MOTOROLA

Portable Cellular Phone SAR Test Report

Tests Requested By:	Motorola Mobility, LLC 600 N. US Highway 45 Libertyville, IL 60048
Test Report #:	25260-1F
Date of Report:	Feb 20, 2013
Date of Test:	Jan 12 – Feb 15, 2013
FCC ID #:	IHDP56NE1
IC ID #:	N/A
Generic Name:	N/A
Test Laboratory:	Motorola Mobility, LLC - ADR Test Services Laboratory 600 N. US Highway 45 Libertyville, IL 60048
Report Author:	Ketal Patel RF Engineer

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), along with other published guidance indicated in the references at the end of this report, as well as other appropriate measurement standards, guidelines and recommended practices. Any deviations from these standards, guidelines and recommended practices are noted below:

(none)

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Revision History

Revision Version	Date	Notes
Rev. 0	Feb-20-2013	Section 3, 4.2, and 4.6: Updated WCDMA 1900 SAR test data for Head-Adjacent Exposure.

1 Introduction

The Motorola Mobility ADR Test Services Laboratory has performed measurements of the maximum potential exposure to the user of the portable cellular phone covered by this test report. The Specific Absorption Rate (SAR) of this product was measured. The portable cellular phone was tested in accordance with [1], [4], [5], [9], and per FCC KDB 941225 D06 for mobile hotspot operation. The SAR values measured for the portable cellular phone 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 DASY52™ system manufactured by Schmid & Partner Engineering AG (SPEAG), of Zurich Switzerland.

Transmit Band	Head SAR (1 g $^{W}/_{kg}$)	Body-Worn Accessory SAR (1 g $^{W}/_{kg}$)	Mobile Hotspot SAR (1 g $^{W}/_{kg}$)
GSM 850	0.56	0.39	1.48
GSM 1900	0.58	0.09	0.73
WCDMA 850	0.79	0.25	1.45
WCDMA 1900	1.09	0.18	1.38
Wi-Fi 2.45 GHz	0.26	0.03	0.08
Bluetooth	N/A		
Simultaneous SAR	1.56		

2 Details of the Device Under Test

2.1 Sample Information

Serial Number(s) (Functional Use)	353207050002579 (WCDMA/GSM conducted power measurements, head/body SAR testing, GSM mobile hotspot SAR testing, Wi-Fi 2.4 GHz SAR testing) 353207050002777 (WCDMA mobile hotspot 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

2.2 Antenna Description

Main (782/850/1900 MHz) Antenna

Type	Internal	
Location	Bottom of Transceiver	
Dimensions	Width	12.53 mm
	Length	54.67 mm

Bluetooth/Wi-Fi 2 GHz Antenna

Type	Internal	
Location	Right-Side Rear of Transceiver	
Dimensions	Width	16.68 mm
	Length	20.29 mm

2.3 Transmission Band Summary

Mode(s) of Operation	Modulation Mode(s)	Target Output Power Setting	Tune-Up Tolerance	Duty Cycle	Transmitting Frequency Range(s)
GSM 850	GMSK	32.0 dBm	-1.0 dB / +1.0 dB	1:8	824.2 - 848.8 MHz
GPRS 850	GMSK	32.0 dBm	-1.0 dB / +1.0 dB	1:8, 2:8, 3:8, 4:8	824.2 - 848.8 MHz
EDGE 850	8PSK	26.5 dBm	-1.0 dB / +1.0 dB	1:8, 2:8, 3:8, 4:8	824.2 - 848.8 MHz
GSM 1900	GMSK	29.0 dBm	-1.0 dB / +1.0 dB	1:8	1850.2 - 1909.8 MHz
GPRS 1900	GSMK	29.0 dBm	-1.0 dB / +1.0 dB	1:8, 2:8, 3:8, 4:8	1850.2 - 1909.8 MHz
EDGE 1900	8PSK	25.5 dBm	-1.0 dB / +1.0 dB	1:8, 2:8, 3:8, 4:8	1850.2 - 1909.8 MHz
WCDMA 850	QPSK	23.0 dBm	-0.5 dB / +0.5 dB	1:1	826.4 - 846.6 MHz
WCDMA 1900	QPSK	22.0 dBm	-0.3 dB / +0.4 dB	1:1	1852.4 - 1907.6 MHz
Wi-Fi 802.11b/g/n	BPSK	13.34 dBm		1:1	2412.0 - 2462.0 MHz
Bluetooth	GFSK	8.981 dBm		1:1	2402.0 – 2480.0 MHz

2.4 Device Test Setup, Operating Configurations, and Conducted Power Measurements

2.4.1 GSM

Technical Description

The phone under test contains a GSM transmitter that supports voice (circuit-switched) capability, and data (packet-switched) capabilities over GPRS/EDGE (GMSK) or EDGE (8PSK).

Exposure Conditions and Test Exclusions

Mode	Type	Head-Adjacent	Body-Worn Accessory	Mobile Hotspot
GSM (GMSK 1-Slot)	Voice	Tested	Tested	N/A
GPRS/EDGE (GMSK Multi-Slot)	Data	Tested (1) (3)	Tested (1) (3)	Tested (3)
EDGE (8PSK Multi-Slot)	Data	Excluded (2) (3)	Excluded (2) (3)	Excluded (2) (3)

Notes:

(1) GPRS/EDGE (GMSK Multi-Slot), as a data-only mode, was tested against the Head and in Body-Worn Accessory exposure conditions to support evaluation for 3rd Party VOIP applications potentially installed and used by the end-user.

(2) EDGE (8PSK Multi-Slot) was excluded from testing per FCC KDB 941225 D03, as the source-based time-averaged output power in this mode is lower than that measured in normal GSM voice mode and GPRS/EDGE (GMSK Multi-Slot) data modes.

(3) GPRS/EDGE (GMSK Multi-Slot) and EDGE (8PSK Multi-Slot) utilize reduced output power as additional time slots are transmitted in the uplink frame, as demonstrated in the following table. The values noted are maximum limits, and conform to the same power tune-up tolerances noted in section 2.3 above. The multi-slot configuration that results in the highest source-based time-averaged output power from the device was chosen for testing when testing of these modes is required.

GSM Data Functionality	GPRS/EDGE Class 12 (4 uplink timeslots; 4 downlink timeslots; 5 total timeslots per frame)															
	Class B (DTM not supported)															
Mode(s) of Operation	GPRS 850				GPRS 900				GPRS 1800				GPRS 1900			
Modulation	GMSK				GMSK				GMSK				GMSK			
Maximum TX Burst Output Power Setting (dBm)	33.0	30.0	28.5	27.2	33.0	31.0	30.0	28.2	30.0	28.0	27.0	25.3	30.0	27.0	25.5	24.2
Maximum Time Average Output Power Setting (dBm)	23.81	23.82	24.08	24.03	23.81	24.82	25.58	25.03	20.81	21.82	22.58	22.13	20.81	21.82	22.58	22.13
Duty Cycle	1:8	2:8	3:8	4:8	1:8	2:8	3:8	4:8	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				880.2 - 914.8 MHz				1710.2 - 1784.8 MHz				1850.2 - 1909.8 MHz			
Mode(s) of Operation	EDGE 850				EDGE 900				EDGE 1800				EDGE 1900			
Modulation	8PSK				8PSK				8PSK				8PSK			
Maximum TX Burst Output Power Setting (dBm)	27.5	26.5	24.5	23.5	27.5	26.5	24.5	23.5	26.5	25.5	23.5	22.5	26.5	25.5	23.5	22.5
Maximum Time Average Output Power Setting (dBm)	18.31	20.32	20.08	20.33	18.31	20.32	20.08	20.33	17.31	19.32	19.08	19.33	17.31	19.32	19.08	19.33
Duty Cycle	1:8	2:8	3:8	4:8	1:8	2:8	3:8	4:8	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				880.2 - 914.8 MHz				1710.2 - 1784.8 MHz				1850.2 - 1909.8 MHz			

Device Test Setup

For GSM modes, the test sample was operated using transmission to a base station simulator. The base station simulator was set up for the proper channel and transmit mode of operation on the phone's uplink. The transmitter power level and power control were set to maximum at power step 5 for GSM 850 band, and power step 0 for GSM 1900 band.

Conducted Power Measurements

Band	Channel	Conducted power (dBm) for GSM modes (Burst Average Power)								
		GSM *CS Voice* **(1 Slot)**	**GPRS** *PS Data* **(1 Slot)**	**GPRS** *PS Data* **(2 Slots)**	**GPRS** *PS Data* **(3 Slots)**	**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	33.00	33.01	29.97	27.98	27.16	27.33	26.18	24.06	22.66
	190	33.00	33.00	29.97	27.93	27.14	27.20	26.11	23.85	22.45
	251	32.97	32.91	29.88	27.85	27.05	27.04	25.91	23.63	22.28
GSM 1900	512	30.00	30.00	27.00	24.89	24.16	26.22	25.13	23.16	22.02
	661	29.94	29.95	26.95	24.87	24.05	26.28	25.16	23.14	21.84
	810	29.93	29.94	26.93	24.85	24.01	26.27	25.27	23.24	21.90

Band	Channel	Conducted power (dBm) for GSM modes (Source-Based Time-Averaged Power)								
		GSM *CS Voice* **(1 Slot)**	**GPRS** *PS Data* **(1 Slot)**	**GPRS** *PS Data* **(2 Slots)**	**GPRS** *PS Data* **(3 Slots)**	**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	23.81	23.82	23.79	23.56	23.99	18.14	20.00	19.64	19.49
	190	23.81	23.81	23.79	23.51	23.97	18.01	19.93	19.43	19.28
	251	23.78	23.72	23.70	23.43	23.88	17.85	19.73	19.21	19.11
GSM 1900	512	20.81	20.81	20.82	20.47	20.99	17.03	18.95	18.74	18.85
	661	20.75	20.76	20.77	20.45	20.88	17.09	18.98	18.72	18.67
	810	20.74	20.75	20.75	20.43	20.84	17.08	19.09	18.82	18.73

Burst Average Power was measured using a power meter set to the appropriate profile to capture average power in the transmitting timeslot(s). Source-Based Time-Averaged Power, being related to the Burst Average Power by a fixed factor dependent on the number of time slots active in the frame, was calculated as follows (in dB), where *x* is the number of time slots active:

$$P_{Source} = P_{Burst} - 10 * \log\left(\frac{x}{8.3}\right)$$

CS Voice denotes circuit-switched transmission for voice call operation, and PS Data denotes packet-switched transmission for data sessions.

2.4.2 WCDMA

Technical Description

The phone under test contains a WCDMA transmitter designed per 3GPP TS 25.101, that supports both voice and data capabilities.

Exposure Conditions and Test Exclusions

Mode	Type	Head-Adjacent	Body-Worn Accessory	Mobile Hotspot
RMC	Voice/ Data	Tested	Tested	Tested
AMR	Voice/ Data	Excluded (1)	Excluded (1)	Excluded (1)
HSDPA (Rel 5) Modes	Data	Excluded (1)	Excluded (1)	Excluded (1)
HSPA (Rel 6) Modes	Data	Excluded (1)	Excluded (1)	Excluded (1)

Notes:

(1) AMR, HSDPA (Rel. 5), and HSPA (Rel. 6) were excluded from testing per FCC KDB 941225 D01, as the measured output power in these modes is not more than ¼ dB higher than that measured in RMC and the maximum SAR for the RMC mode is < 75% of the SAR limit.

Device Test Setup

For WCDMA modes, the test sample was operated using transmission to a base station simulator. The base station simulator was set up for the proper channel and transmit mode of operation on the phone's uplink. The transmitter power level and transmit power control were set to "All 1's" for RMC and AMR modes in WCDMA or HSDPA, or inner loop power control procedures were applied to maintain maximum output power while HSUPA was active.

Conducted Power Measurements

Power measurements were executed per FCC KDB 941225 D01:

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	23.48	23.55	23.52	23.51	23.48	23.49	23.5	23.51	23.47	23.53	23.52
	4180	23.42	23.48	23.42	23.46	23.44	23.44	23.45	23.46	23.42	23.47	23.47
	4233	23.33	23.37	23.33	23.37	23.33	23.32	23.35	23.35	23.32	23.39	23.35
WCDMA 1900	9262	22.28	22.34	22.32	22.27	22.25	22.26	22.29	22.28	22.32	22.32	22.32
	9400	22.33	22.34	22.34	22.29	22.27	22.27	22.29	22.28	22.27	22.35	22.33
	9538	22.25	22.24	22.21	22.3	22.17	22.22	22.18	22.27	22.15	22.24	22.2

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.		

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 device's output power is identical to the case where there is no MPR in the device.

2.4.3 Wi-Fi 802.11

Technical Description

The phone under test contains a Wi-Fi 802.11b/g/n transmitter capable of data transmission in the 2.45 GHz ISM band.

Exposure Conditions and Test Exclusions

Mode	Type	Head-Adjacent	Body-Worn Accessory	Mobile Hotspot
802.11b	Data	Tested (1)	Tested (1)	Tested (1)
802.11g / 802.11n	Data	Excluded (1)	Excluded (1)	Excluded (1)

Notes:

(1) Per FCC KDB 248227 D01 and the April 2010 FCC/TCB Meeting Notes, the highest average output power channel for the lowest data rate for 802.11b was selected for SAR evaluation. Other 802.11 modes (including 802.11g and 802.11n) were not investigated when the average output powers over all channels and data rates were not more than ¼ dB higher than the tested channel in the lowest data rate of the 802.11b mode. The **bolded** data rates and channels in the following conducted power tables were used for SAR testing. For cases where alternate channels, higher data rates, or 802.11 modes resulted in output power more than ¼ dB higher than the tested configuration, additional SAR tests were conducted. Alternate configurations selected for additional testing are marked in **highlighted bold**, and were tested in all applicable exposure conditions.

Device Test Setup

For Wi-Fi 802.11 modes, the test sample was operated using manufacturer test mode software per guidance provided in FCC KDB 248227. The test software was set up for the proper channel, transmitter power level and transmit modes of operation on the phone's uplink.

Conducted Power Measurements

Band	Channel	Average Conducted Power (dBm) for 802.11b Mode Data Rates			
		1 Mbps	2 Mbps	5.5 Mbps	11 Mbps
2450 MHz	1	**13.01**	12.92	12.90	12.80
	6	**13.34**	13.08	13.27	13.03
	11	**13.21**	13.15	13.16	13.00

Band	Channel	Average Conducted Power (dBm) for 802.11g Mode Data Rates							
		6 Mbps	9 Mbps	12 Mbps	18 Mbps	24 Mbps	36 Mbps	48 Mbps	54 Mbps
2450 MHz	1	9.98	9.83	9.76	9.75	9.48	9.83	9.25	9.22
	6	10.24	10.10	10.11	10.16	9.77	9.91	9.08	9.21
	11	10.34	10.28	10.10	10.04	9.63	10.03	9.03	9.20

Band	Channel	Average Conducted Power (dBm) for 802.11n Mode Data Rates (20 MHz Channel, 800 ns Guard Interval)							
		6.5 Mbps	13 Mbps	19.5 Mbps	26 Mbps	39 Mbps	52 Mbps	58.5 Mbps	65 Mbps
2450 MHz	1	9.34	9.55	9.48	9.32	9.22	8.92	8.90	8.74
	6	9.57	9.11	9.55	9.15	9.18	8.99	9.15	9.11
	11	9.42	9.64	9.42	9.25	9.43	9.03	9.36	9.02

Band	Channel	Average Conducted Power (dBm) for 802.11n Mode Data Rates (20 MHz Channel, 400 ns Guard Interval)							
		7.2 Mbps	14.4 Mbps	21.6 Mbps	28.8 Mbps	43.3 Mbps	57.7 Mbps	65 Mbps	72.2 Mbps
2450 MHz	1	9.47	9.38	9.25	9.11	9.01	8.92	8.56	8.50
	6	9.71	9.66	9.58	9.31	8.99	9.17	8.92	8.83
	11	9.64	9.55	9.33	9.10	9.28	9.16	8.86	9.17

Band	Channel	Average Conducted Power (dBm) for 802.11n Mode Data Rates (20 MHz Channel, 800 ns Guard Interval)							
		6.5 Mbps	13 Mbps	19.5 Mbps	26 Mbps	39 Mbps	52 Mbps	58.5 Mbps	65 Mbps
2450 MHz	1	9.32	9.13	9.01	8.53	8.56	8.43	7.73	7.60
	6	8.98	9.40	8.91	8.73	8.65	8.83	8.50	7.88
	11	9.17	9.25	9.15	8.46	8.46	8.26	8.00	7.86

Band	Channel	Average Conducted Power (dBm) for 802.11n Mode Data Rates (20 MHz Channel, 400 ns Guard Interval)							
		7.2 Mbps	14.4 Mbps	21.6 Mbps	28.8 Mbps	43.3 Mbps	57.7 Mbps	65 Mbps	72.2 Mbps
2450 MHz	1	9.30	9.03	9.10	8.87	8.70	7.86	7.52	7.26
	6	9.42	9.08	8.97	8.39	8.76	8.39	8.04	7.56
	11	9.40	9.27	9.20	8.60	8.92	8.13	7.76	7.75

2.4.4 Bluetooth

Technical Description

The phone under test contains a Bluetooth transmitter capable of data transmission in the 2.45 GHz ISM band.

Exposure Conditions and Test Exclusions

Mode	Type	Head-Adjacent	Dispatch/Push-to-Talk	Body-Worn Accessory	Mobile Hotspot
All Modes	Data	Excluded (1)	Excluded (1)	Excluded (1)	Excluded (1)

Notes:

(1) Per FCC KDB 447498 D01, standalone SAR measurements of the Bluetooth transmitter in this phone were not required based on the maximum conducted power and the Bluetooth antenna-to-user separation distance. As detailed by the KDB publication, the SAR exclusion threshold for distances < 50 mm is defined by the following equation:

$$\frac{[maximum\ power\ of\ channel, including\ tune-up\ tolerance]_{(mW)}}{[minimum\ test\ separation\ distance]_{(mm)}} \times \sqrt{f_{(GHz)}} \leq 3.0$$

Based on the maximum conducted power of Bluetooth and the most conservative antenna-to-user separation distance used in testing, standalone SAR measurements for Bluetooth were not required.

$$\frac{[7.91]_{(mW)}}{[10]_{(mm)}} \times \sqrt{2.44_{(GHz)}} = \mathbf{1.3} \leq 3.0$$

Note that simultaneous SAR evaluations include estimations for Bluetooth SAR, as detailed in section 4.6 below.

Conducted Power Measurements

Frequency [MHz]	Data Rate [Mbps]	Channel Number	Conducted Power [mW]
2402	1.0	0	7.55
2441	1.0	39	7.77
2480	1.0	78	7.74
2402	2.0	0	7.32
2441	2.0	39	7.43
2480	2.0	78	7.44
2402	3.0	0	7.70
2441	3.0	39	7.90
2480	3.0	78	7.91

Frequency [MHz]	Mode	Channel Number	Conducted Power [mW]
2402	LE	0	0.91
2441	LE	39	0.89
2480	LE	78	0.79

2.4.5 Near-Field Communications

Technical Description

This device contains an integrated Near Field Communications (NFC) module.

Test Exclusion Evaluation

Evaluation of SAR test requirements for the NFC transmitter was performed per the guidance in FCC KDB 447498, FCC KDB 865664 and FCC KDB 648474. FCC KDB 865664 specifies that the FCC SAR test requirements are applicable to 100 MHz - 6 GHZ only, but states that numerical SAR simulation may be appropriate for transmit frequencies below 100 MHz. Additionally, KDB 447498 provides guidance on test exclusion based on maximum transmit power capabilities, which this NFC transmitter falls into. Finally, KDB 648474 states that "phones with built-in NFC, wireless charging or similar functions that do not require separate SAR testing for these specific capabilities can generally be tested according to the normally required SAR measurement procedures. The SAR influence of the additional accessory hardware and functionality to the transmitters and antennas that require SAR Testing are considered during the required SAR testing; therefore, it is transparent to the testing process." Therefore, no SAR measurements of the NFC transmitter are required.

2.5 Accessories for the Device Under Test

2.5.1 Batteries

The phone tested in this report has the following battery options:
Model SNN5892A - 1735 mAH battery

This battery was used to do all of the SAR testing. The phone was placed in the SAR measurement system with a fully charged battery.

2.5.2 Body-Worn Carry Accessories

There are no body-worn accessories available for this phone at the time of testing thus the device was tested per the Supplement C testing guidelines for devices that do not have body-worn accessories. A separation distance of 25 mm between the device and the flat phantom was used for testing body-worn accessory SAR. The chosen separation distance of 25 mm is utilized in order to support any case or holder accessories offered or to be offered by Motorola for this product. The device was tested with the front and back of the device facing the phantom. Both sides of the device were tested for Body SAR for the purpose of including the SAR evaluation for body-worn accessories that support the device with either side facing the user.

3 Test Equipment Used

3.1 Dosimetric Measurement System

The Motorola Mobility ADR Test Services Laboratory utilizes a DASY52™ Dosimetric Assessment System manufactured by Schmid & Partner Engineering AG (SPEAG™), of Zurich Switzerland. All SAR measurements are taken within a shielded enclosure. The overall 10 g RSS uncertainty of the measurement system is ±11% (K=1) with an expanded uncertainty of ±22% (K=2). The overall 1 g RSS uncertainty of the measurement system is ±11% (K=1) with an expanded uncertainty of ±22% (K=2). The measurement uncertainty budget is given in Appendix 5. 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. All equipment was brought into service and used only during its noted calibration period, except where indicated. Equipment without a calibration period was in service for the entirety of the test period.

Description	Serial Number	Cal Date	Cal Due Date	Service Notes
DASY™ DAE V1	378	Apr-11-2012	Apr-11-2013	Measurement System 1
E-Field Probe ES3DV3	3184	Apr-25-2012	Apr-25-2013	Measurement System 1
Twin SAM Phantom V4.0	TP-1156			Measurement System 1
Twin SAM Phantom V4.0	TP-1319			Measurement System 1
MFP V5.1 C Triple Modular Flat Phantom	1101			Measurement System 1
DASY™ DAE V1	376	Sept-03-2012	Sept-03-2013	Measurement System 2
E-Field Probe ES3DV3	3124	Aug-20-2012	Aug-20-2013	Measurement System 2
Twin SAM Phantom V4.0	TP-1136			Measurement System 2
MFP V5.1 C Triple Modular Flat Phantom	1102			Measurement System 2
DASY™ DAE V1	703	Sep-11-2012	Sep-11-2013	Measurement System 4
E-Field Probe ES3DV3	3037	Sep-13-2012	Sep-13-2013	Measurement System 4
Twin SAM Phantom V4.0	TP-1162			Measurement System 4
Dipole Validation Kit, DV835V2	422	Mar-18-2011	Mar-18-2014	Calibration extension, see note.
Dipole Validation Kit, DV1800V2	259	Oct-20-2011	Oct-20-2013	Calibration extension, see note.
Dipole Validation Kit, DV1800V2	2D191	Jan 05, 2012	Jan-05-2014	Calibration extension, see note.
Dipole Validation Kit, DV2450V2	863	Mar-17-2011	Mar-17-2014	Calibration extension, see note.

Note: Per FCC KDB 450824 D02, evaluation for the extension of the dipole calibration was carried out. Results are provided in Appendix 7 in addition to the original calibration certificate.

3.2 Additional Equipment

Description	Serial Number	Cal Date	Cal Due Date
Signal Generator HP8648C	3847A04810	Sep-26-2011	Sep-26-2013
Power Meter E4419B	GB39511090	Sep-06-2012	Sep-06-2014
Power Sensor #1 - E9301A	US39211009	Aug-28-2012	Aug-28-2013
Power Sensor #2 - E9301A	US39211013	Nov-02-2012	Nov-02-2013
Signal Generator HP8648C	3847M01245	Aug-23-2011	Aug-23-2013
Power Meter E4419B	GB39511084	Mar-28-2011	Mar-28-2013
Power Sensor #1 - E9301A	US39210915	Jan-14-2013	Jan-14-2014
Power Sensor #2 - E9301A	US39210916	Jan-14-2013	Jan-14-2014
Network Analyzer E5071C	MY46212851	May-10-2012	May-10-2013
Dielectric Assessment Kit DAK-3.5	1072		

3.3 Test System Validations

Per [5] and FCC KDB 865664 D01, each SAR system (including probes, system components, and software) used for device testing was validated against its performance specifications prior to deployment. These validation measurements are taken to ensure the accuracy of device test results. Validation measurements utilize reference dipoles and the required tissue-equivalent media, and include assessments of system sensitivity, probe linearity, and probe isotropy. Per FCC KDB 865664 D02, a tabulated summary of the validation results for each SAR system used in testing is given below.

DASY52™ Measurement System 1
System Validation Measurements

Probe	Tissue Type	*f* (MHz)	CW Validations				Modulated Validations				
			Date	Dielectric Parameters		Result	Date	Mod. Type	Dielectric Parameters		Result
				Measured σ (S/m)	Measured ε_r				Measured σ (S/m)	Measured ε_r	
3184	Head	750	1/14/2013	0.876	42.76	PASS					
3184	Head	835	1/10/2013	0.919	40.99	PASS	1/11/2013	GMSK	0.915	40.926	PASS
3184	Head	1800	1/10/2013	1.336	38.94	PASS	1/11/2013	GMSK	1.342	39.026	PASS
3184	Head	1900	1/10/2013	1.443	38.49	PASS					
3184	Head	2450	1/11/2013	1.818	37.98	PASS					
3184	Body	750	1/14/2013	0.980	54.73	PASS					
3184	Body	835	1/14/2013	0.978	53.83	PASS	1/11/2013	GMSK	0.98	53.925	PASS
3184	Body	1800	1/14/2013	1.450	52.38	PASS	1/11/2013	GMSK	1.579	51.544	PASS
3184	Body	1900	1/14/2013	1.568	52.00	PASS					
3184	Body	2450	1/14/2013	1.980	51.87	PASS					

DASY52™ Measurement System 2
System Validation Measurements

Probe	Tissue Type	*f* (MHz)	CW Validations				Modulated Validations				
			Date	Dielectric Parameters		Result	Date	Mod. Type	Dielectric Parameters		Result
				Measured σ (S/m)	Measured ε_r				Measured σ (S/m)	Measured ε_r	
3124	Head	750	1/16/2013	0.876	42.29	PASS					
3124	Head	835	1/16/2013	0.895	39.11	PASS	1/14/2013	GMSK	0.914	40.63	PASS
3124	Head	1800	1/15/2013	1.365	38.34	PASS	1/14/2013	GMSK	1.373	39.61	PASS
3124	Head	1900	1/15/2013	1.457	38.20	PASS					
3124	Head	2450	1/16/2013	1.812	39.28	PASS					
3124	Head	2600	1/16/2013	1.971	38.77	PASS					
3124	Body	750	1/16/2013	0.967	54.55	PASS					
3124	Body	835	1/15/2013	0.989	53.55	PASS	1/15/2013	GMSK	0.99	53.547	PASS
3124	Body	1800	1/15/2013	1.448	51.40	PASS	1/14/2013	GMSK	1.45	52.38	PASS
3124	Body	1900	1/15/2013	1.568	51.03	PASS					
3124	Body	2450	1/16/2013	1.992	50.89	PASS					
3124	Body	2600	1/16/2013	2.179	50.40	PASS					

DASY52™ Measurement System 4
System Validation Measurements

Probe	Tissue Type	*f* (MHz)	CW Validations				Modulated Validations				
			Date	Dielectric Parameters		Result	Date	Mod. Type	Dielectric Parameters		Result
				Measured σ (S/m)	Measured ε_r				Measured σ (S/m)	Measured ε_r	
3037	Head	750	1/8/2013	0.861	43.20	PASS					
3037	Head	835	1/7/2013	0.936	42.10	PASS	1/10/2013	GMSK	0.936	41.632	PASS
3037	Head	1800	1/7/2013	1.352	38.58	PASS	1/8/2013	GMSK	1.345	38.568	PASS
3037	Head	1900	1/7/2013	1.459	38.05	PASS					
3037	Head	2450	1/8/2013	1.822	37.87	PASS					
3037	Head	2600	1/8/2013	1.974	37.32	PASS					
3037	Body	750	1/8/2013	0.911	54.83	PASS					
3037	Body	835	1/7/2013	0.997	53.94	PASS	1/8/2013	GMSK	1.00	54.83	PASS
3037	Body	1800	1/7/2013	1.443	52.70	PASS	1/8/2013	GMSK	1.43	52.459	PASS
3037	Body	1900	1/7/2013	1.567	52.25	PASS					
3037	Body	2450	1/8/2013	1.999	51.31	PASS					
3037	Body	2600	1/8/2013	2.177	50.77	PASS					

3.4 Test System Verifications (System Performance Checks)

System accuracy verifications of the DASY52™ were performed using the measurement equipment listed in Section 3.1. The daily system performance check 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 within 24 hours prior to the measurement of the phone. Recommended limits for permittivity and conductivity, specified in [5], are shown in the table below. The obtained results from the system accuracy verification are also displayed in the table below. SAR values are normalized to 1 W forward power delivered to the dipole. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values. The distributions of SAR compare well with those of the reference measurements (see Appendix 1). For frequencies below 3 GHz, the simulated tissue depth was verified to be 15.0 cm ± 0.5 cm. Z-axis scans showing the SAR penetration are also included in Appendix 1.

