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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:
03/04/13 - 03/19/13
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Document Serial No.:
0Y1303060456-R2.ZNF

FCC ID: ZNFLS720

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

DUT Type: Portable Handset
Application Type: Class II Permissive Change
FCC Rule Part(s): CFR §2.1093
Model(s): LS720, LG-LS720, LGLS720, LG-VM720, VM720, LGVM720, L25L, LGL25L
Permissive Change(s): See FCC Change Document
Date of Original Certification: 03/21/2013

Equipment Class	Band & Mode	Tx Frequency	Measured Conducted Power [dBm]	SAR		
				1 gm Head (W/kg)	1 gm Body-Worn (W/kg)	1 gm Hotspot (W/kg)
PCE	Cell. CDMA - FCC Rule Part 90S	817.90 - 823.10 MHz	24.12	0.51	0.66	0.66
PCE	Cell. CDMA - FCC Rule Part 22H	824.70 - 848.31 MHz	24.34	0.60	0.72	0.79
PCE	PCS CDMA - FCC Rule Part 24E	1851.25 - 1908.75 MHz	24.34	0.66	1.06	1.11
PCE	LTE Band 25 - FCC Rule Part 24E	1851.5 - 1913.5 MHz	22.86	0.95	0.93	0.93
DTS	2.4 GHz WLAN - FCC Rule Part 15C	2412 - 2462 MHz	16.02	< 0.1	0.16	0.16
DSS/DTS	Bluetooth - FCC Rule Part 15C	2402 - 2480 MHz	10.81	N/A	< 0.1	N/A
Simultaneous SAR per KDB 690783 D01v01r02:				1.15	1.55	1.55

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

Note: This revised Test Report (S/N: 0Y1303060456-R2.ZNF) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

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

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

Randy Ortanez
President

ilac-MRA

ACCREDITED
TESTING LABORATORY
CERTIFICATE #2041.01

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1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
Cell. CDMA - FCC Rule Part 90S	Voice/Data	817.90 - 823.10 MHz
Cell. CDMA - FCC Rule Part 22H	Voice/Data	824.70 - 848.31 MHz
PCS CDMA - FCC Rule Part 24E	Voice/Data	1851.25 - 1908.75 MHz
LTE Band 25 - FCC Rule Part 24E	Data	1851.5 - 1913.5 MHz
2.4 GHz WLAN - FCC Rule Part 15C	Data	2412 - 2462 MHz
Bluetooth - FCC Rule Part 15C	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.

A. Maximum CDMA Standalone Output Power

Mode / Band		Modulated Average (dBm)
Cell. CDMA/EVDO FCC Rule Part 90S	Maximum	**24.5**
	Nominal	**24.0**
Cell. CDMA/EVDO FCC Rule Part 22H	Maximum	**24.5**
	Nominal	**24.0**
PCS CDMA/EVDO FCC Rule Part 24E	Maximum	**24.5**
	Nominal	**24.0**

B. Maximum CDMA Output Power in SVLTE Conditions

Mode / Band	Condition	Modulated Average (dBm)	
Cell. CDMA/EVDO FCC Rule Part 90S	SVLTE LTE is not reducing	Maximum	**19.2**
		Nominal	**18.7**
Cell. CDMA/EVDO FCC Rule Part 22H	SVLTE LTE is not reducing	Maximum	**19.2**
		Nominal	**18.7**
PCS CDMA/EVDO FCC Rule Part 24E	SVLTE LTE is not reducing	Maximum	**19.2**
		Nominal	**18.7**

Note: LTE power reduction occurs when the CDMA power is above a specific "threshold" in SVLTE conditions. These threshold levels are tuned in the device to the levels as shown in Section 1.2B.

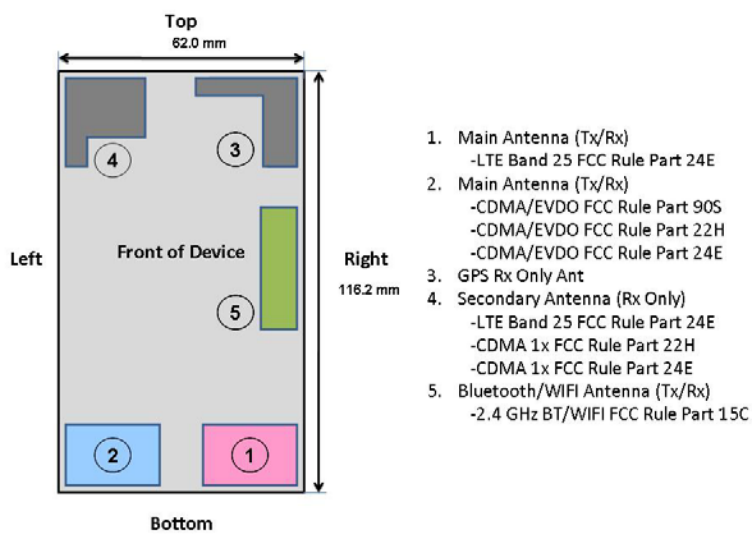
C. Maximum and Reduced LTE Output Power

Mode / Band	Condition	Modulated Average (dBm)	
LTE Band 25 FCC Rule Part 24E	Maximum	Maximum	**23.2**
		Nominal	**22.7**
	Reduced (CDMA Power ≥ Threshold Power)	Maximum	**19.2**
		Nominal	**18.7**

D. 2.4GHz WLAN/Bluetooth – FCC Rule Part 15C Output Power

Mode / Band		Modulated Average (dBm)
IEEE 802.11b	Maximum	**16.1**
	Nominal	**15.4**
IEEE 802.11g	Maximum	**13.4**
	Nominal	**12.7**
IEEE 802.11n	Maximum	**13.3**
	Nominal	**12.6**
Bluetooth	Maximum	**10.9**
	Nominal	**10.2**
Bluetooth LE	Maximum	**7.0**
	Nominal	**6.3**

1.3 DUT Antenna Locations



Note: Specific antenna dimensions and separation distances are shown in the antenna distance document.

Figure 1-1
DUT Antenna Locations

Table 1-1
Mobile Hotspot Sides for SAR Testing

Mobile Hotspot Sides for SAR Testing						
Mode	Back	Front	Top	Bottom	Right	Left
Cell. CDMA/EVDO – FCC Rule Part 90S	Yes	Yes	No	Yes	No	Yes
Cell. EVDO – FCC Rule Part 22H	Yes	Yes	No	Yes	No	Yes
PCS EVDO – FCC Rule Part 24E	Yes	Yes	No	Yes	No	Yes
LTE Band 25 – FCC Rule Part 24E	Yes	Yes	No	Yes	Yes	No
2.4 GHz WLAN – FCC Rule Part 15C	Yes	Yes	No	No	Yes	No

Note: Particular DUT edges were not required to be evaluated for Wireless Router SAR if the edges were greater than 2.5 cm from the transmitting antenna according to FCC KDB Publication 941225 D06v01 guidance, page 2. The antenna document shows the distances between the transmit antennas and the edges of the device.

1.4 Near Field Communications (NFC) Antenna

This DUT has NFC operations. The NFC antenna is integrated into the standard battery cover. The SAR tests were performed with the standard battery cover.

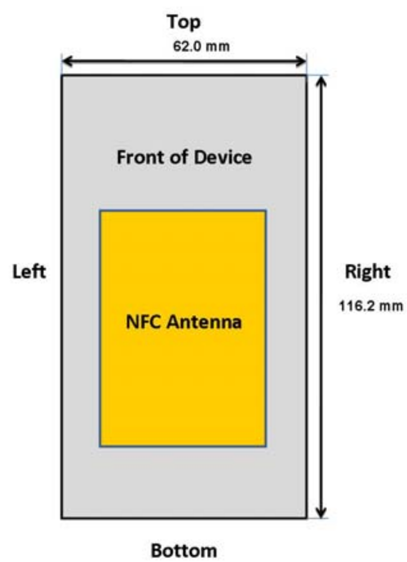


Figure 1-2
NFC Antenna Locations

1.5 Simultaneous Transmission Capabilities

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

Figure 1-3
Simultaneous Transmission Paths

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

Table 1-2
Simultaneous Transmission Scenarios

No.	Capable Transmit Configurations	Head IEEE 1528, Supp C	Body-Worn Accessory Supplement C	Hot Spot FCC KDB 941225 D06 edges/sides	Note
1	1X CDMA 850/1900 Voice + LTE 1900 MHz Data	✓	✓	N/A	SVLTE
2	1X CDMA 850/1900 Voice + LTE 1900 MHz Data + 2.4 GHz WIFI	✓	✓	✓	Voice and LTE + WIFI Hotspot
3	1X CDMA 850/1900 Voice + LTE 1900 MHz Data + 2.4 GHz Bluetooth	N/A	✓	N/A	Voice and LTE + BT
4	1X CDMA 850/1900 Voice + 2.4 GHz WIFI	✓	✓	N/A	1X voice + WiFi Data
5	1X CDMA 850/1900 Voice + 2.4 GHz Bluetooth	N/A	✓	N/A	1X voice + BT
6	1X/EVDO 850/1900 Data + 2.4 GHz WIFI	✓	✓	✓	EVDO + WIFI Hotspot
7	1X/EVDO 850/1900 Data + 2.4 GHz Bluetooth	N/A	✓	N/A	EVDO VoIP + BT
8	LTE 1900 MHz Data + 2.4 GHz WIFI	✓	✓	✓	LTE + WIFI Hotspot
9	LTE 1900 MHz Data + 2.4 GHz Bluetooth	N/A	✓	N/A	LTE + BT
9	1X CDMA 850/1900 Voice + EVDO 850/1900 Data	N/A	N/A	N/A	Not available by HW
10	850/1900 EVDO data + LTE 1900 MHz Data	N/A	N/A	N/A	Not available by SW

Notes:

1. CDMA and EVDO share the same antenna path and cannot transmit simultaneously. (Non-SVDO)
2. 2.4 GHz WLAN and Bluetooth share the same antenna path and cannot transmit simultaneously.

1.6 SAR Test Exclusions Applied

(A) WIFI/BT

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

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

Based on the maximum conducted power of Bluetooth (rounded to the nearest mW) and the antenna to user separation distance, Bluetooth SAR was not required; [(12/10)* √2.441] = 1.9< 3.0. However, estimated SAR was too conservative for this device, so SAR was measured to determine simultaneous SAR exclusion per FCC KDB 447498 D01v05 Section 4.3.2 2).

(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.

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

1.7 Power Reduction for SAR

This device uses power reduction mechanisms for LTE during SVLTE operation (1x-RTT CDMA voice + LTE data) for SAR compliance. See Section 10 for more details.

1.8 Guidance Applied

- FCC OET Bulletin 65 Supplement C [June 2001]
- IEEE 1528-2003
- FCC KDB Publication 941225 D01-D06 (2G/3G/4G and Hotspot)
- FCC KDB Publication 248227 D01v01r02 (SAR Considerations for 802.11 Devices)
- FCC KDB Publication 447498 D01v05 (General SAR Guidance)
- FCC KDB Publication 865664 D01-D02 (SAR Measurements up to 6 GHz)
- October 2012 TCB Workshop Notes (1x Advanced)

1.9 Device Serial Numbers

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

Mode/Band	Maximum Power Device S/N	Reduced Power Device S/N
Cell. CDMA/EVDO - FCC Rule Part 90S	1078	1287
Cell. CDMA/EVDO - FCC Rule Part 22H	1078	1287
PCS CDMA/EVDO - FCC Rule Part 24E	1078	1287
LTE Band 25 - FCC Rule Part 24E	1167	1276
2.4 GHz WLAN - FCC Rule Part 15C	1196	N/A
Bluetooth - FCC Rule Part 15C	1196	N/A

Note: Per KDB 941225 D05v02 Section 4.4 B), SAR testing was additionally performed at the reduced CDMA and LTE power levels with respect to the simultaneous transmission scenarios. Additional samples were tuned to fixed reduced power levels to represent the SVLTE condition in a standalone environment.

2 LTE INFORMATION

LTE Information			
FCC ID	**ZNFLS720**		
Form Factor	Portable Handset		
Frequency Range of each LTE transmission band	LTE Band 25 - FCC Rule Part 24E (1851.5 - 1913.5 MHz)		
Channel Bandwidths	LTE Band 25: 3 MHz, 5 MHz, 10 MHz		
Channel Numbers and Frequencies (MHz)	Low	Mid	High
LTE Band 25: 3 MHz	1851.5 (26055)	1882.5 (26365)	1913.5 (26675)
LTE Band 25: 5 MHz	1852.5 (26065)	1882.5 (26365)	1912.5 (26665)
LTE Band 25: 10 MHz	1855 (26090)	1882.5 (26365)	1910 (26640)
UE Category	3		
Modulations Supported in UL	QPSK, 16QAM		
LTE Transmitter and Antenna Implementation	1 Antenna for LTE Tx/Rx and 1 Rx Only Antenna		
Description of LTE Tx and Ant. Implementation	CDMA/LTE operate on separate transmission paths		
Hotspot with LTE+WIFI	YES		
Hotspot with LTE+WIFI active with 1XVoice sessions?	YES		
LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3~6.2.5? (manufacturer attestation to be provided)	YES		
A-MPR (Additional MPR) disabled for SAR Testing?	YES		
Conducted power Table provided for 1RB (low, mid, and high offset), 50% RB (low, mid, and high offset), 100% RB	YES		

3 INTRODUCTION

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

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz [3] and Health Canada RF Exposure Guidelines Safety Code 6 [24]. The measurement procedure described in IEEE/ANSI C95.3-2002 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave [4] is used for guidance in measuring the Specific Absorption Rate (SAR) due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the International Committee for Non-Ionizing Radiation Protection (ICNIRP) in Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields," Report No. Vol 74. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

3.1 SAR Definition

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

Equation 3-1
SAR Mathematical Equation

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

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

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

where:

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

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

4 DOSIMETRIC ASSESSMENT

4.1 Measurement Procedure

The evaluation was performed using the following procedure:

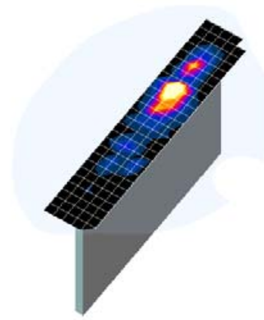


Figure 4-1
Sample SAR Area Scan

1. The SAR distribution at the exposed side of the head or body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head and body interface and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01v01 (See Table 4-1).
2. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during the 1g/10g cube evaluation. SAR at this fixed point was measured and used as a reference value.
3. Based on the area scan data, the peak of the region with maximum SAR was determined by spline interpolation. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB Publication 865664 D01v01 (See Table 4-1). On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual online for more details):
   a. The data was extrapolated to the surface of the outer-shell of the phantom. The combined distance extrapolated was the combined distance from the center of the dipoles 2.7mm away from the tip of the probe housing plus the 1.2 mm distance between the surface and the lowest measuring point. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).
   b. After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were obtained through interpolation, in order to calculate the averaged SAR.
   c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.

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

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

5 DEFINITION OF REFERENCE POINTS

5.1 EAR REFERENCE POINT

Figure 5-2 shows the front, back and side views of the SAM Twin Phantom. The point “M” is the reference point for the center of the mouth, “LE” is the left ear reference point (ERP), and “RE” is the right ERP. The ERP is 15mm posterior to the entrance to the ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 5-1. The plane passing through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck-Front) is perpendicular to the reference plane and passing through the RE (or LE) is called the Reference Pivoting Line (see Figure 5-1). Line B-M is perpendicular to the N-F line. Both N-F and B-M lines are marked on the external phantom shell to facilitate handset positioning [5].

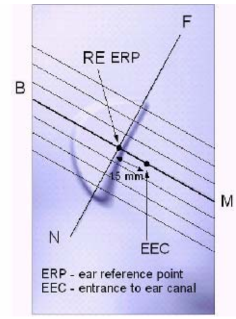


Figure 5-1
Close-Up Side view of ERP

5.2 HANDSET REFERENCE POINTS

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

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

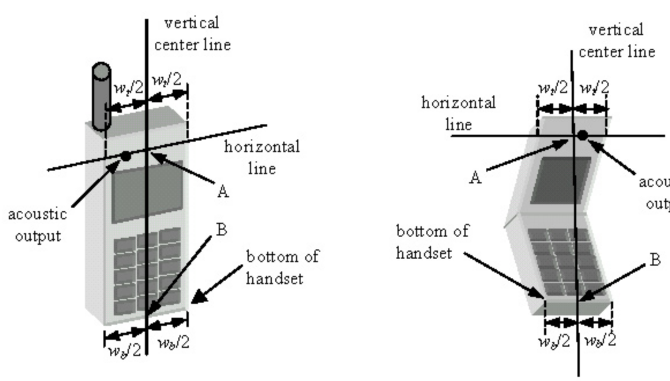


Figure 5-3
Handset Vertical Center & Horizontal Line Reference Points

6 TEST CONFIGURATION POSITIONS FOR HANDSETS

6.1 Device Holder

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

6.2 Positioning for Cheek

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

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

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

6.3 Positioning for Ear / 15º Tilt

With the test device aligned in the "Cheek Position":

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

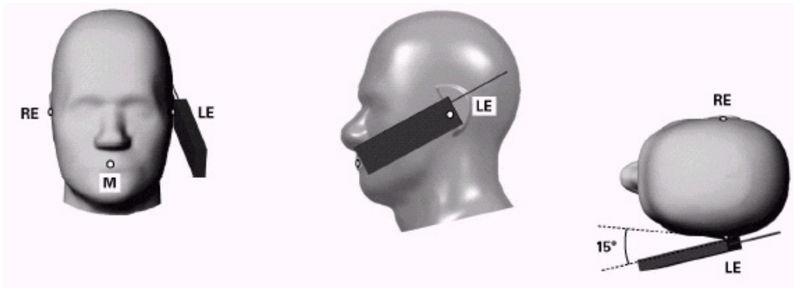


Figure 6-2 Front, Side and Top View of Ear/15º Tilt Position

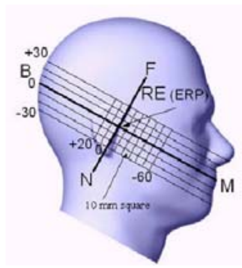


Figure 6-3
Side view w/ relevant markings

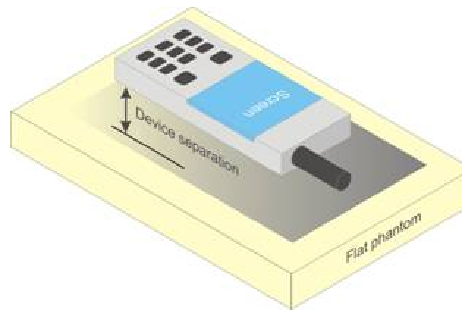


Figure 6-4
Sample Body-Worn Diagram

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

Antennas located near the bottom of a phone may require SAR measurements around the mouth and jaw regions of the SAM head phantom. This typically applies to clam-shell style phones that are generally longer in the unfolded normal use positions or to certain older style long rectangular phones.

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

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

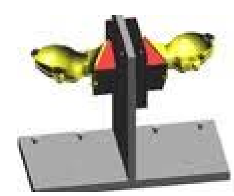


Figure 6-5 Twin SAM Chin20

6.5 Body-Worn Accessory Configurations

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 6-4). Per FCC KDB Publication 648474 D04_v01, Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB Publication 447498 D01_v05 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

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

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

6.6 Wireless Router Configurations

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

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

7 RF EXPOSURE LIMITS

7.1 Uncontrolled Environment

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

7.2 Controlled Environment

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

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

HUMAN EXPOSURE LIMITS		
	UNCONTROLLED ENVIRONMENT *General Population* (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT *Occupational* (W/kg) or (mW/g)
SPATIAL PEAK SAR Brain	1.6	8.0
SPATIAL AVERAGE SAR Whole Body	0.08	0.4
SPATIAL PEAK SAR Hands, Feet, Ankles, Wrists	4.0	20

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

8 FCC MEASUREMENT PROCEDURES

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

8.1 Measured and Reported SAR

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

8.2 Procedures Used to Establish RF Signal for SAR

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

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

8.3 SAR Measurement Conditions for 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
$\hat{I}_{or}$	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
$\hat{I}_{or}$	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 CDMA2000 1x Advanced

This device additionally supports 1x Advanced. Conducted powers were measured using SO75 with RC8 on the uplink and RC11 on the downlink per Oct 2012 TCB Workshop notes. Smart blanking was disabled for all measurements. The EUT was configured with forward power control Mode 000 and reverse power control at 400 bps. Conducted powers were measured on an Agilent 8960 Series 10 Wireless Communications Test Set, Model E5515C using the CDMA2000 1x Advanced application, Option E1962B-410.

Based on the maximum output power measured for 1x Advanced, SAR is required for 1x advanced when if the maximum output for 1x Advanced is more than 0.25 dB higher than the maximum measured for 1x. Also, if the measured SAR in any 1x mode exposure conditions (head, body etc.) is larger than 1.2 W/kg, the highest of those configurations above 1.2 W/kg for each exposure condition in 1x Advanced has to be repeated. All measured SAR in 1x mode higher than 1.5 W/kg must be repeated for 1x Advanced.

8.3.3 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 8.3.5 for EVDO Rev. A configuration parameters.

8.3.4 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.

8.3.5 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.

8.3.6 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.

8.4.1 Spectrum Plots for RB Configurations

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

8.4.2 MPR

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

8.4.3 A-MPR

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

8.4.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05v02r01:

a. Per Section 5.2.1, SAR is required for QPSK 1 RB Allocation for the largest bandwidth
   i. The required channel and offset combination with the highest maximum output power is required for SAR.
   ii. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required. Otherwise, SAR is required for the remaining required test channels using the RB offset configuration with highest output power for that channel.
   iii. When the reported SAR for a required test channel is > 1.45 W/kg, SAR is required for all RB offset configurations for that channel.
b. Per Section 5.2.2, SAR is required for 50% RB allocation using the largest bandwidth following the same procedures outlined in Section 5.2.1.
c. Per Section 5.2.3, QPSK SAR is not required for the 100% allocation when the highest maximum output power for the 100% allocation is less than the highest maximum output power of the 1 RB and 50% RB allocations and the reported SAR for the 1 RB and 50% RB allocations is < 0.8 W/kg.
d. Per Section 5.2.4 and 5.3, SAR tests for higher order modulations and lower bandwidths configurations are not required when the conducted power of the required test configurations determined by Sections 5.2.1 through 5.2.3 is less than or equal to ½ dB higher than the equivalent configuration using QPSK modulation and when the QPSK SAR for those configurations is <1.45 W/kg.

8.5 SAR Testing with 802.11 Transmitters

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

8.5.1 General Device Setup

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

8.5.2 Frequency Channel Configurations [27]

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

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

9 RF CONDUCTED POWERS

9.1 CDMA Conducted Powers

Band	Channel	Rule Part	Frequency	SO55 [dBm]	SO55 [dBm]	SO75 [dBm]	TDSO SO32 [dBm]	TDSO SO32 [dBm]	1x EvDO Rev. 0 [dBm]	1x EvDO Rev. A [dBm]
	F-RC		MHz	RC1	RC3	RC8	FCH+SCH	FCH	(RTAP)	(RETAP)
Cellular	564	90S	820.1	24.14	24.10	24.09	24.08	24.10	24.12	24.04
Cellular	1013	22H	824.7	24.28	24.16	24.07	24.28	24.28	24.28	24.18
	384	22H	836.52	24.21	24.24	24.06	24.33	24.34	24.20	24.16
	777	22H	848.31	24.37	24.31	24.23	24.44	24.39	24.36	24.34
PCS	25	24E	1851.25	24.37	24.22	24.24	24.32	24.29	24.34	24.26
	600	24E	1880	24.22	24.09	24.01	24.15	24.16	24.19	24.18
	1175	24E	1908.75	24.22	24.05	24.12	24.11	24.03	24.12	24.08

Note: RC1 is only applicable for IS-95 compatibility. For FCC Rule Part 90S, Per FCC KDB Publication 447498 D01v05 4.1.6, only one channel is required since the device operates within the transmission range of 817.90 – 823.10 MHz.

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.
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. Since 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 1⁄4 dB higher than that measured in Subtype 0/1 Physical Layer configurations for Rev. 0
4. CDMA 1x-RTT SAR was additionally required to be evaluated for Hotspot exposure conditions to support simultaneous transmission capabilities.
5. Head SAR was additionally evaluated with EVDO Rev. A to determine compliance for held-to-ear VoIP operations.

1x Advanced Considerations per October 2012 TCB Workshop

1. CDMA 1X Advanced technology was not required for SAR since the maximum output powers for 1x Advanced was not more than 0.25 dB higher than the maximum measured powers for 1x and the measured SAR in any 1x mode exposure conditions was not greater than 1.2 W/kg. See Section 8.3.2 for 1x Advanced test set up.

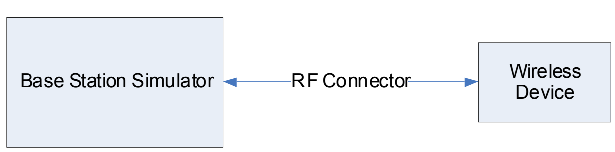


Figure 9-1
Power Measurement Setup

9.2 LTE Conducted Powers

9.2.1 LTE Band 25 - FCC Rule Part 24E

Table 9-1
LTE Band 25 - FCC Rule Part 24E Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Low	1855	26090	10	QPSK	1	0	22.84	0	0
	1855	26090	10	QPSK	1	25	22.74	0	0
	1855	26090	10	QPSK	1	49	22.69	0	0
	1855	26090	10	QPSK	25	0	**21.88**	1	0-1
	1855	26090	10	QPSK	25	12	21.76	1	0-1
	1855	26090	10	QPSK	25	25	21.62	1	0-1
	1855	26090	10	QPSK	50	0	**21.67**	1	0-1
	1855	26090	10	16QAM	1	0	21.98	1	0-1
	1855	26090	10	16QAM	1	25	21.93	1	0-1
	1855	26090	10	16QAM	1	49	21.84	1	0-1
	1855	26090	10	16QAM	25	0	20.87	2	0-2
	1855	26090	10	16QAM	25	12	20.86	2	0-2
	1855	26090	10	16QAM	25	25	20.76	2	0-2
	1855	26090	10	16QAM	50	0	20.66	2	0-2
Mid	1882.5	26365	10	QPSK	1	0	**22.86**	0	0
	1882.5	26365	10	QPSK	1	25	22.76	0	0
	1882.5	26365	10	QPSK	1	49	22.74	0	0
	1882.5	26365	10	QPSK	25	0	21.67	1	0-1
	1882.5	26365	10	QPSK	25	12	21.66	1	0-1
	1882.5	26365	10	QPSK	25	25	21.64	1	0-1
	1882.5	26365	10	QPSK	50	0	21.56	1	0-1
	1882.5	26365	10	16QAM	1	0	21.68	1	0-1
	1882.5	26365	10	16QAM	1	25	21.62	1	0-1
	1882.5	26365	10	16QAM	1	49	21.49	1	0-1
	1882.5	26365	10	16QAM	25	0	20.82	2	0-2
	1882.5	26365	10	16QAM	25	12	20.78	2	0-2
	1882.5	26365	10	16QAM	25	25	20.74	2	0-2
	1882.5	26365	10	16QAM	50	0	20.60	2	0-2
High	1910	26640	10	QPSK	1	0	22.76	0	0
	1910	26640	10	QPSK	1	25	22.58	0	0
	1910	26640	10	QPSK	1	49	22.53	0	0
	1910	26640	10	QPSK	25	0	21.62	1	0-1
	1910	26640	10	QPSK	25	12	21.59	1	0-1
	1910	26640	10	QPSK	25	25	21.48	1	0-1
	1910	26640	10	QPSK	50	0	21.55	1	0-1
	1910	26640	10	16QAM	1	0	21.58	1	0-1
	1910	26640	10	16QAM	1	25	21.42	1	0-1
	1910	26640	10	16QAM	1	49	21.34	1	0-1
	1910	26640	10	16QAM	25	0	20.78	2	0-2
	1910	26640	10	16QAM	25	12	20.69	2	0-2
	1910	26640	10	16QAM	25	25	20.68	2	0-2
	1910	26640	10	16QAM	50	0	20.51	2	0-2

LTE Notes:

1. Please refer to Section 8.4.4 for LTE testing requirements per FCC KDB 941225 D05.
2. The bolded powers were tested for SAR.

