SAR Compliance Test Report

Date of Report	8/11/2023	**Client's Contact person:**	Guido Scheibl
Number of pages:	52		
		Responsible Test engineer:	Ilari Kinnunen
Testing laboratory:	**Verkotan Oy** Elektroniikkatie 17 90590 Oulu Finland	**Client:**	Dentsply GmbH Fabrikstraße 31 64625 Bensheim Germany
Tested device	**Primescan 2**		
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** **IEC/IEEE 62209-1528, 2020** Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices **RSS-102, Issue 5, 2015** 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:	08.11.2023 **Laboratory Manager** Miia Nurkkala		

TABLE OF CONTENTS

1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Equipment under Test (DUT):

Product:	Primescan 2
Manufacturer:	Dentsply Sirona
Model:	Primescan 2
Serial Number:	500120
FCC ID Number:	2AD7W-6802040
ISED ID Number:	12730A-6802040
DUT Number:	21210
Battery Type used in testing:	-
State of the Sample:	Production sample

PC Information:

Product:	GT-R Mini
Manufacturer:	Beelink
Serial Number:	3550U1CF60037
DUT Number:	21211

Testing information:

Testing performed:	21.04.2023 – 09.05.2023
Notes:	-
Document history:	This report replaces test report CE SAR report_Primescan 2 ID5978_15052023.docx. Model number revised.
Document ID:	FCC_ISED SAR report_Primescan 2 ID5978_08112023.docx
Temperature °C	22±2 / Controlled
Humidity RH%	30±20 / Controlled
Measurement performed by:	Ilari Kinnunen, Jesper Varis
FCC Test Firm Designation Number:	FI0005
ISED Company Number:	22218

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 Exposure Condition, 0mm separation	Result
5 GHz WLAN Antenna A	2.79	PASS
5 GHz WLAN Antenna B	2.12	PASS
Bluetooth BR	0.014	PASS

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

1.2.2 Simultaneous Transmission SAR

Highest Simultaneous Transmission SAR	SAR_{10g}(W/kg) in Extremity Exposure Condition	Result
WLAN 5GHz Antenna A + WLAN 5GHz Antenna B	2.91	PASS

1.2.3 Maximum Drift

Maximum Drift During Measurements	-1.39dB*

*Larger than 5% drifts included to scaling factors

1.2.4 Measurement Uncertainty

SAR10g: 0.3 – 3 GHz:

Expanded Uncertainty (k=2) 95 %	±21.9 %

SAR10g: 3 – 6 GHz:

Expanded Uncertainty (k=2) 95 %	±23.8 %

2. DESCRIPTION OF THE DEVICE UNDER TEST (DUT)

The DUT is a hand-held scanner that is used for dentistry applications that supports WLAN 5GHz and Bluetooth wireless technologies.

The DUT has two transmitting antennas; WLAN 5GHz uses antenna A and antenna B and Bluetooth uses Antenna A.

The DUT runs on the Linux operating system, while the module manufacturer's test SW has been developed only for Windows and does not support Linux. Therefore, Windows PC has the same WLAN/BT module as the DUT (Intel Wi-Fi 6 AX200), thus the PC was used to control the WLAN/BT module via software. The transmission from the module goes through the RF cables to the DUT's antennas A or B. Power losses caused by the RF cables have been measured and considered in the measurements by adding the losses to the scaling factor.

Device Category	Portable
Exposure Environment	General population uncontrolled

2.1 Supported Frequency Bands and Operational Modes

TX Frequency bands	**Modes of Operation**	**Transmitter Frequency Range [MHz]**
	WLAN 5GHz	5180 – 5825
	Bluetooth	2402 – 2480

2.2 Simultaneous transmission

Both antennas A and B can be operated simultaneously.

Possible simultaneous transmissions are:
WLAN 5 GHz Antenna A + WLAN 5 GHz Antenna B
WLAN 5 GHz Antenna B + Bluetooth

3. OUTPUT POWER

3.1 Maximum specified conducted output power

From the customer, including tune-up tolerances;

WLAN 5GHz Antenna A	Max Output Power [dBm]
802.11a	20
802.11n	19.25

WLAN 5GHz Antenna B	Max Output Power [dBm]
802.11a	20
802.11n	19.25

Bluetooth	Max Output Power [dBm]
Bluetooth BR	11.2
Bluetooth LE	7

3.2 Tested conducted power

Measured conducted output power at transmitting antenna connector;

5GHz WLAN:

Standard	Channel	Frequency [MHz]	Transmission mode	Data Rate [Mbps]	Antenna A Output power [dBm]	Antenna A Output power [dBm]
802.11a	52	5260	OFDM	6	20.05	20.11
802.11a	56	5280	OFDM	6	19.94	20.20
802.11a	60	5300	OFDM	6	19.83	20.10
802.11a	64	5320	OFDM	6	16.99	17.33
802.11a	100	5500	OFDM	6	18.58	18.72
802.11a	112	5560	OFDM	6	20.16	20.13
802.11a	116	5580	OFDM	6	20.18	20.38
802.11a	128	5640	OFDM	6	20.25	20.21
802.11a	132	5660	OFDM	6	20.09	20.19
802.11a	149	5745	OFDM	6	19.96	19.99
802.11a	165	5825	OFDM	6	20.03	20.15

Bluetooth:

Standard	Output power [dBm]		
	CH 0 2402 MHz	CH 39 2441 MHz	CH 78 2480 MHz
Bluetooth BR	9.71	9.63	9.97

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.

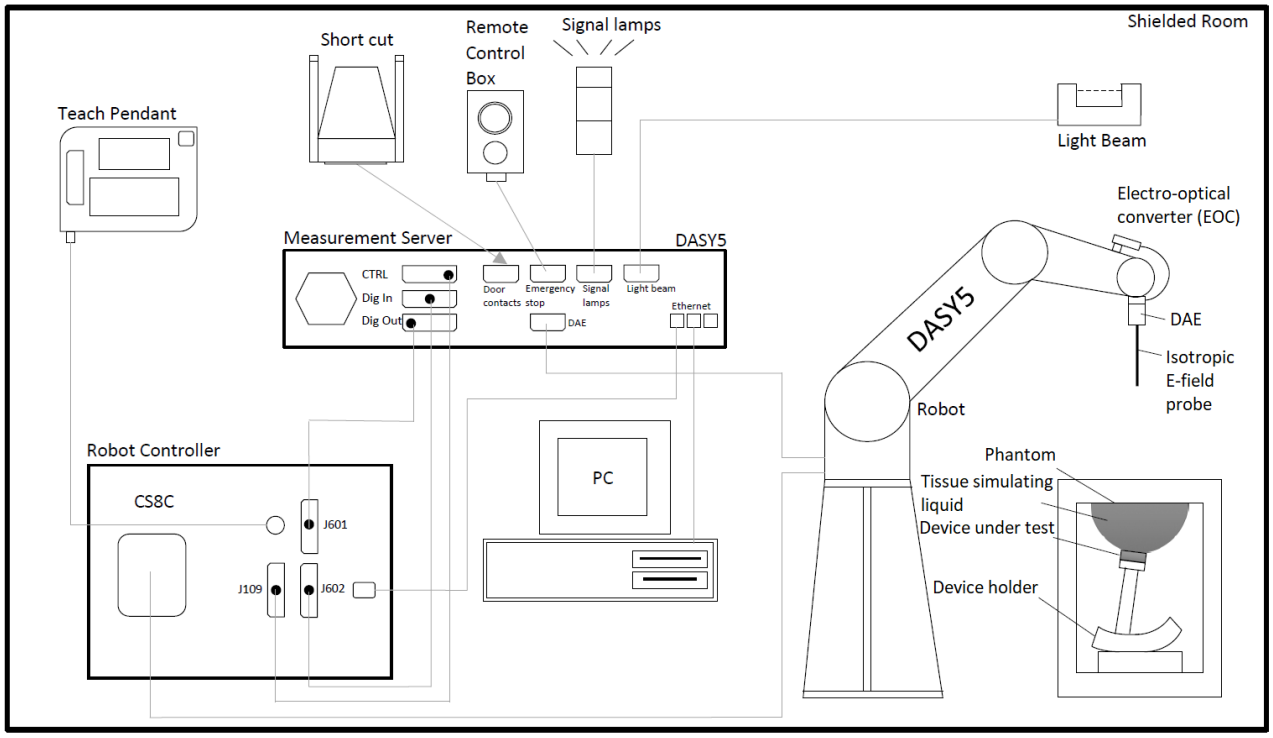


Figure 1 Schematic Laboratory Picture

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	Calibration Interval (years)
DASY5 Software	52.8.8.1258	-	NA	NA
Amplifier, 800-4200MHz, 50W	5163F	1022	NA	NA
Amplifier	5GHz	NA	NA	NA
DAE4, converter	DAE4	1332	02/2023	1
DAE4, converter	DAE4	705	04/2022	1
Inline Peak Power Sensor	MA24105A	2102058	11/2022	1
Isotropic DOS probe	EX3DV4	3852	10/2022	1
Isotropic DOS probe	EX3DV4	7447	02/2023	1
Power Sensor	NRP-Z11	100265	12/2022	1
System validation dipole	D2450V2	729	07/2022	3
System validation dipole	D5GHzV2	1045	03/2023	3
Network Analyzer	E5071C	MY46102812	05/2022	1

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

Eli Phantom:

The phantom used in SAR tests was an ELI phantom, manufactured by SPEAG. ELI phantom is used for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. The phantom conforms to the requirements of IEC/IEEE 62209-1528 and FCC published RF Exposure KDB Procedures.

4.3 Tissue Simulants

Recommended values for the dielectric parameters of the tissue simulants are given in IEC/IEEE 62209-1528 and FCC published RF Exposure KDB Procedures. The dielectric parameters of the used tissue simulants were within ±10% of the recommended values at frequencies under 3GHz and ±5% at frequencies above 3GHz. 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.

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]	Head tissue simulant
2450	D2450V2 - SN: 729	EX3DV4 - SN: 7447	CW	DAE 4 / 1332	41.26	1.71	03/2023
5250	D5GHzV2 - SN: 1045	EX3DV4 - SN: 7447	CW	DAE 4 / 1332	34.53	4.77	03/2023
5600	D5GHzV2 - SN: 1045	EX3DV4 - SN: 7447	CW	DAE 4 / 1332	34.06	5.07	03/2023
5750	D5GHzV2 - SN: 1014	EX3DV4 - SN: 7447	CW	DAE 4 / 1332	35.02	4.98	03/2023

Frequency [MHz]	Dipole Type / SN	Probe Type / SN	Calibrated Signal Type	DAE Unit / SN	Dielectric Constant [ε']	Conductivity σ [S/m]	Head tissue simulant
5250	D5GHzV2 - SN: 1014	EX3DV4 - SN: 3852	CW	DAE 4 / 710	37.44	4.66	11/2022

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 #
21.04.2023	WB HEAD	22	2450	250	12.1	52.3	48.4	-7.46	1
25.04.2023	WB HEAD	22	2450	250	12.6	52.3	50.4	-3.63	2
26.04.2023	WB HEAD	22	5250	250	7.78	73.09	77.8	6.44	3
02.05.2023	WB HEAD	22	5250	250	7.75	73.09	77.5	6.03	4
03.05.2023	WB HEAD	22	5600	250	7.94	72.92	79.4	8.89	5
04.05.2023	WB HEAD	22	5600	250	7.88	72.92	78.8	8.06	6
08.05.2023	WB HEAD	22	5750	250	7.52	69.05	75.2	8.91	7

