SAR Compliance Test Report

Date of Report	22/09/2020	**Client's Contact person:**	Tom Bengter
Number of pages:	47	**Responsible Test engineer:**	Ilari Kinnunen
Testing laboratory:	**Verkotan Oy** Elektroniikkatie 17 90590 Oulu Finland	**Client:**	**Atlas Copco AB** Sickla Industriväg 19, Nacka 105 23 Stockholm Sweden
Tested device	ICB-A Tool, ITB-A Tool		
Related reports:	-		
Testing has been carried out in accordance with:	**47CFR §2.1093** Radiofrequency Radiation Exposure Evaluation: Portable Devices **FCC published RF exposure KDB procedures** **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 Technique **RSS-102** Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)		
Documentation:	The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory		
Test Results:	**The EUT complies with the requirements in respect of all parameters subject to the test.** The test results relate only to devices specified in this document		
Date and signatures:	22.09.2020 Miia Nurkkala Digitaalinen allekirjoittaja: Miia Nurkkala Päiväys: 2020.09.22 09:17:32 +03'00' **Laboratory Manager**		

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1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Equipment under Test (DUT), Model 1:

Product:	ICB-A Tool
Manufacturer:	Atlas Copco
Model:	ICB-A
Serial Number:	A1610006, L1570001
FCC ID Number:	2AQ8P-ICB (The DUT contains XF6-M7DB6)
ISED ID Number:	24224-ICB, 24224-ITB (The DUT contains 8407A-M7DB6)
DUT Number:	22576, 22577
Battery Type used in testing:	Li-Ion 5INR19/66
State of the Sample	Production sample

Model 2:

Product:	ITB-A Tool
Manufacturer:	Atlas Copco
Model:	ITB-A
FCC ID Number:	2AQ8P-ITB (The DUT contains XF6-M7DB6)
ISED ID Number:	24224-ITB (The DUT contains 8407A-M7DB6)

Testing information:

Testing performed:	09.04. – 17.04.2020
Notes:	ITB-A and ICB-A are the same type, but ITB-A is larger tool than the tested ICB-A. The lower part of the ITB-A tool is of the same structure as the tested ICB-A tool with the same PCB's, the same radio module and the same antennas placed in the same location as the ICB-A tool. Both tools also have the same batteries. SAR testing was only conducted for model ICB-A. This report replaces report FCC SAR report ICB-A Tool ID3908. 11092020
Document ID:	FCC SAR report ICB-A Tool ID3908 22092020
Temperature °C	22±2 / Controlled
Humidity RH%	30±20 / Controlled
Measurement performed by:	Ilari Kinnnunen

1.2 Maximum Results

The maximum reported* SAR values for Extremity-configuration for transmitting systems are shown in a table below. The device conforms to the requirements of the standards when the maximum reported SAR value is less than or equal to the limit. The SAR limit specified in FCC 47 CFR part 2 (2.1093) and Health Canada's RF exposure guideline, Safety Code 6 for Extremity SAR_{10g} is 4.0 W/kg.

1.2.1 Standalone SAR

System	Highest Reported* SAR_{10g}(W/kg) in Extremity Condition, 0mm	Result
WLAN 2.4GHz	**0.25**	**PASS**
WLAN 5GHz	**0.86**	**PASS**

* Reported SAR Values are scaled to upper limit of power tuning tolerance.

Maximum Drift

Maximum Drift During Measurements	-0.69 dB

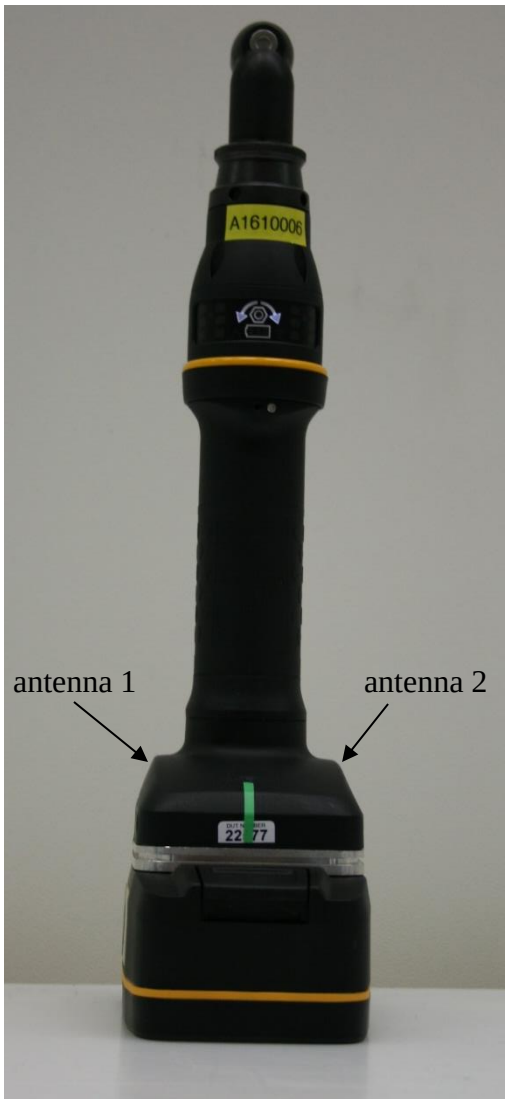
*Larger than 5% drifts included to scaling factors

1.2.2 Measurement Uncertainty

Expanded Uncertainty (k=2) 95 %	±24.5 %

2. DESCRIPTION OF THE DEVICE UNDER TEST (DUT)

The product is an ICB-A Tool for indoor use only. The product has two alternative antennas and it supports 2.4GHz and 5GHz WLAN and Bluetooth. Bluetooth might be disabled in the application.



Device Category	Portable
Exposure Environment	General population

2.1 Supported Frequency Bands and Operational Modes

TX Frequency bands	Modes of Operation	Transmitter Frequency Range (MHz)
	2.4 GHz WLAN	2412 – 2462
	5 GHz WLAN	5180 – 5825
	Bluetooth	2402 – 2480

2.2 Test Exclusions

Since WLAN and BT use same frequency and antenna and WLAN 2.4GHz tuning power is higher and they cannot transmit simultaneously, the WLAN 2.4GHz standalone SAR is conservative estimation of BT SAR. Thus, BT SAR can be deemed to comply without further analysis or measurements.

3. OUTPUT POWER

3.1 Maximum specified conducted output power

From a customer;

WLAN 2.4 GHz	Max Output Power [dBm]
802.11b	13
802.11g	13
802.11n	13

WLAN 5 GHz	Max Output Power [dBm]
802.11a	12
802.11n	12

Bluetooth	Max Output Power [dBm]
Bluetooth	10

3.2 Tested conducted power

2.4GHz WLAN:

Standard	Transmission mode	Data rate [Mbps]	Antenna	Output power [dBm]		
				CH 1 2412 MHz	CH 6 2437 MHz	CH 11 2462 MHz
802.11b	DSSS	1	1	12.87	12.54	12.06
802.11b	DSSS	1	2	12.65	12.16	11.71

5GHz WLAN:

Standard	Channel	Frequency [MHz]	Transmission mode	Data rate [Mbps]	Antenna	Output power [dBm]
802.11a	52	5260	OFDM	9	1	11.43
802.11a	56	5280				11.44
802.11a	60	5300				11.69
802.11a	64	5320				11.83
802.11a	100	5500				11.27
802.11a	112	5560				11.52
802.11a	116	5580				11.44
802.11a	128	5640				11.17
802.11a	132	5660				10.98
802.11a	149	5745				10.2
802.11a	165	5825				10.19

Standard	Channel	Frequency [MHz]	Transmission mode	Data rate [Mbps]	Antenna	Output power [dBm]
802.11a	52	5260	OFDM	9	2	10.79
802.11a	56	5280				11.05
802.11a	60	5300				11.09
802.11a	64	5320				11.42
802.11a	100	5500				11.87
802.11a	112	5560				12.02
802.11a	116	5580				12.16
802.11a	128	5640				11.76
802.11a	132	5660				11.69
802.11a	149	5745				10.52
802.11a	165	5825				10.25

4. TEST EQUIPMENT

Dasy52 near field scanning system, manufactured by SPEAG was used for SAR testing. The test system consists of high precision robotics system (Staubli), robot controller, computer, near-field probe, probe alignment sensor, and a phantom containing the tissue equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location of maximum electromagnetic field.

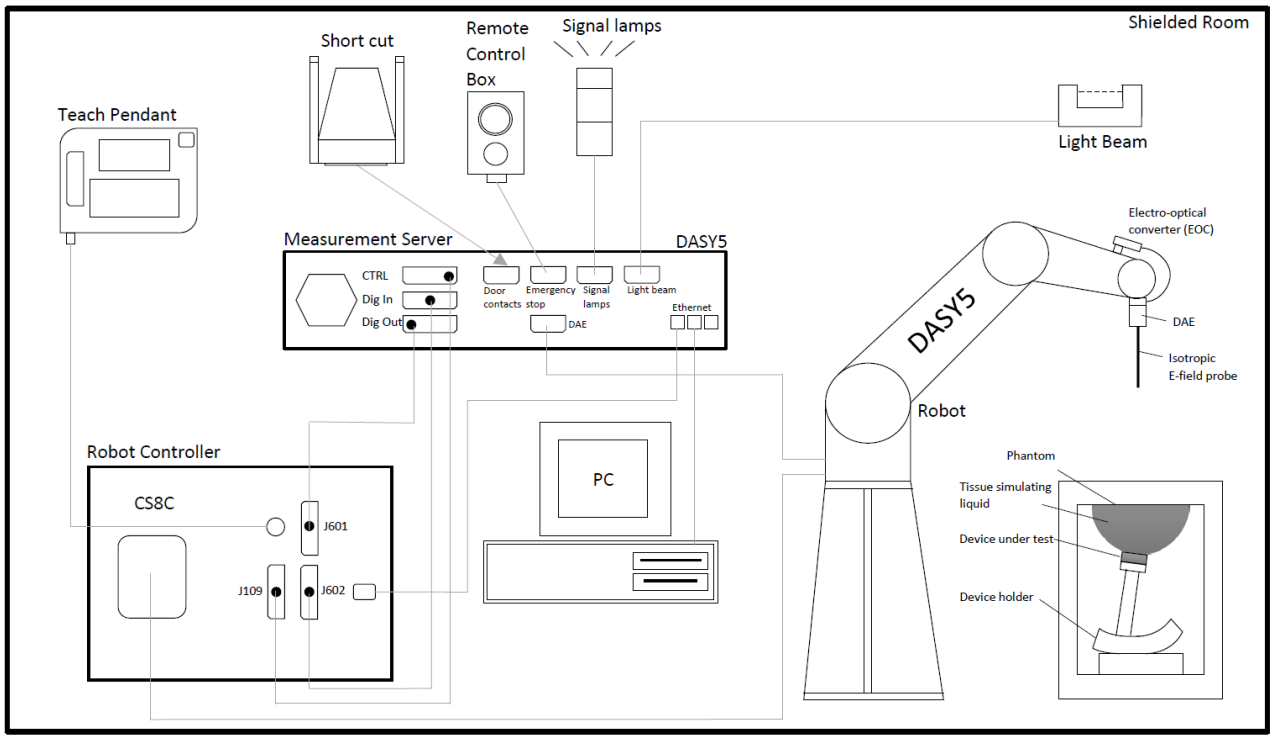


Figure 1 Schematic Laboratory Picture

4.1 Test Equipment List

Main used test system components are listed below. For full equipment list and calibration intervals, please contact the testing laboratory.

