SAR Compliance Test Report

Date of Report	18/04/2019	**Client's Contact person:**	Will Turner
Number of pages:	60	**Responsible Test engineer:**	Kirsi Kyllönen
Testing laboratory:	**Verkotan Oy** Elektroniikkatie 17 90590 Oulu Finland	**Client:**	**GCE Group** 100 Empress Park Penny Lane Haydock ST HELENS WA11 9DB
Tested device	Zen-O Lite Clarity		
Related reports:	-		
Testing has been carried out in accordance with:	**47CFR §2.1093** Radiofrequency Radiation Exposure Evaluation: Portable Devices **FCC published RF exposure KDB procedures** **IEEE 1528 - 2013** IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Technique		
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:

18.04.2019

For the contents:

Miia Nurkkala

Digitally signed by Miia Nurkkala
Date: 2019.04.18 12:15:09 +03'00'

Laboratory Manager

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1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Device under Test (DUT):

Product:	Zen-O Lite Clarity
Manufacturer:	GCE Group
Serial Number:	ZL101418, ZL101427
FCC ID Number:	QOQBGM12LMA, QIPPLS62-W
Model:	RS –00600C
DUT Number:	22694, 22695
Battery Type used in testing:	NH2054OA34
Portable/ Mobile device	Portable
State of the Sample	Production sample

Testing information:

Testing Performed:	08.03.2019 - 13.03.2019
Notes:	-
Document ID:	FCC SAR report_Zeno_Lite_Clarity_ ID2637_ 18042019.docx
Temperature °C	22±2 / Controlled
Humidity RH%	20±20 / Controlled
Measurement performed by:	Kirsi Kyllönen, Ilari Kinnunen

1.2 Maximum Results

The maximum reported* SAR value for Body-worn configuration with 8mm separation distance 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 Body is SAR_{1g} 1.6 W/kg.

System	Equipment Class	Highest Reported* SAR_{1g}(W/kg) in Body-Worn Condition, 8mm separation	Result
GPRS 850	**PCT**	**1.40**	**PASS**
GPRS 1900	**PCT**	**0.83**	**PASS**
WCDMA 2	**PCT**	**0.05**	**PASS**
WCDMA 4	**PCT**	**0.18**	**PASS**
WCDMA 5	**PCT**	**0.05**	**PASS**
LTE 2	**PCT**	**0.02**	**PASS**
LTE 4	**PCT**	**0.05**	**PASS**
LTE 5	**PCT**	**0.02**	**PASS**
LTE 12	**PCT**	**0.01**	**PASS**

* Reported SAR Values are scaled to maximum theoretical output power.

1.2.1 Simultaneous Transmission SAR

The DUT can transmit simultaneously on Bluetooth and Cellular Technology. The maximum reported* simultaneous SAR value for Body-worn configuration with 8 mm separation distance for transmitting systems are shown in a table below.

Highest Simultaneous Transmission SAR DSS+PCT	Highest Reported* SAR_{1g}(W/kg) in Body-Worn Condition, 8mm separation	Result
Bluetooth + GPRS 850	**1.5**	**PASS**

* Reported SAR Values are scaled to maximum theoretical output power.

1.2.1 Maximum Drift

Maximum Drift During Measurements	-0.88 dB*

*Drifts >5% have been considered in the scaling factor

1.2.2 Measurement Uncertainty

Expanded Uncertainty (k=2) 95 %	±23.4%

2. DESCRIPTION OF THE DEVICE UNDER TEST (DUT)

The DUT is a portable oxygen concentrator manufactured by GCE group.

During normal use, the DUT sends data intermittently. Conservative maximum duty cycles have been calculated for the DUT based on the amount of data transferred during a firmware update package. The transmitter duty cycle calculations provided by manufacturer are presented in appendix F.

The DUT is utilizing maximum duty cycles of 100% for GPRS, 4.34% for WCDMA and 1.628% for LTE.

SAR testing was conducted with 100% duty cycle i.e. continuous connection with a communication tester. Thus, the measured SAR results were scaled with the normal mode duty cycles.

Device Category	Portable
Exposure Environment	Uncontrolled

2.1 Supported Frequency Bands and Operational Modes

	Modes of Operation	**Transmitter Frequency Range (MHz)**
TX Frequency bands	GPRS 850	824.2-848.8
	GPRS 1900	1850.2-1909.8
	WCDMA 2	1852.4-1907.6
	WCDMA 4	1712.4-1752.6
	WCDMA 5	826-846
	LTE 2	1850-1910
	LTE 4	1710-1755
	LTE 5	824-849
	LTE 12	699-716
	LTE 17	704-716
	Bluetooth 4.2	2400-2483.5

2.2 Test exclusions

LTE Band 17 is working on frequency range between 704 to 716MHz. This frequency is covered by LTE Band 12, having frequency range between 699 to 716MHz. Both LTE 12 and

LTE 17 have the same tune-up limit and the same channel bandwidth, thus LTE Band 12 SAR testing is covering also LTE Band 17.

According to appendix A of 447498D01 the SAR test exclusion power threshold for 2450MHz is 10mW at ≤5mm separation distance. The maximum output power of the Bluetooth transmitter is 6.3mW thus it is below the test exclusion threshold.

SAR test exclusions based on antenna location were made to according to KDB 447498 D01 General RF Exposure Guidance v06, section 4.3.1, for test separation distances <=50mm and >50mm.

2.2.1 Test exclusions based on antenna location

SAR test exclusions was defined according to equations:

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0, for separation distances <=50mm)

and

{[Power allowed at numeric threshold for 50 mm in step a)] + [(test separation distance – 50 mm)·10]} mW, for > 1500 MHz and ≤ 6 GHz, separation distances >50mm.

Separation distances <=50mm							
Test Position	**Operation mode**	**Frequency [GHz] (high channel)**	**Max time avg power (including tune-up tolerance)**	**Max Power [mW]**	**Antenna to edge distance [mm]**	**Result (4.3.1 a)**	**SAR test required (<=3.0)**
Back	GPRS 850 4tx	0.8488	25.5	355	1	326.9	**yes**
Back	GPRS 1900 1tx	1.9098	22.5	178	1	245.8	**yes**
Back	WCDMA II	1.9076	25	316	1	436.8	**yes**
Back	WCDMA IV	1.7526	25	316	1	418.6	**yes**
Back	WCDMA V	0.8466	25	316	1	291.0	**yes**
Back	LTE 2	1.91	25	316	1	437.0	**yes**
Back	LTE 4	1.755	25	316	1	418.9	**yes**
Back	LTE 5	0.849	25	316	1	291.4	**yes**
Back	LTE 12	0.716	25	316	1	267.6	**yes**
Back	LTE 17	0.716	25	316	1	267.6	**yes**

Separation distances >50mm							
Test Position	**Operation mode**	**Frequency [GHz] (high channel)**	**Max time avg power (including**	**Max Power [mW]**	**Antenna to edge distance [mm]**	**Threshold (4.3.1 b) 2)) [mW]**	**SAR test required (power > threshold)**

			tune-up tolerance)				
Right	GPRS 850/1 slots	0.8488	25.5	355	128	599	**No**
Right	No	1.9098	22.5	178	128	889	**No**
Right	WCDMA II	1.9076	25	316	128	889	**No**
Right	WCDMA IV	1.7526	25	316	128	889	**No**
Right	WCDMA V	0.8466	25	316	128	598	**No**
Right	LTE 2	1.91	25	316	128	889	**No**
Right	LTE 4	1.755	25	316	128	889	**No**
Right	LTE 5	0.849	25	316	128	599	**No**
Right	LTE 12	0.716	25	316	128	530	**No**
Right	LTE 17	0.716	25	316	128	530	**No**
Top	GPRS 850	0.8488	25.5	355	71.95	282	**Yes**
Top	GPRS 1900	1.9098	22.5	178	71.95	329	**No**
Top	WCDMA II	1.9076	25	316	71.95	329	**No**
Top	WCDMA IV	1.7526	25	316	71.95	329	**No**
Top	WCDMA V	0.8466	25	316	71.95	282	**Yes**
Top	LTE 2	1.91	25	316	71.95	329	**No**
Top	LTE 4	1.755	25	316	71.95	329	**No**
Top	LTE 5	0.849	25	316	71.95	282	**Yes**
Top	LTE 12	0.716	25	316	71.95	263	**Yes**
Top	LTE 17	0.716	25	316	71.95	263	**Yes**
Left	GPRS 850	0.8488	25.5	355	87.11	368	**No**
Left	GPRS 1900	1.9098	22.5	178	87.11	480	**No**
Left	WCDMA II	1.9076	25	316	87.11	480	**No**
Left	WCDMA IV	1.7526	25	316	87.11	480	**No**
Left	WCDMA V	0.8466	25	316	87.11	367	**No**
Left	LTE 2	1.91	25	316	87.11	480	**No**
Left	LTE 4	1.755	25	316	87.11	480	**No**
Left	LTE 5	0.849	25	316	87.11	368	**No**
left	LTE 12	0.716	25	316	87.11	335	**No**
Left	LTE 17	0.716	25	316	87.11	335	**No**
Bottom	GPRS 850	0.8488	25.5	355	51.11	164	**Yes**
Bottom	GPRS 1900	1.9098	22.5	178	51.11	120	**Yes**
Bottom	WCDMA II	1.9076	25	316	51.11	120	**Yes**
Bottom	WCDMA IV	1.7526	25	316	51.11	120	**Yes**
Bottom	WCDMA V	0.8466	25	316	51.11	164	**Yes**
Bottom	LTE 2	1.91	25	316	51.11	120	**Yes**
Bottom	LTE 4	1.755	25	316	51.11	120	**Yes**
Bottom	LTE 5	0.849	25	316	51.11	164	**Yes**
Bottom	LTE 12	0.716	25	316	51.11	163	**Yes**

