



SAR EVALUATION REPORT

Applicant Name:

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Date of Testing:

10/16/14 - 11/19/14

Test Site/Location:

PCTEST Lab, Columbia, MD, USA

Document Serial No.:

OY1410141998.A3L

FCC ID:

A3LSMG360P

APPLICANT:

SAMSUNG ELECTRONICS, CO. LTD.

DUT Type:

Portable Handset

Application Type:

Certification

FCC Rule Part(s):

CFR §2.1093

Model(s):

SM-G360P

Equipment Class	Band & Mode	Tx Frequency	SAR		
			1 gm Head (W/kg)	1 gm Body-Worn (W/kg)	1 gm Hotspot (W/kg)
PCE	CDMA/EVDO BC0 (\$22H)	824.70 - 848.31 MHz	0.53	0.79	0.75
PCE	PCS CDMA/EVDO	1851.25 - 1908.75 MHz	1.06	0.80	0.83
PCE	CDMA/EVDO BC10 (\$90S)	817.90 - 823.10 MHz	0.45	0.84	0.83
PCE	LTE Band 25 (PCS)	1850.7 - 1914.3 MHz	1.10	0.76	0.95
PCE	LTE Band 26	814.7 - 848.3 MHz	0.28	0.49	0.49
PCE	LTE Band 41	2498.5 - 2687.5 MHz	0.58	0.42	0.42
DTS	2.4 GHz WLAN	2412 - 2462 MHz	0.14	< 0.1	< 0.1
DSS/DTS	Bluetooth	2402 - 2480 MHz	N/A		
Simultaneous SAR per KDB 690783 D01v01r03:			1.17	1.18	0.96

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

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


Randy Ortanez
President



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1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
CDMA/EVDO BC0 (\$22H)	Voice/Data	824.70 - 848.31 MHz
PCS CDMA/EVDO	Voice/Data	1851.25 - 1908.75 MHz
CDMA/EVDO BC10 (\$90S)	Voice/Data	817.90 - 823.10 MHz
LTE Band 25 (PCS)	Data	1850.7 - 1914.3 MHz
LTE Band 26	Data	814.7 - 848.3 MHz
LTE Band 41	Data	2498.5 - 2687.5 MHz
2.4 GHz WLAN	Data	2412 - 2462 MHz
Bluetooth	Data	2402 - 2480 MHz

1.2 Nominal and Maximum Output Power Specifications

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

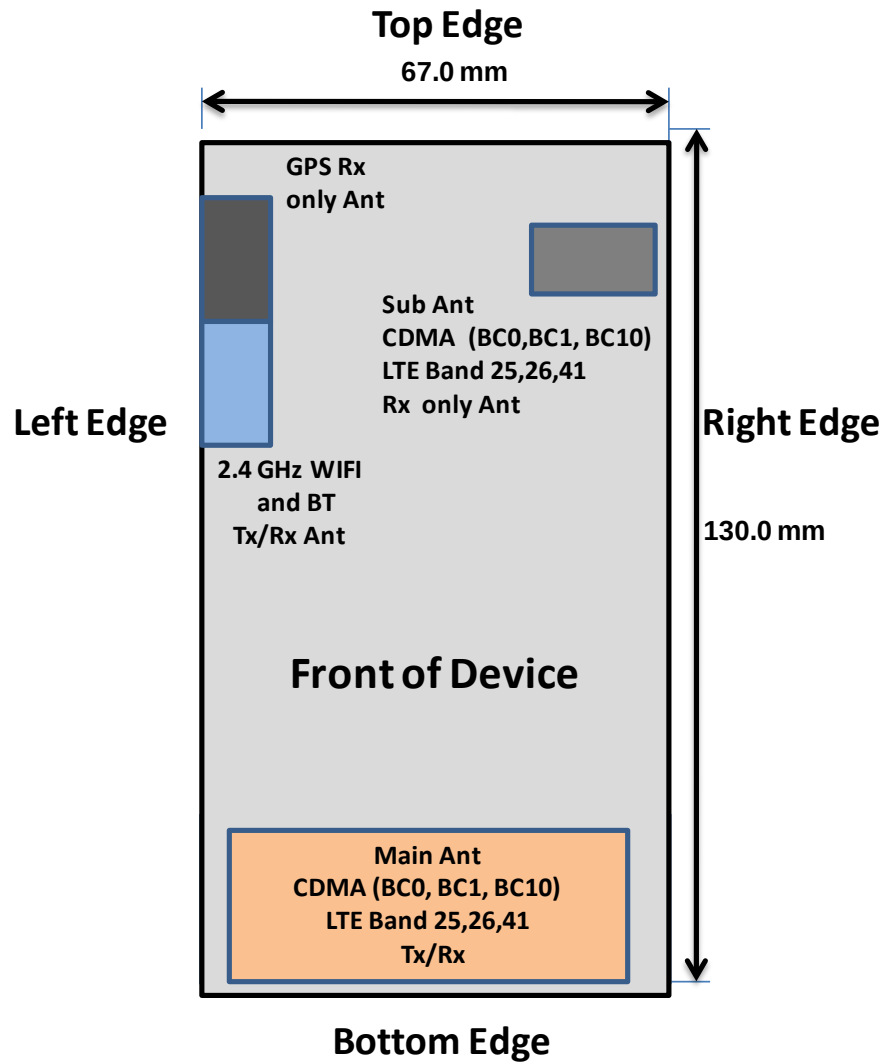
Mode / Band		Modulated Average (dBm)
CDMA/EVDO BC10 (\$90S)	Maximum	25.0
	Nominal	24.5
CDMA/EVDO BC0 (\$22H)	Maximum	25.0
	Nominal	24.5
PCS CDMA/EVDO	Maximum	25.0
	Nominal	24.5

Mode / Band		Modulated Average (dBm)
LTE Band 25 (PCS)	Maximum	23.0
	Nominal	22.5
LTE Band 26	Maximum	24.0
	Nominal	23.5
LTE Band 41	Maximum	24.0
	Nominal	23.5

Mode / Band		Modulated Average (dBm)
IEEE 802.11b (2.4 GHz)	Maximum	13.5
	Nominal	13.0
IEEE 802.11g (2.4 GHz)	Maximum	13.0
	Nominal	12.5
IEEE 802.11n (2.4 GHz)	Maximum	13.0
	Nominal	12.5
Bluetooth	Maximum	12.0
	Nominal	11.5
Bluetooth LE	Maximum	3.5
	Nominal	3.0

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1.3 DUT Antenna Locations



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

Figure 1-1
DUT Antenna Locations

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Table 1-1
Mobile Hotspot Sides for SAR Testing

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

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 distances between the transmit antennas and the edges of the device are included in the filing.

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1.4 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 1-2 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.

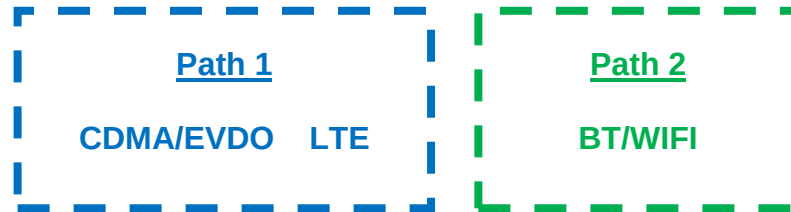


Figure 1-2
Simultaneous Transmission Paths

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

Table 1-2
Simultaneous Transmission Scenarios

No.	Capable Transmit Configuration	Head	Body-Worn Accessory	Wireless Router	Notes
1	1x CDMA voice + 2.4 GHz WI-FI	Yes	Yes	N/A	
2	1x CDMA voice + 2.4 GHz Bluetooth	N/A	Yes	N/A	
3	LTE + 2.4 GHz WI-FI	Yes*	Yes*	Yes	*-Pre-installed VOIP applications are considered.
4	LTE + 2.4 GHz Bluetooth	N/A	Yes*	N/A	*-Pre-installed VOIP applications are considered.
5	CDMA/EVDO data + 2.4 GHz WI-FI	Yes*	Yes*	Yes	*-Pre-installed VOIP applications are considered.
6	CDMA/EVDO data + 2.4 GHz Bluetooth	N/A	Yes*	N/A	*-Pre-installed VOIP applications are considered.
7	1x CDMA voice + CDMA/EVDO data	N/A	N/A	N/A	Not supported by HW
8	CDMA/EVDO data + LTE	N/A	N/A	N/A	Not supported by HW
9	1x CDMA voice + LTE	N/A	N/A	N/A	Not supported by HW
10	1x CDMA voice + LTE + 2.4 GHz WI-FI	N/A	N/A	N/A	Not supported by HW

- 2.4 GHz WLAN, and 2.4 GHz Bluetooth share the same antenna path and cannot transmit simultaneously.
- All licensed modes share the same antenna path and cannot transmit simultaneously.
- (*) = for VOIP applications possibly used by the end-user
- Per the manufacturer, WIFI Direct is not expected to be used in conjunction with a held-to-ear or body-worn accessory voice call. Therefore, there are no simultaneous transmission scenarios involving WIFI direct beyond that listed in the above table.

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1.5 SAR Test Exclusions Applied

(A) WIFI/BT

Per FCC KDB 447498 D01v05, the 1g SAR exclusion threshold for distances <50mm is defined by the following equation:

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

Based on the maximum conducted power of Bluetooth (rounded to the nearest mW) and the antenna to user separation distance, body-worn Bluetooth SAR was not required; $[(16/15) * \sqrt{2.480}] = 1.7 < 3.0$. Per KDB Publication 447498 D01v05, the maximum power of the channel was rounded to the nearest mW before calculation.

(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.

1.6 Power Reduction for SAR

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

1.7 Guidance Applied

- IEEE 1528-2003
- FCC KDB Publication 941225 D01v02, D02v02r02, D05v02r03, D06v01r01 (2G/3G/4G and Hotspot)
- FCC KDB Publication 248227 D01v01r02 (SAR Considerations for 802.11 Devices)
- FCC KDB Publication 447498 D01v05r02 (General SAR Guidance)
- FCC KDB Publication 865664 D01v01r03, D02v01r01 (SAR Measurements up to 6 GHz)
- April 2013 TCB Workshop Notes (LTE TDD)

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1.8 Device Serial Numbers

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

	Head Serial Number	Body-Worn Serial Number	Hotspot Serial Number
CDMA/EVDO BC0 (§22H)	FCC5	FCC5	FCC5
PCS CDMA/EVDO	FCC5	FCC5	FCC5
CDMA/EVDO BC10 (§90S)	FCC5	FCC5	FCC5
LTE Band 25 (PCS)	FCC3	FCC3	FCC3
LTE Band 26	FCC3	FCC3	FCC3
LTE Band 41	FCC6	FCC6	FCC6
2.4 GHz WLAN	FCC3	1410-6	1410-6

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2 LTE INFORMATION

LTE Information				
FCC ID	A3LSMG360P			
Form Factor	Portable Handset			
Frequency Range of each LTE transmission band	LTE Band 25 (PCS) (1850.7 - 1914.3 MHz)			
	LTE Band 26 (814.7 - 848.3 MHz)			
	LTE Band 41 (2498.5 - 2687.5 MHz)			
Channel Bandwidths	LTE Band 25 (PCS): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz			
	LTE Band 26: 1.4 MHz, 3 MHz, 5 MHz, 10 MHz			
	LTE Band 41: 5 MHz, 10 MHz, 15 MHz, 20 MHz			
Channel Numbers and Frequencies (MHz)	Low	Mid	High	
LTE Band 25 (PCS): 1.4 MHz	1850.7 (26047)	1882.5 (26365)	1914.3 (26683)	
LTE Band 25 (PCS): 3 MHz	1851.5 (26055)	1882.5 (26365)	1913.5 (26675)	
LTE Band 25 (PCS): 5 MHz	1852.5 (26065)	1882.5 (26365)	1912.5 (26665)	
LTE Band 25 (PCS): 10 MHz	1855 (26090)	1882.5 (26365)	1910 (26640)	
LTE Band 25 (PCS): 15 MHz	1857.5 (26115)	1882.5 (26365)	1907.5 (26615)	
LTE Band 25 (PCS): 20 MHz	1860 (26140)	1882.5 (26365)	1905 (26590)	
LTE Band 26: 1.4 MHz	814.7 (26697)	831.5 (26865)	848.3 (27033)	
LTE Band 26: 3 MHz	815.5 (26705)	831.5 (26865)	847.5 (27025)	
LTE Band 26: 5 MHz	816.5 (26715)	831.5 (26865)	846.5 (27015)	
LTE Band 26: 10 MHz	819 (26740)	831.5 (26865)	844 (26990)	
LTE Band 41: 5 MHz	2498.5 (39675)	2545.8 (40148)	2593 (40620)	2640.3 (41093) 2687.5 (41565)
LTE Band 41: 10 MHz	2501 (39700)	2547 (40160)	2593 (40620)	2639 (41080) 2685 (41540)
LTE Band 41: 15 MHz	2503.5 (39725)	2548.3 (40173)	2593 (40620)	2637.8 (41068) 2682.5 (41515)
LTE Band 41: 20 MHz	2506 (39750)	2549.5 (40185)	2593 (40620)	2636.5 (41055) 2680 (41490)
UE Category	3			
Modulations Supported in UL	QPSK, 16QAM			
LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3-6.2.5? (manufacturer attestation to be provided)	YES			
A-MPR (Additional MPR) disabled for SAR Testing?	YES			

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

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

3.1 SAR Definition

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

Equation 3-1
SAR Mathematical Equation

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

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

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

where:

- σ = conductivity of the tissue-simulating material (S/m)
- ρ = mass density of the tissue-simulating material (kg/m³)
- 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]

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DOSIMETRIC ASSESSMENT

4.1 Measurement Procedure

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

1. The SAR distribution at the exposed side of the head or body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head and body interface and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01v01 (See Table 4-1) and IEEE 1528-2013.
2. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during the 1g/10g cube evaluation. SAR at this fixed point was measured and used as a reference value.
3. Based on the area scan data, the peak of the region with maximum SAR was determined by spline interpolation. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB Publication 865664 D01v01 (See Table 4-1) and IEEE 1528-2013. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual online for more details):
 - a. SAR values at the inner surface of the phantom are extrapolated from the measured values along the line away from the surface with spacing no greater than that in Table 4-1. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).
 - b. After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were obtained through interpolation, in order to calculate the averaged SAR.
 - c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.

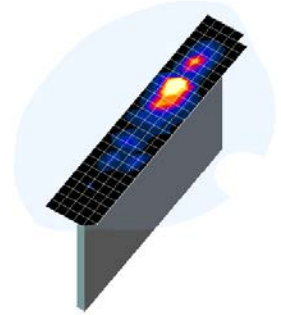


Figure 4-1
Sample SAR Area Scan

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

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

*Also compliant to IEEE 1528-2013 Table 6

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DEFINITION OF REFERENCE POINTS

5.1 EAR REFERENCE POINT

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

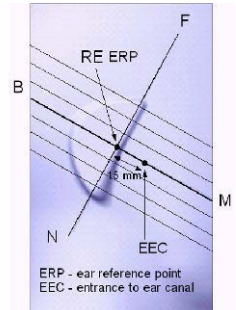


Figure 5-1
Close-Up Side view
of ERP

5.2 HANDSET REFERENCE POINTS

Two imaginary lines on the handset were established: the vertical centerline and the horizontal line. The test device was placed in a normal operating position with the acoustic output located along the “vertical centerline” on the front of the device aligned to the “ear reference point” (See Figure 5-3). The acoustic output was then 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

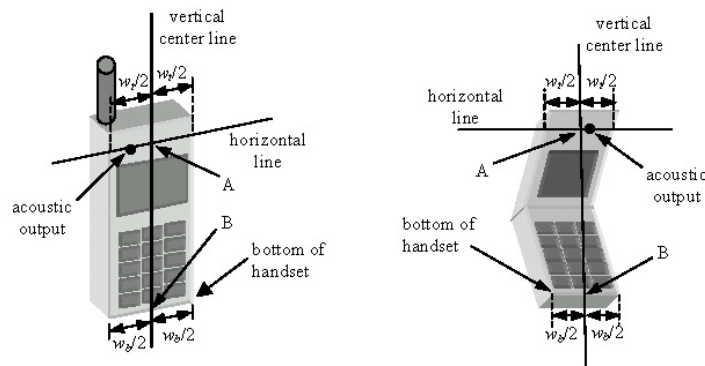


Figure 5-3
Handset Vertical Center & Horizontal Line Reference Points

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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 $\epsilon = 3$ 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.

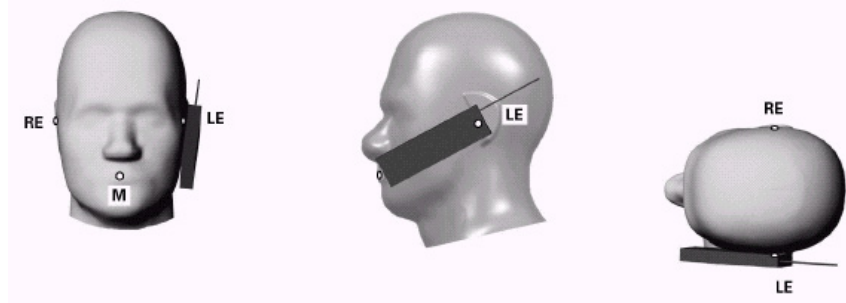


Figure 6-1 Front, Side and Top View of Cheek Position

2. The handset was translated towards the phantom along the line passing through RE & LE until the handset touches the pinna.
3. While maintaining the handset in this plane, the handset was rotated around the LE-RE line until the vertical centerline was in the reference plane.
4. The phone was then rotated around the vertical centerline until the phone (horizontal line) was symmetrical with 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 / 15° 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. In this situation, the tilted position was obtained when any part of the phone was in contact of the ear as well as a second part of the phone was in contact with the head (see Figure 6-2).

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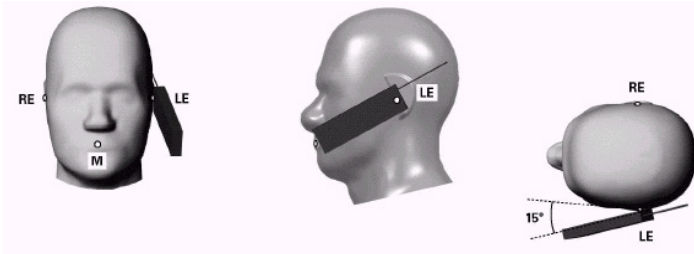


Figure 6-2 Front, Side and Top View of Ear/15° Tilt Position

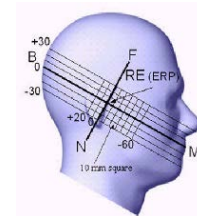


Figure 6-3 Side view w/ relevant markings

6.4 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 D04v01, Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB Publication 447498 D01v05 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is $> 1.2 \text{ W/kg}$, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

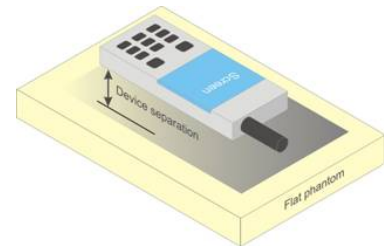


Figure 6-4 Sample Body-Worn Diagram

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

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

6.5 Extremity Exposure Configurations

Devices that are designed or intended for use on extremities or mainly operated in extremity only exposure conditions; i.e., hands, wrists, feet and ankles, may require extremity SAR evaluation. When the device also operates in close proximity to the user's body, SAR compliance for the body is also

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required. The 1-g body and 10-g extremity SAR Exclusion Thresholds found in KDB Publication 44798 D01v05 should be applied to determine SAR test requirements.

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

6.6 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 ($L \times W \geq 9 \text{ cm} \times 5 \text{ cm}$) 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.

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

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

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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 SCH₀ 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.

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Table 8-1
Parameters for Max. Power for RC1

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

Table 8-2
Parameters for Max. Power for RC3

Parameter	Units	Value
I_{or}	dBm/1.23 MHz	-86
$\frac{Pilot E_c}{I_{or}}$	dB	-7
$\frac{Traffic E_c}{I_{or}}$	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 KDB Publication 941225 D02v02. 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 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 $\frac{1}{4}$ 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 $\frac{1}{4}$ 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 SCH₀ 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 $\frac{1}{4}$ 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.

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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 ¼ dB higher than that measured in Subtype 0/1 Physical Layer configurations for Rev. 0. Otherwise, CDMA “Body-SAR Measurement” procedures for “CDMA 2000 1x Handsets” were applied.

8.4 SAR Measurement Conditions for LTE

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

8.4.1 Spectrum Plots for RB Configurations

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

8.4.2 MPR

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

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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 $\frac{1}{2}$ dB higher than the equivalent configuration using QPSK modulation and when the QPSK SAR for those configurations is < 1.45 W/kg.

8.4.5 TDD

LTE TDD testing procedures were performed using guidance from FCC KDB 941225 D05v02r03 and the SAR test guidance provided in April 2013 TCB workshop notes. TDD was tested at the highest duty factor using UL-DL configuration 0 with special subframe configuration 6 and applying the FDD LTE procedures in KDB 941225. SAR testing was performed using the extended cyclic prefix listed in 3GPP TS 36.211 Section 4.

8.5 SAR Testing with 802.11 Transmitters

Normal network operating configurations are not suitable for measuring the SAR of 802.11 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,

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according to a fixed modulation and data rate. The same data pattern should be used for all measurements.

8.5.2 Frequency Channel Configurations [24]

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

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

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9.1 CDMA Conducted Powers

Band	Channel	Rule Part	Frequency	SO55 [dBm]	SO55 [dBm]	SO75 [dBm]	TDSO SO32 [dBm]	TDSO SO32 [dBm]	1x EvDO Rev. 0 [dBm]	1x EvDO Rev. A [dBm]
	F-RC		MHz	RC1	RC3	RC11	FCH+SCH	FCH	(RTAP)	(RETAP)
Cellular	564	90S	820.1	24.44	24.45	24.33	24.41	24.42	24.44	24.41
Cellular	1013	22H	824.7	24.62	24.63	24.56	24.61	24.60	24.66	24.65
	384	22H	836.52	24.47	24.64	24.60	24.43	24.47	24.68	24.66
	777	22H	848.31	24.65	24.63	24.63	24.52	24.55	24.67	24.65
PCS	25	24E	1851.25	24.67	24.58	24.46	24.45	24.55	24.59	24.54
	600	24E	1880	24.45	24.29	24.21	24.27	24.26	24.30	24.24
	1175	24E	1908.75	24.53	24.55	24.48	24.55	24.58	24.58	24.51

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. Head SAR was additionally evaluated using EVDO Rev. A to support compliance for VoIP operations.
3. 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.
4. Hotspot SAR is measured using Subtype 0/1 Physical Layer configurations for Rev. 0. If the average output power of Subtype 2 for Rev. A is less than the Rev. 0 power levels, then Rev. A SAR is not required. Otherwise, SAR is measured on the maximum output channel for Rev. A using the exposure configuration that results in the highest SAR for that RF channel in Rev. 0. SAR is not required for 1x RTT for Ev-Do hotspot devices when the maximum average output of each channel is less than 1/4 dB higher than that measured in Subtype 0/1 Physical Layer configurations for Rev. 0

Per KDB Publication 941225 D02v02

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

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9.2 LTE Conducted Powers

9.2.1 LTE Band 25 (PCS)

Table 9-1
LTE Band 25 (PCS) Conducted Powers - 20 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1860	26140	20	QPSK	1	0	22.57	0	0
	1860	26140	20	QPSK	1	50	22.06	0	0
	1860	26140	20	QPSK	1	99	22.07	0	0
	1860	26140	20	QPSK	50	0	21.10	0-1	1
	1860	26140	20	QPSK	50	25	21.00	0-1	1
	1860	26140	20	QPSK	50	50	21.04	0-1	1
	1860	26140	20	QPSK	100	0	21.02	0-1	1
	1860	26140	20	16QAM	1	0	21.45	0-1	1
	1860	26140	20	16QAM	1	50	21.60	0-1	1
	1860	26140	20	16QAM	1	99	21.57	0-1	1
	1860	26140	20	16QAM	50	0	20.06	0-2	2
	1860	26140	20	16QAM	50	25	20.00	0-2	2
Mid	1860	26140	20	16QAM	50	50	20.01	0-2	2
	1860	26140	20	16QAM	100	0	20.00	0-2	2
	1882.5	26365	20	QPSK	1	0	22.48	0	0
	1882.5	26365	20	QPSK	1	50	22.23	0	0
	1882.5	26365	20	QPSK	1	99	22.13	0	0
	1882.5	26365	20	QPSK	50	0	21.29	0-1	1
	1882.5	26365	20	QPSK	50	25	21.08	0-1	1
	1882.5	26365	20	QPSK	50	50	21.08	0-1	1
	1882.5	26365	20	QPSK	100	0	21.06	0-1	1
	1882.5	26365	20	16QAM	1	0	21.30	0-1	1
	1882.5	26365	20	16QAM	1	50	21.34	0-1	1
	1882.5	26365	20	16QAM	1	99	21.10	0-1	1
High	1882.5	26365	20	16QAM	50	0	20.23	0-2	2
	1882.5	26365	20	16QAM	50	25	20.14	0-2	2
	1882.5	26365	20	16QAM	50	50	20.15	0-2	2
	1882.5	26365	20	16QAM	100	0	20.14	0-2	2
	1905	26590	20	QPSK	1	0	22.58	0	0
	1905	26590	20	QPSK	1	50	22.44	0	0
	1905	26590	20	QPSK	1	99	22.01	0	0
	1905	26590	20	QPSK	50	0	21.30	0-1	1
	1905	26590	20	QPSK	50	25	21.11	0-1	1
	1905	26590	20	QPSK	50	50	21.00	0-1	1
	1905	26590	20	QPSK	100	0	21.08	0-1	1
	1905	26590	20	16QAM	1	0	21.30	0-1	1

Table 9-2
LTE Band 25 (PCS) Conducted Powers - 15 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1857.5	26115	15	QPSK	1	0	22.22	0	0
	1857.5	26115	15	QPSK	1	36	22.19	0	0
	1857.5	26115	15	QPSK	1	74	22.21	0	0
	1857.5	26115	15	QPSK	36	0	21.18	0-1	1
	1857.5	26115	15	QPSK	36	18	21.13	0-1	1
	1857.5	26115	15	QPSK	36	37	21.13	0-1	1
	1857.5	26115	15	QPSK	75	0	21.15	0-1	1
	1857.5	26115	15	16QAM	1	0	21.12	0-1	1
	1857.5	26115	15	16QAM	1	36	21.20	0-1	1
	1857.5	26115	15	16QAM	1	74	21.06	0-1	1
	1857.5	26115	15	16QAM	36	0	20.18	0-2	2
	1857.5	26115	15	16QAM	36	18	20.17	0-2	2
Mid	1857.5	26115	15	16QAM	36	37	20.11	0-2	2
	1857.5	26115	15	16QAM	75	0	20.14	0-2	2
	1882.5	26365	15	QPSK	1	0	22.43	0	0
	1882.5	26365	15	QPSK	1	36	22.22	0	0
	1882.5	26365	15	QPSK	1	74	22.22	0	0
	1882.5	26365	15	QPSK	36	0	21.10	0-1	1
	1882.5	26365	15	QPSK	36	18	21.05	0-1	1
	1882.5	26365	15	QPSK	36	37	21.00	0-1	1
	1882.5	26365	15	QPSK	75	0	21.04	0-1	1
	1882.5	26365	15	16QAM	1	0	21.51	0-1	1
	1882.5	26365	15	16QAM	1	36	21.18	0-1	1
	1882.5	26365	15	16QAM	1	74	21.31	0-1	1
High	1882.5	26365	15	16QAM	36	0	20.01	0-2	2
	1882.5	26365	15	16QAM	36	18	20.00	0-2	2
	1882.5	26365	15	16QAM	36	37	20.01	0-2	2
	1882.5	26365	15	16QAM	75	0	20.02	0-2	2
	1907.5	26615	15	QPSK	1	0	22.69	0	0
	1907.5	26615	15	QPSK	1	36	22.42	0	0
	1907.5	26615	15	QPSK	1	74	22.00	0	0
	1907.5	26615	15	QPSK	36	0	21.28	0-1	1
	1907.5	26615	15	QPSK	36	18	21.14	0-1	1
	1907.5	26615	15	QPSK	36	37	21.00	0-1	1
	1907.5	26615	15	QPSK	75	0	21.09	0-1	1
	1907.5	26615	15	16QAM	1	0	21.51	0-1	1

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

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1855	26090	10	QPSK	1	0	22.36	0	0
	1855	26090	10	QPSK	1	25	22.43	0	0
	1855	26090	10	QPSK	1	49	22.32	0	0
	1855	26090	10	QPSK	25	0	21.19	0-1	1
	1855	26090	10	QPSK	25	12	21.13	0-1	1
	1855	26090	10	QPSK	25	25	21.09	0-1	1
	1855	26090	10	QPSK	50	0	21.09	0-1	1
	1855	26090	10	16QAM	1	0	21.12	0-1	1
	1855	26090	10	16QAM	1	25	21.20	0-1	1
	1855	26090	10	16QAM	1	49	21.63	0-1	1
	1855	26090	10	16QAM	25	0	20.28	0-2	2
	1855	26090	10	16QAM	25	12	20.15	0-2	2
	1855	26090	10	16QAM	25	25	20.15	0-2	2
	1855	26090	10	16QAM	50	0	20.15	0-2	2
	1882.5	26365	10	QPSK	1	0	22.11	0	0
	1882.5	26365	10	QPSK	1	25	22.16	0	0
Mid	1882.5	26365	10	QPSK	1	49	22.27	0	0
	1882.5	26365	10	QPSK	25	0	21.07	0-1	1
	1882.5	26365	10	QPSK	25	12	21.03	0-1	1
	1882.5	26365	10	QPSK	25	25	21.01	0-1	1
	1882.5	26365	10	QPSK	50	0	21.00	0-1	1
	1882.5	26365	10	16QAM	1	0	21.68	0-1	1
	1882.5	26365	10	16QAM	1	25	21.13	0-1	1
	1882.5	26365	10	16QAM	1	49	21.16	0-1	1
	1882.5	26365	10	16QAM	25	0	20.35	0-2	2
	1882.5	26365	10	16QAM	25	12	20.16	0-2	2
	1882.5	26365	10	16QAM	25	25	20.03	0-2	2
	1882.5	26365	10	16QAM	50	0	20.10	0-2	2
	1910	26640	10	QPSK	1	0	22.36	0	0
	1910	26640	10	QPSK	1	25	22.26	0	0
	1910	26640	10	QPSK	1	49	22.00	0	0
	1910	26640	10	QPSK	25	0	21.29	0-1	1
High	1910	26640	10	QPSK	25	12	21.08	0-1	1
	1910	26640	10	QPSK	25	25	21.00	0-1	1
	1910	26640	10	QPSK	50	0	21.04	0-1	1
	1910	26640	10	16QAM	1	0	21.40	0-1	1
	1910	26640	10	16QAM	1	25	21.40	0-1	1
	1910	26640	10	16QAM	1	49	21.14	0-1	1
	1910	26640	10	16QAM	25	0	20.47	0-2	2
	1910	26640	10	16QAM	25	12	20.16	0-2	2
	1910	26640	10	16QAM	25	25	20.05	0-2	2
	1910	26640	10	16QAM	50	0	20.03	0-2	2

Table 9-4
LTE Band 25 (PCS) Conducted Powers - 5 MHz Bandwidth

Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
1852.5	26065	5	QPSK	1	0	22.14	0	0
1852.5	26065	5	QPSK	1	12	22.25	0	0
1852.5	26065	5	QPSK	1	24	22.22	0	0
1852.5	26065	5	QPSK	12	0	21.25	0-1	1
1852.5	26065	5	QPSK	12	6	21.33	0-1	1
1852.5	26065	5	QPSK	12	13	21.26	0-1	1
1852.5	26065	5	QPSK	25	0	21.30	0-1	1
1852.5	26065	5	16-QAM	1	0	21.20	0-1	1
1852.5	26065	5	16-QAM	1	12	21.42	0-1	1
1852.5	26065	5	16-QAM	1	24	21.30	0-1	1
1852.5	26065	5	16-QAM	12	0	20.30	0-2	2
1852.5	26065	5	16-QAM	12	6	20.37	0-2	2
1852.5	26065	5	16-QAM	12	13	20.58	0-2	2
1852.5	26065	5	16-QAM	25	0	20.38	0-2	2
1882.5	26365	5	QPSK	1	0	22.30	0	0
1882.5	26365	5	QPSK	1	12	22.48	0	0
1882.5	26365	5	QPSK	1	24	22.35	0	0
1882.5	26365	5	QPSK	12	0	21.43	0-1	1
1882.5	26365	5	QPSK	12	6	21.39	0-1	1
1882.5	26365	5	QPSK	12	13	21.48	0-1	1
1882.5	26365	5	QPSK	25	0	21.34	0-1	1
1882.5	26365	5	16-QAM	1	0	21.58	0-1	1
1882.5	26365	5	16-QAM	1	12	21.67	0-1	1
1882.5	26365	5	16-QAM	1	24	21.87	0-1	1
1882.5	26365	5	16-QAM	12	0	20.97	0-2	2
1882.5	26365	5	16-QAM	12	6	20.48	0-2	2
1882.5	26365	5	16-QAM	12	13	20.95	0-2	2
1882.5	26365	5	16-QAM	25	0	20.15	0-2	2
1912.5	26665	5	QPSK	1	0	22.16	0	0
1912.5	26665	5	QPSK	1	12	22.47	0	0
1912.5	26665	5	QPSK	1	24	22.52	0	0
1912.5	26665	5	QPSK	12	0	21.07	0-1	1
1912.5	26665	5	QPSK	12	6	21.10	0-1	1
1912.5	26665	5	QPSK	12	13	21.00	0-1	1
1912.5	26665	5	QPSK	25	0	21.01	0-1	1
1912.5	26665	5	16-QAM	1	0	21.19	0-1	1
1912.5	26665	5	16-QAM	1	12	21.56	0-1	1
1912.5	26665	5	16-QAM	1	24	21.55	0-1	1
1912.5	26665	5	16-QAM	12	0	20.07	0-2	2
1912.5	26665	5	16-QAM	12	6	20.10	0-2	2
1912.5	26665	5	16-QAM	12	13	20.02	0-2	2
1912.5	26665	5	16-QAM	25	0	20.11	0-2	2

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Table 9-5

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

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1851.5	26055	3	QPSK	1	0	22.51	0	0
	1851.5	26055	3	QPSK	1	7	22.68	0	0
	1851.5	26055	3	QPSK	1	14	22.61	0	0
	1851.5	26055	3	QPSK	8	0	21.08	0-1	1
	1851.5	26055	3	QPSK	8	4	21.13	0-1	1
	1851.5	26055	3	QPSK	8	7	21.20	0-1	1
	1851.5	26055	3	QPSK	15	0	21.17	0-1	1
	1851.5	26055	3	16-QAM	1	0	21.32	0-1	1
	1851.5	26055	3	16-QAM	1	7	21.60	0-1	1
	1851.5	26055	3	16-QAM	1	14	21.38	0-1	1
	1851.5	26055	3	16-QAM	8	0	20.32	0-2	2
	1851.5	26055	3	16-QAM	8	4	20.28	0-2	2
	1851.5	26055	3	16-QAM	8	7	20.56	0-2	2
	1851.5	26055	3	16-QAM	15	0	20.41	0-2	2
Mid	1882.5	26365	3	QPSK	1	0	22.46	0	0
	1882.5	26365	3	QPSK	1	7	22.62	0	0
	1882.5	26365	3	QPSK	1	14	22.66	0	0
	1882.5	26365	3	QPSK	8	0	21.30	0-1	1
	1882.5	26365	3	QPSK	8	4	21.27	0-1	1
	1882.5	26365	3	QPSK	8	7	21.23	0-1	1
	1882.5	26365	3	QPSK	15	0	21.25	0-1	1
	1882.5	26365	3	16-QAM	1	0	21.51	0-1	1
	1882.5	26365	3	16-QAM	1	7	21.66	0-1	1
	1882.5	26365	3	16-QAM	1	14	21.49	0-1	1
	1882.5	26365	3	16-QAM	8	0	20.07	0-2	2
	1882.5	26365	3	16-QAM	8	4	20.64	0-2	2
	1882.5	26365	3	16-QAM	8	7	20.24	0-2	2
	1882.5	26365	3	16-QAM	15	0	20.39	0-2	2
High	1913.5	26675	3	QPSK	1	0	22.18	0	0
	1913.5	26675	3	QPSK	1	7	22.66	0	0
	1913.5	26675	3	QPSK	1	14	22.12	0	0
	1913.5	26675	3	QPSK	8	0	21.42	0-1	1
	1913.5	26675	3	QPSK	8	4	21.12	0-1	1
	1913.5	26675	3	QPSK	8	7	21.26	0-1	1
	1913.5	26675	3	QPSK	15	0	21.20	0-1	1
	1913.5	26675	3	16-QAM	1	0	21.34	0-1	1
	1913.5	26675	3	16-QAM	1	7	21.30	0-1	1
	1913.5	26675	3	16-QAM	1	14	21.12	0-1	1
	1913.5	26675	3	16-QAM	8	0	20.25	0-2	2
	1913.5	26675	3	16-QAM	8	4	20.46	0-2	2
	1913.5	26675	3	16-QAM	8	7	20.08	0-2	2
	1913.5	26675	3	16-QAM	15	0	20.18	0-2	2

Table 9-6

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

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	1850.7	26047	1.4	QPSK	1	0	22.36	0	0
	1850.7	26047	1.4	QPSK	1	2	22.28	0	0
	1850.7	26047	1.4	QPSK	1	5	22.51	0	0
	1850.7	26047	1.4	QPSK	3	0	22.15	0	0
	1850.7	26047	1.4	QPSK	3	2	22.26	0	0
	1850.7	26047	1.4	QPSK	3	3	22.11	0	0
	1850.7	26047	1.4	QPSK	6	0	21.05	0-1	1
	1850.7	26047	1.4	16-QAM	1	0	21.38	0-1	1
	1850.7	26047	1.4	16-QAM	1	2	21.75	0-1	1
	1850.7	26047	1.4	16-QAM	1	5	21.80	0-1	1
	1850.7	26047	1.4	16-QAM	3	0	21.44	0-1	1
	1850.7	26047	1.4	16-QAM	3	2	21.21	0-1	1
	1850.7	26047	1.4	16-QAM	3	3	21.60	0-1	1
	1850.7	26047	1.4	16-QAM	6	0	20.57	0-2	2
Mid	1882.5	26365	1.4	QPSK	1	0	22.28	0	0
	1882.5	26365	1.4	QPSK	1	2	22.35	0	0
	1882.5	26365	1.4	QPSK	1	5	22.64	0	0
	1882.5	26365	1.4	QPSK	3	0	22.33	0	0
	1882.5	26365	1.4	QPSK	3	2	22.20	0	0
	1882.5	26365	1.4	QPSK	3	3	22.27	0	0
	1882.5	26365	1.4	QPSK	6	0	21.19	0-1	1
	1882.5	26365	1.4	16-QAM	1	0	21.05	0-1	1
	1882.5	26365	1.4	16-QAM	1	2	21.70	0-1	1
	1882.5	26365	1.4	16-QAM	1	5	21.35	0-1	1
	1882.5	26365	1.4	16-QAM	3	0	21.42	0-1	1
	1882.5	26365	1.4	16-QAM	3	2	21.11	0-1	1
	1882.5	26365	1.4	16-QAM	3	3	21.21	0-1	1
	1882.5	26365	1.4	16-QAM	6	0	20.37	0-2	2
High	1914.3	26683	1.4	QPSK	1	0	22.17	0	0
	1914.3	26683	1.4	QPSK	1	2	22.11	0	0
	1914.3	26683	1.4	QPSK	1	5	22.20	0	0
	1914.3	26683	1.4	QPSK	3	0	22.24	0	0
	1914.3	26683	1.4	QPSK	3	2	22.18	0	0
	1914.3	26683	1.4	QPSK	3	3	22.22	0	0
	1914.3	26683	1.4	QPSK	6	0	21.10	0-1	1
	1914.3	26683	1.4	16-QAM	1	0	21.51	0-1	1
	1914.3	26683	1.4	16-QAM	1	2	21.49	0-1	1
	1914.3	26683	1.4	16-QAM	1	5	21.54	0-1	1
	1914.3	26683	1.4	16-QAM	3	0	21.23	0-1	1
	1914.3	26683	1.4	16-QAM	3	2	21.60	0-1	1
	1914.3	26683	1.4	16-QAM	3	3	21.42	0-1	1
	1914.3	26683	1.4	16-QAM	6	0	20.09	0-2	2

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LTE Band 26

Table 9-7
LTE Band 26 Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	819	26740	10	QPSK	1	0	23.50	0	0
	819	26740	10	QPSK	1	25	23.99	0	0
	819	26740	10	QPSK	1	49	23.57	0	0
	819	26740	10	QPSK	25	0	22.58	0-1	1
	819	26740	10	QPSK	25	12	22.75	0-1	1
	819	26740	10	QPSK	25	25	22.73	0-1	1
	819	26740	10	QPSK	50	0	22.72	0-1	1
	819	26740	10	16QAM	1	0	22.39	0-1	1
	819	26740	10	16QAM	1	25	22.79	0-1	1
	819	26740	10	16QAM	1	49	22.73	0-1	1
	819	26740	10	16QAM	25	0	21.61	0-2	2
	819	26740	10	16QAM	25	12	21.65	0-2	2
	819	26740	10	16QAM	25	25	21.73	0-2	2
	819	26740	10	16QAM	50	0	21.88	0-2	2
	831.5	26865	10	QPSK	1	0	23.55	0	0
	831.5	26865	10	QPSK	1	25	23.17	0	0
	831.5	26865	10	QPSK	1	49	23.00	0	0
	831.5	26865	10	QPSK	25	0	22.41	0-1	1
Mid	831.5	26865	10	QPSK	25	12	22.61	0-1	1
	831.5	26865	10	QPSK	25	25	22.47	0-1	1
	831.5	26865	10	QPSK	50	0	22.57	0-1	1
	831.5	26865	10	16QAM	1	0	22.80	0-1	1
	831.5	26865	10	16QAM	1	25	22.78	0-1	1
	831.5	26865	10	16QAM	1	49	22.58	0-1	1
	831.5	26865	10	16QAM	25	0	21.55	0-2	2
	831.5	26865	10	16QAM	25	12	21.73	0-2	2
	831.5	26865	10	16QAM	25	25	21.44	0-2	2
	831.5	26865	10	16QAM	50	0	21.61	0-2	2
	844	26990	10	QPSK	1	0	23.19	0	0
	844	26990	10	QPSK	1	25	23.25	0	0
	844	26990	10	QPSK	1	49	23.22	0	0
	844	26990	10	QPSK	25	0	22.41	0-1	1
	844	26990	10	QPSK	25	12	22.51	0-1	1
	844	26990	10	QPSK	25	25	22.51	0-1	1
	844	26990	10	QPSK	50	0	22.56	0-1	1
	844	26990	10	16QAM	1	0	22.33	0-1	1
	844	26990	10	16QAM	1	25	22.42	0-1	1
High	844	26990	10	16QAM	1	49	22.04	0-1	1
	844	26990	10	16QAM	25	0	21.36	0-2	2
	844	26990	10	16QAM	25	12	21.54	0-2	2
	844	26990	10	16QAM	25	25	21.57	0-2	2
	844	26990	10	16QAM	50	0	21.57	0-2	2

