MOTOROLA

Portable Hand-Held Device SAR Test Report

Tests Requested By: Motorola Mobility, Inc.
600 N. US Highway 45
Libertyville, IL 60048

Test Report #: 24418-1F Rev. D
Date of Report: Apr 29, 2011, Revised on 24 June, 2011
Date of Test: Mar 23 – 27, 2011 and April 28, 2011
FCC ID #: IHDP56LU2
Generic Name: N/A

Test Laboratory: Motorola Mobility, Inc. - Product Safety & Compliance Laboratory
600 N. US Highway 45
Libertyville, IL 60048

Report Author: Steven Hauswirth
Distinguished Member of the Technical Staff

Accreditation:

UKAS TESTING

2404

This laboratory is accredited to ISO/IEC 17025-2005 to perform the following tests:

Tests:	Procedures:
Electromagnetic Specific Absorption Rate	IEC 62209-1 RSS-102 IEEE 1528 - 2003 FCC OET Bulletin 65 (*including Supplement C*) Australian Communications Authority Radio Communications (Electromagnetic Radiation – Human Exposure) Standard 2003 CENELEC EN 50360 ARIB Std. T-56 (2002)

On the following products or types of products:
Wireless Communications Devices (Examples): Two Way Radios; Portable Phones (including Cellular, Licensed Non-Broadcast and PCS); Low Frequency Readers; and Pagers

Statement of Compliance:

Motorola declares under its sole responsibility that the portable hand-held device model to which this declaration relates, is in conformity with the appropriate General Population/Uncontrolled RF exposure standards, recommendations and guidelines (FCC 47 CFR §2.1093) as well as with CENELEC en50360:2001 and ANSI / IEEE C95.1. It also declares that the product was tested in accordance with IEEE 1528 / CENELEC EN62209-1 (2006), as well as other appropriate measurement standards, guidelines and recommended practices. Any deviations from these standards, guidelines and recommended practices are noted below:

Motorola's ISO 17025 accreditation scope does not currently include SAR testing in the 5 GHz band. Therefore, SAR testing performed in this band was performed outside of our ISO 17025 accreditation. The general procedures and guidelines provided within; FCC KDB 248227 D01, FCC KDB 648474 D01, FCC KDB 865664 D01 and IEC 62209-2 were utilized for testing.

Table of Contents

1. Introduction

The Motorola Mobility Product Safety & Compliance Laboratory has performed measurements of the maximum potential exposure to the user of the LTE module covered by this test report. The LTE module was placed into the sole intended host (FCC ID: IHDP56LU1 Exhibit 11 report 24253-1F Rev. B dated Feb 2, 2011). The Specific Absorption Rate (SAR) of this product was measured. The device was tested in accordance with [4] and FCC KDB pub 616217. The SAR values measured for the portable hand-held device are below the maximum recommended levels of 1.6 W/kg in a 1 g average set in [3] and 2.0 W/kg in a 10 g average set in [2]. Specific WiFi sections and tables contained within this report are duplicated from the host device's SAR test report. These are presented as supporting information to be used in the evaluation of simultaneous transmitters with this module when contained within the host device.

For ANSI / IEEE C95.1 (1 g), the final stand-alone SAR readings for this module are 1.30 W/kg for body use. The final simultaneous-transmission SAR readings for this hand-held device are 1.51 W/kg for body use. These measurements were performed using a Dasy4™ v4.7 system manufactured by Schmid & Partner Engineering AG (SPEAG), of Zurich Switzerland.

Summary of Stand-Alone SAR Results for LTE Module	
Modulation	**Body SAR (1 g $^{W}/_{kg}$)**
QSPK	**1.27**
16QAM	**1.30**

2. Description of the Device Under Test

2.1 Antenna description

Host Device LTE Band 13 Antenna (module connected via coaxial connector)

Type	Internal	
Location	Top-Leftt Rear of Device	
Dimensions	Width	12 mm
	Length	42 mm

2.2 Device description

Serial Number(s) (Functional Use)	99000052000875 (Host device Wi-Fi SAR testing – from IHDP56LU1) 99000052018474 (LTE SAR testing)
Production Unit or Identical Prototype (47 CFR §2..908)	Identical Prototype
Device Category	Portable
RF Exposure Limits	General Population / Uncontrolled

Module Functionality

Mode(s) of Operation	LTE 3GPP Band 13							
RB Allocation	1 (Low end)	49 (high end)	50%	100%	1 (Low end)	49 (high end)	50%	100%
Modulation Mode(s)	QPSK	QPSK	QPSK	QPSK	16QAM	16QAM	16QAM	16QAM
Maximum Output Power Setting	24.0 dBm	24.0 dBm	23.0 dBm	23.0 dBm	23.0 dBm	23.0 dBm	22.0 dBm	22.0 dBm
Transmitting Frequency Range(s)	777 – 787 MHz (1 channel 10MHz wide)							

Host Functionality Used for Simultaneous Transmit

Mode(s) of Operation	Wi-Fi 802.11b/g/n	Wi-Fi 802.11a/n	Bluetooth
Modulation Mode(s)	BPSK / QPSK / QAM	BPSK / QPSK / 16QAM	GFSK
Maximum Output Power Setting	18.5 dBm	9.0 dBm	10.7 dBm
Transmitting Frequency Range(s)	2412.0 - 2462.5 MHz	5180 - 5240, 5745 - 5805, MHz	2402.0 - 2483.5 MHz

2.3 Power Reduction techniques on LTE

MPR conditions are defined in 3GPP 36-521, section 6.2.3.3:

6.2.3.3 Minimum conformance requirements

For UE Power Class 3, the allowed Maximum Power Reduction (MPR) for the maximum output power in Table 6.2.2.3-1 due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3.3-1.

Table 6.2.3.3-1: Maximum Power Reduction (MPR) for Power Class 3

Modulation	Channel bandwidth / Transmission bandwidth configuration [RB]						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2

For the UE maximum output power modified by MPR, the power limits specified in subclause 6.2.5.3 apply. The normative reference for this requirement is TS 36.101 clause 6.2.3.

For the DUT architecture, MPR is taken whenever allowed. Per the chart above, for a 10 MHz bandwidth the following MPR is used:

Modulation	# of RBs	MPR (dB)
QPSK	>12	1
16 QAM	<= 12	1
16 QAM	> 12	2

The table applies for any RB start value. RB's are assigned contiguously.

So, given a maximum power of 24 dBm and the MPR described above, the max power of the module is as follows:

Test Case	Max Power (dBm)
QPSK, Start RB: 0, RB Aloc: 1RB@low end	24
QPSK, Start RB: 49, RB Aloc: 1RB@high end	24
QPSK, Start RB: 12, RB Aloc 50%	23
QPSK, Start RB: 0, RB Aloc 100%	23
16QAM, Start RB: 0, RB Aloc: 1RB@low end	23
16QAM, Start RB: 49, RB Aloc: 1RB@high end	23
16QAM, Start RB: 12, RB Aloc 50%	22
16QAM, Start RB: 0, RB Aloc 100%	22

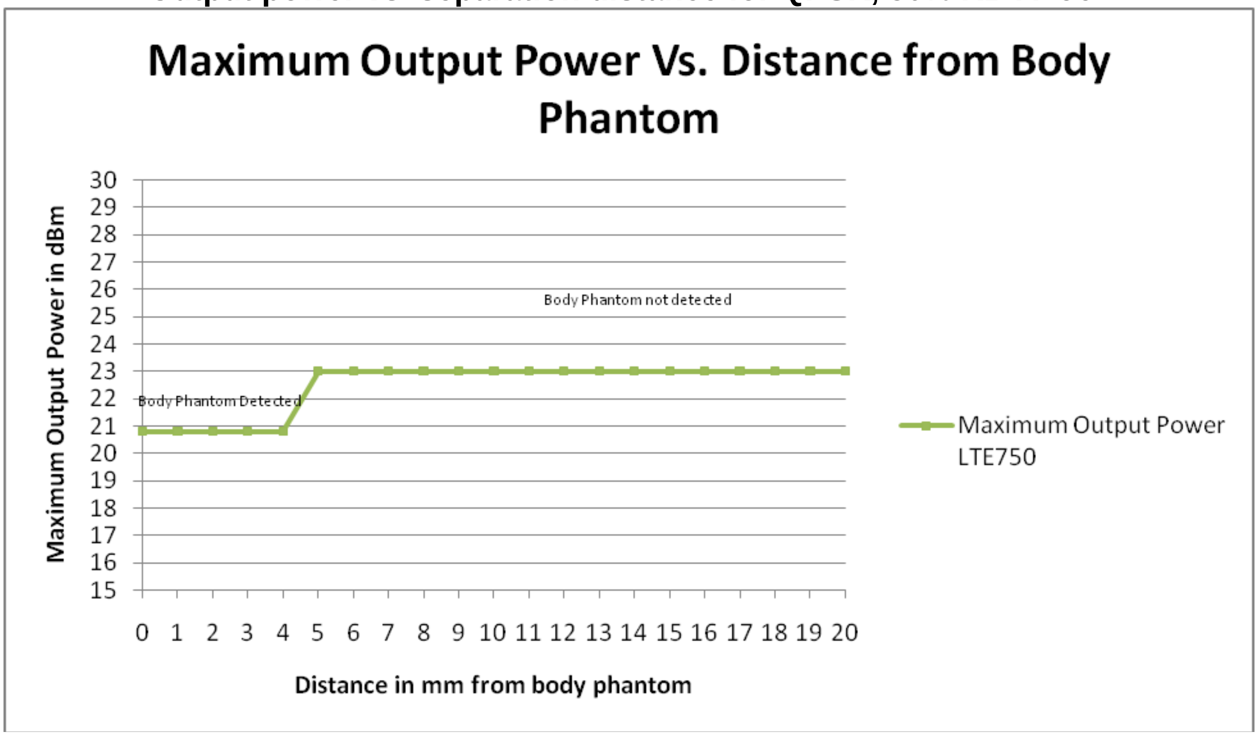
Measured Conducted power (dBm) for module's LTE mode						
Mode	Channel	Center F (MHz)	RB Aloc 1 (low)	RB Aloc 49 (high)	RB Aloc 50%	RB Aloc 100%
QPSK	23230	782	24.16	24.8	23.4	23.97
16QAM	23230	782	24.0	24.85	22.34	22.9

The DUT also utilizes a set of reduced limits for the maximum transmit power for specified device configurations and orientations. A description of this functionality is provided in the "Operational Description" contained within Exhibit 12. These reduced set of limits are used in conjunction with the MPR power reductions listed above. The orientation and/or proximity sensor power reductions listed below is applied first, then LTE MPR detailed above is applied. This implementation results is the reduction in power limits being additive.

Orientation\Mode Power Limit Activation	LTE Band 13	Power Reduction (dB)
Landscape-1 (Bottom Edge toward body)	†	2.2
Landscape-2 (Top Edge toward body)	‡	1.5
Portrait-1 (Right Edge toward body)	†	2.2
Portrait-2 (Left Edge toward body)	†	2.2

† Reduced maximum limit applied only by activation of proximity sensor with back surface towards the user.
‡ Reduced maximum limit applied by when DUT is placed vertically with the top edge facing the user.

Proximity Sensor Activation
Output power vs. separation distance for QPSK, 50% RB Alloc.



The graph above demonstrates the amount of power reduction provided by the activation of the proximity sensors over a range of separation distances between the DUT and the phantom. The 2.2 dB of power reduction is constant for all operating modulations and RB allocations for this display orientation.

2.4 Evaluation of Host Wi-Fi 802.11 modes – Reference Page from IHDP56LU1

The following description and tables of data are duplicated from [7] for the purpose of identification of the required WiFi transmit modes that are needed for simultaneous transmit evaluation.

Per "SAR Measurement Procedures for 802.11 a/b/g Transmitters" (FCC KDB pub. 248227), power measurements were performed for 802.11 operational modes. The conducted power measurements for each mode are shown in the tables below. SAR testing for 802.11 was performed within each transmit band (2.5 GHz, 5.2 GHz, 5.8 GHz) with the transmitter set to the lowest data rate on the default test channels **highlighted in bold** in the tables below. The body positions that resulted in the highest SAR values were further tested on the additional channels and higher data rates **highlighted in blue** in the tables below. Due to the relatively large number of data rates with measured conducted power exceeding the lowest data rate conducted power by more than 0.25 dB, there will be a large number of tests performed on the configuration that results in the highest measured SAR for the lowest data rate.

Band	Channel	Conducted Power (dBm) for 802.11b Mode Data Rates			
		1 Mbps	2 Mbps	5.5 Mbps	11 Mbps
Wi-Fi 2450 MHz	1	**16.83**	**17.38**	**17.60**	**17.67**
	6	**17.69**	**18.19**	**18.39**	**18.43**
	11	**17.45**	**18.12**	**18.19**	**18.38**

Band	Channel	Conducted Power (dBm) for 802.11g Mode Data Rates							
		6 Mbps	9 Mbps	12 Mbps	18 Mbps	24 Mbps	36 Mbps	48 Mbps	54 Mbps
Wi-Fi 2450 MHz	1	11.20	11.17	10.54	10.22	10.28	10.17	10.12	9.31
	6	17.26	17.25	17.21	16.95	14.60	14.76	14.59	14.65
	11	11.36	11.63	11.57	11.26	11.29	11.19	11.12	11.14

Band	Channel	Conducted Power (dBm) for 802.11n Mode Data Rates (20 MHz Channel, 800 ns Guard Interval)							
		6.5 Mbps	13 Mbps	19.5 Mbps	26 Mbps	39 Mbps	52 Mbps	58.5 Mbps	65 Mbps
Wi-Fi 2450 MHz	1	11.04	10.51	10.25	10.32	10.27	10.26	10.14	10.22
	6	15.54	15.44	15.10	13.57	13.81	13.55	13.59	12.10
	11	11.40	11.47	11.12	11.21	11.15	11.13	11.11	10.80

Band	Channel	Conducted Power (dBm) for 802.11n Mode Data Rates (20 MHz Channel, 400 ns Guard Interval)							
		7.2 Mbps	14.4 Mbps	21.6 Mbps	28.8 Mbps	43.3 Mbps	57.7 Mbps	65 Mbps	72.2 Mbps
Wi-Fi 2450 MHz	1	10.65	10.49	10.22	10.25	10.36	10.32	10.18	10.15
	6	15.44	15.63	15.11	13.77	13.76	13.67	13.54	12.09
	11	11.40	11.25	10.98	11.05	11.12	10.92	10.95	10.90

Band	Channel	Conducted Power (dBm) for 802.11a Mode Data Rates							
		6 Mbps	9 Mbps	12 Mbps	18 Mbps	24 Mbps	36 Mbps	48 Mbps	54 Mbps
Wi-Fi 5210 MHz	36	7.81	7.97	8.00	7.79	7.72	7.74	7.66	7.60
	40	**8.49**	**8.76**	7.67	7.57	7.50	7.55	7.53	7.45
	44	7.78	7.86	7.74	7.55	7.51	7.56	7.50	7.51
	48	**8.93**	9.15	7.72	7.37	7.38	7.43	7.42	7.54
Wi-Fi 5775 MHz	149	8.27	8.29	8.21	8.17	8.15	8.21	8.19	8.26
	153	**8.60**	8.59	8.55	8.27	8.18	8.19	8.17	8.01
	157	8.64	8.65	8.62	8.24	8.41	8.27	8.21	8.30
	161	**8.77**	8.76	8.70	8.43	8.50	8.45	8.40	8.51

Band	Channel	Conducted Power (dBm) for 802.11n Mode Data Rates (20 MHz Channel, 800 ns Guard Interval)							
		6.5 Mbps	13 Mbps	19.5 Mbps	26 Mbps	39 Mbps	52 Mbps	58.5 Mbps	65 Mbps
Wi-Fi 5210 MHz	36	8.41	7.65	7.28	7.55	7.50	7.56	7.67	7.47
	40	8.00	8.10	7.75	7.63	7.59	7.85	7.74	7.70
	44	8.15	7.65	7.49	7.63	7.60	7.61	7.74	7.68
	48	8.26	8.26	8.07	8.03	8.06	8.05	8.04	7.73
Wi-Fi 5775 MHz	149	**8.78**	8.06	7.73	7.80	7.78	7.78	7.78	7.71
	153	7.93	8.07	7.70	7.72	7.90	7.68	7.66	7.68
	157	8.14	8.08	7.75	7.83	7.88	7.83	7.72	7.74
	161	8.21	8.29	7.92	8.14	8.01	7.96	7.87	7.85

Band	Channel	Conducted Power (dBm) for 802.11n Mode Data Rates (20 MHz Channel, 400 ns Guard Interval)							
		7.2 Mbps	14.4 Mbps	21.6 Mbps	28.8 Mbps	43.3 Mbps	57.7 Mbps	65 Mbps	72.2 Mbps
Wi-Fi 5210 MHz	36	**8.36**	8.18	7.60	7.74	7.75	7.75	7.74	7.66
	40	7.93	7.95	7.85	7.92	7.90	7.77	7.80	7.79
	44	8.10	8.02	7.74	7.85	7.89	7.98	7.61	7.98
	48	**8.26**	8.18	7.94	8.01	8.02	7.75	7.68	7.64
Wi-Fi 5775 MHz	149	8.45	8.51	8.29	8.41	8.38	7.85	7.76	8.14
	153	**8.53**	8.33	8.35	7.61	7.83	7.86	7.76	7.68
	157	8.05	7.98	7.74	7.89	7.84	7.76	7.86	7.73
	161	**8.29**	8.06	7.85	7.98	7.90	8.02	7.90	7.79

3. Test Equipment Used

3.1 Dosimetric System

The Motorola Mobile Devices Business Product Safety & Compliance Laboratory utilizes a Dosimetric Assessment System (Dasy4™ v4.7) manufactured by Schmid & Partner Engineering AG (SPEAG™), of Zurich Switzerland. All the SAR measurements are taken within a shielded enclosure. The overall 10 g RSS uncertainty of the measurement system is ±10.8% (K=1) with an expanded uncertainty of ±21.6% (K=2). The overall 1 g RSS uncertainty of the measurement system is ±11.1% (K=1) with an expanded uncertainty of ±22.2% (K=2). The measurement uncertainty budget is given in Appendix 4. Per IEEE 1528, this uncertainty budget is applicable to the SAR range of 0.4 W/kg to 10 W/kg.

The list of calibrated equipment used for the measurements is shown in the following table.

Description	Serial Number	Cal Date	Cal Due Date
DASY4™ DAE V1	434	Jan-13-2011	Jan-13-2012
E-Field Probe ES3DV3	3124	Aug-11-2010	Aug-11-2011
DASY4™ DAE V1	699	Sep-20-2010	Sep-20-2011
E-Field Probe ES3DV3	3184	Mar-11-2011	Mar-11-2012
DASY4™ DAE V1	440	Nov-11-2010	Nov-11-2011
E-Field Probe EX3DV4	3730	Jul-16-2010	Jul-16-2011
S.A.M. Phantom used for 780 MHz	TP-1250		
S.A.M. Phantom used for 2450 MHz	TP-1136		
S.A.M. Phantom used for 5210/5775 MHz	TP-1106		
Dipole Validation Kit, DV835V2	425TR	Oct-14-2010	Oct-14-2012
	422TR	Mar-18-2011	Mar-18-2013
Dipole Validation Kit, DV2450V2	740	Mar-17-2011	Mar-17-2013
Dipole Validation Kit, D5GHzV2	1098	Jan-07-2011	Jan-07-2013

3.2 Additional Equipment

Description	Serial Number	Cal Date	Cal Due Date
Rohde & Schwarz CMW500 SW version 2.0.20.10 Used for LTE testing	103402	Dec-01-2010	Dec-01-2012
Signal Generator HP8648C	3847A04810	Oct-30-2009	Oct-30-2011
Power Meter E4419B	GB39511087	Dec-22-2009	Dec-22-2011
Power Sensor #1 - E9301A	US39211006	Oct-25-2010	Oct-25-2011
Power Sensor #2 - E9301A	US39210934	Oct-25-2010	Oct-25-2011
Signal Generator HP8648C	3429A00286	Nov-23-2009	Nov-23-2011
Power Meter E4419B	US39250622	Dec-22-2009	Dec-22-2011
Power Sensor #1 - E9301A	US39210931	Oct-25-2010	Oct-25-2011
Power Sensor #2 - E9301A	US39210932	Oct-25-2010	Oct-25-2011
Network Analyzer HP8753ES	US39172529	Jun-04-2010	Jun-04-2011
Dielectric Probe Kit HP85070C	US99360070		

4. Electrical parameters of the tissue simulating liquid

Prior to conducting SAR measurements, the relative permittivity, ε_r, and the conductivity, σ, of the tissue simulating liquids were measured with a HP85070 Dielectric Probe Kit These values, along with the temperature of the simulated tissue are shown in the table below. The recommended limits for permittivity and conductivity are also shown. A mass density of ρ= 1 $^{g}/_{cm^3}$ was entered into the system in all the cases. It can be seen that the measured parameters are within tolerance of the recommended limits specified in [1] and [5].

f (MHz)	Tissue type	Limits / Measured	Dielectric Parameters		
			ε_r	σ (S/m)	Temp (°C)
782	Body	**Measured,** Mar-23-2011	53.3	0.92	20.1
		Measured, Mar-24-2011	53.3	0.92	20.1
		Measured, Mar-27-2011	54.4	0.93	20.2
		Measured, Ap-28-2011	54.4	0.93	20.2
		Recommended Limits	55.4 ±5%	0.97 ±5%	18-25
2450	Body	**Measured,** Apr-28-2011	47.5	2.03	19.9
		Recommended Limits	52.7 ±10%	1.95 ±5%	18-25
5210	Body	**Measured,** Apr-28-2011	46.2	5.79	19.1
		Recommended Limits	49.0 ±10%	5.31 ±5%	18-25
5785	Body	**Measured,** Apr-28-2011	45.1	6.63	19.3
		Recommended Limits	48.2 ±10%	5.98 ±5%	18-25

The list of ingredients and the percent composition used for the simulated tissues are indicated in the table below.

Ingredient	835 MHz / 900 MHz Head	780 MHz / 835 MHz Body	1800 MHz / 1900 MHz Head	1800 MHz / 1900 MHz Body	2450 MHz Head	2450 MHz Body
Sugar	57	44.9	--	--	--	--
DGBE	--	--	47	30.8	--	30
Diacetin	--	--	--	--	51	--
Water	40.45	53.06	52.62	68.8	48.75	70
Salt	1.45	0.94	0.38	0.4	0.15	--
HEC	1	1	--	--	--	--
Bact.	0.1	0.1	--	--	0.1	--

All 5.2 GHz and 5.8 GHz SAR testing was performed using MSL 3500/5800 tissue simulating liquids from Schmid & Partner Engineering AG. Prior to conducting SAR measurements, the relative permittivity, ε_r, and the conductivity, σ, of the liquids were measured. The conductivity of the purchased liquids was determined to be at the high end of the window from the target parameter. This resulted in the 5.2 GHz and 5.8 GHz System Accuracy Verifications measuring slightly above the 19.9% (k=2) window from the dipole validation target. When conductivity is normalized to the target value, the system accuracy verification is within the 19.9% (k=2) window. Because the system accuracy verifications were measured on the conservative side of the target window, all subsequent 5.2 GHz and 5.8 GHz SAR tests were also on the conservative side of their uncertainty window.

5. System Accuracy Verification

A system accuracy verification of the DASY4™ was performed using the measurement equipment listed in Section 3.1. The daily system accuracy verification occurs within the flat section of the SAM phantom.

A SAR measurement was performed to verify the measured SAR was within ±10% from the target SAR indicated in Appendix 5. These frequencies are within ±10% of the compliance test mid-band frequency as required in [1] and [5]. The test was conducted on the same days as the measurement of the DUT. Recommended limits for permittivity and conductivity, specified in [5], are shown in the table below. The obtained results from the system accuracy verification are also displayed in the table below. SAR values are normalized to 1 W forward power delivered to the dipole. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values. The distributions of SAR compare well with those of the reference measurements (see Appendix 1). For frequencies below 3 GHz, the simulated tissue depth was verified to be 15.0 cm ± 0.5 cm. For frequencies above 3 GHz, the simulated tissue depth was verified to be 10 cm ± 0.5 cm. Z-axis scans showing the SAR penetration are also included in Appendix 1.

f (MHz)	Description	SAR (W/kg), 1 gram	Dielectric Parameters		Ambient Temp (°C)	Tissue Temp (°C)
			ε_r	σ (S/m)		
835	**Measured,** Mar-23-2011	9.90	41.2	0.91	20.6	20.5
	Measured, Mar-24-2011	9.85	42.4	0.92	20.5	20.5
	Measured, Mar-27-2011	9.95	41.9	0.92	20.5	20.5
	Recommended Limits	9.57	41.5 ±5%	0.90 ±5%	18-25	18-25
	Measured, Apr-28-2011	9.80	53.8	0.98	20.3	20.6
	Recommended Limits	9.77	55.2 ±5%	0.97 ±5%	18-25	18-25

The following probe conversion factors were used on the E-Field probe(s) used for the system accuracy verification measurements:

Description	Serial Number	f (MHz)	Conversion Factor	Cal Cert pg #
E-Field Probe ES3DV3	3124	835	5.86	5 of 11

The probe calibration frequency and the system accuracy verification were performed at 835 MHz. The center of the LTE Band 13 transmit band is 782 MHz. The difference exceeds the +/- 50 MHz window specified in KDB pub. 450824 D01. Therefore calculations are given to perform a SAR correction for deviations of the complex permittivity and conductivity from simulated tissue targets if the deviation is in the direction that does not result in a "conservative" SAR result. The sensitivity coefficients for frequencies within "Attachment 1: Tissue Parameter Variations" of KDB pub. 450824 were used.

This attachment provides:
450 MHz tissue has sensitivity coefficients for Er of -0.46 and for Sigma of +0.43
800 MHz tissue has sensitivity coefficients for Er of -0.57 and for Sigma of +0.59

A linear approximation to get the values for 782 MHz (the frequency of the center of the transmit band) were performed. The sensitivity coefficients used for 782 MHz were: Er of -0.56434 and Sigma of +0.581771.

We then applied these coefficients to the delta between the measured conductivity and the target conductivity using the formula:

$$\Delta SAR = S_\varepsilon \, \Delta\varepsilon + S_\sigma \, \Delta\sigma$$

Here, $S_\varepsilon = \partial SAR/\partial\varepsilon$ and $S_\sigma = \partial SAR/\partial\sigma$ are sensitivity coefficients, representing the sensitivity of SAR to permittivity and conductivity, respectively.

Then the measured SAR is adjusted by the delta SAR to compensate for the change in conductivity using the formula: **Adjusted SAR = Measured_SAR / (1 + delta_SAR)**

The Following System Performance checks were performed to support the required simultaneous transmit testing in the WiFi bands:

f (MHz)	Description	SAR (W/kg), 1 gram	Dielectric Parameters		Ambient Temp (°C)	Tissue Temp (°C)
			ε_r	σ (S/m)		
2450	**Measured,** Apr-06-2011	56.0	47.5	2.03	20.1	19.3
	Recommended Limits	51.3	52.7 ±10%	1.95 ±5%	18-25	18-25
5200	**Measured,** Mar-25-2011	84.30	46.3	5.77	20.2	19.3
	Recommended Limits	77.50	49.0 ±10%	5.30 ±5%	18-25	18-25
5800	**Measured,** Mar-28-2011	82.30	45.0	6.65	20.3	19.2
	Recommended Limits	73.10	48.2 ±10%	6.00 ±5%	18-25	18-25

The following probe conversion factors were used on the E-Field probe(s) used for the system accuracy verification measurements:

Description	Serial Number	f (MHz)	Conversion Factor	Cal Cert pg #
E-Field Probe ES3DV3	3184	2450	4.33	6 of 11
E-Field Probe EX3DV4	3730	5200	4.07	6 of 11
		5800	3.53	6 of 11

6. Test Results

For LTE modes, the test sample was operated using an actual transmission through a CMW500 base station simulator. The base station simulator or test software was set up for the proper channels, transmitter power levels and transmit modes of operation.

The DUT was tested in the configurations stipulated in [4] and KDB pub 616217 D03. KDB pub 616217 D03 was used for general guidance with regard to simultaneous transmission for a tablet device. The DUT was positioned into these configurations using the device holder supplied with the DASY4™ SAR measurement system. The default settings for the "coarse" and "cube" scans were chosen and used for measurements. The grid spacing of the coarse scan was set to 15 mm or less as shown in the SAR plots included in Appendix 2. Please refer to the DASY4™ manual for additional information on SAR scanning procedures and algorithms used.

The host device used for testing has an internal battery that is not replaceable by the end user. This battery was used to do all of the SAR testing. The battery was charged prior to each set of three tests.

6.1 Host Body Test Results For Reference in use of Simultaneous Transmission Evaluation

The SAR results shown in tables 1 and 2 are maximum SAR values averaged over 1 gram of phantom tissue, to demonstrate compliance to [3] and also over 10 grams of phantom tissue, to demonstrate compliance to [6]. These tables are taken from the host device's (IHDP56LU1) Exhibit 11 SAR report. They are presented here for reference and to assist in determining the need for simultaneous transmit SAR evaluation.

Body, Back of Host Device 0 mm from Phantom – Reference Table from IHDP56LU1								
***Mid-Band F* (MHz)**	**Mode**	**Channel**	**Temp (°C)**	**Drift (dB)**	***10 g SAR value***		***1 g SAR value***	
					Measured (W/kg)	**Extrapolated (W/kg)**	**Measured (W/kg)**	**Extrapolated (W/kg)**
2450	**802.11b, 1 Mbps**	1	20.0	0.186	0.470	0.47	1.17	1.17
		6	20.0	-0.172	0.407	0.42	1.02	1.06
		11	20.0	-0.098	0.344	0.35	0.895	0.92
	802.11b, 2 Mbps	1	20.5	0.098	0.515	0.52	1.31	1.31
		6	20.5	-0.033	0.413	0.42	1.05	1.06
		11	20.3	-0.125	0.366	0.38	0.93	0.96
	802.11b, 5.5 Mbps	1	20.5	0.046	0.497	0.50	1.26	1.26
		6	20.3	-0.225	0.408	0.43	1.04	1.10
		11	20.3	-0.094	0.356	0.36	0.913	0.93
	802.11b, 11 Mbps	1	**19.5**	**-0.022**	**0.522**	**0.52**	**1.33**	**1.34**
		6	19.5	-0.151	0.429	0.44	1.08	1.12
		11	19.5	0.301	0.384	0.38	1.00	1.00
5210	**802.11a, 6 Mbps**	36	18.5	-0.207	0.117	0.12	0.351	0.37
		40	18.5	-0.211	0.136	0.14	0.412	0.43
		44	18.2	-0.203	0.135	0.14	0.412	0.43
		48	**18.2**	**-0.344**	**0.148**	**0.16**	**0.449**	**0.49**
	802.11a, 9 Mbps	40	19.0	-0.260	0.136	0.14	0.418	0.44
	802.11n, 7.2 Mbps	36	19.3	-0.174	0.069	0.07	0.266	0.28
		48	19.3	-0.041	0.106	0.11	0.334	0.34
5785	**802.11a, 6 Mbps**	153	18.2	-0.198	0.114	0.12	0.421	0.44
		161	18.2	-0.255	0.118	0.13	0.445	0.47
	802.11n, 7.2 Mbps	153	**18.5**	**-0.444**	**0.128**	**0.14**	**0.479**	**0.53**
		161	19.4	-0.354	0.103	0.11	0.441	0.48
	802.11n, 6.5 Mbps	149	18.4	-0.050	0.132	0.13	0.471	0.48

Table 1: SAR measurement results at the highest possible output power, measured in a body position against the ICNIRP and ANSI SAR Limit.

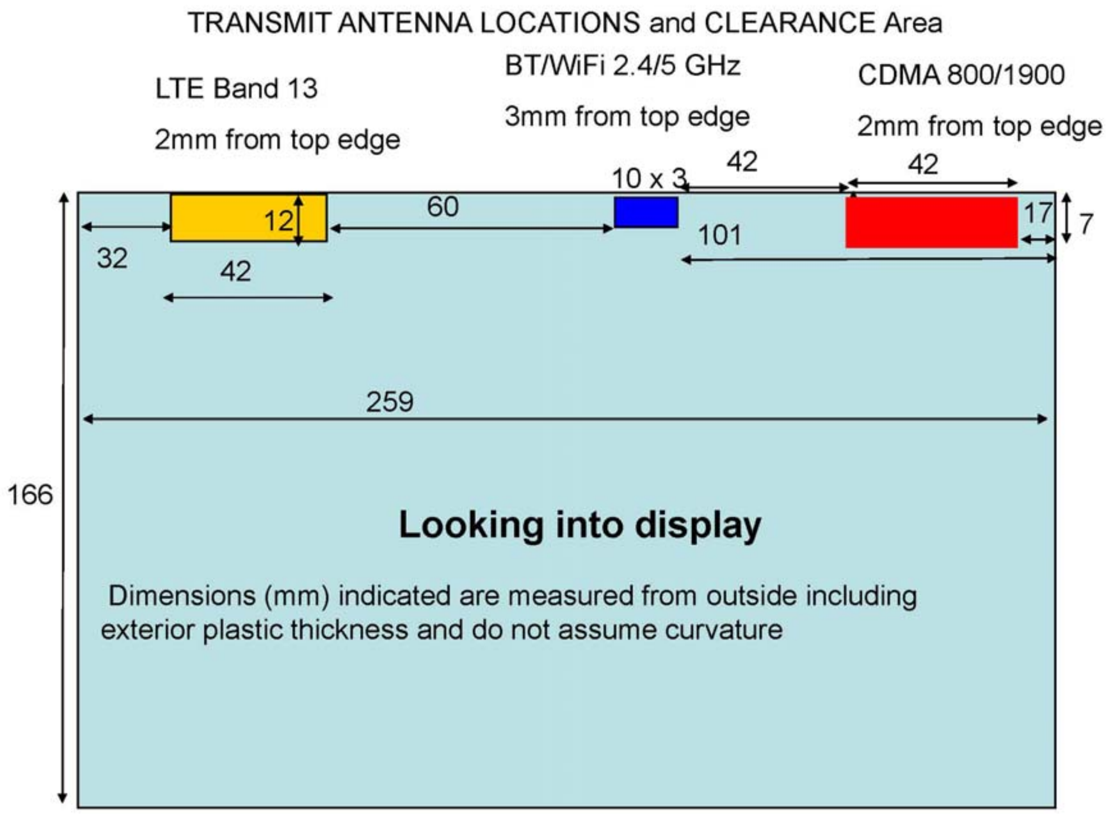
Body, Top Edge of Host Device 0 mm from Phantom – Reference Table from IHDP56LU1									
Mid-Band ***F*** **(MHz)**	**Mode**	**Channel**	**Temp (°C)**	**Drift (dB)**	***10 g SAR value***		***1 g SAR value***	
					Measured (W/kg)	**Extrapolated (W/kg)**	**Measured (W/kg)**	**Extrapolated (W/kg)**
2450	**802.11b, 1 Mbps**	1						
		6	**20.0**	**0.267**	**0.394**	**0.39**	**1.04**	**1.04**
		11						
5210	**802.11a, 6 Mbps**	36	18.6	0.386	0.231	0.23	0.966	0.97
		40	19.7	0.210	0.259	0.26	1.04	1.04
		44	**18.6**	**0.080**	**0.318**	**0.32**	**1.25**	**1.25**
		48	19.6	0.142	0.264	0.26	1.09	1.09
	802.11a, 9 Mbps	40	19.3	0.206	0.283	0.28	1.11	1.11
	802.11n, 7.2 Mbps	36	18.5	-0.440	0.222	0.25	0.926	1.02
		48	18.2	-0.033	0.198	0.20	0.811	0.82
5785	**802.11a, 6 Mbps**	153	18.7	0.145	0.289	0.29	1.04	1.04
		161	**18.2**	**-0.880**	**0.299**	**0.37**	**1.05**	**1.29**
	802.11n, 7.2 Mbps	153	19.3	0.045	0.258	0.26	0.926	0.93
		161	19.3	-0.744	0.283	0.34	0.975	1.16
	802.11n, 6.5 Mbps	149	18.5	0.307	0.286	0.29	1.04	1.04

Table 2: SAR measurement results at the highest possible output power, measured in a body position against the ICNIRP and ANSI SAR Limit.

