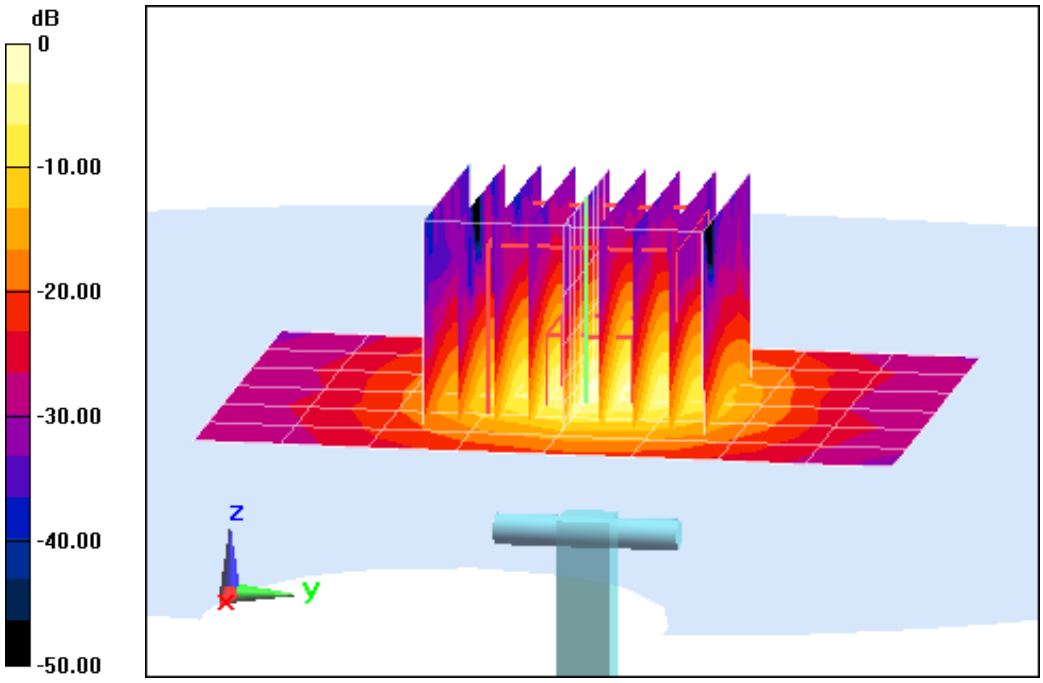
Communication System: UID 0, CW; Frequency: 5600 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body, Medium parameters used:
f = 5600 MHz; σ = 6.014 S/m; ε_r = 47.23; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 06-16-2014; Ambient Temp: 24.5°C; Tissue Temp: 22.5°C

Probe: EX3DV4 - SN3920; ConvF(3.62, 3.62, 3.62); Calibrated: 12/18/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 12/12/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

5600MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 36.5 W/kg
SAR(1 g) = 7.65 W/kg
Deviation = -1.03%



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

PCTEST ENGINEERING LABORATORY, INC.

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

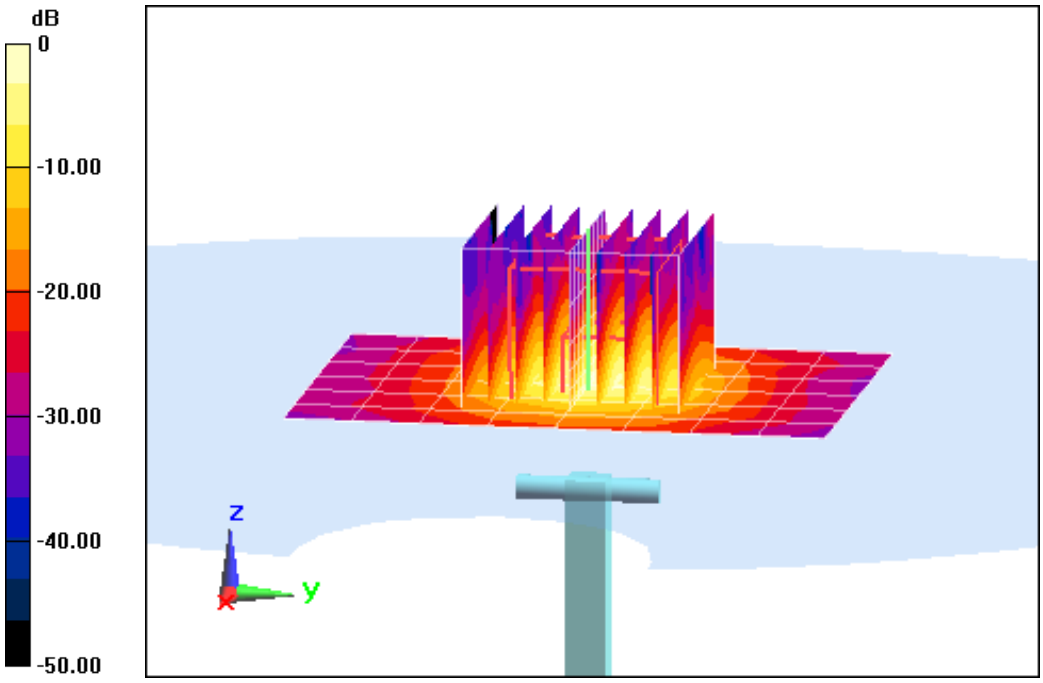
Communication System: UID 0, CW; Frequency: 5800 MHz; Duty Cycle: 1:1
Medium: 5 GHz Body, Medium parameters used:
f = 5800 MHz; σ = 6.21 S/m; ε_r = 46.638; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 06-16-2014; Ambient Temp: 24.5°C; Tissue Temp: 22.5°C

Probe: EX3DV4 - SN3920; ConvF(4, 4, 4); Calibrated: 12/18/2013;
Sensor-Surface: 1.4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 12/12/2013
Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7331)

5800MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm; Graded Ratio = 1.4
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 34.8 W/kg
SAR(1 g) = 6.92 W/kg
Deviation = -5.08%



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

APPENDIX C: PROBE CALIBRATION

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

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

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

Accreditation No.: SCS 108

Client PC Test

Certificate No: ES3-3332_Nov13

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3332

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

VCC 1/12/14

Calibration date: November 25, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: November 25, 2013

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

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

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

Accreditation No.: SCS 108

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:3332

Manufactured: January 24, 2012
Calibrated: November 25, 2013

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]	0.94	1.16	0.97	± 10.1 %
DCP (mV)[B]	103.5	101.0	111.0	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	179.7	±2.5 %
		Y	0.0	0.0	1.0		147.3	
		Z	0.0	0.0	1.0		188.8	

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

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN: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)	Unct. (k=2)
750	41.9	0.89	6.46	6.46	6.46	0.52	1.42	± 12.0 %
850	41.5	0.92	6.29	6.29	6.29	0.78	1.17	± 12.0 %
1750	40.1	1.37	5.27	5.27	5.27	0.80	1.10	± 12.0 %
1900	40.0	1.40	5.06	5.06	5.06	0.80	1.18	± 12.0 %
2450	39.2	1.80	4.50	4.50	4.50	0.80	1.19	± 12.0 %
2600	39.0	1.96	4.38	4.38	4.38	0.76	1.31	± 12.0 %

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

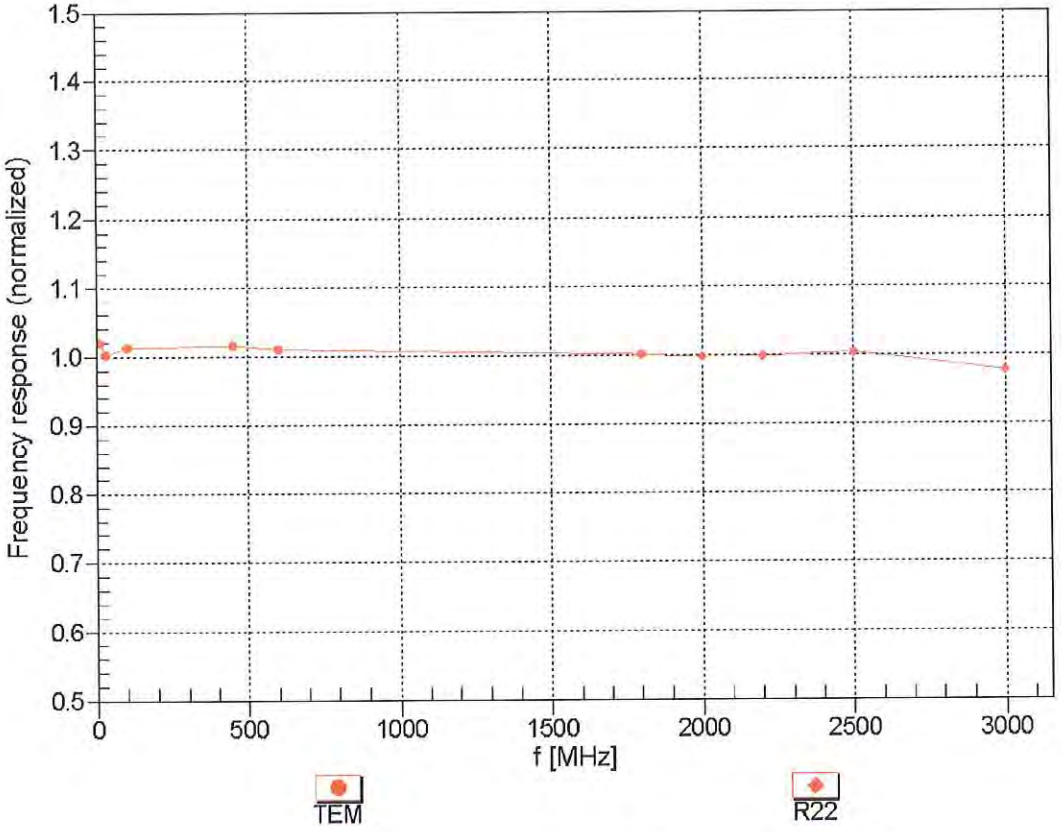
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3332

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)	Unct. (k=2)
750	55.5	0.96	6.21	6.21	6.21	0.80	1.19	± 12.0 %
850	55.2	0.99	6.08	6.08	6.08	0.51	1.48	± 12.0 %
1750	53.4	1.49	4.93	4.93	4.93	0.42	1.72	± 12.0 %
1900	53.3	1.52	4.70	4.70	4.70	0.48	1.59	± 12.0 %
2450	52.7	1.95	4.24	4.24	4.24	0.80	1.01	± 12.0 %
2600	52.5	2.16	4.07	4.07	4.07	0.80	0.50	± 12.0 %

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

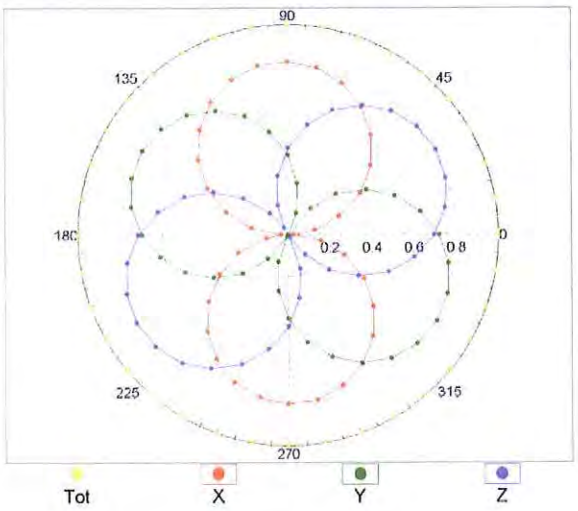
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



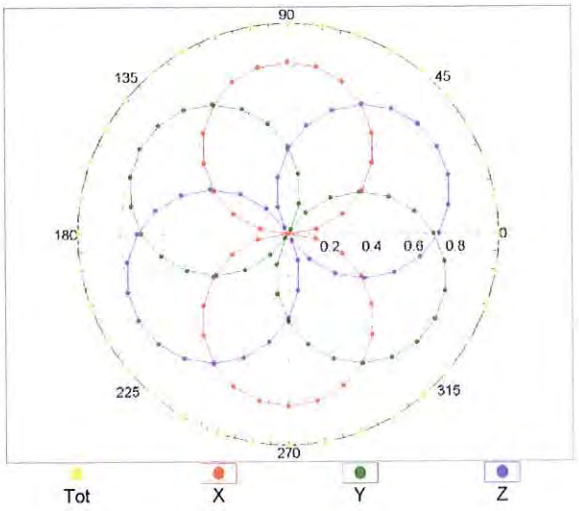
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

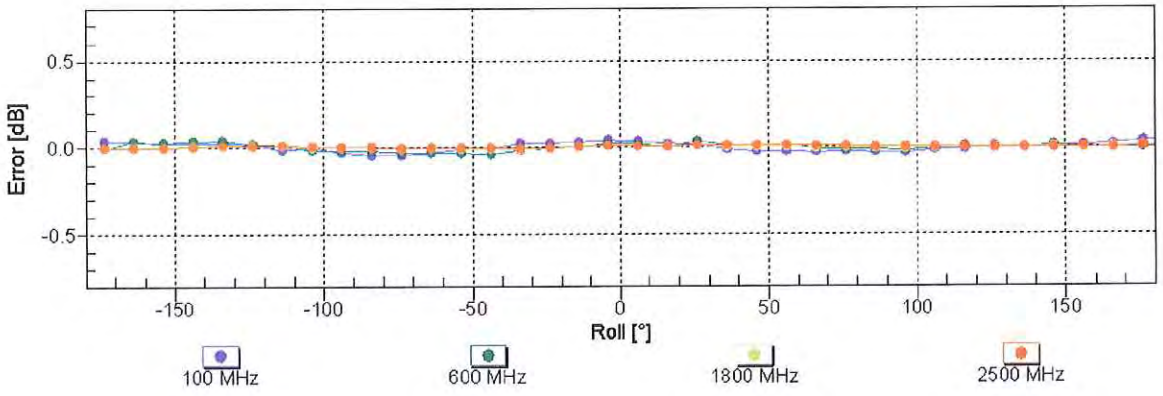
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