Table 9-2
LTE Band 25 - FCC Rule Part 24E Conducted Powers - 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Low	1852.5	26065	5	QPSK	1	0	23.09	0	0
	1852.5	26065	5	QPSK	1	12	23.01	0	0
	1852.5	26065	5	QPSK	1	24	22.91	0	0
	1852.5	26065	5	QPSK	12	0	22.02	1	0-1
	1852.5	26065	5	QPSK	12	6	21.93	1	0-1
	1852.5	26065	5	QPSK	12	13	21.89	1	0-1
	1852.5	26065	5	QPSK	25	0	21.78	1	0-1
	1852.5	26065	5	16-QAM	1	0	22.09	1	0-1
	1852.5	26065	5	16-QAM	1	12	22.01	1	0-1
	1852.5	26065	5	16-QAM	1	24	21.94	1	0-1
	1852.5	26065	5	16-QAM	12	0	20.92	2	0-2
	1852.5	26065	5	16-QAM	12	6	20.89	2	0-2
	1852.5	26065	5	16-QAM	12	13	20.89	2	0-2
	1852.5	26065	5	16-QAM	25	0	20.77	2	0-2
Mid	1882.5	26365	5	QPSK	1	0	22.92	0	0
	1882.5	26365	5	QPSK	1	12	22.86	0	0
	1882.5	26365	5	QPSK	1	24	22.86	0	0
	1882.5	26365	5	QPSK	12	0	21.82	1	0-1
	1882.5	26365	5	QPSK	12	6	21.75	1	0-1
	1882.5	26365	5	QPSK	12	13	21.75	1	0-1
	1882.5	26365	5	QPSK	25	0	21.58	1	0-1
	1882.5	26365	5	16-QAM	1	0	21.81	1	0-1
	1882.5	26365	5	16-QAM	1	12	21.71	1	0-1
	1882.5	26365	5	16-QAM	1	24	21.74	1	0-1
	1882.5	26365	5	16-QAM	12	0	20.82	2	0-2
	1882.5	26365	5	16-QAM	12	6	20.75	2	0-2
	1882.5	26365	5	16-QAM	12	13	20.84	2	0-2
	1882.5	26365	5	16-QAM	25	0	20.71	2	0-2
High	1912.5	26665	5	QPSK	1	0	22.61	0	0
	1912.5	26665	5	QPSK	1	12	22.58	0	0
	1912.5	26665	5	QPSK	1	24	22.56	0	0
	1912.5	26665	5	QPSK	12	0	21.66	1	0-1
	1912.5	26665	5	QPSK	12	6	21.58	1	0-1
	1912.5	26665	5	QPSK	12	13	21.54	1	0-1
	1912.5	26665	5	QPSK	25	0	21.44	1	0-1
	1912.5	26665	5	16-QAM	1	0	21.63	1	0-1
	1912.5	26665	5	16-QAM	1	12	21.54	1	0-1
	1912.5	26665	5	16-QAM	1	24	21.48	1	0-1
	1912.5	26665	5	16-QAM	12	0	20.76	2	0-2
	1912.5	26665	5	16-QAM	12	6	20.70	2	0-2
	1912.5	26665	5	16-QAM	12	13	20.75	2	0-2
	1912.5	26665	5	16-QAM	25	0	20.48	2	0-2

Table 9-3
LTE Band 25 - FCC Rule Part 24E Conducted Powers - 3 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Low	1851.5	26055	3	QPSK	1	0	22.98	0	0
	1851.5	26055	3	QPSK	1	7	22.97	0	0
	1851.5	26055	3	QPSK	1	14	22.80	0	0
	1851.5	26055	3	QPSK	8	0	21.94	1	0-1
	1851.5	26055	3	QPSK	8	4	21.93	1	0-1
	1851.5	26055	3	QPSK	8	7	21.74	1	0-1
	1851.5	26055	3	QPSK	15	0	21.94	1	0-1
	1851.5	26055	3	16-QAM	1	0	21.66	1	0-1
	1851.5	26055	3	16-QAM	1	7	21.56	1	0-1
	1851.5	26055	3	16-QAM	1	14	21.59	1	0-1
	1851.5	26055	3	16-QAM	8	0	20.89	2	0-2
	1851.5	26055	3	16-QAM	8	4	20.91	2	0-2
	1851.5	26055	3	16-QAM	8	7	20.81	2	0-2
	1851.5	26055	3	16-QAM	15	0	20.87	2	0-2
Mid	1882.5	26365	3	QPSK	1	0	22.83	0	0
	1882.5	26365	3	QPSK	1	7	22.78	0	0
	1882.5	26365	3	QPSK	1	14	22.74	0	0
	1882.5	26365	3	QPSK	8	0	21.85	1	0-1
	1882.5	26365	3	QPSK	8	4	21.80	1	0-1
	1882.5	26365	3	QPSK	8	7	21.74	1	0-1
	1882.5	26365	3	QPSK	15	0	21.71	1	0-1
	1882.5	26365	3	16-QAM	1	0	21.73	1	0-1
	1882.5	26365	3	16-QAM	1	7	21.63	1	0-1
	1882.5	26365	3	16-QAM	1	14	21.60	1	0-1
	1882.5	26365	3	16-QAM	8	0	20.85	2	0-2
	1882.5	26365	3	16-QAM	8	4	20.87	2	0-2
	1882.5	26365	3	16-QAM	8	7	20.78	2	0-2
	1882.5	26365	3	16-QAM	15	0	20.73	2	0-2
High	1913.5	26675	3	QPSK	1	0	22.52	0	0
	1913.5	26675	3	QPSK	1	7	22.48	0	0
	1913.5	26675	3	QPSK	1	14	22.39	0	0
	1913.5	26675	3	QPSK	8	0	21.68	1	0-1
	1913.5	26675	3	QPSK	8	4	21.61	1	0-1
	1913.5	26675	3	QPSK	8	7	21.56	1	0-1
	1913.5	26675	3	QPSK	15	0	21.65	1	0-1
	1913.5	26675	3	16-QAM	1	0	21.85	1	0-1
	1913.5	26675	3	16-QAM	1	7	21.72	1	0-1
	1913.5	26675	3	16-QAM	1	14	21.74	1	0-1
	1913.5	26675	3	16-QAM	8	0	20.82	2	0-2
	1913.5	26675	3	16-QAM	8	4	20.64	2	0-2
	1913.5	26675	3	16-QAM	8	7	20.66	2	0-2
	1913.5	26675	3	16-QAM	15	0	20.64	2	0-2

9.3 WLAN/Bluetooth Conducted Powers

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

Table 9-4
IEEE 802.11b – FCC Rule Part 15C Average RF Power

Mode	Freq	Channel	802.11b (2.4 GHz) Conducted Power [dBm]			
			Data Rate [Mbps]			
	[MHz]		**1**	**2**	**5.5**	**11**
802.11b	2412	1	15.44	15.56	15.52	15.55
802.11b	2437	6	15.91	15.85	15.86	15.88
802.11b	2462	11	**16.02**	15.98	16.01	16.02

Table 9-5
IEEE 802.11g – FCC Rule Part 15C Average RF Power

Mode	Freq	Channel	802.11g (2.4 GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
	[MHz]		**6**	**9**	**12**	**18**	**24**	**36**	**48**	**54**
802.11g	2412	1	12.85	12.88	12.89	12.94	12.87	12.88	12.86	12.85
802.11g	2437	6	13.28	13.19	13.30	13.26	13.25	13.23	13.20	13.20
802.11g	2462	11	13.37	13.34	13.31	13.32	13.35	13.36	13.37	13.30

Table 9-6
IEEE 802.11n – FCC Rule Part 15C Average RF Power

Mode	Freq	Channel	802.11n (2.4 GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
	[MHz]		6.5	13	20	26	39	52	58	65
802.11n	2412	1	12.86	12.82	12.75	12.65	12.76	12.73	12.88	12.72
802.11n	2437	6	13.07	13.08	13.12	13.07	13.02	13.10	13.02	13.10
802.11n	2462	11	13.21	13.23	13.25	13.18	13.17	13.23	13.24	13.27

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

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

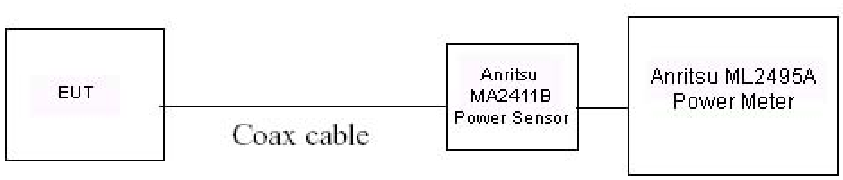


Figure 9-2
WLAN Power Measurement Setup

Table 9-7
Bluetooth – FCC Rule Part 15C RF Conducted Powers

Frequency [MHz]	Data Rate [Mbps]	Channel No.	Peak Conducted Power		Avg Conducted Power	
			[dBm]	[mW]	[dBm]	[mW]
2402	1.0	0	9.74	9.412	9.46	8.838
2441	1.0	39	10.33	10.799	10.23	10.539
2480	1.0	78	10.93	12.397	**10.81**	**12.052**
2402	2.0	0	9.58	9.074	7.14	5.182
2441	2.0	39	10.23	10.554	7.86	6.111
2480	2.0	78	10.71	11.781	8.49	7.070
2402	3.0	0	10.04	10.097	7.15	5.188
2441	3.0	39	10.66	11.644	7.97	6.260
2480	3.0	78	11.14	13.014	8.56	7.176

Note: The bolded data rate and channel above was tested for SAR.

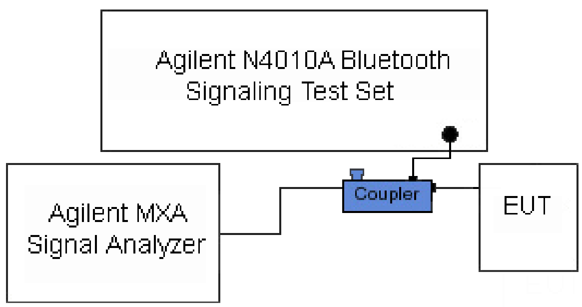


Figure 9-3
Bluetooth Power Measurement Setup

10 LTE POWER REDUCTION

10.1 Introduction to LTE Power Reduction

This device is capable of Simultaneous Voice and LTE (SVLTE) calls, with the voice call supported by a CDMA 1x-RTT transmitter and the data connection supported by a separate LTE transmitter. A LTE power reduction scheme is applied during a LTE connection operating simultaneously with 1x-RTT voice calls. The maximum transmit power of LTE is limited depending on the CDMA 1x voice transmit power level. When CDMA 1x Voice is operating at a certain range of high power levels, the maximum LTE transmit power is limited. When CDMA 1x Voice transmit power is below a certain threshold transmit power level, LTE can transmit at the maximum power. Target levels of power reduction and CDMA voice threshold levels are provided in Table 10-1.

Table 10-1
SVLTE Power Reduction Scheme

Mode	CDMA Current Voice Power for BC0, BC1, BC10 (dbm)	LTE Max Power for B25 (dBm)
SVLTE	P < 18.7	22.7
	P ≥ 18.7	18.7

10.2 Output Power Verification

Per KDB Publication 941225 D05v02 Section 4.4, output powers were measured in SVLTE mode to determine that the power reduction mechanism was operating reliably and consistently. The power reduction was investigated by simultaneously connecting the device to both LTE and CDMA base station simulators. LTE output powers were measured through conducted RF connections by first connecting the device in a LTE data call and subsequently a CDMA 1x-RTT call. CDMA powers were controlled by configuring the CDMA base station simulator to active bits. The LTE output power was monitored while changing the cell output power level.

The power reduction targets and threshold level described in **Table 10-1** were confirmed. Please see results in **Table 10-2**. The low and high channels were additionally confirmed to operate according to the SVLTE power reduction scheme.

Per the FCC change document for this device, the SVLTE power reduction mechanism remains the same as the original certified device. Therefore, SVLTE power reduction verification remains the same as the original device.

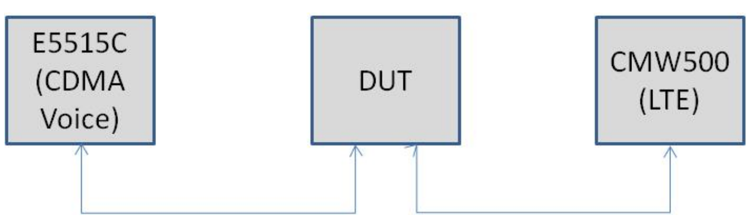


Figure 10-1
SVLTE Conducted Test Setup Diagram

Table 10-2
SVLTE Power Reduction Verification Results

BC0 1x-RTT CDMA Voice Channel	BC0 1x-RTT CDMA Voice Tx(dBm)	LTE Band 25 Conducted Power (dBm)													
		QPSK 1 RB 0 RB Offset	QPSK 1 RB 25 RB Offset	QPSK 1 RB 49 RB Offset	QPSK 25 RB 0 RB Offset	QPS 25 RB 12 RB Offset	QPSK 25 RB 25 RB Offset	QPSK 50 RB 0 RB Offset	16QAM 1 RB 0 RB Offset	16QAM 1 RB 25 RB Offset	16QAM 1 RB 49 RB Offset	16QAM 25 RB 0 RB Offset	16QAM 25 RB 12 RB Offset	16QAM 25 RB 25 RB Offset	16QAM 50 RB 0 RB Offset
384 (Mid)	24	18.94	18.91	18.97	18.85	18.80	18.85	18.84	18.40	18.32	18.39	18.86	18.85	18.86	18.85
	19.5	18.97	18.93	18.99	18.83	18.77	18.87	18.83	18.43	18.34	18.35	18.88	18.86	18.88	18.83
	18	22.85	22.79	22.88	21.66	21.65	21.64	21.61	21.54	21.56	21.51	20.81	20.80	20.81	20.78
	11	22.89	22.81	22.83	21.69	21.67	21.68	21.64	21.54	21.50	21.51	20.88	20.86	20.85	20.79

BC1 1x-RTT CDMA Voice Channel	BC1 1x-RTT CDMA Voice Tx(dBm)	LTE Band 25 Conducted Power (dBm)													
		QPSK 1 RB 0 RB Offset	QPSK 1 RB 25 RB Offset	QPSK 1 RB 49 RB Offset	QPSK 25 RB 0 RB Offset	QPS 25 RB 12 RB Offset	QPSK 25 RB 25 RB Offset	QPSK 50 RB 0 RB Offset	16QAM 1 RB 0 RB Offset	16QAM 1 RB 25 RB Offset	16QAM 1 RB 49 RB Offset	16QAM 25 RB 0 RB Offset	16QAM 25 RB 12 RB Offset	16QAM 25 RB 25 RB Offset	16QAM 50 RB 0 RB Offset
600 (Mid)	24	19.08	19.05	19.06	18.86	18.87	18.94	18.87	18.55	18.40	18.44	18.97	18.95	18.96	18.94
	19.5	19.03	19.01	19.03	18.91	18.86	18.96	18.84	18.62	18.46	18.53	18.94	18.97	18.92	18.95
	18	22.80	22.76	22.79	21.69	21.70	21.69	21.63	21.48	21.50	21.47	20.83	20.78	20.81	20.79
	11	22.75	22.77	22.77	21.74	21.73	21.74	21.68	21.55	21.43	21.44	20.83	20.84	20.85	20.75

BC10 1x-RTT CDMA Voice Channel	BC10 1x-RTT CDMA Voice Tx(dBm)	LTE Band 25 Conducted Power (dBm)													
		QPSK 1 RB 0 RB Offset	QPSK 1 RB 25 RB Offset	QPSK 1 RB 49 RB Offset	QPSK 25 RB 0 RB Offset	QPS 25 RB 12 RB Offset	QPSK 25 RB 25 RB Offset	QPSK 50 RB 0 RB Offset	16QAM 1 RB 0 RB Offset	16QAM 1 RB 25 RB Offset	16QAM 1 RB 49 RB Offset	16QAM 25 RB 0 RB Offset	16QAM 25 RB 12 RB Offset	16QAM 25 RB 25 RB Offset	16QAM 50 RB 0 RB Offset
564 (Mid)	24	19.00	18.94	19.01	18.84	18.86	18.92	18.85	18.45	18.36	18.42	18.88	18.86	18.89	18.85
	19.5	19.02	18.97	19.04	18.85	18.89	18.96	18.87	18.54	18.43	18.47	18.84	18.85	18.91	18.79
	18	22.81	22.73	22.77	21.69	21.68	21.71	21.61	21.45	21.48	21.46	20.74	20.76	20.77	20.77
	11	22.79	22.80	22.80	21.74	21.71	21.69	21.61	21.43	21.52	21.50	20.76	20.79	20.75	20.80

10.3 SVLTE SAR Testing Procedures

Per KDB 941225 D05v02 Section 4.4 B), SAR testing was additionally performed at the reduced CDMA and LTE power levels with respect to the simultaneous transmission scenarios. Additional samples were tuned to fixed reduced power levels to represent the SVLTE condition in a standalone environment. While the power reduction mechanism is activated at the CDMA Voice power level of 18.7 dBm, simultaneous SAR summations of maximum power LTE were evaluated at this reduced fixed CDMA voice power level. SAR was additionally evaluated at reduced power LTE levels to perform simultaneous SAR analysis when CDMA voice is at maximum power.

10.3.1 Reduced LTE Band 25 Conducted Powers

Table 10-3
Reduced LTE Band 25 – FCC Rule Part 24E Conducted Powers – 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Low	1855	26090	10	QPSK	1	0	18.79	0	0
	1855	26090	10	QPSK	1	25	18.81	0	0
	1855	26090	10	QPSK	1	49	18.77	0	0
	1855	26090	10	QPSK	25	0	18.87	0	0-1
	1855	26090	10	QPSK	25	12	18.80	0	0-1
	1855	26090	10	QPSK	25	25	18.71	0	0-1
	1855	26090	10	QPSK	50	0	18.77	0	0-1
	1855	26090	10	16QAM	1	0	19.11	0	0-1
	1855	26090	10	16QAM	1	25	19.07	0	0-1
	1855	26090	10	16QAM	1	49	19.02	0	0-1
	1855	26090	10	16QAM	25	0	18.89	0	0-2
	1855	26090	10	16QAM	25	12	18.75	0	0-2
	1855	26090	10	16QAM	25	25	18.77	0	0-2
	1855	26090	10	16QAM	50	0	18.74	0	0-2
Mid	1882.5	26365	10	QPSK	1	0	18.76	0	0
	1882.5	26365	10	QPSK	1	25	18.79	0	0
	1882.5	26365	10	QPSK	1	49	18.83	0	0
	1882.5	26365	10	QPSK	25	0	18.66	0	0-1
	1882.5	26365	10	QPSK	25	12	18.81	0	0-1
	1882.5	26365	10	QPSK	25	25	18.70	0	0-1
	1882.5	26365	10	QPSK	50	0	18.74	0	0-1
	1882.5	26365	10	16QAM	1	0	18.64	0	0-1
	1882.5	26365	10	16QAM	1	25	18.73	0	0-1
	1882.5	26365	10	16QAM	1	49	18.72	0	0-1
	1882.5	26365	10	16QAM	25	0	18.70	0	0-2
	1882.5	26365	10	16QAM	25	12	18.73	0	0-2
	1882.5	26365	10	16QAM	25	25	18.61	0	0-2
	1882.5	26365	10	16QAM	50	0	18.68	0	0-2
High	1910	26640	10	QPSK	1	0	18.98	0	0
	1910	26640	10	QPSK	1	25	**19.00**	0	0
	1910	26640	10	QPSK	1	49	18.95	0	0
	1910	26640	10	QPSK	25	0	18.83	0	0-1
	1910	26640	10	QPSK	25	12	**18.91**	0	0-1
	1910	26640	10	QPSK	25	25	18.80	0	0-1
	1910	26640	10	QPSK	50	0	18.71	0	0-1
	1910	26640	10	16QAM	1	0	18.92	0	0-1
	1910	26640	10	16QAM	1	25	19.04	0	0-1
	1910	26640	10	16QAM	1	49	18.93	0	0-1
	1910	26640	10	16QAM	25	0	18.86	0	0-2
	1910	26640	10	16QAM	25	12	18.85	0	0-2
	1910	26640	10	16QAM	25	25	18.86	0	0-2
	1910	26640	10	16QAM	50	0	18.68	0	0-2

LTE Notes:
1. Please refer to Section 8.4.4 for LTE testing requirements per FCC KDB 941225 D05.
2. The bolded powers were tested for SAR.

Table 10-4
Reduced LTE Band 25 – FCC Rule Part 24E Conducted Powers – 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Low	1852.5	26065	5	QPSK	1	0	18.97	0	0
	1852.5	26065	5	QPSK	1	12	18.88	0	0
	1852.5	26065	5	QPSK	1	24	18.93	0	0
	1852.5	26065	5	QPSK	12	0	19.02	0	0-1
	1852.5	26065	5	QPSK	12	6	18.94	0	0-1
	1852.5	26065	5	QPSK	12	13	18.87	0	0-1
	1852.5	26065	5	QPSK	25	0	18.88	0	0-1
	1852.5	26065	5	16-QAM	1	0	18.85	0	0-1
	1852.5	26065	5	16-QAM	1	12	18.78	0	0-1
	1852.5	26065	5	16-QAM	1	24	18.79	0	0-1
	1852.5	26065	5	16-QAM	12	0	19.01	0	0-2
	1852.5	26065	5	16-QAM	12	6	18.91	0	0-2
	1852.5	26065	5	16-QAM	12	13	19.00	0	0-2
	1852.5	26065	5	16-QAM	25	0	18.95	0	0-2
Mid	1882.5	26365	5	QPSK	1	0	18.77	0	0
	1882.5	26365	5	QPSK	1	12	18.83	0	0
	1882.5	26365	5	QPSK	1	24	18.76	0	0
	1882.5	26365	5	QPSK	12	0	18.83	0	0-1
	1882.5	26365	5	QPSK	12	6	18.84	0	0-1
	1882.5	26365	5	QPSK	12	13	18.80	0	0-1
	1882.5	26365	5	QPSK	25	0	18.69	0	0-1
	1882.5	26365	5	16-QAM	1	0	18.72	0	0-1
	1882.5	26365	5	16-QAM	1	12	18.71	0	0-1
	1882.5	26365	5	16-QAM	1	24	18.66	0	0-1
	1882.5	26365	5	16-QAM	12	0	18.78	0	0-2
	1882.5	26365	5	16-QAM	12	6	18.83	0	0-2
	1882.5	26365	5	16-QAM	12	13	18.75	0	0-2
	1882.5	26365	5	16-QAM	25	0	18.75	0	0-2
High	1912.5	26665	5	QPSK	1	0	19.11	0	0
	1912.5	26665	5	QPSK	1	12	19.08	0	0
	1912.5	26665	5	QPSK	1	24	19.04	0	0
	1912.5	26665	5	QPSK	12	0	19.03	0	0-1
	1912.5	26665	5	QPSK	12	6	18.96	0	0-1
	1912.5	26665	5	QPSK	12	13	19.05	0	0-1
	1912.5	26665	5	QPSK	25	0	18.83	0	0-1
	1912.5	26665	5	16-QAM	1	0	19.07	0	0-1
	1912.5	26665	5	16-QAM	1	12	19.09	0	0-1
	1912.5	26665	5	16-QAM	1	24	19.10	0	0-1
	1912.5	26665	5	16-QAM	12	0	18.91	0	0-2
	1912.5	26665	5	16-QAM	12	6	18.87	0	0-2
	1912.5	26665	5	16-QAM	12	13	18.90	0	0-2
	1912.5	26665	5	16-QAM	25	0	18.82	0	0-2

Table 10-5
Reduced LTE Band 25 – FCC Rule Part 24E Conducted Powers – 3 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Low	1851.5	26055	3	QPSK	1	0	19.07	0	0
	1851.5	26055	3	QPSK	1	7	19.04	0	0
	1851.5	26055	3	QPSK	1	14	18.90	0	0
	1851.5	26055	3	QPSK	8	0	18.94	0	0-1
	1851.5	26055	3	QPSK	8	4	19.09	0	0-1
	1851.5	26055	3	QPSK	8	7	19.03	0	0-1
	1851.5	26055	3	QPSK	15	0	18.90	0	0-1
	1851.5	26055	3	16-QAM	1	0	18.85	0	0-1
	1851.5	26055	3	16-QAM	1	7	18.75	0	0-1
	1851.5	26055	3	16-QAM	1	14	18.77	0	0-1
	1851.5	26055	3	16-QAM	8	0	19.02	0	0-2
	1851.5	26055	3	16-QAM	8	4	19.09	0	0-2
	1851.5	26055	3	16-QAM	8	7	19.03	0	0-2
	1851.5	26055	3	16-QAM	15	0	18.91	0	0-2
Mid	1882.5	26365	3	QPSK	1	0	18.85	0	0
	1882.5	26365	3	QPSK	1	7	18.91	0	0
	1882.5	26365	3	QPSK	1	14	18.80	0	0
	1882.5	26365	3	QPSK	8	0	18.94	0	0-1
	1882.5	26365	3	QPSK	8	4	18.93	0	0-1
	1882.5	26365	3	QPSK	8	7	18.93	0	0-1
	1882.5	26365	3	QPSK	15	0	18.89	0	0-1
	1882.5	26365	3	16-QAM	1	0	18.92	0	0-1
	1882.5	26365	3	16-QAM	1	7	18.84	0	0-1
	1882.5	26365	3	16-QAM	1	14	18.83	0	0-1
	1882.5	26365	3	16-QAM	8	0	18.80	0	0-2
	1882.5	26365	3	16-QAM	8	4	18.63	0	0-2
	1882.5	26365	3	16-QAM	8	7	18.64	0	0-2
	1882.5	26365	3	16-QAM	15	0	18.89	0	0-2
High	1913.5	26675	3	QPSK	1	0	18.94	0	0
	1913.5	26675	3	QPSK	1	7	18.98	0	0
	1913.5	26675	3	QPSK	1	14	18.94	0	0
	1913.5	26675	3	QPSK	8	0	18.95	0	0-1
	1913.5	26675	3	QPSK	8	4	19.03	0	0-1
	1913.5	26675	3	QPSK	8	7	19.06	0	0-1
	1913.5	26675	3	QPSK	15	0	18.87	0	0-1
	1913.5	26675	3	16-QAM	1	0	19.08	0	0-1
	1913.5	26675	3	16-QAM	1	7	19.02	0	0-1
	1913.5	26675	3	16-QAM	1	14	19.01	0	0-1
	1913.5	26675	3	16-QAM	8	0	19.04	0	0-2
	1913.5	26675	3	16-QAM	8	4	19.05	0	0-2
	1913.5	26675	3	16-QAM	8	7	19.12	0	0-2
	1913.5	26675	3	16-QAM	15	0	18.91	0	0-2

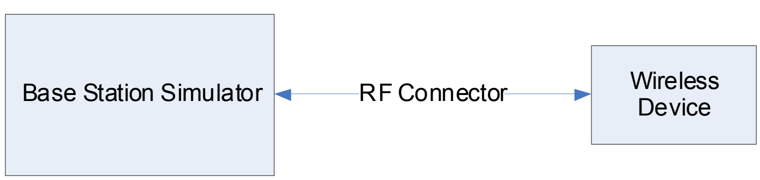


Figure 10-2
Power Measurement Setup

10.3.2 Threshold CDMA Conducted Powers

Table 10-6
Threshold CDMA Conducted Powers

Band	Channel	Rule Part	Frequency	SO55 [dBm]	SO55 [dBm]	SO75 [dBm]	TDSO SO32 [dBm]	TDSO SO32 [dBm]
	F-RC		MHz	RC1	RC3	RC8	FCH+SCH	FCH
Cellular	564	90S	820.1	19.13	19.17	19.01	19.11	19.12
Cellular	1013	22H	824.7	19.00	19.02	18.87	19.06	19.04
	384	22H	836.52	18.95	18.98	18.78	19.06	19.11
	777	22H	848.31	19.09	19.10	19.03	19.16	19.16
PCS	25	24E	1851.25	19.02	18.96	18.75	18.98	19.02
	600	24E	1880	19.13	19.03	18.84	19.00	19.04
	1175	24E	1908.75	19.16	19.17	18.97	19.15	19.18

Notes:
1. RC1 is only applicable for IS-95 compatibility.
2. There is no power reduction applied to the CDMA Voice modes, however the device with output powers represented in the table above was tuned down (for SAR Test purposes only) to analyze simultaneous SAR scenarios in the SVLTE condition where LTE is operating at maximum output power in conjunction with a lower CDMA voice level (see Table 10-1).
3. For FCC Rule Part 90S, Per FCC KDB Publication 447498 D01v05 4.1.6, only one channel is required since the device operates within the transmission range of 817.90 – 823.10 MHz.

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.
2. Body-Worn SAR was tested with 1x RTT with TDSO / SO32 FCH Only. 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. CDMA 1x-RTT SAR was required to be evaluated for Hotspot exposure conditions to support simultaneous transmission capabilities.

1x Advanced Considerations per October 2012 TCB Workshop:
1. CDMA 1X Advanced technology was not required for SAR since the maximum output powers for 1x Advanced was not more than 0.25 dB higher than the maximum measured powers for 1x and the measured SAR in any 1x mode exposure conditions was not greater than 1.2 W/kg. See Section 8.3.2 for 1x Advanced test set up.

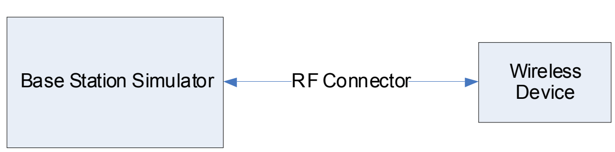


Figure 10-3
Power Measurement Setup

11 SYSTEM VERIFICATION

11.1 Tissue Verification

Table 11-1
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
3/7/2013	835H	23.5	820	0.917	42.236	0.898	41.571	2.12%	1.60%
			835	0.934	42.102	0.900	41.500	3.78%	1.45%
			850	0.950	41.861	0.916	41.500	3.71%	0.87%
3/11/2013	1900H	23.2	1850	1.373	40.597	1.400	40.000	-1.93%	1.49%
			1880	1.405	40.468	1.400	40.000	0.36%	1.17%
			1910	1.434	40.420	1.400	40.000	2.43%	1.05%
3/7/2013	2450H	22.9	2401	1.780	41.185	1.758	39.298	1.25%	4.80%
			2450	1.837	40.994	1.800	39.200	2.06%	4.58%
			2499	1.899	40.773	1.852	39.135	2.54%	4.19%
3/14/2013	835B	23.5	820	0.947	54.151	0.969	55.258	-2.27%	-2.00%
			835	0.962	54.029	0.970	55.200	-0.82%	-2.12%
			850	0.977	53.889	0.988	55.154	-1.11%	-2.29%
3/14/2013	1900B	21.5	1850	1.539	51.588	1.520	53.300	1.25%	-3.21%
			1880	1.567	51.427	1.520	53.300	3.09%	-3.51%
			1910	1.595	51.320	1.520	53.300	4.93%	-3.71%
3/19/2013	1900B	22.1	1850	1.471	52.248	1.520	53.300	-3.22%	-1.97%
			1880	1.502	52.099	1.520	53.300	-1.18%	-2.25%
			1910	1.534	52.060	1.520	53.300	0.92%	-2.33%
3/4/2013	2450B	23.0	2401	1.915	51.521	1.903	52.765	0.63%	-2.36%
			2450	1.977	51.362	1.950	52.700	1.38%	-2.54%
			2499	2.042	51.164	2.019	52.638	1.14%	-2.80%
3/14/2013	2450B	24.0	2401	1.947	51.594	1.903	52.765	2.31%	-2.22%
			2450	2.010	51.380	1.950	52.700	3.08%	-2.50%
			2499	2.076	51.222	2.019	52.638	2.82%	-2.69%

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

11.2 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 11-2
System Verification Results

System Verification TARGET & MEASURED											
Tissue Frequency (MHz)	Tissue Type	Date:	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Dipole SN	Probe SN	Measured SAR_{1g} (W/kg)	1 W Target SAR_{1g} (W/kg)	1 W Normalized SAR_{1g} (W/kg)	Deviation (%)
835	HEAD	03/07/2013	24.4	23.5	0.100	4d026	3022	0.996	9.390	9.960	6.07%
1900	HEAD	03/11/2013	24.4	23.0	0.100	5d148	3920	3.910	39.700	39.100	-1.51%
2450	HEAD	03/07/2013	23.6	23.1	0.100	719	3287	5.590	52.700	55.900	6.07%
835	BODY	03/14/2013	24.4	22.7	0.100	4d026	3022	0.959	9.580	9.590	0.10%
1900	BODY	03/14/2013	23.9	22.7	0.100	5d148	3213	4.150	40.800	41.500	1.72%
1900	BODY	03/19/2013	23.1	22.4	0.100	5d148	3213	4.090	40.800	40.900	0.25%
2450	BODY	03/04/2013	23.8	22.1	0.100	719	3287	4.910	51.600	49.100	-4.84%
2450	BODY	03/14/2013	23.5	23.2	0.100	797	3288	5.080	49.600	50.800	2.42%

