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SAR EVALUATION REPORT

Applicant Name:
Samsung Electronics, Co. Ltd.
129, Samsung-ro, Maetan dong,
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Gyeonggi-do 443-742, Korea

Date of Testing:
09/27/13 - 09/30/13
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Document Serial No.:
0Y1309261919.A3L

FCC ID: **A3LSMN900V**

APPLICANT: **SAMSUNG ELECTRONICS, CO. LTD.**

DUT Type:	Portable Handset
Application Type:	Class II Permissive Change
FCC Rule Part(s):	CFR §2.1093
Model(s):	SM-N900V
Permissive Change(s):	See FCC Change Document
Date of Original Certification:	Check when FCC website is up again

Equipment Class	Band & Mode	Tx Frequency	Measured Conducted Power [dBm]	SAR		
				1 gm Head (W/kg)	1 gm Body-Worn (W/kg)	1 gm Hotspot (W/kg)
PCE	LTE Band 13	782 MHz	23.50	0.09	0.37	0.37
PCE	LTE Band 4 (AWS)	1712.5 - 1752.5 MHz	23.50	0.12	0.44	0.51
Simultaneous SAR per KDB 690783 D01v01r02:				0.63	1.28	1.26

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

Note: The table above shows LTE Band 13 and LTE Band 4 (AWS) SAR Test Data evaluated for the current test report. Please refer to RF Exposure Technical Report S/N 0Y1307301504-R1.A3L for original compliance evaluation.

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

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

Randy Ortanez
President

ACCREDITED
TESTING LABORATORY
CERTIFICATE #2041.01

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1 DEVICE UNDER TEST

1.1 Device Overview

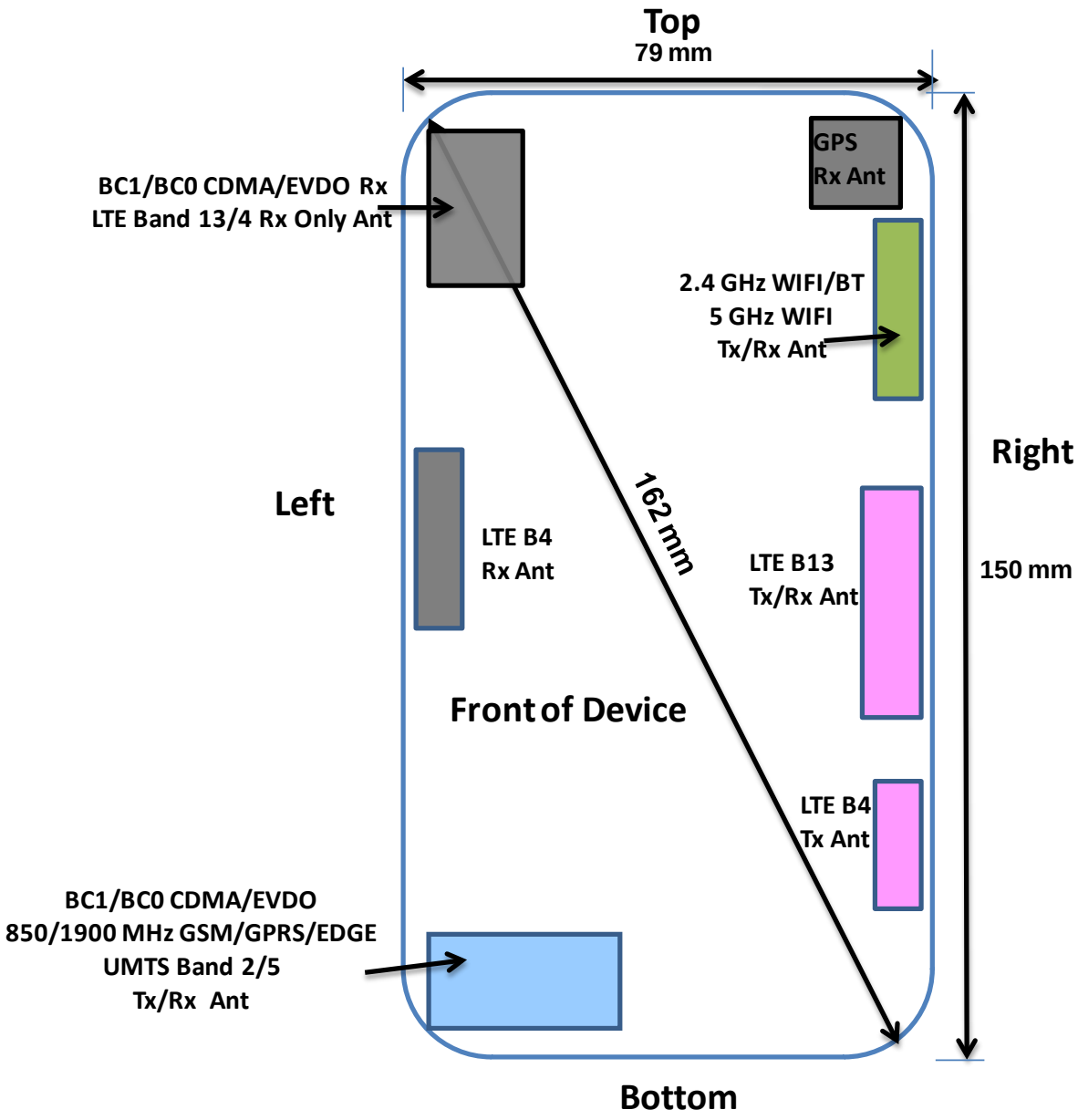
Band & Mode	Operating Modes	Tx Frequency
GSM/GPRS/EDGE 850	Voice/Data	824.20 - 848.80 MHz
GSM/GPRS/EDGE 1900	Voice/Data	1850.20 - 1909.80 MHz
UMTS 850	Voice/Data	826.40 - 846.60 MHz
UMTS 1900	Voice/Data	1852.4 - 1907.6 MHz
Cell. CDMA/EVDO	Voice/Data	824.70 - 848.31 MHz
PCS CDMA/EVDO	Voice/Data	1851.25 - 1908.75 MHz
LTE Band 13	Data	782 MHz
LTE Band 4 (AWS)	Data	1712.5 - 1752.5 MHz
2.4 GHz WLAN	Data	2412 - 2462 MHz
5.8 GHz WLAN	Data	5745 - 5825 MHz
5.2 GHz WLAN	Data	5180 - 5240 MHz
5.3 GHz WLAN	Data	5260 - 5320 MHz
5.5 GHz WLAN	Data	5500 - 5700 MHz
Bluetooth	Data	2402 - 2480 MHz
NFC	Data	13.56 MHz
Ant+	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)
LTE Band 13	Maximum	Maximum	**23.5**
		Nominal	**23.0**
	Reduced (CDMA Power ≥ Threshold Power)	Maximum	**19.5**
		Nominal	**19.0**
LTE Band 4	Maximum	Maximum	**23.5**
		Nominal	**23.0**
	Reduced (CDMA Power ≥ Threshold Power)	Maximum	**19.5**
		Nominal	**19.0**

1.3 DUT Antenna Locations



Note:

1. Exact antenna dimensions and separation distances are shown in the Technical Descriptions in the FCC Filing.
2. Because the diagonal distance is greater than 160mm but less than 200 mm this device is considered a "phablet".

Figure 1-1
DUT Antenna Locations

Table 1-1
Wireless Router Sides/Edges for SAR Testing

Mode	Exposure Configuration	Back	Front	Top	Bottom	Right	Left
LTE Band 13	Hotspot	Yes	Yes	No	No	Yes	No
LTE Band 4 (AWS)	Hotspot	Yes	Yes	No	Yes	Yes	No

Note: Particular DUT edges were not required to be evaluated for Wireless Router SAR if the edges were greater than 2.5 cm from the transmitting antenna according to FCC KDB Publication 941225 D06v01r01 guidance and KDB Publication 648474 D04v01r01.

1.4 Near Field Communications (NFC) Antenna

This DUT has NFC operations. The NFC antenna is integrated into the battery. The SAR tests were performed with the specialized battery (model: B800BZ).

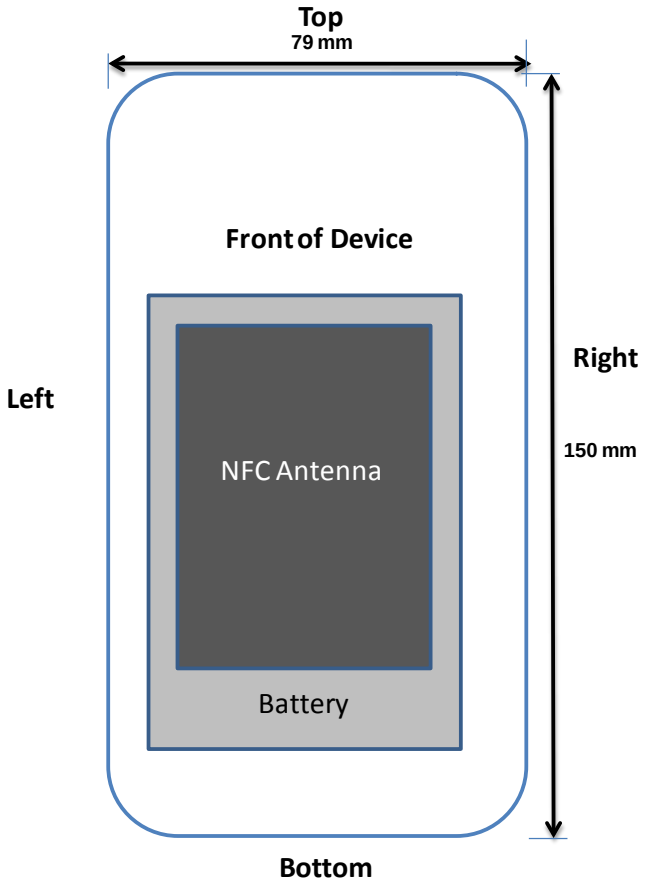


Figure 1-2
NFC Antenna Locations

1.5 Power Reduction for SAR

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

1.6 Simultaneous Transmission Capabilities

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

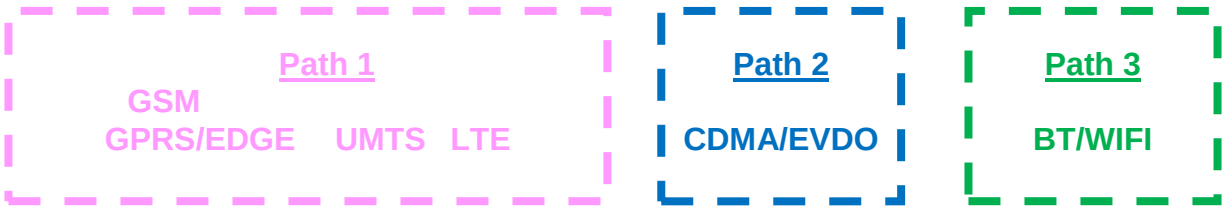


Figure 1-3
Simultaneous Transmission Paths

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

Table 1-2
Simultaneous Transmission Scenarios

Ref.	Simultaneous Transmit Configurations	Power Reduction	Head	Body-Worn Accessory	Hot Spot	Hand	Note
			IEEE 1528, Supp C	Supplement C	FCC KDB 941225 D06 edges/sides	FCC KDB 648474 D03-D04	
1	1X CDMA 850/1900 Mhz Voice + LTE B13 Data	LTE	Yes	10mm	N/A	Yes	SVLTE
2	1X CDMA 850/1900 Mhz Voice + LTE B4 Data	LTE	Yes	10mm	N/A	Yes	SVLTE
3	1X CDMA 850/1900 Mhz Voice + 2.4 GHz WIFI	N/A	Yes	10mm	N/A	Yes	
4	1X CDMA 850/1900 Mhz Voice + 5 GHz WIFI	N/A	Yes	10mm	N/A	Yes	
5	GSM 850/1900 Mhz Voice + 2.4 GHz WIFI	N/A	Yes	10mm	N/A	Yes	
6	GSM 850/1900 Mhz Voice + 5 GHz WIFI	N/A	Yes	10mm	N/A	Yes	
7	UMTS 850/1900 Mhz Voice + 2.4 GHz WIFI	N/A	Yes	10mm	N/A	Yes	
8	UMTS 850/1900 Mhz Voice + 5 GHz WIFI	N/A	Yes	10mm	N/A	Yes	
9	1X CDMA 850/1900 Mhz Voice + 2.4 GHz BT	N/A	N/A	10mm	N/A	Yes	
10	GSM 850/1900 Mhz Voice + 2.4 GHz BT	N/A	N/A	10mm	N/A	Yes	
11	UMTS 850/1900 Mhz Voice + 2.4 GHz BT	N/A	N/A	10mm	N/A	Yes	
12	1X CDMA 850/1900 Mhz Voice + LTE B13 Data + 2.4 GHz WIFI	LTE	Yes	10mm	Yes	Yes	Voice + LTE + WIFI Hotspot
13	1X CDMA 850/1900 Mhz Voice + LTE B4 Data + 2.4 GHz WIFI	LTE	Yes	10mm	Yes	Yes	Voice + LTE + WIFI Hotspot
14	1X CDMA 850/1900 Mhz Voice + LTE B13 Data + 2.4 GHz BT	LTE	N/A	10mm	N/A	Yes	
15	1X CDMA 850/1900 Mhz Voice + LTE B4 Data + 2.4 GHz BT	LTE	N/A	10mm	N/A	Yes	
16	1X CDMA 850/1900 Mhz Voice + LTE B13 Data + 5.8 GHz WIFI	LTE	Yes	10mm	Yes	Yes	Voice + LTE + WIFI Hotspot
17	1X CDMA 850/1900 Mhz Voice + LTE B4 Data + 5.8 GHz WIFI	LTE	Yes	10mm	Yes	Yes	Voice + LTE + WIFI Hotspot
18	LTE B13/B4 Data + 2.4 GHz WIFI	N/A	Yes *	10mm *	Yes	Yes	LTE + WIFI Hotspot
19	LTE B13/B4 Data + 5.8 GHz WIFI	N/A	Yes *	10mm *	Yes	Yes	LTE + WIFI Hotspot
20	LTE B13/B4 Data + 2.4 GHz BT	N/A	N/A	10mm *	N/A	Yes	
21	1X CDMA/EVDO 850/1900 MHz Data + 2.4 GHz WIFI	N/A	N/A	10mm	Yes	Yes	1X CDMA Data / EVDO +WIFI Hotspot
22	1X CDMA/EVDO 850/1900 MHz Data + 2.4 GHz BT	N/A	N/A	10mm	N/A	Yes	
23	1X CDMA/EVDO 850/1900 MHz Data + 5.8 GHz WIFI	N/A	N/A	10mm	Yes	Yes	1X CDMA Data / EVDO +WIFI Hotspot
24	UMTS 850/1900 MHz Data + 2.4 GHz WIFI	N/A	Yes	10mm	Yes	Yes	UMTS + WIFI Hotspot
25	UMTS 850/1900 MHz Data + 5.8 GHz WIFI	N/A	Yes	10mm	Yes	Yes	UMTS + WIFI Hotspot
26	UMTS 850/1900 MHz Data + 2.4 GHz BT	N/A	N/A	10mm	N/A	Yes	
27	GPRS/EDGE 850/1900 MHz Data + 2.4 GHz WIFI	N/A	N/A	N/A	Yes	Yes	GPRS/EDGE + WIFI Hotspot
29	GPRS/EDGE 850/1900 MHz Data + 5 .8GHz WIFI	N/A	N/A	N/A	Yes	Yes	GPRS/EDGE + WIFI Hotspot
30	1X CDMA 850/1900 Mhz Voice + EVDO Data	N/A	N/A	N/A	N/A	N/A	Not Supported by HW(Non-SVDO)
31	1X CDMA 850/1900 Mhz Voice + EVDO Data + 2.4 GHz WIFI	N/A	N/A	N/A	N/A	N/A	Not Supported by HW (Voice + EVDO + WIFI Hotspot)
32	GSM 850/1900 Voice + 850/1900 1X-RTT CDMA Data	N/A	N/A	N/A	N/A	N/A	Not Supported by HW
33	GSM 850/1900 Voice + EVDO/GPRS/EDGE Data	N/A	N/A	N/A	N/A	N/A	Not Supported by HW
34	GSM 850/1900 Voice + LTE	N/A	N/A	N/A	N/A	N/A	Not Supported by SW
35	GSM 850/1900 Voice + 850/1900 1X-RTT CDMA + 2.4/5 GHz WIFI	N/A	N/A	N/A	N/A	N/A	Not Supported by HW
36	GSM 850/1900 Voice + EVDO/GPRS/EDGE + 2.4/5 GHz WIFI	N/A	N/A	N/A	N/A	N/A	Not supported by HW
37	GSM 850/1900 Voice + LTE + 2.4/5 GHz WIFI	N/A	N/A	N/A	N/A	N/A	Not Supported by SW
38	850/1900 GPRS/EDGE Data + LTE 782/1732 MHz Data	N/A	N/A	N/A	N/A	N/A	Not Supported by SW
39	850/1900 EVDO Data + 850/1900 GPRS/EDGE Data	N/A	N/A	N/A	N/A	N/A	Not supported by the HW
40	850/1900 EVDO data + LTE 782/1732 MHz Data	N/A	N/A	N/A	N/A	N/A	Not Supported by SW
41	UMTS 850/1900 Voice + 850/1900 1X-RTT CDMA Data	N/A	N/A	N/A	N/A	N/A	Not Supported by HW
42	UMTS 850/1900 Voice + EVDO/GPRS/EDGE Data	N/A	N/A	N/A	N/A	N/A	Not Supported by HW
43	UMTS 850/1900 Voice + LTE	N/A	N/A	N/A	N/A	N/A	Not Supported by SW
44	UMTS 850/1900 Voice + 850/1900 1X-RTT CDMA + 2.4/5 GHz WIFI	N/A	N/A	N/A	N/A	N/A	Not Supported by HW
45	UMTS 850/1900 Voice + EVDO/GPRS/EDGE + 2.4/5 GHz WIFI	N/A	N/A	N/A	N/A	N/A	Not supported by HW
46	UMTS 850/1900 Voice + LTE + 2.4/5 GHz WIFI	N/A	N/A	N/A	N/A	N/A	Not Supported by SW

Notes:

1. **CDMA and EVDO share the same antenna path and cannot transmit simultaneously. (Non-SVDO)**
2. **Bluetooth and 2.4 GHz WLAN and 5 GHz WLAN share the same antenna path and cannot transmit simultaneously.**
3. **GSM/UMTS/LTE use one modem and transciever IC.The signals can not be transmitted simultaneously.**

Note:

1. (*) = for VOIP 3rd party applications possibly installed and used by the end-user
2. When the user utilizes multiple services in UMTS 3G mode it uses multi-Radio Access Bearer or multi-RAB. The power control is based on a physical control channel (Dedicated Physical Control Channel [DPCCH]) and power control will be adjusted to meet the needs of both services. Therefore, the UMTS+WLAN scenario also represents the UMTS Voice/DATA + WLAN Hotspot scenario.
3. 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.
4. 5GHz hotspot is not enabled for 5.2 – 5.7 GHz WIFI. Therefore all data + 5.2 – 5.7 GHz WIFI hotspot scenarios are not supported.

1.7 Wireless Charging Cover

This DUT may be used with a standard battery cover or with an optional wireless charging battery cover. Per FCC KDB Publication 648474 D04, SAR was measured using the standard battery cover and then repeated with the wireless charging battery cover for the highest reported SAR for each wireless technology, frequency band, operating mode, and exposure condition. No other additional test with wireless charging cover was required since all reported SAR were less than 1.2 W/kg.

1.8 SAR Test Exclusions Applied

Per the FCC change document for this device, the GSM/GPRS/EDGE 850/1900 MHz, UMTS 850/1900 MHz, CDMA/EVDO Cell and PCS Bands, 2.4 GHz WLAN/Bluetooth, and 5 GHz WLAN modes remain the same as the original certified device. Therefore, no additional SAR evaluations were required for these bands/modes.

(A) 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.

Per FCC KDB Publication 648474 D03-D04, this device is considered a "phablet" and hand SAR tests were not required for LTE since hotspot SAR was < 1.2 W/kg.

1.9 Guidance Applied

- FCC OET Bulletin 65 Supplement C [June 2001]
- IEEE 1528-2003
- FCC KDB Publication 941225 D01-D06 (4G and Hotspot)
- FCC KDB Publication 447498 D01v05 (General SAR Guidance)
- FCC KDB Publication 865664 D01-D02 (SAR Measurements up to 6 GHz)
- FCC KDB Publication 648474 D03-D04 (Phablet Procedures, Wireless Charging Cover)

1.10 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.

Mode/Band	Condition	Serial Number
LTE Band 13	Maximum	34C03
	Reduced	FEDB8
LTE Band 4 (AWS)	Maximum	LB4MA
	Reduced	FEABD

2 LTE INFORMATION

LTE Information			
FCC ID	**A3LSMN900V**		
Form Factor	Portable Handset		
Frequency Range of each LTE transmission band	LTE Band 13 (782 MHz)		
	LTE Band 4 (AWS) (1712.5 - 1752.5 MHz)		
Channel Bandwidths	LTE Band 13: 10 MHz		
	LTE Band 4 (AWS): 5 MHz, 10 MHz, 15 MHz, 20 MHz		
Channel Numbers and Frequencies (MHz)	Low	Mid	High
LTE Band 13: 10 MHz	782 (23230)	782 (23230)	782 (23230)
LTE Band 4 (AWS): 5 MHz	1712.5 (19975)	1732.5 (20175)	1752.5 (20375)
LTE Band 4 (AWS): 10 MHz	1715 (20000)	1732.5 (20175)	1750 (20350)
LTE Band 4 (AWS): 15 MHz	1717.5 (20025)	1732.5 (20175)	1747.5 (20325)
LTE Band 4 (AWS): 20 MHz	1720 (20050)	1732.5 (20175)	1745 (20300)
UE Category	3		
Modulations Supported in UL	QPSK, 16QAM		
LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3~6.2.5? (manufacturer attestation to be provided)	YES		
A-MPR (Additional MPR) disabled for SAR Testing?	YES		

3 INTRODUCTION

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

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

3.1 SAR Definition

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

Equation 3-1
SAR Mathematical Equation

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

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

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

where:

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

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

4 DOSIMETRIC ASSESSMENT

4.1 Measurement Procedure

The evaluation was performed using the following procedure:

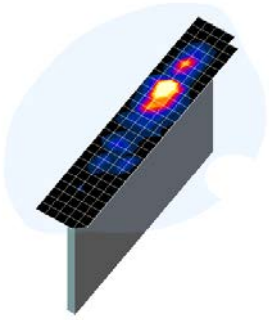


Figure 4-1
Sample SAR Area Scan

1. The SAR distribution at the exposed side of the head or body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head and body interface and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01v01 (See Table 4-1).

2. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during the 1g/10g cube evaluation. SAR at this fixed point was measured and used as a reference value.

3. Based on the area scan data, the peak of the region with maximum SAR was determined by spline interpolation. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB Publication 865664 D01v01 (See Table 4-1). On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual online for more details):

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

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

   c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.

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

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

5 DEFINITION OF REFERENCE POINTS

5.1 EAR REFERENCE POINT

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

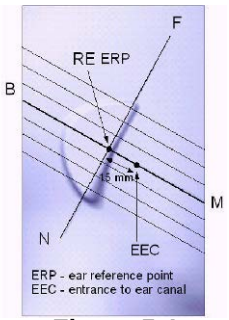


Figure 5-1
Close-Up Side view of ERP

5.2 HANDSET REFERENCE POINTS

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

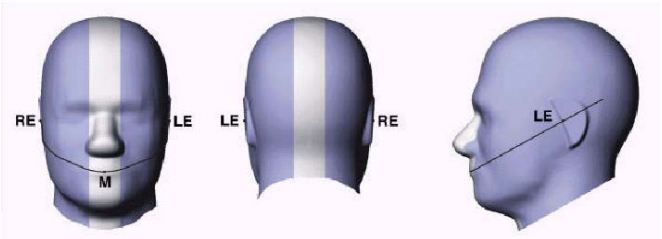


Figure 5-2
Front, back and side view of SAM Twin Phantom

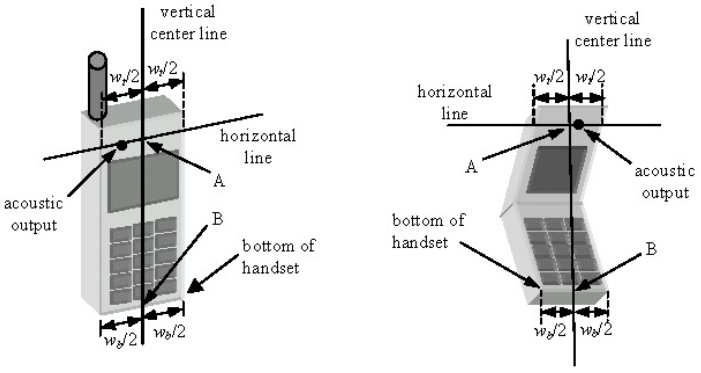


Figure 5-3
Handset Vertical Center & Horizontal Line Reference Points

6 TEST CONFIGURATION POSITIONS FOR HANDSETS

6.1 Device Holder

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

6.2 Positioning for Cheek

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

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

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

6.3 Positioning for Ear / 15º Tilt

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

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

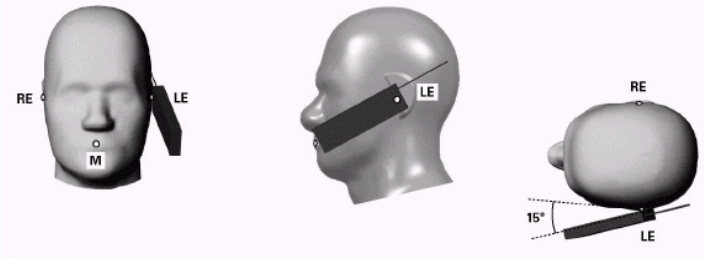


Figure 6-2 Front, Side and Top View of Ear/15º Tilt Position

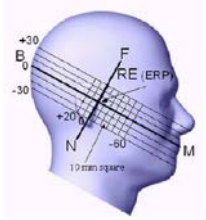


Figure 6-3
Side view w/ relevant markings

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

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

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

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

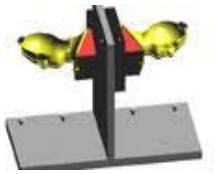


Figure 6-4 Twin SAM Chin20

6.5 Body-Worn Accessory Configurations

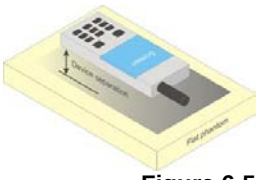


Figure 6-5
Sample Body-Worn Diagram

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 6-5). Per FCC KDB Publication 648474 D04v01, Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB Publication 447498 D01v05 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.
Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are tested with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

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

6.6 Extremity Exposure Configurations

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

For smart phones with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm that provide similar mobile web access and multimedia support found in mini-tablets or UMPC minitablets that support voice calls next to the ear, the phablets procedures outlined in KDB Publication 648474 D04 v01r01DR04 should be applied to evaluate SAR compliance. A device marketed as phablets, regardless of form factors and operating characteristics must be tested as a phablet to determine SAR compliance. In addition to the normally required head and body-worn accessory SAR test procedures required for handsets, the UMPC mini-tablet procedures must also be applied to test the SAR of all surfaces and edges with an antenna <=25 mm from that surface or edge, in direct contact with the phantom, for 10-g SAR. The UMPC mini-tablet 1-g SAR at 5 mm is not required. When hotspot mode applies, 10-g SAR is required only for the surfaces and edges with hotspot mode 1-g SAR > 1.2 W/kg.

6.7 Wireless Router Configurations

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

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

7 RF EXPOSURE LIMITS

7.1 Uncontrolled Environment

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

7.2 Controlled Environment

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

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

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

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

8 FCC MEASUREMENT PROCEDURES

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

8.1 Measured and Reported SAR

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

8.2 Procedures Used to Establish RF Signal for SAR

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

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

8.3 SAR Measurement Conditions for LTE

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

8.3.1 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.

