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SAR EVALUATION REPORT

Applicant Name:
Sirius XM Satellite Radio
1500 Eckington Place, NE
Washington, DC 20002
USA

Date of Testing:
04/17/12
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Document Serial No.:
0Y1204160482-R1.RS2

FCC ID: RS2SX11

APPLICANT: SIRIUS XM SATELLITE RADIO

DUT Type: Portable Radio
Application Type: Class II Permissive Change
FCC Rule Part(s): CFR §2.1093
Model(s): SXi1
Test Device Serial No.: Pre-Production [S/N: J78P04HU]
Class II Permissive Changes: See FCC change document
Date of Original Grant: 10/06/2011

Band & Mode	Tx Frequency	Conducted Power [dBm]	SAR
			1 gm Body SAR (W/kg)
2.4 GHz WLAN	2412 - 2462 MHz	11.29	0.73
Bluetooth	2402 - 2480 MHz	2.98	

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 0Y1204160482-R1.RS2) supersedes and replaces the previously issued test report on the same subject DUT for the same type of testing as 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 FCC/OET Bulletin 65 Supplement C (2001), IEEE 1528-2003 and in applicable Industry Canada Radio Standards Specifications (RSS); 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.

PCTEST certifies that no party to this application has been subject to a denial of Federal benefits that includes FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 862.



Randy Ortanez
President



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1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Tx Frequency
2.4 GHz WLAN	2412 - 2462 MHz
Bluetooth	2402 - 2480 MHz

1.2 Identification of Sides for SAR Testing

Per FCC KDB Publication 447498 D01, 4)c)ii) all applicable orientations were tested at the minimum separation distance (0.0 cm) using the flat phantom.

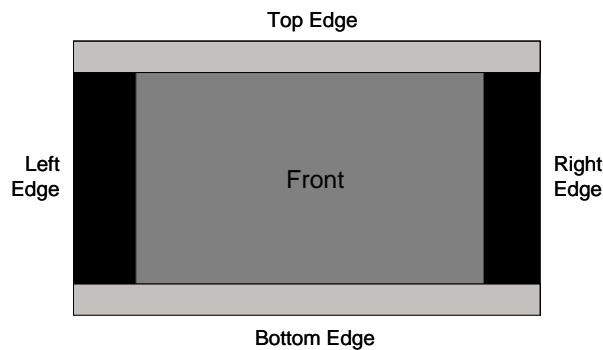


Figure 1-1
DUT Sides for SAR Testing

1.3 SAR Test Exclusions Applied

(A) WIFI/BT

Maximum Average RF Conducted Power of Bluetooth Tx is 1.986 mW. (Please refer to the DSS EMC report filed for this DUT for a complete set of Bluetooth powers) Maximum Average RF Conducted Power of WLAN is 13.583 mW.

Manufacturer has confirmed that 2.4 GHz WIFI and Bluetooth share the same antenna path and cannot transmit simultaneously.



Per KDB Publication 447498 D01, 1)b) **Bluetooth SAR was not required** based on the maximum conducted power.

1.4 Power Reduction for SAR

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

1.5 FCC Guidance Applied

- FCC KDB 248227 (802.11)
- FCC KDB 447498 (Portable Devices)

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2 INTRODUCTION

The FCC has adopted the guidelines for evaluating the environmental effects of radio frequency (RF) radiation in ET Docket 93-62 on Aug. 6, 1996 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.

2.1 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 2-1).

Equation 2-1
SAR Mathematical Equation

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



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

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

where:

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

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

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3 SAR MEASUREMENT SETUP

3.1 Automated SAR Measurement System

Measurements are performed using the DASY automated dosimetric SAR assessment system. The DASY is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland and consists of a high precision robotics system (Staubli), robot controller, desktop computer, near-field probe, probe alignment sensor, and the SAM phantom containing the head or body equivalent material. The robot is a six-axis industrial robot, performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF). See www.speag.com for more information about the specification of the SAR assessment system.





Figure 3-1
SAR Measurement System



Figure 3-2
Near-Field Probe

Table 3-1
Composition of the Tissue Equivalent Matter

Frequency (MHz)	2450
Tissue	Body
Ingredients (% by weight)	
DGBE	26.7
NaCl	0.1
Water	73.2

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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 interface and the horizontal grid resolution was 15mm and 15mm for frequencies < 3 GHz in the x and y directions respectively. When applicable, for frequencies above 3 GHz, a 10 mm by 10 mm resolution was used.
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 1 gram cube evaluation. SAR at this fixed point was measured and used as a reference value.
3. Based on the area scan data, the peak area of the maximum absorption was determined by spline interpolation. Around this point, a volume of 32mm x 32mm x 30mm (fine resolution volume scan, zoom scan) was assessed by measuring at least 5 x 5 x 7 points. On this 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.

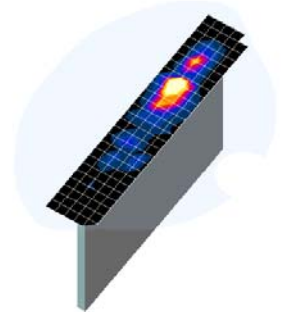




Figure 4-1
Sample SAR Area Scan

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5 FCC RF EXPOSURE LIMITS

5.1 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.



5.2 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 5-1
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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6 FCC MEASUREMENT PROCEDURES

6.1 SAR Testing with 802.11 Transmitters

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



6.1.1 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.

6.1.2 Frequency Channel Configurations [27]

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

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

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7 RF CONDUCTED POWERS

7.1 WLAN Conducted Powers

Table 7-1
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*	10.77	10.80	10.76	10.68
802.11b	2417	2	11.05	11.01	10.99	10.91
802.11b	2437	6*	11.01	11.11	11.20	11.15
802.11b	2457	10	11.16	11.22	11.06	11.08
802.11b	2462	11*	11.29	11.33	11.26	11.22

Table 7-2
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*	10.85	10.88	10.79	10.78	10.66	10.81	10.59	10.41
802.11g	2417	2	10.68	10.66	10.71	10.75	10.69	10.79	10.81	10.68
802.11g	2437	6*	10.92	10.99	10.81	10.90	10.95	10.91	10.98	10.86
802.11g	2457	10	10.97	10.96	10.89	10.79	10.81	10.85	10.81	10.90
802.11g	2462	11*	10.86	10.91	10.88	10.81	10.78	10.89	10.72	10.91

Table 7-3
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*	10.55	10.61	10.42	9.99	10.31	9.83	9.76	9.63
802.11n	2417	2	10.42	10.41	10.36	10.28	10.22	10.04	9.96	9.88
802.11n	2437	6*	10.48	10.42	10.31	10.37	10.17	10.02	9.86	9.73
802.11n	2457	10	10.72	10.51	10.63	10.38	10.35	10.42	10.18	10.07
802.11n	2462	11*	10.41	10.32	10.55	10.49	10.20	10.01	10.06	10.09

Justification for reduced test configurations for WIFI channels per KDB Publication 248227:

- 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.
- When the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is <1.6 W/kg and the 1g averaged SAR is <0.8 W/kg, SAR testing on other channels is not required. Otherwise, the other default (or corresponding required) test channels were additionally tested using the lowest data rate.
- The bolded data rate and channel above were tested for SAR.
- (*) indicates default channel per KDB Publication 248227.
- Conducted power measurements were additionally taken for channels 2 and 10 per manufacturer request.

