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

SAR EVALUATION REPORT

For

Pocket Server with IEEE 802.11b/g

Model: LOG PS-3-913
FCC ID: "Contains FCC ID: OV8-PS-3" and "Contains FCC ID: X7J-A10040601"

Report Number UL-SAR-RP12226309JD04A V3.0
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REVISION HISTORY

Version	Issue Date	Revisions	Revised By
1.0	29 May 2019	Initial Issue	--
2.0	15 July 2019	The following amendments were made in the report: 1. Typo corrected in report number 2. FCC ID corrected in front page 3. Noted added in section 9.4 and 12.2	Naseer Mirza
3.0	17 July 2019	The following amendments were made in the report: 1. Typo corrected in section 6.3	Naseer Mirza

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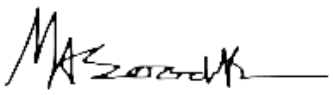
1. Attestation of Test Results

Applicant Name	Seba Dynatronic					
Model	LOG PS-3-913					
Test Device is	A representative test sample					
Device category	Portable					
Date Tested	13 May 2019 to 15 May 2019					
ICNIRP Guidelines Limits for SAR Exposure Characteristics	General Population/Localised SAR (Head and trunk): 1g-SAR limit 1.6 W/kg					
The highest reported SAR values	RF Exposure Conditions		Equipment Class			
			Licensed	DTS	U-NII	DSS
	Standalone	Body	N/A	0.15 W/Kg	N/A	N/A
Applicable Standards	FCC 47 CFR part 2 (2.1093) KDB publication					
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.

Issued By:	Prepared By:
	
Naseer Mirza Project Lead UL VS Ltd.	Masood Khan Lab Engineer UL VS Ltd.

2. Test Specification, Methods and Procedures

2.1. Test Specification

Reference:	KDB Publication Number: 865664 D01 SAR Measurement 100 MHz to 6 GHz
Title:	SAR Measurement Requirements for 100 MHz to 6 GHz
Introduction:	The SAR Measurement procedures for 100MHz to 6GHz are described in this document. 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 standard IEEE 1528-2013. The wireless product and technology specific procedures in applicable KDB publications are required to be used unless further guidance has been approved by the FCC.
Purpose of Test:	To determine if the Equipment Under Test complies 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).

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 Communication Devices: Measurement Techniques.

FCC KDB Publication:
KDB 248227 D01 802.11 Wi-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

2.3. Definition of Measurement Equipment

The measurement equipment used complied with the requirements of the standards referenced in the methods & procedures section above. Section 4.3 contains a list of the test equipment used.

3. Facilities and Accreditation

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

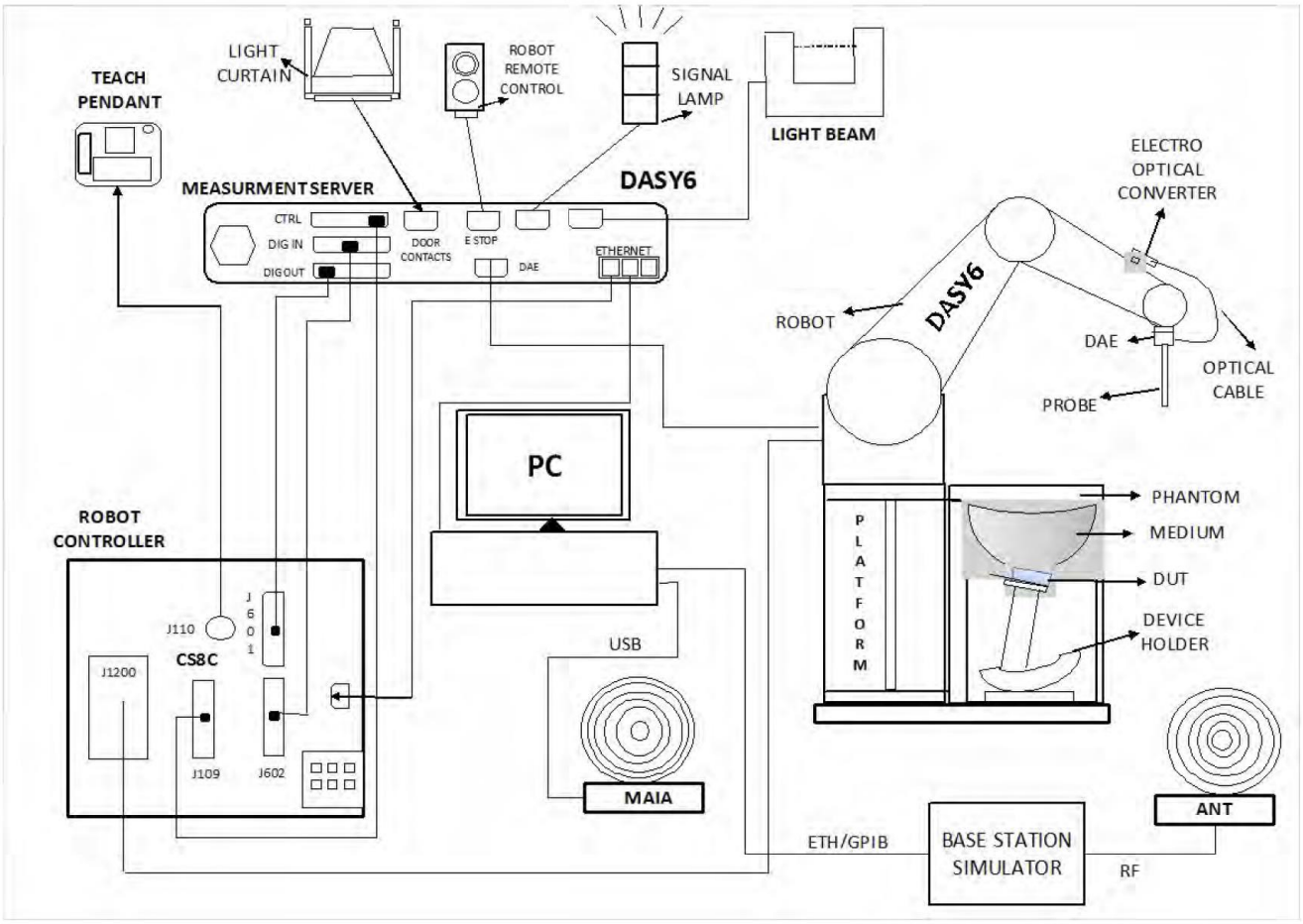
Horizon Unit 1, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, UK	Facility Type
SAR Lab 60	Controlled Environment Chamber

