TEST REPORT

TEST REPORT
FROM
RFI GLOBAL SERVICES LTD

Test of: SO-04D

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

Test Report Serial No:
RFI-SAR-RP86599JD02A V1.0

This Test Report Is Issued Under The Authority Of Chris Guy, Head of Global Approvals:	(APPROVED SIGNATORY)
Checked By: Richelieu Quoi	(APPROVED SIGNATORY)
Issue Date:	**21 May 2012**
Test Dates:	**10 April to 18 May 2012**

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1. Customer Information

Company Name:	Sony Mobile Communications AB
Address:	Nya Vattentornet 22188 Lund Sweden

2. Equipment Under Test (EUT)

2.1. Identification of Equipment Under Test (EUT)

Description:	Mobile Handset
Brand Name:	Sony
Model Name or Number:	SO-04D
Serial Number:	CB5A1JYNEP
Type Number:	PM-0000-BV
IMEI Number:	004402450093590
Hardware Version Number:	AP1
Software Version Number:	7.0.A.0.474
Hardware Revision of GSM Module:	None Specified
Software Revision of GSM Module:	None Specified
FCC ID Number:	PY7PM-0000
Country of Manufacture:	China
Date of Receipt:	10 April 2012

Note(s):

This sample was used to perform 2G and 3G SAR evaluation and conducted power measurements 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"

Identification of Equipment Under Test (EUT) (Continued)

Description:	Mobile Handset
Brand Name:	Sony
Model Name or Number:	SO-04D
Serial Number:	CB5A1JYNF1
Type Number:	PM-0000-BV
IMEI Number:	004402450093517
Hardware Version Number:	AP1
Software Version Number:	ETS0.0.37b
Hardware Revision of GSM Module:	None Specified
Software Revision of GSM Module:	None Specified
FCC ID Number:	PY7PM-0000
Country of Manufacture:	China
Date of Receipt:	10 April 2012

Note(s):

This sample was used to perform WLAN SAR evaluation and conducted power measurements 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"

2.2. Description of EUT

The Equipment Under Test is a Mobile Phone with GSM 2G quad band, 3G quad band, LTE Band I and Wi-Fi bands. The EUT has GPRS Class 12 / EDGE Class 12, UMTS FDD I, V, VI and XIX with HSPA, LTE QPSK / 16QAM uplink modulation 5 MHz / 10 MHz / 15 MHz / 20 MHz BW channel, WLAN 802.11 a/b/g/n, *Bluetooth Class 1*, 'Wi-Fi Hotspot' mode capabilities.

2.3. Modifications Incorporated in the EUT

EUT (IMEI: 004402450093590) was setup for WWAN SAR test and conducted power measurements only.
EUT (IMEI: 004402450093517) was setup for WLAN SAR test and conducted power measurements only.

2.4. Accessories

The following accessories were supplied with the EUT during testing:

Description:	Battery
Brand Name:	Sony
Model Name or Number:	BA900
Type:	None Stated
Serial Number:	001695TWXORS
Cable Length and Type:	Not Applicable
Country of Manufacture:	China
Connected to Port	5 Pin contact

Description:	Personal Hands Free (PHF)
Brand Name:	Sony
Model Name or Number:	MH750
Type:	CCA-0004018
Serial Number:	12060C130061844
Cable Length and Type:	~1.35 m
Country of Manufacture:	China
Connected to Port	3.5mm Audio jack and custom type

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

2.5. Support Equipment

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

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

Description:	Wireless Communication Test Set
Brand Name:	Agilent
Model Name or Number:	8960 Series 10
Serial Number:	MY50261230
Cable Length and Type:	~4.0m Utiflex Cable
Connected to Port:	RF (Input / Output) Air Link

2.6. Additional Information Related to Testing

Equipment Category	GSM/GPRS/EDGE850, PCS1900/GPRS/EDGE1900, UMTS/HSPA FDD V, WiFi802.11 a/b/g/n and *Bluetooth*.	
Type of Unit	Portable Transceiver	
Intended Operating Environment:	Within *Bluetooth*, GSM, UMTS, LTE and Wi-Fi Coverage	
Transmitter Maximum Output Power Characteristics:	GSM850	Communication Test Set was configured to allow the EUT to transmit at a maximum power using Power Control Level (PCL) setting of 5.
	PCS1900	Communication Test Set was configured to allow the EUT to transmit at a maximum power using Power Control Level (PCL) setting of 0.
	UMTS FDD V	Communication Test Set configured to allow to EUT to transmit at a maximum power as per KDB 941225 D01.
	2.4 GHz Wi-Fi 802.11b/g/n	Communication Test S/W was configured to allow the EUT to transmit at a maximum power of up to 14.0 dBm.
	5.0 GHz Wi-Fi 802.11a/n (HT20 / HT40)	< 6.5 dBm
	Bluetooth	< 8.0 dBm
Transmitter Frequency Range:	GSM850	824 to 849 MHz
	PCS 1900	1850 to 1910 MHz
	UMTS Band II	1852 to 1908 MHz
	UMTS Band V	826 to 847 MHz
	2.4 GHz Wi-Fi 802.11b/g/n	2412 to 2462 MHz
	5.0 GHz Wi-Fi 802.11a/n (HT20 / HT40)	5180 to 5825 MHz

Additional Information Related to Testing (Continued)

Transmitter Frequency Allocation of EUT When Under Test:	**Channel Number**	**Channel Description**	**Frequency (MHz)**
	128	Low	824.2
	190	Middle	836.6
	251	High	848.8
	512	Low	1850.2
	661	Middle	1880.0
	810	High	1909.8
	4132	Low	826.4
	4183	Middle	836.6
	4233	High	846.6
	1	Low	2412.0
	6	Middle	2437.0
	11	High	2462.0
	36	Low	5180.0
	40	Middle	5200.0
	48	High	5240.0
	52	Low	5260.0
	60	Middle	5300.0
	64	High	5320.0
	100	Low	5500.0
	120	Middle	5600.0
	140	High	5700.0
	149	Low	5745.0
	157	Middle	5785.0
	165	High	5825.0
Modulation(s):	GMSK (GSM / GPRS / EDGE): 217 Hz QPSK (UMTS FDD/ HSDPA/ HSPA): 0Hz DBPSK, CCK (Wi-Fi): 0 Hz		
Modulation Scheme (Crest Factor):	GSMK (GSM): 8.3 GMSK (GPRS/EDGE): 2 QPSK (UMTS FDD/ HSPA): 1 DBPSK, CCK (Wi-Fi): 1		
Antenna Type:	Internal integral		
Antenna Length:	Unknown		
Number of Antenna Positions:	2 fixed (WWAN and Wi-Fi)		
Power Supply Requirement:	3.7V		
Battery Type(s):	Li-ion		

3. Test Specification, Methods and Procedures

3.1. Test Specification

Reference:	OET Bulletin 65 Supplement C: (2001-01)
Title:	Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.
Purpose of Test:	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 know precision”, IEICE Transactions of communications, Vol. E80-B, No.5, pp. 645-652, May 1997.

EN 62209-1: 2006
Title: Basic standard for the measurement of specific absorption rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz).

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

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 Xmiter and Ant v01r05”

KDB 941225 D01 "SAR test for 3G v02"

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 system validation performed at 900 MHz is valid for 800 MHz to 1000 MHz which covers the 850 MHz band. The probe calibration for SN3814 and SN: 1528 was performed at the spot frequencies of 750 MHz and 900 MHz. The SAR software selects the conversion factor based on the following attributes; 1. The operating frequency 2. The measured permittivity imported to the software and 3. The measured conductivity imported to the software.

The 900 MHz system check is applicable for the 850 band as this is within 100 MHz of the of the 850 MHz spot frequency.

As per FCC KDB pub 450824 for SAR probe calibration; The following procedures are recommended for DUT measurements at 150 MHz to 3 GHz to minimize probe calibration and tissue dielectric parameter discrepancies. Measurements exceeding 50 % of these intervals, in this case +/- 50 MHz, EUT frequency greater than or equal to 300 MHz, shall apply method 1 of the steps.
1) When the actual tissue dielectric parameters used for probe calibration are available the differences for relative permittivity and conductivity between probe calibration and routine measurements should each be less than or equal to 5 % while also satisfying the required +/- 5 % tolerances in target dielectric parameters.

The simulation liquid used satisfies both 835 MHz and 900 MHz target values for all channels in the GSM850 band. The SAR probe coverage and conversion factor has been calibrated to ensure this condition is met and the appropriate conversion factor is used in the frequency range for up to +/- 100 MHz.

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 Xmiter and Ant v01r05”, KDB 941225 D01/D03 ‘’ SAR Test Reduction GSM/GPRS/EDGE v01’’, KDB 941225 D01 "SAR test for 3G v02", 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 and OET Bulletin 65 Supplement C 01-01. The assessment for Personal Wireless Hotspot was also evaluated as per the FCC KDB 941225 D06 "Hot Spot SAR v01".

For technologies bands supporting personal hotspot mode, SAR was evaluated on all the sides and surfaces within 25mm of the transmitting antenna (WWAN or WLAN) as per FCC KDB 941225 D06 "Hot Spot SAR v01".

SAR test was performed in the middle channels for WWAN and WLAN. The most conservative configuration for both Head and Body test was evaluated in the low and high channels as for all technology bands even if the test reduction requirement were met as per FCC pub. 447498 D01. This was a requirement by the customer.

The measured maximum conducted power for WLAN 2.45HGz 802.11g/n is 12.1 (equivalent to 19.95 mW) and for WLAN 5GHz is 6.5dBm (equivalent to 4.47mW).
As per FCC kdb pub. *SAR Handsets Multi Xmiter and Ant, v01r05;* when there is simultaneous transmission occuring, stand- alone SAR evaluation is not required when the output power measured is ≤ 2.Pref for the particular band and antenna separation is ≥5.0cm from other antenna.

Output power thresholds for Unlicensed Transmitters

Pref	2.45	5.15 – 5.35	5.47	GHz
	12	6	5	mW

As per table 1 above, since output power measured for;
2.45 GHz 802.11g/n maximum output power = 19.95mW < 24mW (2*Pref)
5.15 to 5.35 GHz maximum output power = 4.47mW < 12mW (2*Pref)
5.47 to 5.85 GHz maximum output power = 3.39mW < 10mW (2*Pref)

Stand Alone SAR evaluation is not required for 2.4 GHz WLAN 802.11g/n and 5.0 GHz WLAN802.11a/n modes.

Simultaneous transmission was not evaluated as the sum of the individual SAR for WWAN and WLAN was < 1.6 W/kg.

GPRS class 12 / EDGE class 12 uplink setup of 1-uplink; 2-uplink, 3-uplink and 4-uplink were all evaluated to find the setting with the highest Power density (power reference (unit v/m) as per the DASY4 system). 3-uplink was found to give the highest reference measurement on the DASY4 system (unit v/m). All settings were performed with the device in a fixed position Back facing phantom at 0mm separation to ensure there were no positioning errors. The following values were measured relative to the uplink settings:

GPRS Mode	**GPRS850 DASY4 Power Reference (v/m)**	**GPRS1900 DASY4 Power Reference (v/m)**
1 uplink	15.32	7.24
2 uplink	16.79	8.2w
3 uplink	17.13	8.21
4 uplink	**17.72**	**8.71**
EDGE Mode	**EDGE850 DASY4 Power Reference (v/m)**	**EDGE1900 DASY4 Power Reference (v/m)**
1 uplink	15.06	7.36
2 uplink	16.64	8.23
3 uplink	16.98	8.67
4 uplink	**17.53**	**8.71**

Note: SAR Power reference measurements are from the DASY4 system and used to check the device power drift although the units are v/m. For informational purpose to ensure the worst case uplink time slot is also verified by the DASY4 SAR system, this was use as per above comment at a fixed point.

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 – Voice allocated mode with Communication Test Set configured to allow the EUT to transmit at a maximum power using Power Control Level (PCL) setting of 5.
- GPRS/EDGE850 – Data allocated mode with Communication Test Set configured to allow the EUT to transmit at a maximum power using Power Control Level (PCL) setting of 5. Tested using 4 Uplink time slots with CS1 and MCS4 for GPRS and EDGE respectively.
- PCS1900 – Voice allocated mode with Communication Test Set configured to allow the EUT to transmit at a maximum power using Power Control Level (PCL) setting of 0.
- GPRS/EDGE1900 – Data allocated mode with Communication Test Set configured to allow the EUT to transmit at a maximum power using Power Control Level (PCL) setting of 0. Tested using 4 Uplink time slots with CS1 and MCS4 for GPRS and EDGE respectively.

GSM85 – Power Table Settings used for Test Set	
Power Control Level PCL	Nominal Power (dBm)
0 … 2	39
3	37
4	35
5	**33**
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 – Power Table Settings used for Test Set	
Power Control Level PCL	Nominal Power (dBm)
22 … 29	Reserved
30	33
31	32
0	**30**
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

- UMTS FDD V Call allocated mode with Communication Test Set configured to allow the EUT to transmit at a maximum as per KDB 941225 D01.
- UMTS FDD V - RMC 12.2kbps + HSUPA With Test loop mode 1 and TPC bits configured to all "1's", Sub-test 5, AG Index set to 21 and E-TFCI set to 81 with Communication Test Set configured to allow to EUT to transmit at a maximum power as per KDB 941225 D01.
- UMTS FDD V - RMC 12.2kbps + HSDPA With Test loop mode 1 and TPC bits configured to all "1's", Sub-test 1 with Communication Test Set configured to allow to EUT to transmit at a maximum power as per KDB 941225 D01.

Operating Modes (Continued)

- 2.4 GHz WiFi802.11b/g/n Data allocated mode using 'HyperTerminal' software to excise mode ‘b’, ‘g’ and ‘n’, with maximum power of up to 13.2dBm for ‘b’ mode and 12.1 dBm for ‘g’ and 11.2 dBm for ‘n’ modes.
- 5.0 GHz WiFi802.11a/n Data allocated mode using 'HyperTerminal' software to excise mode ‘a’, ‘n HT20’ and ‘n HT40’, with maximum power of up to 6.5 dBm for ‘a’ mode and 6.5 dBm for ‘n HT20’ and 6.3 dBm for ‘n HT40’ modes.

