





TEST REPORT

Test of: Tempus Pro, 00-1004

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

Test Report Serial No:

UL-SAR-RP86493JD08A V1.0

This Test Report Is Issued Under The Authority Of Richelieu Quoi, SAR Technology Consultant:	 (APPROVED SIGNATORY)
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1. Customer Information

Company Name:	Remote Diagnostic Technologies Ltd
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Address:	The Old Coach House The Avenue Farleigh Wallop Hampshire RG25 2HT United Kingdom
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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 5	OET Bulletin 65 Supplement C: (2001-01)	
Specific Absorption Rate - Wi-Fi 802.11b/g 2.4 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)
Lap-Held (Separation Distance 0mm)	GSM850	0.015	PCE	24.00	0.022
	PCS1900	0.008		21.00	
	UMTS FDD 2	0.016		23.00	
	UMTS FDD 5	0.022		23.00	
	WLAN 2.4 GHz	0.003	DTS	16.00	0.003

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
Lap-Held RDT (Separation Distance 0mm)	UMTS FDD 5	0.022	PCE	23.00	0.105	N/A
	<i>Bluetooth</i>	0.083	DSS	3.00		
	WLAN 2.4 GHz	0.003	DTS	16.00	0.086	N/A
	<i>Bluetooth</i>	0.083	DSS	3.00		

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.
2. As per FCC KDB publication 447498, for cases where sum of WWAN and WLAN exceed 1.6W/kg, the SAR to peak location separation ratio distance is calculated as shown below

SAR peak location separation ratio (SPLSR) for each antenna pair in each simultaneous transmission configuration is given by $(SAR_1 + SAR_2)^{1.5} / R_i \leq 0.04$ for 1-g, where R_i is the antenna separation distance in mm.

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
Lap-Held (Separation Distance 0mm)	-	-	PCE	-	N/A
	-	-			

Note(s):

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

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

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

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

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

2.4. Location of Tests

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

2.5.Nominal and Maximum Output power:

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

Bands	GPRS							
	Tx Slot 1		Tx Slot 2		Tx Slot 3		Tx Slot 4	
	Target (dBm)	Tolerance \pm (dB)	Target (dBm)	Tolerance \pm (dB)	Target (dBm)	Tolerance \pm (dB)	Target (dBm)	Tolerance \pm (dB)
GSM850	32.0	-1.0 ~ + 1.0	30.5	-1.0 ~ + 1.0	29.0	-1.0 ~ + 1.0	27.0	-1.0 ~ + 1.0
PCS1900	29.0	-1.0 ~ + 1.0	26.0	-1.0 ~ + 1.0	24.0	-1.0 ~ + 1.0	23.0	-1.0 ~ + 1.0

Bands	EDGE GMSK (MCS1-4)							
	Tx Slot 1		Tx Slot 2		Tx Slot 3		Tx Slot 4	
	Target (dBm)	Tolerance \pm (dB)	Target (dBm)	Tolerance \pm (dB)	Target (dBm)	Tolerance \pm (dB)	Target (dBm)	Tolerance \pm (dB)
GSM850	32.0	-1.0 ~ + 1.0	30.5	-1.0 ~ + 1.0	29.0	-1.0 ~ + 1.0	27.0	-1.0 ~ + 1.0
PCS1900	29.0	-1.0 ~ + 1.0	26.0	-1.0 ~ + 1.0	24.0	-1.0 ~ + 1.0	23.0	-1.0 ~ + 1.0

Bands	EDGE 8PSK (MCS5-9)							
	Tx Slot 1		Tx Slot 2		Tx Slot 3		Tx Slot 4	
	Target (dBm)	Tolerance \pm (dB)	Target (dBm)	Tolerance \pm (dB)	Target (dBm)	Tolerance \pm (dB)	Target (dBm)	Tolerance \pm (dB)
GSM850	27.0	-1.0 ~ + 1.0	27.0	-1.0 ~ + 1.0	25.0	-1.0 ~ + 1.0	24.0	-1.0 ~ + 1.0
PCS1900	25.0	-1.0 ~ + 1.0	25.0	-1.0 ~ + 1.0	23.0	-1.0 ~ + 1.0	22.0	-1.0 ~ + 1.0

Bands	CS		HS	
	Target (dBm)	Tolerance \pm (dB)	Target (dBm)	Tolerance \pm (dB)
UMTS FDD 2	22.0	-1.0 ~ + 1.0	22.0	-1.0 ~ + 1.0
UMTS FDD 5	22.0	-1.0 ~ + 1.0	22.0	-1.0 ~ + 1.0

	WLAN Modes			
	2.4 GHz 802.11b		2.4 GHz 802.11g	
	1 Mbps	11 Mbps	6 Mbps	54 Mbps
Max Power {Target + Upper Tolerance} (dBm)	16.0	16.0	12.0	12.0

Band	Max Power {Target (dBm) + Upper Tolerance (dB)}
Bluetooth	3.0

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 941225 D01 SAR test for 3G devices v02

KDB 941225 D03 " SAR Test Reduction GSM/GPRS/EDGE 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:	Medical vital signs monitor
Brand Name:	Tempus Pro
Model Name or Number:	00-1004
Type Number:	None Stated
Serial Number:	49
IMEI Number:	None Stated
Hardware Version Number (WWAN Module: GTM601W)	3.0
Hardware Version Number (WLAN/WPAN Module: GTM601W)	C
Software Version Number:	V03
Hardware Revision of GSM Module:	None Stated
Software Revision of GSM Module:	None Stated
FCC ID Number:	None Stated
Country of Manufacture:	United Kingdom
Date of Receipt:	24 March 2013

Note(s):

This sample was used to perform WWAN SAR evaluation measurements only. The sample supports simultaneous transmission with the WWAN and WPAN, WLAN and WPAN.

4.2. Description of EUT

The Equipment Under Test is a 'Medical vital Signs Monitor' with GSM 2G Quad Band, 3G Penta band and Wi-Fi bands. The EUT has GPRS Class 12 / EDGE Class 12, UMTS FDD 1, 2, 4, 5, 8 With HSPA, WLAN 802.11 b/g and Bluetooth Bands mode capabilities.

4.3. Modifications Incorporated in the EUT

There were no modifications incorporated in the EUT

4.4. Accessories

The following accessories were supplied with the EUT during testing:

Description:	Battery
Brand Name:	Tempus Pro
Model Name or Number:	01-2051
Serial Number:	N/A
Cable Length and Type:	Not Applicable
Country of Manufacture:	United Kingdom
Connected to Port	8-pin contact

4.4.1. 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

4.5. Additional Information Related to Testing

Equipment Category	GSM/GPRS850, PCS/GPRS1900 UMTS FDD 2, 5 WiFi802.11 b/g	
Type of Unit	Portable Transceiver	
Intended Operating Environment:	Medical Environment (Within GSM, UMTS and Wi-Fi Coverage)	
Transmitter Maximum Output Power Characteristics:	GSM850	Communication Test Set was configured to allow the EUT to transmit at a maximum power using Power Control Level (PCL) setting of 5.
	PCS1900	Communication Test Set was configured to allow the EUT to transmit at a maximum power using Power Control Level (PCL) setting of 0.
	UMTS FDD 2	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.
	WiFi802.11b/g	Test Software was used to configure the EUT to transmit at a maximum power of up to 15.7dBm.
	<i>Bluetooth</i>	:= 2.00 mW or ~3.00 dBm

Additional Information Related to Testing (Continued):

Transmitter Frequency Range:	GSM850	824 to 849 MHz		
	PCS1900	1850 to 1910 MHz		
	UMTS Band 2	1852 to 1908 MHz		
	UMTS Band 5	826 to 847 MHz		
	WiFi802.11b/g	2412 to 2472 MHz		
Transmitter Frequency Allocation of EUT When Under Test:	Band	Channel Number	Channel Description	Frequency (MHz)
	GSM850	128	Low	824.2
		190	Middle	836.6
		251	High	848.8
	PCS1900	512	Low	1850.2
		661	Middle	1880.0
		810	High	1909.8
	UMTS FDD 2	9262	Low	1852.4
		9400	Middle	1880.0
		9538	High	1907.6
	UMTS FDD 5	4132	Low	826.4
		4183	Middle	836.6
		4233	High	846.6
	2.4 GHz Wi-Fi 802.11b/g	1	Low	2412.0
		6	Middle	2437.0
		11	High	2462.0
Modulation(s):	GMSK (GPRS): 217 Hz QPSK(UMTS / HSDPA/HSPA):0Hz DBPSK, BPSK, CCK (Wi-Fi): 0 Hz			
Modulation Scheme (Crest Factor):	GMSK (GPRS850/GPRS1900): 8.3 DBPSK, BPSK, CCK (Wi-Fi): 1 QPSK(UMTS FDD / HSDPA): 1			
Antenna Type:	Internal integral			
Antenna Length:	Unknown			
Number of Antenna Positions:	1 fixed (WWAN) 1 fixed (WLAN) 1 fixed (<i>Bluetooth</i>)			
Power Supply Requirement:	3.2-4.2V			
Battery Type(s):	Li-ion			

5. Deviations from the Test Specification

Test was performed as per KDB 248227 D01 "SAR measurements for 802.11a/b/g v01r02", KDB 447498 D01 General RF Exposure Guidance v05, KDB 941225 D01 SAR test for 3G devices v02, KDB 941225 D03 " SAR Test Reduction GSM/GPRS/EDGE 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.

GPRS class 12 / uplink setup of 1-uplink, 2-uplink, 3-uplink and 4-uplink were all evaluated to find the setting with the highest power reference point (unit v/m) as per the DASY4 system. 1-uplink was found to give the highest power reference point measurement on the DASY4 system (unit v/m) for GPRS850 and 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	2.03	2.33
2 uplink	1.76	2.13
3 uplink	1.79	2.27
4 uplink	1.76	2.26

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.

The test procedure was agreed with FCC prior to testing. The following configuration was agreed to be evaluated:

Based on the described usage scenarios and device specification, only lap-held position (bottom side faces a flat phantom at 0mm) is required. The hand-held and body-worn positions are not required.

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:

- 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 1 Uplink time slots with CS1 for GPRS.
- 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 1 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, 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, 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-TFCl 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, 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.
- 2.4 GHz WiFi802.11b/g Data allocated mode using dedicated software to excise mode 'b', 'g' and 'n', with maximum power of up to 15.7 dBm for 'b' mode and 11.7 dBm for 'g'.

6.2. Configuration and Peripherals

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

- Standalone fully charged battery powered.
- Lap-held configurations were evaluated.
- GPRS class 12: setup for 1-uplink, 2-uplink, 3-uplink and 4-uplink were evaluated to find the setting with the highest power reference measurements. 1-uplink was found to give the highest power reference point measurement on the DASY4 system (unit v/m) for GPRS850 and 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.

Lap-held 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.

6.3. SAR Test Exclusion Consideration

Frequency Band	Configuration(s)
	Lap-held
GSM850	No
PCS1900	No
UMTS FDD 2	No
UMTS FDD 5	No
WLAN 2.4 GHz	No
Bluetooth	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.

Bluetooth estimated SAR result is calculated as per the formula below following FCC KDB publication 447498.

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.

- 5mm Bluetooth estimated SAR level:**

$$\text{Estimated Bluetooth SAR} = (2.0\text{mW}/5\text{mm}) \cdot (\sqrt{2.4} / 7.5) = 0.083 \text{ W/kg}$$

- 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 Average Power Measurements**7.2.1. Conducted Average Power Measurement 2G: GSM850****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	29.5	27.3	26.3	Conducted, GMSK
190	836.6	33.0	29.9	27.6	26.6	Conducted, GMSK
251	848.8	33.0	29.9	27.7	26.6	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	23.5	23.0	23.3	Conducted, GMSK
190	836.6	24.0	23.9	23.3	23.6	Conducted, GMSK
251	848.8	24.0	23.9	23.4	23.6	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	29.5	27.3	26.3	Conducted, GMSK
190	836.6	33.0	29.9	27.6	26.6	Conducted, GMSK
251	848.8	33.0	29.9	27.7	26.6	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	23.5	23.0	23.3	Conducted, GMSK
190	836.6	24.0	23.9	23.3	23.6	Conducted, GMSK
251	848.8	24.0	23.9	23.4	23.6	Conducted, GMSK

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

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

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	26.8	24.9	24.0	Conducted, 8PSK
190	836.6	27.2	27.0	25.1	24.2	Conducted, 8PSK
251	848.8	27.3	27.1	25.1	24.2	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	20.8	20.6	21.0	Conducted, 8PSK
190	836.6	18.2	21.0	20.8	21.2	Conducted, 8PSK
251	848.8	18.3	21.1	20.8	21.2	Conducted, 8PSK

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

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

7.2.2. Conducted Average Power Measurement 2G: PCS1900**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	29.4	25.8	24.2	22.6	Conducted, GMSK
661	1880.0	28.9	25.8	24.0	22.8	Conducted, GMSK
810	1909.8	28.8	26.1	24.1	23.0	Conducted, GMSK

GPRS1900 - Calculated Value with consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Power (dBm) 3Uplink	Power (dBm) 4Uplink	Note
512	1850.2	20.4	19.8	19.9	19.6	Conducted, GMSK
661	1880.0	19.9	19.8	19.7	19.8	Conducted, GMSK
810	1909.8	19.8	20.1	19.8	20.0	Conducted, GMSK

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

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Power (dBm) 3Uplink	Power (dBm) 4Uplink	Note
512	1850.2	29.4	25.8	24.2	22.6	Conducted, GMSK
661	1880.0	28.9	25.8	24.0	22.8	Conducted, GMSK
810	1909.8	28.8	26.1	24.1	23.0	Conducted, GMSK

EDGE1900 - Calculated Value with consideration for Uplink time slots:

Channel Number	Frequency (MHZ)	Power (dBm) 1Uplink	Power (dBm) 2Uplink	Power (dBm) 3Uplink	Power (dBm) 4Uplink	Note
512	1850.2	20.4	19.8	19.9	19.6	Conducted, GMSK
661	1880.0	19.9	19.8	19.7	19.8	Conducted, GMSK
810	1909.8	19.8	20.1	19.8	20.0	Conducted, GMSK

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

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

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	25.3	25.3	23.4	22.4	Conducted, 8PSK
661	1880.0	25.2	25.2	23.4	22.4	Conducted, 8PSK
810	1909.8	25.4	25.4	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	16.3	19.3	19.1	19.4	Conducted, 8PSK
661	1880.0	16.2	19.2	19.1	19.4	Conducted, 8PSK
810	1909.8	16.4	19.4	19.3	19.6	Conducted, 8PSK

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

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

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]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]	Power [dBm]
Band 2 (1900)	9262 9662	20.6	20.2	19.6	19.5	20.2	20.0	19.7	20.6	19.7	22.2
	9400 9800	20.3	20.0	19.4	19.3	19.9	19.9	19.5	20.3	19.4	22.0
	9538 9938	20.0	19.8	19.3	19.2	19.8	19.9	19.3	20.3	19.3	21.8
Band 5 (850)	4132 4357	19.7	19.2	18.7	18.7	19.4	19.4	18.9	19.9	18.9	21.0
	4183 4408	20.0	19.7	19.1	19.0	19.6	19.6	19.1	20.0	19.0	21.1
	4233 4458	19.6	19.3	18.9	18.7	19.4	19.4	18.6	19.6	18.7	21.0
β_c		2	12	15	15	11	6	15	2	15	
β_d		15	15	8	4	15	15	9	15	15	
$\Delta ACK, \Delta NACK,$ ΔCQI		8	8	8	8	8	8	8	8	8	

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

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

Sub-test Setup for Release 5 HSDPA

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

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

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

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

Sub-test 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	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	31/15	B_{al1} : 47/15 B_{al2} : 47/15	4	1	2.0	1.0	15	92
4	2/15	15/15	64	2/15	2/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 ⁽⁴⁾	15/15 ⁽⁴⁾	64	15/15 ⁽⁴⁾	24/15	24/15	134/15	4	1	1.0	0.0	21	81

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

Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $B_{hs}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH AND E-DPCCH for the Power Back-off is based on the relative CM difference.