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 [%]
21.04.2023	WB Head	22.3	2441.0	39.22	1.79	39.89	1.7	1.7	-5.0
21.04.2023	WB Head	22.3	2450.0	39.2	1.8	39.89	1.71	1.8	-5.0
25.04.2023	WB Head	22	2402.0	39.28	1.76	39.91	1.71	1.6	-2.4
25.04.2023	WB Head	22	2441.0	39.22	1.79	39.85	1.74	1.6	-2.7
25.04.2023	WB Head	22	2450.0	39.2	1.8	39.84	1.75	1.6	-2.8
25.04.2023	WB Head	22	2480.0	39.16	1.83	39.78	1.77	1.6	-3.3
26.04.2023	WB Head	21.4	5190.0	36.01	4.65	36.29	4.48	0.8	-3.7
26.04.2023	WB Head	21.4	5250.0	35.95	4.71	36.18	4.55	0.7	-3.4
26.04.2023	WB Head	21.4	5260.0	35.94	4.72	36.17	4.56	0.6	-3.4
26.04.2023	WB Head	21.4	5270.0	35.93	4.73	36.15	4.57	0.6	-3.3
26.04.2023	WB Head	21.4	5280.0	35.92	4.74	36.14	4.58	0.6	-3.4
26.04.2023	WB Head	21.4	5310.0	35.89	4.77	36.07	4.62	0.5	-3.2
26.04.2023	WB Head	21.4	5320.0	35.88	4.78	36.06	4.63	0.5	-3.2
02.05.2023	WB Head	22.3	5190.0	36.01	4.65	35.45	4.44	-1.5	-4.5
02.05.2023	WB Head	22.3	5250.0	35.95	4.71	35.33	4.51	-1.7	-4.2
02.05.2023	WB Head	22.3	5260.0	35.94	4.72	35.31	4.52	-1.7	-4.2
02.05.2023	WB Head	22.3	5270.0	35.93	4.73	35.3	4.53	-1.8	-4.1
02.05.2023	WB Head	22.3	5280.0	35.92	4.74	35.29	4.54	-1.8	-4.2
02.05.2023	WB Head	22.3	5310.0	35.89	4.77	35.22	4.57	-1.9	-4.1
02.05.2023	WB Head	22.3	5320.0	35.88	4.78	35.2	4.58	-1.9	-4.1
03.05.2023	WB Head	22	5500.0	35.65	4.96	35.43	4.82	-0.6	-2.9
03.05.2023	WB Head	22	5510.0	35.64	4.98	35.42	4.83	-0.6	-2.9
03.05.2023	WB Head	22	5580.0	35.53	5.05	35.29	4.91	-0.7	-2.7
03.05.2023	WB Head	22	5590.0	35.52	5.06	35.27	4.93	-0.7	-2.6
03.05.2023	WB Head	22	5600.0	35.5	5.07	35.25	4.94	-0.7	-2.5
03.05.2023	WB Head	22	5640.0	35.46	5.11	35.18	4.99	-0.8	-2.4
03.05.2023	WB Head	22	5670.0	35.43	5.14	35.14	5.02	-0.8	-2.4
04.05.2023	WB Head	22	5500.0	35.65	4.96	34.51	4.81	-3.2	-3.1
04.05.2023	WB Head	22	5510.0	35.64	4.98	34.49	4.82	-3.2	-3.1
04.05.2023	WB Head	22	5580.0	35.53	5.05	34.37	4.9	-3.3	-3.0
04.05.2023	WB Head	22	5590.0	35.52	5.06	34.34	4.91	-3.3	-3.0
04.05.2023	WB Head	22	5600.0	35.5	5.07	34.32	4.92	-3.3	-2.9
04.05.2023	WB Head	22	5640.0	35.46	5.11	34.26	4.97	-3.4	-2.8
04.05.2023	WB Head	22	5670.0	35.43	5.14	34.22	5.0	-3.4	-2.8
08.05.2023	WB Head	22.1	5660.0	35.44	5.13	35.54	4.99	0.3	-2.7
08.05.2023	WB Head	22.1	5745.0	35.35	5.22	35.39	5.09	0.1	-2.4
08.05.2023	WB Head	22.1	5750.0	35.35	5.22	35.38	5.1	0.1	-2.4
08.05.2023	WB Head	22.1	5755.0	35.34	5.22	35.37	5.1	0.1	-2.4
08.05.2023	WB Head	22.1	5795.0	35.3	5.26	35.31	5.14	0.0	-2.3
08.05.2023	WB Head	22.1	5825.0	35.28	5.3	35.25	5.18	-0.1	-2.3

5. TEST PROCEDURE

Testing was carried out in accordance with FCC KDB Publications 447498 D04 Interim General RF Exposure Guidance v01, 248227 D01 802.11 Wi-Fi SAR and RSS-102, Issue 5.

Low, mid and high frequency channels for the configuration with the highest SAR value were tested as per ISED notice 2016-DRS001.

The DUT was set to transmit at maximum power and duty cycle using test software.

The WLAN transmission modes for testing were selected according to largest channel bandwidth configuration, lowest order modulation and lowest data rate.
WLAN 5GHz was tested with 802.11a standard with data rate of 6Mbit/s.

The DUT runs on the Linux operating system, while the module manufacturer's test SW has been developed only for Windows and does not support Linux. Therefore, Windows PC has the same WLAN/BT module as the DUT (Intel Wi-Fi 6 AX200), thus the PC was used to control the WLAN/BT module via software. The transmission from the module goes through the RF cables to the DUT's antennas A or B. Power losses caused by the RF cables have been measured and considered in the measurements by adding the losses to the scaling factor.

Cable extension test setup

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. The device was oriented in the foreseeable use cases with top, bottom, left, right and back sides facing the phantom.

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

DASY5 Uncertainty Budget
According to IEC/IEEE 62209-1528
(Frequency band: 300MHz - 3GHz range)

Symbol	Error Description	Uncert. value	Prob. Dist.	Div.	(ci) 1g	(ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)
Measurement System Errors								
CF	Probe Calibration	±12.0%	N	√2	1	1	±6.0%	±6.0%
CF_{drift}	Probe Calibration Drift	±1.7%	R	√3	1	1	±1.0%	±1.0%
LIN	Probe Linearity	±4.7%	R	√3	1	1	±2.7%	±2.7%
BBS	Broadband Signal	±3.0%	R	√3	1	1	±1.7%	±1.7%
ISO	Probe Isotropy	±7.6%	R	3	1	1	±4.4%	±4.4%
DAE	Data Acquisition	±0.3%	N	1	1	1	±0.3%	±0.3%
AMB	RF Ambient	±1.8%	N	1	1	1	±1.8%	±1.8%
Δ_{syz}	Probe Positioning	±3.9%	N	1	0.14	0.14	±0.5%	±0.5%
DAT	Data Processing	±1.2%	N	1	1	1	±1.2%	±1.2%
Phantom and Device Errors								
LIQ(σ)	Conductivity (meas.)[DAK]	±2.5%	N	√1	0.78	0.71	±2.0%	±1.8%
$LIQ(T_\sigma)$	Conductivity (temp.)[BB]	±3.3%	R	√3	0.78	0.71	±1.5%	±1.4%
EPS	Phantom Permittivity	±14.0%	R	3	0	0	±0%	±0%
DIS	Distance DUT - TSL	±2.0%	N	1	2	2	±4.0%	±4.0%
D_{xyz}	Device Positioning (±0.5mm)	±1.0%	N	1	1	1	±1.0%	±1.0%
H	Device Holder	±3.6%	N	√1	1	1	±3.6%	±3.6%
MOD	DUT Modulation[m]	±2.4%	R	√3	1	1	±1.4%	±1.4%
TAS	Time-average SAR	±2.6%	R	3	1	1	±1.5%	±1.5%
RF_{drift}	DUT drift	±2.5%	N	1	1	1	±2.5%	±2.5%
VAL	Val Antenna Unc.[val]	±0.0%	N	1	1	1	±0%	±0%
RF_{in}	Unc. Input Power[val]	±0.0%	N	1	1	1	±0%	±0%
Correction to the SAR results								
C(ε, σ)	Deviation to Target	±1.9%	N	√1	1	0.84	±1.9%	±1.6%
C(R)	SAR scaling[p]	±0%	R	3	1	1	±0%	±0%
u(ΔSAR)	Combined Uncertainty						±11.0%	±10.9%
U	**Expanded Uncertainty**						±22.1%	±21.9%

DASY5 Uncertainty Budget

According to IEC/IEEE 62209-1528

(Frequency band: 3GHz - 6GHz range)

Symbol	Error Description	Uncert. value	Prob. Dist.	Div.	(c_i) 1g	(c_i) 10g	Std. Unc. (1g)	Std. Unc. (10g)
Measurement System Errors								
CF	Probe Calibration	±14.0%	N	√2	1	1	±7.0%	±7.0%
CF_{drift}	Probe Calibration Drift	±1.7%	N	√3	1	1	±1.0%	±1.0%
LIN	Probe Linearity	±4.7%	R	√3	1	1	±2.7%	±2.7%
BBS	Broadband Signal	±2.6%	R	√3	1	1	±1.5%	±1.5%
ISO	Probe Isotropy	±7.6%	R	3	1	1	±4.4%	±4.4%
DAE	Data Acquisition	±0.3%	N	1	1	1	±0.3%	±0.3%
AMB	RF Ambient	±1.8%	N	1	1	1	±1.8%	±1.8%
Δ_{sys}	Probe Positioning	±3.9%	N	1	0.33	0.33	±1.3%	±1.3%
DAT	Data Processing	±2.3%	N	1	1	1	±2.3%	±2.3%
Phantom and Device Errors								
LIQ(σ)	Conductivity (meas.)^{DAK}	±2.5%	N	√1	0.78	0.71	±2.0%	±1.8%
LIQ(T_σ)	Conductivity (temp.)^{BB}	±3.4%	R	√3	0.78	0.71	±1.5%	±1.4%
EPS	Phantom Permittivity	±14.0%	R	3	0.25	0.25	±2.0%	±2.0%
DIS	Distance DUT - TSL	±2.0%	N	1	2	2	±4.0%	±4.0%
D_{xyz}	Device Positioning (±0.5mm)	±1.0%	N	1	1	1	±1.0%	±1.0%
H	Device Holder	±3.6%	N	√1	1	1	±3.6%	±3.6%
MOD	DUT Modulation^{m}	±2.4%	R	√3	1	1	±1.4%	±1.4%
TAS	Time-average SAR	±2.6%	R	3	1	1	±1.5%	±1.5%
RF_{drift}	DUT drift	±2.5%	N	1	1	1	±2.5%	±2.5%
VAL	Val Antenna Unc.^{val}	±0.0%	N	1	1	1	±0%	±0%
RF_{in}	Unc. Input Power^{val}	±0.0%	N	1	1	1	±0%	±0%
Correction to the SAR results								
C(ε, σ)	Deviation to Target	±1.9%	N	√1	1	0.84	±1.9%	±1.6%
C(R)	SAR scaling^{p}	±0%	R	3	1	1	±0%	±0%
u(ΔSAR)	Combined Uncertainty						±12.0%	±11.9%
U	**Expanded Uncertainty**						±24.0%	±23.8%

7. TEST RESULTS

7.1 SAR Results for Extremity Condition with 0mm separation

Conducted Power Cable Extension = Conducted Power – Cable loss from extension cable, used for scaling the Measured SAR_{10g}.