Table 9-8
LTE Band 26 Conducted Powers - 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	816.5	26715	5	QPSK	1	0	23.44	0	0
	816.5	26715	5	QPSK	1	12	23.99	0	0
	816.5	26715	5	QPSK	1	24	23.53	0	0
	816.5	26715	5	QPSK	12	0	22.63	0-1	1
	816.5	26715	5	QPSK	12	6	22.58	0-1	1
	816.5	26715	5	QPSK	12	13	22.65	0-1	1
	816.5	26715	5	QPSK	25	0	22.64	0-1	1
	816.5	26715	5	16-QAM	1	0	22.64	0-1	1
	816.5	26715	5	16-QAM	1	12	22.28	0-1	1
	816.5	26715	5	16-QAM	1	24	22.68	0-1	1
	816.5	26715	5	16-QAM	12	0	21.74	0-2	2
	816.5	26715	5	16-QAM	12	6	21.83	0-2	2
	816.5	26715	5	16-QAM	12	13	21.75	0-2	2
	816.5	26715	5	16-QAM	25	0	21.75	0-2	2
	831.5	26865	5	QPSK	1	0	23.58	0	0
	831.5	26865	5	QPSK	1	12	23.34	0	0
	831.5	26865	5	QPSK	1	24	23.13	0	0
	831.5	26865	5	QPSK	12	0	22.51	0-1	1
Mid	831.5	26865	5	QPSK	12	6	22.61	0-1	1
	831.5	26865	5	QPSK	12	13	22.51	0-1	1
	831.5	26865	5	QPSK	25	0	22.55	0-1	1
	831.5	26865	5	16-QAM	1	0	22.41	0-1	1
	831.5	26865	5	16-QAM	1	12	22.30	0-1	1
	831.5	26865	5	16-QAM	1	24	22.43	0-1	1
	831.5	26865	5	16-QAM	12	0	21.34	0-2	2
	831.5	26865	5	16-QAM	12	6	21.54	0-2	2
	831.5	26865	5	16-QAM	12	13	21.37	0-2	2
	831.5	26865	5	16-QAM	25	0	21.67	0-2	2
	846.5	27015	5	QPSK	1	0	23.57	0	0
	846.5	27015	5	QPSK	1	12	23.63	0	0
	846.5	27015	5	QPSK	1	24	23.29	0	0
	846.5	27015	5	QPSK	12	0	22.51	0-1	1
	846.5	27015	5	QPSK	12	6	22.48	0-1	1
	846.5	27015	5	QPSK	12	13	22.53	0-1	1
	846.5	27015	5	QPSK	25	0	22.49	0-1	1
	846.5	27015	5	16-QAM	1	0	22.08	0-1	1
	846.5	27015	5	16-QAM	1	12	22.85	0-1	1
High	846.5	27015	5	16-QAM	1	24	22.56	0-1	1
	846.5	27015	5	16-QAM	12	0	21.51	0-2	2
	846.5	27015	5	16-QAM	12	6	21.83	0-2	2
	846.5	27015	5	16-QAM	12	13	21.33	0-2	2
	846.5	27015	5	16-QAM	25	0	21.64	0-2	2

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Table 9-9
LTE Band 26 Conducted Powers - 3 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	815.5	26705	3	QPSK	1	0	23.45	0	0
	815.5	26705	3	QPSK	1	7	23.85	0	0
	815.5	26705	3	QPSK	1	14	23.50	0	0
	815.5	26705	3	QPSK	8	0	22.63	0-1	1
	815.5	26705	3	QPSK	8	4	22.61	0-1	1
	815.5	26705	3	QPSK	8	7	22.60	0-1	1
	815.5	26705	3	QPSK	15	0	22.62	0-1	1
	815.5	26705	3	16-QAM	1	0	22.00	0-1	1
	815.5	26705	3	16-QAM	1	7	22.30	0-1	1
	815.5	26705	3	16-QAM	1	14	22.62	0-1	1
	815.5	26705	3	16-QAM	8	0	21.67	0-2	2
	815.5	26705	3	16-QAM	8	4	21.41	0-2	2
	815.5	26705	3	16-QAM	8	7	21.50	0-2	2
	815.5	26705	3	16-QAM	15	0	21.67	0-2	2
	831.5	26865	3	QPSK	1	0	23.53	0	0
Mid	831.5	26865	3	QPSK	1	7	23.63	0	0
	831.5	26865	3	QPSK	1	14	23.39	0	0
	831.5	26865	3	QPSK	8	0	22.54	0-1	1
	831.5	26865	3	QPSK	8	4	22.59	0-1	1
	831.5	26865	3	QPSK	8	7	22.61	0-1	1
	831.5	26865	3	QPSK	15	0	22.61	0-1	1
	831.5	26865	3	16-QAM	1	0	22.67	0-1	1
	831.5	26865	3	16-QAM	1	7	22.81	0-1	1
	831.5	26865	3	16-QAM	1	14	22.89	0-1	1
	831.5	26865	3	16-QAM	8	0	21.67	0-2	2
	831.5	26865	3	16-QAM	8	4	21.73	0-2	2
	831.5	26865	3	16-QAM	8	7	21.35	0-2	2
	831.5	26865	3	16-QAM	15	0	21.78	0-2	2
	847.5	27025	3	QPSK	1	0	23.42	0	0
	847.5	27025	3	QPSK	1	7	23.55	0	0
High	847.5	27025	3	QPSK	1	14	23.48	0	0
	847.5	27025	3	QPSK	8	0	22.51	0-1	1
	847.5	27025	3	QPSK	8	4	22.49	0-1	1
	847.5	27025	3	QPSK	8	7	22.50	0-1	1
	847.5	27025	3	QPSK	15	0	22.50	0-1	1
	847.5	27025	3	16-QAM	1	0	22.24	0-1	1
	847.5	27025	3	16-QAM	1	7	22.06	0-1	1
	847.5	27025	3	16-QAM	1	14	22.03	0-1	1
	847.5	27025	3	16-QAM	8	0	21.63	0-2	2
	847.5	27025	3	16-QAM	8	4	21.51	0-2	2
	847.5	27025	3	16-QAM	8	7	21.72	0-2	2
	847.5	27025	3	16-QAM	15	0	21.61	0-2	2

Table 9-10
LTE Band 26 Conducted Powers -1.4 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	814.7	26697	1.4	QPSK	1	0	23.64	0	0
	814.7	26697	1.4	QPSK	1	2	23.54	0	0
	814.7	26697	1.4	QPSK	1	5	23.62	0	0
	814.7	26697	1.4	QPSK	3	0	23.54	0	0
	814.7	26697	1.4	QPSK	3	2	23.51	0	0
	814.7	26697	1.4	QPSK	3	3	23.54	0	0
	814.7	26697	1.4	QPSK	6	0	22.57	0-1	1
	814.7	26697	1.4	16-QAM	1	0	22.65	0-1	1
	814.7	26697	1.4	16-QAM	1	2	22.46	0-1	1
	814.7	26697	1.4	16-QAM	1	5	22.35	0-1	1
	814.7	26697	1.4	16-QAM	3	0	22.38	0-1	1
	814.7	26697	1.4	16-QAM	3	2	22.41	0-1	1
	814.7	26697	1.4	16-QAM	3	3	22.55	0-1	1
	814.7	26697	1.4	16-QAM	6	0	21.72	0-2	2
	831.5	26865	1.4	QPSK	1	0	23.48	0	0
Mid	831.5	26865	1.4	QPSK	1	2	23.50	0	0
	831.5	26865	1.4	QPSK	1	5	23.40	0	0
	831.5	26865	1.4	QPSK	3	0	23.38	0	0
	831.5	26865	1.4	QPSK	3	2	23.61	0	0
	831.5	26865	1.4	QPSK	3	3	23.55	0	0
	831.5	26865	1.4	QPSK	6	0	22.54	0-1	1
	831.5	26865	1.4	16-QAM	1	0	22.45	0-1	1
	831.5	26865	1.4	16-QAM	1	2	22.59	0-1	1
	831.5	26865	1.4	16-QAM	1	5	22.34	0-1	1
	831.5	26865	1.4	16-QAM	3	0	22.60	0-1	1
	831.5	26865	1.4	16-QAM	3	2	22.70	0-1	1
	831.5	26865	1.4	16-QAM	3	3	22.52	0-1	1
	831.5	26865	1.4	16-QAM	6	0	21.75	0-2	2
	848.3	27033	1.4	QPSK	1	0	23.57	0	0
	848.3	27033	1.4	QPSK	1	2	23.67	0	0
High	848.3	27033	1.4	QPSK	1	5	23.51	0	0
	848.3	27033	1.4	QPSK	3	0	23.58	0	0
	848.3	27033	1.4	QPSK	3	2	23.50	0	0
	848.3	27033	1.4	QPSK	3	3	23.65	0	0
	848.3	27033	1.4	QPSK	6	0	22.30	0-1	1
	848.3	27033	1.4	16-QAM	1	0	22.44	0-1	1
	848.3	27033	1.4	16-QAM	1	2	22.40	0-1	1
	848.3	27033	1.4	16-QAM	1	5	22.57	0-1	1
	848.3	27033	1.4	16-QAM	3	0	22.37	0-1	1
	848.3	27033	1.4	16-QAM	3	2	22.23	0-1	1
	848.3	27033	1.4	16-QAM	3	3	22.54	0-1	1
	848.3	27033	1.4	16-QAM	6	0	21.42	0-2	2

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LTE Band 41

Table 9-11
LTE Band 41 Conducted Powers - 20 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	2506	39750	20	QPSK	1	0	23.70	0	0
	2506	39750	20	QPSK	1	50	23.63	0	0
	2506	39750	20	QPSK	1	99	23.39	0	0
	2506	39750	20	QPSK	50	0	22.79	0-1	1
	2506	39750	20	QPSK	50	25	22.75	0-1	1
	2506	39750	20	QPSK	50	50	22.62	0-1	1
	2506	39750	20	QPSK	100	0	22.73	0-1	1
	2506	39750	20	16QAM	1	0	22.60	0-1	1
	2506	39750	20	16QAM	1	50	22.47	0-1	1
	2506	39750	20	16QAM	1	99	22.44	0-1	1
	2506	39750	20	16QAM	50	0	21.91	0-2	2
	2506	39750	20	16QAM	50	25	21.87	0-2	2
	2506	39750	20	16QAM	50	50	21.66	0-2	2
	2506	39750	20	16QAM	100	0	21.60	0-2	2
	1253.0	27220	20	QPSK	1	0	23.95	0	0
	1253.0	27220	20	QPSK	1	50	23.50	0	0
Low Mid	1253.0	27220	20	QPSK	1	99	23.25	0	0
	1253.0	27220	20	QPSK	50	0	22.67	0-1	1
	1253.0	27220	20	QPSK	50	25	22.56	0-1	1
	1253.0	27220	20	QPSK	50	50	22.35	0-1	1
	1253.0	27220	20	QPSK	100	0	22.47	0-1	1
	1253.0	27220	20	16-QAM	1	0	22.75	0-1	1
	1253.0	27220	20	16-QAM	1	50	22.11	0-1	1
	1253.0	27220	20	16-QAM	1	99	22.00	0-1	1
	1253.0	27220	20	16-QAM	50	0	21.57	0-2	2
	1253.0	27220	20	16-QAM	50	25	21.33	0-2	2
	1253.0	27220	20	16-QAM	50	50	21.19	0-2	2
	1253.0	27220	20	16-QAM	100	0	21.29	0-2	2
Mid	0	14690	20	QPSK	1	0	23.37	0	0
	0	14690	20	QPSK	1	50	23.26	0	0
	0	14690	20	QPSK	1	99	23.30	0	0
	0	14690	20	QPSK	50	0	22.49	0-1	1
	0	14690	20	QPSK	50	25	22.33	0-1	1
	0	14690	20	QPSK	50	50	22.22	0-1	1
	0	14690	20	QPSK	100	0	22.36	0-1	1
	0	14690	20	16-QAM	1	0	22.32	0-1	1
	0	14690	20	16-QAM	1	50	22.03	0-1	1
	0	14690	20	16-QAM	1	99	22.18	0-1	1
	0	14690	20	16-QAM	50	0	21.35	0-2	2
	0	14690	20	16-QAM	50	25	21.14	0-2	2
	0	14690	20	16-QAM	50	50	21.04	0-2	2
	0	14690	20	16-QAM	100	0	21.06	0-2	2
	1340.0	28090	20	QPSK	1	0	23.11	0	0
	1340.0	28090	20	QPSK	1	50	23.05	0	0
Mid High	1340.0	28090	20	QPSK	1	99	23.01	0	0
	1340.0	28090	20	QPSK	50	0	22.43	0-1	1
	1340.0	28090	20	QPSK	50	25	22.25	0-1	1
	1340.0	28090	20	QPSK	50	50	22.20	0-1	1
	1340.0	28090	20	QPSK	100	0	22.29	0-1	1
	1340.0	28090	20	16-QAM	1	0	22.38	0-1	1
	1340.0	28090	20	16-QAM	1	50	22.12	0-1	1
	1340.0	28090	20	16-QAM	1	99	22.20	0-1	1
	1340.0	28090	20	16-QAM	50	0	21.37	0-2	2
	1340.0	28090	20	16-QAM	50	25	21.29	0-2	2
	1340.0	28090	20	16-QAM	50	50	21.16	0-2	2
	1340.0	28090	20	16-QAM	100	0	21.17	0-2	2
High	2680	41490	20	QPSK	1	0	23.63	0	0
	2680	41490	20	QPSK	1	50	23.40	0	0
	2680	41490	20	QPSK	1	99	23.26	0	0
	2680	41490	20	QPSK	50	0	22.47	0-1	1
	2680	41490	20	QPSK	50	25	22.37	0-1	1
	2680	41490	20	QPSK	50	50	22.30	0-1	1
	2680	41490	20	QPSK	100	0	22.33	0-1	1
	2680	41490	20	16-QAM	1	0	22.22	0-1	1
	2680	41490	20	16-QAM	1	50	22.93	0-1	1
	2680	41490	20	16-QAM	1	99	22.00	0-1	1
	2680	41490	20	16-QAM	50	0	21.18	0-2	2
	2680	41490	20	16-QAM	50	25	21.06	0-2	2
	2680	41490	20	16-QAM	50	50	21.00	0-2	2
	2680	41490	20	16-QAM	100	0	21.06	0-2	2

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Table 9-12
LTE Band 41 Conducted Powers - 15 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	2503.5	39725	15	QPSK	1	0	23.32	0	0
	2503.5	39725	15	QPSK	1	36	23.88	0	0
	2503.5	39725	15	QPSK	1	74	23.85	0	0
	2503.5	39725	15	QPSK	36	0	22.98	0-1	1
	2503.5	39725	15	QPSK	36	18	22.92	0-1	1
	2503.5	39725	15	QPSK	36	37	22.81	0-1	1
	2503.5	39725	15	QPSK	75	0	22.90	0-1	1
	2503.5	39725	15	16QAM	1	0	22.28	0-1	1
	2503.5	39725	15	16QAM	1	36	22.89	0-1	1
	2503.5	39725	15	16QAM	1	74	22.86	0-1	1
	2503.5	39725	15	16QAM	36	0	21.98	0-2	2
	2503.5	39725	15	16QAM	36	18	21.93	0-2	2
Low Mid	1251.75	27208	15	QPSK	1	0	23.53	0	0
	1251.75	27208	15	QPSK	1	36	23.42	0	0
	1251.75	27208	15	QPSK	1	74	23.51	0	0
	1251.75	27208	15	QPSK	36	0	22.46	0-1	1
	1251.75	27208	15	QPSK	36	18	22.31	0-1	1
	1251.75	27208	15	QPSK	36	37	22.35	0-1	1
	1251.75	27208	15	QPSK	75	0	22.37	0-1	1
	1251.75	27208	15	16-QAM	1	0	22.58	0-1	1
	1251.75	27208	15	16-QAM	1	36	22.46	0-1	1
	1251.75	27208	15	16-QAM	1	74	22.59	0-1	1
	1251.75	27208	15	16-QAM	36	0	21.24	0-2	2
	1251.75	27208	15	16-QAM	36	18	21.20	0-2	2
Mid	0	14690	15	QPSK	1	0	23.15	0	0
	0	14690	15	QPSK	1	36	23.17	0	0
	0	14690	15	QPSK	1	74	23.18	0	0
	0	14690	15	QPSK	36	0	22.61	0-1	1
	0	14690	15	QPSK	36	18	22.55	0-1	1
	0	14690	15	QPSK	36	37	22.42	0-1	1
	0	14690	15	QPSK	75	0	22.51	0-1	1
	0	14690	15	16-QAM	1	0	22.58	0-1	1
	0	14690	15	16-QAM	1	36	22.40	0-1	1
	0	14690	15	16-QAM	1	74	22.36	0-1	1
	0	14690	15	16-QAM	36	0	21.15	0-2	2
	0	14690	15	16-QAM	36	18	21.17	0-2	2
Mid High	1341.25	28103	15	QPSK	1	0	23.18	0	0
	1341.25	28103	15	QPSK	1	36	23.23	0	0
	1341.25	28103	15	QPSK	1	74	23.20	0	0
	1341.25	28103	15	QPSK	36	0	22.42	0-1	1
	1341.25	28103	15	QPSK	36	18	22.22	0-1	1
	1341.25	28103	15	QPSK	36	37	22.14	0-1	1
	1341.25	28103	15	QPSK	75	0	22.26	0-1	1
	1341.25	28103	15	16-QAM	1	0	22.15	0-1	1
	1341.25	28103	15	16-QAM	1	36	22.27	0-1	1
	1341.25	28103	15	16-QAM	1	74	22.38	0-1	1
	1341.25	28103	15	16-QAM	36	0	21.05	0-2	2
	1341.25	28103	15	16-QAM	36	18	21.02	0-2	2
High	2682.5	41515	15	QPSK	1	0	23.49	0	0
	2682.5	41515	15	QPSK	1	36	23.37	0	0
	2682.5	41515	15	QPSK	1	74	23.35	0	0
	2682.5	41515	15	QPSK	36	0	22.45	0-1	1
	2682.5	41515	15	QPSK	36	18	22.47	0-1	1
	2682.5	41515	15	QPSK	36	37	22.55	0-1	1
	2682.5	41515	15	QPSK	75	0	22.56	0-1	1
	2682.5	41515	15	16-QAM	1	0	22.52	0-1	1
	2682.5	41515	15	16-QAM	1	36	22.40	0-1	1
	2682.5	41515	15	16-QAM	1	74	22.47	0-1	1
	2682.5	41515	15	16-QAM	36	0	21.55	0-2	2
	2682.5	41515	15	16-QAM	36	18	21.51	0-2	2
High	2682.5	41515	15	16-QAM	36	37	21.45	0-2	2
	2682.5	41515	15	16-QAM	75	0	21.64	0-2	2

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Table 9-13
LTE Band 41 Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	2501	39700	10	QPSK	1	0	23.37	0	0
	2501	39700	10	QPSK	1	25	23.93	0	0
	2501	39700	10	QPSK	1	49	23.90	0	0
	2501	39700	10	QPSK	25	0	22.96	0-1	1
	2501	39700	10	QPSK	25	12	22.97	0-1	1
	2501	39700	10	QPSK	25	25	22.86	0-1	1
	2501	39700	10	QPSK	50	0	22.85	0-1	1
	2501	39700	10	16QAM	1	0	22.23	0-1	1
	2501	39700	10	16QAM	1	25	22.89	0-1	1
	2501	39700	10	16QAM	1	49	22.91	0-1	1
	2501	39700	10	16QAM	25	0	21.98	0-2	2
	2501	39700	10	16QAM	25	12	21.93	0-2	2
	2501	39700	10	16QAM	25	25	21.88	0-2	2
	2501	39700	10	16QAM	50	0	21.97	0-2	2
Low Mid	1251	27195	10	QPSK	1	0	23.53	0	0
	1251	27195	10	QPSK	1	25	23.37	0	0
	1251	27195	10	QPSK	1	49	23.56	0	0
	1251	27195	10	QPSK	25	0	22.41	0-1	1
	1251	27195	10	QPSK	25	12	22.36	0-1	1
	1251	27195	10	QPSK	25	25	22.35	0-1	1
	1251	27195	10	QPSK	50	0	22.37	0-1	1
	1251	27195	10	16-QAM	1	0	22.53	0-1	1
	1251	27195	10	16-QAM	1	25	22.51	0-1	1
	1251	27195	10	16-QAM	1	49	22.54	0-1	1
	1251	27195	10	16-QAM	25	0	21.24	0-2	2
	1251	27195	10	16-QAM	25	12	21.15	0-2	2
	1251	27195	10	16-QAM	25	25	21.21	0-2	2
	1251	27195	10	16-QAM	50	0	21.45	0-2	2
Mid	0	14690	10	QPSK	1	0	23.57	0	0
	0	14690	10	QPSK	1	25	23.51	0	0
	0	14690	10	QPSK	1	49	23.53	0	0
	0	14690	10	QPSK	25	0	22.34	0-1	1
	0	14690	10	QPSK	25	12	22.35	0-1	1
	0	14690	10	QPSK	25	25	22.59	0-1	1
	0	14690	10	QPSK	50	0	22.58	0-1	1
	0	14690	10	16-QAM	1	0	22.63	0-1	1
	0	14690	10	16-QAM	1	25	22.58	0-1	1
	0	14690	10	16-QAM	1	49	22.67	0-1	1
	0	14690	10	16-QAM	25	0	21.55	0-2	2
	0	14690	10	16-QAM	25	12	21.46	0-2	2
	0	14690	10	16-QAM	25	25	21.39	0-2	2
	0	14690	10	16-QAM	50	0	21.42	0-2	2
Mid High	1343	28115	10	QPSK	1	0	23.44	0	0
	1343	28115	10	QPSK	1	25	23.36	0	0
	1343	28115	10	QPSK	1	49	23.35	0	0
	1343	28115	10	QPSK	25	0	22.41	0-1	1
	1343	28115	10	QPSK	25	12	22.35	0-1	1
	1343	28115	10	QPSK	25	25	22.38	0-1	1
	1343	28115	10	QPSK	50	0	22.27	0-1	1
	1343	28115	10	16-QAM	1	0	22.51	0-1	1
	1343	28115	10	16-QAM	1	25	22.34	0-1	1
	1343	28115	10	16-QAM	1	49	22.33	0-1	1
	1343	28115	10	16-QAM	25	0	21.62	0-2	2
	1343	28115	10	16-QAM	25	12	21.57	0-2	2
	1343	28115	10	16-QAM	25	25	21.28	0-2	2
	1343	28115	10	16-QAM	50	0	21.25	0-2	2
High	2685	41540	10	QPSK	1	0	23.54	0	0
	2685	41540	10	QPSK	1	25	23.37	0	0
	2685	41540	10	QPSK	1	49	23.30	0	0
	2685	41540	10	QPSK	25	0	22.40	0-1	1
	2685	41540	10	QPSK	25	12	22.52	0-1	1
	2685	41540	10	QPSK	25	25	22.55	0-1	1
	2685	41540	10	QPSK	50	0	22.51	0-1	1
	2685	41540	10	16-QAM	1	0	22.57	0-1	1
	2685	41540	10	16-QAM	1	25	22.40	0-1	1
	2685	41540	10	16-QAM	1	49	22.47	0-1	1
	2685	41540	10	16-QAM	25	0	21.50	0-2	2
	2685	41540	10	16-QAM	25	12	21.51	0-2	2
	2685	41540	10	16-QAM	25	25	21.50	0-2	2
	2685	41540	10	16-QAM	50	0	21.59	0-2	2

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Table 9-14
LTE Band 41 Conducted Powers - 5 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	MPR Allowed per 3GPP [dB]	MPR [dB]
Low	2498.5	39675	5	QPSK	1	0	23.32	0	0
	2498.5	39675	5	QPSK	1	12	23.88	0	0
	2498.5	39675	5	QPSK	1	24	23.85	0	0
	2498.5	39675	5	QPSK	12	0	22.96	0-1	1
	2498.5	39675	5	QPSK	12	6	22.97	0-1	1
	2498.5	39675	5	QPSK	12	13	22.91	0-1	1
	2498.5	39675	5	QPSK	25	0	22.80	0-1	1
	2498.5	39675	5	16-QAM	1	0	22.28	0-1	1
	2498.5	39675	5	16-QAM	1	12	22.94	0-1	1
	2498.5	39675	5	16-QAM	1	24	22.91	0-1	1
	2498.5	39675	5	16-QAM	12	0	21.96	0-2	2
	2498.5	39675	5	16-QAM	12	6	21.88	0-2	2
	2498.5	39675	5	16-QAM	12	13	21.93	0-2	2
	2498.5	39675	5	16-QAM	25	0	21.97	0-2	2
Low Mid	1249.25	27183	5	QPSK	1	0	23.53	0	0
	1249.25	27183	5	QPSK	1	12	23.42	0	0
	1249.25	27183	5	QPSK	1	24	23.51	0	0
	1249.25	27183	5	QPSK	12	0	22.46	0-1	1
	1249.25	27183	5	QPSK	12	6	22.31	0-1	1
	1249.25	27183	5	QPSK	12	13	22.35	0-1	1
	1249.25	27183	5	QPSK	25	0	22.37	0-1	1
	1249.25	27183	5	16-QAM	1	0	22.48	0-1	1
	1249.25	27183	5	16-QAM	1	12	22.51	0-1	1
	1249.25	27183	5	16-QAM	1	24	22.54	0-1	1
	1249.25	27183	5	16-QAM	12	0	21.19	0-2	2
	1249.25	27183	5	16-QAM	12	6	21.15	0-2	2
	1249.25	27183	5	16-QAM	12	13	21.16	0-2	2
	1249.25	27183	5	16-QAM	25	0	21.40	0-2	2
Mid	0	14690	5	QPSK	1	0	23.52	0	0
	0	14690	5	QPSK	1	12	23.56	0	0
	0	14690	5	QPSK	1	24	23.58	0	0
	0	14690	5	QPSK	12	0	22.61	0-1	1
	0	14690	5	QPSK	12	6	22.62	0-1	1
	0	14690	5	QPSK	12	13	22.54	0-1	1
	0	14690	5	QPSK	25	0	22.63	0-1	1
	0	14690	5	16-QAM	1	0	22.68	0-1	1
	0	14690	5	16-QAM	1	12	22.47	0-1	1
	0	14690	5	16-QAM	1	24	22.46	0-1	1
	0	14690	5	16-QAM	12	0	21.40	0-2	2
	0	14690	5	16-QAM	12	6	21.52	0-2	2
	0	14690	5	16-QAM	12	13	21.21	0-2	2
	0	14690	5	16-QAM	25	0	21.19	0-2	2
Mid High	1343.75	28128	5	QPSK	1	0	23.57	0	0
	1343.75	28128	5	QPSK	1	12	23.60	0	0
	1343.75	28128	5	QPSK	1	24	23.70	0	0
	1343.75	28128	5	QPSK	12	0	22.63	0-1	1
	1343.75	28128	5	QPSK	12	6	22.74	0-1	1
	1343.75	28128	5	QPSK	12	13	22.51	0-1	1
	1343.75	28128	5	QPSK	25	0	22.59	0-1	1
	1343.75	28128	5	16-QAM	1	0	22.46	0-1	1
	1343.75	28128	5	16-QAM	1	12	22.42	0-1	1
	1343.75	28128	5	16-QAM	1	24	22.49	0-1	1
	1343.75	28128	5	16-QAM	12	0	21.37	0-2	2
	1343.75	28128	5	16-QAM	12	6	21.24	0-2	2
	1343.75	28128	5	16-QAM	12	13	21.17	0-2	2
	1343.75	28128	5	16-QAM	25	0	21.20	0-2	2
High	2687.5	41565	5	QPSK	1	0	23.49	0	0
	2687.5	41565	5	QPSK	1	12	23.37	0	0
	2687.5	41565	5	QPSK	1	24	23.30	0	0
	2687.5	41565	5	QPSK	12	0	22.40	0-1	1
	2687.5	41565	5	QPSK	12	6	22.52	0-1	1
	2687.5	41565	5	QPSK	12	13	22.55	0-1	1
	2687.5	41565	5	QPSK	25	0	22.51	0-1	1
	2687.5	41565	5	16-QAM	1	0	22.52	0-1	1
	2687.5	41565	5	16-QAM	1	12	22.40	0-1	1
	2687.5	41565	5	16-QAM	1	24	22.42	0-1	1
	2687.5	41565	5	16-QAM	12	0	21.55	0-2	2
	2687.5	41565	5	16-QAM	12	6	21.51	0-2	2
	2687.5	41565	5	16-QAM	12	13	21.50	0-2	2
	2687.5	41565	5	16-QAM	25	0	21.59	0-2	2

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9.3 WLAN Conducted Powers

Table 9-15
IEEE 802.11b Average RF Power

Mode	Freq [MHz]	Channel	802.11b (2.4 GHz) Conducted Power [dBm]			
			Data Rate [Mbps]			
			1	2	5.5	11
802.11b	2412	1*	13.15	13.25	13.02	13.08
802.11b	2437	6*	13.26	13.43	13.07	13.20
802.11b	2462	11*	12.77	12.81	12.61	12.68

Table 9-16
IEEE 802.11g Average RF Power

Mode	Freq [MHz]	Channel	802.11g Conducted Power [dBm]							
			Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
802.11g	2412	1	12.93	12.94	12.82	12.83	12.92	12.89	12.93	12.88
802.11g	2437	6	12.14	12.18	12.27	12.26	12.08	12.15	12.20	12.11
802.11g	2462	11	12.23	12.16	12.09	12.15	12.23	12.22	12.30	12.16

Table 9-17
IEEE 802.11n Average RF Power

Mode	Freq [MHz]	Channel	802.11n (2.4GHz) Conducted Power [dBm]							
			Data Rate [Mbps]							
			6.5	13	19.5	26	39	52	58.5	65
802.11n	2412	1	11.82	11.80	11.78	11.91	11.84	11.85	11.87	12.04
802.11n	2437	6	12.26	12.26	12.20	12.31	12.29	12.26	12.33	12.46
802.11n	2462	11	12.19	12.18	12.20	12.34	12.25	12.17	12.17	12.41

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

- For 2.4 GHz operations, 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.

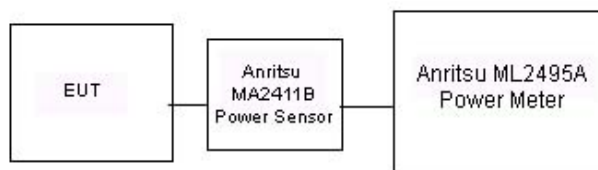


Figure 9-2
Power Measurement Setup

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10 SYSTEM VERIFICATION

10.1 Tissue Verification

Table 10-1
Measured Tissue Properties

Tissue Type	Calibrated Date:	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
10/30/2014	835H	22.6	800	0.897	42.716	0.897	41.682	0.00%	2.48%
			820	0.916	42.459	0.899	41.578	1.89%	2.12%
			835	0.930	42.286	0.900	41.500	3.33%	1.89%
			850	0.944	42.067	0.916	41.500	3.06%	1.37%
10/28/2014	1900H	22.1	1850	1.377	38.826	1.400	40.000	-1.64%	-2.94%
			1880	1.410	38.746	1.400	40.000	0.71%	-3.13%
			1910	1.441	38.585	1.400	40.000	2.93%	-3.54%
11/03/2014	1900H	22.1	1850	1.403	40.240	1.400	40.000	0.21%	0.60%
			1880	1.431	40.157	1.400	40.000	2.21%	0.39%
			1910	1.461	39.938	1.400	40.000	4.36%	-0.15%
10/16/2014	2450H	22.4	2401	1.728	38.679	1.756	39.287	-1.59%	-1.55%
			2450	1.790	38.364	1.800	39.200	-0.56%	-2.13%
			2499	1.845	38.285	1.853	39.138	-0.43%	-2.18%
10/29/2014	2600H	22.8	2500	1.870	38.826	1.855	39.136	0.81%	-0.79%
			2550	1.941	38.645	1.909	39.073	1.68%	-1.10%
			2600	1.988	38.428	1.964	39.009	1.22%	-1.49%
			2650	2.054	38.276	2.018	38.945	1.78%	-1.72%
			2700	2.109	37.994	2.073	38.882	1.74%	-2.28%
10/22/2014	835B	22.0	800	0.964	53.788	0.967	55.366	-0.31%	-2.85%
			820	0.985	53.643	0.969	55.258	1.65%	-2.92%
			835	0.999	53.521	0.970	55.200	2.99%	-3.04%
			850	1.014	53.354	0.988	55.154	2.63%	-3.26%
10/28/2014	1900B	22.6	1850	1.491	53.213	1.520	53.300	-1.91%	-0.16%
			1880	1.526	53.138	1.520	53.300	0.39%	-0.30%
			1910	1.562	53.007	1.520	53.300	2.76%	-0.55%
11/03/2014	1900B	22.2	1850	1.523	53.853	1.520	53.300	0.20%	1.04%
			1880	1.553	53.811	1.520	53.300	2.17%	0.96%
			1910	1.588	53.602	1.520	53.300	4.47%	0.57%
11/19/2014	2450B	22.9	2401	1.839	52.350	1.903	52.765	-3.36%	-0.79%
			2450	1.905	52.170	1.950	52.700	-2.31%	-1.01%
			2499	1.971	52.030	2.019	52.638	-2.38%	-1.16%
10/29/2014	2600B	23.0	2500	2.095	51.685	2.021	52.636	3.66%	-1.81%
			2550	2.172	51.514	2.092	52.573	3.82%	-2.01%
			2600	2.241	51.308	2.163	52.509	3.61%	-2.29%
			2650	2.316	51.129	2.234	52.445	3.67%	-2.51%
			2700	2.388	50.908	2.305	52.382	3.60%	-2.81%

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

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10.2 Test System Verification

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

Table 10-2
System Verification Results

System Verification TARGET & MEASURED												
SAR System #	Tissue Frequency (MHz)	Tissue Type	Date:	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Dipole SN	Probe SN	Measured SAR _{1g} (W/kg)	1 W Target SAR _{1g} (W/kg)	1 W Normalized SAR _{1g} (W/kg)	Deviation _{1g} (%)
I	835	HEAD	10/30/2014	23.3	22.6	0.100	4d119	3209	0.983	9.220	9.830	6.62%
K	1900	HEAD	10/28/2014	24.1	22.0	0.100	5d141	3288	4.040	40.100	40.400	0.75%
K	1900	HEAD	11/03/2014	23.0	22.1	0.100	5d141	3288	4.000	40.100	40.000	-0.25%
G	2450	HEAD	10/16/2014	20.5	22.4	0.100	797	3258	5.440	51.800	54.400	5.02%
G	2600	HEAD	10/29/2014	23.0	22.8	0.100	1004	3258	5.790	57.300	57.900	1.05%
D	835	BODY	10/22/2014	23.9	22.1	0.100	4d119	3263	0.902	9.340	9.020	-3.43%
G	1900	BODY	10/28/2014	22.6	22.6	0.100	5d141	3258	3.920	40.600	39.200	-3.45%
D	1900	BODY	11/03/2014	24.0	22.3	0.100	5d141	3263	4.360	40.600	43.600	7.39%
G	2450	BODY	11/19/2014	24.2	22.9	0.100	797	3258	4.950	49.400	49.500	0.20%
I	2600	BODY	10/29/2014	23.2	23.0	0.100	1004	3209	6.130	56.700	61.300	8.11%

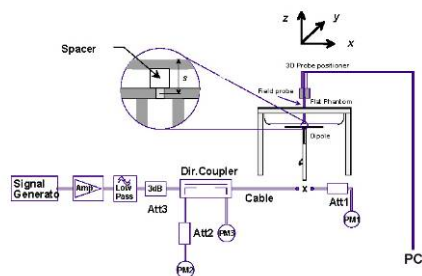


Figure 10-1
System Verification Setup Diagram



Figure 10-2
System Verification Setup Photo

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11 SAR DATA SUMMARY

11.1 Standalone Head SAR Data

Table 11-1
CDMA BC0 (\$22H) Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR [1g]	Scaling Factor	Scaled SAR [1g]	Plot
MHz	Ch.										(W/kg)		Scaled SAR [1g]	
836.52	384	CDMA BC0 (S22H)	RC3 / SO55	25.0	24.64	0.05	Right	Cheek	FCC5	1:1	0.449	1.086	0.488	
836.52	384	CDMA BC0 (S22H)	RC3 / SO55	25.0	24.64	0.12	Right	Tilt	FCC5	1:1	0.274	1.086	0.298	
836.52	384	CDMA BC0 (S22H)	RC3 / SO55	25.0	24.64	0.01	Left	Cheek	FCC5	1:1	0.491	1.086	0.533	
836.52	384	CDMA BC0 (S22H)	RC3 / SO55	25.0	24.64	0.03	Left	Tilt	FCC5	1:1	0.286	1.086	0.311	
836.52	384	CDMA BC0 (S22H)	EVDO Rev. A	25.0	24.66	0.04	Right	Cheek	FCC5	1:1	0.382	1.081	0.413	
836.52	384	CDMA BC0 (S22H)	EVDO Rev. A	25.0	24.66	0.05	Right	Tilt	FCC5	1:1	0.235	1.081	0.254	
836.52	384	CDMA BC0 (S22H)	EVDO Rev. A	25.0	24.66	0.11	Left	Cheek	FCC5	1:1	0.493	1.081	0.533	A1
836.52	384	CDMA BC0 (S22H)	EVDO Rev. A	25.0	24.66	0.01	Left	Tilt	FCC5	1:1	0.277	1.081	0.299	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT										Head				
Spatial Peak										1.6 W/kg (mW/g)				
Uncontrolled Exposure/General Population										averaged over 1 gram				

Table 11-2
PCS CDMA Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power (dBm)	Conducted Power (dBm)	Power Drift (dB)	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g) (W/kg)	Scaling Factor	Scaled SAR (1g) (W/kg)	Plot #
MHz	Ch.													
1880.00	600	PCS CDMA	RC3 / SO55	25.0	24.29	0.19	Right	Cheek	FCC5	1:1	0.429	1.178	0.505	
1880.00	600	PCS CDMA	RC3 / SO55	25.0	24.29	0.04	Right	Tilt	FCC5	1:1	0.325	1.178	0.383	
1851.25	25	PCS CDMA	RC3 / SO55	25.0	24.58	0.03	Left	Cheek	FCC5	1:1	0.846	1.102	0.932	
1880.00	600	PCS CDMA	RC3 / SO55	25.0	24.29	0.02	Left	Cheek	FCC5	1:1	0.800	1.178	0.942	
1908.75	1175	PCS CDMA	RC3 / SO55	25.0	24.55	0.10	Left	Cheek	FCC5	1:1	0.883	1.109	0.979	
1880.00	600	PCS CDMA	RC3 / SO55	25.0	24.29	0.17	Left	Tilt	FCC5	1:1	0.273	1.178	0.322	
1880.00	600	PCS CDMA	EVDO Rev. A	25.0	24.24	0.03	Right	Cheek	FCC5	1:1	0.518	1.191	0.617	
1880.00	600	PCS CDMA	EVDO Rev. A	25.0	24.24	0.03	Right	Tilt	FCC5	1:1	0.320	1.191	0.381	
1851.25	25	PCS CDMA	EVDO Rev. A	25.0	24.54	0.15	Left	Cheek	FCC5	1:1	0.898	1.112	0.999	
1880.00	600	PCS CDMA	EVDO Rev. A	25.0	24.24	0.06	Left	Cheek	FCC5	1:1	0.861	1.191	1.025	
1908.75	1175	PCS CDMA	EVDO Rev. A	25.0	24.51	0.02	Left	Cheek	FCC5	1:1	0.948	1.119	1.061	A2
1880.00	600	PCS CDMA	EVDO Rev. A	25.0	24.24	0.07	Left	Tilt	FCC5	1:1	0.269	1.191	0.320	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT							Head							
Spatial Peak							1.6 W/kg (mW/g)							
Uncontrolled Exposure/General Population							averaged over 1 gram							

Table 11-3
CDMA BC10 (\$90S) Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR [1g]	Scaling Factor	Scaled SAR [1g]	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
820.10	564	CDMA BC10 (90S)	RC3 / SO55	25.0	24.45	0.18	Right	Cheek	FCC5	1:1	0.352	1.135	0.400	
820.10	564	CDMA BC10 (90S)	RC3 / SO55	25.0	24.45	0.19	Right	Tilt	FCC5	1:1	0.231	1.135	0.262	
820.10	564	CDMA BC10 (90S)	RC3 / SO55	25.0	24.45	0.12	Left	Cheek	FCC5	1:1	0.397	1.135	0.451	A3
820.10	564	CDMA BC10 (90S)	RC3 / SO55	25.0	24.45	0.06	Left	Tilt	FCC5	1:1	0.258	1.135	0.293	
820.10	564	CDMA BC10 (90S)	EVDO Rev. A	25.0	24.41	0.03	Right	Cheek	FCC5	1:1	0.325	1.146	0.372	
820.10	564	CDMA BC10 (90S)	EVDO Rev. A	25.0	24.41	0.13	Right	Tilt	FCC5	1:1	0.208	1.146	0.238	
820.10	564	CDMA BC10 (90S)	EVDO Rev. A	25.0	24.41	0.08	Left	Cheek	FCC5	1:1	0.388	1.146	0.445	
820.10	564	CDMA BC10 (90S)	EVDO Rev. A	25.0	24.41	0.02	Left	Tilt	FCC5	1:1	0.304	1.146	0.348	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT								Head						
Spatial Peak								1.6 W/kg (mW/g)						
Uncontrolled Exposure/General Population								averaged over 1 gram						

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Table 11-4
LTE Band 25 (PCS) 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)		
1905.00	26590	High	LTE Band 25 (PCS)	20	23.0	22.58	0.20	0	Right	Cheek	QPSK	1	0	FCC3	1:1	0.650	1.102	0.716	
1905.00	26590	High	LTE Band 25 (PCS)	20	22.0	21.30	0.20	1	Right	Cheek	QPSK	50	0	FCC3	1:1	0.494	1.175	0.580	
1905.00	26590	High	LTE Band 25 (PCS)	20	23.0	22.58	0.13	0	Right	Tilt	QPSK	1	0	FCC3	1:1	0.426	1.102	0.469	
1905.00	26590	High	LTE Band 25 (PCS)	20	22.0	21.30	0.00	1	Right	Tilt	QPSK	50	0	FCC3	1:1	0.336	1.175	0.395	
1860.00	26140	Low	LTE Band 25 (PCS)	20	23.0	22.57	0.15	0	Left	Cheek	QPSK	1	0	FCC3	1:1	0.970	1.104	1.071	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	23.0	22.48	0.09	0	Left	Cheek	QPSK	1	0	FCC3	1:1	0.922	1.127	1.039	
1905.00	26590	High	LTE Band 25 (PCS)	20	23.0	22.58	0.11	0	Left	Cheek	QPSK	1	0	FCC3	1:1	0.896	1.102	0.987	
1860.00	26140	Low	LTE Band 25 (PCS)	20	22.0	21.10	0.20	1	Left	Cheek	QPSK	50	0	FCC3	1:1	0.671	1.230	0.825	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	22.0	21.29	0.07	1	Left	Cheek	QPSK	50	0	FCC3	1:1	0.708	1.178	0.834	
1905.00	26590	High	LTE Band 25 (PCS)	20	22.0	21.30	0.02	1	Left	Cheek	QPSK	50	0	FCC3	1:1	0.718	1.175	0.844	
1905.00	26590	High	LTE Band 25 (PCS)	20	22.0	21.08	0.06	1	Left	Cheek	QPSK	100	0	FCC3	1:1	0.723	1.236	0.894	
1905.00	26590	High	LTE Band 25 (PCS)	20	23.0	22.58	0.06	0	Left	Tilt	QPSK	1	0	FCC3	1:1	0.344	1.102	0.379	
1905.00	26590	High	LTE Band 25 (PCS)	20	22.0	21.30	0.05	1	Left	Tilt	QPSK	50	0	FCC3	1:1	0.294	1.175	0.345	
1860.00	26140	Low	LTE Band 25 (PCS)	20	23.0	22.57	0.20	0	Left	Cheek	QPSK	1	0	FCC3	1:1	0.995	1.104	1.098	A4
ANSI / IEEE C95.1 1992 - SAFETY LIMIT										Head									
Spatial Peak										1.6 W/kg (mW/g)									
Uncontrolled Exposure/General Population										averaged over 1 gram									

Blue entry represents variability measurement.

