SAR EVALUATION REPORT

KDB 865664 D01 SAR Measurement 100MHz to 6GHz
FCC 47 CFR part 2 (2.1093)

For

Model: XMDS2770

Report No.: UL-SAR-RP10659414JD01A V2.0
Issue Date: 29/10/2015

Prepared for

OXFORD INSTRUMENTS ANALYTICAL OY
P.O BOX 85, ESPOO
FI-02631, FINLAND

Prepared by

UL VERIFICATION SERVICES LTD
PAVILION A, ASHWOOD PARK, ASHWOOD WAY
BASINGSTOKE, HAMPSHIRE, RG23 8BG, UK
TEL: +44 (0) 1256 312000
FAX: +44 (0) 1256 312001

0644

REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
--	21 April 2015	Initial Issue	--
1	29 October 2015	The following amendments are made in the report: 1. Wi-Fi max rated power was changed; this is updated in section 6.3. 2. Conducted power was re-measured in Wi-Fi; this is updated in section 8.1. 3. SAR measurement test results for Wi-Fi are updated in section 10 4. Attestation of test results updated with new DTS maximum SAR value	Sandhya Menon

TABLE OF CONTENTS

1. Attestation of Test Results 4

2. Test Specification, Methods and Procedures 5
2.1. Test Specification 5
2.2. Methods and Procedures Reference Documentation 5

3. Facilities and Accreditation 6

4. SAR Measurement System & Test Equipment 7
4.1. SAR Measurement System 7
4.2. Test Equipment 8
4.3. SAR System Specifications 9

5. Measurement Uncertainty 11
5.1. Uncertainty – Wi-Fi 2450 MHz / Bluetooth Body Configuration 1g 12

6. Device Under Test (DUT) Information 13
6.1. DUT Description 13
6.2. Additional Information Related to Testing 13
6.3. Nominal and Maximum Output Power 14
6.4. Simultaneous transmission Conditions 14

7. RF Exposure Conditions (Test Configurations) 15
7.1. Deviation from Test Specification 15
7.2. Body-worn 15
7.3. Operating Modes 16
7.4. Configuration and Peripherals 16

8. Conducted Output Power Measurements 17
8.1. Wi-Fi (2.4 GHz Band) 17
8.2. Bluetooth 17

9. Dielectric Property Measurements & System Check 18
9.1. Tissue Dielectric Parameters 18
9.2. System Check 19
9.3. Reference Target SAR Values 19
9.4. Dielectric Property Measurements & System Check Results 20

10. Measured SAR Results 21

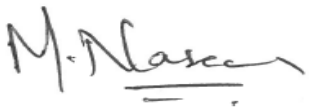
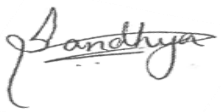
11. Appendixes 22
11.1. Photos and Ports Location 22
11.2. System Check Plots 33
11.3. SAR Test Plots 36
11.4. Calibration Certificate for E-Field Probe 47
11.5. Calibration Certificate for Dipole 48
11.6. Tissues-Equivalent Media Recipes 49

1. Attestation of Test Results

Applicant Name:	Oxford Instruments Analytical Oy		
Application Purpose	☒ **Original Grant**		
DUT Description	The Equipment's Under Test is a 'Hand Held EDXRF (Energy Dispersive X-Ray Fluorescence Analyser).		
Test Device is	An identical prototype		
Device category	Portable		
Exposure Category	General Public Exposure (Localized SAR for Head and Trunk): Limit = 1.6 W/kg (1g)		
Date Tested	11 March 2015 to 29 October 2015		
Applicable Standards	FCC 47 CFR part 2 (2.1093) FCC KDB publication IEEE 1528: 2013		
The highest reported SAR values	**RF Exposure Conditions**	**Equipment Class**	
		DTS	**DSS**
	Body	0.201 W/kg	0.088 W/kg
Test Results	Pass		

UL Verification Services Ltd. Tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Ltd. Based on interpretations and/or observations of test results. Measurement Uncertainties are in accordance with the above standard and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample(s), under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Ltd. And all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Ltd. Will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by UKAS. This report is written to support regulatory compliance of the applicable standards stated above.

Approved & Released By:	Prepared By:
	
Naseer Mirza Project Lead UL Verification Services Ltd.	Sandhya Menon Senior Engineer UL Verification Services Ltd.

2. Test Specification, Methods and Procedures

2.1. Test Specification

Reference:	KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
Title:	SAR Measurement Requirements for 100 MHz to 6 GHz
Purpose of Test:	Field probes, tissue dielectric properties, SAR scans, measurement accuracy and variability of the measured results are discussed. The field probe and SAR scan requirements are derived from criteria considered in IEEE STD 1528-2013.
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 C95.1-2005 and has been tested in accordance with the reference documents in section 2.2 of this report.	

2.2. Methods and Procedures Reference Documentation

The methods and procedures used were as detailed in:

IEEE 1528: 2013 – IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques

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

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

FCC KDB Publication:
KDB 248227 D01 802 11 W-Fi SAR v02r02
KDB 447498 D01 General RF Exposure Guidance v06
KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
KDB 865664 D02 RF Exposure Reporting v01r02
KDB 690783 D01 SAR Listings on Grants v01r02

3. Facilities and Accreditation

The test sites and measurement facilities used to collect data are located at

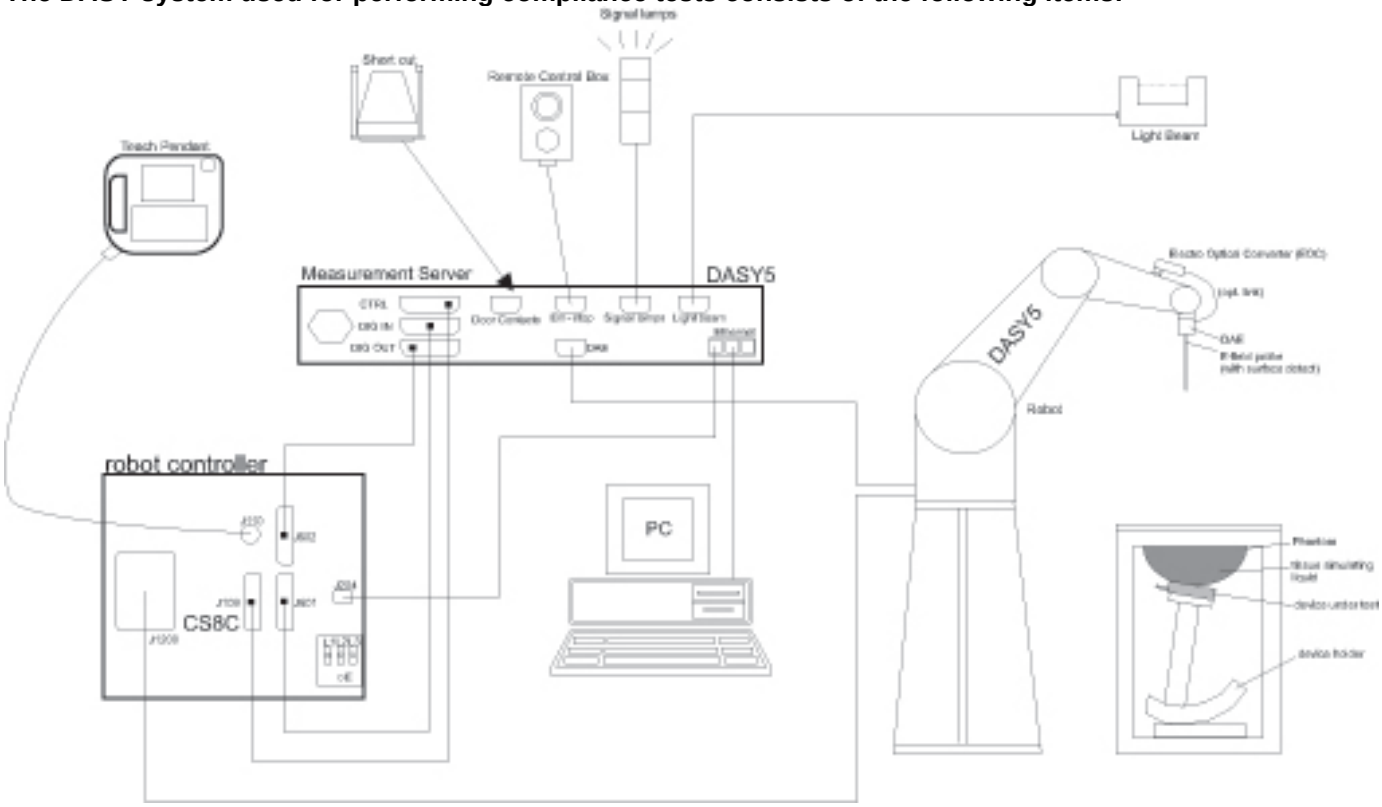
Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire, RG23 8BG UK	Facility Type
SAR Lab 57	Controlled Environment Chamber
SAR Lab 59	Controlled Environment Chamber