Test Equipment	Model	Serial Number	Calibration Date
DAE	DAE4	756	03.2020
Probe	EX3DV4	7447	03.2020
Dipole	D2450V2	729	06.2017
Dipole	D5GHZV2	1045	06.2017
DASY5 Software	52.8.8.1258	-	NA
Signal Generator	E4438C	MY42082527	NA
Amplifier	5163F	1022	NA
Amplifier	5GHz	NA	NA
Power meter	R&S NRT	835065/049	02.2020
Directional Power Sensor	NRT-Z44	102766	02.2020
Power Sensor	NRP-Z81	100797	06.2019
Power Sensor	NRP-Z11	100265	12.2019

Dipole calibration period supporting data:

		Measured on 08/2019			Calibrated		
Dipole and serial number	**Frequency (MHz)**	**Return loss (dB)**	**Impedance (Ω)**		**Return loss (dB)**	**Impedance (Ω)**	
D2450V2 729	2450	-30.51	52.91	0.99	-25.8	51.2	5.1
D5GHzV2 1045	5250	-24.81	53.24	4.98	-21.9	55.9	6.2
D5GHzV2 1045	5600	-25.65	45.70	-2.54	-25.5	45.0	-0.1
D5GHzV2 1045	5750	-22.60	55.04	5.94	-24.13	55.43	3.64

4.1.1 Isotropic E-field Probe Type EX3DV4

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	Calibration certificate in Appendix D
Frequency	10 MHz to >6 GHz (dosimetry); Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 µW/g to > 100 mW/g, Linearity: ± 0.2 dB
Dimensions	Overall length: 330 mm Tip length: 10 mm Body diameter: 12 mm
Application	General dosimetry up to 6 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms

4.2 Phantoms

Modular flat phantom:

The Triple Modular Phantom consists of three identical modules that can be installed and removed separately without emptying the liquid. It is used for compliance testing of small wireless devices in body-worn configurations. The phantom conforms to the requirements of IEEE 1528 and FCC published RF Exposure KDB Procedures. The shell thickness of the bottom plate is 2±0.2mm. The dimensions are 308x192x182mm and filling volume is 9.2 liters giving a filling height of 155mm.

4.3 Tissue Simulants

Recommended values for the dielectric parameters of the tissue simulants are given in IEEE 1528 and FCC published RF Exposure KDB Procedures. The dielectric parameters of the used tissue simulants were within ±10% of the recommended values at 2.4GHz and ±5% at 5GHz frequency area. A liquid compensation algorithm was used in DASY5 with which measured peak average SAR values were corrected for the deviation of used liquid. Depth of the tissue simulant was at least 15.0 cm from the inner surface of the flat phantom.

5 GHz tissue simulant liquid Ingredients
Deionized Water, oil, salt, emulsifiers

4.4 System Validation Status

Frequency [MHz]	Dipole Type / SN	Probe Type / SN	Calibrated Signal Type	DAE Unit / SN	Dielectric Constant ε	Conductivity, σ [S/m]	Validation Done Head tissue simulant
2450	D2450V2 / 729	EX3DV4 / 7447	CW	DAE 4 / 756	39.5	1.9	04.2020
5250	D5GHzV2 - 1045	EX3DV4 - 7447	CW	DAE 4 / 756	34.9	4.6	04.2020
5600	D5GHzV2 - 1045	EX3DV4 - 7447	CW	DAE 4 / 756	34.2	5.0	04.2020
5750	D5GHzV2 - 1045	EX3DV4 - 7447	CW	DAE 4 / 756	33.9	5.2	04.2020

4.5 System Check

Date	Tissue Type	Tissue Temp. [°C]	Frequency [MHz]	Input Power [mW]	Measured SAR_{1g} [W/kg]	1 W Target SAR_{1g} [W/kg]	1 W Normalized SAR_{1g} [W/kg]	Deviation (%)	Plot #
09.04.2020	WB Head	22	5600	100	8.10	80.85	81	0.2	1
14.04.2020	WB Head	22	5250	100	7.42	76.81	74.2	-3.4	2
15.04.2020	WB Head	22	5750	100	7.44	76.57	74.4	-2.8	3
16.04.2020	WB Head	22	2450	250	12.6	53.43	50.4	-5.7	4

4.5.1 Tissue Simulant Verification

				Target		Measured		Deviation	
Date	Tissue Type	Tissue Temp [°C]	Frequency [MHz]	Dielectric Constant [ε] Target	Conductivity σ [S/m] Target	Dielectric Constant [ε]	Conductivity σ [S/m]	ε (%)	σ (%)
07.04.2020	WB Head	22	5600	35.5	5.07	34.2	5.05	-3.7	-0.4
07.04.2020	WB Head	22	5500	35.6	4.96	34.4	4.93	-3.4	-0.7
07.04.2020	WB Head	22	5560	35.6	5.02	34.3	5.00	-3.6	-0.4
07.04.2020	WB Head	22	5580	35.6	5.04	34.3	5.02	-3.6	-0.4
07.04.2020	WB Head	22	5640	35.5	5.11	34.1	5.09	-3.8	-0.2
14.04.2020	WB Head	22	5250	35.9	4.71	34.5	4.53	-4.1	-3.7
14.04.2020	WB Head	22	5260	35.9	4.72	34.5	4.54	-4.1	-3.7
14.04.2020	WB Head	22	5300	35.9	4.76	34.4	4.58	-4.1	-3.6
14.04.2020	WB Head	22	5320	35.8	4.78	34.4	4.61	-4.2	-3.6
14.04.2020	WB Head	22	5750	35.4	5.22	34.7	5.20	-1.8	-0.4
14.04.2020	WB Head	22	5660	35.5	5.13	34.9	5.09	-1.7	-0.7
14.04.2020	WB Head	22	5745	35.4	5.21	34.7	5.19	-1.8	-0.5
14.04.2020	WB Head	22	5825	35.3	5.30	34.6	5.28	-1.9	-0.3
16.04.2020	WB Head	22	2450	39.2	1.80	40.0	1.85	2.0	3.0
16.04.2020	WB Head	22	2412	39.3	1.77	40.1	1.82	2.0	3.3
16.04.2020	WB Head	22	2437	39.2	1.79	40.0	1.84	2.0	3.1
16.04.2020	WB Head	22	2462	39.2	1.81	40.0	1.86	2.0	2.8

5. TEST PROCEDURE

Testing was carried out in accordance with FCC KDB Publications 447498 D01 and D02 and RSS-102. Since the antennas are located near the hand of the user, the device was tested for Extremity SAR.

A control software was used to set the DUT to transmit at maximum power.

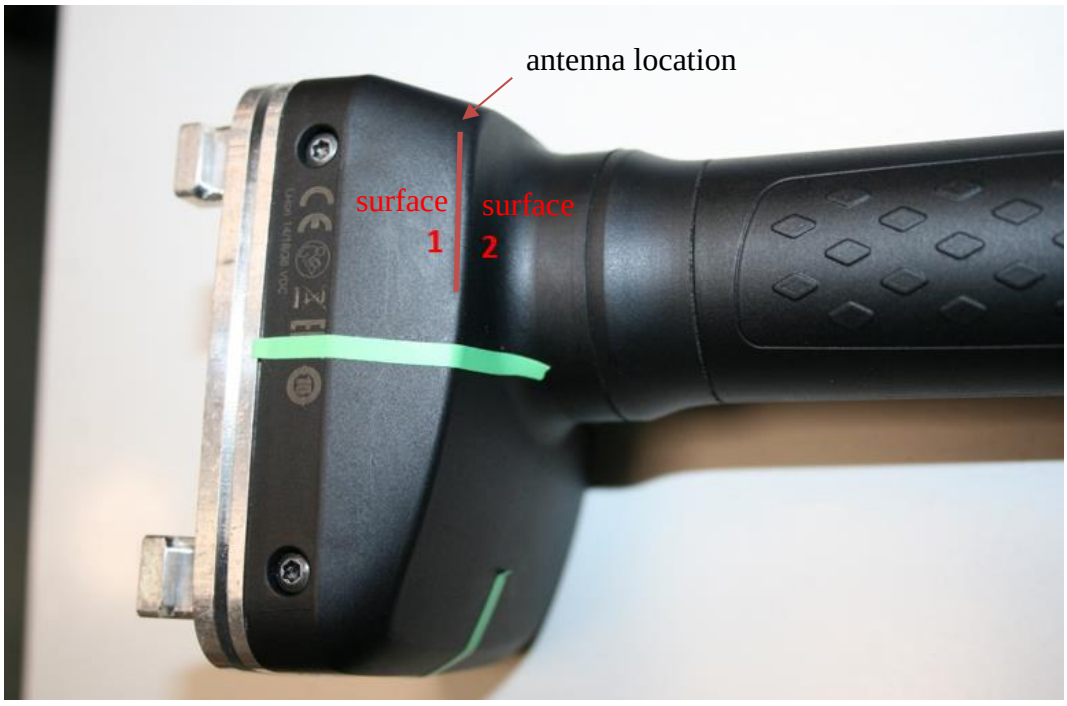
The WLAN transmission modes for testing were selected according to largest channel bandwidth configuration, lowest order modulation and lowest data rate. 2.4GHz WLAN was tested with 802.11b standard with data rate of 1Mbit/s and 5GHz WLAN was tested with 802.11a standard with data rate of 9Mbit/s.

5.1 Test Positions

5.1.1 Extremity Configuration, 0mm separation distance

The device was placed on the top of a Rohacell and lifted towards the phantom until the distance between the phantom and the device was 0mm. Measurements were done from 4 different sides of the device.

At the antenna location, two surfaces of the DUT marked as 1 and 2, may be in direct contact with the user's hand. As the antenna separation distance to the surface 1 was measured to be shorter than to surface 2 and surface 2 was found to be to inaccessible at 0mm separation distance with the measurement equipment, surface 1 was selected for measurements.



Photos of the test positions are presented in appendix A.

5.2 Scan Procedures

First, area scans were used for determination of the field distribution. Next, a zoom scan was performed around the highest E-field value to determine the averaged SAR value. Drift was determined by measuring the same point at the start of the area scan and again at the end of the zoom scan.

5.3 SAR Averaging Methods

The maximum SAR value was averaged over a cube of tissue using interpolation and extrapolation.

The interpolation, extrapolation and maximum search routines within Dasy52 are all based on the modified Quadratic Shepard's method (Robert J. Renka," Multivariate Interpolation of Large Sets of Scattered Data", University of North Texas ACM Transactions on Mathematical Software, vol. 14, no. 2, June 1988, pp. 139-148).
The interpolation scheme combines a least-square fitted function method with a weighted average method. A trivariate 3-D / bivariate 2-D quadratic function is computed for each measurement point and fitted to neighboring points by a least-square method. For the zoom scan, inverse distance weighting is incorporated to fit distant points more accurately. The interpolating function is finally calculated as a weighted average of the quadratics.
In the zoom scan, the interpolation function is used to extrapolate the Peak SAR from the deepest measurement points to the inner surface of the phantom.