Table 11-5
LTE Band 26 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) (W/kg)	Plot #
MHz	Ch.															(W/kg)			
819.00	26740	Low	LTE Band 26	10	24.0	23.99	0.20	0	Right	Cheek	QPSK	1	25	FCC3	1:1	0.228	1.002	0.228	
819.00	26740	Low	LTE Band 26	10	23.0	22.75	0.03	1	Right	Cheek	QPSK	25	12	FCC3	1:1	0.180	1.059	0.191	
819.00	26740	Low	LTE Band 26	10	24.0	23.99	0.20	0	Right	Tilt	QPSK	1	25	FCC3	1:1	0.148	1.002	0.148	
819.00	26740	Low	LTE Band 26	10	23.0	22.75	0.10	1	Right	Tilt	QPSK	25	12	FCC3	1:1	0.119	1.059	0.126	
819.00	26740	Low	LTE Band 26	10	24.0	23.99	0.03	0	Left	Cheek	QPSK	1	25	FCC3	1:1	0.282	1.002	0.283	A5
819.00	26740	Low	LTE Band 26	10	23.0	22.75	0.09	1	Left	Cheek	QPSK	25	12	FCC3	1:1	0.203	1.059	0.215	
819.00	26740	Low	LTE Band 26	10	24.0	23.99	0.20	0	Left	Tilt	QPSK	1	25	FCC3	1:1	0.175	1.002	0.175	
819.00	26740	Low	LTE Band 26	10	23.0	22.75	0.05	1	Left	Tilt	QPSK	25	12	FCC3	1:1	0.132	1.059	0.140	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT										Head									
Spatial Peak										1.6 W/kg (mW/g)									
Uncontrolled Exposure/General Population										averaged over 1 gram									

Table 11-6
LTE Band 41 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)		
2549.50	40185	Low-Mid	LTE Band 41	20	24.0	23.95	0.20	0	Right	Cheek	QPSK	1	0	FCC6	1:1.58	0.243	1.012	0.246	
2506.00	39750	Low	LTE Band 41	20	23.0	22.79	0.06	1	Right	Cheek	QPSK	50	0	FCC6	1:1.58	0.222	1.050	0.233	
2549.50	40185	Low-Mid	LTE Band 41	20	24.0	23.95	0.09	0	Right	Tilt	QPSK	1	0	FCC6	1:1.58	0.195	1.012	0.197	
2506.00	39750	Low	LTE Band 41	20	23.0	22.79	0.17	1	Right	Tilt	QPSK	50	0	FCC6	1:1.58	0.175	1.050	0.184	
2549.50	40185	Low-Mid	LTE Band 41	20	24.0	23.95	0.09	0	Left	Cheek	QPSK	1	0	FCC6	1:1.58	0.577	1.012	0.584	A6
2506.00	39750	Low	LTE Band 41	20	23.0	22.79	0.20	1	Left	Cheek	QPSK	50	0	FCC6	1:1.58	0.536	1.050	0.563	
2549.50	40185	Low-Mid	LTE Band 41	20	24.0	23.95	0.06	0	Left	Tilt	QPSK	1	0	FCC6	1:1.58	0.167	1.012	0.169	
2506.00	39750	Low	LTE Band 41	20	23.0	22.79	0.06	1	Left	Tilt	QPSK	50	0	FCC6	1:1.58	0.152	1.050	0.160	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT									Head										
Spatial Peak									1.6 W/kg (mW/g)										
Uncontrolled Exposure/General Population									averaged over 1 gram										

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**Table 11-7
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)	
2437	6	IEEE 802.11b	DSSS	13.5	13.26	0.04	Right	Cheek	FCC3	1	1:1	0.128	1.057	0.135	A7
2437	6	IEEE 802.11b	DSSS	13.5	13.26	0.05	Right	Tilt	FCC3	1	1:1	0.028	1.057	0.030	
2437	6	IEEE 802.11b	DSSS	13.5	13.26	0.08	Left	Cheek	FCC3	1	1:1	0.069	1.057	0.073	
2437	6	IEEE 802.11b	DSSS	13.5	13.26	0.20	Left	Tilt	FCC3	1	1:1	0.031	1.057	0.033	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Head 1.6 W/kg (mW/g) averaged over 1 gram							

11.2 Standalone Body-Worn SAR Data

**Table 11-8
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)	
836.52	384	CDMA BC0 (S2ZH)	TDSD / SO32	25.0	24.47	0.15	10 mm	FCC5	1:1	back	0.702	1.130	0.793	A8
1880.00	600	PCS CDMA	TDSD / SO32	25.0	24.26	0.05	10 mm	FCC5	1:1	back	0.673	1.186	0.798	A10
820.10	564	CDMA BC10 (S90S)	TDSD / SO32	25.0	24.42	0.04	10 mm	FCC5	1:1	back	0.734	1.143	0.839	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 11-9
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)		
1905.00	26590	High	LTE Band 25 (PCS)	20	23.0	22.58	0.07	0	FCC3	QPSK	1	0	10 mm	back	1:1	0.692	1.102	0.763	A14
1905.00	26590	High	LTE Band 25 (PCS)	20	22.0	21.30	0.14	1	FCC3	QPSK	50	0	10 mm	back	1:1	0.544	1.175	0.639	
819.00	26740	Low	LTE Band 26	10	24.0	23.99	0.20	0	FCC3	QPSK	1	25	10 mm	back	1:1	0.486	1.002	0.487	A16
819.00	26740	Low	LTE Band 26	10	23.0	22.75	0.02	1	FCC3	QPSK	25	12	10 mm	back	1:1	0.392	1.059	0.415	
2549.50	40185	Low-Mid	LTE Band 41	20	24.0	23.95	0.20	0	FCC6	QPSK	1	0	10 mm	back	1:1.58	0.418	1.012	0.423	A17
2506.00	39750	Low	LTE Band 41	20	23.0	22.79	0.04	1	FCC6	QPSK	50	0	10 mm	back	1:1.58	0.341	1.050	0.358	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT										Body									
Spatial Peak										1.6 W/kg (mW/g)									
Uncontrolled Exposure/General Population										averaged over 1 gram									

**Table 11-10
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)	
2437	6	IEEE 802.11b	DSSS	13.5	13.26	0.20	10 mm	1410-6	1	back	1:1	0.031	1.057	0.033	A18
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram								

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11.3 Standalone Wireless Router SAR Data

Table 11-11
CDMA 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)	
836.52	384	CDMA BC0 (\$22H)	EVDO Rev. 0	25.0	24.68	0.02	10 mm	FCC5	1:1	back	0.701	1.076	0.754	A9
836.52	384	CDMA BC0 (\$22H)	EVDO Rev. 0	25.0	24.68	0.04	10 mm	FCC5	1:1	front	0.525	1.076	0.565	
836.52	384	CDMA BC0 (\$22H)	EVDO Rev. 0	25.0	24.68	0.01	10 mm	FCC5	1:1	bottom	0.053	1.076	0.057	
836.52	384	CDMA BC0 (\$22H)	EVDO Rev. 0	25.0	24.68	0.04	10 mm	FCC5	1:1	right	0.359	1.076	0.386	
836.52	384	CDMA BC0 (\$22H)	EVDO Rev. 0	25.0	24.68	0.00	10 mm	FCC5	1:1	left	0.481	1.076	0.518	
1851.25	25	PCS CDMA	EVDO Rev. 0	25.0	24.59	0.05	10 mm	FCC5	1:1	back	0.758	1.099	0.833	A11
1880.00	600	PCS CDMA	EVDO Rev. 0	25.0	24.30	0.00	10 mm	FCC5	1:1	back	0.684	1.175	0.804	
1908.75	1175	PCS CDMA	EVDO Rev. 0	25.0	24.58	0.03	10 mm	FCC5	1:1	back	0.671	1.102	0.739	
1880.00	600	PCS CDMA	EVDO Rev. 0	25.0	24.30	0.06	10 mm	FCC5	1:1	front	0.638	1.175	0.750	
1880.00	600	PCS CDMA	EVDO Rev. 0	25.0	24.30	0.01	10 mm	FCC5	1:1	bottom	0.171	1.175	0.201	
1880.00	600	PCS CDMA	EVDO Rev. 0	25.0	24.30	0.02	10 mm	FCC5	1:1	right	0.076	1.175	0.089	
1880.00	600	PCS CDMA	EVDO Rev. 0	25.0	24.30	0.06	10 mm	FCC5	1:1	left	0.398	1.175	0.468	
820.10	564	CDMA BC10 (\$90S)	EVDO Rev. 0	25.0	24.44	0.04	10 mm	FCC5	1:1	back	0.726	1.138	0.826	A13
820.10	564	CDMA BC10 (\$90S)	EVDO Rev. 0	25.0	24.44	0.11	10 mm	FCC5	1:1	front	0.508	1.138	0.578	
820.10	564	CDMA BC10 (\$90S)	EVDO Rev. 0	25.0	24.44	0.01	10 mm	FCC5	1:1	bottom	0.051	1.138	0.058	
820.10	564	CDMA BC10 (\$90S)	EVDO Rev. 0	25.0	24.44	0.10	10 mm	FCC5	1:1	right	0.373	1.138	0.424	
820.10	564	CDMA BC10 (\$90S)	EVDO Rev. 0	25.0	24.44	0.05	10 mm	FCC5	1:1	left	0.478	1.138	0.544	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram							

Table 11-12
LTE Band 25 (PCS) Hotspot SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #	
MHz	Ch.														(W/kg)		(W/kg)		
1905.00	26590	High	LTE Band 25 (PCS)	20	23.0	22.58	0.07	0	FCC3	QPSK	1	0	10 mm	back	1:1	0.692	1.102	0.763	
1905.00	26590	High	LTE Band 25 (PCS)	20	22.0	21.30	0.14	1	FCC3	QPSK	50	0	10 mm	back	1:1	0.544	1.175	0.639	
1860.00	26140	Low	LTE Band 25 (PCS)	20	23.0	22.57	0.20	0	FCC3	QPSK	1	0	10 mm	front	1:1	0.836	1.104	0.923	
1882.50	26365	Mid	LTE Band 25 (PCS)	20	23.0	22.48	0.17	0	FCC3	QPSK	1	0	10 mm	front	1:1	0.845	1.127	0.952	A15
1905.00	26590	High	LTE Band 25 (PCS)	20	23.0	22.58	0.20	0	FCC3	QPSK	1	0	10 mm	front	1:1	0.804	1.102	0.886	
1905.00	26590	High	LTE Band 25 (PCS)	20	22.0	21.30	0.01	1	FCC3	QPSK	50	0	10 mm	front	1:1	0.670	1.175	0.787	
1905.00	26590	High	LTE Band 25 (PCS)	20	22.0	21.08	0.01	1	FCC3	QPSK	100	0	10 mm	front	1:1	0.602	1.236	0.744	
1905.00	26590	High	LTE Band 25 (PCS)	20	23.0	22.58	0.20	0	FCC3	QPSK	1	0	10 mm	bottom	1:1	0.136	1.102	0.150	
1905.00	26590	High	LTE Band 25 (PCS)	20	22.0	21.30	0.03	1	FCC3	QPSK	50	0	10 mm	bottom	1:1	0.109	1.175	0.128	
1905.00	26590	High	LTE Band 25 (PCS)	20	23.0	22.58	0.20	0	FCC3	QPSK	1	0	10 mm	right	1:1	0.113	1.102	0.125	
1905.00	26590	High	LTE Band 25 (PCS)	20	22.0	21.30	0.13	1	FCC3	QPSK	50	0	10 mm	right	1:1	0.080	1.175	0.094	
1905.00	26590	High	LTE Band 25 (PCS)	20	23.0	22.58	0.10	0	FCC3	QPSK	1	0	10 mm	left	1:1	0.625	1.102	0.689	
1905.00	26590	High	LTE Band 25 (PCS)	20	22.0	21.30	0.02	1	FCC3	QPSK	50	0	10 mm	left	1:1	0.585	1.175	0.687	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Body 1.6 W/kg (mW/g) averaged over 1 gram											

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Table 11-13
LTE Band 26 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) (W/kg)	Plot #	
MHz	Ch.														(W/kg)				
819.00	26740	Low	LTE Band 26	10	24.0	23.99	0.20	0	FCC3	QPSK	1	25	10 mm	back	1:1	0.486	1.002	0.487	A16
819.00	26740	Low	LTE Band 26	10	23.0	22.75	0.02	1	FCC3	QPSK	25	12	10 mm	back	1:1	0.392	1.059	0.415	
819.00	26740	Low	LTE Band 26	10	24.0	23.99	0.20	0	FCC3	QPSK	1	25	10 mm	front	1:1	0.387	1.002	0.388	
819.00	26740	Low	LTE Band 26	10	23.0	22.75	0.02	1	FCC3	QPSK	25	12	10 mm	front	1:1	0.287	1.059	0.304	
819.00	26740	Low	LTE Band 26	10	24.0	23.99	0.12	0	FCC3	QPSK	1	25	10 mm	bottom	1:1	0.039	1.002	0.039	
819.00	26740	Low	LTE Band 26	10	23.0	22.75	0.06	1	FCC3	QPSK	25	12	10 mm	bottom	1:1	0.032	1.059	0.034	
819.00	26740	Low	LTE Band 26	10	24.0	23.99	0.10	0	FCC3	QPSK	1	25	10 mm	right	1:1	0.241	1.002	0.241	
819.00	26740	Low	LTE Band 26	10	23.0	22.75	0.03	1	FCC3	QPSK	25	12	10 mm	right	1:1	0.192	1.059	0.203	
819.00	26740	Low	LTE Band 26	10	24.0	23.99	0.20	0	FCC3	QPSK	1	25	10 mm	left	1:1	0.325	1.002	0.326	
819.00	26740	Low	LTE Band 26	10	23.0	22.75	0.03	1	FCC3	QPSK	25	12	10 mm	left	1:1	0.252	1.059	0.267	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT								Body											
Spatial Peak								1.6 W/kg (mW/g)											
Uncontrolled Exposure/General Population								averaged over 1 gram											

Table 11-14
LTE Band 41 Hotspot SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #	
MHz	Ch.														(W/kg)		(W/kg)		
2549.50	40185	Low-Mid	LTE Band 41	20	24.0	23.95	0.20	0	FCC6	QPSK	1	0	10 mm	back	1:1.58	0.418	1.012	0.423	A17
2506.00	39750	Low	LTE Band 41	20	23.0	22.79	0.04	1	FCC6	QPSK	50	0	10 mm	back	1:1.58	0.341	1.050	0.358	
2549.50	40185	Low-Mid	LTE Band 41	20	24.0	23.95	0.20	0	FCC6	QPSK	1	0	10 mm	front	1:1.58	0.364	1.012	0.368	
2506.00	39750	Low	LTE Band 41	20	23.0	22.79	0.20	1	FCC6	QPSK	50	0	10 mm	front	1:1.58	0.271	1.050	0.285	
2549.50	40185	Low-Mid	LTE Band 41	20	24.0	23.95	0.06	0	FCC6	QPSK	1	0	10 mm	bottom	1:1.58	0.159	1.012	0.161	
2506.00	39750	Low	LTE Band 41	20	23.0	22.79	0.04	1	FCC6	QPSK	50	0	10 mm	bottom	1:1.58	0.137	1.050	0.144	
2549.50	40185	Low-Mid	LTE Band 41	20	24.0	23.95	0.01	0	FCC6	QPSK	1	0	10 mm	right	1:1.58	0.078	1.012	0.079	
2506.00	39750	Low	LTE Band 41	20	23.0	22.79	0.02	1	FCC6	QPSK	50	0	10 mm	right	1:1.58	0.074	1.050	0.078	
2549.50	40185	Low-Mid	LTE Band 41	20	24.0	23.95	0.02	0	FCC6	QPSK	1	0	10 mm	left	1:1.58	0.274	1.012	0.277	
2506.00	39750	Low	LTE Band 41	20	23.0	22.79	0.16	1	FCC6	QPSK	50	0	10 mm	left	1:1.58	0.235	1.050	0.247	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT								Body											
Spatial Peak								1.6 W/kg (mW/g)											
Uncontrolled Exposure/General Population								averaged over 1 gram											

Table 11-15
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)	
2437	6	IEEE 802.11b	DSSS	13.5	13.26	0.20	10 mm	1410-6	1	back	1:1	0.031	1.057	0.033	A18
2437	6	IEEE 802.11b	DSSS	13.5	13.26	0.20	10 mm	1410-6	1	front	1:1	0.011	1.057	0.012	
2437	6	IEEE 802.11b	DSSS	13.5	13.26	0.02	10 mm	1410-6	1	left	1:1	0.023	1.057	0.024	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram								

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11.4 SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2003, and FCC KDB Publication 447498 D01v05.
2. Batteries are fully charged at the beginning of the SAR measurements.
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 15 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. A more conservative body-worn SAR test separation distance of 10 mm was used for CDMA BC0, BC10, BC1; LTE B26, B25, B41, and 2.4 GHz WLAN.
7. Per FCC KDB Publication 648474 D04v01, body-worn SAR was evaluated without a headset connected to the device. Since the standalone reported body-worn SAR was ≤ 1.2 W/kg, no additional body-worn SAR evaluations using a headset cable were required.
8. Per FCC KDB 865664 D01 v01, variability SAR tests were performed when the measured SAR results for a frequency band were greater than 0.8 W/kg. Repeated SAR measurements are highlighted in the tables above for clarity. Please see Section 13 for variability analysis.
9. During SAR Testing for the Wireless Router conditions per FCC KDB Publication 941225 D06v01, the actual Portable Hotspot operation (with actual simultaneous transmission of a transmitter with WIFI) was not activated (See Section 6.6 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, EVDO Rev. A SAR is not required. SAR is not required for 1x RTT for Ev-Do hotspot devices when the maximum average output of each channel is less than 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 $> \frac{1}{2}$ dB, instead of the middle channel, the highest output power channel was used.

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LTE Notes:

1. LTE Considerations: LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05v02r01. The general test procedures used for testing can be found in Section 8.4.4.
2. MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.
3. A-MPR was disabled for all SAR tests by setting NS=01 on the base station simulator. SAR tests were performed with the same number of RB and RB offsets transmitting on all TTI frames (maximum TTI).
4. Per FCC KDB Publication 447498 D01v05r01, when the reported (scaled) for LTE Band 41 SAR measured at the highest output power channel in a given a test configuration was > 0.6 W/kg, testing at the other channels was required for such test configurations.
5. TDD LTE was tested per FCC KDB 941225 D05v02r03 and using the guidance provided in April 2013 TCB workshop notes. Testing was performed using UL-DL configuration 0 with 6 UL subframes and 2 S subframes using extended cyclic prefix only and special subframe configuration 6. SAR tests were performed at maximum output power and worst-case transmission duty factor in extended cyclic prefix. Per 3GPP 36.211 Section 4, the duty factor for special subframe configuration 6 using extended cyclic prefix is 0.633.

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 operations: 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. When the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is <1.6 W/kg and the reported 1g averaged SAR is <0.8 W/kg, SAR testing on other default channels was not required.

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12 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

12.1 Introduction

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

12.2 Simultaneous Transmission Procedures

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

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

Table 12-1
Estimated SAR

Mode	Frequency	Maximum Allowed Power	Separation Distance (Body)	Estimated SAR (Body)
	[MHz]	[dBm]	[mm]	[W/kg]
Bluetooth	2480	12.00	10	0.336

Note:

1. Held-to ear configurations are not applicable to Bluetooth operations and therefore were not considered for simultaneous transmission. Per KDB Publication 447498 D01v05, the maximum power of the channel was rounded to the nearest mW before calculation.
2. A conservative test separation distance of 10 mm was used to estimate Bluetooth SAR.

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12.3 Head SAR Simultaneous Transmission Analysis

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

Simult Tx	Configuration	CDMA BC0 (\$22H) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	EVDO BC0 (\$22H) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.488	0.135	0.623	Head SAR	Right Cheek	0.413	0.135	0.548
	Right Tilt	0.298	0.030	0.328		Right Tilt	0.254	0.030	0.284
	Left Cheek	0.533	0.073	0.606		Left Cheek	0.533	0.073	0.606
	Left Tilt	0.311	0.033	0.344		Left Tilt	0.299	0.033	0.332
Simult Tx	Configuration	PCS CDMA SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	PCS EVDO SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.505	0.135	0.640	Head SAR	Right Cheek	0.617	0.135	0.752
	Right Tilt	0.383	0.030	0.413		Right Tilt	0.381	0.030	0.411
	Left Cheek	0.979	0.073	1.052		Left Cheek	1.061	0.073	1.134
	Left Tilt	0.322	0.033	0.355		Left Tilt	0.320	0.033	0.353
Simult Tx	Configuration	CDMA BC10 (\$90S) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	EVDO BC10 (\$90S) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.400	0.135	0.535	Head SAR	Right Cheek	0.372	0.135	0.507
	Right Tilt	0.262	0.030	0.292		Right Tilt	0.238	0.030	0.268
	Left Cheek	0.451	0.073	0.524		Left Cheek	0.445	0.073	0.518
	Left Tilt	0.293	0.033	0.326		Left Tilt	0.348	0.033	0.381
Simult Tx	Configuration	LTE Band 25 (PCS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 26 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.716	0.135	0.851	Head SAR	Right Cheek	0.228	0.135	0.363
	Right Tilt	0.469	0.030	0.499		Right Tilt	0.148	0.030	0.178
	Left Cheek	1.098	0.073	1.171		Left Cheek	0.283	0.073	0.356
	Left Tilt	0.379	0.033	0.412		Left Tilt	0.175	0.033	0.208
Simult Tx	Configuration	LTE Band 41 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)					
Head SAR	Right Cheek	0.246	0.135	0.381					
	Right Tilt	0.197	0.030	0.227					
	Left Cheek	0.584	0.073	0.657					
	Left Tilt	0.169	0.033	0.202					

12.4 Body-Worn Simultaneous Transmission Analysis

Table 12-3
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 SAR (W/kg)	Σ SAR (W/kg)
Back Side	CDMA BC0 (\$22H)	0.793	0.033	0.826
Back Side	PCS CDMA	0.798	0.033	0.831
Back Side	CDMA BC10 (\$90S)	0.839	0.033	0.872
Back Side	LTE Band 25 (PCS)	0.763	0.033	0.796
Back Side	LTE Band 26	0.487	0.033	0.520
Back Side	LTE Band 41	0.423	0.033	0.456

Note: A more conservative body- worn SAR test separation distance of 10 mm was used for CDMA BC0, BC10, BC1; LTE B26, B25, B41, and 2.4 GHz WLAN.

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

Configuration	Mode	CDMA/LTE SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Back Side	CDMA BC0 (\$22H)	0.793	0.336	1.129
Back Side	PCS CDMA	0.798	0.336	1.134
Back Side	CDMA BC10 (\$90S)	0.839	0.336	1.175
Back Side	LTE Band 25 (PCS)	0.763	0.336	1.099
Back Side	LTE Band 26	0.487	0.336	0.823
Back Side	LTE Band 41	0.423	0.336	0.759

Note:

1. Bluetooth SAR was not required to be measured per FCC KDB 447498. Estimated SAR results were used in the above table to determine simultaneous transmission SAR test exclusion.
2. A more conservative body- worn SAR test separation distance of 10 mm was used for CDMA BC0, BC10, BC1; LTE B26, B25, B41, and Bluetooth.

12.5 Hotspot SAR Simultaneous Transmission Analysis

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

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

Simult Tx	Configuration	EVDO BC0 (\$22H) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	PCS EVDO SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.754	0.033	0.787	Body SAR	Back	0.833	0.033	0.866
	Front	0.565	0.012	0.577		Front	0.750	0.012	0.762
	Top	-	-	0.000		Top	-	-	0.000
	Bottom	0.057	-	0.057		Bottom	0.201	-	0.201
	Right	0.386	-	0.386		Right	0.089	-	0.089
	Left	0.518	0.024	0.542		Left	0.468	0.024	0.492
Simult Tx	Configuration	EVDO BC10 (\$90S) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 25 (PCS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.826	0.033	0.859	Body SAR	Back	0.763	0.033	0.796
	Front	0.578	0.012	0.590		Front	0.952	0.012	0.964
	Top	-	-	0.000		Top	-	-	0.000
	Bottom	0.058	-	0.058		Bottom	0.150	-	0.150
	Right	0.424	-	0.424		Right	0.125	-	0.125
	Left	0.544	0.024	0.568		Left	0.689	0.024	0.713
Simult Tx	Configuration	LTE Band 26 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 41 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.487	0.033	0.520	Body SAR	Back	0.423	0.033	0.456
	Front	0.388	0.012	0.400		Front	0.368	0.012	0.380
	Top	-	-	0.000		Top	-	-	0.000
	Bottom	0.039	-	0.039		Bottom	0.161	-	0.161
	Right	0.241	-	0.241		Right	0.079	-	0.079
	Left	0.326	0.024	0.350		Left	0.277	0.024	0.301

12.6 Simultaneous Transmission Conclusion

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

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13 SAR MEASUREMENT VARIABILITY

13.1 Measurement Variability

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

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

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

Table 13-1
Head SAR Measurement Variability Results

HEAD VARIABILITY RESULTS													
Band	FREQUENCY		Mode/Band	Service	Side	Test Position	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	1860.00	26140	LTE Band 25 (PCS)	QPSK, 1 RB, 0 RB Offset	Left	Cheek	0.970	0.995	1.03	N/A	N/A	N/A	N/A
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population						Head 1.6 W/kg (mW/g) averaged over 1 gram							

13.2 Measurement Uncertainty

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

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14 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8753ES	S-Parameter Network Analyzer	11/29/2013	Annual	11/29/2014	US39170122
Agilent	E5515C	Wireless Communications Test Set	3/28/2014	Annual	3/28/2015	GB44400860
Agilent	E4432B	ESG-D Series Signal Generator	4/15/2014	Annual	4/15/2015	US40053896
Agilent	N5182A	MXG Vector Signal Generator	4/15/2014	Annual	4/15/2015	MY47420651
Agilent	E4407B	ESA Spectrum Analyzer	4/16/2014	Annual	4/16/2015	US39210313
Agilent	E5515C	Wireless Communications Test Set	5/9/2013	Biennial	5/9/2015	GB43304447
Agilent	N9020A	MXA Signal Analyzer	10/27/2014	Annual	10/27/2015	US46470561
Anritsu	MA2411B	Pulse Power Sensor	11/14/2013	Annual	11/14/2014	1126066
Anritsu	MT8820C	Radio Communication Analyzer	12/12/2013	Annual	12/12/2014	6200901190
Anritsu	MT8820C	Radio Communication Analyzer	12/12/2013	Annual	12/12/2014	6201300731
Anritsu	MA24106A	USB Power Sensor	1/3/2014	Annual	1/3/2015	1349509
Anritsu	MA24106A	USB Power Sensor	1/3/2014	Annual	1/3/2015	1349514
Anritsu	MA24106A	USB Power Sensor	1/3/2014	Annual	1/3/2015	1344554
Anritsu	MA24106A	USB Power Sensor	1/3/2014	Annual	1/3/2015	1344557
Anritsu	MA2411B	Pulse Power Sensor	2/3/2014	Annual	2/3/2015	1339018
Anritsu	ML2469A	Power Meter	3/14/2014	Annual	3/14/2015	1306009
COMTECH	AR85729-5/5759B	Solid State Amplifier	CBT	N/A	CBT	M3W1A00-1002
COMTECH	AR85729-5	Solid State Amplifier	CBT	N/A	CBT	M1SSA00-009
Fisher Scientific	S407993	Long Stem Thermometer	11/4/2013	Biennial	11/4/2015	130671821
Fisher Scientific	15-077-960	Digital Thermometer	12/4/2013	Biennial	12/4/2015	130764551
Fisher Scientific	15-077-960	Digital Thermometer	12/4/2013	Biennial	12/4/2015	130764558
Gigatronics	8651A	Universal Power Meter	10/30/2013	Annual	10/30/2014	8650319
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Mitutoyo	CD-6°CSX	Digital Caliper	5/8/2014	Biennial	5/8/2016	13264162
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Rohde & Schwarz	CMU200	Base Station Simulator	6/6/2014	Annual	6/6/2015	109892
Rohde & Schwarz	CMW500	Radio Communication Tester	10/4/2013	Biennial	10/4/2015	103962
Rohde & Schwarz	CMW500	Radio Communication Tester	10/4/2013	Biennial	10/4/2015	108798
Seekonk	NC-100	Torque Wrench	3/18/2014	Biennial	3/18/2016	22313
Seekonk	NC-100	Torque Wrench 5/16", 8" lbs	3/18/2014	Biennial	3/18/2016	N/A
SPEAG	D2450V2	2450 MHz SAR Dipole	1/21/2014	Annual	1/21/2015	797
SPEAG	ES3DV3	SAR Probe	2/25/2014	Annual	2/25/2015	3258
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/26/2014	Annual	2/26/2015	665
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/17/2014	Annual	3/17/2015	1334
SPEAG	ES3DV3	SAR Probe	3/19/2014	Annual	3/19/2015	3209
SPEAG	D2600V2	2600 MHz SAR Dipole	4/8/2014	Annual	4/8/2015	1004
SPEAG	DAK-3.5	Dielectric Assessment Kit	5/6/2014	Annual	5/6/2015	1070
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/14/2014	Annual	5/14/2015	859
SPEAG	ES3DV3	SAR Probe	9/24/2014	Annual	9/24/2015	3288
Speag	AIA	Audio Interference Analyzer	CBT	N/A	CBT	1010
VWR	36934-158	Wall-Mounted Thermometer	8/8/2013	Biennial	8/8/2015	130477877
VWR	36934-158	Wall-Mounted Thermometer	4/29/2014	Biennial	4/29/2016	111859332
Tektronix	RSA6114A	Real Time Spectrum Analyzer	4/16/2014	Annual	4/16/2015	8010177

Note:

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

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15 MEASUREMENT UNCERTAINTIES

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

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

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16 CONCLUSION

16.1 Measurement Conclusion

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

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

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APPENDIX A: SAR TEST DATA

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG360P; Type: Portable Handset; Serial: FCC5

Communication System: UID 0, CDMA; Frequency: 836.52 MHz; Duty Cycle: 1:1

Medium: 835 Head Medium parameters used (interpolated):

$f = 836.52 \text{ MHz}$; $\sigma = 0.931 \text{ S/m}$; $\epsilon_r = 42.264$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 10-30-2014; Ambient Temp: 23.3°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3209; ConvF (6.23, 6.23, 6.23); Calibrated: 3/19/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 3/17/2014

Phantom: SAM front; Type: QD000P40CD; Serial: TP:1759

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Mode: Cell BC0, EVDO RevA, Left Head, Cheek, Mid.ch

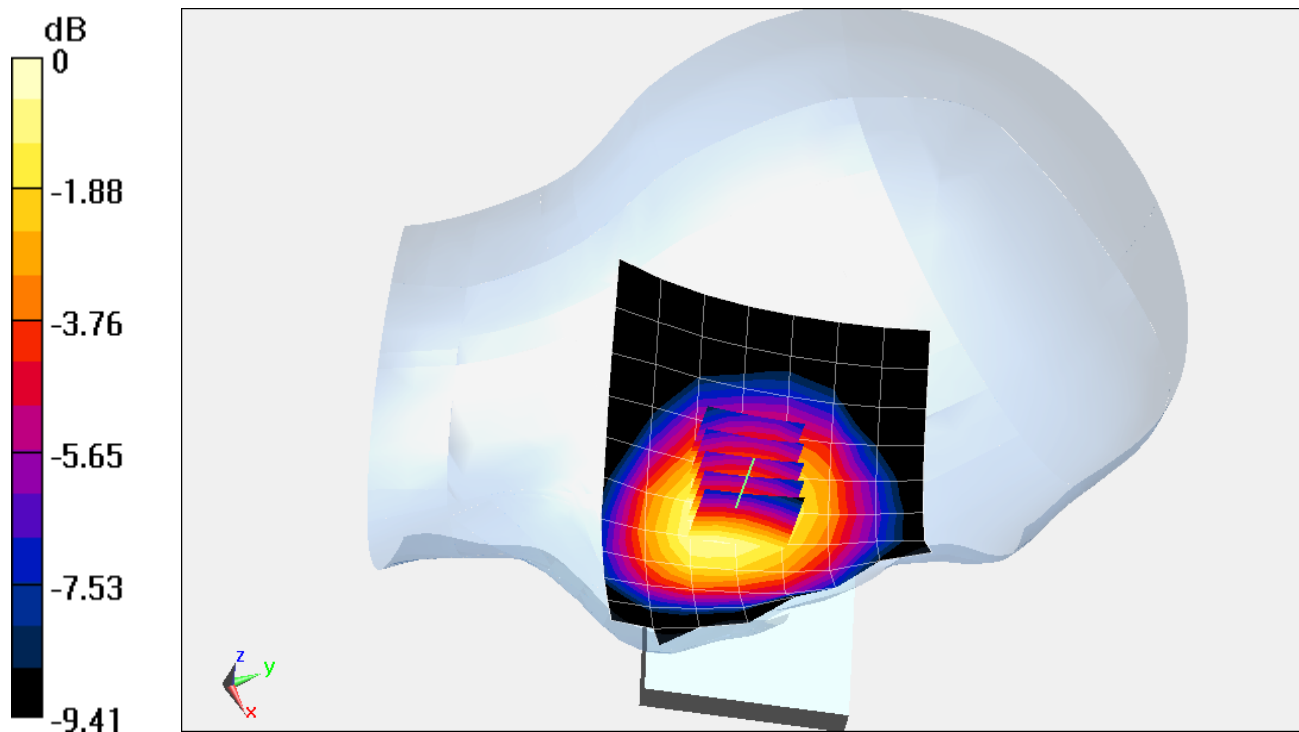
Area Scan (8x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 24.68 V/m; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 0.615 W/kg

SAR (1 g) = 0.493 W/kg



0 dB = 0.544 W/kg = -2.64 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG360P; Type: Portable Handset; Serial: FCC5

Communication System: UID 0, CDMA; Frequency: 1908.75 MHz; Duty Cycle: 1:1
Medium: 1900 Head Medium parameters used (interpolated):
 $f = 1908.75 \text{ MHz}$; $\sigma = 1.46 \text{ S/m}$; $\epsilon_r = 39.947$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Left Section

Test Date: 11-03-2014; Ambient Temp: 23.0°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3288; ConvF (5.17, 5.17, 5.17); Calibrated: 9/24/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1364; Calibrated: 9/18/2014

Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1797

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Mode: PCS BC1, EVDO RevA, Left Head, Cheek, High.ch

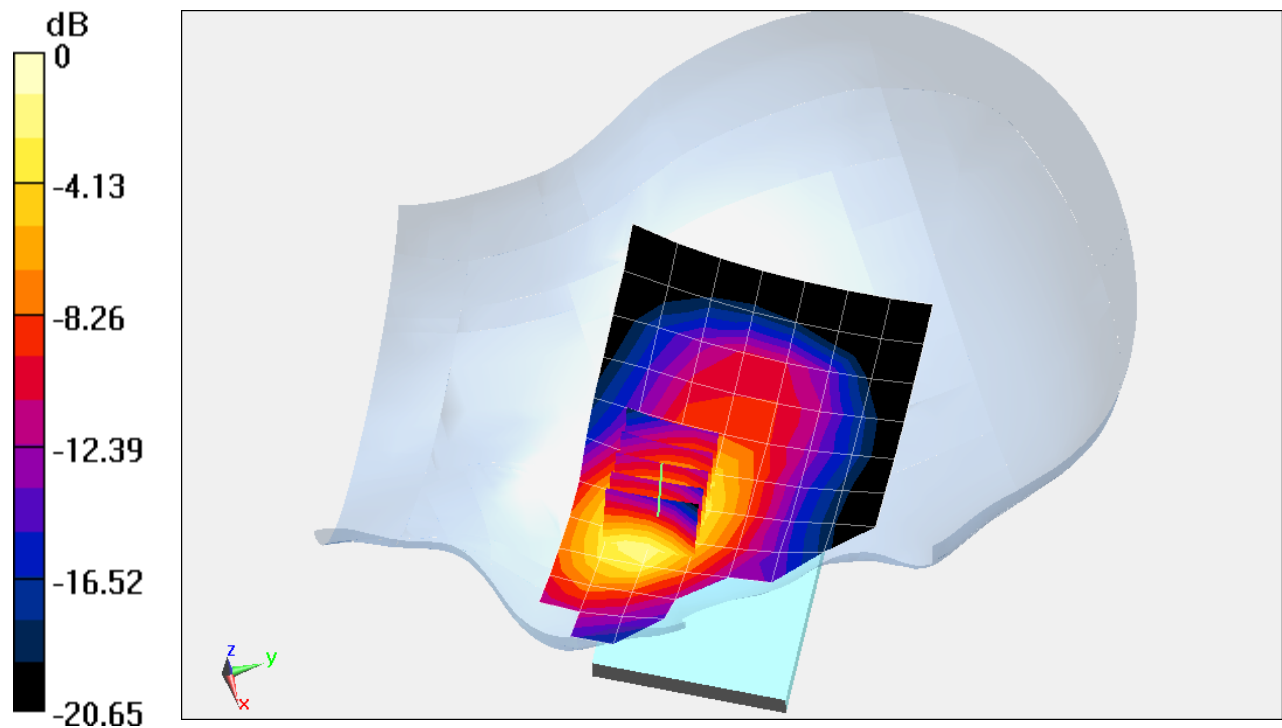
Area Scan (8x13x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 27.28 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 1.48 W/kg

SAR(1 g) = 0.948 W/kg



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

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG360P; Type: Portable Handset; Serial: FCC5

Communication System: UID 0, CDMA; Frequency: 820.1 MHz; Duty Cycle: 1:1

Medium: 835 Head Medium parameters used (interpolated):

$f = 820.1 \text{ MHz}$; $\sigma = 0.916 \text{ S/m}$; $\epsilon_r = 42.458$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 10-30-2014; Ambient Temp: 23.3°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3209; ConvF (6.23, 6.23, 6.23); Calibrated: 3/19/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 3/17/2014

Phantom: SAM front; Type: QD000P40CD; Serial: TP:1759

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Mode: Cell BC10, CDMA, Left Head, Cheek, Mid.ch

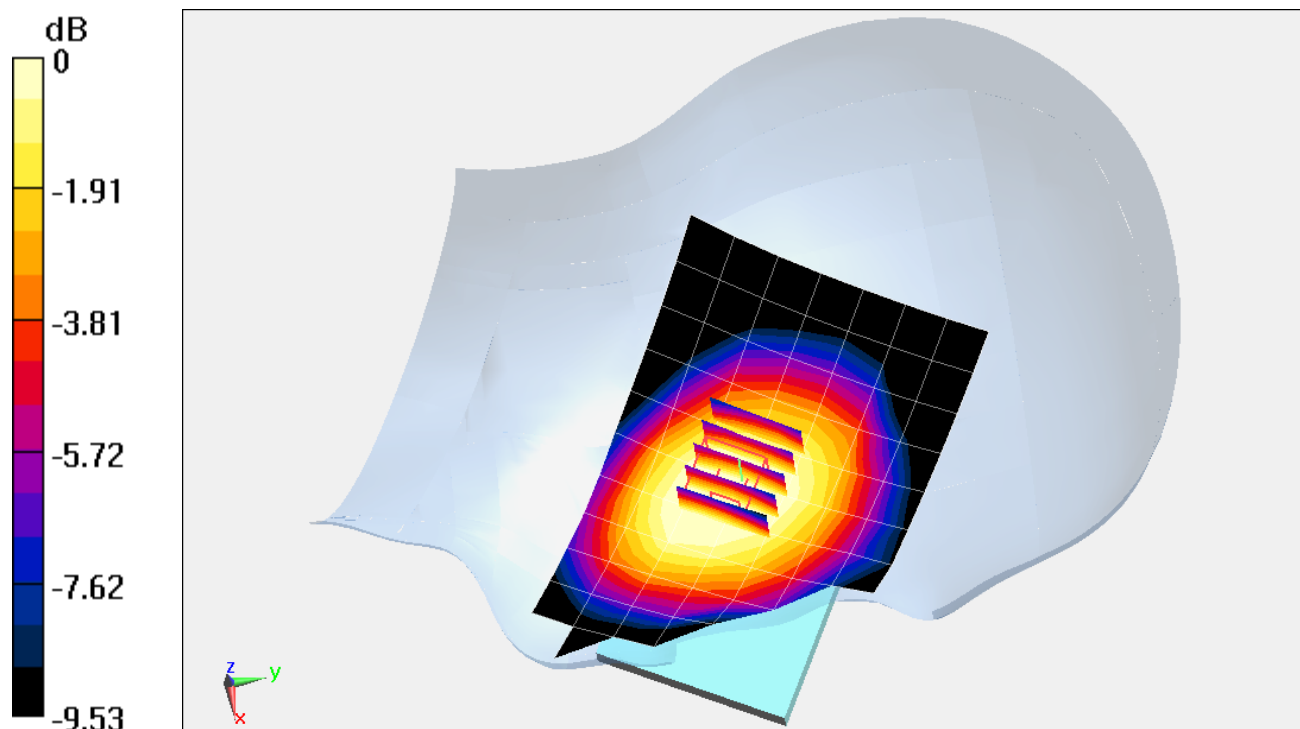
Area Scan (8x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 21.21 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 0.497 W/kg

SAR(1 g) = 0.397 W/kg



0 dB = 0.433 W/kg = -3.64 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG360P; Type: Portable Handset; Serial: FCC3

Communication System: UID 0, LTE Band 25 (PCS); Frequency: 1860 MHz; Duty Cycle: 1:1

Medium: 1900 Head Medium parameters used (interpolated):

$f = 1860 \text{ MHz}$; $\sigma = 1.412 \text{ S/m}$; $\epsilon_r = 40.212$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 11-03-2014; Ambient Temp: 23.0°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3288; ConvF (5.17, 5.17, 5.17); Calibrated: 9/24/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1364; Calibrated: 9/18/2014

Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1797

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 25 (PCS), Left Head, Cheek, Low.ch, QPSK, 20 MHz Bandwidth,
1 RB, 0 RB Offset**

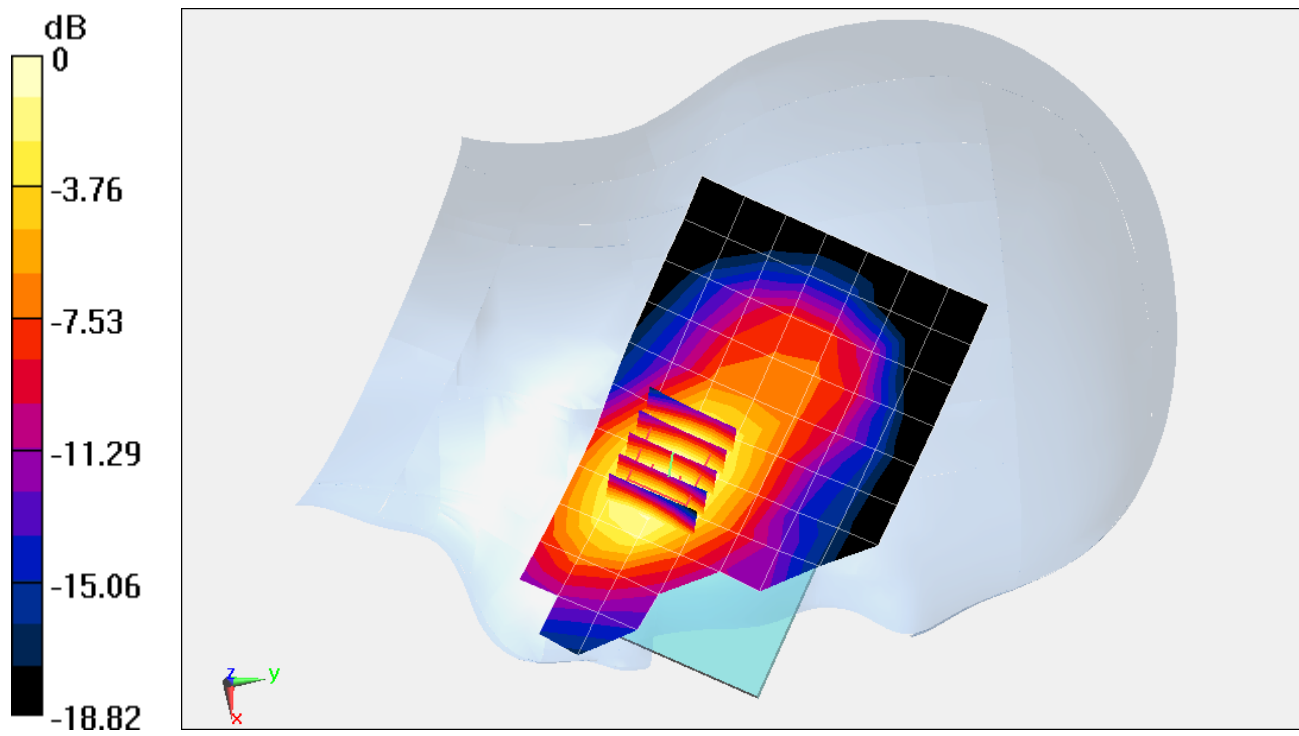
Area Scan (8x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 32.06 V/m; Power Drift = 0.2 dB

Peak SAR (extrapolated) = 1.51 W/kg

SAR(1 g) = 0.995 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG360P; Type: Portable Handset; Serial: FCC3

Communication System: UID 0, LTE Band 26; Frequency: 819 MHz; Duty Cycle: 1:1

Medium: 835 Head Medium parameters used (interpolated):