UL Verification Services Ltd, is accredited by UKAS (United Kingdom Accreditation Service), Laboratory UKAS Code 0644.

4. SAR Measurement System & Test Equipment

4.1. SAR Measurement System

The DASY system used for performing compliance tests consists of the following items:



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP or Win7 and the DASY software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

4.2. Test Equipment

The measuring equipment used to perform the tests documented in this report has been calibrated in accordance with the manufacturers' recommendations, and is traceable to recognized national standards.

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	-
M1755	DAK Fluid Probe	Schmid & Partner Engineering AG	SM DAK 040 CA	1089	Calibrated before use	-
A2111	Data Acquisition Electronics	SPEAG	DAE3	432	20 Aug 2014	12
A2111	Data Acquisition Electronics	SPEAG	DAE3	432	28 Aug 2015	12
A2243	Probe	SPEAG	ES3 DV3	3304	21 Aug 2014	12
A2243	Probe	SPEAG	ES3 DV3	3304	25 Aug 2015	12
A1322	2450 MHz Dipole Kit	SPEAG	D2450V2	725	08 Dec 2014	12
A2550	2mm Oval Phantom	SPEAG	Eli5	00T01 DA	Calibrated before use	-
A215	20 dB Attenuator	Narda	766-20	9402	Calibrated as part of system	-
A1531	Antenna	AARONIA AG	7025	02458	-	-
A2621	Digital Camera	Nikon	S6300	41010357	-	-
M1015	Network Analyser	Agilent Technologies	8753ES	US39172406	26 Sept 2014	12
M1015	Network Analyser	Agilent Technologies	8753ES	US39172406	28 Sept 2015	12
C1145	Cable	Rosenberger MICRO-COAX	FA147A F003003030	41843-1	Calibrated as part of system	-
GO591	Robot Power Supply	SPEAG	DASY4	None	Calibrated before use	-
G0611	Robot Power Supply	SPEAG	DASY53	None	Calibrated before use	-
G087	PSU	Thurlby Thandar	CPX200	100701	Calibrated before use	-
M1653	Robot Arm	Staubli	RX90 L	F01/5J86A1/C/01	Calibrated before use	-
M1875	Robot Arm	Staubli	TX60 L	F13/5SC6F1/A/01	Calibrated before use	-
M1647	Signal Generator	HP	8648C	3537A01598	08 Sept 2015	12
M1841	Dual Channel Power Meter	R&S	NRVD	834501/069	27 Mar 2015	12
M1842	Power Sensor	R&S	NRV-Z1	890/212/015	27 Mar 2015	12
M1843	Power Sensor	R&S	NRV-Z1	826515/018	27 Mar 2015	12
A1938	Amplifier	Mini-Circuits	ZHL-42	QA0826002	Calibrated as part of system	-
A1328	Handset Positioner	SPEAG	Modification	SD 000 H01 DA	-	-
A1182	Handset Positioner	SPEAG	V3.0	None	-	-

4.3. SAR System Specifications

Robot System	
Positioner:	Stäubli Unimation Corp. Robot Model: RX90L
Repeatability:	0.025 mm
No. of Axis:	6
Serial Number(s):	F01/5J86A1/A/01
Reach:	1185 mm
Payload:	3.5 kg
Control Unit:	CS7
Programming Language:	V+
Robot System	
Positioner:	Stäubli Unimation Corp. Robot Model: TX60L
Repeatability:	±0.030 mm
No. of Axis:	6
Serial Number:	F13/5SC6F1/A/01
Reach:	920 mm
Payload:	2.0 kg
Control Unit:	CS8C
Programming Language:	V+
Data Acquisition Electronic (DAE) System	
Serial Number:	DAE3 SN:432; DAE4 SN:1435
PC Controller	
PC:	Dell Precision 340
Operating System:	Windows 2000
Data Card:	DASY4 and DASY5 Measurement Servers
Serial Number:	1080
Data Converter	
Features:	Signal Amplifier, multiplexer, A/D converted and control logic.
Software:	DASY4 and DASY5 PRO Software
Connecting Lines:	Optical downlink for data and status info. Optical uplink for commands and clock.
PC Interface Card	
Function:	24 bit (64 MHz) DSP for real time processing Link to DAE3 and DAE4 16 bit A/D converter for surface detection system serial link to robot direct emergency stop output for robot.

SAR System Specifications (Continued):

E-Field Probe	
Model:	ES3DV3
Serial No:	3341; 3304
Construction:	Triangular core
Frequency:	10 MHz to > 4 GHz
Linearity:	±0.2 dB (30 MHz to 4 GHz)
Probe Length (mm):	337
Probe Diameter (mm):	10
Tip Length (mm):	10
Tip Diameter (mm):	4
Sensor X Offset (mm):	2
Sensor Y Offset (mm):	2
Sensor Z Offset (mm):	2
Phantom	
Phantom:	Eli Phantom
Shell Material:	Fibreglass
Thickness:	2.0 ±0.1 mm

5. 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
Wi-Fi 2450 MHz / Bluetooth Body Configuration 1g	95%	±18.35%

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.

