

**TEST REPORT
FROM
RFI GLOBAL SERVICES LTD**

Test of: Sony Ericsson, ST15a

**To: OET Bulletin 65 Supplement C: (2001-01)
RSS-102 Issue 4 March 2010**

**Test Report Serial No:
RFI/SAR/RP81726JD04A V2.0**

Version 2.0 supersedes all previous versions

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



(APPROVED SIGNATORY)

Checked By: Scott D'Adamo



(APPROVED SIGNATORY)

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25 May 2011 to 30 June 2011

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1. Customer Information

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

2. Equipment Under Test (EUT)

2.1. Identification of Equipment Under Test (EUT)

Description:	Smart Mobile Phone with GSM 2G Quad Band, 3G Tri band and WiFi Tech 802.11b/g/n.
Brand Name:	Sony Ericsson
Model Name or Number:	ST15a
Serial Number:	BX902DCMLA
IMEI Number:	004402141374169
Hardware Version Number:	AP2
Software Version Number:	4.0.B.2.5
Hardware Revision of GSM Module:	Not Applicable
Software Revision of GSM Module:	Not Applicable
FCC ID Number:	PY7A3880106
IC Certification Number:	4170B-A3880106
Country of Manufacture:	China
Date of Receipt:	25 May 2011

Note(s):

This sample was used to perform 2G WWAN SAR evaluation only. The sample supports simultaneous transmission with the WWAN and WLAN antenna > 5 cm apart. Wireless Personal Hotspot is also supported and was evaluated as per KDB 941225 D06 "Hot Spot SAR v01"

Identification of Equipment Under Test (EUT) (Continued)

Description:	Smart Mobile Phone with GSM 2G Quad Band, 3G Tri band and WiFi Tech 802.11b/g/n.
Brand Name:	Sony Ericsson
Model Name or Number:	ST15a
Serial Number:	BX902DCMA5
IMEI Number:	00440214 1374193
Hardware Version Number:	AP2
Software Version Number:	4.0.B.2.5
Hardware Revision of GSM Module:	Not Applicable
Software Revision of GSM Module:	Not Applicable
FCC ID Number:	PY7A3880106
IC Certification Number:	4170B-A3880106
Country of Manufacture:	China
Date of Receipt:	25 May 2011

Note(s):

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

2.2. Description of EUT

The Equipment Under Test is a Smart Mobile Phone with GSM 2G Quad Band, 3G tri-band and WiFi. The EUT has GPRS Class 12, UMTS FDD I, II, V With HSPA, WLAN 802.11b/g/n and *Bluetooth* mode capabilities.

2.3. Modifications Incorporated in the EUT

EUT (IMEI: 004402141374169) was setup for WWAN test only;
EUT (IMEI: 004402141374193) was setup for WLAN test only.

2.4. Accessories

The following accessories were supplied with the EUT during testing:

Description:	Battery
Brand Name:	Sony Ericsson
Model Name or Number:	EP500
Serial Number:	130364SWOENS
Cable Length and Type:	Not Applicable
Country of Manufacture:	China
Connected to Port	3 point contact

Description:	Personal Hands-Free
Brand Name:	Sony Ericsson
Model Name or Number:	MH610
Serial Number:	64
Cable Length and Type:	~1.5m
Country of Manufacture:	China
Connected to Port	3.5mm Jack

Description:	Micro-SD Memory Card
Brand Name:	Generic
Model Name or Number:	None Stated
Serial Number:	None Stated
Cable Length and Type:	Not applicable
Country of Manufacture:	None Stated
Connected to Port	Dedicated micro-SD card port

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

2.6. Additional Information Related to Testing		
Equipment Category	GSM/GPRS850, EGSM/GPRS900, DCS/GPRS1800, PCS1900/GPRS1900 / UMTS FDD I,II, V / WiFi802.11b/g/n / <i>Bluetooth</i>	
Type of Unit	Portable Transceiver	
Intended Operating Environment:	Within, GSM, UMTS FDD I, II, V and WiFi Coverage.	
Transmitter Maximum Output Power Characteristics:	GSM850	Communication Test Set was configured to allow the EUT to transmit at a maximum power of up to 33dBm.
	PCS1900	Communication Test Set was configured to allow the EUT to transmit at a maximum power of up to 29.8dBm.
	UMTS Band II	Communication Test Set was configured to allow the EUT to transmit at a maximum power of up to 24dBm.
	UMTS Band V	Communication Test Set was configured to allow the EUT to transmit at a maximum power of up to 24dBm.
	WiFi802.11b/g/n	EUT setup in test mode to allow the EUT to transmit at a maximum power of up to 18.0dBm 'b' mode, 18.9dBm 'g' / 'n' modes.
	<i>Bluetooth</i>	< 2dBm
Transmitter Frequency Range:	GSM850	(824 to 849) MHz
	PCS1900	(1850 to 1910) MHz
	UMTS Band II	(1852 to 1908) MHz
	UMTS Band V	(826 to 847) MHz
	WiFi802.11b/g/n	(2412 to 2462) 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	848.4
	512	Low	1850.2
	661	Middle	1880
	810	High	1909.8
	9262	Low	1852.4
	9400	Middle	1880
	9538	High	1907.6
	4132	Low	826.4
	4183	Middle	836.6
	4233	High	846.6
	1	Low	2412
	6	Middle	2437
11	High	2462	
Modulation(s):	GMSK (GSM/ GPRS): 217 HZ QPSK (UMTS/HSDPA):0 Hz DBPSK, CCK (WiFi): 0 Hz		
Modulation Scheme (Crest Factor):	GMSK (GSM): 8.3 GMSK (GSM850: GPRS/EGPRS): 2 GMSK (PCS1900: GPRS/EGPRS): 2.67 QPSK (UMTS FDD/HSDPA/HSPA): 1 DBPSK, CCK (WiFi): 1		
Antenna Type:	Internal		
Antenna Length:	Unknown		
Number of Antenna Positions:	2 Fixed (WWAN and WLAN/ <i>Bluetooth</i>)		
Power Supply Requirement:	3.7 V		
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.
Reference:	RSS-102 Issue 4 March 2010
Title:	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
Purpose of Test:	To determine whether the equipment met the basic restrictions as defined in RSS-102 Issue 4 March 2010 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.

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

KDB 447498 D01 "Mobile Portable RF Exposure v04"

KDB 648474 D01 SAR Handsets Multi Xmitter and Ant v01r05"

KDB 941225 D01 "SAR test for 3G v02"

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

KDB 941225 D06 "Hot Spot SAR v01"

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 Xmitter and Ant v01r05", KDB 447498 D01 "Mobile Potable RF Exposure V04", KDB 248227 D01 "SAR measurements for 802.11a/b/g v01r02", KDB 941225 D01 "SAR test for 3G devices V02" according to the handset procedures in IEEE Std 1528-2003, OET Bulletin 65 Supplement C 01-01 and the specific FCC test procedures. The assessment for Personal Wireless Hotspot was also evaluated as per KDB 941225 D06 "Hot Spot SAR v01".

Prior to testing the FCC was contacted for test approach on personal wireless hotspot, as per KDB 941225 D06 "Hot Spot SAR v01". The following tracking number 606201 was issued and Hotspot mode body testing was performed at 9mm separation from the EUT-to-body (SAM phantom flat section).

As per KDB648474 D01, Simultaneous transmission evaluation not required, even though the sum of the individual SAR for WWAN and WLAN was >1.6 W/kg, the antenna-to-antenna distance was > 5 cm and the SAR to peak location separation ratio of simultaneous transmitting antenna pair < 0.3

The calculation of Peak location separation distance are illustrated in SAR distribution Scan 'SCN/81726JD04/087' of 'Appendix 3'

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

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:

- GSM/GPRS850 Voice/Data allocated mode with Communication Test Set configured to allow the EUT to transmit at a maximum power of up to 33.0 dBm.
- PCS/GPRS1900 Voice/Data allocated mode with Communication Test Set configured to allow the EUT to transmit at a maximum power of up to 29.8 dBm.
- UMTS FDD II Call allocated mode with Communication Test Set configured to allow the EUT to transmit at a maximum power of up to 24 dBm.
- UMTS FDD II - 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 of up to 24 dBm.
- UMTS FDD II - RMC 12.2kbps + HSUPA 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 of up to 24 dBm.
- UMTS FDD V Call allocated mode with Communication Test Set configured to allow the EUT to transmit at a maximum power of up to 24 dBm.
- 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 of up to 24 dBm.
- UMTS FDD V - RMC 12.2kbps + HSUPA 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 of up to 24 dBm.
- WiFi802.11b/g/n Data allocated mode using "Putty" test software to excise mode 'b', 'g' and 'n', with maximum power of up to 18.0 dBm for 'b' mode and 18.9 dBm for 'g' and 'n' modes.

5.2. Configuration and Peripherals

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

- Head and Body-worn configuration were both evaluated with the EUT in a Standalone Battery Powered configuration.
- The applied configurations for body-worn orientations where the corresponding edge(s) is closest to the user with the most conservative exposure condition were all evaluated at 9 mm from the body as Personal Hotspot mode was supported. Therefore SAR test at 15 mm for configuration that overlapped with the Personal hotspot configuration were not evaluated.

Head Configuration

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

Body Configuration

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

6. Summary of Test Results

Test Name	Specification Reference	Result
Specific Absorption Rate-GSM 850 Head Configuration 1g	OET Bulletin 65 Supplement C: (2001-01) RSS-102 Issue 4 March 2010	Complied
Specific Absorption Rate-GPRS 850 Body Configuration 1g	OET Bulletin 65 Supplement C: (2001-01) RSS-102 Issue 4 March 2010	Complied
Specific Absorption Rate-EGPRS 850 Body Configuration 1g	OET Bulletin 65 Supplement C: (2001-01) RSS-102 Issue 4 March 2010	Complied
Specific Absorption Rate-GSM 850 Body Configuration 1g	OET Bulletin 65 Supplement C: (2001-01) RSS-102 Issue 4 March 2010	Complied
Specific Absorption Rate-PCS 1900 Head Configuration 1g	OET Bulletin 65 Supplement C: (2001-01) RSS-102 Issue 4 March 2010	Complied
Specific Absorption Rate-GPRS 1900 Body Configuration 1g	OET Bulletin 65 Supplement C: (2001-01) RSS-102 Issue 4 March 2010	Complied
Specific Absorption Rate-EGPRS 1900 Body Configuration 1g	OET Bulletin 65 Supplement C: (2001-01) RSS-102 Issue 4 March 2010	Complied
Specific Absorption Rate-PCS 1900 Body Configuration 1g	OET Bulletin 65 Supplement C: (2001-01) RSS-102 Issue 4 March 2010	Complied
Specific Absorption Rate-FDD 1900 Head Configuration 1g	OET Bulletin 65 Supplement C: (2001-01) RSS-102 Issue 4 March 2010	Complied
Specific Absorption Rate-FDD 1900 Body Configuration 1g	OET Bulletin 65 Supplement C: (2001-01) RSS-102 Issue 4 March 2010	Complied
Specific Absorption Rate-FDD 1900 Body Configuration 1g	OET Bulletin 65 Supplement C: (2001-01) RSS-102 Issue 4 March 2010	Complied
Specific Absorption Rate-UMTS-FDD 850 Head Configuration 1g	OET Bulletin 65 Supplement C: (2001-01) RSS-102 Issue 4 March 2010	Complied
Specific Absorption Rate-UMTS-FDD 850 Body Configuration 1g	OET Bulletin 65 Supplement C: (2001-01) RSS-102 Issue 4 March 2010	Complied
Specific Absorption Rate-FDD 850 Body Configuration 1g	OET Bulletin 65 Supplement C: (2001-01) RSS-102 Issue 4 March 2010	Complied
Specific Absorption Rate-Wi-Fi 2450 Head Configuration 1g	OET Bulletin 65 Supplement C: (2001-01) RSS-102 Issue 4 March 2010	Complied
Specific Absorption Rate-Wi-Fi 2450 Body Configuration 1g	OET Bulletin 65 Supplement C: (2001-01) RSS-102 Issue 4 March 2010	Complied

SAR Individual Transmitter Evaluation					
device, mode	Frequency, (MHz)	P _x (mW)	P _{REF} (mW)	single SAR, W/kg	Remarks
WWAN, GSM	850	2000	60/f	0.815	Routine Evaluation
WWAN, GSM	1900	954	60/f	0.690	Routine Evaluation
WWAN, UMTS	850	224	60/f	0.952	Routine Evaluation
WWAN, UMTS	1900	186	60/f	1.370	Routine Evaluation
WLAN,	2450	78	12	0.313	Routine Evaluation
BT, <i>Bluetooth</i>	2400	<2	12	0*	{P _{BT} ≤ 2P _{REF} } {d _{WWAN, BT} > 5cm}

*Test was not performed because output power for Bluetooth was less than 60/f or 12mw

SAR Simultaneous Transmitter Evaluation					
(x,y)	D(x,y) cm	L(x,y) cm	SPLSR _{xy}	Sim-Tx SAR	Remarks
(WWAN, BT)	>5	N/A	N/A	N/A	{no stand-alone SAR for BT}
(WWAN, WLAN)	>5	7.56	0.22	N/A	{D(x,y) > 5 } & {Σ _{WWAN, WLAN} > 1.6 W/kg} {SPLSR(x,y) < 0.3 }

Note(s):

1. Simultaneous transmission evaluation was not required as the output power for *Bluetooth* was < (60/f) and the Sum of all antenna < 1.6w/kg.
2. *Bluetooth* and WiFi transmitter thresholds output power “P_{Ref} = 12 as listed in KDB 648474.
3. P_x: power level measured by RFI (excluding *Bluetooth* Power).
4. Single SAR value was measured by RFI.
5. The “Antenna-to-Antenna distances were provided by the customer.
6. The Antenna-to-User distances were as per FCC KDB guidelines and procedures.

6.1. Location of Tests

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

7. Measurements, Examinations and Derived Results

7.1. General Comments

This section contains test results only.

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

7.2. Test Results

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

Test Summary:

Tissue Volume:	1g
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Maximum Level (W/kg):	0.545
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Environmental Conditions:

Temperature Variation in Lab (°C):	23.0 to 23.0
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Temperature Variation in Liquid (°C):	22.6 to 22.6
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Results:

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Touch	Left	190	0.494	1.600	1.106	-	Complied
Tilt	Left	190	0.361	1.600	1.239	-	Complied
Touch	Right	190	0.492	1.600	1.108	-	Complied
Tilt	Right	190	0.354	1.600	1.246	-	Complied
Touch	Left	128	0.545	1.600	1.055	-	Complied
Touch	Left	251	0.391	1.600	1.209	-	Complied

7.2.2. Specific Absorption Rate - GPRS 850 Body Configuration 1g

Test Summary:

Tissue Volume:	1g
Maximum Level (W/kg):	0.815

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	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Front of EUT Facing Phantom	Flat (SAM)	190	0.357	1.600	1.243	1, 2	Complied
Rear of EUT Facing Phantom	Flat (SAM)	190	0.815	1.600	0.785	1, 2	Complied
Rear of EUT Facing Phantom	Flat (SAM)	128	0.782	1.600	0.818	1, 2	Complied
Rear of EUT Facing Phantom	Flat (SAM)	251	0.715	1.600	0.885	1, 2	Complied
Left Hand Side of EUT Facing Phantom	Flat (SAM)	190	0.375	1.600	1.225	1, 2	Complied
Right Hand Side of EUT Facing Phantom	Flat (SAM)	190	0.406	1.600	1.194	1, 2	Complied
Top of EUT Facing Phantom	Flat (SAM)	190	0.261	1.600	1.339	1, 2	Complied
Rear of EUT Facing Phantom With PHF	Flat (SAM)	190	0.685	1.600	0.915	1, 2	Complied

Note(s):

1. EUT supports Hotspot; SAR measurements were performed with the EUT closest edge at a separation distance of 9mm from the 'SAM' phantom flat section.
2. SAR measurements were performed using 4 uplink timeslots

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

Tissue Volume:	1g
Maximum Level (W/kg):	0.786

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	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Rear of EUT Facing Phantom	Flat (SAM)	190	0.786	1.600	0.814	1, 2, 3	Complied

Note(s):

1. EUT supports Hotspot; SAR measurements were performed with the EUT closest edge at a separation distance of 9mm from the 'SAM' phantom flat section.
2. SAR measurements were performed using 4 uplink timeslots
3. Worst case configuration and channel of GPRS were applied to EGPRS body test.

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

Tissue Volume:	1g
Maximum Level (W/kg):	0.401

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	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Rear of EUT Facing Phantom	Flat (SAM)	190	0.401	1.600	1.199	1, 2	Complied

Note(s):

1. SAR measurements were performed with the EUT closest edge at a separation distance of 15mm from the 'SAM' phantom flat section.
2. Worst case configuration and channel of GPRS were applied to GSM body test.

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

Tissue Volume:	1g
Maximum Level (W/kg):	0.690

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	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Touch	Left	661	0.470	1.600	1.130	-	Complied
Tilt	Left	661	0.345	1.600	1.255	-	Complied
Touch	Right	661	0.612	1.600	0.988	-	Complied
Tilt	Right	661	0.636	1.600	0.964	-	Complied
Tilt	Right	512	0.423	1.600	1.177	-	Complied
Tilt	Right	810	0.690	1.600	0.910	-	Complied

7.2.6. Specific Absorption Rate - GPRS 1900 Body Configuration 1g

Test Summary:

Tissue Volume:	1g
Maximum Level (W/kg):	0.442

Environmental Conditions:

Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	21.5 to 21.5

Results:

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Front of EUT Facing Phantom	Flat (SAM)	661	0.164	1.600	1.436	1, 2	Complied
Rear of EUT Facing Phantom	Flat (SAM)	661	0.442	1.600	1.158	1, 2	Complied
Left Hand Side of EUT Facing Phantom	Flat (SAM)	661	0.105	1.600	1.495	1, 2	Complied
Right Hand Side of EUT Facing Phantom	Flat (SAM)	661	0.090	1.600	1.510	1, 2	Complied
Top of EUT Facing Phantom	Flat (SAM)	661	0.322	1.600	1.278	1, 2	Complied

Note(s):

1. EUT supports Hotspot; SAR measurements were performed with the EUT closest edge at a separation distance of 9mm from the 'SAM' phantom flat section.
2. SAR measurements were performed using 3 uplink timeslots

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

Tissue Volume:	1g
Maximum Level (W/kg):	0.683

Environmental Conditions:

Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	21.5 to 21.5

Results:

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Rear of EUT Facing Phantom	Flat (SAM)	661	0.573	1.600	1.027	1, 2, 3	Complied
Rear of EUT Facing Phantom	Flat (SAM)	512	0.384	1.600	1.216	1, 2, 3	Complied
Rear of EUT Facing Phantom	Flat (SAM)	810	0.670	1.600	0.930	1, 2, 3	Complied
Rear of EUT Facing Phantom With PHF	Flat (SAM)	810	0.683	1.600	0.917	1, 2, 3	Complied

Note(s):

1. EUT supports Hotspot; SAR measurements were performed with the EUT closest edge at a separation distance of 9mm from the 'SAM' phantom flat section.
2. SAR measurements were performed using 3 uplink timeslots
3. Worst case configuration and channel of GPRS were applied to EGPRS body test.

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

Tissue Volume:	1g
Maximum Level (W/kg):	0.347

Environmental Conditions:

Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	21.5 to 21.5

Results:

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Rear of EUT Facing Phantom	Flat (SAM)	661	0.347	1.600	1.253	1, 2	Complied

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. Worst case configuration and channel of GPRS were applied to PCS body test.

7.2.9. Specific Absorption Rate - UMTS FDD II Head Configuration 1g

Test Summary:

Tissue Volume:	1g
Maximum Level (W/kg):	1.010

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	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Touch	Left	9400	0.706	1.600	0.894	1	Complied
Tilt	Left	9400	0.671	1.600	0.929	1	Complied
Touch	Right	9400	0.913	1.600	0.687	1	Complied
Touch	Right	9262	0.925	1.600	0.675	1	Complied
Touch	Right	9538	1.010	1.600	0.590	1	Complied
Tilt	Right	9400	0.886	1.600	0.714	1	Complied
Tilt	Right	9262	0.827	1.600	0.773	1	Complied
Tilt	Right	9538	0.861	1.600	0.739	1	Complied

Note(s):

1. RMC 12.2kbps with Test loop mode 1 and TPC bits configured to All "1's"

7.2.10. Specific Absorption Rate – UMTS FDD II Body Configuration 1g

Test Summary:

Tissue Volume:	1g
Maximum Level (W/kg):	1.370

Environmental Conditions:

Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	22.2 to 22.2

Results:

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Front of EUT Facing Phantom	Flat (SAM)	9400	0.343	1.600	1.257	1, 2	Complied
Rear of EUT Facing Phantom	Flat (SAM)	9400	1.320	1.600	0.280	1, 2	Complied
Left Hand Side of EUT Facing Phantom	Flat (SAM)	9400	0.151	1.600	1.449	1, 2	Complied
Right Hand Side of EUT Facing Phantom	Flat (SAM)	9400	0.139	1.600	1.461	1, 2	Complied
Top of EUT Facing Phantom	Flat (SAM)	9400	0.513	1.600	1.087	1, 2	Complied
Rear of EUT Facing Phantom	Flat (SAM)	9262	1.370	1.600	0.230	1, 2	Complied
Rear of EUT Facing Phantom	Flat (SAM)	9538	1.250	1.600	0.350	1, 2	Complied
Rear of EUT Facing Phantom With PHF	Flat (SAM)	9262	1.010	1.600	0.590	1, 2	Complied

Specific Absorption Rate – UMTS FDD II Body Configuration 1g (Continued)

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Rear of EUT Facing Phantom	Flat (SAM)	9262	0.558	1.600	1.042	2, 3	Complied
Rear of EUT Facing Phantom	Flat (SAM)	9400	0.523	1.600	1.077	2, 3	Complied
Rear of EUT Facing Phantom	Flat (SAM)	9538	0.623	1.600	0.977	2, 3	Complied

Note(s):

1. EUT supports Hotspot; SAR measurements were performed with the EUT closest edge at a separation distance of 9mm from the 'SAM' phantom flat section.
2. RMC 12.2kbps with Test loop mode 1 and TPC bits configured to All "1's"
3. SAR measurements were performed with the EUT's closest edge at a separation distance of 15mm from the 'SAM' phantom flat section.

7.2.11. Specific Absorption Rate – UMTS FDD II + HSPA Body Configuration 1g

Test Summary:

Tissue Volume:	1g
Maximum Level (W/kg):	0.916

Environmental Conditions:

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

Results:

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Rear of EUT Facing Phantom	Flat (SAM)	9400	0.798	1.600	0.802	1, 2	Complied
Rear of EUT Facing Phantom	Flat (SAM)	9400	0.817	1.600	0.783	1, 3	Complied
Rear of EUT Facing Phantom	Flat (SAM)	9262	0.816	1.600	0.784	1, 3	Complied
Rear of EUT Facing Phantom	Flat (SAM)	9538	0.916	1.600	0.684	1, 3	Complied

Note(s):

1. EUT supports Hotspot; SAR measurements were performed with the EUT closest edge at a separation distance of 9mm from the 'SAM' phantom flat section.
2. RMC 12.2kbps with Test loop mode 1 and TPC bits configured to All "1's" with HSDPA enabled.
3. FRC configured to HS-DPCCH Sub-test 1 and H-Set 1 and QPSK settings with HSPA enabled.

**7.2.12. Specific Absorption Rate – UMTS FDD V Head Configuration 1g
Test Summary:**

Tissue Volume:	1g
Maximum Level (W/kg):	0.523

Environmental Conditions:

Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	22.8 to 22.8

Results:

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Touch	Left	4183	0.276	1.600	1.324	1	Complied
Tilt	Left	4183	0.387	1.600	1.213	1	Complied
Touch	Right	4183	0.523	1.600	1.077	1	Complied
Tilt	Right	4183	0.311	1.600	1.289	1	Complied
Touch	Right	4132	0.325	1.600	1.275	1	Complied
Touch	Right	4233	0.249	1.600	1.351	1	Complied

Note(s):

1. RMC 12.2kbps with Test loop mode 1 and TPC bits configured to All "1's"

7.2.13. Specific Absorption Rate – UMTS FDD V Body Configuration 1g

Test Summary:

Tissue Volume:	1g
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Maximum Level (W/kg):	0.952
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Environmental Conditions:

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

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Front of EUT Facing Phantom	Flat (SAM)	4183	0.323	1.600	1.277	1, 2	Complied
Rear of EUT Facing Phantom	Flat (SAM)	4183	0.937	1.600	0.663	1, 2	Complied
Rear of EUT Facing Phantom	Flat (SAM)	4132	0.952	1.600	0.648	1, 2	Complied
Rear of EUT Facing Phantom	Flat (SAM)	4233	0.926	1.600	0.674	1, 2	Complied
Left Hand Side of EUT Facing Phantom	Flat (SAM)	4183	0.255	1.600	1.345	1, 2	Complied
Right Hand Side of EUT Facing Phantom	Flat (SAM)	4183	0.327	1.600	1.273	1, 2	Complied
Top of EUT Facing Phantom	Flat (SAM)	4183	0.240	1.600	1.360	1, 2	Complied
Rear of EUT Facing Phantom With PHF	Flat (SAM)	4132	0.574	1.600	1.026	1, 2	Complied

Specific Absorption Rate – UMTS FDD V Body Configuration 1g (Continued)

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Rear of EUT Facing Phantom	Flat (SAM)	4132	0.429	1.600	1.171	2, 3	Complied
Rear of EUT Facing Phantom	Flat (SAM)	4183	0.430	1.600	1.170	2, 3	Complied
Rear of EUT Facing Phantom	Flat (SAM)	4233	0.427	1.600	1.173	2, 3	Complied

Note(s):

1. EUT supports Hotspot, SAR measurements were performed with the EUT closest edge at a separation distance of 9mm from the 'SAM' phantom flat section.
2. RMC 12.2kbps with Test loop mode 1 and TPC bits configured to All "1's"
3. SAR measurements were performed with the EUT's closest edge at a separation distance of 15mm from the 'SAM' phantom flat section.

7.2.14. Specific Absorption Rate – UMTS FDD V + HSPA Body Configuration 1g
Test Summary:

Tissue Volume:	1g
Maximum Level (W/kg):	0.456

Environmental Conditions:

Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	22.2 to 22.2

Results:

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Rear of EUT Facing Phantom	Flat (SAM)	4183	0.456	1.600	1.144	1, 2	Complied
Rear of EUT Facing Phantom	Flat (SAM)	4183	0.455	1.600	1.145	1, 3	Complied

Note(s):

1. EUT supports Hotspot; SAR measurements were performed with the EUT closest edge at a separation distance of 9mm from the 'SAM' phantom flat section.
2. RMC 12.2kbps with Test loop mode 1 and TPC bits configured to All "1's" with HSDPA enabled.
3. FRC configured to HS-DPCCH Sub-test 1 and H-Set 1 and QPSK settings with HSPA enabled.

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

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

Environmental Conditions:

Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	22.0 to 22.0

Results:

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Touch	Left	6	0.211	1.600	1.389	1	Complied
Tilt	Left	6	0.070	1.600	1.530	1	Complied
Touch	Right	6	0.281	1.600	1.319	1	Complied
Tilt	Right	6	0.075	1.600	1.525	1	Complied
Touch	Right	1	0.232	1.600	1.368	1	Complied
Touch	Right	11	0.102	1.600	1.498	1	Complied
Touch	Right	6	0.199	1.600	1.401	2	Complied
Touch	Right	6	0.209	1.600	1.391	3	Complied

Note(s):

1. WLAN 802.11b 1Mbps
2. WLAN 802.11g 6Mbps
3. WLAN 802.11n 6.5Mbps (MCS0 Greenfield Mode)

7.2.16. Specific Absorption Rate - Wi-Fi 802.11b/g/n Body Configuration 1g

Test Summary:

Tissue Volume:	1g
Maximum Level (W/kg):	0.313

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	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Front of EUT Facing Phantom	Flat (SAM)	6	0.078	1.600	1.522	1, 2	Complied
Rear of EUT Facing Phantom	Flat (SAM)	6	0.313	1.600	1.331	1, 2	Complied
Left Hand Side of EUT Facing Phantom	Flat (SAM)	6	0.085	1.600	1.515	1, 2	Complied
Right Hand Side of EUT Facing Phantom	Flat (SAM)	6	0.029	1.600	1.571	1, 2	Complied
Top of EUT Facing Phantom	Flat (SAM)	6	0.135	1.600	1.465	1, 2	Complied
Rear of EUT Facing Phantom	Flat (SAM)	6	0.237	1.600	1.363	1, 3	Complied
Rear of EUT Facing Phantom	Flat (SAM)	6	0.206	1.600	1.394	1, 4	Complied
Rear of EUT Facing Phantom	Flat (SAM)	1	0.201	1.600	1.399	1, 2	Complied
Rear of EUT Facing Phantom	Flat (SAM)	11	0.120	1.600	1.480	1, 2	Complied
Rear of EUT Facing Phantom With PHF	Flat (SAM)	6	0.223	1.600	1.377	1, 2	Complied

Note(s):

1. EUT supports Hotspot; SAR measurements were performed with the EUT closest edge at a separation distance of 9mm from the 'SAM' phantom flat section.
2. WLAN 802.11b 1Mbps
3. WLAN 802.11g 6Mbps
4. WLAN 802.11n 6.5Mbps (MCS0 Greenfield Mode)

**7.2.17. Conducted Average Power Measurement 2G
GSM - Measured Average Power:**

Channel Number	Frequency (MHZ)	GSM TX Power before Test (dBm)	Note
128	824.2	33.0	Conducted
190	836.6	33.0	Conducted
251	848.8	32.9	Conducted
512	1850.2	29.8	Conducted
661	1880.0	29.7	Conducted
810	1909.8	29.6	Conducted

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

Channel Number	Frequency (MHZ)	GPRS TX Power before Test (dBm) 4Uplink	GPRS TX Power before Test (dBm) 3Uplink	GPRS TX Power before Test (dBm) 2Uplink	Note
128	824.2	26.9	28.2	29.7	Conducted
190	836.6	27.2	28.1	29.9	Conducted
251	848.8	27.2	28.5	29.9	Conducted
512	1850.2	22.8	24.2	25.2	Conducted
661	1880.0	22.7	24.0	24.9	Conducted
810	1909.8	22.6	24.1	24.7	Conducted

GPRS - Calculated Value With consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	GPRS TX Power before Test (dBm) 4Uplink	GPRS TX Power before Test (dBm) 3Uplink	GPRS TX Power before Test (dBm) 2Uplink	Note
128	824.2	23.9	23.9	23.7	Conducted
190	836.6	24.2	23.8	23.9	Conducted
251	848.8	24.2	24.2	23.9	Conducted
512	1850.2	19.8	19.9	19.2	Conducted
661	1880.0	19.7	19.7	18.9	Conducted
810	1909.8	19.6	19.8	18.7	Conducted

Note:

Scale factor for uplink time slot:

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

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

Channel Number	Frequency (MHZ)	EGPRS TX Power before Test (dBm) 4Uplink	EGPRS TX Power before Test (dBm) 3Uplink	EGPRS TX Power before Test (dBm) 2Uplink	Note
128	824.2	27.1	28.2	29.7	Conducted
190	836.6	27.2	28.2	29.8	Conducted
251	848.8	27.1	28.4	29.9	Conducted
512	1850.2	22.9	24.3	25.3	Conducted
661	1880.0	22.8	24.1	24.9	Conducted
810	1909.8	22.7	24.0	24.6	Conducted

EGPRS - Calculated Value With consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	EGPRS TX Power before Test (dBm) 4Uplink	EGPRS TX Power before Test (dBm) 3Uplink	EGPRS TX Power before Test (dBm) 2Uplink	Note
128	824.2	24.1	23.9	23.7	Conducted
190	836.6	24.2	23.9	23.8	Conducted
251	848.8	24.1	24.1	23.9	Conducted
512	1850.2	19.9	20.0	19.3	Conducted
661	1880.0	19.8	19.8	18.9	Conducted
810	1909.8	19.7	19.7	18.6	Conducted

Note:

Scale factor for uplink time slot:

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

7.2.18. 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	4132 4357	23.1	22.3	21.5	21.0	22.6	22.9	21.3	22.9	21.6	23.4
	4183 4408	23.2	22.2	21.2	20.7	22.5	22.8	21.2	22.7	21.6	23.5
	4233 4458	22.8	21.9	21.0	20.6	22.4	22.8	21.2	22.8	21.4	23.3
1900	9262 9662	22.5	21.7	20.6	20.1	21.9	22.3	20.7	20.5	20.8	22.7
	9400 9800	22.4	21.2	19.9	19.5	21.9	22.2	20.5	20.3	20.7	22.7
	9538 9938	22.3	21.2	20.4	19.8	21.8	22.0	20.5	20.5	20.8	22.7
βc		2	12	15	15	11	6	15	2	15	
βd		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	$\beta_{hs}^{(1)}$	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 $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$

Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $B_{hs}/\beta_c = 24/15$

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 $\beta_c = 11/15$ and $\beta_d = 15/15$

Sub-test 5 Setup for Release 6 HSPA

Sub-test	β_c	β_d	B_d (SF)	β_c/β_d	$\beta_{hs}^{(1)}$	B_{cc}	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	$B_{alt1}: 47/15$ $B_{alt2}: 47/15$	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 $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$

Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $B_{hs}/\beta_c = 24/15$. 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 $\beta_c = 10/15$ and $\beta_d = 15/15$.

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 $\beta_c = 14/15$ and $\beta_d = 15/15$.

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

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

**7.2.19. Conducted Power Measurements Wi-Fi 802.11b/g/n
802.11b/g**

Channel Number	Frequency (GHZ)	TX Power before Test (dBm)	Note
1	2.412	18.0	2.4GHz 802.11b (1Mbps)
6	2.437	17.0	
11	2.462	17.3	
1	2.412	16.2	2.4GHz 802.11b (11Mbps)
6	2.437	15.5	
11	2.462	15.6	
1	2.412	18.9	2.4GHz 802.11g (6Mbps)
6	2.437	17.6	
11	2.462	17.9	
1	2.412	15.6	2.4GHz 802.11g (54Mbps)
6	2.437	14.2	
11	2.462	14.4	

802.11n.

Channel Number	Frequency (GHZ)	TX Power before Test (dBm)	Note
1	2.412	18.7	2.4GHz 802.11n MCS0 (Preamble=3; Mixed Mode)
6	2.437	17.5	
11	2.462	17.7	
1	2.412	15.1	2.4GHz 802.11n MCS7 (Preamble=3; Mixed Mode)
6	2.437	13.7	
11	2.462	14.1	
1	2.412	18.8	2.4GHz 802.11n MCS0 (Preamble=4; Greenfield Mode)
6	2.437	17.6	
11	2.462	17.8	
1	2.412	15.1	2.4GHz 802.11n MCS7 (Preamble=4; Greenfield Mode)
6	2.437	13.7	
11	2.462	14.1	

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%	19.38
Specific Absorption Rate-GSM/GPRS/EGPRS850/UMTS FDD V 850 Body Configuration 1g	95%	19.51
Specific Absorption Rate-PCS 1900 / UMTS FDD II Head Configuration 1g	95%	20.18
Specific Absorption Rate-PCS / GPRS/EGPRS1900 / UMTS FDD II Body Configuration 1g	95%	19.44
Specific Absorption Rate-Wi-Fi 2450 Head Configuration 1g	95%	18.89
Specific Absorption Rate-Wi-Fi 2450 Body Configuration 1g	95%	19.34

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		U _i or U _{eff}
							+ u (%)	- u (%)	
B	Probe calibration	11.000	11.000	normal (k=2)	2.0000	1.0000	5.500	5.500	∞
B	Axial Isotropy	0.500	0.500	normal (k=2)	2.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	2.600	2.600	normal (k=2)	2.0000	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	0.320	0.320	normal (k=2)	2.0000	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			9.89	9.89	>200
	Expanded uncertainty			k = 1.96			19.38	19.38	>200

8.2. Specific Absorption Rate-GSM/GPRS/EGPRS850/UMTS FDD V 850 Body Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	C _i (10g)	Standard Uncertainty		v _i or v _{eff}
							+ u (%)	- u (%)	
B	Probe calibration	11.000	11.000	normal (k=2)	2.0000	1.0000	5.500	5.500	∞
B	Axial Isotropy	0.500	0.500	normal (k=2)	2.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	2.600	2.600	normal (k=2)	2.0000	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	0.320	0.320	normal (k=2)	2.0000	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			9.96	9.96	>250
	Expanded uncertainty			k = 1.96			19.51	19.51	>250

8.3. Specific Absorption Rate-PCS 1900 / UMTS FDD II Head Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	C _i (10g)	Standard Uncertainty		v _i or v _{eff}
							+ u (%)	- u (%)	
B	Probe calibration	11.000	11.000	normal (k=2)	2.0000	1.0000	5.500	5.500	∞
B	Axial Isotropy	0.500	0.500	normal (k=2)	2.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	2.600	2.600	normal (k=2)	2.0000	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	0.320	0.320	normal (k=2)	2.0000	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			10.30	10.30	>200
	Expanded uncertainty			k = 1.96			20.18	20.18	>200

8.4. Specific Absorption Rate-PCS / GPRS/EGPRS1900 / UMTS FDD II Body Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	C _i (10g)	Standard Uncertainty		v _i or v _{eff}
							+ u (%)	- u (%)	
B	Probe calibration	11.000	11.000	normal (k=2)	2.0000	1.0000	5.500	5.500	∞
B	Axial Isotropy	0.500	0.500	normal (k=2)	2.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	2.600	2.600	normal (k=2)	2.0000	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	0.320	0.320	normal (k=2)	2.0000	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			9.92	9.92	>200
	Expanded uncertainty			k = 1.96			19.44	19.44	>200

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		v _i or v _{eff}
							+ u (%)	- u (%)	
B	Probe calibration	11.000	11.000	normal (k=2)	2.0000	1.0000	5.500	5.500	∞
B	Axial Isotropy	0.500	0.500	normal (k=2)	2.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	2.600	2.600	normal (k=2)	2.0000	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	0.320	0.320	normal (k=2)	2.0000	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			9.64	9.64	>250
	Expanded uncertainty			k = 1.96			18.89	18.89	>250

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		v _i or v _{eff}
							+ u (%)	- u (%)	
B	Probe calibration	11.000	11.000	normal (k=2)	2.0000	1.0000	5.500	5.500	∞
B	Axial Isotropy	0.500	0.500	normal (k=2)	2.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	2.600	2.600	normal (k=2)	2.0000	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	0.320	0.320	normal (k=2)	2.0000	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			9.87	9.87	>200
	Expanded uncertainty			k = 1.96			19.34	19.34	>200

Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
A034	Narda 20W Termination	Narda	374BNM	8706	Calibrated as part of system	-
A1097	SMA Directional Coupler	MidISCO	MDC6223-30	None	Calibrated as part of system	-
A1137	3dB Attenuator	Narda	779	04690	Calibrated as part of system	-
A1174	Dielectric Probe Kit	Agilent Technologies	85070C	Us99360072	Calibrated before use	-
A1328	Handset Positioner	Schmid & Partner Engineering AG	Modification	SD 000 H01 DA	-	-
A1182	Handset Positioner	Schmid & Partner Engineering AG	V3.0	None	-	-
A1234	Data Acquisition Electronics	Schmid & Partner Engineering AG	DAE3	450	09 Feb 2011	12
A1329	900 MHz Dipole Kit	Schmid & Partner Engineering AG	D900V2	185	18 Aug 2009	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	-
L1035	Probe	Schmid & Partner Engineering AG	ET3 DV6	1611	12 May 2011	12
A1378	Probe	Schmid & Partner Engineering AG	EX3 DV3	3508	15 Feb 2011	12
A1497	Amplifier	Mini-Circuits	zhl-42w (sma)	e020105	Calibrated as part of system	-
A1566	SAM Phantom	Schmid & Partner Engineering AG	SAM a	002	Calibrated before use	-
A1990	Digital Camera	Samsung	E515	A23WC90 8A05431K	-	-
A215	20 dB Attenuator	Narda	766-20	9402	Calibrated as part of system	-
A1531	Antenna	AARONIA AG	7025	02458	-	-
C1042	Network Analyzer Cable	Agilent	8120-4779	349	-	-

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
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	-
M1015	Network Analyser	Agilent Technologies	8753ES	US39172406	27 Sept 2010	12
M1047	Robot Arm	Staubli	RX908 L	F00/SD8 9A1/A/01	Calibrated before use	-
M1159	Signal Generator	Agilent Technologies	E8241A	US42110332	Internal Checked 14 April 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.

rechecked by *AKB*
27-05-2010

A1329

**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: **D900V2-185_Aug09**

CALIBRATION CERTIFICATE

Object **D900V2 - SN: 185**

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

Calibration date: **August 18, 2009**

Condition of the calibrated item **In Tolerance**

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	08-Oct-08 (No. 217-00898)	Oct-09
Power sensor HP 8481A	US37292783	08-Oct-08 (No. 217-00898)	Oct-09
Reference 20 dB Attenuator	SN: 5086 (20g)	31-Mar-09 (No. 217-01025)	Mar-10
Type-N mismatch combination	SN: 5047.2 / 06327	31-Mar-09 (No. 217-01029)	Mar-10
Reference Probe ES3DV3	SN: 3205	26-Jun-09 (No. ES3-3205_Jun09)	Jun-10
DAE4	SN: 601	07-Mar-09 (No. DAE4-601_Mar09)	Mar-10
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

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

Issued: August 18, 2009

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



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

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V5.0
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	22.0 °C	41.5	0.97 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.4 ± 6 %	0.96 mho/m ± 6 %
Head TSL temperature during test	(22.4 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.75 mW / g
SAR normalized	normalized to 1W	11.0 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	11.0 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.76 mW / g
SAR normalized	normalized to 1W	7.04 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	7.06 mW / g ± 16.5 % (k=2)

¹ Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

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	52.7 ± 6 %	1.06 mho/m ± 6 %
Body TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.80 mW / g
SAR normalized	normalized to 1W	11.2 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	11.0 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.81 mW / g
SAR normalized	normalized to 1W	7.24 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	7.16 mW / g ± 16.5 % (k=2)

² Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.5 Ω - 10.3 j Ω
Return Loss	- 19.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.5 Ω - 11.2 j Ω
Return Loss	- 18.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.403 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	May 27, 2003

DASY5 Validation Report for Head TSL

Date/Time: 18.08.2009 08:57:04

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:185

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

Medium: HSL 900 MHz

Medium parameters used: $f = 900$ MHz; $\sigma = 0.96$ mho/m; $\epsilon_r = 40.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.88, 5.88, 5.88); Calibrated: 26.06.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

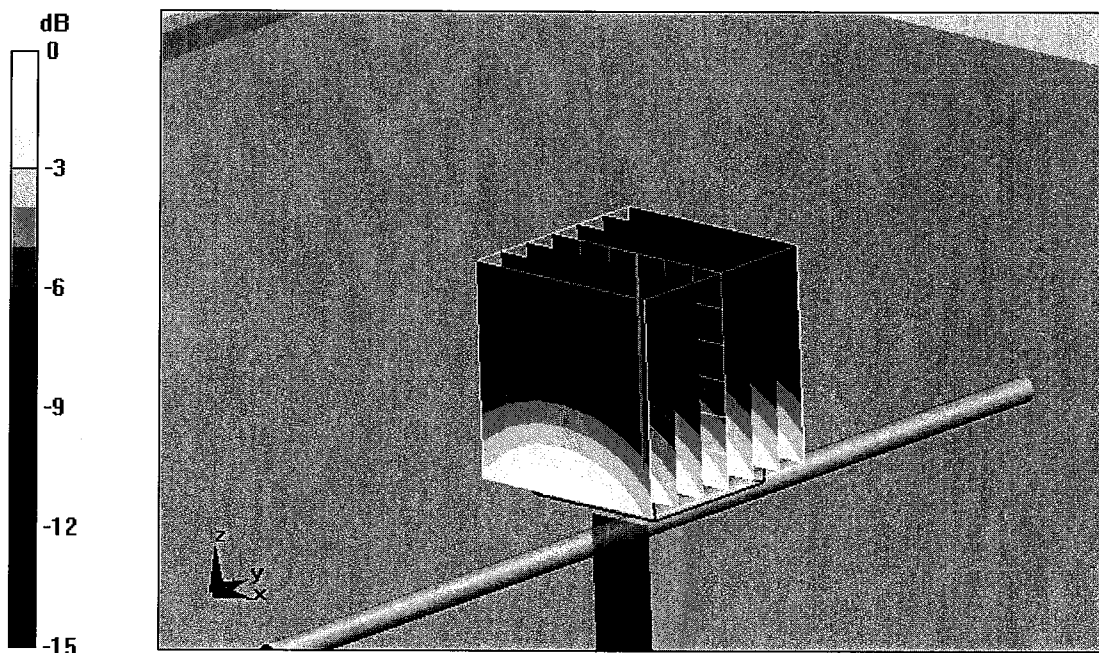
Pin=250mW; dip=15mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 59.7 V/m; Power Drift = 0.015 dB

Peak SAR (extrapolated) = 4.17 W/kg

SAR(1 g) = 2.75 mW/g; SAR(10 g) = 1.76 mW/g

Maximum value of SAR (measured) = 3.23 mW/g



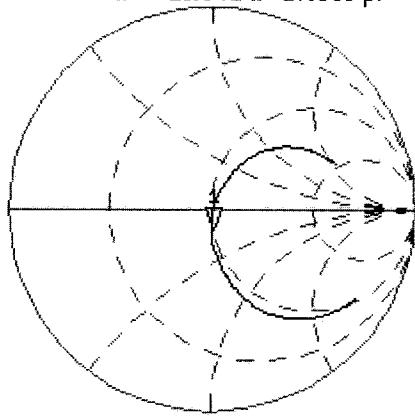
0 dB = 3.23mW/g

Impedance Measurement Plot for Head TSL

18 Aug 2009 08:06:03

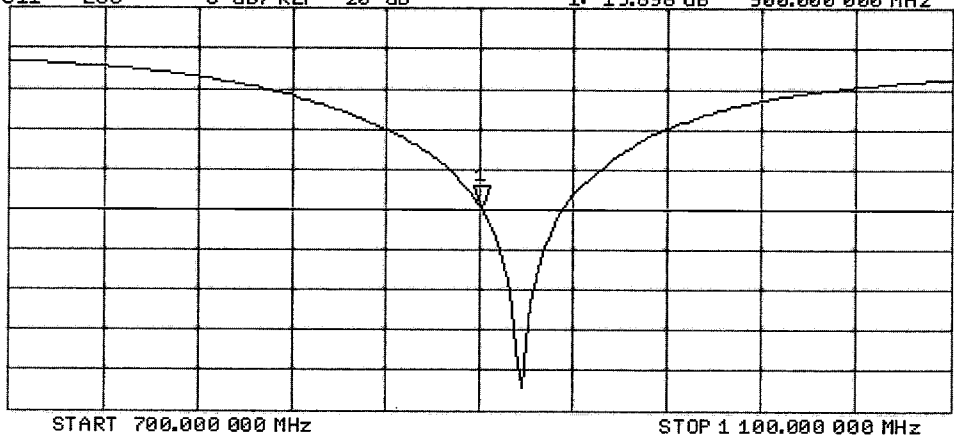
CH1 S11 1 U FS 1: 49.496 Ω -10.342 Ω 17.099 pF 900.000 000 MHz

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16
↑



CH2 S11 LOG 5 dB/REF -20 dB 1:-19.698 dB 900.000 000 MHz

Cor
Avg
16
↑



DASY5 Validation Report for Body

Date/Time: 17.08.2009 11:23:13

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:185

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

Medium: MSL900

Medium parameters used: $f = 900$ MHz; $\sigma = 1.06$ mho/m; $\epsilon_r = 52.7$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.81, 5.81, 5.81); Calibrated: 26.06.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

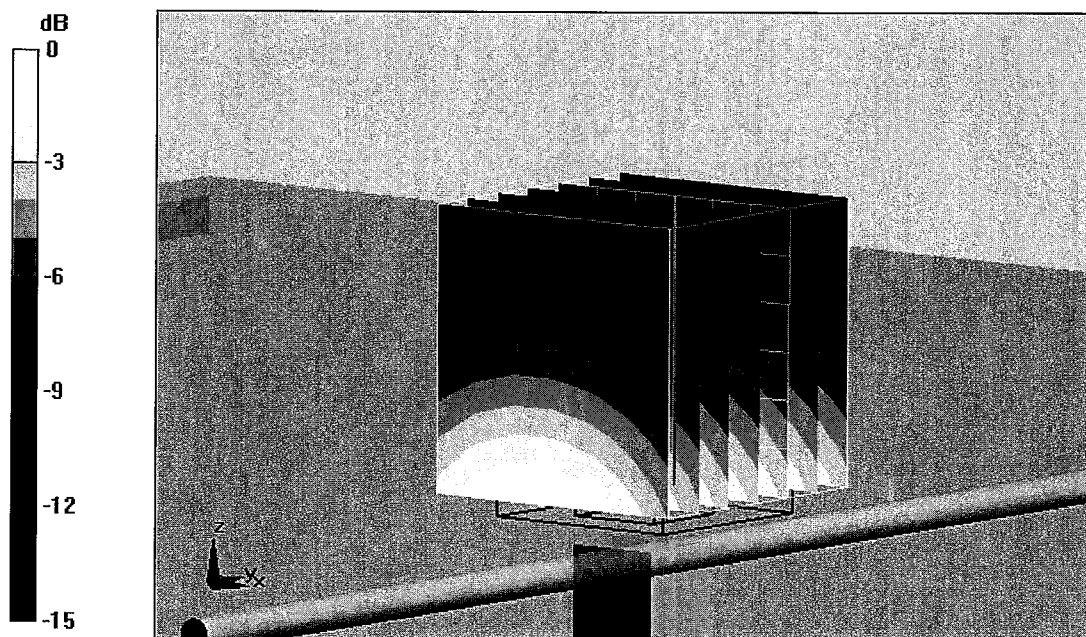
Pin=250mW; dip=15mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.2 V/m; Power Drift = 0.00569 dB

Peak SAR (extrapolated) = 4.19 W/kg

SAR(1 g) = 2.8 mW/g; SAR(10 g) = 1.81 mW/g

Maximum value of SAR (measured) = 3.24 mW/g



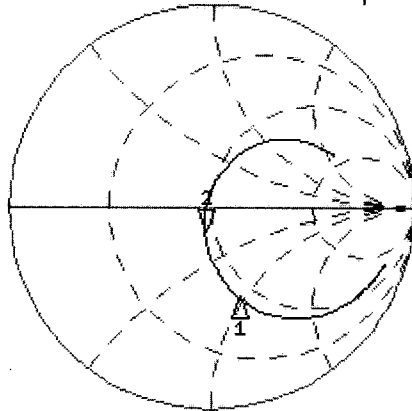
0 dB = 3.24mW/g

Impedance Measurement Plot for Body TSL

17 Aug 2009 08:58:55

CH1 S11 1 U FS 2: 45.471 Ω -11.215 Ω 15.768 pF 900.000 000 MHz

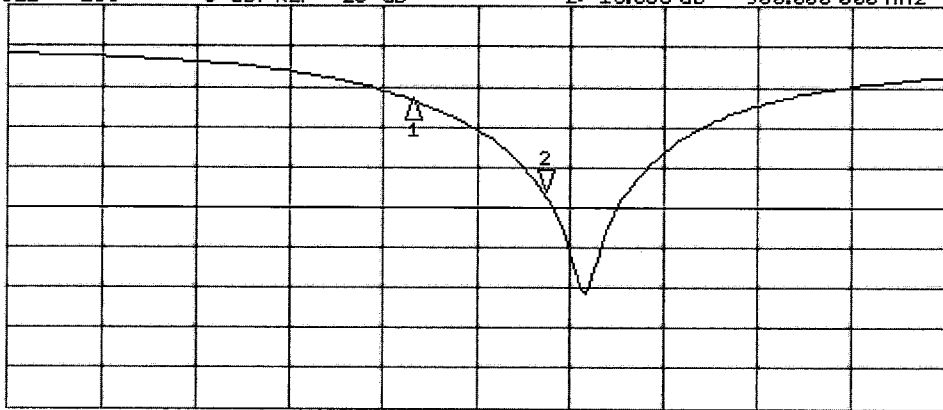
*
De1
Cor
Avg
16



CH1 Markers
1: 41.352 Ω
-46.816 Ω
835.000 MHz

CH2 S11 LOG 5 dB/REF -20 dB 2: -18.006 dB 900.000 000 MHz

Cor
Avg
16



CH2 Markers
1: -6.6738 dB
835.000 MHz

START 635.000 000 MHz

STOP 1 100.000 000 MHz

ASSET: A/237 - checked by *[Signature]*
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

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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

Calibrated by: **Dimce Iliev** (Name), **Laboratory Technician** (Function), *[Signature]* (Signature)

Approved by: **Katja Pokovic** (Name), **Technical Manager** (Function), *[Signature]* (Signature)

Issued: February 8, 2011

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



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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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 \pm 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 \pm 0.2) °C	39.8 \pm 6 %	1.41 mho/m \pm 6 %
Head TSL temperature during test	(21.0 \pm 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (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 \pm 17.0 % (k=2)

SAR averaged over 10 cm³ (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 \pm 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 j Ω
Return Loss	- 27.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.6 Ω + 5.0 j Ω
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: $f = 1900 \text{ MHz}$; $\sigma = 1.41 \text{ mho/m}$; $\epsilon_r = 39.9$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(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)

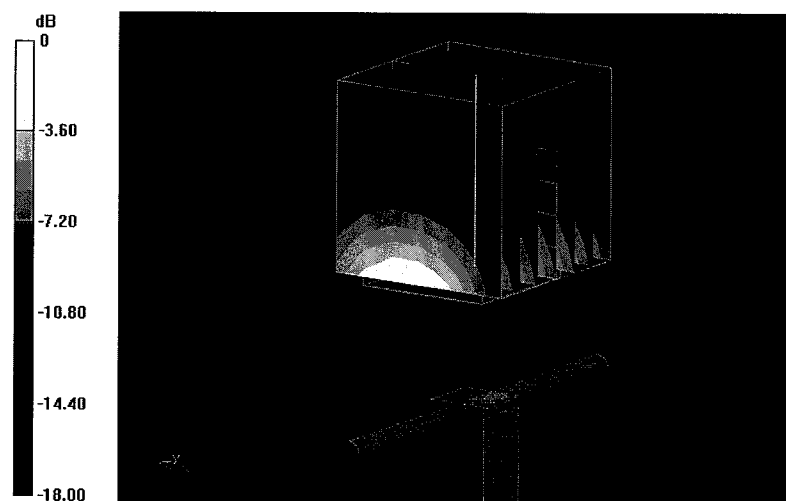
Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

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



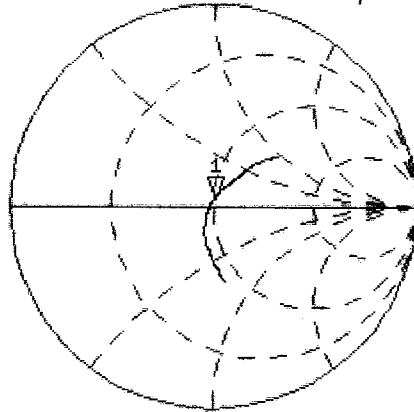
0 dB = 12.380mW/g

Impedance Measurement Plot for Head TSL

7 Feb 2011 16:45:39

CH1 S11 1 U FS 1: 50.525 Ω 4.1680 Ω 349.13 pF 1 900.000 000 MHz

*
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CA

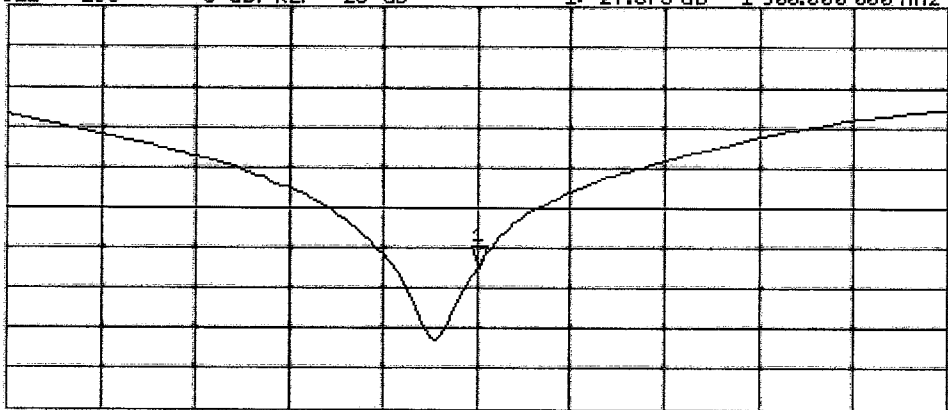


Avg
16
↑

CH2 S11 LOG 5 dB/REF -20 dB 1:-27.575 dB 1 900.000 000 MHz

CA

Avg
16
↑



START 1 700.000 000 MHz

STOP 2 100.000 000 MHz

DASY5 Validation Report for Body TSL

Date/Time: 08.02.2011 12:04:35

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

Medium: MSL U12 BB

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.55$ mho/m; $\epsilon_r = 52.9$; $\rho = 1000$ kg/m³

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)

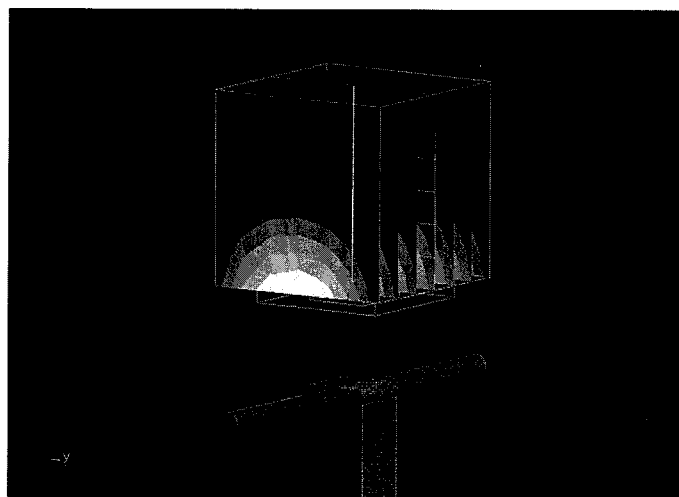
Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

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



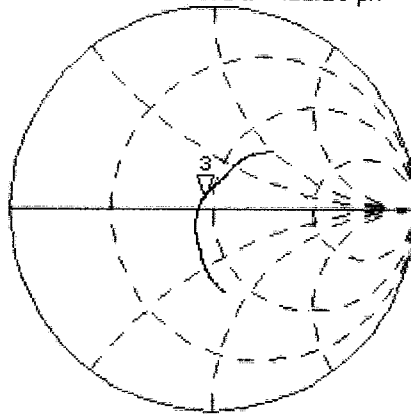
0 dB = 13.040mW/g

Impedance Measurement Plot for Body TSL

8 Feb 2011 10:45:02

CH1 S11 1 U FS 3: 45.568 Ω 5.0391 Ω 422.10 pH 1 900.000 000 MHz

*
De1
CA

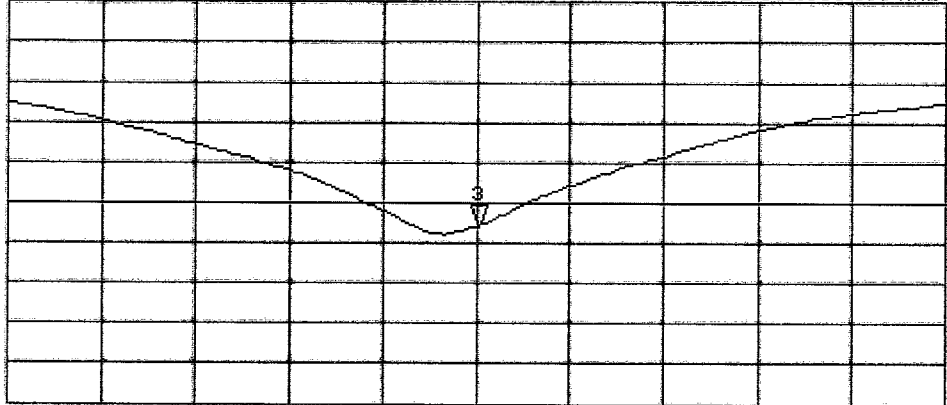


Avg
16

CH2 S11 LOG 5 dB/REF -20 dB 3:-23.090 dB 1 900.000 000 MHz

CA

Avg
16



START 1 700.000 000 MHz

STOP 2 100.000 000 MHz

ASSET A1322 - Checked by *[Signature]*

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: **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	<i>[Signature]</i>

	Name	Function	Signature
Approved by:	Katja Pokovic	Technical Manager	<i>[Signature]</i>

Issued: February 8, 2011

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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

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 \pm 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 \pm 0.2) °C	39.1 \pm 6 %	1.73 mho/m \pm 6 %
Head TSL temperature during test	(21.0 \pm 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (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 \pm 17.0 % (k=2)

SAR averaged over 10 cm³ (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 \pm 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 j Ω
Return Loss	- 20.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.5 Ω + 9.7 j Ω
Return Loss	- 20.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.152 ns
----------------------------------	----------

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

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	October 16, 2002

DASY5 Validation Report for Head TSL

Date/Time: 07.02.2011 14:34:55

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

Medium: HSL U12 BB

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.74$ mho/m; $\epsilon_r = 39.3$; $\rho = 1000$ kg/m³

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)

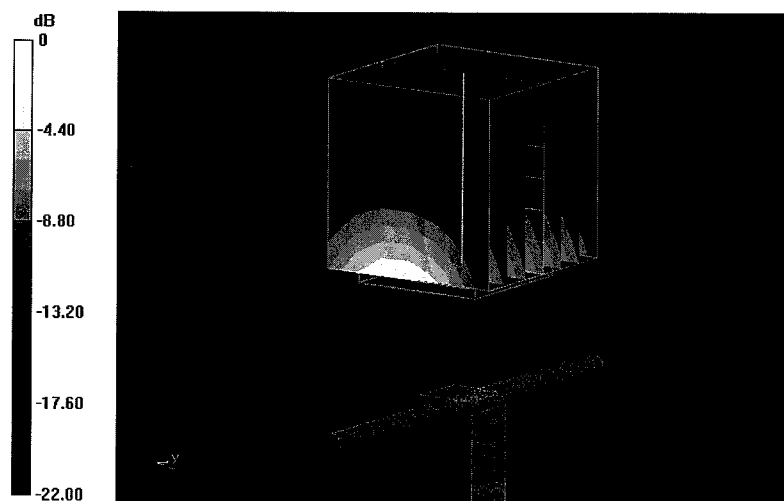
Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

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



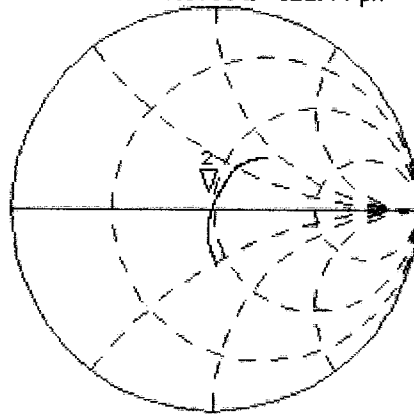
0 dB = 16.610mW/g

Impedance Measurement Plot for Head TSL

7 Feb 2011 16:48:44

CH1 S11 1 U FS 2: 45.582 Ω 7.8730 Ω 511.44 μ H 2 450.000 000 MHz

*
De1
CA



Avg
16

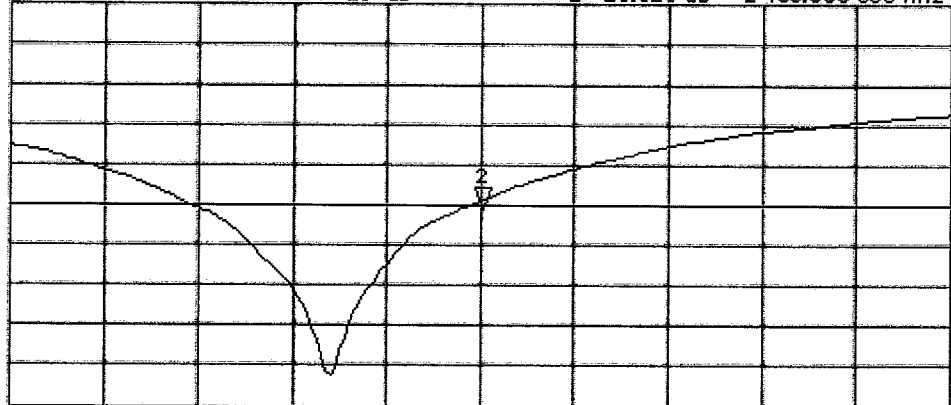
↑

CH2 S11 LOG 5 dB/REF -20 dB 2:-20.528 dB 2 450.000 000 MHz

CA

Avg
16

↑



START 2 250.000 000 MHz

STOP 2 650.000 000 MHz

DASY5 Validation Report for Body TSL

Date/Time: 08.02.2011 12:48:13

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

Medium: MSL U12 BB

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.95$ mho/m; $\epsilon_r = 52.4$; $\rho = 1000$ kg/m³

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)

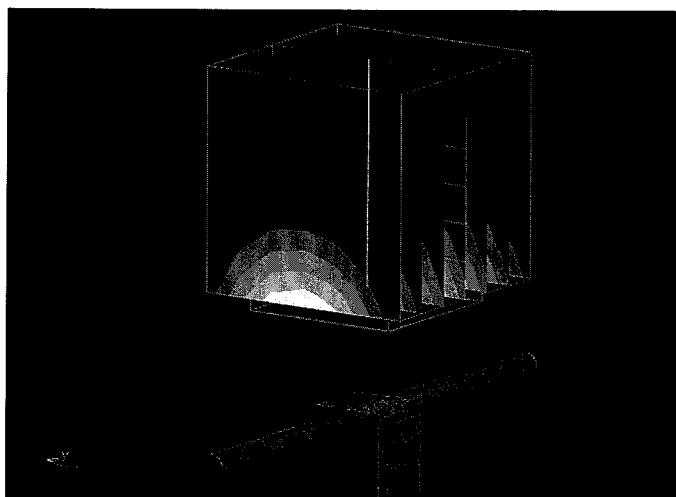
Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

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



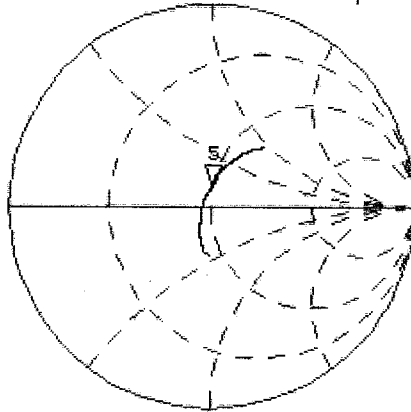
0 dB = 17.120mW/g

Impedance Measurement Plot for Body TSL

8 Feb 2011 10:56:06

[CH1] S11 1 U FS 5: 49.523 Ω 9.7422 Ω 632.86 μ H 2 450.000 000 MHz

*
De1
CA



Avg
16

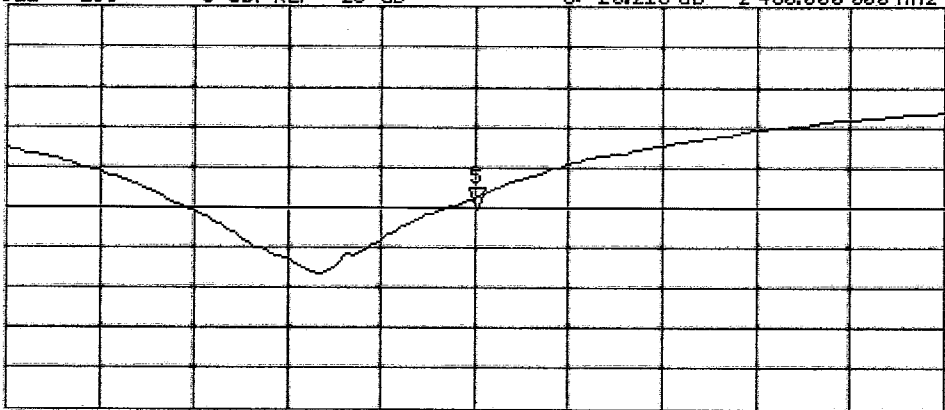
↑

CH2 S11 LOG 5 dB/REF -20 dB 5: -20.215 dB 2 450.000 000 MHz

CA

Avg
16

↑



START 2 250.000 000 MHz

STOP 2 650.000 000 MHz



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Accreditation No.: **SCS 108**

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Multilateral Agreement for the recognition of calibration certificates

Client **Sony Ericsson UK**

Certificate No: **ET3-1611_May11**

CALIBRATION CERTIFICATE

Object **ET3DV6 - SN:1611**

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

Calibration date: **May 12, 2011**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 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

Calibrated by:	Name Jeton Kastrai	Function Laboratory Technician	Signature
Approved by:	Name Katja Pokovic	Function Technical Manager	Signature
			Issued: May 16, 2011

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



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Accreditation No.: **SCS 108**

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Multilateral Agreement for the recognition of calibration certificates

Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,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:

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

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below *ConvF*).
- NORM(f)_{x,y,z}** = NORM_{x,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*.
- DCP_{x,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
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}** are numerical linearization parameters in dB assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media.
- VR**: VR is the validity range of the calibration related to the average diode voltage or DAE voltage in mV.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,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 ET3DV6

SN:1611

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

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

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

Basic Calibration Parameters

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

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	105.3	$\pm 2.7 \%$
			Y	0.00	0.00	1.00	109.8	
			Z	0.00	0.00	1.00	104.6	

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

^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: ET3DV6 - SN:1611

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)
835	41.5	0.90	6.51	6.51	6.51	0.64	2.00	± 12.0 %
900	41.5	0.97	6.41	6.41	6.41	0.66	1.94	± 12.0 %
1750	40.1	1.37	5.43	5.43	5.43	0.54	2.47	± 12.0 %
1900	40.0	1.40	5.23	5.23	5.23	0.55	2.40	± 12.0 %
2450	39.2	1.80	4.55	4.55	4.55	0.69	1.91	± 12.0 %

^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: ET3DV6- SN:1611

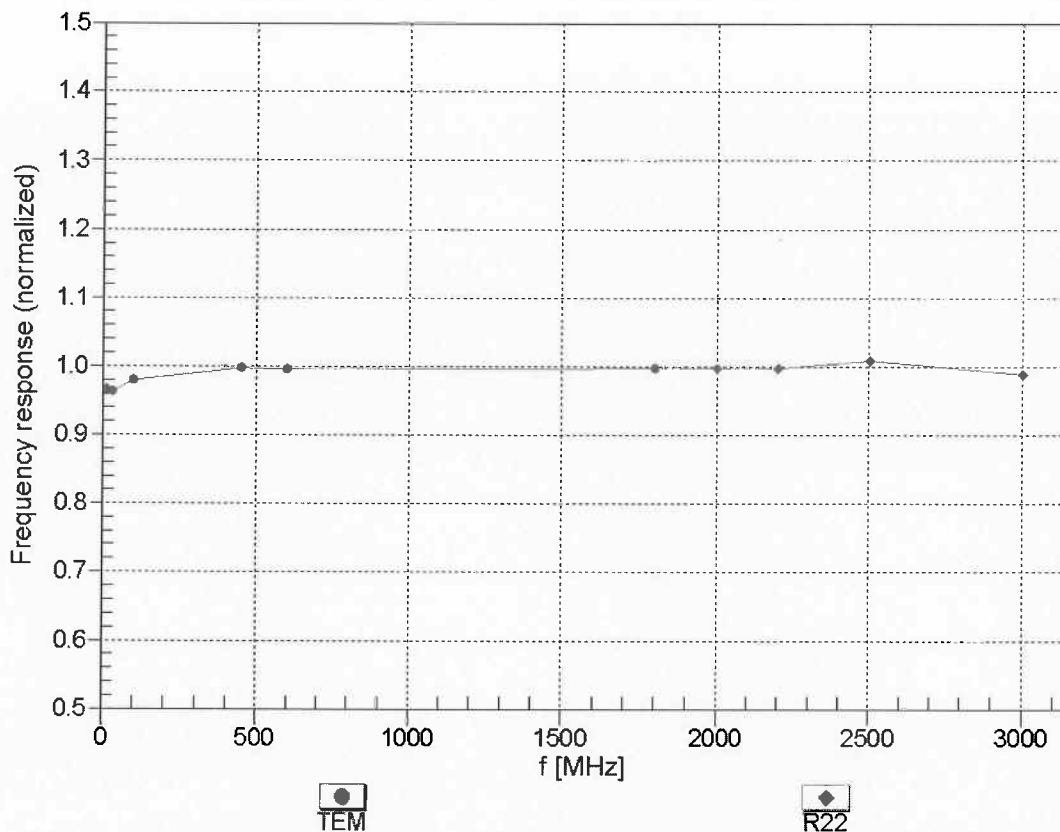
Calibration Parameter Determined in Body Tissue Simulating Media

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

^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.

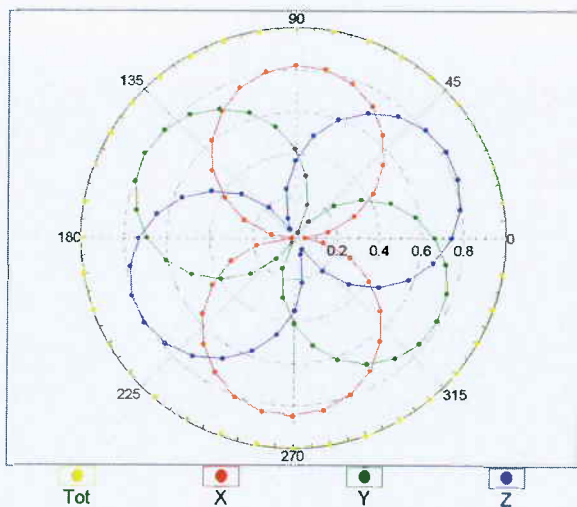
Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



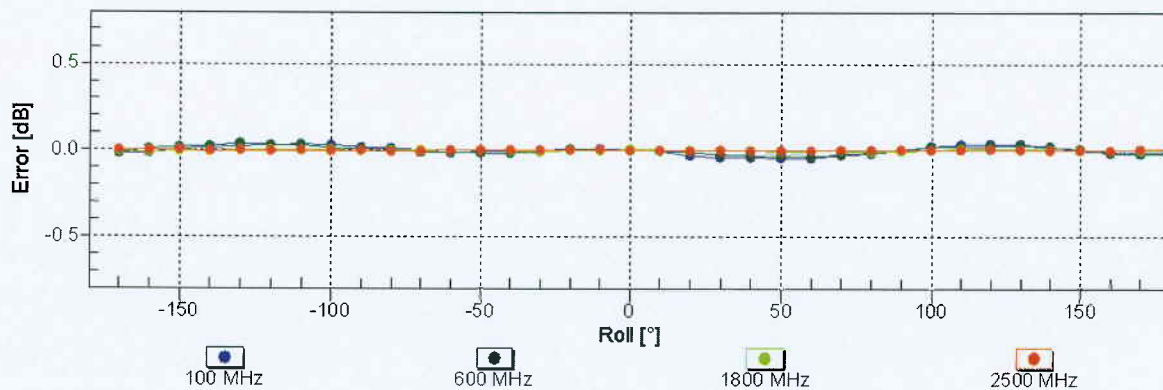
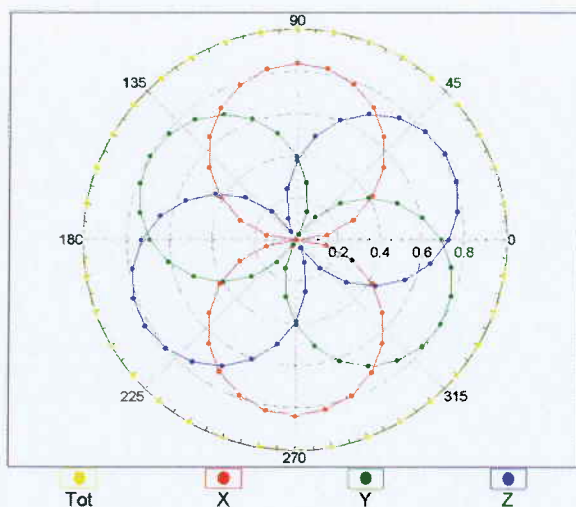
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

Receiving Pattern (ϕ), $\vartheta = 0^\circ$

f=600 MHz,TEM

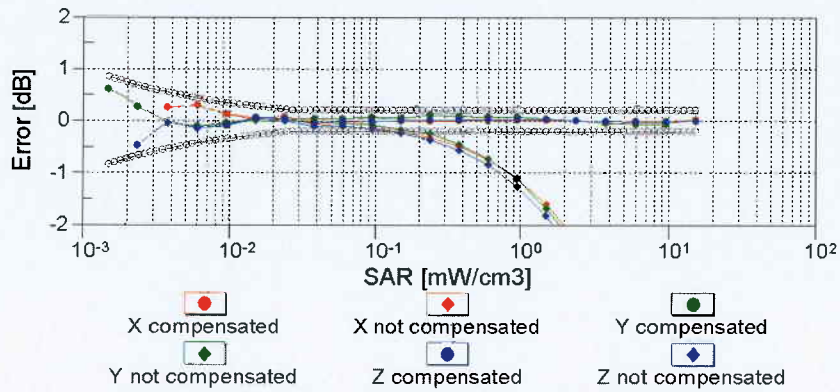
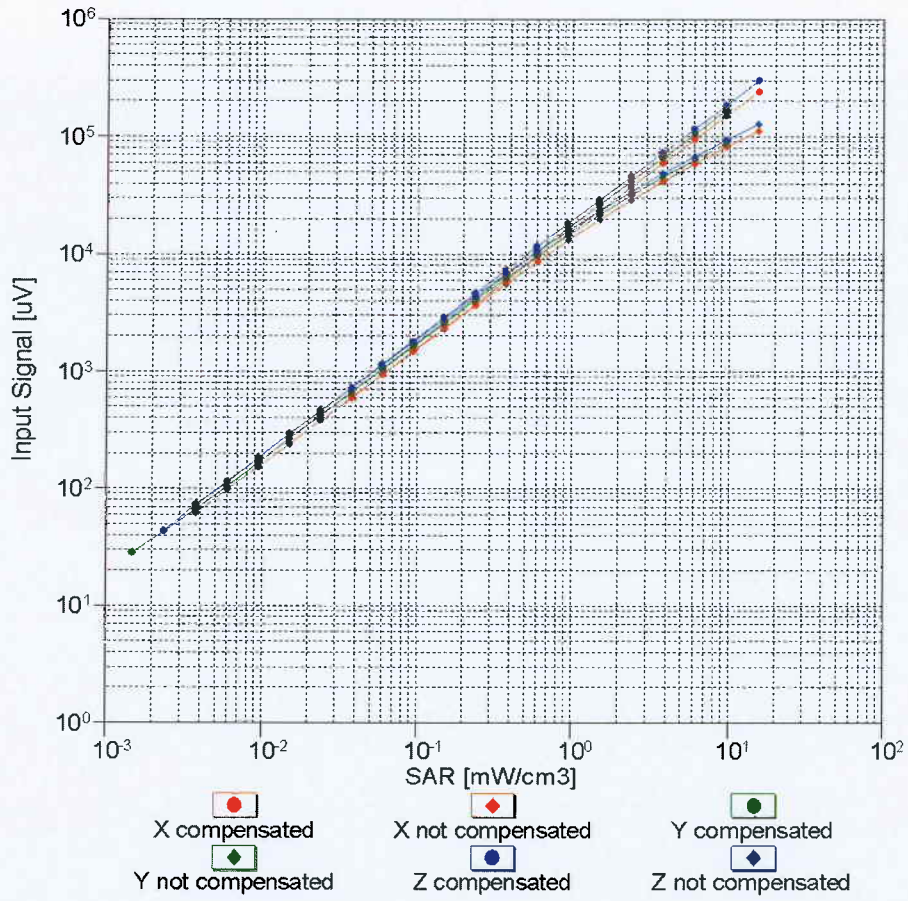


f=1800 MHz,R22



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

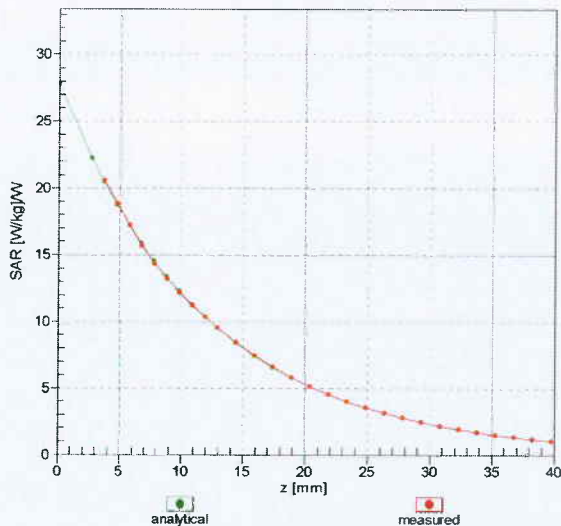
Dynamic Range f(SAR_{head}) (TEM cell , f = 900 MHz)



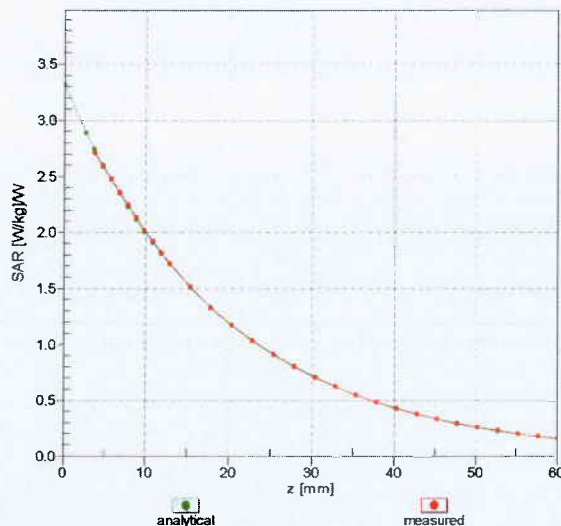
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 1900 MHz, WGLS R22 (H_convF)

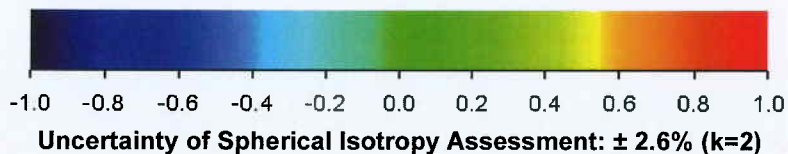
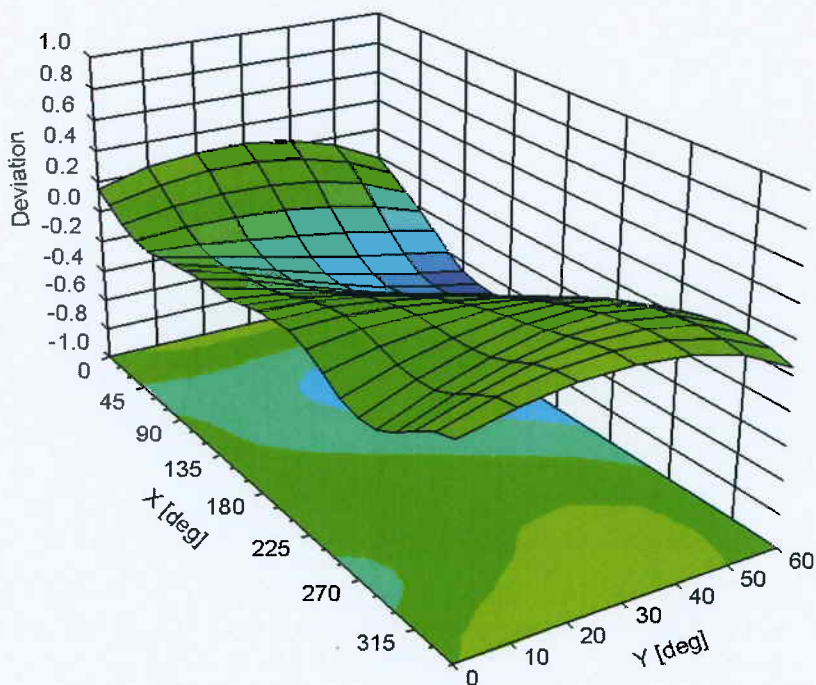


f = 835 MHz, WGLS R9 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, θ), f = 900 MHz



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

Other Probe Parameters

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

ASSET :- A1378 checked by *[Signature]*
21/02/2011

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



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

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **RFI**

Certificate No: **EX-3508_Feb11**

CALIBRATION CERTIFICATE

Object **EX3DV3 - SN:3508**

Calibration procedure(s) **QA CAL-01.v7, QA CAL-12.v6, QA CAL-14.v3, QA CAL-23.v4,
QA CAL-25.v3
Calibration procedure for dosimetric E-field probes**

Calibration date: **February 15, 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	01-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	01-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	01-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	29-Dec-10 (No. ES3-3013_Dec10)	Dec-11
DAE4	SN: 654	23-Apr-10 (No. DAE4-654_Apr10)	Apr-11
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

Calibrated by: **Katja Pokovic** (Name), **Technical Manager** (Function), *[Signature]* (Signature)

Approved by: **Niels Küster** (Name), **Quality Manager** (Function), *[Signature]* (Signature)

Issued: February 15, 2011

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Accreditation No.: **SCS 108**

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Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization ϖ	ϖ 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:

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

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,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.
- DCP_{x,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
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}** are numerical linearization parameters in dB assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media.
- VR**: VR is the validity range of the calibration related to the average diode voltage or DAE voltage in mV.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,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 EX3DV3

SN:3508

Manufactured: December 19, 2003
Calibrated: February 15, 2011

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

DASY/EASY - Parameters of Probe: EX3DV3 - SN:3508

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.74	0.66	0.65	$\pm 10.1 \%$
DCP (mV) ^B	101.8	102.3	101.3	

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	146.8	$\pm 2.2 \%$
			Y	0.00	0.00	1.00	139.4	
			Z	0.00	0.00	1.00	124.4	

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

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

^B Numerical linearization parameter: uncertainty not required.

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

DASY/EASY - Parameters of Probe: EX3DV3 - SN:3508

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	11.15	11.15	11.15	0.11	1.00	± 13.4 %
750	41.9	0.89	10.73	10.73	10.73	0.36	0.82	± 12.0 %
900	41.5	0.97	10.23	10.23	10.23	0.38	0.81	± 12.0 %
1750	40.1	1.37	9.15	9.15	9.15	0.66	0.56	± 12.0 %
1900	40.0	1.40	8.83	8.83	8.83	0.53	0.65	± 12.0 %
2450	39.2	1.80	7.88	7.88	7.88	0.29	0.91	± 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: EX3DV3- SN:3508

Calibration Parameter Determined in Body Tissue Simulating Media

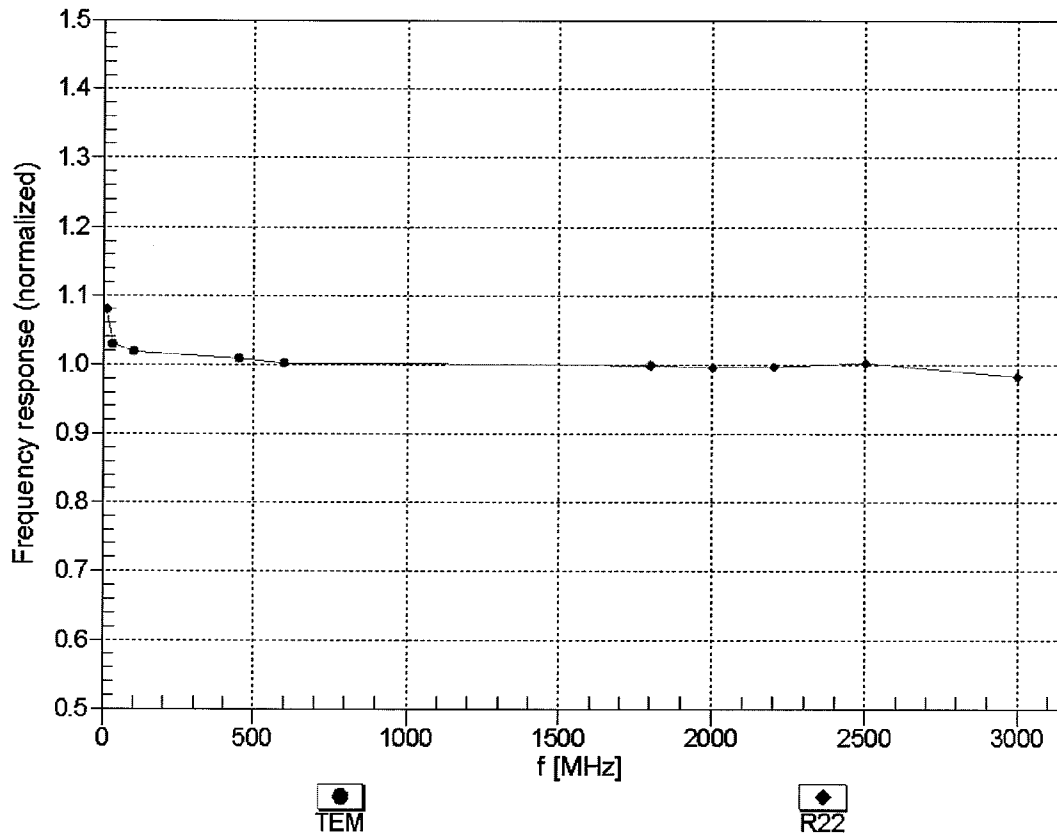
f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	56.7	0.94	11.80	11.80	11.80	0.02	1.00	± 13.4 %
750	55.5	0.96	10.54	10.54	10.54	0.37	0.86	± 12.0 %
900	55.0	1.05	10.27	10.27	10.27	0.30	0.95	± 12.0 %
1750	53.4	1.49	9.08	9.08	9.08	0.40	0.87	± 12.0 %
1900	53.3	1.52	8.56	8.56	8.56	0.35	0.78	± 12.0 %
2150	53.1	1.66	8.51	8.51	8.51	0.18	1.30	± 12.0 %
2450	52.7	1.95	7.97	7.97	7.97	0.39	0.72	± 12.0 %
2600	52.5	2.16	7.62	7.62	7.62	0.33	0.75	± 12.0 %
3700	51.0	3.55	6.84	6.84	6.84	0.25	1.70	± 13.1 %
5200	49.0	5.30	4.19	4.19	4.19	0.50	1.95	± 13.1 %
5500	48.6	5.65	3.72	3.72	3.72	0.58	1.95	± 13.1 %
5800	48.2	6.00	3.71	3.71	3.71	0.65	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

