



TEST REPORT

Test of: C6606

To: OET Bulletin 65 Supplement C: (2001-01)
IEEE1528: 2003

FCC ID: PY7PM-0520

Test Report Serial No:
UL-SAR-RP92375JD02A V4.0

Version 4.0 supersedes all previous versions

This Test Report Is Issued Under The Authority of
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(APPROVED SIGNATORY)

Checked By: Naseer Mirza

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(APPROVED SIGNATORY)

Issue Date: 30 April 2013

Test Dates: 31 January 2013 to 27 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)	✓
Specific Absorption Rate - PCS 1900	OET Bulletin 65 Supplement C: (2001-01)	✓
Specific Absorption Rate - UMTS FDD 2	OET Bulletin 65 Supplement C: (2001-01)	✓
Specific Absorption Rate - UMTS FDD 4	OET Bulletin 65 Supplement C: (2001-01)	✓
Specific Absorption Rate - UMTS FDD 5	OET Bulletin 65 Supplement C: (2001-01)	✓
Specific Absorption Rate - LTE Band 4 (1.4 MHz & 20MHz)	OET Bulletin 65 Supplement C: (2001-01)	✓
Specific Absorption Rate - Wi-Fi 802.11b/g/n 2.4 GHz	OET Bulletin 65 Supplement C: (2001-01)	✓
Specific Absorption Rate- Wi-Fi 802.11a /n 5.0 GHz	OET Bulletin 65 Supplement C: (2001-01)	✓
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	0.661	PCE	24.5	0.697
	PCS1900	0.208		21.5	
	UMTS FDD 2	0.301		23.0	
	UMTS FDD 4	0.423		23.5	
	UMTS FDD 5	0.697		24.5	
	LTE Band 4	0.476		23.7	
	WLAN 2.4 GHz	1.086	DTS	16.0	1.086
	WLAN 5.8 GHz	0.162		9.9	
	WLAN 5.2/5.3/5.6 GHz	0.436	NII	9.9	0.436
HOTSPOT (Separation Distance 10mm)	GSM850	0.732	PCE	26.0	1.473
	PCS1900	1.015		22.5	
	UMTS FDD 2	1.222		23.0	
	UMTS FDD 4	1.390		23.5	
	UMTS FDD 5	0.667		24.5	
	LTE Band 4	1.473		23.7	
	WLAN 2.4 GHz	0.274	DTS	16.0	0.274
	WLAN 5.8 GHz	-		-	
	WLAN 5.2/5.3/5.6 GHz	-	NII	-	-
BODY-WORN (Separation Distance 15mm)	GSM850	0.362	PCE	24.5	0.533
	PCS1900	0.306		21.5	
	UMTS FDD 2	0.533		23.0	
	UMTS FDD 4	0.452		23.5	
	UMTS FDD 5	0.448		24.5	
	LTE Band 4	0.530		23.7	
	WLAN 2.4 GHz	0.116	DTS	16.0	0.116
	WLAN 5.8 GHz	-		-	
	WLAN 5.2/5.3/5.6 GHz	-	NII	-	-

2.2. Highest Reported SAR (Continued):

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.

Simultaneous Transmitter Evaluation:

Exposure Configuration	Technology Band	Highest Reported 1g SAR (W/kg)	Equipment Class	Max Rated Source base Avg Power + Max Tolerance [dBm]	Highest Reported Sum-SAR 1g-SAR (W/kg)	SPLSR Ratio
HEAD (Separation Distance 0mm)	UMTS FDD 5	0.493	PCE	24.5	1.579	N/A
	WLAN 2.4GHz	1.086	DTS	16.0		
HOTSPOT (Separation Distance 10mm)	LTE Band 4	1.353	PCE	23.7	1.627*	0.016
	WLAN 2.4GHz	0.274	DTS	16.0		
	LTE Band 4	1.353	PCE	23.7	1.541	N/A
	Bluetooth	0.188	DSS	9.6		
BODY-WORN (Separation Distance 15mm)	UMTS FDD 2	0.533	PCE	23.0	0.649	N/A
	WLAN 2.4GHz	0.116	DSS	16.0		
	UMTS FDD 2	0.533	PCE	23.0	0.659	N/A
	Bluetooth	0.126	DSS	16.0		

Note(s):

1. As per FCC KDB 447498 D01, the individual test positions of each exposure conditions were considered separately for the sum of 1g reported SAR Simultaneous Transmission test exclusion. See section 7.4 for Worst case simultaneous transmission analysis.
2. See section 7.5 for calculations - As per FCC KDB publication 447498, for cases where sum of WWAN and WLAN (or WPAN) 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 $(\text{SAR}_1 + \text{SAR}_2)^{1.5} / R_i \leq 0.04$ for 1-g, where R_i is the antenna separation distance 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
HEAD (Separation Distance 0mm)	WLAN 2.4GHz (Original)	0.946	DTS	15.4	1.01
	WLAN 2.4GHz (Repeated)	0.938			
HOTSPOT (Separation Distance 10mm)	PCS 1900 (Original)	0.890	PCE	22.0	1.02
	PCS 1900 (Repeated)	0.873		22.3	1.04
	UMTS FDD 2 (Original)	1.040		22.6	1.12
	UMTS FDD 2 (Repeated)	0.998		22.7	1.02
	UMTS FDD 4 (Original)	1.130			
	UMTS FDD 4 (Repeated)	1.010			
	LTE Band 4 (Original)	1.170			
	LTE Band 4 (Repeated)	1.150			

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 ($\sim 10\%$ 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	33.0	-1.0 ~ +0.5
PCS1900	30.0	-1.0 ~ +0.5

Bands	GPRS							
	Tx Slot 1		Tx Slot 2		Tx Slot 3		Tx Slot 4	
	Target (dBm)	Tolerance ± (dB)						
GSM850	33.0	-1.0 ~ +0.5	30.5	-1.0 ~ +0.5	29.5	-1.0 ~ +0.5	28.5	-1.0 ~ +0.5
PCS1900	30.0	-1.0 ~ +0.5	27.5	-1.0 ~ +0.5	26.0	-1.0 ~ +0.5	25.0	-1.0 ~ +0.5

Bands	EDGE GMSK (MCS1-4)							
	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	33.0	-1.0 ~ +0.5	30.5	-1.0 ~ +0.5	29.5	-1.0 ~ +0.5	28.5	-1.0 ~ +0.5
PCS1900	30.0	-1.0 ~ +0.5	27.5	-1.0 ~ +0.5	26.0	-1.0 ~ +0.5	25.0	-1.0 ~ +0.5

Bands	EDGE 8PSK (MCS5-9)							
	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	-1.0 ~ +1.0	25.5	-1.0 ~ +1.0	24.5	-1.0 ~ +1.0	22.5	-1.0 ~ +1.0
PCS1900	26.0	-1.0 ~ +1.0	24.5	-1.0 ~ +1.0	23.5	-1.0 ~ +1.0	22.5	-1.0 ~ +1.0

Bands	CS			HS		
	Target (dBm)	Tolerance ± (dB)		Target (dBm)	Tolerance ± (dB)	
UMTS FDD 2	22.5	-1.0 ~ +0.5		22.5	-1.0 ~ +0.5	
UMTS FDD 4	23.0	-1.0 ~ +0.5		23.0	-1.0 ~ +0.5	
UMTS FDD 5	24.0	-1.0 ~ +0.5		24.0	-1.0 ~ +0.5	

Nominal and Maximum Output power (Continued):

Bands	Target (dBm)						Tolerance ± (dB)	
	QPSK			16QAM				
	1RB	50% RB	100% RB	1RB	50% RB	100% RB		
LTE Band 4	23.0	23.0	23.0	23.0	23.0	23.0	-1.0 ~ +0.7	

	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 Power {Target + Upper Tolerance} (dBm)	16.0	16.0	15.0	15.0	14.0	14.0

	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						
Max Power {Target + Upper Tolerance} (dBm)	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9

	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 Power {Target + Upper Tolerance} (dBm)	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0

	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 Power {Target + Upper Tolerance} (dBm)	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0

Band	Max Power {Target (dBm) + Upper Tolerance (dB)}
Bluetooth	9.6

Note:

- As per KDB865664 D02 SAR Reporting v01, 2.1.4(a), the nominal and maximum average source based rated power, declared by manufacturer are shown in the above tables.
- 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.

3.2. Methods and Procedures Reference Documentation

The methods and procedures used were as detailed in:

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

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

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

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 Xmitter and Ant v01

KDB 941225 D01 SAR test for 3G devices v02

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

KDB 941225 D05 SAR for LTE Devices v02

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:	C6606
Type Number:	PM-0520-BV
Serial Number:	BX903DKQSH
IMEI Number:	00440245-081715-4
Hardware Version Number:	TP2
Software Version Number:	10.2.G.0.4
Hardware Revision of GSM Module:	Not Specified
Software Revision of GSM Module:	Not Specified
FCC ID Number:	PY7PM-0520
Industry Canada ID Number:	4170B-PM0520
Country of Manufacture:	China
Date of Receipt:	31 January 2013

Note(s):

This sample was used to perform WWAN SAR evaluation measurements on bands GSM850, UMTS FDD 5, LTE Band 4 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"

Description:	Mobile Handset
Brand Name:	Sony
Model Name or Number:	C6606
Type Number:	PM-0520-BV
Serial Number:	BX903DK1QF
IMEI Number:	00440245-081723-8
Hardware Version Number:	TP2
Software Version Number:	10.2.G.0.4
Hardware Revision of GSM Module:	Not Specified
Software Revision of GSM Module:	Not Specified
FCC ID Number:	PY7PM-0520
Industry Canada ID Number:	4170B-PM0520
Country of Manufacture:	China
Date of Receipt:	31 January 2013

Note(s):

This sample was used to perform WWAN SAR evaluation measurements on bands UMTS FDD 4 Body and LTE Band 4 (1.4MHz Channel BW) 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"

Identification of Equipment Under Test (EUT) (Continued):

Description:	Mobile Handset
Brand Name:	Sony
Model Name or Number:	C6606
Type Number:	PM-0520-BV
Serial Number:	BX903DKQSB
IMEI Number:	00440245-081721-2
Hardware Version Number:	TP2
Software Version Number:	10.2.G.0.4
Hardware Revision of GSM Module:	Not Specified
Software Revision of GSM Module:	Not Specified
FCC ID Number:	PY7PM-0520
Industry Canada ID Number:	4170B-PM0520
Country of Manufacture:	China
Date of Receipt:	31 January 2013

Note(s):

This sample was used to perform WWAN SAR evaluation measurements on bands PCS1900, UMTS FDD 2, UMTS FDD 4 Head and LTE Band 4 (20MHz Channel BW) 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:	C6606
Type Number:	PM-0520-BV
Serial Number:	BX903DK1R4
IMEI Number:	000440245-081719-6
Hardware Version Number:	TP2
Software Version Number:	s_atp_yuga_0_0_32_3_f
Hardware Revision of GSM Module:	Not Specified
Software Revision of GSM Module:	Not Specified
FCC ID Number:	PY7PM-0520
Industry Canada ID Number:	4170B-PM0520
Country of Manufacture:	China
Date of Receipt:	31 January 2013

Note(s):

This sample was used to perform WLAN SAR evaluation measurements on bands WLAN 2.4 GHz Head and WLAN 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:	C6606
Type Number:	PM-0520-BV
Serial Number:	BX903DK1S7
IMEI Number:	00440245-081700-6
Hardware Version Number:	TP2
Software Version Number:	s_atp_yuga_0_0_32_3_f
Hardware Revision of GSM Module:	Not Specified
Software Revision of GSM Module:	Not Specified
FCC ID Number:	PY7PM-0520
Industry Canada ID Number:	4170B-PM0520
Country of Manufacture:	China
Date of Receipt:	31 January 2013

Note(s):

This sample was used to perform WLAN SAR evaluation measurements on bands WLAN 2.4 GHz 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:	C6606
Type Number:	PM-0520-BV
Serial Number:	BX903DK1S6
IMEI Number:	00440245-081649-5
Hardware Version Number:	TP2
Software Version Number:	10.2.G.0.4
Hardware Revision of GSM Module:	Not Specified
Software Revision of GSM Module:	Not Specified
FCC ID Number:	PY7PM-0520
Industry Canada ID Number:	4170B-PM0520
Country of Manufacture:	China
Date of Receipt:	31 January 2013

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"

Identification of Equipment Under Test (EUT) (Continued):

Description:	Mobile Handset
Brand Name:	Sony
Model Name or Number:	C6606
Type Number:	PM-0520-BV
Serial Number:	BX903DK1RT
IMEI Number:	00440245-081720-4
Hardware Version Number:	TP2
Software Version Number:	s_atp_yuga_0_0_32_3_f
Hardware Revision of GSM Module:	Not Specified
Software Revision of GSM Module:	Not Specified
FCC ID Number:	PY7PM-0520
Industry Canada ID Number:	4170B-PM0520
Country of Manufacture:	China
Date of Receipt:	31 January 2013

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"

4.2. Description of EUT

The Equipment Under Test is a Smart Phone with GSM 2G Quad Band, 3G Penta band, LTE Uni 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) , LTE Band 4, WLAN 802.11 a/b/g/n, Bluetooth Class 1, Personal hotspot mode and RFID mode capabilities.

4.3. Modifications Incorporated in the EUT

EUT (IMEI: 00440245-081715-4) is used to perform GSM850, UMTS FDD 5, LTE Band 4 Head SAR measurements only.

EUT (IMEI: 00440245-081723-8) is used to perform UMTS FDD 4 Body and LTE Band 4 (1.4MHz Channel BW) Body SAR measurements only.

EUT (IMEI: 00440245-081721-2) is used to perform PCS1900, UMTS FDD 2, UMTS FDD 4 Head and LTE Band 4 (20MHz Channel BW) Body SAR measurements only.

EUT (IMEI: 00440245-081719-6) is used to perform WLAN 2.4 GHz Head and WLAN 5GHz Head SAR measurements only.

EUT (IMEI: 00440245-081700-6) is used to perform WLAN 2.4 GHz Body SAR measurements only.

EUT (IMEI: 00440245-081649-5) is used to perform WWAN conducted power measurements only.

EUT (IMEI: 00440245-081720-4) is used to perform WLAN conducted power measurements

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:	MH750
Serial Number:	12060C160061850
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

Description:	Radio Communication Analyzer
Brand Name:	Anritsu
Model Name or Number:	MT8820C
Serial Number:	6200938937
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, UMTS FDD 4, UMTS FDD 5 LTE Band 2, LTE Band 4, LTE Band 5, LTE Band 17 WiFi802.11 a/b/g/n	
Type of Unit	Portable Transceiver	
Intended Operating Environment:	Within GSM, UMTS, LTE, WiFi and <i>Bluetooth</i> 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.
	LTE Band 4	Communication Test Set configured to allow to EUT to transmit at a maximum power as per KDB 941225 D05.
	2.4 GHz Wi-Fi 802.11b/g/n	Test Software was used to configure the EUT to transmit at a maximum power of up to 15.9dBm.
	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 9.5dBm.
	<i>Bluetooth</i>	:= 9.12 mW or ~9.60 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
	LTE Band 4	1710 to 1755 MHz
	2.4 GHz Wi-Fi 802.11b/g/n	2412 to 2462 MHz
	5.0 GHz Wi-Fi 802.11a/n (HT20 / HT40)	5180 to 5825 MHz

Additional Information Related to Testing (Continued)

Transmitter Frequency Allocation of EUT When Under Test:	Bands	Channel Number	Channel Description	Frequency (MHz)
		128	Low	824.2
GSM850	GSM850	190	Middle	836.6
		251	High	848.8
		512	Low	1850.2
PCS1900	PCS1900	661	Middle	1880.0
		810	High	1909.8
		9262	Low	1852.4
UMTS FDD 2	UMTS FDD 2	9400	Middle	1880.0
		9538	High	1907.6
		1312	Low	1712.4
UMTS FDD 4	UMTS FDD 4	1412	Middle	1732.6
		1513	High	1752.6
		4132	Low	826.4
UMTS FDD 5	UMTS FDD 5	4183	Middle	836.6
		4233	High	846.6
		20050(20MHz)	Low	1720.0
LTE Band 4	LTE Band 4	20175(20MHz)	Middle	1732.5
		20300(20MHz)	High	1745.0
		19957(1.4MHz)	Low	1710.7
		20175(1.4MHz)	Middle	1732.5
		20393(1.4MHz)	High	1754.3
		1	Low	2412.0
2.4 GHz Wi-Fi 802.11b/g/n	2.4 GHz Wi-Fi 802.11b/g/n	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/HSPA):0Hz DBPSK, BPSK, CCK (Wi-Fi): 0 Hz FDD (QPSK/ 16QAM): 0 Hz
Modulation Scheme (Crest Factor):	GSMK (GSM): 8.3 GMSK (GPRS850/GPRS1900): 2 DBPSK, BPSK, CCK (Wi-Fi): 1 QPSK(UMTS FDD / HSDPA): 1 FDD (QPSK/ 16QAM): 1
Antenna Type:	Internal integral
Antenna Length:	Unknown
Number of Antenna Positions:	1 fixed (WWAN) 1 fixed (WLAN/Bluetooth/GPS) 1 fixed (Diversity)
Power Supply Requirement:	3.7V
Battery Type(s):	Li-ion

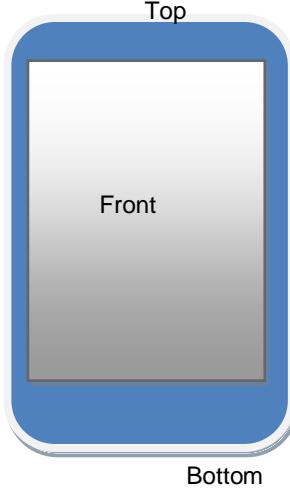
Additional Information Related to LTE Test parameter

#	Description	Parameter
1	Identify the operating frequency range of each LTE transmission FCC band used by the device	Band 4: frequency range – 1710 MHz– 1755 MHz
2	Identify the channel bandwidths used in each frequency band; e.g.: 1.4, 3, 5, 10, 15, 20 MHz etc.	Channel Bandwidths used are: B4 (1.4, 3, 5, 10, 15, 20) MHz
3	Identify the high, middle and low (L, M, H) channel numbers and frequencies tested in each LTE frequency band	B4 -20 MHz (H,M,L)=(20050, 20175, 204300) (1720, 1732.5, 1745) MHz B4 -1.4MHz (H,M,L)=(19957, 20175, 20393) (1710.7, 1732.5, 1754.3) MHz
4	Specify the UE category and uplink modulations used	The UE Category is 3 and the Uplink modulations used are QPSK, 16QAM.

Additional Information Related to LTE Test parameter (Continued):

#	Description	Parameter
5	Descriptions of the LTE transmitter and antenna implementation & identify whether it is a standalone transmitter operating independently of other wireless transmitters in the device or sharing hardware components and/or antenna(s) with other transmitters etc.	<p>This model (C6606) has only one main antenna for LTE/UMTS/GSM bands (as pictured below).</p>

Additional Information Related to LTE Test parameter (Continued):

#	Description	Parameter
6	Identify the LTE Band Voice/data requirements in each operating mode and exposure condition with respect to head and body test configurations, antenna locations, handset flip-cover or slide positions, antenna diversity conditions, etc.	<p>The following exposure condition with respect to head and body test are required for both voice and data modes due to EUT functionality and antenna locations.</p> <ol style="list-style-type: none"> 1) Body-worn SAR is required at 15 mm separation distance 2) Mobile Hot Spot Mode will be tested by positioning the smart phone with 10 mm separation distance. - Wireless Personal Hotspot mode with consideration for the Front Display of EUT, Back of EUT, Left Hand side of EUT, Right Hand side of EUT, Top Edge of EUT and Bottom Edge of EUT with respect to the antenna location. The test separation distance between the EUT edge and phantom flat surface for this mode will be 10mm as the dimensions of the device is > 9cm x 5cm. 3) Head SAR is required in LTE mode as this model supports SVLTE operation.  <p>The diagram shows a blue smartphone with a white border. The top edge is labeled 'Top', the bottom edge is labeled 'Bottom', the left side is labeled 'Left hand side', and the right side is labeled 'Right hand side'. The front face of the phone is labeled 'Front'.</p>

Additional Information Related to LTE Test parameter (Continued):

#	Description	Parameter
7	Identify if Maximum Power Reduction (MPR) is optional or mandatory, i.e. built-in by design: a) only mandatory MPR may be considered during SAR testing, when the maximum output power is permanently limited by the MPR implemented within the UE; and only for the applicable RB (resource block) configurations specified in LTE standards b) A-MPR (additional MPR) must be disabled.	The EUT incorporates MPR as per 36.101 as shown in the section 7.2. MPR cannot be disabled after the phone is manufactured, MPR is mandatory. * Target MPR
8	Include the maximum average conducted output power measured on the required test channels for each channel bandwidth and UL modulation used in each frequency band: a) using 1 RB allocated at the low edge, centered and high edge of a channel b) using 50% RB allocated at the low edge, centered and high edge of a channel c) using 100% RB allocation	This is included in the section 7.2 of this report.
9	Identify all other U.S. wireless operating modes (3G, Wi-Fi, WiMax, Bluetooth etc), device/exposure configurations (head and body, antenna and handset flip-cover or slide positions, antenna diversity conditions etc.) and frequency bands used for these modes	The following bands are supported for the exposure conditions 1) GSM (850/1900) and UMTS FDD (850, 1700, 1900) - Exposure conditions: Head/Body worn SAR required for GSM / UMTS FDD and wireless personal hotspot. DTM is not supported. 2) Bluetooth 2.4GHz (Basic Rate & EDR) - Exposure conditions: BT SAR is not required as maximum output power < 19 mW threshold value for separation distance of 10mm & antenna separation distance > 5cm. 3) WiFi 2.4GHz - Exposure conditions: Head/Body SAR required for wireless personal hotspot. No power reduction. 4) WiFi 5 GHz - Exposure conditions: Head/Body SAR required for wireless personal hotspot. No power reduction

Additional Information Related to LTE Test parameter (Continued):

#	Description	Parameter							
10	Include the maximum average conducted output power measured for the other wireless mode and frequency bands	This is included in the section 7.2 of this report.							
11	Identify the simultaneous transmission conditions for the voice and data configurations supported by all wireless modes, device configurations and frequency bands, for the head and body exposure conditions and device operating configurations (handset flip or cover positions, antenna diversity conditions etc.)	Simultaneous transmission conditions							
#	LTE BAND Voice/ Data	GSM Voice/Dat a	UMTS Voice/ Data	Wi-Fi 802.11a/b/g /n	Bluetooth	Sum of WWAN & WLAN or WPAN			
1	X			X		X			
2		X		X		X			
3			X	X		X			
4	X				X	X			
5		X			X	X			
6			X		X	X			
	Bluetooth average power measurement is below the rated threshold therefore Individual SAR will not be tested. Sim_Tx consideration will be based on the estimated SAR level.								
12	When power reduction is applied to certain wireless modes to satisfy SAR compliance for simultaneous transmission conditions, other equipment certification or operating requirements, include the maximum average conducted output power measured in each power reduction mode applicable to the simultaneous voice/data transmission configurations for such wireless configurations and frequency bands; and also include details of the power reduction implementation and measurement setup	Not applicable.							
13	Include descriptions of the test equipment, test software, built-in test firmware etc. required to support testing the device when power reduction is applied to one or more transmitters/antennas for simultaneous voice/data transmission	Anritsu MT8820C communication simulator Communication tester which support LTE modes (voice/data) were used for testing.							
14	When appropriate, include a SAR test plan proposal with respect to the above.	Not Applicable							
15	If applicable, include preliminary SAR test data and/or supporting information in laboratory testing inquiries to address specific issues and concerns or for requesting further test reduction considerations appropriate for the device; for example simultaneous transmission configurations.	Not Applicable							

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 Xmter and Ant v01, KDB 941225 D01 SAR test for 3G devices v02, KDB 941225 D03 " SAR Test Reduction GSM/GPRS/EDGE v01", KDB 941225 D05 SAR for LTE Devices v02, KDB 941225 D06 "Hot Spot SAR v01" , KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01, KDB 865664 D02 SAR Reporting v01 , according to the handset procedures in IEEE Std 1528-2003 and OET Bulletin 65 Supplement C 01-01. The assessment for Personal Wireless Hotspot was also evaluated as per the FCC KDB 941225 D06 "Hot Spot SAR v01".

The following settings were used for DC-HSDPA:

Apply FRC H-Set 12 (QPSK) in Table C.8.1.12 of TS 34.121-1 to measure DCHSDPA uplink maximum output power using the 4 Rel. 5 HSDPA subtests in Table C.10.1.4 of TS 234.121-1

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".

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. 4-uplink was found to give the highest power reference point measurement on the DASY4 system (unit v/m) for GPRS850 and for GPRS1900. 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	13.72	4.92
2 uplink	14.46	5.29
3 uplink	15.66	5.43
4 uplink	16.11	5.60

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.

For LTE testing, as per KDB 941225 D05, when the maximum average conducted output power for a smaller channel Bandwidth is >0.5 dB higher than that measured for the highest channel Bandwidth, the largest channel Bandwidth test procedures are applied to the smaller channel Bandwidth. Hence, for LTE Band 4, testing was performed on both largest channel Bandwidth and 1.4MHz channel Bandwidth.