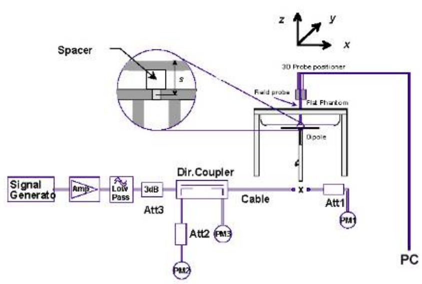


Figure 11-1
System Verification Setup Diagram

Figure 11-2
System Verification Setup Photo

12 SAR DATA SUMMARY

12.1 Standalone Head SAR Data

Table 12-1
Cell. CDMA/EVDO - FCC Rule Part 90S Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
820.10	564	Cell. CDMA/EVDO - FCC Rule Part 90S	RC3 / SO55	24.5	24.10	0.01	Right	Cheek	1078	1:1	0.347	1.096	0.380	
820.10	564	Cell. CDMA/EVDO - FCC Rule Part 90S	RC3 / SO55	24.5	24.10	0.19	Right	Tilt	1078	1:1	0.212	1.096	0.232	
820.10	564	Cell. CDMA/EVDO - FCC Rule Part 90S	RC3 / SO55	24.5	24.10	0.01	Left	Cheek	1078	1:1	0.429	1.096	0.470	
820.10	564	Cell. CDMA/EVDO - FCC Rule Part 90S	RC3 / SO55	24.5	24.10	-0.03	Left	Tilt	1078	1:1	0.245	1.096	0.269	
820.10	564	Cell. CDMA/EVDO - FCC Rule Part 90S	RC3 / SO55	19.2	19.17	0.03	Right	Cheek	1287	1:1	0.104	1.007	0.105	
820.10	564	Cell. CDMA/EVDO - FCC Rule Part 90S	RC3 / SO55	19.2	19.17	0.08	Right	Tilt	1287	1:1	0.066	1.007	0.067	
820.10	564	Cell. CDMA/EVDO - FCC Rule Part 90S	RC3 / SO55	19.2	19.17	0.01	Left	Cheek	1287	1:1	0.134	1.007	0.135	
820.10	564	Cell. CDMA/EVDO - FCC Rule Part 90S	RC3 / SO55	19.2	19.17	0.02	Left	Tilt	1287	1:1	0.074	1.007	0.074	
820.10	564	Cell. CDMA/EVDO - FCC Rule Part 90S	EVDO Rev. A	24.5	24.04	0.01	Right	Cheek	1078	1:1	0.348	1.112	0.387	
820.10	564	Cell. CDMA/EVDO - FCC Rule Part 90S	EVDO Rev. A	24.5	24.04	-0.11	Right	Tilt	1078	1:1	0.163	1.112	0.181	
820.10	564	Cell. CDMA/EVDO - FCC Rule Part 90S	EVDO Rev. A	24.5	24.04	-0.04	Left	Cheek	1078	1:1	0.457	1.112	0.508	A1
820.10	564	Cell. CDMA/EVDO - FCC Rule Part 90S	EVDO Rev. A	24.5	24.04	-0.16	Left	Tilt	1078	1:1	0.242	1.112	0.269	
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 12-2
Cell. CDMA/EVDO - FCC Rule Part 22H Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
836.52	384	Cell. CDMA/EVDO - FCC Rule Part 22H	RC3 / SO55	24.5	24.24	0.02	Right	Cheek	1078	1:1	0.469	1.062	0.498	
836.52	384	Cell. CDMA/EVDO - FCC Rule Part 22H	RC3 / SO55	24.5	24.24	0.03	Right	Tilt	1078	1:1	0.277	1.062	0.294	
836.52	384	Cell. CDMA/EVDO - FCC Rule Part 22H	RC3 / SO55	24.5	24.24	-0.01	Left	Cheek	1078	1:1	0.554	1.062	0.588	
836.52	384	Cell. CDMA/EVDO - FCC Rule Part 22H	RC3 / SO55	24.5	24.24	-0.02	Left	Tilt	1078	1:1	0.301	1.062	0.320	
836.52	384	Cell. CDMA/EVDO - FCC Rule Part 22H	RC3 / SO55	19.2	18.98	0.07	Right	Cheek	1287	1:1	0.123	1.052	0.129	
836.52	384	Cell. CDMA/EVDO - FCC Rule Part 22H	RC3 / SO55	19.2	18.98	0.14	Right	Tilt	1287	1:1	0.080	1.052	0.084	
836.52	384	Cell. CDMA/EVDO - FCC Rule Part 22H	RC3 / SO55	19.2	18.98	0.09	Left	Cheek	1287	1:1	0.156	1.052	0.164	
836.52	384	Cell. CDMA/EVDO - FCC Rule Part 22H	RC3 / SO55	19.2	18.98	0.00	Left	Tilt	1287	1:1	0.084	1.052	0.088	
836.52	384	Cell. CDMA/EVDO - FCC Rule Part 22H	EVDO Rev. A	24.5	24.16	-0.11	Right	Cheek	1078	1:1	0.459	1.081	0.496	
836.52	384	Cell. CDMA/EVDO - FCC Rule Part 22H	EVDO Rev. A	24.5	24.16	0.00	Right	Tilt	1078	1:1	0.269	1.081	0.291	
836.52	384	Cell. CDMA/EVDO - FCC Rule Part 22H	EVDO Rev. A	24.5	24.16	-0.05	Left	Cheek	1078	1:1	0.559	1.081	0.604	A2
836.52	384	Cell. CDMA/EVDO - FCC Rule Part 22H	EVDO Rev. A	24.5	24.16	0.03	Left	Tilt	1078	1:1	0.295	1.081	0.319	
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 12-3
PCS CDMA/EVDO - FCC Rule Part 24E Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
1880.00	600	PCS CDMA/EVDO - FCC Rule Part 24E	RC3 / SO55	24.5	24.09	0.16	Right	Cheek	1078	1:1	0.348	1.099	0.382	
1880.00	600	PCS CDMA/EVDO - FCC Rule Part 24E	RC3 / SO55	24.5	24.09	0.05	Right	Tilt	1078	1:1	0.221	1.099	0.243	
1880.00	600	PCS CDMA/EVDO - FCC Rule Part 24E	RC3 / SO55	24.5	24.09	-0.01	Left	Cheek	1078	1:1	0.603	1.099	0.663	A3
1880.00	600	PCS CDMA/EVDO - FCC Rule Part 24E	RC3 / SO55	24.5	24.09	0.04	Left	Tilt	1078	1:1	0.182	1.099	0.200	
1880.00	600	PCS CDMA/EVDO - FCC Rule Part 24E	RC3 / SO55	19.2	19.03	0.00	Right	Cheek	1287	1:1	0.098	1.040	0.102	
1880.00	600	PCS CDMA/EVDO - FCC Rule Part 24E	RC3 / SO55	19.2	19.03	0.18	Right	Tilt	1287	1:1	0.075	1.040	0.078	
1880.00	600	PCS CDMA/EVDO - FCC Rule Part 24E	RC3 / SO55	19.2	19.03	0.10	Left	Cheek	1287	1:1	0.177	1.040	0.184	
1880.00	600	PCS CDMA/EVDO - FCC Rule Part 24E	RC3 / SO55	19.2	19.03	-0.06	Left	Tilt	1287	1:1	0.063	1.040	0.066	
1880.00	600	PCS CDMA/EVDO - FCC Rule Part 24E	EVDO Rev. A	24.5	24.18	0.07	Right	Cheek	1078	1:1	0.389	1.076	0.419	
1880.00	600	PCS CDMA/EVDO - FCC Rule Part 24E	EVDO Rev. A	24.5	24.18	0.08	Right	Tilt	1078	1:1	0.217	1.076	0.233	
1880.00	600	PCS CDMA/EVDO - FCC Rule Part 24E	EVDO Rev. A	24.5	24.18	0.06	Left	Cheek	1078	1:1	0.599	1.076	0.645	
1880.00	600	PCS CDMA/EVDO - FCC Rule Part 24E	EVDO Rev. A	24.5	24.18	-0.06	Left	Tilt	1078	1:1	0.180	1.076	0.194	
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 12-4
LTE Band 25 - FCC Rule Part 24E Head SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
1855.00	26090	Low	LTE Band 25 - FCC Rule Part 24E	10	23.2	22.84	0.00	0	Right	Cheek	QPSK	1	0	1167	1:1	0.873	1.086	0.948	A4
1882.50	26365	Mid	LTE Band 25 - FCC Rule Part 24E	10	23.2	22.86	0.02	0	Right	Cheek	QPSK	1	0	1167	1:1	0.824	1.081	0.891	
1910.00	26640	High	LTE Band 25 - FCC Rule Part 24E	10	23.2	22.76	-0.04	0	Right	Cheek	QPSK	1	0	1167	1:1	0.840	1.107	0.930	
1855.00	26090	Low	LTE Band 25 - FCC Rule Part 24E	10	22.2	21.88	-0.05	1	Right	Cheek	QPSK	25	0	1167	1:1	0.687	1.076	0.739	
1855.00	26090	Low	LTE Band 25 - FCC Rule Part 24E	10	22.2	21.67	-0.02	1	Right	Cheek	QPSK	50	0	1167	1:1	0.651	1.130	0.736	
1882.50	26365	Mid	LTE Band 25 - FCC Rule Part 24E	10	23.2	22.86	-0.10	0	Right	Tilt	QPSK	1	0	1167	1:1	0.330	1.081	0.357	
1855.00	26090	Low	LTE Band 25 - FCC Rule Part 24E	10	22.2	21.88	0.02	1	Right	Tilt	QPSK	25	0	1167	1:1	0.283	1.076	0.305	
1882.50	26365	Mid	LTE Band 25 - FCC Rule Part 24E	10	23.2	22.86	0.05	0	Left	Cheek	QPSK	1	0	1167	1:1	0.433	1.081	0.468	
1855.00	26090	Low	LTE Band 25 - FCC Rule Part 24E	10	22.2	21.88	0.06	1	Left	Cheek	QPSK	25	0	1167	1:1	0.350	1.076	0.377	
1882.50	26365	Mid	LTE Band 25 - FCC Rule Part 24E	10	23.2	22.86	-0.16	0	Left	Tilt	QPSK	1	0	1167	1:1	0.396	1.081	0.428	
1855.00	26090	Low	LTE Band 25 - FCC Rule Part 24E	10	22.2	21.88	-0.02	1	Left	Tilt	QPSK	25	0	1167	1:1	0.301	1.076	0.324	
1910.00	26640	High	LTE Band 25 - FCC Rule Part 24E	10	19.2	19.00	-0.15	0	Right	Cheek	QPSK	1	25	1276	1:1	0.332	1.047	0.348	
1910.00	26640	High	LTE Band 25 - FCC Rule Part 24E	10	19.2	18.91	0.08	0	Right	Cheek	QPSK	25	12	1276	1:1	0.317	1.069	0.339	
1910.00	26640	High	LTE Band 25 - FCC Rule Part 24E	10	19.2	19.00	0.08	0	Right	Tilt	QPSK	1	25	1276	1:1	0.120	1.047	0.126	
1910.00	26640	High	LTE Band 25 - FCC Rule Part 24E	10	19.2	18.91	0.04	0	Right	Tilt	QPSK	25	12	1276	1:1	0.118	1.069	0.126	
1910.00	26640	High	LTE Band 25 - FCC Rule Part 24E	10	19.2	19.00	0.08	0	Left	Cheek	QPSK	1	25	1276	1:1	0.161	1.047	0.169	
1910.00	26640	High	LTE Band 25 - FCC Rule Part 24E	10	19.2	18.91	0.07	0	Left	Cheek	QPSK	25	12	1276	1:1	0.162	1.069	0.173	
1910.00	26640	High	LTE Band 25 - FCC Rule Part 24E	10	19.2	19.00	0.12	0	Left	Tilt	QPSK	1	25	1276	1:1	0.147	1.047	0.154	
1910.00	26640	High	LTE Band 25 - FCC Rule Part 24E	10	19.2	18.91	0.08	0	Left	Tilt	QPSK	25	12	1276	1:1	0.140	1.069	0.150	
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 12-5
DTS Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Data Rate (Mbps)	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
2462	11	IEEE 802.11b - FCC Rule Part 15C	DSSS	16.1	16.02	0.04	Right	Cheek	1196	1	1:1	0.073	1.019	0.074	
2462	11	IEEE 802.11b - FCC Rule Part 15C	DSSS	16.1	16.02	0.11	Right	Tilt	1196	1	1:1	0.035	1.019	0.035	
2462	11	IEEE 802.11b - FCC Rule Part 15C	DSSS	16.1	16.02	0.05	Left	Cheek	1196	1	1:1	0.081	1.019	0.083	A5
2462	11	IEEE 802.11b - FCC Rule Part 15C	DSSS	16.1	16.02	-0.02	Left	Tilt	1196	1	1:1	0.034	1.019	0.035	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Head 1.6 W/kg (mW/g) averaged over 1 gram							

12.2 Standalone Body-Worn SAR Data

Table 12-6
CDMA Body-Worn SAR Data

MEASUREMENT RESULTS														
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Duty Cycle	Side	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
820.10	564	Cell. CDMA - FCC Rule Part 90S	TDSO / SO32	24.5	24.10	0.08	10 mm	1078	1:1	back	0.600	1.096	0.658	A6
820.10	564	Cell. CDMA - FCC Rule Part 90S	TDSO / SO32	19.2	19.12	0.05	10 mm	1287	1:1	back	0.182	1.019	0.185	
836.52	384	Cell. CDMA - FCC Rule Part 22H	TDSO / SO32	24.5	24.34	-0.13	10 mm	1078	1:1	back	0.690	1.038	0.716	A7
836.52	384	Cell. CDMA - FCC Rule Part 22H	TDSO / SO32	19.2	19.11	0.07	10 mm	1287	1:1	back	0.180	1.021	0.184	
1851.25	25	PCS CDMA - FCC Rule Part 24E	TDSO / SO32	24.5	24.29	-0.07	10 mm	1078	1:1	back	0.955	1.050	1.003	A9
1880.00	600	PCS CDMA - FCC Rule Part 24E	TDSO / SO32	24.5	24.16	-0.15	10 mm	1078	1:1	back	0.864	1.081	0.934	
1908.75	1175	PCS CDMA - FCC Rule Part 24E	TDSO / SO32	24.5	24.03	-0.05	10 mm	1078	1:1	back	0.948	1.114	**1.056**	
1880.00	600	PCS CDMA - FCC Rule Part 24E	TDSO / SO32	19.2	19.04	-0.03	10 mm	1287	1:1	back	0.311	1.038	0.323	
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 12-7
LTE Body-Worn SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
1855.00	26090	Low	LTE Band 25 - FCC Rule Part 24E	10	23.2	22.84	-0.04	0	1167	QPSK	1	0	10 mm	back	1:1	0.853	1.086	0.926	A11
1882.50	26365	Mid	LTE Band 25 - FCC Rule Part 24E	10	23.2	22.86	0.00	0	1167	QPSK	1	0	10 mm	back	1:1	0.790	1.081	0.854	
1910.00	26640	High	LTE Band 25 - FCC Rule Part 24E	10	23.2	22.76	0.14	0	1167	QPSK	1	0	10 mm	back	1:1	0.740	1.107	0.819	
1855.00	26090	Low	LTE Band 25 - FCC Rule Part 24E	10	22.2	21.88	-0.05	1	1167	QPSK	25	0	10 mm	back	1:1	0.576	1.076	0.620	
1855.00	26090	Low	LTE Band 25 - FCC Rule Part 24E	10	22.2	21.67	0.00	1	1167	QPSK	50	0	10 mm	back	1:1	0.738	1.130	0.834	
1910.00	26640	High	LTE Band 25 - FCC Rule Part 24E	10	19.2	19.00	-0.08	0	1276	QPSK	1	25	10 mm	back	1:1	0.312	1.047	0.327	
1910.00	26640	High	LTE Band 25 - FCC Rule Part 24E	10	19.2	18.91	0.00	0	1276	QPSK	25	12	10 mm	back	1:1	0.302	1.069	0.323	
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 12-8
DTS Body-Worn SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
2462	11	IEEE 802.11b - FCC Rule Part 15C	DSSS	16.1	16.02	0.03	10 mm	1196	1	back	1:1	0.161	1.019	**0.164**	A12
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 12-9
DSS Body-Worn SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
2480	78	Bluetooth - FCC Rule Part 15C	FHSS	10.9	10.81	0.15	10 mm	1196	1	back	1:1	0.005	1.021	0.005	A13
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram								

12.3 Standalone Wireless Router SAR Data

Table 12-10
CDMA/EVDO Hotspot SAR Data

MEASUREMENT RESULTS														
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Duty Cycle	Side	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
820.10	564	Cell. CDMA - FCC Rule Part 90S	TDSO / SO32	24.5	24.10	0.08	10 mm	1078	1:1	back	0.600	1.096	0.658	A6
820.10	564	Cell. CDMA - FCC Rule Part 90S	TDSO / SO32	24.5	24.10	-0.02	10 mm	1078	1:1	front	0.438	1.096	0.480	
820.10	564	Cell. CDMA - FCC Rule Part 90S	TDSO / SO32	24.5	24.10	-0.06	10 mm	1078	1:1	bottom	0.180	1.096	0.197	
820.10	564	Cell. CDMA - FCC Rule Part 90S	TDSO / SO32	24.5	24.10	0.02	10 mm	1078	1:1	left	0.561	1.096	0.615	
820.10	564	Cell. CDMA - FCC Rule Part 90S	TDSO / SO32	19.2	19.12	0.05	10 mm	1287	1:1	back	0.182	1.019	0.185	
820.10	564	Cell. CDMA - FCC Rule Part 90S	TDSO / SO32	19.2	19.12	0.00	10 mm	1287	1:1	front	0.153	1.019	0.156	
820.10	564	Cell. CDMA - FCC Rule Part 90S	TDSO / SO32	19.2	19.12	0.06	10 mm	1287	1:1	bottom	0.063	1.019	0.064	
820.10	564	Cell. CDMA - FCC Rule Part 90S	TDSO / SO32	19.2	19.12	0.00	10 mm	1287	1:1	left	0.175	1.019	0.178	
820.10	564	Cell. CDMA - FCC Rule Part 90S	EVDO Rev. 0	24.5	24.12	-0.02	10 mm	1078	1:1	back	0.485	1.091	0.529	
820.10	564	Cell. CDMA - FCC Rule Part 90S	EVDO Rev. 0	24.5	24.12	0.02	10 mm	1078	1:1	front	0.392	1.091	0.428	
820.10	564	Cell. CDMA - FCC Rule Part 90S	EVDO Rev. 0	24.5	24.12	-0.14	10 mm	1078	1:1	bottom	0.214	1.091	0.233	
820.10	564	Cell. CDMA - FCC Rule Part 90S	EVDO Rev. 0	24.5	24.12	0.02	10 mm	1078	1:1	left	0.582	1.091	0.635	
836.52	384	Cell. CDMA - FCC Rule Part 22H	TDSO / SO32	24.5	24.34	-0.13	10 mm	1078	1:1	back	0.690	1.038	0.716	
836.52	384	Cell. CDMA - FCC Rule Part 22H	TDSO / SO32	24.5	24.34	0.03	10 mm	1078	1:1	front	0.589	1.038	0.611	
836.52	384	Cell. CDMA - FCC Rule Part 22H	TDSO / SO32	24.5	24.34	-0.07	10 mm	1078	1:1	bottom	0.266	1.038	0.276	
836.52	384	Cell. CDMA - FCC Rule Part 22H	TDSO / SO32	24.5	24.34	0.00	10 mm	1078	1:1	left	0.762	1.038	0.791	A8
836.52	384	Cell. CDMA - FCC Rule Part 22H	TDSO / SO32	19.2	19.11	0.07	10 mm	1287	1:1	back	0.180	1.021	0.184	
836.52	384	Cell. CDMA - FCC Rule Part 22H	TDSO / SO32	19.2	19.11	0.02	10 mm	1287	1:1	front	0.173	1.021	0.177	
836.52	384	Cell. CDMA - FCC Rule Part 22H	TDSO / SO32	19.2	19.11	-0.04	10 mm	1287	1:1	bottom	0.083	1.021	0.085	
836.52	384	Cell. CDMA - FCC Rule Part 22H	TDSO / SO32	19.2	19.11	-0.03	10 mm	1287	1:1	left	0.195	1.021	0.199	
836.52	384	Cell. CDMA - FCC Rule Part 22H	EVDO Rev. 0	24.5	24.20	0.02	10 mm	1078	1:1	back	0.634	1.072	0.680	
836.52	384	Cell. CDMA - FCC Rule Part 22H	EVDO Rev. 0	24.5	24.20	0.13	10 mm	1078	1:1	front	0.497	1.072	0.533	
836.52	384	Cell. CDMA - FCC Rule Part 22H	EVDO Rev. 0	24.5	24.20	0.00	10 mm	1078	1:1	bottom	0.243	1.072	0.260	
836.52	384	Cell. CDMA - FCC Rule Part 22H	EVDO Rev. 0	24.5	24.20	-0.02	10 mm	1078	1:1	left	0.732	1.072	0.785	
1851.25	25	PCS CDMA - FCC Rule Part 24E	TDSO / SO32	24.5	24.29	-0.07	10 mm	1078	1:1	back	0.955	1.050	1.003	
1880.00	600	PCS CDMA - FCC Rule Part 24E	TDSO / SO32	24.5	24.16	-0.15	10 mm	1078	1:1	back	0.864	1.081	0.934	
1908.75	1175	PCS CDMA - FCC Rule Part 24E	TDSO / SO32	24.5	24.03	-0.05	10 mm	1078	1:1	back	0.948	1.114	1.056	
1880.00	600	PCS CDMA - FCC Rule Part 24E	TDSO / SO32	24.5	24.16	0.07	10 mm	1078	1:1	front	0.507	1.081	0.548	
1851.25	25	PCS CDMA - FCC Rule Part 24E	TDSO / SO32	24.5	24.29	0.11	10 mm	1078	1:1	bottom	1.040	1.050	1.092	A10
1880.00	600	PCS CDMA - FCC Rule Part 24E	TDSO / SO32	24.5	24.16	-0.03	10 mm	1078	1:1	bottom	1.030	1.081	**1.113**	
1908.75	1175	PCS CDMA - FCC Rule Part 24E	TDSO / SO32	24.5	24.03	-0.06	10 mm	1078	1:1	bottom	0.965	1.114	1.075	
1880.00	600	PCS CDMA - FCC Rule Part 24E	TDSO / SO32	24.5	24.16	-0.14	10 mm	1078	1:1	left	0.293	1.081	0.317	
1880.00	600	PCS CDMA - FCC Rule Part 24E	TDSO / SO32	19.2	19.04	-0.03	10 mm	1287	1:1	back	0.311	1.038	0.323	
1880.00	600	PCS CDMA - FCC Rule Part 24E	TDSO / SO32	19.2	19.04	0.10	10 mm	1287	1:1	front	0.178	1.038	0.185	
1880.00	600	PCS CDMA - FCC Rule Part 24E	TDSO / SO32	19.2	19.04	-0.02	10 mm	1287	1:1	bottom	0.350	1.038	0.363	
1880.00	600	PCS CDMA - FCC Rule Part 24E	TDSO / SO32	19.2	19.04	0.03	10 mm	1287	1:1	left	0.104	1.038	0.108	
1851.25	25	PCS CDMA - FCC Rule Part 24E	EVDO Rev. 0	24.5	24.34	0.15	10 mm	1078	1:1	back	1.020	1.038	1.059	
1880.00	600	PCS CDMA - FCC Rule Part 24E	EVDO Rev. 0	24.5	24.19	-0.01	10 mm	1078	1:1	back	0.865	1.074	0.929	
1908.75	1175	PCS CDMA - FCC Rule Part 24E	EVDO Rev. 0	24.5	24.12	-0.17	10 mm	1078	1:1	back	0.850	1.091	0.927	
1880.00	600	PCS CDMA - FCC Rule Part 24E	EVDO Rev. 0	24.5	24.19	-0.03	10 mm	1078	1:1	front	0.517	1.074	0.555	
1851.25	25	PCS CDMA - FCC Rule Part 24E	EVDO Rev. 0	24.5	24.34	0.12	10 mm	1078	1:1	bottom	0.879	1.038	0.912	
1880.00	600	PCS CDMA - FCC Rule Part 24E	EVDO Rev. 0	24.5	24.19	0.02	10 mm	1078	1:1	bottom	0.928	1.074	0.997	
1908.75	1175	PCS CDMA - FCC Rule Part 24E	EVDO Rev. 0	24.5	24.12	-0.15	10 mm	1078	1:1	bottom	0.874	1.091	0.954	
1880.00	600	PCS CDMA - FCC Rule Part 24E	EVDO Rev. 0	24.5	24.19	0.01	10 mm	1078	1:1	left	0.258	1.074	0.277	
1851.25	25	PCS CDMA - FCC Rule Part 24E	TDSO / SO32	24.5	24.29	-0.19	10 mm	1078	1:1	bottom	0.918	1.050	0.964	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**										**Body** **1.6 W/kg (mW/g)** averaged over 1 gram				

Note: Blue entries identify repeatability measurements.

Table 12-11
LTE Band 25 - FCC Rule Part 24E Hotspot SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.															(W/kg)		(W/kg)	
1855.00	26090	Low	LTE Band 25 - FCC Rule Part 24E	10	23.2	22.84	-0.04	0	1167	QPSK	1	0	10 mm	back	1:1	0.853	1.086	0.926	A11
1882.50	26365	Mid	LTE Band 25 - FCC Rule Part 24E	10	23.2	22.86	0.00	0	1167	QPSK	1	0	10 mm	back	1:1	0.790	1.081	0.854	
1910.00	26640	High	LTE Band 25 - FCC Rule Part 24E	10	23.2	22.76	0.14	0	1167	QPSK	1	0	10 mm	back	1:1	0.740	1.107	0.819	
1855.00	26090	Low	LTE Band 25 - FCC Rule Part 24E	10	22.2	21.88	-0.05	1	1167	QPSK	25	0	10 mm	back	1:1	0.576	1.076	0.620	
1855.00	26090	Low	LTE Band 25 - FCC Rule Part 24E	10	22.2	21.67	0.00	1	1167	QPSK	50	0	10 mm	back	1:1	0.738	1.130	0.834	
1882.50	26365	Mid	LTE Band 25 - FCC Rule Part 24E	10	23.2	22.86	-0.06	0	1167	QPSK	1	0	10 mm	front	1:1	0.706	1.081	0.763	
1855.00	26090	Low	LTE Band 25 - FCC Rule Part 24E	10	22.2	21.88	0.00	1	1167	QPSK	25	0	10 mm	front	1:1	0.539	1.076	0.580	
1882.50	26365	Mid	LTE Band 25 - FCC Rule Part 24E	10	23.2	22.86	-0.15	0	1167	QPSK	1	0	10 mm	bottom	1:1	0.184	1.081	0.199	
1855.00	26090	Low	LTE Band 25 - FCC Rule Part 24E	10	22.2	21.88	0.17	1	1167	QPSK	25	0	10 mm	bottom	1:1	0.145	1.076	0.156	
1882.50	26365	Mid	LTE Band 25 - FCC Rule Part 24E	10	23.2	22.86	-0.01	0	1167	QPSK	1	0	10 mm	right	1:1	0.537	1.081	0.580	
1855.00	26090	Low	LTE Band 25 - FCC Rule Part 24E	10	22.2	21.88	0.06	1	1167	QPSK	25	0	10 mm	right	1:1	0.412	1.076	0.443	
1910.00	26640	High	LTE Band 25 - FCC Rule Part 24E	10	19.2	19.00	-0.08	0	1276	QPSK	1	25	10 mm	back	1:1	0.312	1.047	0.327	
1910.00	26640	High	LTE Band 25 - FCC Rule Part 24E	10	19.2	18.91	0.00	0	1276	QPSK	25	12	10 mm	back	1:1	0.302	1.069	0.323	
1910.00	26640	High	LTE Band 25 - FCC Rule Part 24E	10	19.2	19.00	-0.03	0	1276	QPSK	1	25	10 mm	front	1:1	0.298	1.047	0.312	
1910.00	26640	High	LTE Band 25 - FCC Rule Part 24E	10	19.2	18.91	-0.02	0	1276	QPSK	25	12	10 mm	front	1:1	0.287	1.069	0.307	
1910.00	26640	High	LTE Band 25 - FCC Rule Part 24E	10	19.2	19.00	-0.02	0	1276	QPSK	1	25	10 mm	bottom	1:1	0.085	1.047	0.089	
1910.00	26640	High	LTE Band 25 - FCC Rule Part 24E	10	19.2	18.91	0.10	0	1276	QPSK	25	12	10 mm	bottom	1:1	0.083	1.069	0.089	
1910.00	26640	High	LTE Band 25 - FCC Rule Part 24E	10	19.2	19.00	0.05	0	1276	QPSK	1	25	10 mm	right	1:1	0.232	1.047	0.243	
1910.00	26640	High	LTE Band 25 - FCC Rule Part 24E	10	19.2	18.91	-0.03	0	1276	QPSK	25	12	10 mm	right	1:1	0.229	1.069	0.245	
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 12-12
WLAN Hotspot SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
2462	11	IEEE 802.11b - FCC Rule Part 15C	DSSS	16.1	16.02	0.03	10 mm	1196	1	back	1:1	0.161	1.019	0.164	A12
2462	11	IEEE 802.11b - FCC Rule Part 15C	DSSS	16.1	16.02	0.00	10 mm	1196	1	front	1:1	0.020	1.019	0.020	
2462	11	IEEE 802.11b - FCC Rule Part 15C	DSSS	16.1	16.02	0.04	10 mm	1196	1	right	1:1	0.128	1.019	0.130	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram							

12.4 SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2003, FCC/OET Bulletin 65, Supplement C [June 2001] and FCC KDB Publication 447498 D01v05.
2. Batteries are fully charged at the beginning of the SAR measurements. A standard battery was used for all SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v05.
6. Device was tested using a fixed spacing for body-worn accessory testing. A separation distance of 10 mm was considered because the manufacturer has determined that there will be body-worn accessories available in the marketplace for users to support this separation distance.
7. Per FCC KDB Publication 648474 D04v01, SAR was evaluated without a headset connected to the device. Since the standalone reported SAR was ≤ 1.2 W/kg, no additional SAR evaluations using a headset cable were required.

8. Per FCC KDB 865664 D01 v01, variability SAR tests were performed 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 14 for variability analysis.
9. During SAR Testing for the Wireless Router conditions per FCC KDB Publication 941225 D06v01, the actual Portable Hotspot operation (with actual simultaneous transmission of a transmitter with WIFI) was not activated (See Section 6.6 for more details).

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, then EVDO 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 1⁄4 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 must be used.
6. CDMA 1x-RTT Hotspot SAR was additionally evaluated for Hotspot exposure to support simultaneous capabilities.
7. CDMA 1X Advanced technology was not required for SAR when the maximum output powers for 1x Advanced was not more than 0.25 dB higher than the maximum measured powers for 1x and the measured SAR in any 1x mode exposure conditions was not greater than 1.2 W/kg.

LTE Notes:

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

WLAN Notes:

1. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and October 2012 FCC/TCB Meeting Notes for 2.4 GHz WIFI: Highest average RF output power channel for the lowest data rate was selected for SAR evaluation in 802.11b. Other IEEE 802.11 modes (including 802.11g/n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode.
2. WIFI transmission was verified using an uncalibrated spectrum analyzer.
3. 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.

13 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

13.1 Introduction

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

13.2 Simultaneous Transmission Procedures

This device contains transmitters that may operate simultaneously. Therefore simultaneous transmission analysis is required. Per FCC KDB 447498 D01v05 IV.C.1.iii, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is ≤1.6 W/kg.

13.3 Head SAR Simultaneous Transmission Analysis

Table 13-1
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Held to Ear)

Simult Tx	Configuration	Cell. CDMA - FCC Rule Part 90S SAR (W/kg)	2.4 GHz WLAN - FCC Rule Part 15C SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.380	0.074	0.454
	Right Tilt	0.232	0.035	0.267
	Left Cheek	0.470	0.083	**0.553**
	Left Tilt	0.269	0.035	0.304

Simult Tx	Configuration	Cell. CDMA - FCC Rule Part 22H SAR (W/kg)	2.4 GHz WLAN - FCC Rule Part 15C SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.498	0.074	0.572
	Right Tilt	0.294	0.035	0.329
	Left Cheek	0.588	0.083	**0.671**
	Left Tilt	0.320	0.035	0.355

Simult Tx	Configuration	PCS CDMA - FCC Rule Part 24E SAR (W/kg)	2.4 GHz WLAN - FCC Rule Part 15C SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.382	0.074	0.456
	Right Tilt	0.243	0.035	0.278
	Left Cheek	0.663	0.083	**0.746**
	Left Tilt	0.200	0.035	0.235

Simult Tx	Configuration	LTE Band 25 - FCC Rule Part 24E SAR (W/kg)	2.4 GHz WLAN - FCC Rule Part 15C SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.948	0.074	**1.022**
	Right Tilt	0.357	0.035	0.392
	Left Cheek	0.468	0.083	0.551
	Left Tilt	0.428	0.035	0.463

Simult Tx	Configuration	Cell. EVDO - FCC Rule Part 90S SAR (W/kg)	2.4 GHz WLAN - FCC Rule Part 15C SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.387	0.074	0.461
	Right Tilt	0.181	0.035	0.216
	Left Cheek	0.508	0.083	**0.591**
	Left Tilt	0.269	0.035	0.304

Simult Tx	Configuration	Cell. EVDO - FCC Rule Part 22H SAR (W/kg)	2.4 GHz WLAN - FCC Rule Part 15C SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.496	0.074	0.570
	Right Tilt	0.291	0.035	0.326
	Left Cheek	0.604	0.083	**0.687**
	Left Tilt	0.319	0.035	0.354

Simult Tx	Configuration	PCS EVDO - FCC Rule Part 24E SAR (W/kg)	2.4 GHz WLAN - FCC Rule Part 15C SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.419	0.074	0.493
	Right Tilt	0.233	0.035	0.268
	Left Cheek	0.645	0.083	**0.728**
	Left Tilt	0.194	0.035	0.229

13.4 Body-Worn Simultaneous Transmission Analysis

Table 13-2
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body-Worn at 1.0 cm)

Configuration	Mode	CDMA/LTE SAR (W/kg)	2.4 GHz WLAN - FCC Rule Part 15C SAR (W/kg)	Σ SAR (W/kg)
Back Side	Cell. CDMA - FCC Rule Part 90S	0.658	0.164	0.822
Back Side	Cell. CDMA - FCC Rule Part 22H	0.716	0.164	0.880
Back Side	PCS CDMA - FCC Rule Part 24E	1.056	0.164	**1.220**
Back Side	LTE Band 25 - FCC Rule Part 24E	0.926	0.164	1.090

Note: Per KDB 941225, when the maximum output power of each channel in EVDO is less than 0.25 dB higher than measured in TDSO, body SAR for EVDO is not required. Therefore, 1x-RTT CDMA body-worn SAR summations additionally show compliance for EVDO Rev. A VoIP body-worn simultaneous transmission scenarios.

Table 13-3
Simultaneous Transmission Scenario with Bluetooth (Body-Worn at 1.0 cm)

Configuration	Mode	CDMA/LTE SAR (W/kg)	Bluetooth - FCC Rule Part 15C SAR (W/kg)	Σ SAR (W/kg)
Back Side	Cell. CDMA - FCC Rule Part 90S	0.658	0.005	0.663
Back Side	Cell. CDMA - FCC Rule Part 22H	0.716	0.005	0.721
Back Side	PCS CDMA - FCC Rule Part 24E	1.056	0.005	**1.061**
Back Side	LTE Band 25 - FCC Rule Part 24E	0.926	0.005	0.931

Note: Per KDB 941225, when the maximum output power of each channel in EVDO is less than 0.25 dB higher than measured in TDSO, body SAR for EVDO is not required. Therefore, 1x-RTT CDMA body-worn SAR summations additionally show compliance for EVDO Rev. A VoIP body-worn simultaneous transmission scenarios.

13.5 Hotspot SAR Simultaneous Transmission Analysis

Table 13-4
Simultaneous Transmission Scenario (Hotspot at 1.0 cm)

Simult Tx	Configuration	Cell. EVDO - FCC Rule Part 90S SAR (W/kg)	2.4 GHz WLAN - FCC Rule Part 15C SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	Cell. EVDO - FCC Rule Part 22H SAR (W/kg)	2.4 GHz WLAN - FCC Rule Part 15C SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.529	0.164	**0.693**	Body SAR	Back	0.680	0.164	**0.844**
	Front	0.428	0.020	0.448		Front	0.533	0.020	0.553
	Top	-	-	0.000		Top	-	-	0.000
	Bottom	0.233	-	0.233		Bottom	0.260	-	0.260
	Right	-	0.130	0.130		Right	-	0.130	0.130
	Left	0.635	-	0.635		Left	0.785	-	0.785
Simult Tx	Configuration	PCS EVDO - FCC Rule Part 24E SAR (W/kg)	2.4 GHz WLAN - FCC Rule Part 15C SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 25 - FCC Rule Part 24E SAR (W/kg)	2.4 GHz WLAN - FCC Rule Part 15C SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	1.059	0.164	**1.223**	Body SAR	Back	0.926	0.164	**1.090**
	Front	0.555	0.020	0.575		Front	0.763	0.020	0.783
	Top	-	-	0.000		Top	-	-	0.000
	Bottom	0.997	-	0.997		Bottom	0.199	-	0.199
	Right	-	0.130	0.130		Right	0.580	0.130	0.710
	Left	0.277	-	0.277		Left	-	-	0.000

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 (“-“).