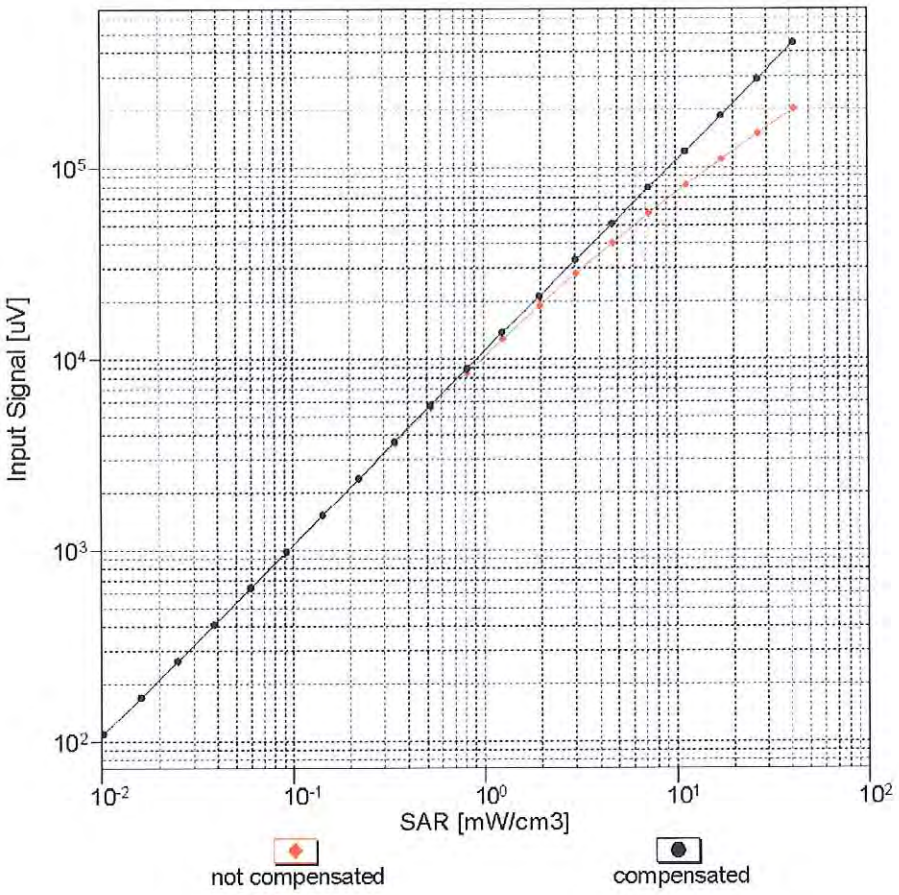
f=1800 MHz,R22

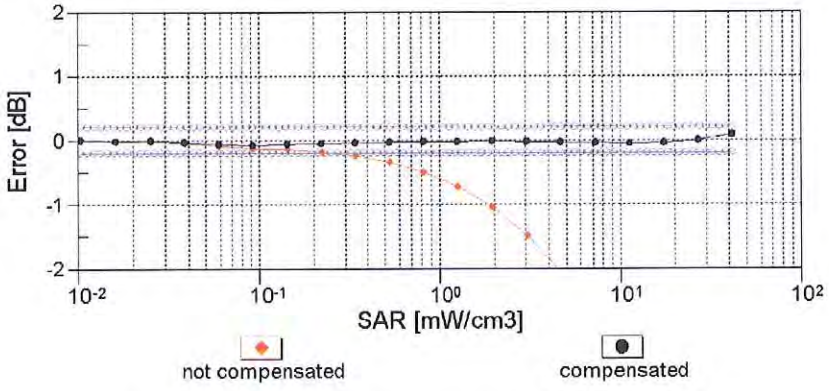




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

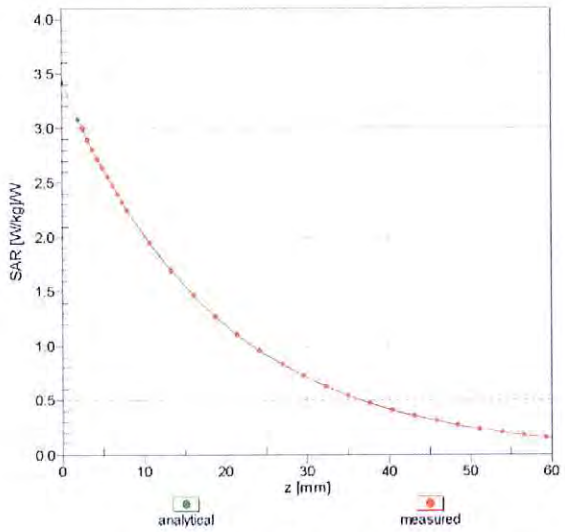




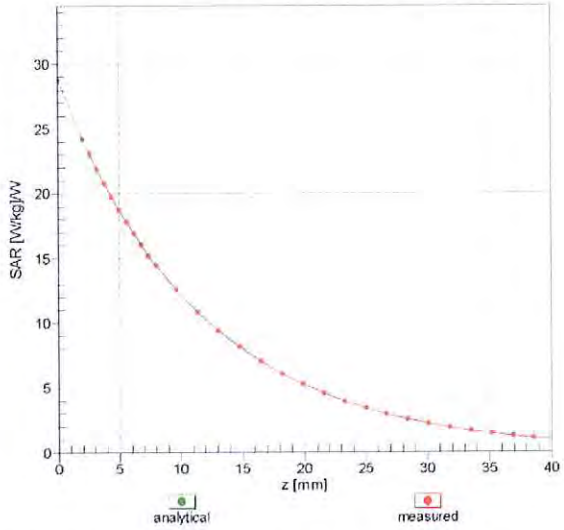
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 850 MHz,WGLS R9 (H_convF)

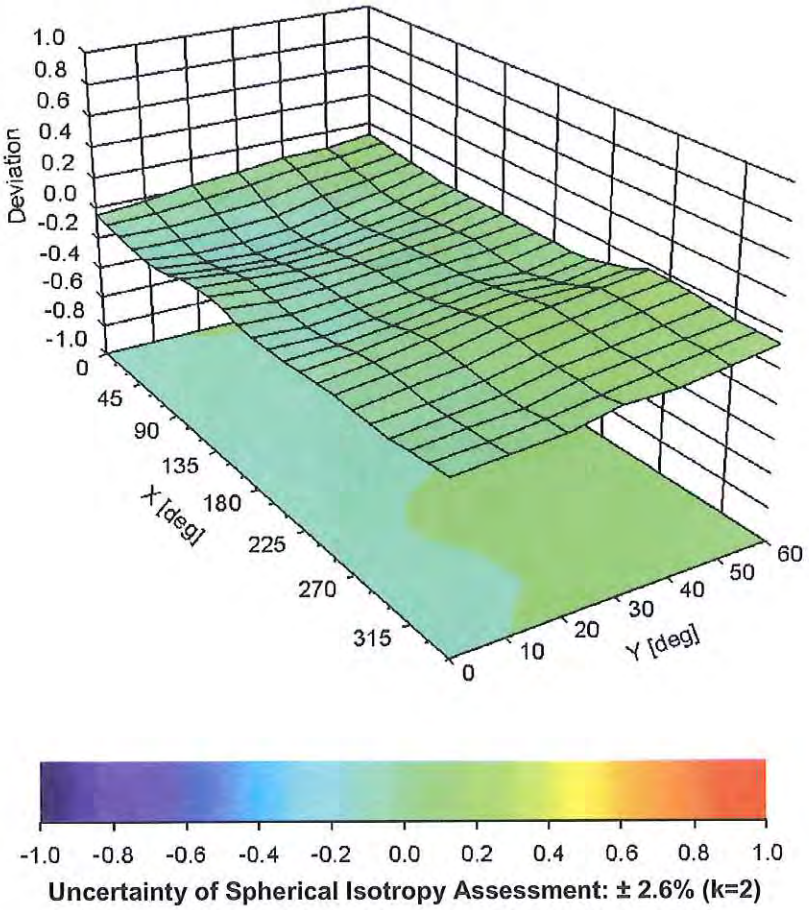


f = 1900 MHz,WGLS R22 (H_convF)



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:3332

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-3.9
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
S Servizio svizzero di taratura
Swiss Calibration Service

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

Accreditation No.: SCS 108

Client PC Test

Certificate No: ES3-3209_Mar14

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3209

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

CCV 3/27/14

Calibration date: March 19, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: March 20, 2014

PCT # 80249

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

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S Servizio svizzero di taratura
S Swiss Calibration Service

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3209

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

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

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

Basic Calibration Parameters

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

Modulation Calibration Parameters

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

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

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

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

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 8 and 9).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	41.9	0.89	6.43	6.43	6.43	0.29	2.01	± 12.0 %
835	41.5	0.90	6.23	6.23	6.23	0.34	1.70	± 12.0 %
1750	40.1	1.37	5.24	5.24	5.24	0.80	1.13	± 12.0 %
1900	40.0	1.40	5.13	5.13	5.13	0.46	1.49	± 12.0 %
2450	39.2	1.80	4.54	4.54	4.54	0.63	1.38	± 12.0 %
2600	39.0	1.96	4.38	4.38	4.38	0.76	1.28	± 12.0 %

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

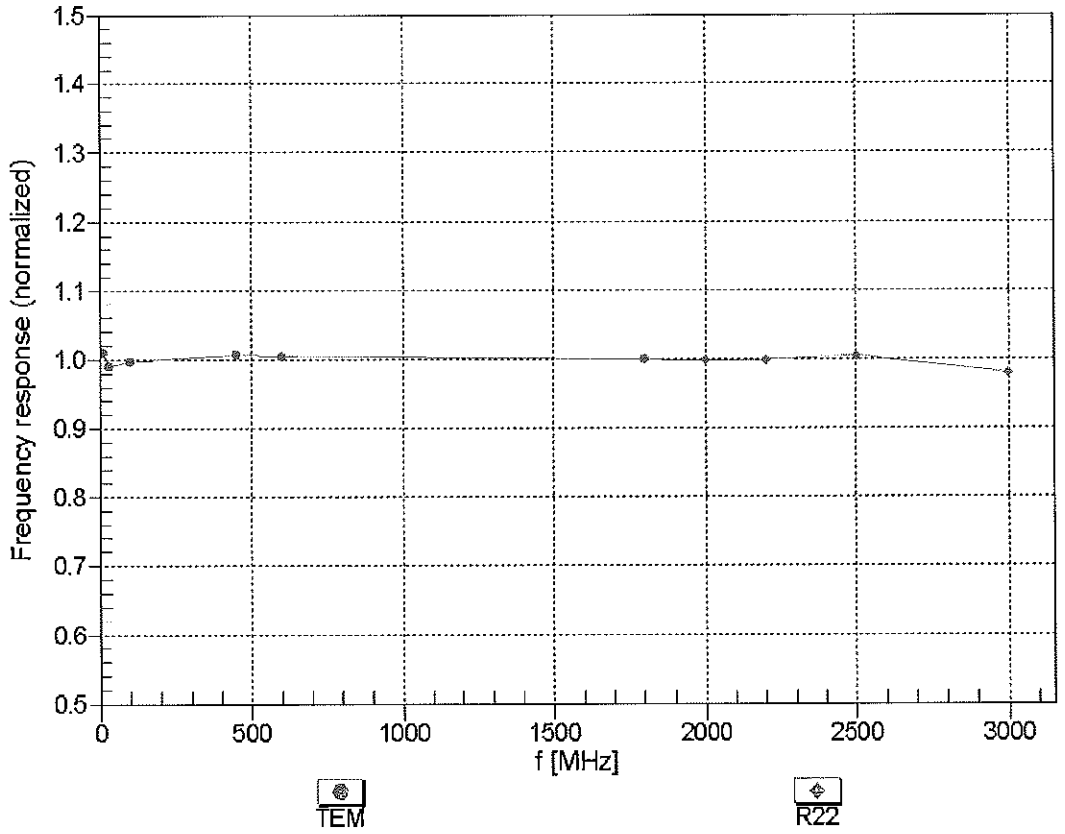
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3209

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	6.16	6.16	6.16	0.26	2.23	± 12.0 %
835	55.2	0.97	6.14	6.14	6.14	0.80	1.13	± 12.0 %
1750	53.4	1.49	4.85	4.85	4.85	0.59	1.42	± 12.0 %
1900	53.3	1.52	4.68	4.68	4.68	0.52	1.59	± 12.0 %
2450	52.7	1.95	4.20	4.20	4.20	0.73	1.08	± 12.0 %
2600	52.5	2.16	4.04	4.04	4.04	0.80	1.00	± 12.0 %

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

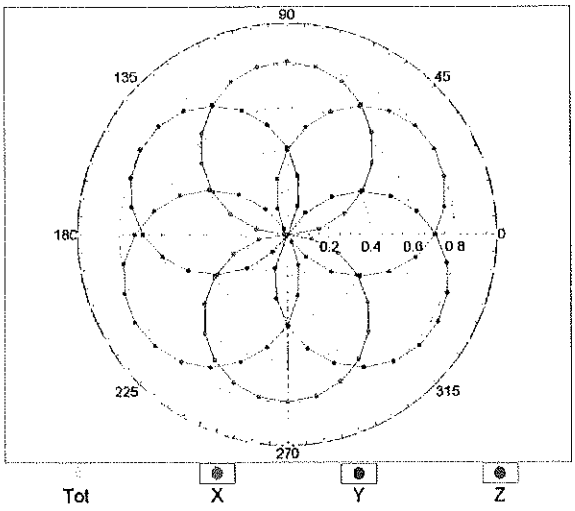
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



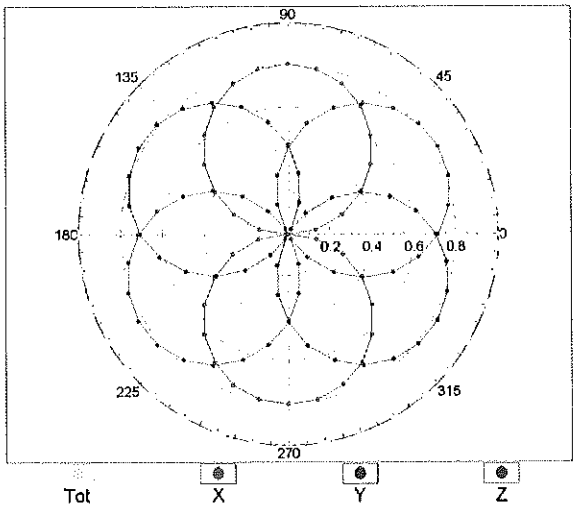
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

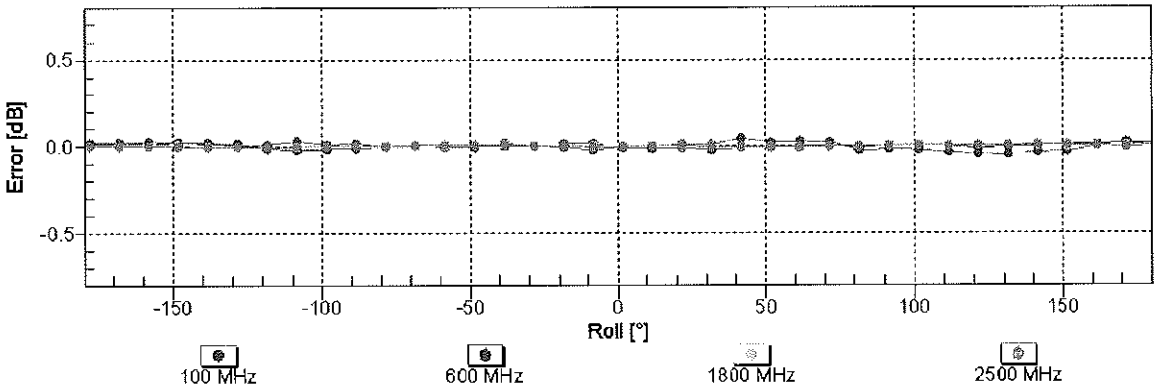
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



