



SAR EVALUATION REPORT

Applicant Name:

Samsung Electronics, Co. Ltd.
416 Maetan 3-Dong, Yeongtong-gu
Suwon-si, Gyeonggi-do
443-742, Republic of Korea

Date of Testing:

12/10/12 - 01/17/13

Test Site/Location:

PCTEST Lab, Columbia, MD, USA

Document Serial No.:

0Y1212101750-R1.A3L

FCC ID:

A3LSCHI425

APPLICANT:

SAMSUNG ELECTRONICS, CO. LTD.

DUT Type:

Portable Handset

Application Type:

Certification

FCC Rule Part(s):

CFR §2.1093

Model(s):

SCH-I425

Equipment Class	Band & Mode	Operating Modes	Tx Frequency	Measured Conducted Power [dBm]	SAR		
					1 gm Head (W/kg)	1 gm Body-Worn (W/kg)	1 gm Hotspot (W/kg)
PCE	Cell. CDMA/EVDO	Voice/Data	824.70 - 848.31 MHz	24.64	0.36	0.79	1.08
PCE	GSM/GPRS/EDGE 850	Voice/Data	824.20 - 848.80 MHz	33.41	< 0.1	0.32	0.44
PCE	UMTS 850	Voice/Data	826.40 - 846.60 MHz	23.48	0.11	0.36	0.36
PCE	PCS CDMA/EVDO	Voice/Data	1851.25 - 1908.75 MHz	24.64	0.24	0.67	0.67
PCE	GSM/GPRS/EDGE 1900	Voice/Data	1850.20 - 1909.80 MHz	30.98	0.14	0.76	1.05
PCE	UMTS 1900	Voice/Data	1852.4 - 1907.6 MHz	22.89	0.11	0.83	0.83
PCE	LTE Band 13	Data	782 MHz	23.38	0.16	0.32	0.32
PCE	LTE Band 4 (AWS)	Data	1712.5 - 1752.5 MHz	23.42	0.16	0.56	0.56
DTS	2.4 GHz WLAN	Data	2412 - 2462 MHz	14.71	< 0.1	0.13	0.13
DTS	5.8 GHz WLAN	Data	5745 - 5825 MHz	9.48	< 0.1	< 0.1	
UNII	5.2 GHz WLAN	Data	5180 - 5240 MHz	9.47	< 0.1	0.23	
UNII	5.3 GHz WLAN	Data	5260 - 5320 MHz	9.43	< 0.1	0.18	
UNII	5.5 GHz WLAN	Data	5500 - 5700 MHz	9.14	< 0.1	0.12	
DSS/DTS	Bluetooth 1x, EDR, LE	Data	2402 - 2480 MHz	7.32		N/A	
Simultaneous SAR per KDB 690783 D01v01r02:					0.45	1.19	1.21

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

Note: This revised test report (S/N: 0Y1212101750-R1.A3L) supersedes and replaces the previously issued test report on the same subject DUT for the same type of testing indicated. Please discard or destroy the previously issued test report(s) and dispose of accordingly.

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

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


Randy Ortanez
President



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1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
Cell. CDMA/EVDO	Voice/Data	824.70 - 848.31 MHz
GSM/GPRS/EDGE 850	Voice/Data	824.20 - 848.80 MHz
UMTS 850	Voice/Data	826.40 - 846.60 MHz
PCS CDMA/EVDO	Voice/Data	1851.25 - 1908.75 MHz
GSM/GPRS/EDGE 1900	Voice/Data	1850.20 - 1909.80 MHz
UMTS 1900	Voice/Data	1852.4 - 1907.6 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 1x, EDR, LE	Data	2402 - 2480 MHz
NFC	Data	13.56 MHz

1.2 Nominal and Maximum Output Power Specifications

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

Mode / Band		Voice (dBm)	Burst Average GMSK (dBm)		Burst Average 8-PSK (dBm)	
		1 TX Slot	1 TX Slots	2 TX Slots	1 TX Slots	2 TX Slots
GSM/GPRS/EDGE 850	Maximum	33.5	33.5	31.5	27.0	27.0
	Nominal	33.0	33.0	31.0	26.5	26.5
GSM/GPRS/EDGE 1900	Maximum	31.0	31.0	30.0	27.0	27.0
	Nominal	30.5	30.5	29.5	26.5	26.5

Mode / Band		Modulated Average (dBm)		
		3GPP RMC	3GPP HSDPA	3GPP HSUPA
UMTS Band 5 (850 MHz)	Maximum	23.5	23.0	22.5
	Nominal	23.0	22.5	22.0
UMTS Band 2 (1900 MHz)	Maximum	23.5	23.0	23.0
	Nominal	23.0	22.5	22.5

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Mode / Band		Modulated Average (dBm)
Cell. CDMA/EVDO	Maximum	25.0
	Nominal	24.5
PCS CDMA/EVDO	Maximum	25.0
	Nominal	24.5

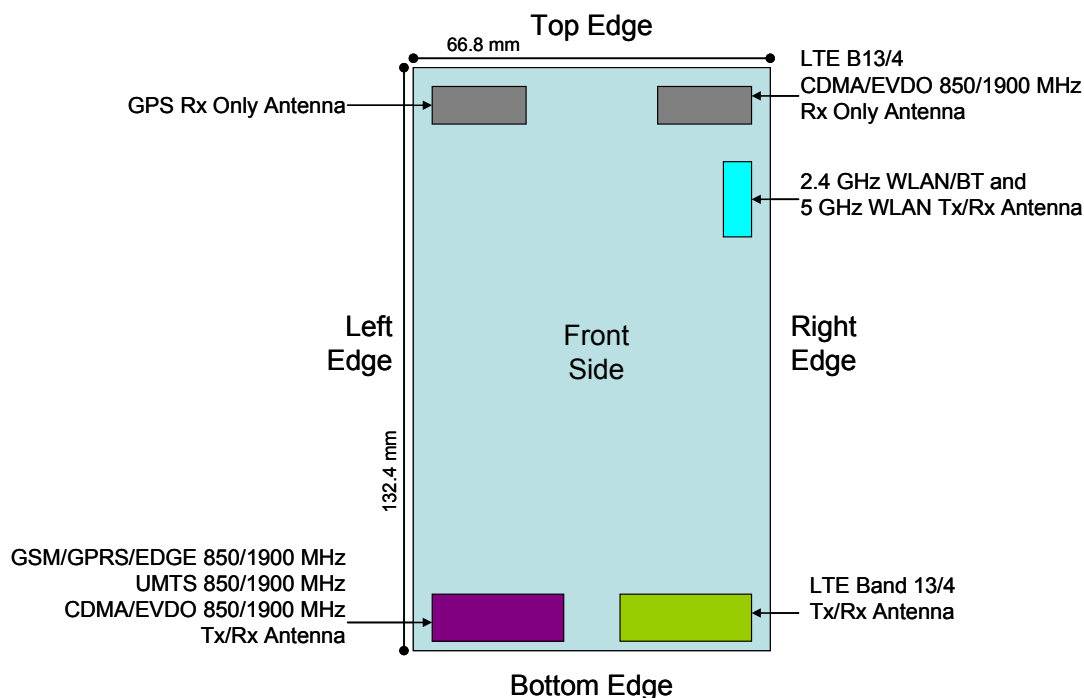
Mode / Band			Modulated Average (dBm)
Cell. CDMA	SVLTE threshold LTE is not reducing	Maximum	18.5
		Nominal	18.0
PCS CDMA	SVLTE threshold LTE is not reducing	Maximum	18.5
		Nominal	18.0

Mode / Band	Power Reduction		Modulated Average (dBm)
LTE Band 13	Inactive	Maximum	23.5
		Nominal	23.0
	Active	Maximum	19.5
		Nominal	19.0
LTE Band 4 (AWS)	Inactive	Maximum	23.5
		Nominal	23.0
	Active	Maximum	19.5
		Nominal	19.0

Mode / Band		Modulated Average (dBm)
IEEE 802.11b (2.4 GHz)	Maximum	15.0
	Nominal	14.5
IEEE 802.11g (2.4 GHz)	Maximum	10.0
	Nominal	9.5
IEEE 802.11n (2.4 GHz)	Maximum	10.0
	Nominal	9.5
IEEE 802.11a (5 GHz)	Maximum	10.0
	Nominal	9.5
IEEE 802.11n (5 GHz)	Maximum	10.0
	Nominal	9.5
Bluetooth	Maximum	7.5
	Nominal	7.0

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1.3 DUT Antenna Locations



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

Figure 1-1
DUT Antenna Locations

Table 1-1
Mobile Hotspot Sides for SAR Testing

Mode	Back	Front	Top	Bottom	Right	Left
Cell. CDMA/EVDO	Yes	Yes	No	Yes	No	Yes
GPRS 850	Yes	Yes	No	Yes	No	Yes
UMTS 850	Yes	Yes	No	Yes	No	Yes
PCS CDMA/EVDO	Yes	Yes	No	Yes	No	Yes
GPRS 1900	Yes	Yes	No	Yes	No	Yes
UMTS 1900	Yes	Yes	No	Yes	No	Yes
LTE Band 13	Yes	Yes	No	Yes	Yes	No
LTE Band 4 (AWS)	Yes	Yes	No	Yes	Yes	No
2.4 GHz WLAN	Yes	Yes	Yes	No	Yes	No

Note: Particular DUT edges were not required to be evaluated for Wireless Router SAR if the edges were greater than 2.5 cm from the transmitting antenna according to FCC KDB Publication 941225 D06v01 guidance, page 2. The antenna document shows the distances between the transmit antennas and the edges of the device. When the wireless router mode is enabled, all 5 GHz bands are disabled. Therefore 5 GHz WIFI is not considered in this section.

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1.4 Near Field Communications (NFC) Antenna

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

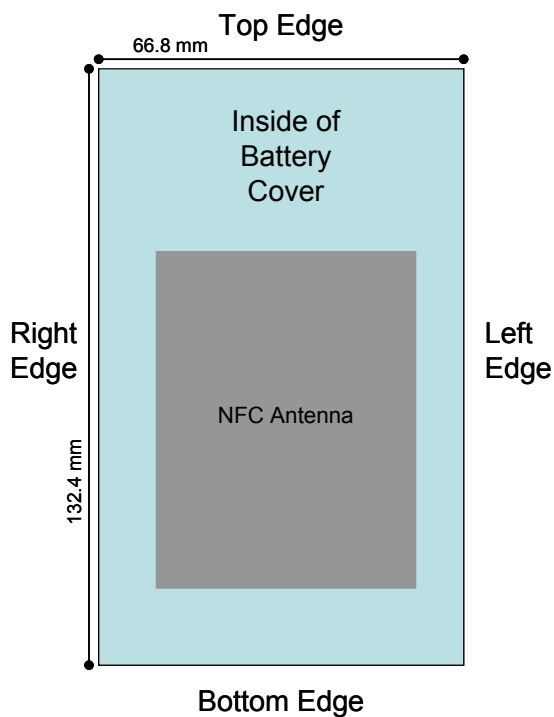


Figure 1-2
NFC Antenna Locations

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1.5 Simultaneous Transmission Capabilities

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



Figure 1-3
Simultaneous Transmission Paths

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

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Table 1-2
Simultaneous Transmission Scenarios

Ref.	Simultaneous Transmit Configurations	Power Reduction	Head	Body-Worn Accessory	Hot Spot	Note
			IEEE 1528, Supp C	Supplement C	FCC KDB 941225 D06 edges/sides	
1	1X CDMA Voice + LTE	SVLTE	Yes	Yes	No	SVLTE
2	1X CDMA Voice + 2.4 GHz WIFI	No	Yes	Yes	No	
3	1X CDMA Voice + 5 GHz WIFI	No	Yes	Yes	No	
4	GSM Voice + 2.4 GHz WIFI	No	Yes	Yes	No	
5	GSM Voice + 5 GHz WIFI	No	Yes	Yes	No	
6	WCDMA Voice + 2.4 GHz WIFI	No	Yes	Yes	No	
7	WCDMA Voice + 5 GHz WIFI	No	Yes	Yes	No	
8	1X CDMA Voice + LTE + 2.4 GHz WIFI	SVLTE	Yes	Yes	Yes	Voice + LTE + WIFI Hotspot
9	1X CDMA Data / EVDO Data + 2.4 GHz WIFI	No	No	No	Yes	1X CDMA Data / EVDO +WIFI Hotspot
10	WCDMA Data + 2.4 GHz WIFI	No	No	No	Yes	WCDMA + WIFI Hotspot
11	LTE + 2.4 GHz WIFI	No	No	No	Yes	LTE+WIFI Hotspot
12	GPRS/EDGE Data + 2.4 GHz WIFI	No	No	No	Yes	GPRS/EDGE + WIFI Hotspot
13	1X CDMA Voice + 2.4 GHz Bluetooth	No	No	Yes	No	
14	WCDMA Voice + 2.4 GHz Bluetooth	No	No	Yes	No	
15	GSM Voice + 2.4 GHz Bluetooth	No	No	Yes	No	
16	LTE + 2.4 GHz Bluetooth	No	No	Yes	No	
17	1X CDMA Voice + LTE + 2.4 GHz Bluetooth	SVLTE	No	Yes	No	
18	1X CDMA 850 Voice + EVDO 850 Data	N/A	N/A	N/A	N/A	Not Supported by HW
19	1X CDMA 850 Voice + EVDO 1900 Data	N/A	N/A	N/A	N/A	Not Supported by HW
20	1X CDMA 1900 Voice + EVDO 850 Data	N/A	N/A	N/A	N/A	Not Supported by HW
21	1X CDMA 1900 Voice + EVDO 1900 Data	N/A	N/A	N/A	N/A	Not Supported by HW
22	1X CDMA 850 Voice + EVDO 850 Data + 2.4 GHz WIFI	N/A	N/A	N/A	N/A	Not Supported by HW (Voice + EVDO + WIFI Hotspot)
23	1X CDMA 1900 Voice + EVDO 850 Data + 2.4 GHz WIFI	N/A	N/A	N/A	N/A	Not Supported by HW (Voice + EVDO + WIFI Hotspot)
24	1X CDMA 850 Voice + EVDO 1900 Data + 2.4 GHz WIFI	N/A	N/A	N/A	N/A	Not Supported by HW (Voice + EVDO + WIFI Hotspot)
25	1X CDMA 1900 Voice + EVDO 1900 Data + 2.4 GHz WIFI	N/A	N/A	N/A	N/A	Not Supported by HW (Voice + EVDO + WIFI Hotspot)
26	GSM 850/1900 Voice + 850/1900 1X-RTT CDMA Data	N/A	N/A	N/A	N/A	Not Supported by HW
27	GSM 850/1900 Voice + EVDO/GPRS/EDGE Data	N/A	N/A	N/A	N/A	Not Supported by HW
28	GSM 850/1900 Voice + LTE	N/A	N/A	N/A	N/A	Not Supported by SW
29	GSM 850/1900 Voice + 850/1900 1X-RTT CDMA + 2.4/5 GHz WIFI	N/A	N/A	N/A	N/A	Not Supported by HW
30	GSM 850/1900 Voice + EVDO/GPRS/EDGE + 2.4/5 GHz WIFI	N/A	N/A	N/A	N/A	Not supported by HW
31	GSM 850/1900 Voice + LTE + 2.4/5 GHz WIFI	N/A	N/A	N/A	N/A	Not supported by SW
32	1X CDMA 850 Voice + LTE 782/1732 MHz Data + 5 GHz WIFI	N/A	N/A	N/A	N/A	Wireless Router functions not available in 5 GHz
33	1X CDMA 1900 Voice + LTE 782/1732 MHz Data + 5 GHz WIFI	N/A	N/A	N/A	N/A	Wireless Router functions not available in 5 GHz
34	GPRS/EDGE 850/1900 Data + 5 GHz WIFI	N/A	N/A	N/A	N/A	Wireless Router functions not available in 5 GHz
35	LTE 782/1732MHz Data + 5 GHz WIFI	N/A	N/A	N/A	N/A	Wireless Router functions not available in 5 GHz
36	1X 850/1900 Data + 5 GHz WIFI	N/A	N/A	N/A	N/A	Wireless Router functions not available in 5 GHz
37	EVDO 850/1900 Data + 5 GHz WIFI	N/A	N/A	N/A	N/A	Wireless Router functions not available in 5 GHz
38	WCDMA 850/1900 Data + 5GHz WIFI	N/A	N/A	N/A	N/A	Wireless Router functions not available in 5 GHz
39	850/1900 GPRS/EDGE Data + LTE 782/1732 MHz Data	N/A	N/A	N/A	N/A	Not supported by the SW
40	850/1900 EVDO Data + 850/1900 GPRS/EDGE Data	N/A	N/A	N/A	N/A	Not supported by the HW
41	850/1900 EVDO data + LTE 782/1732 MHz Data	N/A	N/A	N/A	N/A	Not supported by the SW
42	WCDMA 850/1900 Voice + 850/1900 1X-RTT CDMA Data	N/A	N/A	N/A	N/A	Not Supported by HW
43	WCDMA 850/1900 Voice + EVDO/GPRS/EDGE Data	N/A	N/A	N/A	N/A	Not Supported by HW
44	WCDMA 850/1900 Voice + LTE	N/A	N/A	N/A	N/A	Not Supported by SW
45	WCDMA 850/1900 Voice + 850/1900 1X-RTT CDMA + 2.4/5 GHz WIFI	N/A	N/A	N/A	N/A	Not Supported by HW
46	WCDMA 850/1900 Voice + EVDO/GPRS/EDGE + 2.4/5 GHz WIFI	N/A	N/A	N/A	N/A	Not supported by HW
47	WCDMA 850/1900 Voice + LTE + 2.4/5 GHz WIFI	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. 2. Bluetooth and 2.4 GHz WLAN share the same antenna path and cannot transmit simultaneously. 3. GSM/WCDMA/LTE use one modem and transceiver IC.The signals can not be transmitted simultaneously.						

Note: VOIP 3rd party applications may possibly be installed and used by the end-user.
 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.

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1.6 SAR Test Exclusions Applied

(A) WIFI/BT

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

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

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

Based on the maximum conducted power of Bluetooth and the antenna to use separation distance, Bluetooth SAR was not required; $[(6/10) * \sqrt{2.441}] = 1 < 3.0$.

This device supports 20 MHz and 40 MHz Bandwidths for IEEE 802.11n for 5 GHz WIFI only. IEEE 802.11n was not evaluated for SAR since the average output power of 20 MHz and 40 MHz bandwidths was not more than 0.25 dB higher than the average output power of IEEE 802.11a.

(B) Licensed Transmitter(s)

This model does not support Simultaneous Voice and Data for the licensed transmitter in any modes except in UMTS that allows Multi-RAB transmissions that share voice and data operations on a single physical channel.

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

This device is only capable of QPSK HSUPA in the uplink. Therefore, no additional SAR tests are required beyond that described for devices with HSUPA in KDB 941225 D01v02.

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.

1.7 Power Reduction for SAR

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

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1.8 Guidance Applied

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

1.9 Device Serial Numbers

Several samples were used with identical hardware to support SAR testing.

	Head Serial Number	Body-Worn Serial Number	Hotspot Serial Number
GSM/GPRS/EDGE 850	FCC F	FCC F	FCC F
UMTS 850	FCC F	FCC F	FCC F
GSM/GPRS/EDGE 1900	FCC A	FCC A	FCC A
UMTS 1900	FCC#2	FCC#2	FCC#2
2.4 GHz WLAN	FCC F	FCC C	FCC C
5 GHz WLAN	FCC C	FCC C	FCC C

	Power Condition	Head Serial Number	Body-Worn Serial Number	Hotspot Serial Number
Cell. CDMA/EVDO	Maximum	FCC A	FCC A	FCC A
	Reduced	FCC E	FCC E	FCC E
PCS CDMA/EVDO	Maximum	FCC A	FCC#2	FCC#2
	Reduced	FCC E	FCC E	FCC E
LTE Band 13	Maximum	FCC B	FCC B	FCC B
	Reduced	FCC#X	FCC#X	FCC#X
LTE Band 4 (AWS)	Maximum	FCC B	FCC B	FCC B
	Reduced	FCC#X	FCC#X	FCC#X

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LTE INFORMATION

LTE Information			
FCC ID	A3LSCHI425		
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)	
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 Transmitter and Antenna Implementation	LTE has one Tx/Rx Antenna, CDMA/GSM/UMTS has one Tx/Rx Antenna, and LTE/CDMA has one Rx only Antenna		
Description of LTE Tx and Ant. Implementation	CDMA/GSM/UMTS and LTE operate on separate transmission paths		
LTE Voice available?	YES		
Hotspot with LTE+WIFI	YES		
Hotspot with LTE+WIFI active with 1XVoice sessions?	YES		
LTE MPR Permanently implemented per 3GPP TS 36.101 section 6.2.3~6.2.5? (manufacturer attestation to be provided)	See Section 9.4 and 10.3		
A-MPR (Additional MPR) disabled for SAR Testing?	YES		
Conducted power Table provided for 1RB (low, mid, and high offset), 50% RB (low, mid, and high offset), 100% RB	YES		

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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/m³)
- E = Total RMS electric field strength (V/m)

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

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4 DOSIMETRIC ASSESSMENT

4.1 Measurement Procedure

The evaluation was performed using the following procedure:

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.

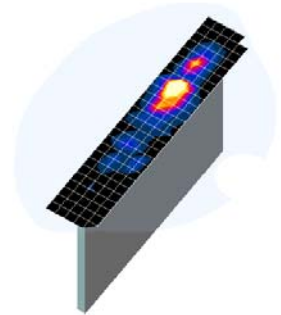


Figure 4-1
Sample SAR Area Scan

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

Frequency	Maximum Area Scan Resolution (mm) (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		
				$\Delta z_{zoom}(n)$	$\Delta z_{zoom}(1)^*$	
≤ 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

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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 $\epsilon = 3$ and loss tangent $\delta = 0.02$.

6.2 Positioning for Cheek

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

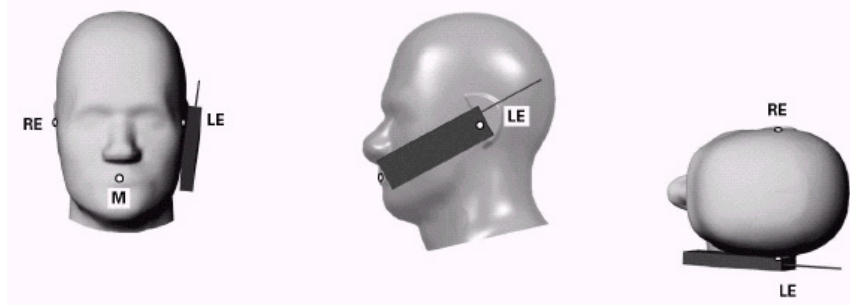


Figure 6-1 Front, Side and Top View of Cheek Position

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

6.3 Positioning for Ear / 15° Tilt

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

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

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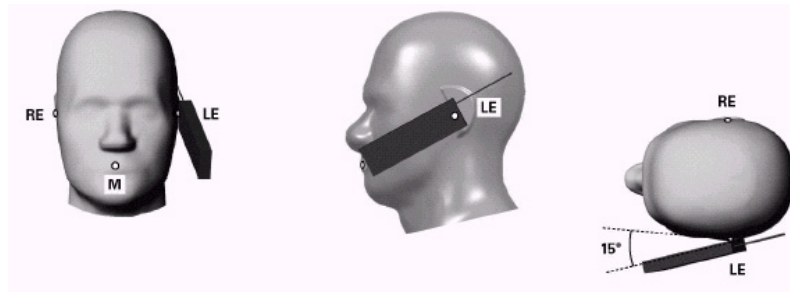


Figure 6-2 Front, Side and Top View of Ear/15° Tilt Position

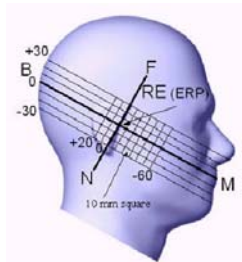


Figure 6-3
Side view w/ relevant markings

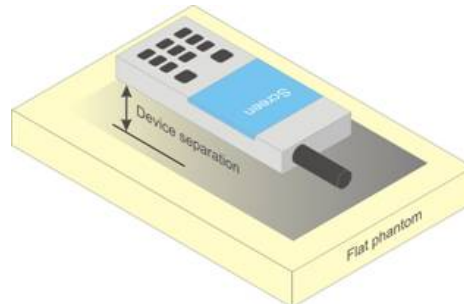


Figure 6-4
Sample Body-Worn Diagram

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

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

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

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

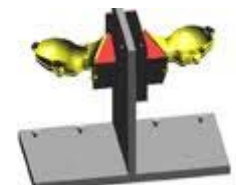


Figure 6-5 Twin SAM
Chin20

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6.5 Body-Worn Accessory Configurations

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

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

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

6.6 Wireless Router Configurations

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

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

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7 RF EXPOSURE LIMITS

7.1 Uncontrolled Environment

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

7.2 Controlled Environment

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

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

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

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

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

8.1 Measured and Reported SAR

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

8.2 Procedures Used to Establish RF Signal for SAR

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

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

8.3 SAR Measurement Conditions for CDMA2000

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

8.3.1 Output Power Verification

See 3GPP2 C.S0011/TIA-98-E as recommended by "SAR Measurement Procedures for 3G Devices" v02, October 2007. Maximum output power is verified on the High, Middle and Low channels according to procedures in section 4.4.5.2 of 3GPP2 C.S0011/TIA-98-E. SO55 tests were measured with power control bits in the "All Up" condition.

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

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Table 8-1
Parameters for Max. Power for RC1

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

Table 8-2
Parameters for Max. Power for RC3

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

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

8.3.2 Head SAR Measurements

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

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

8.3.3 Body SAR Measurements

SAR for body exposure configurations is measured in RC3 with the DUT configured to transmit at full rate on FCH with all other code channels disabled using TDSO / SO32. SAR for multiple code channels (FCH + SCH_n) is not required when the maximum average output of each RF channel is less than ¼ dB higher than that measured with FCH only. Otherwise, SAR is measured on the maximum output channel (FCH + SCH_n) with FCH at full rate and SCH₀ enabled at 9600 bps using the exposure configuration that results in the highest SAR for that channel with FCH only. When multiple code channels are enabled, the DUT output may shift by more than 0.5 dB and lead to higher SAR drifts and SCH dropouts. Body SAR was measured using TDSO / SO32 with power control bits in the “All Up”

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

8.3.4 Handsets with EVDO

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

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8.3.5 Body SAR Measurements for EVDO Hotspot

Hotspot Body SAR is measured using Subtype 0/1 Physical Layer configurations for Rev. 0 per KDB Publication 941225 D01 procedures for “1x Ev-Do data Devices”. SAR for Subtype 2 Physical layer configurations is not required for Rev. A when the maximum average output of each RF channels is less than that measured in Subtype 0/1 Physical layer configurations. Otherwise, SAR is measured on the maximum output channel for Rev. A using the exposure configuration that results in the highest SAR for the RF channels in Rev. 0. The AT is tested with a Reverse Data Channel rate of 153.6 kbps in Subtype 0/1 Physical Layer configurations; and a Reverse Data Channel payload size of 4096 bits and Termination Target of 16 slots in Subtype 2 Physical Layer configurations.

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

8.4 SAR Measurement Conditions for UMTS

8.4.1 Output Power Verification

Maximum output power is measured on the High, Middle and Low channels for each applicable transmission band according to the general descriptions in section 5.2 of 3GPP TS 34.121, using the appropriate RMC or AMR with TPC (transmit power control) set to all “1s”.

Maximum output power is verified on the High, Middle and Low channels according to the general descriptions in section 5.2 of 3GPP TS 34.121 (release 5), using the appropriate RMC with TPC (transmit power control) set to all “1s” or applying the required inner loop power control procedures to maintain maximum output power while HSUPA is active. Results for all applicable physical channel configurations (DPCCH, DPDCHn and spreading codes, HS-DPCCH etc) are tabulated in this test report. All configurations that are not supported by the DUT or cannot be measured due to technical or equipment limitations are identified.

8.4.2 Head SAR Measurements for Handsets

SAR for head exposure configurations is measured using the 12.2 kbps RMC with TPC bits configured to all “1s”. SAR in AMR configurations is not required when the maximum average output of each RF channel for 12.2 kbps AMR is less than 0.25 dB higher than that measured in 12.2 kbps RMC. Otherwise, SAR is measured on the maximum output channel in 12.2 AMR with a 3.4 kbps SRB (signaling radio bearer) using the exposure configuration that resulted in the highest SAR for that RF channel in the 12.2 kbps RMC mode.

8.4.3 Body SAR Measurements

SAR for body exposure configurations is measured using the 12.2 kbps RMC with the TPC bits all “1s”.

8.4.4 SAR Measurements for Handsets with Rel 5 HSDPA

Body SAR for HSDPA is not required for handsets with HSDPA capabilities when the maximum average output power of each RF channel with HSDPA active is less than 0.25 dB higher than that measured without HSDPA using 12.2 kbps RMC and the maximum SAR for 12.2 kbps RMC is $\leq 75\%$ of the SAR limit. Otherwise, SAR is measured for HSDPA, using an FRC with H-Set 1

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in Sub-test 1 and a 12.2 kbps RMC configured in Test Loop Mode 1, using the highest body SAR configuration measured in 12.2 kbps RMC without HSDPA, on the maximum output channel with the body exposure configuration that resulted in the highest SAR in 12.2 kbps RMC mode for that RF channel.

The H-set used in FRC for HSDPA should be configured according to the UE category of a test device. The number of HS-DSCH/HSPDSCHs, HARQ processes, minimum inter-TTI interval, transport block sizes and RV coding sequence are defined by the applicable H-set. To maintain a consistent test configuration and stable transmission conditions, QPSK is used in the FRC for SAR testing. HS-DPCCH should be configured with a CQI feedback cycle of 2 ms to maintain a constant rate of active CQI slots. DPCCH and DPDCH gain factors of $\beta_c=9$ and $\beta_d=15$, and power offset parameters of $\Delta_{ACK} = \Delta_{NACK} = 5$ and $\Delta_{CQI}=2$ is used. The CQI value is determined by the UE category, transport block size, number of HS-PDSCHs and modulation used in the FRC.

8.4.5 SAR Measurements for Handsets with Rel 6 HSUPA

Body SAR for HSUPA is not required when the maximum average output of each RF channel with HSUPA/HSDPA active is less than 0.25 dB higher than as measured without HSUPA/HSDPA using 12.2 kbps RMC and maximum SAR for 12.2 kbps RMC is $\leq 75\%$ of the SAR limit. Otherwise SAR is measured on the maximum output channel for the body exposure configuration produced highest SAR in 12.2 kbps RMC for that RF channel, using the additional procedures under "Release 6 HSPA data devices"

Head SAR for VOIP operations under HSPA is not required when maximum average output of each RF channel with HSPA is less than 0.25 dB higher than as measured using 12.2 kbps RMC. Otherwise SAR is measured using same HSPA configuration as used for body SAR.

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	$\beta_{hs}^{(1)}$	β_{ec}	β_{ed}	β_{ed} (SF)	β_{ed} (codes)	CM ⁽²⁾ (dB)	MPR (dB)	AG ⁽⁴⁾ Index	E-TFCI
1	11/15 ⁽³⁾	15/15 ⁽³⁾	64	11/15 ⁽³⁾	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed1}: 47/15$ $\beta_{ed2}: 47/15$	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 ⁽⁴⁾	15/15 ⁽⁴⁾	64	15/15 ⁽⁴⁾	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK} , Δ_{NACK} and $\Delta_{CQI} = 8 \Rightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Rightarrow \beta_{hs} = 30/15 * \beta_c$.

Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the β_c/β_d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 10/15$ and $\beta_d = 15/15$.

Note 4: For subtest 5 the β_c/β_d ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 14/15$ and $\beta_d = 15/15$.

Note 5: Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g.

Note 6: β_{ed} can not be set directly; it is set by Absolute Grant Value.

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8.5 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.

8.5.1 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.

8.5.2 MPR

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

8.5.3 A-MPR

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

8.5.4 Required RB Size and RB Offsets for SAR Testing

According to FCC KDB 941225 D05v02:

- a. Per Section 5.2.1, SAR is required for QPSK 1 RB Allocation for the largest bandwidth
 - i. The required channel and offset combination with the highest maximum output power is required for SAR.
 - ii. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required. Otherwise, SAR is required for the remaining required test channels using the RB offset configuration with highest output power for that channel.
 - iii. When the reported SAR for a required test channel is > 1.45 W/kg, SAR is required for all RB offset configurations for that channel.
- b. Per Section 5.2.2, SAR is required for 50% RB allocation using the largest bandwidth following the same procedures outlined in Section 5.2.1.
- c. Per Section 5.2.3, QPSK SAR is not required for the 100% allocation when the highest maximum output power for the 100% allocation is less than the highest maximum output power of the 1 RB and 50% RB allocations and the reported SAR for the 1 RB and 50% RB allocations is < 0.8 W/kg.
- d. Per Section 5.2.4 and 5.3, SAR tests for higher order modulations and lower bandwidths configurations are not required when the conducted power of the required test configurations determined by Sections 5.2.1 through 5.2.3 is less than or equal to $\frac{1}{2}$ dB higher than the equivalent configuration using QPSK modulation and when the QPSK SAR for those configurations is < 1.45 W/kg.

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8.6 SAR Testing with 802.11 Transmitters

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

8.6.1 General Device Setup

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

8.6.2 Frequency Channel Configurations [27]

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

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

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

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9 RF CONDUCTED POWERS

9.1 CDMA Conducted Powers

Band	Channel	Frequency	SO55 [dBm]	SO55 [dBm]	TDSO SO32 [dBm]	TDSO SO32 [dBm]	1x EvDO Rev. 0 [dBm]	1x EvDO Rev. A [dBm]
	F-RC	MHz	RC1	RC3	FCH+SCH	FCH	(RTAP)	(RETAP)
Cellular	1013	824.7	24.38	24.35	24.41	24.49	24.59	24.38
	384	836.52	24.54	24.51	24.57	24.64	24.58	24.55
	777	848.31	24.59	24.58	24.58	24.68	24.61	24.59
PCS	25	1851.25	24.72	24.64	24.70	24.71	24.71	24.68
	600	1880	24.54	24.56	24.55	24.64	24.56	24.54
	1175	1908.75	24.69	24.66	24.71	24.69	24.70	24.68

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

Per KDB Publication 941225 D01v02:

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

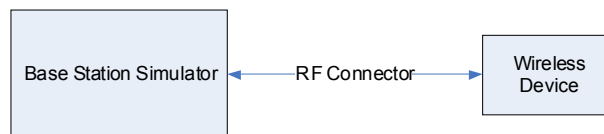


Figure 9-1
Power Measurement Setup

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9.2 GSM Conducted Powers

		Maximum Burst-Averaged Output Power				
		Voice	GPRS/EDGE Data (GMSK)		EDGE Data (8-PSK)	
Band	Channel	GSM [dBm] CS (1 Slot)	GPRS [dBm] 1 Tx Slot	GPRS [dBm] 2 Tx Slot	EDGE [dBm] 1 Tx Slot	EDGE [dBm] 2 Tx Slot
GSM 850	128	33.38	33.47	30.81	26.96	26.74
	190	33.41	33.44	31.29	26.90	26.89
	251	33.39	33.39	31.25	26.80	26.70
GSM 1900	512	30.94	30.99	29.91	26.86	26.71
	661	30.98	30.97	29.49	26.49	26.24
	810	30.85	30.89	29.60	26.73	26.56

		Calculated Maximum Frame-Averaged Output Power				
		Voice	GPRS/EDGE Data (GMSK)		EDGE Data (8-PSK)	
Band	Channel	GSM [dBm] CS (1 Slot)	GPRS [dBm] 1 Tx Slot	GPRS [dBm] 2 Tx Slot	EDGE [dBm] 1 Tx Slot	EDGE [dBm] 2 Tx Slot
GSM 850	128	24.35	24.44	24.79	17.93	20.72
	190	24.38	24.41	25.27	17.87	20.87
	251	24.36	24.36	25.23	17.77	20.68
GSM 1900	512	21.91	21.96	23.89	17.83	20.69
	661	21.95	21.94	23.47	17.46	20.22
	810	21.82	21.86	23.58	17.70	20.54

Note: Both burst-averaged and calculated frame-averaged powers are included. Frame-averaged power was calculated from the measured burst-averaged power by converting the slot powers into linear units and calculating the energy over 8 timeslots.

The bolded GPRS modes were selected for SAR testing according to the highest frame-averaged output power table according to KDB 941225 D03v01.

GPRS/EDGE (GMSK) output powers were measured with coding scheme setting of 1 (CS1) on the base station simulator. CS1 was configured to measure GPRS output power measurements and SAR to ensure GMSK modulation in the signal. Our Investigation has shown that CS1 - CS4 settings do not have any impact on the output levels or modulation in the GPRS modes.

EDGE (8-PSK) output powers were measured with MCS7 on the base station simulator. MCS7 coding scheme was used to measure the output powers for EDGE since investigation has shown that choosing MCS7 coding scheme will ensure 8-PSK modulation. It has been shown that MCS levels that produce 8PSK modulation do not have an impact on output power.

This device does not support evolved EDGE (eEDGE)

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

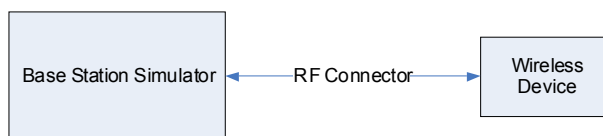


Figure 9-2
Power Measurement Setup

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9.3 UMTS Conducted Powers

3GPP Release Version	Mode	3GPP 34.121 Subtest	Cellular Band [dBm]			PCS Band [dBm]			3GPP MPR [dB]
			4132	4183	4233	9262	9400	9538	
99	WCDMA	12.2 kbps RMC	23.49	23.48	23.40	22.65	22.89	22.51	-
99		12.2 kbps AMR	23.43	23.40	23.45	22.63	22.85	22.50	-
6	HSDPA	Subtest 1	22.54	22.64	22.51	22.60	22.80	22.57	0
6		Subtest 2	22.61	22.76	22.49	22.62	22.84	22.46	0
6		Subtest 3	22.04	22.24	22.20	22.32	22.24	22.12	0.5
6		Subtest 4	22.08	22.31	22.12	21.94	22.03	22.01	0.5
6	HSUPA	Subtest 1	22.31	22.28	22.46	22.53	22.69	22.43	0
6		Subtest 2	21.47	21.73	21.59	21.65	21.84	21.59	2
6		Subtest 3	21.42	21.49	21.46	21.80	21.92	21.72	1
6		Subtest 4	21.40	21.47	21.49	21.97	22.00	21.89	2
6		Subtest 5	22.35	22.30	22.40	22.24	22.31	22.20	0

UMTS SAR was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v02. HSPA SAR was not required since the average output power of the HSPA subtests was not more than 0.25 dB higher than the RMC level and SAR was less than 1.2 W/kg.

This device does not support DC-HSDPA.

It is expected by the manufacturer that MPR for some HSUPA subtests may be up to 1 dB more than specified by 3GPP, but also as low as 0 dB according to the chipset implementation in this model.

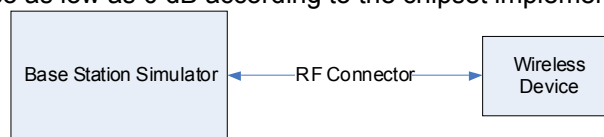


Figure 9-3
Power Measurement Setup

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9.4 LTE Conducted Powers

9.4.1 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	23.38	0	0
	782.0	23230	10	QPSK	1	25	22.92	0	0
	782.0	23230	10	QPSK	1	49	22.83	0	0
	782.0	23230	10	QPSK	25	0	22.24	1	0-1
	782.0	23230	10	QPSK	25	12	21.88	1	0-1
	782.0	23230	10	QPSK	25	25	21.76	1	0-1
	782.0	23230	10	QPSK	50	0	21.81	1	0-1
	782.0	23230	10	16QAM	1	0	21.98	1	0-1
	782.0	23230	10	16QAM	1	25	21.69	1	0-1
	782.0	23230	10	16QAM	1	49	21.51	1	0-1
	782.0	23230	10	16QAM	25	0	21.33	2	0-2
	782.0	23230	10	16QAM	25	12	20.94	2	0-2
	782.0	23230	10	16QAM	25	25	20.85	2	0-2
	782.0	23230	10	16QAM	50	0	20.77	2	0-2

9.4.2 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	23.24	0	0
	1732.5	20175	20	QPSK	1	50	23.41	0	0
	1732.5	20175	20	QPSK	1	99	23.42	0	0
	1732.5	20175	20	QPSK	50	0	22.15	1	0-1
	1732.5	20175	20	QPSK	50	25	22.17	1	0-1
	1732.5	20175	20	QPSK	50	50	22.20	1	0-1
	1732.5	20175	20	QPSK	100	0	22.20	1	0-1
	1732.5	20175	20	16QAM	1	0	22.24	1	0-1
	1732.5	20175	20	16QAM	1	50	22.35	1	0-1
	1732.5	20175	20	16QAM	1	99	22.32	1	0-1
	1732.5	20175	20	16QAM	50	0	21.12	2	0-2
	1732.5	20175	20	16QAM	50	25	21.13	2	0-2
	1732.5	20175	20	16QAM	50	50	21.15	2	0-2
	1732.5	20175	20	16QAM	100	0	21.28	2	0-2

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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	23.12	0	0
	1717.5	20025	15	QPSK	1	36	23.04	0	0
	1717.5	20025	15	QPSK	1	74	23.07	0	0
	1717.5	20025	15	QPSK	36	0	22.29	1	0-1
	1717.5	20025	15	QPSK	36	18	22.16	1	0-1
	1717.5	20025	15	QPSK	36	37	22.13	1	0-1
	1717.5	20025	15	QPSK	75	0	21.76	1	0-1
	1717.5	20025	15	16QAM	1	0	21.76	1	0-1
	1717.5	20025	15	16QAM	1	36	21.83	1	0-1
	1717.5	20025	15	16QAM	1	74	21.85	1	0-1
	1717.5	20025	15	16QAM	36	0	20.84	2	0-2
	1717.5	20025	15	16QAM	36	18	20.89	2	0-2
Mid	1717.5	20025	15	16QAM	36	37	20.92	2	0-2
	1717.5	20025	15	16QAM	75	0	20.83	2	0-2
	1732.5	20175	15	QPSK	1	0	23.44	0	0
	1732.5	20175	15	QPSK	1	36	23.50	0	0
	1732.5	20175	15	QPSK	1	74	23.50	0	0
	1732.5	20175	15	QPSK	36	0	22.13	1	0-1
	1732.5	20175	15	QPSK	36	18	22.03	1	0-1
	1732.5	20175	15	QPSK	36	37	22.15	1	0-1
	1732.5	20175	15	QPSK	75	0	22.11	1	0-1
	1732.5	20175	15	16QAM	1	0	22.47	1	0-1
	1732.5	20175	15	16QAM	1	36	22.48	1	0-1
	1732.5	20175	15	16QAM	1	74	22.50	1	0-1
High	1732.5	20175	15	16QAM	36	0	21.17	2	0-2
	1732.5	20175	15	16QAM	36	18	21.11	2	0-2
	1732.5	20175	15	16QAM	36	37	21.14	2	0-2
	1732.5	20175	15	16QAM	75	0	21.10	2	0-2
	1747.5	20325	15	QPSK	1	0	23.05	0	0
	1747.5	20325	15	QPSK	1	36	23.27	0	0
	1747.5	20325	15	QPSK	1	74	23.22	0	0
	1747.5	20325	15	QPSK	36	0	21.93	1	0-1
	1747.5	20325	15	QPSK	36	18	21.95	1	0-1
	1747.5	20325	15	QPSK	36	37	21.98	1	0-1
	1747.5	20325	15	QPSK	75	0	22.01	1	0-1
	1747.5	20325	15	16QAM	1	0	22.31	1	0-1
	1747.5	20325	15	16QAM	1	36	22.37	1	0-1
	1747.5	20325	15	16QAM	1	74	22.33	1	0-1
	1747.5	20325	15	16QAM	36	0	21.12	2	0-2
	1747.5	20325	15	16QAM	36	18	21.08	2	0-2
	1747.5	20325	15	16QAM	36	37	21.09	2	0-2
	1747.5	20325	15	16QAM	75	0	20.98	2	0-2
	1747.5	20325	15	16QAM	75	0	20.98	2	0-2

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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	23.01	0	0
	1715	20000	10	QPSK	1	25	23.03	0	0
	1715	20000	10	QPSK	1	49	22.93	0	0
	1715	20000	10	QPSK	25	0	22.02	1	0-1
	1715	20000	10	QPSK	25	12	22.03	1	0-1
	1715	20000	10	QPSK	25	25	21.95	1	0-1
	1715	20000	10	QPSK	50	0	21.80	1	0-1
	1715	20000	10	16QAM	1	0	22.14	1	0-1
	1715	20000	10	16QAM	1	25	22.11	1	0-1
	1715	20000	10	16QAM	1	49	21.76	1	0-1
	1715	20000	10	16QAM	25	0	21.02	2	0-2
	1715	20000	10	16QAM	25	12	21.10	2	0-2
	1715	20000	10	16QAM	25	25	20.94	2	0-2
Mid	1732.5	20175	10	QPSK	1	0	23.14	0	0
	1732.5	20175	10	QPSK	1	25	23.09	0	0
	1732.5	20175	10	QPSK	1	49	23.15	0	0
	1732.5	20175	10	QPSK	25	0	21.98	1	0-1
	1732.5	20175	10	QPSK	25	12	21.90	1	0-1
	1732.5	20175	10	QPSK	25	25	22.05	1	0-1
	1732.5	20175	10	QPSK	50	0	21.84	1	0-1
	1732.5	20175	10	16QAM	1	0	21.93	1	0-1
	1732.5	20175	10	16QAM	1	25	21.90	1	0-1
	1732.5	20175	10	16QAM	1	49	21.84	1	0-1
	1732.5	20175	10	16QAM	25	0	20.98	2	0-2
	1732.5	20175	10	16QAM	25	12	20.89	2	0-2
	1732.5	20175	10	16QAM	25	25	20.94	2	0-2
High	1732.5	20175	10	16QAM	50	0	20.78	2	0-2
	1750	20350	10	QPSK	1	0	23.25	0	0
	1750	20350	10	QPSK	1	25	23.21	0	0
	1750	20350	10	QPSK	1	49	23.22	0	0
	1750	20350	10	QPSK	25	0	22.05	1	0-1
	1750	20350	10	QPSK	25	12	22.08	1	0-1
	1750	20350	10	QPSK	25	25	22.06	1	0-1
	1750	20350	10	QPSK	50	0	21.95	1	0-1
	1750	20350	10	16QAM	1	0	22.20	1	0-1
	1750	20350	10	16QAM	1	25	22.12	1	0-1
	1750	20350	10	16QAM	1	49	22.07	1	0-1
	1750	20350	10	16QAM	25	0	21.15	2	0-2
	1750	20350	10	16QAM	25	12	21.05	2	0-2
	1750	20350	10	16QAM	25	25	21.13	2	0-2
	1750	20350	10	16QAM	50	0	20.95	2	0-2

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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	23.26	0	0
	1712.5	19975	5	QPSK	1	12	23.03	0	0
	1712.5	19975	5	QPSK	1	24	23.17	0	0
	1712.5	19975	5	QPSK	12	0	22.12	1	0-1
	1712.5	19975	5	QPSK	12	6	22.08	1	0-1
	1712.5	19975	5	QPSK	12	13	22.14	1	0-1
	1712.5	19975	5	QPSK	25	0	21.97	1	0-1
	1712.5	19975	5	16-QAM	1	0	22.37	1	0-1
	1712.5	19975	5	16-QAM	1	12	22.30	1	0-1
	1712.5	19975	5	16-QAM	1	24	22.15	1	0-1
	1712.5	19975	5	16-QAM	12	0	21.25	2	0-2
	1712.5	19975	5	16-QAM	12	6	21.27	2	0-2
Mid	1712.5	19975	5	16-QAM	12	13	21.29	2	0-2
	1712.5	19975	5	16-QAM	25	0	20.95	2	0-2
	1732.5	20175	5	QPSK	1	0	23.05	0	0
	1732.5	20175	5	QPSK	1	12	23.12	0	0
	1732.5	20175	5	QPSK	1	24	23.02	0	0
	1732.5	20175	5	QPSK	12	0	22.07	1	0-1
	1732.5	20175	5	QPSK	12	6	22.09	1	0-1
	1732.5	20175	5	QPSK	12	13	22.17	1	0-1
	1732.5	20175	5	QPSK	25	0	21.97	1	0-1
	1732.5	20175	5	16-QAM	1	0	21.85	1	0-1
	1732.5	20175	5	16-QAM	1	12	22.04	1	0-1
	1732.5	20175	5	16-QAM	1	24	22.11	1	0-1
High	1732.5	20175	5	16-QAM	12	0	21.16	2	0-2
	1732.5	20175	5	16-QAM	12	6	21.12	2	0-2
	1732.5	20175	5	16-QAM	12	13	21.17	2	0-2
	1732.5	20175	5	16-QAM	25	0	20.94	2	0-2
	1752.5	20375	5	QPSK	1	0	23.15	0	0
	1752.5	20375	5	QPSK	1	12	23.22	0	0
	1752.5	20375	5	QPSK	1	24	23.18	0	0
	1752.5	20375	5	QPSK	12	0	22.21	1	0-1
	1752.5	20375	5	QPSK	12	6	22.16	1	0-1
	1752.5	20375	5	QPSK	12	13	22.21	1	0-1
	1752.5	20375	5	QPSK	25	0	22.17	1	0-1
	1752.5	20375	5	16-QAM	1	0	22.26	1	0-1
	1752.5	20375	5	16-QAM	1	12	22.33	1	0-1
	1752.5	20375	5	16-QAM	1	24	22.35	1	0-1
	1752.5	20375	5	16-QAM	12	0	21.38	2	0-2
	1752.5	20375	5	16-QAM	12	6	21.36	2	0-2
	1752.5	20375	5	16-QAM	12	13	21.37	2	0-2
	1752.5	20375	5	16-QAM	25	0	21.00	2	0-2

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9.5 WLAN Conducted Powers

Table 9-6
IEEE 802.11b Average RF Power

Mode	Freq [MHz]	Channel	Conducted Power [dBm]			
			Data Rate [Mbps]			
			1	2	5.5	11
802.11b	2412	1	14.71	13.76	14.30	14.27
802.11b	2437	6	13.69	13.68	13.26	13.26
802.11b	2462	11	14.05	14.05	13.71	13.72

Table 9-7
IEEE 802.11g Average RF Power

Mode	Freq [MHz]	Channel	Conducted Power [dBm]							
			Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
802.11g	2412	1	9.78	9.72	10.00	9.78	9.77	9.90	9.63	9.55
802.11g	2437	6	8.56	8.67	8.65	8.37	8.60	8.30	8.38	8.34
802.11g	2462	11	7.76	7.74	7.76	7.70	7.79	7.74	7.80	7.74

Table 9-8
IEEE 802.11n Average RF Power

Mode	Freq [MHz]	Channel	Conducted Power [dBm]							
			Data Rate [Mbps]							
			6.5	13	20	26	39	52	58	65
802.11n	2412	1	9.79	9.67	9.80	9.81	9.83	9.81	9.87	9.90
802.11n	2437	6	8.47	8.47	8.72	8.64	8.37	8.55	8.45	8.46
802.11n	2462	11	7.92	7.98	8.07	8.11	7.97	8.01	8.12	7.84

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Table 9-9
IEEE 802.11a Average RF Power

Mode	Freq [MHz]	Channel	Conducted Power [dBm]							
			Data Rate [Mbps]							
			6	9	12	18	24	36	48	54
802.11a	5180	36*	8.78	8.86	8.68	8.82	8.90	8.69	8.70	8.68
802.11a	5200	40	8.88	8.95	8.72	8.92	8.78	8.82	8.74	8.78
802.11a	5220	44	8.75	8.82	8.64	8.69	8.83	8.61	8.68	8.54
802.11a	5240	48*	9.47	9.35	9.35	9.33	9.37	9.30	9.37	9.36
802.11a	5260	52	9.35	9.23	9.24	9.28	9.25	9.33	9.26	9.20
802.11a	5280	56	9.43	9.28	9.36	9.33	9.31	9.38	9.41	9.25
802.11a	5300	60	8.92	8.80	8.83	8.91	8.90	8.83	8.90	8.81
802.11a	5320	64	8.70	8.60	8.51	8.71	8.68	8.70	8.61	8.49
802.11a	5500	100	8.59	8.60	8.48	8.50	8.41	8.45	8.45	8.39
802.11a	5520	104*	8.89	8.96	8.77	8.84	8.70	8.72	8.67	8.64
802.11a	5540	108	9.00	9.02	8.88	8.89	8.76	8.81	8.79	8.82
802.11a	5560	112	9.14	9.12	9.01	9.01	8.96	8.97	8.98	8.92
802.11a	5580	116*	9.11	9.10	8.92	9.03	8.85	8.95	8.99	8.87
802.11a	5600	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11a	5620	124	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11a	5640	128	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11a	5660	132	8.94	8.96	8.91	8.85	8.76	8.81	8.77	8.77
802.11a	5680	136*	8.91	8.87	8.81	8.79	8.73	8.68	8.75	8.71
802.11a	5700	140	9.03	9.10	8.91	8.87	8.88	8.90	8.82	8.81
802.11a	5745	149*	9.48	9.53	9.50	9.50	9.47	9.45	9.38	9.40
802.11a	5765	153	8.95	9.01	8.99	8.94	8.86	8.90	8.87	8.93
802.11a	5785	157*	8.90	8.97	8.97	8.88	8.92	8.88	8.83	8.80
802.11a	5805	161*	9.37	9.45	9.32	9.47	9.35	9.31	9.34	9.23
802.11a	5825	165	9.33	9.43	9.41	9.40	9.25	9.24	9.23	9.24

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

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

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Table 9-10
IEEE 802.11n Average RF Power – 20 MHz Bandwidth

Mode	Freq [MHz]	Channel	Conducted Power [dBm]							
			Data Rate [Mbps]							
			6.5	13	20	26	39	52	58	65
802.11n	5180	36*	8.77	8.85	8.92	8.90	8.91	8.90	8.79	8.83
802.11n	5200	40	9.02	9.09	9.22	9.13	9.20	9.14	9.05	9.16
802.11n	5220	44	8.76	8.90	8.96	8.95	8.95	8.96	8.81	8.80
802.11n	5240	48*	9.41	9.48	9.51	9.55	9.53	9.50	9.43	9.42
802.11n	5260	52	9.30	9.34	9.34	9.33	9.34	9.30	9.35	9.31
802.11n	5280	56	9.31	9.35	9.40	9.34	9.38	9.36	9.40	9.30
802.11n	5300	60	9.36	9.40	9.36	9.34	9.46	9.31	9.35	9.41
802.11n	5320	64	8.87	8.91	8.92	8.89	8.85	8.94	8.89	8.81
802.11n	5500	100	8.64	8.62	8.61	8.45	8.52	8.53	8.56	8.54
802.11n	5520	104*	9.07	9.03	9.11	8.84	8.91	8.94	9.01	8.97
802.11n	5540	108	9.14	9.12	9.07	8.91	9.01	8.98	9.14	9.00
802.11n	5560	112	9.20	9.21	9.16	8.95	9.13	9.00	9.20	9.08
802.11n	5580	116*	9.13	9.12	9.14	8.85	9.04	9.03	9.01	9.05
802.11n	5600	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5620	124	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5640	128	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5660	132	9.09	9.05	9.10	8.89	8.97	8.97	8.98	8.98
802.11n	5680	136*	8.98	8.94	8.99	8.70	8.89	8.92	8.80	8.90
802.11n	5700	140	9.02	9.04	8.94	8.81	8.96	8.93	8.87	8.90
802.11n	5745	149*	9.58	9.50	9.44	9.42	9.46	9.41	9.41	9.45
802.11n	5765	153	9.02	8.95	8.93	8.82	8.94	8.85	8.90	8.90
802.11n	5785	157*	8.92	8.84	8.76	8.77	8.80	8.82	8.82	8.79
802.11n	5805	161*	9.48	9.43	9.31	9.27	9.35	9.26	9.29	9.39
802.11n	5825	165	9.53	9.41	9.33	9.42	9.46	9.37	9.35	9.38

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

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Table 9-11
IEEE 802.11n Average RF Power – 40 MHz Bandwidth

Mode	Freq [MHz]	Channel	Conducted Power [dBm]							
			Data Rate [Mbps]							
			13.5/15	27/30	40.5/45	54/60	81/90	108/120	121.5/135	135/150
802.11n	5190	38	8.63	8.64	8.74	8.52	8.52	8.62	8.04	8.61
802.11n	5230	46	9.06	9.06	9.22	8.95	8.97	8.97	8.39	9.05
802.11n	5270	54	8.99	9.27	9.11	9.00	8.88	8.83	8.98	8.58
802.11n	5310	62	9.07	9.30	9.25	9.14	8.98	8.97	9.03	8.58
802.11n	5510	102	8.76	8.83	8.72	8.70	8.80	8.73	8.73	8.77
802.11n	5550	110	8.69	8.68	8.65	8.63	8.74	8.62	8.57	8.77
802.11n	5590	118	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5630	126	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
802.11n	5670	134	8.70	8.74	8.66	8.62	8.74	8.75	8.71	8.76
802.11n	5755	151	8.82	8.82	8.79	8.78	8.66	8.81	8.90	8.71
802.11n	5795	159	9.22	9.26	9.20	9.21	9.04	9.19	9.35	9.08

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

Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and April 2010 FCC/TCB Meeting Notes:

- For 2.4 GHz, highest average RF output power channel for the lowest data rate for IEEE 802.11b were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11g/n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode.
- For 5 GHz, highest average RF output power channel for the lowest data rate for IEEE 802.11a were selected for SAR evaluation. Other IEEE 802.11 modes (including 802.11n 20 MHz and 40 MHz) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11a mode.
- When the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is <1.6 W/kg and the reported 1g averaged SAR is <0.8 W/kg, SAR testing on other channels is not required. Otherwise, the other default (or corresponding required) test channels were additionally tested using the lowest data rate.
- The bolded powers above were tested for SAR using the corresponding data rate and channel.



Figure 9-4
Power Measurement Setup

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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	$P \geq 18$	19
	$P < 18$	23

10.2 Output Power Verification

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

The power reduction targets and threshold level described in **Table 10-1** were confirmed. Please see results in **Table 10-2**.