5.2. Configuration and Peripherals

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

- Standalone fully charged battery powered.
- Head and Body-worn configurations were evaluated.
- The applied FCC body-worn Personal Hotspot orientations where the corresponding edge(s) closest to the user with the most conservative exposure condition were all evaluated at 10 mm from the body. For configuration that did not overlap with Personal hotspot, SAR evaluation was performed at 15mm separation.
- GPRS class 12 / EDGE class 12 uplink setup of 1-uplink; 2-uplink, 3-uplink and 4-uplink were all evaluated to find the setting with the highest Power density (power reference (unit v/m) as per the DASY4 system). 3-uplink was found to give the highest reference measurement on the DASY4 system (unit v/m). All settings were performed with the device in a fixed position Back facing phantom at 0mm separation to ensure there were no positioning errors.
- GSM, GPRS and EDGE power measurement were all measured as per FCC pubs. 941225 D03 and 941225 D04. Although power reduction was allowed SAR test was performed on GPRS and EDGE using GMSK. Test reduction was applied to 8PSK modulation scheme.

Head Configuration

a) The EUT 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 EUT 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 EUT 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 EUT 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 EUT 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 then 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 EUT 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 Hotspot Mode Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied
Specific Absorption Rate-EDGE850 Hotspot Mode Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied
Specific Absorption Rate-GSM 850 Body-Worn 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 Hotspot Mode Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied
Specific Absorption Rate-EDGE1900 Hotspot Mode Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied
Specific Absorption Rate-PCS 1900 Body-Worn Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied
Specific Absorption Rate-UMTS-FDD V Head Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied
Specific Absorption Rate-UMTS-FDD V Hotspot Mode Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied
Specific Absorption Rate-UMTS-FDD V + HSPA Hotspot Mode Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied
Specific Absorption Rate-UMTS-FDD V Body-Worn Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied
Specific Absorption Rate-Wi-Fi 2450 802.11b Head Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied
Specific Absorption Rate-Wi-Fi 2450 802.11b Hotspot Mode Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied

Summary of Test Results (Continued)

SAR Individual Transmitter Evaluation

device, mode	Frequency, (MHz)	Phantom Configuration	P_x (mW)	P_{REF} (mW)	single SAR, W/kg	Remarks
WWAN, GSM	850	Left Hand Side of EUT (Body)	2399	60/f	0.848	Routine Evaluation
WWAN, UMTS	850	Back of EUT (Body)	288	60/f	0.770	Routine Evaluation
WWAN, GSM	1900	Back of EUT (Body)	1230	60/f	1.070	Routine Evaluation
WLAN, WiFi802.11b	2450	Touch Right (Head)	21	12	0.325	Routine Evaluation
WLAN, WiFi802.11g/n	2450	N/A	~16	12	:=0	$\{P_{BT} \le 2P_{REF}\}$ $\{d_{WWAN, WLAN} > 5cm$
WLAN, WiFi802.11a/n	5150 -5350	N/A	~5	6	:=0	$\{P_{BT} \le 2P_{REF}\}$ $\{d_{WWAN, WLAN} > 5cm$
WLAN, WiFi802.11a/n	5470 -5850	N/A	~3	5	:=0	$\{P_{BT} \le 2P_{REF}\}$ $\{d_{WWAN, WLAN} > 5cm$
BT, *Bluetooth*	2400	N/A	~ 8	12	:=0	$\{P_{BT} \le 2P_{REF}\}$ $\{d_{WWAN, BT} > 5cm\}$

Note(s):

1. Simultaneous transmission was not evaluated as the sum of the individual SAR for WWAN and WLAN was < 1.6 W/kg.
2. *Bluetooth* transmitter thresholds output power "P_{Ref} = 12 mW as listed in KDB 648474.
3. Px: power level measured by RFI.
4. Single SAR value measured by RFI.
5. The "Antenna-to-Antenna distance and Antenna-to-User distance were provided by the customer.

SAR Simultaneous Transmitter Evaluation

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

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

For All SAR measurement in this report the SAR limit tested to is 1.6 W/kg

7.2.1.Specific Absorption Rate - GSM 850 Head Configuration 1g
Test Summary:

Tissue Volume:	1g
Maximum Level (W/kg):	0.674
Environmental Conditions:	
Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	23.2 to 23.2

Results:

EUT Position	Phantom Configuration	Channel Number	Uplink Measured Burst Avg. Power (dBm)	MPR	Measured Level (W/kg)	Note(s)	Modulation
Touch	Left	190	24.8	N/A	0.674	1, 2	GMSK
Tilt	Left	190	24.8	N/A	0.404	1, 2	GMSK
Touch	Right	190	24.8	N/A	0.646	1, 2	GMSK
Tilt	Right	190	24.8	N/A	0.405	1, 2	GMSK
Touch	Left	128	24.7	N/A	0.609	1, 2	GMSK
Touch	Left	251	24.8	N/A	0.588	1, 2	GMSK

Note(s):

1. Voice
2. As per the customer requirement low, middle and high channel were all tested on the most conservative configuration although test reduction applies as per FCC pub. 447498 D01.

7.2.2.Specific Absorption Rate - GPRS 850 Hotspot Mode Configuration 1g Test Summary:

Tissue Volume:	1g
Maximum Level (W/kg):	0.848
Environmental Conditions:	
Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	22.3 to 22.3

Results:

EUT Position	Phantom Configuration	Channel Number	Uplink Measured Burst Avg. Power (dBm)	MPR	Measured Level (W/kg)	Note(s)	Modulation
Front of EUT Facing Phantom	Flat (SAM)	190	25.2	N/A	0.617	1, 2	GMSK
Back of EUT Facing Phantom	Flat (SAM)	190	25.2	N/A	0.649	1, 2	GMSK
Left Hand Side of EUT Facing Phantom	Flat (SAM)	190	25.2	N/A	0.826	1, 2	GMSK
Left Hand Side of EUT Facing Phantom	Flat (SAM)	128	25.0	N/A	0.635	1, 2	GMSK
Left Hand Side of EUT Facing Phantom	Flat (SAM)	251	25.2	N/A	0.848	1, 2	GMSK
Right Hand Side of EUT Facing Phantom	Flat (SAM)	190	25.2	N/A	0.767	1, 2	GMSK
Bottom of EUT Facing Phantom	Flat (SAM)	190	25.2	N/A	0.110	1, 2	GMSK
Left Hand Side of EUT Facing Phantom with PHF	Flat (SAM)	251	25.2	N/A	0.499	1, 2, 3	GMSK

Note(s):

1. Data - SAR measurements were performed using 4 uplink timeslots
2. SAR measurements were performed with the closest edge of the EUT at a separation distance of 10mm from the 'SAM' phantom flat section, as EUT supports Hotspot Mode.
3. This configuration was evaluated in hotspot mode as the most conservative configuration with the Personal hands-free (PHF) kit attached and overlaps with body-worn configuration with PHF. This configuration is possible in this mode as the PHF can be attached while in hotspot mode.

7.2.3.Specific Absorption Rate - EDGE850 Hotspot Mode Configuration 1g
Test Summary:

Tissue Volume:	1g
Maximum Level (W/kg):	0.833
Environmental Conditions:	
Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	22.3 to 22.3

Results:

EUT Position	Phantom Configuration	Channel Number	Uplink Measured Burst Avg. Power (dBm	MPR	Measured Level (W/kg)	Note(s)	Modulation
Left Hand Side of EUT Facing Phantom	Flat (SAM)	190	24.8	N/A	0.830	1, 2, 3, 4	GMSK
Left Hand Side of EUT Facing Phantom	Flat (SAM)	128	24.8	N/A	0.634	1, 2, 3, 4	GMSK
Left Hand Side of EUT Facing Phantom	Flat (SAM)	251	25.2	N/A	0.833	1, 2, 3, 4	GMSK

Note(s):

1. Data - SAR measurements were performed using 4 uplink timeslots
2. SAR measurements were performed with the closest edge of the EUT at a separation distance of 10mm from the 'SAM' phantom flat section.
3. Left Hand Side of EUT (Left edge of EUT) facing phantom configuration from GPRS is used on EDGE body.
4. SAR measurements performed using GMSK as per FCC KDB to minimize SAR measurement error due to higher peak-to-average (PAR) power ratios inherent in 8-PSK. MCS4 was used on the GSM communication test set to achieve this.

7.2.4.Specific Absorption Rate - GSM 850 Body-Worn Configuration 1g Test Summary:

Tissue Volume:	1g
Maximum Level (W/kg):	0.721
Environmental Conditions:	
Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	22.3 to 22.3

Results:

EUT Position	Phantom Configuration	Channel Number	Uplink Measured Burst Avg. Power (dBm)	MPR (dB)	Measured Level (W/kg)	Note(s)	Modulation
Back of EUT Facing Phantom	Flat (SAM)	190	24.8	N/A	0.721	1, 2	GMSK

Note(s):

1. Voice - SAR measurements were performed with the closest edge of the EUT at a separation distance of 15mm from the 'SAM' phantom flat section.
2. Back surface of EUT configuration, which was the most conservative configuration for GPRS hotspot mode is used on GSM body.

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

Tissue Volume:	1g
Maximum Level (W/kg):	0.741
Environmental Conditions:	
Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	22.9 to 22.9

Results:

EUT Position	Phantom Configuration	Channel Number	Uplink Measured Burst Avg. Power (dBm)	MPR (dB)	Measured Level (W/kg)	Note	Modulation
Touch	Left	661	30.7	N/A	0.703	1, 2	GMSK
Tilt	Left	661	30.7	N/A	0.309	1, 2	GMSK
Touch	Right	661	30.7	N/A	0.379	1, 2	GMSK
Tilt	Right	661	30.7	N/A	0.221	1, 2	GMSK
Touch	Left	512	30.9	N/A	0.696	1, 2	GMSK
Touch	Left	810	30.9	N/A	0.741	1, 2	GMSK

Note(s):

1. Voice
2. As per the customer requirement low, middle and high channel were all tested on the most conservative configuration although test reduction applies as per FCC pub. 447498 D01.

7.2.6.Specific Absorption Rate - GPRS 1900 Hotspot Mode Configuration 1g Test Summary:

Tissue Volume:	1g
Maximum Level (W/kg):	0.901
Environmental Conditions:	
Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	22.1 to 22.1

Results:

EUT Position	Phantom Configuration	Channel Number	Uplink Measured Burst Avg. Power (dBm)	MPR (dB)	Measured Level (W/kg)	Note(s)	Modulation
Front of EUT Facing Phantom	Flat (SAM)	661	21.9	N/A	0.840	1, 2	GMSK
Front of EUT Facing Phantom	Flat (SAM)	512	22.1	N/A	0.893	1, 2	GMSK
Front of EUT Facing Phantom	Flat (SAM)	810	21.8	N/A	0.780	1, 2	GMSK
Back of EUT Facing Phantom	Flat (SAM)	661	21.9	N/A	0.857	1, 2	GMSK
Back of EUT Facing Phantom	Flat (SAM)	512	22.1	N/A	0.901	1, 2	GMSK
Back of EUT Facing Phantom	Flat (SAM)	810	21.8	N/A	0.812	1, 2	GMSK
Left Hand Side of EUT Facing Phantom	Flat (SAM)	661	21.9	N/A	0.701	1, 2	GMSK
Right Hand Side of EUT Facing Phantom	Flat (SAM)	661	21.9	N/A	0.203	1, 2	GMSK
Bottom of EUT Facing Phantom	Flat (SAM)	661	21.9	N/A	0.334	1, 2	GMSK

Note(s):

1. Data - SAR measurements were performed using 4 uplink timeslots
2. SAR measurements were performed with the closest edge of the EUT at a separation distance of 10mm from the 'SAM' phantom flat section, as EUT supports Hotspot Mode.

7.2.7.Specific Absorption Rate - EDGE1900 Hotspot Mode Configuration 1g Test Summary:

Tissue Volume:	1g
Maximum Level (W/kg):	1.070
Environmental Conditions:	
Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	22.1 to 22.1

Results:

EUT Position	Phantom Configuration	Channel Number	Uplink Measured Burst Avg. Power (dBm)	MPR (dB)	Measured Level (W/kg)	Note(s)	Modulation
Back of EUT Facing Phantom	Flat (SAM)	661	22.0	N/A	0.955	1, 2, 3, 4	GMSK
Back of EUT Facing Phantom	Flat (SAM)	512	22.1	N/A	1.070	1, 2, 3, 4	GMSK
Back of EUT Facing Phantom	Flat (SAM)	810	21.8	N/A	0.997	1, 2, 3, 4	GMSK
Back of EUT Facing Phantom With PHF	Flat (SAM)	512	22.1	N/A	1.050	1, 2, 3, 4, 5	GMSK

Note(s):

1. Data - SAR measurements were performed using 4 uplink timeslots
2. SAR measurements were performed with the closest edge of the EUT at a separation distance of 10mm from the 'SAM' phantom flat section.
3. Back surface of EUT (Back of EUT Facing phantom) configuration from GPRS is used on EDGE body.
4. SAR measurements performed using GMSK as per FCC KDB to minimize SAR measurement error due to higher peak-to-average (PAR) power ratios inherent in 8-PSK. MCS4 was used on the GSM communication test set to achieve this.
5. This configuration was evaluated in hotspot mode as the most conservative configuration with the Personal hands-free (PHF) kit attached and overlaps with body-worn configuration with PHF. This configuration is possible in this mode as the PHF can be attached while in hotspot mode.

7.2.8.Specific Absorption Rate - PCS 1900 Body-Worn Configuration 1g Test Summary:

Tissue Volume:	1g
Maximum Level (W/kg):	0.551
Environmental Conditions:	
Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	22.1 to 22.1

Results:

EUT Position	Phantom Configuration	Channel Number	Uplink Measured Burst Avg. Power (dBm)	MPR (dB)	Measured Level (W/kg)	Note(s)	Modulation
Back of EUT Facing Phantom	Flat (SAM)	661	30.7	N/A	0.551	1, 2	GMSK

Note(s):

1. Voice - SAR measurements were performed with the closest edge of the EUT at a separation distance of 15mm from the 'SAM' phantom flat section.
2. Back surface of EUT configuration, which was the most conservative configuration for GPRS hotspot mode is used on PCS body.

7.2.9.Specific Absorption Rate - UMTS-FDD V Head Configuration 1g
Test Summary:

Tissue Volume:	1g
Maximum Level (W/kg):	0.563
Environmental Conditions:	
Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	21.3 to 21.3

Results:

EUT Position	Phantom Configuration	Channel Number	Measured Avg. Power (dBm)	MPR (dB)	Measured Level (W/kg)	Note(s)	Modulation
Touch	Left	4183	24.5	N/A	0.538	1, 2	QPSK
Tilt	Left	4183	24.5	N/A	0.328	1, 2	QPSK
Touch	Right	4183	24.5	N/A	0.563	1, 2	QPSK
Tilt	Right	4183	24.5	N/A	0.330	1, 2	QPSK
Touch	Right	4132	24.6	N/A	0.520	1, 2	QPSK
Touch	Right	4233	24.6	N/A	0.523	1, 2	QPSK

Note(s):

1. CS Circuit Switch - RMC 12.2kbps with Test loop mode 1 and TPC bits configured to All "1's"
2. As per the customer requirement low, middle and high channel were all tested on the most conservative configuration although test reduction applies as per FCC pub. 447498 D01.