13.6 SVLTE SAR Simultaneous Transmission Analysis

Table 13-5
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Held to Ear)

Simult Tx	CDMA Power Level (dBm)	Configuration	Cell. CDMA - FCC Rule Part 90S SAR (W/kg)	LTE Band 25 - FCC Rule Part 24E SAR (W/kg)	2.4 GHz WLAN - FCC Rule Part 15C SAR (W/kg)	Σ SAR (W/kg)	
		Tx Antenna	1	2	3	1+2	1+2+3
		Maximum Allowed Power (dBm)	24.5	19.2	16.1		
Head SAR	P ≥ 18.7	Right Cheek	0.380	0.348	0.074	0.728	0.802
		Right Tilt	0.232	0.126	0.035	0.358	0.393
		Left Cheek	0.470	0.173	0.083	0.643	0.726
		Left Tilt	0.269	0.154	0.035	0.423	0.458
		Maximum Allowed Power (dBm)	19.2	23.2	16.1		
	P < 18.7	Right Cheek	0.105	0.948	0.074	1.053	**1.127**
		Right Tilt	0.067	0.357	0.035	0.424	0.459
		Left Cheek	0.135	0.468	0.083	0.603	0.686
		Left Tilt	0.074	0.428	0.035	0.502	0.537

Simult Tx	CDMA Power Level (dBm)	Configuration	Cell. CDMA - FCC Rule Part 22H SAR (W/kg)	LTE Band 25 - FCC Rule Part 24E SAR (W/kg)	2.4 GHz WLAN - FCC Rule Part 15C SAR (W/kg)	Σ SAR (W/kg)	
		Tx Antenna	1	2	3	1+2	1+2+3
		Maximum Allowed Power (dBm)	24.5	19.2	16.1		
Head SAR	P ≥ 18.7	Right Cheek	0.498	0.348	0.074	0.846	0.920
		Right Tilt	0.294	0.126	0.035	0.420	0.455
		Left Cheek	0.588	0.173	0.083	0.761	0.844
		Left Tilt	0.320	0.154	0.035	0.474	0.509
		Maximum Allowed Power (dBm)	19.2	23.2	16.1		
	P < 18.7	Right Cheek	0.129	0.948	0.074	1.077	**1.151**
		Right Tilt	0.084	0.357	0.035	0.441	0.476
		Left Cheek	0.164	0.468	0.083	0.632	0.715
		Left Tilt	0.088	0.428	0.035	0.516	0.551

Simult Tx	CDMA Power Level (dBm)	Configuration	PCS CDMA - FCC Rule Part 24E SAR (W/kg)	LTE Band 25 - FCC Rule Part 24E SAR (W/kg)	2.4 GHz WLAN - FCC Rule Part 15C SAR (W/kg)	Σ SAR (W/kg)	
		Tx Antenna	1	2	3	1+2	1+2+3
		Maximum Allowed Power (dBm)	24.5	19.2	16.1		
Head SAR	P ≥ 18.7	Right Cheek	0.382	0.348	0.074	0.730	0.804
		Right Tilt	0.243	0.126	0.035	0.369	0.404
		Left Cheek	0.663	0.173	0.083	0.836	0.919
		Left Tilt	0.200	0.154	0.035	0.354	0.389
		Maximum Allowed Power (dBm)	19.2	23.2	16.1		
	P < 18.7	Right Cheek	0.102	0.948	0.074	1.050	**1.124**
		Right Tilt	0.078	0.357	0.035	0.435	0.470
		Left Cheek	0.184	0.468	0.083	0.652	0.735
		Left Tilt	0.066	0.428	0.035	0.494	0.529

Table 13-6
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body-Worn at 1.0 cm)

CDMA Power Level (dBm)	Mode		CDMA SAR (W/kg)	LTE Band 25 - FCC Rule Part 24E SAR (W/kg)	2.4 GHz WLAN - FCC Rule Part 15C SAR (W/kg)	Σ SAR (W/kg)	
		Tx Antenna	1	2	3	1+2	1+2+3
		Maximum Allowed Power (dBm)	24.5	19.2	16.1		
P ≥ 18.7	Cell. CDMA - FCC Rule Part 90S	Back Side	0.658	0.327	0.164	0.985	1.149
	Cell. CDMA - FCC Rule Part 22H	Back Side	0.716	0.327	0.164	1.043	1.207
	PCS CDMA - FCC Rule Part 24E	Back Side	1.056	0.327	0.164	1.383	**1.547**
		Maximum Allowed Power (dBm)	19.2	23.2	16.1		
P < 18.7	Cell. CDMA - FCC Rule Part 90S	Back Side	0.185	0.926	0.164	1.111	1.275
	Cell. CDMA - FCC Rule Part 22H	Back Side	0.184	0.926	0.164	1.110	1.274
	PCS CDMA - FCC Rule Part 24E	Back Side	0.323	0.926	0.164	1.249	1.413

Table 13-7
Simultaneous Transmission Scenario with 2.4 GHz Bluetooth (Body-Worn at 1.0 cm)

CDMA Power Level (dBm)	Mode		CDMA SAR (W/kg)	LTE Band 25 - FCC Rule Part 24E SAR (W/kg)	Bluetooth - FCC Rule Part 15C SAR (W/kg)	Σ SAR (W/kg)	
		Tx Antenna	1	2	3	1+2	1+2+3
		Maximum Allowed Power (dBm)	24.5	19.2	10.9		
P ≥ 18.7	Cell. CDMA - FCC Rule Part 90S	Back Side	0.658	0.327	0.005	0.985	0.990
	Cell. CDMA - FCC Rule Part 22H	Back Side	0.716	0.327	0.005	1.043	1.048
	PCS CDMA - FCC Rule Part 24E	Back Side	1.056	0.327	0.005	1.383	**1.388**
		Maximum Allowed Power (dBm)	19.2	23.2	10.9		
P < 18.7	Cell. CDMA - FCC Rule Part 90S	Back Side	0.185	0.926	0.005	1.111	1.116
	Cell. CDMA - FCC Rule Part 22H	Back Side	0.184	0.926	0.005	1.110	1.115
	PCS CDMA - FCC Rule Part 24E	Back Side	0.323	0.926	0.005	1.249	1.254

Table 13-8
Simultaneous Transmission Scenario (Hotspot at 1.0 cm)

Simult Tx	CDMA Power Level (dBm)	Configuration	Cell. CDMA - FCC Rule Part 90S SAR (W/kg)	LTE Band 25 - FCC Rule Part 24E SAR (W/kg)	2.4 GHz WLAN - FCC Rule Part 15C SAR (W/kg)	Σ SAR (W/kg)
		Tx Antenna	1	2	3	1+2+3
		Maximum Allowed Power (dBm)	24.5	19.2	16.1	
Body SAR	P ≥ 18.7	Back	0.658	0.327	0.164	1.149
		Front	0.480	0.312	0.020	0.812
		Top	-	-	-	0.000
		Bottom	0.197	0.089	-	0.286
		Right	-	0.245	0.130	0.375
		Left	0.615	-	-	0.615
		Maximum Allowed Power (dBm)	19.2	23.2	16.1	
	P < 18.7	Back	0.185	0.926	0.164	**1.275**
		Front	0.156	0.763	0.020	0.939
		Top	-	-	-	0.000
		Bottom	0.064	0.199	-	0.263
		Right	-	0.580	0.130	0.710
		Left	0.178	-	-	0.178

Simult Tx	CDMA Power Level (dBm)	Configuration	Cell. CDMA - FCC Rule Part 22H SAR (W/kg)	LTE Band 25 - FCC Rule Part 24E SAR (W/kg)	2.4 GHz WLAN - FCC Rule Part 15C SAR (W/kg)	Σ SAR (W/kg)
		Tx Antenna	1	2	3	1+2+3
		Maximum Allowed Power (dBm)	24.5	19.2	16.1	
Body SAR	P ≥ 18.7	Back	0.716	0.327	0.164	1.207
		Front	0.611	0.312	0.020	0.943
		Top	-	-	-	0.000
		Bottom	0.276	0.089	-	0.365
		Right	-	0.245	0.130	0.375
		Left	0.791	-	-	0.791
		Maximum Allowed Power (dBm)	19.2	23.2	16.1	
	P < 18.7	Back	0.184	0.926	0.164	**1.274**
		Front	0.177	0.763	0.020	0.960
		Top	-	-	-	0.000
		Bottom	0.085	0.199	-	0.284
		Right	-	0.580	0.130	0.710
		Left	0.199	-	-	0.199

Simult Tx	CDMA Power Level (dBm)	Configuration	PCS CDMA - FCC Rule Part 24E SAR (W/kg)	LTE Band 25 - FCC Rule Part 24E SAR (W/kg)	2.4 GHz WLAN - FCC Rule Part 15C SAR (W/kg)	Σ SAR (W/kg)
		Tx Antenna	1	2	3	1+2+3
		Maximum Allowed Power (dBm)	24.5	19.2	16.1	
Body SAR	P ≥ 18.7	Back	1.056	0.327	0.164	**1.547**
		Front	0.548	0.312	0.020	0.880
		Top	-	-	-	0.000
		Bottom	1.113	0.089	-	1.202
		Right	-	0.245	0.130	0.375
		Left	0.317	-	-	0.317
		Maximum Allowed Power (dBm)	19.2	23.2	16.1	
	P < 18.7	Back	0.323	0.926	0.164	1.413
		Front	0.185	0.763	0.020	0.968
		Top	-	-	-	0.000
		Bottom	0.363	0.199	-	0.562
		Right	-	0.580	0.130	0.710
		Left	0.108	-	-	0.108

13.7 Simultaneous Transmission Conclusion

Based on the simultaneous transmission analysis guidance described in KDB Publication 865664 D01 and the April 2012 TCB/FCC Workshop, the above simultaneous transmission SAR analyses indicate that the device operating in any of the simultaneous transmission scenarios will not exceed the SAR limit.

14 SAR MEASUREMENT VARIABILITY

14.1 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 14-1
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 MHz	1851.25	25	PCS CDMA - FCC Rule Part 24E	TDSO / SO32	bottom	10 mm	1.040	0.918	1.13	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						

14.2 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.

15 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8594A	(9kHz-2.9GHz) Spectrum Analyzer	N/A	N/A	N/A	3051A00187
Agilent	85070E	Dielectric Probe Kit	2/14/2013	Annual	2/14/2014	MY44300633
Agilent	E5515C	Wireless Communications Test Set	9/24/2012	Annual	9/24/2013	GB43163447
Agilent	E5515C	Wireless Communications Tester	4/4/2012	Annual	4/4/2013	US41140256
Agilent	E5515C	Wireless Communications Test Set	10/18/2012	Biennial	10/18/2014	GB43193563
Agilent	85047A	S-Parameter Test Set	N/A	N/A	N/A	2904A00579
Agilent	MA24106A	USB Power Sensor	12/7/2012	Annual	12/7/2013	1244524
Agilent	MA24106A	USB Power Sensor	12/7/2012	Annual	12/7/2013	1244515
Agilent	8648D	Signal Generator	4/3/2012	Annual	4/3/2013	3629U00687
Agilent	8753E	(30kHz-6GHz) Network Analyzer	4/3/2012	Annual	4/3/2013	US37390350
Agilent	E8257D	(250kHz-20GHz) Signal Generator	4/5/2012	Annual	4/5/2013	MY45470194
Agilent	8753E	(30kHz-6GHz) Network Analyzer	4/4/2012	Annual	4/4/2013	JP38020182
Agilent	8648D	(9kHz-4GHz) Signal Generator	10/10/2012	Annual	10/10/2013	3613A00315
Amplifier Research	5S1G4	5W, 800MHz-4.2GHz	CBT	N/A	CBT	21910
Anritsu	ML2438A	Power Meter	12/4/2012	Annual	12/4/2013	1070030
Anritsu	ML2438A	Power Meter	2/14/2013	Annual	2/14/2014	1190013
Anritsu	MA2481A	Power Sensor	2/14/2013	Annual	2/14/2014	5318
Anritsu	MA2481A	Power Sensor	4/5/2012	Annual	4/5/2013	5605
Anritsu	MA2481A	Power Sensor	2/14/2013	Annual	2/14/2014	5821
Anritsu	MA2411B	Pulse Power Sensor	9/19/2012	Annual	9/19/2013	1027293
Anritsu	ML2495A	Power Meter	10/11/2012	Annual	10/11/2013	1039008
Anritsu	MA2411B	Pulse Power Sensor	12/5/2012	Annual	12/5/2013	1126066
Anritsu	MA2481D	Universal Sensor	12/17/2012	Annual	12/17/2013	1204419
Anritsu	MA2481D	Universal Sensor	12/17/2012	Annual	12/17/2013	1204343
Anritsu	MT8820C	Radio Communication Tester	11/6/2012	Annual	11/6/2013	6200901190
COMTech	AR85729-5	Solid State Amplifier	CBT	N/A	CBT	M1S5A00-009
COMTECH	AR85729-5/5759B	Solid State Amplifier	CBT	N/A	CBT	M3W1A00-1002
Intelligent Weigh	PD-3000	Electronic Balance	3/27/2012	Annual	3/27/2013	11081534
Intelligent Weighing	PD-3000	Electronic Balance	6/29/2012	Annual	6/29/2013	120405017
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
MiniCircuits	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	NLP-1200+	Low Pass Filter DC to 1000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	CBT	N/A	CBT	N/A
Narda	BW-S3W2	Attenuator (3dB)	CBT	N/A	CBT	120
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Rohde & Schwarz	NRVD	Dual Channel Power Meter	10/12/2012	Biennial	10/12/2014	101695
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	9/26/2012	Annual	9/26/2013	108798
Rohde & Schwarz	SME06	Signal Generator	10/11/2012	Annual	10/11/2013	832026
Rohde & Schwarz	NRV-Z32	Peak Power Sensor	10/12/2012	Biennial	10/12/2014	836019/013
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	10/7/2011	Biennial	10/7/2013	103962
Rohde & Schwarz	SMIQ03B	Signal Generator	4/5/2012	Annual	4/5/2013	DE27259
Seekonk	NC-100	Torque Wrench (8" lb)	11/29/2011	Triennial	11/29/2014	21053
Seekonk	NC-100	Torque Wrench (8" lb)	3/5/2012	Triennial	3/5/2015	N/A
Seekonk	NC-100	Torque Wrench (8" lb)	3/5/2012	Triennial	3/5/2015	N/A
SPEAG	ES3DV3	SAR Probe	4/24/2012	Annual	4/24/2013	3213
SPEAG	DAK-3.5	Dielectric Assessment Kit	6/19/2012	Annual	6/19/2013	1070
SPEAG	ES3DV2	SAR Probe	8/28/2012	Annual	8/28/2013	3022
SPEAG	D2450V2	2450 MHz SAR Dipole	8/23/2012	Annual	8/23/2013	719
SPEAG	D2450V2	2450 MHz SAR Dipole	1/8/2013	Annual	1/8/2014	797
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/6/2013	Annual	2/6/2014	649
SPEAG	ES3DV3	SAR Probe	11/15/2012	Annual	11/15/2013	3287
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/19/2012	Annual	4/19/2013	665
SPEAG	DAK-3.5	Dielectric Assessment Kit	12/11/2012	Annual	12/11/2013	1091
SPEAG	D835V2	835 MHz SAR Dipole	8/23/2012	Annual	8/23/2013	4d026
SPEAG	DAE4	Dasy Data Acquisition Electronics	8/24/2012	Annual	8/24/2013	1322
SPEAG	D1900V2	1900 MHz SAR Dipole	2/6/2013	Annual	2/6/2014	5d148
SPEAG	DAE4	Dasy Data Acquisition Electronics	9/19/2012	Annual	9/19/2013	1323
SPEAG	ES3DV3	SAR Probe	9/20/2012	Annual	9/20/2013	3288
SPEAG	EX3DV4	SAR Probe	2/27/2013	Annual	2/27/2014	3920
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/13/2012	Annual	11/13/2013	1333
Tektronix	RSA-6114A	Real Time Spectrum Analyzer	4/5/2012	Annual	4/5/2013	B010177
VWR	36934-158	Wall-Mounted Thermometer	9/30/2011	Biennial	9/30/2013	111859323
VWR	62344-925	Mini-Thermometer	10/24/2011	Biennial	10/24/2013	111886430
VWR	62344-925	Mini-Thermometer	10/24/2011	Biennial	10/24/2013	111886443
VWR	36934-158	Wall-Mounted Thermometer	9/30/2011	Biennial	9/30/2013	111859332
VWR	23226-658	Long Stem Thermometer	7/11/2012	Biennial	7/11/2014	122389330
VWR	23226-658	Long Stem Thermometer	5/16/2012	Biennial	5/16/2014	122295544
VWR	23226-658	Long Stem Thermometer	6/27/2012	Biennial	6/27/2014	122363923
Agilent	N4010A	Wireless Connectivity Test Set	N/A	N/A	N/A	GB46170464
Agilent	N9020A	MXA Signal Analyzer	10/9/2012	Annual	10/9/2013	US46470561

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.

16 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

17 CONCLUSION

17.1 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: ZNFLS720; Type: Portable Handset; Serial: 1078

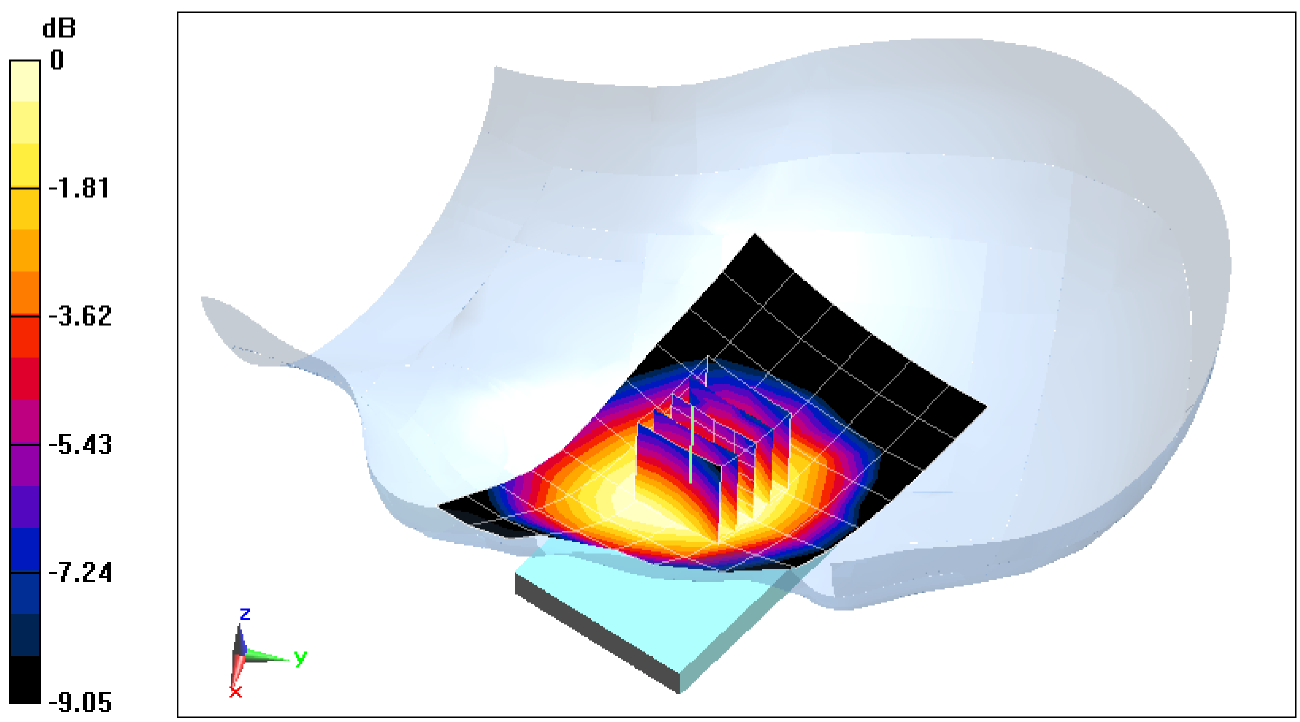
Communication System: Cellular CDMA; Frequency: 820.1 MHz;Duty Cycle: 1:1
Medium: 835 Head Medium parameters used (interpolated):
f = 820.1 MHz; σ = 0.917 S/m; ε_r = 42.235; ρ = 1000 kg/m^3
Phantom section: Left Section

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

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

Mode: Cellular EVDO Rev. A - FCC Rule Part 90S, Left Head, Cheek, Mid.ch

Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.707 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.553 W/kg
SAR(1 g) = 0.457 W/kg; SAR(10 g) = 0.344 W/kg



0 dB = 0.472 W/kg = -3.26 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS720; Type: Portable Handset; Serial: 1078

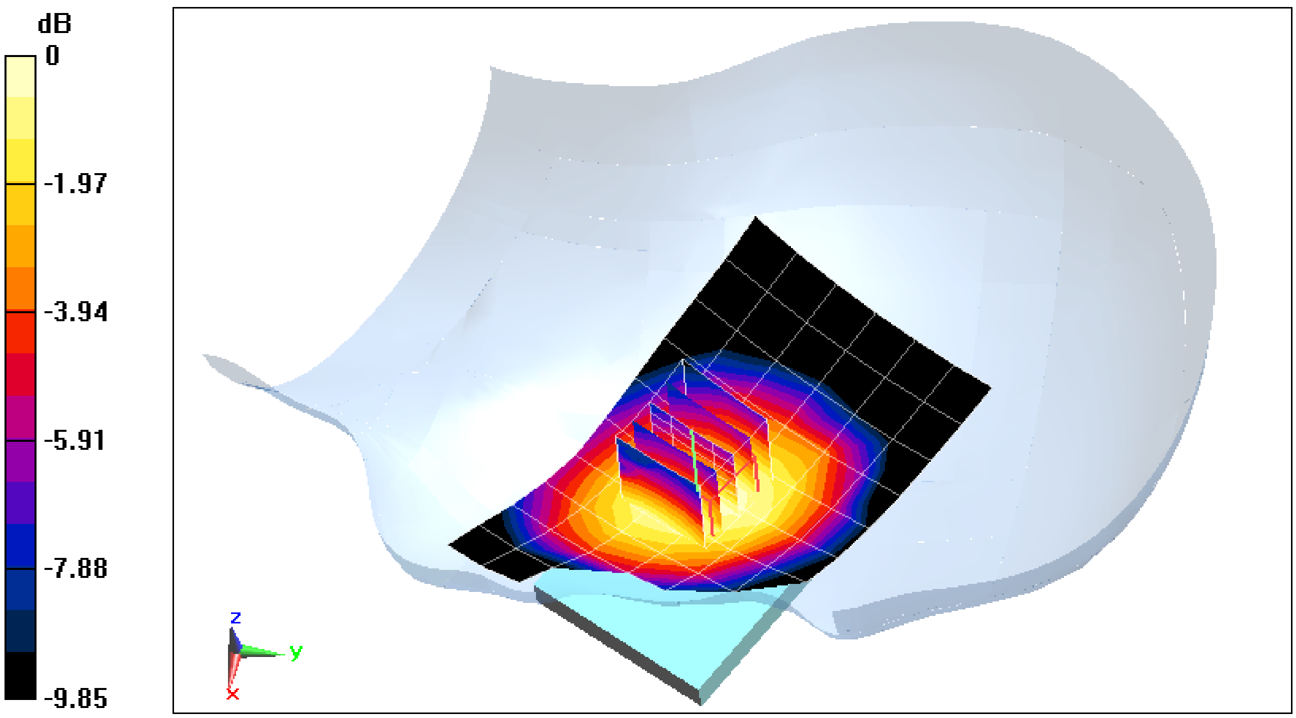
Communication System: Cellular CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium: 835 Head Medium parameters used (interpolated):
$f = 836.52$ MHz; $\sigma = 0.936$ S/m; $\varepsilon_r = 42.078$; $\rho = 1000$ kg/m^3
Phantom section: Left Section

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

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

Mode: Cellular EVDO Rev. A - FCC Rule Part 22H, Left Head, Cheek, Mid.ch

Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.974 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.889 W/kg
SAR(1 g) = 0.559 W/kg; SAR(10 g) = 0.419 W/kg



0 dB = 0.581 W/kg = -2.36 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS720; Type: Portable Handset; Serial: 1078

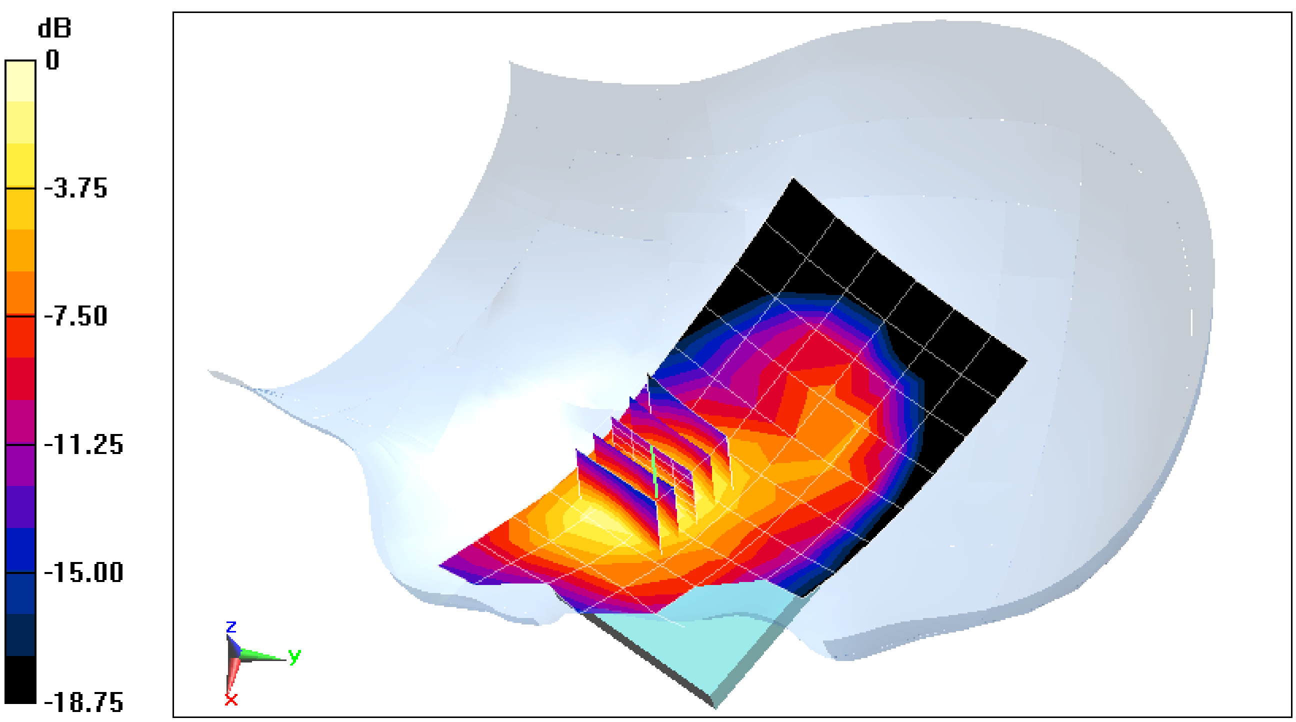
Communication System: CDMA; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: 1900 Head Medium parameters used:
f = 1880 MHz; σ = 1.405 S/m; ε_r = 40.468; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 03-11-2013; Ambient Temp: 24.4°C; Tissue Temp: 23.0°C

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

Mode: PCS CDMA - FCC Rule Part 24E, Left Head, Cheek, Mid.ch

Area Scan (7x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 17.485 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.932 W/kg
SAR(1 g) = 0.603 W/kg



0 dB = 0.681 W/kg = -1.67 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS720; Type: Portable Handset; Serial: 1167

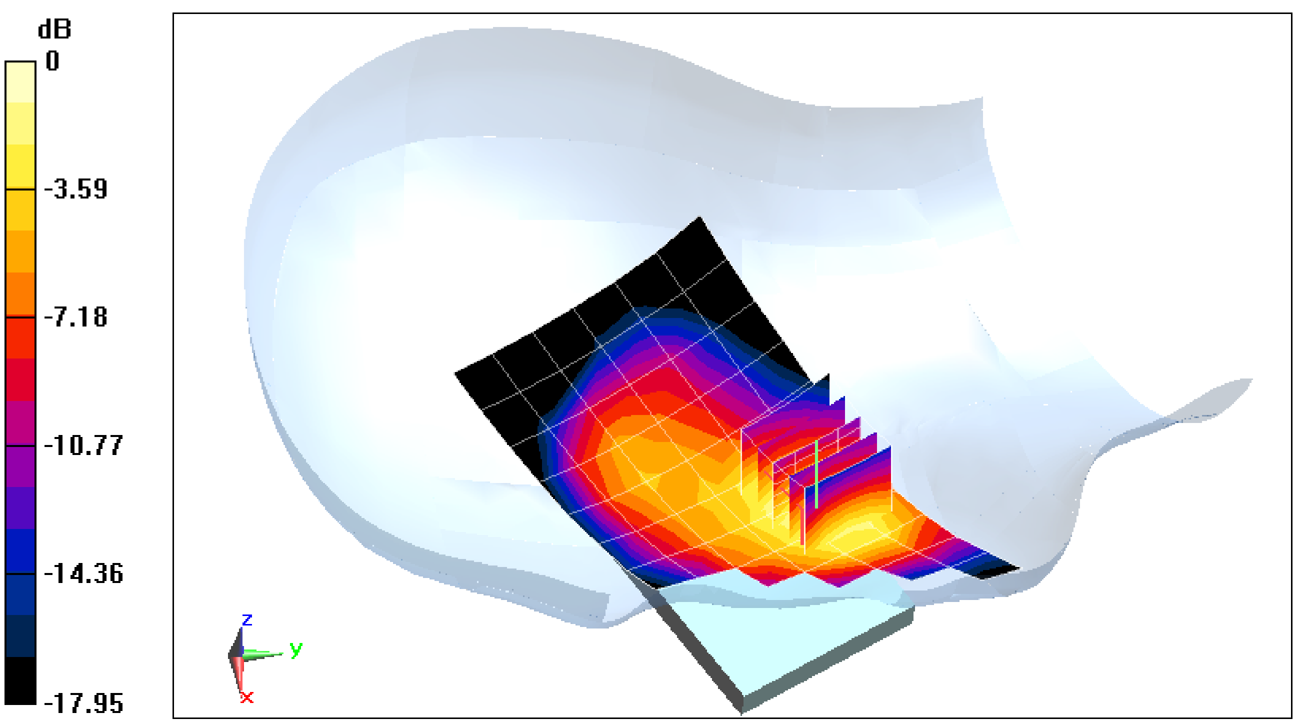
Communication System: LTE Band 25 (PCS); Frequency: 1855 MHz;Duty Cycle: 1:1
Medium: 1900 Head Medium parameters used (interpolated):
f = 1855 MHz; σ = 1.378 S/m; ε_r = 40.576; ρ = 1000 kg/m^3
Phantom section: Right Section

Test Date: 03-11-2013; Ambient Temp: 24.4°C; Tissue Temp: 23.0°C

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

Mode: LTE Band 25 (PCS) - FCC Rule Part 24E, Right Head, Cheek, Low.ch, 10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (7x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 27.635 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 1.31 W/kg
SAR(1 g) = 0.873 W/kg; SAR(10 g) = 0.544 W/kg



0 dB = 0.952 W/kg = -0.21 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS720; Type: Portable Handset; Serial: 1196