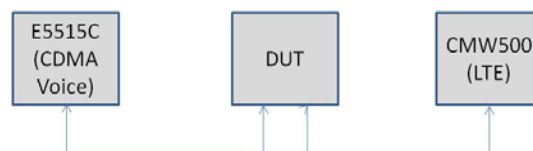


Figure 10-1
SVLTE Conducted Test Setup Diagram

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Table 10-2
SVLTE Power Reduction Verification Results

1xRTT CDMA Voice Band	BC0 1xRTT CDMA Voice Channel	BC0 1xRTT CDMA Voice Tx (dBm)	LTE Band 13 Conducted Power (dBm)												
			Mid Channel - 10 MHz Bandwidth												
			QPSK 1 RB, RB Offset 0	QPSK 1 RB, RB Offset 25	QPSK 1 RB, RB Offset 49	QPSK 25 RB, RB Offset 0	QPSK 25 RB, RB Offset 12	QPSK 25 RB, RB Offset 25	QPSK 50 RB, RB Offset 0	16 QAM 1 RB, RB Offset 0	16 QAM 1 RB, RB Offset 25	16 QAM 1 RB, RB Offset 49	16 QAM 25 RB, RB Offset 0	16 QAM 25 RB, RB Offset 12	16 QAM 25 RB, RB Offset 25
850 MHz	384	25	19.15	19.23	19.14	19.24	19.19	19.23	19.02	19.11	19.15	19.17	19.14	19.2	19.23
		24	19.15	19.23	19.14	19.24	19.19	19.23	19.02	19.11	19.15	19.17	19.14	19.2	19.23
		23	19.15	19.23	19.14	19.24	19.19	19.23	19.02	19.11	19.15	19.17	19.14	19.2	19.23
		22	19.15	19.23	19.14	19.24	19.19	19.23	19.02	19.11	19.15	19.17	19.14	19.2	19.23
		21	19.15	19.23	19.14	19.24	19.19	19.23	19.02	19.11	19.15	19.17	19.14	19.2	19.23
		20	19.15	19.23	19.14	19.24	19.19	19.23	19.02	19.11	19.15	19.17	19.14	19.2	19.23
		19	19.15	19.23	19.14	19.24	19.19	19.23	19.02	19.11	19.15	19.17	19.14	19.2	19.23
		18	19.15	19.23	19.14	19.24	19.19	19.23	19.02	19.11	19.15	19.17	19.14	19.2	19.23
		17	23.32	23.21	23.29	22.27	22.13	22.14	22.09	22.31	22.25	22.18	21.12	21.36	21.25
		16	23.32	23.21	23.29	22.27	22.13	22.14	22.09	22.31	22.25	22.18	21.12	21.36	21.25
		15	23.32	23.21	23.29	22.27	22.13	22.14	22.09	22.31	22.25	22.18	21.12	21.36	21.25
		14	23.32	23.21	23.29	22.27	22.13	22.14	22.09	22.31	22.25	22.18	21.12	21.36	21.25
		13	23.32	23.21	23.29	22.27	22.13	22.14	22.09	22.31	22.25	22.18	21.12	21.36	21.25
		12	23.32	23.21	23.29	22.27	22.13	22.14	22.09	22.31	22.25	22.18	21.12	21.36	21.25
		11	23.32	23.21	23.29	22.27	22.13	22.14	22.09	22.31	22.25	22.18	21.12	21.36	21.25

1xRTT CDMA Voice Band	BC0 1xRTT CDMA Voice Channel	BC1 1xRTT CDMA Voice Tx (dBm)	LTE Band 13 Conducted Power (dBm)												
			Mid Channel - 10 MHz Bandwidth												
			QPSK 1 RB, RB Offset 0	QPSK 1 RB, RB Offset 25	QPSK 1 RB, RB Offset 49	QPSK 25 RB, RB Offset 0	QPSK 25 RB, RB Offset 12	QPSK 25 RB, RB Offset 25	QPSK 50 RB, RB Offset 0	16 QAM 1 RB, RB Offset 0	16 QAM 1 RB, RB Offset 25	16 QAM 1 RB, RB Offset 49	16 QAM 25 RB, RB Offset 0	16 QAM 25 RB, RB Offset 12	16 QAM 25 RB, RB Offset 25
1900 MHz	600	25	19.02	19.24	19.28	19.12	19.27	19.3	19.02	19.21	19.14	19.21	19.02	19.03	19.14
		24	19.02	19.24	19.28	19.12	19.27	19.3	19.02	19.21	19.14	19.21	19.02	19.03	19.14
		23	19.02	19.24	19.28	19.12	19.27	19.3	19.02	19.21	19.14	19.21	19.02	19.03	19.14
		22	19.02	19.24	19.28	19.12	19.27	19.3	19.02	19.21	19.14	19.21	19.02	19.03	19.14
		21	19.02	19.24	19.28	19.12	19.27	19.3	19.02	19.21	19.14	19.21	19.02	19.03	19.14
		20	19.02	19.24	19.28	19.12	19.27	19.3	19.02	19.21	19.14	19.21	19.02	19.03	19.14
		19	19.02	19.24	19.28	19.12	19.27	19.3	19.02	19.21	19.14	19.21	19.02	19.03	19.14
		18	19.02	19.24	19.28	19.12	19.27	19.3	19.02	19.21	19.14	19.21	19.02	19.03	19.14
		17	23.1	23.21	23.24	22.22	22.04	22.08	22.06	22.07	22.13	22.2	21.06	21.08	21.14
		16	23.1	23.21	23.24	22.22	22.04	22.08	22.06	22.07	22.13	22.2	21.06	21.08	21.14
		15	23.1	23.21	23.24	22.22	22.04	22.08	22.06	22.07	22.13	22.2	21.06	21.08	21.14
		14	23.1	23.21	23.24	22.22	22.04	22.08	22.06	22.07	22.13	22.2	21.06	21.08	21.14
		13	23.1	23.21	23.24	22.22	22.04	22.08	22.06	22.07	22.13	22.2	21.06	21.08	21.14
		12	23.1	23.21	23.24	22.22	22.04	22.08	22.06	22.07	22.13	22.2	21.06	21.08	21.14
		11	23.1	23.21	23.24	22.22	22.04	22.08	22.06	22.07	22.13	22.2	21.06	21.08	21.14

1xRTT CDMA Voice Band	BC0 1xRTT CDMA Voice Channel	BC0 1xRTT CDMA Voice Tx (dBm)	LTE Band 4 Conducted Power (dBm)												
			Mid Channel - 20 MHz Bandwidth												
			QPSK 1 RB, RB Offset 0	QPSK 1 RB, RB Offset 50	QPSK 1 RB, RB Offset 99	QPSK 50 RB, RB Offset 0	QPSK 50 RB, RB Offset 25	QPSK 50 RB, RB Offset 50	QPSK 100 RB, RB Offset 0	16 QAM 1 RB, RB Offset 0	16 QAM 1 RB, RB Offset 50	16 QAM 1 RB, RB Offset 99	16 QAM 50 RB, RB Offset 0	16 QAM 50 RB, RB Offset 25	16 QAM 50 RB, RB Offset 50
850 MHz	384	25	19.35	19.24	19.18	19.11	19.23	19.17	19.15	19.25	19.26	19.13	19.18	19.24	19.05
		24	19.35	19.24	19.18	19.11	19.23	19.17	19.15	19.25	19.26	19.13	19.18	19.24	19.05
		23	19.35	19.24	19.18	19.11	19.23	19.17	19.15	19.25	19.26	19.13	19.18	19.24	19.05
		22	19.35	19.24	19.18	19.11	19.23	19.17	19.15	19.25	19.26	19.13	19.18	19.24	19.05
		21	19.35	19.24	19.18	19.11	19.23	19.17	19.15	19.25	19.26	19.13	19.18	19.24	19.05
		20	19.35	19.24	19.18	19.11	19.23	19.17	19.15	19.25	19.26	19.13	19.18	19.24	19.05
		19	19.35	19.24	19.18	19.11	19.23	19.17	19.15	19.25	19.26	19.13	19.18	19.24	19.05
		18	19.35	19.24	19.18	19.11	19.23	19.17	19.15	19.25	19.26	19.13	19.18	19.24	19.05
		17	23.12	23.05	23.07	22.15	22.18	22.25	22.05	22.08	22.16	22.31	21.18	21.06	21.08
		16	23.12	23.05	23.07	22.15	22.18	22.25	22.05	22.08	22.16	22.31	21.18	21.06	21.08
		15	23.12	23.05	23.07	22.15	22.18	22.25	22.05	22.08	22.16	22.31	21.18	21.06	21.08
		14	23.12	23.05	23.07	22.15	22.18	22.25	22.05	22.08	22.16	22.31	21.18	21.06	21.08
		13	23.12	23.05	23.07	22.15	22.18	22.25	22.05	22.08	22.16	22.31	21.18	21.06	21.08
		12	23.12	23.05	23.07	22.15	22.18	22.25	22.05	22.08	22.16	22.31	21.18	21.06	21.08
		11	23.12	23.05	23.07	22.15	22.18	22.25	22.05	22.08	22.16	22.31	21.18	21.06	21.08

1xRTT CDMA Voice Band	BC0 1xRTT CDMA Voice Channel	BC1 1xRTT CDMA Voice Tx (dBm)	LTE Band 4 Conducted Power (dBm)												
			Mid Channel - 20 MHz Bandwidth												
			QPSK 1 RB, RB Offset 0	QPSK 1 RB, RB Offset 50	QPSK 1 RB, RB Offset 99	QPSK 50 RB, RB Offset 0	QPSK 50 RB, RB Offset 25	QPSK 50 RB, RB Offset 50	QPSK 100 RB, RB Offset 0	16 QAM 1 RB, RB Offset 0	16 QAM 1 RB, RB Offset 50	16 QAM 1 RB, RB Offset 99	16 QAM 50 RB, RB Offset 0	16 QAM 50 RB, RB Offset 25	16 QAM 50 RB, RB Offset 50
1900 MHz	600	25	19.19	19.15	19.21	19.07	19.05	19.08	19.12	19.25	19.31	19.24	19.27	19.31	19.26
		24	19.19	19.15	19.21	19.07	19.05	19.08	19.12	19.25	19.31	19.24	19.27	19.31	19.26
		23	19.19	19.15	19.21	19.07	19.05	19.08	19.12	19.25	19.31	19.24	19.27	19.31	19.26
		22	19.19	19.15	19.21	19.07	19.05	19.08	19.12	19.25	19.31	19.24	19.27	19.31	19.26
		21	19.19	19.15	19.21	19.07	19.05	19.08	19.12	19.25	19.31	19.24	19.27	19.31	19.26
		20	19.19	19.15	19.21	19.07	19.05	19.08	19.12	19.25	19.31	19.24	19.27	19.31	19.26
		19	19.19	19.15	19.21	19.07	19.05	19.08	19.12	19.25	19.31	19.24	19.27	19.31	19.26
		18	19.19	19.15	19.21	19.07	19.05	19.08	19.12	19.25	19.31	19.24	19.27	19.31	19.26
		17	23.04	23.09	23.1	22.08	22.07	22.12	22.24	22.14	22.18	22.21	21.07	21.02	21.06
		16	23.04	23.09	23.1	22.08	22.07	22.12	22.24	22.14	22.18	22.21	21.07	21.02	21.06
		15	23.04	23.09	23.1	22.08	22.07	22.12	22.24	22.14	22.18	22.21	21.07	21.02	21.06
		14	23.04	23.09	23.1	22.08	22.07	22.12	22.24	22.14	22.18	22.21	21.07	21.02	21.06
		13	23.04	23.09	23.1	22.08	22.07	22.12	22.24	22.14	22.18	22.21	21.07	21.02	21.06
		12	23.04	23.09	23.1	22.08	22.07	22.12	22.24	22.14	22.18	22.21	21.07	21.02	21.06
		11	23.04	23.09	23.1	22.08	22.07	22.12	22.24	22.14	22.18	22.21	21.07	21.02	21.06

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10.3 SVLTE SAR Testing Procedures

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

10.3.1 Reduced LTE Band 13 Conducted Powers

Table 10-3
Reduced 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	18.88	0	0
	782.0	23230	10	QPSK	1	25	18.64	0	0
	782.0	23230	10	QPSK	1	49	18.57	0	0
	782.0	23230	10	QPSK	25	0	18.66	0	0-1
	782.0	23230	10	QPSK	25	12	18.54	0	0-1
	782.0	23230	10	QPSK	25	25	18.52	0	0-1
	782.0	23230	10	QPSK	50	0	18.65	0	0-1
	782.0	23230	10	16QAM	1	0	18.84	0	0-1
	782.0	23230	10	16QAM	1	25	18.67	0	0-1
	782.0	23230	10	16QAM	1	49	18.77	0	0-1
	782.0	23230	10	16QAM	25	0	18.55	0	0-2
	782.0	23230	10	16QAM	25	12	18.52	0	0-2
	782.0	23230	10	16QAM	25	25	18.54	0	0-2
	782.0	23230	10	16QAM	50	0	18.51	0	0-2

10.3.2 Reduced LTE Band 4 Conducted Powers

Table 10-4
Reduced LTE Band 4 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	19.23	0	0
	1732.5	20175	20	QPSK	1	59	18.82	0	0
	1732.5	20175	20	QPSK	1	99	18.96	0	0
	1732.5	20175	20	QPSK	50	0	18.86	0	0-1
	1732.5	20175	20	QPSK	50	25	18.68	0	0-1
	1732.5	20175	20	QPSK	50	50	18.59	0	0-1
	1732.5	20175	20	QPSK	100	0	18.73	0	0-1
	1732.5	20175	20	16QAM	1	0	19.34	0	0-1
	1732.5	20175	20	16QAM	1	59	18.94	0	0-1
	1732.5	20175	20	16QAM	1	99	18.91	0	0-1
	1732.5	20175	20	16QAM	50	0	18.81	0	0-2
	1732.5	20175	20	16QAM	50	25	18.63	0	0-2
	1732.5	20175	20	16QAM	50	50	18.52	0	0-2
	1732.5	20175	20	16QAM	100	0	18.67	0	0-2

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Table 10-5
Reduced LTE Band 4 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	19.31	0	0
	1717.5	20025	15	QPSK	1	36	19.42	0	0
	1717.5	20025	15	QPSK	1	74	19.14	0	0
	1717.5	20025	15	QPSK	36	0	19.21	0	0-1
	1717.5	20025	15	QPSK	36	18	19.32	0	0-1
	1717.5	20025	15	QPSK	36	37	19.45	0	0-1
	1717.5	20025	15	QPSK	75	0	19.41	0	0-1
	1717.5	20025	15	16QAM	1	0	19.17	0	0-1
	1717.5	20025	15	16QAM	1	36	19.36	0	0-1
	1717.5	20025	15	16QAM	1	74	19.23	0	0-1
	1717.5	20025	15	16QAM	36	0	19.24	0	0-2
	1717.5	20025	15	16QAM	36	18	19.32	0	0-2
Mid	1717.5	20025	15	16QAM	36	37	19.42	0	0-2
	1717.5	20025	15	16QAM	75	0	19.34	0	0-2
	1732.5	20175	15	QPSK	1	0	19.17	0	0
	1732.5	20175	15	QPSK	1	36	18.91	0	0
	1732.5	20175	15	QPSK	1	74	18.70	0	0
	1732.5	20175	15	QPSK	36	0	18.92	0	0-1
	1732.5	20175	15	QPSK	36	18	18.80	0	0-1
	1732.5	20175	15	QPSK	36	37	18.81	0	0-1
	1732.5	20175	15	QPSK	75	0	18.83	0	0-1
	1732.5	20175	15	16QAM	1	0	18.99	0	0-1
	1732.5	20175	15	16QAM	1	36	18.89	0	0-1
	1732.5	20175	15	16QAM	1	74	18.79	0	0-1
High	1732.5	20175	15	16QAM	36	0	18.86	0	0-2
	1732.5	20175	15	16QAM	36	18	18.78	0	0-2
	1732.5	20175	15	16QAM	36	37	18.71	0	0-2
	1732.5	20175	15	16QAM	75	0	18.82	0	0-2
	1747.5	20325	15	QPSK	1	0	18.99	0	0
	1747.5	20325	15	QPSK	1	36	19.07	0	0
	1747.5	20325	15	QPSK	1	74	18.97	0	0
	1747.5	20325	15	QPSK	36	0	19.21	0	0-1
	1747.5	20325	15	QPSK	36	18	18.96	0	0-1
	1747.5	20325	15	QPSK	36	37	18.90	0	0-1
	1747.5	20325	15	QPSK	75	0	19.01	0	0-1
	1747.5	20325	15	16QAM	1	0	19.11	0	0-1
	1747.5	20325	15	16QAM	1	36	19.03	0	0-1
	1747.5	20325	15	16QAM	1	74	19.01	0	0-1
	1747.5	20325	15	16QAM	36	0	19.19	0	0-2
	1747.5	20325	15	16QAM	36	18	18.97	0	0-2
	1747.5	20325	15	16QAM	36	37	18.88	0	0-2
	1747.5	20325	15	16QAM	75	0	19.01	0	0-2

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Table 10-6
Reduced LTE Band 4 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	19.25	0	0
	1715	20000	10	QPSK	1	25	19.30	0	0
	1715	20000	10	QPSK	1	49	19.46	0	0
	1715	20000	10	QPSK	25	0	19.17	0	0-1
	1715	20000	10	QPSK	25	12	19.28	0	0-1
	1715	20000	10	QPSK	25	25	19.35	0	0-1
	1715	20000	10	QPSK	50	0	19.03	0	0-1
	1715	20000	10	16QAM	1	0	19.17	0	0-1
	1715	20000	10	16QAM	1	25	19.09	0	0-1
	1715	20000	10	16QAM	1	49	19.25	0	0-1
	1715	20000	10	16QAM	25	0	19.29	0	0-2
	1715	20000	10	16QAM	25	12	19.24	0	0-2
Mid	1715	20000	10	16QAM	25	25	19.23	0	0-2
	1715	20000	10	16QAM	50	0	19.05	0	0-2
	1732.5	20175	10	QPSK	1	0	18.98	0	0
	1732.5	20175	10	QPSK	1	25	18.91	0	0
	1732.5	20175	10	QPSK	1	49	18.81	0	0
	1732.5	20175	10	QPSK	25	0	18.82	0	0-1
	1732.5	20175	10	QPSK	25	12	18.75	0	0-1
	1732.5	20175	10	QPSK	25	25	18.72	0	0-1
	1732.5	20175	10	QPSK	50	0	18.70	0	0-1
	1732.5	20175	10	16QAM	1	0	18.76	0	0-1
	1732.5	20175	10	16QAM	1	25	18.70	0	0-1
	1732.5	20175	10	16QAM	1	49	18.88	0	0-1
High	1732.5	20175	10	16QAM	25	0	18.71	0	0-2
	1732.5	20175	10	16QAM	25	12	18.61	0	0-2
	1732.5	20175	10	16QAM	25	25	18.71	0	0-2
	1732.5	20175	10	16QAM	50	0	18.76	0	0-2
	1750	20350	10	QPSK	1	0	19.15	0	0
	1750	20350	10	QPSK	1	25	19.02	0	0
	1750	20350	10	QPSK	1	49	19.17	0	0
	1750	20350	10	QPSK	25	0	18.91	0	0-1
	1750	20350	10	QPSK	25	12	18.82	0	0-1
	1750	20350	10	QPSK	25	25	18.78	0	0-1
	1750	20350	10	QPSK	50	0	18.83	0	0-1
	1750	20350	10	16QAM	1	0	18.93	0	0-1
	1750	20350	10	16QAM	1	25	19.01	0	0-1
	1750	20350	10	16QAM	1	49	19.09	0	0-1
	1750	20350	10	16QAM	25	0	18.95	0	0-2
	1750	20350	10	16QAM	25	12	18.90	0	0-2
	1750	20350	10	16QAM	25	25	18.76	0	0-2
	1750	20350	10	16QAM	50	0	18.74	0	0-2

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Table 10-7
Reduced LTE Band 4 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	19.23	0	0
	1712.5	19975	5	QPSK	1	12	19.19	0	0
	1712.5	19975	5	QPSK	1	24	19.28	0	0
	1712.5	19975	5	QPSK	12	0	19.22	0	0-1
	1712.5	19975	5	QPSK	12	6	19.23	0	0-1
	1712.5	19975	5	QPSK	12	13	19.27	0	0-1
	1712.5	19975	5	QPSK	25	0	19.15	0	0-1
	1712.5	19975	5	16-QAM	1	0	19.04	0	0-1
	1712.5	19975	5	16-QAM	1	12	19.12	0	0-1
	1712.5	19975	5	16-QAM	1	24	19.15	0	0-1
	1712.5	19975	5	16-QAM	12	0	19.22	0	0-2
	1712.5	19975	5	16-QAM	12	6	19.29	0	0-2
Mid	1712.5	19975	5	16-QAM	12	13	19.25	0	0-2
	1712.5	19975	5	16-QAM	25	0	19.20	0	0-2
	1732.5	20175	5	QPSK	1	0	18.94	0	0
	1732.5	20175	5	QPSK	1	12	18.83	0	0
	1732.5	20175	5	QPSK	1	24	18.84	0	0
	1732.5	20175	5	QPSK	12	0	18.86	0	0-1
	1732.5	20175	5	QPSK	12	6	18.89	0	0-1
	1732.5	20175	5	QPSK	12	13	18.83	0	0-1
	1732.5	20175	5	QPSK	25	0	18.74	0	0-1
	1732.5	20175	5	16-QAM	1	0	18.88	0	0-1
	1732.5	20175	5	16-QAM	1	12	18.80	0	0-1
	1732.5	20175	5	16-QAM	1	24	18.96	0	0-1
High	1732.5	20175	5	16-QAM	12	0	18.91	0	0-2
	1732.5	20175	5	16-QAM	12	6	18.92	0	0-2
	1732.5	20175	5	16-QAM	12	13	18.89	0	0-2
	1732.5	20175	5	16-QAM	25	0	18.77	0	0-2
	1752.5	20375	5	QPSK	1	0	19.02	0	0
	1752.5	20375	5	QPSK	1	12	18.95	0	0
	1752.5	20375	5	QPSK	1	24	19.15	0	0
	1752.5	20375	5	QPSK	12	0	18.86	0	0-1
	1752.5	20375	5	QPSK	12	6	18.89	0	0-1
	1752.5	20375	5	QPSK	12	13	18.96	0	0-1
	1752.5	20375	5	QPSK	25	0	18.87	0	0-1
	1752.5	20375	5	16-QAM	1	0	19.01	0	0-1
	1752.5	20375	5	16-QAM	1	12	18.97	0	0-1
	1752.5	20375	5	16-QAM	1	24	18.82	0	0-1
	1752.5	20375	5	16-QAM	12	0	18.91	0	0-2
	1752.5	20375	5	16-QAM	12	6	18.94	0	0-2
	1752.5	20375	5	16-QAM	12	13	19.11	0	0-2
	1752.5	20375	5	16-QAM	25	0	18.78	0	0-2

LTE Notes:

1. Please refer to Section 8.5.4 for LTE testing requirements per FCC KDB 941225 D05.
2. The bolded powers were tested for SAR.

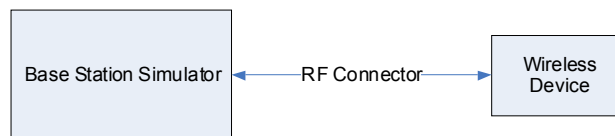


Figure 10-2
Power Measurement Setup

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10.3.3 Fixed CDMA Conducted Powers

Table 10-8
Fixed CDMA Conducted Powers

Band	Channel	Frequency	SO55 [dBm]	SO55 [dBm]	TDSO SO32 [dBm]	TDSO SO32 [dBm]
	F-RC	MHz	RC1	RC3	FCH+SCH	FCH
Cellular	1013	824.7	18.32	18.30	18.32	18.35
	384	836.52	18.44	18.41	18.43	18.42
	777	848.31	18.50	18.49	18.49	18.48
PCS	25	1851.25	18.01	18.44	18.43	18.39
	600	1880	18.46	18.48	18.46	18.44
	1175	1908.75	18.25	18.39	18.46	18.45

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

Note: There is no power reduction applied to the CDMA Voice modes, however the device with output powers represented in the table above was tuned down (for SAR Test purposes only) to analyze simultaneous SAR scenarios in the SVLTE condition where LTE is operating at maximum output power in conjunction with a lower CDMA voice level (see Table 10-1).

Per KDB Publication 941225 D01v02:

1. Head SAR was tested with SO55 RC3. SO55 RC1 was not required since the average output power was not more than 0.25 dB than the SO55 RC3 powers.
2. Head SAR was additionally evaluated for EVDO Rev. A to determine SAR compliance for VoIP over EVDO.
3. Body-Worn SAR was tested with 1x RTT with TDSO / SO32 FCH Only. TDSO / SO32 FCH+SCH SAR tests were not required since the average output power was not more than 0.25 dB higher than the TDSO / SO32 FCH only powers.
4. CDMA 1x-RTT SAR was required to be evaluated for Hotspot exposure conditions to support simultaneous transmission capabilities.

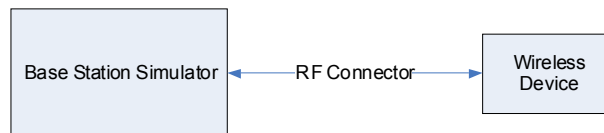


Figure 10-3
Power Measurement Setup

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11 SYSTEM VERIFICATION

11.1 Tissue Verification

Table 11-1
Measured Tissue Properties - Head

Calibrated for Tests Performed on:	Tissue Frequency (MHz)	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
1/2/2013	740	Head	23.0	725	0.860	40.71	0.888	42.033	-3.15%	-3.15%
				740	0.867	40.50	0.889	41.953	-2.47%	-3.46%
				755	0.880	40.47	0.891	41.876	-1.23%	-3.36%
				770	0.898	40.20	0.892	41.806	0.67%	-3.84%
				785	0.903	39.91	0.894	41.735	1.01%	-4.37%
12/10/2012	835	Head	20.4	820	0.886	41.72	0.898	41.571	-1.34%	0.36%
				835	0.889	41.16	0.900	41.500	-1.22%	-0.82%
				850	0.910	40.76	0.916	41.500	-0.66%	-1.78%
12/18/2012	835	Head	20.8	820	0.887	41.58	0.898	41.571	-1.22%	0.02%
				835	0.898	41.45	0.900	41.500	-0.22%	-0.12%
				850	0.914	41.41	0.916	41.500	-0.22%	-0.22%
12/28/2012	1750	Head	21.5	1710	1.371	38.68	1.348	40.136	1.71%	-3.63%
				1750	1.417	38.53	1.370	40.100	3.43%	-3.92%
				1790	1.462	38.35	1.394	40.020	4.88%	-4.17%
12/11/2012	1900	Head	23.4	1850	1.383	38.39	1.400	40.000	-1.21%	-4.03%
				1880	1.416	38.26	1.400	40.000	1.14%	-4.35%
				1910	1.447	38.16	1.400	40.000	3.36%	-4.60%
12/17/2012	1900	Head	21.3	1850	1.418	38.99	1.400	40.000	1.29%	-2.52%
				1880	1.446	38.91	1.400	40.000	3.29%	-2.73%
				1910	1.466	38.75	1.400	40.000	4.71%	-3.13%
1/17/2013	1900	Head	21.9	1850	1.331	38.56	1.400	40.000	-4.93%	-3.60%
				1880	1.353	38.33	1.400	40.000	-3.36%	-4.18%
				1910	1.391	38.24	1.400	40.000	-0.64%	-4.40%
12/12/2012	2450	Head	22.5	2401	1.757	40.21	1.758	39.298	-0.06%	2.32%
				2450	1.814	40.02	1.800	39.200	0.78%	2.09%
				2499	1.864	39.78	1.852	39.135	0.65%	1.65%
12/17/2012	5200H-5800	Head	23.6	5200	4.505	36.13	4.660	36.000	-3.33%	0.36%
				5240	4.548	36.06	4.700	35.960	-3.23%	0.28%
				5280	4.601	35.95	4.740	35.920	-2.93%	0.08%
				5300	4.625	35.98	4.760	35.900	-2.84%	0.22%
				5500	4.776	35.71	4.965	35.650	-3.81%	0.17%
				5560	4.868	35.59	5.028	35.560	-3.18%	0.08%
				5600	4.899	35.60	5.070	35.500	-3.37%	0.28%
				5745	5.038	35.40	5.215	35.355	-3.39%	0.13%
				5800	5.095	35.26	5.270	35.300	-3.32%	-0.11%

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.

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Table 11-2
Measured Tissue Properties – Body

Calibrated for Tests Performed on:	Tissue Frequency (MHz)	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
1/7/2013	740	Body	22.2	725	0.942	54.55	0.961	55.629	-1.98%	-1.94%
				740	0.955	54.42	0.963	55.570	-0.83%	-2.07%
				755	0.971	54.29	0.964	55.512	0.73%	-2.20%
				770	0.986	54.12	0.965	55.453	2.18%	-2.40%
				785	1.000	53.95	0.966	55.395	3.52%	-2.61%
12/10/2012	835	Body	23.1	820	0.965	53.21	0.969	55.258	-0.41%	-3.71%
				835	0.984	53.16	0.970	55.200	1.44%	-3.70%
				850	1.003	52.87	0.988	55.154	1.52%	-4.14%
12/18/2012	835	Body	21.4	820	0.953	54.05	0.969	55.258	-1.65%	-2.19%
				835	0.983	53.89	0.970	55.200	1.34%	-2.37%
				850	0.990	53.56	0.988	55.154	0.20%	-2.89%
12/19/2012	835	Body	22.9	820	0.931	55.47	0.969	55.258	-3.92%	0.38%
				835	0.938	55.27	0.970	55.200	-3.30%	0.13%
				850	0.955	55.36	0.988	55.154	-3.34%	0.37%
1/2/2013	1750	Body	22.7	1710	1.485	53.21	1.460	53.540	1.71%	-0.62%
				1750	1.531	53.06	1.490	53.430	2.75%	-0.69%
				1790	1.575	52.92	1.510	53.330	4.30%	-0.77%
12/10/2012	1900	Body	22.3	1850	1.460	52.26	1.520	53.300	-3.95%	-1.95%
				1880	1.496	52.16	1.520	53.300	-1.58%	-2.14%
				1910	1.526	52.06	1.520	53.300	0.39%	-2.33%
1/17/2013	1900	Body	22.8	1850	1.478	53.24	1.520	53.300	-2.76%	-0.11%
				1880	1.492	53.20	1.520	53.300	-1.84%	-0.19%
				1910	1.509	53.07	1.520	53.300	-0.72%	-0.43%
12/11/2012	2450	Body	23.0	2401	1.915	50.85	1.903	52.765	0.63%	-3.63%
				2450	1.980	50.66	1.950	52.700	1.54%	-3.87%
				2499	2.048	50.49	2.019	52.638	1.44%	-4.08%
12/13/2012	5200B-5800	Body	22.3	5200	5.282	48.04	5.299	49.014	-0.32%	-1.99%
				5240	5.351	47.95	5.346	48.933	0.09%	-2.01%
				5280	5.416	47.84	5.393	48.879	0.43%	-2.13%
				5300	5.442	47.84	5.416	48.851	0.48%	-2.07%
				5500	5.729	47.32	5.650	48.580	1.40%	-2.59%
				5560	5.824	47.20	5.720	48.499	1.82%	-2.68%
				5600	5.865	47.09	5.766	48.444	1.72%	-2.79%
				5745	6.092	46.78	5.936	48.248	2.63%	-3.04%
				5800	6.197	46.61	6.000	48.200	3.28%	-3.30%

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.

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11.2 Test System Verification

Prior to SAR assessment, the system is verified to $\pm 10\%$ of the SAR measurement on the reference dipole at the time of calibration by the calibration facility.

Table 11-3
System Verification Results

System Verification TARGET & MEASURED											
Tissue Frequency (MHz)	Tissue Type	Date:	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Dipole SN	Probe SN	Measured SAR _{1g} (W/kg)	1 W Target SAR _{1g} (W/kg)	1 W Normalized SAR _{1g} (W/kg)	Deviation (%)
750	HEAD	01/02/2013	23.5	23.1	0.100	1054	3209	0.818	8.520	8.180	-3.99%
835	HEAD	12/10/2012	24.2	22.3	0.100	4d132	3288	0.974	9.450	9.740	3.07%
835	HEAD	12/18/2012	22.9	20.9	0.100	4d132	3263	0.922	9.450	9.220	-2.43%
1750	HEAD	12/28/2012	22.2	21.9	0.090	1008	3209	3.290	36.400	36.556	0.43%
1900	HEAD	12/11/2012	24.4	23.5	0.100	502	3209	3.770	39.200	37.700	-3.83%
1900	HEAD	12/17/2012	21.1	19.4	0.100	5d148	3263	4.040	40.500	40.400	-0.25%
1900	HEAD	01/17/2013	23.3	22.7	0.100	5d148	3213	3.910	40.500	39.100	-3.46%
2450	HEAD	12/12/2012	24.0	22.5	0.100	882	3288	5.000	53.500	50.000	-6.54%
5200	HEAD	12/17/2012	23.8	24.0	0.100	1007	3561	7.880	79.800	78.800	-1.25%
5300	HEAD	12/17/2012	24.3	24.1	0.100	1007	3561	8.160	83.100	81.600	-1.81%
5500	HEAD	12/17/2012	24.4	24.1	0.100	1007	3561	8.200	84.900	82.000	-3.42%
5600	HEAD	12/17/2012	24.8	24.2	0.100	1007	3561	7.830	84.500	78.300	-7.34%
5800	HEAD	12/17/2012	24.9	24.3	0.100	1007	3561	7.730	79.800	77.300	-3.13%
750	BODY	01/07/2013	24.5	22.6	0.100	1054	3209	0.925	8.840	9.250	4.64%
835	BODY	12/10/2012	23.8	23.2	0.100	4d026	3022	1.030	9.580	10.300	7.52%
835	BODY	12/18/2012	23.1	21.4	0.100	4d132	3263	0.886	9.410	8.860	-5.84%
835	BODY	12/19/2012	24.2	23.3	0.100	4d026	3209	0.916	9.580	9.160	-4.38%
1750	BODY	01/02/2013	23.2	22.9	0.100	1008	3209	3.880	37.400	38.800	3.74%
1900	BODY	12/10/2012	23.0	22.6	0.100	502	3209	3.820	38.900	38.200	-1.80%
1900	BODY	01/17/2013	24.6	23.7	0.100	5d149	3263	4.080	39.300	40.800	3.82%
2450	BODY	12/11/2012	24.4	23.3	0.040	719	3258	2.220	51.600	55.500	7.56%
5200	BODY	12/13/2012	22.5	21.9	0.040	1120	3589	2.780	72.200	69.500	-3.74%
5300	BODY	12/13/2012	22.8	22.0	0.040	1007	3589	3.040	75.600	76.000	0.53%
5500	BODY	12/13/2012	23.2	21.5	0.050	1120	3589	4.250	80.000	85.000	6.25%
5600	BODY	12/13/2012	23.4	21.8	0.050	1007	3589	4.240	80.000	84.800	6.00%
5800	BODY	12/13/2012	23.4	21.7	0.054	1120	3589	4.220	73.800	78.148	5.89%

Note: Full system validation status and results can be found in Appendix E.

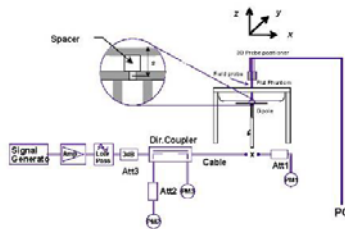


Figure 11-1
System Verification Setup Diagram



Figure 11-2
System Verification Setup Photo

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12 SAR DATA SUMMARY

12.1 Standalone Head SAR Data

Table 12-1
Cell. CDMA Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
836.52	384	Cell. CDMA	RC3 / SO55	25	24.51	-0.21	Right	Cheek	FCC_A	1:1	0.221	1.119	0.247	
836.52	384	Cell. CDMA	RC3 / SO55	25	24.51	-0.01	Right	Tilt	FCC_A	1:1	0.151	1.119	0.169	
836.52	384	Cell. CDMA	RC3 / SO55	25	24.51	0.06	Left	Cheek	FCC_A	1:1	0.308	1.119	0.345	
836.52	384	Cell. CDMA	RC3 / SO55	25	24.51	-0.04	Left	Tilt	FCC_A	1:1	0.157	1.119	0.176	
836.52	384	Cell. CDMA	RC3 / SO55	18.5	18.41	0.02	Right	Cheek	FCC_E	1:1	0.047	1.021	0.048	
836.52	384	Cell. CDMA	RC3 / SO55	18.5	18.41	0.15	Right	Tilt	FCC_E	1:1	0.034	1.021	0.035	
836.52	384	Cell. CDMA	RC3 / SO55	18.5	18.41	0.06	Left	Cheek	FCC_E	1:1	0.061	1.021	0.062	
836.52	384	Cell. CDMA	RC3 / SO55	18.5	18.41	0.02	Left	Tilt	FCC_E	1:1	0.040	1.021	0.041	
836.52	384	Cell. CDMA	EVDO Rev. A	25	24.55	0.02	Right	Cheek	FCC_A	1:1	0.240	1.109	0.266	
836.52	384	Cell. CDMA	EVDO Rev. A	25	24.55	0.03	Right	Tilt	FCC_A	1:1	0.168	1.109	0.186	
836.52	384	Cell. CDMA	EVDO Rev. A	25	24.55	0.00	Left	Cheek	FCC_A	1:1	0.323	1.109	0.358	A2
836.52	384	Cell. CDMA	EVDO Rev. A	25	24.55	0.03	Left	Tilt	FCC_A	1:1	0.189	1.109	0.210	
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
GSM 850 Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
836.60	190	GSM 850	GSM	33.5	33.41	0.09	Right	Cheek	FCC_F	1:8.3	0.073	1.021	0.074	
836.60	190	GSM 850	GSM	33.5	33.41	0.03	Right	Tilt	FCC_F	1:8.3	0.051	1.021	0.052	
836.60	190	GSM 850	GSM	33.5	33.41	0.19	Left	Cheek	FCC_F	1:8.3	0.092	1.021	0.094	A3
836.60	190	GSM 850	GSM	33.5	33.41	0.00	Left	Tilt	FCC_F	1:8.3	0.058	1.021	0.059	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Head 1.6 W/kg (mW/g) averaged over 1 gram						

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Table 12-3
UMTS 850 Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
836.60	4183	UMTS 850	RMC	23.5	23.48	0.03	Right	Cheek	FCC_F	1:1	0.081	1.005	0.082	
836.60	4183	UMTS 850	RMC	23.5	23.48	0.04	Right	Tilt	FCC_F	1:1	0.058	1.005	0.058	
836.60	4183	UMTS 850	RMC	23.5	23.48	0.05	Left	Cheek	FCC_F	1:1	0.112	1.005	0.113	A4
836.60	4183	UMTS 850	RMC	23.5	23.48	0.06	Left	Tilt	FCC_F	1:1	0.069	1.005	0.069	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram							

Table 12-4
PCS CDMA Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
1880.00	600	PCS CDMA	RC3 / SO55	25.0	24.56	0.05	Right	Cheek	FCC_A	1:1	0.156	1.107	0.173	
1880.00	600	PCS CDMA	RC3 / SO55	25.0	24.56	0.19	Right	Tilt	FCC_A	1:1	0.087	1.107	0.097	
1880.00	600	PCS CDMA	RC3 / SO55	25.0	24.56	0.03	Left	Cheek	FCC_A	1:1	0.220	1.107	0.244	A6
1880.00	600	PCS CDMA	RC3 / SO55	25.0	24.56	0.04	Left	Tilt	FCC_A	1:1	0.111	1.107	0.123	
1880.00	600	PCS CDMA	RC3 / SO55	18.5	18.48	0.02	Right	Cheek	FCC_E	1:1	0.027	1.005	0.027	
1880.00	600	PCS CDMA	RC3 / SO55	18.5	18.48	0.03	Right	Tilt	FCC_E	1:1	0.012	1.005	0.012	
1880.00	600	PCS CDMA	RC3 / SO55	18.5	18.48	-0.10	Left	Cheek	FCC_E	1:1	0.037	1.005	0.037	
1880.00	600	PCS CDMA	RC3 / SO55	18.5	18.48	-0.05	Left	Tilt	FCC_E	1:1	0.014	1.005	0.014	
1880.00	600	PCS CDMA	EVDO Rev. A	25.0	24.54	0.03	Right	Cheek	FCC_A	1:1	0.131	1.112	0.146	
1880.00	600	PCS CDMA	EVDO Rev. A	25.0	24.54	-0.06	Right	Tilt	FCC_A	1:1	0.090	1.112	0.100	
1880.00	600	PCS CDMA	EVDO Rev. A	25.0	24.54	0.20	Left	Cheek	FCC_A	1:1	0.206	1.112	0.229	
1880.00	600	PCS CDMA	EVDO Rev. A	25.0	24.54	-0.04	Left	Tilt	FCC_A	1:1	0.103	1.112	0.115	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Head 1.6 W/kg (mW/g) averaged over 1 gram						

Table 12-5
GSM 1900 Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
1880.00	661	GSM 1900	GSM	31.0	30.98	0.18	Right	Cheek	FCC_A	1:8.3	0.087	1.005	0.087	
1880.00	661	GSM 1900	GSM	31.0	30.98	0.01	Right	Tilt	FCC_A	1:8.3	0.059	1.005	0.059	
1880.00	661	GSM 1900	GSM	31.0	30.98	0.10	Left	Cheek	FCC_A	1:8.3	0.138	1.005	0.139	A7
1880.00	661	GSM 1900	GSM	31.0	30.98	-0.06	Left	Tilt	FCC_A	1:8.3	0.054	1.005	0.054	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Head 1.6 W/kg (mW/g) averaged over 1 gram						

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Table 12-6
UMTS 1900 Head SAR

MEASUREMENT RESULTS														
FREQUENCY		Mode/Band	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.										(W/kg)		(W/kg)	
1880.00	9400	UMTS 1900	RMC	23.5	22.89	0.18	Right	Cheek	FCC#2	1:1	0.049	1.151	0.056	
1880.00	9400	UMTS 1900	RMC	23.5	22.89	0.14	Right	Tilt	FCC#2	1:1	0.035	1.151	0.041	
1880.00	9400	UMTS 1900	RMC	23.5	22.89	0.20	Left	Cheek	FCC#2	1:1	0.092	1.151	0.106	A8
1880.00	9400	UMTS 1900	RMC	23.5	22.89	0.03	Left	Tilt	FCC#2	1:1	0.036	1.151	0.041	
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 12-7
LTE Band 13 Head SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Serial Number	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #	
MHz	Ch.														(W/kg)		(W/kg)		
782.00	23230	Mid	LTE Band 13	10	23.5	23.38	0.12	0	Right	Cheek	QPSK	1	0	FCC_B	1:1	0.158	1.028	0.162	A1
782.00	23230	Mid	LTE Band 13	10	22.5	22.24	-0.01	1	Right	Cheek	QPSK	25	0	FCC_B	1:1	0.110	1.062	0.117	
782.00	23230	Mid	LTE Band 13	10	23.5	23.38	0.07	0	Right	Tilt	QPSK	1	0	FCC_B	1:1	0.101	1.028	0.104	
782.00	23230	Mid	LTE Band 13	10	22.5	22.24	0.20	1	Right	Tilt	QPSK	25	0	FCC_B	1:1	0.067	1.062	0.071	
782.00	23230	Mid	LTE Band 13	10	23.5	23.38	-0.16	0	Left	Cheek	QPSK	1	0	FCC_B	1:1	0.113	1.028	0.116	
782.00	23230	Mid	LTE Band 13	10	22.5	22.24	-0.02	1	Left	Cheek	QPSK	25	0	FCC_B	1:1	0.080	1.062	0.085	
782.00	23230	Mid	LTE Band 13	10	23.5	23.38	0.09	0	Left	Tilt	QPSK	1	0	FCC_B	1:1	0.072	1.028	0.074	
782.00	23230	Mid	LTE Band 13	10	22.5	22.24	0.05	1	Left	Tilt	QPSK	25	0	FCC_B	1:1	0.056	1.062	0.059	
782.00	23230	Mid	LTE Band 13	10	19.5	18.88	0.00	0	Right	Cheek	QPSK	1	0	FCC#X	1:1	0.059	1.153	0.068	
782.00	23230	Mid	LTE Band 13	10	19.5	18.66	0.17	0	Right	Cheek	QPSK	25	0	FCC#X	1:1	0.059	1.213	0.072	
782.00	23230	Mid	LTE Band 13	10	19.5	18.88	0.16	0	Right	Tilt	QPSK	1	0	FCC#X	1:1	0.029	1.153	0.034	
782.00	23230	Mid	LTE Band 13	10	19.5	18.66	0.12	0	Right	Tilt	QPSK	25	0	FCC#X	1:1	0.031	1.213	0.038	
782.00	23230	Mid	LTE Band 13	10	19.5	18.88	-0.04	0	Left	Cheek	QPSK	1	0	FCC#X	1:1	0.046	1.153	0.053	
782.00	23230	Mid	LTE Band 13	10	19.5	18.66	0.21	0	Left	Cheek	QPSK	25	0	FCC#X	1:1	0.040	1.213	0.048	
782.00	23230	Mid	LTE Band 13	10	19.5	18.88	0.03	0	Left	Tilt	QPSK	1	0	FCC#X	1:1	0.028	1.153	0.033	
782.00	23230	Mid	LTE Band 13	10	19.5	18.66	0.03	0	Left	Tilt	QPSK	25	0	FCC#X	1:1	0.026	1.213	0.031	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population										Head 1.6 W/kg (mW/g) averaged over 1 gram									

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Table 12-8
LTE Band 4 (AWS) Head SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Device Ser. 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	23.5	23.42	-0.11	0	Right	Cheek	QPSK	1	99	FCC_B	1:1	0.161	1.019	0.164	A5
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	22.20	-0.17	1	Right	Cheek	QPSK	50	50	FCC_B	1:1	0.121	1.072	0.130	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	23.42	0.05	0	Right	Tilt	QPSK	1	99	FCC_B	1:1	0.094	1.019	0.096	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	22.20	-0.11	1	Right	Tilt	QPSK	50	50	FCC_B	1:1	0.069	1.072	0.074	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	23.42	0.10	0	Left	Cheek	QPSK	1	99	FCC_B	1:1	0.140	1.019	0.143	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	22.20	0.09	1	Left	Cheek	QPSK	50	50	FCC_B	1:1	0.107	1.072	0.115	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	23.42	-0.13	0	Left	Tilt	QPSK	1	99	FCC_B	1:1	0.099	1.019	0.101	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	22.20	0.02	1	Left	Tilt	QPSK	50	50	FCC_B	1:1	0.069	1.072	0.074	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	19.5	19.23	0.05	0	Right	Cheek	QPSK	1	0	FCC#X	1:1	0.066	1.064	0.070	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	19.5	18.86	0.07	0	Right	Cheek	QPSK	50	0	FCC#X	1:1	0.058	1.159	0.068	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	19.5	19.23	0.02	0	Right	Tilt	QPSK	1	0	FCC#X	1:1	0.028	1.064	0.030	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	19.5	18.86	0.03	0	Right	Tilt	QPSK	50	0	FCC#X	1:1	0.033	1.159	0.038	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	19.5	19.23	0.04	0	Left	Cheek	QPSK	1	0	FCC#X	1:1	0.060	1.064	0.064	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	19.5	18.86	0.07	0	Left	Cheek	QPSK	50	0	FCC#X	1:1	0.054	1.159	0.063	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	19.5	19.23	0.02	0	Left	Tilt	QPSK	1	0	FCC#X	1:1	0.046	1.064	0.049	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	19.5	18.86	0.01	0	Left	Tilt	QPSK	50	0	FCC#X	1:1	0.043	1.159	0.049	
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 12-9
DTS Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Data Rate (Mbps)	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
2412	1	IEEE 802.11b	DSSS	15.0	14.71	0.10	Right	Cheek	FCC_F	1	1:1	0.011	1.069	0.012	
2412	1	IEEE 802.11b	DSSS	15.0	14.71	0.07	Right	Tilt	FCC_F	1	1:1	0.009	1.069	0.009	
2412	1	IEEE 802.11b	DSSS	15.0	14.71	0.03	Left	Cheek	FCC_F	1	1:1	0.035	1.069	0.037	A9
2412	1	IEEE 802.11b	DSSS	15.0	14.71	0.13	Left	Tilt	FCC_F	1	1:1	0.021	1.069	0.022	
5745	149	IEEE 802.11a	OFDM	10.0	9.48	0.16	Right	Touch	FCC_C	6	1:1	0.014	1.127	0.015	
5745	149	IEEE 802.11a	OFDM	10.0	9.48	0.07	Right	Tilt	FCC_C	6	1:1	0.013	1.127	0.015	
5745	149	IEEE 802.11a	OFDM	10.0	9.48	0.04	Left	Touch	FCC_C	6	1:1	0.012	1.127	0.014	
5745	149	IEEE 802.11a	OFDM	10.0	9.48	0.02	Left	Tilt	FCC_C	6	1:1	0.014	1.127	0.016	A11
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population								Head 1.6 W/kg (mW/g) averaged over 1 gram							

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Table 12-10
NII Head SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Side	Test Position	Device Serial Number	Data Rate (Mbps)	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
5240	48	IEEE 802.11a	OFDM	10.0	9.47	0.14	Right	Touch	FCC_C	6	1:1	0.039	1.130	0.045	A10
5240	48	IEEE 802.11a	OFDM	10.0	9.47	0.05	Right	Tilt	FCC_C	6	1:1	0.037	1.130	0.041	
5240	48	IEEE 802.11a	OFDM	10.0	9.47	0.02	Left	Touch	FCC_C	6	1:1	0.078	1.130	0.088	
5240	48	IEEE 802.11a	OFDM	10.0	9.47	0.09	Left	Tilt	FCC_C	6	1:1	0.043	1.130	0.048	
5280	56	IEEE 802.11a	OFDM	10.0	9.43	0.10	Right	Touch	FCC_C	6	1:1	0.031	1.140	0.036	
5280	56	IEEE 802.11a	OFDM	10.0	9.43	0.07	Right	Tilt	FCC_C	6	1:1	0.036	1.140	0.041	
5280	56	IEEE 802.11a	OFDM	10.0	9.43	0.07	Left	Touch	FCC_C	6	1:1	0.065	1.140	0.074	
5280	56	IEEE 802.11a	OFDM	10.0	9.43	0.10	Left	Tilt	FCC_C	6	1:1	0.051	1.140	0.058	
5560	112	IEEE 802.11a	OFDM	10.0	9.14	0.17	Right	Touch	FCC_C	6	1:1	0.000	1.219	0.000	
5560	112	IEEE 802.11a	OFDM	10.0	9.14	0.19	Right	Tilt	FCC_C	6	1:1	0.000	1.219	0.000	
5560	112	IEEE 802.11a	OFDM	10.0	9.14	0.07	Left	Touch	FCC_C	6	1:1	0.036	1.219	0.044	
5560	112	IEEE 802.11a	OFDM	10.0	9.14	0.12	Left	Tilt	FCC_C	6	1:1	0.023	1.219	0.028	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Head 1.6 W/kg (mW/g) averaged over 1 gram								

12.2 Standalone Body-Worn SAR Data

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

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	# of Time Slots	Duty Cycle	Side	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
836.52	384	Cell. CDMA	TDSO / SO32	25.0	24.64	-0.01	10 mm	FCC_A	N/A	1:1	back	0.730	1.086	0.793	A13
836.52	384	Cell. CDMA	TDSO / SO32	18.5	18.42	0.02	10 mm	FCC_E	N/A	1:1	back	0.149	1.019	0.152	
836.60	190	GSM 850	GSM	33.5	33.41	-0.04	10 mm	FCC_F	1	1:8.3	back	0.309	1.021	0.315	A15
836.60	4183	UMTS 850	RMC	23.5	23.48	-0.07	10 mm	FCC_F	N/A	1:1	back	0.356	1.005	0.358	A17
1880.00	600	PCS CDMA	TDSO / SO32	25.0	24.64	0.02	10 mm	FCC#2	N/A	1:1	back	0.620	1.086	0.673	A19
1880.00	600	PCS CDMA	TDSO / SO32	18.5	18.44	0.07	10 mm	FCC_E	N/A	1:1	back	0.251	1.014	0.255	
1880.00	661	GSM 1900	GSM	31.0	30.98	-0.04	10 mm	FCC_A	1	1:8.3	back	0.757	1.005	0.761	A21
1852.40	9262	UMTS 1900	RMC	23.5	22.65	0.06	10 mm	FCC#2	N/A	1:1	back	0.594	1.216	0.722	
1880.00	9400	UMTS 1900	RMC	23.5	22.89	-0.05	10 mm	FCC#2	N/A	1:1	back	0.723	1.151	0.832	A23
1907.60	9538	UMTS 1900	RMC	23.5	22.51	0.02	10 mm	FCC#2	N/A	1:1	back	0.539	1.256	0.677	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram								

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Table 12-12
LTE Body-Worn SAR

MEASUREMENT RESULTS																			
FREQUENCY		Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g) (W/kg)	Scaling Factor	Scaled SAR (1g) (W/kg)	Plot #	
MHz	Ch.																		
782.00	23230	Mid	LTE Band 13	10	23.5	23.38	0.00	0	FCC_B	QPSK	1	0	10 mm	back	1:1	0.308	1.028	0.317	A12
782.00	23230	Mid	LTE Band 13	10	22.5	22.24	0.07	1	FCC_B	QPSK	25	0	10 mm	back	1:1	0.215	1.062	0.228	
782.00	23230	Mid	LTE Band 13	10	19.5	18.88	-0.05	0	FCC#X	QPSK	1	0	10 mm	back	1:1	0.122	1.153	0.141	
782.00	23230	Mid	LTE Band 13	10	19.5	18.66	0.04	0	FCC#X	QPSK	25	0	10 mm	back	1:1	0.112	1.213	0.136	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	23.42	0.19	0	FCC_B	QPSK	1	99	10 mm	back	1:1	0.545	1.019	0.555	A18
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	22.20	0.00	1	FCC_B	QPSK	50	50	10 mm	back	1:1	0.413	1.072	0.443	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	19.5	19.23	-0.04	0	FCC#X	QPSK	1	0	10 mm	back	1:1	0.248	1.064	0.264	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	19.5	18.86	-0.04	0	FCC#X	QPSK	50	0	10 mm	back	1:1	0.221	1.159	0.256	
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 12-13
DTS Body-Worn SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g) (W/kg)	Scaling Factor	Scaled SAR (1g) (W/kg)	Plot #
MHz	Ch.														
2412	1	IEEE 802.11b	DSSS	15.0	14.71	-0.06	10 mm	FCC_C	1	back	1:1	0.125	1.069	0.134	A24
5745	149	IEEE 802.11a	OFDM	10.0	9.48	-0.10	10 mm	FCC_C	6	back	1:1	0.048	1.127	0.054	A26
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Body 1.6 W/kg (mW/g) averaged over 1 gram						

Table 12-14
NII Body-Worn SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g) (W/kg)	Scaling Factor	Scaled SAR (1g) (W/kg)	Plot #
MHz	Ch.														
5240	48	IEEE 802.11a	OFDM	10.0	9.47	-0.14	10 mm	FCC_C	6	back	1:1	0.206	1.130	0.233	A25
5280	56	IEEE 802.11a	OFDM	10.0	9.43	-0.10	10 mm	FCC_C	6	back	1:1	0.161	1.140	0.184	
5560	112	IEEE 802.11a	OFDM	10.0	9.14	-0.02	10 mm	FCC_C	6	back	1:1	0.097	1.219	0.118	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population									Body 1.6 W/kg (mW/g) averaged over 1 gram						

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12.3 Standalone Wireless Router SAR Data

Table 12-15
GPRS/UMTS/CDMA Hotspot SAR Data

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	# of GPRS Slots	Duty Cycle	Side	SAR (1g)	Scaling Factor	Scaled SAR (1g) (W/kg)	Plot #
MHz	Ch.											(W/kg)			
836.52	384	Cell. CDMA	TDSO / SO32	25.0	24.64	-0.01	10 mm	FCC_A	N/A	1:1	back	0.730	1.086	0.793	
836.52	384	Cell. CDMA	TDSO / SO32	25.0	24.64	-0.01	10 mm	FCC_A	N/A	1:1	front	0.272	1.086	0.295	
836.52	384	Cell. CDMA	TDSO / SO32	25.0	24.64	0.05	10 mm	FCC_A	N/A	1:1	bottom	0.179	1.086	0.194	
836.52	384	Cell. CDMA	TDSO / SO32	25.0	24.64	0.09	10 mm	FCC_A	N/A	1:1	left	0.534	1.086	0.580	
836.52	384	Cell. CDMA	TDSO / SO32	18.5	18.42	0.02	10 mm	FCC_E	N/A	1:1	back	0.149	1.019	0.152	
836.52	384	Cell. CDMA	TDSO / SO32	18.5	18.42	-0.02	10 mm	FCC_E	N/A	1:1	front	0.066	1.019	0.068	
836.52	384	Cell. CDMA	TDSO / SO32	18.5	18.42	-0.03	10 mm	FCC_E	N/A	1:1	bottom	0.040	1.019	0.041	
836.52	384	Cell. CDMA	TDSO / SO32	18.5	18.42	0.07	10 mm	FCC_E	N/A	1:1	left	0.124	1.019	0.126	
824.70	1013	Cell. CDMA	EVDO Rev. 0	25.0	24.59	-0.04	10 mm	FCC_A	N/A	1:1	back	0.979	1.099	1.076	A14
836.52	384	Cell. CDMA	EVDO Rev. 0	25.0	24.58	-0.05	10 mm	FCC_A	N/A	1:1	back	0.822	1.102	0.906	
848.31	777	Cell. CDMA	EVDO Rev. 0	25.0	24.61	-0.08	10 mm	FCC_A	N/A	1:1	back	0.583	1.094	0.638	
836.52	384	Cell. CDMA	EVDO Rev. 0	25.0	24.58	0.05	10 mm	FCC_A	N/A	1:1	front	0.363	1.102	0.400	
836.52	384	Cell. CDMA	EVDO Rev. 0	25.0	24.58	-0.06	10 mm	FCC_A	N/A	1:1	bottom	0.308	1.102	0.339	
836.52	384	Cell. CDMA	EVDO Rev. 0	25.0	24.58	-0.05	10 mm	FCC_A	N/A	1:1	left	0.589	1.102	0.649	
824.70	1013	Cell. CDMA	EVDO Rev. 0	25.0	24.59	0.00	10 mm	FCC_A	N/A	1:1	back	0.930	1.099	1.022	
836.60	190	GSM 850	GPRS	31.5	31.29	-0.03	10 mm	FCC_F	2	1:4.15	back	0.421	1.050	0.442	A16
836.60	190	GSM 850	GPRS	31.5	31.29	-0.06	10 mm	FCC_F	2	1:4.15	front	0.180	1.050	0.189	
836.60	190	GSM 850	GPRS	31.5	31.29	-0.04	10 mm	FCC_F	2	1:4.15	bottom	0.180	1.050	0.189	
836.60	190	GSM 850	GPRS	31.5	31.29	-0.03	10 mm	FCC_F	2	1:4.15	left	0.350	1.050	0.368	
836.60	4183	UMTS 850	RMC	23.5	23.48	-0.07	10 mm	FCC_F	N/A	1:1	back	0.356	1.005	0.358	A17
836.60	4183	UMTS 850	RMC	23.5	23.48	-0.03	10 mm	FCC_F	N/A	1:1	front	0.152	1.005	0.153	
836.60	4183	UMTS 850	RMC	23.5	23.48	-0.03	10 mm	FCC_F	N/A	1:1	bottom	0.169	1.005	0.170	
836.60	4183	UMTS 850	RMC	23.5	23.48	-0.01	10 mm	FCC_F	N/A	1:1	left	0.290	1.005	0.291	
1880.00	600	PCS CDMA	TDSO / SO32	25.0	24.64	0.02	10 mm	FCC#2	N/A	1:1	back	0.620	1.086	0.673	A19
1880.00	600	PCS CDMA	TDSO / SO32	25.0	24.64	-0.07	10 mm	FCC#2	N/A	1:1	front	0.132	1.086	0.143	
1880.00	600	PCS CDMA	TDSO / SO32	25.0	24.64	-0.12	10 mm	FCC#2	N/A	1:1	bottom	0.249	1.086	0.270	
1880.00	600	PCS CDMA	TDSO / SO32	25.0	24.64	0.09	10 mm	FCC#2	N/A	1:1	left	0.055	1.086	0.060	
1880.00	600	PCS CDMA	TDSO / SO32	18.5	18.44	0.07	10 mm	FCC_E	N/A	1:1	back	0.251	1.014	0.255	
1880.00	600	PCS CDMA	TDSO / SO32	18.5	18.44	0.14	10 mm	FCC_E	N/A	1:1	front	0.068	1.014	0.069	
1880.00	600	PCS CDMA	TDSO / SO32	18.5	18.44	-0.03	10 mm	FCC_E	N/A	1:1	bottom	0.147	1.014	0.149	
1880.00	600	PCS CDMA	TDSO / SO32	18.5	18.44	-0.03	10 mm	FCC_E	N/A	1:1	left	0.039	1.014	0.039	
1880.00	600	PCS CDMA	EVDO Rev. 0	25.0	24.56	0.03	10 mm	FCC#2	N/A	1:1	back	0.539	1.107	0.597	A20
1880.00	600	PCS CDMA	EVDO Rev. 0	25.0	24.56	0.01	10 mm	FCC#2	N/A	1:1	front	0.124	1.107	0.137	
1880.00	600	PCS CDMA	EVDO Rev. 0	25.0	24.56	0.02	10 mm	FCC#2	N/A	1:1	bottom	0.236	1.107	0.261	
1880.00	600	PCS CDMA	EVDO Rev. 0	25.0	24.56	0.06	10 mm	FCC#2	N/A	1:1	left	0.062	1.107	0.068	
1850.20	512	GSM 1900	GPRS	30.0	29.91	0.13	10 mm	FCC_A	2	1:4.15	back	0.741	1.021	0.757	
1880.00	661	GSM 1900	GPRS	30.0	29.49	-0.04	10 mm	FCC_A	2	1:4.15	back	0.837	1.125	0.942	
1909.80	810	GSM 1900	GPRS	30.0	29.60	0.07	10 mm	FCC_A	2	1:4.15	back	0.832	1.096	0.912	
1880.00	661	GSM 1900	GPRS	30.0	29.49	0.02	10 mm	FCC_A	2	1:4.15	front	0.304	1.125	0.342	
1880.00	661	GSM 1900	GPRS	30.0	29.49	0.00	10 mm	FCC_A	2	1:4.15	bottom	0.468	1.125	0.527	
1880.00	661	GSM 1900	GPRS	30.0	29.49	-0.04	10 mm	FCC_A	2	1:4.15	left	0.149	1.125	0.168	
1880.00	661	GSM 1900	GPRS	30.0	29.49	-0.02	10 mm	FCC_A	2	1:4.15	back	0.932	1.125	1.049	A22
1852.40	9262	UMTS 1900	RMC	23.5	22.65	0.06	10 mm	FCC#2	N/A	1:1	back	0.594	1.216	0.722	
1880.00	9400	UMTS 1900	RMC	23.5	22.89	-0.05	10 mm	FCC#2	N/A	1:1	back	0.723	1.151	0.832	A23
1907.60	9538	UMTS 1900	RMC	23.5	22.51	0.02	10 mm	FCC#2	N/A	1:1	back	0.539	1.256	0.677	
1880.00	9400	UMTS 1900	RMC	23.5	22.89	-0.04	10 mm	FCC#2	N/A	1:1	front	0.190	1.151	0.219	
1880.00	9400	UMTS 1900	RMC	23.5	22.89	-0.01	10 mm	FCC#2	N/A	1:1	bottom	0.315	1.151	0.363	
1880.00	9400	UMTS 1900	RMC	23.5	22.89	0.00	10 mm	FCC#2	N/A	1:1	left	0.078	1.151	0.090	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT							Body								
Spatial Peak							1.6 W/kg (mW/g)								
Uncontrolled Exposure/General Population							averaged over 1 gram								

Note: Blue entries represent repeatability measurements.