As per 648474 D04 SAR Handsets Multi Xmter and Ant v01, "When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset". Hence, Body worn configurations were not evaluated with PHF attached.

6. Operation and Configuration of the EUT during Testing

6.1. Operating Modes

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

- GSM850 – Voice allocated mode with Communication Test Set configured to allow the EUT to transmit at a maximum power using Power Control Level (PCL) setting of 5.
- 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 4 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 2, 4, 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)

- LTE Band 4 data allocated mode at QPSK on the 1.4MHz BW and 20MHz BW channels, using a Communication Test Set configured to allow to EUT to transmit at a maximum power as per KDB 941225 D05.
- 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 15.9 dBm for 'b' mode and 14.5 dBm for 'g' and 13.5 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 9.5 dBm for 'a' mode and 8.9 dBm for 'n' modes.

6.1. Configuration and Peripherals

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

- Standalone fully charged battery powered.
- Head, Hotspot Mode 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. 4-uplink was found to give the highest power reference point measurement on the DASY4 system (unit v/m) for GPRS850 and for GPRS1900. 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 than 0mm separation the EUT was positioned as per the touch-safe position, and then the vertical height was decreased/adjusted as required.
- e) SAR measurements were evaluated at maximum power and the unit was operated for an appropriate period prior to the evaluation in order to minimise the drift.
- f) The device was keyed to operate continuously in the transmit mode for the duration of the test.
- g) The location of the maximum spatial SAR distribution (hot spot) was determined relative to the 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
WLAN	Head	0mm	Front	<25mm	Yes
			Back	<25mm	Yes
			Touch Left	<25mm	Yes
			Tilt Left	<25mm	Yes
	Hotspot	10mm	Touch Right	<25mm	Yes
			Tilt Right	<25mm	Yes
			Front	<25mm	Yes
			Back	<25mm	Yes
			Top Edge	<25mm	Yes
			Bottom Edge	>25mm	No
	Body	15mm	Right Edge	<25mm	Yes
			Left Edge	>25mm	No

Note(s):

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:

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

- $f_{(\text{GHz})}$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation¹⁷
- The result is rounded to one decimal place for comparison

¹⁶ Taken from FCC KDB publication 447498 D01v05

6.3. SAR Test Exclusion Consideration

Frequency Band	Configuration(s)		
	Head	Hotspot Mode	Body-worn
GSM850	No	No	No
PCS1900	No	No	No
UMTS FDD 2	No	No	No
UMTS FDD 4	No	No	No
UMTS FDD 5	No	No	No
LTE Band 4	No	No	No
WLAN 2.4 GHz	No	No	No
WLAN 5.0 GHz	No	Yes	Yes
Bluetooth	N/A	Yes	Yes

Note:

- As per KDB 447498 D01 General RF Exposure Guidance v05, The Frequency Bands with Rated Power including Upper tolerance, which qualify for **Standalone SAR Test Exclusion**, are as per the above table.

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:

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

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

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

Applying the above formula for WLAN 5.0GHz Hotspot Mode we get:

- For 5200MHz, $[(9.77)/10] * [\sqrt{5.2}] = 2.2 \leq 3.0$
- For 5500MHz, $[(9.77)/10] * [\sqrt{5.5}] = 2.3 \leq 3.0$
- For 5800MHz, $[(9.77)/10] * [\sqrt{5.8}] = 2.4 \leq 3.0$

Applying the above formula for WLAN 5.0GHz Body-worn we get:

- For 5200MHz, $[(9.77)/15] * [\sqrt{5.2}] = 1.5 \leq 3.0$
- For 5500MHz, $[(9.77)/15] * [\sqrt{5.5}] = 1.5 \leq 3.0$
- For 5800MHz, $[(9.77)/15] * [\sqrt{5.8}] = 1.6 \leq 3.0$

Hence, testing is not required on WLAN 5.0GHz Hotspot Mode and Body-worn.

Applying the above formula for Bluetooth Hotspot Mode we get:

- For 2450MHz, $[(9.12)/10] * [\sqrt{2.45}] = 1.4 \leq 3.0$

Applying the above formula for Bluetooth Body-worn we get:

- For 2450MHz, $[(9.12)/15] * [\sqrt{2.45}] = 1.0 \leq 3.0$

Hence, testing is not required on Bluetooth Hotspot Mode and Body-worn configurations.

- The details for the **Maximum Rated Power** and tolerance(s) can be found in section 2.5.

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

Channel Number	Frequency (MHZ)	Power (dBm)	Avg. Burst Power with consideration for uplink time slot (dBm)	Note
128	824.2	32.8	23.8	Conducted, GMSK
190	836.6	32.7	23.7	Conducted, GMSK
251	848.8	32.7	23.7	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	32.8	30.4	29.2	28.2	Conducted, GMSK
190	836.6	32.7	30.3	29.2	28.3	Conducted, GMSK
251	848.8	32.7	30.2	29.2	28.3	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	23.8	24.4	24.9	25.2	Conducted, GMSK
190	836.6	23.7	24.3	24.9	25.3	Conducted, GMSK
251	848.8	23.7	24.2	24.9	25.3	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	32.8	30.4	29.2	28.2	Conducted, GMSK
190	836.6	32.7	30.3	29.2	28.3	Conducted, GMSK
251	848.8	32.7	30.2	29.2	28.3	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	23.8	24.4	24.9	25.2	Conducted, GMSK
190	836.6	23.7	24.3	24.9	25.3	Conducted, GMSK
251	848.8	23.7	24.2	24.9	25.3	Conducted, GMSK

Note:

Scale factor for uplink time slot:

- 1 Uplink: time slot ratio = 8:1 => $10 \log(8/1) = 9.03 \text{ dB}$
- 2 Uplink: time slot ratio = 8:2 => $10 \log(8/2) = 6.02 \text{ dB}$
- 3 Uplink: time slot ratio = 8:3 => $10 \log(8/3) = 4.26 \text{ dB}$
- 4 Uplink: time slot ratio = 8:4 => $10 \log(8/4) = 3.01 \text{ dB}$

EDGE (MCS9 ~ 8PSK)**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	27.0	25.4	24.4	22.4	Conducted, 8PSK
190	836.6	27.0	25.4	24.4	22.4	Conducted, 8PSK
251	848.8	27.0	25.4	24.4	22.4	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	18.0	19.4	20.1	19.4	Conducted, 8PSK
190	836.6	18.0	19.4	20.1	19.4	Conducted, 8PSK
251	848.8	18.0	19.4	20.1	19.4	Conducted, 8PSK

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

- 1 Uplink: time slot ratio = 8:1 => $10 \log(8/1) = 9.03 \text{ dB}$
- 2 Uplink: time slot ratio = 8:2 => $10 \log(8/2) = 6.02 \text{ dB}$
- 3 Uplink: time slot ratio = 8:3 => $10 \log(8/3) = 4.26 \text{ dB}$
- 4 Uplink: time slot ratio = 8:4 => $10 \log(8/4) = 3.01 \text{ dB}$

7.2.2. Conducted Average Power Measurement 2G: PCS1900

Channel Number	Frequency (MHz)	Power (dBm)	Avg. Burst Power with consideration for uplink time slot (dBm)	Note
512	1850.2	30.0	21.0	Conducted, GMSK
661	1880.0	29.7	20.7	Conducted, GMSK
810	1909.8	29.8	20.8	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	30.0	27.5	26.0	25.0	Conducted, GMSK
661	1880.0	29.7	27.3	25.8	24.8	Conducted, GMSK
810	1909.8	29.8	27.3	25.9	24.9	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	21.0	21.5	21.7	22.0	Conducted, GMSK
661	1880.0	20.7	21.3	21.5	21.8	Conducted, GMSK
810	1909.8	20.8	21.3	21.6	21.9	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	30.0	27.5	26.0	25.0	Conducted, GMSK
661	1880.0	29.7	27.3	25.8	24.8	Conducted, GMSK
810	1909.8	29.8	27.3	25.9	24.9	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	21.0	21.5	21.7	22.0	Conducted, GMSK
661	1880.0	20.7	21.3	21.5	21.8	Conducted, GMSK
810	1909.8	20.8	21.3	21.6	21.9	Conducted, GMSK

Note:

Scale factor for uplink time slot:

- 1 Uplink: time slot ratio = 8:1 => $10 \log(8/1) = 9.03 \text{ dB}$
- 2 Uplink: time slot ratio = 8:2 => $10 \log(8/2) = 6.02 \text{ dB}$
- 3 Uplink: time slot ratio = 8:3 => $10 \log(8/3) = 4.26 \text{ dB}$
- 4 Uplink: time slot ratio = 8:4 => $10 \log(8/4) = 3.01 \text{ dB}$

EDGE (MCS9 ~ 8PSK):**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	26.0	24.6	23.6	22.7	Conducted, 8PSK
661	1880.0	25.8	24.5	23.5	22.5	Conducted, 8PSK
810	1909.8	25.9	24.5	23.6	22.6	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	17.0	18.6	19.3	19.7	Conducted, 8PSK
661	1880.0	16.8	18.5	19.2	19.5	Conducted, 8PSK
810	1909.8	16.9	18.5	19.3	19.6	Conducted, 8PSK

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

- 1 Uplink: time slot ratio = 8:1 => $10 \log(8/1) = 9.03 \text{ dB}$
- 2 Uplink: time slot ratio = 8:2 => $10 \log(8/2) = 6.02 \text{ dB}$
- 3 Uplink: time slot ratio = 8:3 => $10 \log(8/3) = 4.26 \text{ dB}$
- 4 Uplink: time slot ratio = 8:4 => $10 \log(8/4) = 3.01 \text{ dB}$

7.2.3. Conducted Average Power Measurement 3G:

Modes		HSDPA				HSUPA				WCDMA	
Sets		1	2	3	4	1	2	3	4	5	Voice / RMC 12.2kbps
Band	Channel	Power [dBm]									
1900 (Band 2)	9262 9662	22.2	22.0	21.4	20.8	22.0	22.1	21.5	22.1	21.5	22.3
	9400 9800	22.2	21.8	21.4	20.8	22.0	22.1	21.5	22.2	21.5	22.4
	9538 9938	22.1	22.0	21.4	20.8	22.1	22.1	21.5	22.1	21.5	22.3
1700 (Band 4)	1312 1537	22.6	22.3	21.8	21.2	22.3	22.5	21.7	22.6	21.8	22.8
	1412 1637	22.4	22.2	21.7	21.1	22.2	22.3	21.6	22.5	21.6	22.6
	1513 1738	22.6	22.3	21.8	21.2	22.3	22.5	21.7	22.6	21.8	22.8
850 (Band 5)	4132 4357	23.8	23.5	22.9	22.4	23.5	23.6	22.9	23.7	22.9	23.9
	4183 4408	23.8	23.5	22.9	22.4	23.5	23.6	22.9	23.7	22.9	23.9
	4233 4458	23.7	23.5	22.9	22.4	23.4	23.6	22.8	23.6	22.9	23.8
Bc		2	12	15	15	11	6	15	2	15	
Bd		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:

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	20.5	20.7	20.9	20.9	22.3
	9662					
	9400	20.5	20.9	20.7	20.7	22.4
	9800					
1700 (Band 4)	9538	20.5	20.8	20.8	20.8	22.3
	9938					
	1312	21.0	21.1	21.1	21.2	22.8
	1537					
850 (Band 5)	1412	21.0	21.0	21.1	21.0	22.6
	1637					
	1513	21.1	21.1	21.1	21.2	22.8
	1738					
	4132	21.9	22.3	22.3	22.2	23.9
	4357					
	4183	21.8	22.3	22.3	22.2	23.9
	4408					
	4233	22.0	22.2	22.1	22.1	23.8
	4458					
β_c		2	12	15	15	
β_d		15	15	8	4	
Δ ACK, Δ NACK, Δ CQI		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 / HSPA release 6.

Sub-test Setup for Release 5 HSDPA

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

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

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

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	$\beta_{hs}^{(1)}$	B_{oc}	B_{od}	B_{od} (SF)	B_{od} (codes)	CM ⁽²⁾ (dB)	Power Back-off (dB)	AG ⁽⁴⁾ Ind ex	E-TFC I
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	94/75	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: $\Delta_{ACK}, \Delta_{NACK}$ and $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$

Note 2: CM = 1 for $\beta_c / \beta_d = 12/15, \beta_{hs}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH AND E-DPCCH 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 Table 5.1g.

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

7.2.4. Conducted Average Power Measurement: LTE Band 4 (1700 MHz)

Ch. BW	Modulations	RB Config	Start RB Offset		Power Back-off	Actual Max Power (dBm)	Measured Avg Power (dBm).		
			Frequency 1720.0 MHz (Low)	Frequency 1732.5 MHz (Middle)			Frequency 1745.0 MHz (High)		
20 MHz	QPSK	1	Low	0	(0)	23.0	22.7	22.7	22.7
		1	Mid	49	(0)	23.0	22.8	22.6	22.7
		1	High	99	(0)	23.0	22.6	22.4	22.6
		50	low	0	(1)	22.0	21.5	21.5	21.4
		50	Mid	25	(1)	22.0	21.5	21.5	21.4
		50	High	50	(1)	22.0	21.5	21.5	21.4
		100	-	0	(1)	22.0	21.5	21.5	21.4
	16QAM	1	Low	0	(1)	22.0	21.7	21.7	21.7
		1	Mid	49	(1)	22.0	21.8	21.6	21.7
		1	High	99	(1)	22.0	21.6	21.4	21.6
		50	low	0	(2)	21.0	20.5	20.5	20.5
		50	Mid	25	(2)	21.0	20.5	20.5	20.5
		50	High	50	(2)	21.0	20.5	20.5	20.5
		100	-	0	(2)	21.0	20.5	20.5	20.4
15 MHz	QPSK	RB Config	Start RB Offset		Power Back-off	Actual Max Power (dBm)	Measured Avg Power (dBm).		
			Frequency 1717.5.0 MHz (Low)	Frequency 1732.5 MHz (Middle)			Frequency 1747.5 MHz (High)		
		1	Low	0	(0)	23.0	22.6	22.6	22.6
		1	Mid	37	(0)	23.0	22.8	22.6	22.9
		1	High	74	(0)	23.0	22.6	22.4	22.6
		36	low	0	(1)	22.0	21.5	21.6	21.4
		36	Mid	19	(1)	22.0	21.5	21.6	21.4
	16QAM	36	High	39	(1)	22.0	21.5	21.6	21.4
		75	-	0	(1)	22.0	21.5	21.6	21.4
		1	Low	0	(1)	22.0	21.6	21.6	21.6
		1	Mid	37	(1)	22.0	21.8	21.6	21.8
		1	High	74	(1)	22.0	21.6	21.5	21.6
		36	low	0	(2)	21.0	20.5	20.6	20.4
		36	Mid	19	(2)	21.0	20.5	20.6	20.4
		36	High	39	(2)	21.0	20.5	20.6	20.4
		75	-	0	(2)	21.0	20.5	20.6	20.4

Conducted Average Power Measurement: LTE Band 4 (1700 MHz) (Continued):

Ch. BW	Modulations	RB Config	Start RB Offset		Power Back-off	Actual Max Power (dBm)	Measured Avg Power (dBm).		
							Frequency 1715.0 MHz (Low)	Frequency 1732.5 MHz (Middle)	Frequency 1780.0 MHz (High)
10 MHz	QPSK	1	Low	0	(0)	23.0	22.7	22.6	22.6
		1	Mid	24	(0)	23.0	22.7	22.6	22.6
		1	High	49	(0)	23.0	22.6	22.4	22.6
		25	Low	0	(1)	22.0	21.5	21.5	21.4
		25	Mid	12	(1)	22.0	21.5	21.5	21.4
		25	High	25	(1)	22.0	21.5	21.5	21.4
		50	-	0	(1)	22.0	21.5	21.5	21.4
	16QAM	1	Low	0	(1)	22.0	21.6	21.5	21.5
		1	mid	24	(1)	22.0	21.6	21.5	21.5
		1	High	49	(1)	22.0	21.6	21.4	21.6
		25	Low	0	(2)	21.0	20.5	20.5	20.5
		25	Mid	12	(2)	21.0	20.5	20.5	20.5
		25	High	25	(2)	21.0	20.5	20.5	20.5
		50	-	0	(2)	21.0	20.5	20.5	20.4
Ch. BW	Modulations	RB Config	Start RB Offset		Power Back-off	Actual Max Power (dBm)	Measured Avg Power (dBm).		
							Frequency 1712.5 MHz (Low)	Frequency 1732.5 MHz (Middle)	Frequency 1782.5 MHz (High)
5 MHz	QPSK	1	Low	0	(0)	23.0	22.6	22.7	22.7
		1	Mid	12	(0)	23.0	22.7	22.6	22.6
		1	High	24	(0)	23.0	22.6	22.6	22.6
		12	low	0	(1)	22.0	21.7	21.7	21.7
		12	Mid	6	(1)	22.0	21.7	21.7	21.7
		12	High	13	(1)	22.0	21.7	21.7	21.7
		25	-	0	(1)	22.0	21.6	21.7	21.7
	16QAM	1	Low	0	(1)	22.0	21.5	21.6	21.5
		1	Mid	12	(1)	22.0	21.6	21.5	21.5
		1	High	24	(1)	22.0	21.5	21.5	21.5
		12	low	0	(2)	21.0	20.6	20.6	20.6
		12	Mid	6	(2)	21.0	20.6	20.6	20.6
		12	High	13	(2)	21.0	20.6	20.6	20.6
		25	-	0	(2)	21.0	20.6	20.6	20.6

Conducted Average Power Measurement: LTE Band 4 (1700 MHz) (Continued):

Ch. BW	Modulations	RB Config	Start RB Offset		Power Back-off	Actual Max Power (dBm)	Measured Avg Power (dBm).		
							Frequency 1711.5 MHz (Low)	Frequency 1732.5 MHz (Middle)	Frequency 1783.5 MHz (High)
3 MHz	QPSK	1	Low	0	(0)	23.0	22.6	22.6	22.5
		1	Mid	7	(0)	23.0	22.7	22.6	22.6
		1	High	14	(0)	23.0	22.5	22.6	22.6
		8	Low	0	(1)	22.0	21.6	21.6	21.6
		8	Mid	4	(1)	22.0	21.6	21.6	21.6
		8	High	7	(1)	22.0	21.6	21.6	21.6
		15	-	0	(1)	22.0	21.6	21.6	21.6
	16QAM	1	Low	0	(1)	22.0	21.4	21.4	21.3
		1	Mid	7	(1)	22.0	21.5	21.4	21.5
		1	High	14	(1)	22.0	21.4	21.4	21.4
		8	Low	0	(2)	21.0	20.5	20.5	20.5
		8	Mid	4	(2)	21.0	20.5	20.5	20.5
		8	High	7	(2)	21.0	20.5	20.5	20.5
		15	-	0	(2)	21.0	20.5	20.5	20.5

Ch. BW	Modulations	RB Config	Start RB Offset		Power Back-off	Actual Max Power (dBm)	Measured Avg Power (dBm).		
							Frequency 1710.7 MHz (Low)	Frequency 1732.5 MHz (Middle)	Frequency 1754.3 MHz (High)
1.4 MHz	QPSK	1	Low	0	(0)	23.0	22.6	22.7	22.6
		1	Mid	3	(0)	23.0	22.6	22.7	22.6
		1	High	5	(0)	23.0	22.6	22.7	22.6
		3	Low	0	(0)	23.0	22.6	22.7	22.7
		3	Mid	1	(0)	23.0	22.6	22.7	22.7
		3	high	3	(0)	23.0	22.6	22.7	22.7
		6	-	0	(1)	22.0	21.6	21.7	21.7
	16QAM	1	Low	0	(1)	22.0	21.7	21.7	21.6
		1	Mid	3	(1)	22.0	21.7	21.8	21.6
		1	High	5	(1)	22.0	21.7	21.7	21.6
		3	Low	0	(1)	22.0	21.6	21.7	21.8
		3	Mid	1	(1)	22.0	21.6	21.7	21.8
		3	high	3	(1)	22.0	21.6	21.7	21.8
		6	-	0	(2)	21.0	20.6	20.6	20.7

**7.2.5.Conducted Power Measurements Wi-Fi802.11b/g/n
802.11b/g**

Channel Number	Frequency (MHz)	TX Power (dBm)	Note
1	2412.0	15.4	2.4GHz 802.11b (1Mbps)
6	2437.0	15.5	
11	2462.0	15.1	
1	2412.0	15.9	2.4GHz 802.11b (11Mbps)
6	2437.0	15.9	
11	2462.0	15.4	
1	2412.0	14.4	2.4GHz 802.11g (6Mbps)
6	2437.0	14.5	
11	2462.0	14.5	
1	2412.0	14.3	2.4GHz 802.11g (54Mbps)
6	2437.0	14.4	
11	2462.0	14.4	

802.11n

Channel Number	Frequency (MHz)	TX Power (dBm)	Note
1	2412.0	12.9	2.4GHz 802.11n (MCS0 6.5Mbps)
6	2437.0	13.5	
11	2462.0	13.2	
1	2412.0	12.4	2.4GHz 802.11n (MCS7 65Mbps)
6	2437.0	13.1	
11	2462.0	12.8	

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

Channel Number	Frequency (MHz)	TX Power (dBm) 6 Mbps	TX Power (dBm) 54 Mbps	Note
36*	5180.0	9.5	9.4	5.2 GHz
40	5200.0	9.5	9.4	
44	5220.0	8.7	8.7	
48*	5240.0	9.1	8.9	
52*	5260.0	9.1	8.8	5.3 GHz
56	5280.0	9.1	8.7	
60	5300.0	9.0	8.7	
64*	5320.0	9.0	8.8	
100	5500.0	8.6	8.7	5.6 GHz
104*	5520.0	9.3	9.2	
108	5540.0	9.2	9.2	
112	5560.0	9.0	8.9	
116*	5580.0	9.0	9.0	
120	5600.0	9.3	9.2	
124*	5620.0	9.1	9.1	
128	5640.0	9.2	9.1	
132	5660.0	9.1	9.0	
136*	5680.0	9.0	8.2	
140	5700.0	8.9	8.7	
149*	5745.0	9.3	9.3	
153	5765.0	9.0	8.5	5.8 GHz
157*	5785.0	8.9	8.7	
161	5805.0	8.9	8.6	
165*	5825.0	8.9	9.0	

* Default test Channels

802.11n (5.0 GHz) (HT20)

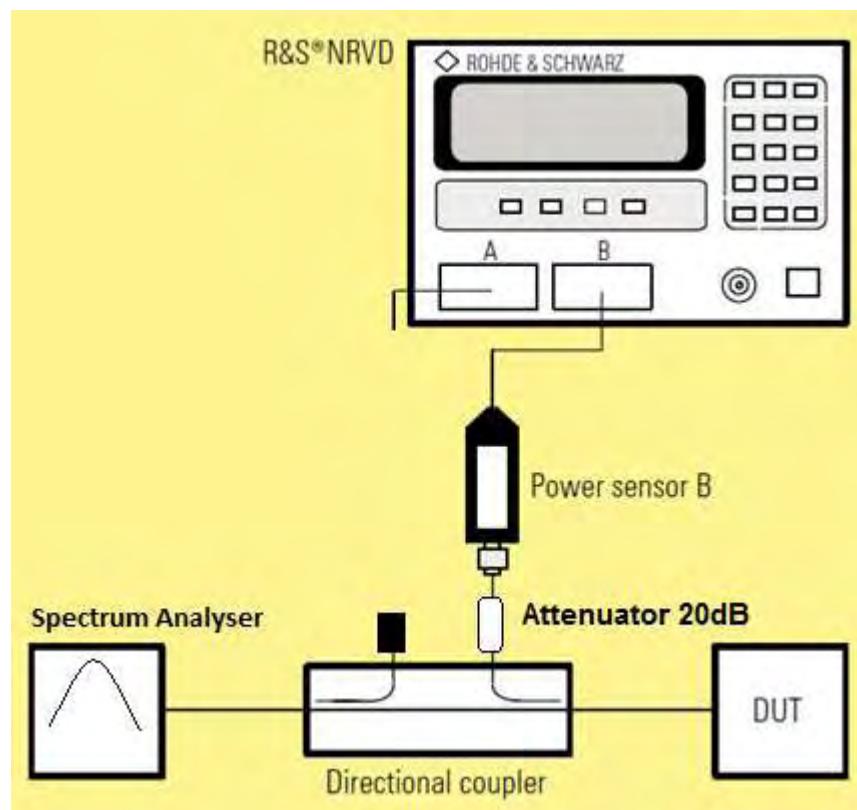
Channel Number	Frequency (MHz)	TX Power (dBm) 6.5 Mbps	TX Power (dBm) 65 Mbps	Note
36*	5180.0	7.8	7.6	5.2 GHz
40	5200.0	7.7	7.5	
44	5220.0	8.4	8.3	
48*	5240.0	8.8	8.9	
52*	5260.0	7.3	7.5	5.3 GHz
56	5280.0	7.9	7.7	
60	5300.0	7.9	7.8	
64*	5320.0	8.2	8.0	
100	5500.0	8.5	8.2	5.6 GHz
104*	5520.0	8.4	8.2	
108	5540.0	8.4	8.1	
112	5560.0	8.5	8.2	
116*	5580.0	8.0	8.0	5.8 GHz
120	5600.0	7.8	7.9	
124*	5620.0	8.0	8.0	
128	5640.0	7.9	7.8	
132	5660.0	8.0	7.8	5.8 GHz
136*	5680.0	8.5	8.4	
140	5700.0	8.5	8.3	
149*	5745.0	8.8	8.7	
153	5765.0	8.0	8.0	5.8 GHz
157*	5785.0	8.0	7.9	
161	5805.0	8.1	8.0	
165*	5825.0	8.3	8.2	

* Default test Channels

802.11n (5.0 GHz) (HT40)

Channel Number	Frequency (MHz)	TX Power (dBm) 13.5 Mbps	TX Power (dBm) 135 Mbps	Note
38	5190.0	7.7	8.1	5.2 GHz
46	5230.0	8.1	8.2	
54	5270.0	8.5	8.5	5.3 GHz
62	5310.0	8.9	8.7	
102	5510.0	8.3	8.4	5.6 GHz
110	5550.0	8.5	8.2	
118	5590.0	8.0	8.3	
126	5630.0	7.5	7.9	
134	5670.0	7.3	7.4	5.8 GHz
151	5755.0	7.7	8.0	
159	5795.0	7.7	8.2	5.8 GHz

Test setup for power measurements



7.3. Test Results

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

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.550
Maximum Reported Level (W/kg):	0.661

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
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.
1	Touch Left	190	23.7	24.5	0.399	0.480	1	GMSK
2	Tilt Left	190	23.7	24.5	0.237	0.285	1	GMSK
3	Touch Right	190	23.7	24.5	0.443	0.533	1	GMSK
4	Tilt Right	190	23.7	24.5	0.251	0.302	1	GMSK
5	Touch Right	128	23.8	24.5	0.355	0.417	1	GMSK
6	Touch Right	251	23.7	24.5	0.550	0.661	1	GMSK

Note(s):

1. Voice Mode

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

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.623
Maximum Reported Level (W/kg):	0.732

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	21.9 to 21.9

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.
7	Front	190	25.3	26.0	0.584	0.686	1, 2	GMSK
8	Back	190	25.3	26.0	0.623	0.732	1, 2	GMSK
9	Left Hand Side	190	25.3	26.0	0.338	0.397	1, 2	GMSK
10	Right Hand Side	190	25.3	26.0	0.345	0.405	1, 2	GMSK
11	Bottom	190	25.3	26.0	0.190	0.223	1, 2	GMSK
12	Back	128	25.2	26.0	0.545	0.655	1, 2	GMSK
13	Back	251	25.3	26.0	0.602	0.707	1, 2	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.