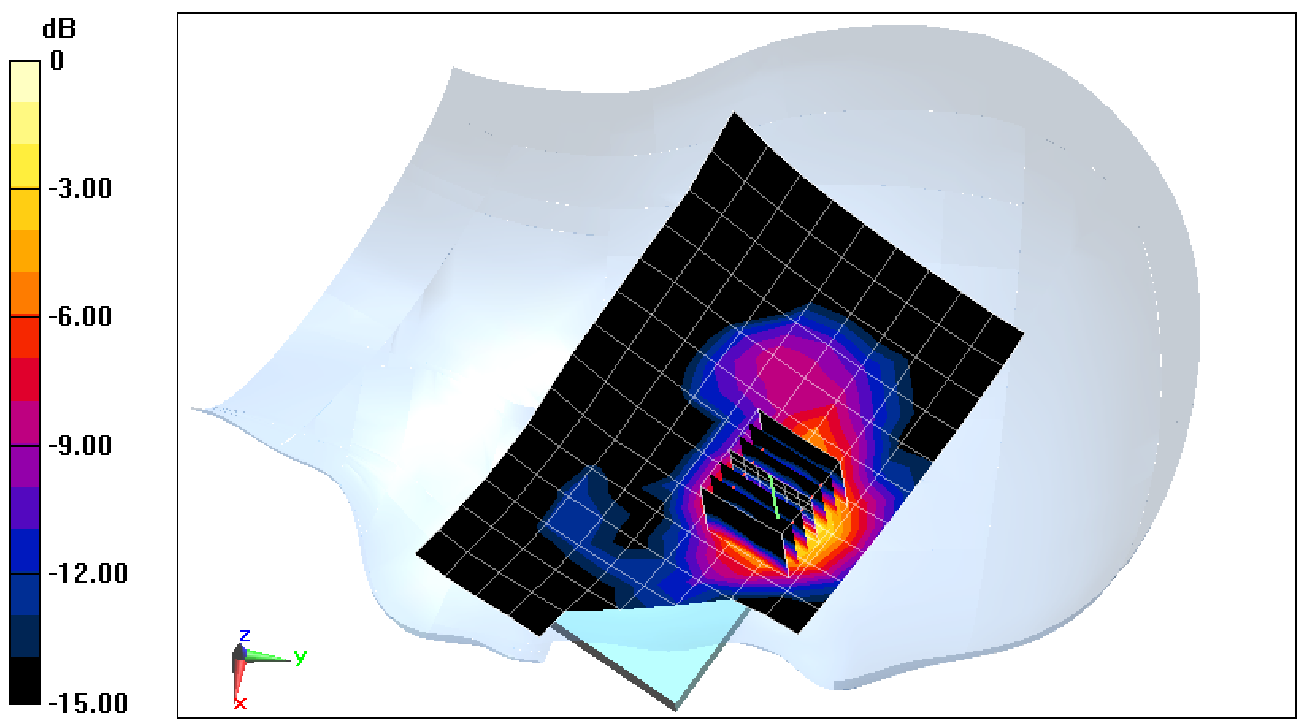
Communication System: IEEE 802.11b; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: 2450 Head Medium parameters used (interpolated):
f = 2462 MHz; σ = 1.852 S/m; ε_r = 40.94; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 03-07-2013; Ambient Temp: 23.6°C; Tissue Temp: 23.1°C

Probe: ES3DV3 - SN3287; ConvF(4.3, 4.3, 4.3); Calibrated: 11/15/2012;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM with CRP; Type: SAM 4.0; Serial: TP1375
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

Mode: IEEE 802.11b - FCC Rule Part 15C,
Left Head, Cheek, Ch 11, 1 Mbps

Area Scan (10x15x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.513 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.170 W/kg
SAR(1 g) = 0.081 W/kg; SAR(10 g) = 0.039 W/kg



0 dB = 0.106 W/kg = -9.75 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS720; Type: Portable Handset; Serial: 1078

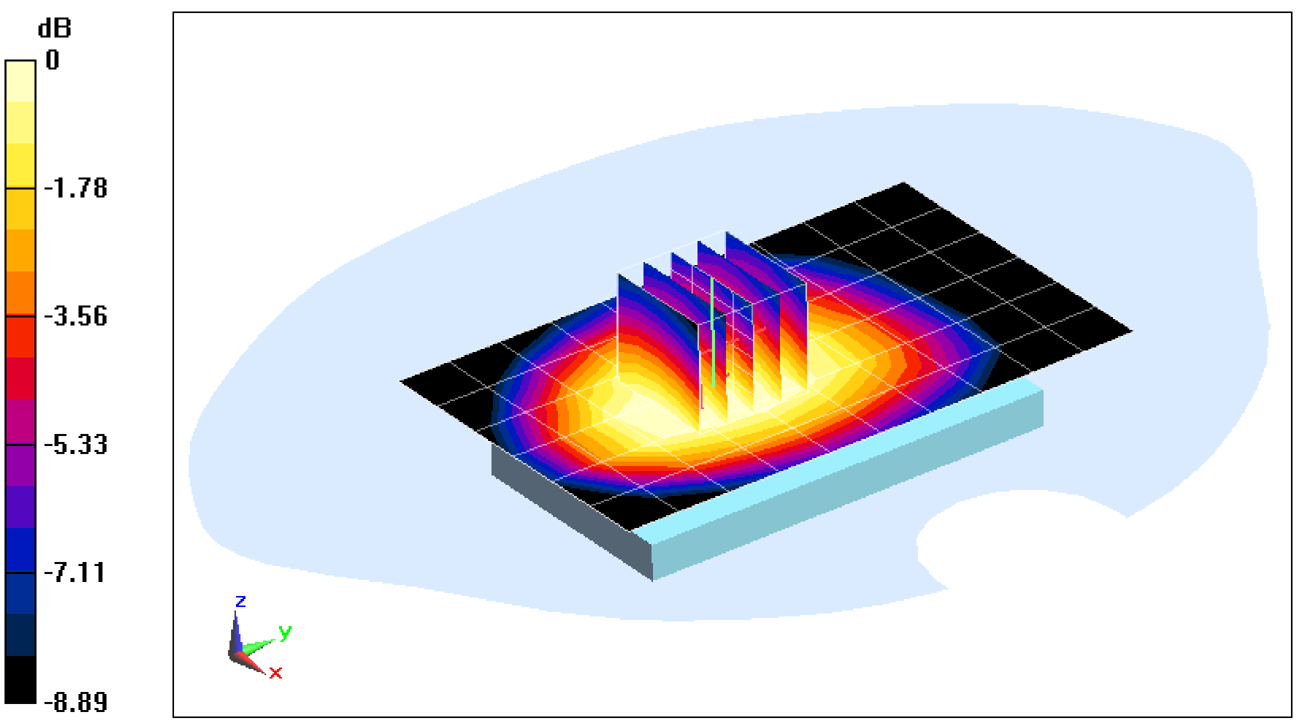
Communication System: Cellular CDMA; Frequency: 820.1 MHz;Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 820.1 MHz; σ = 0.947 S/m; ε_r = 54.15; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-14-2013; Ambient Temp: 24.4°C; Tissue Temp: 22.7°C

Probe: ES3DV2 - SN3022; ConvF(6.02, 6.02, 6.02); Calibrated: 8/28/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/24/2012
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

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

Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 27.202 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 0.762 W/kg
SAR(1 g) = 0.600 W/kg; SAR(10 g) = 0.452 W/kg



0 dB = 0.627 W/kg = -2.03 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS720; Type: Portable Handset; Serial: 1078

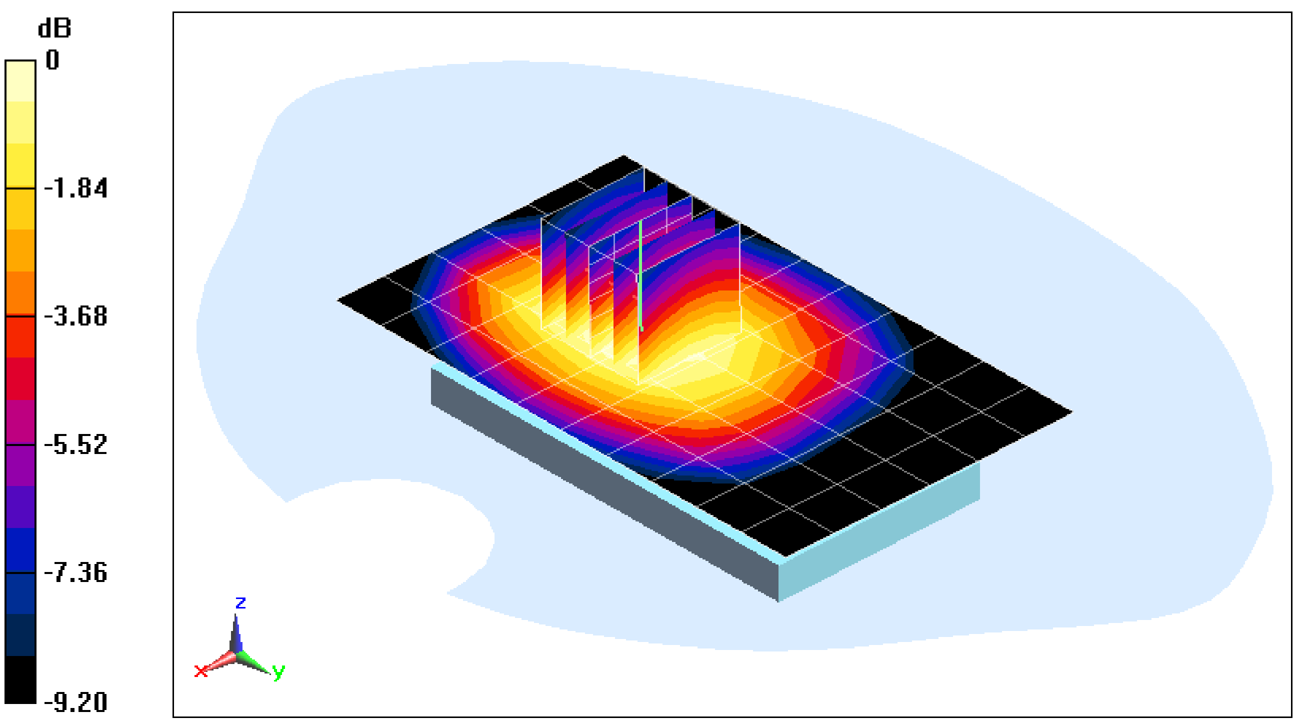
Communication System: Cellular CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
f = 836.52 MHz; σ = 0.964 S/m; ε_r = 54.015; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-14-2013; Ambient Temp: 24.4°C; Tissue Temp: 22.7°C

Probe: ES3DV2 - SN3022; ConvF(6.02, 6.02, 6.02); Calibrated: 8/28/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/24/2012
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

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

Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 29.282 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 0.871 W/kg
SAR(1 g) = 0.690 W/kg; SAR(10 g) = 0.518 W/kg



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

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS720; Type: Portable Handset; Serial: 1078

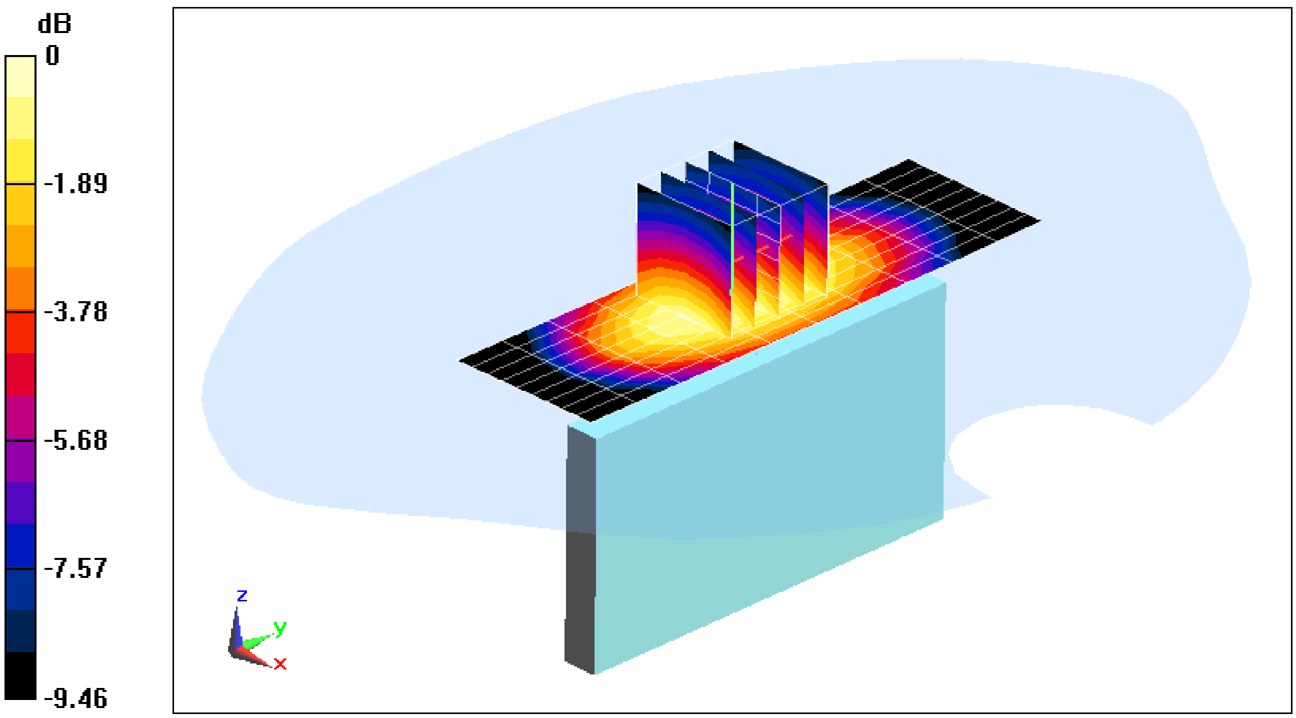
Communication System: Cellular CDMA; Frequency: 836.52 MHz;Duty Cycle: 1:1
Medium: 835 Body Medium parameters used (interpolated):
$f = 836.52$ MHz; $\sigma = 0.964$ S/m; $\varepsilon_r = 54.015$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-14-2013; Ambient Temp: 24.4°C; Tissue Temp: 22.7°C

Probe: ES3DV2 - SN3022; ConvF(6.02, 6.02, 6.02); Calibrated: 8/28/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/24/2012
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

Mode: Cellular CDMA - FCC Rule Part 22H, Body SAR, Left Edge, Mid.ch

Area Scan (10x11x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 30.755 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 1.05 W/kg
SAR(1 g) = 0.762 W/kg; SAR(10 g) = 0.526 W/kg



0 dB = 0.821 W/kg = -0.86 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS720; Type: Portable Handset; Serial: 1078

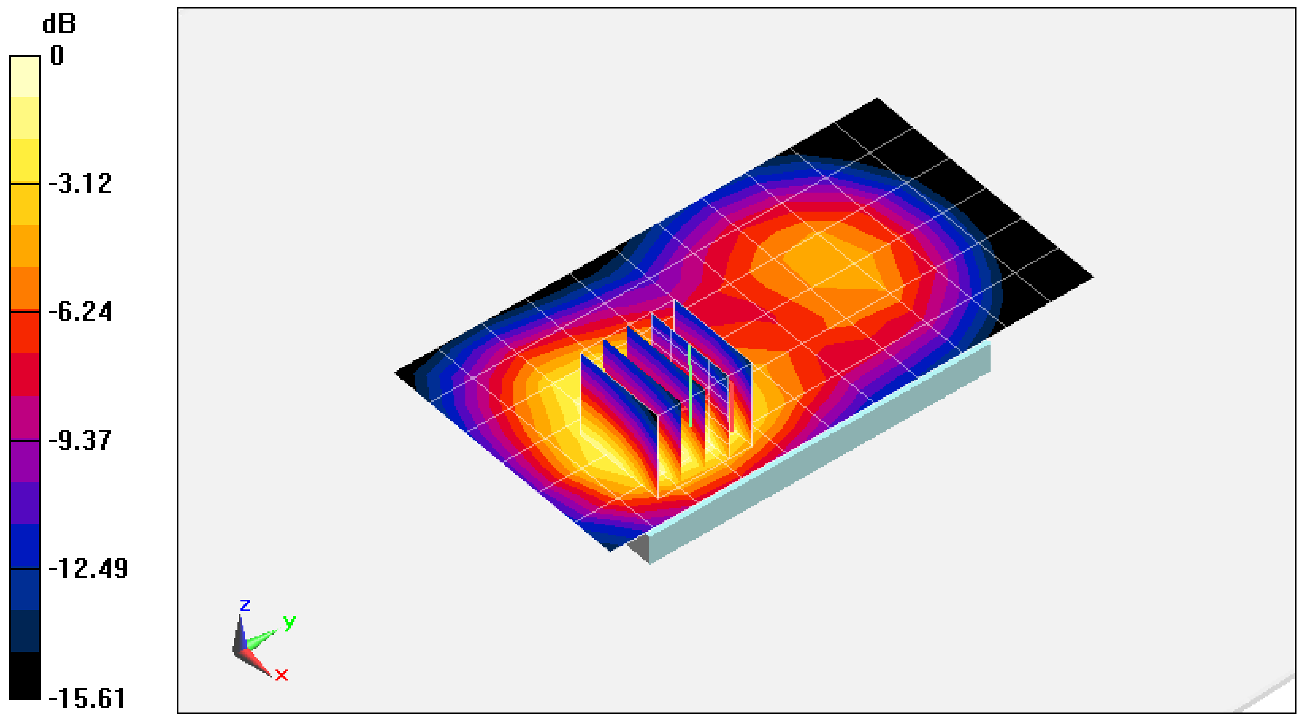
Communication System: CDMA; Frequency: 1851.25 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1851.25 MHz; σ = 1.54 S/m; ε_r = 51.581; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-14-2013; Ambient Temp: 23.9°C; Tissue Temp: 22.7°C

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

Mode: PCS CDMA - FCC Rule Part 24E, Body SAR, Back side, Low.ch

Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 26.551 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 1.60 W/kg
SAR(1 g) = 0.955 W/kg; SAR(10 g) = 0.573 W/kg



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

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS720; Type: Portable Handset; Serial: 1078

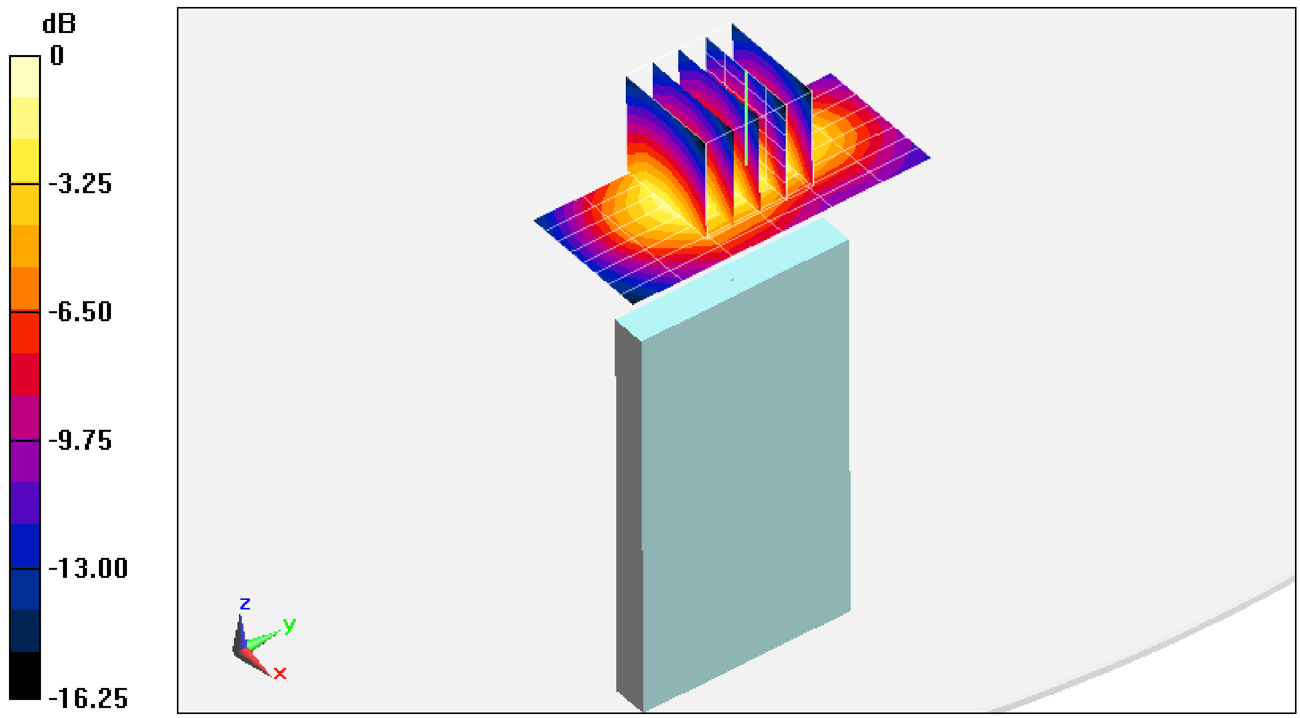
Communication System: CDMA; Frequency: 1851.25 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1851.25 MHz; σ = 1.54 S/m; ε_r = 51.581; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-14-2013; Ambient Temp: 23.9°C; Tissue Temp: 22.7°C

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

Mode: PCS CDMA - FCC Rule Part 24E, Body SAR, Bottom Edge, Low.ch

Area Scan (9x7x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 26.285 V/m; Power Drift = 0.11 dB
Peak SAR (extrapolated) = 1.81 W/kg
SAR(1 g) = 1.04 W/kg



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

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS720; Type: Portable Handset; Serial: 1167

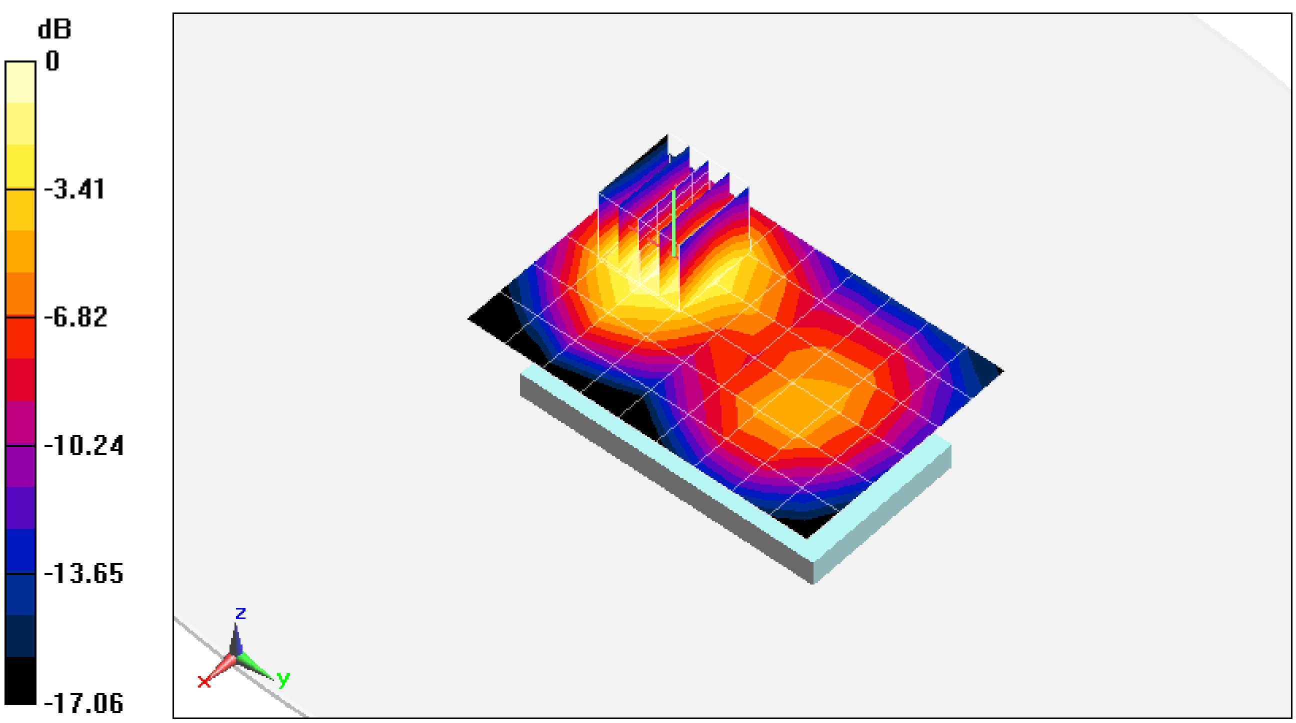
Communication System: LTE Band 25 (PCS); Frequency: 1855 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1855 MHz; σ = 1.544 S/m; ε_r = 51.561; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-14-2013; Ambient Temp: 23.9°C; Tissue Temp: 22.7°C

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

Mode: LTE Band 25 (PCS) - FCC Rule Part 24E, Body SAR, Back side, Low.ch, 10 MHz Bandwidth, QPSK, 1 RB, 0 RB Offset

Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 25.016 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 1.35 W/kg
SAR(1 g) = 0.853 W/kg; SAR(10 g) = 0.517 W/kg



0 dB = 0.920 W/kg = -0.36 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS720; Type: Portable Handset; Serial: 1196

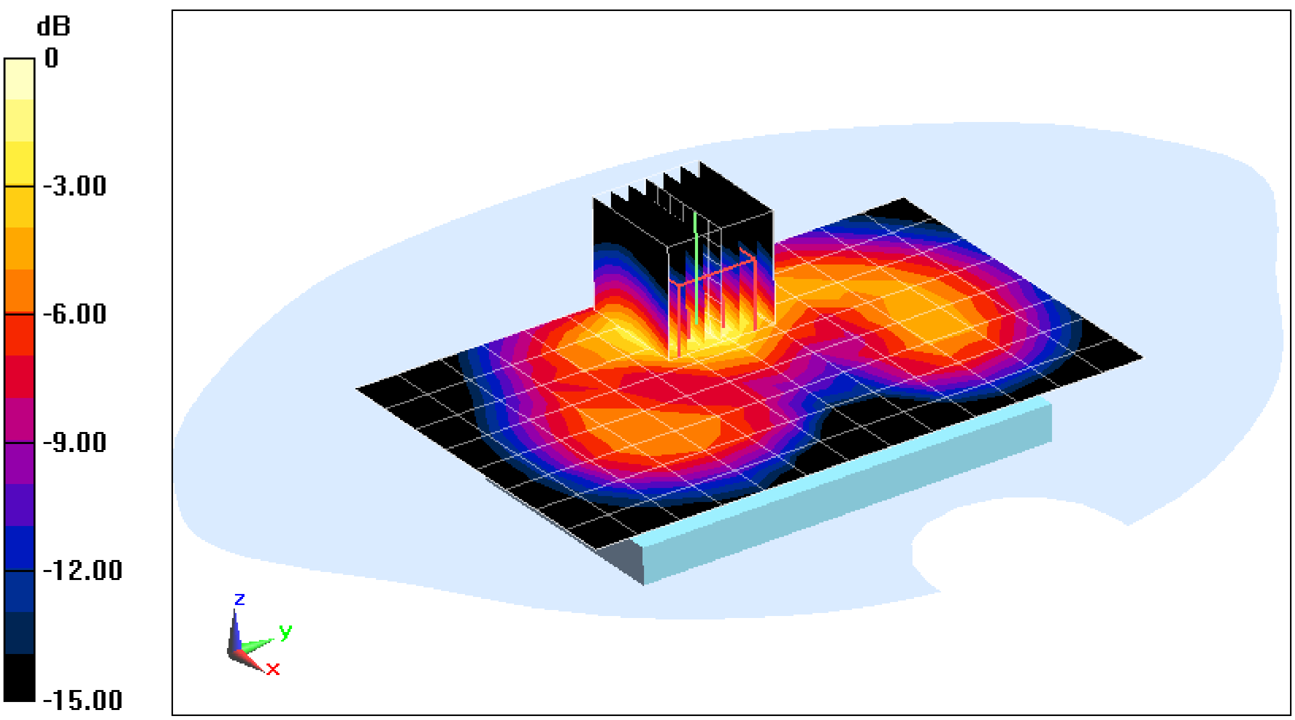
Communication System: IEEE 802.11b; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used (interpolated):
f = 2462 MHz; σ = 1.993 S/m; ε_r = 51.314; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-04-2013; Ambient Temp: 23.8°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3287; ConvF(4.29, 4.29, 4.29); Calibrated: 11/15/2012;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

Mode: IEEE 802.11b - FCC Rule Part 15C, Body SAR, Ch 11, 1 Mbps, Back Side

Area Scan (9x14x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.094 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.362 W/kg
SAR(1 g) = 0.161 W/kg; SAR(10 g) = 0.077 W/kg



0 dB = 0.207 W/kg = -6.84 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: ZNFLS720; Type: Portable Handset; Serial: 1196

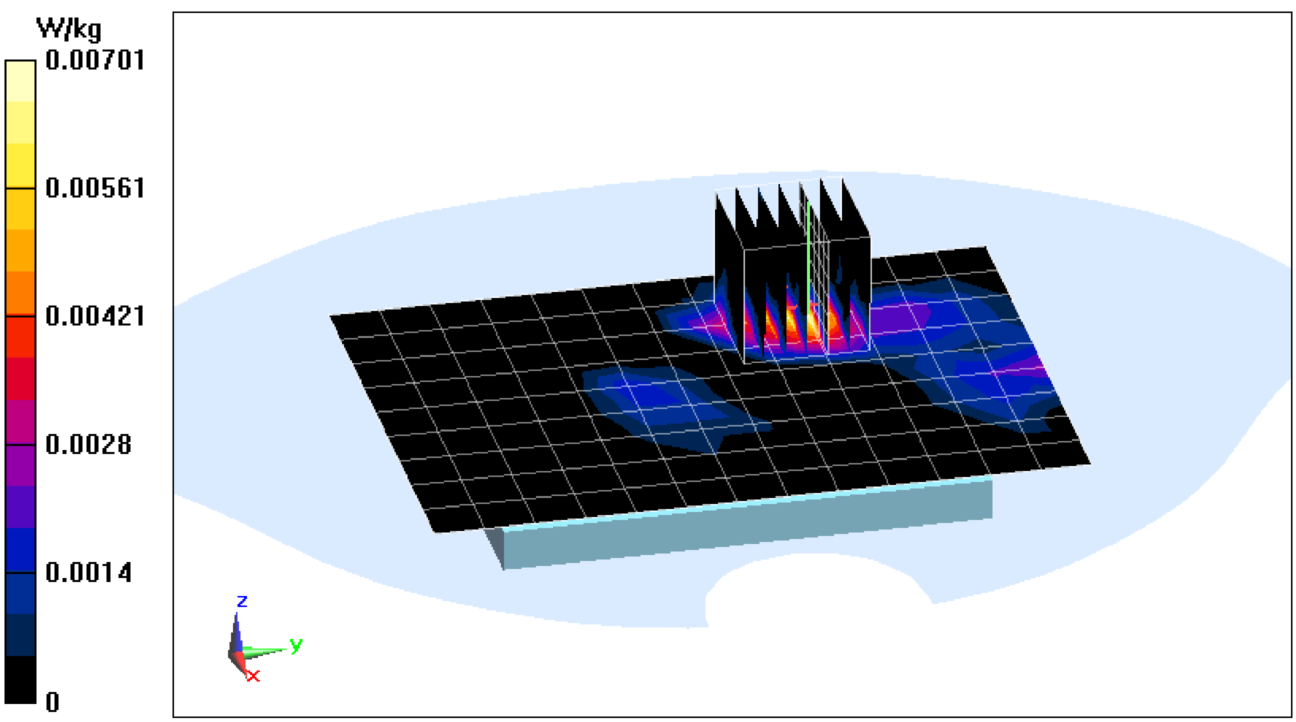
Communication System: Bluetooth; Frequency: 2480 MHz;Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used (interpolated):
f = 2480 MHz; σ = 2.05 S/m; ε_r = 51.283; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-14-2013; Ambient Temp: 23.5°C; Tissue Temp: 23.2°C

Probe: ES3DV3 - SN3288; ConvF(4.35, 4.35, 4.35); Calibrated: 9/20/2012;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/19/2012
Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646
Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.8 (7028)

Mode: Bluetooth - FCC Rule Part 15C, Body SAR, Ch 78, 1 Mbps, Back Side

Area Scan (10x14x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.616 V/m; Power Drift = 0.15 dB
Peak SAR (extrapolated) = 0.0210 W/kg
SAR(1 g) = 0.00495 W/kg



APPENDIX B: SYSTEM VERIFICATION

PCTEST ENGINEERING LABORATORY, INC.