Bottom	LTE 17	0.716	25	316	51.11	163	**Yes**
Front	GPRS 850	0.8488	25.5	355	88.15	374	**No**
Front	GPRS 1900	1.9098	22.5	178	88.15	491	**No**
Front	WCDMA II	1.9076	25	316	88.15	491	**No**
Front	WCDMA IV	1.7526	25	316	88.15	491	**No**
Front	WCDMA V	0.8466	25	316	88.15	373	**No**
Front	LTE 2	1.91	25	316	88.15	491	**No**
Front	LTE 4	1.755	25	316	88.15	491	**No**
Front	LTE 5	0.849	25	316	88.15	374	**No**
Front	LTE 12	0.716	25	316	88.15	340	**No**
Front	LTE 17	0.716	25	316	88.15	340	**No**

3. OUTPUT POWER

3.1 Maximum Output Power

From a Customer, maximum defined output power, including tune-up tolerance;

GSM	Max Output Power [dBm]
GPRS 850 (GMSK, 4Tx-slot)	28.5
GPRS 1900 (GMSK, 1Tx-slot)	31.5

WCDMA	Max Output Power [dBm]
WCDMA 2	25
WCDMA 4	25
WCDMA 5	25

LTE	Max Output Power [dBm]
LTE 2	25
LTE 4	25
LTE 5	25
LTE 12	25
LTE 17	25

Bluetooth	Max Output Power [dBm]
Bluetooth 4.2	8

3.2 Tested conducted power

Measured conducted output power at transmitting antenna connector.

GPRS:

Slot Configuration Info	GSM 850 CH 128 824.2 MHz	GSM 850 CH 189 836.6 MHz	GSM 850 CH 251 848.8 MHz	GSM 1900 CH 512 1850.2 MHz	GSM 1900 CH 661 1880.0 MHz	GSM 1900 CH 810 1909.8 MHz
GPRS (GMSK, 1Tx-slot)	32.46	32.68	33.09	29.69	29.41	29.88
GPRS (GMSK, 2Tx-slot)	30.1	30.2	30.63	26.39	26.16	26.71
GPRS (GMSK, 3Tx-slot)	28.24	28.35	28.79	24.59	24.37	24.86
GPRS (GMSK, 4Tx-slot)	27.95	27.16	27.73	23.63	23.16	23.64
EDGE (8PSK, 1Tx-slot)	26.51	26.43	26.33	25.09	24.91	24.77
EDGE (8PSK, 2Tx-slot)	24.03	23.95	23.89	22.59	22.36	22.22
EDGE (8PSK, 3Tx-slot)	22.21	22.12	22.02	20.62	20.49	20.4
EDGE (8PSK, 4Tx-slot)	21.36	21.25	21.08	19.49	19.31	19.26

Time averaged power:

Slot Configuration	GSM850 CH 128 824.2 MHz	GSM 850 CH 190 836.6 MHz	GSM 850 CH 251 848.8MHz	GSM 1900 CH 512 1850.2 MHz	GSM 1900 CH 661 1880.0 MHz	GSM 1900 CH 810 1909.8 MHz
GPRS 1-slot	23.46	23.68	24.09	**20.69**	**20.41**	**20.88**
GPRS 2-slot	24.1	24.2	24.63	20.39	20.16	20.71
GPRS 3-slot	23.98	24.09	24.53	20.33	20.11	20.6
GPRS 4-slot	**24.95**	**24.16**	**24.73**	20.63	20.16	20.64
EDGE 1-slot	17.51	17.43	17.33	16.09	15.91	15.77
EDGE 2-slot	18.03	17.95	17.89	16.59	16.36	16.22
EDGE 3-slot	17.95	17.86	17.76	16.36	16.23	16.14
EDGE 4-slot	18.36	18.25	18.08	16.49	16.31	16.26

WCDMA:

Reference Channel	WCDMA Band II			WCDMA Band IV			WCDMA Band V		
	CH 9262 1852.4 MHz	CH 9400 1880 MHz	CH 9538 1907.6 MHz	CH 1312 1712.4 MHz	CH 1413 1732.6 MHz	CH 1513 1752.6 MHz	CH 4132 826.4 MHz	CH 4182 836.4 MHz	CH 4233 846.6 MHz
RMC 12.2K	22.9	22.85	23.03	23.6	23.42	23.5	23.68	23.68	23.43
HSDPA Subtest-1	22.73	22.75	22.95	23.47	23.37	23.35	23.61	23.48	23.23
HSDPA Subtest-2	21.96	21.87	22.05	22.58	22.45	22.51	22.67	22.66	22.38
HSDPA Subtest-3	21.49	21.4	21.58	22.1	21.97	22.02	22.19	22.1	21.83
HSDPA Subtest-4	21.22	21.15	21.33	21.88	21.75	21.77	21.9	21.86	21.6
HSUPA Subtest-1	22.35	22.29	22.46	23.05	22.86	22.95	23.01	23.04	22.83
HSUPA Subtest-2	22.85	22.76	22.94	23.43	23.39	23.35	23.5	23.45	23.28
HSUPA Subtest-3	21.51	21.42	21.52	22.07	22.01	21.98	22.14	22.13	21.85
HSUPA Subtest-4	22.73	22.64	22.91	23.39	23.35	23.41	23.48	23.56	23.33
HSUPA Subtest-5	21.97	21.88	22.06	22.63	22.5	22.53	22.66	22.66	22.37

LTE:

LTE Band / BW	RB Size RBs	RB Offset RB Start	QPSK				16QAM			
			CH 18607 1850.7 MHz	CH 18900 1880.0 MHz	CH 19193 1909.3 MHz	3GPP MPR [dB]	CH 18607 1850.7 MHz	CH 18900 1880.0 MHz	CH 19193 1909.3 MHz	3GPP MPR [dB]
2 / 1.4M	1	0	21.42	21.66	21.52	0	20.67	20.79	20.74	1
	1	2	21.41	21.65	21.49	0	20.66	20.76	20.69	1
	1	5	21.41	21.65	21.5	0	20.61	20.74	20.67	1
	3	0	21.49	21.68	21.54	0	20.57	20.74	20.64	1
	3	1	21.46	21.6	21.53	0	20.58	20.72	20.62	1
	3	3	21.48	21.61	21.54	0	20.59	20.7	20.62	1
	6	0	20.5	20.64	20.56	1	19.53	19.71	19.61	2

LTE Band / BW	RB Size RBs	RB Offset RB Start	QPSK				16QAM			
			CH 18615 1851.5 MHz	CH 18900 1880.0 MHz	CH 19185 1918.5 MHz	3GPP MPR [dB]	CH 18615 1851.5 MHz	CH 18900 1880.0 MHz	CH 19185 1918.5 MHz	3GPP MPR [dB]
2 / 3M	1	0	21.51	21.68	21.6	0	20.67	20.91	20.78	1
	1	7	21.48	21.62	21.54	0	20.71	20.83	20.71	1
	1	14	21.45	21.6	21.52	0	20.56	20.77	20.69	1
	8	0	20.55	20.7	20.63	1	19.6	19.76	19.65	2
	8	3	20.53	20.68	20.58	1	19.53	19.71	19.63	2
	8	7	20.5	20.65	20.56	1	19.54	19.71	19.62	2
	15	0	20.5	20.67	20.59	1	19.52	19.69	19.62	2

LTE Band / BW	RB Size RBs	RB Offset RB Start	QPSK				16QAM			
			CH 18625 1852.5 MHz	CH 18900 1880.0 MHz	CH 19175 1907.5 MHz	3GPP MPR [dB]	CH 18625 1852.5 MHz	CH 18900 1880.0 MHz	CH 19175 1907.5 MHz	3GPP MPR [dB]
2 / 5M	1	0	21.56	21.77	21.68	0	20.79	20.88	20.88	1
	1	12	21.49	21.66	21.62	0	20.65	20.75	20.73	1
	1	24	21.44	21.61	21.53	0	20.65	20.8	20.68	1
	12	0	20.62	20.81	20.73	1	19.6	19.78	19.7	2
	12	6	20.51	20.71	20.64	1	19.56	19.72	19.64	2
	12	13	20.49	20.68	20.59	1	19.56	19.71	19.62	2
	25	0	20.51	20.69	20.62	1	19.57	19.74	19.7	2