8.3.2 MPR

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

8.3.3 A-MPR

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

8.3.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05v02r01:

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

9 RF CONDUCTED POWERS

9.1 LTE Conducted Powers

9.1.1 LTE Band 13

Table 9-1
LTE Band 13 Conducted Powers - 10 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Mid	782.0	23230	10	QPSK	1	0	22.93	0	0
	782.0	23230	10	QPSK	1	25	**23.50**	0	0
	782.0	23230	10	QPSK	1	49	23.20	0	0
	782.0	23230	10	QPSK	25	0	22.26	1	0-1
	782.0	23230	10	QPSK	25	12	**22.30**	1	0-1
	782.0	23230	10	QPSK	25	25	22.09	1	0-1
	782.0	23230	10	QPSK	50	0	22.14	1	0-1
	782.0	23230	10	16QAM	1	0	22.20	1	0-1
	782.0	23230	10	16QAM	1	25	22.50	1	0-1
	782.0	23230	10	16QAM	1	49	22.45	1	0-1
	782.0	23230	10	16QAM	25	0	21.24	2	0-2
	782.0	23230	10	16QAM	25	12	21.30	2	0-2
	782.0	23230	10	16QAM	25	25	21.17	2	0-2
	782.0	23230	10	16QAM	50	0	21.00	2	0-2

Note: LTE Band 13 at 10 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

9.1.2 LTE Band 4 (AWS)

Table 9-2
LTE Band 4 (AWS) Conducted Powers - 20 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Mid	1732.5	20175	20	QPSK	1	0	23.20	0	0
	1732.5	20175	20	QPSK	1	50	23.37	0	0
	1732.5	20175	20	QPSK	1	99	**23.50**	0	0
	1732.5	20175	20	QPSK	50	0	21.92	1	0-1
	1732.5	20175	20	QPSK	50	25	22.06	1	0-1
	1732.5	20175	20	QPSK	50	50	**22.20**	1	0-1
	1732.5	20175	20	QPSK	100	0	21.99	1	0-1
	1732.5	20175	20	16QAM	1	0	21.90	1	0-1
	1732.5	20175	20	16QAM	1	50	22.13	1	0-1
	1732.5	20175	20	16QAM	1	99	22.49	1	0-1
	1732.5	20175	20	16QAM	50	0	20.91	2	0-2
	1732.5	20175	20	16QAM	50	25	21.03	2	0-2
	1732.5	20175	20	16QAM	50	50	21.23	2	0-2
	1732.5	20175	20	16QAM	100	0	20.99	2	0-2

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

Table 9-3
LTE Band 4 (AWS) Conducted Powers - 15 MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Low	1717.5	20025	15	QPSK	1	0	23.03	0	0
	1717.5	20025	15	QPSK	1	36	22.89	0	0
	1717.5	20025	15	QPSK	1	74	22.93	0	0
	1717.5	20025	15	QPSK	36	0	21.87	1	0-1
	1717.5	20025	15	QPSK	36	18	21.61	1	0-1
	1717.5	20025	15	QPSK	36	37	21.77	1	0-1
	1717.5	20025	15	QPSK	75	0	21.76	1	0-1
	1717.5	20025	15	16QAM	1	0	21.78	1	0-1
	1717.5	20025	15	16QAM	1	36	21.93	1	0-1
	1717.5	20025	15	16QAM	1	74	21.50	1	0-1
	1717.5	20025	15	16QAM	36	0	20.80	2	0-2
	1717.5	20025	15	16QAM	36	18	20.60	2	0-2
	1717.5	20025	15	16QAM	36	37	20.77	2	0-2
	1717.5	20025	15	16QAM	75	0	20.79	2	0-2
Mid	1732.5	20175	15	QPSK	1	0	22.79	0	0
	1732.5	20175	15	QPSK	1	36	23.05	0	0
	1732.5	20175	15	QPSK	1	74	23.14	0	0
	1732.5	20175	15	QPSK	36	0	21.96	1	0-1
	1732.5	20175	15	QPSK	36	18	21.99	1	0-1
	1732.5	20175	15	QPSK	36	37	22.13	1	0-1
	1732.5	20175	15	QPSK	75	0	21.92	1	0-1
	1732.5	20175	15	16QAM	1	0	22.45	1	0-1
	1732.5	20175	15	16QAM	1	36	22.47	1	0-1
	1732.5	20175	15	16QAM	1	74	22.50	1	0-1
	1732.5	20175	15	16QAM	36	0	20.90	2	0-2
	1732.5	20175	15	16QAM	36	18	20.93	2	0-2
	1732.5	20175	15	16QAM	36	37	21.15	2	0-2
	1732.5	20175	15	16QAM	75	0	20.93	2	0-2
High	1747.5	20325	15	QPSK	1	0	23.46	0	0
	1747.5	20325	15	QPSK	1	36	23.23	0	0
	1747.5	20325	15	QPSK	1	74	22.94	0	0
	1747.5	20325	15	QPSK	36	0	22.08	1	0-1
	1747.5	20325	15	QPSK	36	18	22.03	1	0-1
	1747.5	20325	15	QPSK	36	37	21.84	1	0-1
	1747.5	20325	15	QPSK	75	0	22.02	1	0-1
	1747.5	20325	15	16QAM	1	0	22.50	1	0-1
	1747.5	20325	15	16QAM	1	36	22.39	1	0-1
	1747.5	20325	15	16QAM	1	74	22.23	1	0-1
	1747.5	20325	15	16QAM	36	0	21.15	2	0-2
	1747.5	20325	15	16QAM	36	18	20.95	2	0-2
	1747.5	20325	15	16QAM	36	37	20.82	2	0-2
	1747.5	20325	15	16QAM	75	0	20.92	2	0-2

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

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Low	1715	20000	10	QPSK	1	0	22.92	0	0
	1715	20000	10	QPSK	1	25	22.71	0	0
	1715	20000	10	QPSK	1	49	22.74	0	0
	1715	20000	10	QPSK	25	0	21.78	1	0-1
	1715	20000	10	QPSK	25	12	21.76	1	0-1
	1715	20000	10	QPSK	25	25	21.78	1	0-1
	1715	20000	10	QPSK	50	0	21.71	1	0-1
	1715	20000	10	16QAM	1	0	22.50	1	0-1
	1715	20000	10	16QAM	1	25	22.39	1	0-1
	1715	20000	10	16QAM	1	49	22.40	1	0-1
	1715	20000	10	16QAM	25	0	20.87	2	0-2
	1715	20000	10	16QAM	25	12	20.88	2	0-2
	1715	20000	10	16QAM	25	25	20.85	2	0-2
	1715	20000	10	16QAM	50	0	20.86	2	0-2
Mid	1732.5	20175	10	QPSK	1	0	22.98	0	0
	1732.5	20175	10	QPSK	1	25	23.20	0	0
	1732.5	20175	10	QPSK	1	49	23.29	0	0
	1732.5	20175	10	QPSK	25	0	22.10	1	0-1
	1732.5	20175	10	QPSK	25	12	22.17	1	0-1
	1732.5	20175	10	QPSK	25	25	22.18	1	0-1
	1732.5	20175	10	QPSK	50	0	22.14	1	0-1
	1732.5	20175	10	16QAM	1	0	21.61	1	0-1
	1732.5	20175	10	16QAM	1	25	21.83	1	0-1
	1732.5	20175	10	16QAM	1	49	21.91	1	0-1
	1732.5	20175	10	16QAM	25	0	21.05	2	0-2
	1732.5	20175	10	16QAM	25	12	21.04	2	0-2
	1732.5	20175	10	16QAM	25	25	21.16	2	0-2
	1732.5	20175	10	16QAM	50	0	21.10	2	0-2
High	1750	20350	10	QPSK	1	0	23.26	0	0
	1750	20350	10	QPSK	1	25	23.09	0	0
	1750	20350	10	QPSK	1	49	22.76	0	0
	1750	20350	10	QPSK	25	0	21.99	1	0-1
	1750	20350	10	QPSK	25	12	21.92	1	0-1
	1750	20350	10	QPSK	25	25	21.89	1	0-1
	1750	20350	10	QPSK	50	0	21.91	1	0-1
	1750	20350	10	16QAM	1	0	21.97	1	0-1
	1750	20350	10	16QAM	1	25	21.80	1	0-1
	1750	20350	10	16QAM	1	49	21.56	1	0-1
	1750	20350	10	16QAM	25	0	21.05	2	0-2
	1750	20350	10	16QAM	25	12	21.00	2	0-2
	1750	20350	10	16QAM	25	25	20.86	2	0-2
	1750	20350	10	16QAM	50	0	20.87	2	0-2

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

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Low	1712.5	19975	5	QPSK	1	0	23.19	0	0
	1712.5	19975	5	QPSK	1	12	23.17	0	0
	1712.5	19975	5	QPSK	1	24	22.90	0	0
	1712.5	19975	5	QPSK	12	0	22.04	1	0-1
	1712.5	19975	5	QPSK	12	6	22.02	1	0-1
	1712.5	19975	5	QPSK	12	13	21.93	1	0-1
	1712.5	19975	5	QPSK	25	0	21.83	1	0-1
	1712.5	19975	5	16-QAM	1	0	22.08	1	0-1
	1712.5	19975	5	16-QAM	1	12	21.95	1	0-1
	1712.5	19975	5	16-QAM	1	24	21.67	1	0-1
	1712.5	19975	5	16-QAM	12	0	21.07	2	0-2
	1712.5	19975	5	16-QAM	12	6	21.04	2	0-2
	1712.5	19975	5	16-QAM	12	13	20.94	2	0-2
	1712.5	19975	5	16-QAM	25	0	20.81	2	0-2
Mid	1732.5	20175	5	QPSK	1	0	23.21	0	0
	1732.5	20175	5	QPSK	1	12	23.32	0	0
	1732.5	20175	5	QPSK	1	24	23.23	0	0
	1732.5	20175	5	QPSK	12	0	22.07	1	0-1
	1732.5	20175	5	QPSK	12	6	22.27	1	0-1
	1732.5	20175	5	QPSK	12	13	22.30	1	0-1
	1732.5	20175	5	QPSK	25	0	22.15	1	0-1
	1732.5	20175	5	16-QAM	1	0	22.06	1	0-1
	1732.5	20175	5	16-QAM	1	12	22.20	1	0-1
	1732.5	20175	5	16-QAM	1	24	22.12	1	0-1
	1732.5	20175	5	16-QAM	12	0	21.04	2	0-2
	1732.5	20175	5	16-QAM	12	6	21.22	2	0-2
	1732.5	20175	5	16-QAM	12	13	21.24	2	0-2
	1732.5	20175	5	16-QAM	25	0	21.11	2	0-2
High	1752.5	20375	5	QPSK	1	0	23.00	0	0
	1752.5	20375	5	QPSK	1	12	22.86	0	0
	1752.5	20375	5	QPSK	1	24	22.72	0	0
	1752.5	20375	5	QPSK	12	0	21.94	1	0-1
	1752.5	20375	5	QPSK	12	6	21.96	1	0-1
	1752.5	20375	5	QPSK	12	13	21.92	1	0-1
	1752.5	20375	5	QPSK	25	0	21.89	1	0-1
	1752.5	20375	5	16-QAM	1	0	21.68	1	0-1
	1752.5	20375	5	16-QAM	1	12	21.50	1	0-1
	1752.5	20375	5	16-QAM	1	24	21.50	1	0-1
	1752.5	20375	5	16-QAM	12	0	21.17	2	0-2
	1752.5	20375	5	16-QAM	12	6	21.13	2	0-2
	1752.5	20375	5	16-QAM	12	13	21.12	2	0-2
	1752.5	20375	5	16-QAM	25	0	20.88	2	0-2

10 LTE POWER REDUCTION

10.1 Introduction to LTE Power Reduction

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

Table 10-1
SVLTE Power Reduction Scheme

Mode	Voice Avg Power(P) 1x 850/1900 MHz (dBm)	Max. B13/B4 LTE Data Avg Power (dBm)
SVLTE	P ≥ 18	19
	P < 18	23

10.2 SVLTE SAR Testing Procedures

Per KDB 941225 D05v02 Section 4.4 B), SAR testing was additionally performed at the reduced CDMA and LTE power levels with respect to the simultaneous transmission scenarios. Additional samples were tuned to fixed reduced power levels to represent the SVLTE condition in a standalone environment. While the power reduction mechanism is activated at the CDMA Voice power level of 18 dBm, simultaneous SAR summations of maximum power LTE were evaluated at this reduced fixed CDMA voice power level. SAR was additionally evaluated at reduced power LTE levels to perform simultaneous SAR analysis when CDMA voice is at maximum power.

10.2.1 Reduced LTE B13 Conducted Powers

Table 10-2
Reduced LTE Band 13 Conducted Power – 10MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Mid	782.0	23230	10	QPSK	1	0	19.08	0	0
	782.0	23230	10	QPSK	1	25	**19.10**	0	0
	782.0	23230	10	QPSK	1	49	19.09	0	0
	782.0	23230	10	QPSK	25	0	**18.82**	0	0-1
	782.0	23230	10	QPSK	25	12	18.81	0	0-1
	782.0	23230	10	QPSK	25	25	18.79	0	0-1
	782.0	23230	10	QPSK	50	0	18.73	0	0-1
	782.0	23230	10	16QAM	1	0	18.51	0	0-1
	782.0	23230	10	16QAM	1	25	18.66	0	0-1
	782.0	23230	10	16QAM	1	49	18.54	0	0-1
	782.0	23230	10	16QAM	25	0	18.81	0	0-2
	782.0	23230	10	16QAM	25	12	18.76	0	0-2
	782.0	23230	10	16QAM	25	25	18.77	0	0-2
	782.0	23230	10	16QAM	50	0	18.69	0	0-2

Note: LTE Band 13 at 10 MHz bandwidth does not support three non-overlapping channels. Per KDB Publication 941225 D05v02, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.

10.2.2 Reduced LTE B4 Conducted Powers

Table 10-3
Reduced LTE Band 4 Conducted Power – 20MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Mid	1732.5	20175	20	QPSK	1	0	18.83	0	0
	1732.5	20175	20	QPSK	1	50	19.10	0	0
	1732.5	20175	20	QPSK	1	99	**19.13**	0	0
	1732.5	20175	20	QPSK	50	0	18.82	0	0-1
	1732.5	20175	20	QPSK	50	25	18.77	0	0-1
	1732.5	20175	20	QPSK	50	50	**18.86**	0	0-1
	1732.5	20175	20	QPSK	100	0	18.82	0	0-1
	1732.5	20175	20	16QAM	1	0	18.73	0	0-1
	1732.5	20175	20	16QAM	1	50	18.96	0	0-1
	1732.5	20175	20	16QAM	1	99	19.03	0	0-1
	1732.5	20175	20	16QAM	50	0	18.78	0	0-2
	1732.5	20175	20	16QAM	50	25	18.78	0	0-2
	1732.5	20175	20	16QAM	50	50	18.88	0	0-2
	1732.5	20175	20	16QAM	100	0	18.73	0	0-2

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

Table 10-4
Reduced LTE Band 4 Conducted Power – 15MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Low	1717.5	20025	15	QPSK	1	0	18.72	0	0
	1717.5	20025	15	QPSK	1	36	18.74	0	0
	1717.5	20025	15	QPSK	1	74	18.67	0	0
	1717.5	20025	15	QPSK	36	0	18.65	0	0-1
	1717.5	20025	15	QPSK	36	18	18.69	0	0-1
	1717.5	20025	15	QPSK	36	37	18.62	0	0-1
	1717.5	20025	15	QPSK	75	0	18.63	0	0-1
	1717.5	20025	15	16QAM	1	0	18.50	0	0-1
	1717.5	20025	15	16QAM	1	36	18.51	0	0-1
	1717.5	20025	15	16QAM	1	74	18.50	0	0-1
	1717.5	20025	15	16QAM	36	0	18.55	0	0-2
	1717.5	20025	15	16QAM	36	18	18.58	0	0-2
	1717.5	20025	15	16QAM	36	37	18.56	0	0-2
	1717.5	20025	15	16QAM	75	0	18.62	0	0-2
Mid	1732.5	20175	15	QPSK	1	0	18.59	0	0
	1732.5	20175	15	QPSK	1	36	18.76	0	0
	1732.5	20175	15	QPSK	1	74	18.95	0	0
	1732.5	20175	15	QPSK	36	0	18.74	0	0-1
	1732.5	20175	15	QPSK	36	18	18.82	0	0-1
	1732.5	20175	15	QPSK	36	37	18.92	0	0-1
	1732.5	20175	15	QPSK	75	0	18.79	0	0-1
	1732.5	20175	15	16QAM	1	0	18.90	0	0-1
	1732.5	20175	15	16QAM	1	36	19.04	0	0-1
	1732.5	20175	15	16QAM	1	74	19.19	0	0-1
	1732.5	20175	15	16QAM	36	0	18.74	0	0-2
	1732.5	20175	15	16QAM	36	18	18.76	0	0-2
	1732.5	20175	15	16QAM	36	37	18.97	0	0-2
	1732.5	20175	15	16QAM	75	0	18.72	0	0-2
High	1747.5	20325	15	QPSK	1	0	19.08	0	0
	1747.5	20325	15	QPSK	1	36	19.11	0	0
	1747.5	20325	15	QPSK	1	74	18.82	0	0
	1747.5	20325	15	QPSK	36	0	18.93	0	0-1
	1747.5	20325	15	QPSK	36	18	18.95	0	0-1
	1747.5	20325	15	QPSK	36	37	18.76	0	0-1
	1747.5	20325	15	QPSK	75	0	18.82	0	0-1
	1747.5	20325	15	16QAM	1	0	18.86	0	0-1
	1747.5	20325	15	16QAM	1	36	18.92	0	0-1
	1747.5	20325	15	16QAM	1	74	18.64	0	0-1
	1747.5	20325	15	16QAM	36	0	19.01	0	0-2
	1747.5	20325	15	16QAM	36	18	18.92	0	0-2
	1747.5	20325	15	16QAM	36	37	18.83	0	0-2
	1747.5	20325	15	16QAM	75	0	18.76	0	0-2

Table 10-5
Reduced LTE Band 4 Conducted Power – 10MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Low	1715	20000	10	QPSK	1	0	18.67	0	0
	1715	20000	10	QPSK	1	25	18.72	0	0
	1715	20000	10	QPSK	1	49	18.76	0	0
	1715	20000	10	QPSK	25	0	18.65	0	0-1
	1715	20000	10	QPSK	25	12	18.72	0	0-1
	1715	20000	10	QPSK	25	25	18.67	0	0-1
	1715	20000	10	QPSK	50	0	18.66	0	0-1
	1715	20000	10	16QAM	1	0	18.50	0	0-1
	1715	20000	10	16QAM	1	25	18.51	0	0-1
	1715	20000	10	16QAM	1	49	18.51	0	0-1
	1715	20000	10	16QAM	25	0	18.63	0	0-2
	1715	20000	10	16QAM	25	12	18.65	0	0-2
	1715	20000	10	16QAM	25	25	18.65	0	0-2
	1715	20000	10	16QAM	50	0	18.65	0	0-2
Mid	1732.5	20175	10	QPSK	1	0	18.61	0	0
	1732.5	20175	10	QPSK	1	25	18.78	0	0
	1732.5	20175	10	QPSK	1	49	18.93	0	0
	1732.5	20175	10	QPSK	25	0	18.80	0	0-1
	1732.5	20175	10	QPSK	25	12	18.82	0	0-1
	1732.5	20175	10	QPSK	25	25	18.84	0	0-1
	1732.5	20175	10	QPSK	50	0	18.78	0	0-1
	1732.5	20175	10	16QAM	1	0	18.96	0	0-1
	1732.5	20175	10	16QAM	1	25	19.17	0	0-1
	1732.5	20175	10	16QAM	1	49	19.27	0	0-1
	1732.5	20175	10	16QAM	25	0	18.77	0	0-2
	1732.5	20175	10	16QAM	25	12	18.75	0	0-2
	1732.5	20175	10	16QAM	25	25	18.85	0	0-2
	1732.5	20175	10	16QAM	50	0	18.75	0	0-2
High	1750	20350	10	QPSK	1	0	18.89	0	0
	1750	20350	10	QPSK	1	25	18.77	0	0
	1750	20350	10	QPSK	1	49	18.60	0	0
	1750	20350	10	QPSK	25	0	18.92	0	0-1
	1750	20350	10	QPSK	25	12	18.81	0	0-1
	1750	20350	10	QPSK	25	25	18.77	0	0-1
	1750	20350	10	QPSK	50	0	18.79	0	0-1
	1750	20350	10	16QAM	1	0	19.23	0	0-1
	1750	20350	10	16QAM	1	25	19.13	0	0-1
	1750	20350	10	16QAM	1	49	18.95	0	0-1
	1750	20350	10	16QAM	25	0	18.90	0	0-2
	1750	20350	10	16QAM	25	12	18.78	0	0-2
	1750	20350	10	16QAM	25	25	18.72	0	0-2
	1750	20350	10	16QAM	50	0	18.75	0	0-2

Table 10-6
Reduced LTE Band 4 Conducted Power – 5MHz Bandwidth

	Frequency [MHz]	Channel	Bandwidth [MHz]	Modulation	RB Size	RB Offset	Conducted Power [dBm]	Target MPR [dB]	MPR Allowed per 3GPP [dB]
Low	1712.5	19975	5	QPSK	1	0	18.87	0	0
	1712.5	19975	5	QPSK	1	12	18.83	0	0
	1712.5	19975	5	QPSK	1	24	18.80	0	0
	1712.5	19975	5	QPSK	12	0	18.78	0	0-1
	1712.5	19975	5	QPSK	12	6	18.71	0	0-1
	1712.5	19975	5	QPSK	12	13	18.75	0	0-1
	1712.5	19975	5	QPSK	25	0	18.66	0	0-1
	1712.5	19975	5	16-QAM	1	0	18.66	0	0-1
	1712.5	19975	5	16-QAM	1	12	18.71	0	0-1
	1712.5	19975	5	16-QAM	1	24	18.62	0	0-1
	1712.5	19975	5	16-QAM	12	0	18.77	0	0-2
	1712.5	19975	5	16-QAM	12	6	18.82	0	0-2
	1712.5	19975	5	16-QAM	12	13	18.69	0	0-2
	1712.5	19975	5	16-QAM	25	0	18.52	0	0-2
Mid	1732.5	20175	5	QPSK	1	0	18.71	0	0
	1732.5	20175	5	QPSK	1	12	18.87	0	0
	1732.5	20175	5	QPSK	1	24	18.86	0	0
	1732.5	20175	5	QPSK	12	0	18.91	0	0-1
	1732.5	20175	5	QPSK	12	6	18.89	0	0-1
	1732.5	20175	5	QPSK	12	13	18.95	0	0-1
	1732.5	20175	5	QPSK	25	0	18.84	0	0-1
	1732.5	20175	5	16-QAM	1	0	18.51	0	0-1
	1732.5	20175	5	16-QAM	1	12	18.61	0	0-1
	1732.5	20175	5	16-QAM	1	24	18.65	0	0-1
	1732.5	20175	5	16-QAM	12	0	18.99	0	0-2
	1732.5	20175	5	16-QAM	12	6	18.98	0	0-2
	1732.5	20175	5	16-QAM	12	13	18.99	0	0-2
	1732.5	20175	5	16-QAM	25	0	18.79	0	0-2
High	1752.5	20375	5	QPSK	1	0	19.07	0	0
	1752.5	20375	5	QPSK	1	12	18.95	0	0
	1752.5	20375	5	QPSK	1	24	18.90	0	0
	1752.5	20375	5	QPSK	12	0	18.82	0	0-1
	1752.5	20375	5	QPSK	12	6	18.79	0	0-1
	1752.5	20375	5	QPSK	12	13	18.76	0	0-1
	1752.5	20375	5	QPSK	25	0	18.73	0	0-1
	1752.5	20375	5	16-QAM	1	0	18.90	0	0-1
	1752.5	20375	5	16-QAM	1	12	18.83	0	0-1
	1752.5	20375	5	16-QAM	1	24	18.78	0	0-1
	1752.5	20375	5	16-QAM	12	0	18.76	0	0-2
	1752.5	20375	5	16-QAM	12	6	18.72	0	0-2
	1752.5	20375	5	16-QAM	12	13	18.73	0	0-2
	1752.5	20375	5	16-QAM	25	0	18.67	0	0-2

11 SYSTEM VERIFICATION

11.1 Tissue Verification

Table 11-1
Measured Tissue Properties

Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (C°)	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ε	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ε	%dev σ	%dev ε
9/28/2013	750H	23.2	740	0.887	42.682	0.889	41.953	*-0.22%*	*1.74%*
			755	0.901	42.645	0.891	41.876	*1.12%*	*1.84%*
			770	0.914	42.508	0.892	41.806	*2.47%*	*1.68%*
			785	0.927	42.339	0.894	41.735	*3.69%*	*1.45%*
9/30/2013	1750H	22.6	1710	1.364	39.531	1.348	40.136	*1.19%*	*-1.51%*
			1750	1.412	39.359	1.370	40.100	*3.07%*	*-1.85%*
			1790	1.451	39.219	1.394	40.020	*4.09%*	*-2.00%*
9/27/2013	750B	23.9	740	0.967	56.295	0.963	55.570	*0.42%*	*1.30%*
			755	0.980	56.125	0.964	55.512	*1.66%*	*1.10%*
			770	0.995	55.963	0.965	55.453	*3.11%*	*0.92%*
			785	1.010	55.799	0.966	55.395	*4.55%*	*0.73%*
9/30/2013	1750B	22.3	1710	1.494	51.237	1.460	53.540	*2.33%*	*-4.30%*
			1750	1.536	51.070	1.490	53.430	*3.09%*	*-4.42%*
			1790	1.580	50.878	1.510	53.330	*4.64%*	*-4.60%*

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

11.2 Test System Verification

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

Table 11-2
System Verification Results

System Verification TARGET & MEASURED												
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)	$Deviation_{1g}$ (%)
G	750	HEAD	09/28/2013	23.9	23.2	0.100	1003	3209	0.888	8.460	8.880	4.96%
E	1750	HEAD	09/30/2013	23.3	22.6	0.100	1051	3920	3.840	36.500	38.400	5.21%
G	750	BODY	09/27/2013	24.3	23.9	0.100	1003	3209	0.858	8.830	8.580	-2.83%
B	1750	BODY	09/30/2013	23.1	22.4	0.100	1008	3287	3.950	38.200	39.500	3.40%