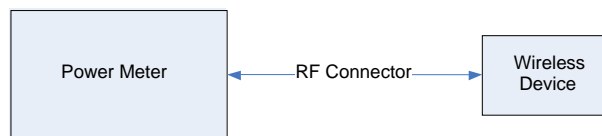


Figure 7-1
Power Measurement Setup

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8 SYSTEM VERIFICATION

8.1 Tissue Verification

**Table 8-1
Measured Tissue Properties**

Calibrated for Tests Performed on:	Tissue Type	Tissue Temp During Calibration (C)	Measured Frequency (MHz)	Measured Conductivity, σ (S/m)	Measured Dielectric Constant, ϵ	TARGET Conductivity, σ (S/m)	TARGET Dielectric Constant, ϵ	% dev σ	% dev ϵ
4/17/2012	2450B	22.5	2401	1.961	51.83	1.903	52.765	3.05%	-1.77%
			2450	2.007	51.13	1.950	52.700	2.92%	-2.98%
			2499	2.083	51.11	2.019	52.638	3.17%	-2.90%

Note: KDB Publication 450824 was ensured to be applied for probe calibration frequencies greater than or equal to 50 MHz of the DUT frequencies.



The above measured tissue parameters were used in the DASY software to perform interpolation via the DASY software to determine actual dielectric parameters at the test frequencies (per IEEE 1528 6.6.1.2). The SAR test plots may slightly differ from the table above since the DASY software rounds to three significant digits.

8.2 Measurement Procedure for Tissue verification

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

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

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

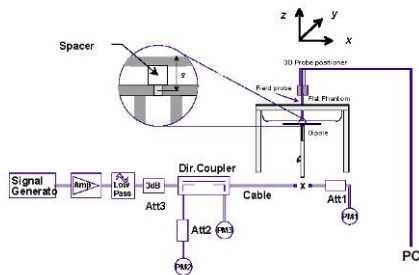
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8.3 Test System Verification

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

**Table 8-2
System Verification Results**

System Verification TARGET & MEASURED											
Tissue Frequency (MHz)	Tissue Type	Date:	Amb. Temp (°C)	Liquid Temp (°C)	Input Power (W)	Dipole SN	Probe SN	Measured SAR _{1g} (W/kg)	1 W Target SAR _{1g} (W/kg)	1 W Normalized SAR _{1g} (W/kg)	Deviation (%)
2450	Body	04/17/2012	23.3	22.6	0.040	719	3209	2.15	51.300	53.750	4.78%



**Figure 8-1
System Verification Setup Diagram**



**Figure 8-2
System Verification Setup Photo**

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9 SAR DATA SUMMARY

9.1 Standalone Body-Worn SAR Data

Table 9-1
WLAN Body SAR Results



MEASUREMENT RESULTS									
FREQUENCY		Mode	Service	Conducted Power [dBm]	Power Drift [dB]	Spacing	Data Rate (Mbps)	Side	SAR (1g)
MHz	Ch.								(W/kg)
2462	11	IEEE 802.11b	DSSS	11.29	0.00	0.0 cm	1	back	0.474
2462	11	IEEE 802.11b	DSSS	11.29	-0.03	0.0 cm	1	front	0.428
2462	11	IEEE 802.11b	DSSS	11.29	-0.07	0.0 cm	1	top	0.169
2462	11	IEEE 802.11b	DSSS	11.29	0.05	0.0 cm	1	bottom	0.044
2462	11	IEEE 802.11b	DSSS	11.29	0.15	0.0 cm	1	right	0.007
2412	1	IEEE 802.11b	DSSS	10.77	-0.05	0.0 cm	1	left	0.639
2417	2	IEEE 802.11b	DSSS	11.05	0.09	0.0 cm	1	left	0.649
2437	6	IEEE 802.11b	DSSS	11.01	-0.14	0.0 cm	1	left	0.585
2457	10	IEEE 802.11b	DSSS	11.16	0.07	0.0 cm	1	left	0.733
2462	11	IEEE 802.11b	DSSS	11.29	-0.17	0.0 cm	1	left	0.679

General Notes:

1. The test data reported are the worst-case SAR value with the position set in a typical configuration. Test procedures used were according to KDB Publication 447498.
2. Batteries are fully charged for all readings.
3. Tissue parameters and temperatures are listed on the SAR plots.
4. Liquid tissue depth was at least 15.0 cm. To confirm the proper SAR liquid depth, the z-axis plots from the system verifications were included since the system verifications were performed using the same liquid, probe and DAE as the SAR tests in the same time period.
5. A separation distance of 0.0 mm was tested per FCC KDB Publication 447498 D01, 4)c)ii).

WLAN Notes:



1. Justification for reduced test configurations for WIFI channels per KDB Publication 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. WLAN transmission was verified using an uncalibrated spectrum analyzer.
3. When the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is <1.6 W/kg and the 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.