6. MEASUREMENT UNCERTAINTY

Uncertainty Budget
According to IEEE 1528-2013 and IEC 62209-1/201x
(0.3 - 3 GHz range)

Error Description	Uncert. value	Prob. Dist.	Div.	(c_i) 1g	(c_i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v_i) v_{eff}
Measurement System								
Probe Calibration	±6.0 %	N	1	1	1	±6.0 %	±6.0 %	∞
Axial Isotropy	±4.7 %	R	$\sqrt{3}$	0.7	0.7	±1.9 %	±1.9 %	∞
Hemispherical Isotropy	±9.6 %	R	$\sqrt{3}$	0.7	0.7	±3.9 %	±3.9 %	∞
Boundary Effects	±1.0 %	R	$\sqrt{3}$	1	1	±0.6 %	±0.6 %	∞
Linearity	±4.7 %	R	$\sqrt{3}$	1	1	±2.7 %	±2.7 %	∞
System Detection Limits	±1.0 %	R	$\sqrt{3}$	1	1	±0.6 %	±0.6 %	∞
Modulation Response^m	±2.4 %	R	$\sqrt{3}$	1	1	±1.4 %	±1.4 %	∞
Readout Electronics	±0.3 %	N	1	1	1	±0.3 %	±0.3 %	∞
Response Time	±0.8 %	R	$\sqrt{3}$	1	1	±0.5 %	±0.5 %	∞
Integration Time	±2.6 %	R	$\sqrt{3}$	1	1	±1.5 %	±1.5 %	∞
RF Ambient Noise	±3.0 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
RF Ambient Reflections	±3.0 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
Probe Positioner	±0.4 %	R	$\sqrt{3}$	1	1	±0.2 %	±0.2 %	∞
Probe Positioning	±2.9 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
Max. SAR Eval.	±2.0 %	R	$\sqrt{3}$	1	1	±1.2 %	±1.2 %	∞
Test Sample Related								
Device Positioning	±2.9 %	N	1	1	1	±2.9 %	±2.9 %	145
Device Holder	±3.6 %	N	1	1	1	±3.6 %	±3.6 %	5
Power Drift	±5.0 %	R	$\sqrt{3}$	1	1	±2.9 %	±2.9 %	∞
Power Scaling^p	±0 %	R	$\sqrt{3}$	1	1	±0.0 %	±0.0 %	∞
Phantom and Setup								
Phantom Uncertainty	±6.1 %	R	$\sqrt{3}$	1	1	±3.5 %	±3.5 %	∞
SAR correction	±1.9 %	R	$\sqrt{3}$	1	0.84	±1.1 %	±0.9 %	∞
Liquid Conductivity (mea.)^{DAK}	±2.5 %	R	$\sqrt{3}$	0.78	0.71	±1.1 %	±1.0 %	∞
Liquid Permittivity (mea.) ^{DAK}	±2.5 %	R	$\sqrt{3}$	0.26	0.26	±0.3 %	±0.4 %	∞
Temp. unc. - Conductivity ^{BB}	±3.4 %	R	$\sqrt{3}$	0.78	0.71	±1.5 %	±1.4 %	∞
Temp. unc. - Permittivity ^{BB}	±0.4 %	R	$\sqrt{3}$	0.23	0.26	±0.1 %	±0.1 %	∞
Combined Std. Uncertainty						±11.2 %	±11.1 %	361
Expanded STD Uncertainty						**±22.3 %**	**±22.2 %**	

Uncertainty Budget

According to IEEE 1528-2013 and IEC 62209-1/2016

(3 - 6 GHz range)

Error Description	Uncert. value	Prob. Dist.	Div.	(c_i) 1g	(c_i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v_i) v_{eff}
Measurement System								
Probe Calibration	±6.55 %	N	1	1	1	±6.55 %	±6.55 %	∞
Axial Isotropy	±4.7 %	R	$\sqrt{3}$	0.7	0.7	±1.9 %	±1.9 %	∞
Hemispherical Isotropy	±9.6 %	R	$\sqrt{3}$	0.7	0.7	±3.9 %	±3.9 %	∞
Boundary Effects	±2.0 %	R	$\sqrt{3}$	1	1	±1.2 %	±1.2 %	∞
Linearity	±4.7 %	R	$\sqrt{3}$	1	1	±2.7 %	±2.7 %	∞
System Detection Limits	±1.0 %	R	$\sqrt{3}$	1	1	±0.6 %	±0.6 %	∞
Modulation Response^{m}	±2.4 %	R	$\sqrt{3}$	1	1	±1.4 %	±1.4 %	∞
Readout Electronics	±0.3 %	N	1	1	1	±0.3 %	±0.3 %	∞
Response Time	±0.8 %	R	$\sqrt{3}$	1	1	±0.5 %	±0.5 %	∞
Integration Time	±2.6 %	R	$\sqrt{3}$	1	1	±1.5 %	±1.5 %	∞
RF Ambient Noise	±3.0 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
RF Ambient Reflections	±3.0 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
Probe Positioner	±0.8 %	R	$\sqrt{3}$	1	1	±0.5 %	±0.5 %	∞
Probe Positioning	±6.7 %	R	$\sqrt{3}$	1	1	±3.9 %	±3.9 %	∞
Max. SAR Eval.	±4.0 %	R	$\sqrt{3}$	1	1	±2.3 %	±2.3 %	∞
Test Sample Related								
Device Positioning	±2.9 %	N	1	1	1	±2.9 %	±2.9 %	145
Device Holder	±3.6 %	N	1	1	1	±3.6 %	±3.6 %	5
Power Drift	±5.0 %	R	$\sqrt{3}$	1	1	±2.9 %	±2.9 %	∞
Power Scaling^{p}	±0 %	R	$\sqrt{3}$	1	1	±0.0 %	±0.0 %	∞
Phantom and Setup								
Phantom Uncertainty	±6.6 %	R	$\sqrt{3}$	1	1	±3.8 %	±3.8 %	∞
SAR correction	±1.9 %	R	$\sqrt{3}$	1	0.84	±1.1 %	±0.9 %	∞
Liquid Conductivity (mea.)^{DAK}	±2.5 %	R	$\sqrt{3}$	0.78	0.71	±1.1 %	±1.0 %	∞
Liquid Permittivity (mea.) ^{DAK}	±2.5 %	R	$\sqrt{3}$	0.26	0.26	±0.3 %	±0.4 %	∞
Temp. unc. - Conductivity ^{BB}	±3.4 %	R	$\sqrt{3}$	0.78	0.71	±1.5 %	±1.4 %	∞
Temp. unc. - Permittivity ^{BB}	±0.4 %	R	$\sqrt{3}$	0.23	0.26	±0.1 %	±0.1 %	∞
Combined Std. Uncertainty						±12.3 %	±12.2 %	748
Expanded STD Uncertainty						**±24.6 %**	**±24.5 %**	

7. TEST RESULTS

7.1 SAR Results for Extremity Exposure Condition with 0mm separation

2.4 GHz WLAN:

Mode	Data Rate [Mbps]	Freq [MHz]	Channel	Antenna	Test position	Maximum Power [dBm]	Conducted Power [dBm]	Measured SAR10g [W/kg]	Power Drift [dB]*	Scaling Factor	Duty Cycle	Reported SAR10g [W/kg]	Plot #
802.11 b	1	2412	1	1	Pos 1	13	12.87	0.164	-0.33	1.11	1:1	0.18	5
802.11 b	1	2412	1	1	Pos 2	13	12.87	0.000172***	0**	1.03	1:1	0.0002	
802.11 b	1	2412	1	1	Pos 3	13	12.87	0.0166	0.67	1.20	1:1	0.02	
802.11 b	1	2412	1	1	Pos 4	13	12.87	0.0826	-0.07	1.03	1:1	0.09	
802.11 b	1	2437	6	1	Pos 1	13	12.54	0.143	-0.12	1.11	1:1	0.16	
802.11 b	1	2462	11	1	Pos 1	13	12.06	0.111	-0.11	1.24	1:1	0.14	

*Larger than 5% drifts included to scaling factors

** Due to low e-field generated by DUT at the location of drift measurement, the measurements are not applicable.

***Area scan only

Mode	Data Rate [Mbps]	Freq [MHz]	Channel	Antenna	Test position	Maximum Power [dBm]	Conducted Power [dBm]	Measured SAR10g [W/kg]	Power Drift [dB]*	Scaling Factor	Duty Cycle	Reported SAR10g [W/kg]	Plot #
802.11 b	1	2412	1	2	Pos 1	13	12.65	0.00319	0**	1.08	1:1	0.003	
802.11 b	1	2412	1	2	Pos 2	13	12.65	0.229	-0.13	1.08	1:1	0.25	6
802.11 b	1	2412	1	2	Pos 3	13	12.65	0.0435***	0.03	1.08	1:1	0.05	
802.11 b	1	2412	1	2	Pos 4	13	12.65	0.0858	-0.06	1.08	1:1	0.09	
802.11 b	1	2437	6	2	Pos 2	13	12.16	0.189	0.04	1.21	1:1	0.23	
802.11 b	1	2462	11	2	Pos 2	13	11.71	0.143	-0.05	1.35	1:1	0.19	

*Larger than 5% drifts included to scaling factors

** Due to low e-field generated by DUT at the location of drift measurement, the measurements are not applicable.

***Area scan only

5 GHz WLAN:

Mode	Data Rate [Mbps]	Freq [MHz]	Channel	Antenna	Test position	Maximum Power [dBm]	Conducted Power [dBm]	Measured SAR10g [W/kg]	Power Drift [dB]*	Scaling Factor	Duty Cycle	Reported SAR10g [W/kg]	Plot #
802.11 a	9	5320	64	1	Pos 1	12	11.83	0.486	-0.07	1.04	1:1	0.51	
802.11 a	9	5320	64	1	Pos 2	12	11.83	0.000661	-0.19	1.04	1:1	0.001	
802.11 a	9	5320	64	1	Pos 3	12	11.83	0.012	0**	1.04	1:1	0.01	
802.11 a	9	5320	64	1	Pos 4	12	11.83	0.0696***	0**	1.04	1:1	0.07	
802.11 a	9	5260	52	1	Pos 1	12	11.43	0.472	-0.36	1.24	1:1	0.58	7
802.11 a	9	5300	60	1	Pos 1	12	11.69	0.488	-0.19	1.07	1:1	0.52	

*Larger than 5% drifts included to scaling factors

** Due to low e-field generated by DUT at the location of drift measurement, the measurements are not applicable.

***Area scan only

Mode	Data Rate [Mbps]	Freq [MHz]	Channel	Antenna	Test position	Maximum Power [dBm]	Conducted Power [dBm]	Measured SAR10g [W/kg]	Power Drift [dB]*	Scaling Factor	Duty Cycle	Reported SAR10g [W/kg]	Plot #
802.11 a	9	5320	64	2	Pos 1	12	11.42	0.00184	-0.21	1.14	1:1	0.002	
802.11 a	9	5320	64	2	Pos 2	12	11.42	0.244	-0.03	1.14	1:1	0.28	
802.11 a	9	5320	64	2	Pos 3	12	11.42	0.0255	-0.66	1.33	1:1	0.03	
802.11 a	9	5320	64	2	Pos 4	12	11.42	0.052***	0**	1.14	1:1	0.06	
802.11 a	9	5260	52	2	Pos 2	12	10.79	0.292	-0.05	1.32	1:1	0.39	8
802.11 a	9	5300	60	2	Pos 2	12	11.09	0.257	0.01	1.23	1:1	0.32	

*Larger than 5% drifts included to scaling factors

** Due to low e-field generated by DUT at the location of drift measurement, the measurements are not applicable.

***Area scan only

Mode	Data Rate [Mbps]	Freq [MHz]	Channel	Antenna	Test position	Maximum Power [dBm]	Conducted Power [dBm]	Measured SAR10g [W/kg]	Power Drift [dB]*	Scaling Factor	Duty Cycle	Reported SAR10g [W/kg]	Plot #
802.11 a	9	5560	112	1	Pos 1	12	11.52	0.582	-0.01	1.12	1:1	0.65	
802.11 a	9	5560	112	1	Pos 2	12	11.52	0.0000963***	0**	1.12	1:1	0.0001	
802.11 a	9	5560	112	1	Pos 3	12	11.52	0.0165	-0.57	1.27	1:1	0.02	
802.11 a	9	5560	112	1	Pos 4	12	11.52	0.0931***	0.57	1.27	1:1	0.12	
802.11 a	9	5500	100	1	Pos 1	12	11.27	0.537	-0.14	1.18	1:1	0.64	
802.11 a	9	5640	128	1	Pos 1	12	11.17	0.583	0.02	1.21	1:1	0.71	9

*Larger than 5% drifts included to scaling factors

** Due to low e-field generated by DUT at the location of drift measurement, the measurements are not applicable.

***Area scan only

Mode	Data Rate [Mbps]	Freq [MHz]	Channel	Antenna	Test position	Maximum Power [dBm]	Conducted Power [dBm]	Measured SAR10g [W/kg]	Power Drift [dB]*	Scaling Factor	Duty Cycle	Reported SAR10g [W/kg]	Plot #
802.11 a	9	5580	116	2	Pos 1	12	12.16	0.00000639	0**	1.00	1:1	0.00001	
802.11 a	9	5580	116	2	Pos 2	12	12.16	0.380	0.02	1.00	1:1	0.38	
802.11 a	9	5580	116	2	Pos 3	12	12.16	0.0252***	0**	1.00	1:1	0.03	
802.11 a	9	5580	116	2	Pos 4	12	12.16	0.0525***	0**	1.00	1:1	0.05	
802.11 a	9	5500	100	2	Pos 2	12	11.87	0.236	0.01	1.03	1:1	0.24	
802.11 a	9	5640	128	2	Pos 2	12	11.76	0.561	0.04	1.06	1:1	0.59	10