DASY52™ Measurement System 1
System Verification Measurements for Head SAR Measurements

f (MHz)	Description	Probe	Dipole	Measured SAR (W/kg), 1 gram	Normalized SAR (W/kg), 1 gram	Dielectric Parameters				Ambient Temp (°C)	Tissue Temp (°C)
						Measured σ (S/m)	Deviation σ (S/m)	Measured ε_r	Deviation ε_r		
835	**Measured,** Jan-12-2013	3184	422	1.97	9.85	0.9150	2.3	40.93	-1.6	21.0	20.0
	Measured, Jan-18-2013	3184	422	1.97	9.85	0.9107	1.2	39.45	-5.0	20.5	18.6
	Recommended Limits	3184	422		9.33	0.90	±10%	41.5	±10%	18-25	18-25
1800	**Measured,** Jan-18-2013	3184	259	7.21	36.1	1.385	-1.5	38.19	-4.6	20.5	19.2
	Recommended Limits	3184	259		38.1	1.40	±10%	40.0	±10%	18-25	18-25

DASY52™ Measurement System 1
System Verification Measurements for Body SAR Measurements

f (MHz)	Description	Probe	Dipole	Measured SAR (W/kg), 1 gram	Normalized SAR (W/kg), 1 gram	Dielectric Parameters				Ambient Temp (°C)	Tissue Temp (°C)
						Measured σ (S/m)	Deviation σ (S/m)	Measured ε_r	Deviation ε_r		
835	**Measured,** Jan-14-2013	3184	422	1.99	9.95	0.9785	1.1	53.83	-2.5	20.8	19.3
	Measured, Jan-24-2013	3184	422	1.95	9.75	0.9802	1.1	52.29	-5.3	20.6	19.1
	Recommended Limits	3184	422		9.77	0.97	±10%	55.2	±10%	18-25	18-25
1800	**Measured,** Jan-15-2013	3184	259	7.99	39.95	1.448	-4.7	51.40	-3.6	20.7	20.2
	Measured, Jan-17-2013	3184	259	7.89	39.45	1.490	-2.0	51.57	-3.3	20.5	19.6
	Measured, Jan-22-2013	3184	259	7.74	38.70	1.471	-3.3	51.55	-3.3	20.6	20.1
	Recommended Limits	3184	259		39.1	1.52	±10%	53.3	±10%	18-25	18-25

DASY52™ Measurement System 2
System Verification Measurements for Head SAR Measurements

f (MHz)	Description	Probe	Dipole	Measured SAR (W/kg), 1 gram	Normalized SAR (W/kg), 1 gram	Dielectric Parameters				Ambient Temp (°C)	Tissue Temp (°C)
						Measured σ (S/m)	Deviation σ (S/m)	Measured ε_r	Deviation ε_r		
2450	**Measured,** Jan-23-2013	3124	863	11.4	57.0	1.851	2.8	38.53	-1.8	20.5	19.2
	Recommended Limits	3124	863		54.2	1.80	±10%	39.2	±10%	18-25	18-25

DASY52™ Measurement System 2
System Verification Measurements for Body SAR Measurements

f (MHz)	Description	Probe	Dipole	Measured SAR (W/kg), 1 gram	Normalized SAR (W/kg), 1 gram	Dielectric Parameters				Ambient Temp (°C)	Tissue Temp (°C)
						Measured σ (S/m)	Deviation σ (S/m)	Measured ε_r	Deviation ε_r		
2450	**Measured,** Jan-23-2013	3124	863	10.7	53.5	2.017	3.6	50.82	-3.6	20.3	18.9
	Measured, Jan-23-2013	3124	863	10.7	53.5	2.017	3.6	50.82	-3.6	20.3	18.9
	Recommended Limits	3124	863		52.8	1.95	±10%	52.7	±10%	18-25	18-25

DASY52™ Measurement System 4
System Verification Measurements for Head SAR Measurements

f (MHz)	Description	Probe	Dipole	Measured SAR (W/kg), 1 gram	Normalized SAR (W/kg), 1 gram	Dielectric Parameters				Ambient Temp (°C)	Tissue Temp (°C)
						Measured σ (S/m)	Deviation σ (S/m)	Measured ε_r	Deviation ε_r		
1800	**Measured,** Feb-15-2013	3037	2D191	7.79	38.95	1.317	-5.8	39.54	-1.2	21.2	19.6
	Recommended Limits	3037	2D191		39.2	1.40	±10%	40.0	±10%	18-25	18-25

3.5 Simulated Tissue Dielectric Properties

Validation, System Performance Check, and device SAR measurements are performed using the DASY52™ system along with liquids specified to simulate head and body tissues subjected to electromagnetic exposure. The list of ingredients and the percent composition of the tissue-simulating liquids used for testing are indicated in the following table.

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	5 GHz Head	5 GHz Body
Sugar	57.0	44.9	--	--	--	--	--	--
DGBE	--	--	47.0	30.8	6.89	8.0	--	--
Water	40.45	53.06	52.62	68.8	57.95	71.8	65.52	78.66
Salt	1.45	0.94	0.38	0.4	0.15	0.2	--	--
HEC	1.0	1.0	--	--	--	--	--	--
Bact.	0.1	0.1	--	--	--	--	--	--
Triton X-100	--	--	--	--	35.02	20.0	17.24	10.67
Di(ethylene glycol) Hexyl Ether	--	--	--	--	--	--	17.24	10.67

Prior to conducting SAR measurements, the relative permittivity, ε_r, and conductivity, σ, of the tissue-simulating liquids were measured with a SPEAG™ DAK-3.5 Dielectric Assessment Kit across the frequency ranges of interest. These values, along with recommended targets, percent deviation from the targets, and the temperature of the simulated tissue are shown in the tables below.

For SAR measurements, the dielectric measurements from the DAK-3.5 are imported into the DASY software which performs interpolation to determine the dielectric parameters at the specific frequencies used for device testing. The DASY software also implements SAR error compensation algorithms to automatically correct the measured SAR results for deviations between the measured and target dielectric parameters. This error compensation has been verified by the lab to meet the requirements in FCC KDB 865664 D01. Therefore, where frequencies of test fall within ±50 MHz of a calibration point of the probe used for test, the acceptable range of tissue variation is ±10% per FCC KDB 865664 D01 section 2.4. For test frequencies outside of ±50 MHz of a probe calibration point, the range of tissue variation is reduced per section 2.6 part 2 of the same KDB, to ensure that tissues used in testing are within the required specification regardless of device performance. A mass density of $\rho = 1\ ^{g}/_{cm^3}$ was entered into the system for all cases. It can be seen that the measured parameters are within tolerance of the recommended targets specified in [1] and [5].

Head Simulated-Tissue Dielectric Parameters									
Index	**Date Measured**	***f* (MHz)**	**Target σ (S/m)**	**Target ε_r**	**Measured σ (S/m)**	**Deviation σ (%)**	**Measured ε_r**	**Deviation ε_r (%)**	**Temp (°C)**
835	Jan-12-2013	820.0	0.90 ±10%	41.58 ±10%	0.91	1.3%	41.0	-1.3%	19.5
		835.0	0.90 ±10%	41.50 ±10%	0.92	2.3%	40.9	-1.6%	
		849.0	0.92 ±10%	41.50 ±10%	0.93	1.7%	40.7	-2.0%	
	Jan-18-2013	820.0	0.90 ±10%	41.58 ±10%	0.90	0.2%	39.6	-4.7%	20.1
		835.0	0.90 ±10%	41.50 ±10%	0.91	1.2%	39.5	-5.0%	
		849.0	0.92 ±10%	41.50 ±10%	0.92	0.6%	39.3	-5.4%	
1880	Jan-18-2013	1850.0	1.40 ±10%	40.00 ±10%	1.44	2.9%	37.9	-5.2%	19.2
		1880.0	1.40 -5%/+10%	40.00 -10%/+5%	1.47	5.0%	37.8	-5.6%	
		1915.0	1.40 -5%/+10%	40.00 -10%/+5%	1.51	7.9%	37.6	-6.1%	
	Feb-15-2013	1850.0	1.40 ±10%	40.00 ±10%	1.37	-2.2%	39.3	-1.9%	19.5
		1880.0	1.40 -5%/+10%	40.00 -10%/+5%	1.40	0.0%	39.1	-2.3%	
		1915.0	1.40 -5%/+10%	40.00 -10%/+5%	1.44	2.9%	39.0	-2.6%	
2450	Jan-23-2013	2412.0	1.77 ±10%	39.27 ±10%	1.81	2.5%	38.6	-1.6%	18.4
		2450.0	1.80 ±10%	39.20 ±10%	1.85	2.8%	38.5	-1.8%	
		2462.0	1.81 ±10%	39.18 ±10%	1.86	2.6%	38.5	-1.8%	

Body Simulated-Tissue Dielectric Parameters									
Index	**Date Measured**	***f* (MHz)**	**Target σ (S/m)**	**Target ε_r**	**Measured σ (S/m)**	**Deviation σ (%)**	**Measured ε_r**	**Deviation ε_r (%)**	**Temp (°C)**
835	Jan-14-2013	820.0	0.97 ±10%	55.26 ±10%	0.96	-1.0%	54.0	-2.4%	18.8
		835.0	0.97 ±10%	55.20 ±10%	0.98	1.1%	53.8	-2.5%	
		849.0	0.99 ±10%	55.16 ±10%	0.99	0.3%	53.7	-2.7%	
	Jan-15-2013	820.0	0.97 ±10%	55.26 ±10%	0.96	-1.0%	53.7	-3.0%	18.5
		835.0	0.97 ±10%	55.20 ±10%	0.98	1.1%	53.5	-3.1%	
		849.0	0.99 ±10%	55.16 ±10%	0.99	0.3%	53.3	-3.4%	
	Jan-24-2013	820.0	0.97 ±10%	55.26 ±10%	0.96	-1.0%	52.5	-5.1%	19.0
		835.0	0.97 ±10%	55.20 ±10%	0.98	1.1%	52.3	-5.3%	
		849.0	0.99 ±10%	55.16 ±10%	0.99	0.3%	52.1	-5.5%	
1880	Jan-15-2013	1850.0	1.52 ±10%	53.30 ±10%	1.51	-0.7%	51.2	-4.0%	19.3
		1880.0	1.52 -5%/+10%	53.30 -10%/+5%	1.54	1.4%	51.1	-4.2%	
		1915.0	1.52 -5%/+10%	53.30 -10%/+5%	1.59	4.7%	51.0	-4.4%	
	Jan-17-2013	1850.0	1.52 ±10%	53.30 ±10%	1.55	2.0%	51.4	-3.6%	19.7
		1880.0	1.52 -5%/+10%	53.30 -10%/+5%	1.59	4.7%	51.3	-3.8%	
		1915.0	1.52 -5%/+10%	53.30 -10%/+5%	1.64	7.9%	51.1	-4.2%	
	Jan-22-2013	1850.0	1.52 ±10%	53.30 ±10%	1.54	1.4%	51.4	-3.7%	19.7
		1880.0	1.52 -5%/+10%	53.30 -10%/+5%	1.57	3.3%	51.2	-3.9%	
		1915.0	1.52 -5%/+10%	53.30 -10%/+5%	1.62	6.6%	51.1	-4.3%	
2450	Jan-23-2013	2412.0	1.91 ±10%	52.75 ±10%	1.97	2.9%	50.9	-3.5%	18.9
		2450.0	1.95 ±10%	52.70 ±10%	2.02	3.6%	50.8	-3.6%	
		2462.0	1.97 ±10%	52.68 ±10%	2.03	3.3%	50.8	-3.7%	
	Jan-24-2013	2412.0	1.91 ±10%	52.75 ±10%	1.96	2.4%	51.1	-3.1%	19.1
		2450.0	1.95 ±10%	52.70 ±10%	2.01	3.1%	51.0	-3.3%	
		2462.0	1.97 ±10%	52.68 ±10%	2.02	2.8%	51.0	-3.3%	

4 Test Setup Information, SAR Measurement Results, and Analysis

4.1 Overview of Test Setup and Results

The phone was tested in the exposure configurations stipulated in [1], [4], [5], [9], and per FCC KDB 941225 D06 for mobile hotspot operation. The phone was positioned into these configurations using the device holder supplied with the DASY52™ SAR measurement system. The default settings for the SAR scans are set in accordance with FCC KDB 865664 D01 for all area scan resolutions, zoom scan resolutions and volumes, and probe positioning. Please refer to the DASY52™ manual for additional information on SAR scanning procedures and algorithms used.

The SAR measurements were performed using the SAM and Flat phantoms listed in section 3.1. The same phantoms and simulated tissues were used for the system performance checks and the device SAR measurements. Consequently the Z-axis scans included in Appendix 1 are applicable for verification of the required simulated tissue depths of 15.0 cm ± 0.5 cm for frequencies less than 3 GHz, or 10.0 cm ± 0.5 cm for frequencies greater than 3 GHz.

The SAR results shown in following tables 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 maximum device power, measured device power, temperature of the simulated tissue after the test, the measured drift and the scaled SAR. The exact method of scaling is:

$$Scaled\ SAR = (Measured\ SAR) * 10^{\left(\frac{(Maximum\ Power)-(Measured\ Power)}{10}\right)} * 10^{\left(\frac{-Drift}{10}\right)}$$

The SAR reported at the end of the measurement process by the DASY52™ 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. Note that measured SAR is scaled only in the manner which results in a more conservative scaled value, i.e. to a higher SAR value as a consequence of measured power being below the maximum allowed power, or for negative drift values.

Per FCC KDB 447498 D01, area-scan based 1 g SAR estimation was used for initial testing in all combinations of device modes and exposure conditions. The highest SAR measurements for each combination of device mode and exposure condition, and all conditions where the area scan estimation reported values greater than 1.2 $^{W}/_{kg}$, were further evaluated with a zoom scan. When operating conditions for the SAR system verifications did not demonstrate that the verification area scan 1 g SAR estimation resulted in values within 3% of zoom scan 1 g SAR, zoom scans were executed for all SAR tests.

The test conditions that produced the highest SAR values for each combination of DUT mode and exposure condition are indicated as **bold** numbers in the following tables. Plots of these tests are included in Appendices 2 through 4.

4.2 Head-Adjacent Exposure Results

Left Cheek-Touch Position												
Mode	Battery/ Accessory	Channel	*f* (MHz)	DUT Power		Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value		Plot Page
				Maximum (dBm)	Measured (dBm)			Measured (W/kg)	Corrected (W/kg)	Measured (W/kg)	Corrected (W/kg)	
GSM 850, CS Voice	SNN5892A	128	824.2	33.00	33.00	19.5	-0.04	0.328	0.33	0.473	0.48	
GSM 1900, CS Voice	SNN5892A	661	1880.0	30.00	29.94	19.6	-0.09	0.204	0.21	0.374	0.39	
GPRS 1900, 3 upslots	SNN5892A	661	1880.0	25.50	24.87	**19.1**	**-0.03**	**0.268**	**0.31**	**0.494**	**0.58**	**A-18**
WCDMA 850, RMC	SNN5892A	4132	824.2	23.50	23.61	19.7	-0.15	0.512	0.53	0.738	0.76	
WCDMA 1900, RMC	SNN5892A	9262	1852.4	22.4	22.57	19.8	-0.04	0.516	0.52	0.951	0.96	
	SNN5892A	9400	1880	22.4	22.38	**18.9**	**-0.16**	**0.558**	**0.58**	**1.050**	**1.09**	**A-20**
	SNN5892A	9538	1907.6	22.4	22.28	19.7	-0.18	0.417	0.45	0.763	0.82	
802.11b, 1 Mbps	SNN5892A	6	2437		13.34	18.2	0.01	0.0793	0.08	0.142	0.14	

Table 4-1: SAR measurement results in a head-adjacent position against the ICNIRP and ANSI SAR Limit.

Right Cheek-Touch Position												
Mode	Battery/ Accessory	Channel	*f* (MHz)	DUT Power		Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value		Plot Page
				Maximum (dBm)	Measured (dBm)			Measured (W/kg)	Corrected (W/kg)	Measured (W/kg)	Corrected (W/kg)	
GSM 850, CS Voice	SNN5892A	128	824.2	33.00	33.00	19.5	-0.01	0.34	0.34	0.491	0.49	
GPRS 850, 3 upslots	SNN5892A	128	824.2	28.50	27.98	**18.6**	**-0.10**	**0.371**	**0.43**	**0.487**	**0.56**	**A-17**
GSM 1900, CS Voice	SNN5892A	661	1880.0	30.00	29.94	19.6	0.07	0.123	0.12	0.210	0.21	
WCDMA 850, RMC	SNN5892A	4132	824.2	23.50	23.61	**19.5**	**-0.03**	**0.595**	**0.60**	**0.780**	**0.79**	**A-19**
WCDMA 1900, RMC	SNN5892A	9262	1852.4	22.4	22.57	19.8	-0.04	0.338	0.34	0.585	0.59	
802.11b, 1 Mbps	SNN5892A	6	2437		13.34	**18.4**	**-0.11**	**0.132**	**0.14**	**0.255**	**0.26**	**A-21**

Table 4-2: SAR measurement results in a head-adjacent position against the ICNIRP and ANSI SAR Limit.

Left 15° Tilt Position												
Mode	Battery/ Accessory	Channel	*f* (MHz)	DUT Power		Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value		Plot Page
				Maximum (dBm)	Measured (dBm)			Measured (W/kg)	Corrected (W/kg)	Measured (W/kg)	Corrected (W/kg)	
GSM 850, CS Voice	SNN5892A	128	824.2	33.00	33.00	19.5	-0.03	0.230	0.23	0.333	0.34	
GSM 1900, CS Voice	SNN5892A	661	1880.0	30.00	29.94	19.6	0.10	0.078	0.08	0.131	0.13	
WCDMA 850, RMC	SNN5892A	4132	824.2	23.50	23.61	19.7	-0.11	0.292	0.30	0.419	0.43	
WCDMA 1900, RMC	SNN5892A	9262	1852.4	22.4	22.57	19.8	0	0.131	0.13	0.221	0.22	
802.11b, 1 Mbps	SNN5892A	6	2437		13.34	18.2	0.03	0.0822	0.08	0.157	0.16	

Table 4-3: SAR measurement results in a head-adjacent position against the ICNIRP and ANSI SAR Limit.

Right 15° Tilt Position												
Mode	Battery/ Accessory	Channel	*f* (MHz)	DUT Power		Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value		Plot Page
				Maximum (dBm)	Measured (dBm)			Measured (W/kg)	Corrected (W/kg)	Measured (W/kg)	Corrected (W/kg)	
GSM 850, CS Voice	SNN5892A	128	824.2	33.00	33.00	19.5	-0.03	0.199	0.20	0.284	0.29	
GSM 1900, CS Voice	SNN5892A	661	1880.0	30.00	29.94	19.6	-0.01	0.083	0.08	0.149	0.15	
WCDMA 850, RMC	SNN5892A	4132	824.2	23.50	23.61	20.1	0.01	0.315	0.32	0.453	0.45	
WCDMA 1900, RMC	SNN5892A	9262	1852.4	22.4	22.57	19.8	0.1	0.195	0.20	0.330	0.33	
802.11b, 1 Mbps	SNN5892A	6	2437		13.34	18.4	0.69	0.0896	0.09	0.166	0.17	

Table 4-4: SAR measurement results in a head-adjacent position against the ICNIRP and ANSI SAR Limit.

4.3 Body-Worn Accessory Exposure Results

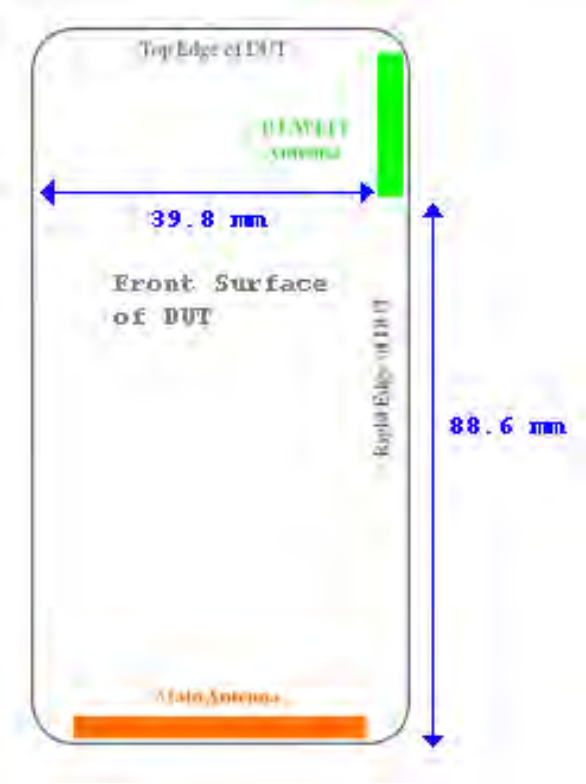
Body-Worn Accessory Position, Front of Phone 25 mm from Phantom												
Mode	Battery/ Accessory	Channel	*f* (MHz)	DUT Power		Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value		Plot Page
				Maximum (dBm)	Measured (dBm)			Measured (W/kg)	Corrected (W/kg)	Measured (W/kg)	Corrected (W/kg)	
GSM 850, CS Voice	SNN5892A	128	824.2	33.00	33.00	18.8	0.08	0.263	0.26	0.375	0.38	
GSM 1900, CS Voice	SNN5892A	661	1880.0	30.00	29.94	19.5	0.01	0.039	0.04	0.063	0.06	
WCDMA 850, RMC	SNN5892A	4132	824.2	23.50	23.61	18.5	0.02	0.155	0.16	0.222	0.22	
WCDMA 1900, RMC	SNN5892A	9400	1880.0	22.40	22.53	19.7	0.02	0.078	0.08	0.125	0.13	
802.11b, 1 Mbps	SNN5892A	6	2437		13.34	19.1	0.17	0.008	0.01	0.014	0.01	

Table 4-5: SAR measurement results in a body-adjacent position against the ICNIRP and ANSI SAR Limit.

Body-Worn Accessory Position, Back of Phone 25 mm from Phantom												
Mode	Battery/ Accessory	Channel	*f* (MHz)	DUT Power		Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value		Plot Page
				Maximum (dBm)	Measured (dBm)			Measured (W/kg)	Corrected (W/kg)	Measured (W/kg)	Corrected (W/kg)	
GSM 850, CS Voice	SNN5892A	128	824.2	33.00	33.00	**18.8**	**0.00**	**0.290**	**0.29**	**0.392**	**0.39**	**A-23**
GSM 1900, CS Voice	SNN5892A	661	1880.0	30.00	29.94	**19.3**	**0.07**	**0.060**	**0.06**	**0.093**	**0.09**	**A-24**
WCDMA 850, RMC	SNN5892A	4132	824.2	23.50	23.61	**18.5**	**0.05**	**0.188**	**0.19**	**0.254**	**0.25**	**A-25**
WCDMA 1900, RMC	SNN5892A	9400	1880.0	22.40	22.53	**19.7**	**0.00**	**0.114**	**0.11**	**0.178**	**0.18**	**A-26**
802.11b, 1 Mbps	SNN5892A	6	2437		13.34	**19.1**	**-0.03**	**0.015**	**0.02**	**0.026**	**0.03**	**A-27**

Table 4-6: SAR measurement results in a body-adjacent position against the ICNIRP and ANSI SAR Limit.

4.4 Mobile Hotspot Exposure Results



Mobile Hotspot Surfaces/Edges for SAR testing						
Mode	Front	Back	Left	Right	Top	Bottom
GSM	Yes	Yes	Yes	Yes	No	Yes
WCDMA	Yes	Yes	Yes	Yes	No	Yes
Wi-Fi	Yes	Yes	No	Yes	Yes	No

Mobile Hotspot Position, Front of Phone 10 mm from Phantom												
Mode	Battery/ Accessory	Channel	*f* (MHz)	DUT Power		Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value		Plot Page
				Maximum (dBm)	Measured (dBm)			Measured (W/kg)	Corrected (W/kg)	Measured (W/kg)	Corrected (W/kg)	
GPRS 850, 3 upslots	SNN5892A	128	824.2	28.5	27.98	19.9	-0.09	0.408	0.47	0.585	0.67	
GPRS 1900, 3 upslots	SNN5892A	512	1850.2	25.5	24.89	19.4	-0.01	0.191	0.22	0.332	0.38	
WCDMA 850, RMC	SNN5892A	4132	824.2	23.5	23.48	18.2	0.00	0.691	0.69	0.989	0.99	
	SNN5892A	4180	836.0	23.5	23.42	18.2	0.00	0.687	0.70	0.983	1.00	
	SNN5892A	4233	846.6	23.5	23.33	18.2	0.01	0.616	0.64	0.880	0.92	
WCDMA 1900, RMC	SNN5892A	9400	1880.0	22.4	22.33	18.7	0.03	0.406	0.41	0.700	0.71	
802.11b, 1 Mbps	SNN5892A	6	2437		13.34	18.7	0.02	0.0397	0.04	0.0702	0.07	

Table 4-7: SAR measurement results in a body-adjacent position against the ICNIRP and ANSI SAR Limit.