$f = 819 \text{ MHz}$; $\sigma = 0.915 \text{ S/m}$; $\epsilon_r = 42.472$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 10-30-2014; Ambient Temp: 23.3°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3209; ConvF (6.23, 6.23, 6.23); Calibrated: 3/19/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 3/17/2014

Phantom: SAM front; Type: QD000P40CD; Serial: TP:1759

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 26, Left Head, Cheek, Low.ch, QPSK, 10 MHz Bandwidth,
1 RB, 25 RB Offset**

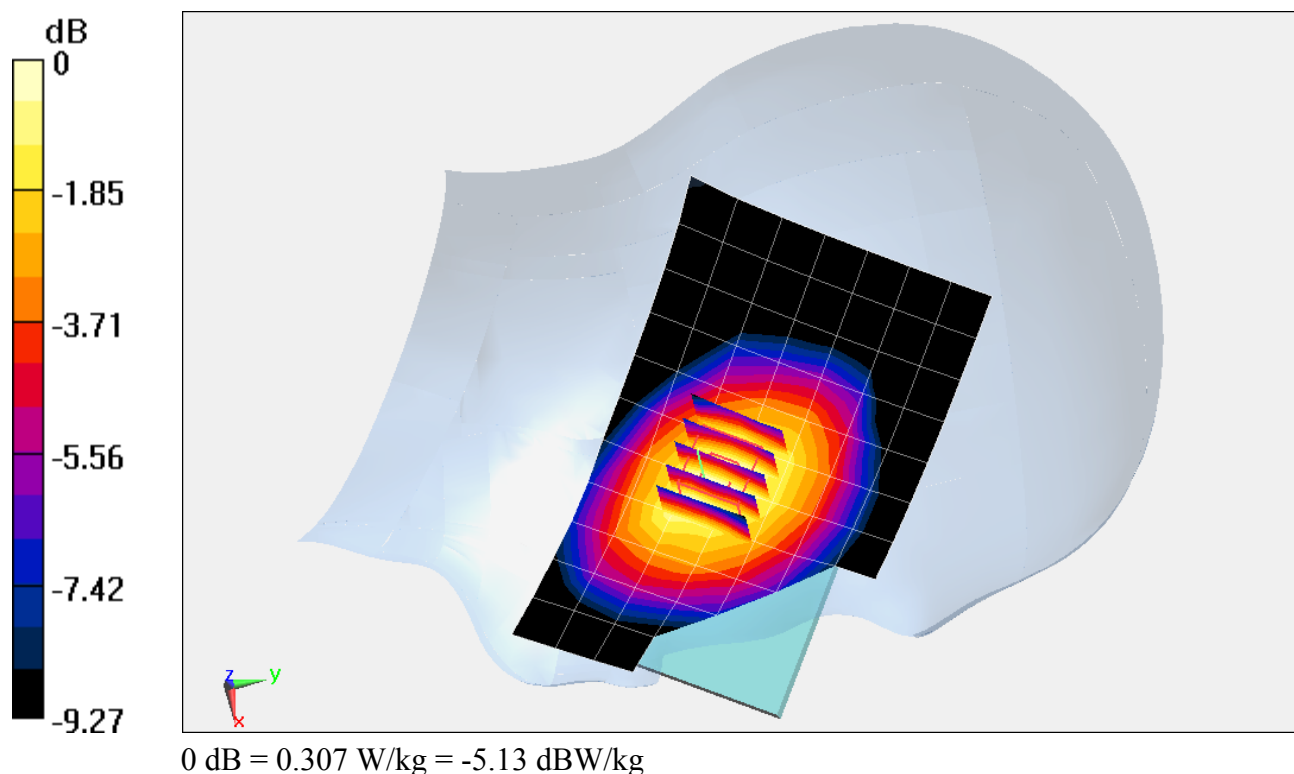
Area Scan (8x13x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 17.89 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 0.354 W/kg

SAR(1 g) = 0.282 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG360P; Type: Portable Handset; Serial: FCC6

Communication System: UID 0, LTE Band 41 (0); Frequency: 2549.5 MHz; Duty Cycle: 1:1.58

Medium: 2600 Head Medium parameters used:

$f = 2550$ MHz; $\sigma = 1.941$ S/m; $\epsilon_r = 38.645$; $\rho = 1000$ kg/m³

Phantom section: Left Section

Test Date: 10-29-2014; Ambient Temp: 23.0°C; Tissue Temp: 22.8°C

Probe: ES3DV3 - SN3258; ConvF (4.34, 4.34, 4.34); Calibrated: 2/25/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn665; Calibrated: 2/26/2014

Phantom: SAM Front; Type: SAM; Serial: 1686

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

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

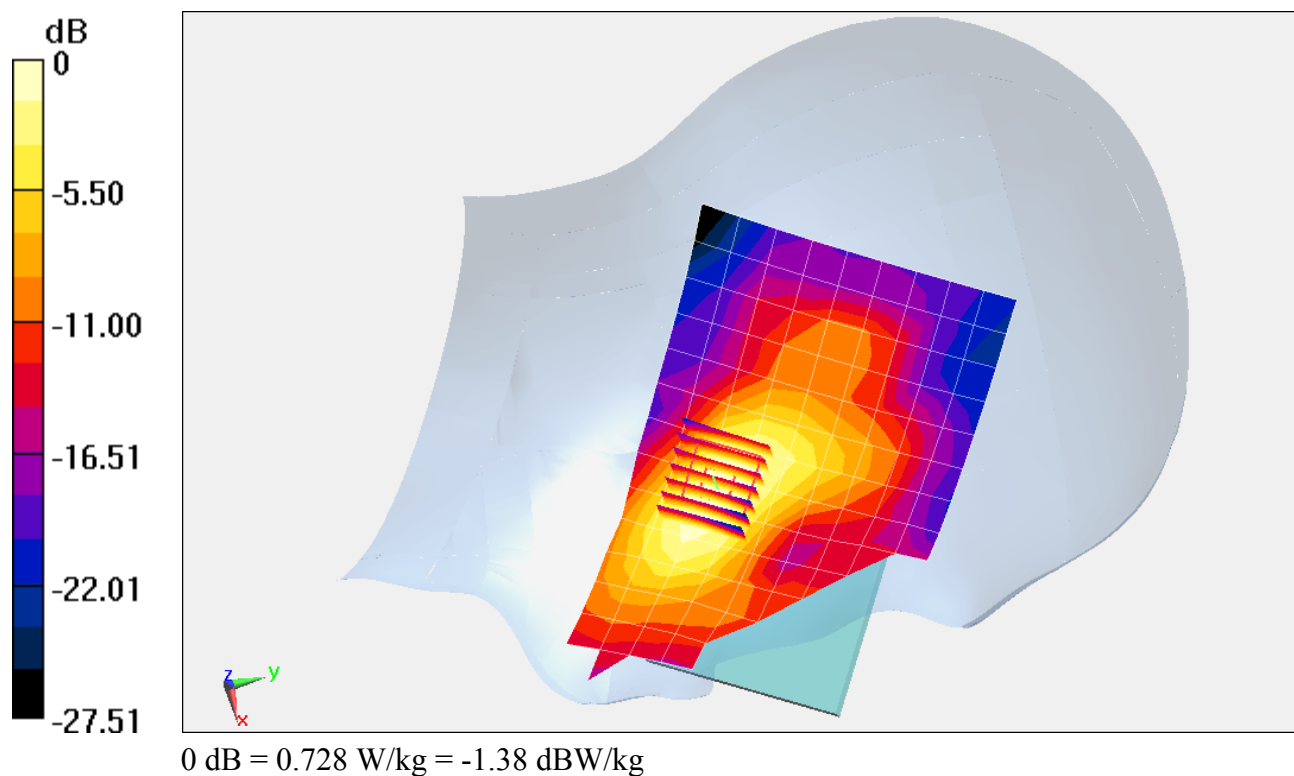
Area Scan (10x17x1): Measurement grid: dx=12mm, dy=12mm

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 20.59 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 1.03 W/kg

SAR(1 g) = 0.577 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG360P; Type: Portable Handset; Serial: FCC3

Communication System: UID 0, IEEE 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: 2450 Head Medium parameters used (interpolated):

$f = 2437 \text{ MHz}$; $\sigma = 1.774 \text{ S/m}$; $\epsilon_r = 38.448$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 10-16-2014; Ambient Temp: 20.5°C; Tissue Temp: 22.4°C

Probe: ES3DV3 - SN3258; ConvF(4.52, 4.52, 4.52); Calibrated: 2/25/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn665; Calibrated: 2/26/2014

Phantom: SAM Front; Type: SAM; Serial: 1686

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

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

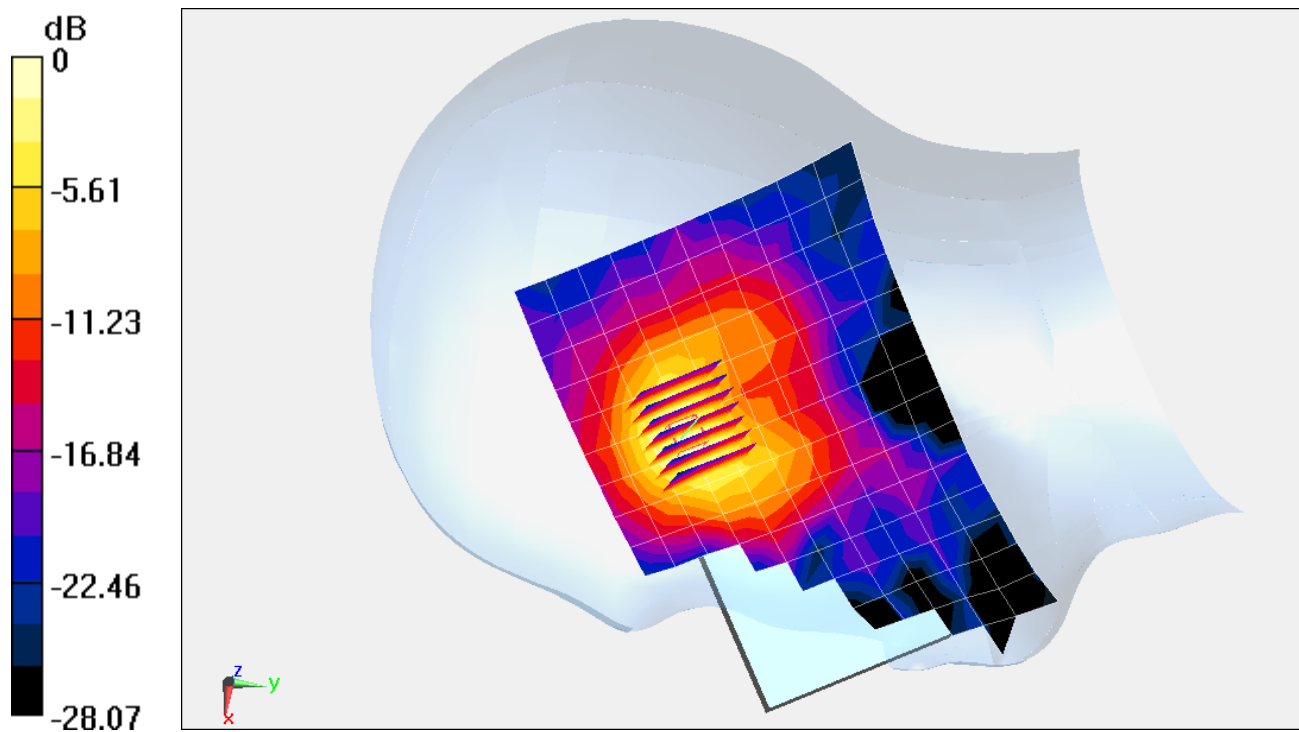
Area Scan (11x18x1): Measurement grid: $dx=12\text{mm}$, $dy=12\text{mm}$

Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 9.347 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.292 W/kg

SAR(1 g) = 0.128 W/kg



0 dB = 0.175 W/kg = -7.57 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG360P; Type: Portable Handset; Serial: FCC5

Communication System: UID 0, CDMA; Frequency: 836.52 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 836.52 \text{ MHz}$; $\sigma = 1.001 \text{ S/m}$; $\epsilon_r = 53.504$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-22-2014; Ambient Temp: 23.9°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3263; ConvF (6.16, 6.16, 6.16); Calibrated: 5/15/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/14/2014

Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Mode: Cell BC0, CDMA, Body SAR, Back side, Mid.ch

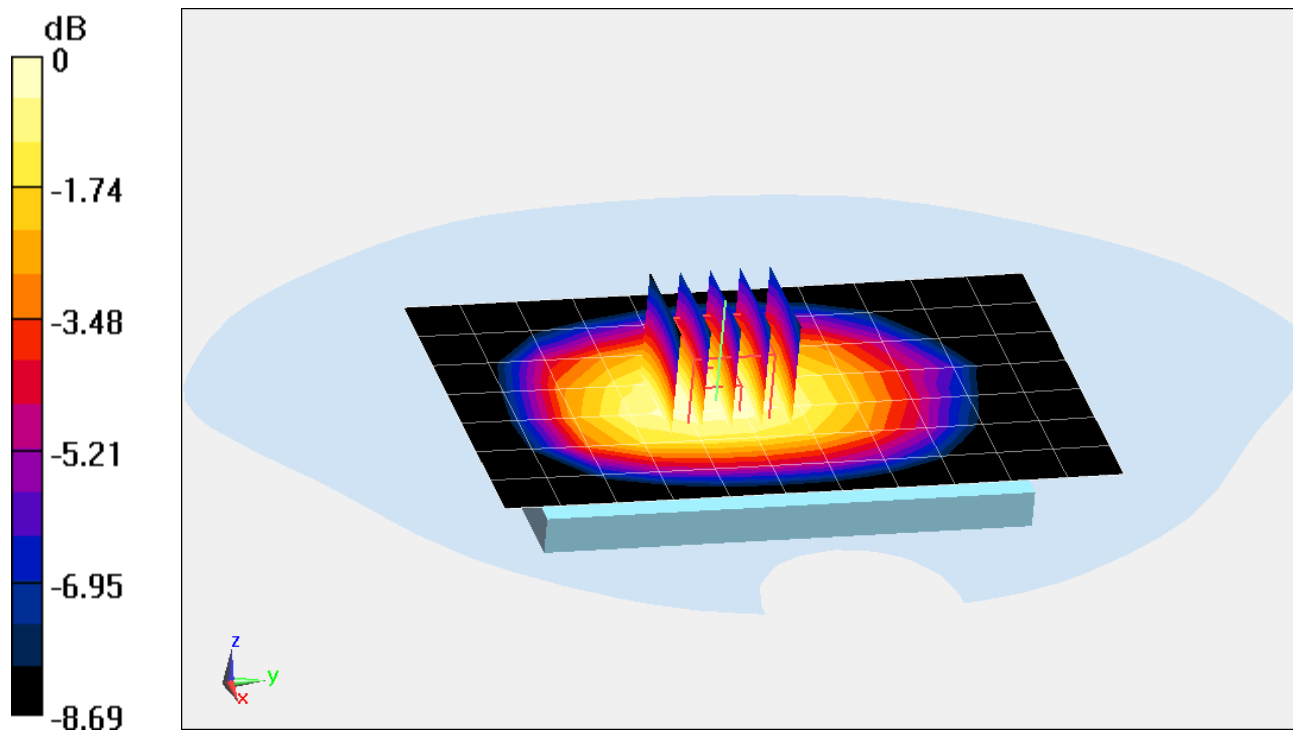
Area Scan (8x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 26.94 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 0.886 W/kg

SAR(1 g) = 0.702 W/kg



0 dB = 0.773 W/kg = -1.12 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG360P; Type: Portable Handset; Serial: FCC5

Communication System: UID 0, CDMA; Frequency: 836.52 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 836.52 \text{ MHz}$; $\sigma = 1.001 \text{ S/m}$; $\epsilon_r = 53.504$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-22-2014; Ambient Temp: 23.9°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3263; ConvF(6.16, 6.16, 6.16); Calibrated: 5/15/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/14/2014

Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Mode: Cell BC0, EVDO Rev0, Body SAR, Back side, Mid.ch

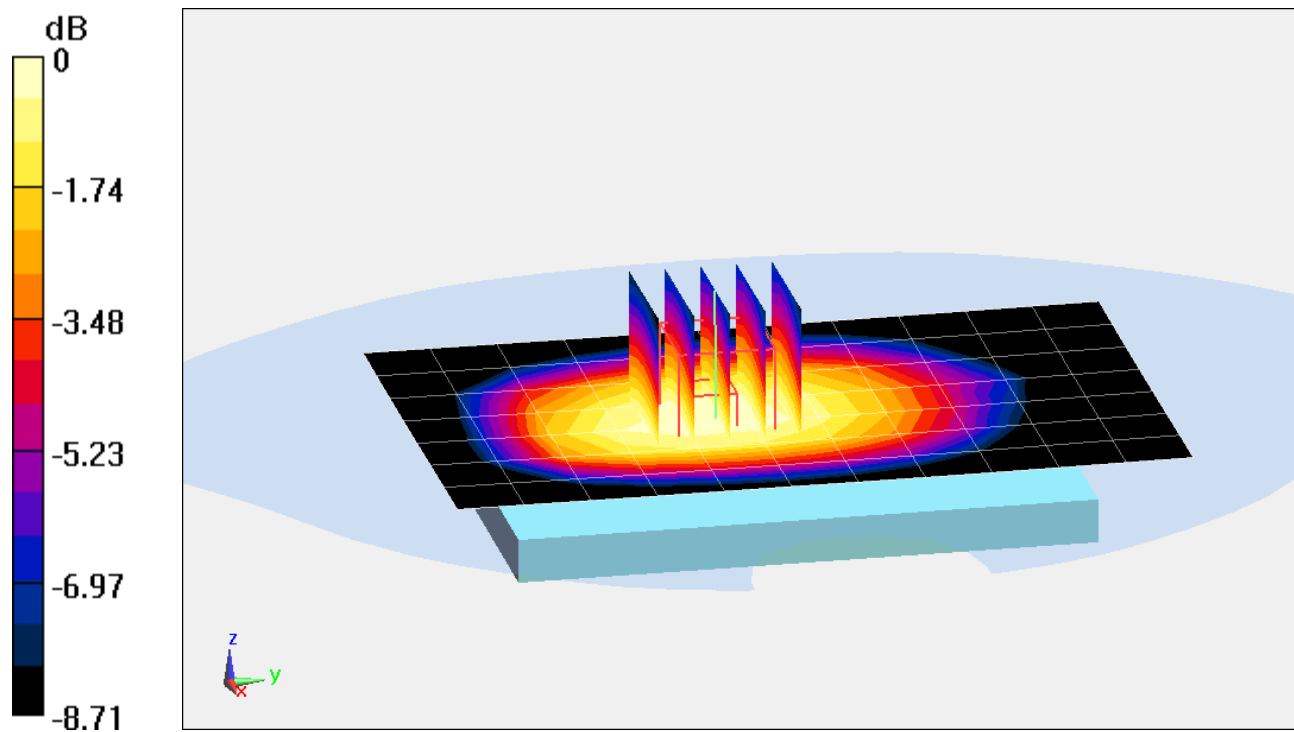
Area Scan (8x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 27.24 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 0.884 W/kg

SAR(1 g) = 0.701 W/kg;



0 dB = 0.769 W/kg = -1.14 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG360P; Type: Portable Handset; Serial: FCC5

Communication System: UID 0, CDMA; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.553 \text{ S/m}$; $\epsilon_r = 53.811$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-03-2014; Ambient Temp: 24.0°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3263; ConvF (4.78, 4.78, 4.78); Calibrated: 5/15/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/14/2014

Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Mode: PCS BC1, CDMA, Body SAR, Back side, Mid.ch

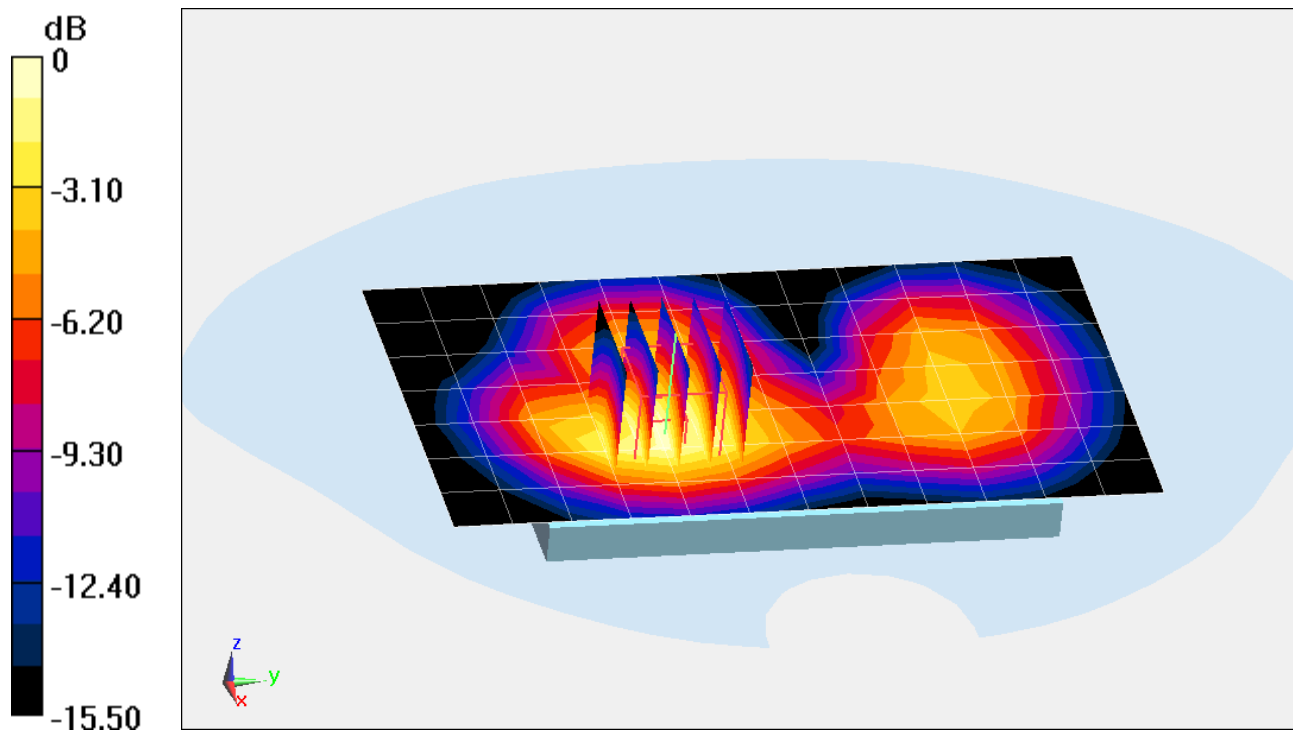
Area Scan (8x13x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 20.90 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 1.06 W/kg

SAR(1 g) = 0.673 W/kg



0 dB = 0.804 W/kg = -0.95 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG360P; Type: Portable Handset; Serial: FCC5

Communication System: UID 0, CDMA; Frequency: 1851.25 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1851.25 \text{ MHz}$; $\sigma = 1.524 \text{ S/m}$; $\epsilon_r = 53.851$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-03-2014; Ambient Temp: 24.0°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3263; ConvF (4.78, 4.78, 4.78); Calibrated: 5/15/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/14/2014

Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Mode: PCS BC1, EVDO Rev0, Body SAR, Back side, Low.ch

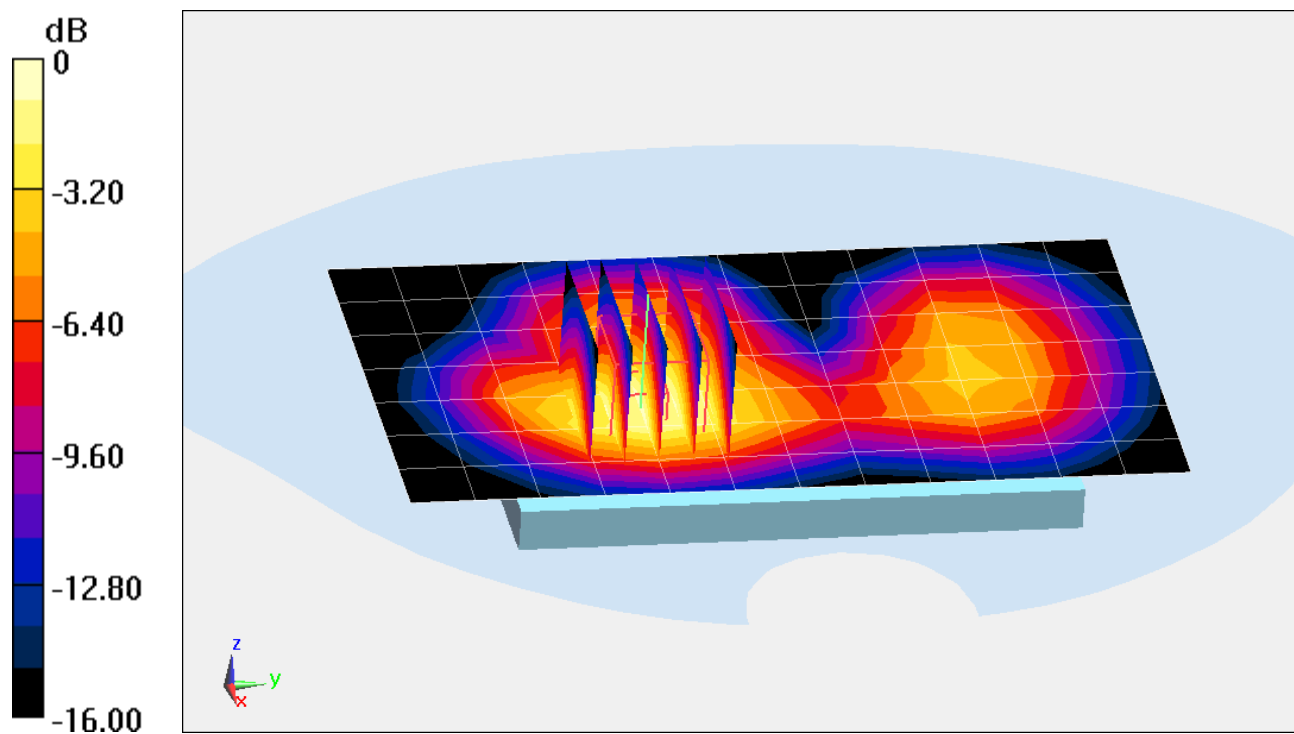
Area Scan (8x13x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (6x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 22.02 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 1.18 W/kg

SAR(1 g) = 0.758 W/kg



0 dB = 0.905 W/kg = -0.43 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG360P; Type: Portable Handset; Serial: FCC5

Communication System: UID 0, CDMA; Frequency: 820.1 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 820.1 \text{ MHz}$; $\sigma = 0.985 \text{ S/m}$; $\epsilon_r = 53.642$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section ; Space: 1.0 cm

Test Date: 10-22-2014; Ambient Temp: 23.9°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3263; ConvF(6.16, 6.16, 6.16); Calibrated: 5/15/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/14/2014

Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Mode: Cell BC10, CDMA, Body SAR, Back side, Mid.ch

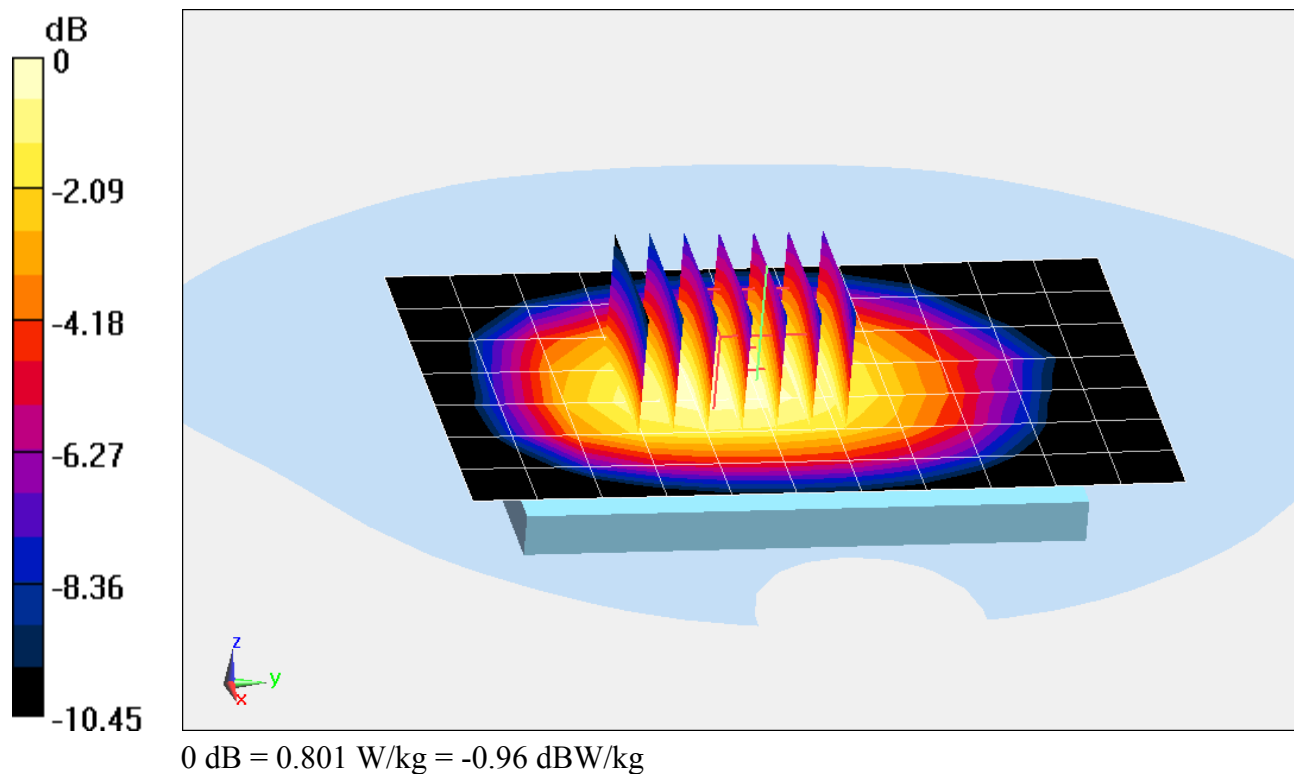
Area Scan (8x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (6x7x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 27.23 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.924 W/kg

SAR(1 g) = 0.734 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG360P; Type: Portable Handset; Serial: FCC5

Communication System: UID 0, CDMA; Frequency: 820.1 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 820.1 \text{ MHz}$; $\sigma = 0.985 \text{ S/m}$; $\epsilon_r = 53.642$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-22-2014; Ambient Temp: 23.9°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3263; ConvF (6.16, 6.16, 6.16); Calibrated: 5/15/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/14/2014

Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

Mode: Cell BC10, EVDO Rev0, Body SAR, Back side, Mid.ch

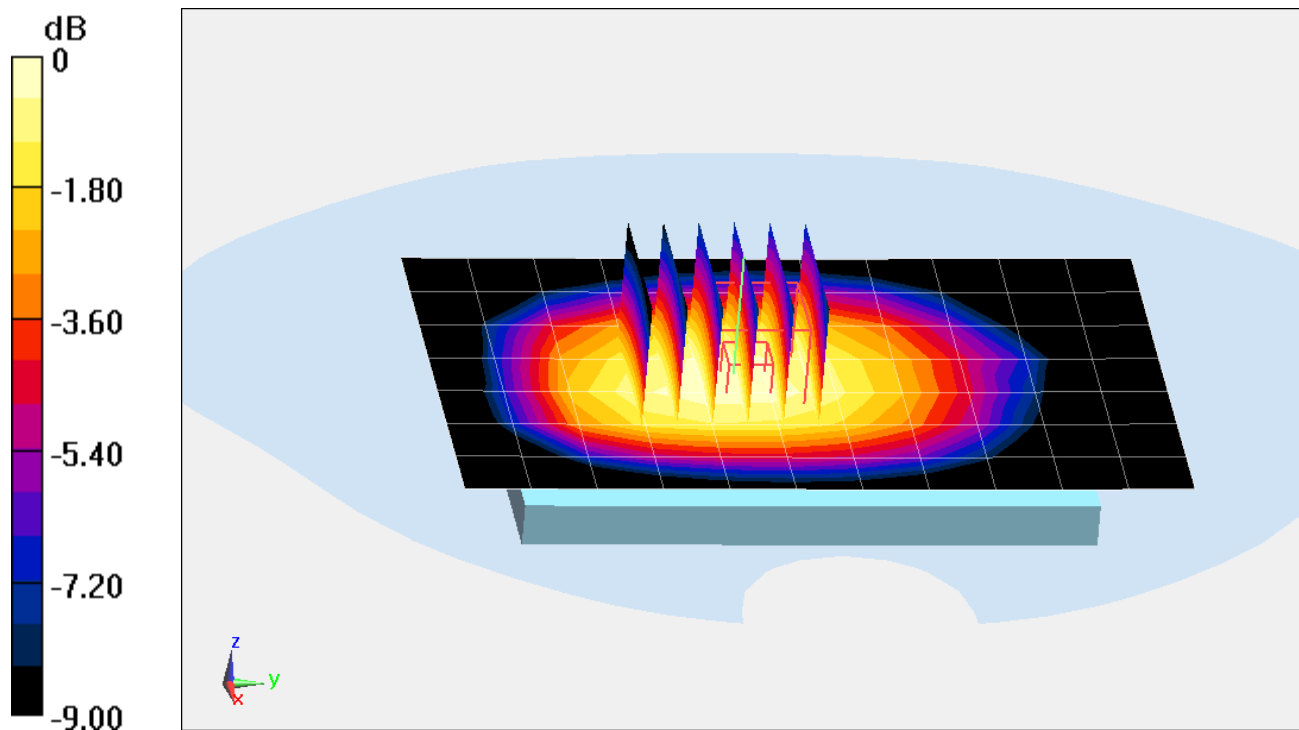
Area Scan (8x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (6x6x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 27.57 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.916 W/kg

SAR(1 g) = 0.726 W/kg



0 dB = 0.790 W/kg = -1.02 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG360P; Type: Portable Handset; Serial: FCC3

Communication System: UID 0, LTE Band 25 (PCS); Frequency: 1905 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1905 \text{ MHz}$; $\sigma = 1.556 \text{ S/m}$; $\epsilon_r = 53.029$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-28-2014; Ambient Temp: 22.6°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3258; ConvF (4.61, 4.61, 4.61); Calibrated: 2/25/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn665; Calibrated: 2/26/2014

Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP-1158

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 25 (PCS), Body SAR, Back side, High.ch, QPSK, 20 MHz Bandwidth,
1 RB, 0 RB Offset**

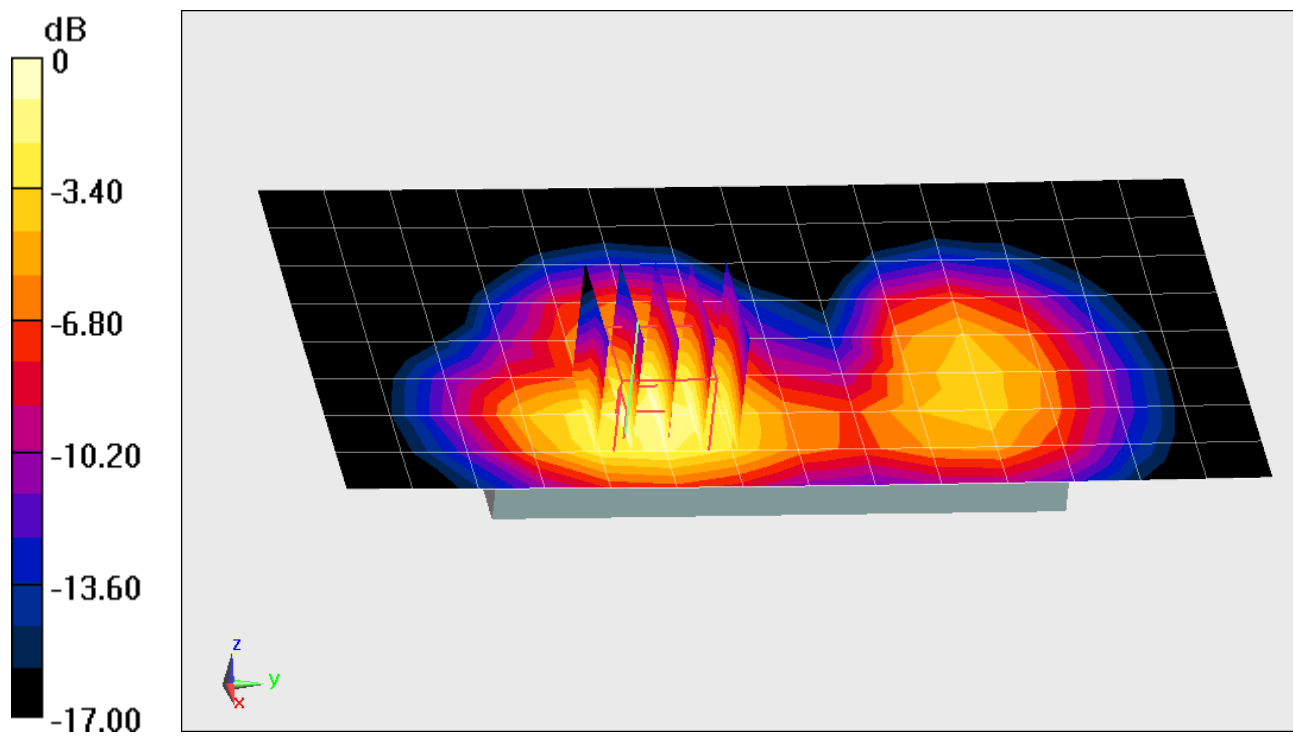
Area Scan (9x15x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 21.71 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 1.05 W/kg

SAR(1 g) = 0.692 W/kg



0 dB = 0.790 W/kg = -1.02 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG360P; Type: Portable Handset; Serial: FCC3

Communication System: UID 0, LTE Band 25 (PCS); Frequency: 1882.5 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1882.5 \text{ MHz}$; $\sigma = 1.529 \text{ S/m}$; $\epsilon_r = 53.127$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-28-2014; Ambient Temp: 22.6°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3258; ConvF(4.61, 4.61, 4.61); Calibrated: 2/25/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn665; Calibrated: 2/26/2014

Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP-1158

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 25 (PCS), Body SAR, Front side, Mid.ch, QPSK, 20 MHz Bandwidth,
1 RB, 0 RB Offset**

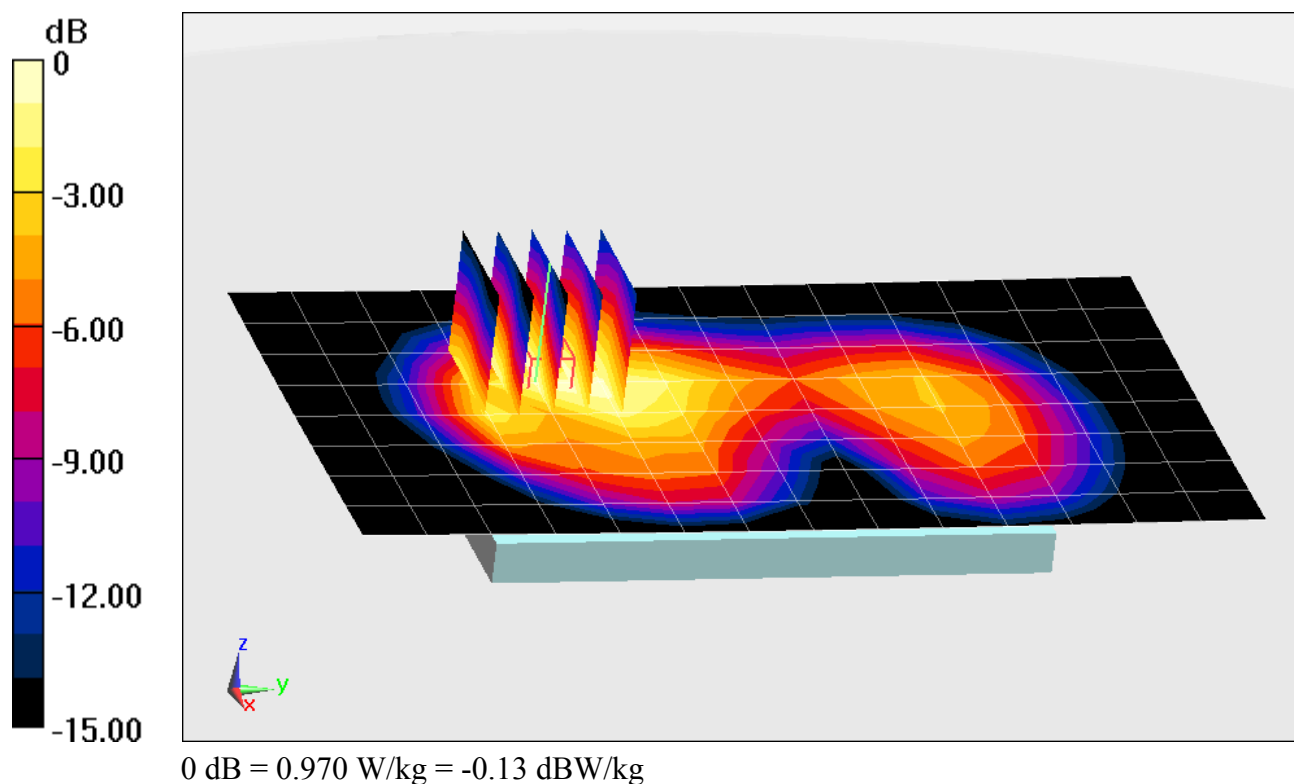
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 24.17 V/m; Power Drift = 0.17 dB

Peak SAR (extrapolated) = 1.30 W/kg

SAR(1 g) = 0.845 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG360P; Type: Portable Handset; Serial: FCC3

Communication System: UID 0, LTE Band 26; Frequency: 819 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 819 \text{ MHz}$; $\sigma = 0.984 \text{ S/m}$; $\epsilon_r = 53.65$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-22-2014; Ambient Temp: 23.9°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3263; ConvF (6.16, 6.16, 6.16); Calibrated: 5/15/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/14/2014

Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

**Mode: LTE Band 26, Body SAR, Back side, Low.ch, QPSK, 10 MHz Bandwidth,
1 RB, 25 RB Offset**

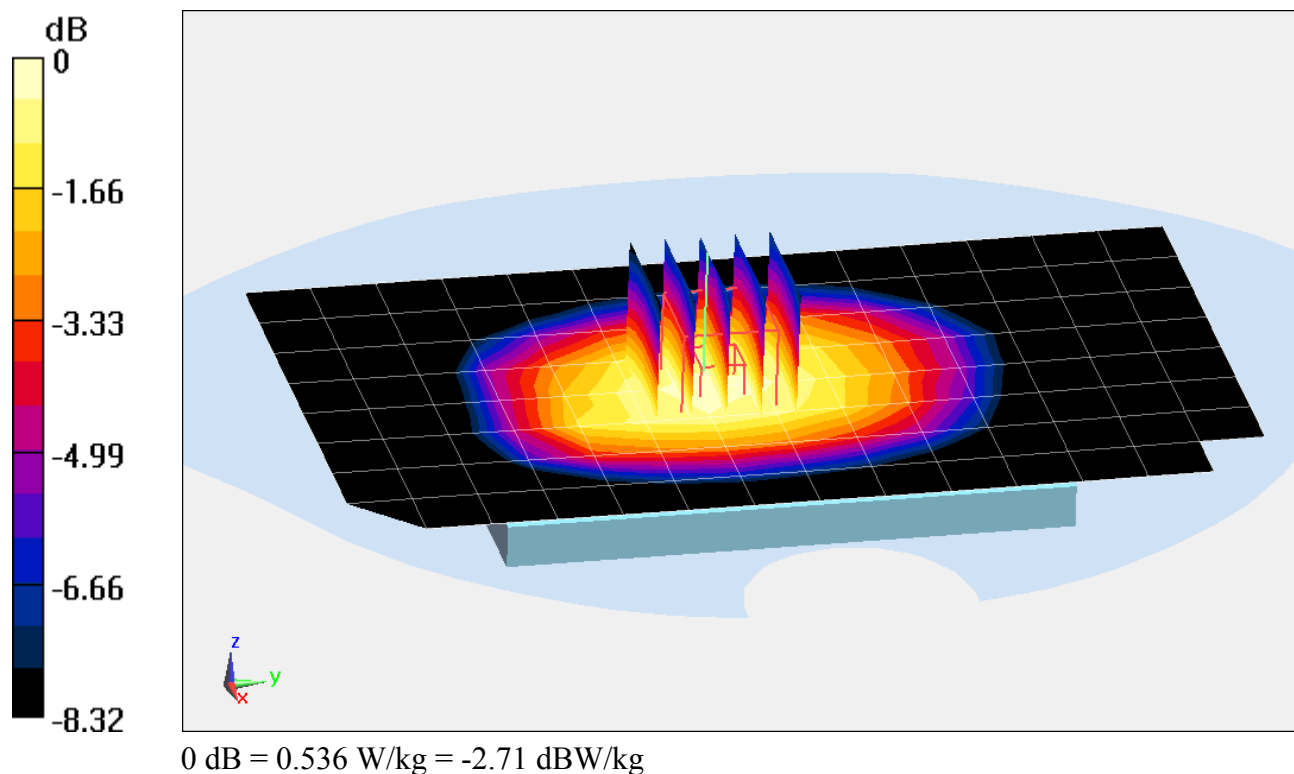
Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 22.57 V/m; Power Drift = 0.2 dB