6.2 Body Test Results

The SAR results shown in tables 3 through 6 are maximum SAR values averaged over 1 gram of phantom tissue, to demonstrate compliance to [3] and also over 10 grams of phantom tissue, to demonstrate compliance to [6]. Also shown is the temperature of the simulated tissue after the test, the measured drift and the extrapolated SAR. The exact method of extrapolation is Extrapolated SAR = Measured SAR * $10^{(-drift/10)}$. The SAR reported at the end of the measurement process by the DASY4™ measurement system can be scaled up by the measured drift to determine the SAR at the beginning of the measurement process. This is the most conservative SAR because it corresponds to the average output power at the beginning of the SAR test. This extrapolation has been done because when the DUT is operating properly it may exhibit a slump in radiated power and SAR over time. This is verified by measuring the SAR drift after the test.

The requisite test positions for the DUT were chosen per the guidance provided in FCC KDB pub. 447498 D01. The DUT was tested with the back surface of the device facing the phantom with no separation for all transmitters requiring test. Additionally, the DUT was tested with the back surface of the device at 5 mm separation from the phantom, to capture compliance at the worst-case proximity sensor trigger point (i.e. the closest the DUT might come to a user without utilizing a set of reduced maximum power limits). The DUT was also tested along the edges of the device in which an antenna is located within 5 cm of that edge. Per the guidance, two of the DUT edges were excluded from testing as no antenna exists within 5 cm of those edges. Pictorial representation of the antenna locations and separation distances are given in below and in Exhibit 7d. Additionally, the software within the DUT was set to invert the orientation results from the DUT's sensor. E.g., the DUT "top edge" facing up (away from the body) was operating instead at the "top edge" facing down (toward the body) performance levels. This inversion of the orientation ensures proper exposure conditions were measured for SAR testing of an edge using the standard DASY4 measurement setup.



The test conditions that produced the highest SAR values in each band are indicated as bold numbers in the following tables and are included in Appendix 2. All other test conditions measured lower SAR values than those included in Appendix 2.

The SAR measurements were performed using the SAM phantoms listed in section 3.1. Since the same phantoms and simulated tissue were used for the system accuracy verification and the device SAR measurements, the Z-axis scans included in Appendix 1 are applicable for verification of simulated tissue depth. The simulated tissue depth was verified to be 15.0 cm ± 0.5 cm for frequencies less than 3 GHz, or 10.0 cm ± 0.5 cm for frequencies greater than 3 GHz. The same device holder described in section 6 was used for positioning the DUT.

The following probe conversion factors were used on the E-Field probe(s) used for the body measurements:

Description	Serial Number	f (MHz)	Conversion Factor	Cal Cert pg #
E-Field Probe ES3DV3	3124	835	5.86	6 of 11

The SAR results below in the "corrected for tissue" column were corrected for the tissue conductivity that was measured below the nominal target. Corrections were performed using the methods specified in section 5.0. No correction was made for permittivity, since the measured tissue value already represents a conservative result in the measured SAR.

Body, Back of DUT 0 mm from Phantom								1 g SAR value		
***Mid-Band F* (MHz)**	**Mode**	**Channel**	**Temp (°C)**	**Conducted Power (dBm)**	**Target Power Reduction (dB)**	**Effective Conducted Power (dB)**	**Drift (dB)**	**Measured (W/kg)**	**Corrected for Tissue**	**Extrapolated (W/kg)**
LTE Band 13 QPSK	**RB 1 (Low End)**	23230	19.5	24.16	2.2	21.96	0.0369	0.986	1.013	1.01
	RB 49 (High End)	23230	19.6	24.80	2.2	22.60	-0.126	0.794	0.816	0.84
	RB 50%	23230	**20.5**	**23.40**	**2.2**	**21.20**	**-0.342**	**1.150**	**1.175**	**1.27**
LTE Band 13 16QAM	**RB 1 (Low End)**	23230	20.0	24.00	2.2	22.80	-0.117	0.892	0.917	0.94
	RB 49 (High End)	23230	20.2	24.85	2.2	22.65	0.0111	0.740	0.760	0.76
	RB 50%	23230	**20.5**	**22.34**	**2.2**	**20.14**	**-0.00306**	**1.150**	**1.175**	**1.18**

Table 3: SAR measurement results at the highest possible output power, measured in a body position against the ICNIRP and ANSI SAR Limit.

Body, Top Edge of DUT 0 mm from Phantom									1 g SAR value	
***Mid-Band F* (MHz)**	**Mode**	**Channel**	**Temp (°C)**	**Conducted Power (dBm)**	**Target Power Reduction (dB)**	**Effective Conducted Power (dB)**	**Drift (dB)**	**Measured (W/kg)**	**Corrected for Tissue**	**Extrapolated (W/kg)**
LTE Band 13 QPSK	**RB 1 (Low End)**	23230	**19.8**	**24.16**	**1.5**	**22.66**	**0.0152**	**1.15**	**1.182**	**1.18**
	RB 49 (High End)	23230	19.9	24.80	1.5	23.30	-0.0506	0.724	0.744	0.75
	RB 50%	23230	20.0	23.40	1.5	21.90	0.0086	0.842	0.865	0.87
LTE Band 13 16QAM	**RB 1 (Low End)**	23230	**20.0**	**24.00**	**1.5**	**22.50**	**-0.00333**	**1.26**	**1.295**	**1.30**
	RB 49 (High End)	23230	20.0	24.85	1.5	23.35	-0.0568	0.743	0.764	0.77
	RB 50%	23230	20.2	22.34	1.5	20.84	-0.0159	0.839	0.862	0.87

Table 4: SAR measurement results at the highest possible output power, measured in a body position against the ICNIRP and ANSI SAR Limit.

Body, Left Edge of DUT 0 mm from Phantom									1 g SAR value	
***Mid-Band F* (MHz)**	**Mode**	**Channel**	**Temp (°C)**	**Conducted Power (dBm)**	**Target Power Reduction (dB)**	**Effective Conducted Power (dB)**	**Drift (dB)**	**Measured (W/kg)**	**Corrected for Tissue**	**Extrapolated (W/kg)**
LTE Band 13 QPSK	**RB 1 (Low End)**	23230	19.8	24.16	2.2	21.96	-0.367	0.343	0.352	0.38
	RB 49 (High End)	23230	**20.0**	**24.80**	**2.2**	**22.60**	**0.194**	**0.424**	**0.436**	**0.44**
	RB 50%	23230	19.9	23.40	2.2	21.20	0.0.498	0.263	0.270	0.27
LTE Band 13 16QAM	**RB 1 (Low End)**	23230	20.0	24.00	2.2	22.80	-0.25	0.349	0.359	0.38
	RB 49 (High End)	23230	**20.0**	**24.85**	**2.2**	**22.65**	**-0.184**	**0.432**	**0.444**	**0.46**
	RB 50%	23230	19.9	22.34	2.2	20.14	0.0128	0.265	0.272	0.27

Table 5: SAR measurement results at the highest possible output power, measured in a body position against the ICNIRP and ANSI SAR Limit.

Body, Back of DUT 5 mm from Phantom								1 g SAR value		
***Mid-Band F* (MHz)**	**Mode**	**Channel**	**Conducted Power (dBm)**	**Target Power Reduction (dB)**	**Effective Conducted Power (dB)**	**Temp (°C)**	**Drift (dB)**	**Measured (W/kg)**	**Corrected for Tissue**	**Extrapolated (W/kg)**
LTE Band 13 QPSK	**RB 50%**	23230	23.40	2.2	21.20	18.9	-0.235	0.902	0.927	0.95
LTE Band 13 16QAM	**RB 50%**	23230	22.34	2.2	20.14	18.9	-0.0594	0.727	0.747	0.76

Table 6: SAR measurement results at the highest possible output power, measured in a body position against the ICNIRP and ANSI SAR Limit.

6.3 Evaluation of Simultaneous Transmitters

The necessity of stand-alone and simultaneous SAR testing was evaluated for the licensed and unlicensed transmitters of the device per FCC KDB pub. 447498 D01, which refers to "SAR Evaluation Considerations for Handsets with Multiple Transmitters and Antennas" (FCC KDB pub. 648474).

By device design the LTE transmitter may operate simultaneously with the host's Wi-Fi 802.11 transmitter or the Bluetooth transmitter. The LTE transmitter does not operate simultaneously with the host's CDMA transmitter. The separation distance between the host's Wi-Fi 802.11/Bluetooth antenna and the LTE antenna is 6.0 cm. Pictorial representations of the antenna locations and separation distances are given in Exhibit 7d.

The host's Bluetooth transmitter of the device under test can be excluded from stand-alone and simultaneous SAR evaluation, per the highlighted requirements from FCC KDB pub. 648474, as follows:

1. The highest output conducted power measured for Bluetooth on the device under test is 11.7 mW [≤ 12 mW]
2. The separation distance between the Bluetooth antenna and the main antenna is 6.0 cm [≥ 2.5 cm]

For the transmitters requiring stand-alone SAR testing (LTE and Wi-Fi 802.11), the KDB guidelines direct that if the sum of the 1g SAR measured for the simultaneously transmitting antennas is less than the SAR limit, SAR measurements for simultaneous transmission is not required. Further, if the SAR-to-peak-location separation ratio for two simultaneously transmitting antennas is less than 0.3 then SAR measurement for simultaneous transmission is likewise not required. The distance between the hotspots was measured using SPEAG Technical Note TN-110209.

The cases where the simple sum of the 1g SAR measured for the simultaneously transmitting antennas is greater than the SAR limit are highlighted in the tables below. The cases where the simple summed SAR-to-peak-location separation ratio is > 0.3 are highlighted below.

			802.11b/g			5.2 GHz 802.11a/n				5.8 GHz 802.11a/n			
	Chn		1	6	11	36	40	44	48	149	153	157	161
		SAR		1.04		1.02	1.11	1.25	1.09	1.04	1.04		1.29
QPSK	RB1	1.15		***2.19***		***2.17***	***2.26***	***2.4***	***2.24***	***2.19***	***2.19***		***2.44***
QPSK	RB49	0.73		***1.77***		***1.75***	***1.84***	***1.98***	***1.82***	***1.77***	***1.77***		***2.02***
QPSK	50%	0.84		***1.88***		***1.86***	***1.95***	***2.09***	***1.93***	***1.88***	***1.88***		***2.13***
16QAM	RB1	1.26		***2.30***		***2.28***	***2.37***	***2.51***	***2.35***	***2.3***	***2.3***		***2.55***
16QAM	RB49	0.75		***1.79***		***1.77***	***1.86***	***2.00***	***1.84***	***1.79***	***1.79***		***2.04***
16QAM	50%	0.84		***1.88***		***1.86***	***1.95***	***2.09***	***1.93***	***1.88***	***1.88***		***2.13***

Body, Top Edge Simple Summed SAR

		2.5 GHz 802.11b/g			5.2 GHz 802.11a/n				5.8 GHz 802.11a/n			
	Chn	1	6	11	36	40	44	48	149	153	157	161
QPSK	RB1	Not Req	***0.35***	Not Req	***0.35***	***0.36***	***0.39***	***0.36***	***0.30***	***0.30***	Not Req	***0.34***
QPSK	RB49	Not Req	0.29	Not Req	0.28	***0.30***	***0.32***	0.29	0.24	0.24	Not Req	0.28
QPSK	50%	Not Req	***0.30***	Not Req	***0.30***	***0.31***	***0.34***	***0.31***	0.26	0.26	Not Req	0.29
16QAM	RB1	Not Req	***0.37***	Not Req	***0.37***	***0.38***	***0.40***	***0.38***	***0.32***	***0.32***	Not Req	***0.35***
16QAM	RB49	Not Req	0.29	Not Req	0.28	***0.30***	***0.32***	***0.30***	0.25	0.25	Not Req	0.28
16QAM	50%	Not Req	***0.30***	Not Req	***0.30***	***0.31***	***0.34***	***0.31***	0.26	0.26	Not Req	0.29

Body, Top Edge Simple Summed SAR–to–Hotspot Distance Ratio

The top edge simple summed SAR-to-Hotspot distance ration is > 0.3 for many configurations. Simultaneous SAR testing is required for LTE operating simultaneously with the 5.2 GHz 802.11 a/n WiFi band, or the 5.8 GHz 802.11 a/n WiFi band or the 2.5 GHz 802.11 b/g WiFi band. Within each combination "block" of LTE and WiFi mode, only the combination of channels that result in the highest summed SAR and highest SAR to distance ratio will be tested for simultaneous SAR. These are the six cells highlighted in **blue** above.

			2.5 GHz 802.11b/g			5.2 GHz 802.11a/n				5.8 GHz 802.11a/n			
	Chn		1	6	11	36	40	44	48	149	153	157	161
		SAR	1.34	1.12	1.00	0.37	0.44	0.43	0.49	0.48	0.53	0	0.48
QPSK	RB1	0.99	***2.33***	***2.11***	***1.99***	1.36	1.43	1.42	1.48	1.47	1.52	0.99	1.47
	RB49	0.82	***2.16***	***1.94***	***1.82***	1.19	1.26	1.25	1.31	1.30	1.35	0.82	1.30
	50%	1.24	***2.58***	***2.36***	***2.24***	***1.61***	***1.68***	***1.67***	***1.73***	***1.72***	***1.77***	1.24	***1.72***
16QAM	RB1	0.92	***2.26***	***2.04***	***1.92***	1.29	1.36	1.35	1.41	1.40	1.45	0.92	1.40
	RB49	0.74	***2.08***	***1.86***	***1.74***	1.11	1.18	1.17	1.23	1.22	1.27	0.74	1.22
	50%	1.15	***2.49***	***2.27***	***2.15***	1.52	1.59	1.58	***1.64***	***1.63***	***1.68***	1.15	***1.63***

Body, Back Surface Simple Summed SAR

		2.5 GHz 802.11b/g			5.2 GHz 802.11a/n				5.8 GHz 802.11a/n			
	Chn	1	6	11	36	40	44	48	149	153	157	161
QPSK	RB1	0.25	0.23	0.21	Not Req	Not Req	Not Req	Not Req	Not Req	Not Req	Not Req	Not Req
	RB49	0.23	0.21	0.19	Not Req	Not Req	Not Req	Not Req	Not Req	Not Req	Not Req	Not Req
	50%	0.28	0.25	0.24	0.16	0.17	0.17	0.18	0.16	0.16	Not Req	0.16
16QAM	RB1	0.24	0.22	0.21	Not Req	Not Req	Not Req	Not Req	Not Req	Not Req	Not Req	Not Req
	RB49	0.22	0.20	0.19	Not Req	Not Req	Not Req	Not Req	Not Req	Not Req	Not Req	Not Req
	50%	0.27	0.24	0.23	Not Req	Not Req	Not Req	0.17	0.11	0.12	Not Req	0.11

Body, Back Surface Simple Summed SAR–to–Hotspot Distance Ratio

The back surface simple summed SAR-to-Hotspot distance ratio is < 0.3 for all configurations. Therefore no simultaneous transmission tests are required for the back surface configuration.

For the configurations noted, combined SAR measurements were required to determine the aggregate 1 g SAR. The results of these measurements are given in the table below, with additional SAR plots of the combined measurements provided in Appendix 3.

Measurements for Simultaneous SAR								
Cellular Transmitter Mode	**Wi-Fi Transmitter Mode**	**Configuration**	**LTE Transmitter 1 g SAR Value (W/kg)**	**Corrected for Tissue (W/kg)**	**Wi-Fi Transmitter 1 g SAR Value (W/kg)**	**Simultaneous 1 g SAR Value (W/kg)**	***Test Plots***	
							Grid	**Plot Page**
LTE Band 13 QPSK RB 1 (Low End)	Wi-Fi 2450 802.11g, 1 Mbps	Top Edge of DUT 0 mm from Phantom	1.37	1.40	0.974	1.51	33x14x5	**47 & 48**
	Wi-Fi 5210 802.11a, 6 Mbps	Top Edge of DUT 0 mm from Phantom	1.37	1.40	1.07	1.28	33x14x5	**49 & 50**
	Wi-Fi 5785 802.11a, 6 Mbps	Top Edge of DUT 0 mm from Phantom	1.37	1.40	0.971	1.25	33x14x5	**51 & 52**
LTE Band 13 16 QAM RB 1 (Low End)	Wi-Fi 2450 802.11g, 1 Mbps	Top Edge of DUT 0 mm from Phantom	1.26	1.29	0.974	1.37	33x14x5	**53 & 54**
	Wi-Fi 5210 802.11a, 6 Mbps	Top Edge of DUT 0 mm from Phantom	1.26	1.29	1.07	1.29	33x14x5	**55 & 56**
	Wi-Fi 5785 802.11a, 6 Mbps	Top Edge of DUT 0 mm from Phantom	1.26	1.29	0.971	1.26	33x14x5	**57 & 58**

Additional SAR measurements for simultaneous transmission evaluation were performed for each of the single transmitters using an extended zoom scan. This extended zoom scan was created to encompass the zoom scan volumes that were found previously in each of the stand-alone transmit SAR tests. The outer dimensions of the extended zoom scan were X = 128 mm, Y = 52 mm, Z = 22 mm with a step size of X = 4 mm, Y = 4 mm, and Z = 3 using a graded step size with a ratio of 1.5. The step sizes and arrangement of measurement points were chosen to comply with the guidance provided in FCC KDB pub. 865664.

The location of these extended zoom scans was established by using X, Y grid offsets from the "Grid Reference Point" in DASY4.7. The results were then combined via the DASY4.7 Multi-Band Combiner feature. A comparison can be performed between the stand-alone measurements for each noted transmitter and the measurements provided for simultaneous transmission. The measurements were not performed sequentially and thus may show slightly different results due to a number of reasons including, but not limited to, measurement system performance, slight differences in DUT positioning, or variations in simulated tissue parameters.

References

[1] CENELEC, en62209-1:2006 "Human Exposure to Radio Frequency Fields From Hand - Held and Body - Mounted Wireless Communication Devices – Human Models, Instrumentation, and Procedures"

[2] CENELEC, en50360:2001 "Product standard to demonstrate the compliance of mobile phones with the basic restrictions related to human exposure to electromagnetic fields (300 MHz – 3 GHz)".

[3] ANSI / IEEE, C95.1 1992 Edition "IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz"

[4] FCC OET Bulletin 65 Supplement C 01-01

[5] IEEE 1528 2003 Edition "IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques"

[6] ICNIRP Guidelines "Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz)"

[7] FCC ID IHDP56LU1 Exhibit 11 report 24253-1F Rev. B "Portable Hand-Held Device SAR test report", Feb 2, 2011

Appendix 1

SAR distribution comparison for the system accuracy verification

Test Laboratory: Motorola 835 MHz System Performance Check

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:425TR;
Procedure Notes: PM1 Power = 200mW Refl.Pwr PM3 = -25.9dB Sim.Temp@SPC = 20.5ºC Room Temp @ SPC = 20.6ºC
Communication System: CW - Dipole; Frequency: 835 MHz; Communication System Channel Number: 3; Duty Cycle: 1:1
Medium: VALIDATION Only; Medium parameters used: f = 835 MHz; σ = 0.91 mho/m; ε_r = 41.2; = 1000 kg/m^3

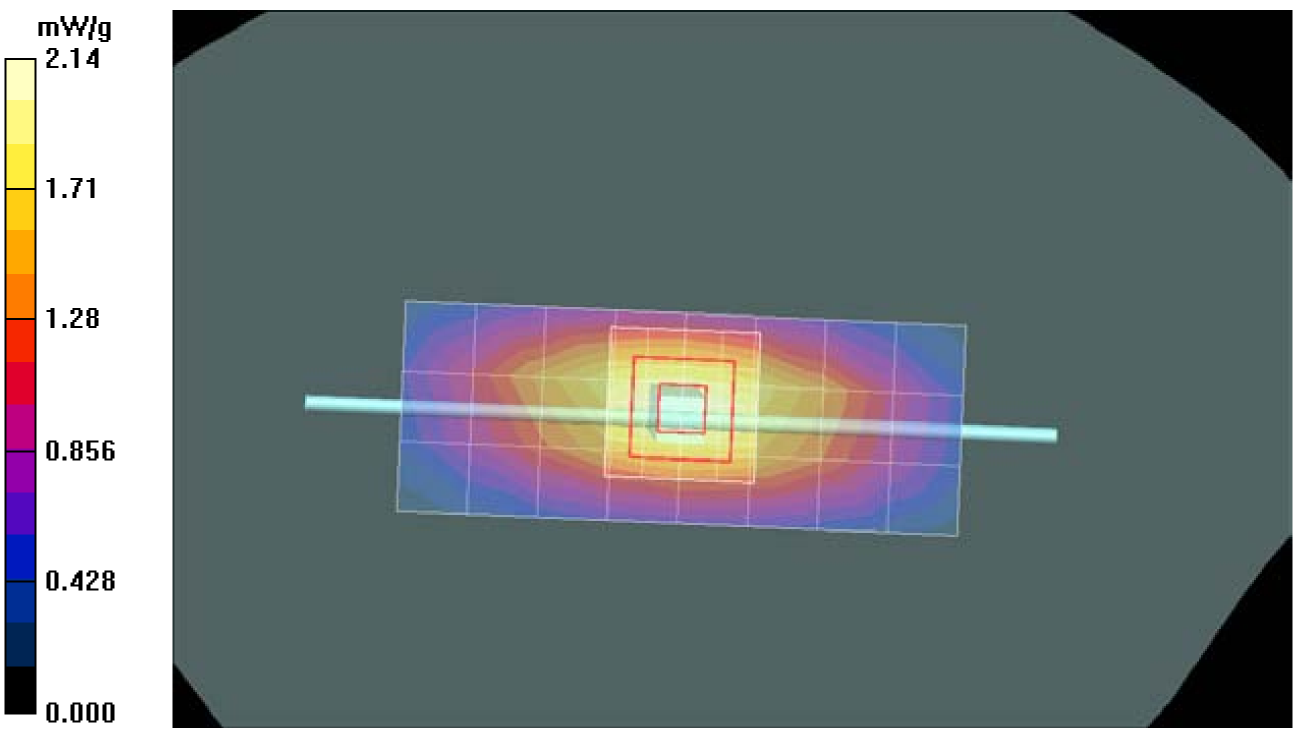
DASY4 Configuration:

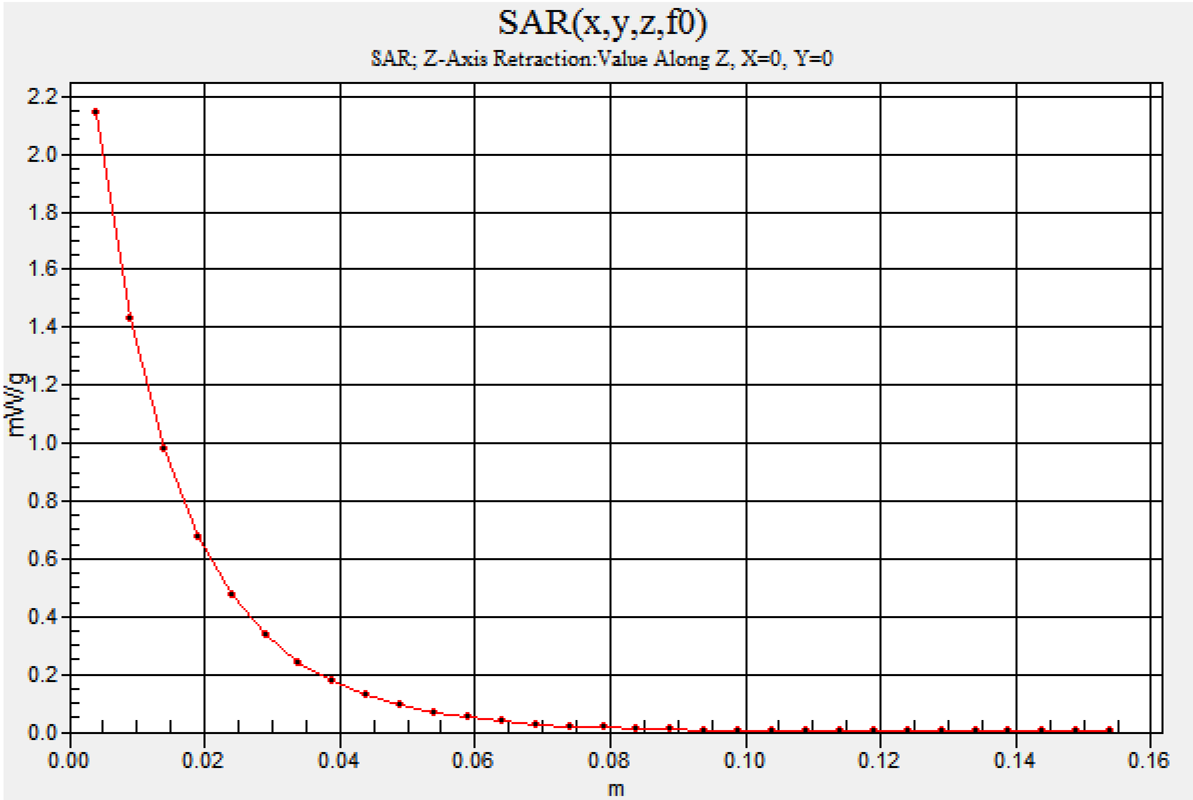
- Probe: ES3DV3 - SN3124; ConvF(5.89, 5.89, 5.89); Calibrated: 8/11/2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#4 Sugar SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1131;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Daily SPC Check/Dipole Area Scan (4x9x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.99 mW/g

Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 48.7 V/m; Power Drift = -0.005 dB
Peak SAR (extrapolated) = 2.96 W/kg
SAR(1 g) = 1.98 mW/g; SAR(10 g) = 1.29 mW/g
Maximum value of SAR (measured) = 2.14 mW/g

Daily SPC Check/Z-Axis Retraction (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm




SAR(x,y,z,f0)
SAR; Z-Axis Retraction:Value Along Z, X=0, Y=0
mW/g
m
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16

Test Laboratory: Motorola 835 MHz System Performance Check

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:425TR;
Procedure Notes: PM1 Power = 200mW Refl.Pwr PM3 = -26.1dB Sim.Temp@SPC = 20.5°C Room Temp @ SPC = 20.5°C
Communication System: CW - Dipole; Frequency: 835 MHz; Communication System Channel Number: 3; Duty Cycle: 1:1
Medium: VALIDATION Only; Medium parameters used: f = 835 MHz; σ = 0.92 mho/m; ε_r = 42.4; = 1000 kg/m^3

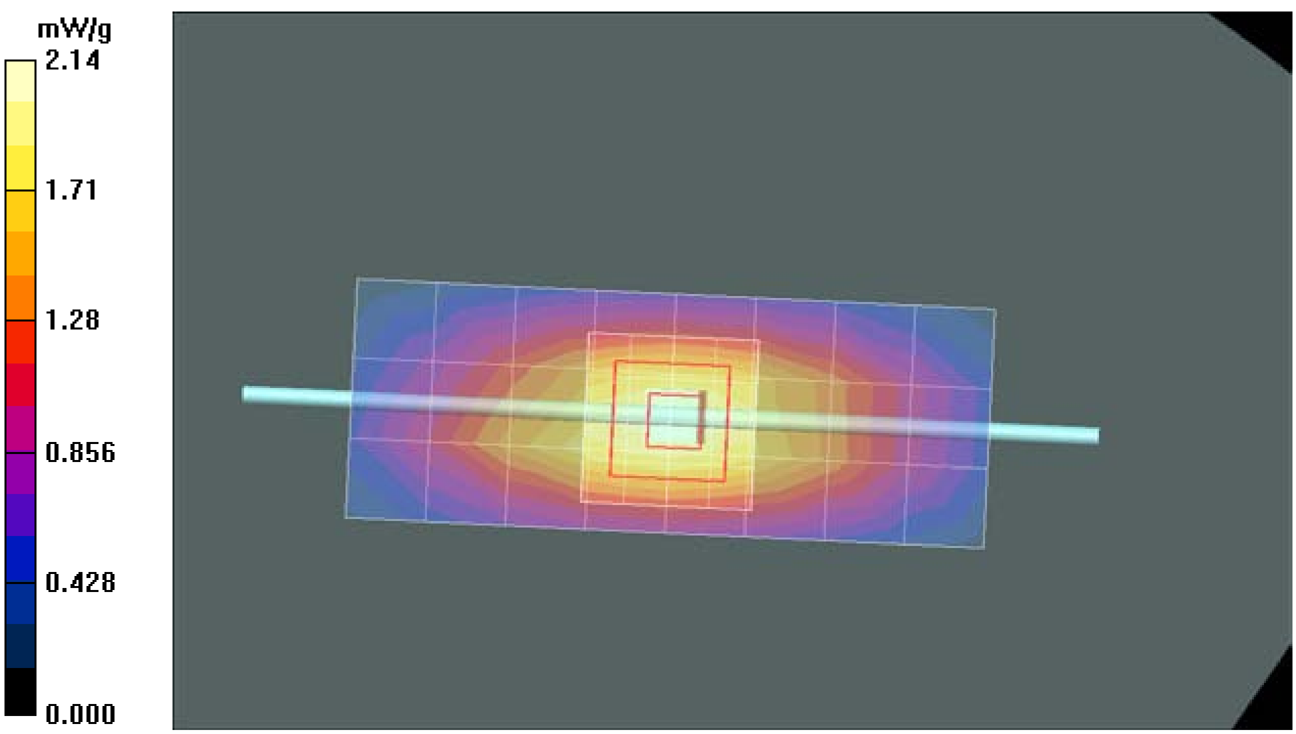
DASY4 Configuration:

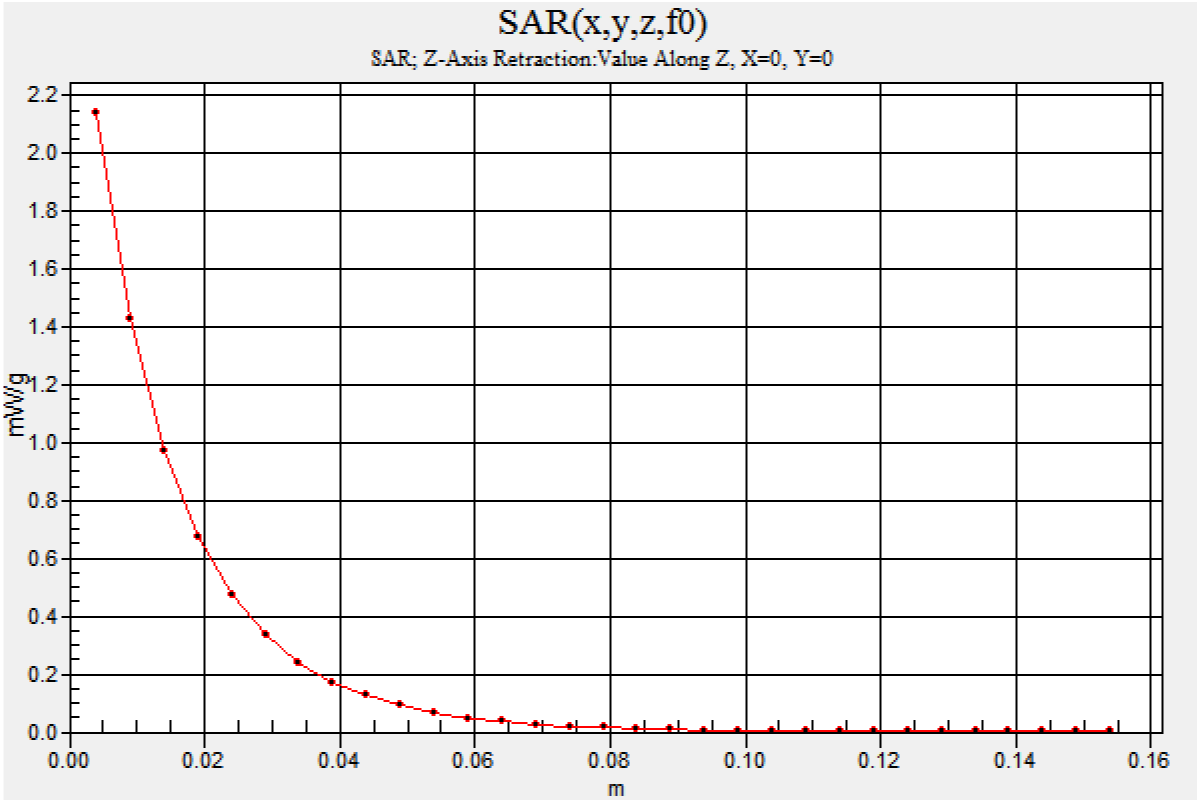
- Probe: ES3DV3 - SN3124; ConvF(5.89, 5.89, 5.89); Calibrated: 8/11/2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#4 Sugar SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1131;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Daily SPC Check/Dipole Area Scan (4x9x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.96 mW/g

Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 48.7 V/m; Power Drift = -0.017 dB
Peak SAR (extrapolated) = 2.94 W/kg
SAR(1 g) = 1.97 mW/g; SAR(10 g) = 1.28 mW/g
Maximum value of SAR (measured) = 2.13 mW/g

Daily SPC Check/Z-Axis Retraction (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 2.14 mW/g




SAR(x,y,z,f0)
SAR; Z-Axis Retraction:Value Along Z, X=0, Y=0
mW/g
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
m

Date/Time: 3/27/2011 6:56:40 AM

Test Laboratory: Motorola 835 MHz System Performance Check

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:425TR;
Procedure Notes: PM1 Power = 200mW Refl.Pwr PM3 = -26.4dB Sim.Temp@SPC = 20.5ºC Room Temp @ SPC = 20.5ºC
Communication System: CW - Dipole; Frequency: 835 MHz; Communication System Channel Number: 3; Duty Cycle: 1:1
Medium: VALIDATION Only; Medium parameters used: f = 835 MHz; σ = 0.92 mho/m; ε_r = 41.9; = 1000 kg/m^3

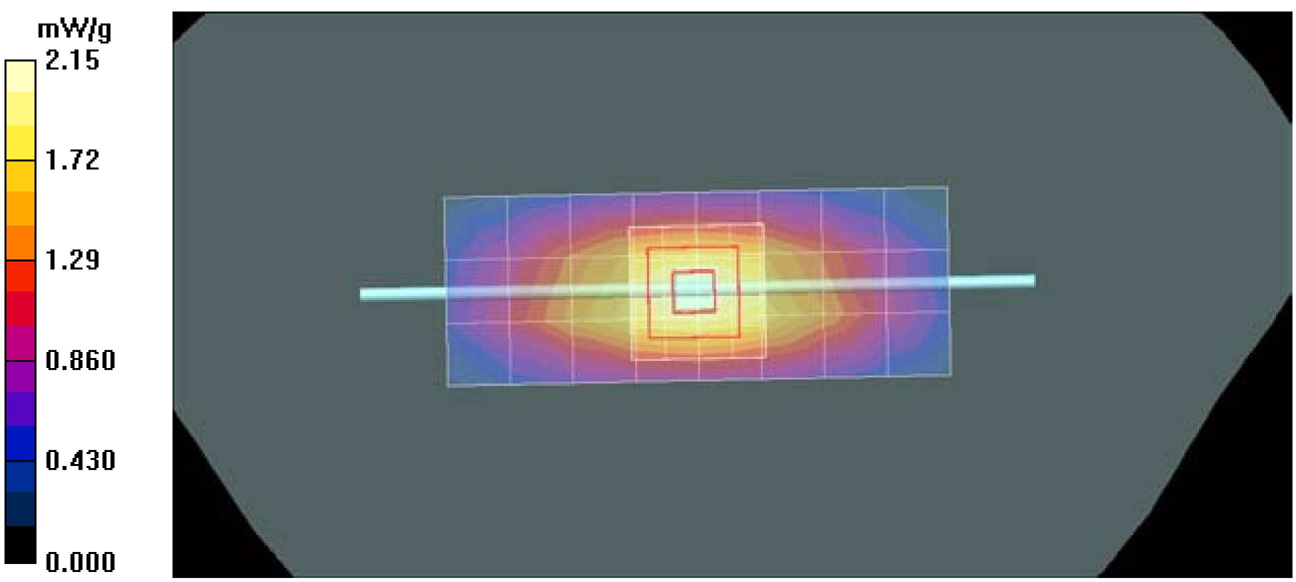
DASY4 Configuration:

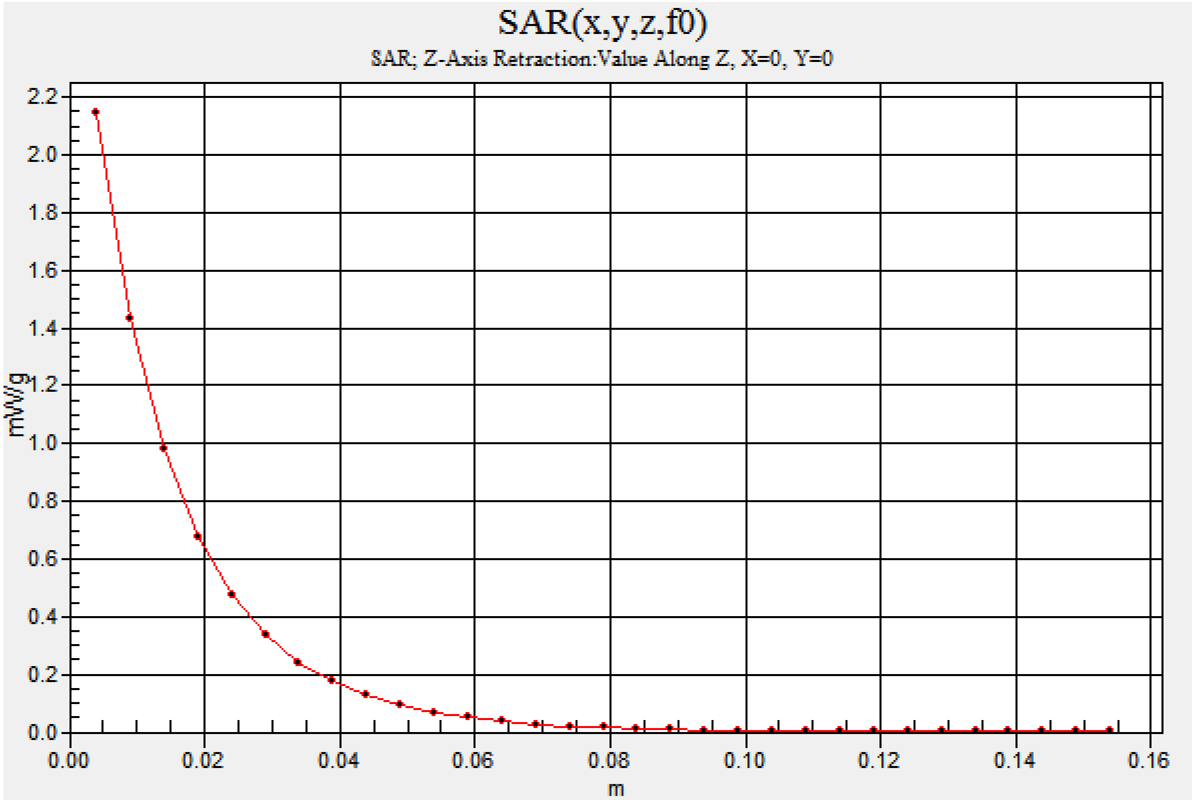
- Probe: ES3DV3 - SN3124; ConvF(5.89, 5.89, 5.89); Calibrated: 8/11/2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#4 Sugar SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1131;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Daily SPC Check/Dipole Area Scan (4x9x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.97 mW/g

Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 49.1 V/m; Power Drift = -0.078 dB
Peak SAR (extrapolated) = 2.97 W/kg
SAR(1 g) = 1.99 mW/g; SAR(10 g) = 1.3 mW/g
Maximum value of SAR (measured) = 2.14 mW/g

Daily SPC Check/Z-Axis Retraction (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 2.15 mW/g




SAR(x,y,z,f0)
SAR; Z-Axis Retraction:Value Along Z, X=0, Y=0
mW/g
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
m

Date/Time: 4/28/2011 8:23:51 AM

Test Laboratory: Motorola 835 MHz System Performance Check

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:422tr;
Procedure Notes: PM1 Power = 200mW Refl.Pwr PM3 = -27.1dB Sim.Temp@SPC = 20.6*C Room Temp @ SPC = 20.3*C
Communication System: CW - Dipole; Frequency: 835 MHz; Communication System Channel Number: 3; Duty Cycle: 1:1
Medium: Validation *BODY Tissue* ; Medium parameters used: f = 835 MHz; σ = 0.98 mho/m; ε_r = 53.8; = 1000 kg/m^3

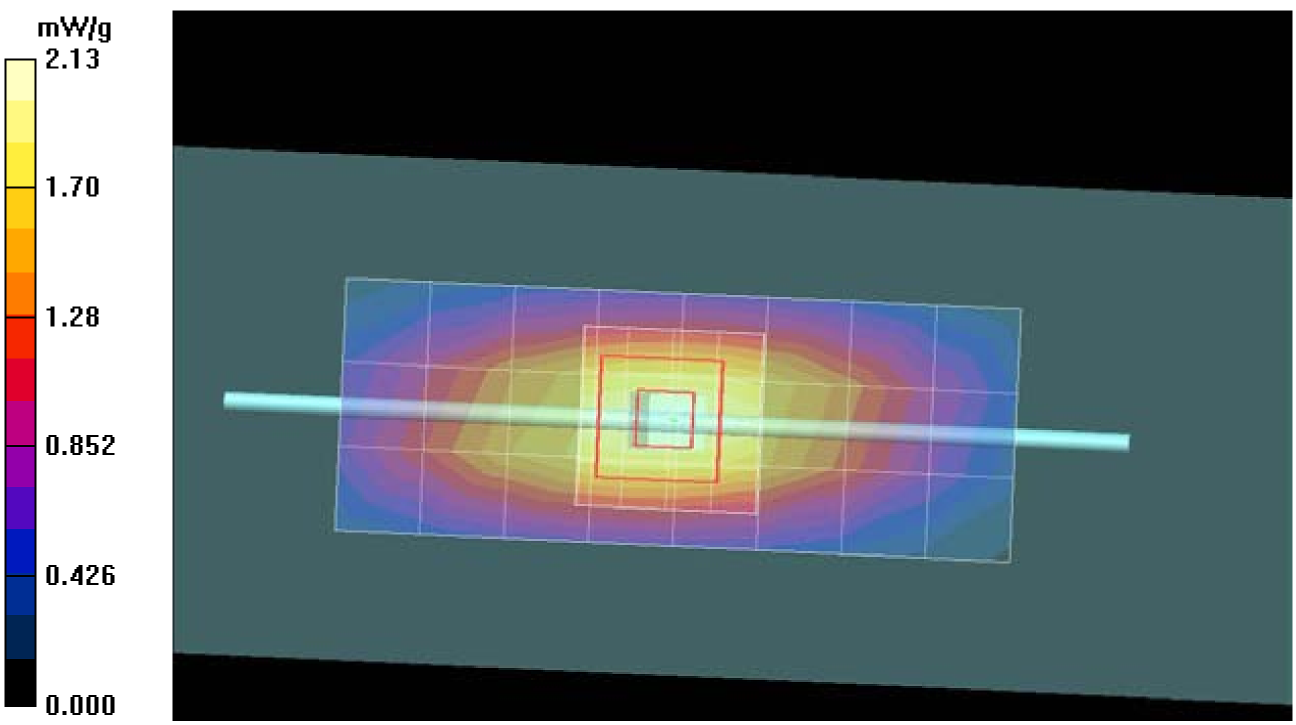
DASY4 Configuration:

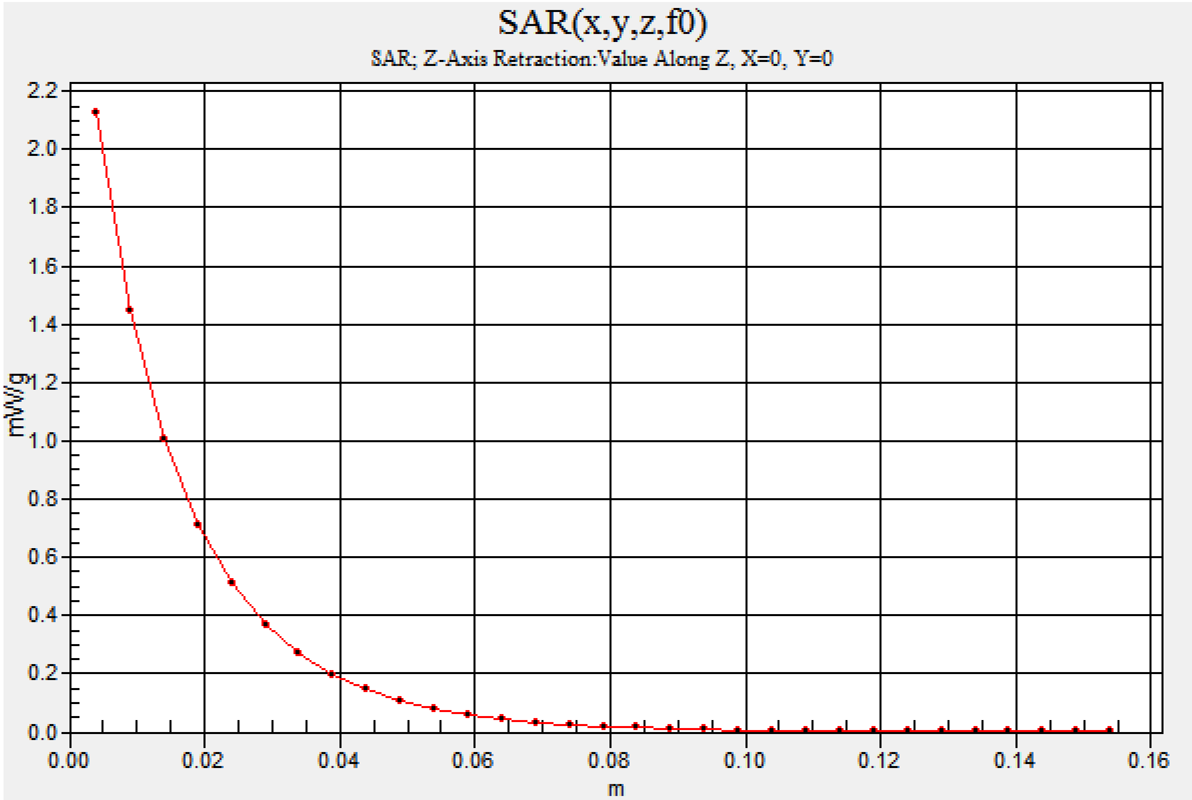
- Probe: ES3DV3 - SN3124; ConvF(5.86, 5.86, 5.86); Calibrated: 8/11/2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R4 : Sect.2, Amy Twin, Rev.3 (3-Feb-10); Type: Amy Twin Flat; Serial: n/a;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Daily SPC Check/Dipole Area Scan (9x4x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.81 mW/g

Daily SPC Check/0-Degree 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 47.0 V/m; Power Drift = 0.003 dB
Peak SAR (extrapolated) = 2.88 W/kg
SAR(1 g) = 1.96 mW/g; SAR(10 g) = 1.29 mW/g
Maximum value of SAR (measured) = 2.12 mW/g

Daily SPC Check/Z-Axis Retraction (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 2.13 mW/g




SAR(x,y,z,f0)
SAR; Z-Axis Retraction:Value Along Z, X=0, Y=0
mW/g
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
m

Date/Time: 4/28/2011 2:29:25 PM

Test Laboratory: Motorola **2450 MHz System Performance Check**

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:740;
Procedure Notes: PM1 Power = 200mW Refl.Pwr PM3 = -22.7 dB Sim.Temp@SPC = 19.3C Room Temp @ SPC = 20.1C
Communication System: CW - Dipole; Frequency: 2450 MHz; Communication System Channel Number: 11; Duty Cycle: 1:1
Medium: Validation *BODY Tissue* ; Medium parameters used: f = 2450 MHz; σ = 2.03 mho/m; ε_r = 47.5; = 1000 kg/m^3

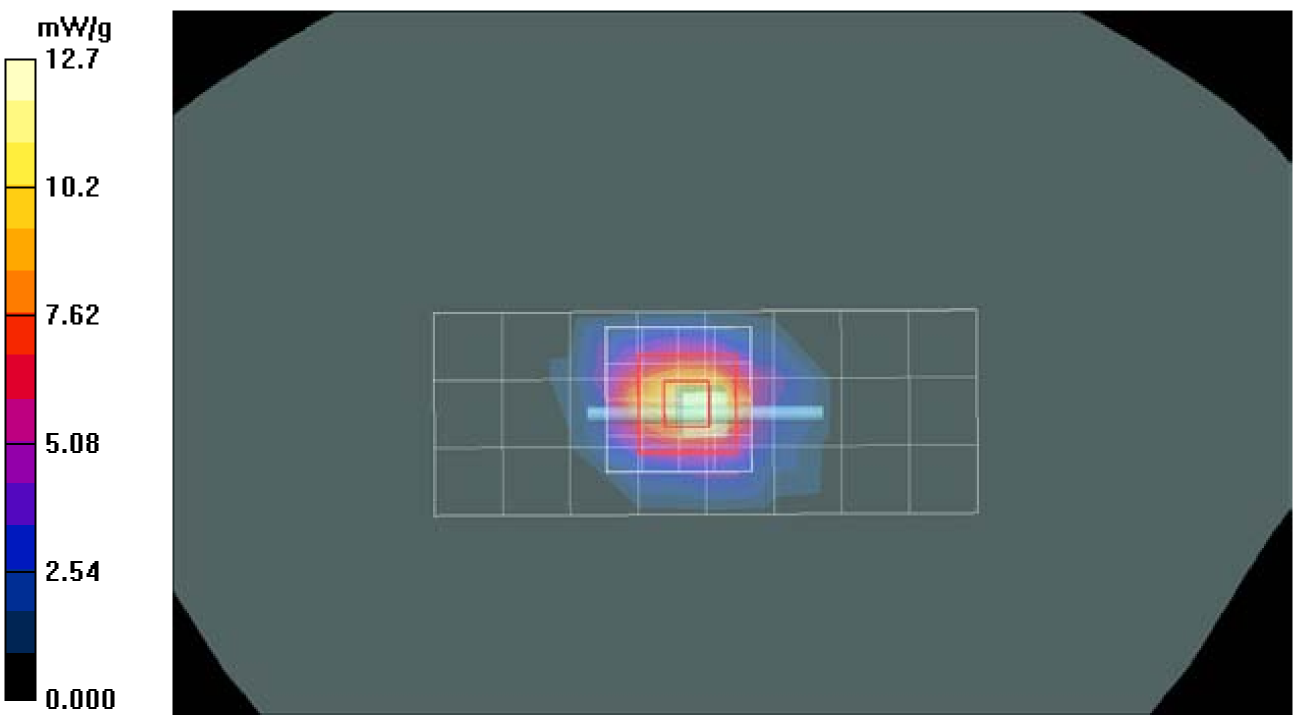
DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(4.33, 4.33, 4.33); Calibrated: 3/11/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn699; Calibrated: 9/20/2010
- Phantom: R#2 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1136;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

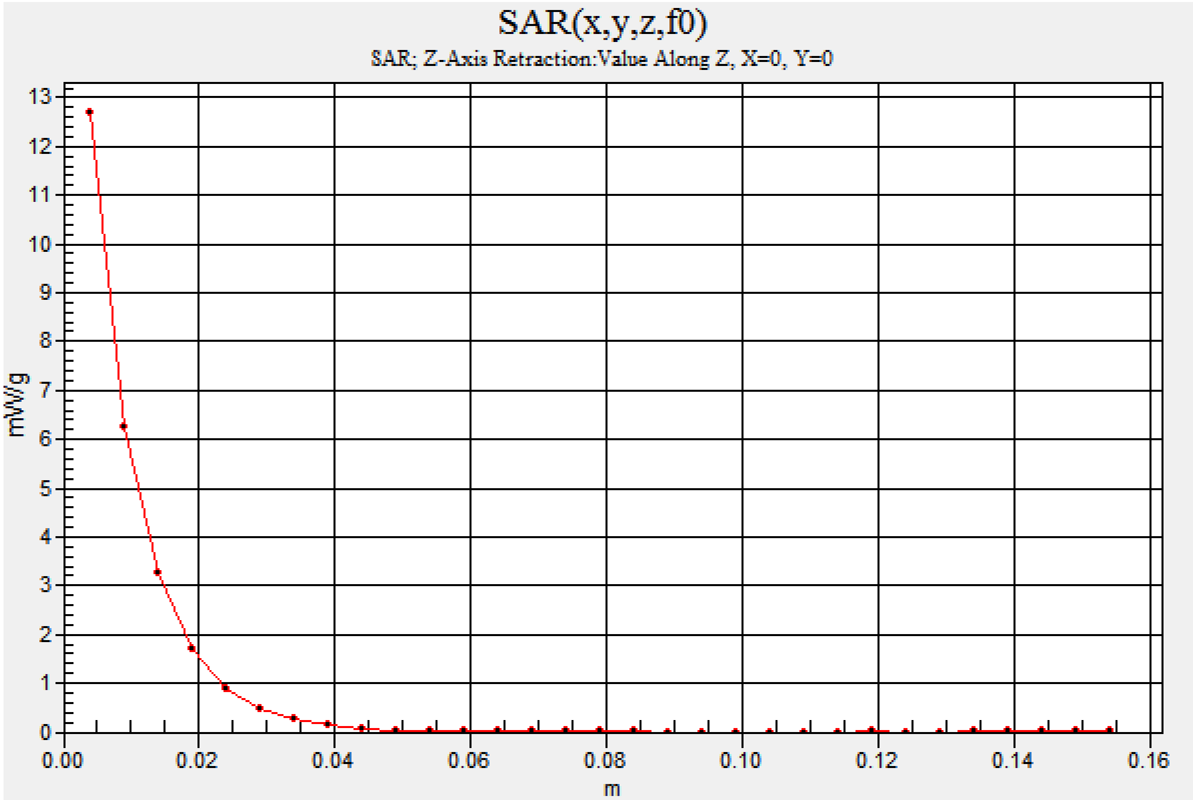
Daily SPC Check/Dipole Area Scan (4x9x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 9.94 mW/g

Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 77.3 V/m; Power Drift = 0.080 dB
Peak SAR (extrapolated) = 23.7 W/kg
SAR(1 g) = 11.2 mW/g; SAR(10 g) = 5.15 mW/g
Maximum value of SAR (measured) = 12.5 mW/g

Daily SPC Check/Z-Axis Retraction (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 12.7 mW/g



.


SAR(x,y,z,f0)
SAR; Z-Axis Retraction:Value Along Z, X=0, Y=0
mW/g
m
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
0
1
2
3
4
5
6
7
8
9
10
11
12
13

Test Laboratory: Motorola **5200 MHz System Performance Check**

DUT: Dipole 5-6GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1098;
Procedure Notes: PM1 Power = 100 mW Refl.Pwr PM3 = -20.60 dB Sim.Temp@SPC = 19.3C Room Temp @ SPC = 20.2C
Communication System: CW - Dipole; Frequency: 5200 MHz; Communication System Channel Number: 15; Duty Cycle: 1:1
Medium: Validation *BODY Tissue* ; Medium parameters used: f = 5200 MHz; σ = 5.77 mho/m; ε_r = 46.3; = 1000 kg/m^3

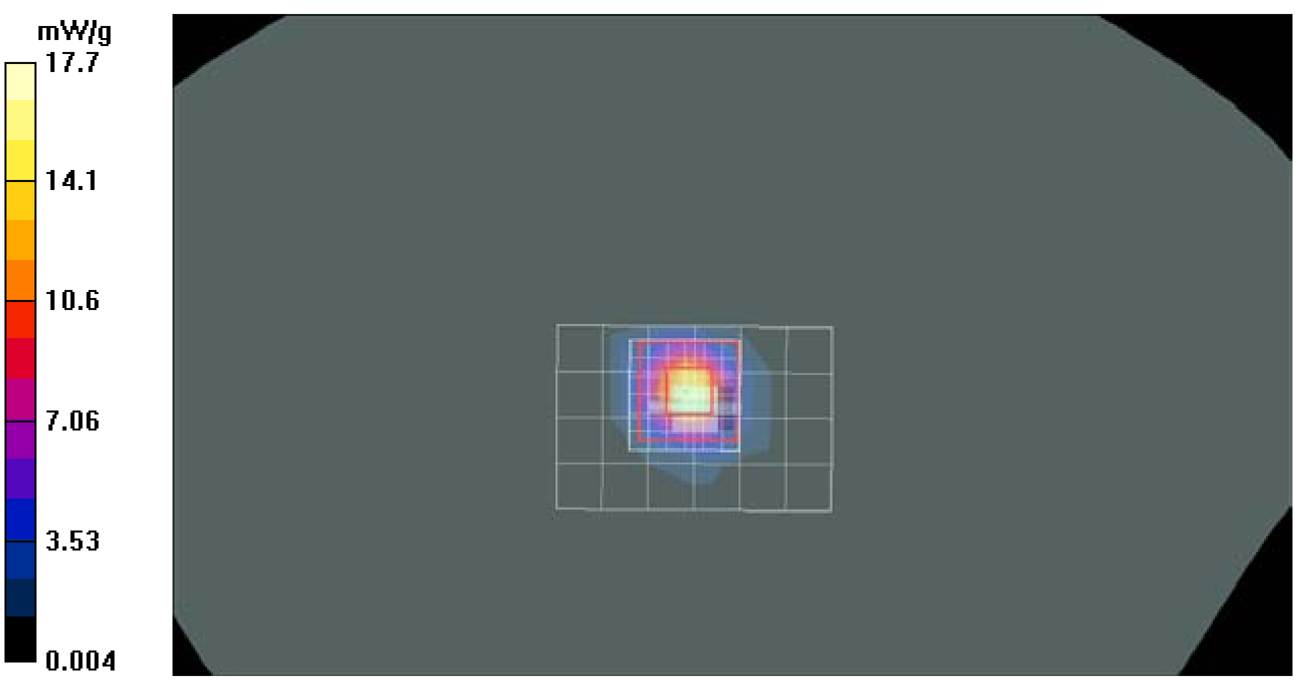
DASY4 Configuration:

- Probe: EX3DV4 - SN3730; ConvF(4.07, 4.07, 4.07); Calibrated: 7/16/2010
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn440; Calibrated: 11/11/2010
- Phantom: R#3 5Ghz BODY SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1106;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

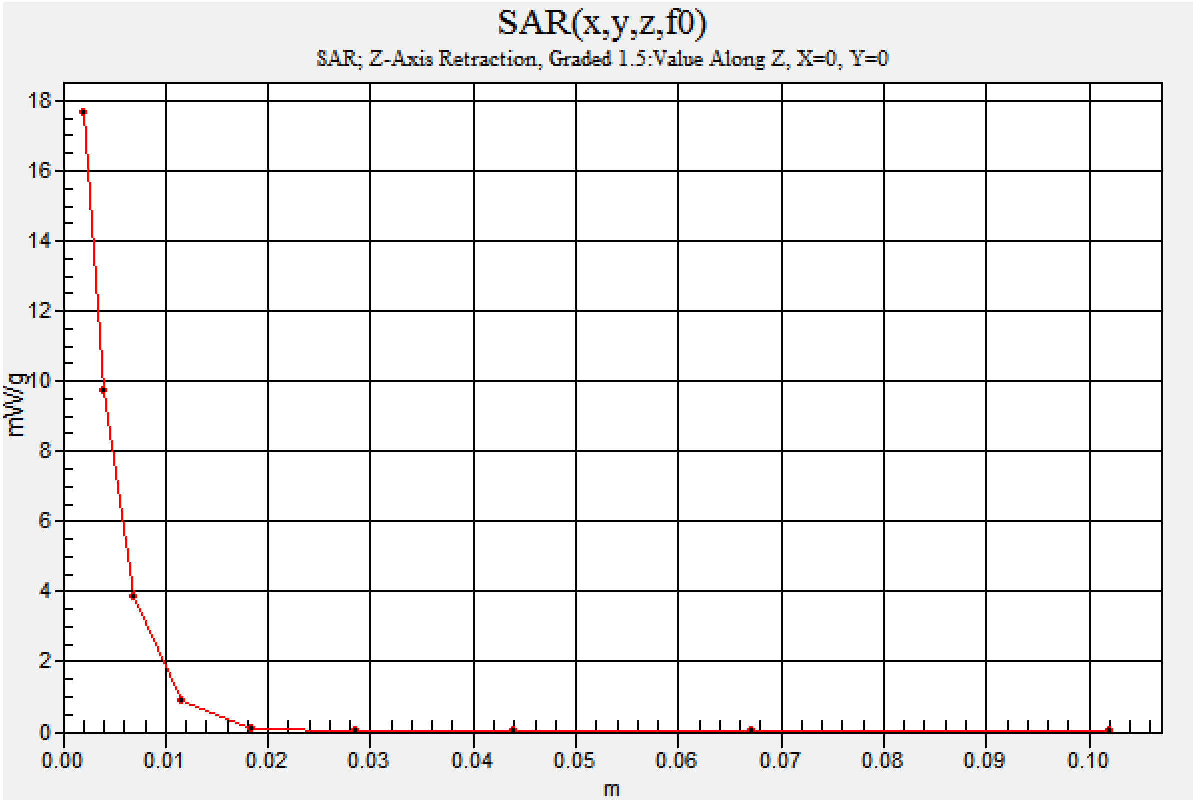
Daily SPC Check/Dipole Area Scan (5x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 13.5 mW/g

Daily SPC Check/0-Degree, 7x7x12 Cube (7x7x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 55.4 V/m; Power Drift = 0.105 dB
Peak SAR (extrapolated) = 33.0 W/kg
SAR(1 g) = 8.43 mW/g; SAR(10 g) = 2.36 mW/g
Maximum value of SAR (measured) = 17.4 mW/g

Daily SPC Check/Z-Axis Retraction, Graded 1.5 (1x1x9): Measurement grid: dx=20mm, dy=20mm, dz=2mm
Maximum value of SAR (measured) = 17.7 mW/g



.