*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

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.301
Maximum Reported Level (W/kg):	0.362

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	21.9 to 21.9

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.
14	Front	190	23.7	24.5	0.301	0.362	1, 2	GMSK
15	Back	190	23.7	24.5	0.285	0.343	1, 2	GMSK

Note(s):

1. Voice Mode - Worst case and most conservative channel of GPRS hotspot mode 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**Test Summary:**

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.183
Maximum Reported Level (W/kg):	0.208

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	22.2 to 22.2

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.
16	Touch Left	661	20.7	21.5	0.160	0.192	1	GMSK
17	Tilt Left	661	20.7	21.5	0.059	0.071	1	GMSK
18	Touch Right	661	20.7	21.5	0.173	0.208	1	GMSK
19	Tilt Right	661	20.7	21.5	0.059	0.071	1	GMSK
20	Touch Right	512	21.0	21.5	0.183	0.205	1	GMSK
21	Touch Right	810	20.8	21.5	0.144	0.169	1	GMSK

Note(s):

1. Voice Mode

7.3.5. Specific Absorption Rate - GPRS 1900 Hotspot Mode Configuration 1g

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.890
Maximum Reported Level (W/kg):	1.015

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	Meas. Avg. Power (dBm)	Max. Rated Power (dBm)	Meas. Level (W/Kg)	Reported SAR (W/Kg)	Note(s)	Mod.
22	Front	661	21.8	22.5	0.522	0.613	1, 2	GMSK
23	Back	661	21.8	22.5	0.760	0.893	1, 2	GMSK
24	Left Hand Side	661	21.8	22.5	0.116	0.136	1, 2	GMSK
25	Right Hand Side	661	21.8	22.5	0.081	0.095	1, 2	GMSK
26	Bottom	661	21.8	22.5	0.864	1.015	1, 2	GMSK
27	Bottom	512	22.0	22.5	0.890	0.999	1, 2, 3	GMSK
28	Bottom	810	21.9	22.5	0.793	0.910	1, 2	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 - PCS 1900 Body-Worn Configuration 1g**Test Summary:**

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.273
Maximum Reported Level (W/kg):	0.306

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	Meas. Avg. Power (dBm)	Max. Rated Power (dBm)	Meas. Level (W/Kg)	Reported SAR (W/Kg)	Note(s)	Mod.
29	Front	512	21.0	21.5	0.207	0.232	1, 2	GMSK
30	Back	512	21.0	21.5	0.273	0.306	1, 2	GMSK

Note(s):

1. Voice Mode - Worst case and most conservative channel of GPRS hotspot mode 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.

7.3.7. Specific Absorption Rate - UMTS-FDD 2 Head Configuration 1g

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.259
Maximum Reported Level (W/kg):	0.301

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	22.2 to 22.2

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.
31	Touch Left	9400	22.4	23.0	0.254	0.292	1	QPSK
32	Tilt Left	9400	22.4	23.0	0.078	0.090	1	QPSK
33	Touch Right	9400	22.4	23.0	0.259	0.297	1	QPSK
34	Tilt Right	9400	22.4	23.0	0.081	0.093	1	QPSK
35	Touch Right	9262	22.3	23.0	0.256	0.301	1	QPSK
36	Touch Right	9538	22.3	23.0	0.236	0.277	1	QPSK

Note(s):

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

7.3.8. Specific Absorption Rate - UMTS-FDD 2 Hotspot Mode Configuration 1g

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	1.040
Maximum Reported Level (W/kg):	1.222

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.
37	Front	9400	22.4	23.0	0.571	0.656	1, 2	QPSK
38	Back	9400	22.4	23.0	0.882	1.013	1, 2	QPSK
39	Back	9262	22.3	23.0	0.920	1.081	1, 2	QPSK
40	Back	9538	22.3	23.0	0.913	1.073	1, 2	QPSK
41	Left Hand Side	9400	22.4	23.0	0.153	0.176	1, 2	QPSK
42	Right Hand Side	9400	22.4	23.0	0.109	0.125	1, 2	QPSK
43	Bottom	9400	22.4	23.0	1.030	1.183	1, 2	QPSK
44	Bottom	9262	22.3	23.0	1.040	1.222	1, 2, 3	QPSK
45	Bottom	9538	22.3	23.0	0.917	1.077	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.

*KDB 941225 - SAR is not required for RMC+HSPA (HSDPA/HSUPA) channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding RMC channels and 1g SAR level measured in 'RMC 12.2kbps' is <75% SAR limit.

7.3.9. Specific Absorption Rate - UMTS-FDD 2 Body-Worn Configuration 1g

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.454
Maximum Reported Level (W/kg):	0.533

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	Meas. Avg. Power (dBm)	Max. Rated Power (dBm)	Meas. Level (W/Kg)	Reported SAR (W/Kg)	Note(s)	Mod.
46	Front	9262	22.3	23.0	0.310	0.364	1, 2	QPSK
47	Back	9262	22.3	23.0	0.454	0.533	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. SAR measurements were performed with the closest edge of the EUT at a separation distance of 15mm from the 'SAM' phantom flat section.

*KDB 941225 - SAR is not required for RMC+HSPA (HSDPA/HSUPA) channels when the maximum average output power is less than ¼ dB higher than that measured on the corresponding RMC channels and 1g SAR level measured in 'RMC 12.2kbps' is <75% SAR limit.

7.3.10. Specific Absorption Rate - UMTS-FDD 4 Head Configuration 1g

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.360
Maximum Reported Level (W/kg):	0.423

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	21.9 to 21.9

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.
48	Touch Left	1412	22.6	23.5	0.251	0.309	1	QPSK
49	Tilt Left	1412	22.6	23.5	0.082	0.101	1	QPSK
50	Touch Right	1412	22.6	23.5	0.336	0.413	1	QPSK
51	Tilt Right	1412	22.6	23.5	0.064	0.079	1	QPSK
52	Touch Right	1312	22.8	23.5	0.338	0.397	1	QPSK
53	Touch Right	1513	22.8	23.5	0.360	0.423	1	QPSK

Note(s):

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

7.3.11. Specific Absorption Rate - UMTS-FDD 4 Hotspot Mode Configuration 1g

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	1.130
Maximum Reported Level (W/kg):	1.390

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	22.6 to 22.6

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.
54	Front	1412	22.6	23.5	0.684	0.842	1, 2	QPSK
55	Back	1412	22.6	23.5	0.875	1.076	1, 2	QPSK
56	Back	1312	22.8	23.5	0.805	0.946	1, 2	QPSK
57	Back	1513	22.8	23.5	0.908	1.067	1, 2	QPSK
58	Left Hand Side	1412	22.6	23.5	0.138	0.170	1, 2	QPSK
59	Right Hand Side	1412	22.6	23.5	0.123	0.151	1, 2	QPSK
60	Bottom	1412	22.6	23.5	1.130	1.390	1, 2, 3	QPSK
61	Bottom	1312	22.8	23.5	1.110	1.304	1, 2	QPSK
62	Bottom	1513	22.8	23.5	0.977	1.148	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. SAR measurements were performed with the closest edge of 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 - SAR is not required for RMC+HSPA (HSDPA/HSUPA) channels when the maximum average output power is less than ¼ dB higher than that measured on the corresponding RMC channels and 1g SAR level measured in 'RMC 12.2kbps' is <75% SAR limit.

7.3.12. Specific Absorption Rate - UMTS-FDD 4 Body-Worn Configuration 1g

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.367
Maximum Reported Level (W/kg):	0.452

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	22.6 to 22.6

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.
63	Front	1412	22.6	23.5	0.288	0.354	1, 2	QPSK
64	Back	1412	22.6	23.5	0.367	0.452	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. SAR measurements were performed with the closest edge of the EUT at a separation distance of 15mm from the 'SAM' phantom flat section.

*KDB 941225 - SAR is not required for RMC+HSPA (HSDPA/HSUPA) channels when the maximum average output power is less than ¼ dB higher than that measured on the corresponding RMC channels and 1g SAR level measured in 'RMC 12.2kbps' is <75% SAR limit.

7.3.13. Specific Absorption Rate - UMTS-FDD 5 Head Configuration 1g

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.593
Maximum Reported Level (W/kg):	0.697

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
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	Touch Left	4183	23.9	24.5	0.429	0.493	1	QPSK
66	Tilt Left	4183	23.9	24.5	0.260	0.299	1	QPSK
67	Touch Right	4183	23.9	24.5	0.475	0.545	1	QPSK
68	Tilt Right	4183	23.9	24.5	0.223	0.256	1	QPSK
69	Touch Right	4132	23.9	24.5	0.522	0.599	1	QPSK
70	Touch Right	4233	23.8	24.5	0.593	0.697	1	QPSK

Note(s):

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

7.3.14. Specific Absorption Rate - UMTS-FDD 5 Hotspot Mode Configuration 1g

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.568
Maximum Reported Level (W/kg):	0.667

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
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.
71	Front	4183	23.9	24.5	0.465	0.534	1, 2	QPSK
72	Back	4183	23.9	24.5	0.490	0.563	1, 2	QPSK
73	Left Hand Side	4183	23.9	24.5	0.339	0.389	1, 2	QPSK
74	Right Hand Side	4183	23.9	24.5	0.328	0.377	1, 2	QPSK
75	Bottom	4183	23.9	24.5	0.162	0.186	1, 2	QPSK
76	Back	4132	23.9	24.5	0.535	0.614	1, 2	QPSK
77	Back	4233	23.8	24.5	0.568	0.667	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.

*KDB 941225 - SAR is not required for RMC+HSPA (HSDPA/HSUPA) channels when the maximum average output power is less than ¼ dB higher than that measured on the corresponding RMC channels and 1g SAR level measured in 'RMC 12.2kbps' is <75% SAR limit.

7.3.15. Specific Absorption Rate - UMTS-FDD 5 Body-Worn Configuration 1g

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.381
Maximum Reported Level (W/kg):	0.448

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
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.
78	Front	4233	23.8	24.5	0.381	0.448	1, 2	QPSK
79	Back	4233	23.8	24.5	0.377	0.443	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. SAR measurements were performed with the closest edge of the EUT at a separation distance of 15mm from the 'SAM' phantom flat section.

*KDB 941225 - SAR is not required for RMC+HSPA (HSDPA/HSUPA) channels when the maximum average output power is less than ¼ dB higher than that measured on the corresponding RMC channels and 1g SAR level measured in 'RMC 12.2kbps' is <75% SAR limit.

7.3.16. Specific Absorption Rate – LTE Band 4 - 20MHz Channel BW Head**Configuration 1g****Test Summary:**

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.387
Maximum Reported Level (W/kg):	0.476

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	21.9 to 21.9

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.
80	Touch Left	20050	22.8	23.7	0.294	0.362	1	QPSK
81	Touch Left	20050	21.5	23.7	0.217	0.360	2	QPSK
82	Tilt Left	20050	22.8	23.7	0.113	0.139	1	QPSK
83	Tilt Left	20050	21.5	23.7	0.086	0.143	2	QPSK
84	Touch Right	20050	22.8	23.7	0.387	0.476	1	QPSK
85	Touch Right	20050	21.5	23.7	0.282	0.468	2	QPSK
86	Tilt Right	20050	22.8	23.7	0.081	0.100	1	QPSK
87	Tilt Right	20050	21.5	23.7	0.061	0.101	2	QPSK
88	Touch Right	20175	22.6	23.7	0.311	0.401	1	QPSK
89	Touch Right	20300	22.7	23.7	0.274	0.345	1	QPSK

Note(s):

- 1 RB Allocation centred on the channel Bandwidth.
- 50% RB Allocation centred within the channel Bandwidth.

*As per KDB 941225 D05 SAR for LTE Devices v02r01, the following steps were followed to perform SAR evaluation:

Largest Channel BW

1. QPSK 1RB Allocation

Start with 1RB offset Config with the highest maximum output power on required test channel (1RB low, 1RB high or 1RB mid). If value in (1) is <0.8W/kg, testing of remaining RB offset configurations and test channels not required for 1RB

2. QPSK 50% RB Allocation

Apply steps followed in (1) for measuring 50% RB

3. QPSK 100% RB Allocation

SAR not required if highest output power from (1) and (2) is higher than 100% RB output power and if SAR Values in step (1) and (2) $\leq 0.8\text{W/kg}$

4. 16 QAM

Apply steps (1), (2) and (3) for testing 16-QAM/64-QAM, for each configuration SAR required only when highest maximum output power for the highest order modulation (ex. 16-QAM) > QPSK by 0.5dB or when reported SAR for QPSK > 1.45W/kg

7.3.17. Specific Absorption Rate - LTE Band 4 - 20MHz Channel BW Hotspot Mode**Configuration 1g****Test Summary:**

Tissue Volume:	1g
Maximum Measured Level (W/kg):	1.080
Maximum Reported Level (W/kg):	1.353

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	22.6 to 22.6

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.
90	Front	20050	22.8	23.7	0.827	1.017	1, 4	QPSK
91	Front	20175	22.6	23.7	0.728	0.938	1, 4	QPSK
92	Front	20300	22.7	23.7	0.707	0.890	1, 4	QPSK
93	Front	20050	21.5	23.7	0.547	0.908	2, 4	QPSK
94	Front	20050	21.5	23.7	0.546	0.906	3, 4	QPSK
95	Back	20050	22.8	23.7	1.080	1.329	1, 4, 5	QPSK
96	Back	20175	22.6	23.7	0.894	1.152	1, 4	QPSK
97	Back	20300	22.7	23.7	0.881	1.109	1, 4	QPSK
98	Back	20050	21.5	23.7	0.771	1.280	2, 4	QPSK
99	Back	20050	21.5	23.7	0.815	1.353	3, 4	QPSK
100	Left Hand Side	20050	22.8	23.7	0.198	0.244	1, 4	QPSK
101	Left Hand Side	20050	21.5	23.7	0.151	0.251	2, 4	QPSK
102	Right Hand Side	20050	22.8	23.7	0.151	0.186	1, 4	QPSK
103	Right Hand Side	20050	21.5	23.7	0.116	0.193	2, 4	QPSK
104	Bottom	20050	22.8	23.7	0.952	1.171	1, 4	QPSK

Specific Absorption Rate - LTE Band 4 - 20MHz Channel BW Hotspot Mode

Configuration 1g (Continued)

Test Summary:

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.
105	Bottom	20175	22.6	23.7	0.854	1.100	1, 4	QPSK
106	Bottom	20300	22.7	23.7	0.823	1.036	1, 4	QPSK
107	Bottom	20050	21.5	23.7	0.748	1.241	2, 4	QPSK
108	Bottom	20050	21.5	23.7	0.749	1.243	3, 4	QPSK

Note(s):

- 1 RB Allocation centred on the channel Bandwidth.
- 50% RB Allocation centred within the channel Bandwidth.
- 100% RB allocation of the channel Bandwidth
- 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.
- 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.

*As per KDB 941225 D05 SAR for LTE Devices v02r01, the following steps were followed to perform SAR evaluation:

Largest Channel BW

1. QPSK 1RB Allocation

Start with 1RB offset Config with the highest maximum output power on required test channel (1RB low, 1RB high or 1RB mid). If value in (1) is <0.8W/kg, testing of remaining RB offset configurations and test channels not required for 1RB

2. QPSK 50% RB Allocation

Apply steps followed in (1) for measuring 50% RB

3. QPSK 100% RB Allocation

SAR not required if highest output power from (1) and (2) is higher than 100% RB output power and if SAR Values in step (1) and (2) ≤0.8W/kg

4. 16 QAM

Apply steps (1), (2) and (3) for testing 16-QAM/64-QAM, for each configuration SAR required only when highest maximum output power for the highest order modulation (ex. 16-QAM) > QPSK by 0.5dB or when reported SAR for QPSK > 1.45W/kg

7.3.18. Specific Absorption Rate - LTE Band 4 - 20MHz Channel BW Body-Worn

Configuration 1g

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.431
Maximum Reported Level (W/kg):	0.530

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	21.9 to 21.9

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.
109	Back	20050	22.8	23.7	0.431	0.530	1, 2	QPSK
110	Front	20050	22.8	23.7	0.331	0.407	1, 2	QPSK

Note(s):

- 1 RB Allocation centred on the channel Bandwidth - Worst case and most conservative channel of hotspot mode is applied to Body-worn.
- SAR measurements were performed with the closest edge of the EUT at a separation distance of 15mm from the 'SAM' phantom flat section.

7.3.19. Specific Absorption Rate - LTE Band 4 - 1.4MHz Channel BW Head**Configuration 1g****Test Summary:**

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.351
Maximum Reported Level (W/kg):	0.452

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	22.6 to 22.6

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.
111	Touch Left	20175	22.7	23.7	0.260	0.327	1	QPSK
112	Touch Left	20175	22.7	23.7	0.265	0.334	2	QPSK
113	Tilt Left	20175	22.7	23.7	0.092	0.116	1	QPSK
114	Tilt Left	20175	22.7	23.7	0.098	0.123	2	QPSK
115	Touch Right	20175	22.7	23.7	0.281	0.354	1	QPSK
116	Touch Right	20175	22.7	23.7	0.278	0.350	2	QPSK
117	Tilt Right	20175	22.7	23.7	0.058	0.073	1	QPSK
118	Tilt Right	20175	22.7	23.7	0.059	0.074	2	QPSK
119	Touch Right	19957	22.6	23.7	0.300	0.386	1	QPSK
120	Touch Right	20393	22.6	23.7	0.351	0.452	1	QPSK

Note(s):

- 1 RB Allocation centred on the channel Bandwidth.
- 50% RB Allocation centred within the channel Bandwidth.

*As per KDB 941225 D05 SAR for LTE Devices v02r01, the following steps were followed to perform SAR evaluation:

Largest Channel BW

- QPSK 1RB Allocation

Start with 1RB offset Config with the highest maximum output power on required test channel (1RB low, 1RB high or 1RB mid). If value in (1) is <0.8W/kg, testing of remaining RB offset configurations and test channels not required for 1RB

- QPSK 50% RB Allocation

Apply steps followed in (1) for measuring 50% RB

- QPSK 100% RB Allocation

SAR not required if highest output power from (1) and (2) is higher than 100% RB output power and if SAR Values in step (1) and (2) $\leq 0.8\text{W/kg}$

- 16 QAM

Apply steps (1), (2) and (3) for testing 16-QAM/64-QAM, for each configuration SAR required only when highest maximum output power for the highest order modulation (ex. 16-QAM) > QPSK by 0.5dB or when reported SAR for QPSK > 1.45W/kg

7.3.20. Specific Absorption Rate - LTE Band 4 - 1.4MHz Channel BW Hotspot Mode
Configuration 1g
Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	1.170
Maximum Reported Level (W/kg):	1.473

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	23.2 to 23.2

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.
121	Front	20175	22.7	23.7	0.663	0.835	1, 4	QPSK
122	Front	20175	22.7	23.7	0.656	0.826	2, 4	QPSK
123	Back	20175	22.7	23.7	0.906	1.141	1, 4	QPSK
124	Back	19957	22.6	23.7	0.871	1.122	1, 4	QPSK
125	Back	20393	22.6	23.7	1.040	1.340	1, 4	QPSK
126	Back	20175	22.7	23.7	0.925	1.165	2, 4	QPSK
127	Back	19957	22.6	23.7	0.970	1.250	2, 4	QPSK
128	Back	20393	22.7	23.7	1.030	1.297	2, 4	QPSK
129	Back	20393	21.7	23.7	0.835	1.323	3, 4	QPSK
130	Left Hand Side	20175	22.7	23.7	0.167	0.210	1, 4	QPSK
131	Left Hand Side	20175	22.7	23.7	0.169	0.213	2, 4	QPSK
132	Right Hand Side	20175	22.7	23.7	0.144	0.181	1, 4	QPSK
133	Right Hand Side	20175	22.7	23.7	0.140	0.176	2, 4	QPSK
134	Bottom	20175	22.7	23.7	1.150	1.448	1, 4	QPSK
135	Bottom	19957	22.6	23.7	1.130	1.456	1, 4	QPSK
136	Bottom	20393	22.6	23.7	1.040	1.340	1, 4	QPSK

Specific Absorption Rate - LTE Band 4 - 1.4MHz Channel BW Hotspot Mode**Configuration 1g (Continued):****Test Summary:**

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.
137	Bottom	20175	22.7	23.7	1.170	1.473	2, 4, 5	QPSK
138	Bottom	19957	22.6	23.7	1.070	1.378	2, 4	QPSK
139	Bottom	20393	22.7	23.7	1.130	1.423	2, 4	QPSK
140	Bottom	20175	21.7	23.7	0.913	1.447	3, 4	QPSK

Note(s):

- 1 RB Allocation centred on the channel Bandwidth.
- 50% RB Allocation centred within the channel Bandwidth.
- 100% RB allocation of the channel Bandwidth
- 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.
- 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.

*As per KDB 941225 D05 SAR for LTE Devices v02r01, the following steps were followed to perform SAR evaluation:

Largest Channel BW

1. QPSK 1RB Allocation

Start with 1RB offset Config with the highest maximum output power on required test channel (1RB low, 1RB high or 1RB mid). If value in (1) is <0.8W/kg, testing of remaining RB offset configurations and test channels not required for 1RB

2. QPSK 50% RB Allocation

Apply steps followed in (1) for measuring 50% RB

3. QPSK 100% RB Allocation

SAR not required if highest output power from (1) and (2) is higher than 100% RB output power and if SAR Values in step (1) and (2) ≤0.8W/kg

4. 16 QAM

Apply steps (1), (2) and (3) for testing 16-QAM/64-QAM, for each configuration SAR required only when highest maximum output power for the highest order modulation (ex. 16-QAM) > QPSK by 0.5dB or when reported SAR for QPSK > 1.45W/kg

7.3.21. Specific Absorption Rate - LTE Band 4 - 1.4MHz Channel BW Body-Worn

Configuration 1g

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.418
Maximum Reported Level (W/kg):	0.526

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	23.2 to 23.2

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.
141	Front	20175	22.7	23.7	0.294	0.370	1, 2	QPSK
142	Back	20175	22.7	23.7	0.418	0.526	1, 2	QPSK

Note(s):

1. 50% RB Allocation centred on the channel Bandwidth - Worst case and most conservative channel of hotspot mode is applied to 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.