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Table 12-16
LTE Band 13 Hotspot SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.	High														(W/kg)		(W/kg)	
782.00	23230	Mid	LTE Band 13	10	23.5	23.38	0.00	0	FCC_B	QPSK	1	0	10 mm	back	1:1	0.308	1.028	0.317	A12
782.00	23230	Mid	LTE Band 13	10	22.5	22.24	0.07	1	FCC_B	QPSK	25	0	10 mm	back	1:1	0.215	1.062	0.228	
782.00	23230	Mid	LTE Band 13	10	23.5	23.38	0.12	0	FCC_B	QPSK	1	0	10 mm	front	1:1	0.141	1.028	0.145	
782.00	23230	Mid	LTE Band 13	10	22.5	22.24	0.05	1	FCC_B	QPSK	25	0	10 mm	front	1:1	0.101	1.062	0.107	
782.00	23230	Mid	LTE Band 13	10	23.5	23.38	0.07	0	FCC_B	QPSK	1	0	10 mm	bottom	1:1	0.079	1.028	0.082	
782.00	23230	Mid	LTE Band 13	10	22.5	22.24	-0.19	1	FCC_B	QPSK	25	0	10 mm	bottom	1:1	0.078	1.062	0.083	
782.00	23230	Mid	LTE Band 13	10	23.5	23.38	0.02	0	FCC_B	QPSK	1	0	10 mm	right	1:1	0.230	1.028	0.236	
782.00	23230	Mid	LTE Band 13	10	22.5	22.24	0.11	1	FCC_B	QPSK	25	0	10 mm	right	1:1	0.160	1.062	0.170	
782.00	23230	Mid	LTE Band 13	10	19.5	18.88	-0.05	0	FCC#X	QPSK	1	0	10 mm	back	1:1	0.122	1.153	0.141	
782.00	23230	Mid	LTE Band 13	10	19.5	18.66	0.04	0	FCC#X	QPSK	25	0	10 mm	back	1:1	0.112	1.213	0.136	
782.00	23230	Mid	LTE Band 13	10	19.5	18.88	0.01	0	FCC#X	QPSK	1	0	10 mm	front	1:1	0.065	1.153	0.075	
782.00	23230	Mid	LTE Band 13	10	19.5	18.66	0.06	0	FCC#X	QPSK	25	0	10 mm	front	1:1	0.057	1.213	0.070	
782.00	23230	Mid	LTE Band 13	10	19.5	18.88	0.07	0	FCC#X	QPSK	1	0	10 mm	bottom	1:1	0.029	1.153	0.033	
782.00	23230	Mid	LTE Band 13	10	19.5	18.66	0.00	0	FCC#X	QPSK	25	0	10 mm	bottom	1:1	0.032	1.213	0.039	
782.00	23230	Mid	LTE Band 13	10	19.5	18.88	0.06	0	FCC#X	QPSK	1	0	10 mm	right	1:1	0.033	1.153	0.037	
782.00	23230	Mid	LTE Band 13	10	19.5	18.66	0.04	0	FCC#X	QPSK	25	0	10 mm	right	1:1	0.033	1.213	0.040	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT								Body 1.6 W/kg (mW/g) averaged over 1 gram											
Spatial Peak																			
Uncontrolled Exposure/General Population																			

Table 12-17
LTE Band 4 (AWS) Hotspot SAR

MEASUREMENT RESULTS																			
FREQUENCY			Mode	Bandwidth [MHz]	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	MPR [dB]	Device Serial Number	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
																(W/kg)		(W/kg)	
MHz	Ch.																		
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	23.42	0.19	0	FCC_B	QPSK	1	99	10 mm	back	1:1	0.545	1.019	0.555	A18
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	22.20	0.00	1	FCC_B	QPSK	50	50	10 mm	back	1:1	0.413	1.072	0.443	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	23.42	-0.01	0	FCC_B	QPSK	1	99	10 mm	front	1:1	0.179	1.019	0.182	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	22.20	0.06	1	FCC_B	QPSK	50	50	10 mm	front	1:1	0.140	1.072	0.150	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	23.42	-0.03	0	FCC_B	QPSK	1	99	10 mm	bottom	1:1	0.127	1.019	0.129	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	22.20	-0.02	1	FCC_B	QPSK	50	50	10 mm	bottom	1:1	0.100	1.072	0.107	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	23.5	23.42	-0.03	0	FCC_B	QPSK	1	99	10 mm	right	1:1	0.152	1.019	0.155	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	22.5	22.20	0.00	1	FCC_B	QPSK	50	50	10 mm	right	1:1	0.111	1.072	0.119	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	19.5	19.23	-0.04	0	FCC#X	QPSK	1	0	10 mm	back	1:1	0.248	1.064	0.264	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	19.5	18.86	-0.04	0	FCC#X	QPSK	50	0	10 mm	back	1:1	0.221	1.159	0.256	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	19.5	19.23	0.02	0	FCC#X	QPSK	1	0	10 mm	front	1:1	0.084	1.064	0.089	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	19.5	18.86	0.10	0	FCC#X	QPSK	50	0	10 mm	front	1:1	0.072	1.159	0.084	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	19.5	19.23	0.03	0	FCC#X	QPSK	1	0	10 mm	bottom	1:1	0.083	1.064	0.088	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	19.5	18.86	0.00	0	FCC#X	QPSK	50	0	10 mm	bottom	1:1	0.077	1.159	0.089	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	19.5	19.23	-0.14	0	FCC#X	QPSK	1	0	10 mm	right	1:1	0.064	1.064	0.068	
1732.50	20175	Mid	LTE Band 4 (AWS)	20	19.5	18.86	-0.11	0	FCC#X	QPSK	50	0	10 mm	right	1:1	0.058	1.159	0.067	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT																			
Spatial Peak								Body											
Uncontrolled Exposure/General Population								1.6 W/kg (mW/g)											
								averaged over 1 gram											

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Table 12-18
WLAN Hotspot SAR

MEASUREMENT RESULTS															
FREQUENCY		Mode	Service	Maximum Allowed Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Spacing	Device Serial Number	Data Rate (Mbps)	Side	Duty Cycle	SAR (1g)	Scaling Factor	Scaled SAR (1g)	Plot #
MHz	Ch.											(W/kg)		(W/kg)	
2412	1	IEEE 802.11b	DSSS	15.0	14.71	-0.06	10 mm	FCC_C	1	back	1:1	0.125	1.069	0.134	A24
2412	1	IEEE 802.11b	DSSS	15.0	14.71	-0.03	10 mm	FCC_C	1	front	1:1	0.047	1.069	0.050	
2412	1	IEEE 802.11b	DSSS	15.0	14.71	-0.02	10 mm	FCC_C	1	top	1:1	0.036	1.069	0.038	
2412	1	IEEE 802.11b	DSSS	15.0	14.71	-0.04	10 mm	FCC_C	1	right	1:1	0.117	1.069	0.125	
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram								

12.4 SAR Test Notes

General Notes:

1. The test data reported are the worst-case SAR values according to test procedures specified in IEEE 1528-2003, FCC/OET Bulletin 65, Supplement C [June 2001] and FCC KDB Publication 447498 D01v05.
2. Batteries are fully charged at the beginning of the SAR measurements. A standard battery was used for all SAR measurements.
3. Liquid tissue depth was at least 15.0 cm for all frequencies.
4. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
5. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v05.
6. Device was tested using a fixed spacing for body-worn accessory testing. A separation distance of 10 mm was considered because the manufacturer has determined that there will be body-worn accessories available in the marketplace for users to support this separation distance.
7. Per FCC KDB Publication 648474 D04v01, SAR was evaluated without a headset connected to the device. Since the standalone reported SAR was ≤ 1.2 W/kg, no additional SAR evaluations using a headset cable were required.
8. Per FCC KDB 865664 D01 v01, variability SAR tests were performed when the measured SAR results for a frequency band were greater than 0.8 W/kg. Repeated SAR measurements are highlighted in the tables above for clarity. Please see Section 14 for variability analysis.
9. During SAR Testing for the Wireless Router conditions per FCC KDB Publication 941225 D06v01, the actual Portable Hotspot operation (with actual simultaneous transmission of a transmitter with WIFI) was not activated (See Section 6.6 for more details).

GSM Test Notes:

1. Body-Worn accessory testing is typically associated with voice operations. Therefore, GSM voice was evaluated for body-worn SAR.
2. Justification for reduced test configurations per KDB Publication 941225 D03v01: The source-based time-averaged output power was evaluated for all multi-slot operations. The multi-slot configuration with the highest frame averaged output power was evaluated for SAR.
3. Per FCC KDB Publication 447498 D01v05, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is $> \frac{1}{2}$ dB, instead of the middle channel, the highest output power channel must be used.

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CDMA Notes:

1. Head SAR for CDMA2000 mode was tested under RC3/SO55 per FCC KDB Publication 941225 D01v02.
2. Body-Worn SAR was tested with 1x RTT with TDSO / SO32 FCH Only. EVDO and TDSO / SO32 FCH+SCH SAR tests were not required since the average output power was not more than 0.25 dB higher than the TDSO / SO32 FCH only powers, per FCC KDB Publication 941225 D01v02.
3. CDMA Wireless Router SAR is measured using Subtype 0/1 Physical Layer configurations for Rev. 0 according to KDB 941225 D01 procedures for data devices. If the average output power of Subtype 2 for Rev. A is less than the Rev. 0 power levels, then EVDO Rev. A SAR is not required. Otherwise, SAR is measured on the maximum output channel for Rev. A using the exposure configuration that results in the highest SAR for that RF channel in Rev. 0. SAR is not required for 1x RTT for Ev-Do hotspot devices when the maximum average output of each channel is less than 1/4 dB higher than that measured in Subtype 0/1 Physical Layer configurations for Rev. 0.
4. Head SAR was additionally evaluated using EVDO Rev. A to determine compliance for VoIP operations.
5. CDMA 1x-RTT Hotspot SAR was additionally evaluated for Hotspot exposure to support simultaneous capabilities.
6. Per FCC KDB Publication 447498 D01v05, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is $> \frac{1}{2}$ dB, instead of the middle channel, the highest output power channel must be used.

UMTS Notes:

1. UMTS mode in Body SAR was tested under RMC 12.2 kbps with HSPA Inactive per KDB Publication 941225 D01v02. HSPA SAR was not required since the average output power of the HSPA subtests was not more than 0.25 dB higher than the RMC level and SAR was less than 1.2 W/kg.
2. Per FCC KDB Publication 447498 D01v05, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s). When the maximum output power variation across the required test channels is $> \frac{1}{2}$ dB, instead of the middle channel, the highest output power channel must be used.

LTE Notes:

1. LTE Considerations: LTE test configurations are determined according to SAR Evaluation Considerations for LTE Devices in FCC KDB Publication 941225 D05v02. Implementation of the general test procedures can be found in Section 8.5.4.
2. MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.
3. A-MPR was disabled for all SAR tests by setting NS=01 on the base station simulator.

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WLAN Notes:

1. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and April 2010 FCC/TCB Meeting Notes for 2.4 GHz WIFI: Highest average RF output power channel for the lowest data rate was selected for SAR evaluation in 802.11b. Other IEEE 802.11 modes (including 802.11g/n) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11b mode.
2. Justification for reduced test configurations for WIFI channels per KDB Publication 248227 D01v01r02 and April 2010 FCC/TCB Meeting Notes for 5 GHz WIFI: Highest average RF output power channel for the lowest data rate was selected for SAR evaluation in 802.11a. Other IEEE 802.11 modes (including 802.11n 20 MHz and 40 MHz bandwidths) were not investigated since the average output powers over all channels and data rates were not more than 0.25 dB higher than the tested channel in the lowest data rate of IEEE 802.11a mode.
3. When Hotspot is enabled, all 5 GHz bands are disabled. Therefore no 5 GHz WIFI Wireless Router SAR Data was required.
4. WIFI transmission was verified using an uncalibrated spectrum analyzer.
5. Since the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is <1.6 W/kg and the reported 1g averaged SAR is <0.8 W/kg, SAR testing on other default channels was not required.

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13 FCC MULTI-TX AND ANTENNA SAR CONSIDERATIONS

13.1 Introduction

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

13.2 Simultaneous Transmission Procedures

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

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

Table 13-1
Estimated SAR

Mode	Frequency	Maximum Allowed Power	Separation Distance (Body)	Estimated SAR (Body)
	[MHz]	[dBm]	[mm]	[W/kg]
Bluetooth	2441	7.50	10	0.125

Notes:

1. The maximum allowed power is rounded to the nearest mW during calculations per KDB 447498.
2. Held-to ear configurations are not applicable to Bluetooth operations and therefore were not considered for simultaneous transmission.

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13.3 Head SAR Simultaneous Transmission Analysis

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

Simult Tx	Configuration	Cell. CDMA SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	GSM 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.247	0.012	0.259	Head SAR	Right Cheek	0.074	0.012	0.086
	Right Tilt	0.169	0.009	0.178		Right Tilt	0.052	0.009	0.061
	Left Cheek	0.345	0.037	0.382		Left Cheek	0.094	0.037	0.131
	Left Tilt	0.176	0.022	0.198		Left Tilt	0.059	0.022	0.081
Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	PCS CDMA SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.082	0.012	0.094	Head SAR	Right Cheek	0.173	0.012	0.185
	Right Tilt	0.058	0.009	0.067		Right Tilt	0.097	0.009	0.106
	Left Cheek	0.113	0.037	0.150		Left Cheek	0.244	0.037	0.281
	Left Tilt	0.069	0.022	0.091		Left Tilt	0.123	0.022	0.145
Simult Tx	Configuration	GSM 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.087	0.012	0.099	Head SAR	Right Cheek	0.056	0.012	0.068
	Right Tilt	0.059	0.009	0.068		Right Tilt	0.041	0.009	0.050
	Left Cheek	0.139	0.037	0.176		Left Cheek	0.106	0.037	0.143
	Left Tilt	0.054	0.022	0.076		Left Tilt	0.041	0.022	0.063
Simult Tx	Configuration	LTE Band 13 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	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	0.162	0.012	0.174	Head SAR	Right Cheek	0.164	0.012	0.176
	Right Tilt	0.104	0.009	0.113		Right Tilt	0.096	0.009	0.105
	Left Cheek	0.116	0.037	0.153		Left Cheek	0.143	0.037	0.180
	Left Tilt	0.074	0.022	0.096		Left Tilt	0.101	0.022	0.123
Simult Tx	Configuration	Cell. EVDO SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	PCS EVDO SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.266	0.012	0.278	Head SAR	Right Cheek	0.146	0.012	0.158
	Right Tilt	0.186	0.009	0.195		Right Tilt	0.100	0.009	0.109
	Left Cheek	0.358	0.037	0.395		Left Cheek	0.229	0.037	0.266
	Left Tilt	0.210	0.022	0.232		Left Tilt	0.115	0.022	0.137

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

Simult Tx	Configuration	Cell. CDMA SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	GSM 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.247	0.045	0.292	Head SAR	Right Cheek	0.074	0.045	0.119
	Right Tilt	0.169	0.041	0.210		Right Tilt	0.052	0.041	0.093
	Left Cheek	0.345	0.088	0.433		Left Cheek	0.094	0.088	0.182
	Left Tilt	0.176	0.058	0.234		Left Tilt	0.059	0.058	0.117
Simult Tx	Configuration	UMTS 850 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	PCS CDMA SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.082	0.045	0.127	Head SAR	Right Cheek	0.173	0.045	0.218
	Right Tilt	0.058	0.041	0.099		Right Tilt	0.097	0.041	0.138
	Left Cheek	0.113	0.088	0.201		Left Cheek	0.244	0.088	0.332
	Left Tilt	0.069	0.058	0.127		Left Tilt	0.123	0.058	0.181
Simult Tx	Configuration	GSM 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Head SAR	Right Cheek	0.087	0.045	0.132	Head SAR	Right Cheek	0.056	0.045	0.101
	Right Tilt	0.059	0.041	0.100		Right Tilt	0.041	0.041	0.082
	Left Cheek	0.139	0.088	0.227		Left Cheek	0.106	0.088	0.194
	Left Tilt	0.054	0.058	0.112		Left Tilt	0.041	0.058	0.099

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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	2G/3G/4G SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	Cell. CDMA	0.793	0.134	0.927
Back Side	GSM 850	0.315	0.134	0.449
Back Side	UMTS 850	0.358	0.134	0.492
Back Side	PCS CDMA	0.673	0.134	0.807
Back Side	GSM 1900	0.761	0.134	0.895
Back Side	UMTS 1900	0.832	0.134	0.966
Back Side	LTE Band 13	0.317	0.134	0.451
Back Side	LTE Band 4 (AWS)	0.555	0.134	0.689

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

Configuration	Mode	2G/3G SAR (W/kg)	5 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Back Side	Cell. CDMA	0.793	0.233	1.026
Back Side	GSM 850	0.315	0.233	0.548
Back Side	UMTS 850	0.358	0.233	0.591
Back Side	PCS CDMA	0.673	0.233	0.906
Back Side	GSM 1900	0.761	0.233	0.994
Back Side	UMTS 1900	0.832	0.233	1.065

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

Configuration	Mode	2G/3G/4G SAR (W/kg)	Bluetooth SAR (W/kg)	Σ SAR (W/kg)
Back Side	Cell. CDMA	0.793	0.125	0.918
Back Side	GSM 850	0.315	0.125	0.440
Back Side	UMTS 850	0.358	0.125	0.483
Back Side	PCS CDMA	0.673	0.125	0.798
Back Side	GSM 1900	0.761	0.125	0.886
Back Side	UMTS 1900	0.832	0.125	0.957
Back Side	LTE Band 13	0.317	0.125	0.442
Back Side	LTE Band 4 (AWS)	0.555	0.125	0.680

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

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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 (Hotspot at 1.0 cm)

Simult Tx	Configuration	Cell. EVDO SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	GSM 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	1.076	0.134	1.210	Body SAR	Back	0.442	0.134	0.576
	Front	0.400	0.050	0.450		Front	0.189	0.050	0.239
	Top	-	0.038	0.038		Top	-	0.038	0.038
	Bottom	0.339	-	0.339		Bottom	0.189	-	0.189
	Right	-	0.125	0.125		Right	-	0.125	0.125
	Left	0.649	-	0.649		Left	0.368	-	0.368
Simult Tx	Configuration	UMTS 850 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	PCS EVDO SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.358	0.134	0.492	Body SAR	Back	0.597	0.134	0.731
	Front	0.153	0.050	0.203		Front	0.137	0.050	0.187
	Top	-	0.038	0.038		Top	-	0.038	0.038
	Bottom	0.170	-	0.170		Bottom	0.261	-	0.261
	Right	-	0.125	0.125		Right	-	0.125	0.125
	Left	0.291	-	0.291		Left	0.068	-	0.068
Simult Tx	Configuration	GSM 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	UMTS 1900 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	1.049	0.134	1.183	Body SAR	Back	0.832	0.134	0.966
	Front	0.342	0.050	0.392		Front	0.219	0.050	0.269
	Top	-	0.038	0.038		Top	-	0.038	0.038
	Bottom	0.527	-	0.527		Bottom	0.363	-	0.363
	Right	-	0.125	0.125		Right	-	0.125	0.125
	Left	0.168	-	0.168		Left	0.090	-	0.090
Simult Tx	Configuration	LTE Band 13 SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)	Simult Tx	Configuration	LTE Band 4 (AWS) SAR (W/kg)	2.4 GHz WLAN SAR (W/kg)	Σ SAR (W/kg)
Body SAR	Back	0.317	0.134	0.451	Body SAR	Back	0.555	0.134	0.689
	Front	0.145	0.050	0.195		Front	0.182	0.050	0.232
	Top	-	0.038	0.038		Top	-	0.038	0.038
	Bottom	0.083	-	0.083		Bottom	0.129	-	0.129
	Right	0.236	0.125	0.361		Right	0.155	0.125	0.280
	Left	-	-	0.000		Left	-	-	0.000

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13.6 SVLTE Simultaneous Transmission Analysis

Table 13-8
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Held to Ear)

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	15		
$P \geq 18$	Right Cheek	0.247	0.072	0.012	0.319	0.331
	Right Tilt	0.169	0.038	0.009	0.207	0.216
	Left Cheek	0.345	0.053	0.037	0.398	0.435
	Left Tilt	0.176	0.033	0.022	0.209	0.231
	Maximum Allowed Power (dBm)	18.5	23.5	15		
$P < 18$	Right Cheek	0.048	0.162	0.012	0.210	0.222
	Right Tilt	0.035	0.104	0.009	0.139	0.148
	Left Cheek	0.062	0.116	0.037	0.178	0.215
	Left Tilt	0.041	0.074	0.022	0.115	0.137

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	15		
$P \geq 18$	Right Cheek	0.173	0.072	0.012	0.245	0.257
	Right Tilt	0.097	0.038	0.009	0.135	0.144
	Left Cheek	0.244	0.053	0.037	0.297	0.334
	Left Tilt	0.123	0.033	0.022	0.156	0.178
	Maximum Allowed Power (dBm)	18.5	23.5	15		
$P < 18$	Right Cheek	0.027	0.162	0.012	0.189	0.201
	Right Tilt	0.012	0.104	0.009	0.116	0.125
	Left Cheek	0.037	0.116	0.037	0.153	0.190
	Left Tilt	0.014	0.074	0.022	0.088	0.110

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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	15		
$P \geq 18$	Right Cheek	0.247	0.070	0.012	0.317	0.329
	Right Tilt	0.169	0.038	0.009	0.207	0.216
	Left Cheek	0.345	0.064	0.037	0.409	0.446
	Left Tilt	0.176	0.049	0.022	0.225	0.247
	Maximum Allowed Power (dBm)	18.5	23.5	15		
$P < 18$	Right Cheek	0.048	0.164	0.012	0.212	0.224
	Right Tilt	0.035	0.096	0.009	0.131	0.140
	Left Cheek	0.062	0.143	0.037	0.205	0.242
	Left Tilt	0.041	0.101	0.022	0.142	0.164

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	15		
$P \geq 18$	Right Cheek	0.173	0.070	0.012	0.243	0.255
	Right Tilt	0.097	0.038	0.009	0.135	0.144
	Left Cheek	0.244	0.064	0.037	0.308	0.345
	Left Tilt	0.123	0.049	0.022	0.172	0.194
	Maximum Allowed Power (dBm)	18.5	23.5	15		
$P < 18$	Right Cheek	0.027	0.164	0.012	0.191	0.203
	Right Tilt	0.012	0.096	0.009	0.108	0.117
	Left Cheek	0.037	0.143	0.037	0.180	0.217
	Left Tilt	0.014	0.101	0.022	0.115	0.137

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Table 13-9
Simultaneous Transmission Scenario with 2.4 GHz WLAN (Body-Worn at 10 mm)

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	1+2	1+2+3
		Maximum Allowed Power (dBm)	25	19.5	15		
P $\geq$ 18	Cell. CDMA	Back Side	0.793	0.141	0.134	0.934	1.068
	PCS CDMA		0.673	0.141	0.134	0.814	0.948
		Maximum Allowed Power (dBm)	18.5	23.5	15		
P < 18	Cell. CDMA	Back Side	0.152	0.317	0.134	0.469	0.603
	PCS CDMA		0.255	0.317	0.134	0.572	0.706

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	1+2	1+2+3
		Maximum Allowed Power (dBm)	25	19.5	15		
P $\geq$ 18	Cell. CDMA	Back Side	0.793	0.264	0.134	1.057	1.191
	PCS CDMA		0.673	0.264	0.134	0.937	1.071
		Maximum Allowed Power (dBm)	18.5	23.5	15		
P < 18	Cell. CDMA	Back Side	0.152	0.555	0.134	0.707	0.841
	PCS CDMA		0.255	0.555	0.134	0.810	0.944

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

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	1+2	1+2+3
		Maximum Allowed Power (dBm)	25	19.5	7.5		
P $\geq$ 18	Cell. CDMA	Back Side	0.793	0.141	0.125	0.934	1.059
	PCS CDMA		0.673	0.141	0.125	0.814	0.939
		Maximum Allowed Power (dBm)	18.5	23.5	7.5		
P < 18	Cell. CDMA	Back Side	0.152	0.317	0.125	0.469	0.594
	PCS CDMA		0.255	0.317	0.125	0.572	0.697

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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	1+2	1+2+3
		Maximum Allowed Power (dBm)	25	19.5	7.5		
$P \geq 18$	Cell. CDMA	Back Side	0.793	0.264	0.125	1.057	1.182
	PCS CDMA		0.673	0.264	0.125	0.937	1.062
		Maximum Allowed Power (dBm)	18.5	23.5	7.5		
$P < 18$	Cell. CDMA	Back Side	0.152	0.555	0.125	0.707	0.832
	PCS CDMA		0.255	0.555	0.125	0.810	0.935

Table 13-11
Simultaneous Transmission Scenario (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	15	
Body SAR	$P \geq 18$	Back	0.793	0.141	0.134	1.068
		Front	0.295	0.075	0.050	0.420
		Top	-	-	0.038	0.038
		Bottom	0.194	0.039	-	0.233
		Right	-	0.040	0.125	0.165
		Left	0.580	-	-	0.580
		Maximum Allowed Power (dBm)	18.5	23.5	15	
	$P < 18$	Back	0.152	0.317	0.134	0.603
		Front	0.068	0.145	0.050	0.263
		Top	-	-	0.038	0.038
		Bottom	0.041	0.083	-	0.124
		Right	-	0.236	0.125	0.361
		Left	0.126	-	-	0.126

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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	15	
Body SAR	P ≥ 18	Back	0.673	0.141	0.134	0.948
		Front	0.143	0.075	0.050	0.268
		Top	-	-	0.038	0.038
		Bottom	0.270	0.039	-	0.309
		Right	-	0.040	0.125	0.165
		Left	0.060	-	-	0.060
		Maximum Allowed Power (dBm)	18.5	23.5	15	
	P < 18	Back	0.255	0.317	0.134	0.706
		Front	0.069	0.145	0.050	0.264
		Top	-	-	0.038	0.038
		Bottom	0.149	0.083	-	0.232
		Right	-	0.236	0.125	0.361
		Left	0.039	-	-	0.039

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	15	
Body SAR	P ≥ 18	Back	0.793	0.264	0.134	1.191
		Front	0.295	0.089	0.050	0.434
		Top	-	-	0.038	0.038
		Bottom	0.194	0.089	-	0.283
		Right	-	0.068	0.125	0.193
		Left	0.580	-	-	0.580
		Maximum Allowed Power (dBm)	18.5	23.5	15	
	P < 18	Back	0.152	0.555	0.134	0.841
		Front	0.068	0.182	0.050	0.300
		Top	-	-	0.038	0.038
		Bottom	0.041	0.129	-	0.170
		Right	-	0.155	0.125	0.280
		Left	0.126	-	-	0.126

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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	15	
Body SAR	$P \geq 18$	Back	0.673	0.264	0.134	1.071
		Front	0.143	0.089	0.050	0.282
		Top	-	-	0.038	0.038
		Bottom	0.270	0.089	-	0.359
		Right	-	0.068	0.125	0.193
		Left	0.060	-	-	0.060
		Maximum Allowed Power (dBm)	18.5	23.5	15	
	$P < 18$	Back	0.255	0.555	0.134	0.944
		Front	0.069	0.182	0.050	0.301
		Top	-	-	0.038	0.038
		Bottom	0.149	0.129	-	0.278
		Right	-	0.155	0.125	0.280
		Left	0.039	-	-	0.039

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 D01_v05.

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14 SAR MEASUREMENT VARIABILITY

14.1 Measurement Variability

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

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

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

Table 14-1
Body SAR Measurement Variability Results

BODY VARIABILITY RESULTS														
Band	FREQUENCY		Mode	Service	# of Time Slots	Side	Spacing	Measured SAR (1g)	1st Repeated SAR (1g)	Ratio	2nd Repeated SAR (1g)	Ratio	3rd Repeated SAR (1g)	Ratio
	MHz	Ch.						(W/kg)	(W/kg)		(W/kg)		(W/kg)	
835	824.70	1013	Cell. CDMA	EVDO Rev. 0	N/A	back	10 mm	0.979	0.930	1.1	N/A	N/A	N/A	N/A
1900	1880.00	661	GSM 1900	GPRS	2	back	10 mm	0.837	0.932	1.1	N/A	N/A	N/A	N/A
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population							Body 1.6 W/kg (mW/g) averaged over 1 gram							

14.2 Measurement Uncertainty

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

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15 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8594A	(9kHz-2.9GHz) Spectrum Analyzer	N/A	N/A	N/A	3051A00187
Agilent	8648D	(9kHz-4GHz) Signal Generator	10/10/2012	Annual	10/10/2013	3613A00315
Agilent	8753E	(30kHz-6GHz) Network Analyzer	4/4/2012	Annual	4/4/2013	JP38020182
Agilent	E8257D	(250kHz-20GHz) Signal Generator	4/5/2012	Annual	4/5/2013	MY45470194
Agilent	E5515C	Wireless Communications Test Set	2/14/2012	Annual	2/14/2013	GB43304447
Agilent	8753E	(30kHz-6GHz) Network Analyzer	4/3/2012	Annual	4/3/2013	US37390350
Agilent	85070E	Dielectric Probe Kit	3/8/2012	Annual	3/8/2013	MY44300633
Agilent	85047A	S-Parameter Test Set	N/A	N/A	N/A	2904A00579
Agilent	MA24106A	USB Power Sensor	12/7/2012	Annual	12/7/2013	1244524
Agilent	MA24106A	USB Power Sensor	12/7/2012	Annual	12/7/2013	1244515
Amplifier Research	5S1G4	5W, 800MHz-4.2GHz	CBT	N/A	CBT	21910
Anritsu	MA2411B	Power Sensor	3/5/2012	Annual	3/5/2013	846215
Anritsu	MA2481A	Power Sensor	2/14/2012	Annual	2/14/2013	5318
Anritsu	ML2438A	Power Meter	2/14/2012	Annual	2/14/2013	1190013
Anritsu	ML2438A	Power Meter	2/14/2012	Annual	2/14/2013	98150041
Anritsu	MA2481A	Power Sensor	2/14/2012	Annual	2/14/2013	5821
Anritsu	MA2481A	Power Sensor	4/5/2012	Annual	4/5/2013	5605
Anritsu	MT8820C	Radio Communication Tester	11/6/2012	Annual	11/6/2013	6200901190
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
Intelligent Weigh	PD-3000	Electronic Balance	3/27/2012	Annual	3/27/2013	11081534
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
MiniCircuits	SLP-2400+	Low Pass Filter	CBT	N/A	CBT	R8979500903
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-1200+	Low Pass Filter DC to 1000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Narda	BW-S3W2	Attenuator (3dB)	CBT	N/A	CBT	120
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Rohde & Schwarz	CMU200	Base Station Simulator	5/22/2012	Annual	5/22/2013	109892
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	SMI003B	Signal Generator	4/5/2012	Annual	4/5/2013	DE27259
Rohde & Schwarz	CMW500	LTE Radio Communication Tester	3/5/2012	Annual	3/5/2013	102060
Seekonk	NC-100	Torque Wrench (8" lb)	11/29/2011	Triennial	11/29/2014	21053
SPEAG	D1765V2	1765 MHz SAR Dipole	5/18/2012	Annual	5/18/2013	1008
SPEAG	D1900V2	1900 MHz SAR Dipole	2/22/2012	Annual	2/22/2013	502
SPEAG	D2450V2	2450 MHz SAR Dipole	8/23/2012	Annual	8/23/2013	719
SPEAG	D5GHzV2	5 GHz SAR Dipole	10/30/2012	Annual	10/30/2013	1007
SPEAG	D835V2	835 MHz SAR Dipole	8/23/2012	Annual	8/23/2013	4d026
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/19/2012	Annual	4/19/2013	665
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/20/2012	Annual	2/20/2013	649
SPEAG	ES3DV2	SAR Probe	8/28/2012	Annual	8/28/2013	3022
SPEAG	ES3DV4	SAR Probe	1/27/2012	Annual	1/27/2013	3589
SPEAG	ES3DV4	SAR Probe	7/26/2012	Annual	7/26/2013	3561
SPEAG	ES3DV3	SAR Probe	4/24/2012	Annual	4/24/2013	3213
SPEAG	ES3DV3	SAR Probe	3/16/2012	Annual	3/16/2013	3209
SPEAG	ES3DV3	SAR Probe	2/21/2012	Annual	2/21/2013	3258
SPEAG	ES3DV3	SAR Probe	5/18/2012	Annual	5/18/2013	3263
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/18/2012	Annual	1/18/2013	1272
SPEAG	DAE4	Dasy Data Acquisition Electronics	9/19/2012	Annual	9/19/2013	1323
SPEAG	ES3DV3	SAR Probe	9/20/2012	Annual	9/20/2013	3288
SPEAG	D2450V2	2450 MHz SAR Dipole	2/7/2012	Annual	2/7/2013	882
SPEAG	D1900V2	1900 MHz SAR Dipole	2/22/2012	Annual	2/22/2013	5d149
SPEAG	D5GHzV2	5 GHz SAR Dipole	2/1/2012	Annual	2/1/2013	1120
SPEAG	D750V3	750 MHz Dipole	2/9/2012	Annual	2/9/2013	1054
SPEAG	D835V2	835 MHz SAR Dipole	2/3/2012	Annual	2/3/2013	4d132
SPEAG	D1900V2	1900 MHz SAR Dipole	2/8/2012	Annual	2/8/2013	5d148
SPEAG	DAE4	Dasy Data Acquisition Electronics	8/24/2012	Annual	8/24/2013	1322
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/7/2012	Annual	5/7/2013	1334
SPEAG	DAK-3.5	Dielectric Assessment Kit	6/19/2012	Annual	6/19/2013	1070
SPEAG	DAK-3.5	Dielectric Assessment Kit	12/11/2012	Annual	12/11/2013	1091
Tektronix	RSA-6114A	Real Time Spectrum Analyzer	4/5/2012	Annual	4/5/2013	B010177
VWR	36934-158	Wall-Mounted Thermometer	1/21/2011	Biennial	1/21/2013	111286445
VWR	36934-158	Wall-Mounted Thermometer	1/21/2011	Biennial	1/21/2013	111286460
VWR	62344-925	Mini-Thermometer	10/24/2011	Biennial	10/24/2013	111886430
VWR	23226-658	Long Stem Thermometer	3/30/2012	Biennial	3/30/2014	122179874
VWR	23226-658	Long Stem Thermometer	5/16/2012	Biennial	5/16/2014	122295544

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

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16 MEASUREMENT UNCERTAINTIES

Applicable for frequencies less than 3000 MHz.

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

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

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Applicable for frequencies up to 6 GHz.

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

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

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17 CONCLUSION

17.1 Measurement Conclusion

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

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

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- [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 Setembro 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.

FCC ID: A3LSCHI425	 SAR EVALUATION REPORT 		Reviewed by: Quality Manager
Document S/N: 0Y1212101750-R1.A3L	Test Dates: 12/10/12 - 01/17/13	DUT Type: Portable Handset	Page 74 of 74

APPENDIX A: SAR TEST DATA

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC_B

Communication System: LTE RF; Frequency: 782 MHz; Duty Cycle: 1:1

Medium: 770 Head Medium parameters used (interpolated):

$f = 782 \text{ MHz}$; $\sigma = 0.902 \text{ mho/m}$; $\epsilon_r = 39.968$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 01-02-2013; Ambient Temp: 23.5°C; Tissue Temp: 23.1°C

Probe: ES3DV3 - SN3209; ConvF(6.47, 6.47, 6.47); Calibrated: 3/16/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/20/2012

Phantom: SAM with CRP; Type: SAM 4.0; Serial: TP1375

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

Mode: LTE Band 13, Right Head, Cheek, Mid.ch

10 MHz Bandwidth, QPSK, 1 RB, RB Offset 0

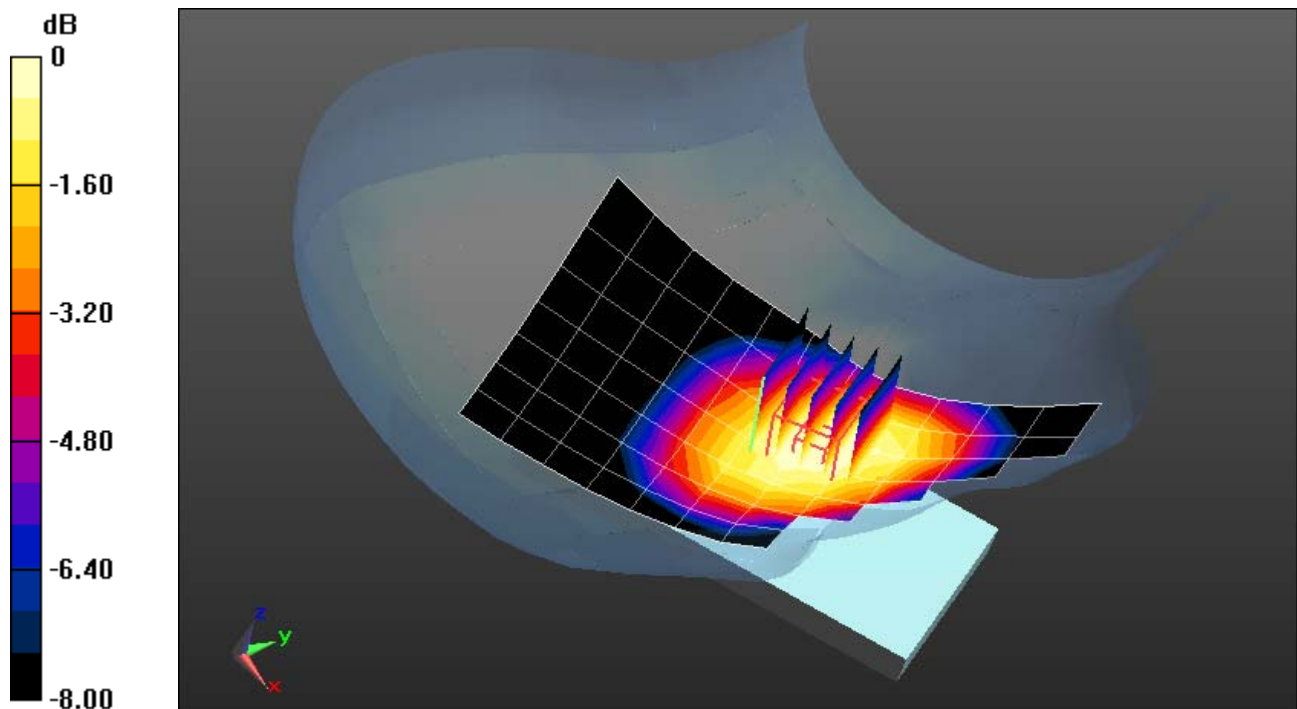
Area Scan (8x14x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 14.243 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 0.203 W/kg

SAR(1 g) = 0.158 W/kg; SAR(10 g) = 0.118 W/kg



0 dB = 0.165 W/kg = -7.83 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC_A

Communication System: CDMA; Frequency: 836.52 MHz; Duty Cycle: 1:1

Medium: 835 Head Medium parameters used (interpolated):

$f = 836.52 \text{ MHz}$; $\sigma = 0.9 \text{ mho/m}$; $\epsilon_r = 41.446$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 12-18-2012; Ambient Temp: 22.9°C; Tissue Temp: 20.9°C

Probe: ES3DV3 - SN3263; ConvF(6.16, 6.16, 6.16); Calibrated: 5/18/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 5/7/2012

Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647

Measurement SW: DASY52, Version 52.8 (3); SEMCAD X Version 14.6.7 (6848)

Mode: Cell. EVDO Rev. A, Left Head, Cheek, Mid.ch

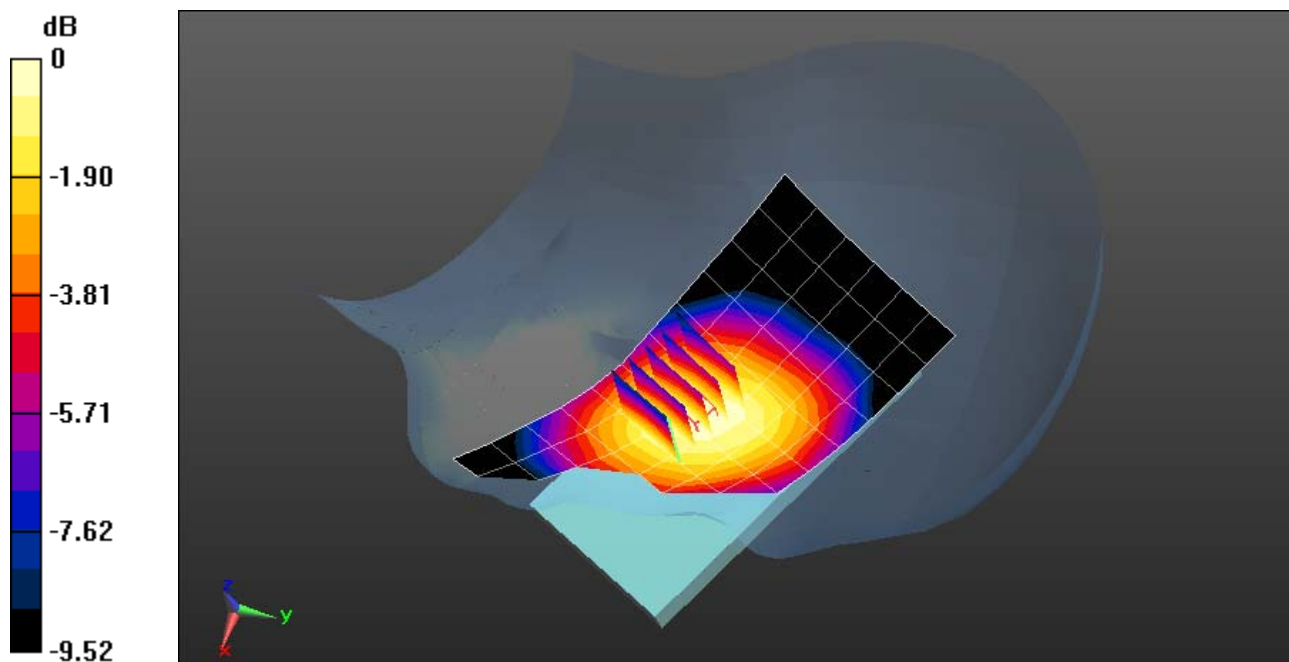
Area Scan (7x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 20.565 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 0.417 W/kg

SAR(1 g) = 0.323 W/kg



0 dB = 0.336 W/kg = -4.74 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC_F

Communication System: GSM; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium: 835 Head Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$; $\sigma = 0.891 \text{ mho/m}$; $\epsilon_r = 41.117$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 12-10-2012; Ambient Temp: 24.2°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3288; ConvF(6.41, 6.41, 6.41); Calibrated: 9/20/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/19/2012

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

Measurement SW: DASY52, Version 52.8 (3); SEMCAD X Version 14.6.7 (6848)

Mode: GSM 850, Left Head, Cheek, Mid.ch

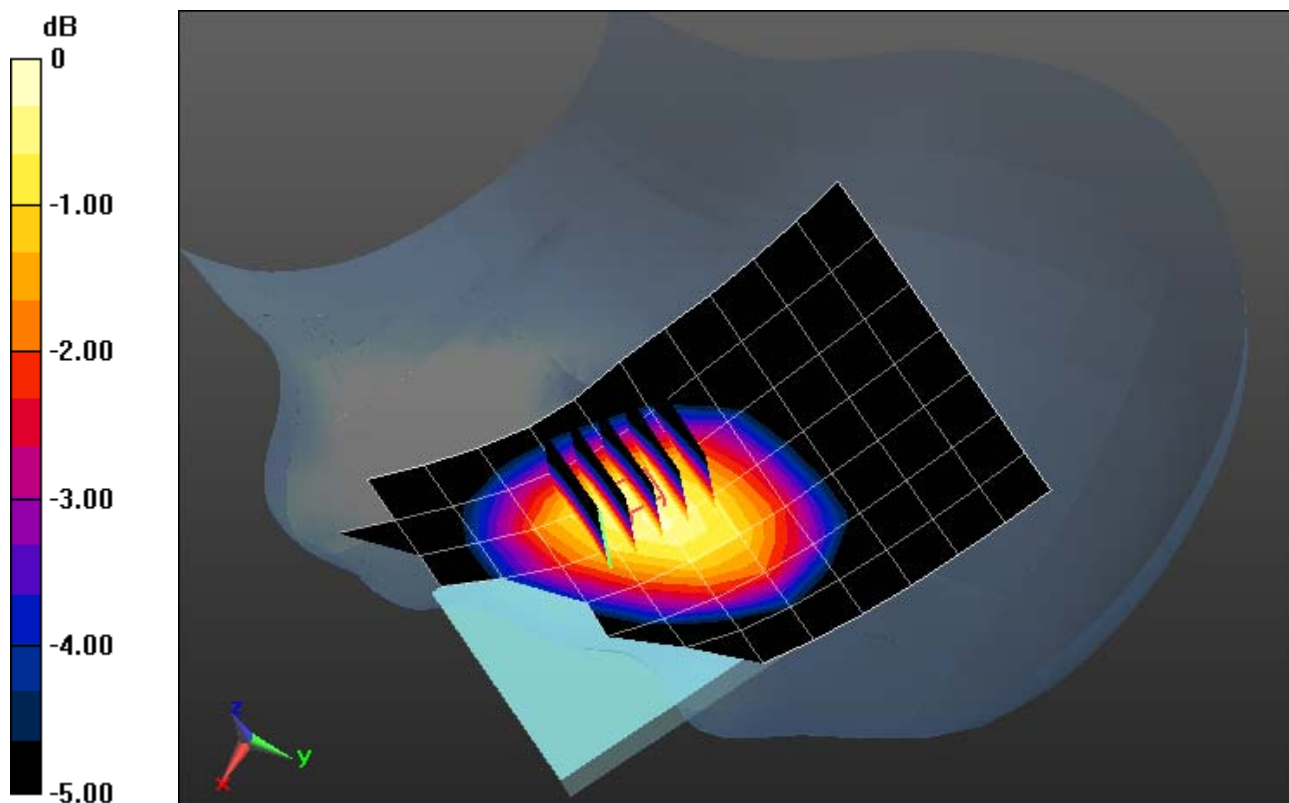
Area Scan (8x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 10.230 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 0.128 W/kg

SAR(1 g) = 0.092 W/kg



0 dB = 0.0960 W/kg = -10.18 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC_F

Communication System: UMTS; Frequency: 836.6 MHz; Duty Cycle: 1:1

Medium: 835 Head Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$; $\sigma = 0.891 \text{ mho/m}$; $\epsilon_r = 41.117$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 12-10-2012; Ambient Temp: 24.2°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3288; ConvF(6.41, 6.41, 6.41); Calibrated: 9/20/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/19/2012

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

Measurement SW: DASY52, Version 52.8 (3); SEMCAD X Version 14.6.7 (6848)

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

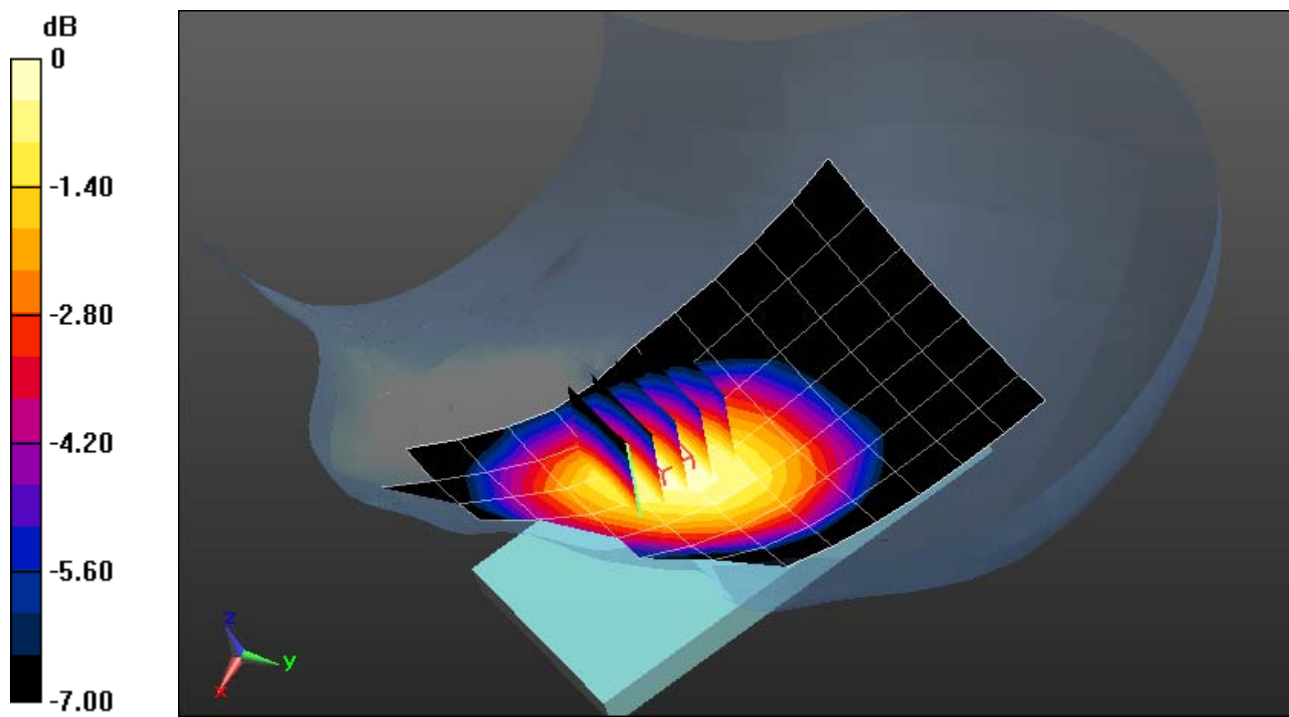
Area Scan (8x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 11.471 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 0.148 W/kg

SAR(1 g) = 0.112 W/kg



0 dB = 0.117 W/kg = -9.32 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC_B

Communication System: LTE RF; Frequency: 1732.5 MHz; Duty Cycle: 1:1

Medium: 1750 Head Medium parameters used (interpolated):

$f = 1732.5 \text{ MHz}$; $\sigma = 1.397 \text{ mho/m}$; $\epsilon_r = 38.596$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

Test Date: 12-28-2012; Ambient Temp: 22.2°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3209; ConvF(5.26, 5.26, 5.26); Calibrated: 3/16/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/20/2012

Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

Mode: LTE Band 4 (AWS), Right Head, Cheek, Mid.ch
20 MHz Bandwidth, QPSK, 1 RB, 99 RB Offset

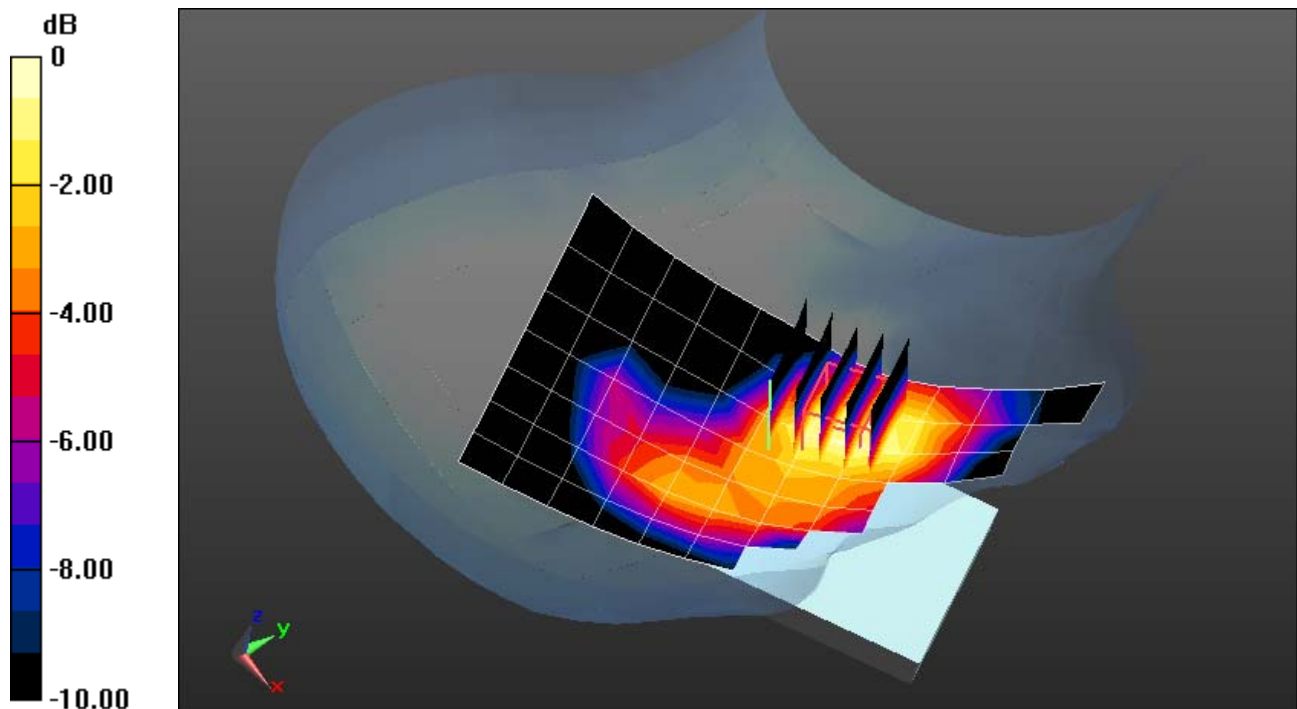
Area Scan (8x14x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 11.413 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 0.265 W/kg

SAR(1 g) = 0.161 W/kg; SAR(10 g) = 0.098 W/kg



0 dB = 0.176 W/kg = -7.54 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC_A

Communication System: CDMA; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium: 1900 Head Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.446 \text{ mho/m}$; $\epsilon_r = 38.91$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 12-17-2012; Ambient Temp: 21.1°C; Tissue Temp: 19.4°C

Probe: ES3DV3 - SN3263; ConvF(5.09, 5.09, 5.09); Calibrated: 5/18/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 5/7/2012

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

Measurement SW: DASY52, Version 52.8 (3); SEMCAD X Version 14.6.7 (6848)

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

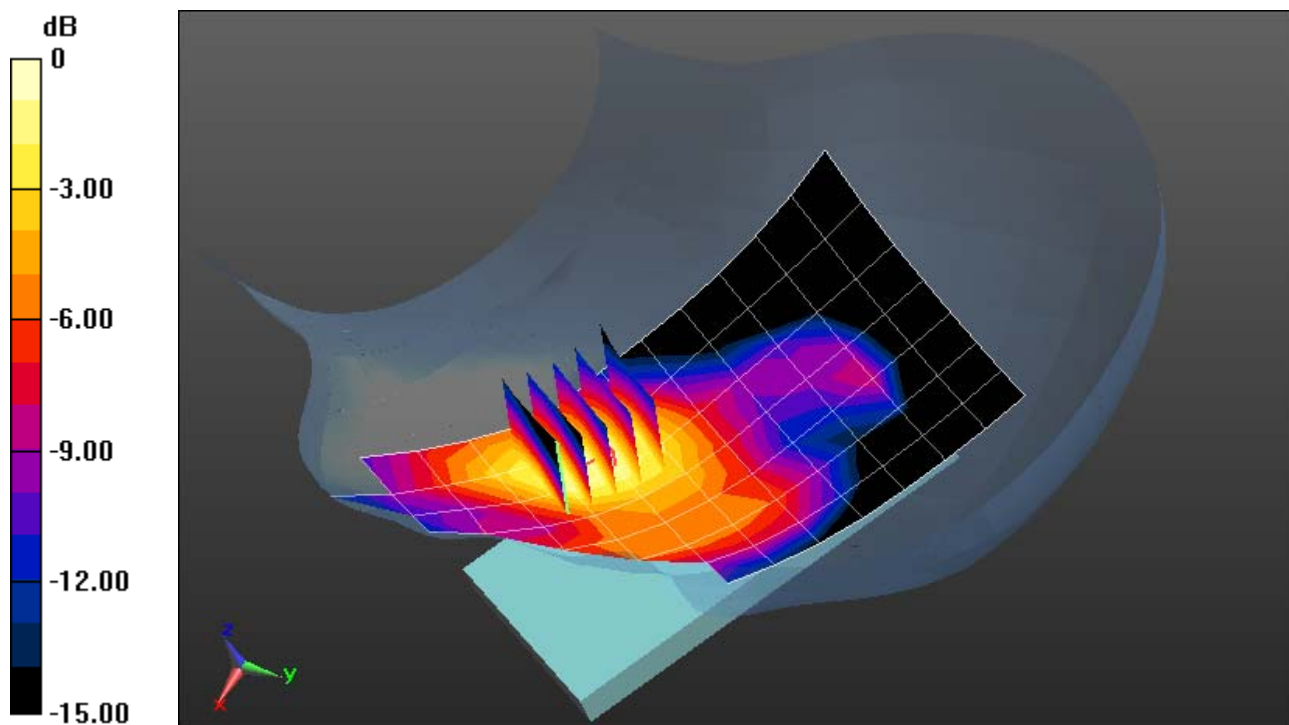
Area Scan (8x14x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 11.696 V/m; Power Drift = 0.033 dB

Peak SAR (extrapolated) = 0.354 W/kg

SAR(1 g) = 0.220 W/kg



0 dB = 0.244 W/kg = -6.13 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC_A

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: 1900 Head Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.416 \text{ mho/m}$; $\epsilon_r = 38.26$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 12-11-2012; Ambient Temp: 24.4°C; Tissue Temp: 23.5°C

Probe: ES3DV3 - SN3209; ConvF(5.15, 5.15, 5.15); Calibrated: 3/16/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/20/2012

Phantom: SAM with CRP; Type: SAM; Serial: TP1375

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

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

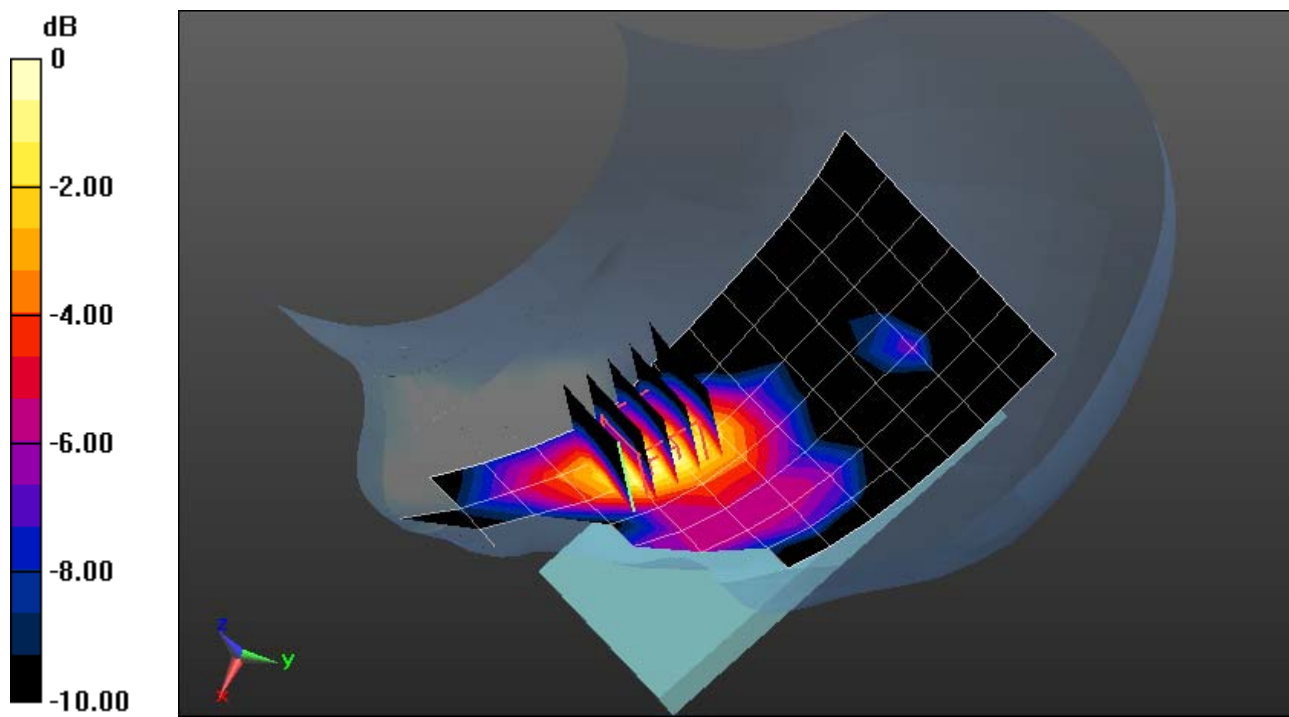
Area Scan (8x14x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 10.022 V/m; Power Drift = 0.10 dB

Peak SAR (extrapolated) = 0.230 W/kg

SAR(1 g) = 0.138 W/kg; SAR(10 g) = 0.080 W/kg



0 dB = 0.154 W/kg = -8.12 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC#2

Communication System: UMTS; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium: 1900 Head Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.353 \text{ mho/m}$; $\epsilon_r = 38.33$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 01-17-2013; Ambient Temp: 23.3°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3213; ConvF(5.02, 5.02, 5.02); Calibrated: 4/24/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn665; Calibrated: 4/19/2012

Phantom: SAM Right; Type: QD000P40CD; Serial: 1686

Measurement SW: DASY52, Version 52.8 (3); SEMCAD X Version 14.6.7 (6848)

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

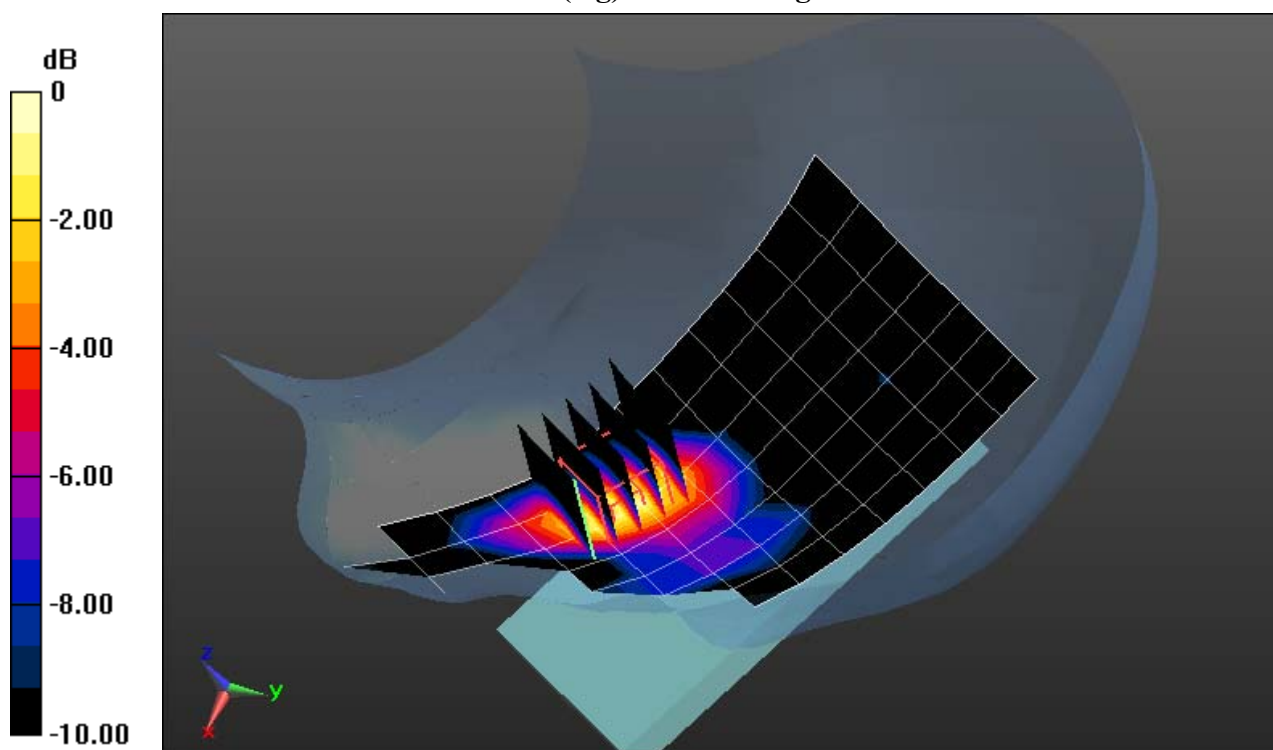
Area Scan (7x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 7.589 V/m; Power Drift = 0.20 dB

Peak SAR (extrapolated) = 0.148 W/kg

SAR(1 g) = 0.092 W/kg



0 dB = 0.102 W/kg = -9.91 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC_F

Communication System: IEEE 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium: 2450 Head Medium parameters used (interpolated):

$f = 2412 \text{ MHz}$; $\sigma = 1.77 \text{ mho/m}$; $\epsilon_r = 40.167$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 12-12-2012; Ambient Temp: 24.0°C; Tissue Temp: 22.5°C

Probe: ES3DV3 - SN3288; ConvF(4.61, 4.61, 4.61); Calibrated: 9/20/2012;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/19/2012

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

Measurement SW: DASY52, Version 52.8 (3); SEMCAD X Version 14.6.7 (6848)