LTE Band / BW	RB Size RBs	RB Offset RB Start	QPSK				16QAM			
			CH 18650 1855 MHz	CH 18900 1880.0	CH 19150 1905 MHz	3GPP MPR [dB]	CH 18650 1855 MHz	CH 18900 1880.0 MHz	CH 19150 1905 MHz	3GPP MPR [dB]
2 / 10M	1	0	21.81	21.98	21.87	0	21.05	21.13	21.07	1
	1	24	21.49	21.64	21.57	0	20.71	20.78	20.75	1
	1	49	21.48	21.62	21.49	0	20.74	20.75	20.68	1
	25	0	20.68	20.83	20.77	1	19.71	19.86	19.8	2
	25	12	20.54	20.68	20.56	1	19.57	19.72	19.66	2
	25	25	20.51	20.63	20.53	1	19.54	19.7	19.63	2
	50	0	20.63	20.71	20.65	1	19.66	19.74	19.69	2

LTE Band / BW	RB Size RBs	RB Offset RB Start	QPSK				16QAM			
			CH 18675 1857.5 MHz	CH 18900 1880.0	CH 19125 1902.5 MHz	3GPP MPR [dB]	CH 18675 1857.5 MHz	CH 18900 1880.0 MHz	CH 19125 1902.5 MHz	3GPP MPR [dB]
2 / 15M	1	0	22.12	22.23	22.18	0	21.27	21.38	21.31	1
	1	37	21.61	21.75	21.61	0	20.8	20.9	20.79	1
	1	74	21.62	21.68	21.51	0	20.86	20.9	20.78	1
	36	0	20.9	20.99	20.99	1	19.9	19.97	19.99	2
	36	19	20.66	20.76	20.72	1	19.67	19.78	19.7	2
	36	39	20.65	20.73	20.69	1	19.67	19.73	19.66	2
	75	0	20.8	20.86	20.85	1	19.81	19.84	19.83	2

LTE Band / BW	RB Size RBs	RB Offset RB Start	QPSK				16QAM			
			CH 18700 1860.0 MHz	CH 18900 1880.0	CH 19100 1900.0 MHz	3GPP MPR [dB]	CH 18700 1860.0 MHz	CH 18900 1880.0	CH 19100 1900.0 MHz	3GPP MPR [dB]
2 / 20M	1	0	21.86	21.33	**21.94**	0	21.25	21.32	21.27	1
	1	50	21.37	21.44	21.37	0	20.63	20.75	20.73	1
	1	99	21.21	21.32	21.16	0	20.62	20.55	20.47	1
	50	0	20.92	21.03	21.01	1	19.97	20.03	19.99	2
	50	25	20.64	20.71	20.67	1	19.64	19.73	19.66	2
	50	50	20.59	20.69	20.61	1	19.63	19.66	19.61	2
	100	0	20.79	20.91	20.81	1	19.84	19.85	19.85	2

LTE Band / BW	RB Size RBs	RB Offset RB Start	QPSK				16QAM			
			CH 19957 1710.7 MHz	CH 20175 1732.5 MHz	CH 20393 1754.3 MHz	3GPP MPR [dB]	CH 19957 1710.7 MHz	CH 20175 1732.5 MHz	CH 20393 1754.3 MHz	3GPP MPR [dB]
4 / 1.4M	1	0	22.25	22.14	22.08	0	21.38	21.3	21.14	1
	1	2	22.23	22.1	21.98	0	21.38	21.18	21.19	1
	1	5	22.23	22.1	22.01	0	21.35	21.15	21.11	1
	3	0	22.25	22.14	22.09	0	21.33	21.17	21.09	1
	3	1	22.25	22.15	22.06	0	21.35	21.21	21.11	1
	3	3	22.26	22.11	22.04	0	21.3	21.14	21.06	1
	6	0	21.28	21.15	21.03	1	20.26	20.13	20.02	2

LTE Band / BW	RB Size RBs	RB Offset RB Start	QPSK				16QAM			
			CH 19965 1711.5 MHz	CH 20175 1732.5 MHz	CH 20385 1753.5 MHz	3GPP MPR [dB]	CH 19965 1711.5 MHz	CH 20175 1732.5 MHz	CH 20385 1753.5 MHz	3GPP MPR [dB]
4 / 3M	1	0	22.22	22.09	22.02	0	21.36	21.25	21.21	1
	1	7	22.16	22.04	21.98	0	21.36	21.23	21.2	1
	1	14	22.12	21.98	21.91	0	21.27	21.17	21.02	1
	8	0	21.28	21.12	21.05	1	20.25	20.2	20.1	2
	8	3	21.23	21.09	21.02	1	20.25	20.18	20.09	2
	8	7	21.21	21.09	20.96	1	20.23	20.18	20.09	2
	15	0	21.22	21.06	20.99	1	20.2	20.13	20.08	2

LTE Band / BW	RB Size RBs	RB Offset RB Start	QPSK				16QAM			
			CH 19975 1711.5 MHz	CH 20175 1732.5 MHz	CH 20375 1753.5 MHz	3GPP MPR [dB]	CH 19975 1711.5 MHz	CH 20175 1732.5 MHz	CH 20375 1753.5 MHz	3GPP MPR [dB]
4 / 5M	1	0	22.25	22.16	22.05	0	21.42	21.28	21.29	1
	1	12	22.18	22.03	21.97	0	21.4	21.17	21.18	1
	1	24	22.09	21.95	21.87	0	21.25	21.1	21.04	1
	12	0	21.31	21.18	21.07	1	20.27	20.25	20.13	2
	12	6	21.2	21.13	20.99	1	20.21	20.17	20.08	2
	12	13	21.19	21.08	20.95	1	20.22	20.12	20.03	2
	25	0	21.21	21.14	20.97	1	20.25	20.16	20.06	2

LTE Band / BW	RB Size RBs	RB Offset RB Start	QPSK				16QAM			
			CH 20000 1715.0 MHz	CH 20175 1732.5 MHz	CH 20350 1750.0 MHz	3GPP MPR [dB]	CH 20000 1715.0 MHz	CH 20175 1732.5 MHz	CH 20350 1750.0 MHz	3GPP MPR [dB]
4 / 10M	1	0	22.42	22.42	22.3	0	21.7	21.53	21.44	1
	1	24	22.15	22.04	21.95	0	21.33	21.22	21.13	1
	1	49	22.09	21.98	21.96	0	21.27	21.1	21.12	1
	25	0	21.32	21.28	21.14	1	20.38	20.28	20.16	2
	25	12	21.2	21.09	21.02	1	20.22	20.11	20.04	2
	25	25	21.16	21.03	20.98	1	20.18	20.06	20.0	2
	50	0	21.25	21.15	21.1	1	20.25	20.16	20.18	2

LTE Band / BW	RB Size RBs	RB Offset RB Start	QPSK				16QAM			
			CH 20025 1717.0 MHz	CH 20175 1732.5 MHz	CH 20325 1747.5 MHz	3GPP MPR [dB]	CH 20025 1717.0 MHz	CH 20175 1732.5 MHz	CH 20325 1747.5 MHz	3GPP MPR [dB]
4 / 15M	1	0	22.64	22.53	22.45	0	21.92	21.88	21.67	1
	1	37	22.2	22.09	21.96	0	21.43	21.15	21.15	1
	1	74	22.17	21.87	22.02	0	21.33	21.22	21.12	1
	36	0	21.52	21.37	21.33	1	20.49	20.45	20.32	2
	36	19	21.3	21.12	21.04	1	20.26	20.19	20.09	2
	36	39	21.24	21.06	21.03	1	20.2	20.27	20.01	2
	75	0	21.38	21.2	21.16	1	20.35	20.2	20.17	2

LTE Band / BW	RB Size RBs	RB Offset RB Start	QPSK				16QAM			
			CH 20050 1720.0 MHz	CH 20175 1732.5 MHz	CH 20300 1745.0 MHz	3GPP MPR [dB]	CH 20050 1720.0 MHz	CH 20175 1732.5 MHz	CH 20300 1745.0 MHz	3GPP MPR [dB]
4 / 20M	1	0	22.56	**22.58**	22.39	0	21.71	21.75	21.57	1
	1	50	22.09	21.98	21.84	0	21.24	21.11	21.1	1
	1	99	21.79	21.72	21.63	0	20.95	20.75	20.75	1
	50	0	21.52	21.38	21.27	1	20.48	20.36	20.3	2
	50	25	21.21	21.06	20.97	1	20.18	20.07	19.94	2
	50	50	21.14	20.97	20.9	1	20.1	20.01	19.91	2
	100	0	21.32	21.26	21.1	1	20.29	20.23	20.18	2

LTE Band / BW	RB Size RBs	RB Offset RB Start	QPSK				16QAM			
			CH 20407 824.7 MHz	CH 20525 836.5 MHz	CH 20643 848.3 MHz	3GPP MPR [dB]	CH 20407 824.7 MHz	CH 20525 836.5 MHz	CH 20643 848.3 MHz	3GPP MPR [dB]
5 / 1.4M	1	0	22.77	22.57	22.55	0	21.8	21.61	21.69	1
	1	2	22.76	22.53	22.55	0	21.77	21.51	21.72	1
	1	5	22.76	22.57	22.52	0	21.78	21.55	21.67	1
	3	0	22.73	22.57	22.54	0	21.69	21.52	21.65	1
	3	1	22.72	22.57	22.53	0	21.71	21.51	21.57	1
	3	3	22.74	22.59	22.54	0	21.76	21.55	21.59	1
	6	0	21.71	21.54	21.52	1	20.71	20.5	20.56	2