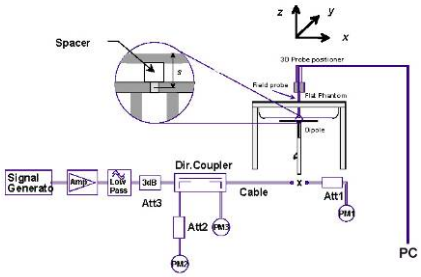


Figure 11-1
System Verification Setup Diagram

Figure 11-2
System Verification Setup Photo

12 SAR DATA SUMMARY

12.1 Standalone Head SAR Data

Table 12-1
LTE Band 13 Head SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Back Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
782.00	23230	Mid	LTE Band 13	10	Standard	23.5	23.50	-0.03	0	Right	Cheek	QPSK	1	25	34C03	1:1	0.037	1.000	0.037	
782.00	23230	Mid	LTE Band 13	10	Standard	22.5	22.30	-0.07	1	Right	Cheek	QPSK	25	12	34C03	1:1	0.031	1.047	0.032	
782.00	23230	Mid	LTE Band 13	10	Standard	23.5	23.50	0.04	0	Right	Tilt	QPSK	1	25	34C03	1:1	0.017	1.000	0.017	
782.00	23230	Mid	LTE Band 13	10	Standard	22.5	22.30	0.16	1	Right	Tilt	QPSK	25	12	34C03	1:1	0.015	1.047	0.016	
782.00	23230	Mid	LTE Band 13	10	Standard	23.5	23.50	-0.14	0	Left	Cheek	QPSK	1	25	34C03	1:1	0.049	1.000	0.049	
782.00	23230	Mid	LTE Band 13	10	Wireless Charging Cover	23.5	23.50	0.00	0	Left	Cheek	QPSK	1	25	34C03	1:1	0.089	1.000	0.089	A1
782.00	23230	Mid	LTE Band 13	10	Standard	22.5	22.30	-0.01	1	Left	Cheek	QPSK	25	12	34C03	1:1	0.042	1.047	0.044	
782.00	23230	Mid	LTE Band 13	10	Standard	23.5	23.50	0.12	0	Left	Tilt	QPSK	1	25	34C03	1:1	0.024	1.000	0.024	
782.00	23230	Mid	LTE Band 13	10	Standard	22.5	22.30	0.08	1	Left	Tilt	QPSK	25	0	34C03	1:1	0.020	1.047	0.021	
782.00	23230	Mid	LTE Band 13	10	Standard	19.5	19.10	0.04	0	Right	Cheek	QPSK	1	25	FEDB8	1:1	0.034	1.096	0.037	
782.00	23230	Mid	LTE Band 13	10	Standard	19.5	18.82	0.01	0	Right	Cheek	QPSK	25	0	FEDB8	1:1	0.031	1.169	0.036	
782.00	23230	Mid	LTE Band 13	10	Standard	19.5	19.10	0.04	0	Right	Tilt	QPSK	1	25	FEDB8	1:1	0.015	1.096	0.016	
782.00	23230	Mid	LTE Band 13	10	Standard	19.5	18.82	0.09	0	Right	Tilt	QPSK	25	0	FEDB8	1:1	0.014	1.169	0.016	
782.00	23230	Mid	LTE Band 13	10	Standard	19.5	19.10	0.14	0	Left	Cheek	QPSK	1	25	FEDB8	1:1	0.044	1.096	0.048	
782.00	23230	Mid	LTE Band 13	10	Standard	19.5	18.82	0.12	0	Left	Cheek	QPSK	25	0	FEDB8	1:1	0.043	1.169	0.050	
782.00	23230	Mid	LTE Band 13	10	Standard	19.5	19.10	0.02	0	Left	Tilt	QPSK	1	25	FEDB8	1:1	0.024	1.096	0.026	
782.00	23230	Mid	LTE Band 13	10	Standard	19.5	18.82	0.18	0	Left	Tilt	QPSK	25	0	FEDB8	1:1	0.022	1.169	0.026	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Head 1.6 W/kg (mW/g) averaged over 1 gram										

Table 12-2
LTE Band 4 (AWS) Head SAR

MEASUREMENT RESULTS																					
FREQUENCY			Mode	Bandwidth [MHz]	Back Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.5	23.50	-0.01	0	Right	Cheek	QPSK	1	99	LB4MA	1:1	0.123	1.000	**0.123**	A2
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Wireless Charging Cover	23.5	23.50	-0.12	0	Right	Cheek	QPSK	1	99	LB4MA	1:1	0.076	1.000	0.076	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	22.5	22.20	0.00	1	Right	Cheek	QPSK	50	50	LB4MA	1:1	0.080	1.072	0.086	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.5	23.50	0.04	0	Right	Tilt	QPSK	1	99	LB4MA	1:1	0.008	1.000	0.008	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	22.5	22.20	0.12	1	Right	Tilt	QPSK	50	50	LB4MA	1:1	0.005	1.072	0.005	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.5	23.50	0.06	0	Left	Cheek	QPSK	1	99	LB4MA	1:1	0.051	1.000	0.049	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	22.5	22.20	0.06	1	Left	Cheek	QPSK	50	50	LB4MA	1:1	0.061	1.072	0.065	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.5	23.50	0.12	0	Left	Tilt	QPSK	1	99	LB4MA	1:1	0.013	1.000	0.013	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	22.5	22.20	-0.01	1	Left	Tilt	QPSK	50	50	LB4MA	1:1	0.006	1.072	0.006	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	19.5	19.13	0.03	0	Right	Cheek	QPSK	1	99	FEABD	1:1	0.050	1.089	0.054	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	19.5	18.86	-0.05	0	Right	Cheek	QPSK	50	50	FEABD	1:1	0.046	1.159	0.053	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	19.5	19.13	0.00	0	Right	Tilt	QPSK	1	99	FEABD	1:1	0.005	1.089	0.005	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	19.5	18.86	0.10	0	Right	Tilt	QPSK	50	50	FEABD	1:1	0.005	1.159	0.006	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	19.5	19.13	-0.06	0	Left	Cheek	QPSK	1	99	FEABD	1:1	0.028	1.089	0.030	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	19.5	18.86	0.04	0	Left	Cheek	QPSK	50	50	FEABD	1:1	0.024	1.159	0.028	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	19.5	19.13	0.05	0	Left	Tilt	QPSK	1	99	FEABD	1:1	0.002	1.089	0.002	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	19.5	18.86	0.04	0	Left	Tilt	QPSK	50	50	FEABD	1:1	0.001	1.159	0.001	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**										**Head** **1.6 W/kg (mW/g)** averaged over 1 gram											

Table 12-3
LTE Body-Worn SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Back Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
782.00	23230	Mid	LTE Band 13	10	Standard	23.5	23.50	0.02	0	34C03	QPSK	1	25	10 mm	back	1:1	0.369	1.000	0.369	A3
782.00	23230	Mid	LTE Band 13	10	Wireless Charging Cover	23.5	23.50	0.00	0	34C03	QPSK	1	25	10 mm	back	1:1	0.361	1.000	0.361	
782.00	23230	Mid	LTE Band 13	10	Standard	22.5	22.30	0.03	1	34C03	QPSK	25	12	10 mm	back	1:1	0.302	1.047	0.316	
782.00	23230	Mid	LTE Band 13	10	Standard	19.5	19.10	-0.11	0	FEDB8	QPSK	1	25	10 mm	back	1:1	0.308	1.096	0.338	
782.00	23230	Mid	LTE Band 13	10	Standard	19.5	18.82	-0.13	0	FEDB8	QPSK	25	0	10 mm	back	1:1	0.289	1.169	0.338	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.5	23.50	0.04	0	LB4MA	QPSK	1	99	10 mm	back	1:1	0.440	1.000	**0.440**	A4
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Wireless Charging Cover	23.5	23.50	0.01	0	LB4MA	QPSK	1	99	10 mm	back	1:1	0.365	1.000	0.365	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	22.5	22.20	0.02	1	LB4MA	QPSK	50	50	10 mm	back	1:1	0.383	1.072	0.411	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	19.5	19.13	-0.19	0	FEABD	QPSK	1	99	10 mm	back	1:1	0.145	1.089	0.158	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	19.5	18.86	-0.09	0	FEABD	QPSK	50	50	10 mm	back	1:1	0.134	1.159	0.155	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT **Spatial Peak** **Uncontrolled Exposure/General Population**										**Body** **1.6 W/kg (mW/g)** averaged over 1 gram										

12.2 Standalone Wireless Router SAR Data

Table 12-4
LTE Band 13 LTE Hotspot SAR

MEASUREMENT RESULTS																					
FREQUENCY			Mode	Bandwidth [MHz]	Back Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
782.00	23230	Mid	LTE Band 13	10	Standard	23.5	23.50	0.02	0	34C03	QPSK	1	25	10 mm	back	1:1	0.369	1.000	0.369	A3
782.00	23230	Mid	LTE Band 13	10	Wireless Charging Cover	23.5	23.50	0.00	0	34C03	QPSK	1	25	10 mm	back	1:1	0.361	1.000	0.361	
782.00	23230	Mid	LTE Band 13	10	Standard	22.5	22.30	0.03	1	34C03	QPSK	25	12	10 mm	back	1:1	0.302	1.047	0.316	
782.00	23230	Mid	LTE Band 13	10	Standard	23.5	23.50	-0.01	0	34C03	QPSK	1	25	10 mm	front	1:1	0.036	1.000	0.036	
782.00	23230	Mid	LTE Band 13	10	Standard	22.5	22.30	0.04	1	34C03	QPSK	25	12	10 mm	front	1:1	0.032	1.047	0.034	
782.00	23230	Mid	LTE Band 13	10	Standard	23.5	23.50	-0.06	0	34C03	QPSK	1	25	10 mm	right	1:1	0.252	1.000	0.252	
782.00	23230	Mid	LTE Band 13	10	Standard	22.5	22.30	-0.01	1	34C03	QPSK	25	12	10 mm	right	1:1	0.211	1.047	0.221	
782.00	23230	Mid	LTE Band 13	10	Standard	19.5	19.10	-0.11	0	FEDB8	QPSK	1	25	10 mm	back	1:1	0.308	1.096	0.338	
782.00	23230	Mid	LTE Band 13	10	Standard	19.5	18.82	-0.13	0	FEDB8	QPSK	25	0	10 mm	back	1:1	0.289	1.169	0.338	
782.00	23230	Mid	LTE Band 13	10	Standard	19.5	19.10	-0.03	0	FEDB8	QPSK	1	25	10 mm	front	1:1	0.034	1.096	0.037	
782.00	23230	Mid	LTE Band 13	10	Standard	19.5	18.82	0.01	0	FEDB8	QPSK	25	0	10 mm	front	1:1	0.033	1.169	0.039	
782.00	23230	Mid	LTE Band 13	10	Standard	19.5	19.10	-0.06	0	FEDB8	QPSK	1	25	10 mm	right	1:1	0.158	1.096	0.173	
782.00	23230	Mid	LTE Band 13	10	Standard	19.5	18.82	-0.05	0	FEDB8	QPSK	25	0	10 mm	right	1:1	0.149	1.169	0.174	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population															Body 1.6 W/kg (mW/g) averaged over 1 gram						

Table 12-5
LTE Band 4 (AWS) LTE Hotspot SAR

MEASUREMENT RESULTS																				
FREQUENCY			Mode	Bandwidth [MHz]	Back Cover Type	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.																(W/kg)		(W/kg)	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.5	23.50	0.04	0	LB4MA	QPSK	1	99	10 mm	back	1:1	0.440	1.000	0.440	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	22.5	22.20	0.02	1	LB4MA	QPSK	50	50	10 mm	back	1:1	0.383	1.072	0.411	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.5	23.50	-0.14	0	LB4MA	QPSK	1	99	10 mm	front	1:1	0.076	1.000	0.076	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	22.5	22.20	-0.01	1	LB4MA	QPSK	50	50	10 mm	front	1:1	0.052	1.072	0.056	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.5	23.50	-0.04	0	LB4MA	QPSK	1	99	10 mm	bottom	1:1	0.018	1.000	0.018	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	22.5	22.20	-0.14	1	LB4MA	QPSK	50	50	10 mm	bottom	1:1	0.010	1.072	0.011	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	23.5	23.50	0.03	0	LB4MA	QPSK	1	99	10 mm	right	1:1	0.508	1.000	**0.508**	A5
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Wireless Charging Cover	22.5	23.50	-0.06	0	LB4MA	QPSK	1	99	10 mm	right	1:1	0.419	0.794	0.419	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	22.5	22.20	0.01	1	LB4MA	QPSK	50	50	10 mm	right	1:1	0.329	1.072	0.353	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	19.5	19.13	-0.19	0	FEABD	QPSK	1	99	10 mm	back	1:1	0.145	1.089	0.158	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	19.5	18.86	-0.09	0	FEABD	QPSK	50	50	10 mm	back	1:1	0.134	1.159	0.155	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	19.5	19.13	0.03	0	FEABD	QPSK	1	99	10 mm	front	1:1	0.031	1.089	0.034	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	19.5	18.86	0.19	0	FEABD	QPSK	50	50	10 mm	front	1:1	0.030	1.159	0.035	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	19.5	19.13	-0.04	0	FEABD	QPSK	1	99	10 mm	bottom	1:1	0.005	1.089	0.005	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	19.5	18.86	-0.06	0	FEABD	QPSK	50	50	10 mm	bottom	1:1	0.004	1.159	0.005	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	19.5	19.13	-0.20	0	FEABD	QPSK	1	99	10 mm	right	1:1	0.213	1.089	0.232	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	Standard	19.5	18.86	-0.11	0	FEABD	QPSK	50	50	10 mm	right	1:1	0.201	1.159	0.233	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population															Body 1.6 W/kg (mW/g) averaged over 1 gram						

12.3 SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2003, FCC/OET Bulletin 65, Supplement C [June 2001] and FCC KDB Publication 447498 D01v05.
2. Batteries are fully charged at the beginning of the SAR measurements. A specialized battery with NFC antenna was used for all SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v05.
6. Device was tested using a fixed spacing for body-worn accessory testing. A separation distance of 10 mm was considered because the manufacturer has determined that there will be body-worn accessories available in the marketplace for users to support this separation distance.
7. Per FCC KDB Publication 648474 D04v01, body-worn SAR was evaluated without a headset connected to the device. Since the standalone reported SAR was ≤ 1.2 W/kg, no additional SAR evaluations using a headset cable were required.
8. Per FCC KDB 865664 D01 v01, variability SAR tests were not required since the original highest measured SAR is < 0.80 W/kg. Please see Section 14 for variability analysis.
9. During SAR Testing for the Wireless Router conditions per FCC KDB Publication 941225 D06v01, the actual Portable Hotspot operation (with actual simultaneous transmission of a transmitter with WIFI) was not activated (See Section 6.7 for more details).
10. Per FCC KDB Publication 648474 D04v01r01, this device is considered a "phablet" since the diagonal distance is greater than 160 mm but less than 200 mm. Therefore, hand SAR tests are required when hotspot mode does not apply or if hotspot 1g SAR > 1.2 W/kg.
11. Per the FCC change document for this device, the GSM/GPRS/EDGE 850/1900 MHz, UMTS 850/1900 MHz, CDMA/EVDO 850/1900 MHz, 2.4 GHz WLAN/Bluetooth, and 5 GHz WLAN modes remain the same as the original certified device. Therefore, no additional SAR evaluations were required for these bands/modes.
12. Only LTE Band 13, and LTE Band 4 (AWS) were evaluated for the current test report. Please refer to RF Exposure Technical Report S/N 0Y1307301504-R1.A3L for standalone SAR for the other bands/modes.
13. Per FCC KDB Publication 648474 D04, SAR was measured using the standard battery cover and then repeated with the wireless charging battery cover for the highest reported SAR for each wireless technology, frequency band, operating mode, and exposure condition. No other additional test with wireless charging cover was required since all reported SAR were less than 1.2 W/kg.

LTE Notes:

1. LTE Considerations: LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05v02r01. The general test procedures used for testing can be found in Section 8.3.4.
2. MPR is implemented for this device by the manufacturer when the device is operating at maximum power. 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.

13 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

13.1 Introduction

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

13.2 Simultaneous Transmission Procedures

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

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

Table 13-1
Estimated SAR

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

Notes:
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.Main Antenna SAR testing was not required for extremity exposure conditions per FCC KDB 648474 D04v01r01. Therefore, no further analysis was required to determine that possible simultaneous scenarios (including those with WIFI direct) would not exceed the SAR limit.
3. The current test report shows the new simultaneous transmission scenarios possible from the FCC Change Document for LTE Band 13, and LTE Band 4 (AWS). Please refer to RF Exposure Technical Report S/N 0Y1307301504-R1.A3L for original device standalone SAR of other bands/modes and for original device simultaneous transmission analysis.

13.3 Head SAR Simultaneous Transmission Analysis

Table 13-2
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Held to Ear)

Simult Tx	Configuration	LTE Band 13 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.037	0.105	0.142
	Right Tilt	0.017	0.102	0.119
	Left Cheek	0.089	0.251	**0.340**
	Left Tilt	0.024	0.116	0.140
Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.123	0.105	0.228
	Right Tilt	0.008	0.102	0.110
	Left Cheek	0.065	0.251	**0.316**
	Left Tilt	0.013	0.116	0.129

Table 13-3
Simultaneous Transmission Scenario with 5 GHz WLAN (Held to Ear)

Simult Tx	Configuration	LTE Band 13 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.037	0.018	0.055
	Right Tilt	0.017	0.027	0.044
	Left Cheek	0.089	0.038	**0.127**
	Left Tilt	0.024	0.035	0.059
Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.123	0.018	0.141
	Right Tilt	0.008	0.027	0.035
	Left Cheek	0.065	0.038	**0.103**
	Left Tilt	0.013	0.035	0.048

Note: The worst case 5 GHz WLAN reported SAR for each head configuration was used for SAR summation, regardless of whether the WLAN channel has WIFI hotspot capability. Therefore, the summations above represent the absolute worst cases for simultaneous transmission with 5 GHz WLAN.

13.4 Body-Worn Simultaneous Transmission Analysis

Table 13-4
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body-Worn at 10 mm)

Configuration	Mode	4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	LTE Band 13	0.369	0.173	0.542
Back Side	LTE Band 4 (AWS)	0.440	0.173	0.613

Table 13-5
Simultaneous Transmission Scenario with 5 GHz WLAN (Body-Worn at 10 mm)

Configuration	Mode	4G SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	LTE Band 13	0.369	0.125	0.494
Back Side	LTE Band 4 (AWS)	0.440	0.125	0.565

Note: The worst case 5 GHz WLAN reported SAR for each body-worn configuration was used for SAR summation, regardless of whether the WLAN channel has WIFI hotspot capability. Therefore, the summations above represent the absolute worst cases for simultaneous transmission with 5 GHz WLAN.

Table 13-6
Simultaneous Transmission Scenario with Bluetooth (Body-Worn at 10 mm)

Configuration	Mode	4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Back Side	LTE Band 13	0.369	0.187	0.556
Back Side	LTE Band 4 (AWS)	0.440	0.187	0.627

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

13.5 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 13-7
Simultaneous Transmission Scenario (2.4 GHz Hotspot at 1.0 cm)

Simult Tx	Configuration	LTE Band 13 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.369	0.173	**0.542**
	Front	0.036	0.057	0.093
	Top	-	0.050	0.050
	Bottom	-	-	0.000
	Right	0.252	0.064	0.316
	Left	-	-	0.000
Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.440	0.173	**0.613**
	Front	0.076	0.057	0.133
	Top	-	0.050	0.050
	Bottom	0.018	-	0.018
	Right	0.508	0.064	0.572
	Left	-	-	0.000

Table 13-8
Simultaneous Transmission Scenario (5.8 GHz Wireless Router at 1.0 cm)

Simult Tx	Configuration	LTE Band 13 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.369	0.083	**0.452**
	Front	0.036	0.008	0.044
	Top	-	0.026	0.026
	Bottom	-	-	0.000
	Right	0.252	0.026	0.278
	Left	-	-	0.000
Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.440	0.083	0.523
	Front	0.076	0.008	0.084
	Top	-	0.026	0.026
	Bottom	0.018	-	0.018
	Right	0.508	0.026	**0.534**
	Left	-	-	0.000

13.6 SVLTE Simultaneous Transmission Analysis

Table 13-9
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Held to Ear)

Simult Tx	CDMA Power Level (dBm)	Configuration	Cell. CDMA SAR (W/kg)	LTE Band 13 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	
		Tx Antenna	1	2	3	1+2	1+2+3
		Maximum Allowed Power (dBm)	25	19.5	17.5		
Head SAR	P ≥ 18	Right Cheek	0.217	0.037	0.105	0.254	0.359
		Right Tilt	0.174	0.016	0.102	0.190	0.292
		Left Cheek	0.325	0.050	0.251	0.375	0.626
		Left Tilt	0.153	0.026	0.116	0.179	0.295
		Maximum Allowed Power (dBm)	18.5	23.5	17.5		
	P < 18	Right Cheek	0.037	0.037	0.105	0.074	0.179
		Right Tilt	0.023	0.017	0.102	0.040	0.142
		Left Cheek	0.042	0.089	0.251	0.131	0.382
		Left Tilt	0.023	0.024	0.116	0.047	0.163

Simult Tx	CDMA Power Level (dBm)	Configuration	Cell. CDMA SAR (W/kg)	LTE Band 4 (AWS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	
		Tx Antenna	1	2	3	1+2	1+2+3
		Maximum Allowed Power (dBm)	25	19.5	17.5		
Head SAR	P ≥ 18	Right Cheek	0.217	0.054	0.105	0.271	0.376
		Right Tilt	0.174	0.006	0.102	0.180	0.282
		Left Cheek	0.325	0.030	0.251	0.355	0.606
		Left Tilt	0.153	0.002	0.116	0.155	0.271
		Maximum Allowed Power (dBm)	18.5	23.5	17.5		
	P < 18	Right Cheek	0.037	0.123	0.105	0.160	0.265
		Right Tilt	0.023	0.008	0.102	0.031	0.133
		Left Cheek	0.042	0.065	0.251	0.107	0.358
		Left Tilt	0.023	0.013	0.116	0.036	0.152

Simult Tx	CDMA Power Level (dBm)	Configuration	PCS CDMA SAR (W/kg)	LTE Band 13 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	
		Tx Antenna	1	2	3	1+2	1+2+3
		Maximum Allowed Power (dBm)	25	19.5	17.5		
Head SAR	P ≥ 18	Right Cheek	0.145	0.037	0.105	0.182	0.287
		Right Tilt	0.150	0.016	0.102	0.166	0.268
		Left Cheek	0.257	0.050	0.251	0.307	0.558
		Left Tilt	0.125	0.026	0.116	0.151	0.267
		Maximum Allowed Power (dBm)	18.5	23.5	17.5		
	P < 18	Right Cheek	0.023	0.037	0.105	0.060	0.165
		Right Tilt	0.026	0.017	0.102	0.043	0.145
		Left Cheek	0.043	0.089	0.251	0.132	0.383
		Left Tilt	0.022	0.024	0.116	0.046	0.162

Simult Tx	CDMA Power Level (dBm)	Configuration	PCS CDMA SAR (W/kg)	LTE Band 4 (AWS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	
		Tx Antenna	1	2	3	1+2	1+2+3
		Maximum Allowed Power (dBm)	25	19.5	17.5		
Head SAR	P ≥ 18	Right Cheek	0.145	0.054	0.105	0.199	0.304
		Right Tilt	0.150	0.006	0.102	0.156	0.258
		Left Cheek	0.257	0.030	0.251	0.287	0.538
		Left Tilt	0.125	0.002	0.116	0.127	0.243
		Maximum Allowed Power (dBm)	18.5	23.5	17.5		
	P < 18	Right Cheek	0.023	0.123	0.105	0.146	0.251
		Right Tilt	0.026	0.008	0.102	0.034	0.136
		Left Cheek	0.043	0.065	0.251	0.108	0.359
		Left Tilt	0.022	0.013	0.116	0.035	0.151

Table 13-10
Simultaneous Transmission Scenario with 5 GHz WLAN (Held to Ear)

Simult Tx	CDMA Power Level (dBm)	Configuration	Cell. CDMA SAR (W/kg)	LTE Band 13 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	
		Tx Antenna	1	2	3	1+2	1+2+3
		Maximum Allowed Power (dBm)	25	19.5	13.5		
Head SAR	P ≥ 18	Right Cheek	0.217	0.037	0.018	0.254	0.272
		Right Tilt	0.174	0.016	0.027	0.190	0.217
		Left Cheek	0.325	0.050	0.038	0.375	0.413
		Left Tilt	0.153	0.026	0.035	0.179	0.214
		Maximum Allowed Power (dBm)	18.5	23.5	13.5		
	P < 18	Right Cheek	0.037	0.037	0.018	0.074	0.092
		Right Tilt	0.023	0.017	0.027	0.040	0.067
		Left Cheek	0.042	0.089	0.038	0.131	0.169
		Left Tilt	0.023	0.024	0.035	0.047	0.082

Simult Tx	CDMA Power Level (dBm)	Configuration	Cell. CDMA SAR (W/kg)	LTE Band 4 (AWS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	
		Tx Antenna	1	2	3	1+2	1+2+3
		Maximum Allowed Power (dBm)	25	19.5	13.5		
Head SAR	P ≥ 18	Right Cheek	0.217	0.054	0.018	0.271	0.289
		Right Tilt	0.174	0.006	0.027	0.180	0.207
		Left Cheek	0.325	0.030	0.038	0.355	0.393
		Left Tilt	0.153	0.002	0.035	0.155	0.190
		Maximum Allowed Power (dBm)	18.5	23.5	13.5		
	P < 18	Right Cheek	0.037	0.123	0.018	0.160	0.178
		Right Tilt	0.023	0.008	0.027	0.031	0.058
		Left Cheek	0.042	0.065	0.038	0.107	0.145
		Left Tilt	0.023	0.013	0.035	0.036	0.071

Simult Tx	CDMA Power Level (dBm)	Configuration	PCS CDMA SAR (W/kg)	LTE Band 13 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	
		Tx Antenna	1	2	3	1+2	1+2+3
		Maximum Allowed Power (dBm)	25	19.5	13.5		
Head SAR	P ≥ 18	Right Cheek	0.145	0.037	0.018	0.182	0.200
		Right Tilt	0.150	0.016	0.027	0.166	0.193
		Left Cheek	0.257	0.050	0.038	0.307	0.345
		Left Tilt	0.125	0.026	0.035	0.151	0.186
		Maximum Allowed Power (dBm)	18.5	23.5	13.5		
	P < 18	Right Cheek	0.023	0.037	0.018	0.060	0.078
		Right Tilt	0.026	0.017	0.027	0.043	0.070
		Left Cheek	0.043	0.089	0.038	0.132	0.170
		Left Tilt	0.022	0.024	0.035	0.046	0.081

Simult Tx	CDMA Power Level (dBm)	Configuration	PCS CDMA SAR (W/kg)	LTE Band 4 (AWS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	
		Tx Antenna	1	2	3	1+2	1+2+3
		Maximum Allowed Power (dBm)	25	19.5	13.5		
Head SAR	P ≥ 18	Right Cheek	0.145	0.054	0.018	0.199	0.217
		Right Tilt	0.150	0.006	0.027	0.156	0.183
		Left Cheek	0.257	0.030	0.038	0.287	0.325
		Left Tilt	0.125	0.002	0.035	0.127	0.162
		Maximum Allowed Power (dBm)	18.5	23.5	13.5		
	P < 18	Right Cheek	0.023	0.123	0.018	0.146	0.164
		Right Tilt	0.026	0.008	0.027	0.034	0.061
		Left Cheek	0.043	0.065	0.038	0.108	0.146
		Left Tilt	0.022	0.013	0.035	0.035	0.070

Note: The worst case 5 GHz WLAN reported SAR for each Head configuration was used for SAR summation, regardless of whether the WLAN channel has WIFI Hotspot capability. Therefore, the summations above represent the absolute worst cases for simultaneous transmission with 5 GHz WLAN.

Table 13-11
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body-Worn at 10 mm)

Configuration	CDMA Power Level (dBm)	Mode		CDMA SAR (W/kg)	LTE Band 13 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	
			Tx Antenna	1	2	3		
			Maximum Allowed Power (dBm)	25	19.5	17.5	1+2	1+2+3
Back Side	P ≥ 18	Cell. CDMA	25.0	0.615	0.338	0.173	0.953	1.126
Back Side		PCS CDMA	25.0	0.753	0.338	0.173	1.091	1.264
			Maximum Allowed Power (dBm)	18.5	23.5	17.5		
Back Side	P < 18	Cell. CDMA	18.5	0.090	0.369	0.173	0.459	0.632
Back Side		PCS CDMA	18.5	0.141	0.369	0.173	0.510	0.683

Configuration	CDMA Power Level (dBm)	Mode		CDMA SAR (W/kg)	LTE Band 4 (AWS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	
			Tx Antenna	1	2	3		
			Maximum Allowed Power (dBm)	25	19.5	17.5	1+2	1+2+3
Back Side	P ≥ 18	Cell. CDMA	25.0	0.615	0.158	0.173	0.773	0.946
Back Side		PCS CDMA	25.0	0.753	0.158	0.173	0.911	1.084
			Maximum Allowed Power (dBm)	18.5	23.5	17.5		
Back Side	P < 18	Cell. CDMA	18.5	0.090	0.440	0.173	0.530	0.703
Back Side		PCS CDMA	18.5	0.141	0.440	0.173	0.581	0.754

Table 13-12
Simultaneous Transmission Scenario with 5 GHz WLAN (Body-Worn at 10 mm)

Configuration	CDMA Power Level (dBm)	Mode		CDMA SAR (W/kg)	LTE Band 13 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	
			Tx Antenna	1	2	3		
			Maximum Allowed Power (dBm)	25	19.5	13.5	1+2	1+2+3
Back Side	P ≥ 18	Cell. CDMA	25.0	0.615	0.338	0.125	0.953	1.078
Back Side		PCS CDMA	25.0	0.753	0.338	0.125	1.091	1.216
			Maximum Allowed Power (dBm)	18.5	23.5	13.5		
Back Side	P < 18	Cell. CDMA	18.5	0.090	0.369	0.125	0.459	0.584
Back Side		PCS CDMA	18.5	0.141	0.369	0.125	0.510	0.635

Configuration	CDMA Power Level (dBm)	Mode		CDMA SAR (W/kg)	LTE Band 4 (AWS) SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	
			Tx Antenna	1	2	3		
			Maximum Allowed Power (dBm)	25	19.5	13.5	1+2	1+2+3
Back Side	P ≥ 18	Cell. CDMA	25.0	0.615	0.158	0.125	0.773	0.898
Back Side		PCS CDMA	25.0	0.753	0.158	0.125	0.911	1.036
			Maximum Allowed Power (dBm)	18.5	23.5	13.5		
Back Side	P < 18	Cell. CDMA	18.5	0.090	0.440	0.125	0.530	0.655
Back Side		PCS CDMA	18.5	0.141	0.440	0.125	0.581	0.706

Note: The worst case 5 GHz WLAN reported SAR for each Head configuration was used for SAR summation, regardless of whether the WLAN channel has WIFI Hotspot capability. Therefore, the summations above represent the absolute worst cases for simultaneous transmission with 5 GHz WLAN.