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10 EQUIPMENT LIST

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8648D	(9kHz-4GHz) Signal Generator	10/10/2011	Annual	10/10/2012	3613A00315
Agilent	8753E	(30kHz-6GHz) Network Analyzer	4/21/2011	Annual	4/21/2012	JP38020182
Gigatronics	80701A	(0.05-18GHz) Power Sensor	10/12/2011	Annual	10/12/2012	1833460
Gigatronics	8651A	Universal Power Meter	10/12/2011	Annual	10/12/2012	8650319
Index SAR	IXTL-010	Dielectric Measurement Kit	N/A	N/A	N/A	N/A
Index SAR	IXTL-030	30MM TEM line for 6 GHz	N/A	N/A	N/A	N/A
Pasternack	PE2208-6	Bidirectional Coupler	6/3/2011	Annual	6/3/2012	N/A
Pasternack	PE2209-10	Bidirectional Coupler	6/3/2011	Annual	6/3/2012	N/A
SPEAG	D2450V2	2450 MHz SAR Dipole	8/19/2011	Annual	8/19/2012	719
Anritsu	ML2438A	Power Meter	10/13/2011	Annual	10/13/2012	1070030
Anritsu	MA2411B	Pulse Sensor	10/13/2011	Annual	10/13/2012	1027293
Anritsu	ML2495A	Power Meter	10/13/2011	Annual	10/13/2012	1039008
Amplifier Research	551G4	5W, 800MHz-4.2GHz	CBT	N/A	N/A	21910
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	N/A	N/A
Control Company	61220-416	Long-Stem Thermometer	2/15/2011	Biennial	2/15/2013	111331322
Control Company	61220-416	Long-Stem Thermometer	2/15/2011	Biennial	2/15/2013	111331323
Control Company	61220-416	Long-Stem Thermometer	2/15/2011	Biennial	2/15/2013	111331330
Control Company	61220-416	Long-Stem Thermometer	2/15/2011	Biennial	2/15/2013	111331332
Control Company	61220-416	Long-Stem Thermometer	3/16/2011	Biennial	3/16/2013	111391601
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	36934-158	Wall-Mounted Thermometer	5/26/2010	Biennial	5/26/2012	101718589
VWR	36934-158	Wall-Mounted Thermometer	1/21/2011	Biennial	1/21/2013	111286454
MiniCircuits	SLP-2400+	Low Pass Filter	CBT	N/A	N/A	R8979500903
Narda	4772-3	Attenuator (3dB)	CBT	N/A	N/A	9406
Narda	BW-S3W2	Attenuator (3dB)	CBT	N/A	N/A	120
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	N/A	N/A
Anritsu	MT8820C	Radio Communication Tester	11/11/2011	Annual	11/11/2012	6200901190
MiniCircuits	VLf-6000+	Low Pass Filter	CBT	N/A	N/A	N/A
MiniCircuits	VLf-6000+	Low Pass Filter	CBT	N/A	N/A	N/A
VWR	61220-416	Long Stem Thermometer	7/1/2011	Biennial	7/1/2013	111642834
VWR	61220-416	Long stem thermometer	7/1/2011	Biennial	7/1/2013	111642916
VWR	61220-416	Long Stem Thermometer	7/1/2011	Biennial	7/1/2013	111642941
VWR	36934-158	Wall Thermometer	9/30/2011	Biennial	9/30/2013	111859323
VWR	36934-158	Wall Thermometer	9/30/2011	Biennial	9/30/2013	111859332
SPEAG	ES3DV3	SAR Probe	3/16/2012	Annual	3/16/2013	3209
Narda	4772-3	Attenuator (3dB)	CBT	N/A	N/A	113
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/15/2012	Annual	2/15/2013	1323
SPEAG	DAK-3.5	Dielectric Assessment Kit	12/1/2011	Annual	12/1/2012	1031
Agilent	N9340A	Spectrum Analyzer	N/A	N/A	N/A	773

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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11 MEASUREMENT UNCERTAINTIES

Applicable for frequencies less than 3000 MHz.

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

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



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12 CONCLUSION

12.1 Measurement Conclusion



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

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



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APPENDIX A: SAR TEST DATA

PCTEST ENGINEERING LABORATORY, INC.

DUT: RS2SXI1; Type: Portable Radio; Serial: J78P04HU

Communication System: IEEE 802.11b; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2462 \text{ MHz}$; $\sigma = 2.03 \text{ mho/m}$; $\epsilon_r = 51.12$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-17-2012; Ambient Temp: 23.3°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3209; ConvF(4.23, 4.23, 4.23); Calibrated: 3/16/2012

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

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

Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: IEEE 802.11b, Body SAR, Ch 11, 1 Mbps, Back Side

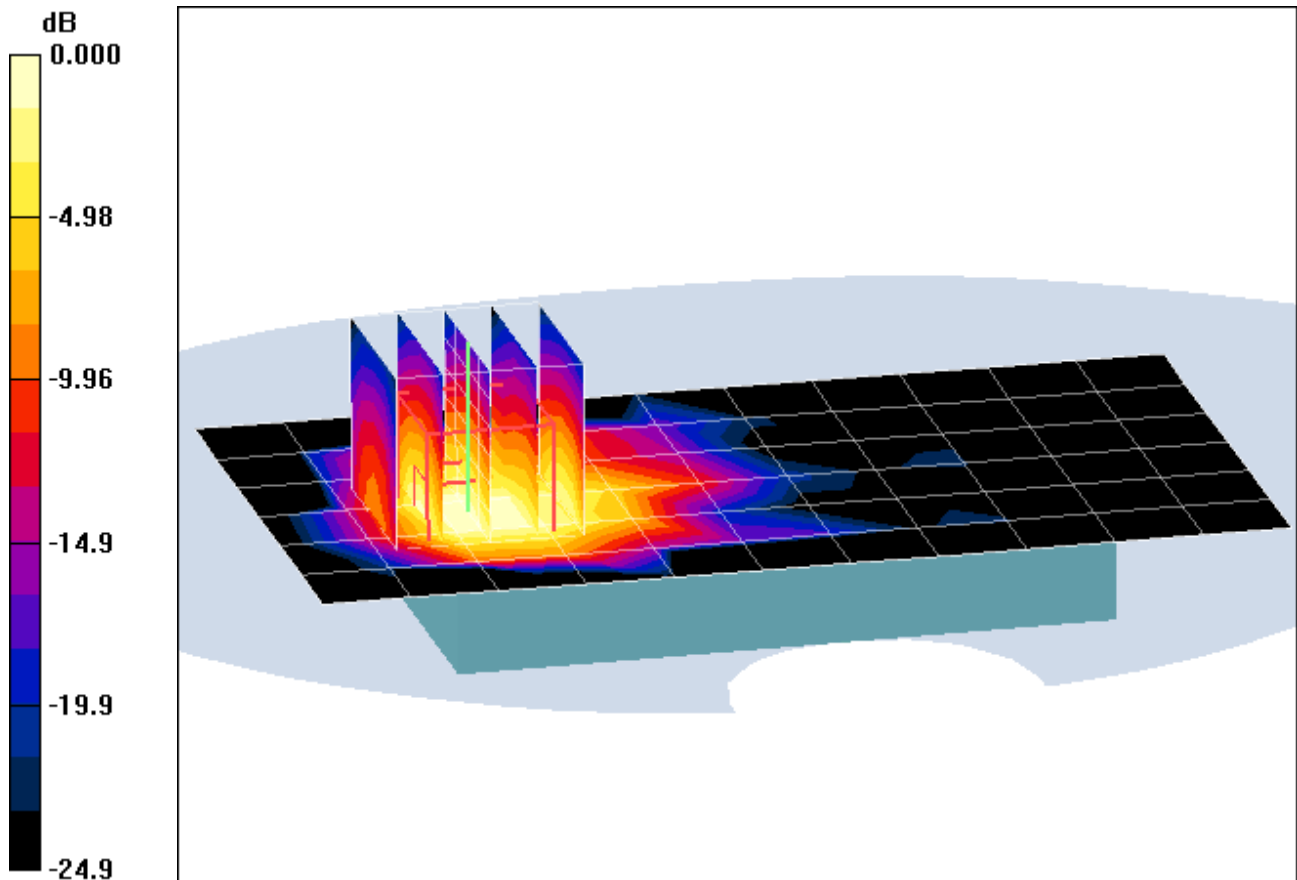
Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 16.7 V/m; Power Drift = 0.002 dB

