Class II Permissive Change Portable Cellular Phone SAR Test Report

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

Test Report #: 24799/24700-1F Rev. B
Date of Report: Oct-31-2011, revised on Nov-15-2011
Date of Test: Oct 24 – 25, 2011
FCC ID #: IHDP56ME2
Generic Name: M0C2E

Test Laboratory: Motorola Mobility, Inc. - ADR Test Services Laboratory
600 N. US Highway 45
Libertyville, IL 60048

Report Author: Steve Hauswirth
Distinguished Member of the Technical Staff

Accreditation:

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)

2404

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 cellular telephone 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.

©Motorola Mobility, Inc. 2011

This test report shall not be reproduced except in full, without written approval of the laboratory. The results and statements contained herein relate only to the items tested. The names of individuals involved may be mentioned only in connection with the statements or results from this report. Motorola encourages all feedback, both positive and negative, on this test report.

Table of Contents

Revision History

Revision Version	Date	Notes
Rev. 0	Oct-31-2011	Initial report release.
Rev. A	Nov-15-2011	Correct typos in System Accuracy Verification Table
Rev. B	Nov-19-2011	Removed Dipole Calibration “measured” values because only the normalized values are utilized for comparison purposes.

1. Introduction

The Motorola Mobility ADR Test Services Laboratory has performed measurements of the maximum potential exposure to the user of portable cellular phone IHDP56ME2 when used with the Lapdock™ 500 accessory covered by this test report. The Specific Absorption Rate (SAR) of this product was measured. The portable cellular phone was setup, and the Lapdock ™ 500 was tested in accordance with [1], [4] and [5]. The SAR values measured for the portable cellular phone when used with the Lapdock™ 500 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].

For ANSI / IEEE C95.1 (1 g), the final stand-alone SAR readings for this phone are given in the table below. These measurements were performed using a Dasy4™ v4.7 system manufactured by Schmid & Partner Engineering AG (SPEAG), of Zurich Switzerland.

Transmit Band	w/ Lapdock 500 Accessory SAR (1 g $^{W}/_{kg}$)
GSM/GPRS 850	0.93
GSM/GPRS 1900	0.10
WCDMA 850	0.58
WCDMA 1900	0.90
Wi-Fi 2.45 GHz	0.66

Section 2 Provided for Reference Only
Specifying Phone Utilized for Testing
ALL DATA COPIED FROM ORIGINAL IHDP56ME2 TEST REPORT

2. Description of the Phone Used for Accessory Testing

2.1 Antenna description

GSM/WCDMA (800/1900 MHz) Antenna

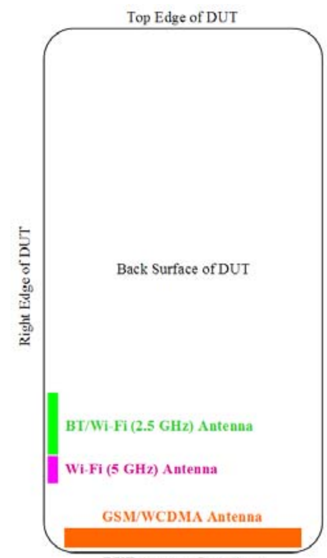
Type	Internal	
Location	Bottom Rear of Transceiver	
Dimensions	Width	1.3 mm
	Length	53.5 mm

Bluetooth/Wi-Fi (2.5 GHz) Antenna

Type	Internal	
Location	Right-Edge Rear of Transceiver	
Dimensions	Width	0.5 mm
	Length	16.2 mm

Wi-Fi (5 GHz) Antenna

Type	Internal	
Location	Right-Edge Rear of Transceiver	
Dimensions	Width	0.5 mm
	Length	3.9 mm



DUT Antenna Locations

2.2 Device Signaling[1]

Serial Number(s) (Functional Use)	LS3A280035 (GSM/WCDMA conducted power measurements, GSM/WCDMA/Wi-Fi lapdock SAR testing)
Production Unit or Identical Prototype (47 CFR §2..908)	Identical Prototype
Device Category	Portable (Mobile Station Class B)
RF Exposure Limits	General Population / Uncontrolled

Mode(s) of Operation	Modulation Mode(s)	Maximum Output Power Setting	Duty Cycle	Transmitting Frequency Range(s)
GSM 850	GMSK	33.5 dBm	1:8	824.2 - 848.8 MHz
GSM 1900	GMSK	31.0 dBm	1:8	1850.2 - 1909.8 MHz
WCDMA 850	QPSK	24.0 dBm	1:1	826.4 - 846.6 MHz
WCDMA 1900	QPSK	24.0 dBm	1:1	1852.4 - 1907.6 MHz
Wi-Fi 802.11b/g/n	BPSK	16.15 dBm	1:1	2412.0 - 2462.5 MHz
Wi-Fi 802.11a/n	BPSK	11.41 dBm	1:1	5180.0 - 5240.0 MHz, 5260.0 - 5320.0 MHz, 5500.0 - 5700.0 MHz, 5745.0 - 5805.0 MHz
Bluetooth	GFSK	9.57 dBm	1:1	2402.0 - 2483.5 MHz

GSM Data Functionality	GPRS/EDGE Class 12 (4 uplink timeslots; 4 downlink timeslots; 5 total timeslots per frame)
	Class B (DTM not supported)

[1] **Bolded** entries indicate data mode configurations of highest time-average power output per band and data mode type, and thus were utilized for SAR testing in this report.

Mode(s) of Operation	GPRS/EDGE 850				GPRS/EDGE 1900			
Modulation	GMSK				GMSK			
Maximum Output Power Setting (dBm)	33.5	30.5	**28.8**	27.5	31.0	28.0	**26.5**	25.0
Time Average Output Power Setting (dBm)	24.5	24.5	**24.6**	24.5	22.0	22.0	**22.3**	22.0
Duty Cycle	1:8	2:8	**3:8**	4:8	1:8	2:8	**3:8**	4:8
Transmitting Frequency Range(s)	824.2 - 848.8 MHz				1850.2 - 1909.8 MHz			

Mode(s) of Operation	EDGE 850				EDGE 1900			
Modulation	8PSK				8PSK			
Maximum Output Power Setting (dBm)	28.6	25.6	**23.9**	22.6	27.8	24.8	**23.1**	21.8
Time Average Output Power Setting (dBm)	19.6	19.6	**19.7**	19.6	18.8	18.8	**18.9**	18.8
Duty Cycle	1:8	2:8	**3:8**	4:8	1:8	2:8	**3:8**	4:8
Transmitting Frequency Range(s)	824.2 - 848.8 MHz				1850.2 - 1909.8 MHz			

2.2.1 Power limit reduction schemes

For specified modes of operation, the DUT utilizes reduced maximum power limits to maintain compliance to SAR exposure limits. Complete descriptions of the following functionalities are provided in the Operational Description contained within Exhibit 12. The implementations to trigger the reductions in power require the device to be radiating, which prevents conducted power measurements of these functionalities without modification of the DUT.

The DUT utilizes reduced limits for the maximum WCDMA 1900 band transmit power on the high channel range when the mobile hotspot functionality is enabled. A table of the reduced limits used for testing is given below.

Mode(s) of Operation	WCDMA 1900		
Test Channel	9262	9400	9538
Channel Ranges	9262-9367	9368-9455	9456-9538
Maximum Output Power Setting (dBm)	24.0	24.0	24.0
Reduced Maximum Output Power Setting (dBm)	24.0	24.0	22.0
Duty Cycle	1:1	1:1	1:1

2.3 Device Conducted Power Measurements

2.3.1 GSM modes

Band	Channel		Conducted power (dBm) for GSM modes[2]							
		GSM *CS Voice* (1 Slot)	GPRS *PS Data* (1 Slot)	GPRS *PS Data* (2 Slots)	GPRS *PS Data* (3 Slots)[3]	GPRS *PS Data* (4 Slots)	EDGE *PS Data* (1 Slot)	EDGE *PS Data* (2 Slots)	EDGE *PS Data* (3 Slots)	EDGE *PS Data* (4 Slots)
GSM 850	128	33.41	33.54	30.55	**28.79**	27.70	28.56	25.57	23.65	22.49
	190	33.41	33.55	30.47	**28.77**	27.57	28.40	25.71	23.64	22.56
	251	33.30	33.45	30.44	**28.77**	27.52	28.55	25.62	23.78	22.69
GSM 1900	512	31.16	31.04	28.19	**26.61**	25.08	27.66	24.60	22.96	21.62
	661	31.20	31.06	28.02	**26.30**	24.92	27.72	24.60	22.87	21.62
	810	31.00	31.07	28.14	**26.57**	25.04	27.87	24.88	23.11	22.01

2.3.2 WCDMA modes

Per the "SAR Measurement Procedures for 3G Devices" released in October, 2007, 12.2 kbps RMC, 12.2 kbps AMR, HS-DPCCH Sub-test 1-4, and E-DCH Sub-test 1-5 modes were considered. The conducted power measurements (per section 5.2 of 3GPP TS 34.121) for each mode are shown in the table below.

Band	Channel	Conducted power (dBm) for WCDMA modes		Conducted Power (dBm) for WCDMA – HSDPA (Rel 5) Modes				Conducted Power (dBm) for WCDMA – HSPA (HSUPA/HSDPA-Rel 6) Modes				
		RMC	AMR	Subtest 1	Subtest 2	Subtest 3	Subtest 4	Subtest 1	Subtest 2	Subtest 3	Subtest 4	Subtest 5
WCDMA 850	4132	23.87	23.87	23.96	23.97	23.98	23.96	23.93	23.93	23.94	23.94	23.97
	4180	23.83	23.88	23.88	23.98	23.93	24.01	23.92	23.96	23.91	23.95	23.94
	4233	23.90	24.02	24.01	24.02	23.97	24.06	23.95	24.01	23.98	24.00	23.97
WCDMA 1900	9262	24.10	24.05	24.05	23.94	24.12	24.00	24.16	24.01	24.14	24.01	24.10
	9400	23.87	23.66	23.84	23.83	23.81	23.78	23.81	23.78	23.81	23.77	23.83
	9538	23.83	23.88	23.79	23.89	23.82	23.92	23.79	23.92	23.81	23.87	23.82

Maximum Power Reduction (MPR)

According to 3GPP 25.101 sub-clause 6.2.2, the maximum output power is allowed to be reduced by following the table.

Table 6.1A: UE maximum output power with HS-DPCCH and E-DCH

UE transmit channel configuration	CM (dB)	MPR (dB)
For all combinations of; DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH	$0 \leq CM \leq 3.5$	MAX (CM-1, 0)
Note 1: CM = 1 for β_c/β_d =12/15, β_{hs}/β_c=24/15. For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.		

[2] *CS Voice* denotes circuit-switched transmission for voice calling, and *PS Data* denotes packet-switched transmission for data sessions.

[3] **Bolded** entries indicate data mode configurations of highest time-average power output per band and data mode type, and thus were utilized for SAR testing in this report.

The device supports MPR to solve linearity issues (ACLR or SEM) due to the higher peak-to-average ratios (PAR) of the HSUPA signal. This prevents saturating the full range of the TX DAC inside of device and provides a reduced power output to the RF transceiver chip according to the Cubic Metric (a function of the combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH).

When E-DPDCH channels are present, the beta gains on those channels are reduced first to try to get the power under the allowed limit. If the beta gains are lowered as far as possible, then a hard limiting is applied at the maximum allowed level.

The SW currently recalculates the cubic metric every time the beta gains on the E-DPDCH are reduced. The cubic metric will likely get lower each time this is done. However, there is no reported reduction of maximum output power in the HSUPA mode since the device also provides a mechanism to compensate for the power back-off by increasing the gain of TX_AGC in the transceiver (PA) device.

The end effect is that the DUT output power is identical to the case where there is no MPR in the device.

2.3.3 Wi-Fi 802.11 modes

Per “SAR Measurement Procedures for 802.11 a/b/g Transmitters” (FCC KDB 248227), power measurements were performed for 802.11 operational modes. The average conducted power measurements for each mode are shown in the tables below.

Justification for reduced test configurations for WiFi channels per KDB pub 248227 and April FCC/TCB Meeting Notes:

- For 2.4 GHz, highest average RF output power channel for the lowest data rate were selected for SAR evaluation. 802.11g & n modes were not investigated since the average output powers were not greater than 0.25 dB than that of the corresponding channel in the lowest data rate IEEE 802.11b.
- For 5 GHz, highest average RF output power channel for the lowest data rate in each sub-band were selected for SAR evaluation. Other channels were not investigated since the average output powers were not greater than 0.25 dB than that of the corresponding channel in the lowest data rate tested.

Mode	Freq	Channel	**Conducted Power [dBm]**			
			Data Rate [Mbps]			
	[MHz]		**1**	**2**	**5.5**	**11**
802.11b	2412	1	15.25	15.27	15.26	15.34
802.11b	2437	6	15.62	15.68	15.67	15.63
802.11b	2462	11	16.15	16.08	16.14	16.09

Mode	Freq	Channel	**Conducted Power [dBm]**							
			Data Rate [Mbps]							
	[MHz]		**6**	**9**	**12**	**18**	**24**	**36**	**48**	**54**
802.11g	2412	1	15.11	15.11	14.02	14.02	12.11	12.14	12.10	12.06
802.11g	2437	6	15.60	15.55	14.50	14.52	12.58	12.54	12.56	12.70
802.11g	2462	11	15.91	15.85	14.84	14.96	12.90	12.93	12.90	13.08

Mode	Freq	Channel	**Conducted Power [dBm]**							
			Data Rate [Mbps] 800 ns Guard Interval							
	[MHz]		**6.5**	**13**	**20**	**26**	**39**	**52**	**58**	**65**
802.11n	2412	1	13.45	13.95	13.91	12.10	12.09	11.95	12.10	9.55
802.11n	2437	6	13.89	14.55	14.44	12.60	12.65	12.61	12.50	10.00
802.11n	2462	11	14.30	14.76	14.74	13.06	12.89	12.88	12.89	10.49

Mode	Freq	Channel	**Conducted Power [dBm]**							
			Data Rate [Mbps] 400 ns Guard Interval							
	[MHz]		**7.2**	**14.4**	**22**	**29**	**43**	**58**	**65**	**72**
802.11n	2412	1	13.46	13.89	13.90	12.08	12.05	11.98	11.98	9.63
802.11n	2437	6	13.93	14.53	14.47	12.61	12.67	12.59	12.50	10.10
802.11n	2462	11	14.33	14.74	14.83	12.96	12.85	12.82	12.82	10.47

Mode	Freq [MHz]	Channel	Conducted Power [dBm]							
			Data Rate [Mbps]							
			6	**9**	**12**	**18**	**24**	**36**	**48**	**54**
802.11a	5180	36	11.09	11.07	11.02	11.10	10.98	11.00	11.09	10.97
802.11a	5200	40	11.00	11.05	11.01	10.92	10.86	10.86	10.92	10.90
802.11a	5220	44	10.87	10.90	10.90	10.89	10.87	10.80	10.89	10.85
802.11a	5240	48	10.89	10.86	10.82	10.87	10.75	10.84	10.81	10.81
Mode	Freq [MHz]	Channel	Conducted Power [dBm]							
			Data Rate [Mbps] 800 ns Guard Interval							
			6.5	**13**	**20**	**26**	**39**	**52**	**58**	**65**
802.11n	5180	36	11.05	11.06	11.08	11.16	11.18	11.12	11.14	11.22
802.11n	5200	40	11.01	11.01	11.07	11.09	11.09	11.08	11.05	11.17
802.11n	5220	44	11.03	11.02	10.98	11.04	11.05	11.05	11.00	11.13
802.11n	5240	48	10.99	10.94	10.97	11.07	11.03	11.00	11.05	11.11
Mode	Freq [MHz]	Channel	Conducted Power [dBm]							
			Data Rate [Mbps] 400 ns Guard Interval							
			7.2	**14.4**	**22**	**29**	**43**	**58**	**65**	**72**
802.11n	5180	36	10.92	10.91	10.92	11.06	10.97	10.94	10.91	11.00
802.11n	5200	40	10.86	10.77	10.81	10.90	10.88	10.87	10.82	10.94
802.11n	5220	44	10.83	10.79	10.78	10.87	10.85	10.85	10.86	10.93
802.11n	5240	48	10.84	10.79	10.77	10.84	10.88	10.80	10.82	10.94