LTE Band / BW	RB Size RBs	RB Offset RB Start	QPSK				16QAM			
			CH 20415 825.5 MHz	CH 20525 836.5 MHz	CH 20635 847.5 MHz	3GPP MPR [dB]	CH 20415 825.5 MHz	CH 20525 836.5 MHz	CH 20635 847.5 MHz	3GPP MPR [dB]
5 / 3M	1	0	22.74	22.53	22.57	0	21.79	21.59	21.58	1
	1	7	22.73	22.49	22.5	0	21.7	21.64	21.65	1
	1	14	22.65	22.46	22.48	0	21.65	21.51	21.57	1
	8	0	21.68	21.52	21.55	1	20.73	20.55	20.64	2
	8	3	21.65	21.47	21.54	1	20.69	20.55	20.59	2
	8	7	21.61	21.48	21.52	1	20.65	20.58	20.58	2
	15	0	21.63	21.43	21.52	1	20.64	20.48	20.46	2

LTE Band / BW	RB Size RBs	RB Offset RB Start	QPSK				16QAM			
			CH 20425 826.5 MHz	CH 20525 836.5 MHz	CH 20625 846.5 MHz	3GPP MPR [dB]	CH 20425 826.5 MHz	CH 20525 836.5 MHz	CH 20625 846.5 MHz	3GPP MPR [dB]
5 / 5M	1	0	22.66	22.44	22.53	0	21.66	21.52	21.62	1
	1	12	22.64	22.41	22.48	0	21.7	21.56	21.55	1
	1	24	22.49	22.4	22.37	0	21.48	21.42	21.54	1
	12	0	21.61	21.43	21.5	1	20.69	20.49	20.52	2
	12	6	21.55	21.37	21.47	1	20.63	20.45	20.51	2
	12	13	21.51	21.38	21.41	1	20.59	20.45	20.46	2
	25	0	21.54	21.39	21.42	1	20.57	20.47	20.5	2

LTE Band / BW	RB Size RBs	RB Offset RB Start	QPSK				16QAM			
			CH 20450 829.0 MHz	CH 20525 836.5 MHz	CH 20600 844 MHz	3GPP MPR [dB]	CH 20450 829.0 MHz	CH 20525 836.5 MHz	CH 20600 844 MHz	3GPP MPR [dB]
5 / 10M	1	0	**22.69**	22.52	22.57	0	21.74	21.66	21.64	1
	1	24	22.56	22.45	22.54	0	21.69	21.52	21.53	1
	1	49	22.35	22.4	22.37	0	21.41	21.44	21.45	1
	25	0	21.58	21.44	21.48	1	20.65	20.49	20.54	2
	25	12	21.54	21.38	21.48	1	20.57	20.4	20.54	2
	25	25	21.4	21.41	21.42	1	20.5	20.4	20.5	2
	50	0	21.52	21.46	21.51	1	20.56	20.48	20.55	2

LTE Band / BW	RB Size RBs	RB Offset RB Start	QPSK				16QAM			
			CH 23017 699.7 MHz	CH 23095 707.5 MHz	CH 23173 715.3 MHz	3GPP MPR [dB]	CH 23017 699.7 MHz	CH 23095 707.5 MHz	CH 23173 715.3 MHz	3GPP MPR [dB]
12 / 1.4M	1	0	22.87	22.82	22.66	0	21.84	21.76	21.79	1
	1	2	22.89	22.81	22.68	0	21.98	21.76	21.66	1
	1	5	22.9	22.81	22.67	0	21.97	21.73	21.73	1
	3	0	22.93	22.85	22.67	0	21.8	21.73	21.64	1
	3	1	22.93	22.82	22.6	0	21.74	21.72	21.68	1
	3	3	22.93	22.83	22.61	0	21.83	21.76	21.67	1
	6	0	21.96	21.82	21.64	1	20.76	20.73	20.62	2

LTE Band / BW	RB Size RBs	RB Offset RB Start	QPSK				16QAM			
			CH 23025 700.5 MHz	CH 23095 707.5 MHz	CH 23165 714.5 MHz	3GPP MPR [dB]	CH 23025 700.5 MHz	CH 23095 707.5 MHz	CH 23165 714.5 MHz	3GPP MPR [dB]
12 / 3M	1	0	22.69	22.63	22.45	0	21.82	21.75	21.6	1
	1	7	22.69	22.58	22.45	0	21.74	21.74	21.64	1
	1	14	22.66	22.52	22.43	0	21.77	21.65	21.67	1
	8	0	21.74	21.62	21.52	1	20.78	20.67	20.59	2
	8	3	21.76	21.61	21.5	1	20.73	20.69	20.63	2
	8	7	21.73	21.6	21.5	1	20.8	20.64	20.59	2
	15	0	21.72	21.6	21.51	1	20.69	20.64	20.49	2

LTE Band / BW	RB Size RBs	RB Offset RB Start	QPSK				16QAM			
			CH 23035 701.5 MHz	CH 23095 707.5 MHz	CH 23155 713.5 MHz	3GPP MPR [dB]	CH 23035 701.5 MHz	CH 23095 707.5 MHz	CH 23155 713.5 MHz	3GPP MPR [dB]
12 / 5M	1	0	22.59	22.6	22.43	0	21.75	21.75	21.66	1
	1	12	22.64	22.56	22.45	0	21.77	21.72	21.64	1
	1	24	22.64	22.48	22.44	0	21.79	21.68	21.58	1
	12	0	21.68	21.66	21.55	1	20.77	20.77	20.57	2
	12	6	21.67	21.64	21.49	1	20.77	20.71	20.55	2
	12	13	21.67	21.6	21.46	1	20.77	20.66	20.59	2
	25	0	21.65	21.61	21.48	1	20.71	20.68	20.55	2

LTE Band / BW	RB Size RBs	RB Offset RB Start	QPSK				16QAM			
			CH 23060 704.0 MHz	CH 23095 707.5 MHz	CH 23130 711.0 MHz	3GPP MPR [dB]	CH 23060 704.0 MHz	CH 23095 707.5 MHz	CH 23130 711.0 MHz	3GPP MPR [dB]
12 / 10M	1	0	22.66	22.62	22.61	0	21.84	21.8	21.74	1
	1	24	**22.7**	22.55	22.46	0	21.75	21.71	21.67	1
	1	49	22.55	22.4	22.47	0	21.69	21.64	21.67	1
	25	0	21.71	21.63	21.59	1	20.73	20.7	20.67	2
	25	12	21.71	21.56	21.51	1	20.67	20.62	20.59	2
	25	25	21.66	21.54	21.52	1	20.74	20.62	20.52	2
	50	0	21.69	21.6	21.56	1	20.7	20.66	20.6	2

4. TEST EQUIPMENT

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

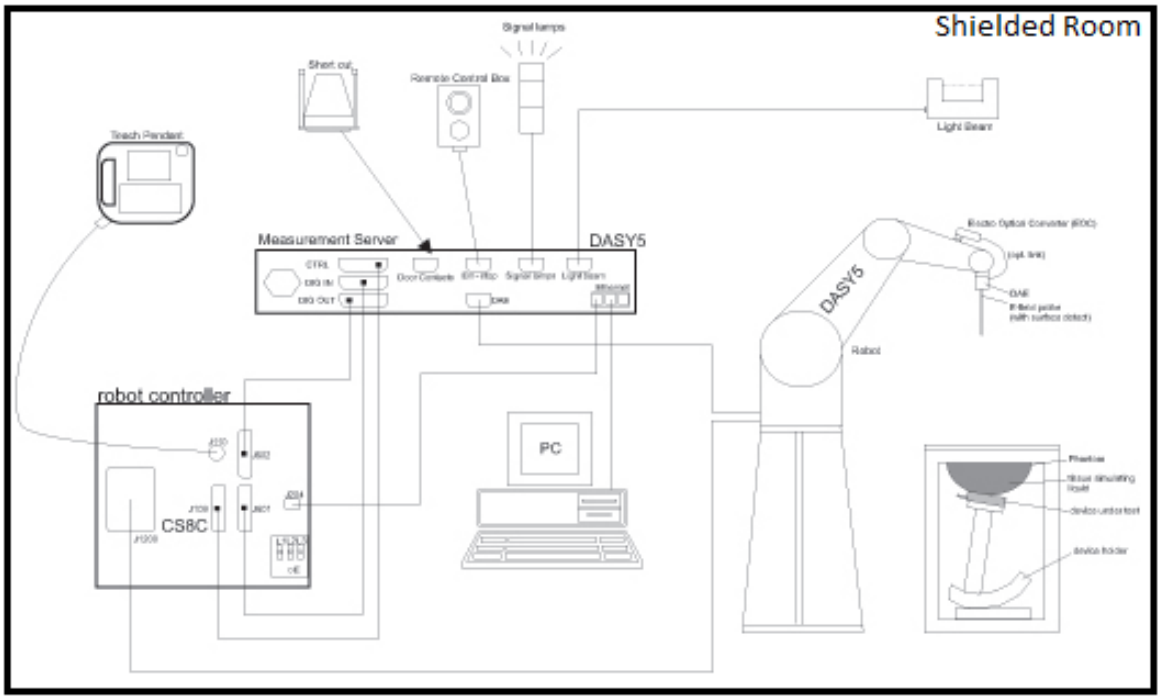


Figure 1 Schematic Laboratory Picture

4.1 Test Equipment List

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

Test Equipment	Model	Serial Number	Calibration Date
DAE	DAE4	756	03.2018
DAE	DAE4	710	12.2018
Probe	EX3DV4	7447	03.2018
Probe	EX3DV4	3892	04.2018
Dipole	D750V3	42/17	12.2018
Dipole	D835V2	455	06.2017
Dipole	D1800V2	2D075	06.2017
Dipole	D1900V2	5D004	06.2017
DASY5 Software	52.8.8.1258	-	NA
Communication tester	Anritsu MT8820C	6200951734	11.2018
Communication tester	Anritsu MT8820C	6200930942	08.2018
Signal generator	R&S SMIQ 06B	1125.5555.06	NA