5.1. Uncertainty – Wi-Fi 2450 MHz / Bluetooth Body Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (10g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ u (%)	- u (%)	
B	Probe calibration	6.000	6.000	normal (k=1)	1.0000	1.0000	6.000	6.000	∞
B	Axial Isotropy	0.250	0.250	normal (k=1)	1.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	1.300	1.300	normal (k=1)	1.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.160	0.160	normal (k=1)	1.0000	1.0000	0.160	0.160	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	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	2.440	2.440	normal (k=1)	1.0000	1.0000	2.440	2.440	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)	2.260	2.260	normal (k=1)	1.0000	0.6400	1.446	1.446	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	2.150	2.150	normal (k=1)	1.0000	0.6000	1.290	1.290	5
	Combined standard uncertainty			t-distribution			9.36	9.36	>500
	Expanded uncertainty			k = 1.96			18.35	18.35	>500

6. Device Under Test (DUT) Information

6.1. DUT Description

Serial Number:	338356737: Used to perform conducted and radiated Wi-Fi SAR testing Proto 4.0: Used to perform conducted and radiated Bluetooth SAR testing
Hardware Version Number:	Proto 4.0
Software Version Number:	0.9.B.1235
Country of Manufacture:	Finland
Date of Receipt:	19 December 2014

DUT Descriptions	The Equipment Under Test is a ''Hand Held EDXRF'' (Energy Dispersive X-Ray Fluorescence Analyser) with Wi-Fi and *Bluetooth* Bands. The EUT has WLAN 802.11 b/g and *Bluetooth* (EDR and Bluetooth 2.0) mode capabilities.
Operating Configurations	Within WiFi and *Bluetooth* Coverage for General Population / Uncontrolled Exposure category.
Accessory	Not Applicable
Battery Options	7.2 Li ION Battery (ND2307)

6.2. Additional Information Related to Testing

Transmitter Frequency Allocation of DUT When Under Test:	**Bands**	**Channel Number**	**Channel Description**	**Frequency (MHz)**
	WLAN 2.4GHz	1	Low	2412.0
		6	Middle	2437.0
		11	High	2462.0
	Bluetooth	0	Low	2402.0
		39	Middle	2441.0
		78	High	2480.0

6.3. Nominal and Maximum Output Power

(From customer)

		RF Output Power (dBm)		
RF Air interface	**Mode**	**Channel**	**Target**	**Tolerance (dB)**
Wi-Fi 2.4GHz	802.11b (1Mbps)	1	14.4	±1.0
		6	14.1	±1.0
		11	13.8	±1.0
	802.11b (54Mbps)	1	13.9	±1.0
		6	13.7	±1.0
		11	13.4	±1.0
	802.11g (6Mbps)	1	11.2	±1.0
		6	13.5	±1.0
		11	10.8	±1.0
	802.11g (54Mbps)	1	8.7	±1.0
		6	8.7	±1.0
		11	8.7	±1.0

	RF Output Power (dBm)		
RF Air interface	**Channel**	**Target**	**Tolerance (dB)**
Bluetooth	DH1	11.7	±1.0
	2DH1	11.7	±1.0
	DH3	11.5	±1.0
	2DH3	11.7	±1.0
	3DH3	11.7	±1.0
	DH5	11.8	±1.0
	2DH5	11.8	±1.0
	3DH5	11.5	±1.0

6.4. Simultaneous transmission Conditions

Simultaneous transmission of Wi-Fi 2.4GHz and Bluetooth is not possible since they both transmit using the same antenna. Hence, there are no possible combinations that can be considered for analysis.

7. RF Exposure Conditions (Test Configurations)

7.1. Deviation from Test Specification

Test was performed as per reference document KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04 and KDB publications listed in Section 2.

7.2. Body-worn

For WLAN and Bluetooth

Test Configurations	Antenna-to-edge/surface	SAR Required	Note
Rear	>25 mm	No	
Front	>25 mm	No	
Left Hand Side	<25 mm	Yes	
Right Hand Side	<25 mm	Yes	
Bottom	>25 mm	No	
Top	<25 mm	Yes	

7.3. Operating Modes

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

- WiFi802.11b/g - Data allocated mode using manufacturer customised software to excise mode 'b' and 'g' modes', with maximum power of up to 14.4 dBm for 'b' mode and 13.6 dBm for 'g' modes.
- Bluetooth - Data allocated mode using manufacturer customised software to excise mode BR DH 1 with maximum power of up to 11.4 dBm.

7.4. Configuration and Peripherals

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

- Standalone fully charged battery powered.
- Body configurations were evaluated.

Body Configuration

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

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

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

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

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

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

g) The location of the maximum spatial SAR distribution (peak) 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.

8. Conducted Output Power Measurements

8.1. Wi-Fi (2.4 GHz Band)

Channel Number	Frequency (MHZ)	TX Power (dBm)	Note
1	2412.0	14.3	**2.4GHz 802.11b** (1Mbps)
6	2437.0	14.4	
11	2472.0	14.2	
1	2412.0	14.0	**2.4GHz 802.11b** (11Mbps)
6	2437.0	14.0	
11	2472.0	13.9	
1	2412.0	11.1	**2.4GHz 802.11g** (6Mbps)
6	2437.0	13.6	
11	2472.0	10.9	
1	2412.0	8.9	**2.4GHz 802.11g** (54Mbps)
6	2437.0	9.0	
11	2472.0	8.9	

8.2.Bluetooth

		Avg Power (dBm)		
Channel Number	Frequency (MHZ)	TX Hopping (All modes)DH1	Pure carrier BR (All Modes)DH1	TX modulated (All Modes)DH1
0	2402.0	9.7	11.4	9.6
39	2441.0	9.7	11.4	9.7
78	2480.0	9.7	11.4	9.7

9. Dielectric Property Measurements & System Check

9.1.Tissue Dielectric Parameters

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized.
The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.
Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

Target Frequency (MHz)	Body	
	ε_r	σ (S/m)
150	61.9	0.80
300	58.2	0.92
450	56.7	0.94
835	55.2	0.97
900	55.0	1.05
915	55.0	1.06
1450	54.0	1.30
1610	53.8	1.40
1800	53.3	1.52
1900	53.3	1.52
2000	53.3	1.52
2450	52.7	1.95
3000	52.0	2.73
5000	49.3	5.07
5100	49.1	5.18
5200	49.0	5.30
5300	48.9	5.42
5400	48.7	5.53
5500	48.6	5.65
5600	48.5	5.77
5700	48.3	5.88
5800	48.2	6.00

NOTE: For convenience, permittivity and conductivity values at some frequencies that are not part of the original data from Drossos et al. [B60] or the extension to 5800 MHz are provided (i.e., the values shown in italics). These values were linearly interpolated between the values in this table that are immediately above and below these values, except the values at 6000 MHz that were linearly extrapolated from the values at 3000 MHz and 5800 MHz.

9.2. System Check

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

9.3. Reference Target SAR Values

The reference SAR values are obtained from the calibration certificate of system validation dipoles. The measured values are normalised to 1 Watt.

System Dipole	Serial No.	Cal. Date	Freq. (MHz)	Target SAR Values (mW/g)	
				1g/10g	Body
D2450V2	725	8 Dec 2014	2450	1g	49.90
				10g	23.20

9.4. Dielectric Property Measurements & System Check Results

The 1-g SAR and 10-g SAR measured with a reference dipole, using the required tissue-equivalent medium at the test frequency, must be within 10% of the manufacturer calibrated dipole SAR target. The internal limit is set to 5%.