7.2.10.Specific Absorption Rate - UMTS-FDD V Hotspot Mode Configuration 1g

Test Summary:

Tissue Volume:	1g
Maximum Level (W/kg):	0.770

Environmental Conditions:

Temperature Variation in Lab (°C):	23.0 to 24.0
Temperature Variation in Liquid (°C):	20.8 to 21.0

Results:

EUT Position	Phantom Configuration	Channel Number	Measured Avg. Power (dBm)	MPR (dB)	Measured Level (W/kg)	Note(s)	Modulation
Front of EUT Facing Phantom	Flat (SAM)	4183	24.5	N/A	0.697	1, 2, 3	QPSK
Back of EUT Facing Phantom	Flat (SAM)	4183	24.5	N/A	0.756	1, 2, 3	QPSK
Left Hand Side of EUT Facing Phantom	Flat (SAM)	4183	24.5	N/A	0.712	1, 2, 3	QPSK
Right Hand Side of EUT Facing Phantom with PHF	Flat (SAM)	4183	24.5	N/A	0.726	1, 2, 3	QPSK
Bottom of EUT Facing Phantom with PHF	Flat (SAM)	4183	24.5	N/A	0.095	1, 2, 3	QPSK
Back of EUT Facing Phantom	Flat (SAM)	4132	24.6	N/A	0.770	1, 2, 3	QPSK
Back of EUT Facing Phantom	Flat (SAM)	4233	24.6	N/A	0.744	1, 2, 3	QPSK
Back of EUT Facing Phantom with PHF	Flat (SAM)	4132	24.5	N/A	0.687	1, 2, 3	QPSK

Note(s):

1. SAR measurements were performed with the closest edge of the EUT at a separation distance of 10mm from the 'SAM' phantom flat section.
2. CS Circuit Switch - RMC 12.2kbps with Test loop mode 1 and TPC bits configured to All "1's"
3. As per the customer requirement low, middle and high channel were all tested on the most conservative configuration although test reduction applies as per FCC pub. 447498 D01.

7.2.11.Specific Absorption Rate – UMTS FDD V + HSPA Hotspot Mode Configuration 1g

Test Summary:

Tissue Volume:	1g
Maximum Level (W/kg):	0.682

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	21.0 to 21.0

Results:

EUT Position	Phantom Configuration	Channel Number	Measured Avg. Power (dBm)	MPR (dB)	Measured Level (W/kg)	Note(s)	Modulation
Left Hand Side of EUT Facing Phantom	Flat (SAM)	4183	24.5	N/A	0.682	1, 2, 3	QPSK
Left Hand Side of EUT Facing Phantom	Flat (SAM)	4183	23.8	N/A	0.668	1, 2, 4	QPSK

Note(s):

1. SAR measurements were performed with the closest edge of the EUT at a separation distance of 10mm from the 'SAM' phantom flat section.
2. The ‘Worst case’ configuration from RMC is used on HSPA (HSDPA/HSUPA) body configuration
3. Packet Switch (PS) - RMC 12.2kbps with Test loop mode 1 and TPC bits configured to All "1's" with HSDPA enabled. Using Sub-Test 1 with βc=2 /βd=15.
4. Packet Switch (PS) - FRC configured to HS-DPCCH Sub-test 5 and H-Set 1 and QPSK settings with HSPA enabled. Using Sub-Test 5 with βc=15 /βd=15.
   - Results included for informational purpose.

7.2.12.Specific Absorption Rate – UMTS FDD V Body-Worn Configuration 1g Test Summary:

Tissue Volume:	1g
Maximum Level (W/kg):	0.657
Environmental Conditions:	
Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	21.0 to 21.0

Results:

EUT Position	Phantom Configuration	Channel Number	Measured Avg. Power (dBm)	MPR (dB)	Measured Level (W/kg)	Note(s)	Result
Back of EUT Facing Phantom	Flat (SAM)	4132	24.6	N/A	0.657	1, 2, 3	QPSK

Note(s):

1. SAR measurements were performed with the closest edge of the EUT at a separation distance of 15mm from the 'SAM' phantom flat section.
2. CS Circuit Switch - RMC 12.2kbps with Test loop mode 1 and TPC bits configured to All "1's"
3. Back surface of EUT Facing phantom Hotspot mode Configuration on RMC body is used on RMC body-worn.

7.2.13.Specific Absorption Rate - Wi-Fi 802.11b Head Configuration 1g Test Summary:

Tissue Volume:	1g
Maximum Level (W/kg):	0.325
Environmental Conditions:	
Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	21.7 to 21.7

Results:

EUT Position	Phantom Configuration	Channel Number	Measured Avg. Power (dBm)	MPR (dB)	Measured Level (W/kg)	Note	Result
Touch	Left	6	13.0	N/A	0.285	1, 2	Complied
Tilt	Left	6	13.0	N/A	0.280	1, 2	Complied
Touch	Right	6	13.0	N/A	0.325	1, 2	Complied
Tilt	Right	6	13.0	N/A	0.310	1, 2	Complied
Touch	Right	1	13.0	N/A	0.259	1, 2	Complied
Touch	Right	11	13.2	N/A	0.267	1, 2	Complied

Note(s):

1. 802.11b 1Mbps

*The measured maximum conducted power for WLAN 2.45HGz 802.11g/n is 12.1 (equivalent to 19.95 mW) and for WLAN 5GHz is 6.5dBm (equivalent to 4.47mW).
As per FCC document, *D01 SAR Handsets Multi Xmiter and Ant, v01r05*, when there is simultaneous transmission occuring, Stand- alone SAR evaluation is not required when the output power measured ≤ 2.Pref for the particular band and antenna separation is ≥5.0cm from other antenna.

Table : Output power thresholds for Unlicensed Transmitters

Pref	2.45	5.15-5.35	5.47-5.85	**GHz**
	12	6	5	**mW**

As per table 1 above, since output power measured for
2.45 GHz 802.11g/n => 19.95mW < 24mW (2*Pref),
5.15 to 5.35 GHz => 4.47mW < 12mW (2*Pref) and
5.47 to 5.85 GHz => 3.39mW < 10mW (2*Pref)

Stand Alone SAR evaluation is not required for 2.4 GHz WLAN 802.11g/n and 5.0 GHz WLAN802.11a/n modes.

2. As per the customer requirement low, middle and high channel were all tested on the most conservative configuration although test reduction applies as per FCC pub. 447498 D01.

7.2.14.Specific Absorption Rate - Wi-Fi 802.11b Hotspot Mode Configuration 1g Test Summary:

Tissue Volume:	1g
Maximum Level (W/kg):	0.218
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	Measured Avg. Power (dBm)	MPR (dB)	Measured Level (W/kg)	Note (s)	Result
Front of EUT Facing Phantom	Flat (SAM)	6	13.0	N/A	0.050	1, 2	Complied
Back of EUT Facing Phantom	Flat (SAM)	6	13.0	N/A	0.146	1, 2	Complied
Left Hand Side of EUT Facing Phantom	Flat (SAM)	6	13.0	N/A	0.007	1, 2	Complied
Right Hand Side of EUT Facing Phantom	Flat (SAM)	6	13.0	N/A	0.004	1, 2	Complied
Top of EUT Facing Phantom	Flat (SAM)	6	13.0	N/A	0.177	1, 2	Complied
Top of EUT Facing Phantom	Flat (SAM)	1	13.0	N/A	0.141	1, 2	Complied
Top of EUT Facing Phantom	Flat (SAM)	11	13.2	N/A	0.186	1, 2	Complied
Top of EUT Facing Phantom with PHF	Flat (SAM)	11	13.2	N/A	0.218	1, 2	Complied

Specific Absorption Rate - Wi-Fi 802.11b Body Configuration 1g (Continued)
Note(s):

1. 802.11b 1Mbps
2. EUT supports Hotspot: As per FCC KDB procedure SAR measurements were performed with the EUT at a separation distance of 10mm from the 'SAM' phantom flat section.

*The measured maximum conducted power for WLAN 2.45HGz 802.11g/n is 12.1 (equivalent to 19.95 mW) and for WLAN 5GHz is 6.5dBm (equivalent to 4.47mW).
As per FCC document, *D01 SAR Handsets Multi Xmiter and Ant, v01r05*, when there is simultaneous transmission occuring, Stand- alone SAR evaluation is not required when the output power measured ≤ 2.Pref for the particular band and antenna separation is ≥5.0cm from other antenna.

Table : Output power thresholds for Unlicensed Transmitters

Pref	2.45	5.15-5.35	5.47-5.85	**GHz**
	12	6	5	**mW**

As per table 1 above, since output power measured for
2.45 GHz 802.11g/n => 19.95mW < 24mW (2*Pref),
5.15 to 5.35 GHz => 4.47mW < 12mW (2*Pref) and
5.47 to 5.85 GHz => 3.39mW < 10mW (2*Pref)

Stand Alone SAR evaluation is not required for 2.4 GHz WLAN 802.11g/n and 5.0 GHz WLAN802.11a/n modes.

7.2.15. Conducted Average Power Measurement 2G: GSM850

Channel Number	Frequency (MHZ)	Power before Test (dBm)	Avg. Burst Power with consideration for uplink time slot (dBm)	Note
128	824.2	33.7	24.7	Conducted
190	836.6	33.8	24.8	Conducted
251	848.8	33.8	24.8	Conducted

GPRS850 - Measured Average Power Without consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power before Test (dBm) 1Uplink	Power before Test (dBm) 2Uplink	Power before Test (dBm) 3Uplink	Power before Test (dBm) 4Uplink	Note
128	824.2	33.7	31.1	29.3	28.0	Conducted
190	836.6	33.8	31.1	29.2	28.2	Conducted
251	848.8	33.8	31.2	29.3	28.2	Conducted

GPRS850 - Calculated Value With consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power before Test (dBm) 1Uplink	Power before Test (dBm) 2Uplink	Power before Test (dBm) 3Uplink	Power before Test (dBm) 4Uplink	Note
128	824.2	24.7	25.1	25.0	25.0	Conducted
190	836.6	24.8	25.1	24.9	25.2	Conducted
251	848.8	24.8	25.2	25.0	25.2	Conducted

EDGE850 - Measured Average Power Without consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power before Test (dBm) 1Uplink	Power before Test (dBm) 2Uplink	Power before Test (dBm) 3Uplink	Power before Test (dBm) 4Uplink	Note
128	824.2	33.7	31.0	29.1	27.8	Conducted
190	836.6	33.8	31.0	29.1	27.8	Conducted
251	848.8	33.8	31.2	29.2	28.2	Conducted

EDGE850 - Calculated Value With consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power before Test (dBm) 1Uplink	Power before Test (dBm) 2Uplink	Power before Test (dBm) 3Uplink	Power before Test (dBm) 4Uplink	Note
128	824.2	24.7	25.0	24.8	24.8	Conducted
190	836.6	24.8	25.0	24.8	24.8	Conducted
251	848.8	24.8	25.2	24.9	25.2	Conducted

Note:

Scale factor for uplink time slot:

1. 1 Uplink: time slot ratio = 8:1 => 10*log(8/1) = **9.03 dB**
2. 2 Uplink: time slot ratio = 8:2 => 10*log(8/2) = **6.02 dB**
3. 3 Uplink: time slot ratio = 8:3 => 10*log(8/3) = **4.26 dB**
4. 4 Uplink: time slot ratio = 8:4 => 10*log(8/4) = **3.01 dB**

EDGE (MCS9 ~ 8PSK)
EDGE850 - Measured Average Power Without consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power before Test (dBm) 1Uplink	Power before Test (dBm) 2Uplink	Power before Test (dBm) 3Uplink	Power before Test (dBm) 4Uplink	Note
128	824.2	26.0	25.3	24.4	22.4	Conducted, 8PSK
190	836.6	26.1	25.3	24.4	22.5	Conducted, 8PSK
251	848.8	26.0	25.3	24.4	22.5	Conducted, 8PSK

EDGE850 - Calculated Value With consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power before Test (dBm) 1Uplink	Power before Test (dBm) 2Uplink	Power before Test (dBm) 3Uplink	Power before Test (dBm) 4Uplink	Note
128	824.2	17.0	19.3	20.1	19.4	Conducted, 8PSK
190	836.6	17.1	19.3	20.1	19.5	Conducted, 8PSK
251	848.8	17.0	19.3	20.1	19.5	Conducted, 8PSK

Note:

Scale factor for uplink time slot:

1. 1 Uplink: time slot ratio = 8:1 => 10*log(8/1) = **9.03 dB**
2. 2 Uplink: time slot ratio = 8:2 => 10*log(8/2) = **6.02 dB**
3. 3 Uplink: time slot ratio = 8:3 => 10*log(8/3) = **4.26 dB**
4. 4 Uplink: time slot ratio = 8:4 => 10*log(8/4) = **3.01 dB**

7.2.16. Conducted Average Power Measurement 2G: PCS1900

Channel Number	Frequency (MHZ)	GSM TX Power before Test (dBm)	Note
512	1850.2	30.9	Conducted
661	1880.0	30.7	Conducted
810	1909.8	30.9	Conducted

GPRS1900 - Measured Average Power Without consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power before Test (dBm) 1Uplink	Power before Test (dBm) 2Uplink	Power before Test (dBm) 3Uplink	Power before Test (dBm) 4Uplink	Note
512	1850.2	31.1	28.3	26.2	25.1	Conducted
661	1880.0	30.9	27.9	25.9	24.9	Conducted
810	1909.8	31.2	28.0	26.1	24.8	Conducted

GPRS1900 - Calculated Value With consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power before Test (dBm) 1Uplink	Power before Test (dBm) 2Uplink	Power before Test (dBm) 3Uplink	Power before Test (dBm) 4Uplink	Note
512	1850.2	22.1	22.3	21.9	22.1	Conducted
661	1880.0	21.9	21.9	21.6	21.9	Conducted
810	1909.8	22.2	22.0	21.8	21.8	Conducted