Table 13-13
Simultaneous Transmission Scenario with 2.4 GHz Bluetooth (Body-Worn at 10 mm)

Configuration	CDMA Power Level (dBm)	Mode		CDMA SAR (W/kg)	LTE Band 13 SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	
			Tx Antenna	1	2	3		
			Maximum Allowed Power (dBm)	25	19.5	9.5	1+2	1+2+3
Back Side	P ≥ 18	Cell. CDMA	25.0	0.615	0.338	0.187	0.953	1.140
Back Side		PCS CDMA	25.0	0.753	0.338	0.187	1.091	**1.278**
			Maximum Allowed Power (dBm)	18.5	23.5	9.5		
Back Side	P < 18	Cell. CDMA	18.5	0.090	0.369	0.187	0.459	0.646
Back Side		PCS CDMA	18.5	0.141	0.369	0.187	0.510	0.697
Configuration	CDMA Power Level (dBm)	Mode		CDMA SAR (W/kg)	LTE Band 4 (AWS) SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)	
			Tx Antenna	1	2	3		
			Maximum Allowed Power (dBm)	25	19.5	9.5	1+2	1+2+3
Back Side	P ≥ 18	Cell. CDMA	25.0	0.615	0.158	0.187	0.773	0.960
Back Side		PCS CDMA	25.0	0.753	0.158	0.187	0.911	1.098
			Maximum Allowed Power (dBm)	18.5	23.5	9.5		
Back Side	P < 18	Cell. CDMA	18.5	0.090	0.440	0.187	0.530	0.717
Back Side		PCS CDMA	18.5	0.141	0.440	0.187	0.581	0.768

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

Table 13-14
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Hotspot at 10 mm)

Simult Tx	CDMA Power Level (dBm)	Configuration	Cell. CDMA SAR (W/kg)	LTE Band 13 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
		Tx Antenna	1	2	3	1+2+3
		Maximum Allowed Power (dBm)	25	19.5	17.5	
Body SAR	P ≥ 18	Back	0.615	0.338	0.173	**1.126**
		Front	0.529	0.039	0.057	0.625
		Top	-	-	0.050	0.050
		Bottom	0.343	-	-	0.343
		Right	-	0.174	0.064	0.238
		Left	0.479	-	-	0.479
		Maximum Allowed Power (dBm)	18.5	23.5	17.5	
	P < 18	Back	0.090	0.369	0.173	0.632
		Front	0.074	0.036	0.057	0.167
		Top	-	-	0.050	0.050
		Bottom	0.048	-	-	0.048
		Right	-	0.252	0.064	0.316
		Left	0.064	-	-	0.064

Simult Tx	CDMA Power Level (dBm)	Configuration	Cell. CDMA SAR (W/kg)	LTE Band 4 (AWS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
		Tx Antenna	1	2	3	1+2+3
		Maximum Allowed Power (dBm)	25	19.5	17.5	
Body SAR	P ≥ 18	Back	0.615	0.158	0.173	**0.946**
		Front	0.529	0.035	0.057	0.621
		Top	-	-	0.050	0.050
		Bottom	0.343	0.005	-	0.348
		Right	-	0.233	0.064	0.297
		Left	0.479	-	-	0.479
		Maximum Allowed Power (dBm)	18.5	23.5	17.5	
	P < 18	Back	0.090	0.440	0.173	0.703
		Front	0.074	0.076	0.057	0.207
		Top	-	-	0.050	0.050
		Bottom	0.048	0.018	-	0.066
		Right	-	0.508	0.064	0.572
		Left	0.064	-	-	0.064

Simult Tx	CDMA Power Level (dBm)	Configuration	PCS CDMA SAR (W/kg)	LTE Band 13 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
		Tx Antenna	1	2	3	1+2+3
		Maximum Allowed Power (dBm)	25	19.5	17.5	
Body SAR	P ≥ 18	Back	0.753	0.338	0.173	**1.264**
		Front	1.019	0.039	0.057	1.115
		Top	-	-	0.050	0.050
		Bottom	0.677	-	-	0.677
		Right	-	0.174	0.064	0.238
		Left	0.332	-	-	0.332
		Maximum Allowed Power (dBm)	18.5	23.5	17.5	
	P < 18	Back	0.141	0.369	0.173	0.683
		Front	0.207	0.036	0.057	0.300
		Top	-	-	0.050	0.050
		Bottom	0.112	-	-	0.112
		Right	-	0.252	0.064	0.316
		Left	0.058	-	-	0.058

Simult Tx	CDMA Power Level (dBm)	Configuration	PCS CDMA SAR (W/kg)	LTE Band 4 (AWS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
		Tx Antenna	1	2	3	1+2+3
		Maximum Allowed Power (dBm)	25	19.5	17.5	
Body SAR	P ≥ 18	Back	0.753	0.158	0.173	1.084
		Front	1.019	0.035	0.057	**1.111**
		Top	-	-	0.050	0.050
		Bottom	0.677	0.005	-	0.682
		Right	-	0.233	0.064	0.297
		Left	0.332	-	-	0.332
		Maximum Allowed Power (dBm)	18.5	23.5	17.5	
	P < 18	Back	0.141	0.440	0.173	0.754
		Front	0.207	0.076	0.057	0.340
		Top	-	-	0.050	0.050
		Bottom	0.112	0.018	-	0.130
		Right	-	0.508	0.064	0.572
		Left	0.058	-	-	0.058

Table 13-15
Simultaneous Transmission Scenario with 5.8 GHz WLAN (Wireless Router at 10 mm)

Simult Tx	CDMA Power Level (dBm)	Configuration	Cell. CDMA SAR (W/kg)	LTE Band 13 SAR (W/kg)	5.8 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
		Tx Antenna	1	2	3	1+2+3
		Maximum Allowed Power (dBm)	25	19.5	13.5	
Body SAR	P ≥ 18	Back	0.615	0.338	0.083	**1.036**
		Front	0.529	0.039	0.008	0.576
		Top	-	-	0.026	0.026
		Bottom	0.343	-	-	0.343
		Right	-	0.174	0.026	0.200
		Left	0.479	-	-	0.479
		Maximum Allowed Power (dBm)	18.5	23.5	13.5	
	P < 18	Back	0.090	0.369	0.083	0.542
		Front	0.074	0.036	0.008	0.118
		Top	-	-	0.026	0.026
		Bottom	0.048	-	-	0.048
		Right	-	0.252	0.026	0.278
		Left	0.064	-	-	0.064

Simult Tx	CDMA Power Level (dBm)	Configuration	Cell. CDMA SAR (W/kg)	LTE Band 4 (AWS) SAR (W/kg)	5.8 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
		Tx Antenna	1	2	3	1+2+3
		Maximum Allowed Power (dBm)	25	19.5	13.5	
Body SAR	P ≥ 18	Back	0.615	0.158	0.083	**0.856**
		Front	0.529	0.035	0.008	0.572
		Top	-	-	0.026	0.026
		Bottom	0.343	0.005	-	0.348
		Right	-	0.233	0.026	0.259
		Left	0.479	-	-	0.479
		Maximum Allowed Power (dBm)	18.5	23.5	13.5	
	P < 18	Back	0.090	0.440	0.083	0.613
		Front	0.074	0.076	0.008	0.158
		Top	-	-	0.026	0.026
		Bottom	0.048	0.018	-	0.066
		Right	-	0.508	0.026	0.534
		Left	0.064	-	-	0.064

Simult Tx	CDMA Power Level (dBm)	Configuration	PCS CDMA SAR (W/kg)	LTE Band 13 SAR (W/kg)	5.8 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
		Tx Antenna	1	2	3	1+2+3
		Maximum Allowed Power (dBm)	25	19.5	13.5	
Body SAR	P ≥ 18	Back	0.753	0.338	0.083	**1.174**
		Front	1.019	0.039	0.008	1.066
		Top	-	-	0.026	0.026
		Bottom	0.677	-	-	0.677
		Right	-	0.174	0.026	0.200
		Left	0.332	-	-	0.332
		Maximum Allowed Power (dBm)	18.5	23.5	13.5	
	P < 18	Back	0.141	0.369	0.083	0.593
		Front	0.207	0.036	0.008	0.251
		Top	-	-	0.026	0.026
		Bottom	0.112	-	-	0.112
		Right	-	0.252	0.026	0.278
		Left	0.058	-	-	0.058

Simult Tx	CDMA Power Level (dBm)	Configuration	PCS CDMA SAR (W/kg)	LTE Band 4 (AWS) SAR (W/kg)	5.8 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
		Tx Antenna	1	2	3	1+2+3
		Maximum Allowed Power (dBm)	25	19.5	13.5	
Body SAR	P ≥ 18	Back	0.753	0.158	0.083	0.994
		Front	1.019	0.035	0.008	**1.062**
		Top	-	-	0.026	0.026
		Bottom	0.677	0.005	-	0.682
		Right	-	0.233	0.026	0.259
		Left	0.332	-	-	0.332
		Maximum Allowed Power (dBm)	18.5	23.5	13.5	
	P < 18	Back	0.141	0.440	0.083	0.664
		Front	0.207	0.076	0.008	0.291
		Top	-	-	0.026	0.026
		Bottom	0.112	0.018	-	0.130
		Right	-	0.508	0.026	0.534
		Left	0.058	-	-	0.058

13.7 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.

14 SAR MEASUREMENT VARIABILITY

14.1 Measurement Variability

Per FCC KDB Publication 865664 D01v01, SAR measurement variability was not required when the original highest measured SAR is < 0.80 W/kg.

14.2 Measurement Uncertainty

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

15 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	85070C	Dielectric Probe Kit	2/14/2013	Annual	2/14/2014	MY44300633
Agilent	85047A	S-Parameter Test Set	N/A	N/A	N/A	2904A00579
Amplifier Research	5S1G4	5W, 800MHz-4.2GHz	N/A	N/A	N/A	21910
Anritsu	ML2495A	Power Meter	10/11/2012	Annual	10/11/2013	1039008
Anritsu	MT8820C	Radio Communication Tester	11/6/2012	Annual	11/6/2013	6200901190
Anritsu	MA24106A	USB Power Sensor	12/7/2012	Annual	12/7/2013	1244512
Anritsu	MA24106A	USB Power Sensor	12/6/2012	Annual	12/6/2013	1248508
Anritsu	MA2481D	Universal Sensor	12/17/2012	Annual	12/17/2013	1204419
Anritsu	MA2481D	Universal Sensor	12/17/2012	Annual	12/17/2013	1204343
Anritsu	ML2496A	Power Meter	11/28/2012	Annual	11/28/2013	1138001
Anritsu	MT8820C	Radio Communication Analyzer	6/28/2013	Annual	6/28/2014	6201240328
COMTECH	AR85729-5/5759B	Solid State Amplifier	CBT	N/A	CBT	M3W1A00-1002
COMTech	AR85729-5	Solid State Amplifier	CBT	N/A	CBT	M1S5A00-009
Gigatronics	80701A	(0.05-18GHz) Power Sensor	10/10/2012	Annual	10/10/2013	1833460
Gigatronics	8651A	Universal Power Meter	10/10/2012	Annual	10/10/2013	8650319
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
MiniCircuits	SLP-2400+	Low Pass Filter	CBT	N/A	CBT	R8979500903
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Rohde & Schwarz	NRVD	Dual Channel Power Meter	10/12/2012	Biennial	10/12/2014	101695
Rohde & Schwarz	NRV-Z32	Peak Power Sensor	10/12/2012	Biennial	10/12/2014	836019/013
Rohde & Schwarz	SMIQ03B	Signal Generator	4/17/2013	Annual	4/17/2014	DE27259
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	10/7/2011	Biennial	10/7/2013	103962
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	2/8/2013	Annual	2/8/2014	101699
Rohde & Schwarz	SME06	Signal Generator	10/11/2012	Annual	10/11/2013	832026
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	6/6/2013	Annual	6/6/2014	111427
Seekonk	NC-100	Torque Wrench (8" lb)	11/29/2011	Triennial	11/29/2014	21053
SPEAG	D1765V2	1765 MHz SAR Dipole	5/14/2013	Annual	5/14/2014	1008
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/6/2013	Annual	2/6/2014	649
SPEAG	ES3DV3	SAR Probe	3/15/2013	Annual	3/15/2014	3209
SPEAG	D1750V2	1750 MHz SAR Dipole	4/30/2013	Annual	4/30/2014	1051
SPEAG	DAE4	Dasy Data Acquisition Electronics	11/13/2012	Annual	11/13/2013	1333
SPEAG	D750V3	750 MHz Dipole	1/7/2013	Annual	1/7/2014	1003
SPEAG	ES3DV3	SAR Probe	11/15/2012	Annual	11/15/2013	3287
SPEAG	DAE4	Dasy Data Acquisition Electronics	3/8/2013	Annual	3/8/2014	1334
SPEAG	EX3DV4	SAR Probe	2/27/2013	Annual	2/27/2014	3920
Tektronix	RSA6114A	Real Time Spectrum Analyzer	4/17/2013	Annual	4/17/2014	B010177
VWR	62344-925	Mini-Thermometer	10/24/2011	Biennial	10/24/2013	111886430
VWR	62344-925	Mini-Thermometer	10/24/2011	Biennial	10/24/2013	111886443
VWR	62344-925	Mini-Thermometer	10/24/2011	Biennial	10/24/2013	111886414
VWR	62344-925	Mini-Thermometer	10/24/2011	Biennial	10/24/2013	111886441
VWR	23226-658	Long Stem Thermometer	3/30/2012	Biennial	3/30/2014	122179874
VWR	23226-658	Long Stem Thermometer	7/11/2012	Biennial	7/11/2014	122389334
VWR	23226-658	Long Stem Thermometer	6/27/2012	Biennial	6/27/2014	122363923
VWR	23226-658	Long Stem Thermometer	7/11/2012	Biennial	7/11/2014	122389330

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. All calibrated equipments were used during their calibration period.

16 MEASUREMENT UNCERTAINTIES

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

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

17 CONCLUSION

17.1 Measurement Conclusion

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

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

18 REFERENCES

[1] Federal Communications Commission, ET Docket 93-62, Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation, Aug. 1996.

[2] ANSI/IEEE C95.1-2005, American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 3kHz to 300GHz, New York: IEEE, 2006.

[3] ANSI/IEEE C95.1-1992, American National Standard safety levels with respect to human exposure to radio frequency electromagnetic fields, 3kHz to 300GHz, New York: IEEE, Sept. 1992.

[4] ANSI/IEEE C95.3-2002, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave, New York: IEEE, December 2002.

[5] Federal Communications Commission, OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01), Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, June 2001.

[6] IEEE Standards Coordinating Committee 34 – IEEE Std. 1528-2003, Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices.

[7] NCRP, National Council on Radiation Protection and Measurements, Biological Effects and Exposure Criteria for RadioFrequency Electromagnetic Fields, NCRP Report No. 86, 1986. Reprinted Feb. 1995.

[8] T. Schmid, O. Egger, N. Kuster, Automated E-field scanning system for dosimetric assessments, IEEE Transaction on Microwave Theory and Techniques, vol. 44, Jan. 1996, pp. 105-113.

[9] K. Pokovic, T. Schmid, N. Kuster, Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies, ICECOM97, Oct. 1997, pp. -124.

[10] K. Pokovic, T. Schmid, and N. Kuster, E-field Probe with improved isotropy in brain simulating liquids, Proceedings of the ELMAR, Zadar, Croatia, June 23-25, 1996, pp. 172-175.

[11] Schmid & Partner Engineering AG, Application Note: Data Storage and Evaluation, June 1998, p2.

[12] V. Hombach, K. Meier, M. Burkhardt, E. Kuhn, N. Kuster, The Dependence of EM Energy Absorption upon Human Modeling at 900 MHz, IEEE Transaction on Microwave Theory and Techniques, vol. 44 no. 10, Oct. 1996, pp. 1865-1873.

[13] N. Kuster and Q. Balzano, Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300MHz, IEEE Transaction on Vehicular Technology, vol. 41, no. 1, Feb. 1992, pp. 17-23.

[14] G. Hartsgrove, A. Kraszewski, A. Surowiec, Simulated Biological Materials for Electromagnetic Radiation Absorption Studies, University of Ottawa, Bioelectromagnetics, Canada: 1987, pp. 29-36.

[15] Q. Balzano, O. Garay, T. Manning Jr., Electromagnetic Energy Exposure of Simulated Users of Portable Cellular Telephones, IEEE Transactions on Vehicular Technology, vol. 44, no.3, Aug. 1995.

[16] W. Gander, Computermathematick, Birkhaeuser, Basel, 1992.

[17] W.H. Press, S.A. Teukolsky, W.T. Vetterling, and B.P. Flannery, Numerical Recipes in C, The Art of Scientific Computing, Second edition, Cambridge University Press, 1992.

[18] Federal Communications Commission, OET Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields. Supplement C, Dec. 1997.

[19] N. Kuster, R. Kastle, T. Schmid, Dosimetric evaluation of mobile communications equipment with known precision, IEEE Transaction on Communications, vol. E80-B, no. 5, May 1997, pp. 645-652.

[20] CENELEC CLC/SC111B, European Prestandard (prENV 50166-2), Human Exposure to Electromagnetic Fields High-frequency: 10kHz-300GHz, Jan. 1995.

[21] Prof. Dr. Niels Kuster, ETH, Eidgenössische Technische Hoschschule Zürich, Dosimetric Evaluation of the Cellular Phone.

[22] IEC 62209-1, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz), Feb. 2005.

[23] Industry Canada RSS-102 Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) Issue 4, March 2010.

[24] Health Canada Safety Code 6 Limits of Human Exposure to Radio Frequency Electromagnetic Fields in the Frequency Range from 3 kHz – 300 GHz, 2009

[25] FCC Public Notice DA-02-1438. Office of Engineering and Technology Announces a Transition Period for the Phantom Requirements of Supplement C to OET Bulletin 65, June 19, 2002

[26] FCC SAR Test Procedures for 2G-3G Devices, Mobile Hotspot and UMPC Devices KDB Publications 941225, D01-D07

[27] SAR Measurement procedures for IEEE 802.11a/b/g KDB Publication 248227 D01v01r02

[28] FCC SAR Considerations for Handsets with Multiple Transmitters and Antennas, KDB Publications 648474 D02-D04

[29] FCC SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers, FCC KDB Publication 616217 D04

[30] FCC SAR Measurement and Reporting Requirements for 100MHz – 6 GHz, KDB Publications 865664 D01-D02

[31] FCC General RF Exposure Guidance and SAR Procedures for Dongles, KDB Publication 447498, D01-D02

[32] Anexo à Resolução No. 533, de 10 de Septembro de 2009.

[33] IEC 62209-2, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz), Mar. 2010.

APPENDIX A: SAR TEST DATA

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN900V; Type: Portable Handset; Serial: 34C03

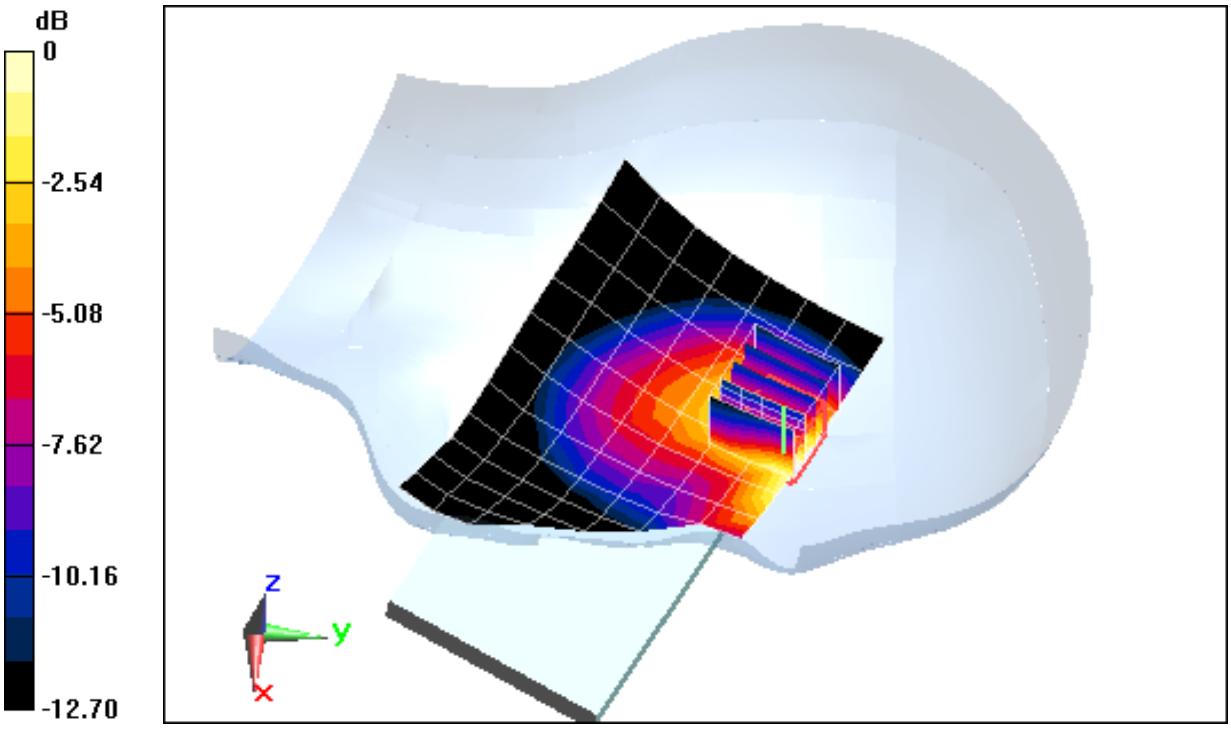
Communication System: LTE Band 13; Frequency: 782 MHz;Duty Cycle: 1:1
Medium: 750 Head Medium parameters used (interpolated):
f = 782 MHz; σ = 0.924 S/m; ε_r = 42.373; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 09-28-2013; Ambient Temp: 23.9°C; Tissue Temp: 23.2°C

Probe: ES3DV3 - SN3209; ConvF(6.74, 6.74, 6.74); Calibrated: 3/15/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 3/8/2013
Phantom: SAM Right; Type: QD000P40CD; Serial: 1686
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Mode: LTE Band 13, Left Head, Cheek, Mid.ch, QPSK, 10 MHz Bandwidth, 1 RB, 25 RB Offset; Wireless Charging Cover

Area Scan (8x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.632 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.146 W/kg
SAR(1 g) = 0.089 W/kg



0 dB = 0.0789 W/kg = -11.03 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN900V; Type: Portable Handset; Serial: LB4MA

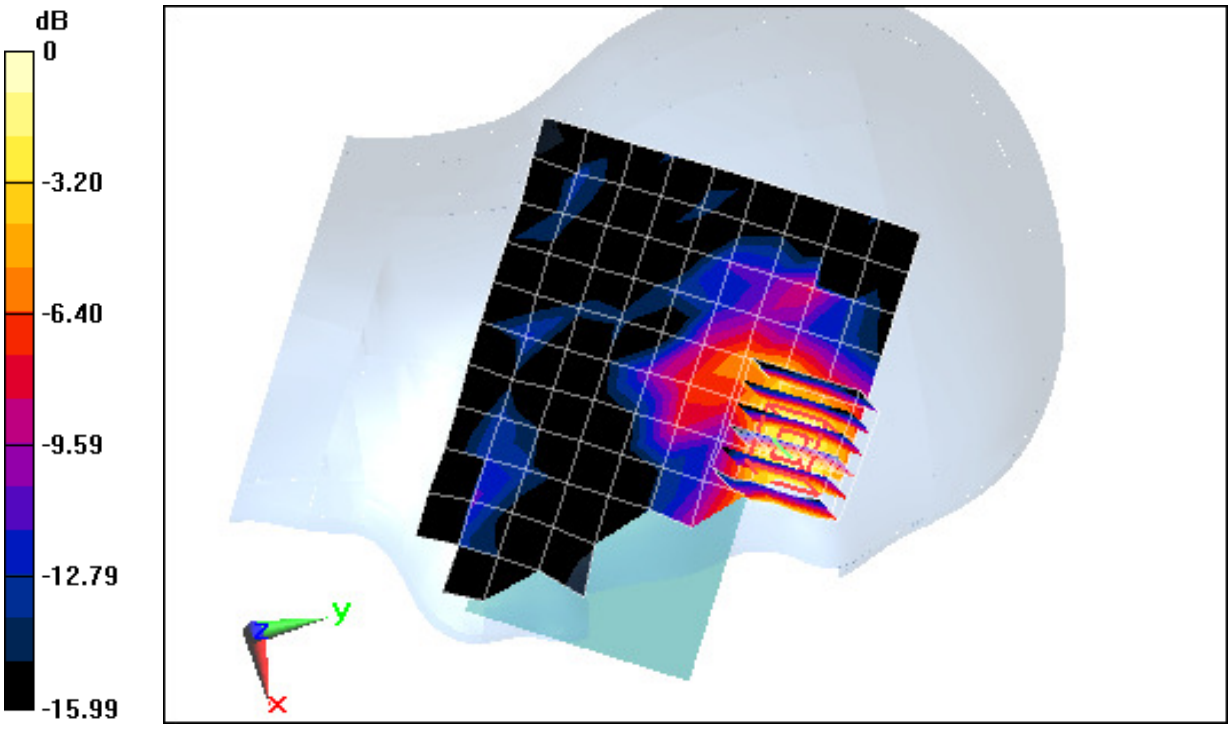
Communication System: LTE Band 4 (AWS) ; Frequency: 1732.5 MHz;Duty Cycle: 1:1
Medium: 1750 Head Medium parameters used (interpolated):
f = 1732.5 MHz; σ = 1.391 S/m; ε_r = 39.434; ρ = 1000 kg/m^3
Phantom section: Left Section

Test Date: 09-30-2013; Ambient Temp: 23.3°C; Tissue Temp: 22.6°C

Probe: EX3DV4 - SN3920; ConvF(7.97, 7.97, 7.97); Calibrated: 2/27/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/6/2013
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Mode: LTE Band 4 (AWS), Left Head, Cheek, Mid.ch, QPSK, 20 MHz Bandwidth, 1 RB, 99 RB Offset; Standard Back Cover

Area Scan (10x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.247 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.211 W/kg
SAR(1 g) = 0.028 W/kg



0 dB = 0.0304 W/kg = -15.17 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN900V; Type: Portable Handset; Serial: 34C03