Mode	Freq [MHz]	Channel	Conducted Power [dBm]							
			Data Rate [Mbps]							
			6	**9**	**12**	**18**	**24**	**36**	**48**	**54**
802.11a	5260	52	10.96	10.93	10.97	10.98	10.93	10.95	10.95	10.97
802.11a	5280	56	10.92	10.90	10.94	10.95	10.90	10.86	10.90	10.98
802.11a	5300	60	10.93	10.95	10.98	11.02	10.97	10.92	10.98	10.97
802.11a	5320	64	10.97	10.97	10.98	10.96	10.89	10.90	10.91	10.95
Mode	Freq [MHz]	Channel	Conducted Power [dBm]							
			Data Rate [Mbps] 800 ns Guard Interval							
			6.5	**13**	**20**	**26**	**39**	**52**	**58**	**65**
802.11n	5260	52	11.02	11.08	11.06	11.15	11.11	11.09	11.04	11.18
802.11n	5280	56	11.00	11.05	11.06	11.13	11.14	11.06	11.07	11.15
802.11n	5300	60	11.05	11.02	11.01	11.09	11.10	11.07	11.05	11.18
802.11n	5320	64	11.00	11.01	11.06	11.08	11.07	11.04	11.08	11.15
Mode	Freq [MHz]	Channel	Conducted Power [dBm]							
			Data Rate [Mbps] 400 ns Guard Interval							
			7.2	**14.4**	**22**	**29**	**43**	**58**	**65**	**72**
802.11n	5260	52	10.87	10.85	10.88	10.95	10.93	10.89	10.90	10.96
802.11n	5280	56	10.88	10.82	10.81	10.95	10.93	10.87	10.94	11.01
802.11n	5300	60	10.87	10.87	10.86	10.90	10.92	10.82	10.85	10.96
802.11n	5320	64	10.84	10.85	10.77	10.86	10.89	10.84	10.88	10.93

Mode	Freq	Channel	**Conducted Power [dBm]**							
			Data Rate [Mbps]							
	[MHz]		**6**	**9**	**12**	**18**	**24**	**36**	**48**	**54**
802.11a	5500	100	10.97	10.92	11.04	11.05	10.99	10.99	10.98	10.98
802.11a	5520	104	10.99	11.00	10.99	10.96	10.90	10.96	10.89	10.84
802.11a	5540	108	10.80	10.82	10.87	10.83	10.74	10.74	10.77	10.78
802.11a	5560	112	10.77	10.74	10.78	10.80	10.73	10.68	10.73	10.84
802.11a	5580	116	10.74	10.86	10.84	10.88	10.82	10.85	10.87	10.84
802.11a	5600	120	10.89	10.83	10.78	10.83	10.78	10.76	10.77	10.82
802.11a	5620	124	10.81	10.82	10.82	10.84	10.72	10.66	10.75	10.68
802.11a	5640	128	10.75	10.77	10.73	10.75	10.65	10.70	10.71	10.69
802.11a	5660	132	10.66	10.73	10.67	10.76	10.60	10.63	10.71	10.69
802.11a	5680	136	10.63	10.64	10.71	10.69	10.64	10.59	10.70	10.65
802.11a	5700	140	10.62	10.66	10.71	10.65	10.61	10.64	10.62	10.65

Mode	Freq	Channel	**Conducted Power [dBm]**							
			Data Rate [Mbps] 800 ns Guard Interval							
	[MHz]		**6.5**	**13**	**20**	**26**	**39**	**52**	**58**	**65**
802.11n	5500	100	11.25	11.33	11.25	11.35	11.32	11.26	11.25	11.39
802.11n	5520	104	11.23	11.22	11.23	11.36	11.29	11.24	11.26	11.35
802.11n	5540	108	11.22	11.27	11.25	11.29	11.29	11.24	11.23	11.36
802.11n	5560	112	11.24	11.22	11.18	11.29	11.30	11.25	11.24	11.36
802.11n	5580	116	11.16	11.18	11.22	11.24	11.31	11.24	11.20	11.30
802.11n	5600	120	11.14	11.15	11.17	11.17	11.20	11.13	11.18	11.27
802.11n	5620	124	11.05	11.07	11.19	11.14	11.11	11.12	11.17	11.25
802.11n	5640	128	11.06	11.05	11.08	11.10	11.15	11.08	11.09	11.16
802.11n	5660	132	11.04	11.03	11.04	11.07	11.12	11.02	11.03	11.15
802.11n	5680	136	10.96	10.95	10.99	11.06	11.07	10.99	11.02	11.12
802.11n	5700	140	10.90	10.95	10.97	11.02	11.04	10.99	10.97	11.08

Mode	Freq	Channel	**Conducted Power [dBm]**							
			Data Rate [Mbps] 400 ns Guard Interval							
	[MHz]		**7.2**	**14.4**	**22**	**29**	**43**	**58**	**65**	**72**
802.11n	5500	100	11.06	11.07	11.08	11.11	11.16	11.08	11.05	11.22
802.11n	5520	104	10.97	11.00	11.01	11.08	11.02	11.18	11.00	11.05
802.11n	5540	108	10.99	11.03	11.00	11.04	11.02	11.09	11.04	11.11
802.11n	5560	112	11.24	11.22	11.19	11.33	11.36	11.30	11.31	11.41
802.11n	5580	116	11.21	11.25	11.20	11.23	11.31	11.21	11.24	11.32
802.11n	5600	120	11.13	11.18	11.12	11.25	11.22	11.16	11.19	11.29
802.11n	5620	124	11.14	11.11	11.15	11.16	11.19	11.12	11.15	11.25
802.11n	5640	128	11.06	11.06	11.09	11.15	11.17	11.09	11.11	11.25
802.11n	5660	132	11.06	11.06	11.05	11.15	11.15	11.10	11.08	11.20
802.11n	5680	136	10.99	11.00	11.03	11.09	11.12	11.07	11.03	11.14
802.11n	5700	140	10.99	10.96	10.97	11.08	11.10	11.02	11.01	11.13

Mode	Freq [MHz]	Channel	Conducted Power [dBm]							
			Data Rate [Mbps]							
			6	**9**	**12**	**18**	**24**	**36**	**48**	**54**
802.11a	5745	149	10.50	10.45	10.52	10.49	10.45	10.40	10.48	10.52
802.11a	5765	153	10.51	10.48	10.54	10.59	10.42	10.45	10.42	10.44
802.11a	5785	157	10.55	10.57	10.50	10.46	10.40	10.39	10.45	10.40
802.11a	5805	161	10.52	10.49	10.42	10.50	10.45	10.40	10.40	10.47
802.11a	5825	165	10.49	10.42	10.47	10.50	10.39	10.40	10.35	10.43

Mode	Freq [MHz]	Channel	Conducted Power [dBm]							
			Data Rate [Mbps] 800 ns Guard Interval							
			6.5	**13**	**20**	**26**	**39**	**52**	**58**	**65**
802.11n	5745	149	10.81	10.77	10.75	10.86	10.87	10.77	10.81	10.94
802.11n	5765	153	10.78	10.80	10.72	10.84	10.88	10.80	10.81	10.91
802.11n	5785	157	10.76	10.75	10.74	10.78	10.82	10.76	10.75	10.88
802.11n	5805	161	10.71	10.74	10.68	10.79	10.82	10.78	10.79	10.90
802.11n	5825	165	10.73	10.77	10.71	10.85	10.83	10.79	10.75	10.90

Mode	Freq [MHz]	Channel	Conducted Power [dBm]							
			Data Rate [Mbps] 400 ns Guard Interval							
			7.2	**14.4**	**22**	**29**	**43**	**58**	**65**	**72**
802.11n	5745	149	10.87	10.85	10.80	10.92	10.89	10.85	10.84	11.00
802.11n	5765	153	10.80	10.80	10.79	10.86	10.91	10.85	10.86	10.97
802.11n	5785	157	10.80	10.79	10.79	10.89	10.92	10.79	10.78	10.98
802.11n	5805	161	10.81	10.81	10.82	10.86	10.88	10.81	10.80	10.92
802.11n	5825	165	10.25	10.30	10.27	10.37	10.33	10.37	10.31	10.46

3. Test Equipment Used

3.1 Dosimetric System

The Motorola Mobility ADR Test Services 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 6. 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	3115	Jan-12-2011	Jan-12-2012
S.A.M. Phantom used for 800/1900/2450 MHz	TP-1131		
Dipole Validation Kit, DV835V2	420	Jul-8-2011	Jul-8-2012
Dipole Validation Kit, DV1800V2	250	Mar-17-2011	Mar-17-2012
Dipole Validation Kit, DV2450V2	863	Mar-17-2011	Mar-17-2012

3.2 Additional Equipment

Description	Serial Number	Cal Date	Cal Due Date
Signal Generator HP8648C	3847A04982	Nov-18-2009	Nov-18-2011
Power Meter E4419B	GB39510900	Mar-28-2011	Mar-28-2013
Power Sensor #1 - E9301A	US39211007	Aug-16-2011	Aug-16-2012
Power Sensor #2 - E9301A	US39211008	Aug-16-2011	Aug-16-2012
Signal Generator HP8648C	3847A04632	Aug-13-2011	Aug-13-2013
Power Meter E4419B	GB39511087	Dec-22-2009	Dec-22-2011
Power Sensor #1 - E9301A	US39211007	Aug-25-2011	Aug-25-2012
Power Sensor #2 - E9301A	US39211008	Aug-25-2011	Aug-25-2012
Signal Generator HP8648C	3847A04843	Mar-28-2011	Mar-28-2013
Power Meter E4419B	GB39511084	Mar-28-2011	Mar-28-2013
Power Sensor #1 - E9301A	US39210929	Mar-31-2011	Mar-31-2012
Power Sensor #2 - E9301A	US39210930	Mar-31-2011	Mar-31-2012
Network Analyzer HP8753ES	US39171846	May-19-2011	May-19-2012
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].

E-field probes calibrated at 1810 MHz were used for "1900 MHz" band (1850 MHz - 1910 MHz) SAR measurements. FCC KDB 450824 provides additional requirements on page 3 of 6 for SAR testing that is performed with probe calibration points that are more than 50 MHz removed from the measured bands. The KDB requires; “(2) When nominal tissue dielectric parameters are specified in the probe calibration data, the tissue dielectric parameters measured for routine measurements should be less than the target Er and higher than the target Sigma values to minimize SAR underestimations”. The 1900 MHz simulated tissues listed below meet these criteria.

f (MHz)	Tissue type	Limits / Measured	Dielectric Parameters		
			ε_r	σ (S/m)	Temp (°C)
835	**Body**	**Measured,** Oct-24-2011	53.6	0.97	18.4
		Recommended Limits	55.2 ±5%	0.97 ±5%	18-25
1880	**Body**	**Measured,** Oct-24-2011	50.9	1.58	18.6
		Recommended Limits	53.3 ±5%	1.52 ±5%	18-25
2450	**Body**	**Measured,** Oct-25-2011	50.3	1.93	20.2
		Recommended Limits	52.7 ±5%	1.95 ±5%	18-25

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

Ingredient	782 / 835 / 900 MHz Head	782 / 835 / 900 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	--

5. System Accuracy Verifications

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 7. 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). The simulated tissue depth was verified to be 15.0 cm ± 0.5 cm. Z-axis scans showing the SAR penetration are also included in Appendix 1. All system accuracy verifications were performed within 24 hours of SAR testing. The same phantoms, simulated tissue and test equipment were used for these verifications and the SAR testing.

System Accuracy Verification Measurements for Body SAR Measurements

f (MHz)	Description	Measured SAR (W/kg), 1 gram	Normalized SAR (W/kg), 1 gram	Dielectric Parameters ε_r	Dielectric Parameters σ (S/m)	Ambient Temp (°C)	Tissue Temp (°C)
835	**Measured,** Oct-24-2011	2.02	10.1	53.6	0.97	21.7	20.5
	Recommended Limits		9.39	55.2 ±5%	0.97 ±5%	18-25	18-25
1800	**Measured,** Oct-24-2011	7.94	39.7	51.3	1.48	21.2	20.6
	Recommended Limits		37.2	53.3 ±5%	1.52 ±5%	18-25	18-25
2450	**Measured,** Oct-25-2011	11.2	56.0	50.3	1.93	21.7	20.8
	Recommended Limits		52.8	52.7 ±5%	1.95 ±5%	18-25	18-25

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

Description	Serial Number	f (MHz)	Conversion Factor	Cal Cert pg #
E-Field Probe ES3DV3	3115	835	5.88	6 of 11
		1810	4.61	6 of 11
		2450	4.12	6 of 11

6. Lapdock 500 Accessory Test Results

The DUT supports the use of the Motorola Lapdock™ 500. SAR testing was performed with the DUT placed into the Lapdock™ 500 and the Lapdock™ 500 placed for testing per FCC KDB 616217. For GSM and WCDMA modes, the test sample was operated using an actual transmission through a base station simulator. Wi-Fi testing was conducted using manufacturer test mode software, per guidance given in FCC KDB 248227. The base station simulator or test software was set up for the proper channels, transmitter power levels and transmit modes of operation.

The Motorola Lapdock™ 500 supports the use of data modes within the phone for a data connection to the Internet. While the phone is attached to the Lapdock™ 500, the phone is still able to make an receive calls. These calls can be simultaneous to the data transmission, if the technology in the phone supports this (eg: WiFi and GSM). An evaluation of the simultaneous transmitter SAR is provided in section 6.5. The 5 GHz WiFi modes (802.11a/n) do not operate in with Lapdock™ 500.

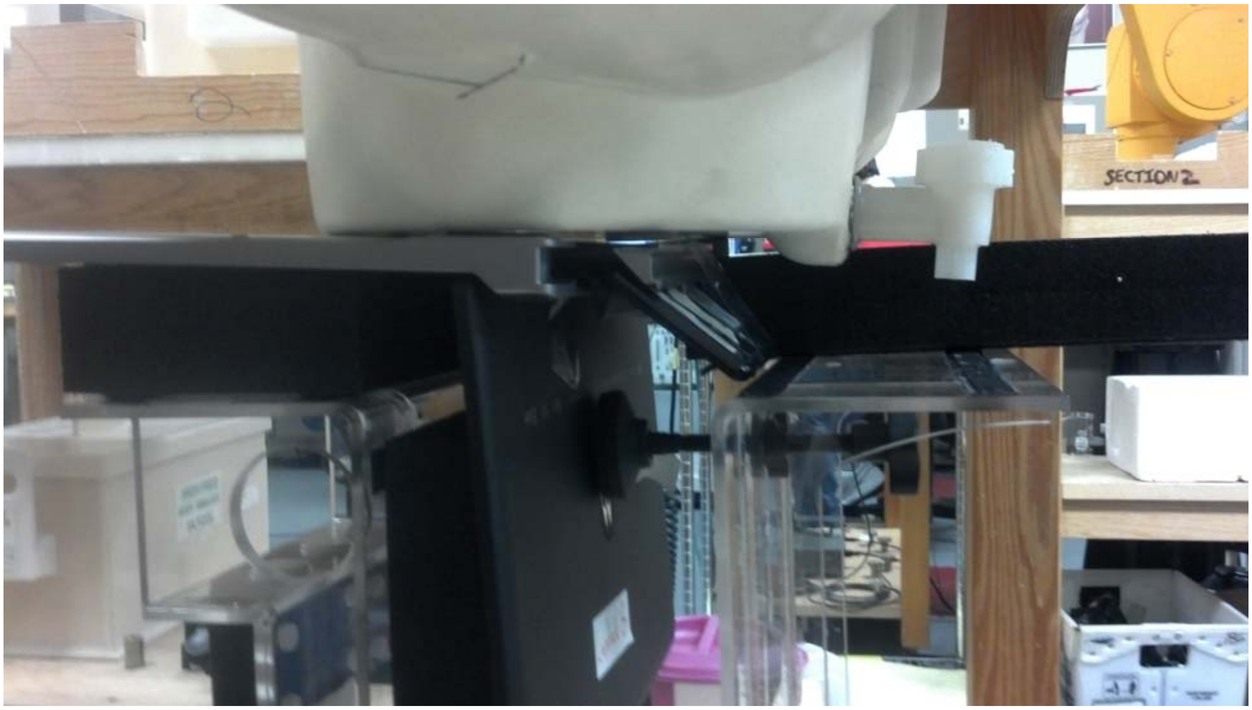
The SAR results shown in table 1 are maximum SAR values averaged over 1 gram of phantom tissue, to demonstrate compliance to [3] and also over 10 grams of phantom tissue, to demonstrate compliance to [6]. Also shown are the temperature of the simulated tissue after the test, the measured drift, the measured conducted output power levels, power reduction amount (when applicable), the measured SAR corrected for probe calibration (when applicable), and the extrapolated SAR. The exact method of extrapolation is:

$$\textit{Extrapolated SAR} = (\textit{Measured or Corrected SAR}) * 10^{(-drift/10)}$$

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 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.