EDGE1900 - Measured Average Power Without consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power before Test (dBm) 1Uplink	Power before Test (dBm) 2Uplink	Power before Test (dBm) 3Uplink	Power before Test (dBm) 4Uplink	Note
512	1850.2	31.1	28.1	26.2	25.1	Conducted
661	1880.0	30.9	28.0	26.0	25.0	Conducted
810	1909.8	31.1	27.9	26.0	24.8	Conducted

EGPR1900 - Calculated Value With consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power before Test (dBm) 1Uplink	Power before Test (dBm) 2Uplink	Power before Test (dBm) 3Uplink	Power before Test (dBm) 4Uplink	Note
512	1850.2	22.1	22.1	21.5	22.1	Conducted
661	1880.0	21.9	22.0	21.3	22.0	Conducted
810	1909.8	22.1	21.9	21.3	21.8	Conducted

Note:

Scale factor for uplink time slot:

1. 1 Uplink: time slot ratio = 8:1 => 10*log(8/1) = **9.03 dB**
2. 2 Uplink: time slot ratio = 8:2 => 10*log(8/2) = **6.02 dB**
3. 3 Uplink: time slot ratio = 8:3 => 10*log(8/3) = **4.26 dB**
4. 4 Uplink: time slot ratio = 8:4 => 10*log(8/4) = **3.01 dB**

EDGE (MCS9 ~ 8PSK)
EDGE1900 - Measured Average Power Without consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power before Test (dBm) 1Uplink	Power before Test (dBm) 2Uplink	Power before Test (dBm) 3Uplink	Power before Test (dBm) 4Uplink	Note
512	1850.2	25.2	24.6	23.4	22.5	Conducted, 8PSK
661	1880.0	25.2	24.5	23.3	22.4	Conducted, 8PSK
810	1909.8	25.0	24.4	23.2	22.2	Conducted, 8PSK

EDGE1900 - Calculated Value With consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power before Test (dBm) 1Uplink	Power before Test (dBm) 2Uplink	Power before Test (dBm) 3Uplink	Power before Test (dBm) 4Uplink	Note
512	1850.2	16.2	18.6	19.1	19.5	Conducted, 8PSK
661	1880.0	16.2	18.5	19.0	19.4	Conducted, 8PSK
810	1909.8	16.0	18.4	18.9	19.2	Conducted, 8PSK

Note:

Scale factor for uplink time slot:

1. 1 Uplink: time slot ratio = 8:1 => 10*log(8/1) = **9.03 dB**
2. 2 Uplink: time slot ratio = 8:2 => 10*log(8/2) = **6.02 dB**
3. 3 Uplink: time slot ratio = 8:3 => 10*log(8/3) = **4.26 dB**
4. 4 Uplink: time slot ratio = 8:4 => 10*log(8/4) = **3.01 dB**

7.2.17. Conducted Average Power Measurement 3g

Modes		HSDPA				HSPA					WCDMA
Sets		1	2	3	4	1	2	3	4	5	Voice / RMC 12.2kbps
Band	Channel	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]
850 (FDD V)	4132 4357	24.5	24.2	23.8	23.9	24.3	24.3	23.7	24.6	23.7	24.6
	4183 4408	24.5	24.1	23.9	24.0	24.1	24.2	23.8	24.4	23.8	24.5
	4233 4458	24.5	24.1	23.7	23.8	24.1	24.2	23.7	24.5	23.6	24.6
ßc		2	12	15	15	11	6	15	2	15	
ßd		15	15	8	4	15	15	9	15	15	
ΔACK, ΔNACK, ΔCQI		8	8	8	8	8	8	8	8	8	
AGV		-	-	-	-	20	12	15	17	21	

* Prior to commencement of SAR testing the module power levels were measured in both HSPA and 3G RMC 12.2kbps modes and compared to ensure the correct mode of operation had been established.

The following tables taken from FCC 3G SAR procedures (KDB 941225 D01 SAR test for 3G devices v02) below were applied using an Agilent 8960 series 10 wireless communications test set which supports 3G / HSDPA release 5 / HSPA release 6.

Sub-test 1 Setup for Release 5 HSDPA

Sub-test	β_c	β_d	B_d *(SF)*	β_c/β_d	β_{hs} (1)	SM (dB) (2)
1	2/15	15/15	64	2/15	4/15	0.0
2	12/15 (3)	15/15 (3)	64	12/15 (3)	24/15	1.0
3	15/15	8/15	64	15/8	30/15	1.5
4	15/15	4/15	64	15/4	30/15	1.5

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 8 ⇔ A_{hs} = β_{hs}/β_c = 30/15 ⇔ β_{hs} = 30/15 * β_c

Note 2: CM = 1 for β_c/β_d = 12/15, B_{hs}/β_c = 24/15

Note 3: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to β_c = 11/15 and β_d = 15/15

Sub-test 5 Setup for Release 6 HSPA

Sub-test	β_c	β_d	B_d *(SF)*	β_c/β_d	β_{hs} (1)	B_{oc}	B_{od}	B_{od} *(SF)*	B_{od} *(codes)*	CM (2) (dB)	MPR (dB)	AG (4) Index	E-TFCI
1	11/15 (3)	15/15 (3)	64	11/15 (3)	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	31/15	B_{al1}: 47/15 B_{al2}: 47/15	4	1	2.0	1.0	15	92
4	2/15	15/15	64	2/15	2/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 (4)	15/15 (4)	64	15/15 (4)	24/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1: Δ_{ACK}, Δ_{NACK} and Δ_{CQI} = 8 ⇔ A_{hs} = β_{hs}/β_c = 30/15 ⇔ β_{hs} = 30/15 * β_c

Note 2: CM = 1 for β_c/β_d = 12/15, B_{hs}/β_c = 24/15. For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH AND E-DPCCH for the MPR is based on the relative CM difference.

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

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

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

Note 6: B_{od} cannot be set directly; it is set by Absolute Grant Value.

7.2.18.Conducted Power Measurements Wi-Fi802.11b/g/n (2.4 GHz)

802.11b/g (2.4 GHz)

Channel Number	Frequency (MHZ)	TX Power before Test (dBm)	Note
1	2412.0	13.0	**2.4GHz 802.11b** (1Mbps)
6	2437.0	13.0	
11	2462.0	13.2	
1	2412.0	12.6	**2.4GHz 802.11b** (11Mbps)
6	2437.0	12.6	
11	2462.0	12.8	
1	2412.0	11.4	**2.4GHz 802.11g** (6Mbps)
6	2437.0	11.9	
11	2462.0	12.1	
1	2412.0	10.3	**2.4GHz 802.11g** (54Mbps)
6	2437.0	10.8	
11	2462.0	11.0	

802.11n (2.4 GHz)

Channel Number	Frequency (MHZ)	TX Power before Test (dBm)	Note
1	2412.0	10.5	**2.4GHz 802.11n** (6.5Mbps)
6	2437.0	10.9	
11	2462.0	11.2	
1	2412.0	9.1	**2.4GHz 802.11n** (65Mbps)
6	2437.0	9.6	
11	2462.0	9.8	

7.2.19.Conducted Power Measurements Wi-Fi802.11a/n (5.0 GHz)
802.11a (5.0 GHz)

Channel Number	Frequency (MHZ)	TX Power before Test (dBm) (6 Mbps)	TX Power before Test (dBm) (54 Mbps)	Note
36	5180	5.3	4.3	**5.2 GHz 802.11a**
40	5200	4.9	4.0	
48	5240	5.6	4.5	
52	5260	5.6	4.6	**5.3 GHz 802.11a**
60	5300	5.4	4.4	
64	5320	**6.5**	5.4	
100	5500	4.8	3.8	**5.6 GHz 802.11a**
120	5600	3.5	2.5	
140	5700	4.5	3.4	
149	5745	3.8	2.7	**5.8 GHz 802.11a**
157	5785	**5.3**	4.2	
165	5825	5.0	3.9	

Conducted Power Measurements Wi-Fi802.11a/n (5.0 GHz) (Continued)

802.11n (5.0 GHz) (HT20)

Channel Number	Frequency (MHZ)	TX Power before Test (dBm) (6.5 Mbps)	TX Power before Test (dBm) (65 Mbps)	Note
36	5180	5.4	4.3	**5.2 GHz 802.11n**
40	5200	5.1	3.9	
48	5240	5.6	4.5	
52	5260	5.7	4.6	**5.3 GHz 802.11n**
60	5300	5.5	4.3	
64	5320	**6.5**	5.4	
100	5500	4.8	3.7	**5.6 GHz 802.11n**
120	5600	3.6	2.5	
140	5700	4.5	3.4	
149	5745	3.8	2.7	**5.8 GHz 802.11n**
157	5785	**5.3**	4.2	
165	5825	5.0	3.8	

802.11n (5.0 GHz) (HT40)

Channel Number	Frequency (MHZ)	TX Power before Test (dBm) (13.5 Mbps)	TX Power before Test (dBm) (135 Mbps)	Note
36	5180	5.3	5.1	**5.2 GHz 802.11n**
40	5200	4.7	4.6	
48	5240	5.6	5.5	
52	5260	5.5	5.4	**5.3 GHz 802.11n**
60	5300	5.2	5.1	
64	5320	**6.3**	6.2	
100	5500	4.4	3.9	**5.6 GHz 802.11n**
120	5600	3.5	3.4	
140	5700	4.5	4.5	
149	5745	3.5	3.5	**5.8 GHz 802.11n**
157	5785	**5.3**	5.2	
165	5825	4.6	4.6	

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 / UMTS FDD V Head Configuration 1g	95%	19.94
Specific Absorption Rate-GSM / GPRS / EDGE850 / UMTS FDD V 850 Body Configuration 1g	95%	20.07
Specific Absorption Rate-PCS 1900 Head Configuration 1g	95%	20.72
Specific Absorption Rate-PCS / GPRS / EDGE1900 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 / UMTS FDD V Head Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (10g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ 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/EDGE850/UMTS FDD V 850 Body Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (10g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ 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	$c_{i\ (10g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ 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/EDGE1900 Body Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (10g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ 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	$c_{i\ (10g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ 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 Head Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (10g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ 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	-	-
A1184	Data Acquisition Electronics	Schmid & Partner Engineering AG	DAE3	394	26 Jan 2012	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	-
A2077	Probe	Schmid & Partner Engineering AG	ET3 DV4	3814	22 Sep 2011	12
A1185	Probe	Schmid & Partner Engineering AG	ET3 DV6	1528	18 Jul 2011	12
A1497	Amplifier	Mini-Circuits	zhl-42w (sma)	e020105	Calibrated as part of system	-
A1566	SAM Phantom	Schmid & Partner Engineering AG	SAM a (Site 56)	002	Calibrated before use	-
A1238	SAM Phantom	Schmid & Partner Engineering AG	SAM b (Site 56)	001	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	-	-

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
M1015	Network Analyser	Agilent Technologies	8753ES	US39172406	27 Sept 2011	12
C1145	Cable	Rosenberger MICRO-COAX	FA147A F003003030	41843-1	Calibrated as part of system	-
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	-
M1047	Robot Arm	Staubli	RX908 L	F00/SD8 9A1/A/01	Calibrated before use	-
M1159	Signal Generator	Agilent Technologies	E8241A	US42110332	Internal Checked 14 Apr 2012	4
M1159	Signal Generator	Agilent Technologies	E8241A	US42110332	Internal Checked 15 Dec 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.

The following information is justification to why the listed dipoles calibration period has been extended. This address FCC KDB 450824 D02

Cal Date	Dipole Calibration History									
	Dipole SN: 124, Frequency 900 MHz									
	Head Parameters					Body Parameters				
	1g (W/Kg)	10g (W/Kg)	Return loss (dB)	Real (Ω)	Imaginary (Ω)	1g (W/Kg)	10g (W/Kg)	Return loss (dB)	Real (Ω)	Imaginary (Ω)
09-Feb-11	11.00	7.01	-21.60	48.90	-8.20	11.10	7.14	-20.20	46.10	-8.60
23-Aug-07	10.20	6.56	-21.20	48.60	-8.50	10.50	6.89	-20.20	45.40	-8.10
31-Aug-05	10.60	6.78	-24.70	49.10	-5.70	10.50	6.77	-18.90	44.90	-8.90
13-May-03	10.60	6.76	-24.00	50.30	-6.40	11.00	7.12	-20.60	46.20	-8.20
03-Aug-01	11.28	7.16	-25.40	50.80	-5.60	Dipole calibrated for Head only				
Standard Deviation	**0.42**	**0.23**	**1.88**	**0.96**	**1.38**	**0.32**	**0.18**	**0.74**	**0.61**	**0.37**
|Mean Value|	**10.74**	**6.85**	**23.38**			**10.78**	**6.98**	**19.98**		
Relative standard deviation %	**3.87%**	**3.41%**	**8.04%**			**2.97%**	**2.58%**	**3.71%**		

Cal Date	Dipole Calibration History									
	Dipole SN: 540, Frequency 1900 MHz									
	Head Parameters					Body Parameters				
	1g (W/Kg)	10g (W/Kg)	Return loss (dB)	Real (Ω)	Imaginary (Ω)	1g (W/Kg)	10g (W/Kg)	Return loss (dB)	Real (Ω)	Imaginary (Ω)
08-Feb-11	40.30	21.00	-27.60	50.50	4.20	40.70	21.60	-23.10	45.60	5.00
26-Jun-09	40.30	21.10	-30.00	48.50	2.70	40.90	21.50	-24.30	44.90	2.80
11-Jun-07	36.10	19.30	-25.40	51.90	5.10	38.00	20.70	-25.30	47.70	4.80
14-Jun-05	38.1	19.90	-25.40	51.90	5.20	39.10	20.70	-24.00	48.10	5.90
04-Jun-03	41.20	21.20	-28.50	50.30	3.80	Dipole calibrated for Head only				
Standard Deviation	**2.08**	**0.85**	**2.00**	**1.40**	**1.03**	**1.38**	**0.49**	**0.91**	**1.56**	**1.31**
|Mean Value|	**39.20**	**20.50**	**27.38**			**39.68**	**21.13**	**24.18**		
Relative standard deviation %	**5.30%**	**4.15%**	**7.31%**			**3.47%**	**2.33%**	**3.75%**		