Signal generator	Agilent E4438C	-	NA
Amplifier	AR	10S1G4A	NA
Amplifier	Ophir 5163F	1022	NA
Power Sensor	NRP-Z11	100265	06.2018
Power Reflection Meter	NRT	835065/049	02.2019
Directional Power Sensor	NRT-Z44	835374/021	02.2019

Dipole calibration period supporting data:

		Measured on 08/2018			Calibrated		
Dipole and serial number	**Frequency (MHz)**	**Return loss (dB)**	**Impedance (Ω)**		**Return loss (dB)**	**Impedance (Ω)**	
D835V2 455	835	-26.37	45.7	1.8	-22.05	44.2	4.6
D1800V2 2D075	1800	-25.70	50.0	5.2	-21.93	47.3	7.3
D1900V2 5D004	1900	-28.86	48.3	-3.1	-27.01	52.1	-4

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 Tip diameter: 2.5 mm Distance from probe tip to dipole centers: 1.0 mm
Application	General dosimetry up to 6 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms

4.2 Phantoms

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 IEEE 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 IEEE 1528 and FCC published RF Exposure KDB Procedures. The dielectric parameters of the used tissue simulants were within ±10% of the recommended values in all frequencies used. 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.

Body 600-6000 MHz 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] Body tissue simulant	Conductivity σ [S/m] Body tissue simulant	Validation Done
							Body tissue simulant
750	D750V3 - SN: 1154	EX3DV4 - SN: 7447	CW/FDD	DAE 4 / 756	56.37	0.97	04.2018
835	D835V2 - SN: 455	EX3DV4 - SN: 7447	CW/GMSK	DAE 4 / 756	56.0	1.0	04.2018
1800	D1800V2-SN: 2D075	EX3DV4 - SN: 7447	CW	DAE 4 / 756	53.82	1.43	05.2018
1800	D1800V2 - SN: 2D075	EX3DV4 - SN3892	CW	DAE4 / 705	49.11	1.53	05.2018
1900	D1900V2-SN:5D004	EX3DV4 - SN: 7447	CW	DAE 4 / 756	53.59	1.49	04.2018

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 1g [%]	Plot #
07.03.2019	M600-6000	22±2	835	250	2.54	9.84	10.16	3.25	1
08.03.2019	M600-6000	22±2	1800	250	9.85	38.74	39.4	1.70	2
11.03.2019	M600-6000	22±2	835	250	2.31	9.84	9.24	-6.10	3
12.03.2019	M600-6000	22±2	1900	250	9.54	38.16	38.16	-4.22	4
13.03.2019	M600-6000	22±2	750	250	2.0	8.73	8.0	-8.36	5
13.03.2019	M600-6000	22±2	1800	250	8.72	38.74	34.88	-9.96	6

4.5.1 Tissue Simulant Verification

				Target		Measured			
Date	Tissue Type	Tissue Temp. [°C]	Frequency [MHz]	Conductivity, σ [S/m]	Dielectric Constant [ε]	Conductivity σ [S/m]	Dielectric Constant [ε]	Deviation σ (%)	Deviation ε (%)
07.03.2019	M600-6000	22	835	55.2	0.97	53.5	0.98	-3.1	0.8
			836.6	55.2	0.97	53.5	0.98	-3.0	0.7
			824.2	55.2	0.97	53.6	0.97	-3.1	0.6
			848.8	55.2	0.99	53.5	0.98	-3.0	-0.3
08.03.2019	M600-6000	22	1800	53.3	1.52	49.0	1.41	-8.0	-7.2
			1732.6	53.5	1.48	49.2	1.37	-8.0	-7.2
11.03.2019	M600-6000	22	835	55.2	0.97	53.1	0.96	-3.8	-1.2
			836.6	55.2	0.97	53.1	0.96	-3.8	-1.4
			829	55.2	0.97	53.1	0.96	-3.8	-1.3

12.03.2019	M600-6000	22	1900	53.3	1.52	50.6	1.47	-5.0	-3.1
			1880	53.3	1.52	50.6	1.46	-5.0	-4.1
			1850.2	53.3	1.52	50.7	1.44	-4.9	-5.2
			1909.8	53.3	1.52	50.6	1.48	-5.0	-2.8
			1852.5	53.3	1.52	50.7	1.44	-4.9	-5.2
			1907.6	53.3	1.52	50.6	1.48	-5.0	-2.9
13.02.2019	M600-6000	22	750	55.5	0.96	53.3	0.93	-4.0	-3.0
			704	55.7	0.96	53.5	0.92	-3.9	-4.4
			1800	53.3	1.52	50.8	1.41	-4.7	-7.4
			1733	53.5	1.48	51.0	1.37	-4.7	-7.0

5. TEST PROCEDURE

The DUT was set to transmit with full power by using a communication tester for cellular technologies.

5.1 Test Positions

The DUT was placed either on a device holder manufactured by SPEAG or ROHACELL support structure and lifted against a flat phantom until the separation distance was reached using a separate flat spacer that was removed before the start of the measurements. Pictures of the test positions are available at Appendix A.

The test separation distance used for each test position i.e. each side of the device was determined based on a separation distance that is provided by a carry bag where the DUT is intended to be worn on a body.

The separation distances provided by the carry bag for the sides that require testing are following:

back – 8 mm
top – 2 mm
bottom – 5mm

5.2 Scan Procedures

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

5.3 SAR Averaging Methods

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

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation.

The interpolation, extrapolation and maximum search routines within Dasy47 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).

6. MEASUREMENT UNCERTAINTY

Uncertainty Budget
IEEE 1528-2013

Error Description	Uncert. value	Prob. Dist.	Div.	(c_i) 1g	(c_i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v_i) v_{eff}
Measurement System								
Probe Calibration	±6.0 %	N	1	1	1	±6.0 %	±6.0 %	∞
Axial Isotropy	±4.7 %	R		0.7	0.7	±1.9 %	±1.9 %	∞
Hemispherical Isotropy	±9.6 %	R	1.73	0.7	0.7	±3.9 %	±3.9 %	∞
Boundary Effects	±1.0 %	R	1.73	1	1	±0.6 %	±0.6 %	∞
Linearity	±4.7 %	R	1.73	1	1	±2.7 %	±2.7 %	∞
System Detection Limits	±1.0 %	R	1.73	1	1	±0.6 %	±0.6 %	∞
Modulation Response^m	±2.4 %	R	1.73	1	1	±1.4 %	±1.4 %	∞
Readout Electronics	±0.3 %	N	1	1	1	±0.3 %	±0.3 %	∞
Response Time	±0.8 %	R	1.73	1	1	±0.5 %	±0.5 %	∞
Integration Time	±2.6 %	R	1.73	1	1	±1.5 %	±1.5 %	∞
RF Ambient Noise	±3.0 %	R	1.73	1	1	±1.7 %	±1.7 %	∞
RF Ambient Reflections	±3.0 %	R	1.73	1	1	±1.7 %	±1.7 %	∞
Probe Positioner	±0.4 %	R	1.73	1	1	±0.2 %	±0.2 %	∞
Probe Positioning	±2.9 %	R	1.73	1	1	±1.7 %	±1.7 %	∞
Max. SAR Eval.	±2.0 %	R	1.73	1	1	±1.2 %	±1.2 %	∞
Test Sample Related								
Device Positioning	±2.9 %	N	1	1	1	±2.9 %	±2.9 %	145
Device Holder	±3.6 %	N	1	1	1	±3.6 %	±3.6 %	5
Power Drift	±5.0 %	R	1.73	1	1	±2.9 %	±2.9 %	∞
Power Scaling	±6 %	R	1.73	1	1	±3.5 %	± 3.5%	∞
Phantom and Setup								
Phantom Uncertainty	±6.1 %	R	1.73	1	1	±3.5 %	±3.5 %	∞
SAR correction	±1.9 %	R	1.73	1	0.84	±1.1 %	±0.9 %	∞
Liquid Conductivity (mea.)	±2.5 %	R	1.73	0.78	0.71	±1.1 %	±1.0 %	∞
Liquid Permittivity (mea.)	±2.5 %	R	1.73	0.26	0.26	±0.3 %	±0.4 %	∞
Temp. unc. - Conductivity	±3.4 %	R	1.73	0.78	0.71	±1.5 %	±1.4 %	∞
Temp. unc. - Permittivity	±0.4 %	R	1.73	0.23	0.26	±0.1 %	±0.1 %	∞
Combined Std. Uncertainty						±11.7 %	±11.6 %	361
Expanded STD Uncertainty						**±23.4 %**	**±23.3 %**	