*Larger than 5% drifts included to scaling factors

** Due to low e-field generated by DUT at the location of drift measurement, the measurements are not applicable.

***Area scan only

Mode	Data Rate [Mbps]	Freq [MHz]	Channel	Antenna	Test position	Maximum Power [dBm]	Conducted Power [dBm]	Measured SAR10g [W/kg]	Power Drift [dB]	Scaling Factor	Duty Cycle	Reported SAR10g [W/kg]	Plot #
802.11 a	9	5660	132	1	Pos 1	12	10.98	0.586	-0.66	1.47	1:1	0.86	11
802.11 a	9	5660	132	1	Pos 2	12	10.98	0.00136	-0.33	1.36	1:1	0.002	
802.11 a	9	5660	132	1	Pos 3	12	10.98	0.0238	-0.4	1.39	1:1	0.03	
802.11 a	9	5660	132	1	Pos 4	12	10.98	0.0733	-0.11	1.26	1:1	0.09	
802.11 a	9	5745	149	1	Pos 1	12	10.2	0.372	-0.21	1.51	1:1	0.56	
802.11 a	9	5825	165	1	Pos 1	12	10.19	0.329	-0.01	1.52	1:1	0.50	

*Larger than 5% drifts included to scaling factors

Mode	Data Rate [Mbps]	Freq [MHz]	Channel	Antenna	Test position	Maximum Power [dBm]	Conducted Power [dBm]	Measured SAR10g [W/kg]	Power Drift [dB]	Scaling Factor	Duty Cycle	Reported SAR10g [W/kg]	Plot #
802.11 a	9	5660	132	2	Pos 1	12	11.69	0.0000499	-0.69	1.26	1:1	0.0001	
802.11 a	9	5660	132	2	Pos 2	12	11.69	0.595	-0.17	1.07	1:1	0.64	
802.11 a	9	5660	132	2	Pos 3	12	11.69	0.0342**	0.06	1.07	1:1	0.04	
802.11 a	9	5660	132	2	Pos 4	12	11.69	0.0806**	-0.02	1.07	1:1	0.09	
802.11 a	9	5745	149	2	Pos 2	12	10.52	0.559	-0.16	1.41	1:1	0.79	
802.11 a	9	5825	165	2	Pos 2	12	10.25	0.561	-0.17	1.50	1:1	0.84	12

*Larger than 5% drifts included to scaling factors

**Area scan only

7.2 IEC 62209-2 AMD1:2019

According to IEC 62209-2 AMD1:2019, the zoom scan complies if the peak spatial-average SAR is below 0.1 W/kg, or if the following criteria is met:

1. The smallest horizontal distance from the local SAR peaks to all points 3 dB below the SAR peak is larger than the horizontal grid step.

2. Ratio of SAR at the second measured point (M2) to the SAR at the closest measured point (M1) at the x-y location of the measured maximum is at least 30%.

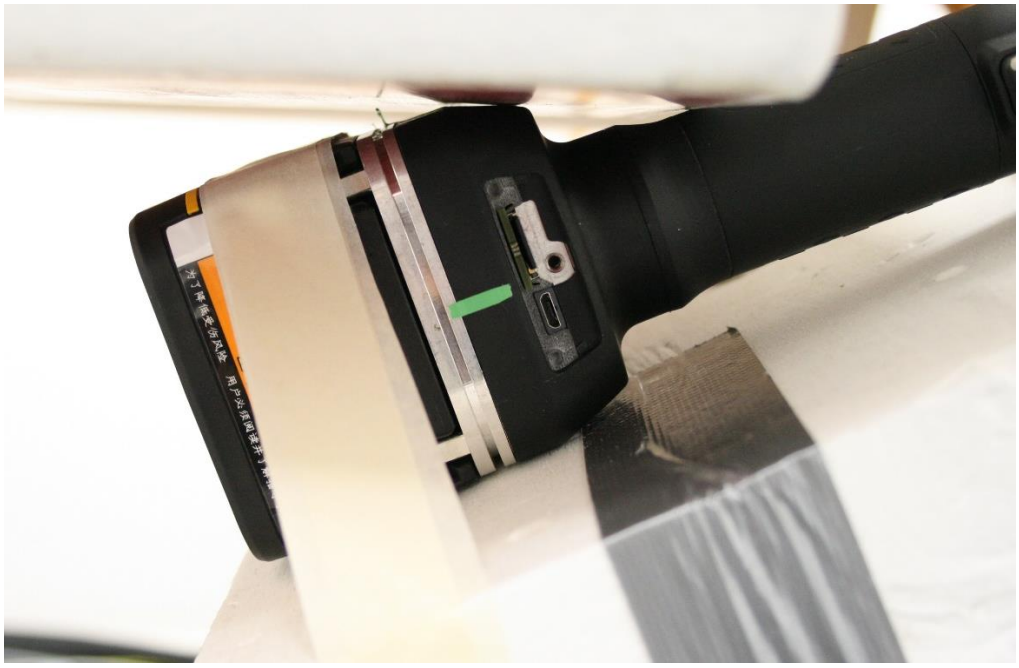
All Zoom scan peak spatial-average SAR results over 0.1 W/kg are in the table below.

Filename	Horizontal Grid Step [mm]	Minimum Distance [mm]	M2/M1 Ratio [%]	Result
FCC, WLAN 2.4, CH 1, Antenna 1, Pos 1	5	7.1	46.3	PASS
FCC, WLAN 5, CH 116, Antenna 2, Pos 2	4	8	53.1	PASS
FCC, WLAN 5, CH 100, Antenna 2, Pos 2	4	5.7	52.5	PASS
FCC, WLAN 5, CH 128, Antenna 2, Pos 2 2	4	5.6	53.1	PASS
FCC, WLAN 5, CH 52, Antenna 1, Pos 1	4	8	56.0	PASS
FCC, WLAN 5, CH 60, Antenna 1, Pos 1 2	4	8	55.7	PASS
FCC, WLAN 5, CH 64, Antenna 1, Pos 1 2 2	4	8	55.0	PASS
FCC, WLAN 5, CH 64, Antenna 2, Pos 2	4	8	53.5	PASS
FCC, WLAN 5, CH 52, Antenna 2, Pos 2 2	4	8	53.6	PASS
FCC, WLAN 5, CH 60, Antenna 2, Pos 2	4	8	54.3	PASS
FCC, WLAN 5, CH 132, Antenna 1, Pos 1	4	5.6	49.7	PASS
FCC, WLAN 2.4, CH 6, Antenna 1, Pos 1	5	10	45.6	PASS
FCC, WLAN 5, CH 149, Antenna 1, Pos 1 2	4	5.6	50.3	PASS
FCC, WLAN 5, CH 165, Antenna 1, Pos 1	4	8	49.8	PASS
FCC, WLAN 5, CH 132, Antenna 2, Pos 2	4	7.9	52.3	PASS
FCC, WLAN 5, CH 149, Antenna 2, Pos 2 2	4	8	51.9	PASS
FCC, WLAN 5, CH 165, Antenna 2, Pos 2	4	8	49.9	PASS
FCC, WLAN 2.4, CH 11, Antenna 1, Pos 1	5	10	45.7	PASS
FCC, WLAN 2.4, CH 1, Antenna 2, Pos 2	5	10	42.4	PASS
FCC, WLAN 2.4, CH 6, Antenna 2, Pos 2	5	10	42.6	PASS
FCC, WLAN 2.4, CH 11, Antenna 2, Pos 2	5	10	42.1	PASS
FCC, WLAN 5, CH 100, Antenna 1, Pos 1 2	4	5.7	52.9	PASS
FCC, WLAN 5, CH 112, Antenna 1, Pos 1 2 2	4	8	51.0	PASS
FCC, WLAN 5, CH 128, Antenna 1, Pos 1	4	8	50.6	PASS

APPENDIX A: PHOTOS OF THE DUT

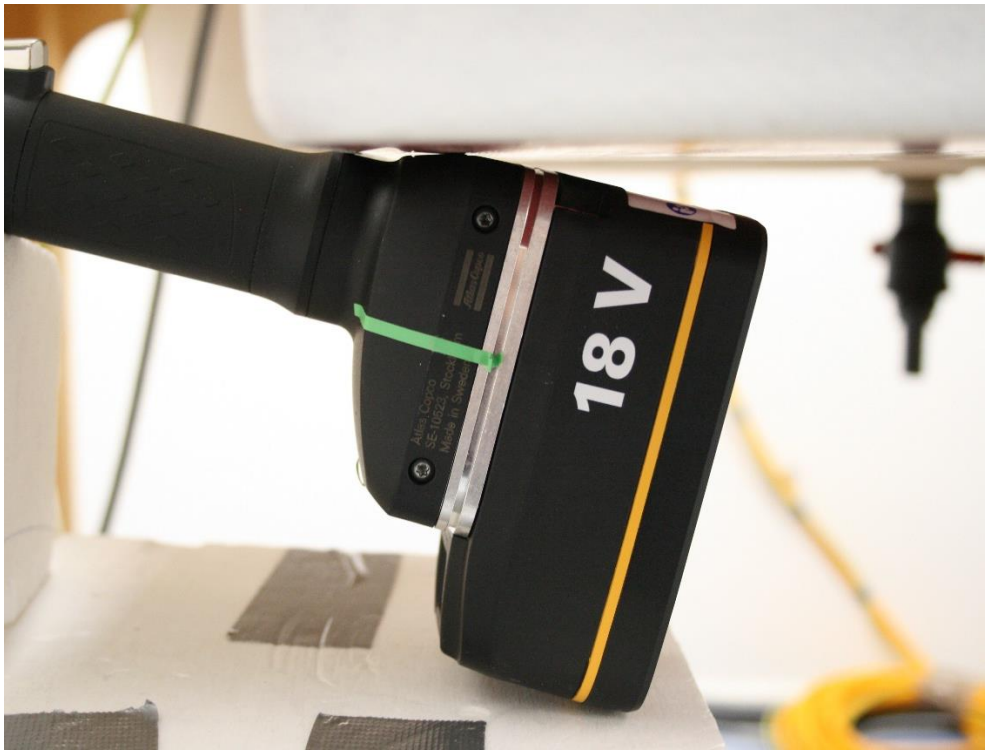
Size of the DUT is 12.1 × 34.0 × 7.8 cm.

DUT in test position 1.



DUT in test position 2.

DUT in test position 3.



DUT in test position 4.