Mode: IEEE 802.11b, Left Head, Cheek, Ch 01, 1 Mbps

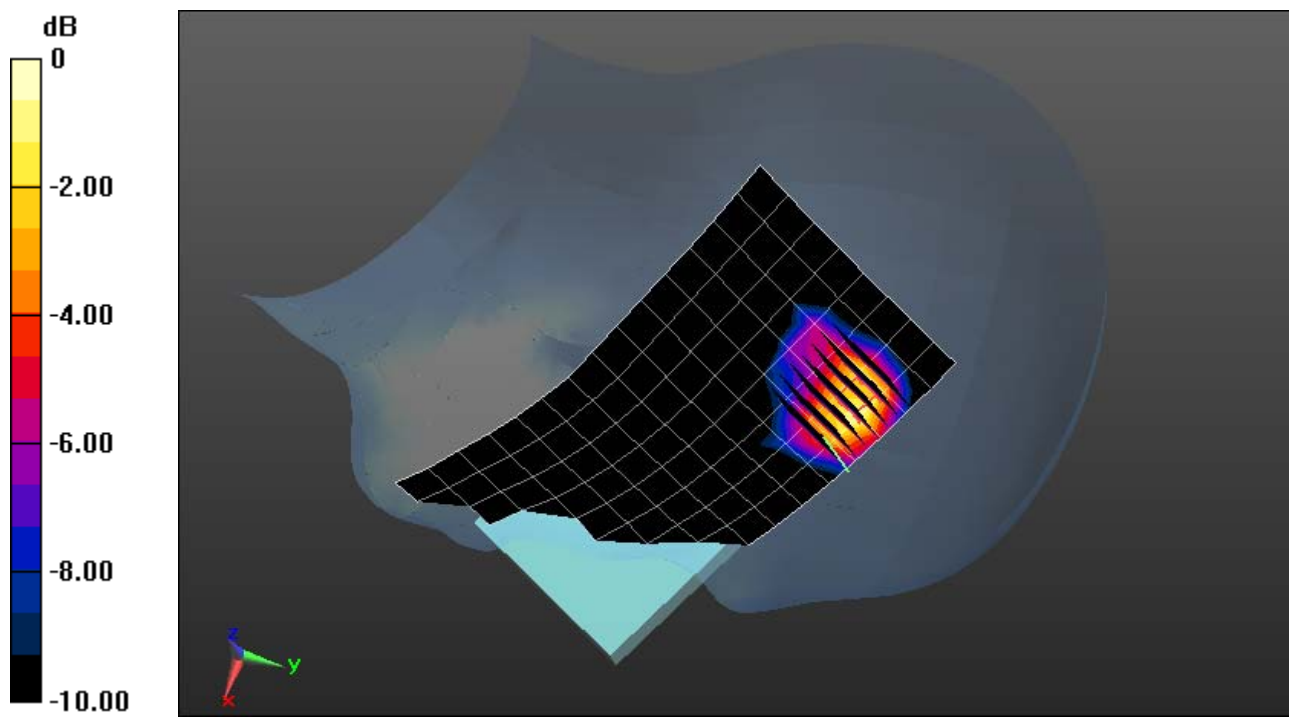
Area Scan (9x15x1): Measurement grid: $dx=12\text{mm}$, $dy=12\text{mm}$

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

Reference Value = 4.633 V/m; Power Drift = 0.029 dB

Peak SAR (extrapolated) = 0.137 W/kg

SAR(1 g) = 0.035 W/kg



0 dB = 0.0480 W/kg = -13.19 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC_C

Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5240 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$f = 5240 \text{ MHz}$; $\sigma = 4.548 \text{ mho/m}$; $\epsilon_r = 36.06$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 12-17-2012; Ambient Temp: 23.8°C; Tissue Temp: 24.0°C

Probe: EX3DV4 - SN3561; ConvF(4.45, 4.45, 4.45); Calibrated: 7/26/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2012

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

Mode: IEEE 802.11a, 5.2 GHz Left Head, Cheek, Ch 48, 6 Mbps

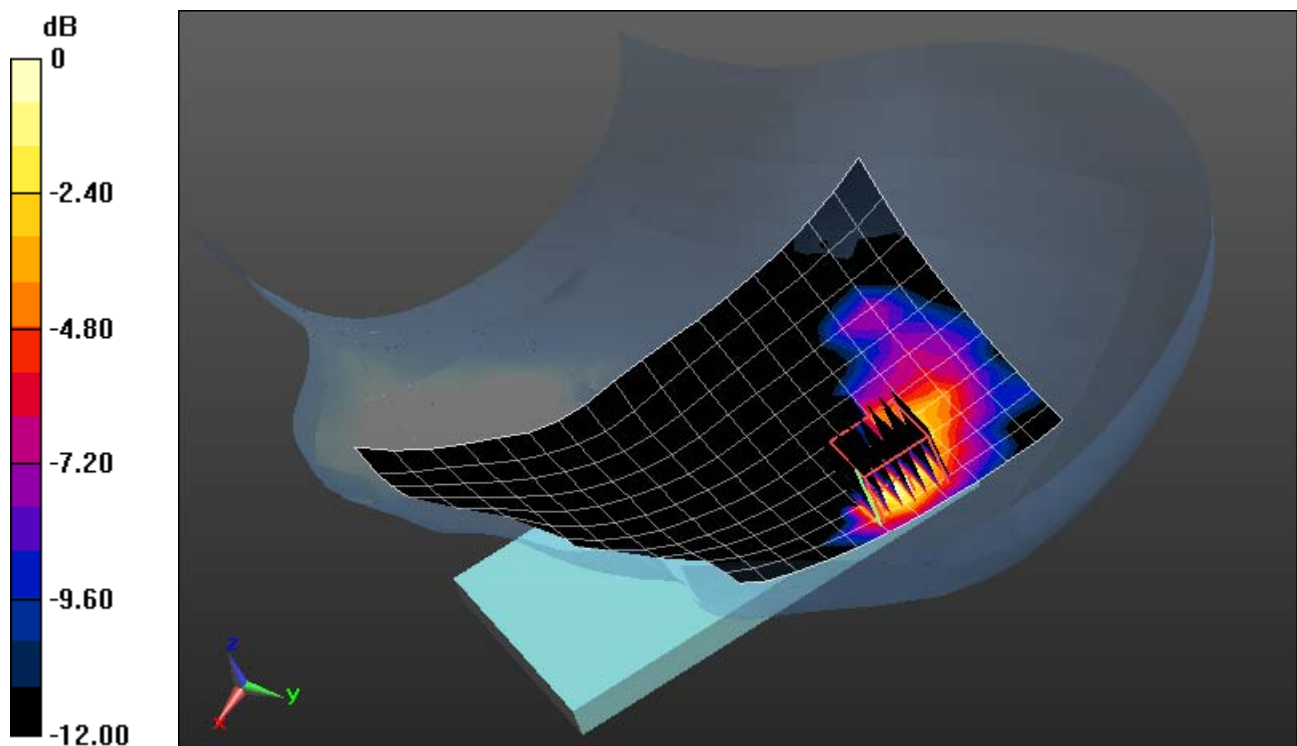
Area Scan (12x18x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Zoom Scan (7x7x12)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=2\text{mm}$

Reference Value = 4.656 V/m; Power Drift = 0.022 dB

Peak SAR (extrapolated) = 0.289 W/kg

SAR(1 g) = 0.078 W/kg; SAR(10 g) = 0.028 W/kg



0 dB = 0.149 W/kg = -8.27 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC_C

Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5745 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$f = 5745 \text{ MHz}$; $\sigma = 5.038 \text{ mho/m}$; $\epsilon_r = 35.4$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

Test Date: 12-17-2012; Ambient Temp: 24.9°C; Tissue Temp: 24.3°C

Probe: EX3DV4 - SN3561; ConvF(3.92, 3.92, 3.92); Calibrated: 7/26/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2012

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

Mode: IEEE 802.11a, 5.8 GHz Left Head, Tilt, Ch 149, 6 Mbps

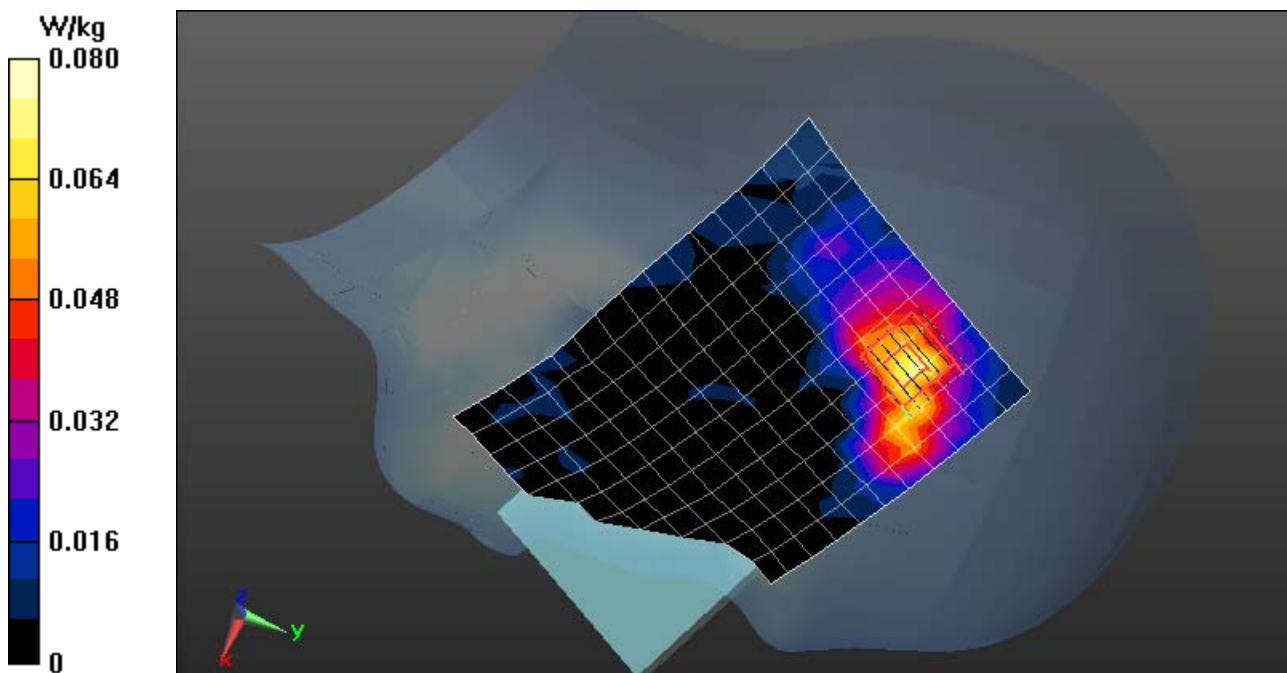
Area Scan (12x16x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Zoom Scan (7x7x12)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=2\text{mm}$

Reference Value = 1.652 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 0.234 W/kg

SAR(1 g) = 0.014 W/kg; SAR(10 g) = 0.00276 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC_B

Communication System: LTE RF; Frequency: 782 MHz; Duty Cycle: 1:1

Medium: 785 Body Medium parameters used (interpolated):

$f = 782 \text{ MHz}$; $\sigma = 0.997 \text{ mho/m}$; $\epsilon_r = 53.984$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-07-2013; Ambient Temp: 24.5°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3209; ConvF(6.23, 6.23, 6.23); Calibrated: 3/16/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/20/2012

Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

Mode: LTE Band 13, Body SAR, Back side, Mid.ch

10 MHz Bandwidth, QPSK, 1 RB, RB Offset 0

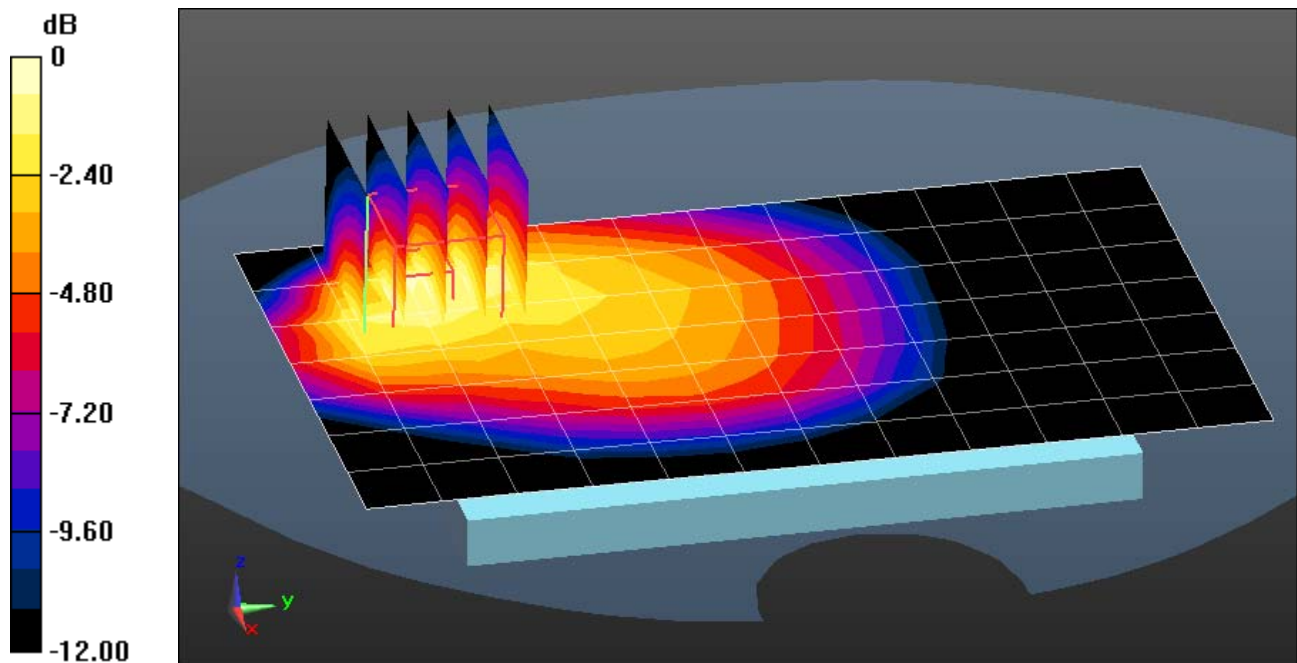
Area Scan (8x13x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 17.511 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 0.499 W/kg

SAR(1 g) = 0.308 W/kg; SAR(10 g) = 0.196 W/kg



0 dB = 0.339 W/kg = -4.70 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC_A

Communication System: Cellular CDMA; Frequency: 836.52 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 836.52 \text{ MHz}$; $\sigma = 0.94 \text{ mho/m}$; $\epsilon_r = 55.279$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-19-2012; Ambient Temp: 24.2°C; Tissue Temp: 23.3°C

Probe: ES3DV3 - SN3209; ConvF(6.13, 6.13, 6.13); Calibrated: 3/16/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/20/2012

Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

Mode: Cell. TDSO, Body SAR, Back side, Mid.ch

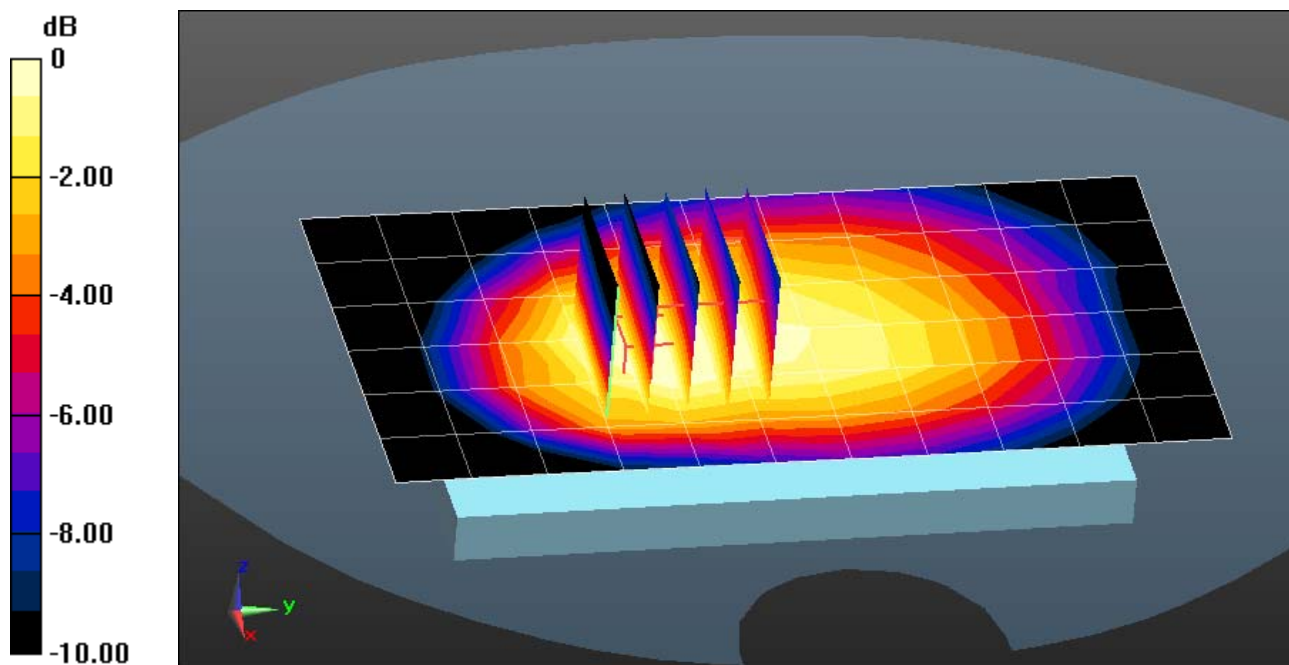
Area Scan (7x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 30.162 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 1.15 W/kg

SAR(1 g) = 0.730 W/kg; SAR(10 g) = 0.516 W/kg



0 dB = 0.767 W/kg = -1.15 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC_A

Communication System: CDMA; Frequency: 824.7 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 824.7 \text{ MHz}$; $\sigma = 0.962 \text{ mho/m}$; $\epsilon_r = 54$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-18-2012; Ambient Temp: 23.1°C; Tissue Temp: 21.4°C

Probe: ES3DV3 - SN3263; ConvF(6.15, 6.15, 6.15); Calibrated: 5/18/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 5/7/2012

Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647

Measurement SW: DASY52, Version 52.8 (3); SEMCAD X Version 14.6.7 (6848)

Mode: Cell. EVDO Rev. 0, Body SAR, Back side, Low.ch

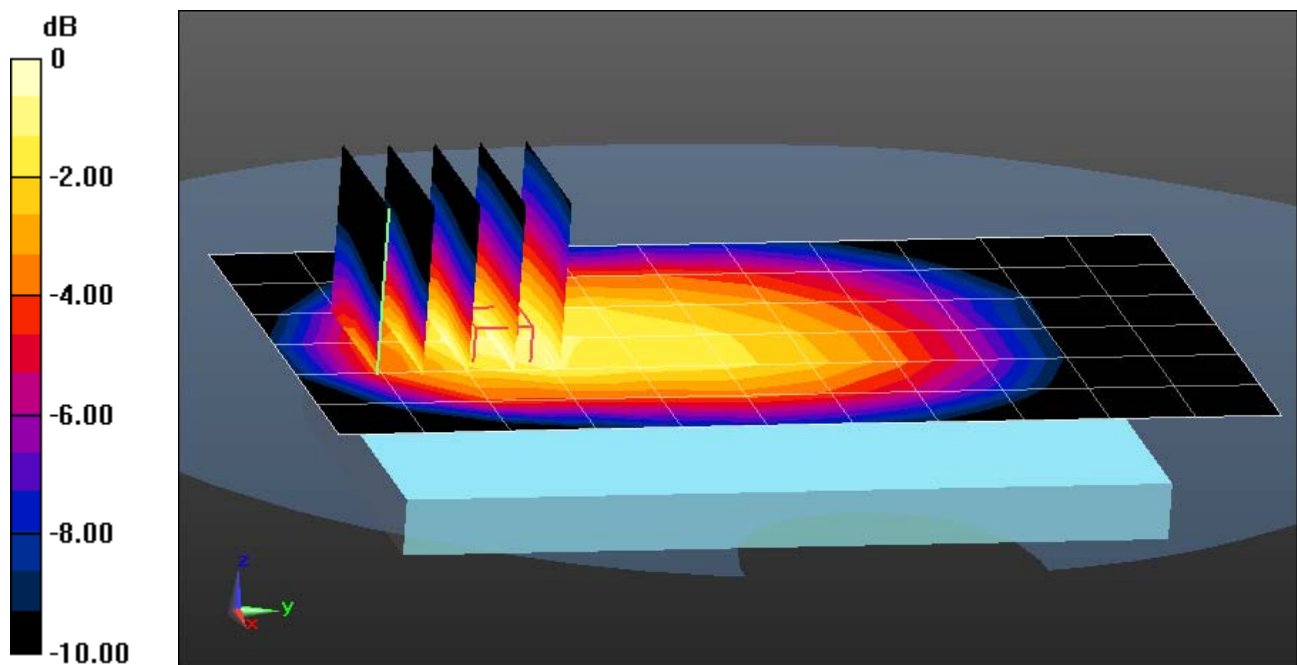
Area Scan (7x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 34.221 V/m; Power Drift = -0.044 dB

Peak SAR (extrapolated) = 1.74 W/kg

SAR(1 g) = 0.979 W/kg



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

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC_F

Communication System: GSM850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium: 835 Body Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$; $\sigma = 0.986 \text{ mho/m}$; $\epsilon_r = 53.129$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-10-2012; Ambient Temp: 23.8°C; Tissue Temp: 23.2°C

Probe: ES3DV2 - SN3022; ConvF(6.02, 6.02, 6.02); Calibrated: 8/28/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

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

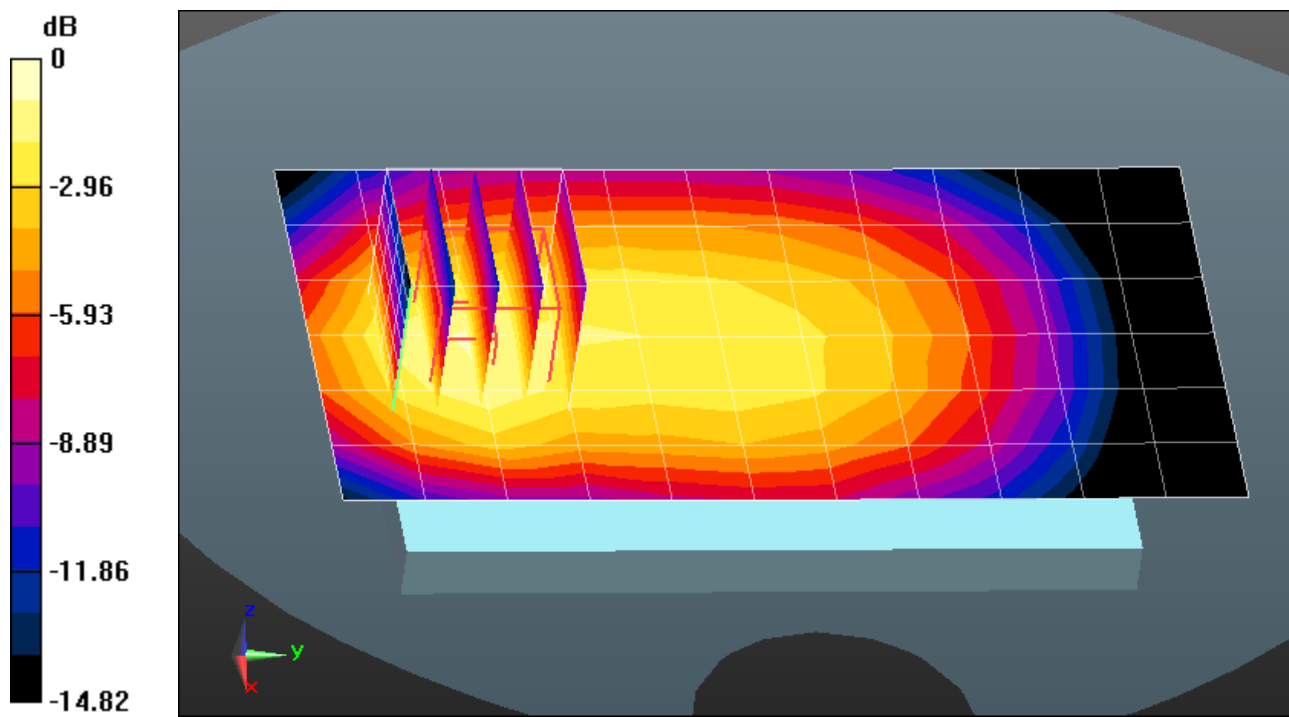
Area Scan (7x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 18.245 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 0.523 W/kg

SAR(1 g) = 0.309 W/kg; SAR(10 g) = 0.193 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC_F

Communication System: GSM850 GPRS; 2 Tx slots; Frequency: 836.6 MHz; Duty Cycle: 1:4.15

Medium: 835 Body Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$; $\sigma = 0.986 \text{ mho/m}$; $\epsilon_r = 53.129$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-10-2012; Ambient Temp: 23.8°C; Tissue Temp: 23.2°C

Probe: ES3DV2 - SN3022; ConvF(6.02, 6.02, 6.02); Calibrated: 8/28/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

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

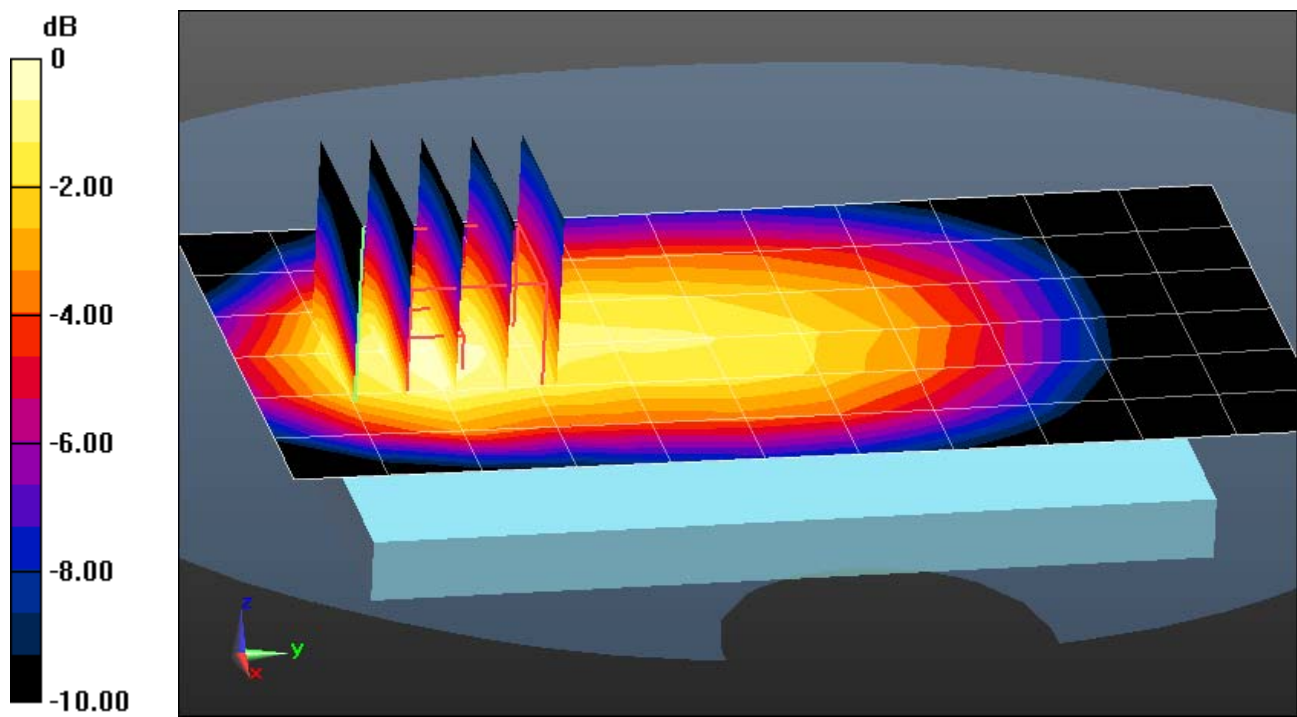
Area Scan (7x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 21.693 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 0.688 W/kg

SAR(1 g) = 0.421 W/kg; SAR(10 g) = 0.274 W/kg



0 dB = 0.454 W/kg = -3.43 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC_F

Communication System: WCDMA850; Frequency: 836.6 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used (interpolated):

$f = 836.6 \text{ MHz}$; $\sigma = 0.986 \text{ mho/m}$; $\epsilon_r = 53.129$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-10-2012; Ambient Temp: 23.8°C; Tissue Temp: 23.2°C

Probe: ES3DV2 - SN3022; ConvF(6.02, 6.02, 6.02); Calibrated: 8/28/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

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

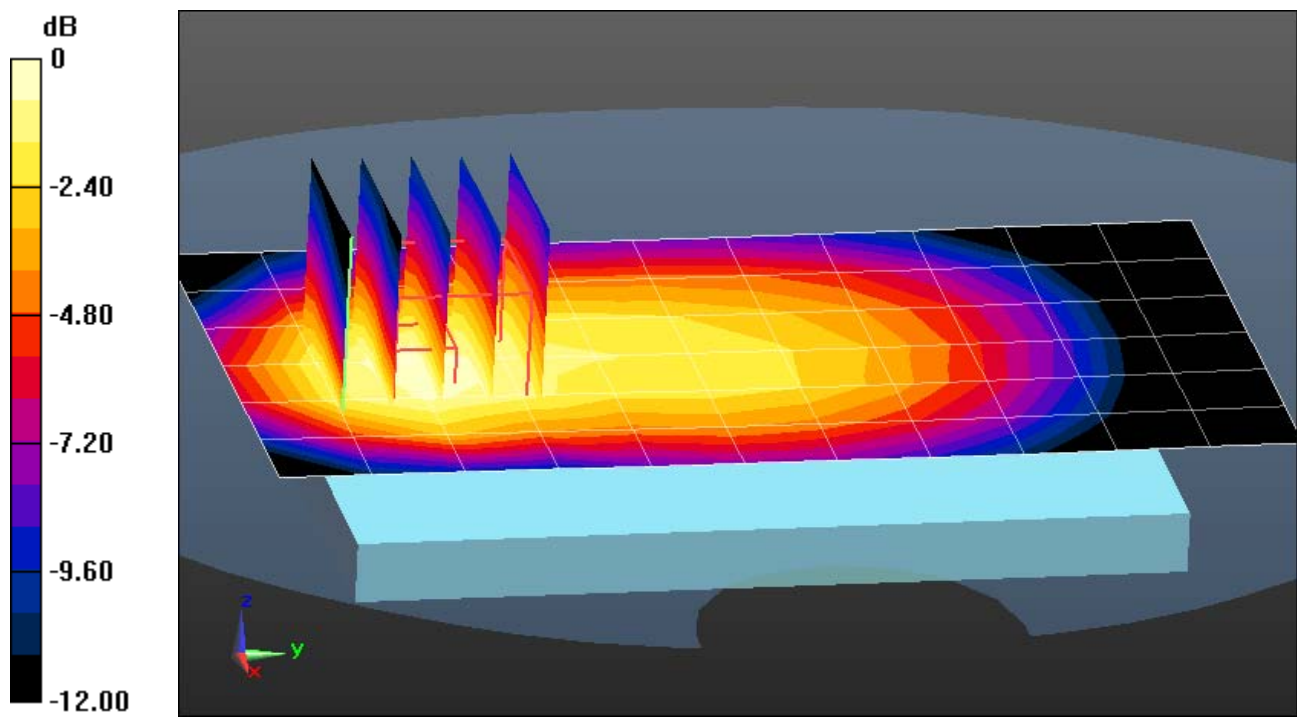
Area Scan (7x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 20.138 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 0.599 W/kg

SAR(1 g) = 0.356 W/kg; SAR(10 g) = 0.229 W/kg



PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC_B

Communication System: LTE RF; Frequency: 1732.5 MHz; Duty Cycle: 1:1

Medium: 1750 Body Medium parameters used (interpolated):

$f = 1732.5 \text{ MHz}$; $\sigma = 1.511 \text{ mho/m}$; $\epsilon_r = 53.126$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-02-2013; Ambient Temp: 23.2°C; Tissue Temp: 22.9°C

Probe: ES3DV3 - SN3209; ConvF(4.83, 4.83, 4.83); Calibrated: 3/16/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/20/2012

Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

Mode: LTE Band 4 (AWS), Body SAR, Back side, Mid.ch

20 MHz Bandwidth, QPSK, 1 RB, RB Offset 99

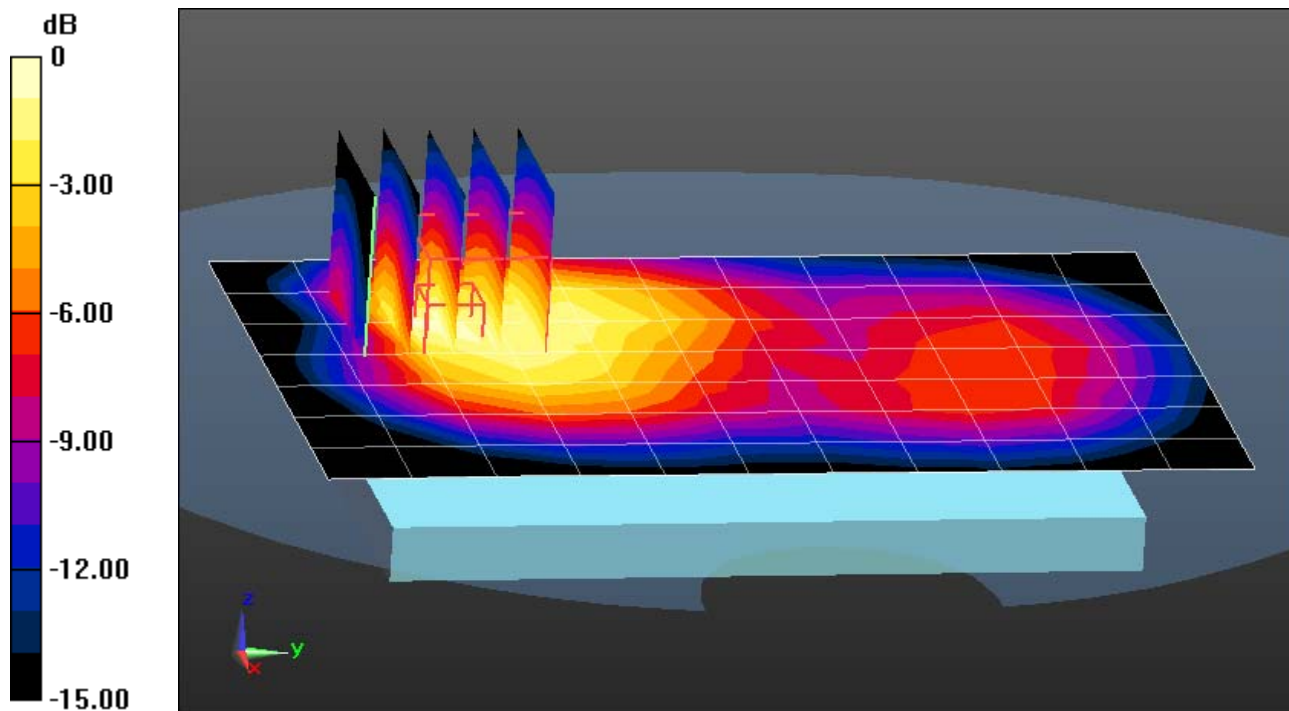
Area Scan (8x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 18.982 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 0.910 W/kg

SAR(1 g) = 0.545 W/kg; SAR(10 g) = 0.323 W/kg



0 dB = 0.618 W/kg = -2.09 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC#2

Communication System: CDMA; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.492 \text{ mho/m}$; $\epsilon_r = 53.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-17-2013; Ambient Temp: 24.6°C; Tissue Temp: 23.7°C

Probe: ES3DV3 - SN3263; ConvF(4.76, 4.76, 4.76); Calibrated: 5/18/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 5/7/2012

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.7 (6848)

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

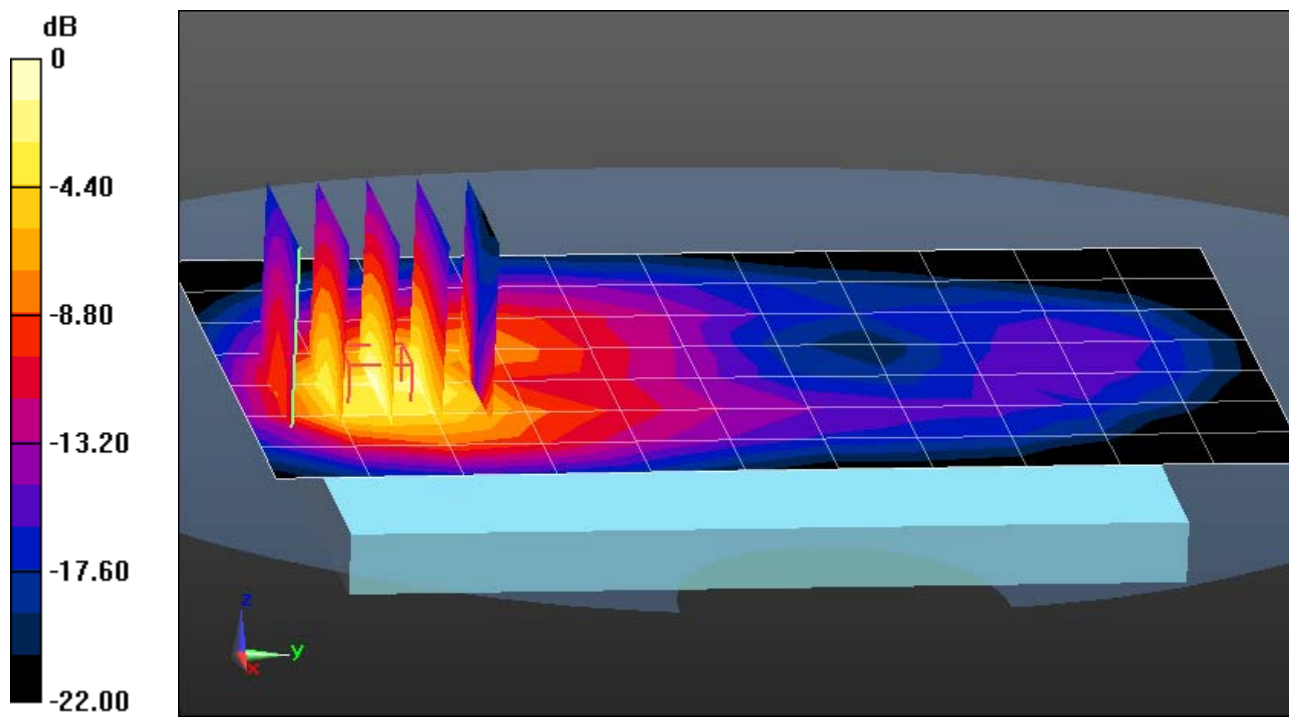
Area Scan (8x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 17.732 V/m; Power Drift = 0.023 dB

Peak SAR (extrapolated) = 1.23 W/kg

SAR(1 g) = 0.620 W/kg



0 dB = 0.735 W/kg = -1.34 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC#2

Communication System: CDMA; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.492 \text{ mho/m}$; $\epsilon_r = 53.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-17-2013; Ambient Temp: 24.6°C; Tissue Temp: 23.7°C

Probe: ES3DV3 - SN3263; ConvF(4.76, 4.76, 4.76); Calibrated: 5/18/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 5/7/2012

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.7 (6848)

Mode: PCS EVDO Rev. 0, Body SAR, Back side, Mid.ch

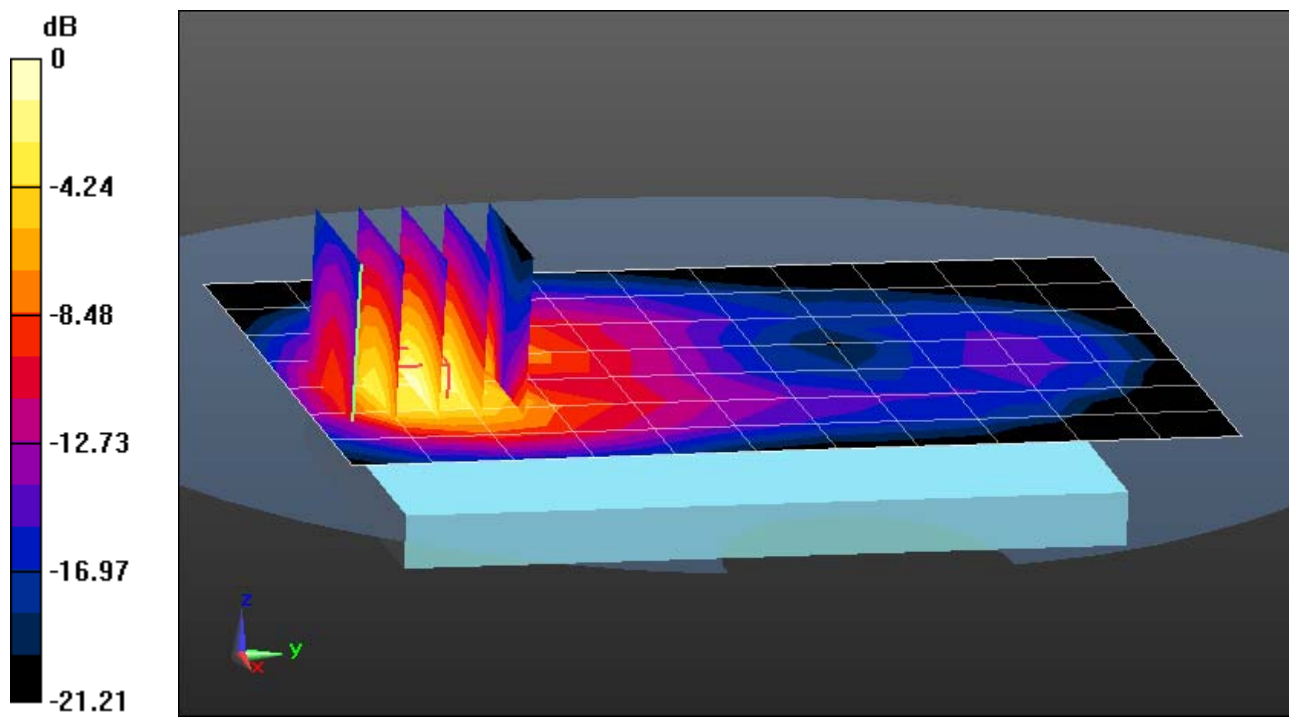
Area Scan (8x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 16.819 V/m; Power Drift = 0.028 dB

Peak SAR (extrapolated) = 1.07 W/kg

SAR(1 g) = 0.539 W/kg



0 dB = 0.633 W/kg = -1.99 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC_A

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.496 \text{ mho/m}$; $\epsilon_r = 52.16$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-10-2012; Ambient Temp: 23.0°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3209; ConvF(4.63, 4.63, 4.63); Calibrated: 3/16/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/20/2012

Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

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

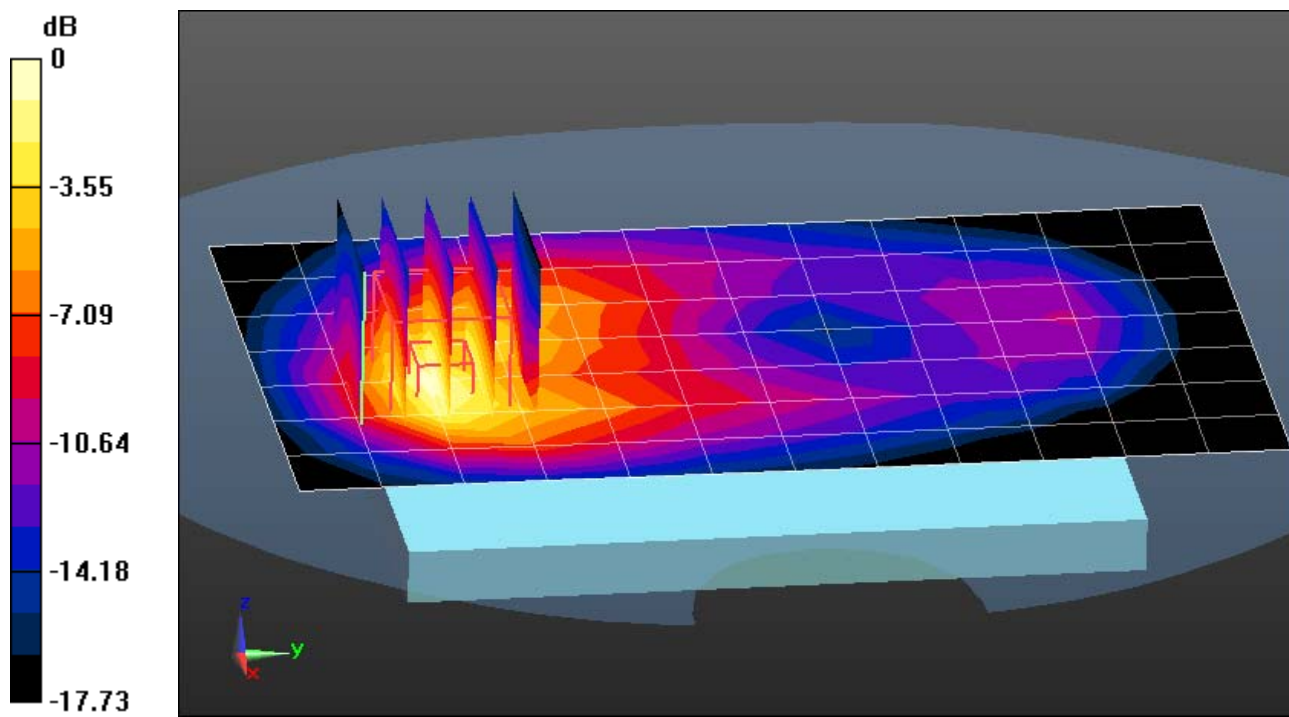
Area Scan (8x13x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 23.850 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 1.35 W/kg

SAR(1 g) = 0.757 W/kg; SAR(10 g) = 0.388 W/kg



0 dB = 0.868 W/kg = -0.61 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC_A

Communication System: GSM GPRS; 2 Tx slots; Frequency: 1880 MHz; Duty Cycle: 1:4.15

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.492 \text{ mho/m}$; $\epsilon_r = 53.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-17-2013; Ambient Temp: 24.6°C; Tissue Temp: 23.7°C

Probe: ES3DV3 - SN3263; ConvF(4.76, 4.76, 4.76); Calibrated: 5/18/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 5/7/2012

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.7 (6848)

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

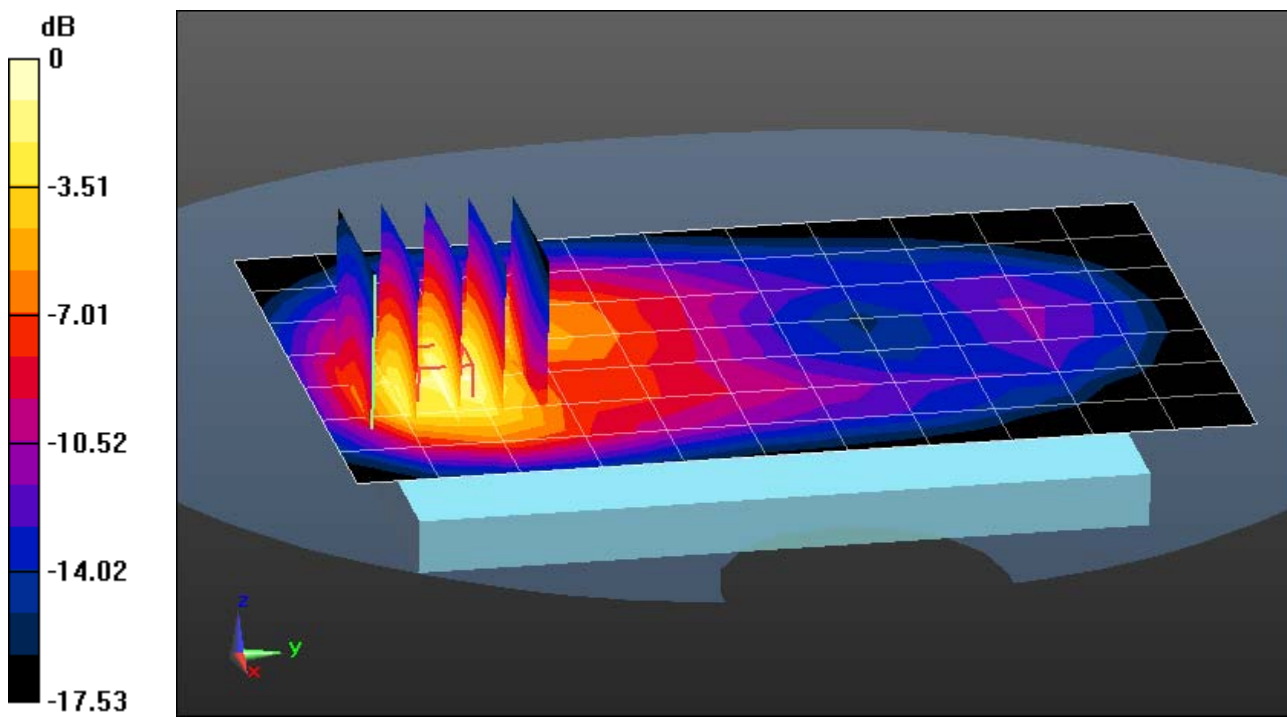
Area Scan (8x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 24.242 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 1.67 W/kg

SAR(1 g) = 0.932 W/kg



0 dB = 1.07 W/kg = 0.29 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC #2

Communication System: UMTS; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used:

$f = 1880 \text{ MHz}$; $\sigma = 1.492 \text{ mho/m}$; $\epsilon_r = 53.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-17-2013; Ambient Temp: 24.6°C; Tissue Temp: 23.7°C

Probe: ES3DV3 - SN3263; ConvF(4.76, 4.76, 4.76); Calibrated: 5/18/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 5/7/2012

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.7 (6848)

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

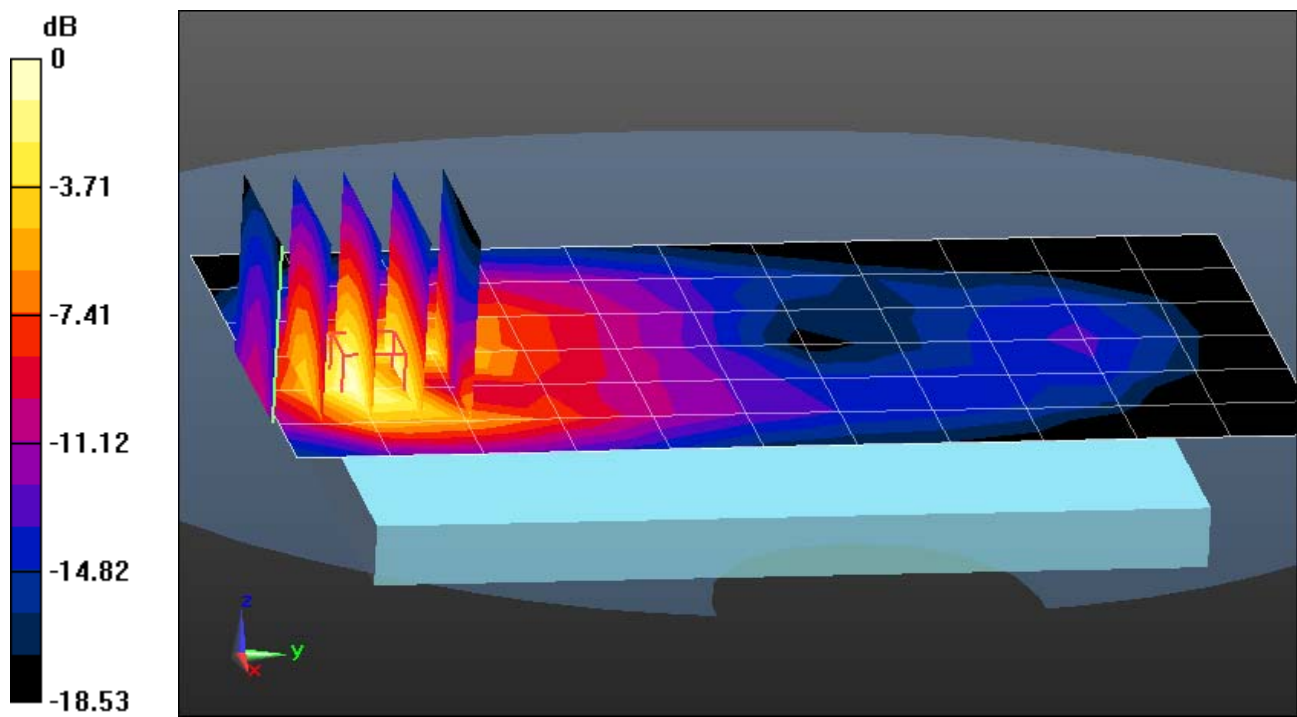
Area Scan (7x12x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Reference Value = 22.944 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 1.44 W/kg

SAR(1 g) = 0.723 W/kg



0 dB = 0.785 W/kg = -1.05 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC_C

Communication System: IEEE 802.11b; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2412 \text{ MHz}$; $\sigma = 1.93 \text{ mho/m}$; $\epsilon_r = 50.807$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-11-2012; Ambient Temp: 24.4°C; Tissue Temp: 23.3°C

Probe: ES3DV3 - SN3258; ConvF(4.28, 4.28, 4.28); Calibrated: 2/21/2012;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/18/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

Mode: IEEE 802.11b, Body SAR, Ch 01, 1 Mbps, Back Side

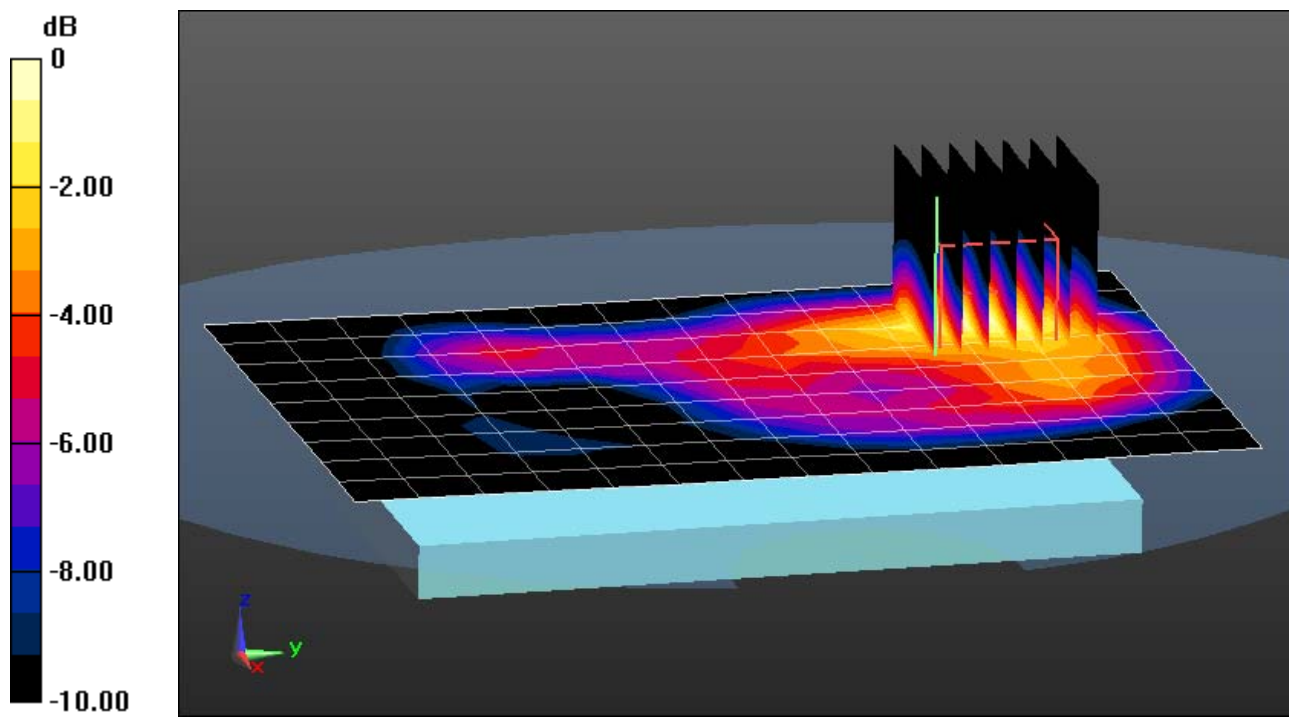
Area Scan (10x15x1): Measurement grid: $dx=12\text{mm}$, $dy=12\text{mm}$

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

Reference Value = 8.244 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 0.264 W/kg

SAR(1 g) = 0.125 W/kg; SAR(10 g) = 0.063 W/kg



0 dB = 0.161 W/kg = -7.93 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC_C

Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5240 MHz; Duty Cycle: 1:1

Medium: 5GHz Body Medium parameters used:

$f = 5240 \text{ MHz}$; $\sigma = 5.351 \text{ mho/m}$; $\epsilon_r = 47.95$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-13-2012; Ambient Temp: 22.5°C; Tissue Temp: 21.9°C

Probe: EX3DV4 - SN3589; ConvF(3.92, 3.92, 3.92); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/18/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

Mode: IEEE 802.11a, 5.2 GHz, Body SAR, Ch 48, 6 Mbps, Back Side

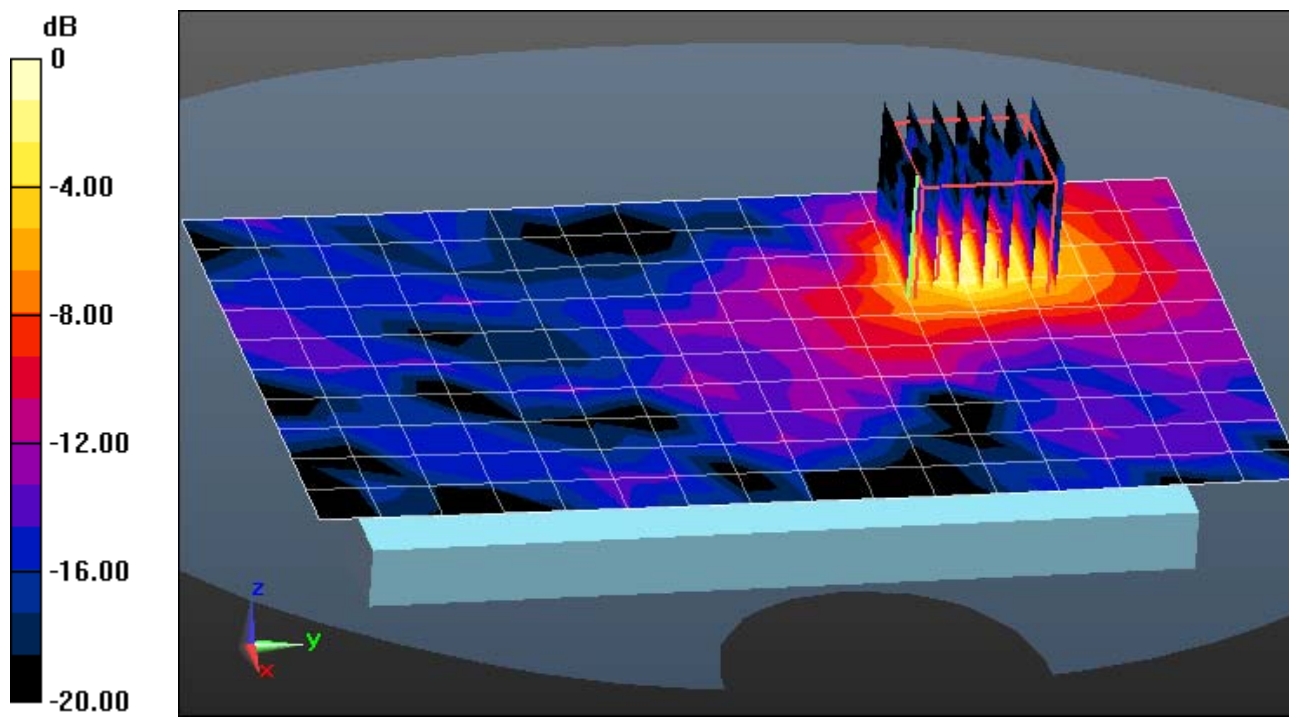
Area Scan (11x17x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Zoom Scan (7x7x12)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=2\text{mm}$

Reference Value = 6.302 V/m; Power Drift = -0.14 dB

Peak SAR (extrapolated) = 0.865 W/kg

SAR(1 g) = 0.206 W/kg; SAR(10 g) = 0.063 W/kg



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

PCTEST ENGINEERING LABORATORY, INC.

