SAR Compliance Test Report

Date of Report	8/12/2023	**Client's Contact person:**	Kelvin Wong
Number of pages:	107		
		Responsible Test engineer:	Kalle Orava
Testing laboratory:	**Verkotan Oy** Elektroniikkatie 17 90590 Oulu Finland	**Client:**	**G4S Monitoring Technologies Ltd.** 3 Centurion Court, Meridian East, Meridian Business Park, Leicester, LE19 1TP United Kingdom
Tested device	**SOLO 3**		
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:

08.12.2023

Laboratory Manager

Miia Nurkkala

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1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Equipment under Test (DUT):

Product:	Electronic tag
Manufacturer:	G4S Monitoring Technologies Ltd.
Model:	SOLO 3
Serial Number:	SOLO 3: SODGMT603023, SODGMT603014, SOLGMT603018 SPC: S3P702059781
Hardware Version	Rev D
FCC ID Number:	2ACGBSOL3915
IC ID:	21948-SOL3915
DUT Number:	SOLO 3: 21321, 21322, 21323 SPC: 21316
Battery Type used in testing:	Li-Ion Battery
State of the Sample:	Production sample

Testing information:

Testing performed:	16.03.2023 – 25.04.2023
Notes:	-
Document history:	This report replaces FCC SAR report_SOLO 3_ID5836_03072023. Fixed ISM transmitter power and frequency.
Document ID:	FCC SAR report_SOLO 3_ID5836_07122023.docx
Temperature °C	22±2 / Controlled
Humidity RH%	30±20 / Controlled
Measurement performed by:	Ilari Kinnunen, Kalle Orava
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
GSM 850	1.65	PASS
GSM 1900	1.01	PASS
WCDMA II	2.31	PASS
WCDMA V	0.83	PASS
LTE 2	2.19	PASS
LTE 4	3.55	PASS
LTE 5	1.20	PASS
LTE 7	0.226	PASS
LTE 12	0.26	PASS
2.4 GHz WLAN	0.30	PASS
Bluetooth	0.0118	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	
Cellular + WLAN + ISM + metal detector	3.68	PASS

1.2.3 Maximum Drift

Maximum Drift During Measurements	-1.08 dB*

*Larger than 5% drifts included to scaling factors

1.2.4 Measurement Uncertainty

SAR 10g: 0.3 – 3 GHz:

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

2. DESCRIPTION OF THE DEVICE UNDER TEST (DUT)

The DUT is an electronic tag that is used for position tracking. It fits securely around one of the ankles of an offender. Supported wireless technologies include LTE, WCDMA, GPRS, WLAN, BLE, ISM and metal detector.

The mains charger can be used to charge the DUT or alternatively portable charger (SPC) can be used.

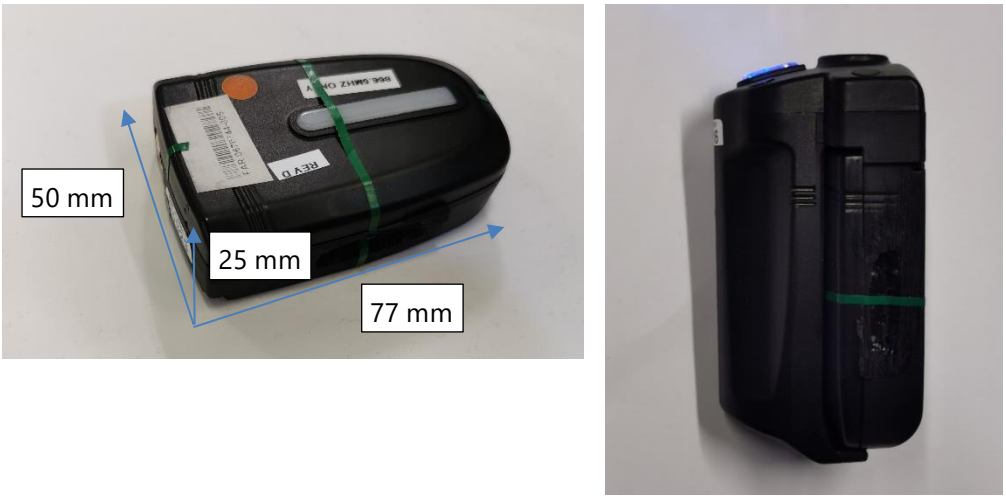


Figure 1. Overview of the DUT and DUT with Portable Charger (SPC)

Device Category	Portable
Exposure Environment	General population uncontrolled

2.1 Supported Frequency Bands and Operational Modes

	Modes of Operation	Transmitter Frequency Range [MHz]
TX Frequency bands	GSM/GPRS 850	824 – 849
	GSM/GPRS 1900	1850 – 1910
	WCDMA 2	1850 – 1910
	WCDMA 5	824 – 849
	LTE 2	1850 – 1910
	LTE 4	1710 – 1755
	LTE 5	824 – 849
	LTE 7	2500 – 2570
	LTE 12	698 – 716
	WLAN 2.4 GHz	2412 – 2462
	Bluetooth	2402 – 2480
	ISM	902 – 928
	Metal detector	15 - 17

2.2 Test Exclusions

2.2.1 Metal detector

2.2.1.1 FCC

Exemption power threshold for distances ≤50mm in mW for less than 100 MHz, was calculated using the following equation below, stated in 447498 D01 General RF Exposure Guidance DR05-44791:

$$P_{7X}(d_{mm}, f_{MHz}) = S_f(f_{MHz}) * P_{431a}(d_{mm}, f_{MHz}) + \left(1 - S_f(f_{MHz})\right) * S_d(d_{mm}) P_{431b1}(50., 100.) * \left((1 + \log_{10}\left(\frac{100.}{f_{MHz}}\right)\right)$$

(Equation 1)

where,

$$S_f(f_{MHz}) = -\frac{e^{(f_{MHz}-100)^2}}{250} \quad \text{(Equation 2)}$$

$$S_d(d_{mm}) = \frac{1}{2} + \frac{\frac{(d_{mm}-50)^2}{250}}{2} \quad \text{(Equation 3)}$$

$$P_{431a}(d_{mm}, f_{MHz}) = \frac{3\, d_{mm}}{\sqrt{f_{MHz}/1000}} \quad \text{(Equation 4)}$$

$$P_{431b1}(d_{mm}, f_{MHz}) = \frac{3\, d_{mm}}{\sqrt{f_{MHz}/1000}} + \frac{(d_{mm}-50)*f_{MHz}}{150} \quad \text{(Equation 5)}$$

Transmission mode	Frequency [MHz]	Separation distance [cm]	P_{7x} [mW]
Metal detector	17	0.5	420

2.2.1.1.1 Maximum defined Output Power and ERP

Maximum output power of the DUT's Metal detector's transmitter is -71.28 dBm i.e. $7.44*10^{-8}$ mW.

According to Appendix B at 447498 D01 General RF Exposure Guidance DR05-44791, the table (B.1.) defines the thresholds for available maximum time-averaged power or maximum time-averaged ERP, whichever is greater. According to the manufacturer's documentation *"Document 75956356-08 Issue 01-Metal Detect"* maximum declared conducted output power is -71.28 dBm, and since the transmitter is near-field only, antenna gain is not applicable.

Transmission mode	Output power [dBm]	Output power [mW]	P_{7x} [mW]
Metal detector	-71.28	$7.44*10^{-8}$	420

The maximum output power for Metal detector is below the test exclusion threshold.

2.2.1.2 ISED

SAR test exemption output power limits based on frequency and separation distance are from RSS-102, issue 5, 2015:

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance[4,5]

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

SAR test exclusion power threshold for 17 MHz is 71mW at ≤5mm separation distance.

2.2.1.2.1 Maximum defined output power and EIRP

According to the manufacturer's documentation *"Document 75956356-08 Issue 01-Metal Detect"* maximum declared conducted output power is -71.28 dBm, and since the transmitter is near-field only, antenna gain is not applicable.
According to the manufacturer, metal detector's transmitters maximum TX output power is -71.28 dBm i.e. $7.44*10^{-8}$ mW.

Transmission mode	Output power [dBm]	Output power [mW]
Metal detector	-71.28	$7.44*10^{-8}$

The maximum output power of the metal detector is below the test exclusion threshold.

2.2.2 ISM transmitter

2.2.2.1 FCC

FCC SAR test exclusion threshold is calculated according to 447498 D04 Interim General RF Exposure Guidance, equation B.2 and B.1:

$$Pth\ (mW) = \begin{cases} ERP_{20\ cm}\ (d\ /\ 20cm)^{x} & d \le 20cm \\ ERP_{20\ cm} & 20cm < d \le 40cm \end{cases} \quad \text{(Equation 6)}$$

where,

$$x = -\log_{10}\left(\frac{60}{ERP_{20\ cm}\sqrt{f}}\right) \quad \text{(Equation 7)}$$

and frequency f is in GHz, d is the separation distance (cm), and ERP20cm is per Equation (B.1) below.

$$ERP20cm\ (mW) = \begin{cases} 2040f & 0.3 \le f < 1.5GHz \\ 3060 & 1.5GHz \le f \le 6GHz \end{cases} \quad \text{(Equation 8)}$$

Transmission mode	Frequency [MHz]	Separation distance [cm]	P_{th} [mW]
ISM	915.25	0.5	20.3

2.2.2.1.1 Maximum defined Output Power and ERP

According to the manufacturer ISM transmitter maximum TX output power is 8 dBm i.e. 6.31 mW and the duty cycle is 0.06%: 0.0006 * 6.31 = 0.0038 mW. Peak antenna gain is -1.73dBi according to datasheet "CZ0005-ISM-R05_G4S".

According to Appendix A at 447498 D04 Interim General RF Exposure Guidance, the equation (B.2.) defines the thresholds for available maximum time-averaged power or maximum time-averaged ERP, whichever is greater. Since the maximum output power is greater than the ERP of the DUT for ISM 915.25 MHz, it is used for SAR test exclusion.

Transmission mode	Output power [dBm]	Output power [mW]	Power Gain of Antenna, G [dBi]	ERP Output power [dBm]	ERP Output power [mW]	P_{th} [mW]
ISM	-24.2	0.0038	-1.73	-28.08	0.0016	20.3

The maximum output power for ISM is below the test exclusion threshold.

2.2.2.2 ISED

SAR test exemption output power limits based on frequency and separation distance are from RSS-102, issue 5, 2015:

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance[4,5]

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

SAR test exclusion power threshold for 915.25 MHz is 16.1mW at ≤5mm separation distance.

2.2.2.2.1 Maximum defined output power and EIRP

According to the manufacturer ISM transmitter maximum TX output power is 8 dBm i.e. 6.31 mW and the duty cycle is 0.06%: 0.0006 * 6.31 = 0.0038 mW. Peak antenna gain is -1.73dBm according to datasheet "CZ0005-ISM-R05_G4S".

Maximum output power of the DUT's ISM transmitter is -24.2 dBm i.e. 0.0038 mW. Since the maximum output power is greater than the EIRP of the DUT for ISM, it is used for SAR test exclusion.

Transmission mode	Output power [dBm]	Output power [mW]	Power Gain of Antenna, G [dBi]	EIRP Output power [dBm]	EIRP Output power [mW]
ISM	-24.2	0.0038	-1.73	-25.93	0.0026

The maximum output power of the ISM transmitter is below the test exclusion threshold.

2.3 Simultaneous transmission

Cellular, ISM, metal detector and WLAN 2.4GHz/Bluetooth can be operated simultaneously.

Possible simultaneous transmissions are:
Cellular + ISM + WLAN 2.4GHz + metal detector
Cellular + ISM + Bluetooth + metal detector

3. OUTPUT POWER

3.1 Maximum specified conducted output power

From the customer, including tune-up tolerances;

GPRS 850 Slot Configuration	Max Output Power [dBm]
GPRS 850 (1Tx-slot)	33
GPRS 850 (2Tx-slot)	32
GPRS 850 (3Tx-slot)	30
GPRS 850 (4Tx-slot)	29

GPRS 1900 Slot Configuration	Max Output Power [dBm]
GPRS 1900 (1Tx-slot)	30
GPRS 1900 (2Tx-slot)	29
GPRS 1900 (3Tx-slot)	27
GPRS 1900 (4Tx-slot)	26

WCDMA	Max Output Power [dBm]
WCDMA 2	23
WCDMA 5	23

LTE	Max Output Power [dBm]
LTE 2	25
LTE 4	25
LTE 5	25
LTE 7	25
LTE 12	25

WLAN 2.4GHz	Max Output Power [dBm]
802.11b	18
802.11g	18
802.11n	12

BLE	Max Output Power [dBm]
BLE	10

ISM	Max Output Power [dBm]
ISM	8

Metal detector	Max Output Power [dBm]
Metal detector	-71.28

3.2 Tested conducted power

Measured conducted output power at transmitting antenna connector;

GRPS 850:

Frequency (MHz)	Channel	Measurement	1TS Measured Power (dBm)	2TS Measured Power (dBm)	3TS Measured Power (dBm)	4TS Measured Power (dBm)
824.2	128	Burst	31.71	30.79	31.32	26.69
		Average*	22.71	24.79	27.06	26.69
836.6	190	Burst	31.81	30.9	31.43	28.89
		Average*	22.81	24.9	27.17	26.69
848.8	251	Burst	31.9	31.41	31.45	29.99
		Average*	22.9	25.41	27.19	26.99

* Average Power was calculated

EDGE 850:

Frequency (MHz)	Channel	Measurement	1TS Measured Power (dBm)	2TS Measured Power (dBm)	3TS Measured Power (dBm)	4TS Measured Power (dBm)
824.2	128	Burst	26.88	25.16	23.47	22.24
		Average*	17.88	19.16	19.21	19.24
836.6	190	Burst	26.61	25.3	23.61	22.37
		Average*	17.61	19.3	19.35	19.37
848.8	251	Burst	26.49	25.27	23.58	22.45
		Average*	17.49	19.27	19.32	19.45

* Average Power was calculated

GPRS 1900:

Frequency (MHz)	Channel	Measurement	1TS Measured Power (dBm)	2TS Measured Power (dBm)	3TS Measured Power (dBm)	4TS Measured Power (dBm)
1850.2	512	Burst	28.81	27.53	25.73	24.32
		Average*	19.81	21.53	21.47	21.32
1880	661	Burst	28.97	27.63	25.86	24.35
		Average*	19.97	21.63	21.6	21.35
1909.8	810	Burst	28.94	27.63	25.79	24.39
		Average*	19.94	21.63	21.53	21.39

* Average Power was calculated

EDGE 1900:

Frequency (MHz)	Channel	Measurement	1TS Measured Power (dBm)	2TS Measured Power (dBm)	3TS Measured Power (dBm)	4TS Measured Power (dBm)
1850.2	512	Burst	25.54	24.36	22.71	21.3
		Average*	16.54	18.36	18.45	18.3
1880	661	Burst	25.75	24.53	22.83	21.41
		Average*	16.75	18.53	18.57	18.41
1909.8	810	Burst	25.98	24.7	22.99	21.54
		Average*	16.98	18.7	18.73	18.54

* Average Power was calculated

Slot configuration with highest time averaged power was selected for SAR testing.

WCDMA 2:

Mode	Frequency (MHz)	Channel	Measured Power (dBm)	Tune Up (dBm)
WCDMA - 12.2kbps RMC	1852.4	9262	22.25	23
	1880	9400	22.36	23
	1907.6	9538	22.6	23
WCDMA - HSDPA (Subtest #1)	1852.4	9262	22.21	23
	1880	9400	22.25	23
	1907.6	9538	22.51	23
WCDMA - HSDPA (Subtest #2)	1852.4	9262	21.83	23
	1880	9400	21.92	23
	1907.6	9538	22.45	23
WCDMA - HSDPA (Subtest #3)	1852.4	9262	22.2	23
	1880	9400	22.31	23
	1907.6	9538	22.54	23
WCDMA - HSDPA (Subtest #4)	1852.4	9262	21.78	23
	1880	9400	21.86	23
	1907.6	9538	21.91	23
WCDMA - HSUPA (Subtest #1)	1852.4	9262	19.83	23
	1880	9400	20.21	23
	1907.6	9538	20.1	23
WCDMA - HSUPA (Subtest #2)	1852.4	9262	21.97	23
	1880	9400	22.13	23
	1907.6	9538	22.41	23
WCDMA - HSUPA (Subtest #3)	1852.4	9262	21.54	23
	1880	9400	21.73	23
	1907.6	9538	21.98	23
WCDMA - HSUPA (Subtest #4)	1852.4	9262	22.19	23
	1880	9400	22.31	23
	1907.6	9538	22.39	23
WCDMA - HSUPA (Subtest #5)	1852.4	9262	21.93	23
	1880	9400	22.12	23
	1907.6	9538	22.37	23

WCDMA 5:

Mode	Frequency (MHz)	Channel	Measured Power (dBm)	Tune Up (dBm)
WCDMA - 12.2kbps RMC	826.4	4132	22.7	23
	836.6	4183	22.85	23
	846.6	4233	22.95	23
WCDMA - HSDPA (Subtest #1)	826.4	4132	22.65	23
	836.6	4183	22.76	23
	846.6	4233	22.92	23
WCDMA - HSDPA (Subtest #2)	826.4	4132	22	23
	836.6	4183	22.15	23
	846.6	4233	22.8	23
WCDMA - HSDPA (Subtest #3)	826.4	4132	22.62	23
	836.6	4183	22.66	23
	846.6	4233	21.8	23
WCDMA - HSDPA (Subtest #4)	826.4	4132	21.37	23
	836.6	4183	21.47	23
	846.6	4233	21.29	23
WCDMA - HSUPA (Subtest #1)	826.4	4132	19.28	23
	836.6	4183	19.92	23
	846.6	4233	19.55	23
WCDMA - HSUPA (Subtest #2)	826.4	4132	22.44	23
	836.6	4183	22.57	23
	846.6	4233	22.6	23
WCDMA - HSUPA (Subtest #3)	826.4	4132	21.51	23
	836.6	4183	21.6	23
	846.6	4233	21.49	23
WCDMA - HSUPA (Subtest #4)	826.4	4132	22.61	23
	836.6	4183	22.73	23
	846.6	4233	22.78	23
WCDMA - HSUPA (Subtest #5)	826.4	4132	22.43	23
	836.6	4183	22.62	23
	846.6	4233	22.65	23

LTE 2:

Bandwidth (MHz)	Frequency (MHz)	Modulation	Resource Block Allocation	Measured Power (dBm)	Tune Up (dBm)
20	1860	QPSK	100%	21.17	25
20	1880	QPSK	100%	21.45	25
20	1899.9	QPSK	100%	21.44	25
20	1880	16QAM	100%	20.45	25
20	1860	QPSK	50% low offset	21.27	25
20	1880	QPSK	50% low offset	21.9	25
20	1899.9	QPSK	50% low offset	21.8	25
20	1860	QPSK	50% high offset	21.15	25
20	1880	QPSK	50% high offset	21.8	25
20	1899.9	QPSK	50% high offset	21.55	25
20	1880	16QAM	50% low offset	20.6	25
20	1860	QPSK	1RB low offset	22.72	25
20	1880	QPSK	1RB low offset	22.64	25
20	1899.9	QPSK	1RB low offset	22.75	25
20	1860	QPSK	1RB mid offset	22.16	25
20	1880	QPSK	1RB mid offset	22.6	25
20	1899.9	QPSK	1RB mid offset	22.59	25
20	1860	QPSK	1RB high offset	22.14	25
20	1880	QPSK	1RB high offset	22.54	25
20	1899.9	QPSK	1RB high offset	22.61	25
20	1899.9	16QAM	1RB low offset	21.9	25
15	1857.5	QPSK	100%	21.47	25
15	1880	QPSK	100%	21.6	25
15	1902.5	QPSK	100%	21.65	25
15	1857.5	QPSK	50% low offset	21.15	25
15	1880	QPSK	50% low offset	21.5	25
15	1902.5	QPSK	50% low offset	20.73	25
15	1857.5	QPSK	50% high offset	20.35	25
15	1880	QPSK	50% high offset	20.8	25
15	1902.5	QPSK	50% low offset	20.6	25
15	1857.5	QPSK	1RB low offset	22.6	25
15	1880	QPSK	1RB low offset	22.5	25
15	1902.5	QPSK	1RB low offset	22.45	25
15	1857.5	QPSK	1RB mid offset	22.24	25
15	1880	QPSK	1RB mid offset	22.2	25

15	1902.5	QPSK	1RB mid offset	22.24	25
15	1857.5	QPSK	1RB high offset	22.29	25
15	1880	QPSK	1RB high offset	22.3	25
15	1902.5	QPSK	1RB low offset	22.11	25
10	1855	QPSK	100%	21.2	25
10	1880	QPSK	100%	21.45	25
10	1905	QPSK	100%	21.38	25
10	1855	QPSK	50% low offset	21.25	25
10	1880	QPSK	50% low offset	21.6	25
10	1905	QPSK	50% low offset	21.38	25
10	1855	QPSK	50% high offset	21.12	25
10	1880	QPSK	50% high offset	21.43	25
10	1905	QPSK	50% low offset	21.33	25
10	1855	QPSK	1RB low offset	22.34	25
10	1880	QPSK	1RB low offset	22.68	25
10	1905	QPSK	1RB low offset	22.55	25
10	1855	QPSK	1RB mid offset	22	25
10	1880	QPSK	1RB mid offset	22.35	25
10	1905	QPSK	1RB mid offset	22.39	25
10	1855	QPSK	1RB high offset	22.1	25
10	1880	QPSK	1RB high offset	22.33	25
10	1905	QPSK	1RB low offset	22.38	25
5	1852.5	QPSK	100%	21.18	25
5	1880	QPSK	100%	21.36	25
5	1907.5	QPSK	100%	21.22	25
5	1852.5	QPSK	50% low offset	21.1	25
5	1880	QPSK	50% low offset	21.5	25
5	1907.5	QPSK	50% low offset	21.18	25
5	1852.5	QPSK	50% high offset	21.09	25
5	1880	QPSK	50% high offset	21.36	25
5	1907.5	QPSK	50% high offset	21.15	25
5	1852.5	QPSK	1RB low offset	22.25	25
5	1880	QPSK	1RB low offset	22.55	25
5	1907.5	QPSK	1RB low offset	22.44	25
5	1852.5	QPSK	1RB mid offset	22.21	25
5	1880	QPSK	1RB mid offset	22.3	25
5	1907.5	QPSK	1RB mid offset	22.39	25
5	1852.5	QPSK	1RB high offset	22.19	25
5	1880	QPSK	1RB high offset	22.27	25
5	1907.5	QPSK	1RB high offset	22.37	25

3	1851.5	QPSK	100%	21.09	25
3	1880	QPSK	100%	21.35	25
3	1908.5	QPSK	100%	21.25	25
3	1851.5	QPSK	50% low offset	21.29	25
3	1880	QPSK	50% low offset	21.41	25
3	1908.5	QPSK	50% low offset	21.35	25
3	1851.5	QPSK	50% high offset	21.25	25
3	1880	QPSK	50% high offset	21.39	25
3	1908.5	QPSK	50% high offset	21.31	25
3	1851.5	QPSK	1RB low offset	22.17	25
3	1880	QPSK	1RB low offset	22.58	25
3	1908.5	QPSK	1RB low offset	22.35	25
3	1851.5	QPSK	1RB mid offset	22.16	25
3	1880	QPSK	1RB mid offset	22.55	25
3	1908.5	QPSK	1RB mid offset	22.31	25
3	1851.5	QPSK	1RB high offset	22.14	25
3	1880	QPSK	1RB high offset	22.53	25
3	1908.5	QPSK	1RB high offset	22.33	25
1.4	1710.7	QPSK	100%	20.96	25
1.4	1732	QPSK	100%	21.3	25
1.4	1754.3	QPSK	100%	21.17	25
1.4	1710.7	QPSK	50% low offset	22.1	25
1.4	1732	QPSK	50% low offset	22.52	25
1.4	1754.3	QPSK	50% low offset	22.45	25
1.4	1710.7	QPSK	50% high offset	21.95	25
1.4	1732	QPSK	50% high offset	22.4	25
1.4	1754.3	QPSK	50% high offset	22.23	25
1.4	1710.7	QPSK	1RB low offset	22	25
1.4	1732	QPSK	1RB low offset	22.5	25
1.4	1754.3	QPSK	1RB low offset	22.25	25
1.4	1710.7	QPSK	1RB mid offset	21.98	25
1.4	1732	QPSK	1RB mid offset	22.34	25
1.4	1754.3	QPSK	1RB mid offset	22.15	25
1.4	1710.7	QPSK	1RB high offset	22.05	25
1.4	1732	QPSK	1RB high offset	22.31	25
1.4	1754.3	QPSK	1RB high offset	22.2	25

LTE 4:

Bandwidth (MHz)	Frequency (MHz)	Modulation	Resource Block Allocation	Measured Power (dBm)	Tune Up (dBm)
20	1720	QPSK	100%	21.25	25
20	1732	QPSK	100%	21.27	25
20	1745	QPSK	100%	21.34	25
20	1720	16QAM	100%	20.57	25
20	1720	QPSK	50% low offset	21.56	25
20	1732	QPSK	50% low offset	21.45	25
20	1745	QPSK	50% low offset	21.49	25
20	1720	QPSK	50% high offset	21.41	25
20	1732	QPSK	50% high offset	21.32	25
20	1745	QPSK	50% high offset	21.3	25
20	1720	16QAM	50% low offset	20.64	25
20	1720	QPSK	1RB low offset	22.5	25
20	1732	QPSK	1RB low offset	22.7	25
20	1745	QPSK	1RB low offset	22.75	25
20	1720	QPSK	1RB mid offset	22.3	25
20	1732	QPSK	1RB mid offset	21.65	25
20	1745	QPSK	1RB mid offset	20.75	25
20	1720	QPSK	1RB high offset	21.95	25
20	1732	QPSK	1RB high offset	21.2	25
20	1745	QPSK	1RB high offset	20.4	25
20	1720	16QAM	1RB low offset	21.8	25
15	1717.5	QPSK	100%	21.17	25
15	1732	QPSK	100%	21.2	25
15	1747.5	QPSK	100%	21.21	25
15	1717.5	QPSK	50% low offset	21.15	25
15	1732	QPSK	50% low offset	21.07	25
15	1747.5	QPSK	50% low offset	21.21	25
15	1717.5	QPSK	50% high offset	21.08	25
15	1732	QPSK	50% high offset	21.05	25
15	1747.5	QPSK	50% low offset	21.18	25
15	1717.5	QPSK	1RB low offset	22.71	25
15	1732	QPSK	1RB low offset	22.51	25
15	1747.5	QPSK	1RB low offset	22.52	25
15	1717.5	QPSK	1RB mid offset	22.14	25
15	1732	QPSK	1RB mid offset	22.15	25

15	1747.5	QPSK	1RB mid offset	22.27	25
15	1717.5	QPSK	1RB high offset	22.1	25
15	1732	QPSK	1RB high offset	22	25
15	1747.5	QPSK	1RB low offset	22.29	25
10	1715	QPSK	100%	21.4	25
10	1732	QPSK	100%	21.18	25
10	1750	QPSK	100%	21.17	25
10	1715	QPSK	50% low offset	21.37	25
10	1732	QPSK	50% low offset	21.16	25
10	1750	QPSK	50% low offset	21.15	25
10	1715	QPSK	50% high offset	21.25	25
10	1732	QPSK	50% high offset	21.1	25
10	1750	QPSK	50% low offset	21.22	25
10	1715	QPSK	1RB low offset	21.73	25
10	1732	QPSK	1RB low offset	21.69	25
10	1750	QPSK	1RB low offset	21.58	25
10	1715	QPSK	1RB mid offset	21.62	25
10	1732	QPSK	1RB mid offset	21.57	25
10	1750	QPSK	1RB mid offset	21.53	25
10	1715	QPSK	1RB high offset	21.59	25
10	1732	QPSK	1RB high offset	21.54	25
10	1750	QPSK	1RB low offset	21.43	25
5	1712.5	QPSK	100%	21.25	25
5	1732	QPSK	100%	21.11	25
5	1752.5	QPSK	100%	21.3	25
5	1712.5	QPSK	50% low offset	21.34	25
5	1732	QPSK	50% low offset	21.21	25
5	1752.5	QPSK	50% low offset	21.4	25
5	1712.5	QPSK	50% high offset	21.3	25
5	1732	QPSK	50% high offset	21.18	25
5	1752.5	QPSK	50% high offset	21.32	25
5	1712.5	QPSK	1RB low offset	22.35	25
5	1732	QPSK	1RB low offset	22.24	25
5	1752.5	QPSK	1RB low offset	22.4	25
5	1712.5	QPSK	1RB mid offset	22.28	25
5	1732	QPSK	1RB mid offset	22.21	25
5	1752.5	QPSK	1RB mid offset	22.35	25
5	1712.5	QPSK	1RB high offset	22.24	25
5	1732	QPSK	1RB high offset	22.12	25
5	1752.5	QPSK	1RB high offset	22.28	25

3	1711.5	QPSK	100%	21.25	25
3	1732	QPSK	100%	21.05	25
3	1753.5	QPSK	100%	21.12	25
3	1711.5	QPSK	50% low offset	21.35	25
3	1732	QPSK	50% low offset	21.34	25
3	1753.5	QPSK	50% low offset	21.25	25
3	1711.5	QPSK	50% high offset	21.28	25
3	1732	QPSK	50% high offset	21.32	25
3	1753.5	QPSK	50% high offset	21.24	25
3	1711.5	QPSK	1RB low offset	22.26	25
3	1732	QPSK	1RB low offset	22.07	25
3	1753.5	QPSK	1RB low offset	22.35	25
3	1711.5	QPSK	1RB mid offset	22.28	25
3	1732	QPSK	1RB mid offset	22.15	25
3	1753.5	QPSK	1RB mid offset	22.27	25
3	1711.5	QPSK	1RB high offset	22.2	25
3	1732	QPSK	1RB high offset	22.05	25
3	1753.5	QPSK	1RB high offset	22.23	25
1.4	1710.7	QPSK	100%	21.4	25
1.4	1732	QPSK	100%	21	25
1.4	1754.3	QPSK	100%	21.38	25
1.4	1710.7	QPSK	50% low offset	22.27	25
1.4	1732	QPSK	50% low offset	22.19	25
1.4	1754.3	QPSK	50% low offset	22.31	25
1.4	1710.7	QPSK	50% high offset	22.29	25
1.4	1732	QPSK	50% high offset	22.18	25
1.4	1754.3	QPSK	50% high offset	22.27	25
1.4	1710.7	QPSK	1RB low offset	22.22	25
1.4	1732	QPSK	1RB low offset	22.2	25
1.4	1754.3	QPSK	1RB low offset	22.31	25
1.4	1710.7	QPSK	1RB mid offset	22.2	25
1.4	1732	QPSK	1RB mid offset	22.16	25
1.4	1754.3	QPSK	1RB mid offset	22.26	25
1.4	1710.7	QPSK	1RB high offset	22.3	25
1.4	1732	QPSK	1RB high offset	22.13	25
1.4	1754.3	QPSK	1RB high offset	22.25	25

LTE 5:

Bandwidth (MHz)	Frequency (MHz)	Modulation	Resource Block Allocation	Measured Power (dBm)	Tune Up (dBm)
10	829	QPSK	100%	21.54	25
10	836.5	QPSK	100%	21.95	25
10	844	QPSK	100%	22	25
10	844	16QAM	100%	21.15	25
10	829	QPSK	50% low offset	21.85	25
10	836.5	QPSK	50% low offset	22.05	25
10	844	QPSK	50% low offset	22.01	25
10	829	QPSK	50% high offset	21.8	25
10	836.5	QPSK	50% high offset	21.94	25
10	844	QPSK	50% high offset	21.93	25
10	836.5	16QAM	50% low offset	21	25
10	829	QPSK	1RB low offset	22.89	25
10	836.5	QPSK	1RB low offset	22.91	25
10	844	QPSK	1RB low offset	22.95	25
10	829	QPSK	1RB mid offset	22.85	25
10	836.5	QPSK	1RB mid offset	22.72	25
10	844	QPSK	1RB mid offset	22.7	25
10	829	QPSK	1RB high offset	22.5	25
10	836.5	QPSK	1RB high offset	22.54	25
10	844	QPSK	1RB high offset	22.59	25
10	844	16QAM	1RB low offset	21.98	25
5	826.5	QPSK	100%	21.83	25
5	836.5	QPSK	100%	21.9	25
5	846.5	QPSK	100%	21.94	25
5	826.5	QPSK	50% low offset	21.85	25
5	836.5	QPSK	50% low offset	21.92	25
5	846.5	QPSK	50% low offset	21.95	25
5	826.5	QPSK	50% high offset	21.83	25
5	836.5	QPSK	50% high offset	21.75	25
5	846.5	QPSK	50% high offset	21.95	25
5	826.5	QPSK	1RB low offset	22.91	25
5	836.5	QPSK	1RB low offset	22.95	25
5	846.5	QPSK	1RB low offset	22.97	25
5	826.5	QPSK	1RB mid offset	22.9	25
5	836.5	QPSK	1RB mid offset	22.95	25

5	846.5	QPSK	1RB mid offset	22.91	25
5	826.5	QPSK	1RB high offset	22.89	25
5	836.5	QPSK	1RB high offset	22.94	25
5	846.5	QPSK	1RB high offset	22.96	25

LTE 7:

Bandwidth (MHz)	Frequency (MHz)	Modulation	Resource Block Allocation	Measured Power (dBm)	Tune Up (dBm)
20	2510	QPSK	1 low offset	23.14	25
20	2510	QPSK	1 mid offset	23.46	25
20	2510	QPSK	1 high offset	23.34	25
20	2510	QPSK	50% low offset	22.31	25
20	2510	QPSK	50% mid offset	22.41	25
20	2510	QPSK	50% high offset	22.52	25
20	2510	QPSK	100%	22.34	25
20	2535	QPSK	1 low offset	23.25	25
20	2535	QPSK	1 mid offset	23.53	25
20	2535	QPSK	1 high offset	23.55	25
20	2535	QPSK	50% low offset	22.54	25
20	2535	QPSK	50% mid offset	22.48	25
20	2535	QPSK	50% high offset	22.43	25
20	2535	QPSK	100%	22.55	25
20	2560	QPSK	1 low offset	23.53	25
20	2560	QPSK	1 mid offset	23.81	25
20	2560	QPSK	1 high offset	23	25
20	2560	QPSK	50% low offset	22.89	25
20	2560	QPSK	50% mid offset	22.83	25
20	2560	QPSK	50% high offset	22.87	25
20	2560	QPSK	100%	22.83	25
15	2507.5	QPSK	1 low offset	23.29	25
15	2507.5	QPSK	1 mid offset	23.64	25
15	2507.5	QPSK	1 high offset	23.52	25
15	2507.5	QPSK	50% low offset	22.37	25
15	2507.5	QPSK	50% mid offset	22.3	25
15	2507.5	QPSK	50% high offset	22.54	25
15	2507.5	QPSK	100%	22.35	25

15	2535	QPSK	1 low offset	23.56	25
15	2535	QPSK	1 mid offset	23.72	25
15	2535	QPSK	1 high offset	23.44	25
15	2535	QPSK	50% low offset	22.58	25
15	2535	QPSK	50% mid offset	22.47	25
15	2535	QPSK	50% high offset	22.5	25
15	2535	QPSK	100%	22.61	25
15	2562.5	QPSK	1 low offset	23.57	25
15	2562.5	QPSK	1 mid offset	24.19	25
15	2562.5	QPSK	1 high offset	22.98	25
15	2562.5	QPSK	50% low offset	22.82	25
15	2562.5	QPSK	50% mid offset	22.82	25
15	2562.5	QPSK	50% high offset	22.93	25
15	2562.5	QPSK	100%	22.94	25
10	2505	QPSK	1 low offset	23.19	25
10	2505	QPSK	1 mid offset	23.36	25
10	2505	QPSK	1 high offset	23.48	25
10	2505	QPSK	50% low offset	22.36	25
10	2505	QPSK	50% mid offset	22.42	25
10	2505	QPSK	50% high offset	22.29	25
10	2505	QPSK	100%	22.37	25
10	2535	QPSK	1 low offset	23.56	25
10	2535	QPSK	1 mid offset	23.63	25
10	2535	QPSK	1 high offset	23.41	25
10	2535	QPSK	50% low offset	22.64	25
10	2535	QPSK	50% mid offset	22.61	25
10	2535	QPSK	50% high offset	22.5	25
10	2535	QPSK	100%	22.6	25
10	2565	QPSK	1 low offset	23.9	25
10	2565	QPSK	1 mid offset	24.04	25
10	2565	QPSK	1 high offset	22.8	25
10	2565	QPSK	50% low offset	22.8	25
10	2565	QPSK	50% mid offset	22.98	25
10	2565	QPSK	50% high offset	22.95	25
10	2565	QPSK	100%	23	25
5	2502.5	QPSK	1 low offset	23.29	25
5	2502.5	QPSK	1 mid offset	23.27	25
5	2502.5	QPSK	1 high offset	23.02	25
5	2502.5	QPSK	50% low offset	22.24	25
5	2502.5	QPSK	50% mid offset	22.35	25

5	2502.5	QPSK	50% high offset	22.26	25
5	2502.5	QPSK	100%	22.3	25
5	2535	QPSK	1 low offset	23.42	25
5	2535	QPSK	1 mid offset	23.43	25
5	2535	QPSK	1 high offset	23.38	25
5	2535	QPSK	50% low offset	22.51	25
5	2535	QPSK	50% mid offset	22.49	25
5	2535	QPSK	50% high offset	22.57	25
5	2535	QPSK	100%	22.6	25
5	2567.5	QPSK	1 low offset	23.66	25
5	2567.5	QPSK	1 mid offset	23.73	25
5	2567.5	QPSK	1 high offset	23.01	25
5	2567.5	QPSK	50% low offset	22.94	25
5	2567.5	QPSK	50% mid offset	22.89	25
5	2567.5	QPSK	50% high offset	23.03	25
5	2567.5	QPSK	100%	22.98	25
20	2510	16QAM	1 low offset	20.71	25
20	2510	16QAM	1 mid offset	21.26	25
20	2510	16QAM	1 high offset	20.71	25
20	2510	16QAM	50% low offset	20.52	25
20	2535	16QAM	50% mid offset	21.35	25
20	2535	16QAM	50% high offset	21.58	25
20	2535	16QAM	100%	21.25	25
20	2535	16QAM	1 low offset	20.74	25
20	2560	16QAM	1 mid offset	21.21	25
20	2560	16QAM	1 high offset	21.69	25
20	2560	16QAM	50% low offset	21.8	25
20	2560	16QAM	50% mid offset	21	25
15	2507.5	16QAM	50% high offset	20.81	25
15	2507.5	16QAM	100%	21.65	25
15	2507.5	16QAM	1 low offset	21.22	25
15	2507.5	16QAM	1 mid offset	20.56	25
15	2535	16QAM	1 high offset	21.3	25
15	2535	16QAM	50% low offset	21.74	25
15	2535	16QAM	50% mid offset	21.37	25
15	2535	16QAM	50% high offset	21.04	25
15	2562.5	16QAM	100%	21.68	25
15	2562.5	16QAM	1 low offset	22	25
15	2562.5	16QAM	1 mid offset	21.54	25
15	2562.5	16QAM	1 high offset	21.08	25

10	2505	16QAM	50% low offset	21.15	25
10	2505	16QAM	50% mid offset	21.38	25
10	2505	16QAM	50% high offset	21.26	25
10	2505	16QAM	100%	20.8	25
10	2535	16QAM	1 low offset	21.56	25
10	2535	16QAM	1 mid offset	21.98	25
10	2535	16QAM	1 high offset	21.24	25
10	2535	16QAM	50% low offset	21.01	25
10	2565	16QAM	50% mid offset	21.55	25
10	2565	16QAM	50% high offset	22	25
10	2565	16QAM	100%	22.21	25
10	2565	16QAM	1 low offset	21.47	25
5	2502.5	16QAM	1 mid offset	21.32	25
5	2502.5	16QAM	1 high offset	21.6	25
5	2502.5	16QAM	50% low offset	21.45	25
5	2502.5	16QAM	50% mid offset	21.01	25
5	2502.5	16QAM	50% high offset	20.67	25
5	2502.5	16QAM	100%	20.64	25
5	2502.5	16QAM	1 low offset	20.89	25
5	2535	16QAM	1 mid offset	21.78	25
5	2535	16QAM	1 high offset	21.95	25
5	2535	16QAM	50% low offset	21.66	25
5	2535	16QAM	50% mid offset	21.01	25
5	2535	16QAM	50% high offset	21.17	25
5	2535	16QAM	100%	21.08	25
5	2535	16QAM	1 low offset	21.1	25
5	2567.5	16QAM	1 mid offset	21.8	25
5	2567.5	16QAM	1 high offset	22.37	25
5	2567.5	16QAM	50% low offset	22.27	25
5	2567.5	16QAM	50% mid offset	21.24	25
5	2567.5	16QAM	50% high offset	21.19	25
5	2567.5	16QAM	100%	21.31	25
5	2567.5	16QAM	1 low offset	21.38	25

LTE 12:

Bandwidth (MHz)	Frequency (MHz)	Modulation	Resource Block Allocation	Measured Power (dBm)	Tune Up (dBm)
10	704	QPSK	100%	21.79	25
10	707	QPSK	100%	21.9	25
10	711	QPSK	100%	21.92	25
10	711	16QAM	100%	20.99	25
10	704	QPSK	50% low offset	22.01	25
10	707	QPSK	50% low offset	21.92	25
10	711	QPSK	50% low offset	22.05	25
10	704	QPSK	50% high offset	21.9	25
10	707	QPSK	50% high offset	21.81	25
10	711	QPSK	50% high offset	21.91	25
10	711	16QAM	50% low offset	21.16	25
10	704	QPSK	1RB low offset	22.95	25
10	707	QPSK	1RB low offset	22.93	25
10	711	QPSK	1RB low offset	22.98	25
10	704	QPSK	1RB mid offset	22.9	25
10	707	QPSK	1RB mid offset	22.87	25
10	711	QPSK	1RB mid offset	22.85	25
10	704	QPSK	1RB high offset	22.8	25
10	707	QPSK	1RB high offset	22.76	25
10	711	QPSK	1RB high offset	22.75	25
10	711	16QAM	1RB low offset	22.09	25
5	701.5	QPSK	100%	22.05	25
5	707	QPSK	100%	22.15	25
5	713.5	QPSK	100%	22.14	25
5	701.5	QPSK	50% low offset	22.05	25
5	707	QPSK	50% low offset	21.9	25
5	713.5	QPSK	50% low offset	22.06	25
5	701.5	QPSK	50% high offset	22.25	25
5	707	QPSK	50% high offset	22.05	25
5	713.5	QPSK	50% high offset	22.1	25
5	701.5	QPSK	1RB low offset	22.95	25
5	707	QPSK	1RB low offset	22.75	25
5	713.5	QPSK	1RB low offset	22.86	25
5	701.5	QPSK	1RB mid offset	22.93	25
5	707	QPSK	1RB mid offset	22.73	25

5	713.5	QPSK	1RB mid offset	22.85	25
5	701.5	QPSK	1RB high offset	22.83	25
5	707	QPSK	1RB high offset	22.65	25
5	713.5	QPSK	1RB high offset	22.72	25
3	700.5	QPSK	100%	22.3	25
3	707	QPSK	100%	22.17	25
3	714.5	QPSK	100%	22.11	25
3	700.5	QPSK	50% low offset	22.39	25
3	707	QPSK	50% low offset	22.31	25
3	714.5	QPSK	50% low offset	22.25	25
3	700.5	QPSK	50% high offset	22.34	25
3	707	QPSK	50% high offset	22.21	25
3	714.5	QPSK	50% high offset	22.1	25
3	700.5	QPSK	1RB low offset	22.95	25
3	707	QPSK	1RB low offset	22.72	25
3	714.5	QPSK	1RB low offset	22.91	25
3	700.5	QPSK	1RB mid offset	22.86	25
3	707	QPSK	1RB mid offset	22.65	25
3	714.5	QPSK	1RB mid offset	22.83	25
3	700.5	QPSK	1RB high offset	22.81	25
3	707	QPSK	1RB high offset	22.61	25
3	714.5	QPSK	1RB high offset	22.85	25
1.4	700.5	QPSK	100%	22.3	25
1.4	707	QPSK	100%	22.21	25
1.4	714.5	QPSK	100%	22.19	25
1.4	700.5	QPSK	50% low offset	22.9	25
1.4	707	QPSK	50% low offset	22.85	25
1.4	714.5	QPSK	50% low offset	22.71	25
1.4	700.5	QPSK	50% high offset	22.88	25
1.4	707	QPSK	50% high offset	22.81	25
1.4	714.5	QPSK	50% high offset	22.68	25
1.4	700.5	QPSK	1RB low offset	22.94	25
1.4	707	QPSK	1RB low offset	22.91	25
1.4	714.5	QPSK	1RB low offset	22.81	25
1.4	700.5	QPSK	1RB mid offset	22.91	25
1.4	707	QPSK	1RB mid offset	22.76	25
1.4	714.5	QPSK	1RB mid offset	22.84	25
1.4	700.5	QPSK	1RB high offset	22.89	25
1.4	707	QPSK	1RB high offset	22.87	25
1.4	714.5	QPSK	1RB high offset	22.85	25

WLAN 2.4 GHz:

Standard	Transmission mode	Data rate [Mbps]	Output power [dBm]		
			CH 1 2412 MHz	CH 6 2437 MHz	CH 11 2462 MHz
802.11b	DSSS	1	21.35	21.26	20.74

BLE:

Standard	Data rate [Mbps]	Output power [dBm]		
		CH 0 2402 MHz	CH 18 2442 MHz	CH 36 2478 MHz
BLE	1	7.04	6.88	6.52

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.

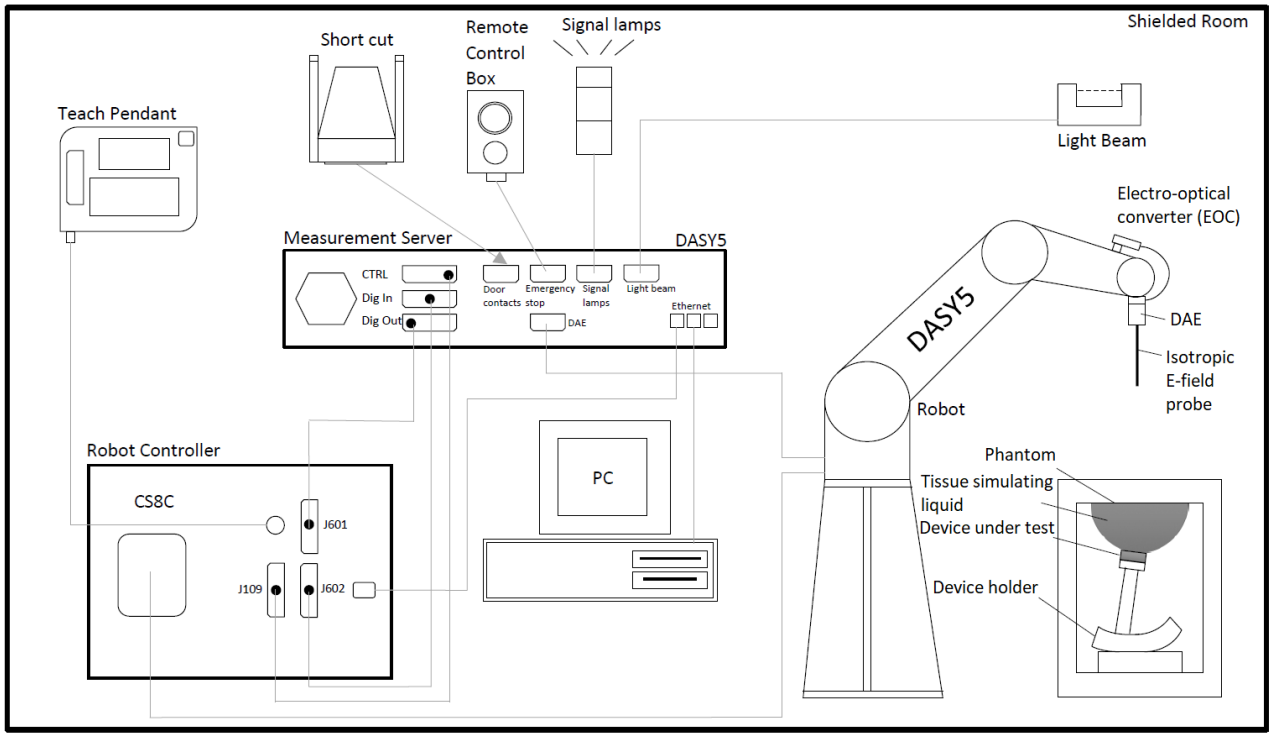


Figure 2 Schematic Laboratory Picture

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, 800MHz-4200MHz, 10W	10S1G4A	320421	NA	NA
Amplifier, 800MHz-4200MHz, 50W	5163F	1022	NA	NA
DAE4, converter	DAE4	1332	02/2023	1
DAE4, converter	DAE4	710	10/2022	1
Isotropic DOS probe	EX3DV4	3852	10/2022	1
Isotropic DOS probe	EX3DV4	3892	04/2022	1
Isotropic DOS probe	EX3DV4	7447	02/2023	1
Network Analyzer	E5071B	MY42301191	03/2023	1
Vector Network Analyzer	P5008A	MY58100258	01/2023	1
Radio Communication Analyzer	MT8820C	6200951734	12/2022	1
Power reflection meter	NRT	835065/049	02/2023	1
Directional Power sensor	NRT-Z44	107780	02/2023	1
Vector Signal Generator	MG3710A	6261911026	NA	NA
Vector Signal Generator	MG3710E	6262028676	NA	NA
System validation dipole	D1800V2	249	07/2022	3
System validation dipole	D1900V2	511	03/2023	3
System validation dipole	D2450V2	729	07/2022	3
System validation dipole	D750V3	1154	07/2022	3
System validation dipole	D835V2	455	07/2022	3
System validation dipole	SID2600	DIP2G600-637	12/2021	3