APPENDIX B: SYSTEM CHECK SCAN

Plot 1

Date/Time: 8.4.2020 11:17:08

Test Laboratory: Verkotan Oy

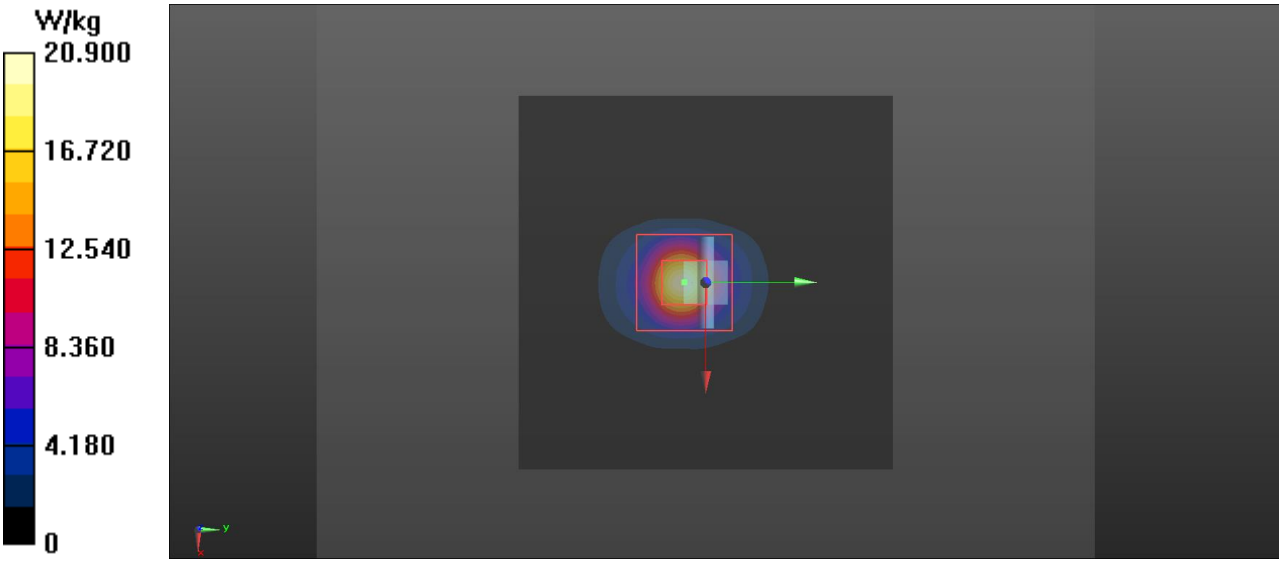
DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1045

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5600 MHz;Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 5600 MHz; σ = 5.047 S/m; ε_r = 34.214; ρ = 1000 kg/m^3 , Medium parameters used: σ = 0 S/m, ε_r = 1; ρ = 1000 kg/m^3
Phantom section: Center Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(4.56, 4.56, 4.56); Calibrated: 25.3.2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 0mm (Fix Surface), z = -4.0, 25.0, 1.0
- Electronics: DAE4 Sn756; Calibrated: 17.3.2020
- Phantom: SAR1_Phantom 1_triple flat; Type: QD 000 P51 Cx
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

System check/Area Scan (71x71x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 20.9 W/kg
System check/Zoom Scan (7x11x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 61.17 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 35.8 W/kg
SAR(1 g) = 8.1 W/kg; SAR(10 g) = 2.3 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 21.5 W/kg



Plot 2

Date/Time: 14.4.2020 8:51:04

Test Laboratory: Verkotan Oy

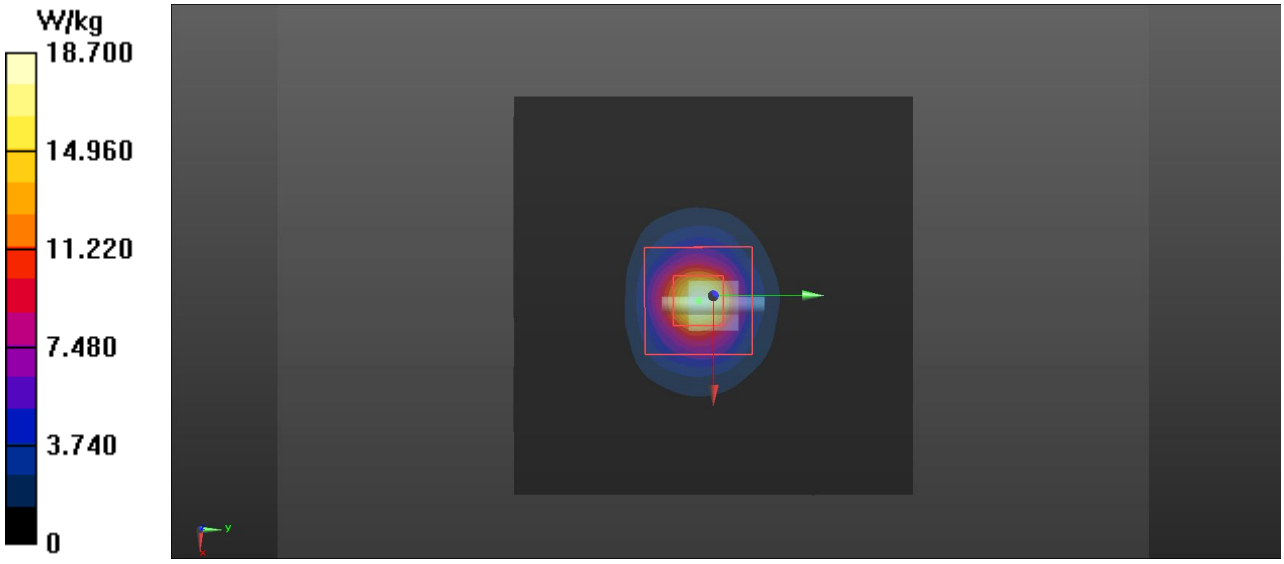
DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1045

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5250 MHz;Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 5250 MHz; σ = 4.53 S/m; ε_r = 34.473; ρ = 1000 kg/m^3
Phantom section: Center Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(5.18, 5.18, 5.18); Calibrated: 25.3.2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 25.0
- Electronics: DAE4 Sn756; Calibrated: 17.3.2020
- Phantom: SAR1_Phantom 1_triple flat; Type: QD 000 P51 Cx
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

System check 5250/Area Scan (81x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 18.7 W/kg
System check 5250/Zoom Scan (7x7x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 67.48 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 28.5 W/kg
SAR(1 g) = 7.42 W/kg; SAR(10 g) = 2.14 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 18.5 W/kg



Plot 3

Date/Time: 15.4.2020 12:21:22

Test Laboratory: Verkotan Oy

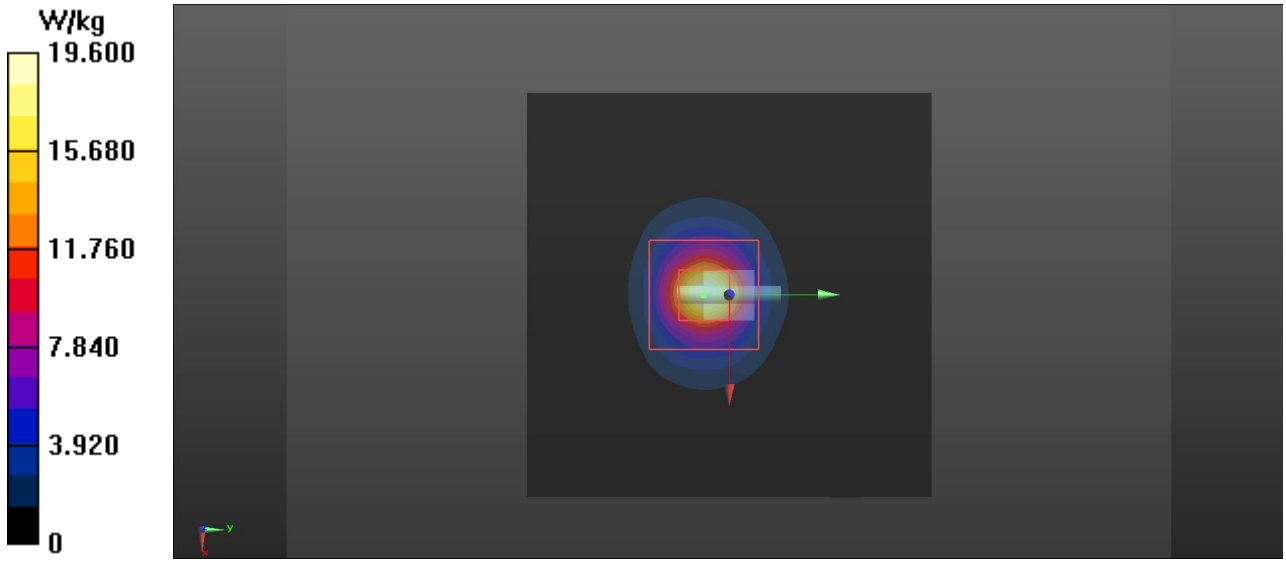
DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1045

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5750 MHz;Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 5750 MHz; σ = 5.197 S/m; ε_r = 34.718; ρ = 1000 kg/m^3
Phantom section: Center Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(4.7, 4.7, 4.7); Calibrated: 25.3.2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 25.0
- Electronics: DAE4 Sn756; Calibrated: 17.3.2020
- Phantom: SAR1_Phantom 1_triple flat; Type: QD 000 P51 Cx
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

System check 5750/Area Scan (81x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 19.6 W/kg
System check 5750/Zoom Scan (7x7x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 60.16 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 33.8 W/kg
SAR(1 g) = 7.44 W/kg; SAR(10 g) = 2.1 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 19.5 W/kg



Plot 4

Date/Time: 16.4.2020 12:51:20

Test Laboratory: Verkotan Oy

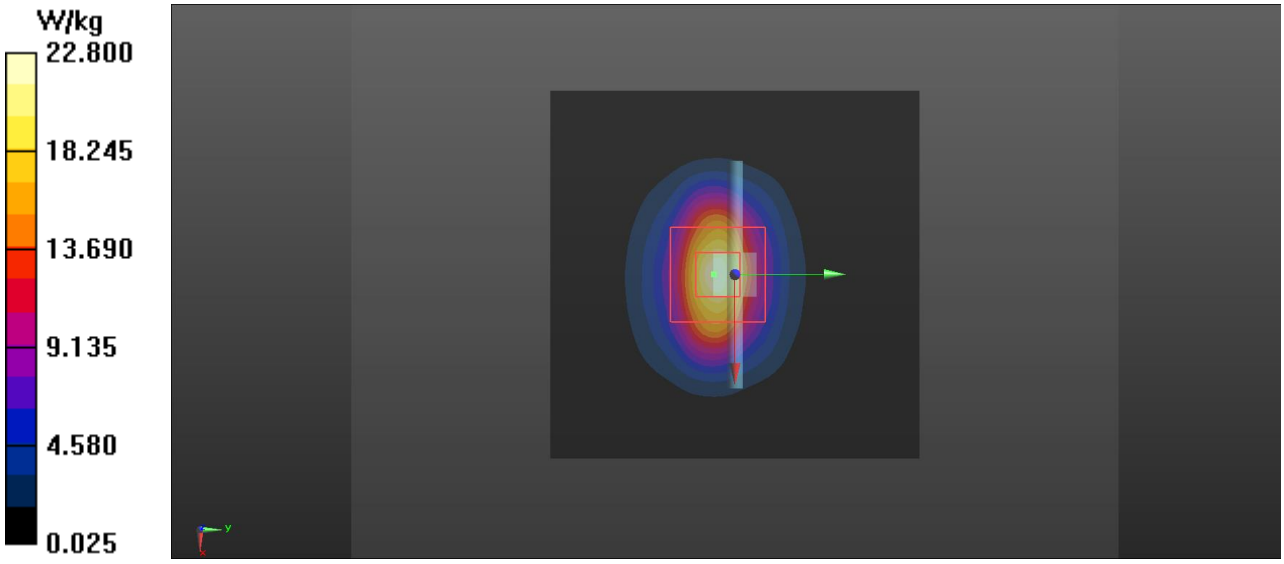
DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:729

Communication System: UID 0, CW (0); Communication System Band: D2450 (2450.0 MHz); Frequency: 2450 MHz;Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 2450 MHz; σ = 1.854 S/m; ε_r = 39.976; ρ = 1000 kg/m^3
Phantom section: Center Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(7.83, 7.83, 7.83); Calibrated: 25.3.2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
- Electronics: DAE4 Sn756; Calibrated: 17.3.2020
- Phantom: SAR1_Phantom 1_triple flat; Type: QD 000 P51 Cx
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

System check/Area Scan (71x71x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 22.8 W/kg
System check/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 104.5 V/m; Power Drift = -0.20 dB
Peak SAR (extrapolated) = 25.7 W/kg
SAR(1 g) = 12.6 W/kg; SAR(10 g) = 5.9 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 20.9 W/kg