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

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

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

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

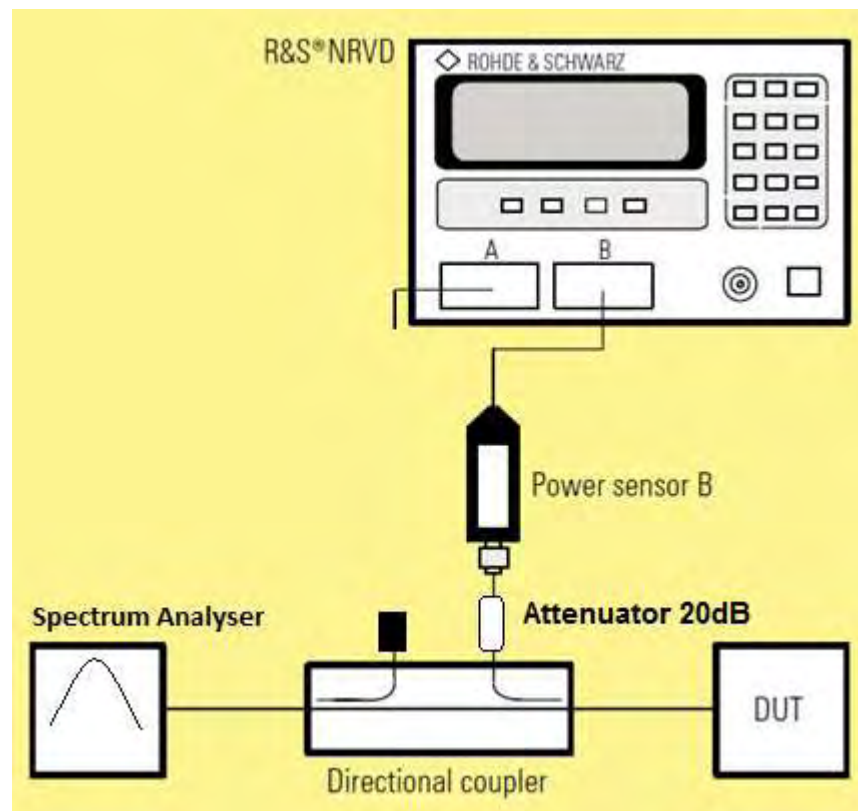
7.2.4. Conducted Average Power Measurements Wi-Fi 802.11b/g

Channel Number	Frequency (MHZ)	TX Power (dBm)	Note
1	2412.0	14.0	2.4GHz 802.11b (1Mbps)
6	2437.0	15.6	
11	2462.0	15.7	
1	2412.0	14.0	2.4GHz 802.11b (11Mbps)
6	2437.0	15.0	
11	2462.0	15.0	
1	2412.0	11.3	2.4GHz 802.11g (6Mbps)
6	2437.0	11.7	
11	2462.0	11.3	
1	2412.0	11.2	2.4GHz 802.11g (54Mbps)
6	2437.0	11.7	
11	2462.0	11.2	

7.2.5. Conducted Average Power Measurements: *Bluetooth*

Channel Number	Frequency (MHZ)	TX Power (dBm)	Note
0	2402.0	2.7	DH5, Conducted
39	2440.0	2.7	
78	2480.0	2.4	

Test setup for power measurements



7.3. Test Results

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

**7.3.1. Specific Absorption Rate - GPRS 850 Lap-Held Configuration 1g
Test Summary:**

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.015
Maximum Reported Level (W/kg):	0.015

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	23.4 to 23.4

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.
001	Back of EUT Facing Phantom	190	24.0	24.0	0.015	0.015	1, 2, 3	GMSK

Note(s):

1. Data - SAR measurements were performed using 1 uplink timeslots
2. SAR measurements were performed with the closest edge of the EUT at a separation distance of 0mm from the 'SAM' phantom flat section.
3. For frequency bands with an operating range of < 100 MHz, when the reported SAR for the highest output power channel within is ≤ 0.8 W/kg, SAR for the remaining channels is not required. As per KDB 447498, section 4.

*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

7.3.2. Specific Absorption Rate - GPRS 1900 Lap-Held Configuration 1g**Test Summary:**

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.007
Maximum Reported Level (W/kg):	0.008

Environmental Conditions:

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

Results:

Scan No.	EUT Position	Channel Number	Meas. Avg Power (dBm)	Max Rated Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
002	Back of EUT Facing Phantom	512	20.4	21.0	0.007	0.008	1, 2, 3	GMSK

Note(s):

1. Data - SAR measurements were performed using 1 uplink timeslots
2. SAR measurements were performed with the closest edge of the EUT at a separation distance of 0mm from the 'SAM' phantom flat section.
3. For frequency bands with an operating range of < 100 MHz, when the reported SAR for the highest output power channel within is ≤ 0.8 W/kg, SAR for the remaining channels is not required. As per KDB 447498, section 4.

*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 - UMTS-FDD 2 Lap-Held Configuration 1g**Test Summary:**

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.013
Maximum Reported Level (W/kg):	0.016

Environmental Conditions:

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

Results:

Scan No.	EUT Position	Channel Number	Meas. Avg Power (dBm)	Max Rated Power (dBm)	Meas. Level (W/kg)	Reported SAR (W/kg)	Note(s)	Mod.
003	Back of EUT Facing Phantom	9400	22.00	23.00	0.013	0.016	1, 2, 3	QPSK

Note(s):

1. Circuit Switch (CS) - RMC 12.2kbps with Test loop mode 1 and TPC bits configured to All "1's"
2. SAR measurements were performed with the closest edge of the EUT at a separation distance of 0mm from the 'SAM' phantom flat section.
3. For frequency bands with an operating range of < 100 MHz, when the reported SAR for the highest output power channel within is ≤ 0.8 W/kg, SAR for the remaining channels is not required. As per KDB 447498, section 4.

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

7.3.4. Specific Absorption Rate - UMTS-FDD 5 Lap-Held Configuration 1g**Test Summary:**

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.014
Maximum Reported Level (W/kg):	0.022

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	23.4 to 23.4

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.
004	Back of EUT Facing Phantom	4183	21.10	23.00	0.014	0.022	1, 2, 3	QPSK

Note(s):

1. Circuit Switch (CS) - RMC 12.2kbps with Test loop mode 1 and TPC bits configured to All "1's"
2. SAR measurements were performed with the closest edge of the EUT at a separation distance of 0mm from the 'SAM' phantom flat section.
3. For frequency bands with an operating range of < 100 MHz, when the reported SAR for the highest output power channel within is ≤ 0.8 W/kg, SAR for the remaining channels is not required. As per KDB 447498, section 4.

*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.

7.3.5. Specific Absorption Rate - Wi-Fi 2450 Lap-Held Configuration 1g**Test Summary:**

Tissue Volume:	1g
Maximum Measured Level (W/kg):	0.003
Maximum Reported Level (W/kg):	0.003

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	22.0 to 22.0

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.
005	Back of EUT Facing Phantom	6	15.60	16.00	0.003	0.003	1, 2, 3	DBPSK

Note(s):

1. WLAN 802.11b 1Mbps
2. SAR measurements were performed with the closest edge of the EUT at a separation distance of 0mm from the 'SAM' phantom flat section.
3. For frequency bands with an operating range of < 100 MHz, when the reported SAR for the highest output power channel within is ≤ 0.8 W/kg, SAR for the remaining channels is not required. As per KDB 447498, section 4.

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

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- GPRS 850 / UMTS FDD 5 Lap-Held Configuration 1g	95%	±20.07%
Specific Absorption Rate- GPRS1900 / UMTS FDD 2 Lap-Held Configuration 1g	95%	±20.00%
Specific Absorption Rate-Wi-Fi 2450 MHz Lap-Held Configuration 1g	95%	±19.90%

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

8.1. Specific Absorption Rate- GPRS / EDGE 850 / UMTS FDD 5 Lap-Held 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

8.2. Specific Absorption Rate- GPRS / EDGE 1900/ UMTS FDD 2 Lap-Held 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

8.3. Specific Absorption Rate-Wi-Fi 2450 MHz Lap-Held 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

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	-
A2111	Data Acquisition Electronics	Schmid & Partner Engineering AG	DAE3	432	02 May 2012	12
A1185	Probe	Schmid & Partner Engineering AG	ET3 DV6	1528	26 Jul 2012	12
A2201	900 MHz Dipole Kit	Schmid & Partner Engineering AG	D900V2	035	16 Aug 2012	12
A2200	1900 MHz Dipole Kit	Schmid & Partner Engineering AG	D1900V2	537	14 Aug 2012	12
A2202	2440 MHz Dipole Kit	Schmid & Partner Engineering AG	D2440V2	701	13 Aug 2012	12
A1497	Amplifier	Mini-Circuits	zhl-42w (sma)	e020105	Calibrated as part of system	-
A2252	2mm Oval Phantom	Schmid & Partner Engineering AG	Eli5	1177	Calibrated before use	-
A1328	Handset Positioner	Schmid & Partner Engineering AG	Modification	SD 000 H01 DA	-	-
A1182	Handset Positioner	Schmid & Partner Engineering AG	V3.0	None	-	-
A215	20 dB Attenuator	Narda	766-20	9402	Calibrated as part of system	-
A1531	Antenna	AARONIA AG	7025	02458	-	-
A2263	Digital Camera	Samsung	PL211	9453C90B 607487L	-	-
M1015	Network Analyser	Agilent Technologies	8753ES	US39172406	09 Oct 2012	12
C1145	Cable	Rosenberger MICRO-COAX	FA147A F003003030	41843-1	Calibrated as part of system	-
C1146	Cable	Rosenberger MICRO-COAX	FA147A F030003030	41752-1	Calibrated as part of system	-
GO591	Robot Power Supply	Schmid & Partner Engineering AG	DASY4	None	Calibrated before use	-
G087	PSU	Thurlby Thandar	CPX200	100701	Calibrated before use	-

UL No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
M1047	Robot Arm	Staubli	RX908 L	F00/SD8 9A1/A/01	Calibrated before use	-
M1647	Signal Generator	Hewlett Packward	8648C	3537A01598	01 Jun 2012	12
M1071	Spectrum Analyzer	Agilent	HP8590E	3647U00514	(Monitoring use only)	-
M1270	Digital Thermometer	RS	N/A	N/A	Internal Checked 13 May 2012	12
M1023	Dual Channel Power Meter	R & S	NRVD	863715/030	18 July 2012	12
S512	SAR Lab	UL	Site 57	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.

Accredited by the Swiss Accreditation Service (SAS)
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **RFI**

Certificate No: **ET3-1528_Jul12**

CALIBRATION CERTIFICATE

Object **ET3DV6 - SN:1528**

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



Calibration date: **July 26, 2012**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ 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 Jeton Kastrati	Function Laboratory Technician	Signature 
Approved by:	Name Katja Pokovic	Function Technical Manager	Signature 

Issued: July 26, 2012

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



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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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}** = NORM_{x,y,z} * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; 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 NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe ET3DV6

SN:1528

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

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

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

Basic Calibration Parameters

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

Modulation Calibration Parameters

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

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

^A The uncertainties of NormX,Y,Z do not affect the 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:1528

Calibration Parameter Determined in Head Tissue Simulating Media

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

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

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

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

Calibration Parameter Determined in Body Tissue Simulating Media

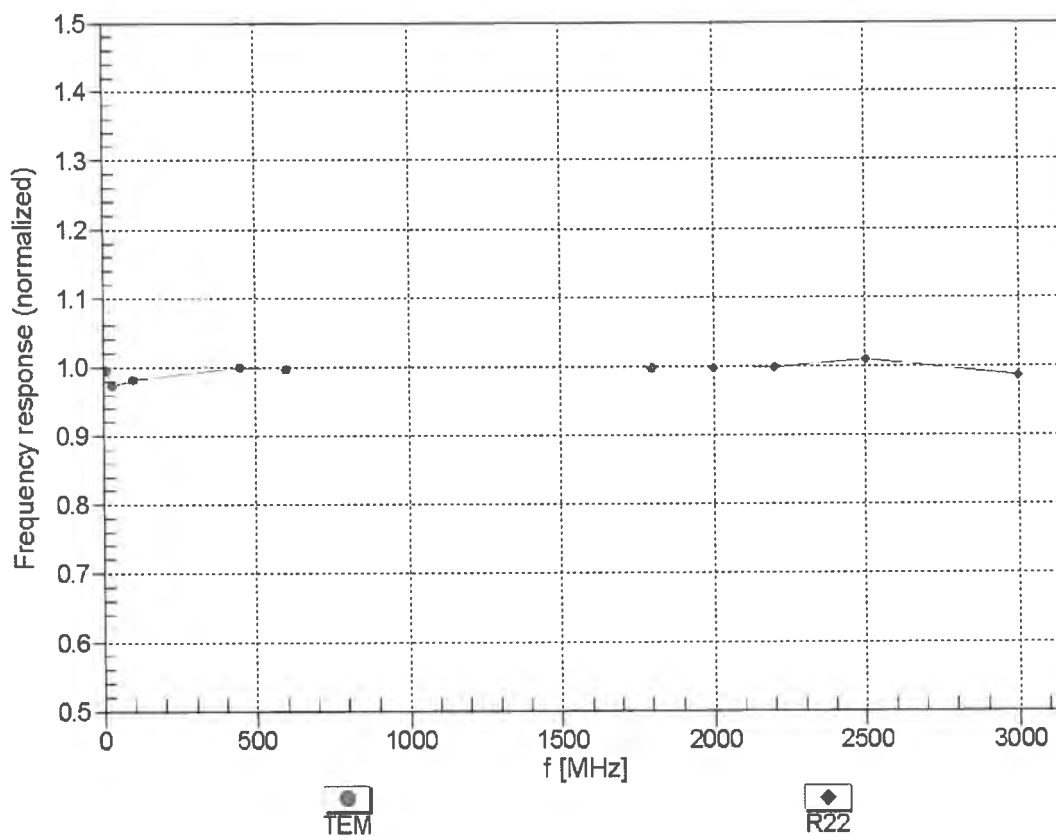
f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
450	56.7	0.94	7.47	7.47	7.47	0.16	2.32	± 13.4 %
750	55.5	0.96	6.17	6.17	6.17	0.33	2.75	± 12.0 %
835	55.2	0.97	5.99	5.99	5.99	0.33	3.00	± 12.0 %
900	55.0	1.05	5.92	5.92	5.92	0.55	2.18	± 12.0 %
1450	54.0	1.30	5.11	5.11	5.11	0.76	2.07	± 12.0 %
1750	53.4	1.49	4.64	4.64	4.64	0.80	2.45	± 12.0 %
1900	53.3	1.52	4.42	4.42	4.42	0.80	2.33	± 12.0 %
2150	53.1	1.66	4.37	4.37	4.37	0.80	1.93	± 12.0 %
2450	52.7	1.95	3.99	3.99	3.99	0.56	0.98	± 12.0 %