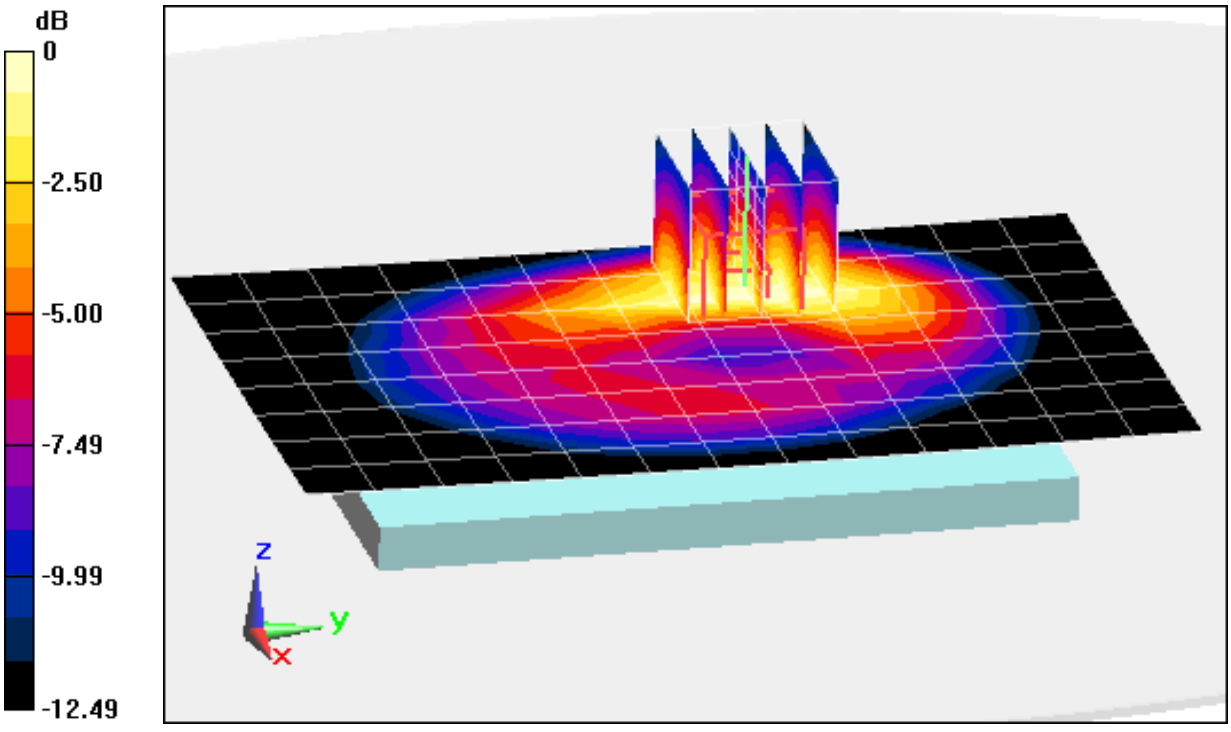
Communication System: LTE Band 13; Frequency: 782 MHz;Duty Cycle: 1:1
Medium: 750 Body Medium parameters used (interpolated):
f = 782 MHz; σ = 1.007 S/m; ε_r = 55.832; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 09-27-2013; Ambient Temp: 24.3°C; Tissue Temp: 23.9°C

Probe: ES3DV3 - SN3209; ConvF(6.38, 6.38, 6.38); Calibrated: 3/15/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 3/8/2013
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Mode: LTE Band 13, Body SAR, Back side, Mid.ch,
10 MHz Bandwidth, QPSK, 1 RB, 25 RB Offset; Standard Back Cover

Area Scan (9x14x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.734 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.579 W/kg
SAR(1 g) = 0.369 W/kg



0 dB = 0.405 W/kg = -3.93 dBW/kg

DUT: A3LSMN900V; Type: Portable Handset; Serial: LB4MA

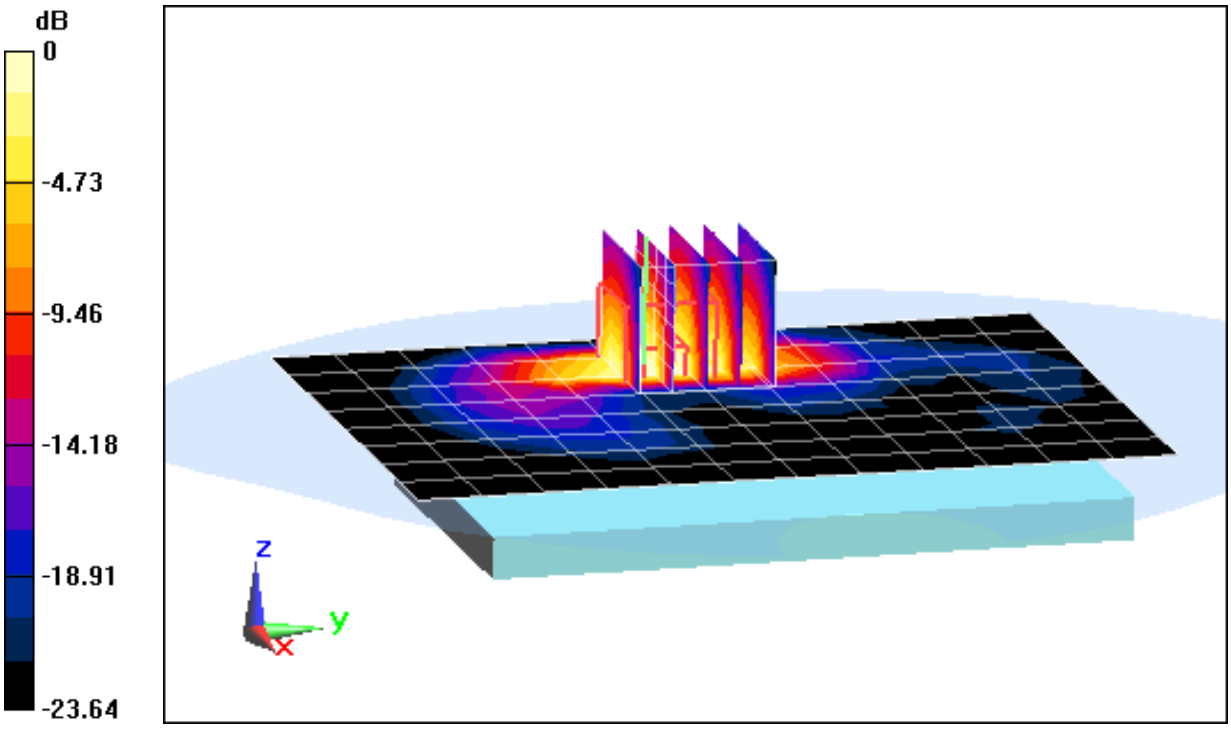
Communication System: LTE RF; Frequency: 1732.5 MHz;Duty Cycle: 1:1
Medium: 1750 Body Medium parameters used (interpolated):
f = 1732.5 MHz; σ = 1.518 S/m; ε_r = 51.143; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 09-30-2013; Ambient Temp: 23.1°C; Tissue Temp: 22.4°C

Probe: ES3DV3 - SN3287; ConvF(4.86, 4.86, 4.86); Calibrated: 11/15/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7164)

Mode: LTE Band 4 (AWS), Body SAR, Back side, Mid.ch,
20 MHz Bandwidth, QPSK, 1 RB, 99 RB Offset; Standard Back Cover

Area Scan (9x13x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.665 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 0.894 W/kg
SAR(1 g) = 0.440 W/kg



0 dB = 0.440 W/kg = -3.57 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSMN900V; Type: Portable Handset; Serial: LB4MA

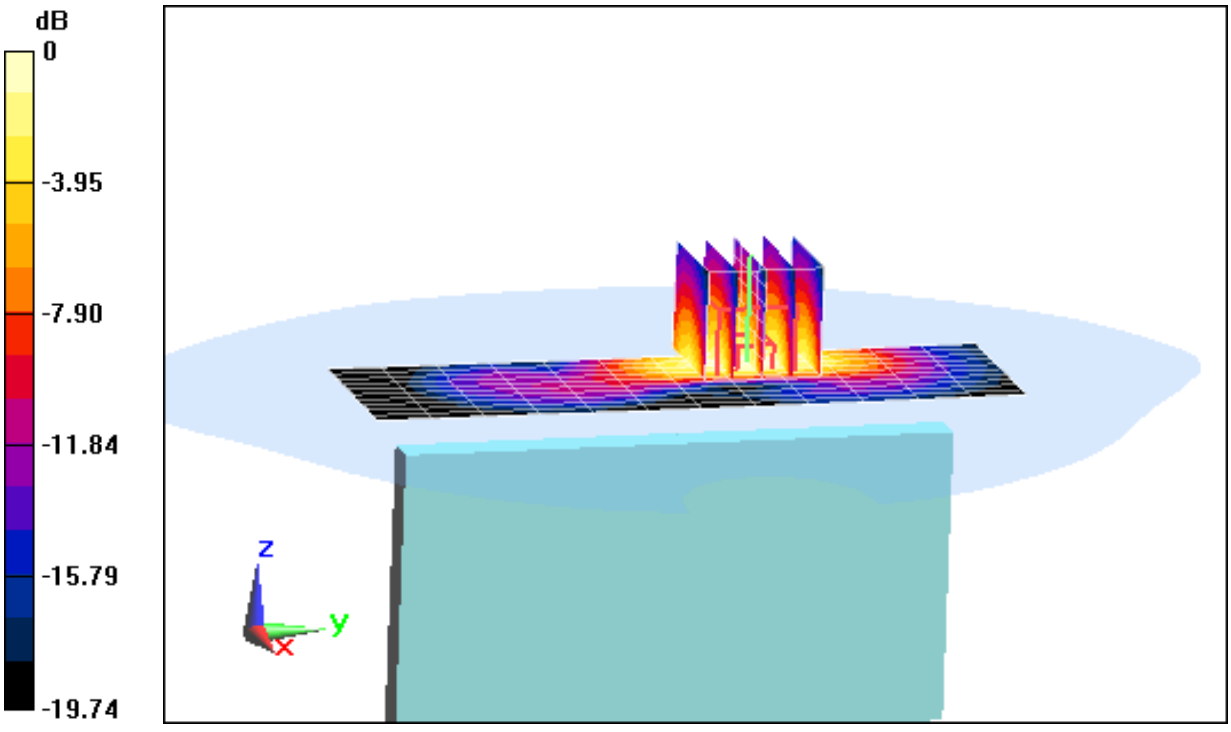
Communication System: LTE RF; Frequency: 1732.5 MHz;Duty Cycle: 1:1
Medium: 1750 Body Medium parameters used (interpolated):
f = 1732.5 MHz; σ = 1.518 S/m; ε_r = 51.143; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 09-30-2013; Ambient Temp: 23.1°C; Tissue Temp: 22.4°C

Probe: ES3DV3 - SN3287; ConvF(4.86, 4.86, 4.86); Calibrated: 11/15/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7164)

Mode: LTE Band 4 (AWS), Body SAR, Right Edge, Mid.ch,
20 MHz Bandwidth, QPSK, 1 RB, 99 RB Offset; Standard Back Cover

Area Scan (11x13x1): Measurement grid: dx=5mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 19.228 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 0.894 W/kg
SAR(1 g) = 0.508 W/kg



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

APPENDIX B: SYSTEM VERIFICATION

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 750 MHz;Duty Cycle: 1:1

Medium: 750 Head Medium parameters used (interpolated):

f = 750 MHz; σ = 0.896 S/m; ε_r = 42.657; ρ = 1000 kg/m^3

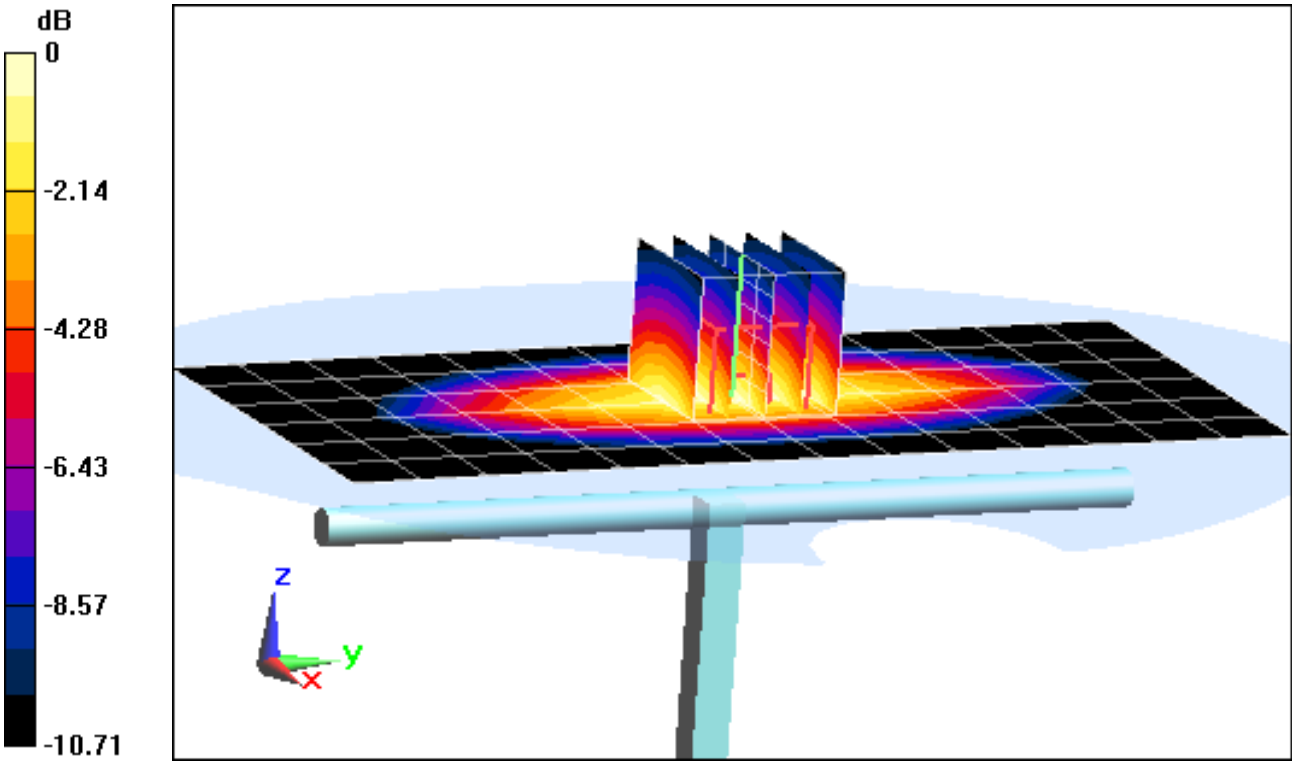
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 09-28-2013; Ambient Temp: 23.9°C; Tissue Temp: 23.2°C

Probe: ES3DV3 - SN3209; ConvF(6.74, 6.74, 6.74); Calibrated: 3/15/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 3/8/2013
Phantom: SAM Right; Type: QD000P40CD; Serial: 1686
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

750 MHz System Verification

Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 1.32 W/kg
SAR(1 g) = 0.888 W/kg
Deviation: 4.96%



0 dB = 0.963 W/kg = -0.16 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

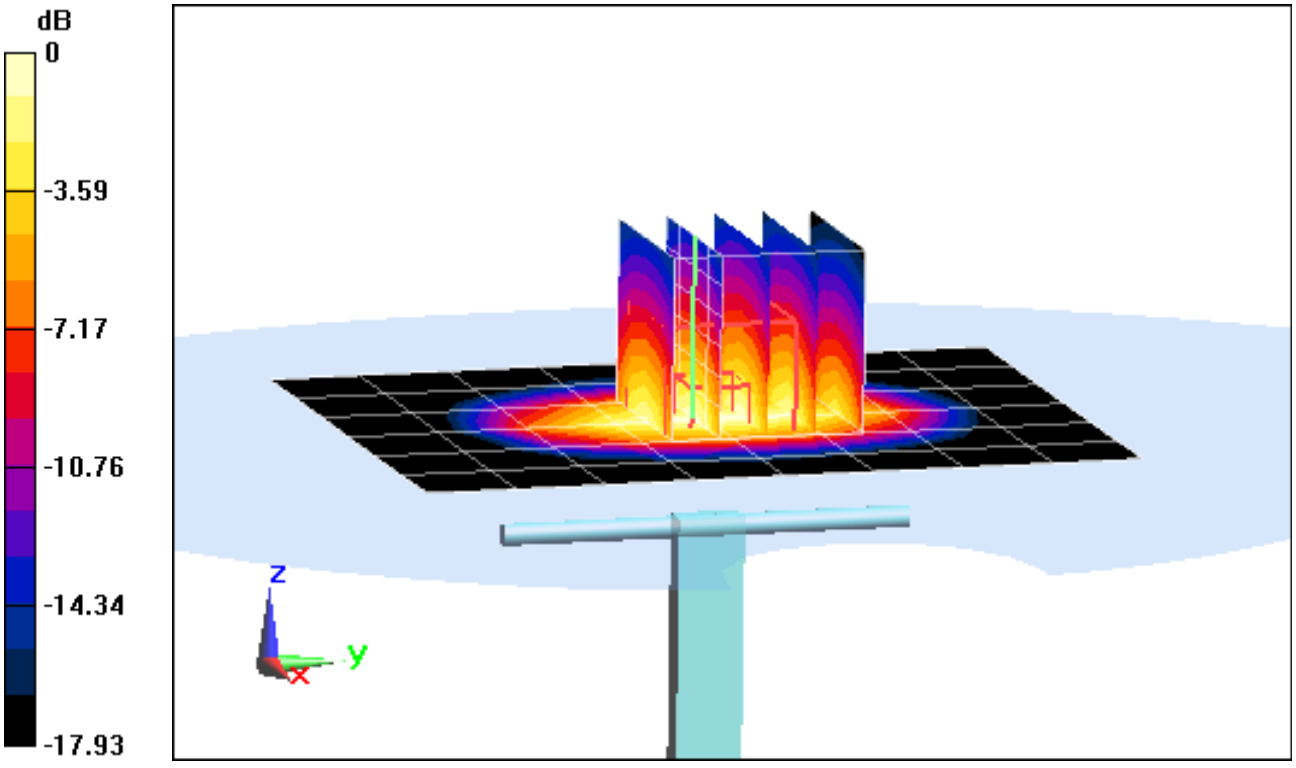
Communication System: CW; Frequency: 1750 MHz;Duty Cycle: 1:1
Medium: 1750 Head Medium parameters used:
f = 1750 MHz; σ = 1.412 S/m; ε_r = 39.359; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 09-30-2013; Ambient Temp: 23.3°C; Tissue Temp: 22.6°C

Probe: EX3DV4 - SN3920; ConvF(7.97, 7.97, 7.97); Calibrated: 2/27/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn649; Calibrated: 2/6/2013
Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

1750 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 7.01 W/kg
SAR(1 g) = 3.84 W/kg
Deviation: 5.21%



0 dB = 4.23 W/kg = 6.26 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 750 MHz;Duty Cycle: 1:1

Medium: 750 Body Medium parameters used (interpolated):

f = 750 MHz; σ = 0.976 S/m; ε_r = 56.182; ρ = 1000 kg/m^3

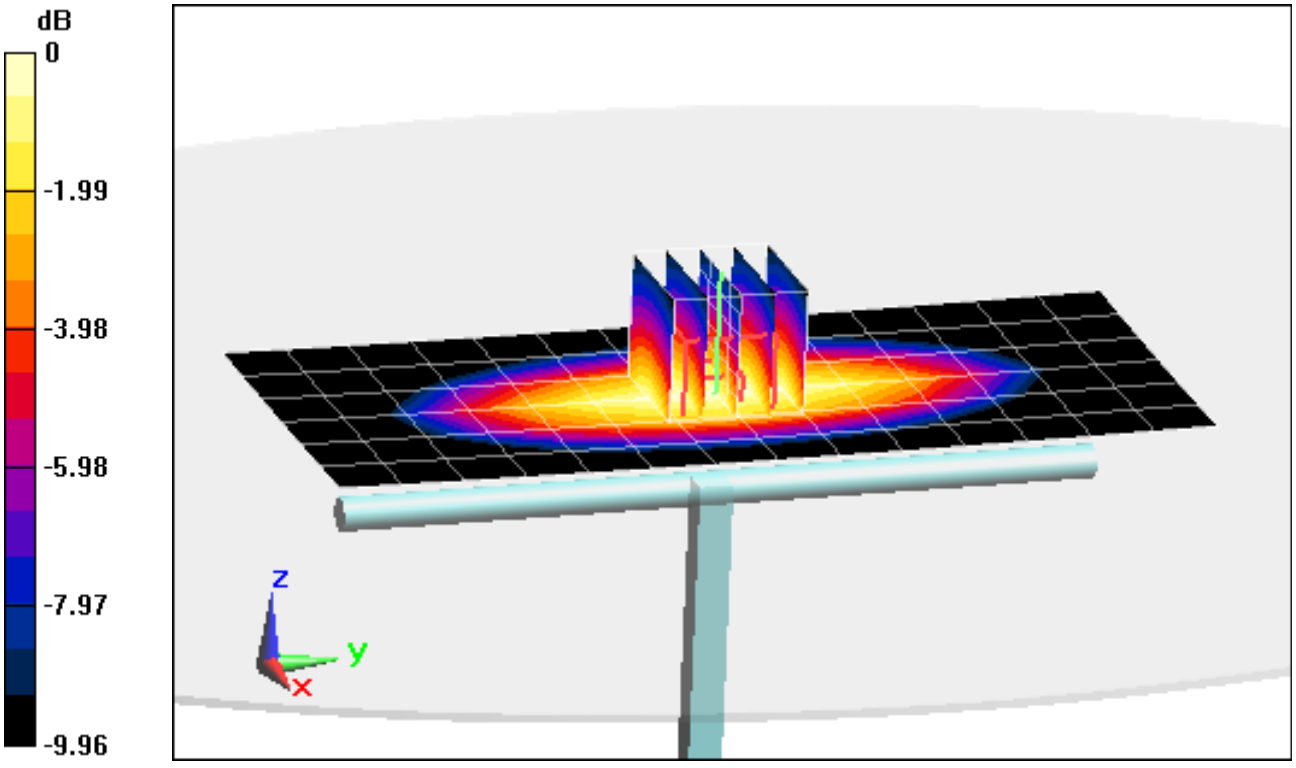
Phantom section: Flat Section; Space: 1.5 cm

Test Date: 09-27-2013; Ambient Temp: 24.3°C; Tissue Temp: 23.9°C

Probe: ES3DV3 - SN3209; ConvF(6.38, 6.38, 6.38); Calibrated: 3/15/2013;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1334; Calibrated: 3/8/2013
Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP-1158
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

750 MHz System Verification

Area Scan (7x15x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 1.25 W/kg
SAR(1 g) = 0.858 W/kg
Deviation: -2.83%



0 dB = 0.927 W/kg = -0.33 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

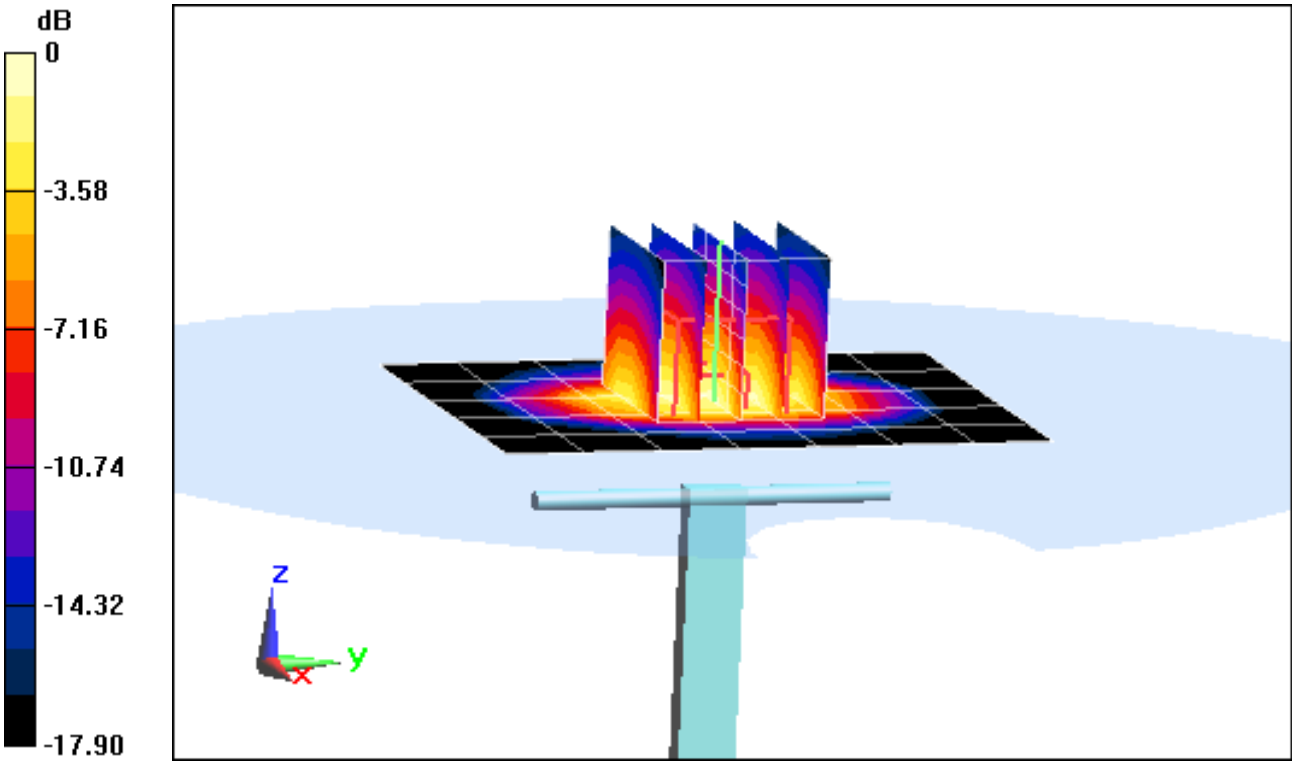
Communication System: CW; Frequency: 1750 MHz;Duty Cycle: 1:1
Medium: 1750 Body Medium parameters used:
f = 1750 MHz; σ = 1.536 S/m; ε_r = 51.07; ρ = 1000 kg/m^3
Phantom section: Flat Section; Space: 1.0 cm

Test Date: 09-30-2013; Ambient Temp: 23.1°C; Tissue Temp: 22.4°C

Probe: ES3DV3 - SN3287; ConvF(4.86, 4.86, 4.86); Calibrated: 11/15/2012;
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE4 Sn1333; Calibrated: 11/13/2012
Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626
Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.10 (7164)

1750 MHz System Verification

Area Scan (6x8x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Input Power: 20 dBm (100 mW)
Peak SAR (extrapolated) = 7.18 W/kg
SAR(1 g) = 3.95 W/kg
Deviation: 3.40%



0 dB = 4.41 W/kg = 6.44 dBW/kg

APPENDIX C: PROBE CALIBRATION

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

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

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

Accreditation No.: SCS 108

Client **PC Test**

Certificate No: D1750V2-1051_Apr13

CALIBRATION CERTIFICATE

Object D1750V2 - SN: 1051

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

Calibration date: April 30, 2013

OK 5/5/13

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	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	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

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

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

Issued: April 30, 2013

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.6
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.1 ± 6 %	1.33 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.01 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**36.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.83 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.5 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.8 ± 6 %	1.50 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.55 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**37.8 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.13 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.4 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.9 Ω + 0.3 jΩ
Return Loss	- 40.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.0 Ω + 0.4 jΩ
Return Loss	- 30.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.222 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	February 19, 2010

DASY5 Validation Report for Head TSL

Date: 30.04.2013

Test Laboratory: SPEAG, Zurich, Switzerland

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

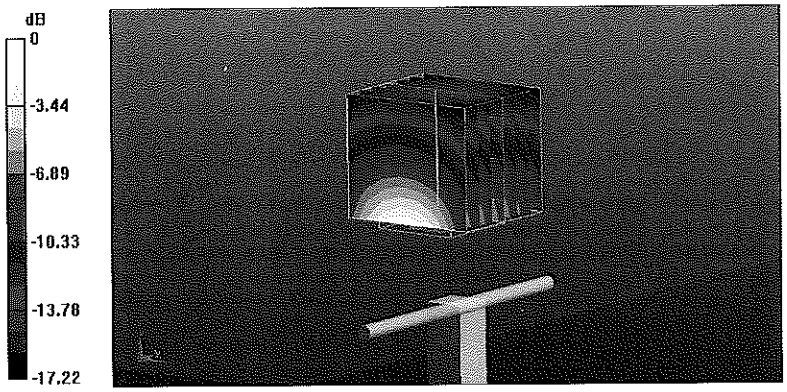
Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.33 S/m; ε_r = 39.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.18, 5.18, 5.18); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.6(1115); SEMCAD X 14.6.9(7117)