DUT: A3LSCHI425; Type: Portable Handset; Serial: FCC_C

Communication System: IEEE 802.11a 5.2-5.8 GHz Band; Frequency: 5745 MHz; Duty Cycle: 1:1

Medium: 5GHz Body Medium parameters used:

$f = 5745 \text{ MHz}$; $\sigma = 6.092 \text{ mho/m}$; $\epsilon_r = 46.78$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-13-2012; Ambient Temp: 23.4°C; Tissue Temp: 21.7°C

Probe: EX3DV4 - SN3589; ConvF(3.59, 3.59, 3.59); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/18/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

Mode: IEEE 802.11a, 5.8 GHz, Body SAR, Ch 149, 6 Mbps, Back Side

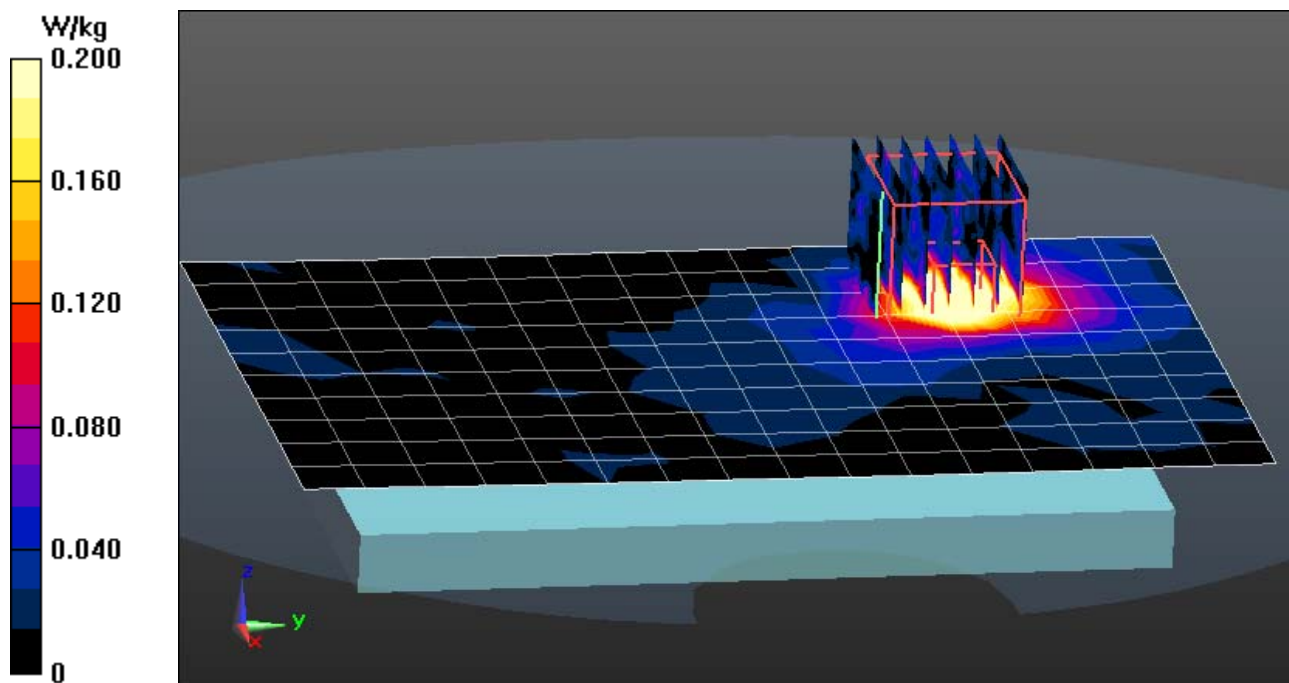
Area Scan (11x17x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

Zoom Scan (7x7x12)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=2\text{mm}$

Reference Value = 3.167 V/m; Power Drift = -0.096 dB

Peak SAR (extrapolated) = 0.278 W/kg

SAR(1 g) = 0.0482 W/kg; SAR(10 g) = 0.015 W/kg



APPENDIX B: SYSTEM VERIFICATION

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 750 MHz; Type: D750V3; Serial: 1054

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

Medium: 740 Head Medium parameters used (interpolated):

$f = 750 \text{ MHz}$; $\sigma = 0.876 \text{ mho/m}$; $\epsilon_r = 40.48$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 01-02-2013; Ambient Temp: 23.5°C; Tissue Temp: 23.1°C

Probe: ES3DV3 - SN3209; ConvF(6.47, 6.47, 6.47); Calibrated: 3/16/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/20/2012

Phantom: SAM with CRP; Type: SAM 4.0; Serial: TP1375

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

750 MHz System Verification

Area Scan (7x13x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

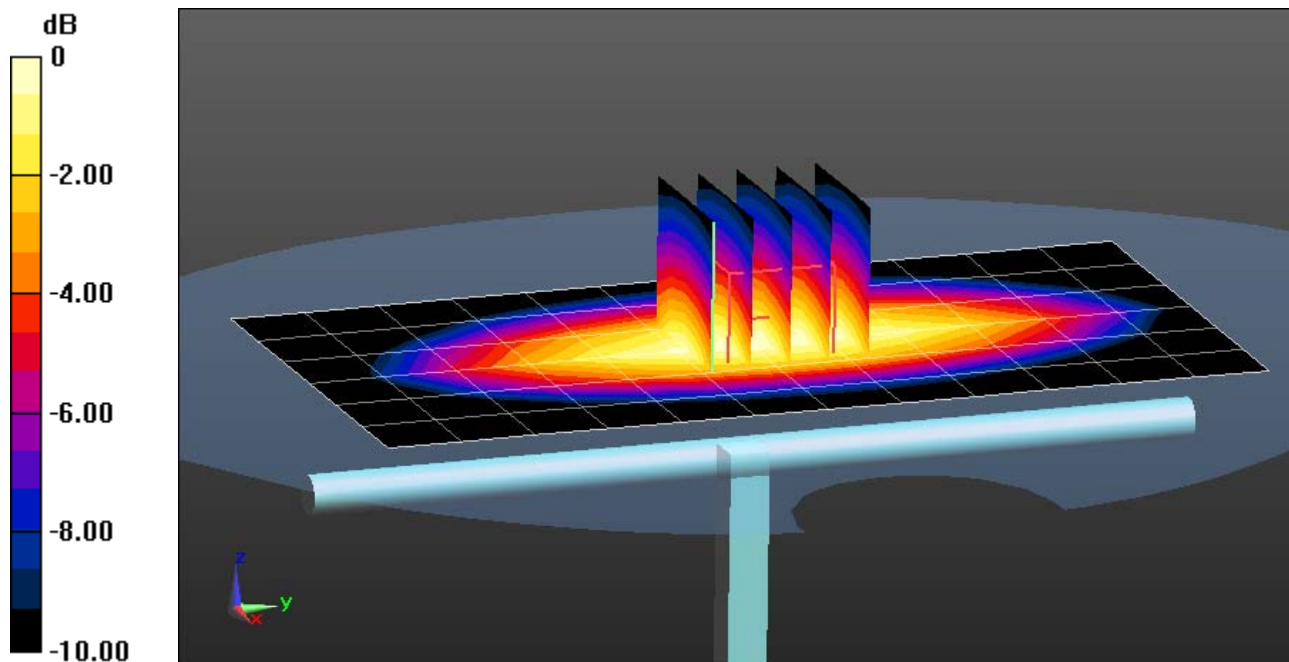
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 1.20 W/kg

SAR(1 g) = 0.818 W/kg; SAR(10 g) = 0.537 W/kg

Deviation = -3.99%



0 dB = 0.887 W/kg = -0.52 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: 835 Head Medium parameters used:

$f = 835 \text{ MHz}$; $\sigma = 0.889 \text{ mho/m}$; $\epsilon_r = 41.16$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 12-10-2012; Ambient Temp: 24.2°C; Tissue Temp: 22.3°C

Probe: ES3DV3 - SN3288; ConvF(6.41, 6.41, 6.41); Calibrated: 9/20/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/19/2012

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

Measurement SW: DASY52, Version 52.8 (3); SEMCAD X Version 14.6.7 (6848)

835 MHz System Verification

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

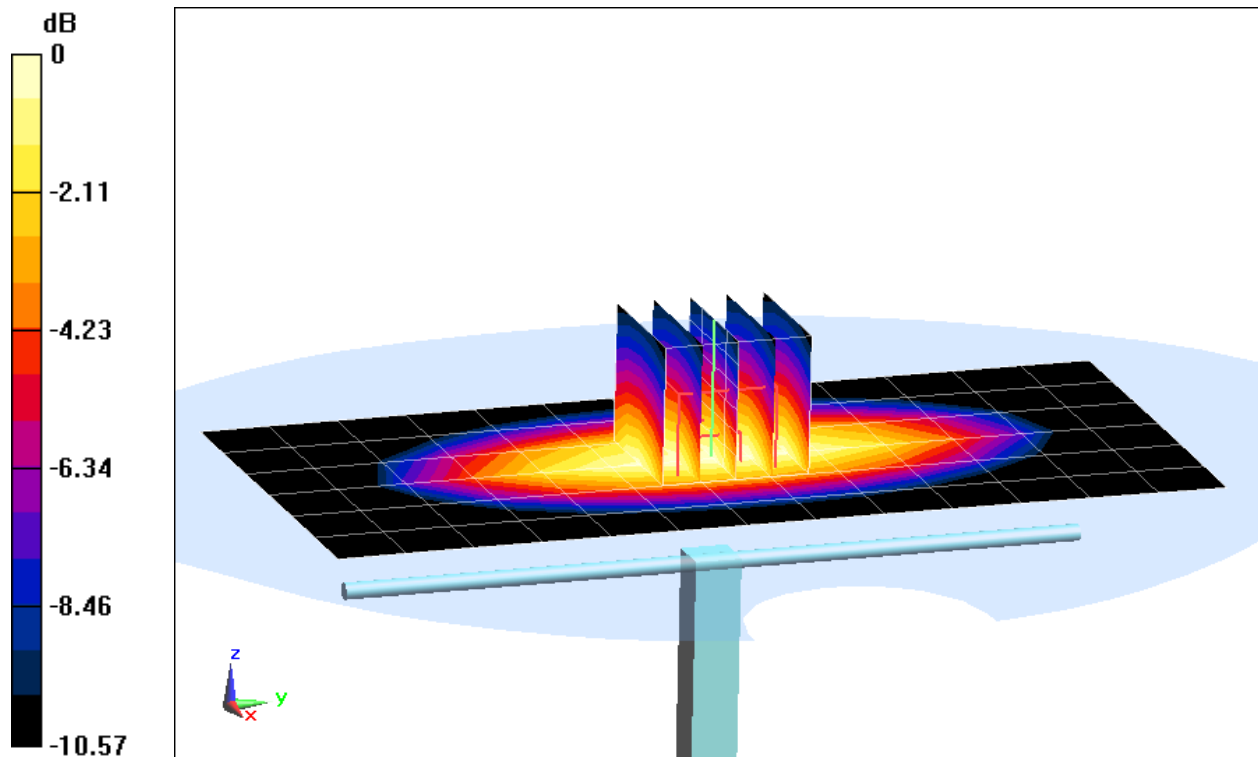
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20.0 dBm (100 mW)

Peak SAR (extrapolated) = 1.45 W/kg

SAR(1 g) = 0.974 W/kg; SAR(10 g) = 0.637 W/kg

Deviation = 3.07 %



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

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: 835 Head Medium parameters used:

$f = 835 \text{ MHz}$; $\sigma = 0.898 \text{ mho/m}$; $\epsilon_r = 41.45$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 12-18-2012; Ambient Temp: 22.9°C; Tissue Temp: 20.9°C

Probe: ES3DV3 - SN3263; ConvF(6.16, 6.16, 6.16); Calibrated: 5/18/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 5/7/2012

Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647

Measurement SW: DASY52, Version 52.8 (3); SEMCAD X Version 14.6.7 (6848)

835 MHz System Verification

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

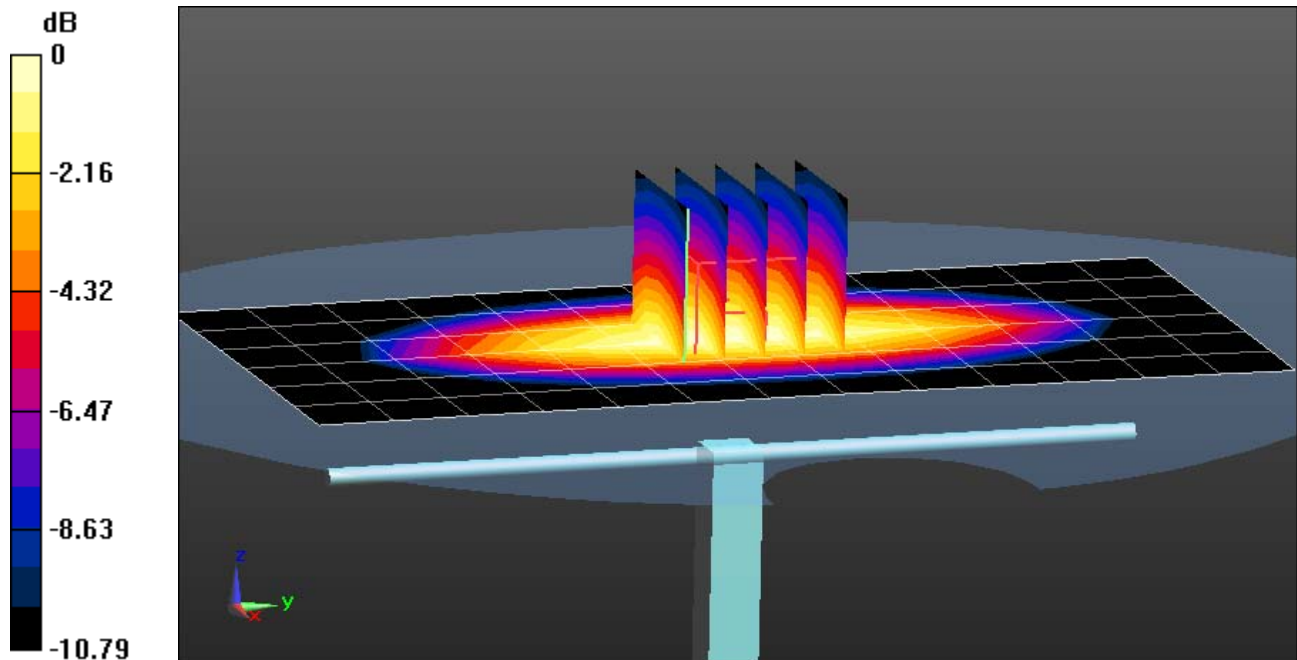
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 1.37 W/kg

SAR(1 g) = 0.922 W/kg; SAR(10 g) = 0.601 W/kg

Deviation = -2.43%



0 dB = 0.996 W/kg = -0.02 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: 1008

Communication System: CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium: 1750 Head Medium parameters used:

$f = 1750 \text{ MHz}$; $\sigma = 1.417 \text{ mho/m}$; $\epsilon_r = 38.53$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-28-2012; Ambient Temp: 22.2°C; Tissue Temp: 21.9°C

Probe: ES3DV3 - SN3209; ConvF(5.26, 5.26, 5.26); Calibrated: 3/16/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/20/2012

Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

1750 MHz System Verification

Area Scan (6x7x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

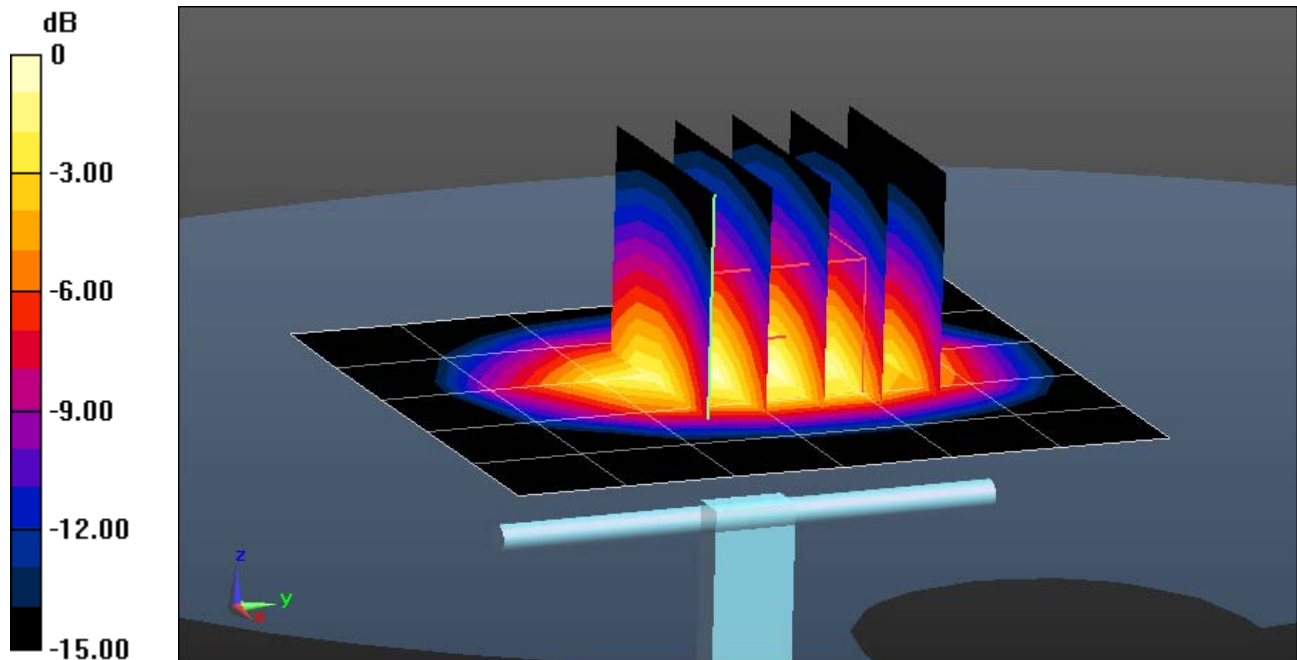
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 19.5 dBm (90 mW)

Peak SAR (extrapolated) = 6.10 W/kg

SAR(1 g) = 3.29 W/kg; SAR(10 g) = 1.7 W/kg

Deviation = 0.43%



0 dB = 3.64 W/kg = 5.61 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 502

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 Head Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$; $\sigma = 1.437 \text{ mho/m}$; $\epsilon_r = 38.193$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-11-2012; Ambient Temp: 24.4°C; Tissue Temp: 23.5°C

Probe: ES3DV3 - SN3209; ConvF(5.15, 5.15, 5.15); Calibrated: 3/16/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/20/2012

Phantom: SAM with CRP; Type: SAM; Serial: TP1375

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

1900 MHz System Verification

Area Scan (5x7x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

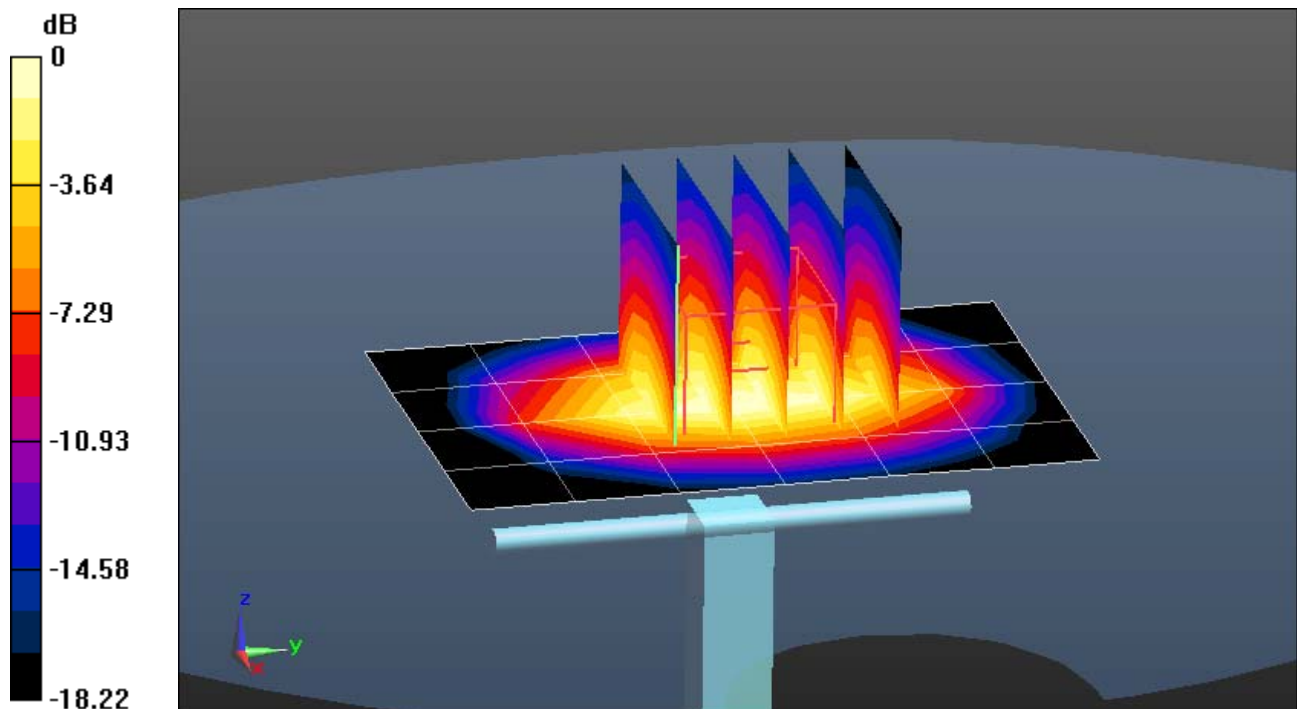
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 7.01 W/kg

SAR(1 g) = 3.77 W/kg; SAR(10 g) = 1.97 W/kg

Deviation = -3.83%



0 dB = 4.19 W/kg = 6.22 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 Head Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$; $\sigma = 1.459 \text{ mho/m}$; $\epsilon_r = 38.803$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-17-2012; Ambient Temp: 21.1°C; Tissue Temp: 19.4°C

Probe: ES3DV3 - SN3263; ConvF(5.09, 5.09, 5.09); Calibrated: 5/18/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 5/7/2012

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

Measurement SW: DASY52, Version 52.8 (3); SEMCAD X Version 14.6.7 (6848)

1900 MHz System Verification

Area Scan (7x9x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

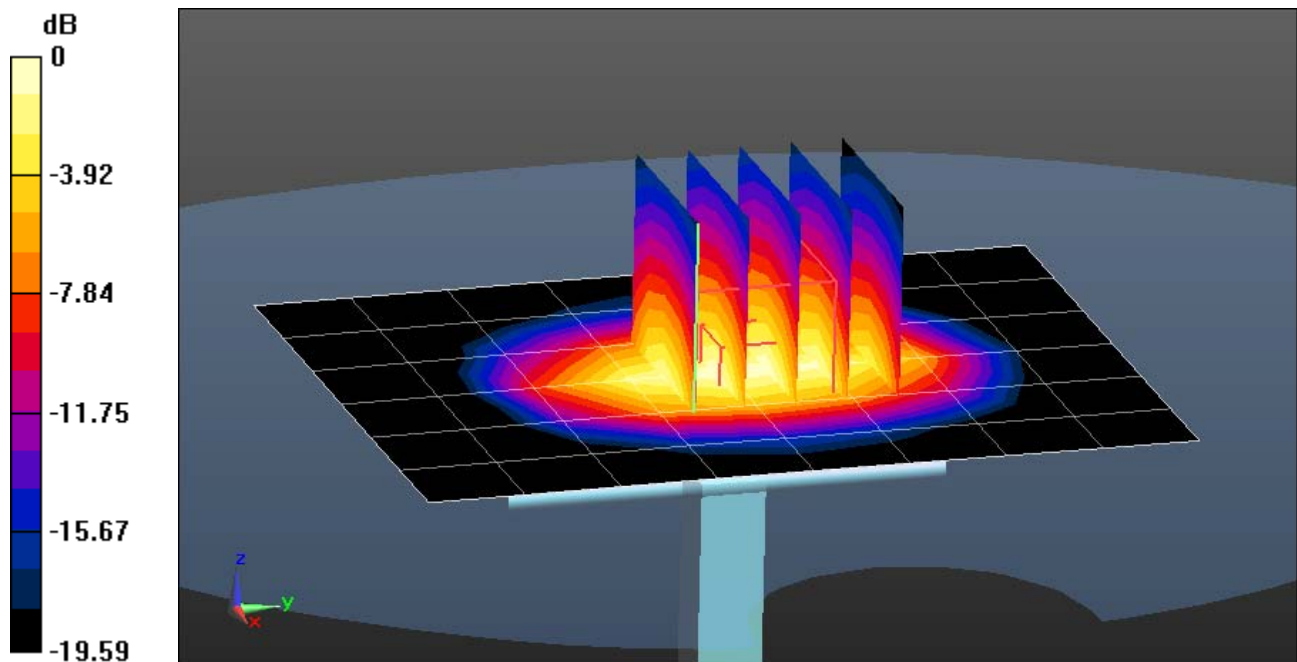
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 7.84 W/kg

SAR(1 g) = 4.04 W/kg; SAR(10 g) = 2.05 W/kg

Deviation = -0.25%



0 dB = 4.46 W/kg = 6.49 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 Head Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$; $\sigma = 1.378 \text{ mho/m}$; $\epsilon_r = 38.27$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-17-2013; Ambient Temp: 23.3°C; Tissue Temp: 22.7°C

Probe: ES3DV3 - SN3213; ConvF(5.02, 5.02, 5.02); Calibrated: 4/24/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn665; Calibrated: 4/19/2012

Phantom: SAM Right; Type: QD000P40CD; Serial: 1686

Measurement SW: DASY52, Version 52.8 (3); SEMCAD X Version 14.6.7 (6848)

1900 MHz System Verification

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

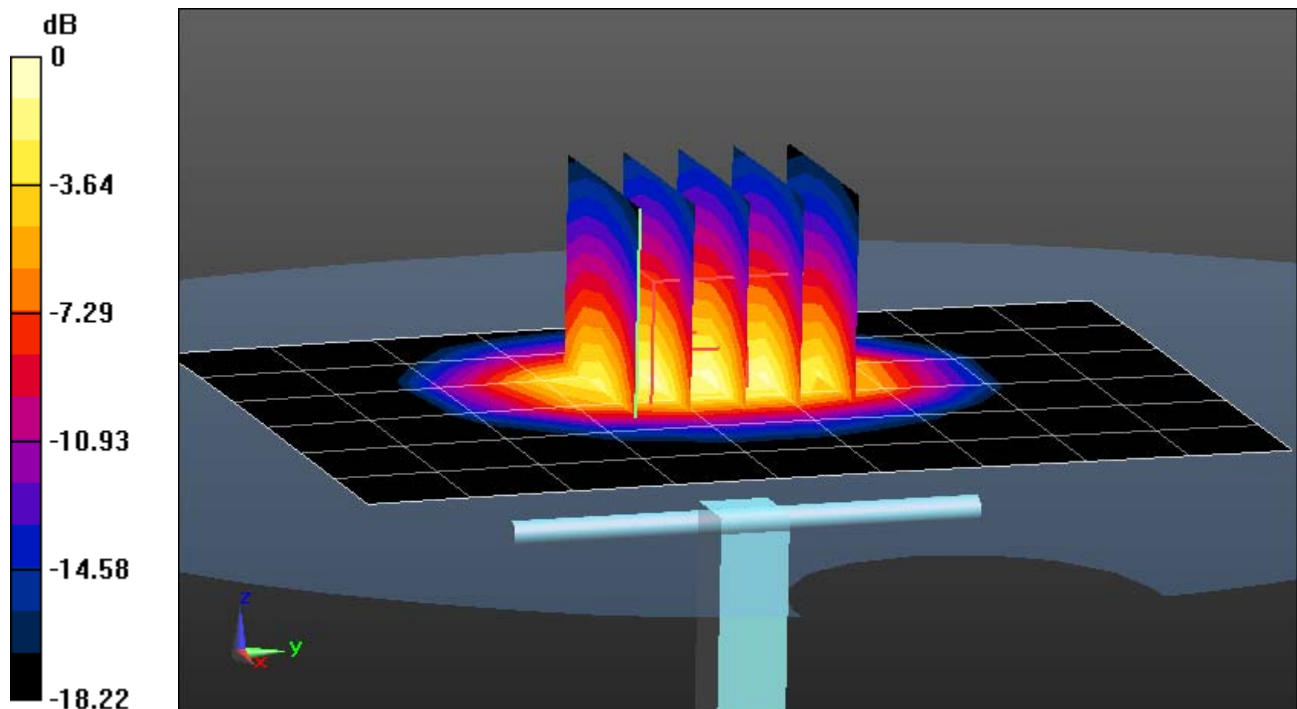
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 7.36 W/kg

SAR(1 g) = 3.91 W/kg; SAR(10 g) = 2.01 W/kg

Deviation = -3.46%



0 dB = 4.37 W/kg = 6.40 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: 2450 Head Medium parameters used:

$f = 2450 \text{ MHz}$; $\sigma = 1.814 \text{ mho/m}$; $\epsilon_r = 40.02$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-12-2012; Ambient Temp: 24.0°C; Tissue Temp: 22.5°C

Probe: ES3DV3 - SN3288; ConvF(4.61, 4.61, 4.61); Calibrated: 9/20/2012;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 9/19/2012

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

Measurement SW: DASY52, Version 52.8 (3); SEMCAD X Version 14.6.7 (6848)

2450 MHz System Verification

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

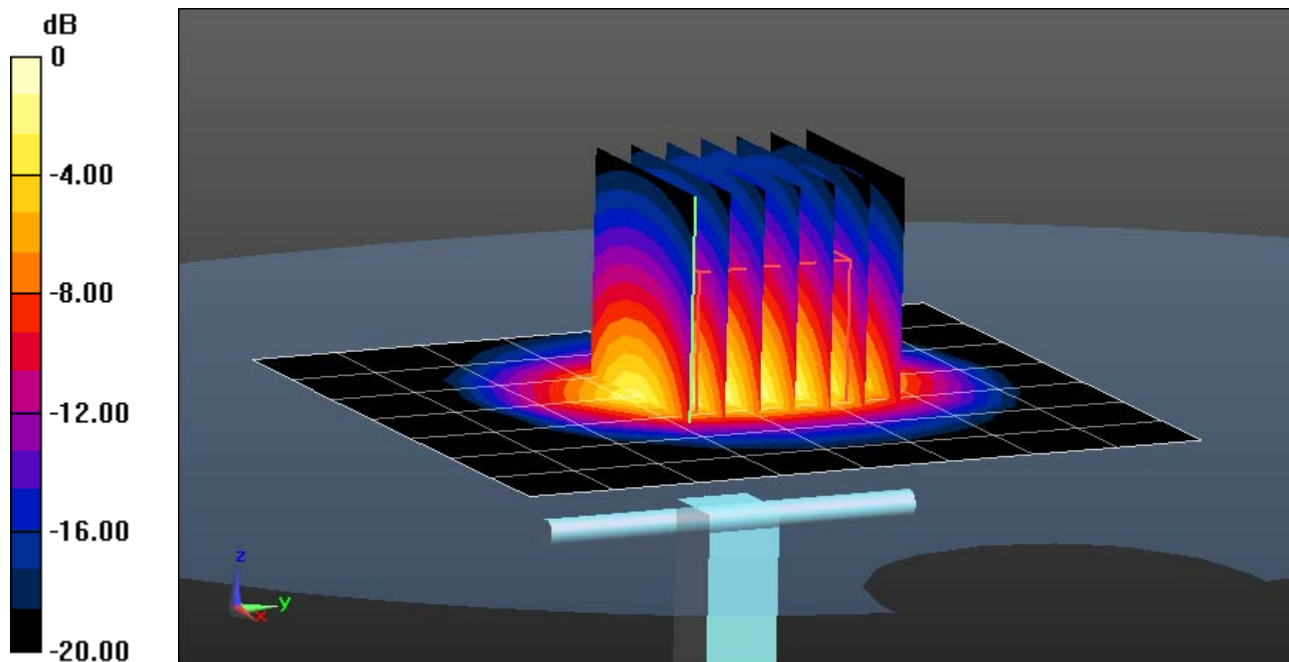
Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 10.2 W/kg

SAR(1 g) = 5.00 W/kg; SAR(10 g) = 2.34 W/kg

Deviation = -6.54%



0 dB = 6.52 W/kg = 8.14 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 5200 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$f = 5200 \text{ MHz}$; $\sigma = 4.505 \text{ mho/m}$; $\epsilon_r = 36.13$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-17-2012; Ambient Temp: 23.8°C; Tissue Temp: 24.0°C

Probe: EX3DV4 - SN3561; ConvF(4.45, 4.45, 4.45); Calibrated: 7/26/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2012

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

5200 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm

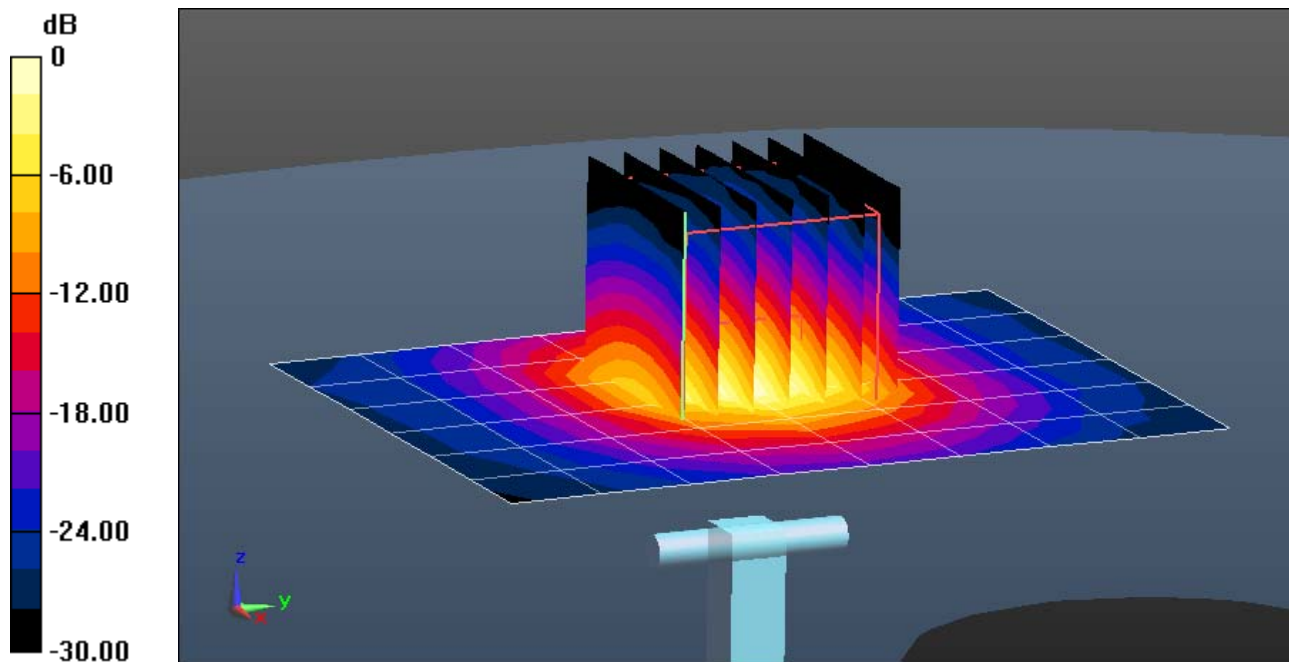
Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 33.2 W/kg

SAR(1 g) = 7.88 W/kg; SAR(10 g) = 2.28 W/kg

Deviation = -1.25%



0 dB = 16.0 W/kg = 12.04 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 5300 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$f = 5300 \text{ MHz}$; $\sigma = 4.625 \text{ mho/m}$; $\epsilon_r = 35.98$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-17-2012; Ambient Temp: 24.3°C; Tissue Temp: 24.1°C

Probe: EX3DV4 - SN3561; ConvF(4.16, 4.16, 4.16); Calibrated: 7/26/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2012

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

5300 MHz System Verification

Area Scan (7x9x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

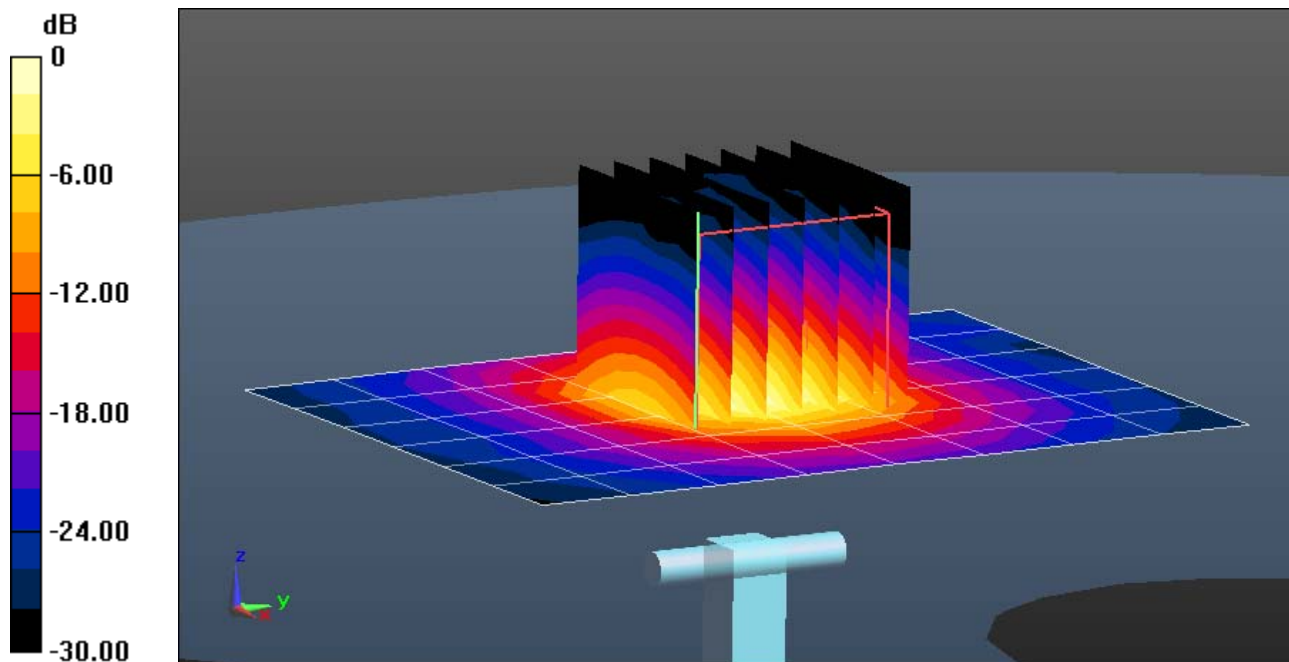
Zoom Scan (7x7x12)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=2\text{mm}$

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 34.6 W/kg

SAR(1 g) = 8.16 W/kg; SAR(10 g) = 2.33 W/kg

Deviation = -1.81%



0 dB = 16.5 W/kg = 12.17 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 5500 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$f = 5500 \text{ MHz}$; $\sigma = 4.776 \text{ mho/m}$; $\epsilon_r = 35.71$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-17-2012; Ambient Temp: 24.4°C; Tissue Temp: 24.1°C

Probe: EX3DV4 - SN3561; ConvF(4.18, 4.18, 4.18); Calibrated: 7/26/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2012

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

5500 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm

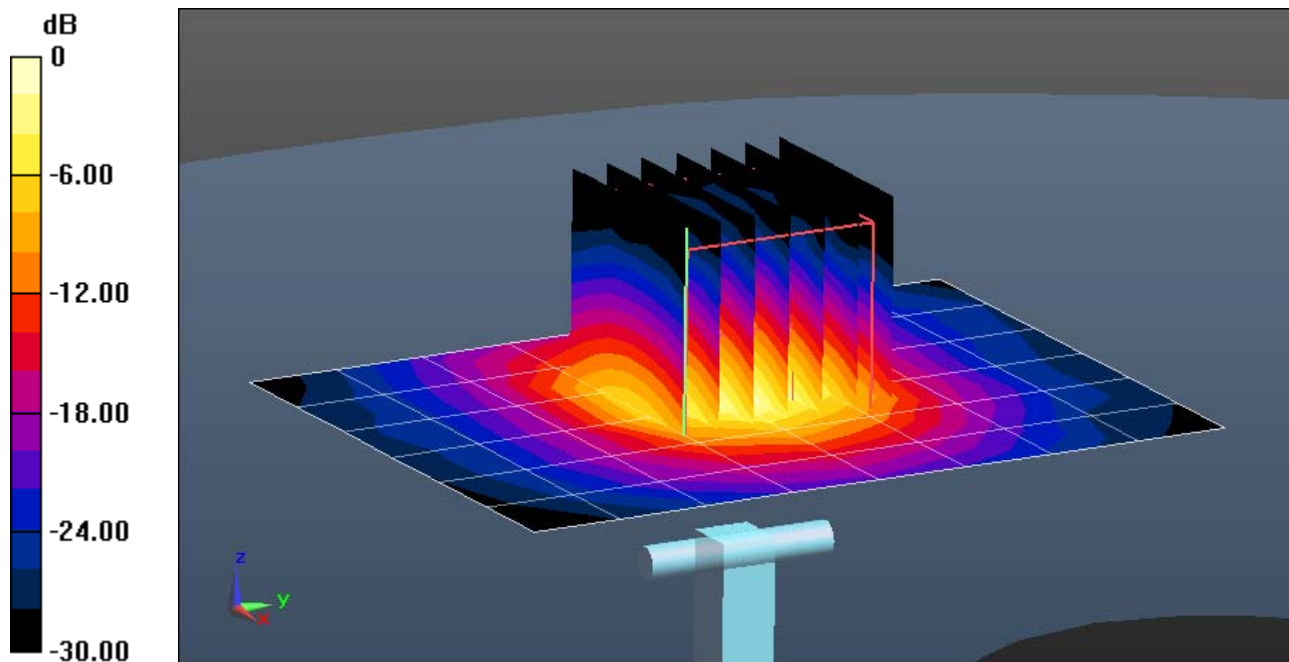
Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 34.3 W/kg

SAR(1 g) = 8.2 W/kg; SAR(10 g) = 2.33 W/kg

Deviation = -3.42%



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

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 5600 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$f = 5600 \text{ MHz}$; $\sigma = 4.899 \text{ mho/m}$; $\epsilon_r = 35.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-17-2012; Ambient Temp: 24.8°C; Tissue Temp: 24.2°C

Probe: EX3DV4 - SN3561; ConvF(4, 4, 4); Calibrated: 7/26/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2012

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

5600 MHz System Verification

Area Scan (7x9x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

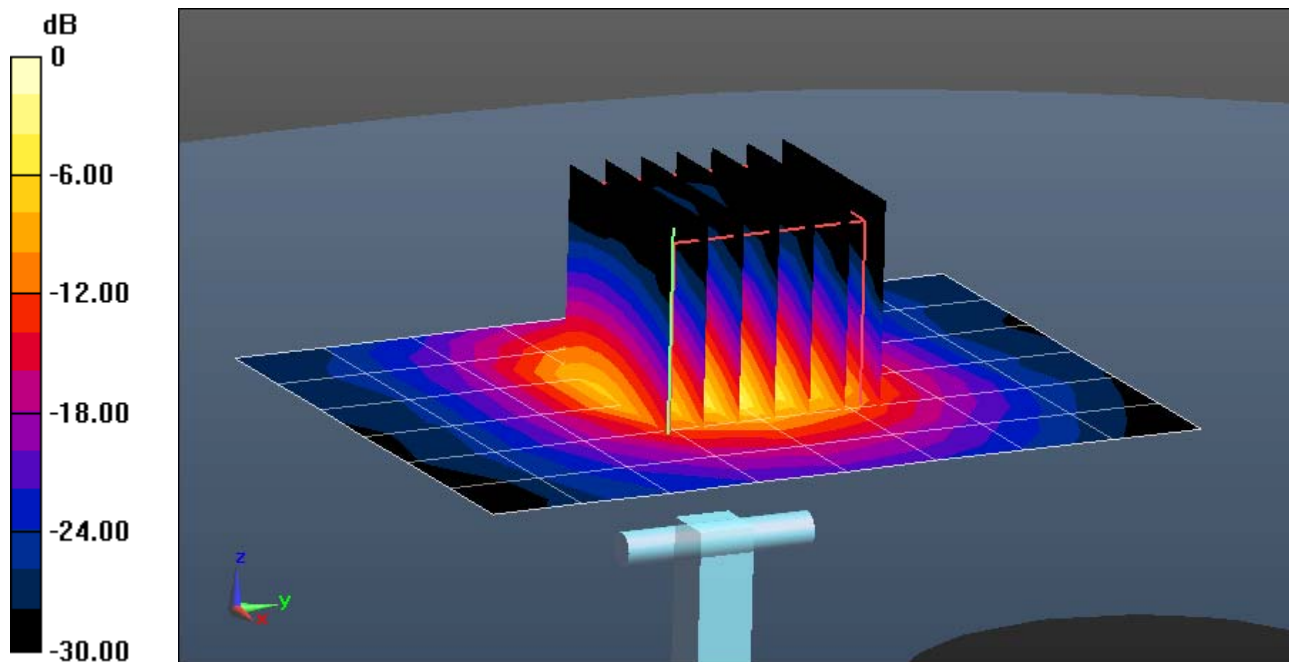
Zoom Scan (7x7x12)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=2\text{mm}$

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 32.6 W/kg

SAR(1 g) = 7.83 W/kg; SAR(10 g) = 2.16 W/kg

Deviation = -7.34%



0 dB = 16.5 W/kg = 12.17 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: 5 GHz Head Medium parameters used:

$f = 5800 \text{ MHz}$; $\sigma = 5.095 \text{ mho/m}$; $\epsilon_r = 35.26$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-17-2012; Ambient Temp: 24.9°C; Tissue Temp: 24.3°C

Probe: EX3DV4 - SN3561; ConvF(3.92, 3.92, 3.92); Calibrated: 7/26/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2012

Phantom: SAM Sub; Type: SAM 4.0; Serial: TP-1357

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

5800 MHz System Verification

Area Scan (7x9x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

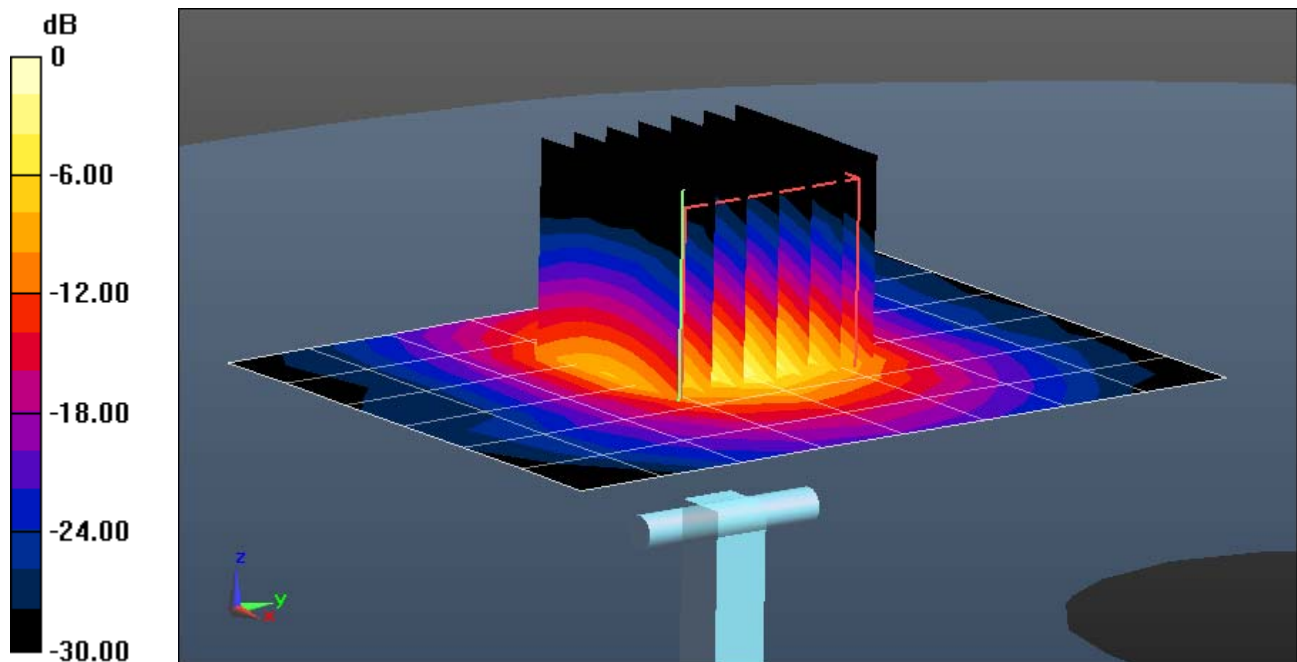
Zoom Scan (7x7x12)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=2\text{mm}$

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 33.9 W/kg

SAR(1 g) = 7.73 W/kg; SAR(10 g) = 2.18 W/kg

Deviation = -3.13%



0 dB = 16.3 W/kg = 12.12 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 750 MHz; Type: D750V3; Serial: 1054

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

Medium: 740 Body Medium parameters used (interpolated):

$f = 750 \text{ MHz}$; $\sigma = 0.966 \text{ mho/m}$; $\epsilon_r = 54.333$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 01-07-2013; Ambient Temp: 24.5°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3209; ConvF(6.23, 6.23, 6.23); Calibrated: 3/16/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/20/2012

Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

750 MHz System Verification

Area Scan (7x13x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

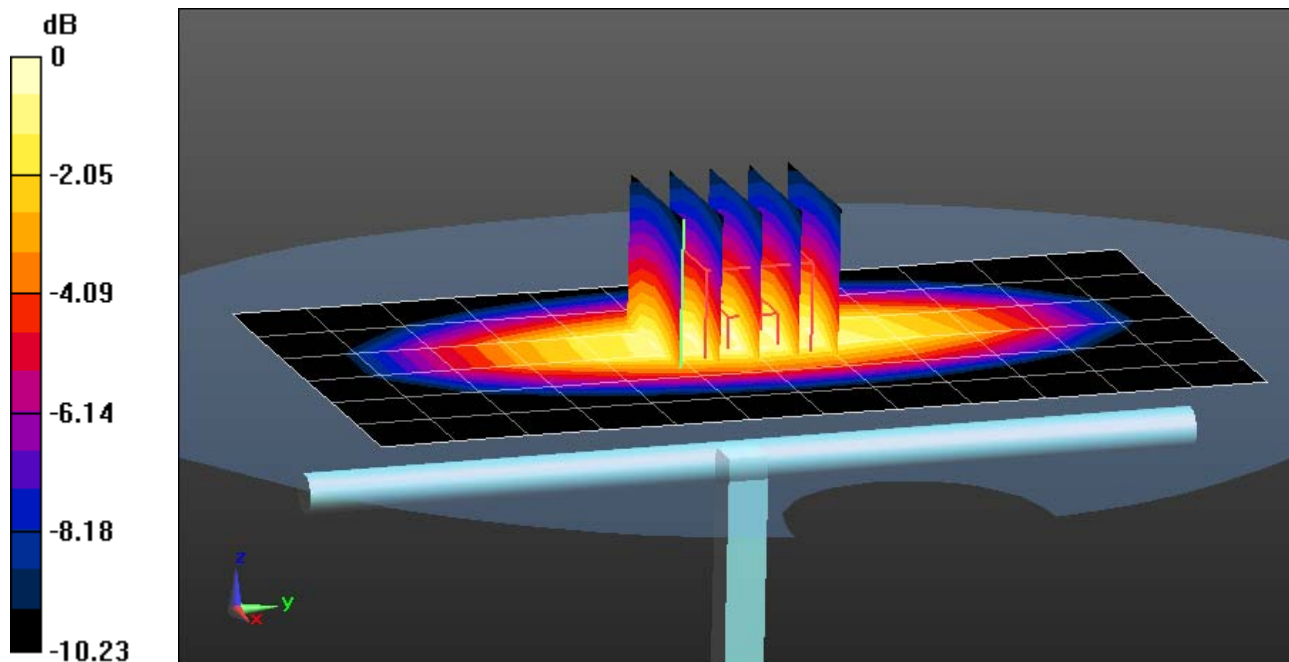
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 1.34 W/kg

SAR(1 g) = 0.925 W/kg; SAR(10 g) = 0.612 W/kg

Deviation = 4.64%



0 dB = 0.996 W/kg = -0.02 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used:

$f = 835 \text{ MHz}$; $\sigma = 0.984 \text{ mho/m}$; $\epsilon_r = 53.16$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 12-10-2012; Ambient Temp: 23.8°C; Tissue Temp: 23.2°C

Probe: ES3DV2 - SN3022; ConvF(6.02, 6.02, 6.02); Calibrated: 8/28/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1322; Calibrated: 8/24/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1406

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

835 MHz System Verification

Area Scan (7x13x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

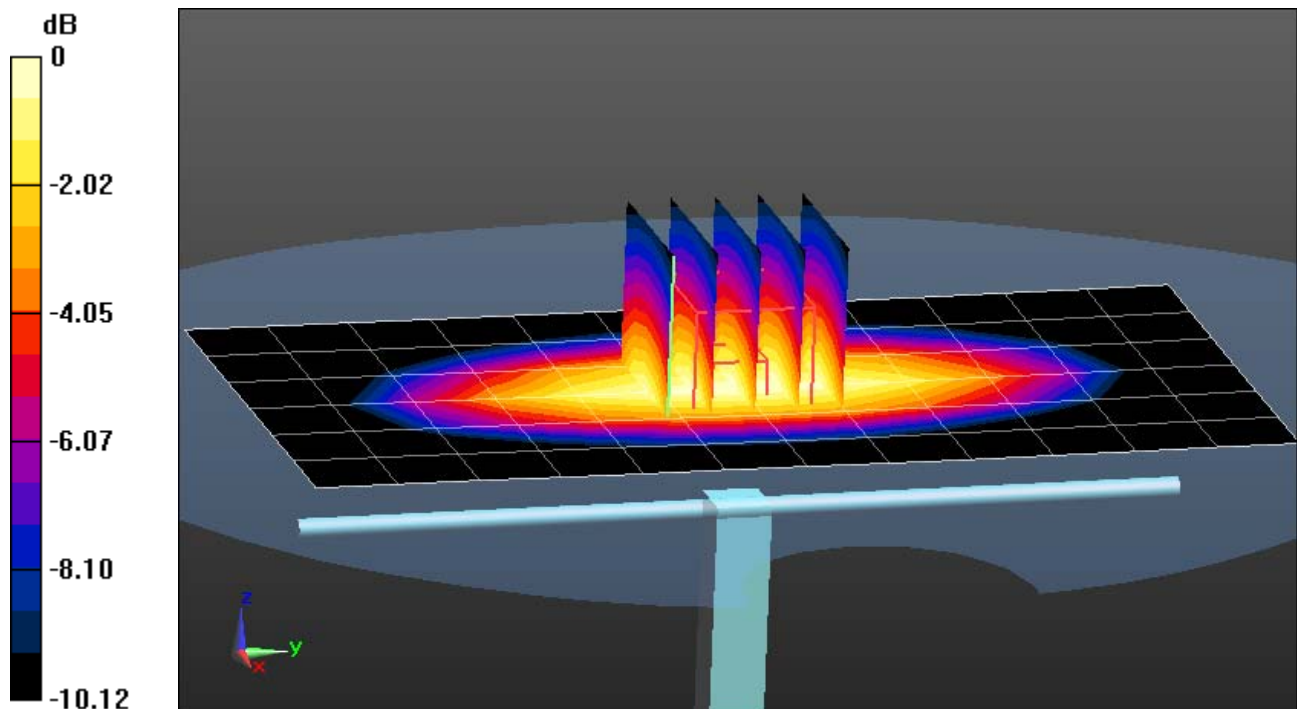
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 1.49 W/kg

SAR(1 g) = 1.03 W/kg; SAR(10 g) = 0.678 W/kg

Deviation = 7.52%



0 dB = 1.11 W/kg = 0.45 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used:

$f = 835 \text{ MHz}$; $\sigma = 0.983 \text{ mho/m}$; $\epsilon_r = 53.89$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 12-18-2012; Ambient Temp: 23.1°C; Tissue Temp: 21.4°C

Probe: ES3DV3 - SN3263; ConvF(6.15, 6.15, 6.15); Calibrated: 5/18/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 5/7/2012

Phantom: SAM V5.0 Right; Type: QD000P40CD; Serial: 1647

Measurement SW: DASY52, Version 52.8 (3); SEMCAD X Version 14.6.7 (6848)

835 MHz System Verification

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

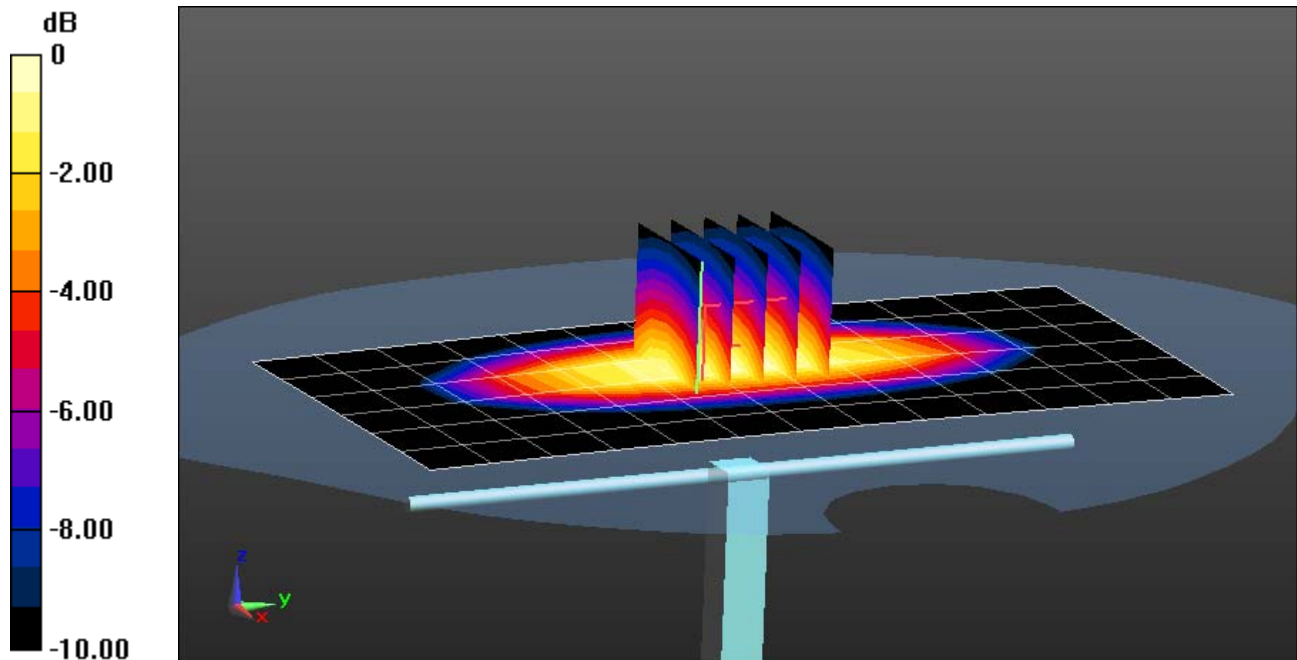
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 1.29 W/kg

SAR(1 g) = 0.886 W/kg; SAR(10 g) = 0.581 W/kg

Deviation = -5.84%



0 dB = 0.958 W/kg = -0.19 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: 835 Body Medium parameters used:

$f = 835 \text{ MHz}$; $\sigma = 0.938 \text{ mho/m}$; $\epsilon_r = 55.27$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.5 cm

Test Date: 12-19-2012; Ambient Temp: 24.2°C; Tissue Temp: 23.3°C

Probe: ES3DV3 - SN3209; ConvF(6.13, 6.13, 6.13); Calibrated: 3/16/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/20/2012

Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

835 MHz System Verification

Area Scan (7x13x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

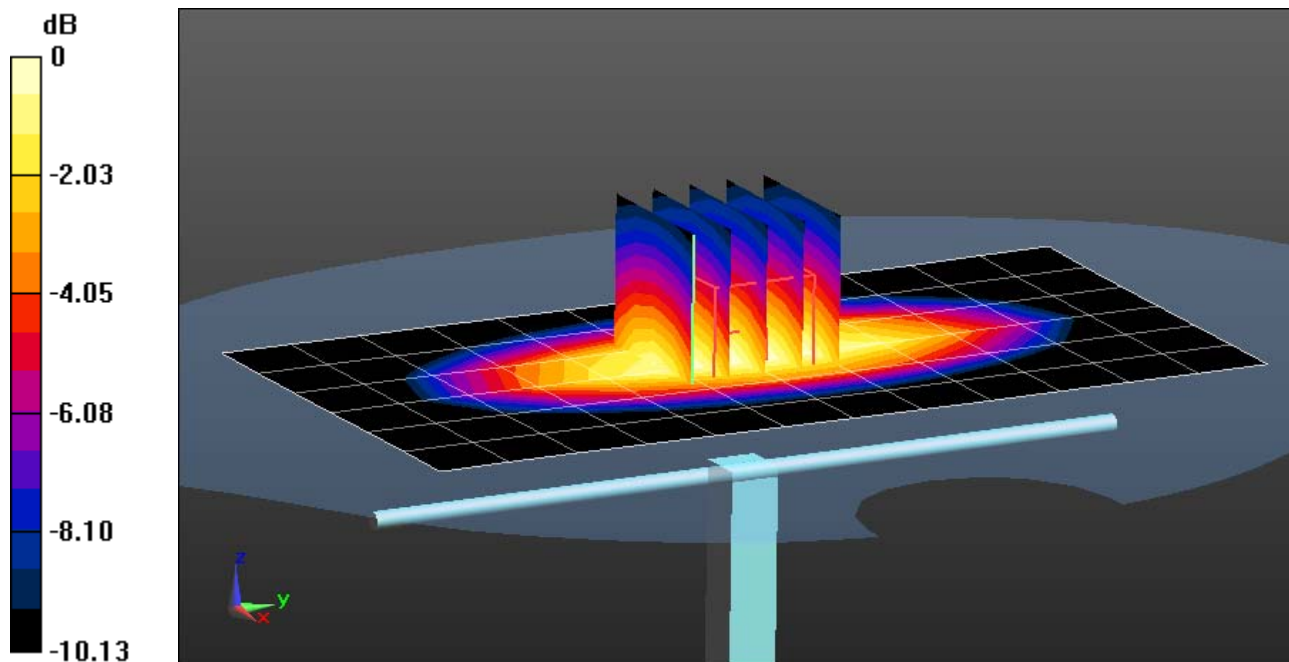
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 1.30 W/kg

SAR(1 g) = 0.916 W/kg; SAR(10 g) = 0.610 W/kg

Deviation = -4.38%



0 dB = 0.999 W/kg = -0.00 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:

$f = 1750 \text{ MHz}$; $\sigma = 1.531 \text{ mho/m}$; $\epsilon_r = 53.06$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-02-2012; Ambient Temp: 23.2°C; Tissue Temp: 22.9°C

Probe: ES3DV3 - SN3209; ConvF(4.83, 4.83, 4.83); Calibrated: 3/16/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/20/2012

Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

1750 MHz System Verification

Area Scan (6x6x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

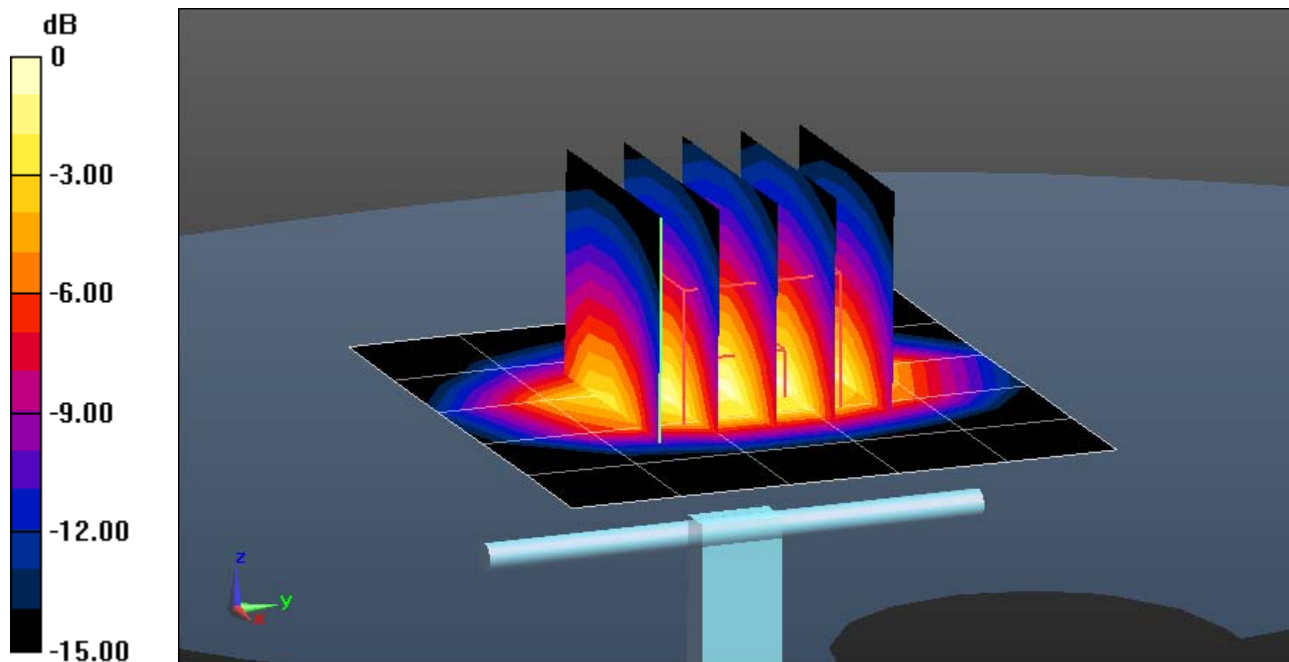
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 7.08 W/kg

SAR(1 g) = 3.88 W/kg; SAR(10 g) = 2.01 W/kg

Deviation = 3.74%



PCTEST ENGINEERING LABORATORY, INC.