The SAR measurements were performed using the flat section of the SAM phantoms listed in section 3.1. The simulated tissue depth was verified to be 15.0 cm ± 0.5 cm. The DUT and Lapdock™ 500 were placed using a Laptop Extension Kit available from SPEAG™ that facilitates the testing of larger devices according to IEC 62209-2 (e.g., laptops, cameras, etc.). The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin-SAM Phantoms.



The following probe conversion factors were used on the E-Field probe(s) used for the Lapdock™ 500 body measurements:

Description	Serial Number	f (MHz)	Conversion Factor	Cal Cert pg #
E-Field Probe ES3DV3	3115	835	5.88	6 of 11
		1810	4.61	6 of 11
		2450	4.12	6 of 11

Lapdock against Body, Bottom Surface of Lapdock 500 Placed 0 mm from Phantom, Screen opened 90 degrees															
f (MHz)	Mode	Battery/ Accessory	Channel	Temp (°C)	Drift (dB)	DUT Power		10 g SAR value			1 g SAR value			Test Plot	
						Measured (dBm)	Power Reduction (dB)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Measured (W/kg)	Corrected (W/kg)	Extrapolated (W/kg)	Grid	Plot Page
835	**GPRS 850, PS Data 3 Upslots**	SNN5899A	128												
			190	**20.1**	**-0.482**	**28.77**		**0.571**		**0.64**	**0.836**		**0.93**	**5x5x7**	
			251												
	GSM 850, CS Voice	SNN5899A	128												
			190	20.1	-0.0807	33.41		0.532		0.54	0.781		0.80		
			251												
	WCDMA 850, 12.2 kbps RMC	SNN5899A	4132												
			4180	**20.1**	**-0.043**	**23.83**		**0.398**		**0.40**	**0.578**		**0.58**	**5x5x7**	
			4233												
1880	**GPRS 1900, PS Data 3 Upslots**	SNN5899A	512												
			661	**20.5**	**-0.186**	**26.30**		**0.0596**		**0.06**	**0.10**		**0.10**	**5x5x7**	
			810												
	GSM 1900, CS Voice	SNN5899A	512												
			661	20.5	-0.001	31.20		0.0595		0.06	0.10		0.10		
			810												
	WCDMA 1900, 12.2 kbps RMC	SNN5899A	9262												
			9400	**20.5**	**-0.0201**	**23.87**		**0.506**		**0.51**	**0.891**		**0.90**	**5x5x7**	
			9538												
2450	**802.11b, 1 Mbps**	SNN5899A	1												
			6												
			11	**20.8**	**-0.0328**	**15.62**		**0.279**		**0.28**	**0.656**		**0.66**	**5x5x7**	

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

7.0 Description and Evaluation of Simultaneous Transmitters

Per "SAR Evaluation Considerations for Handsets with Multiple Transmitters and Antennas" (FCC KDB 648474), the necessity of stand-alone and simultaneous SAR testing was evaluated for the licensed and unlicensed transmitters of the device under test.

By device design the GSM and WCDMA transmitters may operate simultaneously with either the Wi-Fi 802.11 transmitter or the Bluetooth transmitter. The Bluetooth transmitter of the device under test can be excluded from stand-alone and simultaneous SAR evaluation, per the **bolded** requirements from FCC KDB 648474, as follows.

1. The highest output conducted power measured for Bluetooth on the device under test is 9.06 mW **[≤ 12 mW]**
2. The separation distance between the Bluetooth antenna and the GSM/WCDMA antenna is 2.34 cm **[< 2.5 cm]**
3. The highest 1-g Body-Worn SAR values for the other transmitters are:
GSM 850 (0.93 $^{W}/_{kg}$); GSM 1900 (0.10 $^{W}/_{kg}$); WCDMA 850 (0.58 $^{W}/_{kg}$); WCDMA 1900 (0.90 $^{W}/_{kg}$) **[< 1.2 $^{W}/_{kg}$]**

The Wi-Fi and the Bluetooth cannot transmit simultaneously, so there is no co-location test requirement for Wi-Fi and Bluetooth. GSM supports voice and data transmission, though not simultaneously. WCDMA supports voice and data transmission simultaneously.

Description of Simultaneous Transmit Capabilities				
Transmitter Combinations		Scenario Supported?	Supported for Mobile Hotspot?	Notes
#1	GSM (CS Voice) + GSM (PS Data)	No	No	DUT system architecture does not support simultaneous voice and data (except on WCDMA), multiple voice channels, or multiple data channels during a single session on the cellular network.
#2	WCDMA (Voice) + WCDMA (Data)	Yes	Yes	
#3	GSM (CS Voice) + WCDMA (Data)	No	No	
#4	WCDMA (Voice) + GSM (PS Data)	No	No	
#5	GSM (PS Data) + WCDMA (Data)	No	No	
#6	GSM (CS Voice) + WCDMA (Voice)	No	No	
#7	GSM (CS Voice) + Wi-Fi	Yes	No	Supported for voice plus background data.
#8	WCDMA (Voice) + Wi-Fi	Yes	No	
#9	GSM (PS Data) + Wi-Fi	Yes	Yes	Supported for mobile hotspot operation.
#10	WCDMA (Data) + Wi-Fi	Yes	Yes	

For the transmitters requiring stand-alone SAR testing (GSM, WCDMA, and Wi-Fi 802.11), the KDB guidelines direct that if the sum of the 1 g SAR measured for the simultaneously transmitting antennas is less than the SAR limit, SAR measurement 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. Evaluations of the head, body, and mobile hotspot simultaneous SAR summations for the worst-case SAR transmitter configurations are presented in the tables below.

The following LapDock™ 500 position SAR summations for simultaneous evaluation are provided to demonstrate a data link (over WiFi) with a simultaneous voice call (over GSM, WCDMA), and additionally evaluations for mobile hotspot connections (WiFi connected to one of the cellular data modes).

Evaluations for Simultaneous SAR, LapDock Position			
Transmit Mode	**SAR (W/Kg)**	**2.45 GHz WiFi SAR (W/Kg)**	**1 g SAR Summations (W/kg)**
GSM 850	0.80	0.66	1.46
GPRS 850	0.93	0.66	1.59
WCDMA 850	0.58	0.66	1.24
GSM 1900	0.10	0.66	0.76
GPRS 1900	0.10	0.66	0.76
WCDMA 1900	0.90	0.66	1.56

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)"

Appendix 1

SAR distribution comparisons for System Accuracy Verifications

Date/Time: 10/24/2011 3:39:40 PM

Test Laboratory: Motorola Mobility 835 MHz System Performance Check

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:420
Procedure Notes: PM1 Power = 200 mW Refl.Pwr PM3 = -19.7dB Sim.Temp@SPC = 20.5°C Room Temp @ SPC = 21.7°C
Communication System: CW - Dipole; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: BIG BODY Low Freq Body; Medium parameters used: f = 835 MHz; σ = 0.97 mho/m; ε_r = 53.6; ρ = 1000 kg/m^3

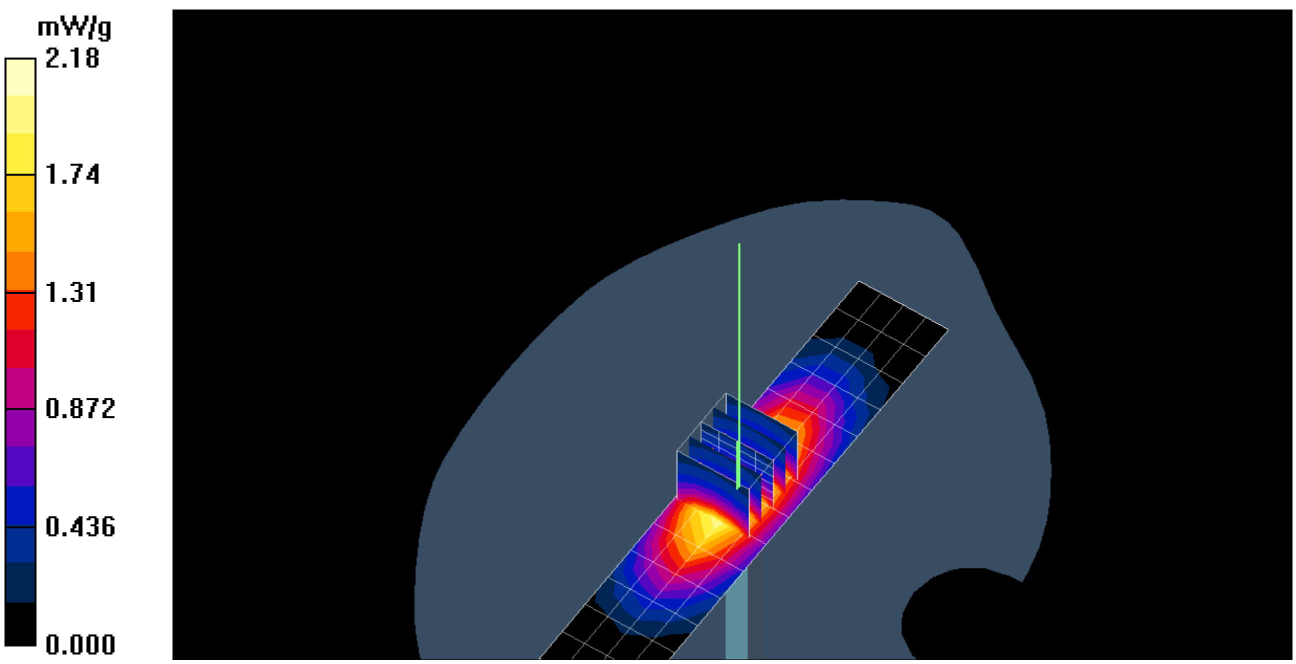
DASY4 Configuration:

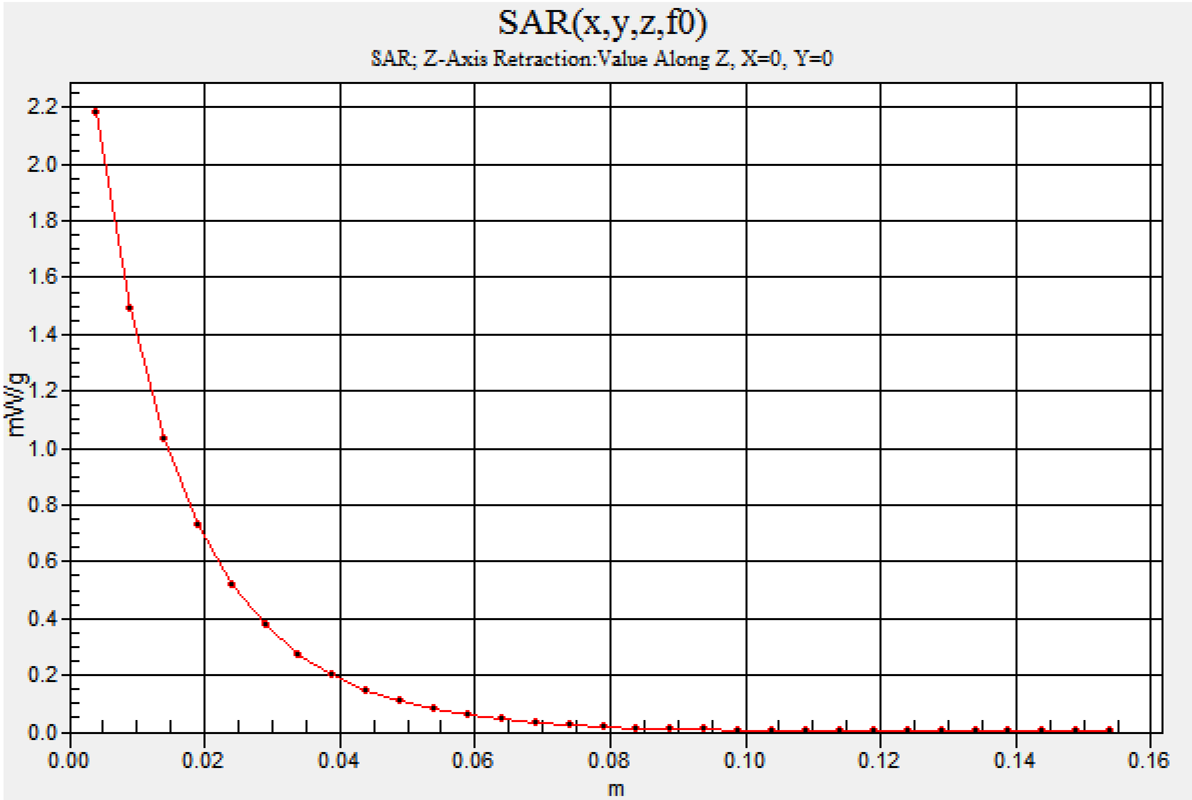
- Probe: ES3DV3 - SN3115; ConvF(5.88, 5.88, 5.88); Calibrated: 1/12/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#-6 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1131;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Daily SPC Check/Dipole Area Scan (5x15x1): Measurement grid: dx=10mm, dy=15mm
Maximum value of SAR (measured) = 2.19 mW/g

Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 48.8 V/m; Power Drift = -0.188 dB
Peak SAR (extrapolated) = 2.93 W/kg
SAR(1 g) = 2.02 mW/g; SAR(10 g) = 1.33 mW/g
Maximum value of SAR (measured) = 2.18 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
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: 10/24/2011 11:11:02 AM

Test Laboratory: Motorola Mobility 1800 MHz System Performance Check

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN:250
Procedure Notes: PM1 Power = 200 mW Refl.Pwr PM3 = -23.7dB Sim.Temp@SPC = 20.6ºC Room Temp @ SPC = 21.2ºC
Communication System: CW - Dipole; Frequency: 1800 MHz;Duty Cycle: 1:1
Medium: Validation *BODY Tissue* ; Medium parameters used: f = 1800 MHz; σ = 1.48 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3

