

# TEST REPORT FROM RFI GLOBAL SERVICES LTD

**Test of: Softbank, 101P**

**To: OET Bulletin 65 Supplement C: (2001-01)**

**Test Report Serial No:  
RFI-SAR-RP83554JD09A V4.0**

**Version 4.0 supersedes all previous versions**

**This Test Report Is Issued Under The  
Authority Of Chris Guy,  
Head of Global Approvals:**



(APPROVED SIGNATORY)

**Checked By: Richelieu Quoi**



(APPROVED SIGNATORY)

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**1. Customer Information**

<b>Company Name:</b>	Panasonic Mobile Comms Dev of Europe Ltd
<b>Address:</b>	Panasonic House, Willoughby Road Bracknell, Berkshire, RG12 8FP, United Kingdom

## 2. Equipment Under Test (EUT)

### 2.1. Identification of Equipment Under Test (EUT)

<b>Description:</b>	Mobile Handset
<b>Brand Name:</b>	Softbank
<b>Model Name or Number:</b>	101P (Project S12BR1)
<b>Serial Number:</b>	None Stated; (Customer Ref: Sample C15)
<b>IMEI Number:</b>	004401221134063
<b>Hardware Version Number:</b>	REV C
<b>Software Version Number:</b>	ACPU: sbm-07-0319 CCPU: R1D_EC01
<b>Hardware Revision of GSM Module:</b>	Not Applicable
<b>Software Revision of GSM Module:</b>	Not Applicable
<b>FCC ID Number:</b>	UCE211043A
<b>Country of Manufacture:</b>	Japan
<b>Date of Receipt:</b>	01 September 2011

#### Note(s):

This sample was used to perform WWAN SAR evaluation only. The sample supports simultaneous transmission with the WWAN and WLAN antenna > 5 cm apart. Wireless Personal Hotspot is also supported and was evaluated as per KDB 941225 D06 "Hot Spot SAR v01"

<b>Description:</b>	Mobile Handset
<b>Brand Name:</b>	Softbank
<b>Model Name or Number:</b>	101P (Project S12BR1)
<b>Serial Number:</b>	None Stated; (Customer Ref: Sample C14)
<b>IMEI Number:</b>	004401221134089
<b>Hardware Version Number:</b>	REV C
<b>Software Version Number:</b>	ACPU: sbm-07-0363 CCPU: R1D_EC01
<b>Hardware Revision of GSM Module:</b>	Not Applicable
<b>Software Revision of GSM Module:</b>	Not Applicable
<b>FCC ID Number:</b>	UCE211043A
<b>Country of Manufacture:</b>	Japan
<b>Date of Receipt:</b>	01 September 2011

#### Note(s):

This Sample was used to perform WLAN SAR evaluation only. The sample supports simultaneous transmission with it WWAN and WLAN antenna > 5 cm apart. Wireless Personal Hotspot is also supported and was evaluated as per KDB 941225 D06 "Hot Spot SAR v01"

## **2.2. Description of EUT**

The equipment under test was a Dual-mode UMTS/GSM mobile handset operating in the GSM850, PCS1900 and WiFi 2450 bands. The EUT has GPRS class 12, WiFi802.11b/g/n, Wireless Personal Hotspot Mode, RFID and *Bluetooth* capabilities

## **2.3. Modifications Incorporated in the EUT**

EUT (IMEI: 004401221134063) was setup for WWAN test only.

EUT (IMEI: 004401221134089) was setup for WLAN test only.

## 2.4. Accessories

The following accessories were supplied with the EUT during testing:

<b>Description:</b>	Battery
<b>Brand Name:</b>	Softbank
<b>Model Name or Number:</b>	PMBBE1
<b>Serial Number:</b>	None Stated
<b>Cable Length and Type:</b>	Not Applicable
<b>Country of Manufacture:</b>	None Stated
<b>Connected to Port</b>	3 pin contact

<b>Description:</b>	Personal Hands Free
<b>Brand Name:</b>	Softbank
<b>Model Name or Number:</b>	PMLBD1
<b>Serial Number:</b>	None Stated
<b>Cable Length and Type:</b>	~1.4m / multi-core
<b>Country of Manufacture:</b>	None Stated
<b>Connected to Port</b>	AV Out Port Unique to Manufacturer

<b>Description:</b>	Memory Card
<b>Brand Name:</b>	Generic
<b>Model Name or Number:</b>	None Stated
<b>Serial Number:</b>	None Stated
<b>Cable Length and Type:</b>	Not Applicable
<b>Country of Manufacture:</b>	None Stated
<b>Connected to Port</b>	Dedicated Micro SD Card Slot

## 2.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

<b>Description:</b>	Wireless Communication Test Set
<b>Brand Name:</b>	Agilent
<b>Model Name or Number:</b>	8960 Series 10
<b>Serial Number:</b>	GB46311280
<b>Cable Length and Type:</b>	~4.0m Utiflex Cable
<b>Connected to Port:</b>	RF (Input / Output) Air Link

## 2.6. Additional Information Related to Testing

<b>Equipment Category</b>	GSM/850/GPRS850 / PCS1900/GPRS1900 / WiFi802.11b/g/n		
<b>Type of Unit</b>	Portable Transceiver		
<b>Intended Operating Environment:</b>	Within GSM and WiFi Coverage		
<b>Transmitter Maximum Output Power Characteristics:</b>	GSM850	Communication Test Set was configured to allow the EUT to transmit at a maximum Using Power Control Level (PCL = 5 with a maximum power of up to 33.0 dBm).	
	PCS1900	Communication Test Set was configured to allow the EUT to transmit at a maximum Using Power Control Level (PCL = 0 with a maximum power of up to 30.0 dBm).	
	WiFi802.11b/g/n	EUT setup in test mode to allow the EUT to transmit at a maximum power of up to 13.8dBm 'b' mode, 12.4dBm 'g' / 12.3dBm 'n' modes.	
	Bluetooth	< 2 dBm	
<b>Transmitter Frequency Range:</b>	GSM850	(824 to 849) MHz	
	PCS1900	(1850 to 1910) MHz	
	WiFi802.11b/g/n	(2412 to 2462) MHz	
<b>Transmitter Frequency Allocation of EUT When Under Test:</b>	<b>Channel Number</b>	<b>Channel Description</b>	<b>Frequency (MHz)</b>
	128	Low	824.2
	189	Middle	836.4
	251	High	848.8
	512	Low	1850.2
	660	Middle	1879.8
	810	High	1909.8
	1	Low	2412.0
	6	Middle	2437.0
	11	High	2462.0
<b>Modulation(s):</b>	GMSK (GSM/ GPRS): 217 Hz DBPSK, CCK (WiFi): 0 Hz		
<b>Modulation Scheme (Crest Factor):</b>	GMSK (GSM): 8.3 GMSK (GPRS): 2 DBPSK, CCK (WiFi): 1		
<b>Antenna Type:</b>	Internal		
<b>Antenna Length:</b>	Unknown		
<b>Number of Antenna Positions:</b>	2 fixed (GSM and WiFi) With extendable and retractable TV antenna		
<b>Power Supply Requirement:</b>	3.7V		
<b>Battery Type(s):</b>	Li-ion		

### 3. Test Specification, Methods and Procedures

#### 3.1. Test Specification

<b>Reference:</b>	OET Bulletin 65 Supplement C: (2001-01)
<b>Title:</b>	Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.
<b>Purpose of Test:</b>	To determine whether the equipment met the basic restrictions as defined in OET Bulletin 65 Supplement C: (2001-01) using the SAR averaging method as described in the test specification above.

#### 3.2. Methods and Procedures Reference Documentation

The methods and procedures used were as detailed in:

Federal Communications Commission, "Evaluating compliance with FCC Guidelines for human exposure to radio frequency electromagnetic fields", OET Bulletin 65 Supplement C, FCC, Washington, D.C, 20554, 2001.

Thomas Schmid, Oliver Egger and Neils Kuster, "Automated E-field scanning system for dosimetric assessments", IEEE Transaction on microwave theory and techniques, Vol. 44, pp. 105-113, January 1996.

Neils Kuster, Ralph Kastle and Thomas Schmid, "Dosimetric evaluation of mobile communications equipment with known precision", IEICE Transactions of communications, Vol. E80-B, No.5, pp. 645-652, May 1997.

KDB 248227 D01 "SAR measurements for 802.11a/b/g v01r02"

KDB 447498 D01 "Mobile Portable RF Exposure v04"

KDB 648474 D01 SAR Handsets Multi Xmitter and Ant v01r05"

KDB 941225 D03 " SAR Test Reduction GSM/GPRS/EDGE v01"

KDB 941225 D06 "Hot Spot SAR v01"

The version of DASY system used by RFI for SAR measurements is v4.7.

The SAR probe for the DASY v4.4 and higher has a validity of +/- 100 MHz from the spot frequency at which the system is calibrated.

The SAR system uses the 900 MHz conversion factor which is valid from 800 MHz to 1000 MHz for the system validation performed at 900 MHz.

The 900 MHz validation is applicable for the 850 band as this is within 50 MHz of the 850 MHz spot frequency.

#### 3.3. Definition of Measurement Equipment

The measurement equipment used complied with the requirements of the standards referenced in the methods & procedures section above. Appendix 1 contains a list of the test equipment used.

#### 4. Deviations from the Test Specification

Test was performed as per KDB 648474 D01 "SAR Handsets Multi Xmter and Ant v01r05", KDB 941225 D03 " SAR Test Reduction GSM/GPRS/EDGE v01", KDB 248227 D01 "SAR measurements for 802.11a/b/g v01r02" and KDB 941225 D06 "Hot Spot SAR v01" according to the handset procedures in IEEE Std 1528-2003, OET Bulletin 65 Supplement C 01-01 and the specific FCC test procedures. The assessment for Personal Wireless Hotspot was also evaluated as per the FCC KDB 941225 D06 "Hot Spot SAR v01".

The SAR was measured on all the sides and surfaces within the transmitting antenna (WWAN or WLAN) located within 25mm from the surface or edge, for the data modes, wireless technologies and frequency bands supporting hotspot mode, as stated in FCC KDB 941225 D06 "Hot Spot SAR v01".

SAR test was performed in the middle channel only as the measured levels were < 50% of the SAR limit as stated in the FCC Public Notice DA 02-1438 by the SCC-34/SC-2.

Simultaneous transmission was not evaluated as the sum of the individual SAR for WWAN and WLAN was < 1.6 W/kg and the antenna-to-antenna distance was greater than 5 cm.

The samples used for SAR assessment were as per section 2 of this report.

For GPRS class 12, the uplink of 2, 3 and 4 were all evaluated to find the setting that gives the highest power reference measurements. 4-uplink was found to give the highest power reference measurement on the DASY4 system. All settings were performed with the device in a fixed position to ensure there were no positioning errors. The following values were measured relative to the uplink settings:

GPRS Mode	GPRS850 Band Power (v/m)	GPRS1900 Power (v/m)
2 uplink	6.387	5.353
3 uplink	6.397	5.358
<b>4 uplink</b>	<b>6.458</b>	<b>5.421</b>

## 5. Operation and Configuration of the EUT during Testing

### 5.1. Operating Modes

The EUT was tested in the following operating mode(s) unless otherwise stated:

- GSM850 Call allocated mode with Communication Test Set was configured to allow the EUT to transmit at a maximum Using Power Control Level (PCL = 5 with a maximum power of up to 33.0 dBm).
- GPRS850 Data allocated mode with Communication Test Set was configured to allow the EUT to transmit at a maximum Using Power Control Level (PCL = 5 with a maximum power of up to 33.0 dBm). With 4-Uplink time slots.
- PCS1900 Call allocated mode with Communication Test Set was configured to allow the EUT to transmit at a maximum Using Power Control Level (PCL = 0 with a maximum power of up to 30.0 dBm).
- GPRS1900 Data allocated mode with Communication Test Set was configured to allow the EUT to transmit at a maximum Using Power Control Level (PCL = 0 with a maximum power of up to 30.0 dBm). With 4-Uplink time slots.
- WiFi802.11b/g/n Data allocated mode using 'FaCTA' test software to excise mode 'b', 'g' and 'n', with maximum power of up to 13.8dBm for 'b' mode and 12.4dBm for 'g' and 12.3dBm for 'n' modes.
- "SAR test was performed in the highest output channel for WLAN as the measured SAR levels were < 0.8 W/kg, where the transmission band corresponding to all channels were <100 MHz. Testing for the other channels were not required as stated in KDB 447498

GSM850 – UPLINK Power Table Settings used for Test Set	
Power Control Level (PCL)	Nominal Power (dBm)
0 ... 2	39
3	37
4	35
<b>5</b>	<b>33</b>
6	31
7	29
8	27
9	25
10	23
11	21
12	19
13	17
14	15
15	13
16	11
17	9
18	7
19 ... 31	5

PCS1900 – UPLINK Power Table Settings used for Test Set	
Power Control Level (PCL)	Nominal Power (dBm)
22 ... 29	Reserved
30	33
31	32
<b>0</b>	<b>30</b>
1	28
2	26
3	24
4	22
5	20
6	18
7	16
8	14
9	12
10	10
11	8
12	6
13	4
14	2
15	0
16 ... 21	Reserved

## 5.2. Configuration and Peripherals

The EUT was tested in the following configuration(s) unless otherwise stated:

- Test performed with the EUT in a Standalone Battery Powered configuration.
- For GPRS class 12, the uplink of 2, 3 and 4 were all evaluated to find the setting that gives the highest power reference measurements. 4 uplink was found to give the highest power reference measurement on the DASY4 system. All settings were performed with the device in a fixed position to ensure there were no positioning errors. The following values were measured relative to the uplink settings:
- The applied configurations for body-worn orientations where the corresponding edge(s) is closest to the user with the most conservative exposure condition were all evaluated at 10 mm from the body as Personal Hotspot mode was supported. Therefore SAR test at 15 mm for configuration that overlapped with the Personal hotspot configuration were not evaluated.