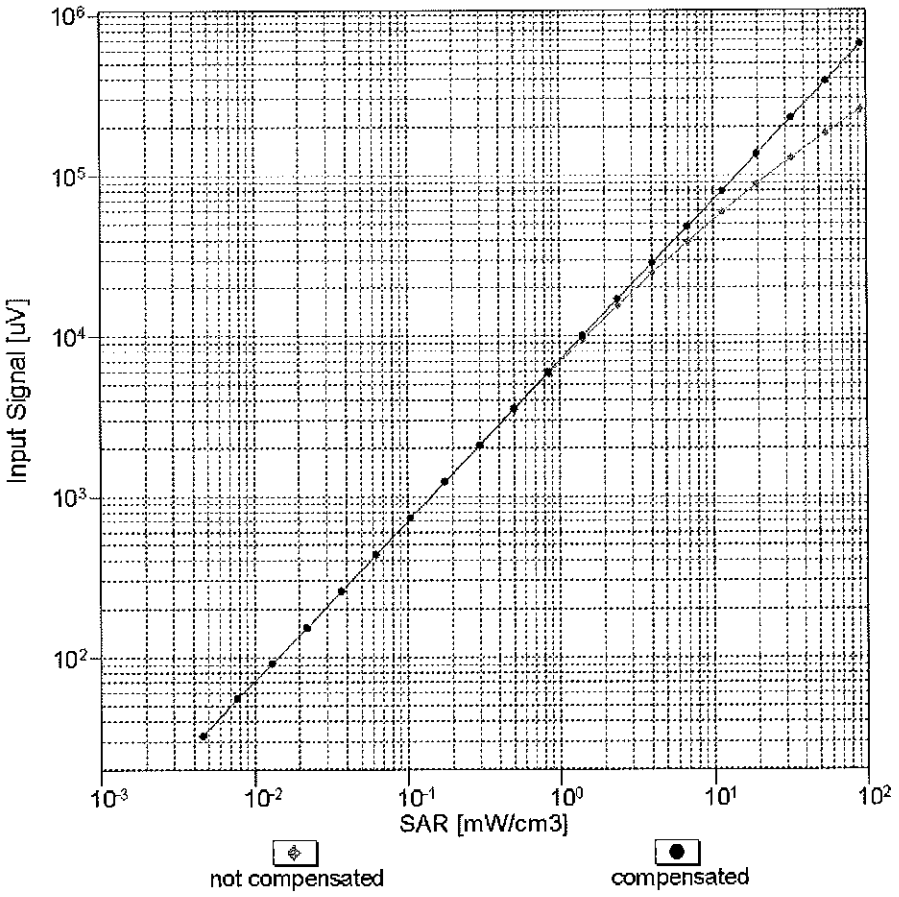
f=1800 MHz,R22

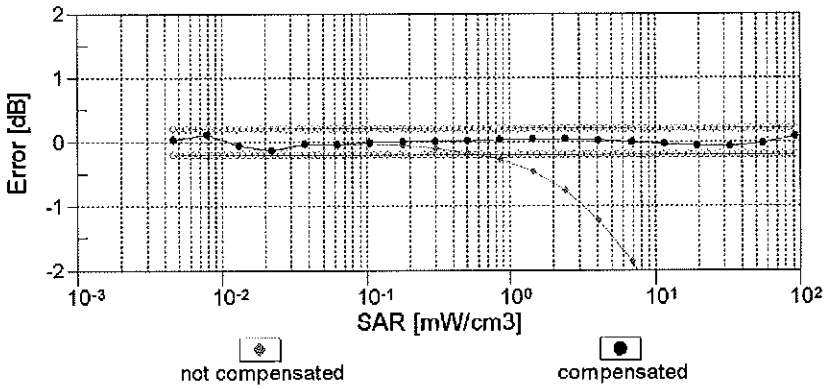




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

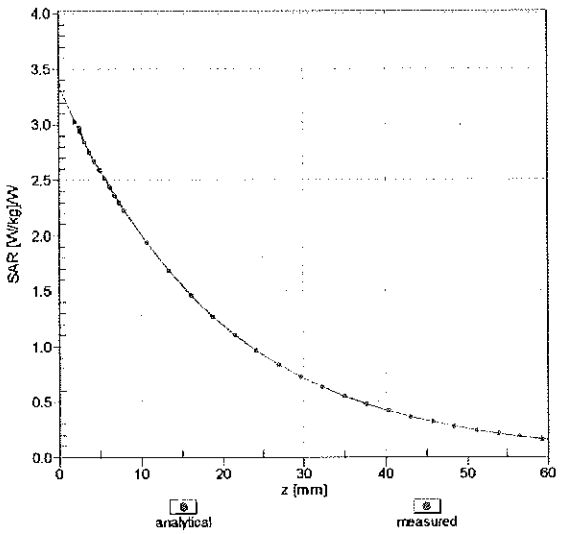




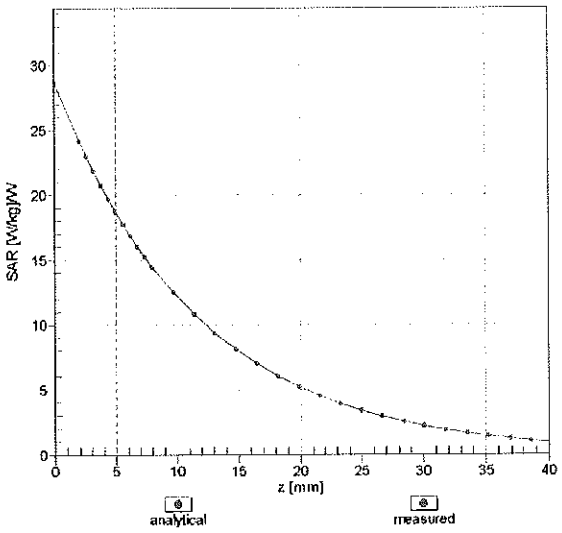
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

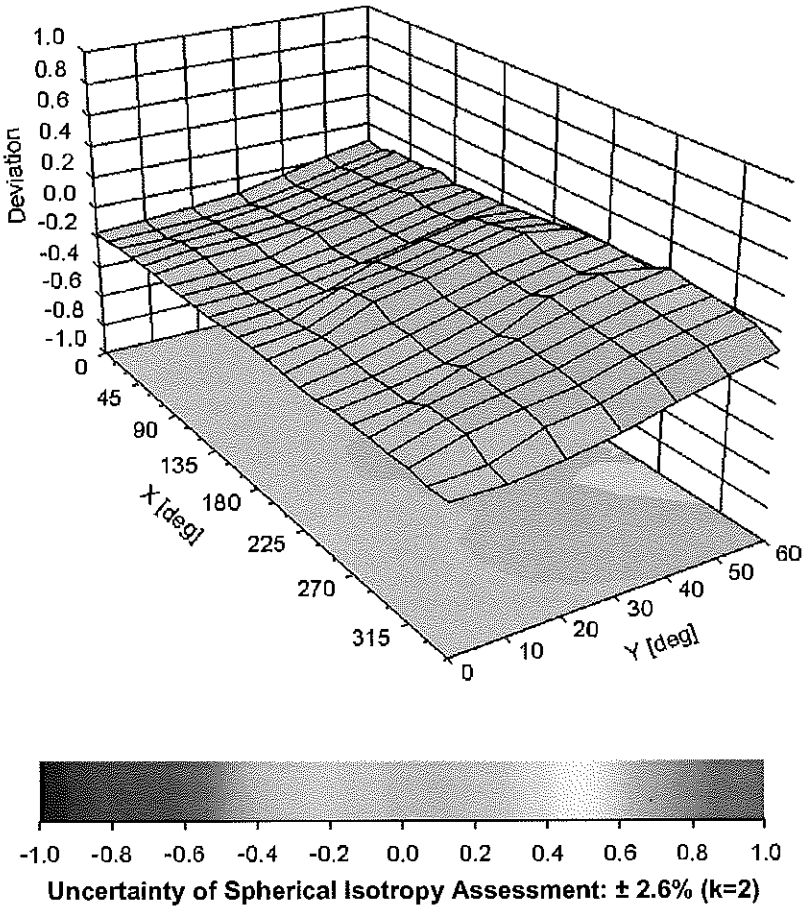


f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-38.3
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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

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

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

Accreditation No.: SCS 108

Client PC Test

Certificate No: ES3-3213_Apr14

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3213

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

CCV 5/7/14

Calibration date: April 11, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	03-Apr-14 (No. 217-01911)	Apr-15
Power sensor E4412A	MY41498087	03-Apr-14 (No. 217-01911)	Apr-15
Reference 3 dB Attenuator	SN: S5054 (3c)	03-Apr-14 (No. 217-01915)	Apr-15
Reference 20 dB Attenuator	SN: S5277 (20x)	03-Apr-14 (No. 217-01919)	Apr-15
Reference 30 dB Attenuator	SN: S5129 (30b)	03-Apr-14 (No. 217-01920)	Apr-15
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: April 14, 2014

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3213

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

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

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

Basic Calibration Parameters

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

Modulation Calibration Parameters

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

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

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

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

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 8 and 9).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	41.9	0.89	6.58	6.58	6.58	0.34	1.79	± 12.0 %
835	41.5	0.90	6.37	6.37	6.37	0.29	1.94	± 12.0 %
1750	40.1	1.37	5.18	5.18	5.18	0.79	1.17	± 12.0 %
1900	40.0	1.40	4.99	4.99	4.99	0.57	1.36	± 12.0 %
2450	39.2	1.80	4.40	4.40	4.40	0.78	1.28	± 12.0 %
2600	39.0	1.96	4.25	4.25	4.25	0.77	1.23	± 12.0 %

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

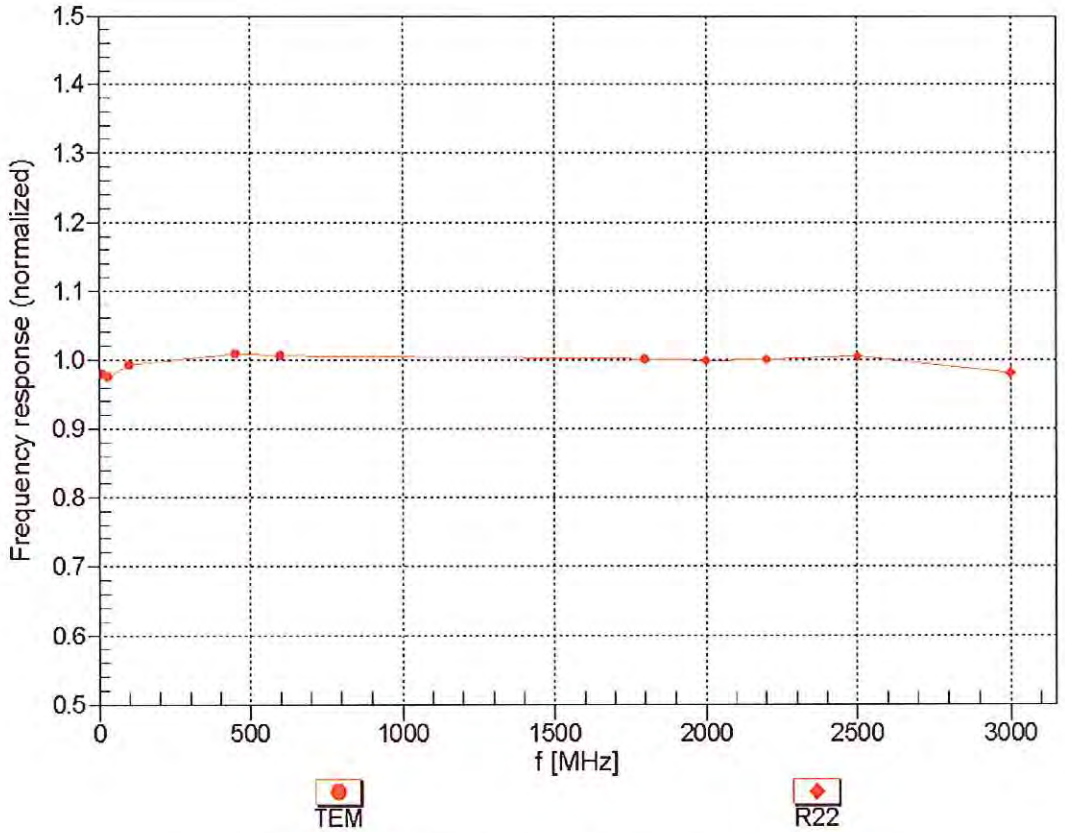
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3213

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	6.21	6.21	6.21	0.77	1.19	± 12.0 %
835	55.2	0.97	6.18	6.18	6.18	0.54	1.37	± 12.0 %
1750	53.4	1.49	4.89	4.89	4.89	0.73	1.27	± 12.0 %
1900	53.3	1.52	4.68	4.68	4.68	0.47	1.70	± 12.0 %
2450	52.7	1.95	4.26	4.26	4.26	0.70	1.16	± 12.0 %
2600	52.5	2.16	4.05	4.05	4.05	0.67	1.00	± 12.0 %

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

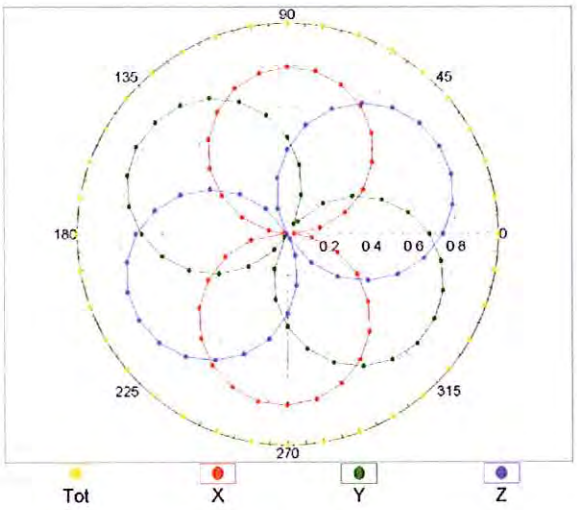
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



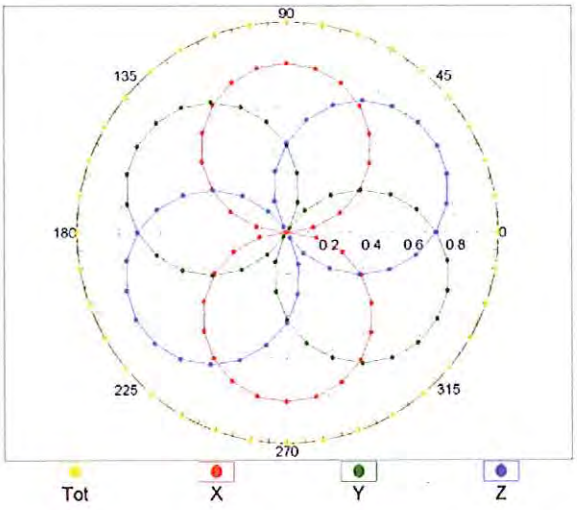
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

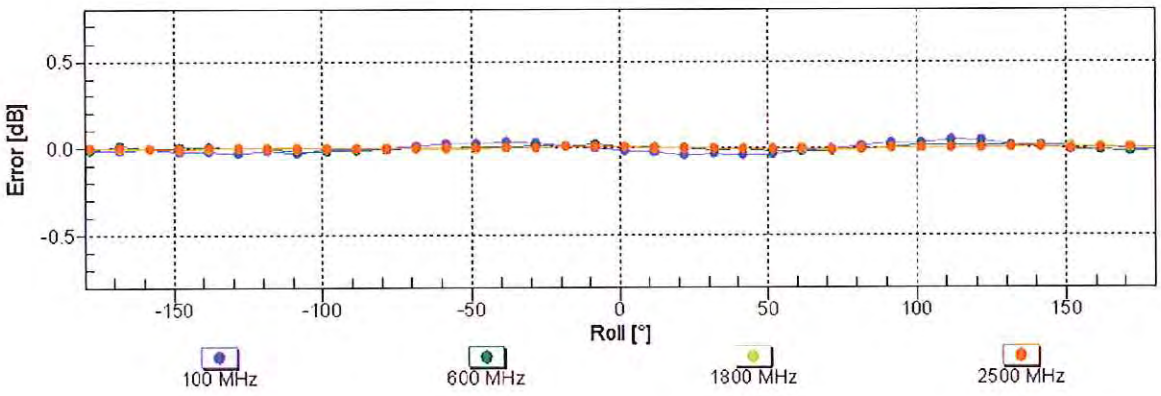
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



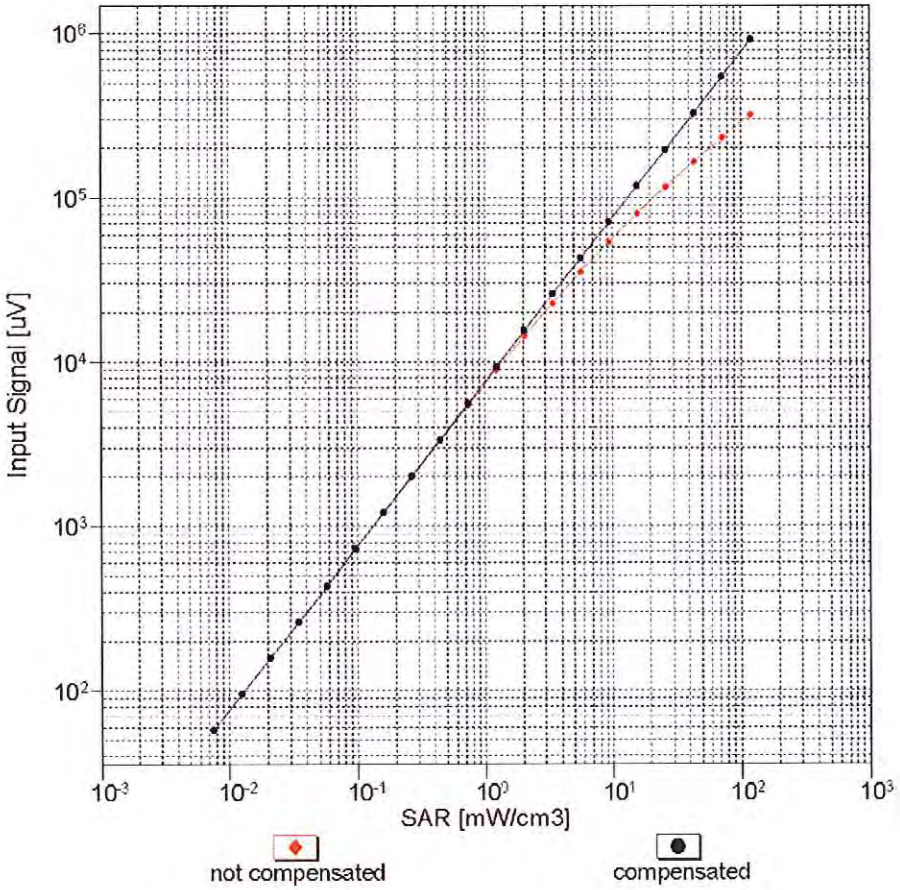
f=1800 MHz,R22

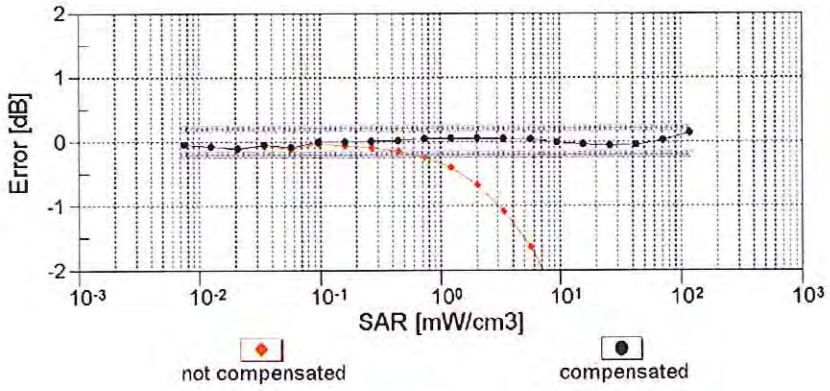




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

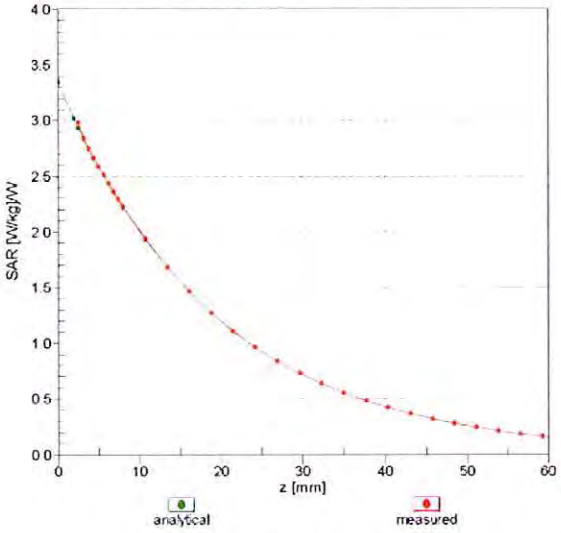




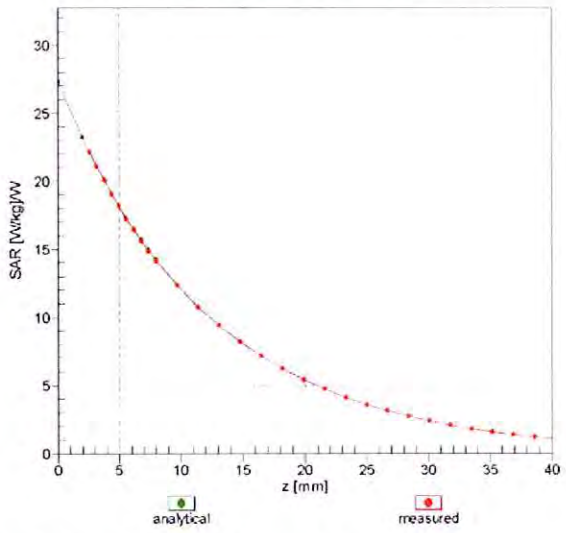
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

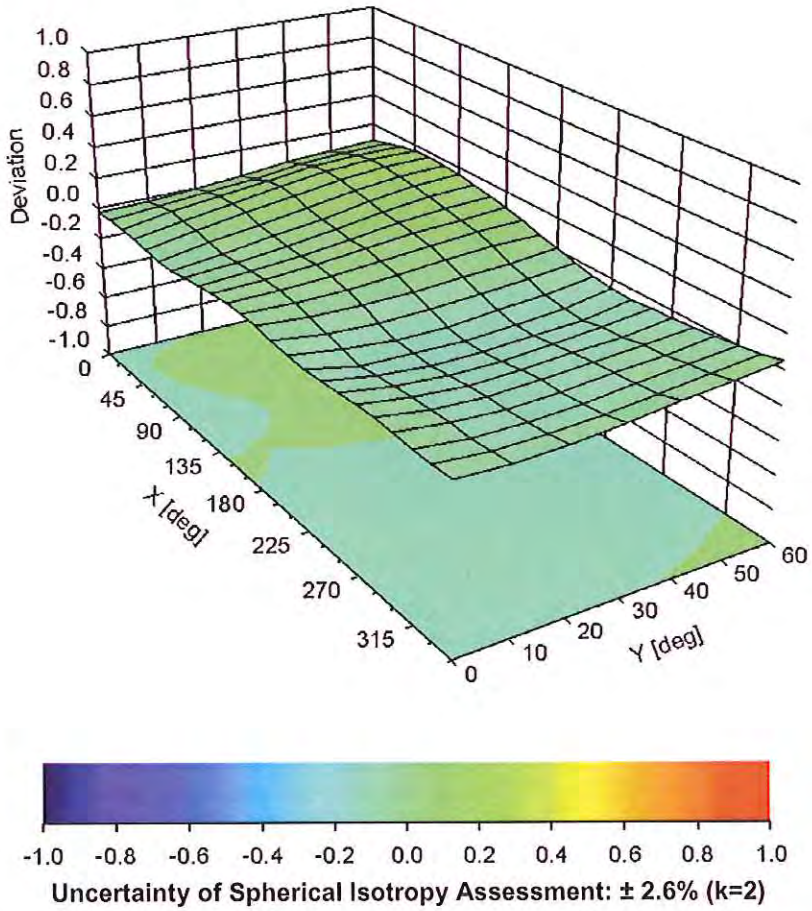


f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-68.3
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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

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

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

Accreditation No.: SCS 108

Client PC Test

Certificate No: ES3-3287_Nov13

CALIBRATION CERTIFICATE

Object ES3DV3 - SN:3287

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

Calibration date: November 20, 2013

CC ✓ 11/26/2013

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: November 20, 2013

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

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

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

Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3287

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

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

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

Basic Calibration Parameters

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

Modulation Calibration Parameters

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

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

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

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

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

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	41.9	0.89	6.52	6.52	6.52	0.47	1.46	± 12.0 %
835	41.5	0.90	6.30	6.30	6.30	0.40	1.59	± 12.0 %
1750	40.1	1.37	5.27	5.27	5.27	0.63	1.34	± 12.0 %
1900	40.0	1.40	5.08	5.08	5.08	0.62	1.37	± 12.0 %
2450	39.2	1.80	4.43	4.43	4.43	0.79	1.28	± 12.0 %
2600	39.0	1.96	4.29	4.29	4.29	0.77	1.38	± 12.0 %

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

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

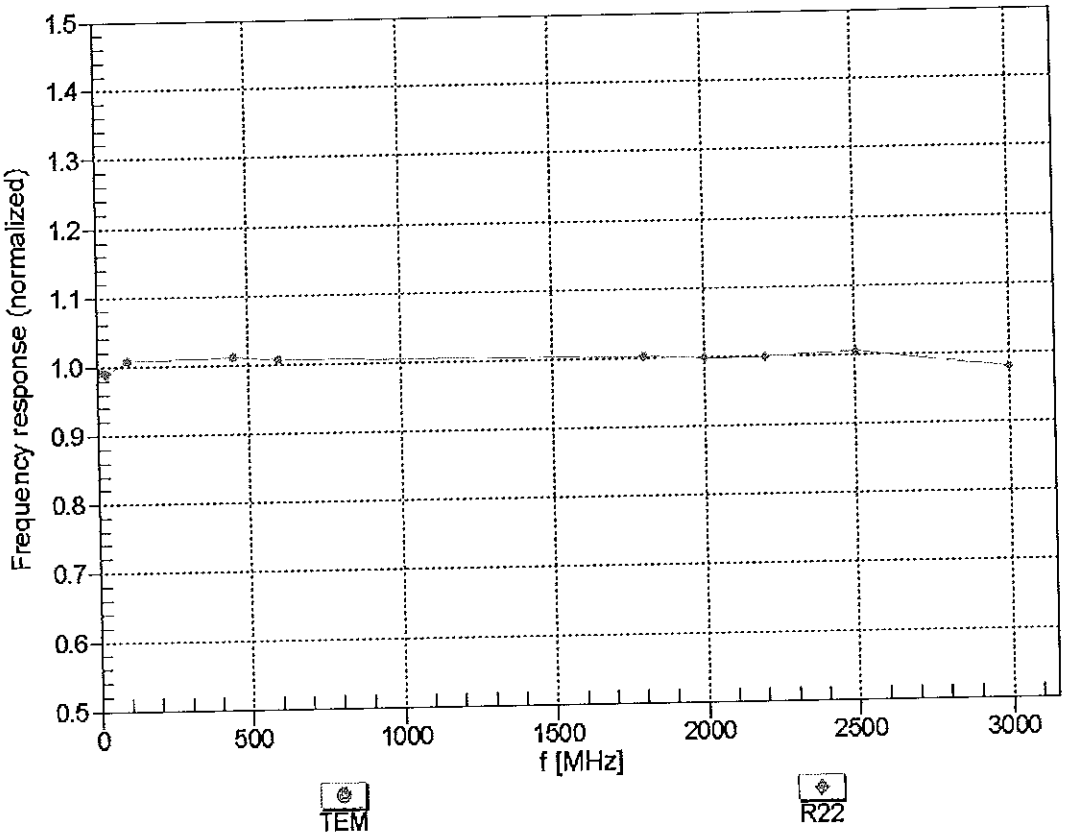
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	6.09	6.09	6.09	0.55	1.37	± 12.0 %
835	55.2	0.97	6.04	6.04	6.04	0.55	1.39	± 12.0 %
1750	53.4	1.49	4.93	4.93	4.93	0.39	1.73	± 12.0 %
1900	53.3	1.52	4.67	4.67	4.67	0.38	1.75	± 12.0 %
2450	52.7	1.95	4.17	4.17	4.17	0.60	1.20	± 12.0 %
2600	52.5	2.16	4.00	4.00	4.00	0.60	1.10	± 12.0 %

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

Frequency Response of E-Field

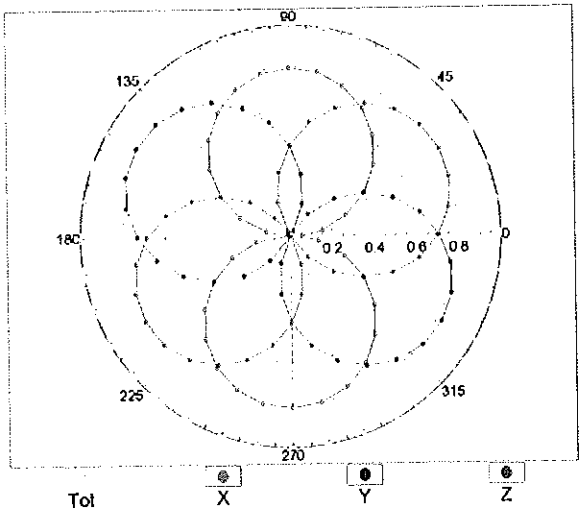
(TEM-Cell:ifi110 EXX, Waveguide: R22)



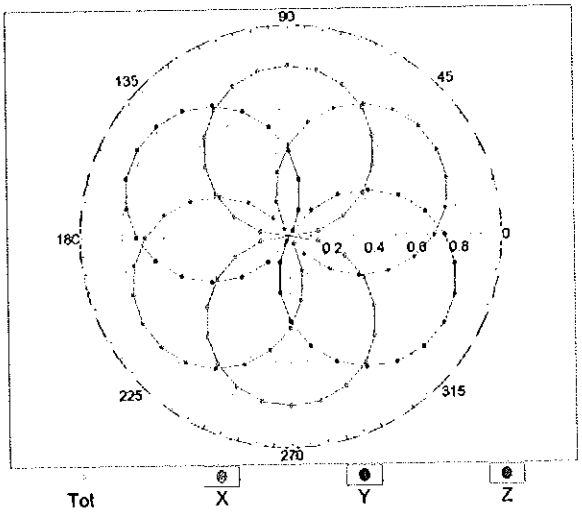
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

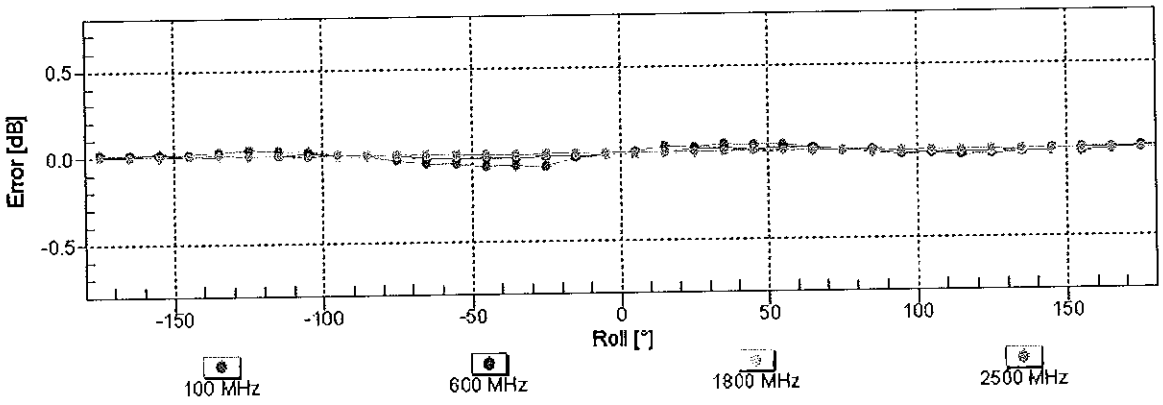
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



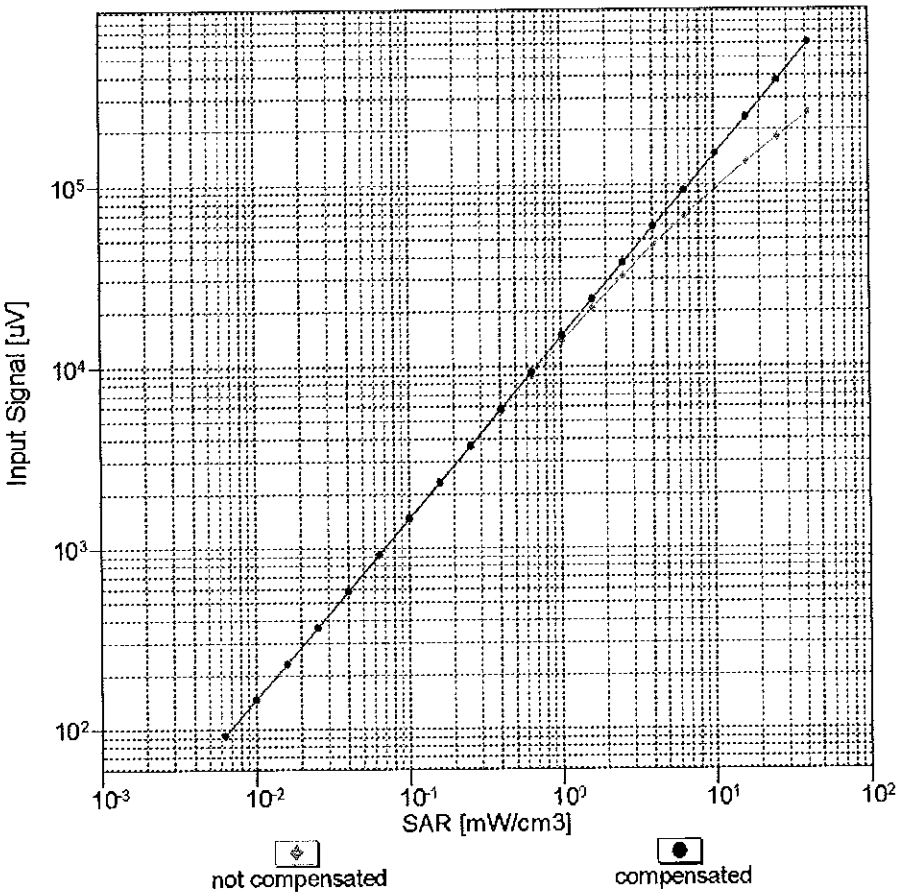
f=1800 MHz,R22

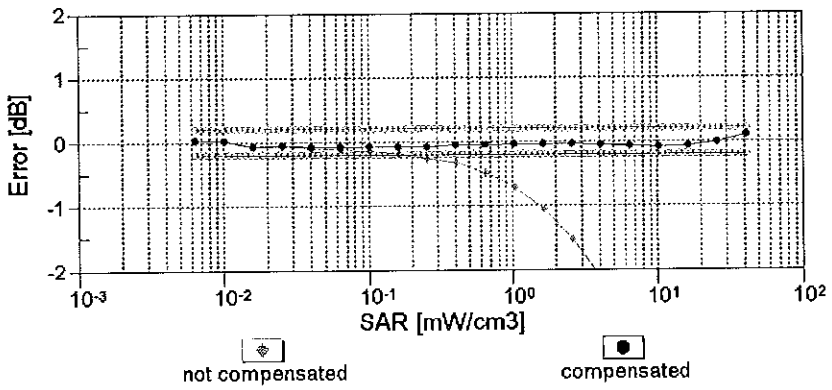




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

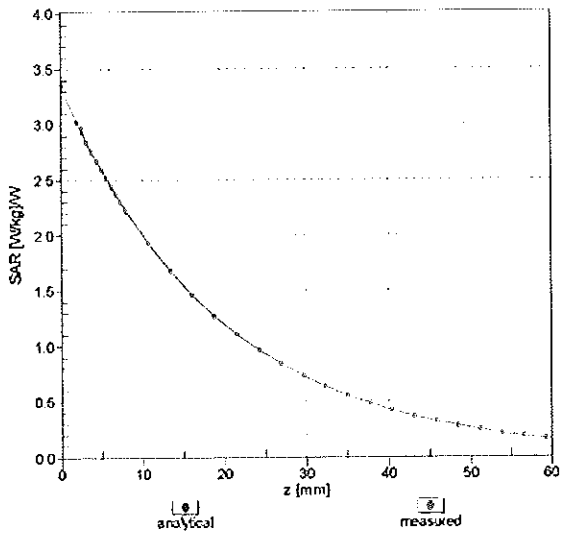




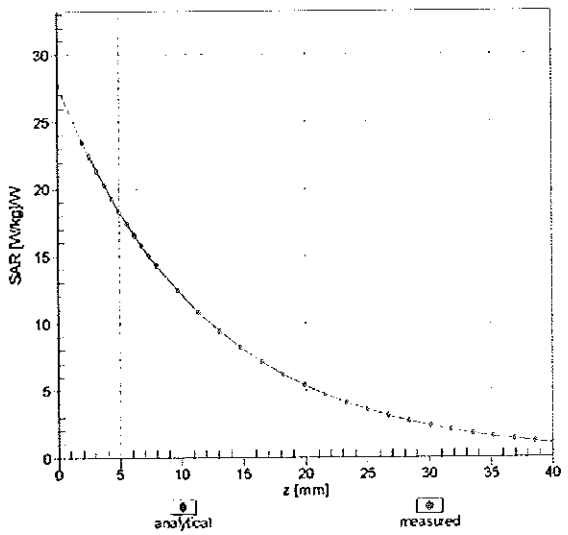
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

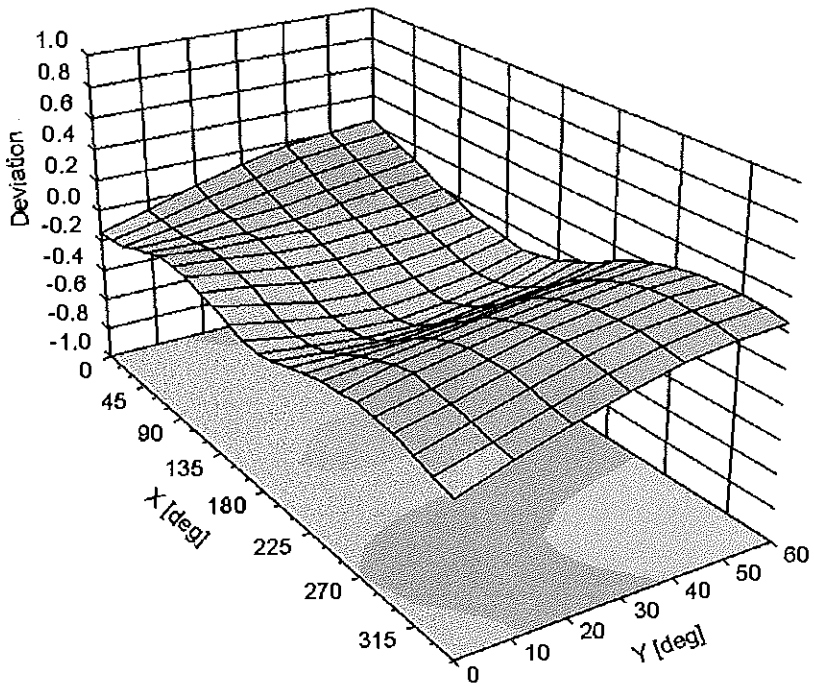


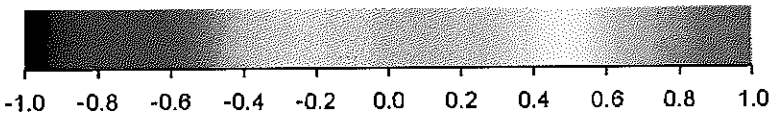
f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





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

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-15
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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

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

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

Accreditation No.: SCS 108

Client **PC Test**

Certificate No: ES3-3258_Feb14

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3258

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

CCV 3/6/14

Calibration date: February 25, 2014

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	30-Dec-13 (No. ES3-3013_Dec13)	Dec-14
DAE4	SN: 660	13-Dec-13 (No. DAE4-660_Dec13)	Dec-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: February 27, 2014

PCT# 80615

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

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

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3258

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

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

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

Basic Calibration Parameters

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

Modulation Calibration Parameters

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

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

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

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

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 8 and 9).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	41.9	0.89	6.53	6.53	6.53	0.40	1.60	± 12.0 %
835	41.5	0.90	6.27	6.27	6.27	0.80	1.17	± 12.0 %
1750	40.1	1.37	5.19	5.19	5.19	0.80	1.10	± 12.0 %
1900	40.0	1.40	5.04	5.04	5.04	0.68	1.27	± 12.0 %
2450	39.2	1.80	4.52	4.52	4.52	0.78	1.23	± 12.0 %
2600	39.0	1.96	4.34	4.34	4.34	0.76	1.33	± 12.0 %

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

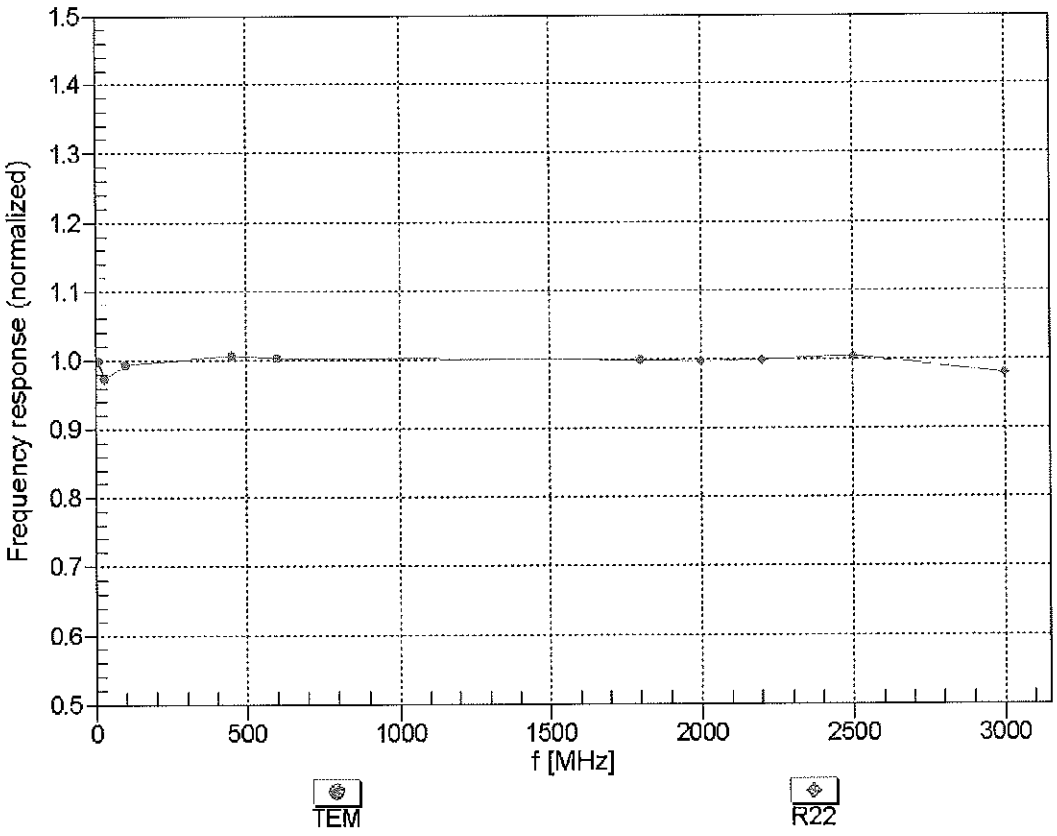
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3258

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unct. (k=2)
750	55.5	0.96	6.15	6.15	6.15	0.61	1.32	± 12.0 %
835	55.2	0.97	6.11	6.11	6.11	0.80	1.15	± 12.0 %
1750	53.4	1.49	4.83	4.83	4.83	0.47	1.74	± 12.0 %
1900	53.3	1.52	4.61	4.61	4.61	0.55	1.59	± 12.0 %
2450	52.7	1.95	4.14	4.14	4.14	0.80	1.11	± 12.0 %
2600	52.5	2.16	3.91	3.91	3.91	0.80	1.00	± 12.0 %

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

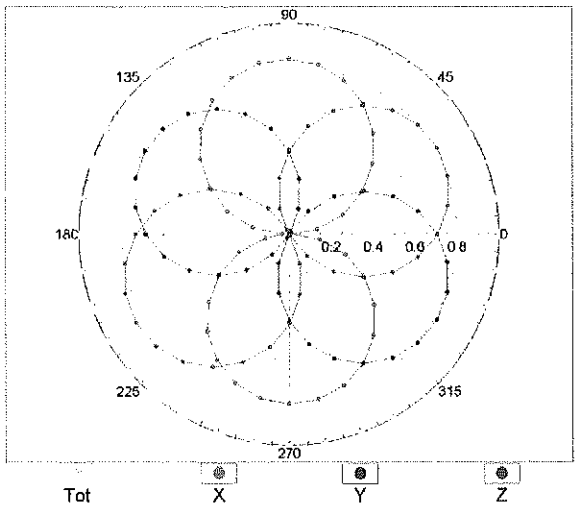
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



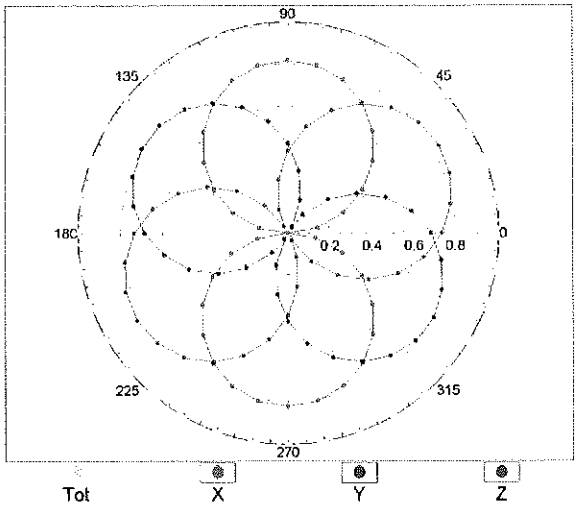
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

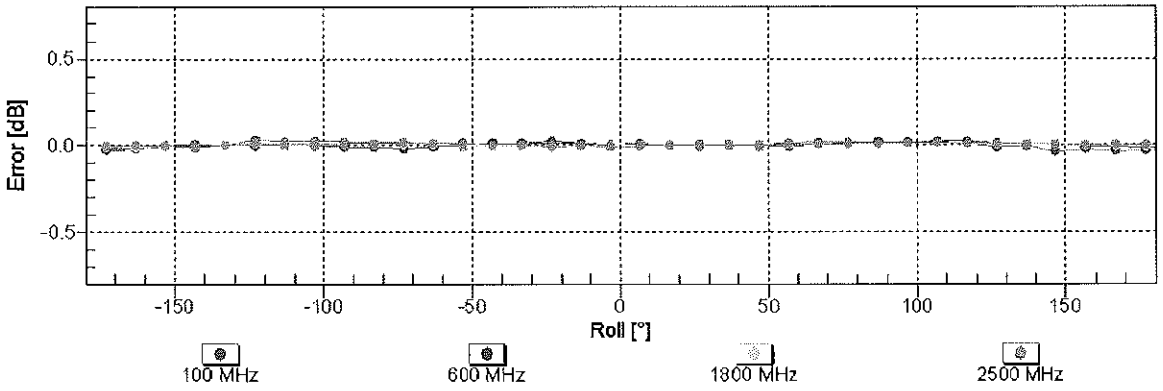
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



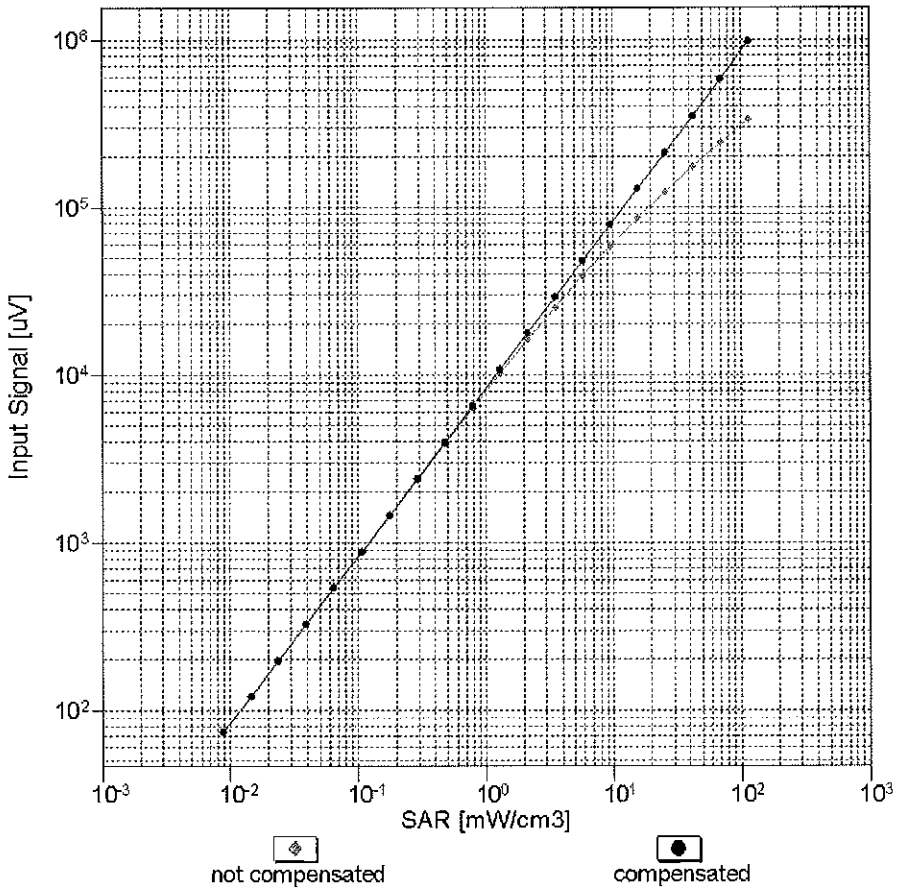
f=1800 MHz,R22

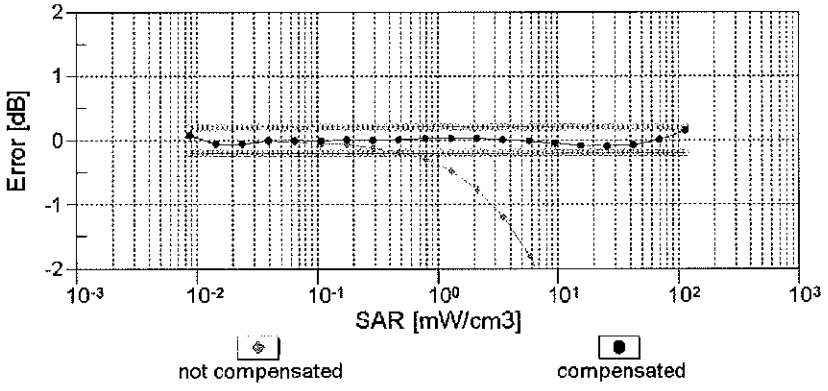




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

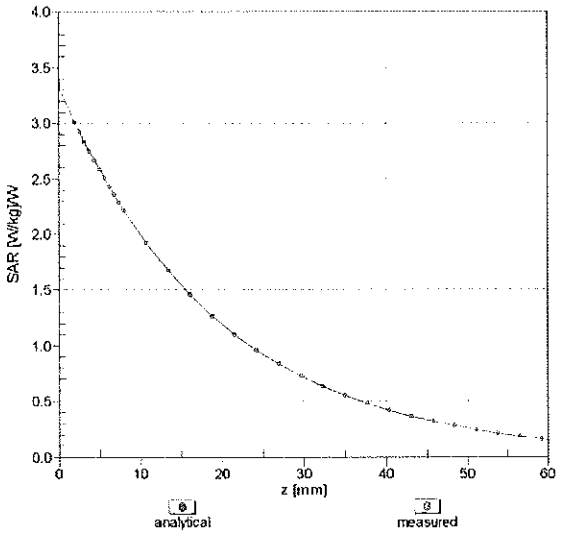




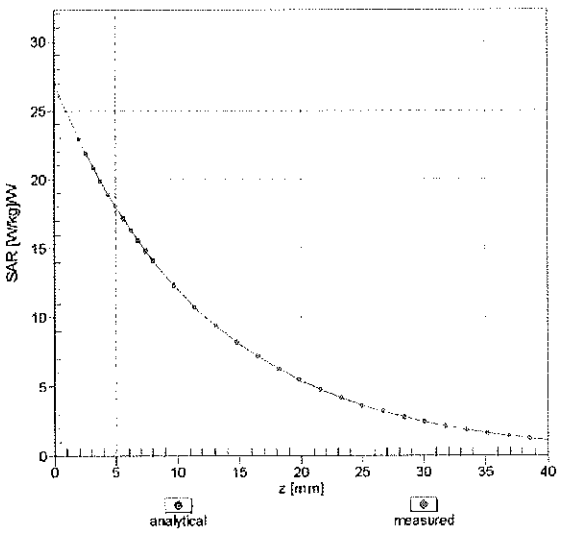
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

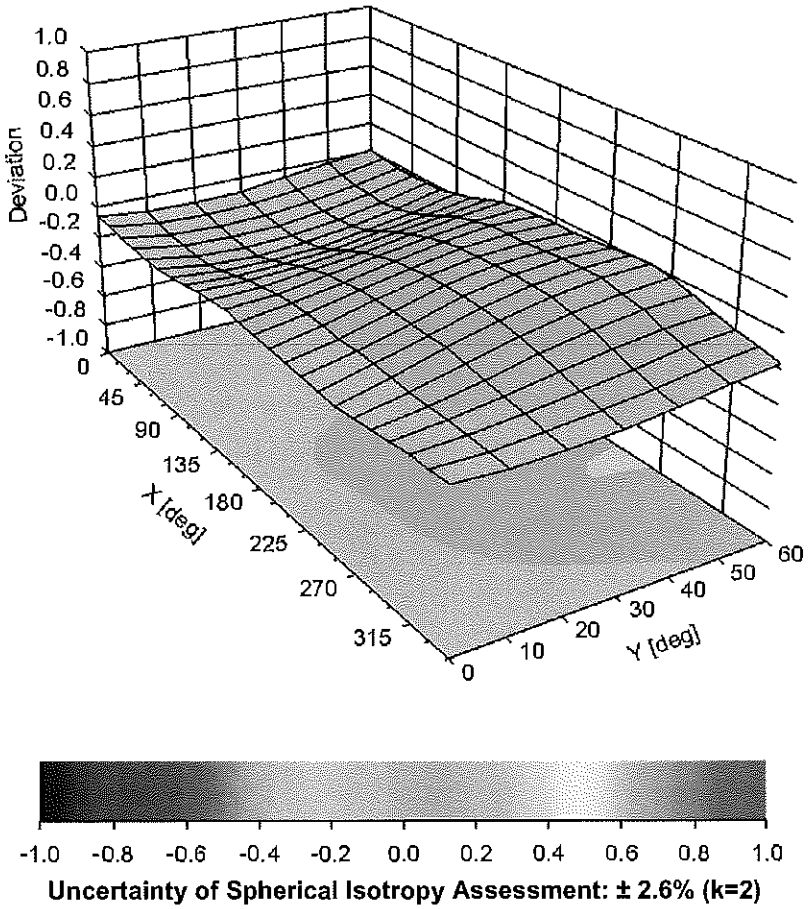


f = 1750 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-123.1
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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

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

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

Accreditation No.: SCS 108

Client PC Test

Certificate No: EX3-3914_Oct13

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3914

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

Calibration date: October 23, 2013 VCL 11/26/2013

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: October 25, 2013

PCT # 81072

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

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

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

Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe EX3DV4

SN:3914

Manufactured: December 18, 2012
Calibrated: October 23, 2013

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3914

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.47	0.49	0.51	± 10.1 %
DCP (mV)[B]	99.2	98.9	98.2	

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	158.3	±3.0 %
		Y	0.0	0.0	1.0		154.6	
		Z	0.0	0.0	1.0		170.8	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	0.71	53.3	6.1	10.00	48.4	±2.5 %
		Y	2.43	67.0	13.8		39.9	
		Z	4.18	68.7	13.8		45.7	
10011-CAA	UMTS-FDD (WCDMA)	X	3.05	64.4	16.5	2.91	122.4	±0.5 %
		Y	3.31	66.5	18.2		123.5	
		Z	3.34	66.3	17.8		136.6	
10012-CAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	2.49	64.8	16.1	1.87	120.6	±0.5 %
		Y	2.94	68.6	18.7		123.6	
		Z	2.63	65.9	17.0		135.4	
10021-DAA	GSM-FDD (TDMA, GMSK)	X	1.52	61.5	10.9	9.39	83.6	±1.2 %
		Y	2.22	67.4	15.0		116.0	
		Z	2.47	66.8	14.7		95.9	
10023-DAA	GPRS-FDD (TDMA, GMSK, TN 0)	X	1.73	63.3	11.9	9.57	81.5	±1.7 %
		Y	2.11	66.2	14.2		111.8	
		Z	2.76	69.0	16.0		93.6	
10024-DAA	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	1.34	62.1	9.4	6.56	121.0	±1.2 %
		Y	4.24	78.6	17.9		130.0	
		Z	2.91	70.7	14.9		141.4	
10027-DAA	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	1.25	63.5	9.7	4.80	143.5	±1.4 %
		Y	1.59	66.9	12.2		149.7	
		Z	2.98	71.5	14.0		123.3	
10028-DAA	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	0.51	58.3	7.4	3.55	113.4	±1.2 %
		Y	25.43	100.0	22.6		121.3	
		Z	38.67	97.5	20.6		133.3	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	0.28	58.6	5.3	1.16	134.7	±0.9 %
		Y	65.75	99.6	18.6		141.3	
		Z	0.20	55.6	4.1		112.1	
10039-CAA	CDMA2000 (1xRTT, RC1)	X	4.33	64.6	17.4	4.57	113.8	±0.7 %
		Y	4.55	66.0	18.6		120.8	
		Z	4.85	66.2	18.4		135.9	
10062-CAA	IEEE 802.11a/h WiFi 5 GHz (OFDM, 6 Mbps)	X	9.83	67.6	20.7	8.68	109.0	±2.5 %
		Y	10.06	68.4	21.5		118.2	
		Z	10.66	69.2	21.7		134.0	

10081-CAA	CDMA2000 (1xRTT, RC3)	X	3.59	63.9	16.9	3.97	113.6	±0.7 %
		Y	3.84	65.6	18.2		119.6	
		Z	3.95	65.4	17.8		134.5	
10098-CAA	UMTS-FDD (HSUPA, Subtest 2)	X	4.41	65.2	17.3	3.98	126.0	±0.7 %
		Y	4.73	66.9	18.6		132.5	
		Z	4.51	65.5	17.7		105.6	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.26	66.2	18.6	5.67	130.5	±1.2 %
		Y	6.61	67.7	19.8		139.3	
		Z	6.21	66.0	18.7		107.7	
10108-CAB	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.13	65.8	18.6	5.80	126.3	±1.2 %
		Y	6.40	67.1	19.6		135.6	
		Z	6.10	65.5	18.5		107.4	
10110-CAB	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	5.78	65.3	18.3	5.75	123.1	±1.2 %
		Y	5.97	66.3	19.2		131.5	
		Z	5.86	65.3	18.4		104.9	
10114-CAA	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	X	9.92	67.7	20.3	8.10	115.7	±2.5 %
		Y	10.25	68.7	21.2		126.8	
		Z	10.71	69.4	21.3		146.0	
10117-CAA	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	9.95	67.8	20.3	8.07	116.6	±2.5 %
		Y	10.26	68.7	21.1		128.3	
		Z	10.70	69.4	21.3		146.9	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	7.19	67.3	21.5	9.28	145.0	±2.2 %
		Y	7.40	68.3	22.4		110.8	
		Z	7.79	68.4	22.0		128.0	
10154-CAB	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	5.79	65.3	18.3	5.75	124.2	±1.2 %
		Y	6.03	66.5	19.4		131.9	
		Z	6.29	66.9	19.3		149.7	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.23	65.9	18.6	5.82	128.3	±1.2 %
		Y	6.51	67.2	19.7		136.9	
		Z	6.24	65.7	18.6		107.3	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	4.83	66.0	18.9	5.73	147.5	±1.2 %
		Y	4.72	65.8	19.2		113.8	
		Z	5.03	66.1	19.1		129.7	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.83	69.2	22.8	9.21	149.9	±1.9 %
		Y	5.81	69.4	23.4		120.3	
		Z	6.38	70.0	23.2		137.2	
10175-CAB	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.86	66.1	18.9	5.72	149.8	±1.2 %
		Y	4.72	65.8	19.2		113.3	
		Z	5.09	66.4	19.1		126.0	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.83	66.0	18.9	5.72	146.3	±1.2 %
		Y	4.69	65.6	19.1		112.2	
		Z	5.02	66.1	19.0		125.1	
10193-CAA	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	X	9.51	67.4	20.2	8.09	108.6	±2.5 %
		Y	9.72	68.1	20.9		118.2	
		Z	10.30	68.9	21.1		135.0	

10196-CAA	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.52	67.4	20.2	8.10	111.6	±2.5 %
		Y	9.79	68.3	21.1		121.3	
		Z	10.30	68.9	21.2		139.2	
10219-CAA	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	X	9.47	67.4	20.2	8.03	111.8	±2.2 %
		Y	9.67	68.3	21.0		120.0	
		Z	10.20	68.9	21.1		138.0	
10222-CAA	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	X	9.96	67.9	20.4	8.06	118.4	±2.5 %
		Y	10.25	68.8	21.2		128.2	
		Z	10.65	69.3	21.3		144.5	
10225-CAA	UMTS-FDD (HSPA+)	X	6.96	66.7	18.9	5.97	140.0	±1.4 %
		Y	7.23	67.9	20.0		148.9	
		Z	7.03	66.4	18.9		115.6	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	5.51	67.5	21.8	9.21	114.2	±1.9 %
		Y	5.82	69.4	23.4		123.0	
		Z	6.49	70.6	23.6		140.2	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	6.83	67.1	21.4	9.24	136.6	±1.9 %
		Y	7.30	69.4	23.2		147.3	
		Z	7.36	68.1	22.0		117.5	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	7.26	67.5	21.6	9.30	142.7	±1.9 %
		Y	7.44	68.4	22.4		110.5	
		Z	7.84	68.7	22.2		122.6	
10274-CAA	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	X	5.86	66.2	18.2	4.87	135.4	±0.9 %
		Y	6.12	67.5	19.2		142.3	
		Z	5.91	65.9	18.2		107.6	
10275-CAA	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.17	64.8	17.3	3.96	115.6	±0.7 %
		Y	4.42	66.4	18.5		124.6	
		Z	4.47	66.0	18.0		132.6	
10291-AAA	CDMA2000, RC3, SO55, Full Rate	X	3.36	64.7	17.1	3.46	109.4	±0.5 %
		Y	3.55	66.2	18.3		118.2	
		Z	3.60	65.6	17.7		120.9	
10292-AAA	CDMA2000, RC3, SO32, Full Rate	X	3.34	64.9	17.2	3.39	110.1	±0.5 %
		Y	3.57	66.7	18.5		121.0	
		Z	3.54	65.6	17.7		123.9	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.14	65.8	18.6	5.81	125.1	±1.2 %
		Y	6.44	67.2	19.7		135.7	
		Z	6.52	67.0	19.3		142.2	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.76	66.6	19.1	6.06	131.8	±1.4 %
		Y	7.03	67.8	20.0		142.5	
		Z	7.15	67.7	19.7		148.6	
10315-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc duty cycle)	X	2.42	64.6	16.1	1.71	116.8	±0.5 %
		Y	3.00	69.3	19.0		126.9	
		Z	2.61	66.3	17.2		128.2	
10317-AAA	IEEE 802.11a WiFi 5 GHz (OFDM, 6 Mbps, 96pc duty cycle)	X	9.71	67.6	20.5	8.36	111.7	±2.5 %
		Y	9.99	68.6	21.4		122.2	
		Z	10.38	68.9	21.3		129.5	

10400-AAA	IEEE 802.11ac WiFi (20MHz, 64-QAM, 99pc duty cycle)	X	9.83	67.8	20.6	8.37	112.9	±2.5 %
		Y	10.09	68.7	21.4		123.9	
		Z	10.48	68.9	21.3		130.5	
10402-AAA	IEEE 802.11ac WiFi (80MHz, 64-QAM, 99pc duty cycle)	X	10.61	68.3	20.7	8.53	121.1	±2.5 %
		Y	11.25	70.0	21.9		135.4	
		Z	11.15	69.4	21.4		137.4	
10403-AAA	CDMA2000 (1xEV-DO, Rev. 0)	X	4.51	67.4	17.8	3.76	119.2	±0.5 %
		Y	4.91	69.5	19.3		128.3	
		Z	4.84	67.5	18.1		135.4	
10404-AAA	CDMA2000 (1xEV-DO, Rev. A)	X	4.51	67.7	18.0	3.77	117.4	±0.5 %
		Y	4.92	69.8	19.5		125.4	
		Z	4.71	67.3	18.0		131.9	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 8 and 9).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3914

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	9.70	9.70	9.70	0.34	1.01	± 12.0 %
835	41.5	0.90	9.34	9.34	9.34	0.67	0.67	± 12.0 %
1750	40.1	1.37	7.99	7.99	7.99	0.79	0.56	± 12.0 %
1900	40.0	1.40	7.69	7.69	7.69	0.80	0.58	± 12.0 %
2450	39.2	1.80	6.95	6.95	6.95	0.41	0.77	± 12.0 %
2600	39.0	1.96	6.79	6.79	6.79	0.40	0.82	± 12.0 %
5200	36.0	4.66	4.99	4.99	4.99	0.30	1.80	± 13.1 %
5300	35.9	4.76	4.82	4.82	4.82	0.30	1.80	± 13.1 %
5500	35.6	4.96	4.55	4.55	4.55	0.35	1.80	± 13.1 %
5600	35.5	5.07	4.37	4.37	4.37	0.35	1.80	± 13.1 %
5800	35.3	5.27	4.52	4.52	4.52	0.35	1.80	± 13.1 %

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3914

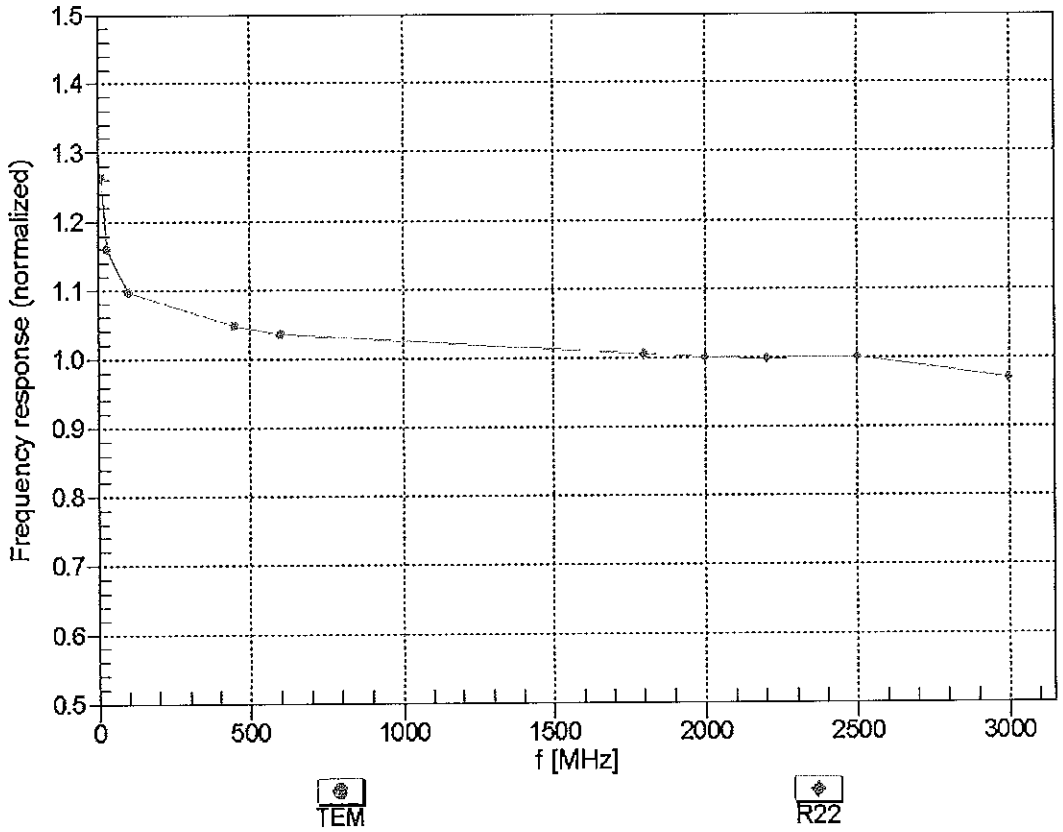
Calibration Parameter Determined in Body Tissue Simulating Media

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	9.39	9.39	9.39	0.63	0.74	± 12.0 %
835	55.2	0.97	9.31	9.31	9.31	0.56	0.76	± 12.0 %
1750	53.4	1.49	7.89	7.89	7.89	0.32	1.03	± 12.0 %
1900	53.3	1.52	7.51	7.51	7.51	0.51	0.76	± 12.0 %
2450	52.7	1.95	7.02	7.02	7.02	0.80	0.50	± 12.0 %
2600	52.5	2.16	6.81	6.81	6.81	0.80	0.50	± 12.0 %
5200	49.0	5.30	4.52	4.52	4.52	0.35	1.90	± 13.1 %
5300	48.9	5.42	4.32	4.32	4.32	0.35	1.90	± 13.1 %
5500	48.6	5.65	4.07	4.07	4.07	0.35	1.90	± 13.1 %
5600	48.5	5.77	3.97	3.97	3.97	0.35	1.90	± 13.1 %
5800	48.2	6.00	4.14	4.14	4.14	0.40	1.90	± 13.1 %

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

Frequency Response of E-Field

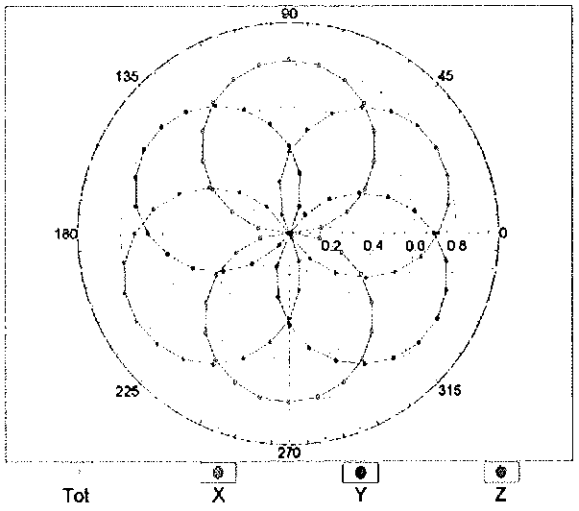
(TEM-Cell:ifi110 EXX, Waveguide: R22)



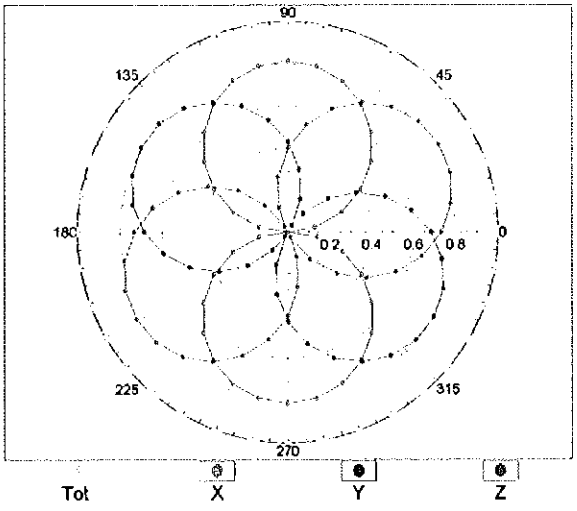
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

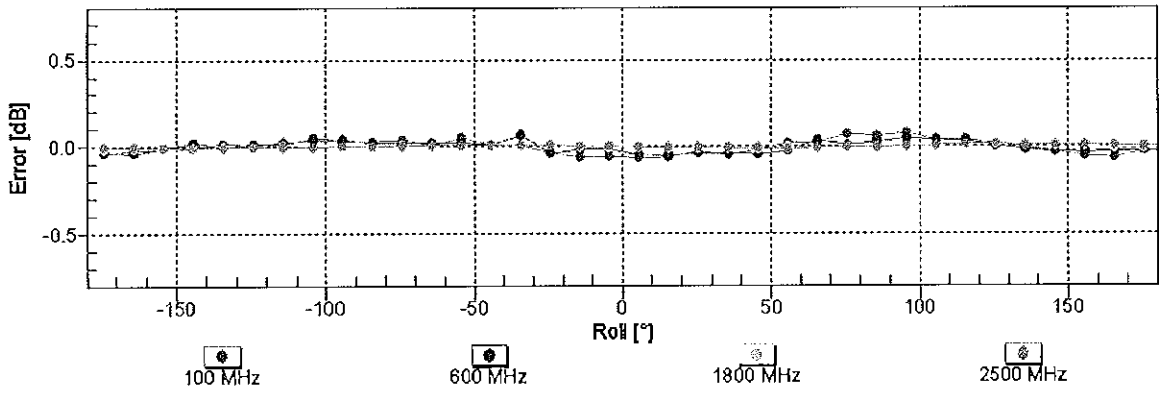
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



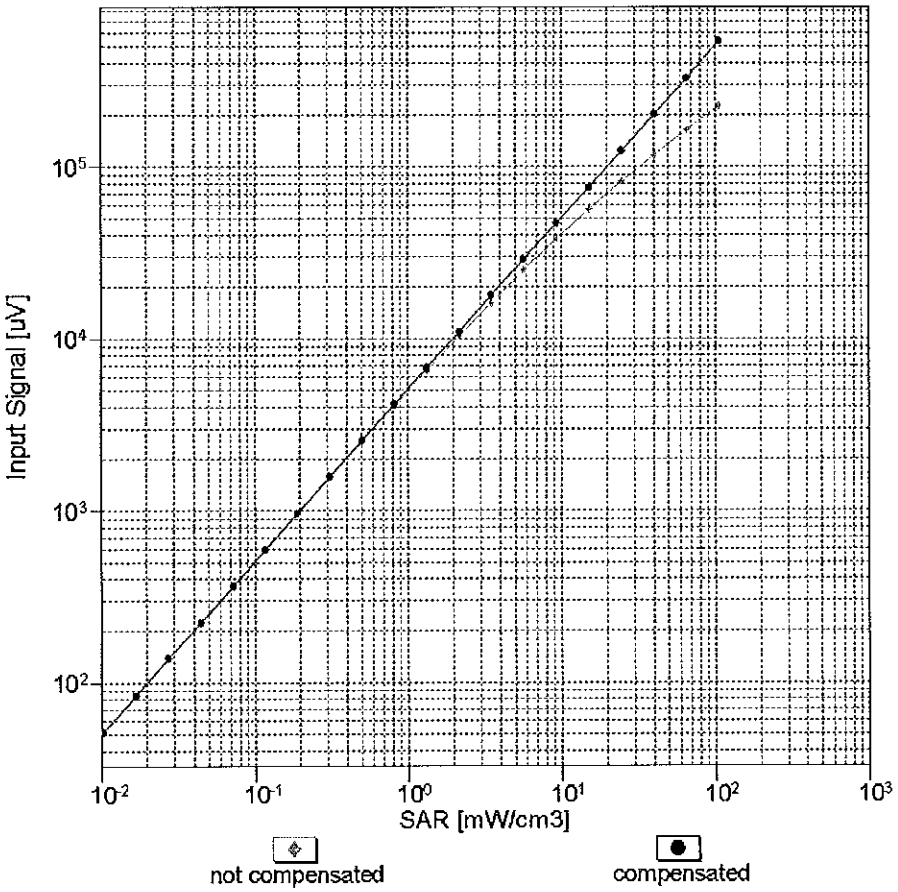
f=1800 MHz,R22

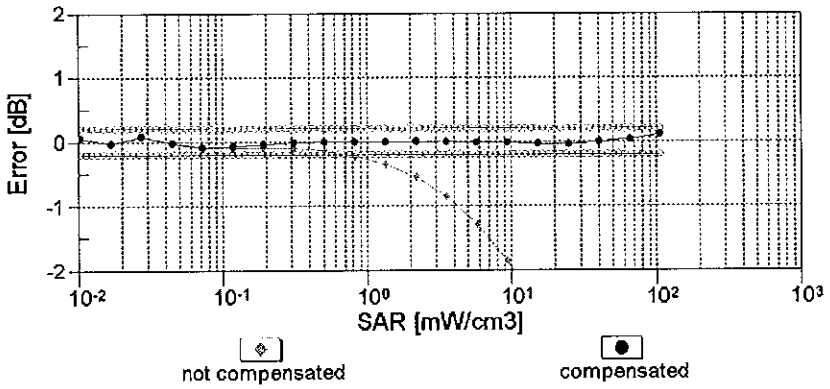




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

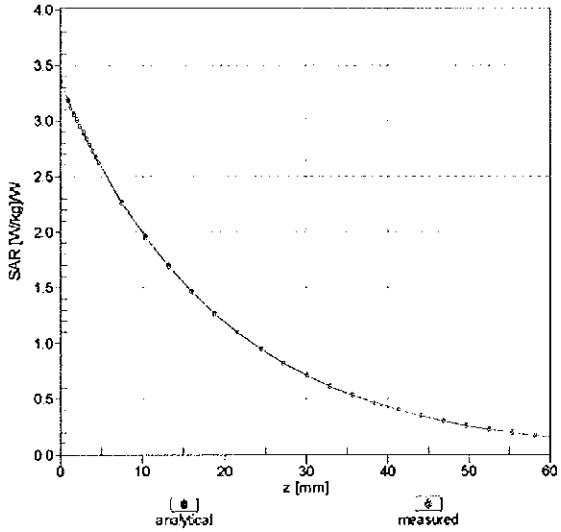




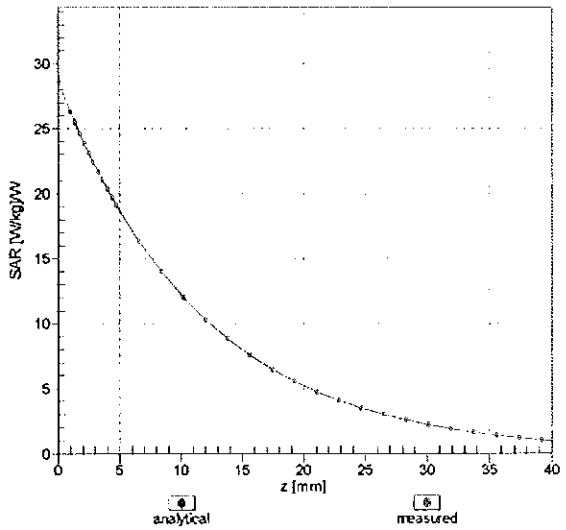
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

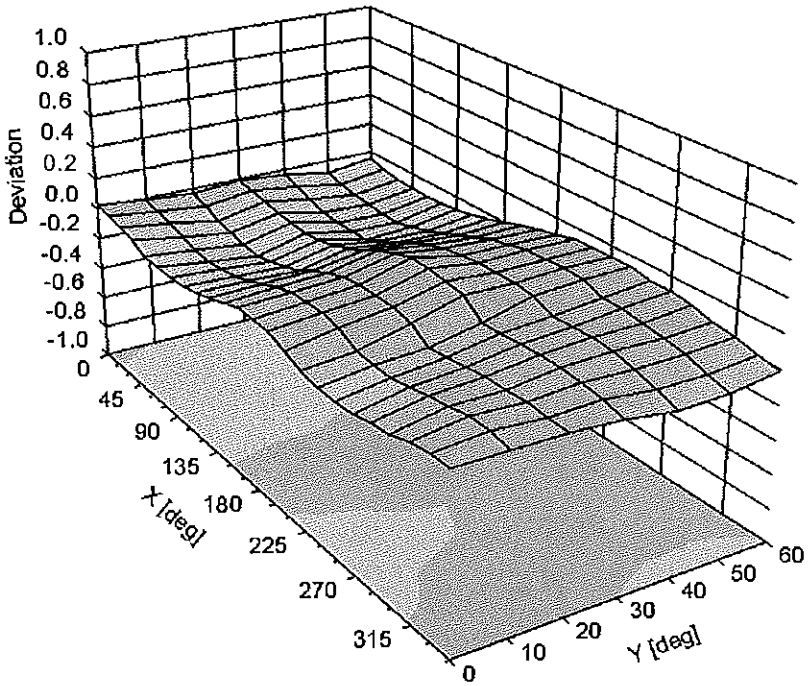


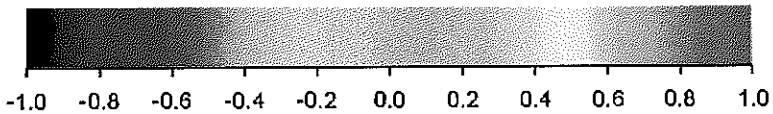
f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3914

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-24.3
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

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

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

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

Accreditation No.: SCS 108

Client PC Test

Certificate No: ES3-3022_Aug13

CALIBRATION CERTIFICATE

Object: ES3DV2 - SN:3022

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

Calibration date: August 22, 2013

UCC
9/13/13

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	04-Apr-13 (No. 217-01733)	Apr-14
Power sensor E4412A	MY41498087	04-Apr-13 (No. 217-01733)	Apr-14
Reference 3 dB Attenuator	SN: S5054 (3c)	04-Apr-13 (No. 217-01737)	Apr-14
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-13 (No. 217-01735)	Apr-14
Reference 30 dB Attenuator	SN: S5129 (30b)	04-Apr-13 (No. 217-01738)	Apr-14
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-15
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: August 23, 2013

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

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Swiss Calibration Service

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; 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.