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

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.946
Maximum Reported Level (W/kg):	1.086

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	23.1 to 23.1

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.
143	Touch Left	6	15.9	16.0	0.486	0.497	1	DBPSK
144	Tilt Left	6	15.9	16.0	0.202	0.207	1	DBPSK
145	Touch Right	6	15.9	16.0	0.125	0.128	1	DBPSK
146	Tilt Right	6	15.9	16.0	0.070	0.072	1	DBPSK
147	Touch Left	1	15.9	16.0	0.248	0.254	1	DBPSK
148	Touch Left	11	15.4	16.0	0.946	1.086	1, 2	DBPSK

Note(s):

1. WLAN 802.11b 11Mbps
2. 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 248227 - SAR is not required for 802.11g/n channels when the maximum average output power is equal to that measured on the corresponding 802.11b channels.

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

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.239
Maximum Reported Level (W/kg):	0.274

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	Meas. Avg. Power (dBm)	Max. Rated Power (dBm)	Meas. Level (W/Kg)	Reported SAR (W/Kg)	Note(s)	Mod.
149	Front	6	15.9	16.0	0.065	0.067	1	DBPSK
150	Back	6	15.9	16.0	0.091	0.093	1	DBPSK
151	Right Hand Side	6	15.9	16.0	0.045	0.046	1	DBPSK
152	Top	6	15.9	16.0	0.042	0.043	1	DBPSK
153	Back	1	15.9	16.0	0.058	0.059	1	DBPSK
154	Back	11	15.4	16.0	0.239	0.274	1	DBPSK

Note(s):

1. WLAN 802.11b 11Mbps
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 equal to that measured on the corresponding 802.11b channels.

7.3.24. Specific Absorption Rate - Wi-Fi 2450 Body-Worn Configuration 1g

Test Summary:

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.101
Maximum Reported Level (W/kg):	0.116

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	Meas. Avg. Power (dBm)	Max. Rated Power (dBm)	Meas. Level (W/Kg)	Reported SAR (W/Kg)	Note(s)	Mod.
155	Front	11	15.4	16.0	0.080	0.092	1, 2, 3	DBPSK
156	Back	11	15.4	16.0	0.101	0.116	1, 2, 3	DBPSK

Note(s):

1. WLAN 802.11b 11Mbps
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. Worst case and most conservative channel from Hotspot mode and used for Body-worn Configuration.

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

7.3.25. Specific Absorption Rate - Wi-Fi 802.11a 5.0GHz Head Configuration 1g**Test Summary:**

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.398
Maximum Reported Level (W/kg):	0.436

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.
157	Touch Left	36	9.5	9.9	0.398	0.436	1, 2	BPSK
158	Tilt Left	36	9.5	9.9	0.176	0.193	1, 2	BPSK
159	Touch Right	36	9.5	9.9	0.090	0.099	1, 2	BPSK
160	Tilt Right	36	9.5	9.9	0.055	0.060	1, 2	BPSK
161	Touch Left	52	9.1	9.9	0.342	0.411	1, 2	BPSK
162	Touch Left	104	9.3	9.9	0.105	0.121	1, 3	BPSK
163	Touch Left	149	9.3	9.9	0.141	0.162	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

*KDB 248227 - SAR is not required for **802.11n** HT20 /HT40 channels as the maximum average output power is less than $\frac{1}{4}$ dB higher than **802.11a**.

7.4. Simultaneous Transmission SAR Analysis

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	LTE Band 4	Wi-Fi	Bluetooth 2.4 GHz	
Back	1.353	0.274		1.627
Back	1.353		0.188	1.541

Normal Analysis:

Head Configuration 1g – Worst cases measurements WWAN+WLAN

EUT Position	Reported SAR 1g (W/Kg)					Sum of WWAN & WLAN
	WWAN				WLAN	
	GSM 850	PCS 1900	UMTS FDD 2	UMTS FDD 4	Wi-Fi	
Touch Left	0.480				1.086	1.566
Touch Right	0.661				0.128	0.789
Tilt Left	0.285				0.207	0.492
Tilt Right	0.302				0.072	0.374
Touch Left		0.192			1.086	1.278
Touch Right		0.208			0.128	0.336
Tilt Left		0.071			0.207	0.278
Tilt Right		0.071			0.072	0.143
Touch Left			0.292		1.086	1.378
Touch Right			0.297		0.128	0.425
Tilt Left			0.090		0.207	0.297
Tilt Right			0.301		0.072	0.373
Touch Left				0.309	1.086	1.395
Touch Right				0.423	0.128	0.551
Tilt Left				0.101	0.207	0.308
Tilt Right				0.079	0.072	0.151

Simultaneous Transmission SAR Analysis (Continued)

Head Configuration 1g – Worst cases measurements WWAN+WLAN

EUT Position	Reported SAR 1g (W/Kg)				Sum of WWAN & WLAN
	WWAN		WLAN		
FDD 5	LTE Band 4 (20MHz)	LTE Band 4 (1.4MHz)	Wi-Fi		
Touch Left	0.493			1.086	1.579
Touch Right	0.697			0.128	0.825
Tilt Left	0.299			0.207	0.506
Tilt Right	0.256			0.072	0.328
Touch Left		0.362		1.086	1.448
Touch Right		0.476		0.128	0.604
Tilt Left		0.143		0.207	0.350
Tilt Right		0.101		0.072	0.173
Touch Left			0.327	1.086	1.413
Touch Right			0.452	0.128	0.580
Tilt Left			0.123	0.207	0.330
Tilt Right			0.074	0.072	0.146

Simultaneous Transmission SAR Analysis (Continued)

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

EUT Position	Reported SAR 1g (W/Kg)					Sum of WWAN & WLAN
	WWAN				WLAN	
GSM850	PCS1900	UMTS FDD 2	UMTS FDD 4	Wi-Fi		
Front	0.686				0.067	0.753
Back	0.732				0.274	1.006
Left Hand Side	0.397					0.397
Right Hand Side	0.405				0.046	0.451
Bottom	0.223					0.223
Top					0.043	0.043
Front		0.613			0.067	0.680
Back		0.893			0.274	1.167
Left Hand Side		0.136				0.136
Right Hand Side		0.095			0.046	0.095
Bottom		1.015				1.015
Top					0.043	0.043
Front			0.656		0.067	0.723
Back			1.081		0.274	1.355
Left Hand Side			0.176			0.176
Right Hand Side			0.125		0.046	0.171
Bottom			1.222			1.222
Top					0.043	0.043
Front				0.842	0.067	0.909
Back				1.076	0.274	1.350
Left Hand Side				0.170		0.170
Right Hand Side				0.151	0.046	0.197
Bottom				1.390		1.390
Top					0.043	0.043

Simultaneous Transmission SAR Analysis (Continued)
Hotspot Mode Configuration 1g – Worst cases measurements WWAN+WLAN

EUT Position	Reported SAR 1g (W/Kg)				Sum of WWAN & WLAN
	UMTS FDD 5	WWAN	WLAN	Wi-Fi	
LTE Band 4 (20MHz)	LTE Band 4 (1.4MHz)				
Front	0.534			0.067	0.601
Back	0.667			0.274	0.941
Left Hand Side	0.389				0.389
Right Hand Side	0.377			0.046	0.423
Bottom	0.186				0.186
Top				0.043	0.043
Front		1.017		0.067	1.084
Back		1.353		0.274	1.627
Left Hand Side		0.251			0.251
Right Hand Side		0.193		0.046	0.239
Bottom		1.243			1.243
Top				0.043	0.043
Front			0.835	0.067	0.902
Back			1.323	0.274	1.597
Left Hand Side			0.213		0.213
Right Hand Side			0.181	0.046	0.227
Bottom			1.473		1.473
Top				0.043	0.043

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

EUT Position	Reported SAR 1g (W/Kg)					
	WWAN				WLAN	
	GSM 850	PCS 1900	UMTS FDD 2	UMTS FDD 4	Wi-Fi	Sum of WWAN & WLAN
Front	0.362				0.092	0.454
Back	0.343				0.116	0.459
Front		0.232			0.092	0.324
Back		0.306			0.116	0.422
Front			0.364		0.092	0.456
Back			0.533		0.116	0.649
Front				0.354	0.092	0.446
Back				0.452	0.116	0.568

EUT Position	Reported SAR 1g (W/Kg)				
	WWAN			WLAN	
	LTE Band 2 (1.4MHz)	LTE Band 4 (20MHz)	LTE Band 4 (1.4MHz)	Wi-Fi	Sum of WWAN & WLAN
Front	0.448			0.092	0.540
Back	0.443			0.116	0.559
Front		0.407		0.092	0.499
Back		0.530		0.116	0.646
Front			0.370	0.092	0.462
Back			0.526	0.116	0.642

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. The highest of 1-g reported SAR value between 2.4 GHz and 5.0 GHz is chosen to determine WWAN+ WLAN worst case measurements.

7.4.1. Simultaneous Transmission SAR Analysis

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

EUT Position	Reported SAR 1g (W/Kg)					
	WWAN				WPAN	Sum of WWAN & WLAN
GSM850	PCS1900	UMTS FDD 2	UMTS FDD 4	Bluetooth		
Front	0.686				0.188	0.874
Back	0.732				0.188	0.920
Left Hand Side	0.397					0.397
Right Hand Side	0.405				0.188	0.593
Bottom	0.223					0.223
Top					0.188	0.188
Front		0.613			0.188	0.801
Back		0.893			0.188	1.081
Left Hand Side		0.136				0.136
Right Hand Side		0.095			0.188	0.283
Bottom		1.015				1.015
Top					0.188	0.188
Front			0.656		0.188	0.844
Back			1.081		0.188	1.269
Left Hand Side			0.176			0.176
Right Hand Side			0.125		0.188	0.313
Bottom			1.222			1.222
Top					0.188	0.188
Front				0.842	0.188	1.030
Back				1.076	0.188	1.264
Left Hand Side				0.170		0.170
Right Hand Side				0.151	0.188	0.339
Bottom				1.390		1.390
Top					0.188	0.188

Simultaneous Transmission SAR Analysis (Continued)
Hotspot Mode Configuration 1g – Worst cases measurements WWAN+WLAN

EUT Position	Reported SAR 1g (W/Kg)				Sum of WWAN & WLAN
	WWAN		WPAN	Bluetooth	
UMTS FDD 5	LTE Band 4 (20MHz)	LTE Band 4 (1.4MHz)			
Front	0.534			0.188	0.722
Back	0.667			0.188	0.855
Left Hand Side	0.389				0.389
Right Hand Side	0.377			0.188	0.565
Bottom	0.186				0.186
Top				0.188	0.188
Front		1.017		0.188	1.205
Back		1.353		0.188	1.541
Left Hand Side		0.251			0.251
Right Hand Side		0.193		0.188	0.381
Bottom		1.243			1.243
Top				0.188	0.188
Front			0.835	0.188	1.023
Back			1.323	0.188	1.511
Left Hand Side			0.213		0.213
Right Hand Side			0.181	0.188	0.369
Bottom			1.473		1.473
Top				0.188	0.188

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

EUT Position	Reported SAR 1g (W/Kg)					
	WWAN				WPAN	Sum of WWAN & WLAN
	GSM 850	PCS 1900	UMTS FDD 2	UMTS FDD 4	Bluetooth	
Front	0.362				0.126	0.488
Back	0.343				0.126	0.469
Front		0.232			0.126	0.358
Back		0.306			0.126	0.432
Front			0.364		0.126	0.490
Back			0.533		0.126	0.659
Front				0.354	0.126	0.480
Back				0.452	0.126	0.578

EUT Position	Reported SAR 1g (W/Kg)				
	WWAN			WPAN	Sum of WWAN & WLAN
	LTE Band 2 (1.4MHz)	LTE Band 4 (20MHz)	LTE Band 4 (1.4MHz)	Bluetooth	
Front	0.448			0.126	0.574
Back	0.443			0.126	0.569
Front		0.407		0.126	0.533
Back		0.530		0.126	0.656
Front			0.370	0.126	0.496
Back			0.526	0.126	0.652

Simultaneous Transmission SAR Analysis (Continued)**Note(s):**

1. The sum of reported SAR for WWAN and WPAN does 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 estimated 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:

- $$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f_{(\text{GHz})}} / x] \text{ W/kg for test separation distances} \leq 50 \text{ mm};$$
 where $x = 7.5$ for 1-g SAR, and $x = 18.75$ for 10-g SAR.

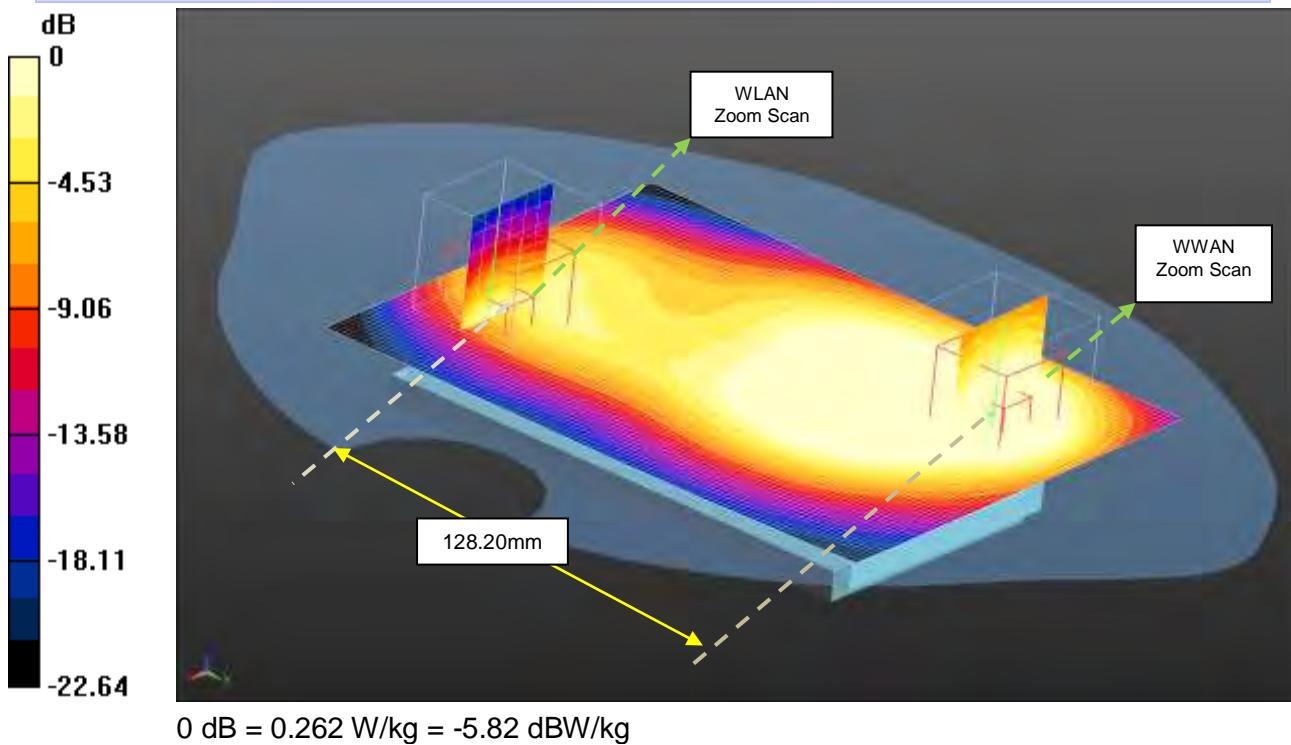
- **10mm Bluetooth estimated SAR level:**

$$\text{Estimated Bluetooth SAR} = (9.12 \text{ mW} / 10 \text{ mm}) * (\sqrt{2.4} / 7.5) = 0.188 \text{ W/kg}$$

- **15mm Bluetooth estimated SAR level:**

$$\text{Estimated Bluetooth SAR} = (9.12 \text{ mW} / 15 \text{ mm}) * (\sqrt{2.4} / 7.5) = 0.126 \text{ W/kg}$$

7.5. SAR to peak location separation ratio distance (SPLSR) plots calculations
Back LTE Band 4 (20MHz BW) CH20050 + Back WLAN 802.11b 11Mbps CH11 SPLSR



SPLSR Calculation:

WWA (LTE Band 4 CH20050) Peak Co-ordinates			WLAN (802.11b CH11) Peak Co-ordinates		
X ₁ (m)	Y ₁ (m)	Z ₁ (m)	X ₂ (m)	Y ₂ (m)	Z ₂ (m)
-0.0399	0.0675	-0.195	0.0136	-0.049	-0.196

x=(X ₂ - X ₁) ² 0.0029	y=(Y ₂ - Y ₁) ² 0.0136	z=(Z ₂ - Z ₁) ² 0.0000	Square Root of Sum of x, y, z (mm), R _i 128.20

SPLSR =	$(\text{SAR1} + \text{SAR2})^{1.5} / R_i$
	$(1.353+0.0274)^{1.5}/128.20 = 0.016 < 0.04$
	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 / LTE Band 5 Head Configuration 1g	95%	$\pm 19.94\%$
Specific Absorption Rate-GSM / GPRS / EDGE 850 / UMTS FDD 5 / LTE Band 5 Body Configurations 1g	95%	$\pm 20.07\%$
Specific Absorption Rate-UMTS FDD 4 / LTE Band 4 Head Configuration 1g	95%	$\pm 19.83\%$
Specific Absorption Rate-UMTS FDD 4 / LTE Band 4 Body Configuration 1g	95%	$\pm 20.04\%$
Specific Absorption Rate-PCS 1900 / UMTS FDD 2 Head Configuration 1g	95%	$\pm 20.72\%$
Specific Absorption Rate-GSM / GPRS / EDGE 1900 / UMTS FDD 2 Body Configuration 1g	95%	$\pm 20.00\%$
Specific Absorption Rate-Wi-Fi 2450 MHz Head Configuration 1g	95%	$\pm 19.47\%$
Specific Absorption Rate-Wi-Fi 2450 MHz Body Configuration 1g	95%	$\pm 19.90\%$
Specific Absorption Rate-Wi-Fi 5GHz Head Configuration 1g	95%	$\pm 20.14\%$

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 Uncertainty -GSM 850 / UMTS FDD 5 / LTE Band 5 Head Configuration 1g

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

8.2. Specific Absorption Rate-GSM / GPRS / EDGE 850 / UMTS FDD 5 / LTE Band 5 Body Configuration 1g

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

8.3. Specific Absorption Rate- FDD 4 / LTE Band 4 Head Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	c _i (1g)	Standard Uncertainty		v _i or v _{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	1.600	1.600	normal (k=1)	1.0000	1.0000	1.600	1.600	∞
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	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	4.990	4.990	normal (k=1)	1.0000	0.6400	3.194	3.194	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	4.660	4.660	normal (k=1)	1.0000	0.6000	2.796	2.796	5
	Combined standard uncertainty			t-distribution			10.12	10.12	>300
	Expanded uncertainty			k = 1.96			19.83	19.83	>300

8.4. Specific Absorption Rate- FDD 4 / LTE Band 4 Body Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	c _i (1g)	Standard Uncertainty		v _i or v _{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	2.700	2.700	normal (k=1)	1.0000	1.0000	2.700	2.700	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	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	4.980	4.980	normal (k=1)	1.0000	0.6400	3.187	3.187	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	4.770	4.770	normal (k=1)	1.0000	0.6000	2.862	2.862	5
	Combined standard uncertainty			t-distribution			10.23	10.23	>250
	Expanded uncertainty			k = 1.96			20.04	20.04	>250

8.5. Specific Absorption Rate-PCS 1900 / UMTS FDD 2 Head Configuration 1g

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

8.6. Specific Absorption Rate-PCS / GPRS / EDGE 1900 / UMTS FDD 2 Body Configuration 1g

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

8.7. Specific Absorption Rate-Wi-Fi 2450 MHz Head Configuration 1g

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

8.8. Specific Absorption Rate-Wi-Fi 2450 MHz Body Configuration 1g

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

8.9. Specific Absorption Rate-Wi-Fi 5GHz Head Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	c _i (1g)	Standard Uncertainty		v _i or v _{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	-
A1328	Handset Positioner	Schmid & Partner Engineering AG	Modification	SD 000 H01 DA	-	-
A1182	Handset Positioner	Schmid & Partner Engineering AG	V3.0	None	-	-
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
A2243	Probe	Schmid & Partner Engineering AG	ES3DV3	3304	31 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
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	-

UL No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
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	-
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	-
M1159	Signal Generator	Agilent Technologies	E8241A	US42110332	Internal Checked 10 Dec 2012	4
M1647	Signal Generator	Hewlett Packard	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

UL No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
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 *R. Baur* Date: 26-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 A2077

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: 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 $(22 \pm 3)^\circ\text{C}$ and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: September 24, 2012

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



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Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- $NORM(f)x,y,z = NORMx,y,z * frequency_response$ (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
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}, VR_{x,y,z}: A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to $NORMx,y,z * ConvF$ whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy): in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe EX3DV4

SN:3814

Manufactured: September 2, 2011
Calibrated: September 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 ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.53	0.50	0.44	$\pm 10.1\%$
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	$\pm 3.0\%$
			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 E²-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

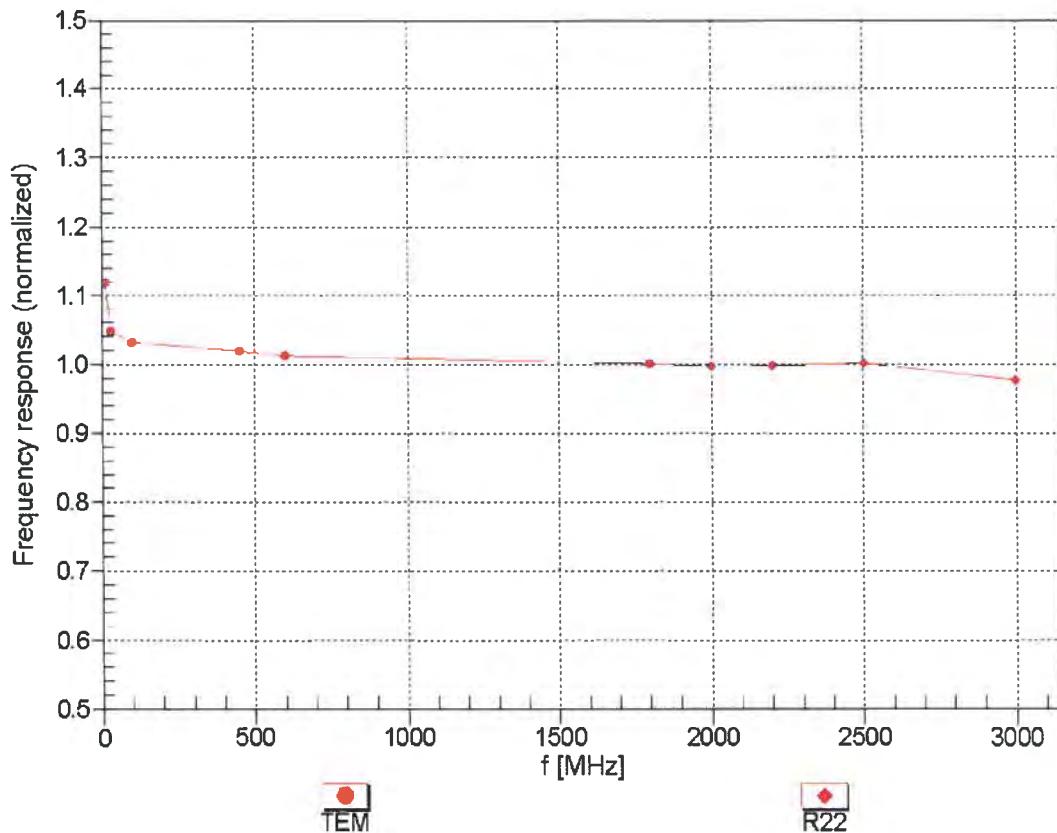
f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
1450	54.0	1.30	8.26	8.26	8.26	0.23	1.40	± 12.0 %
2450	52.7	1.95	7.41	7.41	7.41	0.80	0.66	± 12.0 %
2600	52.5	2.16	7.08	7.08	7.08	0.79	0.61	± 12.0 %
3700	51.0	3.55	6.27	6.27	6.27	0.22	2.24	± 13.1 %
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

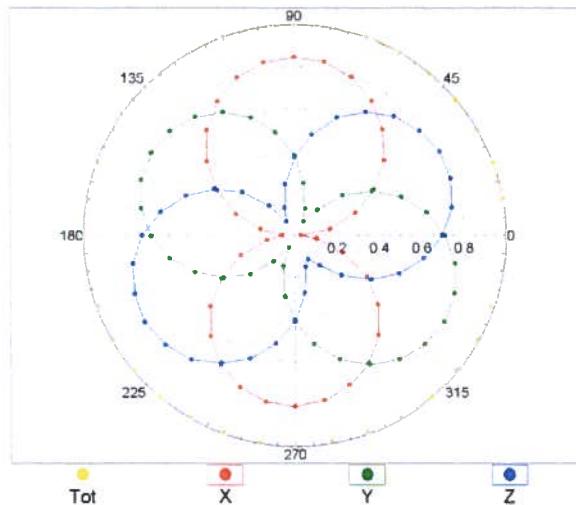
(TEM-Cell:ifi110 EXX, Waveguide: R22)