SAR Lab 57

System Check 2450 Body
Date: 07/04/2015
Validation Dipole and Serial Number: D2450V2 SN: 725

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	2450	24.0	23.0	ε_r	52.70	52.56	-0.27	5.00
				σ	1.95	2.02	3.58	5.00
				1g SAR	49.90	49.20	-1.40	5.00
				10g SAR	23.20	22.76	-1.90	5.00

Channel Number	Frequency (MHz)	Parameters	
0	2402.0	ε_r	52.70
		σ	2.01
39	2441.0	ε_r	52.60
		σ	2.01
78	2462.0	ε_r	52.50
		σ	2.06

SAR Lab 59

System check 2450 Body
Date: 28/10/2015
Validation dipole and Serial Number: D2450V2 / SN: 725

Simulant	Frequency (MHz)	Room Temp	Liquid Temp	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	2450	24.0 ℃	22.5 ℃	**εr**	52.70	51.68	-1.94	5.00
				σ	1.95	2.02	3.44	5.00
				1g	49.90	49.20	-1.40	5.00
				10g	23.20	22.96	-1.03	5.00

Channel Number	Frequency (MHz)	Parameters	
1	2412.0	**εr**	51.75
		σ	1.95
6	2437.0	**εr**	51.70
		σ	1.99
11	2462.0	**εr**	51.64
		σ	2.03

10.Measured SAR Results

10.0.1. Wi-Fi 2.4 GHz Body-Worn Configuration 1g

Max Reported SAR = 0.201 (W/kg)

					Power (dBm)		1g SAR Results (W/kg)		
Mod.	Dist (mm)	EUT Position	Channel Number	Freq (MHz)	Tune-up limit	Meas. Power	Meas. Level	Reported SAR	Scan No.
DBPSK (802.11b 1Mbps)	0.0	Left Hand Side	6	2437.0	15.1	14.4	0.009	0.010	1
	0.0	Top	6	2437.0	15.1	14.4	0.098	0.115	2
	0.0	Right Hand Side	6	2437.0	15.1	14.4	0.048	0.057	3
	0.0	Top	1	2412.0	15.4	14.3	0.088	0.113	4
	0.0	Top	11	2462.0	14.8	14.2	0.175	0.201	5

10.0.2. Bluetooth Body-Worn Configuration 1g

Max Reported SAR = 0.088 (W/kg)

					Power (dBm)		1g SAR Results (W/kg)		
Mod.	Dist (mm)	EUT Position	Channel Number	Freq (MHz)	Tune-up limit	Meas. Power	Meas. Level	Reported SAR	Scan No.
GFSK (BR 1Mbps)	0.0	Left Hand Side	39	2402.0	12.7	11.4	0.006	0.008	6
	0.0	Top	39	2402.0	12.7	11.4	0.063	0.084	7
	0.0	Right Hand Side	39	2402.0	12.7	11.4	0.024	0.032	8
	0.0	Top	0	2441.0	12.7	11.4	0.044	0.059	9
	0.0	Top	78	2480.0	12.7	11.4	0.065	0.088	10

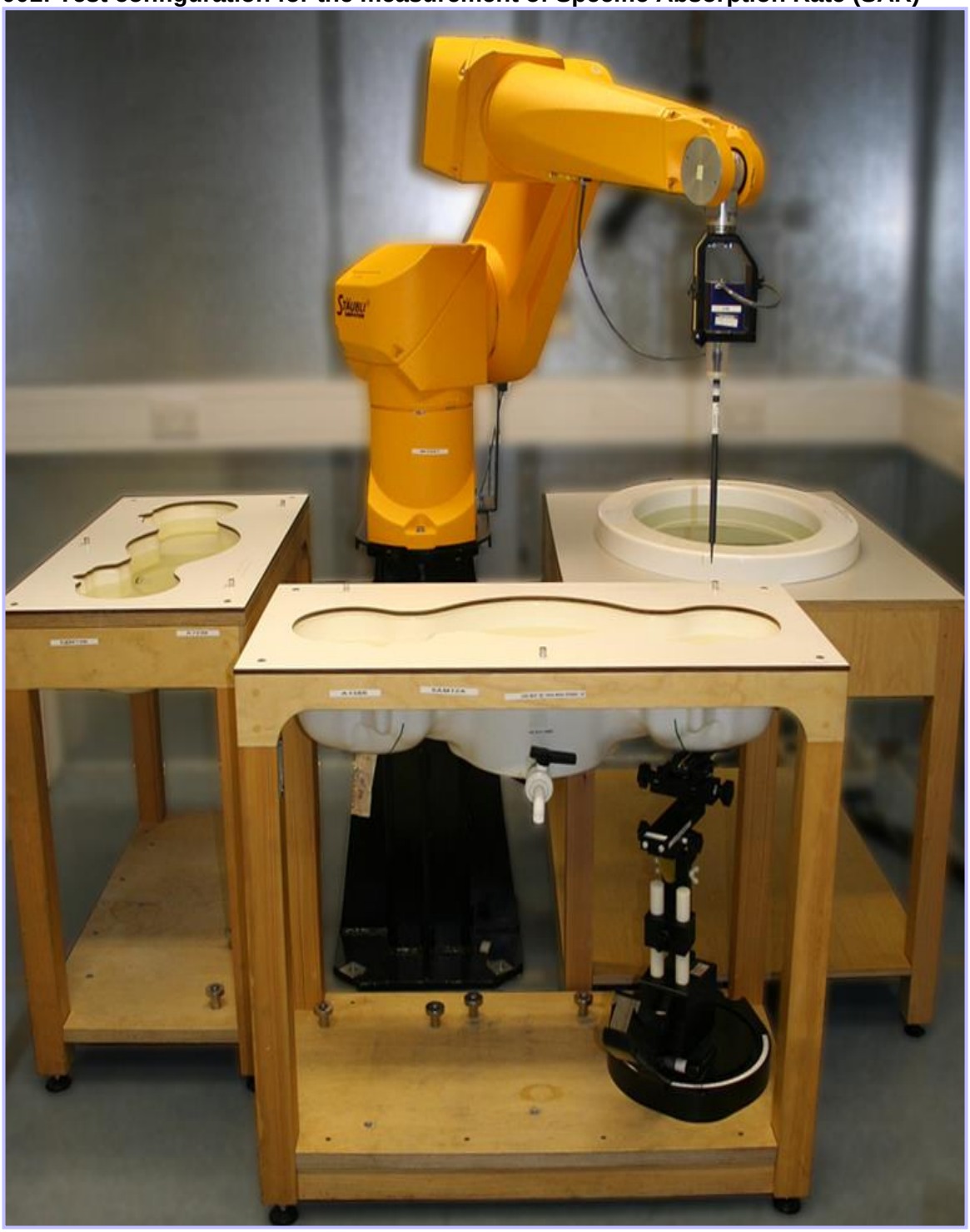
11. Appendixes

11.1. Photos and Ports Location

This appendix contains the following photographs:

Photo Reference Number	Title
001	Test configuration for the measurement of Specific Absorption Rate (SAR)
002	Left Hand Side of the EUT Facing the Phantom
003	Right Hand Side of the EUT Facing the Phantom
004	Top of the EUT Facing the Phantom
005	Left Hand Side View of the EUT
006	Right Hand Side View of the EUT
007	Top View of the EUT
008	Battery View
009	2450 Body Fluid Level
010	Internal View of EUT

001: Test configuration for the measurement of Specific Absorption Rate (SAR)