### Head Configuration

- a) The handset was placed in a normal operating position with the centre of the ear-piece aligned with the ear canal on the phantom.
- b) With the ear-piece touching the phantom the centre line of the handset was aligned with an imaginary plane (X and Y axis) consisting of three lines connecting both ears and the mouth.
- c) For the cheek position the handset was gradually moved towards the cheek until any point of the mouth-piece or keypad touched the cheek.
- d) For the tilted position the EUT was positioned as for the cheek position, and then the horizontal angle was increased by fifteen degrees (the phone keypad was moved away from the cheek by fifteen degrees).
- e) SAR measurements were evaluated at maximum power and the unit was operated for an appropriate period prior to the evaluation in order to minimise the drift.
- f) The device was keyed to operate continuously in the transmit mode for the duration of the test.
- g) The location of the maximum spatial SAR distribution (hot spot) was determined relative to the handset and its antenna.
- h) The EUT was transmitting at full power throughout the duration of the test powered by a fully charged battery.

### Body Configuration

- a) The EUT was placed in a normal operating position where the centre of EUT was aligned with the centre reference point on the flat section of the 'SAM' phantom.
- b) With the EUT touching the phantom at an imaginary centre line. The EUT was aligned with a marked plane (X and Y axis) consisting of two lines.
- c) For the touch-safe position the handset was gradually moved towards the flat section of the 'SAM' phantom until any point of the EUT touched the phantom.
- d) For position(s) greater than 0mm separation the EUT was positioned as per the touch-safe position, and then the vertical height was decreased/adjusted as required.
- e) SAR measurements were evaluated at maximum power and the unit was operated for an appropriate period prior to the evaluation in order to minimise the drift.
- f) The device was keyed to operate continuously in the transmit mode for the duration of the test.
- g) The location of the maximum spatial SAR distribution (hot spot) was determined relative to the handset and its antenna.
- h) The EUT was transmitting at full power throughout the duration of the test powered by a fully charged battery

## 6. Summary of Test Results

Test Name	Specification Reference	Result
Specific Absorption Rate-GSM 850 Head Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied
Specific Absorption Rate-GPRS 850 Head Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied
Specific Absorption Rate-GPRS 850 Body Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied
Specific Absorption Rate-EGPRS 850 Body Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied
Specific Absorption Rate-GSM 850 Body Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied
Specific Absorption Rate-PCS 1900 Head Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied
Specific Absorption Rate-GPRS 1900 Head Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied
Specific Absorption Rate-GPRS 1900 Body Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied
Specific Absorption Rate-EGPRS 1900 Body Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied
Specific Absorption Rate-PCS 1900 Body Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied
Specific Absorption Rate-Wi-Fi 2450 Head Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied
Specific Absorption Rate-Wi-Fi 2450 Body Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied

### SAR Individual Transmitter Evaluation

device, mode	Frequency, (MHz)	P <sub>x</sub> (mW)	P <sub>REF</sub> (mW)	single SAR, W/kg	Remarks
WWAN, GSM	850	1698	60/f	0.619	Routine Evaluation
WWAN, GSM	1900	832	60/f	0.303	Routine Evaluation
WLAN, WiFi802.11b/g/n	2450	24	12	0.260	Routine Evaluation
BT, Bluetooth	2400	~ 2	12	:=0	$\{P_{BT} \leq 2P_{REF}\}$ $\{d_{WWAN, BT} > 5cm\}$

### SAR Simultaneous Transmitter Evaluation

(x,y)	D(x,y) cm	L(x,y) cm	SPLSR <sub>xy</sub>	Sim-Tx SAR	Remarks
(WWAN <sub>GSM</sub> , BT)	>5	N/A	N/A	N/A	{no stand-alone SAR for BT}
(WWAN <sub>GSM</sub> , Wi-Fi)	>5	N/A	N/A	N/A	{D(x,y) > 5 } & $\{\sum_{WWAN, WLAN} < 1.6 W/kg\}$

### Note(s):

1. Simultaneous transmission evaluation was not required as the output power for *Bluetooth* was < (60/f) and the Sum of all antenna < 1.6w/kg.
2. *Bluetooth* transmitter thresholds output power “P<sub>Ref</sub> = 12 mW as listed in KDB 648474.
3. Px: power level measured by RFI.
4. Single SAR value was measured by RFI.
5. The “Antenna-to-Antenna distance and Antenna-to-User distance were provided by the customer.

## 6.1. Location of Tests

All the measurements described in this report were performed at the premises of RFI Global Services Ltd, Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire, RG23 8BG United Kingdom

## 7. Measurements, Examinations and Derived Results

### 7.1. General Comments

This section contains test results only.

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to section 8 for details of measurement uncertainties.

## 7.2. Test Results

### 7.2.1. Specific Absorption Rate - GSM 850 Head Configuration 1g

#### Test Summary:

Tissue Volume:	1g
Maximum Level (W/kg):	0.334

#### Environmental Conditions:

Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	23.0 to 23.0

#### Results:

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Touch Antenna Retracted	Left	189	0.327	1.600	1.273	1	Complied
Touch Antenna Extended	Left	189	0.301	1.600	1.299	1	Complied
Tilt Antenna Retracted	Left	189	0.202	1.600	1.398	1	Complied
Tilt Antenna Extended	Left	189	0.133	1.600	1.467	1	Complied
Touch Antenna Retracted	Right	189	0.334	1.600	1.266	1	Complied
Touch Antenna Extended	Right	189	0.315	1.600	1.285	1	Complied
Tilt Antenna Retracted	Right	189	0.212	1.600	1.388	1	Complied
Tilt Antenna Extended	Right	189	0.155	1.600	1.445	1	Complied

#### Note(s):

1. SAR test was performed in the middle channel only as the measured levels were < 50% of the SAR limit as stated in the FCC Public Notice DA 02-1438 by the SCC-34/SC-2.

**7.2.2. Specific Absorption Rate - GPRS 850 Head Configuration 1g****Test Summary:**

Tissue Volume:	1g
Maximum Level (W/kg):	0.375

**Environmental Conditions:**

Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	23.0 to 23.0

**Results:**

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Touch Antenna Retracted	Right	189	0.375	1.600	1.225	1, 2	Complied

**Note(s):**

1. SAR test was performed in the middle channel only as the measured levels were < 50% of the SAR limit as stated in the FCC Public Notice DA 02-1438 by the SCC-34/SC-2.
2. Worst case configuration and channel of GSM were applied to GPRS head test.

**7.2.3. Specific Absorption Rate - GPRS 850 Body Configuration 1g****Test Summary:**

<b>Tissue Volume:</b>	1g
<b>Maximum Level (W/kg):</b>	0.606

**Environmental Conditions:**

<b>Temperature Variation in Lab (°C):</b>	23.0 to 23.0
<b>Temperature Variation in Liquid (°C):</b>	23.3 to 23.3

**Results:**

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Front of EUT Facing Phantom With Antenna Retracted	Flat (SAM)	189	0.524	1.600	1.076	1, 2, 3	Complied
Front of EUT Facing Phantom With Antenna Extended	Flat (SAM)	189	0.406	1.600	1.194	1, 2, 3	Complied
Rear of EUT Facing Phantom With Antenna Retracted	Flat (SAM)	189	0.606	1.600	0.994	1, 2, 3	Complied
Rear of EUT Facing Phantom With Antenna Extended	Flat (SAM)	189	0.419	1.600	1.181	1, 2, 3	Complied
Left Hand Side of EUT Facing Phantom With Antenna Retracted	Flat (SAM)	189	0.382	1.600	1.218	1, 2, 3	Complied
Left Hand Side of EUT Facing Phantom With Antenna Extended	Flat (SAM)	189	0.196	1.600	1.404	1, 2, 3	Complied

**Specific Absorption Rate - GPRS 850 Body Configuration 1g (Continued)**

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Right Hand Side of EUT Facing Phantom With Antenna Extended	Flat (SAM)	189	0.291	1.600	1.309	1, 2, 3	Complied
Base of EUT Facing Phantom With Antenna Retracted	Flat (SAM)	189	0.056	1.600	1.544	1, 2, 3	Complied

**Note(s):**

1. SAR measurements were performed with the EUT at a separation distance of 10mm from the 'SAM' phantom flat section as the device supports Personal Wireless Hotspot.
2. GPRS mode was evaluated using 4 uplink time slots as this was found to be the worst case setting as per power measurement and SAR power reference measurements.
3. SAR test was performed in the middle channel only as the measured levels were < 50% of the SAR limit as stated in the FCC Public Notice DA 02-1438 by the SCC-34/SC-2.

**7.2.4. Specific Absorption Rate - EGPRS 850 Body Configuration 1g****Test Summary:**

Tissue Volume:	1g
Maximum Level (W/kg):	0.619

**Environmental Conditions:**

Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	23.3 to 23.3

**Results:**

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Rear of EUT Facing Phantom With Antenna Retracted	Flat (SAM)	189	0.619	1.600	0.981	1, 2, 3	Complied
Rear of EUT Facing Phantom With Antenna Retracted With PHF	Flat (SAM)	189	0.362	1.600	1.238	1, 2, 3	Complied

**Note(s):**

1. SAR measurements were performed with the EUT at a separation distance of 10mm from the 'SAM' phantom flat section as the device supports Personal Wireless Hotspot.
2. SAR test was performed in the middle channel only as the measured levels were < 50% of the SAR limit as stated in the FCC Public Notice DA 02-1438 by the SCC-34/SC-2.
3. Worst case configuration and channel of GPRS were applied to EGPRS body test.

### 7.2.5. Specific Absorption Rate - GSM 850 Body Configuration 1g

#### Test Summary:

Tissue Volume:	1g
Maximum Level (W/kg):	0.559

#### Environmental Conditions:

Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	23.3 to 23.3

#### Results:

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Rear of EUT Facing Phantom With Antenna Retracted	Flat (SAM)	189	0.559	1.600	1.041	1, 2, 3	Complied

#### Note(s):

1. SAR measurements were performed with the EUT at a separation distance of 10mm from the 'SAM' phantom flat section as the device supports Personal Wireless Hotspot.
2. SAR test was performed in the middle channel only as the measured levels were < 50% of the SAR limit as stated in the FCC Public Notice DA 02-1438 by the SCC-34/SC-2.
3. Worst case configuration and channel of GPRS were applied to GSM body test.

**7.2.6. Specific Absorption Rate - PCS 1900 Head Configuration 1g****Test Summary:**

<b>Tissue Volume:</b>	1g
<b>Maximum Level (W/kg):</b>	0.273

**Environmental Conditions:**

<b>Temperature Variation in Lab (°C):</b>	23.0 to 23.0
<b>Temperature Variation in Liquid (°C):</b>	23.0 to 23.0

**Results:**

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Touch Antenna Retracted	Left	660	0.268	1.600	1.332	1	Complied
Touch Antenna Extended	Left	660	0.268	1.600	1.332	1	Complied
Tilt Antenna Retracted	Left	660	0.078	1.600	1.522	1	Complied
Tilt Antenna Extended	Left	660	0.101	1.600	1.499	1	Complied
Touch Antenna Retracted	Right	660	0.273	1.600	1.327	1	Complied
Touch Antenna Extended	Right	660	0.263	1.600	1.337	1	Complied
Tilt Antenna Retracted	Right	660	0.107	1.600	1.493	1	Complied
Tilt Antenna Extended	Right	660	0.122	1.600	1.478	1	Complied

**Note(s):**

1. SAR test was performed in the middle channel only as the measured levels were < 50% of the SAR limit as stated in the FCC Public Notice DA 02-1438 by the SCC-34/SC-2.

**7.2.7. Specific Absorption Rate - GPRS 1900 Head Configuration 1g****Test Summary:**

Tissue Volume:	1g
Maximum Level (W/kg):	0.303

**Environmental Conditions:**

Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	23.0 to 23.0

**Results:**

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Touch Antenna Retracted	Right	660	0.303	1.600	1.297	1, 2	Complied

**Note(s):**

1. SAR test was performed in the middle channel only as the measured levels were < 50% of the SAR limit as stated in the FCC Public Notice DA 02-1438 by the SCC-34/SC-2.
2. Worst case configuration and channel of PCS were applied to GPRS head test.

**7.2.8. Specific Absorption Rate - GPRS 1900 Body Configuration 1g****Test Summary:**

<b>Tissue Volume:</b>	1g
<b>Maximum Level (W/kg):</b>	0.282

**Environmental Conditions:**

<b>Temperature Variation in Lab (°C):</b>	23.0 to 23.0
<b>Temperature Variation in Liquid (°C):</b>	23.0 to 23.0

**Results:**

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Front of EUT Facing Phantom With Antenna Retracted	Flat (SAM)	660	0.282	1.600	1.318	1, 2, 3	Complied
Front of EUT Facing Phantom With Antenna Extended	Flat (SAM)	660	0.270	1.600	1.330	1, 2, 3	Complied
Rear of EUT Facing Phantom With Antenna Retracted	Flat (SAM)	660	0.275	1.600	1.325	1, 2, 3	Complied
Rear of EUT Facing Phantom With Antenna Extended	Flat (SAM)	660	0.254	1.600	1.346	1, 2, 3	Complied
Left Hand Side of EUT Facing Phantom With Antenna Retracted	Flat (SAM)	660	0.064	1.600	1.536	1, 2, 3	Complied
Left Hand Side of EUT Facing Phantom With Antenna Extended	Flat (SAM)	660	0.048	1.600	1.552	1, 2, 3	Complied
Right Hand Side of EUT Facing Phantom With Antenna Retracted	Flat (SAM)	660	0.055	1.600	1.545	1, 2, 3	Complied

**Specific Absorption Rate - GPRS 1900 Body Configuration 1g (Continued)**

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Base of EUT Facing Phantom With Antenna Retracted	Flat (SAM)	660	0.104	1.600	1.496	1, 2, 3	Complied
Front of EUT Facing Phantom With Antenna Retracted With PHF	Flat (SAM)	660	0.281	1.600	1.319	1, 2, 3	Complied

**Note(s):**

1. SAR measurements were performed with the EUT at a separation distance of 10mm from the 'SAM' phantom flat section as the device supports Personal Wireless Hotspot.
2. GPRS mode was evaluated using 4 uplink time slots as this was found to be the worst case setting as per power measurement and SAR power reference measurements.
3. SAR test was performed in the middle channel only as the measured levels were < 50% of the SAR limit as stated in the FCC Public Notice DA 02-1438 by the SCC-34/SC-2.