Mobile Hotspot Position, Back of Phone 10 mm from Phantom												
Mode	Battery/ Accessory	Channel	*f* (MHz)	DUT Power		Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value		Plot Page
				Maximum (dBm)	Measured (dBm)			Measured (W/kg)	Corrected (W/kg)	Measured (W/kg)	Corrected (W/kg)	
GPRS 850, 3 upslots	SNN5892A	128	824.2	28.5	27.98	19.9	-0.02	0.767	0.87	1.05	1.19	
	SNN5892A	190	836.6	28.5	27.93	19.9	0.02	0.941	1.07	1.29	1.47	
	SNN5892A	190	836.6	28.5	27.93	**18.7**	**-0.06**	**0.935**	**1.08**	**1.28**	**1.48**	**A-29**
	SNN5892A	251	848.8	28.5	27.85	19.9	0.00	0.893	1.04	1.22	1.42	
GPRS 1900, 3 upslots	SNN5892A	512	1850.2	25.5	24.89	19	0.03	0.284	0.33	0.498	0.57	
WCDMA 850, RMC	SNN5892A	4132	826.4	23.5	23.48	**19**	**-0.18**	**1.00**	**1.05**	**1.38**	**1.45**	**A-31**
	SNN5892A	4132	826.4	23.5	23.48	19.0	-0.01	1.01	1.02	1.40	1.41	
	SNN5892A	4180	836.0	23.5	23.42	18.3	0.01	0.937	0.95	1.36	1.39	
	SNN5892A	4233	846.6	23.5	23.33	19	-0.01	0.859	0.90	1.18	1.23	
WCDMA 1900, RMC	SNN5892A	9262	1852.4	22.4	22.28	18.7	0.08	0.569	0.58	1.01	1.04	
	SNN5892A	9400	1880.0	22.4	22.33	18.7	-0.02	0.613	0.63	1.06	1.08	
	SNN5892A	9538	1907.6	22.4	22.25	18.6	0.06	0.645	0.67	1.15	1.19	
802.11b, 1 Mbps	SNN5892A	6	2437		13.34	**18.9**	**0.03**	**0.0456**	**0.05**	**0.079**	**0.08**	**A-33**

Table 4-8: SAR measurement results in a body-adjacent position against the ICNIRP and ANSI SAR Limit.

Mobile Hotspot Position, Left of Phone 10 mm from Phantom												
Mode	Battery/ Accessory	Channel	*f* (MHz)	DUT Power		Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value		Plot Page
				Maximum (dBm)	Measured (dBm)			Measured (W/kg)	Corrected (W/kg)	Measured (W/kg)	Corrected (W/kg)	
GPRS 850, 3 upslots	SNN5892A	128	824.2	28.5	27.98	19.9	-0.03	0.292	0.33	0.436	0.49	
GPRS 1900, 3 upslots	SNN5892A	512	1850.2	25.5	24.89	18.9	-0.09	0.071	0.08	0.126	0.15	
WCDMA 850, RMC	SNN5892A	4132	826.4	23.5	23.48	18.3	0.03	0.423	0.42	0.630	0.63	
WCDMA 1900, RMC	SNN5892A	9400	1880.0	22.4	22.33	19.7	-0.05	0.161	0.17	0.181	0.19	

Table 4-9: SAR measurement results in a body-adjacent position against the ICNIRP and ANSI SAR Limit.

Mobile Hotspot Position, Right of Phone 10 mm from Phantom												
Mode	Battery/ Accessory	Channel	*f* (MHz)	DUT Power		Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value		Plot Page
				Maximum (dBm)	Measured (dBm)			Measured (W/kg)	Corrected (W/kg)	Measured (W/kg)	Corrected (W/kg)	
GPRS 850, 3 upslots	SNN5892A	128	824.2	28.5	27.98	19.9	0.01	0.309	0.35	0.457	0.52	
GPRS 1900, 3 upslots	SNN5892A	512	1850.2	25.5	24.89	18.8	0.01	0.056	0.06	0.096	0.11	
WCDMA 850, RMC	SNN5892A	4132	826.4	23.5	23.48	18.3	-0.01	0.498	0.50	0.736	0.74	
WCDMA 1900, RMC	SNN5892A	9400	1880.0	22.4	22.33	19.6	-0.01	0.177	0.18	0.129	0.13	
802.11b, 1 Mbps	SNN5892A	6	2437		13.34	18.7	0.12	0.009	0.01	0.0158	0.02	

Table 4-10: SAR measurement results in a body-adjacent position against the ICNIRP and ANSI SAR Limit.

Mobile Hotspot Position, Bottom of Phone 10 mm from Phantom												
Mode	Battery/ Accessory	Channel	*f* (MHz)	DUT Power		Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value		Plot Page
				Maximum (dBm)	Measured (dBm)			Measured (W/kg)	Corrected (W/kg)	Measured (W/kg)	Corrected (W/kg)	
GPRS 850, 3 upslots	SNN5892A	128	824.2	28.5	27.98	19.9	0.01	0.051	0.06	0.080	0.09	
GPRS 1900, 3 upslots	SNN5892A	512	1850.2	25.5	24.89	**18.6**	**0.07**	**0.342**	**0.39**	**0.638**	**0.73**	**A-30**
WCDMA 850, RMC	SNN5892A	4132	826.4	23.5	23.48	18.3	-0.03	0.061	0.06	0.097	0.10	
WCDMA 1900, RMC	SNN5892A	9262	1852.4	22.4	22.28	19.2	-0.05	0.619	0.64	1.15	1.20	
	SNN5892A	9400	1880.0	22.4	22.33	19.3	0.04	0.659	0.67	1.22	1.24	
	SNN5892A	9538	1907.6	22.4	22.25	**19.1**	**-0.01**	**0.714**	**0.74**	**1.33**	**1.38**	**A-32**
	SNN5892A	9538	1907.6	22.4	22.25	17.8	0.02	0.704	0.73	1.32	1.37	

Table 4-11: SAR measurement results in a body-adjacent position against the ICNIRP and ANSI SAR Limit.

Mobile Hotspot Position, Top of Phone 10 mm from Phantom												
Mode	Battery/ Accessory	Channel	*f* (MHz)	DUT Power		Temp (°C)	Drift (dB)	10 g SAR value		1 g SAR value		Plot Page
				Maximum (dBm)	Measured (dBm)			Measured (W/kg)	Corrected (W/kg)	Measured (W/kg)	Corrected (W/kg)	
802.11b, 1 Mbps	SNN5892A	6	2437		13.34	18.7	0.02	0.0368	0.04	0.0675	0.07	

Table 4-12: SAR measurement results in a body-adjacent position against the ICNIRP and ANSI SAR Limit.

4.5 Measurement Variability Analysis

Per FCC KDB 865664 D01, SAR measurement variability was assessed for each frequency band as determined by the SAR probe calibration points and tissue-equivalent mediums used for the device measurements. These additional measurements are executed after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The phone was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for these measurements, to minimize any unexpected variations in the repeated results.

SAR measurement variability was assessed using the following procedures for each frequency band:

1. If the original highest measured SAR is < 0.8 $^{W}/_{kg}$, the following steps do not apply and no repeat measurements were executed.
2. If the original highest measured SAR is ≥ 0.8 $^{W}/_{kg}$, that measurement was repeated once.
3. If the ratio of the largest to smallest SAR for the original and first repeated measurement was > 1.2, or if the original or first repeated measurement was ≥ 1.45 $^{W}/_{kg}$, the measurement was repeated a second time.
4. If the ratio of the largest to smallest SAR for the original, first repeated, or second repeated measurement was > 1.2, and one of those measurements was ≥ 1.5 $^{W}/_{kg}$, the measurement was repeated a third time.

SAR Measurement Variability Results										
Mode	**Exposure Condition**	**Channel**	***f* (MHz)**	**Original Measured SAR (W/kg)**	**1st Repeated SAR (W/kg)**	**Ratio**	**2nd Repeated SAR (W/kg)**	**Ratio**	**3rd Repeated SAR (W/kg)**	**Ratio**
GPRS 850 Class 11 (3 Upslots),	**BACK OF Phone 10MM FROM PHANTOM**	190	836.6	1.29	1.28	1.01	N/A	N/A	N/A	N/A
WCDMA 850	**BACK OF Phone 10MM FROM PHANTOM**	4132	826.4	1.38	1.40	0.99	N/A	N/A	N/A	N/A
WCDMA 1900	**BOTTOM EDGE OF PHONE 10MM AWAY FROM PHANTOM**	9538	1907.6	1.33	1.32	1.01	N/A	N/A	N/A	N/A

Table 4-13: SAR measurement results for Variability Analysis

4.6 Description and Evaluation of Simultaneous Transmitters

Per FCC KDB 447498 D01, the necessity of simultaneous SAR testing was evaluated for the licensed and unlicensed transmitters of the phone under test.

By design some or all of the transmitters built into the phone may operate simultaneously, as described in the tables on the following pages.

When standalone SAR test exclusion applies to a mode and antenna that transmits simultaneously with other modes and antennas, the KDB directs that the standalone SAR of that mode must be estimated for evaluation in the SAR summations.

For simultaneous SAR evaluation, Bluetooth SAR was estimated and included in all applicable SAR summations. For Body-Worn Accessory simultaneous SAR evaluation, the value used for inclusion in these summations was found to be:

$$\frac{[10]_{(mW)}}{[25]_{(mm)}} \times \frac{\sqrt{2.44_{(GHz)}}}{7.5} = 0.1\,{}^{W}/_{kg\,(estimated)}$$

Note that Head-Adjacent exposure configurations are not applicable to Bluetooth operation, and therefore were not considered for simultaneous evaluation. Further, Bluetooth and Wi-Fi share the same transmit path, and cannot transmit simultaneously.

A description of the power conditions or reduced limits for simultaneous transmit modes is provided in section 2.5 and in expanded detail in Exhibit 12. The notation used in the "Exposure Condition" tables is as follows for the *PWR* column:

- *N/A* indicates the transmitter in this case has no reduced power limit enforced and may operate up to its maximum power, and no conditions are contingent on this transmitter's operation.

Per FCC KDB 447498 D01 section 4.3.2, when the sum of the 1 g SAR values of all simultaneously transmitting antennas and device modes in an exposure condition is within the SAR limit, that simultaneous transmission configuration may be excluded from SAR measurements. Simultaneous SAR summations for the head-adjacent, dispatch/push-to-talk, body-worn accessory, and mobile hotspot exposure conditions with the worst-case SAR transmitter configurations are presented in the following tables.

Head Exposure Conditions; Simultaneous Transmit Configurations, including Power Conditions or Reduced Limits					
Case	Transmitter #1		Transmitter #2		Notes
	Transmitter Configuration	PWR	Transmitter Configuration	PWR	
H1	GSM 850 CS Voice	*N/A*	Wi-Fi 2.4 GHz	*N/A*	Voice + Background Data
H2	GSM 1900 CS Voice	*N/A*	Wi-Fi 2.4 GHz	*N/A*	Voice + Background Data
H3	WCDMA 850	*N/A*	Wi-Fi 2.4 GHz	*N/A*	Voice + Background Data
H4	WCDMA 1900	*N/A*	Wi-Fi 2.4 GHz	*N/A*	Voice + Background Data

		Transmitter Stand-Alone 1 g SAR Values (W/kg)			1 g SAR Summations (W/kg)	
					Case H1	Case H2
Band		GSM 850	GSM 1900	Wi-Fi 2.4 GHz	GSM 850 + Wi-Fi 2.4 GHz	GSM 1900 + Wi-Fi 2.4 GHz
Power Condition or Reduced Limit		*N/A*	*N/A*	*N/A*		
Position	Left Head Cheek	0.48	0.58	0.14	0.62	0.72
	Left Head 15° Tilt	0.34	0.13	0.16	0.5	0.29
	Right Head Cheek	0.56	0.21	0.26	0.82	0.47
	Right Head 15° Tilt	0.29	0.15	0.17	0.46	0.32

Table 4-14: SAR summations for simultaneous evaluation – GSM in Head Positions

		Transmitter Stand-Alone 1 g SAR Values (W/kg)			1 g SAR Summations (W/kg)	
					Case H3	Case H4
Band		WCDMA 850	WCDMA 1900	Wi-Fi 2.4 GHz	WCDMA 850 + Wi-Fi 2.4 GHz	WCDMA 1900 + Wi-Fi 2.4 GHz
Power Condition or Reduced Limit		*N/A*	*N/A*	*N/A*		
Position	Left Head Cheek	0.76	1.09	0.14	0.9	1.23
	Left Head 15° Tilt	0.43	0.22	0.16	0.59	0.38
	Right Head Cheek	0.79	0.59	0.26	1.05	0.85
	Right Head 15° Tilt	0.45	0.33	0.17	0.62	0.5

Table 4-15: SAR summations for simultaneous evaluation – WCDMA in Head Positions

Body-Worn Accessory Exposure Conditions; Simultaneous Transmit Configurations, including Power Conditions or Reduced Limits					
Case	Transmitter #1		Transmitter #2		Notes
	Transmitter Configuration	PWR	Transmitter Configuration	PWR	
B1	GSM 850 CS Voice	*N/A*	Wi-Fi 2.4 GHz	*N/A*	Voice + Background Data
B2	GSM 1900 CS Voice	*N/A*	Wi-Fi 2.4 GHz	*N/A*	Voice + Background Data
B3	WCDMA 850	*N/A*	Wi-Fi 2.4 GHz	*N/A*	Voice + Background Data
B4	WCDMA 1900	*N/A*	Wi-Fi 2.4 GHz	*N/A*	Voice + Background Data
B5	GSM 850 CS Voice	*N/A*	Bluetooth	*N/A*	Voice + Bluetooth Headset
B6	GSM 1900 CS Voice	*N/A*	Bluetooth	*N/A*	Voice + Bluetooth Headset
B7	WCDMA 850	*N/A*	Bluetooth	*N/A*	Voice + Bluetooth Headset
B8	WCDMA 1900	*N/A*	Bluetooth	*N/A*	Voice + Bluetooth Headset

		Transmitter Stand-Alone 1 g SAR Values (W/kg)				1 g SAR Summations (W/kg)			
						Case B1	Case B2	Case B5	Case B6
Band		GSM 850	GSM 1900	Wi-Fi 2.4 GHz	Bluetooth	GSM 850 + Wi-Fi 2.4 GHz	GSM 1900 + Wi-Fi 2.4 GHz	GSM 850 + Bluetooth	GSM 1900 + Bluetooth
Power Condition or Reduced Limit		*N/A*	*N/A*	*N/A*	*N/A*				
Position	Body Worn, Front of Phone 25 mm from Phantom	0.38	0.06	0.01	0.1	0.39	0.07	0.48	0.16
	Body Worn, Back of Phone 25 mm from Phantom	0.39	0.09	0.03	0.1	0.42	0.12	0.49	0.19

Table 4-16: SAR summations for simultaneous evaluation – GSM in Body-Worn Accessory Positions

		Transmitter Stand-Alone 1 g SAR Values (W/kg)				1 g SAR Summations (W/kg)			
						Case B3	Case B4	Case B7	Case B8
Band		WCDMA 850	WCDMA 1900	Wi-Fi 2.4 GHz	Bluetooth	WCDMA 850 + Wi-Fi 2.4 GHz	WCDMA 1900 + Wi-Fi 2.4 GHz	WCDMA 850 + Bluetooth	WCDMA 1900 + Bluetooth
Power Condition or Reduced Limit		*N/A*	*N/A*	*N/A*	*N/A*				
Position	Body Worn, Front of Phone 25 mm from Phantom	0.22	0.13	0.01	0.1	0.23	0.14	0.32	0.23
	Body Worn, Back of Phone 25 mm from Phantom	0.25	0.18	0.03	0.1	0.28	0.21	0.35	0.28

Table 4-17: SAR summations for simultaneous evaluation – WCDMA in Body-Worn Accessory Positions

Mobile Hotspot Exposure Conditions; Simultaneous Transmit Configurations, including Power Conditions or Reduced Limits					
Case	Transmitter #1		Transmitter #2		Notes
	Transmitter Configuration	PWR	Transmitter Configuration	PWR	
M1	GPRS 850	*N/A*	Wi-Fi 2.4 GHz	*N/A*	Mobile Hotspot session
M2	GPRS 1900	*24.5*	Wi-Fi 2.4 GHz	*N/A*	Mobile Hotspot session
M3	WCDMA 850	*N/A*	Wi-Fi 2.4 GHz	*N/A*	Mobile Hotspot session
M4	WCDMA 1900	*17*	Wi-Fi 2.4 GHz	*N/A*	Mobile Hotspot session

		Transmitter Stand-Alone 1 g SAR Values (W/kg)					1 g SAR Summations (W/kg)			
							Case M1	Case M2	Case M3	Case M4
Band		GPRS 850	GPRS 1900	WCDMA 850	WCDMA 1900	Wi-Fi 2.4 GHz	GPRS 850 + Wi-Fi 2.4 GHz	GPRS 1900 + Wi-Fi 2.4 GHz	WCDMA 850 + Wi-Fi 2.4 GHz	WCDMA 1900 + Wi-Fi 2.4 GHz
Power Condition or Reduced Limit		*N/A*	*N/A*	*N/A*	*N/A*	*N/A*				
Position	Front of Phone 10 mm from Phantom	0.67	0.38	1.00	0.71	0.07	0.74	0.45	1.07	0.78
	Back of Phone 10 mm from Phantom	1.48	0.57	1.45	1.19	0.08	1.56	0.65	1.53	1.27
	Right Edge of Phone 10 mm from Phantom	0.52	0.11	0.74	0.13	0.02	0.54	0.13	0.76	0.15

Table 4-18: SAR summations for simultaneous evaluation – Positions during a Mobile Hotspot session

Simultaneous Evaluation Conclusion

As no summation of transmitter SAR values results in a value greater than the compliance limit, no measurements for simultaneous SAR are required.

5 References to Test Standards and Guidance

[1] CENELEC, EN 62209-1:2006 “Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures - Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)”

[2] CENELEC, EN 50360:2001 “Product standard to demonstrate the compliance of mobile phones with the basic restrictions related to human exposure to electromagnetic fields (300 MHz – 3 GHz)”.

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

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

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

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

[7] IC RSS-102 “Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

[8] IC Notice 2012-DRS1203 “RE: Applicability of Latest FCC RF Exposure KDB Procedures (Publication Date: October 24, 2012) and Other Procedures”

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

[10] FCC KDB Publication 248227 D01 v01r02 “SAR Measurement Procedures for 802.11 a/b/g Transmitters”

[11] FCC KDB Publication 447498 D01 v05 “Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies”

[12] FCC KDB Publication 648474 D04 v01 “SAR Evaluation Considerations for Wireless Handsets”

[13] FCC KDB Publication 865664 D01 v01 “SAR Measurement Requirements for 100 MHz to 6 GHz”

[14] FCC KDB Publication 865664 D02 v01 “RF Exposure Compliance Reporting and Documentation Considerations”

[15] FCC KDB Publication 941225 D01 v02 “SAR Measurement Procedures for 3G Devices”

[16] FCC KDB Publication 941225 D03 v01 “Recommended SAR Test Reduction Procedures for GMS/GPRS/EDGE”

[17] FCC KDB Publication 941225 D05 v02r01 “SAR Evaluation Considerations for LTE Devices”

[18] FCC KDB Publication 941225 D06 v01 “SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities”

Appendix 1

SAR Distribution Plots for Test System Verification

System Accuracy Verification Measurements for Head SAR Measurements

Date/Time: 1/12/2013 2:34:49 AM

DUT Serial: D835V2 - SN: 422

DASY Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.48,5.48,5.48); Calibrated: 4/25/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#1 - Sugar SAM (extended range), Rev.2 (24-Feb-12); Type: SAM v4.0; Serial: TP-1156
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

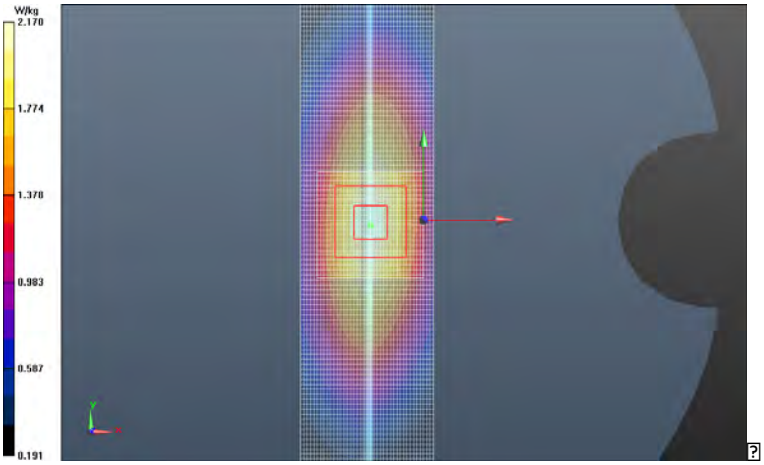
Communication System: _CW - Dipole; Communication System Band: CW for SAR Dipoles; Frequency: 835.0 MHz, Communication System PAR: 0.00 dB; PMF: 1.000; Duty Cycle: 1:1.000
Medium Parameters used: f=835 MHz; σ = 0.9150; ε_r = 40.93 mho/m; ρ = 1000 kg/m^3

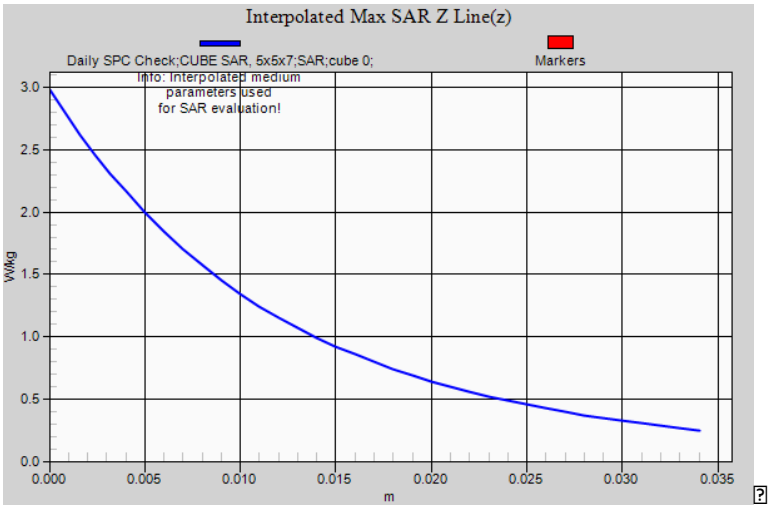
Daily SPC Check/fastSAR, Dipole Area Scan (41x141x1): Interpolated grid: dx=1.000 mm, dy=1.500 mm

Fast SAR: SAR(1g) = 1.98 W/kg; SAR(10g) = 1.32 W/kg

Daily SPC Check/CUBE SAR, 5x5x7 (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 49.472 V/m, Power Drift = -0.015 dB
Averaged SAR: SAR(1g) = 1.97 W/kg; SAR(10g) = 1.29 W/kg





Date/Time: 1/18/2013 8:03:07 AM

DUT Serial: D835V2 - SN: 422

DASY Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.48,5.48,5.48); Calibrated: 4/25/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#1 - Sugar SAM (extended range), Rev.2 (24-Feb-12); Type: SAM v4.0; Serial: TP-1156
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

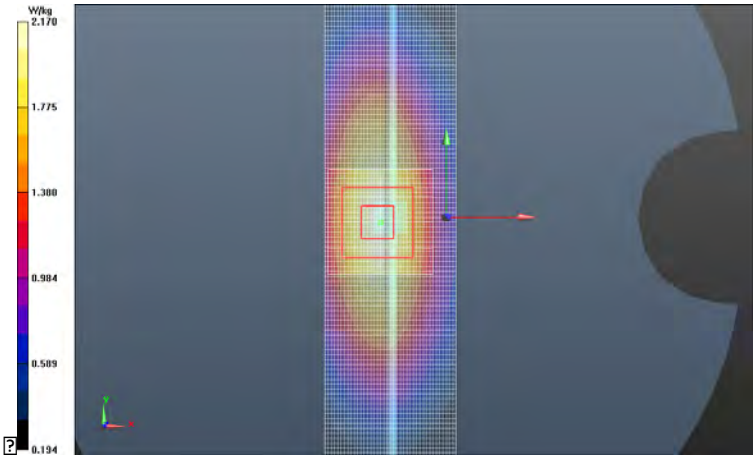
Communication System: _CW - Dipole; Communication System Band: CW for SAR Dipoles; Frequency: 835.0 MHz, Communication System PAR: 0.00 dB; PMF: 1.000; Duty Cycle: 1:1.000
Medium Parameters used: f=835 MHz; σ = 0.9107; ε_r = 39.45 mho/m; ρ = 1000 kg/m^3

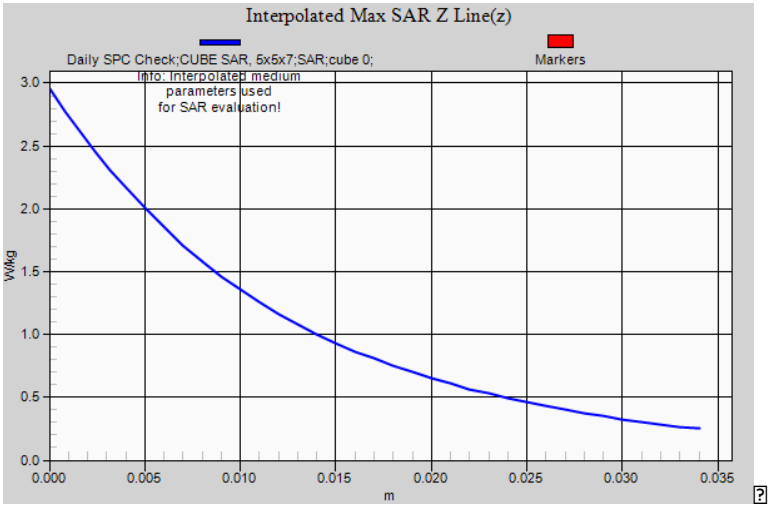
Daily SPC Check/fastSAR, Dipole Area Scan (41x141x1): Interpolated grid: dx=1.000 mm, dy=1.500 mm

Fast SAR: SAR(1g) = 1.98 W/kg; SAR(10g) = 1.33 W/kg

Daily SPC Check/CUBE SAR, 5x5x7 (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 48.719 V/m, Power Drift = -0.026 dB
Averaged SAR: SAR(1g) = 1.97 W/kg; SAR(10g) = 1.30 W/kg