SAR(x,y,z,f0)
SAR; Z-Axis Retraction, Graded 1.5:Value Along Z, X=0, Y=0
mW/g
18
16
14
12
10
8
6
4
2
0
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
m

Date/Time: 4/28/2011 7:33:04 AM

Test Laboratory: Motorola **5800 MHz System Performance Check**

DUT: Dipole 5-6GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1098;
Procedure Notes: PM1 Power = 100 mW Refl.Pwr PM3 = -21.35 dB Sim.Temp@SPC = 19.2C Room Temp @ SPC = 20.3C
Communication System: CW - Dipole; Frequency: 5800 MHz; Communication System Channel Number: 16; Duty Cycle: 1:1
Medium: Validation *BODY Tissue* ; Medium parameters used: f = 5800 MHz; σ = 6.65 mho/m; ε_r = 45; = 1000 kg/m^3

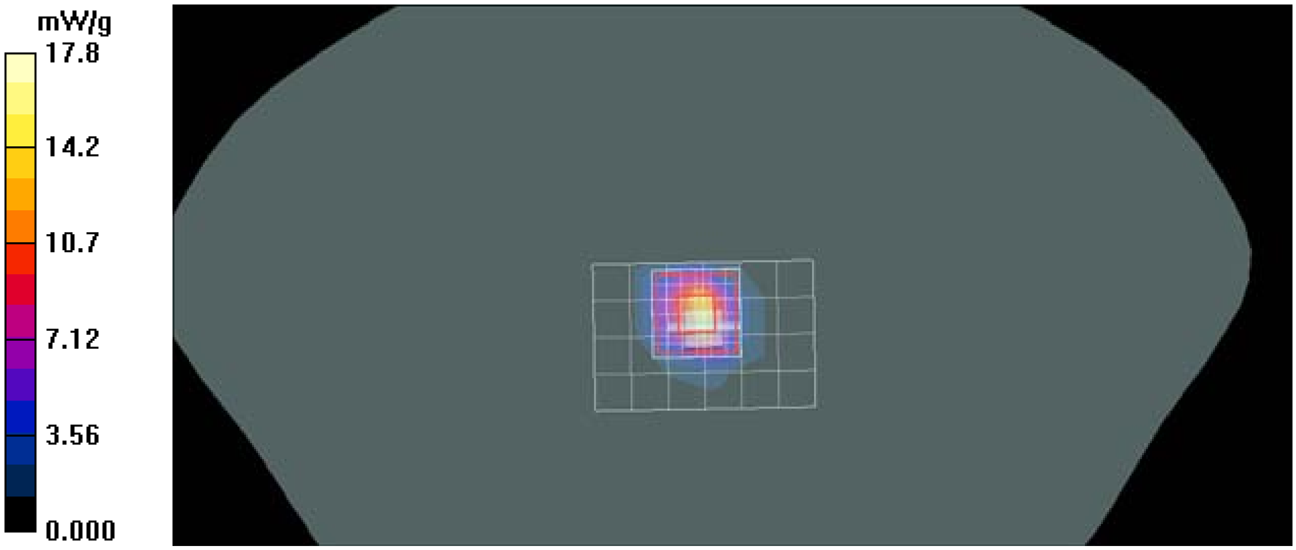
DASY4 Configuration:

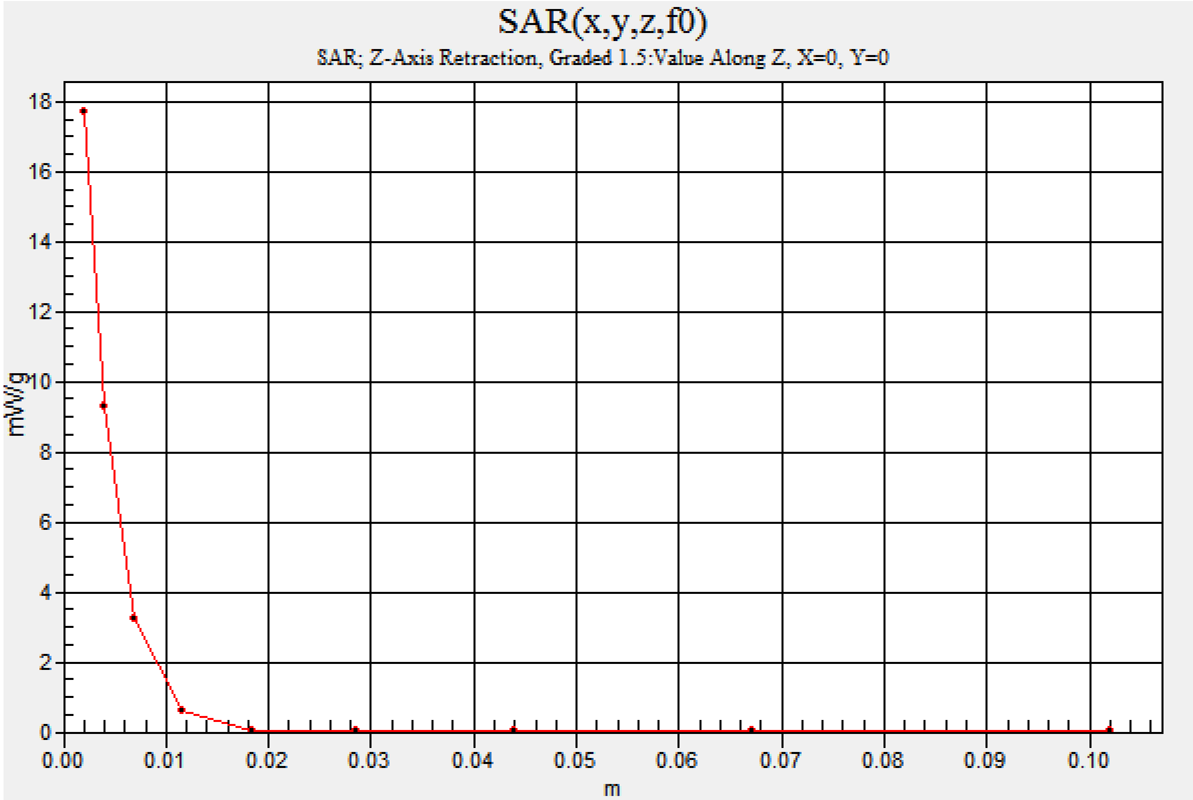
- Probe: EX3DV4 - SN3730; ConvF(3.53, 3.53, 3.53); Calibrated: 7/16/2010
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn440; Calibrated: 11/11/2010
- Phantom: R#3 5Ghz BODY SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1106;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Daily SPC Check/Dipole Area Scan (5x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 13.7 mW/g

Daily SPC Check/Z-Axis Retraction, Graded 1.5 (1x1x9): Measurement grid: dx=20mm, dy=20mm, dz=2mm
Maximum value of SAR (measured) = 17.7 mW/g

Daily SPC Check/0-Degree, 7x7x12 Cube (7x7x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 52.0 V/m; Power Drift = 0.074 dB
Peak SAR (extrapolated) = 33.9 W/kg
SAR(1 g) = 8.23 mW/g; SAR(10 g) = 2.3 mW/g
Maximum value of SAR (measured) = 17.8 mW/g





SAR(x,y,z,f0)
SAR; Z-Axis Retraction, Graded 1.5:Value Along Z, X=0, Y=0
mW/g
18
16
14
12
10
8
6
4
2
0
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
m

Appendix 2

SAR distribution plots for Body Configuration

Date/Time: 3/23/2011 10:17:42 PM

Test Laboratory: Motorola **LTE Band 13 - QPSK - Top Edge**

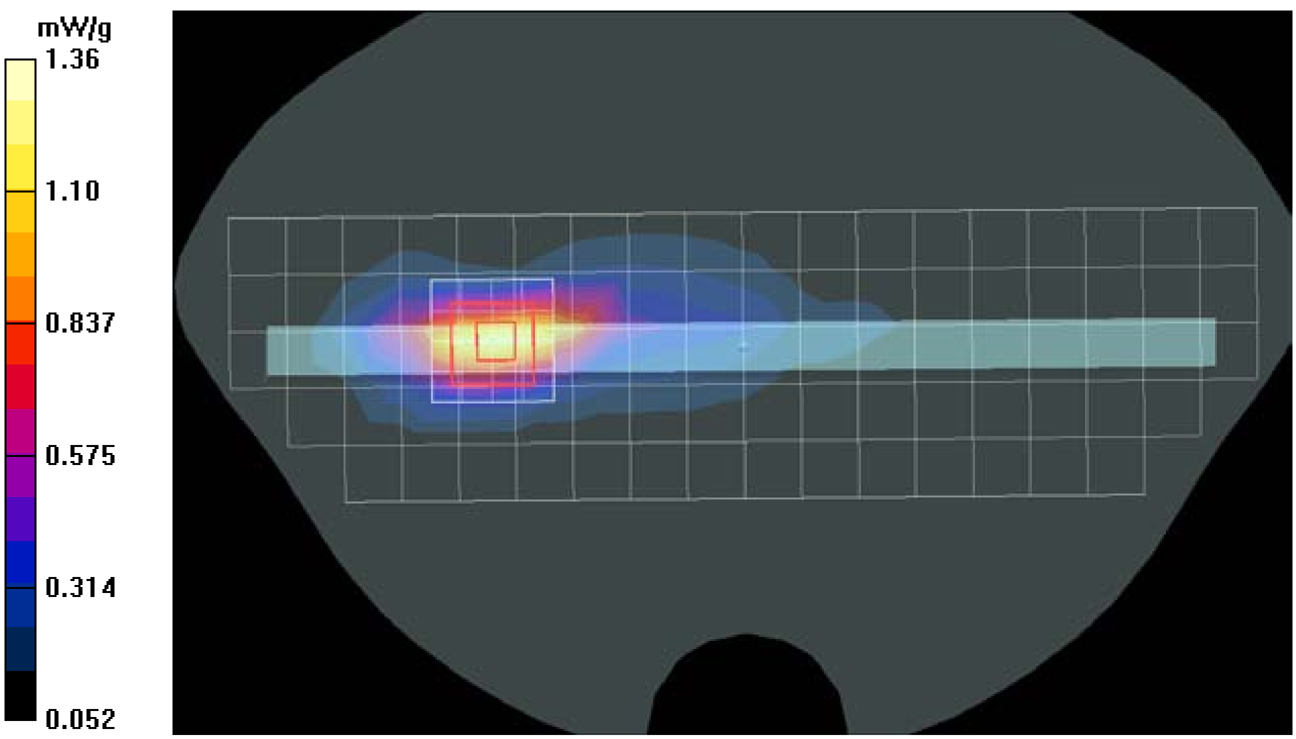
DUT Type: Tablet; Serial: 99000052018474; FCC ID: IHDP56LU2
Procedure Notes: Modulation: QPSK RB Allocation: 1 RB @ Low End Start RB: 0 Test Position: Top Edge 0mm away from Phantom
Communication System: LTE Band 13; Frequency: 782 MHz; Communication System Channel Number: 23230; Duty Cycle: 1:1
Medium: Low Freq Body; Medium parameters used: f = 782 MHz; σ = 0.92 mho/m; ε_r = 53.3; = 1000 kg/m^3

DASY4 Configuration:

- Probe: ES3DV3 - SN3124; ConvF(5.86, 5.86, 5.86); Calibrated: 8/11/2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#4 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1250;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

SAM Phone Against Flat Section/Tablet Long Edge Area Scan - Body (15mm) (21x6x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.22 mW/g

SAM Phone Against Flat Section/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 36.7 V/m; Power Drift = 0.015 dB
Peak SAR (extrapolated) = 2.36 W/kg
SAR(1 g) = 1.15 mW/g; SAR(10 g) = 0.604 mW/g
Maximum value of SAR (measured) = 1.36 mW/g



Test Laboratory: Motorola LTE Band 13 - QPSK - Back Surface

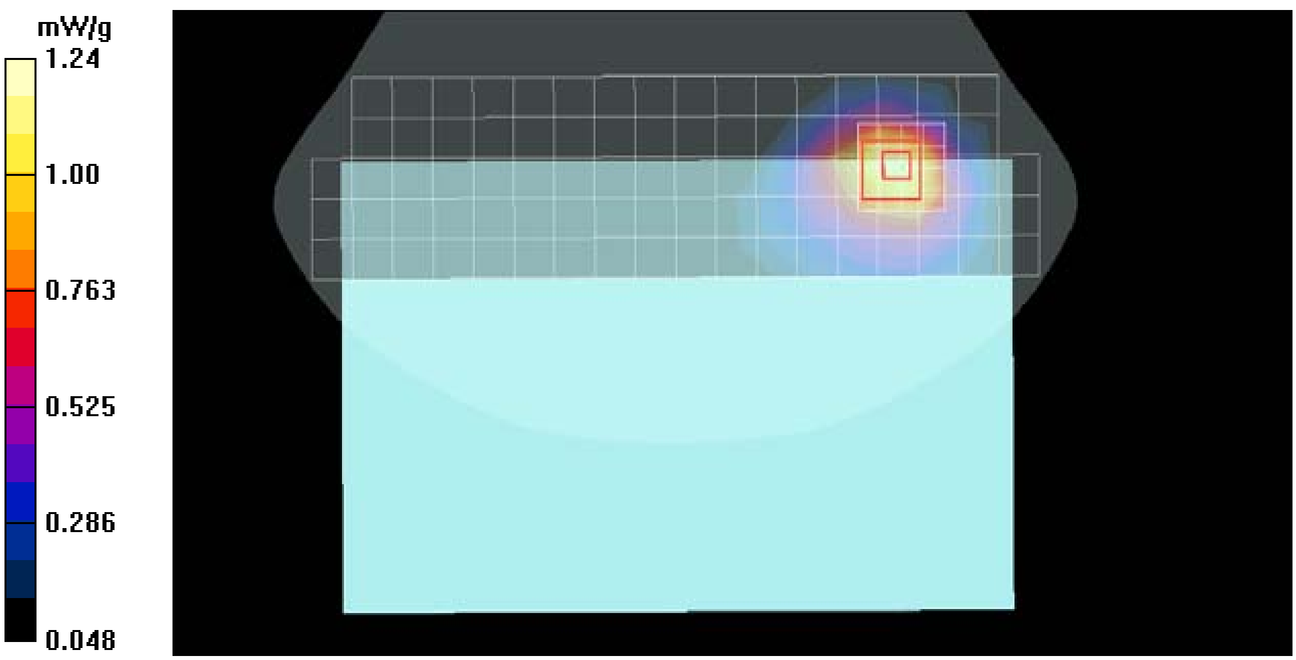
DUT: Serial: 99000052001124; FCC ID: IHDP56LU2
Procedure Notes: Modulation: QPSK RB Allocation: 25 RB's Start RB: 12 Test Position = Back Surface 0mm from Phantom
Communication System: LTE Band 13; Frequency: 782 MHz; Communication System Channel Number: 23230; Duty Cycle: 1:1
Medium: Low Freq Body; Medium parameters used: f = 782 MHz; σ = 0.93 mho/m; ε_r = 54.4; = 1000 kg/m^3

DASY4 Configuration:

- Probe: ES3DV3 - SN3124; ConvF(5.86, 5.86, 5.86); Calibrated: 8/11/2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#4 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1250;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

SAM Phone Against Flat Section/Tablet Partial Face (front/back) Area Scan - Normal Body (15mm) (21x6x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.16 mW/g

SAM Phone Against Flat Section/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 36.7 V/m; Power Drift = -0.342 dB
Peak SAR (extrapolated) = 2.04 W/kg
SAR(1 g) = 1.15 mW/g; SAR(10 g) = 0.692 mW/g
Maximum value of SAR (measured) = 1.24 mW/g



Test Laboratory: Motorola LTE Band 13 - 16QAM - Top Edge

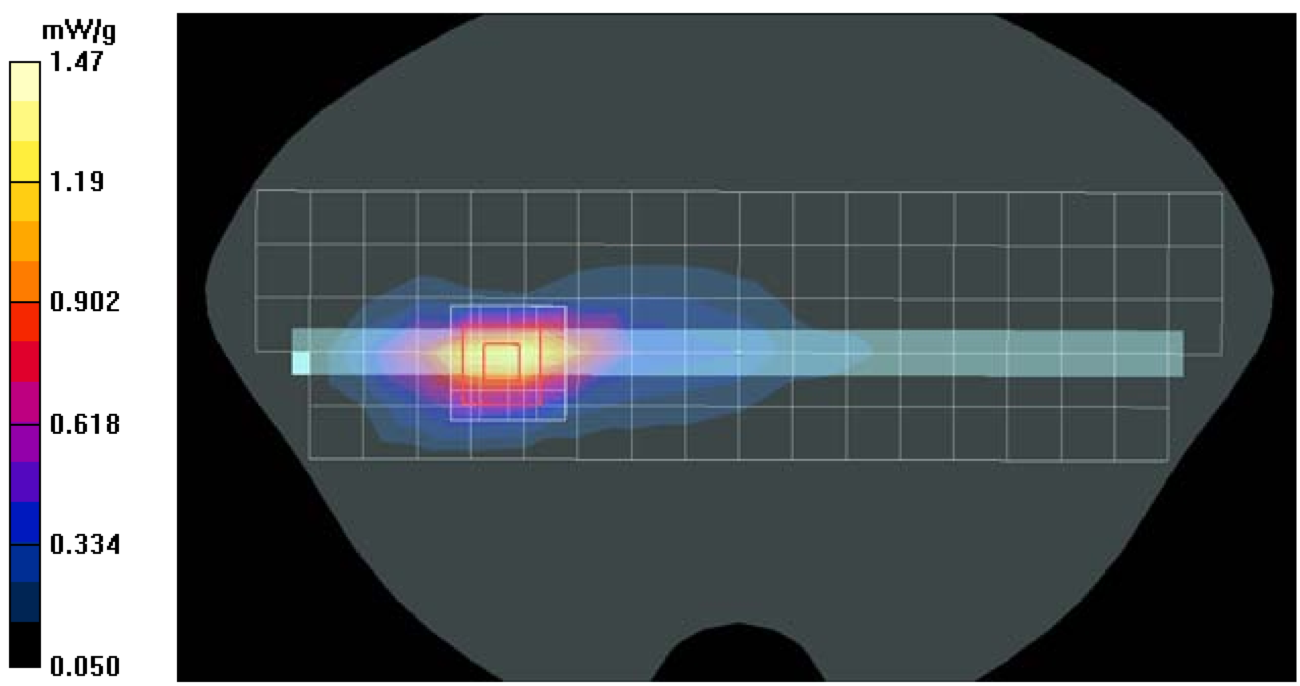
DUT Serial: 99000052018474; FCC ID: IHDP56LU2
Procedure Notes: Modulation: 16QAM RB Allocation: 1 RB @ Low End Start RB: 0 Test Position = Top Edge 0mm from Phantom
Communication System: LTE Band 13; Frequency: 782 MHz; Communication System Channel Number: 23230; Duty Cycle: 1:1
Medium: Low Freq Body; Medium parameters used: f = 782 MHz; σ = 0.92 mho/m; ε_r = 53.3; = 1000 kg/m^3

DASY4 Configuration:

- Probe: ES3DV3 - SN3124; ConvF(5.86, 5.86, 5.86); Calibrated: 8/11/2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#4 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1250;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

SAM Phone Against Flat Section/Tablet Partial Face (front/back) Area Scan - Normal Body (15mm) (21x6x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.33 mW/g

SAM Phone Against Flat Section/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 37.0 V/m; Power Drift = -0.003 dB
Peak SAR (extrapolated) = 2.52 W/kg
SAR(1 g) = 1.26 mW/g; SAR(10 g) = 0.650 mW/g
Maximum value of SAR (measured) = 1.47 mW/g



Test Laboratory: Motorola LTE Band 13 - 16QAM - Back Surface

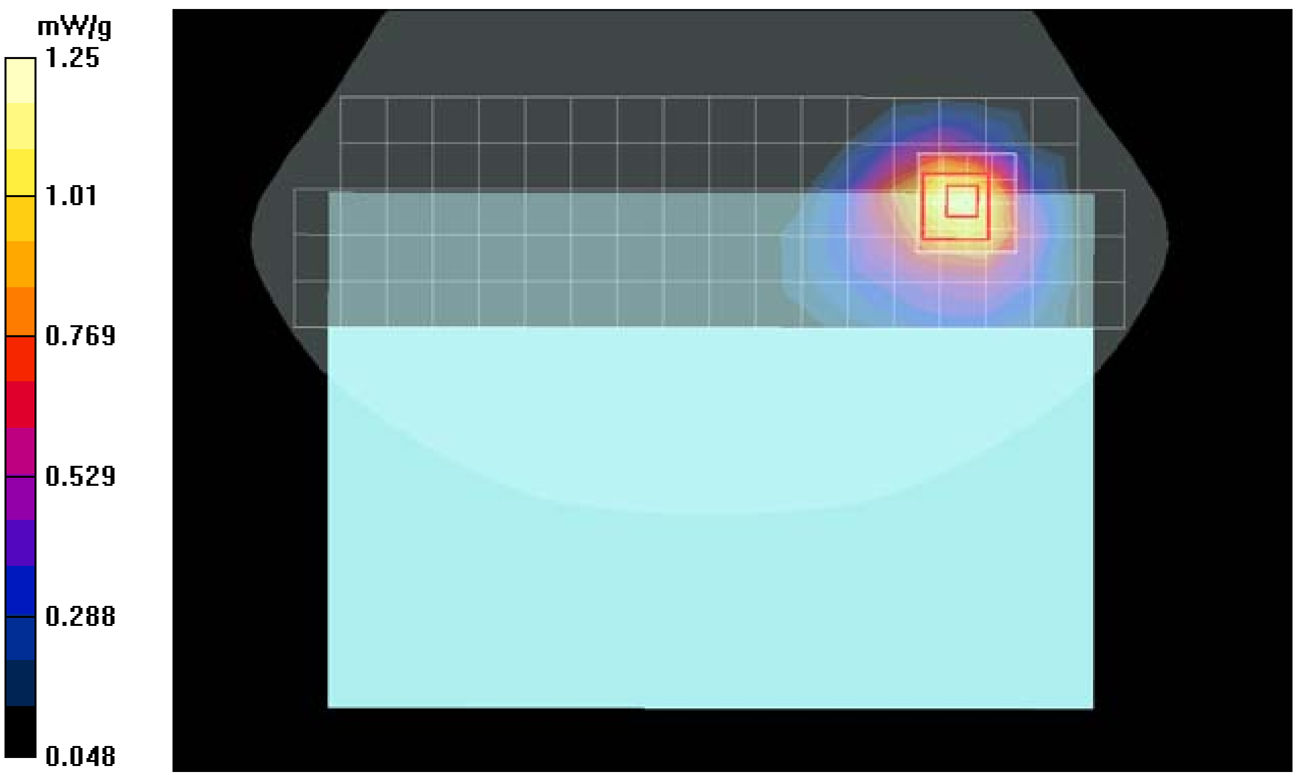
DUT Type: Tablet; Serial: 990000520018474; FCC ID: IHDP56LU2
Procedure Notes: Modulation: 16QAM RB Allocation: 50% RB's Test Position = Back Surface 0mm from Phantom
Communication System: LTE Band 13; Frequency: 782 MHz; Communication System Channel Number: 23230;
Duty Cycle: 1:1
Medium: Low Freq Body; Medium parameters used: f = 782 MHz; σ = 0.93 mho/m; ε_r = 54.4; = 1000 kg/m^3

DASY4 Configuration:

- Probe: ES3DV3 - SN3124; ConvF(5.86, 5.86, 5.86); Calibrated: 8/11/2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#4 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1250;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

SAM Phone Against Flat Section/Tablet Partial Face (front/back) Area Scan - Normal Body (15mm) (21x6x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 1.13 mW/g

SAM Phone Against Flat Section/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 33.5 V/m; Power Drift = -0.003 dB
Peak SAR (extrapolated) = 2.05 W/kg
SAR(1 g) = 1.15 mW/g; SAR(10 g) = 0.691 mW/g
Maximum value of SAR (measured) = 1.25 mW/g



Test Laboratory: Motorola - LTE Band 13 - QPSK - Left Edge

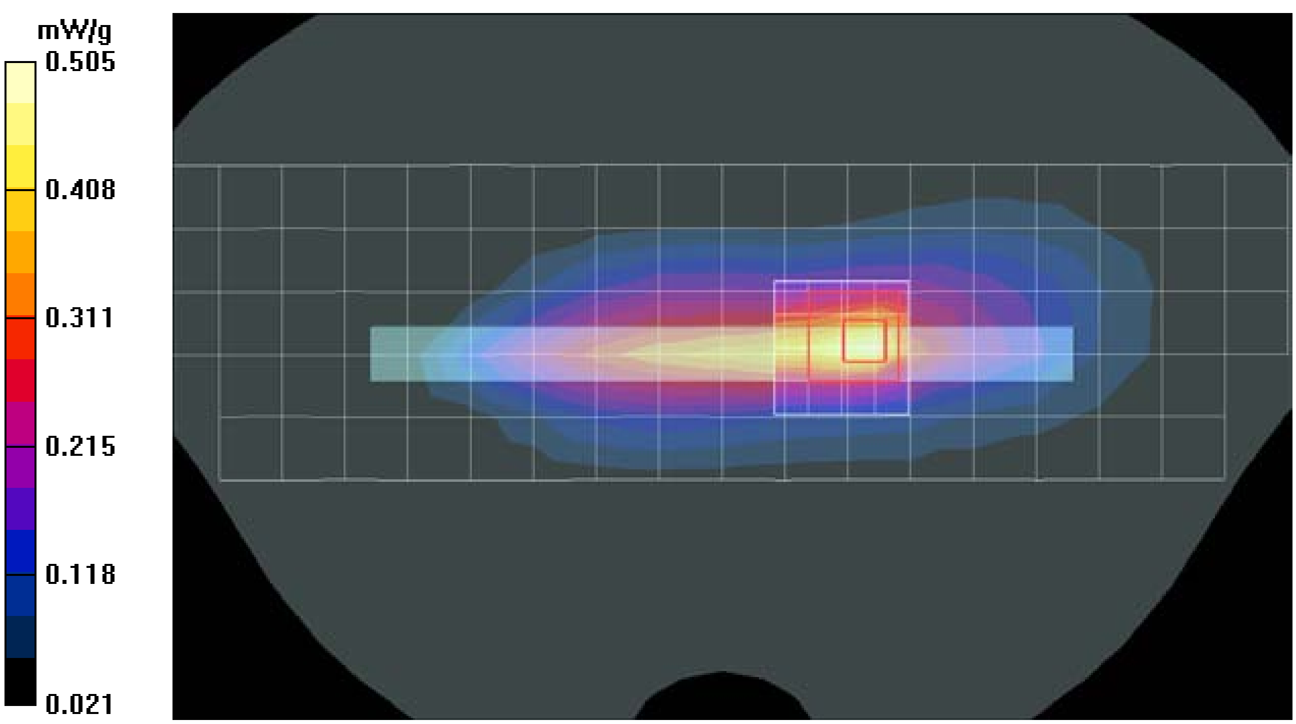
DUT Type: Tablet; Serial: 99000052018474; FCC ID: IHDP56LU2
Procedure Notes: Pwr Step: MAX UL TPC 23 Test Position # = left edge 0mm away from Phamtom Modulation: QPSK RB Allocation: 1 RB @ High End Start RB: 49
Communication System: LTE Band 13; Frequency: 782 MHz; Communication System Channel Number: 23230; Duty Cycle: 1:1
Medium: Low Freq Body; Medium parameters used: f = 782 MHz; σ = 0.92 mho/m; ε_r = 53.3; = 1000 kg/m^3

DASY4 Configuration:

- Probe: ES3DV3 - SN3124; ConvF(5.86, 5.86, 5.86); Calibrated: 8/11/2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#4 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1250;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

SAM Phone Against Flat Section/Tablet Partial Face (front/back) Area Scan - Normal Body (15mm) (21x6x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.424 mW/g

SAM Phone Against Flat Section/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.6 V/m; Power Drift = 0.194 dB
Peak SAR (extrapolated) = 0.879 W/kg
SAR(1 g) = 0.424 mW/g; SAR(10 g) = 0.222 mW/g
Maximum value of SAR (measured) = 0.505 mW/g



Date/Time: 3/24/2011 9:03:36 AM

Test Laboratory: Motorola LTE Band 13 - 16QAM - Left Edge

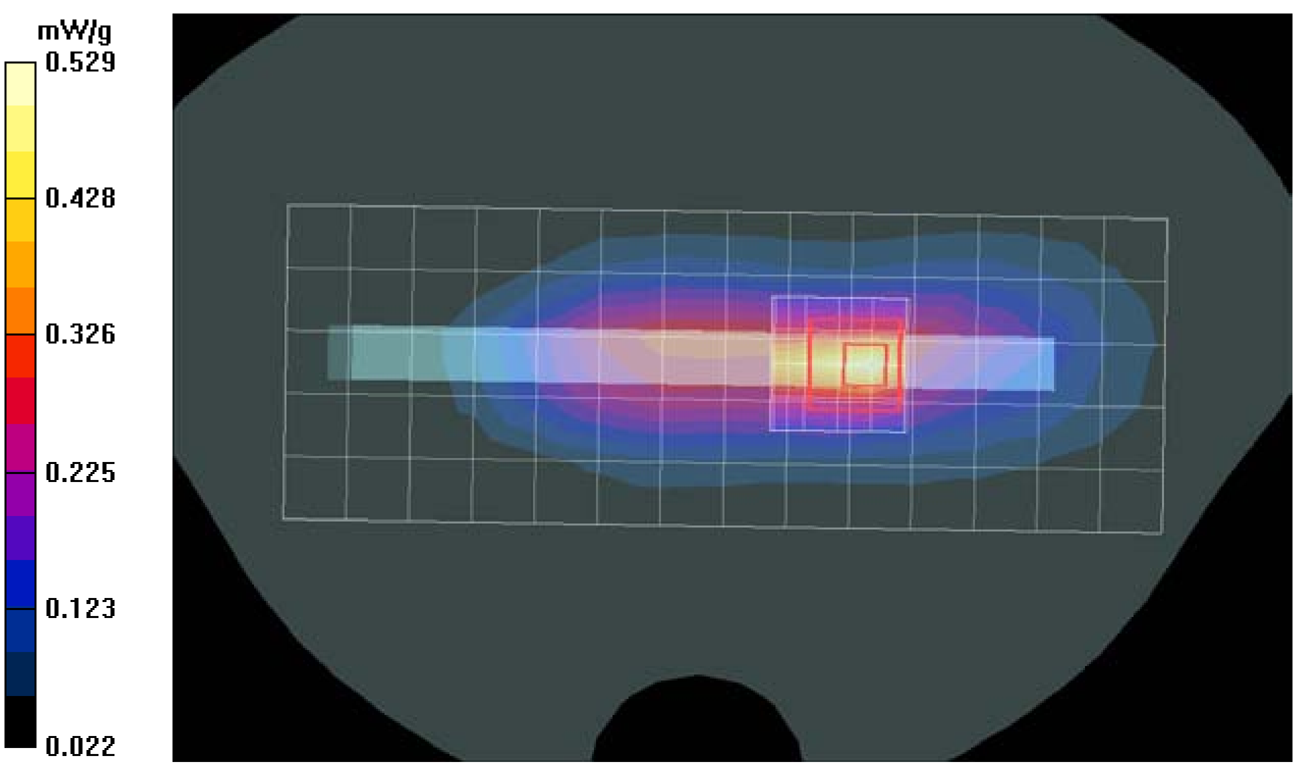
DUT Serial: 99000052018474; FCC ID: IHDP56LU2
Procedure Notes: Modulation: 16QAM RB Allocation: 1 RB @ High End Start RB: 49 Test Postion = Left Edge 0mm
Communication System: LTE Band 13; Frequency: 782 MHz; Communication System Channel Number: 23230; Duty Cycle: 1:1
Medium: Low Freq Body; Medium parameters used: f = 782 MHz; σ = 0.92 mho/m; ε_r = 53.3; = 1000 kg/m^3

DASY4 Configuration:

- Probe: ES3DV3 - SN3124; ConvF(5.86, 5.86, 5.86); Calibrated: 8/11/2010
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#4 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1250;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

SAM Phone Against Flat Section/Tablet Short Edge Area Scan - Body (15mm) (15x6x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.327 mW/g

SAM Phone Against Flat Section/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 24.0 V/m; Power Drift = -0.184 dB
Peak SAR (extrapolated) = 0.903 W/kg
SAR(1 g) = 0.432 mW/g; SAR(10 g) = 0.226 mW/g
Maximum value of SAR (measured) = 0.529 mW/g



Appendix 3

SAR distribution plots for Simultaneous Transmit Configurations

Test Laboratory: Motorola LTE Band 13 - QPSK - Simultaneous Transmit Test

DUT Serial: 99000052018474; FCC ID: IHDP56LU2
Procedure Notes: Modulation: QPSK RB Allocation: 1 RB @ Low End Test Position = Top of Device 0mm from Phantom
Communication System: LTE Band 13; Frequency: 782 MHz; Communication System Channel Number: 23230; Duty Cycle: 1:1
Medium: BIG BODY; Medium parameters used: f = 782 MHz; σ = 0.93 mho/m; ε_r = 54.4; = 1000 kg/m^3

DASY4 Configuration:

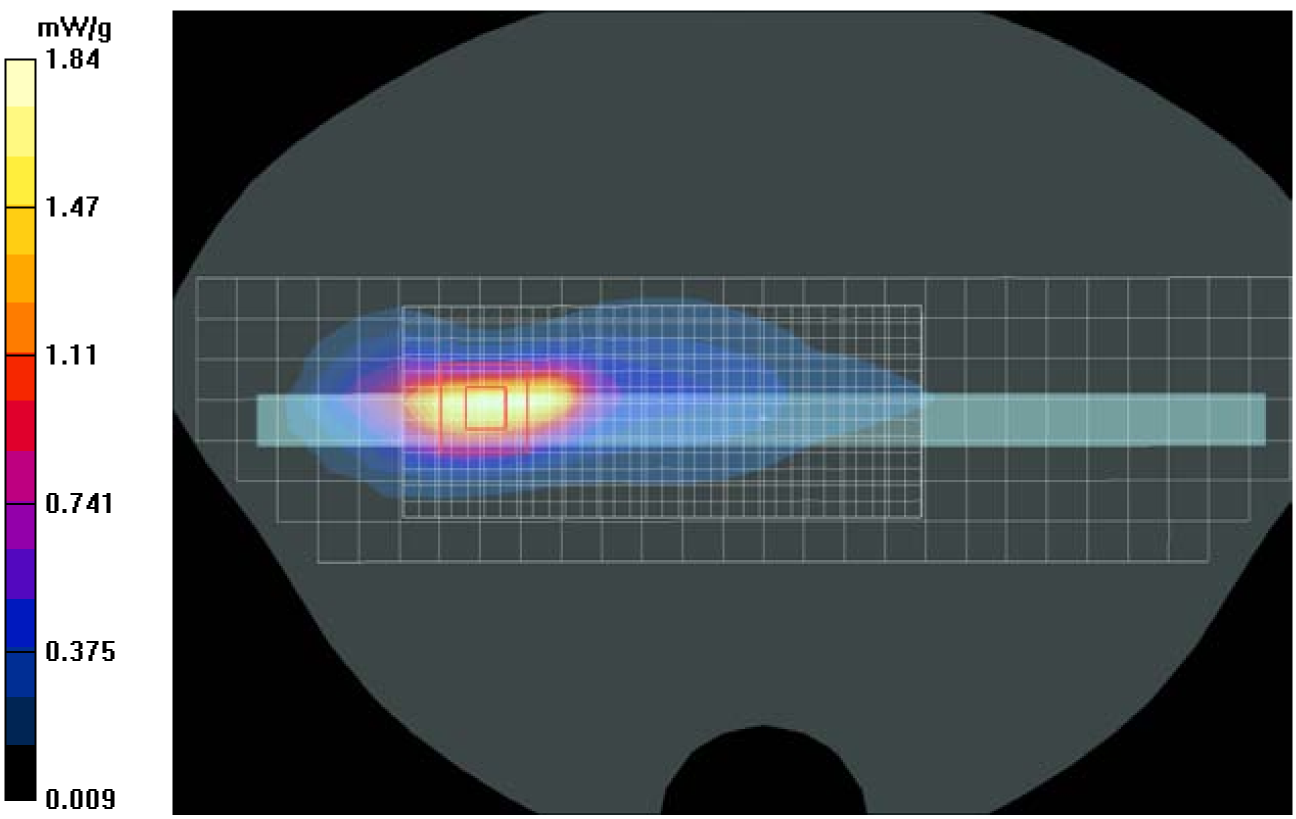
Probe: ES3DV3 - SN3124; ConvF(5.86, 5.86, 5.86); Calibrated: 8/11/2010

- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#4 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1250;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186
-

SAM Phone Against Flat Section/Tablet Long Edge Area Scan - Body (10mm) (31x8x1):

Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.76 mW/g

SAM Phone Against Flat Section/MegaZoom Zoom Scan (5-6GHz) Probe separation 3mm (33x14x5)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=3mm
Reference Value = 41.1 V/m; Power Drift = 0.070 dB
Peak SAR (extrapolated) = 3.93 W/kg
SAR(1 g) = 1.37 mW/g; SAR(10 g) = 0.695 mW/g
Maximum value of SAR (measured) = 1.84 mW/g