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

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

Frequency Response of E-Field

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

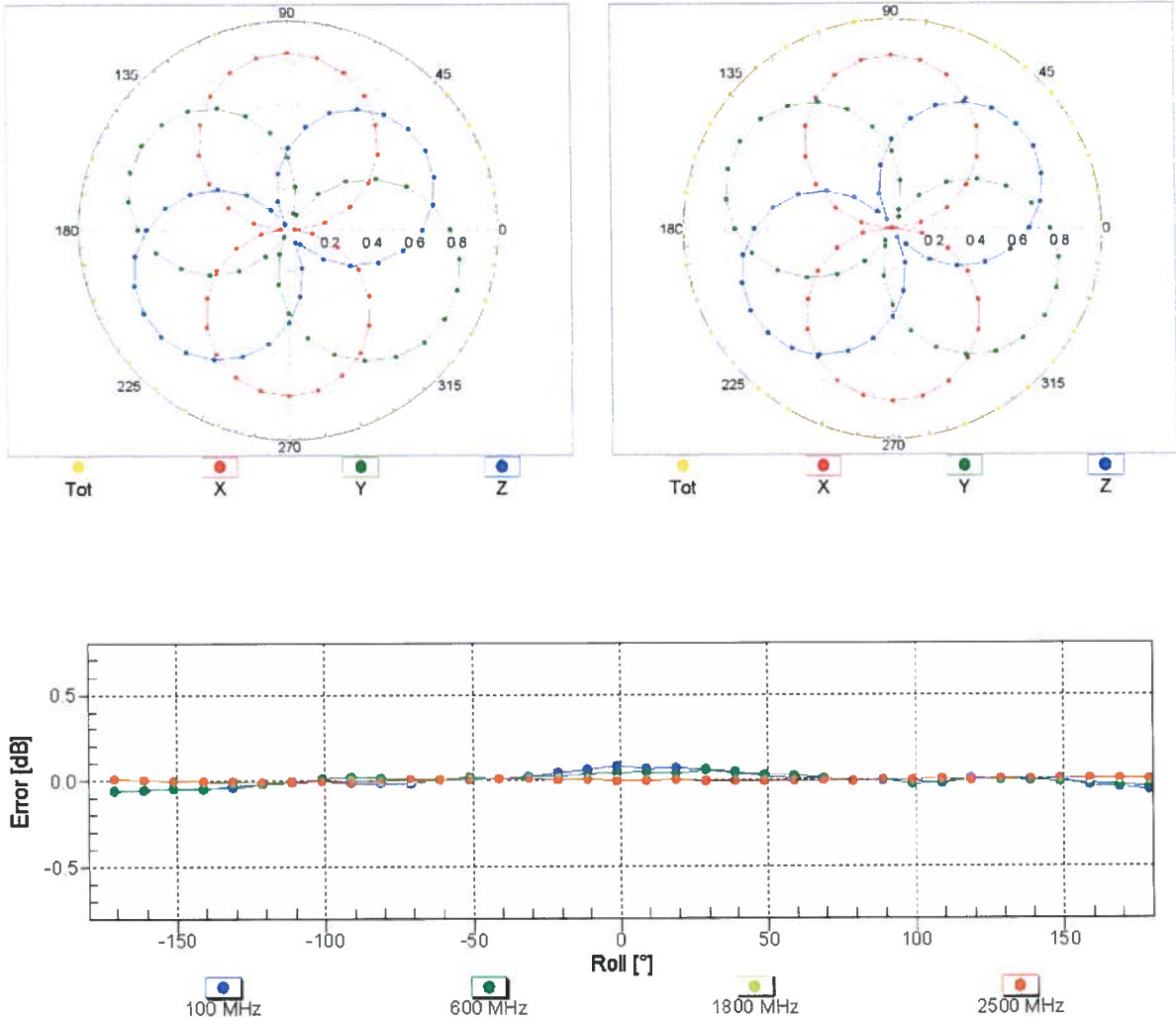


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

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

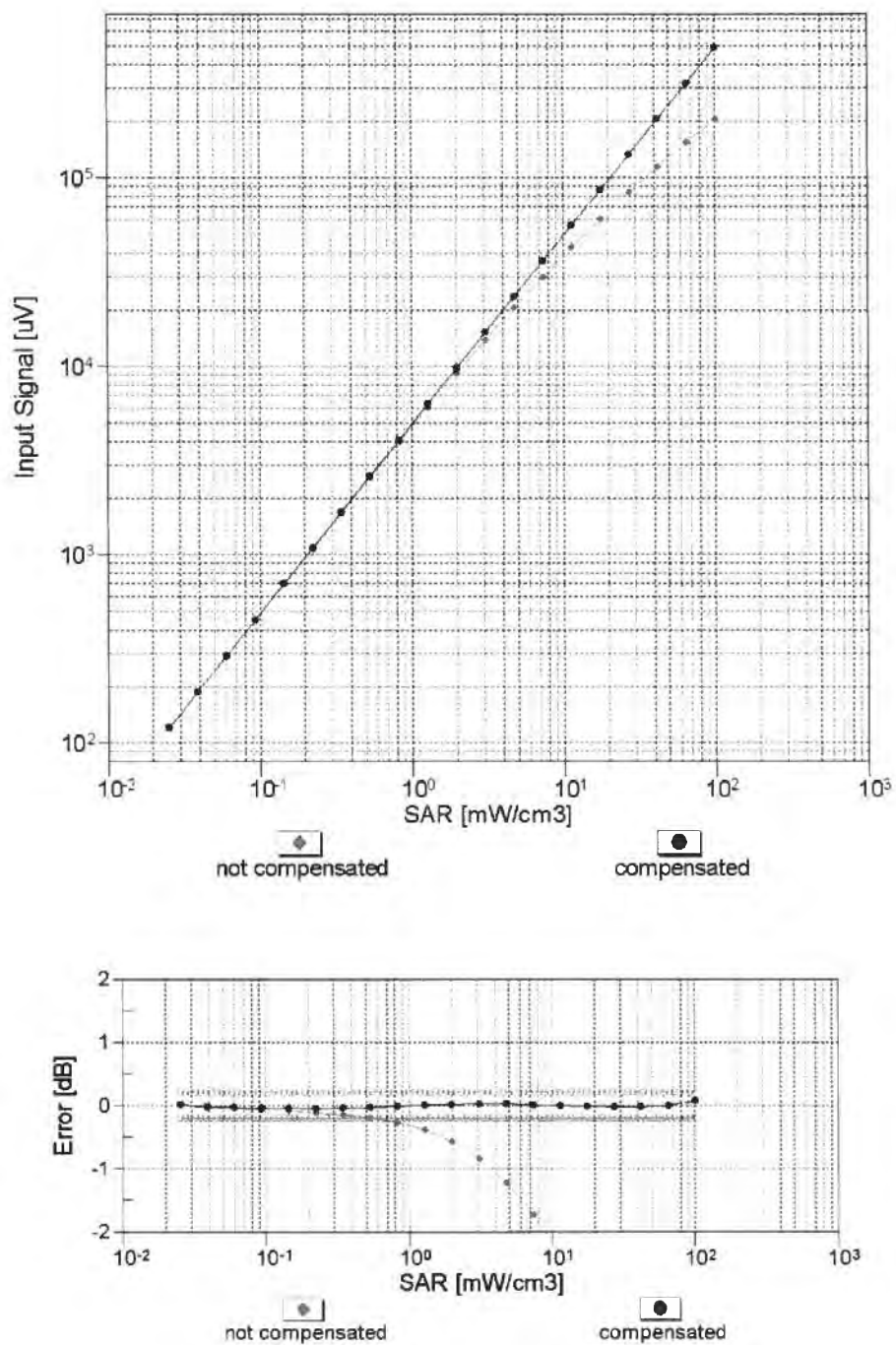
f=600 MHz,TEM

f=1800 MHz,R22



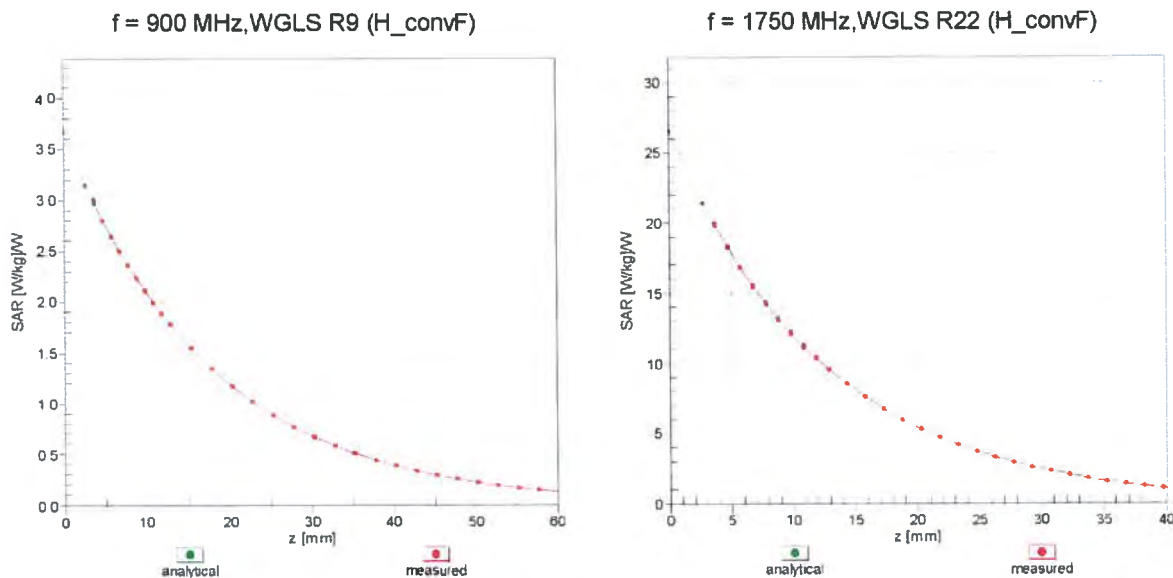
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

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



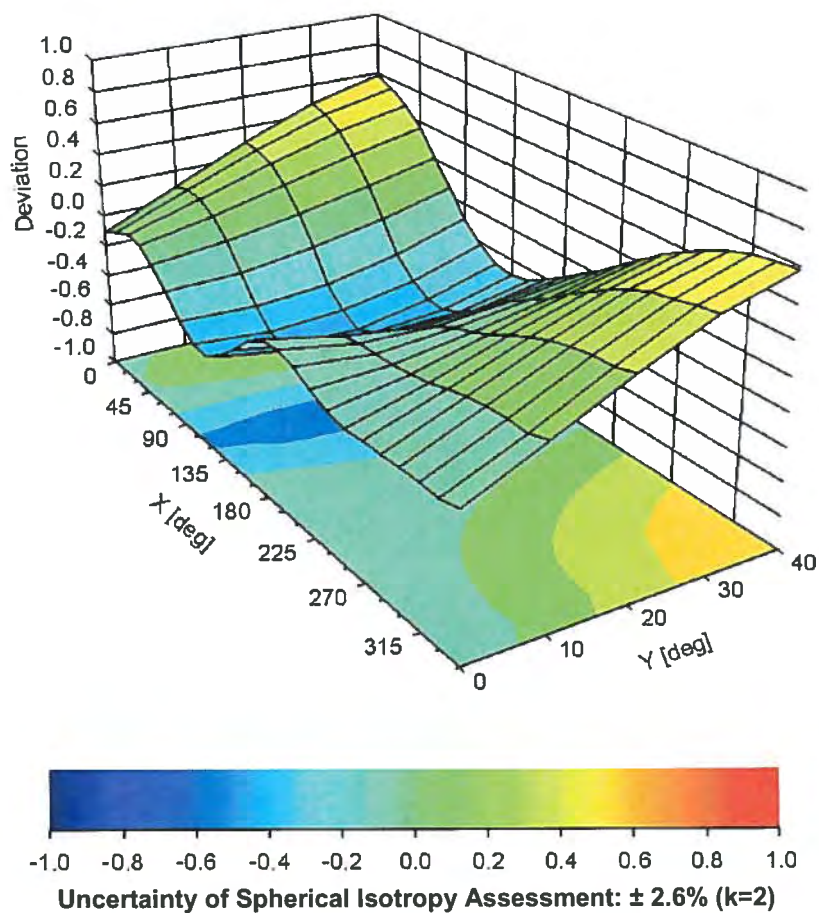
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), $f = 900 \text{ MHz}$



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

Other Probe Parameters

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



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Accreditation No.: **SCS 108**

Client **RFI**

Certificate No: **D900V2-035_Aug12**

CALIBRATION CERTIFICATE

Object **D900V2 - SN: 035**

Calibration procedure(s) **QA CAL-05.v8**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **August 16, 2012**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Approved by: **Katja Pokovic** Technical Manager

Signature
Israe El-Naouq
Katja Pokovic

Issued: August 16, 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
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.