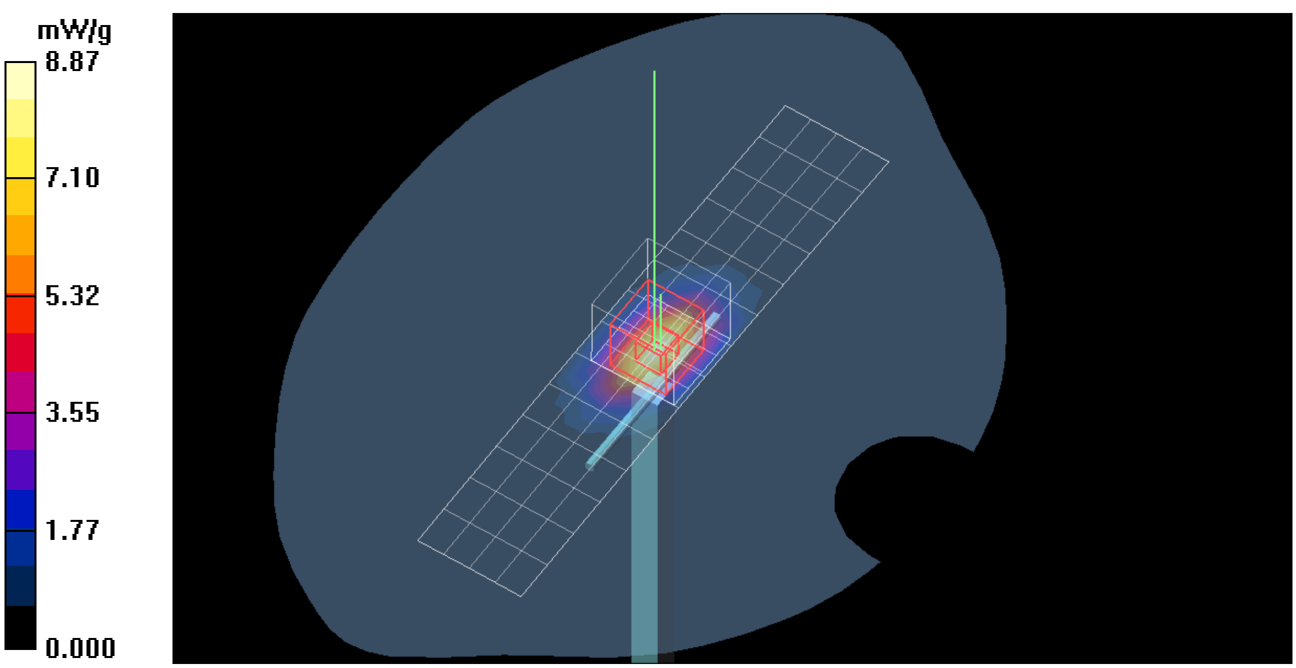
DASY4 Configuration:

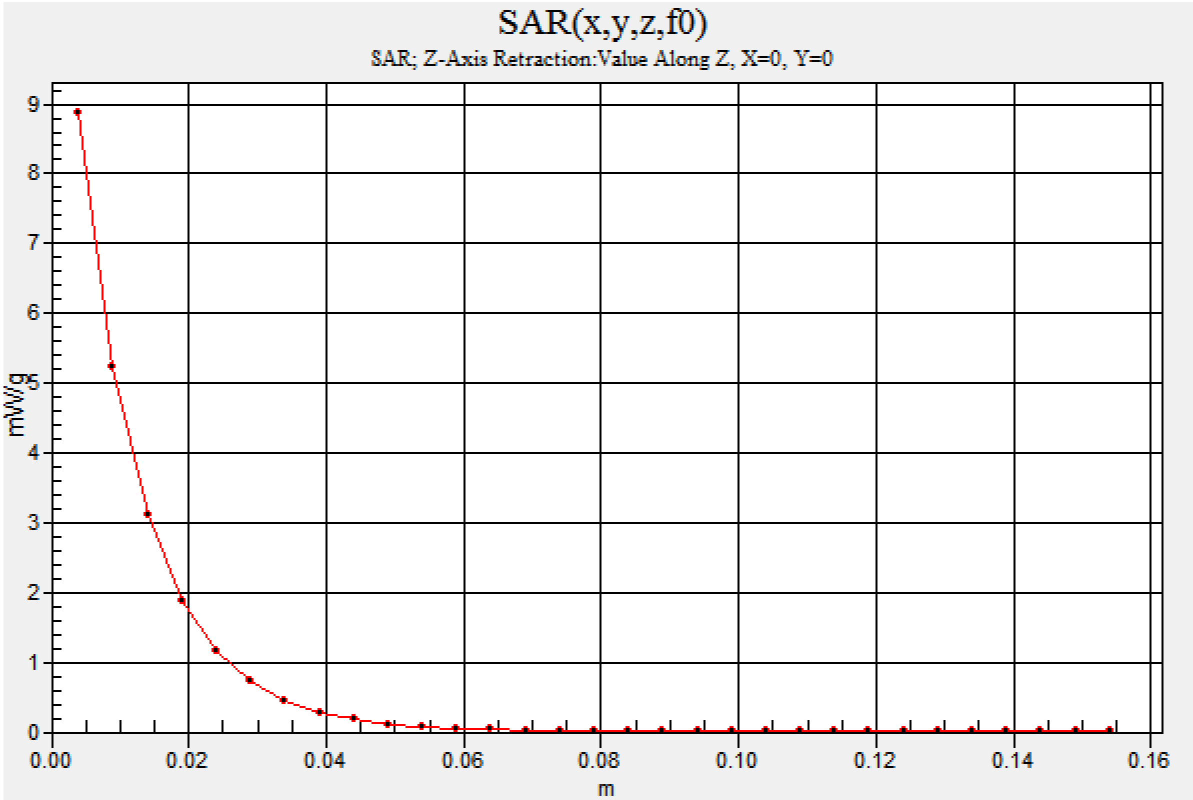
- Probe: ES3DV3 - SN3115; ConvF(4.61, 4.61, 4.61); Calibrated: 1/12/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#-6 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1131;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Daily SPC Check/Dipole Area Scan (5x15x1): Measurement grid: dx=10mm, dy=15mm
Maximum value of SAR (measured) = 8.78 mW/g

Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 79.5 V/m; Power Drift = -0.032 dB
Peak SAR (extrapolated) = 13.6 W/kg
SAR(1 g) = 7.94 mW/g; SAR(10 g) = 4.24 mW/g
Maximum value of SAR (measured) = 8.93 mW/g

Daily SPC Check/Z-Axis Retraction (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm
Maximum value of SAR (measured) = 8.87 mW/g




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

Date/Time: 10/25/2011 11:52:08 AM

Test Laboratory: Motorola Mobility 2450 MHz System Performance Check

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:863
Procedure Notes: PM1 Power = 200 mW Refl.Pwr PM3 = -19.2dB Sim.Temp@SPC = 20.8°C Room Temp @ SPC = 21.7°C
Communication System: CW - Dipole; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: Validation *BODY Tissue* ; Medium parameters used: f = 2450 MHz; σ = 1.93 mho/m; ε_r = 50.3; ρ = 1000 kg/m^3

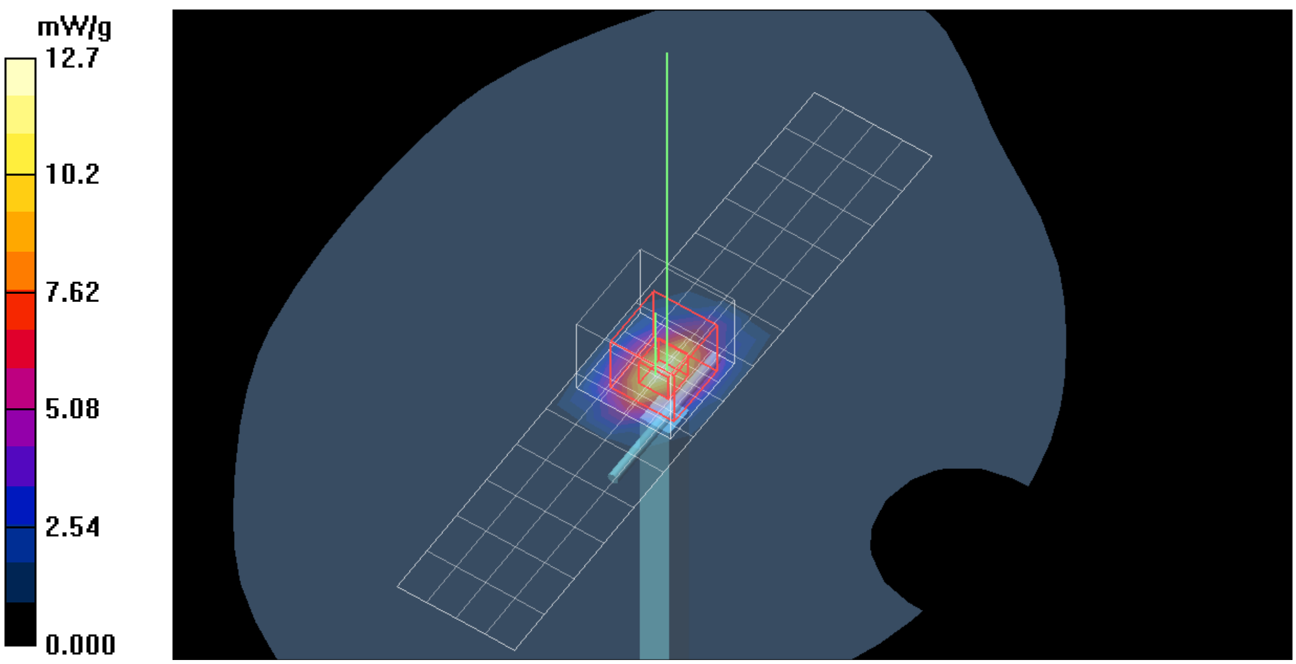
DASY4 Configuration:

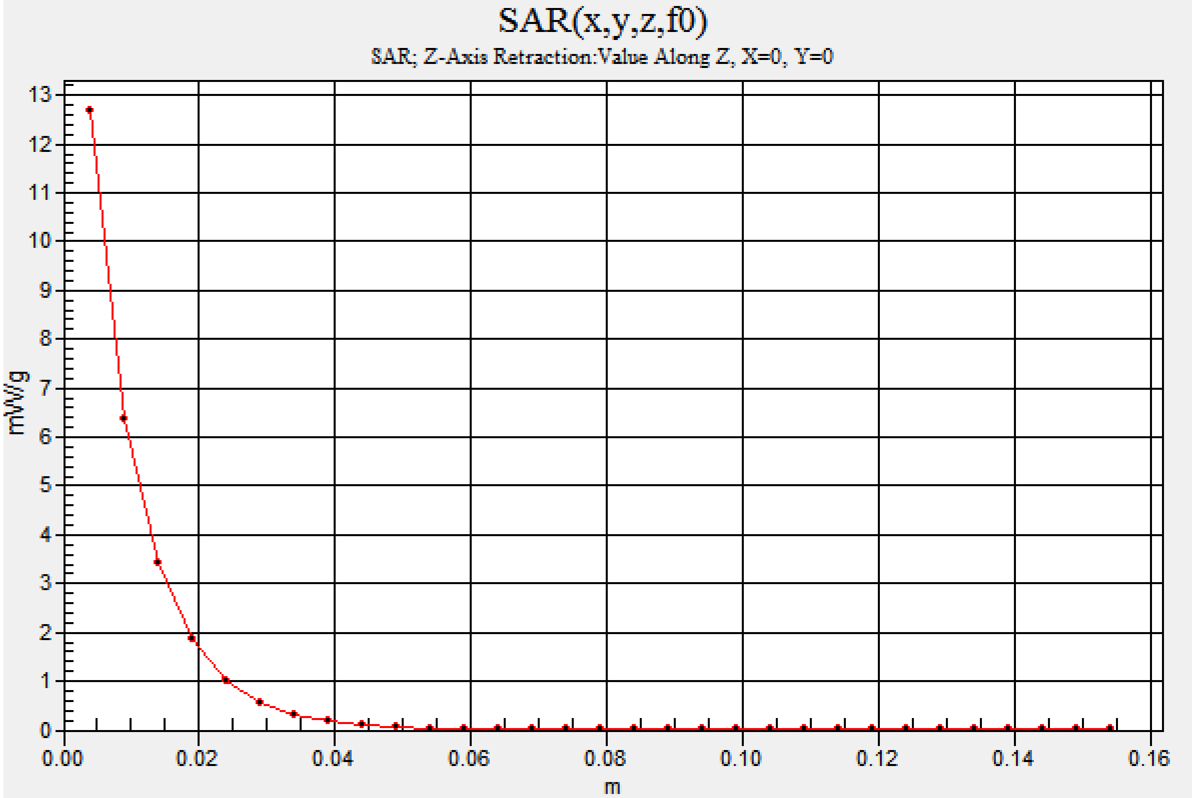
- Probe: ES3DV3 - SN3115; ConvF(4.12, 4.12, 4.12); Calibrated: 1/12/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#-6 Glycol SAM (extended range), Rev.1 (25-Mar-05); Type: SAM v4.0; Serial: TP-1131;
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Daily SPC Check/Dipole Area Scan (5x15x1): Measurement grid: dx=10mm, dy=15mm
Maximum value of SAR (measured) = 12.7 mW/g

Daily SPC Check/0-Degree, 5x5x7 Cube (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 81.4 V/m; Power Drift = -0.027 dB
Peak SAR (extrapolated) = 23.8 W/kg
SAR(1 g) = 11.2 mW/g; SAR(10 g) = 5.22 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




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

Appendix 2

SAR distribution plots for Lapdock™ 500 Accessory Test Results

Date/Time: 10/24/2011 9:26:14 PM

Test Laboratory: Motorola Mobility GPRS 850 with Lapdock 500

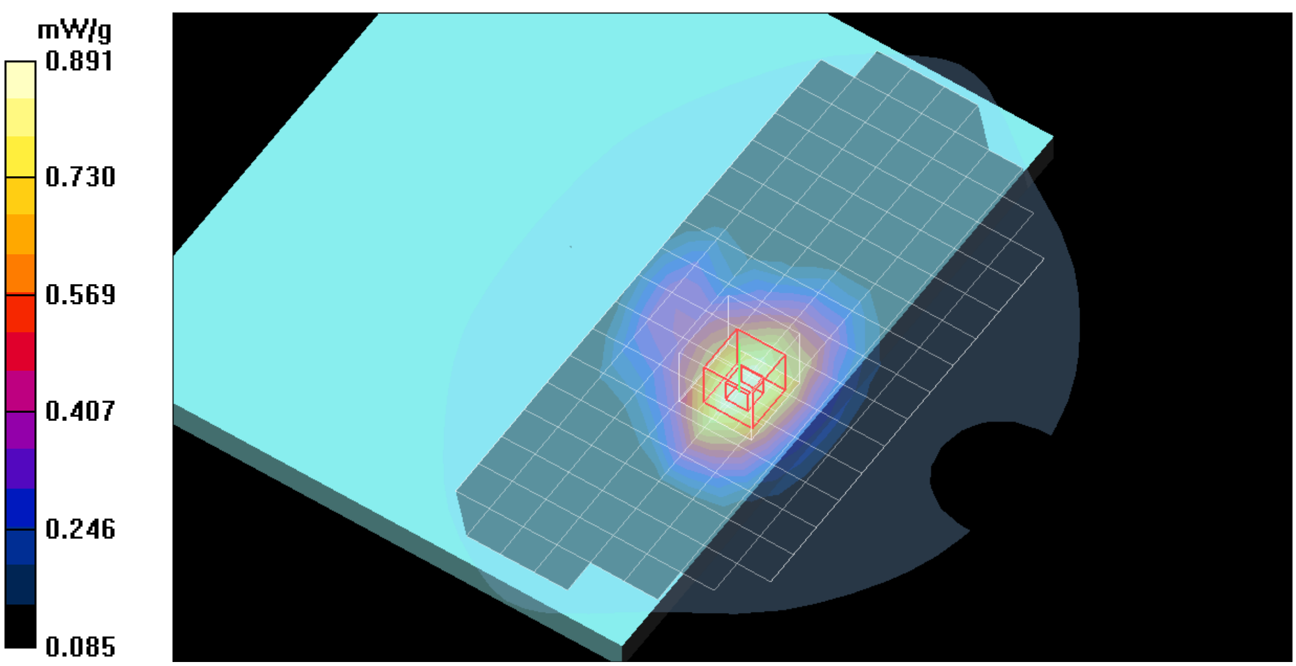
DUT: Type: Motorola Lapdock 500; Phone Serial: LS3A280035
Procedure Notes: Pwr Step: 5, Battery Model #: INTERNAL Test Configuration = Display oepn 90 degrees, Lapdock 0mm separation from phantom
Communication System: GPRS 850 - Class 11; Frequency: 836.6 MHz;Duty Cycle: 1:2.76
Medium: Low Freq Body; Medium parameters used: f = 835 MHz; σ = 0.97 mho/m; ε_r = 53.6; ρ = 1000 kg/m^3