Date/Time: 2/15/2013 8:56:37 AM

DUT: Dipole 1800 MHz, Serial: D1800V2 - SN:2d191

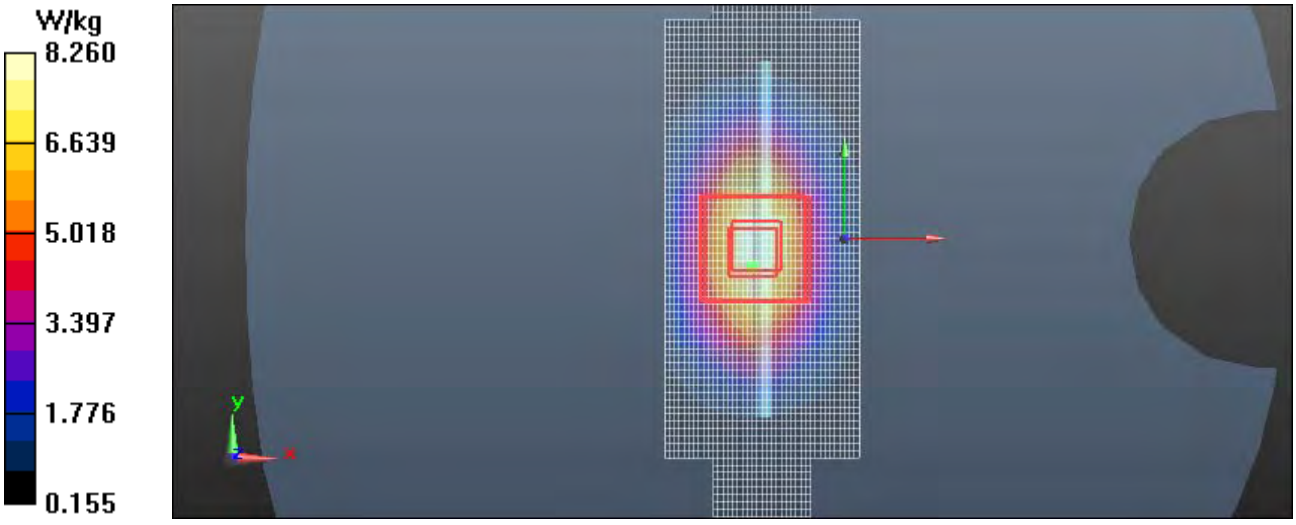
DASY Configuration:

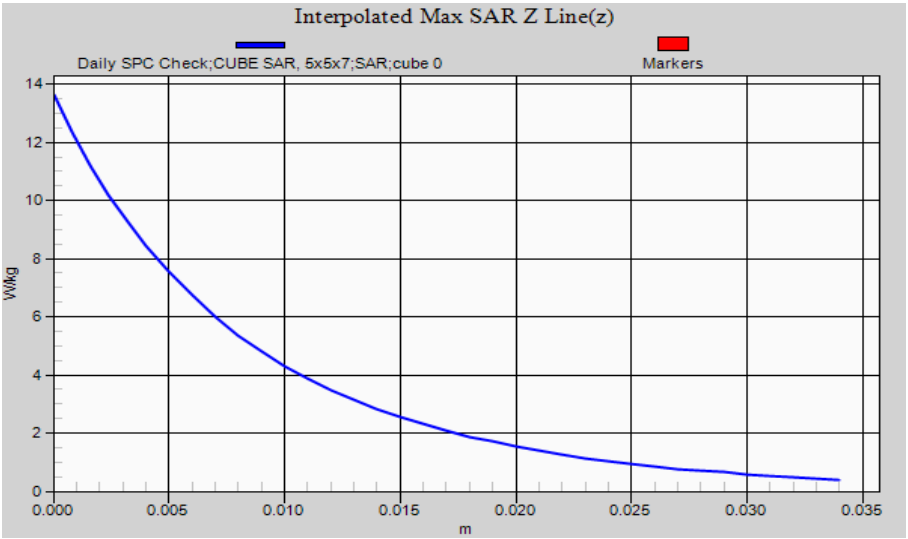
- Probe: ES3DV3 - SN3037; ConvF(5.15,5.15,5.15); Calibrated: 9/13/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn703; Calibrated: 9/11/2012
- Phantom: R#4 Glycol SAM (extended range), Rev.2 (24-Feb-12); Type: SAM v4.0; Serial: TP-1162
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

Communication System: _CW - Dipole; Communication System Band: CW for SAR Dipoles; Frequency: 1800 MHz,
Communication System PAR: 0.00 dB; PMF: 1.000; Duty Cycle: 1:1.000
Medium Parameters used: f=1800 MHz; $\sigma = 1.317$; $\varepsilon_r = 39.54$ mho/m; $\rho = 1.000$ kg/m^3

Daily SPC Check/fastSAR, Dipole Area Scan (41x141x1): Interpolated grid: dx=1.000 mm, dy=1.500 mm
Fast SAR: SAR(1g) = 7.91 W/kg; SAR(10g) = 4.22 W/kg

Daily SPC Check/CUBE SAR, 5x5x7 (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm
Reference Value = 81.191 V/m, Power Drift = -0.083 dB
Averaged SAR: SAR(1g) = 7.79 W/kg; SAR(10g) = 4.09 W/kg





Date/Time: 1/18/2013 9:48:37 PM

DUT Serial: D1800V2 - SN: 259

DASY Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.48,5.48,5.48); Calibrated: 4/25/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#1 - Glycol SAM (extended range), Rev.2 (24-Feb-12); Type: SAM v4.0; Serial: TP-1319
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

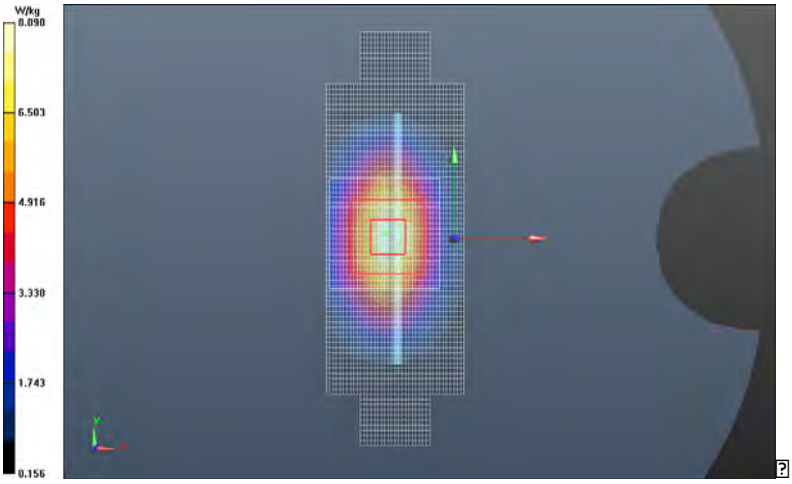
Communication System: _CW - Dipole; Communication System Band: CW for SAR Dipoles; Frequency: 1800 MHz, Communication System PAR: 0.00 dB; PMF: 1.000; Duty Cycle: 1:1.000
Medium Parameters used: f=1800 MHz; σ = 1.385; ε_r = 38.19 mho/m; ρ = 1000 kg/m^3

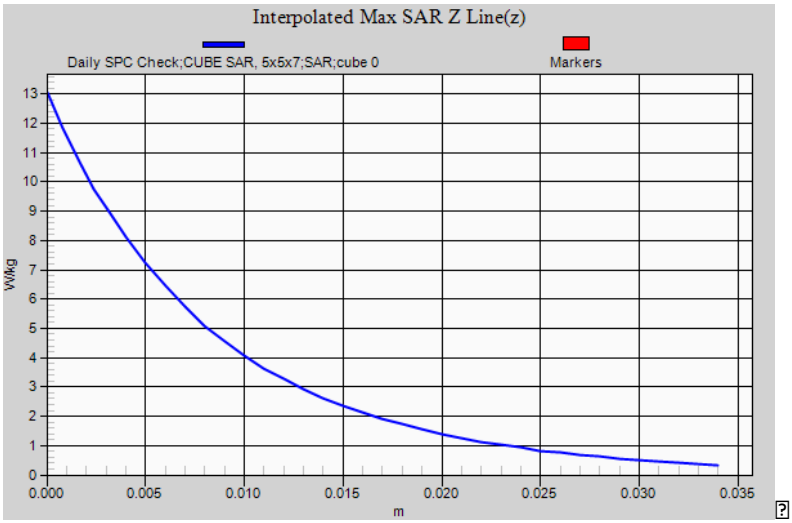
Daily SPC Check/fastSAR, Dipole Area Scan (41x141x1): Interpolated grid: dx=1.000 mm, dy=1.500 mm

Fast SAR: SAR(1g) = 7.26 W/kg; SAR(10g) = 3.96 W/kg

Daily SPC Check/CUBE SAR, 5x5x7 (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 76.748 V/m, Power Drift = 0.030 dB
Averaged SAR: SAR(1g) = 7.21 W/kg; SAR(10g) = 3.82 W/kg





Date/Time: 1/23/2013 9:55:51 AM

DUT Serial: D2450V2 - SN: 863

DASY Configuration:

- Probe: ES3DV3 - SN3124; ConvF(5.07,5.07,5.07); Calibrated: 8/20/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 9/3/2012
- Phantom: R#2 Glycol SAM (extended range), Rev.2 (24-Feb-12); Type: SAM v4.0; Serial: TP-1136
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

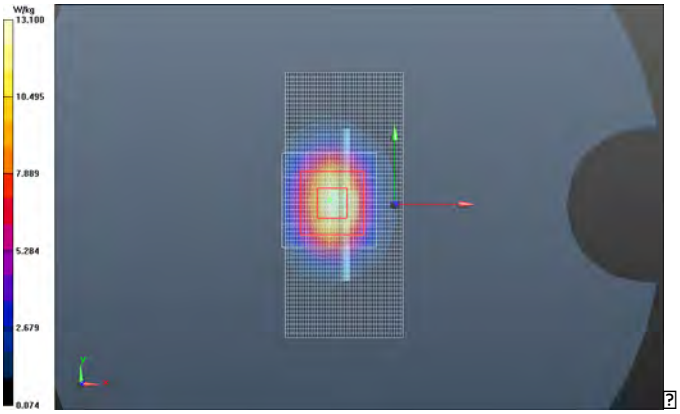
Communication System: _CW - Dipole; Communication System Band: CW for SAR Dipoles; Frequency: 2450 MHz, Communication System PAR: 0.00 dB; PMF: 1.000; Duty Cycle: 1:1.000
Medium Parameters used: f=2450 MHz; σ = 1.851; ε_r = 38.53 mho/m; ρ = 1000 kg/m^3

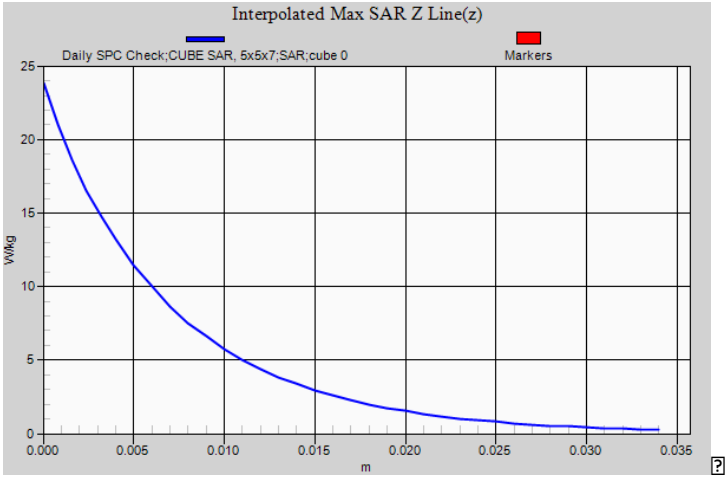
Daily SPC Check/fastSAR, Dipole Area Scan (41x141x1): Interpolated grid: dx=1.000 mm, dy=1.500 mm

Fast SAR: SAR(1g) = 11.8 W/kg; SAR(10g) = 5.57 W/kg

Daily SPC Check/CUBE SAR, 5x5x7 (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 80.792 V/m, Power Drift = 0.044 dB
Averaged SAR: SAR(1g) = 11.4 W/kg; SAR(10g) = 5.32 W/kg





System Accuracy Verification Measurements for Body SAR Measurements

Date/Time: 1/14/2013 9:37:49 PM

DUT Serial: D835V2 – SN 422

DASY Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.48,5.48,5.48); Calibrated: 4/25/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#-1, Triple Flat Phantom 5.1C (Rev.4); Type: QD 000 P51 CA; Serial: n/a
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

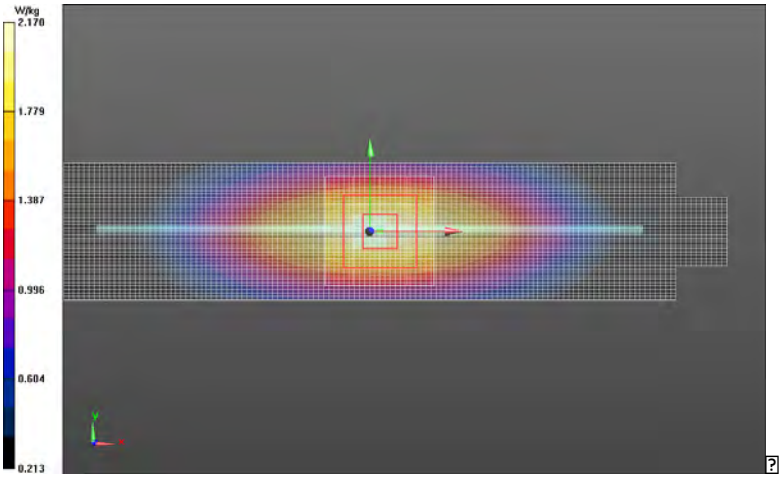
Communication System: _CW - Dipole; Communication System Band: CW for SAR Dipoles; Frequency: 835.0 MHz, Communication System PAR: 0.00 dB; PMF: 1.000; Duty Cycle: 1:1.000
Medium Parameters used: f=835 MHz; σ = 0.9785; ε_r = 53.83 mho/m; ρ = 1000 kg/m^3

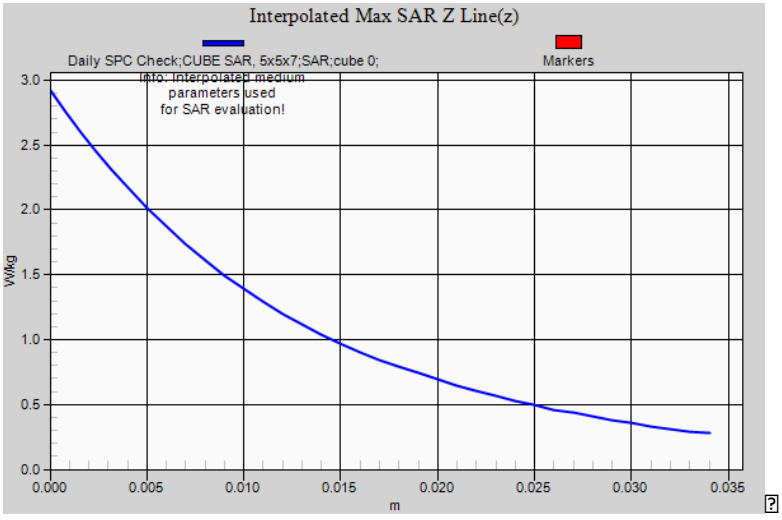
Daily SPC Check/fastSAR, Dipole Area Scan (41x141x1): Interpolated grid: dx=1.000 mm, dy=1.500 mm

Fast SAR: SAR(1g) = 1.99 W/kg; SAR(10g) = 1.32 W/kg

Daily SPC Check/CUBE SAR, 5x5x7 (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 47.693 V/m, Power Drift = -0.030 dB
Averaged SAR: SAR(1g) = 1.99 W/kg; SAR(10g) = 1.32 W/kg





Date/Time: 1/24/2013 11:02:25 PM

DUT Serial: D835V2 – SN 422

DASY Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.48,5.48,5.48); Calibrated: 4/25/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#-1, Triple Flat Phantom 5.1C (Rev.4); Type: QD 000 P51 CA; Serial: n/a
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

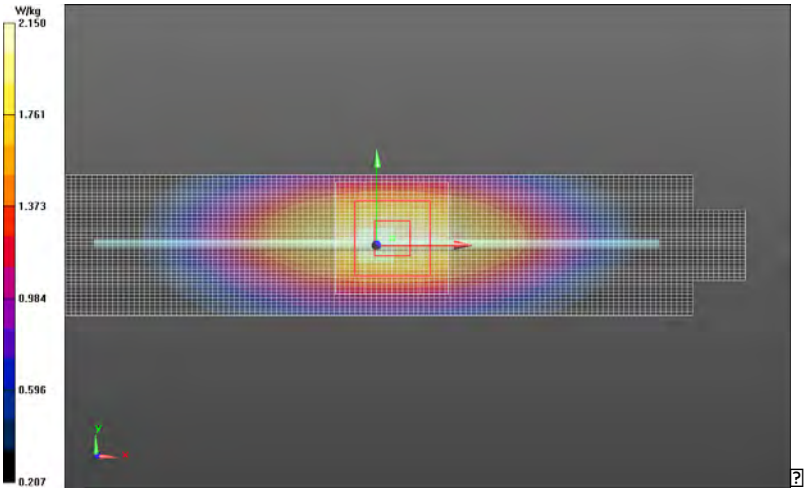
Communication System: _CW - Dipole; Communication System Band: CW for SAR Dipoles; Frequency: 835.0 MHz, Communication System PAR: 0.00 dB; PMF: 1.000; Duty Cycle: 1:1.000
Medium Parameters used: f=835 MHz; σ = 0.9802; ε_r = 52.29 mho/m; ρ = 1000 kg/m^3

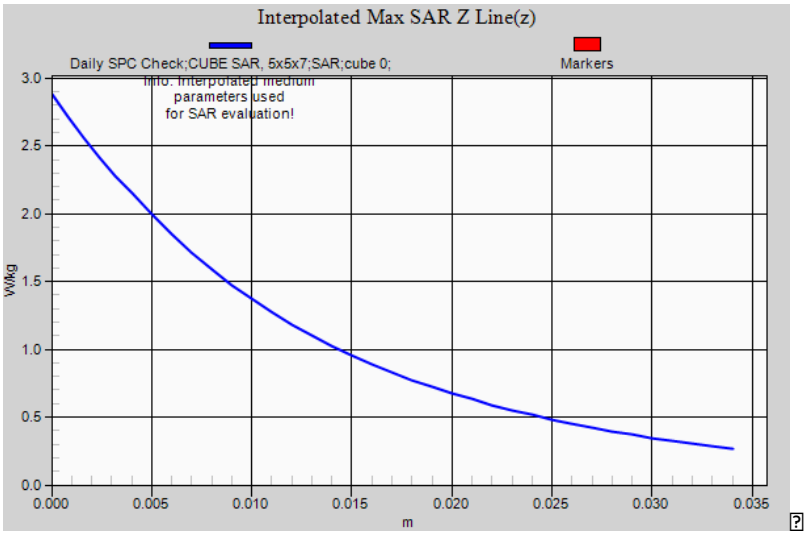
Daily SPC Check/fastSAR, Dipole Area Scan (41x141x1): Interpolated grid: dx=1.000 mm, dy=1.500 mm

Fast SAR: SAR(1g) = 1.95 W/kg; SAR(10g) = 1.30 W/kg

Daily SPC Check/CUBE SAR, 5x5x7 (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 46.339 V/m, Power Drift = -0.00508 dB
Averaged SAR: SAR(1g) = 1.95 W/kg; SAR(10g) = 1.30 W/kg





Date/Time: 1/15/2013 12:43:55 PM

DUT Serial: D1800V2 – SN 259

DASY Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.48,5.48,5.48); Calibrated: 4/25/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#-1, Triple Flat Phantom 5.1C (Rev.4); Type: QD 000 P51 CA; Serial: n/a
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

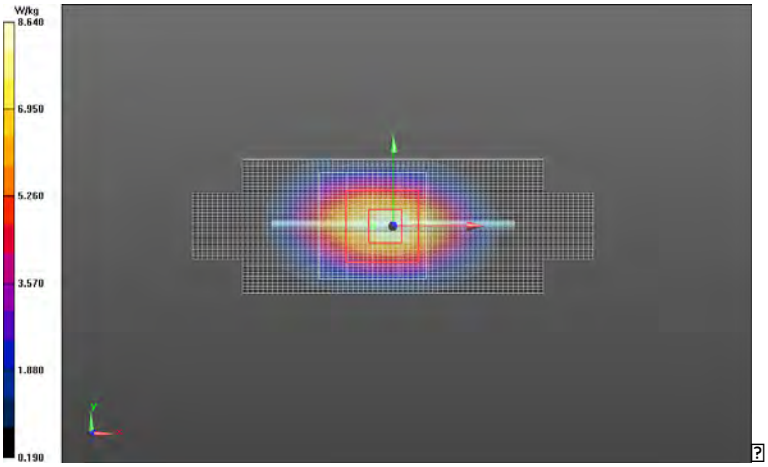
Communication System: _CW - Dipole; Communication System Band: CW for SAR Dipoles; Frequency: 1800 MHz, Communication System PAR: 0.00 dB; PMF: 1.000; Duty Cycle: 1:1.000
Medium Parameters used: f=1800 MHz; σ = 1.448; ε_r = 51.40 mho/m; ρ = 1000 kg/m^3

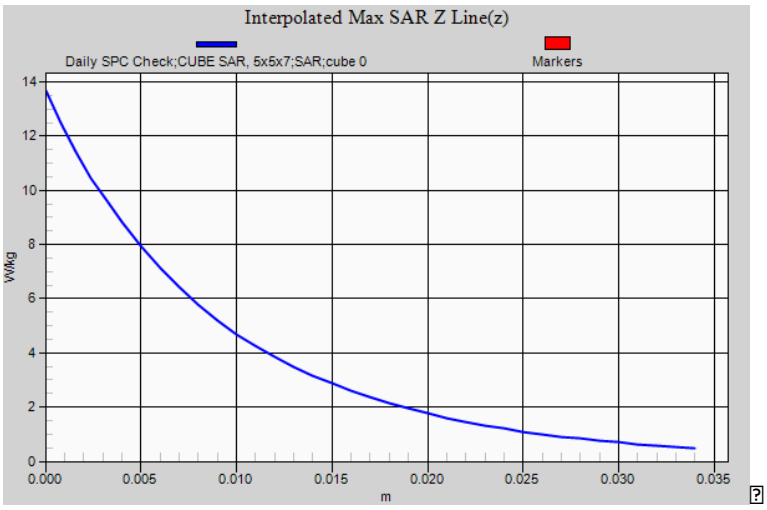
Daily SPC Check/fastSAR, Dipole Area Scan (41x141x1): Interpolated grid: dx=1.000 mm, dy=1.500 mm

Fast SAR: SAR(1g) = 8.12 W/kg; SAR(10g) = 4.28 W/kg

Daily SPC Check/CUBE SAR, 5x5x7 (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 78.804 V/m, Power Drift = -0.00106 dB
Averaged SAR: SAR(1g) = 7.99 W/kg; SAR(10g) = 4.26 W/kg





Date/Time: 1/17/2013 9:50:36 AM

DUT Serial: D1800V2 – SN 259

DASY Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.48,5.48,5.48); Calibrated: 4/25/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#-1, Triple Flat Phantom 5.1C (Rev.4); Type: QD 000 P51 CA; Serial: n/a
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

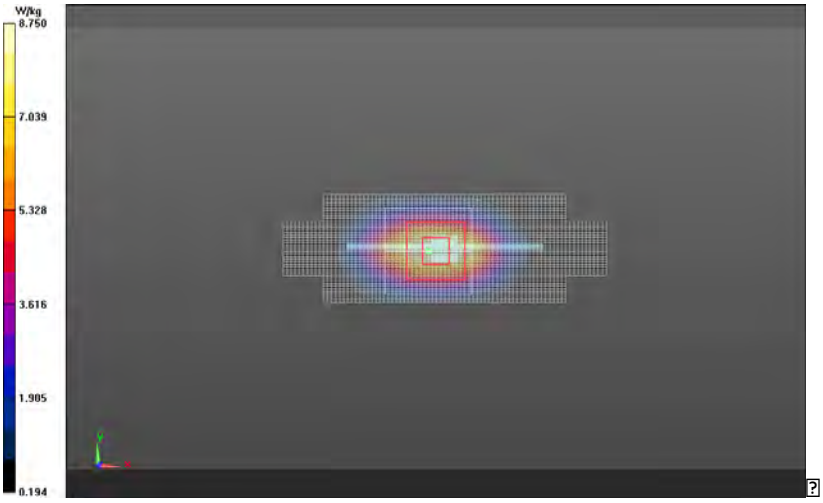
Communication System: _CW - Dipole; Communication System Band: CW for SAR Dipoles; Frequency: 1800 MHz, Communication System PAR: 0.00 dB; PMF: 1.000; Duty Cycle: 1:1.000
Medium Parameters used: f=1800 MHz; σ = 1.490; ε_r = 51.57 mho/m; ρ = 1000 kg/m^3

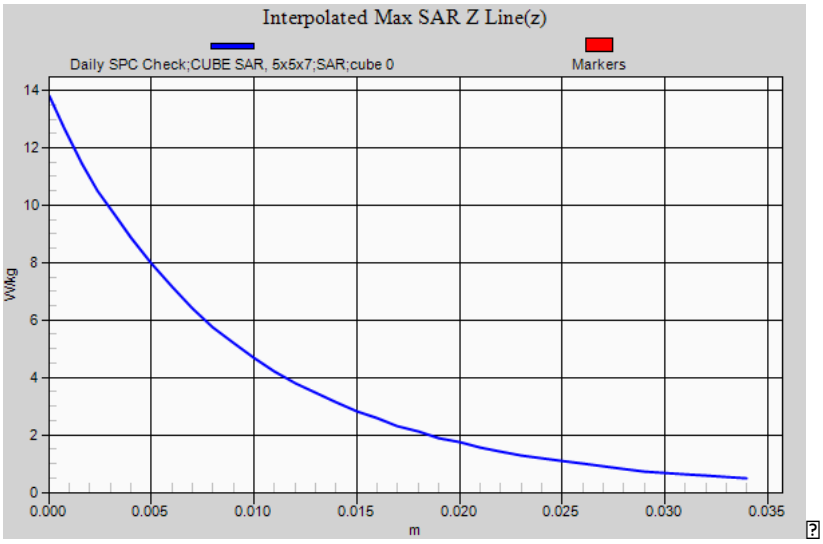
Daily SPC Check/fastSAR, Dipole Area Scan (41x141x1): Interpolated grid: dx=1.000 mm, dy=1.500 mm

Fast SAR: SAR(1g) = 7.99 W/kg; SAR(10g) = 4.23 W/kg

Daily SPC Check/CUBE SAR, 5x5x7 (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 77.553 V/m, Power Drift = 0.00725 dB
Averaged SAR: SAR(1g) = 7.89 W/kg; SAR(10g) = 4.22 W/kg





Date/Time: 1/22/2013 2:23:48 PM

DUT Serial: D1800V2 – SN 259

DASY Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.48,5.48,5.48); Calibrated: 4/25/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#-1, Triple Flat Phantom 5.1C (Rev.4); Type: QD 000 P51 CA; Serial: n/a
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