WLAN 5GHz:

Mode	Antenna	Data Rate	Channel	Frequency [MHz]	Test position	Maximum Power [dBm]	Conducted Power [dBm]	Conducted Power Cable Extension [dBm]	Measured SAR_{10g} [W/kg]	Power Drift [dB]	Scaling Factor	Duty Cycle	Reported SAR_{10g} [W/kg	Plot #
802.11a	A	6 Mbps	52	5260	Top	20	20.05	16.13	0.061	0.41*	2.68	1:1	0.16	
802.11a	A	6 Mbps	52	5260	Bottom	20	20.05	16.13	0.031	-0.45*	2.70	1:1	0.08	
802.11a	A	6 Mbps	52	5260	Left	20	20.05	16.13	0.004	-0.18	2.44	1:1	0.01	
802.11a	A	6 Mbps	52	5260	Right	20	20.05	16.13	0.98	-0.22*	2.56	1:1	2.52	
802.11a	A	6 Mbps	52	5260	Back	20	20.05	16.13	0.00	0.52*	2.75	1:1	0.00	
802.11a	A	6 Mbps	56	5280	Right	20	19.94	15.97	0.94	-0.29*	2.70	1:1	2.54	8
802.11a	A	6 Mbps	64	5320	Right	17.25	16.99	12.98	0.49	-0.14	2.67	1:1	1.31	

*Larger than 5% drifts included to scaling factors

Mode	Antenna	Data Rate	Channel	Frequency [MHz]	Test position	Maximum Power [dBm]	Conducted Power [dBm]	Conducted Power Cable Extension [dBm]	Measured SAR_{10g} [W/kg]	Power Drift [dB]	Scaling Factor	Duty Cycle	Reported SAR_{10g} [W/kg	Plot #
802.11a	B	6 Mbps	52	5260	Top	20	20.11	16.19	0.149	0.41*	2.64	1:1	0.39	
802.11a	B	6 Mbps	52	5260	Bottom	20	20.11	16.19	0.017	0.43*	2.65	1:1	0.04	
802.11a	B	6 Mbps	52	5260	Left	20	20.11	16.19	0.85	-0.2	2.40	1:1	2.04	9
802.11a	B	6 Mbps	52	5260	Right	20	20.11	16.19	N/A***	N/A**	2.40	1:1	0	
802.11a	B	6 Mbps	52	5260	Back	20	20.11	16.19	0.046	0.2	2.40	1:1	0.11	
802.11a	B	6 Mbps	56	5280	Left	20	20.2	16.23	0.686	-0.14	2.38	1:1	1.63	
802.11a	B	6 Mbps	64	5320	Left	17.25	17.33	13.32	0.442	-0.22*	2.60	1:1	1.15	

*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
*** SAR is below the detection limit of the test system

Mode	Antenna	Data Rate	Channel	Frequency [MHz]	Test position	Maximum Power [dBm]	Conducted Power [dBm]	Conducted Power Cable Extension [dBm]	Measured SAR_{10g} [W/kg]	Power Drift [dB]	Scaling Factor	Duty Cycle	Reported SAR_{10g} [W/kg	Plot #
802.11a	A	6 Mbps	116	5580	Top	20	20.18	16.37	0.113	0.49*	2.58	1:1	0.29	
802.11a	A	6 Mbps	116	5580	Bottom	20	20.18	16.37	0.042	1.33*	3.13	1:1	0.13	
802.11a	A	6 Mbps	116	5580	Left	20	20.18	16.37	0.052	-0.13	2.31	1:1	0.12	
802.11a	A	6 Mbps	116	5580	Right	20	20.18	16.37	0.84	0.44*	2.55	1:1	2.14	
802.11a	A	6 Mbps	116	5580	Back	20	20.18	16.37	0.026	0.61*	2.65	1:1	0.07	
802.11a	A	6 Mbps	100	5500	Right	18.5	18.58	14.64	0.537	0.53*	2.75	1:1	1.48	
802.11a	A	6 Mbps	128	5640	Right	20	20.25	16.44	0.953	0.43*	2.51	1:1	2.39	10

*Larger than 5% drifts included to scaling factors

Mode	Antenna	Data Rate	Channel	Frequency [MHz]	Test position	Maximum Power [dBm]	Conducted Power [dBm]	Conducted Power Cable Extension [dBm]	Measured SAR_{10g} [W/kg]	Power Drift [dB]	Scaling Factor	Duty Cycle	Reported SAR_{10g} [W/kg	Plot #
802.11a	B	6 Mbps	116	5580	Top	20	20.38	16.57	0.264	0.33*	2.38	1:1	0.63	
802.11a	B	6 Mbps	116	5580	Bottom	20	20.38	16.57	0.007	N/A**	3.81	1:1	0.03	
802.11a	B	6 Mbps	116	5580	Left	20	20.38	16.57	0.963	-0.19	2.20	1:1	2.12	11
802.11a	B	6 Mbps	116	5580	Right	20	20.38	16.57	0.043	1.03*	2.79	1:1	0.12	
802.11a	B	6 Mbps	116	5580	Back	20	20.38	16.57	0.007	0.44*	2.44	1:1	0.02	
802.11a	B	6 Mbps	100	5500	Left	18.5	18.72	14.78	0.744	-0.17	2.36	1:1	1.75	
802.11a	B	6 Mbps	128	5640	Left	20	20.21	16.4	0.925	-0.21	2.29	1:1	2.12	

*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

Mode	Antenna	Data Rate	Channel	Frequency [MHz]	Test position	Maximum Power [dBm]	Conducted Power [dBm]	Conducted Power Cable Extension [dBm]	Measured SAR_{10g} [W/kg]	Power Drift [dB]	Scaling Factor	Duty Cycle	Reported SAR_{10g} [W/kg	Plot #
802.11a	A	6 Mbps	132	5660	Top	20	20.09	16.28	0.137	0.42*	2.59	1:1	0.36	
802.11a	A	6 Mbps	132	5660	Bottom	20	20.09	16.28	0.031	0.13	2.36	1:1	0.07	
802.11a	A	6 Mbps	132	5660	Left	20	20.09	16.28	0.024	0.37*	2.56	1:1	0.06	
802.11a	A	6 Mbps	132	5660	Right	20	20.09	16.28	1.050	0.36*	2.56	1:1	2.69	
802.11a	A	6 Mbps	132	5660	Back	20	20.09	16.28	0.018	0.95*	2.93	1:1	0.05	
802.11a	A	6 Mbps	149	5745	Right	20	19.96	16.11	0.990	0.61*	2.82	1:1	2.79	12
802.11a	A	6 Mbps	165	5825	Right	20	20.03	16.02	0.879	0.55*	2.84	1:1	2.49	

*Larger than 5% drifts included to scaling factors

Mode	Antenna	Data Rate	Channel	Frequency [MHz]	Test position	Maximum Power [dBm]	Conducted Power [dBm]	Conducted Power Cable Extension [dBm]	Measured SAR_{10g} [W/kg]	Power Drift [dB]	Scaling Factor	Duty Cycle	Reported SAR_{10g} [W/kg	Plot #
802.11a	B	6 Mbps	132	5660	Top	20	20.19	16.38	0.241	0.09	2.30	1:1	0.55	
802.11a	B	6 Mbps	132	5660	Bottom	20	20.19	16.38	0.004	-0.37*	2.51	1:1	0.01	
802.11a	B	6 Mbps	132	5660	Left	20	20.19	16.38	0.886	-0.09	2.30	1:1	2.04	13
802.11a	B	6 Mbps	132	5660	Right	20	20.19	16.38	0.032	-0.43*	2.54	1:1	0.08	
802.11a	B	6 Mbps	132	5660	Back	20	20.19	16.38	0.065	0.46*	2.56	1:1	0.17	
802.11a	B	6 Mbps	149	5745	Left	20	19.99	16.14	0.742	-0.01	2.43	1:1	1.80	
802.11a	B	6 Mbps	165	5825	Left	20	20.15	16.14	0.685	-0.01	2.43	1:1	1.67	

*Larger than 5% drifts included to scaling factors

Bluetooth:

Mode	Data Rate	Channel	Frequency [MHz]	Test position	Maximum Power [dBm]	Conducted Power [dBm]	Conducted Power Cable Extension [dBm]	Measured SAR_{10g} [W/kg]	Power Drift [dB]	Scaling Factor	Duty Cycle	Reported SAR_{10g} [W/kg]	Plot #
Bluetooth BR	1 Mbps	78	2480	Top	11.2	9.97	7.18	0.000002	0	2.52	1:1	0.00001	
Bluetooth BR	1 Mbps	78	2480	Bottom	11.2	9.97	7.18	0.00001**	0	2.52	1:1	0	
Bluetooth BR	1 Mbps	78	2480	Left	11.2	9.97	7.18	0.00000015	0	2.52	1:1	0.0000004	
Bluetooth BR	1 Mbps	78	2480	Right	11.2	9.97	7.18	0.00108	0	2.52	1:1	0.003	
Bluetooth BR	1 Mbps	78	2480	Back	11.2	9.97	7.18	0.00003**	0	2.52	1:1	0	
Bluetooth BR	1 Mbps	0	2402	Right	11.2	9.71	7.11	0.00398	-1.39*	3.53	1:1	0.014	14
Bluetooth BR	1 Mbps	39	2441	Right	11.2	9.63	6.93	0.000837	0	2.67	1:1	0.00224	

*Larger than 5% drifts included to scaling factors
** Measured results of the area scan was below the dynamic range of the E-field Probe Type EX3DV4 thus zoom scan could not be measured. Area scan result was presented.

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%.

Zoom scan compliance according to IEC 62209-2 AMD1:2019 is automatically verified by DASY5 software and all zoom scans in this test report do pass the criteria. The smallest horizontal distance and Ratio between measurement points M2 and M1 of the highest SAR results is available in Appendix C.

7.3 Simultaneous Transmission Analysis

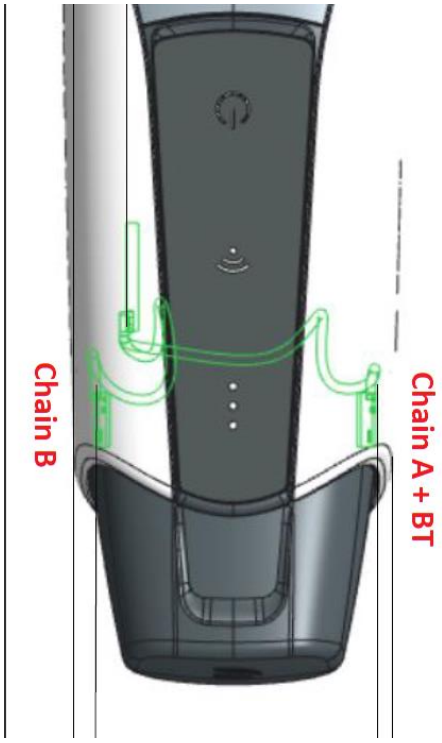
Simultaneous transmission analysis for the maximum WLAN Antenna A SAR, maximum WLAN SAR Antenna B and maximum Bluetooth SAR is in the table below. Direct summation of SAR results was performed.

Extremity SAR:

	Exposure Condition	Limb SAR_{10g} [W/kg]				
	Test Position	**Top**	**Bottom**	**Left**	**Right**	**Back**
Antenna A	**WLAN 5GHz**	0.36	0.13	0.12	2.79	0.07
	Bluetooth BR	0.00001	0.00003	0.0000004	0.014	0.00008
Maximum SAR Antenna A		**0.36**	**0.13**	**0.12**	**2.79**	**0.07**
Antenna B	**WLAN 5GHz**	0.63	0.04	2.12	0.12	0.17
SAR Summation: EN 62209-1 6.4.3.2.2 Alternative 1		**0.99**	**0.17**	**2.24**	**2.91**	**0.24**

APPENDIX A: PHOTOS OF THE DUT

Size of the DUT is: 290 x 45 x 55 mm



Antenna locations of the DUT

Top side of the DUT against the phantom, 0mm separation distance

Bottom side of the DUT against the phantom, 0mm separation distance

Left side of the DUT against the phantom, 0mm separation distance

Right side of the DUT against the phantom, 0mm separation distance

Back side of the DUT against the phantom, 0mm separation distance

APPENDIX B: SYSTEM CHECK SCAN

Plot 1

Date/Time: 21.4.23 11:21:18

Test Laboratory: Verkotan Oy

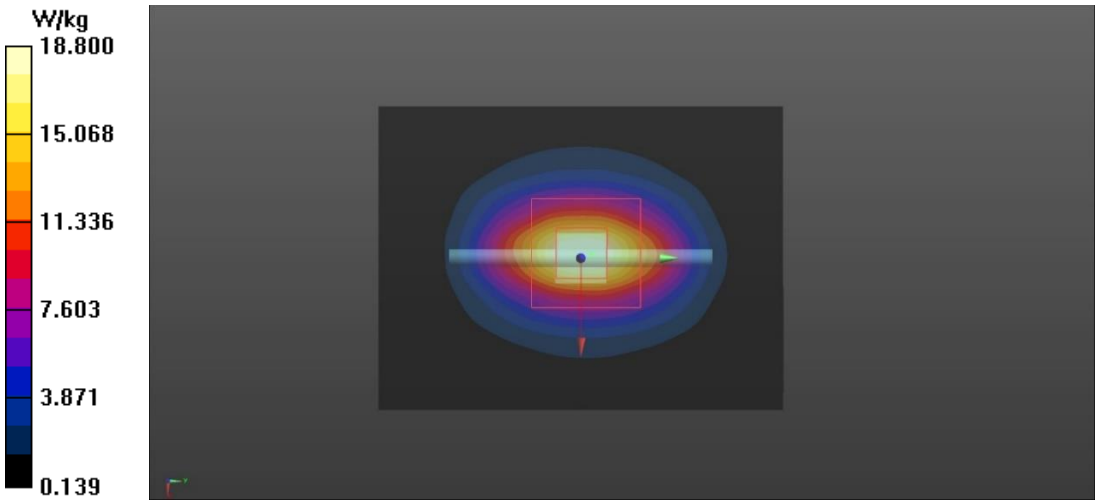
DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:729