Test Laboratory: Motorola LTE Band 13 - 16 QAM - Simultaneous Transmit Test

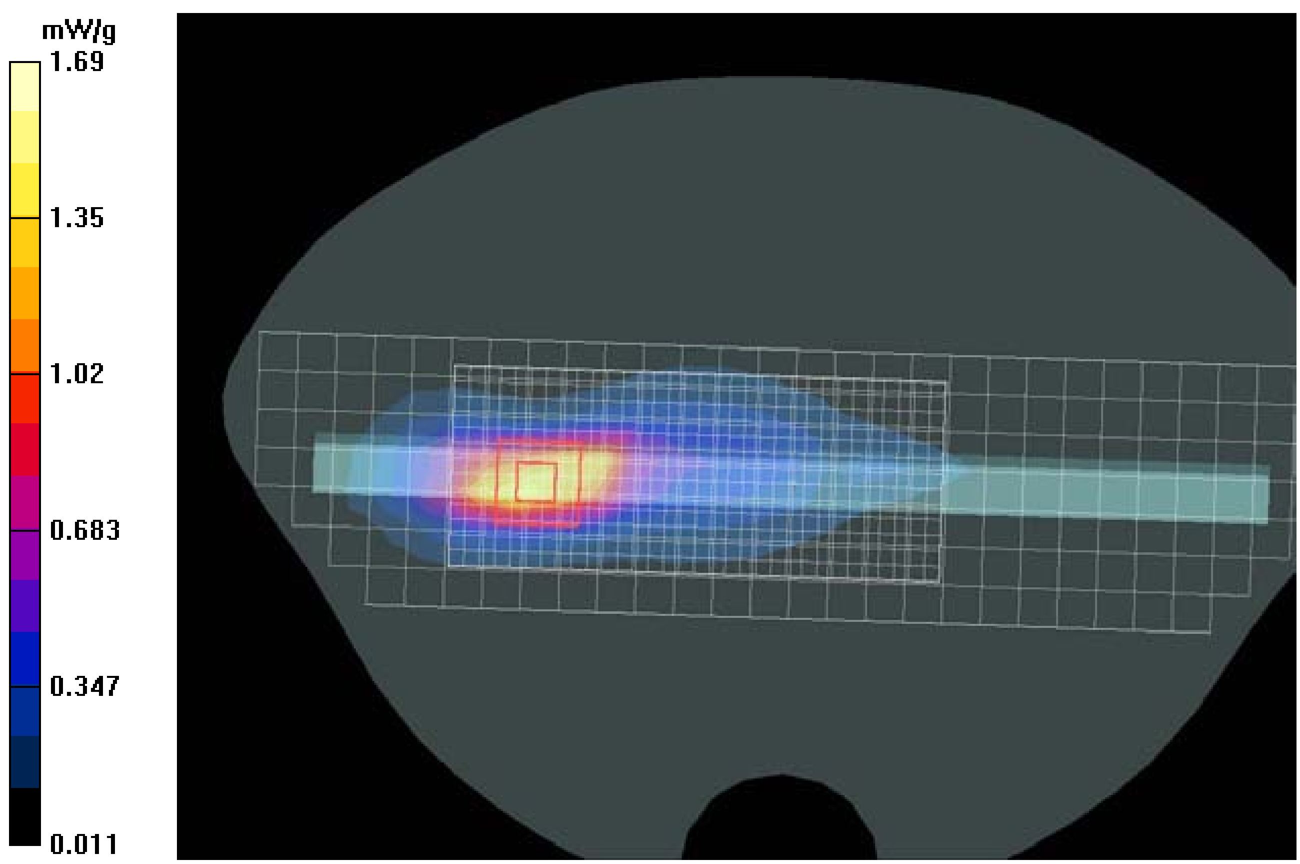
DUT Serial: 99000052018474; FCC ID: IHDP56LU2
Procedure Notes: Modulation: 16QAM RB Allocation: 1RB @ Low End Start Test Position: Top Edge of Device 0mm from Flat Phantom
Communication System: LTE Band 13; Frequency: 782 MHz; Communication System Channel Number: 23230; Duty Cycle: 1:1
Medium: BIG BODY; Medium parameters used: f = 782 MHz; σ = 0.93 mho/m; ε_r = 54.4; = 1000 kg/m^3

DASY4 Configuration:

- Probe: ES3DV3 - SN3124; ConvF(5.86, 5.86, 5.86); Calibrated: 8/11/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#4 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1250;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

SAM Phone Against Flat Section/Tablet Long Edge Area Scan - Body (10mm) (31x8x1):
Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.44 mW/g

SAM Phone Against Flat Section/MegaZoom Zoom Scan (5-6GHz) Probe separation 3mm (33x14x5)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=3mm
Reference Value = 44.6 V/m; Power Drift = -0.031 dB
Peak SAR (extrapolated) = 3.52 W/kg
SAR(1 g) = 1.26 mW/g; SAR(10 g) = 0.655 mW/g
Maximum value of SAR (measured) = 1.69 mW/g



Test Laboratory: Motorola **WiFi 2.45 GHz - Simultaneous Transmit Test**

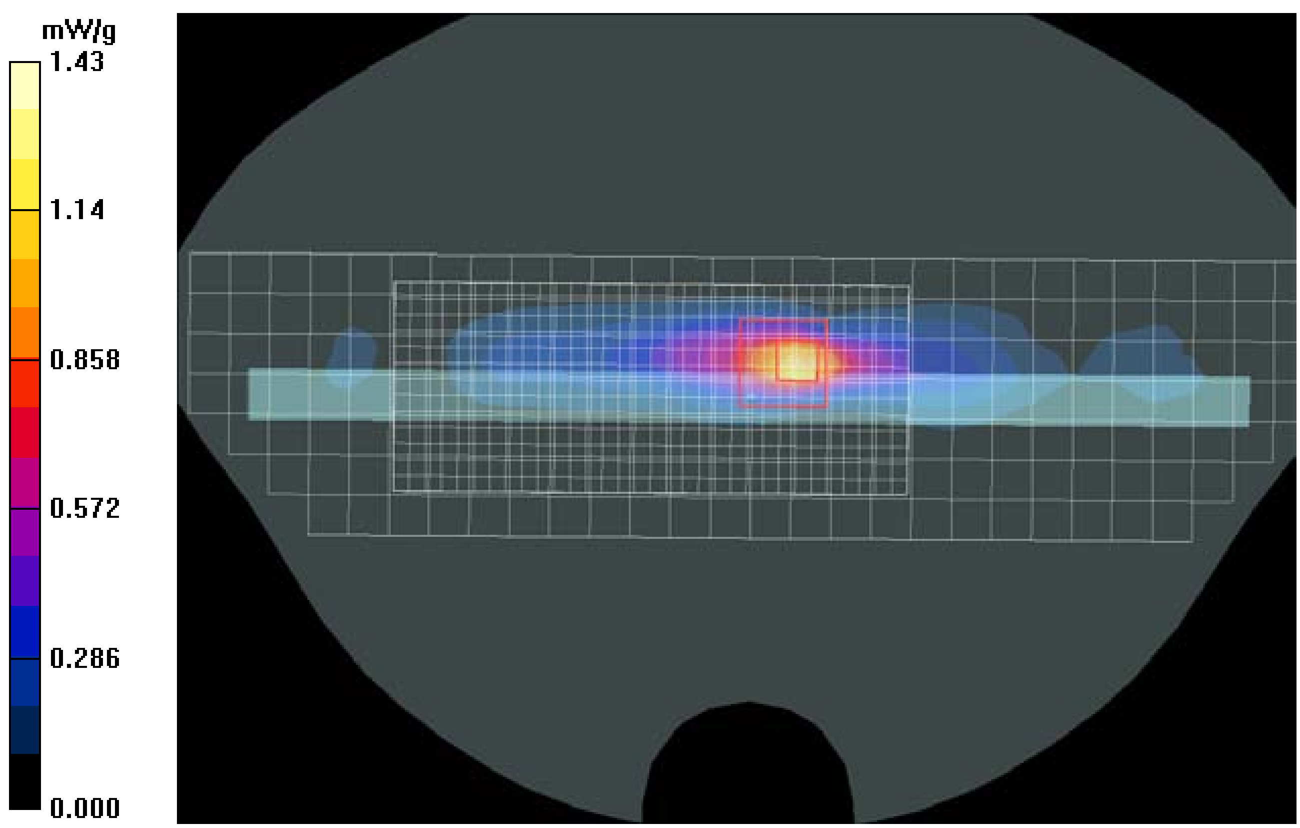
DUT Serial: 990005200875; FCC ID: IHDP56LU2
Procedure Notes: 802.11b, 1Mbps Test Position = TOP EDGE OF DEVICE 0mm FROM PHANTOM
Communication System: Wi-Fi 2450; Frequency: 2437 MHz; Communication System Channel Number: 6; Duty Cycle: 1:1
Medium: 2450 Glycol Body; Medium parameters used: f = 2450 MHz; σ = 2.03 mho/m; ε_r = 47.5; = 1000 kg/m^3

DASY4 Configuration:

- Probe: ES3DV3 - SN3184; ConvF(4.33, 4.33, 4.33); Calibrated: 3/11/2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn699; Calibrated: 9/20/2010
- Phantom: R#2 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1136;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

SAM Phone Against Flat Section/Tablet Long Edge Area Scan - Body (10mm) (31x8x1):
Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 1.05 mW/g

SAM Phone Against Flat Section/MegaZoom Zoom Scan (5-6GHz) Probe separation 3mm (33x14x5)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=3mm
Reference Value = 13.7 V/m; Power Drift = 0.557 dB
Peak SAR (extrapolated) = 2.73 W/kg
SAR(1 g) = 0.974 mW/g; SAR(10 g) = 0.358 mW/g
Maximum value of SAR (measured) = 1.43 mW/g



LTE Band 13 QPSK + WiFi 2.45 GHz Simultaneous Transmit Test

DUT Serial: 99000052018474; FCC ID: IHDP56LU2
Procedure Notes: Modulation: QPSK RB Allocation: 1 RB @ Low End Test Position = Top of Device 0mm from Phantom
Communication System: LTE Band 13; Frequency: 782 MHz; Communication System Channel Number: 23230; Duty Cycle: 1:1
Medium: BIG BODY; Medium parameters used: f = 782 MHz; σ = 0.93 mho/m; ε_r = 54.4; = 1000 kg/m^3

DUT Serial: 990005200875; FCC ID: IHDP56LU2
Procedure Notes: 802.11b, 1Mbps Test Position = TOP EDGE OF DEVICE 0mm FROM PHANTOM
Communication System: Wi-Fi 2450; Frequency: 2437 MHz; Communication System Channel Number: 6; Duty Cycle: 1:1
Medium: 2450 Glycol Body; Medium parameters used: f = 2450 MHz; σ = 2.03 mho/m; ε_r = 47.5; = 1000 kg/m^3

DASY4 Configuration:

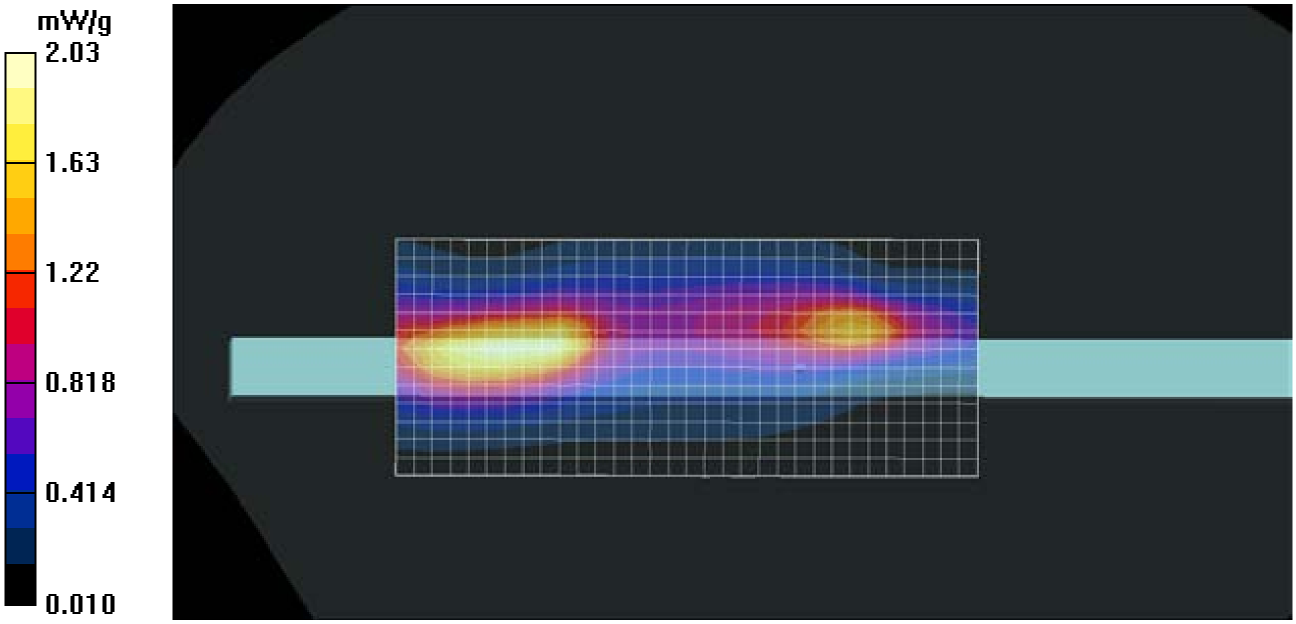
- Probe: ES3DV3 - SN3184; ConvF(4.33, 4.33, 4.33); Calibrated: 3/11/2011
- Probe: ES3DV3 - SN3124; ConvF(5.86, 5.86, 5.86); Calibrated: 8/11/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn699; Calibrated: 9/20/2010
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#2 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1136;
- Phantom: R#4 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1250;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Multi Band Result:

SAM Phone Against Flat Section/Tablet Long Edge Area Scan - Body (10mm) (31x8x1):
Measurement grid: dx=10mm, dy=10mm

SAM Phone Against Flat Section/MegaZoom Zoom Scan (5-6GHz) Probe separation 3mm (33x14x5)/Cube 0: **Measurement grid: dx=4mm, dy=4mm, dz=3mm**
SAR(1 g) = 1.51 mW/g; SAR(10 g) = 0.762 mW/g
Maximum value of SAR (measured) = 2.03 mW/g

.


mW/g
2.03
1.63
1.22
0.818
0.414
0.010

Simultaneous Transmission LTE QPSK and 5.2 GHz WiFi

DASY4 Configuration for 5GHz MegaZoom Template, SAM Flat - Rev.28-Apr-11/SAM Phone Against Flat Section/MegaZoom Zoom Scan (5-6GHz) Probe separation 2mm:

Date/Time: 4/28/2011 10:18:24 AM
Test Laboratory: Motorola
DUT: Serial: 990005200875, FCC ID: IHDP56LU1
Communication System: 5210MHz Band - 802.11a; Frequency: 5220 MHz; Duty Cycle: 1:1
Medium: 5-6 GHz SPEAG Tissue BODY Medium parameters used: f = 5210 MHz; σ = 5.79 mho/m; ε_r = 46.2; = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

- Probe: EX3DV4 - SN3730; ConvF(4.07, 4.07, 4.07); Calibrated: 7/16/2010
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn440; Calibrated: 11/11/2010
- Phantom: R#3 5Ghz BODY SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1106
- Measurement SW: DASY4, V4.7 Build 80

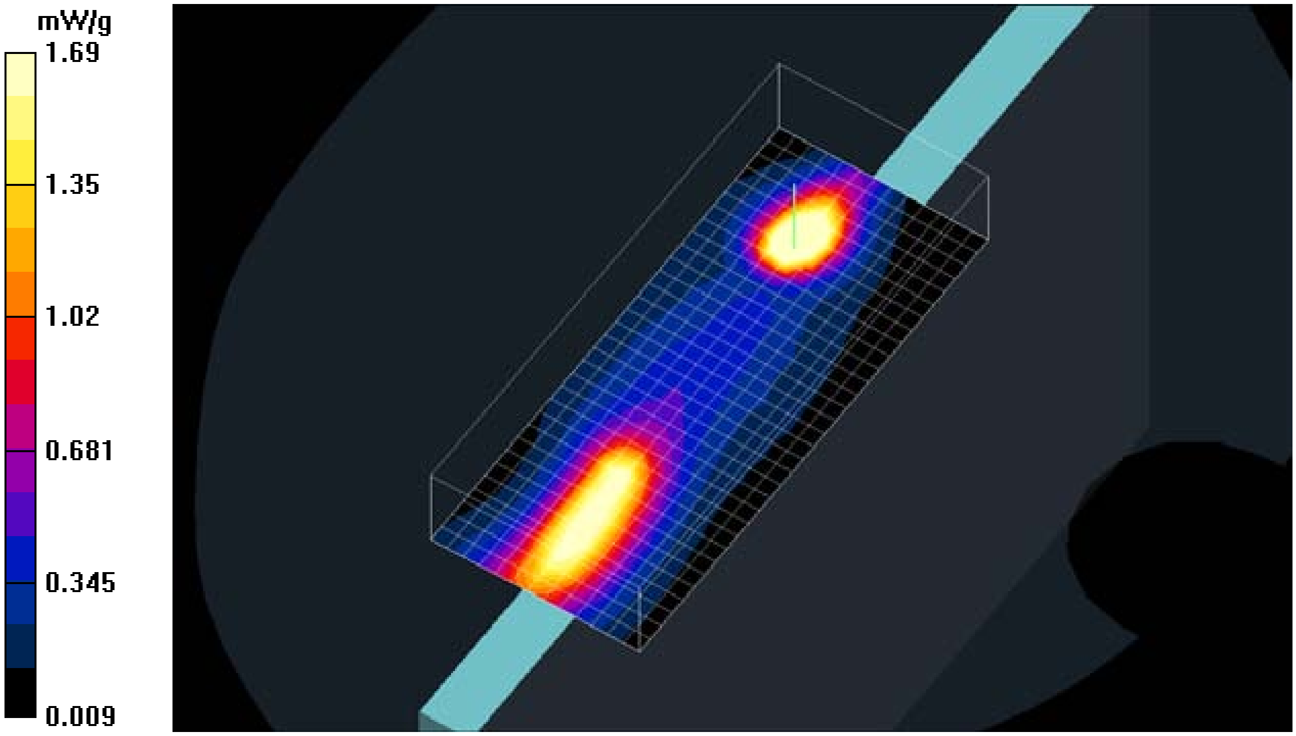
DASY4 Configuration for LTE & 2450MHz - MegaZoom Template, SAM Flat - Rev.28-Apr-11/SAM Phone Against Flat Section/MegaZoom Zoom Scan (5-6GHz) Probe separation 3mm:

Date/Time: 4/28/2011 12:55:16 PM
Test Laboratory: Motorola
DUT: Serial: 99000052018474, FCC ID: IHDP56LU2
Communication System: LTE Band 13; Frequency: 782 MHz; Duty Cycle: 1:1
Medium: BIG BODY Medium parameters used: f = 782 MHz; σ = 0.93 mho/m; ε_r = 54.4; = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

- Probe: ES3DV3 - SN3124; ConvF(5.86, 5.86, 5.86); Calibrated: 8/11/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#4 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1250
- Measurement SW: DASY4, V4.7 Build 80

Multi Band Result:
SAR(1 g) = 1.28 mW/g; SAR(10 g) = 0.635 mW/g
Maximum value of SAR (measured) = 2.59 mW/g

.


mW/g
1.69
1.35
1.02
0.681
0.345
0.009

Simultaneous Transmission LTE QPSK and 5.8 GHz WiFi

DASY4 Configuration for 5GHz MegaZoom Template, SAM Flat - Rev.28-Apr-11/SAM Phone Against Flat Section/MegaZoom Zoom Scan (5-6GHz) Probe separation 2mm:

Date/Time: 4/28/2011 3:12:39 PM
Test Laboratory: Motorola
DUT: Tablet; Serial: 990005200875, FCC ID: IHDP56LU1
Communication System: 5785MHz Band - 802.11a; Frequency: 5805 MHz; Duty Cycle: 1:1
Medium: 5-6 GHz SPEAG Tissue BODY Medium parameters used: f = 5785 MHz; σ = 6.63 mho/m; ε_r = 45.1; = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

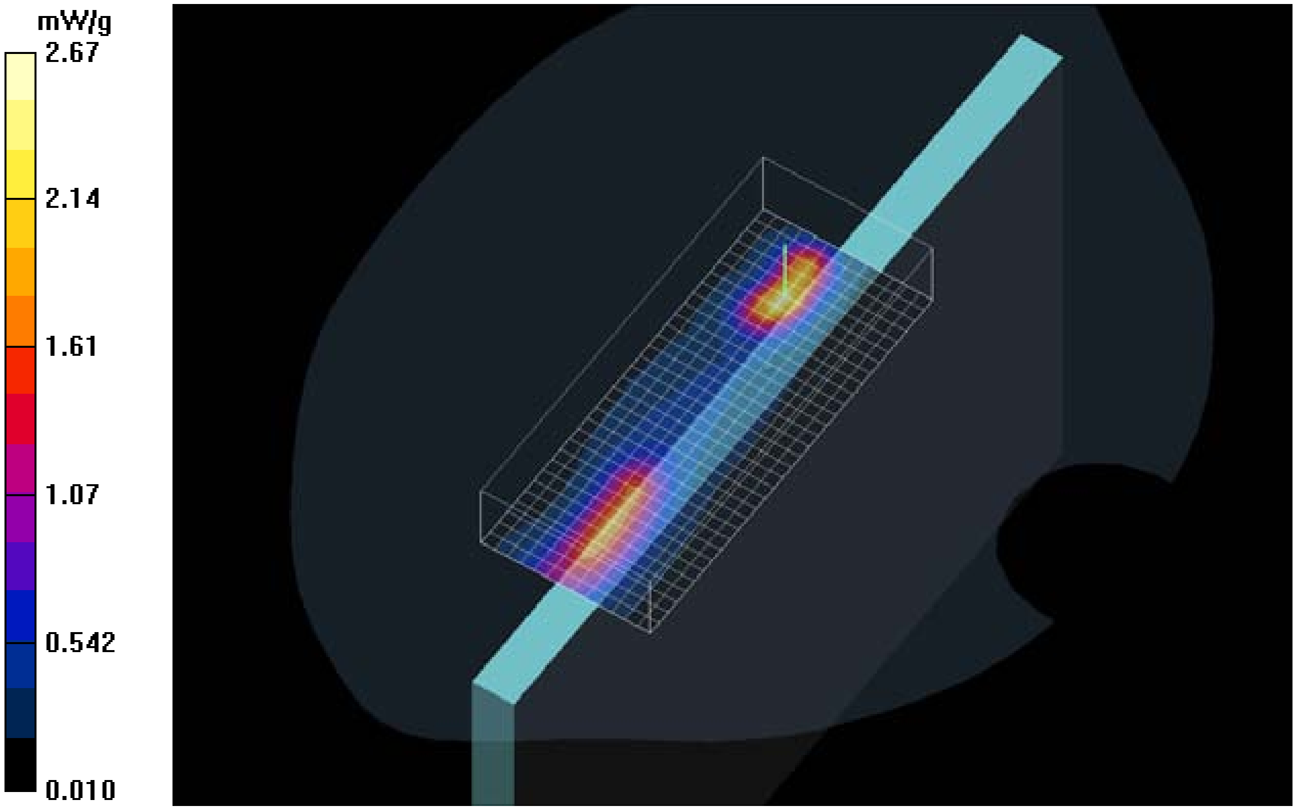
- Probe: EX3DV4 - SN3730; ConvF(3.53, 3.53, 3.53); Calibrated: 7/16/2010
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn440; Calibrated: 11/11/2010
- Phantom: R#3 5Ghz BODY SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1106
- Measurement SW: DASY4, V4.7 Build 80

DASY4 Configuration for LTE & 2450MHz - MegaZoom Template, SAM Flat - Rev.28-Apr-11/SAM Phone Against Flat Section/MegaZoom Zoom Scan (5-6GHz) Probe separation 3mm:

Date/Time: 4/28/2011 12:55:16 PM
Test Laboratory: Motorola
DUT: Serial: 99000052018474, FCC ID: IHDP56LU2
Communication System: LTE Band 13; Frequency: 782 MHz; Duty Cycle: 1:1
Medium: BIG BODY Medium parameters used: f = 782 MHz; σ = 0.93 mho/m; ε_r = 54.4; = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

- Probe: ES3DV3 - SN3124; ConvF(5.86, 5.86, 5.86); Calibrated: 8/11/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#4 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1250
- Measurement SW: DASY4, V4.7 Build 80

Multi Band Result:
SAR(1 g) = 1.25 mW/g; SAR(10 g) = 0.638 mW/g
Maximum value of SAR (measured) = 2.67 mW/g


mW/g
2.67
2.14
1.61
1.07
0.542
0.010

LTE Band 13 16QAM and WiFi 2.45 GHz Simultaneous Transmit Test

DUT Serial: 99000052018474; FCC ID: IHDP56LU2
Procedure Notes: Modulation: 16QAM RB Allocation: 1RB @ Low End Start Test Position: Top Edge of Device 0mm from Flat Phantom
Communication System: LTE Band 13; Frequency: 782 MHz; Communication System Channel Number: 23230; Duty Cycle: 1:1
Medium: BIG BODY; Medium parameters used: f = 782 MHz; σ = 0.93 mho/m; ε_r = 54.4; = 1000 kg/m^3

DUT Serial: 990005200875; FCC ID: IHDP56LU2
Procedure Notes: 802.11b, 1Mbps Test Position = TOP EDGE OF DEVICE 0mm FROM PHANTOM
Communication System: Wi-Fi 2450; Frequency: 2437 MHz; Communication System Channel Number: 6; Duty Cycle: 1:1
Medium: 2450 Glycol Body; Medium parameters used: f = 2450 MHz; σ = 2.03 mho/m; ε_r = 47.5; = 1000 kg/m^3

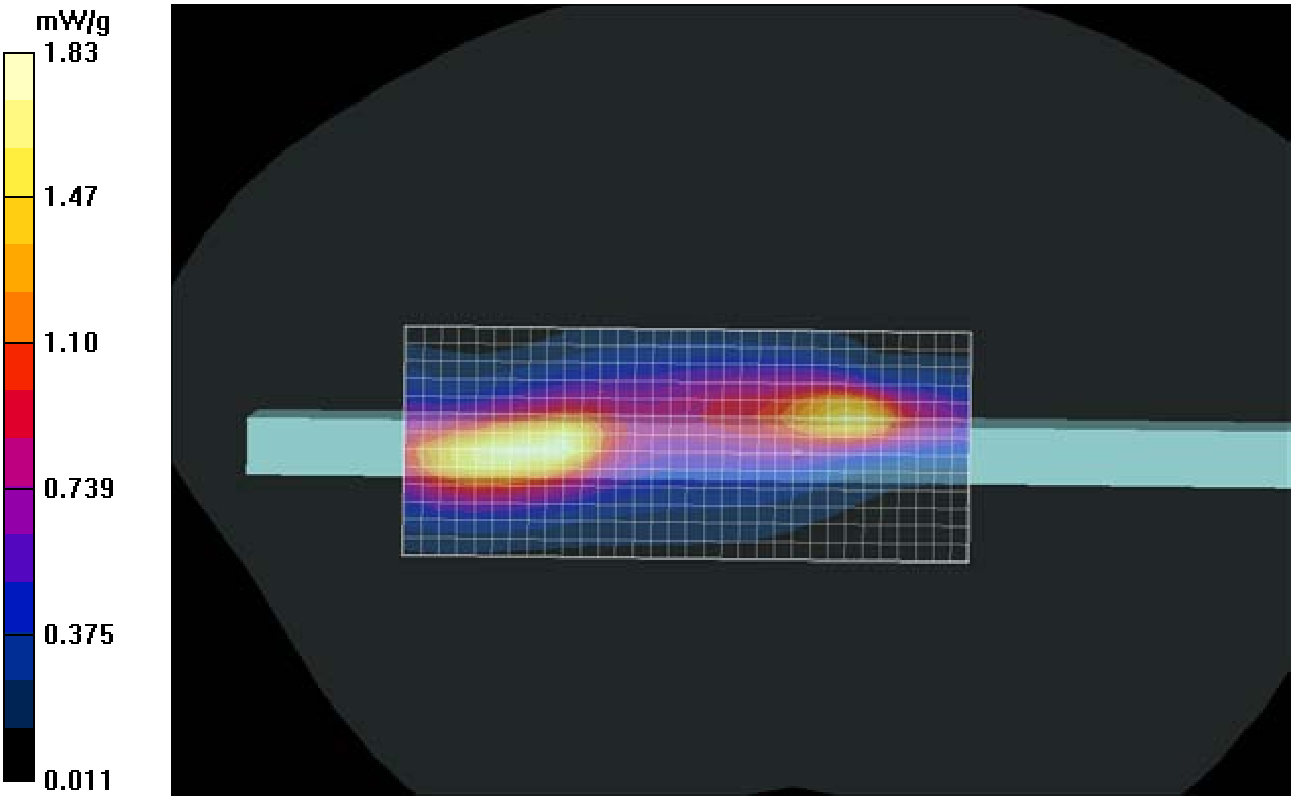
DASY4 Configuration:

- Probe: ES3DV3 - SN3124; ConvF(5.86, 5.86, 5.86); Calibrated: 8/11/2010
- Probe: ES3DV3 - SN3184; ConvF(4.33, 4.33, 4.33); Calibrated: 3/11/2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Electronics: DAE4 Sn699; Calibrated: 9/20/2010
- Phantom: R#4 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1250;
- Phantom: R#2 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1136;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Multi Band Result:

SAM Phone Against Flat Section/Tablet Long Edge Area Scan - Body (10mm) (31x8x1):
Measurement grid: dx=10mm, dy=10mm

SAM Phone Against Flat Section/MegaZoom Zoom Scan (5-6GHz) Probe separation 3mm (33x14x5)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=3mm
SAR(1 g) = 1.37 mW/g; SAR(10 g) = 0.715 mW/g
Maximum value of SAR (measured) = 1.83 mW/g


mW/g
1.83
1.47
1.10
0.739
0.375
0.011

Simultaneous Transmission LTE 16QAM and 5.2 GHz WiFi

DASY4 Configuration for 5GHz MegaZoom Template, SAM Flat - Rev.28-Apr-11/SAM Phone Against Flat Section/MegaZoom Zoom Scan (5-6GHz) Probe separation 2mm:

Date/Time: 4/28/2011 10:18:24 AM
Test Laboratory: Motorola
DUT: Tablet; Serial: 990005200875, FCC ID: IHDP56LU1
Communication System: 5210MHz Band - 802.11a; Frequency: 5220 MHz; Duty Cycle: 1:1
Medium: 5-6 GHz SPEAG Tissue BODY Medium parameters used: f = 5210 MHz; σ = 5.79 mho/m; ε_r = 46.2; = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

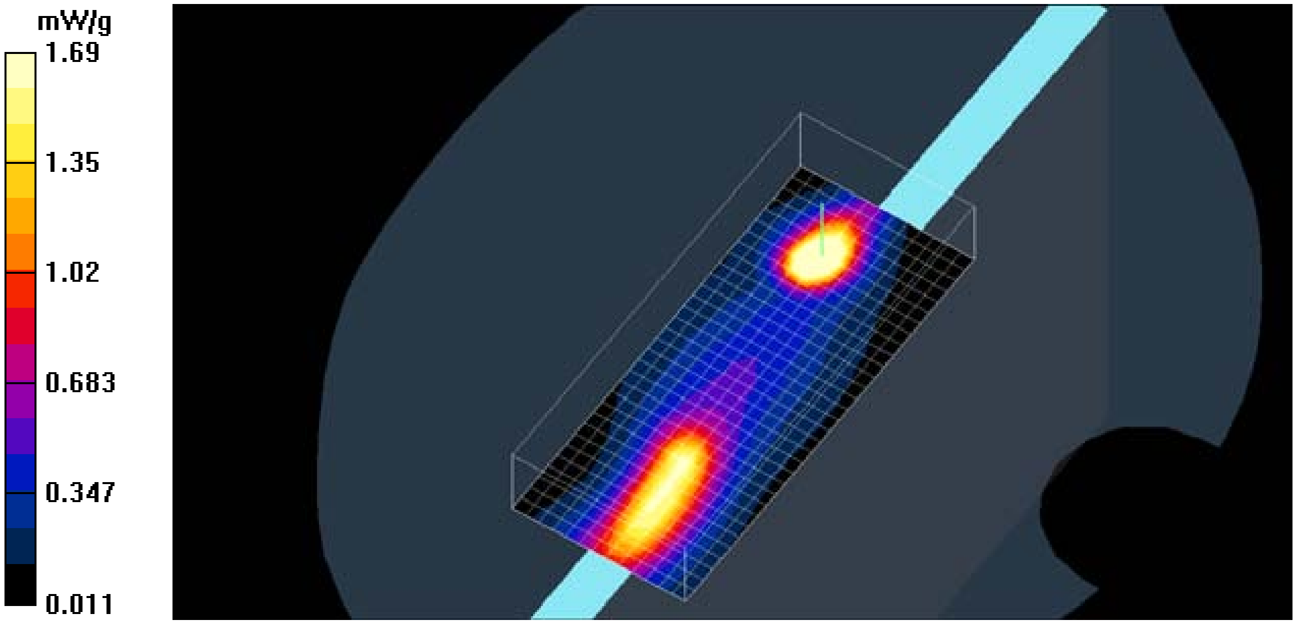
- Probe: EX3DV4 - SN3730; ConvF(4.07, 4.07, 4.07); Calibrated: 7/16/2010
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn440; Calibrated: 11/11/2010
- Phantom: R#3 5Ghz BODY SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1106
- Measurement SW: DASY4, V4.7 Build 80

DASY4 Configuration for LTE & 2450MHz - MegaZoom Template, SAM Flat - Rev.28-Apr-11/SAM Phone Against Flat Section/MegaZoom Zoom Scan (5-6GHz) Probe separation 3mm:

Date/Time: 4/28/2011 8:12:35 PM
Test Laboratory: Motorola
DUT: Serial: 99000052018474, FCC ID: IHDP56LU2
Communication System: LTE Band 13; Frequency: 782 MHz; Duty Cycle: 1:1
Medium: BIG BODY Medium parameters used: f = 782 MHz; σ = 0.93 mho/m; ε_r = 54.4; = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

- Probe: ES3DV3 - SN3124; ConvF(5.86, 5.86, 5.86); Calibrated: 8/11/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#4 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1250
- Measurement SW: DASY4, V4.7 Build 80

Multi Band Result:
SAR(1 g) = 1.29 mW/g; SAR(10 g) = 0.599 mW/g
Maximum value of SAR (measured) = 2.60 mW/g



Postprocessing SW: SEMCAD, V1.8 Build 186..