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, tween, salt

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
750	D750V3 - SN: 635	EX3DV4 - SN: 7447	CW	DAE 4 / 1332	45.44	0.86	03/2023
835	D835V2- SN:448	EX3DV4 - SN: 7447	CW	DAE 4 / 1332	45.03	0.88	03/2023
1800	D1800V2- SN:249	EX3DV4 - SN: 7447	CW	DAE 4 / 1332	43.51	1.35	02/2023
1900	D1900V2- SN:511	EX3DV4 - SN: 7447	CW	DAE 4 / 1332	43.33	1.4	02/2023
2450	D2450V2 - SN: 729	EX3DV4 - SN: 7447	CW	DAE 4 / 1332	41.26	1.71	03/2023
2600	51/18 DIP 2G600-637	EX3DV4 - SN: 7447	CW	DAE 4 / 710	41.46	1.82	03/2023
835	D835V2- SN:455	EX3DV4 - SN: 3852	CW	DAE 4 / 710	39.38	0.84	04/2023
1800	D1800V2- SN:249	EX3DV4 - SN: 3852	CW	DAE 4 / 710	41.71	1.36	11/2022
1900	D1900V2- SN:511	EX3DV4 - SN: 3852	CW	DAE 4 / 710	40.05	1.39	11/2022
2450	D2450V2 - SN: 758	EX3DV4 - SN: 3852	CW	DAE 4 / 710	40.46	1.75	11/2022
835	D835V2- SN:448	EX3DV4 - SN: 3892	CW	DAE 4 / 705	42.47	0.94	05/2022
750	D750V3 - SN: 635	EX3DV4 - SN: 3892	CW	DAE 4 / 705	42.71	0.91	04/2022
1800	D1800V2- SN:2D075	EX3DV4 - SN: 3892	CW	DAE 4 / 705	39.35	1.29	04/2022
1900	D1900V2- SN:511	EX3DV4 - SN: 3892	CW	DAE 4 / 705	39.98	1.36	04/2022
2450	D2450V2 - SN: 758	EX3DV4 - SN: 3892	CW	DAE 4 / 705	39.13	1.7	04/2022

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 #
16.03.2023	WB Head	22	835	250	2.22	9.69	8.88	-8.36	1
20.03.2023	WB Head	22	835	250	2.36	9.69	9.44	-2.58	2
21.03.2023	WB Head	22	835	250	2.32	9.69	9.28	-4.23	3
22.03.2023	WB Head	22	750	250	1.94	8.54	7.76	-9.1	4
22.03.2023	WB Head	22	1900	250	10	39.3	40	1.8	5
23.03.2023	WB Head	22	1800	250	8.79	38.9	35.16	-9.6	6
23.03.2023	WB Head	22	2450	250	12.1	52.3	48.4	-7.46	7
27.03.2023	WB Head	22	835	250	2.34	9.36	9.36	0.00	8
28.03.2023	WB Head	22	1800	250	8.97	38.9	35.88	-7.8	9
29.03.2023	WB Head	22	1900	250	9.11	38.02	36.44	-4.2	10
30.03.2023	WB Head	22	1800	250	8.88	38.9	35.52	-8.7	11
11.04.2023	WB Head	22	750	250	2.18	8.54	8.72	2.11	12
21.04.2023	WB Head	22	1900	250	9.49	38.02	37.96	-0.2	13
21.04.2023	WB Head	22	2600	250	13	56.47	52	-7.92	14
24.04.2023	WB Head	22	2450	250	12.4	52.3	49.6	-5.16	15
25.04.2023	WB Head	22	835	250	2.45	9.69	9.8	1.14	16
25.04.2023	WB Head	22	1900	250	9.01	38.02	36.04	-5.2	17

4.6 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 (%)
16.03.2023	WB Head	22	835	41.5	0.9	43.4	0.87	4.6	-3.9
16.03.2023	WB Head	22	897.6	41.5	0.97	43.12	0.89	3.9	-8.3
20.03.2023	WB Head	22	835	41.5	0.9	43.23	0.89	4.2	-1.2
20.03.2023	WB Head	22	880.2	41.5	0.95	43.01	0.91	3.6	-4.6
20.03.2023	WB Head	22	914.8	41.47	0.98	42.86	0.92	3.4	-5.9
21.03.2023	WB Head	22	835	41.5	0.9	44.91	0.93	8.2	2.8
21.03.2023	WB Head	22	880.7	41.5	0.95	44.71	0.94	7.7	-0.6
21.03.2023	WB Head	22	897.5	41.5	0.97	44.66	0.95	7.6	-1.7
21.03.2023	WB Head	22	897.6	41.5	0.97	44.66	0.95	7.6	-1.8
21.03.2023	WB Head	22	914.3	41.47	0.98	44.59	0.96	7.5	-1.9
22.03.2023	WB Head	22	711	42.11	0.89	44.42	0.83	5.5	-6.9
22.03.2023	WB Head	22	750	41.9	0.89	44.2	0.84	5.5	-5.6
22.03.2023	WB Head	22	1900	40	1.4	41.07	1.35	2.7	-3.2
22.03.2023	WB Head	22	1922.4	40	1.4	41.03	1.37	2.6	-2.3
22.03.2023	WB Head	22	1927.5	40	1.4	41.02	1.37	2.5	-2.1
22.03.2023	WB Head	22	1950	40	1.4	40.98	1.38	2.5	-1.2
22.03.2023	WB Head	22	1972.5	40	1.4	40.95	1.39	2.4	-0.4
22.03.2023	WB Head	22	1977.6	40	1.4	40.94	1.4	2.3	-0.2
23.03.2023	WB Head	22	704	42.15	0.89	44.4	0.83	5.3	-6.0
23.03.2023	WB Head	22	707	42.13	0.89	44.37	0.83	5.3	-5.9
23.03.2023	WB Head	22	750	41.9	0.89	44.12	0.85	5.3	-4.5
23.03.2023	WB Head	22	1710.2	40.13	1.35	41.25	1.27	2.8	-6.1
23.03.2023	WB Head	22	1720	40.11	1.35	41.23	1.27	2.8	-6.1
23.03.2023	WB Head	22	1732.5	40.1	1.36	41.22	1.28	2.8	-6.0
23.03.2023	WB Head	22	1745	40.08	1.37	41.2	1.29	2.8	-6.0
23.03.2023	WB Head	22	1747.5	40.08	1.37	41.2	1.29	2.8	-6.0
23.03.2023	WB Head	22	1747.6	40.07	1.37	41.2	1.29	2.8	-6.0
23.03.2023	WB Head	22	1775	40.04	1.39	41.15	1.3	2.8	-6.0
23.03.2023	WB Head	22	1784.8	40.02	1.39	41.13	1.31	2.8	-6.1
23.03.2023	WB Head	22	1800	40	1.4	41.1	1.31	2.8	-6.1
27.03.2023	WB Head	22	826.4	41.54	0.9	42.43	0.86	2.1	-4.3
27.03.2023	WB Head	22	829	41.53	0.9	42.42	0.86	2.2	-4.2
27.03.2023	WB Head	22	835	41.5	0.9	42.39	0.86	2.2	-4.0
27.03.2023	WB Head	22	836.5	41.5	0.9	42.38	0.86	2.1	-4.1
27.03.2023	WB Head	22	836.6	41.5	0.9	42.38	0.86	2.1	-4.1
27.03.2023	WB Head	22	842	41.5	0.91	42.36	0.87	2.1	-4.5
27.03.2023	WB Head	22	844	41.5	0.91	42.35	0.87	2.0	-4.7
27.03.2023	WB Head	22	846.6	41.5	0.91	42.33	0.87	2.0	-4.9
27.03.2023	WB Head	22	847	41.5	0.91	42.33	0.87	2.0	-4.9
27.03.2023	WB Head	22	852	41.5	0.92	42.3	0.87	1.9	-5.2
27.03.2023	WB Head	22	882.4	41.5	0.95	42.16	0.88	1.6	-7.3
27.03.2023	WB Head	22	897.4	41.5	0.97	42.1	0.89	1.5	-8.3
27.03.2023	WB Head	22	897.5	41.5	0.97	42.1	0.89	1.5	-8.3
27.03.2023	WB Head	22	912.6	41.48	0.98	42.04	0.89	1.4	-8.4
28.03.2023	WB Head	22	1710.2	40.13	1.35	40.36	1.26	0.6	-6.5
28.03.2023	WB Head	22	1747.5	40.08	1.37	40.28	1.28	0.5	-6.8
28.03.2023	WB Head	22	1784.8	40.02	1.39	40.2	1.3	0.5	-6.8
28.03.2023	WB Head	22	1800	40	1.4	40.18	1.3	0.5	-6.8
29.03.2023	WB Head	22	1720	40.11	1.35	40.12	1.26	0.0	-6.7
29.03.2023	WB Head	22	1732.5	40.1	1.36	40.1	1.27	0.0	-6.6
29.03.2023	WB Head	22	1745	40.08	1.37	40.09	1.28	0.0	-6.6
29.03.2023	WB Head	22	1800	40	1.4	40.0	1.3	-0.0	-7.0
29.03.2023	WB Head	22	1852.4	40	1.4	39.91	1.33	-0.2	-5.0
29.03.2023	WB Head	22	1860	40	1.4	39.9	1.33	-0.2	-4.7
29.03.2023	WB Head	22	1880	40	1.4	39.87	1.34	-0.3	-4.1
29.03.2023	WB Head	22	1899.9	40	1.4	39.83	1.35	-0.4	-3.4

29.03.2023	WB Head	22	1900	40	1.4	39.83	1.35	-0.4	-3.4
29.03.2023	WB Head	22	1907.6	40	1.4	39.81	1.36	-0.5	-3.1
29.03.2023	WB Head	22	1950	40	1.4	39.75	1.38	-0.6	-1.3
29.03.2023	WB Head	22	1972.4	40	1.4	39.72	1.39	-0.7	-0.5
11.04.2023	WB Head	22	711	42.11	0.89	43.65	0.85	3.7	-4.6
11.04.2023	WB Head	22	750	41.9	0.89	43.53	0.86	3.9	-3.4

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.

For the cellular technologies, the device was set to transmit using maximum power with a communication tester.

A control software for WLAN was used to set the DUT to transmit at maximum power. Due to the use of test software, the measured conducted power is higher than the maximum specified output power, resulting in conservative SAR values.

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

5.1 Device Holder

The device was placed in the device holder (illustrated below) that is supplied by SPEAG as an integral part of the Dasy system.

Device holder supplied by SPEAG

5.2 Test Positions

5.2.1 Extremity Configuration, 0mm separation distance

Extremity SAR was tested from the front and back side of the device. The device was placed in the SPEAG holder on the top of a Rohacell and lifted towards the phantom until the distance between the phantom and the device was 0mm.

Front and back sides facing the phantom were also measured with SOLO 3 Portable Charger (SPC) using the worst-case SAR configuration for each frequency band.

Photos of the test positions are presented in appendix A.

5.3 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.

5.4 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%

7. TEST RESULTS

7.1 SAR Results for Extremity Condition with 0mm separation

GPRS:

Band	Channel	Frequency [MHz]	Tx Slot Configuration	Maximum slot-averaged Power [dBm]	Conducted Power [dBm]	Test Position	Measured SAR_{10g} [W/kg]	Power Drift* [dB]	Duty Cycle	Scaling Factor	Reported SAR_{10g} [W/kg]	Plot #
GPRS 850	190	836.6	3	33	31.43	Back side, 0mm	1.15	0.17	1:1	1.44	1.65	18
GPRS 850	190	836.6	3	33	31.43	Front side, 0mm	0.625	-0.24	1:1	1.52	0.95	
GPRS 850	128	824.2	3	33	31.32	Back side, 0mm	0.679	-0.52	1:1	1.66	1.13	
GPRS 850	251	848.8	3	33	31.45	Back side, 0mm	1.07	-0.21	1:1	1.43	1.53	
GPRS 850	190	836.6	3	33	31.43	Front, Portable Charger, 0mm	0.122	-1.05	1:1	1.83	0.22	
GPRS 850	190	836.6	3	33	31.43	Back, Portable Charger, 0mm	0.586	0.07	1:1	1.44	0.84	

*Larger than 5% drifts included to scaling factors

Band	Channel	Frequency [MHz]	Tx Slot Configuration	Maximum slot-averaged Power [dBm]	Conducted Power [dBm]	Test Position	Measured SAR_{10g} [W/kg]	Power Drift* [dB]	Duty Cycle	Scaling Factor	Reported SAR_{10g} [W/kg]	Plot #
GPRS 1900	661	1880	2	30	27.63	Back side, 0mm	0.44	-0.64	1:1	2.00	0.88	
GPRS 1900	661	1880	2	30	27.63	Front side, 0mm	0.15	-0.13	1:1	1.73	0.26	
GPRS 1900	512	1850.2	2	30	27.53	Back side, 0mm	0.535	0.3	1:1	1.89	1.01	19
GPRS 1900	810	1909.8	2	30	27.63	Back side, 0mm	0.438	0.06	1:1	1.73	0.76	
GPRS 1900	512	1850.2	2	30	27.53	Front, Portable Charger, 0mm	0.0287	0.31	1:1	1.90	0.05	
GPRS 1900	512	1850.2	2	30	27.53	Back, Portable Charger, 0mm	0.526	-0.24	1:1	1.87	0.98	

*Larger than 5% drifts included to scaling factors

WCDMA:

Band	Channel	Frequency [MHz]	Mode	Maximum Power [dBm]	Conducted Power [dBm]	Test Position	Measured SAR_{10g} [W/kg]	Power Drift* [dB]	Duty Cycle	Scaling Factor	Reported SAR_{10g} [W/kg]	Plot #
WCDMA 2	9400	1880	RMC 12.2K	23	22.36	Back	1.12	0.27	1:1	1.23	1.38	
WCDMA 2	9400	1880	RMC 12.2K	23	22.36	Front	0.362	0.18	1:1	1.16	0.42	
WCDMA 2	9538	1907.6	RMC 12.2K	23	22.6	Back	1.19	-0.29	1:1	1.17	1.39	
WCDMA 2	9262	1852.4	RMC 12.2K	23	22.25	Back	1.77	-0.4	1:1	1.30	2.31	20
WCDMA 2	9262	1852.4	RMC 12.2K	23	22.25	Front, Portable Charger, 0mm	0.07	-0.18	1:1	1.19	0.08	
WCDMA 2	9262	1852.4	RMC 12.2K	23	22.25	Back, Portable Charger, 0mm	1.47	0.09	1:1	1.19	1.75	

*Larger than 5% drifts included to scaling factors

Band	Channel	Frequency [MHz]	Mode	Maximum Power [dBm]	Conducted Power [dBm]	Test Position	Measured SAR_{10g} [W/kg]	Power Drift* [dB]	Duty Cycle	Scaling Factor	Reported SAR_{10g} [W/kg]	Plot #
WCDMA 5	4183	836.6	RMC 12.2K	23	22.85	Back	0.684	0.69	1:1	1.21	0.83	21
WCDMA 5	4183	836.6	RMC 12.2K	23	22.85	Front	0.439	0.19	1:1	1.04	0.45	
WCDMA 5	4233	846.6	RMC 12.2K	23	22.95	Back	0.775	0.11	1:1	1.01	0.78	
WCDMA 5	4132	826.4	RMC 12.2K	23	22.7	Back	0.636	0.51	1:1	1.21	0.77	
WCDMA 5	4183	836.6	RMC 12.2K	23	22.85	Front, Portable Charger, 0mm	0.0887	0.75	1:1	1.23	0.11	
WCDMA 5	4183	836.6	RMC 12.2K	23	22.85	Back, Portable Charger, 0mm	0.407	-0.05	1:1	1.04	0.42	

*Larger than 5% drifts included to scaling factors

LTE:

Band	Channel	Frequency [MHz]	Modulation / BW [MHz]	RB Size	RB Offset	Maximum Power [dBm]	Conducted Power [dBm]	Test position	Measured SAR_{10g} [W/kg]	Power Drift* [dB]	Duty Cycle	Scaling Factor	Reported SAR_{10g} [W/kg]	Plot #
LTE 2	19100	1899.9	QPSK / 20	1	0	25	22.75	Back side, 0mm	0.862	-0.41	1:1	1.85	1.59	
LTE 2	19100	1899.9	QPSK / 20	50	0	25	21.8	Back side, 0mm	0.654	0.15	1:1	2.09	1.37	
LTE 2	19100	1899.9	QPSK / 20	1	0	25	22.75	Front side, 0mm	0.32	0.33	1:1	1.81	0.58	
LTE 2	19100	1899.9	QPSK / 20	50	0	25	21.8	Front side, 0mm	0.253	-0.57	1:1	2.38	0.60	
LTE 2	18900	1880	QPSK / 20	1	0	25	22.64	Back side, 0mm	1.02	-0.5	1:1	1.93	1.97	
LTE 2	18700	1860	QPSK / 20	1	0	25	22.72	Back side, 0mm	1.2	-0.33	1:1	1.82	2.19	22
LTE 2	18700	1860	QPSK / 20	1	0	25	22.72	Front, Portable Charger, 0mm	0.0513	0.28	1:1	1.80	0.09	
LTE 2	18700	1860	QPSK / 20	1	0	25	22.72	Front, Portable Charger, 0mm	1.18	0.36	1:1	1.84	2.17	
LTE 2	18700	1860	QPSK / 20	100	0	25	22.72	Back, Portable Charger, 0mm	0.794	-0.47	1:1	1.88	1.50	
LTE 2	18700	1860	QPSK / 20	50	0	25	21.27	Back, Portable Charger, 0mm	0.812	-0.02	1:1	2.36	1.92	
LTE 2	18900	1880	QPSK / 20	50	0	25	21.9	Back, Portable Charger, 0mm	0.754	-0.01	1:1	2.04	1.54	

*Larger than 5% drifts included to scaling factors

Band	Channel	Frequency [MHz]	Modulation / BW [MHz]	RB Size	RB Offset	Maximum Power [dBm]	Conducted Power [dBm]	Test position	Measured SAR_{10g} [W/kg]	Power Drift* [dB]	Duty Cycle	Scaling Factor	Reported SAR_{10g} [W/kg]	Plot #
LTE 4	20300	1745	QPSK / 20	1	0	25	23.16	Back side, 0mm	2.02	-0.07	1:1	1.53	3.09	
LTE 4	20300	1745	QPSK / 20	1	0	25	23.16	Back side, 0mm	2.08	-0.1	1:1	1.53	3.18	
LTE 4	20300	1745	QPSK / 20	100	0	25	21.81	Back side, 0mm	1.56	-0.01	1:1	2.08	3.25	
LTE 4	20300	1745	QPSK / 20	50	0	25	22.16	Back side, 0mm	1.56	-0.11	1:1	1.92	3.00	
LTE 4	20300	1745	QPSK / 20	1	0	25	23.16	Front side, 0mm	0.355	-0.24	1:1	1.61	0.57	
LTE 4	20300	1745	QPSK / 20	50	0	25	22.16	Front side, 0mm	0.278	-0.01	1:1	1.92	0.53	
LTE 4	20050	1720	QPSK / 20	1	0	25	22.86	Back side, 0mm	1.39	-0.38	1:1	1.79	2.48	
LTE 4	20050	1720	QPSK / 20	50	0	25	21.84	Back side, 0mm	1.45	-0.37	1:1	2.25	3.27	
LTE 4	20050	1720	QPSK / 20	100	0	25	21.95	Back side, 0mm	1.5	-0.12	1:1	2.02	3.03	
LTE 4	20175	1732	QPSK / 20	1	0	25	23	Back side, 0mm	1.86	-0.09	1:1	1.58	2.95	
LTE 4	20175	1732	QPSK / 20	50	0	25	22.16	Back side, 0mm	1.51	-0.01	1:1	1.92	2.90	
LTE 4	20175	1732	QPSK / 20	100	0	25	22.04	Back side, 0mm	1.48	-0.11	1:1	1.98	2.93	
LTE 4	20300	1745	QPSK / 20	100	0	25	21.81	Front, Portable Charger, 0mm	0.0978	0.54	1:1	2.36	0.23	
LTE 4	20300	1745	QPSK / 20	100	0	25	21.81	Back, Portable Charger, 0mm	1.5	-0.55	1:1	2.37	3.55	23

*Larger than 5% drifts included to scaling factors

Band	Channel	Frequency [MHz]	Modulation / BW [MHz]	RB Size	RB Offset	Maximum Power [dBm]	Conducted Power [dBm]	Test position	Measured SAR_{10g} [W/kg]	Power Drift* [dB]	Duty Cycle	Scaling Factor	Reported SAR_{10g} [W/kg]	Plot #
LTE 5	20600	844	QPSK / 10	1	0	25	22.95	Back side, 0mm	0.682	-0.34	1:1	1.73	1.18	
LTE 5	20600	844	QPSK / 10	50	0	25	22.01	Back side, 0mm	0.601	0.17	1:1	1.99	1.20	24
LTE 5	20600	844	QPSK / 10	1	0	25	22.95	Front side, 0mm	0.397	0.74	1:1	1.90	0.75	
LTE 5	20600	844	QPSK / 10	50	0	25	22.01	Front side, 0mm	0.326	0.94	1:1	2.47	0.81	
LTE 5	20450	829	QPSK / 10	1	0	25	22.89	Back side, 0mm	0.606	0.41	1:1	1.79	1.08	
LTE 5	20525	836.5	QPSK / 10	1	0	25	22.91	Back side, 0mm	0.671	-0.23	1:1	1.71	1.14	
LTE 5	20600	844	QPSK / 10	50	0	25	22.01	Front, Portable Charger, 0mm	0.0646	0.4	1:1	2.18	0.14	
LTE 5	20600	844	QPSK / 10	50	0	25	22.01	Back, Portable Charger, 0mm	0.246	0.25	1:1	2.11	0.52	

*Larger than 5% drifts included to scaling factors

Band	Channel	Frequency [MHz]	Modulation / BW [MHz]	RB Size	RB Offset	Maximum Power [dBm]	Conducted Power [dBm]	Test position	Measured SAR_{10g} [W/kg]	Power Drift* [dB]	Duty Cycle	Scaling Factor	Reported SAR_{10g} [W/kg]	Plot #
LTE 7	21350	2560	QPSK / 20	1	50	25	23.81	Back side, 0mm	0.151	-0.45	1:1	1.46	0.220	
LTE 7	21350	2560	QPSK / 20	50	0	25	22.89	Back side, 0mm	0.115	-0.56	1:1	1.85	0.21	
LTE 7	21350	2560	QPSK / 20	1	50	25	23.81	Front side, 0mm	0.0506	-0.73	1:1	1.56	0.08	
LTE 7	21350	2560	QPSK / 20	50	0	25	22.89	Front side, 0mm	0.0338	-1.21	1:1	2.15	0.07	
LTE 7	20850	2510	QPSK / 20	1	50	25	23.46	Back side, 0mm	0.115	0.23	1:1	1.50	0.17	
LTE 7	21100	2535	QPSK / 20	1	99	25	23.55	Back side, 0mm	0.13	-0.95	1:1	1.74	0.226	25
LTE 7	21100	2535	QPSK / 20	1	99	25	23.55	Front, Portable Charger, 0mm	0.00000207	0	1:1	1.40	0.0000029	
LTE 7	21100	2535	QPSK / 20	1	99	25	23.55	Back, Portable Charger, 0mm	0.112	0.15	1:1	1.40	0.16	

*Larger than 5% drifts included to scaling factors

Band	Channel	Frequency [MHz]	Modulation / BW [MHz]	RB Size	RB Offset	Maximum Power [dBm]	Conducted Power [dBm]	Test position	Measured SAR_{10g} [W/kg]	Power Drift* [dB]	Duty Cycle	Scaling Factor	Reported SAR_{10g} [W/kg]	Plot #
LTE 12	23130	711	QPSK / 10	1	0	25	22.98	Back side, 0mm	0.129	-1.08	1:1	2.04	0.26	26
LTE 12	23130	711	QPSK / 10	50	0	25	22.05	Back side, 0mm	0.0998	0.25	1:1	2.09	0.21	
LTE 12	23130	711	QPSK / 10	1	0	25	22.98	Front side, 0mm	0.0734	-0.41	1:1	1.75	0.13	
LTE 12	23130	711	QPSK / 10	50	0	25	22.05	Front side, 0mm	0.0681	-0.71	1:1	2.32	0.16	
LTE 12	23060	704	QPSK / 10	1	0	25	22.95	Back side, 0mm	0.0986	-0.35	1:1	1.74	0.17	
LTE 12	23095	707	QPSK / 10	1	0	25	22.93	Back side, 0mm	0.118	-0.23	1:1	1.70	0.20	
LTE 12	23130	711	QPSK / 10	1	0	25	22.98	Front, Portable Charger, 0mm	0.00561	0**	1:1	2.85	0.02	
LTE 12	23130	711	QPSK / 10	1	0	25	22.98	Back, Portable Charger, 0mm	0.108	0.69	1:1	1.87	0.20	

*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.