Peak SAR (extrapolated) = 0.618 W/kg

SAR(1 g) = 0.486 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG360P; Type: Portable Handset; Serial: FCC6

Communication System: UID 0, LTE Band 41; Frequency: 2549.5 MHz; Duty Cycle: 1:1.58

Medium: 2600 Body Medium parameters used:

$f = 2550 \text{ MHz}$; $\sigma = 2.172 \text{ S/m}$; $\epsilon_r = 51.514$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-29-2014; Ambient Temp: 23.2°C; Tissue Temp: 23.0°C

Probe: ES3DV3 - SN3209; ConvF(4.04, 4.04, 4.04); Calibrated: 3/19/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 3/17/2014

Phantom: SAM front; Type: QD000P40CD; Serial: TP:1759

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

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

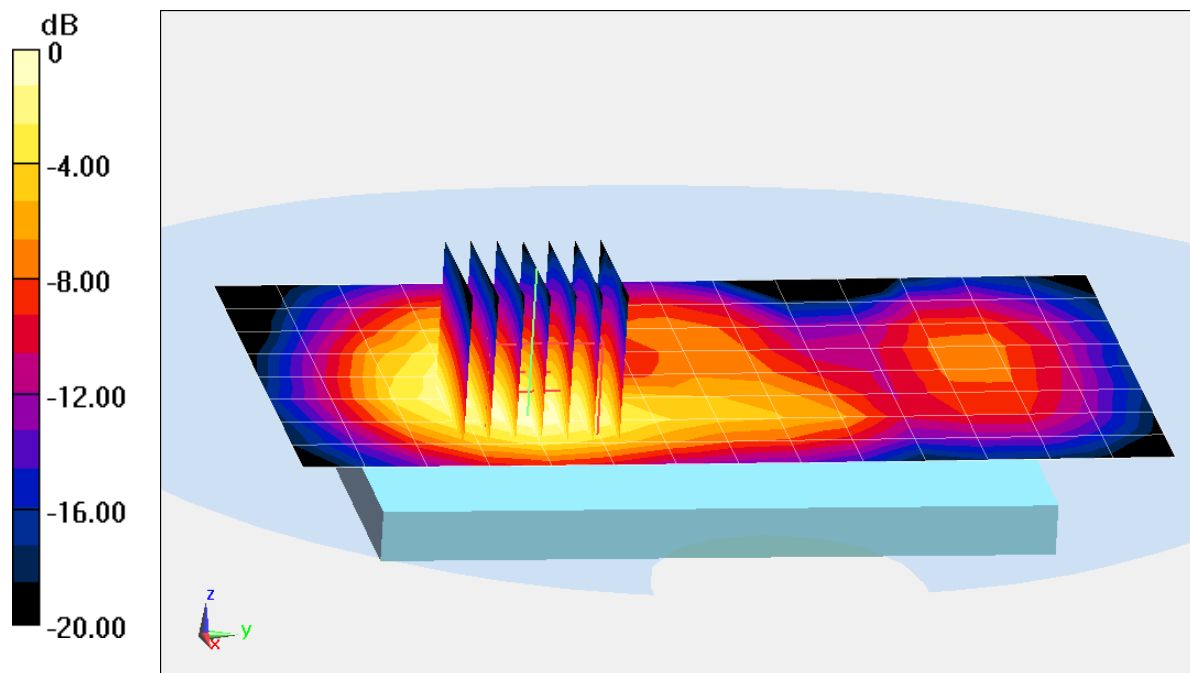
Area Scan (9x15x1): Measurement grid: dx=12mm, dy=12mm

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 14.67 V/m; Power Drift = 0.2 dB

Peak SAR (extrapolated) = 0.828 W/kg

SAR(1 g) = 0.418 W/kg



0 dB = 0.530 W/kg = -2.76 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMG360P; Type: Portable Handset; Serial: 1410-6

Communication System: UID 0, IEEE 802.11b; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2437 \text{ MHz}$; $\sigma = 1.887 \text{ S/m}$; $\epsilon_r = 52.218$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-19-2014; Ambient Temp: 24.2°C; Tissue Temp: 22.9°C

Probe: ES3DV3 - SN3258; ConvF(4.14, 4.14, 4.14); Calibrated: 2/25/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn665; Calibrated: 2/26/2014

Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP-1158

Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

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

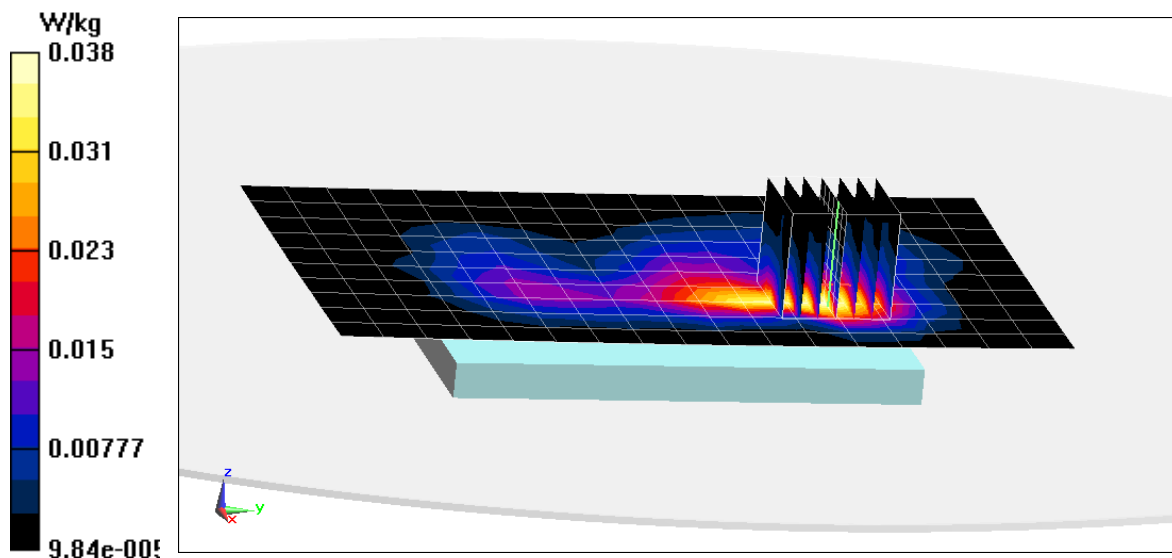
Area Scan (11x18x1): Measurement grid: dx=12mm, dy=12mm

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.307 V/m; Power Drift = 0.20 dB

Peak SAR (extrapolated) = 0.0630 W/kg

SAR(1 g) = 0.031 W/kg



APPENDIX B: SYSTEM VERIFICATION

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: 835 Head Medium parameters used:

$f = 835 \text{ MHz}$; $\sigma = 0.93 \text{ S/m}$; $\epsilon_r = 42.286$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 10-30-2014; Ambient Temp: 23.3°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3209; ConvF (6.23, 6.23, 6.23); Calibrated: 3/19/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 3/17/2014

Phantom: SAM front; Type: QD000P40CD; Serial: TP:1759

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

835 MHz System Verification

Area Scan (7x14x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

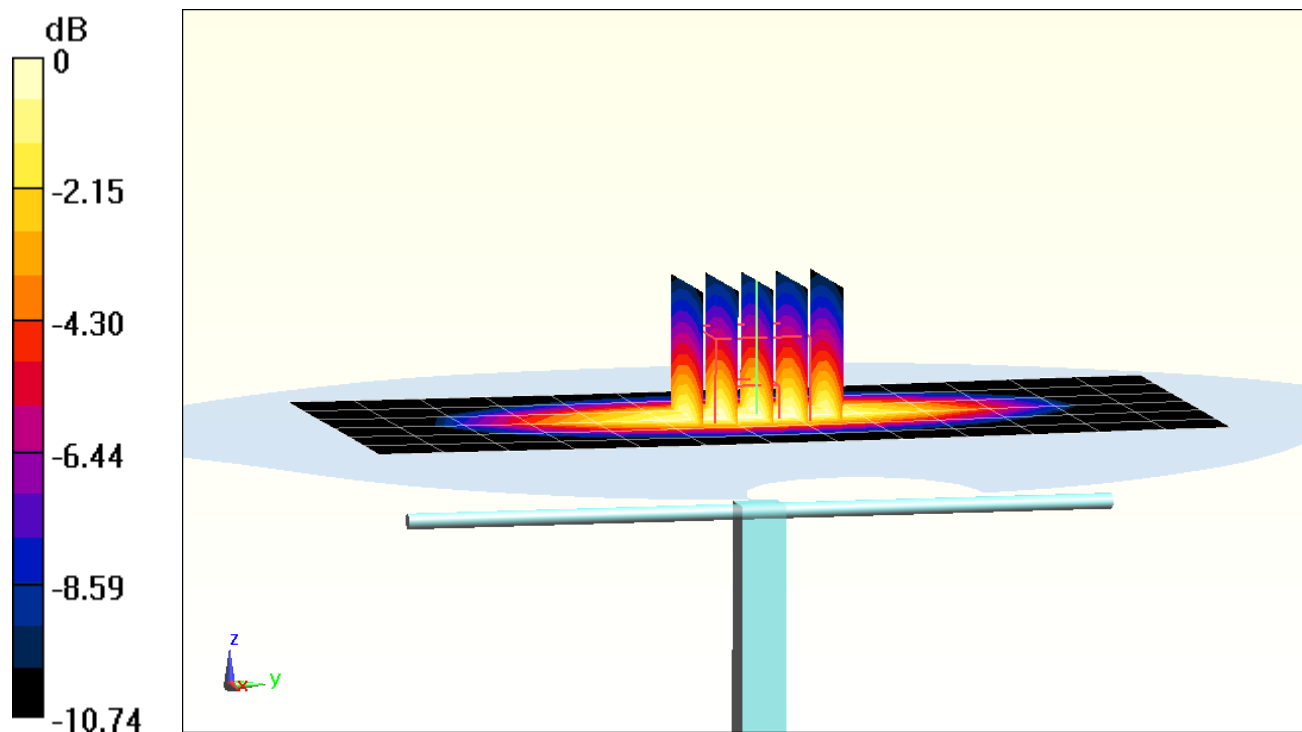
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 1.47 W/kg

SAR(1 g) = 0.983 W/kg

Deviation = 6.62%



PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d141

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 Head Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$; $\sigma = 1.431 \text{ S/m}$; $\epsilon_r = 38.639$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-28-2014; Ambient Temp: 24.1°C; Tissue Temp: 22.0°C

Probe: ES3DV3 - SN3288; ConvF(5.17, 5.17, 5.17); Calibrated: 9/24/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1364; Calibrated: 9/18/2014

Phantom: SAM with CRP v4.0; Type: QD000P40CD; Serial: TP:1797

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

1900 MHz System Verification

Area Scan (7x10x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

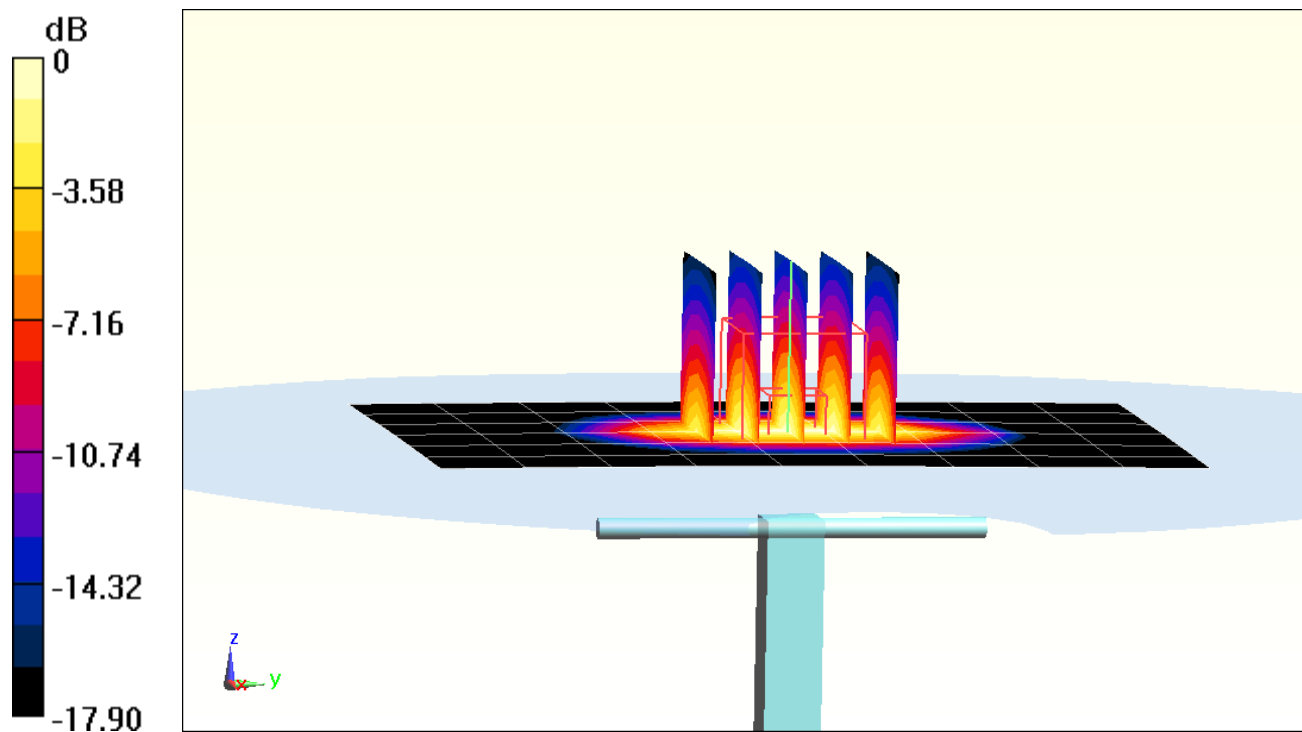
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 7.43 W/kg

SAR(1 g) = 4.04 W/kg

Deviation = 0.75%



PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: 2450 Head Medium parameters used:

$f = 2450 \text{ MHz}$; $\sigma = 1.79 \text{ S/m}$; $\epsilon_r = 38.364$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-16-2014; Ambient Temp: 20.5°C; Tissue Temp: 22.4°C

Probe: ES3DV3 - SN3258; ConvF (4.52, 4.52, 4.52); Calibrated: 2/25/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn665; Calibrated: 2/26/2014

Phantom: SAM Front; Type: SAM; Serial: 1686

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

2450 MHz System Verification

Area Scan (8x9x1): Measurement grid: $dx=12\text{mm}$, $dy=12\text{mm}$

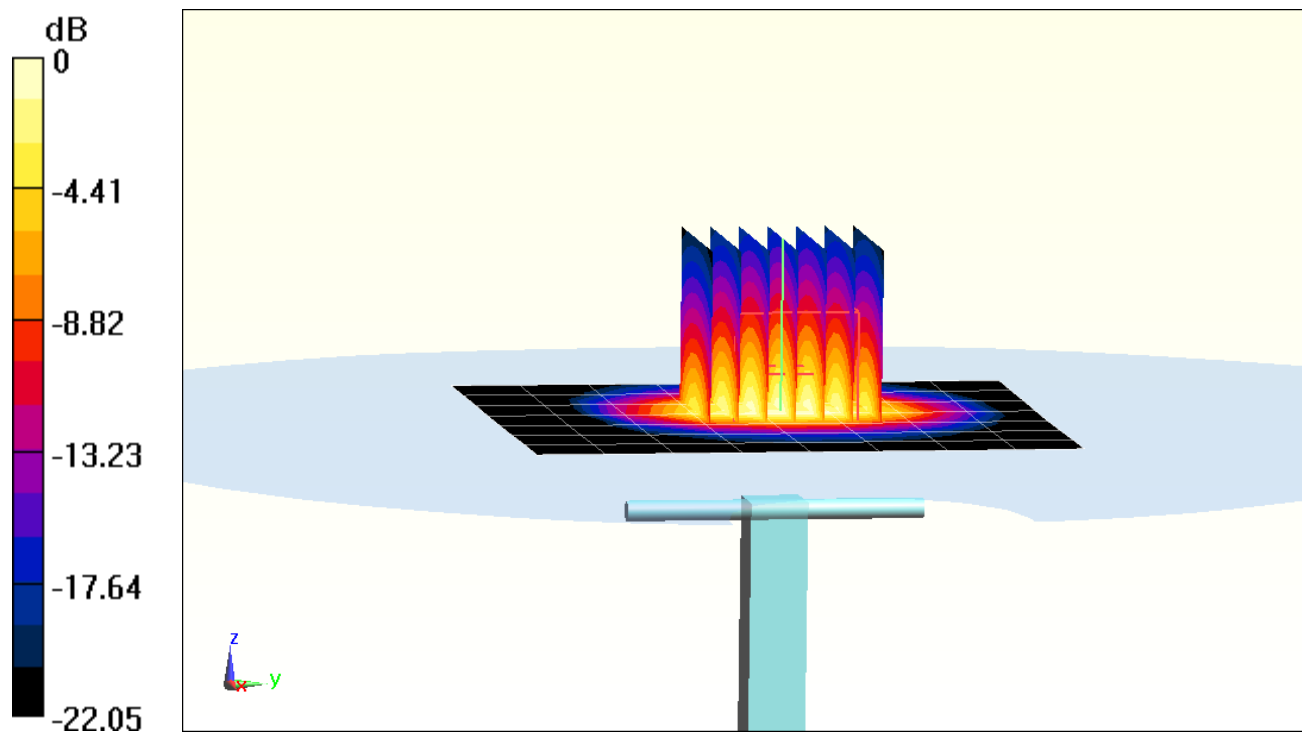
Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 11.3 W/kg

SAR(1 g) = 5.44 W/kg

Deviation = 5.02%



0 dB = 7.19 W/kg = 8.57 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: 1004

Communication System: UID 0, CW (0); Frequency: 2600 MHz; Duty Cycle: 1:1

Medium: 2600 Head Medium parameters used:

$f = 2600 \text{ MHz}$; $\sigma = 1.988 \text{ S/m}$; $\epsilon_r = 38.428$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-29-2014; Ambient Temp: 23.0°C; Tissue Temp: 22.8°C

Probe: ES3DV3 - SN3258; ConvF (4.34, 4.34, 4.34); Calibrated: 2/25/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn665; Calibrated: 2/26/2014

Phantom: SAM Front; Type: SAM; Serial: 1686

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

2600 MHz System Verification

Area Scan (8x9x1): Measurement grid: $dx=12\text{mm}$, $dy=12\text{mm}$

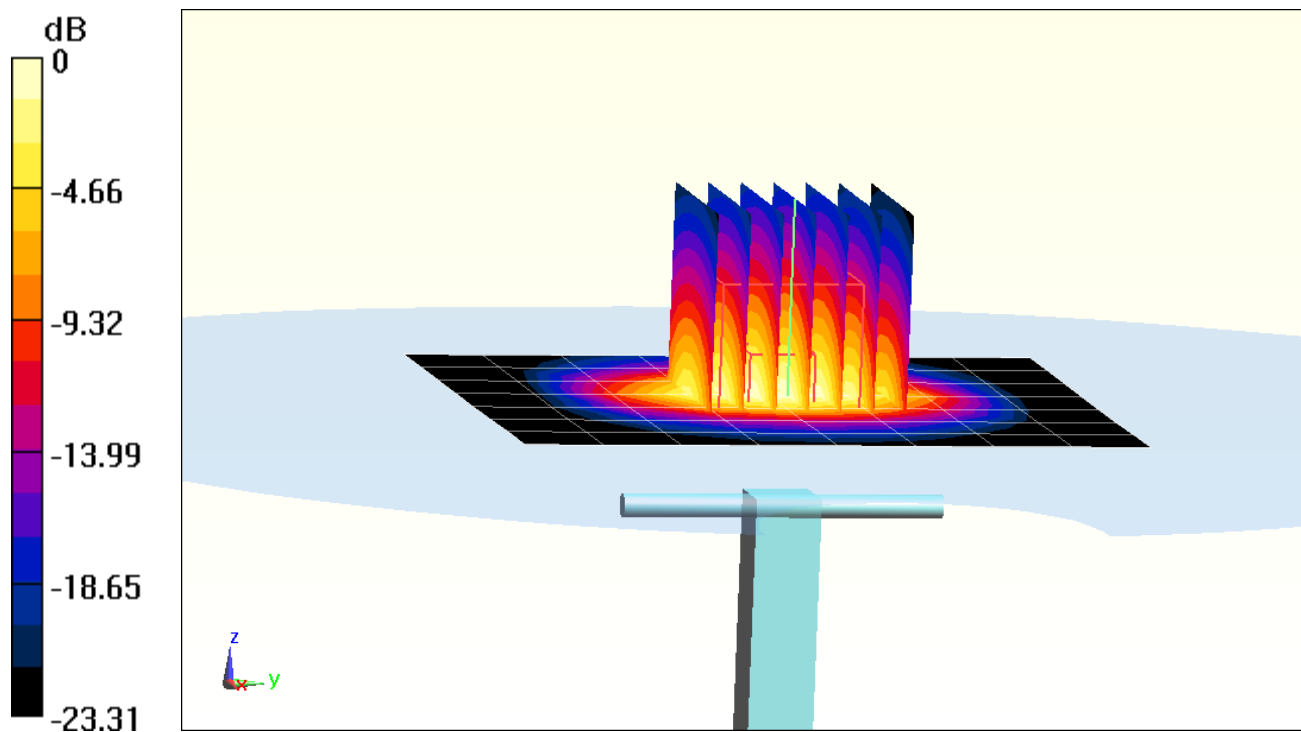
Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 12.1 W/kg

SAR(1 g) = 5.79 W/kg

Deviation = 1.05%



0 dB = 7.58 W/kg = 8.80 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used:

$f = 835 \text{ MHz}$; $\sigma = 0.999 \text{ S/m}$; $\epsilon_r = 53.521$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 10-22-2014; Ambient Temp: 23.9°C; Tissue Temp: 22.1°C

Probe: ES3DV3 - SN3263; ConvF(6.16, 6.16, 6.16); Calibrated: 5/15/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/14/2014

Phantom: SAM v5.0 Left; Type: QD000P40CD; Serial: TP: 1687

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

835 MHz System Verification

Area Scan (7x14x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

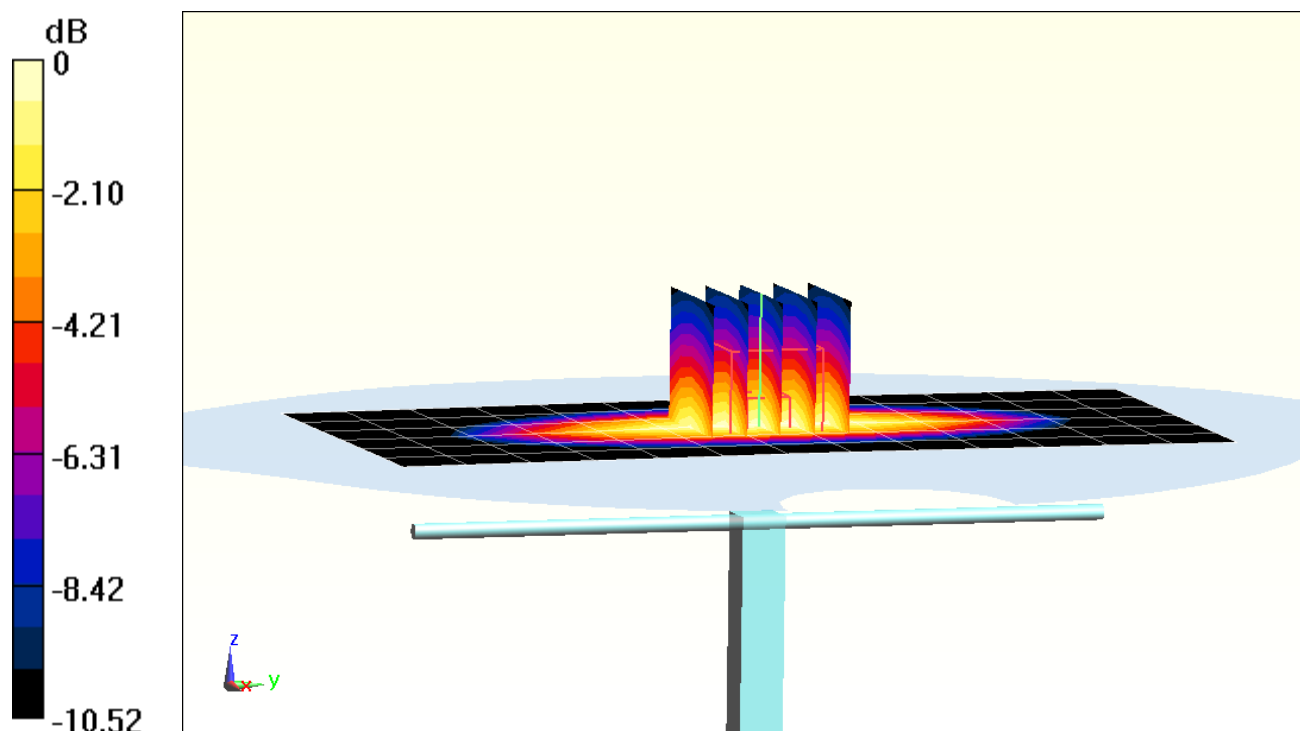
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 1.33 W/kg

SAR(1 g) = 0.902 W/kg

Deviation = -3.43%



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

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d141

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$; $\sigma = 1.55 \text{ S/m}$; $\epsilon_r = 53.051$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-28-2014; Ambient Temp: 22.6°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3258; ConvF (4.61, 4.61, 4.61); Calibrated: 2/25/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn665; Calibrated: 2/26/2014

Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP-1158

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

1900 MHz System Verification

Area Scan (7x10x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

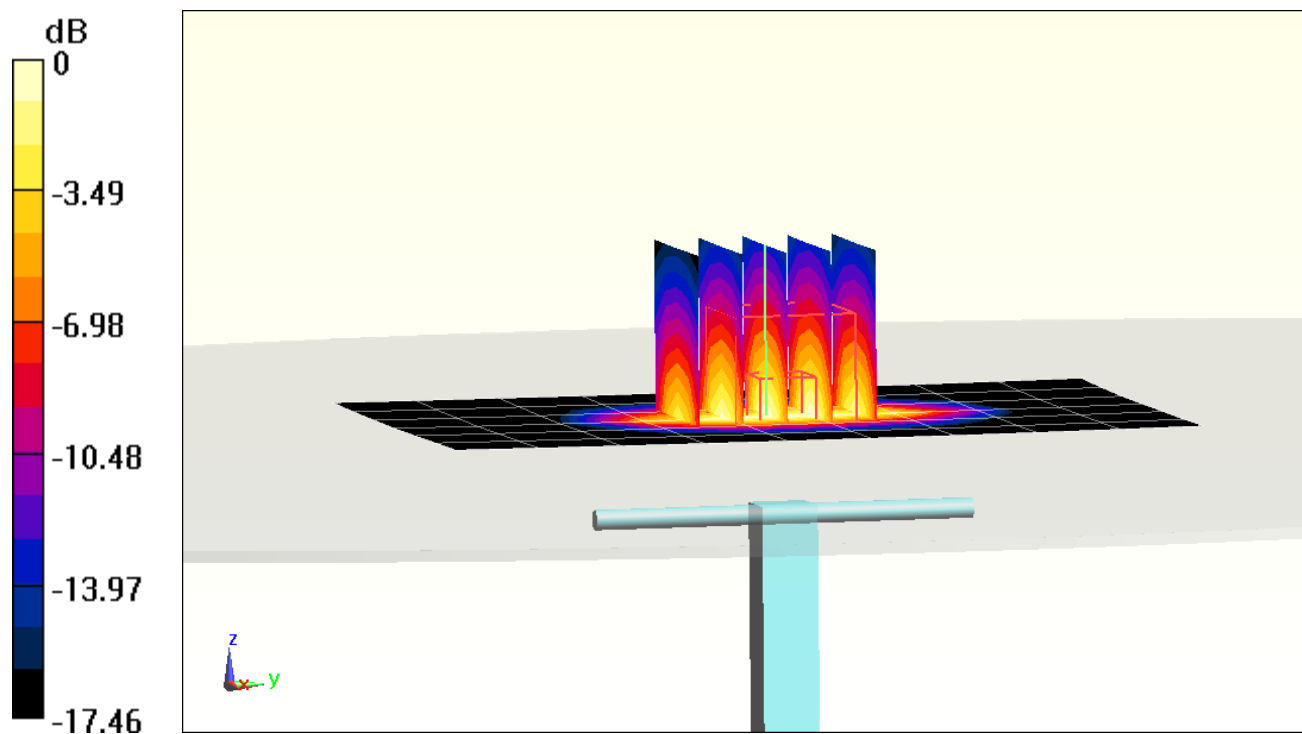
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 6.77 W/kg

SAR(1 g) = 3.92 W/kg

Deviation = -3.45%



PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 5d141

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$; $\sigma = 1.576 \text{ S/m}$; $\epsilon_r = 53.672$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-03-2014; Ambient Temp: 24.0°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3263; ConvF (4.78, 4.78, 4.78); Calibrated: 5/15/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn859; Calibrated: 5/14/2014

Phantom: SAM v5.0 front; Type: QD000P40CD; Serial: TP-1646

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

1900 MHz System Verification

Area Scan (7x10x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

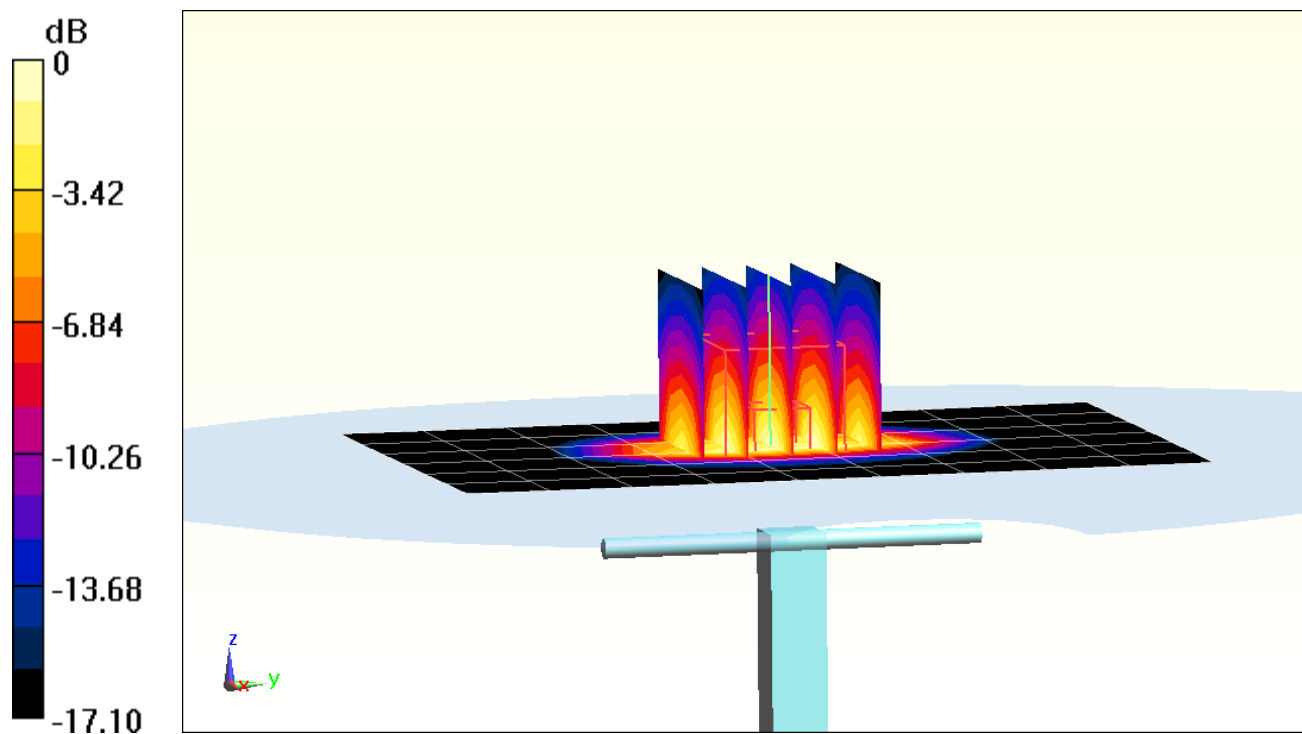
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 7.72 W/kg

SAR(1 g) = 4.36 W/kg

Deviation = 7.39%



0 dB = 5.51 W/kg = 7.41 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used:

$f = 2450 \text{ MHz}$; $\sigma = 1.905 \text{ S/m}$; $\epsilon_r = 52.17$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 11-19-2014; Ambient Temp: 24.2°C; Tissue Temp: 22.9°C

Probe: ES3DV3 - SN3258; ConvF(4.14, 4.14, 4.14); Calibrated: 2/25/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn665; Calibrated: 2/26/2014

Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP-1158

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

2450 MHz System Verification

Area Scan (8x9x1): Measurement grid: $dx=12\text{mm}$, $dy=12\text{mm}$

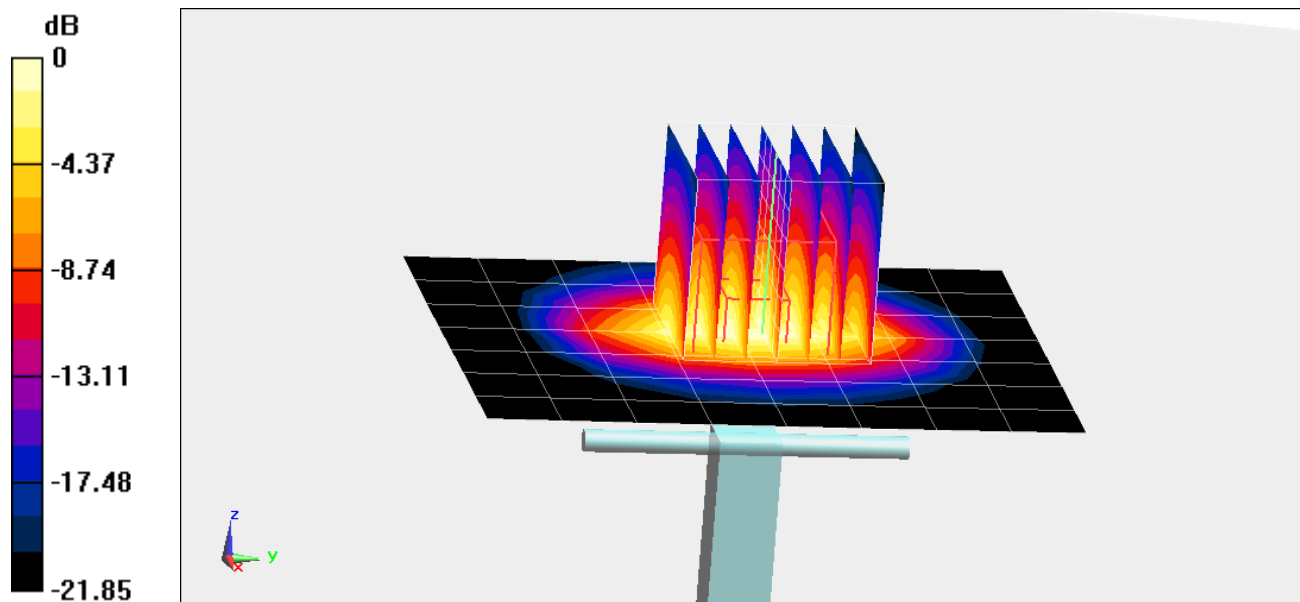
Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 10.3 W/kg

SAR(1 g) = 4.92 W/kg

Deviation = -0.40%



0 dB = 6.44 W/kg = 8.09 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: 1004

Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium: 2600 Body Medium parameters used:

$f = 2600$ MHz; $\sigma = 2.241$ S/m; $\epsilon_r = 51.308$; $\rho = 1000$ kg/m³

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 10-29-2014; Ambient Temp: 23.2°C; Tissue Temp: 23.0°C

Probe: ES3DV3 - SN3209; ConvF(4.04, 4.04, 4.04); Calibrated: 3/19/2014;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 3/17/2014

Phantom: SAM front; Type: QD000P40CD; Serial: TP:1759

Measurement SW: DASY52, Version 52.8 (8);SEMCAD X Version 14.6.10 (7331)

2600 MHz System Verification

Area Scan (8x9x1): Measurement grid: dx=12mm, dy=12mm

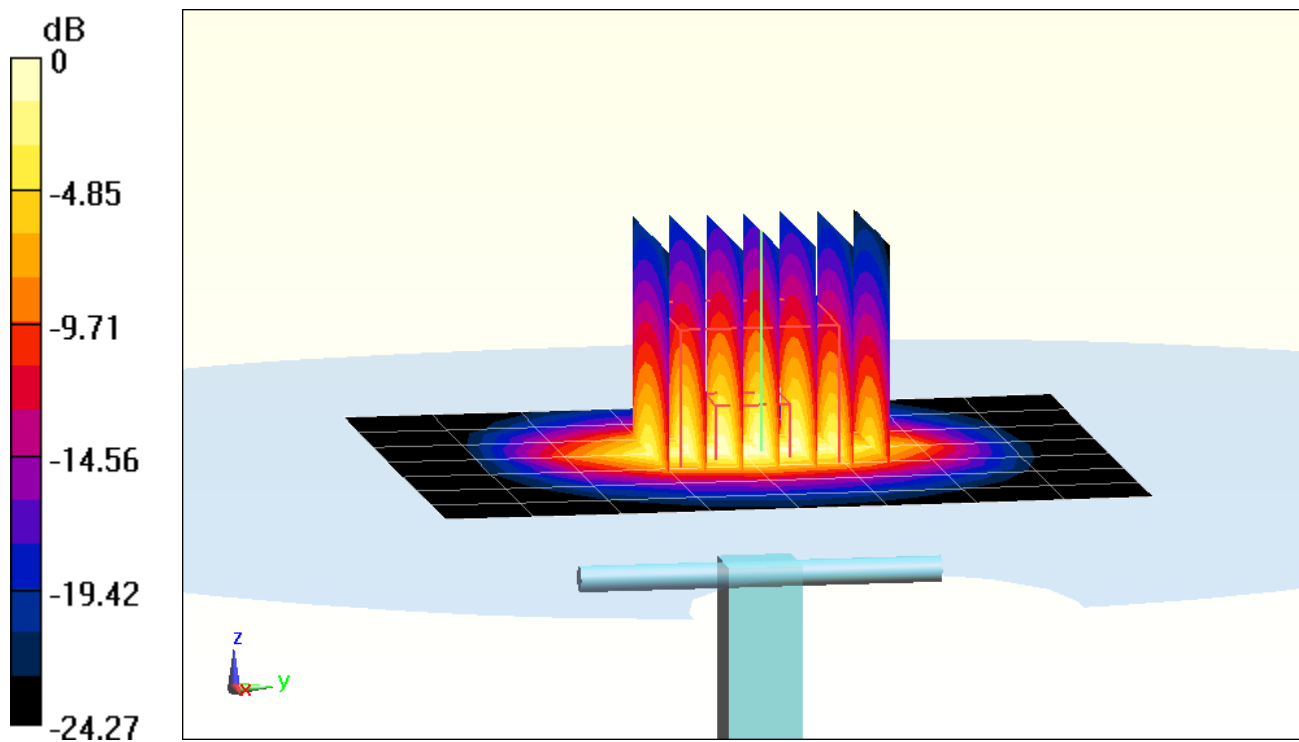
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 13.8 W/kg

SAR(1 g) = 6.13 W/kg

Deviation = 8.11%



0 dB = 8.06 W/kg = 9.06 dBW/kg

APPENDIX C: PROBE CALIBRATION



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

Client **PC Test**

Certificate No: **ES3-3209_Mar14**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3209**

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

CCV
 3/27/14

Calibration date: **March 19, 2014**

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

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

Calibration Equipment used (M&TE critical for calibration)

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

Calibrated by:	Name Claudio Leubler	Function Laboratory Technician	Signature
Approved by:	Katja Pokovic	Technical Manager	
Issued: March 20, 2014			
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- 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:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E^2 -field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,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.
- DCP_{x,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
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,y,z}**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).