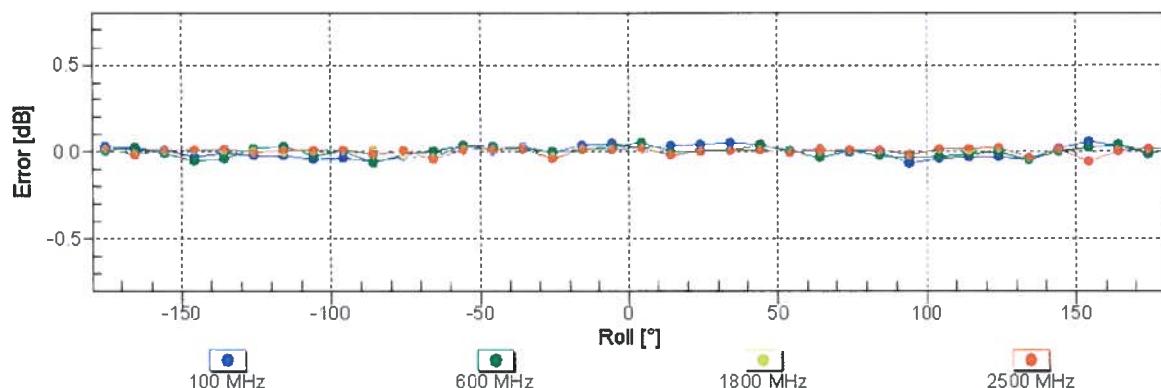
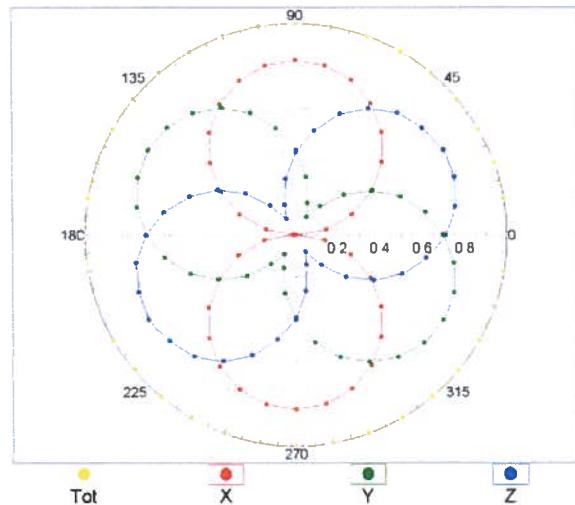
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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

f=600 MHz, TEM

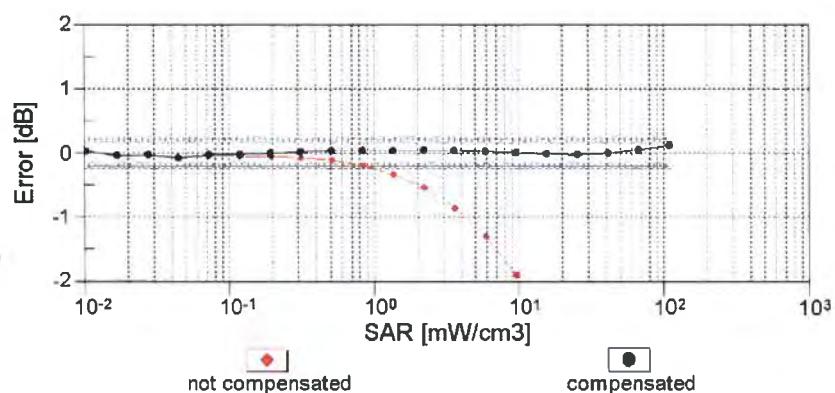
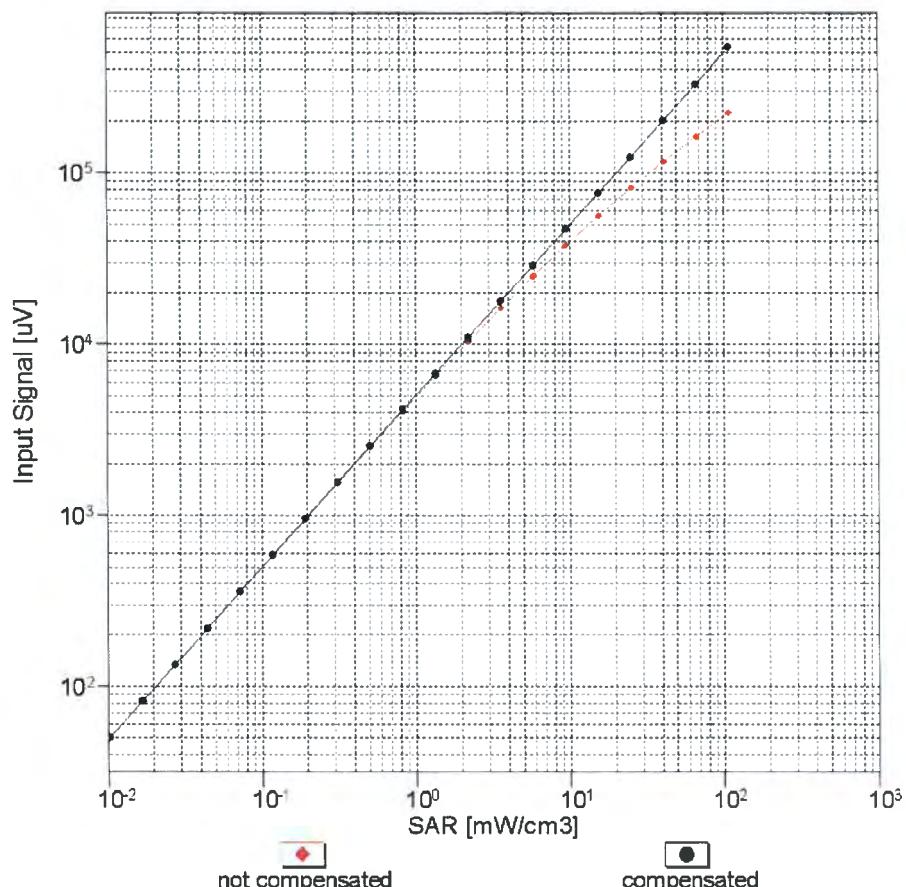


f=1800 MHz, R22



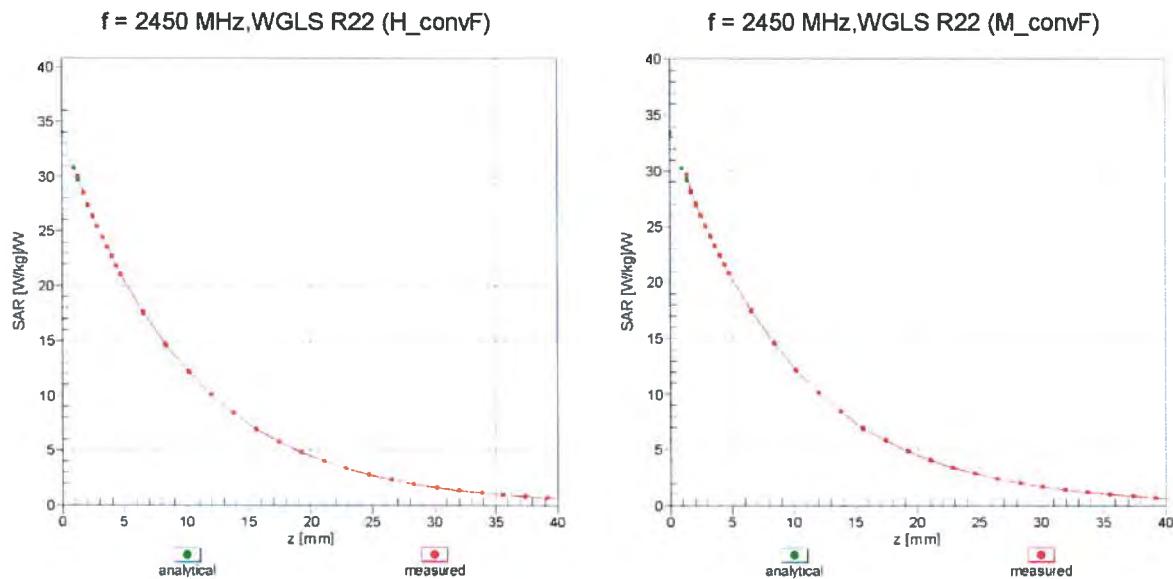
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

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



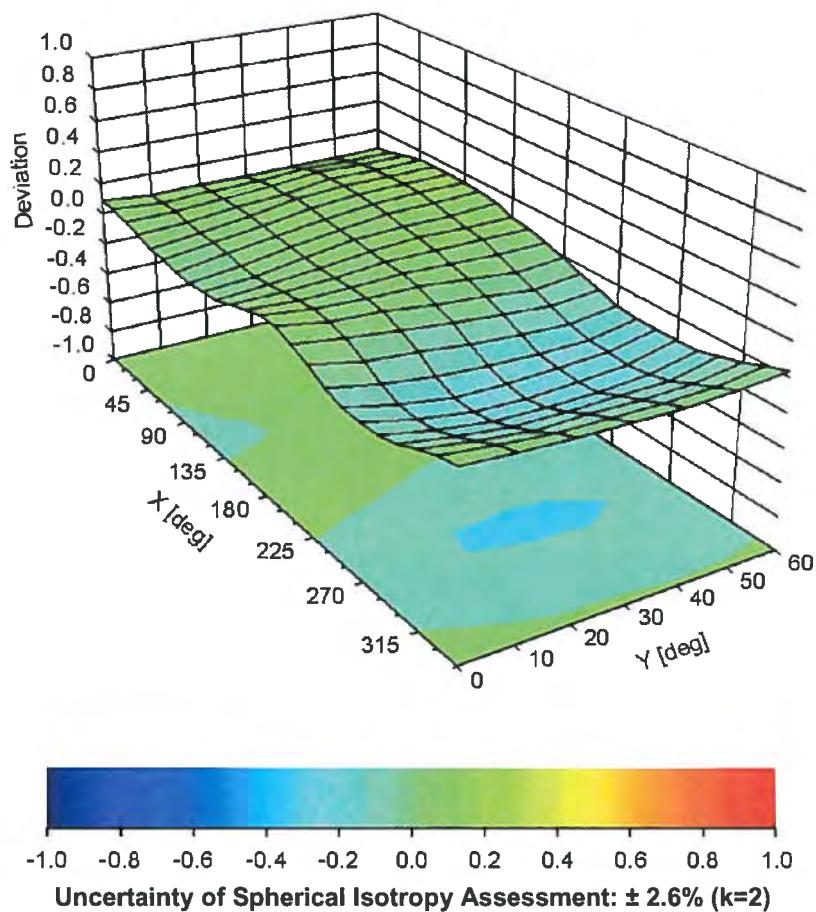
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), $f = 900 \text{ MHz}$



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 R.H.

17-May-2012

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



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Swiss Calibration Service

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Accreditation No.: **SCS 108***ASSET A 2113*

Client

RFICertificate 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

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

Issued: May 11, 2012

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



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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- $NORMx,y,z$: Assessed for E-field polarization $\theta = 0$ ($f \leq 900$ 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 ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	2.14	1.92	1.79	$\pm 10.1\%$
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	$\pm 2.7\%$
			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 E²-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

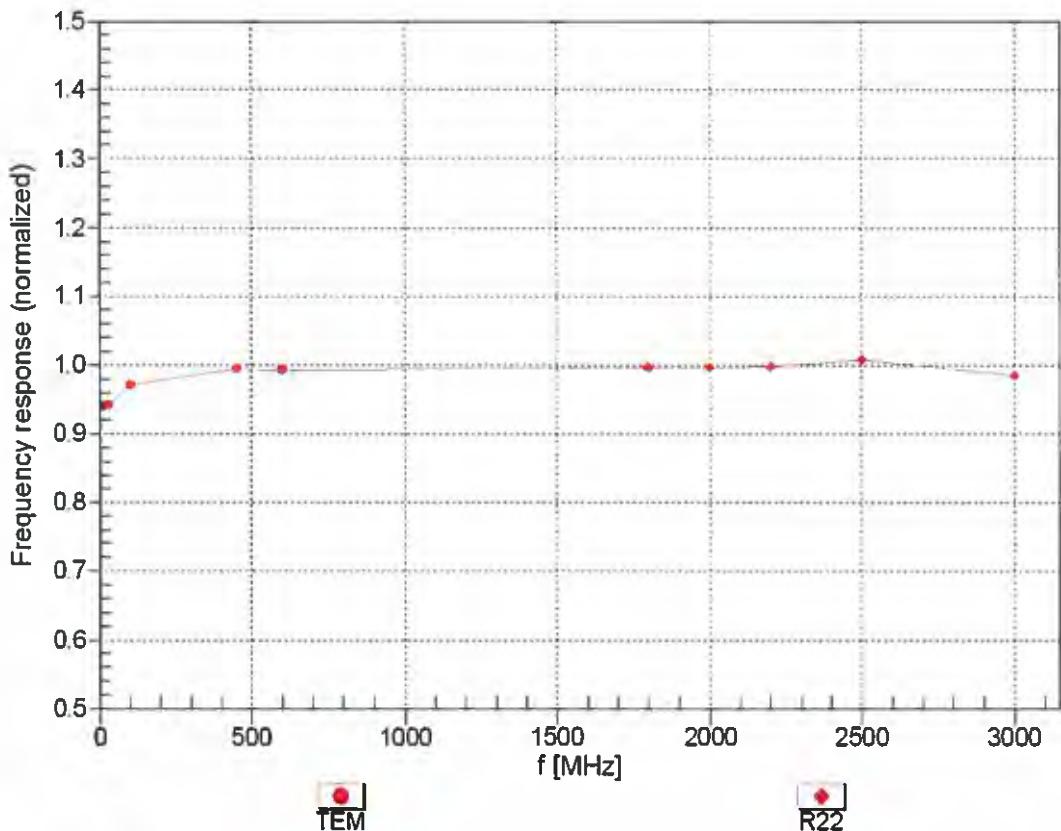
Calibration Parameter Determined in Body Tissue Simulating Media

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.

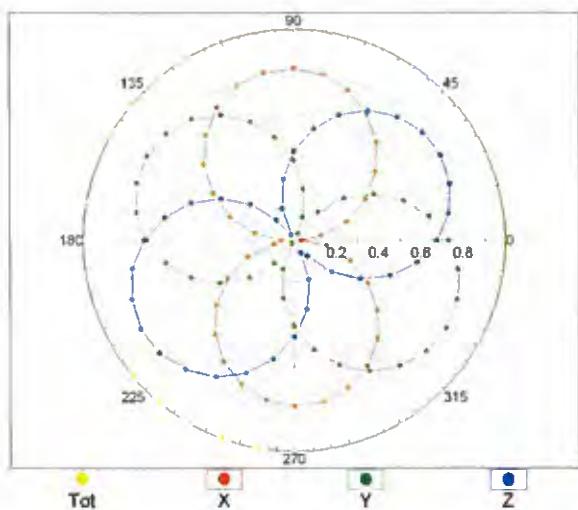
Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



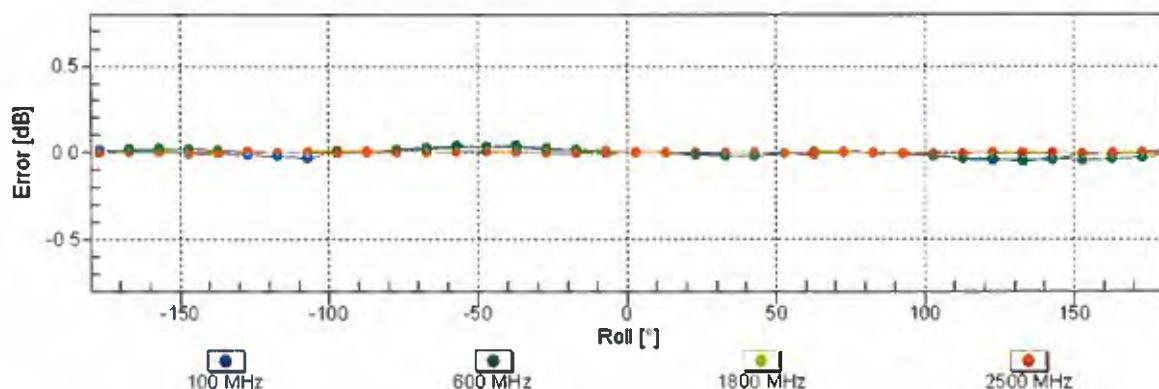
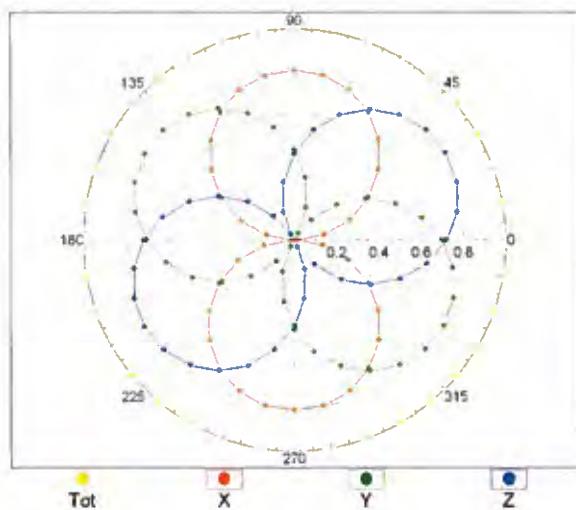
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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

f=600 MHz, TEM

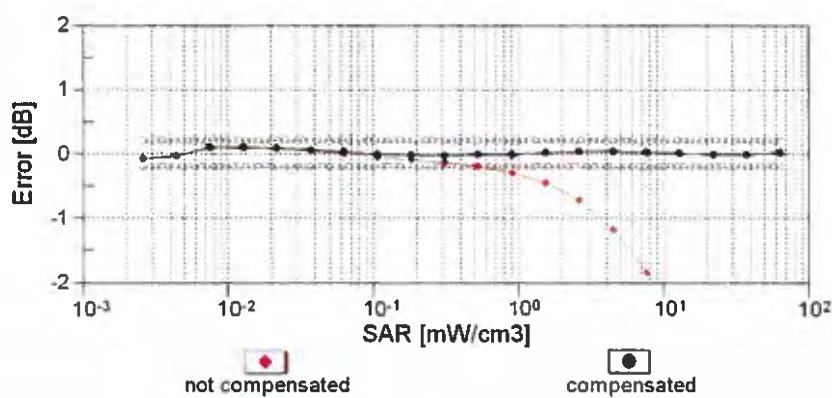
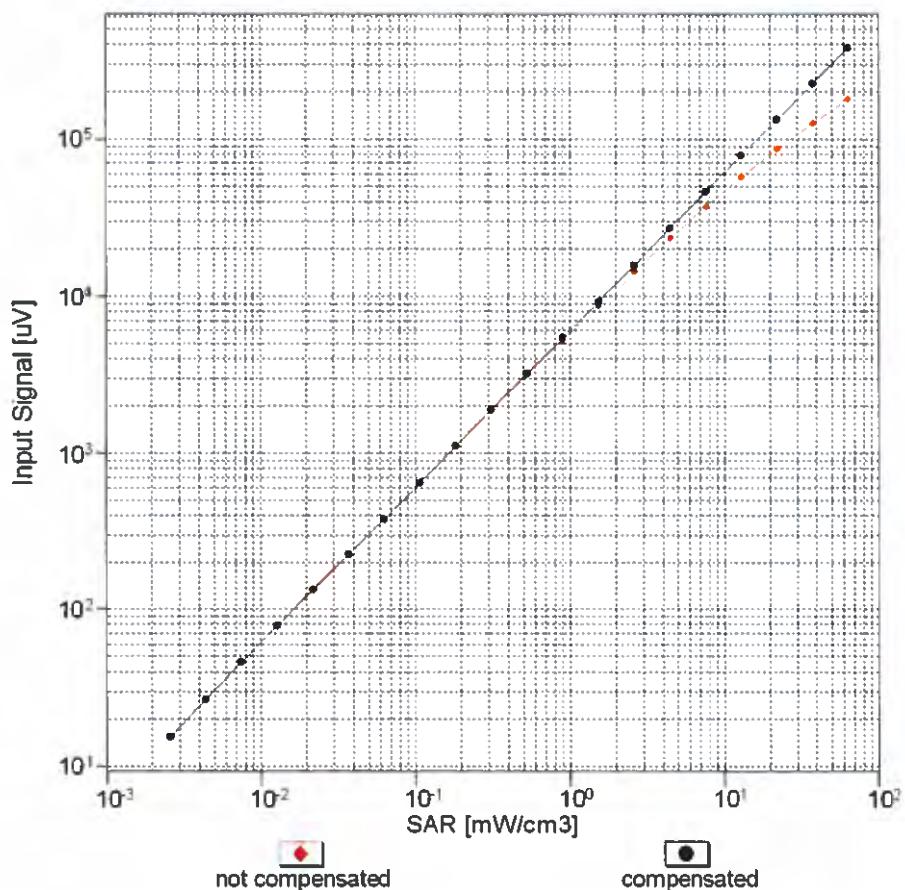


f=1800 MHz, R22



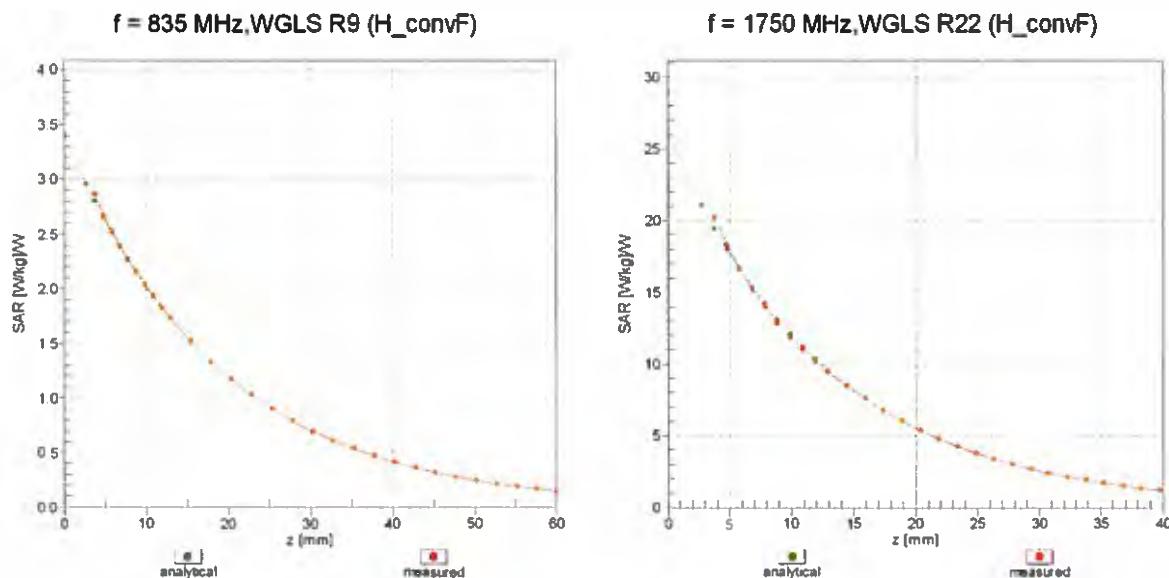
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

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



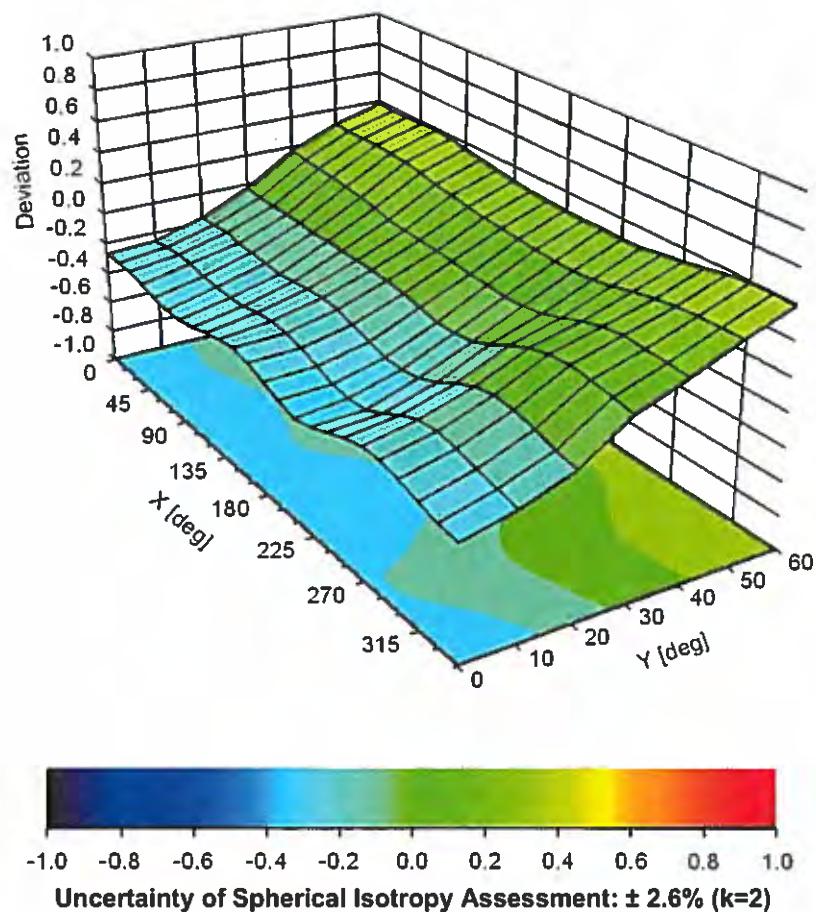
Uncertainty of Linearity Assessment: $\pm 0.6\% (k=2)$