2.4GHz WLAN:

Mode	Data Rate [Mbps]	Frequency [MHz]	Channel	Test position	Maximum Power [dBm]	Conducted Power [dBm]	Measured SAR_{10g} [W/kg]	Power Drift [dB]*	Scaling Factor	Duty Cycle [%]	Reported SAR_{10g} [W/kg]	Plot #
802.11b	1	2412	1	Back side, 0mm	18	21.35	0.0476000	0.13	1.00	100	0.05	
802.11b	1	2412	1	Front side, 0mm	18	21.35	0.162000	-0.72	1.18	100	0.19	
802.11b	1	2437	6	Front side, 0mm	18	21.26	0.21	-0.65	1.16	100	0.24	
802.11b	1	2462	11	Front side, 0mm	18	20.74	0.27	-0.45	1.11	100	0.30	27
802.11b	1	2462	11	Front, Portable Charger, 0mm	18	20.74	0.02	-0.17	1.00	100	0.02	
802.11b	1	2462	11	Back, Portable Charger, 0mm	18	20.74	0.11	-0.89	1.23	100	0.13	

*Larger than 5% drifts included to scaling factors

BLE:

Data Rate [Mbps]	Frequency [MHz]	Channel	Test position	Maximum Power [dBm]	Conducted Power [dBm]	Measured SAR_{10g} [W/kg]	Power Drift [dB]**	Scaling Factor	Duty Cycle [%]	Reported SAR_{10g} [W/kg]	Plot #
1	2402	0	Back side, 0mm	10	7.04	0.00037	0	1.98	100	0.0007	
1	2402	0	Front side, 0mm	10	7.04	0.0029	0.18	1.98	100	0.0057	
1	2442	18	Front side, 0mm	10	6.88	0.0058	-0.19	2.05	100	0.0118	28
1	2478	36	Front side, 0mm	10	6.52	0.0026	-0.8	2.68	100	0.0069	
1	2442	18	Front, Portable Charger, 0mm	10	6.88	0*	0***	2.05	100	0.0000	
1	2442	18	Back, Portable Charger, 0mm	10	6.88	0.0010	0***	2.05	100	0.0020	

*Due to low e-field generated by DUT, the measurements are not applicable
**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.

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 Calculated ISM 915.25 MHz SAR

7.3.1 FCC

For simultaneous transmission evaluation the estimated standalone SAR values are calculated according to the following equation below.

$$SAR_{estimated} = 0.4 * Pant/Pth \ [w/kg] \quad \text{(Equation 9)}$$

Estimated ISM 915.25 MHz SAR = 0.4*(0.0038/20.3) = 0.00007 W/kg

7.3.2 ISED

The estimated SAR value for ISM 915.25 MHz is evaluated according to the following equation stated in Notice 2016-DRS001:

(maximum power level including tune-up tolerance for transmitter A / maximum power level of exemption at the same frequency and distance) * 0.4 W/kg

According to RSS-102, issue 5, 2015, the SAR test exclusion power threshold for 915.25 MHz is 16.2mW at ≤5mm separation distance.

Estimated ISM 915.25 MHz SAR = 0.0038/16.2*0.4 = 0.00009 W/kg

7.4 Calculated Metal detector 17MHz SAR

7.4.1 FCC

For simultaneous transmission evaluation the estimated standalone SAR values are calculated according to the following equation above.

$$SAR_{estimated} = 0.4 * Pant/Pth \ [w/kg] \quad \text{(Equation 10)}$$

Estimated Metal detector 17 MHz SAR = $0.4*(7.44*10^{-8}/420) = 7.09^{-11}$ W/kg

7.4.2 ISED

The estimated SAR value for Metal detector's transmitter 17MHz is evaluated according to the following equation stated in Notice 2016-DRS001:

(maximum power level including tune-up tolerance for transmitter A / maximum power level of exemption at the same frequency and distance) * 0.4 W/kg

According to RSS-102, issue 5, 2015, the SAR test exclusion power threshold for 17MHz is 71mW at ≤5mm separation distance.
Estimated Metal detector 17MHz SAR = $7.44*10^{-8}/71*0.4 = 4.191^{-10}$ W/kg

7.5 Simultaneous Transmission Analysis

Simultaneous transmission analysis for the maximum Cellular, WLAN, BLE, ISM and metal detector SAR is in the table below. Direct summation of SAR results was performed.

7.5.1 FCC Extremity SAR:

	Exposure Condition	Extremity SAR_{10g} [W/kg]			
		Front side		Back side	
	Test Position	Front	Front, Portable Charger	Back	Back, Portable Charger
Cellular	GPRS 850	0.95	0.22	1.65	0.84
	GPRS 1900	0.26	0.05	1.01	0.98
	WCDMA 2	0.42	0.08	2.31	1.75
	WCDMA 5	0.45	0.11	0.83	0.42
	LTE 2	0.60	2.17	2.19	1.92
	LTE 4	0.57	0.23	3.27	3.55
	LTE 5	0.81	0.14	1.20	0.52
	LTE 7	0.08	0.0000029	0.226	0.16
	LTE 12	0.16	0.02	0.26	0.20
Maximum Cellular SAR		2.17		3.55	
WLAN 2.4GHz		0.30	0.02	0.05	0.13
BLE		0.012	0	0.0007	0.002
ISM		0.00007			
Metal detector		7.09^{-11}			
SAR Summation:		2.48	2.19	3.60	3.68

7.5.2 ISED Extremity SAR:

	Exposure Condition	Extremity SAR_{10g} [W/kg]			
		Front side		Back side	
	Test Position	Front	Front, Portable Charger	Back	Back, Portable Charger
Cellular	GPRS 850	0.95	0.22	1.65	0.84
	GPRS 1900	0.26	0.05	1.01	0.98
	WCDMA 2	0.42	0.08	2.31	1.75
	WCDMA 5	0.45	0.11	0.83	0.42
	LTE 2	0.60	2.17	2.19	1.92
	LTE 4	0.57	0.23	3.27	3.55
	LTE 5	0.81	0.14	1.20	0.52
	LTE 7	0.08	0.0000029	0.226	0.16
	LTE 12	0.16	0.02	0.26	0.20
Maximum Cellular SAR		2.17		3.55	
WLAN 2.4GHz		0.30	0.02	0.05	0.13
BLE		0.012	0	0.0007	0.002
ISM		0.00009			
Metal detector		4.191^{-10}			
SAR Summation:		2.48	2.19	3.60	3.68

APPENDIX A: PHOTOS OF THE DUT

Size of the DUT is: 77mm x 50mm x 25mm

Figure 3. Front side of the DUT

Figure 4. Back side of the DUT

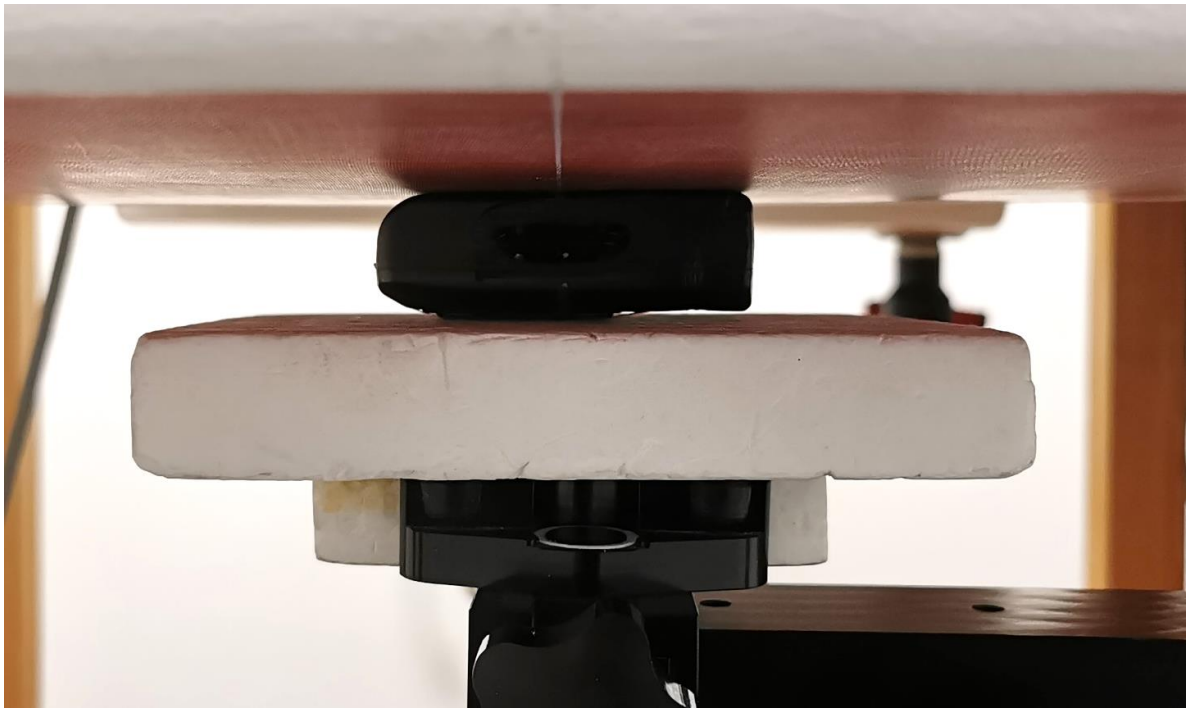


Figure 5. Back side of the DUT, 0mm

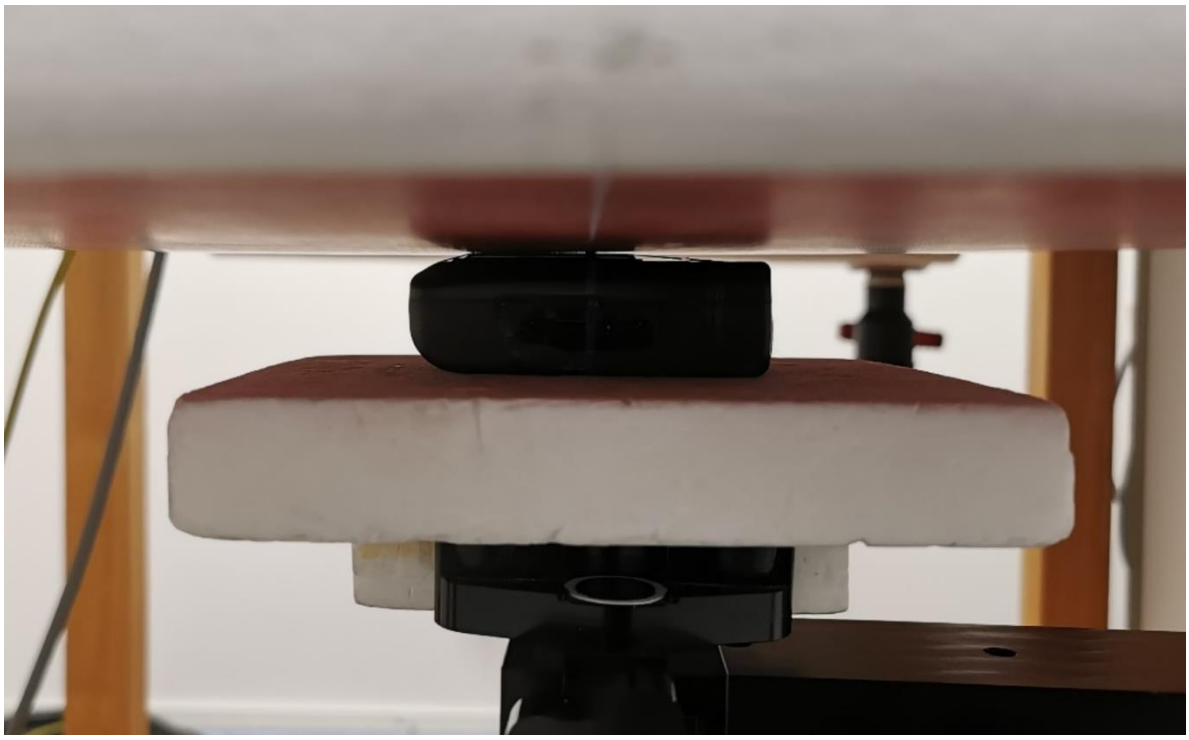


Figure 6. Front side of the DUT, 0mm

Figure 7. Front side of the DUT, SOLO 3 Portable Charger (SPC), 0mm

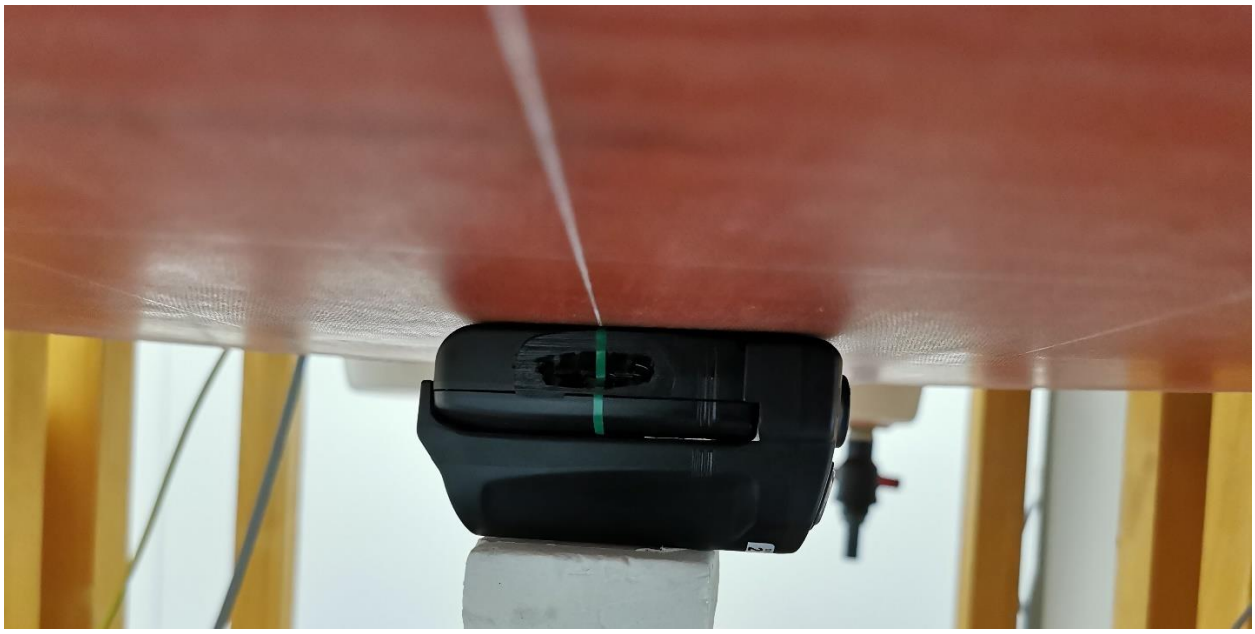


Figure 8. Back side of the DUT, SOLO 3 Portable Charger (SPC), 0mm

APPENDIX B: SYSTEM CHECK SCAN

Plot 1

Date/Time: 16.3.2023 11.10.36

Test Laboratory: Verkotan Oy

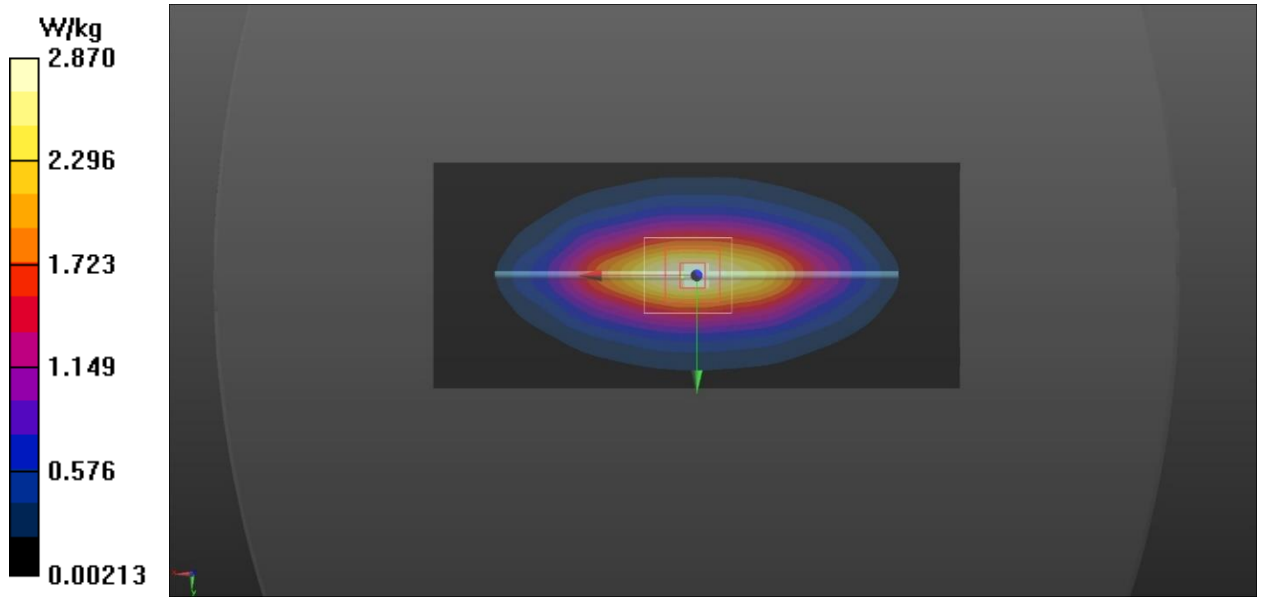
DUT: Dipole 835 MHz D835V2; Type: D835V2; Serial: D835V2 - SN:455

Communication System: UID 0, CW (0); Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 835 MHz; σ = 0.865 S/m; ε_r = 43.404; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(9.37, 8.45, 8.89) @ 835 MHz; Calibrated: 17.2.2023
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn1332; Calibrated: 15.2.2023
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System Check 835MHz/Area Scan (141x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.87 W/kg
Configuration/System Check 835MHz/Zoom Scan (8x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 58.96 V/m; Power Drift = -0.25 dB
Peak SAR (extrapolated) = 3.10 W/kg
SAR(1 g) = 2.22 W/kg; SAR(10 g) = 1.45 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 18.6 mm
Ratio of SAR at M2 to SAR at M1 = 68.4%
Maximum value of SAR (measured) = 2.81 W/kg



Plot 2

Date/Time: 20.3.2023 8.35.02

Test Laboratory: Verkotan Oy

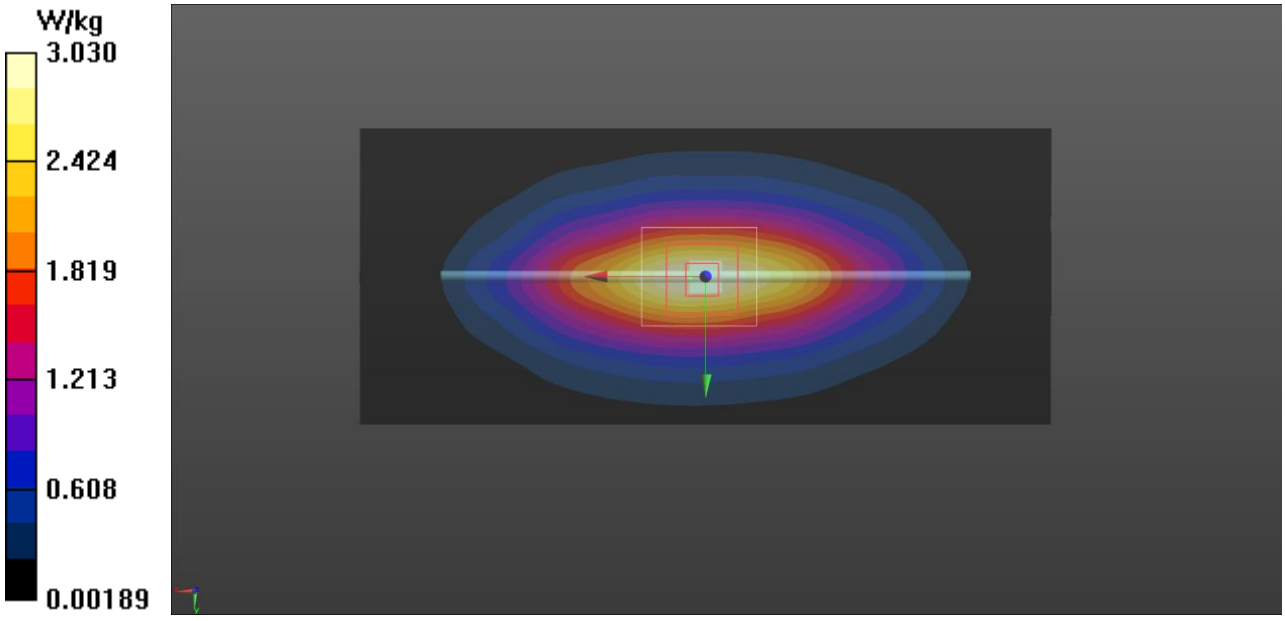
DUT: Dipole 835 MHz D835V2; Type: D835V2; Serial: D835V2 - SN:455

Communication System: UID 0, CW (0); Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 835 MHz; σ = 0.889 S/m; ε_r = 43.23; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(9.37, 8.45, 8.89) @ 835 MHz; Calibrated: 17.2.2023
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn1332; Calibrated: 15.2.2023
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System Check 835MHz/Area Scan (141x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 3.03 W/kg
Configuration/System Check 835MHz/Zoom Scan (8x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 59.40 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.36 W/kg
SAR(1 g) = 2.36 W/kg; SAR(10 g) = 1.56 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 16.3 mm
Ratio of SAR at M2 to SAR at M1 = 68.5%
Maximum value of SAR (measured) = 3.05 W/kg



Plot 3

Date/Time: 21.3.2023 8.39.31

Test Laboratory: Verkotan Oy

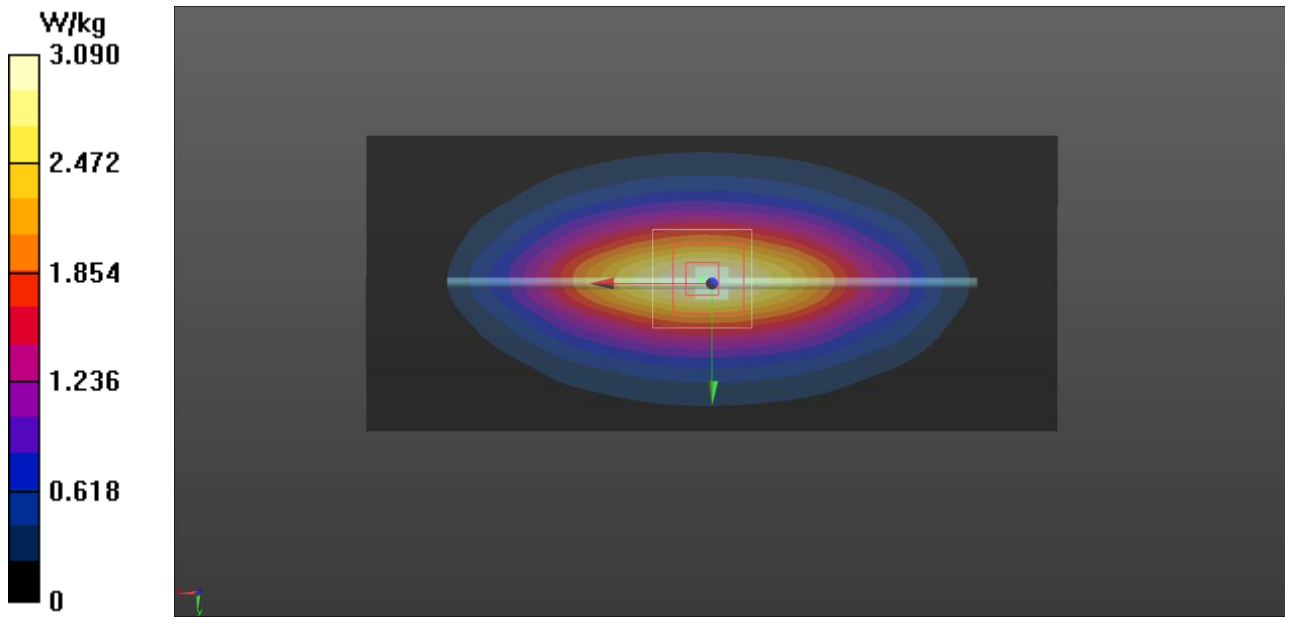
DUT: Dipole 835 MHz D835V2; Type: D835V2; Serial: D835V2 - SN:455

Communication System: UID 0, CW (0); Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 835 MHz; σ = 0.925 S/m; ε_r = 44.911; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3892; ConvF(9.95, 9.95, 9.95) @ 835 MHz; Calibrated: 12.4.2022
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.2022
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System Check 835MHz/Area Scan (141x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 3.09 W/kg
Configuration/System Check 835MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.66 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 3.56 W/kg
SAR(1 g) = 2.32 W/kg; SAR(10 g) = 1.52 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 17.4 mm
Ratio of SAR at M2 to SAR at M1 = 65.4%
Maximum value of SAR (measured) = 3.15 W/kg