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

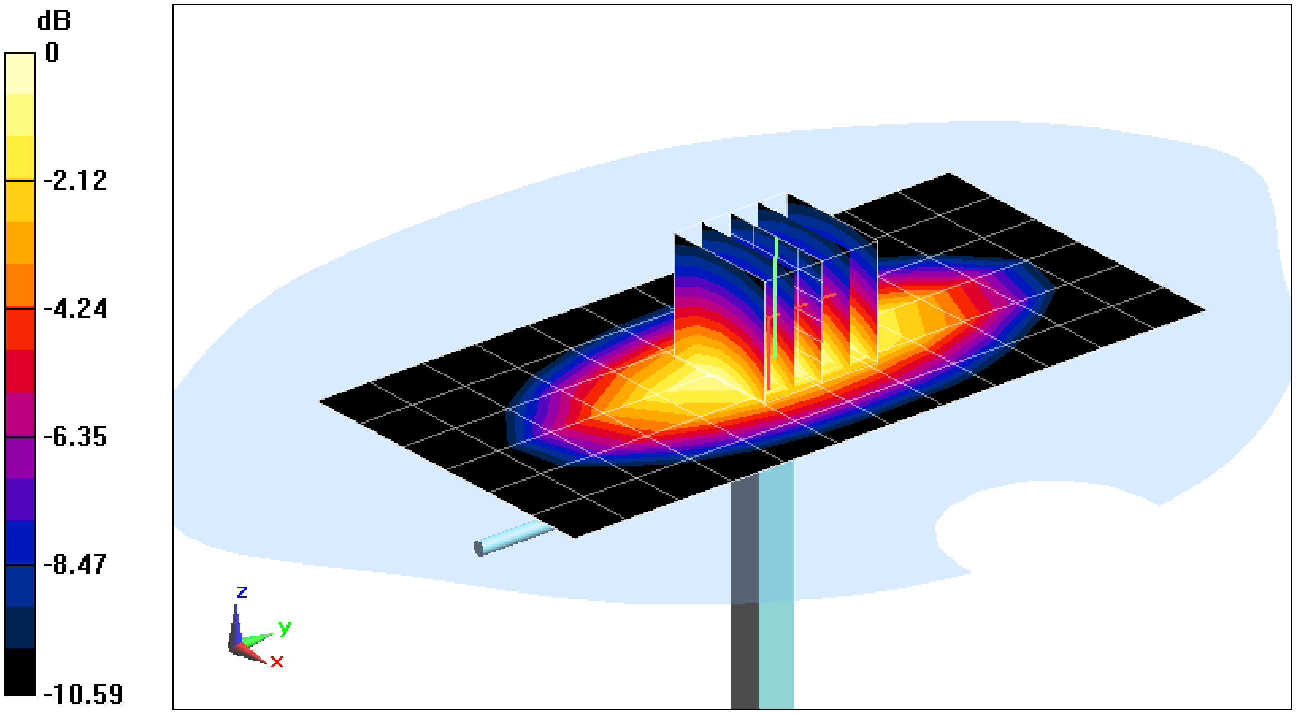
Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: 835 Head Medium parameters used:
f = 835 MHz; σ = 0.934 S/m; ε_r = 42.102; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

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

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

835 MHz System Verification

Area Scan (7x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power: 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 1.47 W/kg
SAR(1 g) = 0.996 W/kg; SAR(10 g) = 0.652 W/kg
Deviation: 6.07%



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

PCTEST ENGINEERING LABORATORY, INC.

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

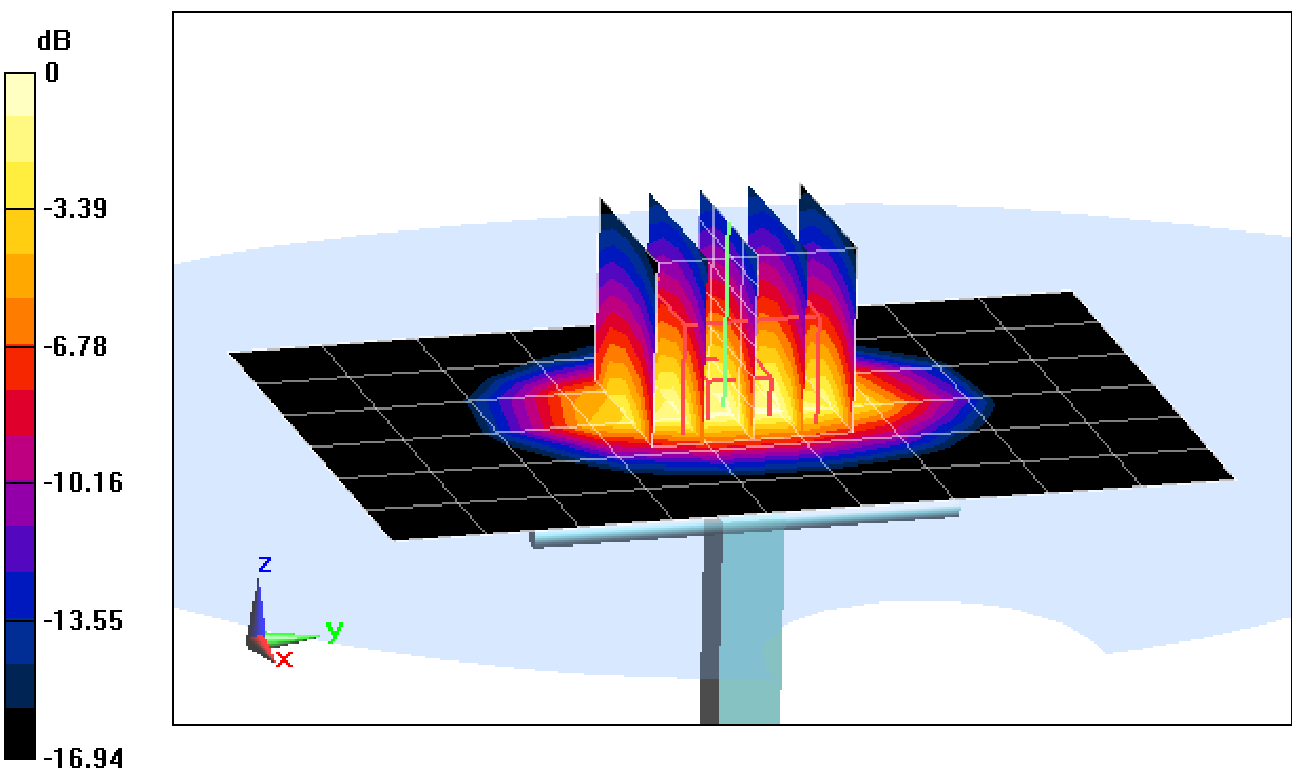
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: 1900 Head Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.424 S/m; ε_r = 40.436; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-11-2013; Ambient Temp: 24.4°C; Tissue Temp: 23.0°C

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

1900 MHz System Verification

Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power = 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 7.16 W/kg
SAR(1 g) = 3.91 W/kg; SAR(10 g) = 2.05 W/kg
Deviation = -1.51%



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

PCTEST ENGINEERING LABORATORY, INC.

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

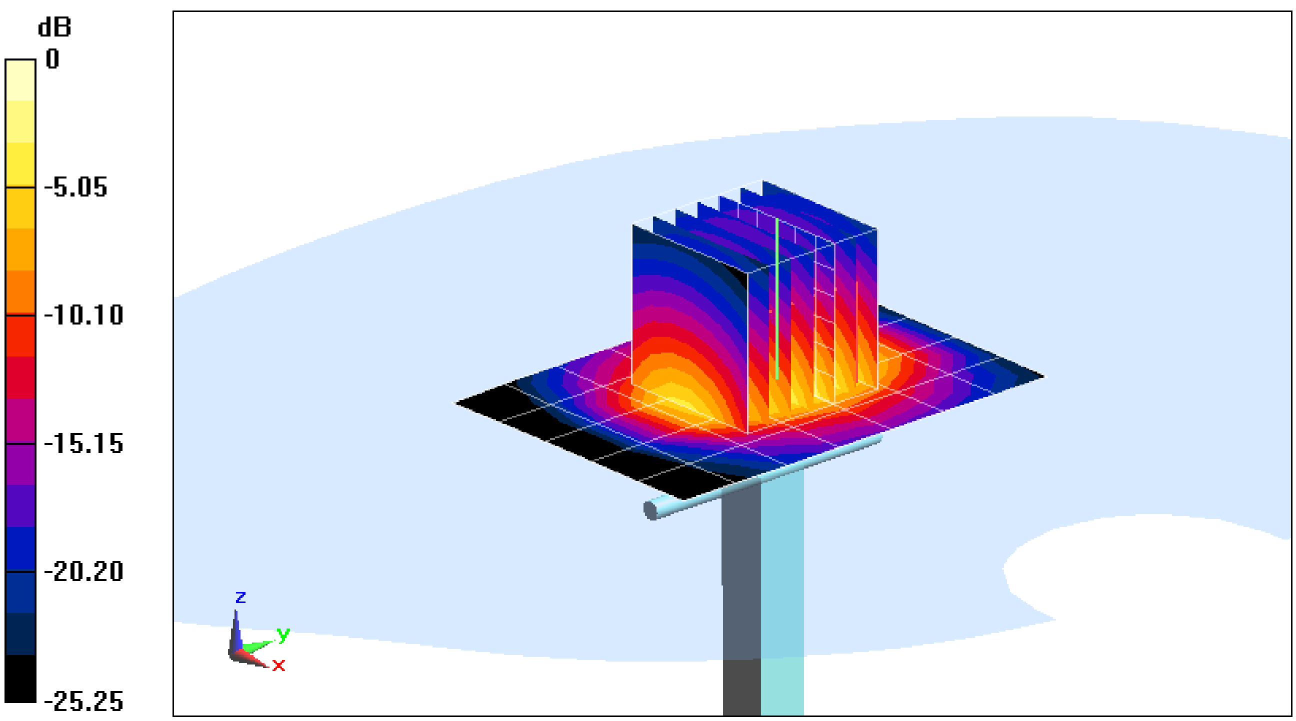
Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: 2450 Head Medium parameters used:
f = 2450 MHz; σ = 1.837 S/m; ε_r = 40.994; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-07-2013; Ambient Temp: 23.6°C; Tissue Temp: 23.1°C

Probe: ES3DV3 - SN3287; ConvF(4.3, 4.3, 4.3); Calibrated: 11/15/2012;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM with CRP; Type: SAM 4.0; Serial: TP1375
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

2450 MHz System Verification

Area Scan (6x8x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Input Power: 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 11.9 W/kg
SAR(1 g) = 5.59 W/kg; SAR(10 g) = 2.54 W/kg
Deviation: 6.07%



0 dB = 7.39 W/kg = 8.69 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

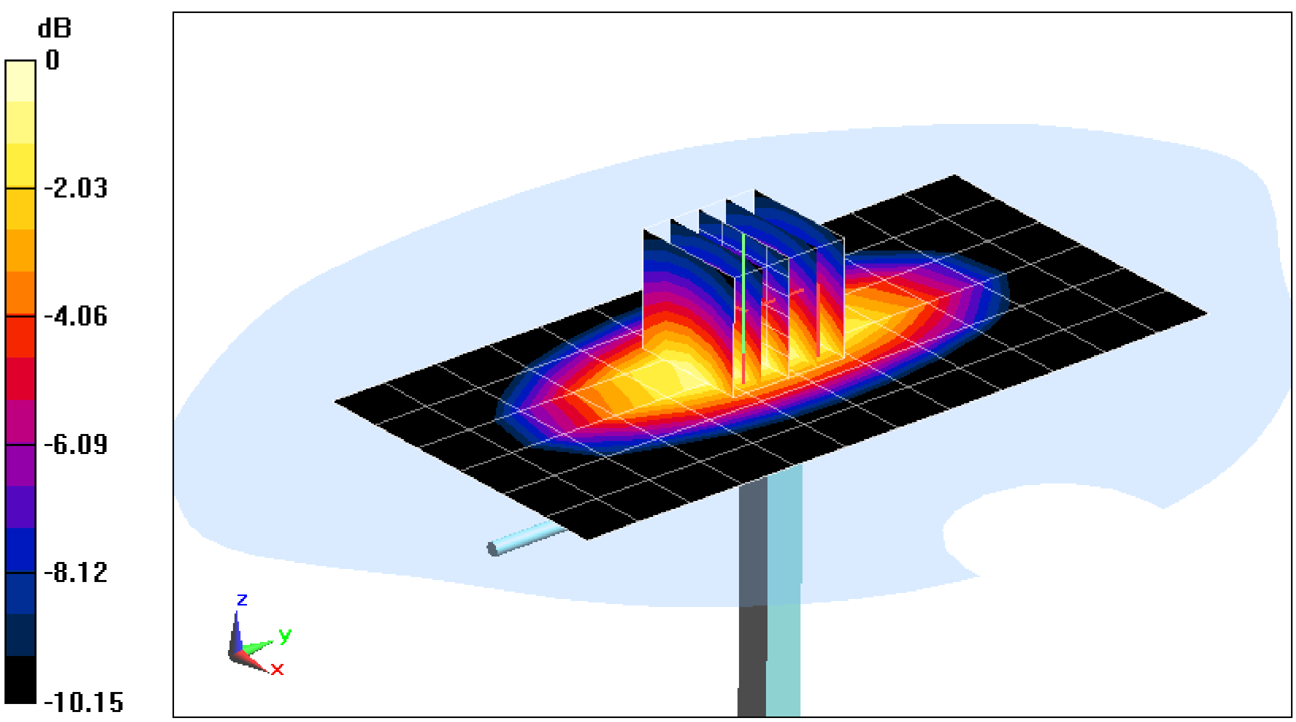
Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: 835 Body Medium parameters used:
f = 835 MHz; σ = 0.962 S/m; ε_r = 54.029; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 03-14-2013; Ambient Temp: 24.4°C; Tissue Temp: 22.7°C

Probe: ES3DV2 - SN3022; ConvF(6.02, 6.02, 6.02); Calibrated: 8/28/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1322; Calibrated: 8/24/2012
Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

835 MHz System Verification

Area Scan (7x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power: 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 1.39 W/kg
SAR(1 g) = 0.959 W/kg; SAR(10 g) = 0.635 W/kg
Deviation: 0.10%



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

PCTEST ENGINEERING LABORATORY, INC.

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

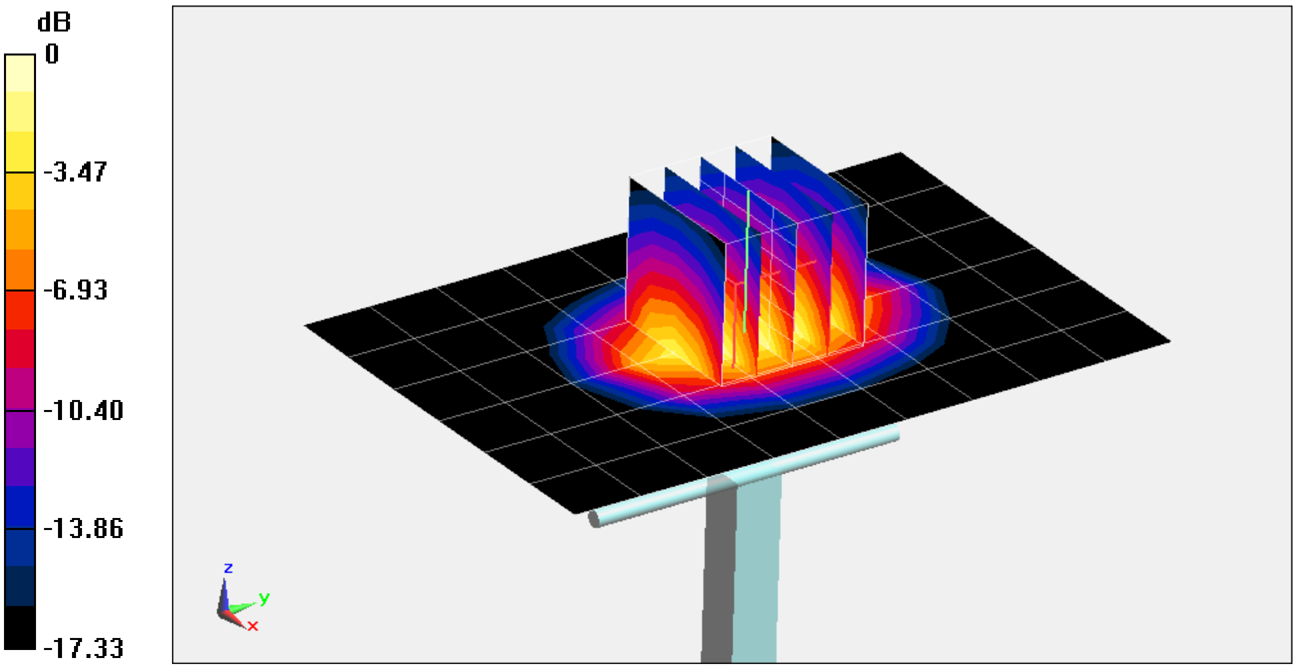
Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: 1900 Body Medium parameters used (interpolated):
f = 1900 MHz; σ = 1.586 S/m; ε_r = 51.356; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 03-14-2013; Ambient Temp: 23.9°C; Tissue Temp: 22.7°C

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

1900 MHz System Verification

Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power: 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 7.53 W/kg
SAR(1 g) = 4.15 W/kg; SAR(10 g) = 2.17 W/kg
Deviation: 1.72%



0 dB = 4.77 W/kg = 6.78 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

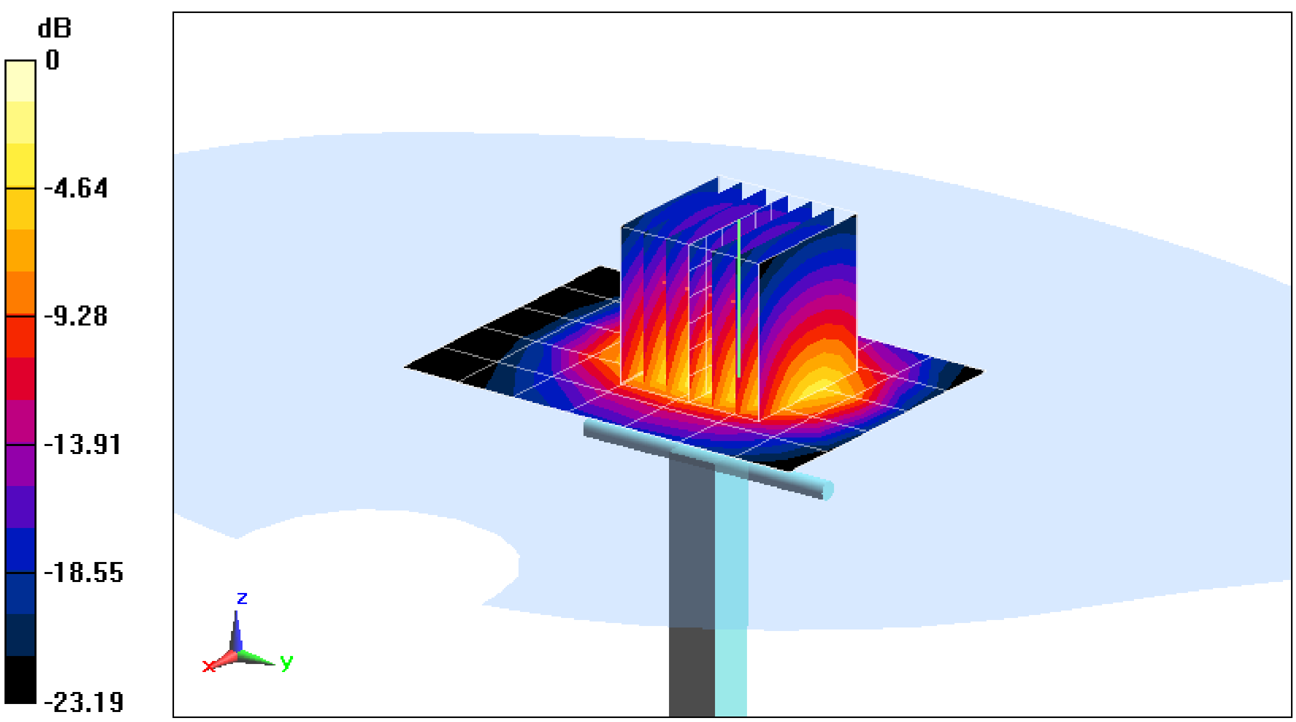
Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used:
f = 2450 MHz; σ = 1.977 S/m; ε_r = 51.362; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 03-04-2013; Ambient Temp: 23.8°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3287; ConvF(4.29, 4.29, 4.29); Calibrated: 11/15/2012;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.8 (7028)

2450 MHz System Verification

Area Scan (6x8x1): Measurement grid: dx=12mm, dy=12mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Input Power: 20.0 dBm (100 mW)
Peak SAR (extrapolated) = 10.7 W/kg
SAR(1 g) = 4.91 W/kg; SAR(10 g) = 2.25 W/kg
Deviation: -4.84%



0 dB = 6.17 W/kg = 7.90 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

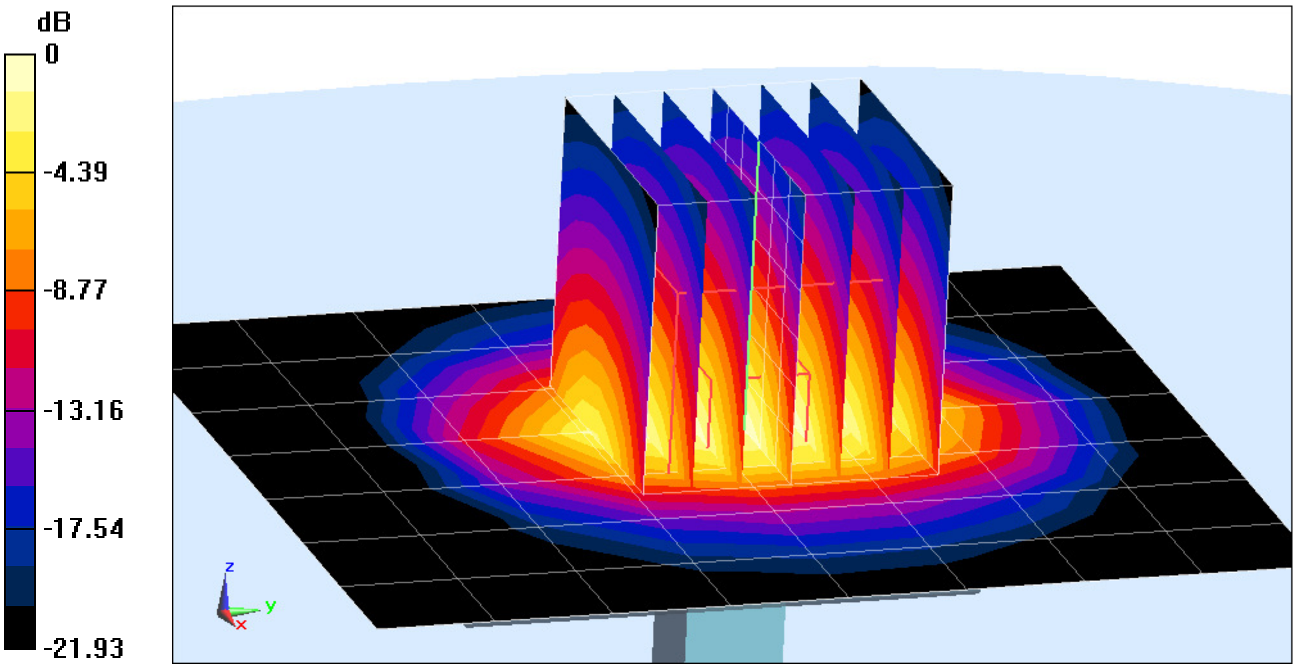
Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: 2450 Body Medium parameters used:
f = 2450 MHz; σ = 2.01 S/m; ε_r = 51.38; ρ = 1000 kg/m^3
Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 03-14-2013; Ambient Temp: 23.5°C; Tissue Temp: 23.2°C

Probe: ES3DV3 - SN3288; ConvF(4.35, 4.35, 4.35); Calibrated: 9/20/2012;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1323; Calibrated: 9/19/2012
Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646
Measurement SW: DASY52, Version 52.8 (5);SEMCAD X Version 14.6.8 (7028)

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) = 10.6 W/kg
SAR(1 g) = 5.08 W/kg; SAR(10 g) = 2.34 W/kg
Deviation = 2.42 %



0 dB = 6.69 W/kg = 8.25 dBW/kg

APPENDIX C: PROBE CALIBRATION

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

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

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

Accreditation No.: SCS 108

Client **PC Test**

Certificate No: D1900V2-5d148_Feb13

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d148
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	February 06, 2013

✓ KOK 2/21/13

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

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

Issued: February 6, 2013

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

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied.

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

SAR result with Head TSL

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

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

Body TSL parameters

The following parameters and calculations were applied.

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

SAR result with Body TSL

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

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

Appendix

Antenna Parameters with Head TSL

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

Antenna Parameters with Body TSL

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

General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 11, 2011

DASY5 Validation Report for Head TSL

Date: 06.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

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

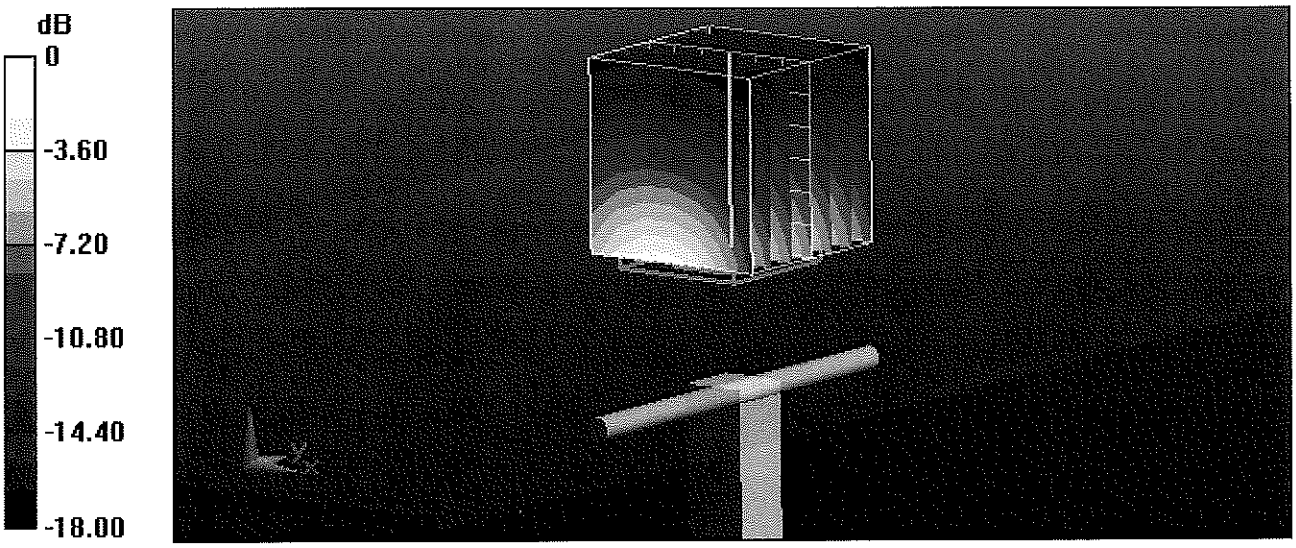
Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.38 S/m; ε_r = 39.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

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

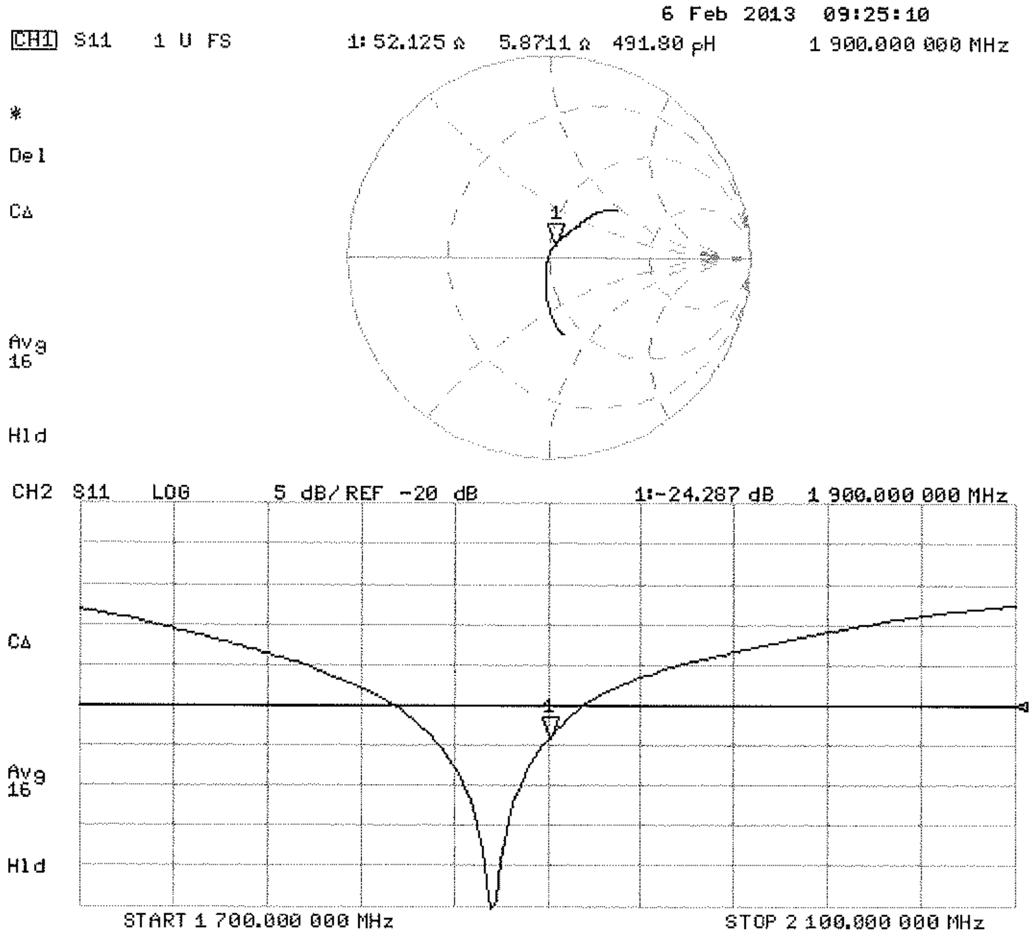
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

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



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

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 06.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

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

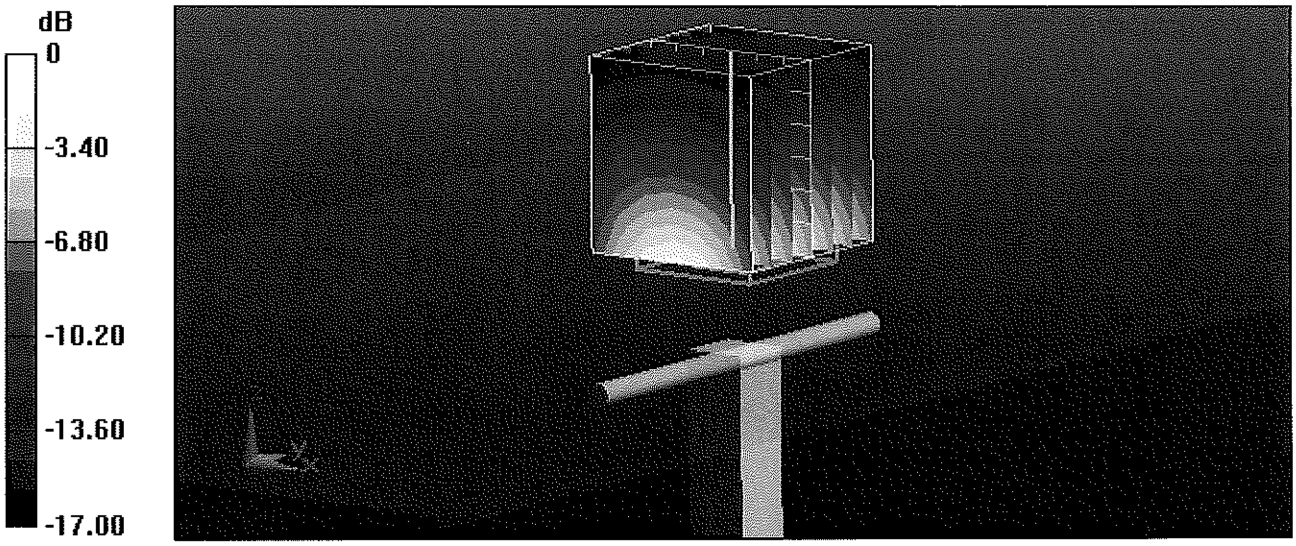
Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.53 S/m; ε_r = 51.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

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

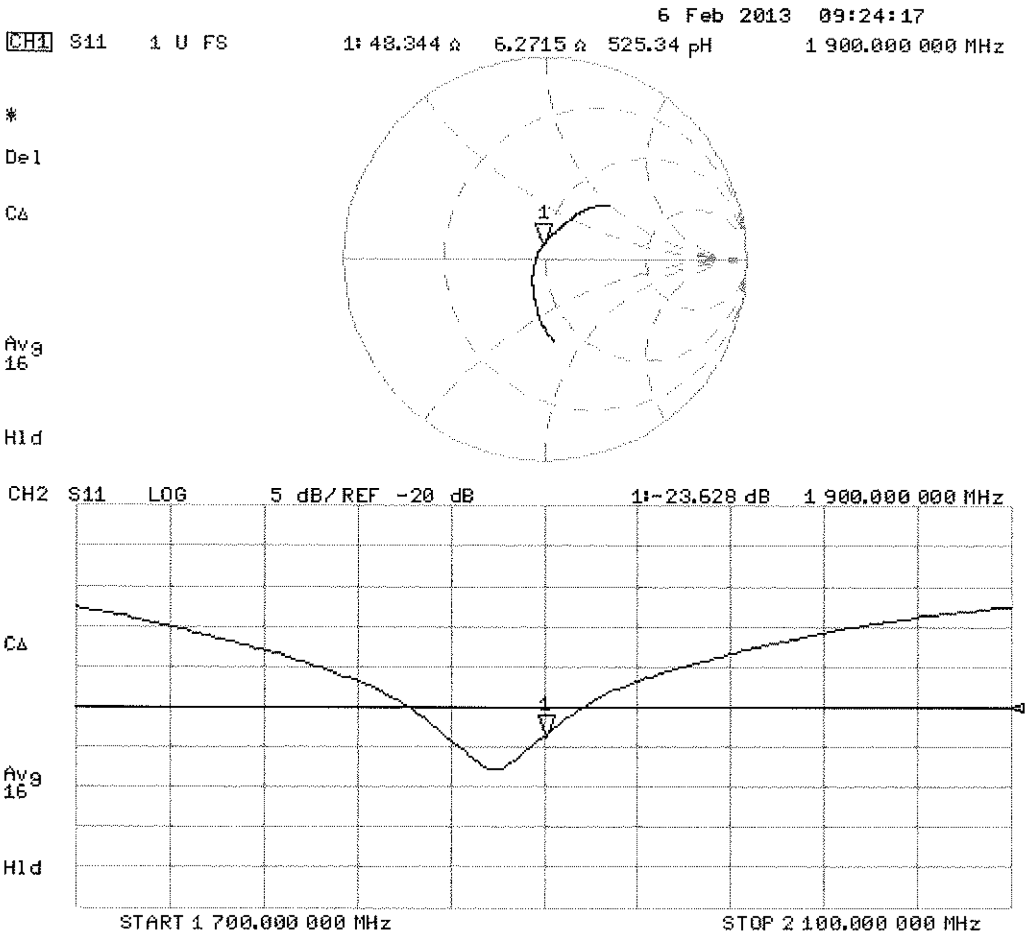
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

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



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

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client PC Test

Certificate No: D2450V2-719_Aug12

CALIBRATION CERTIFICATE

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

✓ KOK 9/17/12

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

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

Issued: August 23, 2012

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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied.