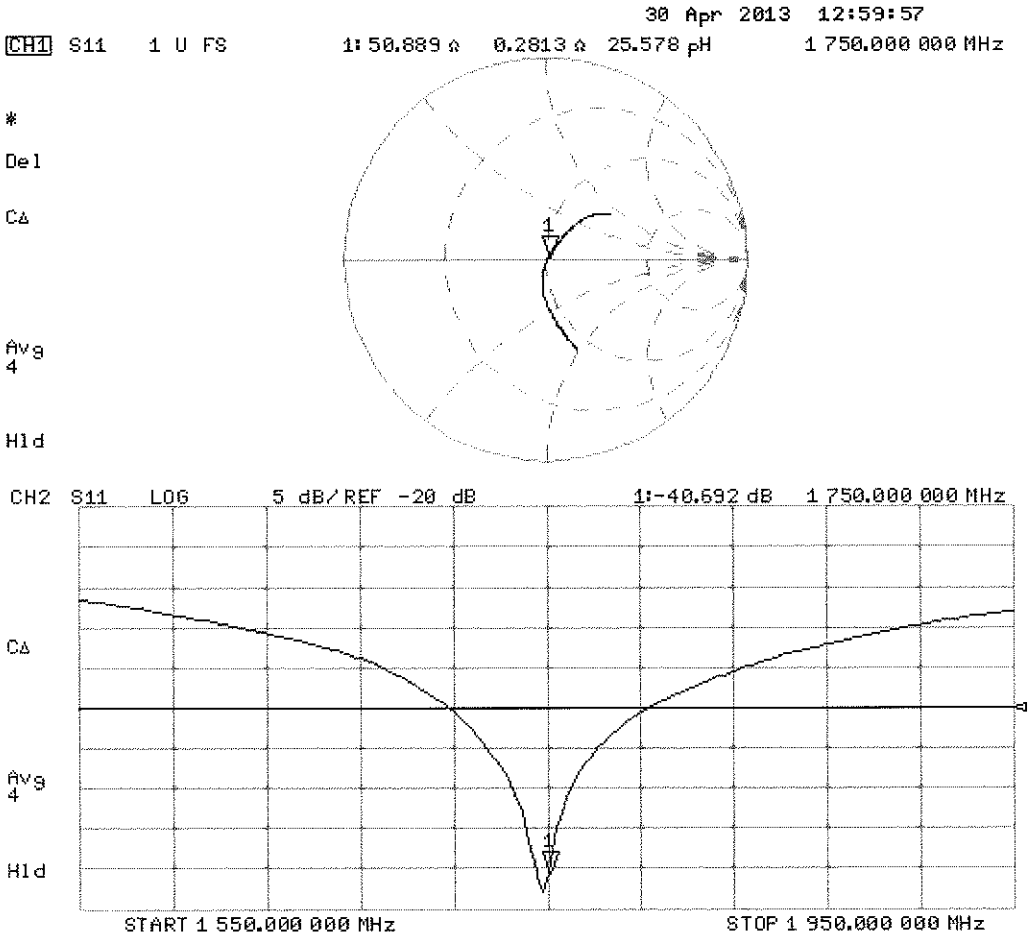
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (8x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 90.104 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 16.0 W/kg
SAR(1 g) = 9.01 W/kg; SAR(10 g) = 4.83 W/kg
Maximum value of SAR (measured) = 11.3 W/kg



0 dB = 11.3 W/kg = 10.53 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 30.04.2013

Test Laboratory: SPEAG, Zurich, Switzerland

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

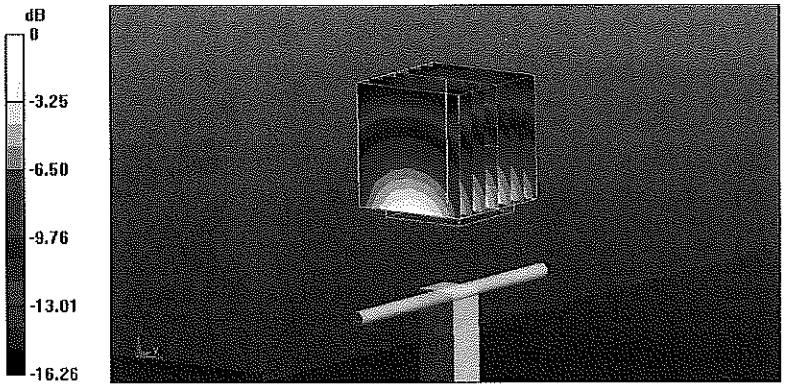
Communication System: UID 0 - CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.5 S/m; ε_r = 51.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.83, 4.83, 4.83); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.6(1115); SEMCAD X 14.6.9(7117)

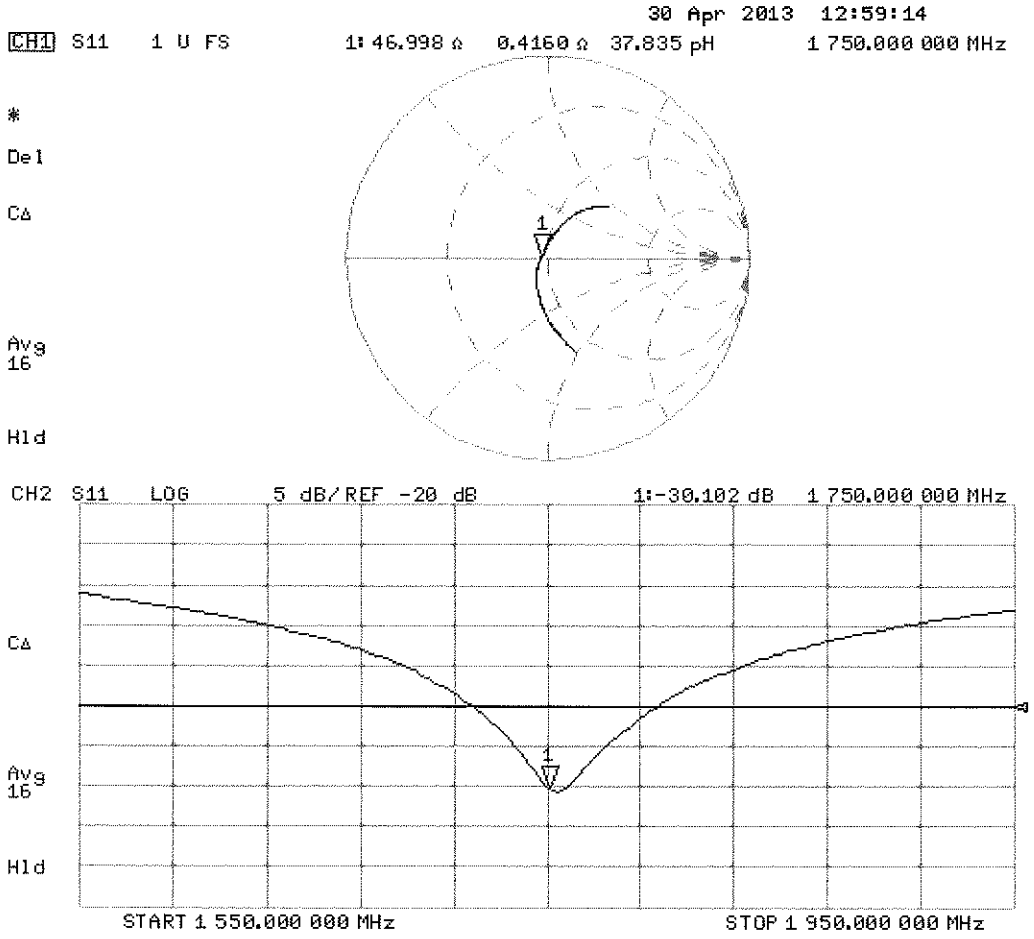
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.473 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 16.4 W/kg
SAR(1 g) = 9.55 W/kg; SAR(10 g) = 5.13 W/kg
Maximum value of SAR (measured) = 12.0 W/kg



0 dB = 12.0 W/kg = 10.79 dBW/kg

Impedance Measurement Plot for Body TSL



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

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

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

Accreditation No.: SCS 108

Client **PC Test**

Certificate No: D1765V2-1008_May13

CALIBRATION CERTIFICATE

Object D1765V2 - SN: 1008

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

Calibration date: May 14, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	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	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14

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

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

Issued: May 15, 2013

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.6
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.1 ± 6 %	1.33 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.09 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**36.8 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.85 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.6 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.7 ± 6 %	1.47 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.53 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**38.2 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.4 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.3 Ω - 6.4 jΩ
Return Loss	- 23.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	43.8 Ω - 6.1 jΩ
Return Loss	- 20.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.211 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	October 06, 2005

DASY5 Validation Report for Head TSL

Date: 14.05.2013

Test Laboratory: SPEAG, Zurich, Switzerland

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

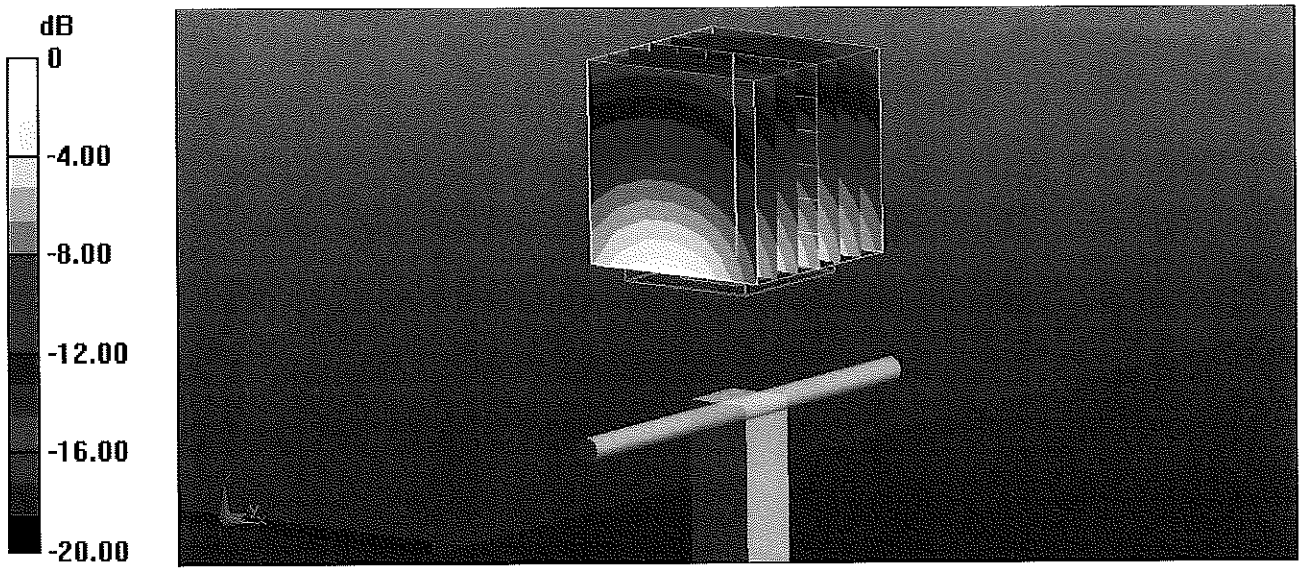
Communication System: UID 0 - CW ; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.33 S/m; ε_r = 39.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.18, 5.18, 5.18); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.6(1115); SEMCAD X 14.6.9(7117)

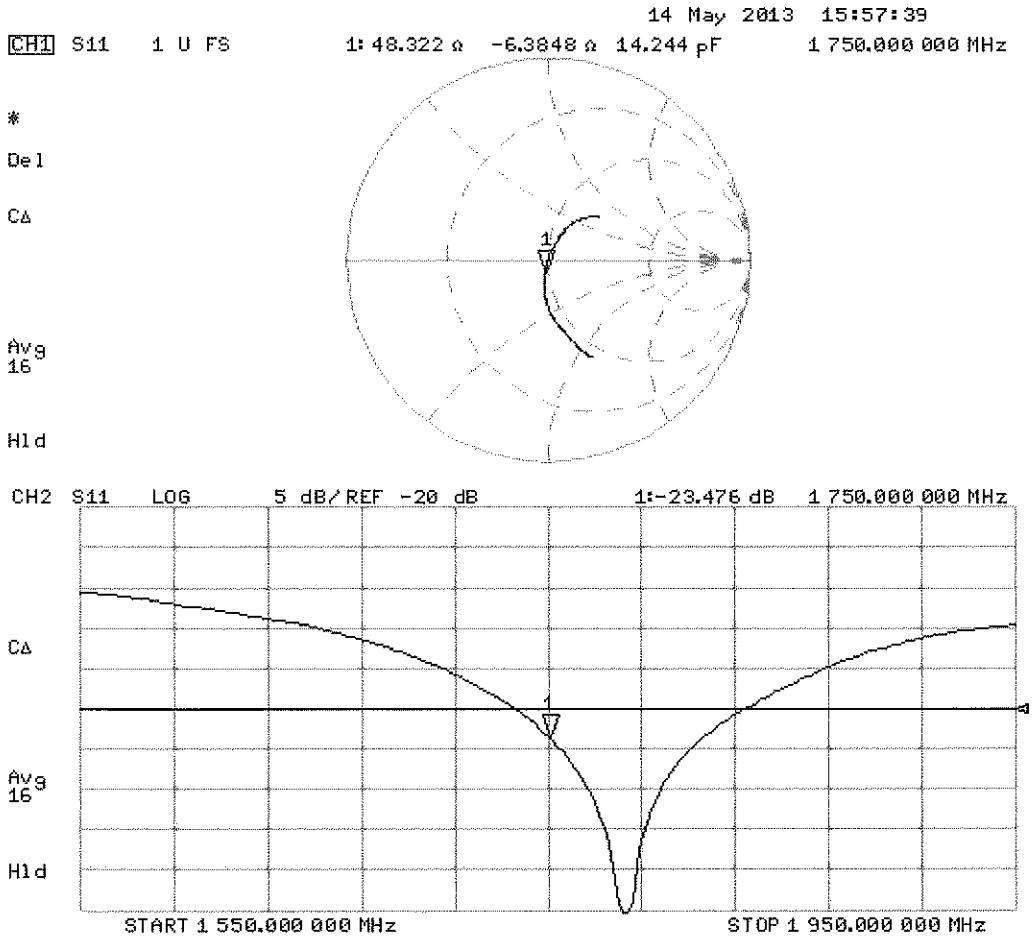
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.430 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 16.3 W/kg
SAR(1 g) = 9.09 W/kg; SAR(10 g) = 4.85 W/kg
Maximum value of SAR (measured) = 11.3 W/kg



0 dB = 11.3 W/kg = 10.53 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 13.05.2013

Test Laboratory: SPEAG, Zurich, Switzerland

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

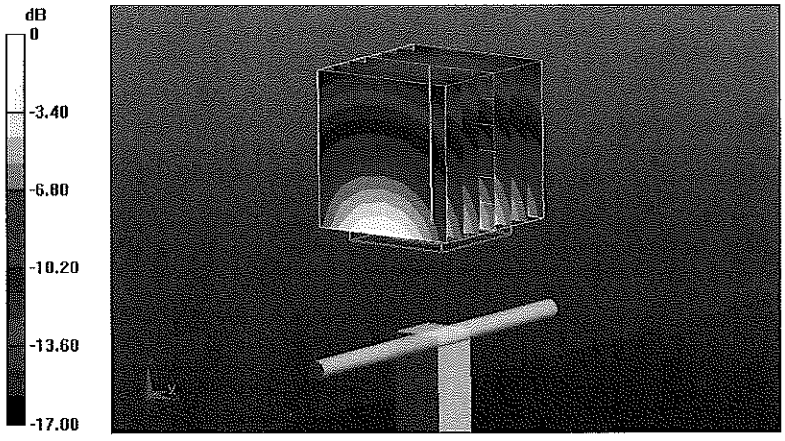
Communication System: UID 0 - CW ; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.47 S/m; ε_r = 51.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.83, 4.83, 4.83); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.6(1115); SEMCAD X 14.6.9(7117)

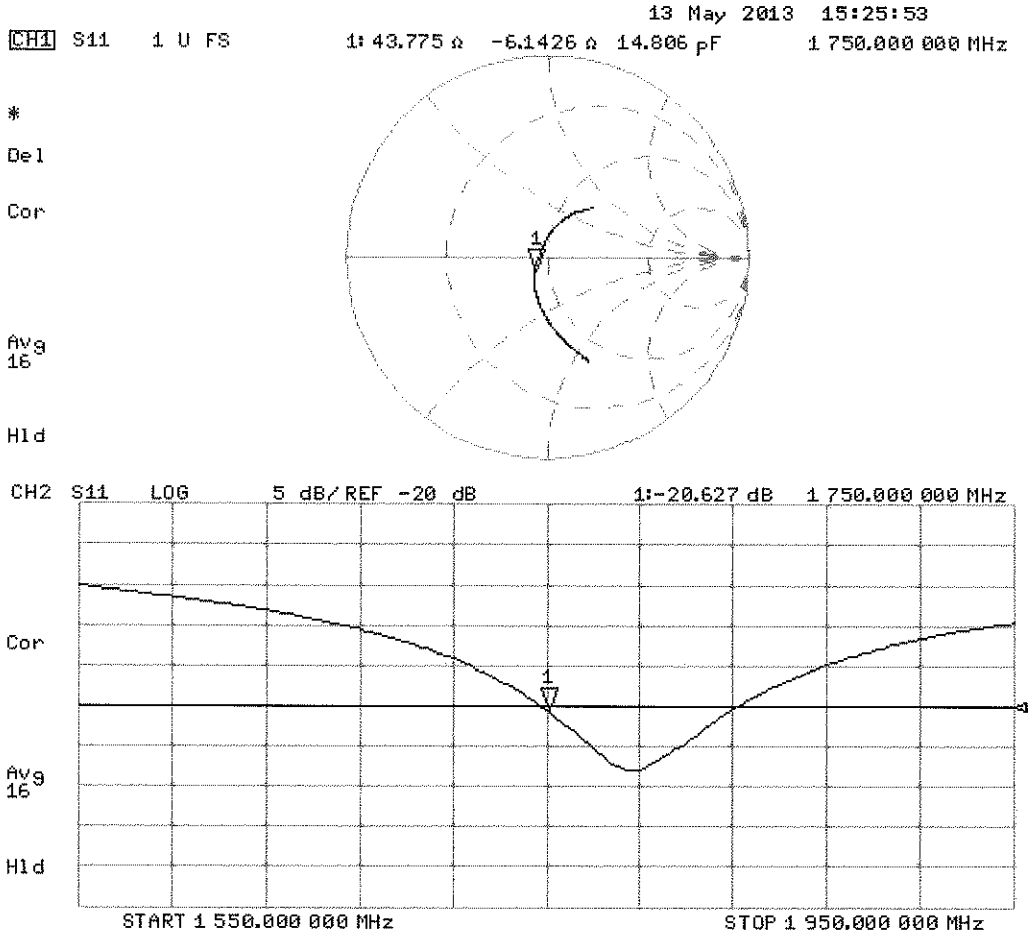
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.430 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 16.4 W/kg
SAR(1 g) = 9.53 W/kg; SAR(10 g) = 5.1 W/kg
Maximum value of SAR (measured) = 12.0 W/kg



0 dB = 12.0 W/kg = 10.79 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client **PC Test**

Certificate No: D750V3-1003_Jan13

CALIBRATION CERTIFICATE

Object D750V3 - SN: 1003

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

Calibration date: January 07, 2013

OK 1/25/13

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

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

Issued: January 8, 2013

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied.

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

SAR result with Head TSL

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

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

Body TSL parameters

The following parameters and calculations were applied.

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

SAR result with Body TSL

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

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

Appendix

Antenna Parameters with Head TSL

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

Antenna Parameters with Body TSL

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

General Antenna Parameters and Design

Electrical Delay (one direction)	1.043 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	January 21, 2009

DASY5 Validation Report for Head TSL

Date: 07.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

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

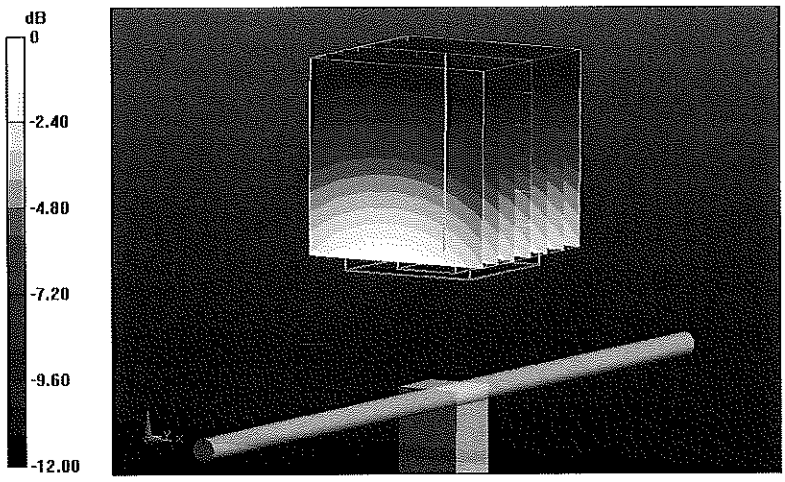
Communication System: CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.89 S/m; ε_r = 41.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

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

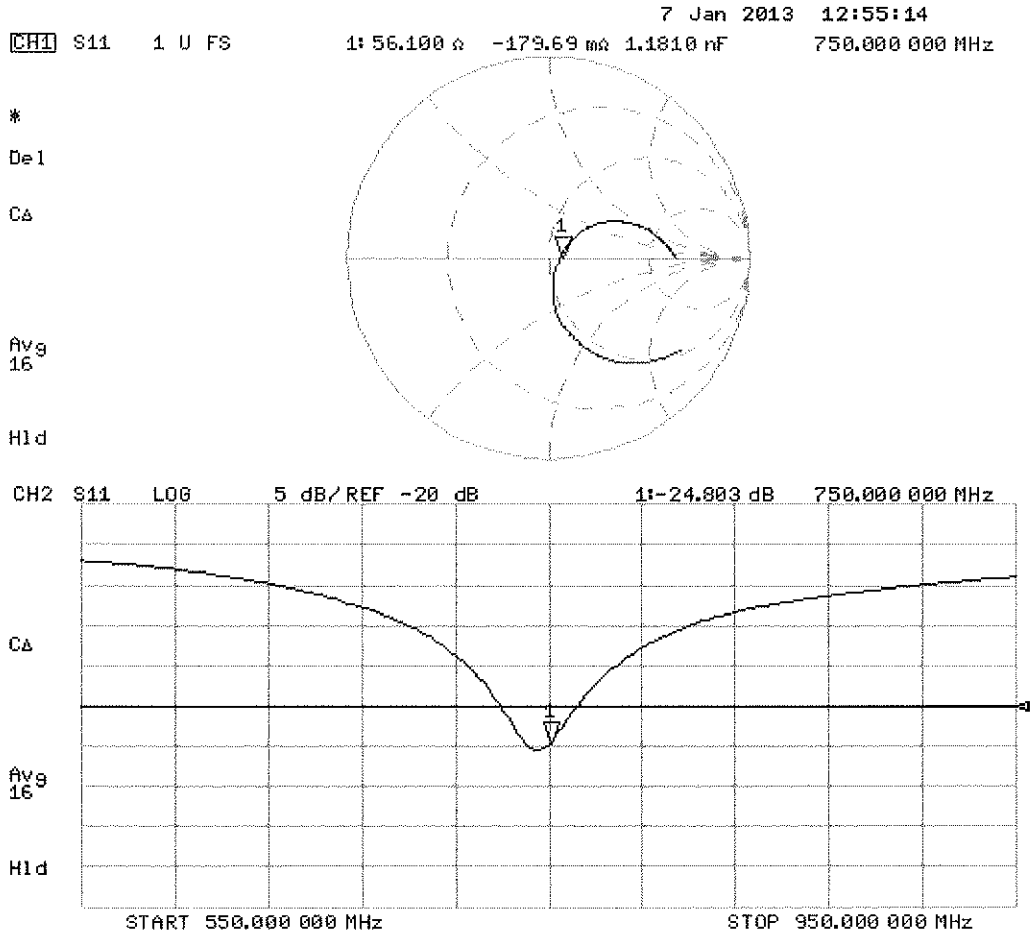
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

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



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

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 07.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

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

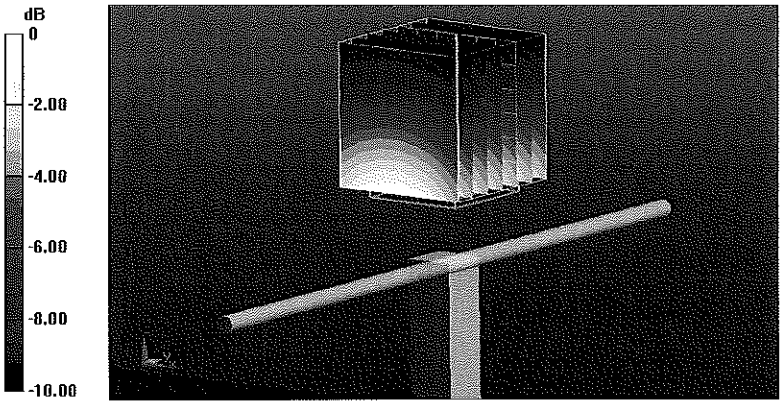
Communication System: CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.97 S/m; ε_r = 54.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

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

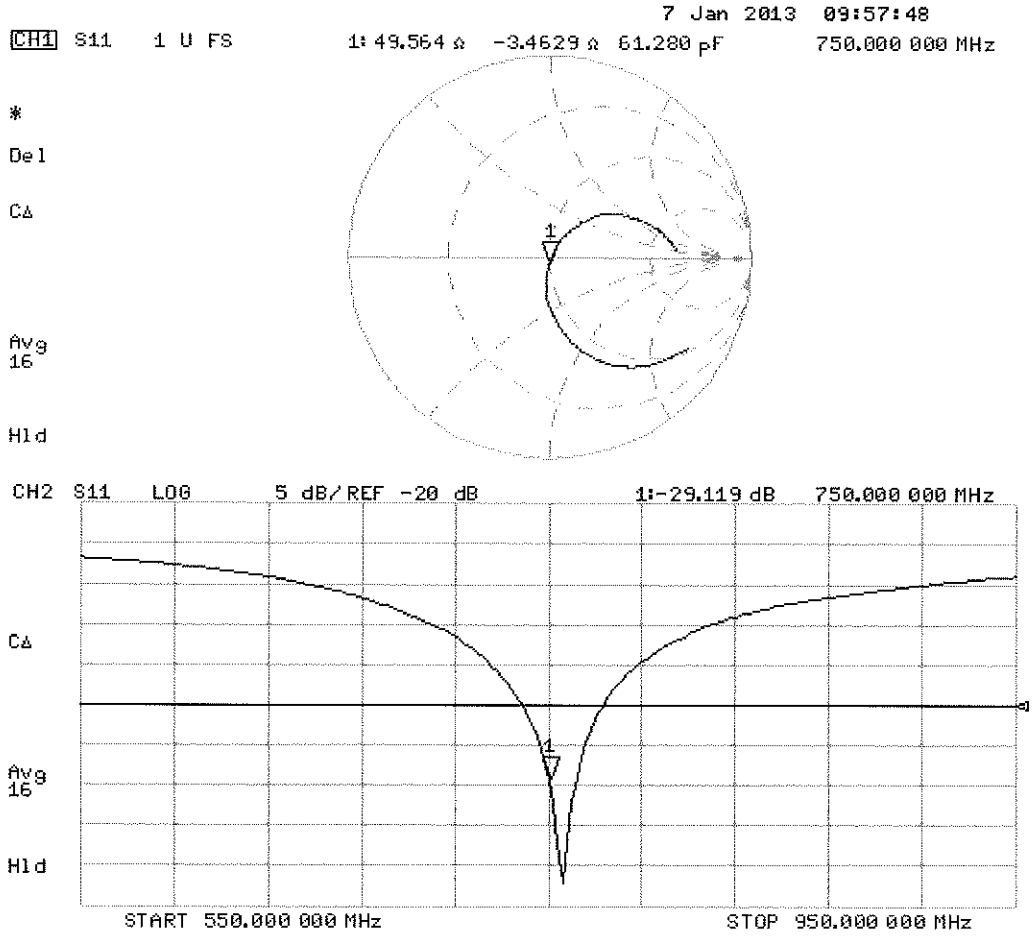
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