Probe ES3DV3

SN:3209

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

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

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

Basic Calibration Parameters

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

Modulation Calibration Parameters

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

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

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

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

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

^A The uncertainties of NormX,Y,Z do not affect the E^2 -field uncertainty inside TSL (see Pages 8 and 9).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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

Calibration Parameter Determined in Head Tissue Simulating Media

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

^C Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

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

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

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

Calibration Parameter Determined in Body Tissue Simulating Media

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

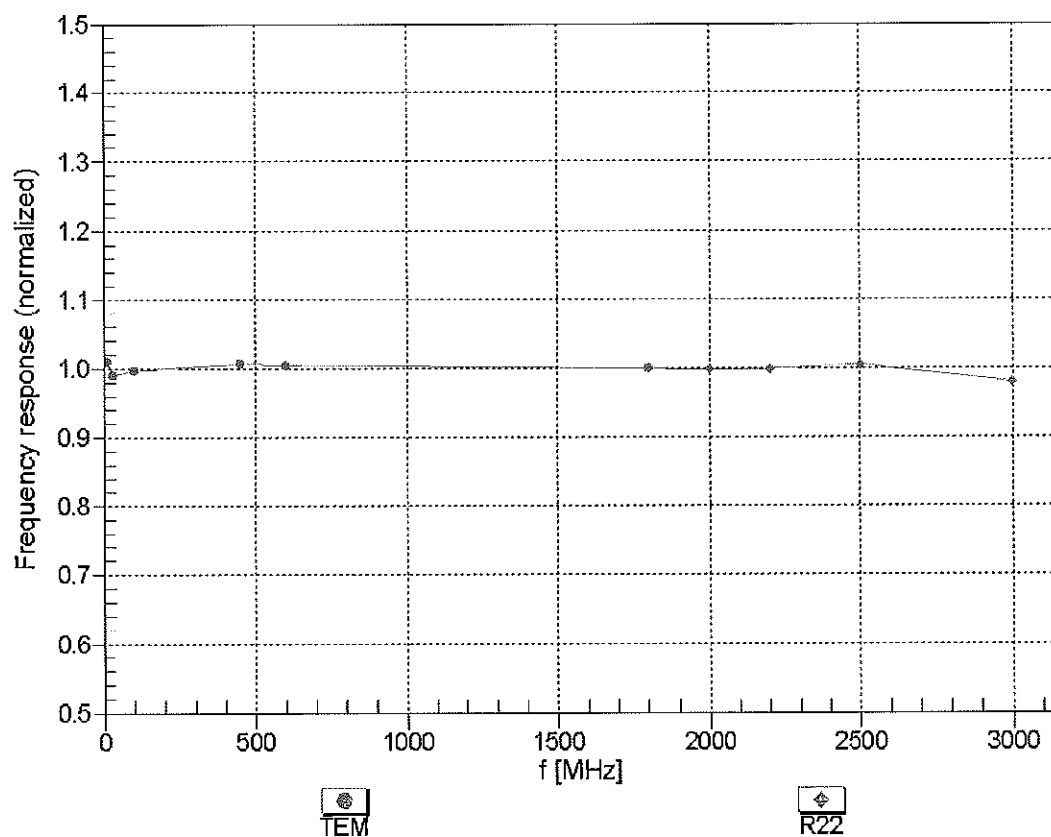
^C Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

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

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

Frequency Response of E-Field

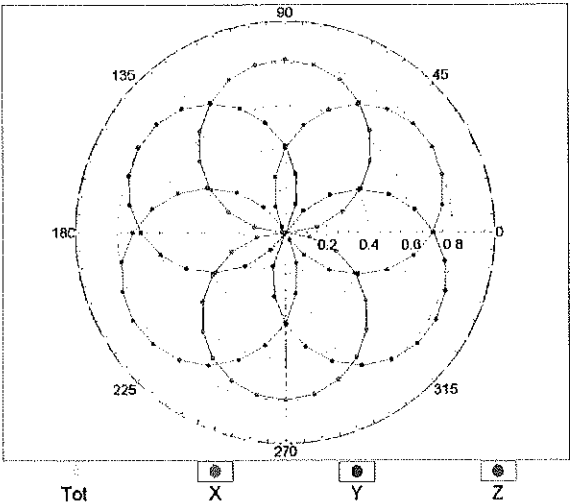
(TEM-Cell:ifi110 EXX, Waveguide: R22)



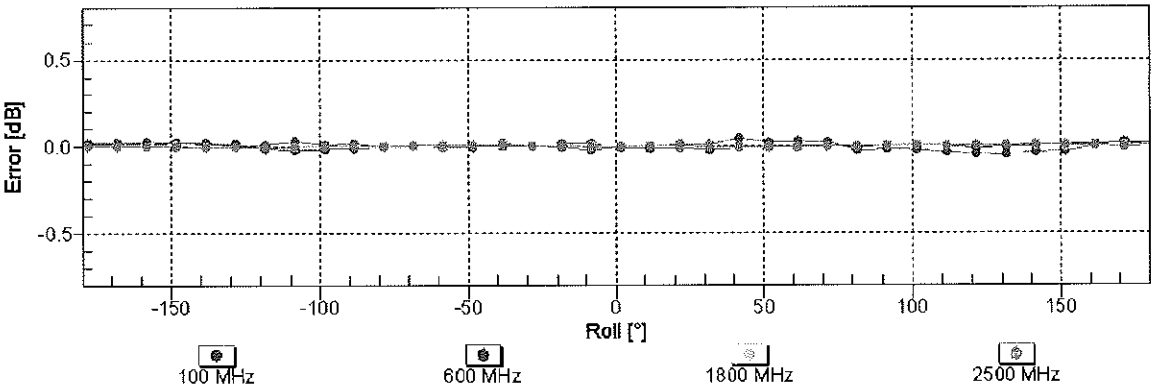
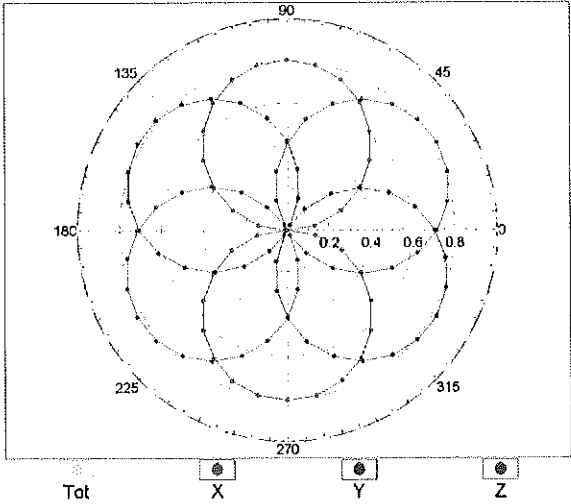
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

Receiving Pattern (ϕ), $\vartheta = 0^\circ$

f=600 MHz,TEM

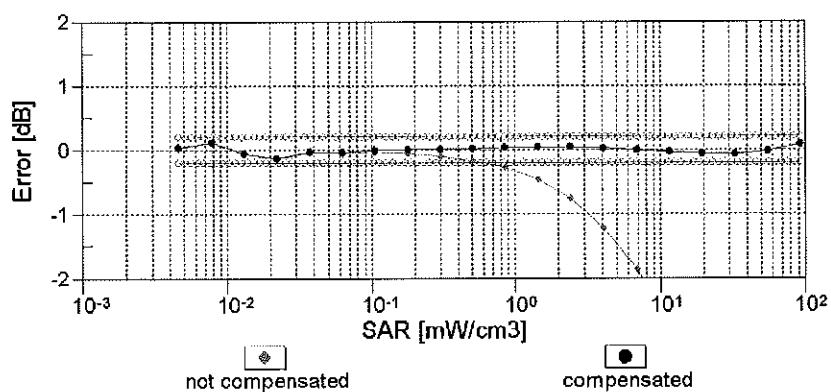
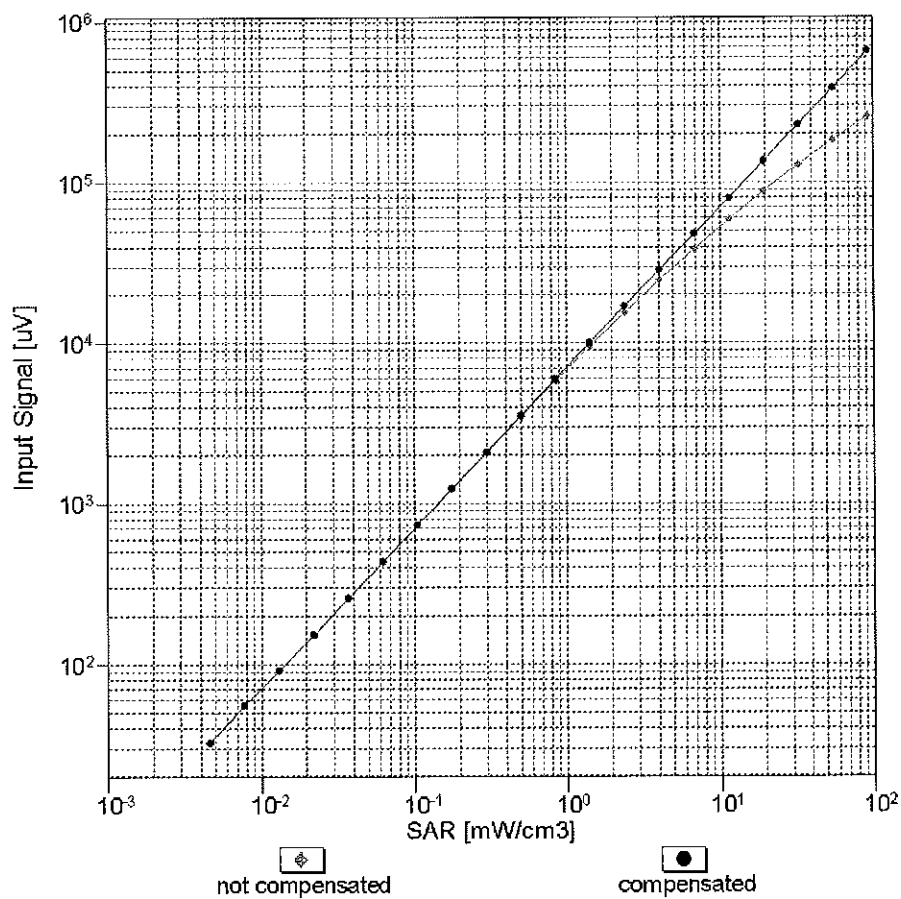


f=1800 MHz,R22



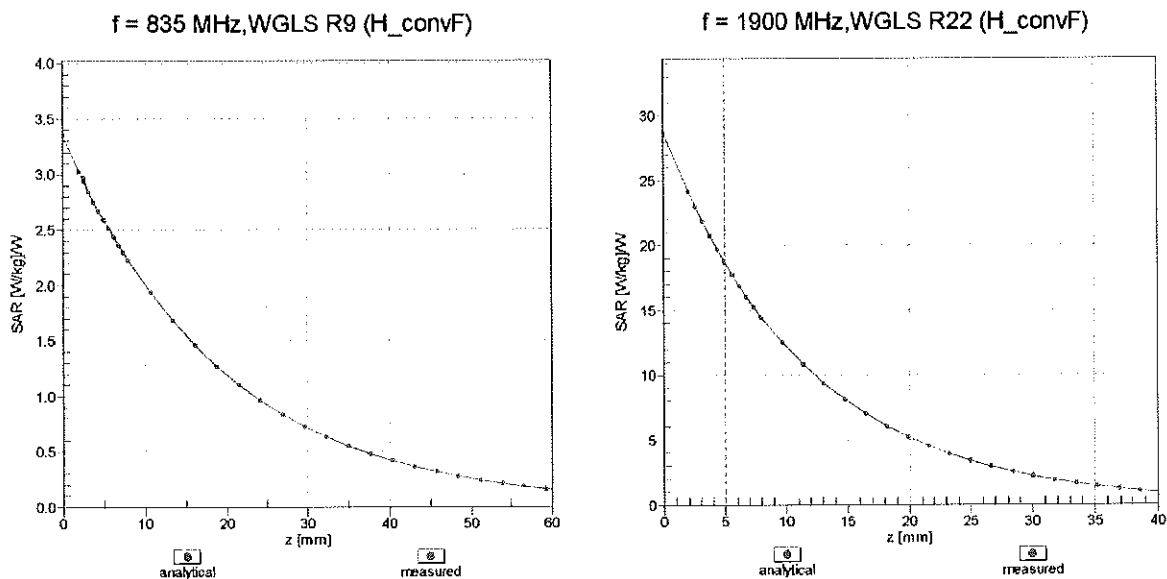
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell , $f_{\text{eval}} = 1900 \text{ MHz}$)



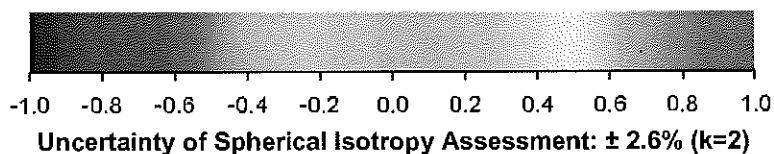
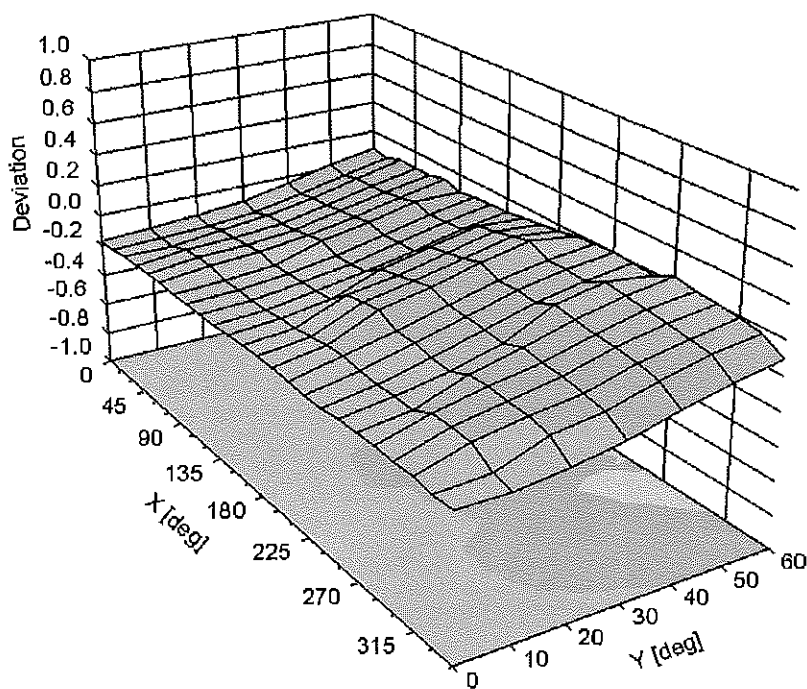
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ , θ), $f = 900 \text{ MHz}$



Uncertainty of Spherical Isotropy Assessment: $\pm 2.6\%$ ($k=2$)

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

Other Probe Parameters

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



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

Client **PC Test**

Certificate No: **ES3-3288_Sep14**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3288**

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

Calibration date: **September 24, 2014**

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

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

Calibration Equipment used (M&TE critical for calibration)

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

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	
Issued: September 24, 2014			
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			



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Accreditation No.: **SCS 108**

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 Multilateral Agreement for the recognition of calibration certificates

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- 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:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,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.
- DCP_{x,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
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,y,z}**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).

Probe ES3DV3

SN:3288

Manufactured:	July 6, 2010
Repaired:	September 18, 2014
Calibrated:	September 24, 2014

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

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$) ^A	1.05	1.16	0.92	± 10.1 %
DCP (mV) ^B	105.1	104.6	106.7	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu V}$	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	195.8	±3.5 %
		Y	0.0	0.0	1.0		175.9	
		Z	0.0	0.0	1.0		177.1	
10010- CAA	SAR Validation (Square, 100ms, 10ms)	X	2.71	61.9	11.4	10.00	40.3	±2.2 %
		Y	2.37	60.2	11.2		42.6	
		Z	1.54	56.6	8.9		41.2	
10011- CAB	UMTS-FDD (WCDMA)	X	3.29	67.1	18.4	2.91	133.8	±0.5 %
		Y	3.43	67.9	18.9		139.5	
		Z	3.45	68.1	18.9		141.3	
10012- CAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	2.99	68.9	18.6	1.87	135.1	±0.7 %
		Y	3.59	72.4	20.4		140.7	
		Z	3.54	72.4	20.3		143.0	
10013- CAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	11.15	70.8	23.3	9.46	132.3	±3.5 %
		Y	11.29	70.8	23.2		141.1	
		Z	11.07	70.7	23.2		139.2	
10021- DAB	GSM-FDD (TDMA, GMSK)	X	14.71	90.5	24.5	9.39	149.0	±1.9 %
		Y	16.40	92.8	26.0		131.3	
		Z	11.34	87.2	23.6		126.1	
10023- DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	15.91	92.2	25.3	9.57	138.9	±2.5 %
		Y	21.25	96.9	27.2		142.0	
		Z	11.68	87.2	23.5		145.9	
10024- DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	38.62	99.8	24.7	6.56	123.8	±2.2 %
		Y	36.71	99.7	25.2		128.1	
		Z	36.56	99.4	24.5		129.5	
10027- DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	56.60	99.6	22.6	4.80	138.8	±1.9 %
		Y	46.94	99.9	23.7		149.9	
		Z	51.17	99.8	22.9		144.9	
10028- DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	70.88	100.0	21.6	3.55	147.5	±1.9 %
		Y	52.58	99.8	22.6		129.4	
		Z	76.98	99.8	21.2		128.7	
10032- CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	98.89	99.5	18.9	1.16	135.8	±1.4 %
		Y	78.39	99.6	19.5		141.7	
		Z	95.21	95.5	17.1		143.4	
10039- CAB	CDMA2000 (1xRTT, RC1)	X	4.72	66.7	18.9	4.57	133.7	±0.9 %
		Y	4.85	67.1	19.1		137.7	
		Z	4.81	67.4	19.2		141.9	

10081-CAB	CDMA2000 (1xRTT, RC3)	X	3.91	66.3	18.6	3.97	129.5	±0.7 %
		Y	4.00	66.6	18.7		133.7	
		Z	3.99	66.8	18.8		137.5	
10098-CAB	UMTS-FDD (HSUPA, Subtest 2)	X	4.63	66.9	18.7	3.98	141.4	±0.7 %
		Y	4.78	67.5	19.0		147.7	
		Z	4.57	66.8	18.6		127.8	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.59	68.2	20.1	5.67	149.2	±1.4 %
		Y	6.36	67.3	19.6		130.7	
		Z	6.36	67.5	19.6		133.6	
10108-CAB	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.44	67.8	20.0	5.80	146.6	±1.4 %
		Y	6.23	66.8	19.4		128.8	
		Z	6.24	67.1	19.6		131.4	
10110-CAB	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	6.08	67.1	19.6	5.75	143.2	±1.4 %
		Y	6.20	67.4	19.8		148.0	
		Z	5.92	66.6	19.3		128.5	
10114-CAA	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	X	10.32	69.3	21.5	8.10	137.0	±2.2 %
		Y	10.31	69.1	21.4		143.5	
		Z	10.37	69.5	21.6		146.1	
10117-CAA	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.35	69.4	21.6	8.07	138.3	±2.2 %
		Y	10.36	69.3	21.4		146.4	
		Z	10.42	69.6	21.6		149.0	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	9.95	75.7	26.2	9.28	134.9	±3.3 %
		Y	10.37	76.0	26.1		146.6	
		Z	9.77	75.4	26.0		142.5	
10154-CAB	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	6.12	67.2	19.7	5.75	144.9	±1.4 %
		Y	6.21	67.4	19.8		148.8	
		Z	5.91	66.5	19.3		128.7	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.28	66.7	19.4	5.82	125.5	±1.2 %
		Y	6.37	66.8	19.4		129.7	
		Z	6.36	67.1	19.6		132.9	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	5.08	67.6	20.2	5.73	147.0	±1.2 %
		Y	4.95	66.6	19.6		128.6	
		Z	4.91	66.9	19.8		131.2	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	8.18	77.2	27.2	9.21	123.4	±2.7 %
		Y	8.37	76.6	26.6		129.5	
		Z	7.97	76.7	26.9		128.7	
10175-CAB	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	5.05	67.4	20.1	5.72	146.2	±1.4 %
		Y	5.10	67.3	20.0		142.8	
		Z	4.87	66.7	19.6		129.6	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	5.04	67.4	20.0	5.72	145.5	±1.2 %
		Y	5.12	67.4	20.0		143.4	
		Z	4.87	66.7	19.6		129.9	
10193-CAA	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	X	9.92	68.9	21.4	8.09	131.0	±2.2 %
		Y	9.84	68.5	21.1		130.0	
		Z	9.94	69.0	21.4		138.6	

10196-CAA	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.90	68.9	21.4	8.10	130.8	±2.2 %
		Y	9.81	68.4	21.0		131.4	
		Z	9.95	69.1	21.5		140.5	
10219-CAA	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	X	9.81	68.8	21.3	8.03	130.0	±2.2 %
		Y	9.89	68.9	21.3		138.1	
		Z	9.89	69.1	21.5		140.5	
10222-CAA	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	X	10.25	69.2	21.4	8.06	137.1	±2.2 %
		Y	10.30	69.2	21.4		144.4	
		Z	10.38	69.6	21.6		148.4	
10225-CAB	UMTS-FDD (HSPA+)	X	6.90	66.8	19.3	5.97	132.8	±1.4 %
		Y	7.09	67.3	19.6		142.0	
		Z	7.04	67.4	19.6		143.5	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	9.61	81.9	29.6	9.21	149.3	±2.7 %
		Y	8.66	77.6	27.1		133.7	
		Z	8.20	77.5	27.3		132.2	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	9.16	74.5	25.8	9.24	126.3	±3.0 %
		Y	9.62	75.0	25.8		137.4	
		Z	9.16	74.8	25.9		135.2	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	9.97	75.7	26.3	9.30	133.7	±3.3 %
		Y	10.38	75.9	26.1		146.1	
		Z	9.91	75.7	26.3		143.8	
10274-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	X	5.86	66.6	18.7	4.87	129.9	±0.9 %
		Y	6.01	67.1	19.0		135.7	
		Z	5.95	67.1	19.0		139.4	
10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.40	66.7	18.6	3.96	136.4	±0.7 %
		Y	4.55	67.3	19.0		138.3	
		Z	4.56	67.6	19.1		144.3	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.64	66.9	18.7	3.46	127.4	±0.5 %
		Y	3.77	67.6	19.1		130.2	
		Z	3.72	67.5	19.0		134.4	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.58	67.0	18.7	3.39	128.4	±0.5 %
		Y	3.73	67.7	19.1		132.7	
		Z	3.69	67.8	19.1		136.1	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.43	67.7	19.9	5.81	145.5	±1.4 %
		Y	6.49	67.7	19.9		149.5	
		Z	6.23	67.0	19.6		129.5	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	6.74	67.3	19.8	6.06	126.7	±1.4 %
		Y	6.83	67.5	19.8		132.9	
		Z	6.81	67.6	19.9		135.8	
10315-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc duty cycle)	X	3.00	69.9	19.4	1.71	133.9	±0.5 %
		Y	3.30	71.5	20.1		141.0	
		Z	3.22	71.4	20.0		142.9	
10316-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 96pc duty cycle)	X	10.17	69.2	21.8	8.36	130.5	±2.5 %
		Y	10.20	69.1	21.6		138.4	
		Z	10.20	69.4	21.8		140.7	

10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.75	68.3	18.8	3.76	138.5	±0.7 %
		Y	5.00	69.1	19.2		146.7	
		Z	4.92	69.2	19.1		148.5	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.73	68.6	18.9	3.77	136.3	±0.7 %
		Y	4.97	69.4	19.4		143.7	
		Z	4.91	69.6	19.3		146.0	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.65	68.1	18.5	1.54	135.2	±0.5 %
		Y	3.05	70.8	19.9		140.7	
		Z	2.87	69.8	19.3		144.8	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	10.00	69.0	21.5	8.23	130.8	±2.2 %
		Y	10.06	68.9	21.4		138.6	
		Z	10.08	69.3	21.7		141.6	

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

^A The uncertainties of NormX,Y,Z do not affect the E^2 -field uncertainty inside TSL (see Pages 8 and 9).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unct. (k=2)
750	41.9	0.89	6.81	6.81	6.81	0.37	1.70	± 12.0 %
835	41.5	0.90	6.51	6.51	6.51	0.45	1.52	± 12.0 %
1750	40.1	1.37	5.38	5.38	5.38	0.44	1.58	± 12.0 %
1900	40.0	1.40	5.17	5.17	5.17	0.80	1.18	± 12.0 %
2450	39.2	1.80	4.56	4.56	4.56	0.80	1.21	± 12.0 %
2600	39.0	1.96	4.44	4.44	4.44	0.80	1.22	± 12.0 %

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

^F At frequencies below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to $\pm 10\%$ 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 $\pm 5\%$. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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

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

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^c	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unct. (k=2)
750	55.5	0.96	6.38	6.38	6.38	0.31	1.89	± 12.0 %
835	55.2	0.97	6.32	6.32	6.32	0.55	1.39	± 12.0 %
1750	53.4	1.49	5.03	5.03	5.03	0.57	1.44	± 12.0 %
1900	53.3	1.52	4.82	4.82	4.82	0.51	1.54	± 12.0 %
2450	52.7	1.95	4.36	4.36	4.36	0.71	1.07	± 12.0 %
2600	52.5	2.16	4.22	4.22	4.22	0.80	1.07	± 12.0 %

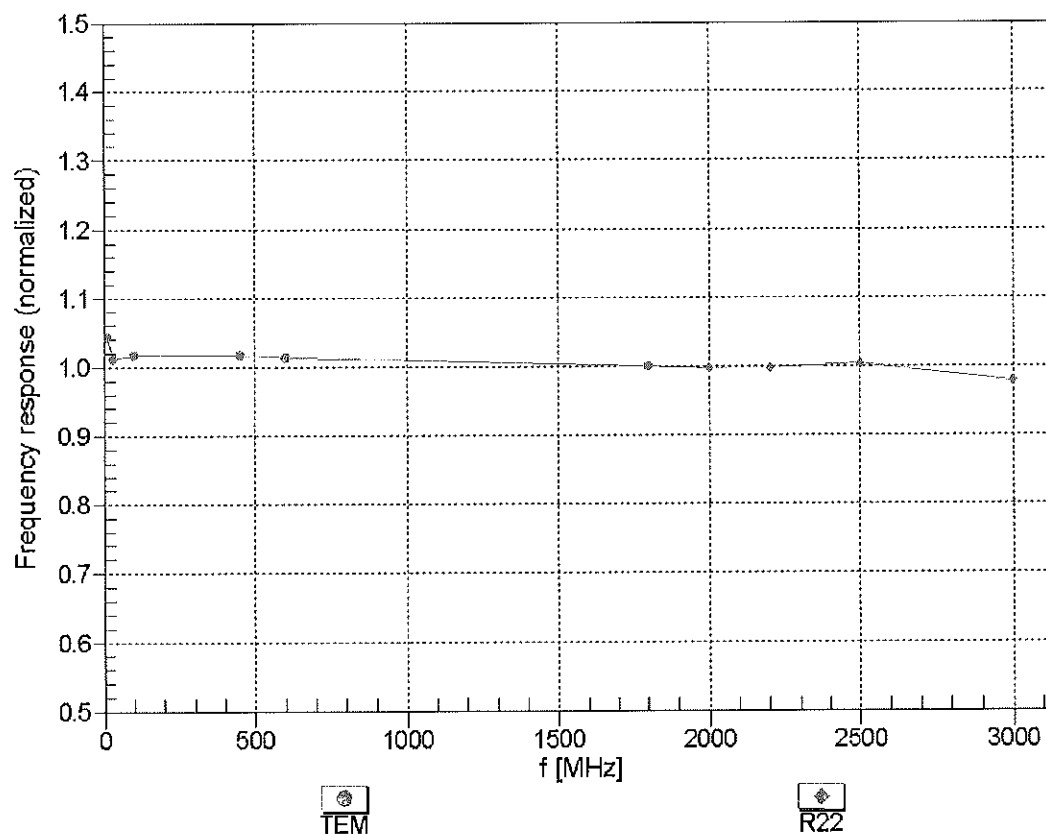
^c Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is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

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

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

Frequency Response of E-Field

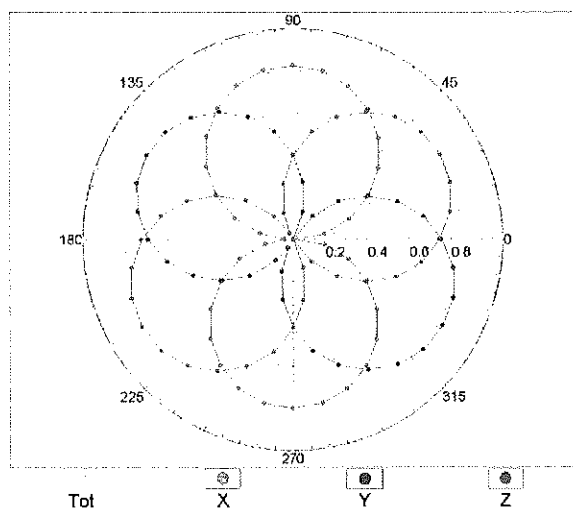
(TEM-Cell:ifi110 EXX, Waveguide: R22)



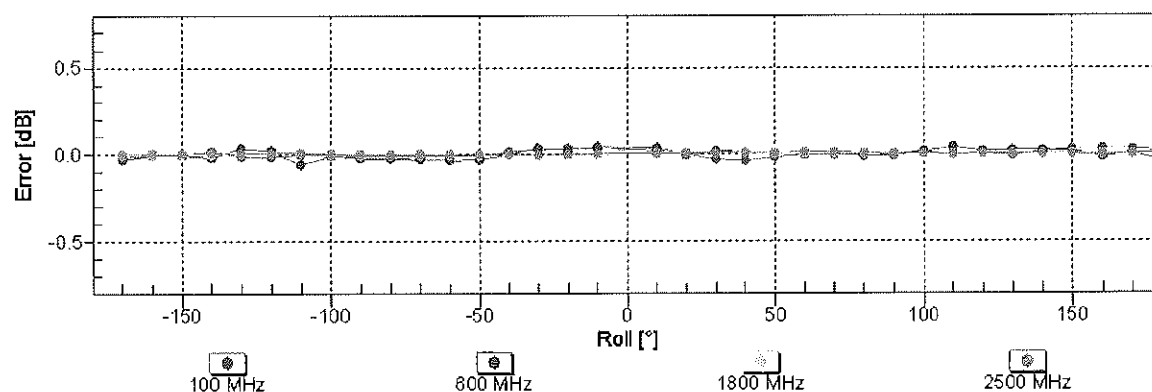
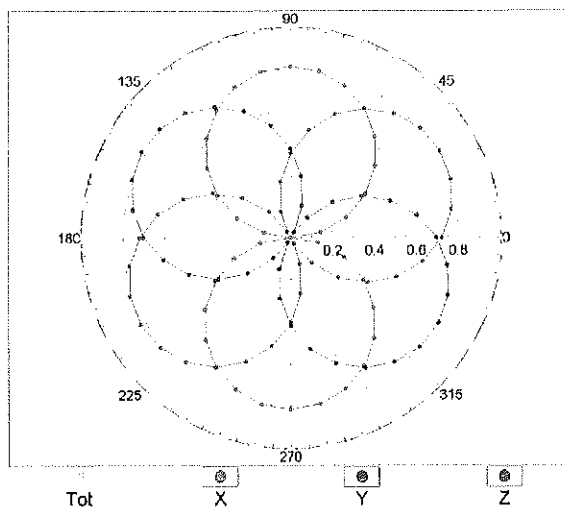
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

Receiving Pattern (ϕ), $\theta = 0^\circ$

f=600 MHz,TEM

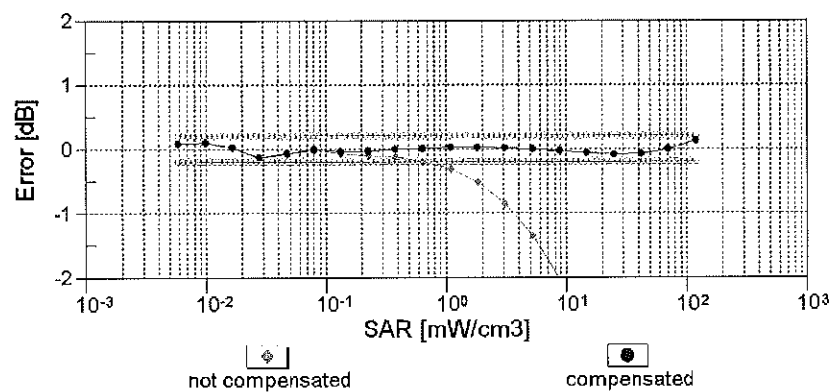
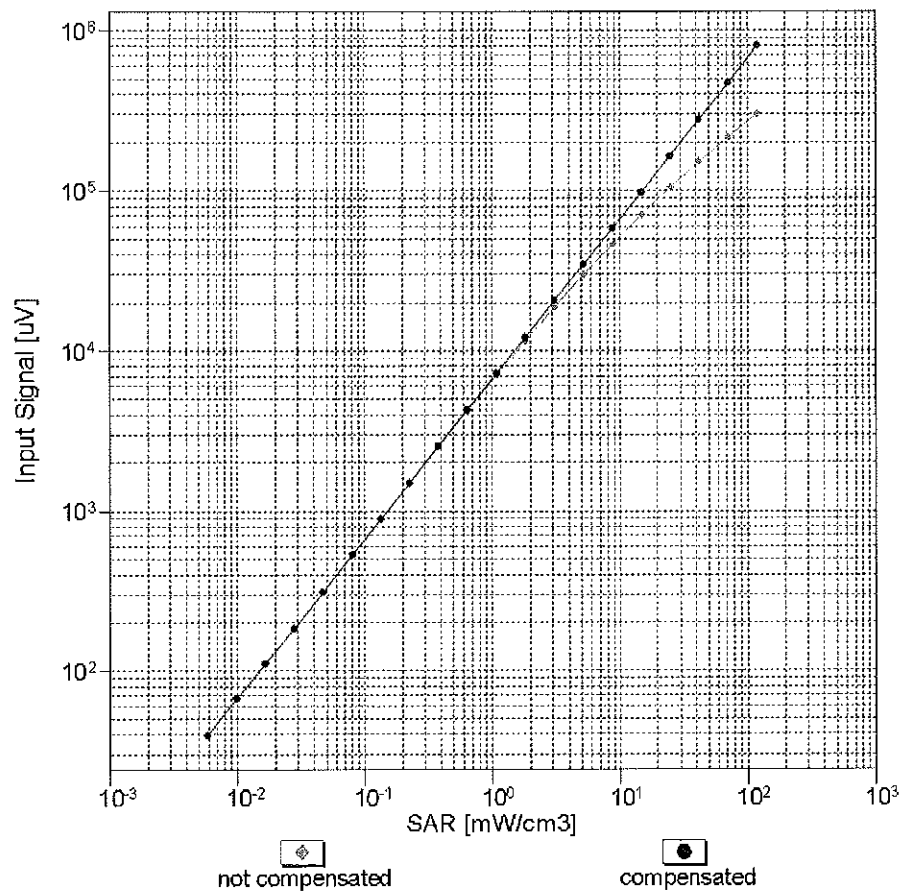


f=1800 MHz,R22



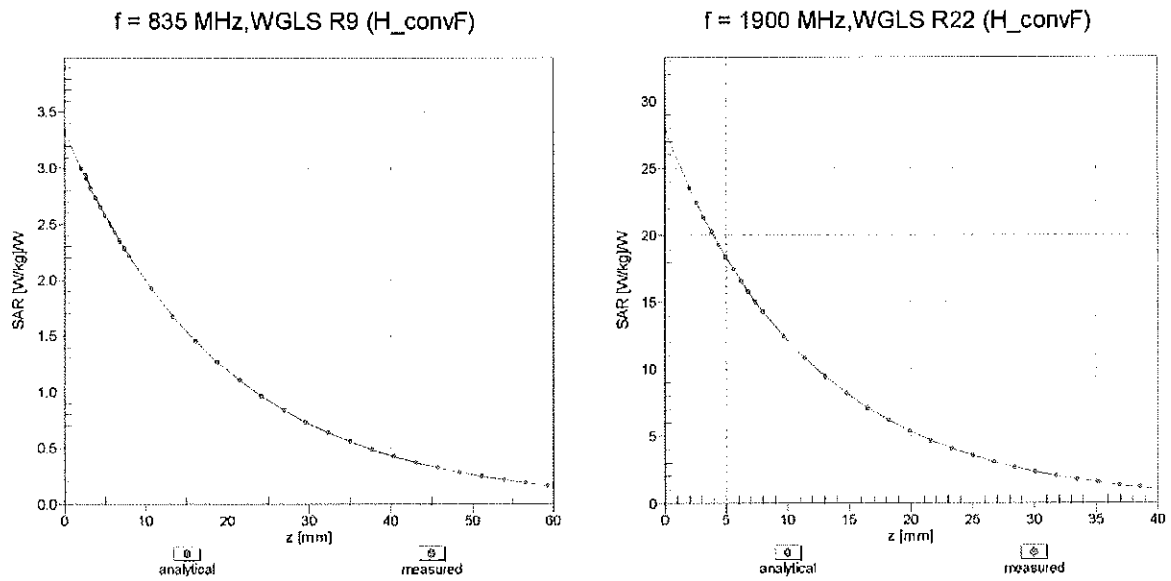
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell , $f_{\text{eval}} = 1900 \text{ MHz}$)

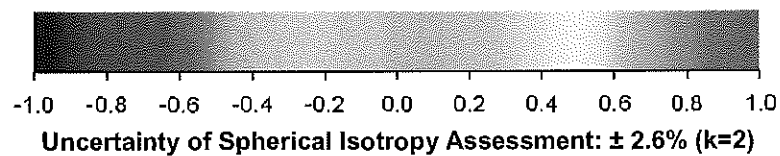
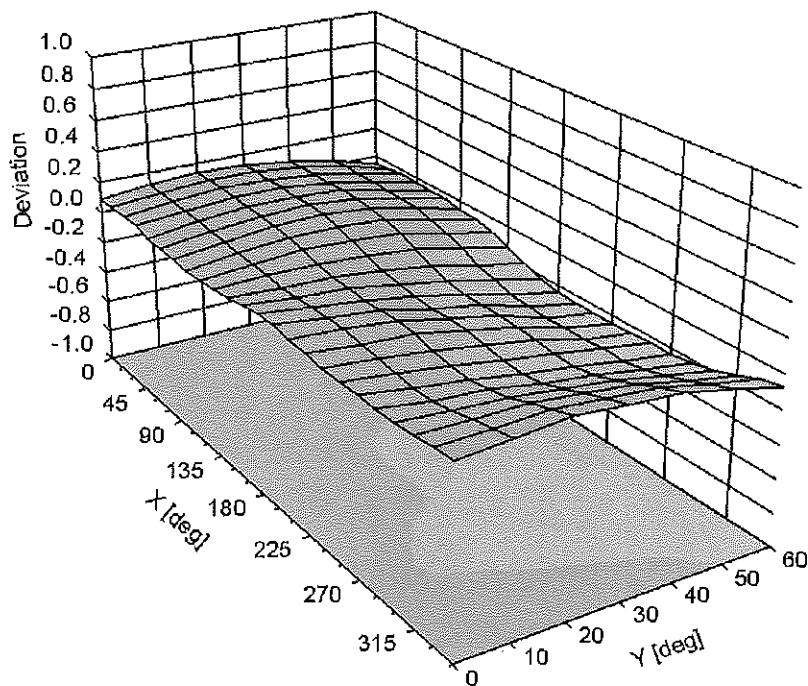


Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid Error (ϕ, ϑ), $f = 900 \text{ MHz}$



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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-110
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	2 mm



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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **ES3-3258_Feb14**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3258**

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

CCV
 3/6/14

Calibration date: **February 25, 2014**

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

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

Calibration Equipment used (M&TE critical for calibration)

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

Calibrated by:	Name Israe El-Naouq	Function Laboratory Technician	Signature
Approved by:	Katja Pokovic	Technical Manager	
			Issued: February 27, 2014
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- 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:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E^2 -field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,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.
- DCP_{x,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
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,y,z}**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).

Probe ES3DV3

SN:3258

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

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

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

Basic Calibration Parameters

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

Modulation Calibration Parameters

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

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

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

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

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

^A The uncertainties of NormX,Y,Z do not affect the E^2 -field uncertainty inside TSL (see Pages 8 and 9).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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

Calibration Parameter Determined in Head Tissue Simulating Media

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

^C Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

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

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

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

Calibration Parameter Determined in Body Tissue Simulating Media

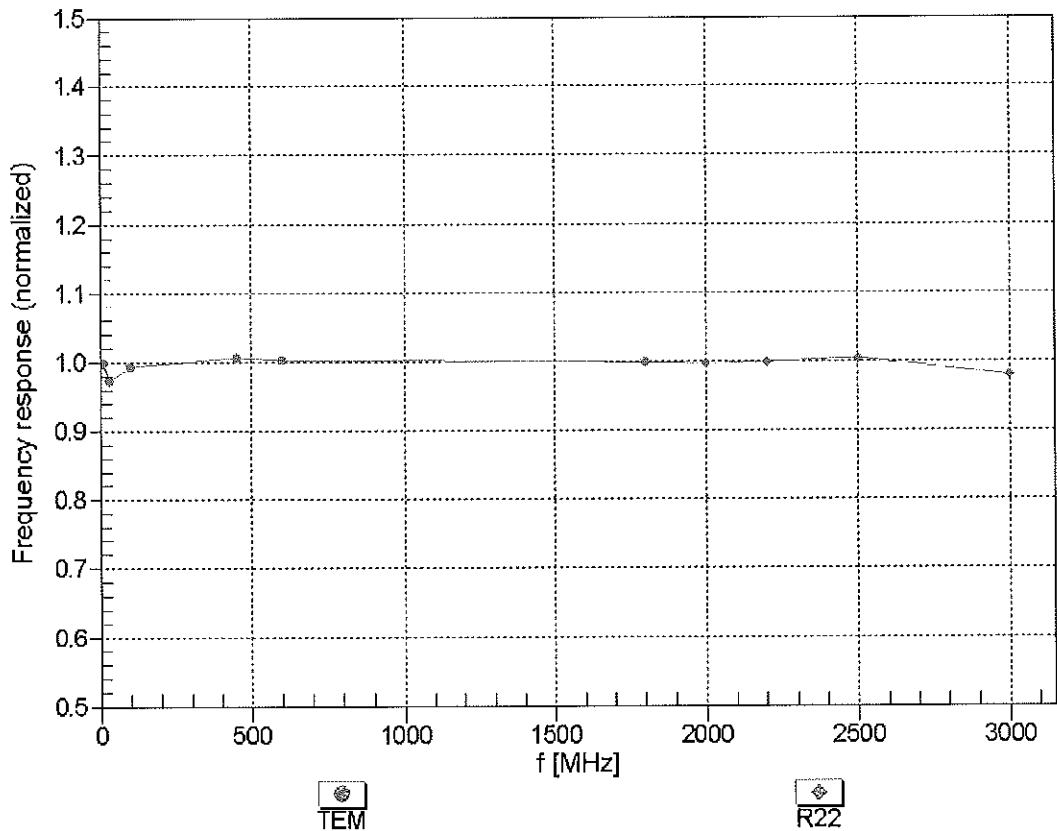
f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unct. (k=2)
750	55.5	0.96	6.15	6.15	6.15	0.61	1.32	± 12.0 %
835	55.2	0.97	6.11	6.11	6.11	0.80	1.15	± 12.0 %
1750	53.4	1.49	4.83	4.83	4.83	0.47	1.74	± 12.0 %
1900	53.3	1.52	4.61	4.61	4.61	0.55	1.59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

^C Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

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

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

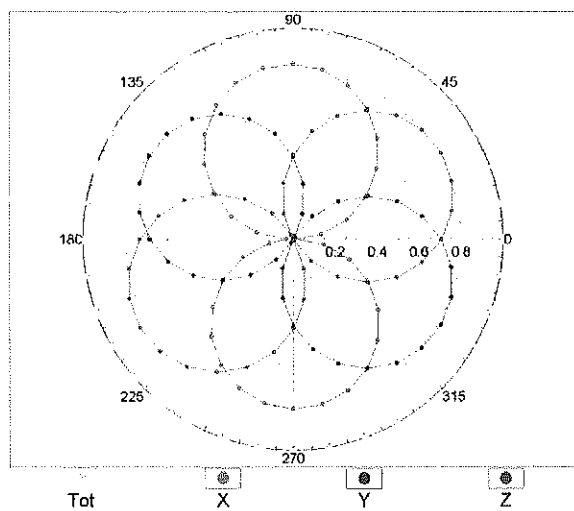
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



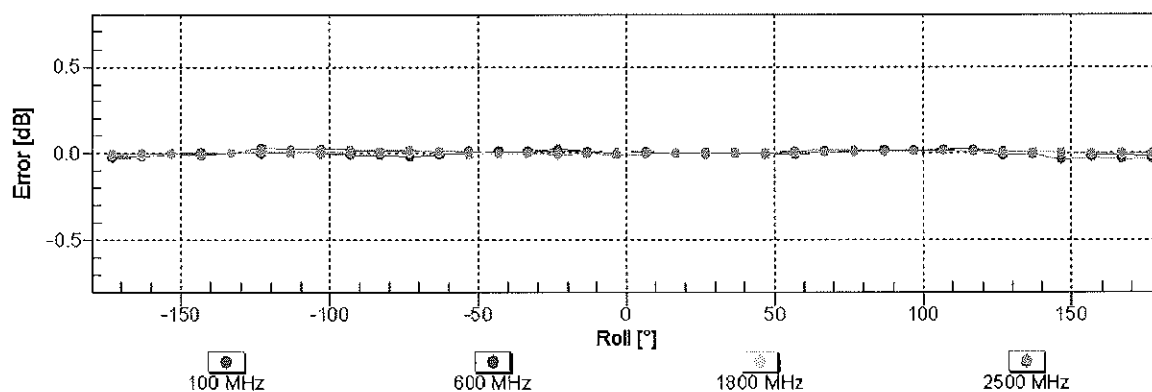
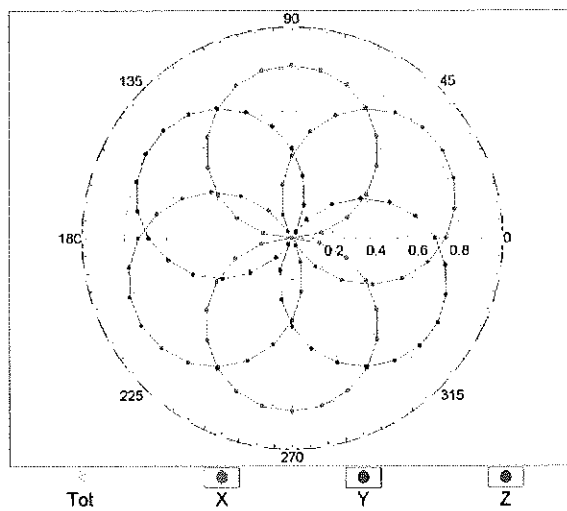
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