Peak SAR (extrapolated) = 1.08 W/kg

SAR(1 g) = 0.474 mW/g; SAR(10 g) = 0.215 mW/g



0 dB = 0.561mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: RS2SXI1; Type: Portable Radio; Serial: J78P04HU

Communication System: IEEE 802.11b; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2462 \text{ MHz}$; $\sigma = 2.03 \text{ mho/m}$; $\epsilon_r = 51.12$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-17-2012; Ambient Temp: 23.3°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3209; ConvF(4.23, 4.23, 4.23); Calibrated: 3/16/2012

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

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

Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: IEEE 802.11b, Body SAR, Ch 11, 1 Mbps, Front Side

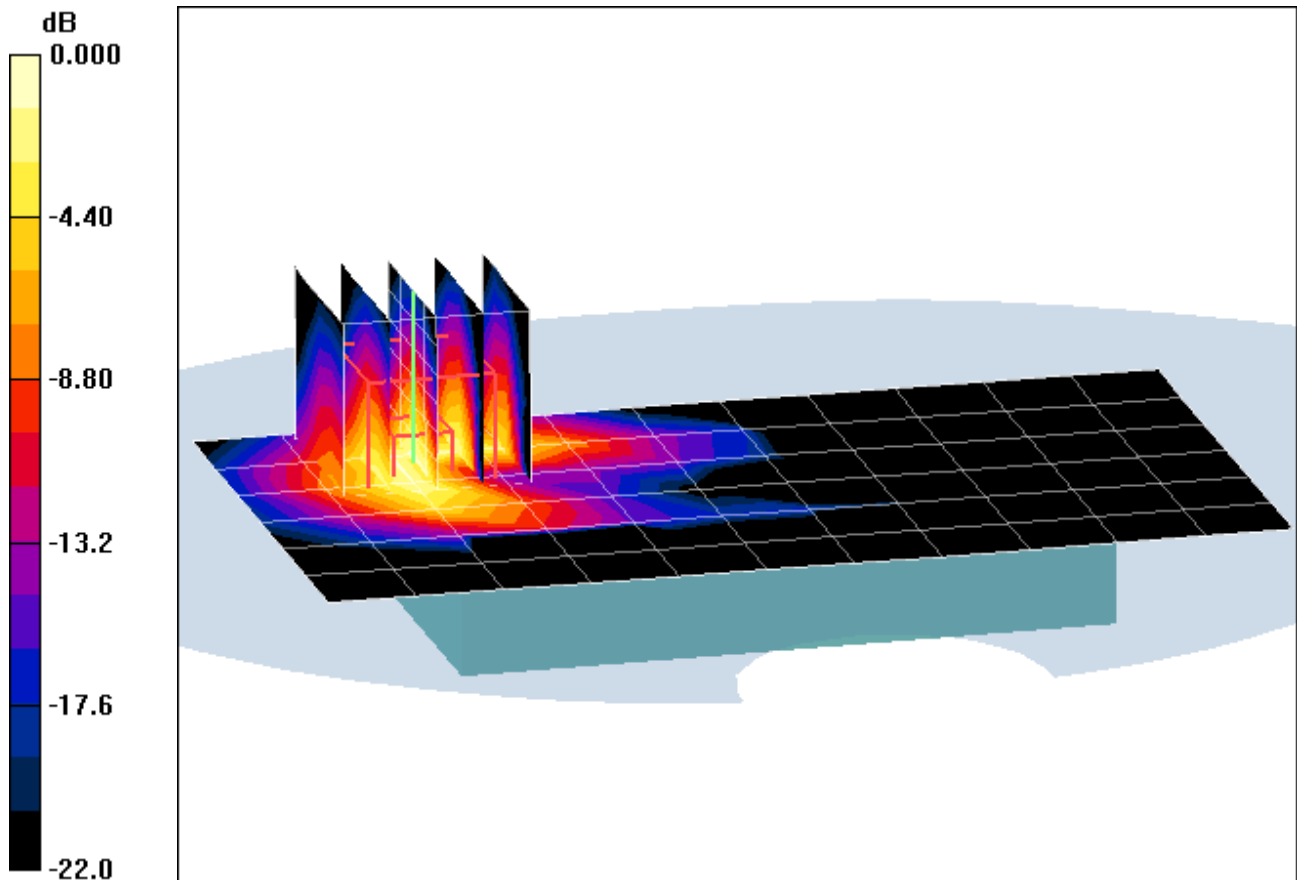
Area Scan (7x12x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 13.6 V/m; Power Drift = -0.031 dB

Peak SAR (extrapolated) = 1.02 W/kg

SAR(1 g) = 0.428 mW/g; SAR(10 g) = 0.179 mW/g



0 dB = 0.540mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: RS2SX11; Type: Portable Radio; Serial: J78P04HU

Communication System: IEEE 802.11b; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2462 \text{ MHz}$; $\sigma = 2.03 \text{ mho/m}$; $\epsilon_r = 51.12$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-17-2012; Ambient Temp: 23.3°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3209; ConvF(4.23, 4.23, 4.23); Calibrated: 3/16/2012

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

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

Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: IEEE 802.11b, Body SAR, Ch 11, 1 Mbps, Top Edge