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 \pm 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 \pm 0.2) °C	40.6 \pm 6 %	0.96 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	2.62 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	10.5 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	1.68 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	6.74 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	55.0	1.05 mho/m
Measured Body TSL parameters	(22.0 \pm 0.2) °C	52.6 \pm 6 %	1.06 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	2.74 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	10.8 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	1.76 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	6.96 mW / g \pm 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

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

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.5 Ω - 5.5 j Ω
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: $f = 900 \text{ MHz}$; $\sigma = 0.96 \text{ mho/m}$; $\epsilon_r = 40.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY52 Configuration:

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

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

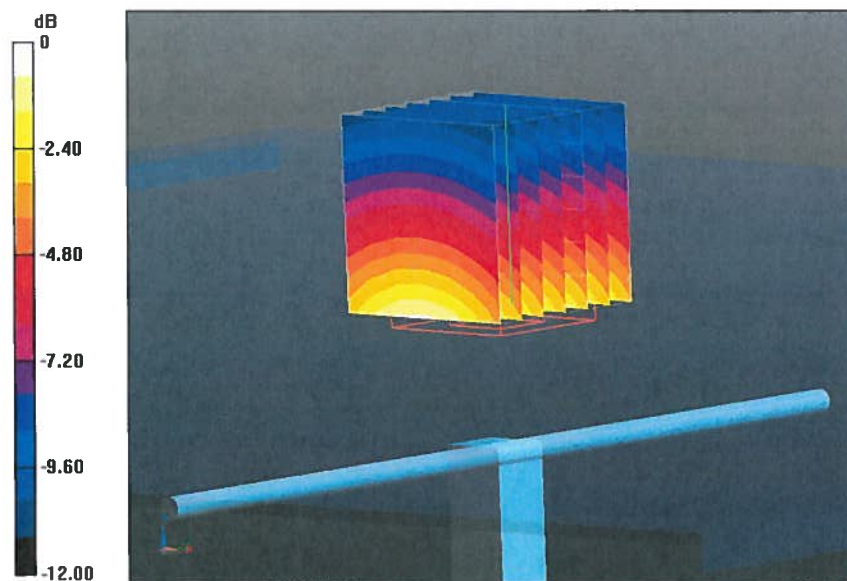
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

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

Peak SAR (extrapolated) = 3.926 mW/g

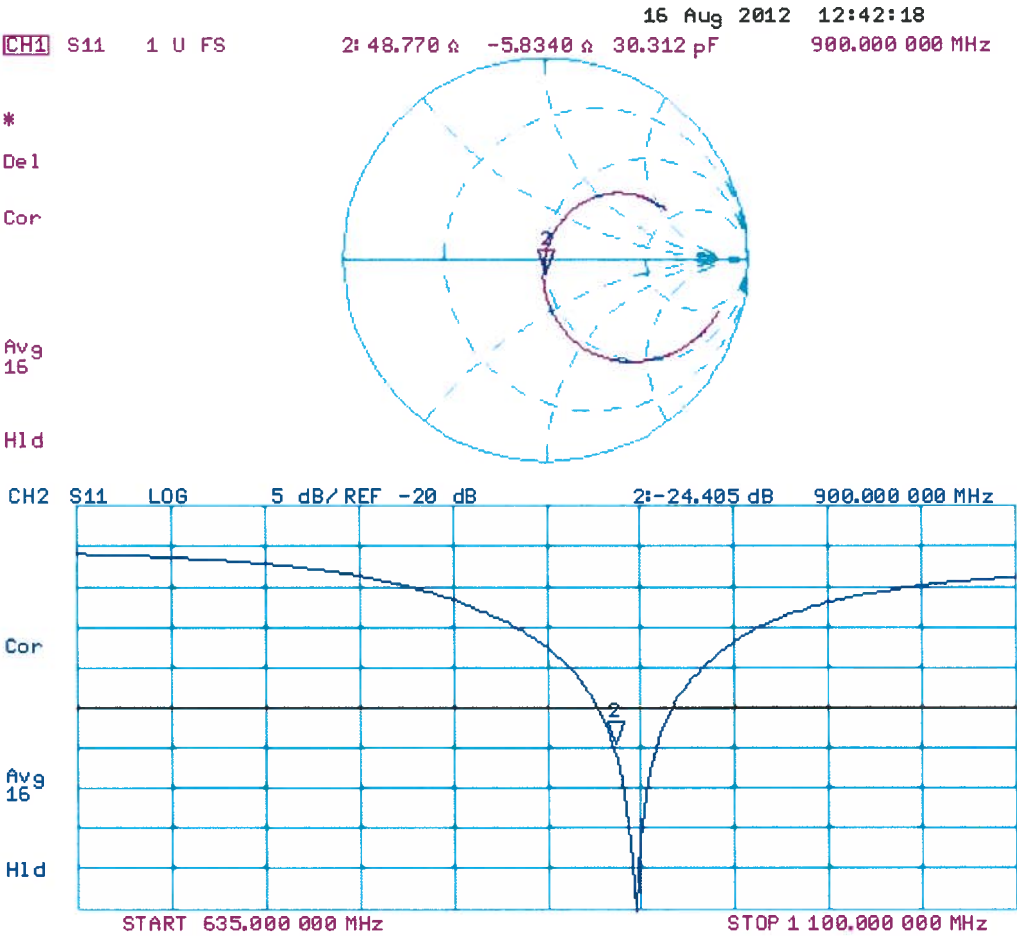
SAR(1 g) = 2.62 mW/g; SAR(10 g) = 1.68 mW/g

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



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

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 16.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW; Frequency: 900 MHz

Medium parameters used: $f = 900$ MHz; $\sigma = 1.06$ 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:

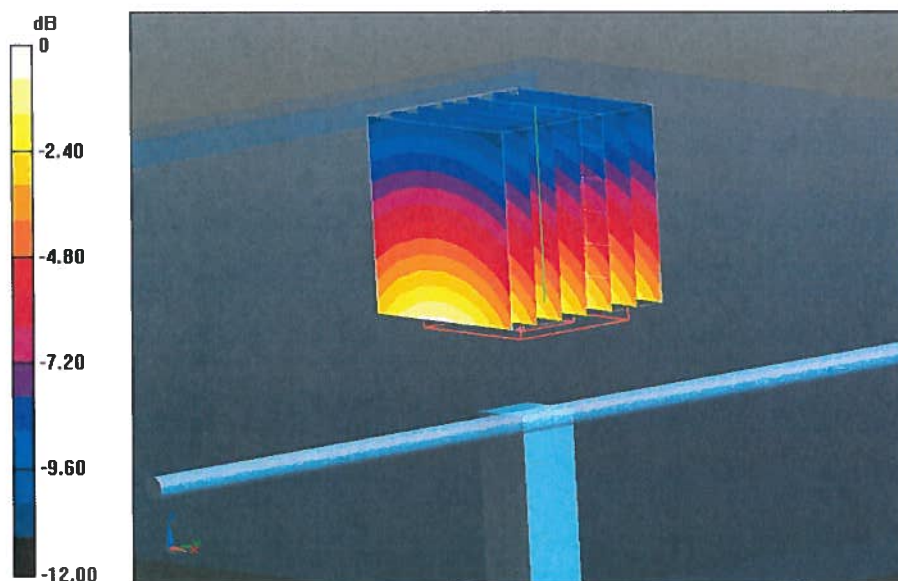
Measurement grid: dx=5mm, dy=5mm, dz=5mm

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

Peak SAR (extrapolated) = 4.184 mW/g

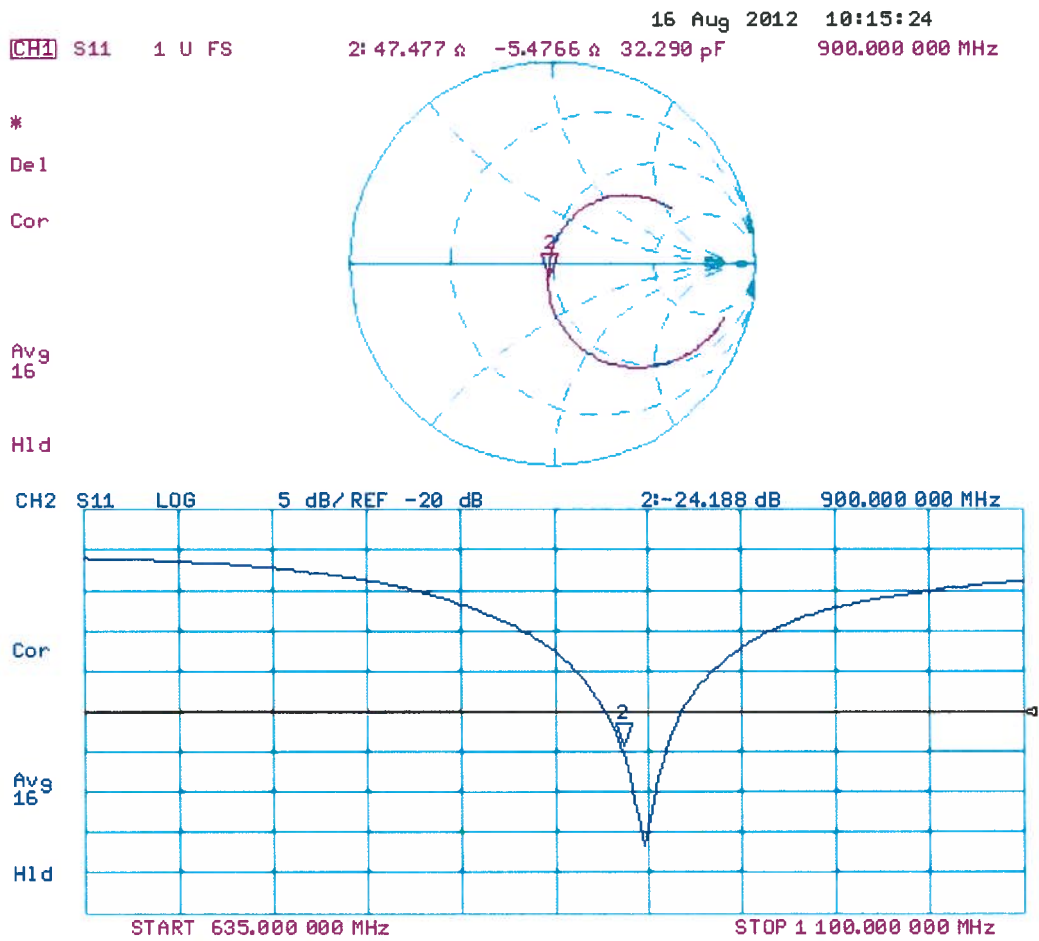
SAR(1 g) = 2.74 mW/g; SAR(10 g) = 1.76 mW/g

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



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

Impedance Measurement Plot for Body TSL



checked by *AB*

Date: *Sept 1 2012*



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Accreditation No.: **SCS 108**

Client **RFI**

Certificate No: **D1900V2-537_Aug12**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 537**

Calibration procedure(s) **QA CAL-05.v8**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **August 14, 2012**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Issued: August 14, 2012

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Accreditation No.: **SCS 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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	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	39.9 \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	9.78 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	39.4 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	5.16 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	20.7 mW / g \pm 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 \pm 0.2) °C	52.5 \pm 6 %	1.53 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	10.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	40.5 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	5.37 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	21.4 mW / g \pm 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.1 Ω - 5.7 j Ω
Return Loss	- 24.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	44.0 Ω - 5.2 j Ω
Return Loss	- 21.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.181 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 22, 2001

DASY5 Validation Report for Head TSL

Date: 14.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 537

Communication System: CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.38$ mho/m; $\epsilon_r = 39.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.01, 5.01, 5.01); 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:

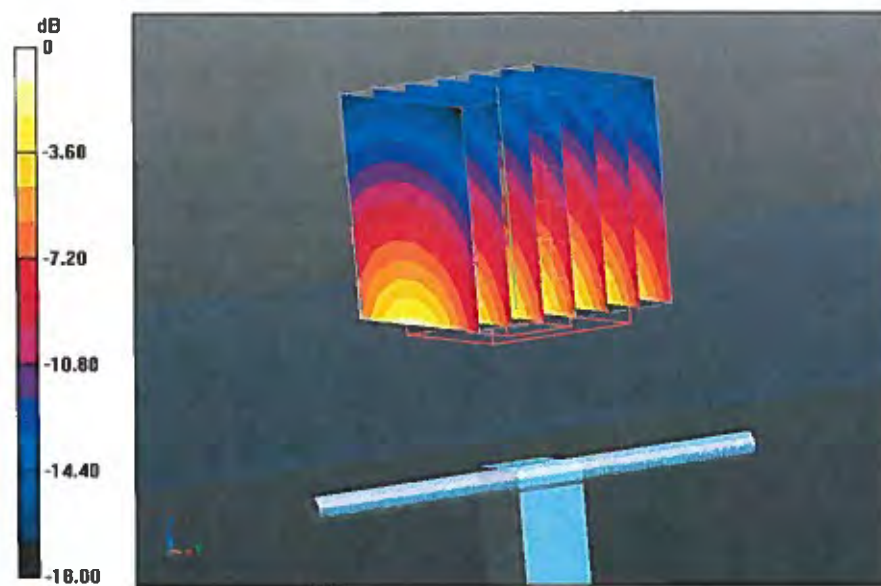
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.874 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 17.436 mW/g

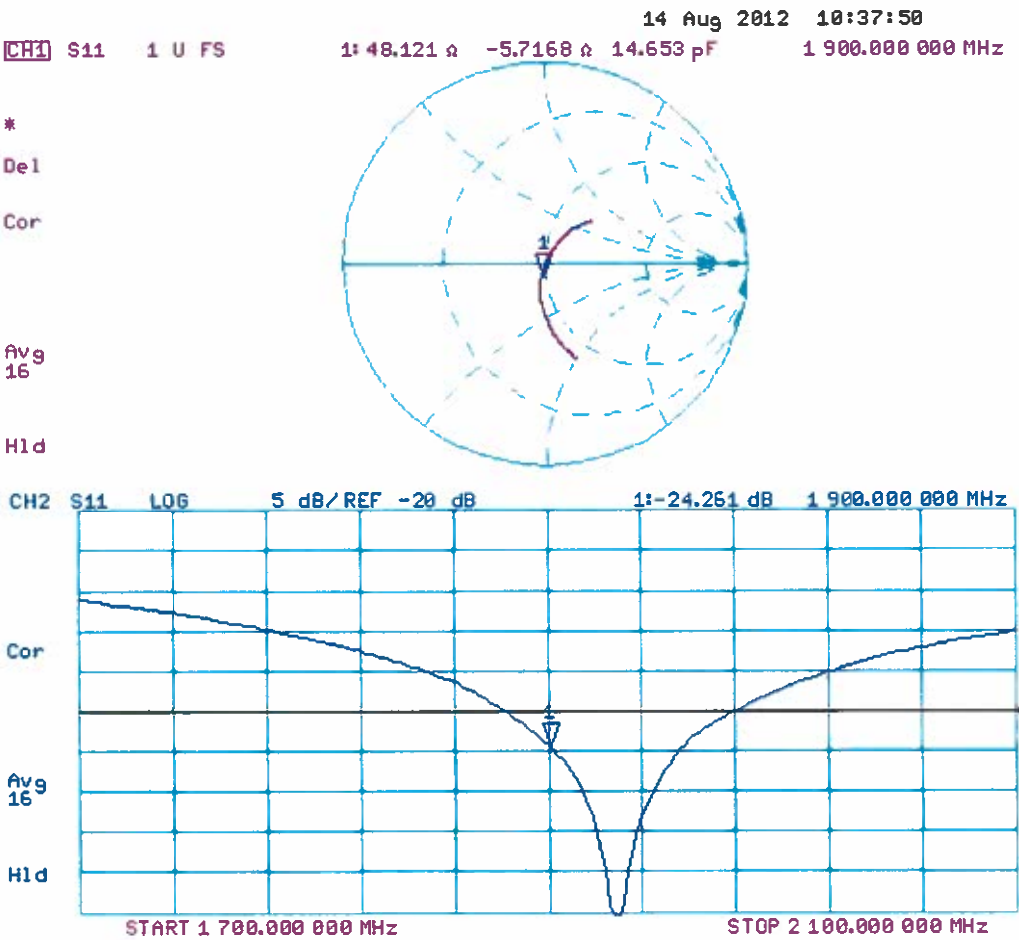
SAR(1 g) = 9.78 mW/g; SAR(10 g) = 5.16 mW/g