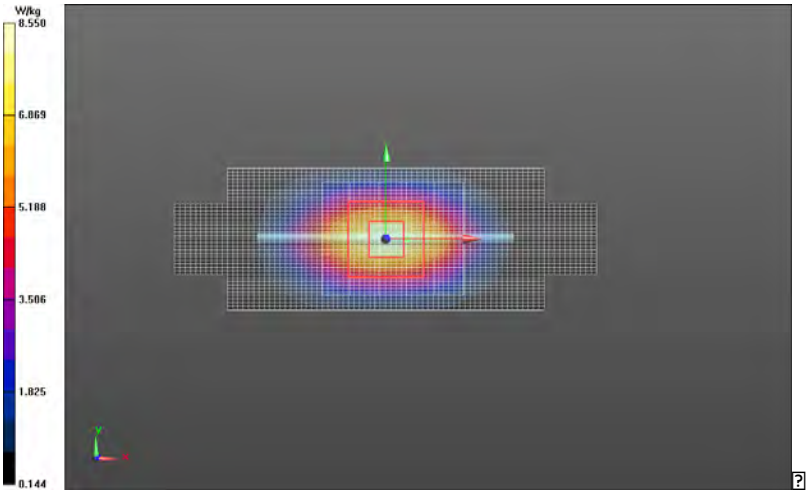
Communication System: _CW - Dipole; Communication System Band: CW for SAR Dipoles; Frequency: 1800 MHz, Communication System PAR: 0.00 dB; PMF: 1.000; Duty Cycle: 1:1.000
Medium Parameters used: f=1800 MHz; σ = 1.471; ε_r = 51.55 mho/m; ρ = 1000 kg/m^3

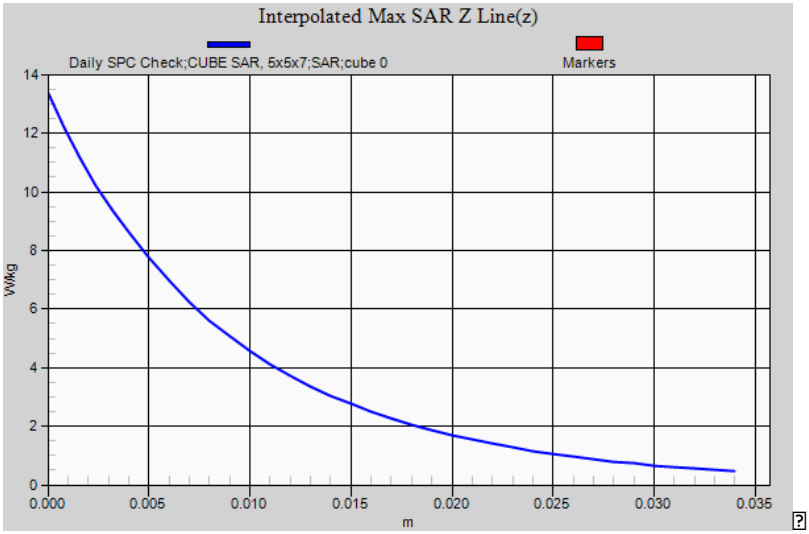
Daily SPC Check/fastSAR, Dipole Area Scan (41x141x1): Interpolated grid: dx=1.000 mm, dy=1.500 mm

Fast SAR: SAR(1g) = 7.82 W/kg; SAR(10g) = 4.17 W/kg

Daily SPC Check/CUBE SAR, 5x5x7 (21x26x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 77.566 V/m, Power Drift = -0.0098 dB
Averaged SAR: SAR(1g) = 7.74 W/kg; SAR(10g) = 4.15 W/kg





Date/Time: 1/23/2013 6:20:05 PM

DUT Serial: D2450V2 – SN 863

DASY Configuration:

- Probe: ES3DV3 - SN3124; ConvF(5.07,5.07,5.07); Calibrated: 8/20/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 9/3/2012
- Phantom: R#2 Triple Flat Phantom 5.1C (Rev.4); Type: QD 000 P51 CA; Serial: n/a
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

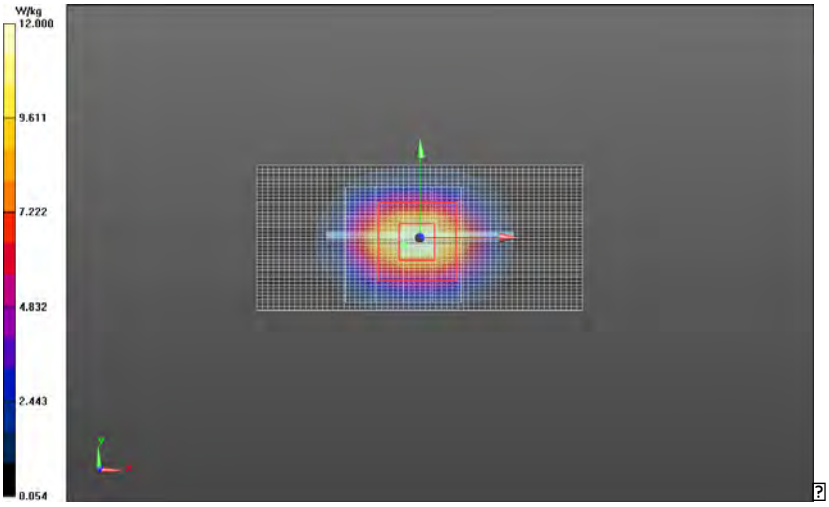
Communication System: _CW - Dipole; Communication System Band: CW for SAR Dipoles; Frequency: 2450 MHz, Communication System PAR: 0.00 dB; PMF: 1.000; Duty Cycle: 1:1.000
Medium Parameters used: f=2450 MHz; σ = 2.017; ε_r = 50.82 mho/m; ρ = 1000 kg/m^3

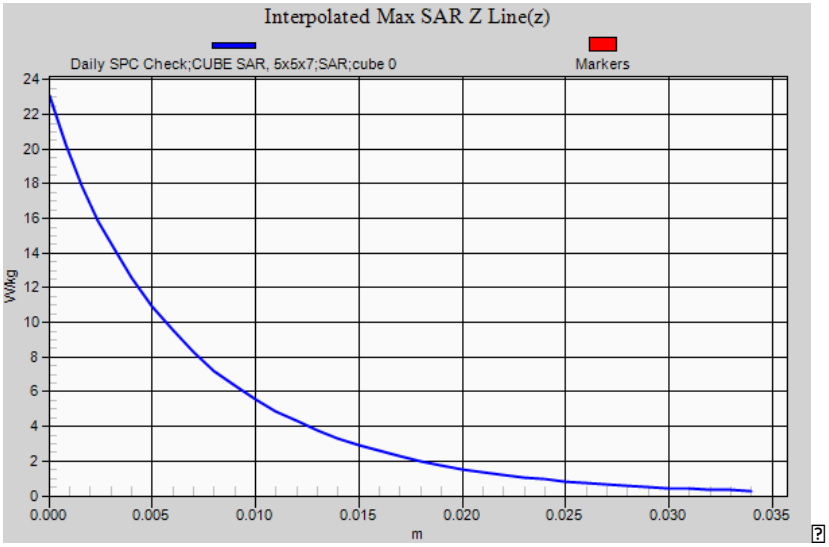
Daily SPC Check/fastSAR, Dipole Area Scan (41x141x1): Interpolated grid: dx=1.000 mm, dy=1.500 mm

Fast SAR: SAR(1g) = 11.2 W/kg; SAR(10g) = 5.15 W/kg

Daily SPC Check/CUBE SAR, 5x5x7 (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 78.019 V/m, Power Drift = -0.115 dB
Averaged SAR: SAR(1g) = 10.7 W/kg; SAR(10g) = 4.94 W/kg





Date/Time: 1/23/2013 9:56:24 PM

DUT Serial: D2450V2 – SN 863

DASY Configuration:

- Probe: ES3DV3 - SN3124; ConvF(5.07,5.07,5.07); Calibrated: 8/20/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 9/3/2012
- Phantom: R#2 Triple Flat Phantom 5.1C (Rev.4); Type: QD 000 P51 CA; Serial: n/a
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

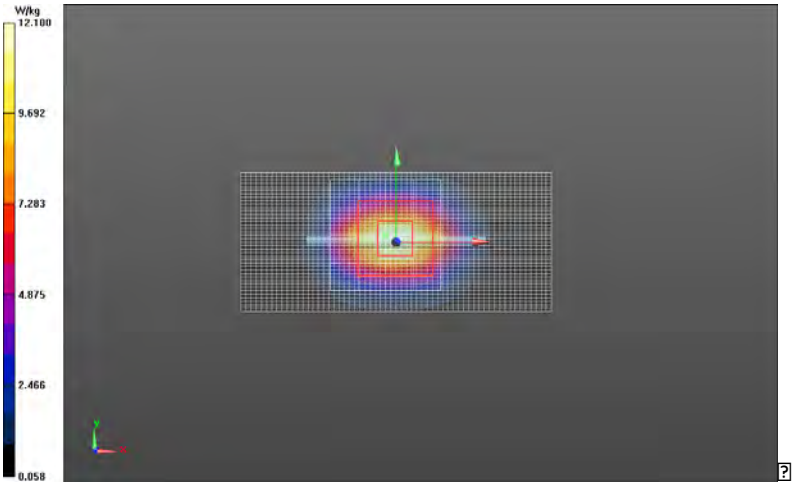
Communication System: _CW - Dipole; Communication System Band: CW for SAR Dipoles; Frequency: 2450 MHz, Communication System PAR: 0.00 dB; PMF: 1.000; Duty Cycle: 1:1.000
Medium Parameters used: f=2450 MHz; σ = 2.017; ε_r = 50.82 mho/m; ρ = 1000 kg/m^3

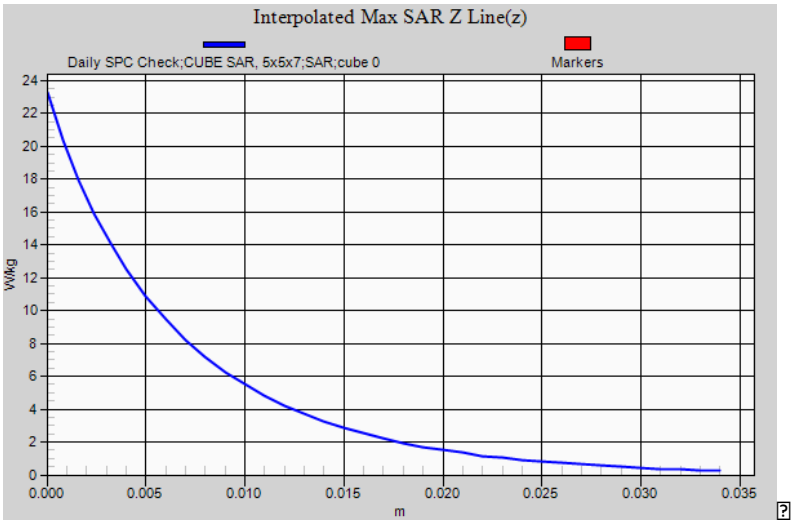
Daily SPC Check/fastSAR, Dipole Area Scan (41x141x1): Interpolated grid: dx=1.000 mm, dy=1.500 mm

Fast SAR: SAR(1g) = 10.9 W/kg; SAR(10g) = 5.04 W/kg

Daily SPC Check/CUBE SAR, 5x5x7 (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 78.278 V/m, Power Drift = -0.015 dB
Averaged SAR: SAR(1g) = 10.7 W/kg; SAR(10g) = 4.92 W/kg





Appendix 2

SAR Distribution Plots for Head-Adjacent Test Results

Date/Time: 1/18/2013 9:04:58 PM

DUT Serial: 353207050002579

DASY Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.48,5.48,5.48); Calibrated: 4/25/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#1 - Sugar SAM (extended range), Rev.2 (24-Feb-12); Type: SAM v4.0; Serial: TP-1156
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

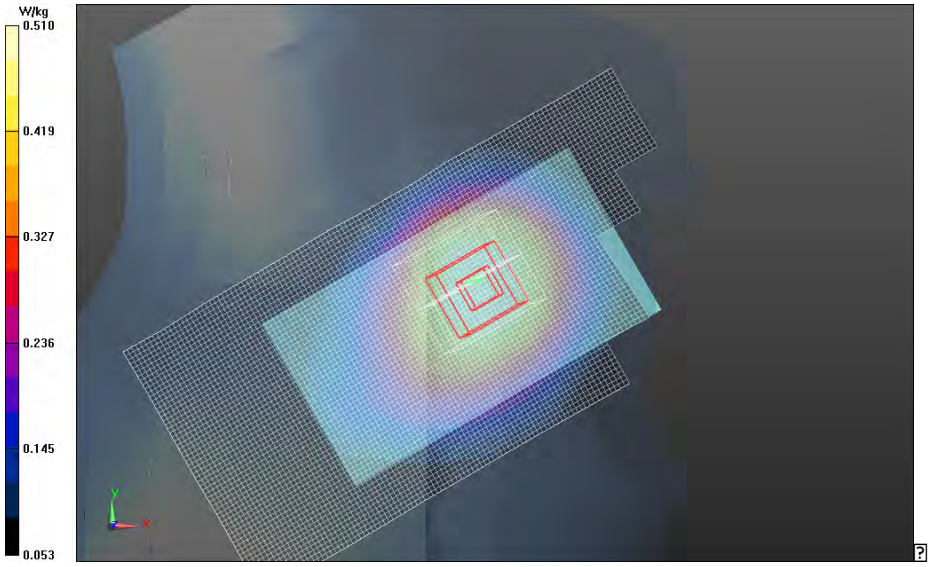
Communication System: _GPRS Class 11; Communication System Band: 850 MHz; Frequency: 824.2 MHz, Communication System PAR: 4.41 dB; PMF: 1.661; Duty Cycle: 1:2.760
Medium Parameters used: f=824.2 MHz; σ = 0.9003; ε_r = 39.58 mho/m; ρ = 1000 kg/m^3

Right Head Template/15mm, Area Scan - Not for 2450 FCC TA... (61x161x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Fast SAR: SAR(1g) = 0.503 W/kg; SAR(10g) = 0.346 W/kg

Right Head Template/5x5x7 Zoom Scan (<=3GHz) (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 24.257 V/m, Power Drift = -0.10 dB
Averaged SAR: SAR(1g) = 0.487 W/kg; SAR(10g) = 0.371 W/kg



Right Head Template

Date/Time: 1/18/2013 10:30:32 PM

DUT Serial: 353207050002579

DASY Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.48,5.48,5.48); Calibrated: 4/25/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#1 - Glycol SAM (extended range), Rev.2 (24-Feb-12); Type: SAM v4.0; Serial: TP-1319
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

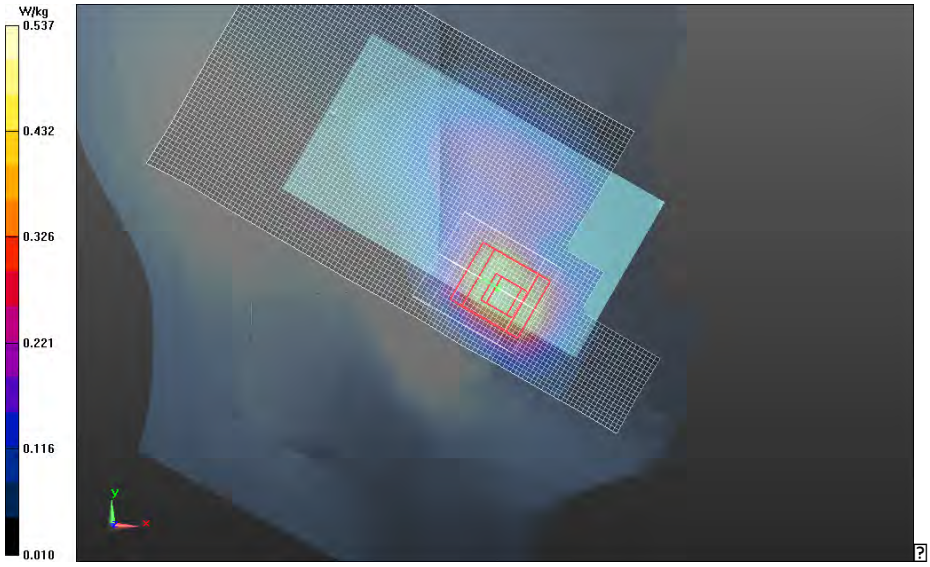
Communication System: _GPRS Class 11; Communication System Band: 1900 MHz; Frequency: 1880 MHz, Communication System PAR: 4.41 dB; PMF: 1.661; Duty Cycle: 1:2.760
Medium Parameters used: f=1880 MHz; σ = 1.468; ε_r = 37.76 mho/m; ρ = 1000 kg/m^3

Left Head Template/15mm, Area Scan - NOT for 2450 FCC TA... (61x161x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Fast SAR: SAR(1g) = 0.454 W/kg; SAR(10g) = 0.254 W/kg

Left Head Template/5x5x7 Zoom Scan (<=3GHz) (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 13.572 V/m, Power Drift = -0.03 dB
Averaged SAR: SAR(1g) = 0.494 W/kg; SAR(10g) = 0.268 W/kg



Left Head Template

Date/Time: 1/12/2013 9:16:49 AM

DUT Serial: 353207050002579

DASY Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.48,5.48,5.48); Calibrated: 4/25/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#1 - Sugar SAM (extended range), Rev.2 (24-Feb-12); Type: SAM v4.0; Serial: TP-1156
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

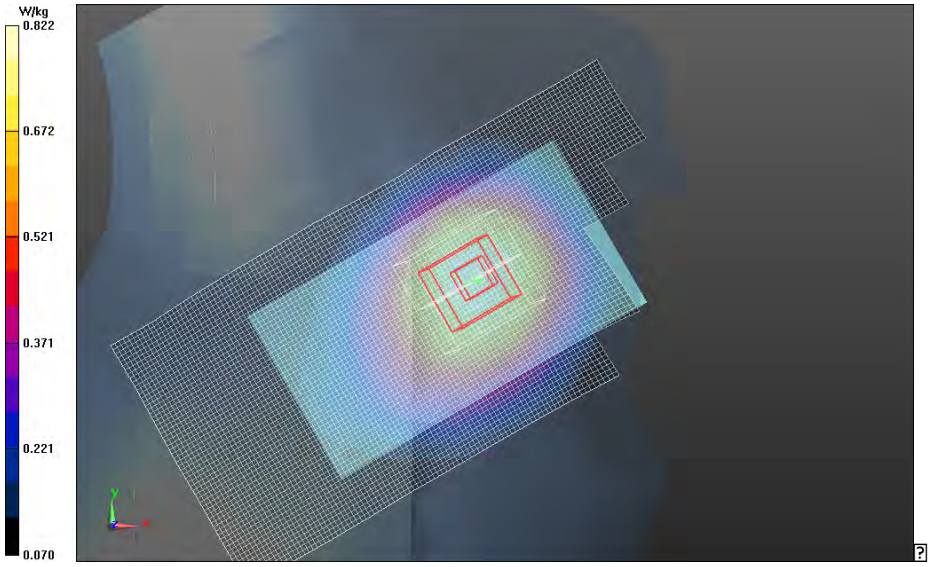
Communication System: _WCDMA; Communication System Band: WCDMA-850, Band 5; Frequency: 826.4 MHz, Communication System PAR: 0.00 dB; PMF: 1.000; Duty Cycle: 1:1.000
Medium Parameters used: f=826.4 MHz; σ = 0.9119; ε_r = 40.97 mho/m; ρ = 1000 kg/m^3

Right Head Template/15mm, Area Scan - Not for 2450 FCC TA... (61x161x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Fast SAR: SAR(1g) = 0.777 W/kg; SAR(10g) = 0.535 W/kg

Right Head Template/5x5x7 Zoom Scan (<=3GHz) (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 30.334 V/m, Power Drift = -0.03 dB
Averaged SAR: SAR(1g) = 0.780 W/kg; SAR(10g) = 0.595 W/kg



Right Head Template

Date/Time: 2/15/2013 4:26:57 PM

Test Laboratory: Motorola Mobility

DUT Serial: 353207050018419;

DASY4 Configuration:

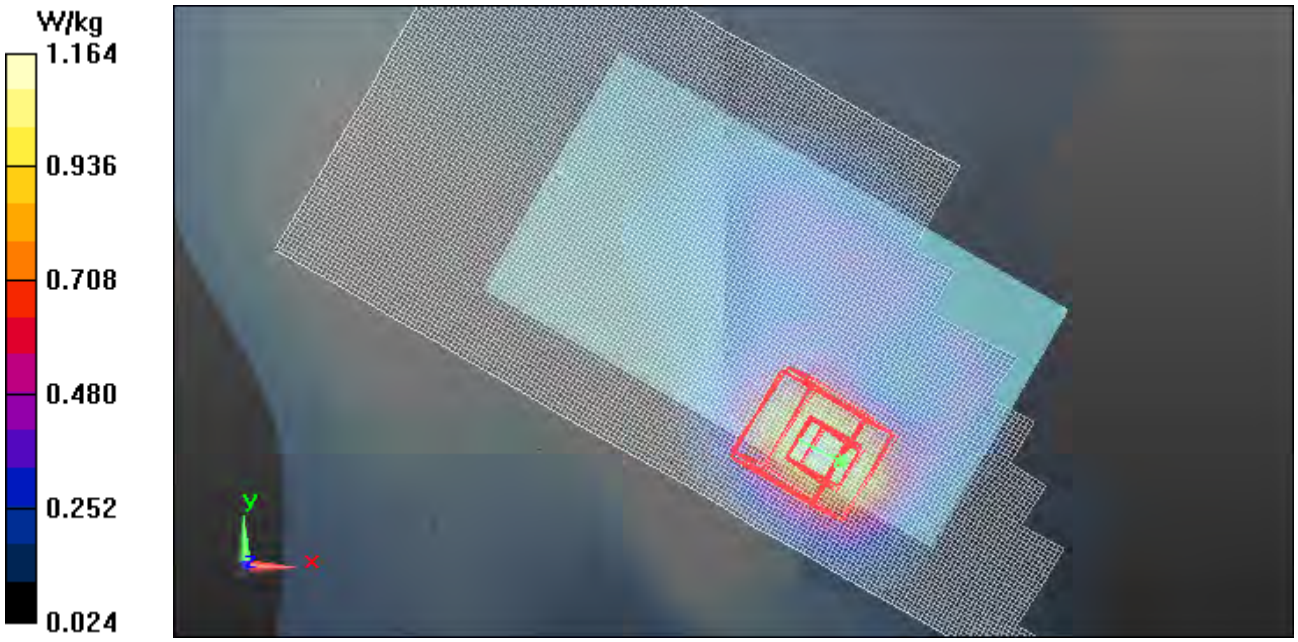
- Probe: ES3DV3 - SN3037; ConvF(5.15, 5.15, 5.15); Calibrated: 9/13/2012;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn703; Calibrated: 9/11/2012
- Phantom: R#4 Glycol SAM (extended range), Rev.2 (24-Feb-12); Type: SAM v4.0; Serial: TP-1162; Phantom section: Left Section
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

Left Head Template/10mm, Area Scan (91x241x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Reference Value = 19.201 V/m; Power Drift = -0.40 dB
Fast SAR: SAR(1 g) = 1.01 W/kg; SAR(10 g) = 0.545 W/kg (SAR corrected for target medium)
Maximum value of SAR (interpolated) = 1.18 W/kg

Left Head Template/5x5x7 Zoom Scan (<=3GHz) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 19.201 V/m; Power Drift = -0.16 dB
SAR(1 g) = 1.05 W/kg; SAR(10 g) = 0.558 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 1.16 W/kg



Date/Time: 1/23/2013 5:58:21 PM

DUT Serial: 353207050002579

DASY Configuration:

- Probe: ES3DV3 - SN3124; ConvF(5.07,5.07,5.07); Calibrated: 8/20/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 9/3/2012
- Phantom: R#2 Glycol SAM (extended range), Rev.2 (24-Feb-12); Type: SAM v4.0; Serial: TP-1136
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

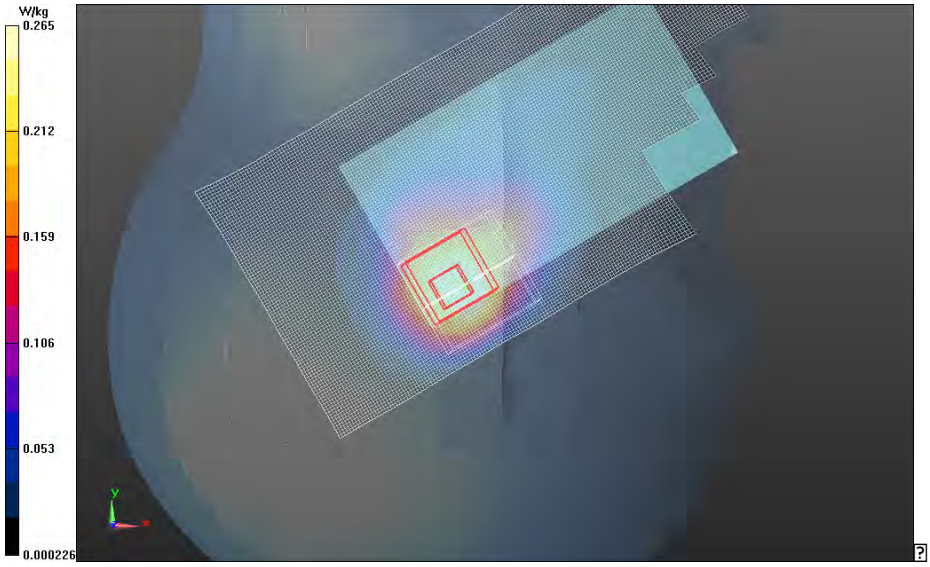
Communication System: _Wi-Fi 2450MHz; Communication System Band: 2450MHz WIFI; Frequency: 2437 MHz, Communication System PAR: 0.00 dB; PMF: 1.000; Duty Cycle: 1:1.000
Medium Parameters used: f=2437 MHz; σ = 1.837; ε_r = 38.57 mho/m; ρ = 1000 kg/m^3

Right Head Template/10mm, Area Scan (91x241x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Fast SAR: SAR(1g) = 0.252 W/kg; SAR(10g) = 0.137 W/kg

Right Head Template/5x5x7 Zoom Scan (<=3GHz) (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 11.641 V/m, Power Drift = -0.11 dB
Averaged SAR: SAR(1g) = 0.255 W/kg; SAR(10g) = 0.132 W/kg



Right Head Template

Appendix 3

SAR Distribution Plots for Body-Worn Accessory Test Results

Date/Time: 1/15/2013 12:02:46 AM

DUT Serial: 353207050002579

DASY Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.48,5.48,5.48); Calibrated: 4/25/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#-1, Triple Flat Phantom 5.1C (Rev.4); Type: QD 000 P51 CA; Serial: n/a
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