Simultaneous Transmission LTE 16QAM and 5.8 GHz WiFi

DASY4 Configuration for 5GHz MegaZoom Template, SAM Flat - Rev.28-Apr-11/SAM Phone Against Flat Section/MegaZoom Zoom Scan (5-6GHz) Probe separation 2mm:

Date/Time: 4/28/2011 3:12:39 PM
Test Laboratory: Motorola
DUT: Serial: 990005200875, FCC ID: IHDP56LU1
Communication System: 5785MHz Band - 802.11a; Frequency: 5805 MHz; Duty Cycle: 1:1
Medium: 5-6 GHz SPEAG Tissue BODY Medium parameters used: f = 5785 MHz; σ = 6.63 mho/m; ε_r = 45.1;   = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

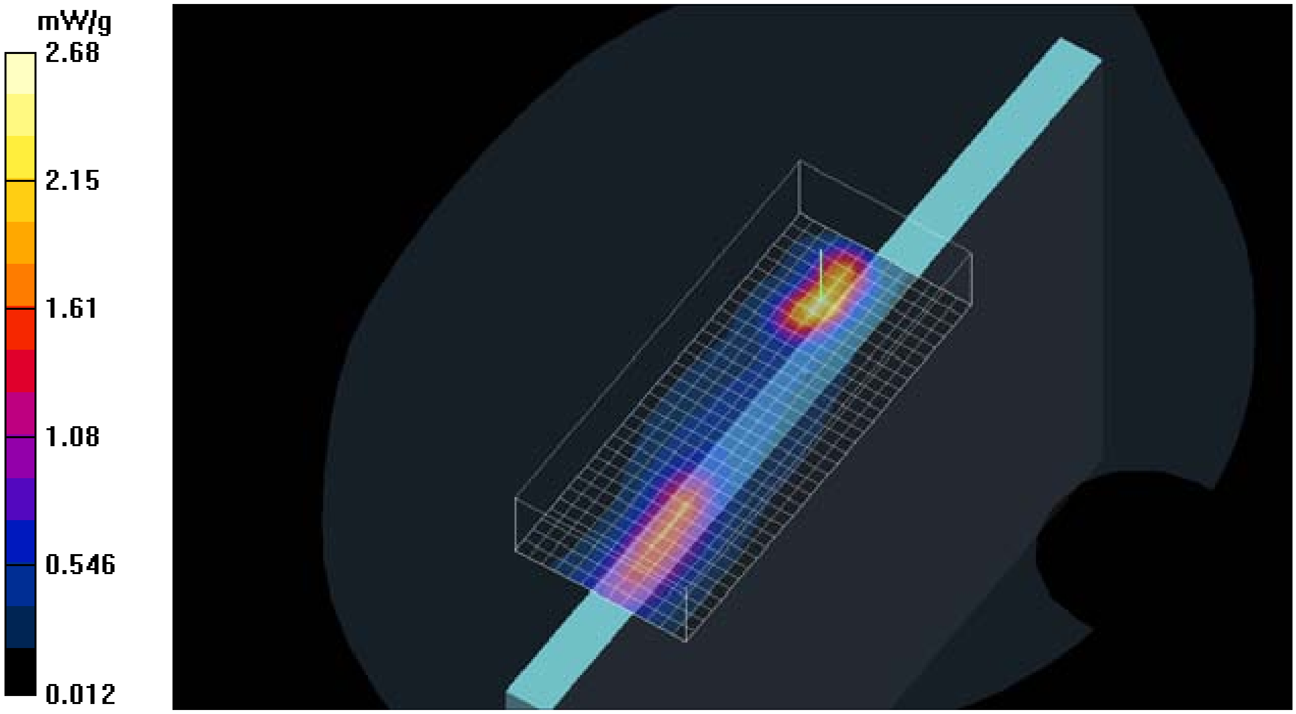
- Probe: EX3DV4 - SN3730; ConvF(3.53, 3.53, 3.53); Calibrated: 7/16/2010
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn440; Calibrated: 11/11/2010
- Phantom: R#3 5Ghz BODY SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1106
- Measurement SW: DASY4, V4.7 Build 80

DASY4 Configuration for LTE & 2450MHz - MegaZoom Template, SAM Flat - Rev.28-Apr-11/SAM Phone Against Flat Section/MegaZoom Zoom Scan (5-6GHz) Probe separation 3mm:

Date/Time: 4/28/2011 8:12:35 PM
Test Laboratory: Motorola
DUT: Serial: 99000052018474, FCC ID: IHDP56LU2
Communication System: LTE Band 13; Frequency: 782 MHz; Duty Cycle: 1:1
Medium: BIG BODY Medium parameters used: f = 782 MHz; σ = 0.93 mho/m; ε_r = 54.4;   = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

- Probe: ES3DV3 - SN3124; ConvF(5.86, 5.86, 5.86); Calibrated: 8/11/2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#4 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1250
- Measurement SW: DASY4, V4.7 Build 80

Multi Band Result:
SAR(1 g) = 1.26 mW/g; SAR(10 g) = 0.602 mW/g
Maximum value of SAR (measured) = 2.68 mW/g



mW/g
2.68
2.15
1.61
1.08
0.546
0.012

Appendix 4

Measurement Uncertainty Budget

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 section**	**Tol. (± %)**	**Prob Dist**	**Div.**	**c_i (1 g)**	**c_i (10 g)**	**1 g u_i (±%)**	**10 g u_i (±%)**	**v_i**
Measurement System									
Probe Calibration	E.2.1	5.9	N	1.00	1	1	5.9	5.9	∞
Axial Isotropy	E.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	E.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3	1.0	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8	1.1	R	1.73	1	1	0.6	0.6	∞
RF Ambient Conditions - Noise	E.6.1	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1	0.0	R	1.73	1	1	0.0	0.0	∞
Probe Positioner Mech. Tolerance	E.6.2	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning w.r.t Phantom	E.6.3	1.4	R	1.73	1	1	0.8	0.8	∞
Max. SAR Evaluation (ext., int., avg.)	E.5	3.4	R	1.73	1	1	2.0	2.0	∞
Test sample Related									
Test Sample Positioning	E.4.2	3.2	N	1.00	1	1	3.2	3.2	29
Device Holder Uncertainty	E.4.1	4.0	N	1.00	1	1	4.0	4.0	8
SAR drift	6.6.2	5.0	R	1.73	1	1	2.9	2.9	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1	4.0	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity (target)	E.3.2	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity (measurement)	E.3.3	3.3	N	1.00	0.64	0.43	2.1	1.4	∞
Liquid Permittivity (target)	E.3.2	5.0	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity (measurement)	E.3.3	1.9	N	1.00	0.6	0.49	1.1	0.9	∞
Combined Standard Uncertainty			RSS				11.1	10.8	411
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				22.2	21.6	

Appendix 5

Probe Calibration Certificate

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

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

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

Accreditation No.: **SCS 108**

Client **Motorola MDb**

Certificate No: **EX3-3730_Jul10/2**

CALIBRATION CERTIFICATE (Replacement of No: EX3-3730_Jul10

Object	EX3DV4 - SN:3730
Calibration procedure(s)	QA CAL-01.v6, QA CAL-14.v3, QA CAL-23.v3 and QA CAL-25.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	July 16, 2010

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	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	1-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	30-Dec-09 (No. ES3-3013_Dec09)	Dec-10
DAE4	SN: 660	20-Apr-10 (No. DAE4-660_Apr10)	Apr-11
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-09)	In house check: Oct10

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: September 4, 2010

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe EX3DV4

SN:3730

Manufactured: October 19, 2009
Calibrated: July 16, 2010

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 SN:3730

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.41	0.53	0.50	± 10.1%
DCP (mV)[B]	87.3	92.6	93.4	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	300	± 1.5%
			Y	0.00	0.00	1.00	300	
			Z	0.00	0.00	1.00	300	

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 maximum deviation from linear response applying rectangular distribution and is expressed for the square of the field value

DASY/EASY - Parameters of Probe: EX3DV4 SN:3730

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth	Unc (k=2)
5200	± 50 / ± 100	36.0 ± 5%	4.66 ± 5%	4.67	4.67	4.67	0.45	1.80	± 13.1%
5300	± 50 / ± 100	35.9 ± 5%	4.76 ± 5%	4.38	4.38	4.38	0.45	1.80	± 13.1%
5600	± 50 / ± 100	35.5 ± 5%	5.07 ± 5%	4.14	4.14	4.14	0.45	1.80	± 13.1%
5800	± 50 / ± 100	35.3 ± 5%	5.27 ± 5%	4.06	4.06	4.06	0.50	1.80	± 13.1%

[C] The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

DASY/EASY - Parameters of Probe: EX3DV4 SN:3730

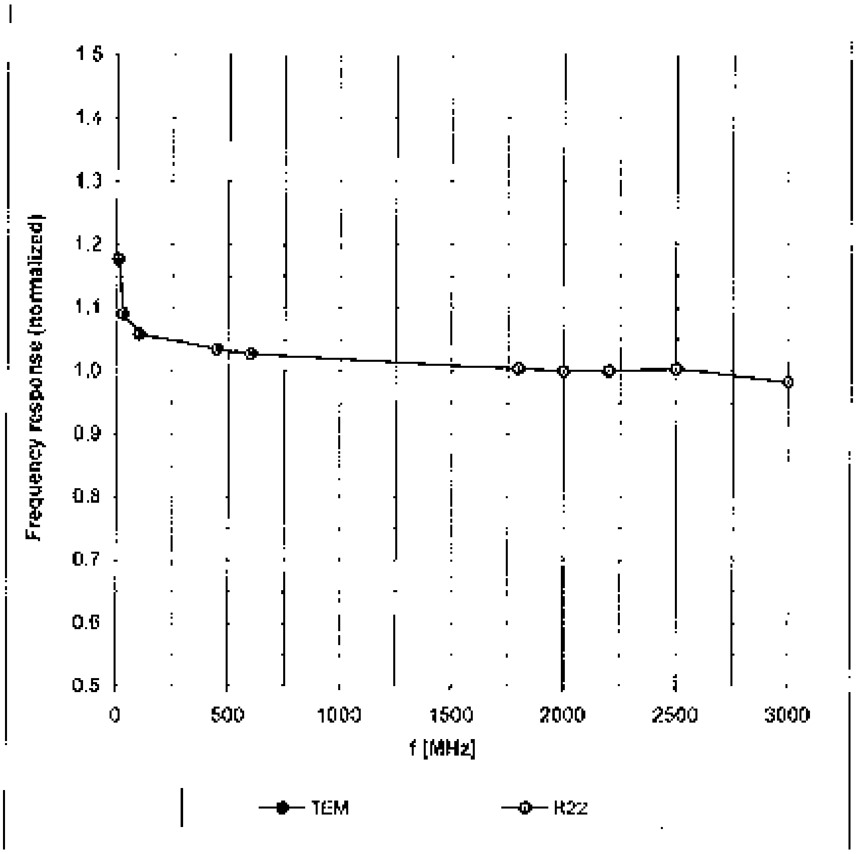
Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
5200	± 50 / ± 100	49.0 ± 5%	5.30 ± 5%	4.07	4.07	4.07	0.50	1.90 ± 13.1%
5300	± 50 / ± 100	48.9 ± 5%	5.42 ± 5%	3.81	3.81	3.81	0.55	1.90 ± 13.1%
5600	± 50 / ± 100	48.5 ± 5%	5.77 ± 5%	3.33	3.33	3.33	0.60	1.90 ± 13.1%
5800	± 50 / ± 100	48.2 ± 5%	6.00 ± 5%	3.53	3.53	3.53	0.60	1.90 ± 13.1%

[C] The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

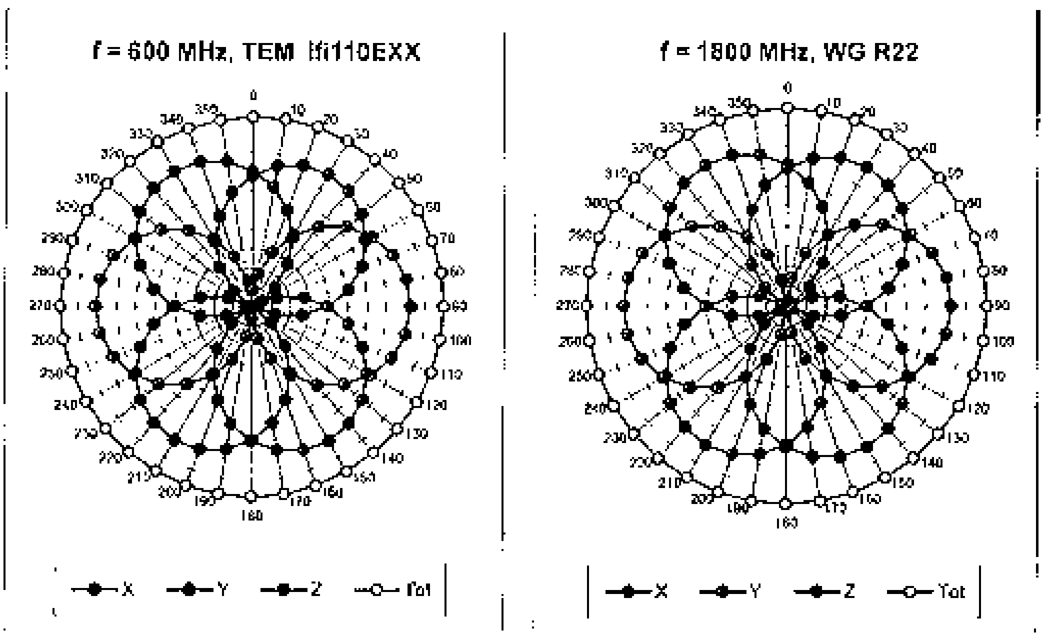
Frequency Response of E-Field

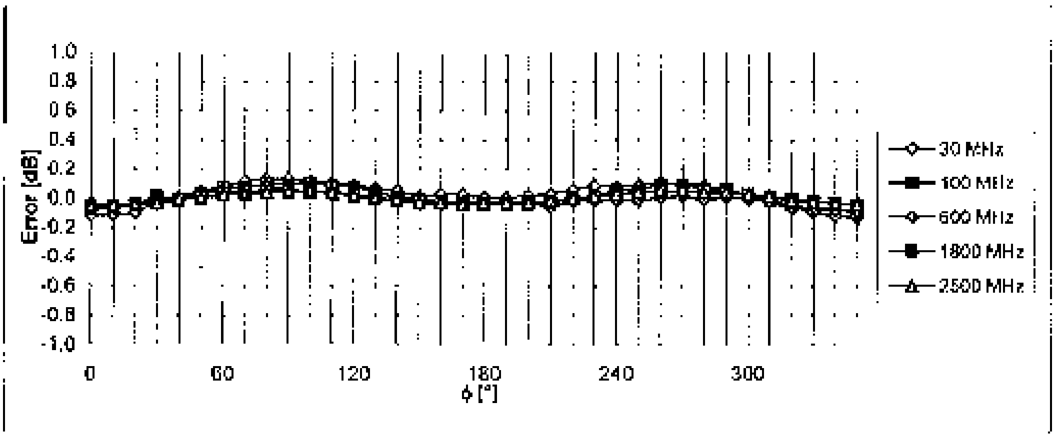
(TEM-Cell:ifi110 EXX, Waveguide: R22)



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

Receiving Pattern (ϕ), ϑ = 0°

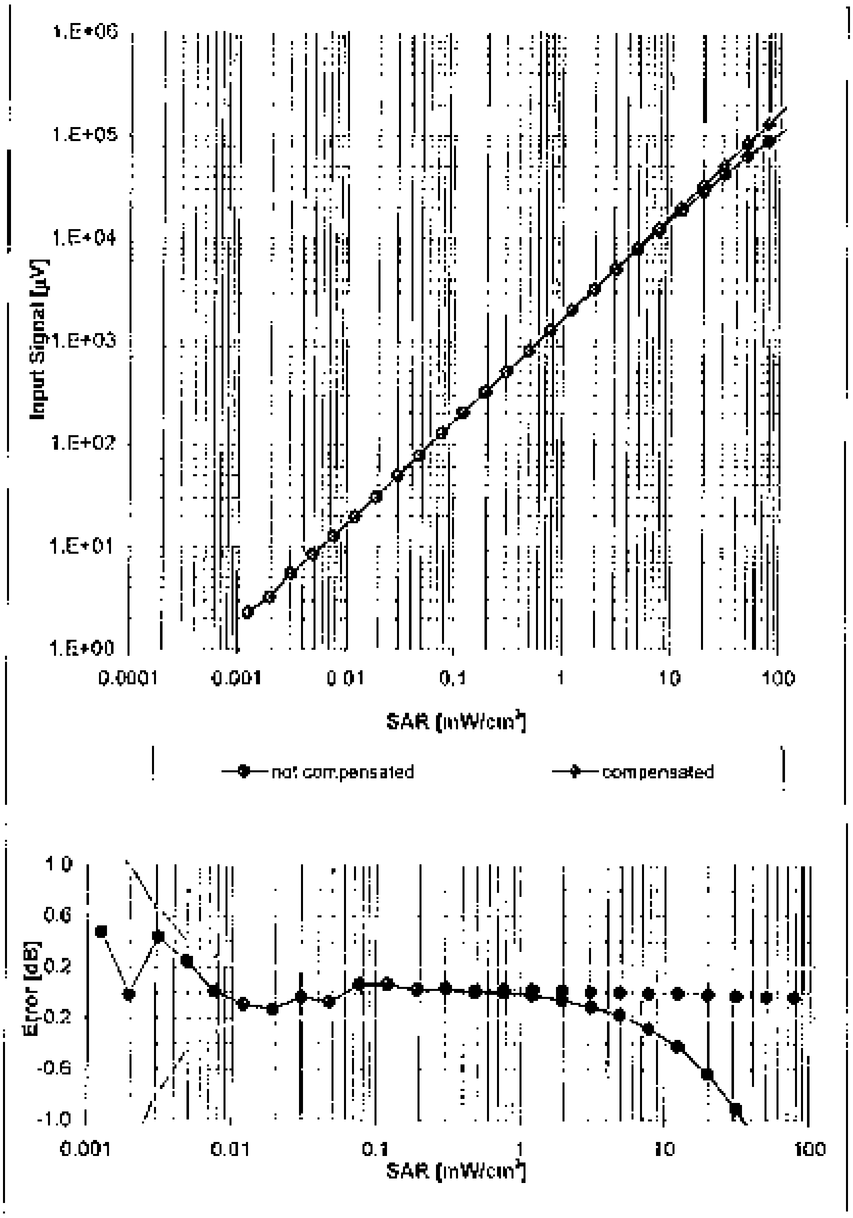




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

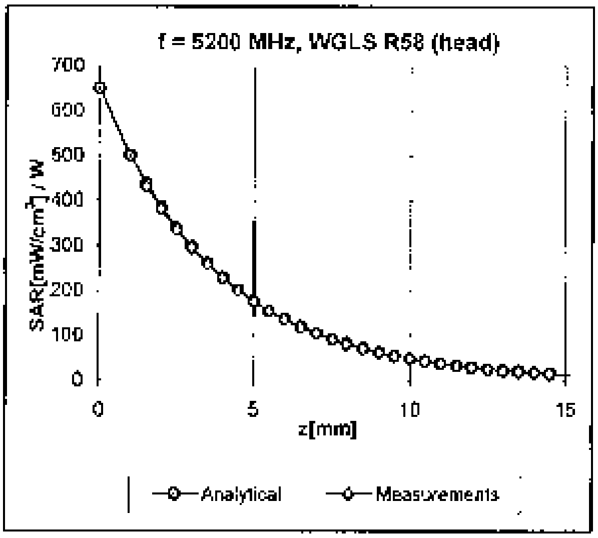
Dynamic Range f(SAR_{head})

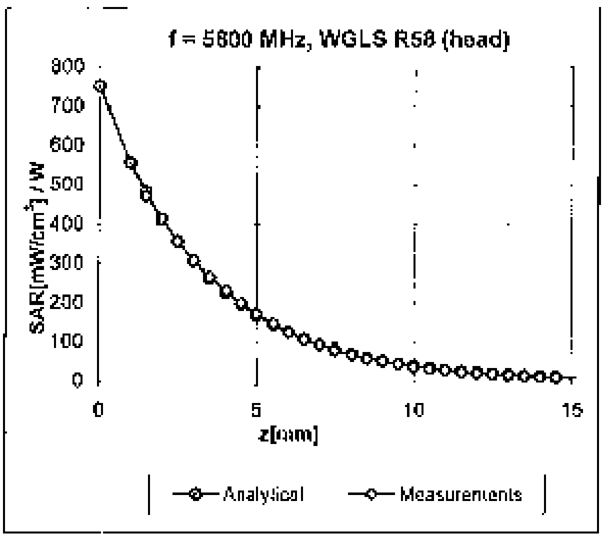
(Waveguide R22, f = 1800 MHz)



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

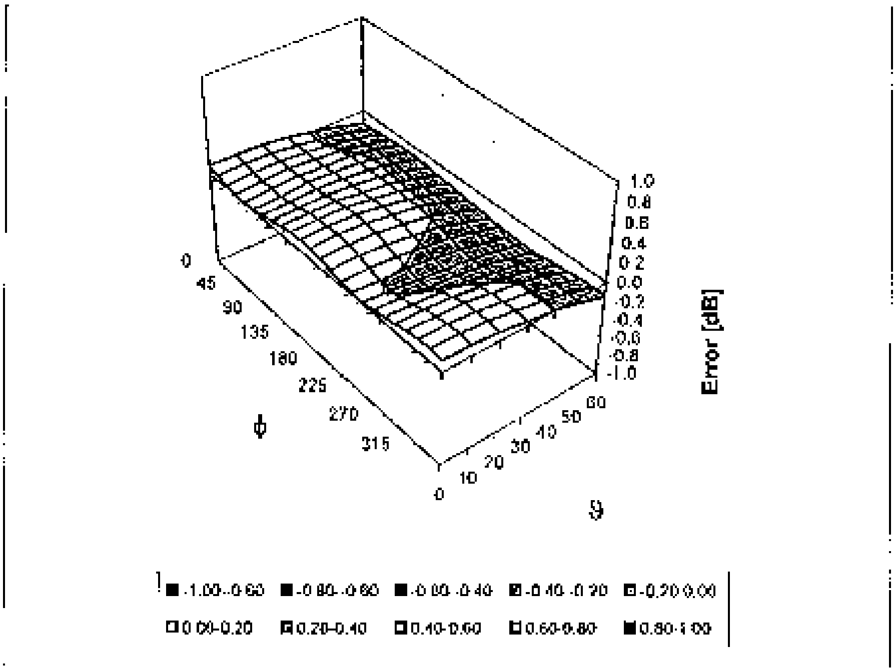
Conversion Factor Assessment





Deviation from Isotropy in HSL

Error (φ, ϑ), f = 900 MHz



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

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	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

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

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

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

Accreditation No.: **SCS 108**

Client **Motorola MDb**

Certificate No: **ES3-3184_Mar11**

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3184
Calibration procedure(s)	QA CAL-01.v7, QA CAL-23.v4, QA CAL-25.v3 Calibration procedure for dosimetric E-field probes
Calibration date:	March 11, 2011

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	01-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	01-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	01-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	29-Dec-10 (No. ES3-3013_Dec10)	Dec-11
DAE4	SN: 654	23-Apr-10 (No. DAE4-654_Apr10)	Apr-11
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

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

Issued: March 16, 2011

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

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

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

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3184

Manufactured: August 19, 2008
Calibrated: March 11, 2011

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3184

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.27	1.40	1.27	± 10.1 %
DCP (mV)[B]	96.8	98.9	99.5	

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	110.8	±3.0 %
			Y	0.00	0.00	1.00	117.2	
			Z	0.00	0.00	1.00	107.9	

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: ES3DV3 - SN:3184

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)
835	41.5	0.90	6.11	6.11	6.11	1.00	1.04	± 12.0 %
1810	40.0	1.40	5.11	5.11	5.11	0.93	1.08	± 12.0 %
1950	40.0	1.40	4.93	4.93	4.93	0.96	1.07	± 12.0 %
2450	39.2	1.80	4.48	4.48	4.48	0.73	1.28	± 12.0 %

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

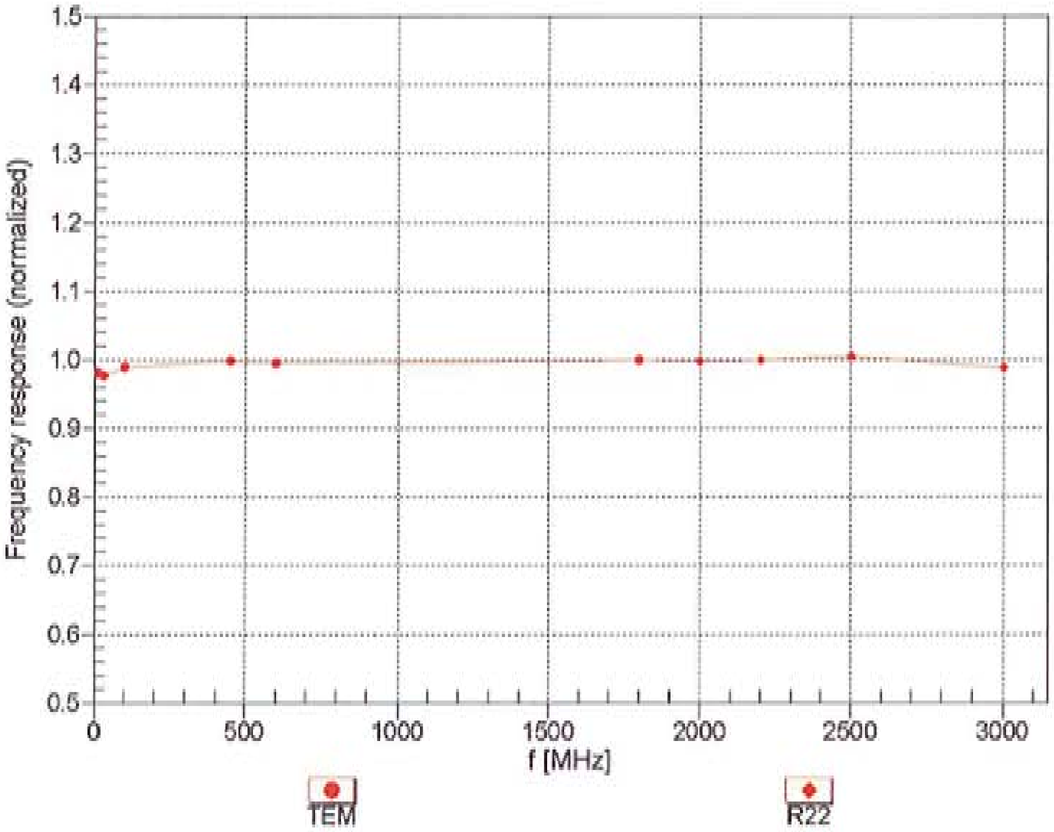
DASY/EASY - Parameters of Probe: ES3DV3- SN:3184

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)
835	55.2	0.97	6.10	6.10	6.10	1.00	1.00	± 12.0 %
1810	53.3	1.52	4.90	4.90	4.90	0.87	1.26	± 12.0 %
1950	53.3	1.52	4.86	4.86	4.86	0.73	1.38	± 12.0 %
2450	52.7	1.95	4.33	4.33	4.33	1.00	1.03	± 12.0 %

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

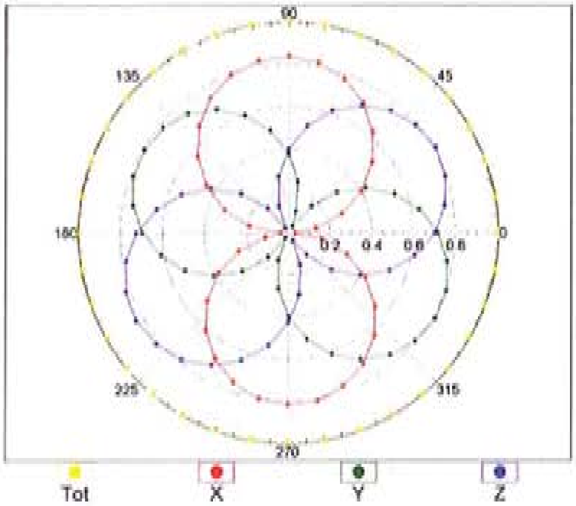
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



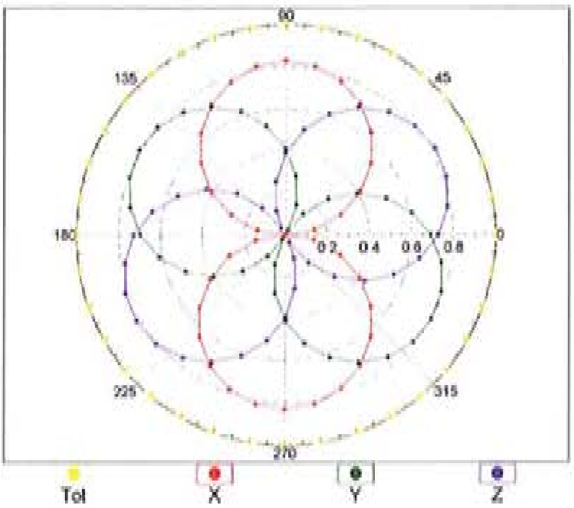
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

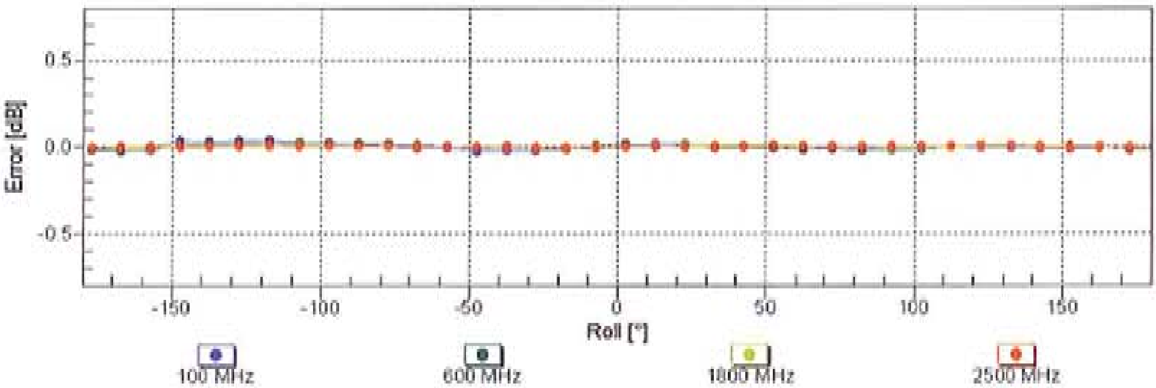
Receiving Pattern (φ), $\vartheta = 0°$

f=600 MHz,TEM



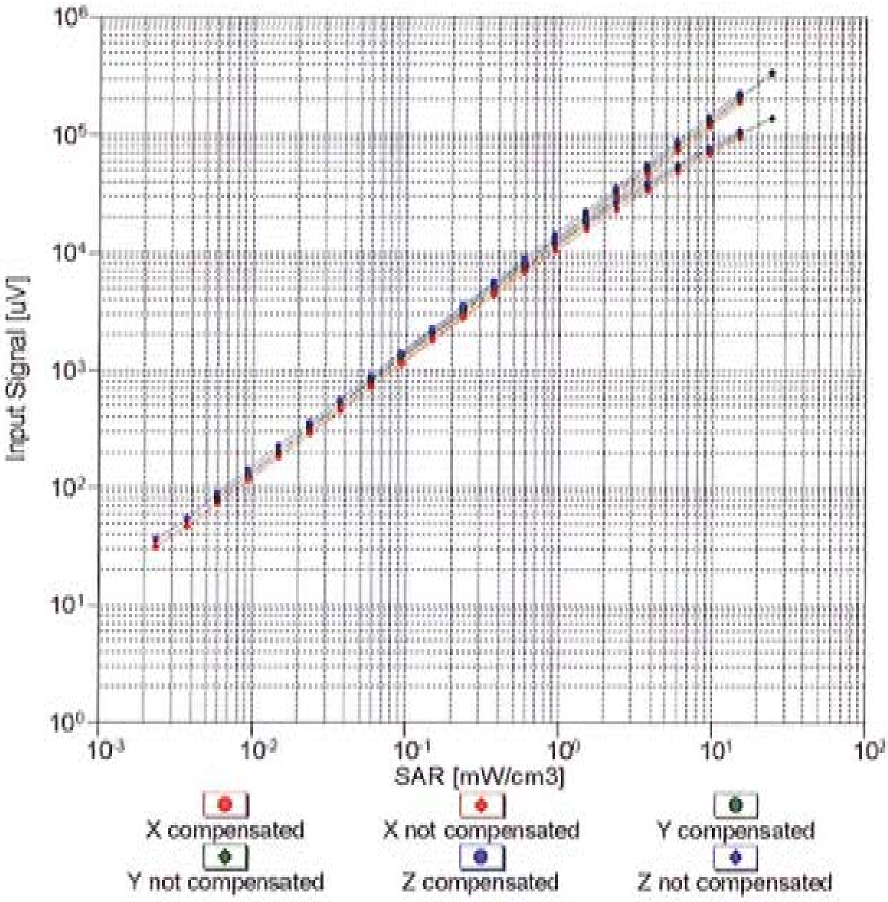
f=1800 MHz,R22

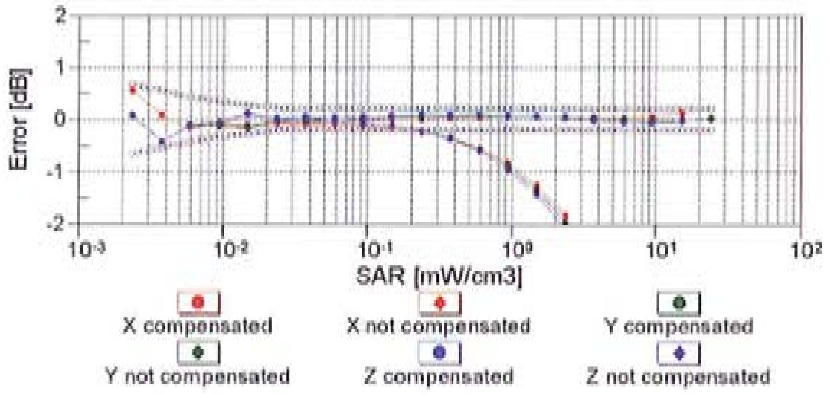




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

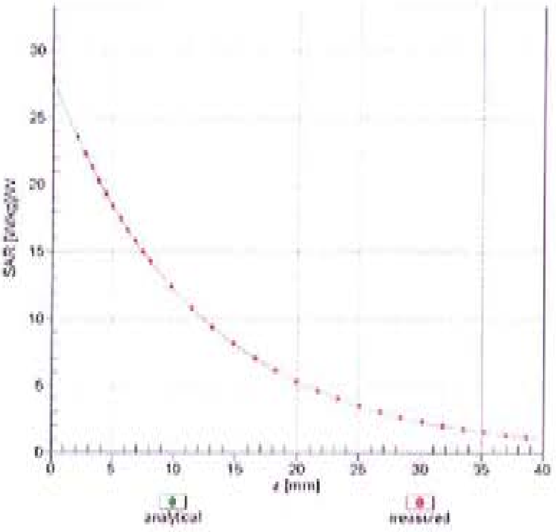




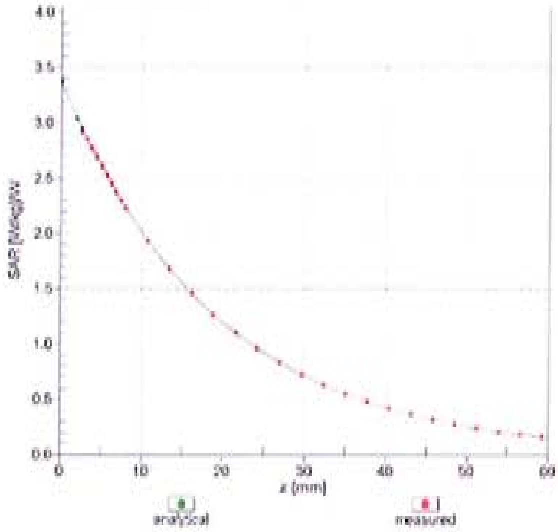
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 1950 MHz,WGLS R22 (H_convF)