Communication System: UID 0, CW (0); Communication System Band: D2450 (2450.0 MHz); Frequency: 2450 MHz;
Communication System PAR: 0 dB;
Medium parameters used (interpolated): f = 2450 MHz; σ = 1.709 S/m; ε_r = 39.887; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(7.48, 7.48, 7.48) @ 2450 MHz; Calibrated: 27.10.22
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/system check 2450Mhz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 111.7 V/m; Power Drift = -0.25 dB
Peak SAR (extrapolated) = 22.8 W/kg
SAR(1 g) = 12.1 W/kg; SAR(10 g) = 5.69 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 9 mm
Ratio of SAR at M2 to SAR at M1 = 51.9%
Maximum value of SAR (measured) = 18.8 W/kg
Configuration/system check 2450Mhz/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 20.3 W/kg



Plot 2

Date/Time: 25.4.23 13:02:11

Test Laboratory: Verkotan Oy

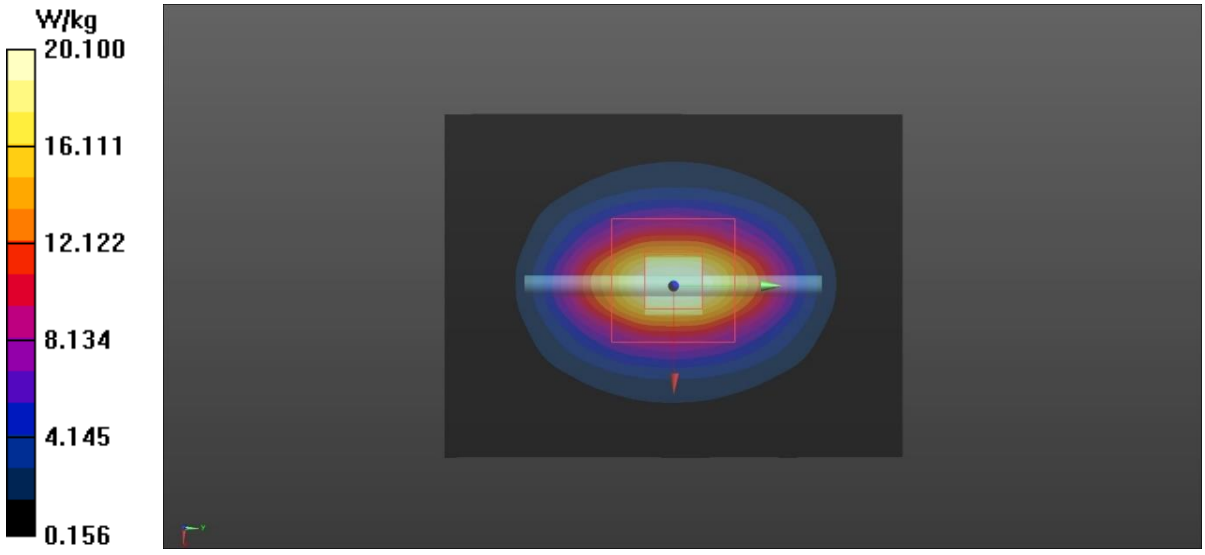
DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:729

Communication System: UID 0, CW (0); Communication System Band: D2450 (2450.0 MHz); Frequency: 2450 MHz;
Communication System PAR: 0 dB;
Medium parameters used (interpolated): f = 2450 MHz; σ = 1.75 S/m; ε_r = 39.837; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(7.48, 7.48, 7.48) @ 2450 MHz; Calibrated: 27.10.22
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/system check 2450Mhz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 114.5 V/m; Power Drift = -0.20 dB
Peak SAR (extrapolated) = 24.3 W/kg
SAR(1 g) = 12.6 W/kg; SAR(10 g) = 5.96 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 9 mm
Ratio of SAR at M2 to SAR at M1 = 51.5%
Maximum value of SAR (measured) = 20.1 W/kg
Configuration/system check 2450Mhz/Area Scan (61x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 20.9 W/kg



Plot 3

Date/Time: 26.4.23 13:25:42

Test Laboratory: Verkotan Oy

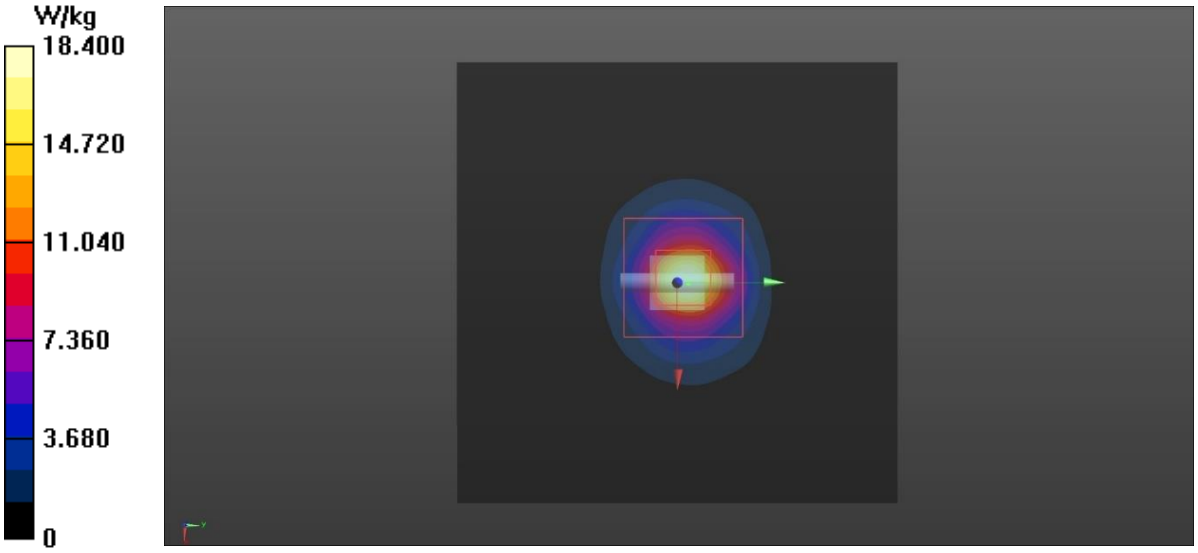
DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1045

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5250 MHz;
Communication System PAR: 0 dB;
Medium parameters used (interpolated): f = 5250 MHz; σ = 4.55 S/m; ε_r = 36.184; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(4.9, 4.9, 4.9) @ 5250 MHz; Calibrated: 27.10.22
  - 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 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/system check 5250MHz/Area Scan (81x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 18.4 W/kg
Configuration/system check 5250MHz/Zoom Scan (7x7x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 70.71 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 29.3 W/kg
SAR(1 g) = 7.78 W/kg; SAR(10 g) = 2.23 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 6.8 mm
Ratio of SAR at M2 to SAR at M1 = 66.8%
Maximum value of SAR (measured) = 18.7 W/kg



Plot 4

Date/Time: 2.5.23 09:29:41

Test Laboratory: Verkotan Oy

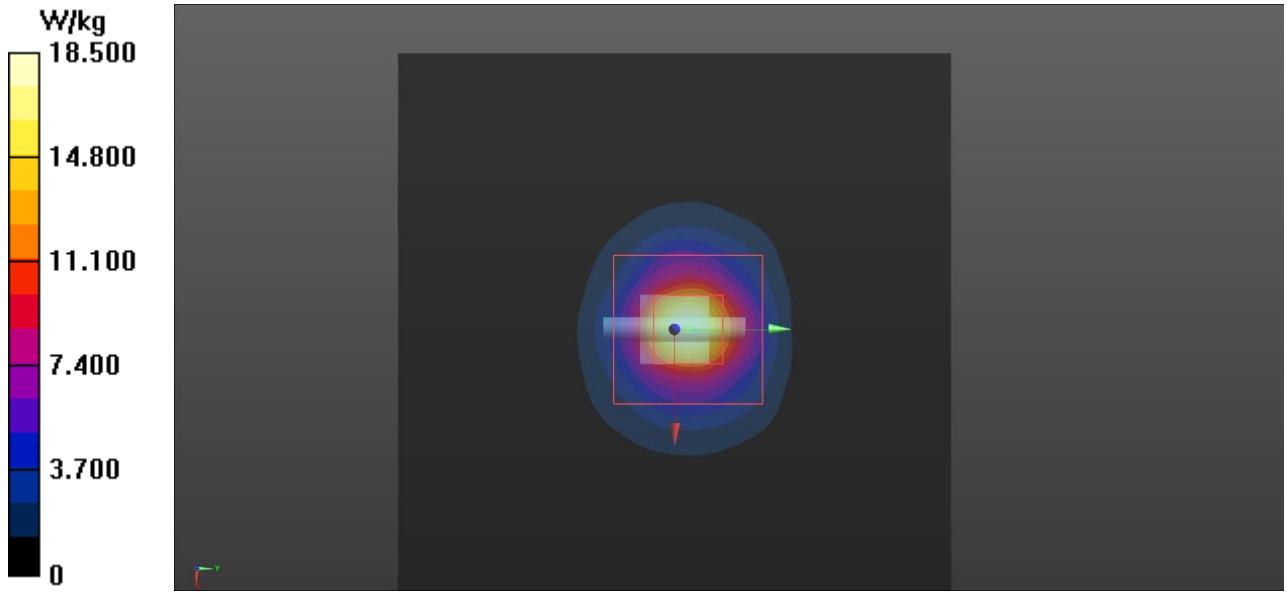
DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1045

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5250 MHz;
Communication System PAR: 0 dB;
Medium parameters used (interpolated): f = 5250 MHz; σ = 4.511 S/m; ε_r = 35.329; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(5.18, 4.99, 5.17) @ 5250 MHz; Calibrated: 17.2.23
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 25.0
  - Electronics: DAE4 Sn1332; Calibrated: 15.2.23
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/system check 5250MHz/Area Scan (81x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 18.5 W/kg
Configuration/system check 5250MHz/Zoom Scan (7x7x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 71.58 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 29.8 W/kg
SAR(1 g) = 7.75 W/kg; SAR(10 g) = 2.23 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 7.1 mm
Ratio of SAR at M2 to SAR at M1 = 66.4%
Maximum value of SAR (measured) = 19.4 W/kg



Plot 5

Date/Time: 3.5.23 09:44:37

Test Laboratory: Verkotan Oy

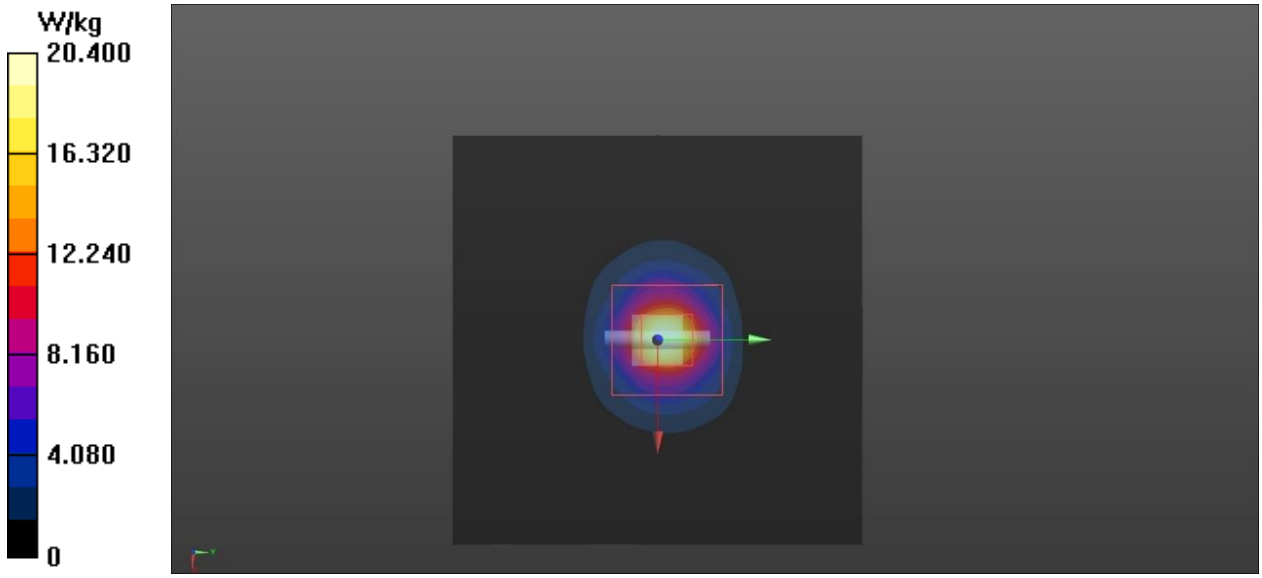
DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1045