Plot 4

Date/Time: 22/03/2023 09:17:57

Test Laboratory: Verkotan Oy

DUT: Dipole 750 MHz D750V3; Type: D750V3; Serial: D750V3 - SN:1154

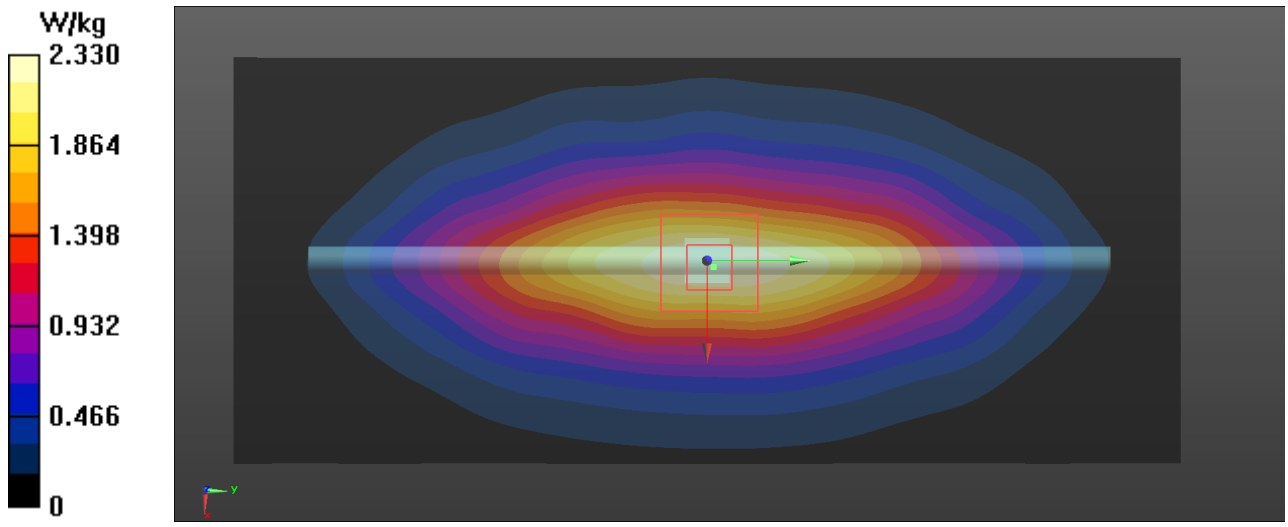
Communication System: UID 0, CW (0); Communication System Band: D750 (750.0 MHz); Frequency: 750 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 750 MHz; σ = 0.84 S/m; ε_r = 44.205; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3892; ConvF(10.26, 10.26, 10.26) @ 750 MHz; Calibrated: 12/04/2022
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19/10/2022
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System Check 750MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.54 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 2.77 W/kg
SAR(1 g) = 1.94 W/kg; SAR(10 g) = 1.26 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 21.2 mm
Ratio of SAR at M2 to SAR at M1 = 66.1%
Maximum value of SAR (measured) = 2.46 W/kg

Configuration/System Check 750MHz/Area Scan (141x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.33 W/kg



Plot 5

Date/Time: 22.3.2023 13.27.48

Test Laboratory: Verkotan Oy

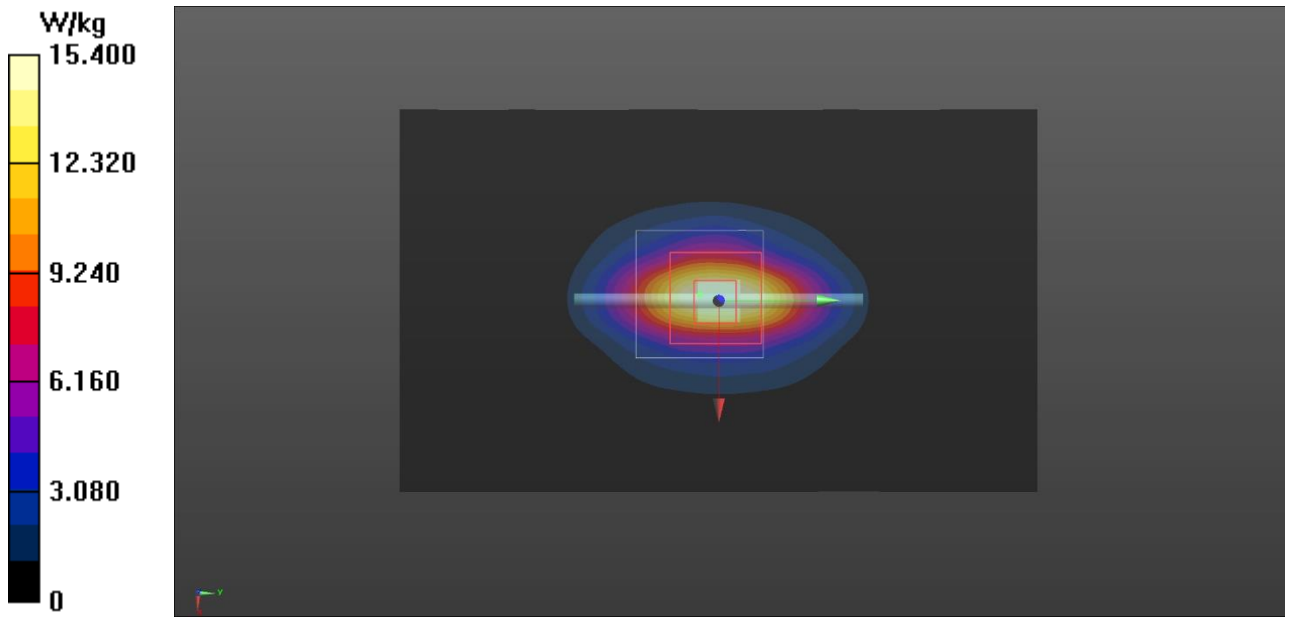
DUT: D1900V2 - SN5d004; Type: D1900V2; Serial: SN5d004

Communication System: UID 0, CW (0); Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 1900 MHz; σ = 1.355 S/m; ε_r = 41.067; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3892; ConvF(8.31, 8.31, 8.31) @ 1900 MHz; Calibrated: 12.4.2022
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.2022
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System Check 1900MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 104.7 V/m; Power Drift = -0.20 dB
Peak SAR (extrapolated) = 18.8 W/kg
SAR(1 g) = 10 W/kg; SAR(10 g) = 5.12 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 8.1 mm
Ratio of SAR at M2 to SAR at M1 = 54.1%
Maximum value of SAR (measured) = 14.9 W/kg
Configuration/System Check 1900MHz/Area Scan (101x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 15.4 W/kg



Plot 6

Date/Time: 23.3.2023 15.18.27

Test Laboratory: Verkotan Oy

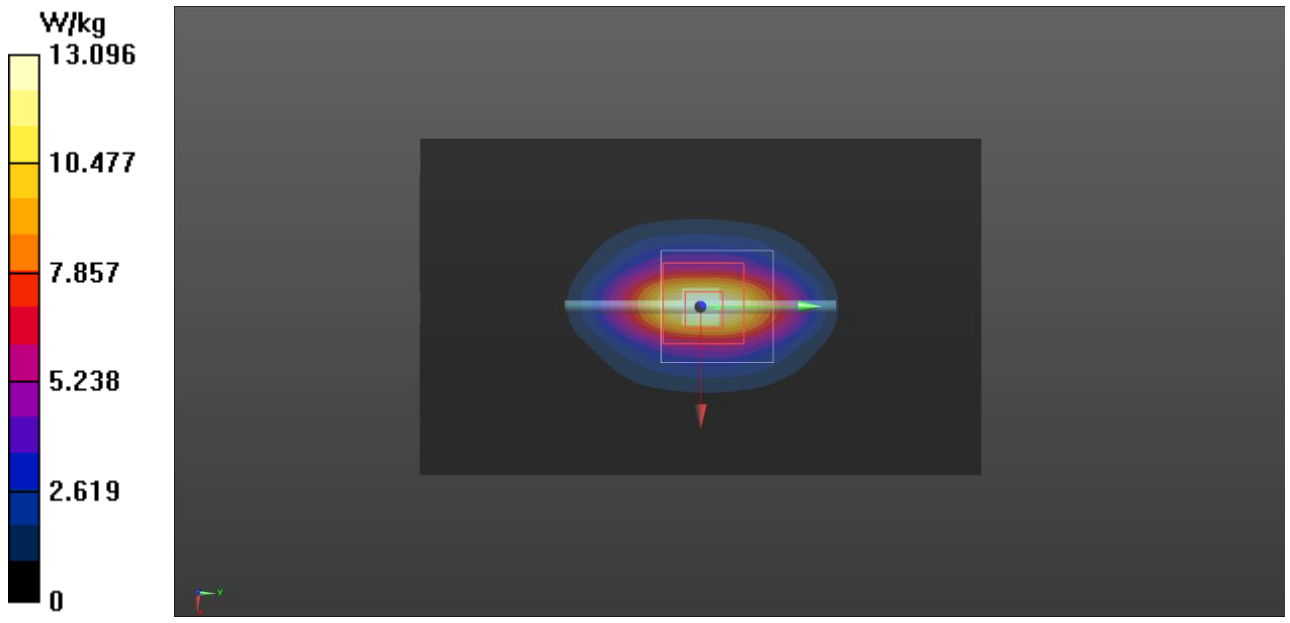
DUT: Dipole 1800 MHz D1800V2; Type: D1800V2; Serial: D1800V2 - SN:249

Communication System: UID 0, CW (0); Communication System Band: D1800 (1800.0 MHz); Frequency: 1800 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 1800 MHz; σ = 1.315 S/m; ε_r = 41.102; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(7.9, 7.9, 7.9) @ 1800 MHz; Calibrated: 27.10.2022
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.2022
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System Check 1800MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 97.56 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 15.2 W/kg
SAR(1 g) = 8.79 W/kg; SAR(10 g) = 4.62 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 8 mm
Ratio of SAR at M2 to SAR at M1 = 56.6%
Maximum value of SAR (measured) = 12.7 W/kg
Configuration/System Check 1800MHz/Area Scan (101x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 13.1 W/kg



Plot 7

Date/Time: 23/03/2023 14:00:44

Test Laboratory: Verkotan Oy

DUT: D2450V2 - SN729; Type: D2450V2; Serial: SN729

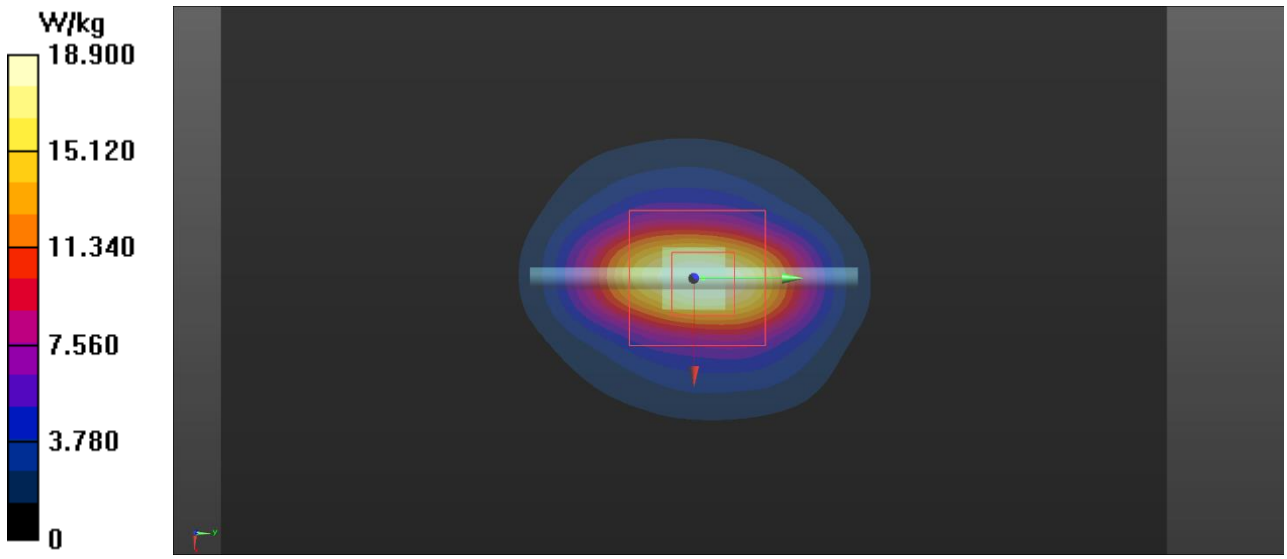
Communication System: UID 0, CW (0); Communication System Band: D2450 (2450.0 MHz); Frequency: 2450 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 2450 MHz; σ = 1.693 S/m; ε_r = 40.214; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3892; ConvF(7.66, 7.66, 7.66) @ 2450 MHz; Calibrated: 12/04/2022
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19/10/2022
  - Phantom: SAR2_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 = 103.6 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 23.8 W/kg
SAR(1 g) = 12.1 W/kg; SAR(10 g) = 5.66 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 7 mm
Ratio of SAR at M2 to SAR at M1 = 51.1%
Maximum value of SAR (measured) = 18.9 W/kg

Configuration/System Check 2450MHz/Area Scan (101x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 18.9 W/kg



Plot 8

Date/Time: 27.3.2023 9.32.24

Test Laboratory: Verkotan Oy

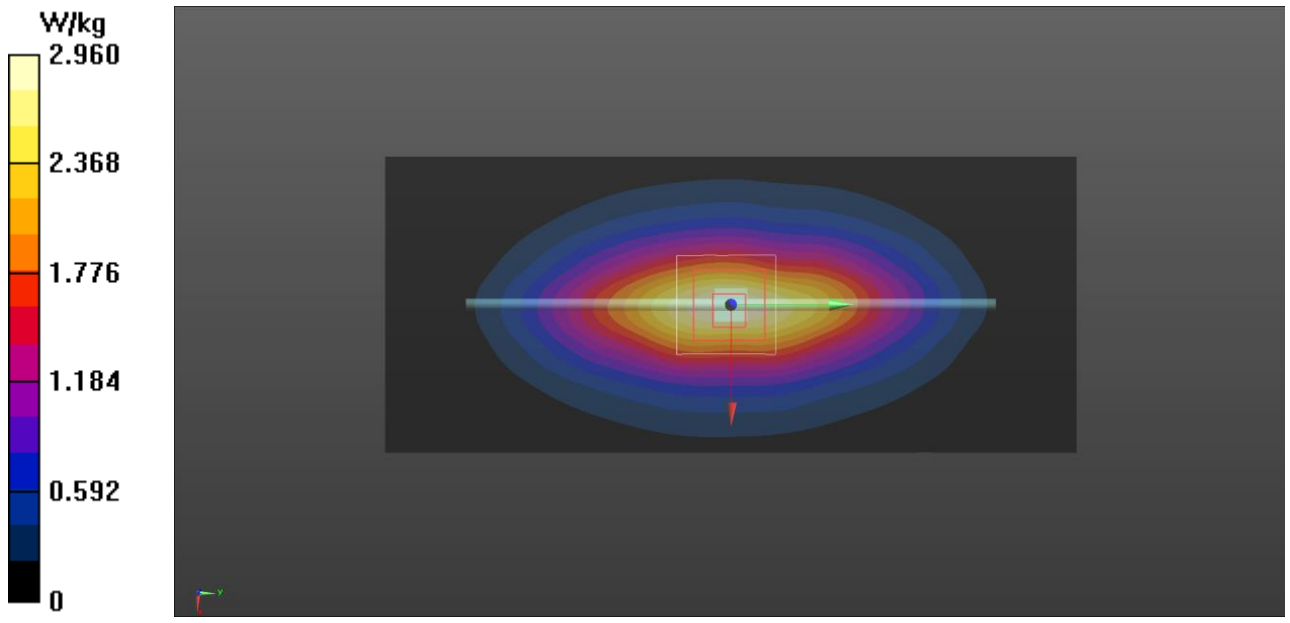
DUT: Dipole 835 MHz D835V2; Type: D835V2; Serial: D835V2 - SN:455

Communication System: UID 0, CW (0); Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 835 MHz; σ = 0.864 S/m; ε_r = 42.394; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(8.82, 8.82, 8.82) @ 835 MHz; Calibrated: 27.10.2022
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.2022
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System Check 835MHz/Area Scan (141x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.96 W/kg
Configuration/System Check 835MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 60.36 V/m; Power Drift = -0.20 dB
Peak SAR (extrapolated) = 3.39 W/kg
SAR(1 g) = 2.34 W/kg; SAR(10 g) = 1.51 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 18 mm
Ratio of SAR at M2 to SAR at M1 = 67.4%
Maximum value of SAR (measured) = 2.98 W/kg



Plot 9

Date/Time: 28.3.2023 9.52.35

Test Laboratory: Verkotan Oy

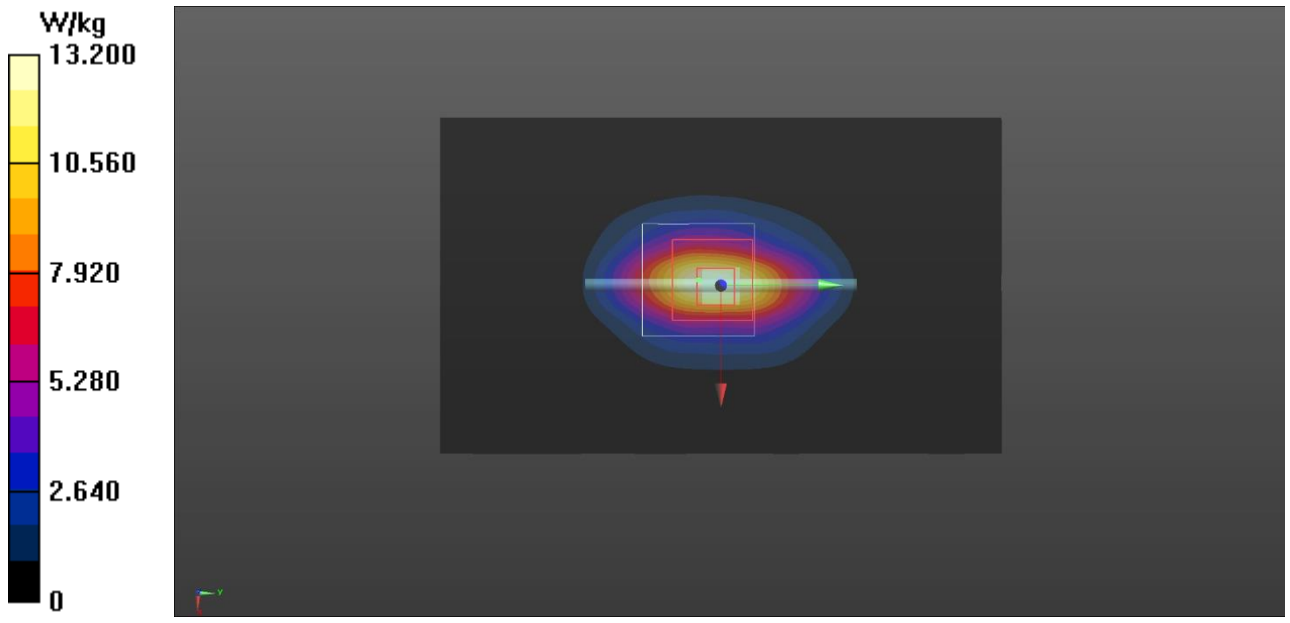
DUT: Dipole 1800 MHz D1800V2; Type: D1800V2; Serial: D1800V2 - SN:249

Communication System: UID 0, CW (0); Communication System Band: D1800 (1800.0 MHz); Frequency: 1800 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 1800 MHz; σ = 1.315 S/m; ε_r = 41.102; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(7.9, 7.9, 7.9) @ 1800 MHz; Calibrated: 27.10.2022
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.2022
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System Check 1800MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 98.00 V/m; Power Drift = -0.17 dB
Peak SAR (extrapolated) = 15.7 W/kg
SAR(1 g) = 8.97 W/kg; SAR(10 g) = 4.67 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 8 mm
Ratio of SAR at M2 to SAR at M1 = 56.9%
Maximum value of SAR (measured) = 12.8 W/kg
Configuration/System Check 1800MHz/Area Scan (101x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 13.2 W/kg



Plot 10

Date/Time: 29.3.2023 10.06.46

Test Laboratory: Verkotan Oy

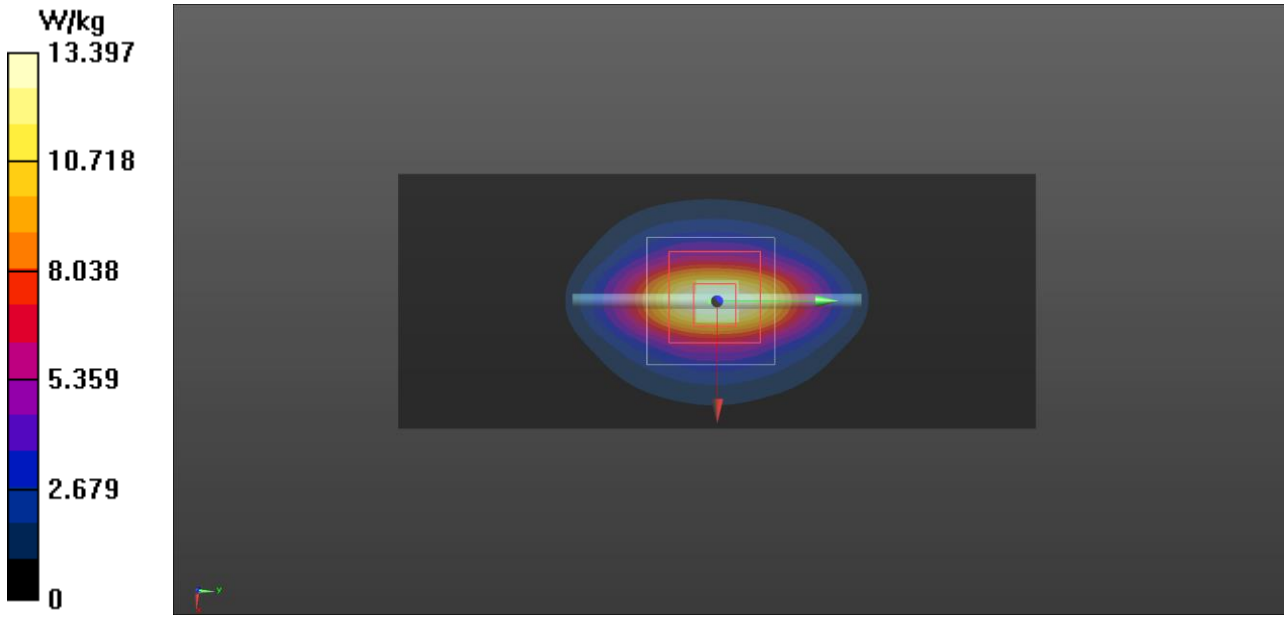
DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: D1900V2 - SN:511

Communication System: UID 0, CW (0); Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 1900 MHz; σ = 1.353 S/m; ε_r = 39.827; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(7.72, 7.72, 7.72) @ 1900 MHz; Calibrated: 27.10.2022
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.2022
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System Check 1900MHz/Area Scan (101x41x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 13.4 W/kg
Configuration/System Check 1900MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 104.4 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 16.6 W/kg
SAR(1 g) = 9.11 W/kg; SAR(10 g) = 4.73 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 = 55.8%
Maximum value of SAR (measured) = 13.6 W/kg



Plot 11

Date/Time: 30.3.2023 7.47.29

Test Laboratory: Verkotan Oy

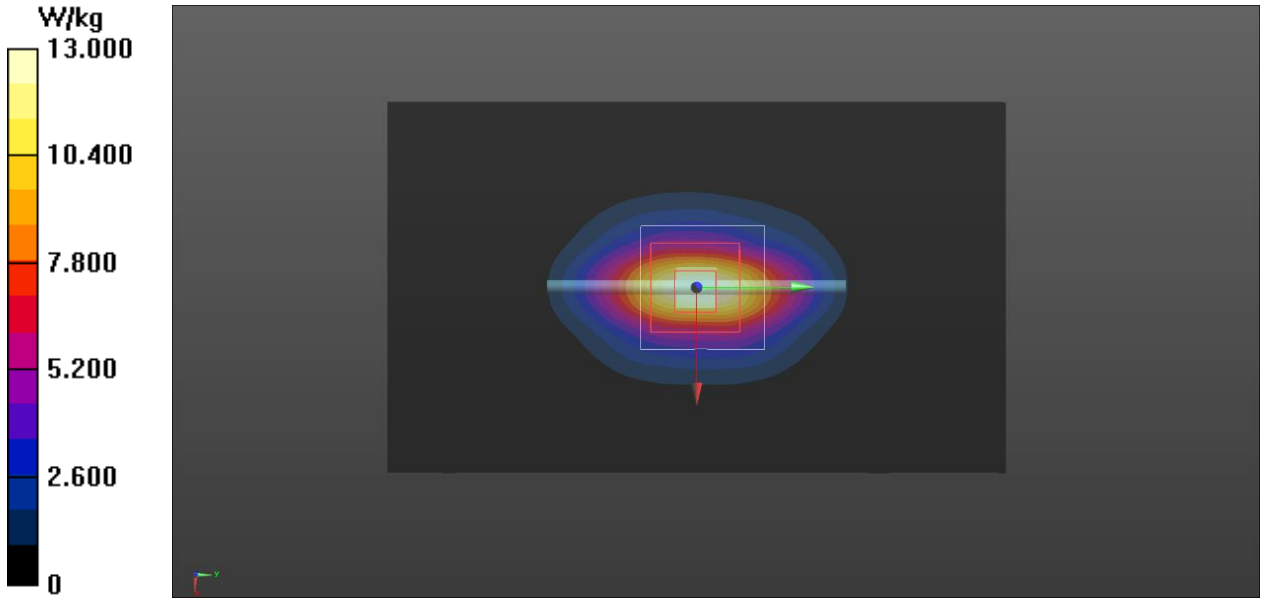
DUT: Dipole 1800 MHz D1800V2; Type: D1800V2; Serial: D1800V2 - SN:249

Communication System: UID 0, CW (0); Communication System Band: D1800 (1800.0 MHz); Frequency: 1800 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 1800 MHz; σ = 1.302 S/m; ε_r = 39.997; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(7.9, 7.9, 7.9) @ 1800 MHz; Calibrated: 27.10.2022
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn710; Calibrated: 19.10.2022
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System Check 1800MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 105.1 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 15.5 W/kg
SAR(1 g) = 8.88 W/kg; SAR(10 g) = 4.65 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 8 mm
Ratio of SAR at M2 to SAR at M1 = 56.7%
Maximum value of SAR (measured) = 12.7 W/kg
Configuration/System Check 1800MHz/Area Scan (101x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 13.0 W/kg



Plot 12

Date/Time: 11.4.2023 15.02.46

Test Laboratory: Verkotan Oy

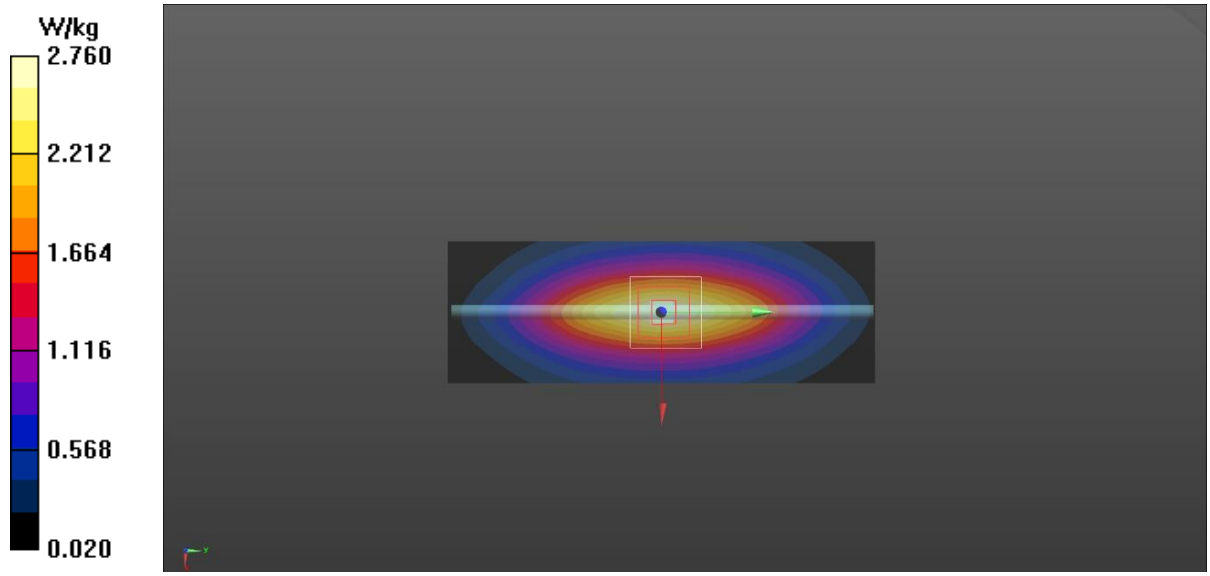
DUT: Dipole 750 MHz D750V3; Type: D750V3; Serial: D750V3 - SN:1154

Communication System: UID 0, CW (0); Communication System Band: D750 (750.0 MHz); Frequency: 750 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 750 MHz; σ = 0.859 S/m; ε_r = 43.532; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(9.91, 8.74, 9.52) @ 750 MHz; Calibrated: 17.2.2023
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn1332; Calibrated: 15.2.2023
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/system check 750Mhz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 63.06 V/m; Power Drift = -0.42 dB
Peak SAR (extrapolated) = 3.05 W/kg
SAR(1 g) = 2.18 W/kg; SAR(10 g) = 1.44 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 = 68.5%
Maximum value of SAR (measured) = 2.75 W/kg
Configuration/system check 750Mhz/Area Scan (61x181x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 2.76 W/kg



Plot 13

Date/Time: 21/04/2023 09:53:54

Test Laboratory: Verkotan Oy

DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: D1900V2 - SN:511

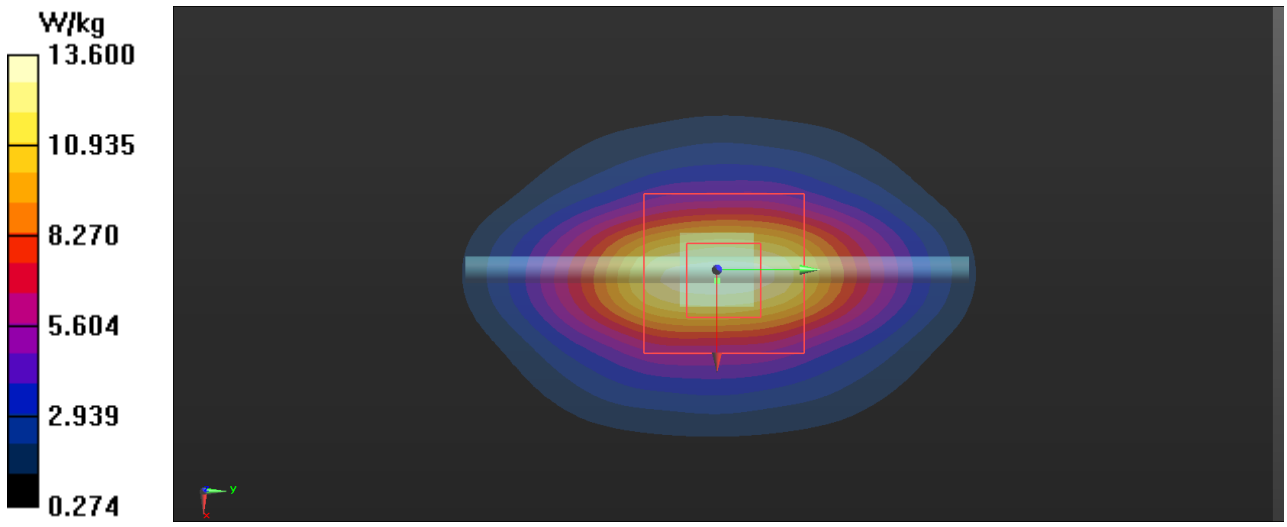
Communication System: UID 0, CW (0); Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 1900 MHz; σ = 1.345 S/m; ε_r = 42.102; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.05, 7.59, 7.97) @ 1900 MHz; Calibrated: 17/02/2023
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn1332; Calibrated: 15/02/2023
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System Check 1900MHz/Area Scan (101x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 13.1 W/kg

Configuration/System Check 1900MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 108.0 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 16.1 W/kg
SAR(1 g) = 9.49 W/kg; SAR(10 g) = 5 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 7 mm
Ratio of SAR at M2 to SAR at M1 = 57.9%
Maximum value of SAR (measured) = 13.6 W/kg



Plot 14

Date/Time: 21/04/2023 09:30:58

Test Laboratory: Verkotan Oy

DUT: Dipole 2600 MHz D2600V2; Type: D2600V2; Serial: D2600V2 - SN:DIP2G600-637

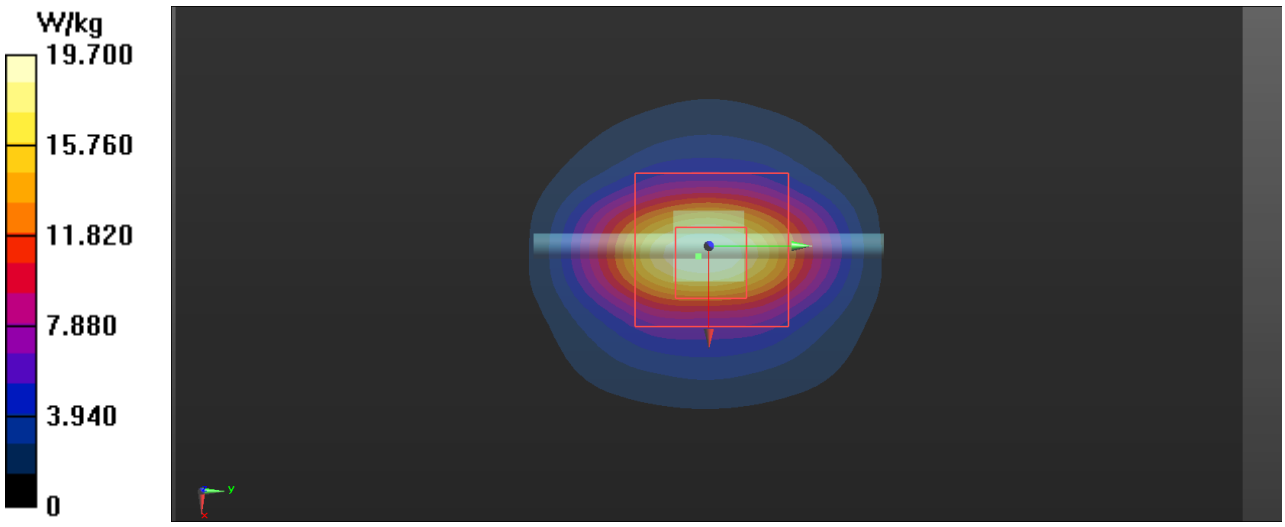
Communication System: UID 0, CW (0); Communication System Band: D2600 (2600.0 MHz); Frequency: 2600 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 2600 MHz; σ = 1.814 S/m; ε_r = 40.836; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(7.55, 7.37, 7.73) @ 2600 MHz; Calibrated: 17/02/2023
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn1332; Calibrated: 15/02/2023
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System Check 2600MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 113.5 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 25.3 W/kg
SAR(1 g) = 13 W/kg; SAR(10 g) = 5.89 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 6 mm
Ratio of SAR at M2 to SAR at M1 = 51.1%
Maximum value of SAR (measured) = 20.2 W/kg

Configuration/System Check 2600MHz/Area Scan (101x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 19.7 W/kg



Plot 15

Date/Time: 24/04/2023 09:00:36

Test Laboratory: Verkotan Oy

DUT: D2450V2 - SN729; Type: D2450V2; Serial: SN729

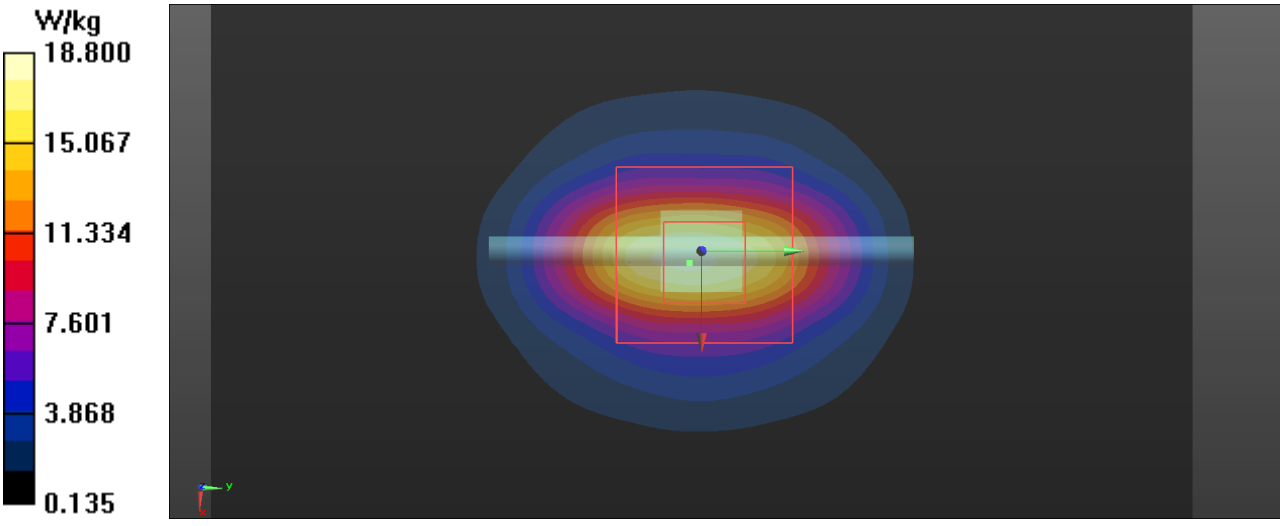
Communication System: UID 0, CW (0); Communication System Band: D2450 (2450.0 MHz); Frequency: 2450 MHz;
Communication System PAR: 0 dB;
Medium parameters used (interpolated): f = 2450 MHz; σ = 1.655 S/m; ε_r = 41.408; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(7.7, 7.5, 7.63) @ 2450 MHz; Calibrated: 17/02/2023
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn1332; Calibrated: 15/02/2023
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System Check 2450MHz 2 2/Area Scan (81x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 17.9 W/kg

Configuration/System Check 2450MHz 2 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 111.0 V/m; Power Drift = 0.15 dB
Peak SAR (extrapolated) = 23.3 W/kg
SAR(1 g) = 12.4 W/kg; SAR(10 g) = 5.78 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 7 mm
Ratio of SAR at M2 to SAR at M1 = 51.4%
Maximum value of SAR (measured) = 18.8 W/kg



Plot 16

Date/Time: 25/04/2023 11:49:50

Test Laboratory: Verkotan Oy

DUT: Dipole 835 MHz D835V2; Type: D835V2; Serial: D835V2 - SN:455

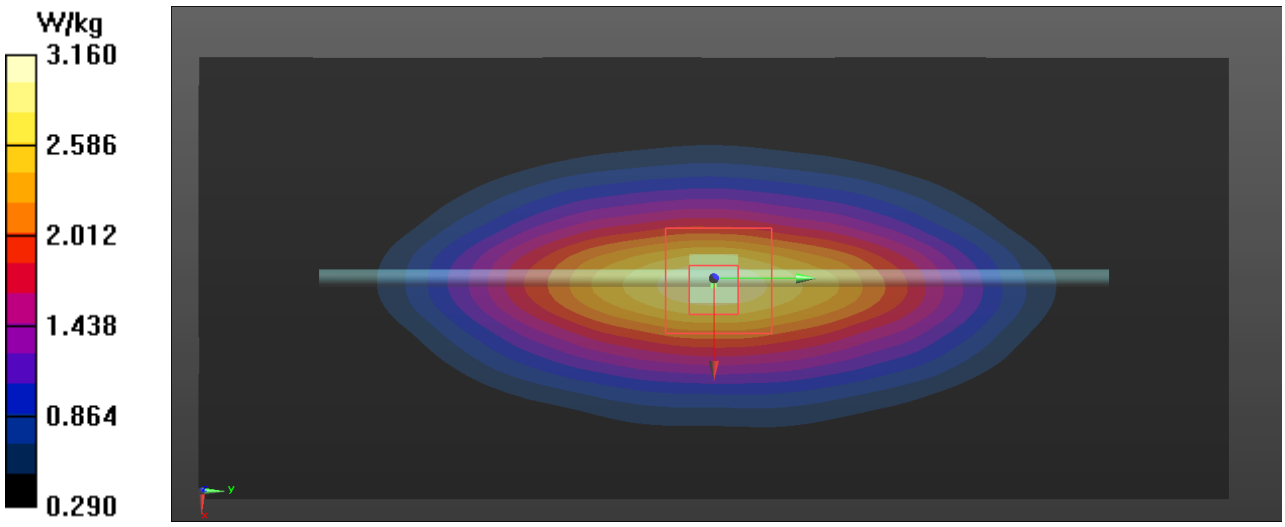
Communication System: UID 0, CW (0); Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 835 MHz; σ = 0.889 S/m; ε_r = 44.04; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(9.37, 8.45, 8.89) @ 835 MHz; Calibrated: 17/02/2023
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn1332; Calibrated: 15/02/2023
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System Check 835MHz/Area Scan (141x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.95 W/kg

Configuration/System Check 835MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 62.91 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 3.54 W/kg
SAR(1 g) = 2.45 W/kg; SAR(10 g) = 1.6 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 17 mm
Ratio of SAR at M2 to SAR at M1 = 68.1%
Maximum value of SAR (measured) = 3.16 W/kg



Plot 17

Date/Time: 25/04/2023 07:55:05

Test Laboratory: Verkotan Oy

DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: D1900V2 - SN:511

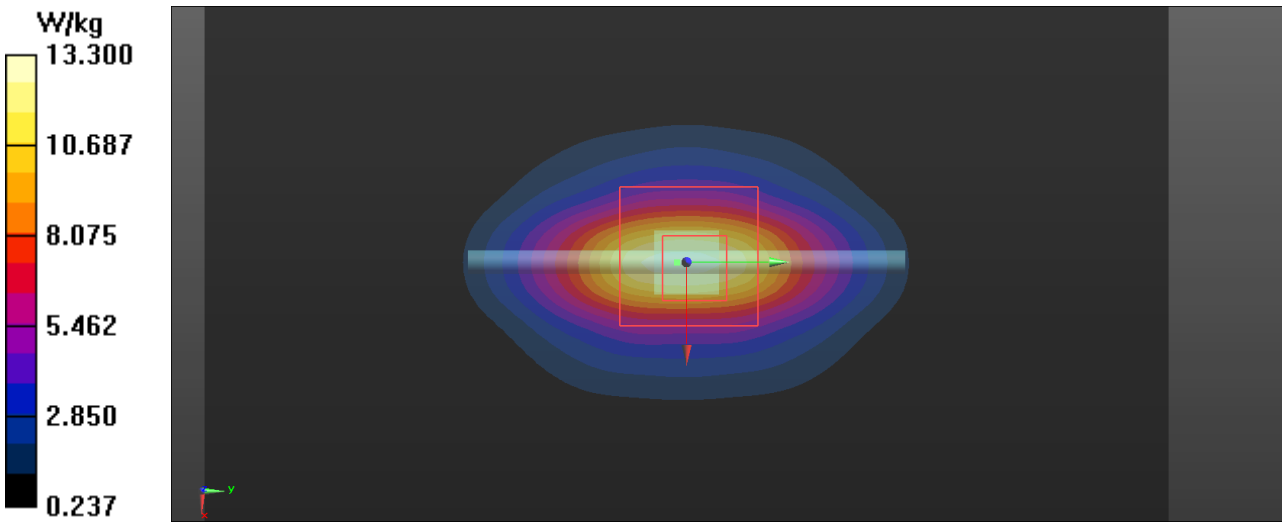
Communication System: UID 0, CW (0); Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 1900 MHz; σ = 1.354 S/m; ε_r = 41.23; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.05, 7.59, 7.97) @ 1900 MHz; Calibrated: 17/02/2023
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn1332; Calibrated: 15/02/2023
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System Check 1900MHz/Area Scan (101x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 12.7 W/kg

Configuration/System Check 1900MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 105.7 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 16.1 W/kg
SAR(1 g) = 9.01 W/kg; SAR(10 g) = 4.67 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 7 mm
Ratio of SAR at M2 to SAR at M1 = 55.9%
Maximum value of SAR (measured) = 13.3 W/kg



APPENDIX C: MEASUREMENT SCANS

Plot 18

Date/Time: 25/04/2023 12:41:01

Test Laboratory: Verkotan Oy

DUT: SOLO 3

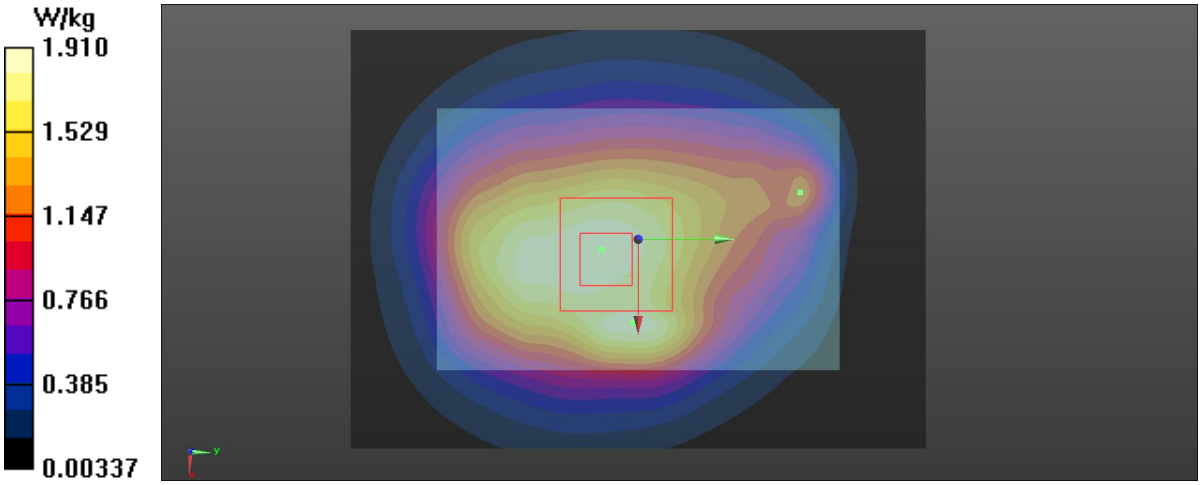
Communication System: UID 0, GPRS 3slots (0); Communication System Band: 850; Frequency: 836.6 MHz;
Communication System PAR: 4.265 dB;
Medium parameters used: f = 837 MHz; σ = 0.889 S/m; ε_r = 44.037; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(9.37, 8.45, 8.89) @ 836.6 MHz; Calibrated: 17/02/2023
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn1332; Calibrated: 15/02/2023
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/SOLO3, GPRS 850, TXslot 3, CH190, MID, Back 0mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 47.95 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 2.19 W/kg
SAR(1 g) = 1.66 W/kg; SAR(10 g) = 1.15 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 = 74.6%
Maximum value of SAR (measured) = 2.02 W/kg

Configuration/SOLO3, GPRS 850, TXslot 3, CH190, MID, Back 0mm/Area Scan (111x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.91 W/kg



Plot 19

Date/Time: 25/04/2023 10:19:37

Test Laboratory: Verkotan Oy

DUT: SOLO 3

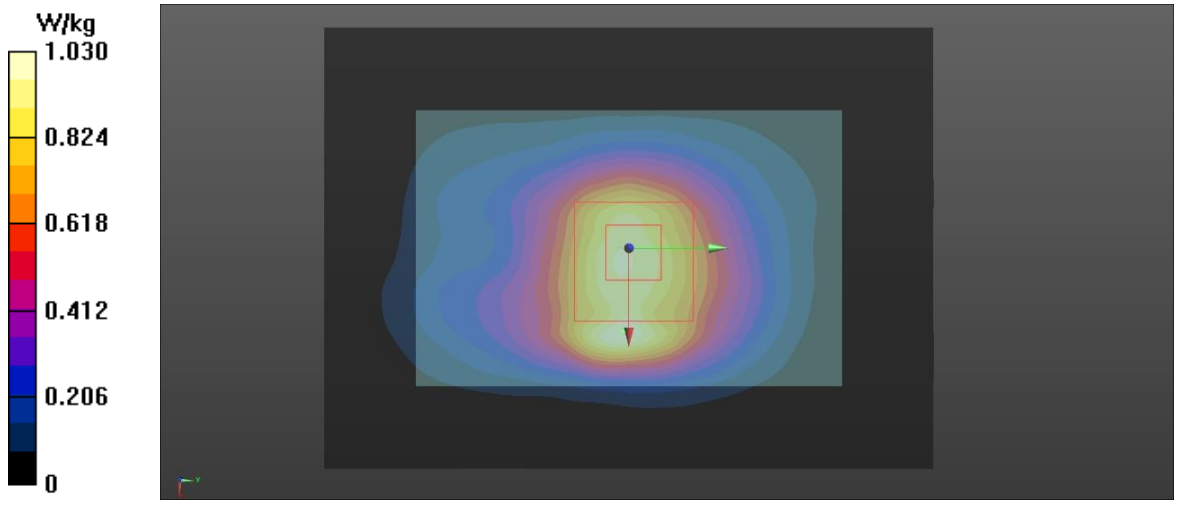
Communication System: UID 0, GPRS1900 (0); Communication System Band: GPRS1900; Frequency: 1850.2 MHz;
Communication System PAR: 3.263 dB;
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.328 S/m; ε_r = 41.291; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.05, 7.59, 7.97) @ 1850.2 MHz; Calibrated: 17/02/2023
  - 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 Sn1332; Calibrated: 15/02/2023
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/SOLO3, GPRS 1900, TXslot 2, CH512, LOW, Back 0mm/Zoom Scan (9x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 29.21 V/m; Power Drift = 0.30 dB
Peak SAR (extrapolated) = 1.17 W/kg
SAR(1 g) = 0.865 W/kg; SAR(10 g) = 0.535 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 13 mm
Ratio of SAR at M2 to SAR at M1 = 72.6%
Maximum value of SAR (measured) = 1.04 W/kg

Configuration/SOLO3, GPRS 1900, TXslot 2, CH512, LOW, Back 0mm/Area Scan (111x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.03 W/kg