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

SAR result with Head TSL

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

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

Body TSL parameters

The following parameters and calculations were applied.

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

SAR result with Body TSL

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

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

Appendix

Antenna Parameters with Head TSL

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

Antenna Parameters with Body TSL

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

General Antenna Parameters and Design

Electrical Delay (one direction)	1.150 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 10, 2002

DASY5 Validation Report for Head TSL

Date: 23.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

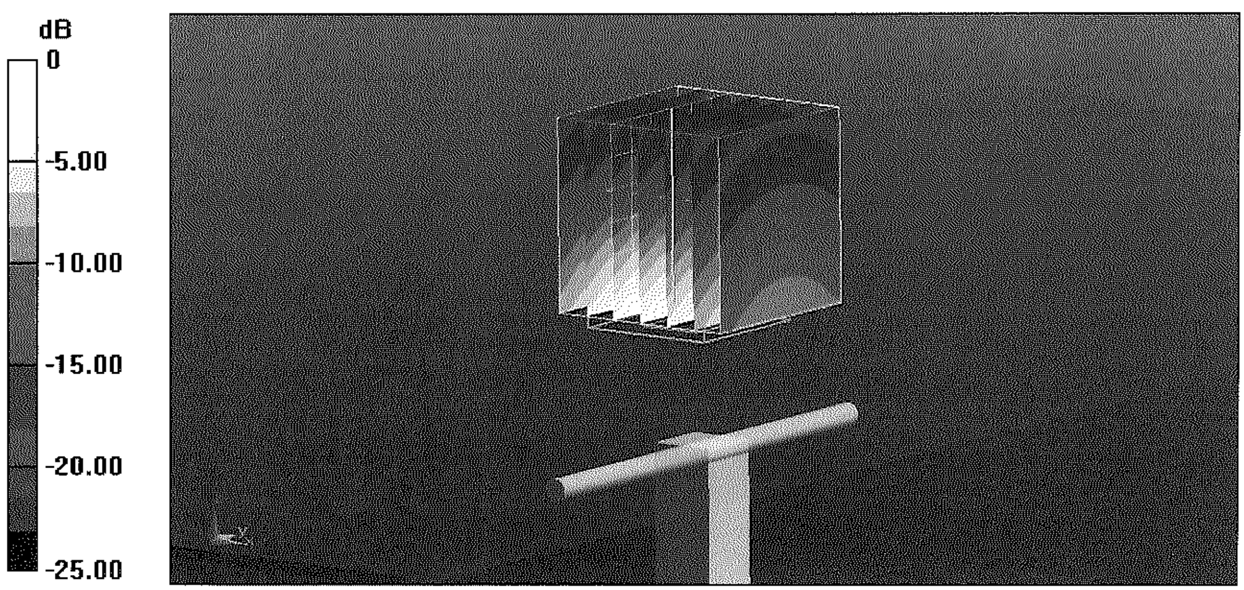
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; $\sigma = 1.81$ mho/m; $\varepsilon_r = 39.2$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

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

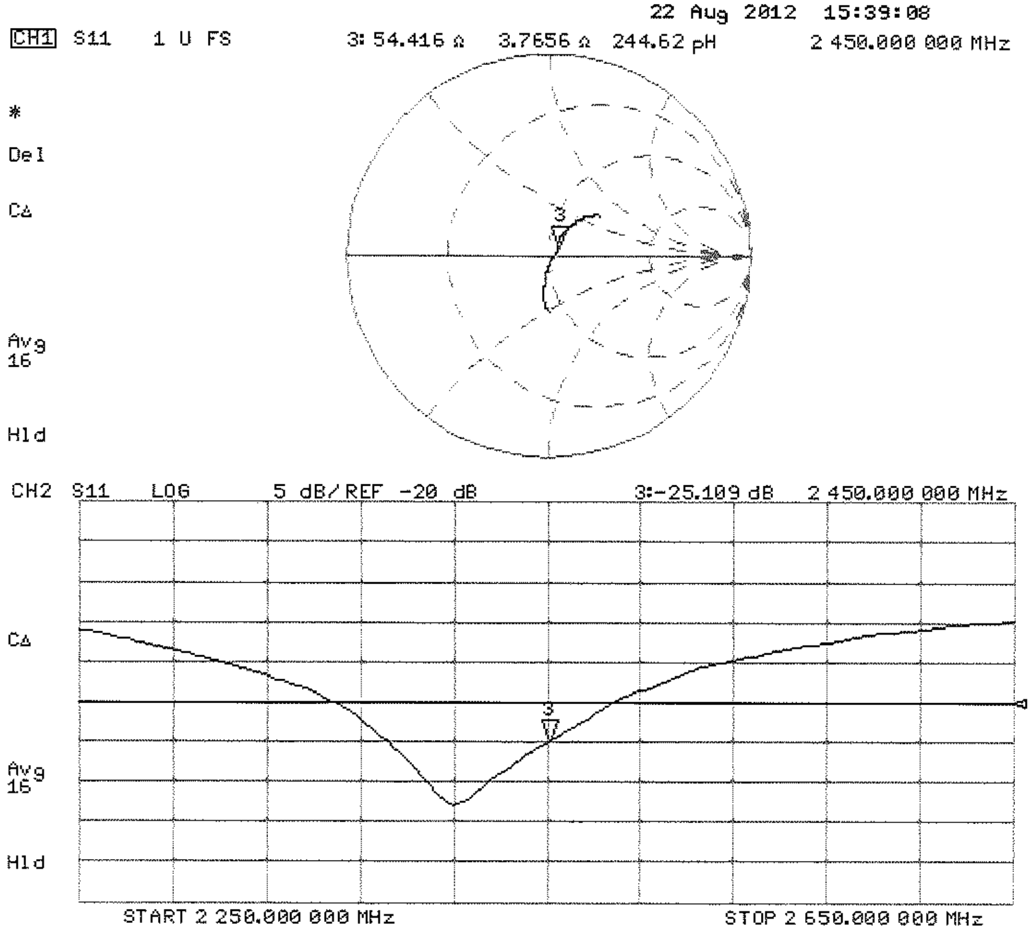
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

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



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

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 22.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

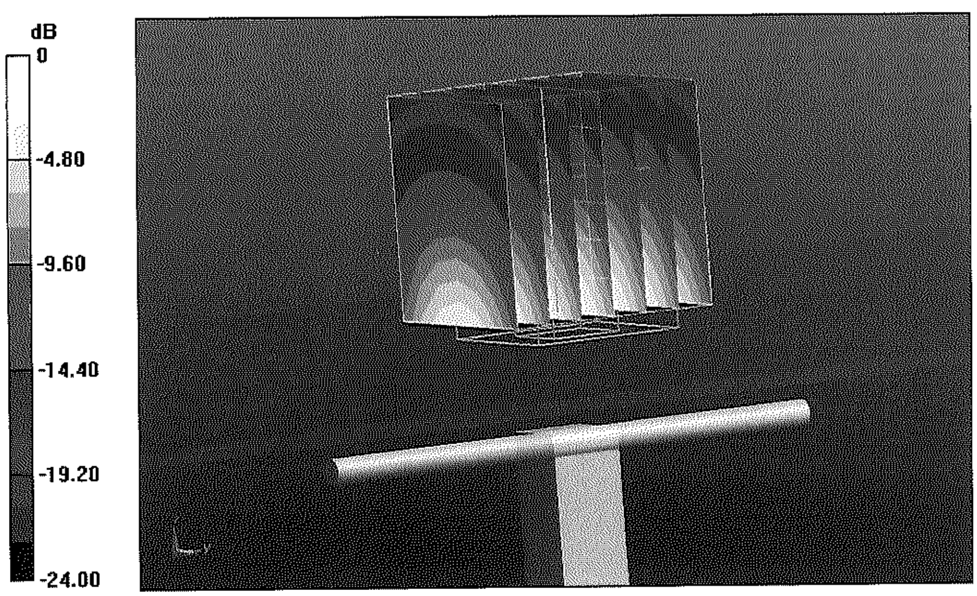
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.99 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

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

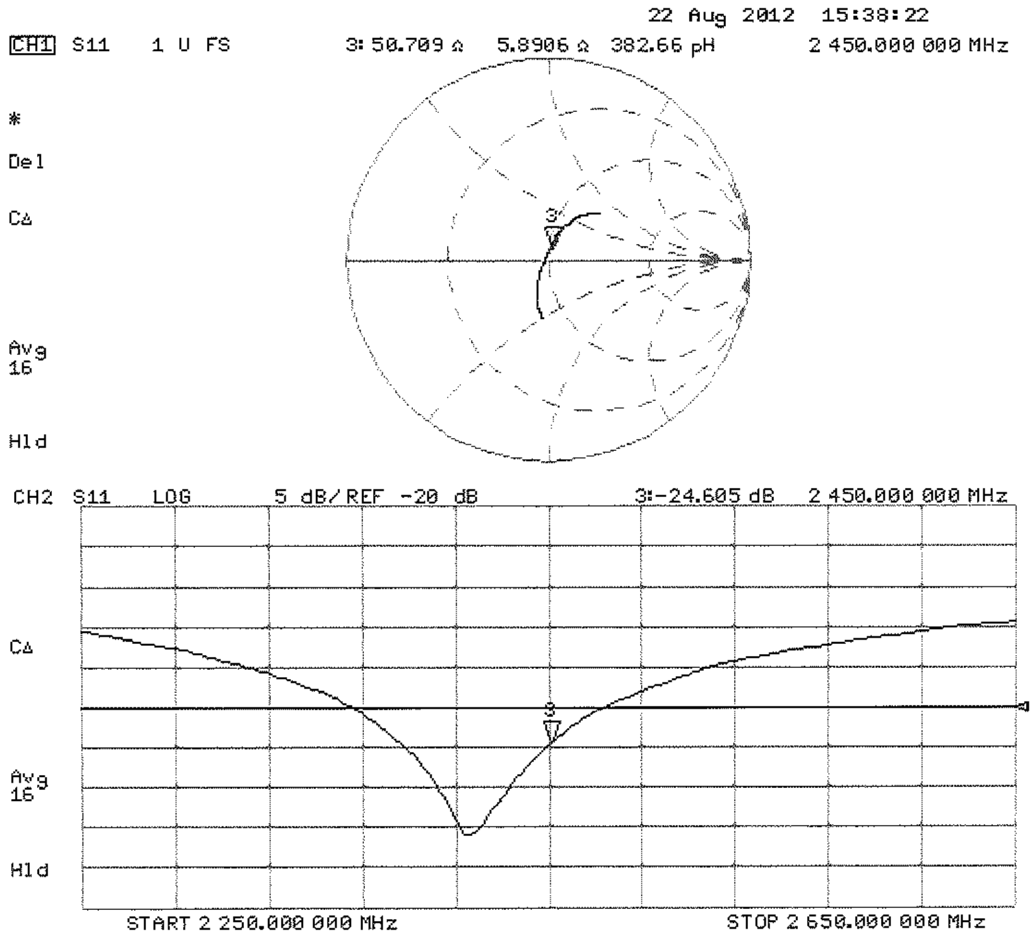
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

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



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

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client **PC Test**

Certificate No: D2450V2-797_Jan13

CALIBRATION CERTIFICATE

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

✓ KOK 1/28/13

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

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

Issued: January 8, 2013

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied.

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

SAR result with Head TSL

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

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

Body TSL parameters

The following parameters and calculations were applied.

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

SAR result with Body TSL

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

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

Appendix

Antenna Parameters with Head TSL

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

Antenna Parameters with Body TSL

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

General Antenna Parameters and Design

Electrical Delay (one direction)	1.152 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	January 24, 2006

DASY5 Validation Report for Head TSL

Date: 08.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

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

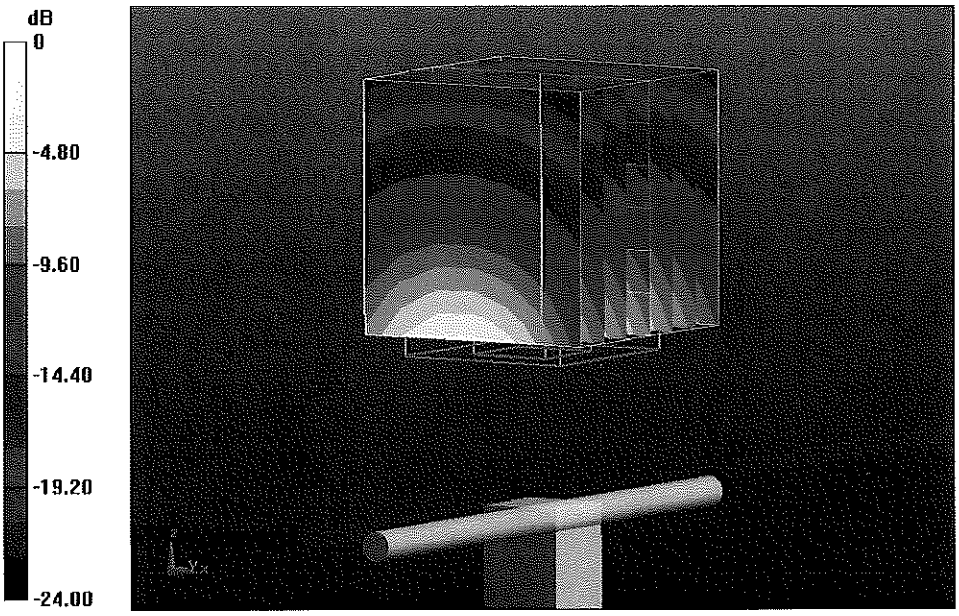
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.85 S/m; ε_r = 37.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

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

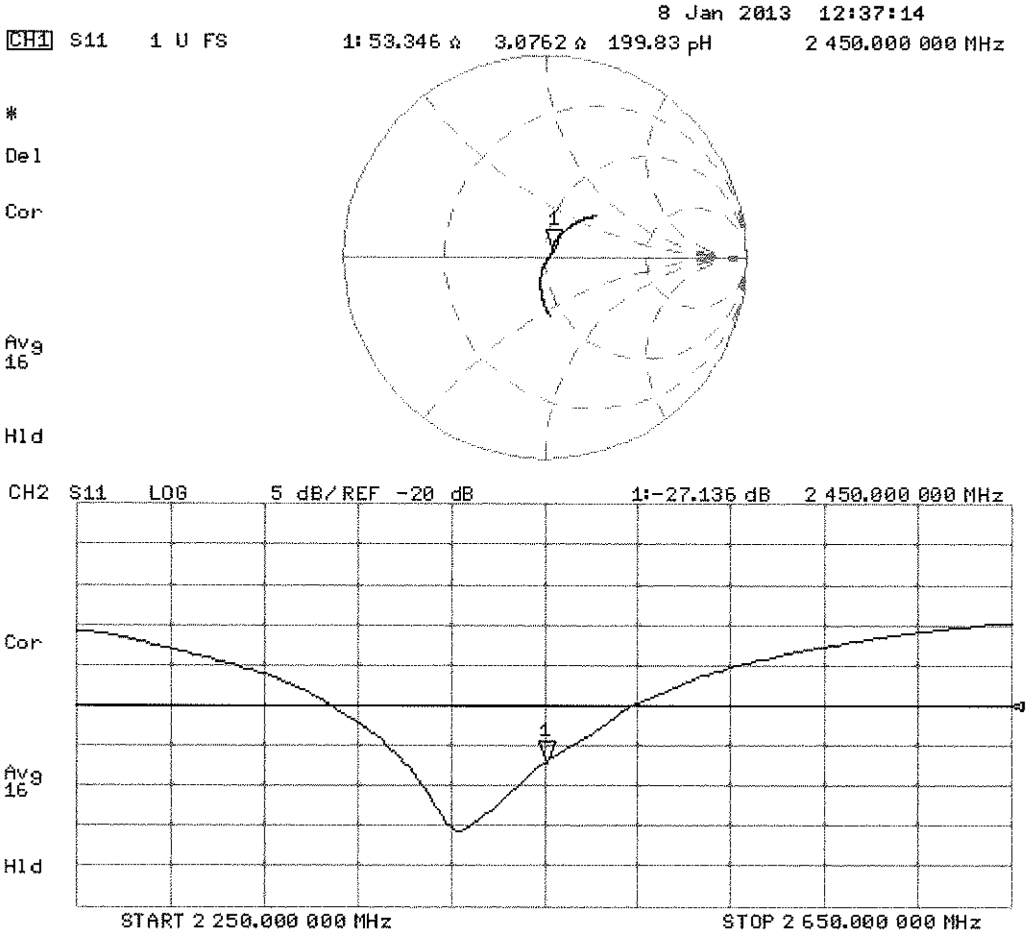
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

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



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

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 08.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

DASY52 Configuration:

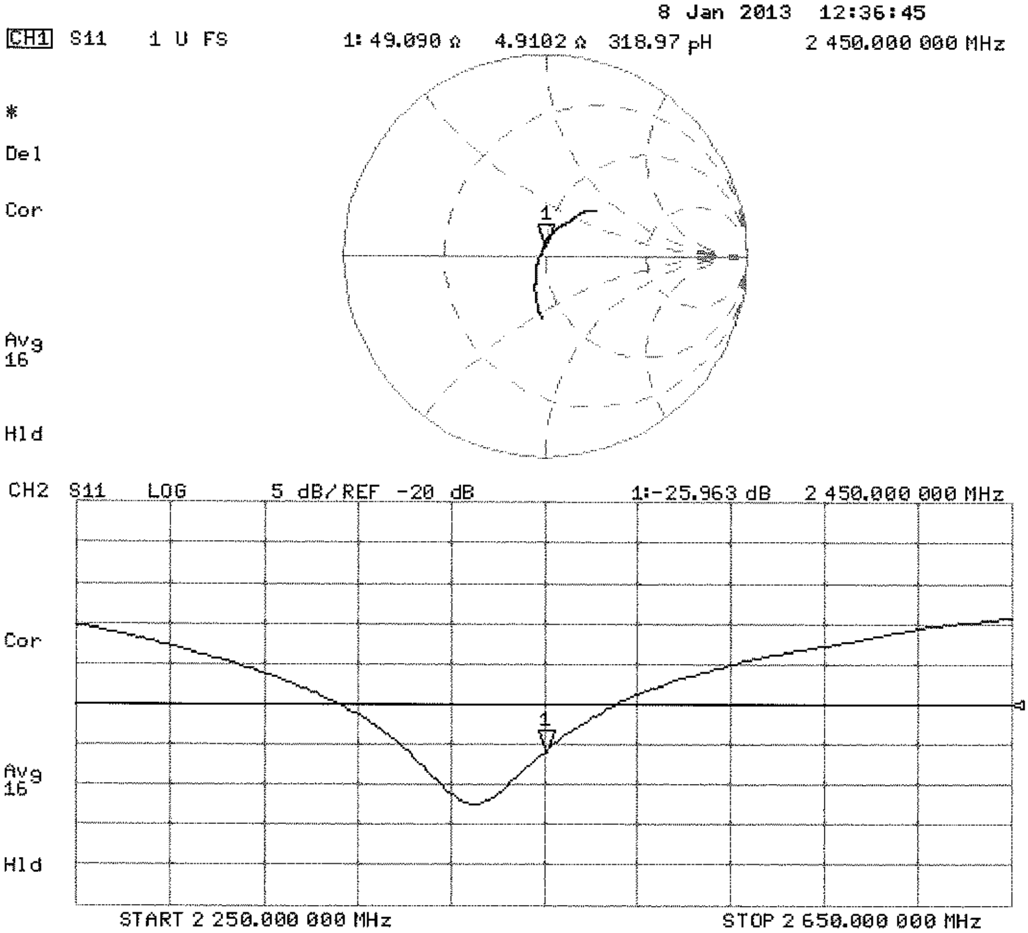
- Probe: ES3DV3 - SN3205; ConvF(4.42, 4.42, 4.42); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.4(1052); SEMCAD X 14.6.8(7028)

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

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

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

Impedance Measurement Plot for Body TSL



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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D835V2-4d026_Aug12**

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d026
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	August 23, 2012

KOK 9/17/12

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

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

Issued: August 23, 2012

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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.3 ± 6 %	0.90 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.35 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**9.39 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.53 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**6.12 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.2 ± 6 %	1.00 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.47 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**9.58 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.62 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**6.33 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.7 Ω - 3.4 jΩ
Return Loss	- 26.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.6 Ω - 4.8 jΩ
Return Loss	- 26.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.389 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 17, 2004

DASY5 Validation Report for Head TSL

Date: 23.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

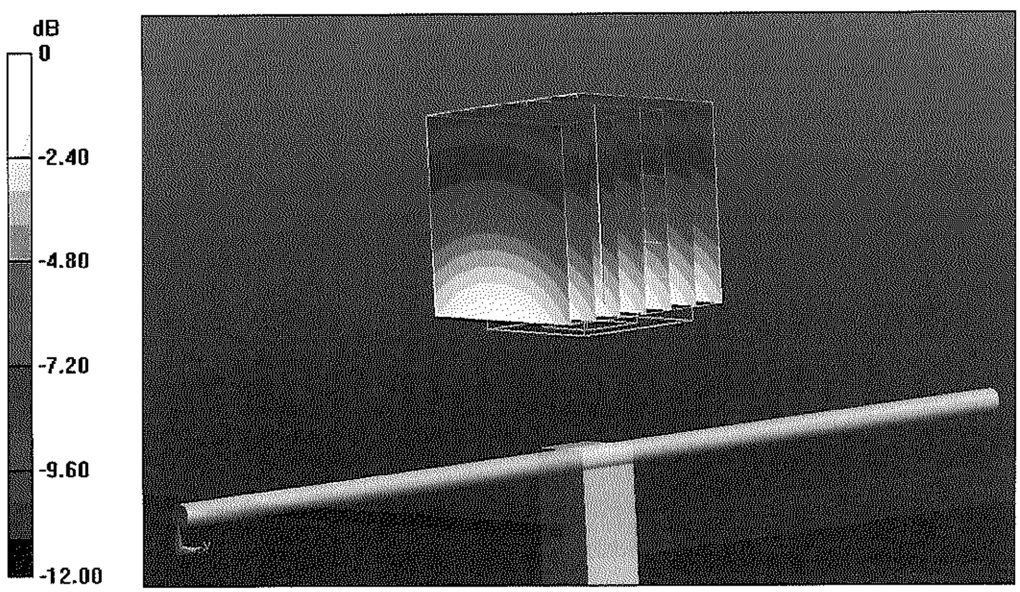
Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.9 mho/m; ε_r = 41.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.07, 6.07, 6.07); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

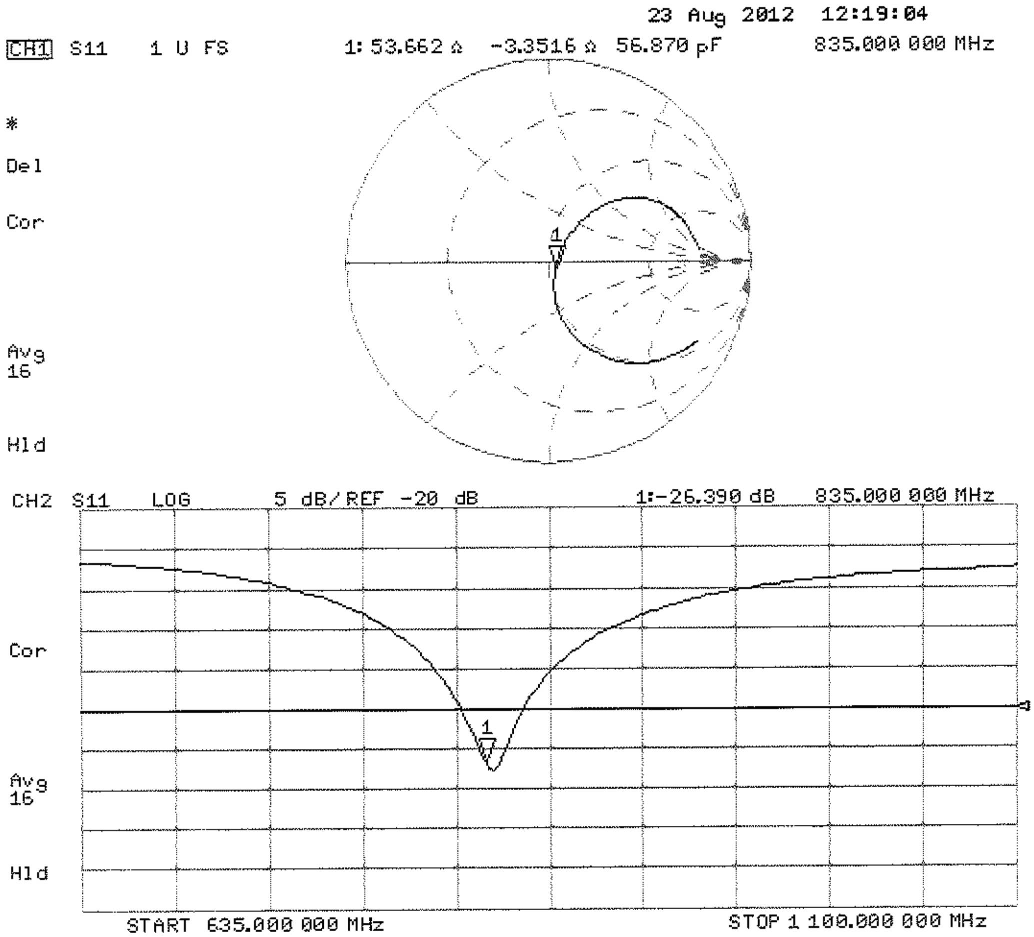
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm 2/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.824 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.482 mW/g
SAR(1 g) = 2.35 mW/g; SAR(10 g) = 1.53 mW/g
Maximum value of SAR (measured) = 2.72 W/kg



0 dB = 2.72 W/kg = 8.69 dB W/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 23.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

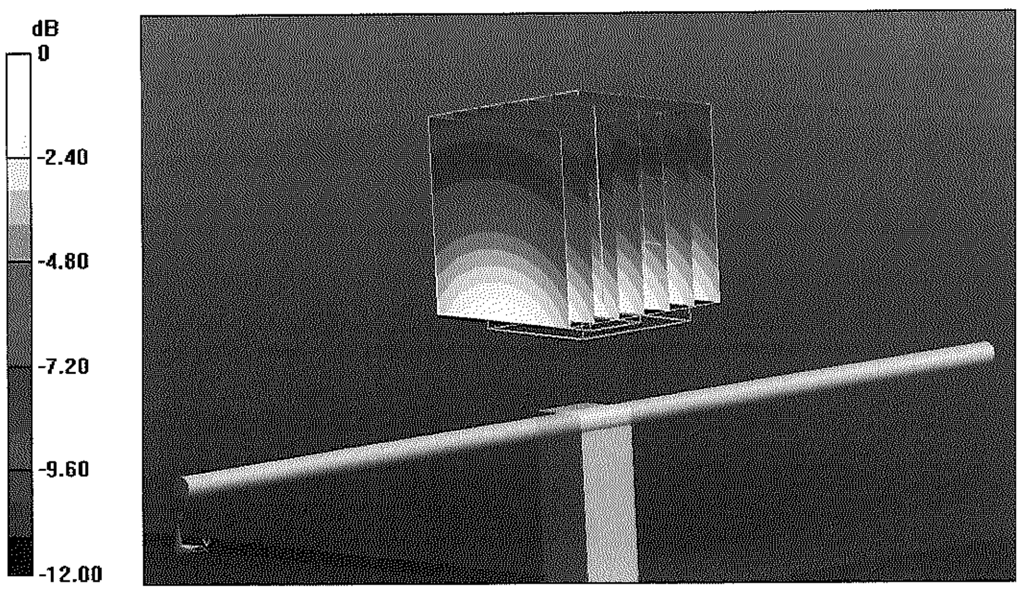
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d026

Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1 mho/m; ε_r = 53.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

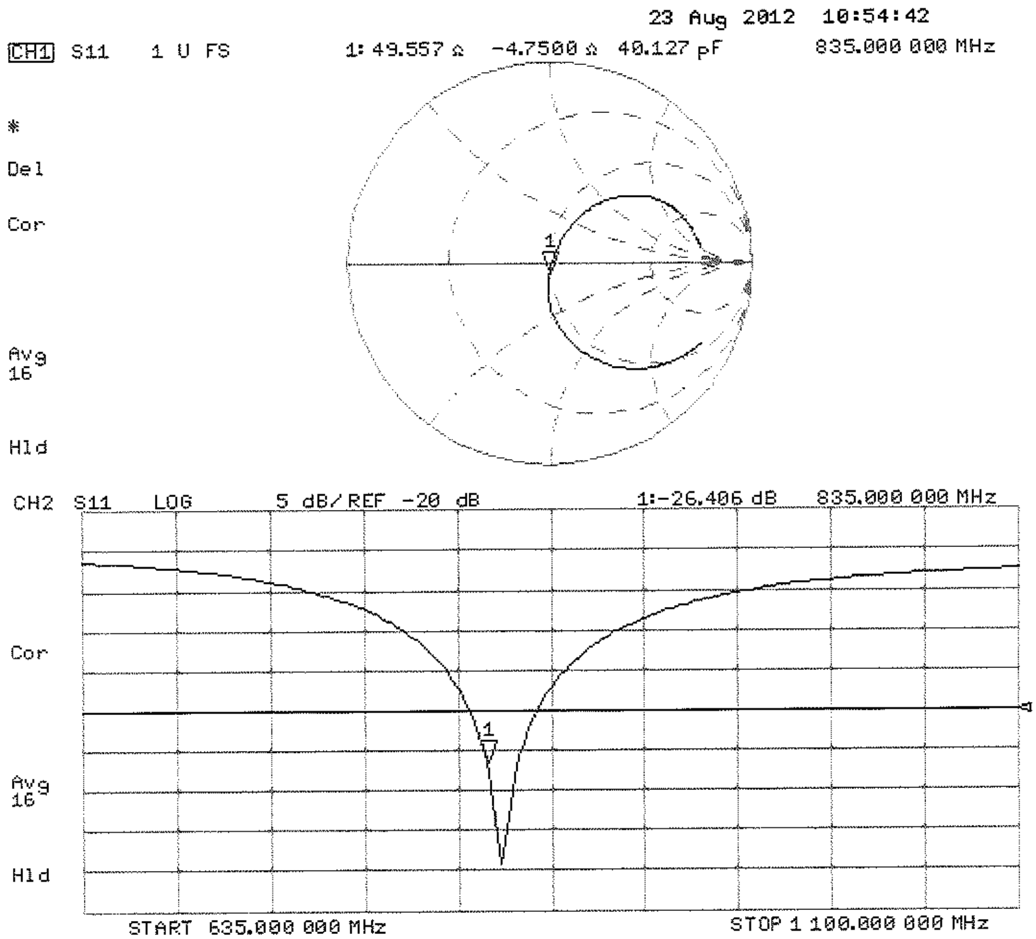
- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.339 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 3.592 mW/g
SAR(1 g) = 2.47 mW/g; SAR(10 g) = 1.62 mW/g
Maximum value of SAR (measured) = 2.87 W/kg



0 dB = 2.87 W/kg = 9.16 dB W/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client **PC Test**