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), $f = 900$ MHz



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 *R.B.* DATE: 18-09-2012

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



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Assot A2243

Accreditation No.: SCS 108

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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

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

Issued: September 3, 2012

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Accreditation No.: **SCS 108**

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 Multilateral Agreement for the recognition of calibration certificates

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- $NORMx,y,z$: 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 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 ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	1.14	1.33	1.33	$\pm 10.1\%$
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	$\pm 3.8\%$
			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 E²-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

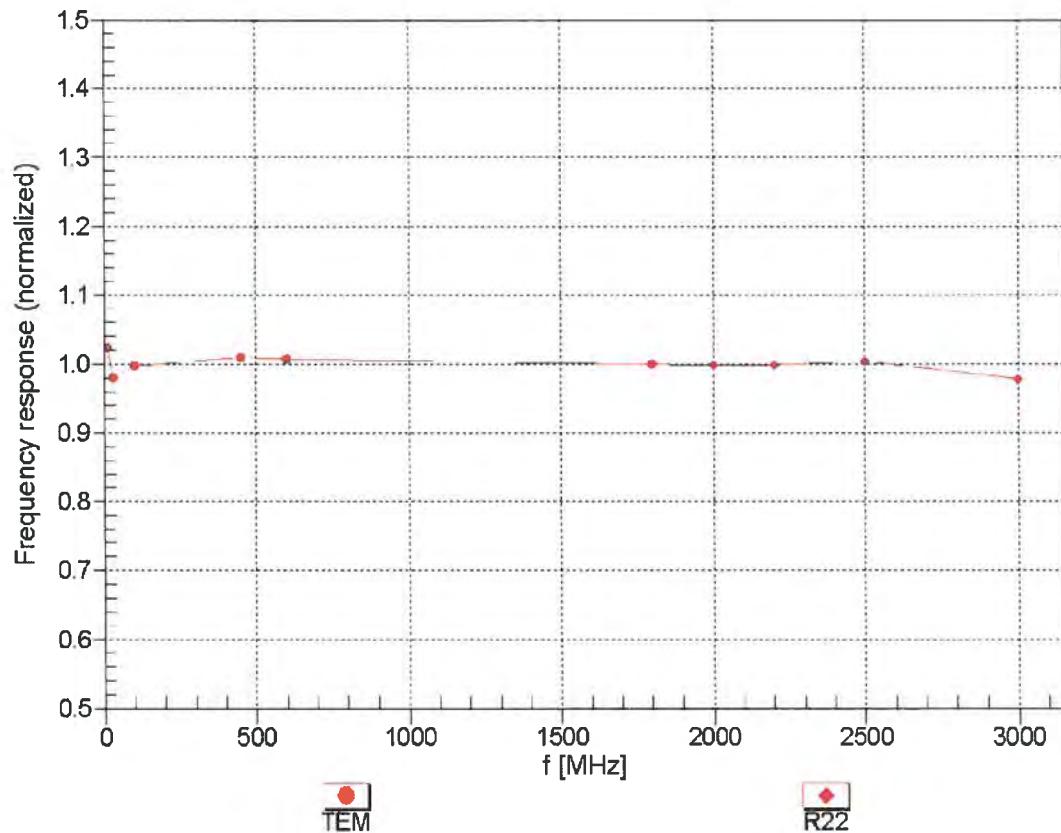
f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	6.25	6.25	6.25	0.58	1.30	± 12.0 %
835	55.2	0.97	6.13	6.13	6.13	0.60	1.32	± 12.0 %
900	55.0	1.05	6.11	6.11	6.11	0.80	1.18	± 12.0 %
1750	53.4	1.49	5.15	5.15	5.15	0.45	1.78	± 12.0 %
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

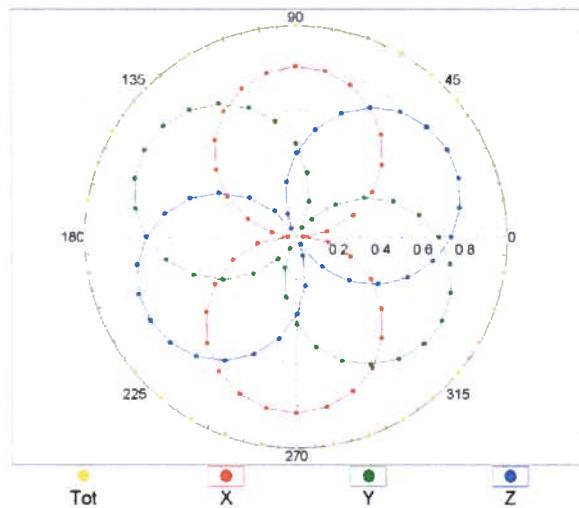
(TEM-Cell:ifi110 EXX, Waveguide: R22)



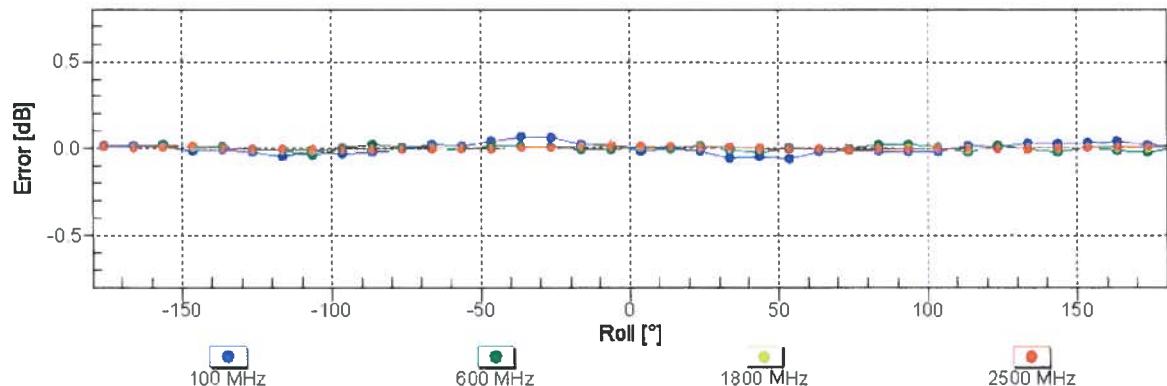
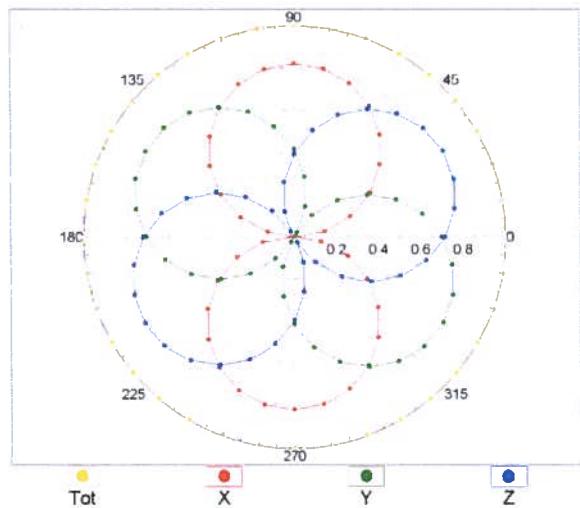
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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

$f=600$ MHz, TEM

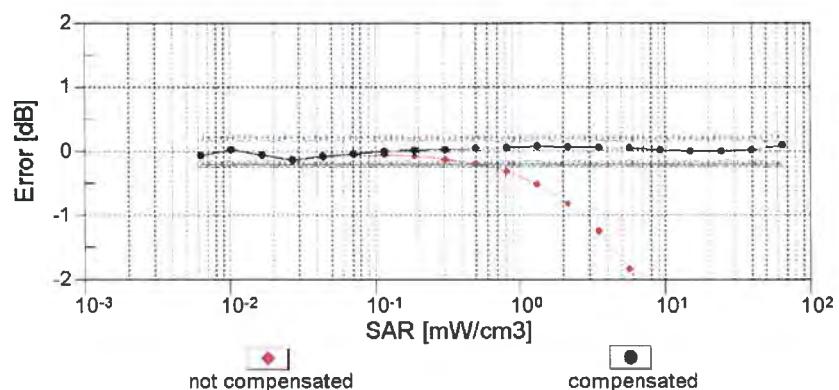
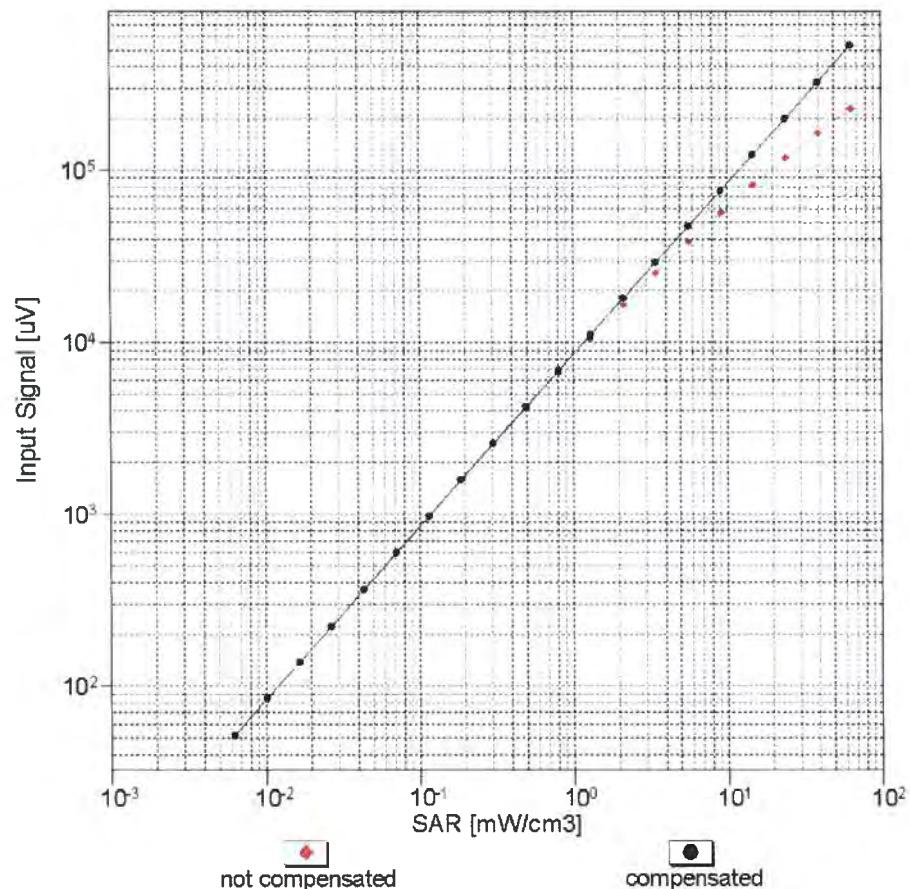


$f=1800$ MHz, R22



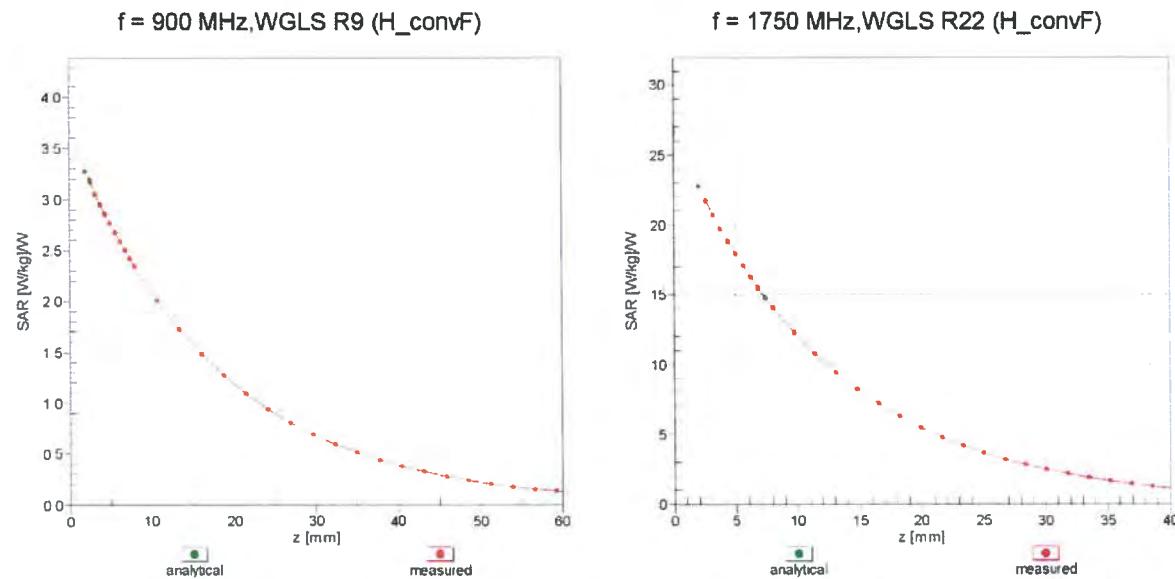
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

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

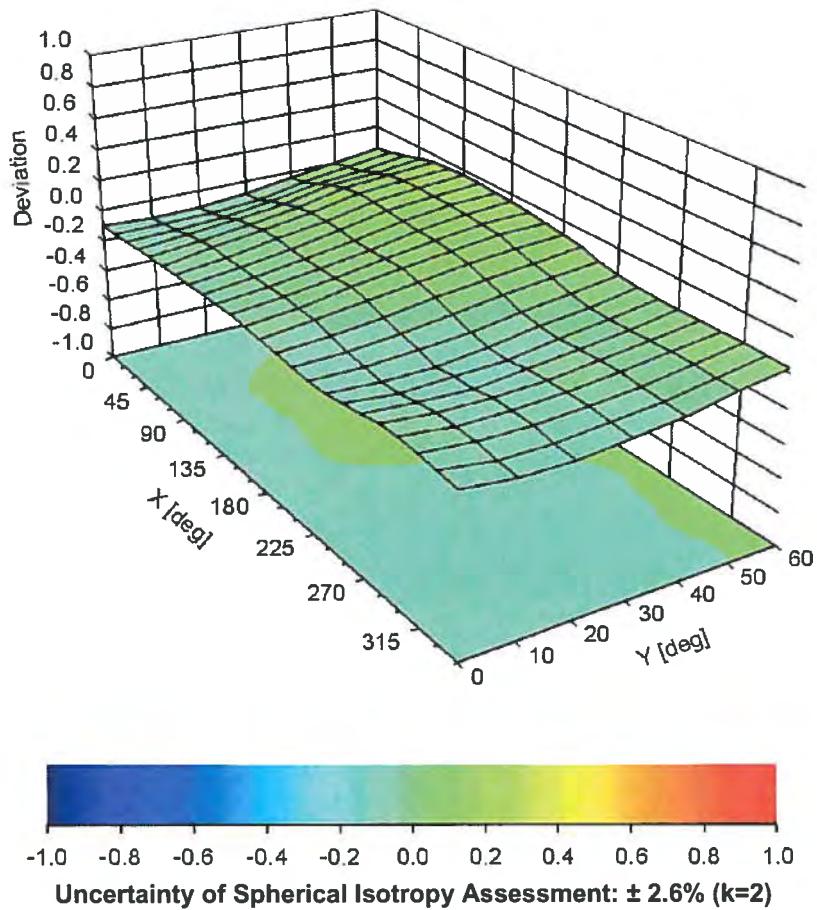


Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid Error (ϕ , 9), $f = 900$ MHz



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

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



Check by RFI DATE: 7-August 2012

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

Accredited by the Swiss Accreditation Service (SAS) *ASSET: A220/*

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 Multilateral Agreement for the recognition of calibration certificates

Client **RFI**

Accreditation No.: **SCS 108**

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

Calibrated by: Name **Israe El-Naouq** Function **Laboratory Technician**

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

Israe El-Naouq
Katja Pokovic

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Accredited by the Swiss Accreditation Service (SAS)

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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 $j\Omega$
Return Loss	- 24.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.5 Ω - 5.5 $j\Omega$
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; $\sigma = 0.96$ mho/m; $\epsilon_r = 40.6$; $\rho = 1000$ kg/m³

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:

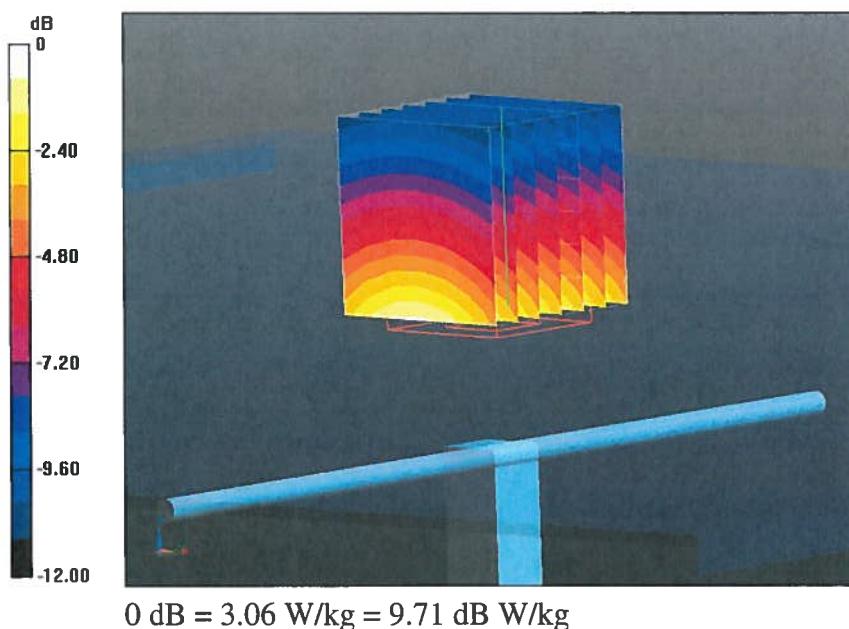
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.325 V/m; Power Drift = -0.01 dB

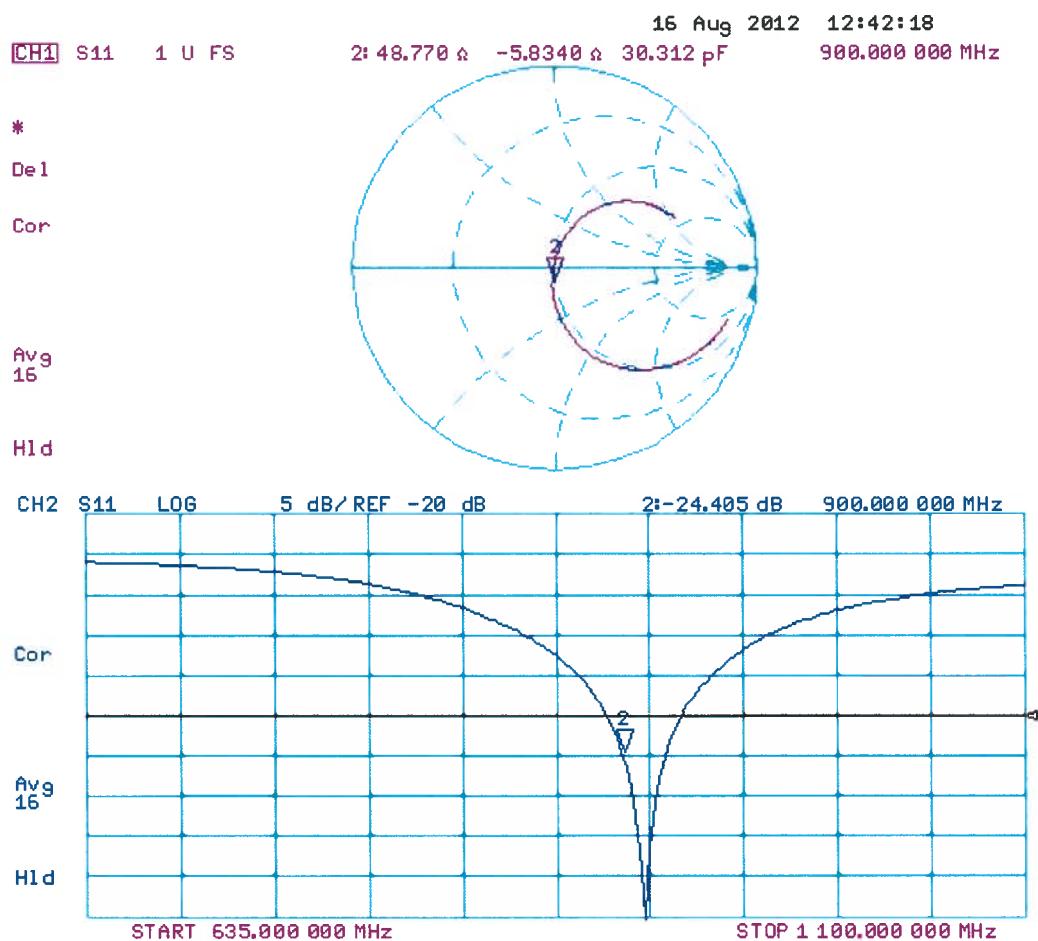
Peak SAR (extrapolated) = 3.926 mW/g

SAR(1 g) = 2.62 mW/g; SAR(10 g) = 1.68 mW/g

Maximum value of SAR (measured) = 3.06 W/kg



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; $\sigma = 1.06$ mho/m; $\epsilon_r = 52.6$; $\rho = 1000$ kg/m³

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:

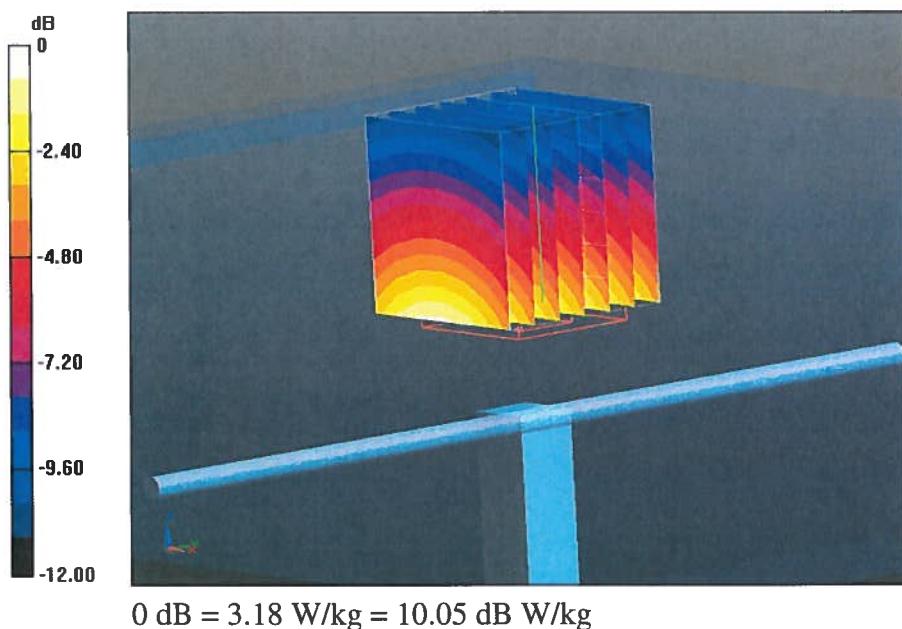
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.325 V/m; Power Drift = -0.01 dB