Cal Date	Dipole Calibration History									
	Dipole SN: 725, Frequency 2450 MHz									
	Head Parameters					Body Parameters				
	1g (W/Kg)	10g (W/Kg)	Return loss (dB)	Real (Ω)	Imaginary (Ω)	1g (W/Kg)	10g (W/Kg)	Return loss (dB)	Real (Ω)	Imaginary (Ω)
08-Feb-11	52.90	24.70	-20.50	45.60	7.90	51.90	24.10	-20.20	49.50	9.70
08-Jan-09	52.10	24.30	-23.70	54.40	5.30	52.20	24.70	-23.40	49.00	6.70
17-Jan-07	53.30	24.80	-22.10	52.40	7.70	53.30	24.50	-21.80	47.80	7.70
04-Jan-05	54.5	24.70	-22.30	53.50	7.20	52.90	24.50	-22.20	48.50	7.50
17-Jan-03	54.70	24.50	-22.60	53.00	7.00	52.10	24.10	-21.70	49.00	8.10
Standard Deviation	**1.10**	**0.20**	**1.15**	**3.53**	**1.03**	**0.59**	**0.27**	**1.15**	**0.64**	**1.11**
|Mean Value|	**53.50**	**24.60**	**22.24**			**52.48**	**24.38**	**21.86**		
Relative standard deviation %	**2.05%**	**0.81%**	**5.18%**			**1.13%**	**1.10%**	**5.25%**		

Note:

1. SAR lab has more than one dipole, the 900 MHz calibration gap is 24 months from 2007 and a second dipole was use after this period.
2. The dipole history shows that the measured SAR relative standard deviation was all less than 10% for the calibration period. The return loss relative standard deviation was all less than 10 %. And the real and imaginary impedance standard deviation is within 5 **(Ω).**

Asset: #1255 checked by RD 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)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client 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 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

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

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

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

Issued: February 9, 2011

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V52.6
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.2 °C	41.5	0.97 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.3 ± 6 %	0.95 mho/m ± 6 %
Head TSL temperature during test	(21.5 ± 0.2) °C	----	----

SAR result with Head TSL

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

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

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.0	1.05 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.6 ± 6 %	1.05 mho/m ± 6 %
Body TSL temperature during test	(21.8 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.79 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^3 (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 Ω - 8.2 jΩ
Return Loss	- 21.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.1 Ω - 8.6 jΩ
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

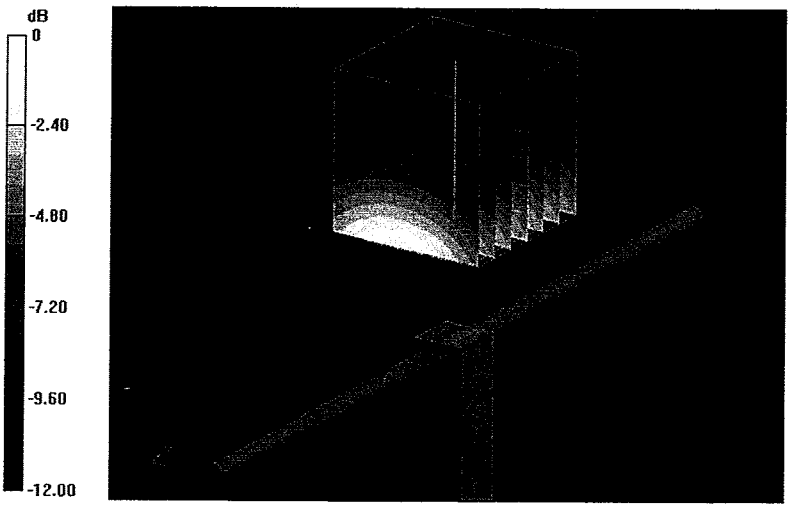
DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:124

Communication System: CW; Frequency: 900 MHz; Duty Cycle: 1:1
Medium: HSL900
Medium parameters used: f = 900 MHz; σ = 0.95 mho/m; ε_r = 40.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

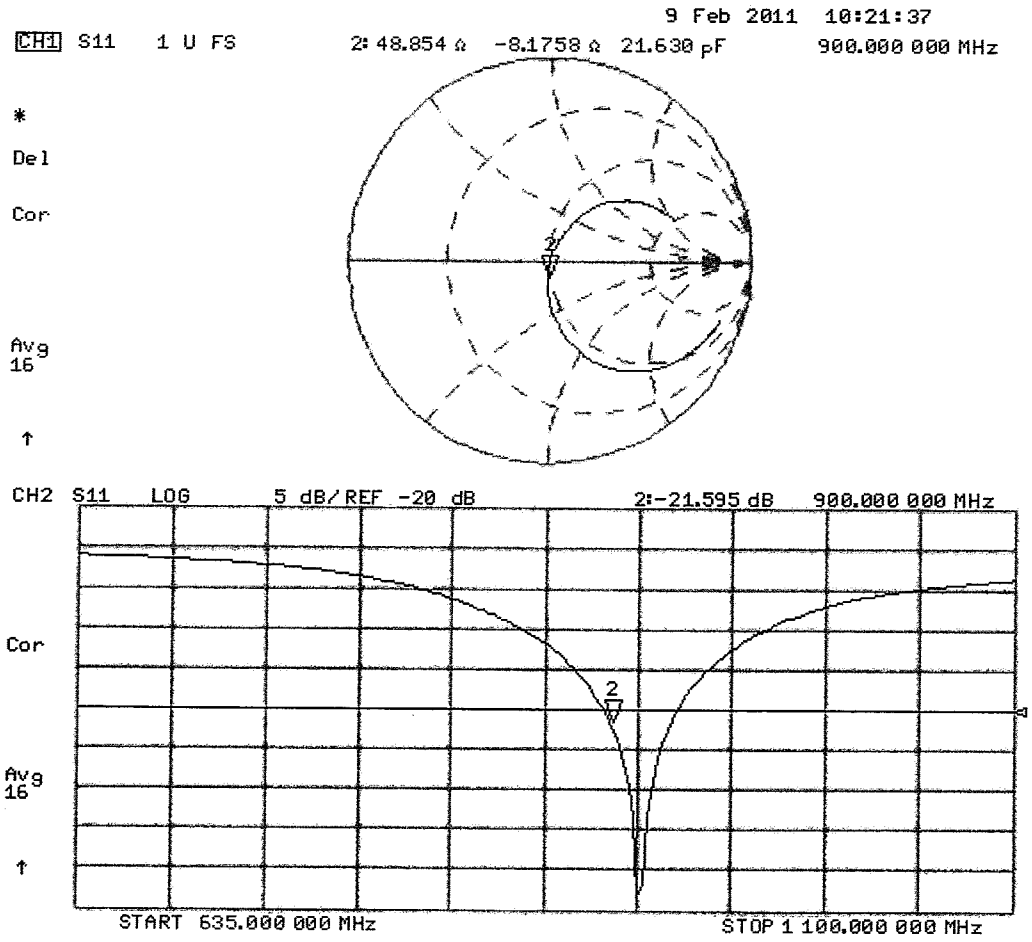
- Probe: ES3DV3 - SN3205; ConvF(5.88, 5.88, 5.88); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing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



0 dB = 3.180mW/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

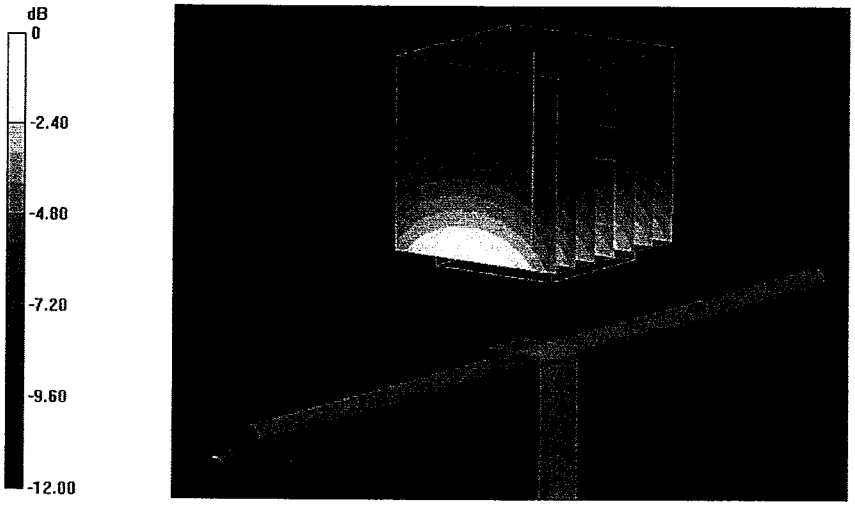
DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:124

Communication System: CW; Frequency: 900 MHz; Duty Cycle: 1:1
Medium: M900
Medium parameters used: f = 900 MHz; σ = 1.05 mho/m; ε_r = 53.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

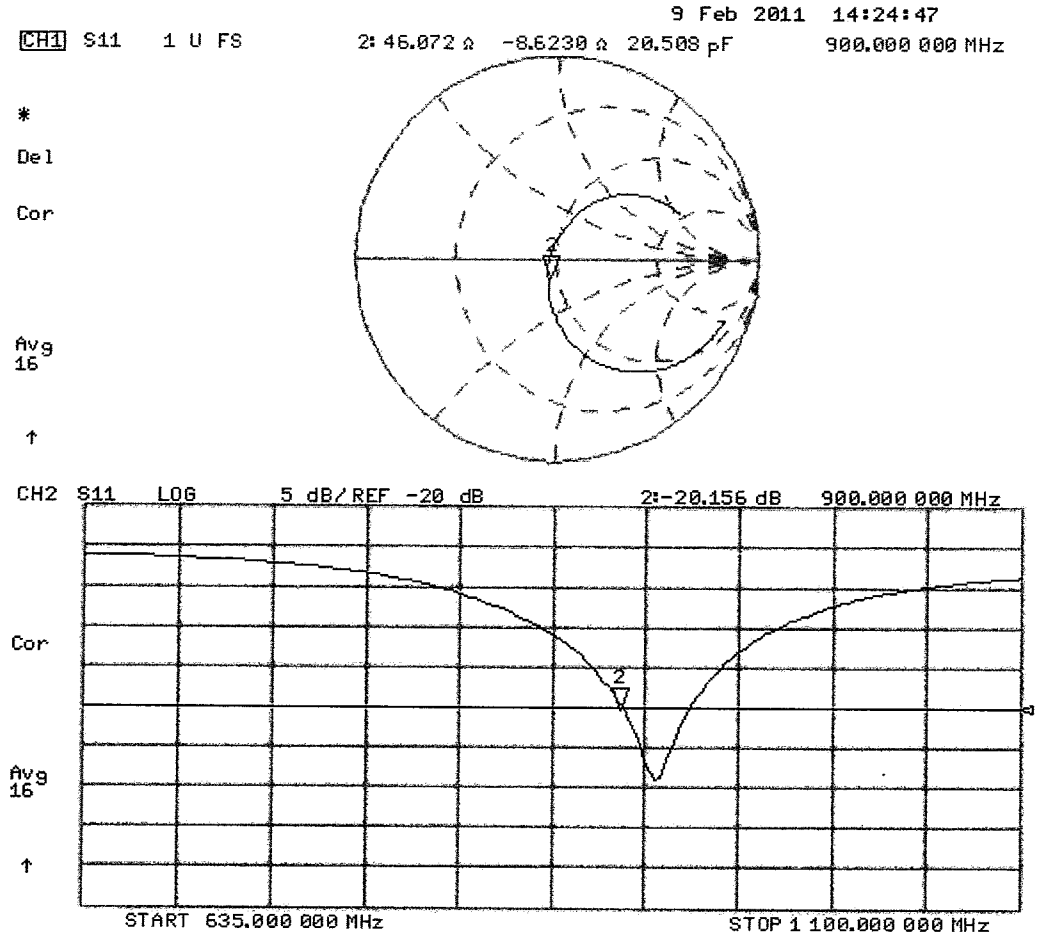
- Probe: ES3DV3 - SN3205; ConvF(5.81, 5.81, 5.81); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing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



0 dB = 3.270mW/g

Impedance Measurement Plot for Body TSL



ASSET: A1237 — Checked by KB 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

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

Accreditation No.: SCS 108

Client 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

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

Issued: February 8, 2011

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V52.6
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.8 ± 6 %	1.41 mho/m ± 6 %
Head TSL temperature during test	(21.0 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	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 ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
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 ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.8 ± 6 %	1.55 mho/m ± 6 %
Body TSL temperature during test	(21.2 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.3 mW / g
SAR normalized	normalized to 1W	41.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**40.7 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.43 mW / g
SAR normalized	normalized to 1W	21.7 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**21.6 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.5 Ω + 4.2 jΩ
Return Loss	- 27.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.6 Ω + 5.0 jΩ
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

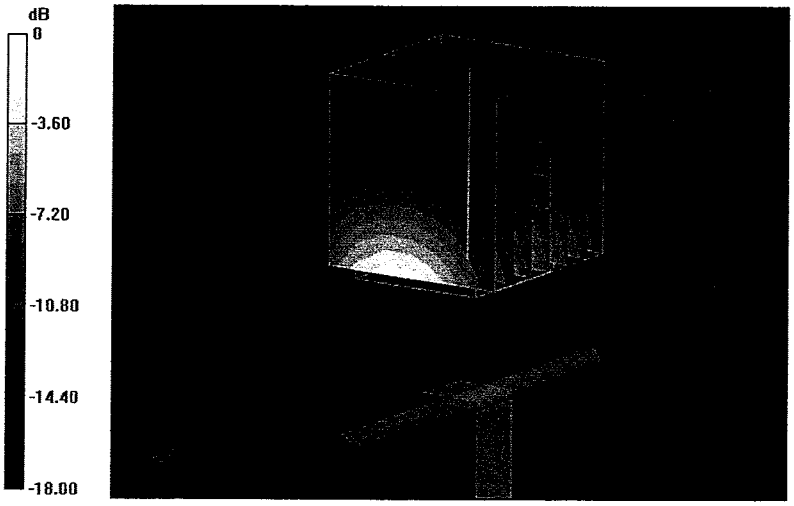
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:540

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: HSL U12 BB
Medium parameters used: f = 1900 MHz; σ = 1.41 mho/m; ε_r = 39.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

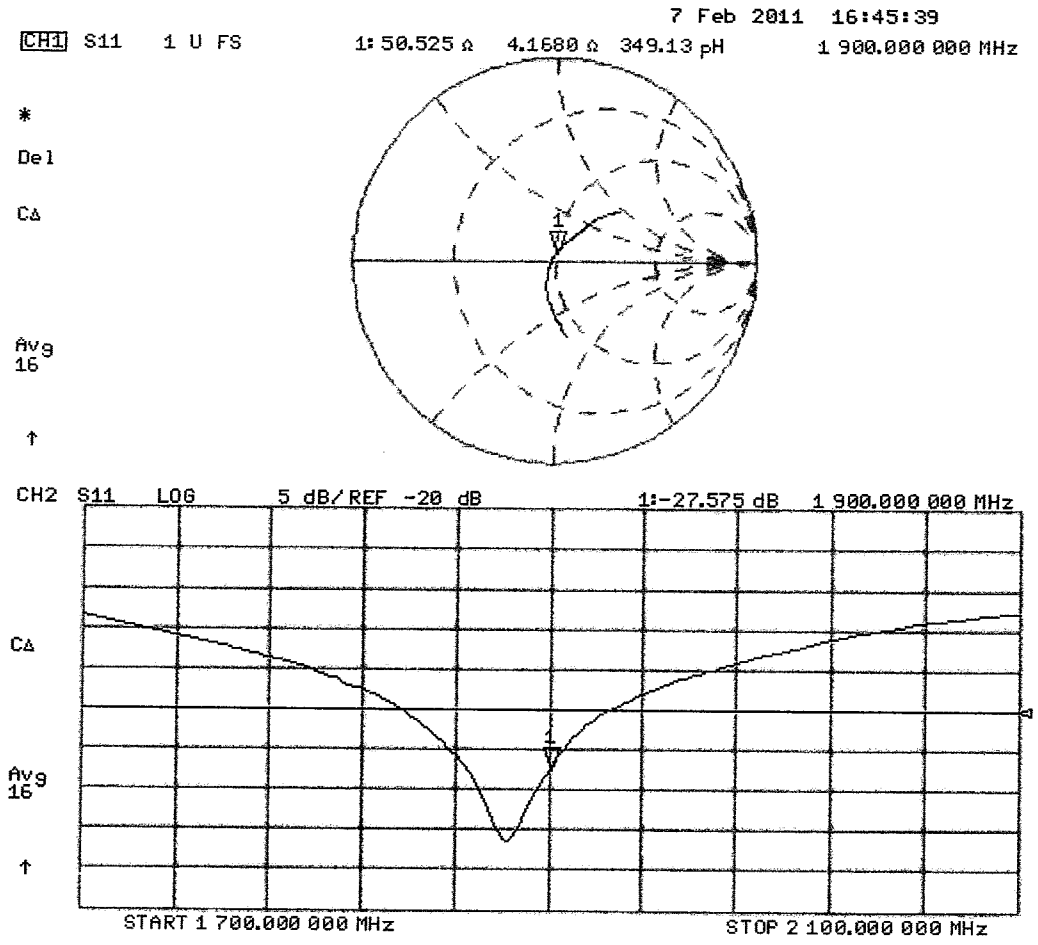
- Probe: ES3DV3 - SN3205; ConvF(5.09, 5.09, 5.09); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing 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



0 dB = 12.380mW/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

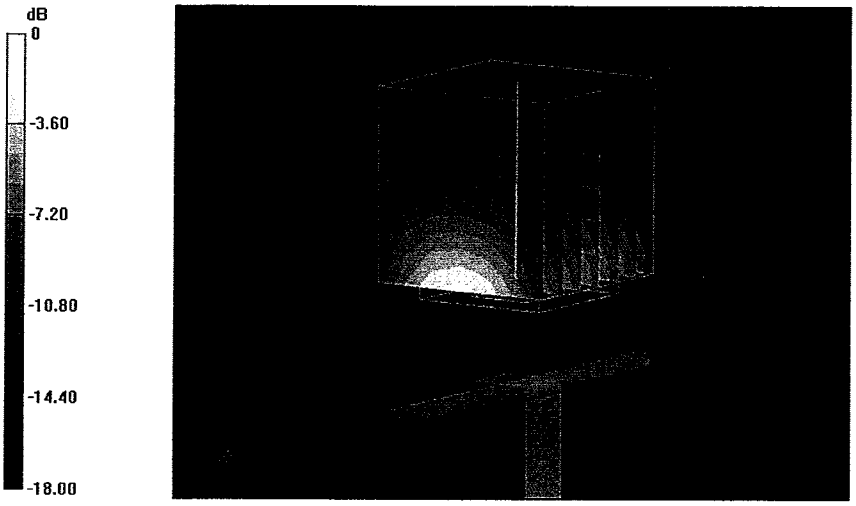
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:540

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: MSL U12 BB
Medium parameters used: f = 1900 MHz; σ = 1.55 mho/m; ε_r = 52.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

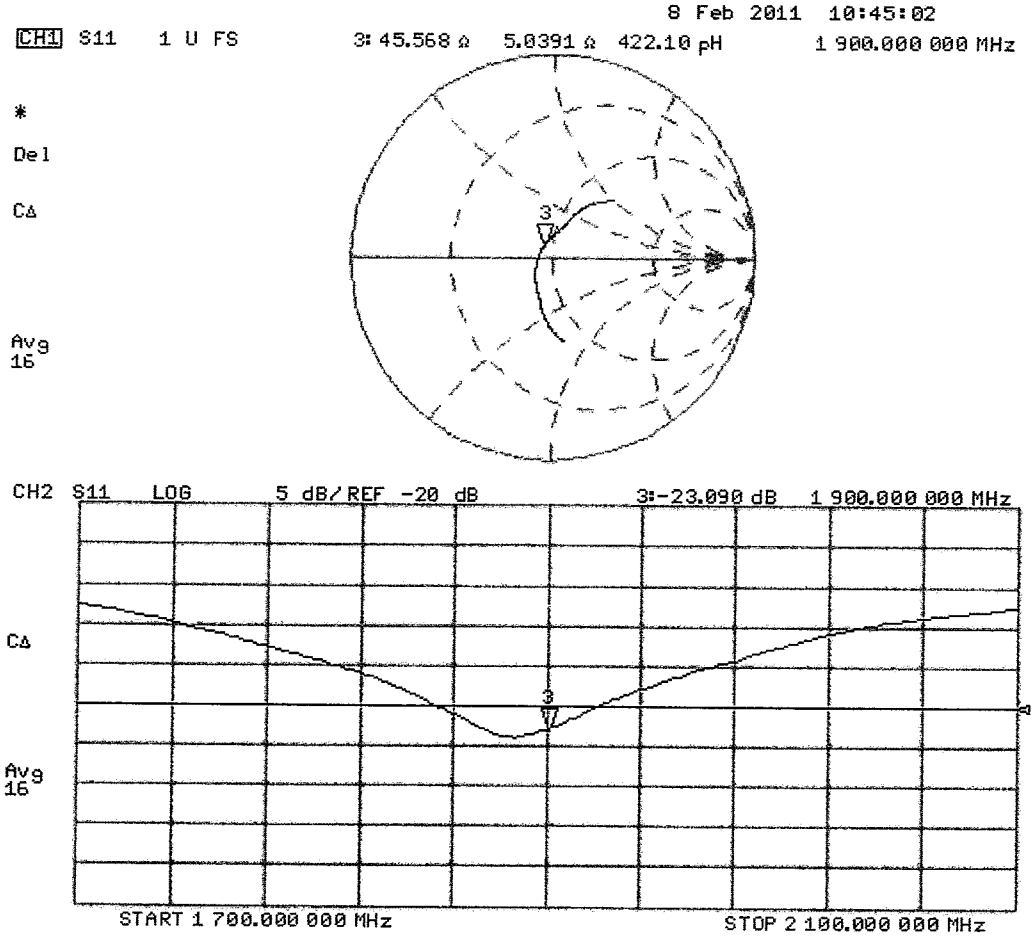
- Probe: ES3DV3 - SN3205; ConvF(4.59, 4.59, 4.59); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing 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



0 dB = 13.040mW/g

Impedance Measurement Plot for Body TSL



ASSET / A1322 - Checked by KP
21/02/2011

Calibration Laboratory of
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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: SCS 108

Client RFI

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 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

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

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

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

Issued: February 8, 2011

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V52.6
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.1 ± 6 %	1.73 mho/m ± 6 %
Head TSL temperature during test	(21.0 ± 0.2) °C	----	----

SAR result with Head TSL

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

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

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.2 ± 6 %	1.94 mho/m ± 6 %
Body TSL temperature during test	(21.0 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.0 mW / g
SAR normalized	normalized to 1W	52.0 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**51.9 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.04 mW / g
SAR normalized	normalized to 1W	24.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**24.1 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	45.6 Ω + 7.9 jΩ
Return Loss	- 20.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.5 Ω + 9.7 jΩ
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

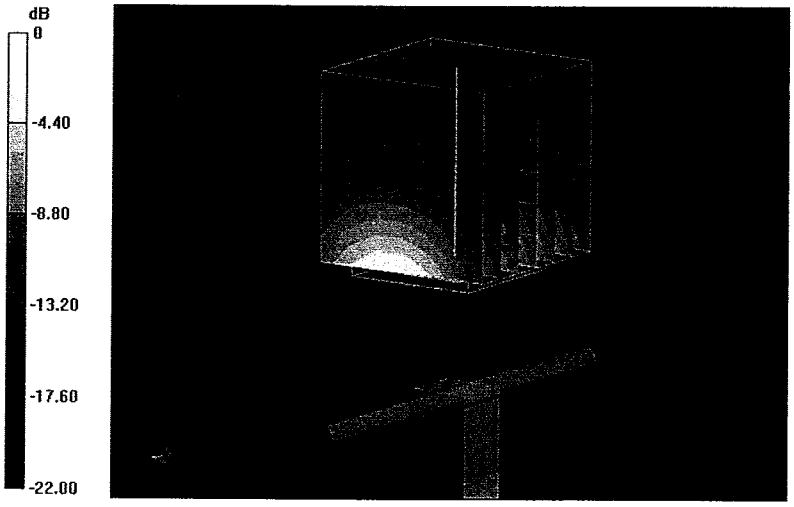
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:725

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL U12 BB
Medium parameters used: f = 2450 MHz; σ = 1.74 mho/m; ε_r = 39.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

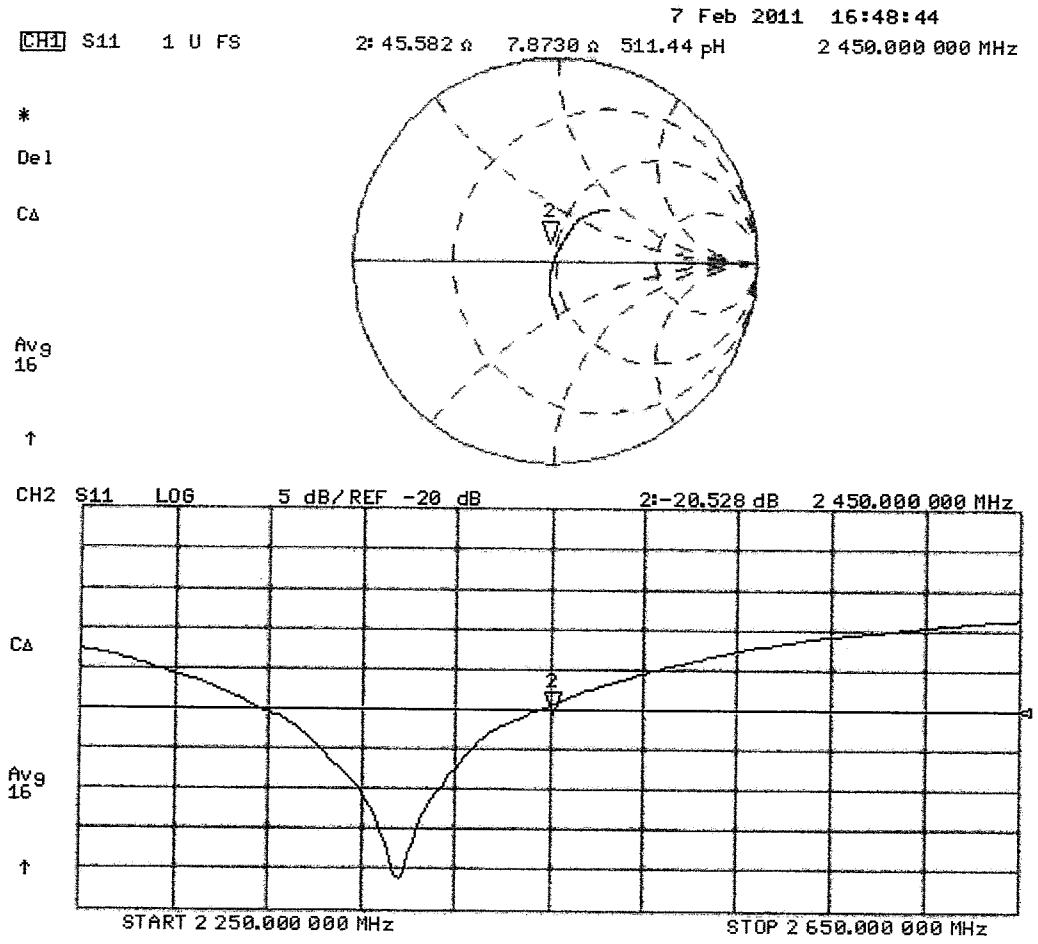
- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing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



0 dB = 16.610mW/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

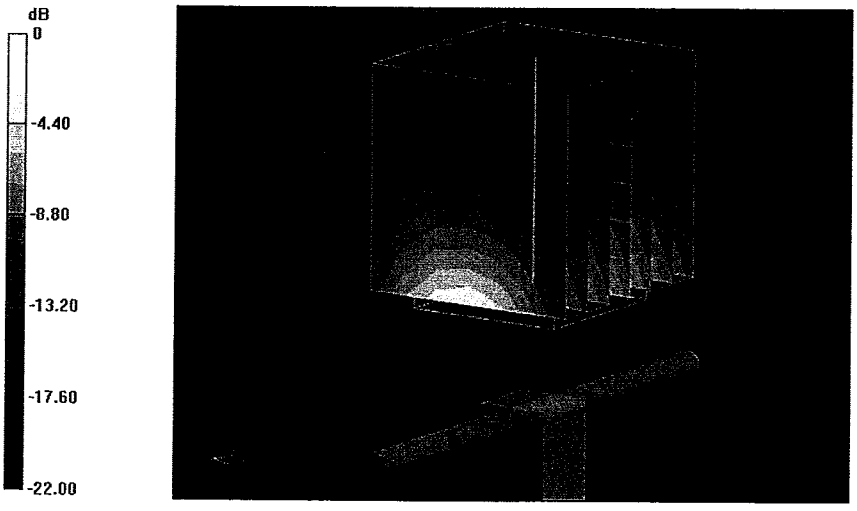
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:725

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: MSL U12 BB
Medium parameters used: f = 2450 MHz; σ = 1.95 mho/m; ε_r = 52.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