Receiving Pattern (ϕ), $\theta = 0^\circ$

f=600 MHz,TEM



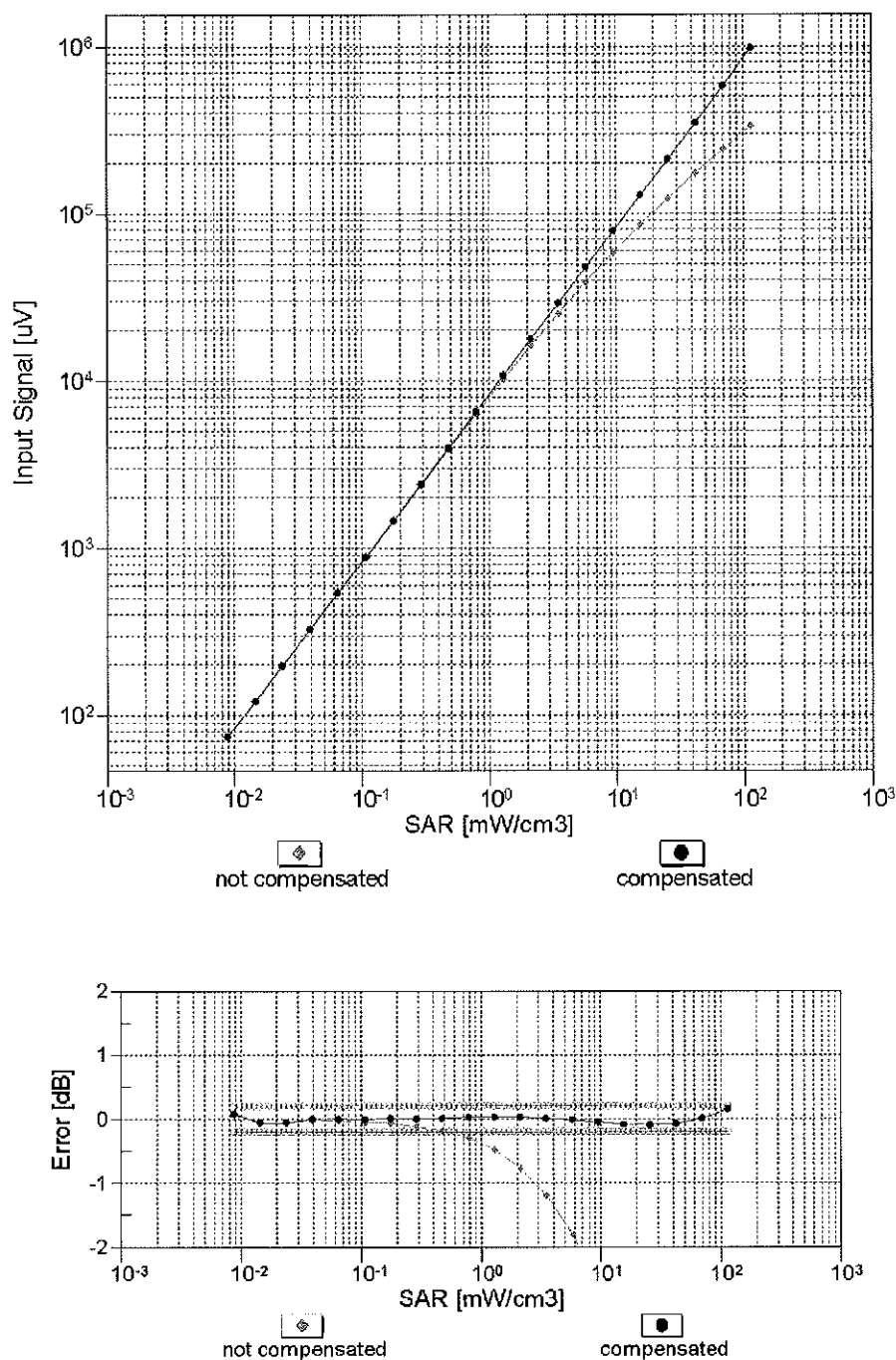
f=1800 MHz,R22



Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

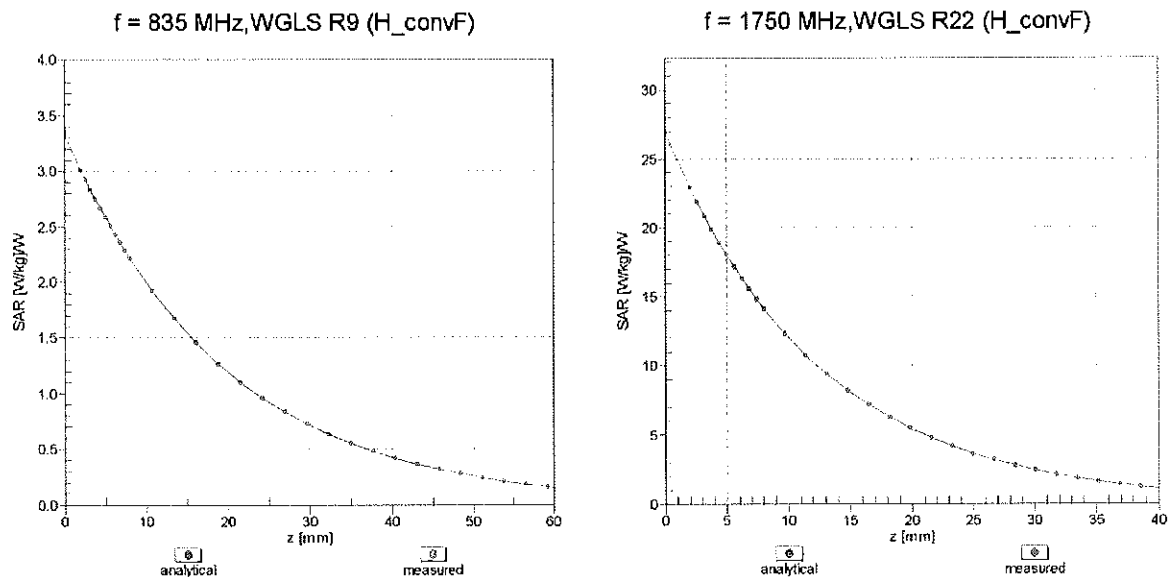
Dynamic Range f(SAR_{head})

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



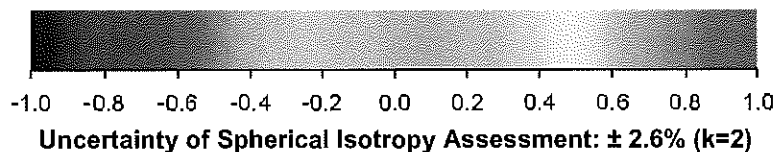
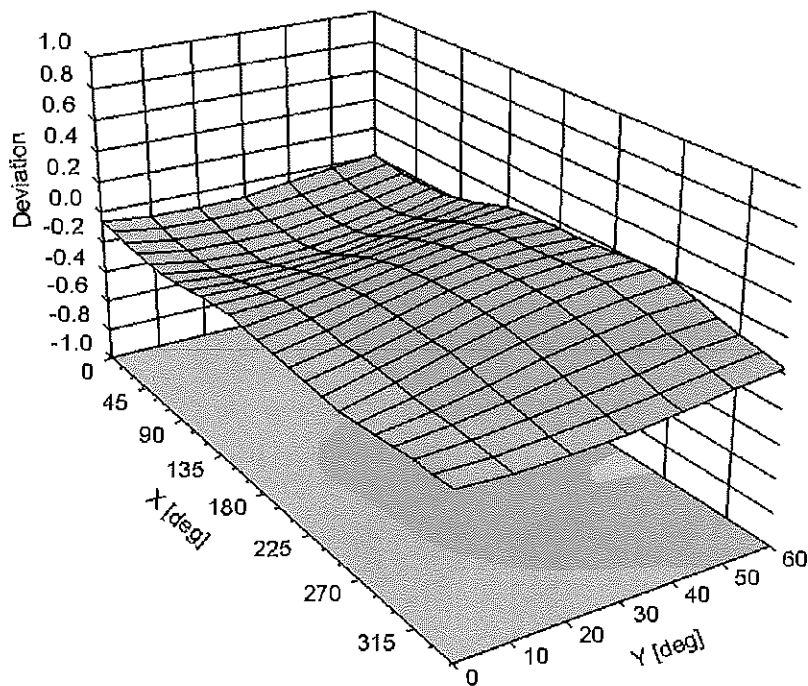
Uncertainty of Linearity Assessment: $\pm 0.6\%$ (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), $f = 900 \text{ MHz}$



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

Other Probe Parameters

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



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

Client **PC Test**

Certificate No: **ES3-3263_May14**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3263**

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

CCV
 7/17/14

Calibration date: **May 15, 2014**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

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

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	
			Issued: May 15, 2014
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			



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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- 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:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below *ConvF*).
- NORM(*f*)_{x,y,z}** = NORM_{x,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*.
- DCP_{x,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
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,y,z}**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * *ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).

Probe ES3DV3

SN:3263

Manufactured: January 25, 2010
Calibrated: May 15, 2014

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

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	1.21	1.24	1.13	$\pm 10.1 \%$
DCP (mV) ^B	103.8	102.3	104.7	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	156.3	$\pm 3.5 \%$
		Y	0.0	0.0	1.0		203.1	
		Z	0.0	0.0	1.0		197.2	
10010-CAA	SAR Validation (Square, 100ms, 10ms)	X	2.33	59.4	10.8	10.00	46.4	$\pm 1.4 \%$
		Y	4.39	63.4	13.6		50.8	
		Z	1.35	55.5	7.8		39.6	
10011-CAB	UMTS-FDD (WCDMA)	X	3.49	68.2	19.1	2.91	126.7	$\pm 0.7 \%$
		Y	3.28	66.9	18.5		120.7	
		Z	2.74	63.1	15.1		113.5	
10012-CAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps)	X	3.51	72.0	20.3	1.87	127.9	$\pm 0.7 \%$
		Y	3.21	69.4	18.8		124.1	
		Z	1.93	60.6	12.6		113.3	
10013-CAA	IEEE 802.11g WiFi 2.4 GHz (DSSS-OFDM, 6 Mbps)	X	11.30	70.8	23.3	9.46	125.2	$\pm 2.5 \%$
		Y	12.42	72.7	24.4		129.4	
		Z	10.03	67.8	21.1		105.5	
10021-DAB	GSM-FDD (TDMA, GMSK)	X	24.45	99.1	27.6	9.39	141.4	$\pm 1.4 \%$
		Y	29.93	99.5	29.0		124.5	
		Z	4.53	73.0	18.1		111.6	
10023-DAB	GPRS-FDD (TDMA, GMSK, TN 0)	X	25.10	99.7	27.9	9.57	134.2	$\pm 1.9 \%$
		Y	24.85	96.1	28.0		120.2	
		Z	5.99	76.5	19.1		142.5	
10024-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1)	X	24.34	93.0	23.0	6.56	117.1	$\pm 1.4 \%$
		Y	26.49	92.6	24.2		148.7	
		Z	4.00	69.6	13.8		136.6	
10027-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2)	X	51.24	99.9	23.5	4.80	131.1	$\pm 1.9 \%$
		Y	56.83	99.5	24.3		101.8	
		Z	1.70	61.4	9.1		107.7	
10028-DAB	GPRS-FDD (TDMA, GMSK, TN 0-1-2-3)	X	60.12	99.6	22.2	3.55	138.7	$\pm 1.9 \%$
		Y	64.73	99.9	23.4		105.5	
		Z	1.13	58.4	6.0		116.0	
10032-CAA	IEEE 802.15.1 Bluetooth (GFSK, DH5)	X	77.27	99.6	19.6	1.16	149.5	$\pm 2.5 \%$
		Y	60.44	99.7	21.0		109.4	
		Z	0.34	55.9	2.9		131.4	
10039-CAB	CDMA2000 (1xRTT, RC1)	X	4.79	66.8	19.0	4.57	124.5	$\pm 0.9 \%$
		Y	4.85	66.4	18.8		125.6	
		Z	4.06	63.4	16.1		108.1	

10081-CAB	CDMA2000 (1xRTT, RC3)	X	3.93	66.1	18.5	3.97	119.8	±0.7 %
		Y	3.90	65.5	18.2		120.1	
		Z	3.29	62.4	15.3		108.5	
10098-CAB	UMTS-FDD (HSUPA, Subtest 2)	X	4.68	66.9	18.7	3.98	131.2	±0.7 %
		Y	4.64	66.6	18.6		130.5	
		Z	4.15	64.5	16.5		118.8	
10100-CAB	LTE-FDD (SC-FDMA, 100% RB, 20 MHz, QPSK)	X	6.61	68.1	20.0	5.67	137.5	±1.7 %
		Y	6.70	68.4	20.2		137.7	
		Z	5.90	65.6	17.9		124.0	
10108-CAB	LTE-FDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	6.44	67.5	19.8	5.80	135.1	±1.7 %
		Y	6.60	68.0	20.1		135.4	
		Z	5.75	64.9	17.6		121.8	
10110-CAB	LTE-FDD (SC-FDMA, 100% RB, 5 MHz, QPSK)	X	6.14	67.1	19.7	5.75	131.6	±1.2 %
		Y	6.28	67.4	19.9		132.7	
		Z	5.62	65.5	18.2		118.4	
10114-CAA	IEEE 802.11n (HT Greenfield, 13.5 Mbps, BPSK)	X	10.18	68.8	21.2	8.10	124.3	±1.9 %
		Y	10.60	69.7	21.8		126.2	
		Z	9.38	67.0	19.8		108.4	
10117-CAA	IEEE 802.11n (HT Mixed, 13.5 Mbps, BPSK)	X	10.23	68.9	21.3	8.07	125.0	±1.9 %
		Y	10.56	69.6	21.7		127.1	
		Z	9.37	67.1	19.8		109.1	
10151-CAB	LTE-TDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	10.23	75.7	26.0	9.28	125.0	±2.7 %
		Y	14.60	83.3	29.5		147.3	
		Z	8.05	69.7	22.3		106.3	
10154-CAB	LTE-FDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	6.12	67.0	19.6	5.75	131.6	±1.4 %
		Y	6.28	67.4	19.9		132.4	
		Z	5.49	64.7	17.4		117.9	
10160-CAB	LTE-FDD (SC-FDMA, 50% RB, 15 MHz, QPSK)	X	6.57	67.5	19.8	5.82	136.0	±1.4 %
		Y	6.71	67.9	20.1		137.1	
		Z	5.89	65.2	17.8		122.4	
10169-CAB	LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	4.82	66.0	19.3	5.73	113.5	±1.4 %
		Y	5.12	66.3	19.4		116.6	
		Z	4.75	65.9	18.3		142.7	
10172-CAB	LTE-TDD (SC-FDMA, 1 RB, 20 MHz, QPSK)	X	9.53	80.6	28.6	9.21	136.5	±2.2 %
		Y	11.32	81.6	28.8		109.2	
		Z	6.84	72.0	23.8		117.3	
10175-CAB	LTE-FDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	4.86	66.2	19.4	5.72	112.9	±1.2 %
		Y	5.10	66.2	19.4		115.9	
		Z	4.55	64.9	17.8		137.7	
10181-CAB	LTE-FDD (SC-FDMA, 1 RB, 15 MHz, QPSK)	X	4.81	66.0	19.2	5.72	111.6	±1.2 %
		Y	5.13	66.4	19.5		116.1	
		Z	4.70	65.7	18.3		137.1	
10193-CAA	IEEE 802.11n (HT Greenfield, 6.5 Mbps, BPSK)	X	9.80	68.3	21.0	8.09	117.2	±2.2 %
		Y	10.23	69.1	21.6		121.5	
		Z	9.85	68.9	20.8		148.4	

10196-CAA	IEEE 802.11n (HT Mixed, 6.5 Mbps, BPSK)	X	9.81	68.4	21.1	8.10	117.7	±2.2 %
		Y	10.23	69.2	21.6		121.7	
		Z	9.87	69.0	20.9		149.9	
10219-CAA	IEEE 802.11n (HT Mixed, 7.2 Mbps, BPSK)	X	9.71	68.3	21.0	8.03	117.8	±2.2 %
		Y	10.12	69.1	21.6		121.0	
		Z	8.90	66.6	19.6		104.1	
10222-CAA	IEEE 802.11n (HT Mixed, 15 Mbps, BPSK)	X	10.14	68.7	21.2	8.06	122.3	±1.9 %
		Y	10.52	69.5	21.7		125.4	
		Z	9.28	66.8	19.6		108.5	
10225-CAB	UMTS-FDD (HSPA+)	X	7.25	67.8	19.9	5.97	146.3	±1.7 %
		Y	7.32	67.5	19.8		149.3	
		Z	6.52	65.7	18.0		130.7	
10237-CAB	LTE-TDD (SC-FDMA, 1 RB, 10 MHz, QPSK)	X	9.55	80.7	28.7	9.21	137.2	±2.5 %
		Y	11.34	81.7	28.9		109.9	
		Z	6.98	72.5	24.0		119.5	
10252-CAB	LTE-TDD (SC-FDMA, 50% RB, 10 MHz, QPSK)	X	9.26	74.1	25.3	9.24	115.6	±3.3 %
		Y	13.72	82.5	29.3		137.9	
		Z	8.83	73.3	24.4		144.1	
10267-CAB	LTE-TDD (SC-FDMA, 100% RB, 10 MHz, QPSK)	X	10.06	75.2	25.8	9.30	122.9	±2.7 %
		Y	14.69	83.4	29.6		147.6	
		Z	8.02	69.6	22.3		103.4	
10274-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.10)	X	6.08	67.2	19.0	4.87	140.2	±1.2 %
		Y	6.23	67.5	19.2		143.5	
		Z	5.52	65.4	17.4		125.1	
10275-CAB	UMTS-FDD (HSUPA, Subtest 5, 3GPP Rel8.4)	X	4.44	66.7	18.7	3.96	122.1	±0.7 %
		Y	4.39	66.3	18.5		124.4	
		Z	3.83	63.7	16.0		114.0	
10291-AAB	CDMA2000, RC3, SO55, Full Rate	X	3.64	66.7	18.6	3.46	115.7	±0.7 %
		Y	3.60	66.0	18.2		118.0	
		Z	3.17	64.2	16.3		108.4	
10292-AAB	CDMA2000, RC3, SO32, Full Rate	X	3.62	67.0	18.8	3.39	116.9	±0.9 %
		Y	3.54	66.1	18.2		119.1	
		Z	3.24	64.2	15.8		145.6	
10297-AAA	LTE-FDD (SC-FDMA, 50% RB, 20 MHz, QPSK)	X	6.43	67.5	19.8	5.81	132.0	±1.4 %
		Y	6.60	68.0	20.1		134.9	
		Z	5.81	65.4	18.0		115.0	
10311-AAA	LTE-FDD (SC-FDMA, 100% RB, 15 MHz, QPSK)	X	7.04	68.1	20.2	6.06	137.5	±1.4 %
		Y	7.19	68.6	20.5		140.3	
		Z	6.26	65.7	18.2		119.6	
10315-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 96pc duty cycle)	X	3.05	70.0	19.4	1.71	121.7	±0.7 %
		Y	2.91	68.7	18.7		123.4	
		Z	1.83	60.2	12.3		108.4	
10316-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 96pc duty cycle)	X	10.05	68.7	21.4	8.36	117.3	±1.9 %
		Y	10.57	69.7	22.0		122.8	
		Z	9.11	66.5	19.7		103.1	

10403-AAB	CDMA2000 (1xEV-DO, Rev. 0)	X	4.81	68.3	18.8	3.76	125.8	±0.7 %
		Y	4.65	66.5	18.1		130.8	
		Z	3.98	64.7	16.0		114.7	
10404-AAB	CDMA2000 (1xEV-DO, Rev. A)	X	4.91	69.1	19.2	3.77	123.3	±0.7 %
		Y	4.60	66.6	18.1		128.5	
		Z	3.73	64.0	15.4		112.0	
10415-AAA	IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle)	X	2.78	69.0	19.0	1.54	121.9	±0.7 %
		Y	2.46	66.8	17.9		122.5	
		Z	1.83	60.9	13.0		112.4	
10416-AAA	IEEE 802.11g WiFi 2.4 GHz (ERP-OFDM, 6 Mbps, 99pc duty cycle)	X	9.88	68.4	21.2	8.23	116.6	±1.7 %
		Y	10.29	69.2	21.7		121.5	
		Z	9.25	67.3	20.2		103.4	

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

^A The uncertainties of NormX,Y,Z do not affect the E^2 -field uncertainty inside TSL (see Pages 8 and 9).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unct. (k=2)
750	41.9	0.89	6.42	6.42	6.42	0.72	1.18	± 12.0 %
835	41.5	0.90	6.23	6.23	6.23	0.27	2.02	± 12.0 %
1750	40.1	1.37	5.41	5.41	5.41	0.74	1.23	± 12.0 %
1900	40.0	1.40	5.08	5.08	5.08	0.80	1.16	± 12.0 %
2450	39.2	1.80	4.47	4.47	4.47	0.80	1.22	± 12.0 %
2600	39.0	1.96	4.33	4.33	4.33	0.66	1.41	± 12.0 %

^C Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

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

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

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

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unct. (k=2)
750	55.5	0.96	6.19	6.19	6.19	0.52	1.41	± 12.0 %
835	55.2	0.97	6.16	6.16	6.16	0.68	1.28	± 12.0 %
1750	53.4	1.49	4.98	4.98	4.98	0.38	1.91	± 12.0 %
1900	53.3	1.52	4.78	4.78	4.78	0.66	1.35	± 12.0 %
2450	52.7	1.95	4.27	4.27	4.27	0.72	1.13	± 12.0 %
2600	52.5	2.16	4.11	4.11	4.11	0.74	1.07	± 12.0 %

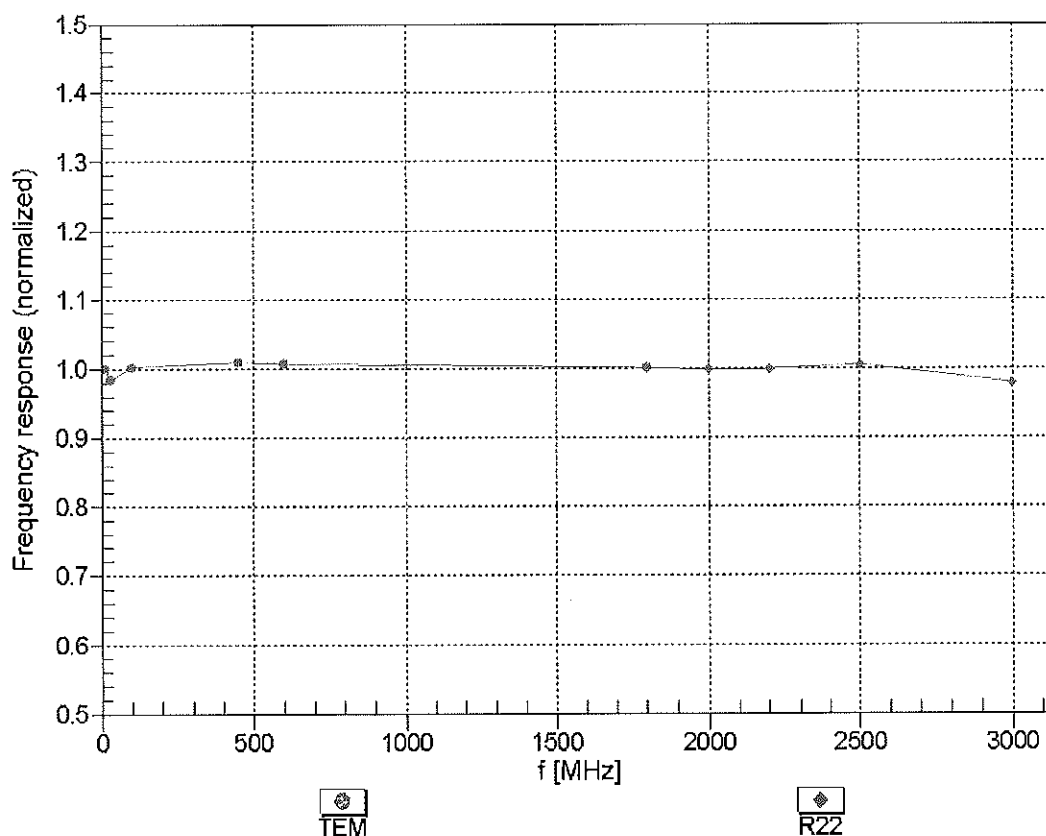
^C Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

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

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

Frequency Response of E-Field

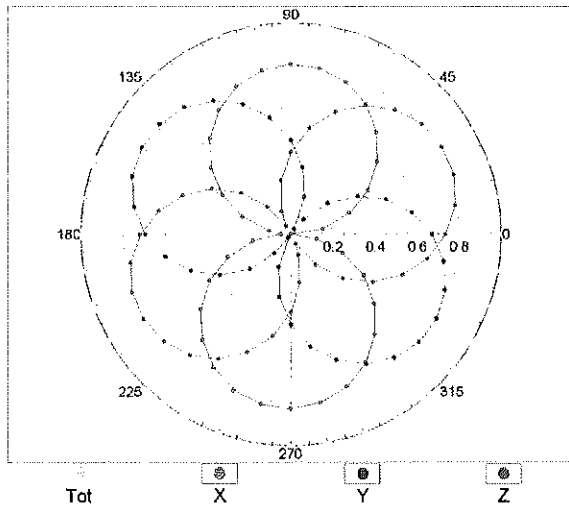
(TEM-Cell:ifi110 EXX, Waveguide: R22)



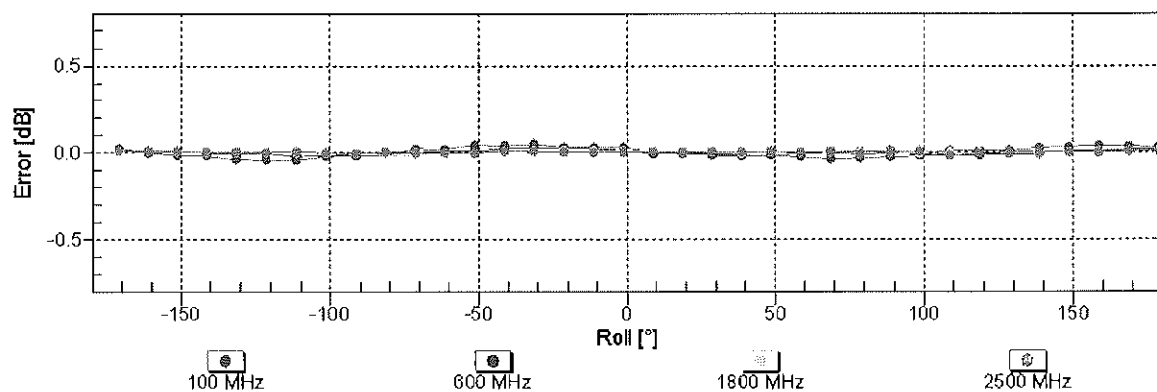
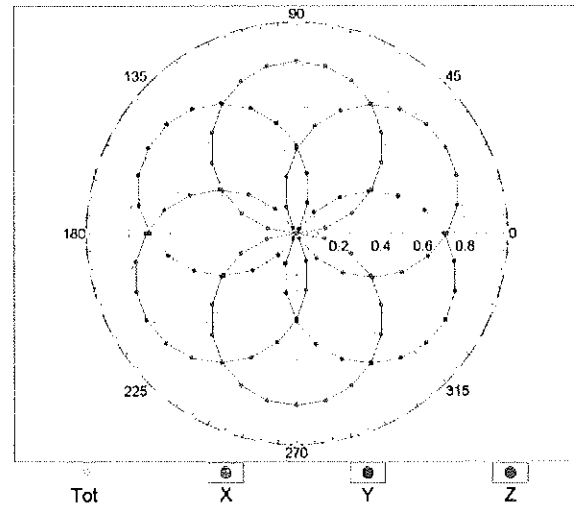
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

Receiving Pattern (ϕ), $\theta = 0^\circ$

f=600 MHz,TEM

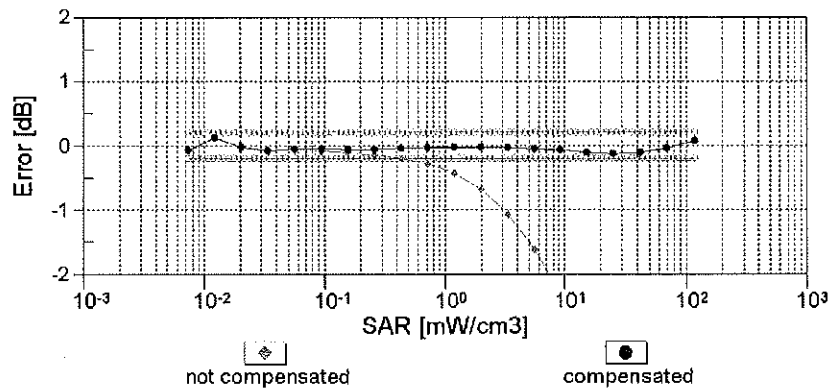
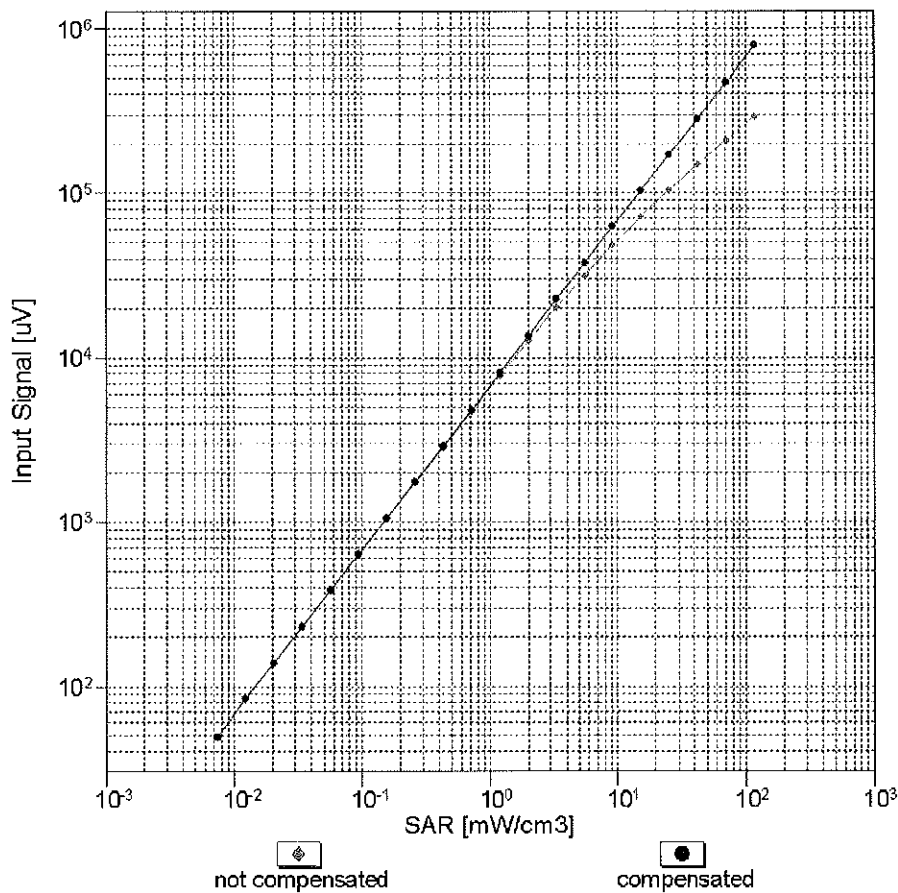


f=1800 MHz,R22



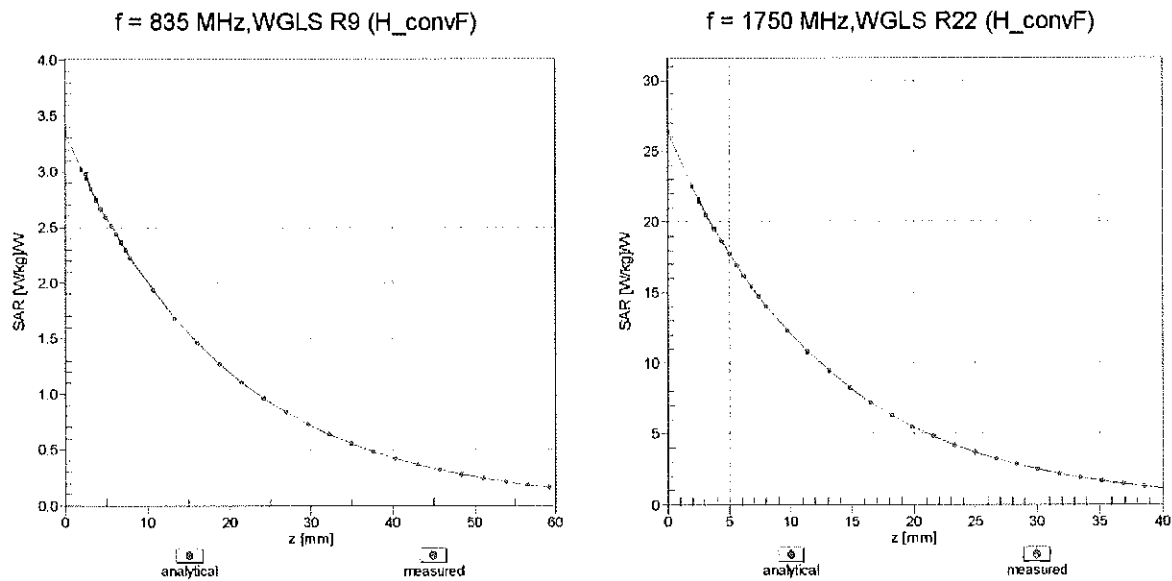
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

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

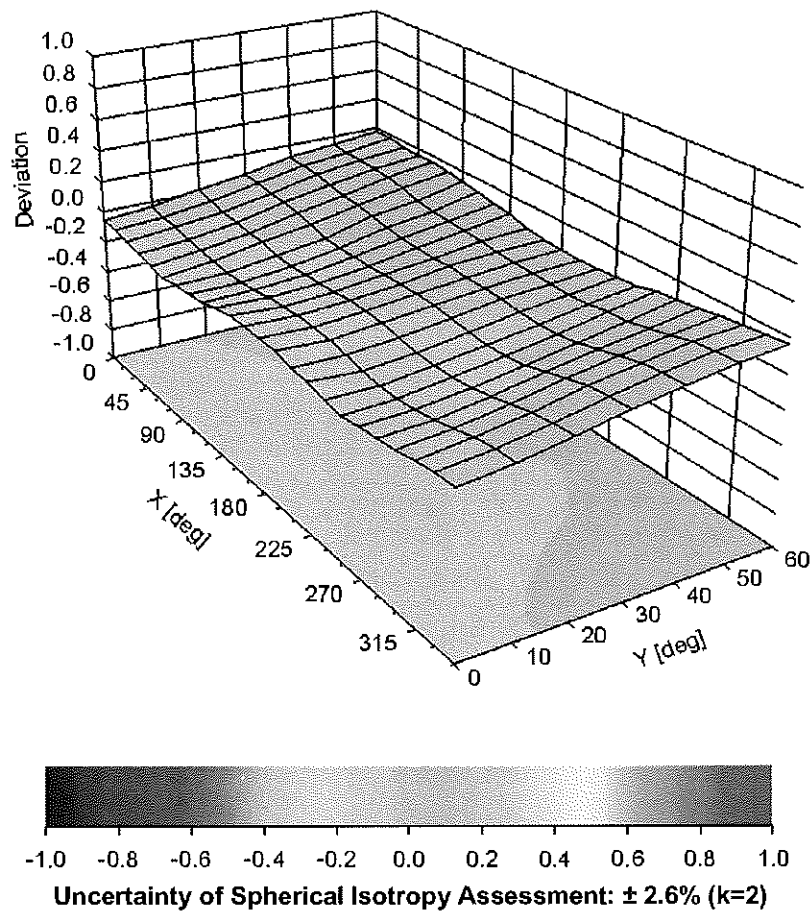


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid Error (ϕ, ϑ), $f = 900 \text{ MHz}$



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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-111.2
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



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: **D835V2-4d119_Apr14**

CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d119**

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

CCV
4/25/14

Calibration date: **April 07, 2014**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

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

Calibrated by: **Name** **Function** **Signature**
Leif Klysner **Laboratory Technician**

Approved by: **Katja Pokovic** **Technical Manager**

Issued: April 9, 2014

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



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Accreditation No.: **SCS 108**

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.7
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 $\pm$ 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 $\pm$ 0.2) °C	41.6 $\pm$ 6 %	0.94 mho/m $\pm$ 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	2.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.22 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.53 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	5.97 W/kg $\pm$ 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 $\pm$ 0.2) °C	53.6 $\pm$ 6 %	1.02 mho/m $\pm$ 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	2.44 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.34 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.59 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.15 W/kg $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.2 Ω - 1.6 j Ω
Return Loss	- 34.0 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.3 Ω - 4.5 j Ω
Return Loss	- 24.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.386 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	June 29, 2010

DASY5 Validation Report for Head TSL

Date: 07.04.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: $f = 835$ MHz; $\sigma = 0.94$ S/m; $\epsilon_r = 41.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.22, 6.22, 6.22); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

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

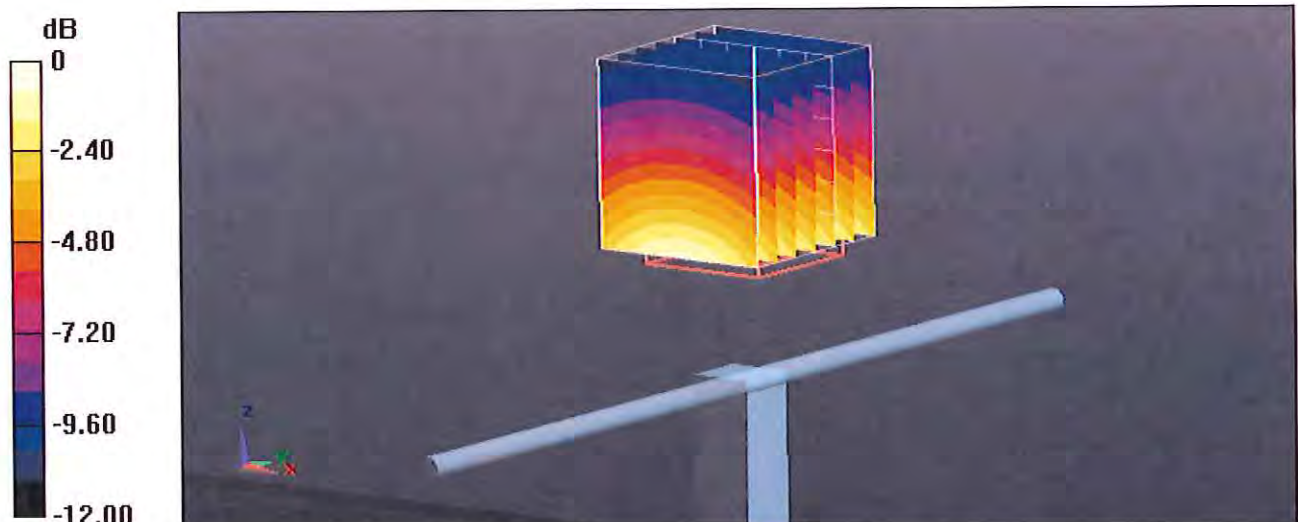
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.289 V/m; Power Drift = 0.01 dB

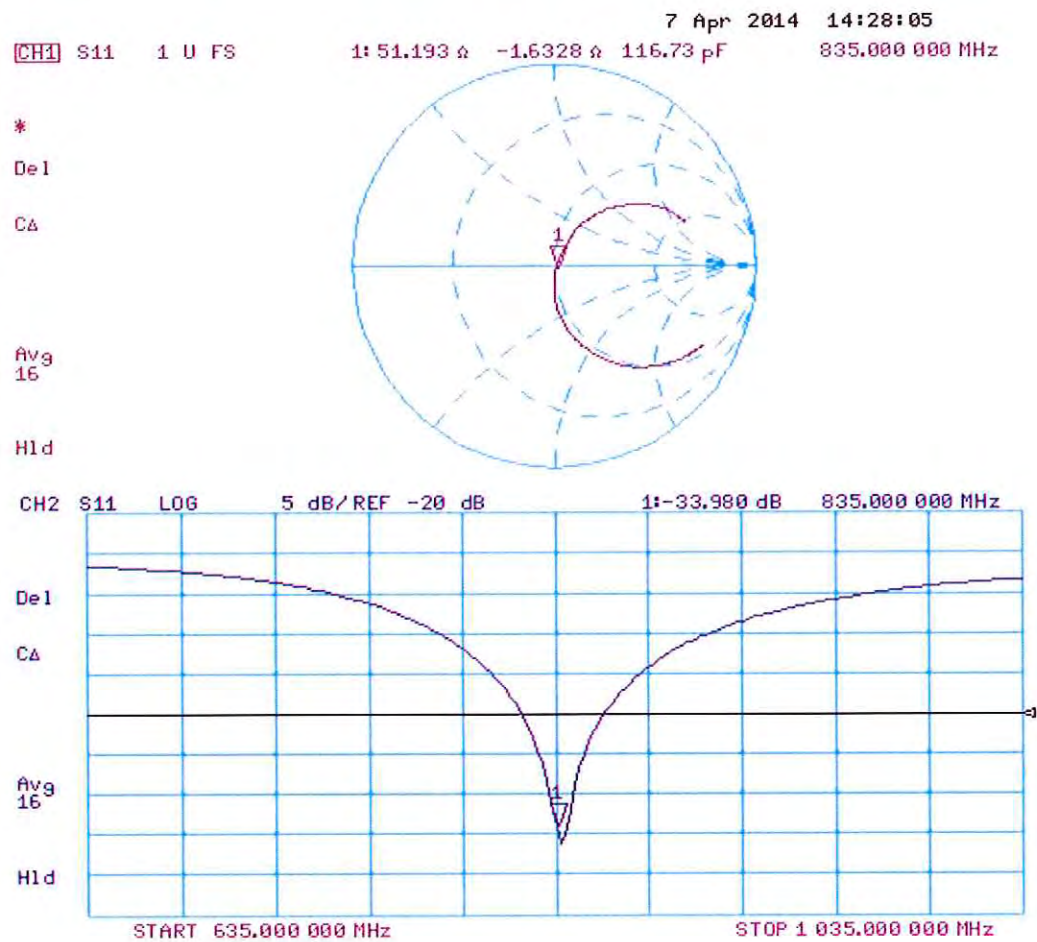
Peak SAR (extrapolated) = 3.59 W/kg

SAR(1 g) = 2.38 W/kg; SAR(10 g) = 1.53 W/kg

Maximum value of SAR (measured) = 2.80 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 07.04.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used: $f = 835$ MHz; $\sigma = 1.02$ S/m; $\epsilon_r = 53.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.09, 6.09, 6.09); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

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

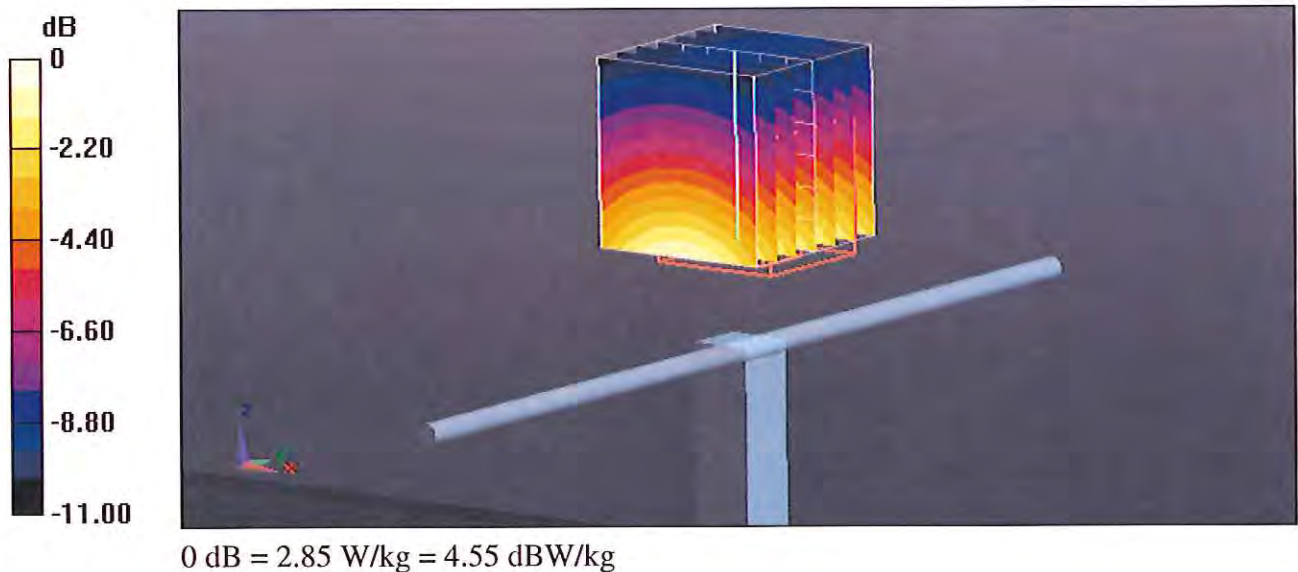
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 54.594 V/m; Power Drift = -0.01 dB