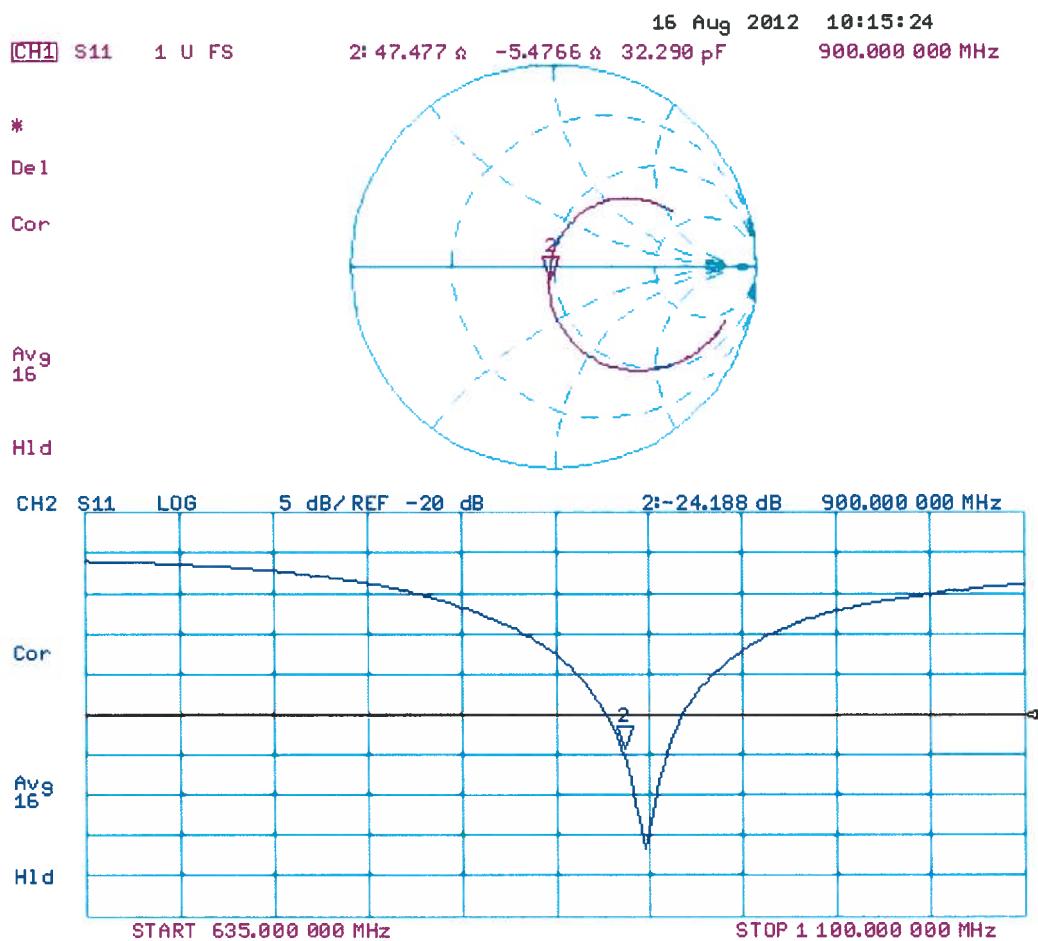
Peak SAR (extrapolated) = 4.184 mW/g

SAR(1 g) = 2.74 mW/g; SAR(10 g) = 1.76 mW/g

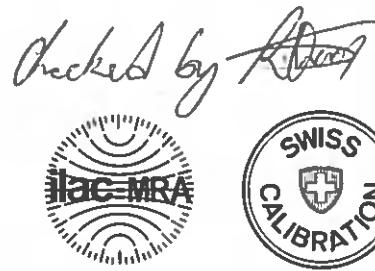
Maximum value of SAR (measured) = 3.18 W/kg



Impedance Measurement Plot for Body TSL



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



Checked by *Alain* Date: 7 ^{Sept} 2012

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Accreditation No.: SCS 108

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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

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

Issued: August 15, 2012

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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 \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	39.8 \pm 6 %	1.38 mho/m \pm 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 \pm 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 \pm 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 \pm 0.2) °C	52.0 \pm 6 %	1.52 mho/m \pm 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 \pm 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 \pm 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	45.8 Ω - 5.8 $j\Omega$
Return Loss	- 22.6 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	42.9 Ω - 5.3 $j\Omega$
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; $\sigma = 1.38$ mho/m; $\epsilon_r = 39.8$; $\rho = 1000$ kg/m³

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:

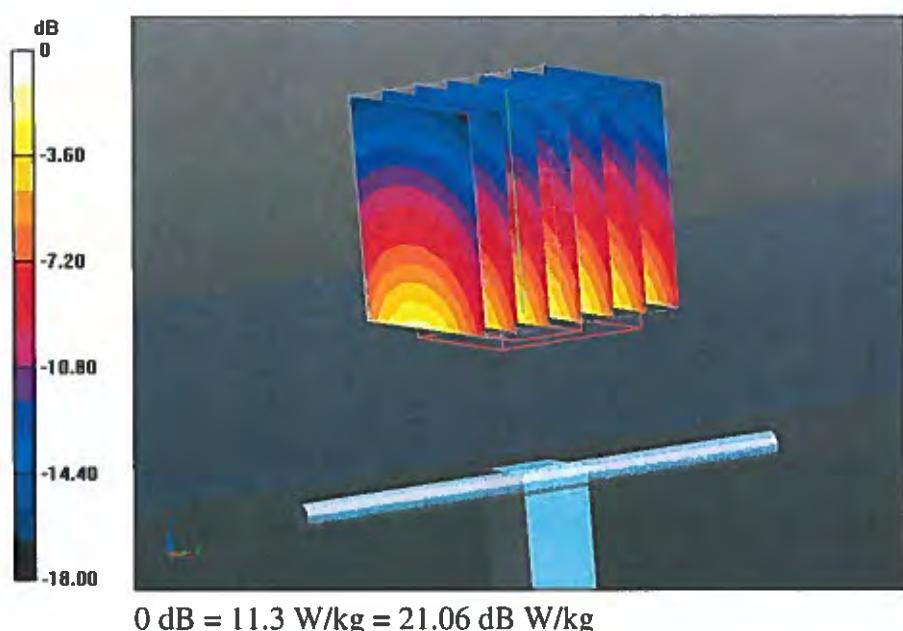
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.984 V/m; Power Drift = 0.03 dB

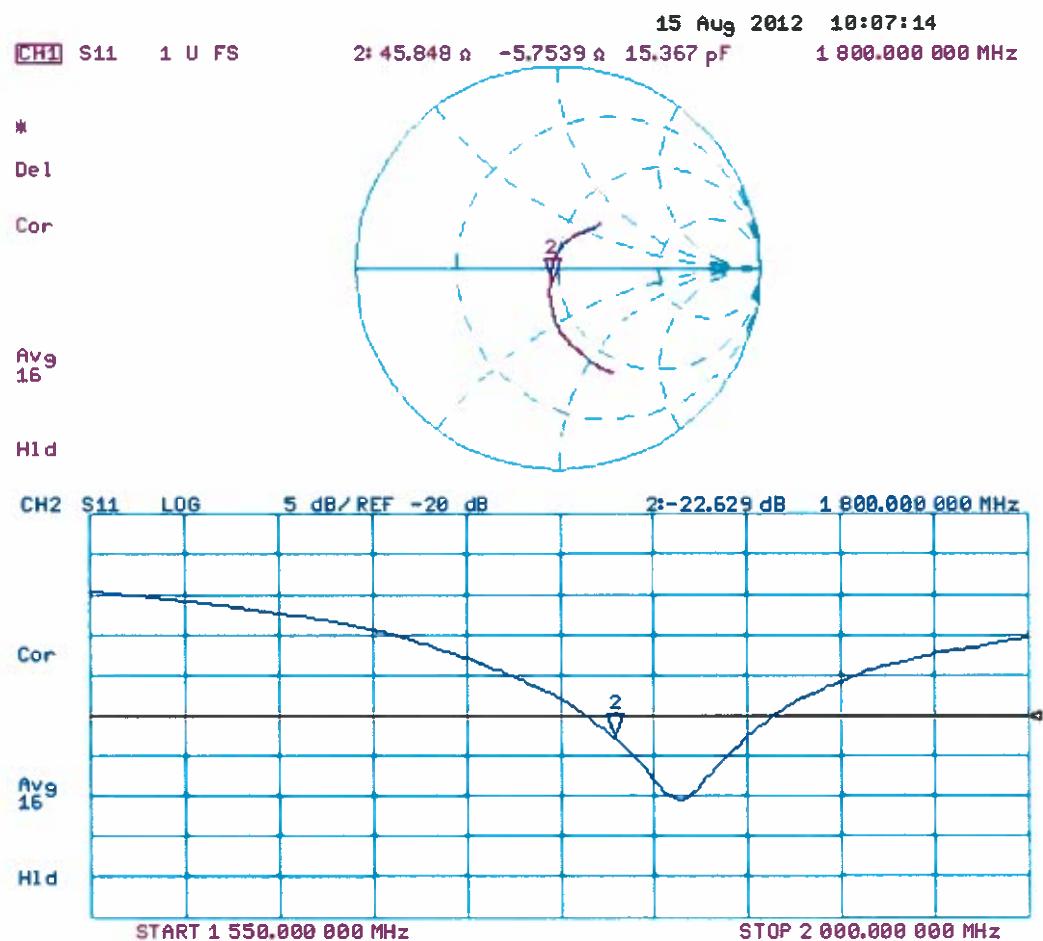
Peak SAR (extrapolated) = 16.364 mW/g

SAR(1 g) = 9.22 mW/g; SAR(10 g) = 4.87 mW/g

Maximum value of SAR (measured) = 11.3 W/kg



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; $\sigma = 1.52$ mho/m; $\epsilon_r = 52$; $\rho = 1000$ kg/m³

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:

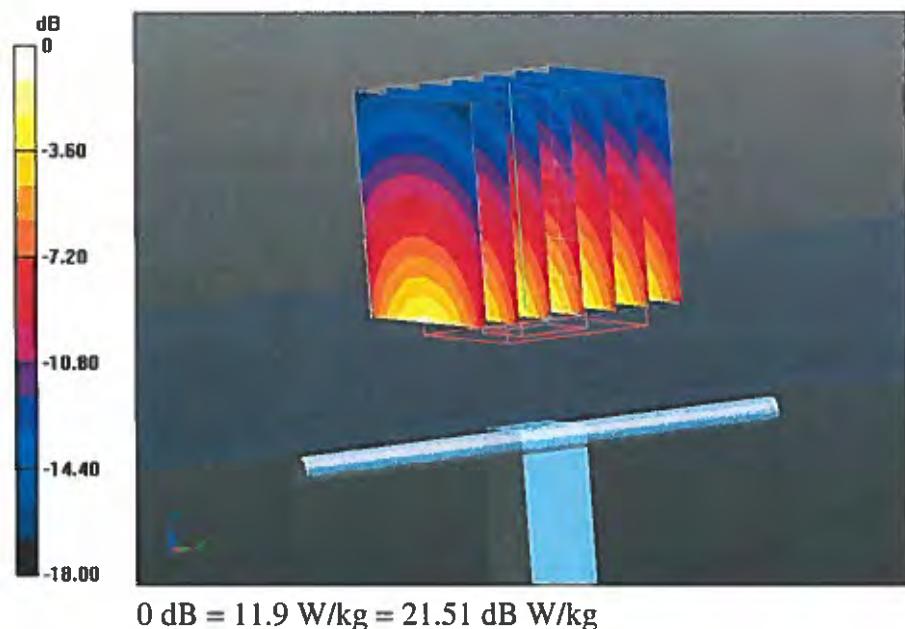
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 92.107 V/m; Power Drift = 0.02 dB

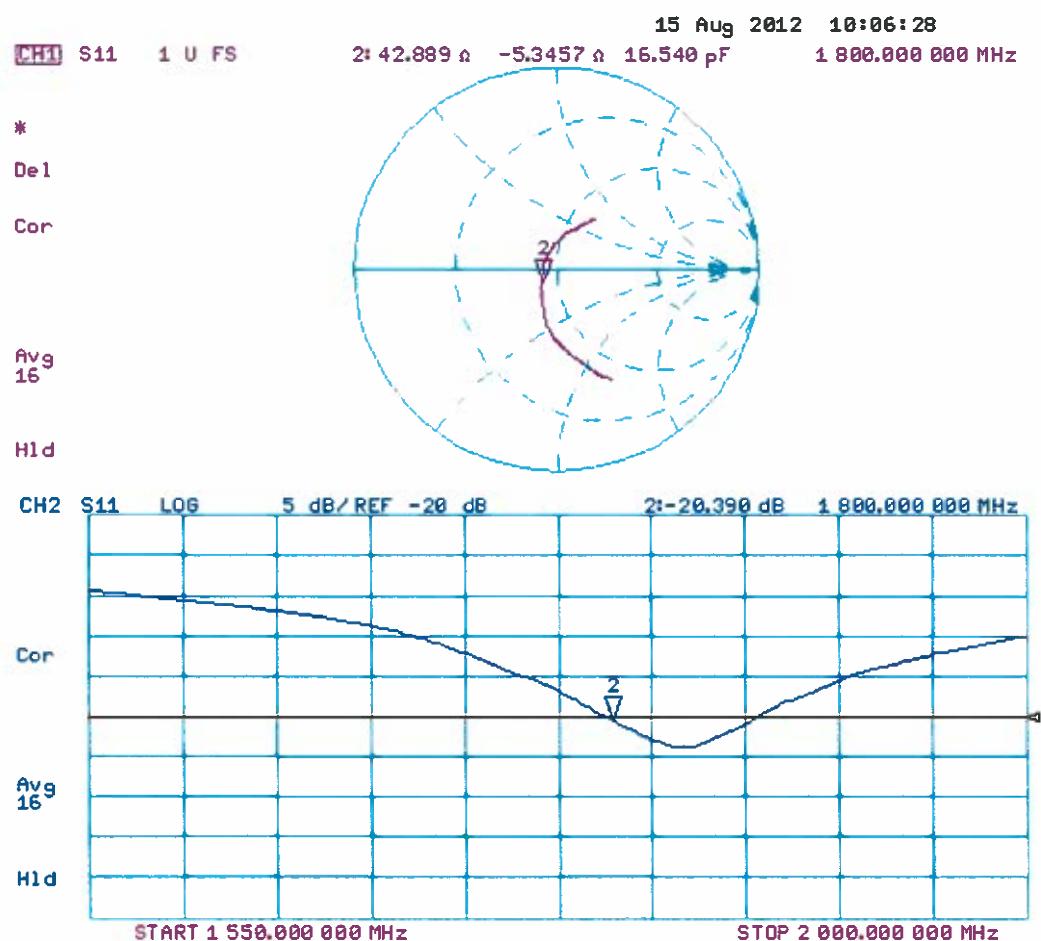
Peak SAR (extrapolated) = 16.733 mW/g

SAR(1 g) = 9.5 mW/g; SAR(10 g) = 5.04 mW/g

Maximum value of SAR (measured) = 11.9 W/kg



Impedance Measurement Plot for Body TSL





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Client

RFI

Accreditation No.: SCS 108

Certificate No: D1900V2-540_Feb11

CALIBRATION CERTIFICATE

Object D1900V2 - SN: 540

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

Calibration date: February 08, 2011

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

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

Calibration Equipment used (M&TE critical for calibration)

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

Calibrated by: Name: Dimce Iliev Function: Laboratory Technician

Approved by: Name: Katja Pokovic Function: Technical Manager

Issued: February 8, 2011

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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied.

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

SAR result with Head TSL

SAR averaged over 1 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 \pm 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 \pm 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

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

SAR result with Body TSL

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

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

Appendix

Antenna Parameters with Head TSL

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

Antenna Parameters with Body TSL

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

General Antenna Parameters and Design

Electrical Delay (one direction)	1.195 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 26, 2001

DASY5 Validation Report for Head TSL

Date/Time: 07.02.2011 15:18:47

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

Medium: HSL U12 BB

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.41$ mho/m; $\epsilon_r = 39.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

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

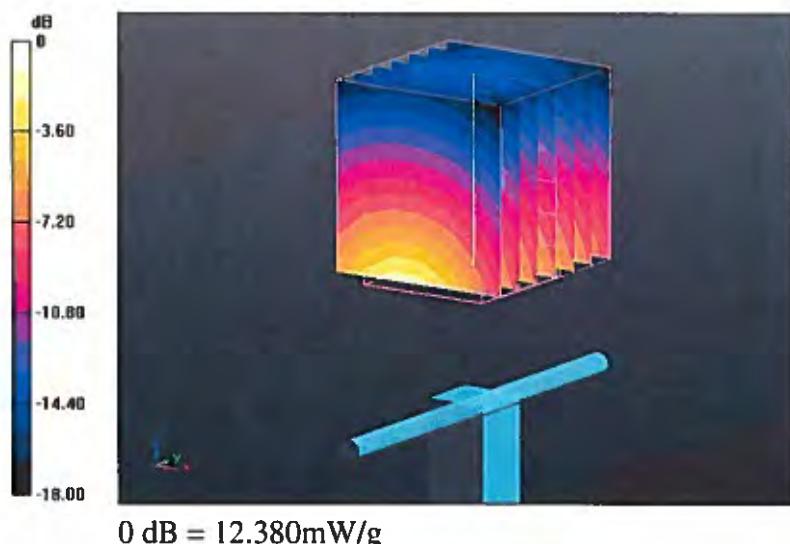
Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

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

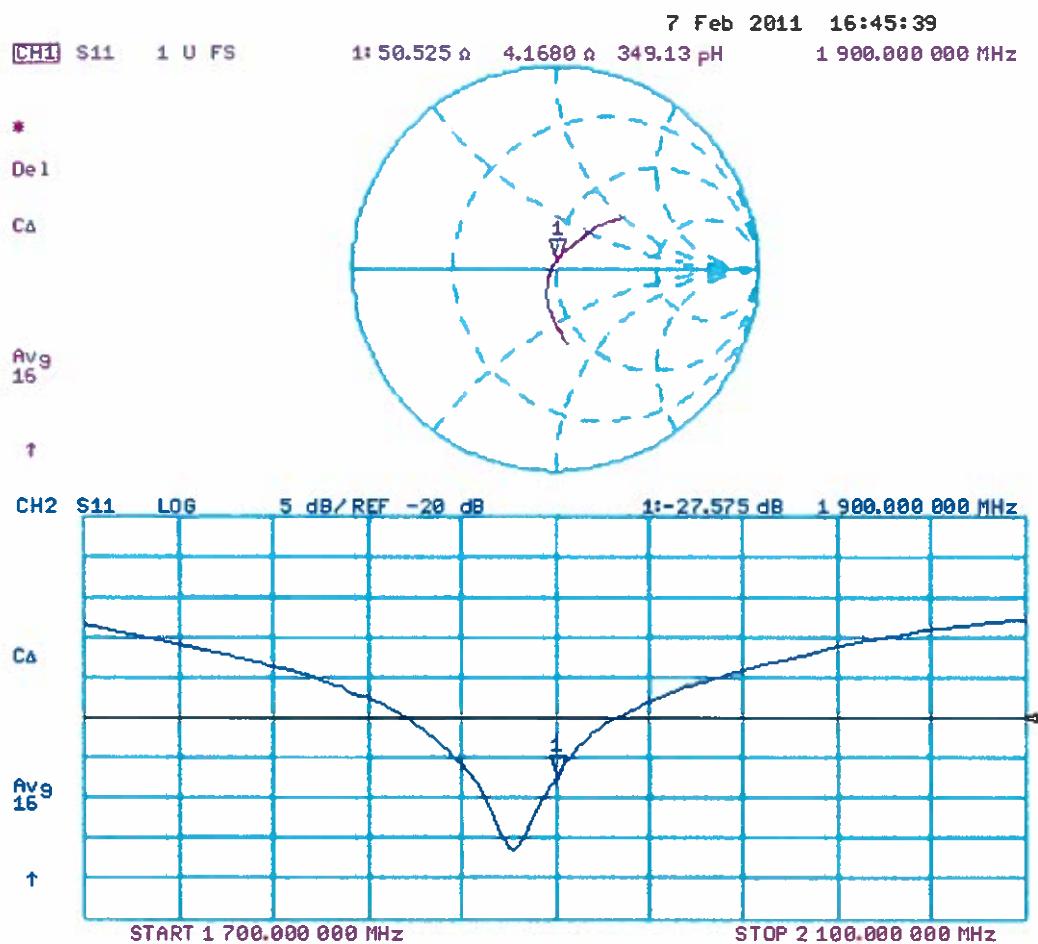
Peak SAR (extrapolated) = 18.544 W/kg

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

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



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 08.02.2011 12:04:35

Test Laboratory: SPEAG, Zurich, Switzerland

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

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

Medium: MSL U12 BB

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

Phantom section: Flat Section

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

DASY5 Configuration:

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

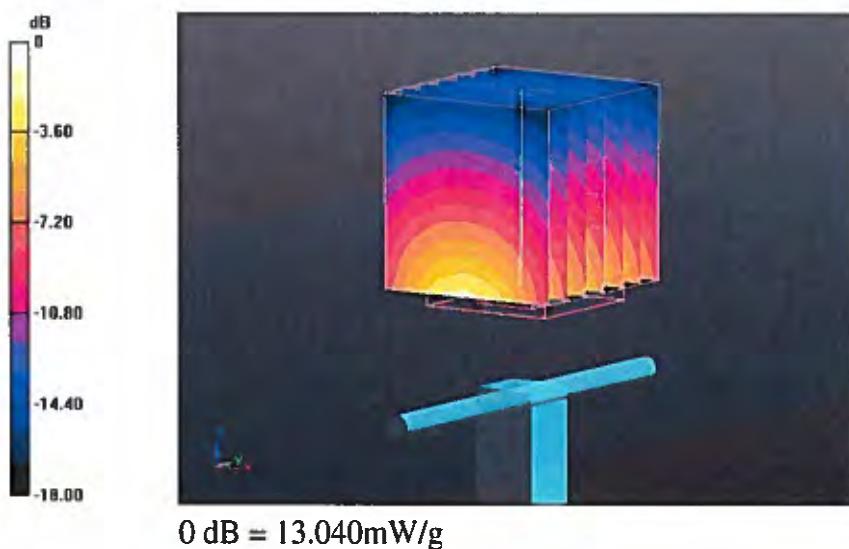
Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

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

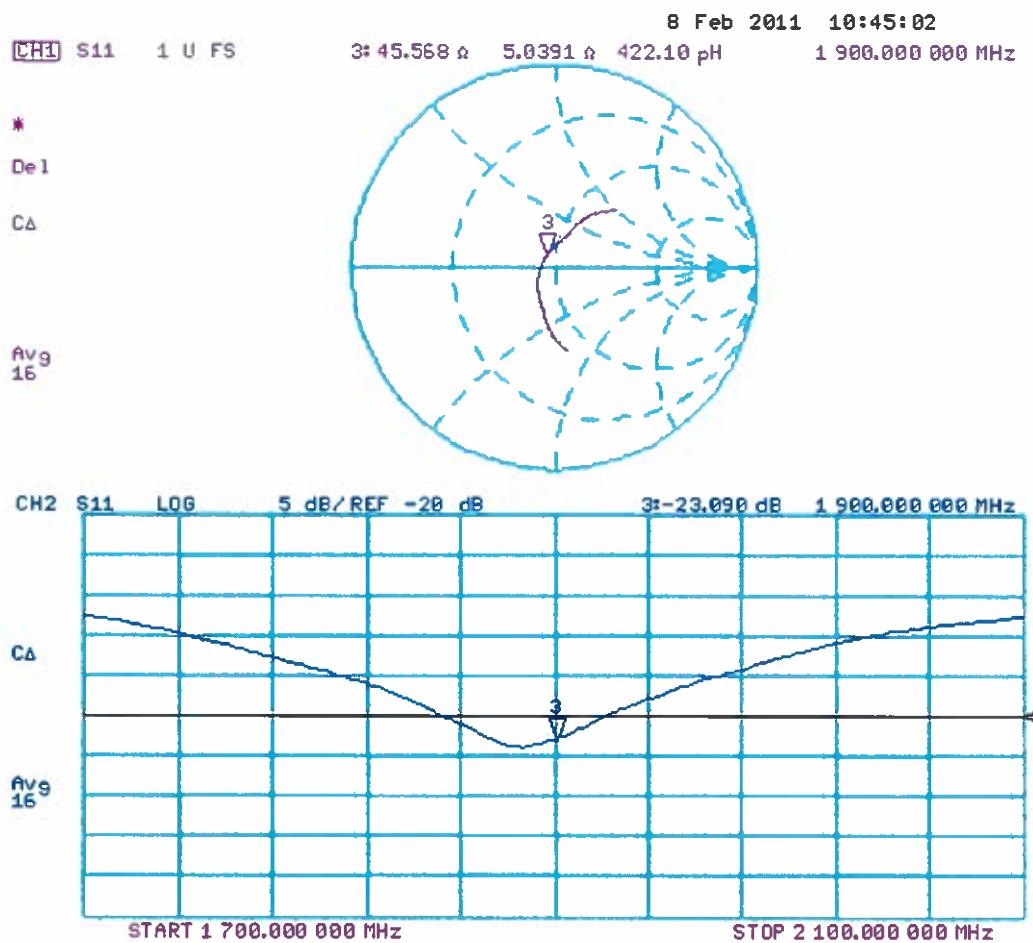
Peak SAR (extrapolated) = 17.597 W/kg

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

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



Impedance Measurement Plot for Body TSL



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



checked by *Roland* DATE: 7 ^{Sep 12} ~~Aug 12~~ 2012

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

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Accreditation No.: SCS 108

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Client RFI

Certificate No: 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 $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	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

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

Issued: August 13, 2012

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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 \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	39.2 \pm 6 %	1.81 mho/m \pm 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 \pm 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 \pm 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 \pm 0.2) °C	51.3 \pm 6 %	1.99 mho/m \pm 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 \pm 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 \pm 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.4 Ω - 8.2 $j\Omega$
Return Loss	- 21.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.8 Ω - 6.9 $j\Omega$
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; $\sigma = 1.81$ mho/m; $\epsilon_r = 39.2$; $\rho = 1000$ kg/m³

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:

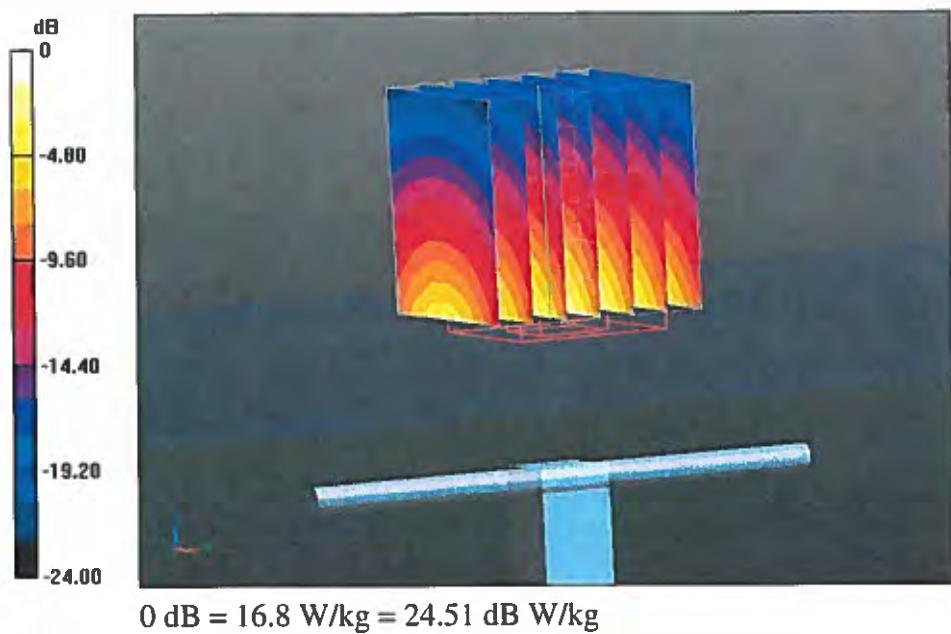
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 99.955 V/m; Power Drift = 0.00 dB

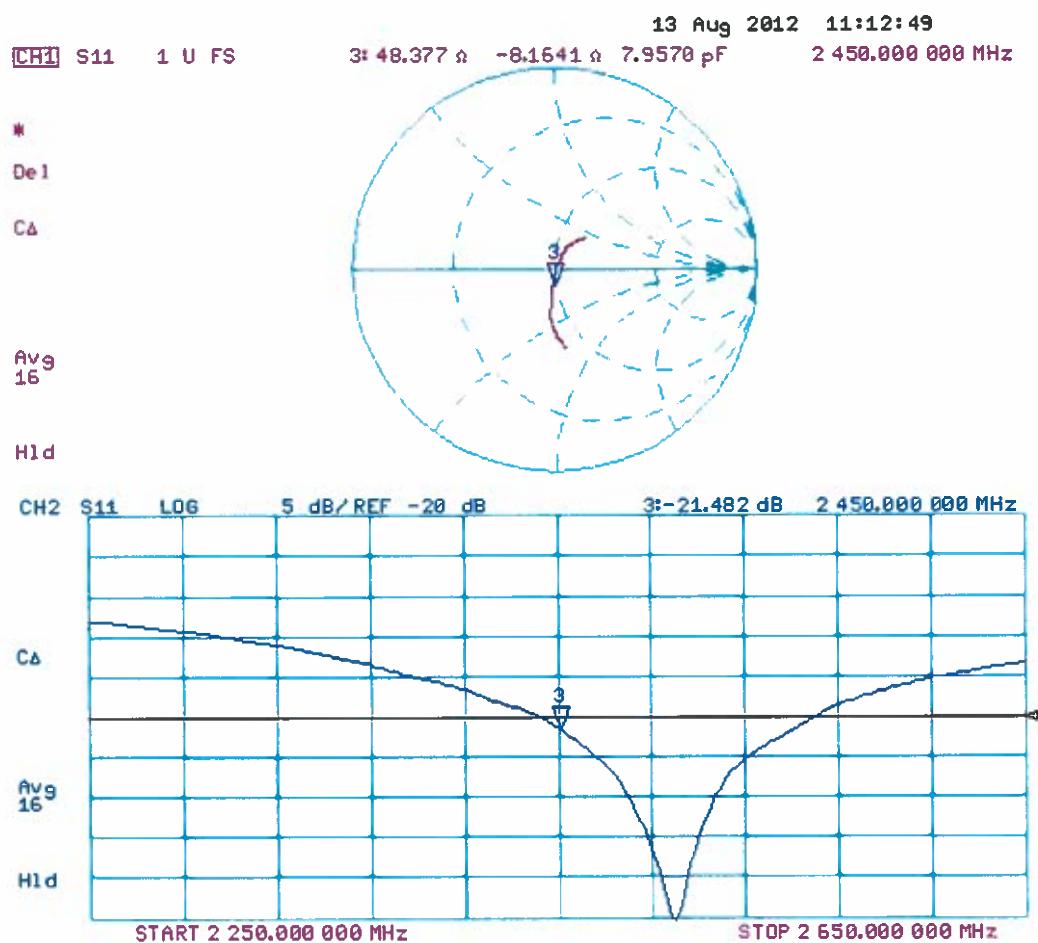
Peak SAR (extrapolated) = 27.027 mW/g

SAR(1 g) = 13.1 mW/g; SAR(10 g) = 6.06 mW/g

Maximum value of SAR (measured) = 16.8 W/kg



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; $\sigma = 1.99$ mho/m; $\epsilon_r = 51.3$; $\rho = 1000$ kg/m³

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:

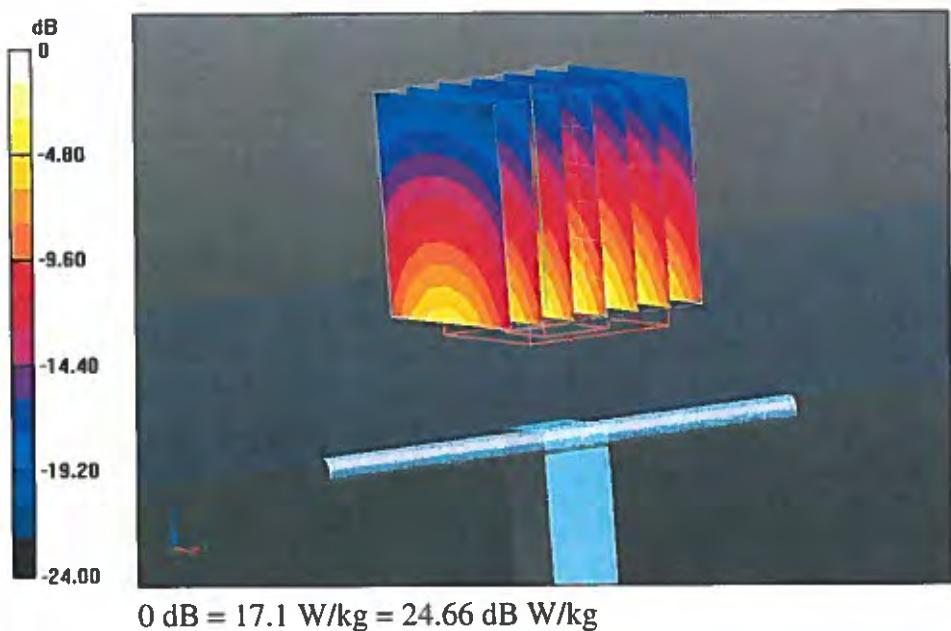
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.149 V/m; Power Drift = 0.00 dB

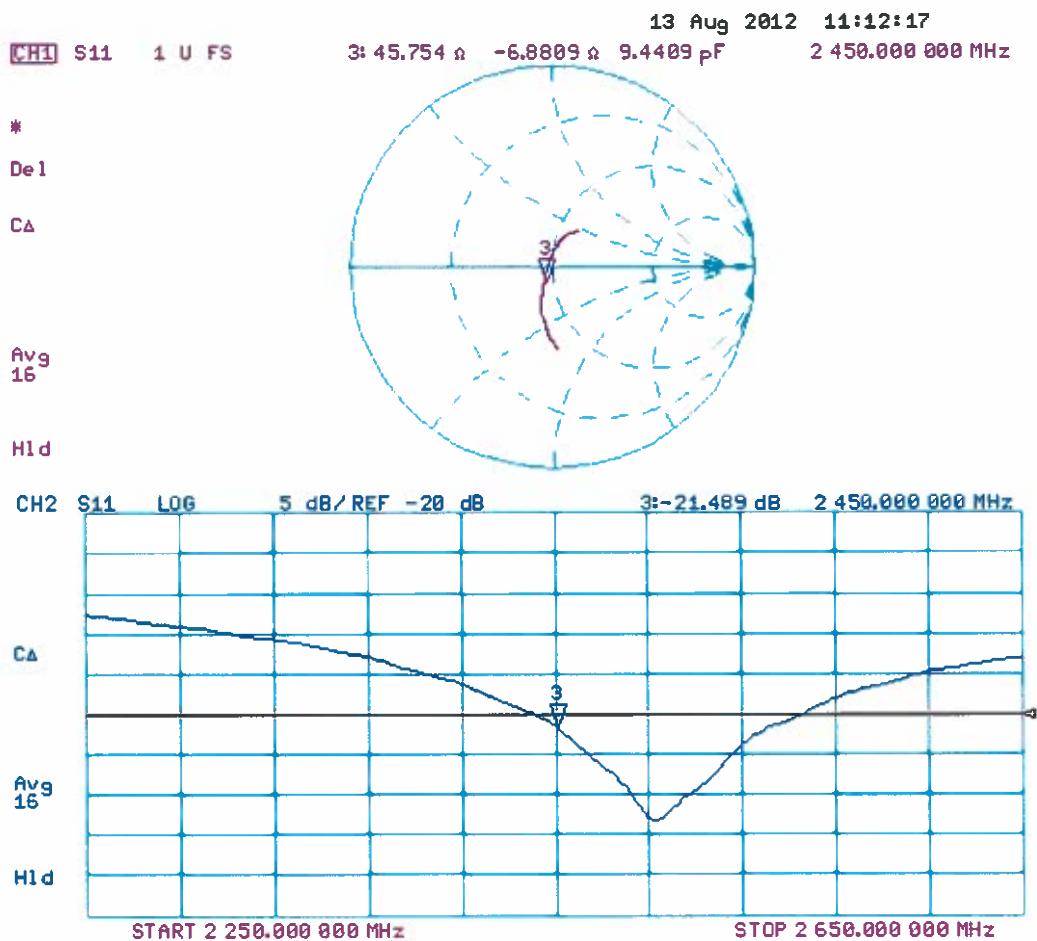
Peak SAR (extrapolated) = 26.944 mW/g

SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.09 mW/g

Maximum value of SAR (measured) = 17.1 W/kg



Impedance Measurement Plot for Body TSL



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



checked by *[Signature]*
DATE: 26-FEB-2013
S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

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Client RFI

A1377

Accreditation No.: SCS 108

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

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

Issued: February 20, 2013

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



Accredited by the Swiss Accreditation Service (SAS)

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

Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- a) 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 cm³ (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 cm³ (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 cm³ (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 cm³ (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	$52.7 \Omega - 9.7 j\Omega$
Return Loss	- 20.2 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	$48.5 \Omega - 0.8 j\Omega$
Return Loss	- 35.3 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	$57.1 \Omega + 7.1 j\Omega$
Return Loss	- 20.6 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	$53.2 \Omega - 9.1 j\Omega$
Return Loss	- 20.6 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	$48.7 \Omega - 0.2 j\Omega$
Return Loss	- 37.3 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	$57.1 \Omega + 8.7 j\Omega$
Return Loss	- 19.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 ns
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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: $f = 5200 \text{ MHz}$; $\sigma = 4.47 \text{ S/m}$; $\epsilon_r = 34.7$; $\rho = 1000 \text{ kg/m}^3$, Medium parameters used: $f = 5500 \text{ MHz}$; $\sigma = 4.74 \text{ S/m}$; $\epsilon_r = 34.2$; $\rho = 1000 \text{ kg/m}^3$, Medium parameters used: $f = 5800 \text{ MHz}$; $\sigma = 5.05 \text{ S/m}$; $\epsilon_r = 33.9$; $\rho = 1000 \text{ kg/m}^3$

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

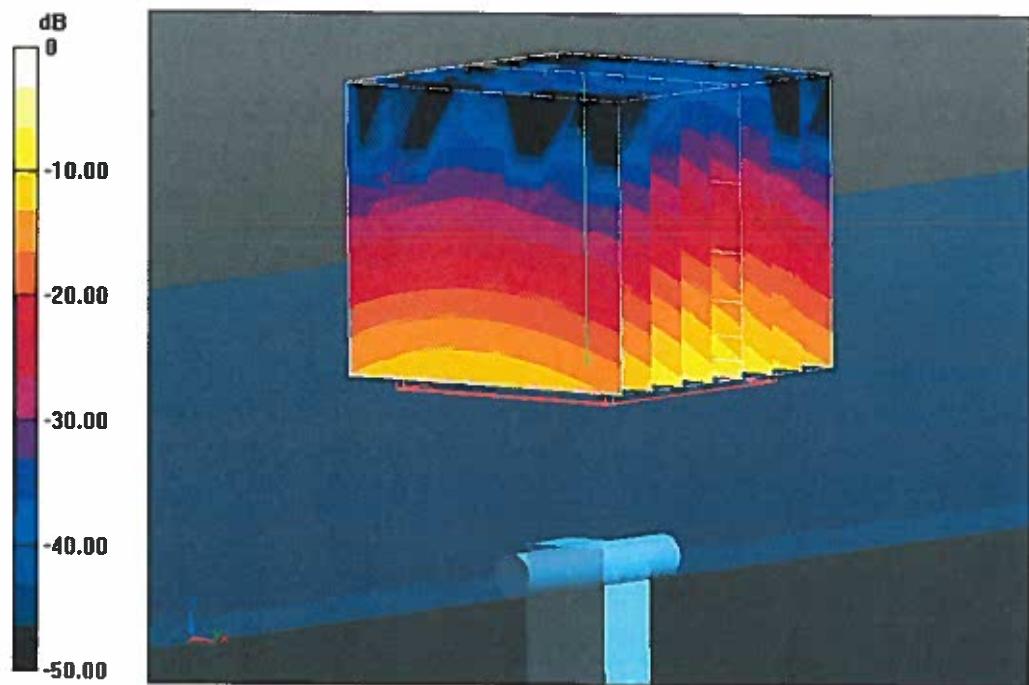
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 61.682 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 32.4 W/kg

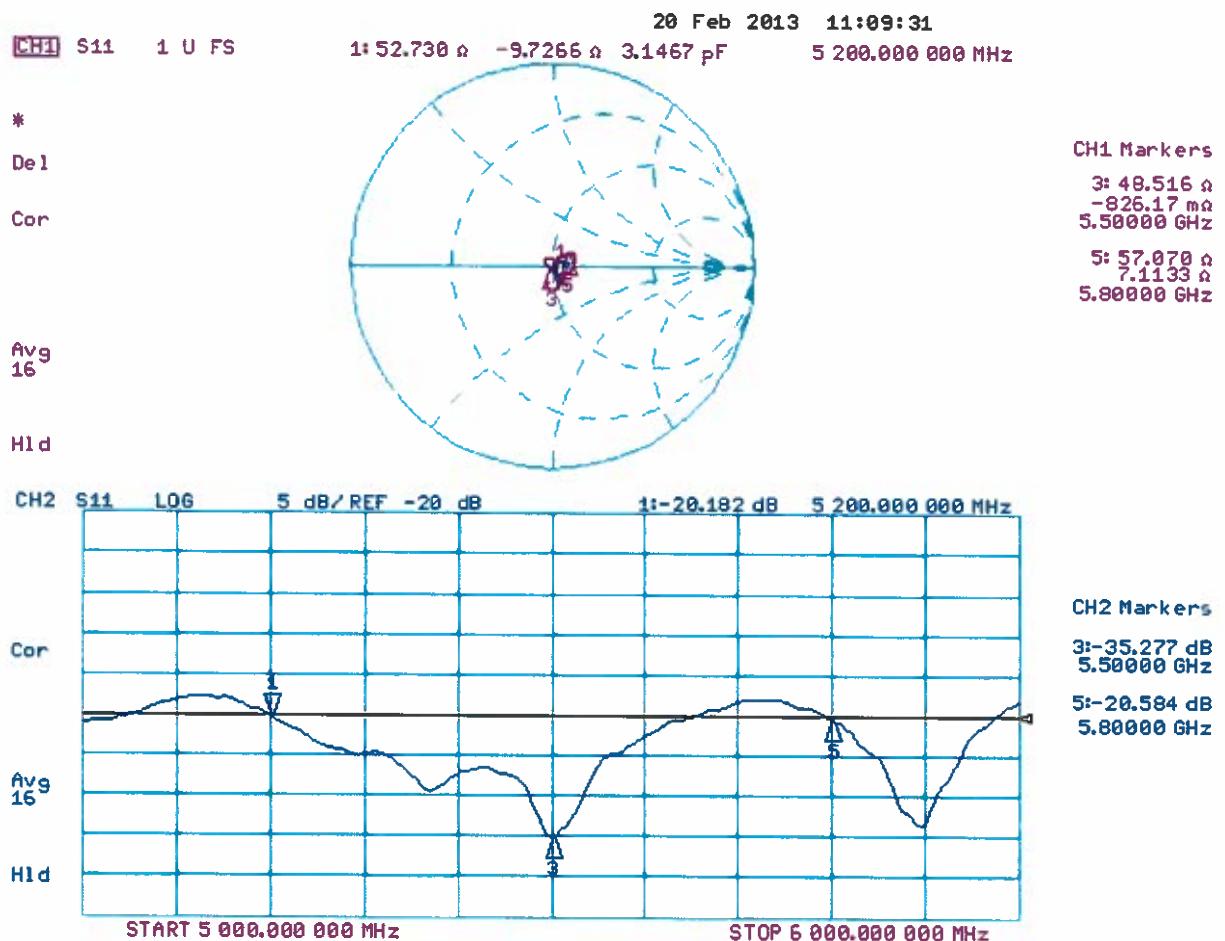
SAR(1 g) = 7.78 W/kg; SAR(10 g) = 2.22 W/kg

Maximum value of SAR (measured) = 19.1 W/kg



$0 \text{ dB} = 19.1 \text{ W/kg} = 12.81 \text{ dBW/kg}$

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: $f = 5200 \text{ MHz}$; $\sigma = 5.36 \text{ S/m}$; $\epsilon_r = 46.9$; $\rho = 1000 \text{ kg/m}^3$, Medium parameters used: $f = 5500 \text{ MHz}$; $\sigma = 5.71 \text{ S/m}$; $\epsilon_r = 46.3$; $\rho = 1000 \text{ kg/m}^3$, Medium parameters used: $f = 5800 \text{ MHz}$; $\sigma = 6.12 \text{ S/m}$; $\epsilon_r = 45.9$; $\rho = 1000 \text{ kg/m}^3$

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

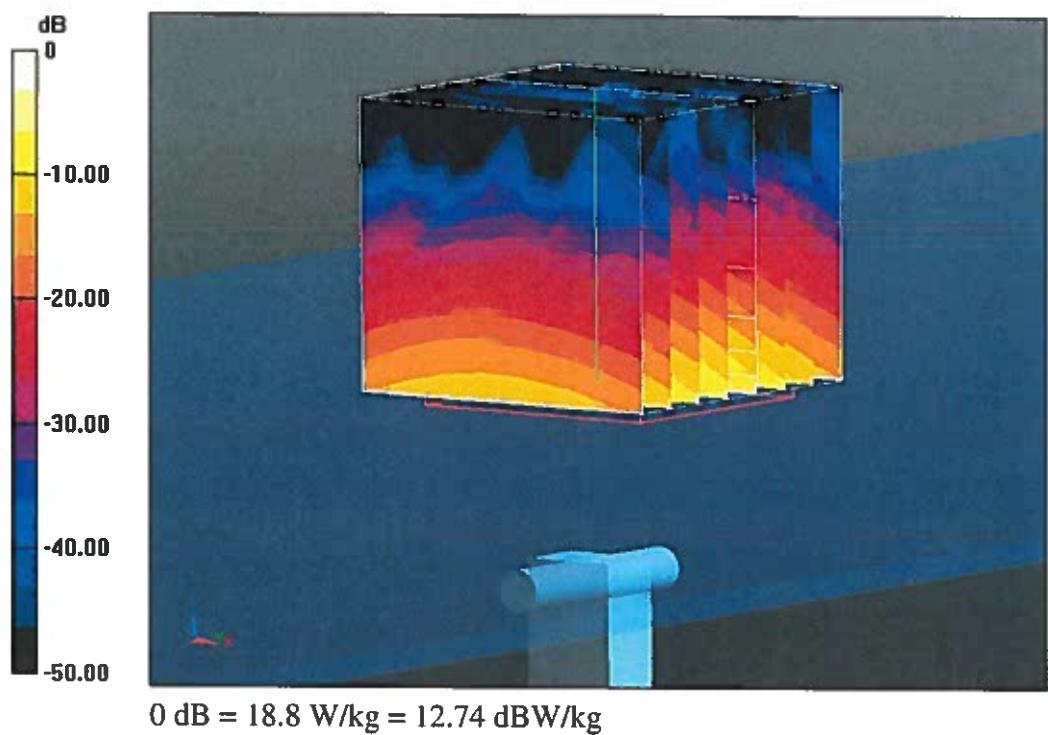
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 56.431 V/m; Power Drift = -0.01 dB

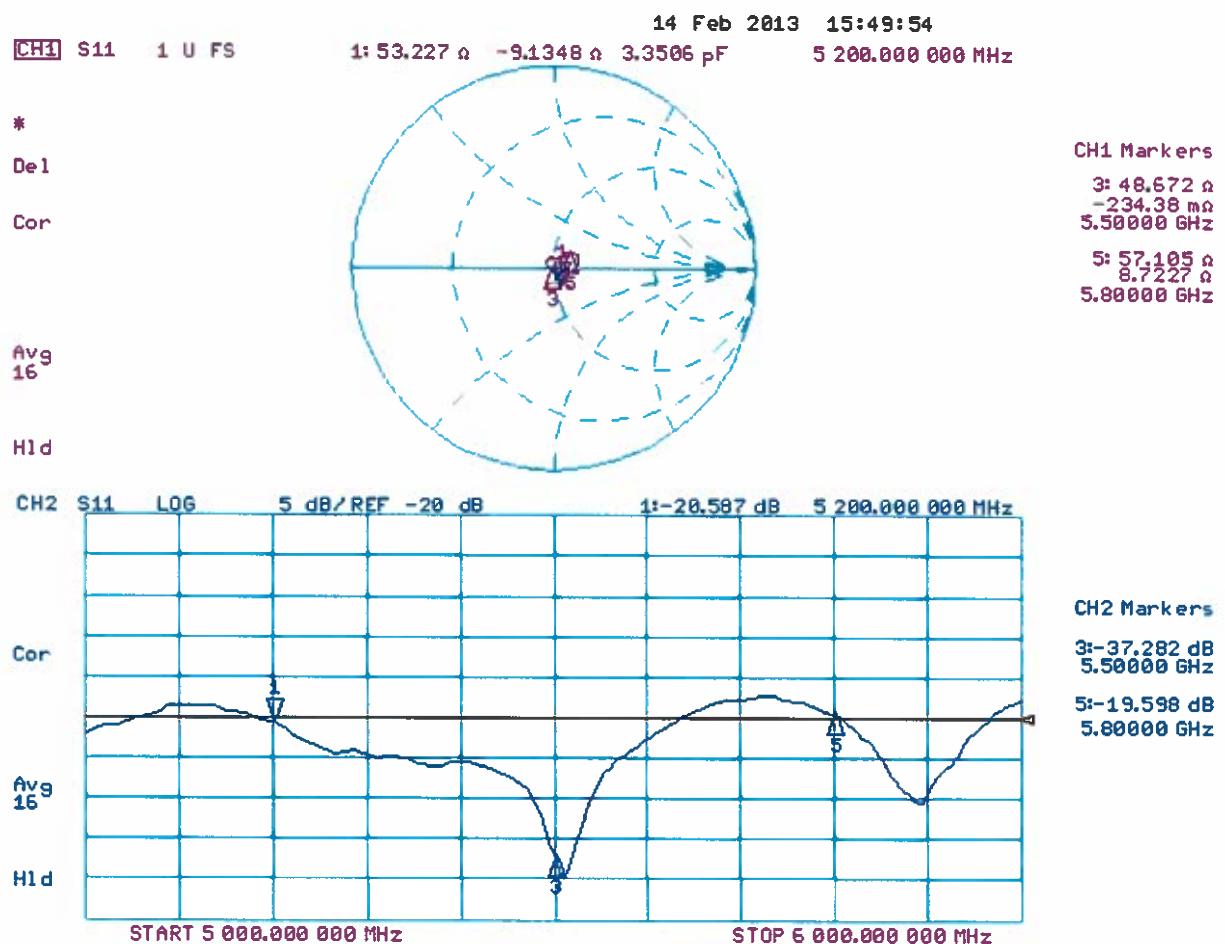
Peak SAR (extrapolated) = 35.6 W/kg

SAR(1 g) = 7.51 W/kg; SAR(10 g) = 2.09 W/kg

Maximum value of SAR (measured) = 18.8 W/kg



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 +18.0°C and +25.0°C. The tissue equivalent material fluid temperature was controlled to give a maximum variation of $\pm 2.0^{\circ}\text{C}$.

Prior to any SAR measurements on the EUT, system 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 865664 D01.

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 for frequency below 2.0 GHz, above 2.0GHz up to 3.0 GHz 7x7x7 cube of 343 points and a 7x7x12 cube of 588 points for frequency 5.0 GHz and above 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 7x7x7 or 7x7x12 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.