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



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

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 14.08.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 537

Communication System: CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.53$ mho/m; $\epsilon_r = 52.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.62, 4.62, 4.62); 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 = 94.874 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 17.899 mW/g

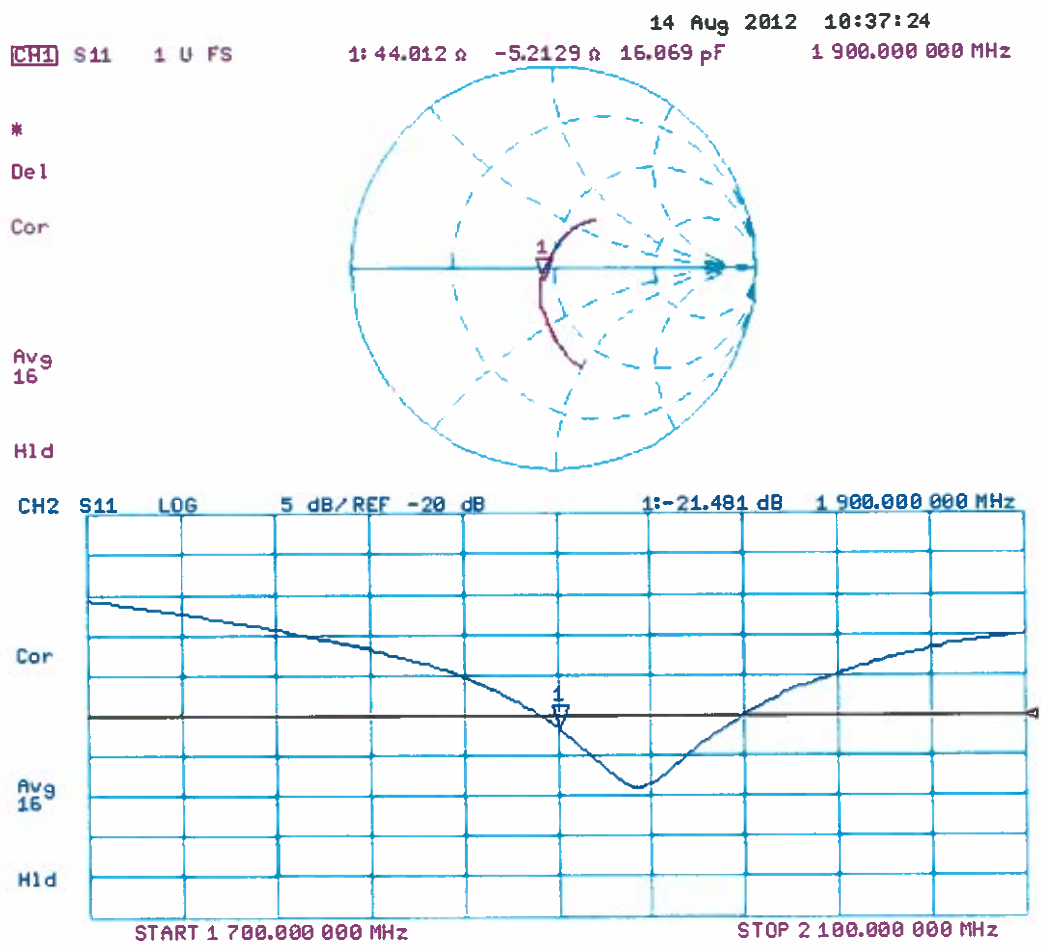
SAR(1 g) = 10.2 mW/g; SAR(10 g) = 5.37 mW/g

Maximum value of SAR (measured) = 12.8 W/kg



0 dB = 12.8 W/kg = 22.14 dB W/kg

Impedance Measurement Plot for Body TSL



Checked by *R. D.* DATE: 7 ^{Sept} August 2012



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Accreditation No.: **SCS 108**

Client **RFI**

Certificate No: **D2440V2-701_Aug12**

CALIBRATION CERTIFICATE

Object **D2440V2 - SN: 701**

Calibration procedure(s) **QA CAL-05.v8**
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **August 13, 2012**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

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

Signature

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

Issued: August 13, 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
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 Ω
Return Loss	- 21.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.8 Ω - 6.9 j Ω
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:

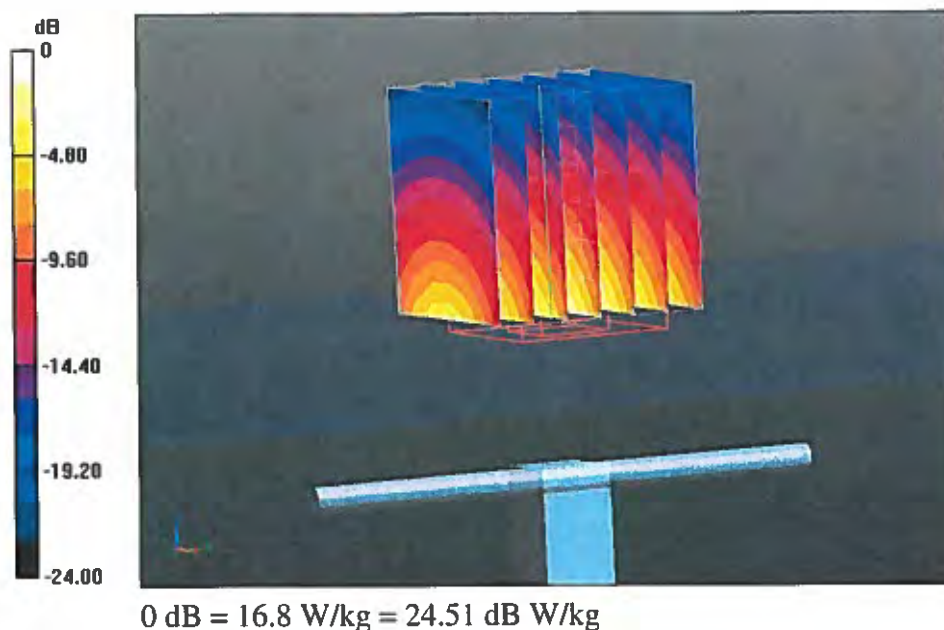
Measurement grid: dx=5mm, dy=5mm, dz=5mm

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

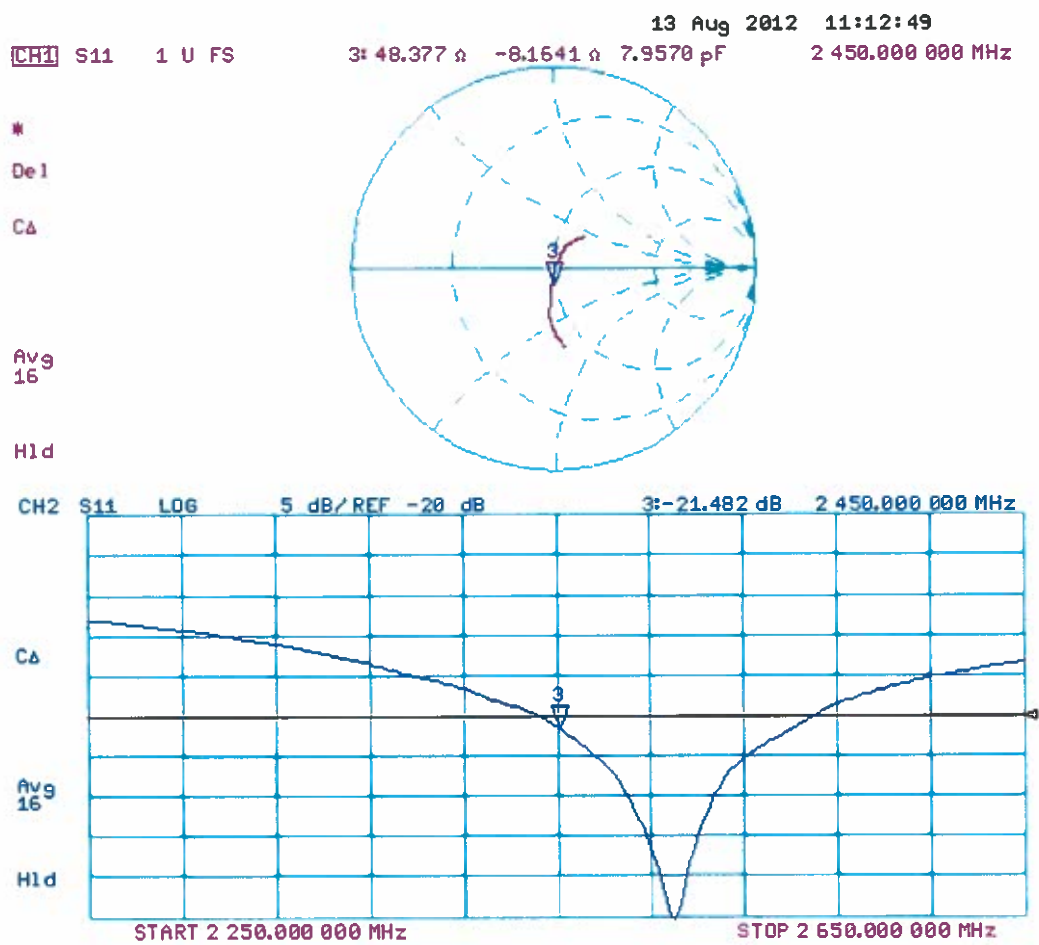
Peak SAR (extrapolated) = 27.027 mW/g

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:

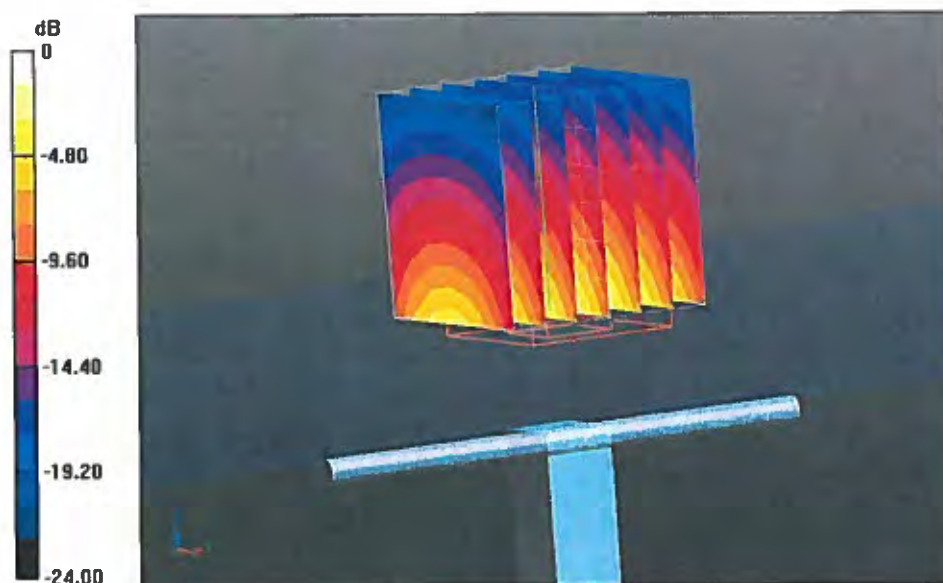
Measurement grid: dx=5mm, dy=5mm, dz=5mm

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



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

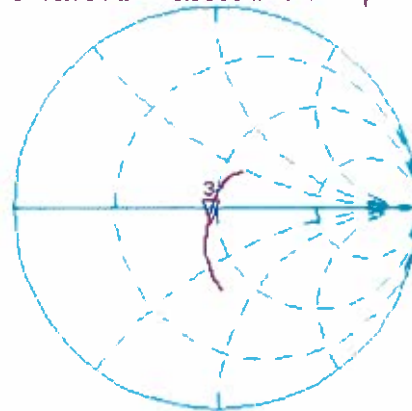
Impedance Measurement Plot for Body TSL

13 Aug 2012 11:12:17
 CH1 S11 1 U FS 3: 45.754 Ω -6.8809 Ω 9.4409 pF 2 450.000 000 MHz

*
 De1
 CA

Avg
 16

H1d

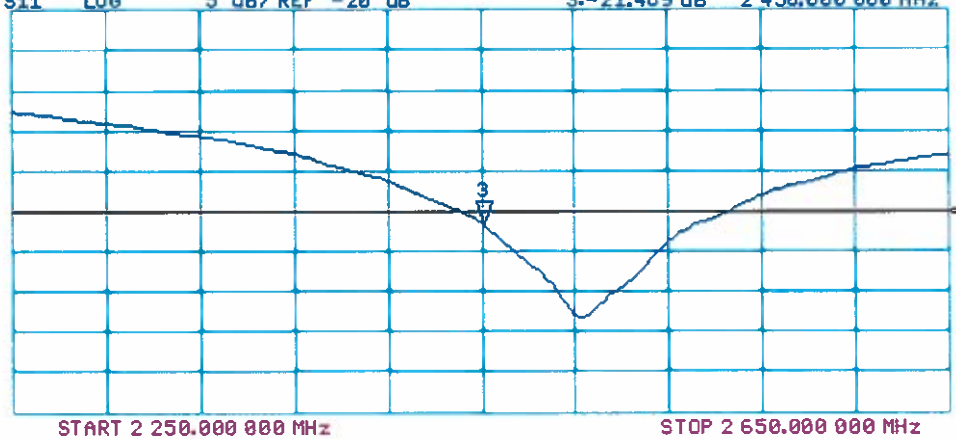


CH2 S11 LOG 5 dB/REF -20 dB 3: -21.489 dB 2 450.000 000 MHz

CA

Avg
 16

H1d



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.