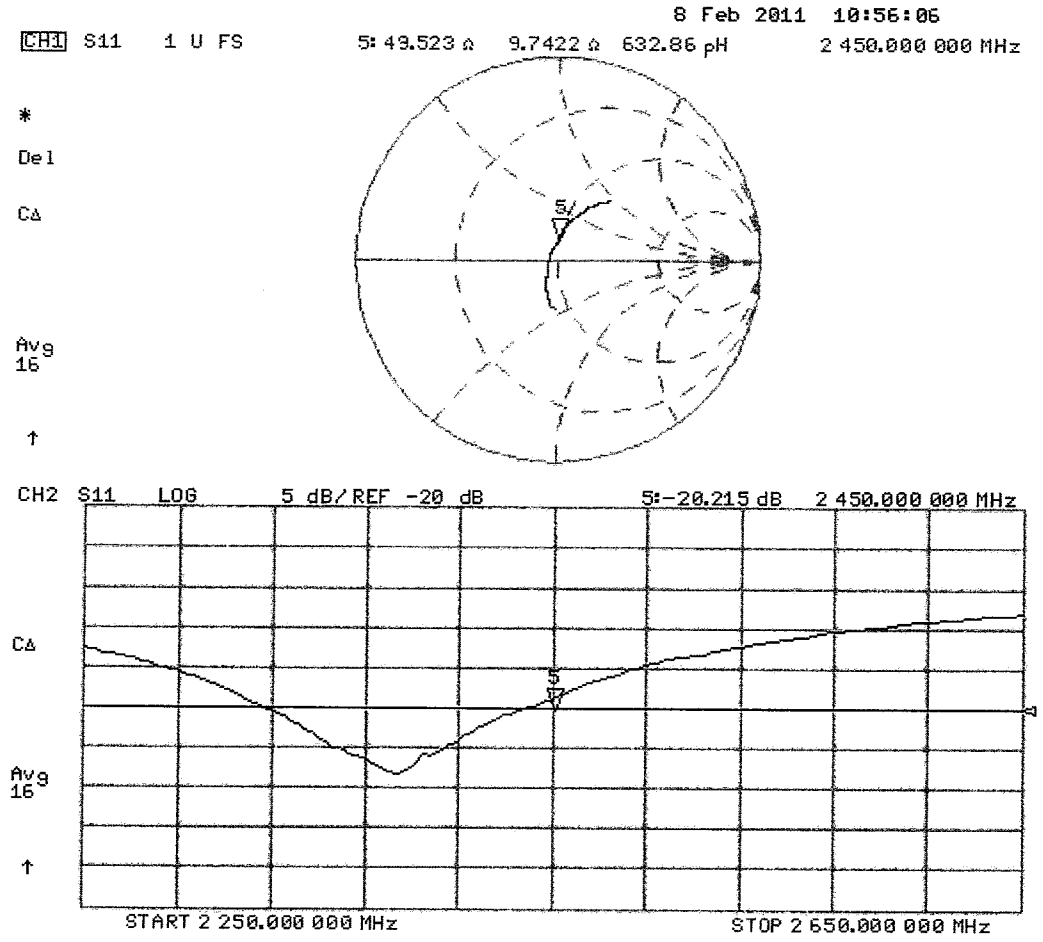
- Probe: ES3DV3 - SN3205; ConvF(4.31, 4.31, 4.31); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing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



0 dB = 17.120mW/g

Impedance Measurement Plot for Body TSL



27-SEPT-2011
Checked by R. Dinn

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Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: SCS 108

Client RFI

Certificate No: EX3-3814_Sep11

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3814

Calibration procedure(s): QA CAL-01.v8, QA CAL-12.v7, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes

Calibration date: September 22, 2011

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	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

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Fin Bomholt	R&D Director	

Issued: September 22, 2011

Calibration Laboratory of
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Zeughausstrasse 43, 8004 Zurich, Switzerland

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

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

Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe EX3DV4

SN:3814

Manufactured: September 2, 2011
Calibrated: September 22, 2011

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3814

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.52	0.51	0.44	± 10.1 %
DCP (mV)[B]	100.8	96.5	101.1	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	121.7	±2.7 %
			Y	0.00	0.00	1.00	115.0	
			Z	0.00	0.00	1.00	105.3	

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

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3814

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	43.5	0.87	9.55	9.55	9.55	0.12	1.00	± 13.4 %
750	41.9	0.89	9.26	9.26	9.26	0.80	0.67	± 12.0 %
900	41.5	0.97	8.75	8.75	8.75	0.71	0.73	± 12.0 %
1750	40.1	1.37	8.13	8.13	8.13	0.80	0.62	± 12.0 %
1900	40.0	1.40	7.78	7.78	7.78	0.80	0.61	± 12.0 %
2450	39.2	1.80	7.02	7.02	7.02	0.80	0.60	± 12.0 %

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

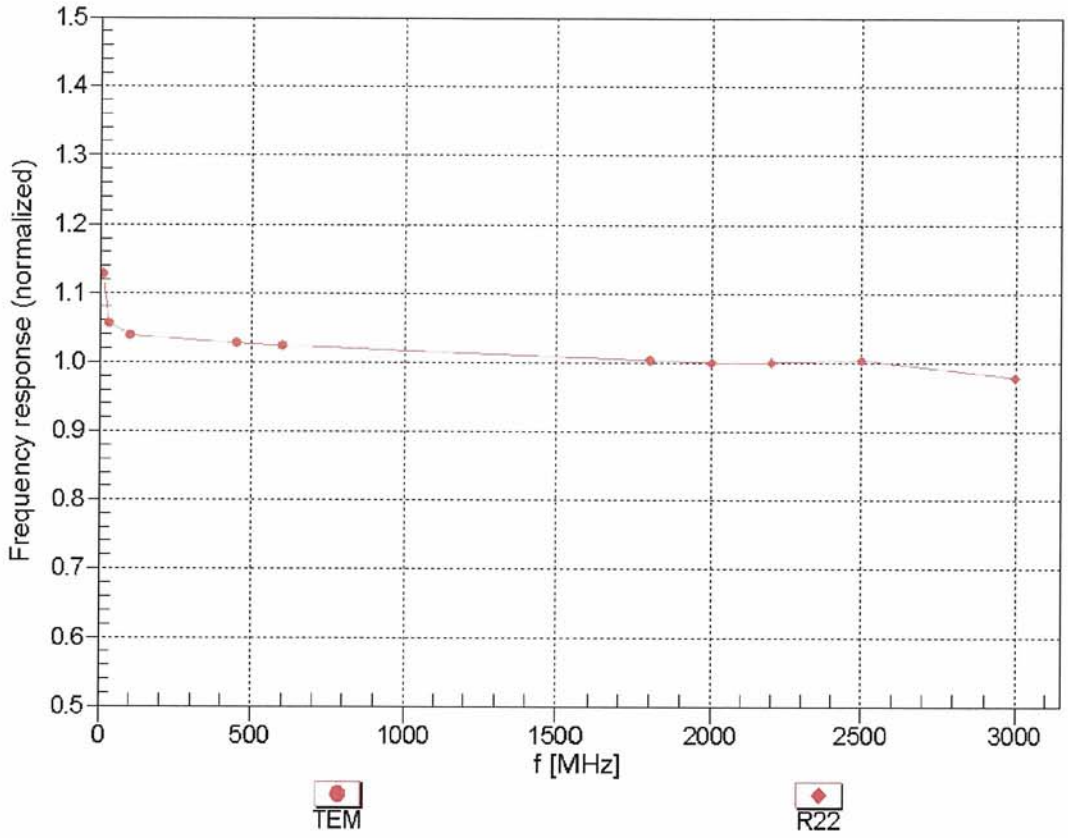
DASY/EASY - Parameters of Probe: EX3DV4 - SN:3814

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	56.7	0.94	10.39	10.39	10.39	0.04	1.00	± 13.4 %
750	55.5	0.96	9.28	9.28	9.28	0.80	0.65	± 12.0 %
900	55.0	1.05	8.92	8.92	8.92	0.80	0.65	± 12.0 %
1750	53.4	1.49	7.58	7.58	7.58	0.80	0.67	± 12.0 %
1900	53.3	1.52	7.31	7.31	7.31	0.80	0.68	± 12.0 %
2150	53.1	1.66	7.38	7.38	7.38	0.80	0.65	± 12.0 %
2450	52.7	1.95	7.15	7.15	7.15	0.80	0.50	± 12.0 %
2600	52.5	2.16	7.02	7.02	7.02	0.80	0.50	± 12.0 %
3700	51.0	3.55	6.35	6.35	6.35	0.26	1.68	± 13.1 %
5200	49.0	5.30	4.19	4.19	4.19	0.60	1.95	± 13.1 %
5500	48.6	5.65	3.86	3.86	3.86	0.60	1.95	± 13.1 %
5800	48.2	6.00	3.94	3.94	3.94	0.60	1.95	± 13.1 %

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

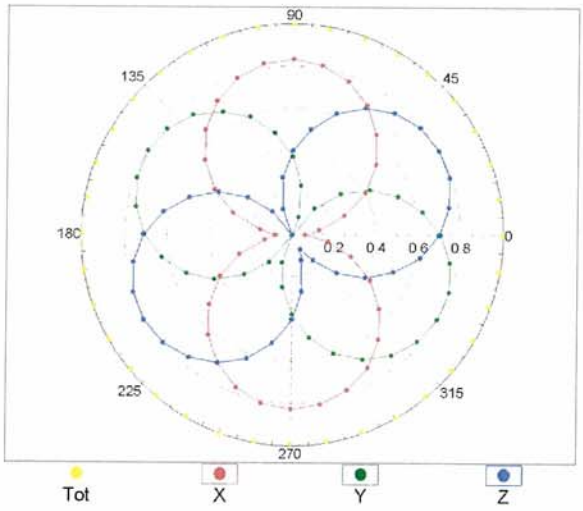
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



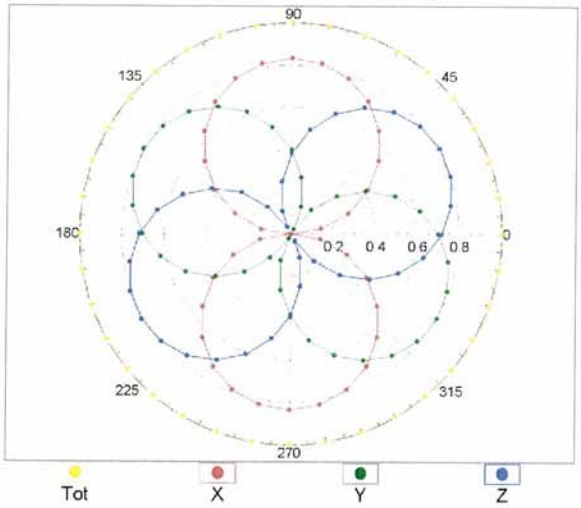
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

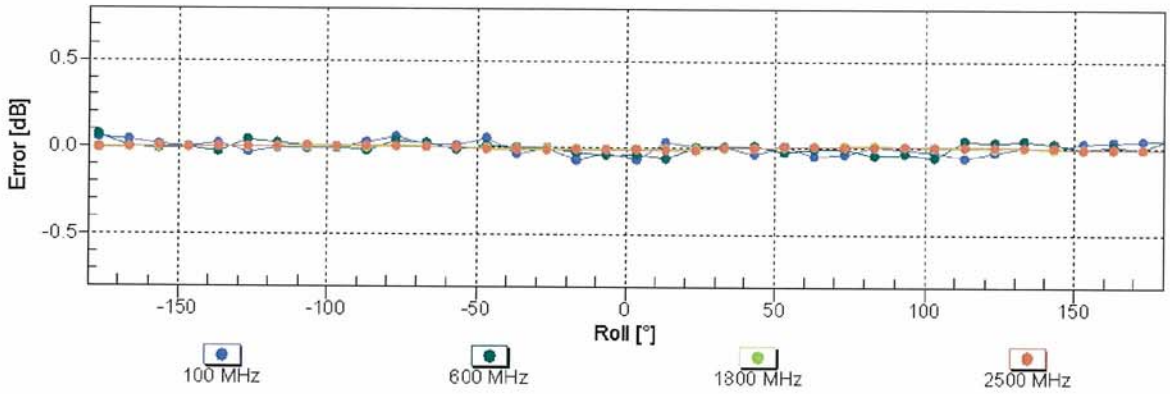
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