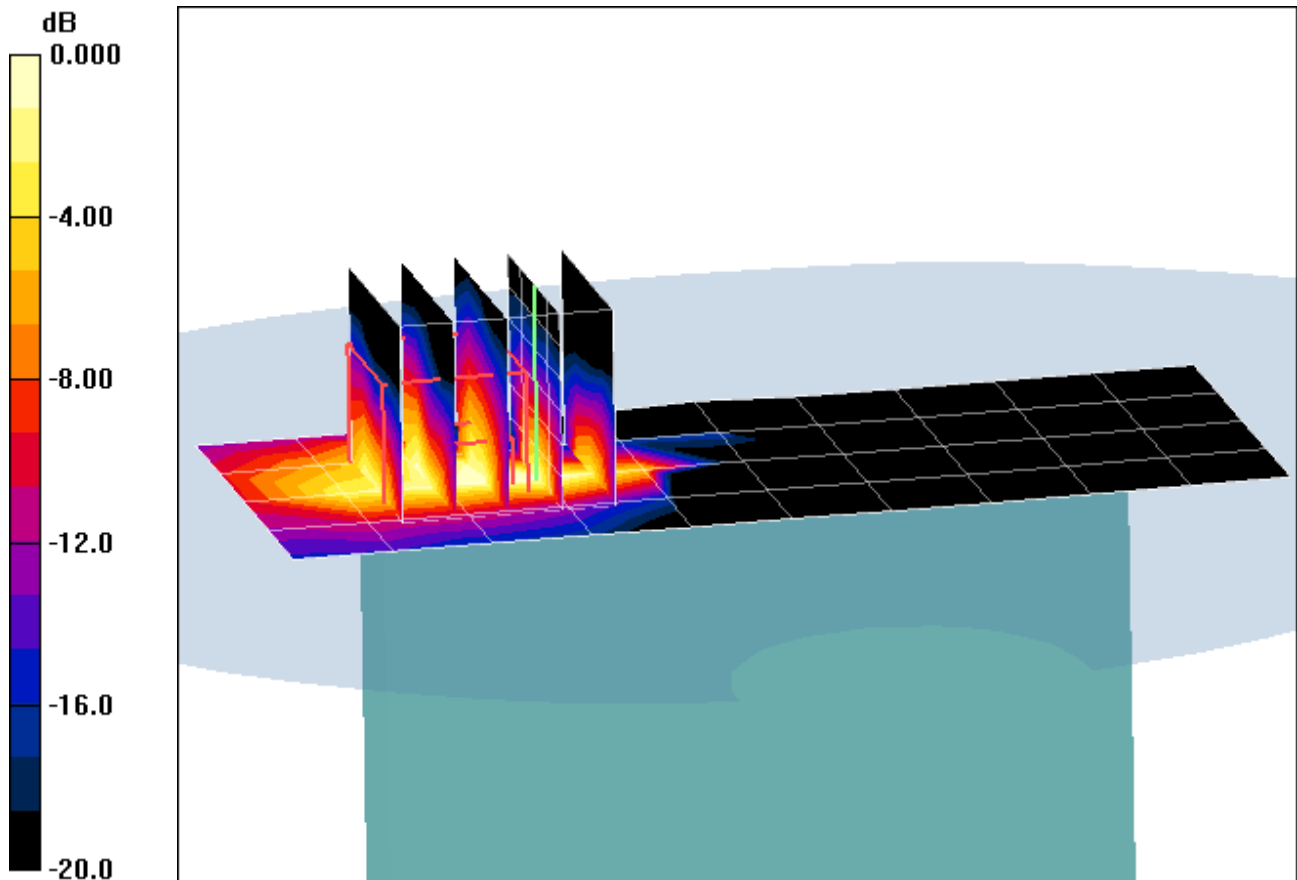
Area Scan (5x11x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 9.40 V/m; Power Drift = -0.065 dB

Peak SAR (extrapolated) = 0.440 W/kg

SAR(1 g) = 0.169 mW/g; SAR(10 g) = 0.072 mW/g



0 dB = 0.217mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: RS2SXI1; Type: Portable Radio; Serial: J78P04HU

Communication System: IEEE 802.11b; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2462 \text{ MHz}$; $\sigma = 2.03 \text{ mho/m}$; $\epsilon_r = 51.12$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-17-2012; Ambient Temp: 23.3°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3209; ConvF(4.23, 4.23, 4.23); Calibrated: 3/16/2012

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

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

Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: IEEE 802.11b, Body SAR, Ch 11, 1 Mbps, Bottom Edge

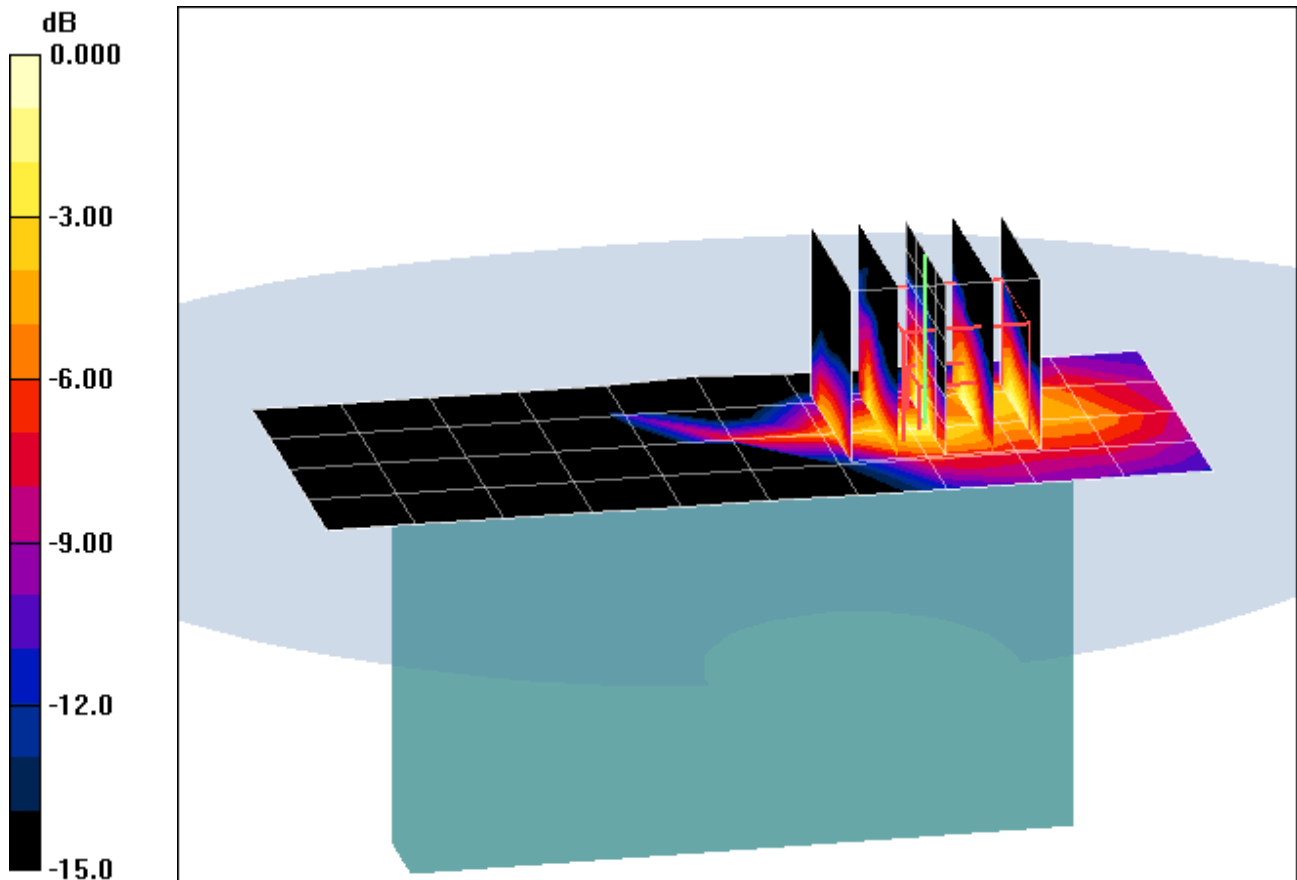
Area Scan (5x11x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 4.10 V/m; Power Drift = 0.050 dB