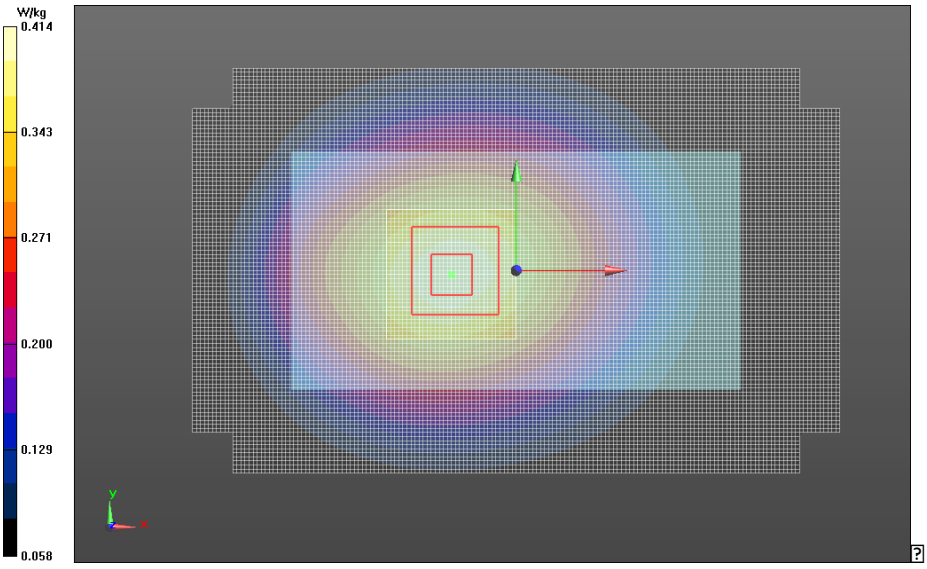
Communication System: _GSM; Communication System Band: GSM 850; Frequency: 824.2 MHz,
Communication System PAR: 9.19 dB; PMF: 2.881; Duty Cycle: 1:8.300
Medium Parameters used: f=824.2 MHz; σ = 0.9672; ε_r = 53.92 mho/m; ρ = 1000 kg/m^3

Triple Flat Phone Template/Area Scan (10mm) (261x141x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Fast SAR: SAR(1g) = 0.387 W/kg; SAR(10g) = 0.270 W/kg

Triple Flat Phone Template/5x5x7 Zoom Scan (<=3GHz) (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 21.020 V/m, Power Drift = 0.00 dB
Averaged SAR: SAR(1g) = 0.392 W/kg; SAR(10g) = 0.290 W/kg



Triple Flat Phone Template

Date/Time: 1/15/2013 2:47:12 PM

DUT Serial: 353207050002579

DASY Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.48,5.48,5.48); Calibrated: 4/25/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#-1, Triple Flat Phantom 5.1C (Rev.4); Type: QD 000 P51 CA; Serial: n/a
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

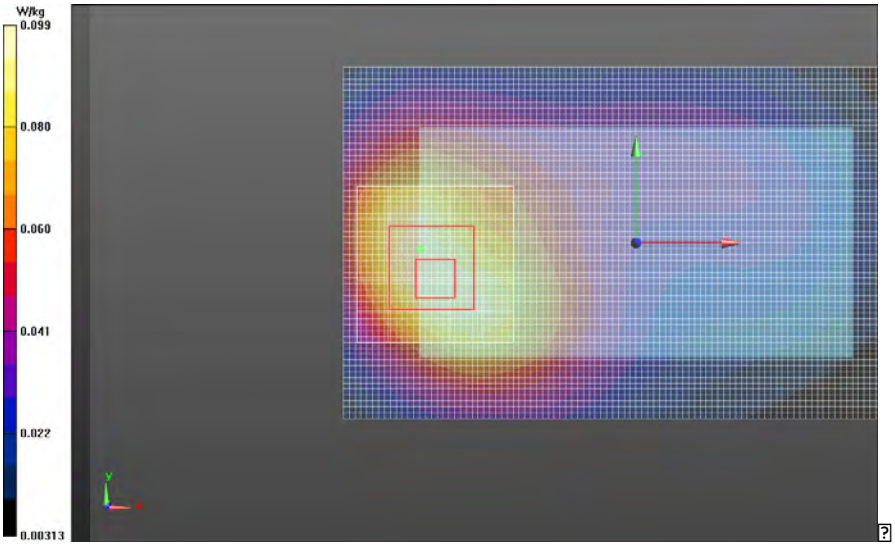
Communication System: _GSM; Communication System Band: GSM 1900; Frequency: 1880 MHz,
Communication System PAR: 9.19 dB; PMF: 2.881; Duty Cycle: 1:8.300
Medium Parameters used: f=1880 MHz; σ = 1.544; ε_r = 51.11 mho/m; ρ = 1000 kg/m^3

Triple Flat Phone Template/Area Scan (15mm), not for EDGES, not for FCC 2450 TA... (181x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Fast SAR: SAR(1g) = 0.0929 W/kg; SAR(10g) = 0.0576 W/kg

Triple Flat Phone Template/5x5x7 Zoom Scan (<=3GHz) (26x26x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 7.621 V/m, Power Drift = 0.07 dB
Averaged SAR: SAR(1g) = 0.0933 W/kg; SAR(10g) = 0.0603 W/kg



Triple Flat Phone Template

Date/Time: 1/15/2013 9:56:53 AM

DUT Serial: 353207050002579

DASY Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.48,5.48,5.48); Calibrated: 4/25/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#-1, Triple Flat Phantom 5.1C (Rev.4); Type: QD 000 P51 CA; Serial: n/a
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

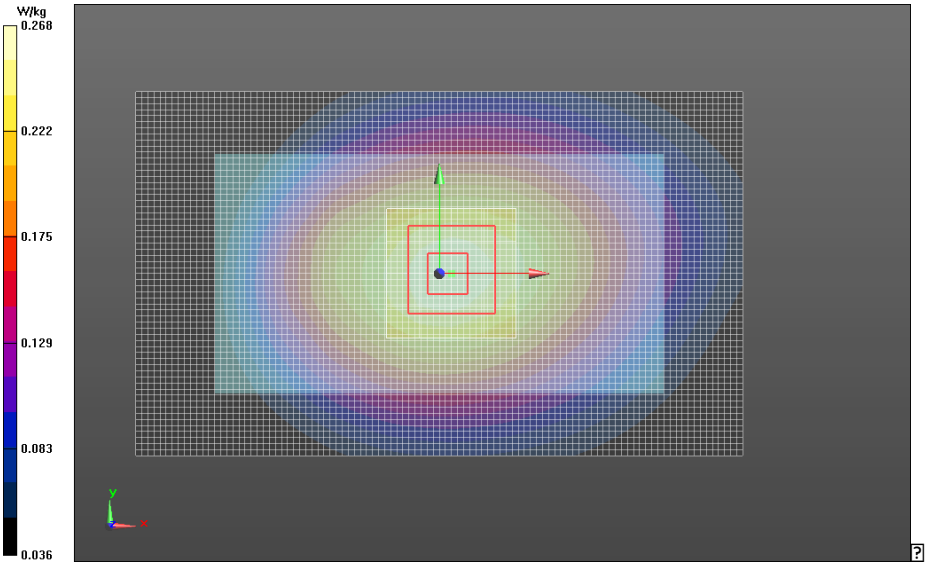
Communication System: _WCDMA; Communication System Band: WCDMA-850, Band 5; Frequency: 826.4 MHz, Communication System PAR: 0.00 dB; PMF: 1.000; Duty Cycle: 1:1.000
Medium Parameters used: f=826.4 MHz; σ = 0.9708; ε_r = 53.58 mho/m; ρ = 1000 kg/m^3

Triple Flat Phone Template/Area Scan (15mm), not for EDGES, not for FCC 2450 TA... (181x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Fast SAR: SAR(1g) = 0.252 W/kg; SAR(10g) = 0.176 W/kg

Triple Flat Phone Template/5x5x7 Zoom Scan (<=3GHz) (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 16.369 V/m, Power Drift = 0.05 dB
Averaged SAR: SAR(1g) = 0.254 W/kg; SAR(10g) = 0.188 W/kg



Triple Flat Phone Template

Date/Time: 1/15/2013 1:44:52 PM

DUT Serial: 353207050002579

DASY Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.48,5.48,5.48); Calibrated: 4/25/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#-1, Triple Flat Phantom 5.1C (Rev.4); Type: QD 000 P51 CA; Serial: n/a
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

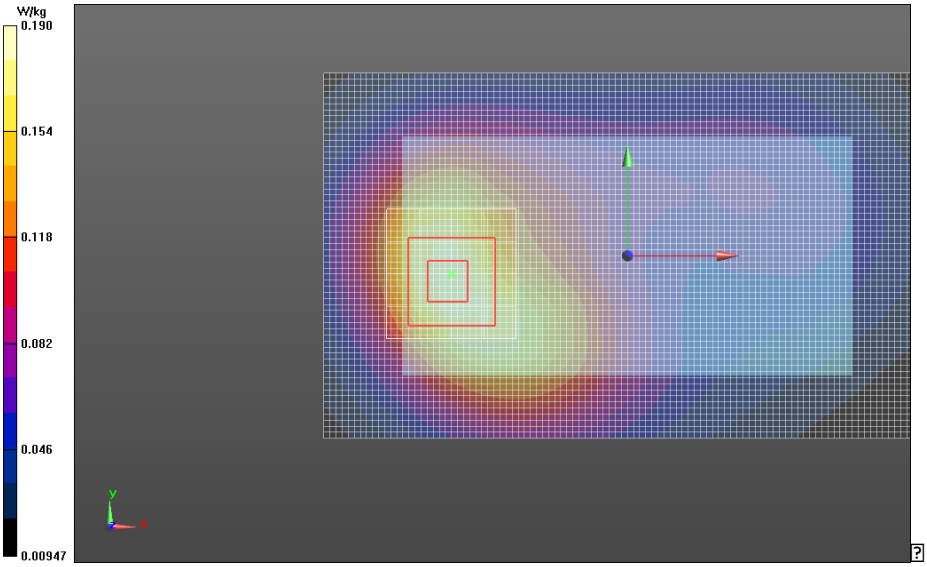
Communication System: _WCDMA; Communication System Band: WCDMA-1900, Band 2; Frequency: 1880 MHz, Communication System PAR: 0.00 dB; PMF: 1.000; Duty Cycle: 1:1.000
Medium Parameters used: f=1880 MHz; σ = 1.544; ε_r = 51.11 mho/m; ρ = 1000 kg/m^3

Triple Flat Phone Template/Area Scan (15mm), not for EDGES, not for FCC 2450 TA... (181x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Fast SAR: SAR(1g) = 0.178 W/kg; SAR(10g) = 0.109 W/kg

Triple Flat Phone Template/5x5x7 Zoom Scan (<=3GHz) (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 11.308 V/m, Power Drift = 0.00 dB
Averaged SAR: SAR(1g) = 0.178 W/kg; SAR(10g) = 0.114 W/kg



Triple Flat Phone Template

Date/Time: 1/24/2013 7:07:23 PM

DUT Serial: 353207050002579

DASY Configuration:

- Probe: ES3DV3 - SN3124; ConvF(5.07,5.07,5.07); Calibrated: 8/20/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 9/3/2012
- Phantom: R#2 Triple Flat Phantom 5.1C (Rev.4); Type: QD 000 P51 CA; Serial: n/a
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

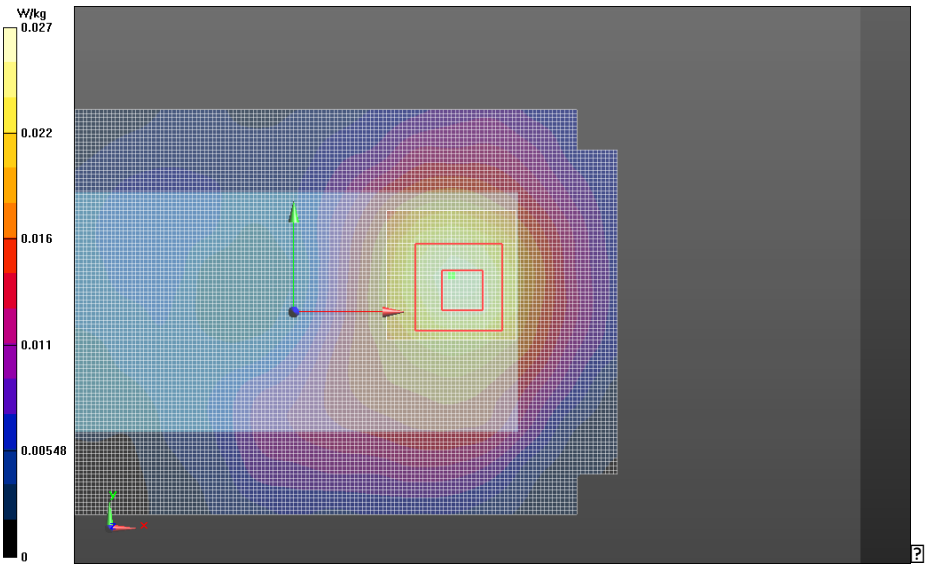
Communication System: _Wi-Fi 2450MHz; Communication System Band: 2450MHz WIFI; Frequency: 2437 MHz, Communication System PAR: 0.00 dB; PMF: 1.000; Duty Cycle: 1:1.000
Medium Parameters used: f=2437 MHz; σ = 1.991; ε_r = 51.05 mho/m; ρ = 1000 kg/m^3

Triple Flat Phone Template/Area Scan (10mm) (261x141x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Fast SAR: SAR(1g) = 0.0247 W/kg; SAR(10g) = 0.0143 W/kg

Triple Flat Phone Template/5x5x7 Zoom Scan (<=3GHz) (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 3.676 V/m, Power Drift = -0.034 dB
Averaged SAR: SAR(1g) = 0.0257 W/kg; SAR(10g) = 0.0149 W/kg



Triple Flat Phone Template

Appendix 4

SAR Distribution Plots for Mobile Hotspot Test Results

Date/Time: 1/25/2013 12:55:28 AM

DUT Serial: 353207050002579

DASY Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.48,5.48,5.48); Calibrated: 4/25/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#-1, Triple Flat Phantom 5.1C (Rev.4); Type: QD 000 P51 CA; Serial: n/a
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

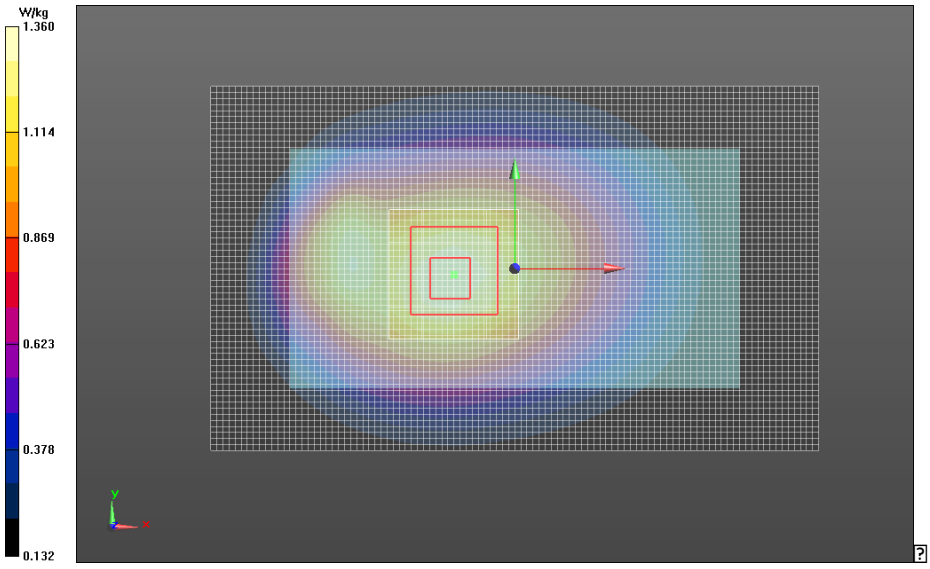
Communication System: _GPRS Class 11; Communication System Band: 850 MHz; Frequency: 836.6 MHz, Communication System PAR: 4.41 dB; PMF: 1.661; Duty Cycle: 1:2.760
Medium Parameters used: f=836.6 MHz; σ = 0.9819; ε_r = 52.27 mho/m; ρ = 1000 kg/m^3

Triple Flat Phone Template/Area Scan (15mm), not for EDGES, not for FCC 2450 TA... (181x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Fast SAR: SAR(1g) = 1.27 W/kg; SAR(10g) = 0.877 W/kg

Triple Flat Phone Template/5x5x7 Zoom Scan (<=3GHz) (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 37.924 V/m, Power Drift = -0.061 dB
Averaged SAR: SAR(1g) = 1.28 W/kg; SAR(10g) = 0.935 W/kg



Triple Flat Phone Template

Date/Time: 1/22/2013 6:18:34 PM

DUT Serial: 353207050002579

DASY Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.48,5.48,5.48); Calibrated: 4/25/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#-1, Triple Flat Phantom 5.1C (Rev.4); Type: QD 000 P51 CA; Serial: n/a
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

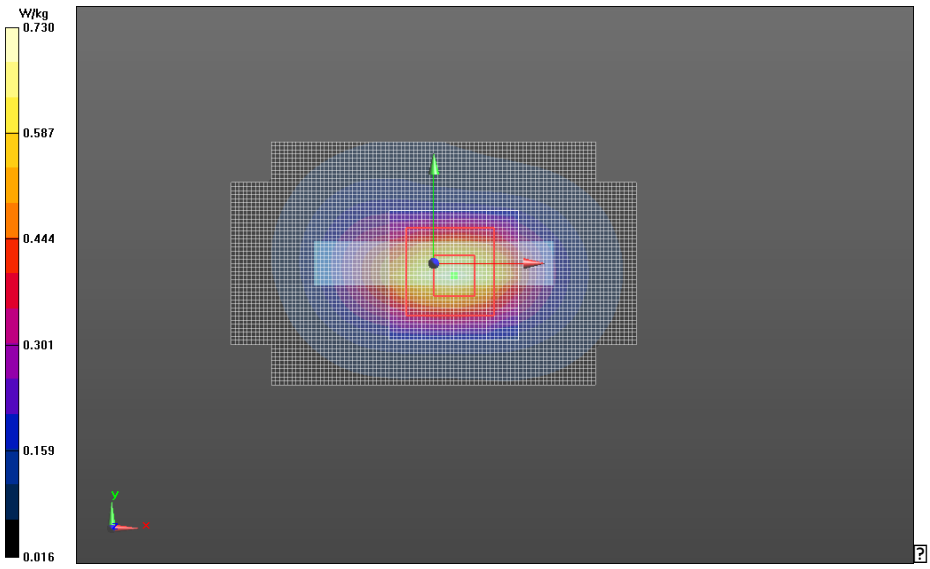
Communication System: _GPRS Class 11; Communication System Band: 1900 MHz; Frequency: 1850 MHz, Communication System PAR: 4.41 dB; PMF: 1.661; Duty Cycle: 1:2.760
Medium Parameters used: f=1850.2 MHz; σ = 1.536; ε_r = 51.35 mho/m; ρ = 1000 kg/m^3

Triple Flat Phone Template/Area Scan (10mm) (261x141x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Fast SAR: SAR(1g) = 0.642 W/kg; SAR(10g) = 0.331 W/kg

Triple Flat Phone Template/5x5x7 Zoom Scan (<=3GHz) (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 19.495 V/m, Power Drift = 0.066 dB
Averaged SAR: SAR(1g) = 0.638 W/kg; SAR(10g) = 0.342 W/kg



Triple Flat Phone Template

Date/Time: 1/24/2013 11:48:12 PM

DUT Serial: 353207050002777

DASY Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.48,5.48,5.48); Calibrated: 4/25/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#-1, Triple Flat Phantom 5.1C (Rev.4); Type: QD 000 P51 CA; Serial: n/a
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

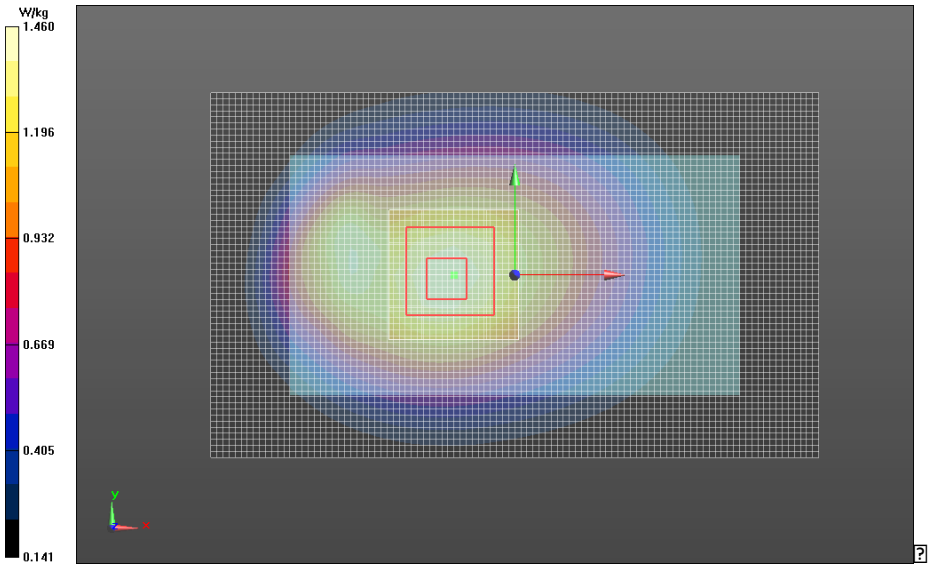
Communication System: _WCDMA; Communication System Band: WCDMA-850, Band 5; Frequency: 826.4 MHz, Communication System PAR: 0.00 dB; PMF: 1.000; Duty Cycle: 1:1.000
Medium Parameters used: f=826.4 MHz; σ = 0.9711; ε_r = 52.38 mho/m; ρ = 1000 kg/m^3

Triple Flat Phone Template/Area Scan (15mm), not for EDGES, not for FCC 2450 TA... (181x101x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Fast SAR: SAR(1g) = 1.38 W/kg; SAR(10g) = 0.947 W/kg

Triple Flat Phone Template/5x5x7 Zoom Scan (<=3GHz) (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 40.029 V/m, Power Drift = -0.183 dB
Averaged SAR: SAR(1g) = 1.38 W/kg; SAR(10g) = 1.00 W/kg



Triple Flat Phone Template

Date/Time: 1/17/2013 12:11:09 PM

DUT Serial: 353207050002777

DASY Configuration:

- Probe: ES3DV3 - SN3184; ConvF(5.48,5.48,5.48); Calibrated: 4/25/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn378; Calibrated: 4/11/2012
- Phantom: R#-1, Triple Flat Phantom 5.1C (Rev.4); Type: QD 000 P51 CA; Serial: n/a
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

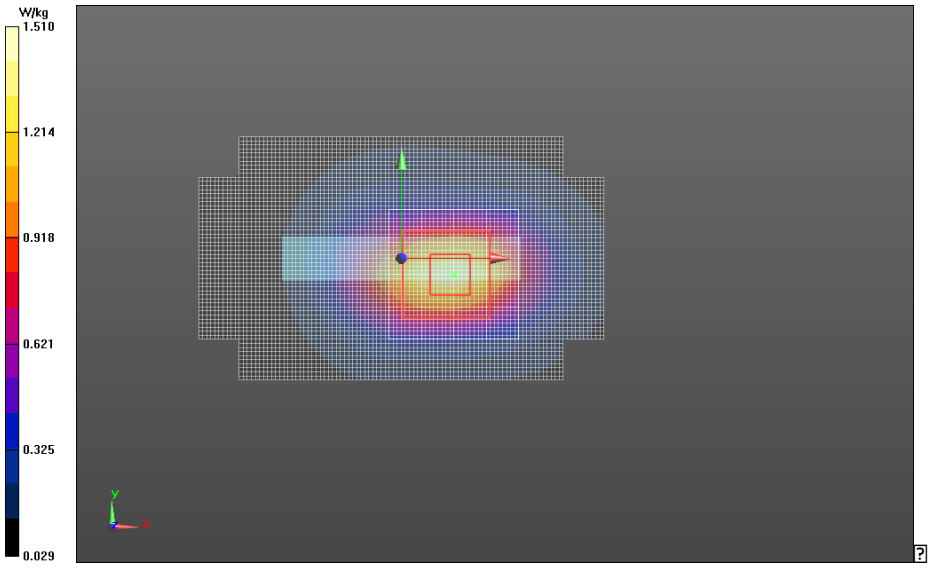
Communication System: _WCDMA; Communication System Band: WCDMA-1900, Band 2; Frequency: 1908 MHz, Communication System PAR: 0.00 dB; PMF: 1.000; Duty Cycle: 1:1.000
Medium Parameters used: f=1907.6 MHz; σ = 1.632; ε_r = 51.14 mho/m; ρ = 1000 kg/m^3

Triple Flat Phone Template/Area Scan (10mm) (261x141x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Fast SAR: SAR(1g) = 1.33 W/kg; SAR(10g) = 0.696 W/kg

Triple Flat Phone Template/5x5x7 Zoom Scan (<=3GHz) (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 29.611 V/m, Power Drift = -0.011 dB
Averaged SAR: SAR(1g) = 1.33 W/kg; SAR(10g) = 0.714 W/kg



Triple Flat Phone Template

Date/Time: 1/23/2013 9:12:59 PM

DUT Serial: 353207050002579

DASY Configuration:

- Probe: ES3DV3 - SN3124; ConvF(5.07,5.07,5.07); Calibrated: 8/20/2012;
- Sensor-Surface: 4 mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn376; Calibrated: 9/3/2012
- Phantom: R#2 Triple Flat Phantom 5.1C (Rev.4); Type: QD 000 P51 CA; Serial: n/a
- DASY52 52.8.5(1059); SEMCAD X Version 14.6.8 (7028)

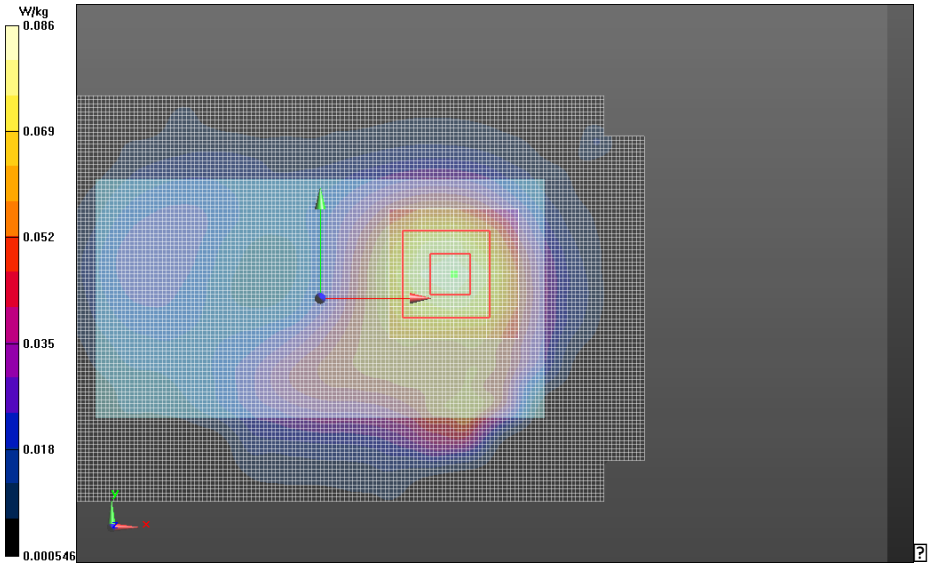
Communication System: _Wi-Fi 2450MHz; Communication System Band: 2450MHz WIFI; Frequency: 2437 MHz, Communication System PAR: 0.00 dB; PMF: 1.000; Duty Cycle: 1:1.000
Medium Parameters used: f=2437 MHz; σ = 1.999; ε_r = 50.86 mho/m; ρ = 1000 kg/m^3