DUT: SAR Dipole 1900 MHz; Type: D1900V2; Serial: 502

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$; $\sigma = 1.516 \text{ mho/m}$; $\epsilon_r = 52.093$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-10-2012; Ambient Temp: 23.0°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3209; ConvF(4.63, 4.63, 4.63); Calibrated: 3/16/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn649; Calibrated: 2/20/2012

Phantom: SAM Sub Dasy B; Type: SAM 5.0; Serial: TP-1626

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

1900 MHz System Verification

Area Scan (5x7x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

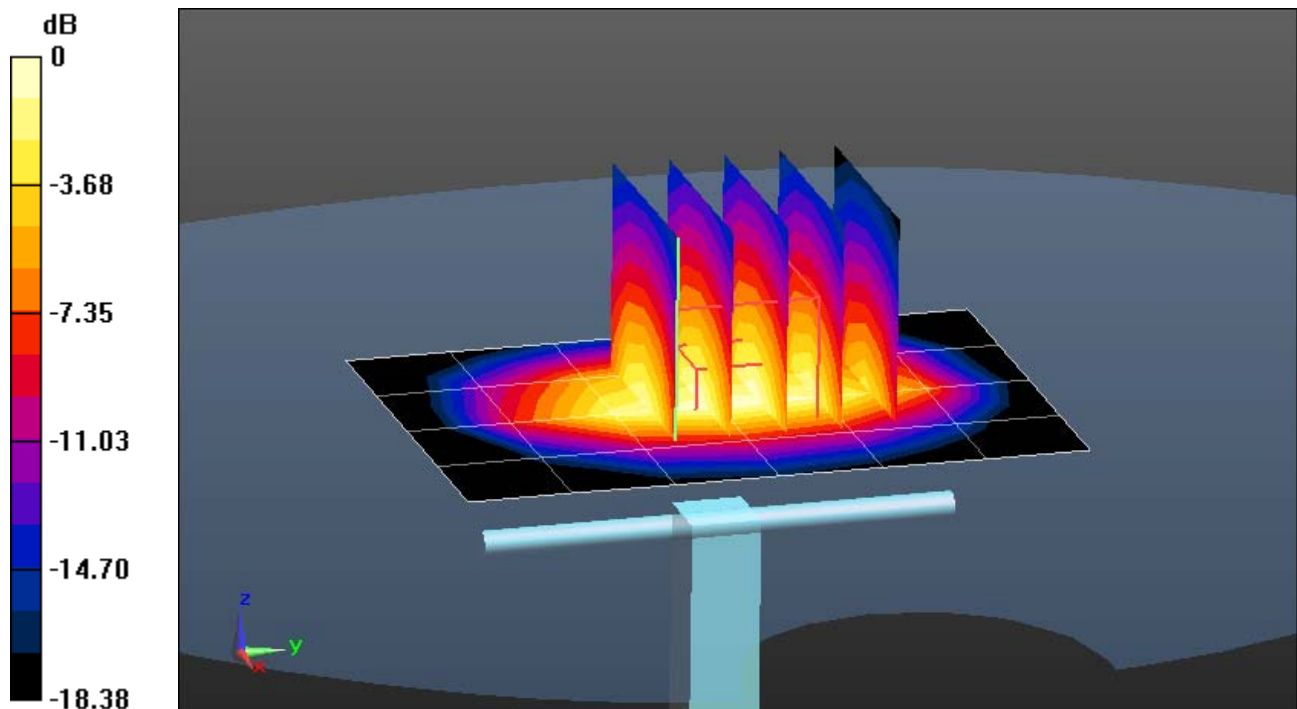
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 6.88 W/kg

SAR(1 g) = 3.82 W/kg; SAR(10 g) = 1.99 W/kg

Deviation = -1.80%



0 dB = 4.25 W/kg = 6.28 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 Body Medium parameters used (interpolated):

$f = 1900 \text{ MHz}$; $\sigma = 1.503 \text{ mho/m}$; $\epsilon_r = 53.113$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 01-17-2013; Ambient Temp: 24.6°C; Tissue Temp: 23.7°C

Probe: ES3DV3 - SN3263; ConvF(4.76, 4.76, 4.76); Calibrated: 5/18/2012;

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1334; Calibrated: 5/7/2012

Phantom: SAM 5.0 front; Type: QD000P40CD; Serial: TP:-1648

Measurement SW: DASY52, Version 52.8 (5); SEMCAD X Version 14.6.7 (6848)

1900 MHz System Verification

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

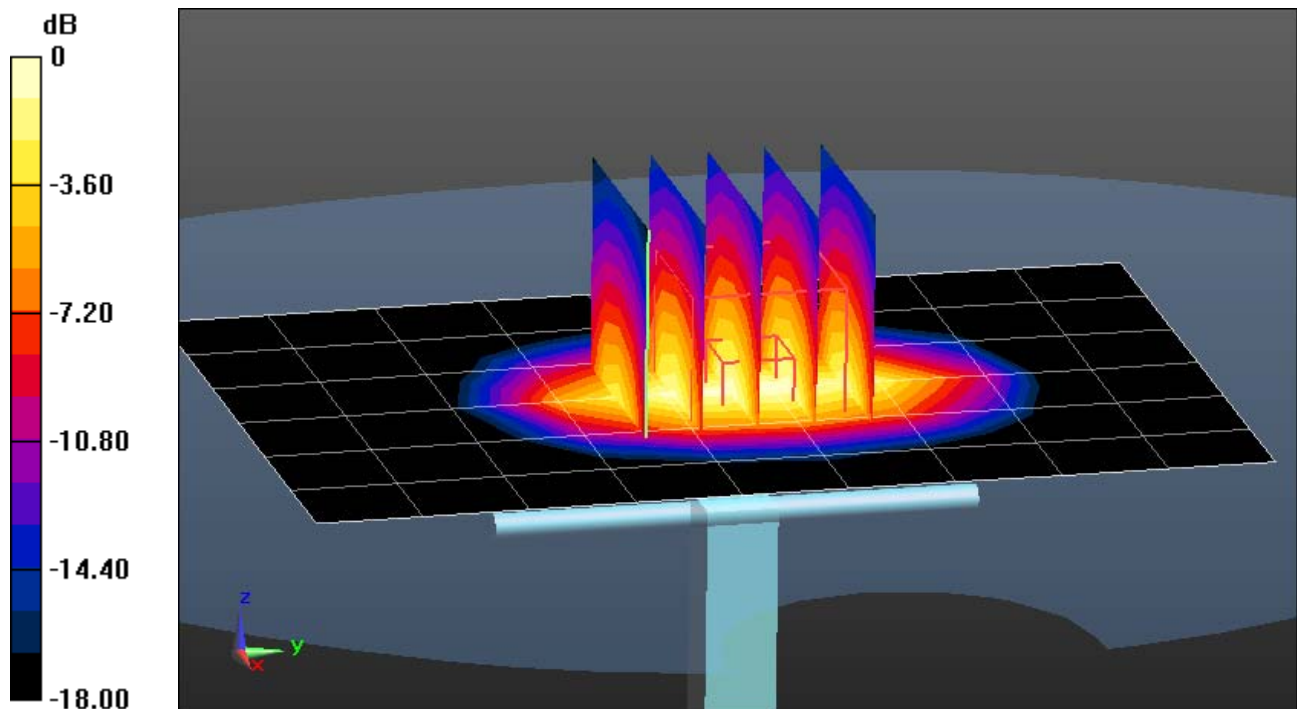
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Input Power = 20 dBm (100 mW)

Peak SAR (extrapolated) = 7.28 W/kg

SAR(1 g) = 4.08 W/kg; SAR(10 g) = 2.15 W/kg

Deviation = 3.82%



0 dB = 4.53 W/kg = 6.56 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used:

$f = 2450 \text{ MHz}$; $\sigma = 1.98 \text{ mho/m}$; $\epsilon_r = 50.66$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section, Space 1.0 cm

Test Date: 12-11-2012; Ambient Temp: 24.4°C; Tissue Temp: 23.3°C

Probe: ES3DV3 - SN3258; ConvF(4.28, 4.28, 4.28); Calibrated: 2/21/2012;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/18/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

2450 MHz System Verification

Area Scan (6x8x1): Measurement grid: $dx=12\text{mm}$, $dy=12\text{mm}$

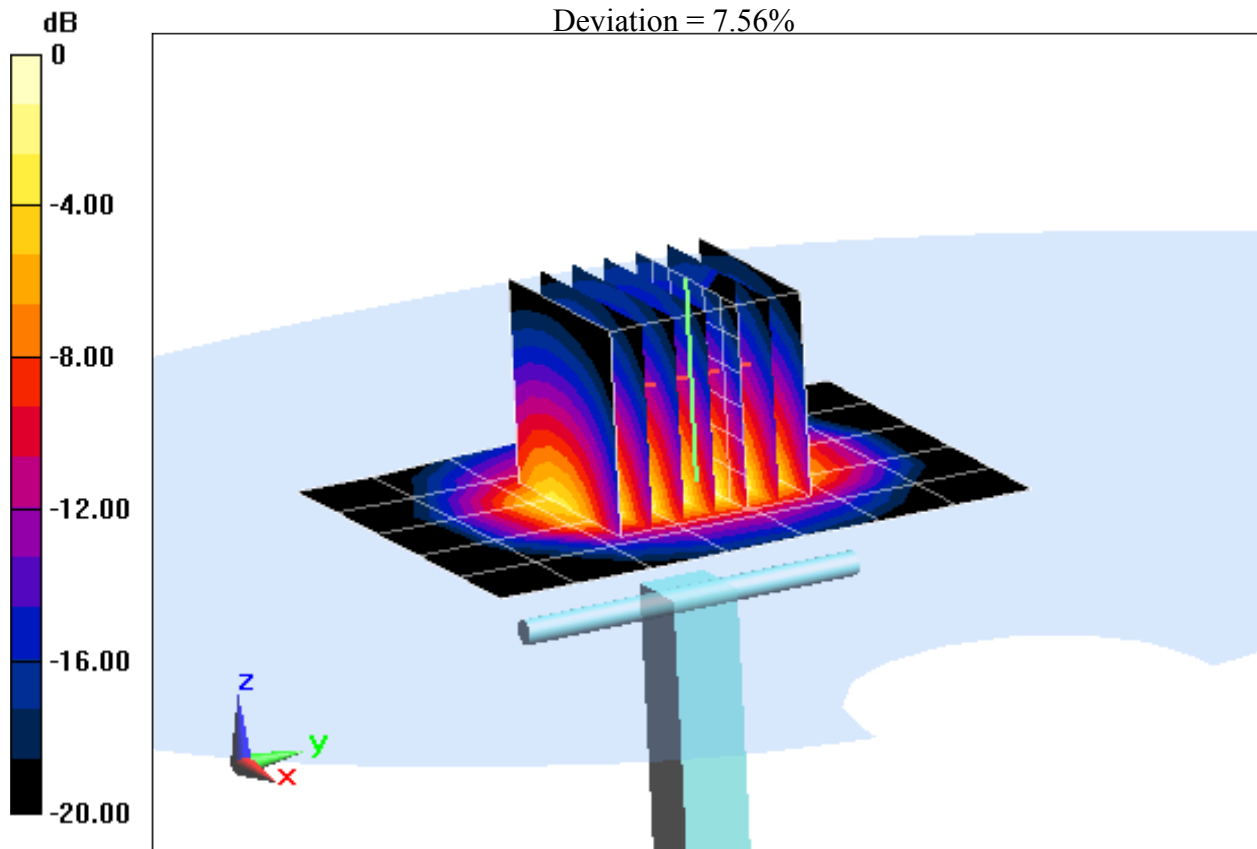
Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Input Power = 16 dBm (40 mW)

Peak SAR (extrapolated) = 4.821 mW/g

SAR(1 g) = 2.22 mW/g; SAR(10 g) = 1.02 mW/g

Deviation = 7.56%



0 dB = 2.85 mW/g = 9.10 dB mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5200 MHz; Type: D5GHzV2; Serial: 1120

Communication System: CW; Frequency: 5200 MHz; Duty Cycle: 1:1

Medium: 5GHz Body Medium parameters used:

$f = 5200 \text{ MHz}$; $\sigma = 5.282 \text{ mho/m}$; $\epsilon_r = 48.04$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-13-2012; Ambient Temp: 22.5°C; Tissue Temp: 21.9°C

Probe: EX3DV4 - SN3589; ConvF(3.92, 3.92, 3.92); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/18/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

5200 MHz System Verification

Area Scan (7x9x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

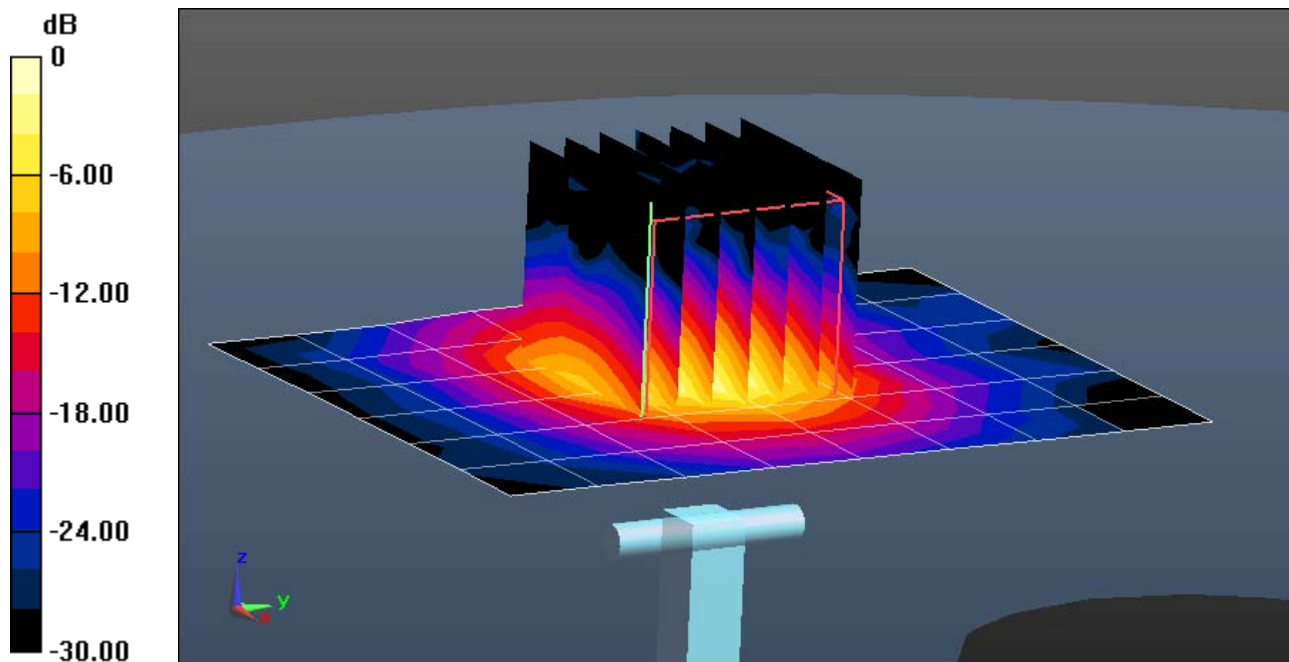
Zoom Scan (7x7x12)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=2\text{mm}$

Input Power = 16 dBm (40 mW)

Peak SAR (extrapolated) = 12.8 W/kg

SAR(1 g) = 2.78 W/kg; SAR(10 g) = 0.767 W/kg

Deviation = -3.74%



0 dB = 5.73 W/kg = 7.58 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 5300 MHz; Duty Cycle: 1:1

Medium: 5GHz Body Medium parameters used:

$f = 5300 \text{ MHz}$; $\sigma = 5.442 \text{ mho/m}$; $\epsilon_r = 47.84$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-13-2012; Ambient Temp: 22.8°C; Tissue Temp: 22.0°C

Probe: EX3DV4 - SN3589; ConvF(3.72, 3.72, 3.72); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/18/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

5300 MHz System Verification

Area Scan (7x9x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

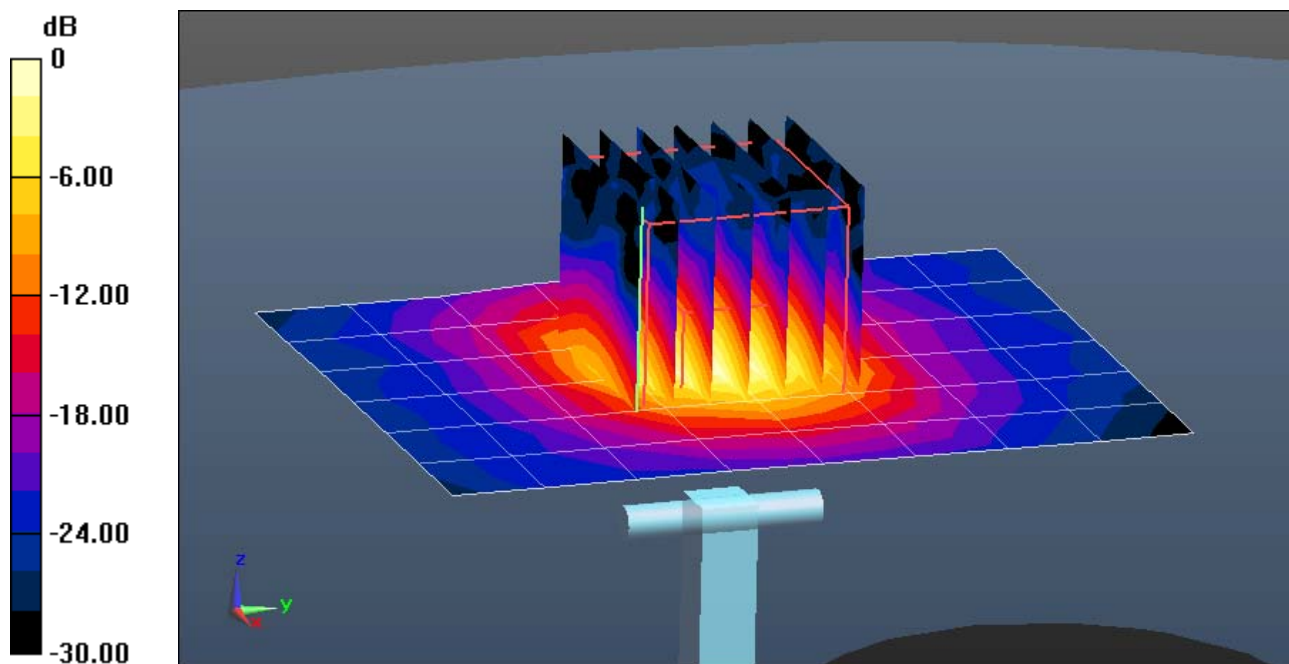
Zoom Scan (7x7x12)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=2\text{mm}$

Input Power = 16 dBm (40 mW)

Peak SAR (extrapolated) = 14.3 W/kg

SAR(1 g) = 3.04 W/kg; SAR(10 g) = 0.836 W/kg

Deviation = 0.53%



0 dB = 6.36 W/kg = 8.03 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5500 MHz; Type: D5GHzV2; Serial: 1120

Communication System: CW; Frequency: 5500 MHz; Duty Cycle: 1:1

Medium: 5GHz Body Medium parameters used:

$f = 5500 \text{ MHz}$; $\sigma = 5.729 \text{ mho/m}$; $\epsilon_r = 47.32$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-13-2012; Ambient Temp: 23.2°C; Tissue Temp: 21.5°C

Probe: EX3DV4 - SN3589; ConvF(3.4, 3.4, 3.4); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/18/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

5500 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm

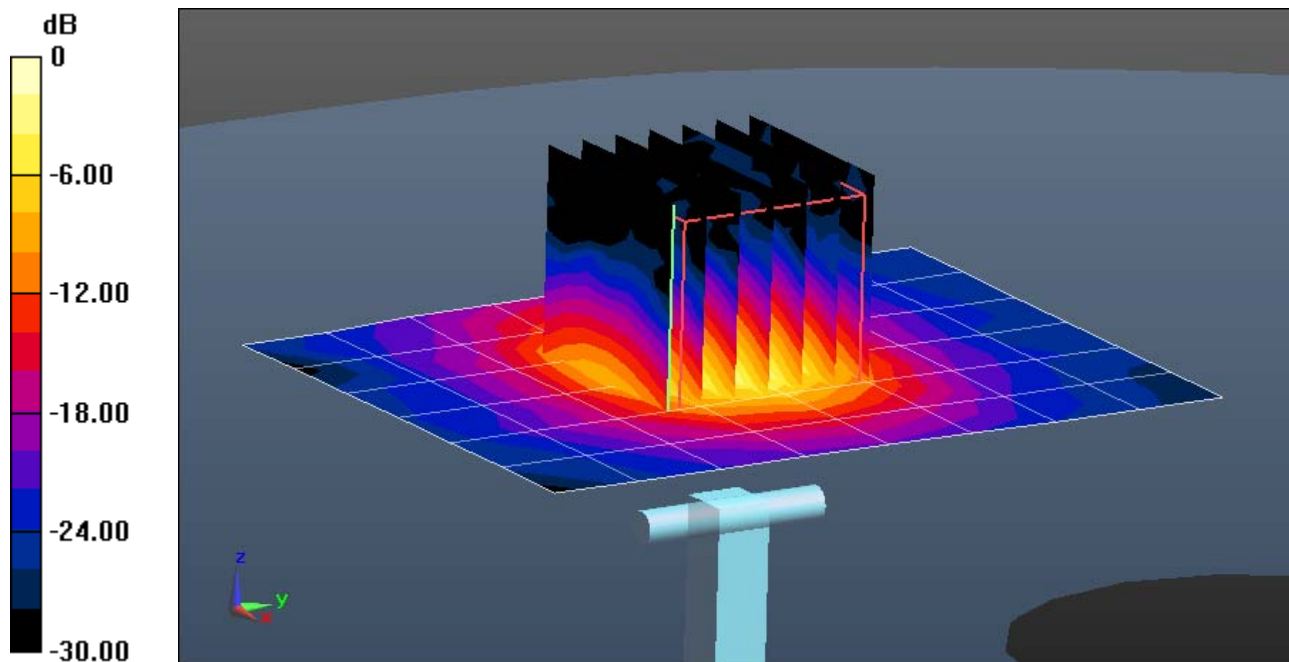
Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Input Power = 17 dBm (50 mW)

Peak SAR (extrapolated) = 19.7 W/kg

SAR(1 g) = 4.25 W/kg; SAR(10 g) = 1.17 W/kg

Deviation = 6.25%



0 dB = 9.03 W/kg = 9.56 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

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

Communication System: CW; Frequency: 5600 MHz; Duty Cycle: 1:1

Medium: 5GHz Body Medium parameters used:

$f = 5600 \text{ MHz}$; $\sigma = 5.865 \text{ mho/m}$; $\epsilon_r = 47.09$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-13-2012; Ambient Temp: 23.4°C; Tissue Temp: 21.8°C

Probe: EX3DV4 - SN3589; ConvF(3.25, 3.25, 3.25); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/18/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

5600 MHz System Verification

Area Scan (7x9x1): Measurement grid: dx=10mm, dy=10mm

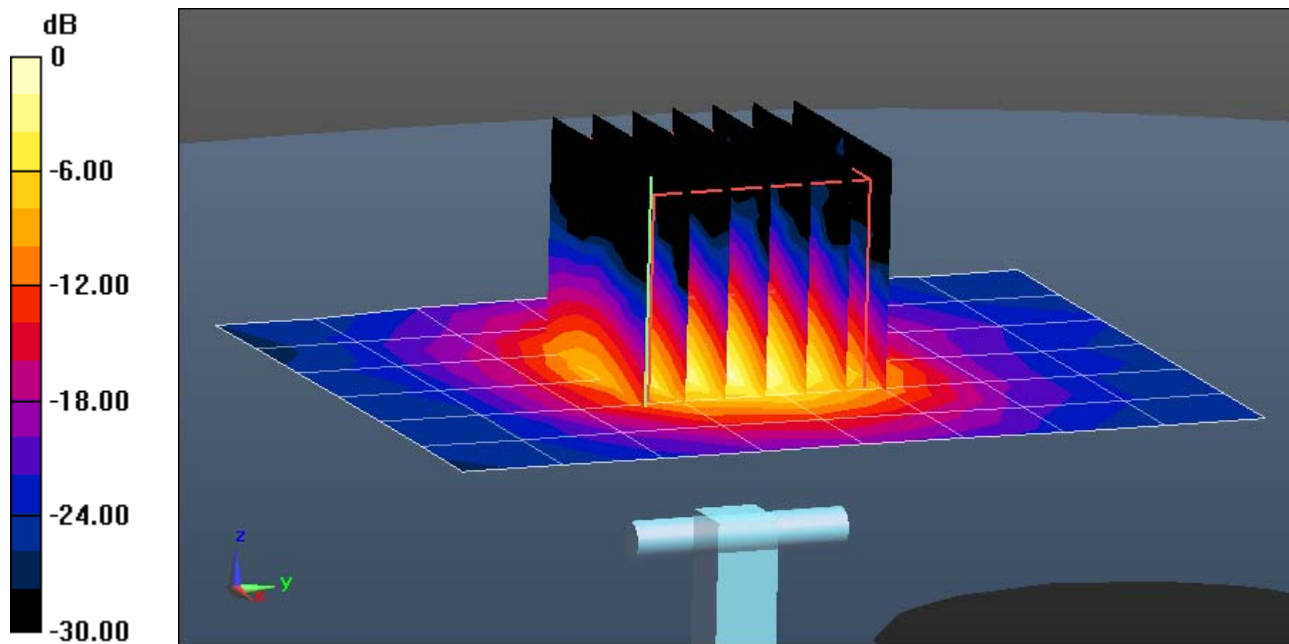
Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Input Power = 17 dBm (50 mW)

Peak SAR (extrapolated) = 19.6 W/kg

SAR(1 g) = 4.24 W/kg; SAR(10 g) = 1.16 W/kg

Deviation = 6.00%



0 dB = 8.83 W/kg = 9.46 dBW/kg

PCTEST ENGINEERING LABORATORY, INC.

DUT: Dipole 5800 MHz; Type: D5GHzV2; Serial: 1120

Communication System: CW; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: 5GHz Body Medium parameters used:

$f = 5800 \text{ MHz}$; $\sigma = 6.197 \text{ mho/m}$; $\epsilon_r = 46.61$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 12-13-2012; Ambient Temp: 23.4°C; Tissue Temp: 21.7°C

Probe: EX3DV4 - SN3589; ConvF(3.59, 3.59, 3.59); Calibrated: 1/27/2012;

Sensor-Surface: 2mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1272; Calibrated: 1/18/2012

Phantom: SAM Main; Type: SAM 4.0; Serial: TP-1114

Measurement SW: DASY4, Version 4.7 (80); SEMCAD X Version 14.6.7 (6848)

5800 MHz System Verification

Area Scan (7x9x1): Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$

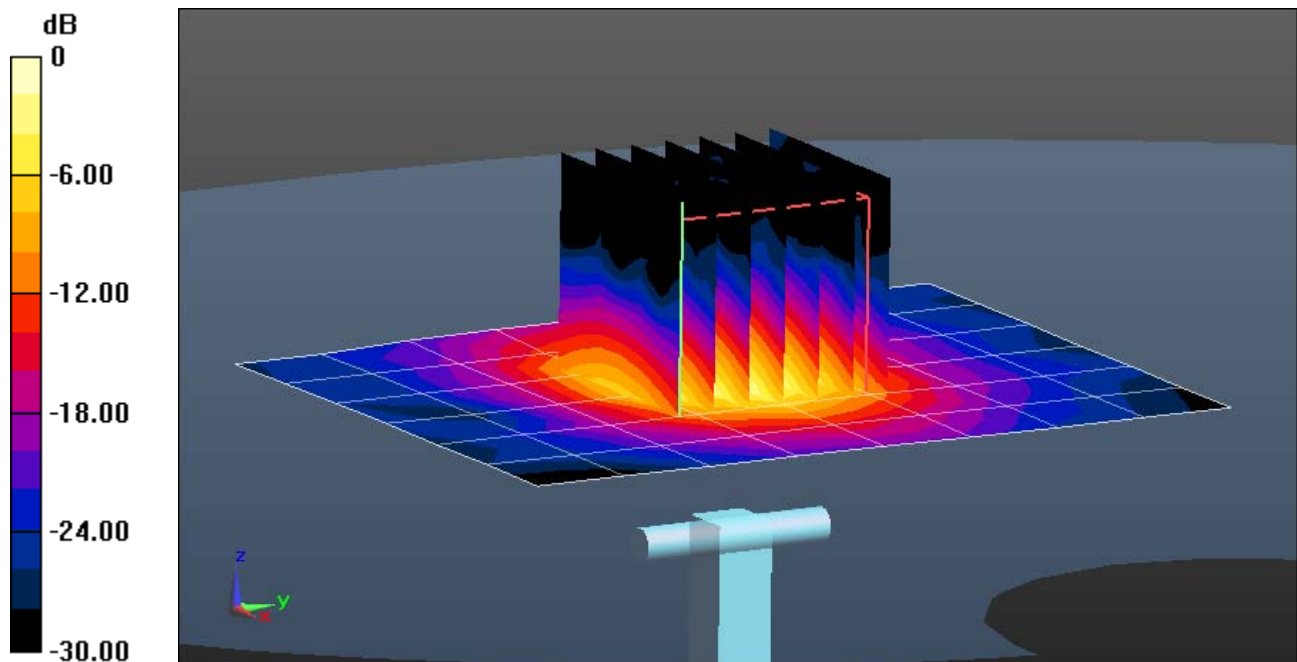
Zoom Scan (7x7x12)/Cube 0: Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=2\text{mm}$

Input Power = 17.3 dBm (54 mW)

Peak SAR (extrapolated) = 19.9 W/kg

SAR(1 g) = 4.22 W/kg; SAR(10 g) = 1.15 W/kg

Deviation = 5.89%



0 dB = 8.83 W/kg = 9.46 dBW/kg

APPENDIX C: PROBE CALIBRATION



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_May12**

CALIBRATION CERTIFICATE

Object **D1765V2 - SN 1008**

Calibration procedure(s) **QA CAL-05.v8**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **May 18, 2012**

KOK
6/11/12

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Issued: May 18, 2012

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



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

Accreditation No.: **SCS 108**

Glossary:

TSL	tissue simulating liquid
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	V52.8.1
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 $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.38 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	40.5 $\pm$ 6 %	1.34 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	8.92 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	36.4 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.77 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	19.3 mW / g $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.4	1.50 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	52.9 $\pm$ 6 %	1.46 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.22 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	37.4 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	4.95 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	20.0 mW / g $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	47.7 Ω - 5.9 j Ω
Return Loss	- 23.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	43.4 Ω - 6.0 j Ω
Return Loss	- 20.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.212 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: 18.05.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 1750 MHz

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.34$ mho/m; $\epsilon_r = 40.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.22, 5.22, 5.22); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

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

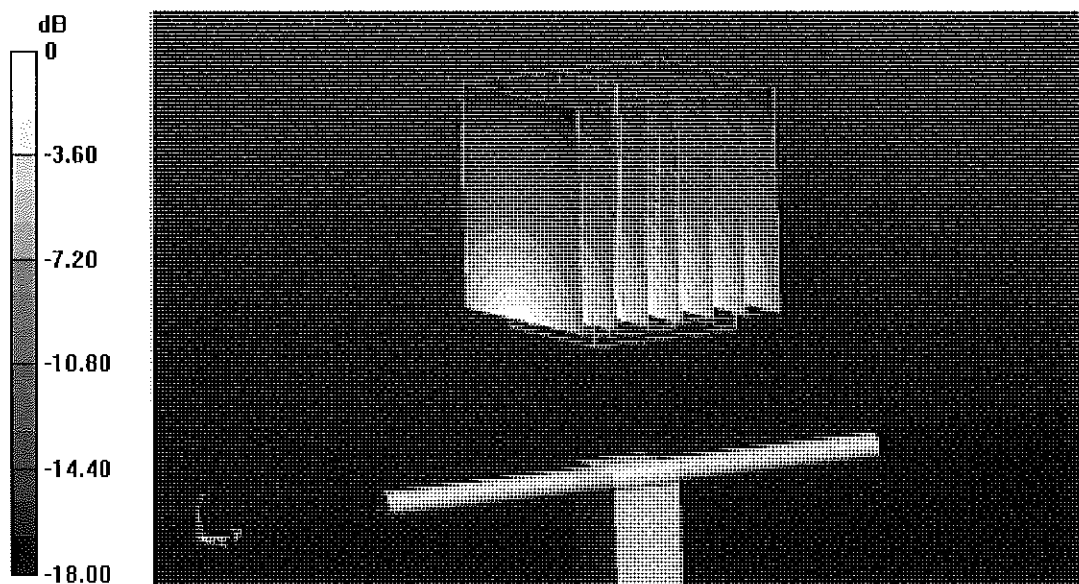
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.890 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 15.761 mW/g

SAR(1 g) = 8.92 mW/g; SAR(10 g) = 4.77 mW/g

Maximum value of SAR (measured) = 11.0 mW/g

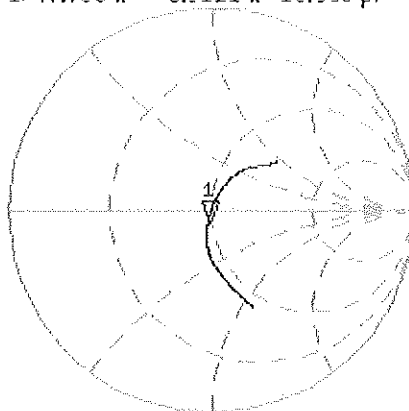


0 dB = 11.0 mW/g = 20.83 dB mW/g

Impedance Measurement Plot for Head TSL

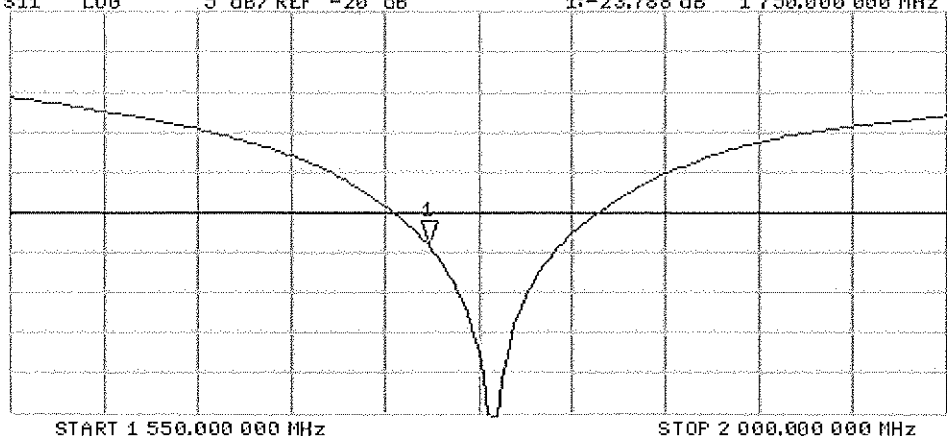
18 May 2012 15:10:53
 [CH1] S11 1 U FS 1: 47.736 Ω -5.9121 Ω 15.383 pF 1 750.000 000 MHz

*
 Del
 Cor
 Avg
 16
 H1 d



CH2 S11 LOG 5 dB/REF -20 dB 1:-23.788 dB 1 750.000 000 MHz

Cor
 Avg
 16
 H1 d



DASY5 Validation Report for Body TSL

Date: 18.05.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 1750 MHz

Medium parameters used: $f = 1750$ MHz; $\sigma = 1.46$ mho/m; $\epsilon_r = 52.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.85, 4.85, 4.85); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.1(838); SEMCAD X 14.6.5(6469)

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

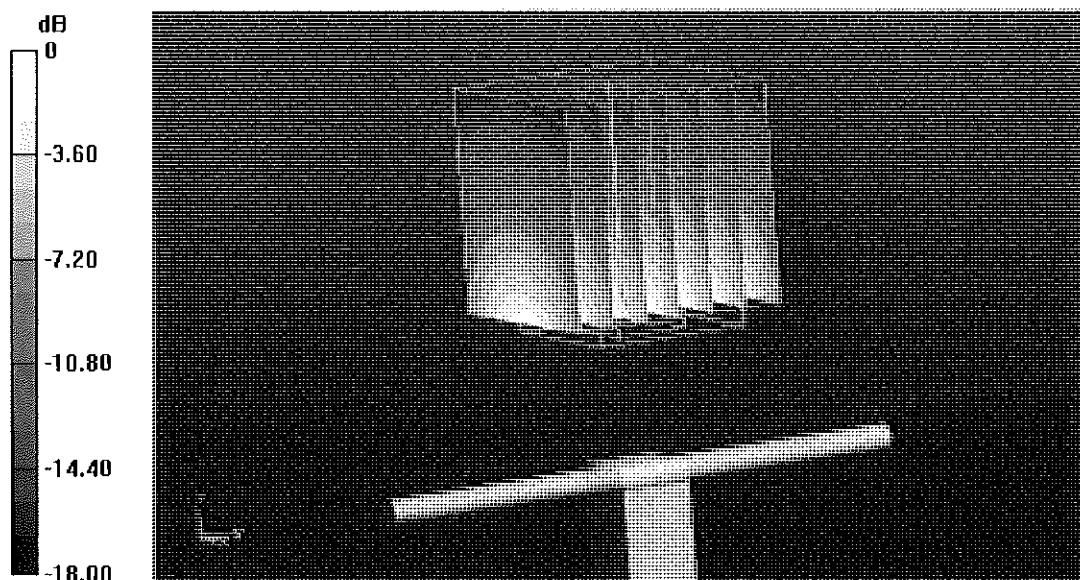
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.032 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 15.840 mW/g

SAR(1 g) = 9.22 mW/g; SAR(10 g) = 4.95 mW/g

Maximum value of SAR (measured) = 11.6 mW/g



0 dB = 11.6 mW/g = 21.29 dB mW/g

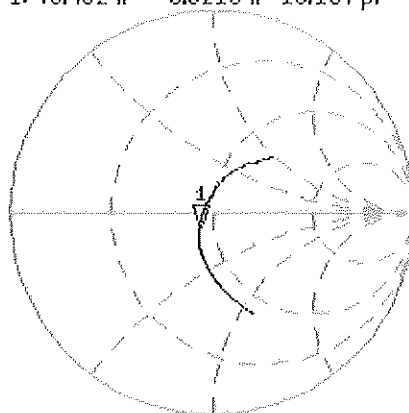
Impedance Measurement Plot for Body TSL

18 May 2012 15:09:57
 [CH1] S11 1 U FS 1: 43.432 Ω -6.0215 Ω 15.104 pF 1 750.000 000 MHz

*
 Del
 Cor

Avg
 16

H1d

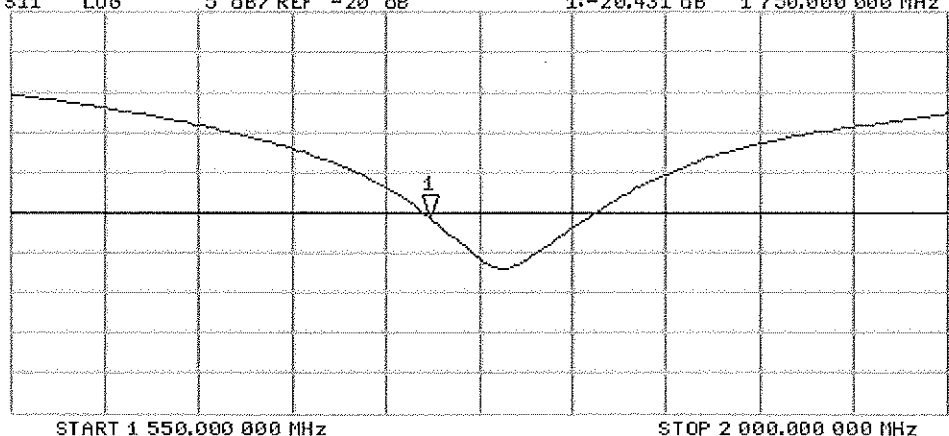


CH2 S11 LOG 5 dB/REF -20 dB 1:-20.431 dB 1 750.000 000 MHz

Cor

Avg
 16

H1d





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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D1900V2-5d148_Feb12**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d148**

Calibration procedure(s) **QA CAL-05.v8**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **February 08, 2012**

✓ 5/14/12
KOK

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5086 (20g)	29-Mar-11 (No. 217-01368)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Signature

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

Signature

Issued: February 8, 2012

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- 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
- 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
- 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:

- 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.

Measurement Conditions

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

DASY Version	DASY5	V52.8.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	40.4 $\pm$ 6 %	1.40 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	40.5 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.35 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	21.4 mW / g $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	53.0 $\pm$ 6 %	1.56 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.95 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	39.1 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.25 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	20.8 mW / g $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.7 Ω + 4.9 j Ω
Return Loss	- 25.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.9 Ω + 6.3 j Ω
Return Loss	- 23.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 ns
----------------------------------	----------

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

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 11, 2011

DASY5 Validation Report for Head TSL

Date: 08.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.4$ mho/m; $\epsilon_r = 40.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

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

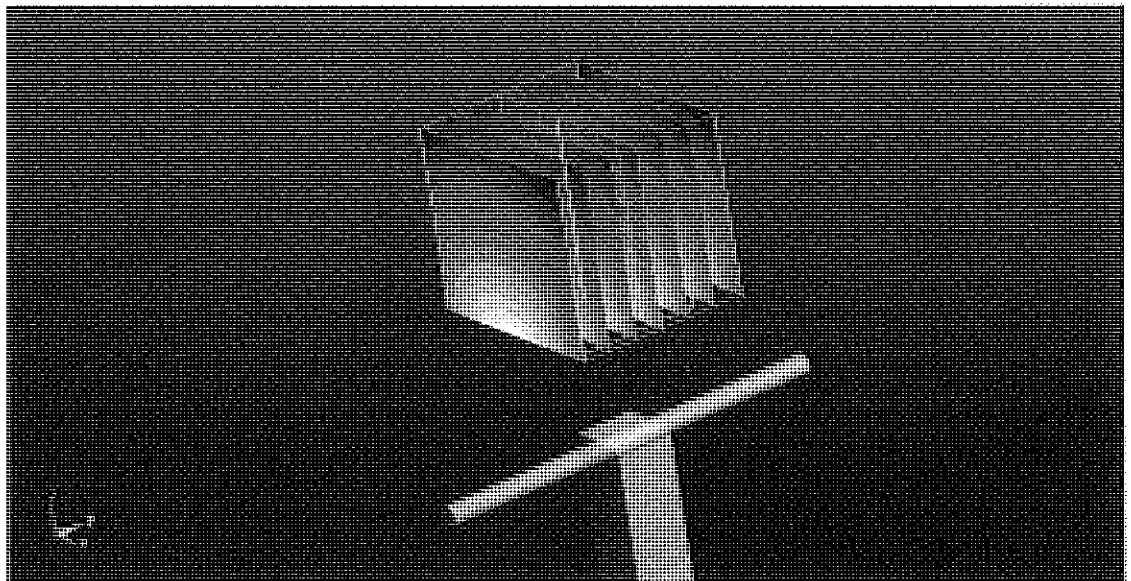
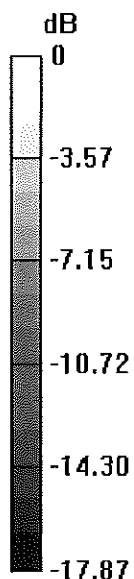
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.284 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 18.0570

SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.35 mW/g

Maximum value of SAR (measured) = 12.808 mW/g

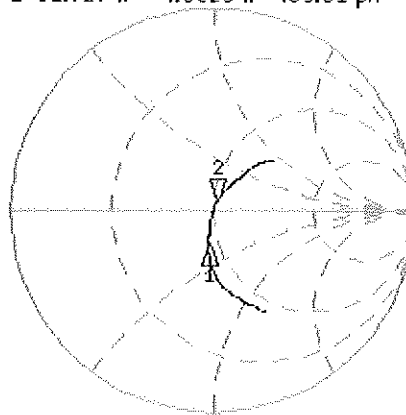


0 dB = 12.810mW/g = 22.15 dB mW/g

Impedance Measurement Plot for Head TSL

8 Feb 2012 11:26:41
 [CH1] S11 1 U FS 2: 51.727 Ω 4.8828 Ω 409.01 μ H 1 900.000 000 MHz

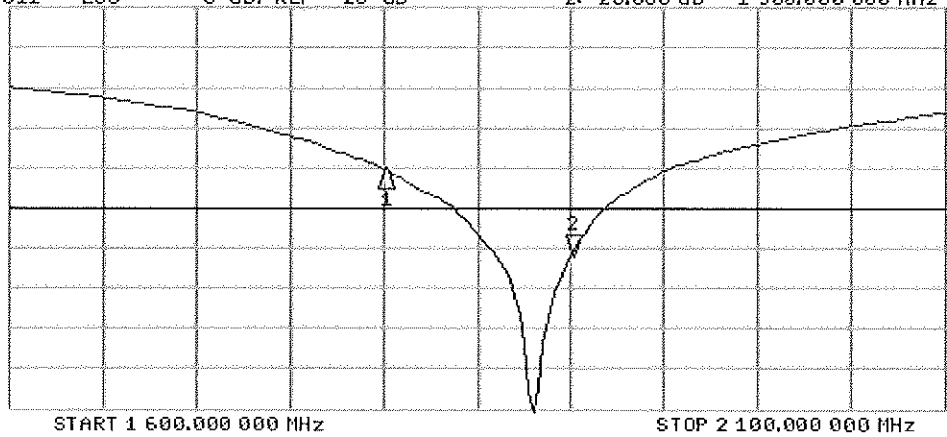
*
 Del
 CA
 Avg
 15
 H1d



CH1 Markers
 1: 44.816 Ω
 -16.234 Ω
 1.80000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 2: -25.868 dB 1 900.000 000 MHz

CA
 Avg
 15
 H1d



CH2 Markers
 1: -15.032 dB
 1.80000 GHz

START 1 600.000 000 MHz

STOP 2 100.000 000 MHz

DASY5 Validation Report for Body TSL

Date: 06.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.56$ mho/m; $\epsilon_r = 53$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.62, 4.62, 4.62); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

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

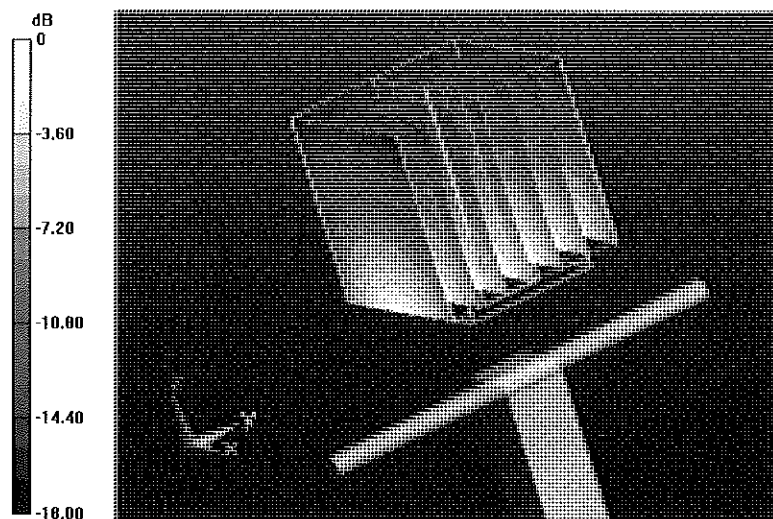
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.855 V/m; Power Drift = 0.006 dB

Peak SAR (extrapolated) = 17.7160

SAR(1 g) = 9.95 mW/g; SAR(10 g) = 5.25 mW/g

Maximum value of SAR (measured) = 12.606 mW/g

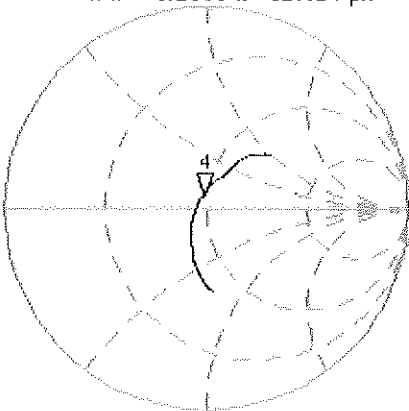


0 dB = 12.610mW/g = 22.01 dB mW/g

Impedance Measurement Plot for Body TSL

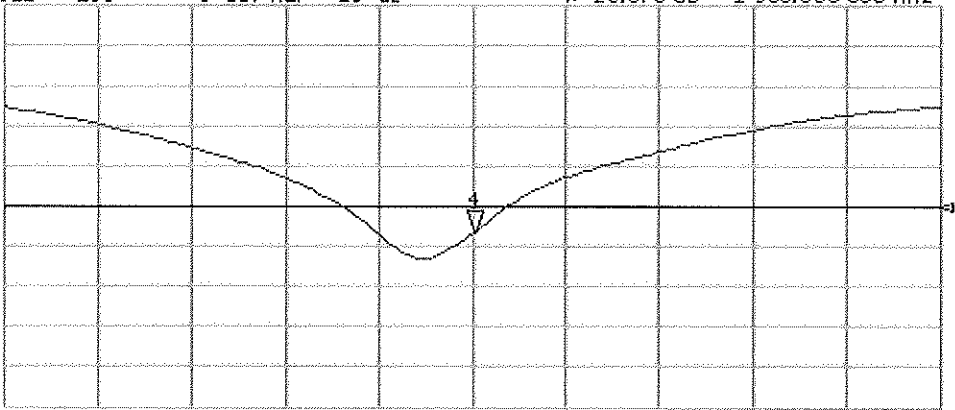
6 Feb 2012 12:11:40
[CH1] S11 1 U FS 4: 47.852 Ω 6.2930 Ω 527.14 μ H 1 900.000 000 MHz

*
De1
CA
Avg
16
H1d



CH2 S11 LOG 5 dB/REF -20 dB 4:-23.373 dB 1 900.000 000 MHz

CA
Avg
16
H1d





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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D1900V2-5d149_Feb12**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d149**

Calibration procedure(s) **QA CAL-05.v8**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **February 22, 2012**

✓ KOK
4/11/12

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5086 (20g)	29-Mar-11 (No. 217-01368)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Issued: February 23, 2012

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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- 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
- 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
- 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:

- 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.

Measurement Conditions

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

DASY Version	DASY5	V52.8.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	40.4 $\pm$ 6 %	1.40 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.80 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	39.3 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.18 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	20.7 mW / g $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	53.0 $\pm$ 6 %	1.56 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.99 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	39.3 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.23 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	20.7 mW / g $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$52.4 \Omega + 5.5 j\Omega$
Return Loss	- 24.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$48.0 \Omega + 6.7 j\Omega$
Return Loss	- 23.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 ns
----------------------------------	----------

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

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	March 11, 2011

DASY5 Validation Report for Head TSL

Date: 22.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.4$ mho/m; $\epsilon_r = 40.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

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

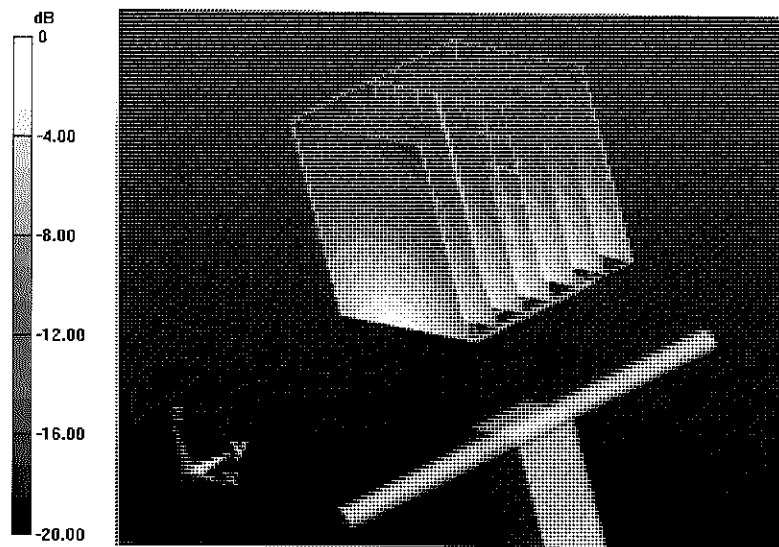
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.685 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 17.4710

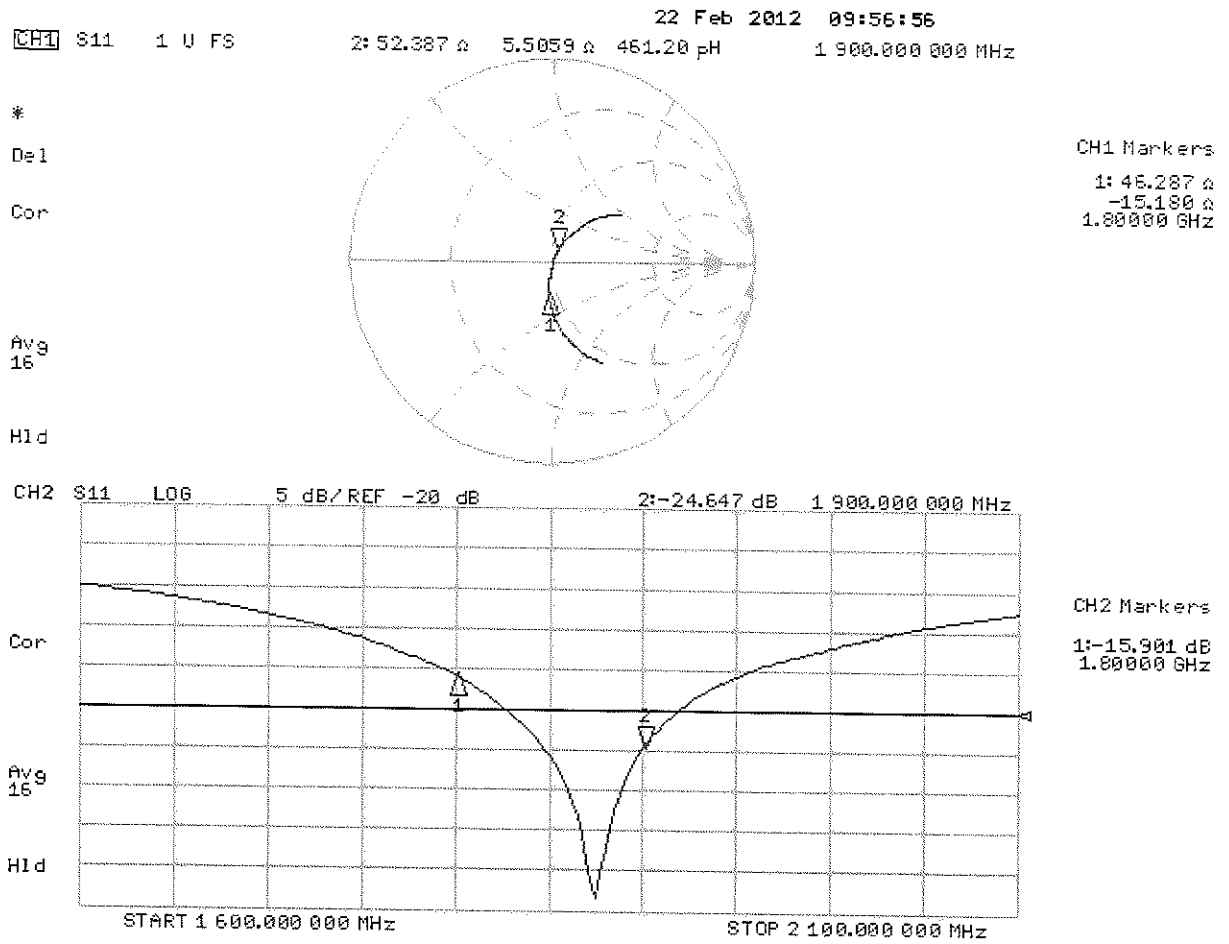
SAR(1 g) = 9.8 mW/g; SAR(10 g) = 5.18 mW/g

Maximum value of SAR (measured) = 12.114 mW/g



0 dB = 12.110mW/g = 21.66 dB mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 06.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.56$ mho/m; $\epsilon_r = 53$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.62, 4.62, 4.62); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

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

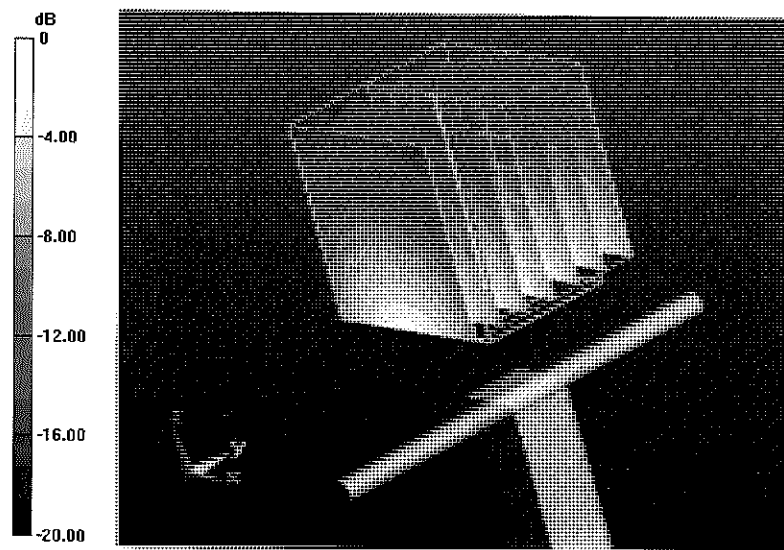
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.047 V/m; Power Drift = 0.0017 dB

Peak SAR (extrapolated) = 18.1310

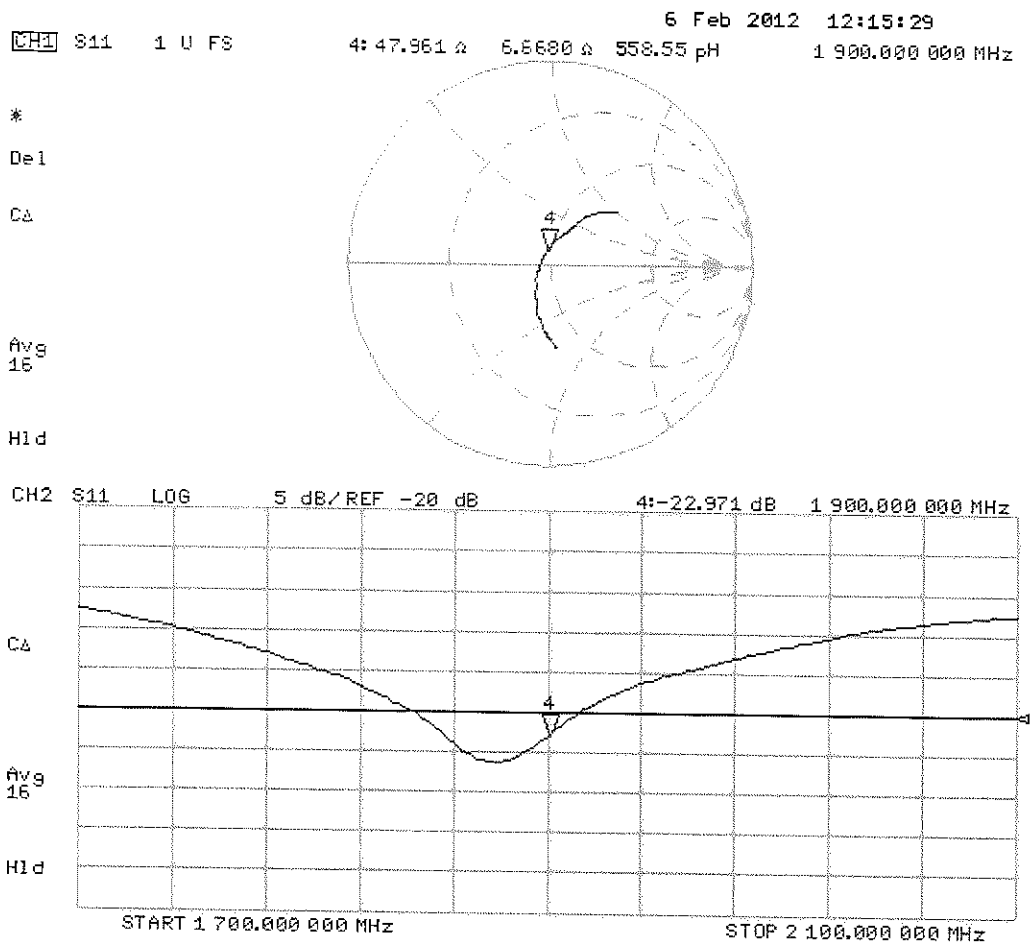
SAR(1 g) = 9.99 mW/g; SAR(10 g) = 5.23 mW/g

Maximum value of SAR (measured) = 12.672 mW/g



0 dB = 12.670mW/g = 22.06 dB mW/g

Impedance Measurement Plot for Body TSL





Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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Client **PC Test**

Certificate No: **D1900V2-502_Feb12**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 502**

Calibration procedure(s) **QA CAL-05.v8**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **February 22, 2012**

KOK
2/27/12

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5086 (20g)	29-Mar-11 (No. 217-01368)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Issued: February 22, 2012

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Accreditation No.: **SCS 108**

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Multilateral Agreement for the recognition of calibration certificates

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "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
- 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
- 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:

- 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.