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



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

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client **PC Test**

Certificate No: ES3-3209_Mar13

CALIBRATION CERTIFICATE

Object ES3DV3 - SN:3209

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

Calibration date: March 15, 2013

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: March 15, 2013

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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3209

Manufactured: October 14, 2008
Calibrated: March 15, 2013

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

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.35	1.33	1.14	± 10.1 %
DCP (mV)[B]	99.2	97.8	98.3	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	163.6	±3.5 %
		Y	0.0	0.0	1.0		170.3	
		Z	0.0	0.0	1.0		158.7	

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

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

DASY/EASY - Parameters of Probe: 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	Depth (mm)	Unct. (k=2)
750	41.9	0.89	6.74	6.74	6.74	0.76	1.18	± 12.0 %
835	41.5	0.90	6.46	6.46	6.46	0.31	1.81	± 12.0 %
1750	40.1	1.37	5.39	5.39	5.39	0.80	1.21	± 12.0 %
1900	40.0	1.40	5.21	5.21	5.21	0.78	1.26	± 12.0 %
2450	39.2	1.80	4.57	4.57	4.57	0.65	1.43	± 12.0 %
2600	39.0	1.96	4.43	4.43	4.43	0.75	1.36	± 12.0 %

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

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

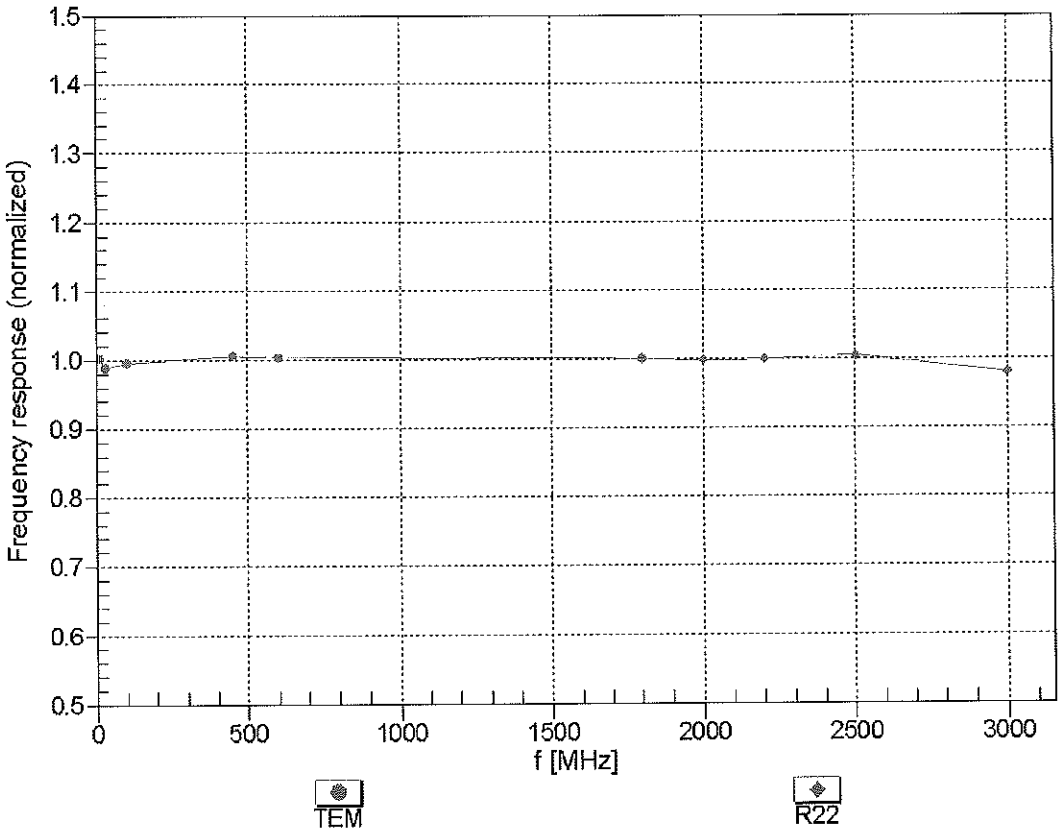
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	6.38	6.38	6.38	0.80	1.16	± 12.0 %
835	55.2	0.97	6.28	6.28	6.28	0.52	1.45	± 12.0 %
1750	53.4	1.49	5.03	5.03	5.03	0.58	1.45	± 12.0 %
1900	53.3	1.52	4.77	4.77	4.77	0.70	1.36	± 12.0 %
2450	52.7	1.95	4.34	4.34	4.34	0.80	1.15	± 12.0 %
2600	52.5	2.16	4.11	4.11	4.11	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.

Frequency Response of E-Field

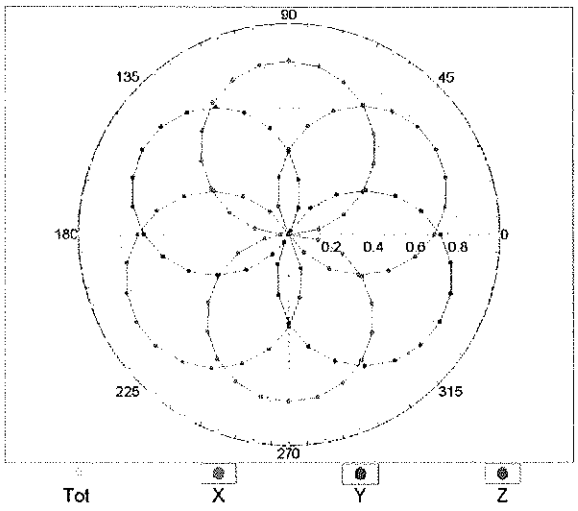
(TEM-Cell:ifi110 EXX, Waveguide: R22)



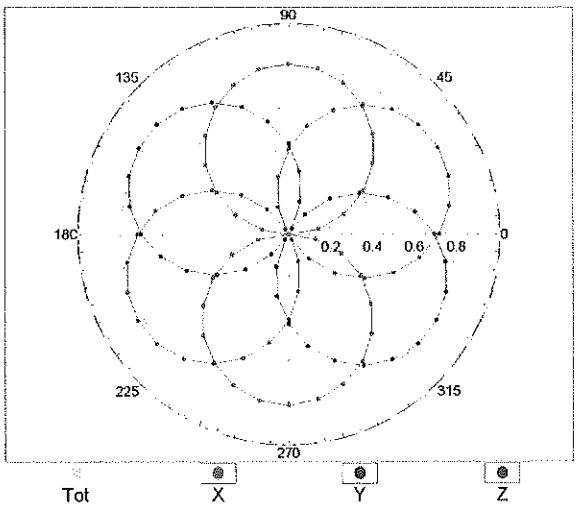
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

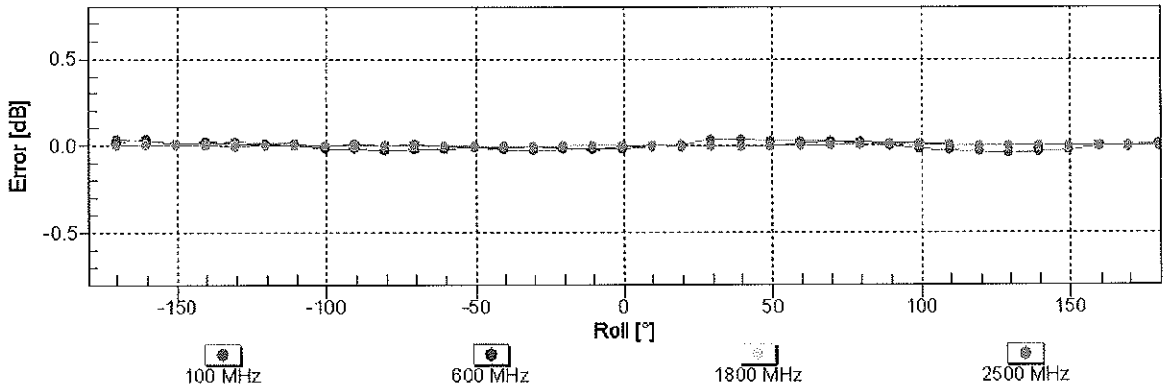
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



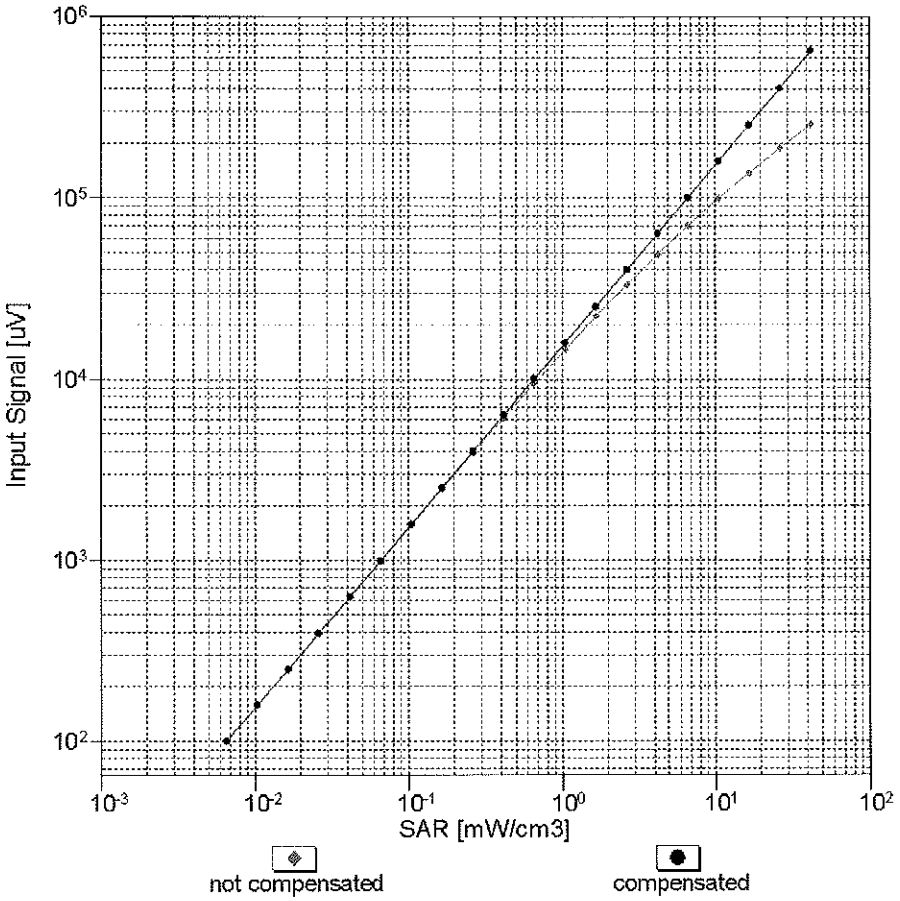
f=1800 MHz,R22

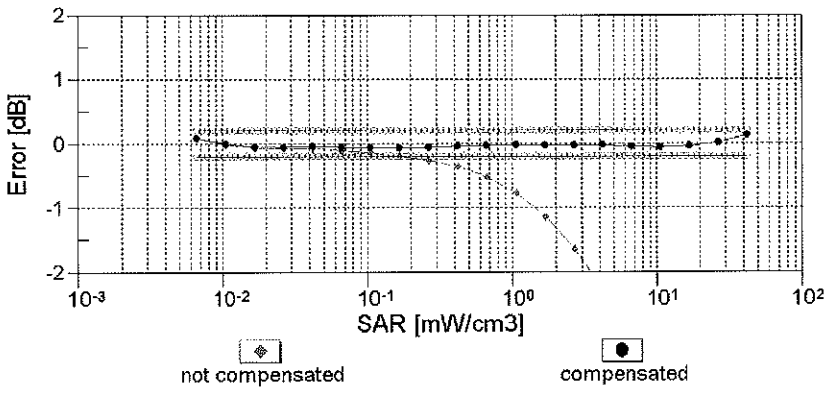




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

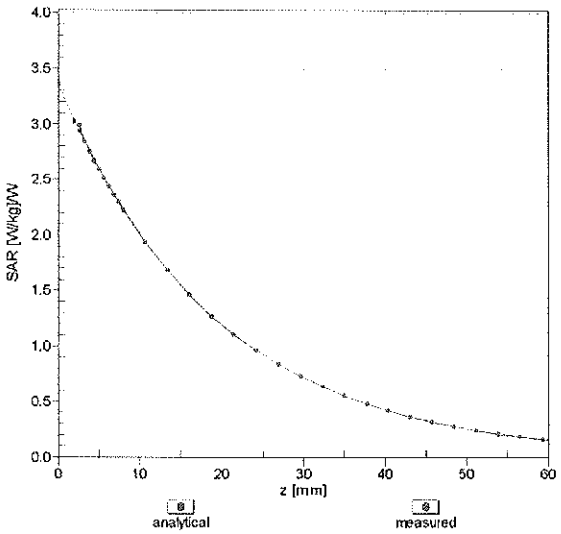




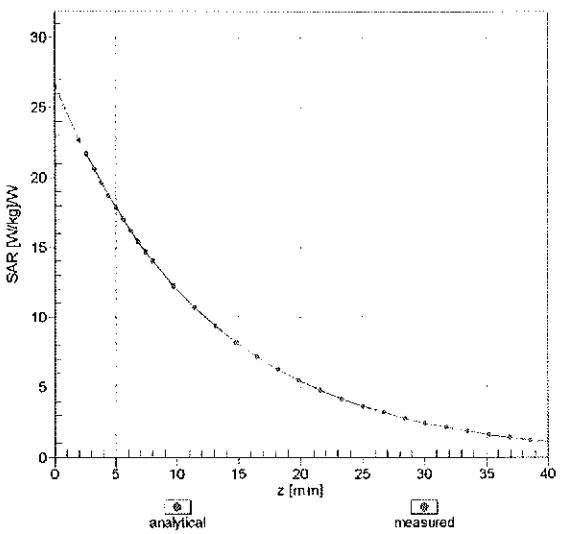
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

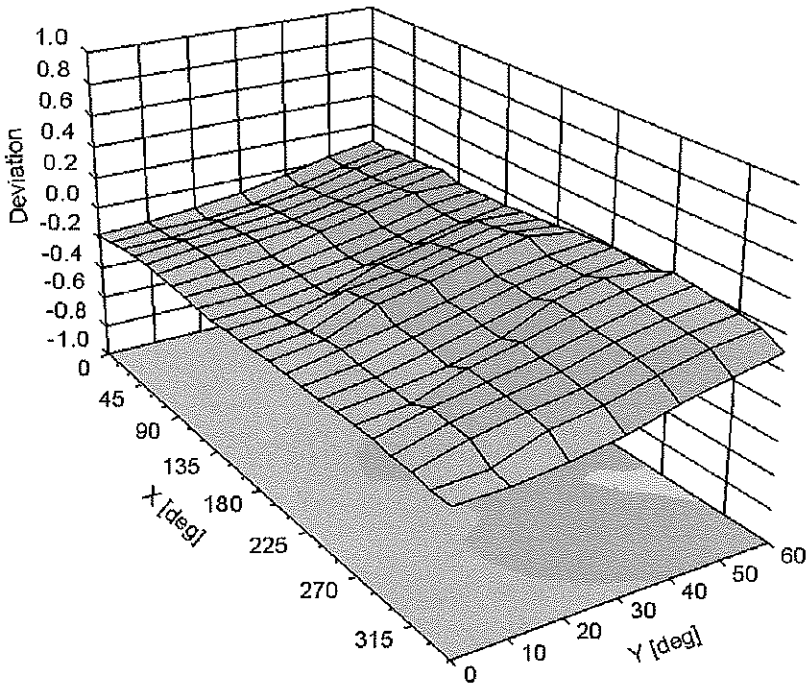


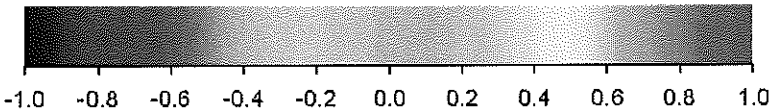
f = 1750 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





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

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-40.6
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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

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Accreditation No.: SCS 108

Client **PC Test**

Certificate No: ES3-3287_Nov12

CALIBRATION CERTIFICATE

Object ES3DV3 - SN:3287

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

Calibration date: November 15, 2012

OK 11/20/12

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: November 16, 2012

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

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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3287

Manufactured: June 7, 2010
Calibrated: November 15, 2012

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

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.31	1.25	1.25	± 10.1 %
DCP (mV)[B]	102.9	103.6	101.6	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
0	CW	0.00	X	0.0	0.0	1.0	116.8	±3.5 %
			Y	0.0	0.0	1.0	118.5	
			Z	0.0	0.0	1.0	154.1	

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

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

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	6.40	6.40	6.40	0.20	2.54	± 12.0 %
835	41.5	0.90	6.17	6.17	6.17	0.34	1.68	± 12.0 %
1750	40.1	1.37	5.16	5.16	5.16	0.63	1.30	± 12.0 %
1900	40.0	1.40	4.96	4.96	4.96	0.48	1.55	± 12.0 %
2450	39.2	1.80	4.30	4.30	4.30	0.79	1.31	± 12.0 %
2600	39.0	1.96	4.19	4.19	4.19	0.80	1.31	± 12.0 %

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

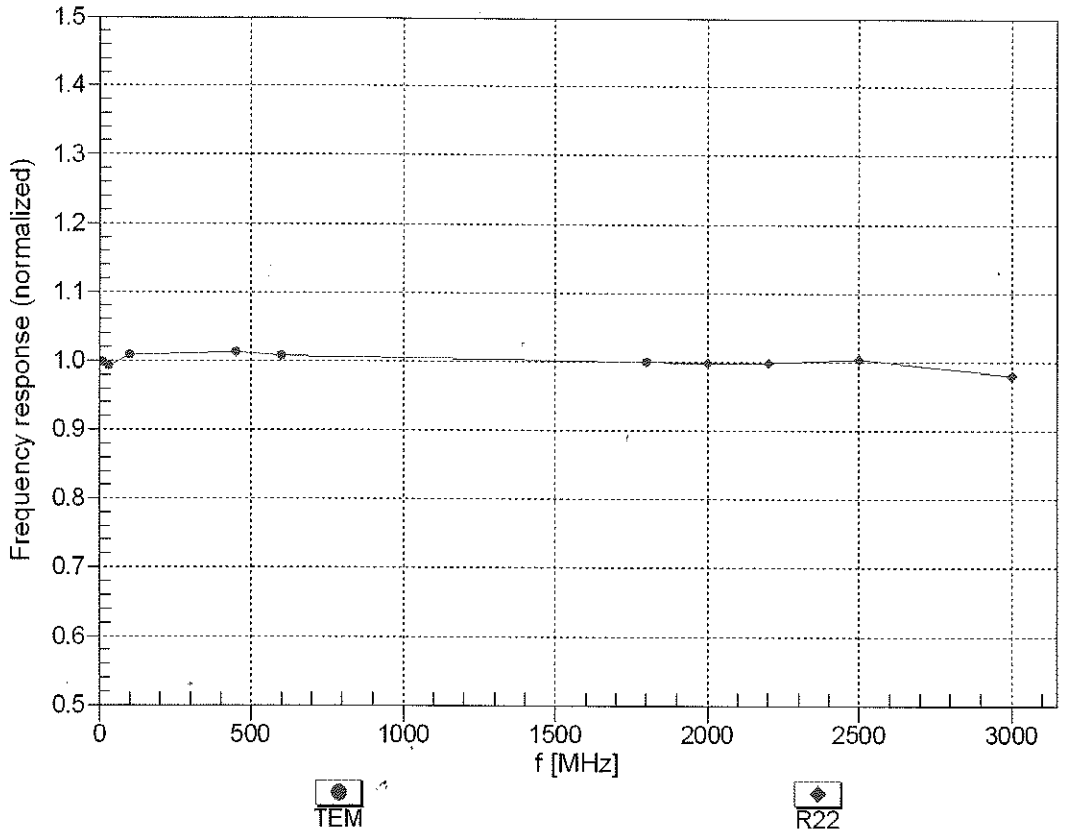
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3287

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	6.14	6.14	6.14	0.28	2.06	± 12.0 %
835	55.2	0.97	6.06	6.06	6.06	0.42	1.63	± 12.0 %
1750	53.4	1.49	4.86	4.86	4.86	0.43	1.64	± 12.0 %
1900	53.3	1.52	4.69	4.69	4.69	0.56	1.54	± 12.0 %
2450	52.7	1.95	4.29	4.29	4.29	0.80	1.02	± 12.0 %
2600	52.5	2.16	4.12	4.12	4.12	0.64	0.92	± 12.0 %

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

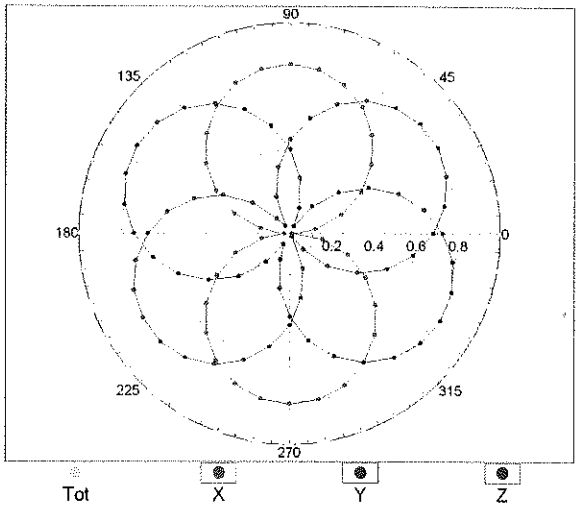
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



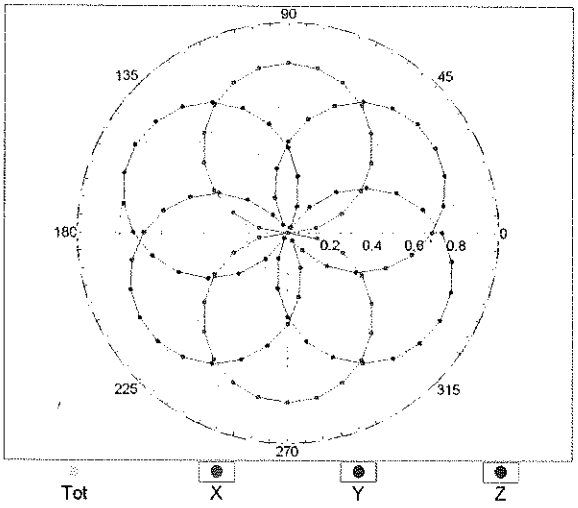
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

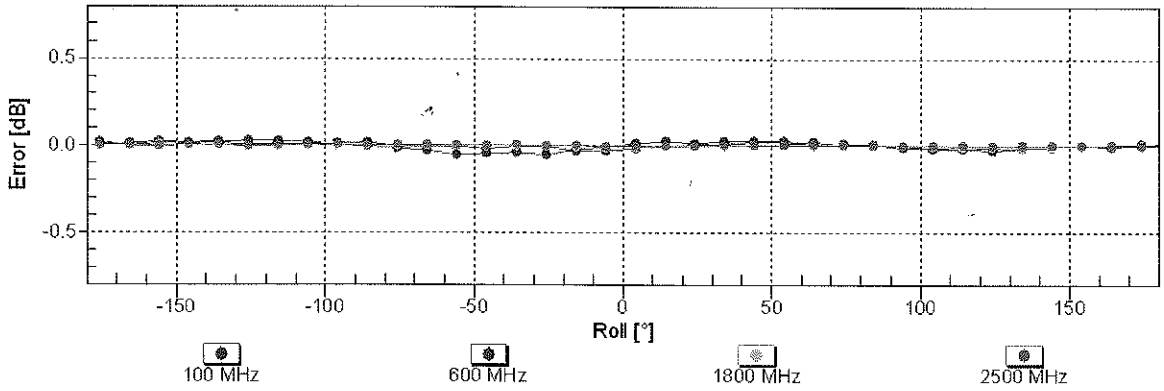
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



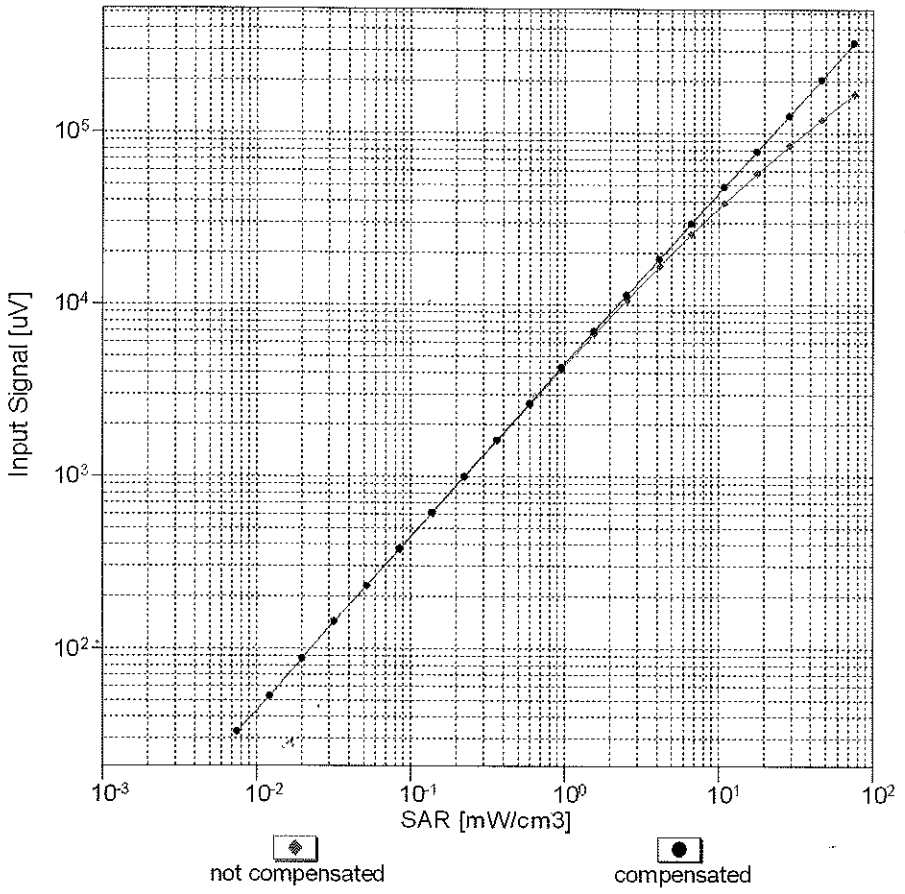
f=1800 MHz,R22

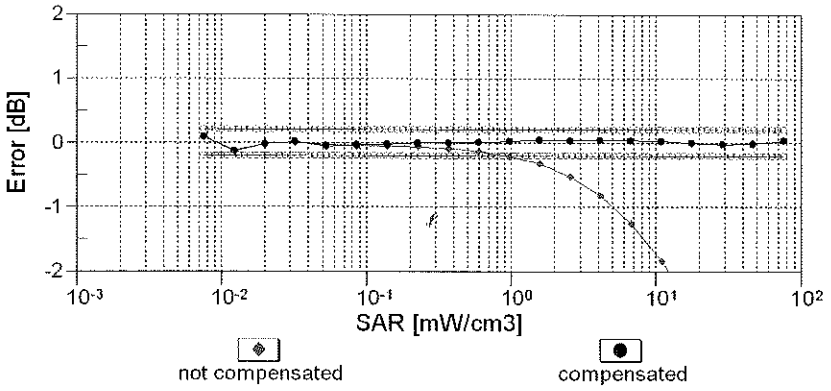




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

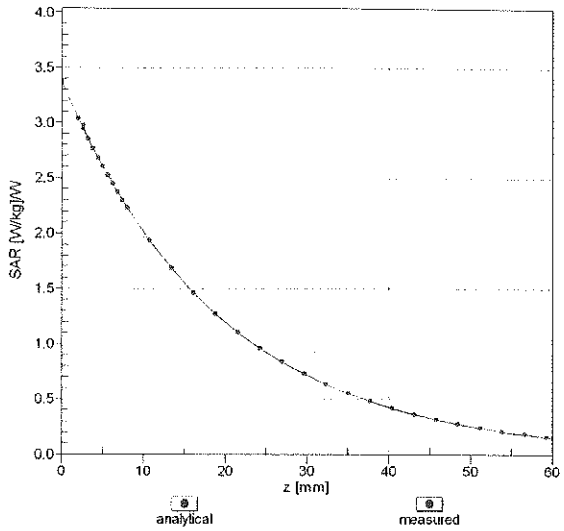




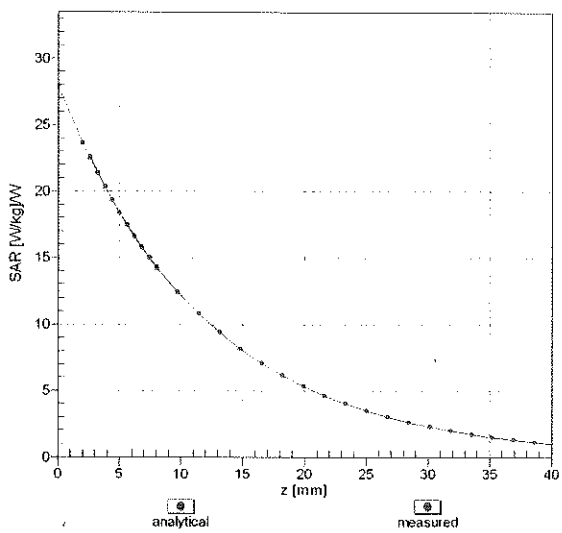
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