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5600 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 5600 MHz; σ = 4.941 S/m; ε_r = 35.252; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(4.4, 4.29, 4.43) @ 5600 MHz; Calibrated: 17.2.23
  - 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 Sn1332; Calibrated: 15.2.23
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/system check 5600MHz/Zoom Scan (7x7x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 71.31 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 33.2 W/kg
SAR(1 g) = 7.94 W/kg; SAR(10 g) = 2.27 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 63.6%
Maximum value of SAR (measured) = 20.4 W/kg
Configuration/system check 5600MHz/Area Scan (81x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 19.9 W/kg



Plot 6

Date/Time: 4.5.23 10:07:33

Test Laboratory: Verkotan Oy

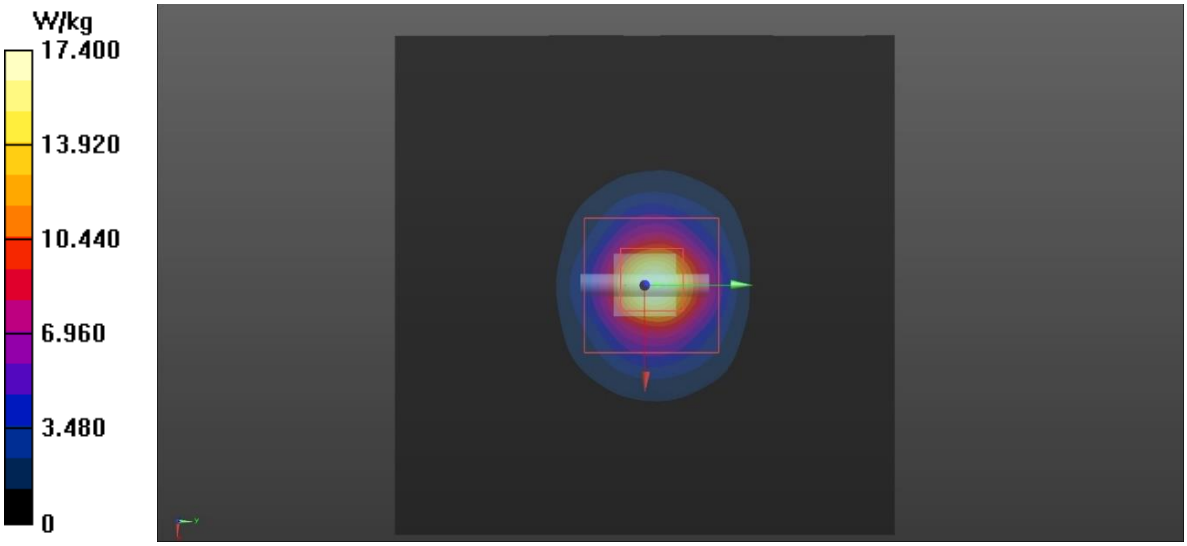
DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1045

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5600 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 5600 MHz; σ = 4.923 S/m; ε_r = 34.323; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(4.61, 4.61, 4.61) @ 5600 MHz; Calibrated: 27.10.22
  - 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 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

probe 3852/system check 5600MHz/Area Scan (81x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 17.4 W/kg
probe 3852/system check 5600MHz/Zoom Scan (7x7x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 69.77 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 32.3 W/kg
SAR(1 g) = 7.88 W/kg; SAR(10 g) = 2.23 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 7.1 mm
Ratio of SAR at M2 to SAR at M1 = 64.4%
Maximum value of SAR (measured) = 20.1 W/kg



Plot 7

Date/Time: 8.5.23 09:04:20

Test Laboratory: Verkotan Oy

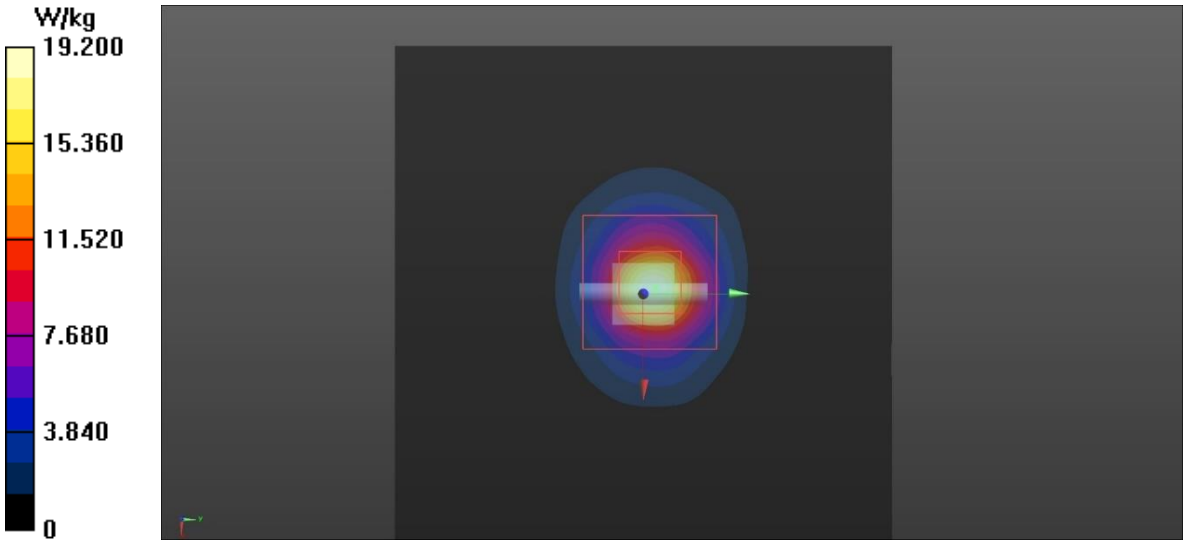
DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1045

Communication System: UID 0, CW (0); Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5750 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 5750 MHz; σ = 5.096 S/m; ε_r = 35.379; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(4.65, 4.65, 4.65) @ 5750 MHz; Calibrated: 27.10.22
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 25.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/system check 5750MHz/Zoom Scan (7x7x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 68.54 V/m; Power Drift = -0.32 dB
Peak SAR (extrapolated) = 31.8 W/kg
SAR(1 g) = 7.52 W/kg; SAR(10 g) = 2.12 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 7.4 mm
Ratio of SAR at M2 to SAR at M1 = 62.7%
Maximum value of SAR (measured) = 19.2 W/kg
Configuration/system check 5750MHz/Area Scan (81x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 19.0 W/kg



APPENDIX C: MEASUREMENT SCANS

Plot 8

Date/Time: 27.4.23 12:16:22

Test Laboratory: Verkotan Oy

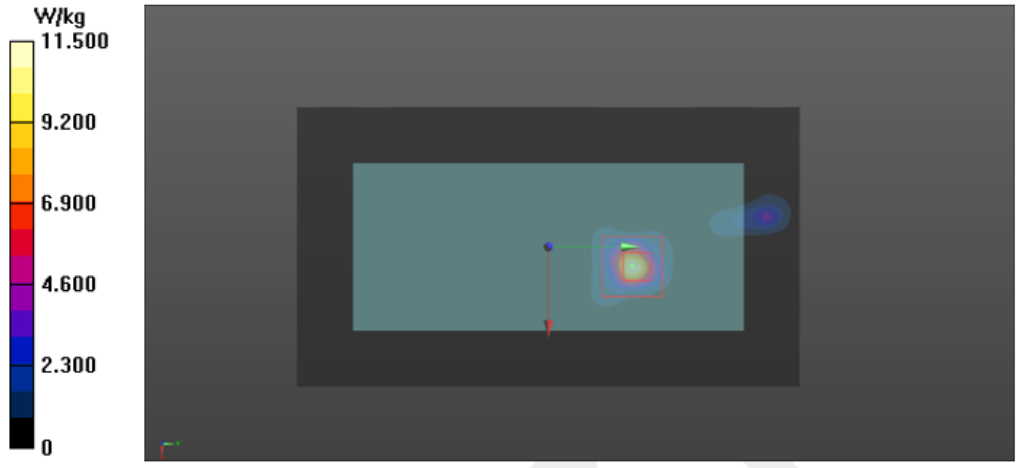
DUT: Sirona Primescan 2

Communication System: UID 0, WLAN5GHz (0); Communication System Band: 5GHz; Frequency: 5280 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 5280 MHz; σ = 4.579 S/m; ε_r = 36.137; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(4.9, 4.9, 4.9) @ 5280 MHz; Calibrated: 27.10.22
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), z = 31.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/FCC WLAN 5GHz 802.11a BW20MHz, DataRate 6Mbps, CH56 Chain A, Right/Zoom Scan (7x7x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 16.27 V/m; Power Drift = -0.29 dB
Peak SAR (extrapolated) = 20.3 W/kg
SAR(1 g) = 4.3 W/kg; SAR(10 g) = 0.941 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 4.5 mm
Ratio of SAR at M2 to SAR at M1 = 65.5%
Maximum value of SAR (measured) = 11.5 W/kg
Configuration/FCC WLAN 5GHz 802.11a BW20MHz, DataRate 6Mbps, CH56 Chain A, Right/Area Scan (101x181x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 10.3 W/kg



Plot 9

Date/Time: 28.4.23 11:08:34

Test Laboratory: Verkotan Oy

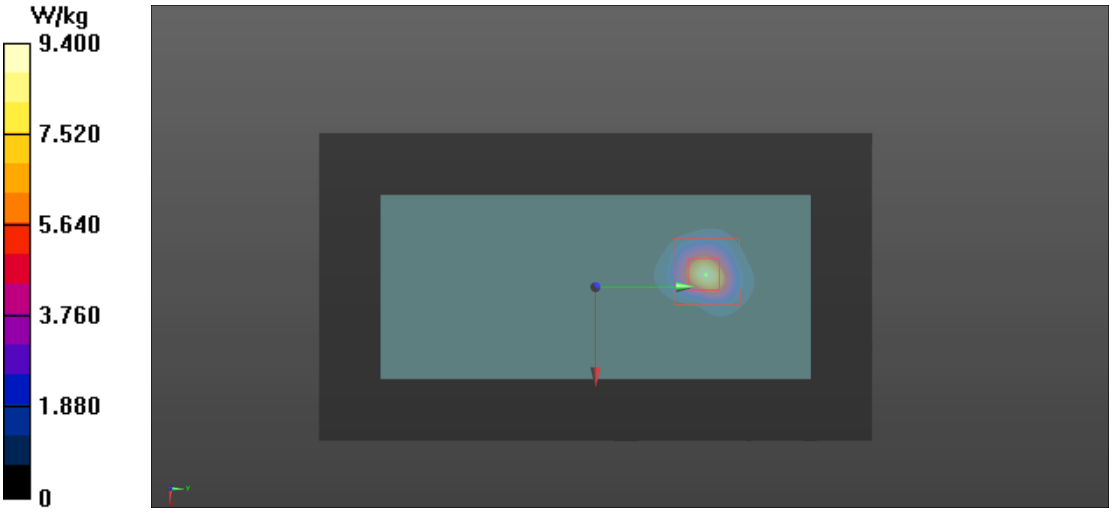
DUT: Sirona Primescan 2

Communication System: UID 0, WLAN5GHz (0); Communication System Band: 5GHz; Frequency: 5260 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 5260 MHz; σ = 4.561 S/m; ε_r = 36.166; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(4.9, 4.9, 4.9) @ 5260 MHz; Calibrated: 27.10.22
  - 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 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/FCC WLAN 5GHz 802.11a BW20MHz, DataRate 6Mbps, CH52 Chain B, Left/Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 31.74 V/m; Power Drift = -0.20 dB
Peak SAR (extrapolated) = 15.4 W/kg
SAR(1 g) = 3.53 W/kg; SAR(10 g) = 0.850 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 4.9 mm
Ratio of SAR at M2 to SAR at M1 = 65%
Maximum value of SAR (measured) = 9.40 W/kg
Configuration/FCC WLAN 5GHz 802.11a BW20MHz, DataRate 6Mbps, CH52 Chain B, Left/Area Scan (101x181x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 6.09 W/kg



