

SAR Compliance Test Report

Date of Report:	5/09/2025	Client's Contact person:	Hassan Alahi
Number of pages:	61	Responsible Test engineer:	Kalle Orava
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Tested device:	Data Acquisition SONO HUB		
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		
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:	05.09.2025 Laboratory Manager <i>Miia Nurkkala</i>		

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1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Device under Test (DUT):

Product:	Data Acquisition SONO HUB
Manufacturer:	Vemaventuri AB
Model:	HUB-1
IMEI/Serial Number:	353500727306849, 353500727326391
HW ID:	HV01MK04
FCC ID Number:	Host ID: 2A60FPICHBM02 Contains transmitter module XPYUBX21BE01
DUT Number:	20287, 20280
Battery Type used in testing:	Li-Ion Battery
State of the Sample:	Production sample

Testing information:

Testing performed:	26.09.2024 – 07.10.2024
Notes:	-
Document history & changes:	This report replaces test report FCC_SAR report_SONO Hub.ID6663d_07112024. Photos have been moved to separate document.
Document ID:	FCC_SAR report_SONO Hub ID6663d_05092025.docx
Temperature °C	22±2 / Controlled
Humidity RH%	30±20 / Controlled
Measurement performed by:	Kalle Orava, Jesper Varis
FCC Test Firm Designation Number:	FI0005

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) 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 distance	Result
LTE 2	2.49	PASS
LTE 4	1.98	PASS
LTE 5	0.30	PASS
LTE 12	0.97	PASS
LTE 13	0.55	PASS

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

1.2.2 Maximum Drift

Maximum Drift During Measurements	-0.75dB*
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*Larger than 5% drifts included to scaling factors

1.2.3 Measurement Uncertainty

Expanded Uncertainty (k=2) 95 %	±21.9 %
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2. DESCRIPTION OF THE DEVICE UNDER TEST (DUT)

The DUT is a handheld device and is connected to the sensor through M16 connector and RS485 interface. The sensor is a probe which measures the water content in fresh concrete.

Photos of the DUT are shown in appendix A.

Device Category	Portable
Exposure Environment	General population uncontrolled

2.1 Supported Frequency Bands and Operational Modes

TX Frequency bands	Modes of Operation	Transmitter Frequency Range [MHz]
	LTE 2	1850 – 1910
	LTE 4	1710 – 1755
	LTE 5	824 – 849
	LTE 12	698 – 716
	LTE 13	777 – 787

3. OUTPUT POWER

3.1 Maximum specified conducted output power

From the customer, including tune-up tolerances;

LTE	Output power [dBm]	Tolerance $\pm$ [dB]	Max Output Power [dBm]
LTE 2	23	2	25
LTE 4	23	2	25
LTE 5	23	2	25
LTE 12	23	2	25
LTE 13	23	2	25

3.2 Tested conducted power

Measured conducted output power at transmitting antenna connector;

The DUT is LTE Cat 1 device and has limited data rate up to 5 Mb/s in uplink, for this reason the resource block allocations for 16QAM modulation vary from the KDB 941225 D05 SAR for LTE Devices v02r05.

Band / BW [MHz]	Modulation	RBs	RB Start	CH:18607 1850.7 MHz	CH:18900 1880 MHz	CH:19193 1909.3 MHz	3GPP MPR [dB]
B2 / BW:1.4	QPSK	1	0	23.1	23.41	23.61	0
			2	23.48	23.64	23.63	
			5	23.22	23.37	23.61	
		3	0	23.46	23.51	23.69	
			1	23.47	23.62	23.73	
			3	23.43	23.59	23.62	
		6	0	22.45	22.58	22.65	1
	16QAM	1	0	21.99	22.22	22.29	
			2	22.06	22.1	22.32	
			5	22.04	22.08	22.3	
		3	0	22.5	22.47	22.64	
			1	22.47	22.59	22.81	
			3	22.52	22.72	22.75	
		6	0	21.63	21.44	21.74	2

Band / BW [MHz]	Modulation	RBs	RB Start	CH:18615 1851.5 MHz	CH:18900 1880 MHz	CH:19185 1908.5 MHz	3GPP MPR [dB]
B2 / BW:3	QPSK	1	0	23.53	23.36	23.58	0
			7	23.77	23.53	23.59	
			14	23.31	23.56	23.5	
		8	0	22.6	22.55	22.64	1
			3	22.58	22.5	22.68	
			7	22.46	22.63	22.67	
		15	0	22.39	22.61	22.67	
	16QAM	1	0	22.05	22.05	22.22	
			7	22.11	22.23	22.23	
			14	21.66	22.06	22.17	
		8	0	21.4	21.48	21.44	2
			3	21.4	21.5	21.52	
			7	21.29	21.5	21.58	
		15	0	21.41	21.63	21.57	

Band / BW [MHz]	Modulation	RBs	RB Start	CH:18625 1852.5 MHz	CH:18900 1880 MHz	CH:19175 1907.5 MHz	3GPP MPR [dB]
B2 / BW:5	QPSK	1	0	23.32	23.35	23.52	0
			12	23.36	23.58	23.55	
			24	23.36	23.26	23.75	
		12	0	22.5	22.54	22.68	1
			6	22.57	22.61	22.62	
			13	22.57	22.51	22.64	
		25	0	22.55	22.57	22.61	
	16QAM	1	0	21.98	21.68	22.14	
			12	22.11	22.12	22.14	
			24	22.0	21.43	22.14	
		12	0	21.27	21.38	21.52	2
			6	21.41	21.55	21.48	
			13	21.34	21.52	21.41	
		25	0	21.41	21.44	21.52	

Band / BW [MHz]	Modulation	RBs	RB Start	CH:18650 1855 MHz	CH:18900 1880 MHz	CH:19150 1905 MHz	3GPP MPR [dB]
B2 / BW:10	QPSK	1	0	23.46	23.31	23.64	0
			24	23.54	23.63	23.78	
			49	23.53	23.6	23.54	
		25	0	22.55	22.61	22.66	1
			12	22.69	22.55	22.66	
			25	22.5	22.5	22.67	
		50	0	22.54	22.51	22.6	
	16QAM	1	0	22.04	22.26	22.32	
			24	22.15	22.12	22.18	
			49	21.86	21.87	21.94	
		25	0	21.53	21.58	21.62	2
			12	21.62	21.5	21.61	
			25	21.48	21.43	21.45	
		27	0	21.38	21.56	21.53	

Band / BW [MHz]	Modulation	RBs	RB Start	CH:18675 1857.5 MHz	CH:18900 1880 MHz	CH:19125 1902.5 MHz	3GPP MPR [dB]
B2 / BW:15	QPSK	1	0	23.37	23.4	23.43	0
			37	23.54	23.76	23.86	
			74	23.58	23.44	23.7	
		36	0	22.52	22.57	22.59	1
			19	22.52	22.56	22.62	
			39	22.52	22.51	22.51	
		75	0	22.44	22.56	22.54	
	16QAM	1	0	22.17	22.42	22.16	
			37	22.28	22.45	22.55	
			74	22.02	21.79	21.98	
		12	0	22.26	22.4	22.59	2
			8	22.41	22.61	22.82	
			16	22.59	22.63	22.64	
		27	0	21.44	21.5	21.45	

Band / BW [MHz]	Modulation	RBs	RB Start	CH:18700 1860 MHz	CH:18900 1880 MHz	CH:19100 1900 MHz	3GPP MPR [dB]
B2 / BW:20	QPSK	1	0	23.61	23.45	23.59	0
			50	23.66	23.6	23.72	
			99	23.53	23.48	23.62	
		50	0	22.61	22.75	22.67	1
			25	22.58	22.59	22.63	
			50	22.59	22.54	22.68	
		100	0	22.6	22.53	22.56	
	16QAM	1	0	22.22	22.26	21.95	
			50	22.61	22.44	22.58	
			99	22.08	22.08	21.97	
		12	0	22.34	22.46	22.43	
			8	22.66	22.57	22.7	
			16	22.42	22.68	22.64	
		27	0	21.35	21.56	21.38	2

Band / BW [MHz]	Modulation	RBs	RB Start	CH:19957 1710.7 MHz	CH:20175 1732.5 MHz	CH:20393 1754.3 MHz	3GPP MPR [dB]
B4 / BW:1.4	QPSK	1	0	23.2	23.14	23.0	0
			2	23.3	23.27	23.19	
			5	23.25	23.18	23.13	
		3	0	23.21	23.23	23.24	1
			1	23.3	23.36	23.29	
			3	23.22	23.3	23.27	
		6	0	22.14	22.34	22.25	
	16QAM	1	0	21.82	22.16	21.76	
			2	21.45	22.0	21.82	
			5	21.4	21.89	21.77	
		3	0	22.23	22.5	22.31	
			1	22.27	22.45	22.34	
			3	22.28	22.46	22.27	
		6	0	21.12	21.57	21.49	2

Band / BW [MHz]	Modulation	RBs	RB Start	CH:19965 1711.5 MHz	CH:20175 1732.5 MHz	CH:20385 1753.5 MHz	3GPP MPR [dB]
B4 / BW:3	QPSK	1	0	23.02	23.45	22.91	0
			7	23.11	23.36	23.14	
			14	23.21	23.27	23.16	
		8	0	22.31	22.39	22.2	1
			3	22.28	22.32	22.18	
			7	22.32	22.34	22.18	
		15	0	22.27	22.36	22.14	
	16QAM	1	0	21.69	21.91	21.71	1
			7	22.1	22.04	21.88	
			14	21.91	21.82	21.54	
		8	0	21.17	21.3	21.14	
			3	21.27	21.23	21.16	
			7	21.27	21.29	21.09	
		15	0	21.22	21.38	21.23	2

Band / BW [MHz]	Modulation	RBs	RB Start	CH:19975 1712.5 MHz	CH:20175 1732.5 MHz	CH:20375 1752.5 MHz	3GPP MPR [dB]
B4 / BW:5	QPSK	1	0	23.14	23.27	23.02	0
			12	23.2	23.25	23.43	
			24	23.11	23.09	23.27	
		12	0	22.23	22.39	22.32	1
			6	22.3	22.32	22.3	
			13	22.41	22.34	22.42	
	16QAM	25	0	22.27	22.45	22.27	
			0	21.73	21.54	21.75	
			12	22.27	22.14	21.8	
		1	24	21.84	21.68	21.75	
			0	20.98	21.2	21.02	2
			6	21.27	21.23	21.0	
		12	13	21.18	21.25	21.13	
			0	21.34	21.3	21.11	
			0	21.34	21.3	21.11	

Band / BW [MHz]	Modulation	RBs	RB Start	CH:20000 1715 MHz	CH:20175 1732.5 MHz	CH:20350 1750 MHz	3GPP MPR [dB]
B4 / BW:10	QPSK	1	0	23.21	23.18	23.01	0
			24	23.33	23.45	23.37	
			49	23.24	23.16	23.25	
		25	0	22.47	22.43	22.24	1
			12	22.43	22.43	22.34	
			25	22.31	22.32	22.27	
	16QAM	50	0	22.33	22.36	22.2	
			0	21.4	21.93	21.73	
			24	21.73	21.93	21.84	
		1	49	21.46	21.52	21.61	
			0	21.24	21.38	21.04	2
		25	12	21.42	21.36	21.25	
			25	21.33	21.25	21.18	
			0	21.19	21.39	21.3	
		27	0	21.19	21.39	21.3	

Band / BW [MHz]	Modulation	RBs	RB Start	CH:20025 1717.5 MHz	CH:20175 1732.5 MHz	CH:20325 1747.5 MHz	3GPP MPR [dB]
B4 / BW:15	QPSK	1	0	23.14	23.34	23.39	0
			37	23.6	23.55	23.52	
			74	23.36	23.16	23.38	
		36	0	22.4	22.46	22.2	1
			19	22.33	22.45	22.24	
			39	22.26	22.27	22.18	
	16QAM	75	0	22.36	22.39	22.17	
			0	21.86	22.21	22.02	
			37	22.2	22.23	22.09	
		1	74	21.62	21.5	21.7	
			0	22.23	22.38	22.04	
		12	8	22.61	22.27	22.38	
			16	22.28	22.38	22.31	
		27	0	21.31	21.27	21.2	2

Band / BW [MHz]	Modulation	RBs	RB Start	CH:20050 1720 MHz	CH:20175 1732.5 MHz	CH:20300 1745 MHz	3GPP MPR [dB]
B4 / BW:20	QPSK	1	0	23.32	23.46	23.52	0
			50	23.42	23.55	23.18	
			99	23.29	23.34	23.3	
		50	0	22.46	22.52	22.57	1
			25	22.46	22.46	22.41	
			50	22.43	22.36	22.26	
		100	0	22.37	22.39	22.33	
	16QAM	1	0	22.03	22.27	22.18	
			50	22.21	22.21	22.01	
			99	21.57	21.54	21.83	
		12	0	22.17	22.5	22.26	
			8	22.56	22.64	22.42	
			16	22.32	22.55	22.43	
		27	0	21.35	21.3	21.47	2

Band / BW [MHz]	Modulation	RBs	RB Start	CH:20407 824.7 MHz	CH:20525 836.5 MHz	CH:20643 848.3 MHz	3GPP MPR [dB]
B5 / BW:1.4	QPSK	1	0	21.76	21.73	21.92	0
			2	21.78	21.72	22.08	
			5	21.73	21.64	22.04	
		3	0	21.71	21.8	22.11	1
			1	21.77	21.81	22.16	
			3	21.76	21.77	22.15	
		6	0	20.75	20.73	21.01	
	16QAM	1	0	20.43	20.49	20.83	
			2	20.52	20.55	20.8	
			5	20.54	20.5	20.75	
		3	0	20.73	20.67	20.96	
			1	20.88	20.93	21.24	
			3	20.77	20.91	21.05	
		6	0	19.61	19.97	20.25	2

Band / BW [MHz]	Modulation	RBs	RB Start	CH:20415 825.5 MHz	CH:20525 836.5 MHz	CH:20635 847.5 MHz	3GPP MPR [dB]
B5 / BW:3	QPSK	1	0	21.49	21.72	21.79	0
			7	21.74	21.65	21.91	
			14	21.7	21.56	21.88	
		8	0	20.71	20.8	21.21	1
			3	20.76	20.73	21.14	
			7	20.79	20.73	21.05	
		15	0	20.7	20.81	21.13	
	16QAM	1	0	20.33	20.42	20.54	
			7	20.79	20.4	20.8	
			14	20.18	20.39	20.61	
		8	0	19.5	19.78	20.03	2
			3	19.74	19.67	20.03	
			7	19.73	19.7	20.02	
		15	0	19.72	19.66	20.0	

Band / BW [MHz]	Modulation	RBs	RB Start	CH:20425 826.5 MHz	CH:20525 836.5 MHz	CH:20625 846.5 MHz	3GPP MPR [dB]
B5 / BW:5	QPSK	1	0	21.5	21.66	21.91	0
			12	21.95	21.7	22.26	
			24	21.8	21.52	21.84	
		12	0	20.77	20.74	21.1	1
			6	20.77	20.76	21.03	
			13	20.7	20.7	20.99	
	16QAM	25	0	20.75	20.72	21.0	
			0	20.7	20.4	20.48	
			12	20.68	20.49	20.61	
		1	24	20.34	20.42	20.4	
			0	19.55	19.51	19.99	2
			6	19.66	19.47	19.92	
		12	13	19.75	19.48	19.71	
			0	19.72	19.58	19.91	
			0	19.72	19.58	19.91	

Band / BW [MHz]	Modulation	RBs	RB Start	CH:20450 829 MHz	CH:20525 836.5 MHz	CH:20600 844 MHz	3GPP MPR [dB]
B5 / BW:10	QPSK	1	0	21.77	21.45	21.59	0
			24	21.83	21.78	22.05	
			49	21.81	21.86	22.07	
		25	0	20.85	20.85	20.99	1
			12	20.96	20.75	21.03	
			25	20.7	20.72	20.96	
	16QAM	50	0	20.74	20.81	20.97	
			0	20.05	20.39	20.4	
			24	20.52	20.45	20.77	
		1	49	20.12	20.3	20.45	
			0	19.82	19.71	19.86	2
		25	12	19.93	19.7	19.92	
			25	19.74	19.68	19.94	
			0	19.68	19.55	19.72	
		27	0	19.68	19.55	19.72	

Band / BW [MHz]	Modulation	RBs	RB Start	CH:23017 699.7 MHz	CH:23095 707.5 MHz	CH:23173 715.3 MHz	3GPP MPR [dB]
B12 / BW:1.4	QPSK	1	0	22.8	22.97	22.84	0
			2	22.95	23.07	23.02	
			5	23.01	23.02	23.01	
		3	0	22.9	22.95	22.98	1
			1	23.04	23.05	23.0	
			3	23.05	23.05	22.99	
	16QAM	6	0	21.98	22.14	22.1	
			0	21.68	21.82	21.8	
			2	21.69	21.45	21.65	
		1	5	21.71	21.55	21.45	
			0	21.99	22.02	22.11	
		3	1	22.15	22.09	22.19	
			3	22.22	22.15	22.05	
		6	0	20.93	20.95	21.03	2

Band / BW [MHz]	Modulation	RBs	RB Start	CH:23025 700.5 MHz	CH:23095 707.5 MHz	CH:23165 714.5 MHz	3GPP MPR [dB]
B12 / BW:3	QPSK	1	0	22.9	22.88	22.95	0
			7	23.05	23.02	22.98	
			14	22.97	22.91	22.86	
		8	0	22.09	22.11	22.23	1
			3	22.07	22.09	22.12	
			7	22.11	22.18	22.02	
		15	0	21.99	22.05	22.2	
	16QAM	1	0	21.52	21.75	21.71	1
			7	22.05	21.9	21.77	
			14	21.71	21.55	21.09	
		8	0	21.06	21.07	21.07	2
			3	21.11	21.07	21.18	
			7	21.23	21.07	21.02	
		15	0	21.09	21.22	21.16	

Band / BW [MHz]	Modulation	RBs	RB Start	CH:23035 701.5 MHz	CH:23095 707.5 MHz	CH:23155 713.5 MHz	3GPP MPR [dB]
B12 / BW:5	QPSK	1	0	22.79	22.79	22.62	0
			12	23.18	22.98	22.8	
			24	22.95	22.84	22.82	
		12	0	21.93	22.05	22.04	1
			6	22.0	22.11	22.16	
			13	21.98	22.11	22.04	
		25	0	22.0	22.02	22.05	
	16QAM	1	0	21.54	21.7	21.55	1
			12	21.96	22.12	21.83	
			24	21.49	21.47	20.88	
		12	0	20.98	20.84	20.9	2
			6	21.02	20.98	21.05	
			13	21.02	20.97	20.89	
		25	0	21.02	21.01	21.22	

Band / BW [MHz]	Modulation	RBs	RB Start	CH:23060 704 MHz	CH:23095 707.5 MHz	CH:23130 711 MHz	3GPP MPR [dB]
B12 / BW:10	QPSK	1	0	22.76	22.57	23.05	0
			24	23.1	22.7	23.03	
			49	22.97	23.07	22.87	
		25	0	21.97	22.07	22.21	1
			12	22.01	22.05	22.24	
			25	22.01	22.16	22.11	
		50	0	22.01	22.05	22.05	
	16QAM	1	0	21.22	21.65	21.57	1
			24	21.6	21.65	21.12	
			49	21.5	21.84	21.35	
		25	0	20.93	20.95	21.02	2
			12	20.99	21.33	21.11	
			25	21.04	21.2	21.09	
		27	0	21.12	21.02	21.03	

Band / BW [MHz]	Modulation	RBs	RB Start	CH:23205 779.5 MHz	CH:23230 782 MHz	CH:23255 784.5 MHz	3GPP MPR [dB]
B13 / BW:5	QPSK	1	0	22.77	22.54	22.49	0
			12	22.65	22.67	22.54	
			24	22.68	22.54	22.43	
		12	0	21.75	21.69	21.79	1
			6	21.76	21.88	21.73	
			13	21.8	21.78	21.63	
		25	0	21.82	21.73	21.71	
	16QAM	1	0	21.54	21.4	21.46	
			12	21.44	21.8	21.52	
			24	21.33	21.08	20.95	
		12	0	20.53	20.57	20.84	2
			6	20.54	20.75	20.65	
			13	20.77	20.81	20.54	
		25	0	20.72	20.76	20.96	

Band / BW [MHz]	Modulation	RBs	RB Start	CH:23230 782 MHz	3GPP MPR [dB]
B13 / BW:10	QPSK	1	0	22.52	0
			24	22.75	
			49	22.53	
		25	0	21.77	1
			12	21.84	
			25	21.67	
		50	0	21.72	
	16QAM	1	0	21.53	
			24	21.41	
			49	21.01	
		25	0	20.71	2
			12	20.8	
			25	20.76	
		27	0	20.64	

4. TEST EQUIPMENT

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

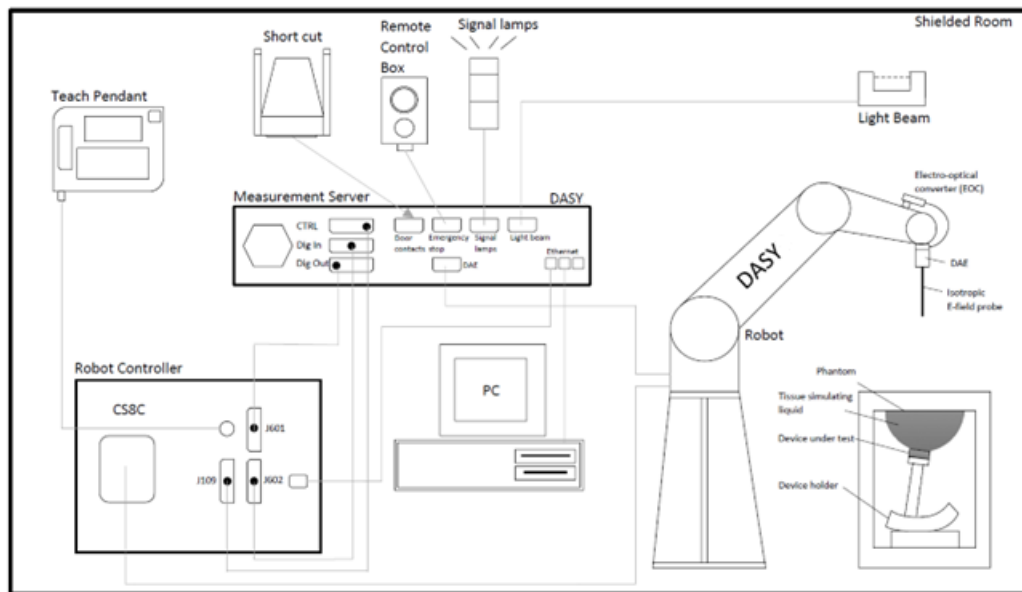


Figure 1 Schematic Laboratory Picture

4.1 Test Equipment List

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

Test Equipment	Model	Serial Number	Calibration Date	Interval [years]
Amplifier, 0.5-1000MHz	TVA-R5-13A+	2202002	NA	NA
Amplifier, 800MHz-4200MHz, 10W	10S1G4A	320421	NA	NA
DAE4, converter	DAE4	1332	02/2024	1
DAE4, converter	DAE4	705	04/2024	1
DAE4, converter	DAE4	710	10/2023	1
DASY5 Software	52.8.8.1258	-	NA	NA
Directional Power sensor	NRT-Z44	107780	02/2024	1
Inline Peak Power Sensor	MA24105A	2102058	10/2023	1
Isotropic DOS probe	EX3DV4	3892	04/2024	1
Isotropic DOS probe	EX3DV4	7447	02/2024	1
Network Analyzer	E5071B	MY42301191	03/2024	1
Power reflection meter	NRT	835065/049	02/2024	3
Radio Communication Analyzer	MT8820C	6200883099	10/2023	1
Radio Communication Analyzer	MT8820C	6200951734	12/2023	1
System validation dipole	D1800V2	249	07/2022	3
System validation dipole	D1900V2	511	03/2023	3
System validation dipole	D750V3	1154	07/2022	3
System validation dipole	D835V2	448	03/2023	3
Vector Signal Generator	MG3710A	6201502519	NA	1
Vector Signal Generator	MG3710E	6262028676	NA	1

Dipole calibration period supporting data:

		Measured on 09/2024			Calibrated		
Dipole and Serial Number	Frequency [MHz]	Return Loss [dB]	Impedance [Ω]		Return Loss [dB]	Impedance [Ω]	
D750V3-SN: 1154	750	-24.1	50.9	-6.3	-27	54.4	-1.5
D835V2-SN:448	835	-23.0	43.6	-1.9	-21.53	42.3	-0.1
D1800V2 - SN:249	1800	-24.3	45.6	-3.9	-28.3	48.5	-3.5
D1900V2-SN:511	1900	-23.0	44.5	-3.8	-23.34	48.5	-6.6

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	4 MHz to 10 GHz (dosimetry) Linearity: ± 0.2 dB (30 MHz to 10 GHz)
Directivity (typical)	± 0.1 dB in TSL (rotation around probe axis) ± 0.3 dB in TSL (rotation normal to probe axis)
Dynamic Range	10 μ W/g – > 100 mW/g Linearity: ± 0.2 dB (noise: typically <1 μ W/g)
Dimensions	Overall length: 337 mm (tip: 20 mm) Tip diameter: 2.5 mm (body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm
Application	General dosimetry up to 6 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms

4.2 Phantoms

Modular Flat Phantom (MFP):

The Triple Modular Phantom consists of three identical modules that can be installed and removed separately without emptying the liquid. It is used for compliance testing of small wireless devices in body-worn configurations. The phantom conforms to the requirements of 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 $\pm 10\%$ of the recommended values at frequencies under 3GHz. A liquid compensation algorithm was used in DASY 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]	Date
1800	D1800V2-SN:2D075	EX3DV4 - SN: 3892	CW	DAE 4 / 705	39.08	1.35	05/2024
1900	D1900V2-SN:511	EX3DV4 - SN: 3892	CW	DAE 4 / 705	38.9	1.4	05/2024
750	D750V3 - SN: 635	EX3DV4 - SN: 7447	CW	DAE 4 / 1332	41.36	0.87	03/2024
835	D835V2-SN:455	EX3DV4 - SN: 7447	CW	DAE 4 / 1332	43.14	0.95	04/2024

4.5 System Check

Date	Tissue Type	Tissue Temp. [°C]	Frequency [MHz]	Input Power [mW]	Measured SAR _{1q} [W/kg]	1 W Target SAR _{1q} [W/kg]	1 W Normalized SAR _{1q} [W/kg]	Deviation [%]	Plot #
30.09.2024	WB Head	22	750	250	2.06	8.54	8.24	-3.5	1
30.09.2024	WB Head	22	1800	250	9.36	38.9	37.44	-3.8	2
01.10.2024	WB Head	22	750	250	2.02	8.54	8.08	-5.4	3
02.10.2024	WB Head	22	835	250	2.4	9.36	9.6	2.6	4
02.10.2024	WB Head	22	1800	250	9.42	38.9	37.68	-3.1	5
03.10.2024	WB Head	22	835	250	2.45	9.36	9.8	4.7	6
03.10.2024	WB Head	22	1900	250	9.14	38.02	36.56	-3.8	7
03.10.2024	WB Head	22	835	250	2.29	9.36	9.16	-2.1	8
03.10.2024	WB Head	22	1900	250	9.47	38.02	37.88	-0.4	9

4.5.1 Tissue Simulant Verification

Date	Tissue Type	Tissue Temp [°C]	Frequency [MHz]	Measured		Target		Deviation	
				Dielectric Constant [ε]	Conductivity σ [S/m]	Dielectric Constant [ε] Target	Conductivity σ [S/m] Target	ε [%]	σ [%]
30.09.2024	WB Head	22	704	44.21	0.83	42.15	0.89	4.9	-6.7
30.09.2024	WB Head	22	750	43.91	0.84	41.9	0.89	4.8	-5.2
30.09.2024	WB Head	22	782	43.71	0.85	41.75	0.89	4.7	-4.4
30.09.2024	WB Head	22	1720	39.85	1.26	40.11	1.35	-0.7	-6.8
30.09.2024	WB Head	22	1732.5	39.82	1.27	40.1	1.36	-0.7	-6.9
30.09.2024	WB Head	22	1745	39.79	1.27	40.08	1.37	-0.7	-6.9
30.09.2024	WB Head	22	1800	39.71	1.3	40.0	1.4	-0.7	-7.1
01.10.2024	WB Head	22	704	43.82	0.84	42.15	0.89	4.0	-5.2
01.10.2024	WB Head	22	707.5	43.79	0.84	42.13	0.89	4.0	-5.2
01.10.2024	WB Head	22	711	43.76	0.84	42.11	0.89	3.9	-5.0
01.10.2024	WB Head	22	750	43.49	0.86	41.9	0.89	3.8	-3.7
01.10.2024	WB Head	22	782	43.31	0.87	41.75	0.89	3.7	-2.9
01.10.2024	WB Head	22	835	42.99	0.89	41.5	0.9	3.6	-1.4
02.10.2024	WB Head	21.7	1800	40.47	1.31	40.0	1.4	1.2	-6.3
02.10.2024	WB Head	21.7	704	43.56	0.83	42.15	0.89	3.3	-6.1
02.10.2024	WB Head	21.7	779.5	43.08	0.86	41.76	0.89	3.2	-3.8
02.10.2024	WB Head	21.7	782	43.06	0.86	41.75	0.89	3.1	-3.7
02.10.2024	WB Head	21.7	784.5	43.05	0.86	41.74	0.89	3.1	-3.7
02.10.2024	WB Head	21.7	835	42.71	0.88	41.5	0.9	2.9	-2.2
02.10.2024	WB Head	21.7	844	42.68	0.88	41.5	0.91	2.8	-2.8
03.10.2024	WB Head	21.7	835	41.88	0.87	41.5	0.9	0.9	-3.3
03.10.2024	WB Head	21.7	836.6	41.87	0.87	41.5	0.9	0.9	-3.4
03.10.2024	WB Head	21.7	844	41.83	0.87	41.5	0.91	0.8	-4.0
03.10.2024	WB Head	21.7	1880	37.7	1.3	40.0	1.4	-5.8	-7.5
03.10.2024	WB Head	21.7	1900	37.67	1.3	40.0	1.4	-5.8	-6.8
03.10.2024	WB Head	21.2	824.2	43.06	0.88	41.55	0.9	3.6	-1.7
03.10.2024	WB Head	21.2	829	43.03	0.89	41.53	0.9	3.6	-1.6
03.10.2024	WB Head	21.2	835	42.99	0.89	41.5	0.9	3.6	-1.4
03.10.2024	WB Head	21.2	836.5	42.99	0.89	41.5	0.9	3.6	-1.5
03.10.2024	WB Head	21.2	844	42.95	0.89	41.5	0.91	3.5	-2.1
03.10.2024	WB Head	22	1860	39.45	1.35	40.0	1.4	-1.4	-3.9
03.10.2024	WB Head	22	1880	39.42	1.36	40.0	1.4	-1.5	-3.1
03.10.2024	WB Head	22	1900	39.39	1.37	40.0	1.4	-1.5	-2.5

5. TEST PROCEDURE

Testing was carried out in accordance with FCC KDB Publications 447498 D04 Interim General RF Exposure Guidance v01.

Test configurations for SAR testing were selected based on conducted power measurements.

The DUT is LTE Cat 1 device and has limited data rate up to 5 Mb/s in uplink, for this reason the 50% and 100% resource block allocations for 16QAM modulation may be missing. This has been compensated with highest supported resource block allocation available.

The DUT was measured from all the sides surrounding the TX antenna, without the sensor probe in place. Spot check measurements were done to ensure that the sensor probe does not have an impact on the DUT SAR.

Spot check SAR results with and without the sensor probe:

Band	Modulation / BW	Frequency [MHz]	RBs	RB Start	Maximum Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Test position	Reported SAR _{10g} [W/kg]
5	QPSK / 10	844	25	12	25	21.03	-0.27	Top	0.30
5	QPSK / 10	844	25	12	25	21.03	-0.2	Top with probe	0.29
4	QPSK / 20	1732.5	1	50	25	23.55	0.07	Top	1.94
4	QPSK / 20	1732.5	1	50	25	23.55	-0.17	Top with probe	1.87

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.



Figure 2 Device holder supplied by SPEAG

5.2 Test Positions

5.2.1 Extremity Configuration, 0mm separation distance

Extremity SAR was tested from the front, back, left, right and top sides of the device. The device was placed in the SPEAG holder and lifted towards the phantom until the distance between the phantom and the device was 0mm.

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 Dasy 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.	(c) 1g	(c) 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 _{sys}	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 _a)	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

Band	Channel	Frequency [MHz]	Modulation/BW [MHz]	RB Size	RB Offset	Maximum Power [dBm]	Conducted Power [dBm]	Test position	Measured SAR10g [W/kg]	Power Drift [dB]	Duty Cycle	Scaling Factor	Reported SAR10g [W/kg]	Plot #
LTE B2	19100	1900	QPSK / 20	1	50	25	23.72	Front	0.55	-0.08	1:1	1.34	0.74	
LTE B2	19100	1900	QPSK / 20	50	50	25	22.68	Front	0.42	-0.2	1:1	1.71	0.72	
LTE B2	19100	1900	QPSK / 20	1	50	25	23.72	Back	0.43	-0.09	1:1	1.34	0.57	
LTE B2	19100	1900	QPSK / 20	50	50	25	22.68	Back	0.33	0	1:1	1.71	0.57	
LTE B2	19100	1900	QPSK / 20	1	50	25	23.72	Left	0.26	-0.21	1:1	1.34	0.35	
LTE B2	19100	1900	QPSK / 20	50	50	25	22.68	Left	0.21	-0.09	1:1	1.71	0.35	
LTE B2	19100	1900	QPSK / 20	1	50	25	23.72	Right	0.41	-0.75*	1:1	1.60	0.65	
LTE B2	19100	1900	QPSK / 20	50	50	25	22.68	Right	0.29	-0.17	1:1	1.71	0.50	
LTE B2	19100	1900	QPSK / 20	1	50	25	23.72	Top	1.73	-0.31*	1:1	1.44	2.49	10
LTE B2	19100	1900	QPSK / 20	50	50	25	22.68	Top	1.36	-0.08	1:1	1.71	2.32	
LTE B2	18700	1860	QPSK / 20	1	50	25	23.66	Top	1.61	-0.03	1:1	1.36	2.19	
LTE B2	18900	1880	QPSK / 20	1	50	25	23.6	Top	1.6	-0.07	1:1	1.38	2.21	
LTE B2	19100	1900	QPSK / 20	100	0	25	22.56	Top	1.32	-0.01	1:1	1.75	2.32	
LTE B2	18700	1860	QPSK / 20	50	0	25	22.61	Top	1.25	-0.14	1:1	1.73	2.17	
LTE B2	18700	1860	QPSK / 20	100	0	25	22.6	Top	1.25	-0.06	1:1	1.74	2.17	
LTE B2	18900	1880	QPSK / 20	50	0	25	22.75	Top	1.26	-0.03	1:1	1.68	2.12	
LTE B2	18900	1880	QPSK / 20	100	0	25	22.53	Top	1.26	0.07	1:1	1.77	2.23	

*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 SAR10g [W/kg]	Power Drift [dB]	Duty Cycle	Scaling Factor	Reported SAR10g [W/kg]	Plot #
LTE B4	20175	1732.5	QPSK / 20	1	50	25	23.55	Front	0.291	-0.12	1:1	1.40	0.41	
LTE B4	20175	1732.5	QPSK / 20	50	0	25	22.52	Front	0.426	0.09	1:1	1.77	0.75	
LTE B4	20175	1732.5	QPSK / 20	1	50	25	23.55	Back	0.293	-0.1	1:1	1.40	0.41	
LTE B4	20175	1732.5	QPSK / 20	50	0	25	22.52	Back	0.238	-0.2	1:1	1.77	0.42	
LTE B4	20175	1732.5	QPSK / 20	1	50	25	23.55	Left	0.224	-0.25*	1:1	1.48	0.33	
LTE B4	20175	1732.5	QPSK / 20	50	0	25	22.52	Left	0.183	0.29*	1:1	1.89	0.35	
LTE B4	20175	1732.5	QPSK / 20	1	50	25	23.55	Right	0.21	-0.07	1:1	1.40	0.29	
LTE B4	20175	1732.5	QPSK / 20	50	0	25	22.52	Right	0.163	-0.03	1:1	1.77	0.29	
LTE B4	20175	1732.5	QPSK / 20	1	50	25	23.55	Top	1.39	0.07	1:1	1.40	1.94	
LTE B4	20175	1732.5	QPSK / 20	50	0	25	22.52	Top	1.12	0.05	1:1	1.77	1.98	11
LTE B4	20050	1720	QPSK / 20	1	50	25	23.42	Top	1.3	-0.02	1:1	1.44	1.87	
LTE B4	20300	1745	QPSK / 20	1	0	25	23.52	Top	1.37	-0.11	1:1	1.41	1.93	

*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 SAR10g [W/kg]	Power Drift [dB]	Duty Cycle	Scaling Factor	Reported SAR10g [W/kg]	Plot #
LTE B5	20600	844	QPSK / 10	1	49	25	22.07	Front	0.083	-0.03	1:1	1.96	0.16	
LTE B5	20600	844	QPSK / 10	25	12	25	21.03	Front	0.072	-0.11	1:1	2.49	0.18	
LTE B5	20600	844	QPSK / 10	1	49	25	22.07	Back	0.040	-0.48*	1:1	2.19	0.09	
LTE B5	20600	844	QPSK / 10	25	12	25	21.03	Back	0.028	-0.32*	1:1	2.69	0.07	
LTE B5	20600	844	QPSK / 10	1	49	25	22.07	Left	0.024	-0.19	1:1	1.96	0.05	
LTE B5	20600	844	QPSK / 10	25	12	25	21.03	Left	0.017	-0.25*	1:1	2.64	0.04	
LTE B5	20600	844	QPSK / 10	1	49	25	22.07	Right	0.058	-0.13	1:1	1.96	0.11	
LTE B5	20600	844	QPSK / 10	25	12	25	21.03	Right	0.044	-0.31*	1:1	2.68	0.12	
LTE B5	20600	844	QPSK / 10	1	49	25	22.07	Top	0.146	-0.01	1:1	1.96	0.29	
LTE B5	20600	844	QPSK / 10	25	12	25	21.03	Top	0.112	-0.27*	1:1	2.65	0.30	12
LTE B5	20450	829	QPSK / 10	1	24	25	21.83	Top	0.138	-0.05	1:1	2.07	0.29	
LTE B5	20525	836.5	QPSK / 10	1	49	25	21.86	Top	0.134	0.08	1:1	2.06	0.28	

*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 SAR10g [W/kg]	Power Drift *[dB]	Duty Cycle	Scaling Factor	Reported SAR10g [W/kg]	Plot #
LTE B12	23060	704	QPSK / 10	1	24	25	23.1	Front	0.362	-0.23*	1:1	1.63	0.59	
LTE B12	23060	704	QPSK / 10	25	12	25	22.01	Front	0.282	-0.17	1:1	1.99	0.56	
LTE B12	23060	704	QPSK / 10	1	24	25	23.1	Back	0.079	-0.11	1:1	1.55	0.12	
LTE B12	23060	704	QPSK / 10	25	12	25	22.01	Back	0.057	0	1:1	1.99	0.11	
LTE B12	23060	704	QPSK / 10	1	24	25	23.1	Left	0.056	-0.7*	1:1	1.82	0.10	
LTE B12	23060	704	QPSK / 10	25	12	25	22.01	Left	0.044	0.59*	1:1	2.28	0.10	
LTE B12	23060	704	QPSK / 10	1	24	25	23.1	Right	0.129	-0.16	1:1	1.55	0.20	
LTE B12	23060	704	QPSK / 10	25	12	25	22.01	Right	0.100	-0.02	1:1	1.99	0.20	
LTE B12	23060	704	QPSK / 10	1	24	25	23.1	Top	0.620	-0.12	1:1	1.55	0.96	
LTE B12	23060	704	QPSK / 10	25	12	25	22.01	Top	0.488	-0.1	1:1	1.99	0.97	13
LTE B12	23095	707.5	QPSK / 10	1	49	25	23.07	Top	0.602	-0.07	1:1	1.56	0.94	
LTE B12	23130	711	QPSK / 10	1	0	25	23.05	Top	0.600	0.06	1:1	1.57	0.94	

*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 SAR10g [W/kg]	Power Drift *[dB]	Duty Cycle	Scaling Factor	Reported SAR10g [W/kg]	Plot #
LTE B13	23230	782	QPSK / 10	1	24	25	22.75	Front	0.215	-0.18	1:1	1.68	0.36	
LTE B13	23230	782	QPSK / 10	25	12	25	21.84	Front	0.171	-0.01	1:1	2.07	0.35	
LTE B13	23230	782	QPSK / 10	1	24	25	22.75	Back	0.078	-0.23*	1:1	1.77	0.14	
LTE B13	23230	782	QPSK / 10	25	12	25	21.84	Back	0.064	-0.2	1:1	2.07	0.13	
LTE B13	23230	782	QPSK / 10	1	24	25	22.75	Left	0.060	-0.32*	1:1	1.81	0.11	
LTE B13	23230	782	QPSK / 10	25	12	25	21.84	Left	0.049	-0.43*	1:1	2.29	0.11	
LTE B13	23230	782	QPSK / 10	1	24	25	22.75	Right	0.126	-0.2	1:1	1.68	0.21	
LTE B13	23230	782	QPSK / 10	25	12	25	21.84	Right	0.122	0.05	1:1	2.07	0.25	
LTE B13	23230	782	QPSK / 10	1	24	25	22.75	Top	0.302	-0.13	1:1	1.68	0.51	
LTE B13	23230	782	QPSK / 10	25	12	25	21.84	Top	0.253	-0.24*	1:1	2.19	0.55	14
LTE B13	23205	779.5	QPSK / 5	1	0	25	22.77	Top	0.313	-0.03	1:1	1.67	0.52	
LTE B13	23255	784.5	QPSK / 5	1	12	25	22.54	Top	0.301	0.01	1:1	1.76	0.53	

*Larger than 5% drifts included to scaling factors

7.2 Zoom Scan Compliance

According to IEC 62209-1528, 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 62209-1528 is automatically verified by DASY 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.

APPENDIX A: PHOTOS OF THE DUT

Appendix A is provided as a separate document.

APPENDIX B: SYSTEM CHECK SCAN

Plot 1

Date/Time: 30/09/2024 09:23:50

Test Laboratory: Verkotan Oy

DUT: D750V3 - SN1154

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; $\sigma = 0.844$ S/m; $\epsilon_r = 43.906$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASYS (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(9.63, 9.05, 9.58) @ 750 MHz; Calibrated: 23/02/2024
 - Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 31.0, -4.0$
 - Electronics: DAE4 Sn1332; Calibrated: 14/02/2024
 - Phantom: SAR1_Phantom 1_triple flat right; Type: QD 000 P51 Cx;
 - DASYS2 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System check, 750MHz/Zoom Scan (5x5x5)/Cube 0: Measurement grid: $dx=7.5$ mm, $dy=7.5$ mm, $dz=7.5$ mm

Reference Value = 57.63 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 2.78 W/kg

SAR(1 g) = 2.06 W/kg; SAR(10 g) = 1.36 W/kg (SAR corrected for target medium)

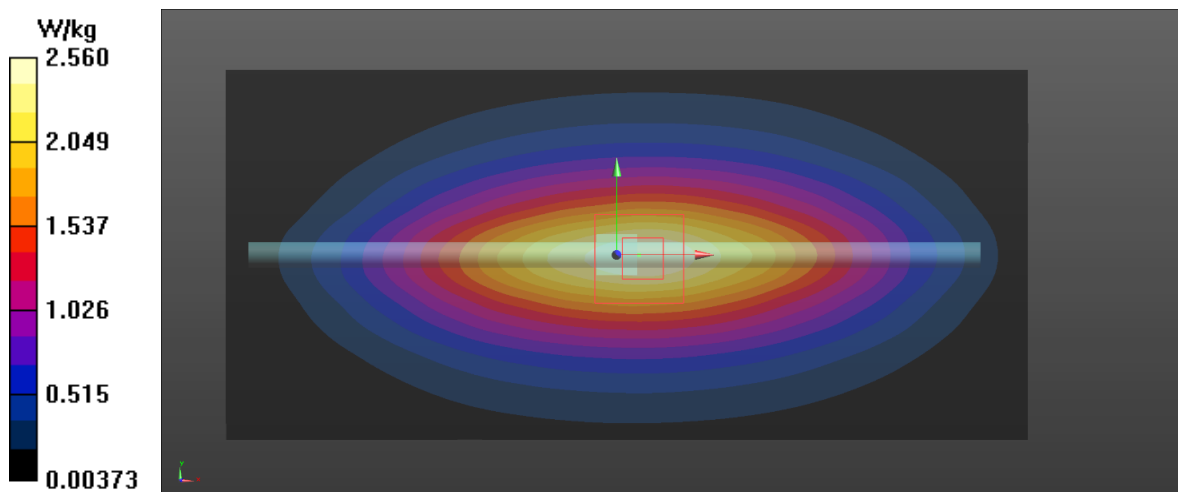
Smallest distance from peaks to all points 3 dB below = 20.2 mm

Ratio of SAR at M2 to SAR at M1 = 57.9%

Maximum value of SAR (measured) = 2.54 W/kg

Configuration/System check, 750MHz/Area Scan (131x61x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 2.56 W/kg



Plot 2

Date/Time: 30/09/2024 10:23:15

Test Laboratory: Verkotan Oy

DUT: D1800V2 - SN249

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; $\sigma = 1.301$ S/m; $\epsilon_r = 39.715$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASYS (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3892; ConvF(8.02, 8.45, 7.93) @ 1800 MHz; Calibrated: 15/04/2024
 - Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = -4.0, 31.0$
 - Electronics: DAE4 Sn710; Calibrated: 24/10/2023
 - Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx;
 - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System check 1800MHz/Area Scan (91x61x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 13.5 W/kg

Configuration/System check 1800MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 85.53 V/m; Power Drift = -0.28 dB

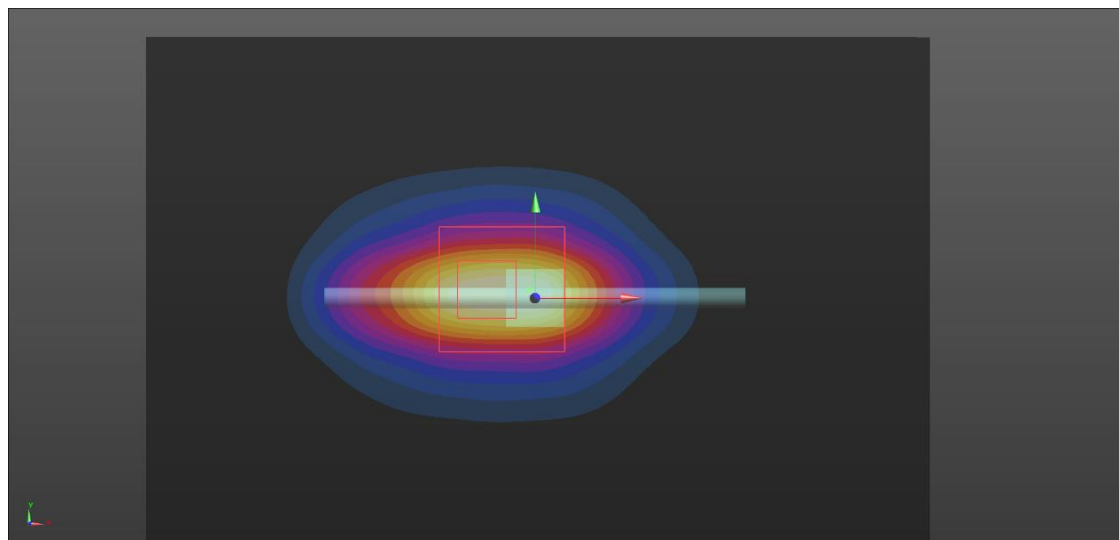
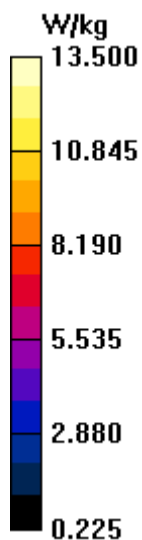
Peak SAR (extrapolated) = 15.9 W/kg

SAR(1 g) = 9.36 W/kg; SAR(10 g) = 4.91 W/kg (SAR corrected for target medium)

Smallest distance from peaks to all points 3 dB below = 10 mm

Ratio of SAR at M2 to SAR at M1 = 57.5%

Maximum value of SAR (measured) = 13.5 W/kg



Plot 3

Date/Time: 01/10/2024 09:29:02

Test Laboratory: Verkotan Oy

DUT: D750V3 - SN1154

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; $\sigma = 0.857$ S/m; $\epsilon_r = 43.494$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASYS (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(9.63, 9.05, 9.58) @ 750 MHz; Calibrated: 23/02/2024
 - Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = -4.0, 31.0$
 - Electronics: DAE4 Sn1332; Calibrated: 14/02/2024
 - Phantom: SAR1_Phantom 1_triple flat right; Type: QD 000 P51 Cx;
 - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System check, 750MHz/Area Scan (131x61x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 2.57 W/kg

Configuration/System check, 750MHz/Zoom Scan (5x5x5)/Cube 0: Measurement grid: $dx=7.5$ mm, $dy=7.5$ mm, $dz=7.5$ mm

Reference Value = 57.91 V/m; Power Drift = -0.09 dB

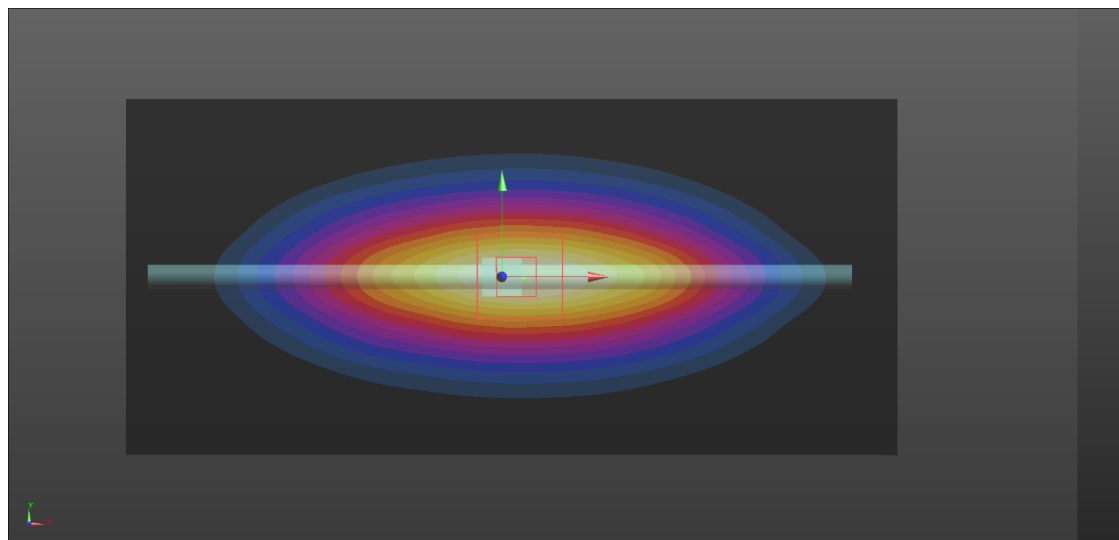
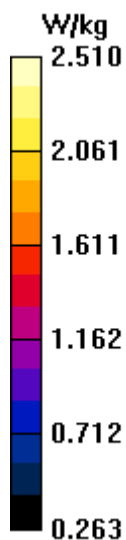
Peak SAR (extrapolated) = 2.76 W/kg

SAR(1 g) = 2.02 W/kg; SAR(10 g) = 1.34 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 = 58%

Maximum value of SAR (measured) = 2.51 W/kg



Plot 4

Date/Time: 02/10/2024 09:26:23

Test Laboratory: Verkotan Oy

DUT: D835V2 - SN448

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; $\sigma = 0.88$ S/m; $\epsilon_r = 42.712$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.89, 9.05, 8.92) @ 835 MHz; Calibrated: 23/02/2024
 - Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = -4.0, 31.0$
 - Electronics: DAE4 Sn1332; Calibrated: 14/02/2024
 - Phantom: SAR1_Phantom 1_triple flat right; Type: QD 000 P51 Cx;
 - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System check, 835MHz/Area Scan (131x61x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 3.06 W/kg

Configuration/System check, 835MHz/Zoom Scan (5x5x5)/Cube 0: Measurement grid: $dx=7.5$ mm, $dy=7.5$ mm, $dz=7.5$ mm

Reference Value = 62.07 V/m; Power Drift = -0.04 dB

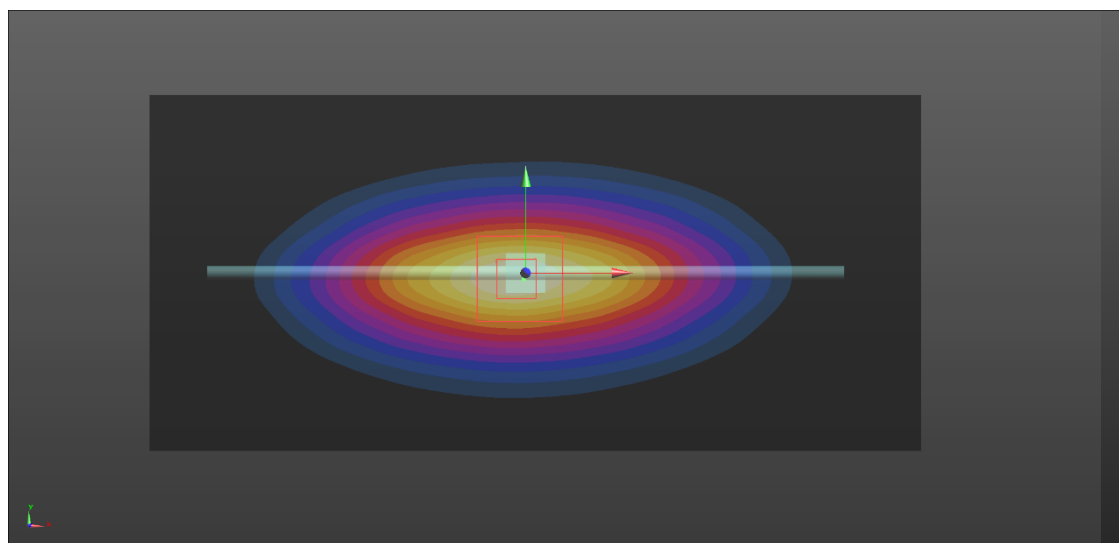
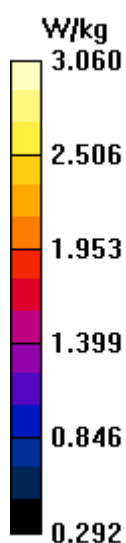
Peak SAR (extrapolated) = 3.36 W/kg

SAR(1 g) = 2.4 W/kg; SAR(10 g) = 1.58 W/kg (SAR corrected for target medium)

Smallest distance from peaks to all points 3 dB below = 20.2 mm

Ratio of SAR at M2 to SAR at M1 = 57.5%

Maximum value of SAR (measured) = 3.06 W/kg



Plot 5

Date/Time: 02/10/2024 08:22:05

Test Laboratory: Verkotan Oy

DUT: D1800V2 - SN249

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; $\sigma = 1.312$ S/m; $\epsilon_r = 40.474$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3892; ConvF(8.02, 8.45, 7.93) @ 1800 MHz; Calibrated: 15/04/2024
 - Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 31.0, -4.0$
 - Electronics: DAE4 Sn705; Calibrated: 09/04/2024
 - Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx;
 - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System check 1800MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 87.15 V/m; Power Drift = -0.27 dB

Peak SAR (extrapolated) = 16.0 W/kg

SAR(1 g) = 9.42 W/kg; SAR(10 g) = 4.95 W/kg (SAR corrected for target medium)

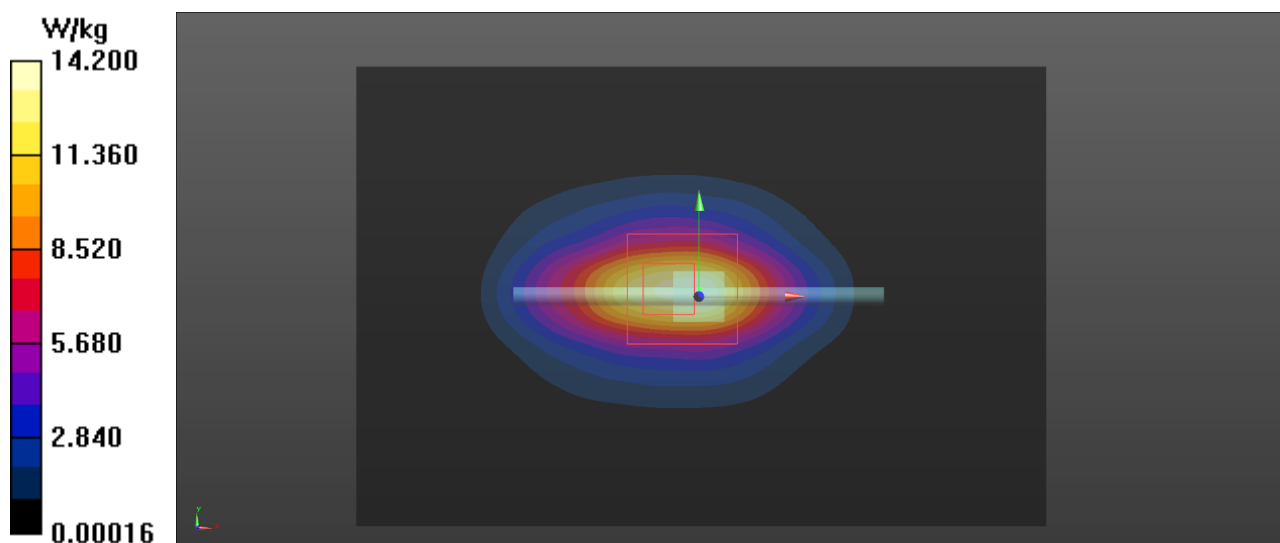
Smallest distance from peaks to all points 3 dB below = 10 mm

Ratio of SAR at M2 to SAR at M1 = 58%

Maximum value of SAR (measured) = 13.6 W/kg

Configuration/System check 1800MHz/Area Scan (91x61x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 14.2 W/kg



Plot 6

Date/Time: 03/10/2024 08:03:26

Test Laboratory: Verkotan Oy

DUT: D835V2 - SN448

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; $\sigma = 0.87$ S/m; $\epsilon_r = 41.881$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASYS (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.89, 9.05, 8.92) @ 835 MHz; Calibrated: 23/02/2024
 - Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = -4.0, 31.0$
 - Electronics: DAE4 Sn1332; Calibrated: 14/02/2024
 - Phantom: SAR1_Phantom 1_triple flat right; Type: QD 000 P51 Cx;
 - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System check, 835MHz/Area Scan (131x61x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 3.11 W/kg

Configuration/System check, 835MHz/Zoom Scan (5x5x5)/Cube 0: Measurement grid: $dx=7.5$ mm, $dy=7.5$ mm, $dz=7.5$ mm

Reference Value = 62.86 V/m; Power Drift = -0.14 dB

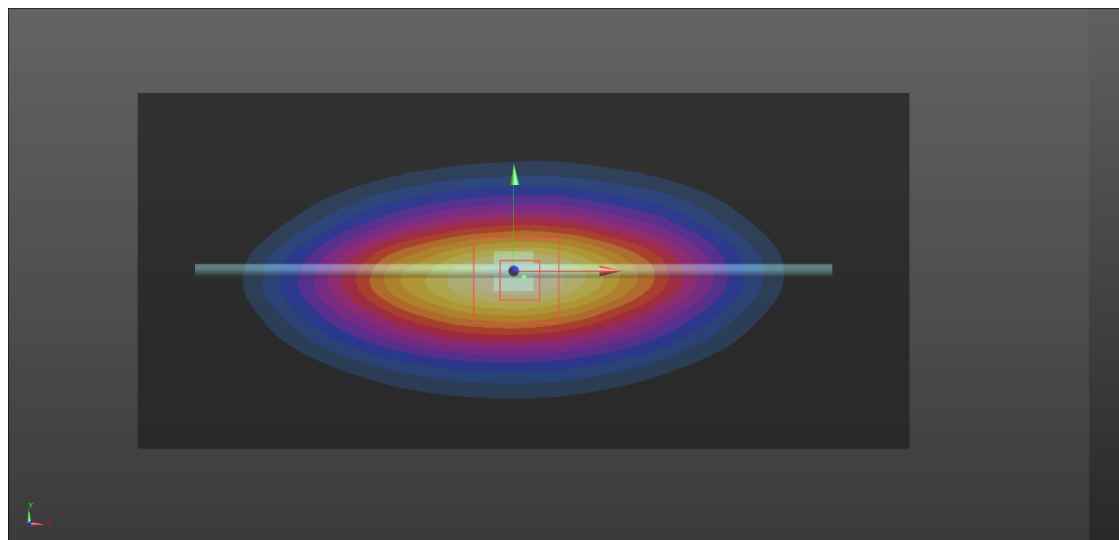
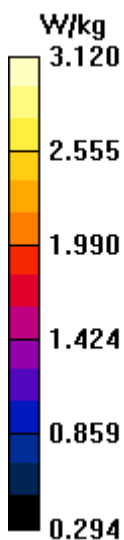
Peak SAR (extrapolated) = 3.42 W/kg

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 = 16.8 mm

Ratio of SAR at M2 to SAR at M1 = 57.4%

Maximum value of SAR (measured) = 3.12 W/kg



Plot 7

Date/Time: 03/10/2024 09:21:41

Test Laboratory: Verkotan Oy

DUT: D1900V2 - SN511

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; $\sigma = 1.305$ S/m; $\epsilon_r = 37.667$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASYS (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3892; ConvF(7.72, 8.09, 7.63) @ 1900 MHz; Calibrated: 15/04/2024
 - Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = 31.0, -4.0$
 - Electronics: DAE4 Sn705; Calibrated: 09/04/2024
 - Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx;
 - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System check 1900MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 85.01 V/m; Power Drift = -0.33 dB

Peak SAR (extrapolated) = 16.0 W/kg

SAR(1 g) = 9.14 W/kg; SAR(10 g) = 4.77 W/kg (SAR corrected for target medium)

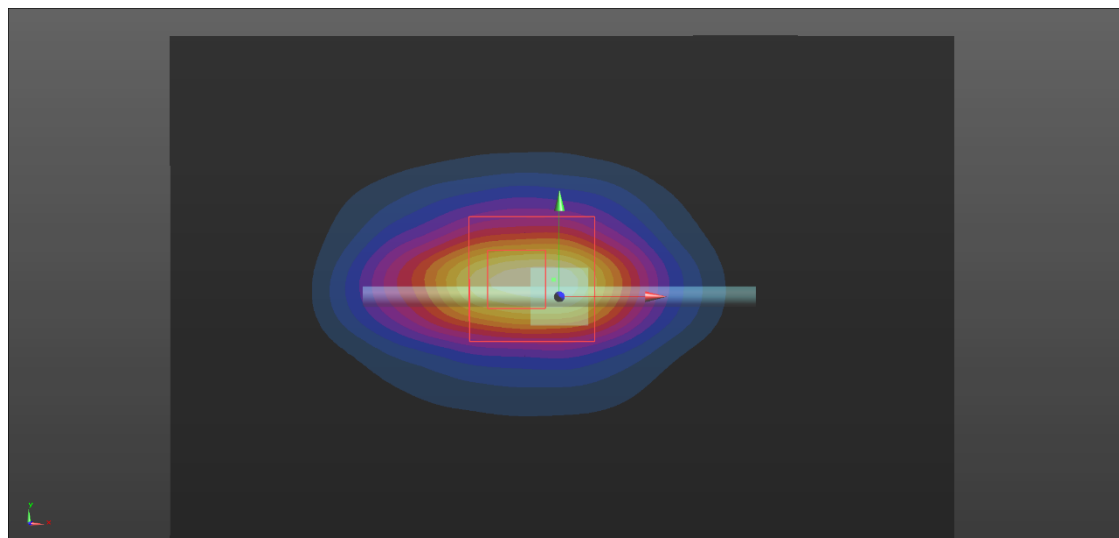
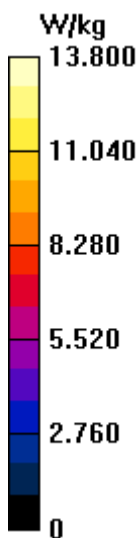
Smallest distance from peaks to all points 3 dB below = 9.9 mm

Ratio of SAR at M2 to SAR at M1 = 56.5%

Maximum value of SAR (measured) = 13.6 W/kg

Configuration/System check 1900MHz/Area Scan (91x61x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 13.8 W/kg



Plot 8

Date/Time: 03/10/2024 15:42:28

Test Laboratory: Verkotan Oy

DUT: D835V2 - SN455

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; $\sigma = 0.888$ S/m; $\epsilon_r = 42.993$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASYS (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.89, 9.05, 8.92) @ 835 MHz; Calibrated: 23/02/2024
 - Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = -4.0, 31.0$
 - Electronics: DAE4 Sn1332; Calibrated: 14/02/2024
 - Phantom: SAR1_Phantom 1_triple flat right; Type: QD 000 P51 Cx;
 - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System check, 835MHz/Area Scan (131x61x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 2.97 W/kg

Configuration/System check, 835MHz/Zoom Scan (5x5x5)/Cube 0: Measurement grid: $dx=7.5$ mm, $dy=7.5$ mm, $dz=7.5$ mm

Reference Value = 61.18 V/m; Power Drift = -0.03 dB

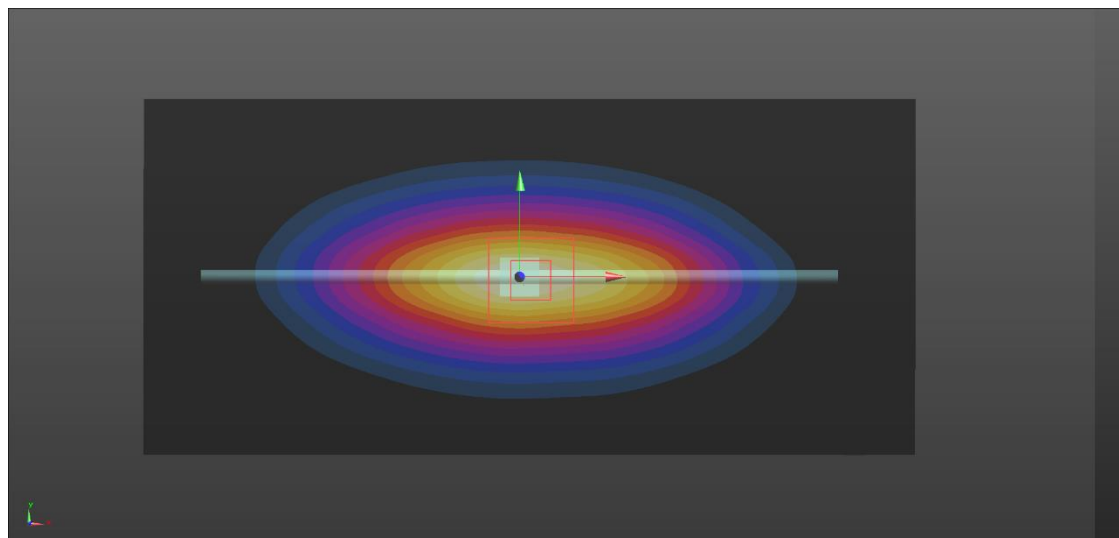
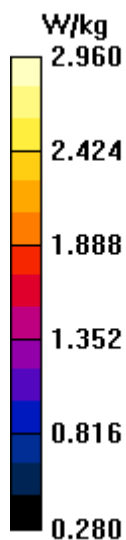
Peak SAR (extrapolated) = 3.29 W/kg

SAR(1 g) = 2.29 W/kg; SAR(10 g) = 1.5 W/kg (SAR corrected for target medium)

Smallest distance from peaks to all points 3 dB below = 18.3 mm

Ratio of SAR at M2 to SAR at M1 = 56%

Maximum value of SAR (measured) = 2.96 W/kg



Plot 9

Date/Time: 03/10/2024 15:43:50

Test Laboratory: Verkotan Oy

DUT: D1900V2 - SN511

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; $\sigma = 1.366$ S/m; $\epsilon_r = 39.387$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASYS (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3892; ConvF(7.72, 8.09, 7.63) @ 1900 MHz; Calibrated: 15/04/2024
 - Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = -4.0, 31.0$
 - Electronics: DAE4 Sn705; Calibrated: 09/04/2024
 - Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx;
 - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System check 1900MHz/Area Scan (91x61x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 14.7 W/kg

Configuration/System check 1900MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 84.81 V/m; Power Drift = -0.15 dB

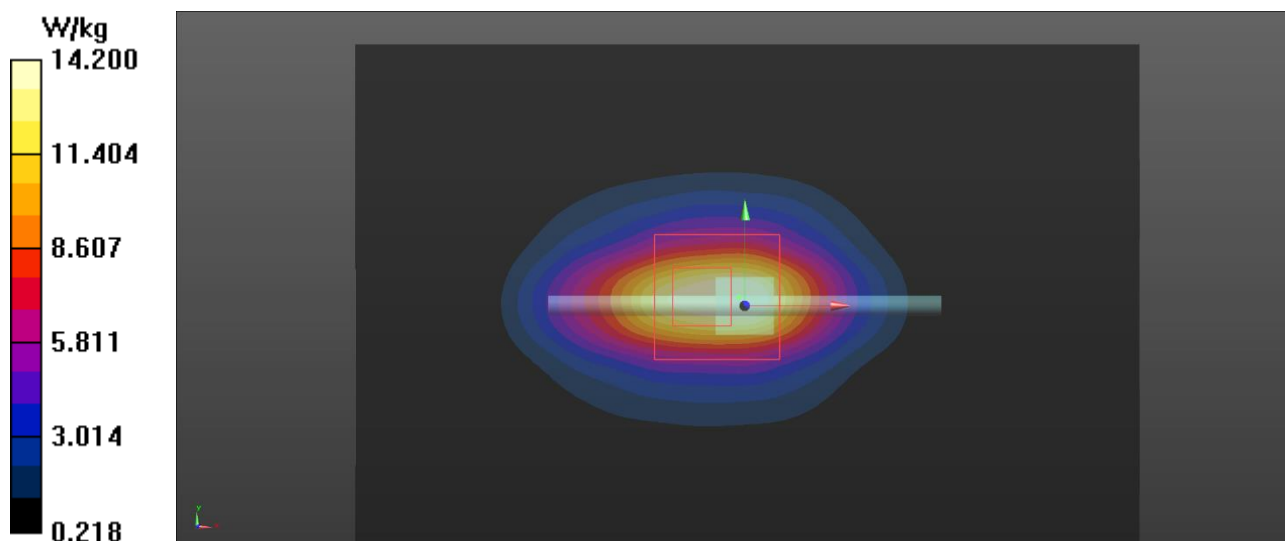
Peak SAR (extrapolated) = 16.7 W/kg

SAR(1 g) = 9.47 W/kg; SAR(10 g) = 4.98 W/kg (SAR corrected for target medium)

Smallest distance from peaks to all points 3 dB below = 10 mm

Ratio of SAR at M2 to SAR at M1 = 56.9%

Maximum value of SAR (measured) = 14.2 W/kg



APPENDIX C: MEASUREMENT SCANS

Plot 10

Date/Time: 04/10/2024 10:43:29

Test Laboratory: Verkotan Oy

DUT: Data Acquisition SONO HUB

Communication System: UID 0, Generic LTE (0); Communication System Band: Band 2, E-UTRA/FDD (1850.0 - 1910.0 MHz); Frequency: 1900 MHz;

Communication System PAR: 0 dB;

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.366$ S/m; $\epsilon_r = 39.387$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASYS (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3892; ConvF(7.72, 8.09, 7.63) @ 1900 MHz; Calibrated: 15/04/2024
 - 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 Sn705; Calibrated: 09/04/2024
 - Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx;
 - DASYS2 52.10.4(1527); SEMCAD X 14.6.14(7483)

LTE B2, QPSK, BW20, CH19100, RBs 1, RB Start 50, Top 0mm/Area Scan (121x61x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 5.74 W/kg

LTE B2, QPSK, BW20, CH19100, RBs 1, RB Start 50, Top 0mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 70.39 V/m; Power Drift = -0.31 dB

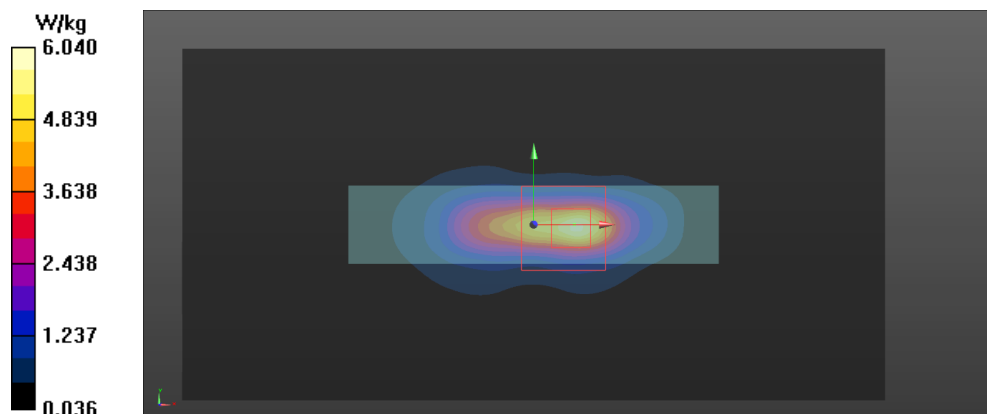
Peak SAR (extrapolated) = 7.48 W/kg

SAR(1 g) = 3.87 W/kg; SAR(10 g) = 1.73 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 = 54.9%

Maximum value of SAR (measured) = 6.04 W/kg



Plot 13

Date/Time: 30/09/2024 15:44:06

Test Laboratory: Verkotan Oy

DUT: Data Acquisition SONO HUB

Communication System: UID 0, Generic LTE (0); Communication System Band: Band 4, E-UTRA/FDD (1710.0 - 1755.0 MHz); Frequency: 1732.5 MHz;

Communication System PAR: 0 dB;

Medium parameters used: $f = 1733$ MHz; $\sigma = 1.268$ S/m; $\epsilon_r = 39.816$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASYS (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3892; ConvF(8.02, 8.45, 7.93) @ 1732.5 MHz; Calibrated: 15/04/2024
 - 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: 24/10/2023
 - Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx;
 - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

LTE B4 QPSK, BW20, CH20175, RBs 50, RB Start 0, Top, 0mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 50.58 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 4.92 W/kg

SAR(1 g) = 2.52 W/kg; SAR(10 g) = 1.12 W/kg (SAR corrected for target medium)

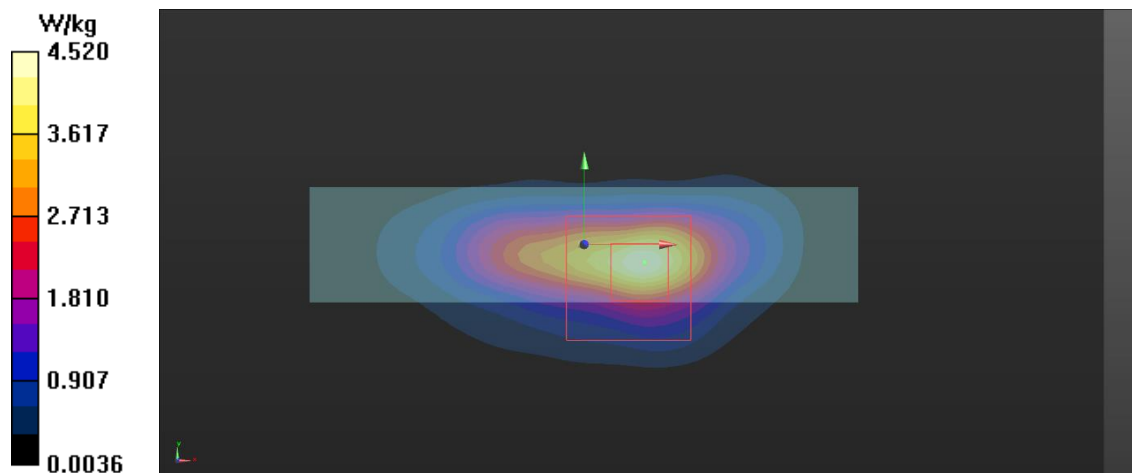
Smallest distance from peaks to all points 3 dB below = 7 mm

Ratio of SAR at M2 to SAR at M1 = 51.8%

Maximum value of SAR (measured) = 3.81 W/kg

LTE B4 QPSK, BW20, CH20175, RBs 50, RB Start 0, Top, 0mm/Area Scan (121x81x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 4.52 W/kg



Plot 14

Date/Time: 04/10/2024 12:27:39

Test Laboratory: Verkotan Oy

DUT: Data Acquisition SONO HUB

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; $\sigma = 0.89$ S/m; $\epsilon_r = 42.95$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASYS (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.89, 9.05, 8.92) @ 844 MHz; Calibrated: 23/02/2024
 - 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: 14/02/2024
 - Phantom: SAR1_Phantom 1_triple flat right; Type: QD 000 P51 Cx;
 - DASYS2 52.10.4(1527); SEMCAD X 14.6.14(7483)

LTE B5, QPSK, BW10, CH20600, RBs 25, RB Start 12, Top, 0mm/Area Scan (101x51x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 0.414 W/kg

LTE B5, QPSK, BW10, CH20600, RBs 25, RB Start 12, Top, 0mm/Zoom Scan (7x7x8)/Cube 0: Measurement grid:

$dx=5$ mm, $dy=5$ mm, $dz=1.4$ mm

Reference Value = 24.45 V/m; Power Drift = -0.27 dB

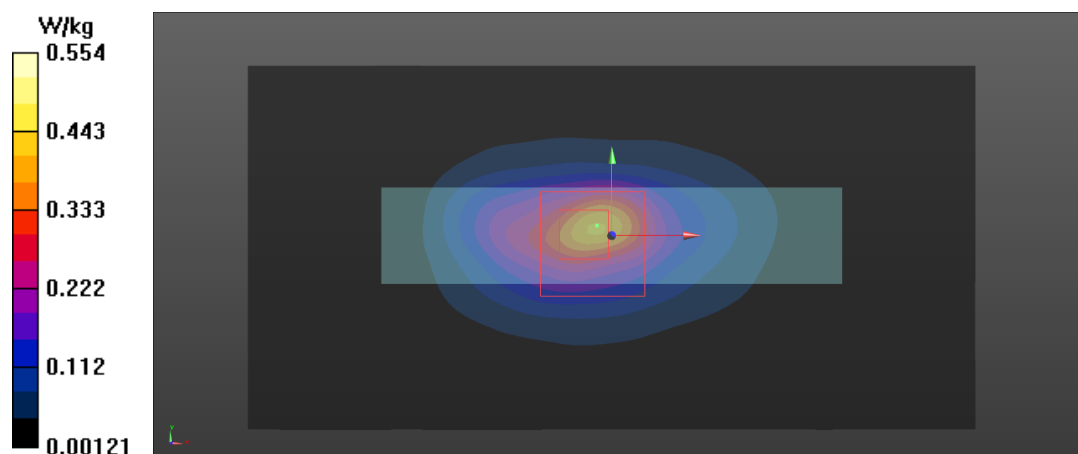
Peak SAR (extrapolated) = 1.16 W/kg

SAR(1 g) = 0.272 W/kg; SAR(10 g) = 0.112 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 = 58.6%

Maximum value of SAR (measured) = 0.554 W/kg



Plot 15

Date/Time: 01/10/2024 16:49:42

Test Laboratory: Verkotan Oy

DUT: Data Acquisition SONO HUB

Communication System: UID 0, Generic LTE (0); Communication System Band: Band 12, E-UTRA/FDD (698.0 - 716.0 MHz); Frequency: 704 MHz;

Communication System PAR: 0 dB;

Medium parameters used: $f = 704$ MHz; $\sigma = 0.84$ S/m; $\epsilon_r = 43.824$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASYS (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(9.63, 9.05, 9.58) @ 704 MHz; Calibrated: 23/02/2024
 - 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: 14/02/2024
 - Phantom: SAR1_Photom 1_triple flat right; Type: QD 000 P51 Cx;
 - DASYS2 52.10.4(1527); SEMCAD X 14.6.14(7483)

LTE B12, QPSK, BW10, CH23060, RBs 25, RB Start 12, Top, 0mm/Area Scan (101x51x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 1.56 W/kg

LTE B12, QPSK, BW10, CH23060, RBs 25, RB Start 12, Top, 0mm/Zoom Scan (7x7x8)/Cube 0: Measurement grid:

$dx=5$ mm, $dy=5$ mm, $dz=1.4$ mm

Reference Value = 41.22 V/m; Power Drift = -0.10 dB

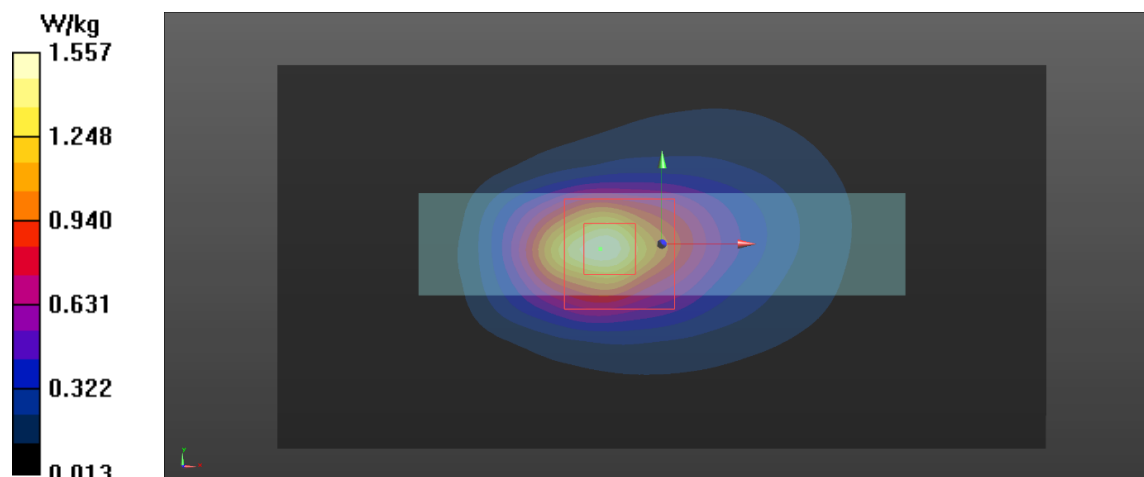
Peak SAR (extrapolated) = 6.21 W/kg

SAR(1 g) = 1.28 W/kg; SAR(10 g) = 0.488 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 = 56.7%

Maximum value of SAR (measured) = 2.77 W/kg



Plot 16

Date/Time: 02/10/2024 10:27:36

Test Laboratory: Verkotan Oy

DUT: Data Acquisition SONO HUB

Communication System: UID 0, Generic LTE (0); Communication System Band: Band 13, E-UTRA/FDD (777.0 - 787.0 MHz); Frequency: 782 MHz;

Communication System PAR: 0 dB;

Medium parameters used: $f = 782$ MHz; $\sigma = 0.861$ S/m; $\epsilon_r = 43.063$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASYS (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(9.63, 9.05, 9.58) @ 782 MHz; Calibrated: 23/02/2024
 - 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: 14/02/2024
 - Phantom: SAR1_Phantom 1_triple flat right; Type: QD 000 P51 Cx;
 - DASYS2 52.10.4(1527); SEMCAD X 14.6.14(7483)

LTE B13, QPSK, BW10, CH23230, RBs 25, RB Start 12, Top, 0mm/Zoom Scan (7x7x8)/Cube 0: Measurement grid:

$dx=5$ mm, $dy=5$ mm, $dz=1.4$ mm

Reference Value = 23.94 V/m; Power Drift = -0.24 dB

Peak SAR (extrapolated) = 3.13 W/kg

SAR(1 g) = 0.644 W/kg; SAR(10 g) = 0.253 W/kg (SAR corrected for target medium)

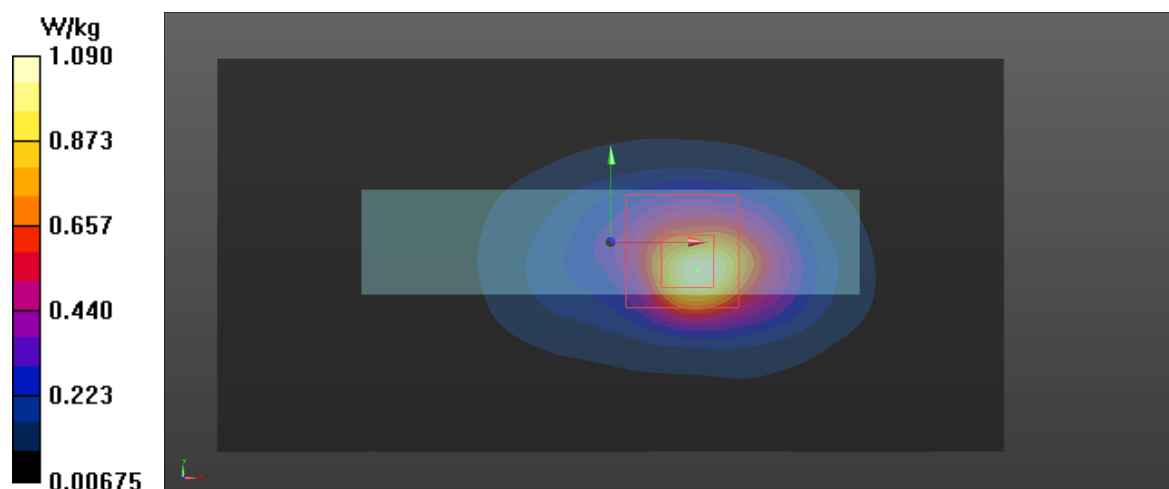
Smallest distance from peaks to all points 3 dB below = 7 mm

Ratio of SAR at M2 to SAR at M1 = 56.5%

Maximum value of SAR (measured) = 1.45 W/kg

LTE B13, QPSK, BW10, CH23230, RBs 25, RB Start 12, Top, 0mm/Area Scan (101x51x1): Interpolated grid: $dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 1.09 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**
Oulu, Finland

Certificate No. **EX-3892_Apr24**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3892**

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 **April 15, 2024**

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 $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP2	SN: 104778	26-Mar-24 (No. 217-04036/04037)	Mar-25
Power sensor NRP-Z91	SN: 103244	26-Mar-24 (No. 217-04036)	Mar-25
OCF DAK-3.5 (weighted)	SN: 1249	05-Oct-23 (OCF-DAK3.5-1249_Oct23)	Oct-24
OCF DAK-12	SN: 1016	05-Oct-23 (OCF-DAK12-1016_Oct23)	Oct-24
Reference 20 dB Attenuator	SN: CC2552 (20x)	26-Mar-24 (No. 217-04046)	Mar-25
DAE4	SN: 660	23-Feb-24 (No. DAE4-660_Feb24)	Feb-25
Reference Probe EX3DV4	SN: 7349	03-Nov-23 (No. EX3-7349_Nov23)	Nov-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	Sven Kühn	Technical Manager	
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			
Issued: April 15, 2024			

Certificate No: EX-3892_Apr24

Page 1 of 9

EX3DV4 - SN:3892

April 15, 2024

Parameters of Probe: EX3DV4 - SN:3892

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k = 2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.47	0.39	0.49	±10.1%
DCP (mV) ^B	102.6	104.9	102.5	±4.7%

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Max dev.	Max Unc ^E k = 2
0	CW	X	0.00	0.00	1.00	0.00	118.3	±1.9%	±4.7%
		Y	0.00	0.00	1.00		139.8		
		Z	0.00	0.00	1.00		123.5		

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 E²-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.