Certificate No: ES3-3022_Aug12

CALIBRATION CERTIFICATE

Object: ES3DV2 - SN:3022

Calibration procedure(s): QA CAL-01.v8, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes

Calibration date: August 28, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 660	20-Jun-12 (No. DAE4-660_Jun12)	Jun-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Issued: August 28, 2012

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV2

SN:3022

Manufactured: April 15, 2003
Calibrated: August 28, 2012

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.00	1.04	0.99	± 10.1 %
DCP (mV)[B]	98.3	99.5	101.3	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
0	CW	0.00	X	0.00	0.00	1.00	133.3	±2.7 %
			Y	0.00	0.00	1.00	140.3	
			Z	0.00	0.00	1.00	178.9	

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

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

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	6.30	6.30	6.30	0.30	1.72	± 12.0 %
835	41.5	0.90	6.03	6.03	6.03	0.35	1.63	± 12.0 %
1750	40.1	1.37	5.07	5.07	5.07	0.32	1.89	± 12.0 %
1900	40.0	1.40	4.86	4.86	4.86	0.40	1.57	± 12.0 %
2450	39.2	1.80	4.23	4.23	4.23	0.59	1.44	± 12.0 %
2600	39.0	1.96	4.10	4.10	4.10	0.67	1.37	± 12.0 %

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

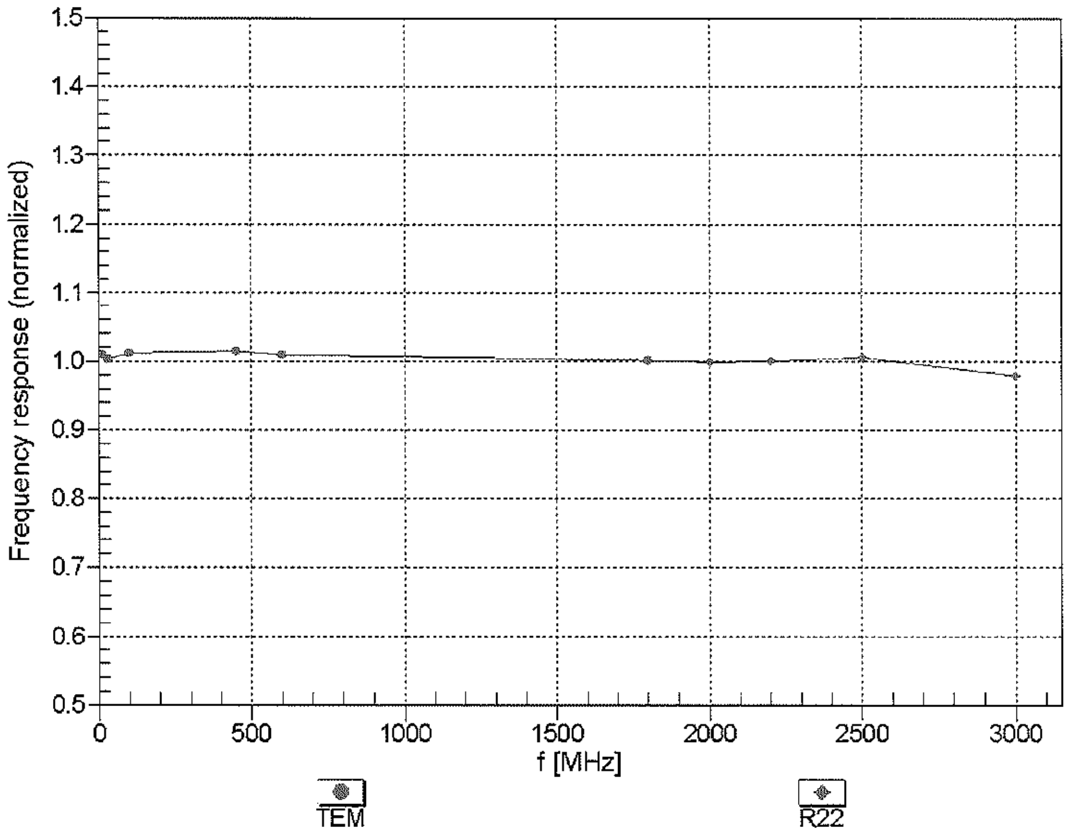
DASY/EASY - Parameters of Probe: ES3DV2 - SN:3022

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	6.07	6.07	6.07	0.23	2.09	± 12.0 %
835	55.2	0.97	6.02	6.02	6.02	0.47	1.44	± 12.0 %
1750	53.4	1.49	4.70	4.70	4.70	0.46	1.55	± 12.0 %
1900	53.3	1.52	4.43	4.43	4.43	0.36	1.87	± 12.0 %
2450	52.7	1.95	3.97	3.97	3.97	0.65	1.06	± 12.0 %
2600	52.5	2.16	3.80	3.80	3.80	0.54	0.75	± 12.0 %

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

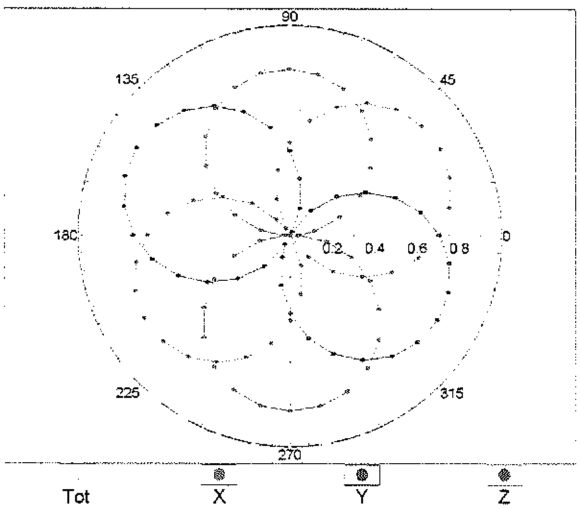
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



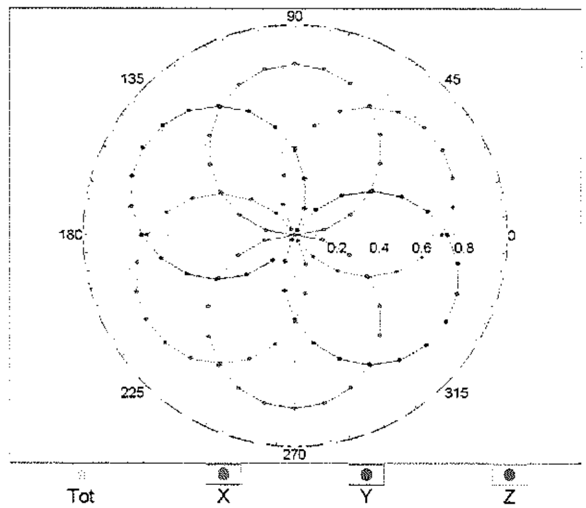
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

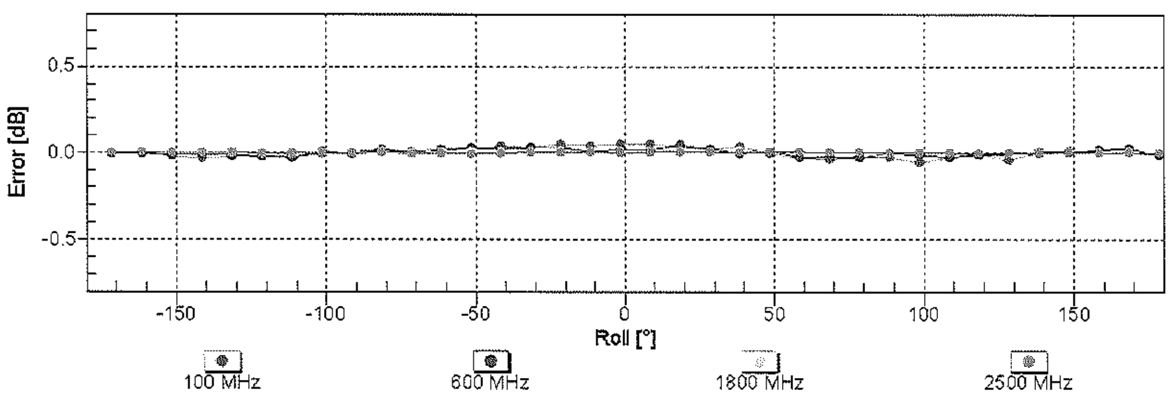
Receiving Pattern (ϕ), $\vartheta = 0°$

f=600 MHz,TEM



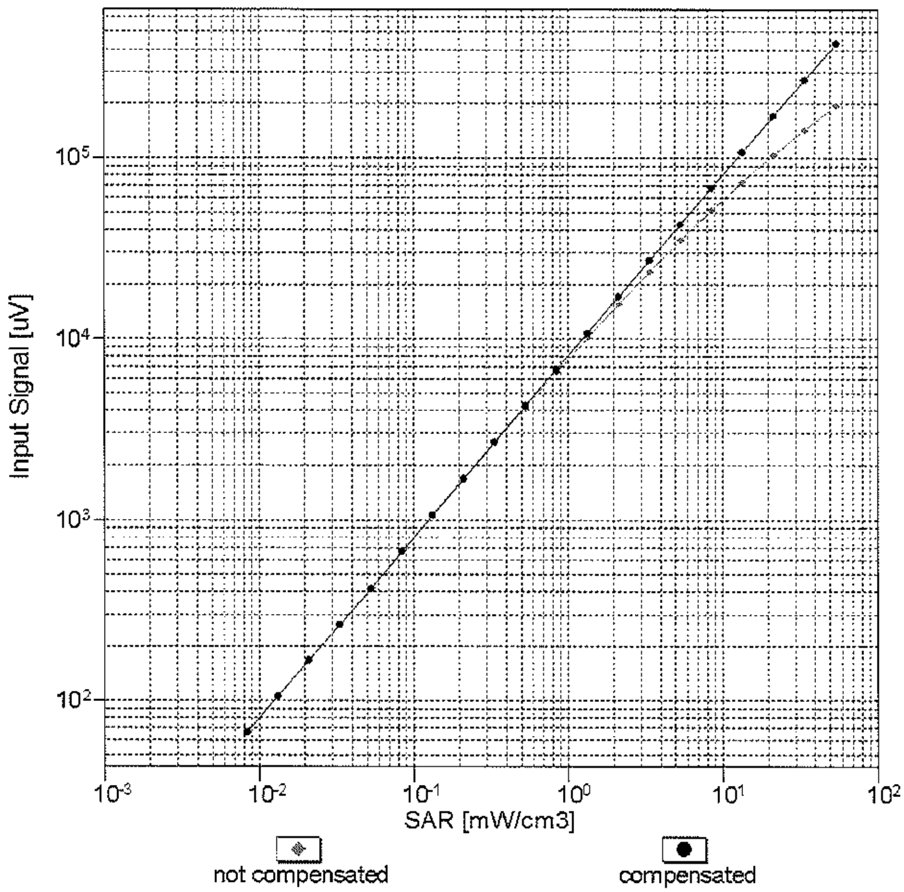
f=1800 MHz,R22

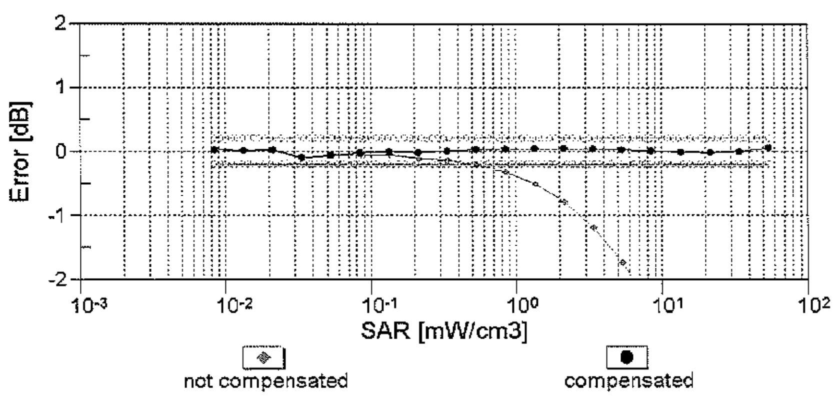




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

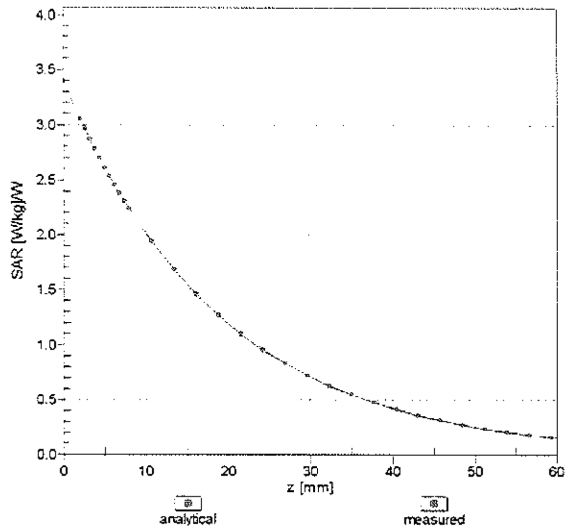




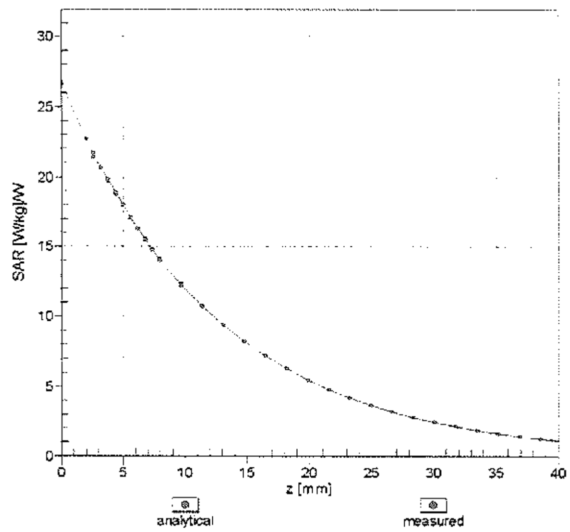
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

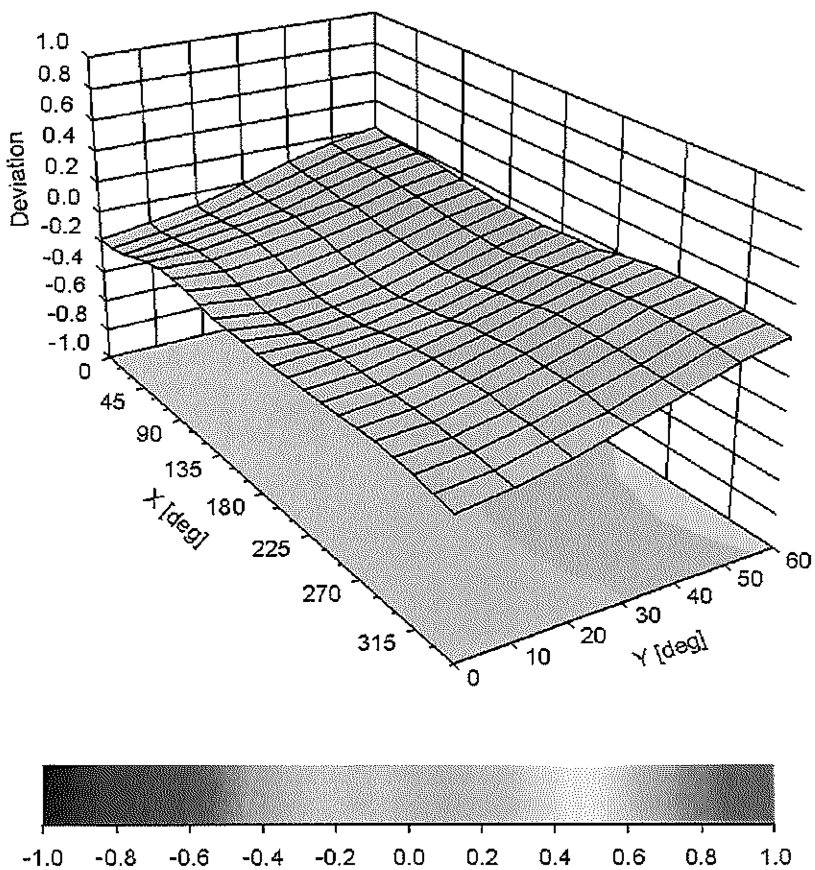


f = 1750 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	98.5
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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

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Accreditation No.: SCS 108

Client **PC Test**

Certificate No: ES3-3213_Apr12

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3213
Calibration procedure(s)	QA CAL-01.v8, QA CAL-23.v4, QA CAL-25.v4 Calibration procedure for dosimetric E-field probes
Calibration date:	April 24, 2012

✓ KOK 5/2/12

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 660	10-Jan-12 (No. DAE4-660_Jan12)	Jan-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

	Name	Function	Signature
Calibrated by:	Dimce Iliev	Laboratory Technician	D. Iliev
Approved by:	Katja Pokovic	Technical Manager	

Issued: April 25, 2012

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

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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3213

Manufactured: October 14, 2008
Calibrated: April 24, 2012

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

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm (µV/(V/m)^2)[A]	1.48	1.36	1.33	± 10.1 %
DCP (mV)[B]	97.8	101.0	99.1	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
0	CW	0.00	X	0.00	0.00	1.00	125.2	±2.5 %
			Y	0.00	0.00	1.00	127.5	
			Z	0.00	0.00	1.00	169.0	

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

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

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	6.32	6.32	6.32	0.50	1.38	± 12.0 %
835	41.5	0.90	6.07	6.07	6.07	0.41	1.57	± 12.0 %
1640	40.3	1.29	5.36	5.36	5.36	0.64	1.24	± 12.0 %
1750	40.1	1.37	5.22	5.22	5.22	0.57	1.39	± 12.0 %
1900	40.0	1.40	5.02	5.02	5.02	0.63	1.32	± 12.0 %
2450	39.2	1.80	4.43	4.43	4.43	0.80	1.22	± 12.0 %
2600	39.0	1.96	4.26	4.26	4.26	0.72	1.36	± 12.0 %

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

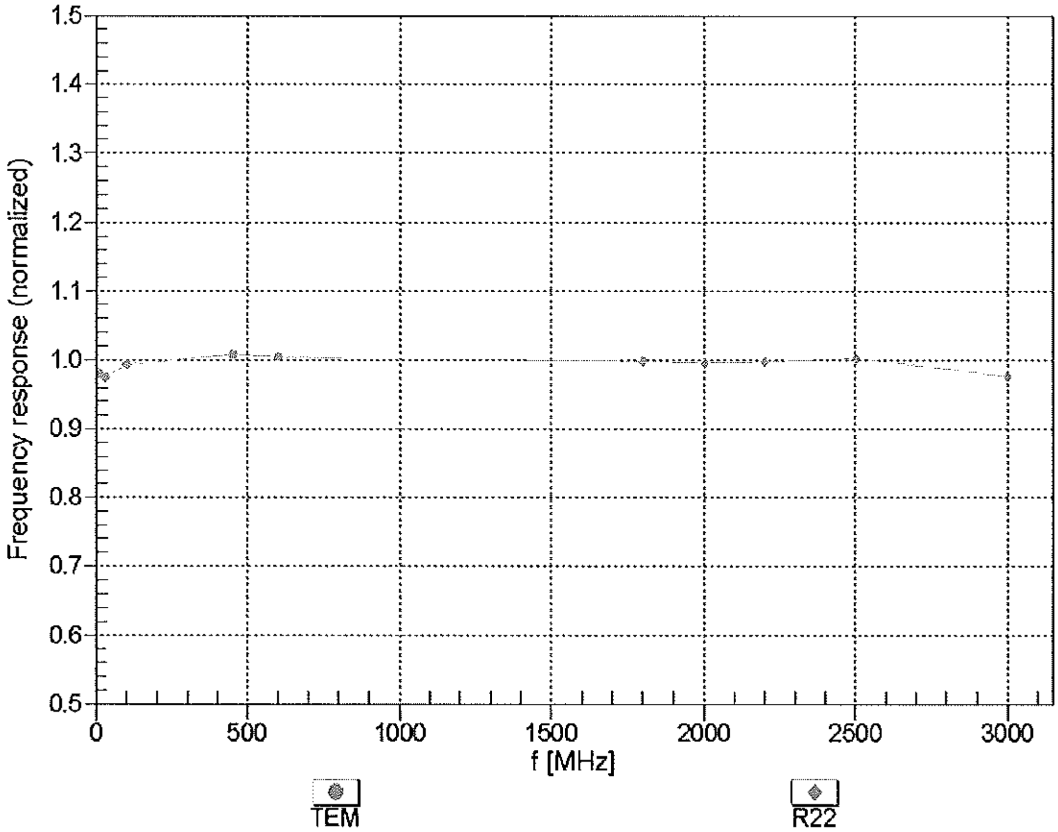
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3213

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	6.19	6.19	6.19	0.31	1.96	± 12.0 %
835	55.2	0.97	6.07	6.07	6.07	0.38	1.73	± 12.0 %
1640	53.8	1.40	5.13	5.13	5.13	0.35	2.07	± 12.0 %
1750	53.4	1.49	4.68	4.68	4.68	0.54	1.56	± 12.0 %
1900	53.3	1.52	4.50	4.50	4.50	0.69	1.37	± 12.0 %
2450	52.7	1.95	4.11	4.11	4.11	0.80	1.04	± 12.0 %
2600	52.5	2.16	3.91	3.91	3.91	0.63	0.92	± 12.0 %

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

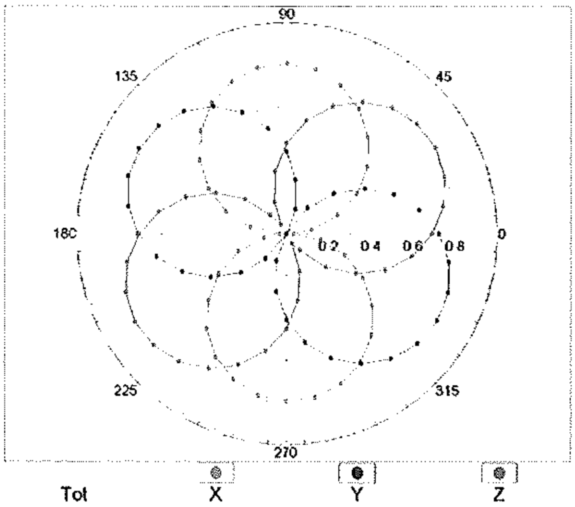
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



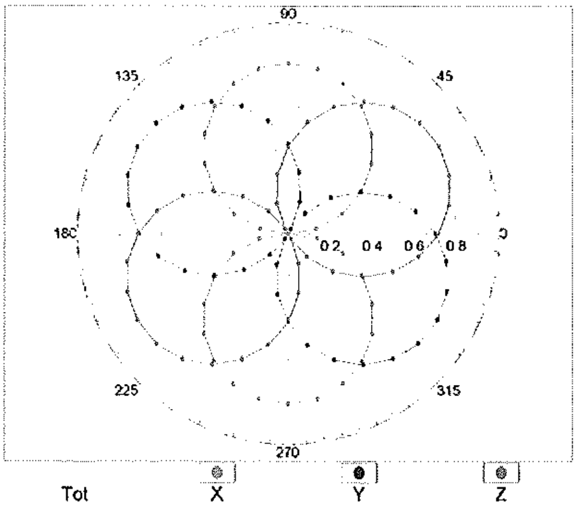
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

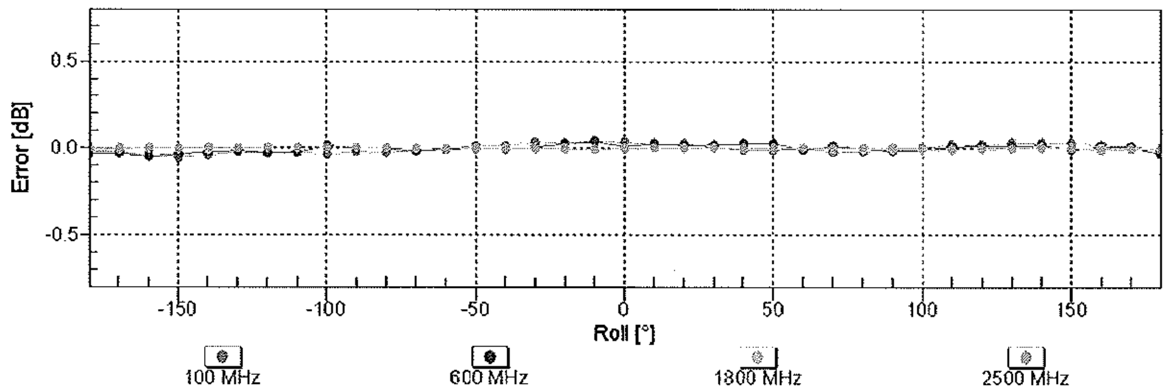
Receiving Pattern (ϕ), $\vartheta = 0°$

f=600 MHz,TEM



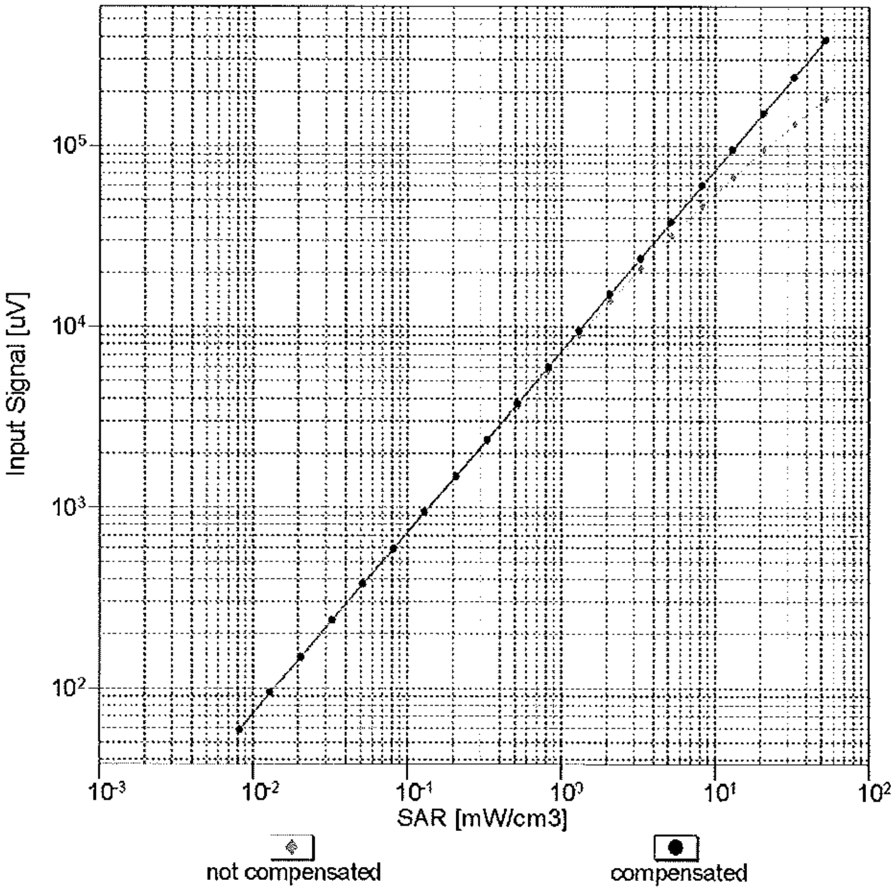
f=1800 MHz,R22

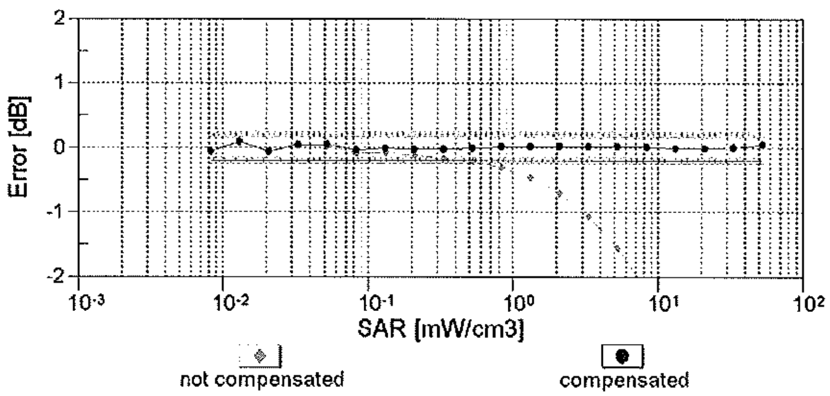




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

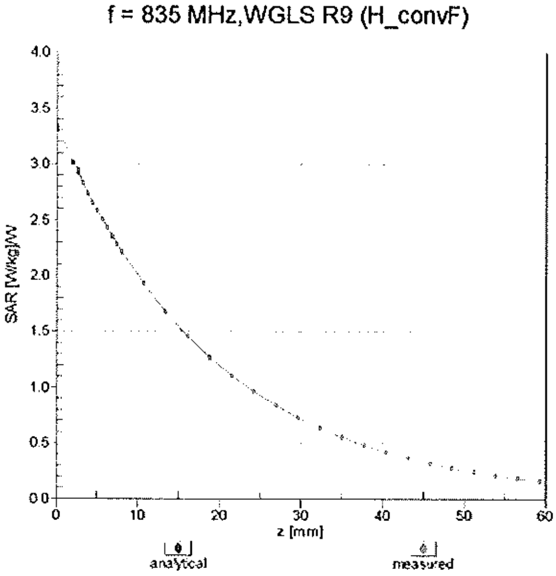
Dynamic Range f(SAR_{head})
(TEM cell , f = 900 MHz)

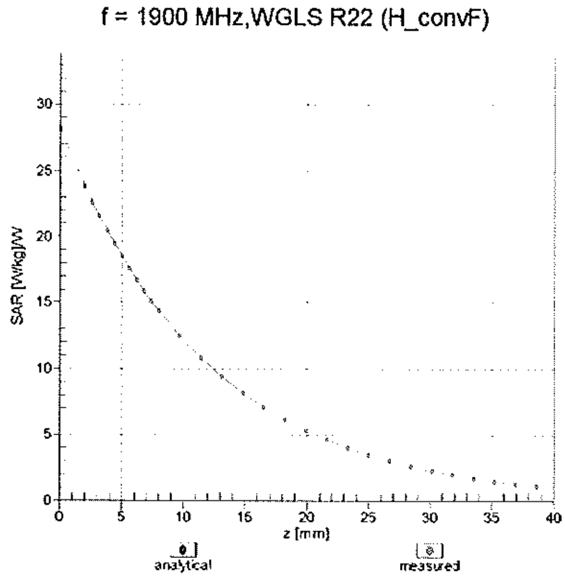




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

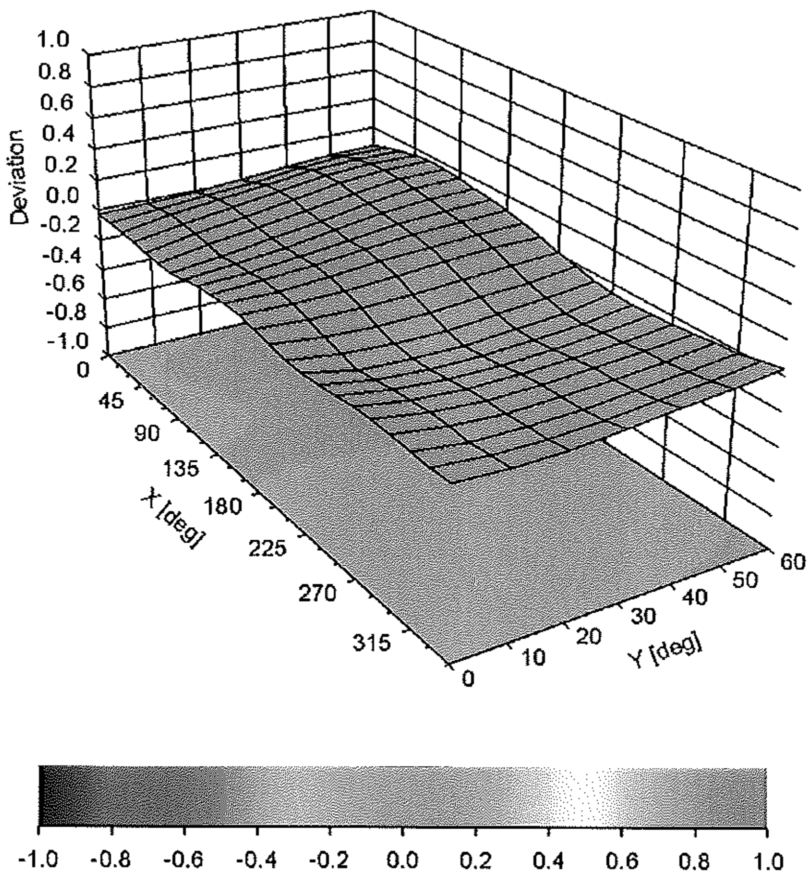
Conversion Factor Assessment





Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	140.1
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm