TEST REPORT

Test of: C6502

To: OET Bulletin 65 Supplement C: (2001-01)
RSS-102 Issue 4 March 2010
IEEE1528:2003

FCC ID: PY7PM-0340; IC ID: 4170B-PM0340

Test Report Serial No:
UL-SAR-RP91686JD02A V6.0

Version 6.0 supersedes all previous report versions

This Test Report Is Issued Under The Authority Of Richelieu Quoi, SAR Technology Consultant:	 (APPROVED SIGNATORY)
Checked By: Naseer Mirza	 (APPROVED SIGNATORY)
Issue Date:	**27 February 2013**
Test Dates:	**20 December 2012 to 26 February 2013**

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1. Customer Information

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

2. Summary of Test Results

Test Name	Specification Reference	Result
Specific Absorption Rate-GSM 850	OET Bulletin 65 Supplement C: (2001-01) RSS-102 Issue 4 March 2010	✓
Specific Absorption Rate-PCS 1900	OET Bulletin 65 Supplement C: (2001-01) RSS-102 Issue 4 March 2010	✓
Specific Absorption Rate-UMTS-FDD 2	OET Bulletin 65 Supplement C: (2001-01) RSS-102 Issue 4 March 2010	✓
Specific Absorption Rate - UMTS-FDD 4	OET Bulletin 65 Supplement C: (2001-01) RSS-102 Issue 4 March 2010	✓
Specific Absorption Rate - UMTS-FDD 5	OET Bulletin 65 Supplement C: (2001-01) RSS-102 Issue 4 March 2010	✓
Specific Absorption Rate-Wi-Fi 802.11b/g/n 2.4 GHz	OET Bulletin 65 Supplement C: (2001-01) RSS-102 Issue 4 March 2010	✓
Specific Absorption Rate- Wi-Fi 802.11a/n 5.0 GHz	OET Bulletin 65 Supplement C: (2001-01) RSS-102 Issue 4 March 2010	✓
Key to Results	✓ = Complied ✗ = Did not comply	

2.1. Highest Reported SAR: Individual Transmitter Evaluation per Band

Exposure Configuration	Technology Band	Highest Reported 1g -SAR (W/kg)	Equipment Class	Max Rated Source base Avg Power + Max Tolerance [dBm]	Highest Reported 1g-SAR (W/kg)
HEAD (Separation Distance 0mm)	GSM850	0.355	PCE	23.8	0.724
	PCS1900	0.204		19.7	
	UMTS FDD 2	0.612		23.8	
	UMTS FDD 4	0.724		24.8	
	UMTS FDD 5	0.602		25.0	
	WLAN 2.4 GHz	0.150	DTS	19.0	0.150
	WLAN 5.0 GHz	0.031	NII	12.0	0.031
HOTSPOT (Separation Distance 10mm)	GSM850	1.121	PCE	25.3	1.121
	PCS1900	0.975		20.5	
	UMTS FDD 2	0.915		21.5	
	UMTS FDD 4	0.934		22.5	
	UMTS FDD 5	1.015		25.0	
	WLAN 2.4 GHz	0.659	DTS	19.0	0.659
	WLAN 5.0 GHz	0.204	NII	12.0	0.204
BODY-WORN (Separation Distance 15mm)	GSM850	0.727	PCE	23.8	1.214
	PCS1900	0.488		22.0	
	UMTS FDD 2	0.872		23.8	
	UMTS FDD 4	1.214		24.8	
	UMTS FDD 5	0.938		25.0	
	WLAN 2.4 GHz	0.176	DTS	19.0	0.176
	WLAN 5.0 GHz	0.161	NII	12.0	0.161

2.2. Highest Reported Simultaneous Transmitter SAR per Exposure condition

Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the *reported* standalone SAR of each applicable simultaneous transmitting antenna.

Exposure Configuration	Technology Band	Highest Reported 1g SAR (W/kg)	Equipment Class	Max Rated Source base Avg Power + Max Tolerance [dBm]	Highest Reported 1g Sum-SAR (W/kg)	SPLSR Ratio
HEAD (Separation Distance 0mm)	UMTS FDD 4	0.724	PCE	24.8	0.874	N/A
	WLAN 2.4 GHz	0.150	DTS	19.0		
HOTSPOT (Separation Distance 10mm)	GSM850	1.121	PCE	25.3	1.780*	0.031
	WLAN 2.4 GHz	0.659	DTS	19.0		
	UMTS FDD 5	1.015	PCE	25.0	1.674*	0.027
	WLAN 2.4 GHz	0.659	DTS	19.0		
	GSM850	1.121	PCE	25.3	1.328	N/A
	Bluetooth 2.4 GHz	0.207	DSS	10.0		
BODY-WORN (Separation Distance 15mm)	UMTS FDD 4	1.214	PCE	24.8	1.390	N/A
	WLAN 2.4 GHz	0.176	DTS	19.0		
	UMTS FDD 4	1.214	PCE	24.8	1.352	N/A
	Bluetooth 2.4 GHz	0.138	DSS	10.0		

Note(s):

* See section 7.6 for calculations - As per FCC KDB publication 447498 D01, for cases where sum of WWAN and WLAN exceed 1.6W/kg, the SAR to peak location separation ratio distance is calculated as shown below

- SAR peak location separation ratio (SPLSR) for each antenna pair in each simultaneous transmission configuration is given by $(SAR_1 + SAR_2)^{1.5} / R_I \leq 0.04$ for 1-g, where R_I is the separation distance between peak SAR locations for the antenna pair in mm.
- The SPLSR value is below the threshold ratio of 0.04 as indicated in the table above.

2.3. SAR measurement variability and measurement uncertainty analysis:

Exposure Configuration	Technology Band	Measured 1g -SAR (W/kg)	Equipment Class	Max Meas. Source base Avg Power [dBm]	Ratio of Largest to Smallest SAR Measured
HOTSPOT (Separation Distance 10mm)	GSM850 (Original)	0.954	PCE	25.3	1.03
	GSM850 (Repeat)	0.924		25.3	
	PCS1900 (Original)	0.869		20.5	1.02
	PCS1900 (Repeat)	0.855		20.5	
	UMTS FDD 2 (Original)	0.854		21.5	1.01
	UMTS FDD 2 (Repeat)	0.848		21.5	
	UMTS FDD 5 (Original)	0.806		25.0	1.09
	UMTS FDD 5 (Repeat)	0.743		25.0	
BODY-WORN (Separation Distance 10mm)	UMTS FDD 4(Original)	1.010		24.8	1.11
	UMTS FDD 4 (Repeat)	0.910		24.8	

Note(s):

1. The following step below were followed as per KDB publication 865664 D01:

1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.

2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.

3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).

4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

2.4. Location of Tests

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

2.5.Nominal and Maximum Output power:

Note: The following source based average rated powers for GSM/GPRS/EDGE are without consideration of uplink time slot.

Bands	Speech (Voice Mode)	
	Target (dBm)	Tolerance + - (dB)
GSM850	32.0	-1.0 ~ +0.8
PCS1900	27.8	-0.8 ~ +0.9

Bands	GPRS (Power Back Off Disabled)							
	Tx Slot 1		Tx Slot 2		Tx Slot 3		Tx Slot 4	
	Target (dBm)	Tolerance + - (dB)	Target (dBm)	Tolerance + - (dB)	Target (dBm)	Tolerance + - (dB)	Target (dBm)	Tolerance + - (dB)
GSM850	32.0	-1.0 ~ +0.8	30.5	-1.5 ~ +0.9	28.7	-1.5 ~ +0.9	27.5	-1.5 ~ +0.9
PCS1900	27.8	-0.8 ~ +0.9	27.5	-1.5 ~ +0.5	25.7	-1.5 ~ +0.5	24.5	-1.5 ~ +0.5

Bands	GPRS (Hotspot On ~ Power Back Off Enabled)							
	Tx Slot 1		Tx Slot 2		Tx Slot 3		Tx Slot 4	
	Target (dBm)	Tolerance + - (dB)	Target (dBm)	Tolerance + - (dB)	Target (dBm)	Tolerance + - (dB)	Target (dBm)	Tolerance + - (dB)
GSM850	32.0	-1.0 ~ +0.8	30.5	-1.5 ~ +0.9	28.7	-1.5 ~ +0.9	27.5	-1.5 ~ +0.9
PCS1900	27.8	-0.8 ~ +0.9	26.0	-1.5 ~ +0.5	24.2	-1.5 ~ +0.5	23.0	-1.5 ~ +0.5

Bands	EDGE GMSK (MCS1-4) (Power Back Off Disabled)							
	Tx Slot 1		Tx Slot 2		Tx Slot 3		Tx Slot 4	
	Target (dBm)	Tolerance + - (dB)	Target (dBm)	Tolerance + - (dB)	Target (dBm)	Tolerance + - (dB)	Target (dBm)	Tolerance + - (dB)
GSM850	32.0	-1.0 ~ +0.8	30.5	-1.5 ~ +0.8	28.7	-1.5 ~ +0.8	27.5	-1.5 ~ +0.8
PCS1900	27.8	-0.8 ~ +0.9	27.5	-1.5 ~ +0.5	25.7	-1.5 ~ +0.5	24.5	-1.5 ~ +0.5

Bands	EDGE GMSK (MCS1-4) (Hotspot On ~ Power Back Off Enabled)							
	Tx Slot 1		Tx Slot 2		Tx Slot 3		Tx Slot 4	
	Target (dBm)	Tolerance + - (dB)	Target (dBm)	Tolerance + - (dB)	Target (dBm)	Tolerance + - (dB)	Target (dBm)	Tolerance + - (dB)
GSM850	32.0	-1.0 ~ +0.8	30.5	-1.5 ~ +0.8	28.7	-1.5 ~ +0.8	27.5	-1.5 ~ +0.8
PCS1900	27.8	-0.8 ~ +0.9	26.0	-1.5 ~ +0.5	24.2	-1.5 ~ +0.5	23.0	-1.5 ~ +0.5

Bands	EDGE 8PSK (MCS5-9) (Power Back Off Disabled)							
	Tx Slot 1		Tx Slot 2		Tx Slot 3		Tx Slot 4	
	Target (dBm)	Tolerance + - (dB)	Target (dBm)	Tolerance + - (dB)	Target (dBm)	Tolerance + - (dB)	Target (dBm)	Tolerance + - (dB)
GSM850	27.0	-1.5 ~ +1.5	24.0	-1.5 ~ +1.5	23.2	-1.5 ~ +1.5	22.0	-1.5 ~ +1.5
PCS1900	25.2	-1.5 ~ +1.5	23.0	-1.5 ~ +1.5	22.2	-1.5 ~ +1.5	21.0	-1.5 ~ +1.5

Bands	EDGE 8PSK (MCS5-9) (Hotspot On ~ Power Back Off Enabled)							
	Tx Slot 1		Tx Slot 2		Tx Slot 3		Tx Slot 4	
	Target (dBm)	Tolerance + - (dB)	Target (dBm)	Tolerance + - (dB)	Target (dBm)	Tolerance + - (dB)	Target (dBm)	Tolerance + - (dB)
GSM850	27.0	-1.5 ~ +1.5	24.0	-1.5 ~ +1.5	23.2	-1.5 ~ +1.5	22.0	-1.5 ~ +1.5
PCS1900	25.2	-1.5 ~ +1.5	23.0	-1.5 ~ +1.5	22.2	-1.5 ~ +1.5	21.0	-1.5 ~ +1.5

Nominal and Maximum Output power (Continued):

Bands	UMTS FDD (Power Back Off Disabled)			
	CS		HS	
	Target (dBm)	Tolerance + - (dB)	Target (dBm)	Tolerance + - (dB)
UMTS FDD 2	23.0	-1.5 ~ +0.8	23.0	-1.5 ~ +0.8
UMTS FDD 4	24.0	-1.5 ~ +0.8	24.0	-1.5 ~ +0.8
UMTS FDD 5	24.0	-1.5 ~ +1.0	24.0	-1.5 ~ +1.0

Bands	UMTS FDD (Hotspot On ~ Power Back Off Enabled)			
	CS		HS	
	Target (dBm)	Tolerance + - (dB)	Target (dBm)	Tolerance + - (dB)
UMTS FDD 2	20.7	-1.5 ~ +0.8	20.7	-1.5 ~ +0.8
UMTS FDD 4	21.7	-1.5 ~ +0.8	21.7	-1.5 ~ +0.8
UMTS FDD 5	24.0	-1.5 ~ +1.0	24.0	-1.5 ~ +1.0

	WLAN Modes					
	2.4 GHz 802.11b		2.4 GHz 802.11g		2.4 GHz 802.11n	
	1 Mbps	11 Mbps	6 Mbps	54 Mbps	6.5 Mbps	65 Mbps
Max Tx Power (dBm)	19.0	17.0	16.0	11.0	15.5	10.0

WLAN Modes								
5.0 GHz 802.11a								
	5.2 GHz 802.11a		5.3 GHz 802.11a		5.6 GHz 802.11a		5.8 GHz 802.11a	
	6 Mbps	54 Mbps	6 Mbps	54 Mbps	6 Mbps	54 Mbps	6 Mbps	54 Mbps
Max Tx Power (dBm)	12.0	8.0	12.0	8.0	12.0	8.0	12.0	8.0

WLAN Modes								
5.0 GHz 802.11n HT20								
	5.2 GHz 802.11n		5.3 GHz 802.11n		5.6 GHz 802.11n		5.8 GHz 802.11n	
	6.5 Mbps	65 Mbps	6.5 Mbps	65 Mbps	6.5 Mbps	65 Mbps	6.5 Mbps	65 Mbps
Max Tx Power (dBm)	12.0	6.0	12.0	6.0	12.0	6.0	12.0	6.0

WLAN Modes								
5.0 GHz 802.11n HT40								
	5.2 GHz 802.11n		5.3 GHz 802.11n		5.6 GHz 802.11n		5.8 GHz 802.11n	
	13.5 Mbps	135 Mbps	13.5 Mbps	135 Mbps	13.5 Mbps	135 Mbps	13.5 Mbps	135 Mbps
Max Tx Power (dBm)	12.0	6.5	12.0	6.5	12.0	6.5	14.0	6.5

Band	Max Power {Target (dBm) + Upper Tolerance (dB)}
Bluetooth	10.0

Note:

1. As per KDB865664 D02 SAR Reporting v01, 2.1.4(a), the nominal and maximum average source based rated power, declared by manufacute are shown in the above tables.
2. These are specified maximum allowed average power for all the wireless modes and frequency bands supported.

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.

The Equipment Under Test complied with the Specific Absorption Rate for general population/uncontrolled exposure limit of 1.6 W/kg as specified in FCC 47 CFR part 2 (2.1093) and ANSI C95.1-1992 and has been tested in accordance with the reference documents in section 3.2 of this report.

Reference:	RSS-102 Issue 4 March 2010
Title:	Radio Frequency (RF) Exposure Compliance of Radio communication 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.

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

FCC KDB Publication:

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

KDB 447498 D01 General RF Exposure Guidance v05

KDB 648474 D04 SAR Handsets Multi Xmiter and Ant v01

KDB 941225 D01 SAR test for 3G devices v02

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

KDB 941225 D06 Hot Spot SAR v01

KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01

KDB 865664 D02 SAR Reporting 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. Equipment Under Test (EUT)

4.1. Identification of Equipment Under Test (EUT)

Description:	Mobile Handset
Brand Name:	Sony
Model Name or Number:	C6502
Type Number:	PM-0340-BV
Serial Number:	CB51231NBG
IMEI Number:	00440214-631287-5
Hardware Version Number:	AP1.05
Software Version Number:	10.1.A.1.78
Hardware Revision of GSM Module:	Not Specified
Software Revision of GSM Module:	Not Specified
FCC ID Number:	PY7PM-0340
Industry Canada ID Number:	4170B-PM0340
Country of Manufacture:	China
Date of Receipt:	10 December 2012

Note(s):

This sample was used to perform WWAN SAR evaluation measurements on bands GSM850 Body, UMTS FDD Band 5 Body only. The sample supports simultaneous transmission with the WWAN and WLAN. Wireless Personal Hotspot is also supported and was evaluated as per KDB 941225 D06 "Hot Spot SAR v01"

Description:	Mobile Handset
Brand Name:	Sony
Model Name or Number:	C6502
Type Number:	PM-0340-BV
Serial Number:	CB51231NCM
IMEI Number:	00440214-631267-7
Hardware Version Number:	AP1.05
Software Version Number:	10.1.A.1.78
Hardware Revision of GSM Module:	Not Specified
Software Revision of GSM Module:	Not Specified
FCC ID Number:	PY7PM-0340
Industry Canada ID Number:	4170B-PM0340
Country of Manufacture:	China
Date of Receipt:	10 December 2012

Note(s):

This sample was used to perform WWAN SAR evaluation measurements on bands GSM850 Head, PCS1900, UMTS FDD 2, UMTS FDD 4, and UMTS FDD 5 Head only. The sample supports simultaneous transmission with the WWAN and WLAN. Wireless Personal Hotspot is also supported and was evaluated as per KDB 941225 D06 "Hot Spot SAR v01"

Identification of Equipment Under Test (EUT) (Continued):	
Description:	Mobile Handset
Brand Name:	Sony
Model Name or Number:	C6502
Type Number:	PM-0340-BV
Serial Number:	CB51231NBK
IMEI Number:	00440214-631309-7
Hardware Version Number:	AP1.05
Software Version Number:	ETS Special
Hardware Revision of GSM Module:	Not Specified
Software Revision of GSM Module:	Not Specified
FCC ID Number:	PY7PM-0340
Industry Canada ID Number:	4170B-PM0340
Country of Manufacture:	China
Date of Receipt:	10 December 2012

Note(s):

This sample was used to perform WLAN SAR evaluation measurements on bands 2.4 GHz and 5GHz Body only. The sample supports simultaneous transmission with the WWAN and WLAN. Wireless Personal Hotspot is also supported and was evaluated as per KDB 941225 D06 "Hot Spot SAR v01"

Description:	Mobile Handset
Brand Name:	Sony
Model Name or Number:	C6502
Type Number:	PM-0340-BV
Serial Number:	CB51231NEM
IMEI Number:	00440214-631315-4
Hardware Version Number:	AP1.05
Software Version Number:	ETS Special
Hardware Revision of GSM Module:	Not Specified
Software Revision of GSM Module:	Not Specified
FCC ID Number:	PY7PM-0340
Industry Canada ID Number:	4170B-PM0340
Country of Manufacture:	China
Date of Receipt:	10 December 2012

Note(s):

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

Identification of Equipment Under Test (EUT) (Continued):	
Description:	Mobile Handset
Brand Name:	Sony
Model Name or Number:	C6502
Type Number:	PM-0340-BV
Serial Number:	CB51231NCS
IMEI Number:	00440214-631359-2
Hardware Version Number:	AP1.05
Software Version Number:	10.1.A.1.78
Hardware Revision of GSM Module:	Not Specified
Software Revision of GSM Module:	Not Specified
FCC ID Number:	PY7PM-0340
Industry Canada ID Number:	4170B-PM0340
Country of Manufacture:	China
Date of Receipt:	10 December 2012

Note(s):

This sample was used to perform WWAN conducted power measurements only. The sample supports simultaneous transmission with the WWAN and WLAN. Wireless Personal Hotspot is also supported and was evaluated as per KDB 941225 D06 "Hot Spot SAR v01"

Description:	Mobile Handset
Brand Name:	Sony
Model Name or Number:	C6502
Type Number:	PM-0340-BV
Serial Number:	CB51231NET
IMEI Number:	00440214-631310-5
Hardware Version Number:	AP1.05
Software Version Number:	ETS Special
Hardware Revision of GSM Module:	Not Specified
Software Revision of GSM Module:	Not Specified
FCC ID Number:	PY7PM-0340
Industry Canada ID Number:	4170B-PM0340
Country of Manufacture:	China
Date of Receipt:	10 December 2012

Note(s):

This sample was used to perform WLAN conducted power measurements only. The sample supports simultaneous transmission with the WWAN and WLAN. Wireless Personal Hotspot is also supported and was evaluated as per KDB 941225 D06 "Hot Spot SAR v01"

'Auto RF Power Back-off' mode facility is available on 'Hotspot Mode Configuration of PCS1900 and UMTS FDD 2, 4 bands only'. There is no power back-off to the WLAN 2.4 GHz or WLAN 5.0 GHz.

4.2. Description of EUT

The Equipment Under Test is a Smart Phone with GSM 2G Quad Band, 3G Penta band and Wi-Fi bands. The EUT has GPRS Class 33 / EDGE Class 33, UMTS FDD 1, 2, 4, 5, 8 With HSPA (with HSDPA Category 24 and HSUPA Category 6), WLAN 802.11 a/b/g/n, Bluetooth Class 1, Personal hotspot mode with 'Auto RF Power Back-Off' and RFID mode capabilities.

4.3. Modifications Incorporated in the EUT

EUT (IMEI: 00440214-631287-5) is used to perform GSM850 Body, UMTS FDD Band 5 Body SAR measurements only.

EUT (IMEI: 00440214-631267-7) is used to perform GSM850 Head, PCS1900, UMTS FDD 2, UMTS FDD 4, and UMTS FDD 5 Head SAR measurements only.

EUT (IMEI: 00440214-631309-7) is used to perform WLAN 2.4 GHz and WLAN 5GHz Body SAR measurements only.

EUT (IMEI: 00440214-631315-4) is used to perform WLAN 5GHz Head SAR measurements only

EUT (IMEI: 00440214-631359-2) is used to perform WWAN conducted power measurements only.

EUT (IMEI: 00440214-631310-5) is used to perform WLAN conducted power measurements only.

4.4. Accessories

The following accessories were supplied with the EUT during testing:

Description:	Personal Hands-Free Kit (PHF)
Brand Name:	Sony
Model Name or Number:	None Stated
Serial Number:	None Stated
Cable Length and Type:	~1.2 m
Country of Manufacture:	None Stated
Connected to Port	3.5mm Audio jack and custom type

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

4.5. 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 (E5515C)
Serial Number:	GB46311280
Cable Length and Type:	~4.0m Utiflex Cable
Connected to Port:	RF (Input / Output) Air Link

Description:	Wireless Communication Test Set
Brand Name:	Agilent
Model Name or Number:	8960 Series 10 (E5515E)
Serial Number:	GB46200666
Cable Length and Type:	~4.0m Utiflex Cable
Connected to Port:	RF (Input / Output) Air Link

4.6. Additional Information Related to Testing

Equipment Category	GSM/GPRS850 PCS/GPRS1900 UMTS FDD 2, 4, 5 WiFi802.11 a/b/g/n	
Type of Unit	Portable Transceiver	
Intended Operating Environment:	Within GSM, UMTS, WiFi and *Bluetooth* Coverage	
Transmitter Maximum Output Power Characteristics:	GSM850	Communication Test Set was configured to allow the EUT to transmit at a maximum power using Power Control Level (PCL) setting of 5.
	PCS1900	Communication Test Set was configured to allow the EUT to transmit at a maximum power using Power Control Level (PCL) setting of 0.
	UMTS FDD 2	Communication Test Set configured to allow to EUT to transmit at a maximum power as per KDB 941225 D01.
	UMTS FDD 4	Communication Test Set configured to allow to EUT to transmit at a maximum power as per KDB 941225 D01.
	UMTS FDD 5	Communication Test Set configured to allow to EUT to transmit at a maximum power as per KDB 941225 D01.
	2.4 GHz WiFi 802.11b/g/n	Test Software was used to configure the EUT to transmit at a maximum power of up to 17.6dBm.
	5.0 GHz Wi-Fi 802.11a/n (HT20 / HT40)	Test Software was used to configure the EUT to transmit at a maximum power of up to 11.6dBm.
	Bluetooth	:= 10.0 mW or 10.0 dBm

Additional Information Related to Testing (Continued):

Transmitter Frequency Range:	GSM850	824 to 849 MHz
	PCS1900	1850 to 1910 MHz
	UMTS FDD 2	1852 to 1908 MHz
	UMTS FDD 4	1712 to 1753 MHz
	UMTS FDD 5	826 to 847 MHz
	2.4 GHz Wi-Fi 802.11b/g/n	2412 to 2462 MHz
	5.0 GHz Wi-Fi 802.11a/n (HT20 / HT40)	5180 to 5825 MHz

Transmitter Frequency Allocation of EUT When Under Test:

Bands	Channel Number	Channel Description	Frequency (MHz)
GSM850	128	Low	824.2
	190	Middle	836.6
	251	High	848.8
PCS1900	512	Low	1850.2
	661	Middle	1880.0
	810	High	1909.8
UMTS FDD 2	9262	Low	1852.4
	9400	Middle	1880.0
	9538	High	1907.6
UMTS FDD 4	1312	Low	1712.4
	1412	Middle	1732.4
	1513	High	1752.6
UMTS FDD 5	4132	Low	826.4
	4183	Middle	836.6
	4233	High	846.6
2.4 GHz Wi-Fi 802.11b/g/n	1	Low	2412.0
	6	Middle	2437.0
	11	High	2462.0

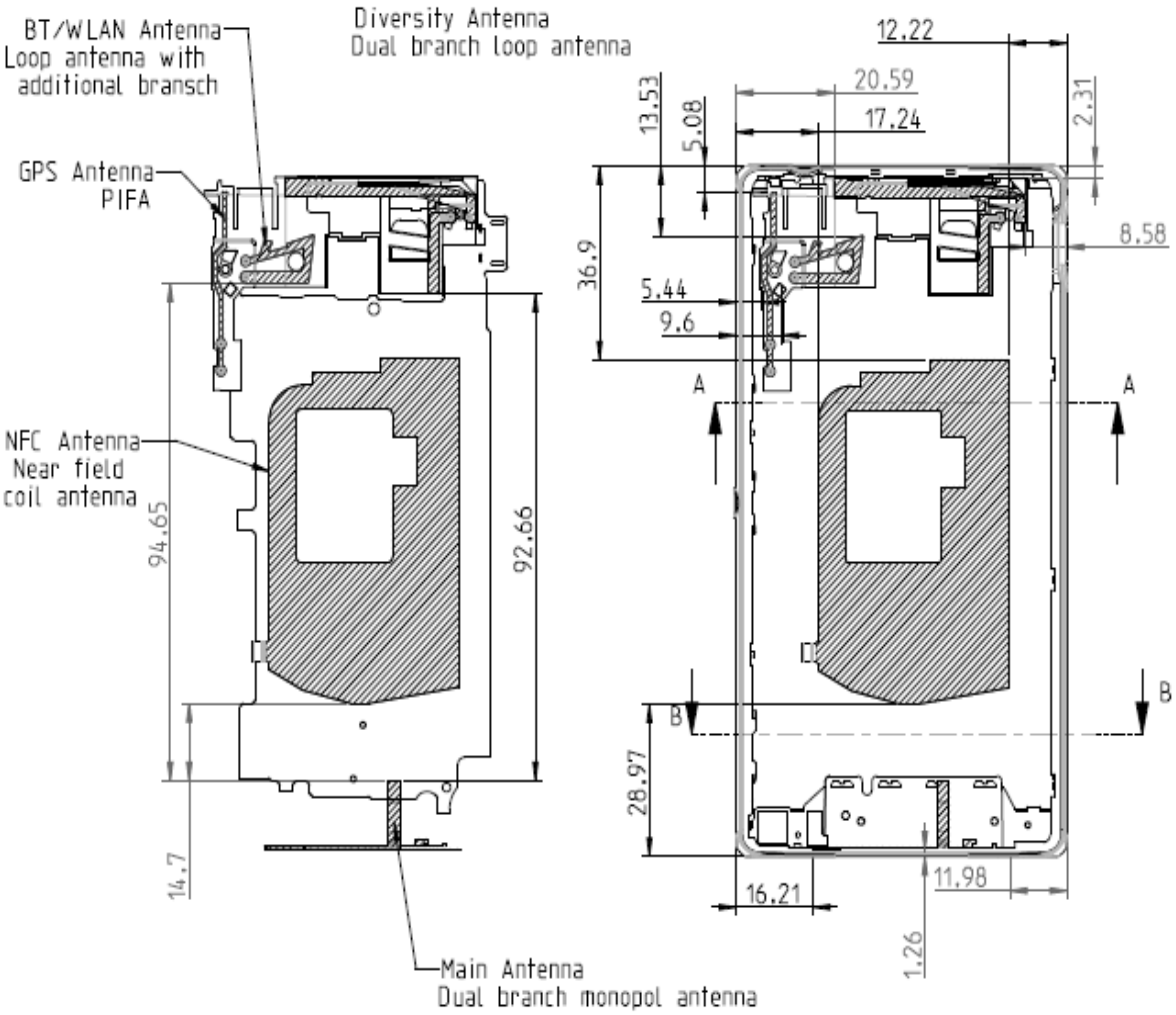
Additional Information Related to Testing (Continued)

Transmitter Frequency Allocation of EUT When Under Test:

Band: 5.0 GHz Wi-Fi 802.11a/n (HT20 / HT40)

Channel Number	Frequency (MHz)
36	5180.0
38	5190.0
40	5200.0
44	5220.0
46	5230.0
48	5240.0
52	5260.0
54	5270.0
56	5280.0
60	5300.0
62	5310.0
64	5320.0
100	5500.0
102	5510.0
104	5520.0
108	5540.0
110	5550.0
112	5560.0
116	5580.0
118	5590.0
120	5600.0
124	5620.0
126	5630.0
128	5640.0
132	5660.0
134	5670.0
136	5680.0
140	5700.0
149	5745.0
151	5755.0
153	5765.0
157	5785.0
159	5795.0
161	5805.0
165	5825.0

Additional Information Related to Testing (Continued):	
Modulation(s):	GMSK (GSM/ GPRS): 217 Hz QPSK(UMTS / HSDPA/HSUPA):0Hz DBPSK, CCK (Wi-Fi): 0 Hz
Modulation Scheme (Crest Factor):	GSMK (GSM): 8.3 GMSK (GPRS850): 4 GMSK (GPRS1900): 2 DBPSK, CCK (Wi-Fi): 1 QPSK(UMTS FDD / HSDPA): 1
Antenna Type:	Internal integral
Antenna Length:	Unknown
Number of Antenna Positions:	1 fixed (WWAN) 1 fixed (GPS/WLAN/*Bluetooth*) 1 fixed (NFC) 1 fixed (Diversity)
Power Supply Requirement:	3.7V
Battery Type(s):	Li-ion



5. Deviations from the Test Specification

Test was performed as per KDB 248227 D01 SAR measurements for 802.11a/b/g v01r02, KDB 447498 D01 General RF Exposure Guidance v05, KDB 648474 D04 SAR Handsets Multi Xmiter and Ant v01, KDB 941225 D01 SAR test for 3G devices v02, KDB 941225 D03 SAR Test Reduction GSM/GPRS/EDGE v01, KDB 941225 D06 Hot Spot SAR v01, KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01, KDB , according to the handset procedures in IEEE Std 1528-2003 and OET Bulletin 65 Supplement C 01-01. The assessment for Personal Wireless Hotspot was also evaluated as per the FCC KDB 941225 D06 "Hot Spot SAR v01".

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

As per KDB 447498 and RSS-102 Issue 4 March 2010, the SAR Test exclusion for 2450 MHz frequency is below threshold and hence Stand-Alone SAR body testing was not required for the *Bluetooth* Technology.

As per conducted average power measured, SAR test was performed in the middle channels for WWAN and WiFi 2.4 GHz. The worst case configuration for both Head and Hotspot mode test was evaluated in the low and high channels.

The measured maximum conducted power for WLAN 2.4 HGz 802.11b/n is 17.6dBm (equivalent to 57.5 mW) and for WLAN 5GHz is 11.6dBm (equivalent to 14.5 mW).

As per KDB 447498, the SAR exclusion threshold value for separation distance of 5mm is 10mW and for separation distance of ≥10mm is 19mW for 2450MHz and hence, Stand-Alone SAR testing was performed on WLAN 2.4 Head, Hotspot and Body Configurations.

As per KDB 447498, the SAR exclusion threshold value for separation distance of 10mm is 19mW for 2450MHz, 13mW for frequencies between 5.2- 5.4GHz and 12mW for 5.6GHz and hence, Stand-Alone SAR testing was performed on 2.4 GHz and 5GHz bands.

GPRS clas33 / uplink setup of 1-uplink, 2-uplink, 3-uplink and 4-uplink were all evaluated to find the setting with the highest power reference point (unit v/m) as per the DASY4 system. 2-uplink and 4-uplink were found to give the highest power reference point measurement on the DASY4 system (unit v/m) for GPRS850 and GPRS1900 respectively. All settings were performed with the device in a fixed position Front facing phantom at 0mm separation to ensure there were no positioning errors. The following values were measured relative to the uplink settings:

GPRS Mode	GPRS850 Power reference (v/m)	GPRS1900 Power reference (v/m)
1 uplink	9.12	1.97
2 uplink	**11.00**	2.23
3 uplink	10.04	2.24
4 uplink	10.17	**2.29**

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

6. Operation and Configuration of the EUT during Testing

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

- GSM850 – Voice allocated mode with Communication Test Set configured to allow the EUT to transmit at a maximum power using Power Control Level (PCL) setting of 5.
- GPRS850 – Data allocated mode with Communication Test Set configured to allow the EUT to transmit at a maximum power using Power Control Level (PCL) setting of 5. Tested using 2 Uplink time slots with CS1 for GPRS.
- PCS1900 – Voice allocated mode with Communication Test Set configured to allow the EUT to transmit at a maximum power using Power Control Level (PCL) setting of 0.
- GPRS1900 – Data allocated mode with Communication Test Set configured to allow the EUT to transmit at a maximum power using Power Control Level (PCL) setting of 0. Tested using 4 Uplink time slots with CS1 for GPRS.

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

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

- UMTS FDD 2, 4, 5 - Call allocated mode with Communication Test Set configured to allow the EUT to transmit at a maximum as per KDB 941225 D01.
- UMTS FDD 2, 4, 5 - RMC 12.2kbps + HSUPA With Test loop mode 1 and TPC bits configured to all "1's", Sub-test 5, AG Index set to 21 and E-TFCI set to 81 with Communication Test Set configured to allow to EUT to transmit at a maximum power as per KDB 941225 D01.
- UMTS FDD 2, 4, 5 - RMC 12.2kbps + HSDPA With Test loop mode 1 and TPC bits configured to all "1's", Sub-test 1 with Communication Test Set configured to allow to EUT to transmit at a maximum power as per KDB 941225 D01.
- UMTS FDD 5 - DC HSDPA (Cat 24) With Test loop mode 1 and TPC bits configured to all "1's", Sub-test 1 with Communication Test Set configured to allow to EUT to transmit at a maximum power as per KDB 941225 D01. (See Appendix 8 for detailed description)

Operating Modes (Continued)

- 2.4 GHz WiFi802.11b/g/n Data allocated mode using 'HyperTerminal' software to excise mode ‘b’, ‘g’ and ‘n’, with maximum power of up to 17.6 dBm for ‘b’ mode and 15.7 dBm for ‘g’ and 15.4 dBm for ‘n’ modes.
- 5.0 GHz WiFi802.11a/n Data allocated mode using 'HyperTerminal' software to excise mode ‘a’ and ‘n’, with maximum power of up to 11.6 dBm for ‘a’ mode and 10.3 dBm for ‘n’ modes.
- **Activating the ‘Portable Wi-Fi hotspot’ mode**

Go to the home screen of the EUT:

1. Press the ‘*Applications’* icon on the screen of the device and then tap "*Settings*".
2. On the Settings screen, tap the "*Wireless & networks*" option, followed by "*Portable Wi-Fi hotspot*".
3. Click the check mark beside it to turn on the hotspot and the EUT starts acting like a wireless access point. (It should also see a message in the notification bar when it's activated.).
4. Once ‘*Portable Wi-Fi Hotspot’* mode is activated, it is active until it is deactivated by the user.

‘Auto RF Power Back-off’ mode facility is available on ‘Hotspot Mode Configuration of PCS1900 and UMTS FDD 2, 4 bands only. There is no power back-off to the WLAN 2.4 GHz or WLAN 5.0 GHz.

Once the ‘Portable Wi-Fi hotspot’ mode is activated, the ‘Auto RF Power Reduction’ mode is active. This enables ‘Power Back-Off’ and the RF power gets reduced on the specific band on which it is supported. This option is available in the device to ‘Reduce the RF Power’ and to comply with the *Standard* for the measured SAR and conducted power level. Once ‘Auto RF Power Back-off’ mode is activated, power reduction applies until ‘Portable Wi-Fi hotspot’ is deactivated by the user.

6.1. Configuration and Peripherals

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

- Standalone fully charged battery powered.
- Head, Hotspot and Body-worn configurations were evaluated.
- The applied FCC body-worn Personal Hotspot orientations where the corresponding edge(s) closest to the user with the most conservative exposure condition were all evaluated at 10 mm from the body. For configuration that did not overlap with Personal hotspot, SAR evaluation was performed at 15mm separation.
- GPRS class 33: setup for 1-uplink, 2-uplink, 3-uplink and 4-uplink were evaluated to find the setting with the highest power reference measurements. 2-uplink and 4-uplink were found to give the highest power reference point measurement on the DASY4 system (unit v/m) for GPRS850 and GPRS1900 respectively. All settings were performed with the device in a fixed position 'Back facing phantom' at 0mm separation to ensure there were no positioning errors.
- GSM, GPRS and EDGE power measurement were all measured as per FCC pubs. 941225 D03. Although power reduction was allowed SAR test was performed on GPRS using GMSK. Test reduction was applied to EDGE using GMSK and 8PSK modulation scheme.

Head Configuration

a) The EUT was placed in a normal operating position with the centre of the ear-piece aligned with the ear canal on the phantom.

b) With the ear-piece touching the phantom the centre line of the EUT was aligned with an imaginary plane (X and Y axis) consisting of three lines connecting both ears and the mouth.

c) For the cheek position the EUT was gradually moved towards the cheek until any point of the mouth-piece or keypad touched the cheek.

d) For the tilted position the EUT was positioned as for the cheek position, and then the horizontal angle was increased by fifteen degrees (the phone keypad was moved away from the cheek by fifteen degrees).

e) SAR measurements were evaluated at maximum power and the unit was operated for an appropriate period prior to the evaluation in order to minimise the drift.

f) The device was keyed to operate continuously in the transmit mode for the duration of the test.

g) The location of the maximum spatial SAR distribution (hot spot) was determined relative to the EUT and its antenna.

h) The EUT was transmitting at full power throughout the duration of the test powered by a fully charged battery.

Body Configuration

a) The EUT was placed in a normal operating position where the centre of EUT was aligned with the centre reference point on the flat section of the 'SAM' phantom.

b) With the EUT touching the phantom at an imaginary centre line. The EUT was aligned with a marked plane (X and Y axis) consisting of two lines.

c) For the touch-safe position the EUT was gradually moved towards the flat section of the 'SAM' phantom until any point of the EUT touched the phantom.

d) For position(s) greater then 0mm separation the EUT was positioned as per the touch-safe position, and then the vertical height was decreased/adjusted as required.

e) SAR measurements were evaluated at maximum power and the unit was operated for an appropriate period prior to the evaluation in order to minimise the drift.

f) The device was keyed to operate continuously in the transmit mode for the duration of the test.

g) The location of the maximum spatial SAR distribution (hot spot) was determined relative to the EUT and its antenna.

h) The EUT was transmitting at full power throughout the duration of the test powered by a fully charged battery.

6.2. Configuration Consideration

Technology Antenna	Configuration	Antenna-to-User Separation	Position	Antenna-to-Edge Separation	Evaluation Considered
WWAN	Head	0mm	Touch Left	<25mm	Yes
			Tilt Left	<25mm	Yes
			Touch Right	<25mm	Yes
			Tilt Right	<25mm	Yes
	Hotspot	10mm	Front	<25mm	Yes
			Back	<25mm	Yes
			Top Edge	>25mm	No
			Bottom Edge	<25mm	Yes
			Right Edge	<25mm	Yes
			Left Edge	<25mm	Yes
	Body	15mm	Front	<25mm	Yes
			Back	<25mm	Yes
WLAN	Head	0mm	Touch Left	<25mm	Yes
			Tilt Left	<25mm	Yes
			Touch Right	<25mm	Yes
			Tilt Right	<25mm	Yes
	Hotspot	10mm	Front	<25mm	Yes
			Back	<25mm	Yes
			Top Edge	<25mm	Yes
			Bottom Edge	>25mm	No
			Right Edge	<25mm	Yes
			Left Edge	>25mm	No
	Body	15mm	Front	<25mm	Yes
			Back	<25mm	Yes

Note:

1. Test distances are as per FCC KDB publication 447498 D01v05 for mobile handsets.
2. Bluetooth standalone SAR is excluded as the output power meets the exclusion threshold:

"

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:

   [(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] · [$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR,[16] where

   - $f_{(GHz)}$ is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest mW and mm before calculation[17]
   - The result is rounded to one decimal place for comparison

" **Taken from FCC KDB publication 447498 D01v05**

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. Conducted Power Measurements

7.2.1.Conducted Average Power Measurement 2G: GSM850 Power Back-off Disabled

Channel Number	Frequency (MHZ)	Power (dBm)	Avg. Burst Power with consideration for uplink time slot (dBm)	Note
128	824.2	32.4	23.4	Conducted, GMSK
190	836.6	32.4	23.4	Conducted, GMSK
251	848.8	32.3	23.3	Conducted, GMSK

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

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Power (dBm) 3Uplink	Power (dBm) 4Uplink	Note
128	824.2	32.4	30.6	28.8	27.2	Conducted, GMSK
190	836.6	32.4	30.6	29.0	27.4	Conducted, GMSK
251	848.8	32.3	30.4	29.0	27.4	Conducted, GMSK

GPRS850 - Calculated Value with consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Power (dBm) 3Uplink	Power (dBm) 4Uplink	Note
128	824.2	23.4	24.6	24.5	24.2	Conducted, GMSK
190	836.6	23.4	24.6	24.7	24.4	Conducted, GMSK
251	848.8	23.3	24.4	24.7	24.4	Conducted, GMSK

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

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Power (dBm) 3Uplink	Power (dBm) 4Uplink	Note
128	824.2	32.4	30.6	28.8	27.2	Conducted, GMSK
190	836.6	32.4	30.6	29.0	27.4	Conducted, GMSK
251	848.8	32.3	30.4	29.0	27.4	Conducted, GMSK

EDGE850 - Calculated Value with consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Power (dBm) 3Uplink	Power (dBm) 4Uplink	Note
128	824.2	23.4	24.6	24.5	24.2	Conducted, GMSK
190	836.6	23.4	24.6	24.7	24.4	Conducted, GMSK
251	848.8	23.3	24.4	24.7	24.4	Conducted, GMSK

Note:

Scale factor for uplink time slot:

3. 1 Uplink: time slot ratio = 8:1 => 10*log(8/1) = **9.03 dB**
4. 2 Uplink: time slot ratio = 8:2 => 10*log(8/2) = **6.02 dB**
5. 3 Uplink: time slot ratio = 8:3 => 10*log(8/3) = **4.26 dB**
6. 4 Uplink: time slot ratio = 8:4 => 10*log(8/4) = **3.01 dB**

EDGE (MCS9 ~ 8PSK)
EDGE850 - Measured Average Power without consideration for Uplink time slots: Power Back-off Disabled

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Power (dBm) 3Uplink	Power (dBm) 4Uplink	Note
128	824.2	27.8	24.8	23.9	22.9	Conducted, 8PSK
190	836.6	27.9	24.8	24.0	23.0	Conducted, 8PSK
251	848.8	27.9	24.8	24.0	23.0	Conducted, 8PSK

EDGE850 - Calculated Value with consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Power (dBm) 3Uplink	Power (dBm) 4Uplink	Note
128	824.2	18.8	18.8	19.6	19.9	Conducted, 8PSK
190	836.6	18.9	18.8	19.7	20.0	Conducted, 8PSK
251	848.8	18.9	18.8	19.7	20.0	Conducted, 8PSK

Note:

Scale factor for uplink time slot:

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

7.2.2.Conducted Average Power Measurement 2G: PCS1900 Power Back-off Disabled

Channel Number	Frequency (MHZ)	Power (dBm)	Avg. Burst Power with consideration for uplink time slot (dBm)	Note
512	1850.2	28.5	19.5	Conducted, GMSK
661	1880.0	28.4	19.4	Conducted, GMSK
810	1909.8	28.6	19.6	Conducted, GMSK

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

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Power (dBm) 3Uplink	Power (dBm) 4Uplink	Note
512	1850.2	28.5	27.4	25.6	24.6	Conducted, GMSK
661	1880.0	28.4	27.4	25.6	24.5	Conducted, GMSK
810	1909.8	28.6	27.4	25.6	24.5	Conducted, GMSK

GPRS1900 - Calculated Value with consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Power (dBm) 3Uplink	Power (dBm) 4Uplink	Note
512	1850.2	19.5	21.4	21.3	21.6	Conducted, GMSK
661	1880.0	19.4	21.4	21.3	21.5	Conducted, GMSK
810	1909.8	19.6	21.4	21.3	21.5	Conducted, GMSK

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

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Power (dBm) 3Uplink	Power (dBm) 4Uplink	Note
512	1850.2	28.5	27.4	25.6	24.6	Conducted, GMSK
661	1880.0	28.4	27.4	25.6	24.5	Conducted, GMSK
810	1909.8	28.6	27.4	25.6	24.5	Conducted, GMSK

EDGE1900 - Calculated Value with consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Power (dBm) 3Uplink	Power (dBm) 4Uplink	Note
512	1850.2	19.5	21.4	21.3	21.6	Conducted, GMSK
661	1880.0	19.4	21.4	21.3	21.5	Conducted, GMSK
810	1909.8	19.6	21.4	21.3	21.5	Conducted, GMSK

Note:

Scale factor for uplink time slot:

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

EDGE (MCS9 ~ 8PSK):
EDGE1900 - Measured Average Power without consideration for Uplink time slots:
Power Back-off Disabled

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Power (dBm) 3Uplink	Power (dBm) 4Uplink	Note
512	1850.2	25.9	23.6	22.9	21.6	Conducted, 8PSK
661	1880.0	25.9	23.6	22.8	21.5	Conducted, 8PSK
810	1909.8	25.9	23.6	22.9	21.5	Conducted, 8PSK

EDGE1900 - Calculated Value with consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Power (dBm) 3Uplink	Power (dBm) 4Uplink	Note
512	1850.2	16.9	17.6	18.6	18.6	Conducted, 8PSK
661	1880.0	16.9	17.6	18.5	18.5	Conducted, 8PSK
810	1909.8	16.9	17.6	18.6	18.5	Conducted, 8PSK

Note:

Scale factor for uplink time slot:

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

7.2.3.Conducted Average Power Measurement 2G: PCS1900 Power Back-off Enabled

Channel Number	Frequency (MHZ)	Power (dBm)	Avg. Burst Power with consideration for uplink time slot (dBm)	Note
512	1850.2	28.5	19.5	Conducted, GMSK
661	1880.0	28.4	19.4	Conducted, GMSK
810	1909.8	28.6	19.6	Conducted, GMSK

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

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Power (dBm) 3Uplink	Power (dBm) 4Uplink	Note
512	1850.2	28.5	26.0	24.3	23.1	Conducted, GMSK
661	1880.0	28.4	25.8	24.1	23.0	Conducted, GMSK
810	1909.8	28.6	25.9	24.1	23.0	Conducted, GMSK

GPRS1900 - Calculated Value with consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Power (dBm) 3Uplink	Power (dBm) 4Uplink	Note
512	1850.2	19.5	20.0	20.0	20.1	Conducted, GMSK
661	1880.0	19.4	19.8	19.8	20.0	Conducted, GMSK
810	1909.8	19.6	19.9	19.8	20.0	Conducted, GMSK

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

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Power (dBm) 3Uplink	Power (dBm) 4Uplink	Note
512	1850.2	28.5	26.0	24.3	23.1	Conducted, GMSK
661	1880.0	28.4	25.8	24.1	23.0	Conducted, GMSK
810	1909.8	28.6	25.9	24.1	23.0	Conducted, GMSK

EDGE1900 - Calculated Value with consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Power (dBm) 3Uplink	Power (dBm) 4Uplink	Note
512	1850.2	19.5	20.0	20.0	20.1	Conducted, GMSK
661	1880.0	19.4	19.8	19.8	20.0	Conducted, GMSK
810	1909.8	19.6	19.9	19.8	20.0	Conducted, GMSK

Note:

Scale factor for uplink time slot:

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

EDGE (MCS9 ~ 8PSK):
EDGE1900 - Measured Average Power without consideration for Uplink time slots:
Power Back-off Enabled

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Power (dBm) 3Uplink	Power (dBm) 4Uplink	Note
512	1850.2	25.9	23.6	22.9	21.6	Conducted, 8PSK
661	1880.0	25.9	23.6	22.8	21.5	Conducted, 8PSK
810	1909.8	25.9	23.6	22.9	21.5	Conducted, 8PSK

EDGE1900 - Calculated Value with consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Power (dBm) 3Uplink	Power (dBm) 4Uplink	Note
512	1850.2	16.9	17.6	18.6	18.6	Conducted, 8PSK
661	1880.0	16.9	17.6	18.5	18.5	Conducted, 8PSK
810	1909.8	16.9	17.6	18.6	18.5	Conducted, 8PSK

Note:

Scale factor for uplink time slot:

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

7.2.4.Conducted Average Power Measurement 3G: Power Back-off Disabled

Modes		HSDPA				HSUPA					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]
1900 (Band 2)	9262	21.3	21.0	20.4	20.4	21.1	21.1	20.4	21.3	20.5	23.2
	9662										
	9400	21.3	21.0	20.4	20.4	21.0	21.1	20.4	21.3	20.5	23.3
	9800										
	9538	21.2	20.9	20.3	20.3	20.9	21.0	20.4	21.2	20.4	23.1
	9938										
1700 (Band 4)	1312	22.2	21.8	21.4	21.4	21.9	22.0	21.3	22.3	21.3	24.1
	1537										
	1412	22.2	21.8	21.3	21.3	21.8	21.9	21.2	22.2	21.2	24.0
	1637										
	1513	22.1	21.7	21.3	21.3	21.8	21.9	21.2	22.2	21.2	24.0
	1738										
850 (Band 5)	4132	22.4	22.0	21.5	21.5	22.1	22.1	21.4	22.4	21.5	24.0
	4357										
	4183	22.4	22.0	21.4	21.4	22.0	22.1	21.4	22.4	21.4	24.0
	4408										
	4233	22.2	21.8	21.2	21.3	22.0	22.0	21.3	22.3	21.3	23.9
	4458										
ßc		2	12	15	15	11	6	15	2	15	
ßd		15	15	8	4	15	15	9	15	15	
ΔACK, ΔNACK, ΔCQI		8	8	8	8	8	8	8	8	8	
AGV		-	-	-	-	20	12	15	17	21	

Conducted Average Power Measurement 3G: Power Back-off Disabled

Modes		DC HSDPA (Cat 24)				WCDMA
Sets		1	2	3	4	Voice / RMC 12.2kbps
Band	Channel	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]
1900 (Band 2)	9262 9662	20.4	20.4	20.4	20.4	23.2
	9400 9800	20.3	20.5	20.4	20.5	23.3
	9538 9938	20.4	20.4	20.4	20.3	23.1
1700 (Band 4)	1312 1537	21.2	21.0	21.1	21.4	24.1
	1412 1637	21.2	21.1	21.1	21.3	24.0
	1513 1738	21.3	21.0	21.2	21.2	24.0
850 (Band 5)	4132 4357	21.2	21.1	21.2	21.3	24.0
	4183 4408	21.3	21.2	21.2	21.3	24.0
	4233 4458	21.3	21.3	21.0	21.0	23.9
Modes		HSDPA (Cat 24)				WCDMA
Sets		1	2	3	4	Voice / RMC 12.2kbps
ßc		2	12	15	15	
ßd		15	15	8	4	
ΔACK, ΔNACK, ΔCQI		8	8	8	8	
AGV		-	-	-	-	

7.2.5.Conducted Average Power Measurement 3G: Power Back-off Enabled

Modes		HSDPA				HSUPA					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]
1900 (Band 2)	9262 9662	20.1	19.6	19.2	19.1	19.8	19.9	19.2	20.1	19.1	21.2
	9400 9800	20.2	19.7	19.1	19.1	19.8	19.9	19.2	20.1	19.2	21.3
	9538 9938	20.1	19.6	19.1	19.0	19.7	19.9	19.1	20.0	19.1	21.2
1700 (Band 4)	1312 1537	21.2	20.8	20.3	20.2	20.7	21.0	20.2	20.2	20.2	22.3
	1412 1637	21.1	20.8	20.2	20.1	20.6	20.9	20.2	20.1	20.1	22.2
	1513 1738	21.0	20.7	20.2	20.2	20.7	20.9	20.2	20.1	20.1	22.1
ßc		2	12	15	15	11	6	15	2	15	
ßd		15	15	8	4	15	15	9	15	15	
ΔACK, ΔNACK, ΔCQI		8	8	8	8	8	8	8	8	8	
AGV		-	-	-	-	20	12	15	17	21	

Conducted Average Power Measurement 3G: Power Back-off Enabled

Modes		DC HSDPA (Cat 24)				WCDMA
Sets		1	2	3	4	Voice / RMC 12.2kbps
Band	Channel	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]
1900 (Band 2)	9262 9662	18.2	18.3	18.2	18.4	21.2
	9400 9800	18.6	18.4	18.2	18.3	21.3
	9538 9938	18.7	18.5	18.3	18.4	21.2
1700 (Band 4)	1312 1537	19.6	19.6	19.6	19.7	22.3
	1412 1637	19.6	19.7	19.5	19.5	22.2
	1513 1738	19.6	19.6	19.5	19.4	22.1
ßc		2	12	15	15	
ßd		15	15	8	4	
ΔACK, ΔNACK, ΔCQI		8	8	8	8	
AGV		-	-	-	-	

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 / HSUPA release 6.

Sub-test Setup for Release 5 HSDPA

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

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

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 Setup for Release 6 HSUPA

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

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

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 Power Back-off 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 Tavle 5.1g.

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

7.2.6.Conducted Power Measurements Wi-Fi802.11b/g/n

802.11b/g

Power Back-off Disabled

Channel Number	Frequency (MHZ)	TX Power (dBm)	Note
1	2412.0	17.5	**2.4GHz 802.11b** (1Mbps)
6	2437.0	17.4	
11	2462.0	17.6	
1	2412.0	15.8	**2.4GHz 802.11b** (11Mbps)
6	2437.0	16.1	
11	2462.0	16.2	
1	2412.0	15.2	**2.4GHz 802.11g** (6Mbps)
6	2437.0	15.7	
11	2462.0	15.5	
1	2412.0	10.4	**2.4GHz 802.11g** (54Mbps)
6	2437.0	11.1	
11	2462.0	10.9	

802.11n

Channel Number	Frequency (MHZ)	TX Power (dBm)	Note
1	2412.0	14.6	**2.4GHz 802.11n** (MCS0 6.5Mbps)
6	2437.0	15.4	
11	2462.0	15.1	
1	2412.0	9.1	**2.4GHz 802.11n** (MCS7 65Mbps)
6	2437.0	9.9	
11	2462.0	9.7	

7.2.7.Conducted Power Measurements Wi-Fi802.11a/n (5.0 GHz) Power Back-off Disabled

Channel Number	Frequency (MHZ)	TX Power (dBm) 6 Mbps	TX Power (dBm) 54 Mbps	Note
36*	**5180.0**	11.6	7.3	**5.2 GHz**
40	5200.0	11.5	6.7	
44	5220.0	11.6	6.7	
48*	**5240.0**	11.5	6.7	
52*	**5260.0**	10.9	6.8	**5.3 GHz**
56	5280.0	11.0	6.8	
60	5300.0	11.0	6.8	
64*	**5320.0**	11.1	6.8	
100	5500.0	10.8	7.1	**5.6 GHz**
104*	**5520.0**	11.4	7.1	
108	5540.0	10.9	7.1	
112	5560.0	10.8	7.1	
116*	**5580.0**	11.1	6.9	
120	5600.0	11.3	7.0	
124*	**5620.0**	11.4	7.2	
128	5640.0	10.7	7.2	
132	5660.0	11.1	7.0	
136*	**5680.0**	11.2	7.2	
140	5700.0	11.4	7.1	
149*	**5745.0**	11.4	7.3	**5.8 GHz**
153	5765.0	11.3	7.1	
157*	**5785.0**	11.4	7.1	
161	5805.0	11.4	7.1	
165*	**5825.0**	10.9	7.3	

*** Default test Channels**

802.11n (5.0 GHz) (HT20)
Power Back-off Disabled

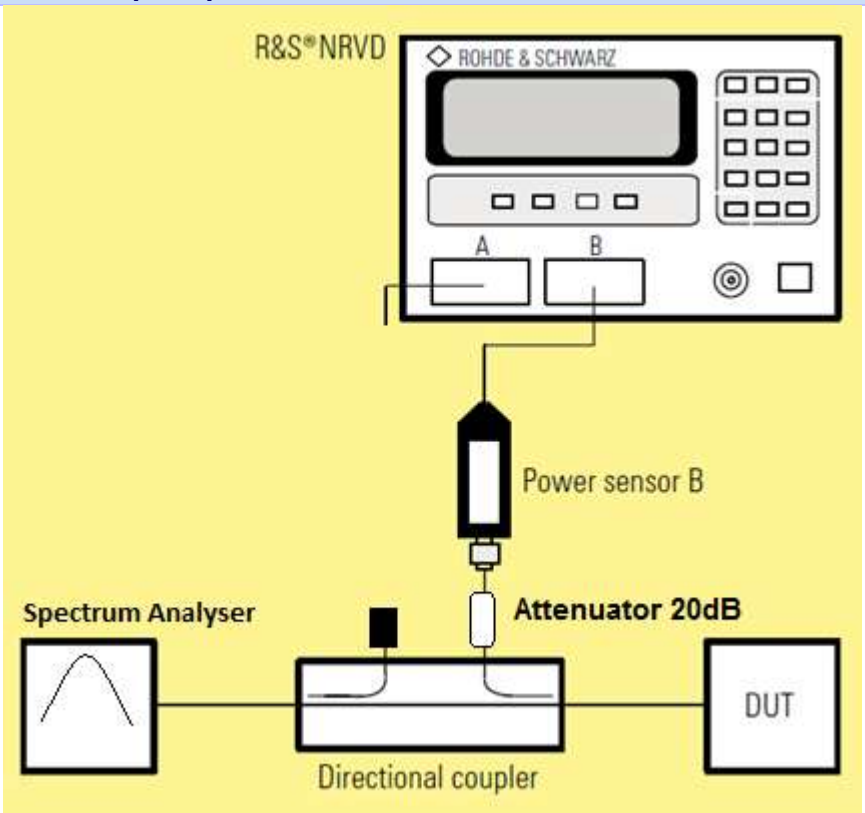
Channel Number	Frequency (MHZ)	TX Power (dBm) 6.5 Mbps	TX Power (dBm) 65 Mbps	Note
36*	**5180.0**	10.1	5.1	**5.2 GHz**
40	5200.0	10.1	4.4	
44	5220.0	10.1	4.5	
48*	**5240.0**	10.1	4.4	
52*	**5260.0**	10.2	4.5	**5.3 GHz**
56	5280.0	10.2	4.5	
60	5300.0	10.1	4.4	
64*	**5320.0**	10.2	4.4	
100	5500.0	9.9	4.4	**5.6 GHz**
104*	**5520.0**	10.5	4.4	
108	5540.0	10.0	4.7	
112	5560.0	10.1	4.5	
116*	**5580.0**	10.3	4.7	
120	5600.0	10.3	4.6	
124*	**5620.0**	10.3	4.3	
128	5640.0	10.3	4.7	
132	5660.0	10.4	4.5	
136*	**5680.0**	10.3	4.7	
140	5700.0	10.4	4.7	
149*	**5745.0**	10.3	4.4	**5.8 GHz**
153	5765.0	10.4	4.8	
157*	**5785.0**	10.5	4.9	
161	5805.0	10.3	5.0	
165*	**5825.0**	10.4	5.7	

*** Default test Channels**

802.11n (5.0 GHz) (HT40)
Power Back-off Disabled

Channel Number	Frequency (MHZ)	TX Power (dBm) 13.5 Mbps	TX Power (dBm) 135 Mbps	Note
38	5190.0	10.0	5.8	5.2 GHz
46	5230.0	10.0	6.3	
54	5270.0	10.0	5.7	5.3 GHz
62	5310.0	10.0	5.7	
102	5510.0	10.3	5.4	5.6 GHz
110	5550.0	10.3	5.5	
118	5590.0	10.2	5.7	
126	5630.0	10.2	6.0	
134	5670.0	10.1	6.0	
151	5755.0	10.2	6.1	5.8 GHz
159	5795.0	10.3	6.0	

Test setup for power measurements



7.3. Test Results

All measurements in this report are tested to the SAR limit of 1.6W/kg

All Maximum Rated Power in the following table is inclusive of the maximum tolerance.

7.3.1.Specific Absorption Rate - GSM 850 Head Configuration 1g Power Back-Off Disabled Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.324
Maximum Reported Level (W/kg):	0.355

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	22.1 to 22.1

Results:

Scan No.	EUT Position	Channel Number	Uplink Meas. Burst Avg. Power (dBm)	Uplink Max. Rated Burst Avg. Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
1	Touch Left	190	23.4	23.8	0.292	0.320	1	GMSK
2	Tilt Left	190	23.4	23.8	0.197	0.216	1	GMSK
3	Touch Right	190	23.4	23.8	0.288	0.316	1	GMSK
4	Tilt Right	190	23.4	23.8	0.186	0.204	1	GMSK
5	Touch Left	128	23.4	23.8	0.324	0.355	1	GMSK
6	Touch Left	251	23.3	23.8	0.279	0.313	1	GMSK

Note(s):

1. Voice Mode

7.3.2.Specific Absorption Rate - GPRS 850 Hotspot Mode Configuration 1g Power Back-Off Disabled Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.954
Maximum Reported Level (W/kg):	1.121

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	22.1 to 22.1

Results:

Scan No.	EUT Position	Channel Number	Uplink Meas. Burst Avg. Power (dBm)	Uplink Max. Rated Burst Avg. Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
7	Front	190	24.6	25.3	0.552	0.649	1, 2	GMSK
8	Back	190	24.6	25.3	0.819	0.962	1, 2	GMSK
9	Left Hand Side	190	24.6	25.3	0.549	0.645	1, 2	GMSK
10	Right Hand Side	190	24.6	25.3	0.520	0.611	1, 2	GMSK
11	Bottom	190	24.6	25.3	0.142	0.167	1, 2	GMSK
12	Back	128	24.6	25.3	0.954	1.121	1, 2, 3	GMSK
13	Back	251	24.4	25.3	0.792	0.974	1, 2	GMSK

Note(s):

1. Data - SAR measurements were performed using 2 uplink timeslots
2. EUT supports Hotspot: As per FCC KDB procedure SAR measurements were performed with the EUT at a separation distance of 10mm from the 'SAM' phantom flat section.
3. As per 865664 D01, the highest SAR measured > 0.8 W/kg has been re-measured and included in the report in section 2.3 under ***SAR Measurement Variability and Measurement Uncertainty Analysis Results*** Table.

*KDB 941225 D03 - SAR is not required for EDGE technology when the maximum average output power is lower than that measured on the corresponding GPRS channels.

7.3.3.Specific Absorption Rate - GSM 850 Body-Worn Configuration 1g Power Back-Off Disabled Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.663
Maximum Reported Level (W/kg):	0.727

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	22.1 to 22.1

Results:

Scan No.	EUT Position	Channel Number	Uplink Meas. Burst Avg. Power (dBm)	Uplink Max. Rated Burst Avg. Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
14	Back	190	23.4	23.8	0.663	0.727	1, 2	GMSK
15	Back	128	23.4	23.8	0.586	0.643	1, 2	GMSK
16	Back	251	23.3	23.8	0.577	0.647	1, 2	GMSK

Note(s):

1. Voice Mode - Back of EUT is worst case and most conservative configuration of GPRS hotspot mode and is applied to GSM Body-worn.
2. SAR measurements were performed with the closest edge of the EUT at a separation distance of 15mm from the 'SAM' phantom flat section.

7.3.4.Specific Absorption Rate - PCS 1900 Head Configuration 1g Power Back-Off Disabled Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.195
Maximum Reported Level (W/kg):	0.204

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	22.1 to 22.1

Results:

Scan No.	EUT Position	Channel Number	Uplink Meas. Burst Avg. Power (dBm)	Uplink Max. Rated Burst Avg. Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
17	Touch Left	661	19.4	19.7	0.184	0.197	1	GMSK
18	Tilt Left	661	19.4	19.7	0.023	0.025	1	GMSK
19	Touch Right	661	19.4	19.7	0.095	0.102	1	GMSK
20	Tilt Right	661	19.4	19.7	0.038	0.041	1	GMSK
21	Touch Left	512	19.5	19.7	0.195	0.204	1	GMSK
22	Touch Left	810	19.6	19.7	0.153	0.157	1	GMSK

Note(s):

1. Voice Mode

7.3.5.Specific Absorption Rate - GPRS 1900 Hotspot Mode Configuration 1g Power Back-Off Enabled

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.869
Maximum Reported Level (W/kg):	0.975

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	22.5 to 22.5

Results:

Scan No.	EUT Position	Channel Number	Uplink Meas. Burst Avg. Power (dBm)	Uplink Max. Rated Burst Avg. Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
23	Front	661	20.0	20.5	0.680	0.763	1, 2	GMSK
24	Back	661	20.0	20.5	0.647	0.726	1, 2	GMSK
25	Left Hand Side	661	20.0	20.5	0.109	0.122	1, 2	GMSK
26	Right Hand Side	661	20.0	20.5	0.052	0.058	1, 2	GMSK
27	Bottom	661	20.0	20.5	0.837	0.939	1, 2	GMSK
28	Bottom	512	20.1	20.5	0.723	0.793	1, 2	GMSK
29	Bottom	810	20.0	20.5	0.869	0.975	1, 2, 3	GMSK

Note(s):

1. Data - SAR measurements were performed using 4 uplink timeslots
2. EUT supports Hotspot: As per FCC KDB procedure SAR measurements were performed with the EUT at a separation distance of 10mm from the 'SAM' phantom flat section.
3. As per 865664 D01, the highest SAR measured > 0.8 W/kg has been re-measured and included in the report in section 2.3 under ***SAR Measurement Variability and Measurement Uncertainty Analysis Results*** Table.

*KDB 941225 D03 - SAR is not required for EDGE technology when the maximum average output power is lower than that measured on the corresponding GPRS channels.

7.3.6.Specific Absorption Rate - GPRS 1900 Body-Worn Configuration 1g Power Back-Off Disabled Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.443
Maximum Reported Level (W/kg):	0.488

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	22.5 to 22.5

Results:

Scan No.	EUT Position	Channel Number	Uplink Meas. Burst Avg. Power (dBm)	Uplink Max. Rated Burst Avg. Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
30	Front	661	21.5	22.0	0.435	0.488	1, 2	GMSK
31	Front	512	21.6	22.0	0.443	0.486	1, 2	GMSK
32	Front	810	21.5	22.0	0.433	0.486	1, 2	GMSK

Note(s):

1. Data - SAR measurements were performed using 4 uplink timeslots - Front of EUT, is worst case and most conservative configuration from Hotspot mode and used for Body-worn Configuration.
2. SAR measurements were performed with the closest edge of the EUT at a separation distance of 15mm from the 'SAM' phantom flat section.

7.3.7.Specific Absorption Rate - PCS 1900 Body-Worn Configuration 1g Power Back-Off Disabled Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.291
Maximum Reported Level (W/kg):	0.309

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	23.5 to 23.5

Results:

Scan No.	EUT Position	Channel Number	Uplink Meas. Burst Avg. Power (dBm)	Uplink Max. Rated Burst Avg. Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
33	Front	512	19.5	19.7	0.285	0.298	1, 2	GMSK
34	Front	661	19.4	19.7	0.288	0.309	1, 2	GMSK
35	Front	810	19.6	19.7	0.291	0.298	1, 2	GMSK

Note(s):

1. Voice Mode - Front of EUT, is worst case and most conservative configuration from Hotspot mode and used for Body-worn Configuration.
2. SAR measurements were performed with the closest edge of the EUT at a separation distance of 15mm from the 'SAM' phantom flat section.

7.3.8.Specific Absorption Rate - UMTS-FDD 2 Head Configuration 1g Power Back-Off Disabled Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.545
Maximum Reported Level (W/kg):	0.612

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	22.1 to 22.1

Results:

Scan No.	EUT Position	Channel Number	Meas. Avg. Power (dBm)	Max. Rated Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
36	Touch Left	9400	23.3	23.8	0.545	0.612	1	QPSK
37	Tilt Left	9400	23.3	23.8	0.066	0.074	1	QPSK
38	Touch Right	9400	23.3	23.8	0.265	0.297	1	QPSK
39	Tilt Right	9400	23.3	23.8	0.097	0.109	1	QPSK
40	Touch Left	9262	23.2	23.8	0.522	0.599	1	QPSK
41	Touch Left	9538	23.1	23.8	0.508	0.597	1	QPSK

Note(s):

1. Circuit Switch (CS) - RMC 12.2kbps with Test loop mode 1 and TPC bits configured to All "1's"

7.3.9.Specific Absorption Rate - UMTS-FDD 2 Hotspot Mode Configuration 1g Power Back-Off Enabled

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.854
Maximum Reported Level (W/kg	0.915

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	23.5 to 23.5

Results:

Scan No.	EUT Position	Channel Number	Meas. Avg. Power (dBm)	Max. Rated Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
42	Front	9400	21.3	21.5	0.676	0.708	1, 2	QPSK
43	Back	9400	21.3	21.5	0.647	0.677	1, 2	QPSK
44	Left Hand Side	9400	21.3	21.5	0.103	0.108	1, 2	QPSK
45	Right Hand Side	9400	21.3	21.5	0.062	0.065	1, 2	QPSK
46	Bottom	9400	21.3	21.5	0.783	0.820	1, 2	QPSK
47	Bottom	9262	21.2	21.5	0.628	0.673	1, 2	QPSK
48	Bottom	9538	21.2	21.5	0.854	0.915	1, 2, 3	QPSK

Note(s):

1. Circuit Switch (CS) - RMC 12.2kbps with Test loop mode 1 and TPC bits configured to All "1's"
2. EUT supports Hotspot: As per FCC KDB procedure SAR measurements were performed with the EUT at a separation distance of 10mm from the 'SAM' phantom flat section.
3. As per 865664 D01, the highest SAR measured > 0.8 W/kg has been re-measured and included in the report in section 2.3 under ***SAR Measurement Variability and Measurement Uncertainty Analysis Results*** Table.

7.3.10.Specific Absorption Rate - UMTS-FDD 2 Body-Worn Configuration 1g Power Back-Off Disabled

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.742
Maximum Reported Level (W/kg):	0.872

Environmental Conditions:

Temperature Variation in Lab (°C):	23.5 to 23.5
Temperature Variation in Liquid (°C):	24.0 to 24.0

Results:

Scan No.	EUT Position	Channel Number	Meas. Avg. Power (dBm)	Max. Rated Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
49	Front	9400	23.3	23.8	0.737	0.827	1, 2	QPSK
50	Front	9262	23.2	23.8	0.656	0.753	1, 2	QPSK
51	Front	9538	23.1	23.8	0.742	0.872	1, 2	QPSK

Note(s):

1. Circuit Switch (CS) - RMC 12.2kbps with Test loop mode 1 and TPC bits configured to All "1's"- Front of EUT, is worst case and most conservative configuration from Hotspot mode and used for Body-worn Configuration.
2. SAR measurements were performed with the closest edge of the EUT at a separation distance of 15mm from the 'SAM' phantom flat section.
3. Personal Hands-Free Kit attached, using the worst-case configuration acquired.

7.3.11.Specific Absorption Rate - UMTS-FDD 4 Head Configuration 1g Power Back-Off Disabled Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.602
Maximum Reported Level (W/kg):	0.724

Environmental Conditions:

Temperature Variation in Lab (°C):	22.8 to 22.8
Temperature Variation in Liquid (°C):	21.0 to 21.0

Results:

Scan No.	EUT Position	Channel Number	Meas. Avg. Power (dBm)	Max. Rated Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
52	Touch Left	1412	24.0	24.8	0.602	0.724	1	QPSK
53	Tilt Left	1412	24.0	24.8	0.130	0.156	1	QPSK
54	Touch Right	1412	24.0	24.8	0.249	0.299	1	QPSK
55	Tilt Right	1412	24.0	24.8	0.111	0.133	1	QPSK
56	Touch Left	1312	24.1	24.8	0.537	0.631	1	QPSK
57	Touch Left	1513	24.0	24.8	0.540	0.649	1	QPSK

Note(s):

1. Circuit Switch (CS) - RMC 12.2kbps with Test loop mode 1 and TPC bits configured to All "1's"

7.3.12.Specific Absorption Rate - UMTS-FDD 4 Hotspot Mode Configuration 1g Power Back-Off Enabled

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.866
Maximum Reported Level (W/kg):	0.934

Environmental Conditions:

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

Results:

Scan No.	EUT Position	Channel Number	Meas. Avg. Power (dBm)	Max. Rated Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
58	Front	1412	22.2	22.5	0.643	0.689	1, 2	QPSK
59	Back	1412	22.2	22.5	0.661	0.708	1, 2	QPSK
60	Left Hand Side	1412	22.2	22.5	0.121	0.130	1, 2	QPSK
61	Right Hand Side	1412	22.2	22.5	0.029	0.031	1, 2	QPSK
62	Bottom	1412	22.2	22.5	0.866	0.928	1, 2	QPSK
63	Bottom	1312	22.3	22.5	0.778	0.815	1, 2	QPSK
64	Bottom	1513	22.1	22.5	0.852	0.934	1, 2	QPSK

Note(s):

1. Circuit Switch (CS) - RMC 12.2kbps with Test loop mode 1 and TPC bits configured to All "1's"
2. EUT supports Hotspot: As per FCC KDB procedure SAR measurements were performed with the EUT at a separation distance of 10mm from the 'SAM' phantom flat section.

7.3.13.Specific Absorption Rate - UMTS-FDD 4 Body-Worn Configuration 1g Power Back-Off Disabled Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	1.010
Maximum Reported Level (W/kg):	1.214

Environmental Conditions:

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

Results:

Scan No.	EUT Position	Channel Number	Meas. Avg. Power (dBm)	Max. Rated Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
65	Back	1412	24.0	24.8	0.940	1.130	1, 2	QPSK
66	Back	1312	24.1	24.8	0.924	1.086	1, 2	QPSK
67	Back	1513	24.0	24.8	1.010	1.214	1, 2, 4	QPSK
68	Back with PHF	1513	24.0	24.8	0.828	0.995	1, 2, 3	QPSK

Note(s):

1. Circuit Switch (CS) - RMC 12.2kbps with Test loop mode 1 and TPC bits configured to All "1's"- Back of EUT, is worst case and most conservative configuration from Hotspot mode and used for Body-worn Configuration.
2. SAR measurements were performed with the closest edge of the EUT at a separation distance of 15mm from the 'SAM' phantom flat section
3. Personal Hands-Free Kit attached, using the worst-case configuration acquired.
4. As per 865664 D01, the highest SAR measured > 0.8 W/kg has been re-measured and included in the report in section 2.3 under ***SAR Measurement Variability and Measurement Uncertainty Analysis Results*** Table.

7.3.14.Specific Absorption Rate - UMTS-FDD 5 Head Configuration 1g Power Back-Off Disabled Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.467
Maximum Reported Level (W/kg):	0.602

Environmental Conditions:

Temperature Variation in Lab (°C):	23.5 to 23.5
Temperature Variation in Liquid (°C):	22.1 to 22.1

Results:

Scan No.	EUT Position	Channel Number	Meas. Avg. Power (dBm)	Max. Rated Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
69	Touch Left	4183	24.0	25.0	0.425	0.535	1	QPSK
70	Tilt Left	4183	24.0	25.0	0.263	0.331	1	QPSK
71	Touch Right	4183	24.0	25.0	0.389	0.490	1	QPSK
72	Tilt Right	4183	24.0	25.0	0.265	0.334	1	QPSK
73	Touch Left	4132	24.0	25.0	0.399	0.502	1	QPSK
74	Touch Left	4233	23.9	25.0	0.467	0.602	1	QPSK

Note(s):

1. Circuit Switch (CS) - RMC 12.2kbps with Test loop mode 1 and TPC bits configured to All "1's"

7.3.15.Specific Absorption Rate - UMTS-FDD 5 Hotspot Mode Configuration 1g Power Back-Off Disabled

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.806
Maximum Reported Level (W/kg):	1.015

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	21.5 to 21.5

Results:

Scan No.	EUT Position	Channel Number	Meas. Avg. Power (dBm)	Max. Rated Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
75	Front	4183	24.0	25.0	0.548	0.690	1, 2	QPSK
76	Back	4183	24.0	25.0	0.806	1.015	1, 2, 3	QPSK
77	Left Hand Side	4183	24.0	25.0	0.541	0.681	1, 2	QPSK
78	Right Hand Side	4183	24.0	25.0	0.511	0.643	1, 2	QPSK
79	Bottom	4183	24.0	25.0	0.122	0.154	1, 2	QPSK
80	Back	4132	24.0	25.0	0.736	0.927	1, 2	QPSK
81	Back	4233	23.9	25.0	0.728	0.938	1, 2	QPSK

Note(s):

1. Circuit Switch (CS) - RMC 12.2kbps with Test loop mode 1 and TPC bits configured to All "1's"
2. EUT supports Hotspot: As per FCC KDB procedure SAR measurements were performed with the EUT at a separation distance of 10mm from the 'SAM' phantom flat section.
3. As per 865664 D01, the highest SAR measured > 0.8 W/kg has been re-measured and included in the report in section 2.3 under ***SAR Measurement Variability and Measurement Uncertainty Analysis Results*** Table.

7.3.16.Specific Absorption Rate - UMTS-FDD 5 Body-Worn Configuration 1g Power Back-Off Disabled

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.745
Maximum Reported Level (W/kg):	0.938

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	22.9 to 22.9

Results:

Scan No.	EUT Position	Channel Number	Meas. Avg. Power (dBm)	Max. Rated Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
82	Back	4183	24.0	25.0	0.745	0.938	1, 2	QPSK
83	Back	4132	24.0	25.0	0.699	0.880	1,2	QPSK
84	Back	4233	23.9	25.0	0.678	0.873	1, 2	QPSK

Note(s):

1. Circuit Switch (CS) - RMC 12.2kbps with Test loop mode 1 and TPC bits configured to All "1's"- Back of EUT, is worst case and most conservative configuration from Hotspot mode and used for Body-worn Configuration.
2. SAR measurements were performed with the closest edge of the EUT at a separation distance of 15mm from the 'SAM' phantom flat section

7.3.17.Specific Absorption Rate - Wi-Fi 2450 Head Configuration 1g Power Back-Off Disabled Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.106
Maximum Reported Level (W/kg):	0.150

Environmental Conditions:

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

Results:

Scan No.	EUT Position	Channel Number	Meas. Avg. Power (dBm)	Max. Rated Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
85	Touch Left	6	17.4	19.0	0.076	0.110	1	DBPSK
86	Tilt Left	6	17.4	19.0	0.036	0.052	1	DBPSK
87	Touch Right	6	17.4	19.0	0.035	0.051	1	DBPSK
88	Tilt Right	6	17.4	19.0	0.095	0.137	1	DBPSK
89	Touch Left	1	17.5	19.0	0.106	0.150	1	DBPSK
90	Touch Left	11	17.6	19.0	0.053	0.073	1	DBPSK

Note(s):

1. WLAN 802.1b 1Mbps

*KDB 248227 - SAR is not required for 802.11g/n channels when the maximum average output power is lower than that measured on the corresponding 802.11b channels.

7.3.18.Specific Absorption Rate - Wi-Fi 2450 Hotspot Mode Configuration 1g Power Back-Off Disabled

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.456
Maximum Reported Level (W/kg):	0.659

Environmental Conditions:

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

Results:

Scan No.	EUT Position	Channel Number	Meas. Avg. Power (dBm)	Max. Rated Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
91	Front	6	17.4	19.0	0.029	0.042	1	DBPSK
92	Back	6	17.4	19.0	0.456	0.659	1	DBPSK
93	Right Hand Side	6	17.4	19.0	0.059	0.085	1	DBPSK
94	Top	6	17.4	19.0	0.072	0.104	1	DBPSK
95	Back	1	17.5	19.0	0.380	0.537	1	DBPSK
96	Back	11	17.6	19.0	0.279	0.385	1	DBPSK

Note(s):

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

*KDB 248227 - SAR is not required for 802.11g/n channels when the maximum average output power is lower than that measured on the corresponding 802.11b channels.

7.3.19.Specific Absorption Rate - Wi-Fi 2450 Body-Worn Configuration 1g Power Back-Off Disabled Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.122
Maximum Reported Level (W/kg):	0.176

Environmental Conditions:

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

Results:

Scan No.	EUT Position	Channel Number	Meas. Avg. Power (dBm)	Max. Rated Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
97	Back	6	17.4	19.0	0.122	0.176	1, 2	DBPSK

Note(s):

1. WLAN 802.11b 1Mbps – Back of EUT, is worst case and most conservative configuration from Hotspot mode and used for Body-worn Configuration.
2. SAR measurements were performed with the closest edge of the EUT at a separation distance of 15mm from the 'SAM' phantom flat section.

*KDB 248227 - SAR is not required for 802.11g/n channels when the maximum average output power is lower than that measured on the corresponding 802.11b channels.

7.3.20.Specific Absorption Rate - Wi-Fi 802.11a HT20 5GHz Head Configuration 1g Power Back-Off Disabled

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.025
Maximum Reported Level (W/kg):	0.031

Environmental Conditions:

Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	21.4 to 21.4

Results:

Scan No.	EUT Position	Channel Number	Meas. Avg. Power (dBm)	Max. Rated Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
-	Touch Left	36	11.6	12.0	0.000	0.000	1, 2, 4	BPSK
98	Tilt Left	36	11.6	12.0	0.000	0.000	1, 2	BPSK
99	Touch Right	36	11.6	12.0	0.021	0.023	1, 2	BPSK
100	Tilt Right	36	11.6	12.0	0.001	0.001	1, 2, 4	BPSK
101	Touch Right	64	11.1	12.0	0.025	0.031	1, 2, 4	BPSK
-	Touch Right	104	11.4	12.0	0.000	0.000	1, 3	BPSK
102	Touch Right	149	11.4	12.0	0.001	0.001	1, 2	BPSK

Note(s):

1. WLAN 802.11a 6Mbps
2. For frequency bands with an operating range of < 100 MHz, when the reported SAR for the highest output power channel within is ≤ 0.8 W/kg, SAR for the remaining channels is not required. Per KDB 447498, section 4.3.3
3. For frequency bands with an operating range of < 200 MHz, when the reported SAR for the highest output power channel within is ≤ 0.4 W/kg, SAR for the remaining channels is not required. Per KDB 447498, section 4.3.3
4. SAR could not be evaluated as the level measured was below the noise floor and hence no peak was found to perform the zoom scan.

*KDB 248227 - SAR is not required for 802.11n HT20 /HT40 channels as the maximum average output power is less than ¼ dB higher than 802.11a.

7.3.21.Specific Absorption Rate - Wi-Fi 802.11a HT20 5GHz Hotspot Mode Configuration 1g Power Back-Off Disabled Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.178
Maximum Reported Level (W/kg):	0.204

Environmental Conditions:

Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	22.7 to 22.7

Results:

Scan No.	EUT Position	Channel Number	Meas. Avg. Power (dBm)	Max. Rated Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
103	Front	36	11.6	12.0	0.000	0.000	1, 2, 3	BPSK
104	Back	36	11.6	12.0	0.175	0.192	1, 2, 3	BPSK
105	Right Hand Side	36	11.6	12.0	0.005	0.005	1, 2, 3	BPSK
106	Top	36	11.6	12.0	0.020	0.022	1, 2, 3	BPSK
107	Back	64	11.1	12.0	0.063	0.078	1, 2, 3	BPSK
108	Back	104	11.4	12.0	0.067	0.077	1, 2, 4	BPSK
109	Back	149	11.4	12.0	0.178	0.204	1, 2, 3	BPSK

Note(s):

1. WLAN 802.11a 6Mbps
2. EUT supports Hotspot: As per FCC KDB procedure SAR measurements were performed with the EUT at a separation distance of 10mm from the 'SAM' phantom flat section.
3. For frequency bands with an operating range of < 100 MHz, when the reported SAR for the highest output power channel within is ≤ 0.8 W/kg, SAR for the remaining channels is not required. Per KDB 447498, section 4.3.3
4. For frequency bands with an operating range of < 200 MHz, when the reported SAR for the highest output power channel within is ≤ 0.4 W/kg, SAR for the remaining channels is not required. Per KDB 447498, section 4.3.3

*KDB 248227 - SAR is not required for 802.11n HT20 /HT40 channels as the maximum average output power is less than ¼ dB higher than 802.11a.

7.3.22.Specific Absorption Rate - Wi-Fi 802.11a HT20 5GHz Body-Worn Configuration 1g
Power Back-Off Disabled
Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.140
Maximum Reported Level (W/kg):	0.161

Environmental Conditions:

Temperature Variation in Lab (°C):	23.0 to 23.0
Temperature Variation in Liquid (°C):	21.7 to 21.7

Results:

Scan No.	EUT Position	Channel Number	Meas. Avg. Power (dBm)	Max. Rated Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
114	Back	149	11.4	12.0	0.140	0.161	1, 2, 3	BPSK

Note(s):

1. The Worst case configuration of Wi-Fi Hotspot Mode is applied on Body-Worn configuration.
2. WLAN 802.11a 6Mbps
3. EUT Supports Hotspot; SAR measurements were performed with the closest edge of the EUT at a separation distance of 15mm from the 'SAM' phantom flat section.

7.4. Simultaneous Transmission SAR Analysis WWAN + WLAN

Simultaneous transmission analysis of worst cases is shown in the tables below.

Overall Worst Case:

1. WWAN+WLAN
2. WWAN+WPAN

	Reported SAR 1g (W/kg)					
	WWAN			WLAN	WPAN	Maximum Sum of SAR
EUT Position	GSM850	UMTS FDD 5	UMTS FDD 4	Wi-Fi 802.11b 2.4 GHz	Bluetooth 2.4 GHz	
Back	1.121			0.659		1.780
Back		1.015		0.659		1.674
Back			1.214		0.138	1.352

Normal Analysis:

Head Configuration 1g – Worst cases measurements WWAN + WLAN

	Reported SAR 1g (W/kg)						
	WWAN					WLAN	Sum of WWAN & WLAN
EUT Position	GSM 850	PCS 1900	UMTS FDD 2	UMTS FDD 4	UMTS FDD 5	Wi-Fi	
Touch Left	0.355					0.150	0.505
Touch Right	0.316					0.051	0.367
Tilt Left	0.216					0.052	0.268
Tilt Right	0.204					0.137	0.341
Touch Left		0.204				0.150	0.354
Touch Right		0.102				0.051	0.153
Tilt Left		0.025				0.052	0.077
Tilt Right		0.041				0.137	0.178
Touch Left			0.612			0.150	0.762
Touch Right			0.297			0.051	0.348
Tilt Left			0.074			0.052	0.126
Tilt Right			0.109			0.137	0.246
Touch Left				0.724		0.150	0.874
Touch Right				0.299		0.051	0.350
Tilt Left				0.156		0.052	0.208
Tilt Right				0.133		0.137	0.270
Touch Left					0.602	0.150	0.752
Touch Right					0.490	0.051	0.541
Tilt Left					0.331	0.052	0.383
Tilt Right					0.334	0.137	0.471

Simultaneous Transmission SAR Analysis (Continued)

Hotspot Mode Configuration 1g – Worst cases measurements WWAN+WLAN

	Reported SAR 1g (W/kg)				
	WWAN			WLAN	Sum of WWAN & WLAN
EUT Position	GSM850	PCS1900	UMTS FDD 2	Wi-Fi	
Front	0.649			0.042	0.691
Back	**1.121**			**0.659**	**1.780**
Left Hand Side	0.645				0.645
Right Hand Side	0.611			0.085	0.696
Bottom	0.167				0.167
Top				0.104	0.104
Front		0.763		0.042	0.805
Back		0.726		0.659	1.385
Left Hand Side		0.122			0.122
Right Hand Side		0.058		0.085	0.143
Bottom		0.975			0.975
Top				0.104	0.104
Front			0.708	0.042	0.750
Back			0.677	0.659	1.336
Left Hand Side			0.108		0.108
Right Hand Side			0.065	0.085	0.150
Bottom			0.915		0.915
Top				0.104	0.104

	Reported SAR 1g (W/kg)			
	WWAN		WLAN	Sum of WWAN & WLAN
EUT Position	UMTS FDD 4	UMTS FDD 5	Wi-Fi	
Front	0.689		0.042	0.731
Back	0.708		0.659	1.367
Left Hand Side	0.130			0.130
Right Hand Side	0.031		0.085	0.116
Bottom	0.934			0.934
Top			0.104	0.104
Front		0.690	0.042	0.732
Back		**1.015**	**0.659**	**1.674**
Left Hand Side		0.681		0.681
Right Hand Side		0.643	0.085	0.728
Bottom		0.154		0.154
Top			0.104	0.104

Simultaneous Transmission SAR Analysis (Continued)
Body-Worn Configuration 1g – Worst cases measurements WWAN + WLAN

	Reported SAR 1g (W/kg)				
	WWAN			WLAN	Sum of WWAN & WLAN
EUT Position	GSM850	PCS1900	UMTS FDD 2	Wi-Fi	
Front					
Back	0.727			0.176	0.903
Front With PHF					
Back with PHF					
Front		0.488			
Back				0.176	
Front With PHF					
Back with PHF					
Front			0.872		
Back				0.176	
Front With PHF					
Back with PHF					

Body-Worn Configuration 1g (Continued): – Worst cases measurements

	Reported SAR 1g (W/kg)			
	WWAN		WLAN	Sum of WWAN & WLAN
EUT Position	UMTS FDD 4	UMTS FDD 5	Wi-Fi	
Front				
Back	1.214		0.176	1.390
Front With PHF				
Back with PHF	0.995			
Front				
Back		0.938	0.176	1.114
Front With PHF				
Back with PHF				

Note(s):

1. SPLSR calculations for values exceeding 1.6 W/kg were done and conclusion was drawn that simultaneous transmission was not required as SPLSR level was below the threshold. (See section 2.2 of this report)
2. For Bluetooth, SAR results are provided in the following table below. The separation distance of 10mm was used for hotspot mode and 15mm for body-worn configuration.
3. Since 2.4 GHz WLAN 1g SAR measurements for head and body were higher than 5GHz WLAN 1g SAR measurements, 2.4 GHz WLAN is considered as worst case for the Simultaneous transmission worst case measurements in above tables

***All WWAN and WLAN 1g SAR values used for Simultaneous Transmission SAR analysis are Reported SAR values**

7.5. Simultaneous Transmission SAR Analysis WWAN+WPAN

Hotspot Mode Configuration 1g – Worst cases measurements WWAN+WPAN

	Reported SAR 1g (W/kg)				
	WWAN			WPAN	Sum of WWAN & WPAN
EUT Position	GSM850	PCS1900	UMTS FDD 2	*Bluetooth*	
Front	0.649			0.207	0.856
Back	1.121			0.207	1.328
Left Hand Side	0.645			0.207	0.852
Right Hand Side	0.611			0.207	0.818
Bottom	0.167				0.167
Top				0.207	0.207
Front		0.763		0.207	0.970
Back		0.726		0.207	0.933
Left Hand Side		0.122		0.207	0.329
Right Hand Side		0.058		0.207	0.265
Bottom		0.975			0.975
Top				0.207	0.207
Front			0.708	0.207	0.915
Back			0.677	0.207	0.884
Left Hand Side			0.108	0.207	0.315
Right Hand Side			0.065	0.207	0.272
Bottom			0.915		0.915
Top				0.207	0.207

Hotspot Mode Configuration 1g (Continued): – Worst cases measurements WWAN+WPAN

	Reported SAR 1g (W/kg)			
	WWAN		WPAN	Sum of WWAN & WPAN
EUT Position	UMTS FDD 4	UMTS FDD 5	*Bluetooth*	
Front	0.689		0.207	0.896
Back	0.708		0.207	0.915
Left Hand Side	0.130		0.207	0.337
Right Hand Side	0.031		0.207	0.238
Bottom	0.934			0.934
Top			0.207	0.207
Front		0.690	0.207	0.897
Back		1.015	0.207	1.222
Left Hand Side		0.681	0.207	0.888
Right Hand Side		0.643	0.207	0.850
Bottom		0.154		0.154
Top			0.207	0.207

Simultaneous Transmission SAR Analysis WWAN+WPAN (Continued)

Body-Worn Configuration 1g – Worst cases measurements WWAN + WPAN

	Reported SAR 1g (W/kg)				
	WWAN			WPAN	Sum of WWAN & WPAN
EUT Position	GSM850	PCS1900	UMTS FDD 2	*Bluetooth*	
Front					
Back	0.727			0.138	0.865
Front With PHF					
Back with PHF					
Front		0.488		0.138	0.626
Back					
Front With PHF					
Back with PHF					
Front			0.872	0.138	1.010
Back					
Front With PHF					
Back with PHF					

Body-Worn Configuration 1g (Continued): – Worst cases measurements

	Reported SAR 1g (W/kg)			
	WWAN		WPAN	Sum of WWAN & WPAN
EUT Position	UMTS FDD 4	UMTS FDD 5	*Bluetooth*	
Front				
Back	**1.214**		**0.138**	**1.352**
Front With PHF				
Back with PHF	0.995		0.138	1.133
Front				
Back		0.938	0.138	1.076
Front With PHF				
Back with PHF				

Note(s):

1. The sum of WWAN and WLAN did not exceed 1.6W/kg in any of the above cases and hence, the SAR to peak location separation ratio distance was not calculated.
2. Bluetooth SAR result is calculated as per the formula below following FCC KDB publication 447498.
3. Separation distance of 10mm was used for hotspot mode and 15mm for body-worn configuration.

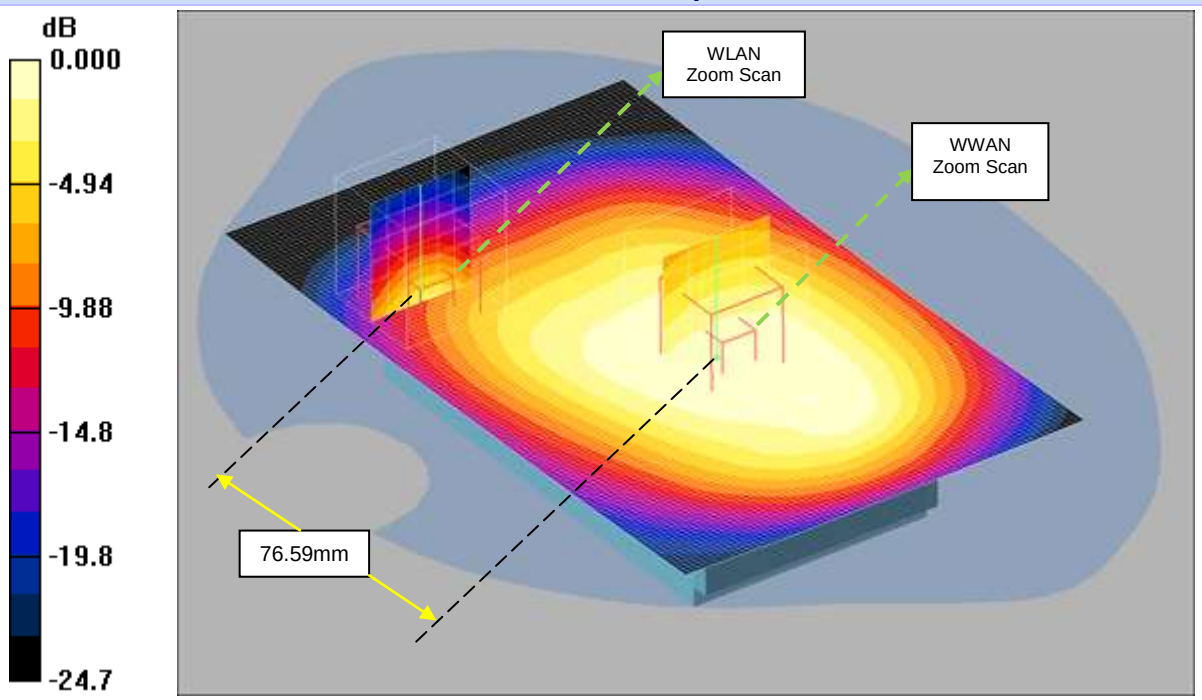
When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

- *(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)/x]* W/kg for *test separation distances* ≤ 50 mm;
  where $x = 7.5$ for 1-g SAR, and $x = 18.75$ for 10-g SAR.
  - **10mm Bluetooth estimated SAR level:**
    Estimated *Bluetooth* SAR = (10mW/10mm)*(√2.4 / 7.5) = 0.207 W/kg
  - **15mm Bluetooth estimated SAR level:**
    Estimated *Bluetooth* SAR = (10mW/15mm)*(√2.4 / 7.5) = 0.138 W/kg

***All WWAN and WLAN 1g SAR values used for Simultaneous Transmission SAR analysis are Reported SAR values**

7.6. SAR to peak location separation ratio distance (SPLSR) plots calculations

Back GPRS850 CH128 + Back WLAN 802.11b 6Mbps CH6 SPLSR



0 dB = 1.00mW/g

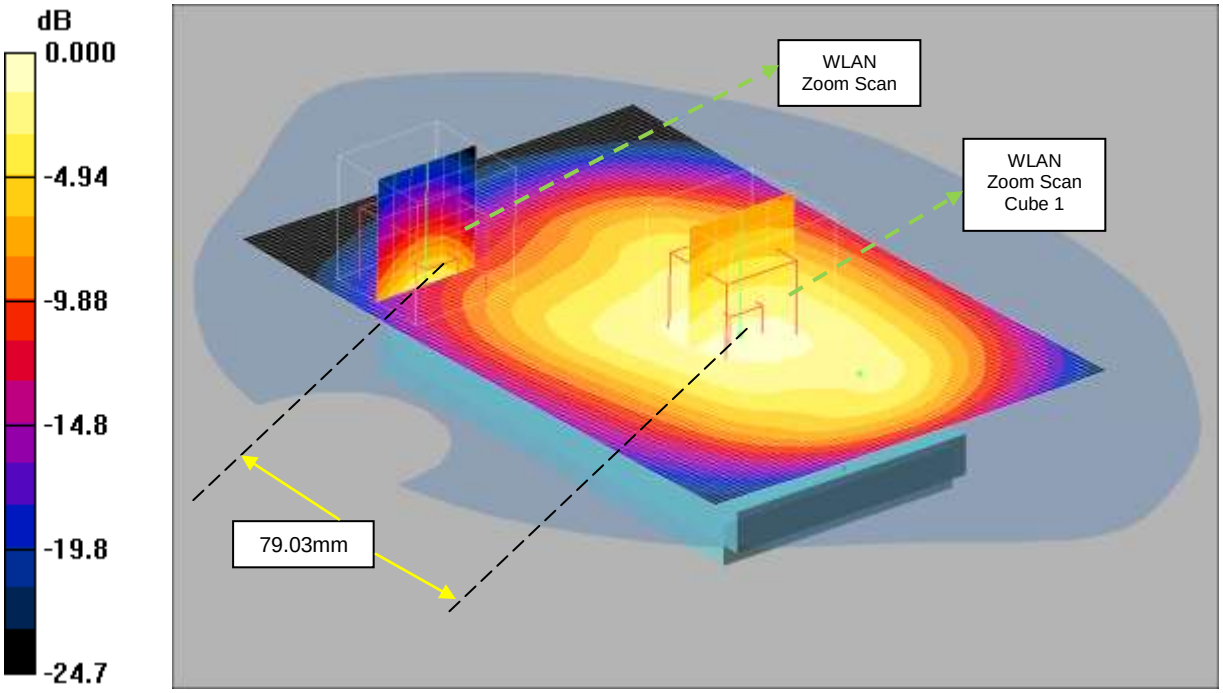
SPLSR Calculation:

WWAN (GPRS850 CH128) Peak Co-ordinates			WLAN (802.11b CH6) Peak Co-ordinates		
X_1	Y_1	Z_1	X_2	Y_2	Z_2
(m)	(m)	(m)	(m)	(m)	(m)
-0.0229	0.0155	-0.205	0.0224	-0.0456	-0.196

x=(X2- X1)^2	y=(Y2- Y1)^2	z=(Z2- Z1)^2	Square Root of Sum of x, y, z (mm), R_i
0.0021	0.0037	0.0001	76.59

SPLSR =	**$(SAR1 + SAR2)^{1.5} / R_i$**
	$(1.121+0.659)^{1.5}/76.59 = 0.031 < 0.04$
	As per KDB 447498 D01, Simultaneous Transmission not Required.

Back FDD 5 (Cube 1) CH4183 + Back WLAN 802.11b 6Mbps CH6 SPLSR



0 dB = 1.00mW/g

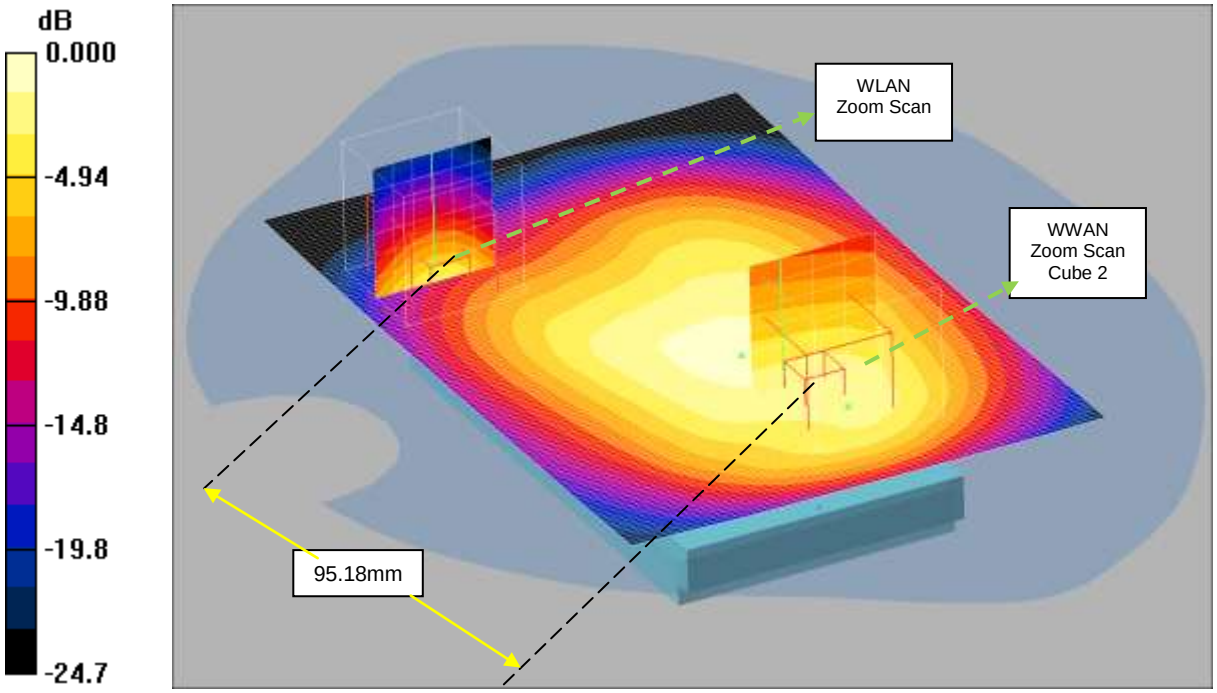
SPLSR Calculation:

WWAN (FDD 5 CH4183 Cube 1) Peak Co-ordinates			WLAN (802.11b CH6) Peak Co-ordinates		
X_1	Y_1	Z_1	X_2	Y_2	Z_2
(m)	(m)	(m)	(m)	(m)	(m)
-0.0215	0.0195	-0.205	0.0224	-0.0456	-0.196

x=(X2- X1)^2	y=(Y2- Y1)^2	z=(Z2- Z1)^2	Square Root of Sum of x, y, z (mm), R_i
0.0019	0.0042	0.0001	79.03

SPLSR =	**$(SAR1 + SAR2)^{1.5} / R_i$**
	$(1.015+0.659)^{1.5}/79.03 = 0.027 < 0.04$
	As per KDB 447498 D01, Simultaneous Transmission not Required.

Back FDD 5 (Cube 2) CH4183 + Back WLAN 802.11b 6Mbps CH6 SPLSR



0 dB = 1.00mW/g

SPLSR Calculation:

WWAN (FDD 5 CH4183 Cube 2) Peak Co-ordinates			WLAN (802.11b CH6) Peak Co-ordinates		
X_1	Y_1	Z_1	X_2	Y_2	Z_2
(m)	(m)	(m)	(m)	(m)	(m)
-0.0224	0.038	-0.204	0.0224	-0.0456	-0.196

x=(X2- X1)^2	y=(Y2- Y1)^2	z=(Z2- Z1)^2	Square Root of Sum of x, y, z (mm), R_i
0.0020	0.0070	0.0001	95.18

SPLSR =	**$(SAR1 + SAR2)^{1.5} / R_i$**
	$(0.774+0.659)^{1.5} / = 0.018 < 0.04$
	As per KDB 447498 D01, Simultaneous Transmission not Required.

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 5 Head Configuration 10g	95%	±18.53%
Specific Absorption Rate-GSM / GPRS 850/ UMTS FDD 5 Body Configuration 10g	95%	±18.53%
Specific Absorption Rate-DCS 1800/ UMTS FDD 4 Head Configuration 10g	95%	±18.49%
Specific Absorption Rate-DCS / GPRS 1800/ UMTS FDD 4 Body Configuration 10g	95%	±18.27%
Specific Absorption Rate-PCS 1900/ UMTS FDD 2 Head Configuration 10g	95%	±19.01%
Specific Absorption Rate-PCS / GPRS1900/ UMTS FDD 2 Body Configuration 10g	95%	±18.38%
Specific Absorption Rate-Wi-Fi 2450 MHz Head Configuration 10g	95%	±18.66%
Specific Absorption Rate-Wi-Fi 2450 MHz Body Configuration 10g	95%	±18.92%
Specific Absorption Rate-Wi-Fi 5GHz Head Configuration 10g	95%	±20.14%
Specific Absorption Rate-Wi-Fi 5GHz Body Configuration 10g	95%	±20.14%

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-GSM 850/ UMTS FDD 5 Head Configuration 10g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (10g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration / Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	1.700	1.700	normal (k=1)	1.0000	1.0000	1.700	1.700	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	0.4300	1.241	1.241	∞
A	Liquid Conductivity (measured value)	4.920	4.920	normal (k=1)	1.0000	0.4300	2.116	2.116	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.4900	1.415	1.415	∞
A	Liquid Permittivity (measured value)	4.970	4.970	normal (k=1)	1.0000	0.4900	2.435	2.435	5
	Combined standard uncertainty			t-distribution			9.45	9.45	>500
	Expanded uncertainty			k = 1.96			18.53	18.53	>500

8.2. Specific Absorption Rate-GSM / GPRS 850/ UMTS FDD 5 Body Configuration 10g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (10g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration /Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	1.900	1.900	normal (k=1)	1.0000	1.0000	1.900	1.900	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	0.4300	1.241	1.241	∞
A	Liquid Conductivity (measured value)	4.690	4.690	normal (k=1)	1.0000	0.4300	2.017	2.017	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.4900	1.415	1.415	∞
A	Liquid Permittivity (measured value)	4.860	4.860	normal (k=1)	1.0000	0.4900	2.381	2.381	5
	Combined standard uncertainty			t-distribution			9.46	9.46	>500
	Expanded uncertainty			k = 1.96			18.53	18.53	>500

8.3. Specific Absorption Rate-DCS 1800/ UMTS FDD 4 Head Configuration 10g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (10g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration/ Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	1.700	1.700	normal (k=1)	1.0000	1.0000	1.700	1.700	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	0.4300	1.241	1.241	∞
A	Liquid Conductivity (measured value)	4.980	4.980	normal (k=1)	1.0000	0.4300	2.141	2.141	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.4900	1.415	1.415	∞
A	Liquid Permittivity (measured value)	4.770	4.770	normal (k=1)	1.0000	0.4900	2.337	2.337	5
	Combined standard uncertainty			t-distribution			9.43	9.43	>500
	Expanded uncertainty			k = 1.96			18.49	18.49	>500

8.4. Specific Absorption Rate-DCS / GPRS 1800/ UMTS FDD 4 Body Configuration 10g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (10g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration/ Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	1.000	1.000	normal (k=1)	1.0000	1.0000	1.000	1.000	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	0.4300	1.241	1.241	∞
A	Liquid Conductivity (measured value)	4.990	4.990	normal (k=1)	1.0000	0.4300	2.146	2.146	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.4900	1.415	1.415	∞
A	Liquid Permittivity (measured value)	4.660	4.660	normal (k=1)	1.0000	0.4900	2.283	2.283	5
	Combined standard uncertainty			t-distribution			9.32	9.32	>500
	Expanded uncertainty			k = 1.96			18.27	18.27	>500

8.5. Specific Absorption Rate-PCS 1900/ UMTS FDD 2 Head Configuration 10g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (10g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with Regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration / Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	2.800	2.800	normal (k=1)	1.0000	1.0000	2.800	2.800	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	0.4300	1.241	1.241	∞
A	Liquid Conductivity (measured value)	4.900	4.900	normal (k=1)	1.0000	0.4300	2.107	2.107	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.4900	1.415	1.415	∞
A	Liquid Permittivity (measured value)	4.880	4.880	normal (k=1)	1.0000	0.4900	2.391	2.391	5
	Combined standard uncertainty			t-distribution			9.70	9.70	>500
	Expanded uncertainty			k = 1.96			19.01	19.01	>500

8.6. Specific Absorption Rate-PCS / GPRS1900/ UMTS FDD 2 Body Configuration 10g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (10g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration / Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	1.200	1.200	normal (k=1)	1.0000	1.0000	1.200	1.200	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	0.4300	1.241	1.241	∞
A	Liquid Conductivity (measured value)	4.940	4.940	normal (k=1)	1.0000	0.4300	2.124	2.124	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.4900	1.415	1.415	∞
A	Liquid Permittivity (measured value)	4.980	4.980	normal (k=1)	1.0000	0.4900	2.440	2.440	5
	Combined standard uncertainty			t-distribution			9.38	9.38	>500
	Expanded uncertainty			k = 1.96			18.38	18.38	>500

8.7. Specific Absorption Rate-Wi-Fi 2450 Head Configuration 10g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (10g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration/ Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	2.470	2.470	normal (k=1)	1.0000	1.0000	2.470	2.470	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	0.4300	1.241	1.241	∞
A	Liquid Conductivity (measured value)	4.410	4.410	normal (k=1)	1.0000	0.4300	1.896	1.896	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.4900	1.415	1.415	∞
A	Liquid Permittivity (measured value)	4.930	4.930	normal (k=1)	1.0000	0.4900	2.416	2.416	5
	Combined standard uncertainty			t-distribution			9.52	9.52	>500
	Expanded uncertainty			k = 1.96			18.66	18.66	>500

8.8. Specific Absorption Rate-Wi-Fi 2450 Body Configuration 10g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (10g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration/ Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	2.810	2.810	normal (k=1)	1.0000	1.0000	2.810	2.810	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	0.4300	1.241	1.241	∞
A	Liquid Conductivity (measured value)	4.900	4.900	normal (k=1)	1.0000	0.4300	2.107	2.107	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.4900	1.415	1.415	∞
A	Liquid Permittivity (measured value)	4.920	4.920	normal (k=1)	1.0000	0.4900	2.411	2.411	5
	Combined standard uncertainty			t-distribution			9.65	9.65	>500
	Expanded uncertainty			k = 1.96			18.92	18.92	>500

8.9. Specific Absorption Rate-Wi-Fi 5GHz Configuration 10g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (1g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.550	6.550	normal (k=1)	1.0000	1.0000	6.550	6.550	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration / Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	2.540	2.540	normal (k=1)	1.0000	1.0000	2.540	2.540	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)	3.830	3.830	normal (k=1)	1.0000	0.6000	2.298	2.298	5
	Combined standard uncertainty			t-distribution			10.28	10.28	>400
	Expanded uncertainty			k = 1.96			20.14	20.14	>400

8.10. Specific Absorption Rate-Wi-Fi 5GHz Body Configuration 10g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (1g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.550	6.550	normal (k=1)	1.0000	1.0000	6.550	6.550	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration / Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	2.540	2.540	normal (k=1)	1.0000	1.0000	2.540	2.540	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)	3.830	3.830	normal (k=1)	1.0000	0.6000	2.298	2.298	5
	Combined standard uncertainty			t-distribution			10.28	10.28	>400
	Expanded uncertainty			k = 1.96			20.14	20.14	>400

Appendix 1. Test Equipment Used

UL 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	-
A1184	Data Acquisition Electronics	Schmid & Partner Engineering AG	DAE3	394	26 Jan 2012	12
A2111	Data Acquisition Electronics	Schmid & Partner Engineering AG	DAE3	432	02 May 2012	12
A2110	Data Acquisition Electronics	Schmid & Partner Engineering AG	DAE3	431	20 Sept 2012	12
A1234	Data Acquisition Electronics	Schmid & Partner Engineering AG	DAE3	450	22 Jan 2013	12
A2077	Probe	Schmid & Partner Engineering AG	EX3 DV4	3814	24 Sep 2012	12
A2113	Probe	Schmid & Partner Engineering AG	ET3 DV6	1587	11 May 2012	12
A1185	Probe	Schmid & Partner Engineering AG	ET3 DV6	1528	26 Jul 2012	12
A2243	Probe	Schmid & Partner Engineering AG	ES3DV3	3304	31 Aug 2012	12
L1090	Probe	Schmid & Partner Engineering AG	EX3DV4	3871	20 Aug 2012	12
A2201	900 MHz Dipole Kit	Schmid & Partner Engineering AG	D900V2	035	16 Aug 2012	12
A1190	1800 MHz Dipole Kit	Schmid & Partner Engineering AG	D1800V2	264	15 Aug 2012	12
A1237	1900 MHz Dipole Kit	Schmid & Partner Engineering AG	D1900V2	540	08 Feb 2011	24
A2202	2440 MHz Dipole Kit	Schmid & Partner Engineering AG	D2440V2	701	13 Aug 2012	12

UL No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
A1377	5.0 GHz Dipole Kit	Schmid & Partner Engineering AG	D5GHzV2	1016	20 Feb 2013	12
A1497	Amplifier	Mini-Circuits	zhl-42w (sma)	e020105	Calibrated as part of system	-
A1566	SAM Phantom	Schmid & Partner Engineering AG	SAM a (Site 56)	002	Calibrated before use	-
A1238	SAM Phantom	Schmid & Partner Engineering AG	SAM b (Site 56)	001	Calibrated before use	-
A2125	SAM Phantom	Schmid & Partner Engineering AG	SAM b (Site 57)	TP-1031	Calibrated before use	-
A2124	SAM Phantom	Schmid & Partner Engineering AG	SAM a (Site 57)	TP-1030	Calibrated before use	-
A2252	2mm Oval Phantom	Schmid & Partner Engineering AG	Eli5	1177	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	-	-
A215	20 dB Attenuator	Narda	766-20	9402	Calibrated as part of system	-
A1531	Antenna	AARONIA AG	7025	02458	-	-
A2263	Digital Camera	Samsung	PL211	9453C90B 607487L	-	-
M1015	Network Analyser	Agilent Technologies	8753ES	US39172406	09 Oct 2012	12
C1145	Cable	Rosenberger MICRO-COAX	FA147A F003003030	41843-1	Calibrated as part of system	-
C1146	Cable	Rosenberger MICRO-COAX	FA147A F030003030	41752-1	Calibrated as part of system	-
G0528	Robot Power Supply	Schmid & Partner Engineering AG	DASY4	None	Calibrated before use	-
GO591	Robot Power Supply	Schmid & Partner Engineering AG	DASY4	None	Calibrated before use	-
G0592	Robot Power Supply	Schmid & Partner Engineering AG	DASY53	None	Calibrated before use	-
G087	PSU	Thurlby Thandar	CPX200	100701	Calibrated before use	-
M1047	Robot Arm	Staubli	RX908 L	F00/SD8 9A1/A/01	Calibrated before use	-
M1653	Robot Arm	Staubli	RX908 L	F01/5J8 6A1/C/01	Calibrated before use	-
M1680	Robot Arm	Staubli	TX60 L	F12/5MZ7 A1/A/01	Calibrated before use	-

UL No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
M1159	Signal Generator	Agilent Technologies	E8241A	US42110332	Internal Checked 10 Dec 2012	4
M1647	Signal Generator	Hewlett Packward	8648C	3537A01598	01 Jun 2012	12
M1071	Spectrum Analyzer	Agilent	HP8590E	3647U00514	(Monitoring use only)	-
M1270	Digital Thermometer	RS	N/A	N/A	Internal Checked 13 May 2012	12
M1023	Dual Channel Power Meter	R & S	NRVD	863715/030	18 July 2012	12
S256	SAR Lab	UL	Site 56	N/A	Calibrated before use	-
S512	SAR Lab	UL	Site 57	N/A	Calibrated before use	-
S513	SAR Lab	UL	Site 58	N/A	Calibrated before use	-

Note:

All the assets were in calibration during the course of testing.

A.1.1. Calibration Certificates

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

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

Cal Date	Dipole Calibration History									
	Dipole SN: 540, Frequency 1900 MHz									
	Head Parameters					Body Parameters				
	1g (W/Kg)	10g (W/Kg)	Return loss (dB)	Real (Ω)	Imaginary (Ω)	1g (W/Kg)	10g (W/Kg)	Return loss (dB)	Real (Ω)	Imaginary (Ω)
27-Jun-12	Lab Annual Check of dipole		-30.57	49.54	1.41	Lab Annual Check of dipole		-29.80	50.34	2.37
08-Feb-11	40.30	21.00	-27.60	50.50	4.20	40.70	21.60	-23.10	45.60	5.00
26-Jun-09	40.30	21.10	-30.00	48.50	2.70	40.90	21.50	-24.30	44.90	2.80
11-Jun-07	36.10	19.30	-25.40	51.90	5.10	38.00	20.70	-25.30	47.70	4.80
14-Jun-05	38.1	19.90	-25.40	51.90	5.20	39.10	20.70	-24.00	48.10	5.90
04-Jun-03	41.20	21.20	-28.50	50.30	3.80	Dipole calibrated for Head only				
Standard Deviation	**2.08**	**0.85**	**2.21**	**1.33**	**1.46**	**1.38**	**0.49**	**2.64**	**2.16**	**1.52**
|Mean Value|	**39.20**	**20.50**	**27.91**			**39.68**	**21.13**	**25.30**		
Relative standard deviation %	**5.30%**	**4.15%**	**7.93%**			**3.47%**	**2.33%**	**10.42%**		

Note:

1. The dipole history shows that the measured SAR relative standard deviation was all less than 10% for the calibration period. The return loss relative standard deviation was all less than 10.42 %. And the real and imaginary impedance standard deviation is within 5 **(Ω).**

Checked by [illegible] DATE: 26-SEPT-2012

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

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

Client RFI **Certificate No: EX3-3814_Sep12**

CALIBRATION CERTIFICATE

Object EX3DV4 - SN:3814

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

Calibration date: September 24, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: September 24, 2012

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

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Swiss Calibration Service

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

Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe EX3DV4

SN:3814

Manufactured: September 2, 2011
Calibrated: September 24, 2012

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

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.53	0.50	0.44	± 10.1 %
DCP (mV)[B]	99.9	93.7	98.7	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
0	CW	0.00	X	0.00	0.00	1.00	172.6	±3.0 %
			Y	0.00	0.00	1.00	154.1	
			Z	0.00	0.00	1.00	144.1	

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

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

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
1450	40.5	1.20	8.56	8.56	8.56	0.19	2.04	± 12.0 %
2450	39.2	1.80	6.89	6.89	6.89	0.33	0.97	± 12.0 %
2600	39.0	1.96	6.81	6.81	6.81	0.34	1.00	± 12.0 %
5200	36.0	4.66	5.06	5.06	5.06	0.42	1.80	± 13.1 %
5300	35.9	4.76	4.73	4.73	4.73	0.42	1.80	± 13.1 %
5500	35.6	4.96	4.54	4.54	4.54	0.45	1.80	± 13.1 %
5600	35.5	5.07	4.26	4.26	4.26	0.50	1.80	± 13.1 %
5800	35.3	5.27	4.50	4.50	4.50	0.45	1.80	± 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.

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

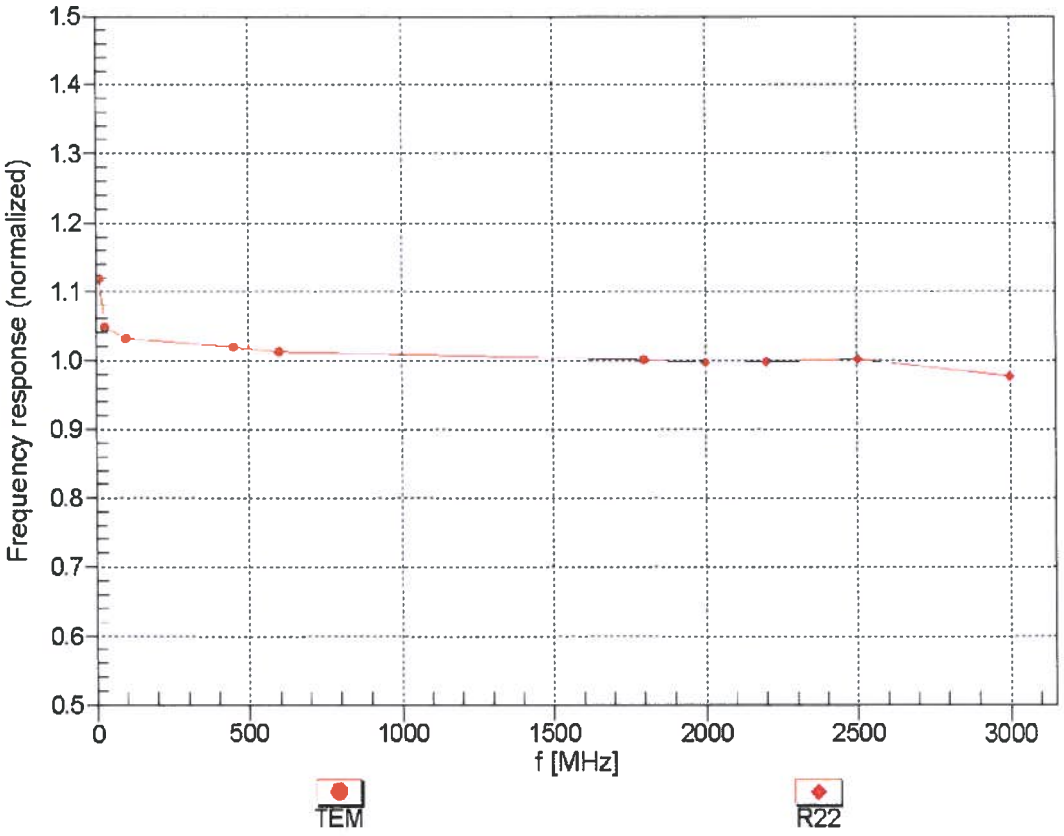
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
1450	54.0	1.30	8.26	8.26	8.26	0.23	1.40	± 12.0 %
2450	52.7	1.95	7.41	7.41	7.41	0.80	0.66	± 12.0 %
2600	52.5	2.16	7.08	7.08	7.08	0.79	0.61	± 12.0 %
3700	51.0	3.55	6.27	6.27	6.27	0.22	2.24	± 13.1 %
5200	49.0	5.30	4.39	4.39	4.39	0.52	1.90	± 13.1 %
5300	48.9	5.42	4.11	4.11	4.11	0.55	1.90	± 13.1 %
5500	48.6	5.65	4.02	4.02	4.02	0.52	1.90	± 13.1 %
5600	48.5	5.77	3.71	3.71	3.71	0.60	1.90	± 13.1 %
5800	48.2	6.00	3.97	3.97	3.97	0.60	1.90	± 13.1 %

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

Frequency Response of E-Field

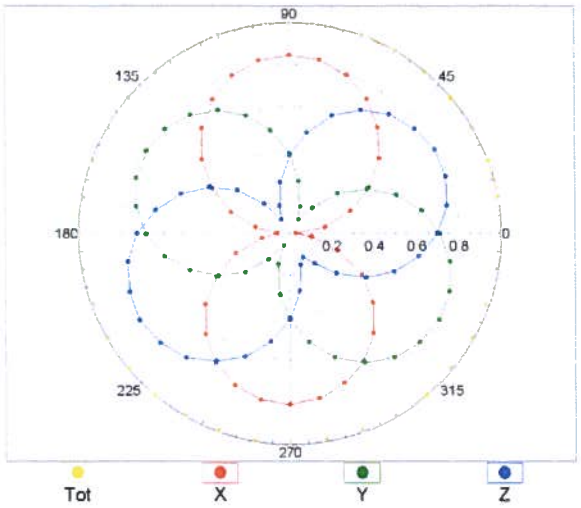
(TEM-Cell:ifi110 EXX, Waveguide: R22)



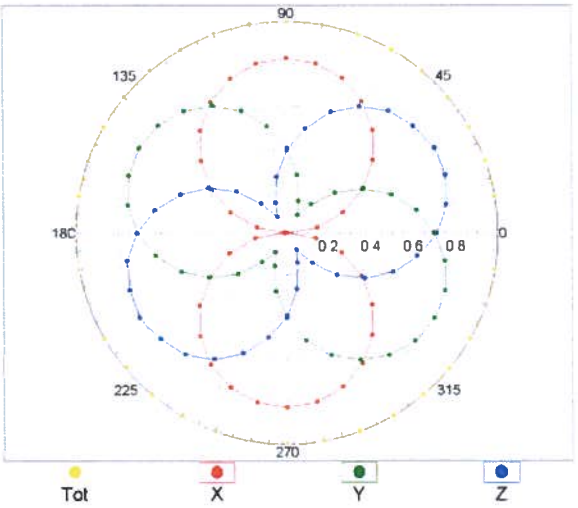
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

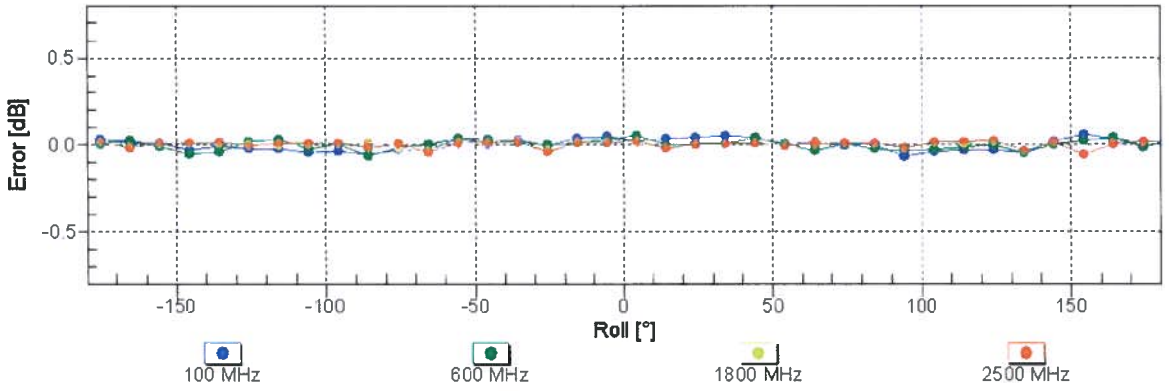
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



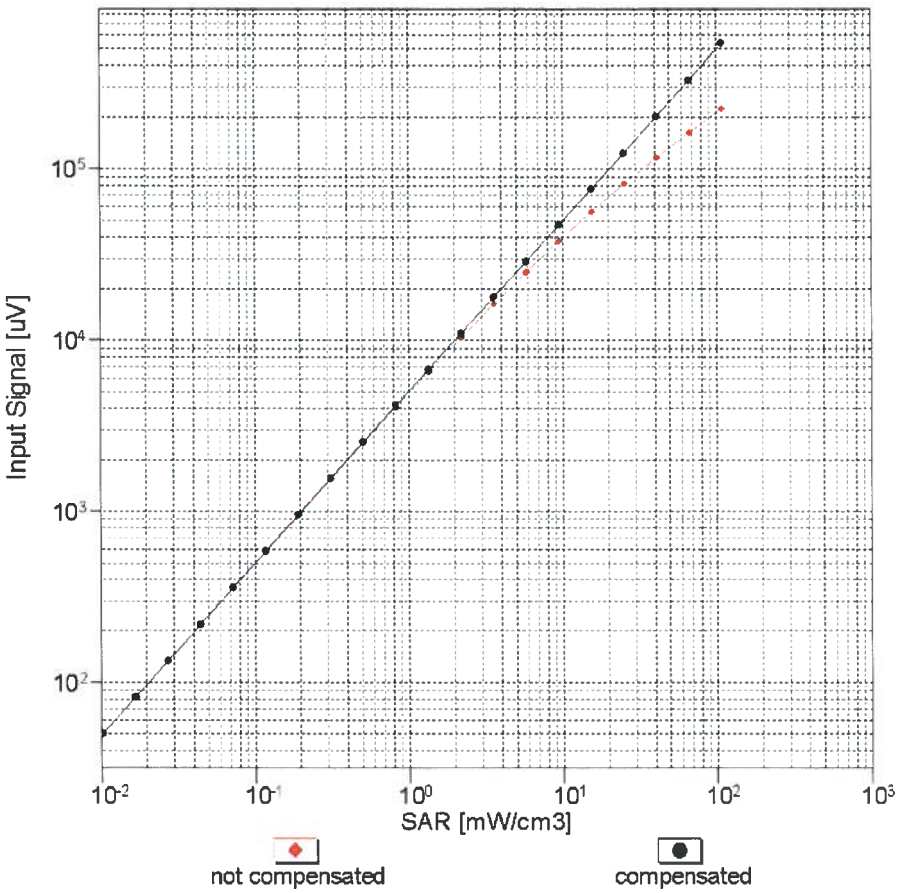
f=1800 MHz,R22

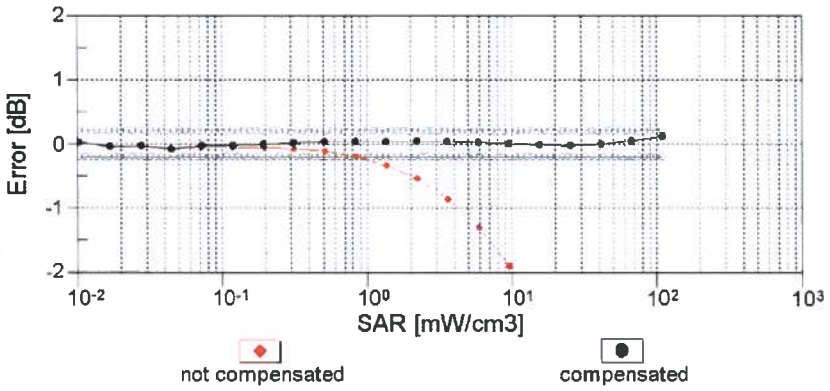




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

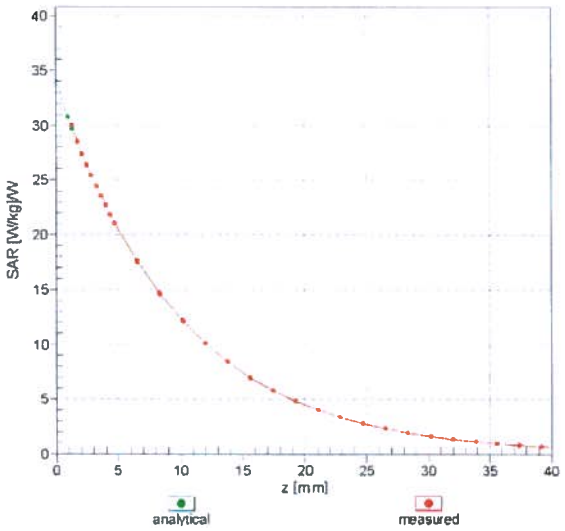




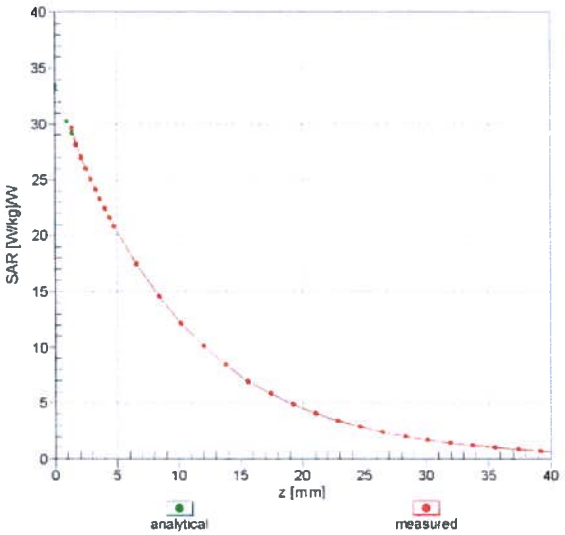
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 2450 MHz,WGLS R22 (H_convF)

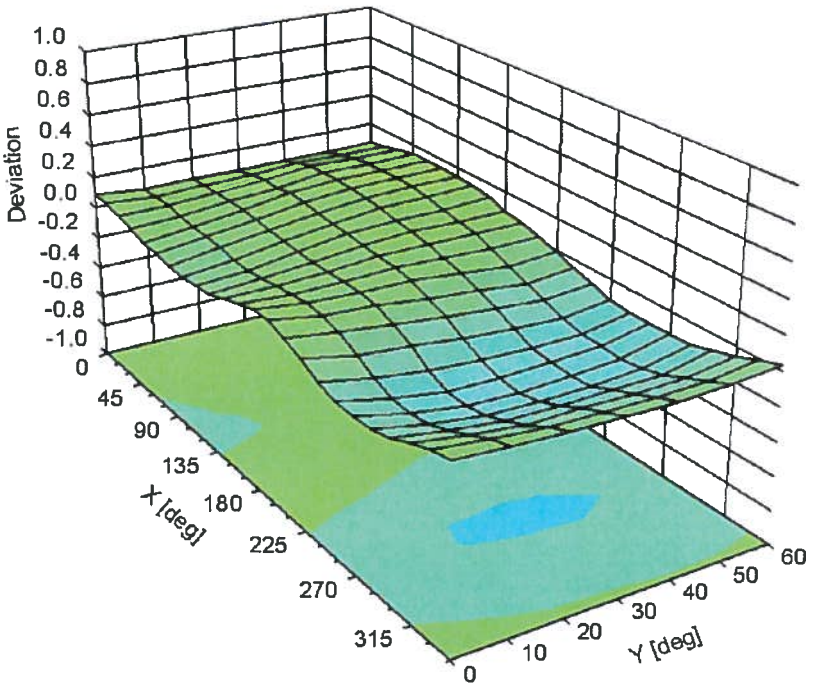


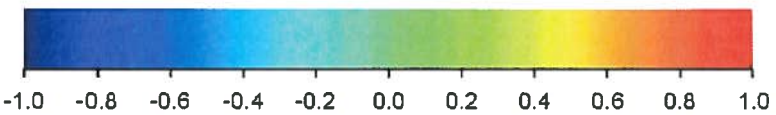
f = 2450 MHz,WGLS R22 (M_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





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

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-65.7
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	2 mm

Checked by [illegible] 17-May-2012

Calibration Laboratory of
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Accreditation No.: SCS 108

Asset A2113

Client RFI

Certificate No: ET3-1587_May12

CALIBRATION CERTIFICATE

Object: ET3DV6 - SN:1587

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

Calibration date: May 11, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: May 11, 2012

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

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ET3DV6

SN:1587

Manufactured: May 7, 2001
Calibrated: May 11, 2012

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

DASY/EASY - Parameters of Probe: ET3DV6 - SN:1587

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	2.14	1.92	1.79	± 10.1 %
DCP (mV)[B]	99.0	97.5	99.1	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
0	CW	0.00	X	0.00	0.00	1.00	119.0	±2.7 %
			Y	0.00	0.00	1.00	114.6	
			Z	0.00	0.00	1.00	111.6	

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:1587

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	6.33	6.33	6.33	0.24	3.00	± 12.0 %
900	41.5	0.97	6.18	6.18	6.18	0.28	3.00	± 12.0 %
1750	40.1	1.37	5.47	5.47	5.47	0.58	2.35	± 12.0 %
1900	40.0	1.40	5.18	5.18	5.18	0.80	1.68	± 12.0 %
2450	39.2	1.80	4.52	4.52	4.52	0.80	1.95	± 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.

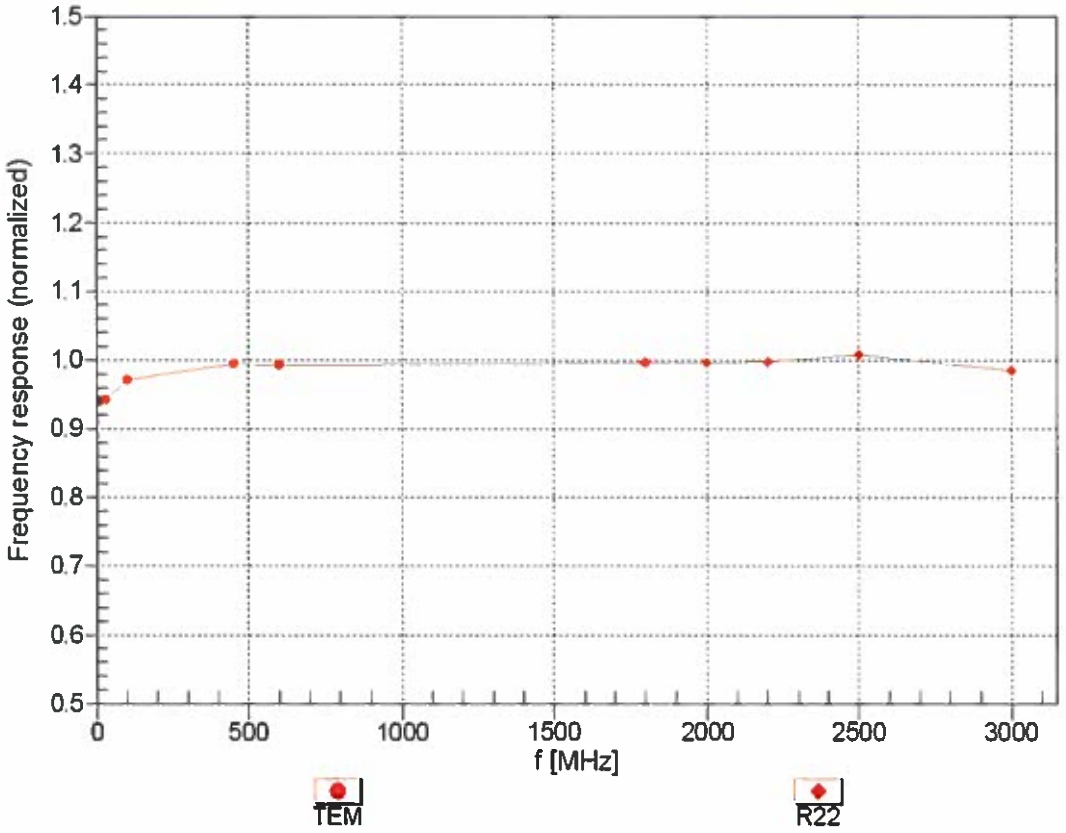
DASY/EASY - Parameters of Probe: ET3DV6 - SN:1587

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	6.28	6.28	6.28	0.30	3.00	± 12.0 %
900	55.0	1.05	6.26	6.26	6.26	0.37	2.56	± 12.0 %
1750	53.4	1.49	4.92	4.92	4.92	0.74	2.18	± 12.0 %
1900	53.3	1.52	4.69	4.69	4.69	0.77	2.38	± 12.0 %
2450	52.7	1.95	4.13	4.13	4.13	0.80	2.02	± 12.0 %

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

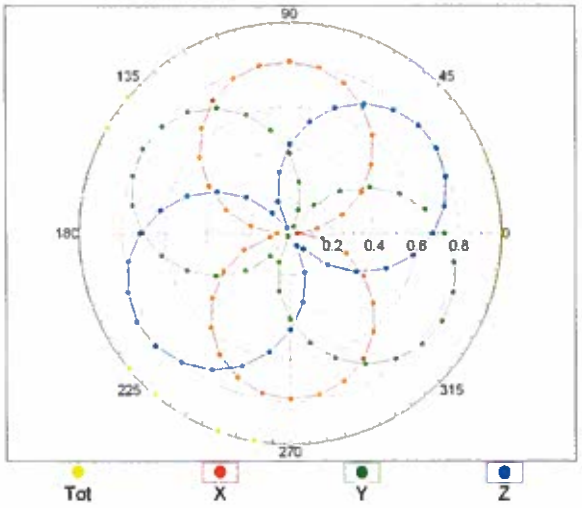
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



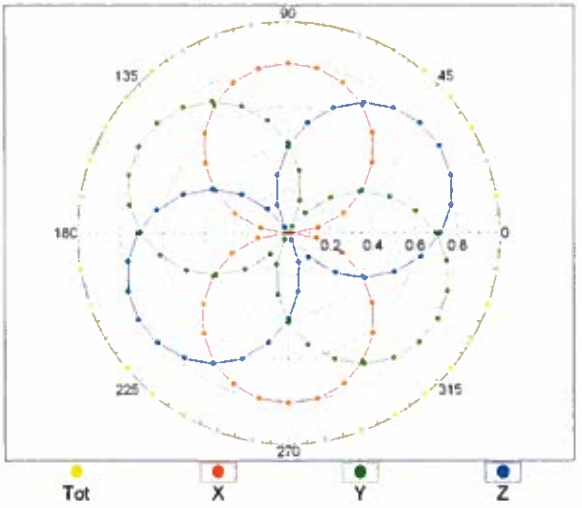
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

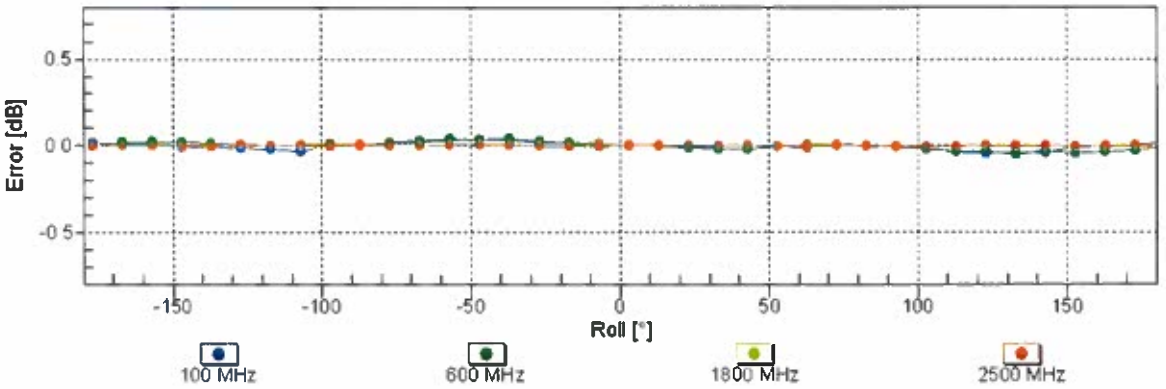
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



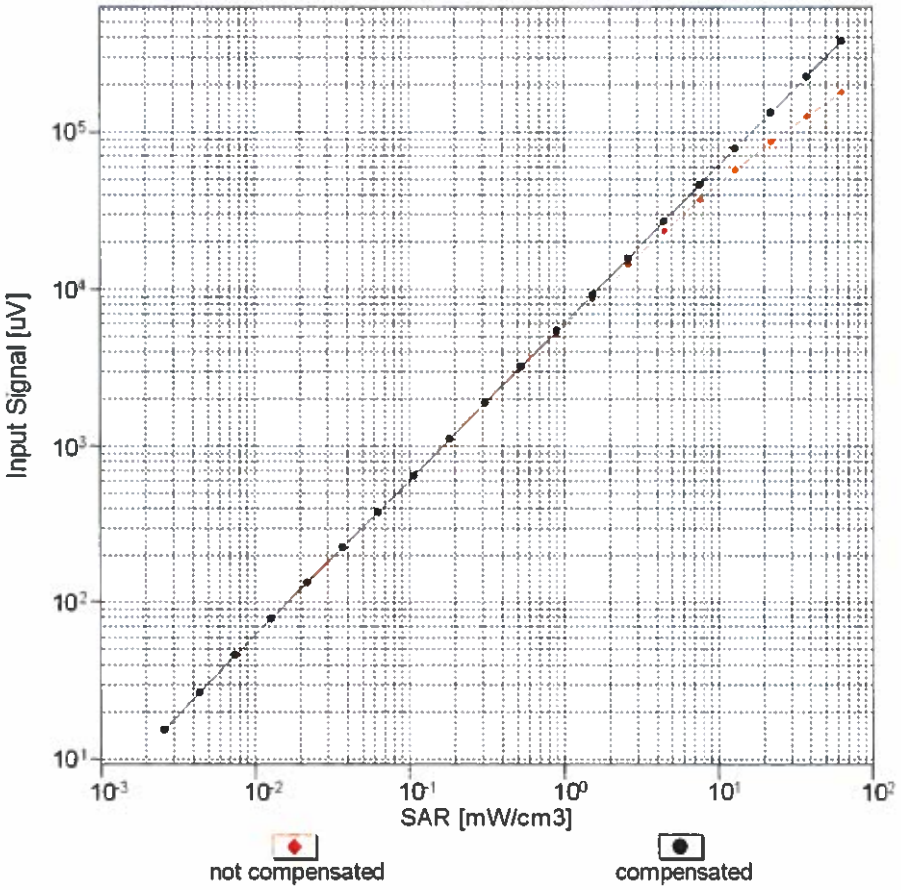
f=1800 MHz,R22

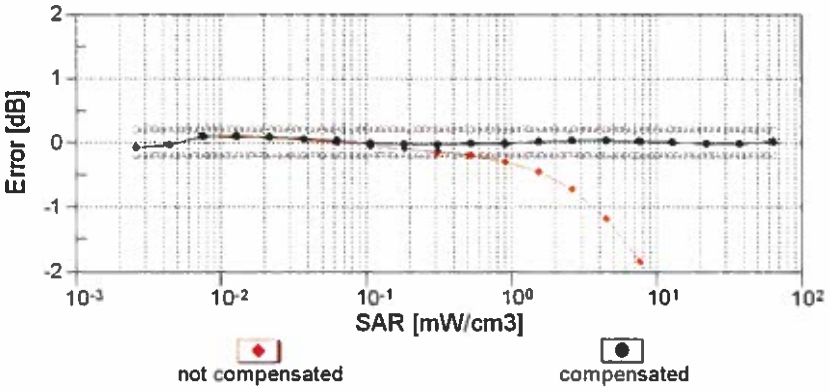




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

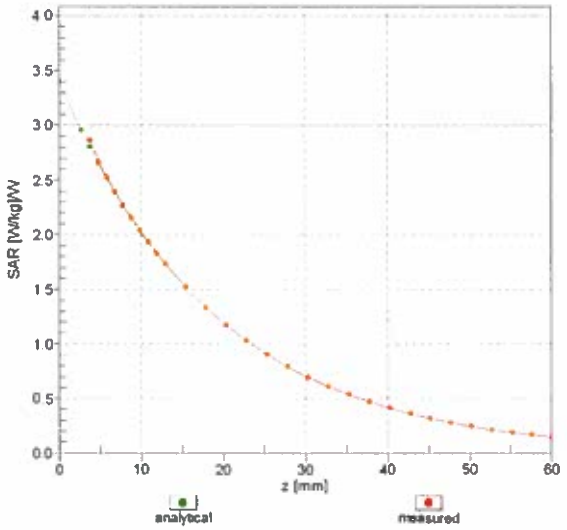




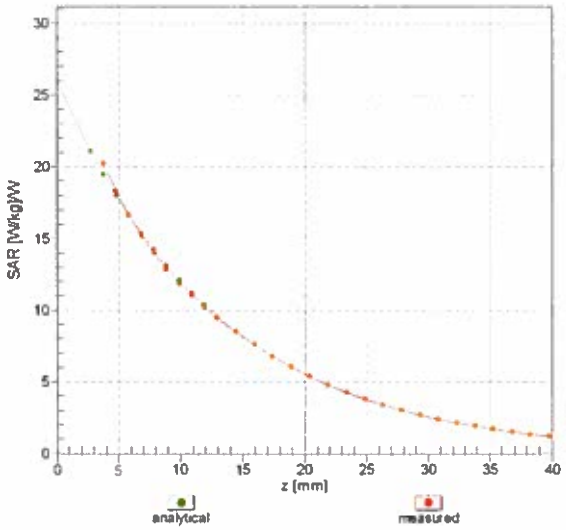
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

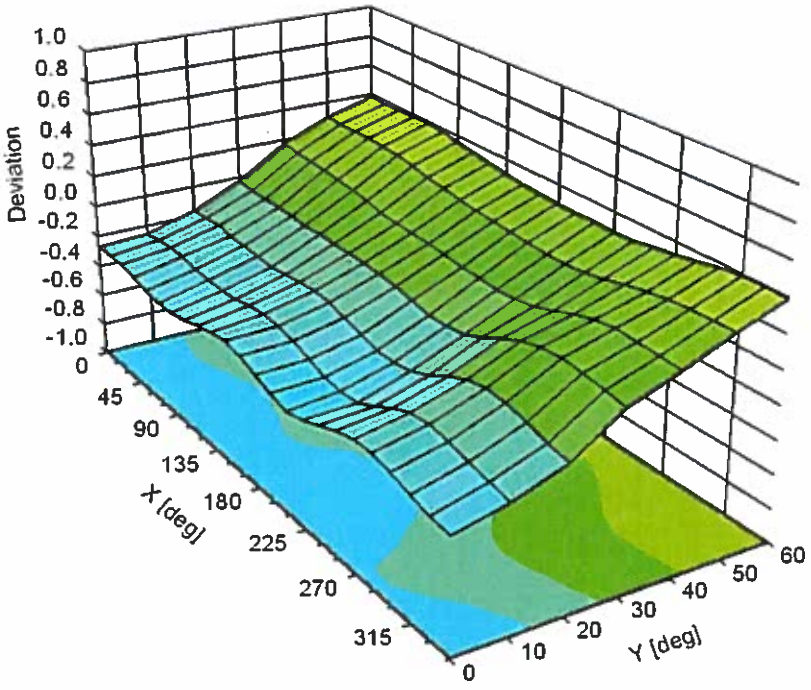


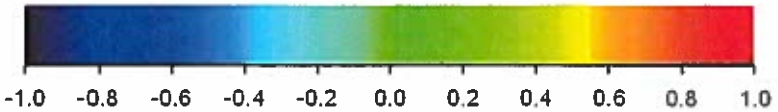
f = 1750 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





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

DASY/EASY - Parameters of Probe: ET3DV6 - SN:1587

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	72.9
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	enabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	6.8 mm
Probe Tip to Sensor X Calibration Point	2.7 mm
Probe Tip to Sensor Y Calibration Point	2.7 mm
Probe Tip to Sensor Z Calibration Point	2.7 mm
Recommended Measurement Distance from Surface	4 mm

checked by KD 16 Aug 2012

ASSET: A1185

Calibration Laboratory of
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Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: SCS 108

Client RFI

Certificate No: ET3-1528_Jul12

CALIBRATION CERTIFICATE

Object: ET3DV6 - SN:1528

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

Calibration date: July 26, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: July 26, 2012

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

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Accreditation No.: SCS 108
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Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ET3DV6

SN:1528

Manufactured: March 21, 2000
Calibrated: July 26, 2012

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

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

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.45	1.86	1.61	± 10.1 %
DCP (mV)[B]	95.5	97.5	100.3	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
0	CW	0.00	X	0.00	0.00	1.00	166.6	±1.9 %
			Y	0.00	0.00	1.00	160.4	
			Z	0.00	0.00	1.00	170.5	

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:1528

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	43.5	0.87	7.01	7.01	7.01	0.23	2.32	± 13.4 %
750	41.9	0.89	6.37	6.37	6.37	0.49	2.16	± 12.0 %
835	41.5	0.90	6.06	6.06	6.06	0.61	1.95	± 12.0 %
900	41.5	0.97	5.95	5.95	5.95	0.30	3.00	± 12.0 %
1450	40.5	1.20	5.22	5.22	5.22	0.49	2.80	± 12.0 %
1750	40.1	1.37	5.12	5.12	5.12	0.80	2.07	± 12.0 %
1900	40.0	1.40	4.92	4.92	4.92	0.80	2.10	± 12.0 %
2150	39.7	1.53	4.65	4.65	4.65	0.80	2.00	± 12.0 %
2450	39.2	1.80	4.31	4.31	4.31	0.80	1.74	± 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.

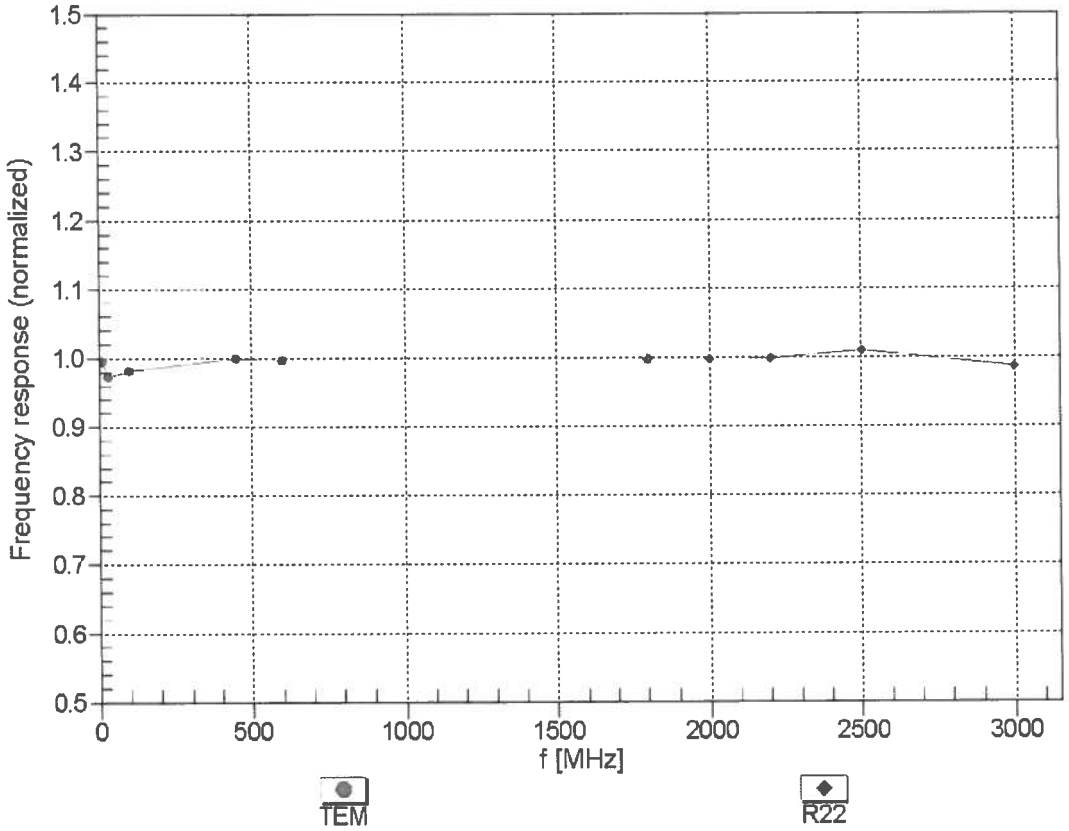
DASY/EASY - Parameters of Probe: ET3DV6 - SN:1528

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	7.47	7.47	7.47	0.16	2.32	± 13.4 %
750	55.5	0.96	6.17	6.17	6.17	0.33	2.75	± 12.0 %
835	55.2	0.97	5.99	5.99	5.99	0.33	3.00	± 12.0 %
900	55.0	1.05	5.92	5.92	5.92	0.55	2.18	± 12.0 %
1450	54.0	1.30	5.11	5.11	5.11	0.76	2.07	± 12.0 %
1750	53.4	1.49	4.64	4.64	4.64	0.80	2.45	± 12.0 %
1900	53.3	1.52	4.42	4.42	4.42	0.80	2.33	± 12.0 %
2150	53.1	1.66	4.37	4.37	4.37	0.80	1.93	± 12.0 %
2450	52.7	1.95	3.99	3.99	3.99	0.56	0.98	± 12.0 %

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

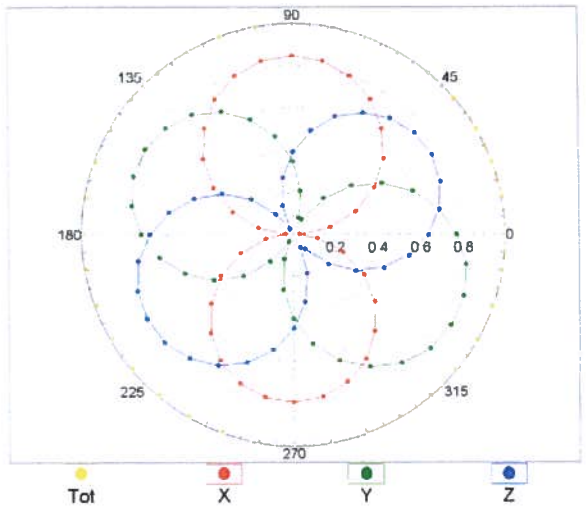
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



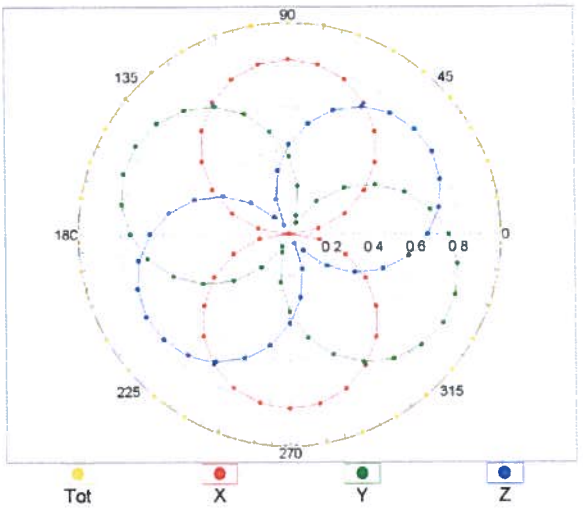
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

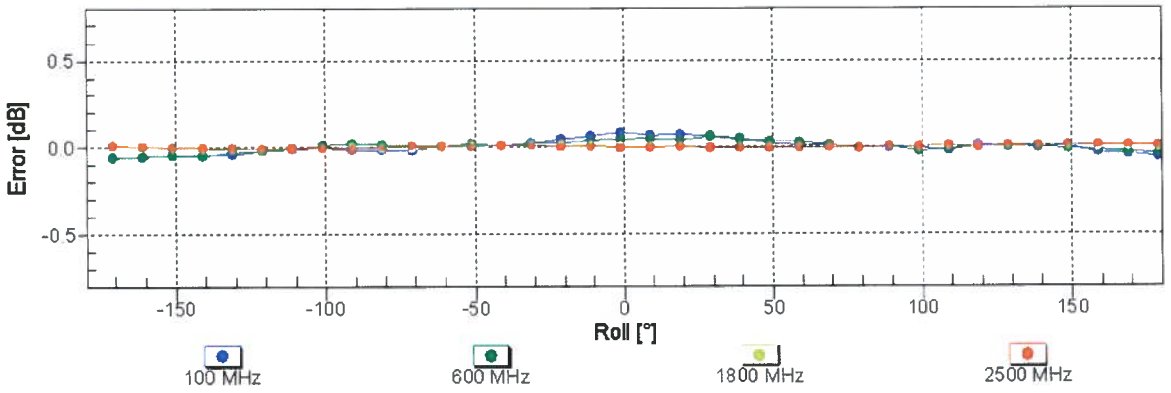
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



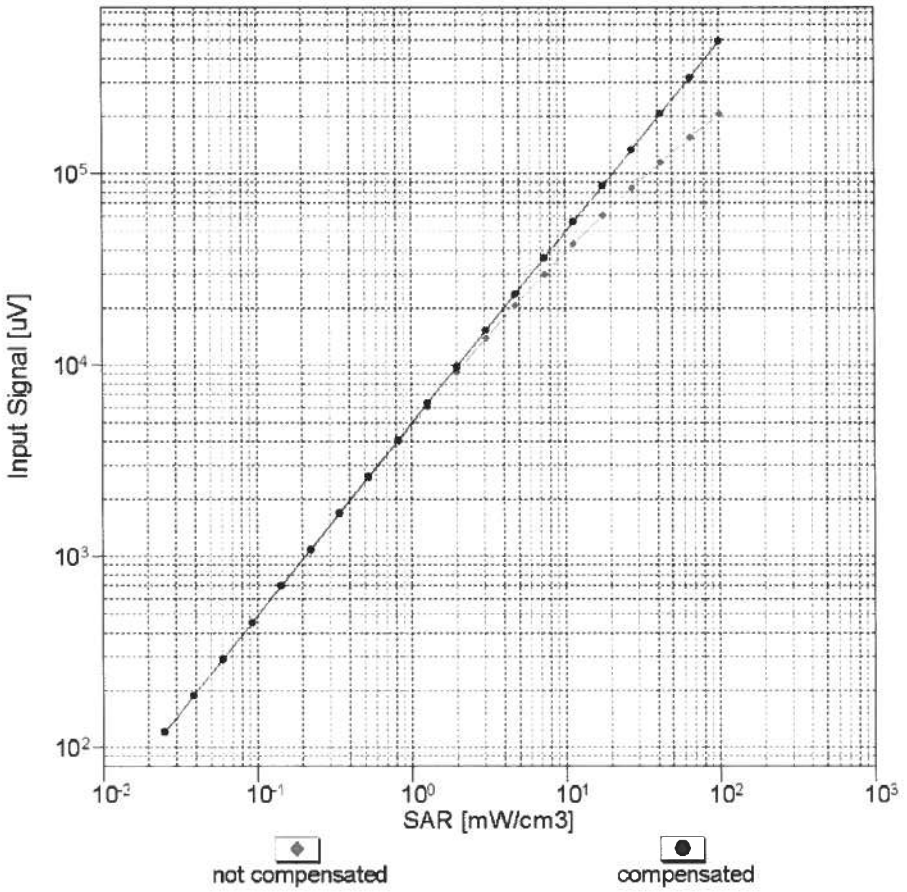
f=1800 MHz,R22

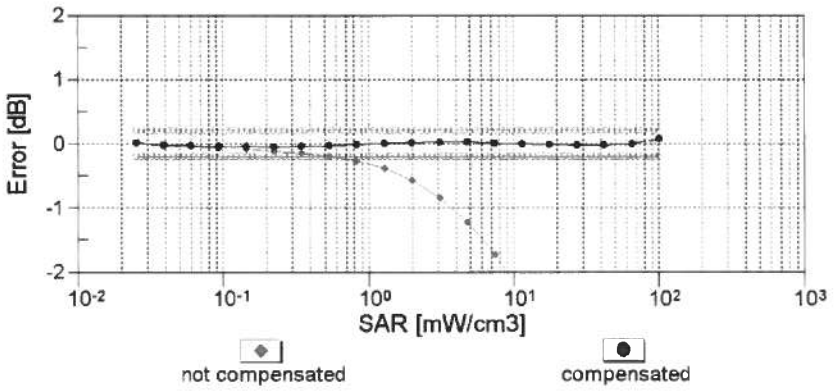




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

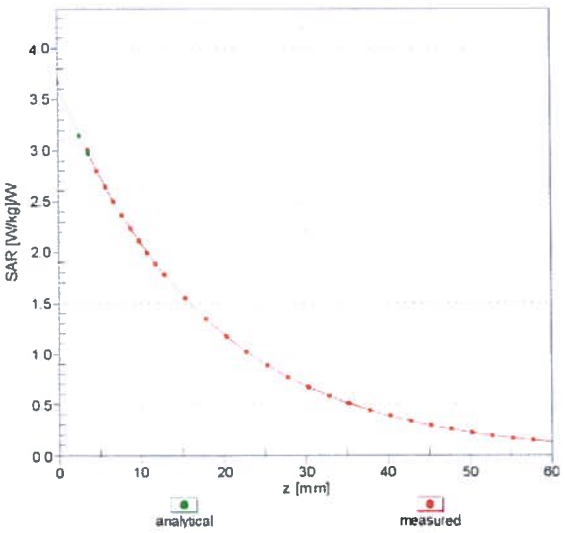




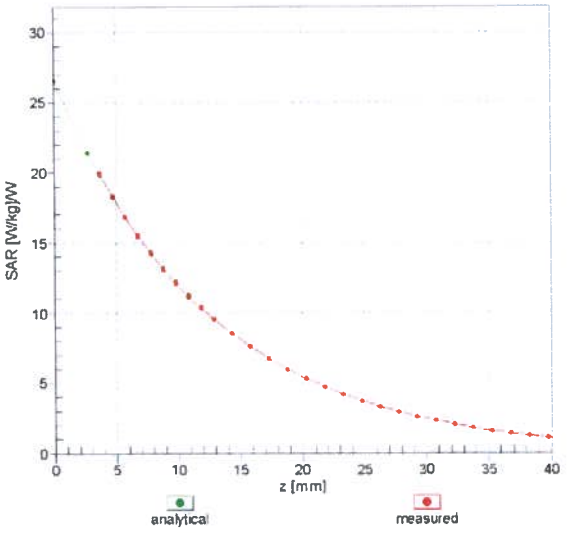
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 900 MHz,WGLS R9 (H_convF)

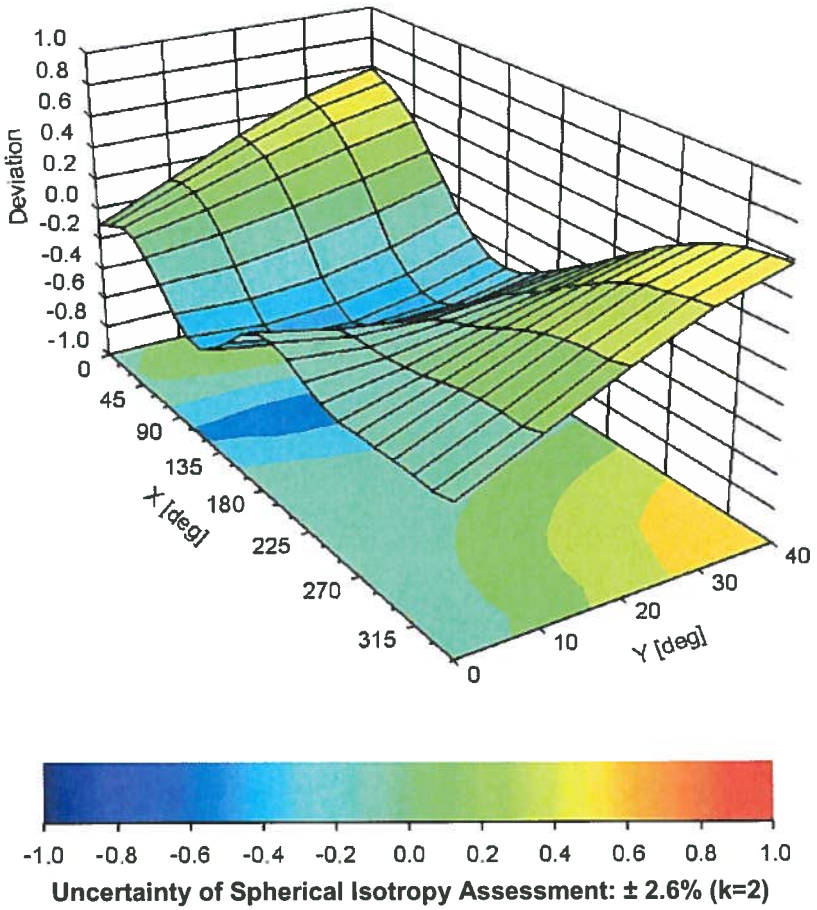


f = 1750 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

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

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	18.9
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	enabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	6.8 mm
Probe Tip to Sensor X Calibration Point	2.7 mm
Probe Tip to Sensor Y Calibration Point	2.7 mm
Probe Tip to Sensor Z Calibration Point	2.7 mm
Recommended Measurement Distance from Surface	4 mm

checked by DATE: 18-09-2012

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

Client RFI **Certificate No: ES3-3304_Aug12**

CALIBRATION CERTIFICATE

Object ES3DV3 - SN:3304

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

Calibration date: August 31, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: September 3, 2012

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

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe ES3DV3

SN:3304

Manufactured: August 27, 2010
Calibrated: August 31, 2012

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3304

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.14	1.33	1.33	± 10.1 %
DCP (mV)[B]	104.7	101.1	103.7	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
0	CW	0.00	X	0.00	0.00	1.00	146.4	±3.8 %
			Y	0.00	0.00	1.00	159.8	
			Z	0.00	0.00	1.00	158.8	

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

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3304

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	6.44	6.44	6.44	0.29	1.92	± 12.0 %
835	41.5	0.90	6.17	6.17	6.17	0.27	1.96	± 12.0 %
900	41.5	0.97	6.09	6.09	6.09	0.33	1.75	± 12.0 %
1750	40.1	1.37	5.47	5.47	5.47	0.61	1.36	± 12.0 %
1900	40.0	1.40	5.24	5.24	5.24	0.80	1.18	± 12.0 %
2100	39.8	1.49	5.24	5.24	5.24	0.80	1.16	± 12.0 %
2450	39.2	1.80	4.59	4.59	4.59	0.78	1.22	± 12.0 %
2600	39.0	1.96	4.40	4.40	4.40	0.75	1.28	± 12.0 %

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3304

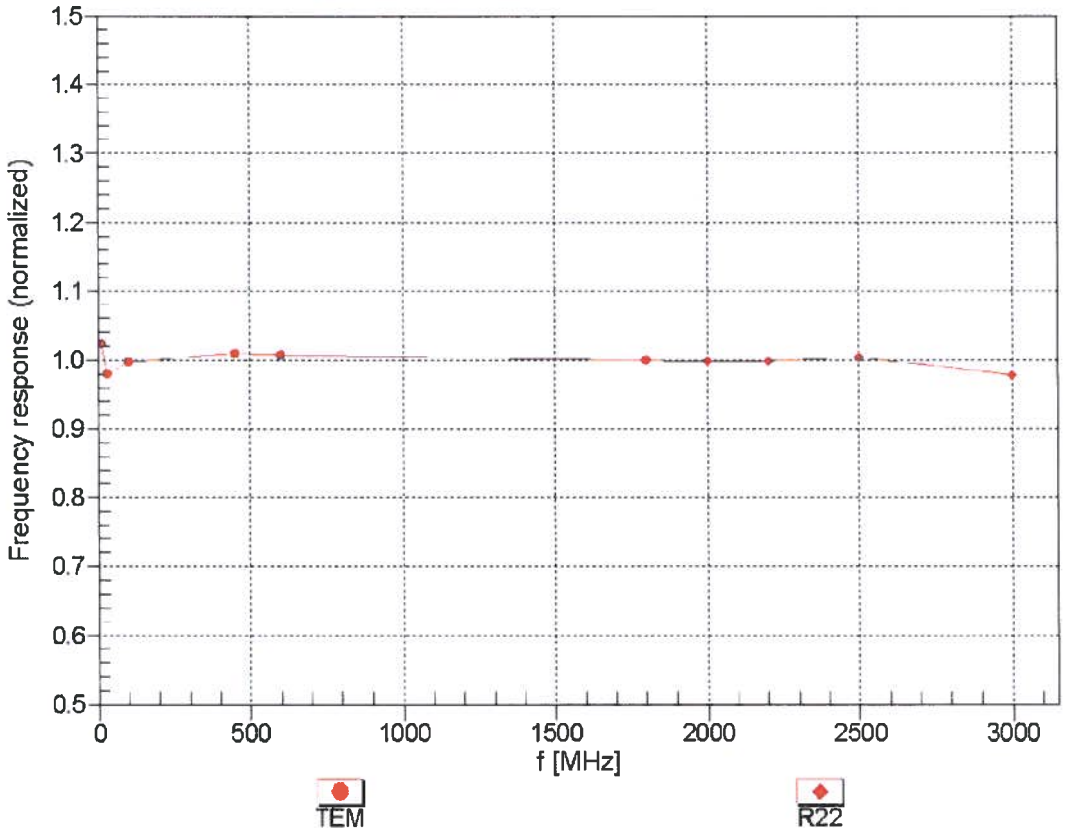
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	6.25	6.25	6.25	0.58	1.30	± 12.0 %
835	55.2	0.97	6.13	6.13	6.13	0.60	1.32	± 12.0 %
900	55.0	1.05	6.11	6.11	6.11	0.80	1.18	± 12.0 %
1750	53.4	1.49	5.15	5.15	5.15	0.45	1.78	± 12.0 %
1900	53.3	1.52	4.88	4.88	4.88	0.70	1.35	± 12.0 %
2100	53.2	1.62	4.94	4.94	4.94	0.64	1.43	± 12.0 %
2450	52.7	1.95	4.32	4.32	4.32	0.74	1.09	± 12.0 %
2600	52.5	2.16	4.16	4.16	4.16	0.68	0.99	± 12.0 %

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

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

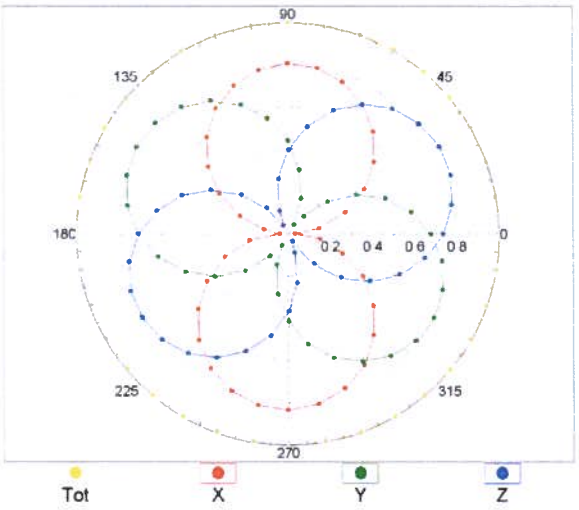
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



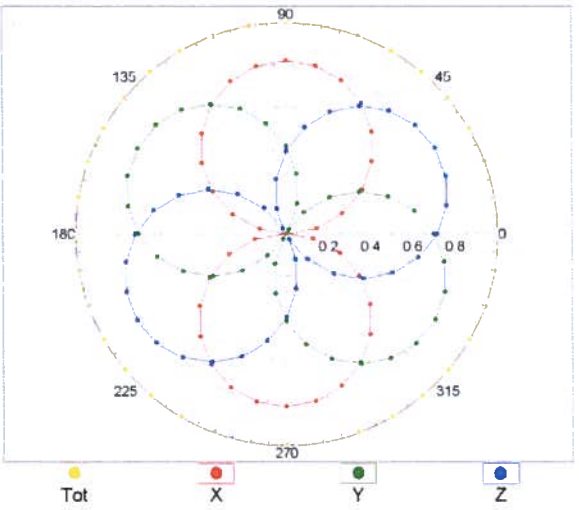
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

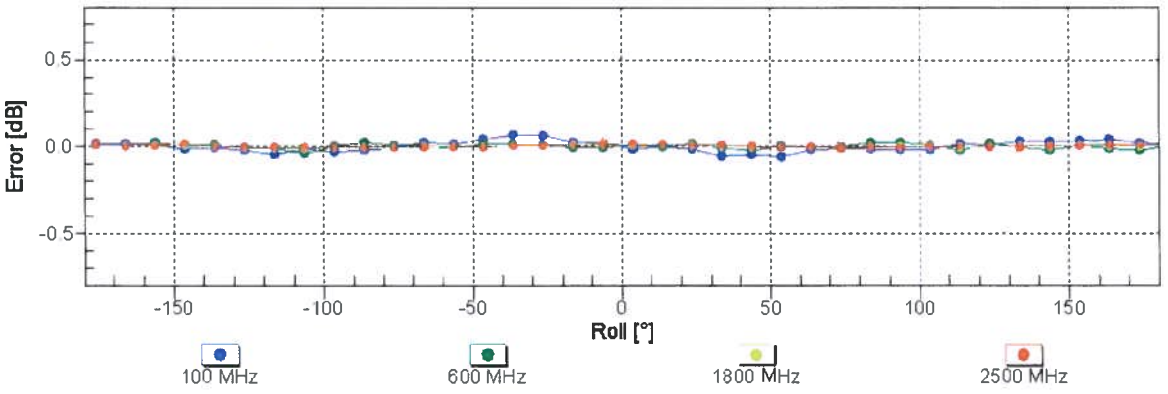
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



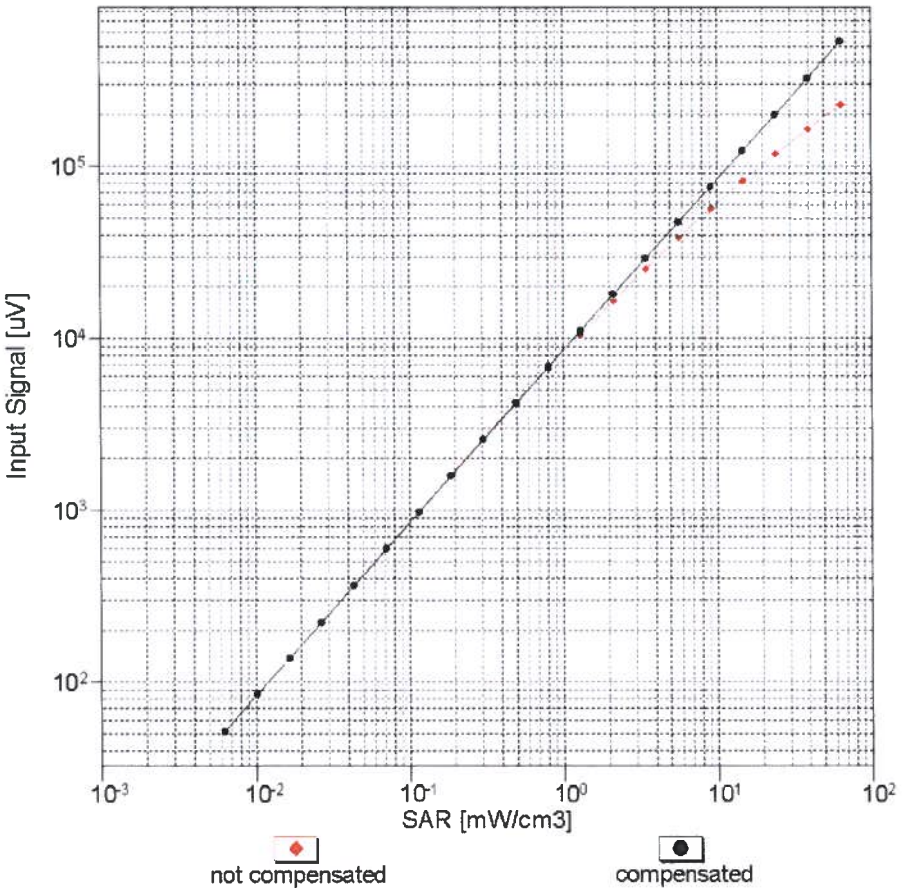
f=1800 MHz,R22

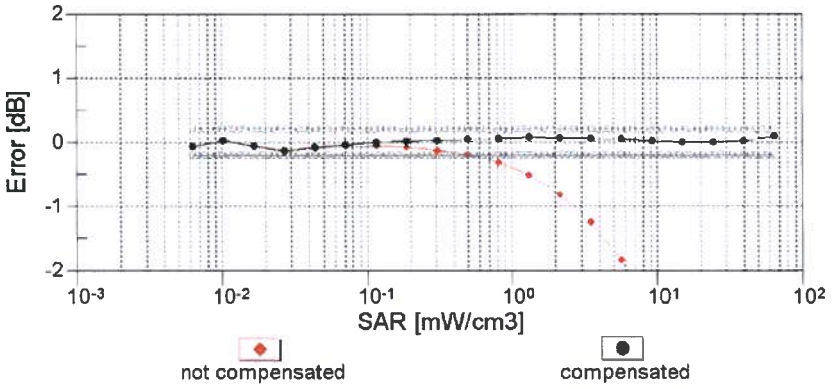




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

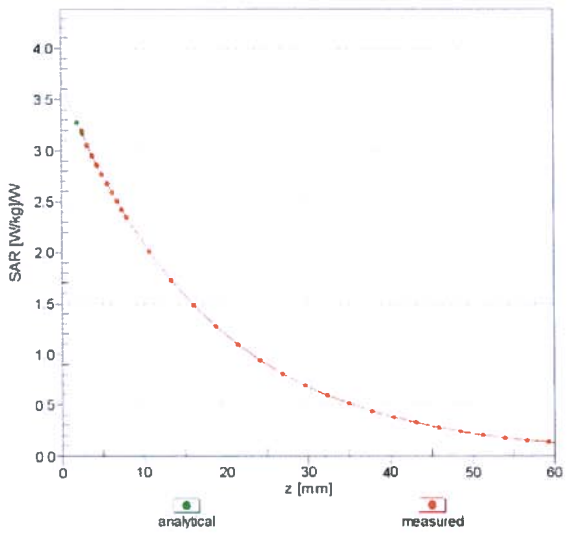




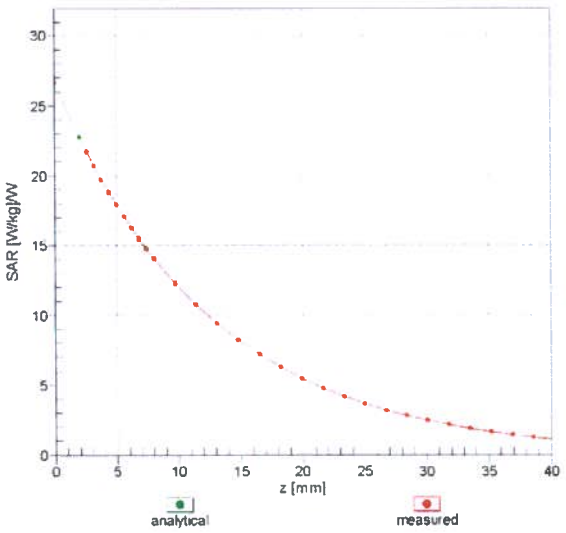
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 900 MHz,WGLS R9 (H_convF)

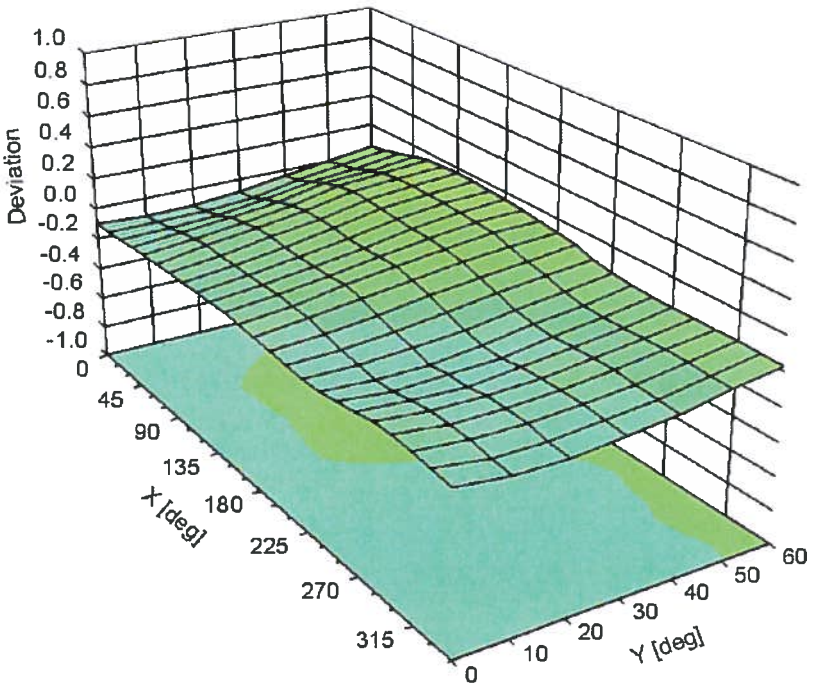


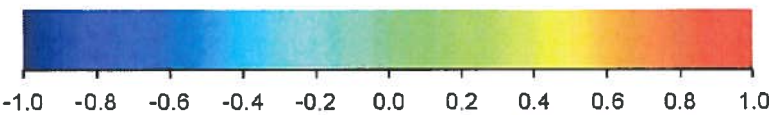
f = 1750 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3304

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	33.7
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

Checked by [redacted]
DATE: 26-FEB-2013

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 UL CCS USA

Certificate No: EX3-3871_Aug12

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3871

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

Calibration date: August 20, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: August 20, 2012

TS ✓

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

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

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

Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

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

Probe EX3DV4

SN:3871

Manufactured: February 2, 2012
Calibrated: August 20, 2012

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3871

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.40	0.50	0.44	± 10.1 %
DCP (mV)[B]	107.2	96.3	103.6	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
0	CW	0.00	X	0.00	0.00	1.00	145.3	±3.5 %
			Y	0.00	0.00	1.00	163.2	
			Z	0.00	0.00	1.00	151.9	

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

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3871

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	10.39	10.39	10.39	0.12	1.00	± 13.4 %
750	41.9	0.89	10.04	10.04	10.04	0.80	0.60	± 12.0 %
835	41.5	0.90	9.55	9.55	9.55	0.28	1.06	± 12.0 %
900	41.5	0.97	9.51	9.51	9.51	0.33	0.99	± 12.0 %
1450	40.5	1.20	8.83	8.83	8.83	0.28	1.02	± 12.0 %
1640	40.3	1.29	9.22	9.22	9.22	0.37	0.84	± 12.0 %
1750	40.1	1.37	8.62	8.62	8.62	0.42	0.77	± 12.0 %
1900	40.0	1.40	8.26	8.26	8.26	0.46	0.75	± 12.0 %
1950	40.0	1.40	8.01	8.01	8.01	0.71	0.57	± 12.0 %
2000	40.0	1.40	8.23	8.23	8.23	0.44	0.75	± 12.0 %
2300	39.5	1.67	7.76	7.76	7.76	0.34	0.83	± 12.0 %
2450	39.2	1.80	7.35	7.35	7.35	0.32	0.82	± 12.0 %
2600	39.0	1.96	7.14	7.14	7.14	0.34	0.92	± 12.0 %
3500	37.9	2.91	7.06	7.06	7.06	0.46	0.95	± 13.1 %
3700	37.7	3.12	6.39	6.39	6.39	0.48	0.89	± 13.1 %
4950	36.3	4.40	5.44	5.44	5.44	0.30	1.80	± 13.1 %
5200	36.0	4.66	5.18	5.18	5.18	0.35	1.80	± 13.1 %
5300	35.9	4.76	4.92	4.92	4.92	0.35	1.80	± 13.1 %
5500	35.6	4.96	4.75	4.75	4.75	0.45	1.80	± 13.1 %
5600	35.5	5.07	4.49	4.49	4.49	0.50	1.80	± 13.1 %
5800	35.3	5.27	4.53	4.53	4.53	0.50	1.80	± 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.

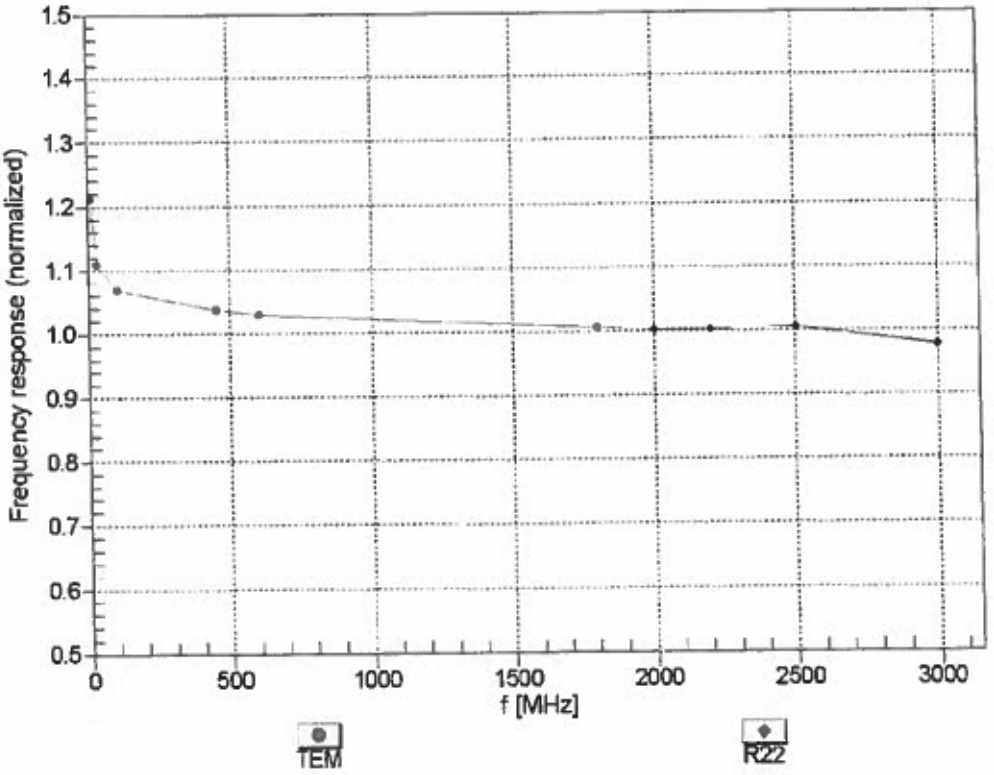
DASY/EASY - Parameters of Probe: EX3DV4 - SN:3871

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	11.10	11.10	11.10	0.04	1.00	± 13.4 %
750	55.5	0.96	9.75	9.75	9.75	0.25	1.17	± 12.0 %
835	55.2	0.97	9.68	9.68	9.68	0.28	1.08	± 12.0 %
900	55.0	1.05	9.62	9.62	9.62	0.41	0.90	± 12.0 %
1450	54.0	1.30	8.65	8.65	8.65	0.35	0.89	± 12.0 %
1640	53.8	1.40	8.77	8.77	8.77	0.60	0.69	± 12.0 %
1750	53.4	1.49	8.10	8.10	8.10	0.36	0.85	± 12.0 %
1900	53.3	1.52	7.83	7.83	7.83	0.56	0.68	± 12.0 %
1950	53.3	1.52	8.06	8.06	8.06	0.53	0.70	± 12.0 %
2000	53.3	1.52	7.97	7.97	7.97	0.45	0.75	± 12.0 %
2300	52.9	1.81	7.67	7.67	7.67	0.52	0.67	± 12.0 %
2450	52.7	1.95	7.44	7.44	7.44	0.79	0.54	± 12.0 %
2600	52.5	2.16	7.31	7.31	7.31	0.80	0.50	± 12.0 %
3500	51.3	3.31	6.54	6.54	6.54	0.40	1.09	± 13.1 %
3700	51.0	3.55	6.61	6.61	6.61	0.34	1.18	± 13.1 %
4950	49.4	5.01	4.73	4.73	4.73	0.50	1.90	± 13.1 %
5200	49.0	5.30	4.42	4.42	4.42	0.50	1.90	± 13.1 %
5300	48.9	5.42	4.21	4.21	4.21	0.53	1.90	± 13.1 %
5500	48.6	5.65	4.01	4.01	4.01	0.55	1.90	± 13.1 %
5600	48.5	5.77	3.89	3.89	3.89	0.55	1.90	± 13.1 %
5800	48.2	6.00	4.23	4.23	4.23	0.55	1.90	± 13.1 %

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

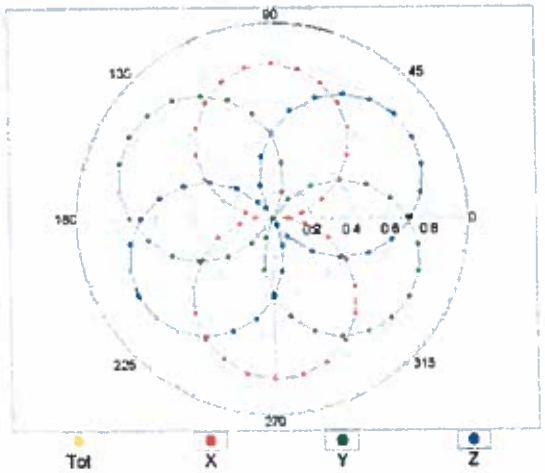
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



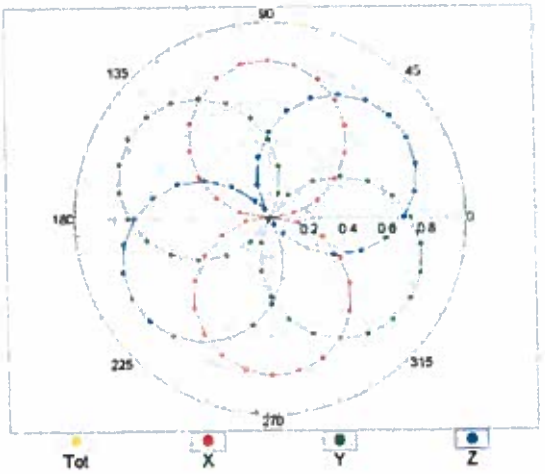
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

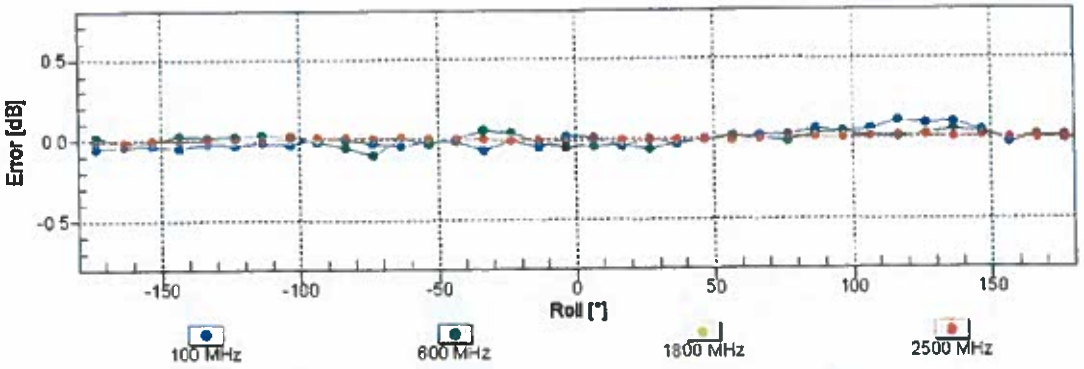
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



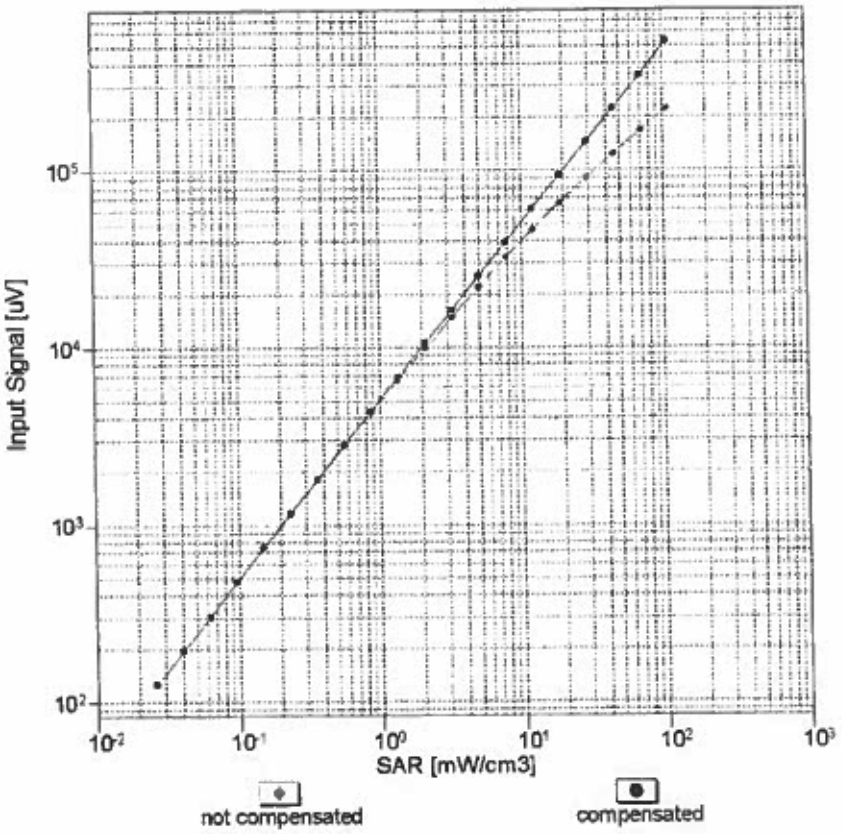
f=1800 MHz,R22

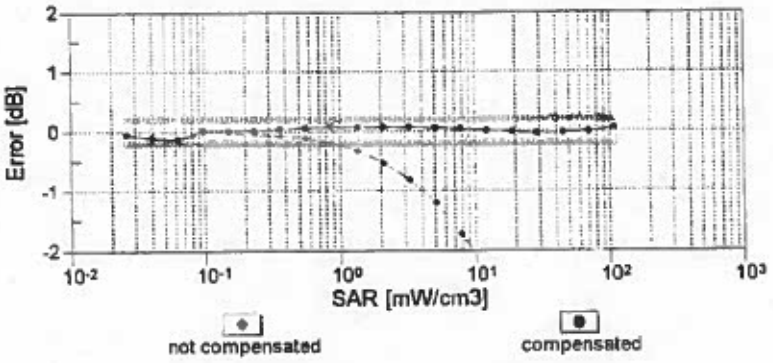




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

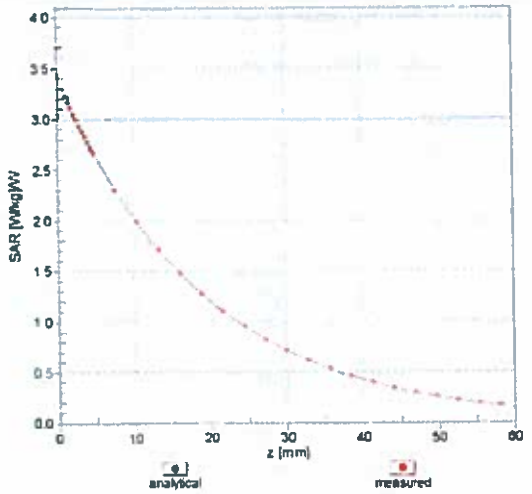




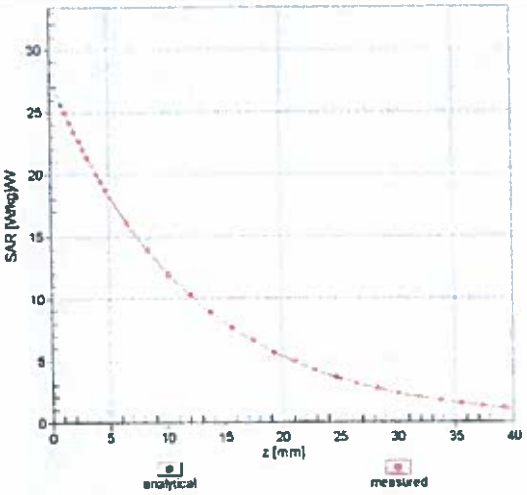
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

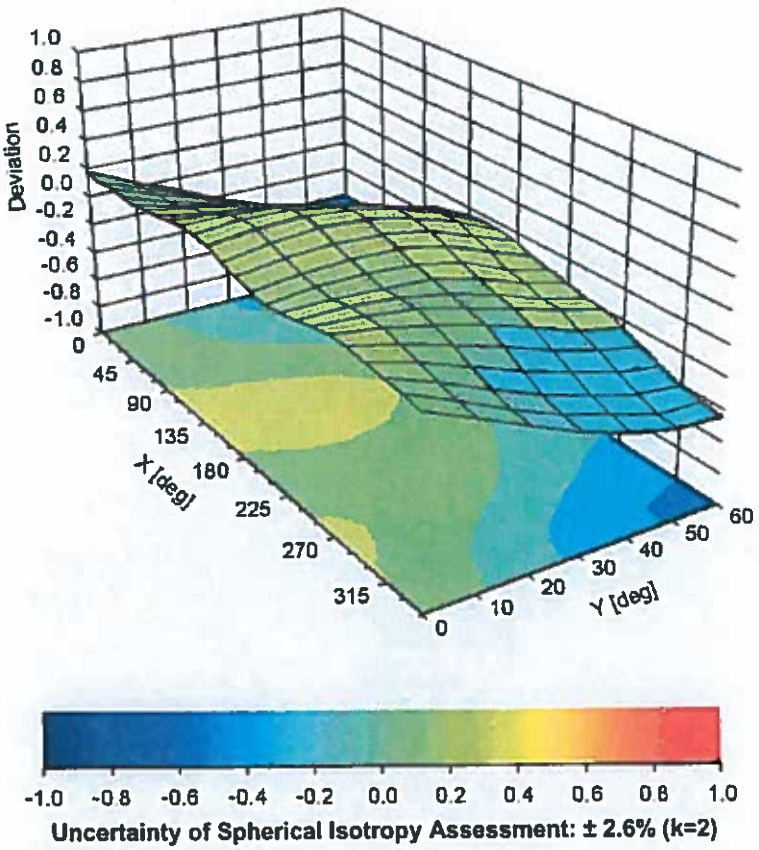


f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3871

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	36.6
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

Check by [signature] DATE: 7-August 2012

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

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

Accredited by the Swiss Accreditation Service (SAS) ASSET: A220/ **Accreditation No.: SCS 108**
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Client RFI **Certificate No: D900V2-035_Aug12**

CALIBRATION CERTIFICATE

Object	D900V2 - SN: 035
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	August 16, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

	Name	Function	Signature
Calibrated by:	Israe El-Naouq	Laboratory Technician	[signature]
Approved by:	Katja Pokovic	Technical Manager	[signature]

Issued: August 16, 2012

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.

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
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	40.6 ± 6 %	0.96 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.62 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**10.5 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.68 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**6.74 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.0	1.05 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.6 ± 6 %	1.06 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.74 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**10.8 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.76 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**6.96 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.8 Ω - 5.8 jΩ
Return Loss	- 24.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.5 Ω - 5.5 jΩ
Return Loss	- 24.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.404 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. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
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	February 26, 1998

DASY5 Validation Report for Head TSL

Date: 16.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN: 035

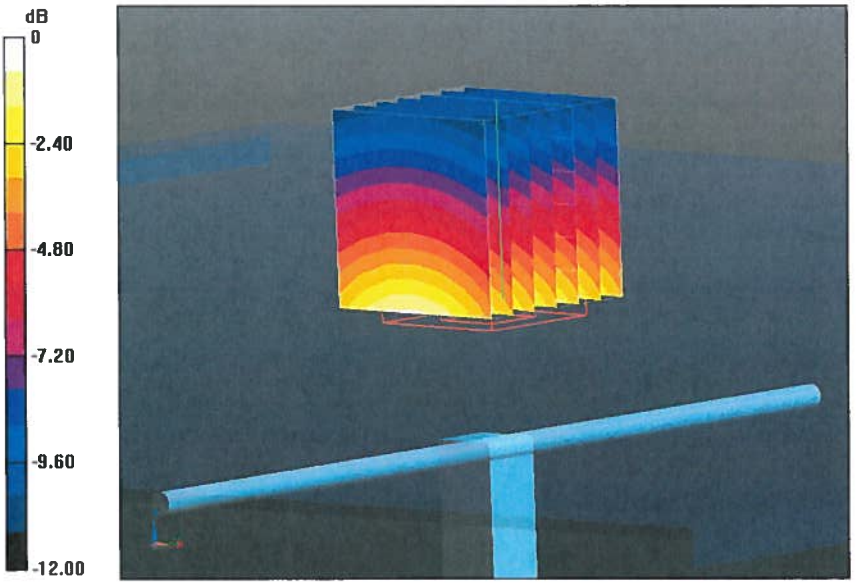
Communication System: CW; Frequency: 900 MHz
Medium parameters used: f = 900 MHz; σ = 0.96 mho/m; ε_r = 40.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.97, 5.97, 5.97); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

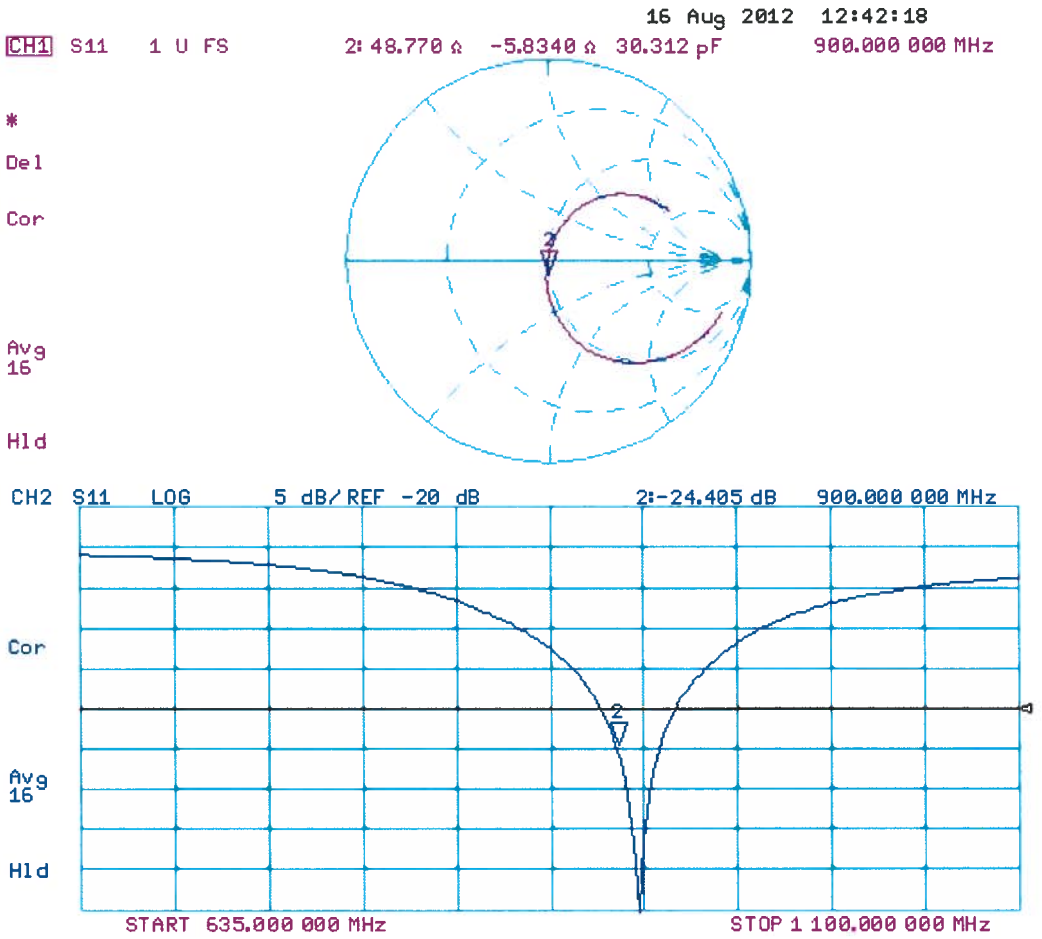
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.325 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.926 mW/g
SAR(1 g) = 2.62 mW/g; SAR(10 g) = 1.68 mW/g
Maximum value of SAR (measured) = 3.06 W/kg



0 dB = 3.06 W/kg = 9.71 dB W/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 16.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN: 035

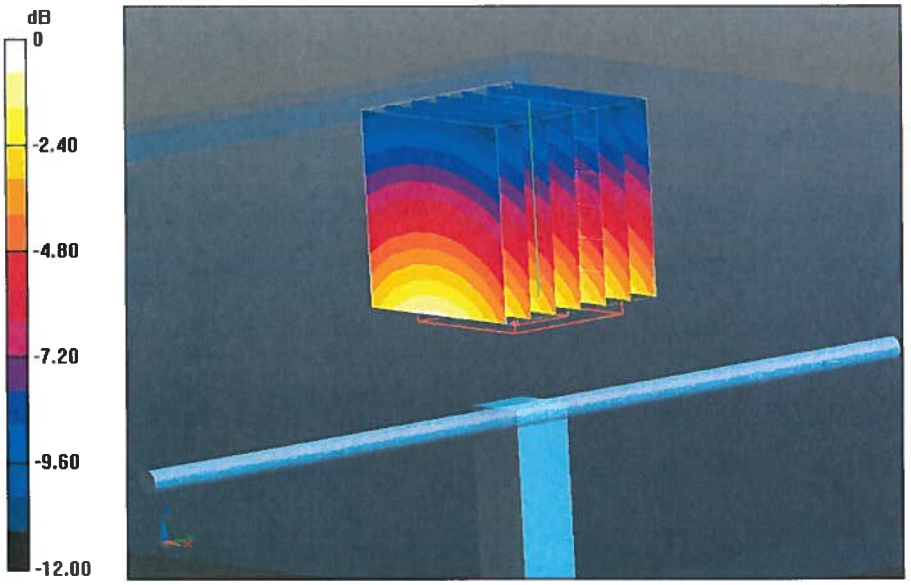
Communication System: CW; Frequency: 900 MHz
Medium parameters used: f = 900 MHz; σ = 1.06 mho/m; ε_r = 52.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.94, 5.94, 5.94); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

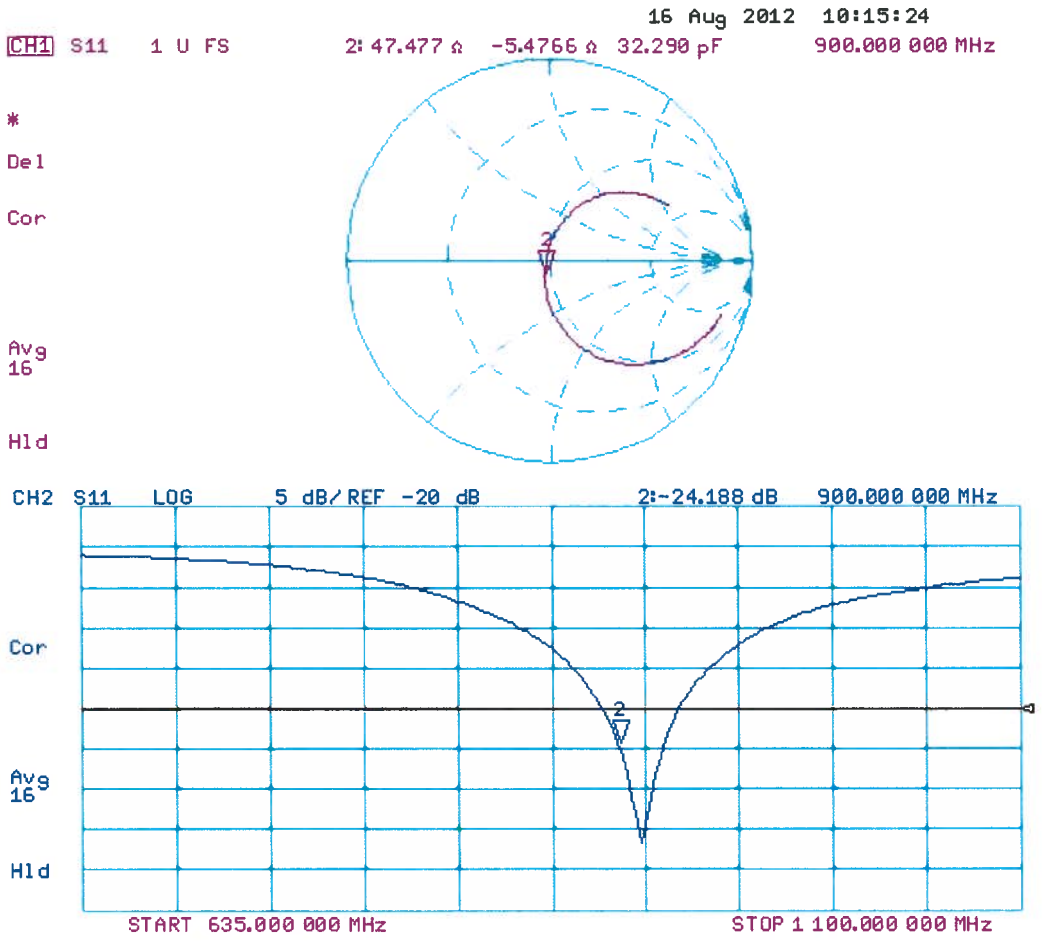
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.325 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 4.184 mW/g
SAR(1 g) = 2.74 mW/g; SAR(10 g) = 1.76 mW/g
Maximum value of SAR (measured) = 3.18 W/kg



0 dB = 3.18 W/kg = 10.05 dB W/kg

Impedance Measurement Plot for Body TSL



ASSET: A1237 – Checked by KB 21/02/2011

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
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: D1900V2-540_Feb11

CALIBRATION CERTIFICATE

Object: D1900V2 - SN: 540

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

Calibration date: February 08, 2011

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

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

Issued: February 8, 2011

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied.

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

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 mW / g
SAR normalized	normalized to 1W	40.4 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**40.3 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.25 mW / g
SAR normalized	normalized to 1W	21.0 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**21.0 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

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

SAR result with Body TSL

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

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

Appendix

Antenna Parameters with Head TSL

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

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.6 Ω + 5.0 jΩ
Return Loss	- 23.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.195 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 26, 2001

DASY5 Validation Report for Head TSL

Date/Time: 07.02.2011 15:18:47

Test Laboratory: SPEAG, Zurich, Switzerland

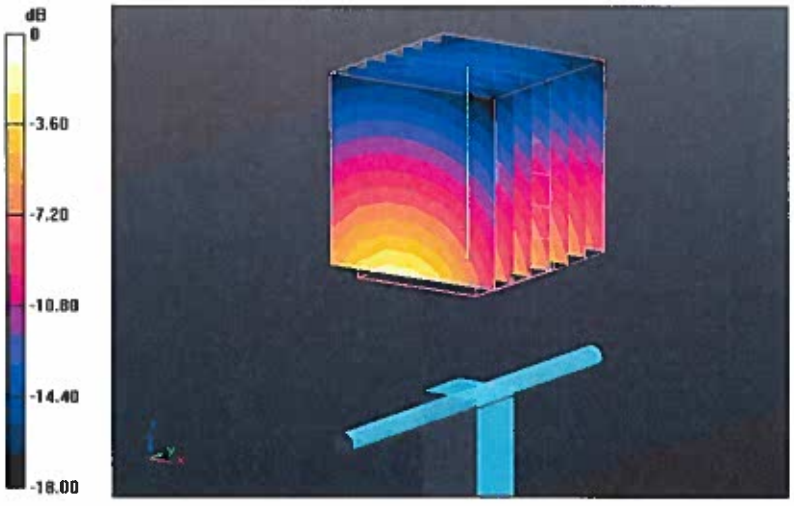
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:540

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

DASY5 Configuration:

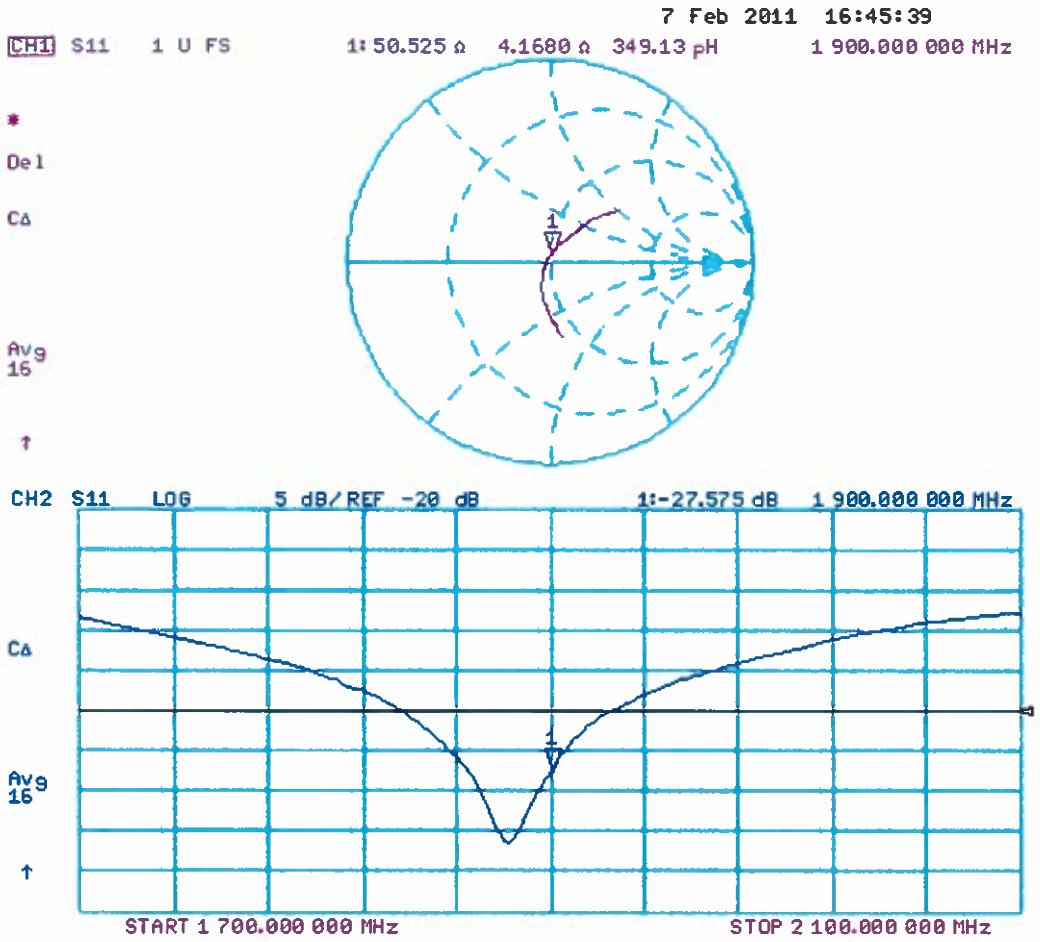
- Probe: ES3DV3 - SN3205; ConvF(5.09, 5.09, 5.09); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.936 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 18.544 W/kg
SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.25 mW/g
Maximum value of SAR (measured) = 12.384 mW/g



0 dB = 12.380mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 08.02.2011 12:04:35

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

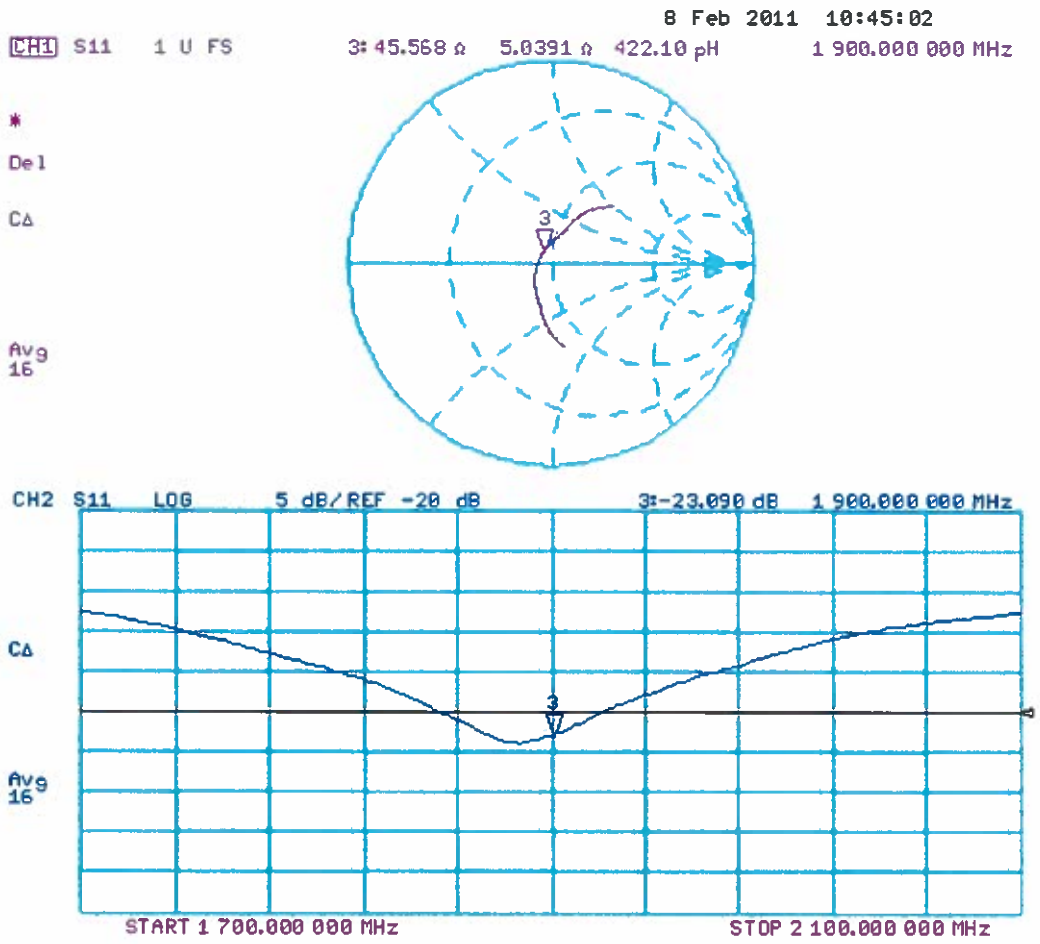
DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.59, 4.59, 4.59); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.899 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 17.597 W/kg
SAR(1 g) = 10.3 mW/g; SAR(10 g) = 5.43 mW/g
Maximum value of SAR (measured) = 13.038 mW/g

0 dB = 13.040mW/g

Impedance Measurement Plot for Body TSL



Checked by [signature] DATE: 7 Sept 2012

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

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

Accredited by the Swiss Accreditation Service (SAS) ASSET: A1190 **Accreditation No.: SCS 108**
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Client RFI **Certificate No: D1800V2-264_Aug12**

CALIBRATION CERTIFICATE

Object	D1800V2 - SN: 264
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	August 15, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

	Name	Function	Signature
Calibrated by:	Israe El-Naouq	Laboratory Technician	Israe El-Naouq
Approved by:	Katja Pokovic	Technical Manager	

Issued: August 15, 2012

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.

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1800 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.8 ± 6 %	1.38 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.22 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**37.2 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.87 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**19.6 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.0 ± 6 %	1.52 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.50 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**37.8 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.04 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**20.1 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	45.8 Ω - 5.8 jΩ
Return Loss	- 22.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	42.9 Ω - 5.3 jΩ
Return Loss	- 20.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.201 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. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
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	March 05, 2000

DASY5 Validation Report for Head TSL

Date: 15.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN: 264

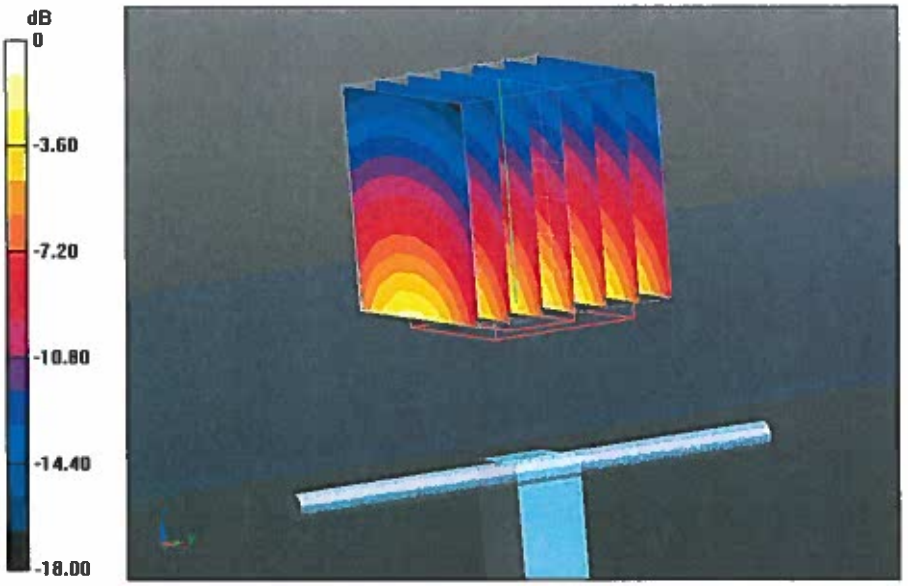
Communication System: CW; Frequency: 1800 MHz
Medium parameters used: f = 1800 MHz; σ = 1.38 mho/m; ε_r = 39.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.07, 5.07, 5.07); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

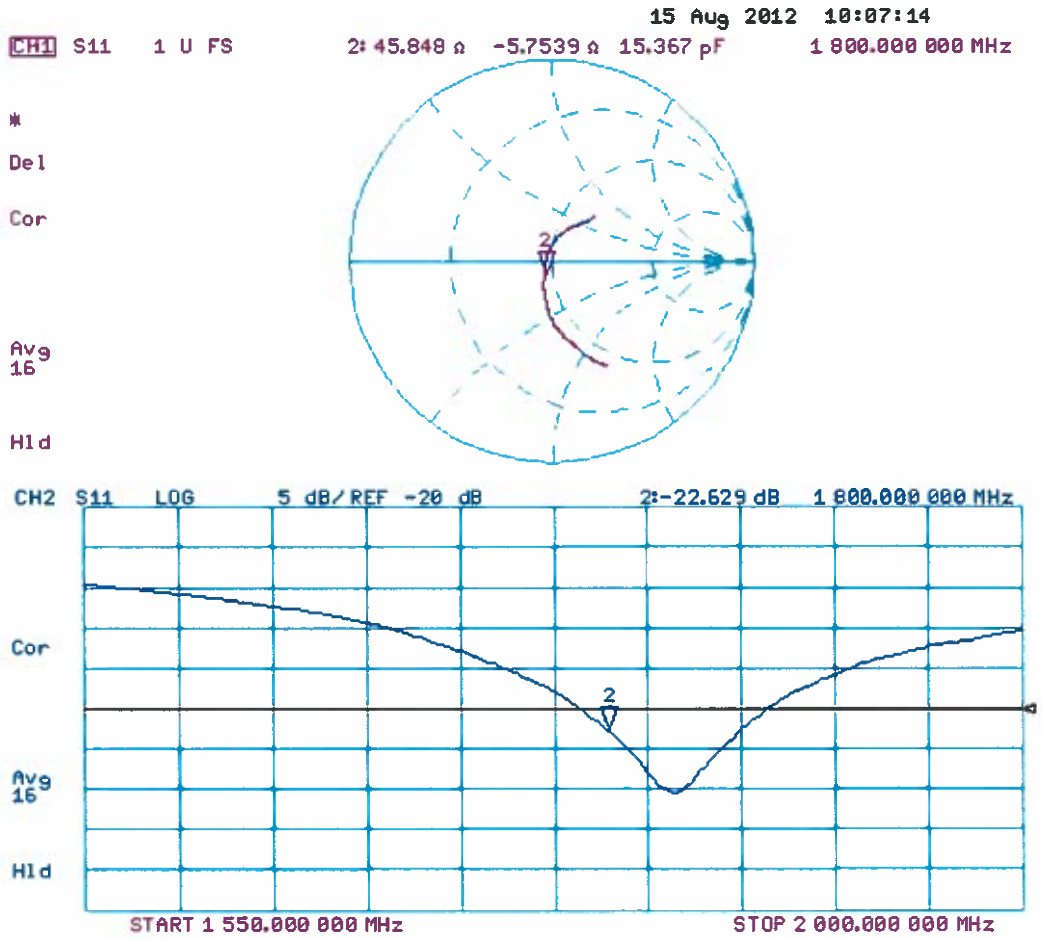
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.984 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 16.364 mW/g
SAR(1 g) = 9.22 mW/g; SAR(10 g) = 4.87 mW/g
Maximum value of SAR (measured) = 11.3 W/kg



0 dB = 11.3 W/kg = 21.06 dB W/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 15.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN: 264

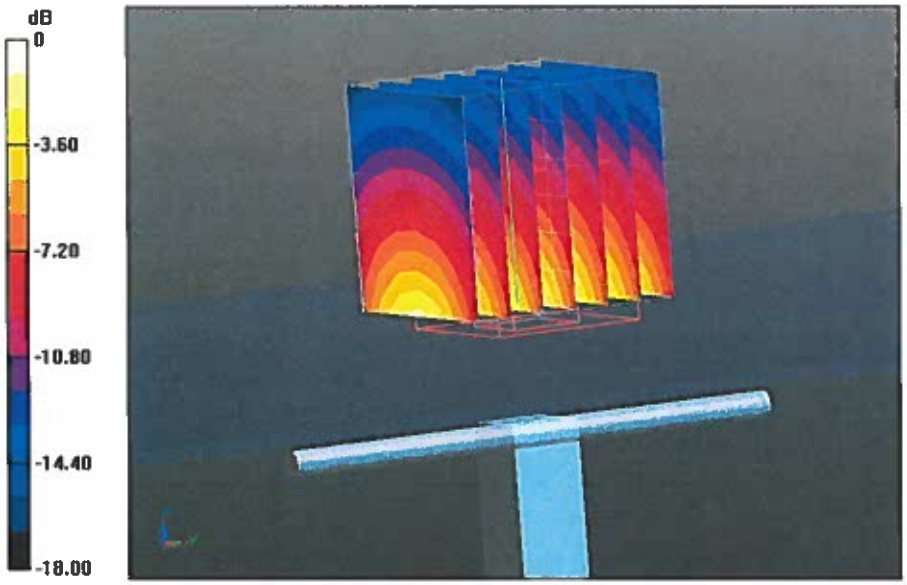
Communication System: CW; Frequency: 1800 MHz
Medium parameters used: f = 1800 MHz; σ = 1.52 mho/m; ε_r = 52; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.74, 4.74, 4.74); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

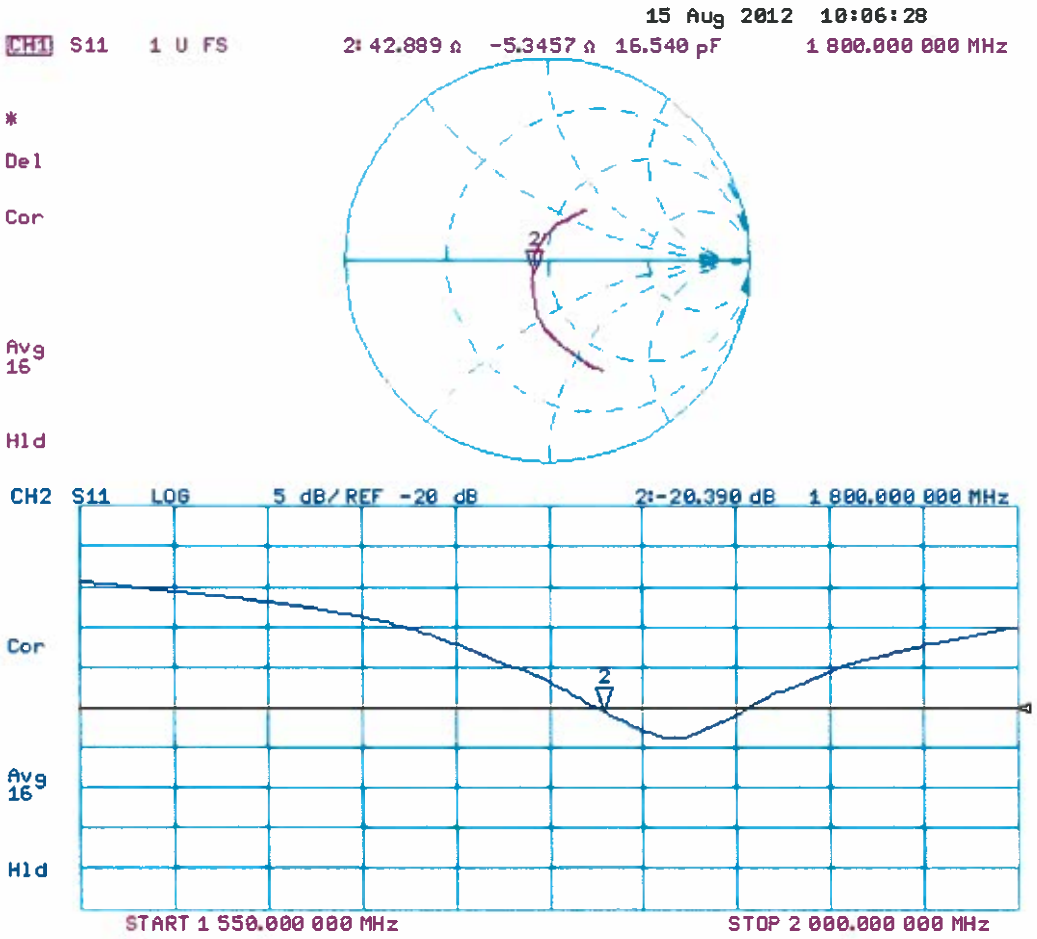
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 92.107 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 16.733 mW/g
SAR(1 g) = 9.5 mW/g; SAR(10 g) = 5.04 mW/g
Maximum value of SAR (measured) = 11.9 W/kg



0 dB = 11.9 W/kg = 21.51 dB W/kg

Impedance Measurement Plot for Body TSL



ASSET: A1237 – Checked by KB 21/02/2011

Calibration Laboratory of
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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: D1900V2-540_Feb11

CALIBRATION CERTIFICATE

Object: D1900V2 - SN: 540

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

Calibration date: February 08, 2011

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

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

Calibration Equipment used (M&TE critical for calibration)

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

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

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

Issued: February 8, 2011

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied.