Appendix 3. SAR Distribution Scans

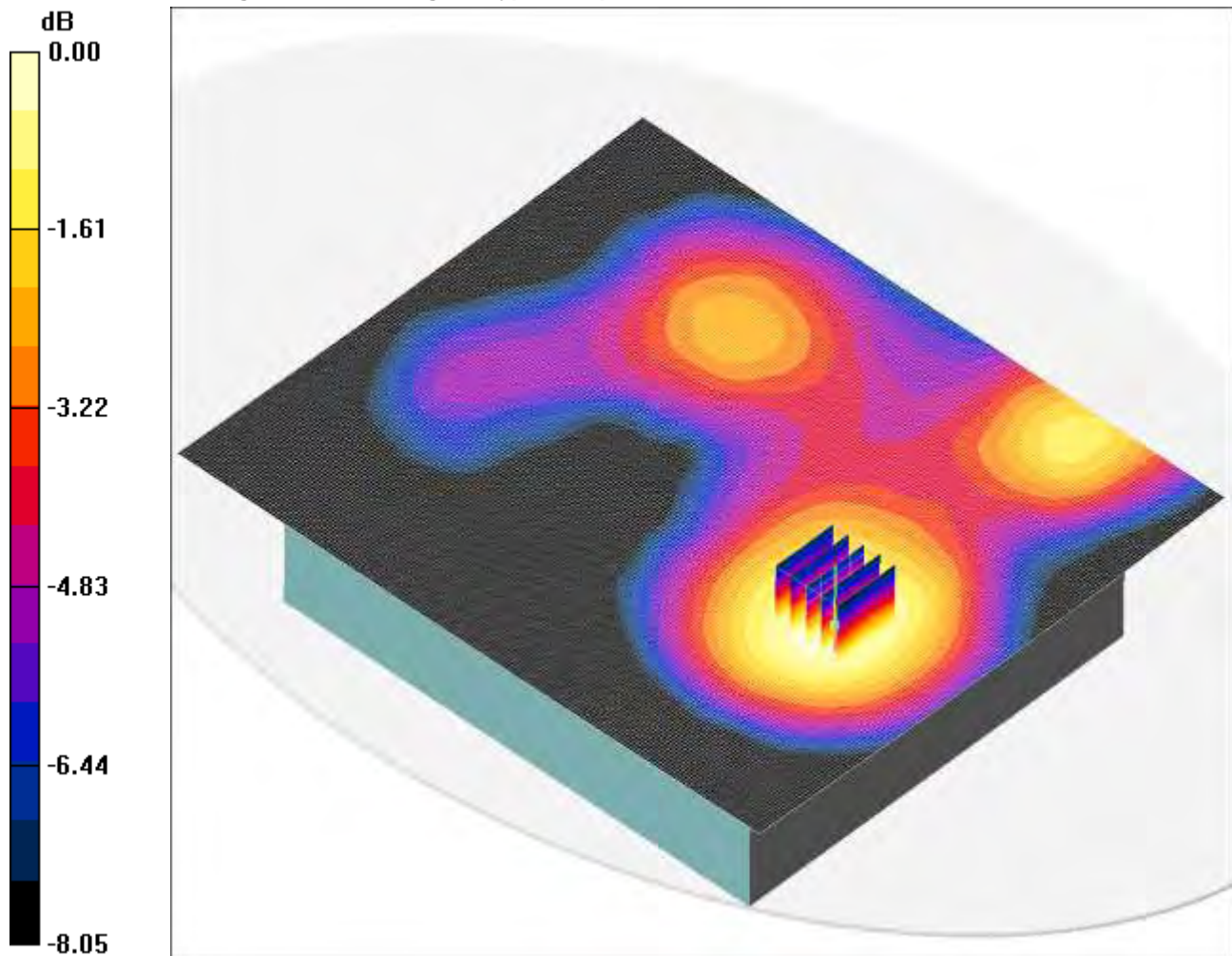
This appendix contains SAR distribution scans which are not included in the total number of pages for this report.

Scan Reference Number	Title
SCN/86493JD01/001	Back of EUT Facing Phantom GPRS CH190
SCN/86493JD01/002	Back of EUT Facing Phantom GPRS CH512
SCN/86493JD01/003	Back of EUT Facing Phantom UMTS FDD 2 CH9400
SCN/86493JD01/004	Back of EUT Facing Phantom UMTS FDD 5 CH4183
SCN/86493JD01/005	Back of EUT Facing Phantom 802.11b 1Mbps CH6
SCN/86493JD01/006	System Performance Check 900MHz Body 26 03 13
SCN/86493JD01/007	System Performance Check 1900MHz Body 28 03 13
SCN/86493JD01/008	System Performance Check 1900MHz Body 12 04 13
SCN/86493JD01/009	System Performance Check 2450MHz Body 25 03 13

SCN/86493JD01/001: Back of EUT Facing Phantom GPRS CH190

Date: 26/03/2013

DUT: Remote Diagnostic Technologies; Type: Tempus Pro; Serial: 000047



0 dB = 0.016mW/g

Communication System: GPRS 850 MHz 1TX; Frequency: 836.6 MHz; Duty Cycle: 1:8.3

Medium: 900 MHz MSL Medium parameters used (interpolated): $f = 836.6$ MHz; $\sigma = 1.02$ mho/m; $\epsilon_r = 53.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1528; ConvF(5.99, 5.99, 5.99); Calibrated: 26/07/2012

- Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE3 Sn432; Calibrated: 02/05/2012

- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

Back of EUT Facing Phantom - Middle 2/Area Scan 2 3 (171x201x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.016 mW/g

Back of EUT Facing Phantom - Middle 2/Zoom Scan (5x5x7) 2 (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.20 V/m; Power Drift = 0.067 dB

Peak SAR (extrapolated) = 0.018 W/kg

SAR(1 g) = 0.015 mW/g; SAR(10 g) = 0.011 mW/g

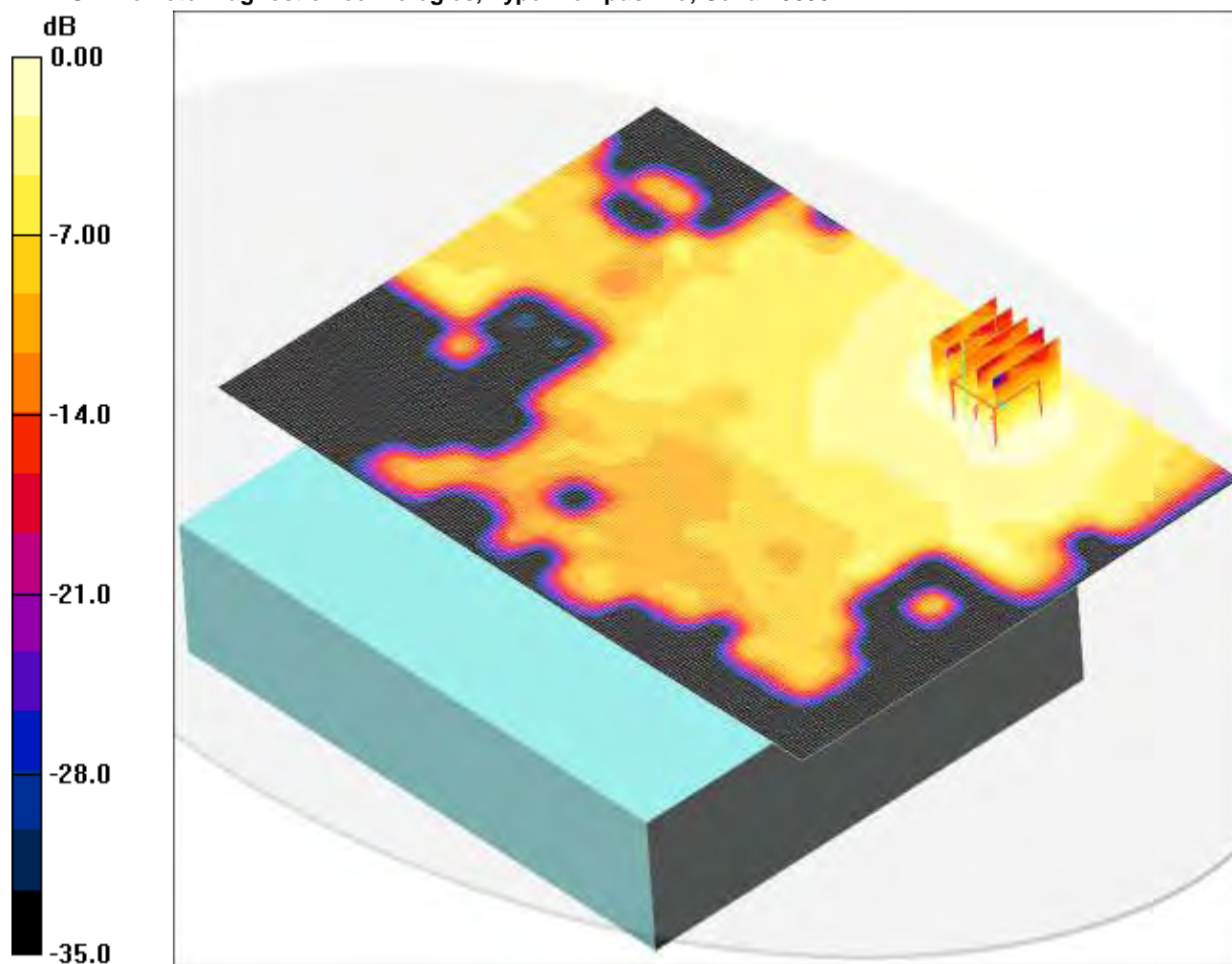
Maximum value of SAR (measured) = 0.016 mW/g

Note: DASY system is configured to measure any secondary maxima that are within 2dB of the measured SAR level.

SCN/86493JD01/002: Back of EUT Facing Phantom GPRS CH512

Date: 28/03/2013

DUT: Remote Diagnostic Technologies; Type: Tempus Pro; Serial: 000047



0 dB = 0.010mW/g

Communication System: GPRS 1900 1Tx; Frequency: 1850.2 MHz; Duty Cycle: 1:8.3

Medium: 1900 MHz MSL Medium parameters used (interpolated): $f = 1850.2$ MHz; $\sigma = 1.49$ mho/m; $\epsilon_r = 51.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1528; ConvF(4.42, 4.42, 4.42); Calibrated: 26/07/2012

- Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE3 Sn432; Calibrated: 02/05/2012

- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

Back of EUT Facing Phantom - Middle/Area Scan (141x201x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.01 mW/g

Back of EUT Facing Phantom - Middle/Zoom Scan (5x5x7) 2 (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.25 V/m; Power Drift = 0.056 dB

Peak SAR (extrapolated) = 0.011 W/kg

SAR(1 g) = 0.00707 mW/g; SAR(10 g) = 0.00442 mW/g

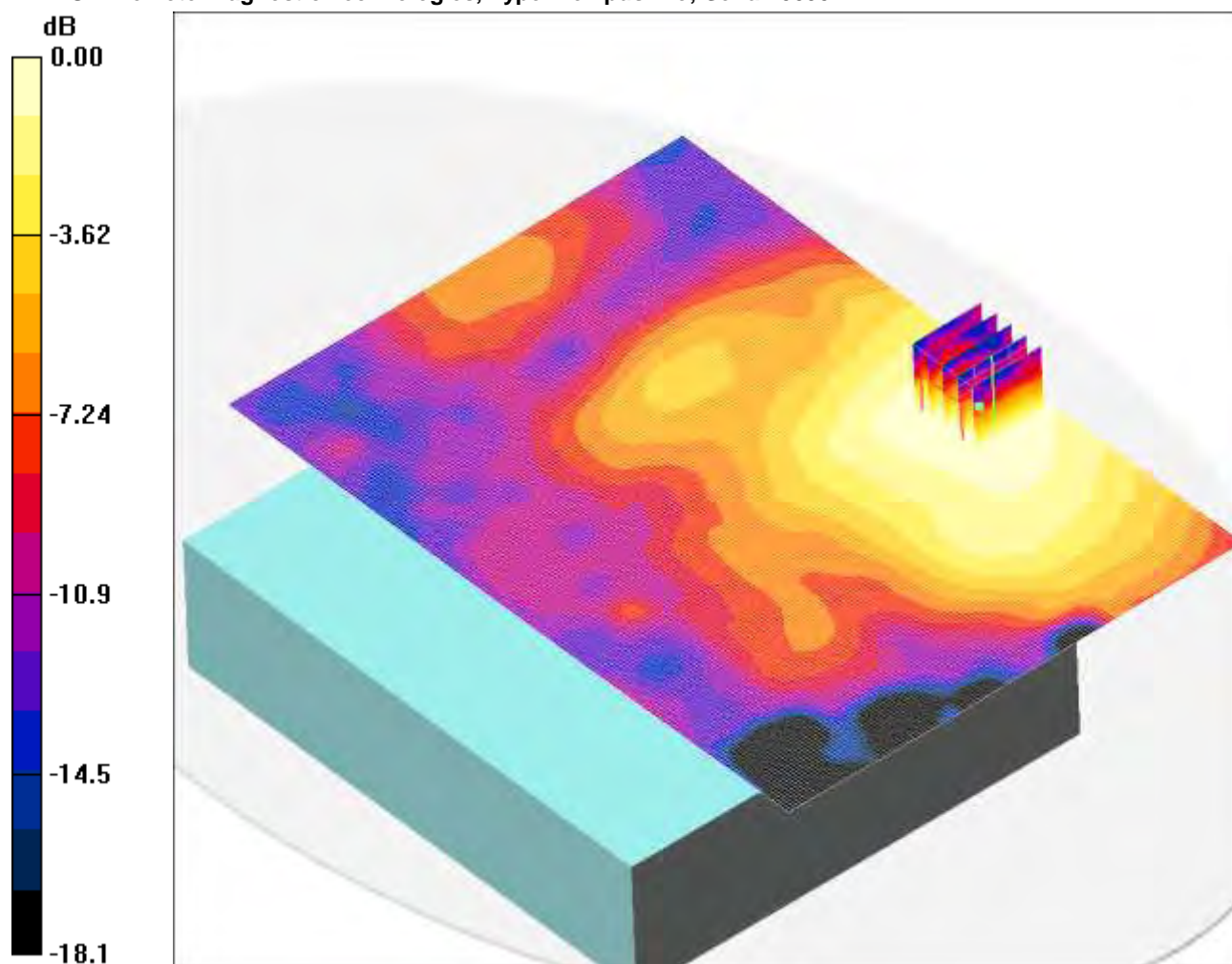
Maximum value of SAR (measured) = 0.01 mW/g

Note: DASY system is configured to measure any secondary maxima that are within 2dB of the measured SAR level.