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 Win 8.1 or Win 10 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. SAR Measurement Procedure

4.2.1. Normal SAR Measurement Procedure

The following procedure shall be performed for each of the test conditions Measure the local SAR at a test point within 8 mm of the phantom inner surface that is closest to the DUT.

a) Measure the two-dimensional SAR distribution within the phantom (area scan procedure).
b) The boundary of the measurement area shall not be closer than 20 mm from the phantom side walls. The distance between the measurement points should enable the detection of the location of local maximum with an accuracy of better than half the linear dimension of the tissue cube after interpolation. A maximum grid spacing of 20 mm for frequencies below 3 GHz and (60/f [GHz]) mm for frequencies of 3 GHz and greater is recommended. The maximum distance between the geometrical centre of the probe detectors and the inner surface of the phantom shall be 5 mm for frequencies below 3 GHz and δ ln(2)/2 mm for frequencies of 3 GHz and greater, where δ is the plane wave skin depth and ln(x) is the natural logarithm. The maximum variation of the sensor-phantom surface distance shall be ± 1 mm for frequencies below 3 GHz and ± 0,5 mm for frequencies of 3 GHz and greater. At all measurement points the angle of the probe with respect to the line normal to the surface should be less than 5°. If this cannot be achieved for a measurement distance to the phantom inner surface shorter than the probe diameter, additional uncertainty evaluation is needed.
c) From the scanned SAR distribution, identify the position of the maximum SAR value, in addition identify the positions of any local maxima with SAR values within 2 dB of the maximum value that will not be within the zoom scan of other peaks; additional peaks shall be measured only when the primary peak is within 2 dB 6 of the SAR compliance limit (e.g., 1 W/kg for 1,6 W /kg 1 g limit, or 1,26 W/kg for 2 W /kg, 10 g limit).
d) Measure the three-dimensional SAR distribution at the local maxima locations identified in step c) (zoom scan procedure). The horizontal grid step shall be (24 / f [GHz]) mm or less but not more than 8 mm. The minimum zoom scan size is 30 mm by 30 mm by 30 mm for frequencies below 3 GHz. For higher frequencies, the minimum zoom scan size can be reduced to 22 mm by 22 mm by 22 mm. The grid step in the vertical direction shall be (8-f [GHz]) mm or less but not more than 5 mm, if uniform spacing is used. If variable spacing is used in the vertical direction, the maximum spacing between the two closest measured points to the phantom shell shall be (12/f [GHz]) mm or less but not more than 4 mm, and the spacing between farther points shall increase by an incremental factor not exceeding 1,5. When variable spacing is used, extrapolation routines shall be tested with the same spacing as used in measurements. The maximum distance between the geometrical centre of the probe detectors and the inner surface of the phantom shall be 5 mm for frequencies below 3 GHz and δ ln(2)/2 mm for frequencies of 3 GHz and greater, where δ is the plane wave skin depth and ln(x) is the natural logarithm. Separate grids shall be centred on each of the local SAR maxima found in step c). Uncertainties due to field distortion between the media boundary and the dielectric enclosure of the probe should also be minimized, which is achieved if the distance between the phantom surface and physical tip of the probe is larger than probe tip diameter. Other methods may utilize correction procedures for these boundary effects that enable high precision measurements closer than half the probe diameter. For all measurement points, the angle of the probe with respect to the flat phantom surface shall be less than 5º.
e) Use post processing (e.g. interpolation and extrapolation) procedures to determine the local SAR values at the spatial resolution needed for mass averaging.
f) The local SAR should be measured at the same location as in Step a). SAR drift is assessed and reported in the uncertainty budget.
In the event that the evaluation of measurement drift exceeds the 5 % tolerance, it is required that SAR be reassessed following guidelines contained within this standard.
If the drift is larger than 5 %, then the measurement drift shall be considered a bias, not an uncertainty. A correction shall be applied to the measured SAR value. It is not necessary to record the drift in the uncertainty budget (i.e. ui = 0 %). The uncertainty budget reported in a measurement report should correspond to the highest SAR value reported (after correction, if applicable). Alternatively, the uncertainty budget reported should cover all measurements, i.e., it should report a conservative value.

Area Scan Parameters:

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 mm ± 1 mm	$½ \cdot \delta \cdot \ln(2)$ mm ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

Zoom Scan Parameters:

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ 1.5·$\Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

4.3. 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)
PRE0178316	Data Acquisition Electronics	SPEAG	DAE4	1541	14 Mar 2019	12
A1322	Dipole Kit	SPEAG	D2450V2	725	17 Sep 2018	12
PRE0178314	Probe	SPEAG	EX3DV4	7496	28 Mar 2019	12
G0611	Robot Power Supply	SPEAG	DASY52	F14/5UA6A1/C/01	Calibrated as part of system	-
M1876	Robot Arm	Staubli	TX60 L	F14/5UA6A1/A/01	Calibrated as part of system	-
A2811	Body Handset Positioner	SPEAG	MD4HACV5	None	Calibrated before use	-
M1755	DAK Fluid Probe	SPEAG	SM DAK 040 CA	1089	Calibrated before use	-
M1855	Power Sensor	R & S	NRV-Z51	103246	18 Jan 2019	12
PRE0159221	Power Source	SPEAG	SE UMS 160 AB	1026	07 Nov 2018	12
PRE0151154	Network Analyser	R&S	ZND	100151	03 Jan 2019	12
A2621	Digital Camera	Nikon	S3600	41010357	N/A	-
A2252	Phantom	SPEAG	SAM Twin Phantom	1951	Calibrated as part of system	-
PRE0141348	Phantom Support Structure	SPEAG	DASY6 Phantom Table	-	Calibrated as part of system	-
PRE0155857	RS Hygrometer	RS Components	408-6109	612Q19R(2)	20 Mar 2019	12

SAR System Specifications

Robot System	
Positioner:	Stäubli Unimation Corp. Robot Model: TX60L
Repeatability:	±0.030 mm
No. of Axis:	6
Serial Number(s):	F14/5UA6A1/A/01
Reach:	800 mm
Payload:	2.0 kg
Control Unit:	CS8C
Programming Language:	V+
Data Acquisition Electronic (DAE) System	
Serial Number:	DAE4 SN: 1541
PC Controller	
PC:	HP EliteDesk800
Operating System:	Windows 10
Data Card:	DASY5 Measurement Servers
Data Converter	
Features:	Signal Amplifier, multiplexer, A/D converted and control logic.
Software:	DASY6 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 DAE4 16 bit A/D converter for surface detection system serial link to robot direct emergency stop output for robot.
Phantom	
Phantom:	SAM Phantom
Shell Material:	Fibreglass
Thickness:	2.0 ±0.1 mm
E-Field Probe	
Model:	EX3DV4
Serial No:	7496
Construction:	Triangular core
Frequency:	10MHz to >6GHz
Linearity:	±0.2 dB (30 MHz to 6 GHz)
Probe Length (mm):	337
Probe Diameter (mm):	10
Tip Length (mm):	9
Tip Diameter (mm):	2.5
Sensor X Offset (mm):	1
Sensor Y Offset (mm):	1
Sensor Z Offset (mm):	1

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
Uncertainty- Freq. < 3 GHz Body Configuration 1g	95 %	±19.22 %

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 – Freq. < 3 GHz Body Configuration 1g

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	$c_{i\ (1g)}$	Standard Uncertainty		υ_i or υ_{eff}
							+ u (%)	- u (%)	
B	Probe calibration	5.050	5.050	normal (k=1)	1.0000	1.0000	5.050	5.050	∞
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	0.300	0.300	Rectangular	1.7321	1.0000	0.173	0.173	∞
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	8.520	8.520	Rectangular	1.7321	1.0000	4.919	4.919	∞
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	0.147	0.147	normal (k=1)	1.0000	1.0000	0.147	0.147	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)	2.470	2.470	normal (k=1)	1.0000	0.6400	1.581	1.581	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	2.430	2.430	normal (k=1)	1.0000	0.6000	1.458	1.458	5
	Combined standard uncertainty			t-distribution			9.81	9.81	>500
	Expanded uncertainty			k = 1.96			19.22	19.22	>500

6. Device Under Test (DUT) Information

6.1. DUT Description

DUT Description:	The DUT (LOG PS-3-913) is a bridge between WIFI devices and seba radio devices. It allows to communicate (program, read and view data, perform real time measurement) with the following seba devices LOG N-3, LOG P-3, LOG DX and LOG D-3. All communication between the user device and the LOG PS-3-913 is done via WIFI (LOG PS-3-913 creates a WIFI-network and has a webserver running). Thus it can be controlled by any WIFI device able to run a web browser (smartphone, tablet, laptop, PC). The LOG PS-3-913 consists of a Raspberry Pi 3 (FCC-ID: 2ABCB-RPI32) with integrated WIFI module and an additional PCB containing charging circuit, voltage converters, radio module (Anaren A1101R09A, FCC-ID: X7J-A10040601) and front panel connection. The DUT supports WLAN 2.4 GHz 802.11 b/g modes.	
Sample Used:	SAR	S/N: 12323710002
	Conducted Power Measurements	S/N: 12334000005
Hardware Version Number:	6.057.03	
Software Version Number:	1.1.0	
Country of Manufacture:	Germany	
Device dimension	150 x 92 x 29 mm	
Date of Receipt:	07 February 2019	

Antenna Type:	Internal integral	
Number of Antenna Positions:	WLAN ~ Wi-Fi 2.4 GHz	1 fixed
	Short Range Radio ~ SRD	1 fixed
Battery Type(s):	Embedded Li-ion	

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6.2. Wireless Technologies

Wireless Technologies	Frequency Bands	Operating Mode	Duty Cycle
Wi-Fi	2.4 GHz	802.11b/g	~100%

Wireless Technologies (Continued):

Wi-Fi						
Band	Description					
	20 MHz BW Ch.#	Frq. (MHz)	40 MHz BW Ch.#	Frq. (MHz)	80 MHz BW Ch.#	Frq. (MHz)
Wi-Fi 2.4 GHz (802.11b/g/n)	1	2412.0	N/A			
	2	2417.0				
	3	2422.0				
	4	2427.0				
	5	2432.0				
	6	2437.0				
	7	2442.0				
	8	2447.0				
	9	2452.0				
	10	2457.0				
	11	2462.0				
	12	Not Supported				
	13	Not Supported				

6.3.Nominal and Maximum Output power: Wi-Fi

Wi-Fi 2.4 GHz - WF1 Antenna

			Target + Tolerances (dBm)	
Band	**Channel**	**Centre Frequency (MHz)**	**802.11b**	**802.11g**
Wi-Fi 2.4 GHz	1	2412.0	18 dBm +/-2 dB	18 dBm +/-2 dB
	2	2417.0	18 dBm +/-2 dB	18 dBm +/-2 dB
	3	2422.0	18 dBm +/-2 dB	18 dBm +/-2 dB
	4	2427.0	18 dBm +/-2 dB	18 dBm +/-2 dB
	5	2432.0	18 dBm +/-2 dB	18 dBm +/-2 dB
	6	2437.0	18 dBm +/-2 dB	18 dBm +/-2 dB
	7	2442.0	18 dBm +/-2 dB	18 dBm +/-2 dB
	8	2447.0	18 dBm +/-2 dB	18 dBm +/-2 dB
	9	2452.0	18 dBm +/-2 dB	18 dBm +/-2 dB
	10	2457.0	18 dBm +/-2 dB	18 dBm +/-2 dB
	11	2462.0	18 dBm +/-2 dB	18 dBm +/-2 dB
	12	2467.0	Not Supported	Not Supported
	13	2472.0	Not Supported	Not Supported

Frequency Band	Target + Tolerances (dBm)
SRD	-40 dBm +/-3 dB

7. RF Exposure Conditions (Test Configurations)

7.1. Configuration Consideration

Technology Antenna	Configuration	Antenna-to-User Separation	Position	Antenna-to-Edge Separation (mm)	Evaluation Considered
WLAN ~ (Wi-Fi 2.4 GHz)	Body	0mm	Front	< 25	Yes
			Back	< 25	Yes
			Top	> 25	No
			Right	> 25	No
			Bottom	> 25	No
			Left	> 25	No

Note: The Antenna to edge separation distances are indicated in the 'Antenna Schematics' located in Section 12.1 of this report.

7.2. SAR Test Exclusion Consideration

Frequency Band	Configuration(s)
	Body
WLAN 2.4 GHz	No
SRD	Yes

Note:

1. As per KDB 447498, The frequency Bands with Rated Power including Upper tolerance, which qualify for **Standalone SAR Test Exclusion,** are as per the above table.
2. The details for the Maximum Rated Power and tolerance(s) can be found in section 6.

8. Conducted Output Power Measurements

8.1. RF Output Average Power Measurement: Wi-Fi 2.4 GHz

8.1.1. Wi-Fi 802.11b (2.4 GHz) - SISO

		Avg Power (dBm)	
Channel Number	Frequency (MHz)	1Mbps	Operating Mode
		Body	
1	2412	18.04	802.11b
6	2437	18.10	
11	2462	18.16	
12	2467	Not Supported	
13	2472	Not Supported	

Note: Conducted power measurements for 802.11g mode not required, as the Max. Rated Power for the mode was ≤ 802.11b mode

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.

IEEE 1528:2013

Target Frequency (MHz)	Head		Body (FCC only)	
	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
750	41.9	0.89	-	-
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1500	40.4	1.23	-	-
1610	40.3	1.29	53.8	1.40
1640	40.2	1.31	-	-
1750	40.1	1.37	-	-
1800	40	1.40	53.3	1.52
1900	40	1.40	53.3	1.52
2000	40	1.40	53.3	1.52
2100	39.8	1.49	-	-
2300	39.5	1.67	-	-
2450	39.2	1.80	52.7	1.95
2600	39	1.96	-	-
3000	38.5	2.40	52.0	2.73
3500	37.9	2.91	-	-
4000	37.4	3.43	-	-
4500	36.8	3.94	-	-
5000	36.2	4.45	49.3	5.07
5100	36.1	4.55	49.1	5.18
5200	36.0	4.66	49.0	5.30
5250	35.9	4.71	48.9	5.36
5300	35.9	4.76	48.9	5.42
5400	35.8	4.86	48.7	5.53
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5700	35.4	5.17	48.3	5.88
5750	35.4	5.22	48.3	5.94
5800	35.3	5.27	48.2	6.00
6000	35.1	5.48	-	-

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	Head
D2450V2	725	17 Sep 2018	2450	1g	51.1
				10g	23.8

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 ±10%.

Site 60

System check 2450 Head

Date: 14/05/2019
Validation dipole and Serial Number: D2450V2 / SN: 725

Simulant	Frequency (MHz)	Room Temp (℃)	Liquid Temp (℃)	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head Tissue Simulation Liquid	2450.00	22.3	20.3	**εr**	39.20	39.01	-0.48	10.00
				Σ	1.80	1.79	-0.79	10.00
				1g (W/kg)	51.10	51.47	0.73	10.00
				10g (W/kg)	23.80	23.54	-1.07	10.00

Note: As per FCC RF Exposure procedures - April 2019 presentation - Tissue Simulating Liquids (TSL), page 19, effective February 19, 2019, FCC has permitted the use of the head-tissue simulating liquid specified in IEC 62209-1 for all SAR tests – head and body and extremity.

10. Measurements, Examinations and Derived Results

10.1. General Comments

SAR test was performed in accordance with the criteria in KDB 248227.

In the 2.4 GHz band, separate SAR procedures were applied to DSSS and OFDM configurations to simplify DSSS test requirements. SAR test was evaluated on the mode with the highest rated power, which is in this case was 802.11b mode. OFDM mode was not evaluated because when the highest reported SAR for DSSS was adjusted by the ratio of OFDM to DSSS specified maximum output power, the adjusted SAR obtained was < 1.2W/kg.

Note: As per FCC RF Exposure procedures - April 2019 presentation - Tissue Simulating Liquids (TSL), page 19, effective February 19, 2019, FCC has permitted the use of the head-tissue simulating liquid specified in IEC 62209-1 for all SAR tests – head and body and extremity.

10.2.Specific Absorption Rate - Test Results - WLAN Antenna

10.2.1.WLAN 2.4GHz Body 1g - WLAN

Max Reported SAR = 0.15 (W/kg)

					Power (dBm)		1g: SAR Results (W/kg)			
Mode	Dist. (mm)	DUT Position	Channel Number	Freq (MHz)	Tune Up Limit	Meas.	Meas. SAR Level	Reported SAR	Notes	Plot No.
802.11b	0	Front	11	2462.0	20.00	18.16	0.01	0.02	-	-
802.11b	0	Back	11	2462.0	20.00	18.16	0.05	0.07	-	-
802.11b	0	Left	11	2462.0	20.00	18.16	0.01	0.01	-	-
802.11b	0	Back	1	2412.0	20.00	18.04	0.09	0.15	-	001
802.11b	0	Back	6	2437.0	20.00	18.10	0.05	0.08	-	-

Note(s):

1. SAR measurements for 802.11g mode not required, as the Max. Rated Power for the mode was ≤ 802.11b mode.

11. Highest Standalone SAR and Simultaneous Transmission

11.1. Highest Standalone Reported SAR

Individual Transmitter Evaluation per Band: Wi-Fi

Exposure Configuration	Technology Band	Reported 1g - SAR (W/Kg)	Equipment Class	Highest Reported 1g SAR (W/Kg)
		SISO		
BODY-WORN (Separation Distance 0mm)	WLAN 2.4 GHz	0.15	DTS	0.15

11.2. Simultaneous Transmission Analysis

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

The worst case simultaneous transmission analysis is considered for the following cases:

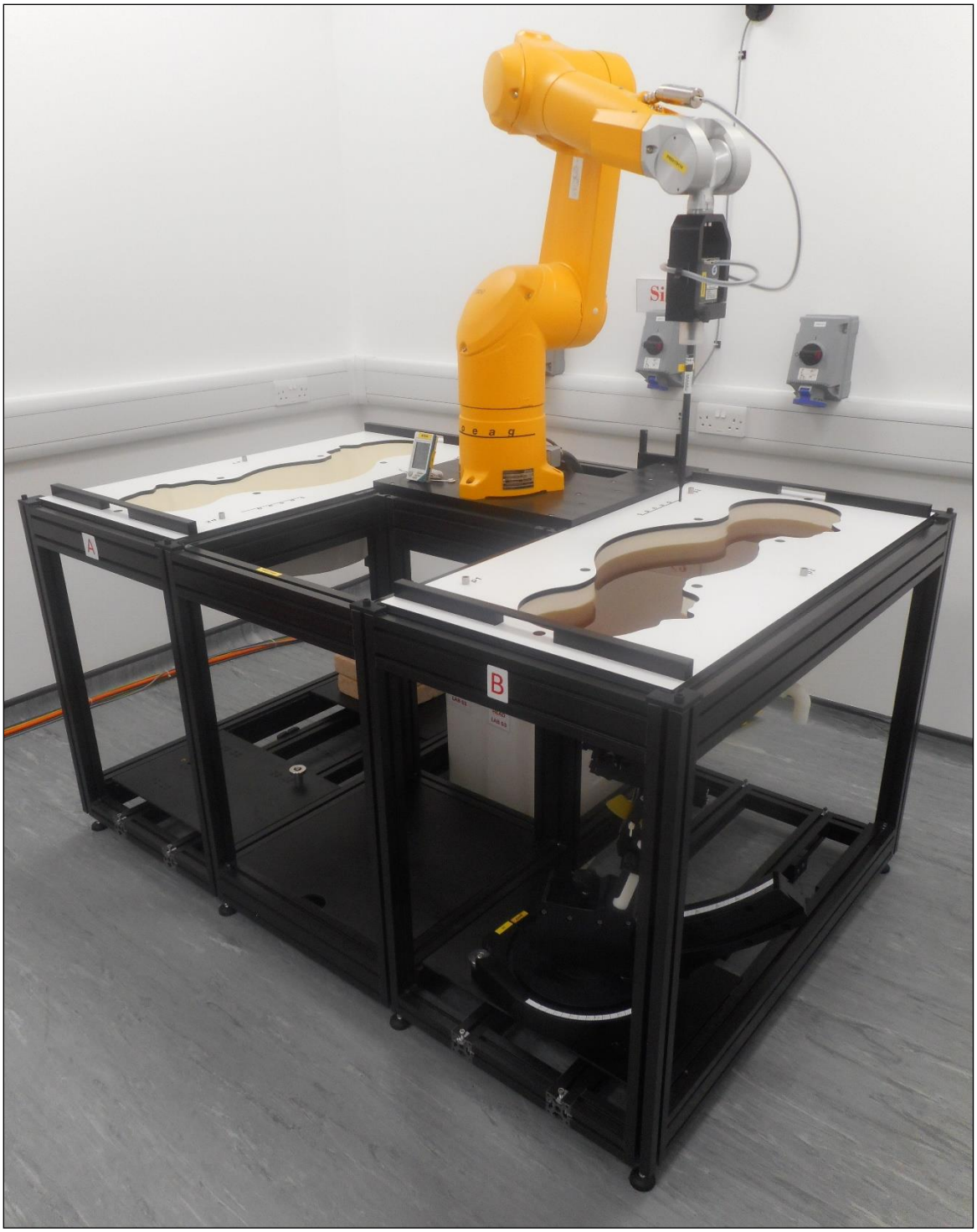
Simultaneous Transmission combination is not considered as not supported by DUT.

12.Appendixes

12.1.Photos and Ports Location

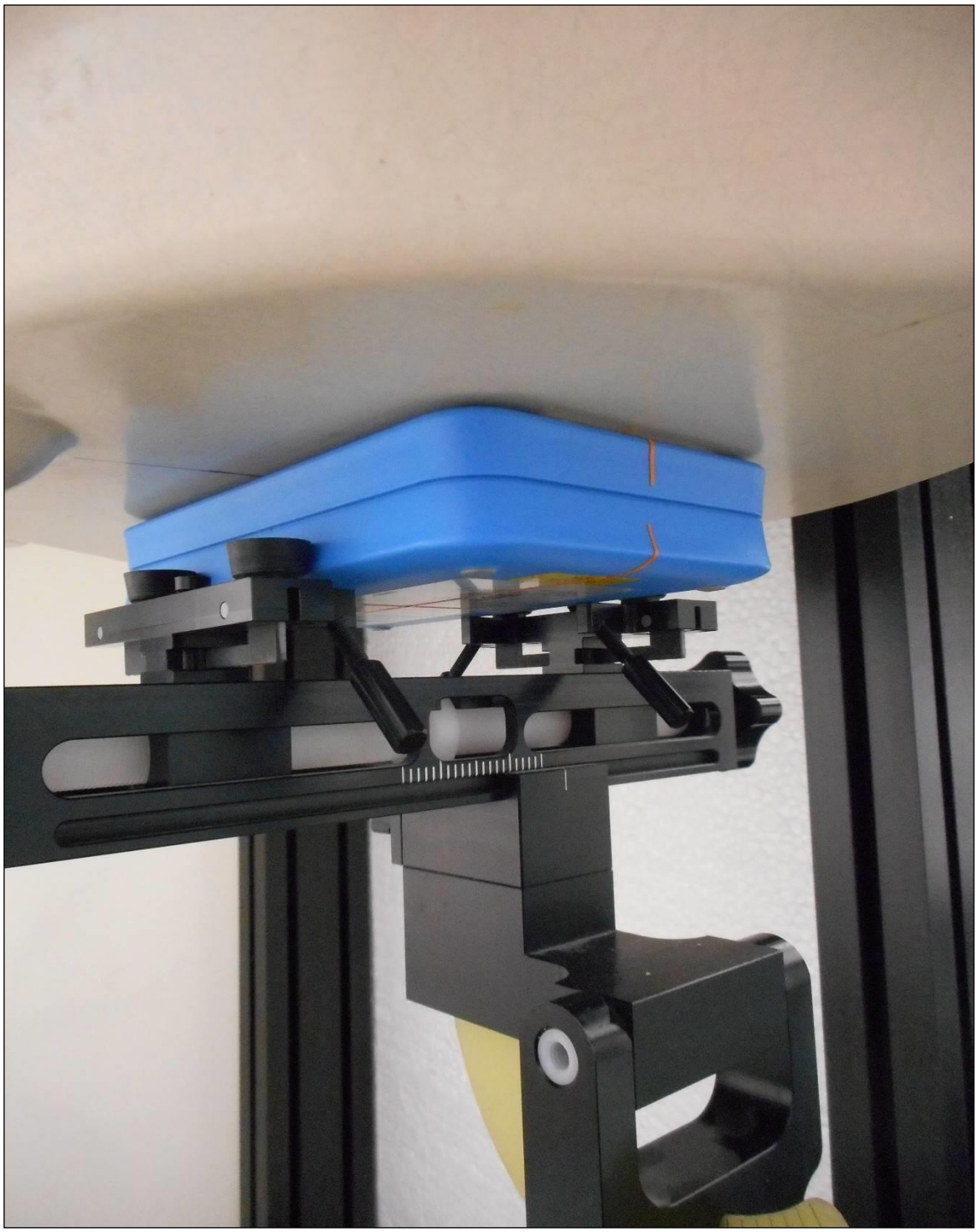
Photo Reference Number	Title
PHT/001	Test configuration for the measurement of SAR Lab
PHT/002	Back of DUT Facing Phantom at 0mm
PHT/003	Front of DUT Facing Phantom at 0mm
PHT/004	Front View of DUT
PHT/005	Back View of the DUT
PHT/006	Open View of DUT showing connection method via Ethernet
PHT/007	Antenna Schematics

PHT/001: Test configuration for the measurement of SAR Lab

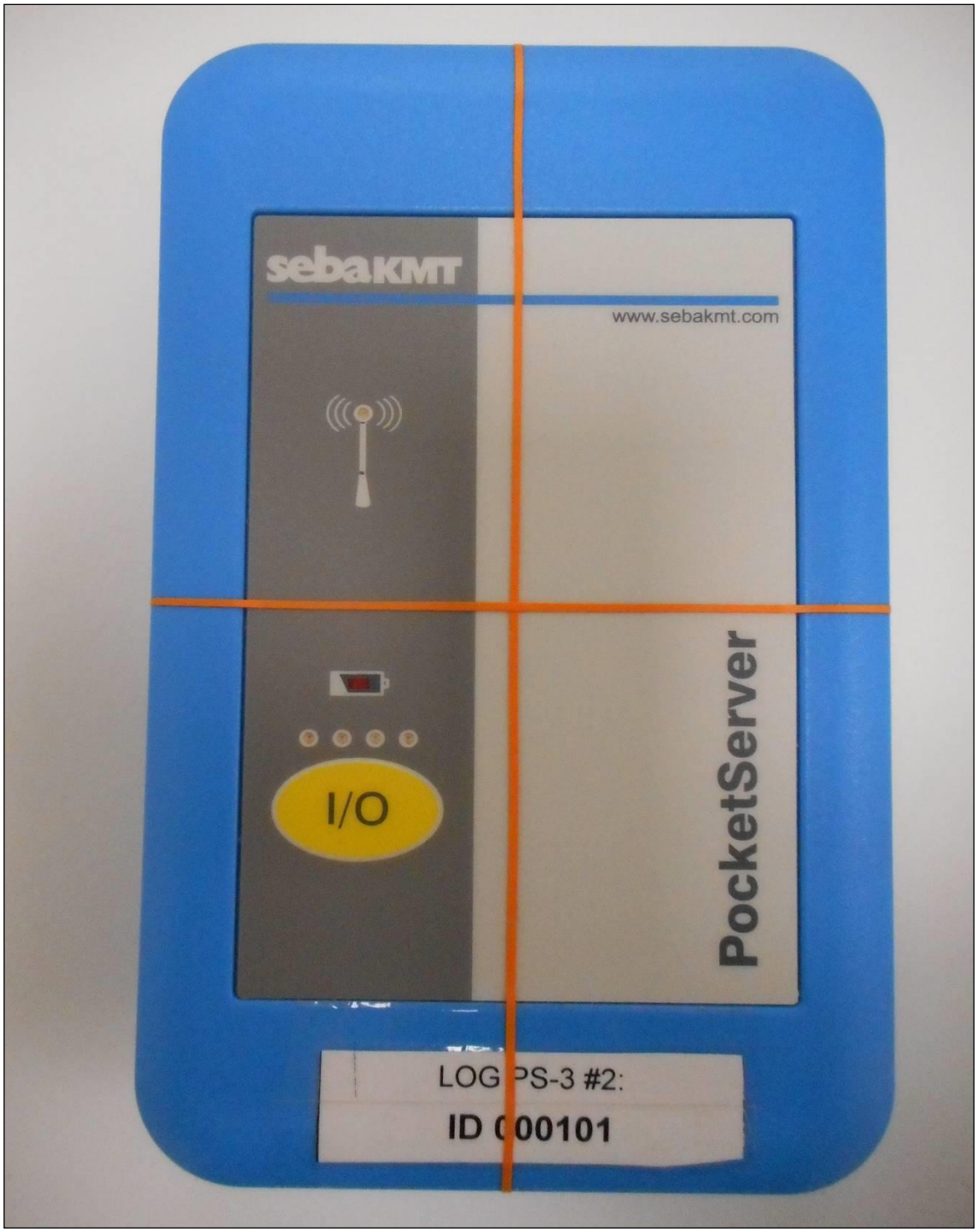


PHT/002: Back of DUT Facing Phantom at 0mm

PHT/003: Front of DUT Facing Phantom at 0mm



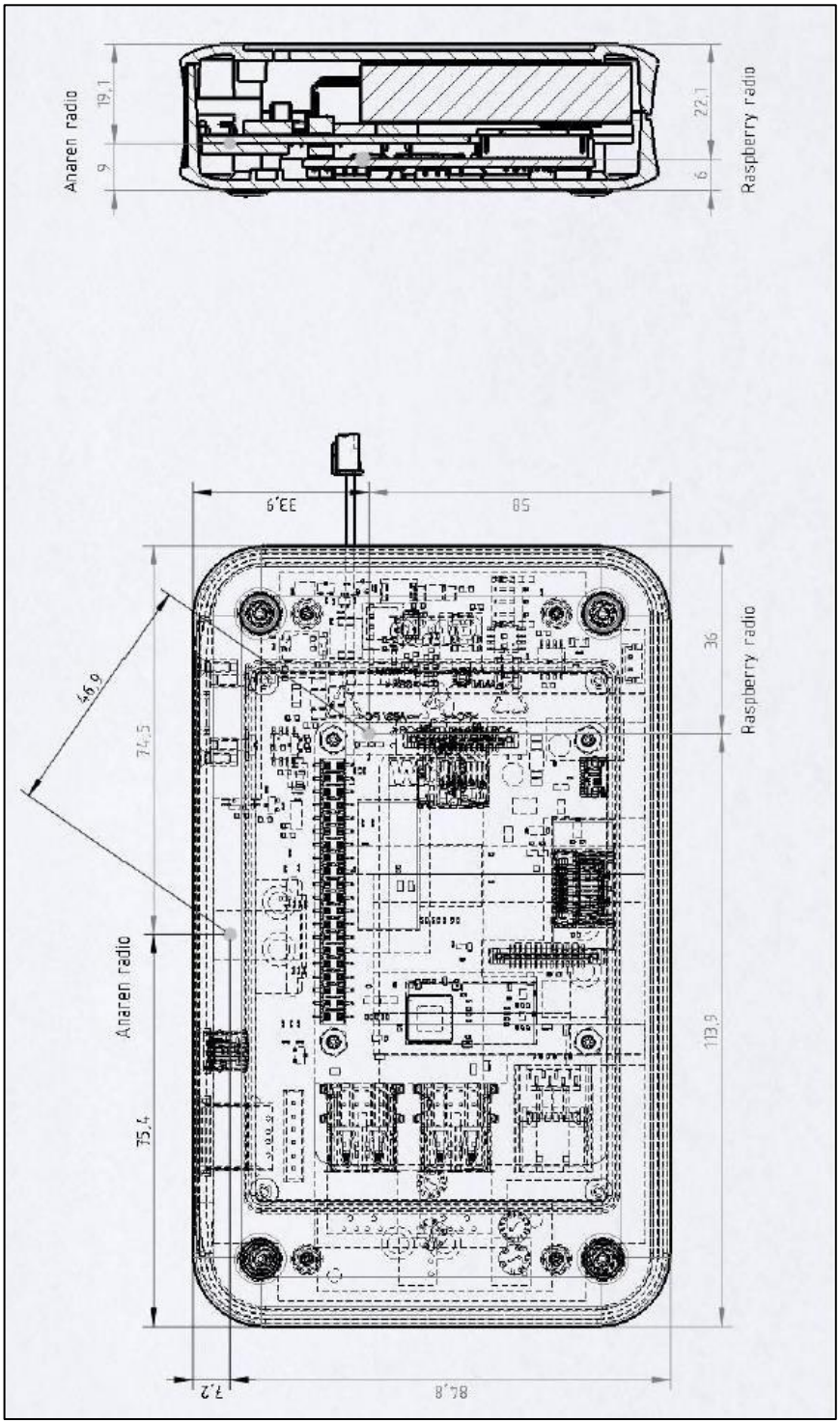
PHT/004: Front View of DUT



PHT/005: Back View of the DUT

PHT/006: Open View of DUT showing connection method via Ethernet

PHT/007: Antenna Schematics



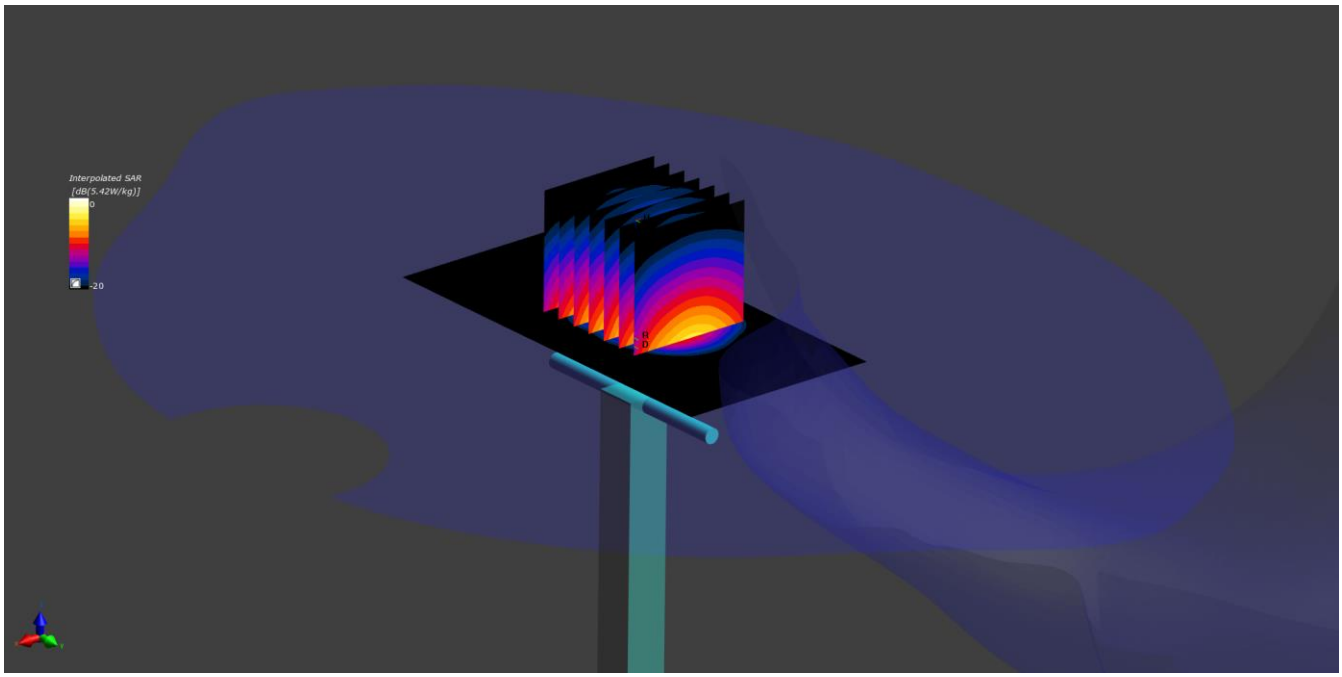
12.2. System Check Plots

This appendix contains the following system validation distribution scan(s).

Scan Reference Number	Title
SYS/001	System Check 2450MHz Head 14 05 19 (Site 60)

SYS/001: System Check 2450MHz Head 14 05 19 (Site 60)

Date: 14/05/2019
DUT: D2450V2;Type: Dipole; Serial: SN725;



Communication System: CW UID: 0 Frequency: 2450.0 MHz; Duty Cycle: 1
Medium: HSL 14 05 19 2450 5% Medium parameters used: f = 2450.0 MHz; σ = 1.79 S/m; εr =39.0 ;ρ = 1000 kg/m3; No correction
Phantom section: Flat

DASY 6 Configuration:
-Probe: EX3DV4 - SN7496; ConvF (7.69, 7.69, 7.69); Calibrated:28/03/2019
-Sensor-Surface: 1.4mm Mother Scan
-Electronics:DAE4 - SN1541; Calibrated:14/03/2019
-Phantom Type: Twin-SAM V8.0 (30deg probe tilt); Serial: 1951
Area Scan (48.0 x96.0): Interpolated grid: dx=12.0 mm, dy=12.0 mm

Zoom Scan1(30.0x30.0x30.0): Measurement grid: dx=5.0 mm, dy=5.0mm, dz=5.0mm
Reference Value = 3.115V/m; Power Drift = -0.02 dB

SAR(1 g) = 2.58 W/kg; SAR(10 g) = 1.18 W/kg

Note: As per FCC RF Exposure procedures - April 2019 presentation - Tissue Simulating Liquids (TSL), page 19, effective February 19, 2019, FCC has permitted the use of the head-tissue simulating liquid specified in IEC 62209-1 for all SAR tests – head and body and extremity.

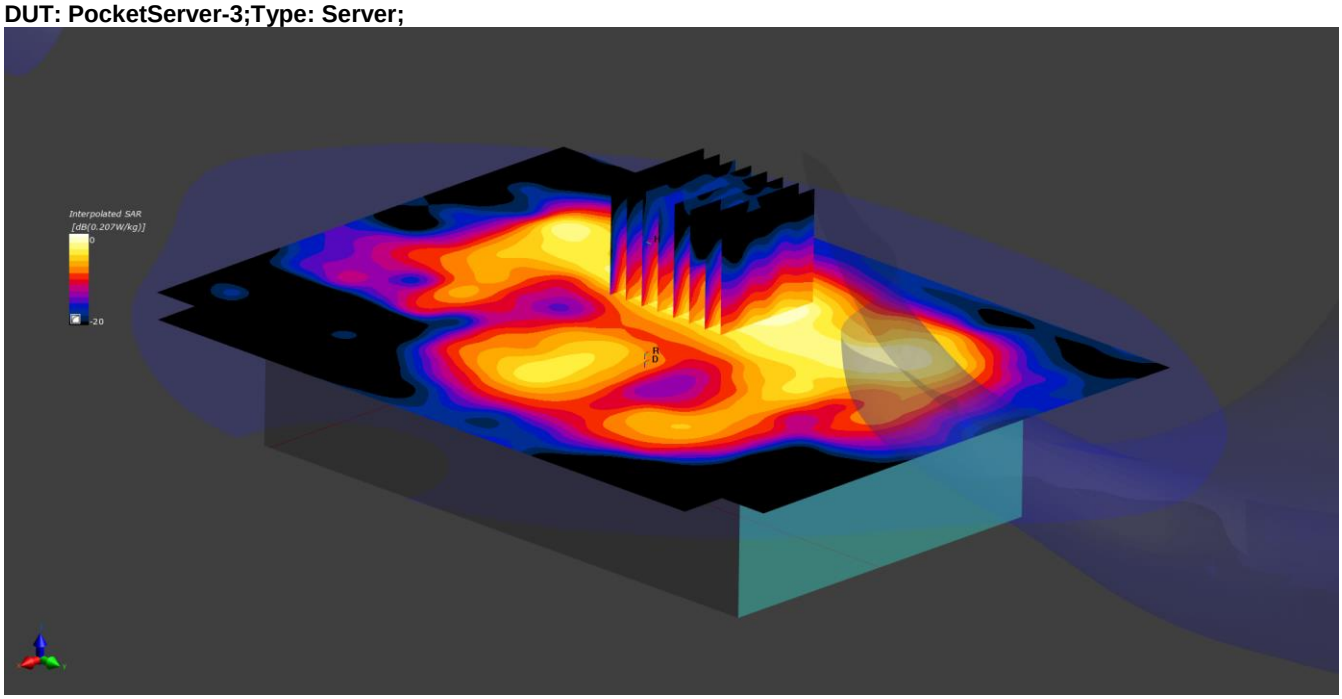
12.3. SAR Test Plots

This appendix contains the following SAR distribution scans.

Scan Reference Number	Title
SAR/001	Back 0mm WiFi 2.4 802.11b CH1

SAR/001: Back 0mm WiFi 2.4 802.11b CH1

Date: 15/05/2019
DUT: PocketServer-3;Type: Server;



Communication System: IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps, 99pc duty cycle) UID: 10415 Frequency: 2412.0 MHz; Duty Cycle: 0.99
Medium: HSL 14 05 19 2450 5% Medium parameters used: f = 2412.0 MHz; σ = 1.76 S/m; εr =39.1 ;ρ = 1000 kg/m3; No correction
Phantom section: Flat

DASY 6 Configuration:
-Probe: EX3DV4 - SN7496; ConvF (7.69, 7.69, 7.69); Calibrated:28/03/2019
-Sensor-Surface: 1.4mm Mother Scan
-Electronics:DAE4 - SN1541; Calibrated:14/03/2019
-Phantom Type: Twin-SAM V8.0 (30deg probe tilt); Serial: 1951
Area Scan (144.0 x192.0): Interpolated grid: dx=12.0 mm, dy=12.0 mm

Zoom Scan1(30.0x30.0x30.0): Measurement grid: dx=5.0 mm, dy=5.0mm, dz=5.0mm
Reference Value = 0.108V/m; Power Drift = -0.14 dB

SAR(1 g) = 0.093 W/kg; SAR(10 g) = 0.047 W/kg