



Report No.: RZA2010-1428SAR



# OET 65

# TEST REPORT

<b>Product Name</b>	H9 USB MODEM
<b>Model</b>	H9
<b>FCC ID</b>	R17TELITH9
<b>Client</b>	Dai Telecom Ltd

**TA Technology (Shanghai) Co., Ltd.**



## GENERAL SUMMARY

<b>Product Name</b>	H9 USB MODEM	<b>Model</b>	H9
<b>FCC ID</b>	R17TELITH9		
<b>Report No.</b>	RZA2010-1428SAR		
<b>Client</b>	Dai Telecom Ltd		
<b>Manufacturer</b>	SHANGHAI SIMCOM LTD		
<b>Reference Standard(s)</b>	<p><b>IEEE Std C95.1, 1999:</b> IEEE Standard for Safety Levels with Respect to Human Exposure to Radiofrequency Electromagnetic Fields, 3 kHz to 300 GHz.</p> <p><b>SUPPLEMENT C Edition 01-01 to OET BULLETIN 65 Edition 97-01 June 2001 including DA 02-1438, published June 2002:</b> Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields Additional Information for Evaluation Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions.</p> <p><b>KDB 447498 D02 SAR Procedures for Dongle Xmtr v02:</b> SAR Measurement Procedures for USB Dongle Transmitters.</p>		
<b>Conclusion</b>	<p>This portable wireless equipment has been measured in all cases requested by the relevant standards. Test results in Chapter 7 of this test report are below limits specified in the relevant standards.</p> <p>General Judgment: <b>Pass</b></p> <p style="text-align: right;">(Stamp) Date of issue: <b>October 27<sup>th</sup> 2010</b></p>		
<b>Comment</b>	The test result only responds to the measured sample.		

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## TABLE OF CONTENT

1. General Information .....	5
1.1. Notes of the Test Report.....	5
1.2. Testing Laboratory .....	5
1.3. Applicant Information .....	6
1.4. Manufacturer Information.....	6
1.5. Information of EUT.....	7
1.6. The Maximum SAR <sub>1g</sub> Values and Conducted Power of Each Tested Band.....	8
1.7. Test Date .....	8
2. Operational Conditions during Test .....	9
2.1. General Description of Test Procedures .....	9
2.2. GSM Test Configuration .....	9
2.3. WCDMA Test Configuration .....	10
2.4. HSDPA Test Configuration .....	10
2.5. HSUPA Test Configuration .....	12
2.6. Position of Module in Portable Devices.....	14
2.7. Picture of Host Product .....	15
3. SAR Measurements System Configuration.....	17
3.1. SAR Measurement Set-up .....	17
3.2. DASY4 E-field Probe System .....	18
3.2.1. EX3DV4 Probe Specification .....	18
3.2.2. E-field Probe Calibration .....	19
3.3. Other Test Equipment .....	19
3.3.1. Device Holder for Transmitters .....	19
3.3.2. Phantom .....	20
3.4. Scanning Procedure .....	20
3.5. Data Storage and Evaluation .....	22
3.5.1. Data Storage.....	22
3.5.2. Data Evaluation by SEMCAD .....	22
3.6. System Check.....	25
3.7. Equivalent Tissues.....	26
4. Laboratory Environment.....	26
5. Characteristics of the Test.....	27
5.1. Applicable Limit Regulations.....	27
5.2. Applicable Measurement Standards .....	27
6. Conducted Output Power Measurement.....	28
6.1. Summary .....	28
6.2. Conducted Power Results .....	28
7. Test Results .....	30
7.1. Dielectric Performance.....	30
7.2. System Check.....	30
7.3. Summary of Measurement Results.....	31
7.3.1. GSM 850 (GPRS/EGPRS).....	31

**TA Technology (Shanghai) Co., Ltd.**  
**Test Report**

Report No. RZA2010-1428SAR

Page 4 of 105

---

7.3.2. GSM 1900 (GPRS/EGPRS).....	33
7.3.3. WCDMA Band V (WCDMA/HSDPA/HSUPA).....	35
8. Measurement Uncertainty .....	36
9. Main Test Instruments .....	37
ANNEX A: Test Layout .....	38
ANNEX B: System Check Results .....	40
ANNEX C: Graph Results .....	42
ANNEX D: Probe Calibration Certificate .....	69
ANNEX E: D835V2 Dipole Calibration Certificate .....	80
ANNEX F: D1900V2 Dipole Calibration Certificate .....	89
ANNEX G: DAE4 Calibration Certificate.....	98
ANNEX H: The EUT Appearances and Test Configuration.....	103

## **1. General Information**

### **1.1. Notes of the Test Report**

**TA Technology (Shanghai) Co., Ltd.** guarantees the reliability of the data presented in this test report, which is the results of measurements and tests performed for the items under test on the date and under the conditions stated in this test report and is based on the knowledge and technical facilities available at TA Technology (Shanghai) Co., Ltd. at the time of execution of the test.

**TA Technology (Shanghai) Co., Ltd.** is liable to the client for the maintenance by its personnel of the confidentiality of all information related to the items under test and the results of the test. This report only refers to the item that has undergone the test.

This report standalone does not constitute or imply by its own an approval of the product by the certification Bodies or competent Authorities. This report cannot be used partially or in full for publicity and/or promotional purposes without previous written approval of **TA Technology (Shanghai) Co., Ltd.** and the Accreditation Bodies, if it applies.

### **1.2. Testing Laboratory**

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### **1.3. Applicant Information**

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**TA Technology (Shanghai) Co., Ltd.**  
**Test Report**

Report No. RZA2010-1428SAR

Page 7 of 105

**1.5. Information of EUT**

**General Information**

Device Type :	Portable Device		
Exposure Category:	Uncontrolled Environment / General Population		
Name of EUT:	H9 USB MODEM		
IMEI:	357881010013581		
Hardware Version:	UW621BL-T-MB V2.00		
Software Version:	QCT_30_V16_0_090827_V30.20.3_for_PCL_H9		
Antenna Type:	Internal Antenna		
Device Operating Configurations :			
Supporting Mode(s):	GSM 850/ GSM 1900; (tested) GSM 900/ GSM 1800; WCDMA Band I; WCDMA Band V (tested)		
Test Modulation:	(GSM)GMSK; (WCDMA) QPSK		
Device Class:	B		
GPRS Multislot Class(10):	Max Number of Timeslots in Uplink	2	
	Max Number of Timeslots in Downlink	4	
	Max Total Timeslot	5	
EGPRS Multislot Class(10):	Max Number of Timeslots in Uplink	2	
	Max Number of Timeslots in Downlink	4	
	Max Total Timeslot	5	
HSDPA UE Category:	8		
HSUPA UE Category:	5		
Power Class:	GSM 850: 4, tested with power level 5		
	GSM 1900: 1, tested with power level 0		
	WCDMA Band V: 3, tested with power control all up bits		
Test Channel: (Low - Middle - High)	128 -190 - 251 (GSM 850) (tested) 512 - 661 - 810 (GSM 1900) (tested) 4132 - 4183 - 4233 (WCDMA Band V) (tested)		
Operating Frequency Range(s):	Band	Tx (MHz)	Rx (MHz)
	GSM 850	824.2 ~ 848.8	869.2 ~ 893.8
	GSM 1900	1850.2 ~ 1909.8	1930.2 ~ 1989.8
	WCDMA Band V	826.4 ~ 846.6	871.4 ~ 891.6
Used Host Product:	IBM T61 Lenovo Y-450		

**TA Technology (Shanghai) Co., Ltd.**  
**Test Report**

Report No. RZA2010-1428SAR

Page 8 of 105

Equipment Under Test (EUT) is a H9 USB MODEM. The EUT has a GSM/WCDMA antenna that is used for Tx/Rx. During SAR test of the EUT, it was connected to a portable computer. SAR is tested for the EUT respectively for GSM 850, GSM 1900 and WCDMA Band V in this report.

The sample undergoing test was selected by the Client.

Components list please refer to documents of the manufacturer.

**1.6. The Maximum SAR<sub>1g</sub> Values and Conducted Power of Each Tested Band**

Mode	Channel	Position	Distance(mm)	SAR <sub>1g</sub> (W/kg)
2 slots GPRS 850	251	Back side	5	<b>0.265</b>
2 slots EGPRS 1900	810	Back side	5	<b>0.738</b>
WCDMA Band V	4183	Back side	5	<b>0.246</b>

**The Maximum Power**

Band		Maximum Conducted Power (dBm)	Maximum Average Power (dBm)
GSM 850	GPRS,2 time-slots	<b>32.56</b>	<b>26.54</b>
	EGPRS,2 time-slots	<b>32.43</b>	<b>26.41</b>
GSM 1900	GPRS,2 time-slots	<b>30.15</b>	<b>24.13</b>
	EGPRS,2 time-slots	<b>30.16</b>	<b>24.14</b>
WCDMA Band V		<b>23.60</b>	<b>/</b>

**1.7. Test Date**

The test is performed from October 21, 2010 to October 22, 2010.



## 2. Operational Conditions during Test

### 2.1. General Description of Test Procedures

Connection to the EUT is established via air interface with E5515C, and the EUT is set to maximum output power by E5515C. The antenna connected to the output of the base station simulator shall be placed at least 50 cm away from the EUT. The signal transmitted by the simulator to the antenna feeding point shall be lower than the output power level of the EUT by at least 30 dB.

The tests in the band of GSM 850 and GSM 1900 are performed in the mode of GPRS and EGPRS, The tests in the band of WCDMA Band V is performed in the mode of WCDMA, HSDPA and HSUPA. The measurements were performed in combination with two host products (IBM T61 and Lenovo Y-450). IBM T61 laptop has horizontal USB slot, Lenovo Y-450 laptop has vertical USB slot.

### 2.2. GSM Test Configuration

For the body SAR tests for GSM 850 and GSM 1900, a communication link is set up with a System Simulator (SS) by air link. The EUT is commanded to operate at maximum transmitting power. Using E5515C the power lever is set to "5" in SAR of GSM 850, set to "0" in SAR of GSM 1900, The tests in the band of GSM 850 and GSM 1900 are performed in the mode of GPRS and EGPRS. Since the GPRS class is 10 for this EUT, it has at most 2 timeslots in uplink and at most 4 timeslots in downlink, the maximum total timeslot is 5. Since the EGPRS class is 10 for this EUT, it has at most 2 timeslots in uplink and at most 4 timeslots in downlink, the maximum total timeslot is 5.

When SAR tests for EGPRS mode is necessary, GMSK modulation should be used to minimize SAR measurement error due to higher peak-to-average power (PAR) ratios inherent in 8-PSK.

According to specification 3GPP TS 51.010, the maximum power of the GSM can do the power reduction for the multi-slot. The allowed power reduction in the multi-slot configuration is as following:

**Table 1: The allowed power reduction in the multi-slot configuration**

<b>Number of timeslots in uplink assignment</b>	<b>Permissible nominal reduction of maximum output power,(dB)</b>
1	0
2	0 to 3,0

### 2.3. WCDMA Test Configuration

As the SAR body test for WCDMA Band V, we established the radio link through call processing. The maximum output power were verified on high, middle and low channels for each test band according to 3GPP TS 34.121 with the following configuration:

- 1) 12.2kbps RMC, 64,144,384 kbps RMC with TPC set to all "all '1's"
- 2) Test loop Mode 1

For the output power, the configurations for the DPCCH and DPDCH<sub>1</sub> are as followed (EUT do not support the DPDCH<sub>2-n</sub>)

**Table 2: The configurations for the DPCCH and DPDCH<sub>1</sub>**

	Channel Bit Rate(kbps)	Channel Symbol Rate(kcps)	Spreading Factor	Spreading Code Number	Bits/Slot
DPCCH	15	15	256	0	10
DPDCH <sub>1</sub>	15	15	256	64	10
	30	30	128	32	20
	60	60	64	16	40
	120	120	32	8	80
	240	240	16	4	160
	480	480	8	2	320
	960	960	4	1	640

SAR is tested with 12.2kps RMC and not required for other spreading codes (64,144, and 384 kbps RMC) and multiple DPDCH<sub>n</sub>, because the maximum output power for each of these other configurations<0.25dB higher than 12.2kbps RMC and the multiple DPDCH<sub>n</sub> is not applicable for the EUT.

### 2.4. HSDPA Test Configuration

SAR for body exposure configurations is measured according to the "Body SAR Measurements" procedures of 3G device. In addition, body SAR is also measured for HSDPA when the maximum average output of each RF channel with HSDPA active is at least 1/4 dB higher than that measured without HSDPA using 12.2kbps RMC or the maximum SAR 12.2kbps RMC is above 75% of the SAR limit. Body SAR for HSDPA is measured using an FRC with H-Set 1 in Sub-test 1 and a 12.2kbps RMC configured in Test Loop Mode 1, using the highest body SAR configuration in 12.2 kbps RMC without HSDPA.

HSDPA should be configured according to the UE category of a test device. The number of HS-DSCH/HS-PDSCHs, HARQ processes, minimum inter-TTI interval, transport block sizes and RV coding sequence are defined by the H-set. To maintain a consistent test configuration and stable transmission condition, QPSK is used in the H-set for SAR testing. HS-DPCCH should be

# TA Technology (Shanghai) Co., Ltd.

## Test Report

configured with a CQI feedback cycle of 4 ms with a CQI repetition factor of 2 to maintain a constant rate of active CQI slots. DPCCH and DPDCH gain factors( $\beta_c, \beta_d$ ), and HS-DPCCH power offset parameters( $\Delta_{ACK}$ ,  $\Delta_{NACK}$ ,  $\Delta_{CQI}$ ) should be set according to values indicated in the Table below. The CQI value is determined by the UE category, transport block size, number of HS-PDSCHs and modulation used in the H-set.

**Table 3: Subtests for UMTS Release 5 HSDPA**

Sub-set	$\beta_c$	$\beta_d$	$\beta_d$ (SF)	$\beta_c/\beta_d$	$\beta_{hs}$ (note 1, note 2)	CM(dB) (note 3)	MPR(dB)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (note 4)	15/15 (note 4)	64	12/15 (note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note1:  $\Delta_{ACK}$ ,  $\Delta_{NACK}$  and  $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$   
 Note2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1.A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA,  $\Delta_{ACK}$  and  $\Delta_{NACK} = 8$  ( $A_{hs} = 30/15$ ) with  $\beta_{hs} = 30/15 * \beta_c$ , and  $\Delta_{CQI} = 7$  ( $A_{hs} = 24/15$ ) with  $\beta_{hs} = 24/15 * \beta_c$ .  
 Note3: CM=1 for  $\beta_c/\beta_d = 12/15$ ,  $\beta_{hs}/\beta_c = 24/15$ . For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.  
 Note 4: For subtest 2 the  $\beta_c/\beta_d$  ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TFC1, TF1) to  $\beta_c = 11/15$  and  $\beta_d = 15/15$ .

**Table 4: Settings of required H-Set 1 QPSK in HSDPA mode**

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	534
Inter-TTI Distance	TTI's	3
Number of HARQ Processes	Processes	2
Information Bit Payload ( $N_{INF}$ )	Bits	3202
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	4800
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	9600
Coding Rate	/	0.67
Number of Physical Channel Codes	Codes	5
Modulation	/	QPSK

**Table 5: HSDPA UE category**

<b>HS-DSCH Category</b>	<b>Maximum HS-DSCH Codes Received</b>	<b>Minimum Inter-TTI Interval</b>	<b>Maximum Transport Bits/HS-DSCH</b>	<b>Total Channel</b>
1	5	3	7298	19200
2	5	3	7298	28800
3	5	2	7298	28800
4	5	2	7298	38400
5	5	1	7298	57600
6	5	1	7298	67200
7	10	1	14411	115200
8	10	1	14411	134400
9	15	1	25251	172800
10	15	1	27952	172800
11	5	2	3630	14400
12	5	1	3630	28800
13	15	1	34800	259200
14	15	1	42196	259200
15	15	1	23370	345600
16	15	1	27952	345600

## 2.5. HSUPA Test Configuration

Body SAR is also measured for HSPA when the maximum average output of each RF channel with HSPA active is at least ¼ dB higher than that measured without HSPA using 12.2 kbps RMC or the maximum SAR for 12.2 kbps RMC is above 75% of the SAR limit. Body SAR for HSPA is measured with E-DCH Sub-test 5, using H-Set 1 and QPSK for FRC and a 12.2 kbps RMC configured in Test Loop Mode 1 with power control algorithm 2, according to the highest body SAR configuration in 12.2 kbps RMC without HSPA.<sup>40</sup>

Due to inner loop power control requirements in HSPA, a commercial communication test set should be used for the output power and SAR tests.<sup>41</sup> The 12.2 kbps RMC, FRC H-set 1 and E-DCH configurations for HSPA should be configured according to the  $\beta$  values indicated below as well as other applicable procedures described in the 'WCDMA Handset' and 'Release 5 HSDPA Data Devices' sections of 3 G device.

# TA Technology (Shanghai) Co., Ltd. Test Report

Report No. RZA2010-1428SAR

Page 13 of 105

**Table 6: Sub-Test 5 Setup for Release 6 HSUPA**

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

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

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

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

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

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

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

**Table 7: HSUPA UE category**

UE E-DCH Category	Maximum E-DCH Codes Transmitted	Number of HARQ Processes	E-DCH TTI (ms)	Minimum Spreading Factor	Maximum E-DCH Transport Block Bits	Max Rate (Mbps)
1	1	4	10	4	7110	0.7296
2	2	8	2	4	2798	1.4592
	2	4	10	4	14484	
3	2	4	10	4	14484	1.4592
4	2	8	2	2	5772	2.9185
	2	4	10	2	20000	2.00
5	2	4	10	2	20000	2.00
6 (No DPDCH)	4	8	2	2 SF2 & 2 SF4	11484	5.76
	4	4	10		20000	2.00
7 (No DPDCH)	4	8	2	2 SF2 & 2 SF4	22996	?
	4	4	10		20000	?

NOTE: When 4 codes are transmitted in parallel, two codes shall be transmitted with SF2 and two with SF4.

UE Categories 1 to 6 supports QPSK only. UE Category 7 supports QPSK and 16QAM. (TS25.306-7.3.0)

## **2.6. Position of Module in Portable Devices**

The measurements were performed in combination with two host products (IBM T61 and Lenovo Y-450). IBM T61 laptop has horizontal USB slot, Lenovo Y-450 laptop has vertical USB slot.

A test distance of 5mm or less, according to KDB 447498 D02, should be considered for the orientation that can satisfy such requirements.

For each channel, the EUT is tested at the following 4 test positions:

- Test Position 1: The EUT is connected to the portable computer with horizontal USB slot. The back side of the EUT and the back side of the portable computer towards to the bottom of the flat phantom. The distance from back side of the EUT to the bottom of the flat phantom is 5mm. (ANNEX H Picture 6)
- Test Position 2: The EUT is connected to the portable computer through a 19 cm USB cable. The front side of the EUT towards the bottom of the flat phantom. The distance from front side of the EUT to the bottom of the flat phantom is 5mm. (ANNEX H Picture 7)
- Test Position 3: The EUT is connected to the portable computer through a 19 cm USB cable. The left side of the EUT towards the bottom of the flat phantom. The distance from left side of the EUT to the bottom of the flat phantom is 5mm. (ANNEX H Picture 8)
- Test Position 4: The EUT is connected to the portable computer with vertical USB slot. The right side of the EUT and the back side of the portable computer towards to the bottom of the flat phantom. The distance from right side of the EUT to the bottom of the flat phantom is 5mm. (ANNEX H Picture 9)

## 2.7. Picture of Host Product

During the test, IBM T61 and Lenovo Y-450 laptop were used as an assistant to help to setup communication. (See Picture 1)



Picture 1-a: IBM T61 Close



Picture 1-b: IBM T61 Open



Picture 1-c: Lenovo Y-450 Close



Picture 1-d: Lenovo Y-450 Open



Picture 1-e: IBM T61 with horizontal USB slot



Picture 1-f: Lenovo Y-450 with Vertical USB slot



Picture 1-g: a 19 cm USB cable

**Picture 1: Computer as a test assistant**



### 3. SAR Measurements System Configuration

#### 3.1. SAR Measurement Set-up

The DASY4 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- A data acquisition electronic (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- A unit to operate the optical surface detector which is connected to the EOC.
- The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY4 measurement server.
- The DASY4 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 2003
- DASY4 software and SEMCAD data evaluation software.
- Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
- The generic twin phantom enabling the testing of left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- System validation dipoles allowing to validate the proper functioning of the system.

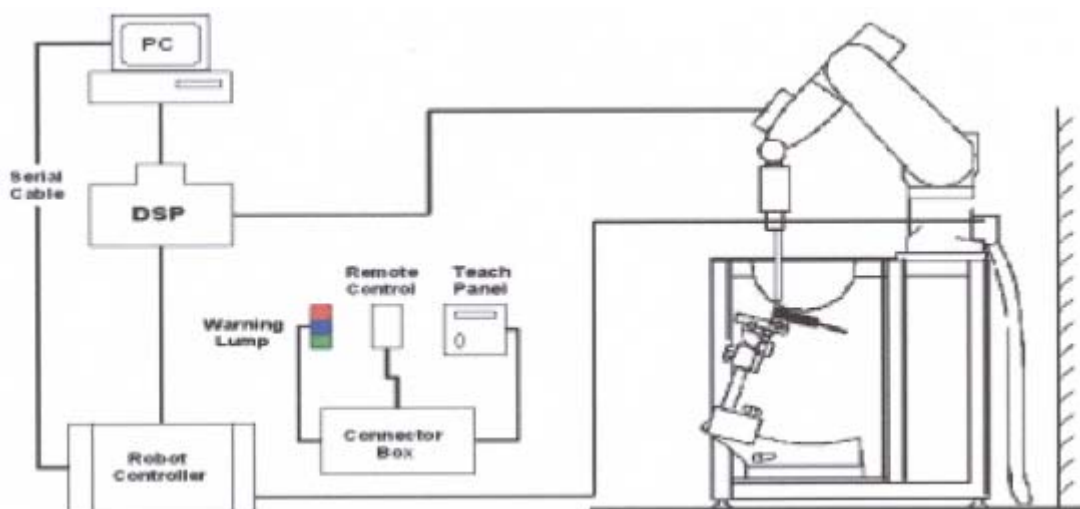


Figure 1. SAR Lab Test Measurement Set-up

### 3.2. DASY4 E-field Probe System

The SAR measurements were conducted with the dosimetric probe EX3DV4 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

#### 3.2.1. EX3DV4 Probe Specification

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available
Frequency	10 MHz to > 6 GHz Linearity: $\pm 0.2$ dB (30 MHz to 6 GHz)
Directivity	$\pm 0.3$ dB in HSL (rotation around probe axis) $\pm 0.5$ dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 $\mu$ W/g to > 100 mW/g Linearity: $\pm 0.2$ dB (noise: typically < 1 $\mu$ W/g)
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.



Figure 2. EX3DV4 E-field Probe



Figure 3. EX3DV4 E-field probe

### 3.2.2. E-field Probe Calibration

Each probe is calibrated according to a dosimetric assessment procedure with accuracy better than  $\pm 10\%$ . The spherical isotropy was evaluated and found to be better than  $\pm 0.25\text{dB}$ . The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies below 1 GHz, and in a wave guide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

$$SAR = C \frac{\Delta T}{\Delta t}$$

Where:  $\Delta t$  = Exposure time (30 seconds),

C = Heat capacity of tissue (brain or muscle),

$\Delta T$  = Temperature increase due to RF exposure.

Or

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

Where:

$\sigma$  = Simulated tissue conductivity,

$\rho$  = Tissue density (kg/m<sup>3</sup>).

### 3.3. Other Test Equipment

#### 3.3.1. Device Holder for Transmitters

**Construction:** Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices according to IEC 62209-2 (e.g., laptops, cameras, etc.) It is lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioner. The extension is fully compatible with the Twin SAM, ELI4 and SAM v6.0 Phantoms.

**Material:** POM, Acrylic glass, Foam

### 3.3.2. Phantom

The Generic Twin Phantom is constructed of a fiberglass shell integrated in a wooden Figure. The shape of the shell is based on data from an anatomical study designed to determine the maximum exposure in at least 90% of all users. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents the evaporation of the liquid. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

Shell Thickness	2±0.1 mm
Filling Volume	Approx. 20 liters
Dimensions	810 x 1000 x 500 mm (H x L x W)
Available	Special



**Figure 4. Generic Twin Phantom**

### 3.4. Scanning Procedure

The DASY4 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

- The “reference” and “drift” measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT’s output power and should vary max.  $\pm 5\%$ .
- The “surface check” measurement tests the optical surface detection system of the DASY4 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above  $\pm 0.1\text{mm}$ ). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe. (It does not depend on the surface reflectivity or the probe angle to the surface within  $\pm 30^\circ$ .)
- Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot. Before starting the area scan a grid spacing of 10 mm x 10 mm is set. During the scan the distance of the probe to the phantom remains

unchanged.

After finishing area scan, the field maxima within a range of 2 dB will be ascertained.

- **Zoom Scan**

Zoom Scans are used to estimate the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan is done by 7x7x7 points within a cube whose base is centered around the maxima found in the preceding area scan.

- **Spatial Peak Detection**

The procedure for spatial peak SAR evaluation has been implemented and can determine values of masses of 1g and 10g, as well as for user-specific masses. The DASY4 system allows evaluations that combine measured data and robot positions, such as:

- maximum search
- extrapolation
- boundary correction
- peak search for averaged SAR

During a maximum search, global and local maxima searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard's method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation. Extrapolation routines require at least 10 measurement points in 3-D space.

They are used in the Zoom Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard's method for extrapolation. For a grid using 7x7x7 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1g and 10g cubes.

- A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube 7x7x7 scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 5mm steps.