APPENDIX C: MEASUREMENT SCANS

Plot 5

Date/Time: 16/04/2020 14.12.57

Test Laboratory: Verkotan Oy

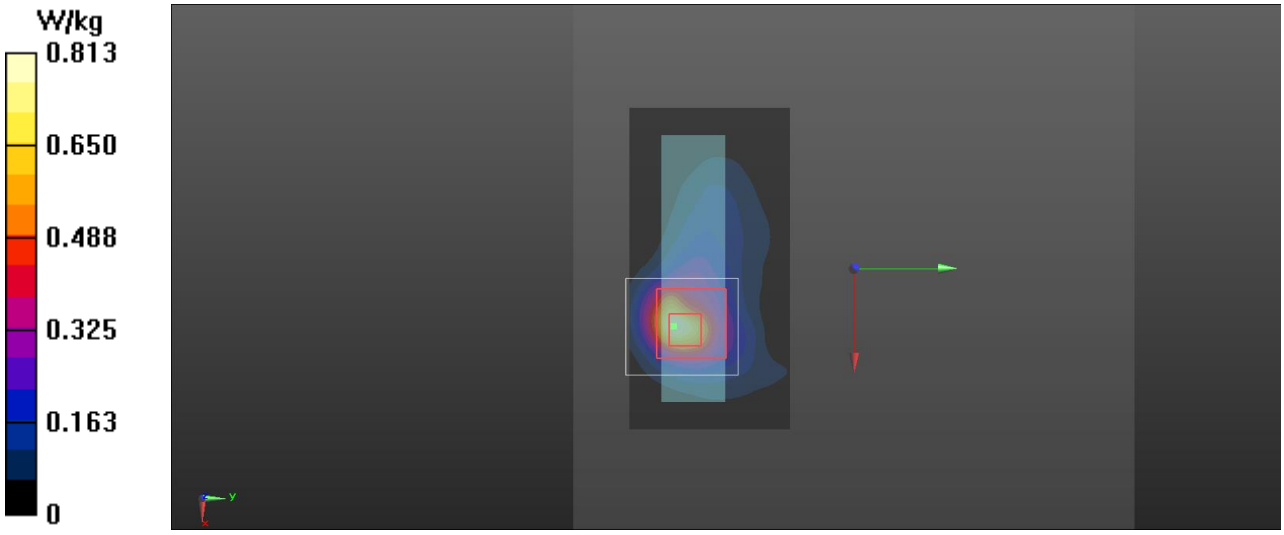
DUT: ICB-A Tool

Communication System: UID 0, WLAN 2.4 (0); Communication System Band: WLAN2.4GHz; Frequency: 2412 MHz;Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 2412 MHz; σ = 1.824 S/m; ε_r = 40.056; ρ = 1000 kg/m^3
Phantom section: Center Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(7.83, 7.83, 7.83) @ 2412 MHz; Calibrated: 25/03/2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
- Electronics: DAE4 Sn756; Calibrated: 17/03/2020
- Phantom: SAR1_Phantom 1_triple flat; Type: QD 000 P51 Cx; Serial: 28_March_2017
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

FCC, WLAN 2.4, CH 1, Antenna 1, Pos 1/Zoom Scan (7x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 12.68 V/m; Power Drift = -0.33 dB
Peak SAR (extrapolated) = 0.963 W/kg
SAR(1 g) = 0.403 W/kg; SAR(10 g) = 0.164 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.682 W/kg
FCC, WLAN 2.4, CH 1, Antenna 1, Pos 1/Area Scan (101x51x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.813 W/kg



Plot 6

Date/Time: 17/04/2020 9.16.08

Test Laboratory: Verkotan Oy

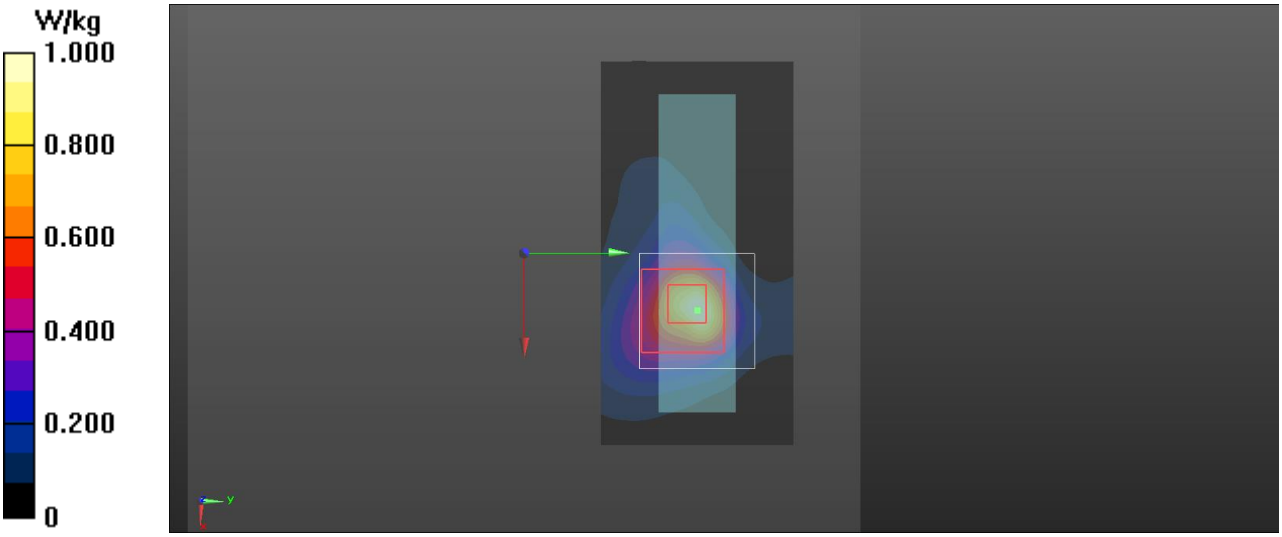
DUT: ICB-A Tool

Communication System: UID 0, WLAN 2.4 (0); Communication System Band: WLAN2.4GHz; Frequency: 2412 MHz;Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 2412 MHz; σ = 1.824 S/m; ε_r = 40.056; ρ = 1000 kg/m^3
Phantom section: Center Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(7.83, 7.83, 7.83) @ 2412 MHz; Calibrated: 25/03/2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
- Electronics: DAE4 Sn756; Calibrated: 17/03/2020
- Phantom: SAR1_Phantom 1_triple flat; Type: QD 000 P51 Cx; Serial: 28_March_2017
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

FCC, WLAN 2.4, CH 1, Antenna 2, Pos 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.53 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 1.18 W/kg
SAR(1 g) = 0.512 W/kg; SAR(10 g) = 0.229 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.894 W/kg
FCC, WLAN 2.4, CH 1, Antenna 2, Pos 2/Area Scan (101x51x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.00 W/kg



Plot 7

Date/Time: 14.4.2020 9:30:01

Test Laboratory: Verkotan Oy

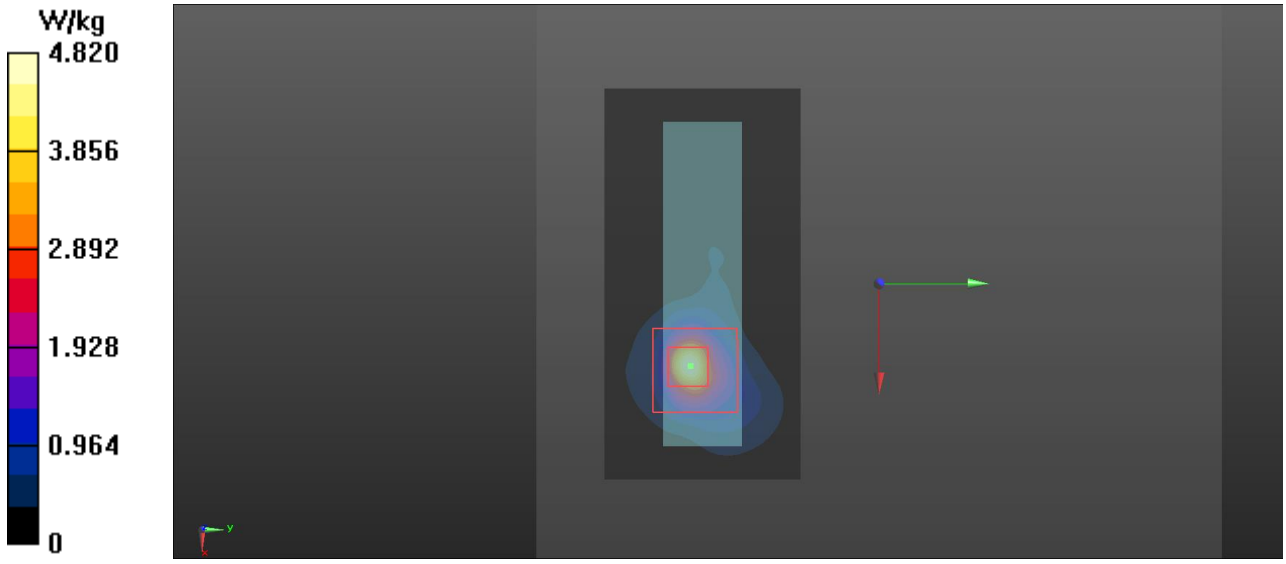
DUT: ICB-A Tool

Communication System: UID 0, WLAN5GHz (0); Communication System Band: 5GHz; Frequency: 5260 MHz;Communication System PAR: 0 dB; PMF: 1.12202e-005
Medium parameters used: f = 5260 MHz; σ = 4.542 S/m; ε_r = 34.455; ρ = 1000 kg/m^3
Phantom section: Center Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(5.18, 5.18, 5.18); Calibrated: 25.3.2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 25.0
- Electronics: DAE4 Sn756; Calibrated: 17.3.2020
- Phantom: SAR1_Phantom 1_triple flat; Type: QD 000 P51 Cx
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

FCC, WLAN 5, CH 52, Antenna 1, Pos 1/Area Scan (101x51x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 4.82 W/kg
FCC, WLAN 5, CH 52, Antenna 1, Pos 1/Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 28.49 V/m; Power Drift = -0.36 dB
Peak SAR (extrapolated) = 6.91 W/kg
SAR(1 g) = 1.66 W/kg; SAR(10 g) = 0.472 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 4.05 W/kg



Plot 8

Date/Time: 14.4.2020 12:02:33

Test Laboratory: Verkotan Oy

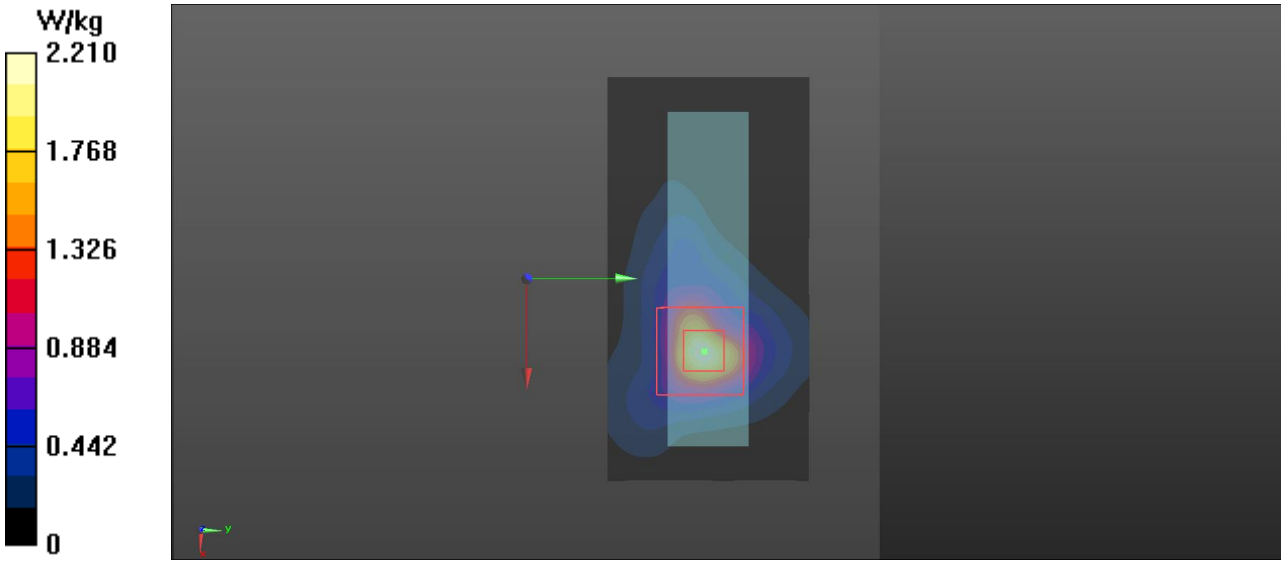
DUT: ICB-A Tool

Communication System: UID 0, WLAN5GHz (0); Communication System Band: 5GHz; Frequency: 5260 MHz;Communication System PAR: 0 dB; PMF: 1.12202e-005
Medium parameters used: f = 5260 MHz; σ = 4.542 S/m; ε_r = 34.455; ρ = 1000 kg/m^3
Phantom section: Center Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(5.18, 5.18, 5.18); Calibrated: 25.3.2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 25.0
- Electronics: DAE4 Sn756; Calibrated: 17.3.2020
- Phantom: SAR1_Phantom 1_triple flat; Type: QD 000 P51 Cx
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