SCN/86493JD01/003: Back of EUT Facing Phantom UMTS FDD 2 CH9400

Date: 28/03/2013

DUT: Remote Diagnostic Technologies; Type: Tempus Pro; Serial: 000047



0 dB = 0.014mW/g

Communication System: UMTS-FDD 2; Frequency: 1880 MHz; Duty Cycle: 1:1

Medium: 1900 MHz MSL Medium parameters used (interpolated): $f = 1880$ MHz; $\sigma = 1.52$ mho/m; $\epsilon_r = 51.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1528; ConvF(4.42, 4.42, 4.42); Calibrated: 26/07/2012

- Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE3 Sn432; Calibrated: 02/05/2012

- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

Back of EUT Facing Phantom - Middle/Area Scan (141x201x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.013 mW/g

Back of EUT Facing Phantom - Middle/Zoom Scan (5x5x7) 2 (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.02 V/m; Power Drift = 0.132 dB

Peak SAR (extrapolated) = 0.020 W/kg

SAR(1 g) = 0.013 mW/g; SAR(10 g) = 0.00842 mW/g

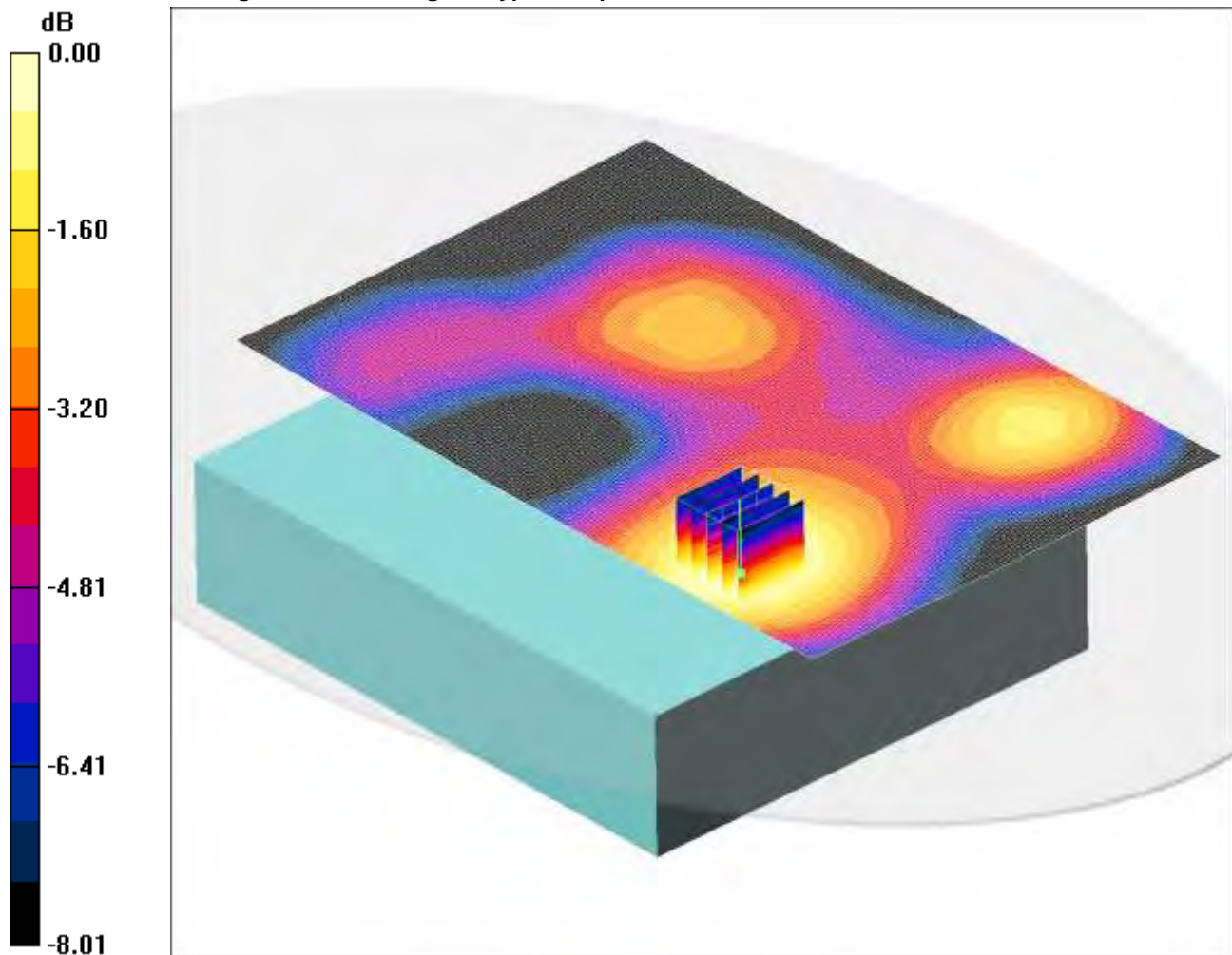
Maximum value of SAR (measured) = 0.014 mW/g

Note: DASY system is configured to measure any secondary maxima that are within 2dB of the measured SAR level.

SCN/86493JD01/004: Back of EUT Facing Phantom UMTS FDD 5 CH4183

Date: 26/03/2013

DUT: Remote Diagnostic Technologies; Type: Tempus Pro; Serial: 000047



0 dB = 0.015mW/g

Communication System: UMTS-FDD 5; Frequency: 836.6 MHz; Duty Cycle: 1:1

Medium: 900 MHz MSL Medium parameters used (interpolated): $f = 836.6$ MHz; $\sigma = 1.02$ mho/m; $\epsilon_r = 53.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1528; ConvF(5.99, 5.99, 5.99); Calibrated: 26/07/2012

- Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE3 Sn432; Calibrated: 02/05/2012

- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

Back of EUT Facing Phantom - Middle 2/Area Scan 2 3 2 2 (131x201x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.015 mW/g

Back of EUT Facing Phantom - Middle 2/Zoom Scan (5x5x7) 2 2 (5x5x7)/Cube 0: Measurement grid:

dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.89 V/m; Power Drift = 0.112 dB

Peak SAR (extrapolated) = 0.018 W/kg

SAR(1 g) = 0.014 mW/g; SAR(10 g) = 0.011 mW/g

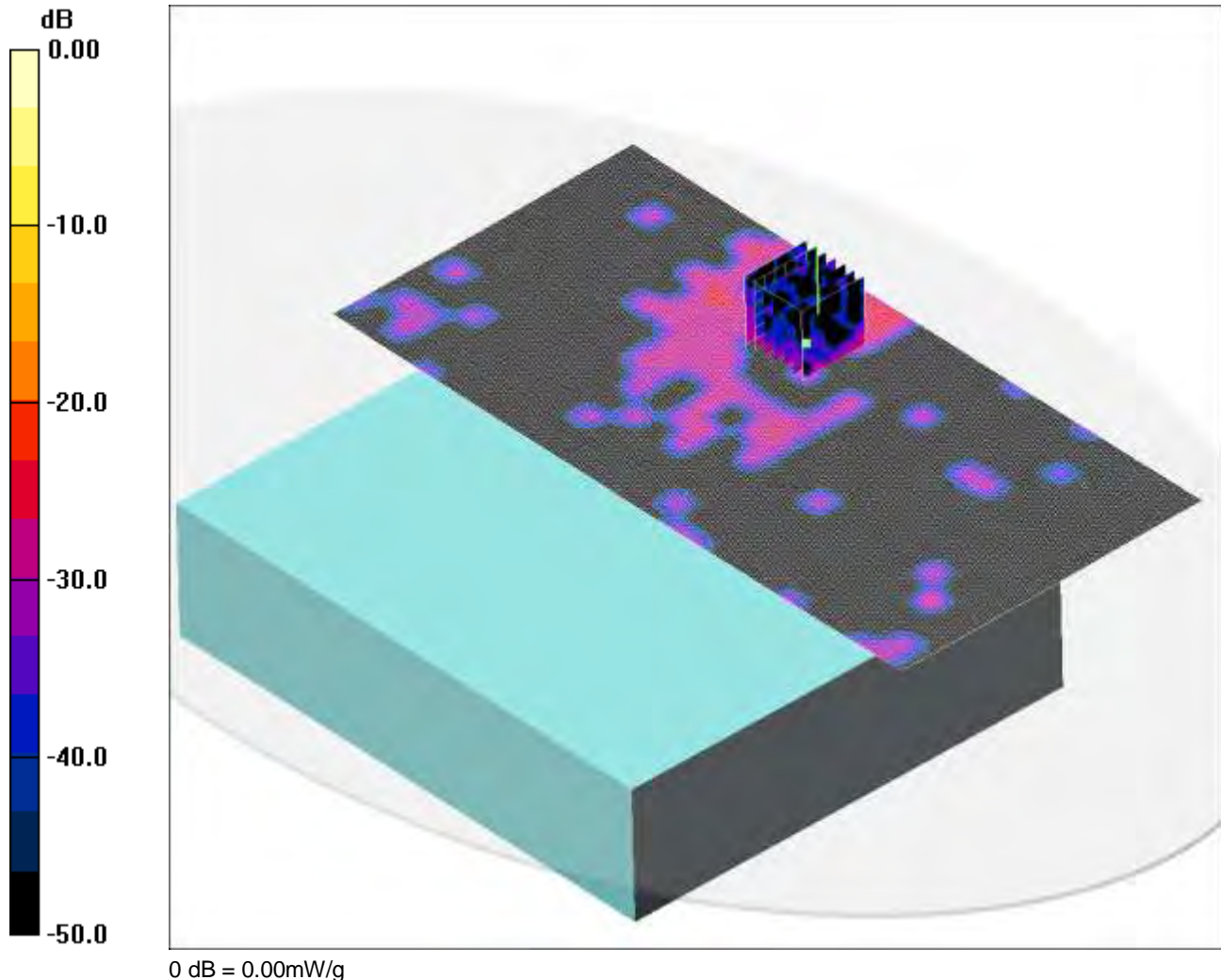
Maximum value of SAR (measured) = 0.015 mW/g

Note: DASY system is configured to measure any secondary maxima that are within 2dB of the measured SAR level.

SCN/86493JD01/005: Back of EUT Facing Phantom 802.11b 1Mbps CH6

Date: 25/03/2013

DUT: Remote Diagnostic Technologies; Type: Tempus Pro; Serial: 000047



Communication System: WLAN; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: 2450 MHz MSL Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 2.01$ mho/m; $\epsilon_r = 52$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1528; ConvF(3.99, 3.99, 3.99); Calibrated: 26/07/2012

- Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE3 Sn432; Calibrated: 02/05/2012

- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

Back of EUT Facing Phantom - Middle/Area Scan 2 (121x251x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 0.01 mW/g

Back of EUT Facing Phantom - Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 0.655 V/m; Power Drift = 0.686 dB

Peak SAR (extrapolated) = 0.014 W/kg

SAR(1 g) = 0.00278 mW/g; SAR(10 g) = 0.000832 mW/g

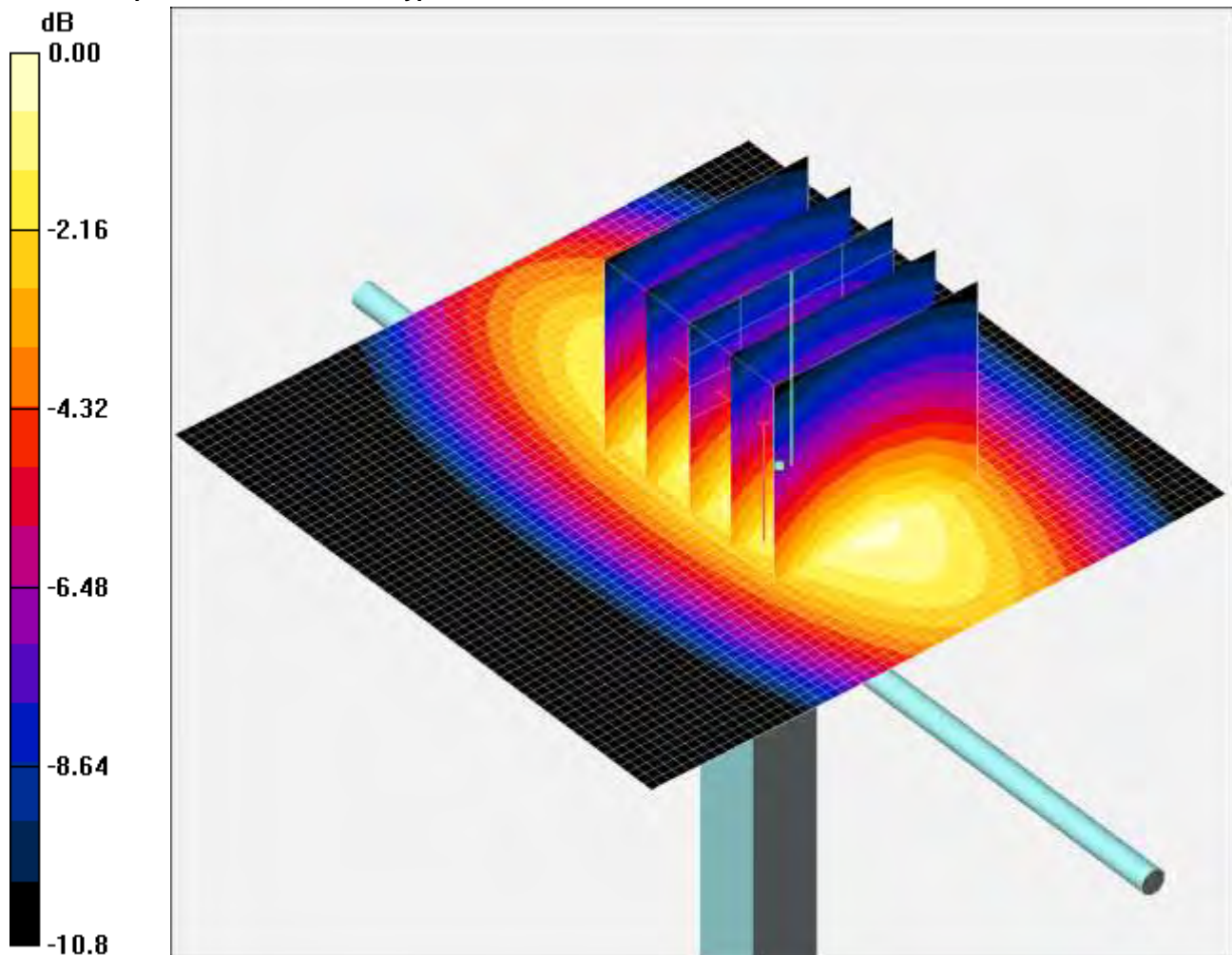
Maximum value of SAR (measured) = 0.00 mW/g

Note: DASY system is configured to measure any secondary maxima that are within 2dB of the measured SAR level.