### **3.5. Data Storage and Evaluation**

#### **3.5.1. Data Storage**

The DASY4 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension “.DA4”. The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [mW/g], [mW/cm<sup>2</sup>], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

#### **3.5.2. Data Evaluation by SEMCAD**

The SEMCAD software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	- Sensitivity	Normi, a <sub>i0</sub> , a <sub>i1</sub> , a <sub>i2</sub>
	- Conversion factor	ConvF <sub>i</sub>
	- Diode compression point	Dcp <sub>i</sub>
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	
	- Density	

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY4 components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics.

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**Test Report**

If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot c f / d c p_i$$

With  $V_i$  = compensated signal of channel i (i = x, y, z)

$U_i$  = input signal of channel i (i = x, y, z)

$cf$  = crest factor of exciting field (DASY parameter)

$dcp_i$  = diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

E-field probes:  $E_i = (V_i / Norm_i \cdot ConvF)^{1/2}$

H-field probes:  $H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1} f + a_{i2} f^2) / f$

With  $V_i$  = compensated signal of channel i (i = x, y, z)

$Norm_i$  = sensor sensitivity of channel i (i = x, y, z)  
[mV/(V/m)<sup>2</sup>] for E-field Probes

$ConvF$  = sensitivity enhancement in solution

$a_{ij}$  = sensor sensitivity factors for H-field probes

$f$  = carrier frequency [GHz]

$E_i$  = electric field strength of channel i in V/m

$H_i$  = magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = (E_x^2 + E_y^2 + E_z^2)^{1/2}$$

The primary field data are used to calculate the derived field units.

$$SAR = (E_{tot}^2 \cdot \dots) / (\dots \cdot 1000)$$

with  $SAR$  = local specific absorption rate in mW/g

$E_{tot}$  = total field strength in V/m

$\sigma$  = conductivity in [mho/m] or [Siemens/m]

$\rho$  = equivalent tissue density in g/cm<sup>3</sup>

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{pwe} = E_{tot}^2 / 3770 \quad \text{or} \quad P_{pwe} = H_{tot}^2 \cdot 37.7$$

with  $P_{pwe}$  = equivalent power density of a plane wave in mW/cm<sup>2</sup>

$E_{tot}$  = total electric field strength in V/m

$H_{tot}$  = total magnetic field strength in A/m



### 3.6. System Check

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulants were measured every day using the dielectric probe kit and the network analyzer. A system check measurement was made following the determination of the dielectric parameters of the simulant, using the dipole validation kit. A power level of 250 mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom. The system check results (dielectric parameters and SAR values) are given in the table 12.

System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system ( $\pm 10\%$ ).

System check is performed regularly on all frequency bands where tests are performed with the DASY4 system.

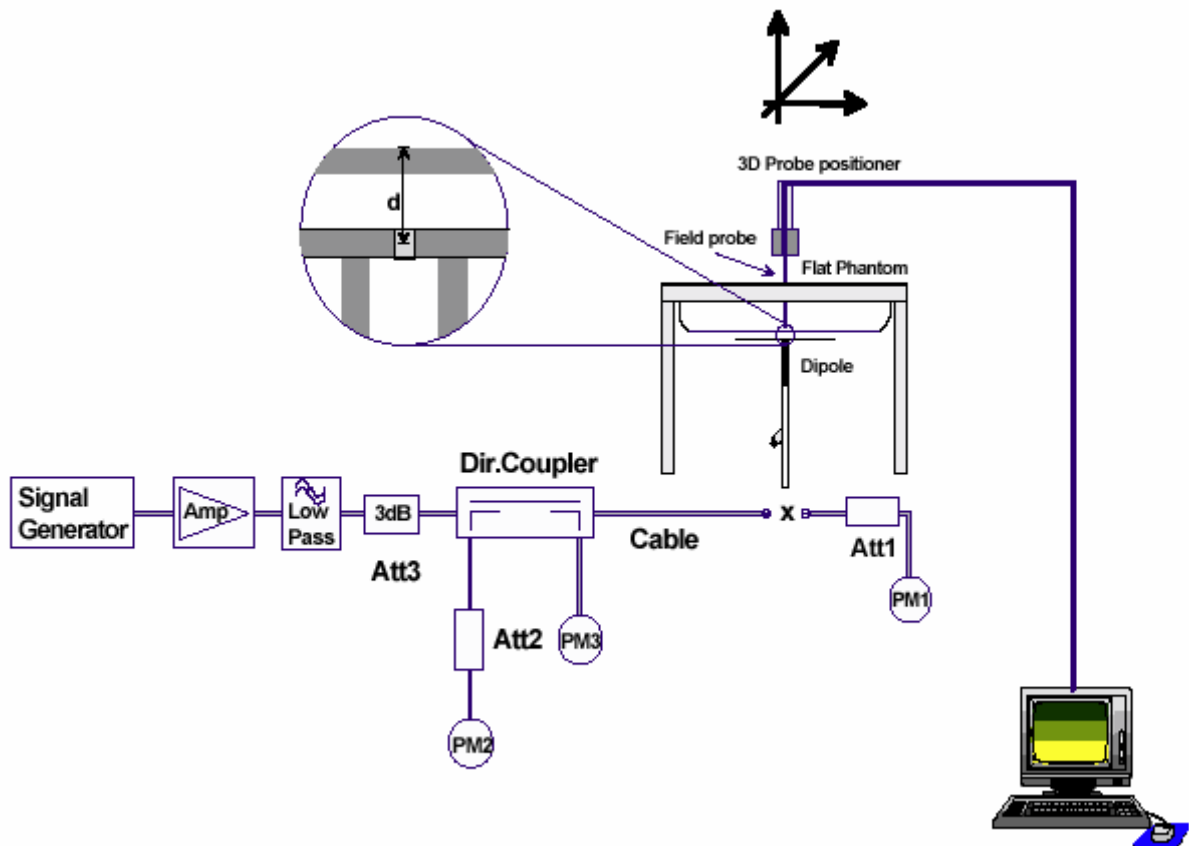


Figure 5. System Check Set-up

### 3.7. Equivalent Tissues

The liquid is consisted of water, sugar, salt, Glycol monobutyl, Preventol and Cellulose. The liquid has previously been proven to be suited for worst-case. The Table 8 shows the detail solution. It's satisfying the latest tissue dielectric parameters requirements proposed by OET 65.

**Table 8: Composition of the Body Tissue Equivalent Matter**

MIXTURE%	FREQUENCY(Body) 835MHz		
Water	52.5		
Sugar	45		
Salt	1.4		
Preventol	0.1		
Cellulose	1.0		
<b>Dielectric Parameters Target Value</b>	<b>f=835MHz</b>	<b>ε=55.2</b>	<b>σ=0.97</b>

MIXTURE%	FREQUENCY (Body) 1900MHz		
Water	69.91		
Glycol monobutyl	29.96		
Salt	0.13		
<b>Dielectric Parameters Target Value</b>	<b>f=1900MHz</b>	<b>ε=53.3</b>	<b>σ=1.52</b>

## 4. Laboratory Environment

**Table 9: The Ambient Conditions during Test**

Temperature	Min. = 20°C, Max. = 25 °C
Relative humidity	Min. = 30%, Max. = 70%
Ground system resistance	< 0.5 Ω
Ambient noise is checked and found very low and in compliance with requirement of standards.	
Reflection of surrounding objects is minimized and in compliance with requirement of standards.	

## **5. Characteristics of the Test**

### **5.1. Applicable Limit Regulations**

**IEEE Std C95.1, 1999:** IEEE Standard for Safety Levels with Respect to Human Exposure to Radiofrequency Electromagnetic Fields, 3 kHz to 300 GHz.

### **5.2. Applicable Measurement Standards**

**SUPPLEMENT C Edition 01-01 to OET BULLETIN 65 Edition 97-01 June 2001 including DA 02-1438, published June 2002:** Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields Additional Information for Evaluation Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions.

**KDB 447498 D02 SAR Procedures for Dongle Xmtr v02:** SAR Measurement Procedures for USB Dongle Transmitters.

## 6. Conducted Output Power Measurement

### 6.1. Summary

The DUT is tested using an E5515C communications tester as controller unit to set test channels and maximum output power to the DUT, as well as for measuring the conducted power. Conducted output power was measured using an integrated RF connector and attached RF cable. This result contains conducted output power for the EUT.

### 6.2. Conducted Power Results

**Table 10: Conducted Power Measurement Results**

WCDMA Band V			Conducted Power(dBm)			
			Channel 4132	Channel 4183	Channel 4233	
RMC	12.2kbps	Before	23.47	23.60	23.52	
		After	23.46	23.59	23.50	
	64kbps	Before	23.45	23.59	23.51	
		After	23.43	23.58	23.50	
	144kbps	Before	23.46	23.58	23.50	
		After	23.44	23.57	23.49	
	384kbps	Before	23.45	23.58	23.51	
		After	23.43	23.56	23.50	
	HSDPA	Sub-Test 1	Before	23.53	23.49	23.56
			After	23.52	23.48	23.55
		Sub-Test 2	Before	23.50	23.42	23.45
			After	23.48	23.41	23.44
Sub-Test 3		Before	23.01	22.92	22.94	
		After	23.00	22.91	22.93	
Sub-Test 4		Before	22.78	22.77	22.86	
		After	22.77	22.76	22.85	
HSUPA		Sub-Test 1	Before	23.25	23.43	23.47
			After	23.23	23.42	23.46
	Sub-Test 2	Before	21.37	21.78	21.51	
		After	21.36	21.77	21.50	
	Sub-Test 3	Before	22.36	22.59	22.85	
		After	22.35	22.58	22.83	
	Sub-Test 4	Before	21.33	21.73	21.51	
		After	21.32	21.71	21.50	
	Sub-Test 5	Before	23.36	23.48	23.51	
		After	23.35	23.49	23.52	

# TA Technology (Shanghai) Co., Ltd. Test Report

GSM 850			Conducted Power(dBm)				Average power(dBm)		
			Channel 128	Channel 190	Channel 251		Channel 128	Channel 190	Channel 251
GPRS (GMSK)	1TXslot	Before	32.61	32.49	32.43	-9.03dB	23.58	23.46	23.4
		After	32.60	32.47	32.41	-9.03dB	23.57	23.44	23.38
	2TXslots	Before	32.56	32.46	32.40	-6.02dB	<b>26.54</b>	<b>26.44</b>	<b>26.38</b>
		After	32.54	32.45	32.38	-6.02dB	26.52	26.43	26.36
EGPRS (GMSK)	1TXslot	Before	32.65	32.55	32.47	-9.03dB	23.62	23.52	23.44
		After	32.64	32.53	32.46	-9.03dB	23.61	23.5	23.43
	2TXslots	Before	32.43	32.36	32.31	-6.02dB	<b>26.41</b>	<b>26.34</b>	<b>26.29</b>
		After	32.42	32.34	32.30	-6.02dB	26.4	26.32	26.28
GSM 1900			Conducted Power(dBm)				Average power(dBm)		
			Channel 512	Channel 661	Channel 810		Channel 512	Channel 661	Channel 810
GSM	Before		30.20	30.17	30.03	-9.03dB	21.17	21.14	21
	After		30.19	30.16	30.02	-9.03dB	21.16	21.13	20.99
GPRS (GMSK)	1TXslot	Before	30.22	30.18	30.04	-9.03dB	21.19	21.15	21.01
		After	30.21	30.17	30.02	-9.03dB	21.18	21.14	20.99
	2TXslots	Before	30.15	30.12	29.99	-6.02dB	<b>24.13</b>	<b>24.1</b>	<b>23.97</b>
		After	30.14	30.10	29.98	-6.02dB	24.12	24.08	23.96
EGPRS (GMSK)	1TXslot	Before	30.22	30.19	30.06	-9.03dB	21.19	21.16	21.03
		After	30.21	30.17	30.05	-9.03dB	21.18	21.14	21.02
	2TXslots	Before	30.16	30.13	30.00	-6.02dB	<b>24.14</b>	<b>24.11</b>	<b>23.98</b>
		After	30.15	30.12	29.98	-6.02dB	24.13	24.1	23.96

Note:

1) Division Factors

To average the power, the division factor is as follows:

1 TX- slot = 1 transmit tome slot out of 8 time slots

=> conducted power divided by (8/1) => -9.03 dB

2 TX- slot = 2 transmit tome slots out of 8 time slots

=> conducted power divided by (8/2) => -6.02 dB

2) Average power numbers

The maximum power numbers are marks in bold.

3) For SAR testing the EUT was set to multislot class based on the maximum averaged conducted power.

## 7. Test Results

### 7.1. Dielectric Performance

**Table 11: Dielectric Performance of Body Tissue Simulating Liquid**

Frequency	Description	Dielectric Parameters		Temp °C
		$\epsilon_r$	$\sigma$ (s/m)	
<b>835MHz (body)</b>	Target value ±5% window	55.20 52.44 — 57.96	0.97 0.92 — 1.02	/
	Measurement value 2010-10-21	55.66	0.93	21.5
<b>1900MHz (body)</b>	Target value ±5% window	53.30 50.64 — 55.97	1.52 1.44 — 1.60	/
	Measurement value 2010-10-21	51.92	1.53	21.7

### 7.2. System Check

**Table 12: System Check for Body Tissue Simulating Liquid**

Frequency	Description	SAR(W/kg)		Dielectric Parameters		Temp °C
		10g	1g	$\epsilon_r$	$\sigma$ (s/m)	
<b>835MHz</b>	Recommended result ±10% window	1.63 1.47 — 1.79	2.49 2.24 — 2.74	54.6	0.98	/
	Measurement value 2010-10-21	1.68	2.56	55.66	0.93	21.5
<b>1900 MHz</b>	Recommended result ±10% window	5.52 4.97 — 6.07	10.3 9.27 — 11.33	53.5	1.54	/
	Measurement value 2010-10-21	5.50	10.28	51.92	1.53	21.7

Note: 1. The graph results see ANNEX B.

2. Target Values used derive from the calibration certificate and 250 mW is used as feeding power to the Calibrated dipole.

**7.3. Summary of Measurement Results**

**7.3.1. GSM 850 (GPRS/EGPRS)**

**Table 13: SAR Values [GSM 850 (GPRS/EGPRS)]**

Limit of SAR			10 g Average	1g Average	Power Drift	Graph Results
			2.0 W/kg	1.6 W/kg	± 0.21 dB	
Test Case Of Body			Measurement Result (W/kg)		Power Drift (dB)	
Test Position	Timeslots	Channel	10 g Average	1 g Average		
<b>IBM T61</b>						
Test Position 1	1 timeslot	Middle	0.085	0.132	-0.018	Figure 8
	2 timeslots	High	0.171	0.265	0.065	Figure 9
		Middle	0.161	0.248	-0.034	Figure 10
		Low	0.158	0.244	0.105	Figure 11
Test Position 2	2 timeslots	Middle	0.102	0.160	0.150	Figure 12
<b>Lenovo Y-450</b>						
Test Position 3	2 timeslots	Middle	0.034	0.056	0.037	Figure 13
Test Position 4	2 timeslots	Middle	0.111	0.169	-0.072	Figure 14
<b>Worst Case Position of GPRS with EGPRS (GMSK)</b>						
Test Position 1	2 timeslots	High	0.170	0.264	-0.005	Figure 15

Note: 1. The value with blue color is the maximum SAR Value of each test band.

2. The SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the SAR measured at mid-band channel for each test configuration is at least 3.0 dB (< 0.8W/kg) lower than the SAR limit, testing at the high and low channels is optional.
3. Upper and lower frequencies were measured at the worst case.
4. When SAR tests for EGPRS mode is necessary, GMSK modulation should be used to minimize SAR measurement error due to higher peak-to-average power (PAR) ratios inherent in 8-PSK.

**TA Technology (Shanghai) Co., Ltd.**  
**Test Report**

**Table 14: Extrapolated SAR Values of highest measured SAR [GSM 850 (GPRS/EGPRS)]**

Different Test Position	Channel	Conducted Power(dBm)	1g Average (W/kg)	Tune-up procedures	1g Average Limit 1.6 W/kg
		Measurement Result		MAX Power(dBm)	Extrapolated Result (W/kg)
<b>GPRS (2Up)</b>					
Test Position 1	High	32.56	0.265	33	0.293
<b>EGPRS (GMSK, 2Up)</b>					
Test Position 1	High	32.43	0.264	33	0.301



# TA Technology (Shanghai) Co., Ltd.

## Test Report

### 7.3.2. GSM 1900 (GPRS/EGPRS)

**Table 15: SAR Values [GSM 1900 (GPRS/EGPRS)]**

Limit of SAR			10 g Average	1g Average	Power Drift	Graph Results
			2.0 W/kg	1.6 W/kg	± 0.21 dB	
Test Case Of Body			Measurement Result (W/kg)		Power Drift (dB)	
Test Position	Timeslots	Channel	10 g Average	1 g Average		
<b>IBM T61</b>						
Test Position 1	1 timeslot	Middle	0.150	0.286	-0.089	Figure 16
	2 timeslots	High	0.344	0.655	-0.086	Figure 17
		Middle	0.289	0.562	-0.010	Figure 18
		Low	0.261	0.504	-0.040	Figure 19
Test Position 2	2 timeslots	Middle	0.233	0.477	0.071	Figure 20
<b>Lenovo Y-450</b>						
Test Position 3	2 timeslots	Middle	0.140	0.279	0.001	Figure 21
Test Position 4	2 timeslots	Middle	0.259	0.516	-0.119	Figure 22
<b>Worst Case Position of GPRS with EGPRS (GMSK)</b>						
Test Position 1	2 timeslots	High	0.388	0.738	-0.090	Figure 23

Note: 1. The value with blue color is the maximum SAR Value of each test band.

2. The SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the SAR measured at mid-band channel for each test configuration is at least 3.0 dB (< 0.8W/kg) lower than the SAR limit, testing at the high and low channels is optional.
3. Upper and lower frequencies were measured at the worst case.
4. When SAR tests for EGPRS mode is necessary, GMSK modulation should be used to minimize SAR measurement error due to higher peak-to-average power (PAR) ratios inherent in 8-PSK.

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**Test Report**

**Table 16: Extrapolated SAR Values of highest measured SAR [GSM 1900 (GPRS/EGPRS)]**

Different Test Position	Channel	Conducted Power(dBm)	1g Average (W/kg)	Tune-up procedures	1g Average Limit 1.6 W/kg
		Measurement Result		MAX Power(dBm)	Extrapolated Result (W/kg)
<b>GPRS (2Up)</b>					
Test Position 1	High	30.15	0.655	30	0.633
<b>EGPRS (GMSK, 2Up)</b>					
Test Position 1	High	30.16	0.738	30	0.711

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**Test Report**

**7.3.3. WCDMA Band V (WCDMA/HSDPA/HSUPA)**

**Table 17: SAR Values [WCDMA Band V (WCDMA/HSDPA/HSUPA)]**

Limit of SAR		10 g Average	1g Average	Power Drift	Graph Results
		2.0 W/kg	1.6 W/kg	± 0.21 dB	
Test Case Of Body		Measurement Result (W/kg)		Power Drift (dB)	
Different Test Position	Channel	10 g Average	1 g Average		
<b>IBM T61</b>					
Test Position 1	High	0.147	0.227	0.001	Figure 24
	Middle	0.159	0.246	-0.008	Figure 25
	Low	0.144	0.222	0.100	Figure 26
Test Position 2	Middle	0.111	0.190	0.055	Figure 27
<b>Lenovo Y-450</b>					
Test Position 3	Middle	0.047	0.075	0.024	Figure 28
Test Position 4	Middle	0.123	0.186	-0.069	Figure 29
<b>Worst Case Position of RMC with HSDPA</b>					
Test Position 1	Middle	0.150	0.231	0.074	Figure 30
<b>Worst Case Position of RMC with HSUPA</b>					
Test Position 1	Middle	0.130	0.200	0.099	Figure 31

Note: 1. The value with blue color is the maximum SAR Value of each test band.

2. The SAR test shall be performed at the high, middle and low frequency channels of each operating mode. If the SAR measured at mid-band channel for each test configuration is at least 3.0 dB (< 0.8W/kg) lower than the SAR limit, testing at the high and low channels is optional.
3. Upper and lower frequencies were measured at the worst case.

**Table 18: Extrapolated SAR Values of highest measured SAR [WCDMA Band V WCDMA/HSDPA/HSUPA]**

Different Test Position	Channel	Conducted Power(dBm)	1g Average (W/kg)	Tune-up procedures MAX Power(dBm)	1g Average Limit 1.6 W/kg
		Measurement Result			Extrapolated Result (W/kg)
Test Position 1	Middle	23.60	0.246	22.50	0.191

**TA Technology (Shanghai) Co., Ltd.**  
**Test Report**

Report No. RZA2010-1428SAR

Page 36 of 105

## 8. Measurement Uncertainty

No.	source	Type	Uncertainty Value (%)	Probability Distribution	k	c <sub>i</sub>	Standard uncertainty u <sub>i</sub> (%)	Degree of freedom V <sub>eff</sub> or v <sub>i</sub>
1	System repetivity	A	0.5	N	1	1	0.5	9
Measurement system								
2	probe calibration	B	5.9	N	1	1	5.9	∞
3	axial isotropy of the probe	B	4.7	R	$\sqrt{3}$	$\sqrt{0.5}$	1.9	∞
4	Hemispherical isotropy of the probe	B	9.4	R	$\sqrt{3}$	$\sqrt{0.5}$	3.9	∞
6	boundary effect	B	1.9	R	$\sqrt{3}$	1	1.1	∞
7	probe linearity	B	4.7	R	$\sqrt{3}$	1	2.7	∞
8	System detection limits	B	1.0	R	$\sqrt{3}$	1	0.6	∞
9	readout Electronics	B	1.0	N	1	1	1.0	∞
10	response time	B	0	R	$\sqrt{3}$	1	0	∞
11	integration time	B	4.32	R	$\sqrt{3}$	1	2.5	∞
12	noise	B	0	R	$\sqrt{3}$	1	0	∞
13	RF Ambient Conditions	B	3	R	$\sqrt{3}$	1	1.73	∞
14	Probe Positioner Mechanical Tolerance	B	0.4	R	$\sqrt{3}$	1	0.2	∞
15	Probe Positioning with respect to Phantom Shell	B	2.9	R	$\sqrt{3}$	1	1.7	∞
16	Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	B	3.9	R	$\sqrt{3}$	1	2.3	∞
Test sample Related								
17	-Test Sample Positioning	A	2.9	N	1	1	2.9	5
18	-Device Holder Uncertainty	A	4.1	N	1	1	4.1	5
19	-Output Power Variation - SAR drift measurement	B	5.0	R	$\sqrt{3}$	1	2.9	∞
Physical parameter								

**TA Technology (Shanghai) Co., Ltd.**  
**Test Report**

Report No. RZA2010-1428SAR

Page 37 of 105

20	-phantom	B	4.0	R	$\sqrt{3}$	1	2.3	$\infty$
21	-liquid conductivity (deviation from target)	B	5.0	R	$\sqrt{3}$	0.64	1.8	$\infty$
22	-liquid conductivity (measurement uncertainty)	B	5.0	N	1	0.64	3.2	$\infty$
23	-liquid permittivity (deviation from target)	B	5.0	R	$\sqrt{3}$	0.6	1.7	$\infty$
24	-liquid permittivity (measurement uncertainty)	B	5.0	N	1	0.6	3.0	$\infty$
Combined standard uncertainty		$u_c = \sqrt{\sum_{i=1}^{21} c_i^2 u_i^2}$				12.0		
Expanded uncertainty (confidence interval of 95 %)		$u_e = 2u_c$		N	k=2	24.0		

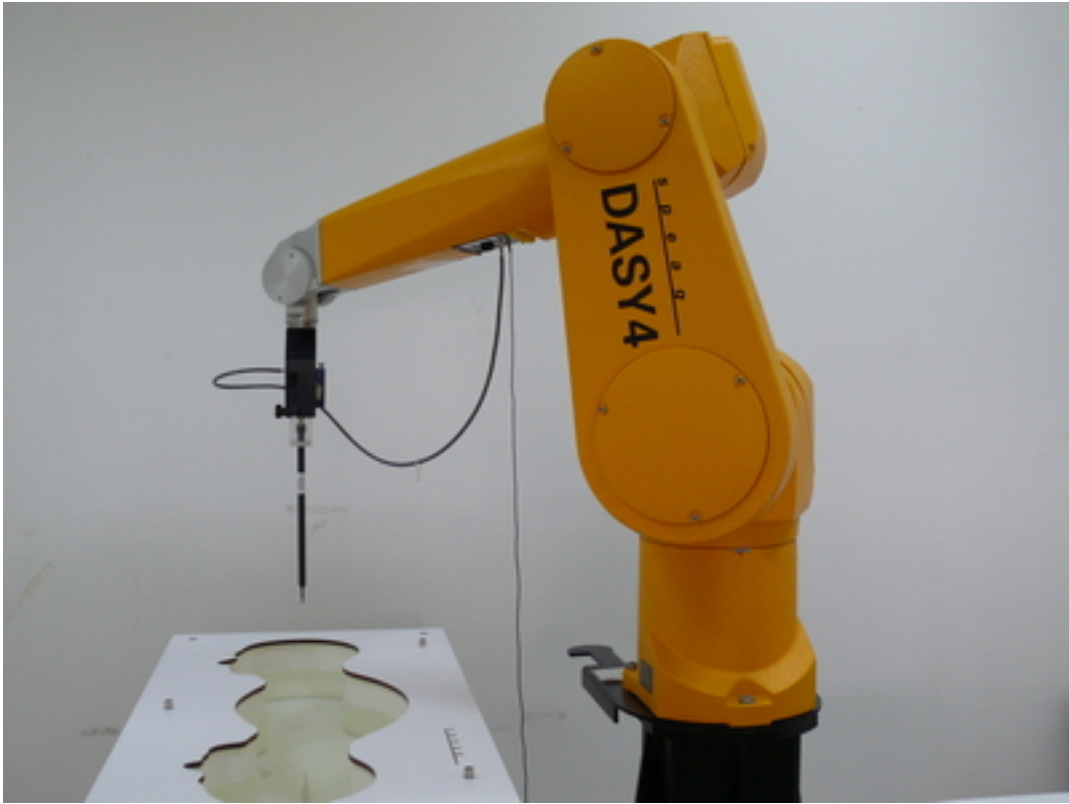
## 9. Main Test Instruments

**Table 19: List of Main Instruments**

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Network analyzer	Agilent 8753E	US37390326	September 13, 2010	One year
02	Dielectric Probe Kit	Agilent 85070E	US44020115	No Calibration Requested	
03	Power meter	Agilent E4417A	GB41291714	March 13, 2010	One year
04	Power sensor	Agilent 8481H	MY41091316	March 26, 2010	One year
05	Signal Generator	HP 8341B	2730A00804	September 13, 2010	One year
06	Amplifier	IXA-020	0401	No Calibration Requested	
07	BTS	E5515C	MY48360988	December 4, 2009	One year
08	E-field Probe	EX3DV4	3661	December 30, 2009	One year
09	DAE	DAE4	871	November 11, 2009	One year
10	Validation Kit 835MHz	D835V2	4d092	January 14, 2010	One year
11	Validation Kit 1900MHz	D1900V2	5d018	June 15, 2010	One year