DASY4 Configuration:

- Probe: ES3DV3 - SN3115; ConvF(5.88, 5.88, 5.88); Calibrated: 1/12/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#-6 Glycol 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

SAM Phone Against Flat Section/Tablet Long Edge Area Scan - Body (15mm) 2 (21x9x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.897 mW/g

SAM Phone Against Flat Section/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.7 V/m; Power Drift = -0.482 dB
Peak SAR (extrapolated) = 1.21 W/kg
SAR(1 g) = 0.836 mW/g; SAR(10 g) = 0.571 mW/g
Maximum value of SAR (measured) = 0.891 mW/g



Test Laboratory: Motorola Mobility WCDMA 850 with Lapdock 500

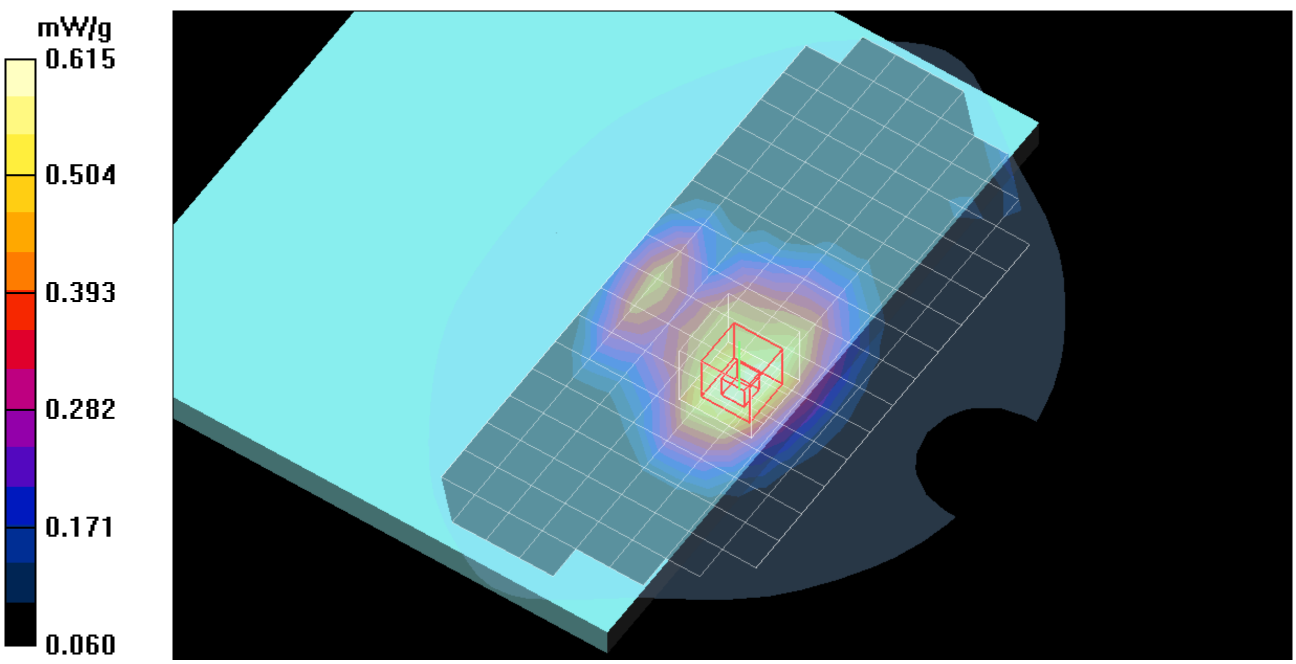
DUT: Type: Motorola Lapdock 500; Phone Serial: LS3A280035
Procedure Notes: Pwr Step: ALL UP BITS Battery Model #: INTERNAL Test Configuration = Display open 90 degrees, Lapdock 0mm separation from phantom
Communication System: 3G-WCDMA 850; Frequency: 836 MHz;Duty Cycle: 1:1
Medium: Low Freq Body; Medium parameters used: f = 835 MHz; $\sigma = 0.97$ mho/m; $\varepsilon_r = 53.6$; $\rho = 1000$ kg/m^3

DASY4 Configuration:

- Probe: ES3DV3 - SN3115; ConvF(5.88, 5.88, 5.88); Calibrated: 1/12/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#-6 Glycol 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

SAM Phone Against Flat Section/Tablet Long Edge Area Scan - Body (15mm) 2 (21x9x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.580 mW/g

SAM Phone Against Flat Section/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 23.8 V/m; Power Drift = -0.043 dB
Peak SAR (extrapolated) = 0.823 W/kg
SAR(1 g) = 0.578 mW/g; SAR(10 g) = 0.398 mW/g
Maximum value of SAR (measured) = 0.615 mW/g



Date/Time: 10/24/2011 12:27:03 PM

Test Laboratory: Motorola Mobility GPRS 1900 with Lapdock 500

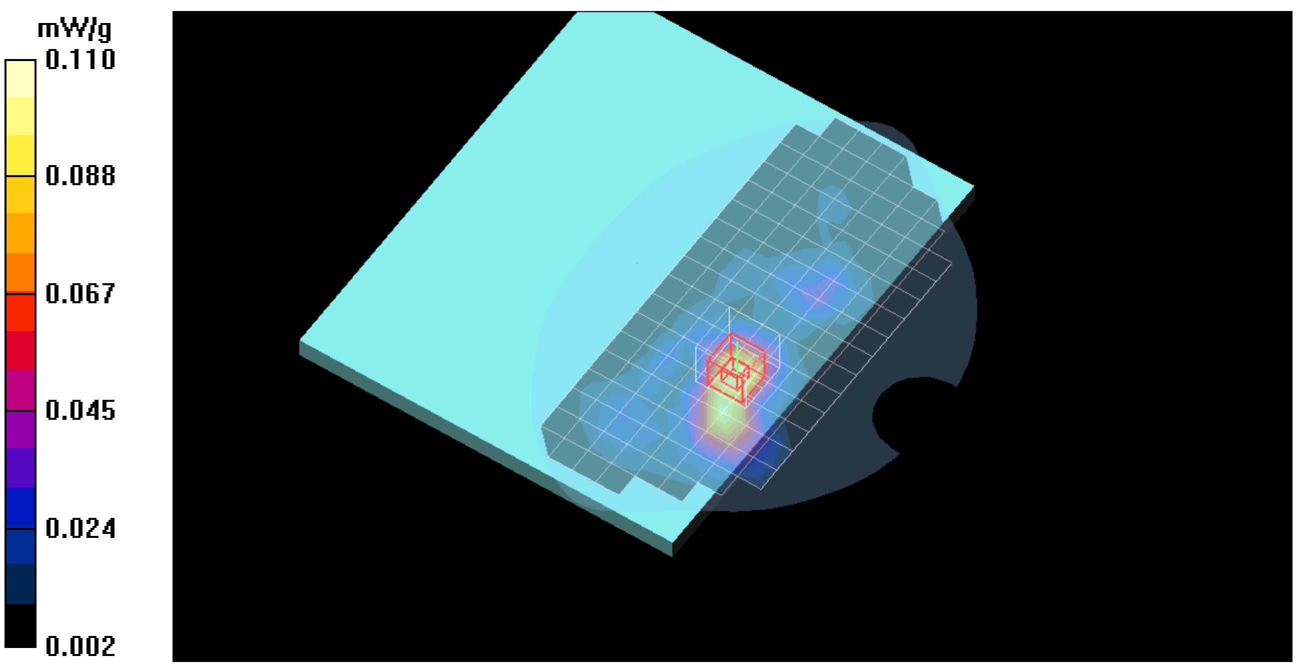
DUT: Type: Motorola Lapdock 500; Phone Serial: LS3A280035
Procedure Notes: Pwr Step: 0 Battery Model #: INTERNAL Test Configuration = Display open 90 degrees, lapdock 0mm separation
Communication System: GPRS 1900 - Class 11; Frequency: 1880 MHz;Duty Cycle: 1:2.76
Medium: Regular Glycol Body 1750/1880; Medium parameters used: f = 1880 MHz; σ = 1.58 mho/m; ε_r = 50.9; ρ = 1000 kg/m^3

DASY4 Configuration:

- Probe: ES3DV3 - SN3115; ConvF(4.61, 4.61, 4.61); Calibrated: 1/12/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#-6 Glycol 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

SAM Phone Against Flat Section/Tablet Long Edge Area Scan - Body (15mm) 2 (21x9x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.103 mW/g

SAM Phone Against Flat Section/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.31 V/m; Power Drift = -0.186 dB
Peak SAR (extrapolated) = 0.154 W/kg
SAR(1 g) = 0.100 mW/g; SAR(10 g) = 0.060 mW/g
Maximum value of SAR (measured) = 0.110 mW/g



Date/Time: 10/24/2011 1:22:25 PM

Test Laboratory: Motorola Mobility **WCDMA 1900 with Lapdock 500**

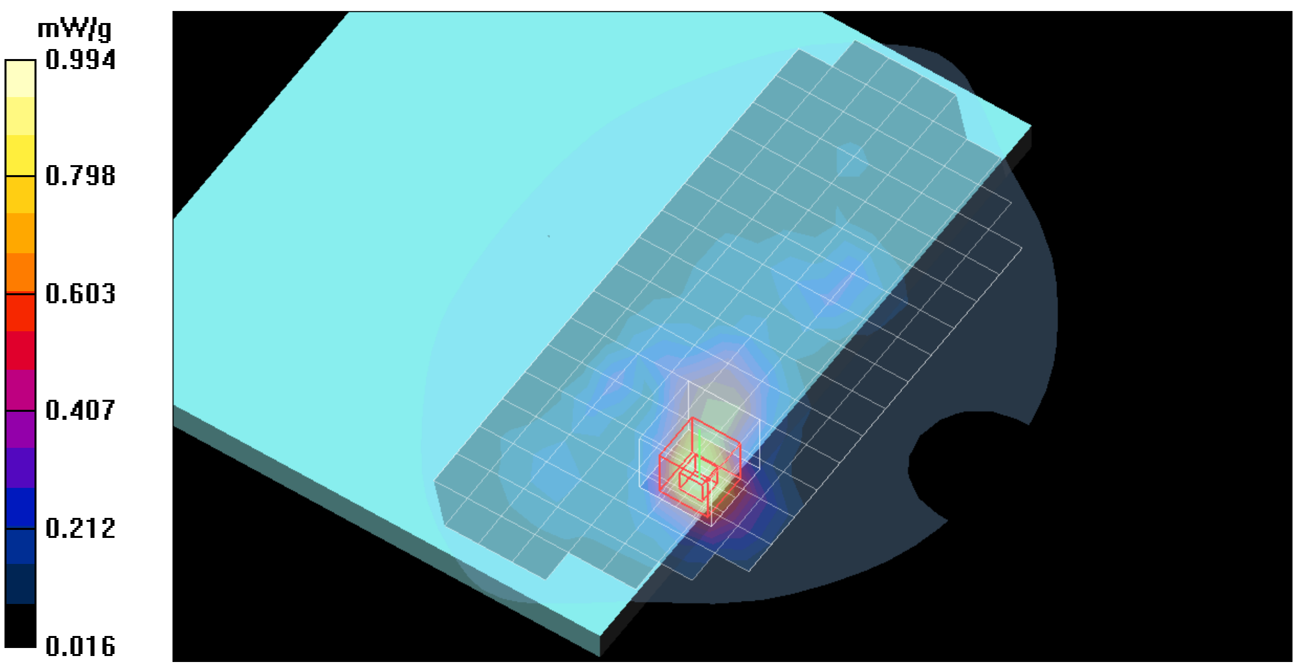
DUT: Type: Motorola Lapdock 500; Phone Serial: LS3A280035
Procedure Notes: Pwr Step: ALL UP BITS Battery Model #: INTERNAL Test Configuration = Display open 90 degrees, lapdock 0mm from separation from phantom
Communication System: 3G/WCDMA 1900; Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: Regular Glycol Body 1750/1880; Medium parameters used: f = 1880 MHz; σ = 1.58 mho/m; ε_r = 50.9; ρ = 1000 kg/m^3

DASY4 Configuration:

- Probe: ES3DV3 - SN3115; ConvF(4.61, 4.61, 4.61); Calibrated: 1/12/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#-6 Glycol 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

SAM Phone Against Flat Section/Tablet Long Edge Area Scan - Body (15mm) 2 (21x9x1):
Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.907 mW/g

SAM Phone Against Flat Section/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 21.2 V/m; Power Drift = -0.020 dB
Peak SAR (extrapolated) = 1.44 W/kg
SAR(1 g) = 0.891 mW/g; SAR(10 g) = 0.506 mW/g
Maximum value of SAR (measured) = 0.994 mW/g



Date/Time: 10/25/2011 1:48:06 PM

Test Laboratory: Motorola Mobility 2450 MHz WiFi with Lapdock 500

DUT: Type: Motorola Lapdock 500; Phone Serial: LS3A280035
Procedure Notes: Pwr Step: 802.11b 1 Mbps Chn 11 Battery Model #: INTERNAL Test Configuration = Display open 90 degrees, lapdock 0mm separation from phantom
Communication System: Wi-Fi 2450; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium: 2450 Glycol Body; Medium parameters used: f = 2450 MHz; σ = 1.93 mho/m; ε_r = 50.3; ρ = 1000 kg/m^3

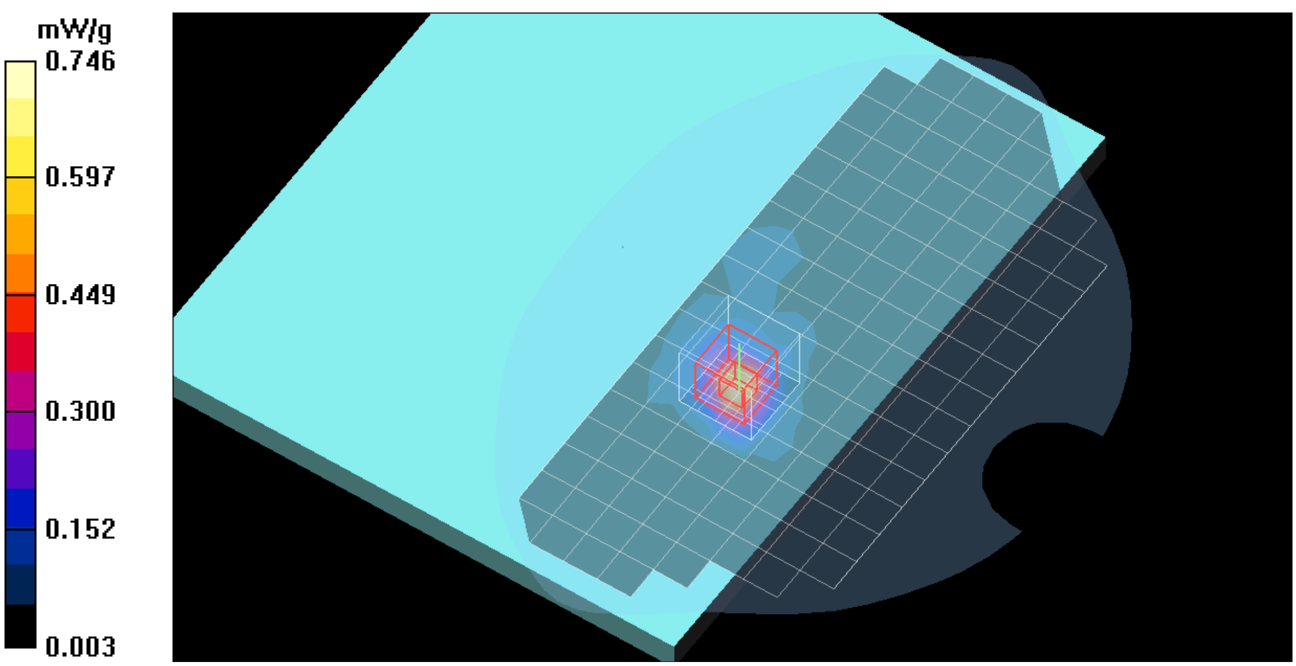
DASY4 Configuration:

- Probe: ES3DV3 - SN3115; ConvF(4.12, 4.12, 4.12); Calibrated: 1/12/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn434; Calibrated: 1/13/2011
- Phantom: R#-6 Glycol 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

SAM Phone Against Flat Section/Tablet Long Edge Area Scan - Body (15mm) (21x9x1):

Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.425 mW/g

SAM Phone Against Flat Section/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.52 V/m; Power Drift = -0.033 dB
Peak SAR (extrapolated) = 1.52 W/kg
SAR(1 g) = 0.656 mW/g; SAR(10 g) = 0.279 mW/g
Maximum value of SAR (measured) = 0.746 mW/g



Appendix 3

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 4

Probe Calibration Certificate

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: ES3-3115_Jan11

CALIBRATION CERTIFICATE

Object	ES3DV3 - SN:3115
Calibration procedure(s)	QA CAL-01.v7, QA CAL-23.v4 and QA CAL-25.v3 Calibration procedure for dosimetric E-field probes
Calibration date:	January 12, 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	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	29-Dec-10 (No. ES3-3013_Dec10)	Dec-11
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-10)	In house check: Oct-11

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

Issued: January 13, 2011

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 ES3DV3

SN:3115

Manufactured:	March 6, 2006
Last calibrated:	January 19, 2010
Recalibrated:	January 12, 2011

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: ES3DV3 SN:3115

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.29	1.30	1.18	± 10.1%
DCP (mV)[B]	100.2	102.3	101.3	

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	113.4	± 2.4 %
			Y	0.00	0.00	1.00	150.5	
			Z	0.00	0.00	1.00	142.6	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 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:3115

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%	5.87	5.87	5.87	0.34	1.74	± 11.0%
1810	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	5.02	5.02	5.02	0.43	1.62	± 11.0%
1950	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	4.80	4.80	4.80	0.62	1.36	± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	4.39	4.39	4.39	0.94	1.13	± 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:3115

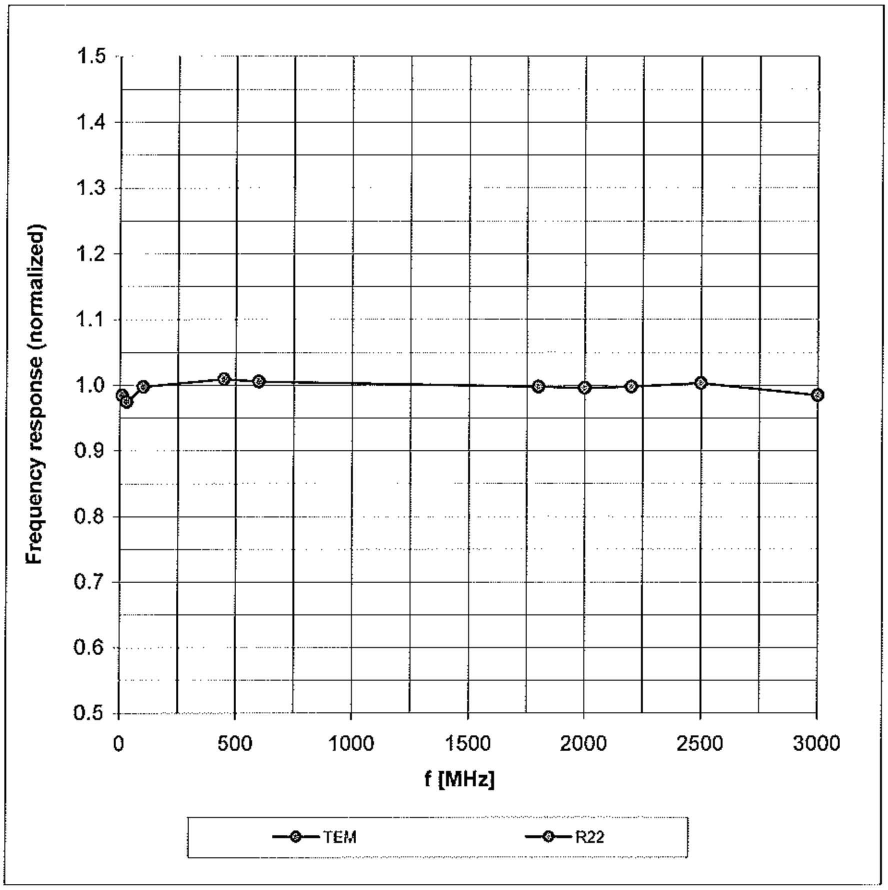
Calibration Parameter Determined in Body Tissue Simulating Media

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%	5.88	5.88	5.88	0.57	1.41	± 11.0%
1810	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.61	4.61	4.61	0.33	2.26	± 11.0%
1950	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.57	4.57	4.57	0.36	2.19	± 11.0%
2450	± 50 / ± 100	52.7 ± 5%	1.95 ± 5%	4.12	4.12	4.12	0.99	0.75	± 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.

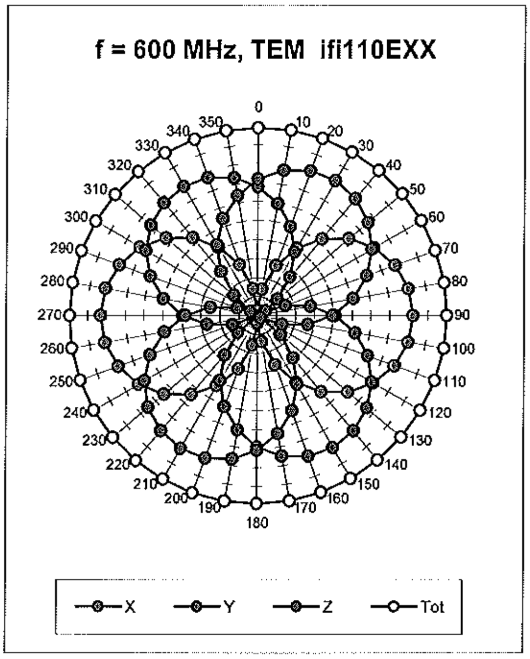
Frequency Response of E-Field

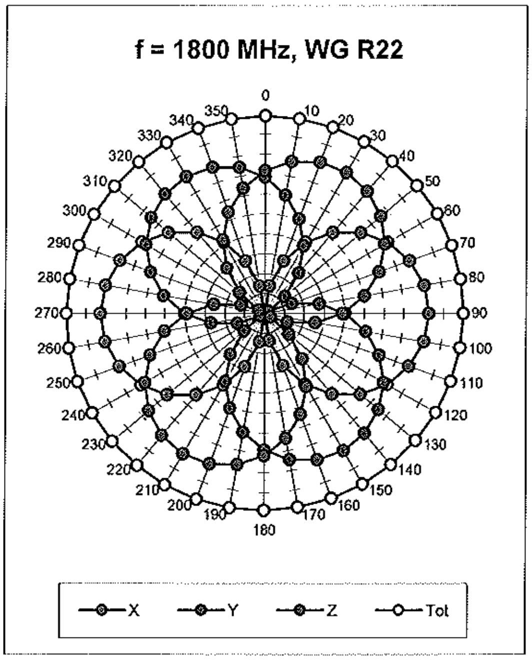
(TEM-Cell:ifi110 EXX, Waveguide: R22)

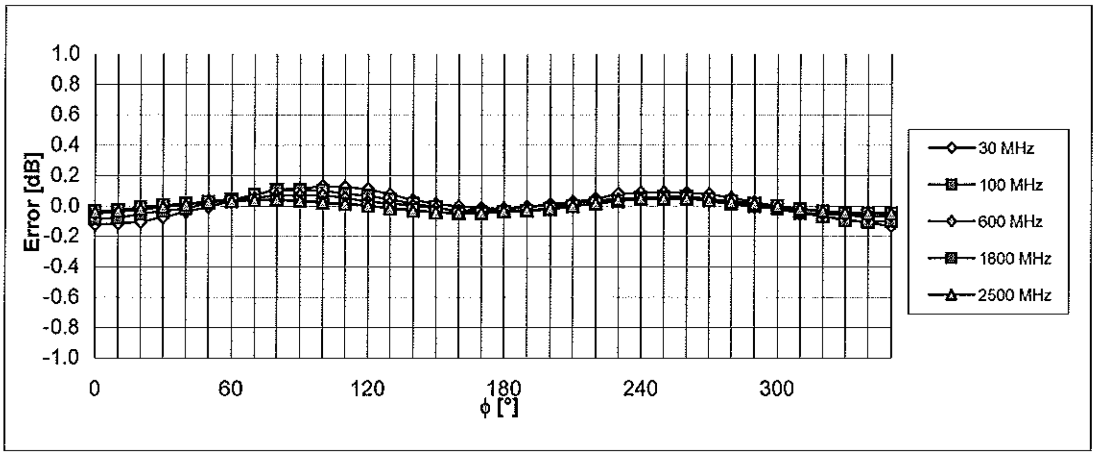


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



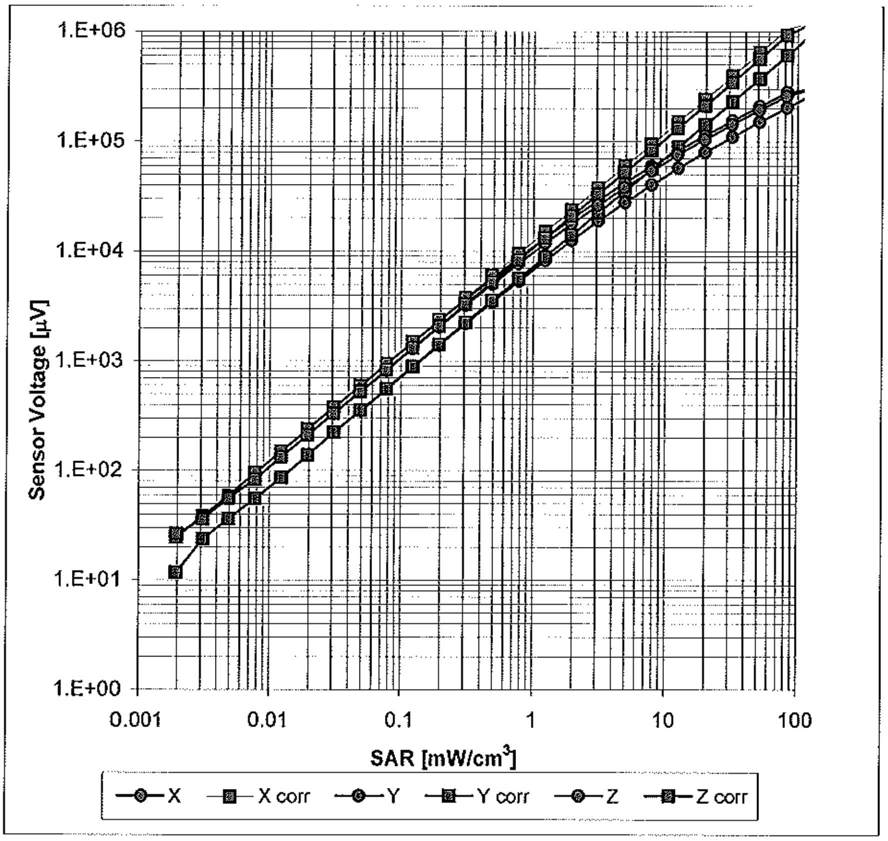


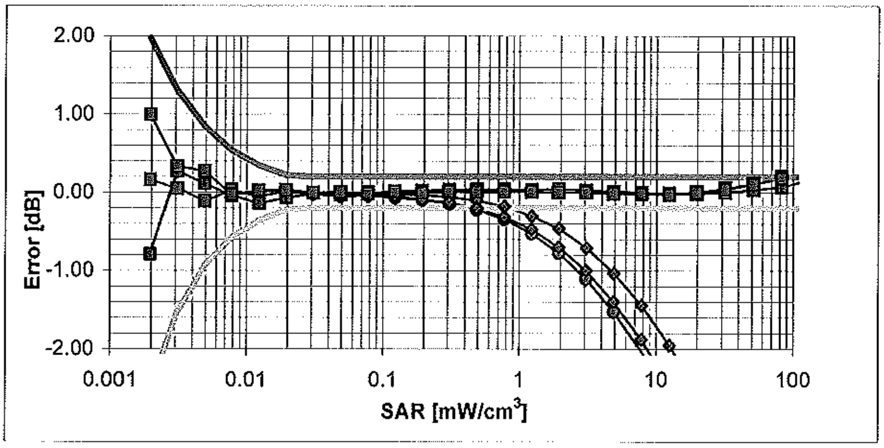


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

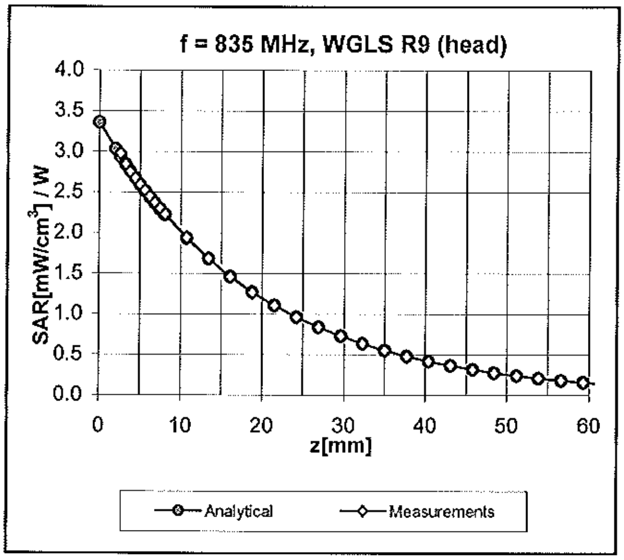
(TEM cell, f = 900 MHz)

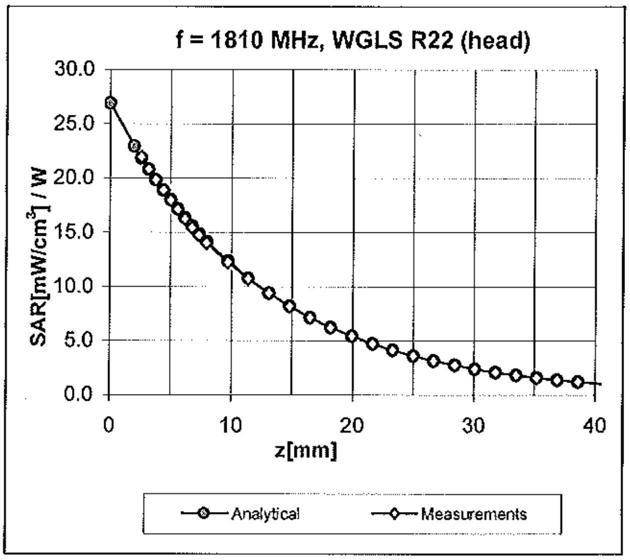




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

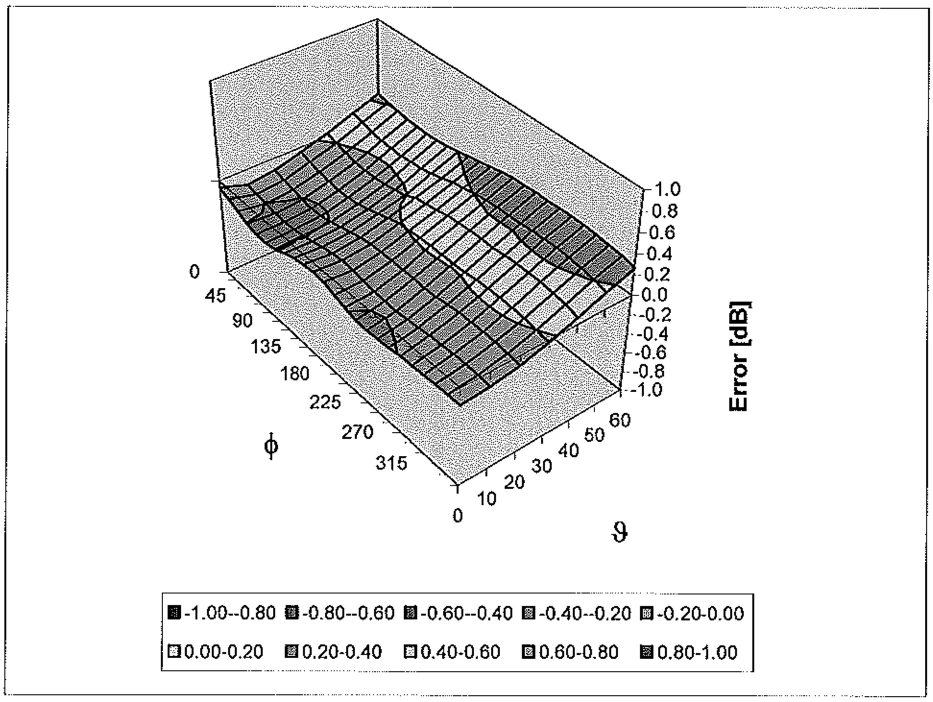
Conversion Factor Assessment





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 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 5