Probe ES3DV2

SN:3022

Manufactured: April 15, 2003
Calibrated: August 22, 2013

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

DASY/EASY - Parameters of Probe: ES3DV2 - SN:3022

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.00	1.04	0.99	± 10.1 %
DCP (mV)[B]	100.7	97.4	99.7	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	178.6	±3.0 %
		Y	0.0	0.0	1.0		141.9	
		Z	0.0	0.0	1.0		134.7	

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

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

DASY/EASY - Parameters of Probe: ES3DV2 - SN:3022

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	6.21	6.21	6.21	0.19	2.37	± 12.0 %
835	41.5	0.90	6.09	6.09	6.09	0.30	1.70	± 12.0 %
1750	40.1	1.37	5.19	5.19	5.19	0.65	1.23	± 12.0 %
1900	40.0	1.40	5.03	5.03	5.03	0.51	1.43	± 12.0 %
2450	39.2	1.80	4.36	4.36	4.36	0.51	1.51	± 12.0 %
2600	39.0	1.96	4.16	4.16	4.16	0.74	1.29	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

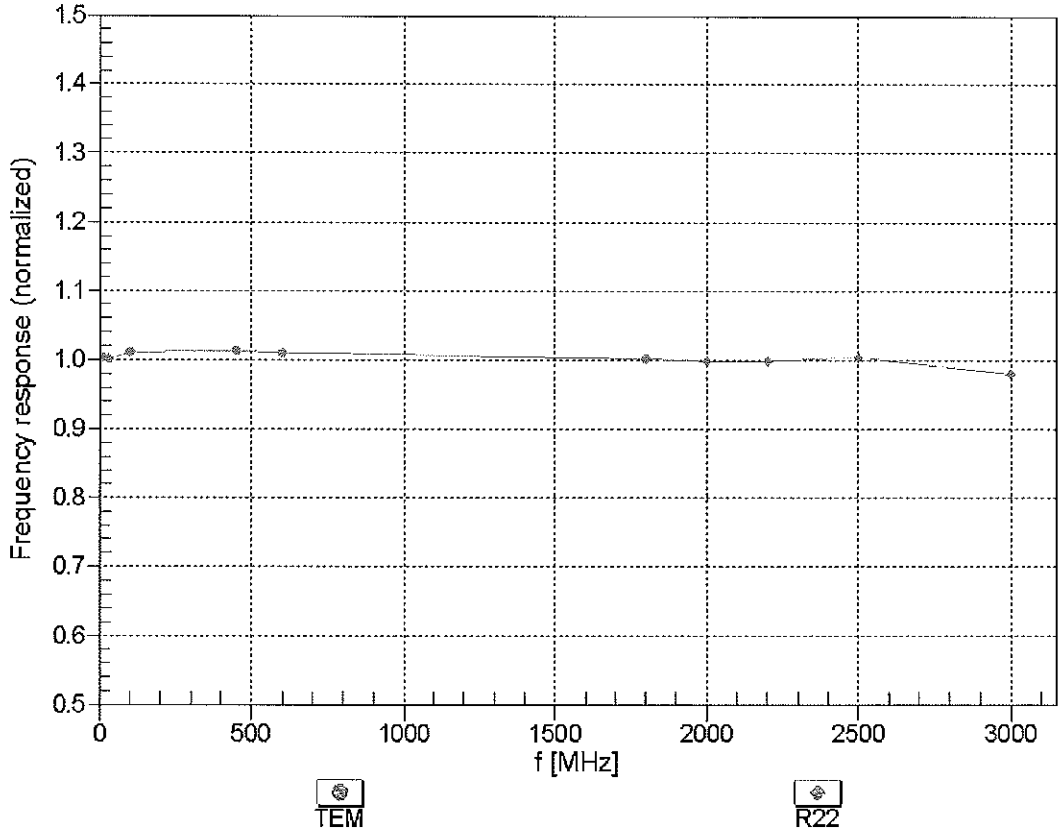
DASY/EASY - Parameters of Probe: ES3DV2 - SN:3022

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	5.92	5.92	5.92	0.24	1.99	± 12.0 %
835	55.2	0.97	5.91	5.91	5.91	0.29	1.85	± 12.0 %
1750	53.4	1.49	4.75	4.75	4.75	0.52	1.52	± 12.0 %
1900	53.3	1.52	4.49	4.49	4.49	0.49	1.56	± 12.0 %
2450	52.7	1.95	4.01	4.01	4.01	0.70	1.02	± 12.0 %
2600	52.5	2.16	3.85	3.85	3.85	0.58	0.90	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

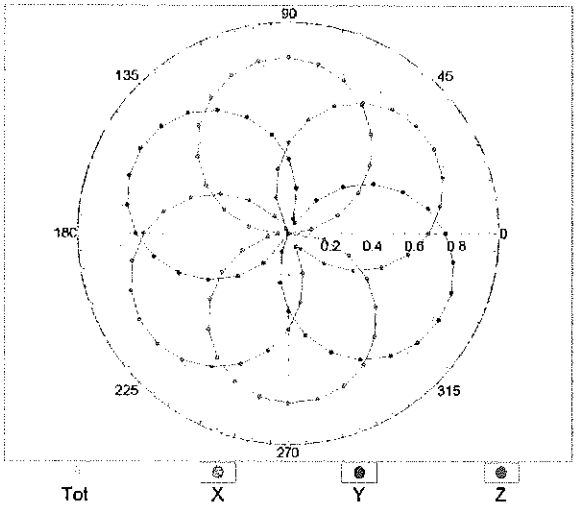
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



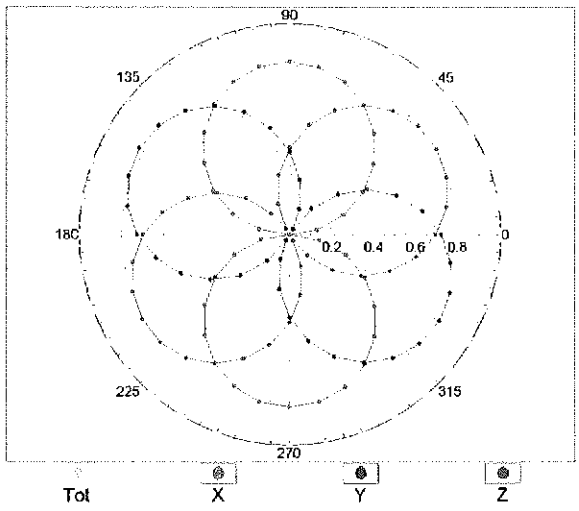
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

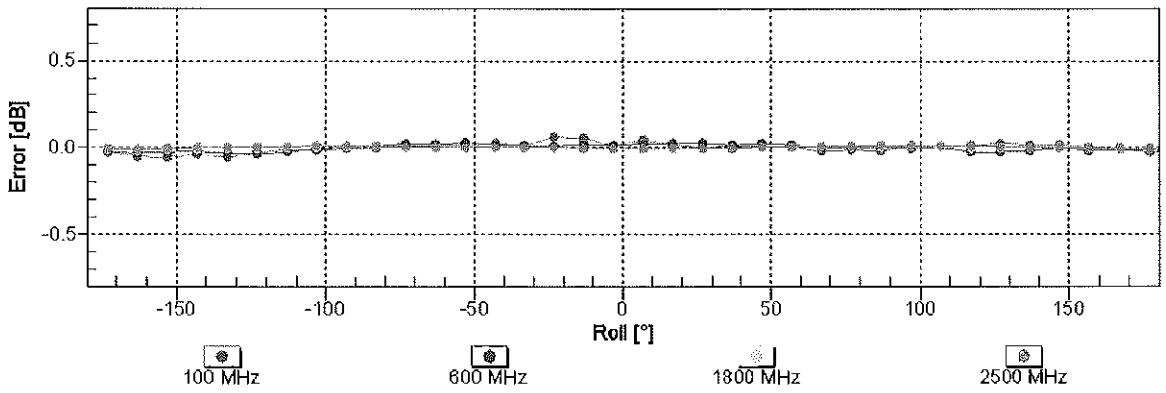
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



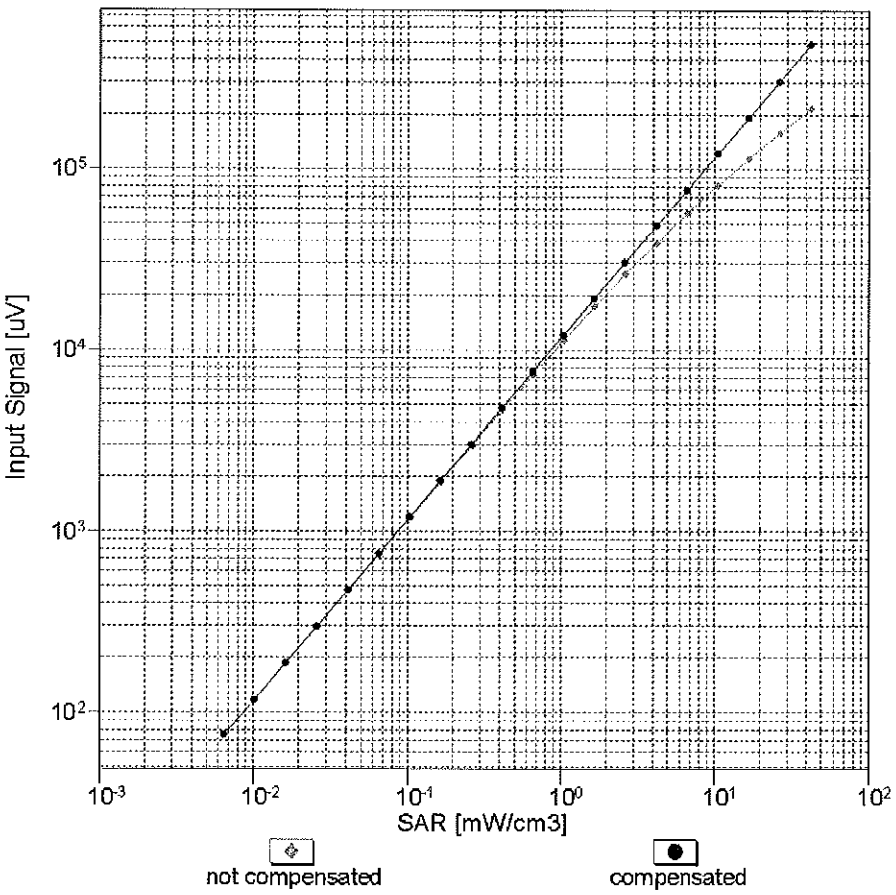
f=1800 MHz,R22

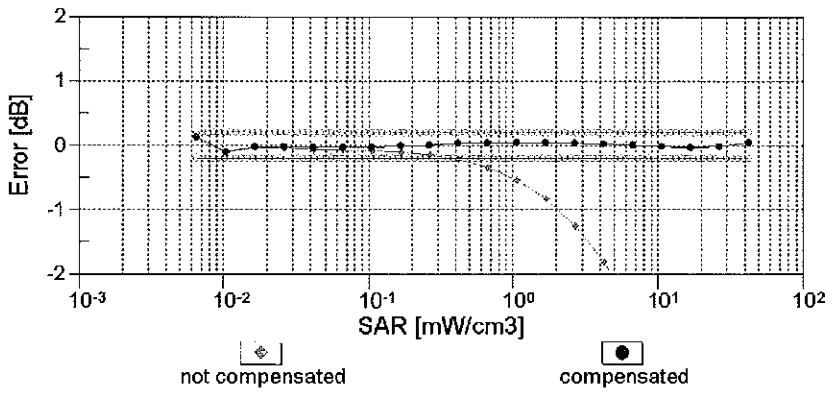




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

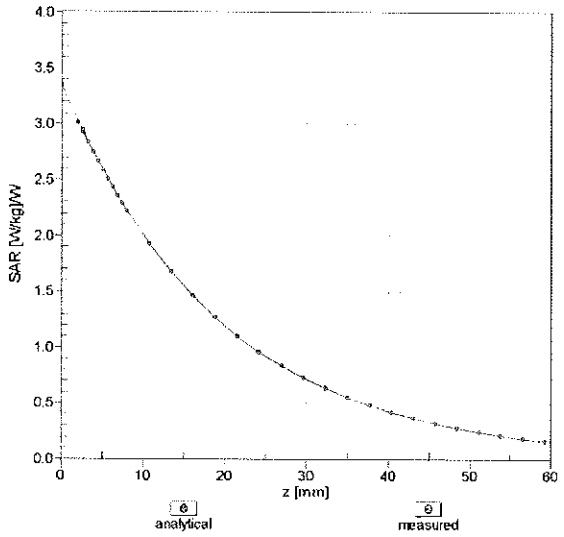




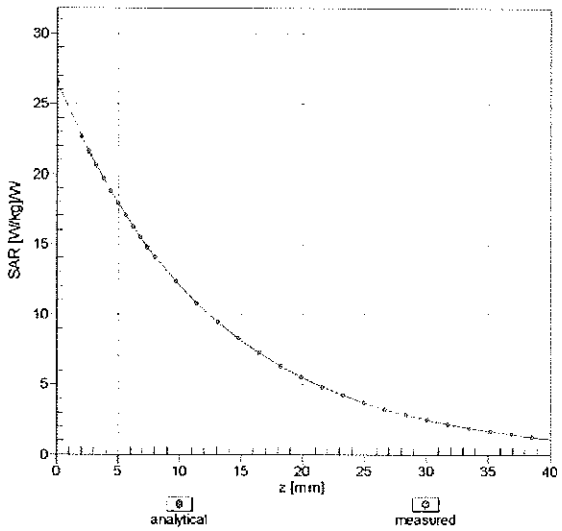
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

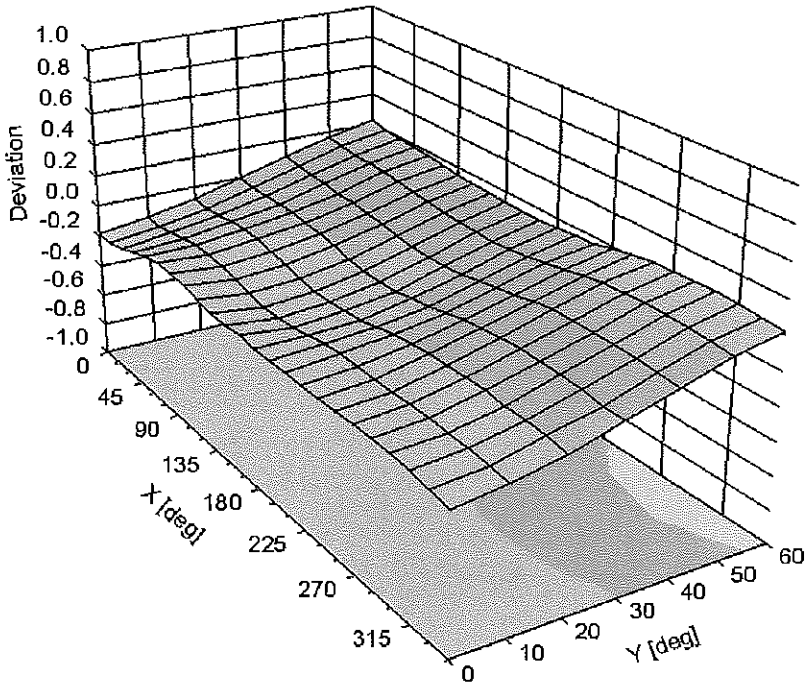


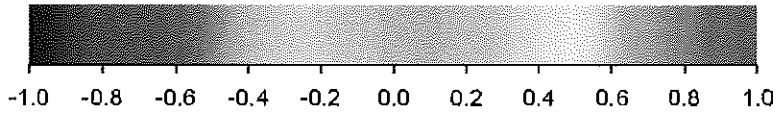
f = 1750 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





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

DASY/EASY - Parameters of Probe: ES3DV2 - SN:3022

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-83.1
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