002: Left Hand Side of the EUT Facing the Phantom

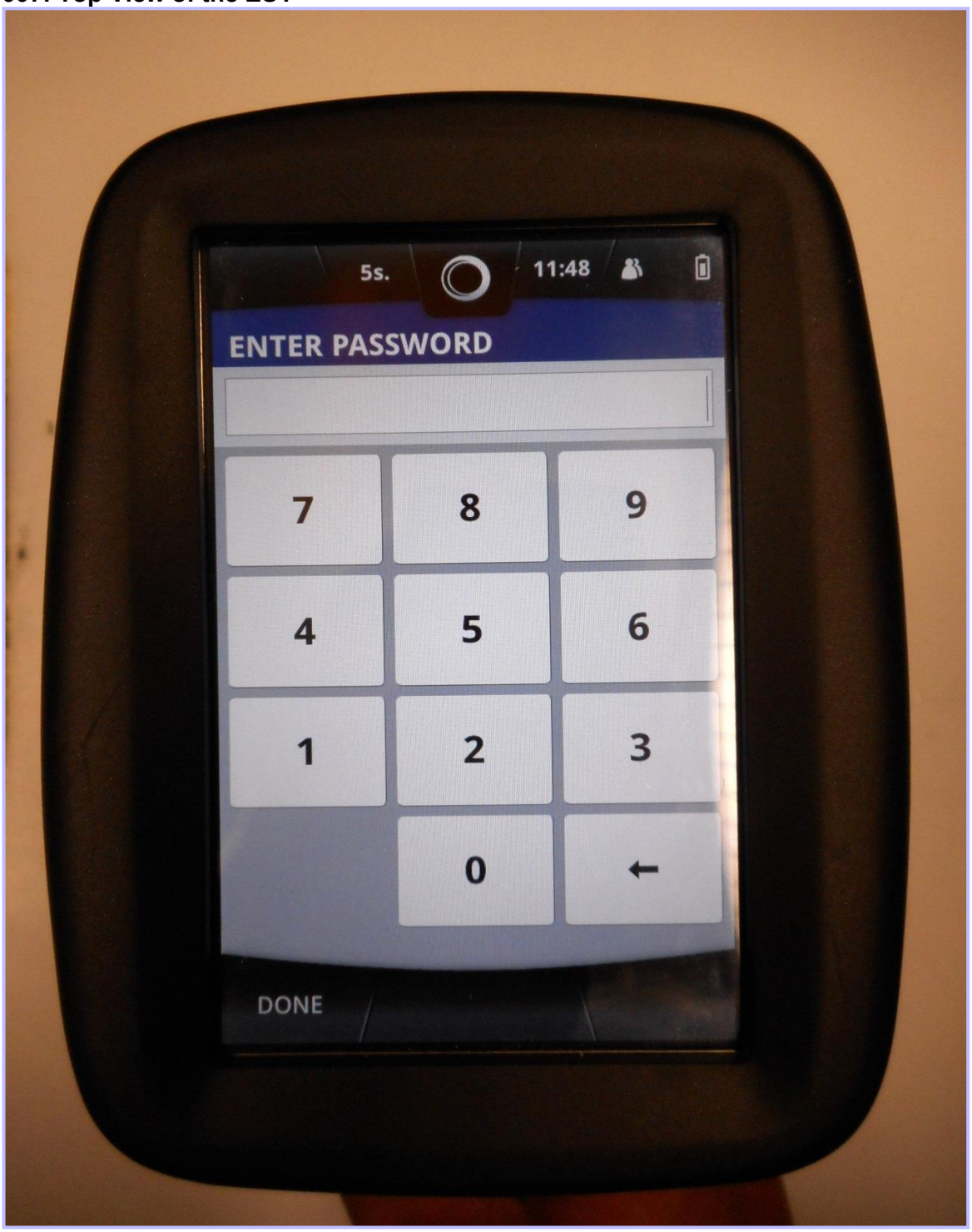
003: Right Hand Side of the EUT Facing the Phantom