7. TEST RESULTS

7.1 SAR Results for Body-worn:

Band	Channel	TX Slot configuration	Maximum Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Test Position/ Separation	GPRS Duty Cycle	Measured SAR1g [mW/g]	Scaling Factor	Normal Duty Cycle [%]	Reported SAR1g [mW/g]	Plot #
GPRS850	190	4	28.5	26.68	-0.07	Back, 8mm	1:2	0.922	1.52	100	1.40	7
GPRS850	128	4	28.5	27.47	-0.02	Back, 8mm	1:2	0.89	1.27	100	1.13	
GPRS850	251	4	28.5	27.26	-0.01	Back, 8mm	1:2	1.02	1.33	100	1.36	
GPRS850	251	4	28.5	27.26	-0.11	Back, 8mm	1:2	1.02	1.33	100	1.36	
GPRS850	190	4	28.5	26.68	0.22*	Bottom, 5mm	1:2	0.00948	1.60	100	0.015	8
GPRS850	190	4	28.5	26.68	NA**	Top, 2mm	1:2	0***	1.52	100	0***	

*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.
*** Due to very low e-field generated by DUT at the measured area, maximum was not found.

Band	Channel	TX Slot configuration	Maximum Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Test Position/ Separation	GPRS Duty Cycle	Measured SAR1g [mW/g]	Scaling Factor	Normal Duty Cycle [%]	Reported SAR1g [mW/g]	Plot #
GPRS1900	661	1	31.5	28.68	0.34*	Back, 8mm	1:8	0.401	2.07	100	0.83	9
GPRS1900	512	1	31.5	28.96	-0.16	Back, 8mm	1:8	0.445	1.79	100	0.80	
GPRS1900	810	1	31.5	29.15	-0.14	Back, 8mm	1:8	0.47	1.72	100	0.81	
GPRS1900	661	1	31.5	28.68	NA**	Bottom, 5mm	1:8	0.000238	1.91	100	0.000	

*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.

Band	Channel	Mode	Maximum Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Test Position/ Separation	Duty Cycle	Measured SAR1g [mW/g]	Scaling Factor	Normal Duty Cycle [%]	Reported SAR1g [mW/g]	Plot #
WCDMA 2	9400	RMC 12.2K	25	22.85	-0.05	Back, 8mm	1:1	0.723	1.64	4.34	0.05	10
WCDMA 2	9400	RMC 12.2K	25	22.85	NA**	Bottom, 5mm	1:1	0.0000201	1.64	4.34	0.000	

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

Band	Channel	Mode	Maximum Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Test Position/ Separation	Duty Cycle	Measured SAR1g [mW/g]	Scaling Factor	Normal Duty Cycle [%]	Reported SAR1g [mW/g]	Plot #
WCDMA 4	1413	RMC 12.2K	25	23.42	-0.14	Back, 8mm	1:1	2.84	1.44	4.34	0.177	11
WCDMA 4	1413	RMC 12.2K	25	23.42	0.20	Bottom, 5mm	1:1	0.013	1.44	4.34	0.001	

Band	Channel	Mode	Maximum Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Test Position/ Separation	Duty Cycle	Measured SAR1g [mW/g]	Scaling Factor	Normal Duty Cycle [%]	Reported SAR1g [mW/g]	Plot #
WCDMA 5	4183	RMC 12.2K	25	23.68	-0.06	Back, 8mm	1:1	0.787	1.36	4.34	0.046	12
WCDMA 5	4183	RMC 12.2K	25	23.68	-0.13	Bottom, 5mm	1:1	0.00872	1.36	4.34	0.001	
WCDMA 5	4183	RMC 12.2K	25	23.68	0.29*	Top, 2mm	1:1	0.00225	1.45	4.34	0.000	

*Larger than 5% drifts included to scaling factors

Band	Channel	Modulation QPSK BW [MHz]	RB Size	RB Offset	Maximum Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Test Position/ Separation	Duty Cycle	Measured SAR1g [mW/g]	Scaling Factor	Normal Duty Cycle [%]	Reported SAR 1g [mW/g]	Plot #
LTE 2	19100	20	1	0	25	21.94	-0.16	Back, 8mm	1:1	0.613	2.02	1.628	0.02019	13
LTE 2	19100	20	50	0	25	21.01	-0.13	Back, 8mm	1:1	0.474	2.51	1.628	0.01934	
LTE 2	19100	20	1	0	25	21.94	NA**	Bottom, 5mm	1:1	0.0000086	2.02	1.628	0.00000	
LTE 2	19100	20	50	0	25	21.01	NA**	Bottom, 5mm	1:1	0***	2.51	1.628	0***	

** Due to low e-field generated by DUT at the location of drift measurement, the measurements are not applicable.
*** Due to very low e-field generated by DUT at the measured area, maximum was not found.

Band	Channel	Modulation QPSK BW [MHz]	RB Size	RB Offset	Maximum Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Test Position/ Separation	Duty Cycle	Measured SAR1g [mW/g]	Scaling Factor	Normal Duty Cycle [%]	Reported SAR 1g [mW/g]	Plot #
LTE 4	20175	20	1	0	25	22.58	-0.01	Back, 8mm	1:1	1.78	1.75	1.628	0.051	14
LTE 4	20175	20	1	0	25	22.58	-0.02	Back, 8mm	1:1	1.65	1.75	1.628	0.047	
LTE 4	20175	20	1	0	25	22.58	0.05	Back, 8mm	1:1	1.56	1.75	1.628	0.044	
LTE 4	20175	20	50	0	25	21.38	0.01	Back, 8mm	1:1	1.18	2.30	1.628	0.044	
LTE 4	20175	20	50	0	25	21.38	-0.02	Back, 8mm	1:1	1.12	2.30	1.628	0.042	
LTE 4	20175	20	1	0	25	22.58	-0.14	Bottom, 5mm	1:1	0.0104	1.75	1.628	0.000	
LTE 4	20175	20	50	0	25	21.38	-0.11	Bottom, 5mm	1:1	0.00518	2.30	1.628	0.000	

Band	Channel	Modulation QPSK BW [MHz]	RB Size	RB Offset	Maximum Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Test Position/ Separation	Duty Cycle	Measured SAR1g [mW/g]	Scaling Factor	Normal Duty Cycle [%]	Reported SAR 1g [mW/g]	Plot #
LTE 5	20450	10	1	0	25	22.69	0.05	Back, 8mm	1:1	0.587	1.70	1.628	0.01627	
LTE 5	20450	10	25	0	25	21.58	0.01	Back, 8mm	1:1	0.466	2.20	1.628	0.01667	15
LTE 5	20450	10	1	0	25	22.69	-0.88*	Bottom, 5mm	1:1	0.0107	2.08	1.628	0.00036	
LTE 5	20450	10	25	0	25	21.58	-0.28*	Bottom, 5mm	1:1	0.0072	2.34	1.628	0.00027	
LTE 5	20450	10	1	0	25	22.69	-0.17	Top, 2mm	1:1	0.00453	1.70	1.628	0.00013	
LTE 5	20450	10	25	0	25	21.58	-0.22*	Top, 2mm	1:1	0.00287	2.31	1.628	0.00011	

*Larger than 5% drifts included to scaling factors

Band	Channel	Modulation QPSK BW [MHz]	RB Size	RB Offset	Maximum Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Test Position/ Separation	Duty Cycle	Measured SAR1g [mW/g]	Scaling Factor	Normal Duty Cycle [%]	Reported SAR 1g [mW/g]	Plot #
LTE 12	23060	10	1	24	25	22.7	-0.05	Back, 8mm	1:1	0.357	1.70	1.628	0.010	16
LTE 12	23060	10	25	0	25	22.71	-0.03	Back, 8mm	1:1	0.283	2.13	1.628	0.010	
LTE 12	23060	10	1	24	25	22.7	NA**	Top, 2mm	1:1	0.00106	1.70	1.628	0.000	
LTE 12	23060	10	25	0	25	22.71	NA**	Top, 2mm	1:1	0***	2.13	1.628	0.000	

LTE 12	23060	10	1	24	25	22.7	NA**	Bottom, 5mm	1:1	0.00117	1.70	1.628	0.000	
LTE 12	23060	10	25	0	25	22.71	NA**	Bottom, 5mm	1:1	0.000789	2.13	1.628	0.000	

** Due to low e-field generated by DUT at the location of drift measurement, the measurements are not applicable.
*** Due to very low e-field generated by DUT at the measured area, maximum was not found.

The pictures of the test positions are presented in appendix A.

7.2 Calculated Bluetooth SAR Results

For simultaneous transmission evaluation the Bluetooth standalone SAR value is estimated according to the following equation:

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)]·[√f(GHz)/x] W/kg, where x = 7.5 for 1-g SAR.