\*\*\*END OF REPORT BODY\*\*\*

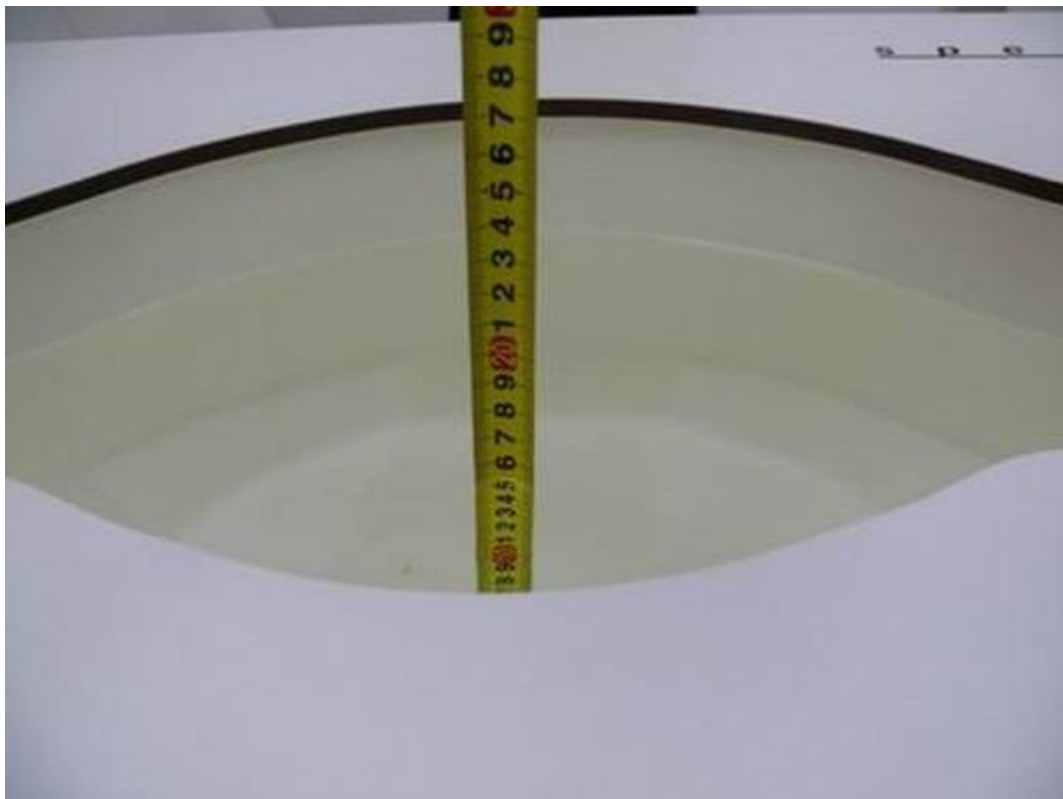
## ANNEX A: Test Layout



Picture 2: Specific Absorption Rate Test Layout



Picture 3: Liquid depth in the Flat Phantom (835 MHz, 15.4cm depth)



Picture 4: Liquid depth in the Flat Phantom (1900 MHz, 15.2cm depth)

## ANNEX B: System Check Results

### System Performance Check at 835 MHz

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d092

Date/Time: 10/21/2010 6:21:20 PM

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

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.93$  mho/m;  $\epsilon_r = 55.66$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(9.24, 9.24, 9.24); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**d=15mm, Pin=250mW/Area Scan (61x121x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 2.77 mW/g

**d=15mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 50.9 V/m; Power Drift = 0.023 dB

Peak SAR (extrapolated) = 3.68 W/kg

**SAR(1 g) = 2.56 mW/g; SAR(10 g) = 1.68 mW/g**

Maximum value of SAR (measured) = 2.77 mW/g

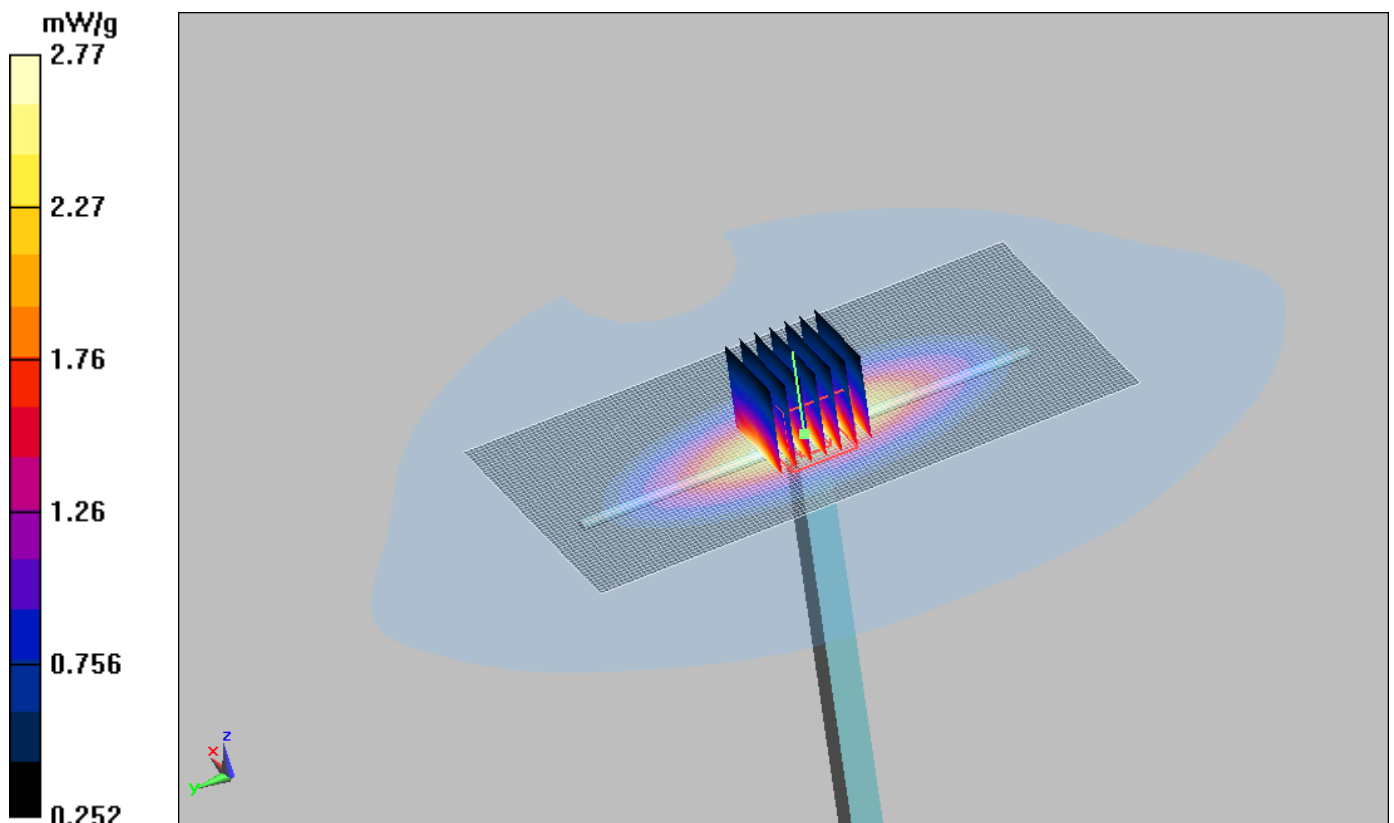


Figure 6 System Performance Check 835MHz 250mW



### System Performance Check at 1900 MHz

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d018

Date/Time: 10/21/2010 8:25:19 AM

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

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.53$  mho/m;  $\epsilon_r = 51.92$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.7 °C

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(7.60, 7.60, 7.60); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM000 T01; Type: SAM V4.0; Serial: TP-1246

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

**d=10mm, Pin=250mW/Area Scan (41x71x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 12.5 mW/g

**d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 75.9 V/m; Power Drift = 0.051 dB

Peak SAR (extrapolated) = 16.8 W/kg

**SAR(1 g) = 10.28 mW/g; SAR(10 g) = 5.50 mW/g**

Maximum value of SAR (measured) = 11 mW/g

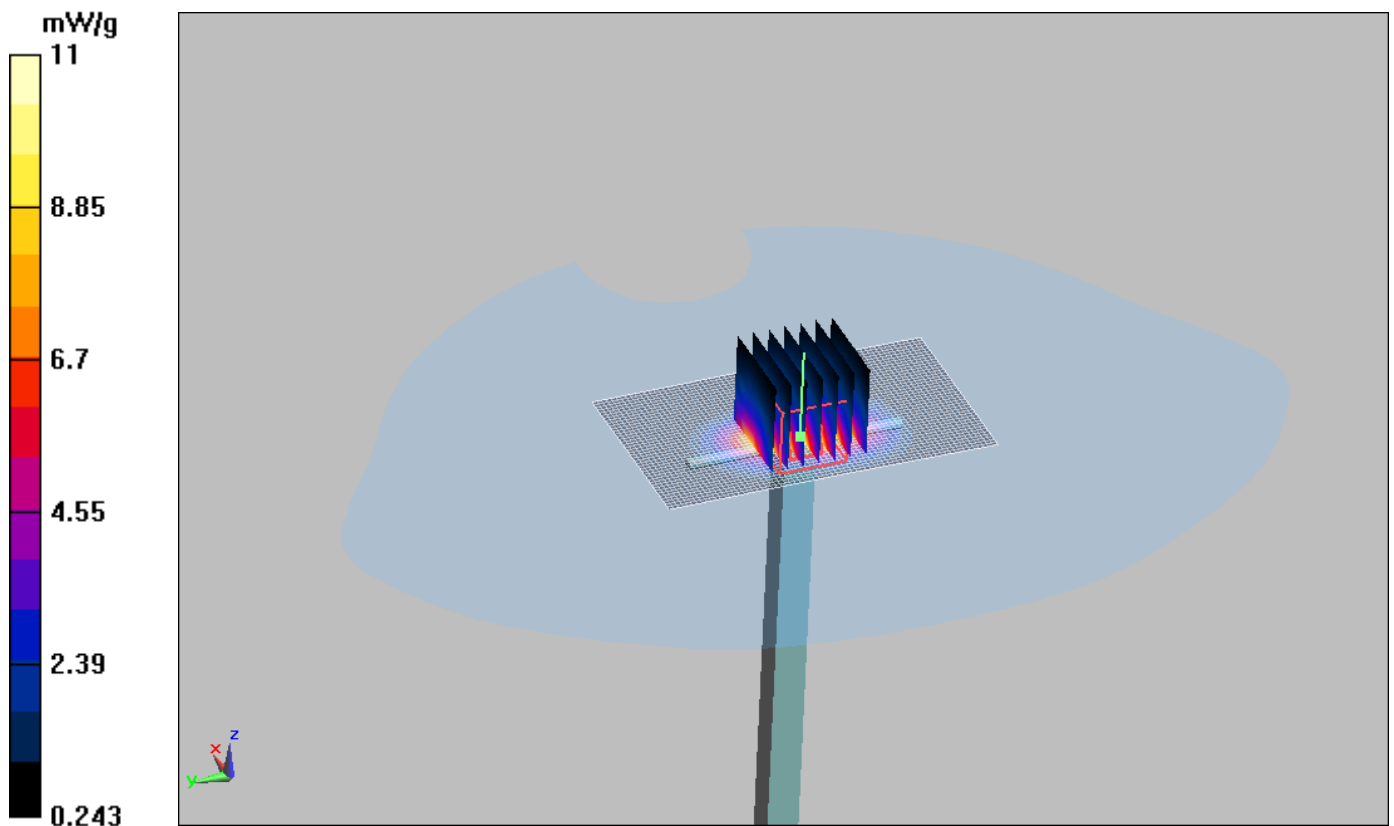


Figure 7 System Performance Check 1900MHz 250mW

## ANNEX C: Graph Results

### GSM 850 GPRS (1Up) with IBM T61 Test Position 1 Middle

Date/Time: 10/21/2010 7:36:09 PM

Communication System: GSM850 + GPRS(1Up); Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium parameters used:  $f = 837$  MHz;  $\sigma = 0.928$  mho/m;  $\epsilon_r = 55.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5°C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(9.24, 9.24, 9.24); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 1 Middle/Area Scan (51x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.144 mW/g

**Test Position 1 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 10.2 V/m; Power Drift = -0.018 dB

Peak SAR (extrapolated) = 0.196 W/kg

**SAR(1 g) = 0.132 mW/g; SAR(10 g) = 0.085 mW/g**

Maximum value of SAR (measured) = 0.143 mW/g

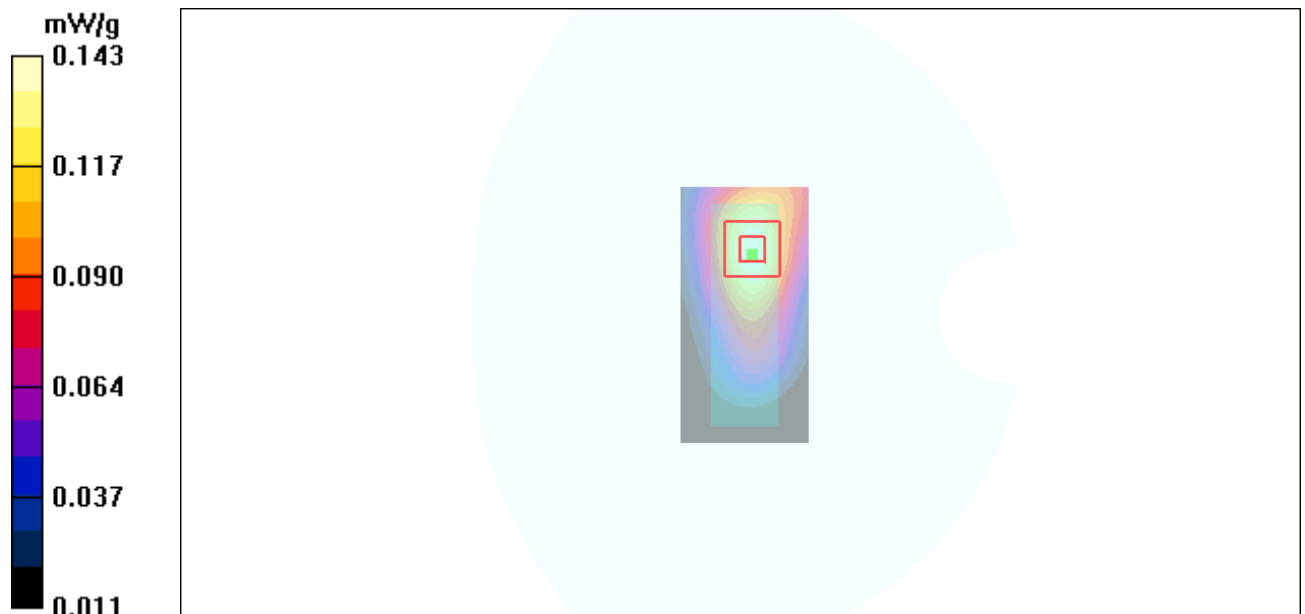


Figure 8 GSM 850 GPRS (1Up) with IBM T61 Test Position 1 Channel 190

**GSM 850 GPRS (2Up) with IBM T61 Test Position 1 High**

Date/Time: 10/21/2010 8:36:05 PM

Communication System: GSM850 + GPRS(2Up); Frequency: 848.8 MHz; Duty Cycle: 1:4.15

Medium parameters used:  $f = 849$  MHz;  $\sigma = 0.941$  mho/m;  $\epsilon_r = 55.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(9.24, 9.24, 9.24); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 1 High/Area Scan (51x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.286 mW/g

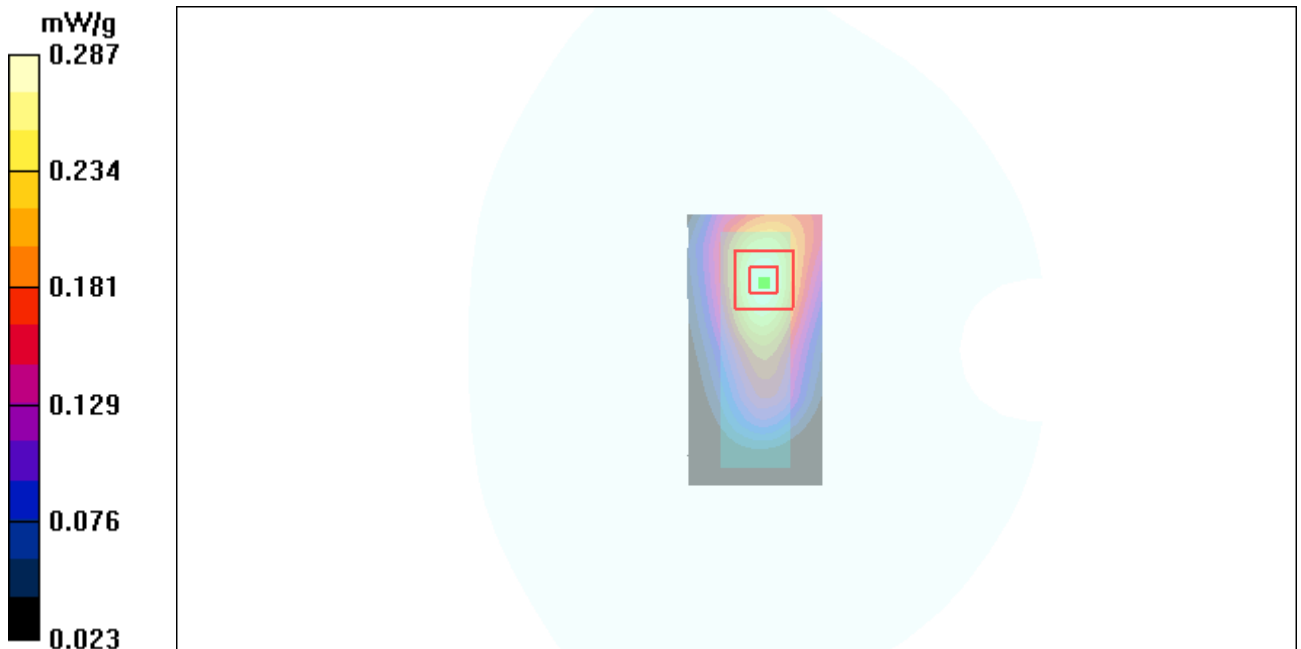
**Test Position 1 High/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 14.3 V/m; Power Drift = 0.065 dB

Peak SAR (extrapolated) = 0.395 W/kg

**SAR(1 g) = 0.265 mW/g; SAR(10 g) = 0.171 mW/g**

Maximum value of SAR (measured) = 0.287 mW/g



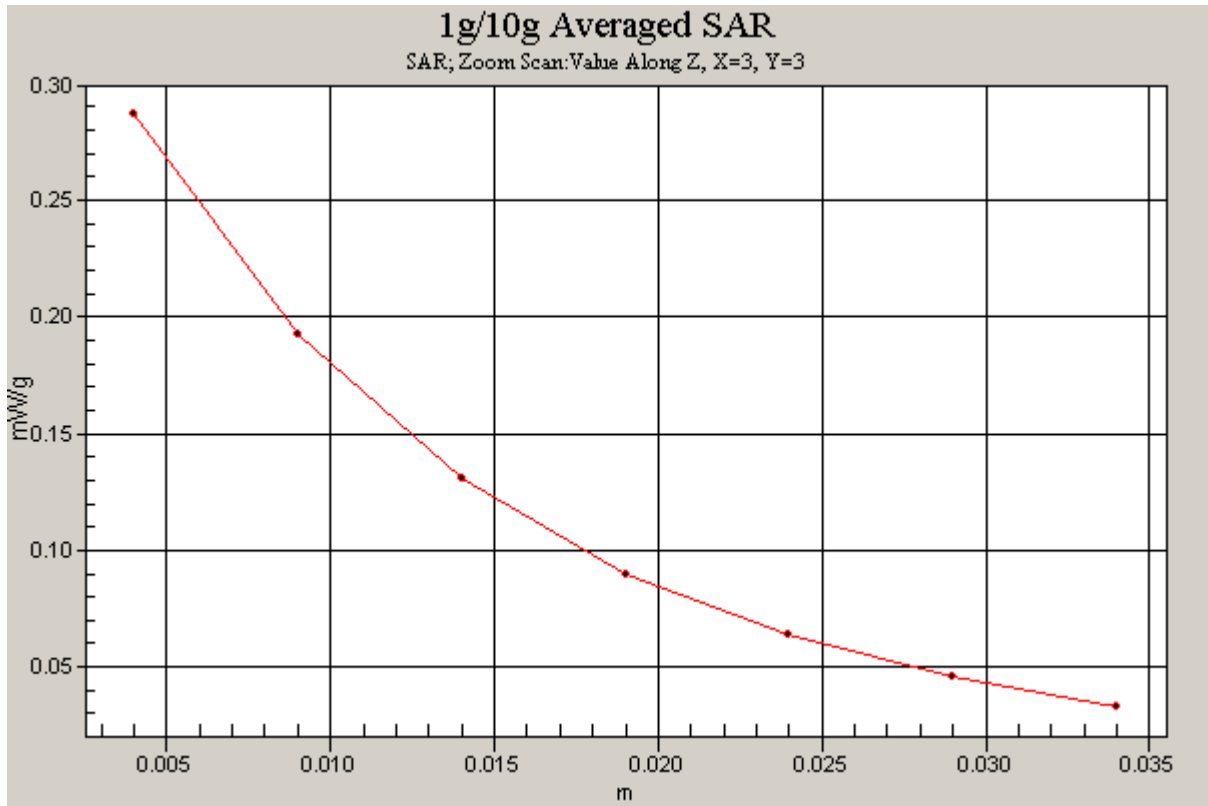


Figure 9 GSM 850 GPRS (2Up) with IBM T61 Test Position 1 Channel 251

**GSM 850 GPRS (2Up) with IBM T61 Test Position 1 Middle**

Date/Time: 10/21/2010 7:57:41 PM

Communication System: GSM850 + GPRS(2Up); Frequency: 836.6 MHz; Duty Cycle: 1:4.15

Medium parameters used:  $f = 837$  MHz;  $\sigma = 0.928$  mho/m;  $\epsilon_r = 55.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(9.24, 9.24, 9.24); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 1 Middle/Area Scan (51x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.272 mW/g

**Test Position 1 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 14.2 V/m; Power Drift = -0.034 dB

Peak SAR (extrapolated) = 0.365 W/kg

**SAR(1 g) = 0.248 mW/g; SAR(10 g) = 0.161 mW/g**

Maximum value of SAR (measured) = 0.269 mW/g

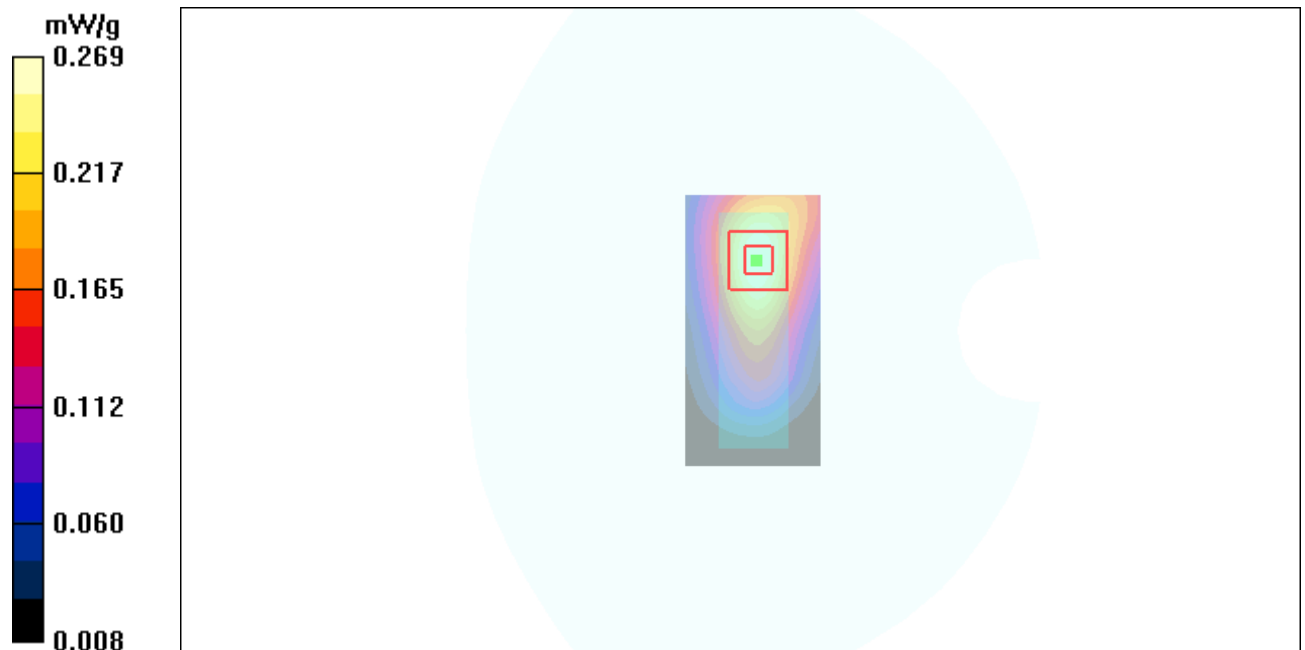


Figure 10 GSM 850 GPRS (2Up) with IBM T61 Test Position 1 Channel 190

**GSM 850 GPRS (2Up) with IBM T61 Test Position 1 Low**

Date/Time: 10/21/2010 8:17:29 PM

Communication System: GSM850 + GPRS(2Up); Frequency: 824.2 MHz;Duty Cycle: 1:4.15