**7.2.9. Specific Absorption Rate - EGPRS 1900 Body Configuration 1g****Test Summary:**

Tissue Volume:	1g
Maximum Level (W/kg):	0.281

**Environmental Conditions:**

Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	23.0 to 23.0

**Results:**

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Front of EUT Facing Phantom With Antenna Retracted	Flat (SAM)	660	0.281	1.600	1.319	1, 2, 3	Complied

**Note(s):**

1. SAR measurements were performed with the EUT at a separation distance of 10mm from the 'SAM' phantom flat section as the device supports Personal Wireless Hotspot.
2. SAR test was performed in the middle channel only as the measured levels were < 50% of the SAR limit as stated in the FCC Public Notice DA 02-1438 by the SCC-34/SC-2.
3. Worst case configuration and channel of GPRS were applied to EGPRS body test.

**7.2.10. Specific Absorption Rate - PCS 1900 Body Configuration 1g****Test Summary:**

Tissue Volume:	1g
Maximum Level (W/kg):	0.254

**Environmental Conditions:**

Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	23.0 to 23.0

**Results:**

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Front of EUT Facing Phantom With Antenna Retracted	Flat (SAM)	660	0.254	1.600	1.346	1, 2, 3	Complied

**Note(s):**

1. SAR measurements were performed with the EUT at a separation distance of 10mm from the 'SAM' phantom flat section as the device supports Personal Wireless Hotspot.
2. SAR test was performed in the middle channel only as the measured levels were < 50% of the SAR limit as stated in the FCC Public Notice DA 02-1438 by the SCC-34/SC-2.
3. Worst case configuration and channel of GPRS were applied to PCS body test.

### 7.2.11. Specific Absorption Rate – WLAN 802.11b/g/n Head Configuration 1g

#### Test Summary:

Tissue Volume:	1g
Maximum Level (W/kg):	0.260

#### Environmental Conditions:

Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	22.4 to 22.4

#### Results:

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Touch Antenna Retracted	Left	6	0.122	1.600	1.478	1, 2	Complied
Touch Antenna Extended	Left	6	0.109	1.600	1.491	1, 2	Complied
Tilt Antenna Retracted	Left	6	0.109	1.600	1.491	1, 2	Complied
Tilt Antenna Extended	Left	6	0.106	1.600	1.494	1, 2	Complied
Touch Antenna Retracted	Right	6	0.260	1.600	1.340	1, 2	Complied
Touch Antenna Extended	Right	6	0.258	1.600	1.342	1, 2	Complied
Tilt Antenna Retracted	Right	6	0.219	1.600	1.381	1, 2	Complied
Tilt Antenna Extended	Right	6	0.229	1.600	1.371	1, 2	Complied
Touch Antenna Retracted	Right	6	0.157	1.600	1.443	1, 3	Complied
Touch Antenna Retracted	Right	6	0.145	1.600	1.455	1, 4	Complied

#### Note(s):

1. SAR test was performed in the middle channel only as the measured levels were < 50% of the SAR limit as stated in the FCC Public Notice DA 02-1438 by the SCC-34/SC-2.
2. WLAN 802.11b 1Mbps
3. WLAN 802.11g 6Mbps
4. WLAN 802.11n 6.5Mbps

**7.2.12. Specific Absorption Rate – WLAN 802.11b/g/n Body Configuration 1g****Test Summary:**

<b>Tissue Volume:</b>	1g
<b>Maximum Level (W/kg):</b>	0.067

**Environmental Conditions:**

<b>Temperature Variation in Lab (°C):</b>	23.0 to 23.0
<b>Temperature Variation in Liquid (°C):</b>	22.2 to 22.2

**Results:**

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Front of EUT Facing Phantom With Antenna Retracted	Flat (SAM)	6	0.026	1.600	1.574	1, 2, 3	Complied
Front of EUT Facing Phantom With Antenna Extended	Flat (SAM)	6	0.022	1.600	1.578	1, 2, 3	Complied
Rear of EUT Facing Phantom With Antenna Retracted	Flat (SAM)	6	0.024	1.600	1.576	1, 2, 3	Complied
Rear of EUT Facing Phantom With Antenna Extended	Flat (SAM)	6	0.019	1.600	1.581	1, 2, 3	Complied
Left Hand Side of EUT Facing Phantom With Antenna Retracted	Flat (SAM)	6	0.018	1.600	1.582	1, 2, 3	Complied
Left Hand Side of EUT Facing Phantom With Antenna Extended	Flat (SAM)	6	0.021	1.600	1.579	1, 2, 3	Complied

## Specific Absorption Rate – WLAN 802.11b/g/n Body Configuration 1g (Continued)

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Right Hand Side of EUT Facing Phantom With Antenna Extended	Flat (SAM)	6	0.003*	1.600	1.597	1, 2, 3	Complied
Top of EUT Facing Phantom With Antenna Retracted	Flat (SAM)	6	0.067	1.600	1.533	1, 2, 3	Complied
Top of EUT Facing Phantom With Antenna Retracted	Flat (SAM)	6	0.037	1.600	1.563	1, 2, 4	Complied
Top of EUT Facing Phantom With Antenna Retracted	Flat (SAM)	6	0.040	1.600	1.560	1, 2, 5	Complied
Top of EUT Facing Phantom With Antenna Retracted	Flat (SAM)	6	0.055	1.600	1.545	1, 2, 3	Complied

## Note(s):

1. SAR measurements were performed with the EUT at a separation distance of 10mm from the 'SAM' phantom flat section as the device supports Personal Wireless Hotspot.
2. SAR test was performed in the middle channel only as the measured levels were < 50% of the SAR limit as stated in the FCC Public Notice DA02-1438 by the SCC-34/SC-2
3. WLAN 802.11b 1Mbps
4. WLAN 802.11g 6Mbps
5. WLAN 802.11n 6.5Mbps

\*The SAR level measured is near noise flow.

**7.2.13. Conducted Average Power Measurement****GSM - Measured Average Power:**

Channel Number	Frequency (MHz)	GSM TX Power before Test (dBm)	Note
128	824.2	32.0	Conducted
189	836.4	32.0	Conducted
251	848.8	32.3	Conducted
512	1850.2	28.9	Conducted
660	1879.8	29.0	Conducted
810	1909.8	29.2	Conducted

**GPRS - Measured Average Power Without consideration for Uplink time slots:**

Channel Number	Frequency (MHz)	GPRS TX Power before Test (dBm) 4Uplink	GPRS TX Power before Test (dBm) 3Uplink	GPRS TX Power before Test (dBm) 2Uplink	GPRS TX Power before Test (dBm) 1Uplink	Note
128	824.2	26.6	27.8	29.5	32.0	Conducted
189	836.4	26.8	28.0	30.0	32.3	Conducted
251	848.8	26.8	28.0	29.9	32.2	Conducted
512	1850.2	23.6	24.7	26.4	28.7	Conducted
660	1879.8	23.6	24.8	26.5	28.8	Conducted
810	1909.8	23.7	24.8	26.5	28.8	Conducted

**GPRS - Calculated Average Power With consideration for Uplink time slots:**

Channel Number	Frequency (MHz)	GPRS TX Power before Test (dBm) 4Uplink	GPRS TX Power before Test (dBm) 3Uplink	GPRS TX Power before Test (dBm) 2Uplink	GPRS TX Power before Test (dBm) 1Uplink	Note
128	824.2	23.6	23.5	23.5	23.0	Conducted
189	836.4	23.8	23.7	24.0	23.3	Conducted
251	848.8	23.8	23.7	23.9	23.2	Conducted
512	1850.2	20.6	20.4	20.4	19.7	Conducted
660	1879.8	20.6	20.5	20.5	19.8	Conducted
810	1909.8	20.7	20.5	20.5	19.8	Conducted

**Note:****Scale factor for uplink time slot:**

- 1 Uplink: time slot ratio = 8:1 =>  $10 \log(8/1) = 9.00 \text{ dB}$
- 2 Uplink: time slot ratio = 8:2 =>  $10 \log(8/2) = 6.02 \text{ dB}$
- 3 Uplink: time slot ratio = 8:3 =>  $10 \log(8/3) = 4.26 \text{ dB}$
- 4 Uplink: time slot ratio = 8:4 =>  $10 \log(8/4) = 3.00 \text{ dB}$

**Conducted Average Power Measurement (Continued)****EGPRS - Measured Average Power Without consideration for Uplink time slots:**

Channel Number	Frequency (MHZ)	EGPRS TX Power before Test (dBm) 4Uplink	EGPRS TX Power before Test (dBm) 3Uplink	EGPRS TX Power before Test (dBm) 2Uplink	EGPRS TX Power before Test (dBm) 1Uplink	Note
128	824.2	26.6	27.8	29.5	32.0	Conducted
189	836.4	26.8	28.0	30.0	32.3	Conducted
251	848.8	26.8	28.0	29.9	32.2	Conducted
512	1850.2	23.6	24.7	26.4	28.7	Conducted
660	1879.8	23.6	24.8	26.5	28.8	Conducted
810	1909.8	23.7	24.8	26.5	28.8	Conducted

**EGPRS - Calculated Average Power With consideration for Uplink time slots:**

Channel Number	Frequency (MHZ)	EGPRS TX Power before Test (dBm) 4Uplink	EGPRS TX Power before Test (dBm) 3Uplink	EGPRS TX Power before Test (dBm) 2Uplink	EGPRS TX Power before Test (dBm) 1Uplink	Note
128	824.2	23.6	23.5	23.5	23.0	Conducted
189	836.4	23.8	23.7	24.0	23.3	Conducted
251	848.8	23.8	23.7	23.9	23.2	Conducted
512	1850.2	20.6	20.4	20.4	19.7	Conducted
660	1879.8	20.6	20.5	20.5	19.8	Conducted
810	1909.8	20.7	20.5	20.5	19.8	Conducted

**Note:****Scale factor for uplink time slot:**

- 1 Uplink: time slot ratio = 8:1 =>  $10 \log(8/1) = 9.00 \text{ dB}$
- 2 Uplink: time slot ratio = 8:2 =>  $10 \log(8/2) = 6.02 \text{ dB}$
- 3 Uplink: time slot ratio = 8:3 =>  $10 \log(8/3) = 4.26 \text{ dB}$
- 4 Uplink: time slot ratio = 8:4 =>  $10 \log(8/4) = 3.00 \text{ dB}$

**Conducted Average Power Measurement (Continued)****Wi-Fi802.11b/g/n****802.11b/g**

Channel Number	Frequency (MHz)	TX Power before Test (dBm)	Note
1	2412.0	13.2	<b>2.4GHz 802.11b</b> (1Mbps)
6	2437.0	13.7	
11	2462.0	13.8	
1	2412.0	12.6	<b>2.4GHz 802.11b</b> (11Mbps)
6	2437.0	13.3	
11	2462.0	13.4	
1	2412.0	11.7	<b>2.4GHz 802.11g</b> (6Mbps)
6	2437.0	11.6	
11	2462.0	12.4	
1	2412.0	10.6	<b>2.4GHz 802.11g</b> (54Mbps)
6	2437.0	11.5	
11	2462.0	11.6	

**802.11n.**

Channel Number	Frequency (MHz)	TX Power before Test (dBm)	Note
1	2412.0	11.3	<b>2.4GHz 802.11n</b> (6.5Mbps)
6	2437.0	12.3	
11	2462.0	12.3	

## 8. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently, the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor, such that a confidence level of approximately 95% is maintained. For the purposes of this document "approximately" is interpreted as meaning "effectively" or "for most practical purposes".

Test Name	Confidence Level	Calculated Uncertainty
Specific Absorption Rate-GSM 850 Head Configuration 1g	95%	19.94
Specific Absorption Rate-GSM / GPRS / EGPRS850 Body Configuration 1g	95%	20.07
Specific Absorption Rate-PCS 1900 Head Configuration 1g	95%	20.72
Specific Absorption Rate-PCS / GPRS / EGPRS1900 Body Configuration 1g	95%	20.00
Specific Absorption Rate-Wi-Fi 2450 Head Configuration 1g	95%	19.47
Specific Absorption Rate-Wi-Fi 2450 Body Configuration 1g	95%	19.90

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty, the published guidance of the appropriate accreditation body is followed.

## 8.1. Specific Absorption Rate Uncertainty -GSM 850 Head Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	c <sub>i</sub> (10 <sup>3</sup> )	Standard Uncertainty		v <sub>i</sub> or v <sub>eff</sub>
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration / Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	2.400	2.400	normal (k=1)	1.0000	1.0000	2.400	2.400	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	4.920	4.920	normal (k=1)	1.0000	0.6400	3.149	3.149	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	4.970	4.970	normal (k=1)	1.0000	0.6000	2.982	2.982	5
	Combined standard uncertainty			t-distribution			10.17	10.17	>250
	Expanded uncertainty			k = 1.96			19.94	19.94	>250

## 8.2. Specific Absorption Rate-GSM / GPRS / EGPRS 850 Body Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	C <sub>i</sub> (10 <sup>3</sup> )	Standard Uncertainty		v <sub>i</sub> or v <sub>eff</sub>
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration /Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	2.900	2.900	normal (k=1)	1.0000	1.0000	2.900	2.900	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	4.690	4.690	normal (k=1)	1.0000	0.6400	3.002	3.002	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	4.860	4.860	normal (k=1)	1.0000	0.6000	2.916	2.916	5
	Combined standard uncertainty			t-distribution			10.24	10.24	>250
	Expanded uncertainty			k = 1.96			20.07	20.07	>250

## 8.3. Specific Absorption Rate-PCS 1900 Head Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	C <sub>i</sub> (10 <sup>3</sup> )	Standard Uncertainty		v <sub>i</sub> or v <sub>eff</sub>
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with Regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration / Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	3.800	3.800	normal (k=1)	1.0000	1.0000	3.800	3.800	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	4.900	4.900	normal (k=1)	1.0000	0.6400	3.136	3.136	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	4.880	4.880	normal (k=1)	1.0000	0.6000	2.928	2.928	5
	Combined standard uncertainty			t-distribution			10.57	10.57	>200
	Expanded uncertainty			k = 1.96			20.72	20.72	>200

## 8.4. Specific Absorption Rate-PCS / GPRS / EGPRS 1900 Body Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	C <sub>i</sub> (10 <sup>3</sup> )	Standard Uncertainty		v <sub>i</sub> or v <sub>eff</sub>
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration / Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	2.500	2.500	normal (k=1)	1.0000	1.0000	2.500	2.500	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	4.940	4.940	normal (k=1)	1.0000	0.6400	3.162	3.162	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	4.980	4.980	normal (k=1)	1.0000	0.6000	2.988	2.988	5
	Combined standard uncertainty			t-distribution			10.20	10.20	>250
	Expanded uncertainty			k = 1.96			20.00	20.00	>250

## 8.5. Specific Absorption Rate-Wi-Fi 2450 Head Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	C <sub>i</sub> (10 <sup>3</sup> )	Standard Uncertainty		v <sub>i</sub> or v <sub>eff</sub>
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration / Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	2.000	2.000	normal (k=1)	1.0000	1.0000	2.000	2.000	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	4.410	4.410	normal (k=1)	1.0000	0.6400	2.822	2.822	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	4.930	4.930	normal (k=1)	1.0000	0.6000	2.958	2.958	5
	Combined standard uncertainty			t-distribution			9.93	9.93	>300
	Expanded uncertainty			k = 1.96			19.47	19.47	>300

## 8.6. Specific Absorption Rate-Wi-Fi 2450 Body Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	C <sub>i</sub> (10 <sup>3</sup> )	Standard Uncertainty		v <sub>i</sub> or v <sub>eff</sub>
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration / Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	2.570	2.570	normal (k=1)	1.0000	1.0000	2.570	2.570	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	4.900	4.900	normal (k=1)	1.0000	0.6400	3.136	3.136	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	4.920	4.920	normal (k=1)	1.0000	0.6000	2.952	2.952	5
	Combined standard uncertainty			t-distribution			10.15	10.15	>250
	Expanded uncertainty			k = 1.96			19.90	19.90	>250

## Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
A034	Narda 20W Termination	Narda	374BNM	8706	Calibrated as part of system	-
A1097	SMA Directional Coupler	MiDISCO	MDC6223-30	None	Calibrated as part of system	-
A1137	3dB Attenuator	Narda	779	04690	Calibrated as part of system	-
A1174	Dielectric Probe Kit	Agilent Technologies	85070C	Us99360072	Calibrated before use	-
A1328	Handset Positioner	Schmid & Partner Engineering AG	Modification	SD 000 H01 DA	-	-
A1182	Handset Positioner	Schmid & Partner Engineering AG	V3.0	None	-	-
A1234	Data Acquisition Electronics	Schmid & Partner Engineering AG	DAE3	450	09 Feb 2011	12
A1235	900 MHz Dipole Kit	Schmid & Partner Engineering AG	D900V2	124	09 Feb 2011	24
A1237	1900 MHz Dipole Kit	Schmid & Partner Engineering AG	D1900V2	540	08 Feb 2011	24
A1322	2450 MHz Dipole Kit	Schmid & Partner Engineering AG	D2450V2	725	08 Feb 2011	24
A1238	SAM Phantom	Schmid & Partner Engineering AG	SAM b	001	Calibrated before use	-
L1036	Probe	Schmid & Partner Engineering AG	ET3 DV6	1611	12 May 2011	12
A1497	Amplifier	Mini-Circuits	zhl-42w (sma)	e020105	Calibrated as part of system	-
A1566	SAM Phantom	Schmid & Partner Engineering AG	SAM a	002	Calibrated before use	-
A1990	Digital Camera	Samsung	E515	A23WC90 8A05431K	-	-
A215	20 dB Attenuator	Narda	766-20	9402	Calibrated as part of system	-
A1531	Antenna	AARONIA AG	7025	02458	-	-
C1042	Network Analyzer Cable	Agilent	8120-4779	349	-	-
C1145	Cable	Rosenberger MICRO-COAX	FA147A F003003030	41843-1	Calibrated as part of system	-

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
C1146	Cable	Rosenberger MICRO-COAX	FA147A F030003030	41752-1	Calibrated as part of system	-
G0528	Robot Power Supply	Schmid & Partner Engineering AG	DASY4	None	Calibrated before use	-
G087	PSU	Thurlby Thandar	CPX200	100701	Calibrated before use	-
M1015	Network Analyser	Agilent Technologies	8753ES	US39172406	27 Sept 2010	12
M1047	Robot Arm	Staubli	RX908 L	F00/SD8 9A1/A/01	Calibrated before use	-
M1159*	Signal Generator	Agilent Technologies	E8241A	US42110332	Internal Checked 15 August 2011	4
M1071	Spectrum Analyzer	Agilent	HP8590E	3647U00514	(Monitoring use only)	-
M1044	Diode Power Sensor	Rohde & Schwarz	NRV-Z1	893350/019	26 May 2011	12
M265	Diode Power Sensor	Rohde & Schwarz	NRV-Z1	893350/017	26 May 2011	12
M263	Dual Channel Power Meter	Rohde & Schwarz	NRVD	826558/004	25 May 2011	12
M509	Thermometer	Testo 110 Immersion Probe & Thermometer	Testo 110	03100047	25 May 2011	12
M1270	Digital Thermometer	RS	N/A	N/A	Internal Checked 13 May 2011	12
S256	SAR Lab	RFI	Site 56	N/A	Calibrated before use	-

### **A.1.1. Calibration Certificates**

This section contains the calibration certificates and data for the Probe(s) and Dipole(s) used, which are not included in the total number of pages for this report.

Asset: A1235 Checked by *DK*  
21/02/2011

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



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

Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

Client

**RFI**

Certificate No: **D900V2-124 Feb11**

## CALIBRATION CERTIFICATE

Object **D900V2 - SN: 124**

Calibration procedure(s) **QA CAL-05.v8**  
Calibration procedure for dipole validation kits

Calibration date: **February 09, 2011**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

Calibrated by: Name **Dimce Iliev** Function **Laboratory Technician**

*D. Iliev*

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

*K. Pokovic*

Issued: February 9, 2011

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



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

### **Glossary:**

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

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

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

### **Additional Documentation:**

- d) DASY4/5 System Handbook

### **Methods Applied and Interpretation of Parameters:**

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

## Measurement Conditions

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

<b>DASY Version</b>	DASY5	V52.6
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Modular Flat Phantom V4.9	
<b>Distance Dipole Center - TSL</b>	15 mm	with Spacer
<b>Zoom Scan Resolution</b>	$dx, dy, dz = 5 \text{ mm}$	
<b>Frequency</b>	$900 \text{ MHz} \pm 1 \text{ MHz}$	

## Head TSL parameters

The following parameters and calculations were applied.

	<b>Temperature</b>	<b>Permittivity</b>	<b>Conductivity</b>
<b>Nominal Head TSL parameters</b>	22.2 °C	41.5	0.97 mho/m
<b>Measured Head TSL parameters</b>	$(22.0 \pm 0.2) \text{ °C}$	$40.3 \pm 6 \text{ %}$	$0.95 \text{ mho/m} \pm 6 \text{ %}$
<b>Head TSL temperature during test</b>	$(21.5 \pm 0.2) \text{ °C}$	----	----

## SAR result with Head TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	<b>Condition</b>	
SAR measured	250 mW input power	2.72 mW / g
SAR normalized	normalized to 1W	10.9 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>11.0 mW /g ± 17.0 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	<b>Condition</b>	
SAR measured	250 mW input power	1.74 mW / g
SAR normalized	normalized to 1W	6.96 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>7.01 mW /g ± 16.5 % (k=2)</b>

## Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Body TSL parameters</b>	22.0 °C	55.0	1.05 mho/m
<b>Measured Body TSL parameters</b>	(22.0 ± 0.2) °C	53.6 ± 6 %	1.05 mho/m ± 6 %
<b>Body TSL temperature during test</b>	(21.8 ± 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	2.79 mW / g
SAR normalized	normalized to 1W	11.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	11.1 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.79 mW / g
SAR normalized	normalized to 1W	7.16 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	7.14 mW / g ± 16.5 % (k=2)

## Appendix

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.9 $\Omega$ - 8.2 $j\Omega$
Return Loss	- 21.6 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.1 $\Omega$ - 8.6 $j\Omega$
Return Loss	- 20.2 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.409 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	July 04, 2001

# DASY5 Validation Report for Head TSL

Date/Time: 09.02.2011 11:44:15

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:124**

Communication System: CW; Frequency: 900 MHz; Duty Cycle: 1:1

Medium: HSL900

Medium parameters used:  $f = 900$  MHz;  $\sigma = 0.95$  mho/m;  $\epsilon_r = 40.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.88, 5.88, 5.88); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

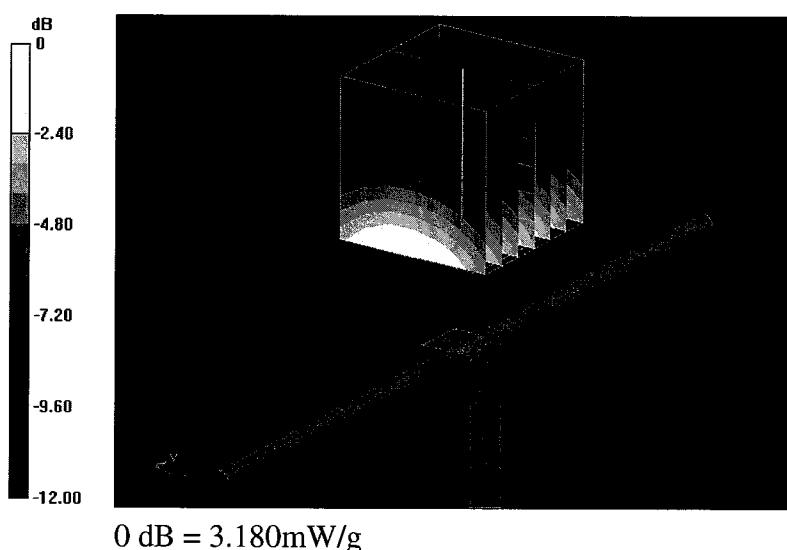
**Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 59.560 V/m; Power Drift = 0.03 dB

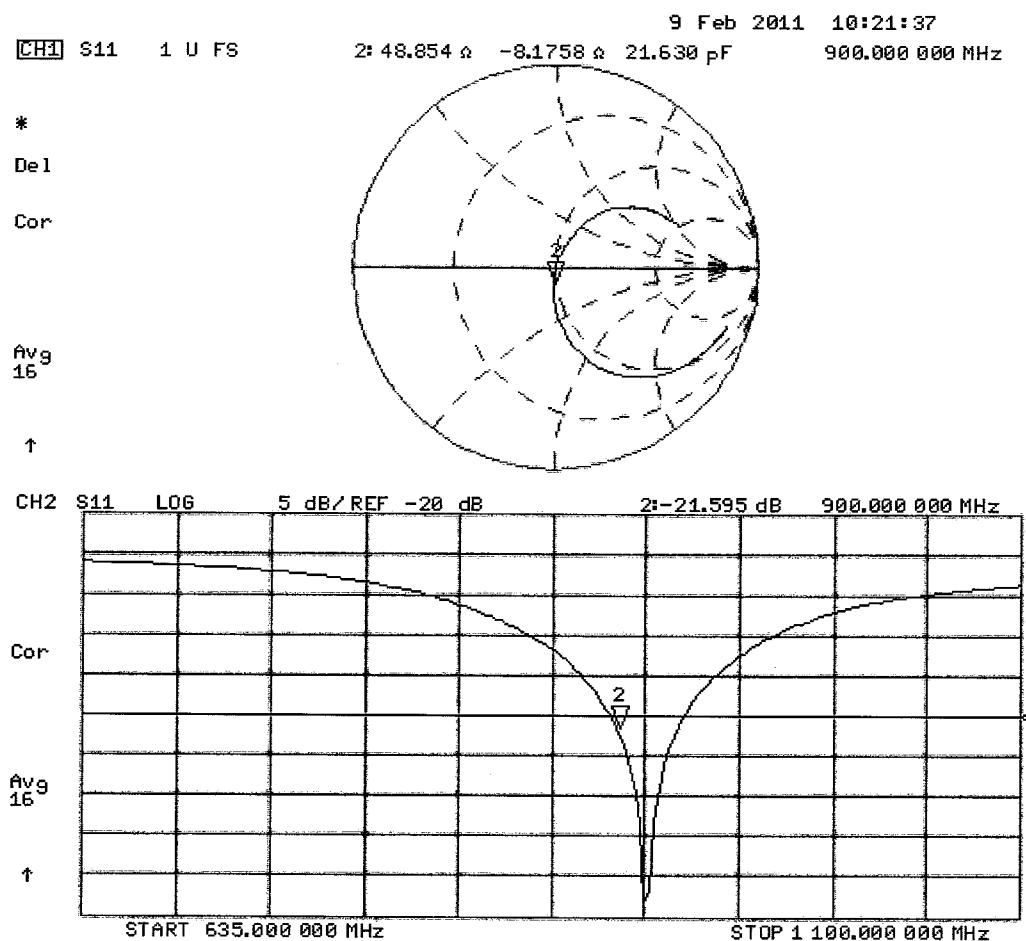
Peak SAR (extrapolated) = 4.135 W/kg

**SAR(1 g) = 2.72 mW/g; SAR(10 g) = 1.74 mW/g**

Maximum value of SAR (measured) = 3.183 mW/g



## Impedance Measurement Plot for Head TSL



# DASY5 Validation Report for Body TSL

Date/Time: 09.02.2011 14:54:48

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:124**

Communication System: CW; Frequency: 900 MHz; Duty Cycle: 1:1

Medium: M900

Medium parameters used:  $f = 900$  MHz;  $\sigma = 1.05$  mho/m;  $\epsilon_r = 53.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.81, 5.81, 5.81); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

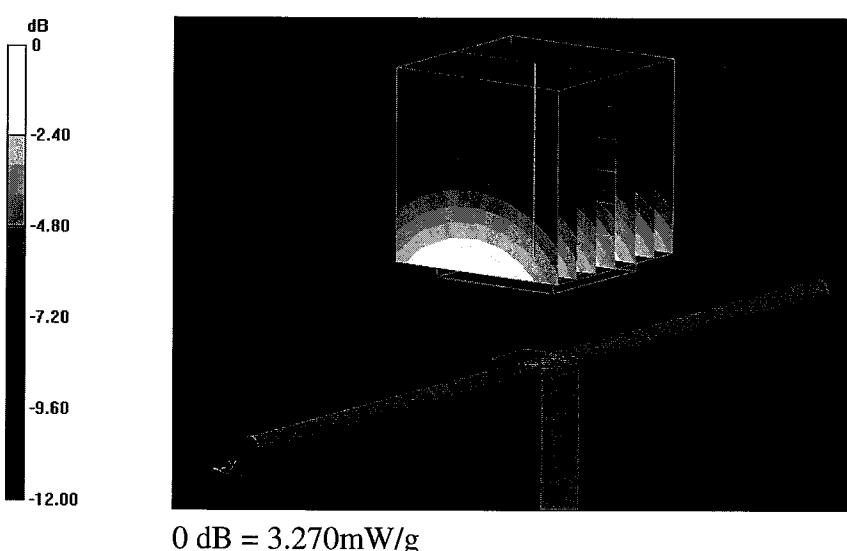
**Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.520 V/m; Power Drift = 0.01 dB

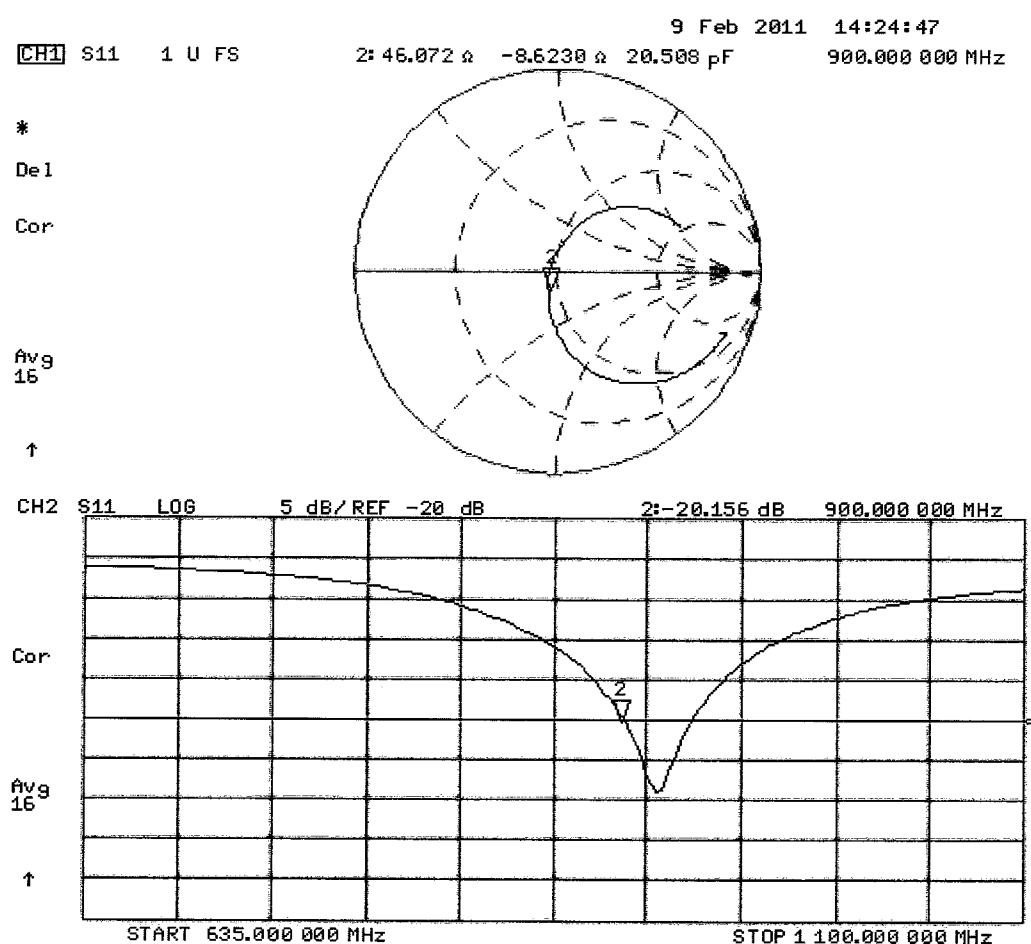
Peak SAR (extrapolated) = 4.203 W/kg

**SAR(1 g) = 2.79 mW/g; SAR(10 g) = 1.79 mW/g**

Maximum value of SAR (measured) = 3.271 mW/g



## Impedance Measurement Plot for Body TSL



Asset: A1237 - Checked by *KH*

21/02/2011

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



S Schweizerischer Kalibrierdienst  
C Service suisse d'étalonnage  
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S Swiss Calibration Service

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Accreditation No.: SCS 108

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Client

RFI

Certificate No.: D1900V2-540\_Feb11

## CALIBRATION CERTIFICATE

Object D1900V2 - SN: 540

Calibration procedure(s)  
QA CAL-05.v8  
Calibration procedure for dipole validation kits

Calibration date: February 08, 2011

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11

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

Calibrated by:	Name	Function	Signature
	Dimce Iliev	Laboratory Technician	<i>D. Iliev</i>
Approved by:	Katja Pokovic	Technical Manager	<i>K. Pokovic</i>

Issued: February 8, 2011

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Accreditation No.: **SCS 108**

### **Glossary:**

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

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

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

### **Additional Documentation:**

- d) DASY4/5 System Handbook

### **Methods Applied and Interpretation of Parameters:**

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

## Measurement Conditions

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

<b>DASY Version</b>	DASY5	V52.6
<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 $\pm$ 1 MHz	

## Head TSL parameters

The following parameters and calculations were applied.

	<b>Temperature</b>	<b>Permittivity</b>	<b>Conductivity</b>
<b>Nominal Head TSL parameters</b>	22.0 °C	40.0	1.40 mho/m
<b>Measured Head TSL parameters</b>	(22.0 $\pm$ 0.2) °C	39.8 $\pm$ 6 %	1.41 mho/m $\pm$ 6 %
<b>Head TSL temperature during test</b>	(21.0 $\pm$ 0.2) °C	----	----

## SAR result with Head TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	<b>Condition</b>	
SAR measured	250 mW input power	10.1 mW / g
SAR normalized	normalized to 1W	40.4 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	40.3 mW / g $\pm$ 17.0 % (k=2)

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	<b>Condition</b>	
SAR measured	250 mW input power	5.25 mW / g
SAR normalized	normalized to 1W	21.0 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	21.0 mW / g $\pm$ 16.5 % (k=2)

## 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	52.8 ± 6 %	1.55 mho/m ± 6 %
<b>Body TSL temperature during test</b>	(21.2 ± 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>40.7 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	5.43 mW / g
SAR normalized	normalized to 1W	21.7 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>21.6 mW / g ± 16.5 % (k=2)</b>

## Appendix

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	$50.5 \Omega + 4.2 j\Omega$
Return Loss	- 27.6 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	$45.6 \Omega + 5.0 j\Omega$
Return Loss	- 23.1 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.195 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	July 26, 2001

# DASY5 Validation Report for Head TSL

Date/Time: 07.02.2011 15:18:47

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:540**

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

Medium: HSL U12 BB

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.41$  mho/m;  $\epsilon_r = 39.9$ ;  $\rho = 1000$  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, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

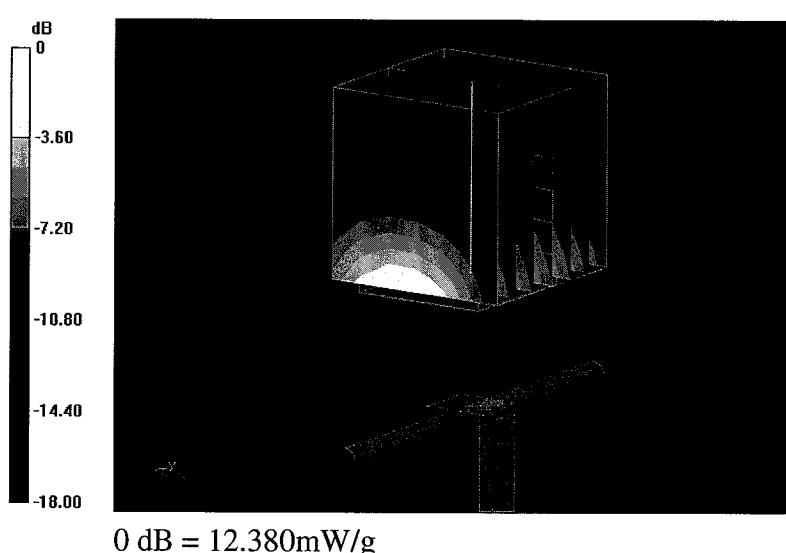
**Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.936 V/m; Power Drift = 0.04 dB

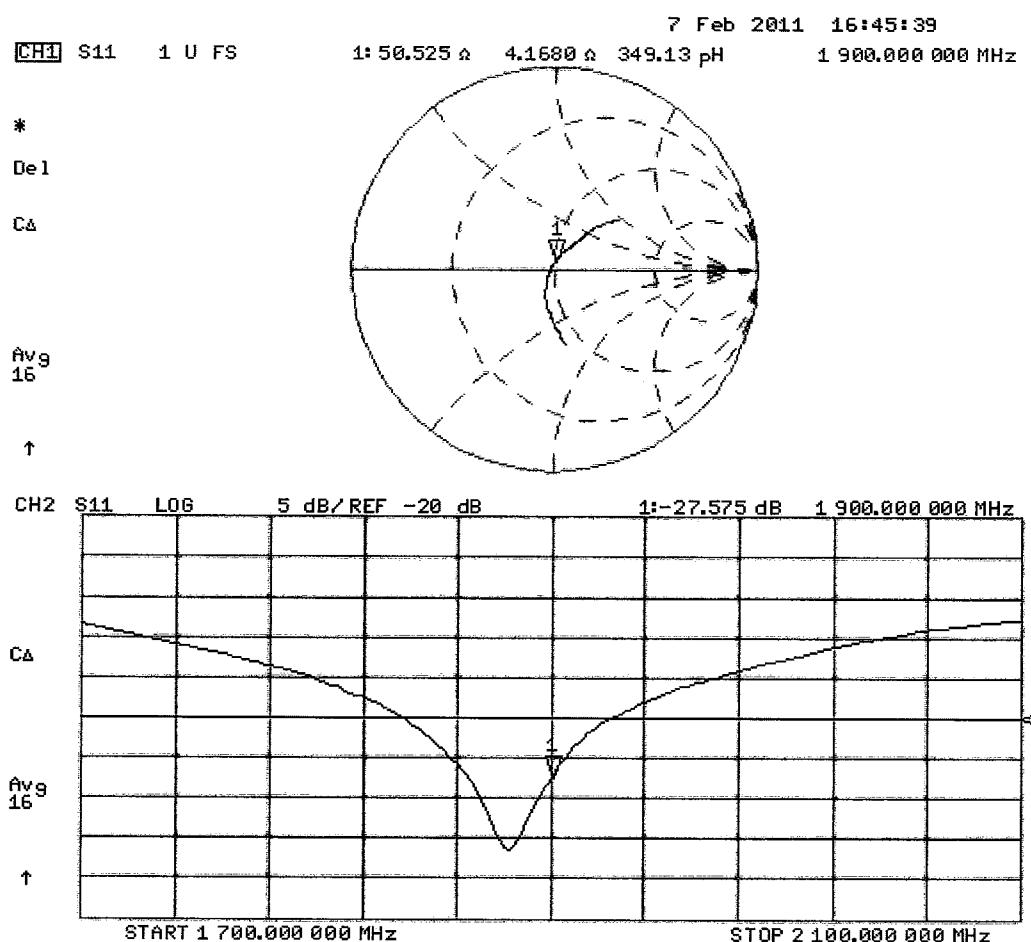
Peak SAR (extrapolated) = 18.544 W/kg

**SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.25 mW/g**

Maximum value of SAR (measured) = 12.384 mW/g



## Impedance Measurement Plot for Head TSL



# DASY5 Validation Report for Body TSL

Date/Time: 08.02.2011 12:04:35

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:540**

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

Medium: MSL U12 BB

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.55$  mho/m;  $\epsilon_r = 52.9$ ;  $\rho = 1000$  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, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

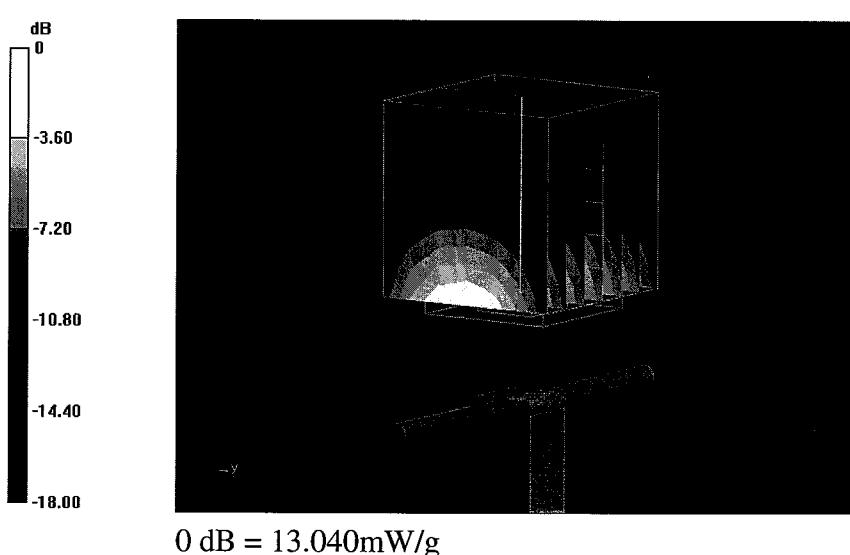
**Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.899 V/m; Power Drift = -0.03 dB

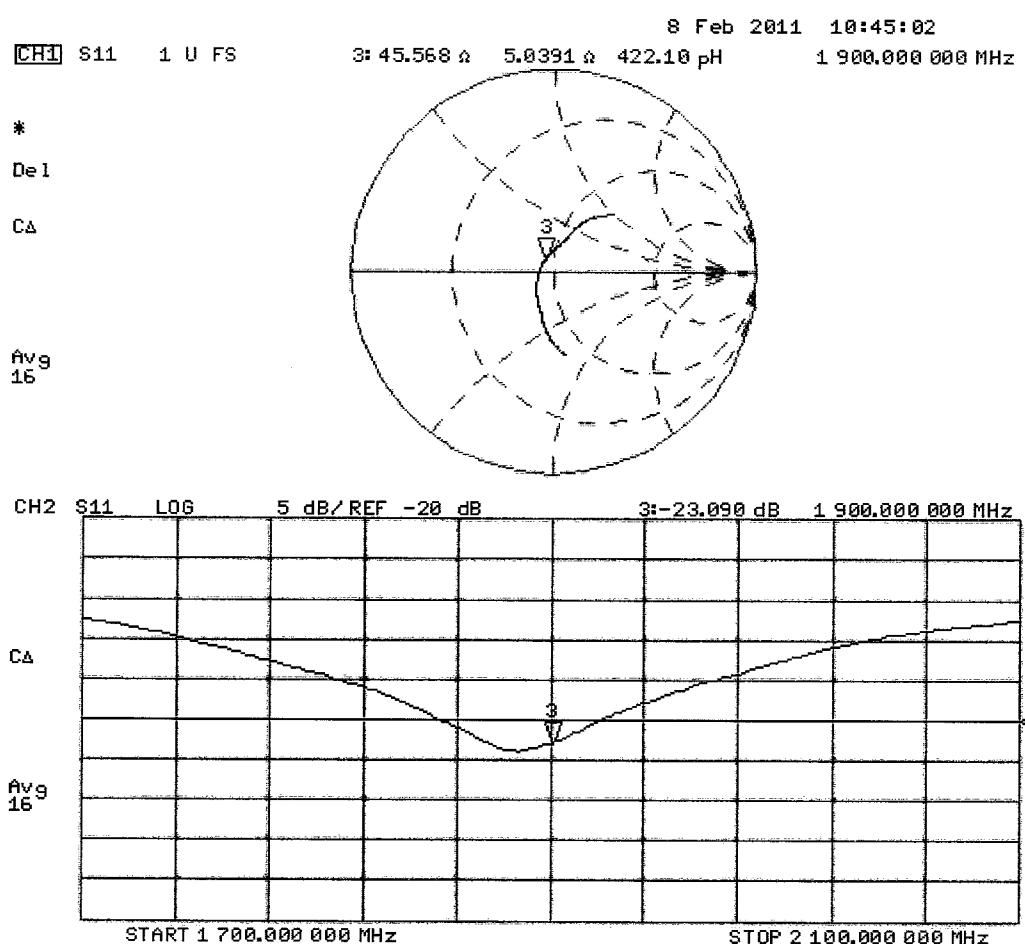
Peak SAR (extrapolated) = 17.597 W/kg

**SAR(1 g) = 10.3 mW/g; SAR(10 g) = 5.43 mW/g**

Maximum value of SAR (measured) = 13.038 mW/g



## Impedance Measurement Plot for Body TSL



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



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Accreditation No.: **SCS 108**

Client

**Sony Ericsson UK**

Certificate No: **ET3-1611\_May11**

## CALIBRATION CERTIFICATE

Object **ET3DV6 - SN:1611**

Calibration procedure(s) **QA CAL-01.v7, QA CAL-23.v4, QA CAL-25.v3**  
 Calibration procedure for dosimetric E-field probes

Calibration date: **May 12, 2011**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature  $(22 \pm 3)^\circ\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	31-Mar-11 (No. 217-01372)	Apr-12
Power sensor E4412A	MY41498087	31-Mar-11 (No. 217-01372)	Apr-12
Reference 3 dB Attenuator	SN: S5054 (3c)	29-Mar-11 (No. 217-01369)	Apr-12
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Reference 30 dB Attenuator	SN: S5129 (30b)	29-Mar-11 (No. 217-01370)	Apr-12
Reference Probe ES3DV2	SN: 3013	29-Dec-10 (No. ES3-3013_Dec10)	Dec-11
DAE4	SN: 654	3-May-11 (No. DAE4-654_May11)	May-12
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

Calibrated by:	Name <b>Jeton Kastrai</b>	Function <b>Laboratory Technician</b>	Signature 
Approved by:	<b>Katja Pokovic</b>	Technical Manager	

Issued: May 16, 2011

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### **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 $\varphi$	$\varphi$ rotation around probe axis
Polarization $\vartheta$	$\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis

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

- 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  $\vartheta = 0$  ( $f \leq 900$  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 affect the E<sup>2</sup>-field uncertainty inside TSL (see below *ConvF*).
- NORM(f)x,y,z = 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*.
- DCPx,y,z**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- Ax,y,z; Bx,y,z; Cx,y,z** are numerical linearization parameters in dB assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media.
- VR**: VR is the validity range of the calibration related to the average diode voltage or DAE voltage in mV.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for  $f \leq 800$  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.

# Probe ET3DV6

**SN:1611**

Manufactured: July 27, 2001  
Calibrated: May 12, 2011

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

## DASY/EASY - Parameters of Probe: ET3DV6 - SN:1611

### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V}/\text{m})^2$ ) <sup>A</sup>	1.74	1.95	1.77	$\pm 10.1\%$
DCP (mV) <sup>B</sup>	96.7	99.3	98.5	

### Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc <sup>E</sup> (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	105.3	$\pm 2.7\%$
			Y	0.00	0.00	1.00	109.8	
			Z	0.00	0.00	1.00	104.6	

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

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

## DASY/EASY - Parameters of Probe: ET3DV6 - SN:1611

### Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>c</sup>	Relative Permittivity <sup>f</sup>	Conductivity (S/m) <sup>f</sup>	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
835	41.5	0.90	6.51	6.51	6.51	0.64	2.00	± 12.0 %
900	41.5	0.97	6.41	6.41	6.41	0.66	1.94	± 12.0 %
1750	40.1	1.37	5.43	5.43	5.43	0.54	2.47	± 12.0 %
1900	40.0	1.40	5.23	5.23	5.23	0.55	2.40	± 12.0 %
2450	39.2	1.80	4.55	4.55	4.55	0.69	1.91	± 12.0 %

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

<sup>f</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

## DASY/EASY - Parameters of Probe: ET3DV6- SN:1611

### Calibration Parameter Determined in Body Tissue Simulating Media

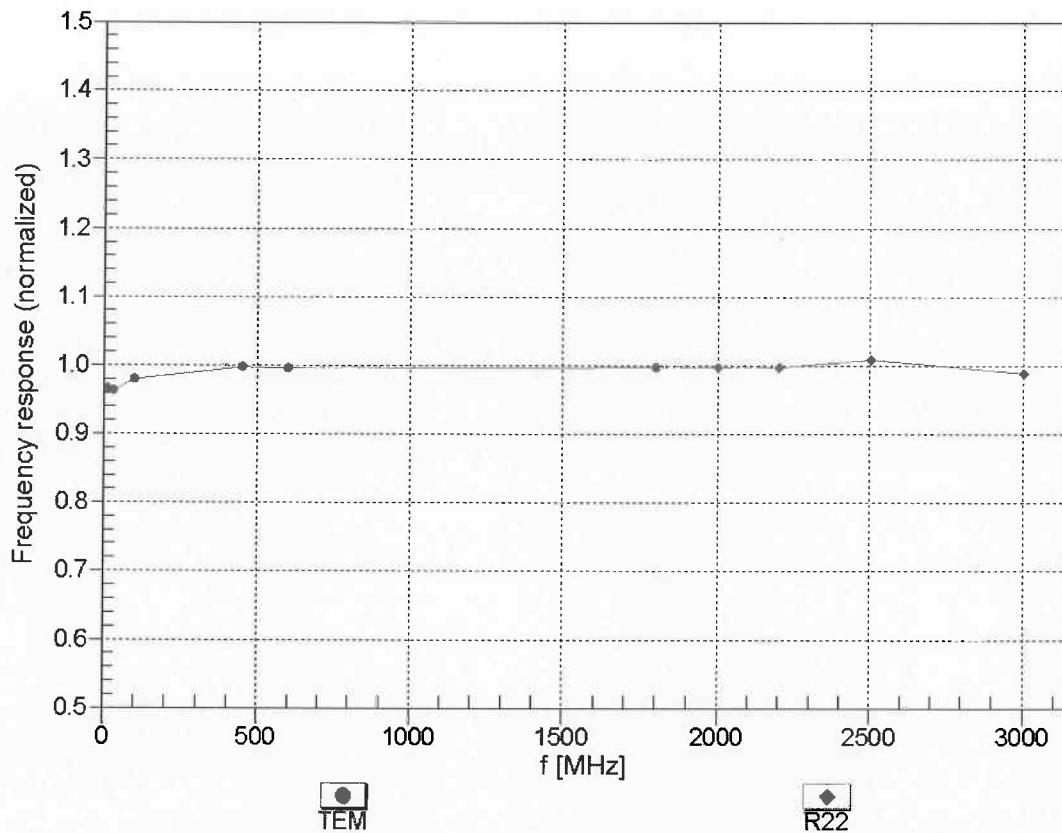
f (MHz) <sup>c</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
835	55.2	0.97	6.40	6.40	6.40	0.72	1.90	± 12.0 %
900	55.0	1.05	6.32	6.32	6.32	0.75	1.85	± 12.0 %
1750	53.4	1.49	4.80	4.80	4.80	0.57	2.77	± 12.0 %
1900	53.3	1.52	4.55	4.55	4.55	0.57	2.59	± 12.0 %
2450	52.7	1.95	4.09	4.09	4.09	1.00	1.22	± 12.0 %

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

<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

## Frequency Response of E-Field

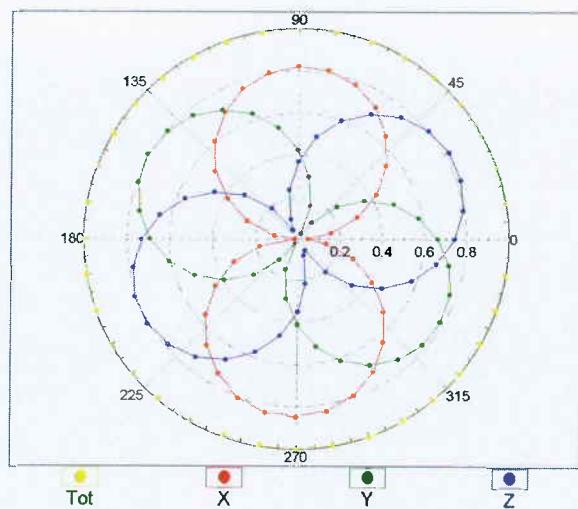
(TEM-Cell:ifi110 EXX, Waveguide: R22)



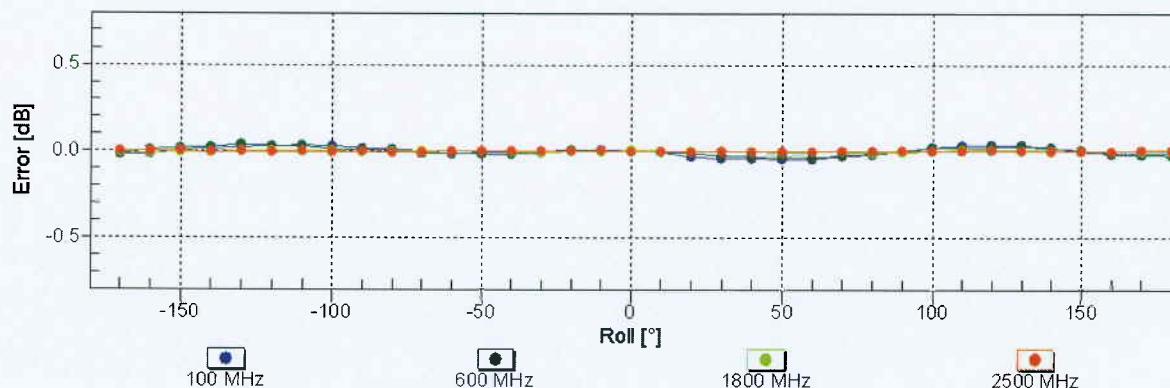
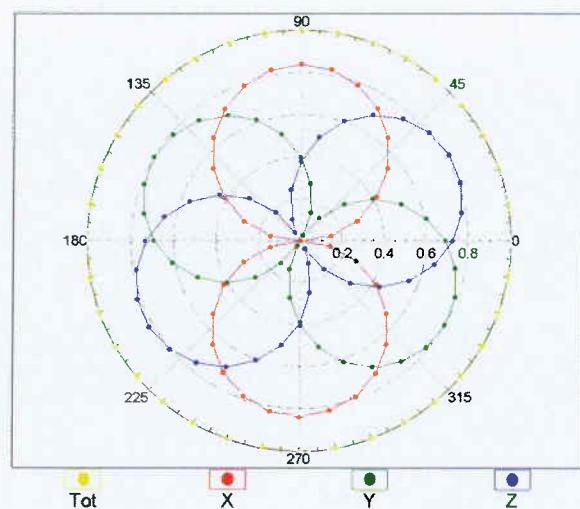
**Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )**

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

f=600 MHz,TEM



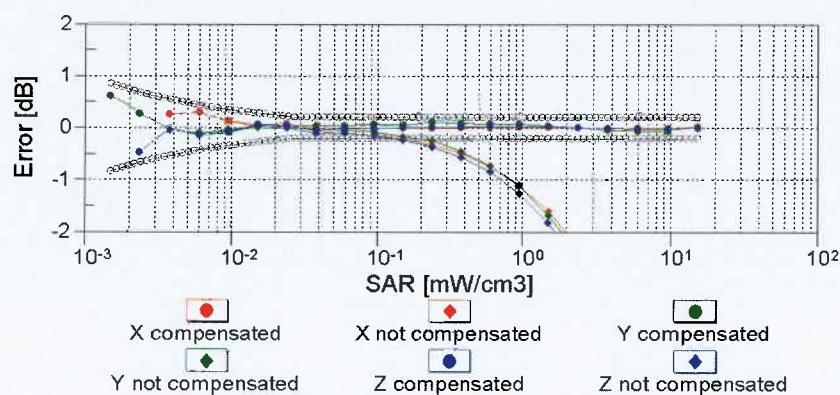
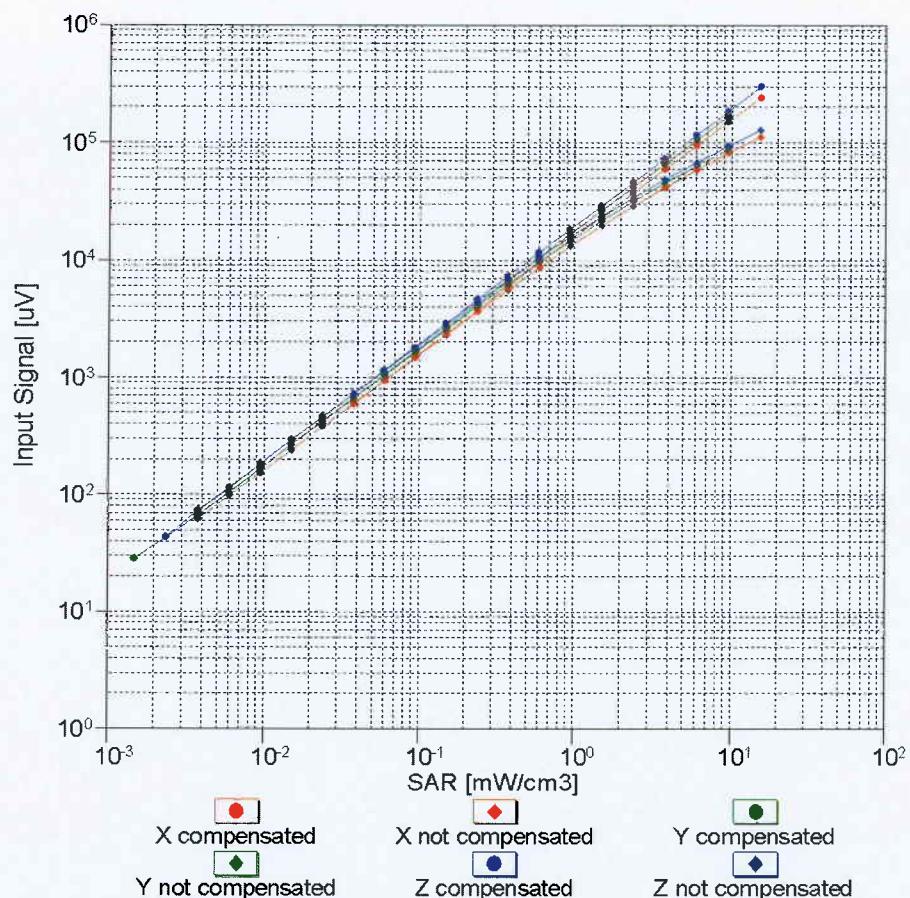
f=1800 MHz,R22



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

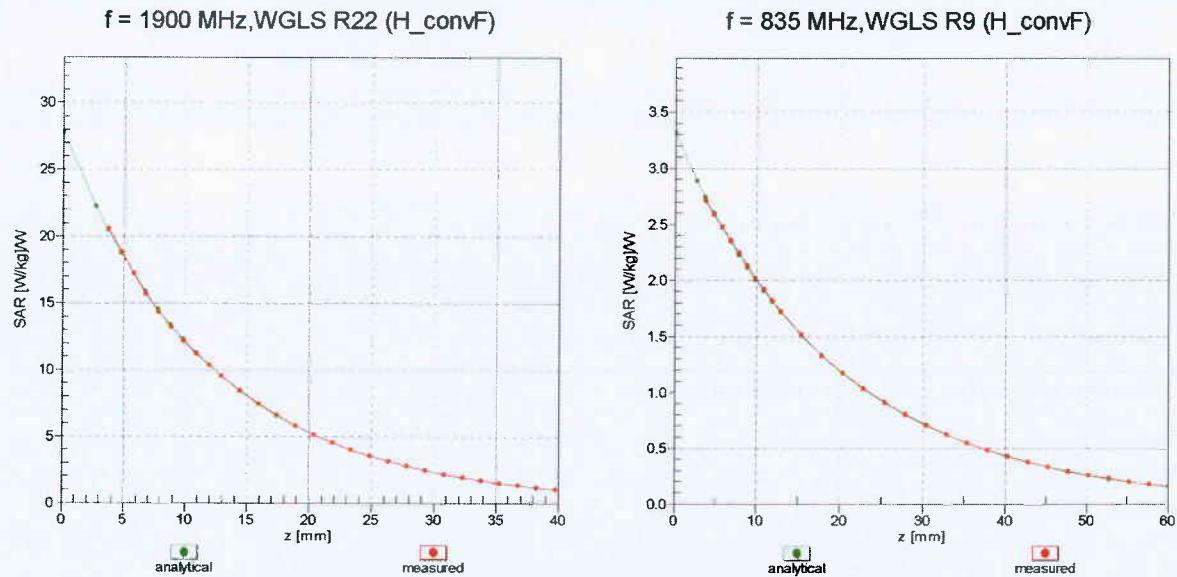
## Dynamic Range f(SAR<sub>head</sub>)

(TEM cell , f = 900 MHz)



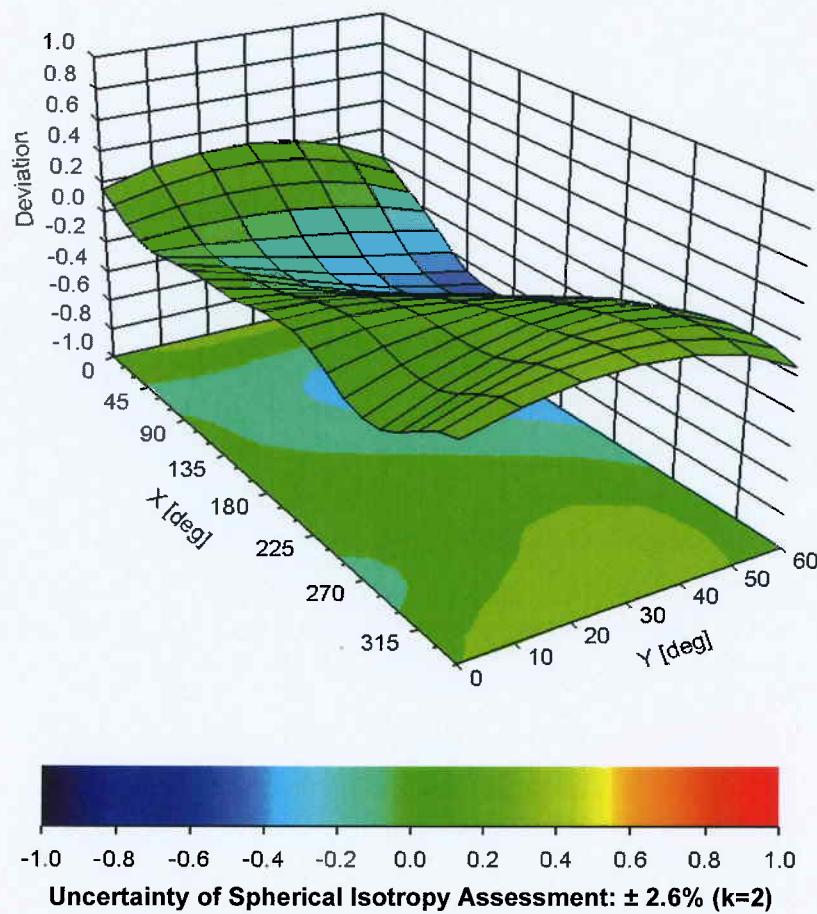
**Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )**

## Conversion Factor Assessment



## Deviation from Isotropy in Liquid

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



## DASY/EASY - Parameters of Probe: ET3DV6 - SN:1611

### Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	6.8 mm
Probe Tip to Sensor X Calibration Point	2.7 mm
Probe Tip to Sensor Y Calibration Point	2.7 mm
Probe Tip to Sensor Z Calibration Point	2.7 mm
Recommended Measurement Distance from Surface	4 mm

ASSET A1322 - Checked by *RFI*

21/02/2011

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



S Schweizerischer Kalibrierdienst  
C Service suisse d'étalonnage  
S Servizio svizzero di taratura  
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Multilateral Agreement for the recognition of calibration certificates

Client

RFI

Accreditation No.: SCS 108

Certificate No.: D2450V2-725 Feb11

## CALIBRATION CERTIFICATE

Object D2450V2 - SN: 725

Calibration procedure(s)  
QA CAL-05.v8  
Calibration procedure for dipole validation kits

Calibration date: February 08, 2011

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

All calibrations have been conducted in the closed laboratory facility: environment temperature  $(22 \pm 3)^\circ\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

Calibrated by:	Name	Function	Signature
	Dimce Iliev	Laboratory Technician	<i>D. Iliev</i>
Approved by:	Katja Pokovic	Technical Manager	<i>K. Pokovic</i>

Issued: February 8, 2011

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



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Accreditation No.: **SCS 108**

### **Glossary:**

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

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

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

### **Additional Documentation:**

- d) DASY4/5 System Handbook

### **Methods Applied and Interpretation of Parameters:**

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TS:* 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 TS parameters:* The measured TS parameters are used to calculate the nominal SAR result.