Plot 10

Date/Time: 4.5.23 13:43:12

Test Laboratory: Verkotan Oy

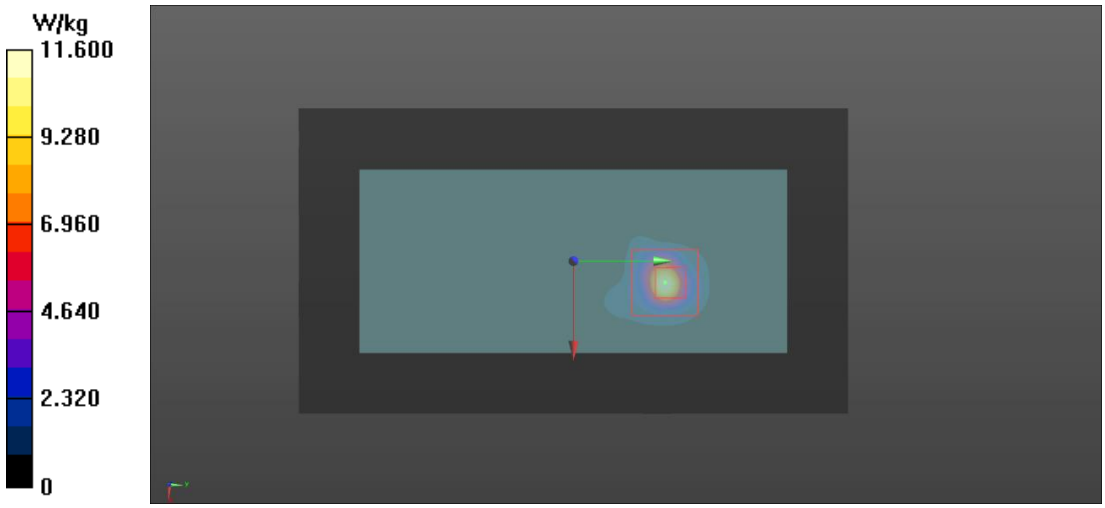
DUT: Sirona Primescan 2

Communication System: UID 0, WLAN5GHz (0); Communication System Band: 5GHz; Frequency: 5640 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 5640 MHz; σ = 4.969 S/m; ε_r = 34.256; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(4.61, 4.61, 4.61) @ 5640 MHz; Calibrated: 27.10.22
  - 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 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/FCC WLAN 5GHz 802.11a BW20MHz, DataRate 6Mbps, CH128Chain A, Right 2/Area Scan (101x181x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 11.6 W/kg
Configuration/FCC WLAN 5GHz 802.11a BW20MHz, DataRate 6Mbps, CH128Chain A, Right 2/Zoom Scan (7x7x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 15.28 V/m; Power Drift = 0.43 dB
Peak SAR (extrapolated) = 22.3 W/kg
SAR(1 g) = 4.17 W/kg; SAR(10 g) = 0.953 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 4.8 mm
Ratio of SAR at M2 to SAR at M1 = 63.6%
Maximum value of SAR (measured) = 11.2 W/kg



Plot 11

Date/Time: 4.5.23 16:13:39

Test Laboratory: Verkotan Oy

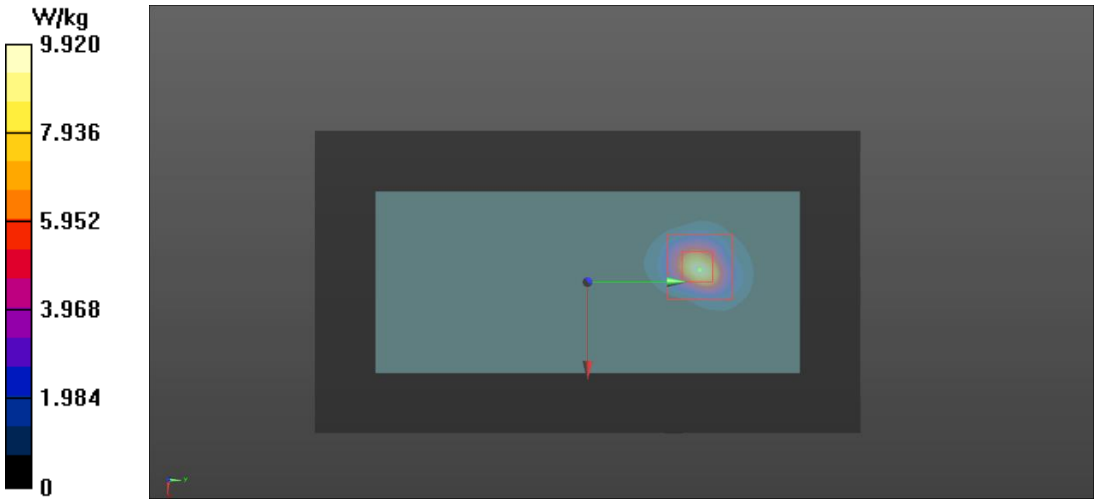
DUT: Sirona Primescan 2

Communication System: UID 0, WLAN5GHz (0); Communication System Band: 5GHz; Frequency: 5580 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 5580 MHz; σ = 4.896 S/m; ε_r = 34.37; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(4.61, 4.61, 4.61) @ 5580 MHz; Calibrated: 27.10.22
  - 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 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/FCC WLAN 5GHz 802.11a BW20MHz, DataRate 6Mbps, CH116 Chain B, Left/Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 32.45 V/m; Power Drift = -0.20 dB
Peak SAR (extrapolated) = 16.4 W/kg
SAR(1 g) = 3.8 W/kg; SAR(10 g) = 0.963 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 5.6 mm
Ratio of SAR at M2 to SAR at M1 = 65.1%
Maximum value of SAR (measured) = 9.92 W/kg
Configuration/FCC WLAN 5GHz 802.11a BW20MHz, DataRate 6Mbps, CH116 Chain B, Left/Area Scan (101x181x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 8.82 W/kg



Plot 12

Date/Time: 9.5.23 18:00:48

Test Laboratory: Verkotan Oy

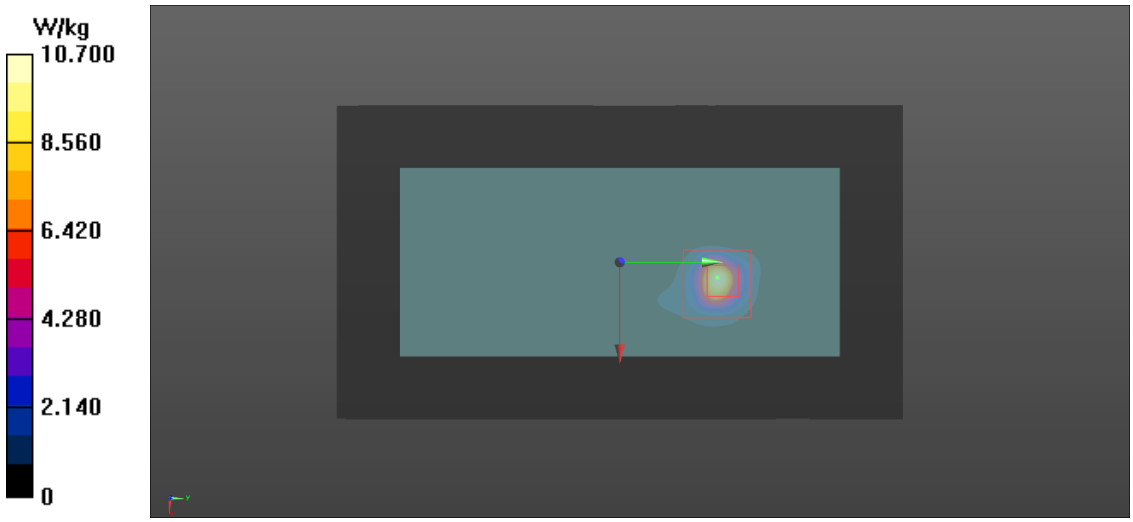
DUT: Sirona Primescan 2

Communication System: UID 0, WLAN5GHz (0); Communication System Band: 5GHz; Frequency: 5745 MHz;
Communication System PAR: 0 dB;
Medium parameters used (interpolated): f = 5745 MHz; σ = 5.09 S/m; ε_r = 35.386; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(4.65, 4.65, 4.65) @ 5745 MHz; Calibrated: 27.10.22
  - 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 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/FCC WLAN 5GHz 802.11a BW20MHz, DataRate 6Mbps, CH149 Chain A, Right/Area Scan (101x181x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 10.7 W/kg
Configuration/FCC WLAN 5GHz 802.11a BW20MHz, DataRate 6Mbps, CH149 Chain A, Right/Zoom Scan (9x9x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 14.18 V/m; Power Drift = 0.61 dB
Peak SAR (extrapolated) = 27.8 W/kg
SAR(1 g) = 4.88 W/kg; SAR(10 g) = 0.990 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 4 mm
Ratio of SAR at M2 to SAR at M1 = 62.4%
Maximum value of SAR (measured) = 14.0 W/kg



Plot 13

Date/Time: 9.5.23 11:26:44

Test Laboratory: Verkotan Oy

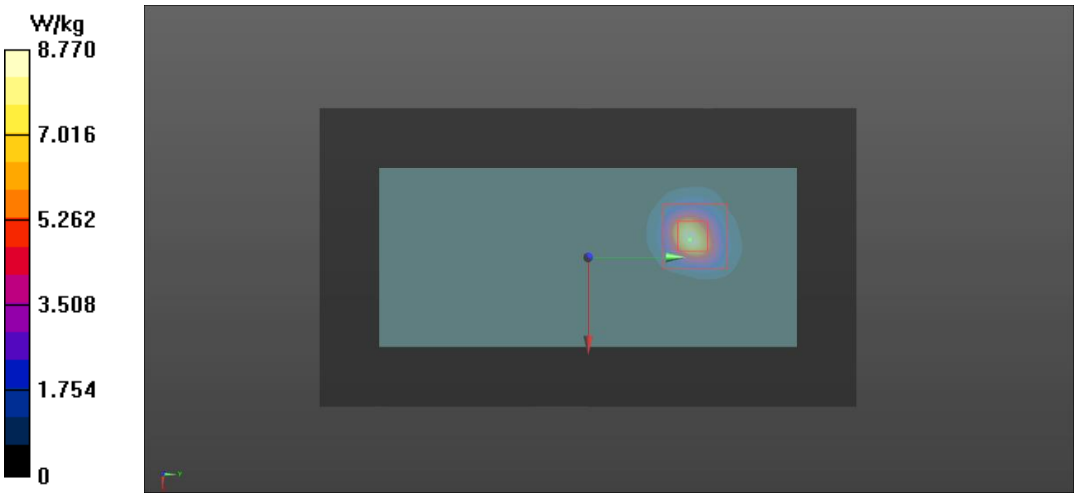
DUT: Sirona Primescan 2

Communication System: UID 0, WLAN5GHz (0); Communication System Band: 5GHz; Frequency: 5660 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 5660 MHz; σ = 4.993 S/m; ε_r = 35.537; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(4.61, 4.61, 4.61) @ 5660 MHz; Calibrated: 27.10.22
  - 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 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/FCC WLAN 5GHz 802.11a BW20MHz, DataRate 6Mbps, CH132 Chain B, Left/Area Scan (101x181x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 8.77 W/kg
Configuration/FCC WLAN 5GHz 802.11a BW20MHz, DataRate 6Mbps, CH132 Chain B, Left/Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 39.15 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 15.0 W/kg
SAR(1 g) = 3.46 W/kg; SAR(10 g) = 0.886 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 5.6 mm
Ratio of SAR at M2 to SAR at M1 = 63.3%
Maximum value of SAR (measured) = 9.12 W/kg