Medium parameters used (interpolated):  $f = 824.2$  MHz;  $\sigma = 0.924$  mho/m;  $\epsilon_r = 55.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature:22.3 °C      Liquid Temperature: 21.5°C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(9.24, 9.24, 9.24); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 1 Low/Area Scan (51x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.261 mW/g

**Test Position 1 Low/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.9 V/m; Power Drift = 0.105 dB

Peak SAR (extrapolated) = 0.364 W/kg

**SAR(1 g) = 0.244 mW/g; SAR(10 g) = 0.158 mW/g**

Maximum value of SAR (measured) = 0.262 mW/g

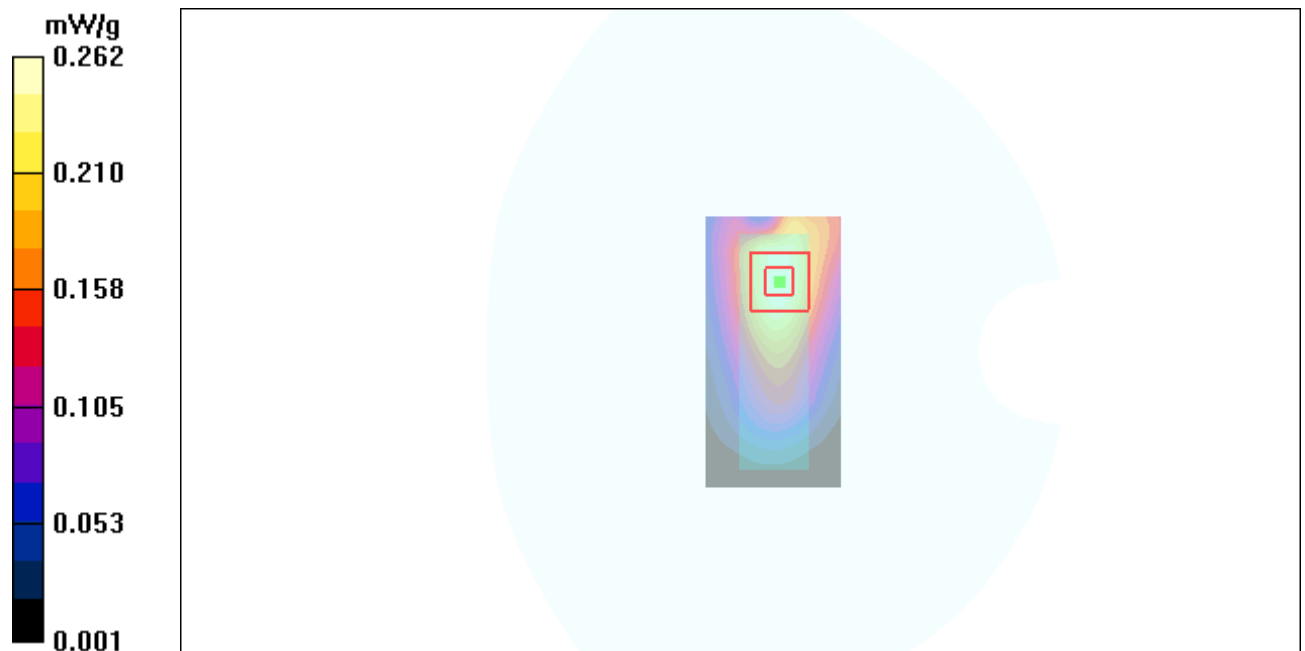


Figure 11 GSM 850 GPRS (2Up) with IBM T61 Test Position 1 Channel 128

**GSM 850 GPRS (2Up) with IBM T61 Test Position 2 Middle**

Date/Time: 10/21/2010 9:26:11 PM

Communication System: GSM850 + GPRS(2Up); Frequency: 836.6 MHz; Duty Cycle: 1:4.15

Medium parameters used:  $f = 837$  MHz;  $\sigma = 0.928$  mho/m;  $\epsilon_r = 55.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5°C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(9.24, 9.24, 9.24); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 2 Middle/Area Scan (51x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.172 mW/g

**Test Position 2 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.2 V/m; Power Drift = 0.150 dB

Peak SAR (extrapolated) = 0.240 W/kg

**SAR(1 g) = 0.160 mW/g; SAR(10 g) = 0.102 mW/g**

Maximum value of SAR (measured) = 0.175 mW/g

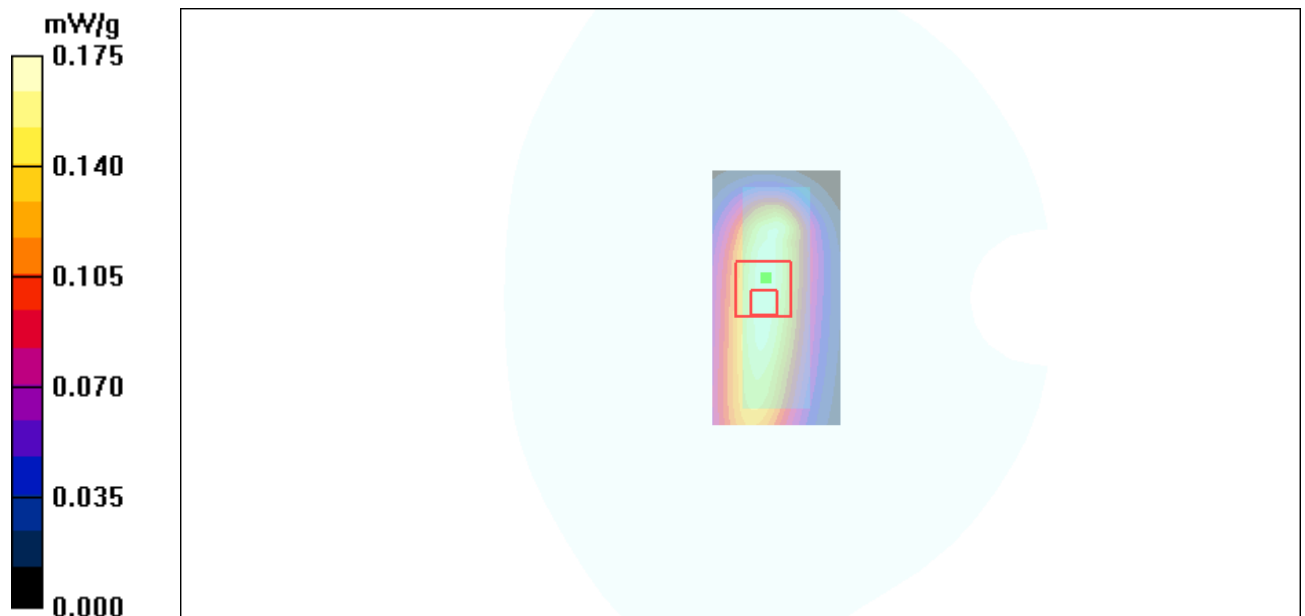


Figure 12 GSM 850 GPRS (2Up) with IBM T61 Test Position 2 Channel 190

**GSM 850 GPRS (2Up) with Lenovo Y-450 Test Position 3 Middle**

Date/Time: 10/21/2010 9:58:14 PM

Communication System: GSM850 + GPRS(2Up); Frequency: 836.6 MHz;Duty Cycle: 1:4.15

Medium parameters used:  $f = 837$  MHz;  $\sigma = 0.928$  mho/m;  $\epsilon_r = 55.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature:22.3 °C      Liquid Temperature: 21.5°C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(9.24, 9.24, 9.24); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 3 Middle/Area Scan (31x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.065 mW/g

**Test Position 3 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.39 V/m; Power Drift = 0.037 dB

Peak SAR (extrapolated) = 0.107 W/kg

**SAR(1 g) = 0.056 mW/g; SAR(10 g) = 0.034 mW/g**

Maximum value of SAR (measured) = 0.061 mW/g

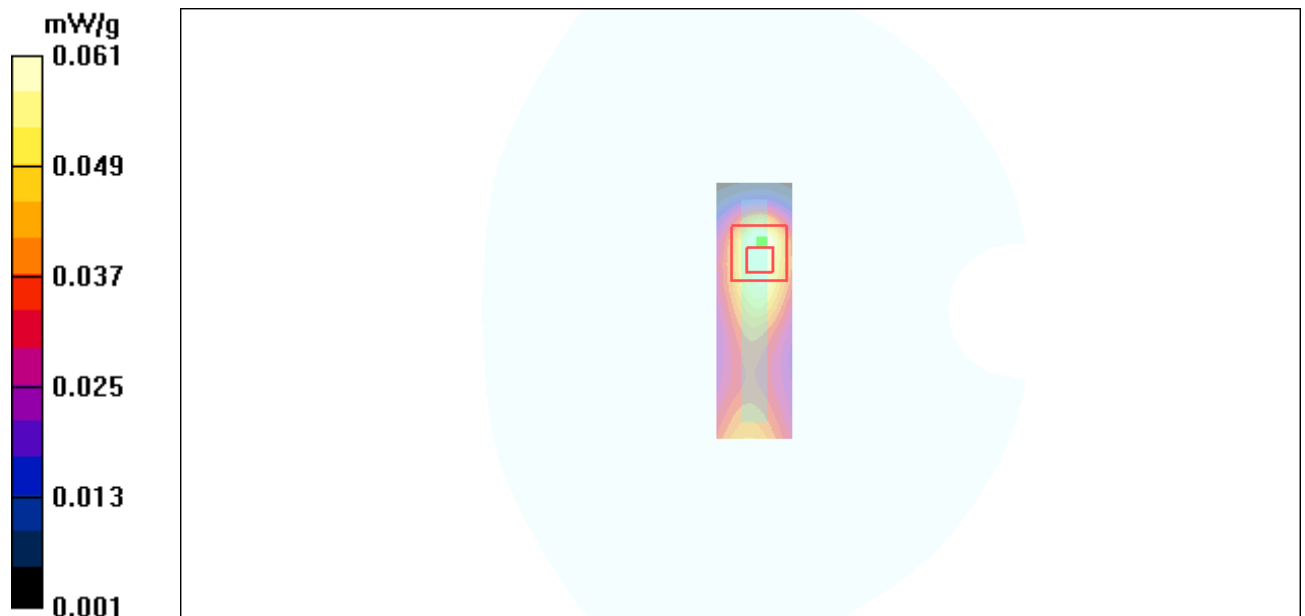


Figure 13 GSM 850 GPRS (2Up) with Lenovo Y-450 Test Position 3 Channel 190



**GSM 850 GPRS (2Up) with Lenovo Y-450 Test Position 4 Middle**

Date/Time: 10/21/2010 10:21:59 PM

Communication System: GSM850 + GPRS(2Up); Frequency: 836.6 MHz;Duty Cycle: 1:4.15

Medium parameters used:  $f = 837$  MHz;  $\sigma = 0.928$  mho/m;  $\epsilon_r = 55.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature:22.3 °C      Liquid Temperature: 21.5°C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(9.24, 9.24, 9.24); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 4 Middle/Area Scan (31x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.184 mW/g

**Test Position 4 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 11.6 V/m; Power Drift = -0.072 dB

Peak SAR (extrapolated) = 0.334 W/kg

**SAR(1 g) = 0.169 mW/g; SAR(10 g) = 0.111 mW/g**

Maximum value of SAR (measured) = 0.181 mW/g

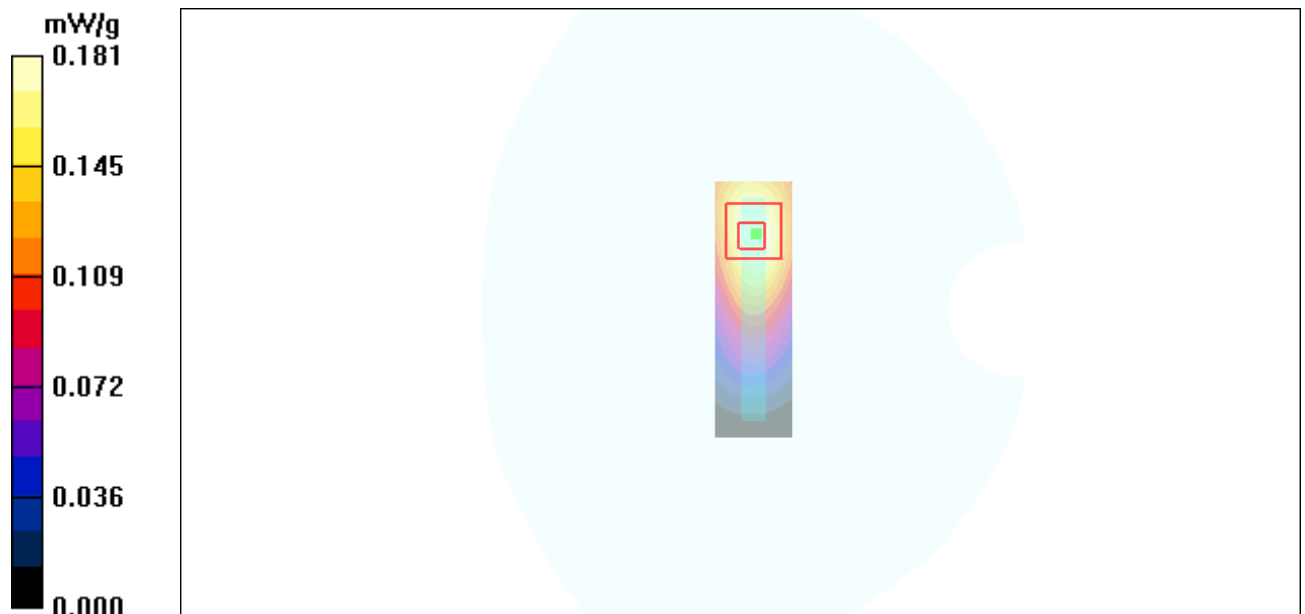


Figure 14 GSM 850 GPRS (2Up) with Lenovo Y-450 Test Position 4 Channel 190

### GSM 850 EGPRS (2Up) with IBM T61 Test Position 1 High

Date/Time: 10/21/2010 8:57:36 PM

Communication System: GSM850 + EGPRS(2Up); Frequency: 848.8 MHz; Duty Cycle: 1:4.15

Medium parameters used:  $f = 849$  MHz;  $\sigma = 0.941$  mho/m;  $\epsilon_r = 55.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5°C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(9.24, 9.24, 9.24); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 1 High/Area Scan (51x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.286 mW/g

**Test Position 1 High/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 14.3 V/m; Power Drift = -0.005 dB

Peak SAR (extrapolated) = 0.400 W/kg

**SAR(1 g) = 0.264 mW/g; SAR(10 g) = 0.170 mW/g**

Maximum value of SAR (measured) = 0.285 mW/g

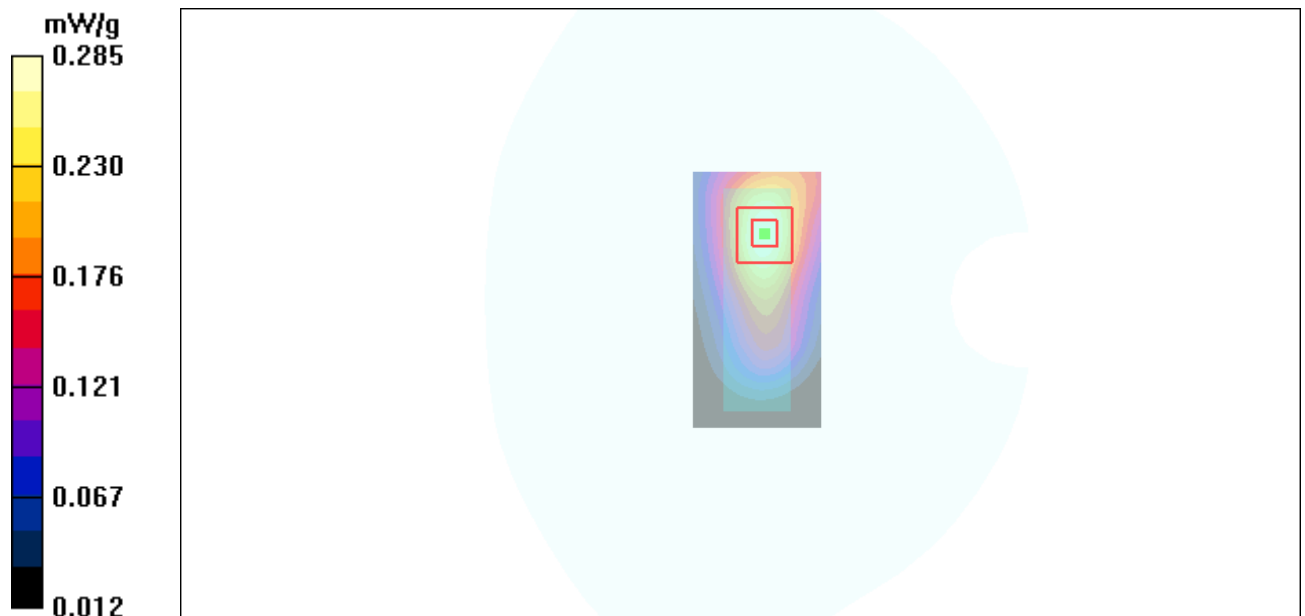


Figure 15 GSM 850 EGPRS (2Up) with IBM T61 Test Position 1 Channel 251

**GSM 1900 GPRS (1Up) with IBM T61 Test Position 1 Middle**

Date/Time: 10/21/2010 10:44:18 AM

Communication System: PCS 1900+GPRS(1Up); Frequency: 1880 MHz;Duty Cycle: 1:8.3

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.5$  mho/m;  $\epsilon_r = 52.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature:22.3 °C      Liqjud Temperature: 21.5°C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(7.60, 7.60, 7.60); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM000 T01; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 1 Middle/Area Scan (51x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.342 mW/g

**Test Position 1 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 9.23 V/m; Power Drift = -0.089 dB

Peak SAR (extrapolated) = 0.512 W/kg

**SAR(1 g) = 0.286 mW/g; SAR(10 g) = 0.150 mW/g**

Maximum value of SAR (measured) = 0.319 mW/g

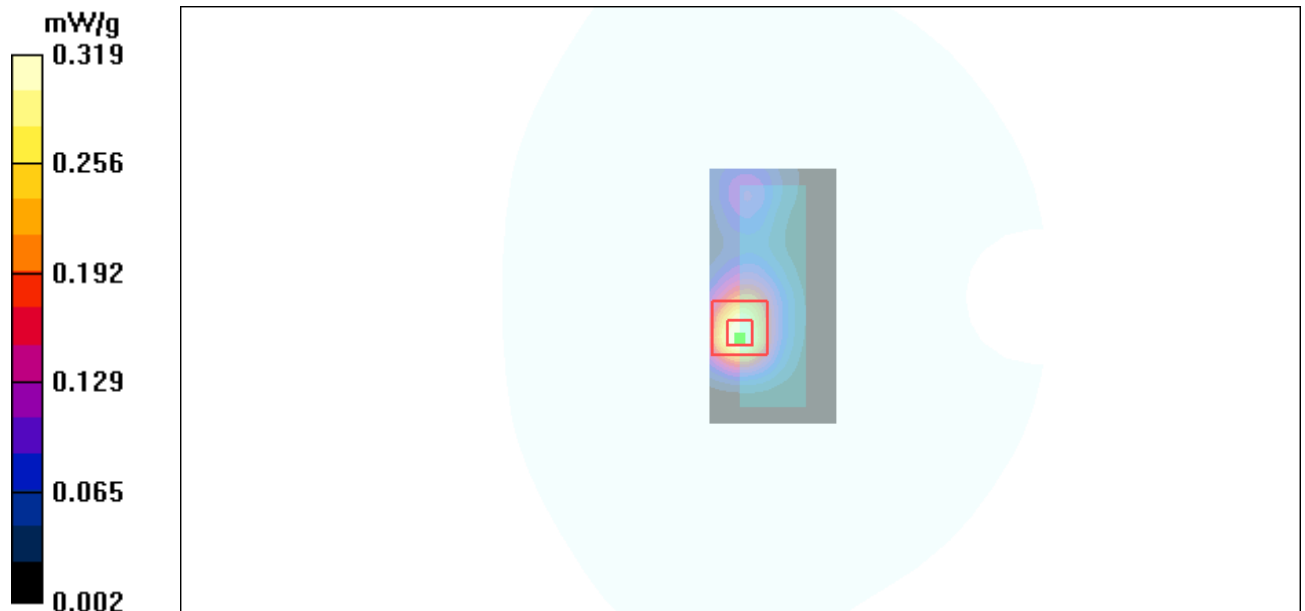


Figure 16 GSM 1900 GPRS (1Up) with IBM T61 Test Position 1 Channel 661

### GSM 1900 GPRS (2Up) with IBM T61 Test Position 1 High

Date/Time: 10/21/2010 9:42:29 AM

Communication System: PCS 1900+GPRS(2Up); Frequency: 1909.8 MHz; Duty Cycle: 1:4.15

Medium parameters used:  $f = 1910$  MHz;  $\sigma = 1.54$  mho/m;  $\epsilon_r = 51.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5°C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(7.60, 7.60, 7.60); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM000 T01; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 1 High/Area Scan (51x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.770 mW/g

**Test Position 1 High/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 17.7 V/m; Power Drift = -0.086 dB

Peak SAR (extrapolated) = 1.17 W/kg

**SAR(1 g) = 0.655 mW/g; SAR(10 g) = 0.344 mW/g**

Maximum value of SAR (measured) = 0.731 mW/g

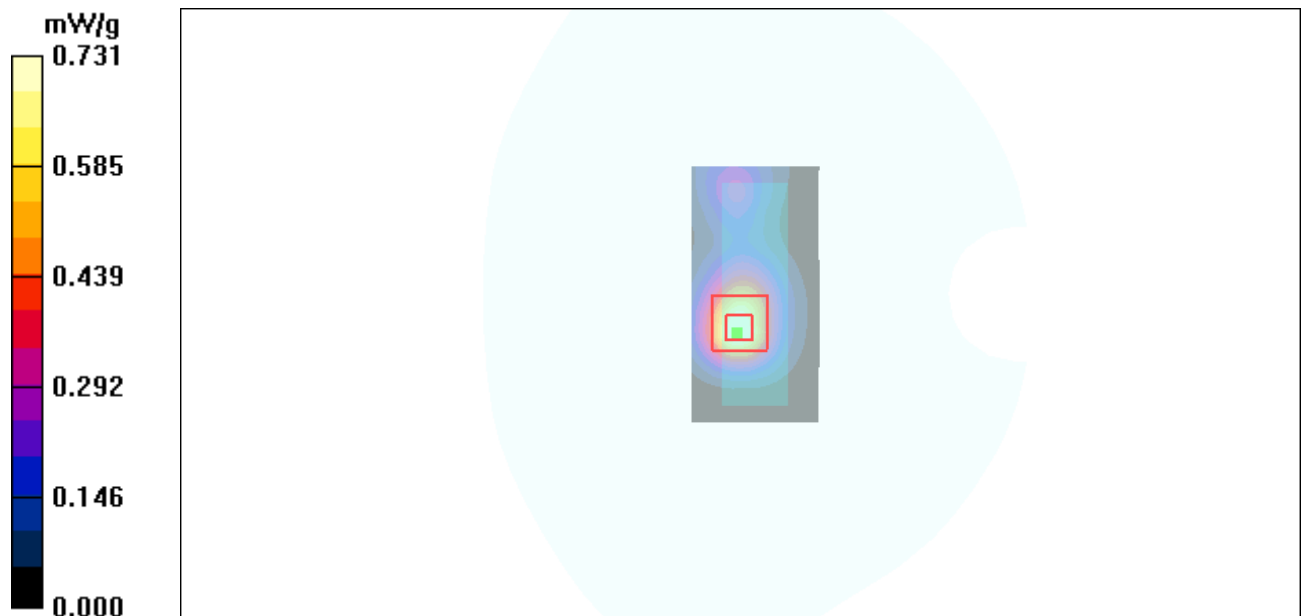


Figure 17 GSM 1900 GPRS (2Up) with IBM T61 Test Position 1 Channel 810

**GSM 1900 GPRS (2Up) with IBM T61 Test Position 1 Middle**

Date/Time: 10/21/2010 11:24:14 AM

Communication System: PCS 1900+GPRS(2Up); Frequency: 1880 MHz;Duty Cycle: 1:4.15

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.5$  mho/m;  $\epsilon_r = 52.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature:22.3 °C      Liquid Temperature: 21.5°C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(7.60, 7.60, 7.60); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM000 T01; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 1 Middle/Area Scan (51x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.659 mW/g