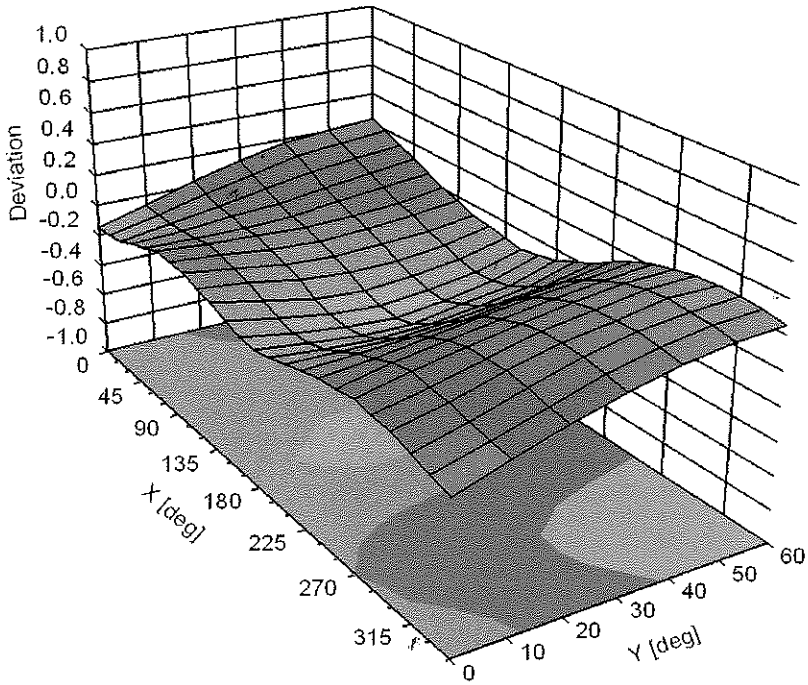


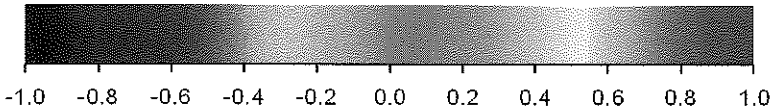
f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





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

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-15.9
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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Accreditation No.: SCS 108

Client **PC Test**

Certificate No: EX3-3920_Feb13

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3920

Calibration procedure(s): QA CAL-01.v8, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes

Calibration date: February 27, 2013

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

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

✓ IC/IC 3/6/13

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: February 27, 2013

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

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Swiss Calibration Service

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

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe EX3DV4

SN:3920

Manufactured: December 18, 2012
Calibrated: February 27, 2013

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3920

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.34	0.50	0.50	± 10.1 %
DCP (mV)[B]	101.2	101.0	99.1	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	134.3	±3.3 %
		Y	0.0	0.0	1.0		164.7	
		Z	0.0	0.0	1.0		161.4	

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 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3920

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	9.86	9.86	9.86	0.19	1.39	± 12.0 %
835	41.5	0.90	9.58	9.58	9.58	0.77	0.54	± 12.0 %
1750	40.1	1.37	7.97	7.97	7.97	0.57	0.69	± 12.0 %
1900	40.0	1.40	7.73	7.73	7.73	0.54	0.73	± 12.0 %
2450	39.2	1.80	7.04	7.04	7.04	0.40	0.82	± 12.0 %
2600	39.0	1.96	6.80	6.80	6.80	0.49	0.76	± 12.0 %
5200	36.0	4.66	4.87	4.87	4.87	0.35	1.80	± 13.1 %
5300	35.9	4.76	4.73	4.73	4.73	0.37	1.80	± 13.1 %
5500	35.6	4.96	4.52	4.52	4.52	0.39	1.80	± 13.1 %
5600	35.5	5.07	4.17	4.17	4.17	0.50	1.80	± 13.1 %
5800	35.3	5.27	4.02	4.02	4.02	0.45	1.80	± 13.1 %

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

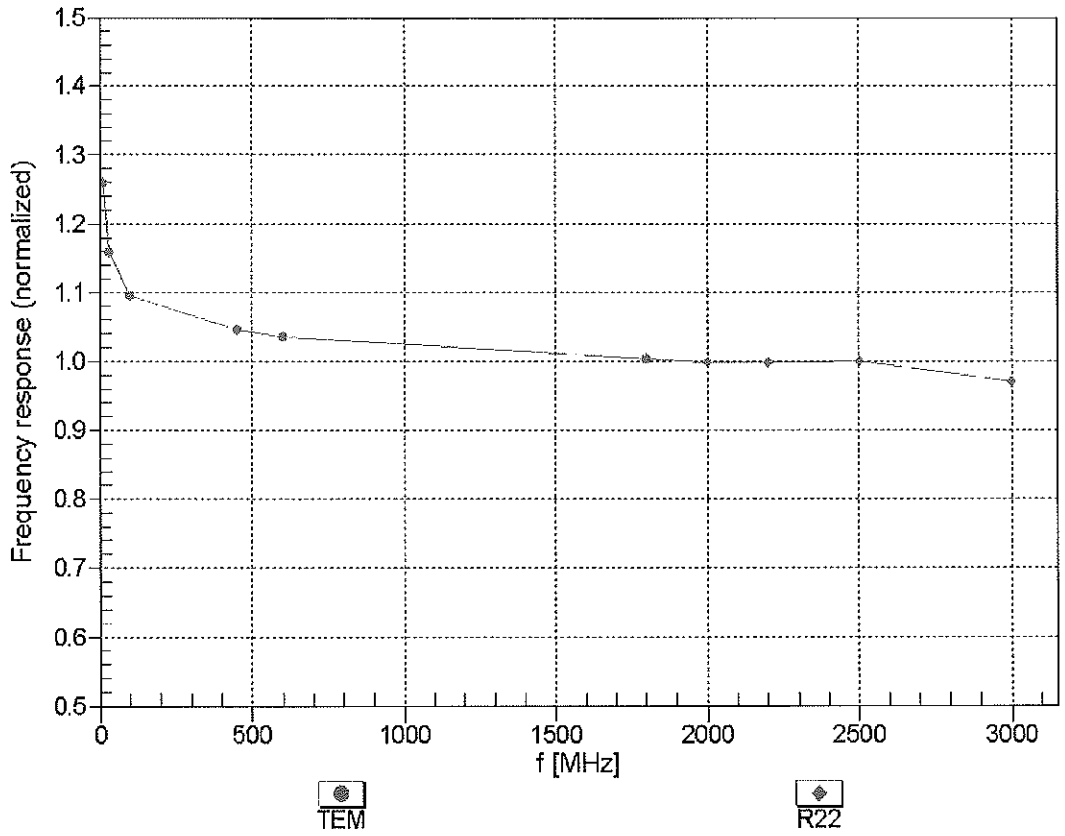
DASY/EASY - Parameters of Probe: EX3DV4 - SN:3920

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	9.57	9.57	9.57	0.43	0.83	± 12.0 %
835	55.2	0.97	9.42	9.42	9.42	0.36	0.98	± 12.0 %
1750	53.4	1.49	7.59	7.59	7.59	0.43	0.78	± 12.0 %
1900	53.3	1.52	7.38	7.38	7.38	0.33	0.91	± 12.0 %
2450	52.7	1.95	7.07	7.07	7.07	0.80	0.55	± 12.0 %
2600	52.5	2.16	6.73	6.73	6.73	0.80	0.56	± 12.0 %
5200	49.0	5.30	4.23	4.23	4.23	0.51	1.90	± 13.1 %
5300	48.9	5.42	4.13	4.13	4.13	0.49	1.90	± 13.1 %
5500	48.6	5.65	3.63	3.63	3.63	0.52	1.90	± 13.1 %
5600	48.5	5.77	3.62	3.62	3.62	0.49	1.90	± 13.1 %
5800	48.2	6.00	3.91	3.91	3.91	0.54	1.90	± 13.1 %

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

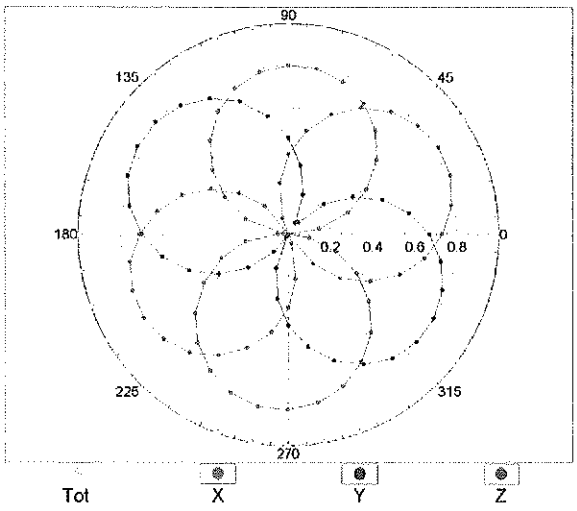
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



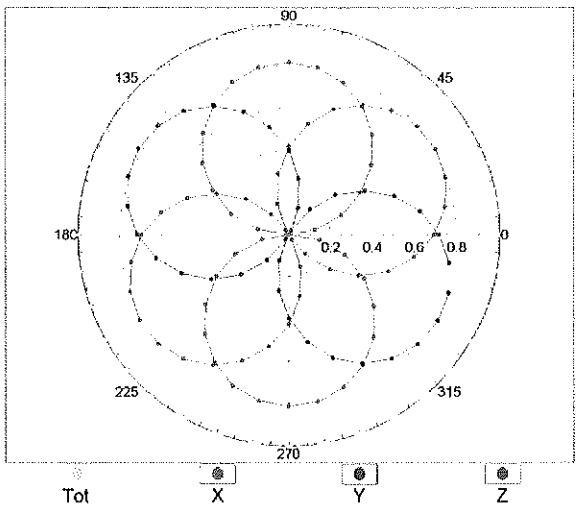
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

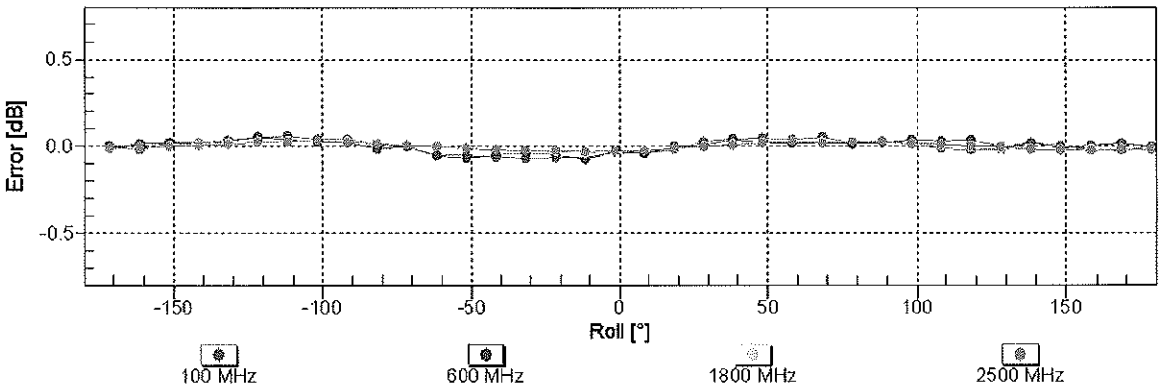
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



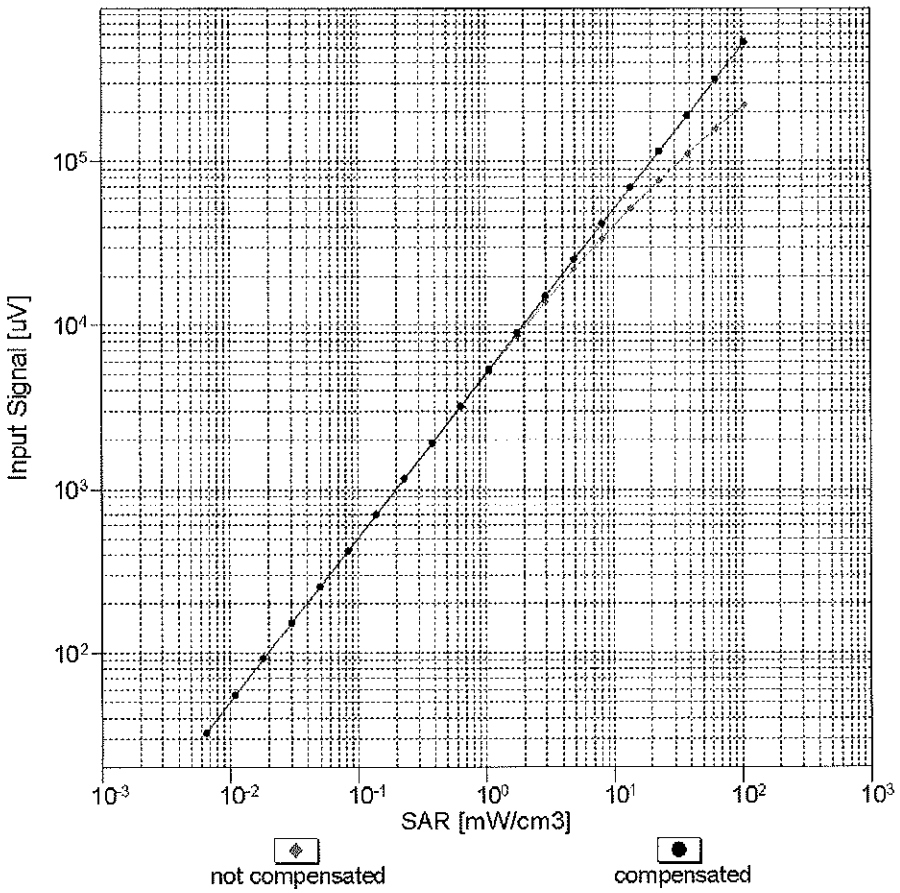
f=1800 MHz,R22

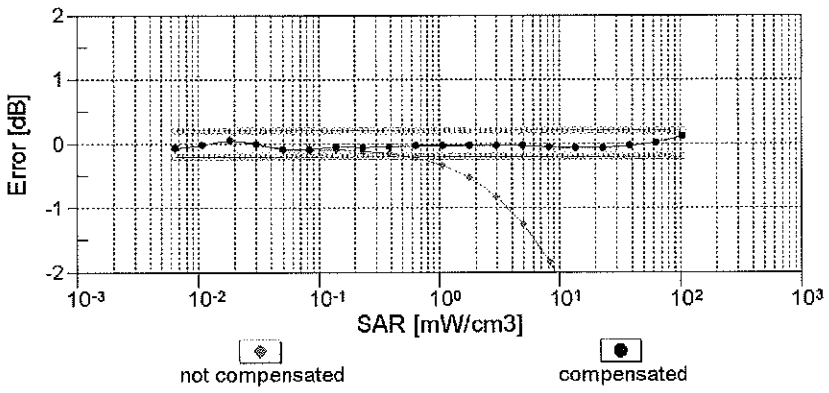




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

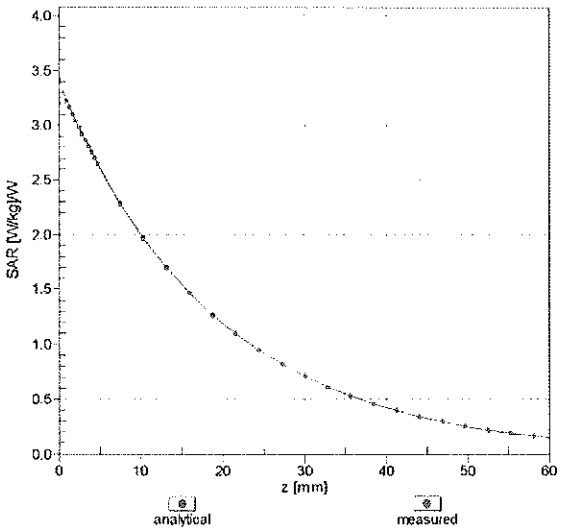




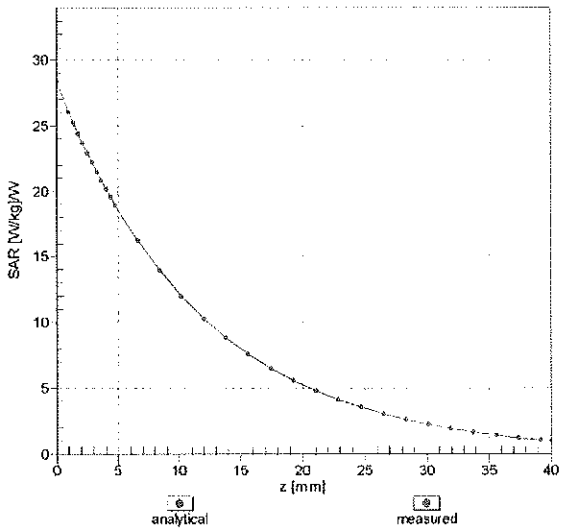
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

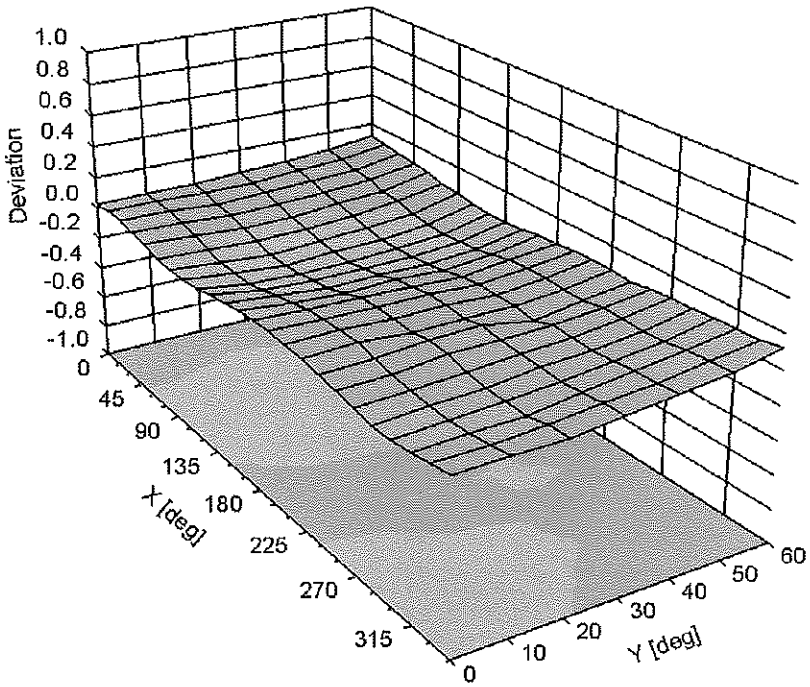


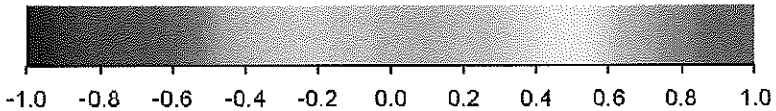
f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3920

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-21.6
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

APPENDIX D: SAR TISSUE SPECIFICATIONS

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_r' can be calculated from the below equation (Pournaropoulos and Misra):

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

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

Table D-I
Composition of the Tissue Equivalent Matter

Frequency (MHz)	750	750	1750	1750
Tissue	Head	Body	Head	Body
Ingredients (% by weight)				
DGBE	See Page 2-3		47	31
NaCl			0.4	0.2
Water			52.6	68.8

2 Composition / Information on ingredients

The Item is composed of the following ingredients:

H_2O	Water, 35 – 58%
Sucrose	Sugar, white, refined, 40 – 60%
NaCl	Sodium Chloride, 0 – 6%
Hydroxyethyl-cellulose	Medium Viscosity (CAS# 9004-62-0), <0.3%
Preventol-D7	Preservative: aqueous preparation, (CAS# 55965-84-9), containing 5-chloro-2-methyl-3(2H)-isothiazolone and 2-methyyl-3(2H)-isothiazolone, 0.1 – 0.7% Relevant for safety; Refer to the respective Safety Data Sheet*.

Figure D-1
Composition of 750 MHz Head and Body Tissue Equivalent Matter

Note: 750MHz 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	**Body Tissue Simulating Liquid (MSL750)**
Product No.	SL AAM 075 AA (Charge: 111130-3)
Manufacturer	SPEAG

Measurement Method

TSL dielectric parameters measured using calibrated OCP probe (type DAK).

Target Parameters

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

Test Condition

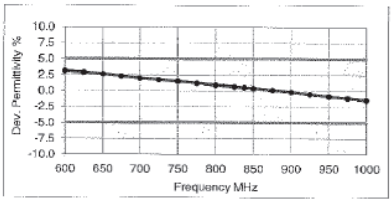
Ambient Condition	22°C ; 30% humidity
TSL Temperature	22°C
Test Date	7-Dec-11

Additional Information

TSL Density	1.212 g/cm^3
TSL Heat-capacity	3.006 kJ/(kg*K)

Results

	Measured			Target		Diff.to Target [%]	
f [MHz]	HP-ε'	HP-ε''	sigma	eps	sigma	Δ-eps	Δ-sigma
600	57.9	25.01	0.83	56.1	0.95	3.1	-12.3
625	57.6	24.66	0.86	56.0	0.95	2.9	-10.1
650	57.4	24.31	0.88	55.9	0.96	2.6	-8.0
675	57.1	24.02	0.90	55.8	0.96	2.3	-5.8
700	56.8	23.74	0.92	55.7	0.96	2.0	-3.7
725	56.6	23.50	0.95	55.6	0.96	1.7	-1.5
750	56.4	23.26	0.97	55.5	0.96	1.5	0.8
775	56.1	23.06	0.99	55.4	0.97	1.2	3.0
800	55.8	22.86	1.02	55.3	0.97	0.9	5.2
825	55.6	22.72	1.04	55.2	0.98	0.6	6.6
838	55.5	22.64	1.05	55.2	0.98	0.5	7.3
850	55.4	22.57	1.07	55.2	0.99	0.4	8.0
875	55.1	22.44	1.09	55.1	1.02	0.1	7.2
900	54.9	22.31	1.12	55.0	1.05	-0.2	6.4
925	54.7	22.20	1.14	55.0	1.06	-0.5	7.5
950	54.5	22.09	1.17	54.9	1.08	-0.9	8.5
975	54.3	21.99	1.19	54.9	1.09	-1.2	9.7
1000	54.1	21.89	1.22	54.8	1.10	-1.4	10.9



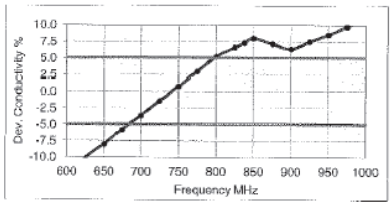


Figure D-2
750MHz Body Tissue Equivalent Matter

Measurement Certificate / Material Test

Item Name	**Head Tissue Simulating Liquid (HSL 750)**
Product No.	SL AAH 075 (Charge: 111208-2)
Manufacturer	SPEAG

Measurement Method

TSL dielectric parameters measured using calibrated OCP probe (type DAK).

Target Parameters

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

Test Condition

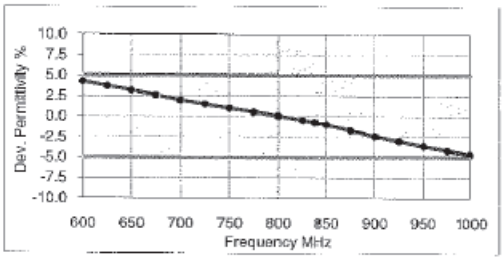
Ambient Condition	22°C ; 30% humidity
TSL Temperature	22°C
Test Date	14-Dec-11

Additional Information

TSL Density	1.284 g/cm^3
TSL Heat-capacity	2.701 kJ/(kg*K)

Results

	Measured			Target		Diff.to Target [%]	
f [MHz]	HP-ε'	HP-ε"	sigma	eps	sigma	Δ-eps	Δ-sigma
600	44.5	22.77	0.76	42.7	0.88	4.2	-13.8
625	44.2	22.50	0.78	42.6	0.88	3.7	-11.5
650	43.8	22.24	0.80	42.5	0.89	3.1	-9.2
675	43.4	22.03	0.83	42.3	0.89	2.5	-6.8
700	43.0	21.82	0.85	42.2	0.89	1.9	-4.5
725	42.7	21.64	0.87	42.1	0.89	1.4	-2.1
750	42.3	21.45	0.89	41.9	0.89	1.0	0.2
775	42.0	21.28	0.92	41.8	0.90	0.5	2.4
800	41.7	21.11	0.94	41.7	0.90	0.0	4.7
825	41.4	20.97	0.96	41.6	0.91	-0.5	6.1
838	41.2	20.90	0.97	41.5	0.91	-0.7	6.8
850	41.1	20.83	0.98	41.5	0.92	-1.0	7.5
875	40.8	20.69	1.01	41.5	0.94	-1.7	6.8
900	40.5	20.55	1.03	41.5	0.97	-2.4	6.1
925	40.2	20.45	1.05	41.5	0.98	-3.0	7.1
950	39.9	20.34	1.08	41.4	0.99	-3.6	8.1
975	39.7	20.24	1.10	41.4	1.00	-4.2	9.3
1000	39.4	20.14	1.12	41.3	1.01	-4.7	10.4



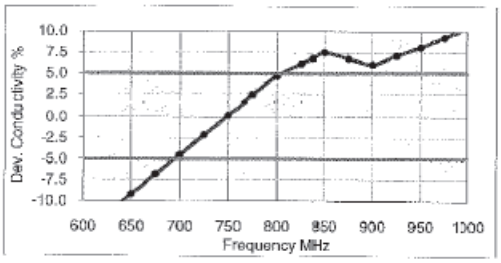


Figure D-3
750MHz Head Tissue Equivalent Matter

APPENDIX E: SAR SYSTEM VALIDATION

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 IEEE 1528-2003 and FCC KDB 865664 D01 v01. 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
G	750	3/26/2013	3209	ES3DV3	750	Head	0.912	41.01	PASS	PASS	PASS	N/A	N/A	N/A
E	1750	3/13/2013	3920	EX3DV4	1750	Head	1.386	38.47	PASS	PASS	PASS	N/A	N/A	N/A
G	750	3/28/2013	3209	ES3DV3	750	Body	0.974	55.21	PASS	PASS	PASS	N/A	N/A	N/A
B	1750	1/28/2013	3287	ES3DV3	1750	Body	1.524	52.77	PASS	PASS	PASS	N/A	N/A	N/A

NOTE: All measurements were performed using probes calibrated for CW signals only. 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.