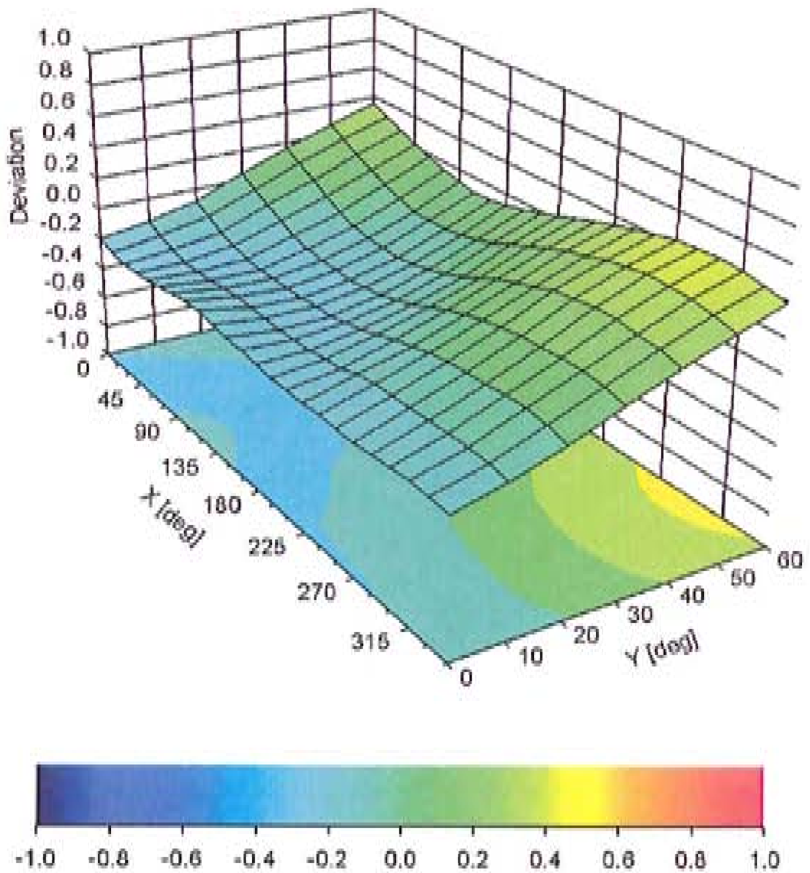


f = 835 MHz,WGLS R9 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3184

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

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

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

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

Accreditation No.: **SCS 108**

Client **Motorola MDb**

Certificate No: **ES3-3124_Aug10**

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3124

Calibration procedure(s): QA CAL-01.v6, QA CAL-23.v3 and QA CAL-25.v2
Calibration procedure for dosimetric E-field probes

Calibration date: August 11, 2010

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	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	1-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	30-Dec-09 (No. ES3-3013_Dec09)	Dec-10
DAE4	SN: 660	20-Apr-10 (No. DAE4-660_Apr10)	Apr-11

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-09)	In house check: Oct10

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

Issued: August 14, 2010

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

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

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

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

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3124

Manufactured:	July 11, 2006
Last calibrated:	April 21, 2009
Recalibrated:	August 11, 2010

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: ES3DV3 SN:3124

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.26	1.33	1.34	± 10.1%
DCP (mV)[B]	92.9	96.4	96.7	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	300.0	± 1.5%
			Y	0.00	0.00	1.00	300.0	
			Z	0.00	0.00	1.00	300.0	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).

[B] Numerical linearization parameter: uncertainty not required.

[E] Uncertainty is determined using the maximum deviation from linear response applying recatangular distribution and is expressed for the square of the field value

DASY/EASY - Parameters of Probe: ES3DV3 SN:3124

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
835	± 50 / ± 100	41.5 ± 5%	0.90 ± 5%	5.89	5.89	5.89	0.97	1.07 ± 11.0%
1810	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	4.89	4.89	4.89	0.49	1.54 ± 11.0%
1950	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	4.68	4.68	4.68	0.50	1.52 ± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	4.35	4.35	4.35	0.45	1.78 ± 11.0%

[C] The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

DASY/EASY - Parameters of Probe: ES3DV3 SN:3124

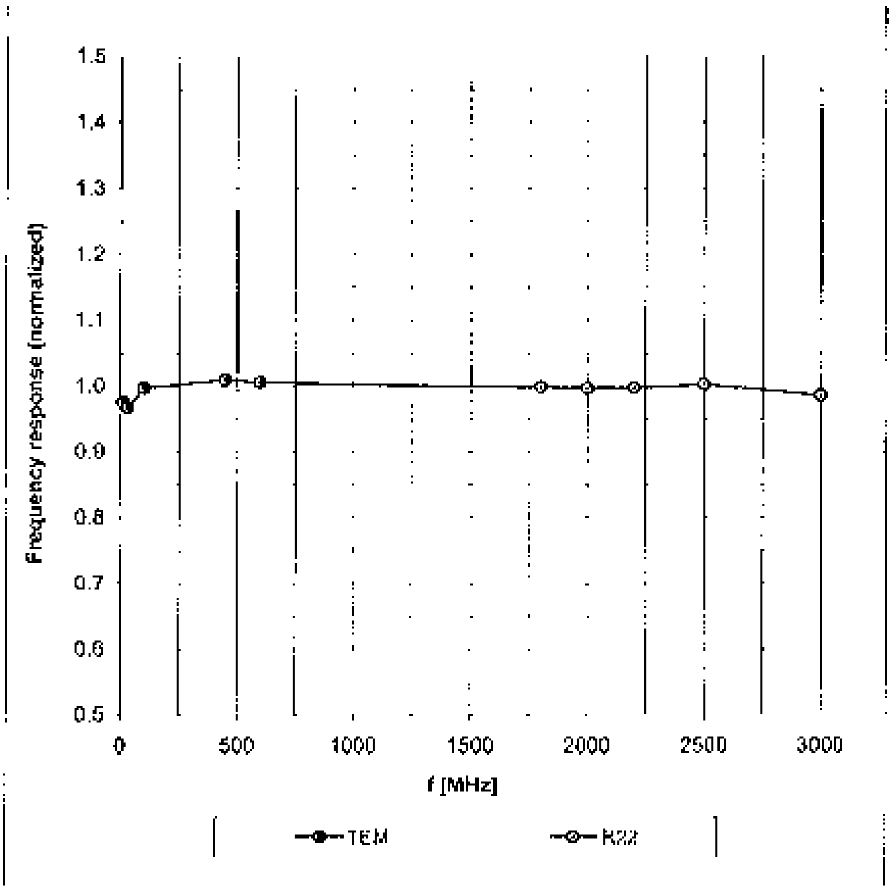
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz)	Validity (MHz)[C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
835	± 50 / ± 100	55.2 ± 5%	0.97 ± 5%	5.86	5.86	5.86	0.96	1.11 ± 11.0%
1810	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.76	4.76	4.76	0.41	1.84 ± 11.0%
1950	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.78	4.78	4.78	0.32	2.33 ± 11.0%
2450	± 50 / ± 100	52.7 ± 5%	1.95 ± 5%	4.19	4.19	4.19	0.69	1.29 ± 11.0%

[C] The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band

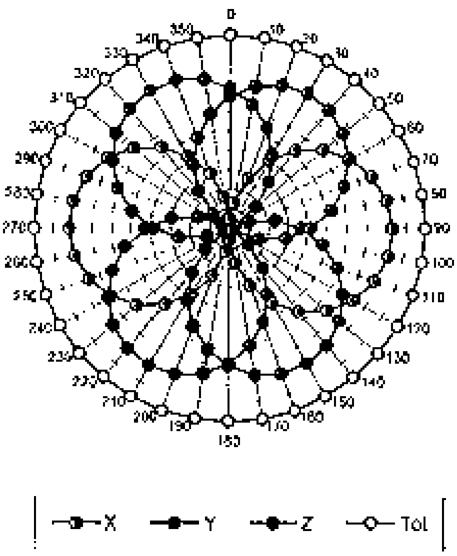
Frequency Response of E-Field

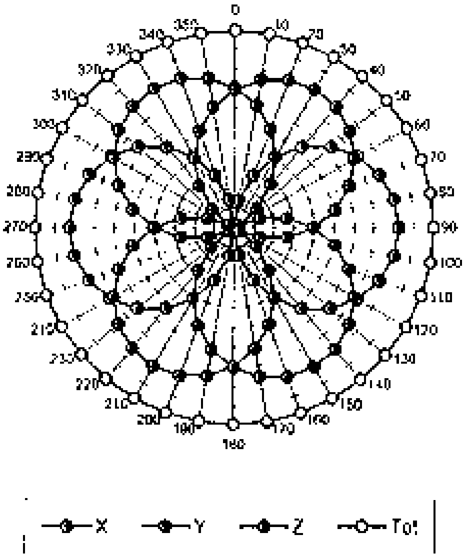
(TEM-Cell:ifi110 EXX, Waveguide: R22)

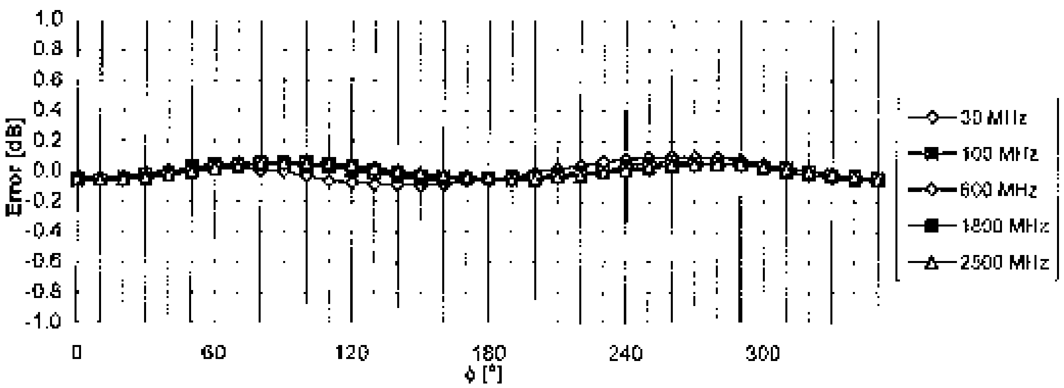


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



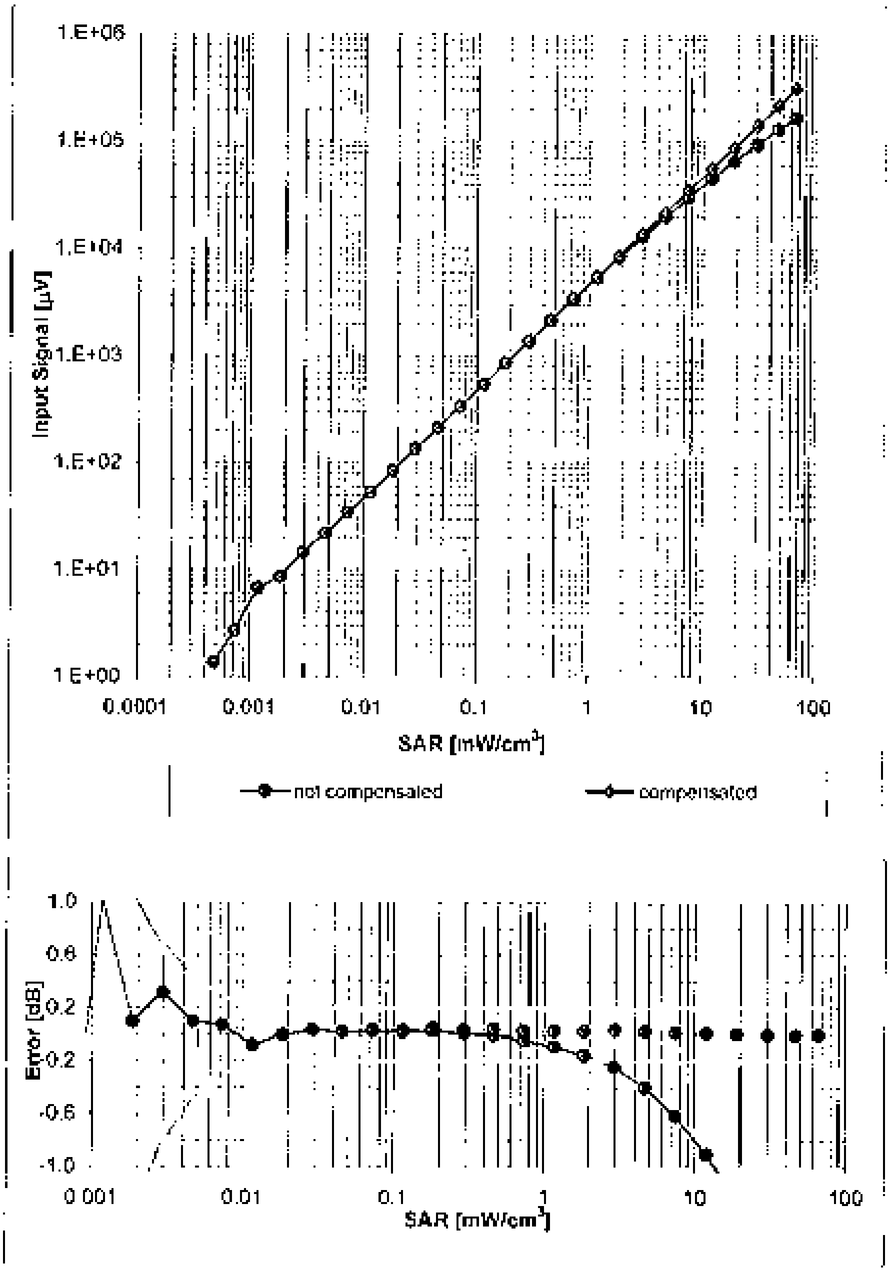




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

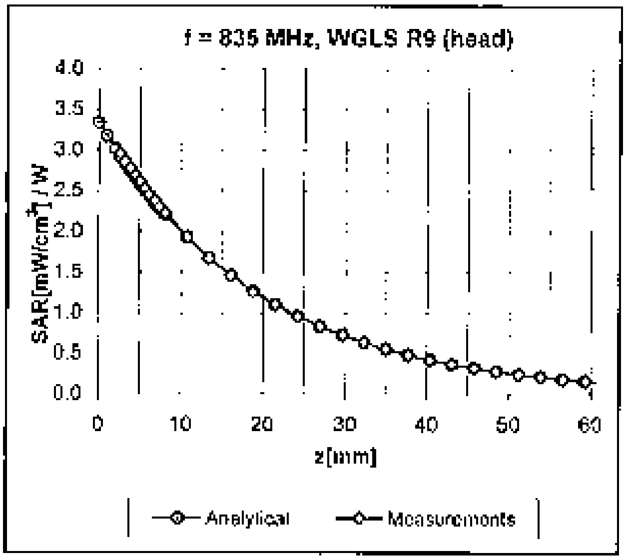
Dynamic Range f(SAR_{head})

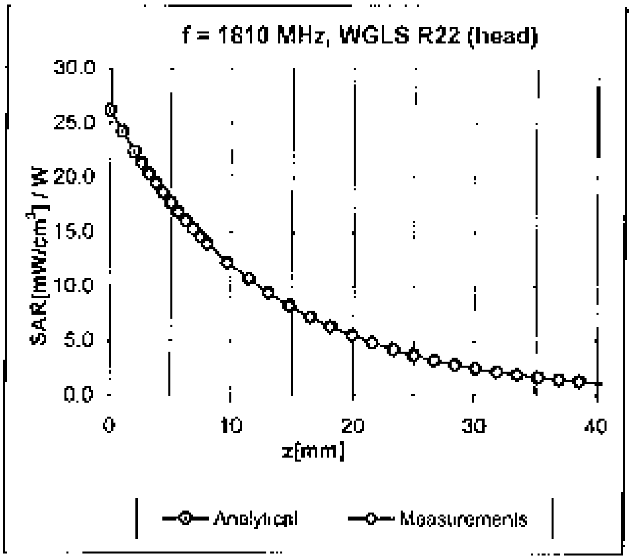
(Waveguide R22, f = 1800 MHz)



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

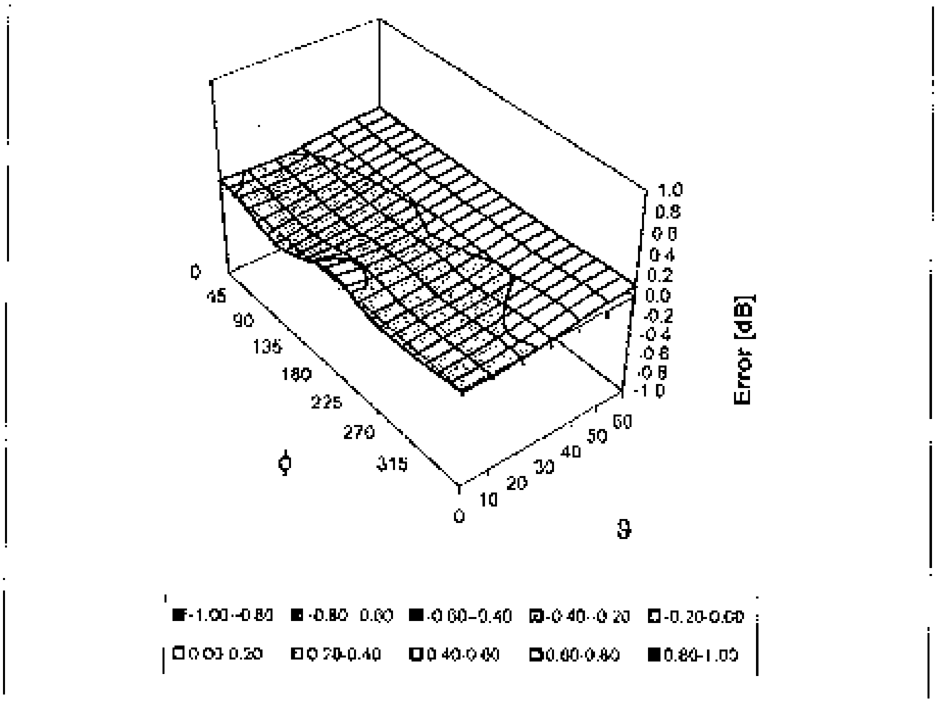
Conversion Factor Assessment





Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



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

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	4.0 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

Appendix 6

Dipole Characterization Certificate

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

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

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

Accreditation No.: **SCS 108**

Client **Motorola MDb**

Certificate No: **D2450V2-740_Mar11**

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 740
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits
Calibration date:	March 17, 2011

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	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

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

Issued: March 21, 2011

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	V52.6.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.7 ± 6 %	1.72 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 0.2) °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 normalized	normalized to 1W	52.8 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**53.8 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.16 mW / g
SAR normalized	normalized to 1W	24.6 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**24.8 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.5 ± 6 %	1.92 mho/m ± 6 %
Body TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.8 mW / g
SAR normalized	normalized to 1W	51.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**51.3 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.88 mW / g
SAR normalized	normalized to 1W	23.5 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**23.5 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.3 Ω + 2.6 jΩ
Return Loss	- 27.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.9 Ω + 5.3 jΩ
Return Loss	- 25.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.164 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.
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 18, 2003

DASY5 Validation Report for Head TSL

Date/Time: 17.03.2011 12:12:34

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:740

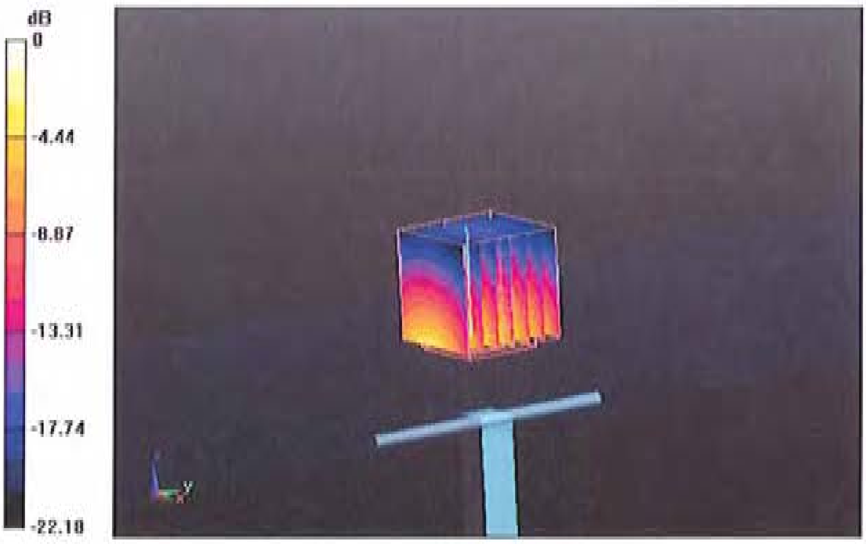
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL U12 BB
Medium parameters used: f = 2450 MHz; σ = 1.72 mho/m; ε_r = 38.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.6.2 Build (424)
- Postprocessing SW: SEMCAD X, V14.4.4 Build (2829)

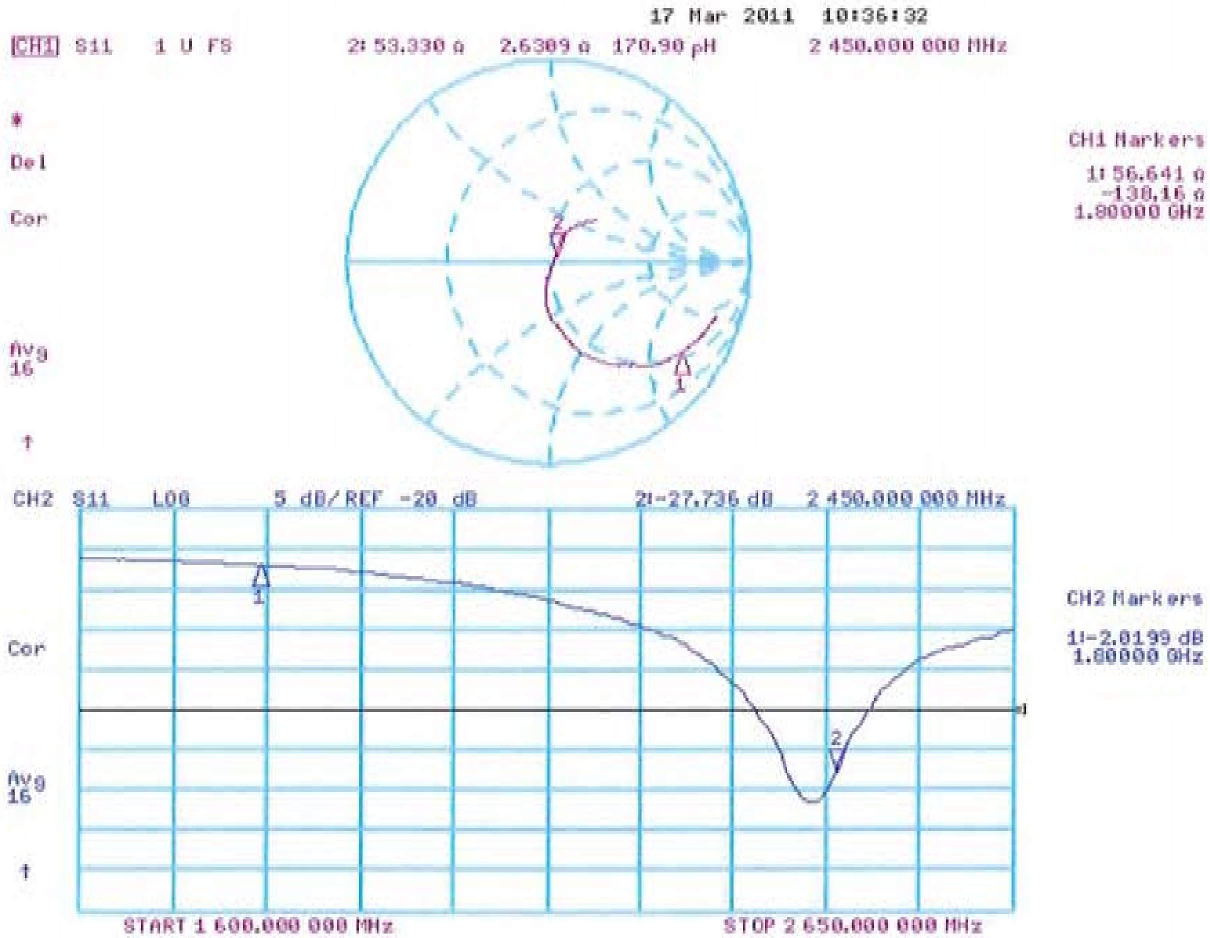
Head/d=10mm, Pin=250 mW, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 100.2 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 26.990 W/kg
SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.16 mW/g
Maximum value of SAR (measured) = 17.012 mW/g



0 dB = 17.010mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 17.03.2011 14:38:41

Test Laboratory: SPEAG, Zurich, Switzerland

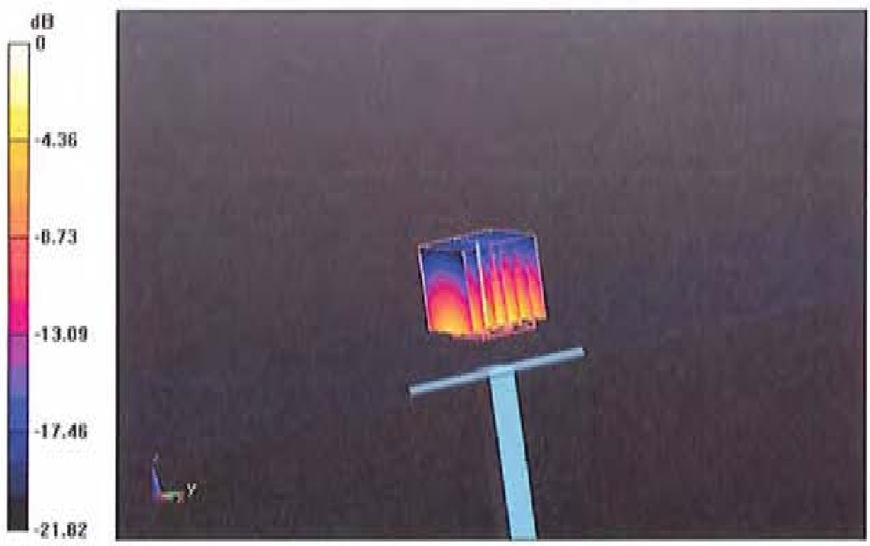
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:740

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: MSL U12 BB
Medium parameters used: f = 2450 MHz; σ = 1.92 mho/m; ε_r = 51.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

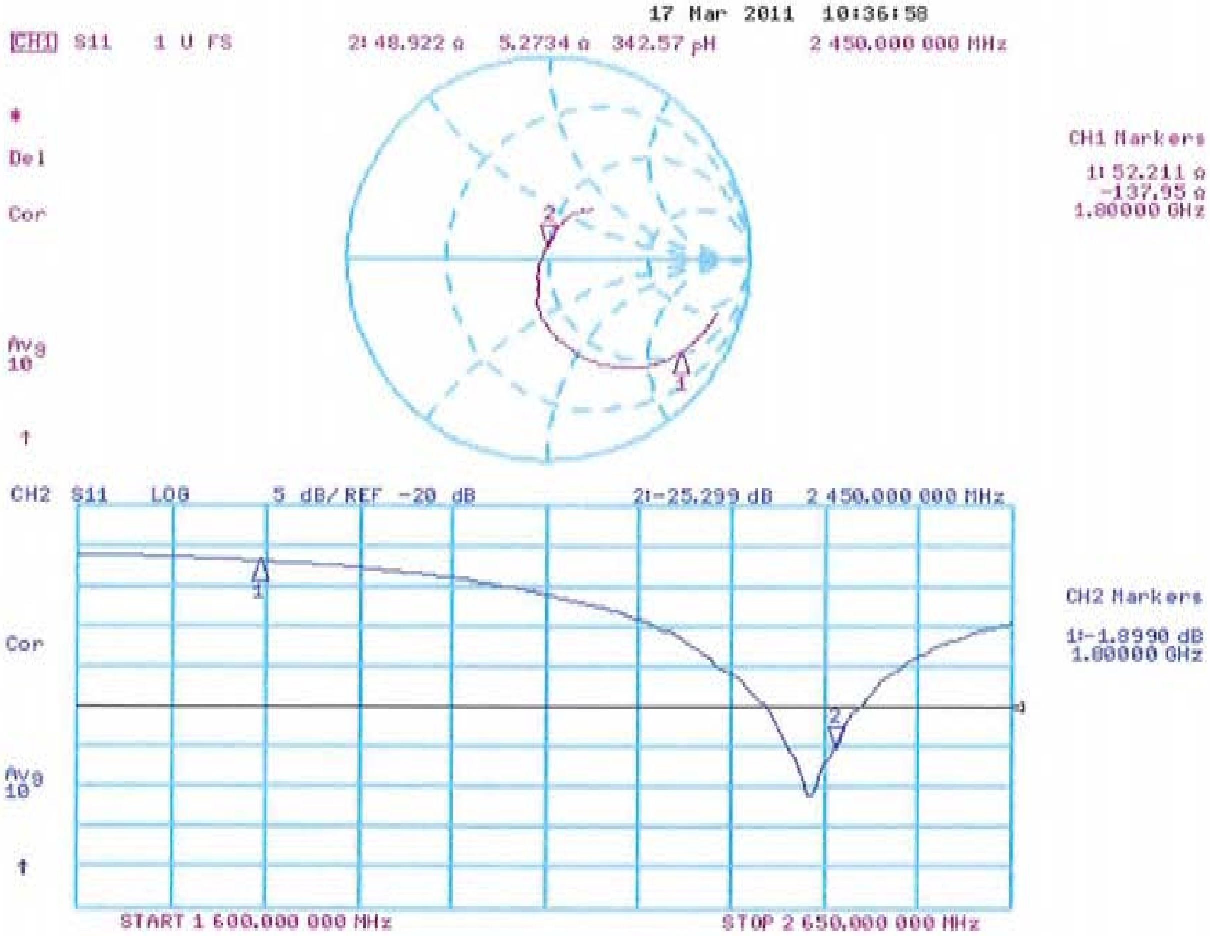
- Probe: ES3DV3 - SN3205; ConvF(4.31, 4.31, 4.31); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.6.2 Build (424)
- Postprocessing SW: SEMCAD X, V14.4.4 Build (2829)

Body/d=10mm, Pin=250 mW, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.402 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 27.038 W/kg
SAR(1 g) = 12.8 mW/g; SAR(10 g) = 5.88 mW/g
Maximum value of SAR (measured) = 16.855 mW/g



0 dB = 16.850mW/g

Impedance Measurement Plot for Body TSL



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

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

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

Accreditation No.: SCS 108

Client **Motorola MDb**

Certificate No: D835V2-425_Oct10

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 425
Calibration procedure(s)	QA CAL-05.v7 Calibration procedure for dipole validation kits
Calibration date:	October 14, 2010

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	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

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

Issued: October 14, 2010

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	V52.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.3 ± 6 %	0.90 mho/m ± 6 %
Head TSL temperature during test	(22.5 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.38 mW / g
SAR normalized	normalized to 1W	9.52 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**9.57 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.55 mW / g
SAR normalized	normalized to 1W	6.20 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**6.22 mW /g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.8 Ω + 3.7 jΩ
Return Loss	- 26.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.396 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.
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 24, 2000