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: D2450V2-863_Mar11

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 863
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:	Dimce Iliev	Laboratory Technician	D. Iliev
Approved by:	Katja Pokovic	Technical Manager	

Issued: March 17, 2011

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
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	13.3 mW / g
SAR normalized	normalized to 1W	53.2 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**54.2 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.23 mW / g
SAR normalized	normalized to 1W	24.9 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**25.1 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	(21.0 ± 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	13.2 mW / g
SAR normalized	normalized to 1W	52.8 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**52.8 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.11 mW / g
SAR normalized	normalized to 1W	24.4 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**24.4 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.1 Ω + 2.9 jΩ
Return Loss	- 27.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.5 Ω + 5.2 jΩ
Return Loss	- 25.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.165 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	April 23, 2010

DASY5 Validation Report for Head TSL

Date/Time: 17.03.2011 13:48:21

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:863

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)

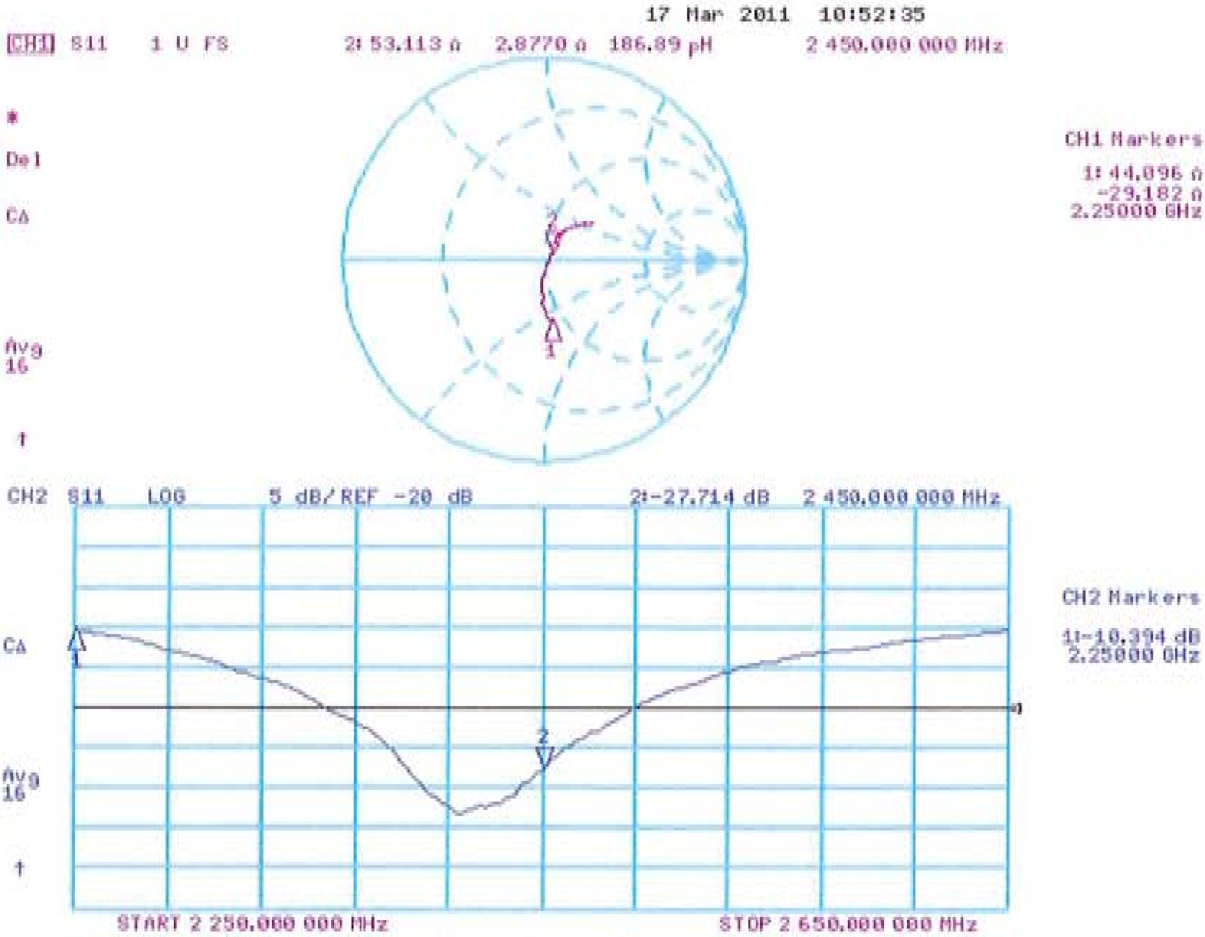
DASY5 Configuration:

- 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)

Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe) /Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 104.8 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 27.215 W/kg
SAR(1 g) = 13.3 mW/g; SAR(10 g) = 6.23 mW/g
Maximum value of SAR (measured) = 17.128 mW/g

0 dB = 17.130mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 08.03.2011 15:14:58

Test Laboratory: SPEAG, Zurich, Switzerland

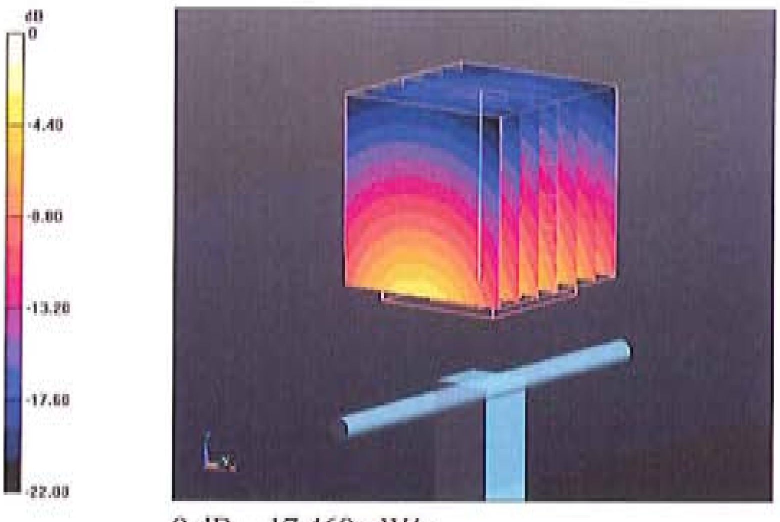
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:863

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: MSL U12 BB
Medium parameters used: f = 2450 MHz; σ = 1.93 mho/m; ε_r = 51.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

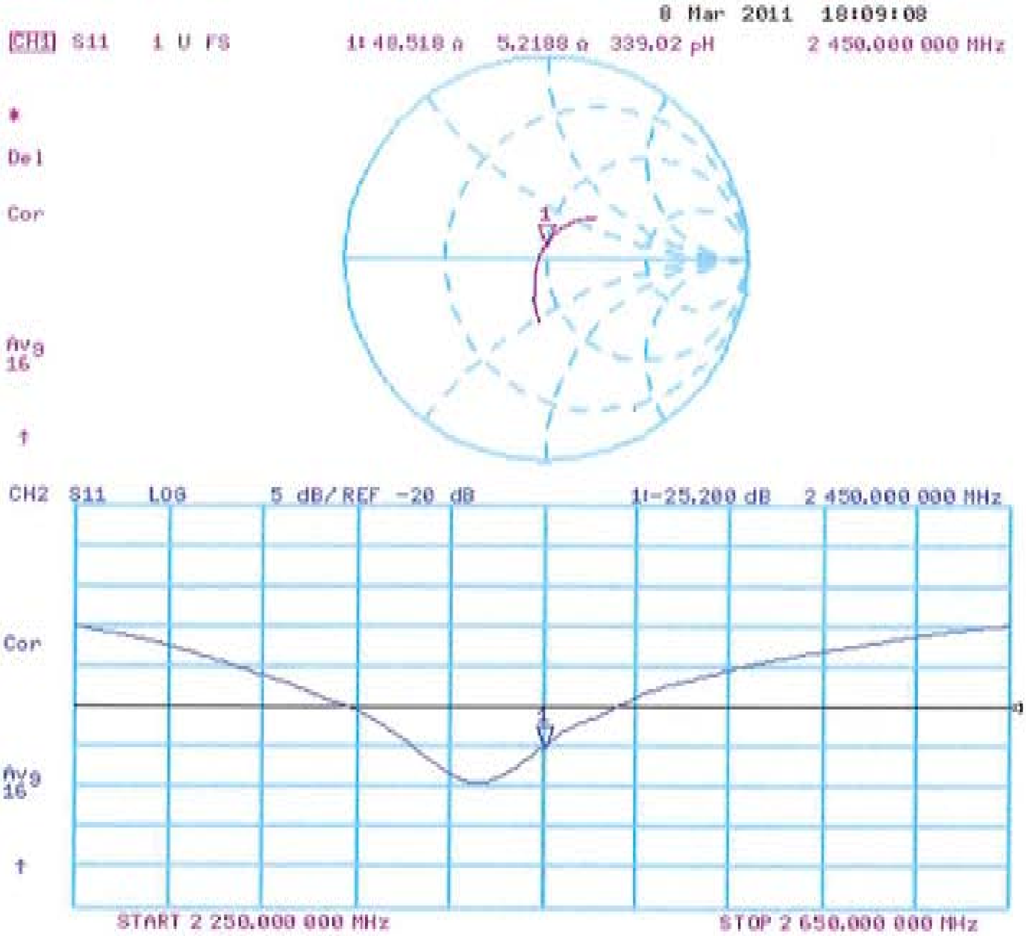
- Probe: ES3DV3 - SN3205; ConvF(4.31, 4.31, 4.31); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.6.2 Build (424)
- Postprocessing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

Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 97.651 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 27.947 W/kg
SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.11 mW/g
Maximum value of SAR (measured) = 17.459 mW/g



0 dB = 17.460mW/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: **D1800V2-250_Mar11**

CALIBRATION CERTIFICATE

Object	D1800V2 - SN: 250
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 18, 2011

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

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	1800 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.4 ± 6 %	1.35 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	9.47 mW / g
SAR normalized	normalized to 1W	37.9 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**38.6 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.99 mW / g
SAR normalized	normalized to 1W	20.0 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**20.1 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	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.2 ± 6 %	1.45 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	9.08 mW / g
SAR normalized	normalized to 1W	36.3 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**37.2 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	4.81 mW / g
SAR normalized	normalized to 1W	19.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**19.4 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.8 Ω + 5.5 jΩ
Return Loss	- 25.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.1 Ω + 5.6 jΩ
Return Loss	- 23.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.208 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	September 25, 1999

DASY5 Validation Report for Head TSL

Date/Time: 17.03.2011 11:03:14

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN:250

Communication System: CW; Frequency: 1800 MHz; Duty Cycle: 1:1
Medium: HSL U12 BB
Medium parameters used: f = 1800 MHz; σ = 1.35 mho/m; ε_r = 39.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

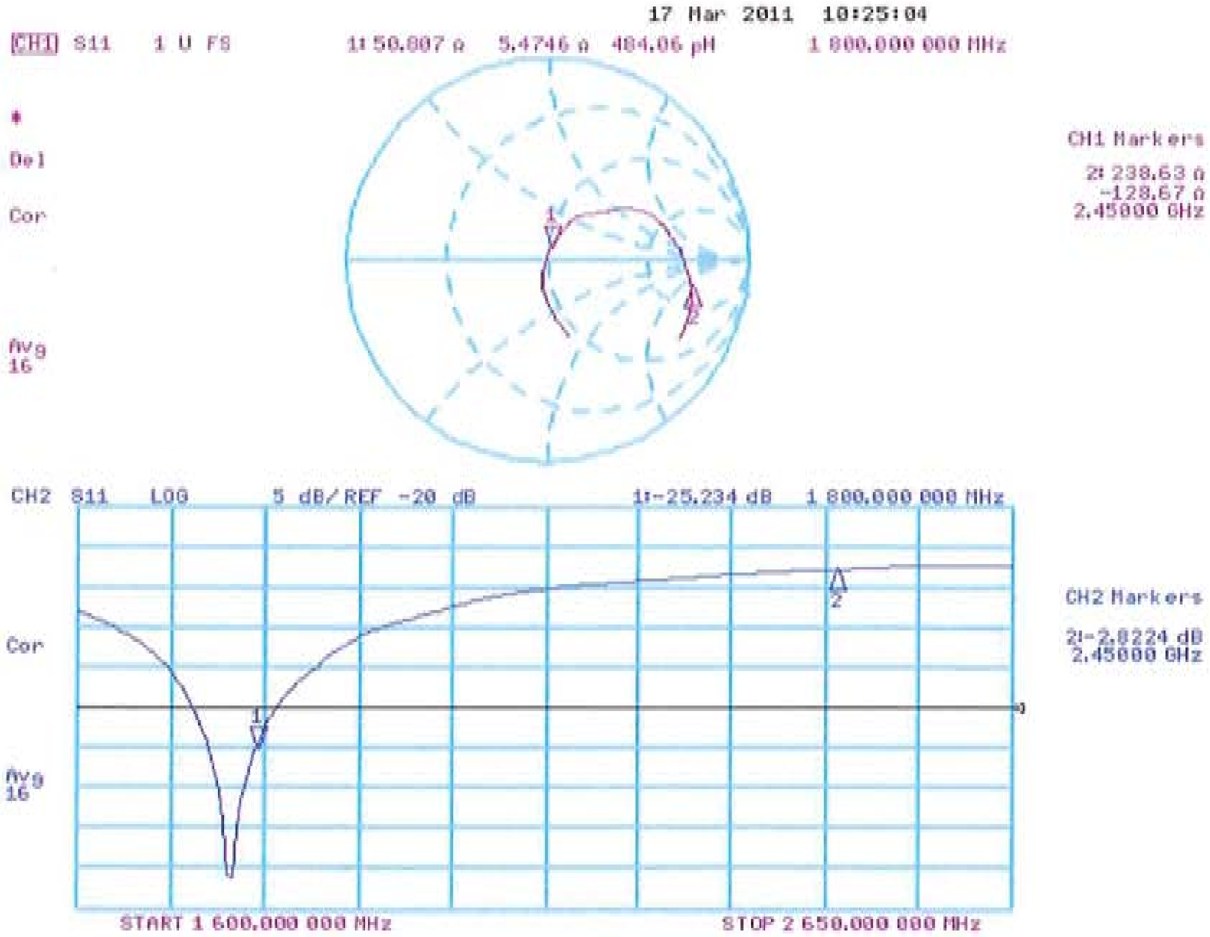
DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.05, 5.05, 5.05); 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 = 95.117 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 17.216 W/kg
SAR(1 g) = 9.47 mW/g; SAR(10 g) = 4.99 mW/g
Maximum value of SAR (measured) = 11.641 mW/g

0 dB = 11.640mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 17.03.2011 15:52:49