**Test Position 1 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 15.4 V/m; Power Drift = -0.010 dB

Peak SAR (extrapolated) = 1.53 W/kg

**SAR(1 g) = 0.562 mW/g; SAR(10 g) = 0.289 mW/g**

Maximum value of SAR (measured) = 0.627 mW/g

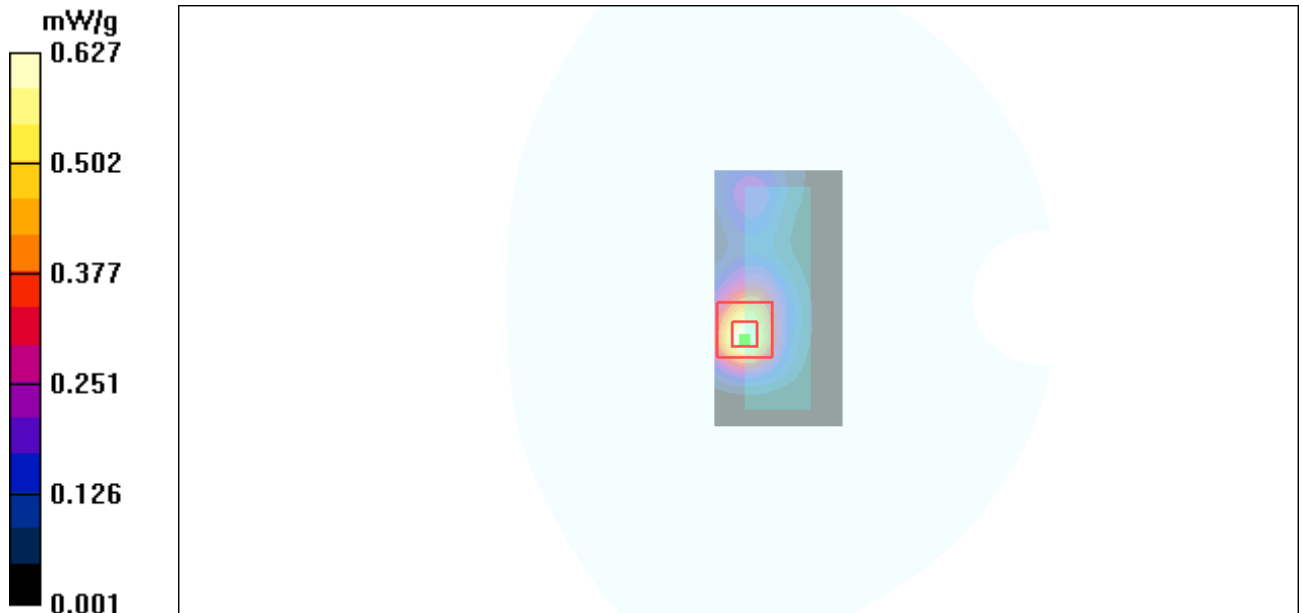


Figure 18 GSM 1900 GPRS (2Up) with IBM T61 Test Position 1 Channel 661

**GSM 1900 GPRS (2Up) with IBM T61 Test Position 1 Low**

Date/Time: 10/21/2010 11:04:35 AM

Communication System: PCS 1900+GPRS(2Up); Frequency: 1850.2 MHz; Duty Cycle: 1:4.15

Medium parameters used (interpolated):  $f = 1850.2$  MHz;  $\sigma = 1.47$  mho/m;  $\epsilon_r = 52.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5°C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(7.60, 7.60, 7.60); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM000 T01; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 1 Low/Area Scan (51x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.602 mW/g

**Test Position 1 Low/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 14.3 V/m; Power Drift = -0.040 dB

Peak SAR (extrapolated) = 0.938 W/kg

**SAR(1 g) = 0.504 mW/g; SAR(10 g) = 0.261 mW/g**

Maximum value of SAR (measured) = 0.575 mW/g

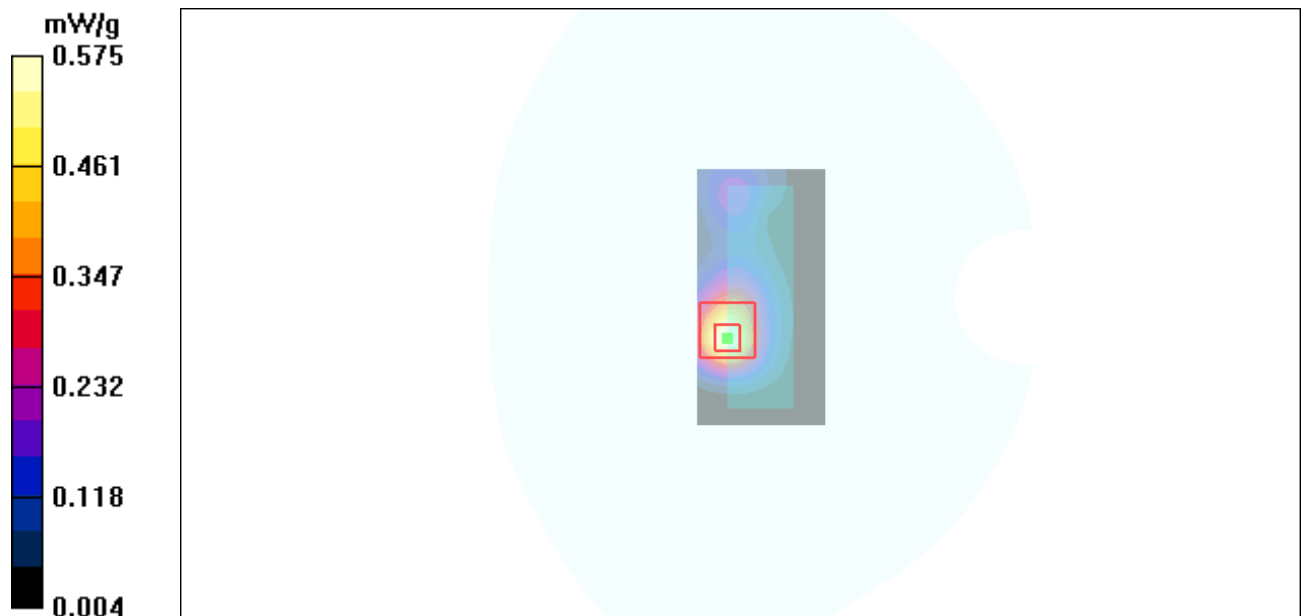


Figure 19 GSM 1900 GPRS (2Up) with IBM T61 Test Position 1 Channel 512

**GSM 1900 GPRS (2Up) with IBM T61 Test Position 2 Middle**

Date/Time: 10/21/2010 1:21:45 PM

Communication System: PCS 1900+GPRS(2Up); Frequency: 1880 MHz;Duty Cycle: 1:4.15

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.5$  mho/m;  $\epsilon_r = 52.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature:22.3 °C      Liqjud Temperature: 21.5°C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(7.60, 7.60, 7.60); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM000 T01; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 2 Middle/Area Scan (51x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.548 mW/g

**Test Position 2 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 12.0 V/m; Power Drift = 0.071 dB

Peak SAR (extrapolated) = 0.974 W/kg

**SAR(1 g) = 0.477 mW/g; SAR(10 g) = 0.233 mW/g**

Maximum value of SAR (measured) = 0.547 mW/g

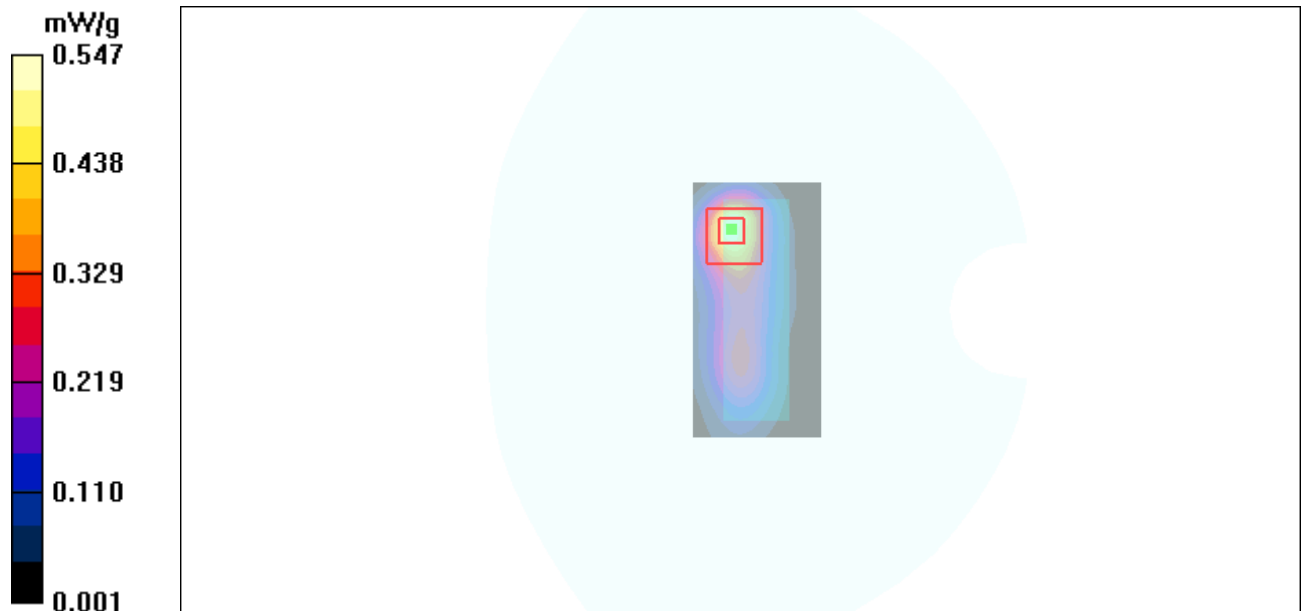


Figure 20 GSM 1900 GPRS (2Up) with IBM T61 Test Position 2 Channel 661

**GSM 1900 GPRS (2Up) with Lenovo Y-450 Test Position 3 Middle**

Date/Time: 10/21/2010 1:49:11 PM

Communication System: PCS 1900+GPRS(2Up); Frequency: 1880 MHz;Duty Cycle: 1:4.15

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.5$  mho/m;  $\epsilon_r = 52.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature:22.3 °C      Liquid Temperature: 21.5°C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(7.60, 7.60, 7.60); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM000 T01; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 3 Middle/Area Scan (31x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.321 mW/g

**Test Position 3 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 9.30 V/m; Power Drift = 0.001 dB

Peak SAR (extrapolated) = 0.552 W/kg

**SAR(1 g) = 0.279 mW/g; SAR(10 g) = 0.140 mW/g**

Maximum value of SAR (measured) = 0.309 mW/g

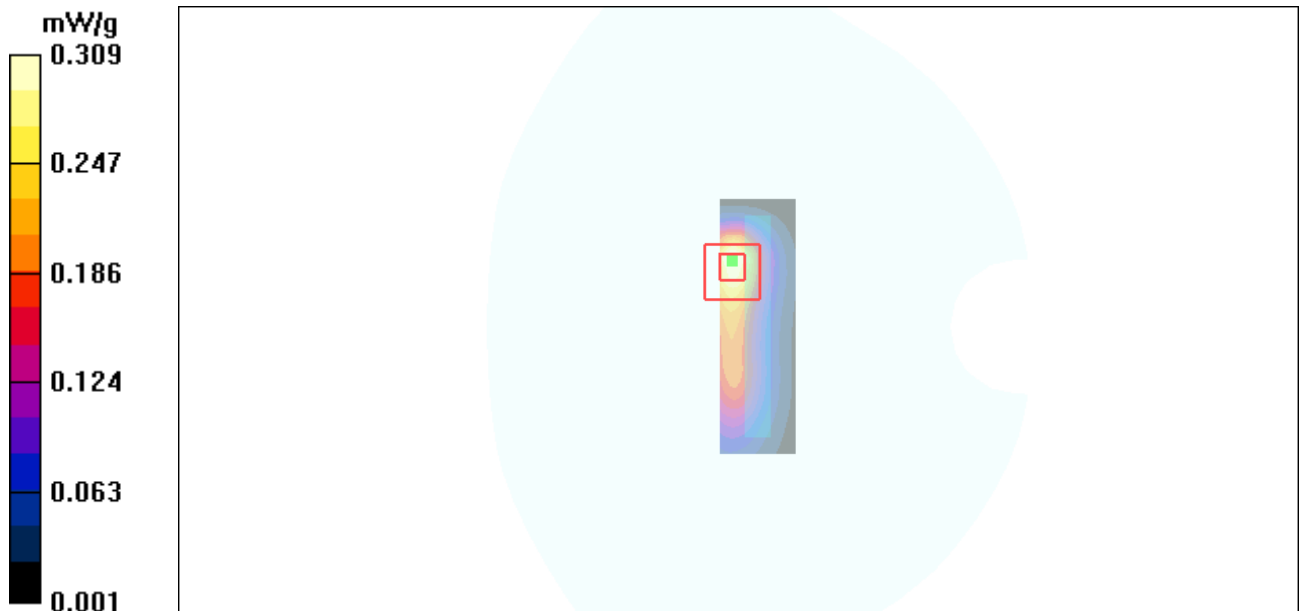


Figure 21 GSM 1900 GPRS (2Up) with Lenovo Y-450 Test Position 3 Channel 661



**GSM 1900 GPRS (2Up) with Lenovo Y-450 Test Position 4 Middle**

Date/Time: 10/21/2010 12:00:35 PM

Communication System: PCS 1900+GPRS(2Up); Frequency: 1880 MHz;Duty Cycle: 1:4.15

Medium parameters used:  $f = 1880$  MHz;  $\sigma = 1.5$  mho/m;  $\epsilon_r = 52.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature:22.3 °C      Liqid Temperature: 21.5°C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(7.60, 7.60, 7.60); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM000 T01; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 4 Middle/Area Scan (31x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.610 mW/g

**Test Position 4 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 17.3 V/m; Power Drift = -0.119 dB

Peak SAR (extrapolated) = 0.966 W/kg

**SAR(1 g) = 0.516 mW/g; SAR(10 g) = 0.259 mW/g**

Maximum value of SAR (measured) = 0.580 mW/g

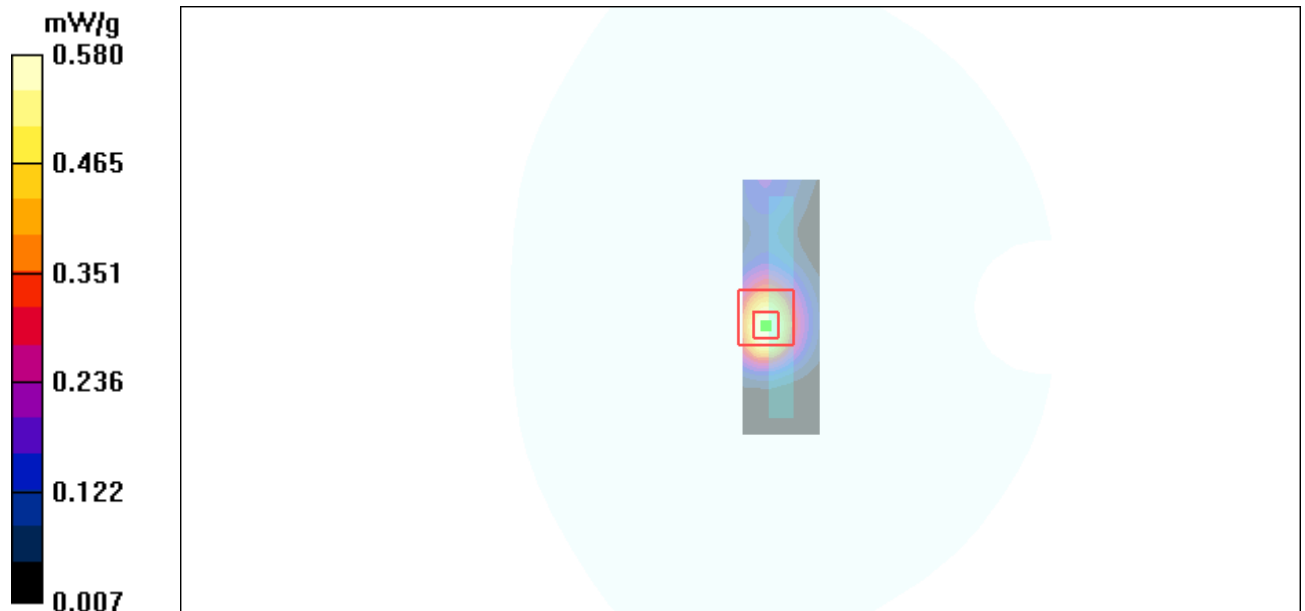


Figure 22 GSM 1900 GPRS (2Up) with Lenovo Y-450 Test Position 4 Channel 661

### GSM 1900 EGPRS (2Up) with IBM T61 Test Position 1 High

Date/Time: 10/21/2010 2:36:38 PM

Communication System: PCS 1900+EGPRS(2Up); Frequency: 1909.8 MHz; Duty Cycle: 1:4.15

Medium parameters used:  $f = 1910$  MHz;  $\sigma = 1.54$  mho/m;  $\epsilon_r = 51.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5°C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(7.60, 7.60, 7.60); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM000 T01; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 1 High/Area Scan (51x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.865 mW/g

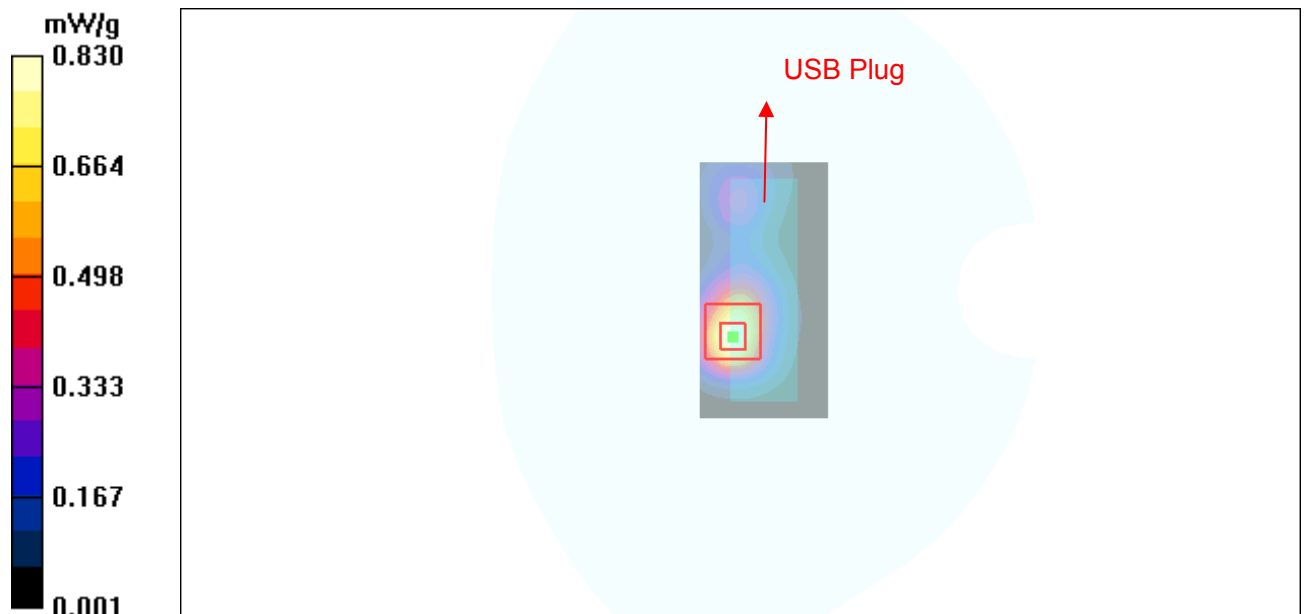
**Test Position 1 High/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 14.4 V/m; Power Drift = -0.090 dB

Peak SAR (extrapolated) = 1.32 W/kg

**SAR(1 g) = 0.738 mW/g; SAR(10 g) = 0.388 mW/g**

Maximum value of SAR (measured) = 0.830 mW/g



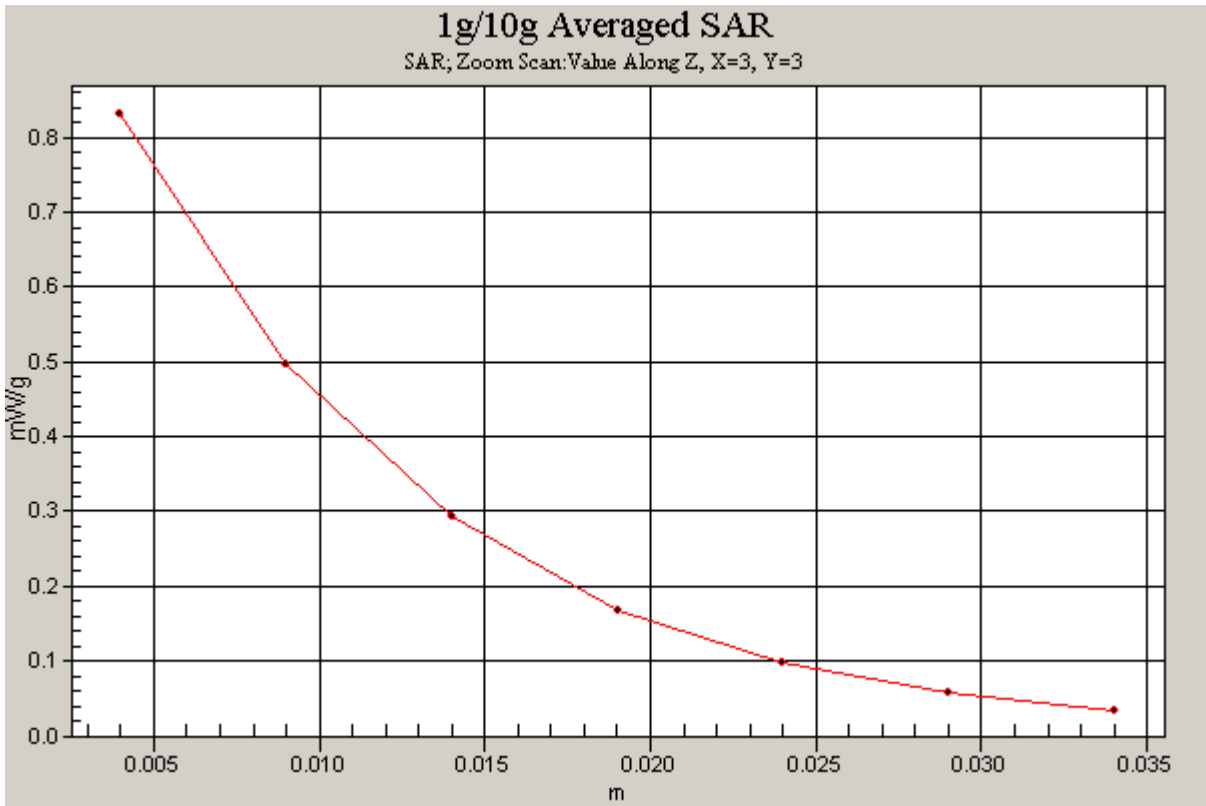


Figure 23 GSM 1900 EGPRS (2Up) with IBM T61 Test Position 1 Channel 810

### WCDMA Band V with IBM T61 Test Position 1 High

Date/Time: 10/21/2010 11:30:17 PM

Communication System: WCDMA Band V; Frequency: 846.6 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 847$  MHz;  $\sigma = 0.94$  mho/m;  $\epsilon_r = 55.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(9.24, 9.24, 9.24); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 1 High/Area Scan (51x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.240 mW/g

**Test Position 1 High/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.9 V/m; Power Drift = 0.001 dB

Peak SAR (extrapolated) = 0.338 W/kg

**SAR(1 g) = 0.227 mW/g; SAR(10 g) = 0.147 mW/g**

Maximum value of SAR (measured) = 0.245 mW/g

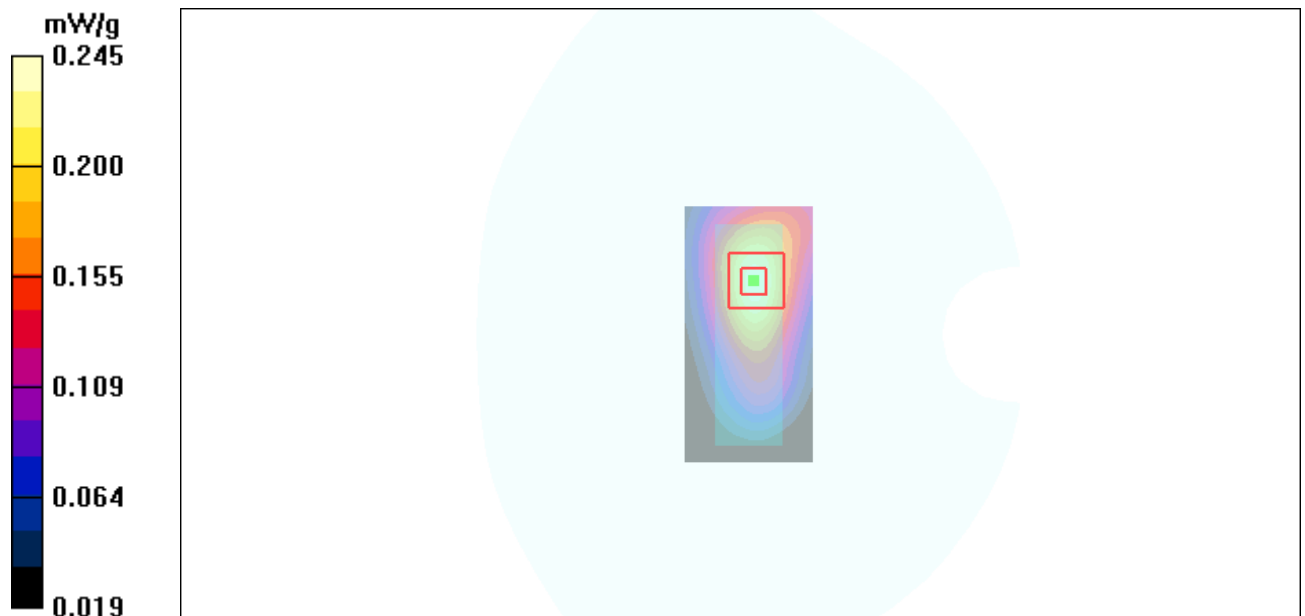


Figure 24 WCDMA Band V with IBM T61 Test Position 1 Channel 4233

**WCDMA Band V with IBM T61 Test Position 1 Middle**

Date/Time: 10/21/2010 10:53:04 PM

Communication System: WCDMA Band V; Frequency: 836.6 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 837$  MHz;  $\sigma = 0.928$  mho/m;  $\epsilon_r = 55.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5°C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(9.24, 9.24, 9.24); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 1 Middle/Area Scan (51x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.266 mW/g