Plot 20

Date/Time: 30/03/2023 14:54:33

Test Laboratory: Verkotan Oy

DUT: SOLO 3

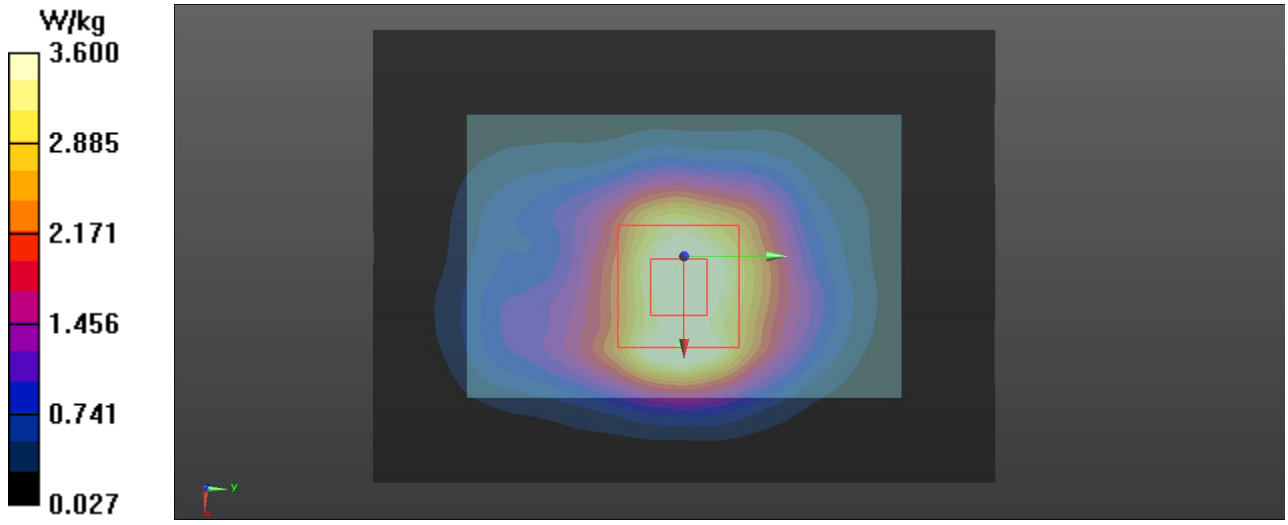
Communication System: UID 0, WCDMA (0); Communication System Band: Band 2; Frequency: 1852.4 MHz;
Communication System PAR: 0 dB;
Medium parameters used (interpolated): f = 1852.4 MHz; σ = 1.33 S/m; ε_r = 39.909; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(7.72, 7.72, 7.72) @ 1852.4 MHz; Calibrated: 27/10/2022
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn710; Calibrated: 19/10/2022
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/SOLO3, WCDMA 2, LOW, RMC 12.2K, Back 0mm/Area Scan (111x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 3.97 W/kg

Configuration/SOLO3, WCDMA 2, LOW, RMC 12.2K, Back 0mm/Zoom Scan (9x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.58 V/m; Power Drift = -0.40 dB
Peak SAR (extrapolated) = 3.93 W/kg
SAR(1 g) = 2.89 W/kg; SAR(10 g) = 1.77 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 15 mm
Ratio of SAR at M2 to SAR at M1 = 73.3%
Maximum value of SAR (measured) = 3.60 W/kg



Plot 21

Date/Time: 28/03/2023 17:10:05

Test Laboratory: Verkotan Oy

DUT: SOLO 3

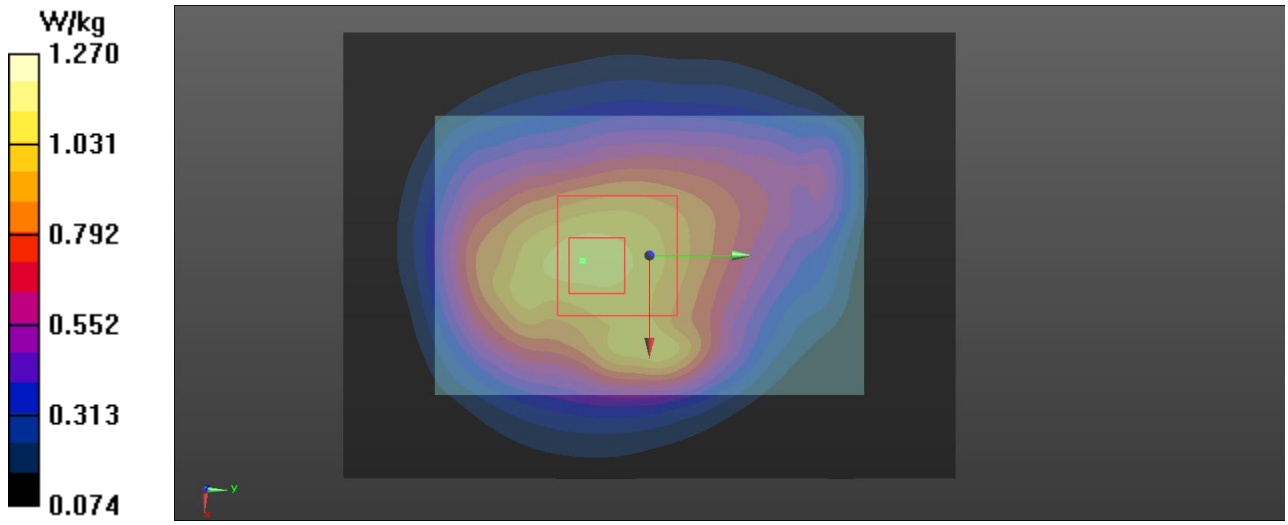
Communication System: UID 0, WCDMA (0); Communication System Band: Band 5; Frequency: 836.6 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 837 MHz; σ = 0.865 S/m; ε_r = 42.384; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(8.82, 8.82, 8.82) @ 836.6 MHz; Calibrated: 27/10/2022
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn710; Calibrated: 19/10/2022
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/SOLO3, WCDMA 5, MID, RMC 12.2K, back 0mm/Area Scan (111x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.08 W/kg

Configuration/SOLO3, WCDMA 5, MID, RMC 12.2K, back 0mm/Zoom Scan (7x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 35.28 V/m; Power Drift = 0.69 dB
Peak SAR (extrapolated) = 1.38 W/kg
SAR(1 g) = 1.01 W/kg; SAR(10 g) = 0.684 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 20.6 mm
Ratio of SAR at M2 to SAR at M1 = 69.2%
Maximum value of SAR (measured) = 1.27 W/kg



Plot 22

Date/Time: 30/03/2023 08:47:40

Test Laboratory: Verkotan Oy

DUT: SOLO 3

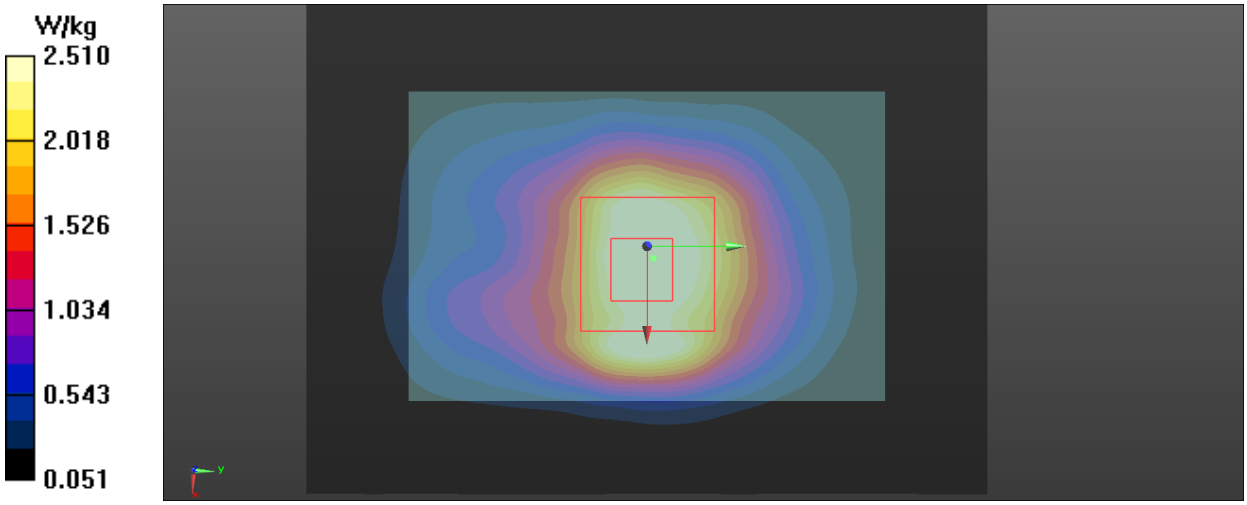
Communication System: UID 0, Generic LTE (0); Communication System Band: Band 2, E-UTRA/FDD (1850.0 - 1910.0 MHz); Frequency: 1860 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 1860 MHz; σ = 1.334 S/m; ε_r = 39.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(7.72, 7.72, 7.72) @ 1860 MHz; Calibrated: 27/10/2022
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn710; Calibrated: 19/10/2022
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/SOLO3, LTE 2, LOW,QPSK 20, RBs 1, Offset 0, Back 0mm/Area Scan (111x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 2.76 W/kg

Configuration/SOLO3, LTE 2, LOW,QPSK 20, RBs 1, Offset 0, Back 0mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 47.05 V/m; Power Drift = -0.34 dB
Peak SAR (extrapolated) = 2.75 W/kg
SAR(1 g) = 2 W/kg; SAR(10 g) = 1.2 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 16 mm
Ratio of SAR at M2 to SAR at M1 = 72.7%
Maximum value of SAR (measured) = 2.51 W/kg



Plot 23

Date/Time: 30/03/2023 12:34:44

Test Laboratory: Verkotan Oy

DUT: SOLO 3

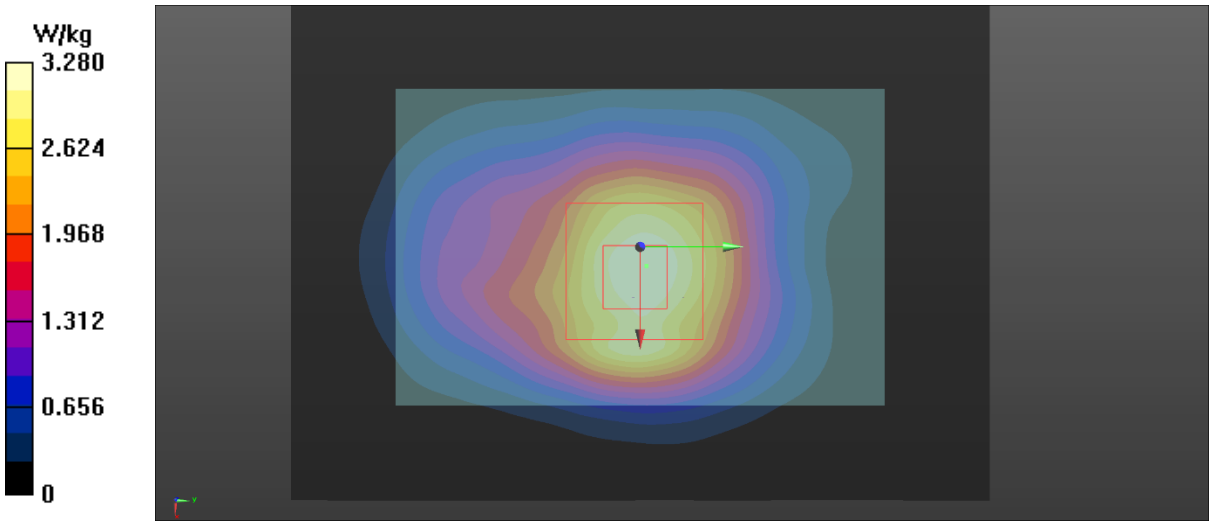
Communication System: UID 0, Generic LTE (0); Communication System Band: Band 4, E-UTRA/FDD (1710.0 - 1755.0 MHz); Frequency: 1745 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 1745 MHz; σ = 1.278 S/m; ε_r = 40.092; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(7.9, 7.9, 7.9) @ 1745 MHz; Calibrated: 27/10/2022
  - 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: 19/10/2022
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/SOLO3, LTE 4, HIGH,QPSK 20, RBs 100, Offset 0, BatteryBack 0mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.96 V/m; Power Drift = -0.56 dB
Peak SAR (extrapolated) = 3.37 W/kg
SAR(1 g) = 2.47 W/kg; SAR(10 g) = 1.5 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 16.5 mm
Ratio of SAR at M2 to SAR at M1 = 71.1%
Maximum value of SAR (measured) = 3.00 W/kg

Configuration/SOLO3, LTE 4, HIGH,QPSK 20, RBs 100, Offset 0, BatteryBack 0mm/Area Scan (111x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 3.28 W/kg



Plot 24

Date/Time: 27/03/2023 11:50:59

Test Laboratory: Verkotan Oy

DUT: SOLO 3

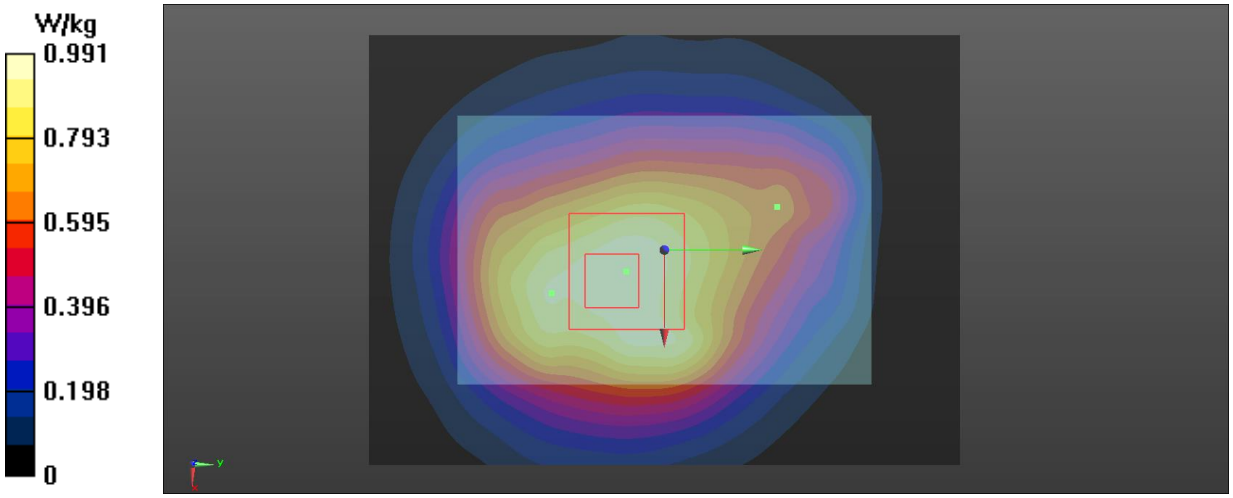
Communication System: UID 0, Generic LTE (0); Communication System Band: Band 5, E-UTRA/FDD (824.0 - 849.0 MHz); Frequency: 844 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 844 MHz; σ = 0.867 S/m; ε_r = 42.346; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(8.82, 8.82, 8.82) @ 844 MHz; Calibrated: 27/10/2022
  - 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: 19/10/2022
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/SOLO3, LTE 5, QPSK 10, RBs50, Offset 0, Back 0mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 34.60 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 1.16 W/kg
SAR(1 g) = 0.871 W/kg; SAR(10 g) = 0.601 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 = 71.6%
Maximum value of SAR (measured) = 1.06 W/kg

Configuration/SOLO3, LTE 5, QPSK 10, RBs50, Offset 0, Back 0mm/Area Scan (111x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.991 W/kg



Plot 25

Date/Time: 24/04/2023 10:00:13

Test Laboratory: Verkotan Oy

DUT: SOLO 3

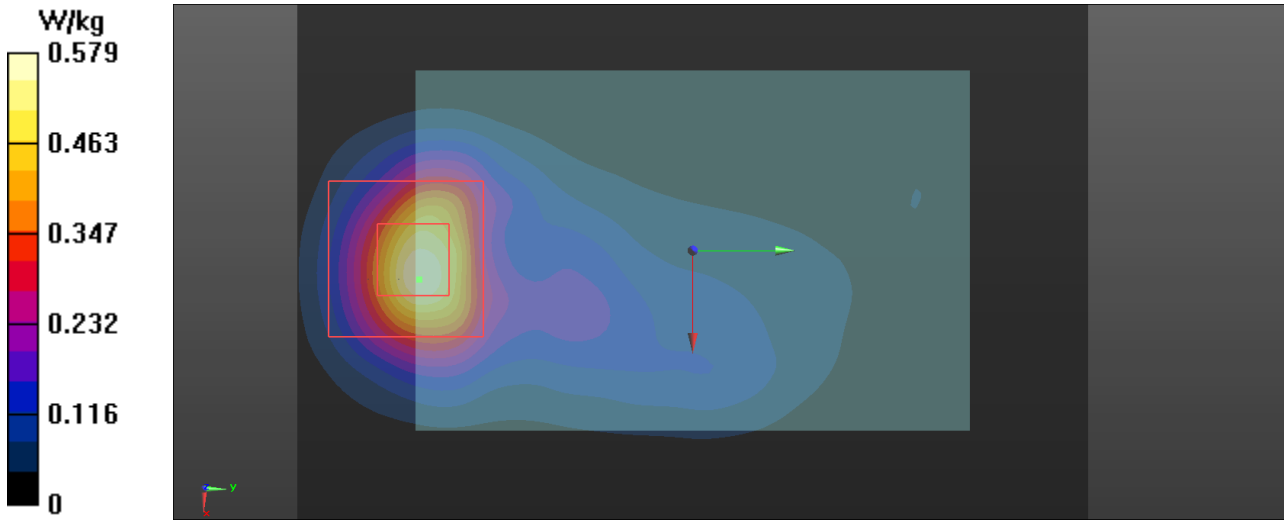
Communication System: UID 0, Generic LTE (0); Communication System Band: Band 7, E-UTRA/FDD (2500.0 - 2570.0 MHz); Frequency: 2535 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 2535 MHz; σ = 1.708 S/m; ε_r = 41.267; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(7.55, 7.37, 7.73) @ 2535 MHz; Calibrated: 17/02/2023
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn1332; Calibrated: 15/02/2023
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/SOLO3, LTE 7, MID, QPSK 20, RBs 1, Offset 99, Back 0mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.521 V/m; Power Drift = -0.95 dB
Peak SAR (extrapolated) = 0.764 W/kg
SAR(1 g) = 0.345 W/kg; SAR(10 g) = 0.130 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 6 mm
Ratio of SAR at M2 to SAR at M1 = 44.3%
Maximum value of SAR (measured) = 0.591 W/kg

Configuration/SOLO3, LTE 7, MID, QPSK 20, RBs 1, Offset 99, Back 0mm/Area Scan (111x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.579 W/kg



Plot 26

Date/Time: 23/03/2023 10:53:23

Test Laboratory: Verkotan Oy

DUT: SOLO 3

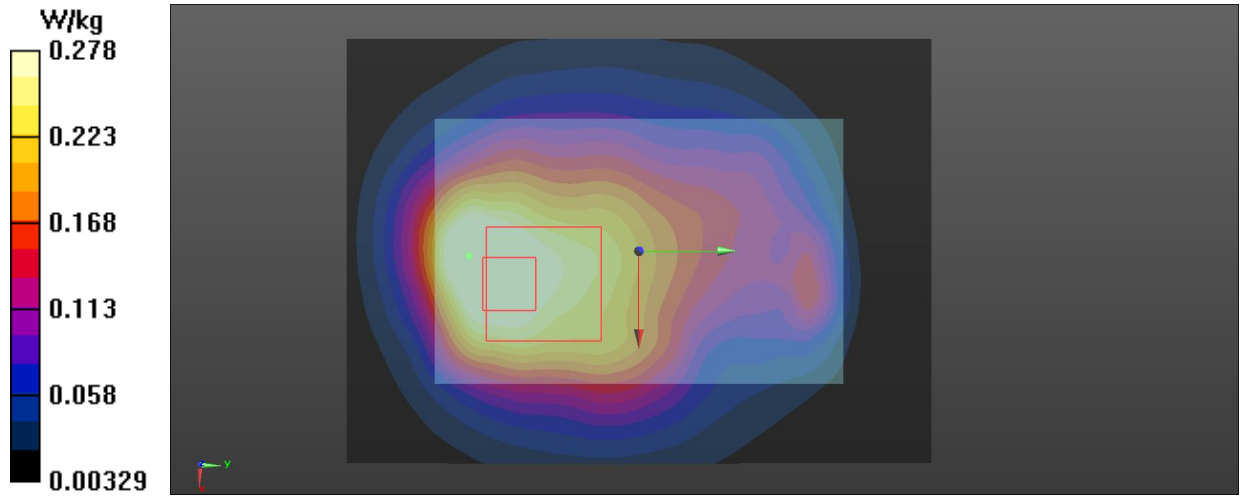
Communication System: UID 0, Generic LTE (0); Communication System Band: Band 12, E-UTRA/FDD (698.0 - 716.0 MHz); Frequency: 711 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 711 MHz; σ = 0.826 S/m; ε_r = 44.419; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3892; ConvF(10.26, 10.26, 10.26) @ 711 MHz; Calibrated: 12/04/2022
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn710; Calibrated: 19/10/2022
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/SOLO3, LTE 12, HIGH, QPSK 10, RBs 1, Offset 0, back 0mm/Area Scan (111x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.339 W/kg

Configuration/SOLO3, LTE 12, HIGH, QPSK 10, RBs 1, Offset 0, back 0mm/Zoom Scan (8x10x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 17.74 V/m; Power Drift = -1.08 dB
Peak SAR (extrapolated) = 0.355 W/kg
SAR(1 g) = 0.202 W/kg; SAR(10 g) = 0.129 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 9.8 mm
Ratio of SAR at M2 to SAR at M1 = 48.1%
Maximum value of SAR (measured) = 0.278 W/kg



Plot 27

Date/Time: 24/04/2023 13:13:29

Test Laboratory: Verkotan Oy

DUT: SOLO 3

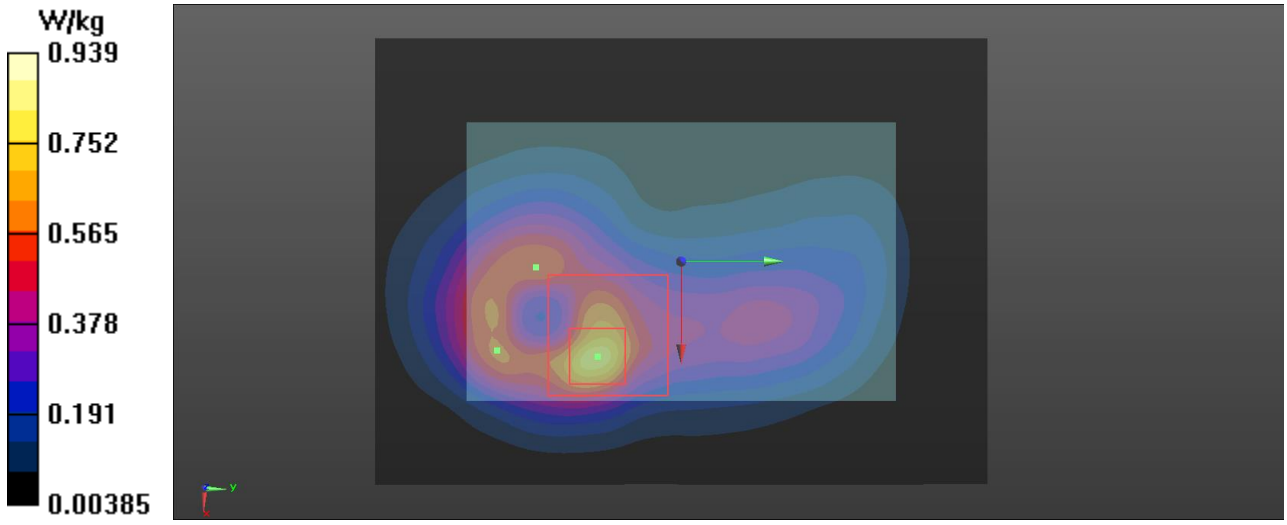
Communication System: UID 0, WLAN 2.4 (0); Communication System Band: WLAN2.4GHz; Frequency: 2462 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 2462 MHz; σ = 1.662 S/m; ε_r = 41.391; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(7.7, 7.5, 7.63) @ 2462 MHz; Calibrated: 17/02/2023
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn1332; Calibrated: 15/02/2023
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/SOLO3, WLAN 2.4GHz, CH11, HIGH, Front 0mm/Area Scan (111x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.807 W/kg

Configuration/SOLO3, WLAN 2.4GHz, CH11, HIGH, Front 0mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.26 V/m; Power Drift = -0.45 dB
Peak SAR (extrapolated) = 1.18 W/kg
SAR(1 g) = 0.589 W/kg; SAR(10 g) = 0.268 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 6.1 mm
Ratio of SAR at M2 to SAR at M1 = 51.1%
Maximum value of SAR (measured) = 0.939 W/kg