Triple Flat Phone Template/Area Scan (10mm) (261x141x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Fast SAR: SAR(1g) = 0.0786 W/kg; SAR(10g) = 0.0443 W/kg

Triple Flat Phone Template/5x5x7 Zoom Scan (<=3GHz) (21x21x36)/Cube 0: Interpolated grid: dx=1.600 mm, dy=1.600 mm, dz=1.000 mm

Reference Value = 5.781 V/m, Power Drift = 0.030 dB
Averaged SAR: SAR(1g) = 0.0794 W/kg; SAR(10g) = 0.0456 W/kg



Triple Flat Phone Template

Appendix 5

Measurement Uncertainty Budget

Uncertainty Budget for Device Under Test, for 735 MHz to 3 GHz

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	Description IEEE 1528(2003) / IEC 62209-1(2005)	**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 [ES3DV3]	E.2.1 / 7.2.1	6.0	N	1.00	1	1	6.0	6.0	∞
Axial Isotropy	E.2.2 / 7.2.1.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	E.2.2 / 7.2.1.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	E.2.3 / 7.2.1.5	1.0	R	1.73	1	1	0.6	0.6	∞
Linearity	E.2.4 / 7.2.1.3	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	E.2.5 / 7.2.1.4	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	E.2.6 / 7.2.1.6	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	E.2.7 / 7.2.1.7	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	E.2.8 / 7.2.1.8	1.1	R	1.73	1	1	0.6	0.6	∞
RF Ambient Conditions - Noise	E.6.1 / 7.2.3.6	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	E.6.1 / 7.2.3.6	3.0	R	1.73	1	1	1.7	1.7	∞
Probe Positioner Mech. Tolerance	E.6.2 / 7.2.2.1	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning w.r.t Phantom	E.6.3 / 7.2.2.3	2.9	R	1.73	1	1	1.7	1.7	∞
Max. SAR Evaluation (ext., int., avg.)	E.5 / 7.2.4	3.4	R	1.73	1	1	2.0	2.0	∞
Test sample Related									
Test Sample Positioning	E.4.2 / 7.2.2.4	3.4	N	1.00	1	1	3.4	3.4	79
Device Holder Uncertainty	E.4.1 / 7.2.2.4.2	4.5	N	1.00	1	1	4.5	4.5	11
SAR drift	6.6.2 / 7.2.3.5	0.0	R	1.73	1	1	0.0	0.0	
Phantom and Tissue Parameters									
Phantom Uncertainty	E.3.1 / 7.2.2.2	6.1	R	1.73	1	1	3.5	3.5	∞
SAR Correction		1.9	R	1.73	1	0.84	1.1	0.9	∞
Liquid Conductivity (measurement)	E.3.3 / 7.2.3.3	1.3	N	1.00	0.64	0.43	0.9	0.6	6
Liquid Permittivity (measurement)	E.3.2 / 7.2.3.4	0.7	N	1.00	0.6	0.49	0.4	0.3	6
Combined Standard Uncertainty			RSS				11	11	390
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				22	22	

Uncertainty Budget for Device Under Test for 3 to 6 GHz

a	*b*	*c*	*d*	*e = f(d,k)*	*f*	*g*	*h = c x f / e*	*i = c x g / e*	*k*
Uncertainty Component	Description IEC 62209-2 (2010)	**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 [EX3DV4]	7.2.2.1	6.6	N	1.00	1	1	6.6	6.6	∞
Axial Isotropy	7.2.2.2	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	7.2.2.2	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effect	7.2.2.6	2.0	R	1.73	1	1	1.2	1.2	∞
Linearity	7.2.2.5	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	7.2.2	1.0	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	7.2.2.7	0.3	N	1.00	1	1	0.3	0.3	∞
Response Time	7.2.2.8	1.1	R	1.73	1	1	0.6	0.6	∞
Integration Time	7.2.2.9	1.1	R	1.73	1	1	0.6	0.6	∞
RF Ambient Conditions - Noise	7.2.4.5	3.0	R	1.73	1	1	1.7	1.7	∞
RF Ambient Conditions - Reflections	7.2.4.5	3.0	R	1.73	1	1	1.7	1.7	∞
Probe Positioner Mech. Tolerance	7.2.3.1	1.0	R	1.73	1	1	0.6	0.6	∞
Probe Positioning w.r.t Phantom	7.2.3.3	6.7	R	1.73	1	1	3.9	3.9	∞
Max. SAR Evaluation (ext., int., avg.)	7.2.5.3	4.0	R	1.73	1	1	2.3	2.3	∞
Test sample Related									
Test Sample Positioning	7.2.3.4	3.4	N	1.00	1	1	3.4	3.4	79
Device Holder Uncertainty	7.2.3.4	4.5	N	1.00	1	1	4.5	4.5	11
SAR drift	7.2.2.10	0.0	R	1.73	1	1	0.0	0.0	
Phantom and Tissue Parameters									
Phantom Uncertainty	7.2.3.2	6.6	R	1.73	1	1	3.8	3.8	∞
SAR Correction	7.2.4.3	1.9	R	1.73	1	0.84	1.1	0.9	∞
Liquid Conductivity (measurement)	7.2.4.3	1.4	N	1.00	0.64	0.43	0.9	0.6	6
Liquid Permittivity (measurement)	7.2.4.3	0.7	N	1.00	0.6	0.49	0.4	0.4	6
Combined Standard Uncertainty			RSS				12	12	557
Expanded Uncertainty (95% CONFIDENCE LEVEL)			*k*=2				24	24	

Appendix 6

Probe Calibration Certificates

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

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

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

Accreditation No.: SCS 108

Client Motorola MDb

Certificate No: ES3-3124_Aug12

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3124

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

Calibration date: August 20, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: August 20, 2012

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

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

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

Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3124

Manufactured: July 11, 2006
Calibrated: August 20, 2012

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

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.27	1.30	1.30	± 10.1 %
DCP (mV)[B]	98.9	102.1	100.4	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[F] (k=2)
0	CW	0.00	X	0.00	0.00	1.00	158.7	±3.3 %
			Y	0.00	0.00	1.00	163.3	
			Z	0.00	0.00	1.00	160.2	

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.
[F] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	6.23	6.23	6.23	0.21	2.37	± 12.0 %
835	41.5	0.90	6.01	6.01	6.01	0.57	1.31	± 12.0 %
1810	40.0	1.40	5.07	5.07	5.07	0.66	1.33	± 12.0 %
1950	40.0	1.40	4.88	4.88	4.88	0.80	1.19	± 12.0 %
2450	39.2	1.80	4.37	4.37	4.37	0.67	1.42	± 12.0 %
2600	39.0	1.96	4.26	4.26	4.26	0.80	1.30	± 12.0 %

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

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

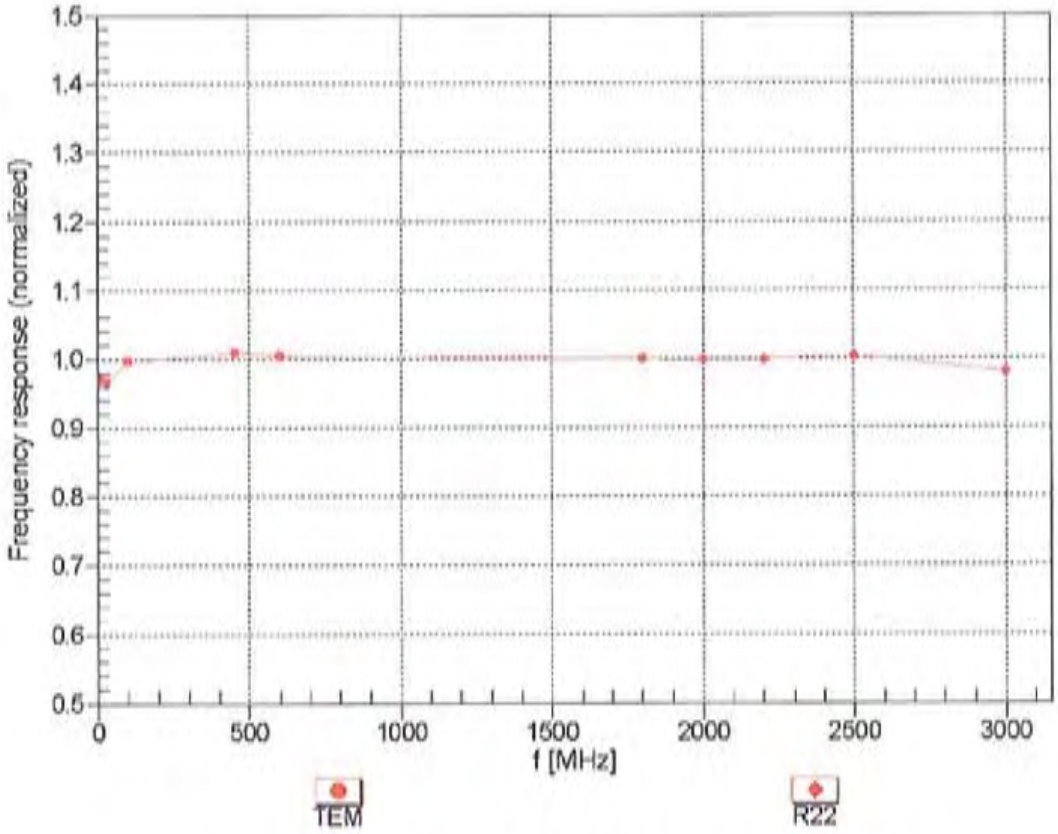
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	6.15	6.15	6.15	0.50	1.45	± 12.0 %
835	55.2	0.97	6.02	6.02	6.02	0.52	1.46	± 12.0 %
1810	53.3	1.52	4.76	4.76	4.76	0.62	1.57	± 12.0 %
1950	53.3	1.52	4.81	4.81	4.81	0.52	1.63	± 12.0 %
2450	52.7	1.95	4.40	4.40	4.40	0.72	1.15	± 12.0 %
2600	52.5	2.16	4.19	4.19	4.19	0.80	0.98	± 12.0 %

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

Frequency Response of E-Field

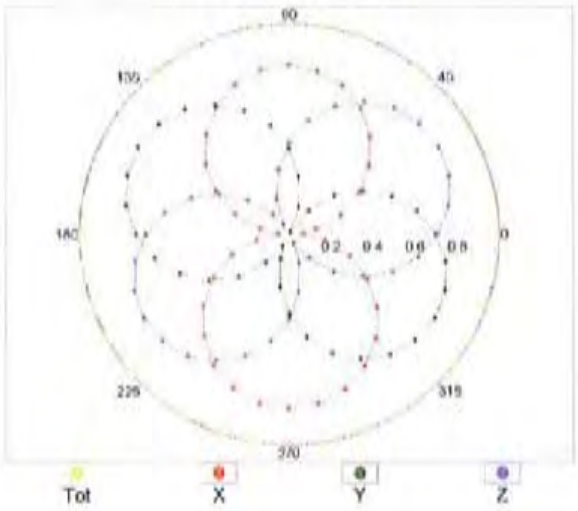
(TEM-Cell:ifi110 EXX, Waveguide: R22)



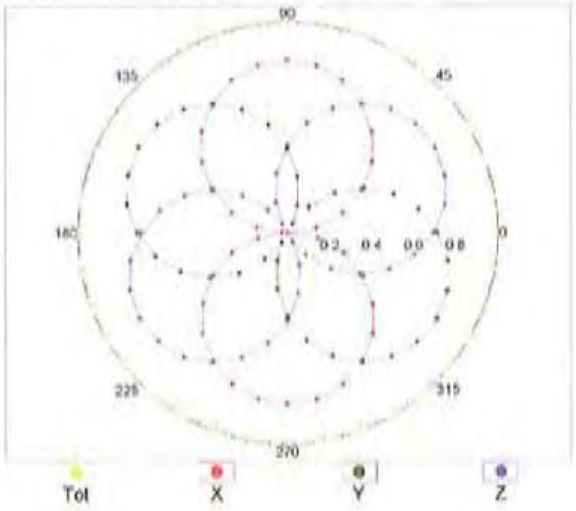
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

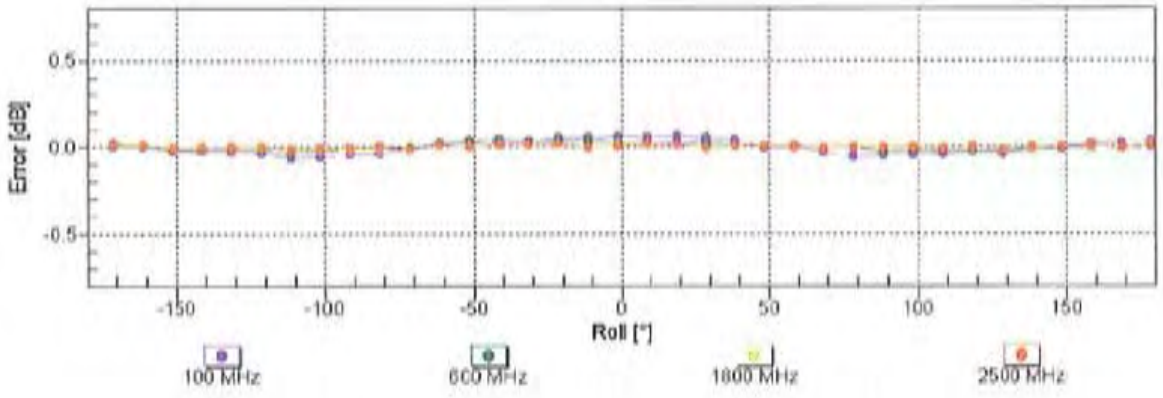
Receiving Pattern (ϕ), $\vartheta = 0°$

f=600 MHz,TEM



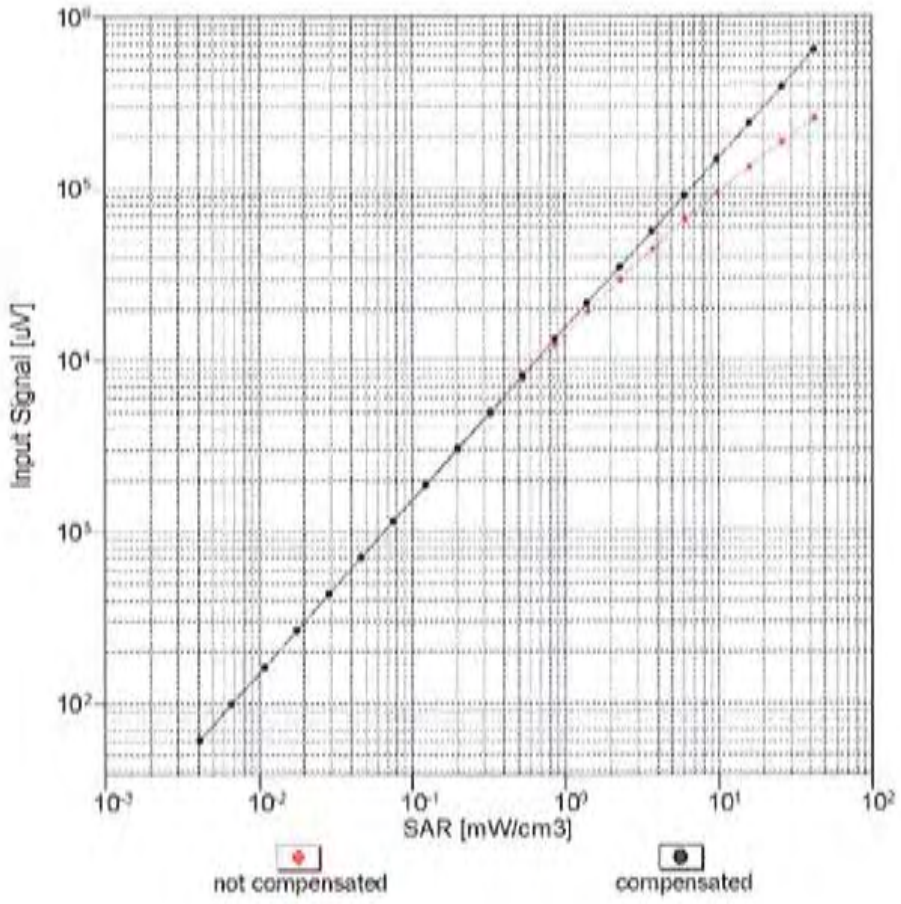
f=1800 MHz,R22

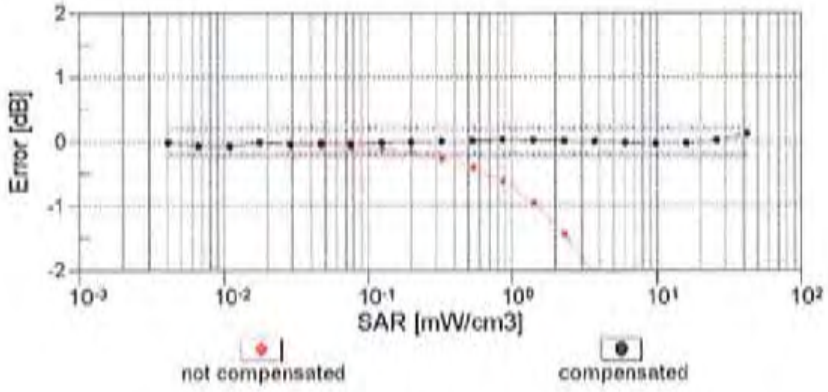




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

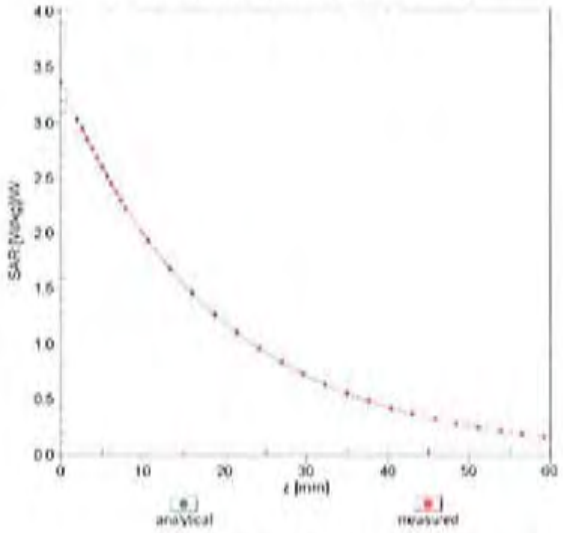




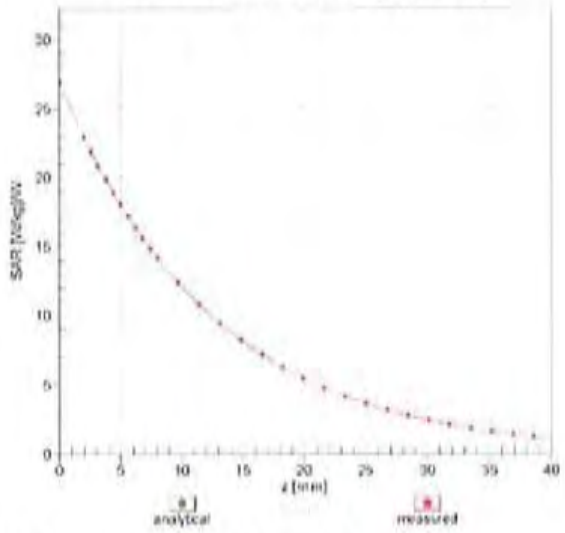
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

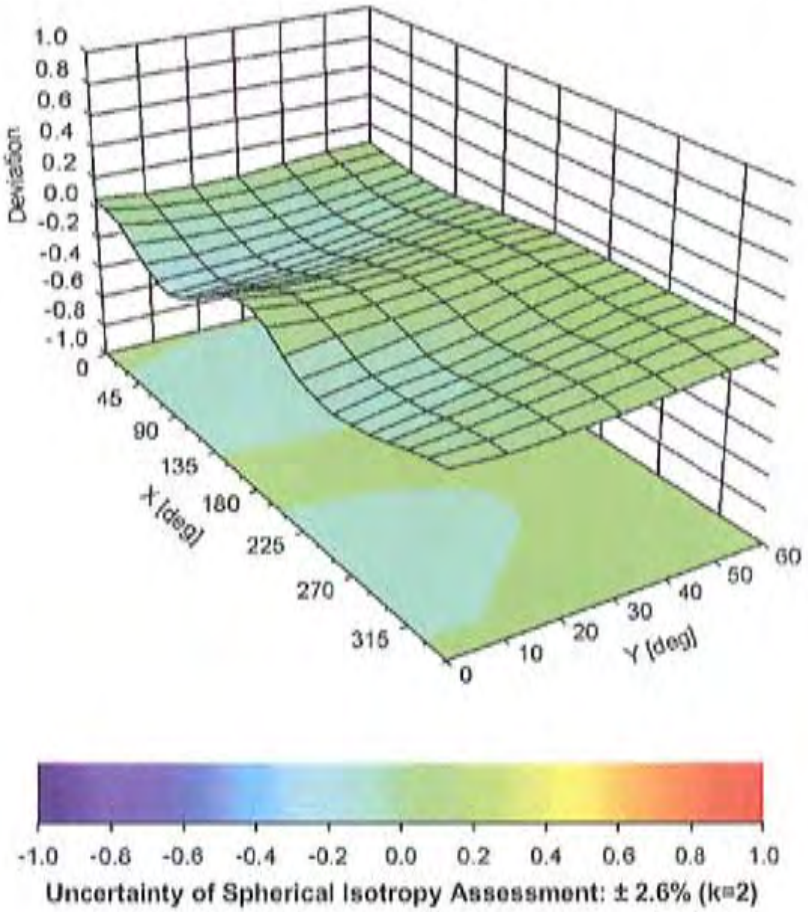


f = 1810 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	128.4
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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Accreditation No.: SCS 108

Client Motorola MDb

Certificate No: ES3-3184_Apr12

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3184

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

Calibration date: April 25, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 660	10-Jan-12 (No. DAE4-660_Jan12)	Jan-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Issued: April 25, 2012

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

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S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS) **Accreditation No.: SCS 108**
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z, 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:3184

Manufactured: August 19, 2008
Calibrated: April 25, 2012

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

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.24	1.38	1.25	± 10.1 %
DCP (mV)[B]	101.9	99.5	100.6	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
0	CW	0.00	X	0.00	0.00	1.00	158.6	±3.0 %
			Y	0.00	0.00	1.00	163.2	
			Z	0.00	0.00	1.00	156.8	

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

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

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	6.38	6.38	6.38	0.24	2.29	± 12.0 %
835	41.5	0.90	6.15	6.15	6.15	0.70	1.20	± 12.0 %
1810	40.0	1.40	5.48	5.48	5.48	0.80	1.28	± 12.0 %
1950	40.0	1.40	5.19	5.19	5.19	0.65	1.38	± 12.0 %
2450	39.2	1.80	4.61	4.61	4.61	0.80	1.32	± 12.0 %
2600	39.0	1.96	4.40	4.40	4.40	0.80	1.35	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

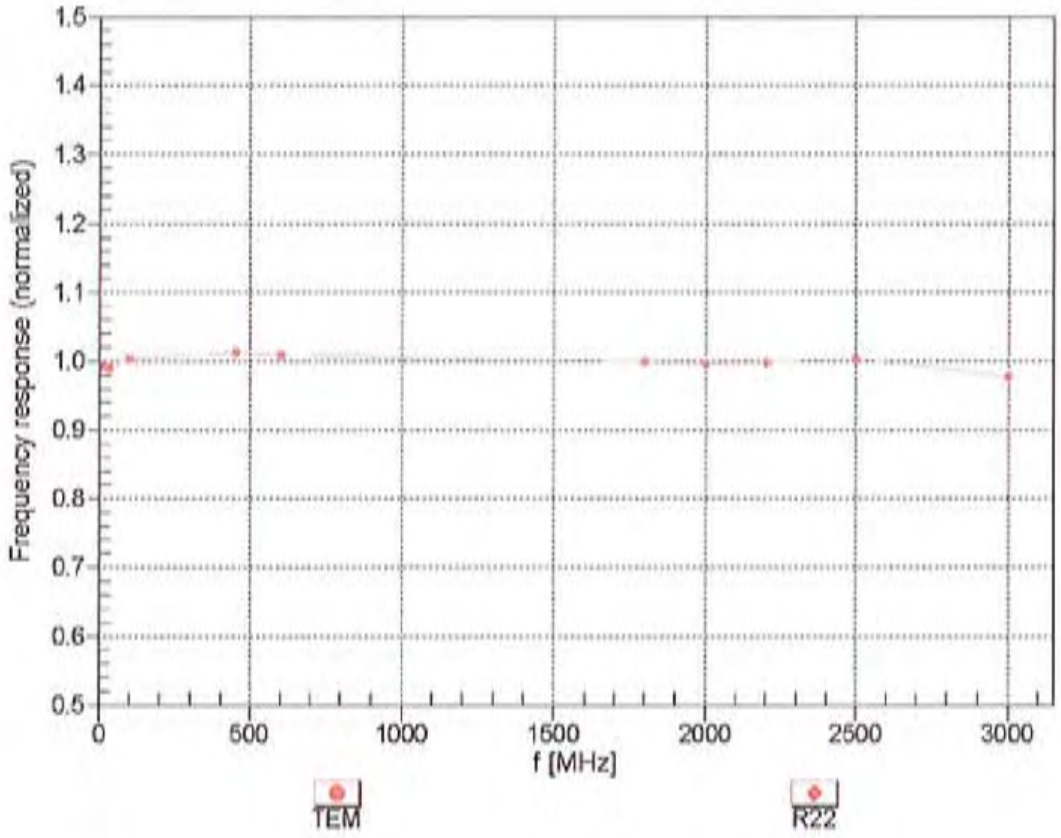
DASY/EASY - Parameters of Probe: ES3DV3 - SN:3184

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	6.28	6.28	6.28	0.53	1.40	± 12.0 %
835	55.2	0.97	6.19	6.19	6.19	0.53	1.40	± 12.0 %
1810	53.3	1.52	4.88	4.88	4.88	0.55	1.49	± 12.0 %
1950	53.3	1.52	4.87	4.87	4.87	0.53	1.57	± 12.0 %
2450	52.7	1.95	4.33	4.33	4.33	0.80	0.96	± 12.0 %
2600	52.5	2.16	4.13	4.13	4.13	0.80	0.99	± 12.0 %