004: Top of the EUT Facing the Phantom

005: Left Hand Side View of the EUT

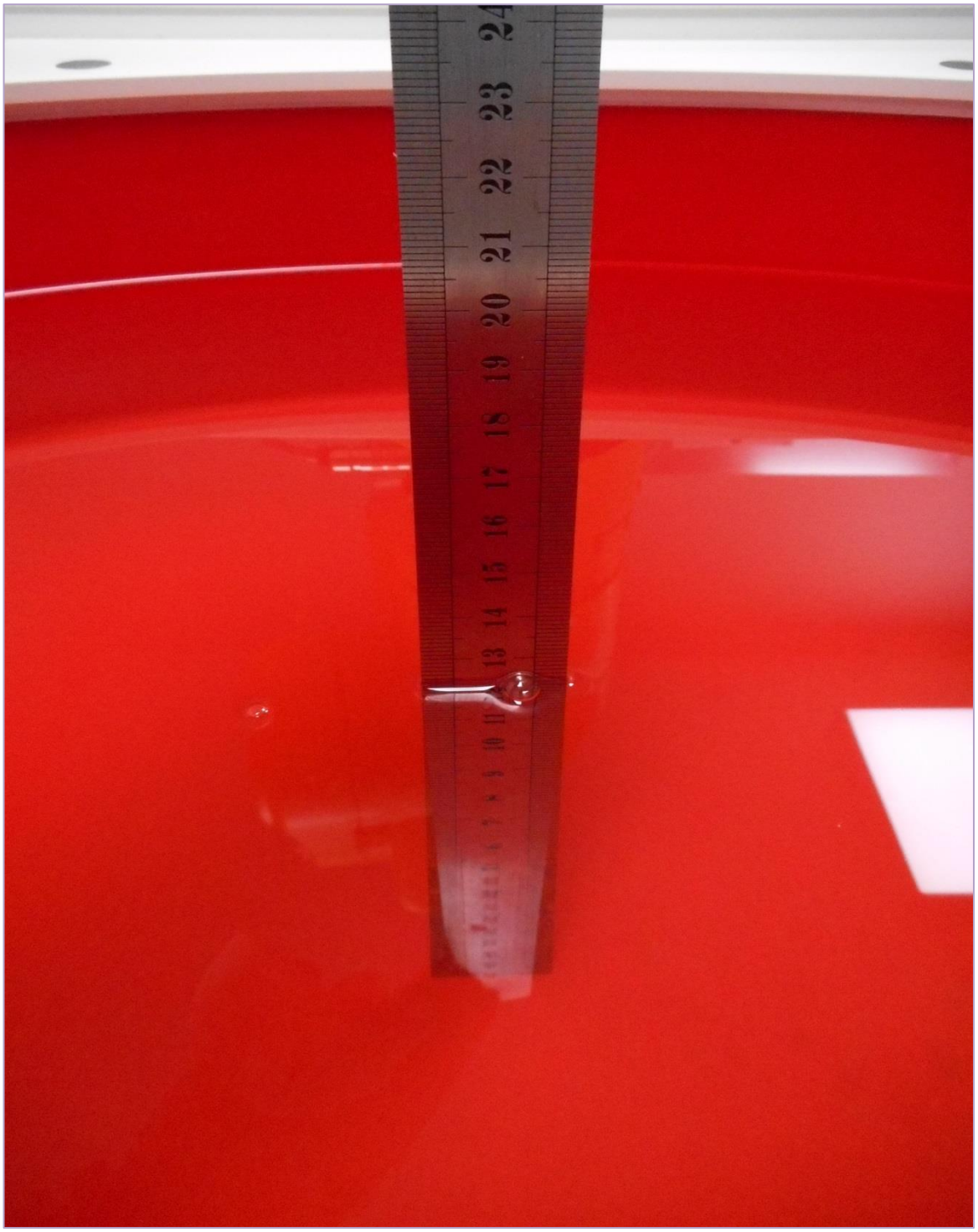
006: Right Hand Side View of the EUT

007: Top View of the EUT

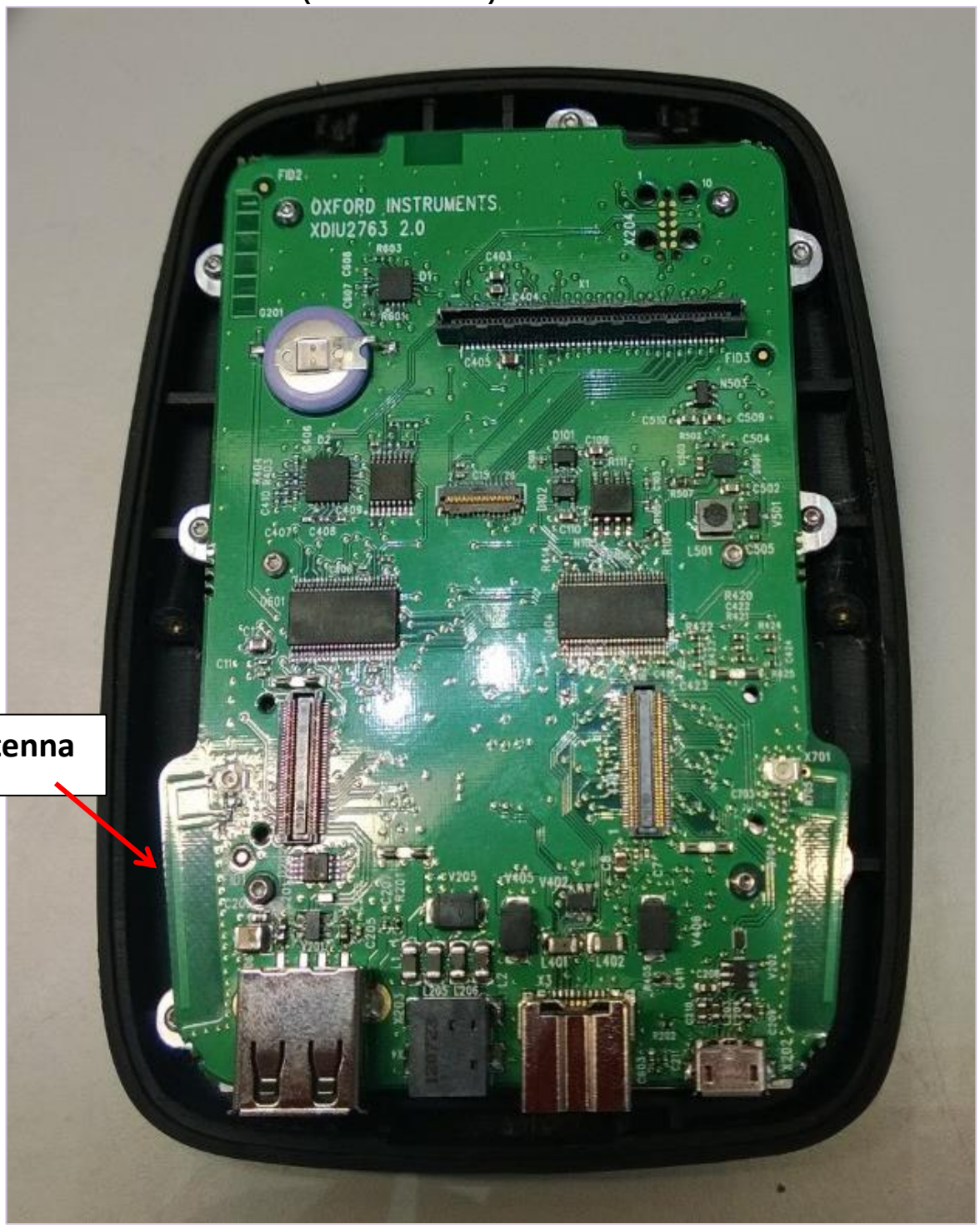


008: Battery View

009: 2450 Body Fluid Level



010: Internal View of EUT (From customer)

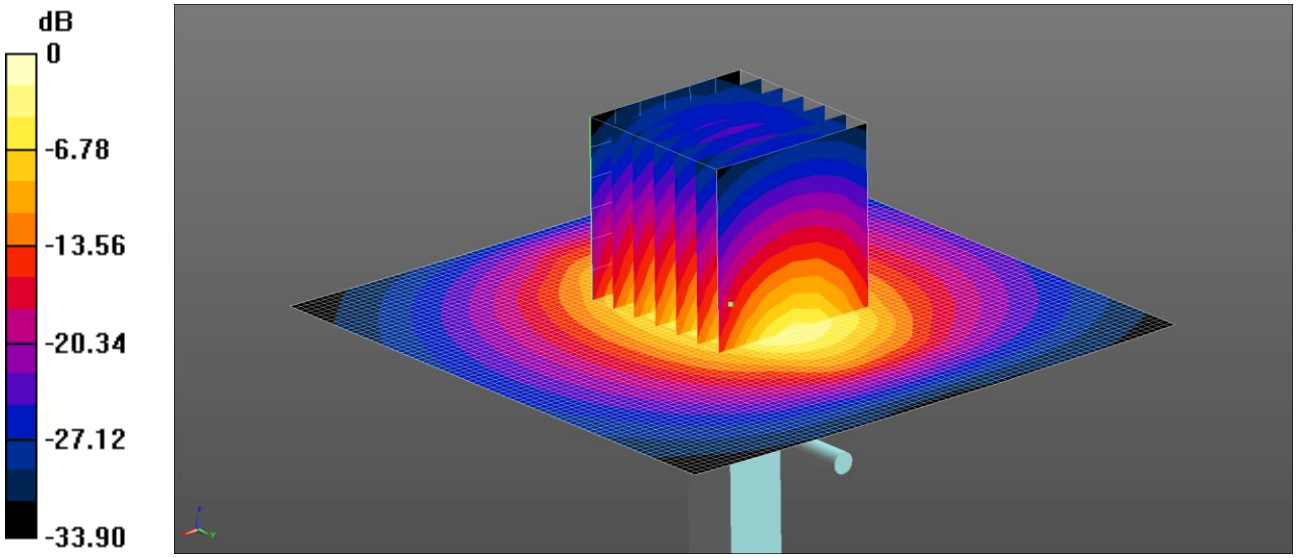


11.2. System Check Plots

This appendix contains the following system validation distribution scans.

Scan Reference Number	Title
001	System Performance Check 2450MHz Body 28 10 15
002	System Performance Check 2450MHz Body 07 04 15

001: System Performance Check 2450MHz Body 28 10 2015
Date: 28/10/2015
DUT: Dipole 2450 MHz; SN725; Type: D2450V2; Serial: D2450V2 - SN:725