FCC, WLAN 5, CH 52, Antenna 2, Pos 2 2/Area Scan (101x51x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 2.21 W/kg
FCC, WLAN 5, CH 52, Antenna 2, Pos 2 2/Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 20.44 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 4.25 W/kg
SAR(1 g) = 1.03 W/kg; SAR(10 g) = 0.292 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 2.60 W/kg



Plot 9

Date/Time: 9.4.2020 10:39:48

Test Laboratory: Verkotan Oy

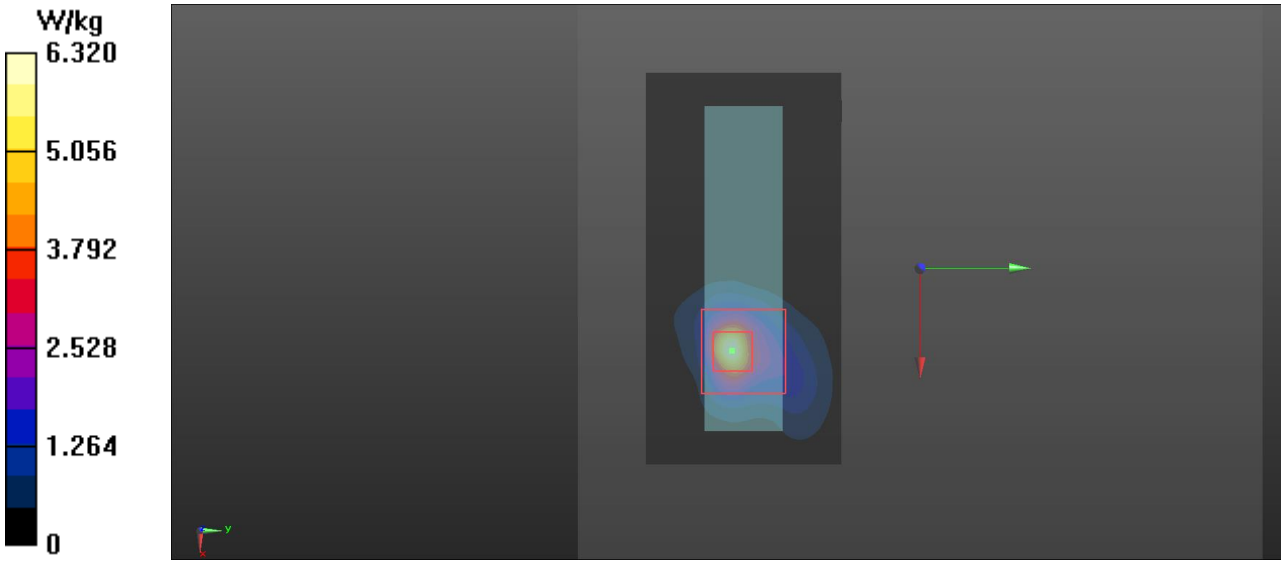
DUT: ICB-A Tool

Communication System: UID 0, WLAN5GHz (0); Communication System Band: 5GHz; Frequency: 5640 MHz;Communication System PAR: 0 dB; PMF: 1.12202e-005
Medium parameters used: f = 5640 MHz; σ = 5.093 S/m; ε_r = 34.139; ρ = 1000 kg/m^3
Phantom section: Center Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(4.56, 4.56, 4.56); Calibrated: 25.3.2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 25.0
- Electronics: DAE4 Sn756; Calibrated: 17.3.2020
- Phantom: SAR1_Phantom 1_triple flat; Type: QD 000 P51 Cx
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

FCC, WLAN 5, CH 128, Antenna 1, Pos 1/Area Scan (101x51x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 6.32 W/kg
FCC, WLAN 5, CH 128, Antenna 1, Pos 1/Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 32.87 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 10.3 W/kg
SAR(1 g) = 2.19 W/kg; SAR(10 g) = 0.583 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 5.93 W/kg



Plot 10

Date/Time: 9.4.2020 13:07:47

Test Laboratory: Verkotan Oy

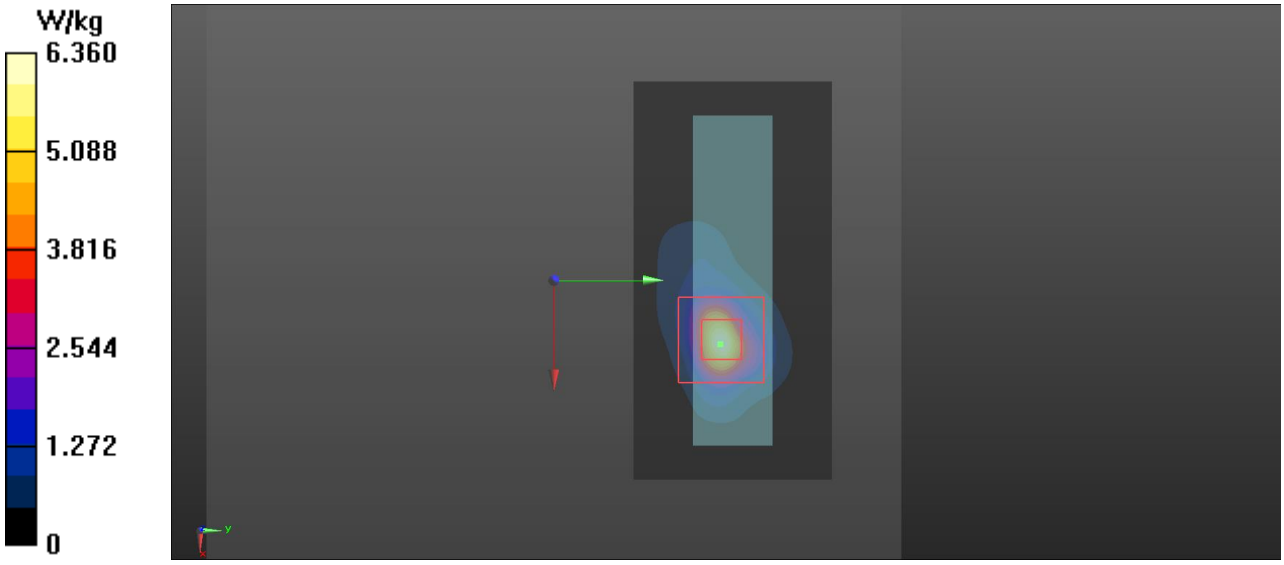
DUT: ICB-A Tool

Communication System: UID 0, WLAN5GHz (0); Communication System Band: 5GHz; Frequency: 5640 MHz;Communication System PAR: 0 dB; PMF: 1.12202e-005
Medium parameters used: f = 5640 MHz; σ = 5.093 S/m; ε_r = 34.139; ρ = 1000 kg/m^3
Phantom section: Center Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(4.56, 4.56, 4.56); Calibrated: 25.3.2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), z = 25.0, -4.0
- Electronics: DAE4 Sn756; Calibrated: 17.3.2020
- Phantom: SAR1_Phantom 1_triple flat; Type: QD 000 P51 Cx
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

FCC, WLAN 5, CH 128, Antenna 2, Pos 2 2/Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 19.59 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 10.8 W/kg
SAR(1 g) = 2.35 W/kg; SAR(10 g) = 0.561 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 6.36 W/kg
FCC, WLAN 5, CH 128, Antenna 2, Pos 2 2/Area Scan (101x51x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 4.97 W/kg



Plot 11

Date/Time: 15.4.2020 13:10:09

Test Laboratory: Verkotan Oy

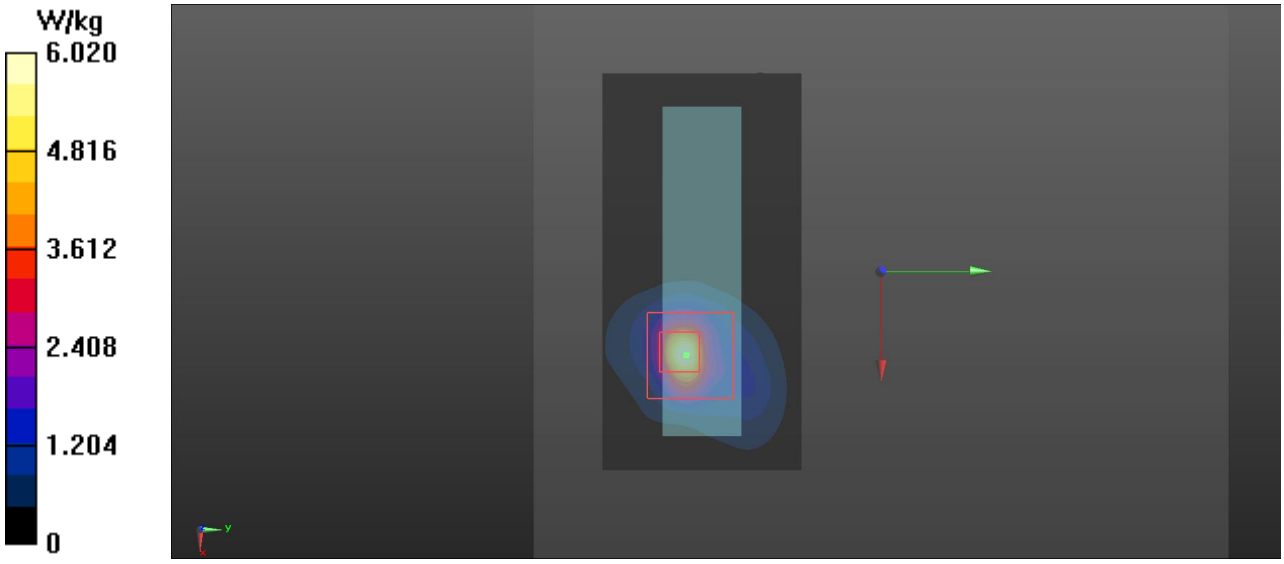
DUT: ICB-A Tool

Communication System: UID 0, WLAN5GHz (0); Communication System Band: 5GHz; Frequency: 5660 MHz;Communication System PAR: 0 dB; PMF: 1.12202e-005
Medium parameters used: f = 5660 MHz; σ = 5.09 S/m; ε_r = 34.872; ρ = 1000 kg/m^3
Phantom section: Center Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(4.56, 4.56, 4.56); Calibrated: 25.3.2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 25.0
- Electronics: DAE4 Sn756; Calibrated: 17.3.2020
- Phantom: SAR1_Phantom 1_triple flat; Type: QD 000 P51 Cx
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

FCC, WLAN 5, CH 132, Antenna 1, Pos 1/Area Scan (101x51x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 6.02 W/kg
FCC, WLAN 5, CH 132, Antenna 1, Pos 1/Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 28.75 V/m; Power Drift = -0.66 dB
Peak SAR (extrapolated) = 10.2 W/kg
SAR(1 g) = 2.15 W/kg; SAR(10 g) = 0.586 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 5.49 W/kg