Peak SAR (extrapolated) = 0.102 W/kg

SAR(1 g) = 0.044 mW/g; SAR(10 g) = 0.017 mW/g



0 dB = 0.062mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: RS2SXI1; Type: Portable Radio; Serial: J78P04HU

Communication System: IEEE 802.11b; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2462 \text{ MHz}$; $\sigma = 2.03 \text{ mho/m}$; $\epsilon_r = 51.12$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-17-2012; Ambient Temp: 23.3°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3209; ConvF(4.23, 4.23, 4.23); Calibrated: 3/16/2012

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

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

Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: IEEE 802.11b, Body SAR, Ch 11, 1 Mbps, Right Edge

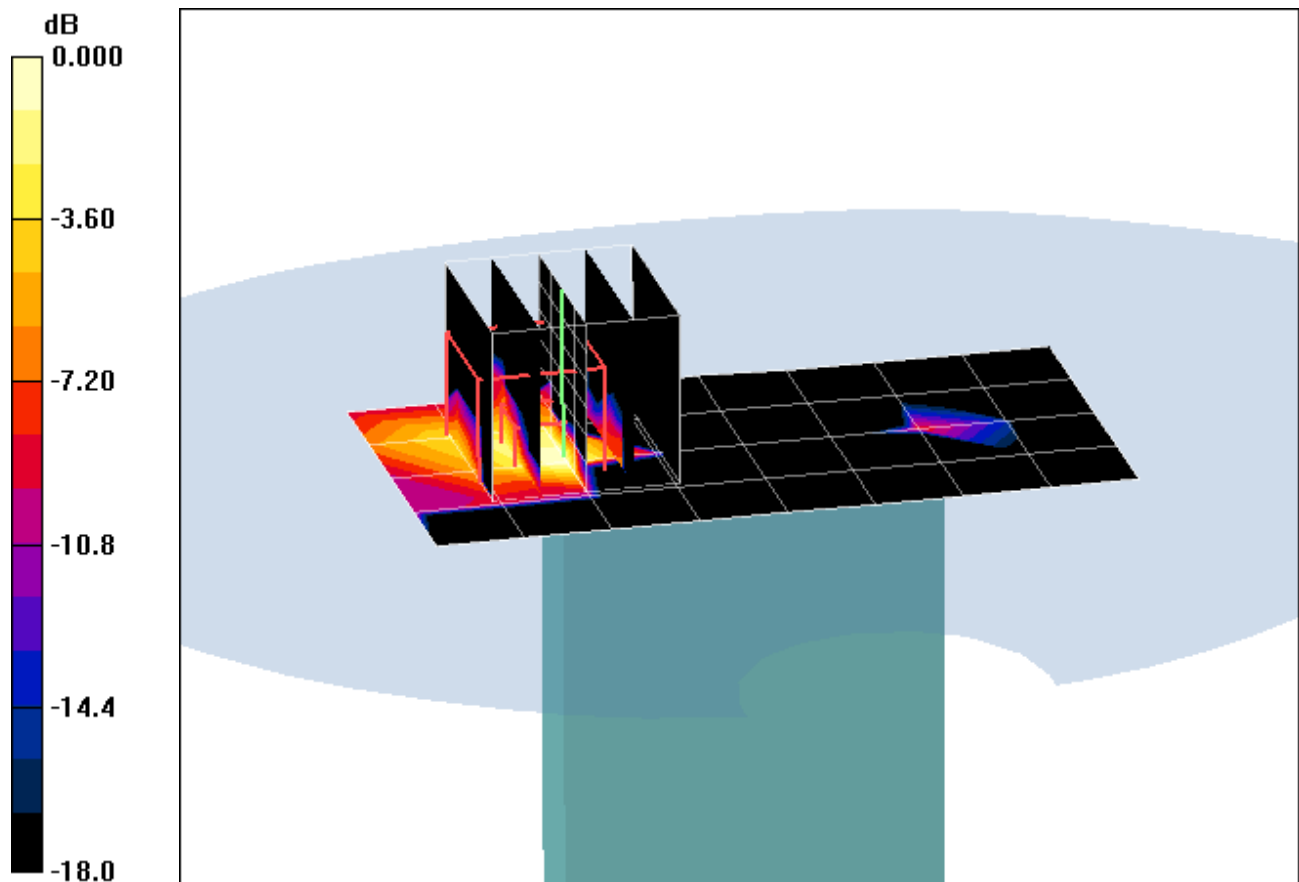
Area Scan (5x9x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 1.89 V/m; Power Drift = 0.153 dB