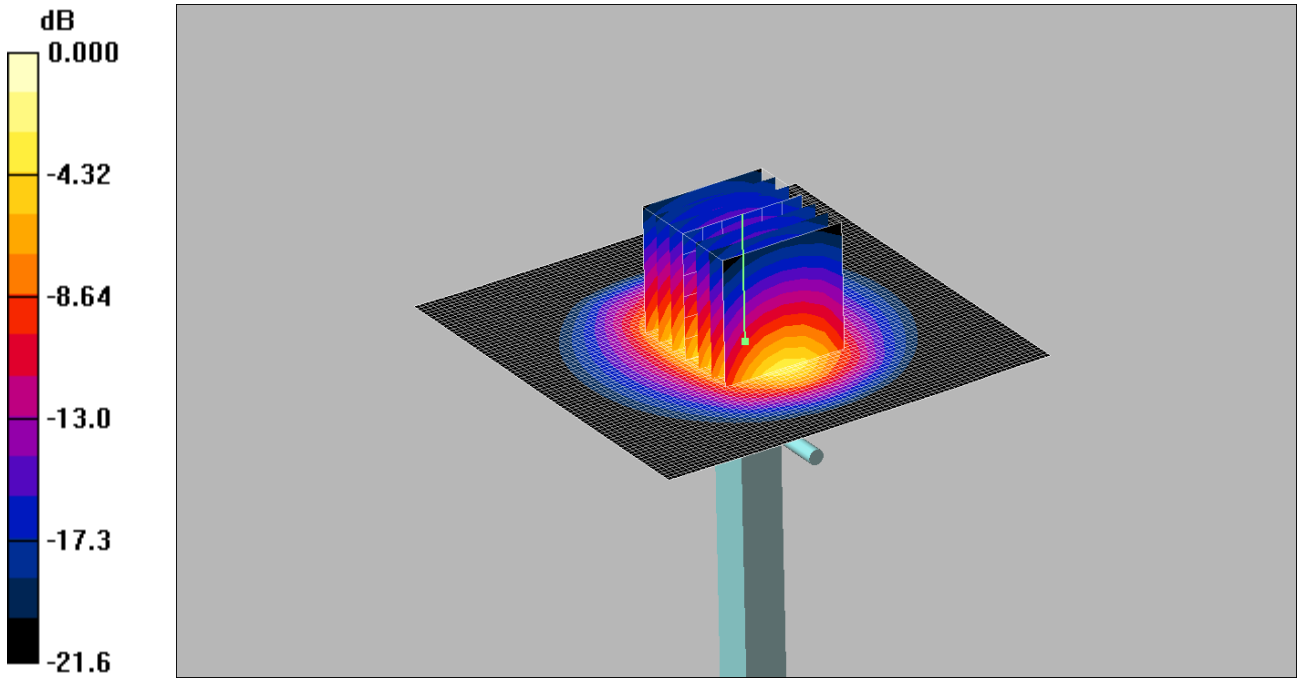


0 dB = 18.9 W/kg = 12.77 dBW/kg

Communication System: UID 0, CW (0); Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: 2450 MHz MSL Medium parameters used: f = 2450 MHz; σ = 2.02 S/m; ε_r = 51.675; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY4 Configuration:
- Probe: ES3DV3 - SN3304; ConvF(4.31, 4.31, 4.31); Calibrated: 25/08/2015;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn432; Calibrated: 25/08/2015
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- ; SEMCAD X Version 14.6.10 (7164)

Configuration/d=10mm, Pin=250mW 2 2/Area Scan (81x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 18.9 W/kg
Configuration/d=10mm, Pin=250mW 2 2/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 77.470 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 25.7 W/kg
SAR(1 g) = 12.3 W/kg; SAR(10 g) = 5.74 W/kg
Maximum value of SAR (measured) = 18.8 W/kg

001: System Performance Check 2450MHz Body 07 04 15
Date: 07/04/2015
DUT: Dipole 2450 MHz; Type: D2440V2; Serial: D2440V2 - SN:725



0 dB = 14.1mW/g

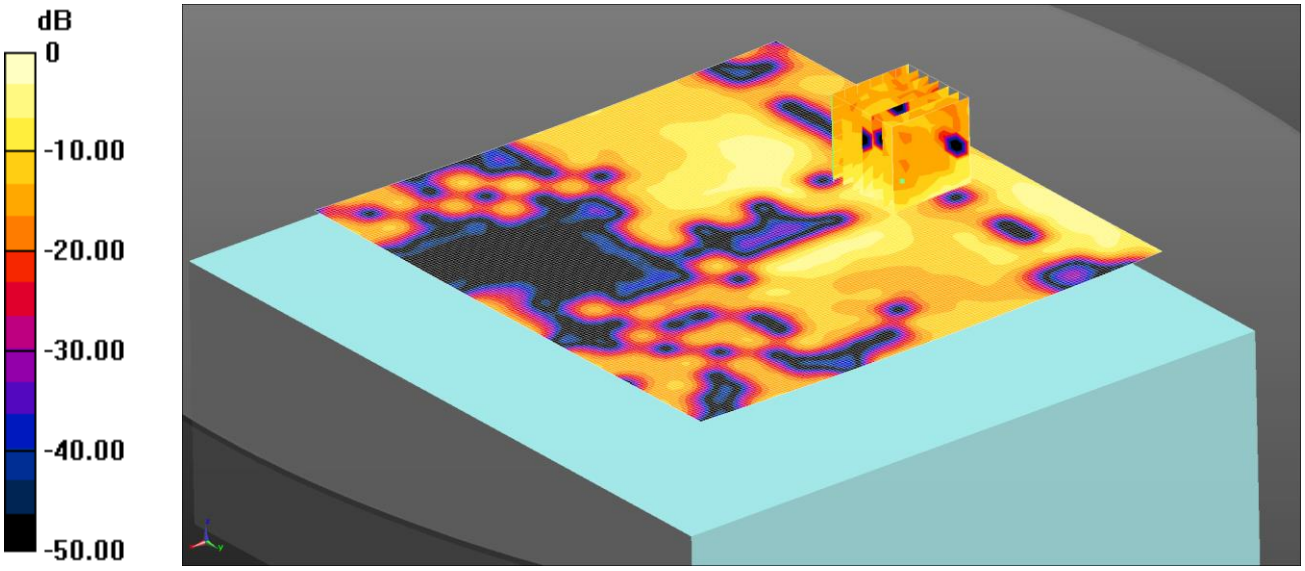
Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: 2450 MHz MSL Medium parameters used: f = 2450 MHz; σ = 2.02 mho/m; εr = 52.6; ρ = 1000 kg/m3
Phantom section: Flat Section
DASY4 Configuration:
- Probe: ES3DV3 - SN3304; ConvF(4.24, 4.24, 4.24);
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn432; Calibrated: 20/08/2014
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186
d=10mm, Pin=250mW/Area Scan (81x81x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (interpolated) = 14.6 mW/g
d=10mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 83.4 V/m; Power Drift = -0.126 dB
Peak SAR (extrapolated) = 25.9 W/kg
SAR(1 g) = 12.3 mW/g; SAR(10 g) = 5.69 mW/g
Maximum value of SAR (measured) = 14.1 mW/g

11.3. SAR Test Plots

This appendix contains the following SAR distribution scans.

Scan Reference Number	Title
001	Left Hand Side of EUT Facing Phantom 802.11b CH6
002	Top of EUT Facing Phantom 802.11b CH6
003	Right Hand Side of EUT Facing Phantom 802.11b CH6
004	Top of EUT Facing Phantom 802.11b CH1
005	Top of EUT Facing Phantom 802.11b CH11
006	Left Hand Side of EUT Facing Phantom Bluetooth BR CH39
007	Top of EUT Facing Phantom Bluetooth BR CH39
008	Right Hand Side of EUT Facing Phantom Bluetooth BR CH39
009	Top of EUT Facing Phantom Bluetooth BR CH0
010	Top of EUT Facing Phantom Bluetooth BR CH78

001: Left Hand Side of EUT Facing Phantom 802.11b CH6
Date: 28/10/2015
DUT: XMDS2770; Type: Oxford Instruments Analytical