SCN/86493JD01/006: System Performance Check 900MHz Body 26 03 13

Date: 26/03/2013

DUT: Dipole 900 MHz; SN: 035; Type: D900V2; Serial: SN035



0 dB = 2.82mW/g

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

Medium: 900 MHz MSL Medium parameters used: $f = 900 \text{ MHz}$; $\sigma = 1.06 \text{ mho/m}$; $\epsilon_r = 53$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1528; ConvF(5.92, 5.92, 5.92); Calibrated: 26/07/2012

- Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE3 Sn432; Calibrated: 02/05/2012

- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

d=10mm, Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 2.85 mW/g

d=10mm, Pin=250mW/Zoom Scan (5x5x7) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 53.6 V/m; Power Drift = -0.045 dB

Peak SAR (extrapolated) = 3.65 W/kg

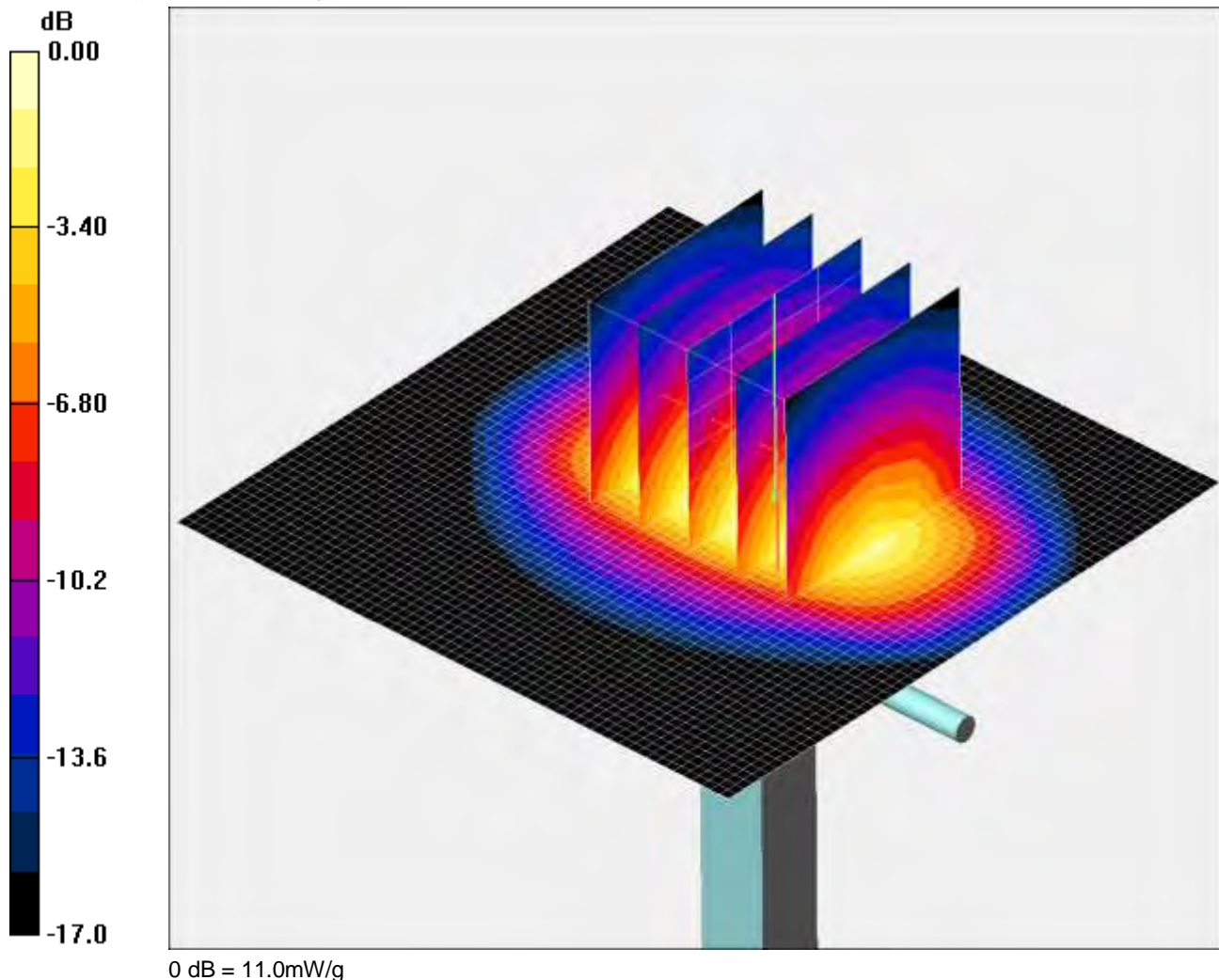
SAR(1 g) = 2.59 mW/g; SAR(10 g) = 1.7 mW/g

Maximum value of SAR (measured) = 2.82 mW/g

SCN/86493JD01/007: System Performance Check 1900MHz Body 28 03 13

Date: 28/03/2013

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: SN537



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

Medium: 1900 MHz MSL Medium parameters used: $f = 1900 \text{ MHz}$; $\sigma = 1.54 \text{ mho/m}$; $\epsilon_r = 51.4$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1528; ConvF(4.42, 4.42, 4.42); Calibrated: 26/07/2012

- Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE3 Sn432; Calibrated: 02/05/2012

- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

d=10mm, Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 12.6 mW/g

d=10mm, Pin=250mW/Zoom Scan (5x5x7) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 90.4 V/m; Power Drift = 0.016 dB

Peak SAR (extrapolated) = 16.0 W/kg

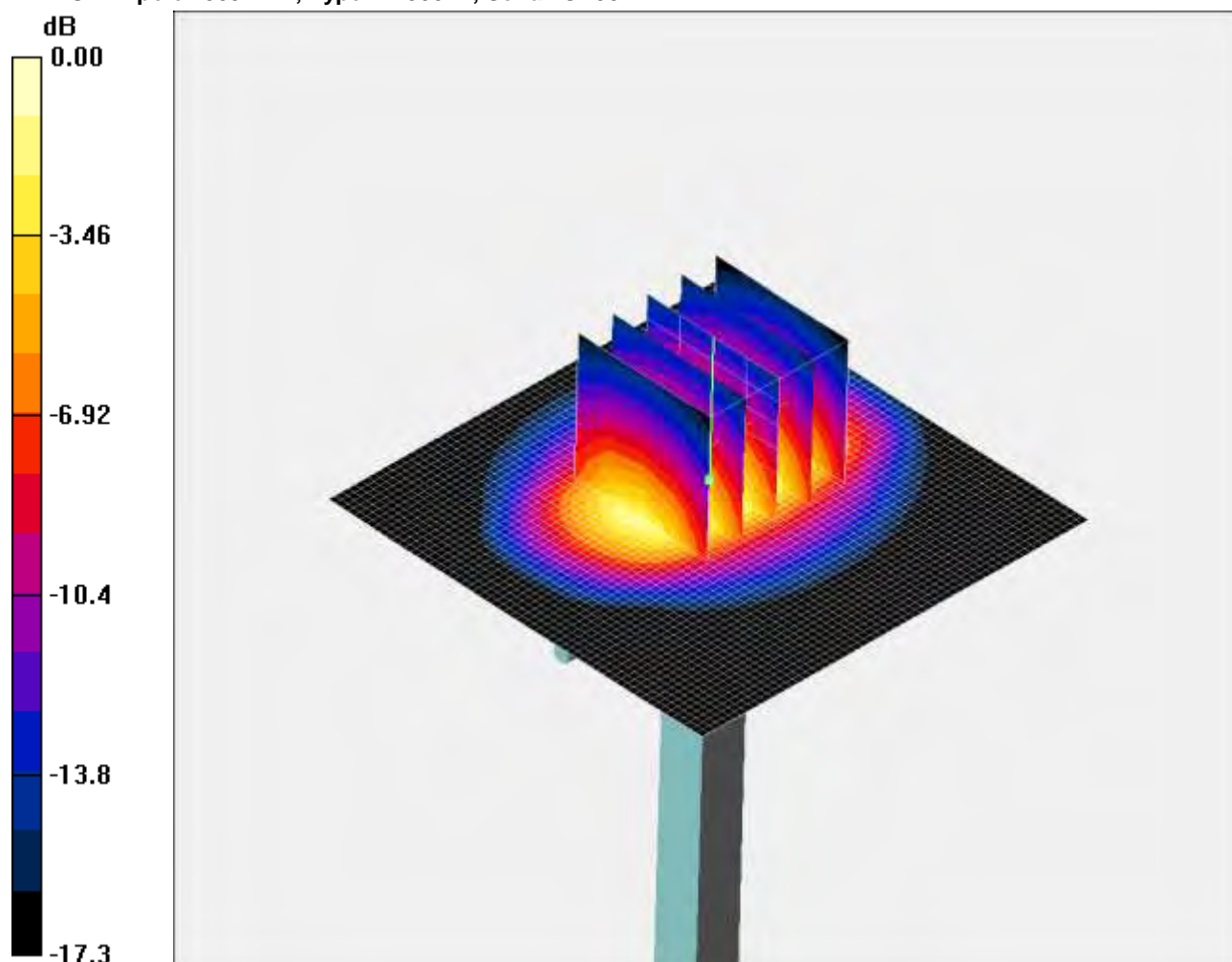
SAR(1 g) = 9.72 mW/g; SAR(10 g) = 5.24 mW/g

Maximum value of SAR (measured) = 11.0 mW/g

SCN/86493JD01/008: System Performance Check 1900MHz Body 12 04 13

Date: 12/04/2013

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: SN537



0 dB = 11.5mW/g

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

Medium: 1900 MHz MSL Medium parameters used: $f = 1900$ MHz; $\sigma = 1.55$ mho/m; $\epsilon_r = 51.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1528; ConvF(4.42, 4.42, 4.42); Calibrated: 26/07/2012

- Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE3 Sn432; Calibrated: 02/05/2012

- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

d=10mm, Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 13.1 mW/g

d=10mm, Pin=250mW/Zoom Scan (5x5x7) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 92.8 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 16.8 W/kg

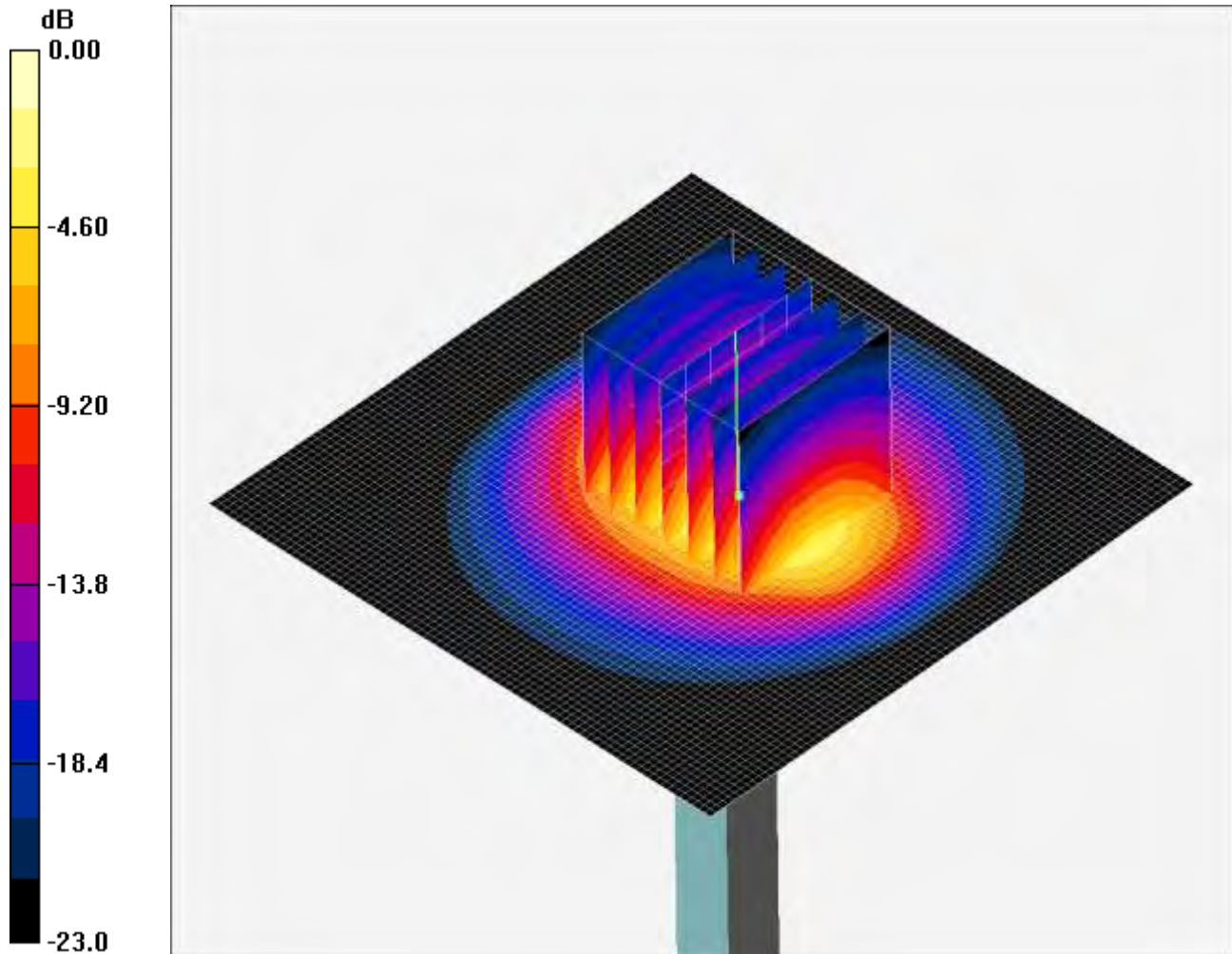
SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.4 mW/g

Maximum value of SAR (measured) = 11.5 mW/g

SCN/86493JD01/009: System Performance Check 2450MHz Body 25 03 13

Date: 25/03/2013

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



0 dB = 14.6mW/g

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

Medium: 2450 MHz MSL Medium parameters used: $f = 2450 \text{ MHz}$; $\sigma = 2.03 \text{ mho/m}$; $\epsilon_r = 52$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1528; ConvF(3.99, 3.99, 3.99); Calibrated: 26/07/2012

- Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE3 Sn432; Calibrated: 02/05/2012

- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx

- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

d=10mm, Pin=250mW 2/Area Scan (81x81x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (interpolated) = 14.9 mW/g

d=10mm, Pin=250mW 2/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 84.3 V/m; Power Drift = 0.048 dB

Peak SAR (extrapolated) = 36.3 W/kg

SAR(1 g) = 13.6 mW/g; SAR(10 g) = 5.97 mW/g

Maximum value of SAR (measured) = 14.6 mW/g