Measurement Conditions

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

DASY Version	DASY5	V52.8.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	40.4 $\pm$ 6 %	1.40 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.79 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	39.2 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.17 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	20.7 mW / g $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	53.0 $\pm$ 6 %	1.56 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.88 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	38.9 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.17 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	20.5 mW / g $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$51.7 \Omega + 7.2 j\Omega$
Return Loss	- 22.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$47.2 \Omega + 7.6 j\Omega$
Return Loss	- 21.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.206 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	November 14, 1998

DASY5 Validation Report for Head TSL

Date: 22.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 502

Communication System: CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.4$ mho/m; $\epsilon_r = 40.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

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

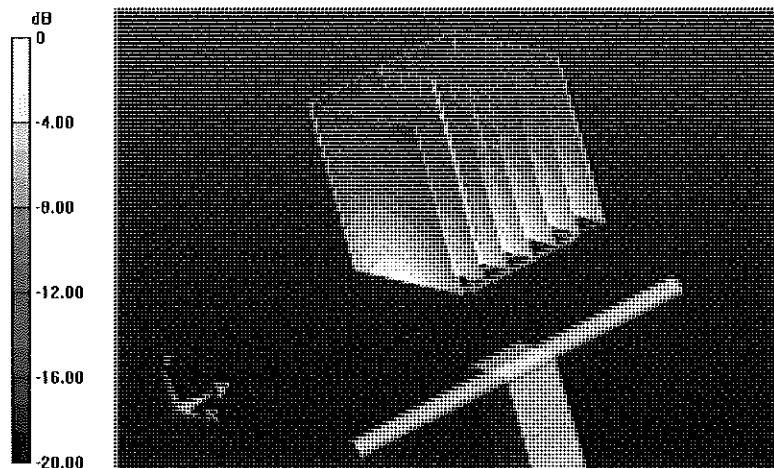
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.315 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 17.4000

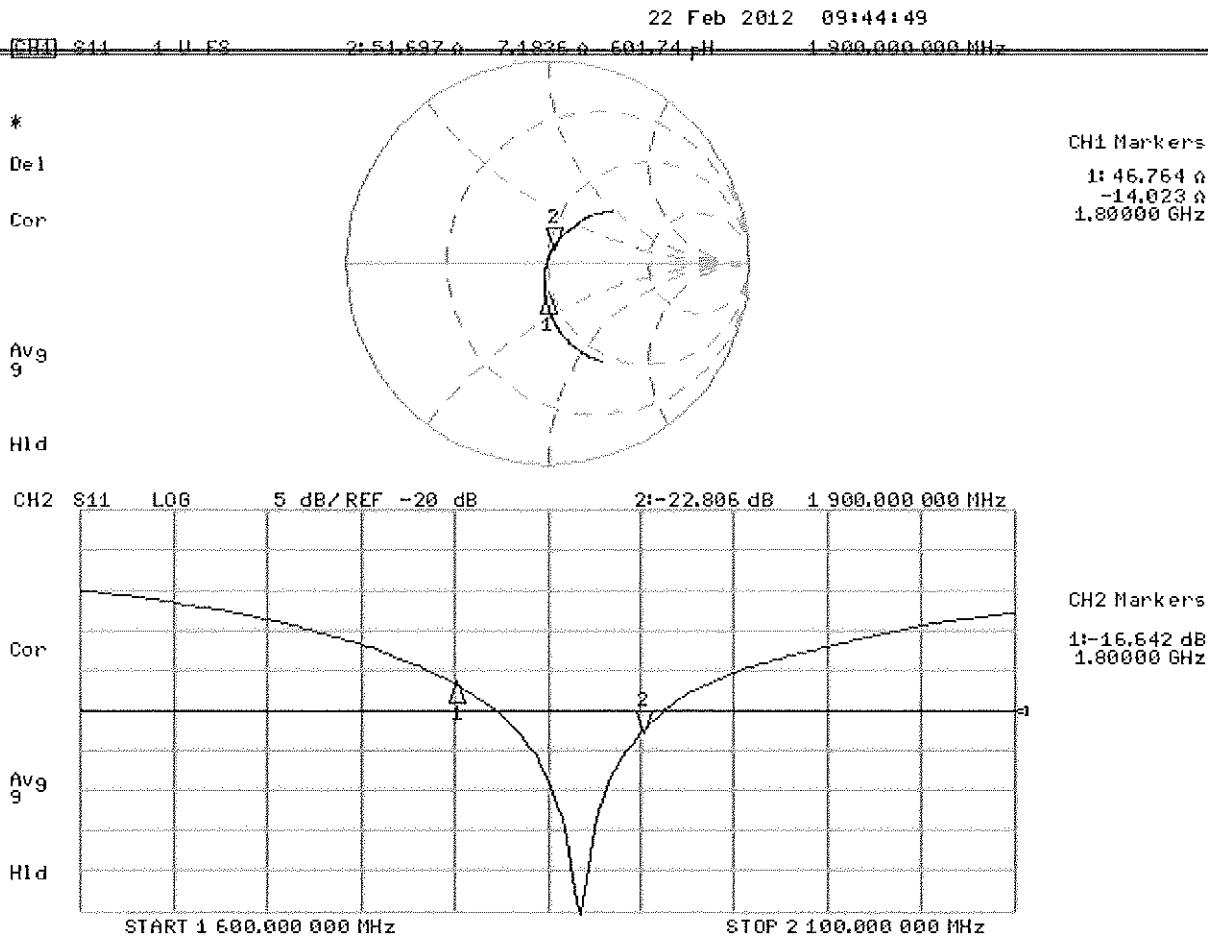
SAR(1 g) = 9.79 mW/g; SAR(10 g) = 5.17 mW/g

Maximum value of SAR (measured) = 12.015 mW/g



0 dB = 12.020mW/g = 21.60 dB mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 22.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 502

Communication System: CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.56$ mho/m; $\epsilon_r = 53$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.62, 4.62, 4.62); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

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

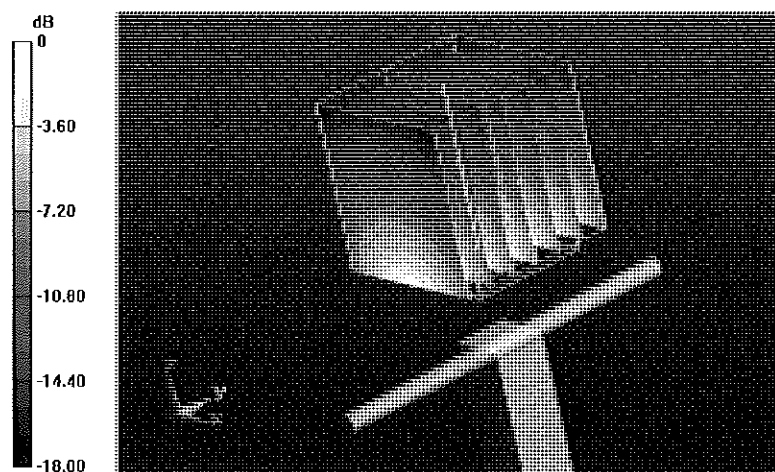
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.607 V/m; Power Drift = 0.0093 dB

Peak SAR (extrapolated) = 17.4260

SAR(1 g) = 9.88 mW/g; SAR(10 g) = 5.17 mW/g

Maximum value of SAR (measured) = 12.532 mW/g



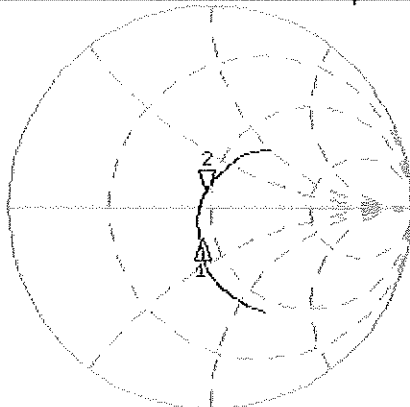
0 dB = 12.530mW/g = 21.96 dB mW/g

Impedance Measurement Plot for Body TSL

22 Feb 2012 09:44:23

[CH3] S11 1 U FS 2:47.184 Ω 2:6133 Ω 637.73 μ H 1.900.000.000 MHz

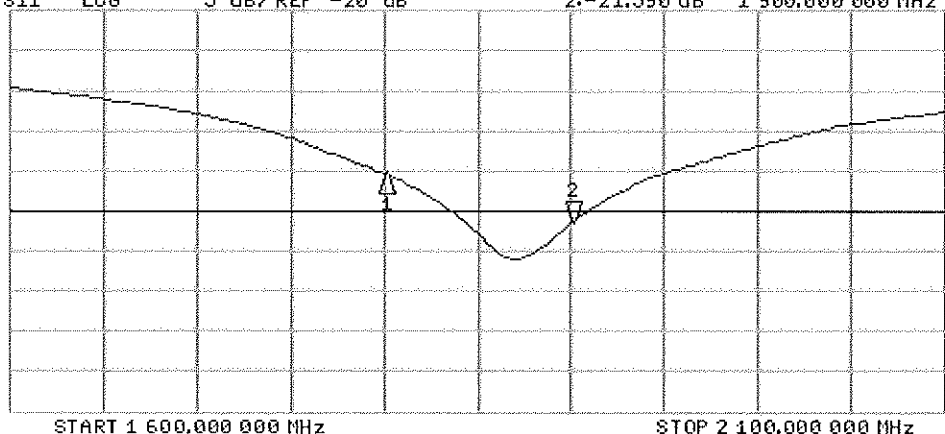
*
Del
Cor
Avg
16
H1d



CH1 Markers
1: 43.225 Ω
-14.492 Ω
1.80000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 2:-21.590 dB 1.900.000.000 MHz

Cor
Avg
16
H1d



CH2 Markers
1:-15.413 dB
1.80000 GHz

START 1 600.000 000 MHz

STOP 2 100.000 000 MHz



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Client **PC Test**

Certificate No: **D2450V2-882_Feb12**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 882**

Calibration procedure(s) **QA CAL-05.v8**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **February 07, 2012**

LOK
4/6/12

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 $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5086 (20g)	29-Mar-11 (No. 217-01368)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Issued: February 15, 2012

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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	38.9 $\pm$ 6 %	1.86 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.6 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	53.5 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.27 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	24.8 mW / g $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	52.3 $\pm$ 6 %	2.02 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.8 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	50.3 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.94 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	23.5 mW / g $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$53.7 \Omega + 1.1 j\Omega$
Return Loss	- 28.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$51.0 \Omega + 3.2 j\Omega$
Return Loss	- 29.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.156 ns
----------------------------------	----------

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

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	October 06, 2011

DASY5 Validation Report for Head TSL

Date: 07.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.86$ mho/m; $\epsilon_r = 38.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

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

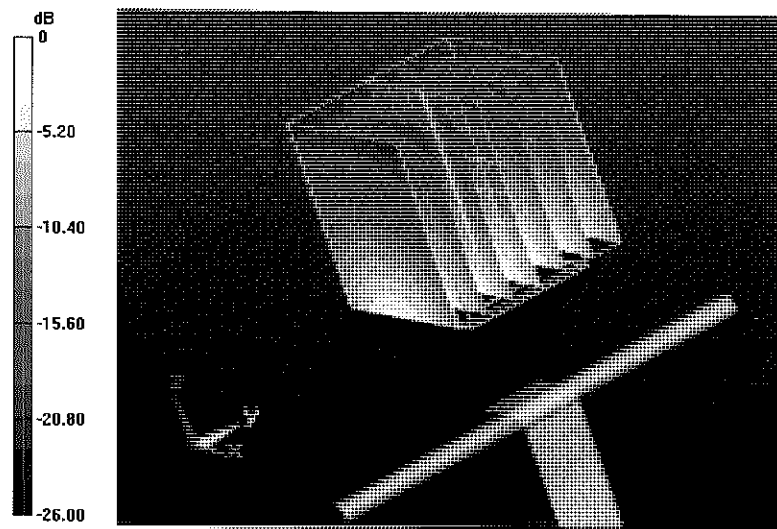
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 100.8 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 28.3920

SAR(1 g) = 13.6 mW/g; SAR(10 g) = 6.27 mW/g

Maximum value of SAR (measured) = 17.598 mW/g

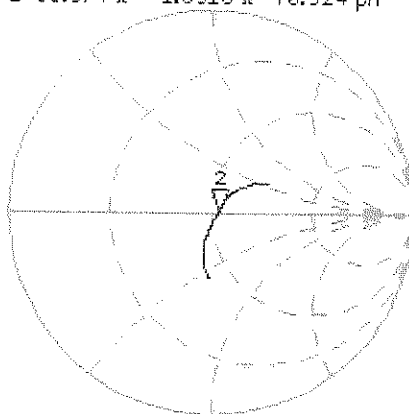


0 dB = 17.600mW/g = 24.91 dB mW/g

Impedance Measurement Plot for Head TSL

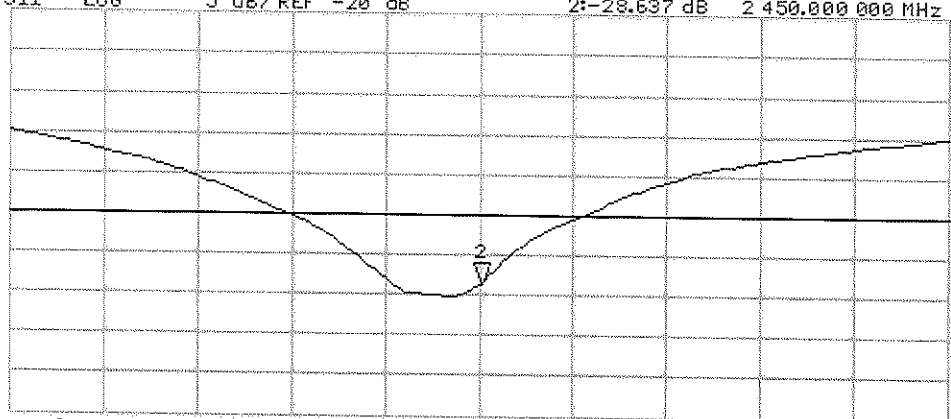
CH1 S11 1 U FS 7 Feb 2012 11:30:04
 2: 53.674 Ω 1.0918 Ω 70.924 μH 2 450.000 000 MHz

*
 Del
 CA
 Avg
 15
 H1 d



CH2 S11 LOG 5 dB/REF -20 dB 2:-28.637 dB 2 450.000 000 MHz

CA
 Avg
 15
 H1 d



START 2 250.000 000 MHz

STOP 2 650.000 000 MHz

DASY5 Validation Report for Body TSL

Date: 07.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.02$ mho/m; $\epsilon_r = 52.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

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

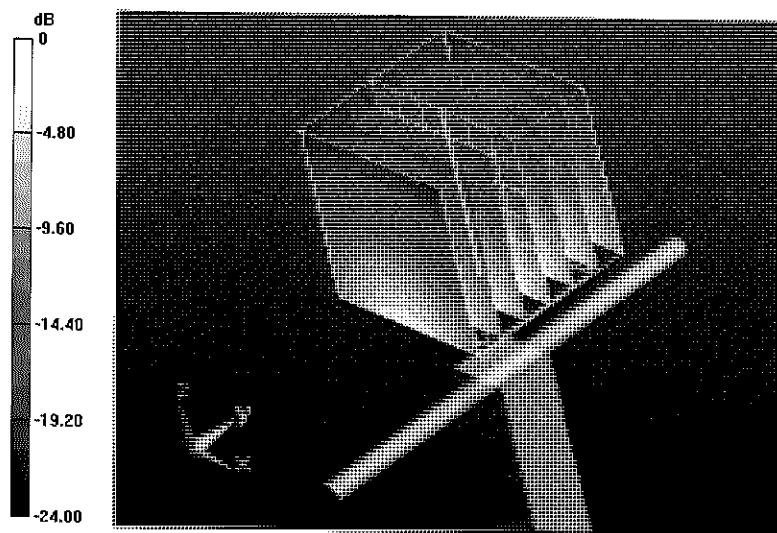
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.959 V/m; Power Drift = 0.0036 dB

Peak SAR (extrapolated) = 26.2610

SAR(1 g) = 12.8 mW/g; SAR(10 g) = 5.94 mW/g

Maximum value of SAR (measured) = 16.899 mW/g

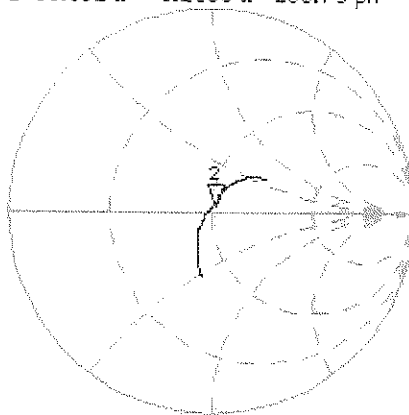


0 dB = 16.900mW/g = 24.56 dB mW/g

Impedance Measurement Plot for Body TSL

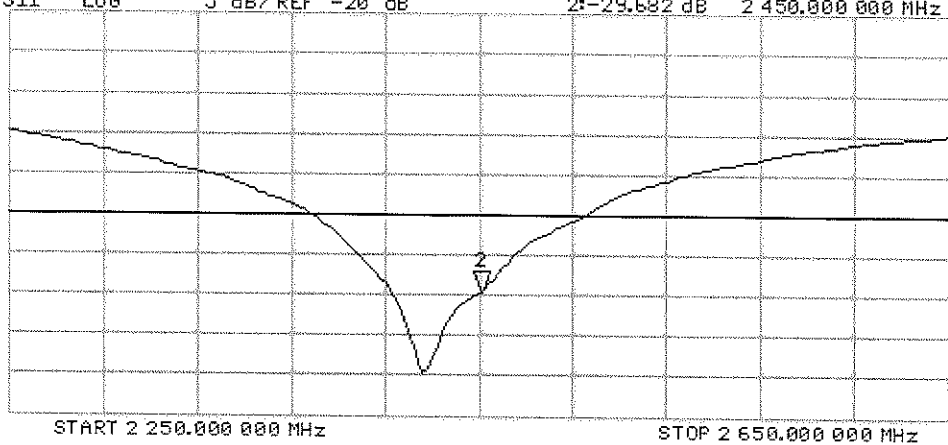
7 Feb 2012 11:28:39
 CH1 S11 1 U FS 2: 50.982 Ω 3.1680 Ω 205.79 μ H 2 450.000 000 MHz

*
 Del
 CA
 Avg
 16
 H1 d



CH2 S11 LOG 5 dB/REF -20 dB 2:-29.682 dB 2 450.000 000 MHz

CA
 Avg
 16
 H1 d



START 2 250.000 000 MHz STOP 2 650.000 000 MHz



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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D2450V2-719_Aug12**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 719**

Calibration procedure(s) **QA CAL-05.v8**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **August 23, 2012**

✓ KOK
9/17/12

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

Calibrated by: **Israe El-Naouq** Name: **Israe El-Naouq** Function: **Laboratory Technician**

Approved by: **Katja Pokovic** Technical Manager

Signature

Israe El-Naouq
Katja Pokovic

Issued: August 23, 2012

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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- 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
- 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
- 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:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied.

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

SAR result with Head TSL

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

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

Body TSL parameters

The following parameters and calculations were applied.

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

SAR result with Body TSL

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

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

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$54.4 \Omega + 3.8 j\Omega$
Return Loss	- 25.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$50.7 \Omega + 5.9 j\Omega$
Return Loss	- 24.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.150 ns
----------------------------------	----------

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

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 10, 2002

DASY5 Validation Report for Head TSL

Date: 23.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.81$ mho/m; $\epsilon_r = 39.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

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

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

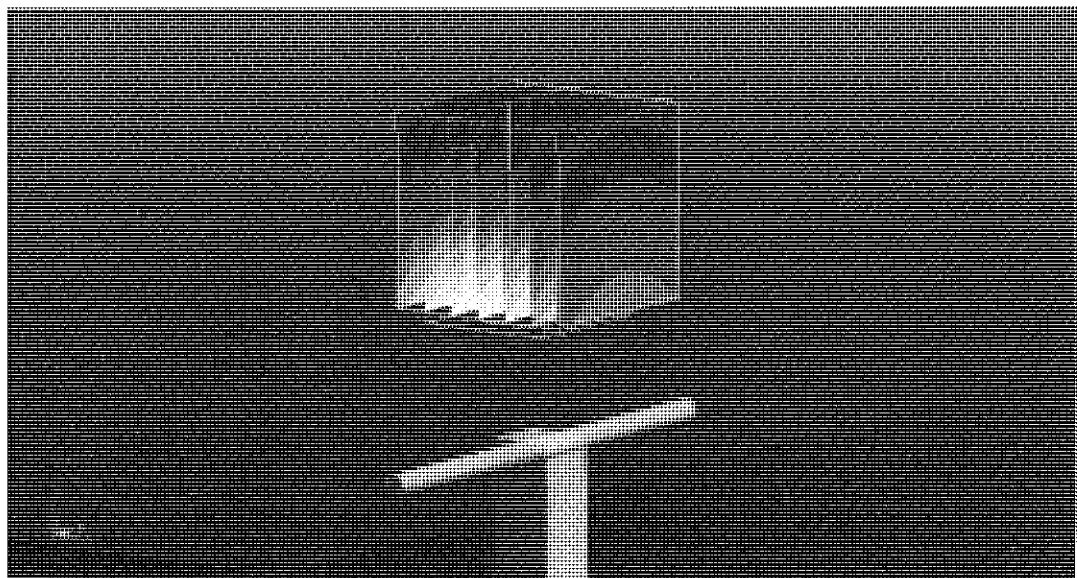
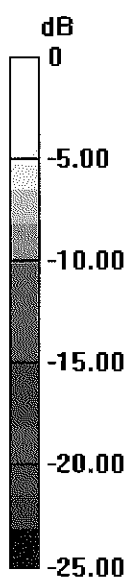
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 99.219 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 26.633 mW/g

SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.19 mW/g

Maximum value of SAR (measured) = 16.5 W/kg

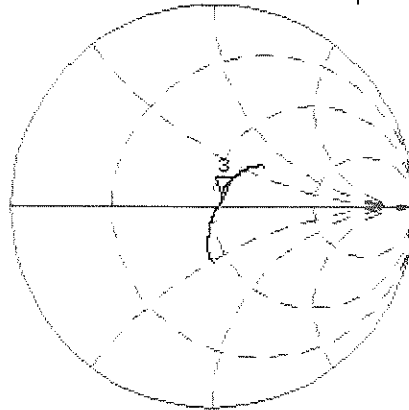


0 dB = 16.5 W/kg = 24.35 dB W/kg

Impedance Measurement Plot for Head TSL

22 Aug 2012 15:39:08
 [CH1] S11 1 U FS 3: 54.416 Ω 3.7656 Ω 244.62 pH 2 450.000 000 MHz

*
 Del
 CA



Avg
 16

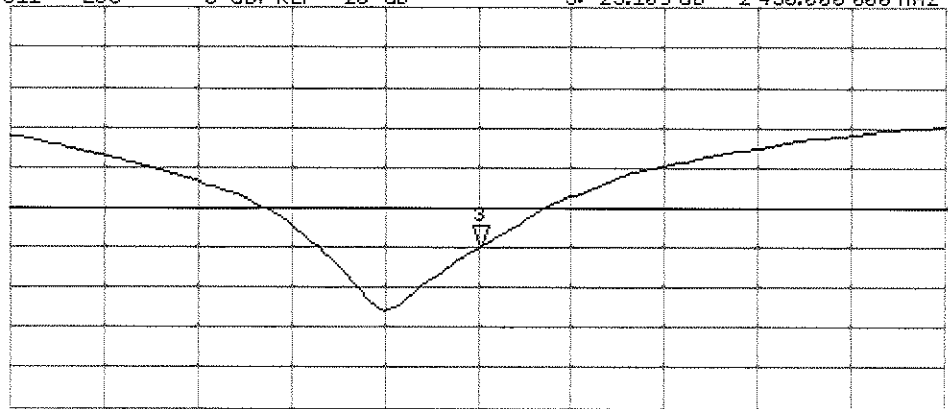
H1d

CH2 S11 LOG 5 dB/REF -20 dB 3: -25.109 dB 2 450.000 000 MHz

CA

Avg
 16

H1d



START 2 250.000 000 MHz

STOP 2 650.000 000 MHz

DASY5 Validation Report for Body TSL

Date: 22.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.99$ mho/m; $\epsilon_r = 51.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

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

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

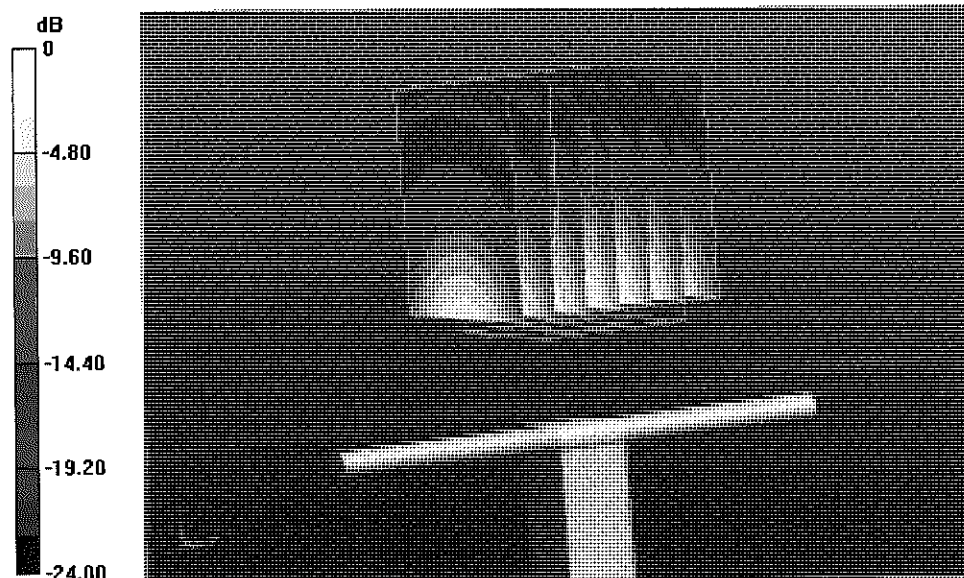
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.970 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 26.692 mW/g

SAR(1 g) = 13.1 mW/g; SAR(10 g) = 6.16 mW/g

Maximum value of SAR (measured) = 17.1 W/kg

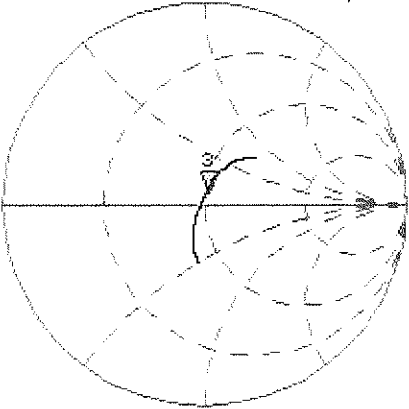


0 dB = 17.1 W/kg = 24.66 dB W/kg

Impedance Measurement Plot for Body TSL

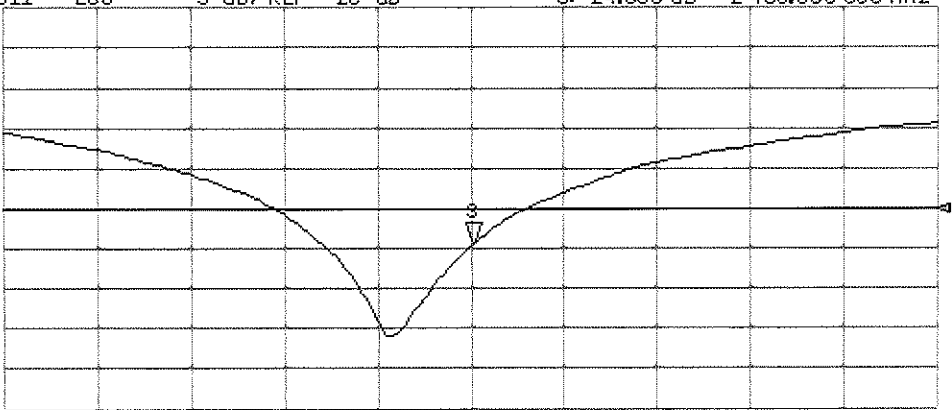
22 Aug 2012 15:38:22
[CH1] S11 1 U FS 3: 50.709 Ω 5.8906 Ω 382.66 pF 2 450.000 000 MHz

*
Del
CA
Avg
16
H1d



CH2 S11 LOG 5 dB/REF -20 dB 3:-24.605 dB 2 450.000 000 MHz

CA
Avg
16
H1d



START 2 250.000 000 MHz STOP 2 650.000 000 MHz



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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D5GHzV2-1120_Feb12**

CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN: 1120**

Calibration procedure(s) **QA CAL-22.v1**
Calibration procedure for dipole validation kits between 3-6 GHz

Calibration date: **February 01, 2012**

✓ KOK
5/14/12

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 $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5086 (20g)	29-Mar-11 (No. 217-01368)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe EX3DV4	SN: 3503	30-Dec-11 (No. EX3-3503_Dec11)	Dec-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

Calibrated by: **Jeton Kastrati** **Laboratory Technician**

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

Issued: February 6, 2012

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



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz $\pm$ 1 MHz 5500 MHz $\pm$ 1 MHz 5800 MHz $\pm$ 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	36.3 $\pm$ 6 %	4.60 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.95 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	79.6 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.28 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	22.8 mW / g $\pm$ 16.5 % (k=2)

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	35.8 $\pm$ 6 %	4.90 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.49 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	84.9 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.42 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	24.2 mW / g $\pm$ 16.5 % (k=2)

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.3 ± 6 %	5.22 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.88 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	78.8 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.24 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	22.4 mW / g ± 16.5 % (k=2)

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	49.2 ± 6 %	5.46 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.21 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	72.2 mW / g ± 18.1 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.03 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	20.4 mW / g ± 17.6 % (k=2)

Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.7 ± 6 %	5.86 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.98 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	80.0 mW / g ± 18.1 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.22 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	22.2 mW / g ± 17.6 % (k=2)

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.2 ± 6 %	6.28 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.37 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	73.8 mW / g ± 18.1 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.04 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	20.4 mW / g ± 17.6 % (k=2)

Appendix

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	54.4 Ω - 5.1 j Ω
Return Loss	- 23.8 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	51.9 Ω - 3.1 j Ω
Return Loss	- 28.9 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	52.9 Ω + 2.3 j Ω
Return Loss	- 28.9 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	53.8 Ω - 2.7 j Ω
Return Loss	- 27.0 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	53.3 Ω + 1.1 j Ω
Return Loss	- 29.4 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	55.2 Ω + 3.9 j Ω
Return Loss	- 24.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.207 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 08, 2011

DASY5 Validation Report for Head TSL

Date: 01.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1120

Communication System: CW; Frequency: 5200 MHz, Frequency: 5500 MHz, Frequency: 5800 MHz
Medium parameters used: $f = 5200$ MHz; $\sigma = 4.6$ mho/m; $\epsilon_r = 36.3$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5500$ MHz; $\sigma = 4.9$ mho/m; $\epsilon_r = 35.8$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5800$ MHz; $\sigma = 5.22$ mho/m; $\epsilon_r = 35.3$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.41, 5.41, 5.41), ConvF(4.91, 4.91, 4.91), ConvF(4.81, 4.81, 4.81); Calibrated: 30.12.2011
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 64.814 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 29.5200

SAR(1 g) = 7.95 mW/g; SAR(10 g) = 2.28 mW/g

Maximum value of SAR (measured) = 17.959 mW/g

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 65.007 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 33.8120

SAR(1 g) = 8.49 mW/g; SAR(10 g) = 2.42 mW/g

Maximum value of SAR (measured) = 19.722 mW/g

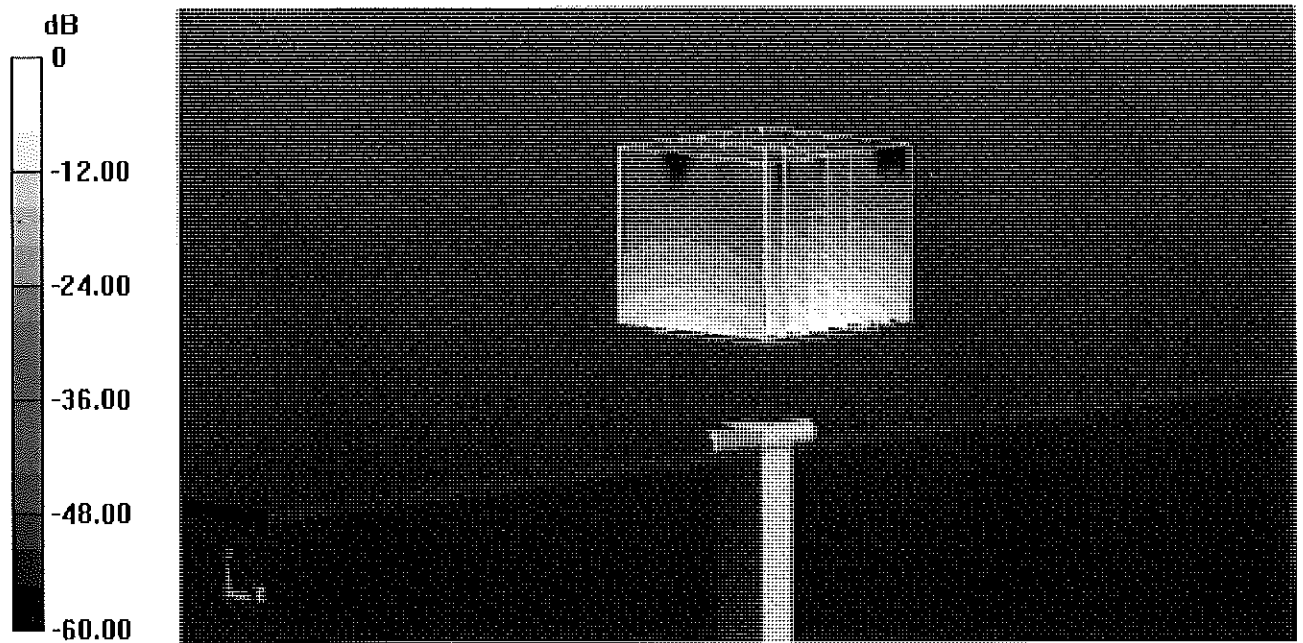
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 61.595 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 32.9250

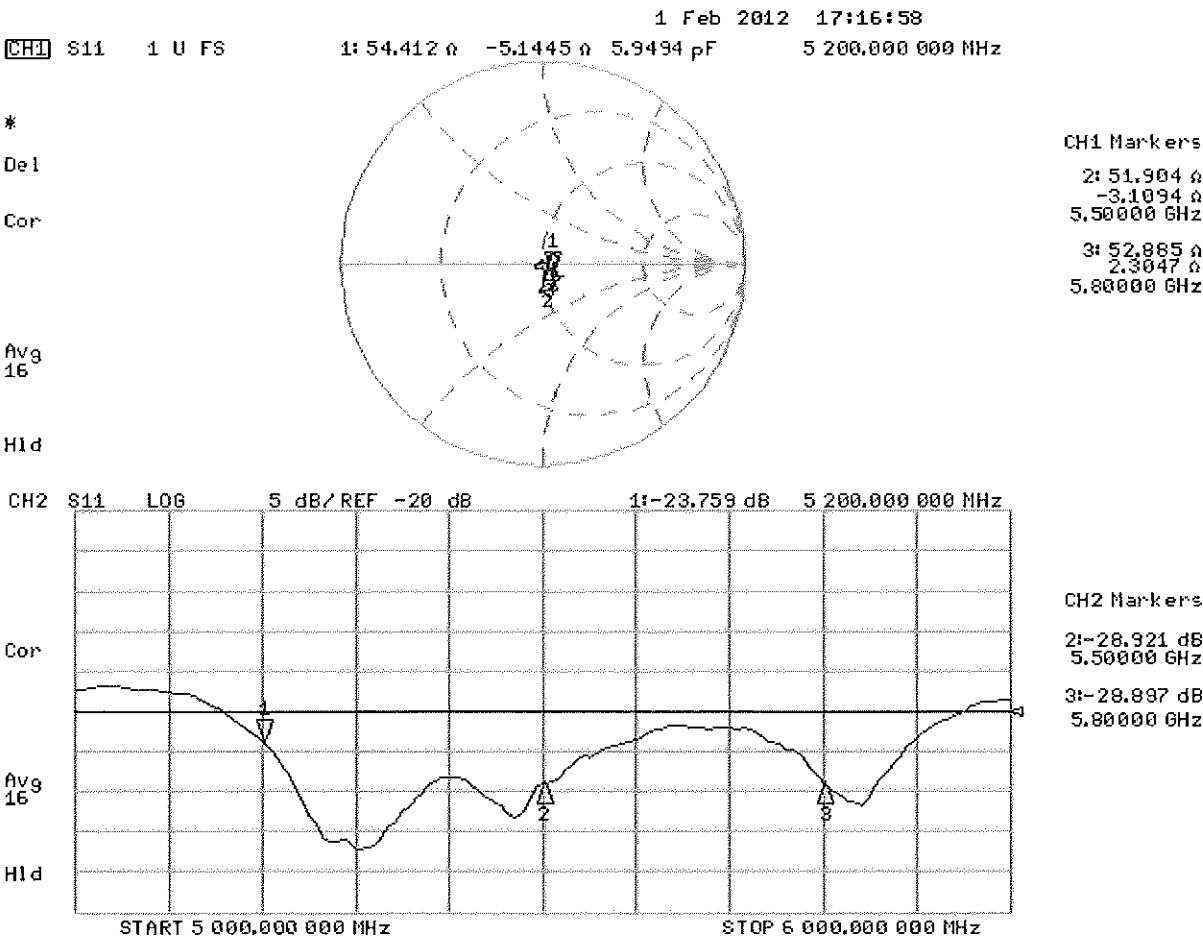
SAR(1 g) = 7.88 mW/g; SAR(10 g) = 2.24 mW/g

Maximum value of SAR (measured) = 18.643 mW/g



0 dB = 18.640mW/g = 25.41 dB mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 31.01.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1120

Communication System: CW; Frequency: 5200 MHz, Frequency: 5500 MHz, Frequency: 5800 MHz
Medium parameters used: $f = 5200$ MHz; $\sigma = 5.46$ mho/m; $\epsilon_r = 49.2$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5500$ MHz; $\sigma = 5.86$ mho/m; $\epsilon_r = 48.7$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5800$ MHz; $\sigma = 6.28$ mho/m; $\epsilon_r = 48.2$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.91, 4.91, 4.91), ConvF(4.43, 4.43, 4.43), ConvF(4.38, 4.38, 4.38); Calibrated: 30.12.2011
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 57.518 V/m; Power Drift = -0.008 dB

Peak SAR (extrapolated) = 28.3990

SAR(1 g) = 7.21 mW/g; SAR(10 g) = 2.03 mW/g

Maximum value of SAR (measured) = 16.537 mW/g

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 58.605 V/m; Power Drift = -0.0017 dB

Peak SAR (extrapolated) = 34.4630

SAR(1 g) = 7.98 mW/g; SAR(10 g) = 2.22 mW/g

Maximum value of SAR (measured) = 19.105 mW/g

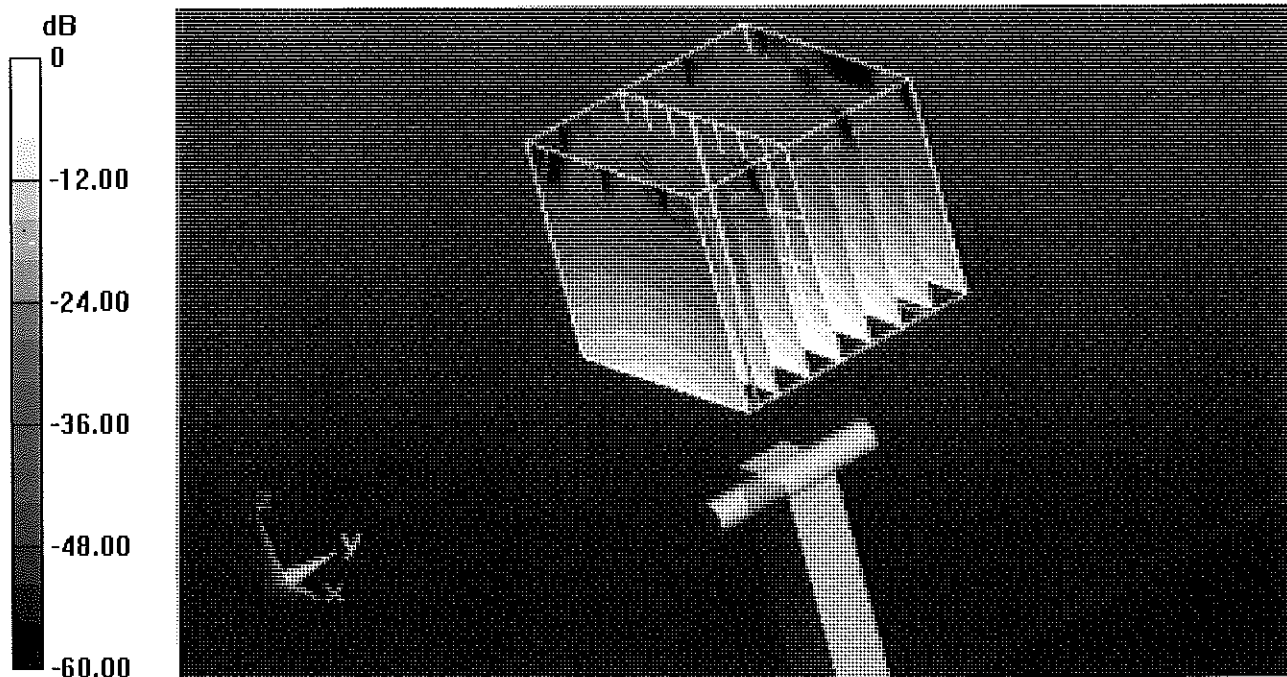
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 54.867 V/m; Power Drift = 0.0057 dB

Peak SAR (extrapolated) = 34.2880

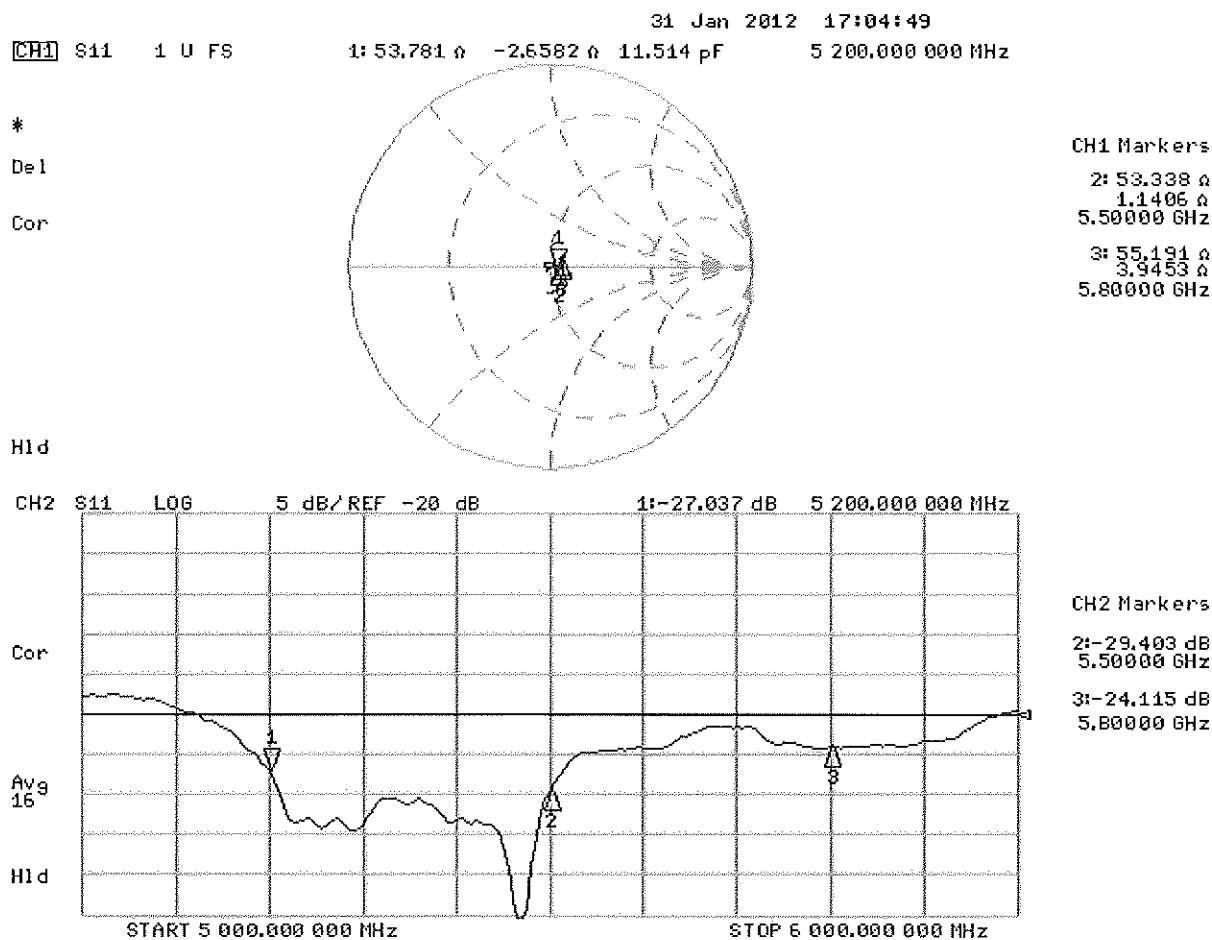
SAR(1 g) = 7.37 mW/g; SAR(10 g) = 2.04 mW/g

Maximum value of SAR (measured) = 17.882 mW/g



0 dB = 17.880mW/g = 25.05 dB mW/g

Impedance Measurement Plot for Body TSL





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

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D5GHzV2-1007_Oct12**

CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN: 1007**

Calibration procedure(s) **QA CAL-22.v1**
Calibration procedure for dipole validation kits between 3-6 GHz

Calibration date: **October 30, 2012**

✓ KOK
11/15/12

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe EX3DV4	SN: 3503	30-Dec-11 (No. EX3-3503_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

Calibrated by: **Israe El-Naouq** Name: **Israe El-Naouq** Function: **Laboratory Technician**

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

Signature: *Israe El-Naouq*
Katja Pokovic

Issued: October 31, 2012

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



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

Glossary:

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

Calibration is Performed According to the Following Standards:

- a) IEC 62209-2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", March 2010
- b) 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:

- c) 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	V52.8.3
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz $\pm$ 1 MHz 5300 MHz $\pm$ 1 MHz 5500 MHz $\pm$ 1 MHz 5600 MHz $\pm$ 1 MHz 5800 MHz $\pm$ 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	34.8 $\pm$ 6 %	4.53 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.04 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.8 W/kg $\pm$ 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.9 W/kg $\pm$ 19.5 % (k=2)

Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	34.7 $\pm$ 6 %	4.63 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	83.1 W/kg $\pm$ 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.9 W/kg $\pm$ 19.5 % (k=2)

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.4 ± 6 %	4.83 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.56 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	84.9 W / kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.44 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.1 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.2 ± 6 %	4.93 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.53 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	84.5 W / kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.43 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.0 W/kg ± 19.5 % (k=2)

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.0 ± 6 %	5.15 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.05 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.8 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.29 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.7 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.8 ± 6 %	5.41 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.40 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	73.3 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.08 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.6 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.7 ± 6 %	5.52 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.63 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	75.6 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.2 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.3 ± 6 %	5.78 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.92 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	78.5 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.21 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.8 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.2 ± 6 %	5.90 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	8.07 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	80.0 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.25 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	22.2 W/kg ± 19.5 % (k=2)

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	45.9 ± 6 %	6.18 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.49 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	74.3 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.08 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	20.6 W/kg ± 19.5 % (k=2)

Appendix

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	55.1 Ω - 11.2 j Ω
Return Loss	- 18.7 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	56.8 Ω - 1.2 j Ω
Return Loss	- 23.8 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	49.5 Ω - 4.3 j Ω
Return Loss	- 27.3 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	59.3 Ω - 7.4 j Ω
Return Loss	- 19.3 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	57.2 Ω + 5.4 j Ω
Return Loss	- 21.6 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	52.1 Ω - 10.0 j Ω
Return Loss	- 20.1 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	55.6 Ω - 3.0 j Ω
Return Loss	- 24.4 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	50.1 Ω - 3.3 j Ω
Return Loss	- 29.5 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	57.6 Ω - 6.2 j Ω
Return Loss	- 20.8 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	$59.7 \Omega + 4.5 j\Omega$
Return Loss	- 20.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.201 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	August 28, 2003

DASY5 Validation Report for Head TSL

Date: 30.10.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1007

Communication System: CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used: $f = 5200$ MHz; $\sigma = 4.53$ mho/m; $\epsilon_r = 34.8$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5300$ MHz; $\sigma = 4.63$ mho/m; $\epsilon_r = 34.7$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5500$ MHz; $\sigma = 4.83$ mho/m; $\epsilon_r = 34.4$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5600$ MHz; $\sigma = 4.93$ mho/m; $\epsilon_r = 34.2$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5800$ MHz; $\sigma = 5.15$ mho/m; $\epsilon_r = 34$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.41, 5.41, 5.41); Calibrated: 30.12.2011, ConvF(5.1, 5.1, 5.1); Calibrated: 30.12.2011, ConvF(4.91, 4.91, 4.91); Calibrated: 30.12.2011, ConvF(4.76, 4.76, 4.76); Calibrated: 30.12.2011, ConvF(4.81, 4.81, 4.81); Calibrated: 30.12.2011;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 64.518 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 29.8 W/kg

SAR(1 g) = 8.04 W/kg; SAR(10 g) = 2.31 W/kg

Maximum value of SAR (measured) = 18.7 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 64.964 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 31.8 W/kg

SAR(1 g) = 8.38 W/kg; SAR(10 g) = 2.41 W/kg

Maximum value of SAR (measured) = 19.8 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 64.435 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 33.8 W/kg

SAR(1 g) = 8.56 W/kg; SAR(10 g) = 2.44 W/kg

Maximum value of SAR (measured) = 20.5 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 64.179 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 33.9 W/kg

SAR(1 g) = 8.53 W/kg; SAR(10 g) = 2.43 W/kg

Maximum value of SAR (measured) = 20.4 W/kg

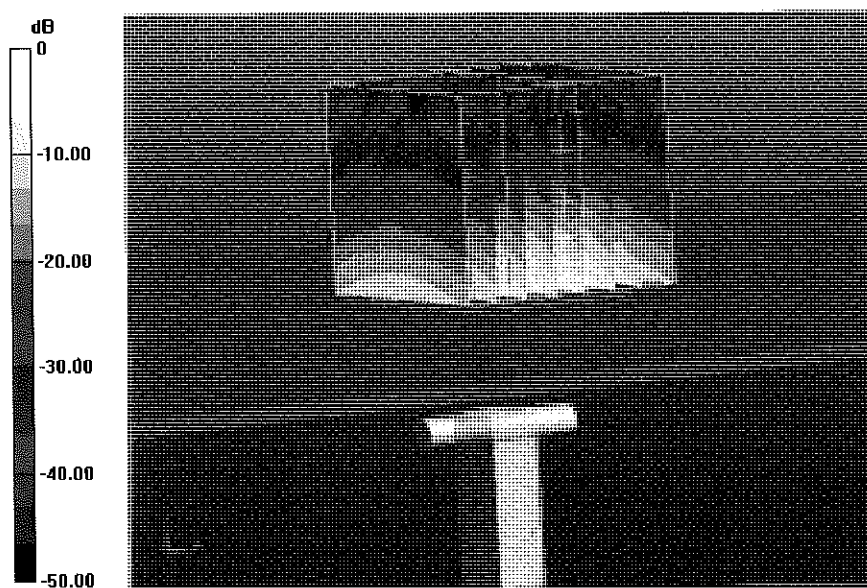
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 61.223 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 33.5 W/kg

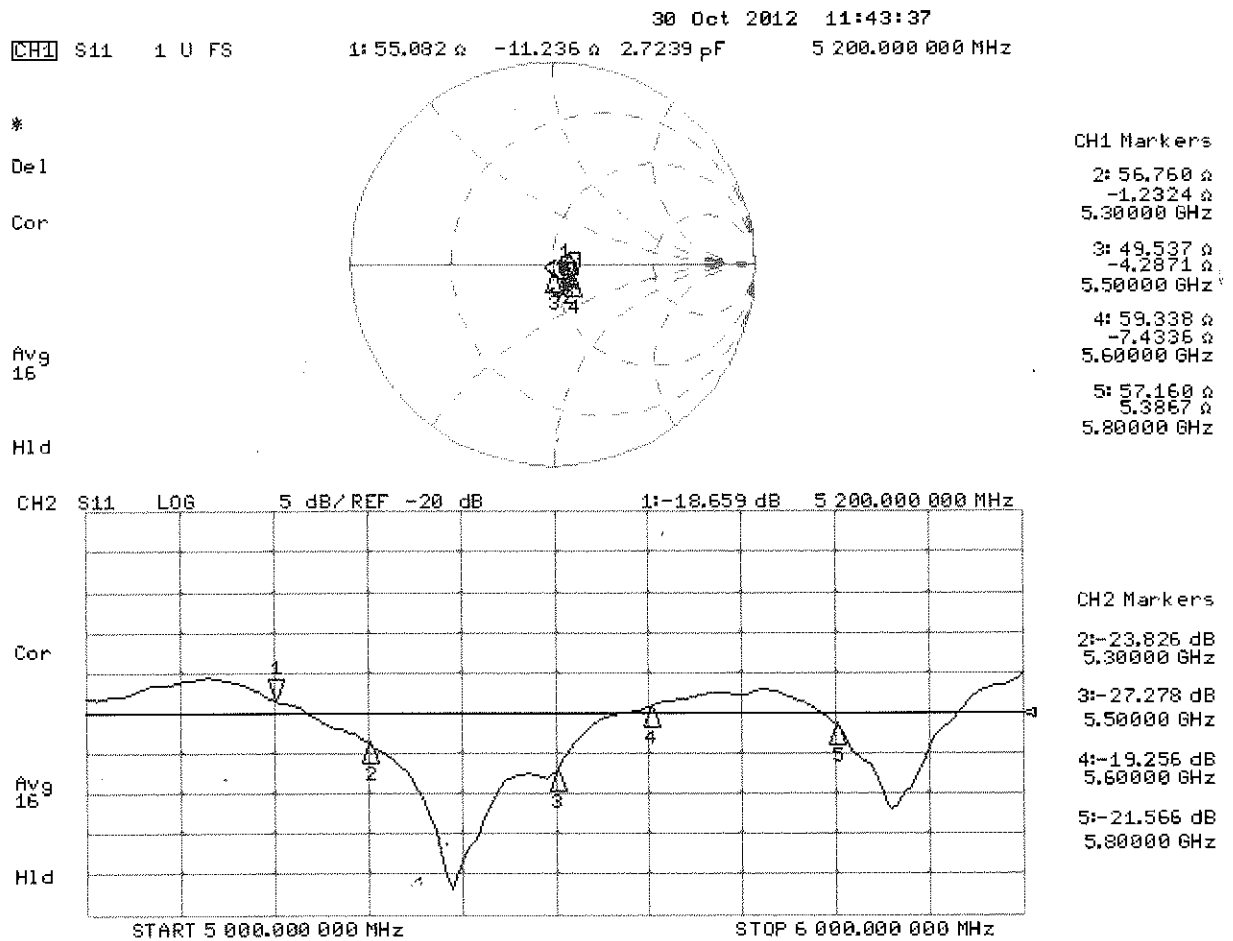
SAR(1 g) = 8.05 W/kg; SAR(10 g) = 2.29 W/kg

Maximum value of SAR (measured) = 19.6 W/kg



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

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 30.10.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1007

Communication System: CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz

Medium parameters used: $f = 5200$ MHz; $\sigma = 5.41$ mho/m; $\epsilon_r = 46.8$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5300$ MHz; $\sigma = 5.52$ mho/m; $\epsilon_r = 46.7$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5500$ MHz; $\sigma = 5.78$ mho/m; $\epsilon_r = 46.3$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5600$ MHz; $\sigma = 5.9$ mho/m; $\epsilon_r = 46.2$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5800$ MHz; $\sigma = 6.18$ mho/m; $\epsilon_r = 45.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.91, 4.91, 4.91); Calibrated: 30.12.2011, ConvF(4.67, 4.67, 4.67); Calibrated: 30.12.2011, ConvF(4.43, 4.43, 4.43); Calibrated: 30.12.2011, ConvF(4.22, 4.22, 4.22); Calibrated: 30.12.2011, ConvF(4.38, 4.38, 4.38); Calibrated: 30.12.2011;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 58.536 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 29.4 W/kg

SAR(1 g) = 7.4 W/kg; SAR(10 g) = 2.08 W/kg

Maximum value of SAR (measured) = 17.6 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 58.637 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 31.3 W/kg

SAR(1 g) = 7.63 W/kg; SAR(10 g) = 2.14 W/kg

Maximum value of SAR (measured) = 18.4 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 58.216 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 34.4 W/kg

SAR(1 g) = 7.92 W/kg; SAR(10 g) = 2.21 W/kg

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

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 58.347 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 35.9 W/kg

SAR(1 g) = 8.07 W/kg; SAR(10 g) = 2.25 W/kg

Maximum value of SAR (measured) = 19.9 W/kg

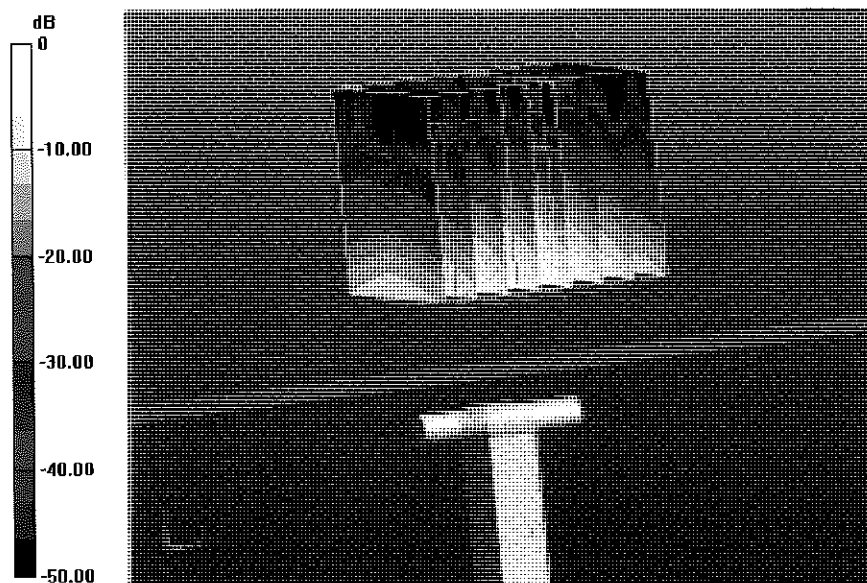
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 55.261 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 35.4 W/kg

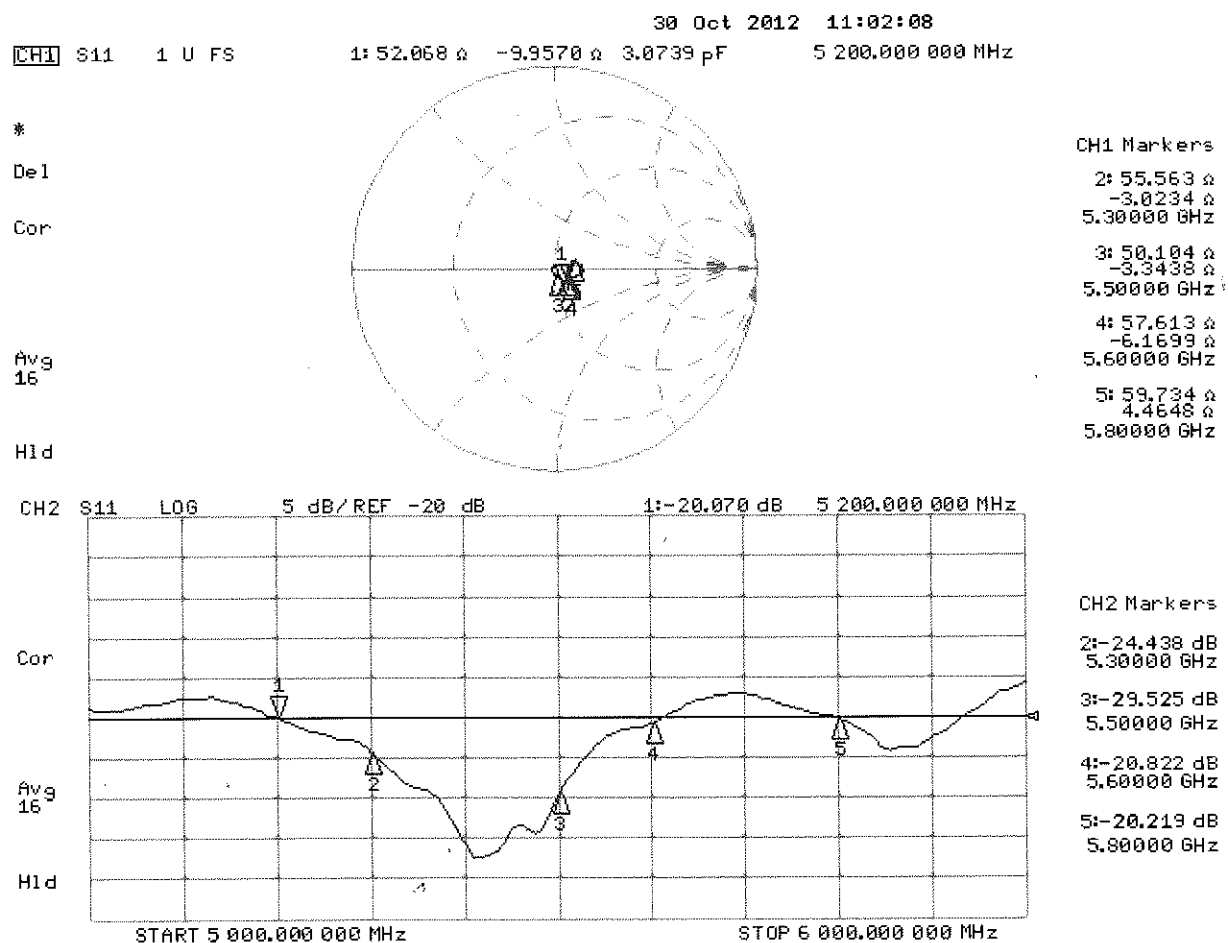
SAR(1 g) = 7.49 W/kg; SAR(10 g) = 2.08 W/kg

Maximum value of SAR (measured) = 18.9 W/kg



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

Impedance Measurement Plot for Body TSL





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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D750V3-1054_Feb12**

CALIBRATION CERTIFICATE

Object **D750V3 - SN: 1054**

Calibration procedure(s) **QA CAL-05.v8**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **February 09, 2012**

✓
KOK
5/11/12

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5086 (20g)	29-Mar-11 (No. 217-01368)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12

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

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

Issued: February 9, 2012

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Accreditation No.: **SCS 108**

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Multilateral Agreement for the recognition of calibration certificates

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "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
- 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
- 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:

- 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.