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

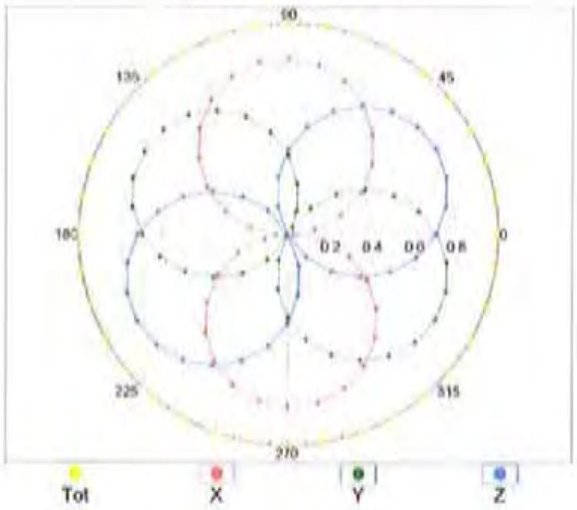
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



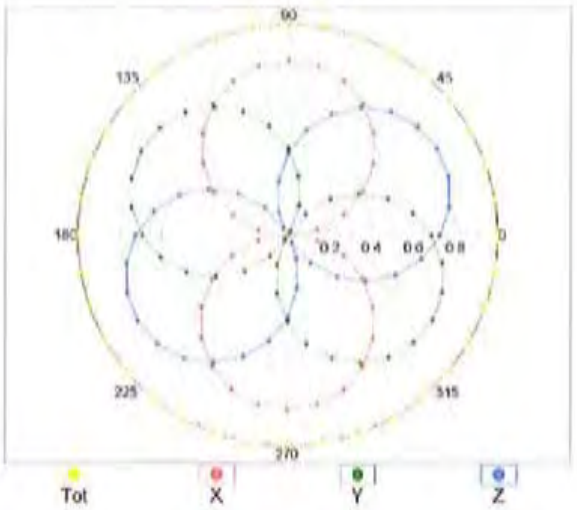
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

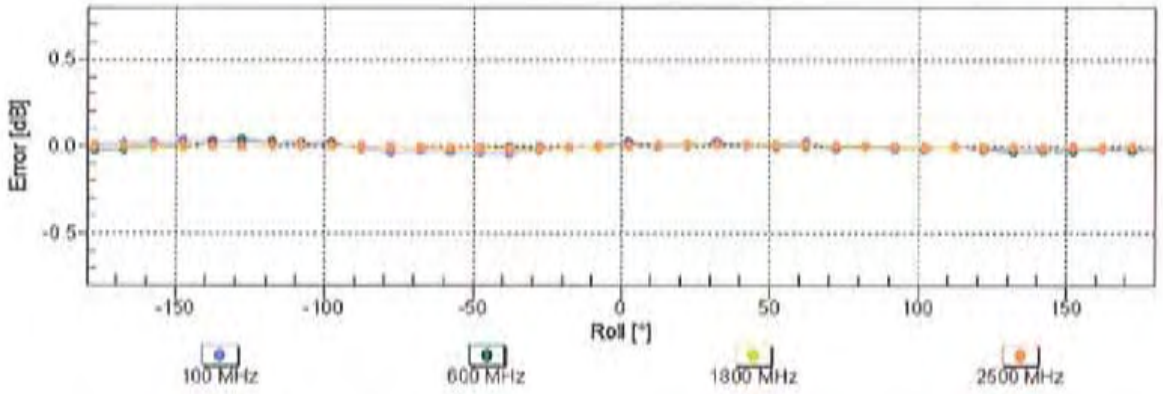
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



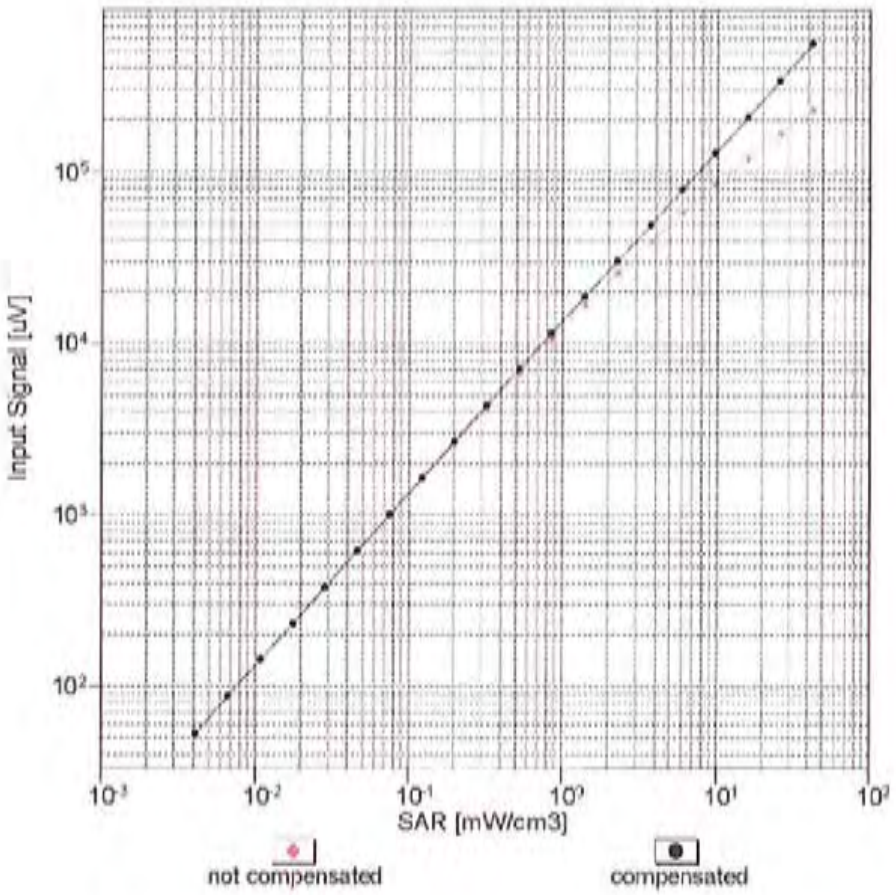
f=1800 MHz,R22

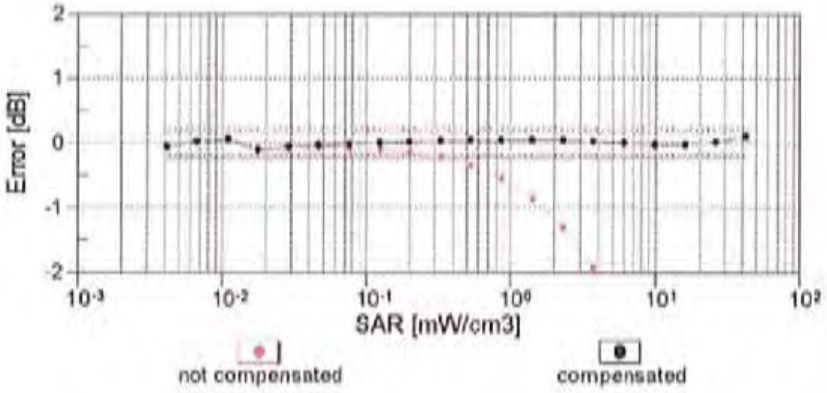




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

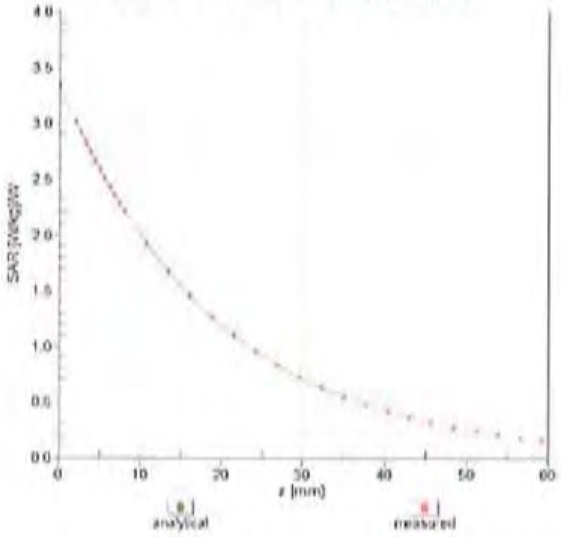




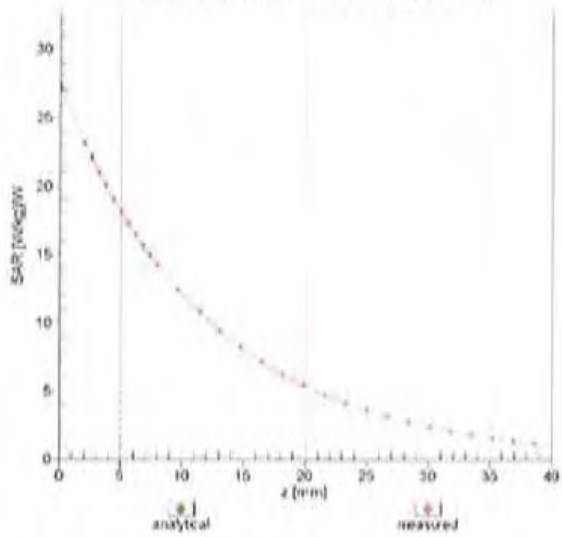
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

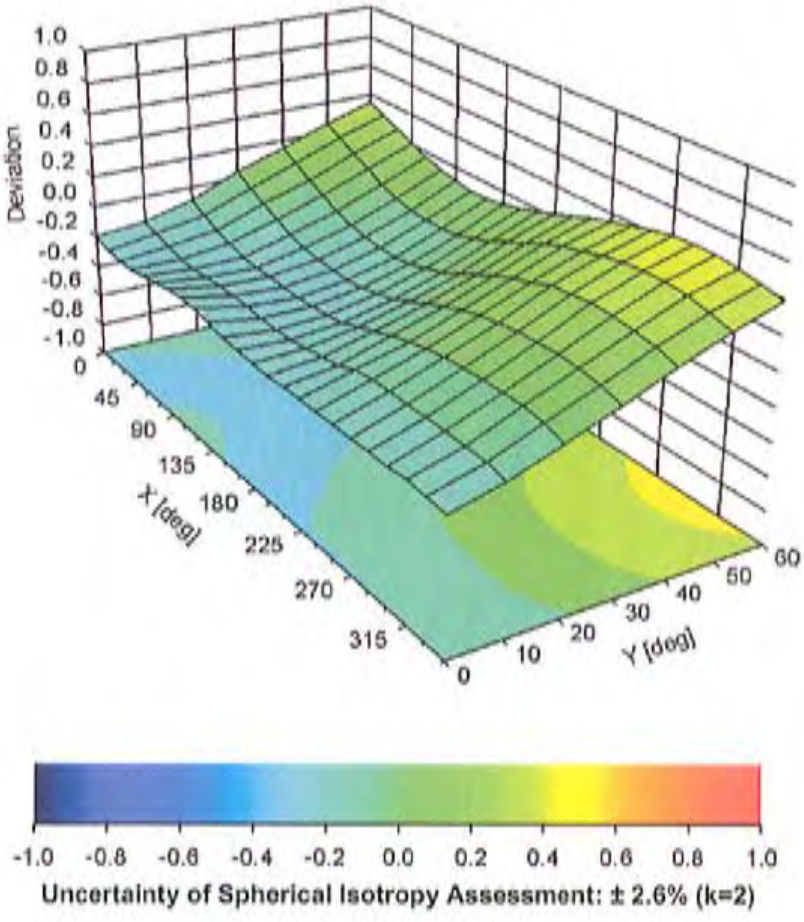


f = 1810 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	132.3
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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Accreditation No.: SCS 108

Client Motorola MDb

Certificate No: ES3-3037_Sep12

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3037

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

Calibration date: September 13, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: September 18, 2012

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3037

Manufactured: August 21, 2003
Calibrated: September 13, 2012

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3037

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.13	0.84	0.97	± 10.1 %
DCP (mV)[B]	102.8	103.8	101.9	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
0	CW	0.00	X	0.00	0.00	1.00	148.4	±3.5 %
			Y	0.00	0.00	1.00	162.2	
			Z	0.00	0.00	1.00	177.4	

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

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3037

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	6.46	6.46	6.46	0.24	2.00	± 12.0 %
835	41.5	0.90	6.23	6.23	6.23	0.72	1.15	± 12.0 %
1810	40.0	1.40	5.15	5.15	5.15	0.78	1.16	± 12.0 %
1950	40.0	1.40	4.96	4.96	4.96	0.79	1.15	± 12.0 %
2450	39.2	1.80	4.43	4.43	4.43	0.77	1.22	± 12.0 %
2600	39.0	1.96	4.23	4.23	4.23	0.80	1.22	± 12.0 %

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3037

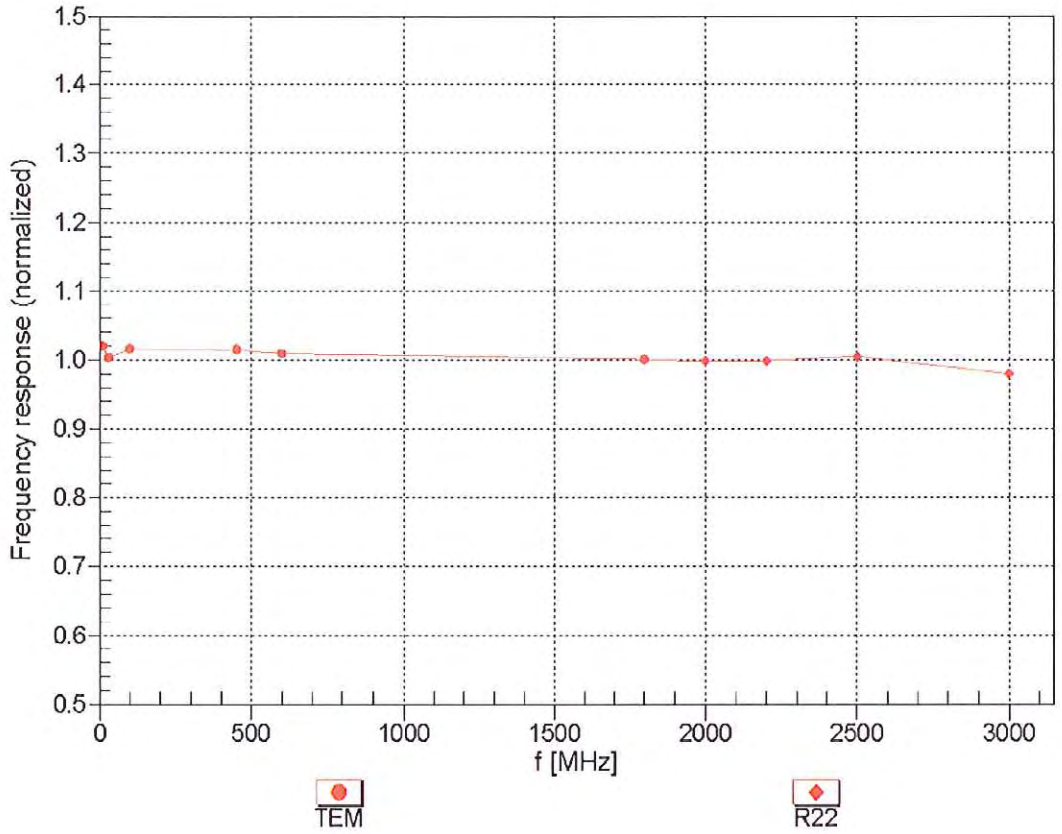
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	6.22	6.22	6.22	0.51	1.37	± 12.0 %
835	55.2	0.97	6.16	6.16	6.16	0.34	1.69	± 12.0 %
1810	53.3	1.52	4.83	4.83	4.83	0.66	1.32	± 12.0 %
1950	53.3	1.52	4.76	4.76	4.76	0.63	1.31	± 12.0 %
2450	52.7	1.95	4.13	4.13	4.13	0.80	0.98	± 12.0 %
2600	52.5	2.16	3.92	3.92	3.92	0.80	0.98	± 12.0 %

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

Frequency Response of E-Field

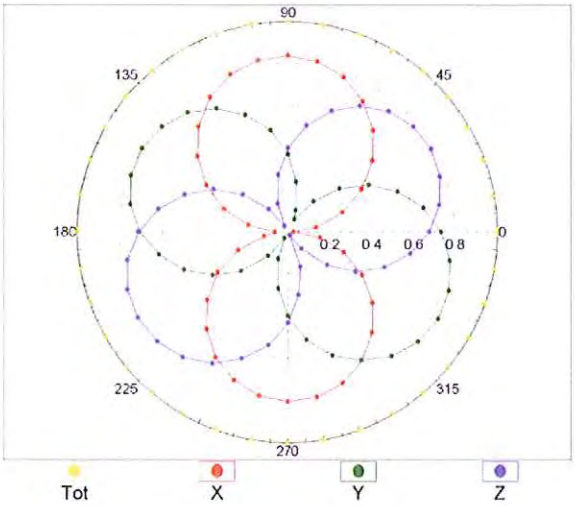
(TEM-Cell:ifi110 EXX, Waveguide: R22)



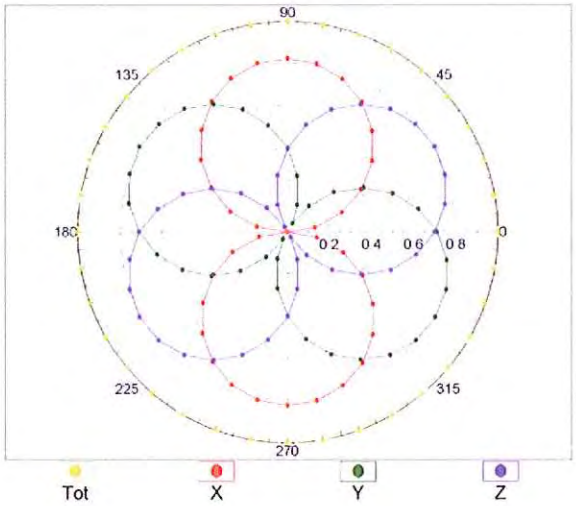
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

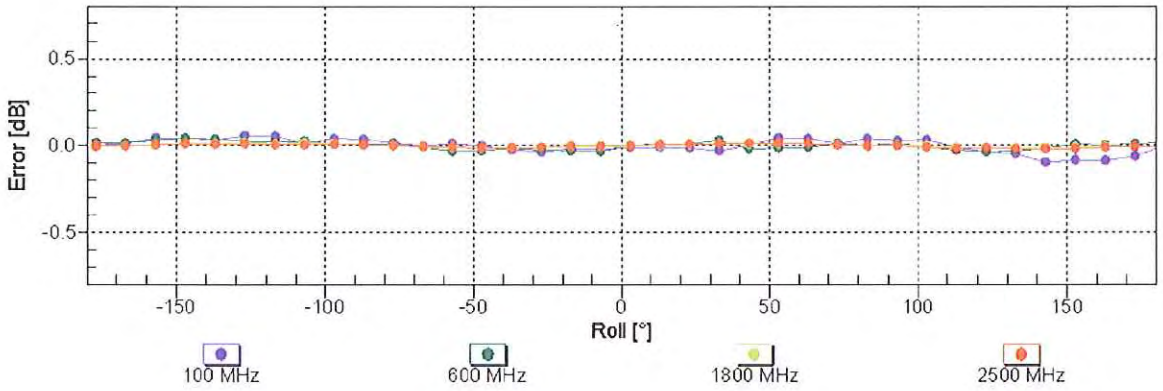
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



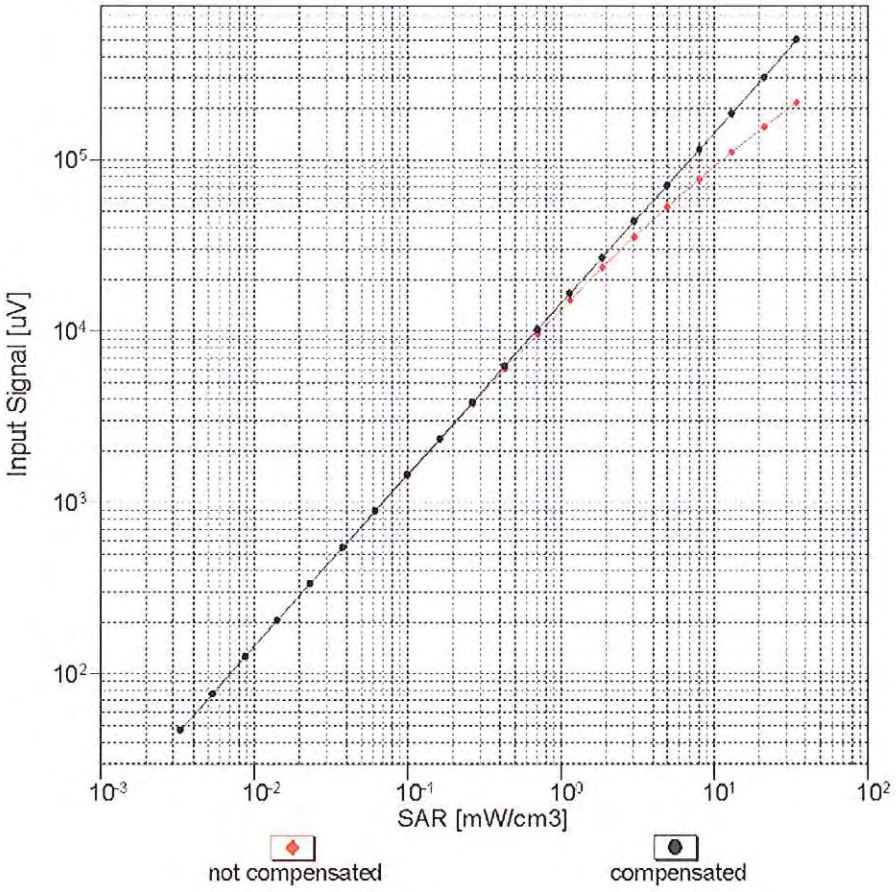
f=1800 MHz,R22

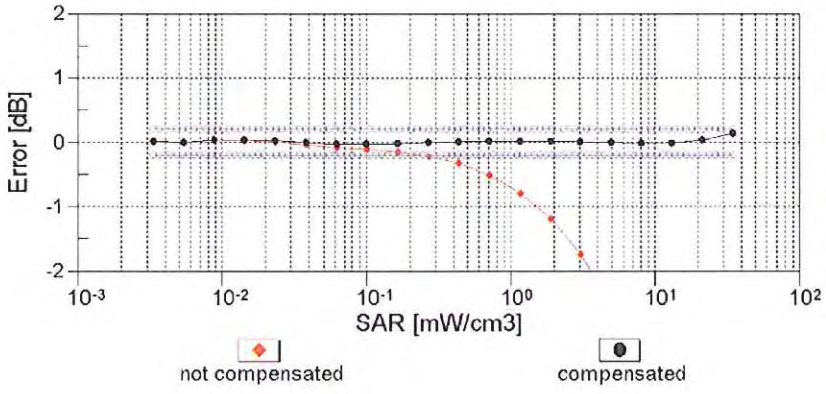




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

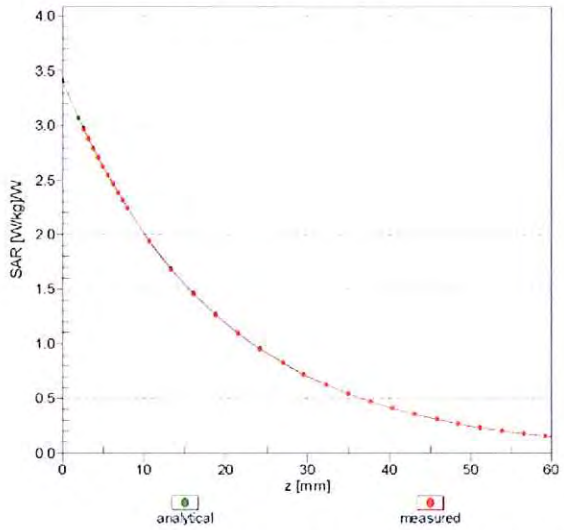




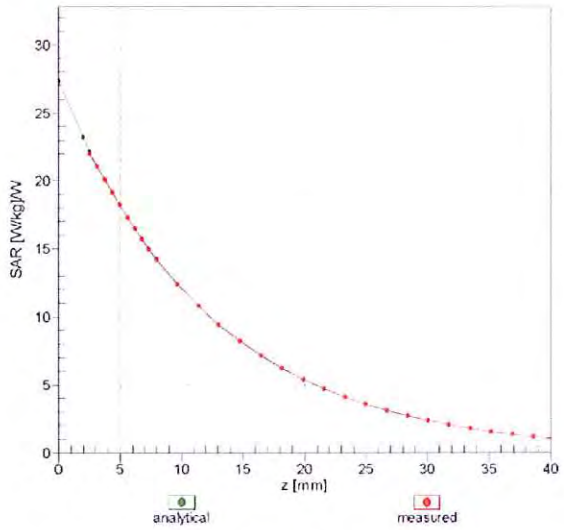
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

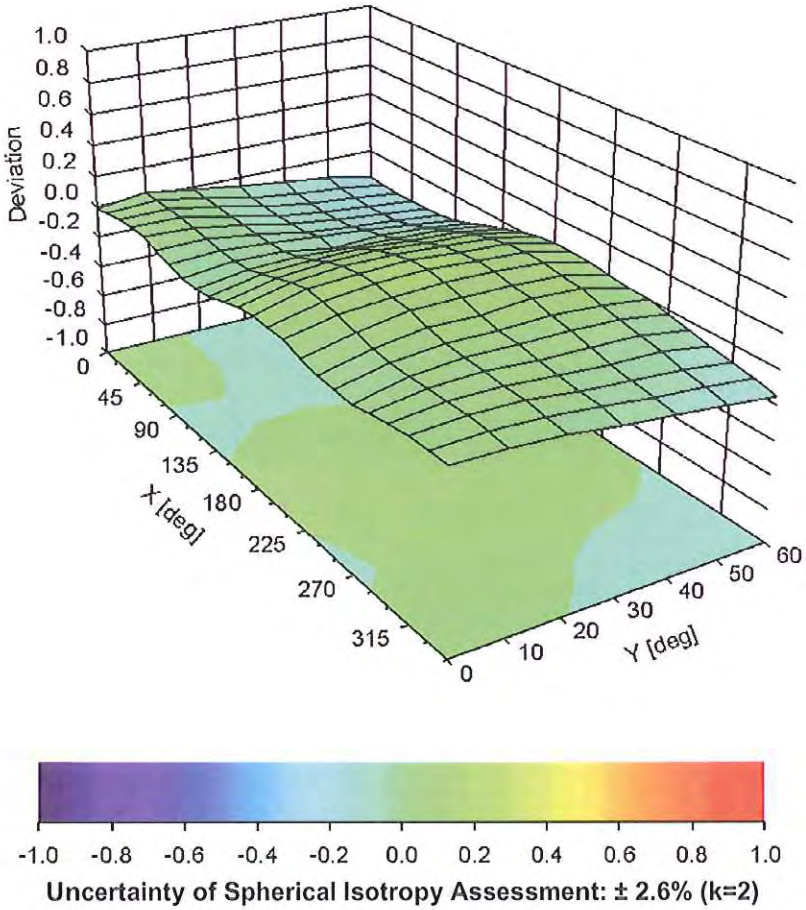


f = 1810 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3037

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	103
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