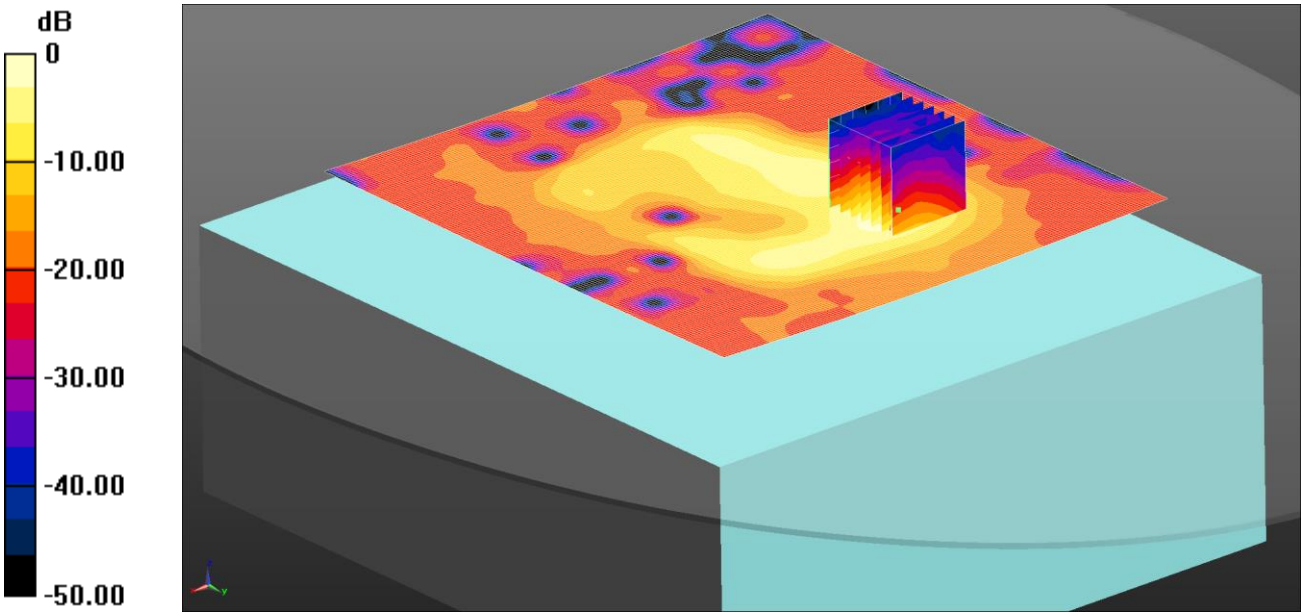
0 dB = 0.0206 W/kg = -16.87 dBW/kg

Communication System: UID 0, WLAN 802.11 (0); Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: 2450 MHz MSL Medium parameters used (interpolated): f = 2437 MHz; σ = 1.999 S/m; ε_r = 51.702; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY4 Configuration:
- Probe: ES3DV3 - SN3304; ConvF(4.31, 4.31, 4.31); Calibrated: 25/08/2015;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn432; Calibrated: 25/08/2015
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- ; SEMCAD X Version 14.6.10 (7164)

Configuration/Left Hand Side of EUT - Middle 2 2/Area Scan (151x161x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.0206 W/kg
Configuration/Left Hand Side of EUT - Middle 2 2/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.050 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.0180 W/kg
SAR(1 g) = 0.00866 W/kg; SAR(10 g) = 0.00346 W/kg
Maximum value of SAR (measured) = 0.00995 W/kg

Note: SAR level measured is very low as equivalent to noise floor.

002: Top of EUT Facing Phantom 802.11b CH6
Date: 28/10/2015
DUT: XMDS2770; Type: Oxford Instruments Analytical



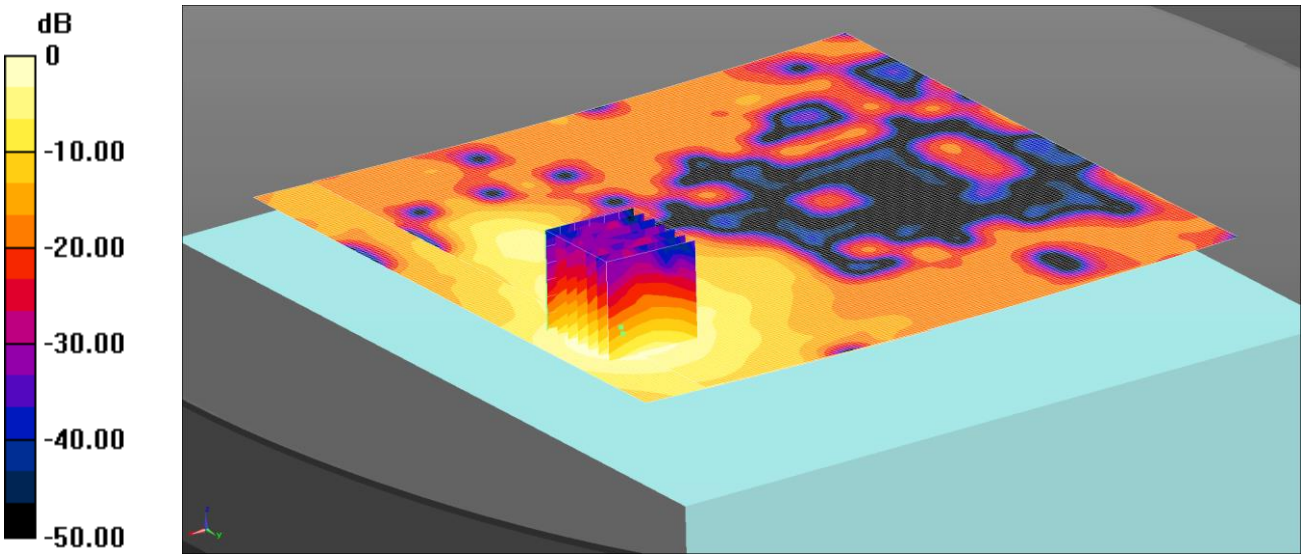
0 dB = 0.114 W/kg = -9.42 dBW/kg

Communication System: UID 0, WLAN 802.11 (0); Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: 2450 MHz MSL Medium parameters used (interpolated): f = 2437 MHz; σ = 1.999 S/m; ε_r = 51.702; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY4 Configuration:
- Probe: ES3DV3 - SN3304; ConvF(4.31, 4.31, 4.31); Calibrated: 25/08/2015;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn432; Calibrated: 25/08/2015
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- ; SEMCAD X Version 14.6.10 (7164)

Configuration/Top of EUT - Middle 2 2/Area Scan (151x161x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.114 W/kg
Configuration/Top of EUT - Middle 2 2/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.833 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 0.206 W/kg
SAR(1 g) = 0.098 W/kg; SAR(10 g) = 0.046 W/kg
Maximum value of SAR (measured) = 0.113 W/kg

Note: SAR level measured is very low as equivalent to noise floor.

003: Right Hand Side of EUT Facing Phantom 802.11b CH6
Date: 28/10/2015
DUT: XMDS2770; Type: Oxford Instruments Analytical



0 dB = 0.0595 W/kg = -12.26 dBW/kg

Communication System: UID 0, WLAN 802.11 (0); Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: 2450 MHz MSL Medium parameters used (interpolated): f = 2437 MHz; σ = 1.999 S/m; ε_r = 51.702; ρ = 1000 kg/m^3
Phantom section: Flat Section
DASY4 Configuration:
- Probe: ES3DV3 - SN3304; ConvF(4.31, 4.31, 4.31); Calibrated: 25/08/2015;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn432; Calibrated: 25/08/2015
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- ; SEMCAD X Version 14.6.10 (7164)

Configuration/Right Hand of EUT - Middle 2/Area Scan 2 (81x161x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.0513 W/kg
Configuration/Right Hand of EUT - Middle 2/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.087 V/m; Power Drift = 0.15 dB
Peak SAR (extrapolated) = 0.121 W/kg
SAR(1 g) = 0.048 W/kg; SAR(10 g) = 0.025 W/kg
Maximum value of SAR (measured) = 0.0554 W/kg

Note: SAR level measured is very low as equivalent to noise floor.