Plot 14

Date/Time: 26.4.23 11:09:27

Test Laboratory: Verkotan Oy

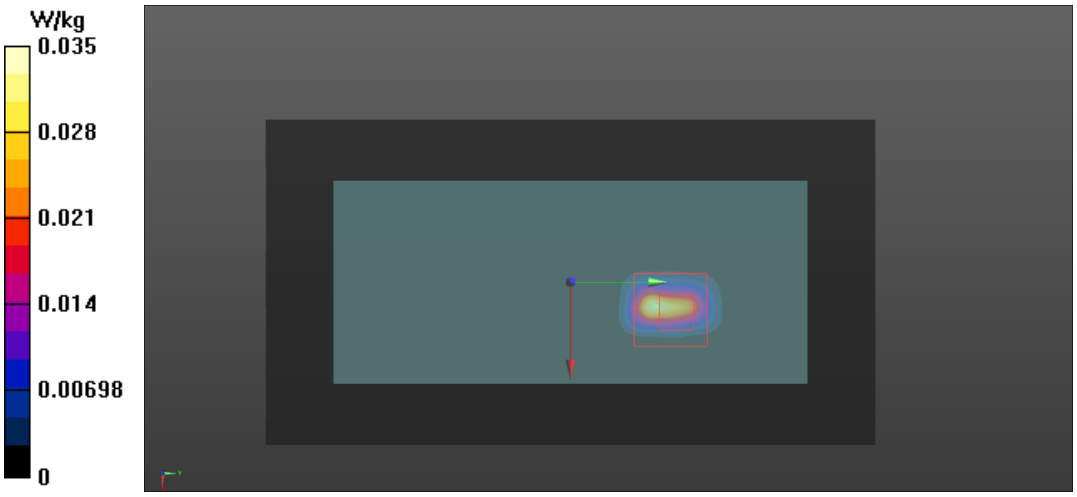
DUT: Sirona Primescan 2

Communication System: UID 0, Bluetooth (0); Communication System Band: Bluetooth; Frequency: 2402 MHz;
Communication System PAR: 3.98 dB;
Medium parameters used (interpolated): f = 2402 MHz; σ = 1.715 S/m; ε_r = 39.906; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(7.48, 7.48, 7.48) @ 2402 MHz; Calibrated: 27.10.22
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), z = 31.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.22
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/Bluetooth CH0 Data rate 1Mbps Right/Zoom Scan (7x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.8340 V/m; Power Drift = -1.39 dB
Peak SAR (extrapolated) = 0.0530 W/kg
SAR(1 g) = 0.017 W/kg; SAR(10 g) = 0.00398 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid
Ratio of SAR at M2 to SAR at M1 = 38.4%
Maximum value of SAR (measured) = 0.0349 W/kg
Configuration/Bluetooth CH0 Data rate 1Mbps Right/Area Scan (81x151x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.0902 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
S 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: EX-3852_Oct22

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3852
Calibration procedure(s)	QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v6, QA CAL-23.v5, QA CAL-25.v7 Calibration procedure for dosimetric E-field probes
Calibration date	October 27, 2022

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	04-Apr-22 (No. 217-03525/03524)	Apr-23
Power sensor NRP-Z91	SN: 103244	04-Apr-22 (No. 217-03524)	Apr-23
OCP DAK-3.5 (weighted)	SN: 1249	20-Oct-22 (OCP-DAK3.5-1249_Oct22)	Oct-23
OCP DAK-12	SN: 1016	20-Oct-22 (OCP-DAK12-1016_Oct22)	Oct-23
Reference 20 dB Attenuator	SN: CC2552 (20x)	04-Apr-22 (No. 217-03527)	Apr-23
DAE4	SN: 660	10-Oct-22 (No. DAE4-660_Oct22)	Oct-23
Reference Probe ES3DV2	SN: 3013	27-Dec-21 (No. ES3-3013_Dec21)	Dec-22

Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-22)	In house check: Jun-24
Power sensor E4412A	SN: MY41496087	06-Apr-16 (in house check Jun-22)	In house check: Jun-24
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-22)	In house check: Jun-24
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-22)	In house check: Jun-24
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

	Name	Function	Signature
Calibrated by	Michael Weber	Laboratory Technician	
Approved by	Sven Kühn	Technical Manager	

Issued: October 27, 2022

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

Certificate No: EX-3852_Oct22 Page 1 of 9

Parameters of Probe: EX3DV4 - SN:3852

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc ($k = 2$)
Norm ($\mu V/(V/m)^2$) [A]	0.41	0.39	0.46	±10.1%
DCP (mV) [B]	99.8	98.2	99.9	±4.7%

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB$\sqrt{\mu V}$	C	D dB	VR mV	Max dev.	Max Unc[E] $k = 2$
0	CW	X	0.00	0.00	1.00	0.00	147.5	±2.5%	±4.7%
		Y	0.00	0.00	1.00		138.0		
		Z	0.00	0.00	1.00		137.1		

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

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

Parameters of Probe: EX3DV4 - SN:3852

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle	126.7°
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

Note: Measurement distance from surface can be increased to 3–4 mm for an *Area Scan* job.

Parameters of Probe: EX3DV4 - SN:3852

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz)[C]	Relative Permittivity[F]	Conductivity[F] (S/m)	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unc ($k = 2$)
6	55.0	0.75	15.18	15.18	15.18	0.00	1.00	±13.3%
30	55.0	0.75	13.34	13.34	13.34	0.00	1.00	±13.3%
64	54.2	0.75	11.88	11.88	11.88	0.00	1.00	±13.3%
128	52.8	0.76	11.57	11.57	11.57	0.00	1.00	±13.3%
220	49.0	0.81	10.92	10.92	10.92	0.00	1.00	±13.3%
450	43.5	0.87	10.20	10.20	10.20	0.16	1.30	±13.3%
900	41.5	0.97	8.82	8.82	8.82	0.44	0.94	±12.0%
1300	40.8	1.14	8.54	8.54	8.54	0.27	1.22	±12.0%
1450	40.5	1.20	8.63	8.63	8.63	0.39	0.80	±12.0%
1640	40.2	1.31	8.33	8.33	8.33	0.34	0.90	±12.0%
1810	40.0	1.40	7.90	7.90	7.90	0.38	0.90	±12.0%
1900	40.0	1.40	7.72	7.72	7.72	0.36	0.90	±12.0%
2450	39.2	1.80	7.48	7.48	7.48	0.41	0.90	±12.0%
3300	38.2	2.71	6.85	6.85	6.85	0.30	1.30	±13.1%
3500	37.9	2.91	6.83	6.83	6.83	0.30	1.35	±13.1%
3700	37.7	3.12	6.65	6.65	6.65	0.30	1.35	±13.1%
3900	37.5	3.32	6.38	6.38	6.38	0.40	1.60	±13.1%
4100	37.2	3.53	6.19	6.19	6.19	0.40	1.60	±13.1%
5250	35.9	4.71	4.90	4.90	4.90	0.40	1.80	±13.1%
5600	35.5	5.07	4.61	4.61	4.61	0.40	1.80	±13.1%
5750	35.4	5.22	4.65	4.65	4.65	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.

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

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

Accredited by the Swiss Accreditation Service (SAS)
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** EX-7447_Feb23

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:7447
Calibration procedure(s)	QA CAL-01.v10, QA CAL-12.v10, QA CAL-14.v7, QA CAL-23.v6, QA CAL-25.v8 Calibration procedure for dosimetric E-field probes
Calibration date	February 17, 2023

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	04-Apr-22 (No. 217-03525/03524)	Apr-23
Power sensor NRP-Z91	SN: 103244	04-Apr-22 (No. 217-03524)	Apr-23
OCP DAK-3.5 (weighted)	SN: 1249	20-Oct-22 (OCP-DAK3.5-1249_Oct22)	Oct-23
OCP DAK-12	SN: 1016	20-Oct-22 (OCP-DAK12-1016_Oct22)	Oct-23
Reference 20 dB Attenuator	SN: CC2552 (20x)	04-Apr-22 (No. 217-03527)	Apr-23
DAE4	SN: 660	10-Oct-22 (No. DAE4-660_Oct22)	Oct-23
Reference Probe ES3DV2	SN: 3013	06-Jan-23 (No. ES3-3013_Jan23)	Jan-24

Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-22)	In house check: Jun-24
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-22)	In house check: Jun-24
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-22)	In house check: Jun-24
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-22)	In house check: Jun-24
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-22)	In house check: Oct-24

	Name	Function	Signature
Calibrated by	Joanna Lleshaj	Laboratory Technician	
Approved by	Niels Kuster	Quality Manager	

Issued: February 21, 2023

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

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]	0.43	0.43	0.43	±10.1%
DCP (mV) [B]	90.0	91.0	96.0	±4.7%

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B $dB\sqrt{\mu V}$	C	D dB	VR mV	Max dev.	Max Unc[E] $k = 2$
0	CW	X	0.00	0.00	1.00	0.00	130.7	±2.3%	±4.7%
		Y	0.00	0.00	1.00		130.1		
		Z	0.00	0.00	1.00		134.6		

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

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

Parameters of Probe: EX3DV4 - SN:7447

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle	-139.3°
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

Note: Measurement distance from surface can be increased to 3–4 mm for an *Area Scan* job.

Parameters of Probe: EX3DV4 - SN:7447

Calibration Parameter Determined in Head Tissue Simulating Media

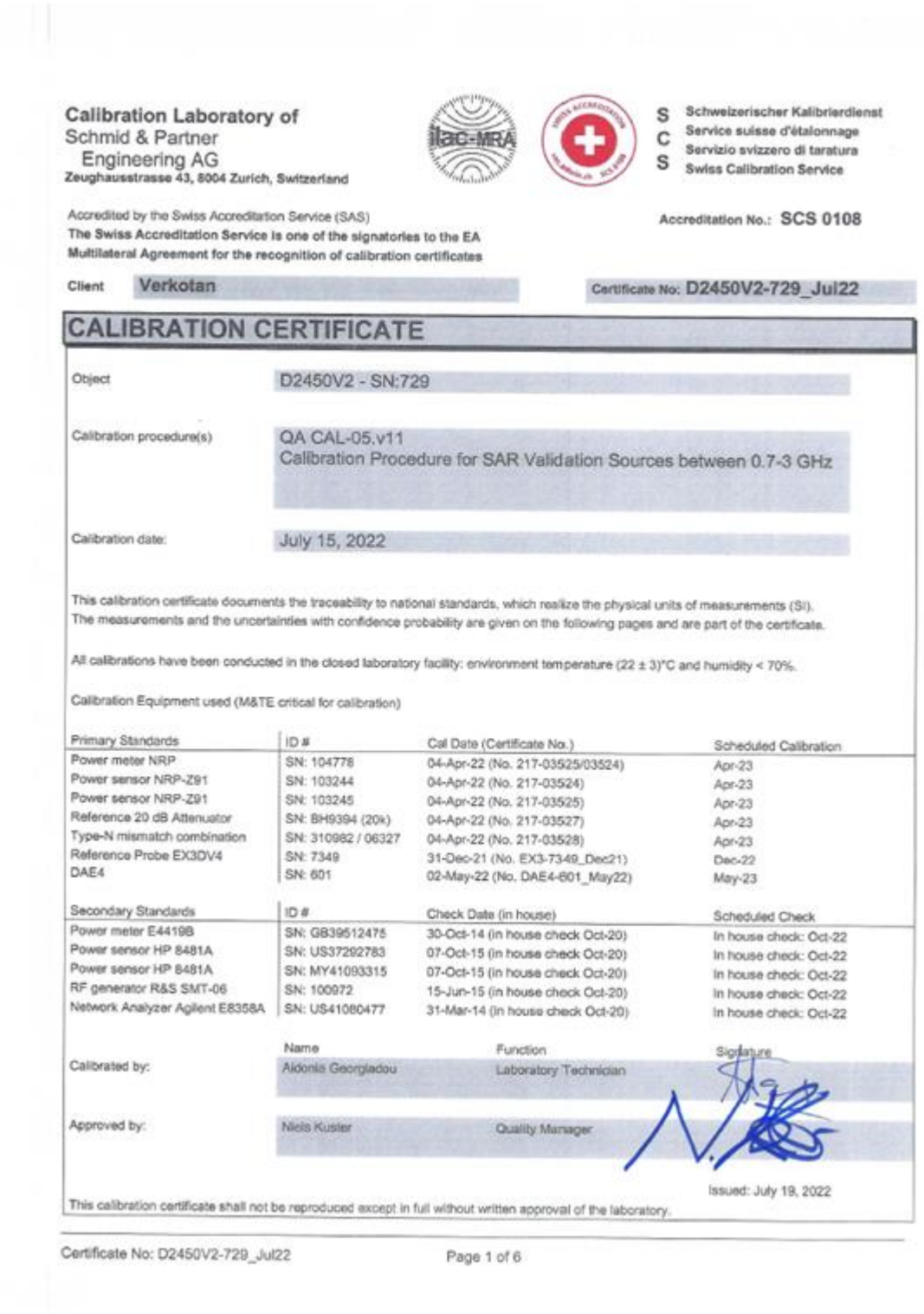
f (MHz)[C]	Relative Permittivity[F]	Conductivity[F] (S/m)	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unc (k = 2)
13	55.0	0.75	17.42	17.42	17.42	0.00	1.25	±13.3%
750	41.9	0.89	9.91	8.74	9.52	0.31	1.27	±12.0%
900	41.5	0.97	9.37	8.45	8.89	0.32	1.27	±12.0%
1750	40.1	1.37	8.45	7.97	8.40	0.25	1.27	±12.0%
1950	40.0	1.40	8.05	7.59	7.97	0.29	1.27	±12.0%
2150	39.7	1.53	8.01	7.58	7.90	0.28	1.27	±12.0%
2300	39.5	1.67	7.85	7.46	7.80	0.28	1.27	±12.0%
2450	39.2	1.80	7.70	7.50	7.63	0.28	1.27	±12.0%
2600	39.0	1.96	7.55	7.37	7.73	0.28	1.27	±12.0%
3300	38.2	2.71	7.02	6.71	7.02	0.34	1.27	±14.0%
5250	35.9	4.71	5.18	4.99	5.17	0.39	1.53	±14.0%
5600	35.5	5.07	4.40	4.29	4.43	0.38	1.77	±14.0%
5750	35.4	5.22	4.47	4.33	4.53	0.38	1.85	±14.0%