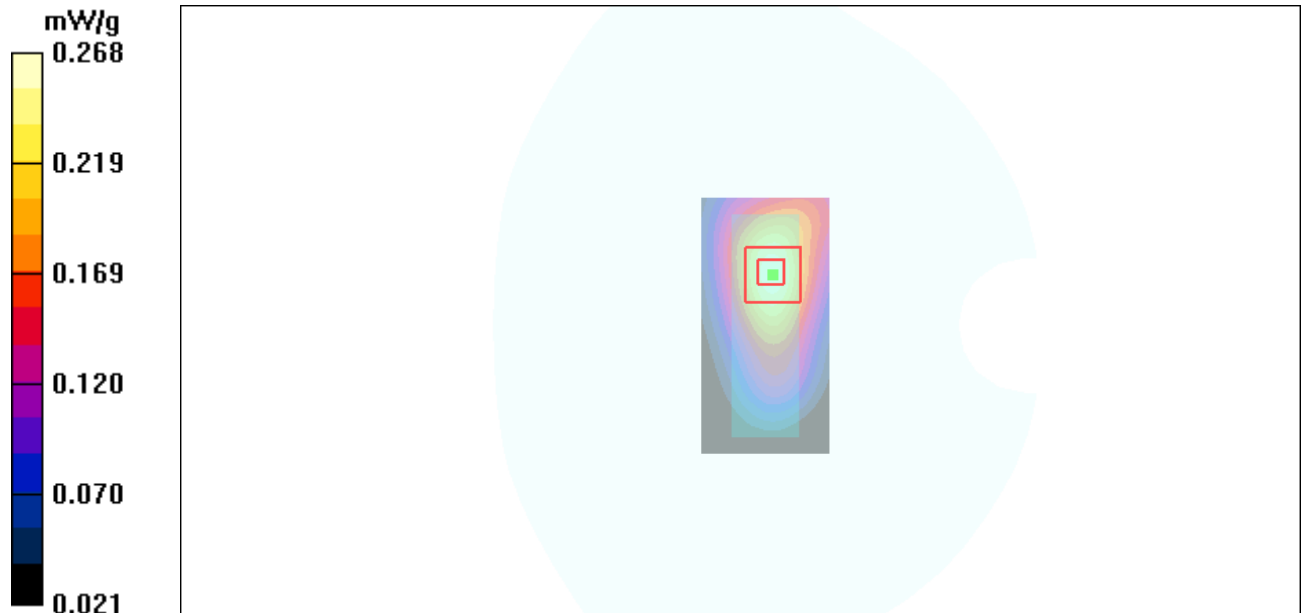
**Test Position 1 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 14.9 V/m; Power Drift = -0.008 dB

Peak SAR (extrapolated) = 0.366 W/kg

**SAR(1 g) = 0.246 mW/g; SAR(10 g) = 0.159 mW/g**

Maximum value of SAR (measured) = 0.268 mW/g



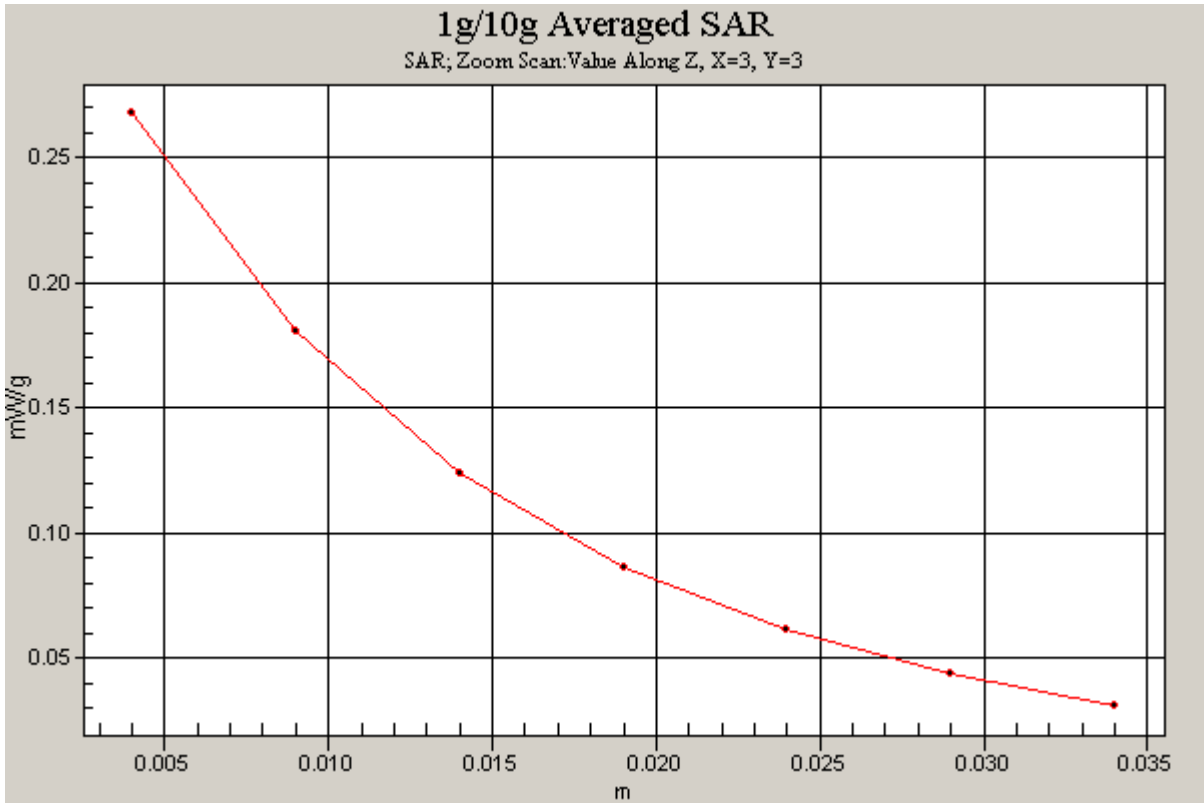


Figure 25 WCDMA Band V with IBM T61 Test Position 1 Channel 4183

### WCDMA Band V with IBM T61 Test Position 1 Low

Date/Time: 10/21/2010 11:12:10 PM

Communication System: WCDMA Band V; Frequency: 826.4 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated):  $f = 826.4$  MHz;  $\sigma = 0.925$  mho/m;  $\epsilon_r = 55.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5°C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(9.24, 9.24, 9.24); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 1 Low/Area Scan (51x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.241 mW/g

**Test Position 1 Low/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 14.0 V/m; Power Drift = 0.100 dB

Peak SAR (extrapolated) = 0.329 W/kg

**SAR(1 g) = 0.222 mW/g; SAR(10 g) = 0.144 mW/g**

Maximum value of SAR (measured) = 0.240 mW/g

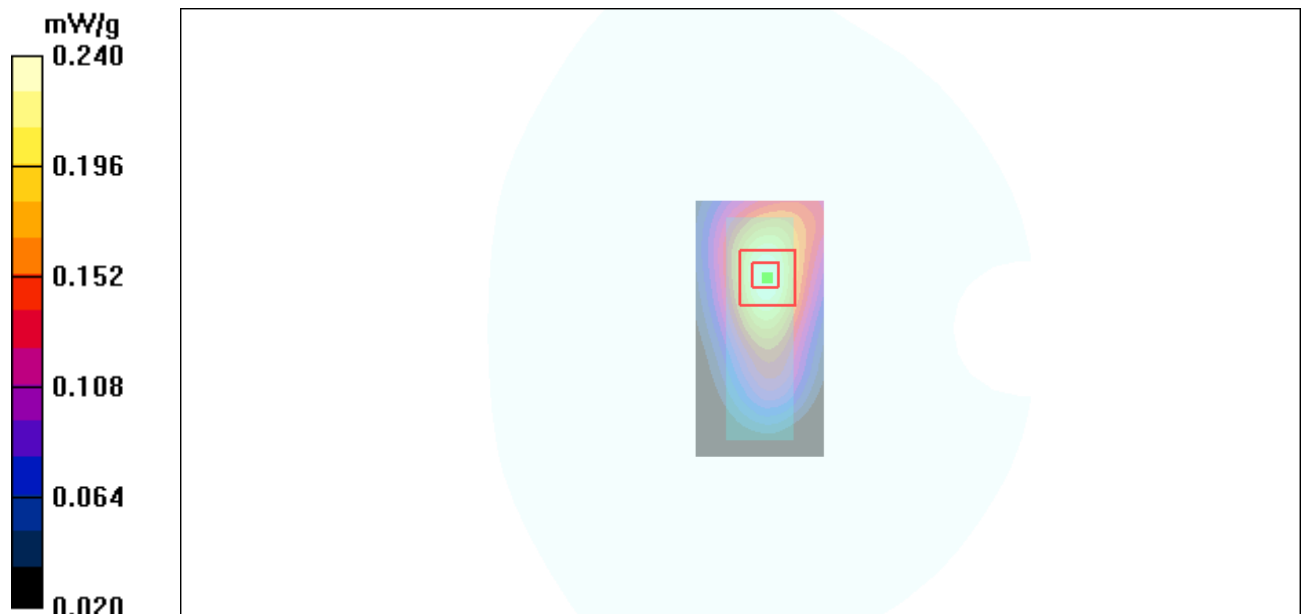


Figure 26 WCDMA Band V with IBM T61 Test Position 1 Channel 4132

### WCDMA Band V with IBM T61 Test Position 2 Middle

Date/Time: 10/22/2010 9:46:44 AM

Communication System: WCDMA Band V; Frequency: 836.6 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 837$  MHz;  $\sigma = 0.928$  mho/m;  $\epsilon_r = 55.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5°C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(9.24, 9.24, 9.24); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 2 Middle/Area Scan (51x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.202 mW/g

**Test Position 2 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 14.5 V/m; Power Drift = 0.055 dB

Peak SAR (extrapolated) = 0.372 W/kg

**SAR(1 g) = 0.190 mW/g; SAR(10 g) = 0.111 mW/g**

Maximum value of SAR (measured) = 0.206 mW/g

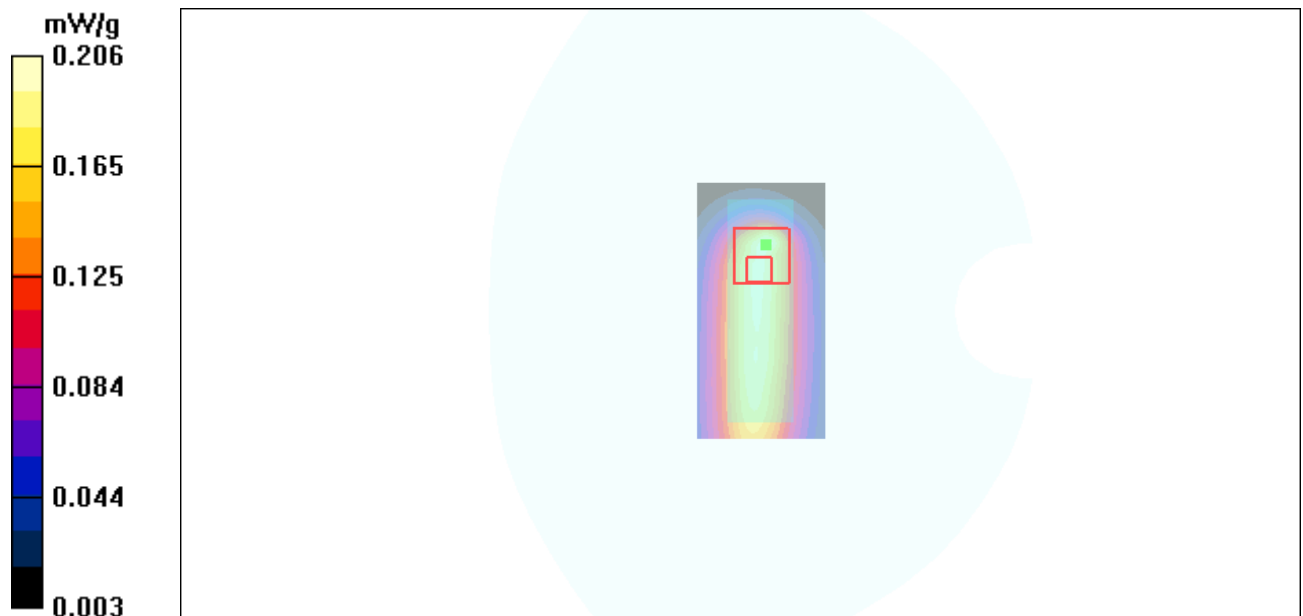


Figure 27 WCDMA Band V with IBM T61 Test Position 2 Channel 4183



**WCDMA Band V with Lenovo Y-450 Test Position 3 Middle**

Date/Time: 10/22/2010 12:10:11 PM

Communication System: WCDMA Band V; Frequency: 836.6 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 837$  MHz;  $\sigma = 0.928$  mho/m;  $\epsilon_r = 55.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5°C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(9.24, 9.24, 9.24); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 3 Middle/Area Scan (31x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.081 mW/g

**Test Position 3 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 9.26 V/m; Power Drift = 0.024 dB

Peak SAR (extrapolated) = 0.116 W/kg

**SAR(1 g) = 0.075 mW/g; SAR(10 g) = 0.047 mW/g**

Maximum value of SAR (measured) = 0.082 mW/g

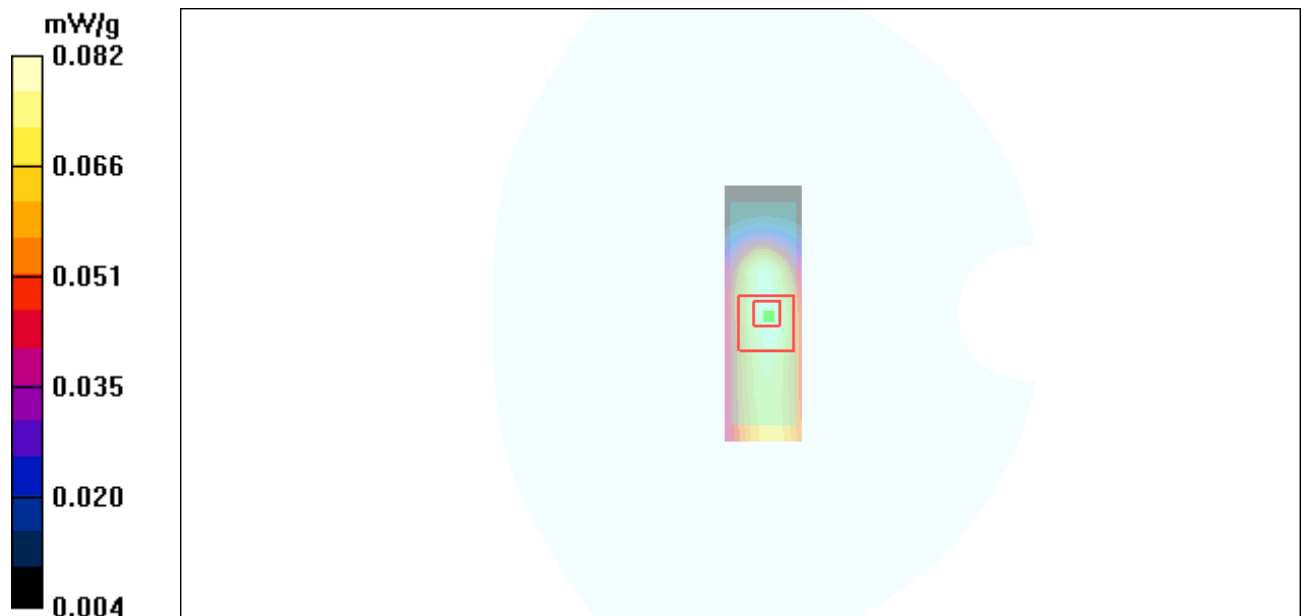


Figure 28 WCDMA Band V with Lenovo Y-450 Test Position 3 Channel 4183

**WCDMA Band V with Lenovo Y-450 Test Position 4 Middle**

Date/Time: 10/22/2010 11:01:25 AM

Communication System: WCDMA Band V; Frequency: 836.6 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 837$  MHz;  $\sigma = 0.928$  mho/m;  $\epsilon_r = 55.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(9.24, 9.24, 9.24); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 4 Middle/Area Scan (31x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.205 mW/g

**Test Position 4 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 12.9 V/m; Power Drift = -0.069 dB

Peak SAR (extrapolated) = 0.273 W/kg

**SAR(1 g) = 0.186 mW/g; SAR(10 g) = 0.123 mW/g**

Maximum value of SAR (measured) = 0.201 mW/g

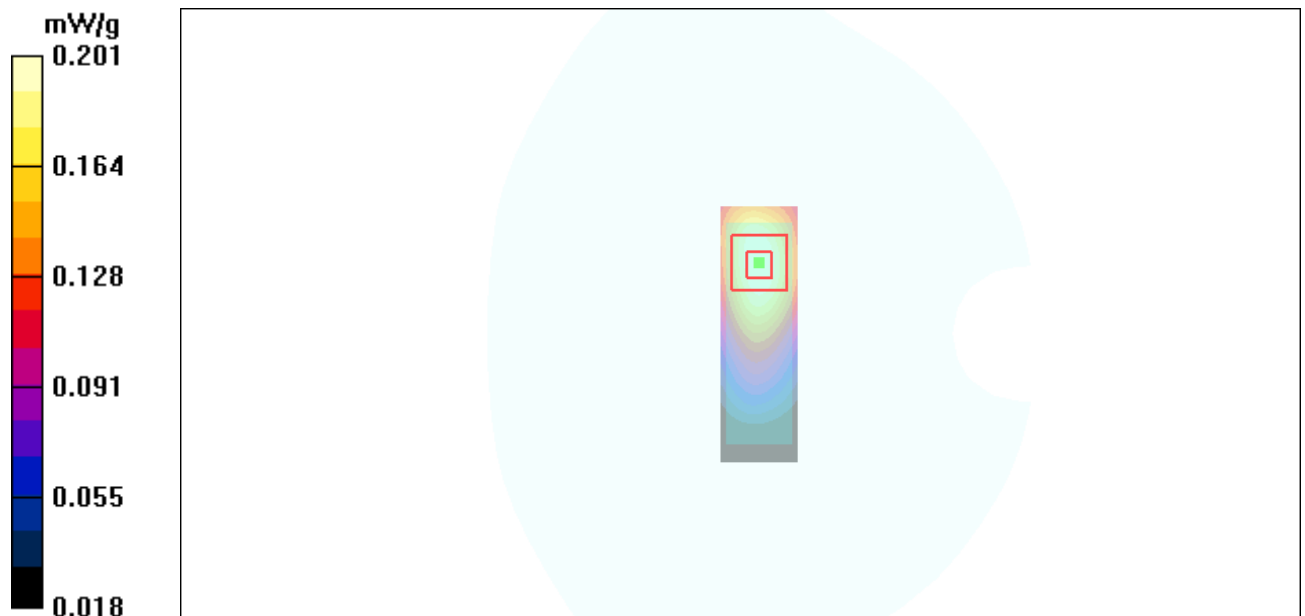


Figure 29 WCDMA Band V with Lenovo Y-450 Test Position 4 Channel 4183

### WCDMA Band V HSDPA with IBM T61 Test Position 1 Middle

Date/Time: 10/22/2010 1:35:02 PM

Communication System: WCDMA Band V+HSDPA; Frequency: 836.6 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 837$  MHz;  $\sigma = 0.928$  mho/m;  $\epsilon_r = 55.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5°C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(9.24, 9.24, 9.24); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 1 Middle/Area Scan (51x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.254 mW/g

**Test Position 1 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.5 V/m; Power Drift = 0.074 dB

Peak SAR (extrapolated) = 0.343 W/kg

**SAR(1 g) = 0.231 mW/g; SAR(10 g) = 0.150 mW/g**

Maximum value of SAR (measured) = 0.251 mW/g

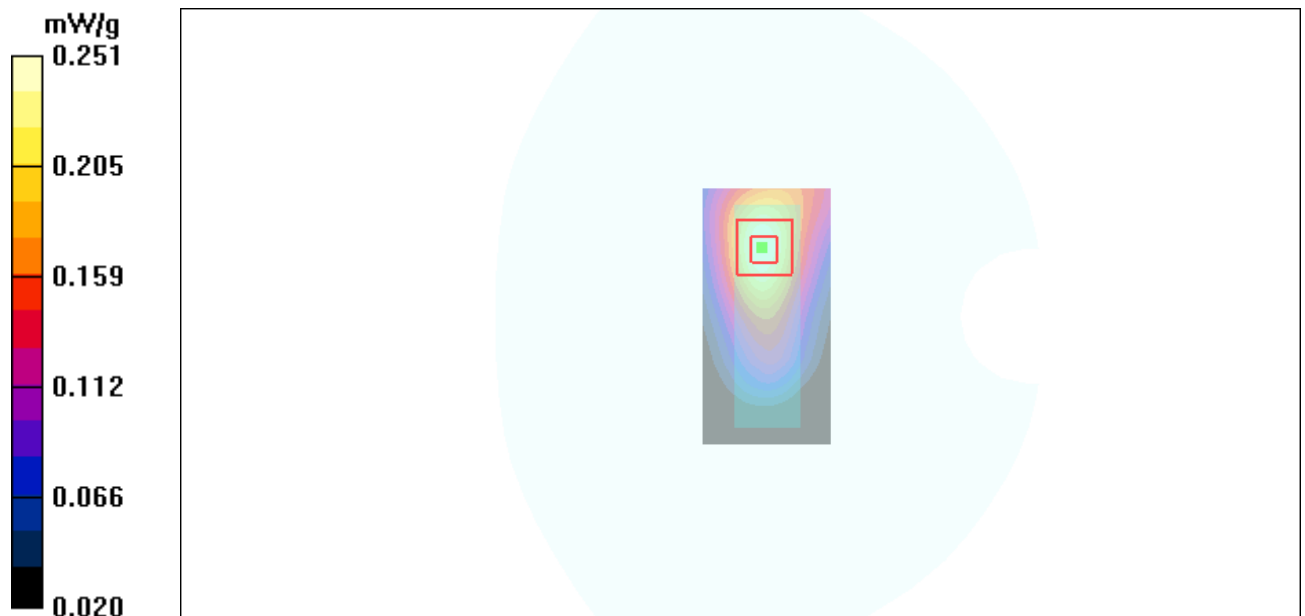


Figure 30 WCDMA Band V HSDPA with IBM T61 Test Position 1 Channel 4183

### WCDMA Band V HSUPA with IBM T61 Test Position 1 Middle

Date/Time: 10/22/2010 1:11:41 PM

Communication System: WCDMA Band V+HSUPA; Frequency: 836.6 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 837$  MHz;  $\sigma = 0.928$  mho/m;  $\epsilon_r = 55.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Ambient Temperature: 22.3 °C      Liquid Temperature: 21.5 °C

Phantom section: Flat Section

DASY4 Configuration:

Probe: EX3DV4 - SN3661; ConvF(9.24, 9.24, 9.24); Calibrated: 12/30/2009

Electronics: DAE4 Sn871; Calibrated: 11/11/2009

Phantom: SAM 12; Type: SAM V4.0; Serial: TP-1246

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

**Test Position 1 Middle/Area Scan (51x101x1):** Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.194 mW/g

**Test Position 1 Middle/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 12.0 V/m; Power Drift = 0.099 dB

Peak SAR (extrapolated) = 0.297 W/kg

**SAR(1 g) = 0.200 mW/g; SAR(10 g) = 0.130 mW/g**

Maximum value of SAR (measured) = 0.218 mW/g

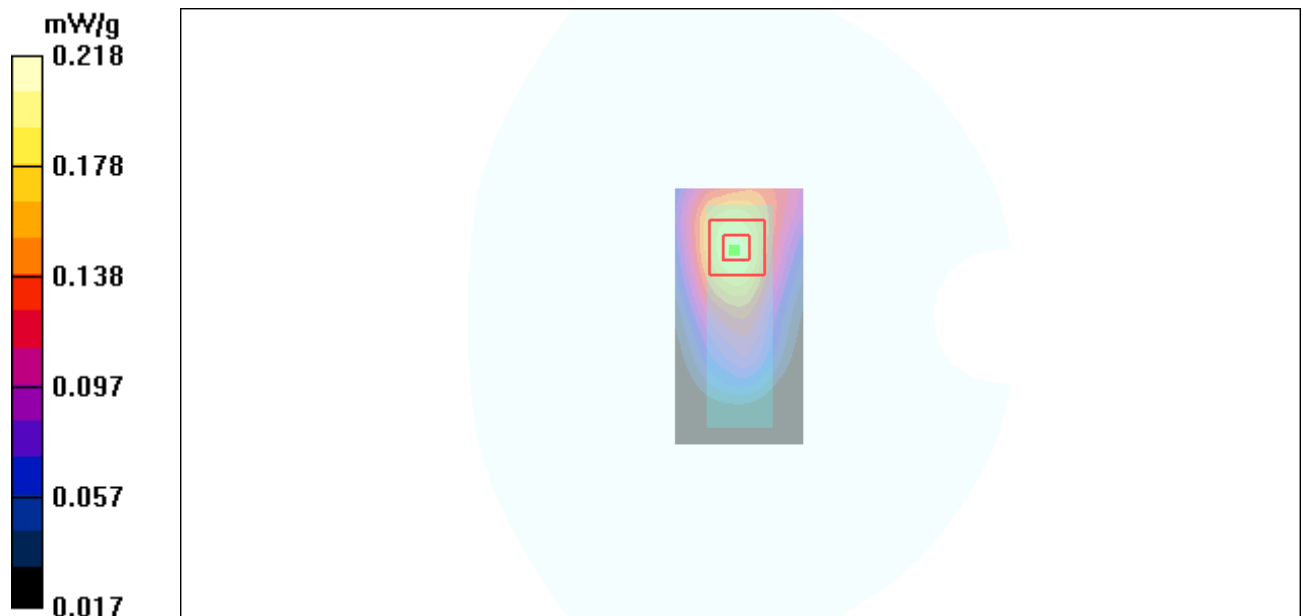


Figure 31 WCDMA Band V HSUPA with IBM T61 Test Position 1 Channel 4183

# TA Technology (Shanghai) Co., Ltd. Test Report

Report No. RZA2010-1428SAR

Page 69 of 105

## ANNEX D: Probe Calibration Certificate

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



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

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

Accreditation No.: **SCS 108**

Client **Auden**

Certificate No: **EX3-3661\_Dec09**

### CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3661**

Calibration procedure(s) **QA CAL-01.v6, QA CAL-14.v3, QA CAL-23.v3 and QA CAL-25.v2  
Calibration procedure for dosimetric E-field probes**

Calibration date: **December 30, 2009**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41495277	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41498087	1-Apr-09 (No. 217-01030)	Apr-10
Reference 3 dB Attenuator	SN: S5054 (3c)	31-Mar-09 (No. 217-01026)	Mar-10
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-09 (No. 217-01028)	Mar-10
Reference 30 dB Attenuator	SN: S5129 (30b)	31-Mar-09 (No. 217-01027)	Mar-10
Reference Probe ES3DV2	SN: 3013	2-Jan-09 (No. E53-3013_Jan09)	Jan-10
DAE4	SN: 880	29-Sep-08 (No. DAE4-880_Sep08)	Sep-10
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-09)	In house check: Oct10

Calibrated by: **Katja Pokovic**      Name: **Katja Pokovic**      Function: **Technical Manager**

Approved by: **Niels Kuster**      Name: **Niels Kuster**      Function: **Quality Manager**

Signature

Issued: December 30, 2009

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

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



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

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

Accreditation No.: SCS 108

#### Glossary:

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

#### Calibration is Performed According to the Following Standards:

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

#### Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>:** Assessed for E-field polarization  $\theta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not effect the E<sup>2</sup>-field uncertainty inside TSL (see below ConvF).
- NORM(f)<sub>x,y,z</sub> = NORM<sub>x,y,z</sub> \* frequency\_response** (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP<sub>x,y,z</sub>:** 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.
- A<sub>x,y,z</sub>; B<sub>x,y,z</sub>; C<sub>x,y,z</sub>; VR<sub>x,y,z</sub>:** A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters:** Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  MHz) and inside waveguide using analytical field distributions based on power measurements for  $f > 800$  MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM<sub>x,y,z</sub> \* 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  $\pm 50$  MHz to  $\pm 100$  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.

EX3DV4 SN:3661

December 30, 2009

# Probe EX3DV4

## SN:3661

Manufactured:	October 20, 2008
Calibrated:	December 30, 2009

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

# TA Technology (Shanghai) Co., Ltd. Test Report

EX3DV4 SN:3661

December 30, 2009

## DASY - Parameters of Probe: EX3DV4 SN:3661

### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup>	0.46	0.52	0.48	± 10.1%
DCP (mV) <sup>B</sup>	89.4	91.4	90.5	

### Modulation Calibration Parameters

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

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

<sup>A</sup> The uncertainties of NormX,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Pages 5 and 6).

<sup>B</sup> Numerical linearization parameter; uncertainty not required.

<sup>C</sup> Uncertainty is determined using the maximum deviation from linear response applying rectangular distribution and is expressed for the square of the field value.



EX3DV4 SN:3661

December 30, 2009

### DASY - Parameters of Probe: EX3DV4 SN:3661

#### Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz] <sup>c</sup>	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
835	± 50 / ± 100	41.5 ± 5%	0.90 ± 5%	9.34	9.34	9.34	0.69	0.64 ± 11.0%
900	± 50 / ± 100	41.5 ± 5%	0.97 ± 5%	9.06	9.06	9.06	0.72	0.64 ± 11.0%
1750	± 50 / ± 100	40.1 ± 5%	1.37 ± 5%	8.19	8.19	8.19	0.59	0.63 ± 11.0%
1950	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	7.77	7.77	7.77	0.83	0.56 ± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	7.22	7.22	7.22	0.35	0.83 ± 11.0%
5200	± 50 / ± 100	36.0 ± 5%	4.66 ± 5%	5.01	5.01	5.01	0.45	1.75 ± 13.1%
5500	± 50 / ± 100	35.6 ± 5%	4.96 ± 5%	4.38	4.38	4.38	0.48	1.75 ± 13.1%
5800	± 50 / ± 100	35.3 ± 5%	5.27 ± 5%	4.26	4.26	4.26	0.45	1.75 ± 13.1%

<sup>c</sup> The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

EX3DV4 SN:3661

December 30, 2009

### DASY - Parameters of Probe: EX3DV4 SN:3661

#### Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz] <sup>c</sup>	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
835	± 50 / ± 100	55.2 ± 5%	0.97 ± 5%	9.24	9.24	9.24	0.54	0.73 ± 11.0%
900	± 50 / ± 100	55.0 ± 5%	1.05 ± 5%	8.97	8.97	8.97	0.53	0.72 ± 11.0%
1750	± 50 / ± 100	53.4 ± 5%	1.49 ± 5%	7.93	7.93	7.93	0.67	0.65 ± 11.0%
1950	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	7.60	7.60	7.60	0.60	0.69 ± 11.0%
2450	± 50 / ± 100	52.7 ± 5%	1.95 ± 5%	7.34	7.34	7.34	0.26	1.12 ± 11.0%
5200	± 50 / ± 100	49.0 ± 5%	5.30 ± 5%	4.59	4.59	4.59	0.46	1.75 ± 13.1%
5500	± 50 / ± 100	48.6 ± 5%	5.65 ± 5%	4.11	4.11	4.11	0.46	1.75 ± 13.1%
5800	± 50 / ± 100	48.2 ± 5%	6.00 ± 5%	4.12	4.12	4.12	0.48	1.75 ± 13.1%

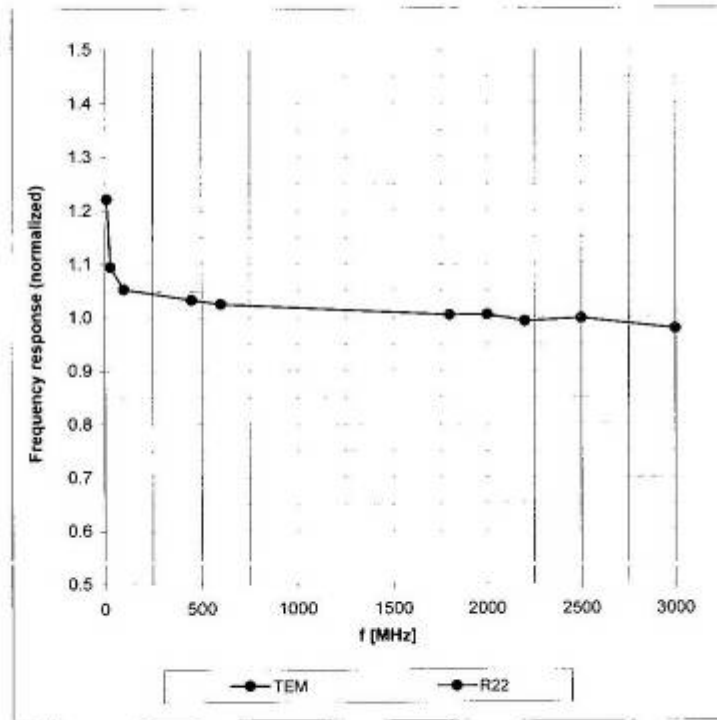
<sup>c</sup> The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

EX3DV4 SN:3661

December 30, 2009

### Frequency Response of E-Field

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



Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

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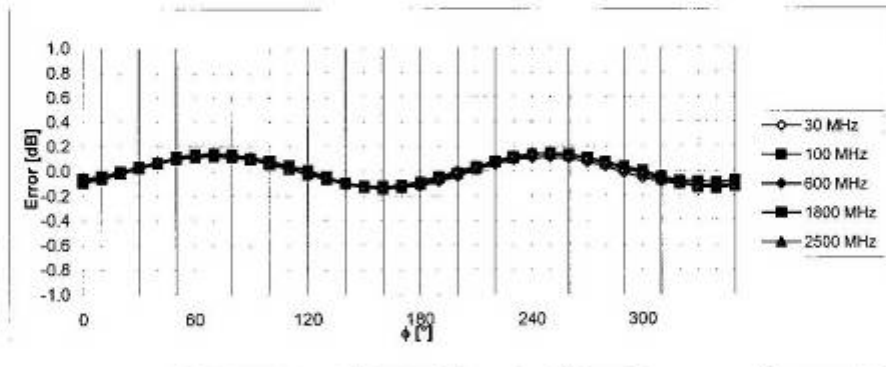
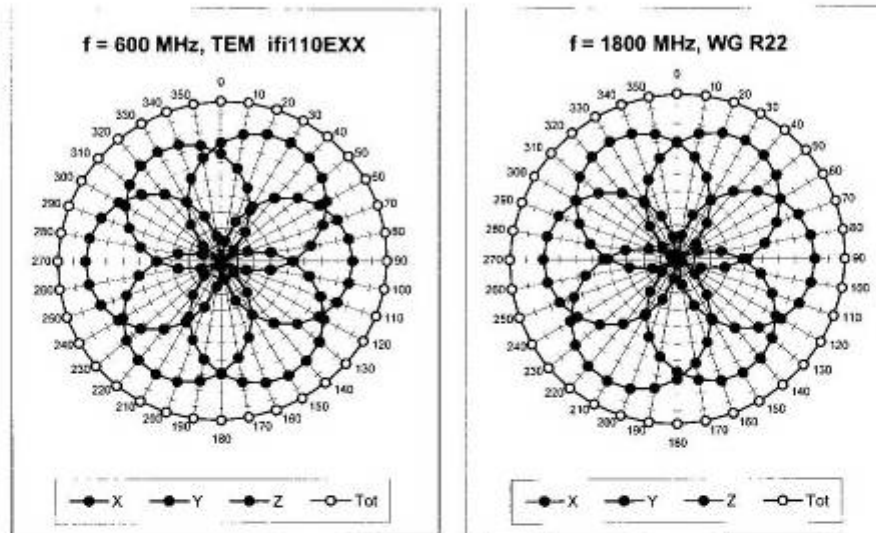
Report No. RZA2010-1428SAR

Page 76 of 105

EX3DV4 SN:3661

December 30, 2009

## Receiving Pattern ( $\phi$ ), $\theta = 0^\circ$

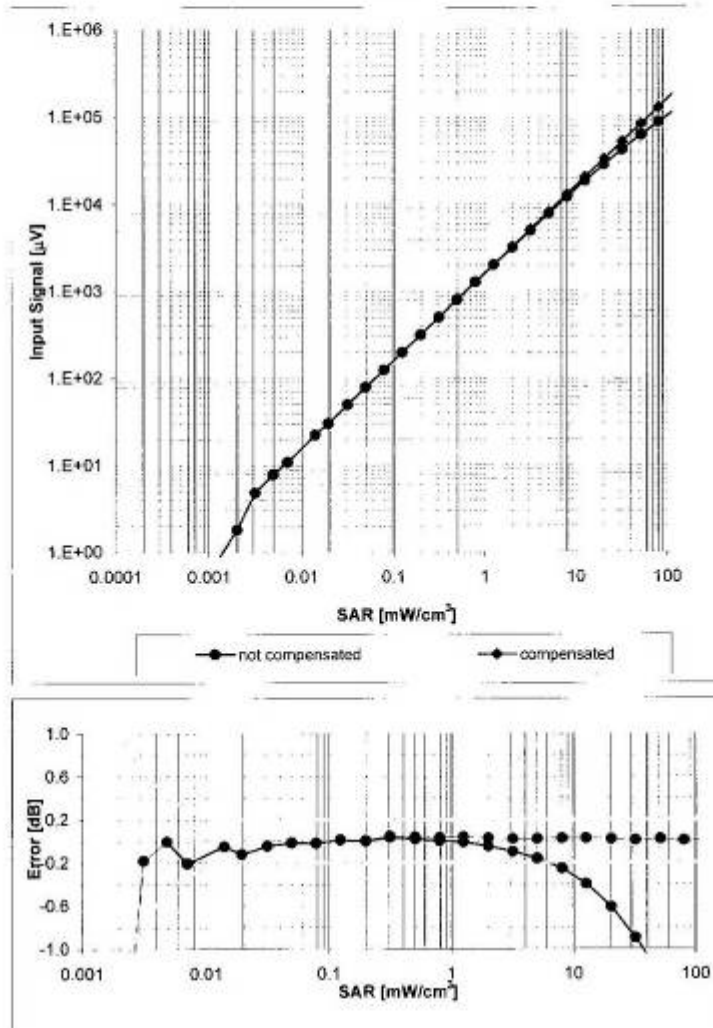


Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  (k=2)

EX3DV4 SN:3661

December 30, 2009

**Dynamic Range f(SAR<sub>head</sub>)**  
(Waveguide R22, f = 1800 MHz)

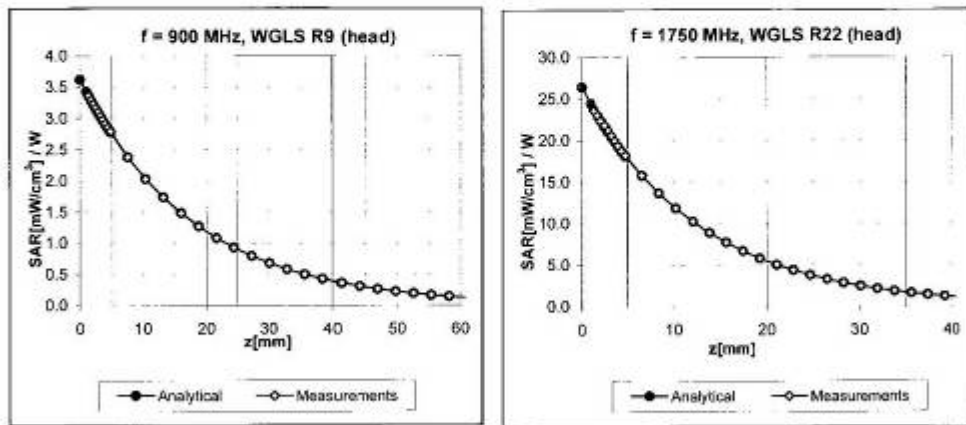


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

EX3DV4 SN:3661

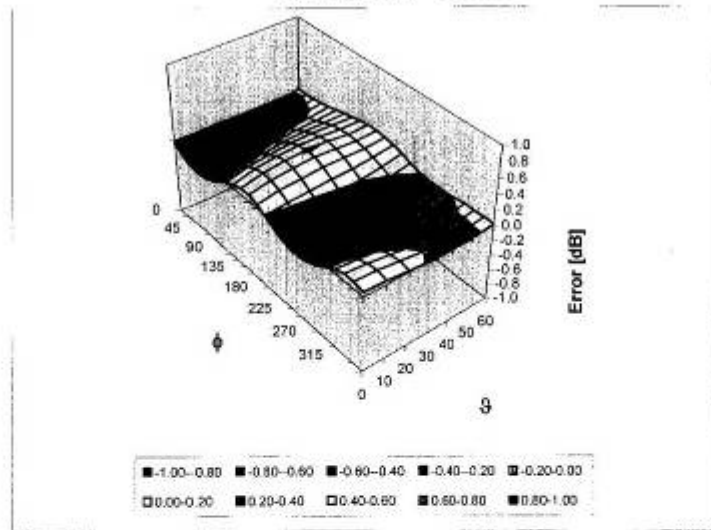
December 30, 2009

Conversion Factor Assessment



Deviation from Isotropy in HSL

Error ( $\phi, \theta$ ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment:  $\pm 2.6\%$  (k=2)

**TA Technology (Shanghai) Co., Ltd.**  
**Test Report**

Report No. RZA2010-1428SAR

Page 79 of 105

EX3DV4 SN:3661

December 30, 2009

**Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

# TA Technology (Shanghai) Co., Ltd. Test Report

Report No. RZA2010-1428SAR

Page 80 of 105

## ANNEX E: D835V2 Dipole Calibration Certificate

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



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

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The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Auden**

Certificate No: **D835V2-4d092\_Jan10**

### CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d092**

Calibration procedure(s) **QA CAL-05.v7  
Calibration procedure for dipole validation kits**

Calibration date: **January 14, 2010**

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

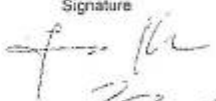

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-09 (No. 217-01086)	Oct-10
Power sensor HP 8481A	US37292783	06-Oct-09 (No. 217-01086)	Oct-10
Reference 20 dB Attenuator	SN: 5086 (20g)	31-Mar-09 (No. 217-01025)	Mar-10
Type-N mismatch combination	SN: 5047.2 / 06327	31-Mar-09 (No. 217-01029)	Mar-10
Reference Probe ES3DV3	SN: 3205	26-Jun-09 (No. ES3-3205_Jun09)	Jun-10
DAE4	SN: 601	07-Mar-09 (No. DAE4-601_Mar09)	Mar-10
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	in house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	in house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-09)	In house check: Oct-10

Calibrated by: **Name: Jeton Kastrioti**      **Function: Laboratory Technician**

Approved by: **Katja Pokovic**      **Technical Manager**

Signature  
  


Issued: January 18, 2010

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



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



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S Swiss Calibration Service

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The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

**Glossary:**

TSL tissue simulating liquid  
ConvF sensitivity in TSL / NORM x,y,z  
N/A not applicable or not measured

**Calibration is Performed According to the Following Standards:**

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

**Additional Documentation:**

- DASY4/5 System Handbook

**Methods Applied and Interpretation of Parameters:**

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

# TA Technology (Shanghai) Co., Ltd. Test Report

### Measurement Conditions

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

DASY Version	DASY5	V5.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.2 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.4 $\pm$ 6 %	0.89 mho/m $\pm$ 6 %
Head TSL temperature during test	(21.5 $\pm$ 0.2) °C	---	---

### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.39 mW / g
SAR normalized	normalized to 1W	9.56 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>9.63 mW / g <math>\pm</math> 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.56 mW / g
SAR normalized	normalized to 1W	6.24 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>6.27 mW / g <math>\pm</math> 16.5 % (k=2)</b>

# TA Technology (Shanghai) Co., Ltd. Test Report

### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.8 ± 6 %	0.98 mho/m ± 6 %
Body TSL temperature during test	(22.0 ± 0.2) °C	---	---

### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.49 mW / g
SAR normalized	normalized to 1W	10.0 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>9.86 mW / g ± 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.63 mW / g
SAR normalized	normalized to 1W	6.52 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>6.47 mW / g ± 16.5 % (k=2)</b>

# TA Technology (Shanghai) Co., Ltd.

## Test Report

### Appendix

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.2 $\Omega$ - 2.8 j $\Omega$
Return Loss	- 30.3 dB

#### Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.6 $\Omega$ - 4.5 j $\Omega$
Return Loss	- 25.6 dB

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.392 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

#### Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 15, 2009

**DASY5 Validation Report for Head TSL**

Date/Time: 11.01.2010 12:00:00

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d092**

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

Medium: HSL900

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.89 \text{ mho/m}$ ;  $\epsilon_r = 41.2$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

**DASY5 Configuration:**

- Probe: ES3DV3 - SN3205; ConvF(6.04, 6.04, 6.04); Calibrated: 26.06.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

**Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement**

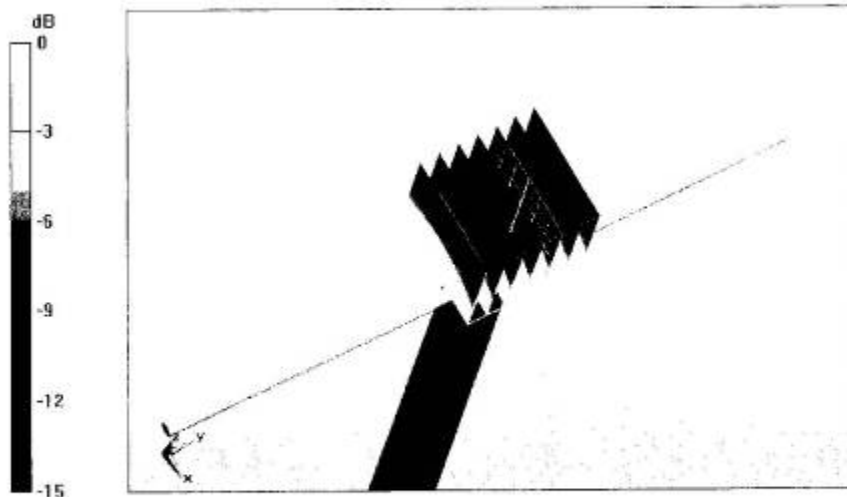
grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.5 V/m; Power Drift = -0.00176 dB

Peak SAR (extrapolated) = 3.58 W/kg

**SAR(1 g) = 2.39 mW/g; SAR(10 g) = 1.56 mW/g**

Maximum value of SAR (measured) = 2.77 mW/g



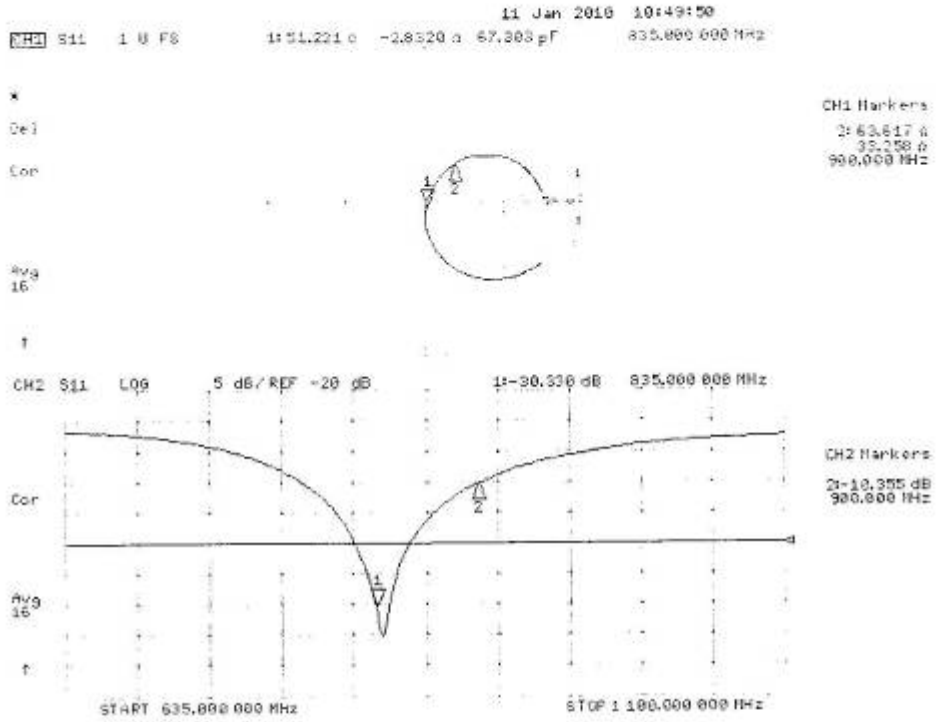
0 dB = 2.77mW/g

# TA Technology (Shanghai) Co., Ltd. Test Report

Report No. RZA2010-1428SAR

Page 86 of 105

## Impedance Measurement Plot for Head TSL



**DASY5 Validation Report for Body**

Date/Time: 14.01.2010 15:40:17

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d092**

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

Medium: MSL900

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.98$  mho/m;  $\epsilon_r = 54.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

**DASY5 Configuration:**

- Probe: ES3DV3 - SN3205; ConvF(5.97, 5.97, 5.97); Calibrated: 26.06.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