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

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 mW / g
SAR normalized	normalized to 1W	40.4 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**40.3 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.25 mW / g
SAR normalized	normalized to 1W	21.0 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**21.0 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

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

SAR result with Body TSL

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

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

Appendix

Antenna Parameters with Head TSL

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

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.6 Ω + 5.0 jΩ
Return Loss	- 23.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.195 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 26, 2001

DASY5 Validation Report for Head TSL

Date/Time: 07.02.2011 15:18:47

Test Laboratory: SPEAG, Zurich, Switzerland

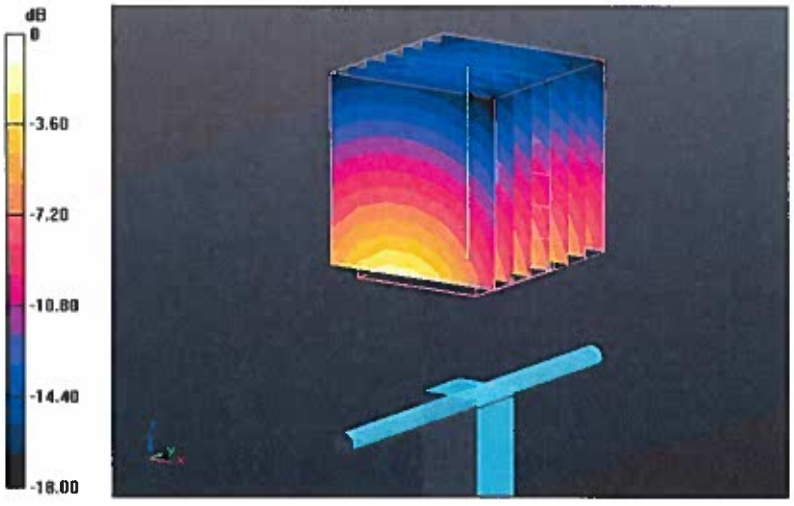
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:540

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

DASY5 Configuration:

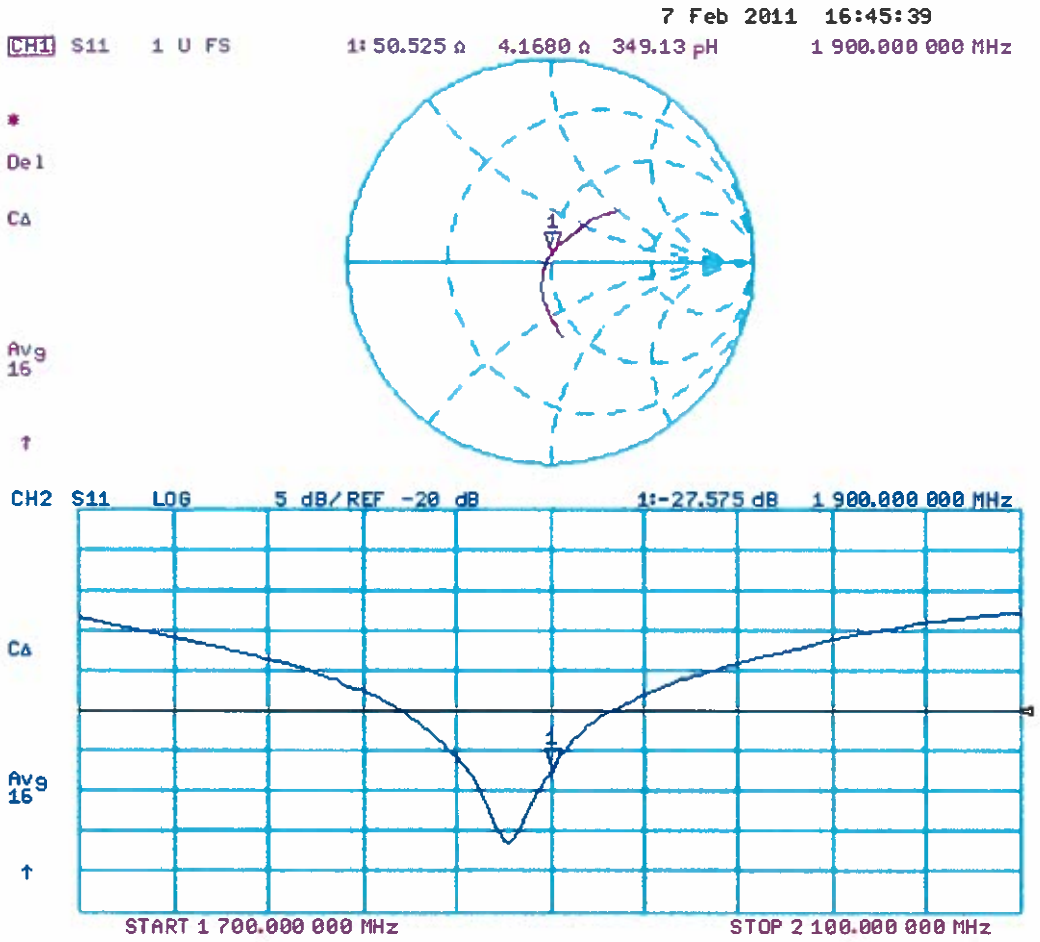
- Probe: ES3DV3 - SN3205; ConvF(5.09, 5.09, 5.09); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.936 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 18.544 W/kg
SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.25 mW/g
Maximum value of SAR (measured) = 12.384 mW/g



0 dB = 12.380mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 08.02.2011 12:04:35

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

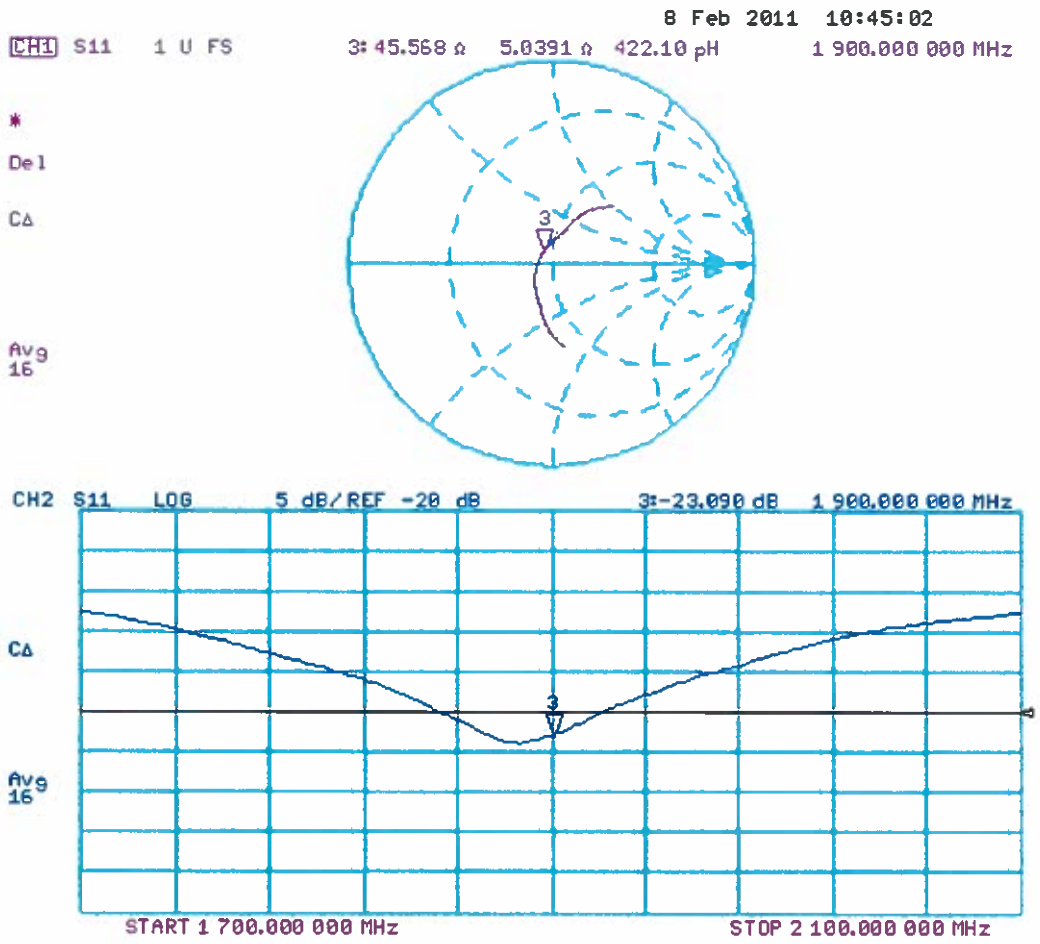
DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.59, 4.59, 4.59); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.899 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 17.597 W/kg
SAR(1 g) = 10.3 mW/g; SAR(10 g) = 5.43 mW/g
Maximum value of SAR (measured) = 13.038 mW/g

0 dB = 13.040mW/g

Impedance Measurement Plot for Body TSL



Checked by [signature] DATE: 7 Sept 2012

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

S Schweizerischer Kalibrierdienst
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S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS) ASSET: A2202
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: D2440V2-701_Aug12

CALIBRATION CERTIFICATE

Object	D2440V2 - SN: 701
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	August 13, 2012

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

	Name	Function	Signature
Calibrated by:	Israe El-Naouq	Laboratory Technician	Israa El-Naouq
Approved by:	Katja Pokovic	Technical Manager	

Issued: August 13, 2012

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.

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.2 ± 6 %	1.81 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.1 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**52.3 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.06 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**24.2 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.3 ± 6 %	1.99 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**52.0 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.09 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	48.4 Ω - 8.2 jΩ
Return Loss	- 21.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.8 Ω - 6.9 jΩ
Return Loss	- 21.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.141 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. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
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	August 24, 2000

DASY5 Validation Report for Head TSL

Date: 13.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2440 MHz; Type: D2440V2; Serial: D2440V2 - SN: 701

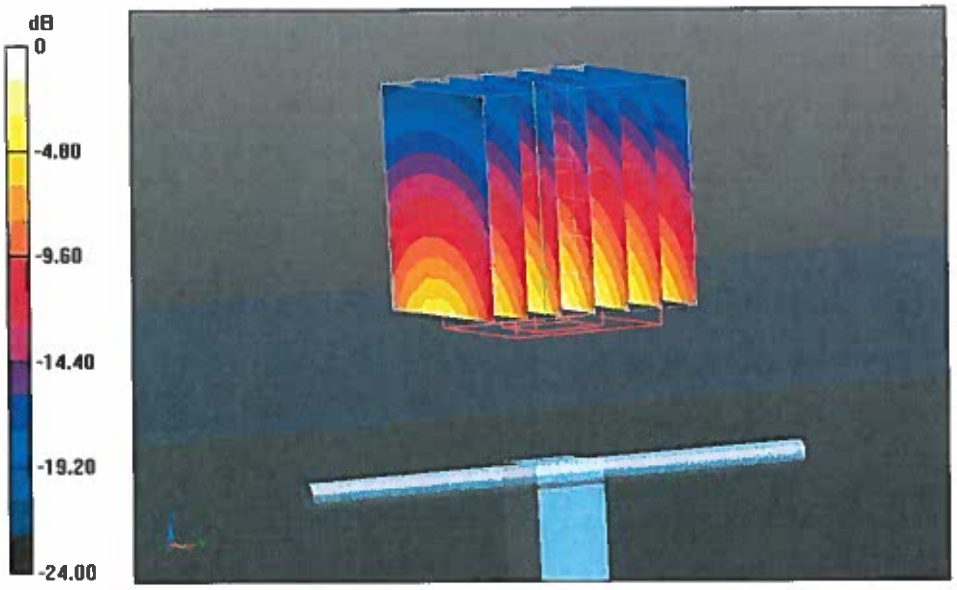
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.81 mho/m; ε_r = 39.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

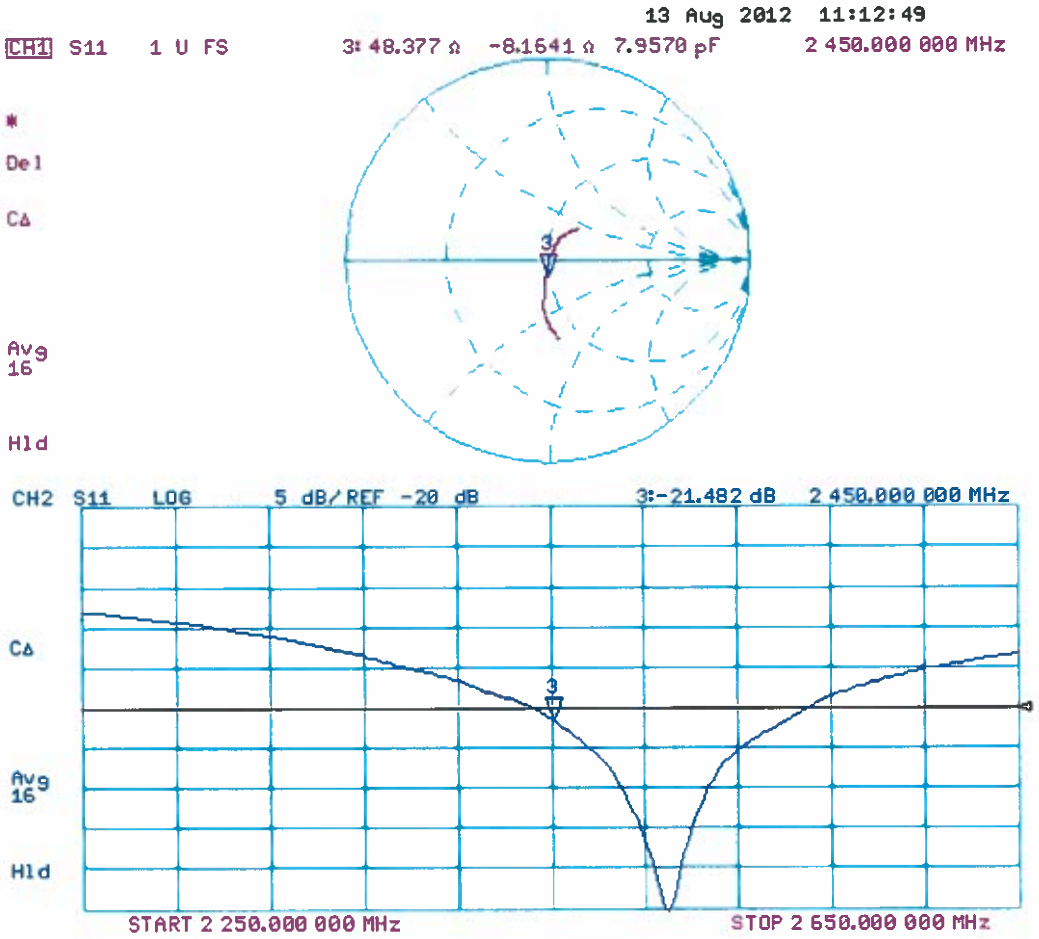
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 99.955 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 27.027 mW/g
SAR(1 g) = 13.1 mW/g; SAR(10 g) = 6.06 mW/g
Maximum value of SAR (measured) = 16.8 W/kg



0 dB = 16.8 W/kg = 24.51 dB W/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 13.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2440 MHz; Type: D2440V2; Serial: D2440V2 - SN: 701

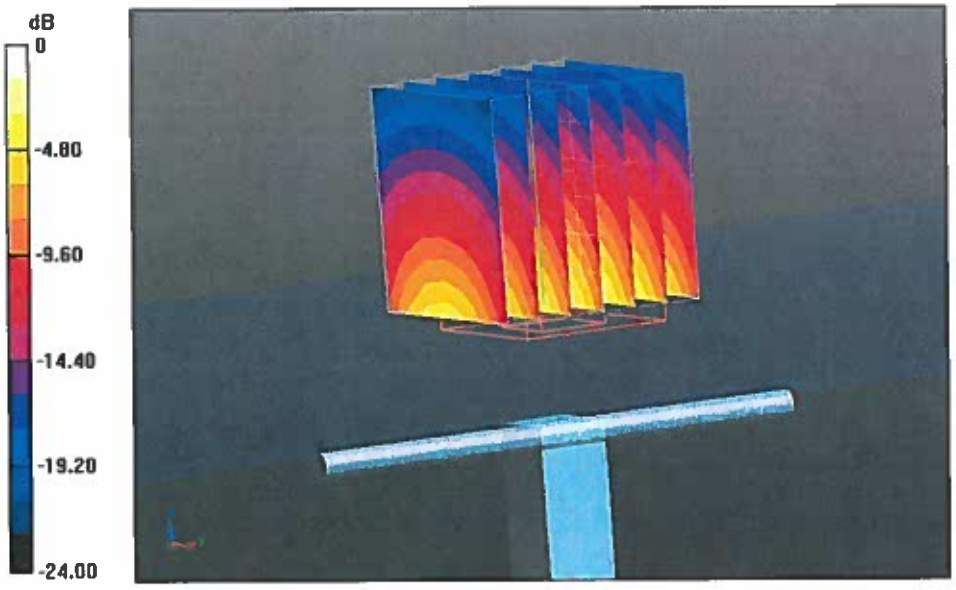
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.99 mho/m; ε_r = 51.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

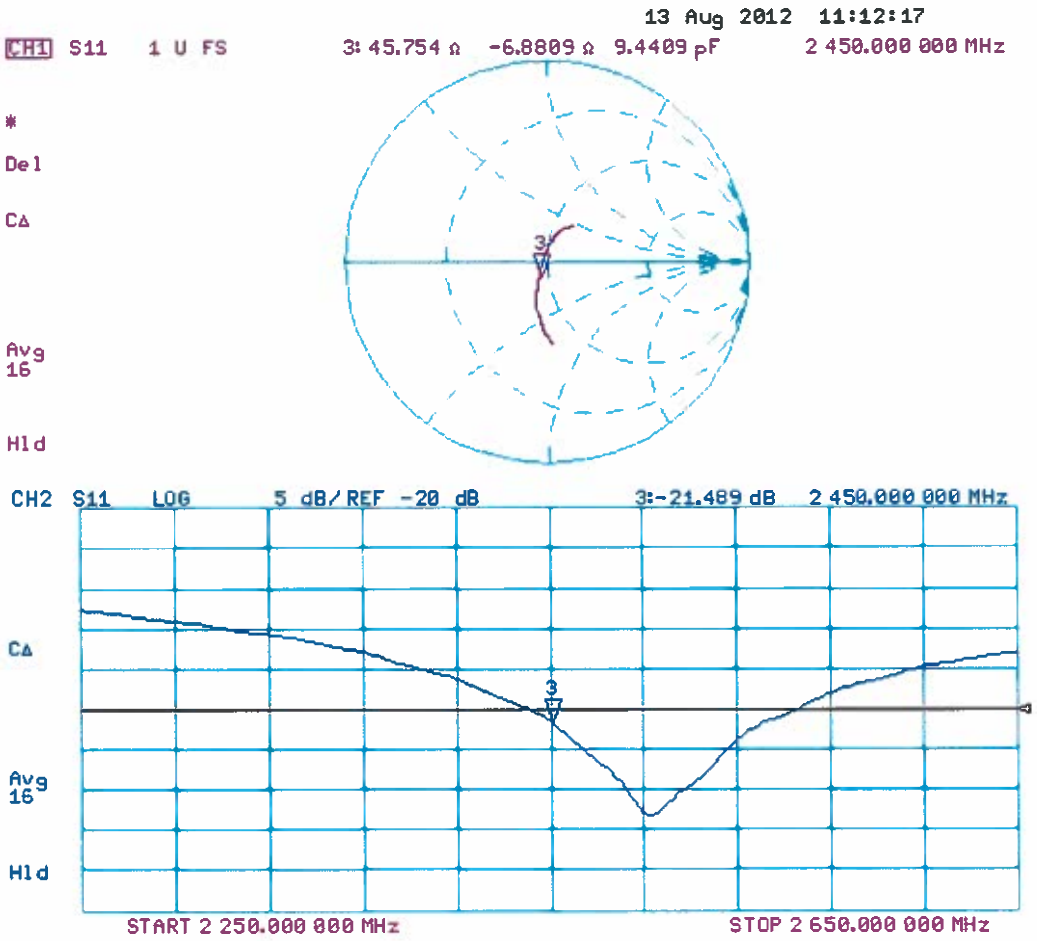
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.149 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 26.944 mW/g
SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.09 mW/g
Maximum value of SAR (measured) = 17.1 W/kg



0 dB = 17.1 W/kg = 24.66 dB W/kg

Impedance Measurement Plot for Body TSL



checked by: [illegible] DATE: 26-Feb-2013

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

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

Accreditation No.: SCS 108

Client RFI A1377 **Certificate No: D5GHzV2-1016_Feb13**

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN: 1016
Calibration procedure(s)	QA CAL-22.v2 Calibration procedure for dipole validation kits between 3-6 GHz
Calibration date:	February 20, 2013

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	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe EX3DV4	SN: 3503	28-Dec-12 (No. EX3-3503_Dec12)	Dec-13
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Israe El-Naouq	Laboratory Technician	Israe El-Naouq
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 20, 2013

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) IEC 62209-2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", March 2010

b) 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:

c) 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.

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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.5
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5500 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.7 ± 6 %	4.47 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.88 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**78.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.26 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.3 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.2 ± 6 %	4.74 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**82.5 W / kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.5 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	33.9 ± 6 %	5.05 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.78 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**77.0 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.22 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.9 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.9 ± 6 %	5.36 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.58 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.13 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.1 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.3 ± 6 %	5.71 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.98 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**79.0 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.23 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.0 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	45.9 ± 6 %	6.12 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.51 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**74.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.09 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.6 W/kg ± 19.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	52.7 Ω - 9.7 jΩ
Return Loss	- 20.2 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	48.5 Ω - 0.8 jΩ
Return Loss	- 35.3 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	57.1 Ω + 7.1 jΩ
Return Loss	- 20.6 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	53.2 Ω - 9.1 jΩ
Return Loss	- 20.6 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	48.7 Ω - 0.2 jΩ
Return Loss	- 37.3 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	57.1 Ω + 8.7 jΩ
Return Loss	- 19.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 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. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
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	November 14, 2003

DASY5 Validation Report for Head TSL

Date: 20.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1016

Communication System: CW; Frequency: 5200 MHz, Frequency: 5500 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 4.47 S/m; ε_r = 34.7; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 4.74 S/m; ε_r = 34.2; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 5.05 S/m; ε_r = 33.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

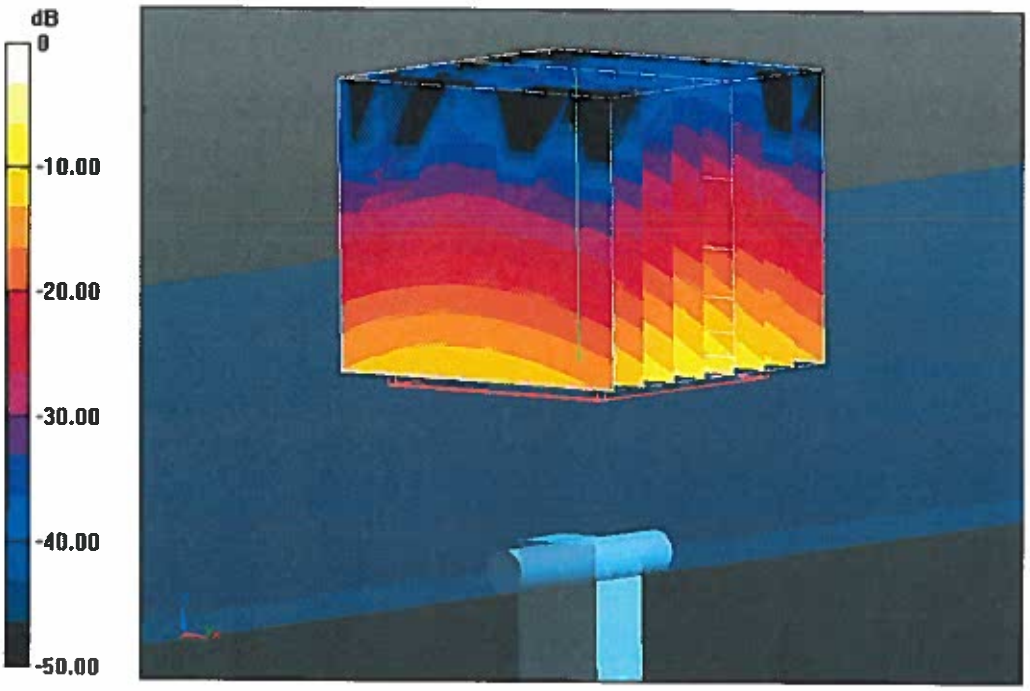
DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.41, 5.41, 5.41); Calibrated: 28.12.2012, ConvF(4.91, 4.91, 4.91); Calibrated: 28.12.2012, ConvF(4.81, 4.81, 4.81); Calibrated: 28.12.2012;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.875 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 29.2 W/kg
SAR(1 g) = 7.88 W/kg; SAR(10 g) = 2.26 W/kg
Maximum value of SAR (measured) = 18.5 W/kg

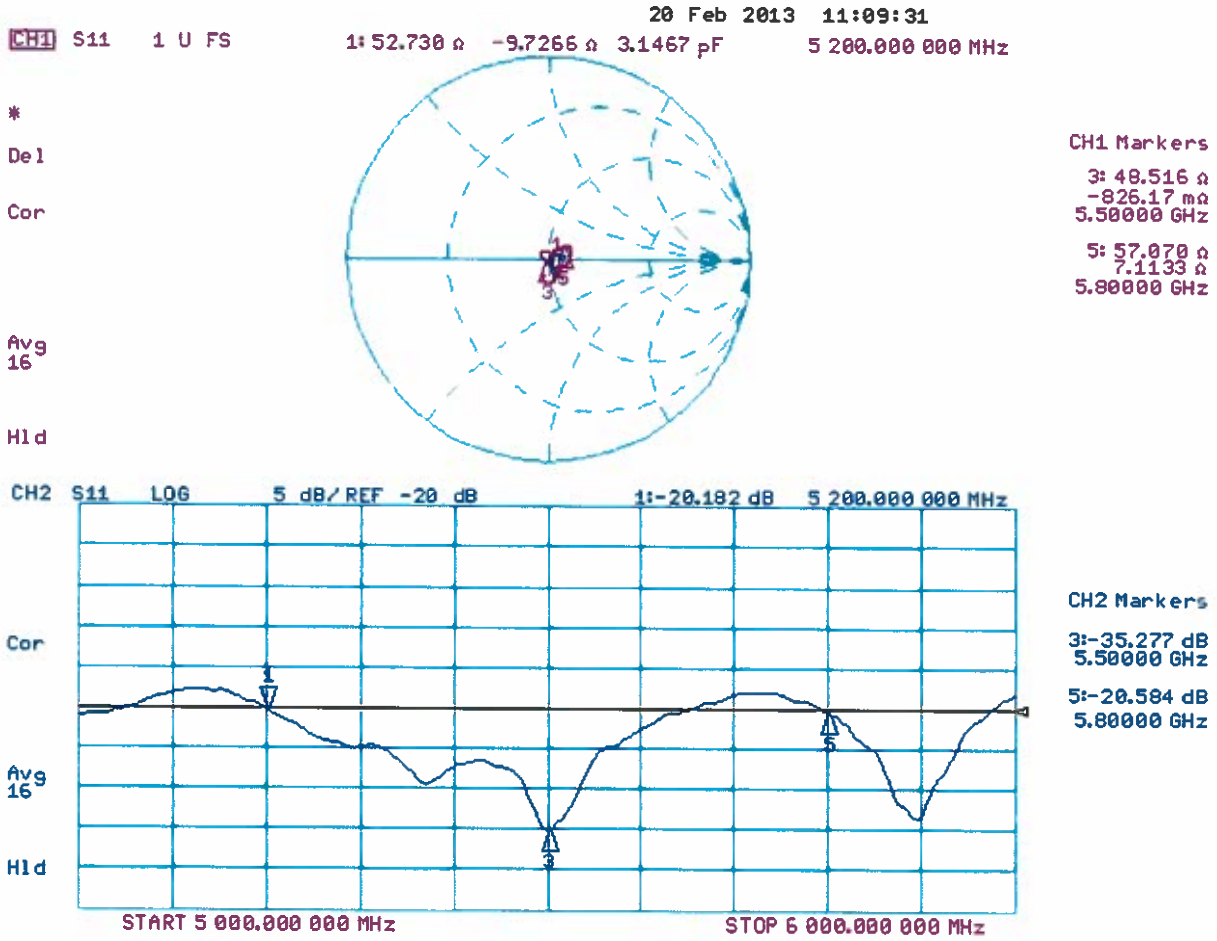
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.120 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 33.0 W/kg
SAR(1 g) = 8.34 W/kg; SAR(10 g) = 2.38 W/kg
Maximum value of SAR (measured) = 20.1 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 61.682 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 32.4 W/kg
SAR(1 g) = 7.78 W/kg; SAR(10 g) = 2.22 W/kg
Maximum value of SAR (measured) = 19.1 W/kg



0 dB = 19.1 W/kg = 12.81 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 14.02.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1016

Communication System: CW; Frequency: 5200 MHz, Frequency: 5500 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 5.36 S/m; ε_r = 46.9; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 5.71 S/m; ε_r = 46.3; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 6.12 S/m; ε_r = 45.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

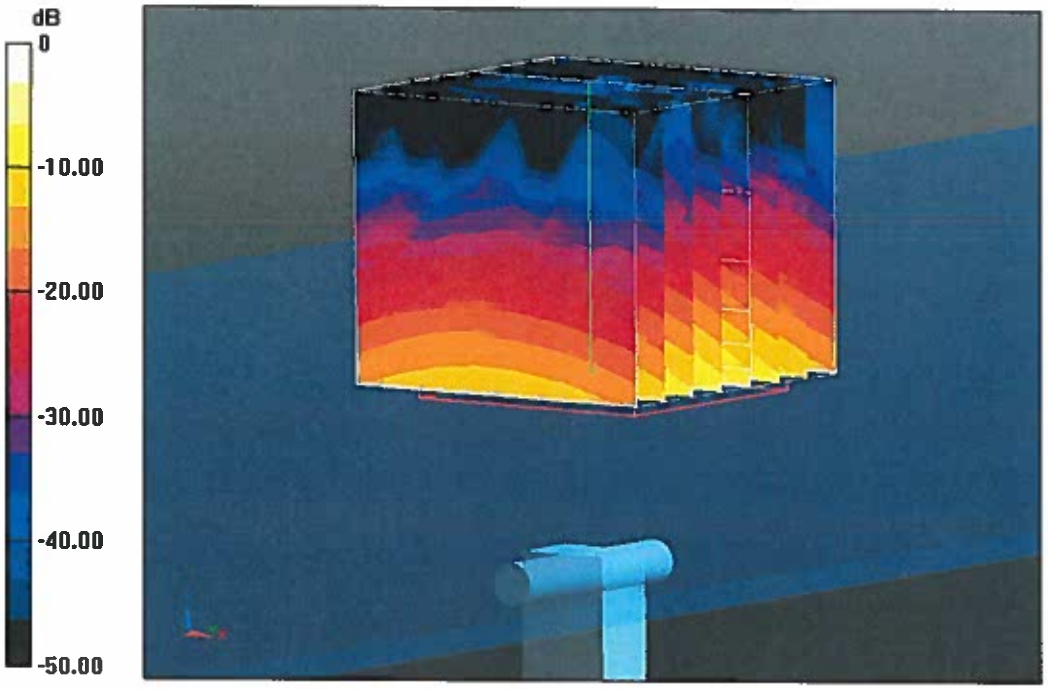
DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.91, 4.91, 4.91); Calibrated: 28.12.2012, ConvF(4.43, 4.43, 4.43); Calibrated: 28.12.2012, ConvF(4.38, 4.38, 4.38); Calibrated: 28.12.2012;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 60.072 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 30.6 W/kg
SAR(1 g) = 7.58 W/kg; SAR(10 g) = 2.13 W/kg
Maximum value of SAR (measured) = 18.0 W/kg

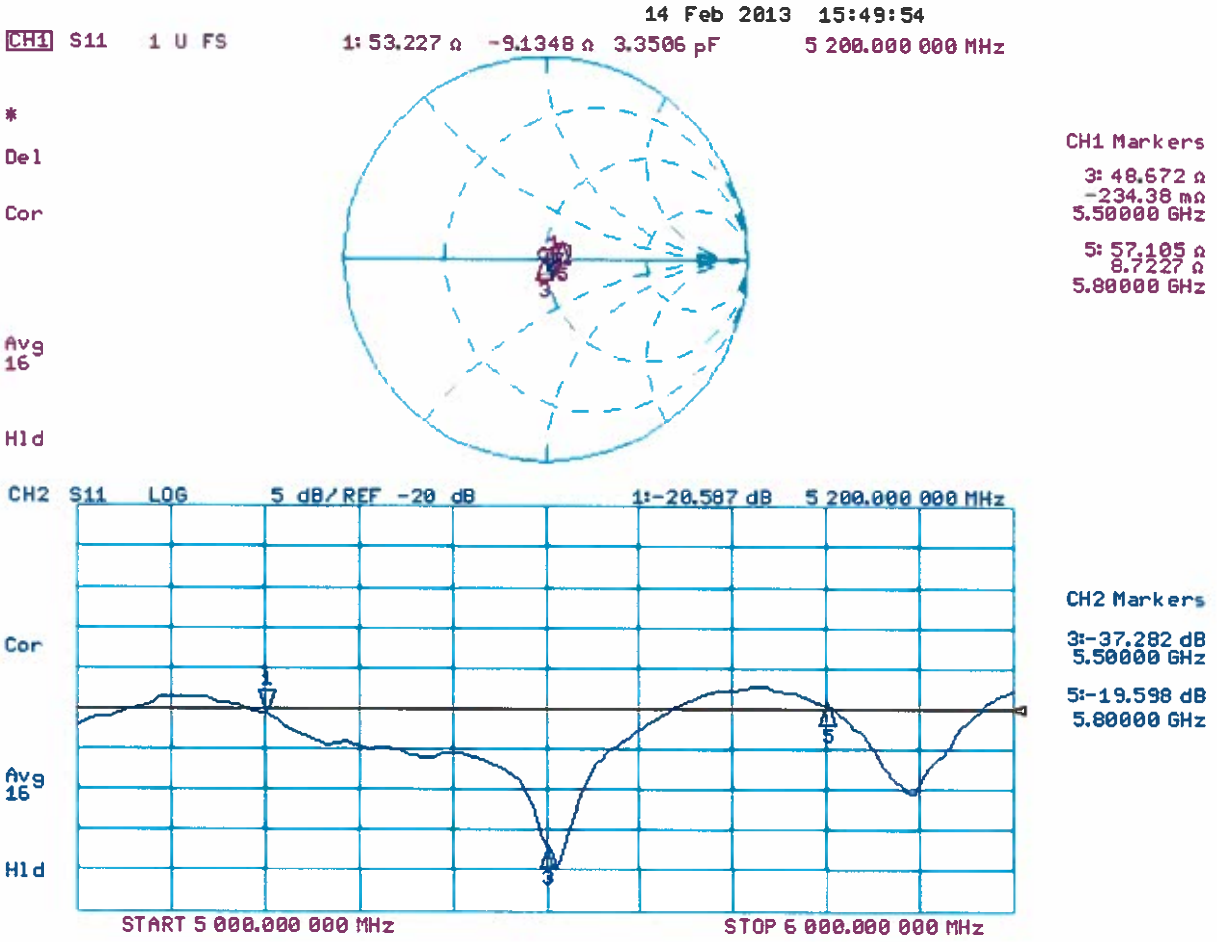
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 59.550 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 35.1 W/kg
SAR(1 g) = 7.98 W/kg; SAR(10 g) = 2.23 W/kg
Maximum value of SAR (measured) = 19.5 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 56.431 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 35.6 W/kg
SAR(1 g) = 7.51 W/kg; SAR(10 g) = 2.09 W/kg
Maximum value of SAR (measured) = 18.8 W/kg



0 dB = 18.8 W/kg = 12.74 dBW/kg

Impedance Measurement Plot for Body TSL



Appendix 2. Measurement Methods

A.2.1. Evaluation Procedure

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

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

(ii) For body worn devices or devices which can be operated within 20 cm of the body, the flat section of the SAM phantom was used were the size of the device(s) is normal. for bigger devices and base station the 2mm Oval phantom is used for evaluation. The type of device being evaluated dictated the distance of the EUT to the outer surface of the phantom flat section.

b) The SAR was determined by a pre-defined procedure within the DASY4 software. The exposed region of the phantom was scanned near the inner surface with a grid spacing of 20mm x 20mm or appropriate resolution.

c) A 5x5x7 matrix for measurement < 2.0 GHz, 7x7x7 matrix for measurement 2.0 GHz to 3.0 GHz, and 7x7x12 for > 5.0 GHz was performed around the greatest spatial SAR distribution found during the area scan of the applicable exposed region. SAR values were then calculated using a 3-D spline interpolation algorithm and averaged over spatial volumes of 1 and 10 grams.

d) If the EUT had any appreciable drift over the course of the evaluation, then the EUT was re-evaluated. Any unusual anomalies over the course of the test also warranted a re-evaluation.

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

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

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

The test was performed in a shielded enclosure with the temperature controlled to remain between +18.0ºC and +25.0ºC. The tissue equivalent material fluid temperature was controlled to give a maximum variation of ± 2.0ºC

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

Following the successful system Check and material dielectric property measurements, a SAR versus time sweep shall be performed within 10 mm of the phantom inner surface. If the EUT power output is stable after three minutes then the measurement probe will perform a coarse surface level scan at each test position in order to ascertain the location of the maximum local SAR level. Once this area had been established, a 5x5x7 cube of 175 points below 4.5 GHz and above 4.5GHz 7x7x9 cube of 441 points (5 mm spacing in each axis ≈ 27g) will be centred at the area of concern. Extrapolation and interpolation will then be carried out on the 27g of tissue and the highest averaged SAR over a 1g 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 or 7x7x9 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.