Test Laboratory: SPEAG, Zurich, Switzerland

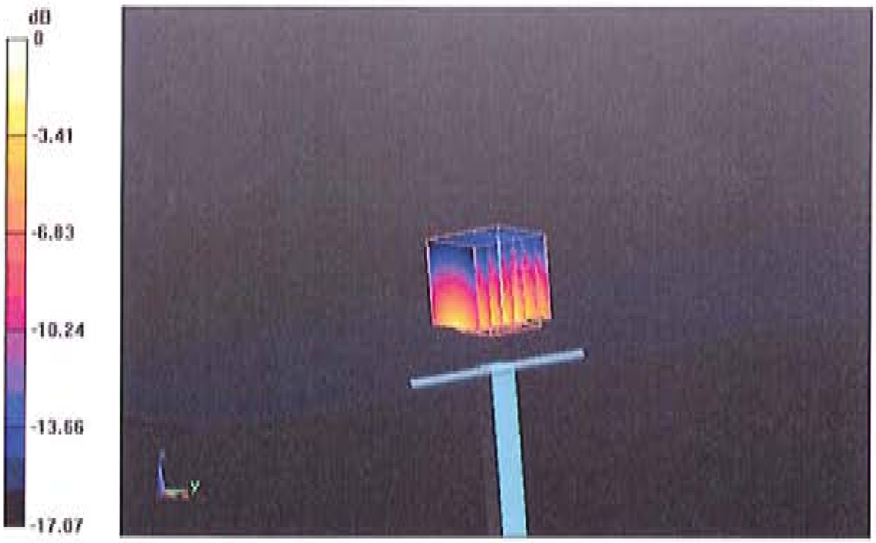
DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN:250

Communication System: CW; Frequency: 1800 MHz; Duty Cycle: 1:1
Medium: MSL U12 BB
Medium parameters used: f = 1800 MHz; σ = 1.45 mho/m; ε_r = 52.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

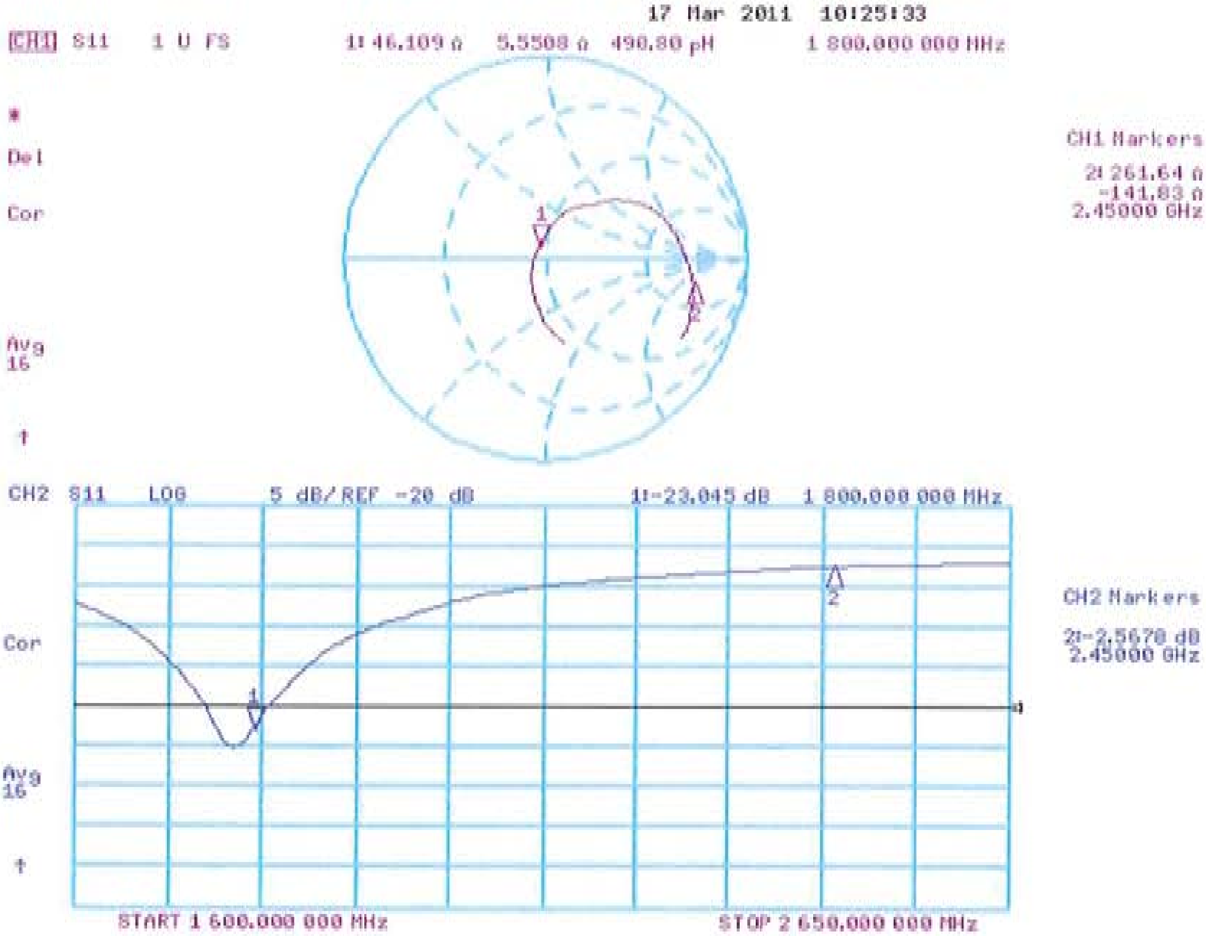
- Probe: ES3DV3 - SN3205; ConvF(4.74, 4.74, 4.74); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.6.2 Build (424)
- Postprocessing 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 = 93.370 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 15.727 W/kg
SAR(1 g) = 9.08 mW/g; SAR(10 g) = 4.81 mW/g
Maximum value of SAR (measured) = 11.477 mW/g



0 dB = 11.480mW/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
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: **D835V2-420_Jul11**

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 420
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	July 08, 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: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	29-Apr-11 (No. ES3-3205_Apr11)	Apr-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	04-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: July 12, 2011

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

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	
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 %	0.88 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.25 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**9.13 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.48 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**5.98 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	53.8 ± 6 %	0.98 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.38 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**9.39 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.57 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**6.22 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.2 Ω + 0.1 jΩ
Return Loss	- 52.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.4 Ω - 1.0 jΩ
Return Loss	- 28.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.401 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	December 23, 1999

DASY5 Validation Report for Head TSL

Date: 08.07.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 420

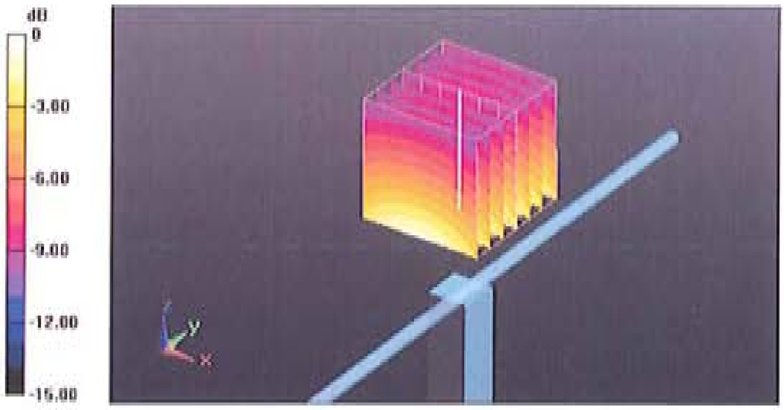
Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; $\sigma = 0.88$ mho/m; $\varepsilon_r = 41$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.07, 6.07, 6.07); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

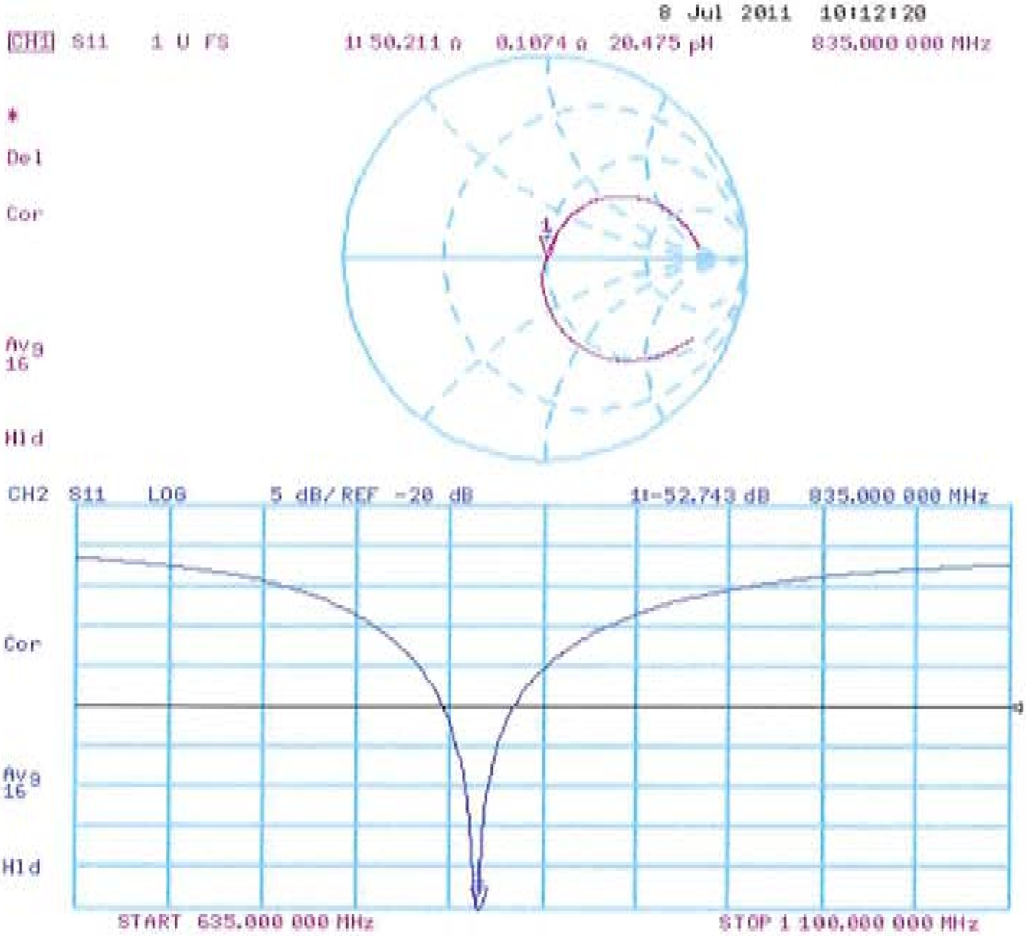
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.430 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 3.291 W/kg
SAR(1 g) = 2.25 mW/g; SAR(10 g) = 1.48 mW/g
Maximum value of SAR (measured) = 2.629 mW/g



0 dB = 2.630mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 08.07.2011

Test Laboratory: SPEAG, Zurich, Switzerland

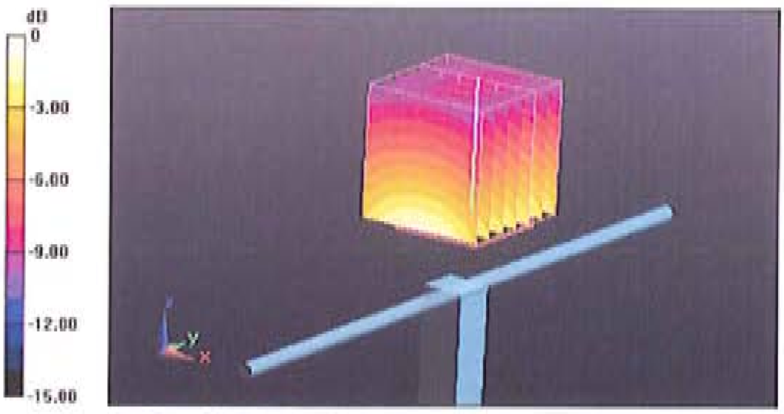
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 420

Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; $\sigma = 0.98$ mho/m; $\varepsilon_r = 53.8$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

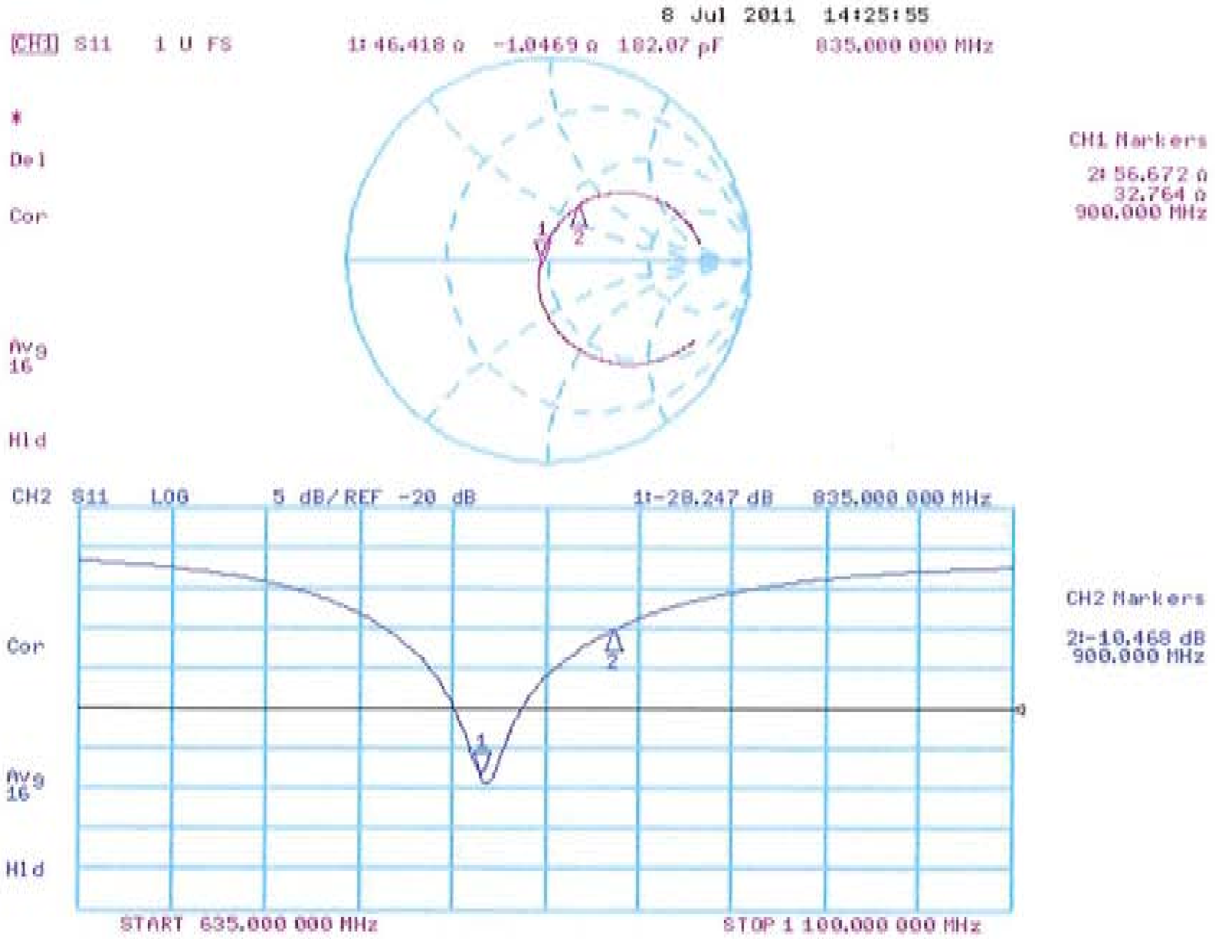
- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.233 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.447 W/kg
SAR(1 g) = 2.38 mW/g; SAR(10 g) = 1.57 mW/g
Maximum value of SAR (measured) = 2.773 mW/g



0 dB = 2.770mW/g

Impedance Measurement Plot for Body TSL



END OF REPORT