EX3DV4 - SN:3892

April 15, 2024

Parameters of Probe: EX3DV4 - SN:3892

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle	34.0°
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.

EX3DV4 - SN:3892

April 15, 2024

Parameters of Probe: EX3DV4 - SN:3892

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)
300	45.3	0.87	11.28	11.28	11.28	0.09	1.00	±13.3%
450	43.5	0.87	10.66	10.66	10.66	0.16	1.30	±13.3%
600	42.7	0.88	10.14	10.14	10.14	0.10	1.25	±13.3%
750	41.9	0.89	9.10	9.76	9.42	0.38	1.27	±11.0%
900	41.5	0.97	9.05	9.23	9.06	0.37	1.27	±11.0%
1750	40.1	1.37	8.02	8.45	7.93	0.26	1.27	±11.0%
1950	40.0	1.40	7.72	8.09	7.63	0.29	1.27	±11.0%
2450	39.2	1.80	7.14	7.45	7.00	0.30	1.27	±11.0%
2600	39.0	1.96	6.97	7.29	6.83	0.29	1.27	±11.0%
4400	36.9	3.84	6.07	6.33	5.93	0.37	1.27	±13.1%
4800	36.4	4.25	5.75	6.00	5.64	0.37	1.27	±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 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 SAR correction is applied.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ±1% for frequencies below 3 GHz and below ±2% for frequencies between 3–6 GHz at any distance larger than half the probe tip diameter from the boundary.

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



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

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

Accreditation No.: SCS 0108

Client **Verkotan**
Oulu, Finland

Certificate No. **EX-7447_Feb24**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:7447**

Calibration procedure(s) **QA CAL-01.v10, QA CAL-12.v10, QA CAL-14.v7, QA CAL-23.v8,
QA CAL-25.v8
Calibration procedure for dosimetric E-field probes**

Calibration date **February 23, 2024**

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 (20 ± 3) °C and humidity < 70%.
Calibration Equipment used (NATE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP2	SN: 104778	30-Mar-23 (No. 217-03804/03805)	Mar-24
Power sensor NRP-291	SN: 103244	30-Mar-23 (No. 217-03804)	Mar-24
CCP DAK 3.5 (weighted)	SN: 1249	05-Oct-23 (CCP-DAK3 5-1249_Oct23)	Oct-24
CCP DAK12	SN: 1018	05-Oct-23 (CCP-DAK12-1018_Oct23)	Oct-24
Reference 20 dB Attenuator	SN: CC2652 (20u)	30-Mar-23 (No. 217-03806)	Mar-24
DAE4	SN: 660	16-Mar-23 (No. DAE4-660_Mar23)	Mar-24
Reference Probe EX3DV4	SN: 7349	03-Nov-23 (No. EX3-7349_Nov23)	Nov-24

Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: CB41295874	08-Apr-18 (in house check Jun-22)	in house check: Jun-24
Power sensor E4412A	SN: MY41488267	08-Apr-18 (in house check Jun-22)	in house check: Jun-24
Power sensor E4412A	SN: 000110210	08-Apr-18 (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: US41565477	31-Mar-14 (in house check Oct-22)	in house check: Oct-24

	Name	Function	Signature
Calibrated by	Aidenia Georgiadou	Laboratory Technician	
Approved by	Sven Kühn	Technical Manager	

Issued: February 23, 2024

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

EX3DV4 - SN:7447

February 23, 2024

Parameters of Probe: EX3DV4 - SN:7447

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k = 2)
Norm [$\mu\text{V}/(\text{V}/\text{m})^2$] ^A	0.42	0.42	0.43	$\pm 10.1\%$
DCP (mV) ^B	83.9	92.0	99.2	$\pm 4.7\%$

Calibration Results for Modulation Response

UID	Communication System Name	A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Max dev.	Max Unc ^E k = 2
0	CW	X 0.00	0.00	1.00	0.00	132.1	$\pm 2.0\%$	$\pm 4.7\%$
		Y 0.00	0.00	1.00		134.8		
		Z 0.00	0.00	1.00		127.6		

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.

EX3DV4 - SN:7447

February 23, 2024

Parameters of Probe: EX3DV4 - SN:7447

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle	40.2°
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.

EX3DV4 - SN:7447

February 23, 2024

Parameters of Probe: EX3DV4 - SN:7447

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) ^C	Relative Permittivity ^E	Conductivity ^F (S/m)	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unc (k = 2)
13	55.0	0.75	17.59	17.59	17.59	0.00	1.25	±13.3%
750	41.9	0.89	9.63	9.05	9.58	0.34	1.27	±11.0%
900	41.5	0.97	8.89	9.05	8.92	0.34	1.27	±11.0%
1750	40.1	1.37	8.35	8.14	8.40	0.25	1.27	±11.0%
1950	40.0	1.40	7.96	7.80	8.03	0.27	1.27	±11.0%
2150	39.7	1.53	7.80	7.68	7.86	0.29	1.27	±11.0%
2300	39.5	1.67	7.75	7.61	7.75	0.29	1.27	±11.0%
2450	39.2	1.80	7.59	7.49	7.65	0.29	1.27	±11.0%
2600	39.0	1.96	7.53	7.40	7.55	0.28	1.27	±11.0%
5250	35.9	4.71	5.27	5.32	5.36	0.35	1.62	±13.1%
5600	35.5	5.07	4.42	4.45	4.52	0.35	1.75	±13.1%
5750	35.4	5.22	4.62	4.68	4.75	0.34	1.83	±13.1%

^C Frequency validity above 300 MHz of ±100 MHz only applies for DASV 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, ±5, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 126, 150 and 230 MHz respectively. Validity of ConvF assessed at 6 MHz is 4–8 MHz, and ConvF assessed at 13 MHz is 9–19 MHz. Above 5 GHz frequency validity can be extended to ±110 MHz.

^E 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 SAR correction is applied.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ±1% for frequencies below 3 GHz and below ±2% for frequencies between 3–6 GHz at any distance larger than half the probe tip diameter from the boundary.

APPENDIX E: RELEVANT PAGES FROM DIPOLE CALIBRATION REPORTS

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



S 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: 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 $(22 \pm 3)^\circ\text{C}$ 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: 8H9394 (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 E44198	SN: G839512475	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: US41060477	31-Mar-14 (in house check Oct-20)	In house check: Oct-22

Calibrated by: Name: Aidona Georgiadou, Function: Laboratory Technician, Signature: [Signature]

Approved by: Name: Niels Kuster, Function: Quality Manager, Signature: [Signature]

Issued: July 19, 2022

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

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 cm ³ (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 cm ³ (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)



SAR Reference Dipole Calibration Report

Ref : ACR.68.6.23.BES.A

VERKOTAN OY
ELEKTRONIIKKATIE 17
90590, OULU, FINLAND
SAR REFERENCE DIPOLE
FREQUENCY: 835 MHZ
SERIAL NO.: 448

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

Calibration date: 03/09/2023



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

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

Summary:

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

Page: 1/8



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.68.6.23.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
15:03:27 +01'00'

	Customer Name
Distribution :	Verkotan Oy

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

Page: 2/8

Template: ACR.DDD.N.YY.MVGB.ISSUE_SAR Reference Dipole vL

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.68.6.23.BES.A

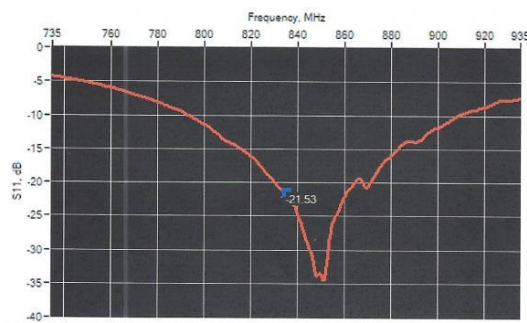
6 CALIBRATION RESULTS

6.1 MECHANICAL DIMENSIONS

L mm		h mm		d mm	
Measured	Required	Measured	Required	Measured	Required
-	161.00 +/- 2%	-	89.80 +/- 2%	-	3.60 +/- 2%

6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
835	-21.53	-20	42.3Ω - 0.1jΩ

6.3 SAR

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

6.3.1 SAR with Head Liquid

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

Page: 6/8

Template_ACR.DDD.N.YY.MVGB.ISSUE_SAR Reference Dipole vL

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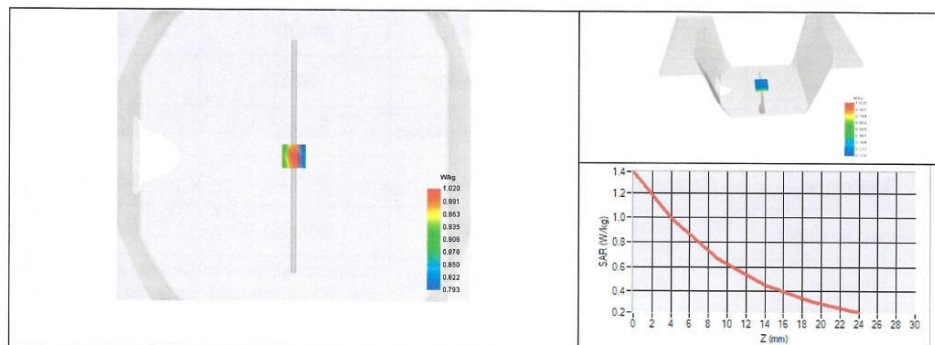


SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.68.6.23.BES.A

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPG0333
Liquid	Head Liquid Values: eps' : 44.1 sigma : 0.89
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	835 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
835 MHz	0.94	9.36	9.56	0.61	6.05	6.22



Page: 7/8

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**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: **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 $(22 \pm 3)^\circ\text{C}$ 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

Calibrated by: **Joanna Ueshaj** (Name) **Laboratory Technician** (Function) *[Signature]* (Signature)

Approved by: **Niels Kuster** (Name) **Quality Manager** (Function) *[Signature]* (Signature)

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 $\pm$ 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 $\pm$ 0.2) °C	38.4 $\pm$ 6 %	1.38 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	-----	-----

SAR result with Head TSL

SAR averaged over 1 cm ³ (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 $\pm$ 17.0 % (k=2)
SAR averaged over 10 cm ³ (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 $\pm$ 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



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

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

Summary:

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



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACTL68.5.23.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

Template: ACR.DDD.N.YY.MTVG.B.ISSUE_SAR Reference Dipole v1.

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.68.5.23.BES.A

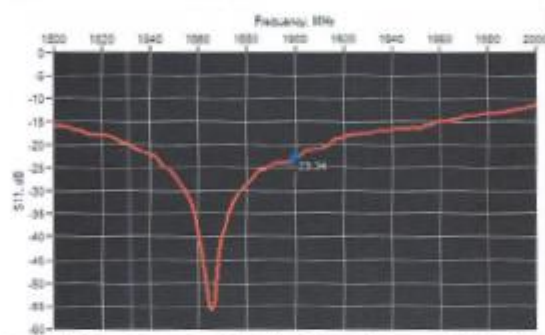
6 CALIBRATION RESULTS

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.

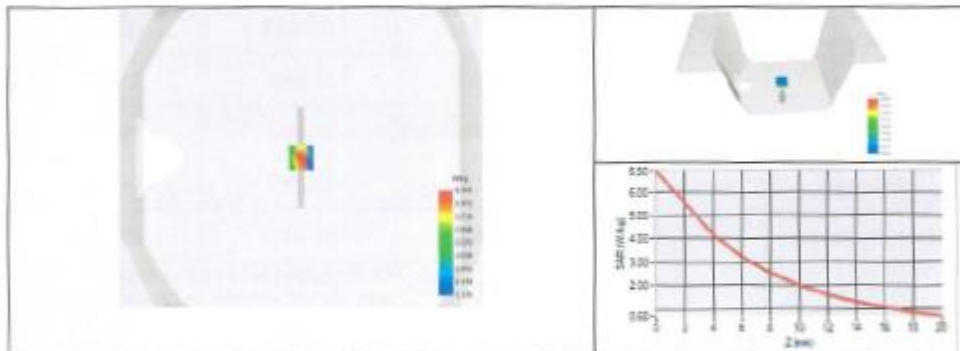


SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.68.5.23.BFS.A

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPG0333
Liquid	Head Liquid Values: ϵ_{rel} : 40.4 sigma : 1.40
Distance between dipole center and liquid	10.0 mm
Area scan resolution	$dx=8\text{mm}/dy=8\text{mm}$
Zoon Scan Resolution	$dx=8\text{mm}/dy=8\text{mm}/dz=5\text{mm}$
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



Page: 7/8

Template: ACR.DDD.N.YY.MYGB.ISSUE_SAR Reference Dipole vL

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