DASY5 Validation Report for Head TSL

Date/Time: 14.10.2010 10:27:24

Test Laboratory: SPEAG, Zurich, Switzerland

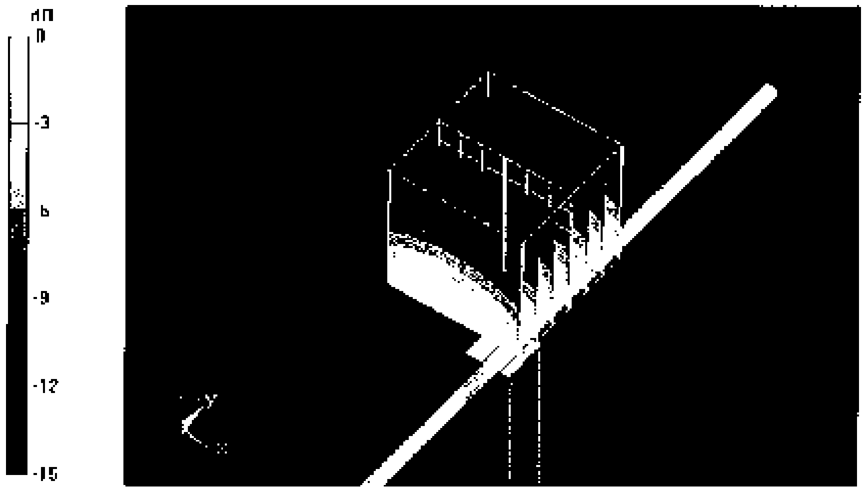
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:425

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: HSL900
Medium parameters used: f = 835 MHz; $\sigma = 0.9$ mho/m; $\varepsilon_r = 42.5$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

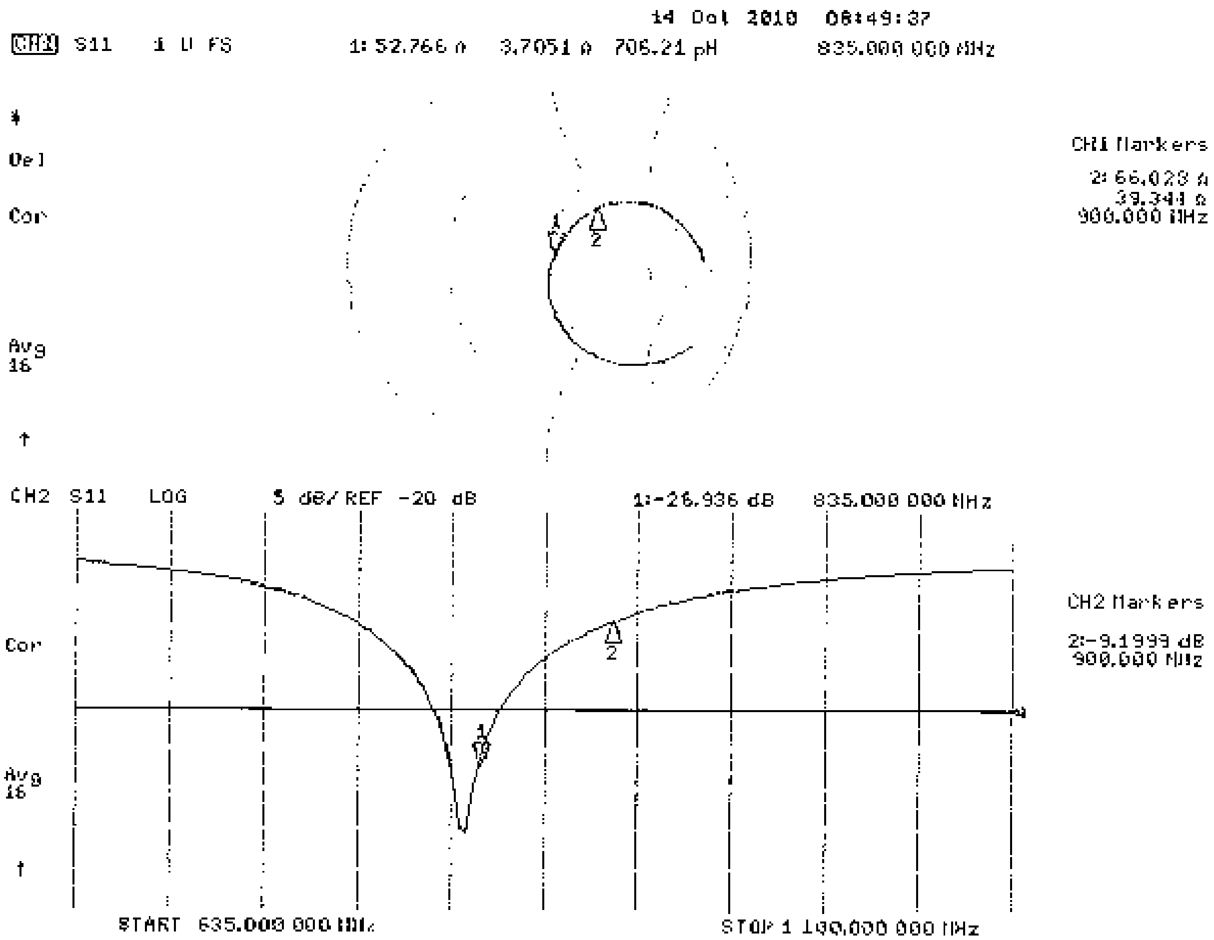
- Probe: ES3DV3 - SN3205; ConvF(6.03, 6.03, 6.03); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57 V/m; Power Drift = 0.010 dB
Peak SAR (extrapolated) = 3.59 W/kg
SAR(1 g) = 2.38 mW/g; SAR(10 g) = 1.55 mW/g
Maximum value of SAR (measured) = 2.76 mW/g



0 dB = 2.76mW/g

Impedance Measurement Plot for Head TSL



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

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

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

Accreditation No.: SCS 108

Client **Motorola MDb**

Certificate No: **D835V2-422_Mar11**

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 422
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits
Calibration date:	March 18, 2011

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	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

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

Issued: March 18, 2011

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	V52.6.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.0 ± 6 %	0.89 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.32 mW / g
SAR normalized	normalized to 1W	9.28 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**9.33 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.52 mW / g
SAR normalized	normalized to 1W	6.08 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**6.11 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.3 ± 6 %	0.99 mho/m ± 6 %
Body TSL temperature during test	(22.2 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.49 mW / g
SAR normalized	normalized to 1W	10.0 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**9.77 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.63 mW / g
SAR normalized	normalized to 1W	6.52 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**6.43 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.3 Ω + 3.3 jΩ
Return Loss	- 26.9 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.8 Ω + 1.8 jΩ
Return Loss	- 33.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.427 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.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Design Modification by End User

The dipole has been modified with Teflon Rings (TR) placed within identified markings close to the end of each dipole arm. Calibration has been performed with TR attached to the dipole.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	August 24, 2000

DASY5 Validation Report for Head TSL

Date/Time: 18.03.2011 10:31:11

Test Laboratory: SPEAG, Zurich, Switzerland

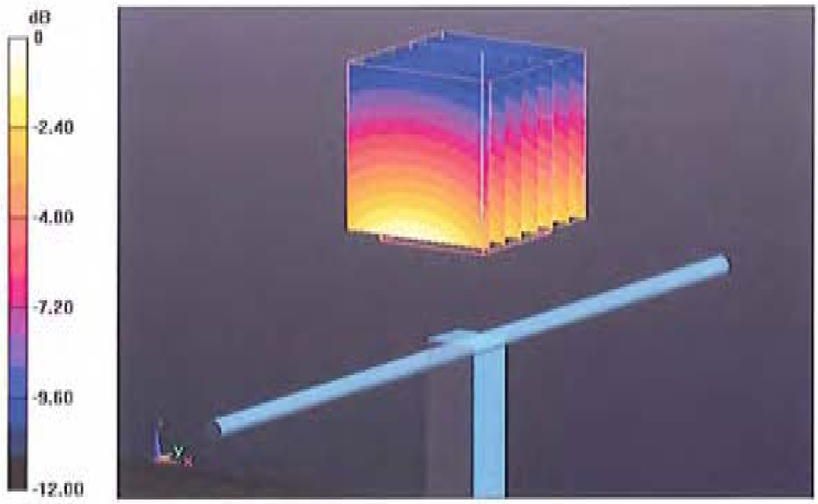
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:422

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: HSL900
Medium parameters used: f = 835 MHz; σ = 0.89 mho/m; ε_r = 41; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

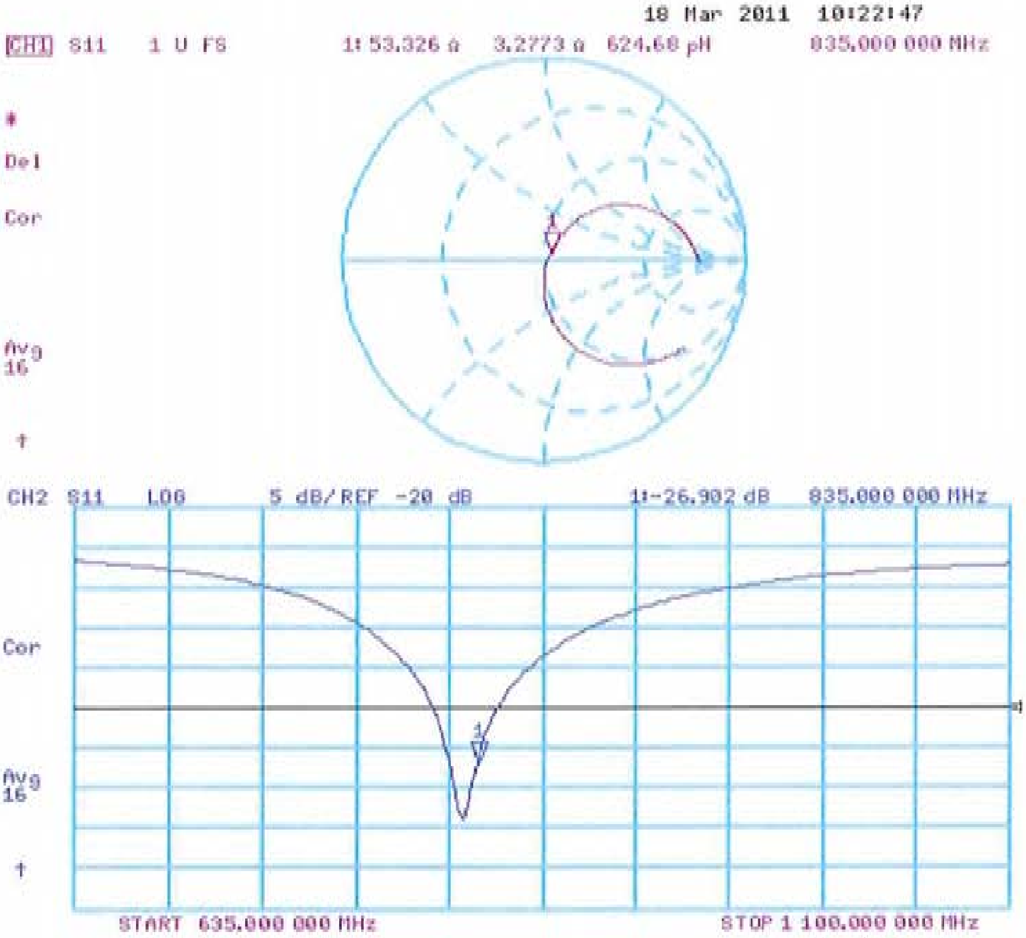
- Probe: ES3DV3 - SN3205; ConvF(6.03, 6.03, 6.03); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.6.2 Build (424)
- Postprocessing SW: SEMCAD X, V14.4.4 Build (2829)

Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.580 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.476 W/kg
SAR(1 g) = 2.32 mW/g; SAR(10 g) = 1.52 mW/g
Maximum value of SAR (measured) = 2.692 mW/g



0 dB = 2.690mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 16.03.2011 15:51:37

Test Laboratory: SPEAG, Zurich, Switzerland

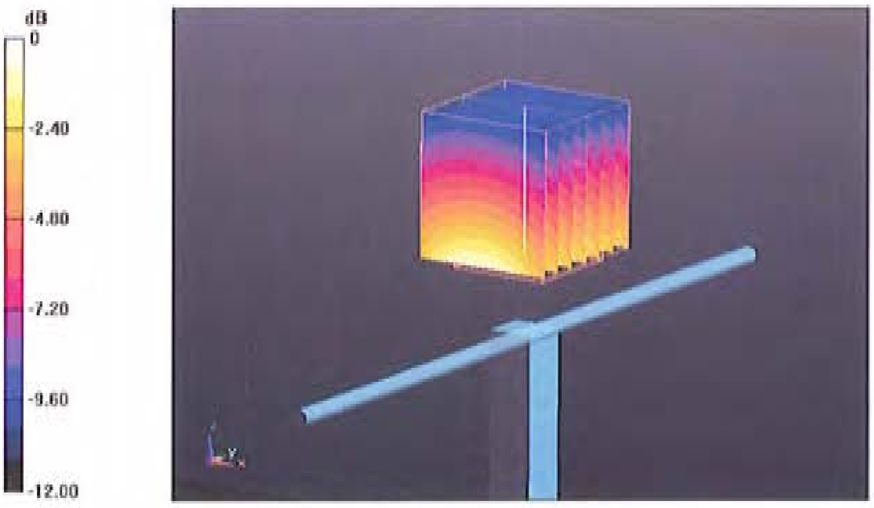
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:422

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: MSL900
Medium parameters used: f = 835 MHz; σ = 0.99 mho/m; ε_r = 54.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

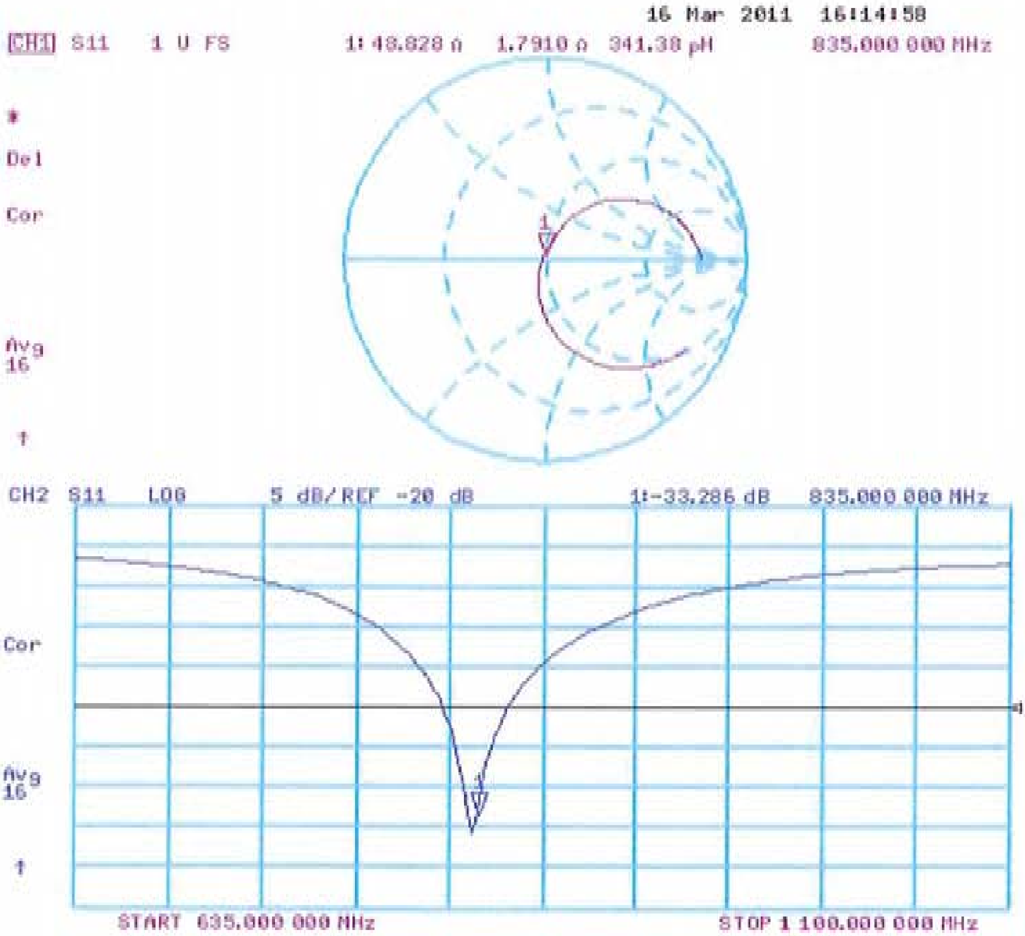
- Probe: ES3DV3 - SN3205; ConvF(5.86, 5.86, 5.86); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.6.2 Build (424)
- Postprocessing SW: SEMCAD X, V14.4.4 Build (2829)

Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.816 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.673 W/kg
SAR(1 g) = 2.49 mW/g; SAR(10 g) = 1.63 mW/g
Maximum value of SAR (measured) = 2.900 mW/g



0 dB = 2.900mW/g

Impedance Measurement Plot for Body TSL



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

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

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

Accreditation No.: **SCS 108**

Client **Motorola MDb**

Certificate No: **D5GHzV2-1098_Jan11**

CALIBRATION CERTIFICATE

Object: D5GHzV2 - SN: 1098

Calibration procedure(s): QA CAL-22.v1
Calibration procedure for dipole validation kits between 3-6 GHz

Calibration date: January 07, 2011

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	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe EX3DV4	SN: 3503	05-Mar-10 (No. EX3-3503_Mar10)	Mar-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

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

Issued: January 11, 2011

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.

Measurement Conditions

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

DASY Version	DASY5	V52.6
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Area Scan resolution	dx, dy = 10 mm	
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 2.0 mm	
Frequency	5200 MHz ± 1 MHz 5800 MHz ± 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 ± 0.2) °C	35.3 ± 6 %	4.50 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 0.2) °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	8.28 mW / g
SAR normalized	normalized to 1W	82.8 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**82.5 mW / g ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.35 mW / g
SAR normalized	normalized to 1W	23.5 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**23.4 mW / g ± 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	35.5 ± 6 %	5.17 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	condition	
SAR measured	100 mW input power	8.22 mW / g
SAR normalized	normalized to 1W	82.2 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**82.2 mW / g ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.31 mW / g
SAR normalized	normalized to 1W	23.1 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**23.1 mW / g ± 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	47.2 ± 6 %	5.37 mho/m ± 6 %
Body TSL temperature during test	(21.5 ± 0.2) °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	condition	
SAR measured	100 mW input power	7.81 mW / g
SAR normalized	normalized to 1W	78.1 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**77.5 mW / g ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.17 mW / g
SAR normalized	normalized to 1W	21.7 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**21.5 mW / g ± 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	46.1 ± 6 %	6.14 mho/m ± 6 %
Body TSL temperature during test	(21.5 ± 0.2) °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	7.37 mW / g
SAR normalized	normalized to 1W	7.37 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**73.1 mW / g ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.01 mW / g
SAR normalized	normalized to 1W	20.1 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**19.9 mW / g ± 19.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	51.3 Ω - 8.8 jΩ
Return Loss	-21.2 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	55.1 Ω - 0.6 jΩ
Return Loss	-26.2 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	51.4 Ω - 7.4 jΩ
Return Loss	-22.6 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	55.3 Ω + 1.5 jΩ
Return Loss	-25.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.206 ns

After long term use with 40 W 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.
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 24, 2010

DASY5 Validation Report for Head TSL

Date/Time: 07.01.2011 12:59:58

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1098

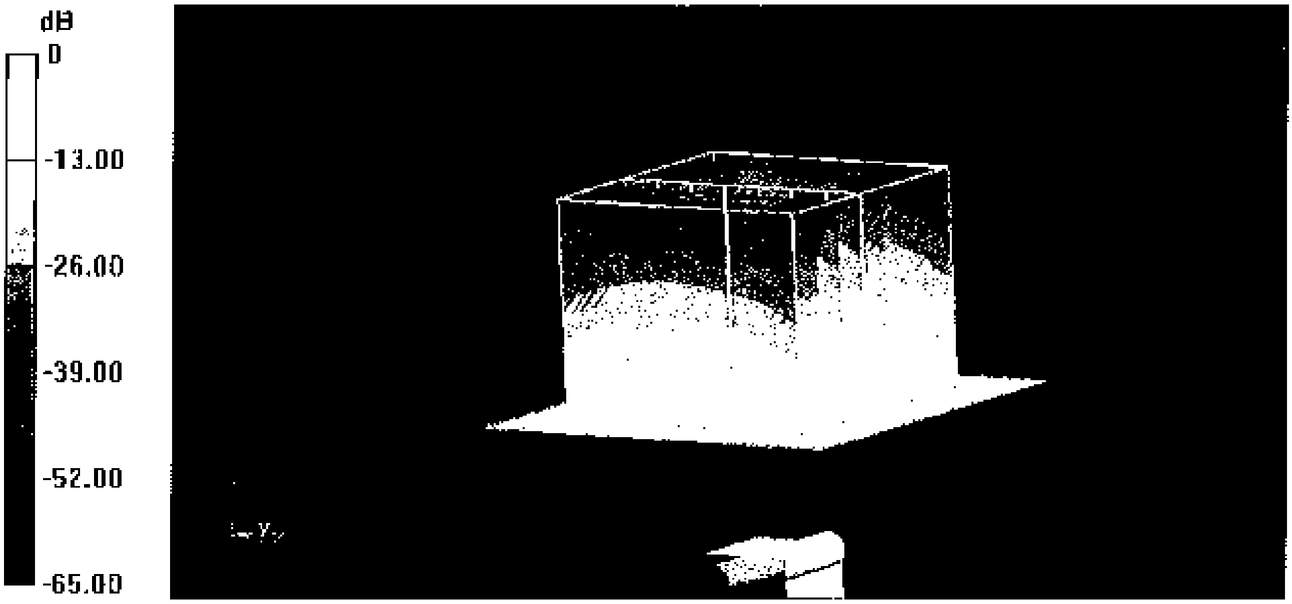
Communication System: CW; Frequency: 5200 MHz, Frequency: 5800 MHz; Duty Cycle: 1:1
Medium: HSL 5000
Medium parameters used: f = 5200 MHz; σ = 4.5 mho/m; εr = 35.3; ρ = 1000 kg/m3 ,
Medium parameters used: f = 5800 MHz; σ = 5.17 mho/m; εr = 35.5; ρ = 1000 kg/m3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.36, 5.36, 5.36), ConvF(4.85, 4.85, 4.85), ConvF(4.74, 4.74, 4.74); Calibrated: 05.03.2010
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

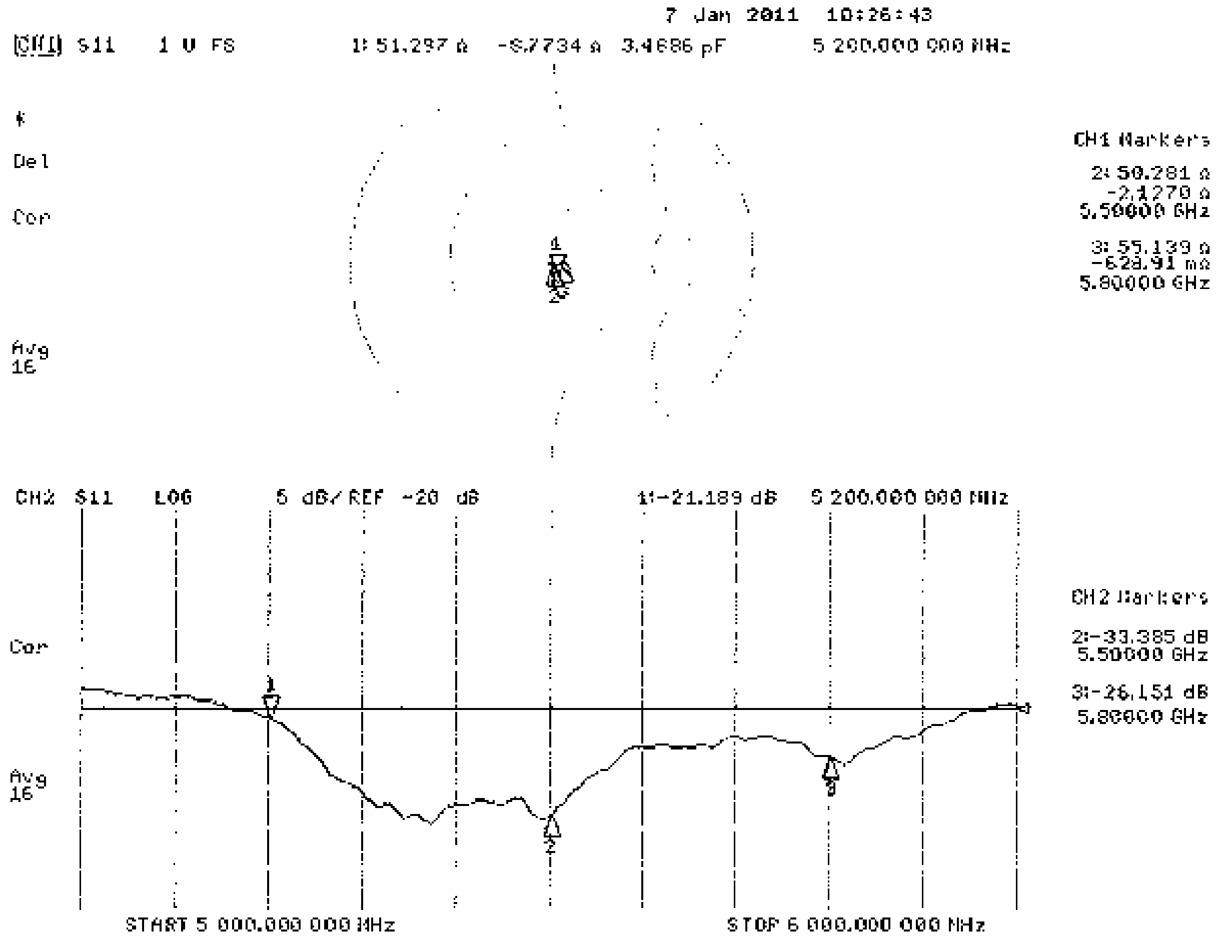
Pin=100mW/d=10mm, f=5200 MHz/Zoom Scan (4x4x2mm), dist=2mm (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 66.501 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 31.519 W/kg
SAR(1 g) = 8.28 mW/g; SAR(10 g) = 2.35 mW/g
Maximum value of SAR (measured) = 16.048 mW/g

Pin=100mW/d=10mm, f=5800 MHz/Zoom Scan (4x4x2mm), dist=2mm (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 62.703 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 34.812 W/kg
SAR(1 g) = 8.22 mW/g; SAR(10 g) = 2.31 mW/g
Maximum value of SAR (measured) = 16.262 mW/g



0 dB = 16.260mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 06.01.2011 13:18:41

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1098

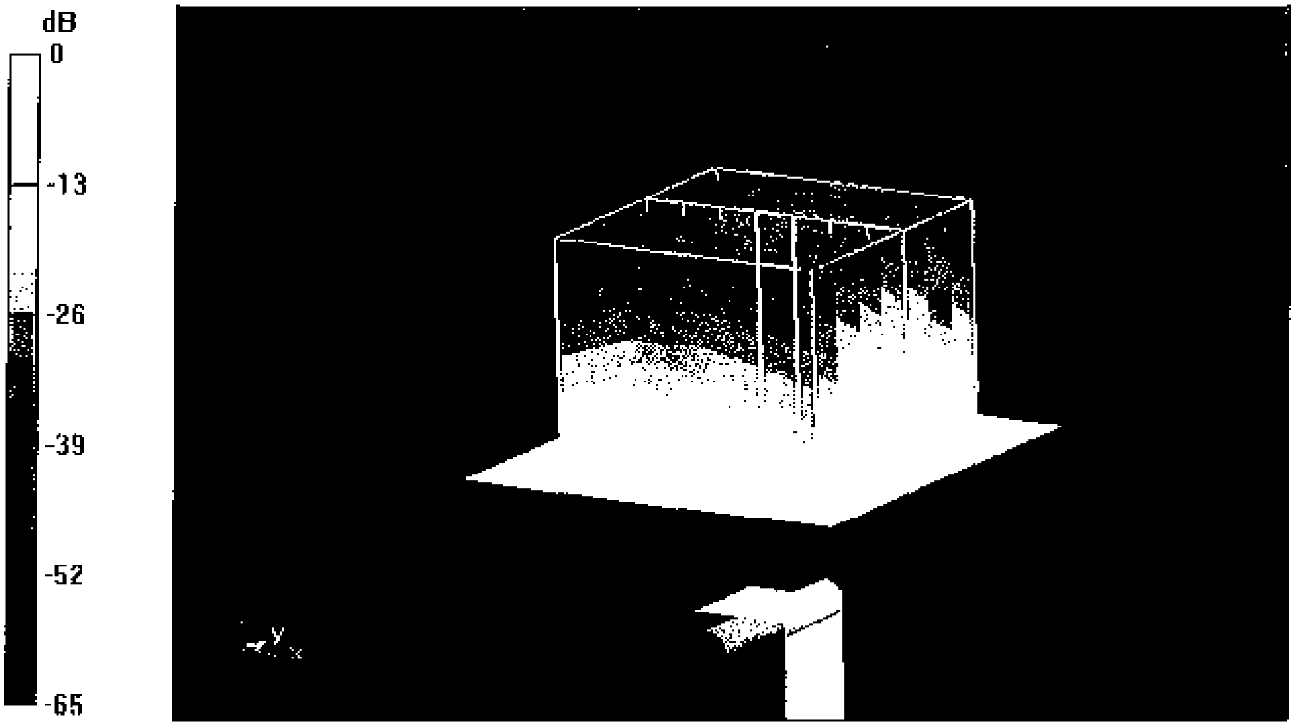
Communication System: CW; Frequency: 5200 MHz, Frequency: 5800 MHz; Duty Cycle: 1:1
Medium: MSL 5000 MHz
Medium parameters used: f = 5200 MHz; σ = 5.4 mho/m; ε_r = 47.2; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5800 MHz; σ = 6.18 mho/m; ε_r = 46.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.88, 4.88, 4.88), ConvF(4.37, 4.37, 4.37), ConvF(4.57, 4.57, 4.57); Calibrated: 05.03.2010
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

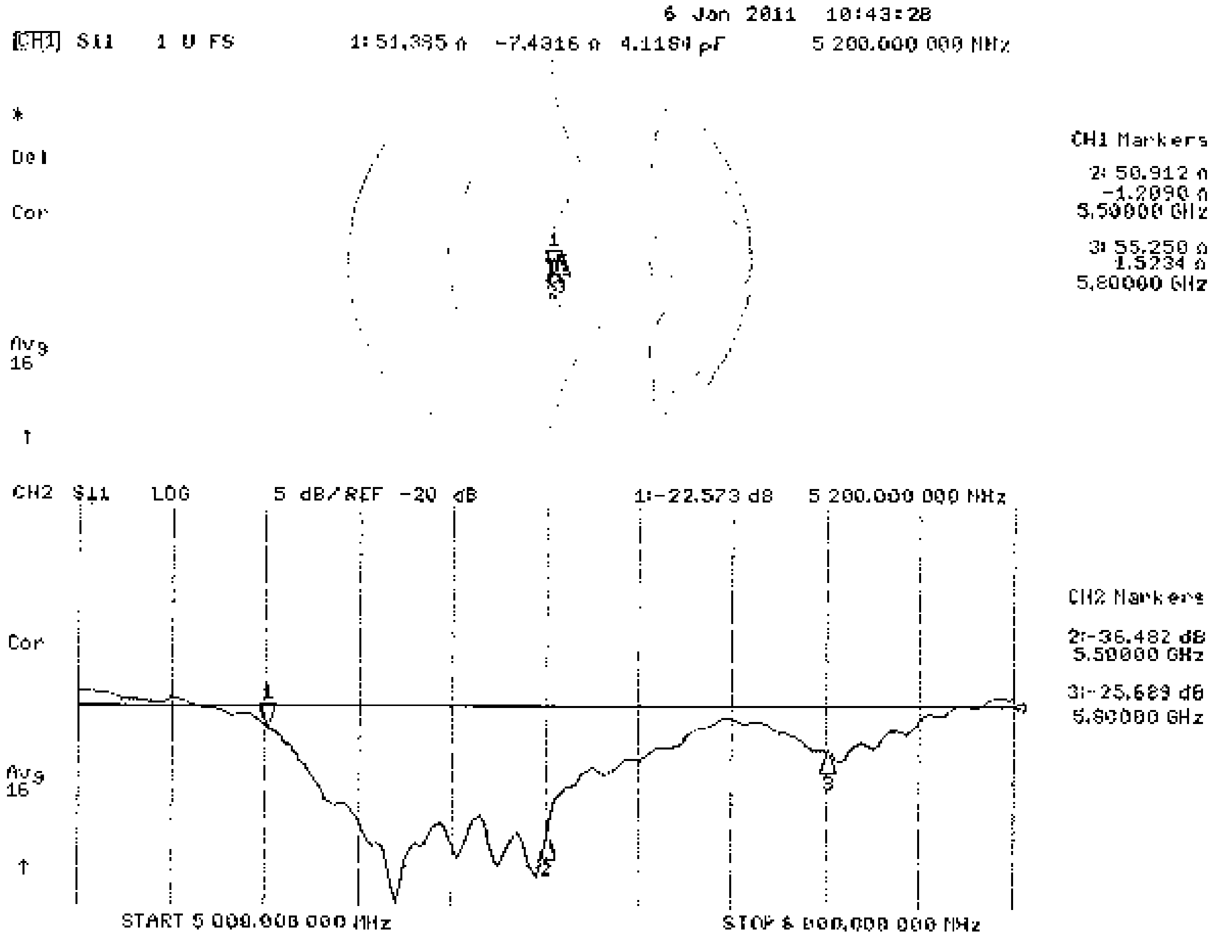
Pin=100mW/d=10mm, f=5200 MHz/Zoom Scan (4x4x2mm), dist=2mm (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 59.9 V/m; Power Drift = -0.00278 dB
Peak SAR (extrapolated) = 31.1 W/kg
SAR(1 g) = 7.81 mW/g; SAR(10 g) = 2.17 mW/g
Maximum value of SAR (measured) = 15.2 mW/g

Pin=100mW/d=10mm, f=5800 MHz/Zoom Scan (4x4x2mm), dist=2mm (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 54.4 V/m; Power Drift = -0.029 dB
Peak SAR (extrapolated) = 35.4 W/kg
SAR(1 g) = 7.37 mW/g; SAR(10 g) = 2.01 mW/g
Maximum value of SAR (measured) = 14.5 mW/g



0 dB = 14.5mW/g

Impedance Measurement Plot for Body TSL



END OF REPORT