[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] The probes are calibrated using tissue simulating liquids (TSL) that deviate for ε and σ by less than ±5% from the target values (typically better than ±3%) and are valid for TSL with deviations of up to ±10%. If TSL with deviations from the target of less than ±5% are used, the calibration uncertainties are 11.1% for 0.7 - 3 GHz and 13.1% for 3 - 6 GHz.

[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



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

S C S Schweizerischer Kalibrierdienst
Service suisse d'étalonnage
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: D2450V2-729_Jul22

CALIBRATION CERTIFICATE

Object	D2450V2 - SN:729
Calibration procedure(s)	QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	July 15, 2022

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	04-Apr-22 (No. 217-03525/03524)	Apr-23
Power sensor NRP-Z91	SN: 103244	04-Apr-22 (No. 217-03524)	Apr-23
Power sensor NRP-Z91	SN: 103245	04-Apr-22 (No. 217-03525)	Apr-23
Reference 20 dB Attenuator	SN: BH9394 (20k)	04-Apr-22 (No. 217-03527)	Apr-23
Type-N mismatch combination	SN: 310982 / 06327	04-Apr-22 (No. 217-03528)	Apr-23
Reference Probe EX3DV4	SN: 7349	31-Dec-21 (No. EX3-7349_Dec21)	Dec-22
DAE4	SN: 601	02-May-22 (No. DAE4-601_May22)	May-23

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: MY41093315	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-20)	In house check: Oct-22
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-22

	Name	Function	Signature
Calibrated by:	Aldonia Georgiadou	Laboratory Technician	
Approved by:	Niels Kuster	Quality Manager	

Issued: July 19, 2022

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

Certificate No: D2450V2-729_Jul22 Page 1 of 6

Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

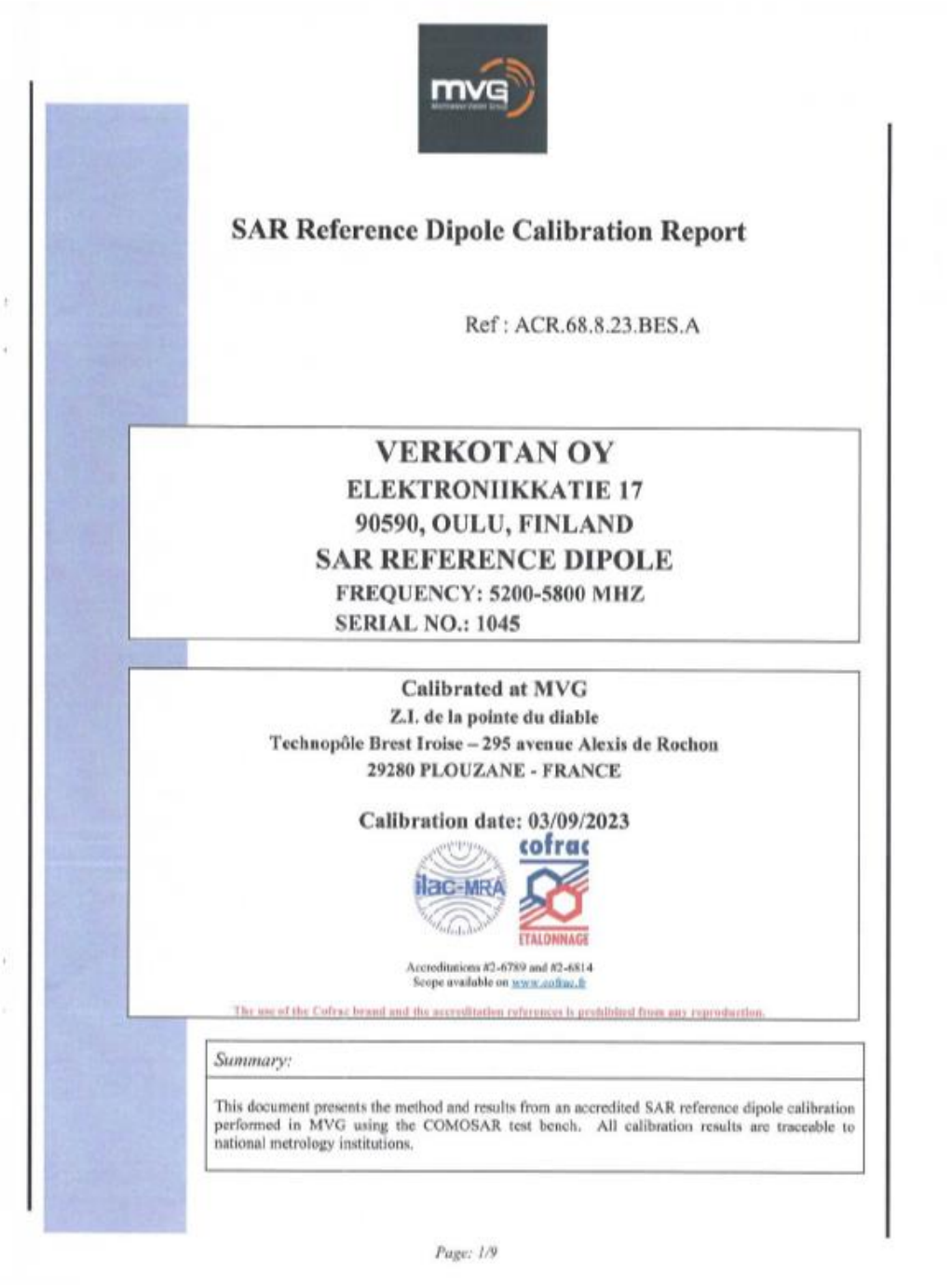
The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	37.9 ± 6 %	1.85 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	---	---

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.4 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.21 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.5 W/kg ± 16.5 % (k=2)**



SAR Reference Dipole Calibration Report

Ref : ACR.68.8.23.BES.A

VERKOTAN OY
ELEKTRONIIKKATIE 17
90590, OULU, FINLAND
SAR REFERENCE DIPOLE
FREQUENCY: 5200-5800 MHZ
SERIAL NO.: 1045

Calibrated at MVG
Z.I. de la pointe du diable
Technopôle Brest Iroise – 295 avenue Alexis de Rochon
29280 PLOUZANE - FRANCE

Calibration date: 03/09/2023

Accreditations #2-6789 and #2-6814
Scope available on www.cofrac.fr

The use of the Cofrac brand and its accreditation references is prohibited from any reproduction.

Summary:

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

Page: 1/9

mvg

SAR REFERENCE DIPOLE CALIBRATION REPORT Ref: ACR.60.8.23.BES.A

	Name	Function	Date	Signature
Prepared by :	Cyrille ONNEE	Measurement Responsible	3/9/2023	
Checked & approved by:	Jérôme Luc	Technical Manager	3/9/2023	
Authorized by:	Yann Toutain	Laboratory Director	3/9/2023	

Yann Toutain ID Signature numérique de Yann Toutain ID Date : 2023.03.09 15:05:03 +01'00'

	Customer Name
Distribution :	Verkotan Oy

Issue	Name	Date	Modifications
A	Cyrille ONNEE	3/9/2023	Initial release

Page: 2/9

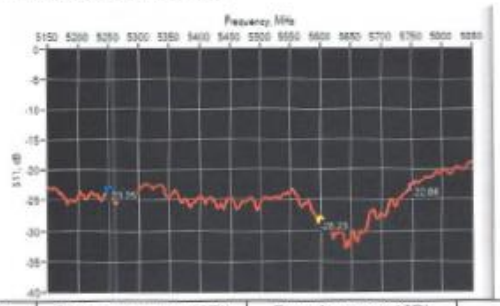
6 CALIBRATION RESULTS

6.1 MECHANICAL DIMENSIONS

L mm		h mm		d mm	
Measured	Required	Measured	Required	Measured	Required
-	20.60 +/- 2%	-	40.30 +/- 2%	-	3.60 +/- 2%

6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
5250	-23.25	-20	47.8Ω + 6.4jΩ
5600	-28.23	-20	48.5Ω - 3.5jΩ
5750	-22.86	-20	46.7Ω + 6.1jΩ

6.3 SAR

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

6.3.1 SAR with Head Liquid

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 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.

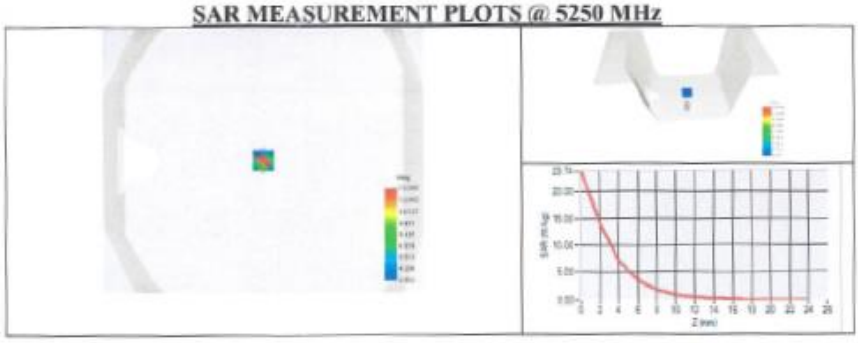
SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.68.8.23.BES.A

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPGO333
Liquid	Head Liquid Values @ 5250 MHz: eps' : 34.3 sigma : 4.67 Head Liquid Values @ 5600 MHz: eps' : 33.6 sigma : 5.05 Head Liquid Values @ 5750 MHz: eps' : 32.9 sigma : 5.46
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	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency	1g SAR (W/kg)			10g SAR (W/kg)		
	Measured	Measured normalized to 1W	Target normalized to 1W	Measured	Measured normalized to 1W	Target normalized to 1W
5250 MHz	7.31	73.09	-	2.11	21.12	-
5600 MHz	7.29	72.92	78.30	2.13	21.29	23.20
5750 MHz	6.91	69.05	-	2.03	20.27	-

SAR MEASUREMENT PLOTS @ 5250 MHz



Page: 7/9