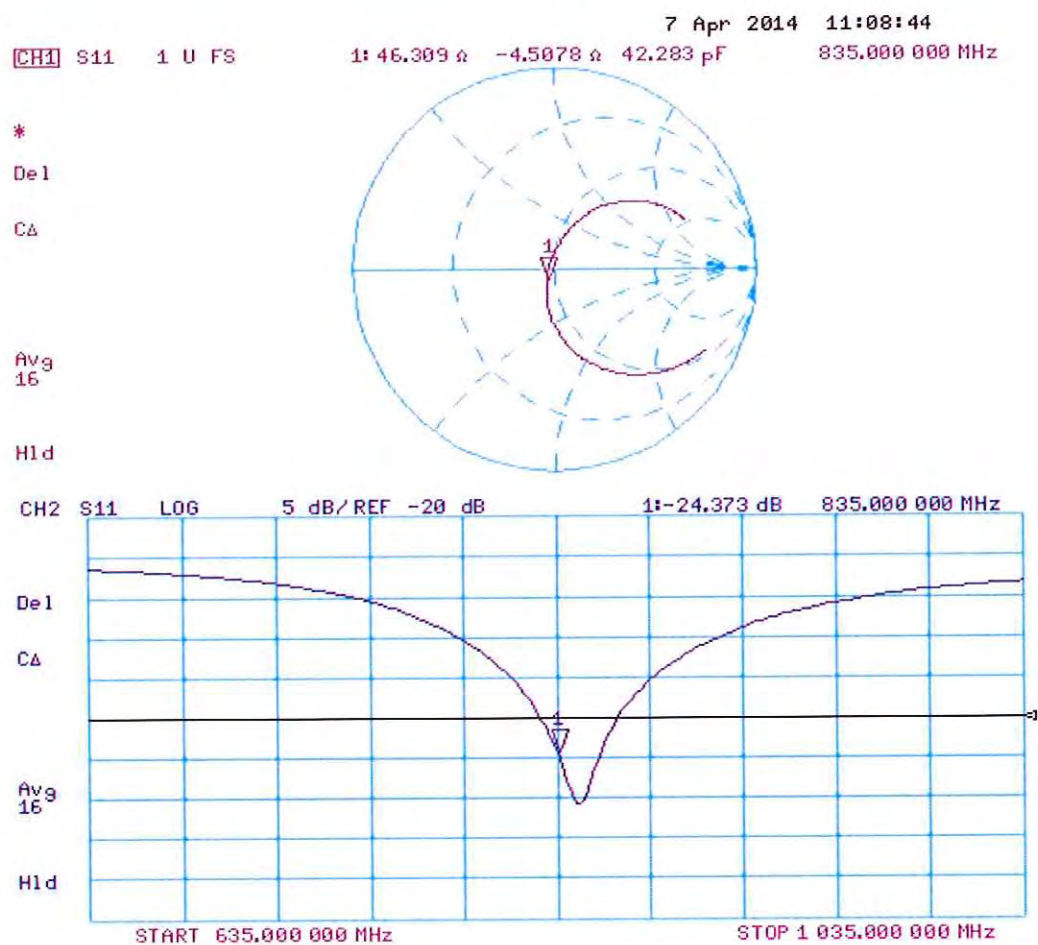
Peak SAR (extrapolated) = 3.61 W/kg

SAR(1 g) = 2.44 W/kg; SAR(10 g) = 1.59 W/kg

Maximum value of SAR (measured) = 2.85 W/kg



Impedance Measurement Plot for Body TSL





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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D1900V2-5d141_Apr14**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d141**

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

Calibration date: **April 09, 2014**

✓
KOK
5/7/14

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 $(22 \pm 3)^{\circ}\text{C}$ 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	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

Calibrated by: **Claudio Leubler** Name: **Claudio Leubler** Function: **Laboratory Technician**

Approved by: **Katja Pokovic** Name: **Katja Pokovic** Function: **Technical Manager**

Signature

[Handwritten signatures]

Issued: April 9, 2014

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Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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Multilateral Agreement for the recognition of calibration certificates

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:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- 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	V52.8.7
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 $\pm$ 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 $\pm$ 0.2) °C	39.1 $\pm$ 6 %	1.36 mho/m $\pm$ 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	9.91 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.1 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.8 W/kg $\pm$ 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 $\pm$ 0.2) °C	52.4 $\pm$ 6 %	1.52 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.2 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	40.6 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.41 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.6 W/kg $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$52.8 \Omega + 5.5 j\Omega$
Return Loss	- 24.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$48.8 \Omega + 6.3 j\Omega$
Return Loss	- 23.7 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: 09.04.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d141

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.36$ S/m; $\epsilon_r = 39.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.06, 5.06, 5.06); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

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

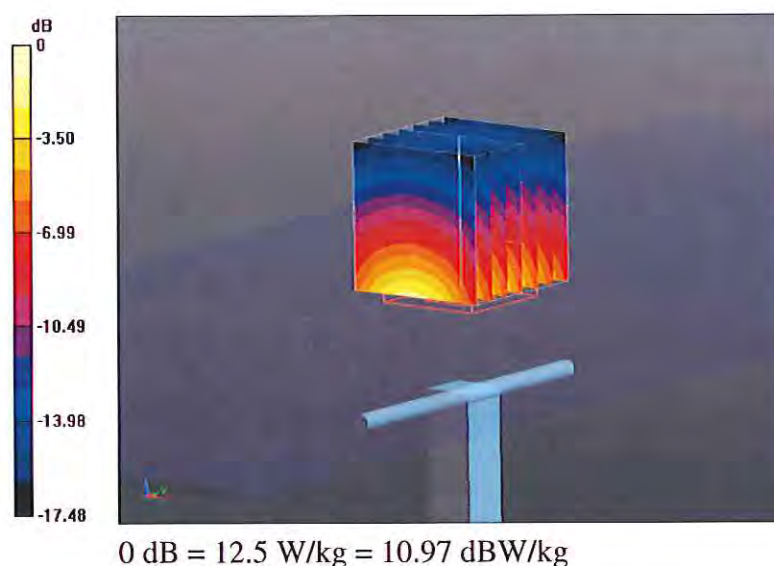
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 99.080 V/m; Power Drift = 0.01 dB

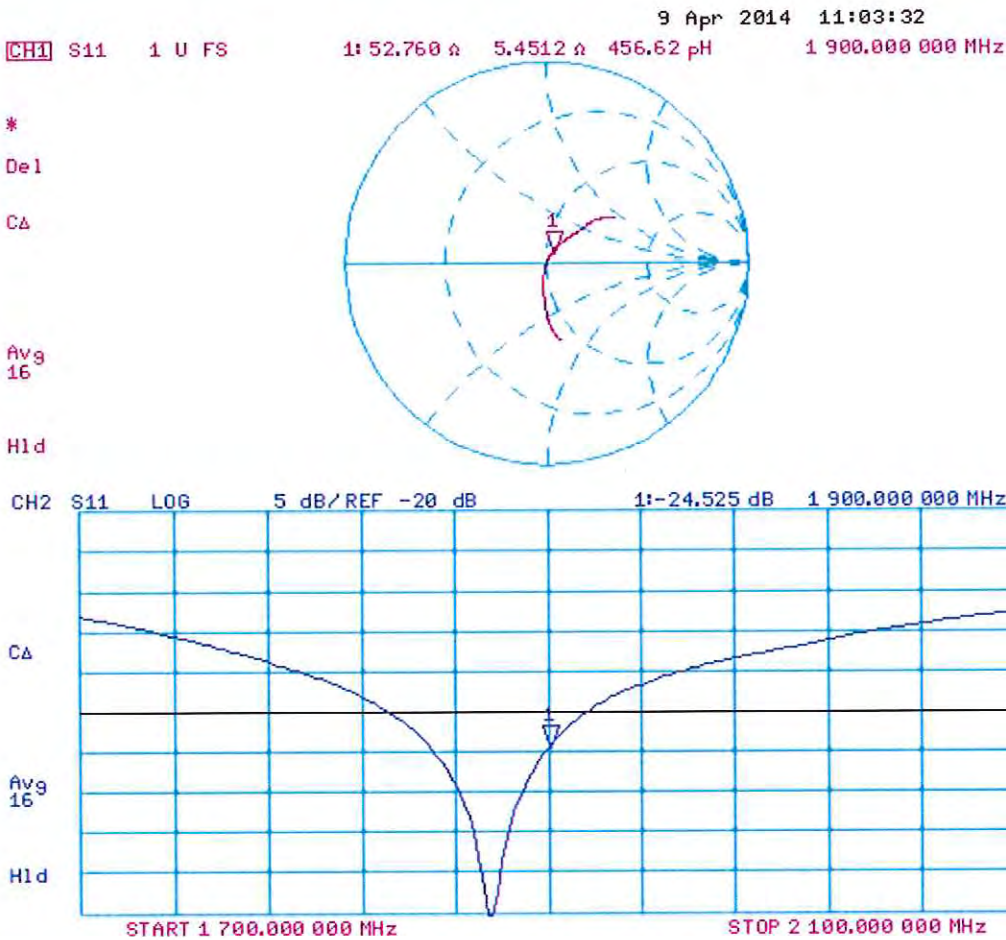
Peak SAR (extrapolated) = 18.2 W/kg

SAR(1 g) = 9.91 W/kg; SAR(10 g) = 5.17 W/kg

Maximum value of SAR (measured) = 12.5 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 09.04.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d141

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.52$ S/m; $\epsilon_r = 52.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.76, 4.76, 4.76); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

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

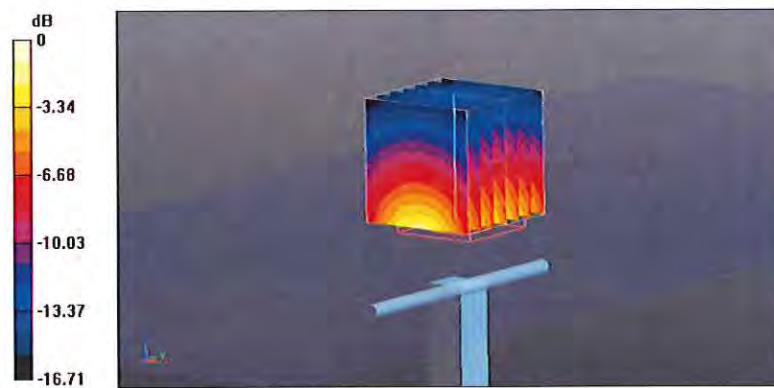
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.820 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 17.9 W/kg

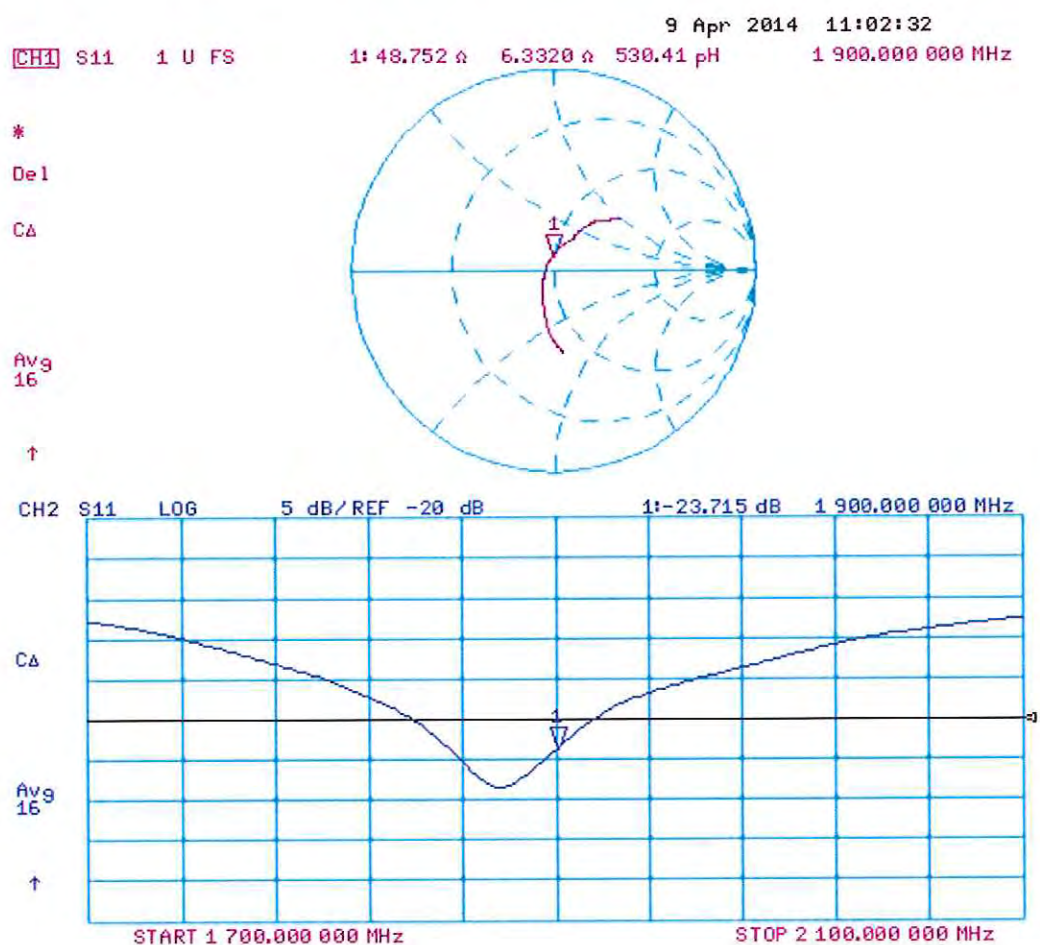
SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.41 W/kg

Maximum value of SAR (measured) = 12.9 W/kg



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

Impedance Measurement Plot for Body TSL





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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D2450V2-797_Jan14**

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 21, 2014**

CC ✓
2/5/14

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 $(22 \pm 3)^{\circ}\text{C}$ 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	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-13 (No. 217-01736)	Apr-14
Type-N mismatch combination	SN: 5047.3 / 06327	04-Apr-13 (No. 217-01739)	Apr-14
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: January 21, 2014

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Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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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:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- 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	V52.8.7
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 $\pm$ 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 $\pm$ 0.2) °C	38.7 $\pm$ 6 %	1.86 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	51.8 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.13 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.3 W/kg $\pm$ 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 $\pm$ 0.2) °C	51.3 $\pm$ 6 %	2.04 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.7 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	49.4 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.86 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	23.1 W/kg $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$53.5 \Omega + 3.2 j\Omega$
Return Loss	- 26.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$50.0 \Omega + 4.9 j\Omega$
Return Loss	- 26.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.151 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	January 24, 2006

DASY5 Validation Report for Head TSL

Date: 21.01.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.86$ S/m; $\epsilon_r = 38.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

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

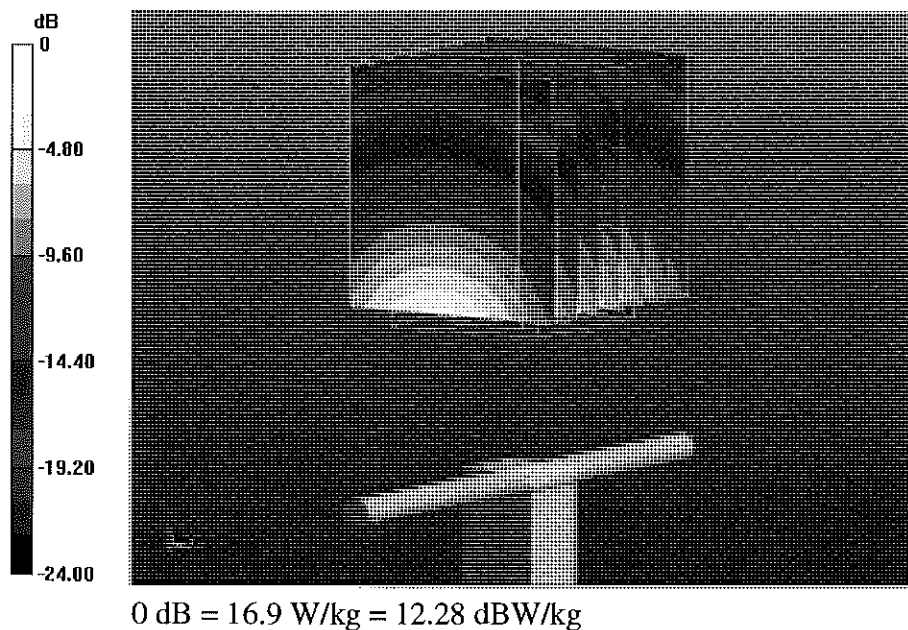
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 99.151 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 27.5 W/kg

SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.13 W/kg

Maximum value of SAR (measured) = 16.9 W/kg



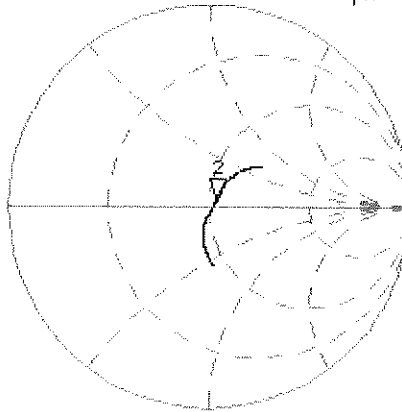
Impedance Measurement Plot for Head TSL

21 Jan 2014 11:31:52
 [CH1] S11 1 U FS 2: 53.512 $\angle$ 3.2285 $\angle$ 209.73 pH 2 450.000 000 MHz

*
 Del
 CA

Avg
 16

H1d

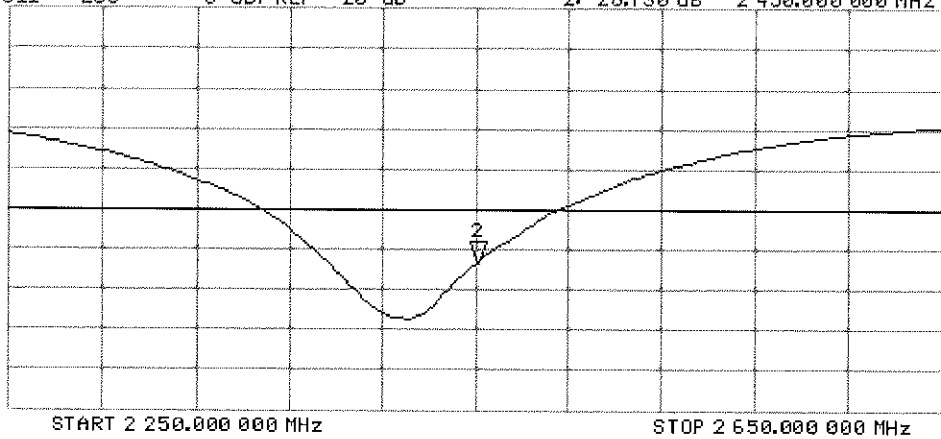


CH2 S11 LOG 5 dB/REF -20 dB 2:-26.730 dB 2 450.000 000 MHz

CA

Avg
 16

H1d



DASY5 Validation Report for Body TSL

Date: 21.01.2014

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: UID 0 - CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.04$ S/m; $\epsilon_r = 51.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

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

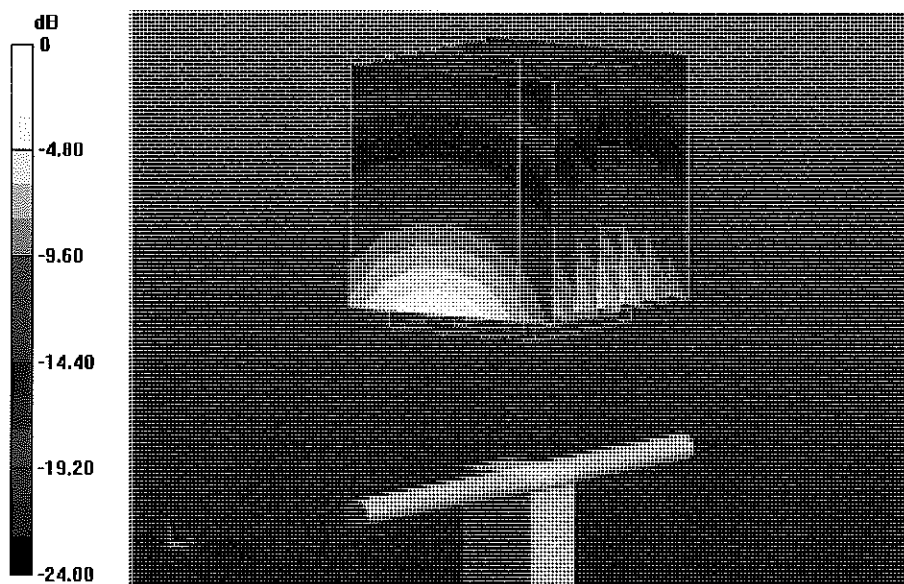
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.709 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 26.4 W/kg

SAR(1 g) = 12.7 W/kg; SAR(10 g) = 5.86 W/kg

Maximum value of SAR (measured) = 16.8 W/kg



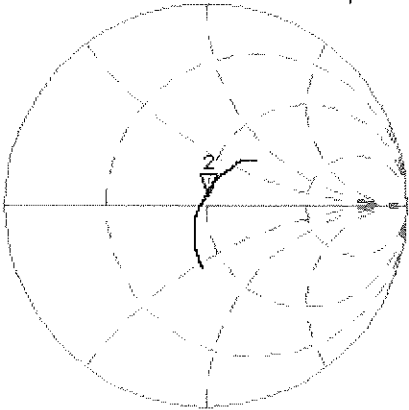
0 dB = 16.8 W/kg = 12.25 dBW/kg

Impedance Measurement Plot for Body TSL

21 Jan 2014 11:31:29

CH1 S11 1 U FS 2: 49.994 Ω 4.9258 Ω 319.98 μH 2 450.000 000 MHz

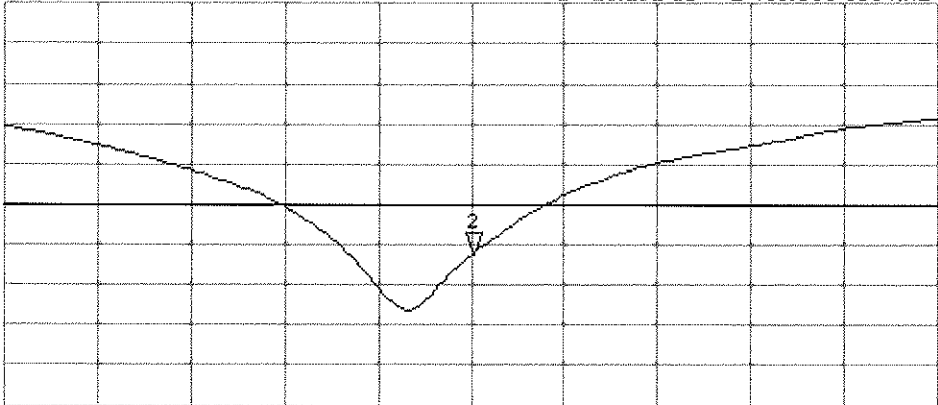
*
Del
CA



Avg
16
H1d

CH2 S11 LOG 5 dB/REF -20 dB 2:-26.162 dB 2 450.000 000 MHz

CA
Avg
16
H1d



START 2 250.000 000 MHz

STOP 2 450.000 000 MHz



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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D2600V2-1004_Apr14**

CALIBRATION CERTIFICATE

Object **D2600V2 - SN: 1004**

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

Calibration date: **April 08, 2014**

✓ KOK
5/7/14

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	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: April 9, 2014

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



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- 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	V52.8.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	37.7 $\pm$ 6 %	1.98 mho/m $\pm$ 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	14.5 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	57.3 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.44 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	25.6 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	50.2 $\pm$ 6 %	2.19 mho/m $\pm$ 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	14.4 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	56.7 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.38 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	25.2 W/kg $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.4 Ω - 4.8 j Ω
Return Loss	- 26.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.4 Ω - 3.3 j Ω
Return Loss	- 25.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.149 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 23, 2006

DASY5 Validation Report for Head TSL

Date: 08.04.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1004

Communication System: UID 0 - CW; Frequency: 2600 MHz

Medium parameters used: $f = 2600$ MHz; $\sigma = 1.98$ S/m; $\epsilon_r = 37.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.46, 4.46, 4.46); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

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

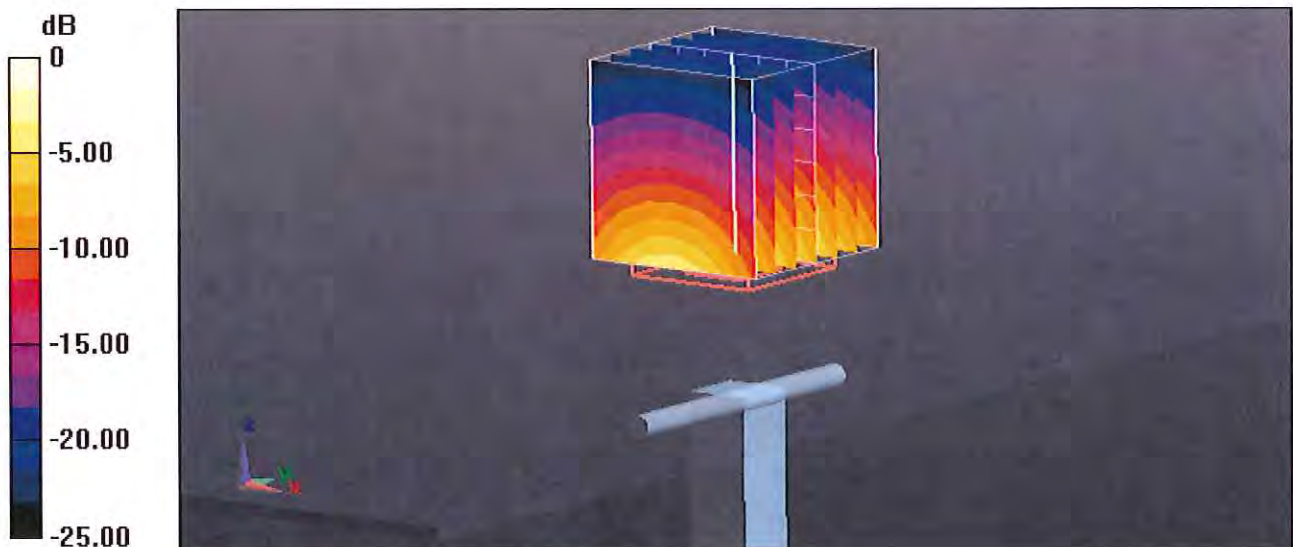
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 103.0 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 30.7 W/kg

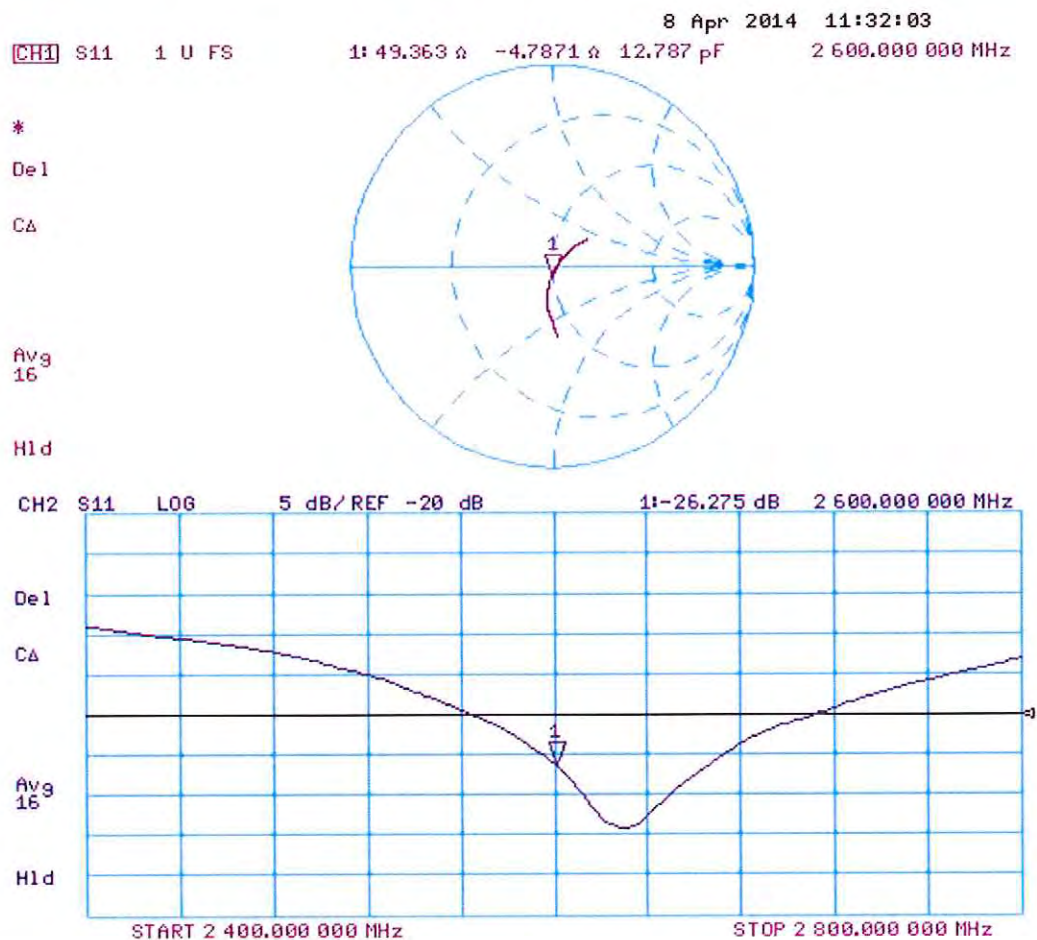
SAR(1 g) = 14.5 W/kg; SAR(10 g) = 6.44 W/kg

Maximum value of SAR (measured) = 19.3 W/kg



0 dB = 19.3 W/kg = 12.86 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 08.04.2014

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1004

Communication System: UID 0 - CW; Frequency: 2600 MHz

Medium parameters used: $f = 2600$ MHz; $\sigma = 2.19$ S/m; $\epsilon_r = 50.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.24, 4.24, 4.24); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

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

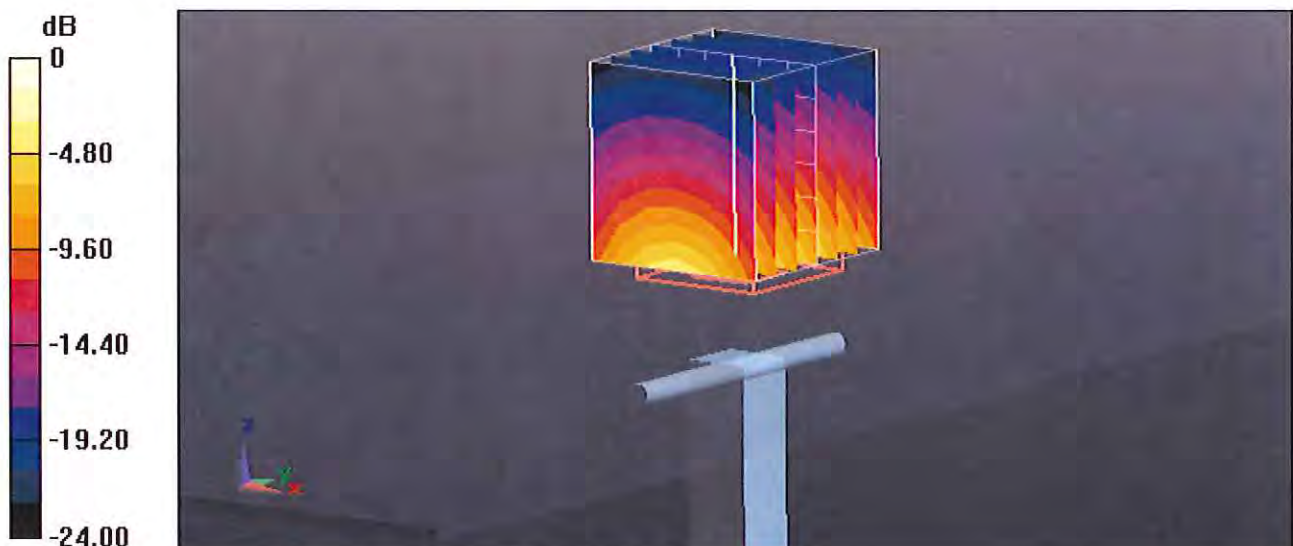
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.472 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 31.1 W/kg

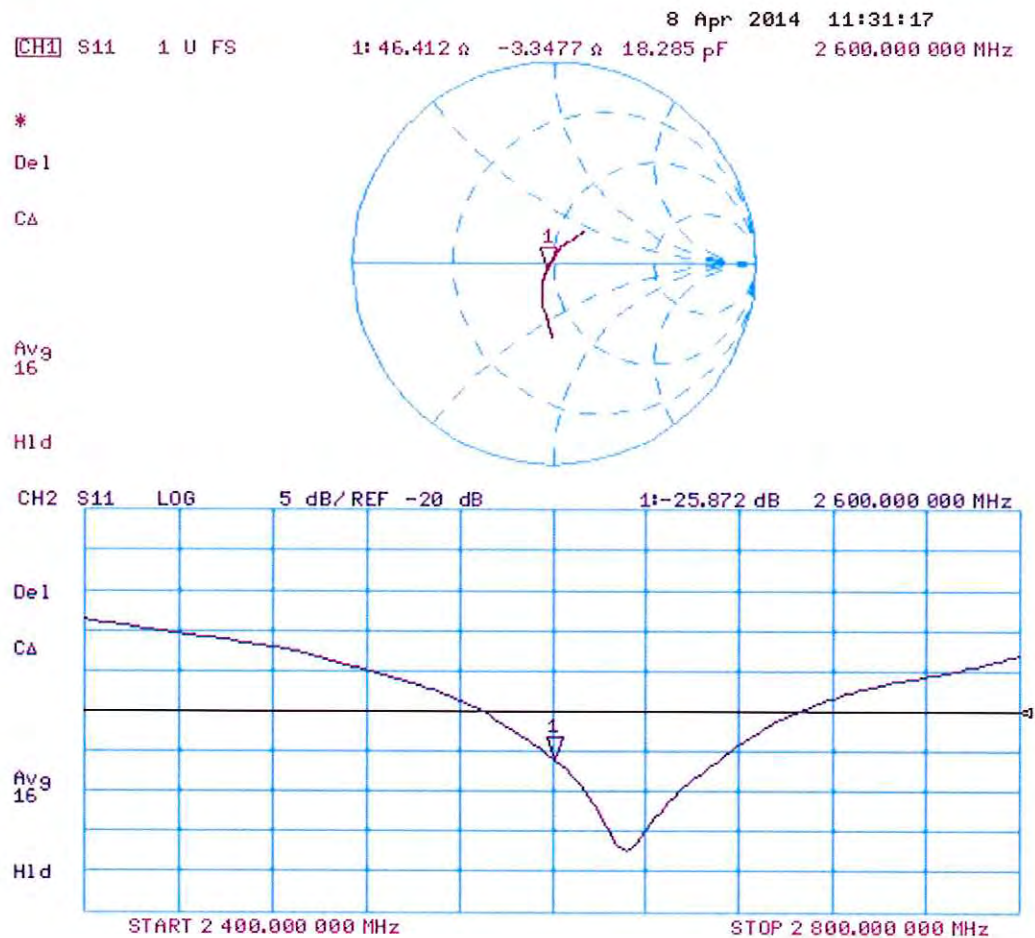
SAR(1 g) = 14.4 W/kg; SAR(10 g) = 6.38 W/kg

Maximum value of SAR (measured) = 19.4 W/kg



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

Impedance Measurement Plot for Body TSL



APPENDIX D: SAR TISSUE SPECIFICATIONS

Measurement Procedure for Tissue verification:

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

$$Y = \frac{j2\omega\epsilon_r\epsilon_0}{[\ln(b/a)]^2} \int_a^b \int_a^b \int_0^\pi \cos\phi' \frac{\exp[-j\omega r(\mu_0\epsilon_r'\epsilon_0)^{1/2}]}{r} d\phi' d\rho' d\rho$$

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

Table D-I
Composition of the Tissue Equivalent Matter

Frequency (MHz)	835	835	1900	1900	2450-2600	2450-2600
Tissue	Head	Body	Head	Body	Head	Body
Ingredients (% by weight)						
Bactericide	0.1	0.1			See page 2	
DGBE			44.92	29.44		26.7
HEC	1	1				
NaCl	1.45	0.94	0.18	0.39		0.1
Sucrose	57	44.9				
Water	40.45	53.06	54.9	70.17		73.2

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2 Composition / Information on ingredients

The Item is composed of the following ingredients:

H ₂ O	Water, 52 – 75%
C ₈ H ₁₈ O ₃	Diethylene glycol monobutyl ether (DGBE), 25 – 48% (CAS-No. 112-34-5, EC-No. 203-961-6, EC-index-No. 603-096-00-8) Relevant for safety; Refer to the respective Safety Data Sheet*.
NaCl	Sodium Chloride, <1.0%

Figure D-1

Composition of 2.4-2.6 GHz Head Tissue Equivalent Matter

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

Measurement Certificate / Material Test

Item Name	Head Tissue Simulating Liquid (HSL2450V2)
Product No.	SL AAH 245 BA (Charge: 130212-2)
Manufacturer	SPEAG

Measurement Method

TSL dielectric parameters measured using calibrated OCP probe.

Setup Validation

Validation results were within $\pm 2.5\%$ towards the target values of Methanol.

Target Parameters

Target parameters as defined in the IEEE 1526 and IEC 62209 compliance standards.

Test Condition

Ambient	Environment temperatur (22 ± 3)°C and humidity < 70%.
TSL Temperature	23°C
Test Date	13-Feb-13
Operator	DI

Additional Information

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

f (MHz)	Measured			Target		Diff to Target [%]	
	HP-e*	HP-e*	sigma	eps	sigma	delta-eps	delta-sigma
1900	40.4	11.94	1.26	40.0	1.40	1.0	-9.9
1925	40.3	12.02	1.29	40.0	1.40	0.7	-8.0
1950	40.2	12.11	1.31	40.0	1.40	0.5	-6.2
1975	40.1	12.20	1.34	40.0	1.40	0.2	-4.2
2000	40.0	12.29	1.37	40.0	1.40	-0.1	-2.3
2025	39.9	12.36	1.40	40.0	1.42	-0.2	-1.9
2050	39.8	12.49	1.42	39.9	1.44	-0.4	-1.4
2075	39.6	12.57	1.45	39.9	1.47	-0.6	-1.1
2100	39.5	12.65	1.48	39.8	1.49	-0.7	-0.7
2125	39.4	12.74	1.51	39.8	1.51	-0.9	-0.4
2150	39.3	12.82	1.53	39.7	1.53	-1.0	0.0
2175	39.2	12.89	1.56	39.7	1.56	-1.2	0.3
2200	39.1	12.97	1.59	39.6	1.58	-1.3	0.6
2225	39.0	13.04	1.61	39.6	1.60	-1.5	0.9
2250	38.9	13.11	1.64	39.6	1.62	-1.7	1.2
2275	38.8	13.20	1.67	39.5	1.64	-1.8	1.6
2300	38.7	13.28	1.70	39.5	1.67	-2.0	2.0
2325	38.6	13.35	1.73	39.4	1.69	-2.1	2.3
2350	38.5	13.42	1.75	39.4	1.71	-2.3	2.6
2375	38.4	13.50	1.78	39.3	1.73	-2.4	2.9
2400	38.3	13.58	1.81	39.3	1.76	-2.6	3.3
2425	38.2	13.65	1.84	39.2	1.78	-2.7	3.6
2450	38.1	13.73	1.87	39.2	1.80	-2.9	4.0
2475	38.0	13.79	1.90	39.2	1.83	-3.1	3.9
2500	37.9	13.85	1.93	39.1	1.85	-3.3	3.9
2525	37.8	13.94	1.96	39.1	1.88	-3.4	4.0
2550	37.7	14.02	1.99	39.1	1.91	-3.6	4.2
2575	37.6	14.09	2.02	39.0	1.94	-3.8	4.3
2600	37.5	14.17	2.05	39.0	1.96	-4.0	4.6
2625	37.4	14.23	2.08	39.0	1.99	-4.2	4.4
2650	37.3	14.29	2.11	38.9	2.02	-4.3	4.4
2675	37.1	14.36	2.14	38.9	2.05	-4.5	4.5
2700	37.0	14.43	2.17	38.9	2.07	-4.8	4.6

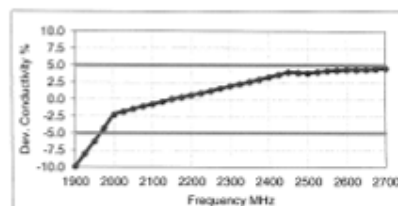
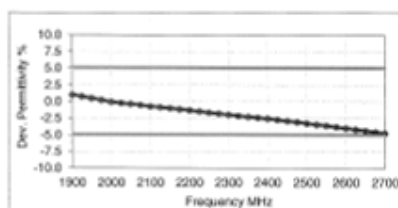


Figure D-2

2.4- 2.6 GHz Head Tissue Equivalent Matter

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APPENDIX E: SAR SYSTEM VALIDATION

Per FCC KDB 865664 D02v01, SAR system validation status should be documented to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles were used with the required tissue- equivalent media for system validation, according to the procedures outlined in FCC KDB 865664 D01 v01 and IEEE 1528-2013. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

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

Table E-I
SAR System Validation Summary

SAR SYSTEM #	FREQ. [MHz]	DATE	PROBE SN	PROBE TYPE	PROBE CAL. POINT		COND.	PERM.	CW VALIDATION			MOD. VALIDATION		
							(σ)	(ϵ_r)	SENSI-TIVITY	PROBE LINEARITY	PROBE ISOTROPY	MOD. TYPE	DUTY FACTOR	PAR
I	835	6/10/2014	3209	ES3DV3	835	Head	0.918	42.48	PASS	PASS	PASS	GMSK	PASS	N/A
K	1900	10/16/2014	3288	ES3DV3	1900	Head	1.454	39.51	PASS	PASS	PASS	GMSK	PASS	N/A
G	2450	3/6/2014	3258	ES3DV3	2450	Head	1.736	38.36	PASS	PASS	PASS	OFDM/TDD	PASS	PASS
G	2600	3/6/2014	3258	ES3DV3	2600	Head	1.893	37.87	PASS	PASS	PASS	TDD	PASS	N/A
D	835	8/11/2014	3263	ES3DV3	835	Body	1.000	53.26	PASS	PASS	PASS	GMSK	PASS	N/A
G	1900	6/25/2014	3258	ES3DV3	1900	Body	1.534	51.23	PASS	PASS	PASS	GMSK	PASS	N/A
D	1900	10/9/2014	3263	ES3DV3	1900	Body	1.569	52.31	PASS	PASS	PASS	GMSK	PASS	N/A
G	2450	3/5/2014	3258	ES3DV3	2450	Body	2.044	51.30	PASS	PASS	PASS	OFDM/TDD	PASS	PASS
I	2600	7/14/2014	3209	ES3DV3	2600	Body	2.133	50.50	PASS	PASS	PASS	TDD	PASS	PASS

NOTE: While the probes have been calibrated for both CW and modulated signals, all measurements were performed using communication systems calibrated for CW signals only. Modulations in the table above represent test configurations for which the measurement system has been validated per FCC KDB Publication 865664 D01v01 for scenarios when CW probe calibrations are used with other signal types. SAR systems were validated for modulated signals with a periodic duty cycle, such as GMSK, or with a high peak to average ratio (>5 dB), such as OFDM according to KDB 865664.

FCC ID: A3LSMG360P	 PCTEST ENGINEERING LABORATORY, INC.	SAR EVALUATION REPORT		Reviewed by: Quality Manager
Test Dates: 10/16/14 - 11/19/14	DUT Type: Portable Handset			APPENDIX E: Page 1 of 1