Measurement Conditions

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

DASY Version	DASY5	V52.8.0
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 $\pm$ 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 $\pm$ 0.2) °C	42.3 $\pm$ 6 %	0.92 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.18 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	8.52 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.42 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	5.57 mW / g $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	55.6 $\pm$ 6 %	0.96 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.21 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	8.84 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.46 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	5.84 mW / g $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.0 Ω - 1.5 j Ω
Return Loss	- 27.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.6 Ω - 3.4 j Ω
Return Loss	- 29.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.041 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	November 08, 2011

DASY5 Validation Report for Head TSL

Date: 09.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1054

Communication System: CW; Frequency: 750 MHz

Medium parameters used: $f = 750$ MHz; $\sigma = 0.92$ mho/m; $\epsilon_r = 42.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.33, 6.33, 6.33); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

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

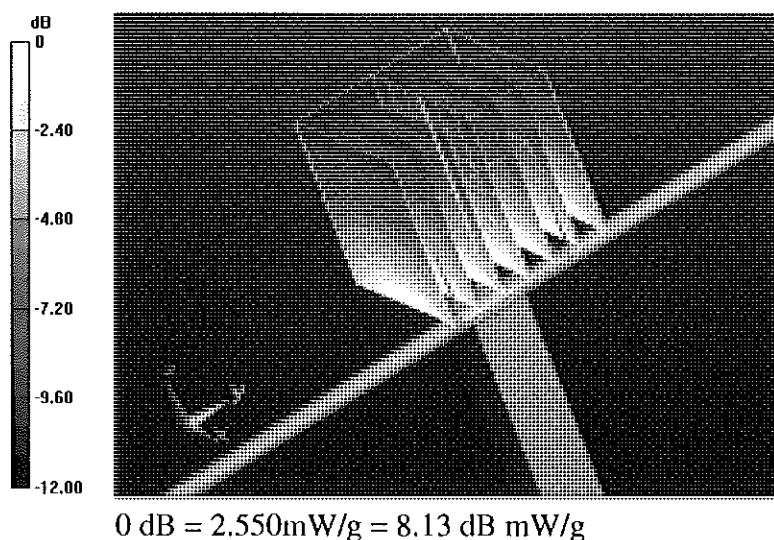
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 53.659 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 3.2940

SAR(1 g) = 2.18 mW/g; SAR(10 g) = 1.42 mW/g

Maximum value of SAR (measured) = 2.552 mW/g



Impedance Measurement Plot for Head TSL

9 Feb 2012 15:46:54
 [CH1] S11 1 U FS 1: 53.955 Ω -1.4746 Ω 143.91 pF 750.000 000 MHz

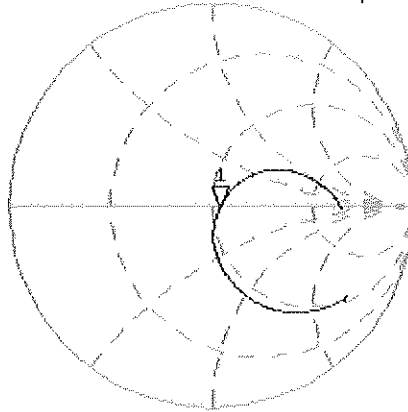
*

De1

Cor

Avg
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H1d

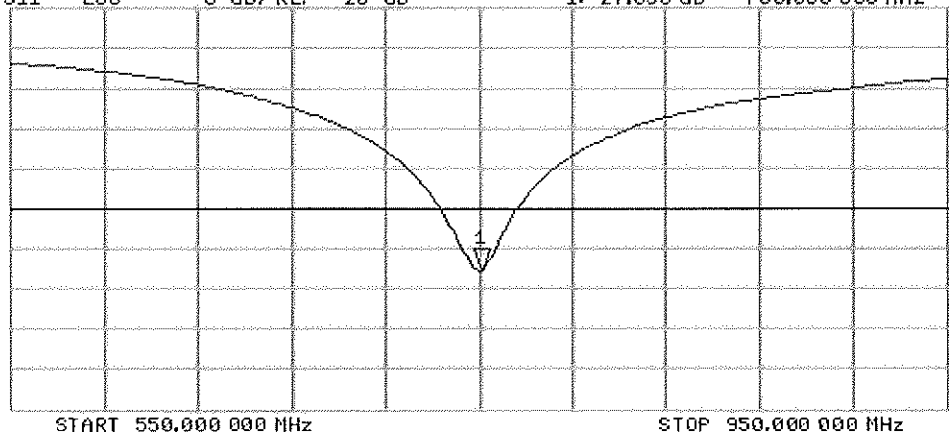


CH2 S11 LOG 5 dB/REF -20 dB 1:-27.835 dB 750.000 000 MHz

Cor

Avg
0

H1d



DASY5 Validation Report for Body TSL

Date: 09.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1054

Communication System: CW; Frequency: 750 MHz

Medium parameters used: $f = 750$ MHz; $\sigma = 0.96$ mho/m; $\epsilon_r = 55.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.12, 6.12, 6.12); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

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

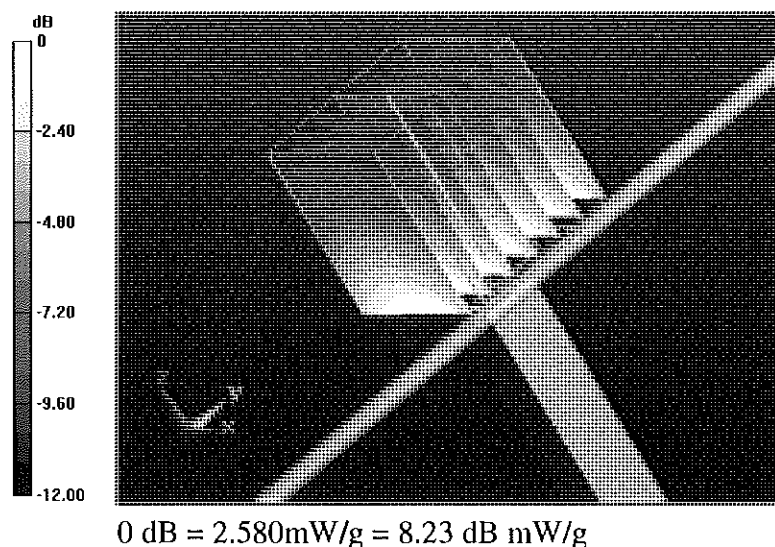
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 53.016 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 3.2860

SAR(1 g) = 2.21 mW/g; SAR(10 g) = 1.46 mW/g

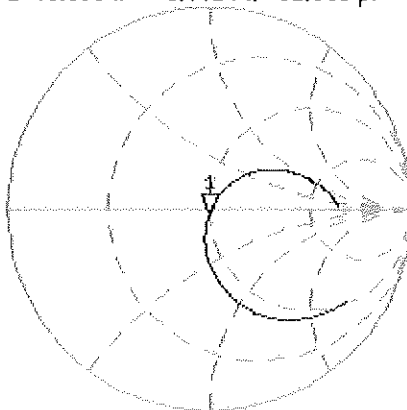
Maximum value of SAR (measured) = 2.576 mW/g



Impedance Measurement Plot for Body TSL

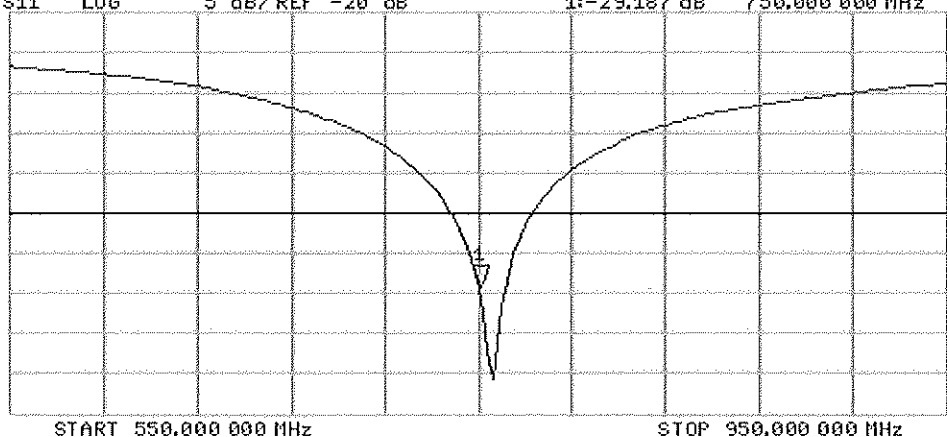
9 Feb 2012 12:59:08
 [CH1] S11 1 U FS 1: 49.650 Ω -3.4414 Ω 61.663 pF 750.000 000 MHz

*
 De1
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 Avg
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 H1d



CH2 S11 LOG 5 dB/REF -20 dB 1:-29.187 dB 750.000 000 MHz

Cor
 Avg
 16
 H1d





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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D835V2-4d132_Feb12**

CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d132**

Calibration procedure(s) **QA CAL-05.v8**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **February 03, 2012**

✓ FOK
 5/11/12

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5086 (20g)	29-Mar-11 (No. 217-01368)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Issued: February 3, 2012

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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- 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
- 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
- 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:

- 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.

Measurement Conditions

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

DASY Version	DASY5	V52.8.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.8 $\pm$ 6 %	0.89 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.34 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	9.45 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.53 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	6.17 mW / g $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	53.3 $\pm$ 6 %	0.98 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.39 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	9.41 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.57 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	6.21 mW / g $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.7 Ω - 2.3 j Ω
Return Loss	- 29.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.9 Ω - 3.5 j Ω
Return Loss	- 28.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.392 ns
----------------------------------	----------

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

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 22, 2011

DASY5 Validation Report for Head TSL

Date: 03.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 835 MHz

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.89 \text{ mho/m}$; $\epsilon_r = 41.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.07, 6.07, 6.07); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

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

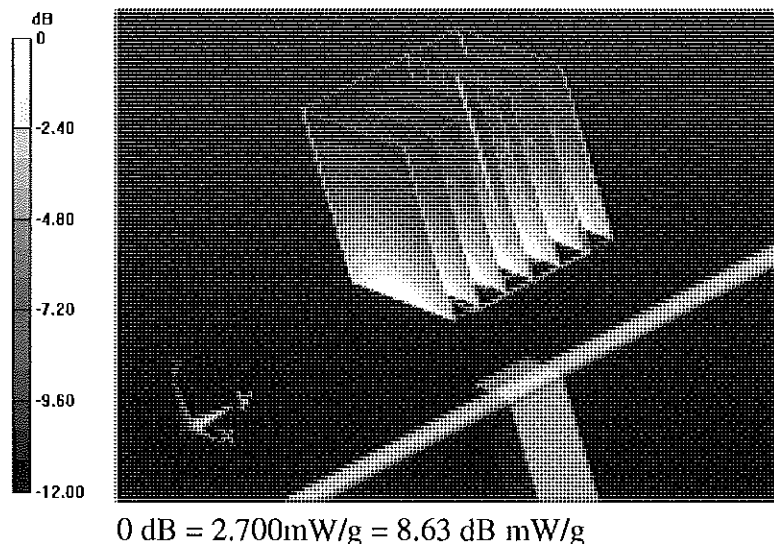
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 56.867 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 3.4300

SAR(1 g) = 2.34 mW/g; SAR(10 g) = 1.53 mW/g

Maximum value of SAR (measured) = 2.701 mW/g



Impedance Measurement Plot for Head TSL

3 Feb 2012 10:50:38
 [CH1] S11 1 U FS 1: 52.697 Ω -2.3262 Ω 81.939 pF 835.000 000 MHz

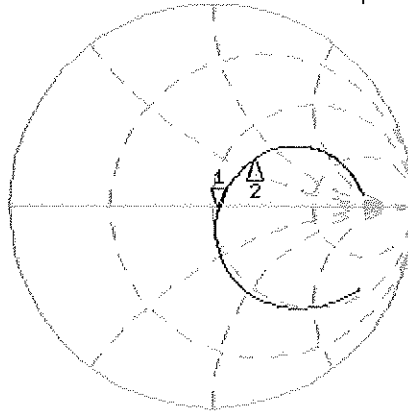
*

De1

Cor

Avg
16

H1 d



CH1 Markers

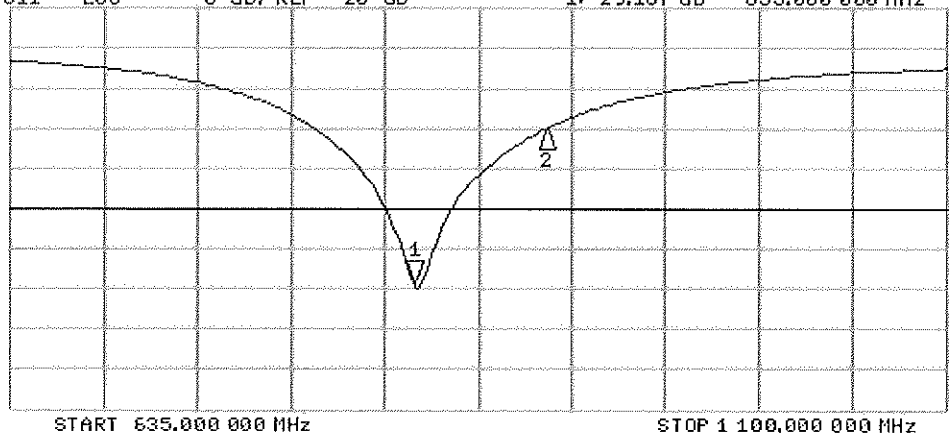
2: 66.223 Ω
 33.813 Ω
 900.000 MHz

CH2 S11 LOG 5 dB/REF -20 dB 1: -29.187 dB 835.000 000 MHz

Cor

Avg
16

H1 d



CH2 Markers

2: -10.177 dB
 900.000 MHz

DASY5 Validation Report for Body TSL

Date: 02.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 835 MHz

Medium parameters used: $f = 835$ MHz; $\sigma = 0.98$ mho/m; $\epsilon_r = 53.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

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

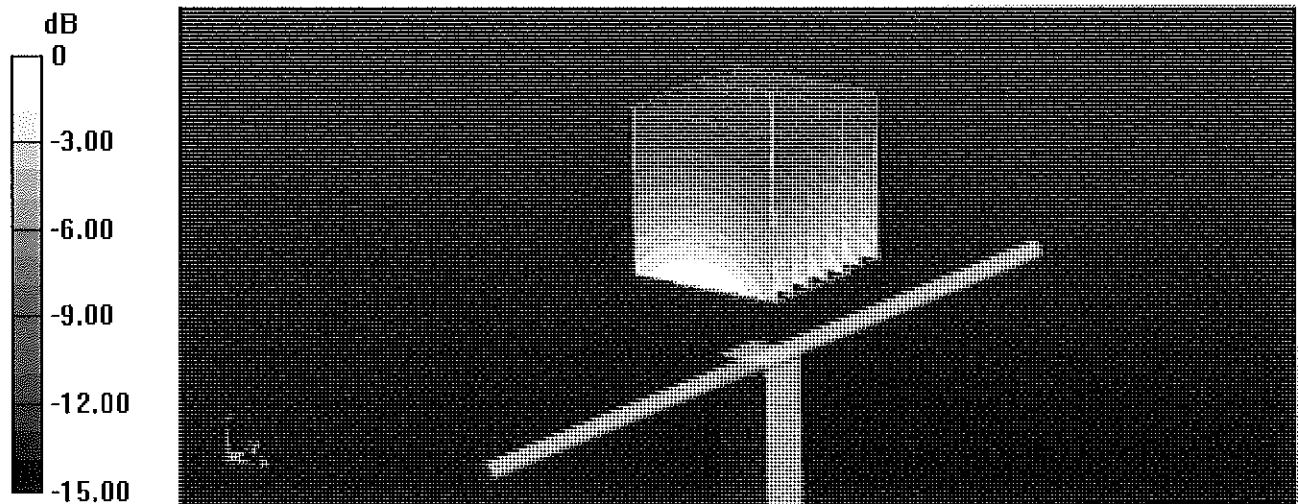
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.137 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.4770

SAR(1 g) = 2.39 mW/g; SAR(10 g) = 1.57 mW/g

Maximum value of SAR (measured) = 2.781 mW/g

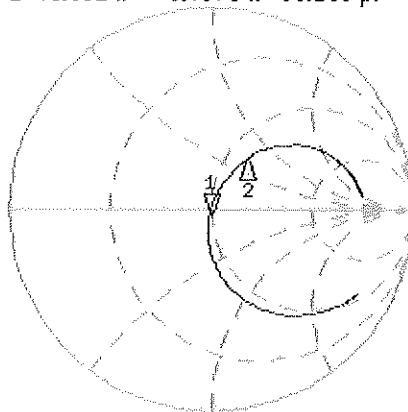


0 dB = 2.780mW/g = 8.88 dB mW/g

Impedance Measurement Plot for Body TSL

2 Feb 2012 17:18:48
 [CH1] S11 1 U FS 1: 48.902 Ω -3.4570 Ω 55.135 pF 835.000 000 MHz

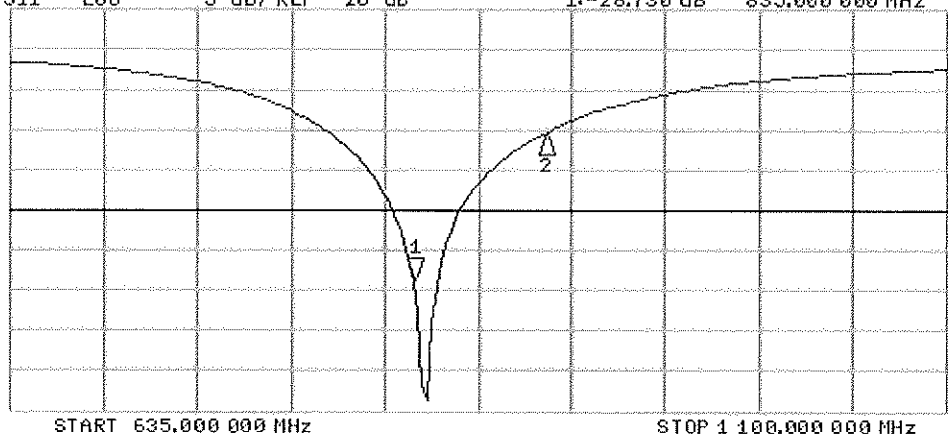
*
 De l
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 Avg
 16
 H1 d



CH1 Markers
 2: 61.023 Ω
 32.770 Ω
 900.000 MHz

CH2 S11 LOG 5 dB/REF -20 dB 1: -28.730 dB 835.000 000 MHz

Cor
 Avg
 16
 H1 d



CH2 Markers
 2: -10.497 dB
 900.000 MHz



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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **D835V2-4d026_Aug12**

CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d026**

Calibration procedure(s) **QA CAL-05.v8**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **August 23, 2012**

*1/10K
9/12/12*

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 $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

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

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

Calibrated by: **Israe El-Naouq** **Function**
Laboratory Technician

Signature

Israe El-Naouq
Katja Pokovic

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

Issued: August 23, 2012

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- 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
- 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
- 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:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied.

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

SAR result with Head TSL

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

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

Body TSL parameters

The following parameters and calculations were applied.

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

SAR result with Body TSL

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

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

Appendix

Antenna Parameters with Head TSL

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

Antenna Parameters with Body TSL

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

General Antenna Parameters and Design

Electrical Delay (one direction)	1.389 ns
----------------------------------	----------

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

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 17, 2004

DASY5 Validation Report for Head TSL

Date: 23.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 835 MHz

Medium parameters used: $f = 835$ MHz; $\sigma = 0.9$ mho/m; $\epsilon_r = 41.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

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

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

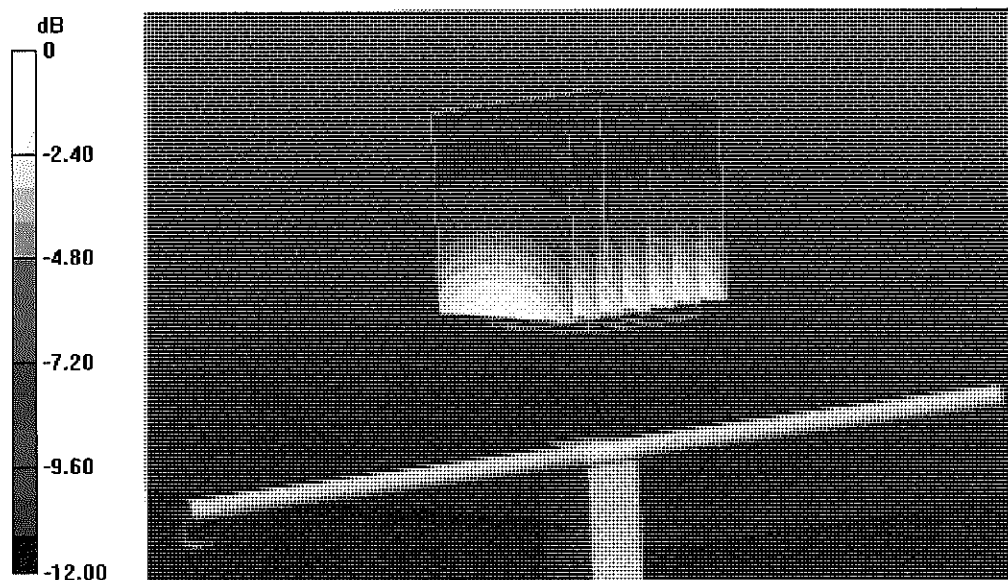
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.824 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.482 mW/g

SAR(1 g) = 2.35 mW/g; SAR(10 g) = 1.53 mW/g

Maximum value of SAR (measured) = 2.72 W/kg

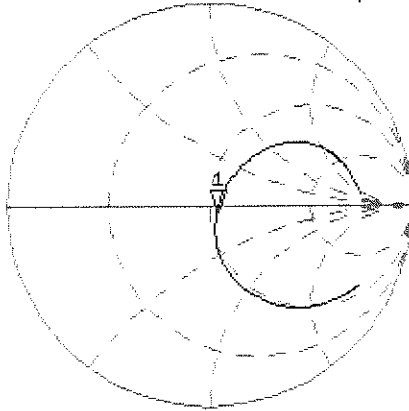


0 dB = 2.72 W/kg = 8.69 dB W/kg

Impedance Measurement Plot for Head TSL

23 Aug 2012 12:19:04
 CH1 S11 1 U FS 1: 53.662 $\angle$ -3.3516 $\angle$ 56.870 pF 835.000 000 MHz

*
 Del
 Cor



Avg
 15

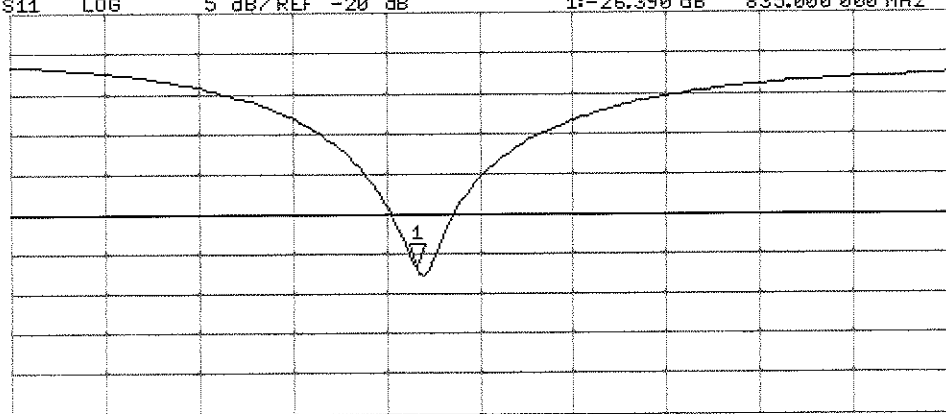
H1 d

CH2 S11 LOG 5 dB/REF -20 dB 1:-26.390 dB 835.000 000 MHz

Cor

Avg
 15

H1 d



START 635.000 000 MHz

STOP 1 100.000 000 MHz

DASY5 Validation Report for Body TSL

Date: 23.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 835 MHz

Medium parameters used: $f = 835$ MHz; $\sigma = 1$ mho/m; $\epsilon_r = 53.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

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

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

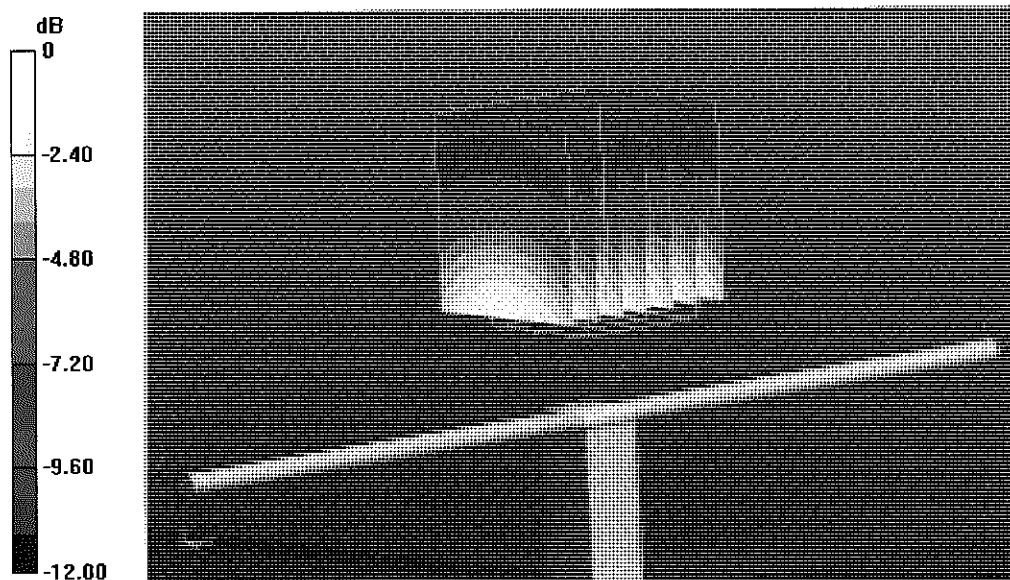
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.339 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 3.592 mW/g

SAR(1 g) = 2.47 mW/g; SAR(10 g) = 1.62 mW/g

Maximum value of SAR (measured) = 2.87 W/kg

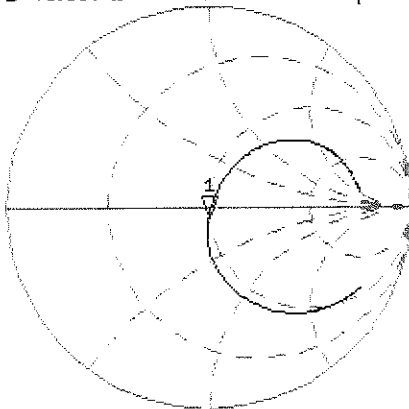


0 dB = 2.87 W/kg = 9.16 dB W/kg

Impedance Measurement Plot for Body TSL

23 Aug 2012 10:54:42
[CH1] S11 1 U FS 1: 49.557 $\angle$ -4.7500 $\angle$ 40.127 pF 835.000 000 MHz

*
Del
Cor



Avg
16

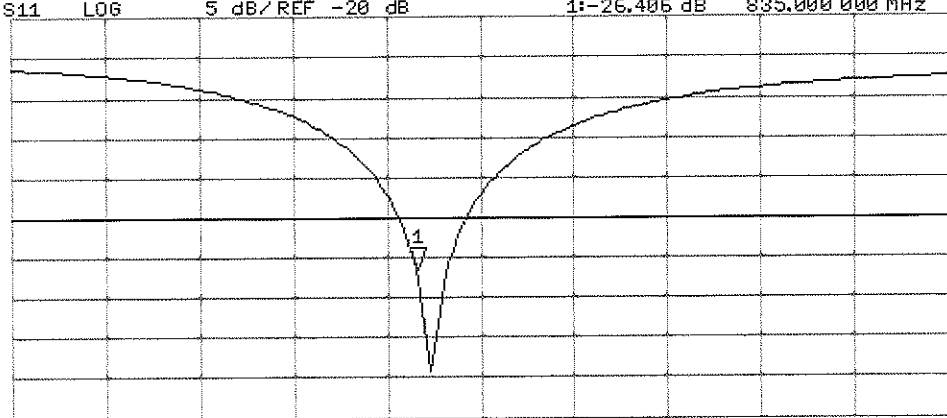
H1d

CH2 S11 LOG 5 dB/REF -20 dB 1: -26.405 dB 835.000 000 MHz

Cor

Avg
16

H1d



START 635.000 000 MHz

STOP 1100.000 000 MHz



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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **ES3-3022_Aug12**

CALIBRATION CERTIFICATE

Object **ES3DV2 - SN:3022**

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

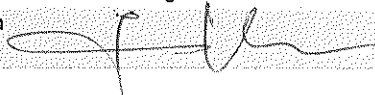
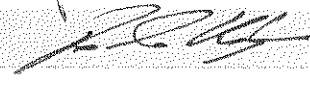
Calibration date: **August 28, 2012**

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

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

Calibration Equipment used (M&TE critical for calibration)

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

Calibrated by:	Name Jeton Kastrati	Function Laboratory Technician	Signature 
Approved by:	Name Katja Pokovic	Function Technical Manager	Signature 
			Issued: August 28, 2012
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	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:

- 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
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,y,z} * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,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 NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe ES3DV2

SN:3022

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

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

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

Basic Calibration Parameters

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

Modulation Calibration Parameters

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

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

^A The uncertainties of NormX,Y,Z do not affect the E^2 -field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

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

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

Calibration Parameter Determined in Head Tissue Simulating Media

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

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

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

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

Calibration Parameter Determined in Body Tissue Simulating Media

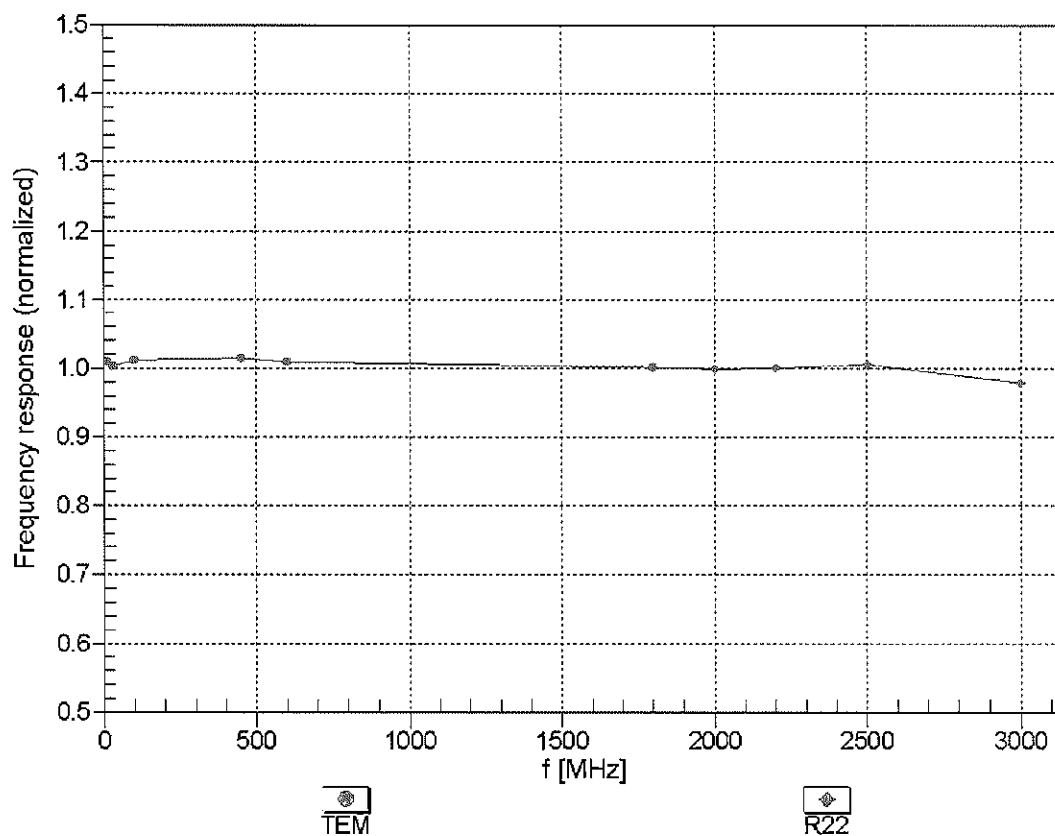
f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	6.07	6.07	6.07	0.23	2.09	± 12.0 %
835	55.2	0.97	6.02	6.02	6.02	0.47	1.44	± 12.0 %
1750	53.4	1.49	4.70	4.70	4.70	0.46	1.55	± 12.0 %
1900	53.3	1.52	4.43	4.43	4.43	0.36	1.87	± 12.0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

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

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

Frequency Response of E-Field

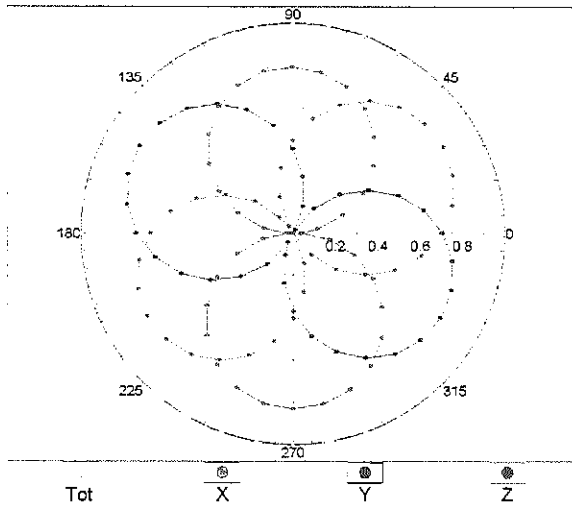
(TEM-Cell:ifi110 EXX, Waveguide: R22)



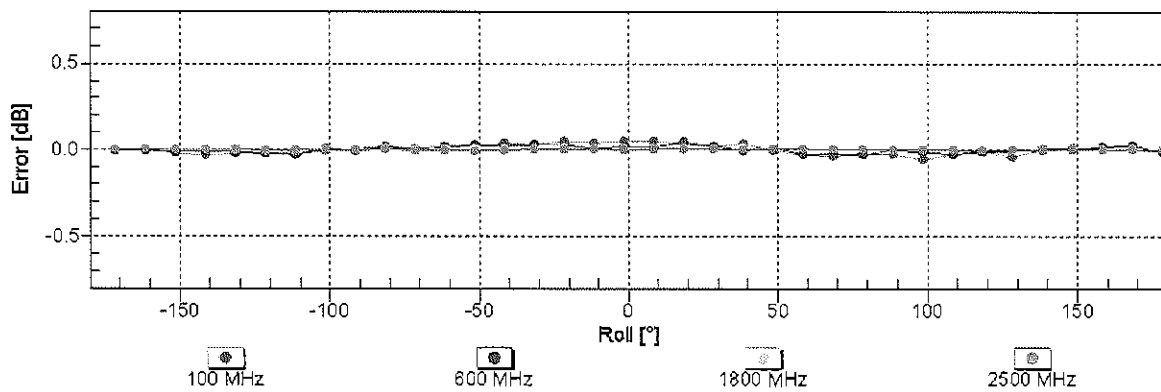
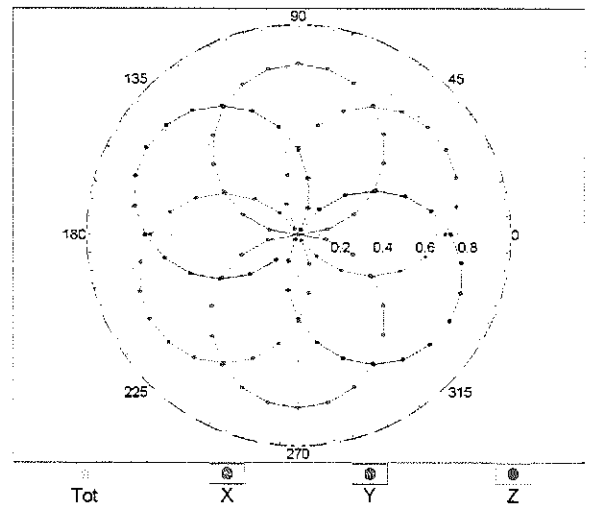
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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

f=600 MHz, TEM

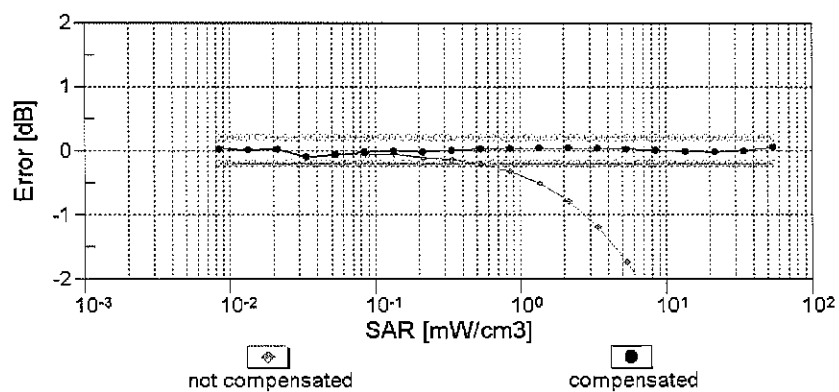
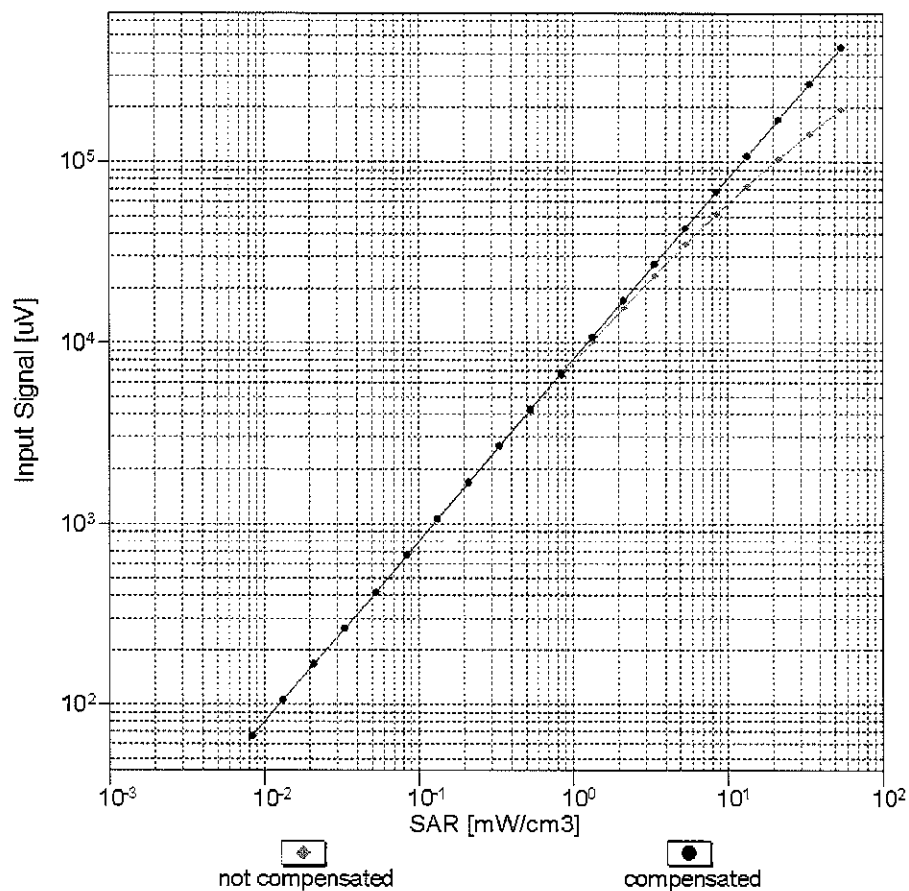


f=1800 MHz, R22



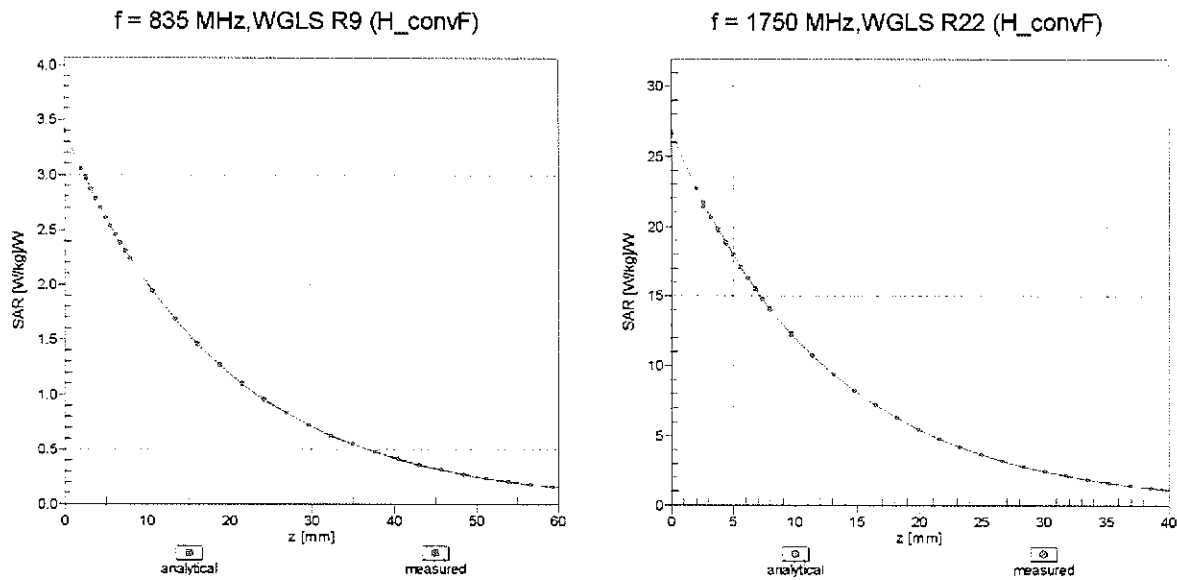
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell , $f = 900 \text{ MHz}$)



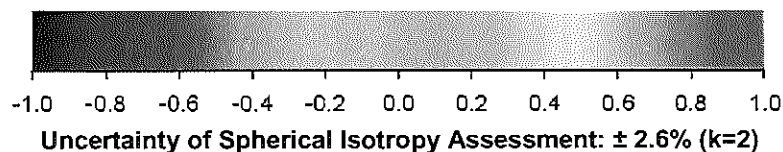
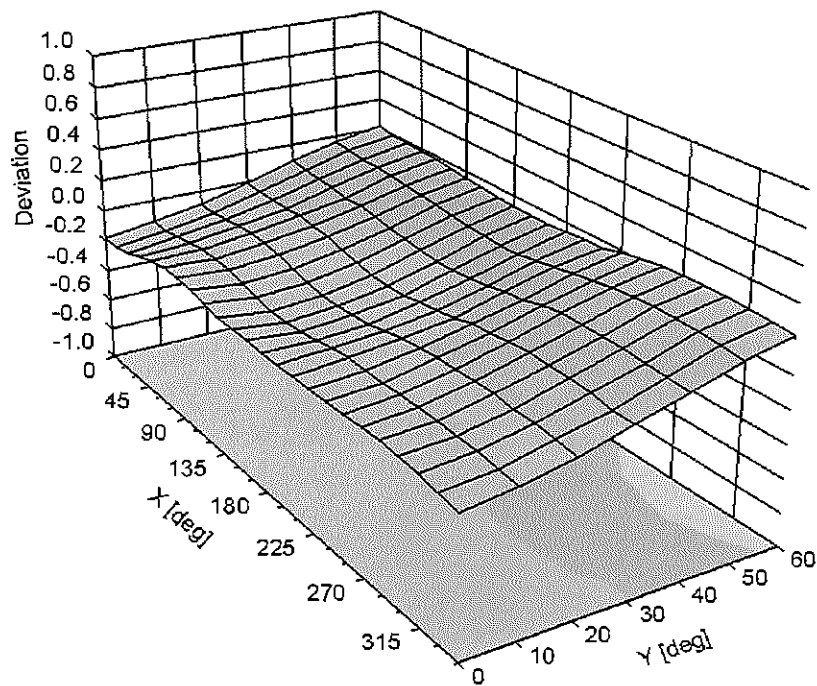
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ , θ), $f = 900 \text{ MHz}$



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

Other Probe Parameters

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



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Accreditation No.: **SCS 108**

Client **PC Test**

Certificate No: **ES3-3209_Mar12**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3209**

Calibration procedure(s) **QA CAL-01.v8, QA CAL-12.v7, QA CAL-23.v4, QA CAL-25.v4**
Calibration procedure for dosimetric E-field probes

Calibration date: **March 16, 2012**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	31-Mar-11 (No. 217-01372)	Apr-12
Power sensor E4412A	MY41498087	31-Mar-11 (No. 217-01372)	Apr-12
Reference 3 dB Attenuator	SN: S5054 (3c)	29-Mar-11 (No. 217-01369)	Apr-12
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Reference 30 dB Attenuator	SN: S5129 (30b)	29-Mar-11 (No. 217-01370)	Apr-12
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 654	3-May-11 (No. DAE4-654_May11)	May-12
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Issued: March 19, 2012

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



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	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:

- 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
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E^2 -field uncertainty inside TSL (see below *ConvF*).
- NORM(f)_{x,y,z}** = NORM_{x,y,z} * *frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,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 NORM_{x,y,z} * *ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe ES3DV3

SN:3209

Manufactured: October 14, 2008
Calibrated: March 16, 2012

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

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	1.36	1.34	1.15	$\pm 10.1 \%$
DCP (mV) ^B	98.2	97.4	98.7	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc ^E (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	119.2	$\pm 3.5 \%$
			Y	0.00	0.00	1.00	89.3	
			Z	0.00	0.00	1.00	111.5	

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	6.47	6.47	6.47	0.37	1.61	± 12.0 %
835	41.5	0.90	6.22	6.22	6.22	0.24	2.24	± 12.0 %
1640	40.3	1.29	5.38	5.38	5.38	0.41	1.56	± 12.0 %
1750	40.1	1.37	5.26	5.26	5.26	0.41	1.60	± 12.0 %
1900	40.0	1.40	5.15	5.15	5.15	0.80	1.16	± 12.0 %
2450	39.2	1.80	4.46	4.46	4.46	0.64	1.39	± 12.0 %
2600	39.0	1.96	4.30	4.30	4.30	0.69	1.42	± 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

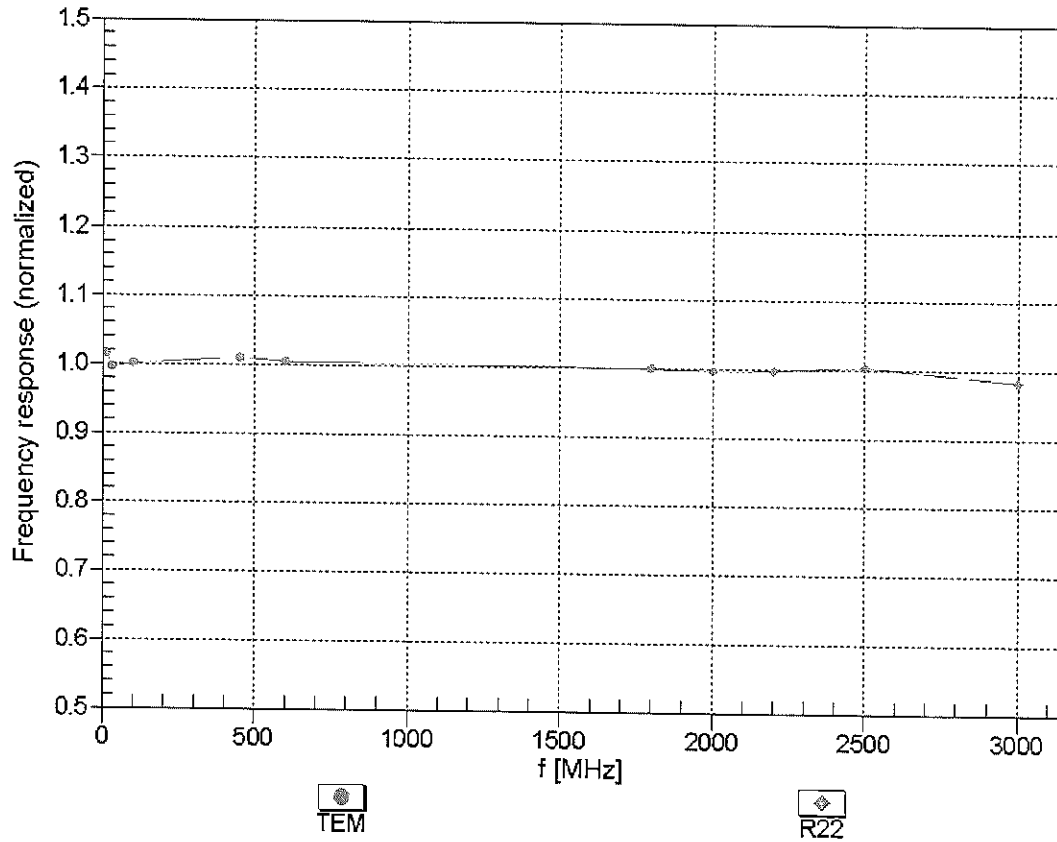
f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	56.7	0.94	7.11	7.11	7.11	0.07	1.00	± 13.4 %
750	55.5	0.96	6.23	6.23	6.23	0.54	1.40	± 12.0 %
835	55.2	0.97	6.13	6.13	6.13	0.24	2.27	± 12.0 %
1640	53.8	1.40	5.21	5.21	5.21	0.72	1.29	± 12.0 %
1750	53.4	1.49	4.83	4.83	4.83	0.59	1.44	± 12.0 %
1900	53.3	1.52	4.63	4.63	4.63	0.57	1.50	± 12.0 %
2450	52.7	1.95	4.23	4.23	4.23	0.80	1.00	± 12.0 %
2600	52.5	2.16	4.02	4.02	4.02	0.62	0.90	± 12.0 %

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

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

Frequency Response of E-Field

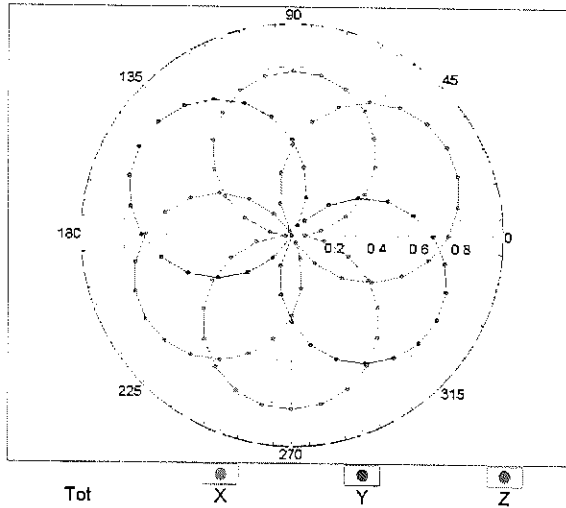
(TEM-Cell: ifi110 EXX, Waveguide: R22)



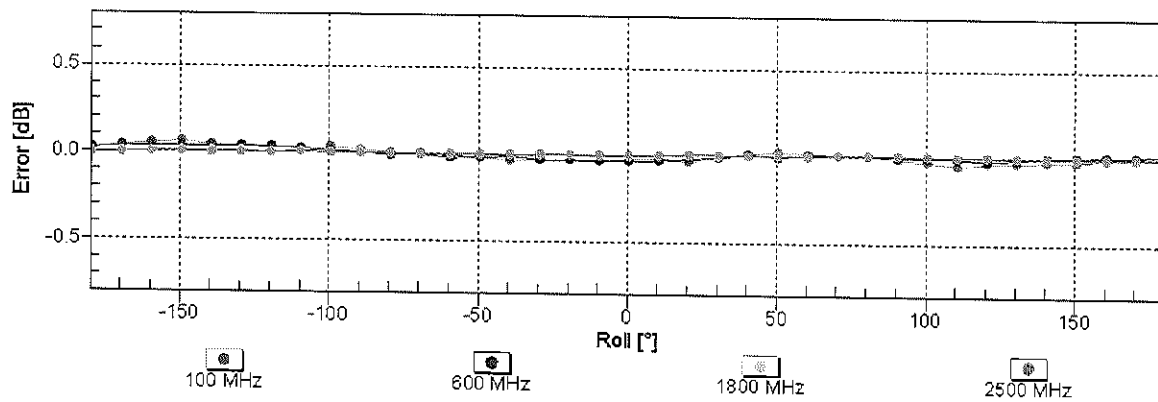
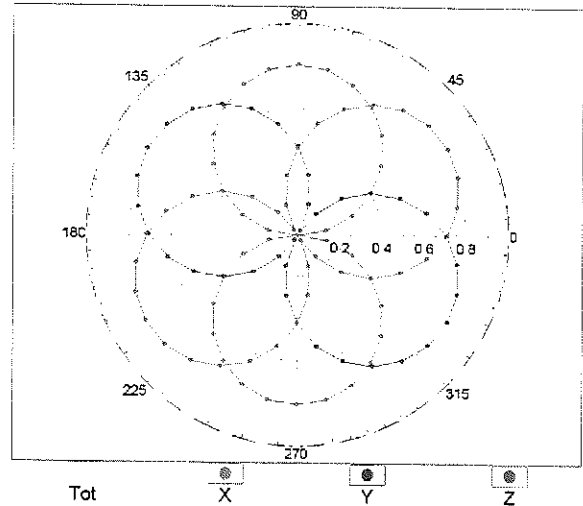
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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

f=600 MHz, TEM

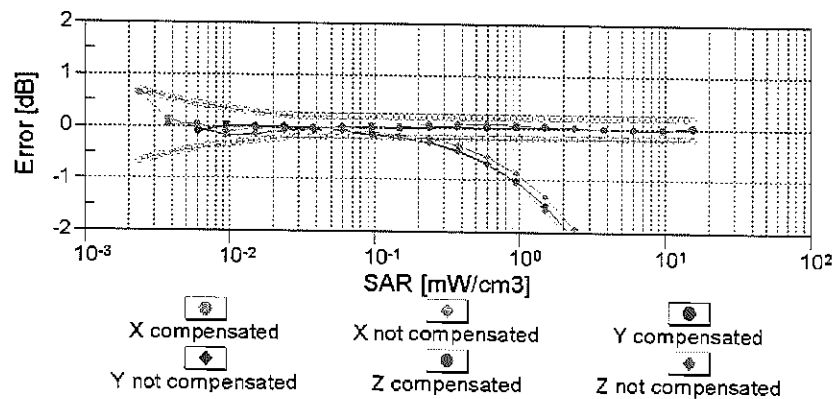
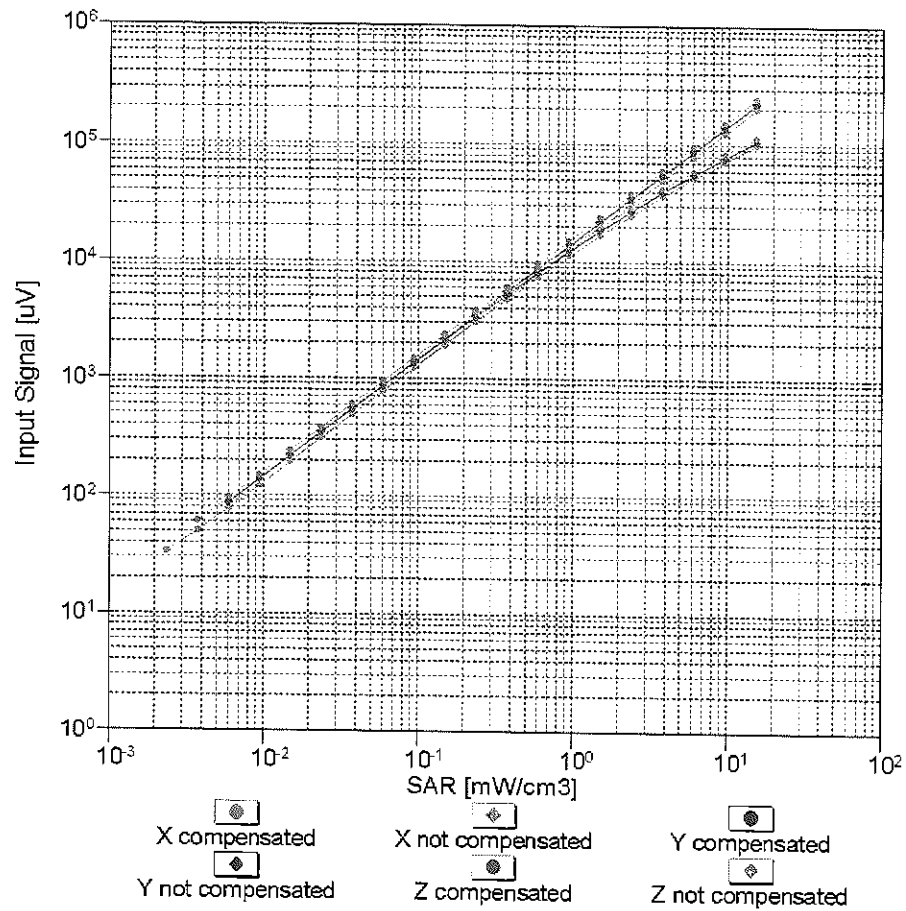


f=1800 MHz, R22



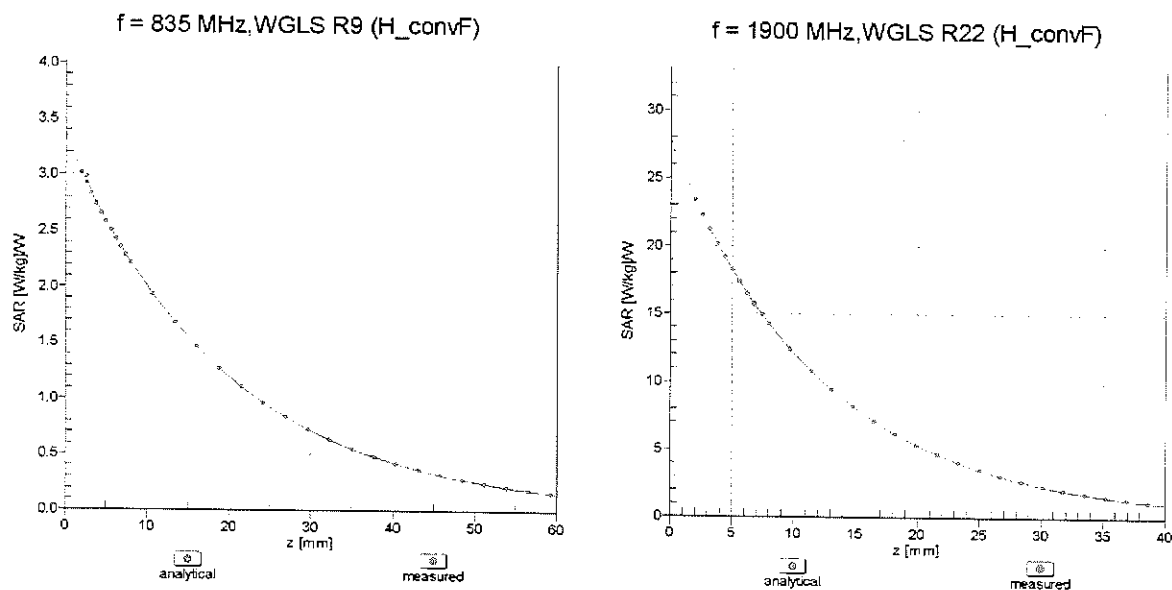
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell , $f = 900 \text{ MHz}$)



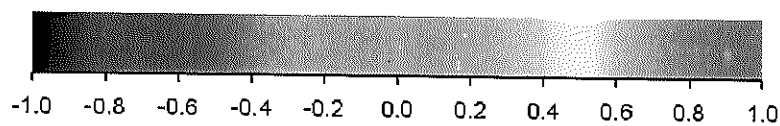
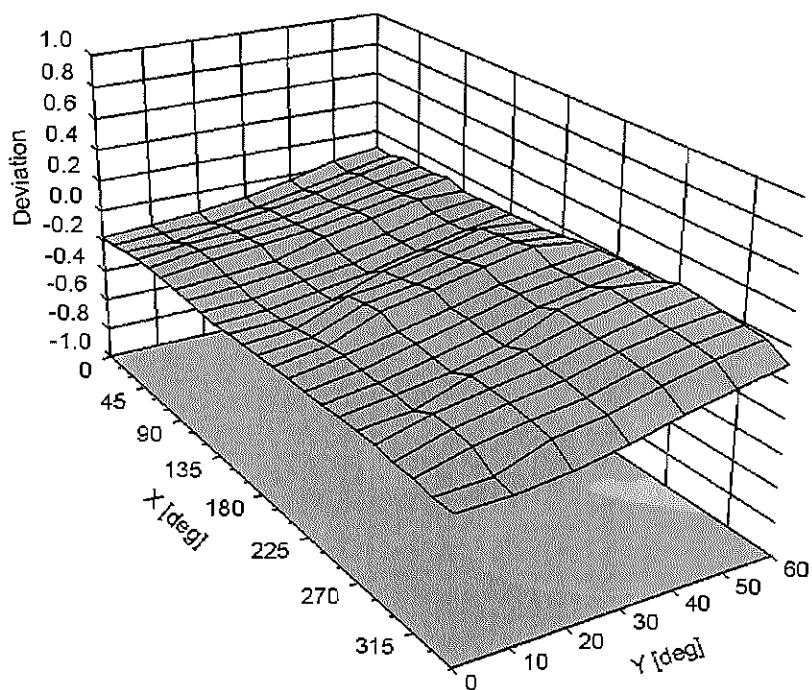
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), $f = 900 \text{ MHz}$



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

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
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