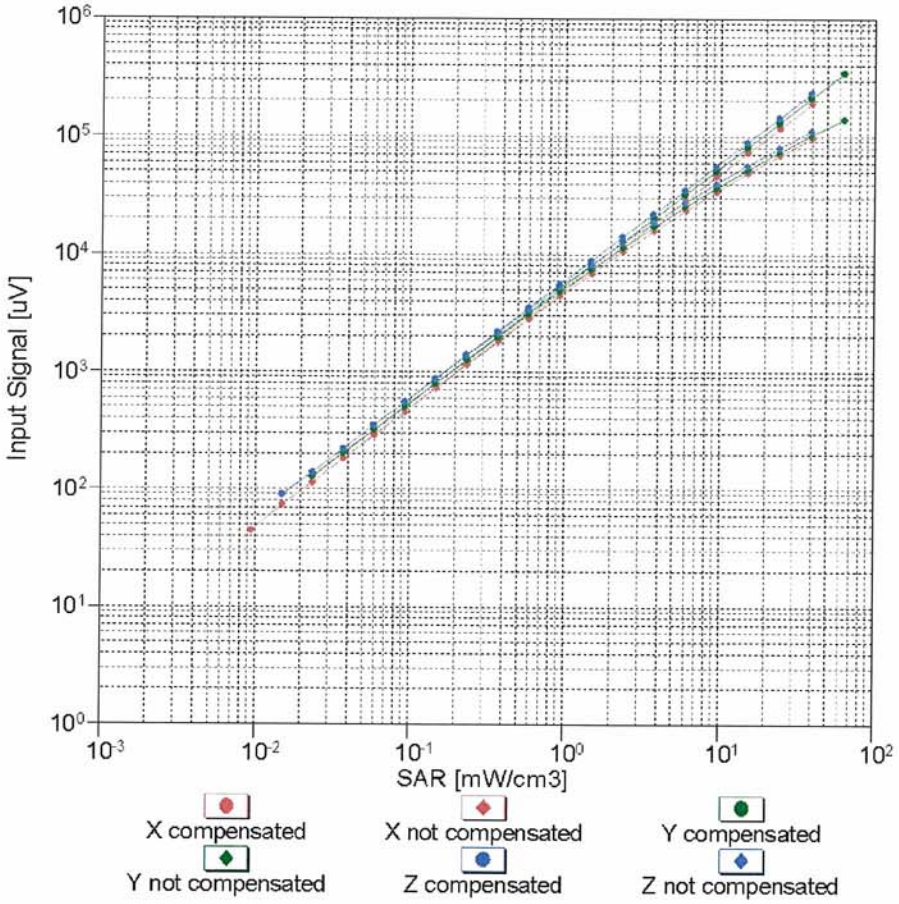
f=1800 MHz,R22

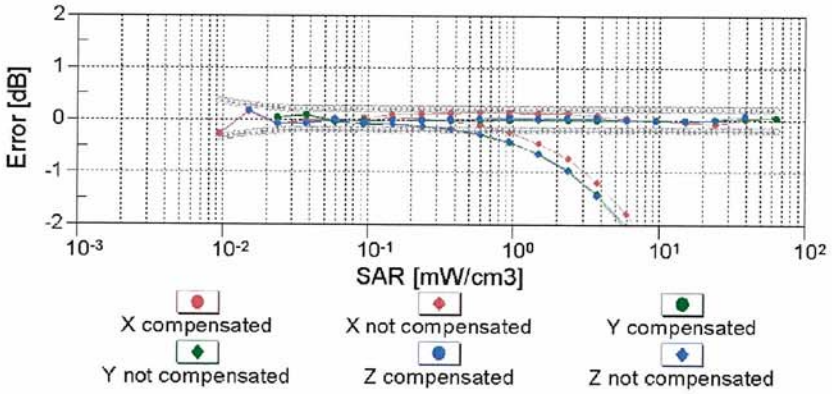




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

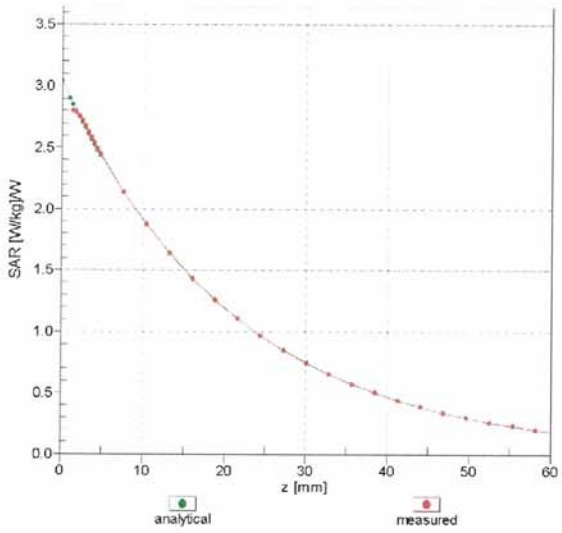




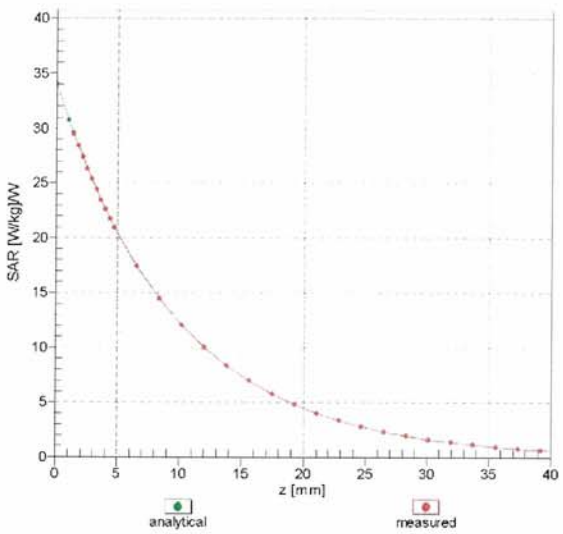
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 750 MHz,WGLS R9 (H_convF)

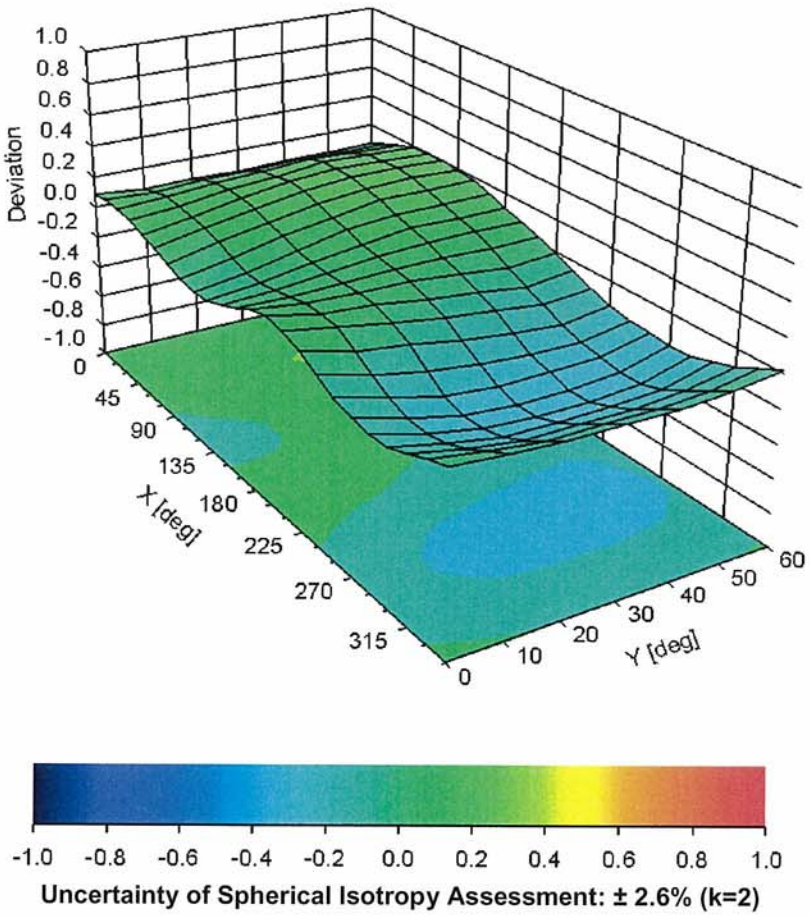


f = 2450 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3814

Other Probe Parameters

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

Checked by [redacted] 31- July - 2011

RFI Asset A1185

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

Accreditation No.: SCS 108

Client RFI

Certificate No: ET3-1528_Jul11

CALIBRATION CERTIFICATE

Object: ET3DV6 - SN:1528

Calibration procedure(s): QA CAL-01.v8, QA CAL-12.v7, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes

Calibration date: July 18, 2011

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter 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

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

Issued: July 20, 2011

Probe ET3DV6

SN:1528

Manufactured: March 21, 2000
Calibrated: July 18, 2011

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

DASY/EASY - Parameters of Probe: ET3DV6 - SN:1528

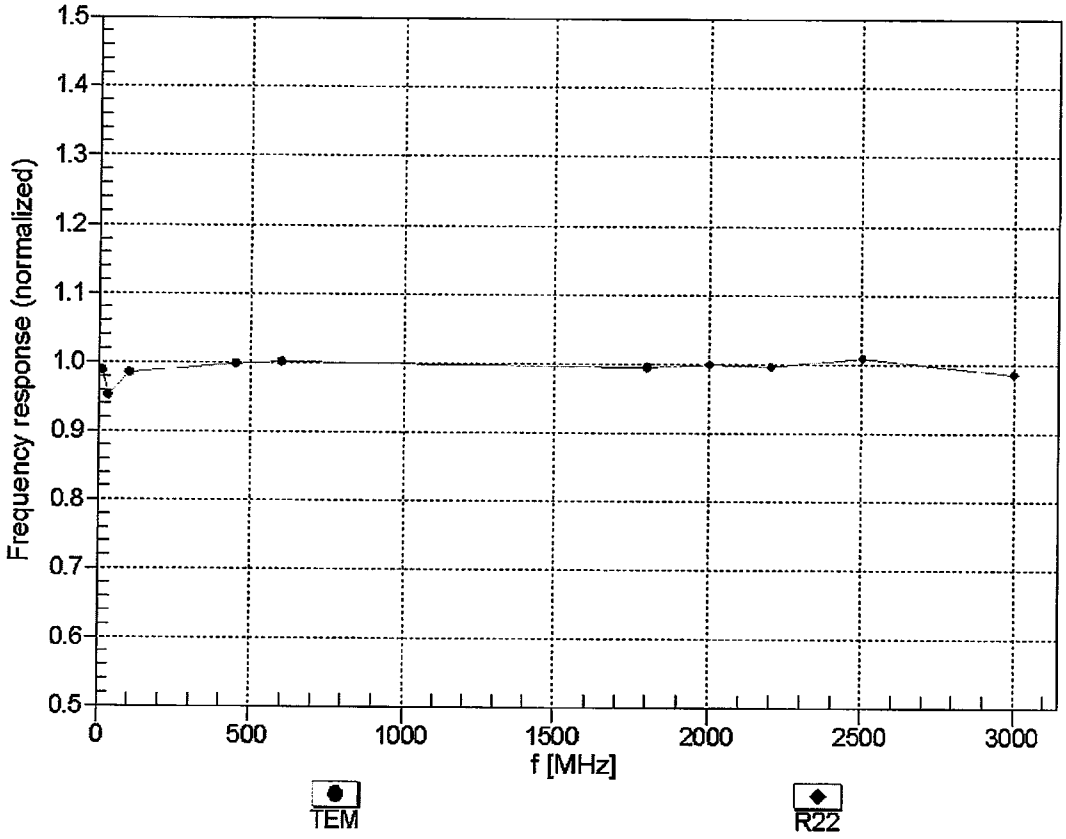
Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	45.3	0.87	7.28	7.28	7.28	0.20	2.22	± 13.4 %
750	41.9	0.89	6.26	6.26	6.26	0.97	1.69	± 12.0 %
900	41.5	0.97	5.85	5.85	5.85	0.97	1.65	± 12.0 %
1750	40.1	1.37	5.03	5.03	5.03	0.57	2.17	± 12.0 %
1900	40.0	1.40	4.81	4.81	4.81	0.68	2.03	± 12.0 %

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

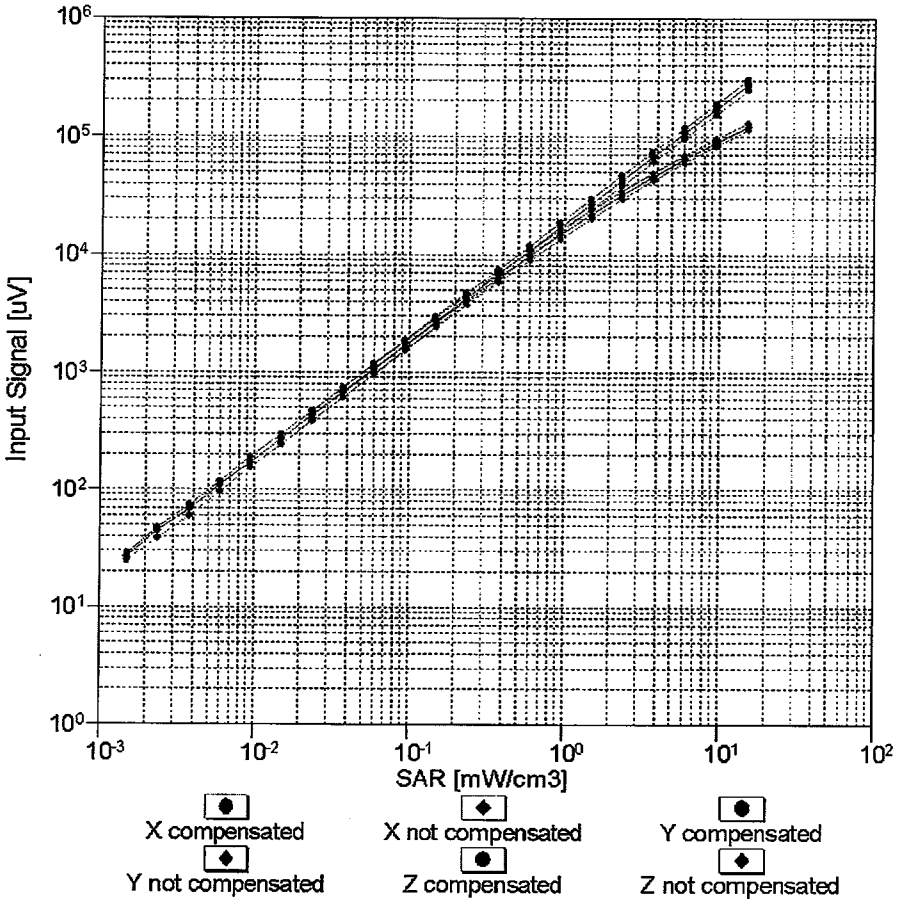
Frequency Response of E-Field

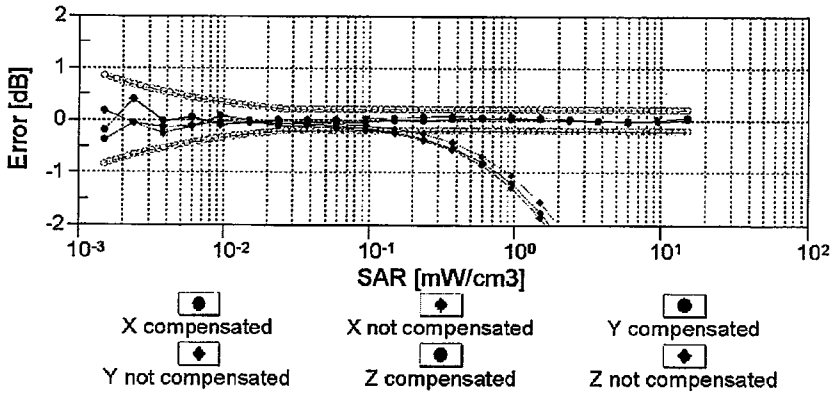
(TEM-Cell:ifi110 EXX, Waveguide: R22)



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

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





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

DASY/EASY - Parameters of Probe: ET3DV6 - SN:1528

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	enabled
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

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 +18.0ºC and +25.0ºC. The tissue equivalent material fluid temperature was controlled to give a maximum variation of ± 2.0ºC

Prior to any SAR measurements on the EUT, system Check and material dielectric property measurements were conducted. In the absence of a detailed procedure within the specification, system Check 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 Check 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 ≈ 27g) 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.