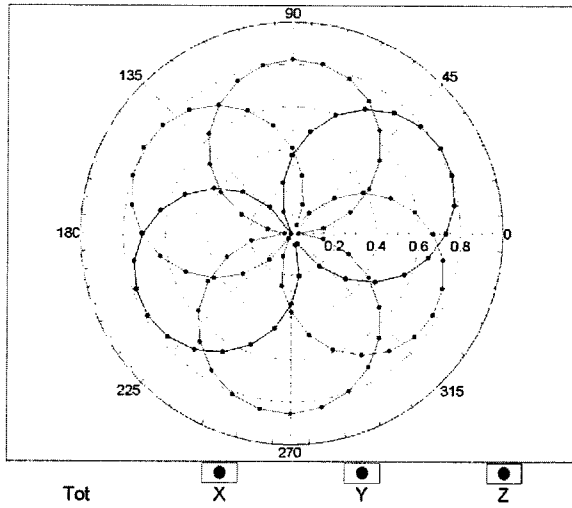
(TEM-Cell:ifi110 EXX, Waveguide: R22)



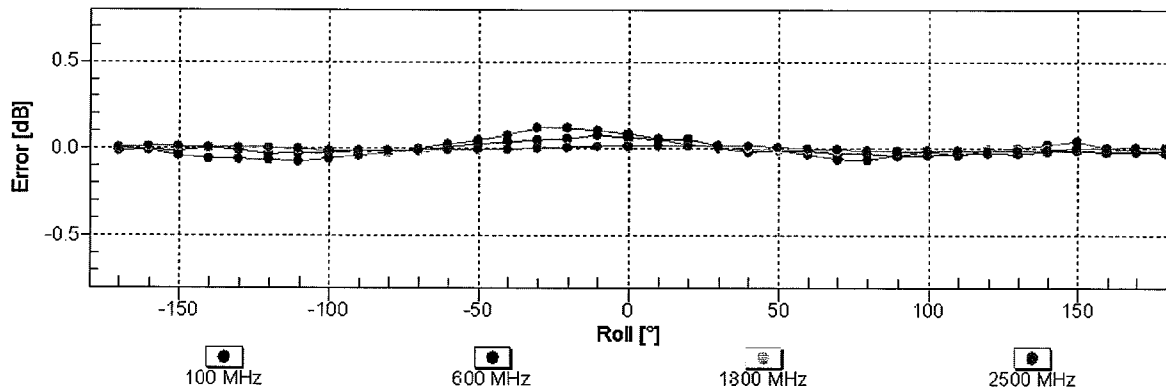
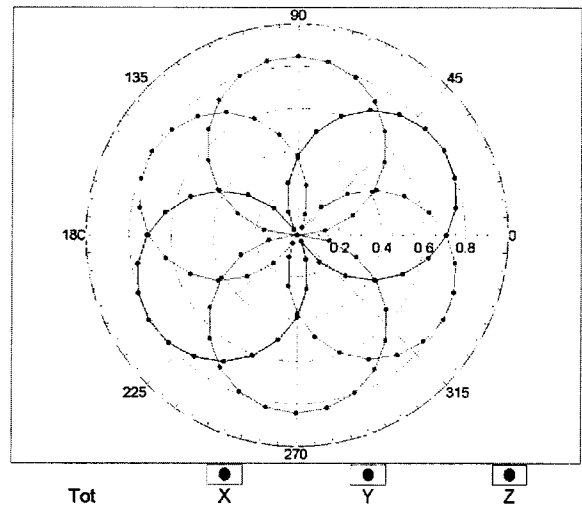
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

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

f=600 MHz,TEM

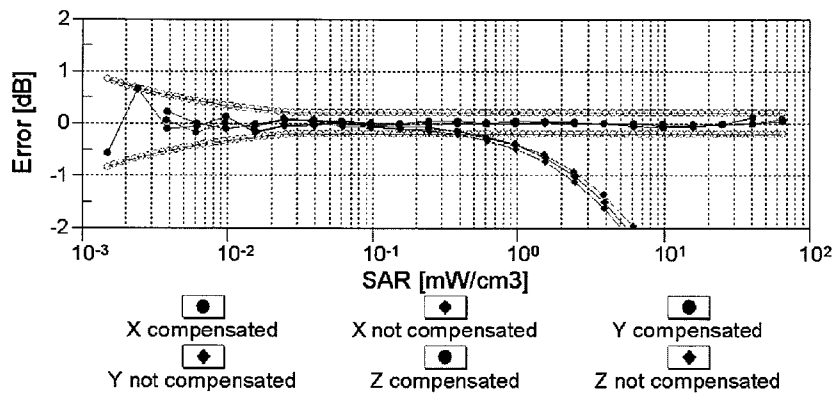
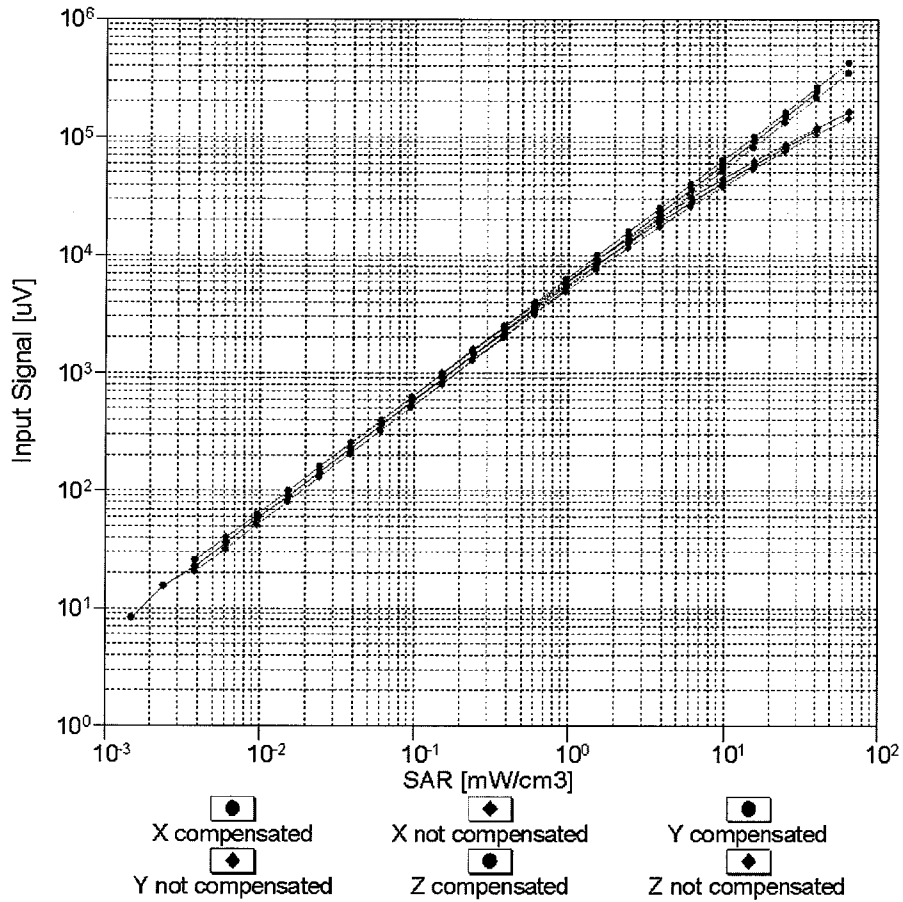


f=1800 MHz,R22



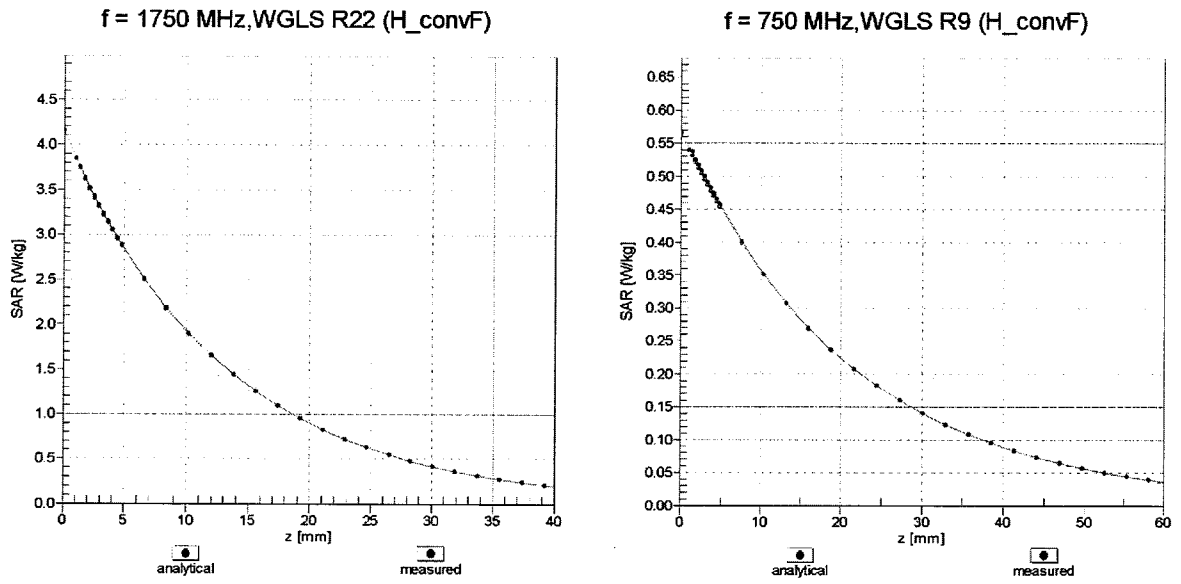
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell , $f = 900 \text{ MHz}$)

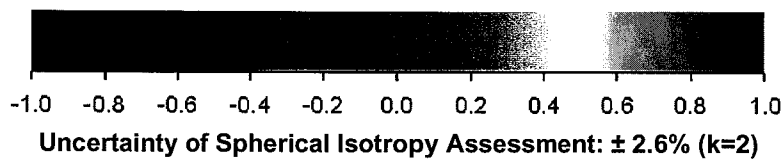
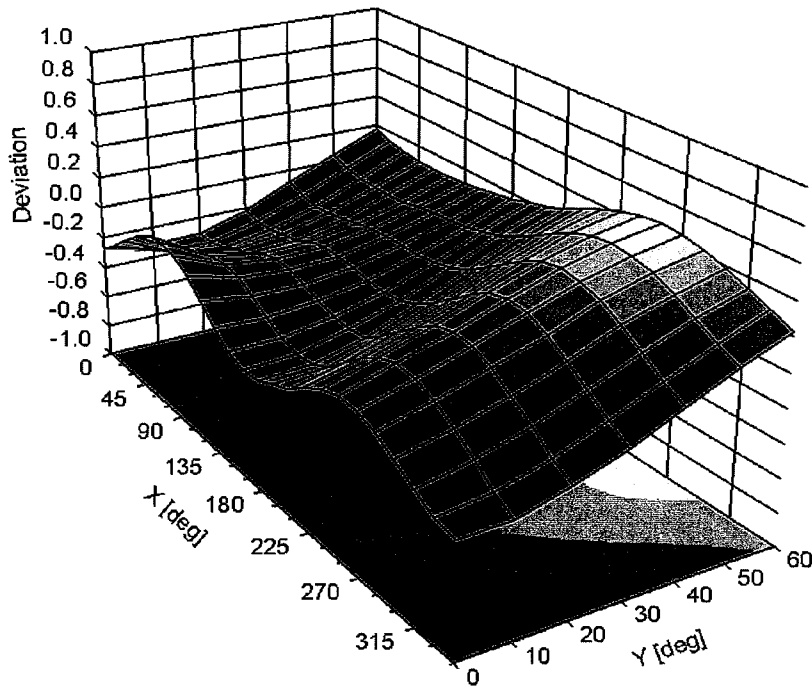


Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Air Error (ϕ, ϑ), f = 900 MHz



DASY/EASY - Parameters of Probe: EX3DV3 - SN:3508**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

Appendix 2. Measurement Methods

A.2.1. Evaluation Procedure

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

- a) (i) The evaluation was performed in an applicable area of the phantom depending on the type of device being tested. For devices worn about the ear during normal operation, both the left and right ear positions were evaluated at the centre frequency of the band at maximum power. The side, which produced the greatest SAR, determined which side of the phantom would be used for the entire evaluation. The positioning of the head worn device relative to the phantom was dictated by the test specification identified in section 3.1 of this report.

(ii) For body worn devices or devices which can be operated within 20 cm of the body, the flat section of the SAM phantom was used were the size of the device(s) is normal. for bigger devices and base station the 2mm Oval phantom is used for evaluation. The type of device being evaluated dictated the distance of the EUT to the outer surface of the phantom flat section.
- b) The SAR was determined by a pre-defined procedure within the DASY4 software. The exposed region of the phantom was scanned near the inner surface with a grid spacing of 20mm x 20mm or appropriate resolution.
- c) A 5x5x7 matrix was performed around the greatest spatial SAR distribution found during the area scan of the applicable exposed region. SAR values were then calculated using a 3-D spline interpolation algorithm and averaged over spatial volumes of 1 and 10 grams.
- d) If the EUT had any appreciable drift over the course of the evaluation, then the EUT was re-evaluated. Any unusual anomalies over the course of the test also warranted a re-evaluation.

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

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

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

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

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

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

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

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