Peak SAR (extrapolated) = 0.033 W/kg

SAR(1 g) = 0.00695 mW/g; SAR(10 g) = 0.00224 mW/g



0 dB = 0.008mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: RS2SX11; Type: Portable Radio; Serial: J78P04HU

Communication System: IEEE 802.11b; Frequency: 2457 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2457 \text{ MHz}$; $\sigma = 2.02 \text{ mho/m}$; $\epsilon_r = 51.12$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-17-2012; Ambient Temp: 23.3°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3209; ConvF(4.23, 4.23, 4.23); Calibrated: 3/16/2012

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

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

Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: IEEE 802.11b, Body SAR, Ch 10, 1 Mbps, Left Edge

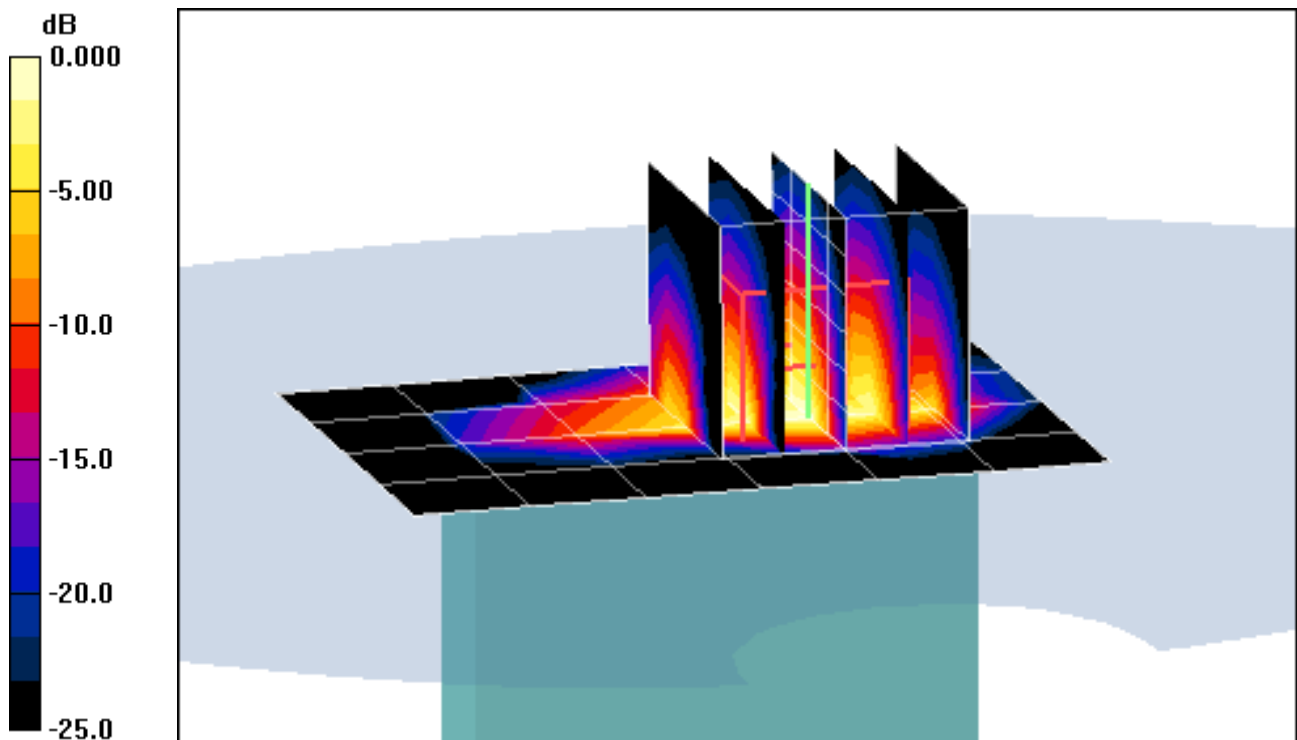
Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 18.6 V/m; Power Drift = 0.072 dB

Peak SAR (extrapolated) = 1.95 W/kg

SAR(1 g) = 0.733 mW/g; SAR(10 g) = 0.277 mW/g



0 dB = 0.706mW/g

PCTEST ENGINEERING LABORATORY, INC.

DUT: RS2SX11; Type: Portable Radio; Serial: J78P04HU

Communication System: IEEE 802.11b; Frequency: 2457 MHz; Duty Cycle: 1:1

Medium: 2450 Body Medium parameters used (interpolated):

$f = 2457 \text{ MHz}$; $\sigma = 2.02 \text{ mho/m}$; $\epsilon_r = 51.12$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 0.0 cm

Test Date: 04-17-2012; Ambient Temp: 23.3°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3209; ConvF(4.23, 4.23, 4.23); Calibrated: 3/16/2012

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

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

Measurement SW: DAS4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Mode: IEEE 802.11b, Body SAR, Ch 10, 1 Mbps, Left Edge

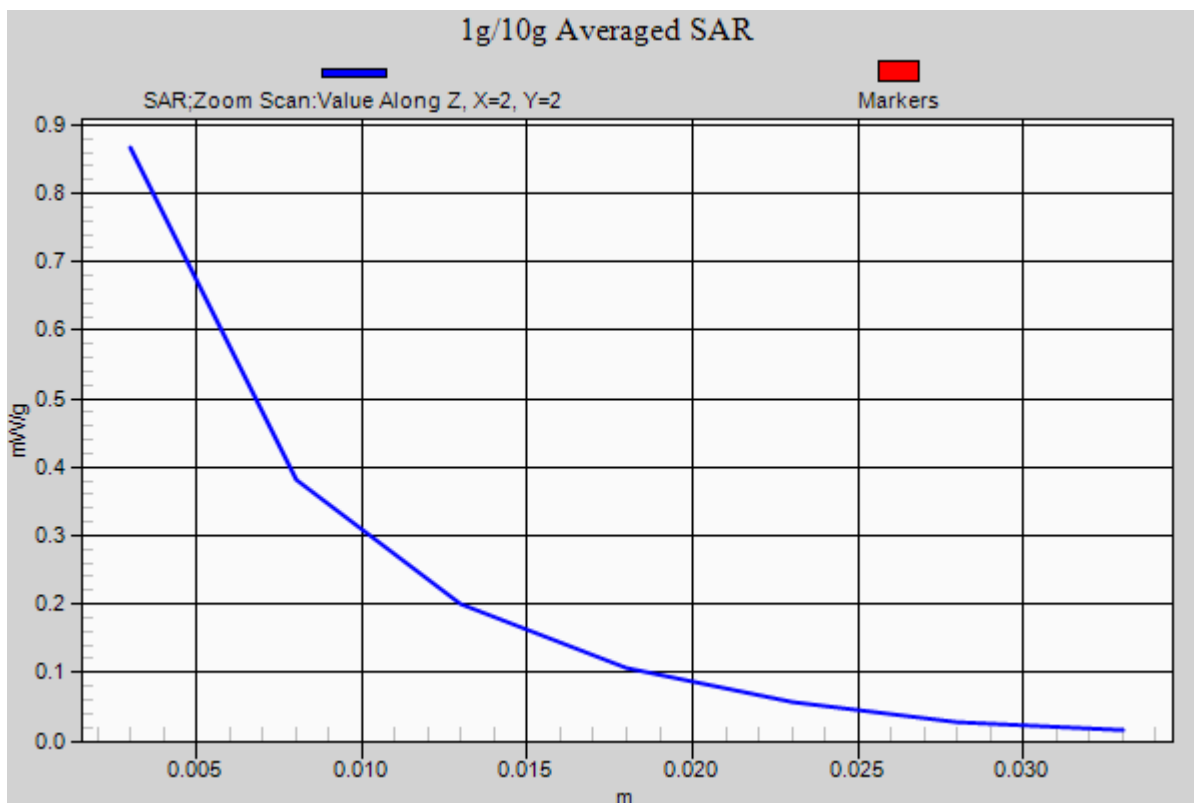
Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm

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

Reference Value = 18.6 V/m; Power Drift = 0.072 dB

Peak SAR (extrapolated) = 1.95 W/kg

SAR(1 g) = 0.733 mW/g; SAR(10 g) = 0.277 mW/g



APPENDIX B: SYSTEM VERIFICATION

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:

$f = 2450 \text{ MHz}$; $\sigma = 2.01 \text{ mho/m}$; $\epsilon_r = 51.13$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 04-17-2012; Ambient Temp: 23.3°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3209; ConvF(4.23, 4.23, 4.23); Calibrated: 3/16/2012

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

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

Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

2450MHz System Verification

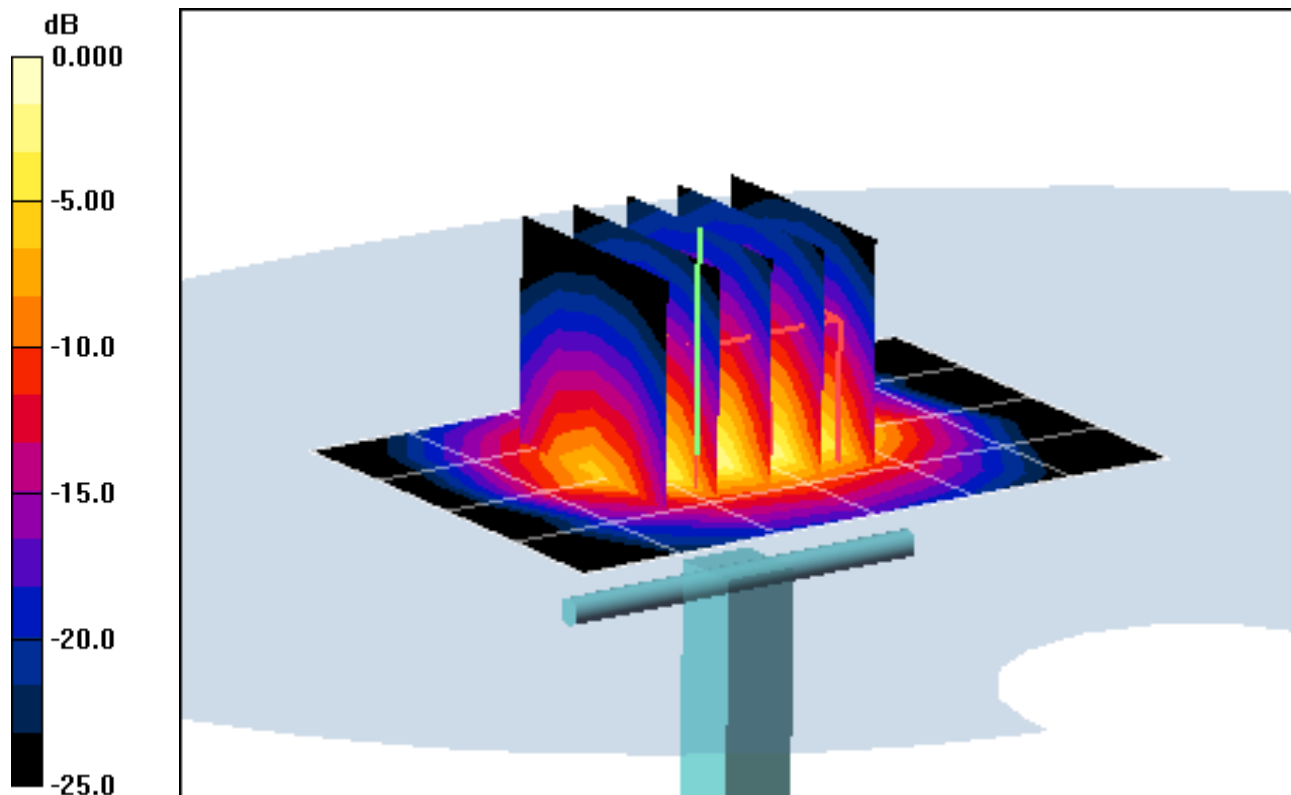
Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm

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

Input Power = 16.0 dBm (40 mW)

SAR(1 g) = 2.15 mW/g; SAR(10 g) = 0.996 mW/g

Deviation = 4.78 %



0 dB = 2.79mW/g

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:

$f = 2450 \text{ MHz}$; $\sigma = 2.01 \text{ mho/m}$; $\epsilon_r = 51.13$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section; Space: 1.0 cm

Test Date: 04-17-2012; Ambient Temp: 23.3°C; Tissue Temp: 22.6°C

Probe: ES3DV3 - SN3209; ConvF(4.23, 4.23, 4.23); Calibrated: 3/16/2012

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn1323; Calibrated: 2/15/2012

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

Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

2450MHz System Verification

Area Scan (5x7x1): Measurement grid: dx=15mm, dy=15mm

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

Input Power = 16.0 dBm (40 mW)

SAR(1 g) = 2.15 mW/g; SAR(10 g) = 0.996 mW/g

Deviation = 4.78 %