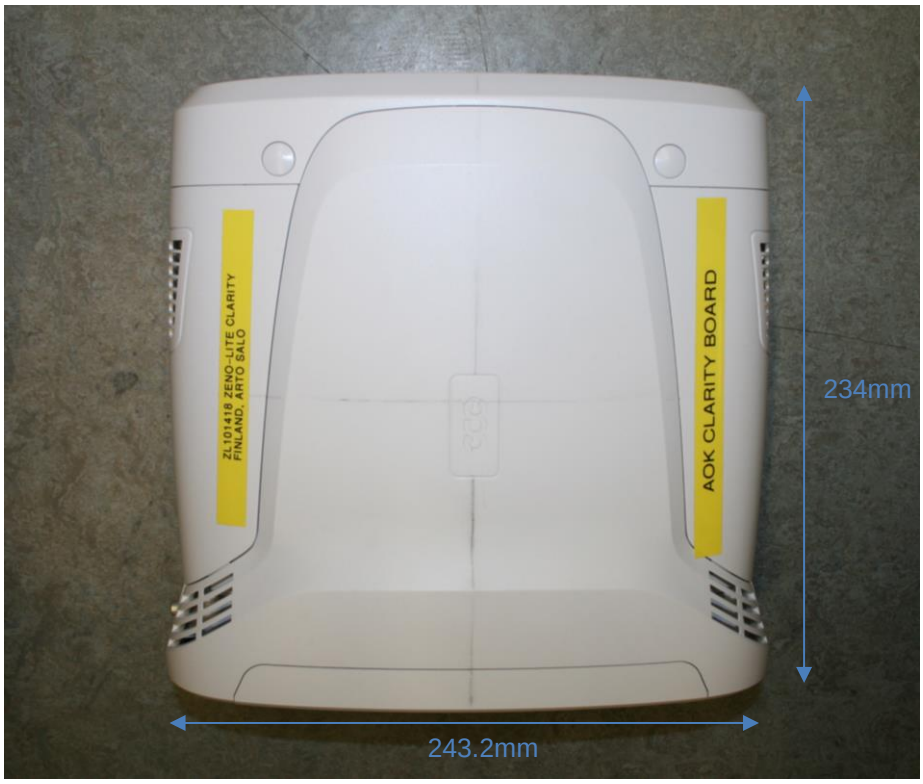
Bluetooth SAR_{1g}= (6.3mW/13mm)*(2.4835GHz)$^{1/2}$/7.5=0.10 W/kg

13mm minimum separation distance was calculated from test separation distance of 8mm, Bluetooth antenna location of 3mm from the DUT plastic cover and 2 mm plastic cover thickness.

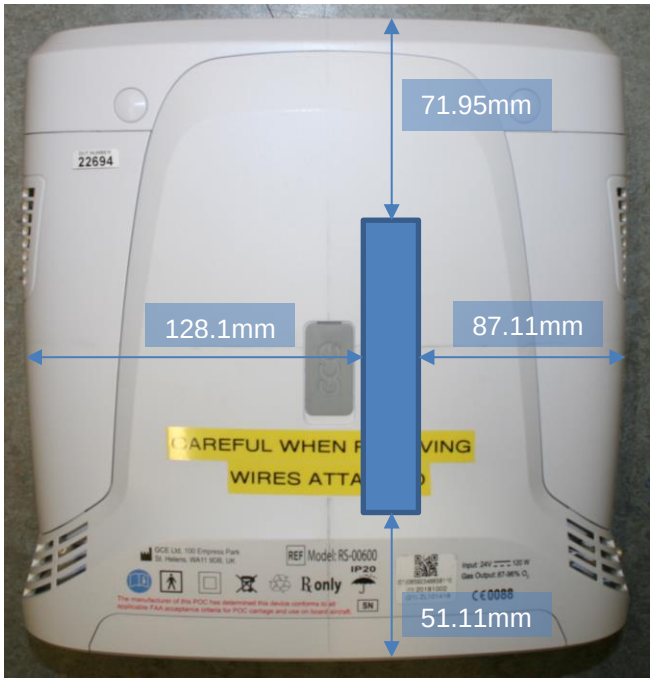
APPENDIX A: PHOTOS OF THE DUT

Dimension of the DUT are:

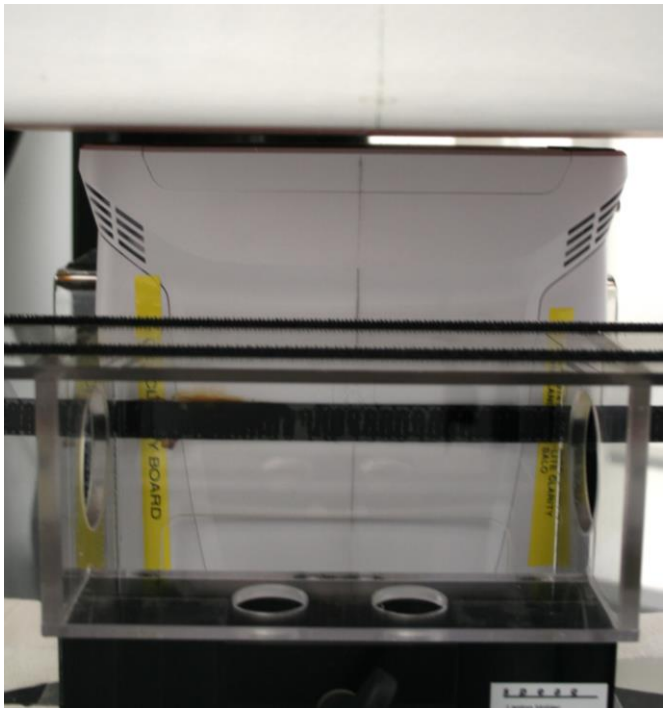
243.2 x 88.1 x 234mm



Antenna location:



Back test position, 8mm separation distance



Bottom test position, 5mm separation distance

Top test position, 2mm separation distance

APPENDIX B: SYSTEM CHECK SCAN

Plot 1

Date/Time: 7.3.2019 14:36:02

Test Laboratory: Verkotan Oy

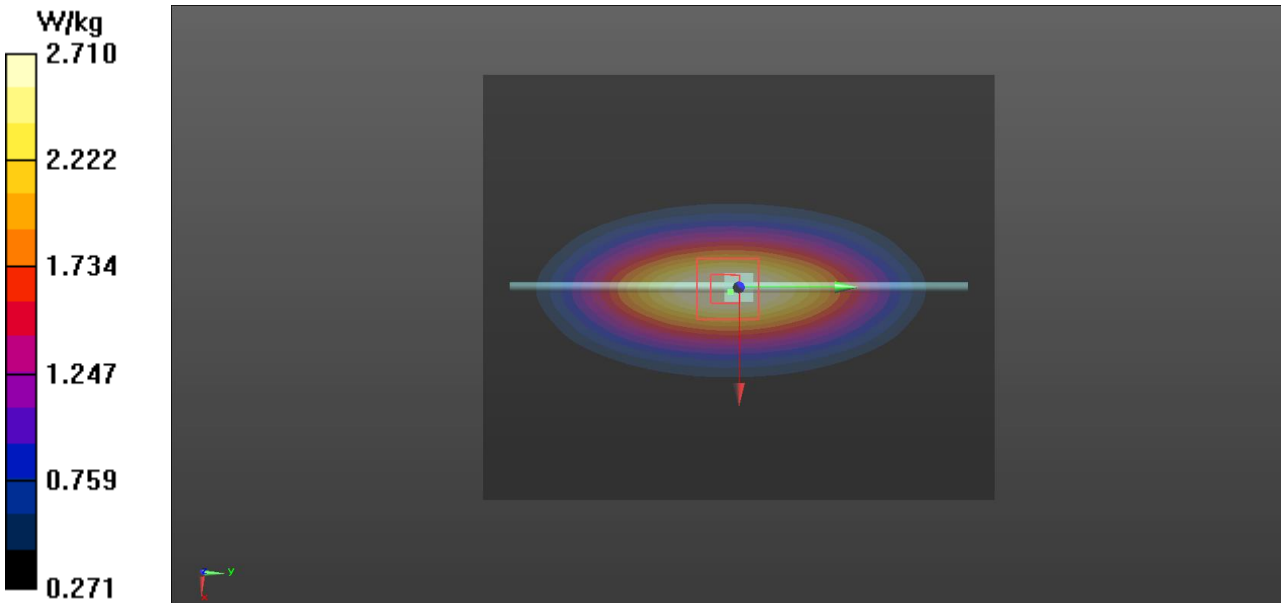
DUT: Dipole 835 MHz D835V2; Type: D835V2; Serial: D835V2 - SN:455

Communication System: UID 0, CW (0); Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz; Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 835 MHz; σ = 0.949 S/m; ε_r = 53.354; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(9.89, 9.89, 9.89); Calibrated: 20.3.2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = -4.0, 31.0
- Electronics: DAE4 Sn710; Calibrated: 3.12.2018
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/System Check/Area Scan 2 (101x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.87 W/kg
Configuration/System Check/Zoom Scan (7x9x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.17 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 3.68 W/kg
SAR(1 g) = 2.54 W/kg; SAR(10 g) = 1.68 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 2.71 W/kg