## Measurement Conditions

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

<b>DASY Version</b>	DASY5	V52.6
<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>	2450 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	39.2	1.80 mho/m
<b>Measured Head TSL parameters</b>	(22.0 ± 0.2) °C	39.1 ± 6 %	1.73 mho/m ± 6 %
<b>Head TSL temperature during test</b>	(21.0 ± 0.2) °C	----	----

## SAR result with Head TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	Condition	
SAR measured	250 mW input power	13.0 mW / g
SAR normalized	normalized to 1W	52.0 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>52.9 mW /g ± 17.0 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	condition	
SAR measured	250 mW input power	6.13 mW / g
SAR normalized	normalized to 1W	24.5 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>24.7 mW /g ± 16.5 % (k=2)</b>

## Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Body TSL parameters</b>	22.0 °C	52.7	1.95 mho/m
<b>Measured Body TSL parameters</b>	(22.0 ± 0.2) °C	52.2 ± 6 %	1.94 mho/m ± 6 %
<b>Body TSL temperature during test</b>	(21.0 ± 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	13.0 mW / g
SAR normalized	normalized to 1W	52.0 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>51.9 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	6.04 mW / g
SAR normalized	normalized to 1W	24.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	<b>24.1 mW / g ± 16.5 % (k=2)</b>

## Appendix

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	$45.6 \Omega + 7.9 j\Omega$
Return Loss	- 20.5 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	$49.5 \Omega + 9.7 j\Omega$
Return Loss	- 20.2 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.152 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	October 16, 2002

# DASY5 Validation Report for Head TSL

Date/Time: 07.02.2011 14:34:55

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:725**

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: HSL U12 BB

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.74$  mho/m;  $\epsilon_r = 39.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

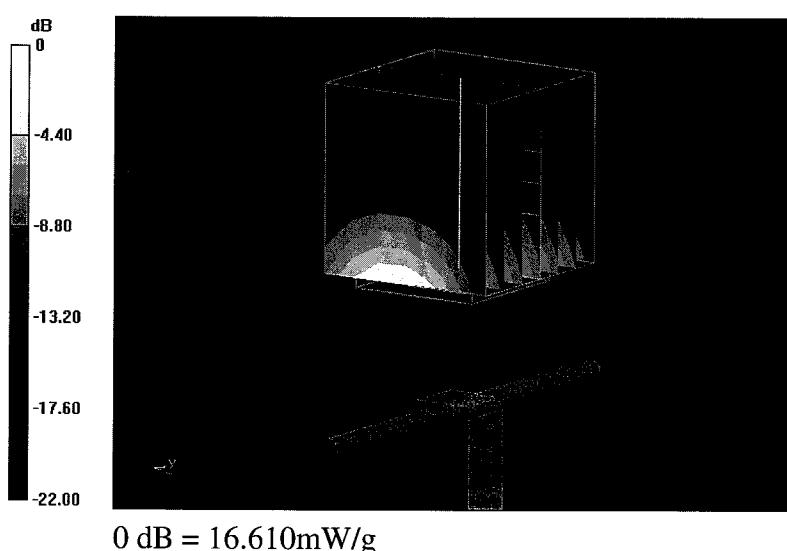
**Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 101.3 V/m; Power Drift = 0.05 dB

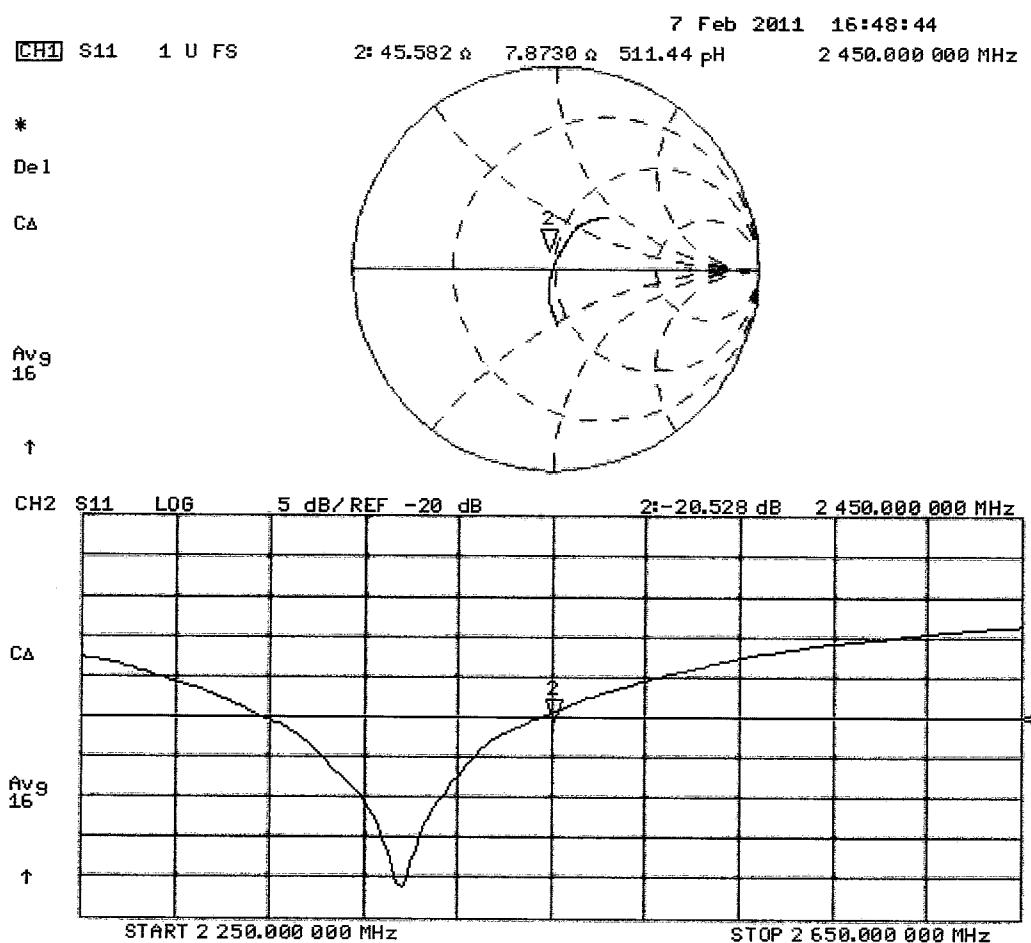
Peak SAR (extrapolated) = 26.701 W/kg

**SAR(1 g) = 13 mW/g; SAR(10 g) = 6.13 mW/g**

Maximum value of SAR (measured) = 16.608 mW/g



## Impedance Measurement Plot for Head TSL



# DASY5 Validation Report for Body TSL

Date/Time: 08.02.2011 12:48:13

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:725**

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: MSL U12 BB

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.95$  mho/m;  $\epsilon_r = 52.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.31, 4.31, 4.31); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

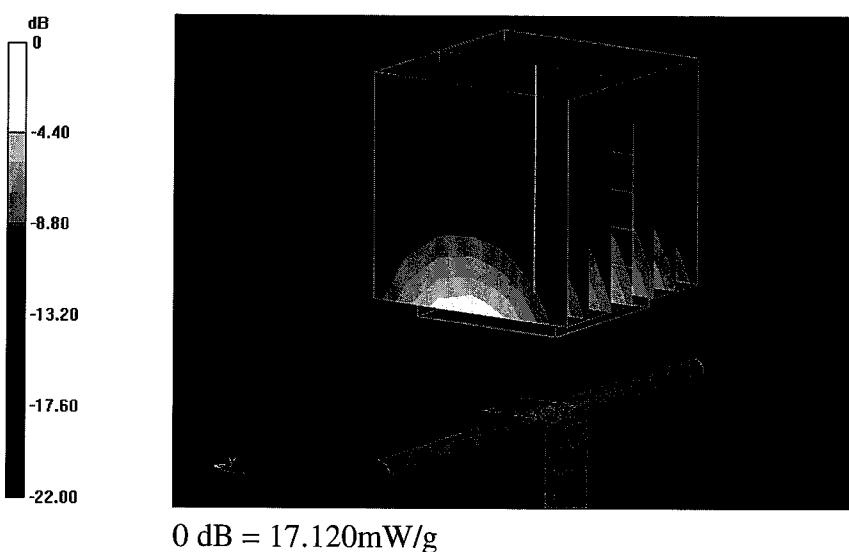
**Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.406 V/m; Power Drift = -0.08 dB

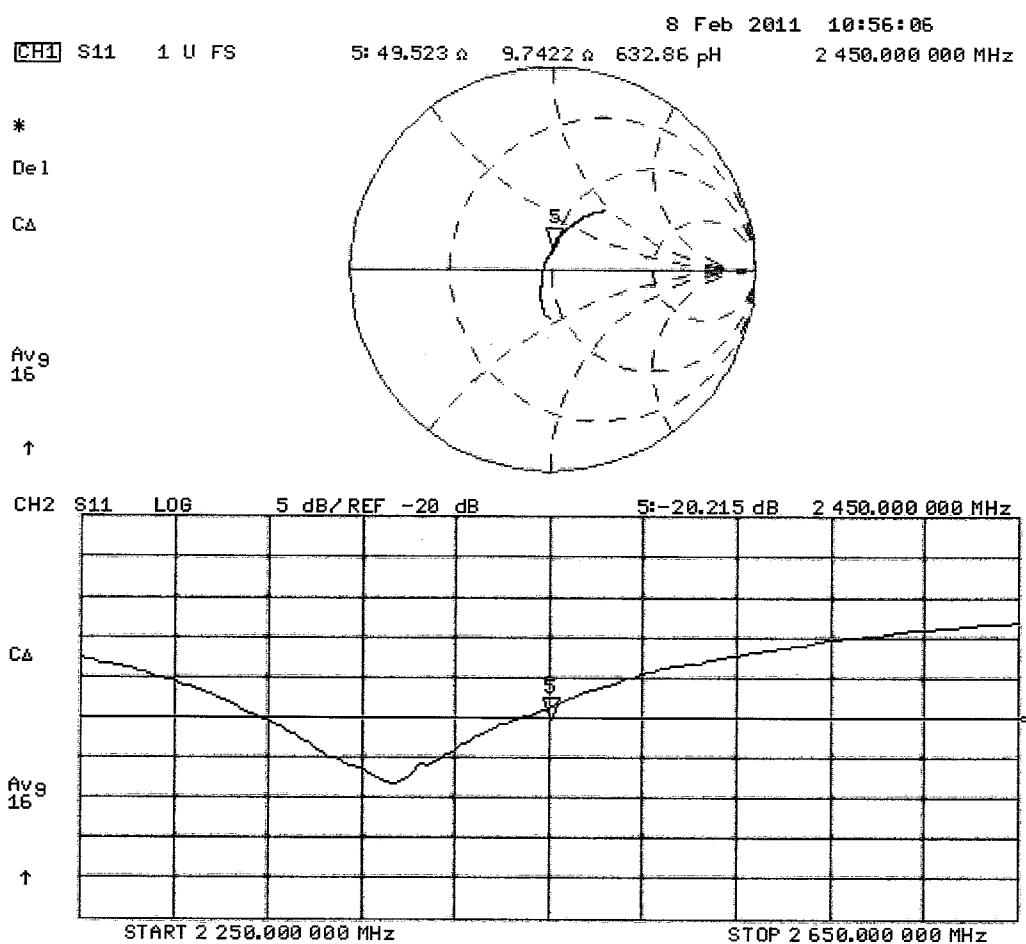
Peak SAR (extrapolated) = 27.401 W/kg

**SAR(1 g) = 13 mW/g; SAR(10 g) = 6.04 mW/g**

Maximum value of SAR (measured) = 17.121 mW/g



## Impedance Measurement Plot for Body TSL



## Appendix 2. Measurement Methods

### A.2.1. Evaluation Procedure

The Specific Absorption Rate (SAR) evaluation was performed in the following manner:

- a) (i) The evaluation was performed in an applicable area of the phantom depending on the type of device being tested. For devices worn about the ear during normal operation, both the left and right ear positions were evaluated at the centre frequency of the band at maximum power. The side, which produced the greatest SAR, determined which side of the phantom would be used for the entire evaluation. The positioning of the head worn device relative to the phantom was dictated by the test specification identified in section 3.1 of this report.  
(ii) For body worn devices or devices which can be operated within 20 cm of the body, the flat section of the SAM phantom was used were the size of the device(s) is normal. for bigger devices and base station the 2mm Oval phantom is used for evaluation. The type of device being evaluated dictated the distance of the EUT to the outer surface of the phantom flat section.
- b) The SAR was determined by a pre-defined procedure within the DASY4 software. The exposed region of the phantom was scanned near the inner surface with a grid spacing of 20mm x 20mm or appropriate resolution.
- c) A 5x5x7 matrix was performed around the greatest spatial SAR distribution found during the area scan of the applicable exposed region. SAR values were then calculated using a 3-D spline interpolation algorithm and averaged over spatial volumes of 1 and 10 grams.
- d) If the EUT had any appreciable drift over the course of the evaluation, then the EUT was re-evaluated. Any unusual anomalies over the course of the test also warranted a re-evaluation.

**A.2.2. Specific Absorption Rate (SAR) Measurements to OET Bulletin 65 Supplement C: (2001-01)**

Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields

SAR measurements were performed in accordance with Appendix D of the standard FCC OET Bulletin 65 Supplement C: 2001, IEEE 1528 and FCC KDB procedures, against appropriate limits for each measurement position in accordance with the standard. In some cases the FCC was contacted using a PBA or KDB process to ensure test is performed correctly.

The test was performed in a shielded enclosure with the temperature controlled to remain between +18.0°C and +25.0°C. The tissue equivalent material fluid temperature was controlled to give a maximum variation of  $\pm 2.0^{\circ}\text{C}$

Prior to any SAR measurements on the EUT, system validation and material dielectric property measurements were conducted. In the absence of a detailed procedure within the specification, system validation and material dielectric property measurements were performed in accordance with Appendix C and Appendix D of FCC OET Bulletin 65 Supplement C: 2001 and FCC KDB publication 450824.

Following the successful system validation and material dielectric property measurements, a SAR versus time sweep shall be performed within 10 mm of the phantom inner surface. If the EUT power output is stable after three minutes then the measurement probe will perform a coarse surface level scan at each test position in order to ascertain the location of the maximum local SAR level. Once this area had been established, a 5x5x7 cube of 175 points (5 mm spacing in each axis  $\approx 27\text{g}$ ) will be centred at the area of concern. Extrapolation and interpolation will then be carried out on the 27g of tissue and the highest averaged SAR over a 10g cube determined.

Once the maximum interpolated SAR measurement is complete; the coarse scan is visually assessed to check for secondary peaks within 50% of the maximum SAR level. If there are any further SAR measurements required, extra 5x5x7 cubes shall be centred on each of these extra local SAR maxima.

At the end of each position test case a second time sweep shall be performed to check whether the EUT has remained stable throughout the test.