Plot 28

Date/Time: 24/04/2023 17:31:11

Test Laboratory: Verkotan Oy

DUT: SOLO 3

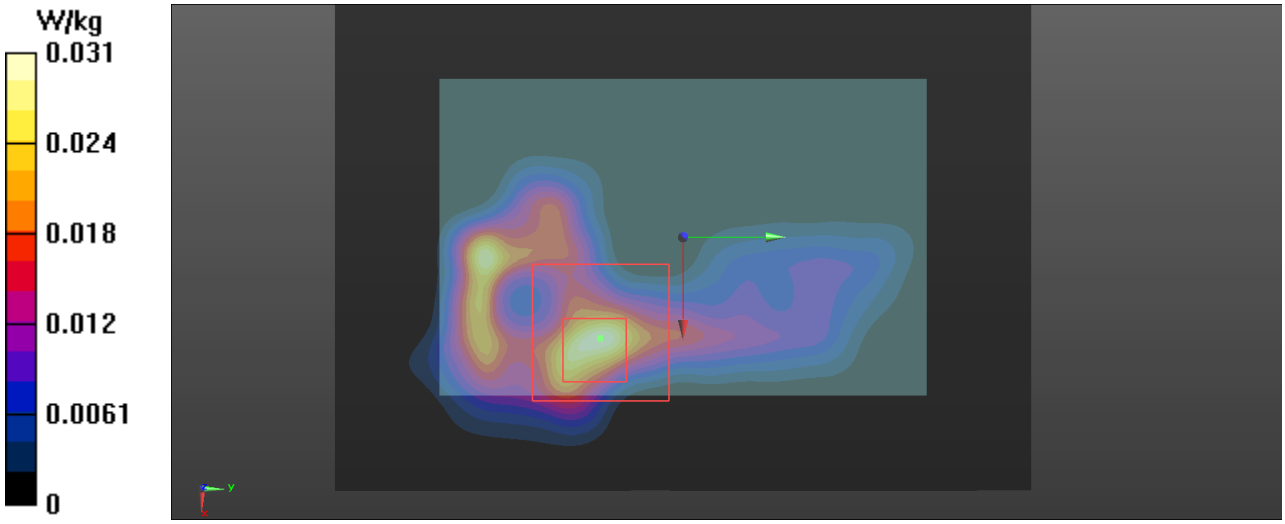
Communication System: UID 0, Bluetooth (0); Communication System Band: BLE; Frequency: 2441 MHz;
Communication System PAR: 4.771 dB;
Medium parameters used (interpolated): f = 2441 MHz; σ = 1.649 S/m; ε_r = 41.413; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(7.7, 7.5, 7.63) @ 2441 MHz; Calibrated: 17/02/2023
  - 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 Sn1332; Calibrated: 15/02/2023
  - Phantom: SAR2_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/SOLO3, BLE, CH18, MID, Front 0mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.915 V/m; Power Drift = -0.19 dB
Peak SAR (extrapolated) = 0.0400 W/kg
SAR(1 g) = 0.017 W/kg; SAR(10 g) = 0.00577 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 = 53%
Maximum value of SAR (measured) = 0.0269 W/kg

Configuration/SOLO3, BLE, CH18, MID, Front 0mm/Area Scan (111x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.0305 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

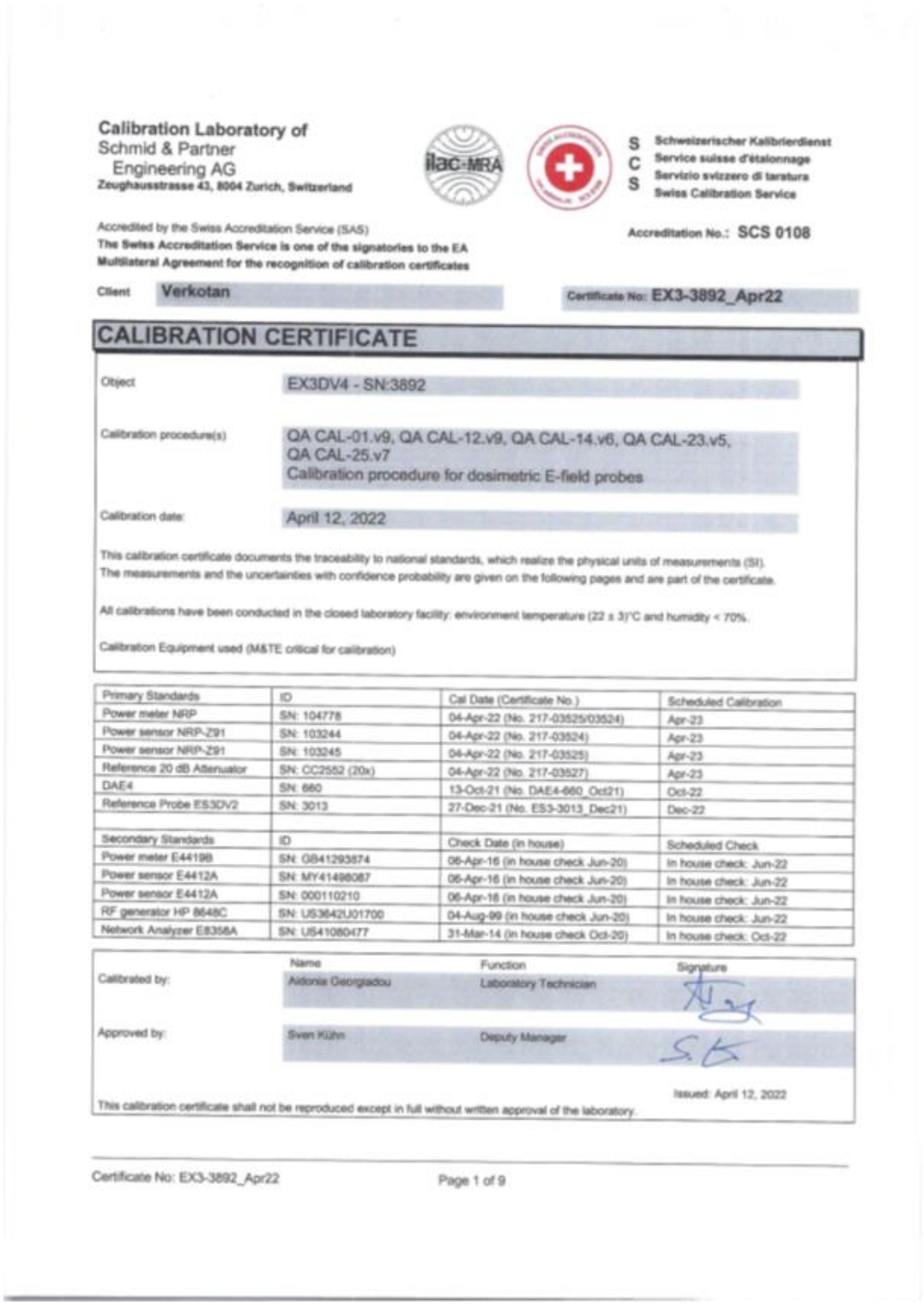
Calibration Parameter Determined in Head Tissue Simulating Media

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

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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: EX3-3892_Apr22**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3892
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:	April 12, 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: CC2552 (20x)	04-Apr-22 (No. 217-03527)	Apr-23
DAE4	SN: 660	13-Oct-21 (No. DAE4-660_Oct21)	Oct-22
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-20)	In house check: Jun-22
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-20)	In house check: Jun-22
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-22

	Name	Function	Signature
Calibrated by:	Aidonia Georgiadou	Laboratory Technician	
Approved by:	Sven Kühn	Deputy Manager	

Issued: April 12, 2022

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

Certificate No: EX3-3892_Apr22 Page 1 of 9

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3892

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.47	0.38	0.47	± 10.1 %
DCP (mV)[B]	102.0	105.5	101.6	

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB$\sqrt{\mu V}$	C	D dB	VR mV	Max dev.	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	154.3	± 3.0 %	± 4.7 %
		Y	0.0	0.0	1.0		165.8		
		Z	0.0	0.0	1.0		158.8		

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:3892

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-148.5
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.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3892

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)
600	42.7	0.88	10.43	10.43	10.43	0.10	1.25	± 13.3 %
750	41.9	0.89	10.26	10.26	10.26	0.48	0.80	± 12.0 %
900	41.5	0.97	9.95	9.95	9.95	0.36	0.91	± 12.0 %
1900	40.0	1.40	8.31	8.31	8.31	0.29	0.86	± 12.0 %
2450	39.2	1.80	7.66	7.66	7.66	0.33	0.90	± 12.0 %
2600	39.0	1.96	7.55	7.55	7.55	0.39	0.90	± 12.0 %
4400	36.9	3.84	6.08	6.08	6.08	0.40	1.60	± 13.1 %
4800	36.4	4.25	5.65	5.65	5.65	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

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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

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

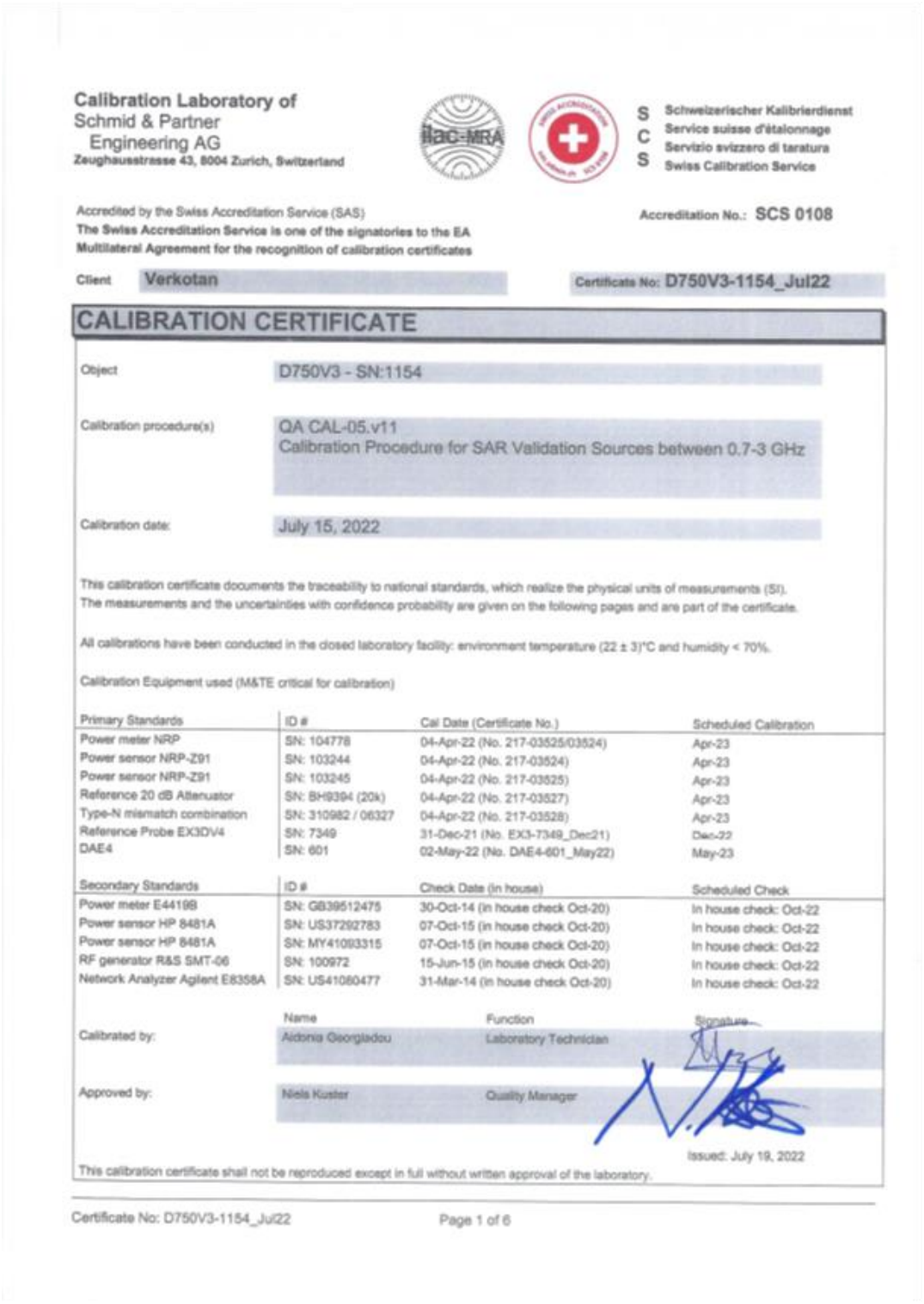
f (MHz)[C]	Relative Permittivity[F]	Conductivity[F] (S/m)	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unc (k = 2)
13	55.0	0.75	17.42	17.42	17.42	0.00	1.25	±13.3%
750	41.9	0.89	9.91	8.74	9.52	0.31	1.27	±12.0%
900	41.5	0.97	9.37	8.45	8.89	0.32	1.27	±12.0%
1750	40.1	1.37	8.45	7.97	8.40	0.25	1.27	±12.0%
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



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Accredited by the Swiss Accreditation Service (SAS)
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Accreditation No.: SCS 0108

Client: Verkotan

Certificate No: D750V3-1154_Jul22

CALIBRATION CERTIFICATE

Object: D750V3 - SN:1154

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:	Aidonia Georgiadou	Laboratory Technician	
Approved by:	Niels Kuster	Quality Manager	

Issued: July 19, 2022

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Certificate No: D750V3-1154_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	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.5 ± 6 %	0.90 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	2.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.54 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.57 W/kg ± 16.5 % (k=2)**

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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: SCS 0108

Client Verkotan

Certificate No: D835V2-455_Jul22

CALIBRATION CERTIFICATE

Object D835V2 - SN:455

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: BH8394 (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

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Certificate No: D835V2-455_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	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

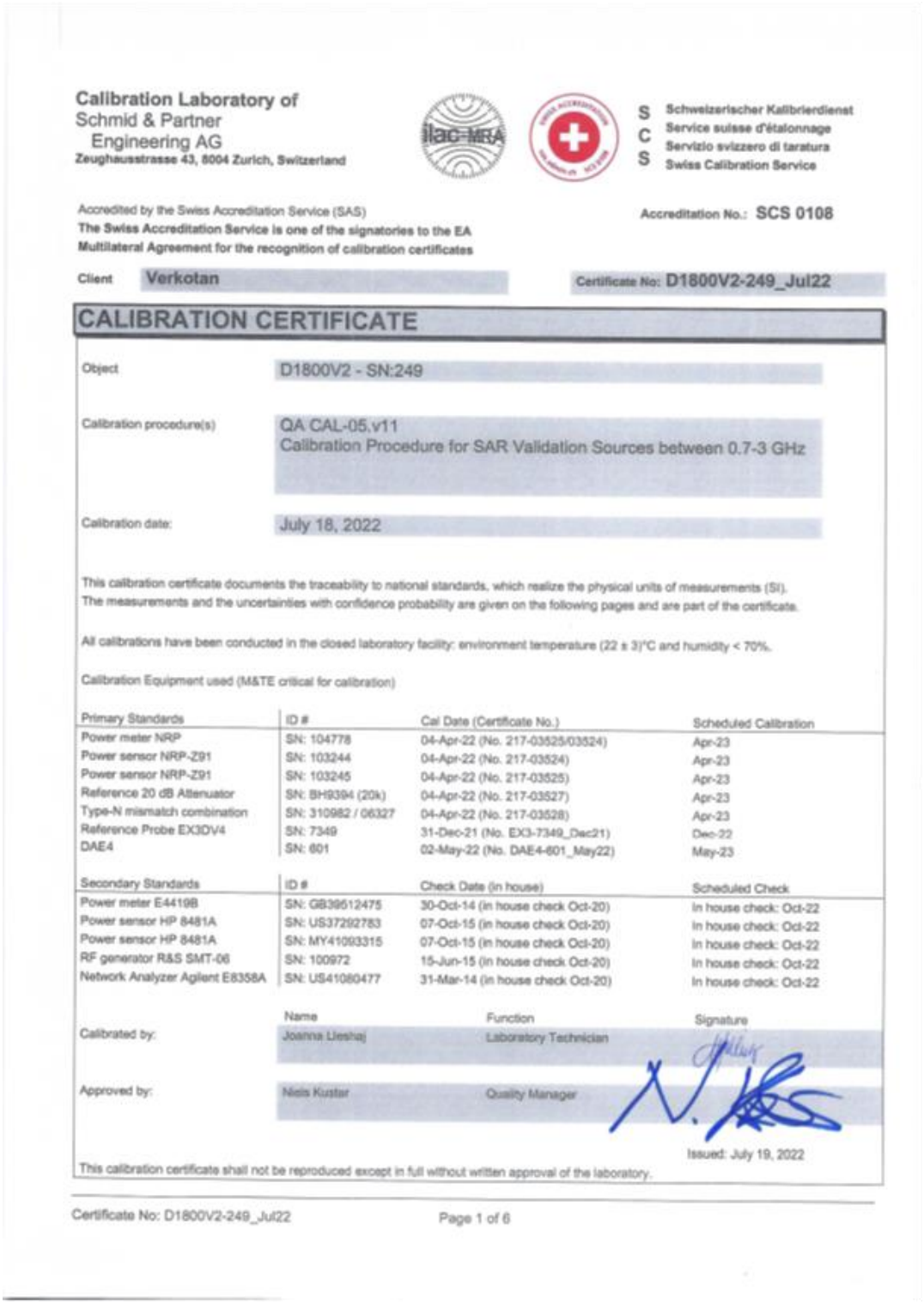
The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.3 ± 6 %	0.93 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	2.50 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.69 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.61 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.29 W/kg ± 16.5 % (k=2)**



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Accredited by the Swiss Accreditation Service (SAS)
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Accreditation No.: SCS 0108

Client: Verkotan

Certificate No: D1800V2-249_Jul22

CALIBRATION CERTIFICATE

Object: D1800V2 - SN:249

Calibration procedure(s): QA CAL-05.v11
Calibration Procedure for SAR Validation Sources between 0.7-3 GHz

Calibration date: July 18, 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:	Joanna Lleshaj	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: D1800V2-249_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	1800 MHz ± 1 MHz	

Head TSL parameters

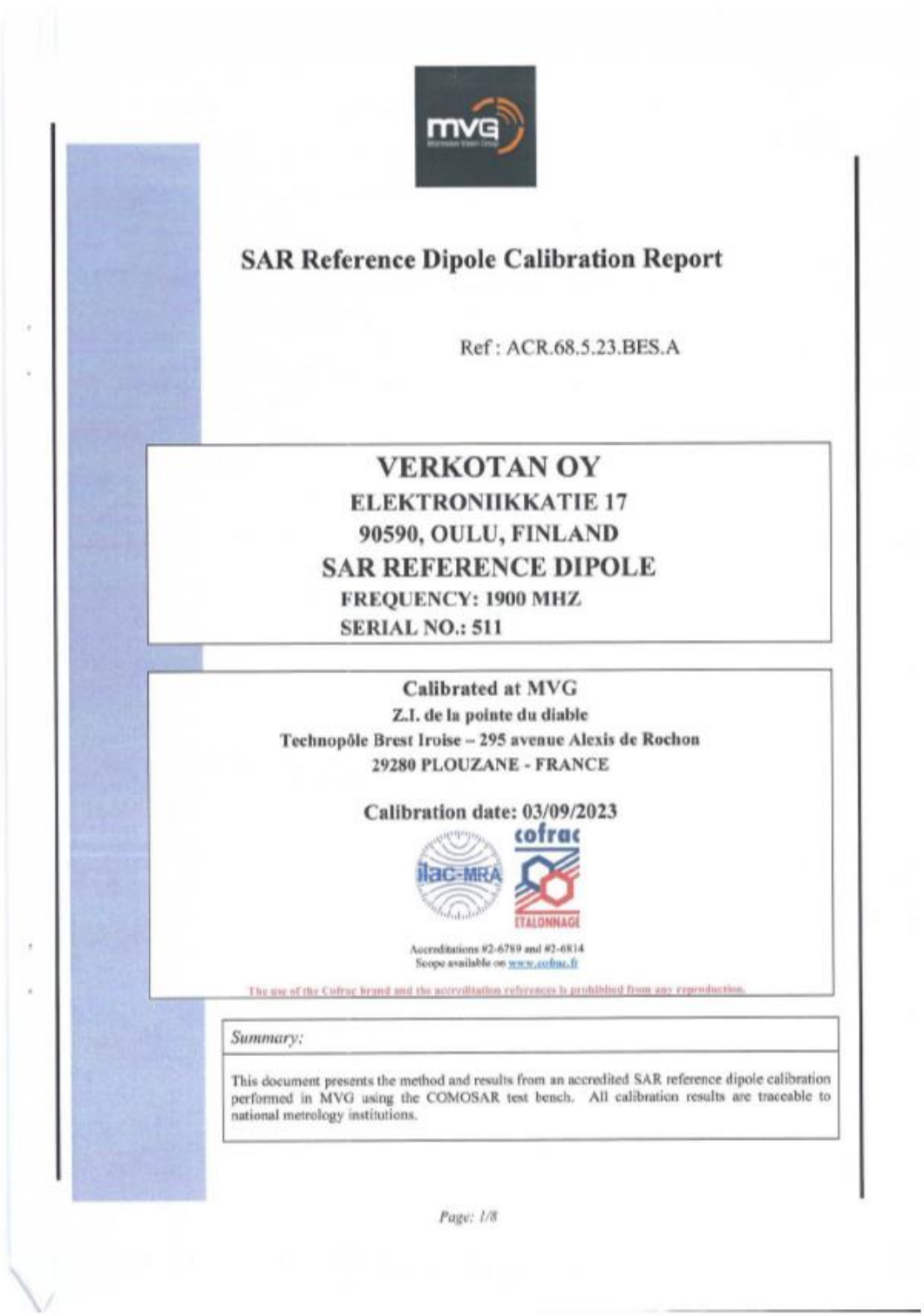
The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.4 ± 6 %	1.38 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	9.74 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**38.9 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**20.3 W/kg ± 16.5 % (k=2)**



SAR Reference Dipole Calibration Report

Ref : ACR.68.5.23.BES.A

VERKOTAN OY
ELEKTRONIIKKATIE 17
90590, OULU, FINLAND
SAR REFERENCE DIPOLE
FREQUENCY: 1900 MHZ
SERIAL NO.: 511

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

ilac-MRA cofrac ETALONNAGE

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

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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: 1/8

mvg

SAR REFERENCE DIPOLE CALIBRATION REPORT Ref: ACR.68.5.23.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 15:01:12 +01'00'

	Customer Name
Distribution :	Verkotan Oy

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

Page: 2/8

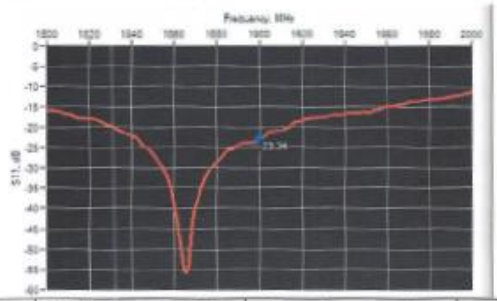
6 CALIBRATION RESULTS

6.1 MECHANICAL DIMENSIONS

L mm		h mm		d mm	
Measured	Required	Measured	Required	Measured	Required
-	68.00 +/- 2%	-	39.50 +/- 2%	-	3.60 +/- 2%

6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
1900	-23.34	-20	48.5Ω - 6.6jΩ

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

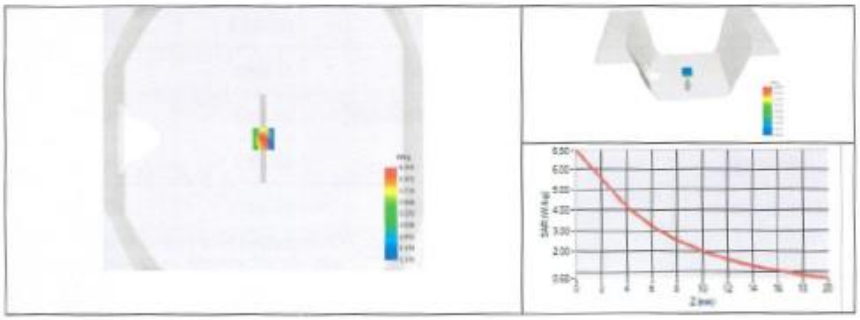
The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.68.5.23.BUS.A

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPGO333
Liquid	Head Liquid Values: eps' : 40.4 sigma : 1.40
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoom Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	1900 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
1900 MHz	3.80	38.02	39.70	1.94	19.41	20.50



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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

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.343.8.21.BES.A

VERKOTAN LTD.
ELEKTRONIIKKATIE 17
90590, OULU, FINLAND
MVG COMOSAR REFERENCE DIPOLE
FREQUENCY: 2600 MHZ
SERIAL NO.: SN 49/21 DIP 2G600-637

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

Calibration date: 12/09/21

ilac-MRA cofrac ETALONNAGE

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

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: 1/11

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ε_r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±10 %		0.87 ±10 %	
450	43.5 ±10 %		0.87 ±10 %	
750	41.9 ±10 %		0.89 ±10 %	
835	41.5 ±10 %		0.90 ±10 %	
900	41.5 ±10 %		0.97 ±10 %	
1450	40.5 ±10 %		1.20 ±10 %	
1500	40.4 ±10 %		1.23 ±10 %	
1640	40.2 ±10 %		1.31 ±10 %	
1750	40.1 ±10 %		1.37 ±10 %	
1800	40.0 ±10 %		1.40 ±10 %	
1900	40.0 ±10 %		1.40 ±10 %	
1950	40.0 ±10 %		1.40 ±10 %	
2000	40.0 ±10 %		1.40 ±10 %	
2100	39.8 ±10 %		1.49 ±10 %	
2300	39.5 ±10 %		1.67 ±10 %	
2450	39.2 ±10 %		1.80 ±10 %	
2600	39.0 ±10 %	35.7	1.96 ±10 %	2.12
3000	38.5 ±10 %		2.40 ±10 %	
3300	38.2 ±10 %		2.71 ±10 %	
3500	37.9 ±10 %		2.91 ±10 %	
3700	37.7 ±10 %		3.12 ±10 %	
3900	37.5 ±10 %		3.32 ±10 %	
4200	37.1 ±10 %		3.63 ±10 %	
4600	36.7 ±10 %		4.04 ±10 %	
4900	36.3 ±10 %		4.35 ±10 %	

7.2 SAR MEASUREMENT RESULT 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.343.8.21.BES.A

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPGO333
Liquid	Head Liquid Values: eps' : 35.7 sigma : 2.12
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	2600 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

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	56.47 (5.65)	24.6	24.22 (2.42)
3000	63.8		25.7	
3300	-		-	
3500	67.1		25	
3700	67.4		24.2	
3900	-		-	
4200	-		-	
4600	-		-	
4900	-		-	