**Pin250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement**

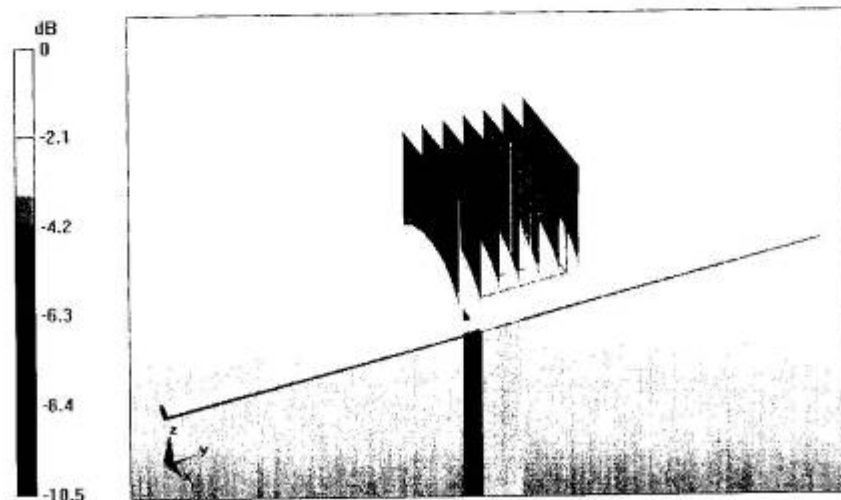
grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.9 V/m; Power Drift = 0.013 dB

Peak SAR (extrapolated) = 3.67 W/kg

**SAR(1 g) = 2.49 mW/g; SAR(10 g) = 1.63 mW/g**

Maximum value of SAR (measured) = 2.89 mW/g



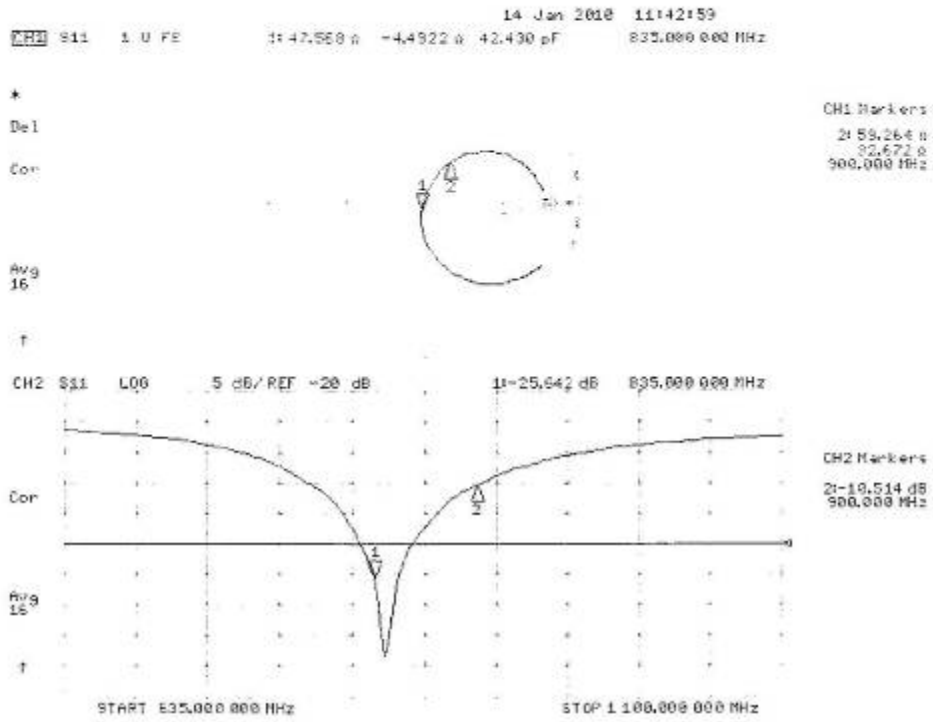
0 dB = 2.89mW/g

# TA Technology (Shanghai) Co., Ltd. Test Report

Report No. RZA2010-1428SAR

Page 88 of 105

## Impedance Measurement Plot for Body TSL





# TA Technology (Shanghai) Co., Ltd. Test Report

Report No. RZA2010-1428SAR

Page 89 of 105

## ANNEX F: D1900V2 Dipole Calibration Certificate

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



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

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

Accreditation No.: **SCS 108**

Client: **Audon**

Certificate No.: **D1900V2-5d018\_Jun10**

<b>CALIBRATION CERTIFICATE</b>																																															
Object	D1900V2 - SN: 5d018																																														
Calibration procedure(s)	QA CAL-05.v7 Calibration procedure for dipole validation kits																																														
Calibration date:	June 15, 2010																																														
<p>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.</p> <p>All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity &lt; 70%.</p> <p>Calibration Equipment used (M&amp;TE critical for calibration)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 30%;">Primary Standards</th> <th style="width: 15%;">ID #</th> <th style="width: 30%;">Cal Date (Certificate No.)</th> <th style="width: 25%;">Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Power meter EPM-442A</td> <td>GB37480704</td> <td>06-Oct-09 (No. 217-01086)</td> <td>Oct-10</td> </tr> <tr> <td>Power sensor HP 8481A</td> <td>US37292783</td> <td>06-Oct-09 (No. 217-01086)</td> <td>Oct-10</td> </tr> <tr> <td>Reference 20 dB Attenuator</td> <td>SN: 5086 (20g)</td> <td>30-Mar-10 (No. 217-01158)</td> <td>Mar-11</td> </tr> <tr> <td>Type-N mismatch combination</td> <td>SN: 5047.2 / 06327</td> <td>30-Mar-10 (No. 217-01162)</td> <td>Mar-11</td> </tr> <tr> <td>Reference Probe ES3DV3</td> <td>SN: 3205</td> <td>30-Apr-10 (No. ES3-3205_Apr10)</td> <td>Apr-11</td> </tr> <tr> <td>DAE4</td> <td>SN: 601</td> <td>10-Jun-10 (No. DAE4-601_Jun10)</td> <td>Jun-11</td> </tr> </tbody> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 30%;">Secondary Standards</th> <th style="width: 15%;">ID #</th> <th style="width: 30%;">Check Date (in house)</th> <th style="width: 25%;">Scheduled Check</th> </tr> </thead> <tbody> <tr> <td>Power sensor HP 8481A</td> <td>MY41092317</td> <td>18-Oct-02 (in house check Oct-09)</td> <td>In house check: Oct-11</td> </tr> <tr> <td>RF generator R&amp;S SMT-06</td> <td>100005</td> <td>4-Aug-99 (in house check Oct-09)</td> <td>In house check: Oct-11</td> </tr> <tr> <td>Network Analyzer HP 8753E</td> <td>US37390585 S4206</td> <td>18-Oct-01 (in house check Oct-09)</td> <td>In house check: Oct-10</td> </tr> </tbody> </table>				Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration	Power meter EPM-442A	GB37480704	06-Oct-09 (No. 217-01086)	Oct-10	Power sensor HP 8481A	US37292783	06-Oct-09 (No. 217-01086)	Oct-10	Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11	Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11	Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11	DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11	Secondary Standards	ID #	Check Date (in house)	Scheduled Check	Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11	RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11	Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-09)	In house check: Oct-10
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Calibrated by:	Name Dimoe Iliev	Function Laboratory Technician	Signature 																																												
Approved by:	Name Katja Pokovic	Technical Manager																																													
Issued: June 17, 2010																																															
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.																																															

# TA Technology (Shanghai) Co., Ltd. Test Report

Report No. RZA2010-1428SAR

Page 90 of 105

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



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

Accredited by the Swiss Accreditation Service (SAS)

The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

## Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

## Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

## Additional Documentation:

- DASY4/5 System Handbook

## Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

# TA Technology (Shanghai) Co., Ltd. Test Report

### Measurement Conditions

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

<b>DASY Version</b>	DASY5	V52.2
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Modular Flat Phantom V5.0	
<b>Distance Dipole Center - TSL</b>	10 mm	with Spacer
<b>Zoom Scan Resolution</b>	dx, dy, dz = 5 mm	
<b>Frequency</b>	1900 MHz ± 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.0 °C	40.0	1.40 mho/m
<b>Measured Head TSL parameters</b>	(22.0 ± 0.2) °C	39.6 ± 6 %	1.44 mho/m ± 6 %
<b>Head TSL temperature during test</b>	(22.5 ± 0.2) °C	----	----

### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.0 mW / g
SAR normalized	normalized to 1W	40.0 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>39.2 mW / g ± 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.22 mW / g
SAR normalized	normalized to 1W	20.9 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>20.7 mW / g ± 16.5 % (k=2)</b>

# TA Technology (Shanghai) Co., Ltd. Test Report

### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Body TSL parameters</b>	22.0 °C	53.3	1.52 mho/m
<b>Measured Body TSL parameters</b>	(22.0 ± 0.2) °C	53.4 ± 6 %	1.54 mho/m ± 6 %
<b>Body TSL temperature during test</b>	(21.7 ± 0.2) °C	----	----

### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.3 mW / g
SAR normalized	normalized to 1W	41.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>40.9 mW / g ± 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.52 mW / g
SAR normalized	normalized to 1W	22.1 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>22.0 mW / g ± 16.5 % (k=2)</b>

# TA Technology (Shanghai) Co., Ltd. Test Report

## Appendix

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.1 $\Omega$ + 2.6 j $\Omega$
Return Loss	- 29.7 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.4 $\Omega$ + 3.2 j $\Omega$
Return Loss	- 27.6 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.194 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

### Additional EUT Data

Manufactured by	SPEAG
Manufactured on	June 04, 2002

**DASY5 Validation Report for Head TSL**

Date/Time: 15.06.2010 10:40:45

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d018**

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

Medium: HSL U11 BB

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.44$  mho/m;  $\epsilon_r = 39.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.09, 5.09, 5.09); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

**Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement**  
grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.7 V/m; Power Drift = 0.022 dB

Peak SAR (extrapolated) = 18.4 W/kg

**SAR(1 g) = 10 mW/g; SAR(10 g) = 5.22 mW/g**

Maximum value of SAR (measured) = 12.6 mW/g

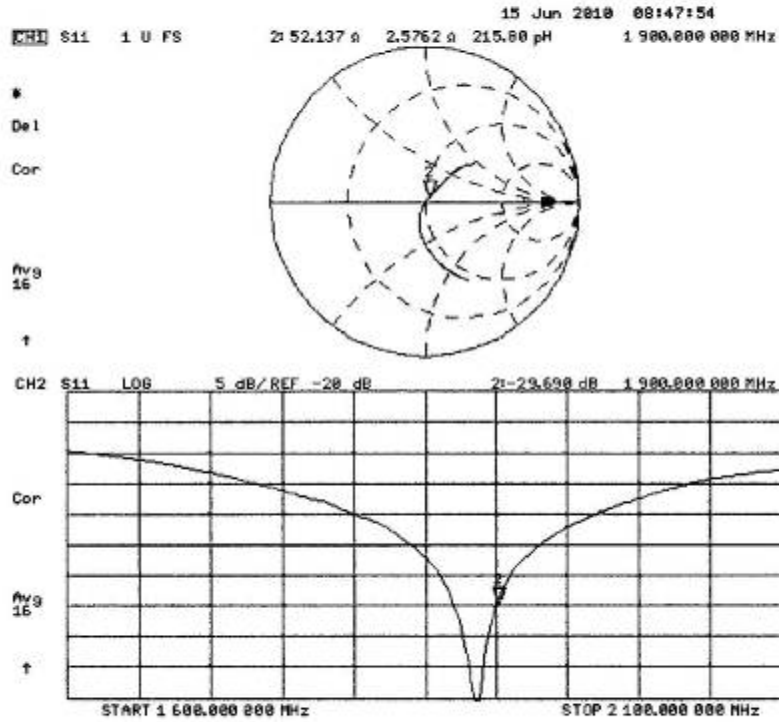


# TA Technology (Shanghai) Co., Ltd. Test Report

Report No. RZA2010-1428SAR

Page 95 of 105

## Impedance Measurement Plot for Head TSL



**DASY5 Validation Report for Body**

Date/Time: 15.06.2010 14:14:27

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d018**

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

Medium: MSL U11 BB

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.54$  mho/m;  $\epsilon_r = 53.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.59, 4.59, 4.59); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

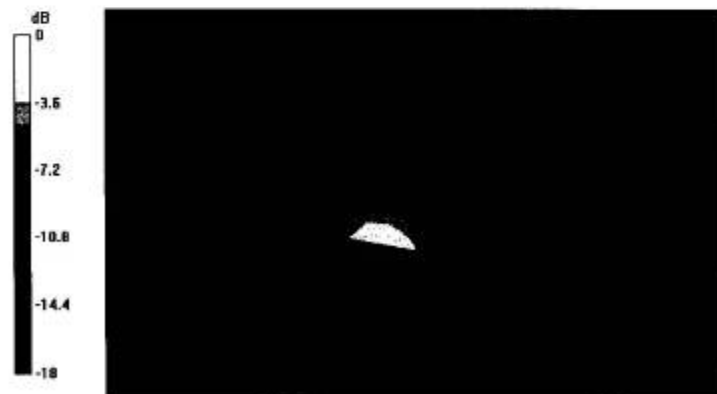
**Pin250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.1 V/m; Power Drift = 0.055 dB

Peak SAR (extrapolated) = 17.3 W/kg

**SAR(1 g) = 10.3 mW/g; SAR(10 g) = 5.52 mW/g**

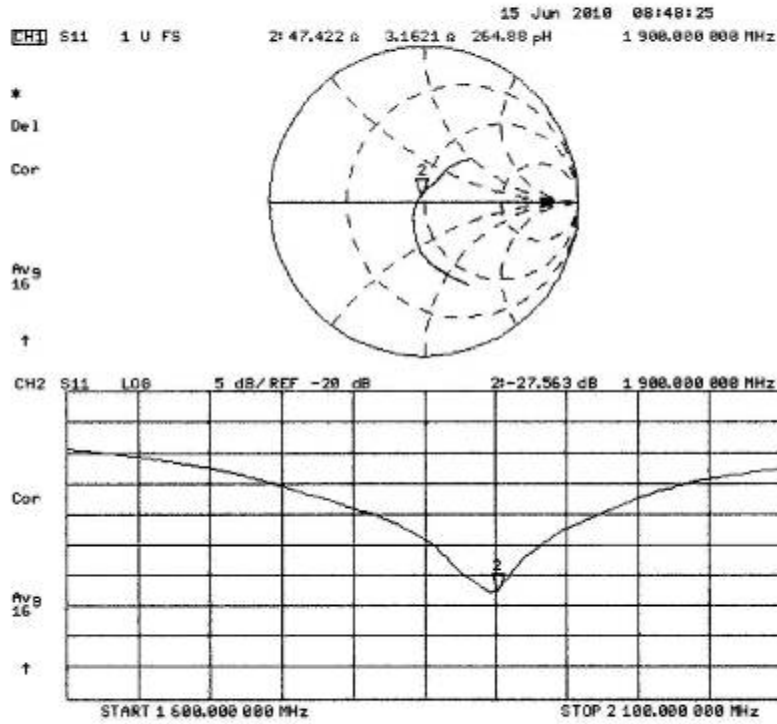
Maximum value of SAR (measured) = 12.8 mW/g



0 dB = 12.8mW/g



Impedance Measurement Plot for Body TSL



# TA Technology (Shanghai) Co., Ltd. Test Report

Report No. RZA2010-1428SAR

Page 98 of 105

## ANNEX G: DAE4 Calibration Certificate

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



**S** Schweizerischer Kalibrierdienst  
**S** Service suisse d'étalonnage  
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**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 **TA - SH (Auden)**

Certificate No: **DAE4-871\_Nov09**

### CALIBRATION CERTIFICATE

Object: **DAE4 - SD 000 D04 BJ - SN: 871**

Calibration procedure(s): **QA CAL-06.v12  
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **November 11, 2009**

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
Keithley Multimeter Type 2001	SN: 081027B	1-Oct-09 (No: 9055)	Oct-10
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Calibrator Box V1.1	SE UMS 006 AB 1004	05-Jun-09 (in house check)	In house check: Jun-10

Calibrated by:	Name <b>Andrea Guntli</b>	Function <b>Technician</b>	Signature 
Approved by:	Name <b>Fin Bomholt</b>	Function <b>R&amp;D Director</b>	Signature 

Issued: November 11, 2009

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

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



**S** Schweizerischer Kalibrierdienst  
**S** Service suisse d'étalonnage  
**C** 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

**DAE** data acquisition electronics  
**Connector angle** information used in DASY system to align probe sensor X to the robot coordinate system.

### Methods Applied and Interpretation of Parameters

- **DC Voltage Measurement:** Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- **Connector angle:** The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - **DC Voltage Measurement Linearity:** Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - **Common mode sensitivity:** Influence of a positive or negative common mode voltage on the differential measurement.
  - **Channel separation:** Influence of a voltage on the neighbor channels not subject to an input voltage.
  - **AD Converter Values with inputs shorted:** Values on the internal AD converter corresponding to zero input voltage
  - **Input Offset Measurement:** Output voltage and statistical results over a large number of zero voltage measurements.
  - **Input Offset Current:** Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - **Input resistance:** DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - **Low Battery Alarm Voltage:** Typical value for information. Below this voltage, a battery alarm signal is generated.
  - **Power consumption:** Typical value for information. Supply currents in various operating modes.

**TA Technology (Shanghai) Co., Ltd.**  
**Test Report**

**DC Voltage Measurement**

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 $\mu$ V , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	404.813 $\pm$ 0.1% (k=2)	404.794 $\pm$ 0.1% (k=2)	405.237 $\pm$ 0.1% (k=2)
Low Range	3.98191 $\pm$ 0.7% (k=2)	3.98417 $\pm$ 0.7% (k=2)	3.98912 $\pm$ 0.7% (k=2)

**Connector Angle**

Connector Angle to be used in DASY system	90.0 $\pm$ 1 $^{\circ}$
---	-------------------------

# TA Technology (Shanghai) Co., Ltd.

## Test Report

### Appendix

#### 1. DC Voltage Linearity

High Range	Reading ( $\mu\text{V}$ )	Difference ( $\mu\text{V}$ )	Error (%)
Channel X + Input	199994.0	1.84	0.00
Channel X + Input	19999.85	0.05	0.00
Channel X - Input	-19997.97	1.83	-0.01
Channel Y + Input	200010.3	-3.71	-0.00
Channel Y + Input	19999.12	-0.48	-0.00
Channel Y - Input	-20000.18	-0.78	0.00
Channel Z + Input	200010.2	-2.80	-0.00
Channel Z + Input	19998.54	-0.86	-0.00
Channel Z - Input	-19999.82	0.00	0.00

Low Range	Reading ( $\mu\text{V}$ )	Difference ( $\mu\text{V}$ )	Error (%)
Channel X + Input	2000.3	0.22	0.01
Channel X + Input	200.20	0.30	0.15
Channel X - Input	-199.89	0.21	-0.10
Channel Y + Input	1999.8	-0.13	-0.01
Channel Y + Input	200.06	-0.04	-0.02
Channel Y - Input	-200.43	-0.73	0.36
Channel Z + Input	1999.5	-0.57	-0.03
Channel Z + Input	199.58	-0.72	-0.36
Channel Z - Input	-201.11	-1.01	0.51

#### 2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading ( $\mu\text{V}$ )	Low Range Average Reading ( $\mu\text{V}$ )
Channel X	200	13.79	12.75
	- 200	-12.26	-13.72
Channel Y	200	-11.82	-11.47
	- 200	10.67	10.68
Channel Z	200	-1.08	-1.35
	- 200	0.32	0.12

#### 3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X ( $\mu\text{V}$ )	Channel Y ( $\mu\text{V}$ )	Channel Z ( $\mu\text{V}$ )
Channel X	200	-	3.36	1.06
Channel Y	200	1.52	-	3.59
Channel Z	200	2.55	1.41	-

# TA Technology (Shanghai) Co., Ltd.

## Test Report

#### 4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	15928	16288
Channel Y	16188	15745
Channel Z	15790	16219

#### 5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10M $\Omega$

	Average ( $\mu$ V)	min. Offset ( $\mu$ V)	max. Offset ( $\mu$ V)	Std. Deviation ( $\mu$ V)
Channel X	0.06	-3.43	1.18	0.52
Channel Y	-0.71	-2.66	0.96	0.57
Channel Z	-0.95	-1.94	0.04	0.41

#### 6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

#### 7. Input Resistance

	Zeroing (MOhm)	Measuring (MOhm)
Channel X	0.1999	204.4
Channel Y	0.1999	203.6
Channel Z	0.1999	203.8

#### 8. Low Battery Alarm Voltage (verified during pre test)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

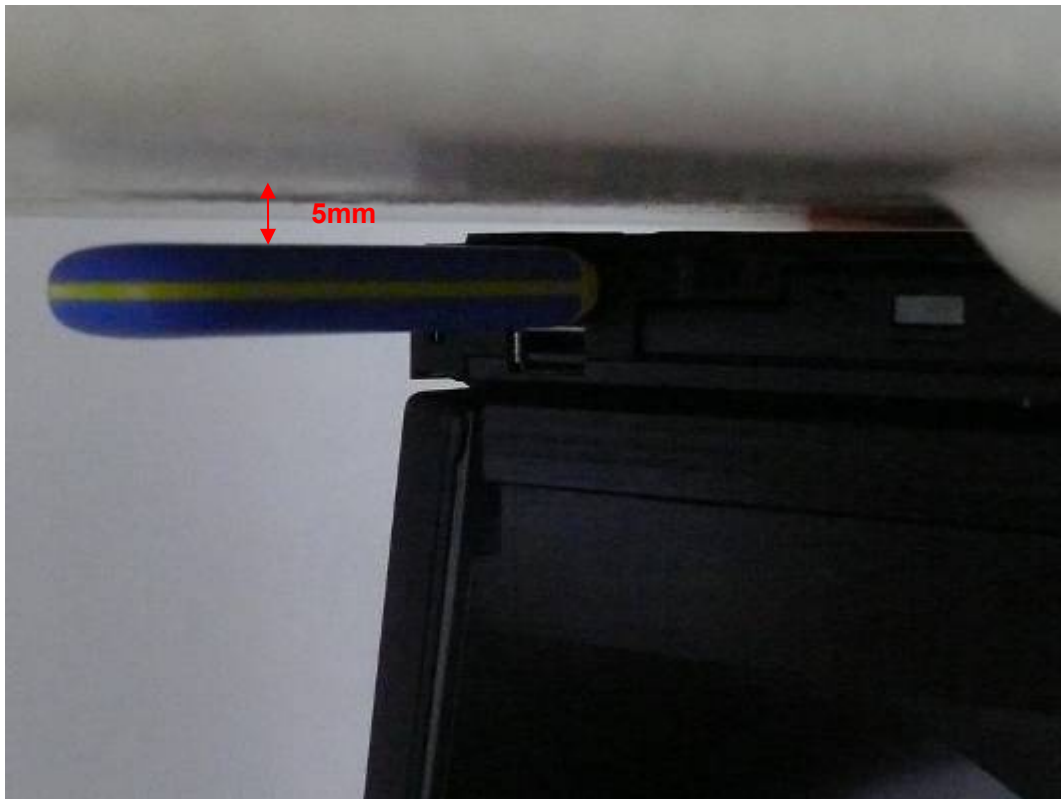
#### 9. Power Consumption (verified during pre test)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.0	+6	+14
Supply (- Vcc)	-0.01	-8	-9

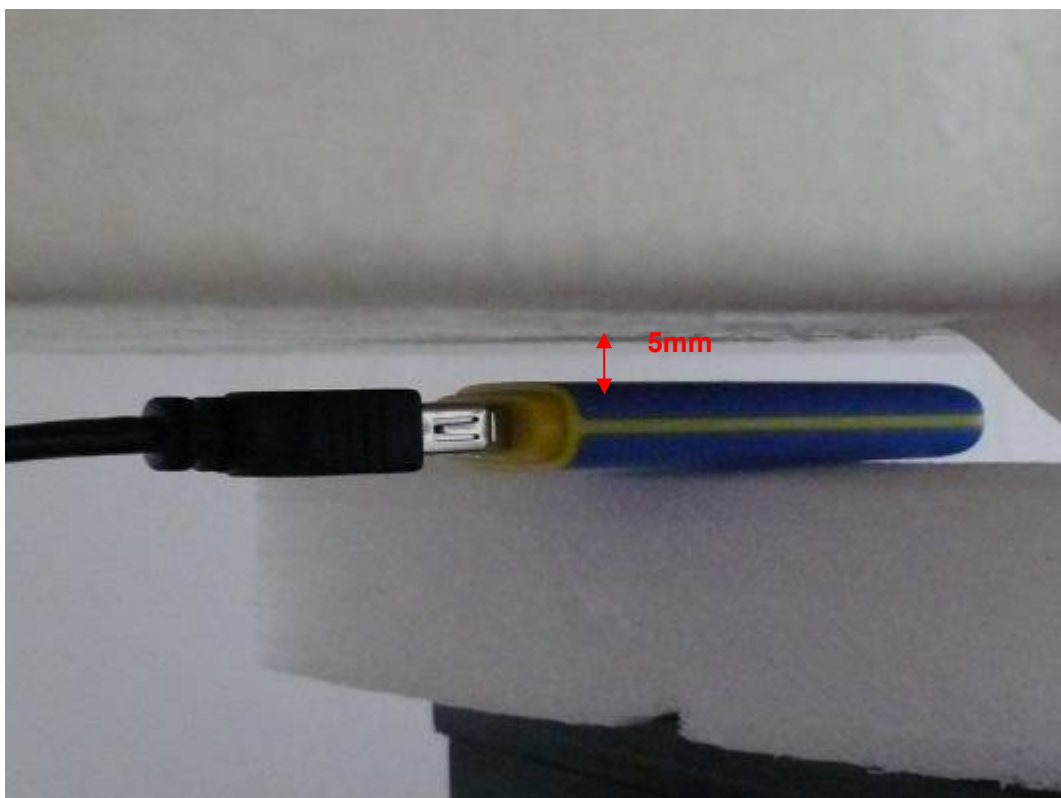
## ANNEX H: The EUT Appearances and Test Configuration



Picture 5: Constituents of the EUT



Picture 6: Test position 1



Picture 7: Test position 2





Picture 8: Test Position 3



Picture 9: Test Position 4