Plot 12

Date/Time: 15.4.2020 16:27:08

Test Laboratory: Verkotan Oy

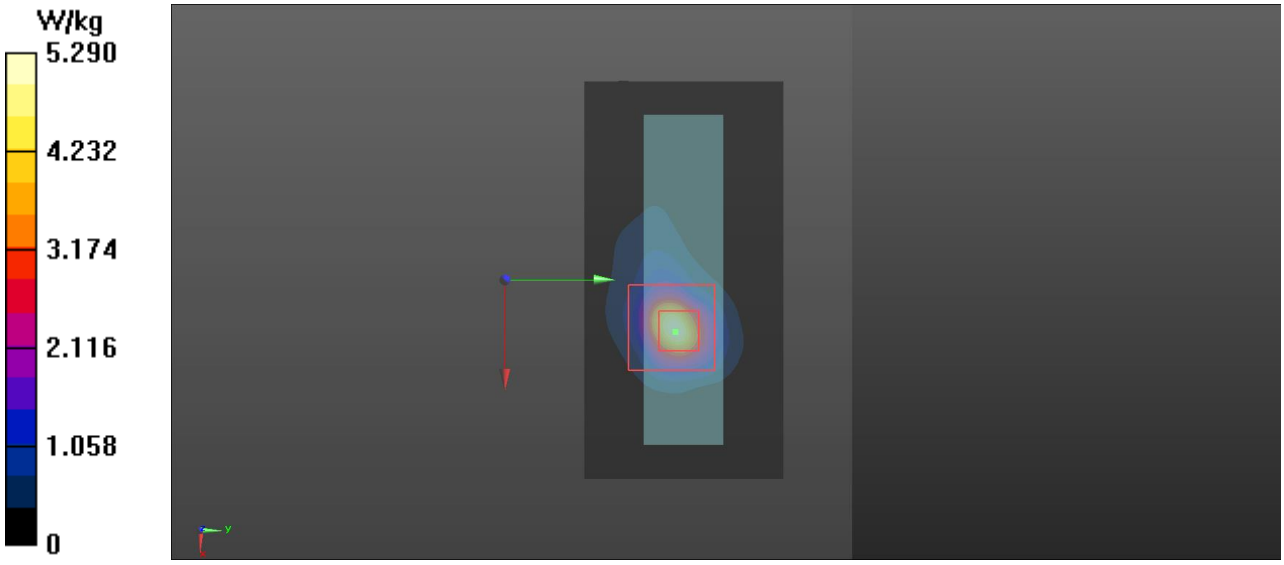
DUT: ICB-A Tool

Communication System: UID 0, WLAN5GHz (0); Communication System Band: 5GHz; Frequency: 5825 MHz;Communication System PAR: 0 dB; PMF: 1.12202e-005
Medium parameters used: f = 5825 MHz; σ = 5.282 S/m; ε_r = 34.586; ρ = 1000 kg/m^3
Phantom section: Center Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(4.7, 4.7, 4.7); Calibrated: 25.3.2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), z = -4.0, 25.0
- Electronics: DAE4 Sn756; Calibrated: 17.3.2020
- Phantom: SAR1_Phantom 1_triple flat; Type: QD 000 P51 Cx
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

FCC, WLAN 5, CH 165, Antenna 2, Pos 2/Area Scan (101x51x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 5.29 W/kg
FCC, WLAN 5, CH 165, Antenna 2, Pos 2/Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 16.93 V/m; Power Drift = -0.17 dB
Peak SAR (extrapolated) = 10.8 W/kg
SAR(1 g) = 2.27 W/kg; SAR(10 g) = 0.561 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 6.17 W/kg



APPENDIX D: RELEVANT PAGES FROM PROBE CALIBRATION REPORTS

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

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

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

Accreditation No.: SCS 0108

Client Verkotan **Certificate No: EX3-7447_Mar20**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:7447
Calibration procedure(s)	QA CAL-01.v9, QA CAL-14.v5, QA CAL-23.v5, QA CAL-25.v7 Calibration procedure for dosimetric E-field probes
Calibration date:	March 25, 2020

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 NRP	SN: 104778	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
Power sensor NRP-Z91	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-19 (No. 217-02894)	Apr-20
DAE4	SN: 660	27-Dec-19 (No. DAE4-660_Dec19)	Dec-20
Reference Probe ES3DV2	SN: 3013	31-Dec-19 (No. ES3-3013_Dec19)	Dec-20
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-18)	In house check: Jun-20
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-19)	In house check: Oct-20

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

Issued: March 27, 2020

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7447

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.41	0.42	0.42	± 10.1 %
DCP (mV)[B]	98.5	91.0	100.2	

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Max dev.	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	197.2	± 2.7 %	± 4.7 %
		Y	0.0	0.0	1.0		185.8		
		Z	0.0	0.0	1.0		172.3		

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7447

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 [G]	Depth [G] (mm)	Unc (k=2)
750	41.9	0.89	10.38	10.38	10.38	0.52	0.88	± 12.0 %
900	41.5	0.97	9.97	9.97	9.97	0.31	1.05	± 12.0 %
1750	40.1	1.37	8.65	8.65	8.65	0.29	0.88	± 12.0 %
1950	40.0	1.40	8.29	8.29	8.29	0.23	0.98	± 12.0 %
2150	39.7	1.53	8.21	8.21	8.21	0.29	0.88	± 12.0 %
2300	39.5	1.67	8.05	8.05	8.05	0.30	1.00	± 12.0 %
2450	39.2	1.80	7.83	7.83	7.83	0.29	1.00	± 12.0 %
2600	39.0	1.96	7.64	7.64	7.64	0.19	1.20	± 12.0 %
3300	38.2	2.71	7.00	7.00	7.00	0.30	1.30	± 13.1 %
5250	35.9	4.71	5.18	5.18	5.18	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.56	4.56	4.56	0.40	1.80	± 13.1 %
5750	35.4	5.22	4.70	4.70	4.70	0.40	1.80	± 13.1 %

[C] Frequency validity above 300 MHz 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. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[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.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

APPENDIX E: RELEVANT PAGES FROM DIPOLE CALIBRATION REPORTS

SAR Reference Dipole Calibration Report

Ref : ACR.165.32.17.SATU.A

VERKOTAN LTD.
ELEKTRONIIKKATIE 17
90590, OULU, FINLAND
SAR REFERENCE DIPOLE
FREQUENCY: 2450 MHZ
SERIAL NO.: D2450V2-729

Calibrated at MVG US
2105 Barrett Park Dr. - Kennesaw, GA 30144

Calibration Date: 06/14/17

Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in SATIMO USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.

SAR REFERENCE DIPOLE CALIBRATION REPORT Ref: ACR.165.32.17.SATU.A

	Name	*Function*	*Date*	*Signature*
Prepared by :	Jérôme LUC	Product Manager	6/14/2017	
Checked by :	Jérôme LUC	Product Manager	6/14/2017	
Approved by :	Kim RUTKOWSKI	Quality Manager	6/14/2017	

	Customer Name
Distribution :	Verkotan Ltd.

Issue	*Date*	*Modifications*
A	6/14/2017	Initial release

1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %	PASS	1.80 ±5 %	PASS
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

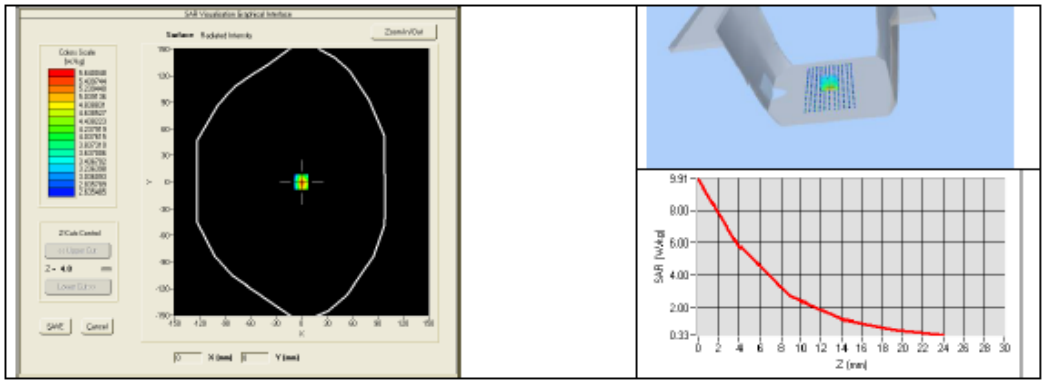
7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 37.5 sigma : 1.80
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=5mm/dy=5mm/dz=5mm
Frequency	2450 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	

2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4	53.43 (5.34)	24	24.05 (2.41)
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	



7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ε_r')		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 ±5 %		0.80 ±5 %	
300	58.2 ±5 %		0.92 ±5 %	
450	56.7 ±5 %		0.94 ±5 %	
750	55.5 ±5 %		0.96 ±5 %	
835	55.2 ±5 %		0.97 ±5 %	
900	55.0 ±5 %		1.05 ±5 %	
915	55.0 ±5 %		1.06 ±5 %	
1450	54.0 ±5 %		1.30 ±5 %	
1610	53.8 ±5 %		1.40 ±5 %	
1800	53.3 ±5 %		1.52 ±5 %	
1900	53.3 ±5 %		1.52 ±5 %	
2000	53.3 ±5 %		1.52 ±5 %	
2100	53.2 ±5 %		1.62 ±5 %	
2450	52.7 ±5 %	PASS	1.95 ±5 %	PASS
2600	52.5 ±5 %		2.16 ±5 %	
3000	52.0 ±5 %		2.73 ±5 %	

SAR Reference Dipole Calibration Report

Ref : ACR.165.33.17.SATU.A

VERKOTAN LTD.
ELEKTRONIIKKATIE 17
90590, OULU, FINLAND
SAR REFERENCE DIPOLE
FREQUENCY: 5000 MHZ
SERIAL NO.: D5GHZV2-1045

Calibrated at MVG US
2105 Barrett Park Dr. - Kennesaw, GA 30144

ilac-MRA A2LA ACCREDITED Calibration CERT #2166.02

Calibration Date: 06/14/17

Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in SATIMO USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Product Manager	6/14/2017	
Checked by :	Jérôme LUC	Product Manager	6/14/2017	
Approved by :	Kim RUTKOWSKI	Quality Manager	6/14/2017	

	Customer Name
Distribution :	Verkotan Ltd.

Issue	Date	Modifications
A	6/14/2017	Initial release

900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	
1800	40.0 ±5 %		1.40 ±5 %	
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	
5000	36.2 ±10 %		4.45 ±10 %	
5100	36.1 ±10 %		4.56 ±10 %	
5200	36.0 ±10 %		4.66 ±10 %	
5300	35.9 ±10 %		4.76 ±10 %	
5400	35.8 ±10 %		4.86 ±10 %	
5500	35.6 ±10 %		4.97 ±10 %	
5600	35.5 ±10 %	PASS	5.07 ±10 %	PASS
5700	35.4 ±10 %		5.17 ±10 %	
5800	35.3 ±10 %		5.27 ±10 %	
5900	35.2 ±10 %		5.38 ±10 %	
6000	35.1 ±10 %		5.48 ±10 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values 5250 MHz: eps' :35.46 sigma : 4.69 Head Liquid Values 5600 MHz: eps' :36.66 sigma : 5.17 Head Liquid Values 5750 MHz: eps' :35.55 sigma : 5.30
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=4mm/dy=4mm/dz=2mm
Frequency	5250 MHz 5600 MHz

	5750 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	
5200	76.5		21.6	
5250	-	76.81 (7.68)	-	22.78 (2.28)
5500	83.3		23.4	
5600	-	80.85 (8.08)	-	23.65 (2.36)
5750	-	76.57 (7.66)	-	22.51 (2.25)
5800	78.0		21.9	