Plot 2

Date/Time: 8.3.2019 9:55:20

Test Laboratory: Verkotan Oy

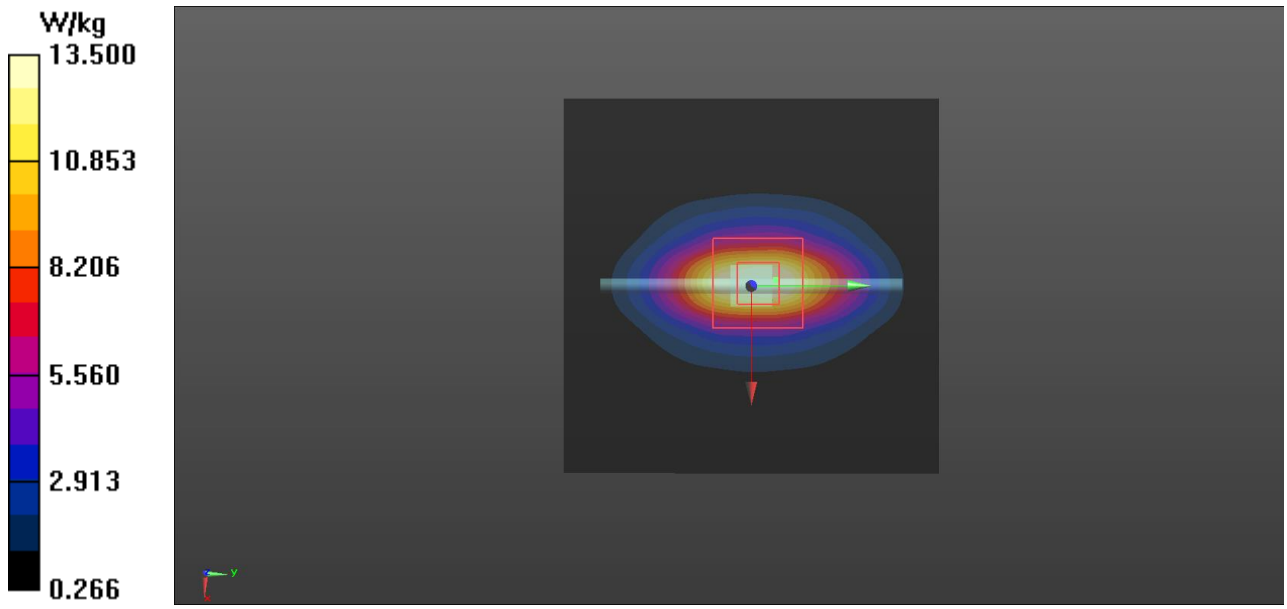
DUT: Dipole 1800 MHz D1800V2; Type: D1800V2; Serial: D1800V2 - SN:2D075

Communication System: UID 0, CW (0); Communication System Band: D1800 (1800.0 MHz); Frequency: 1800 MHz; Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 1800 MHz; σ = 1.41 S/m; ε_r = 49.02; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3892; ConvF(8.21, 8.21, 8.21); Calibrated: 20.4.2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = -4.0, 31.0
- Electronics: DAE4 Sn756; Calibrated: 8.3.2018
- Phantom: SAR2_Phantom1_ELI back; Type: QD OVA 002 AA;
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/System Check/Area Scan 2 (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 14.1 W/kg
Configuration/System Check/Zoom Scan (7x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 88.37 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 16.8 W/kg
SAR(1 g) = 9.85 W/kg; SAR(10 g) = 5.24 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 13.5 W/kg



Date/Time: 11.3.2019 8:51:59

Test Laboratory: Verkotan Oy

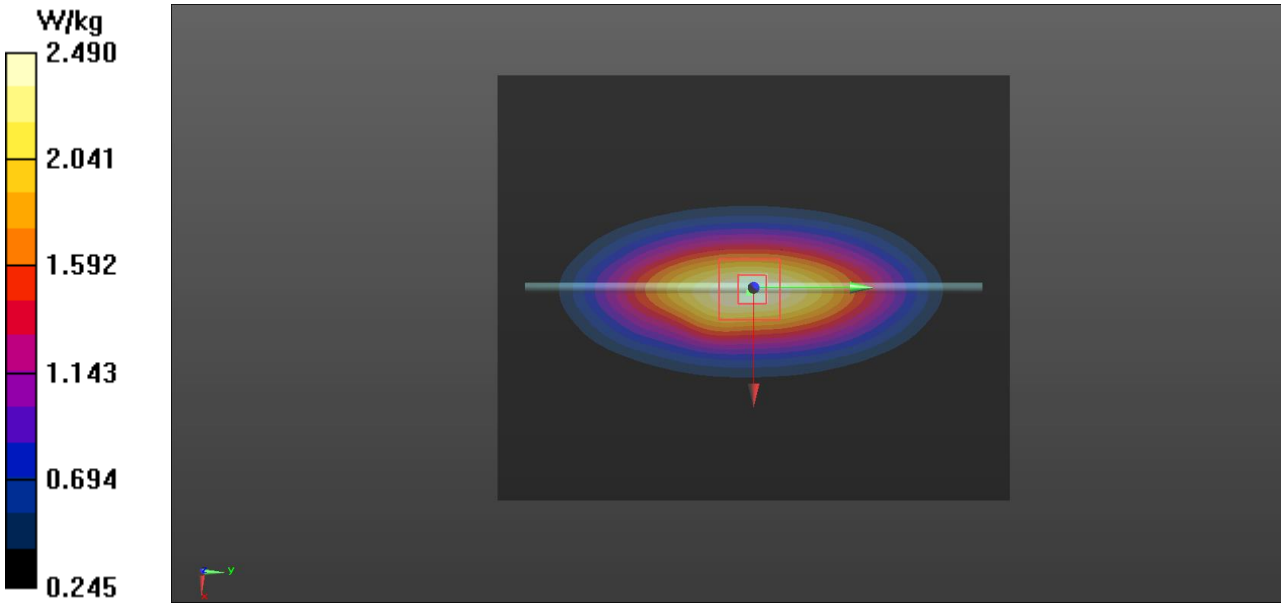
DUT: Dipole 835 MHz D835V2; Type: D835V2; Serial: D835V2 - SN:455

Communication System: UID 0, CW (0); Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz; Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 835 MHz; σ = 0.959 S/m; ε_r = 53.119; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(9.89, 9.89, 9.89); Calibrated: 20.3.2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = -4.0, 31.0
- Electronics: DAE4 Sn710; Calibrated: 3.12.2018
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/System Check/Area Scan 2 (101x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.52 W/kg
Configuration/System Check/Zoom Scan (7x9x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 51.50 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.42 W/kg
SAR(1 g) = 2.31 W/kg; SAR(10 g) = 1.54 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 2.49 W/kg



Date/Time: 12.3.2019 8:59:50

Test Laboratory: Verkotan Oy

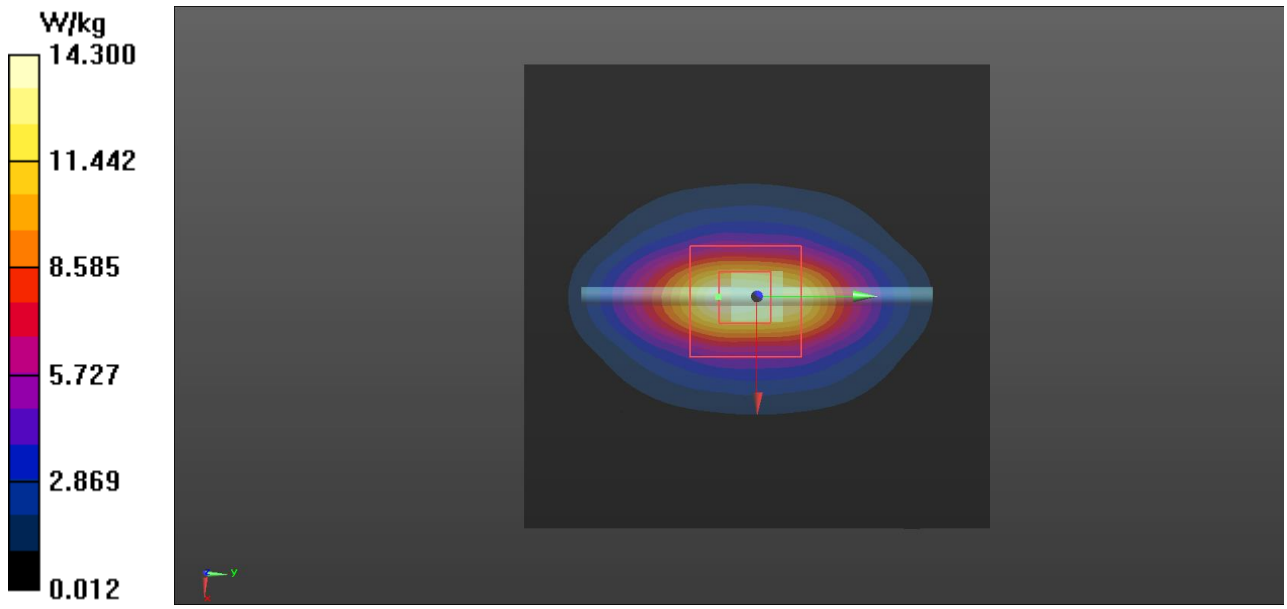
DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: D1900V2 - SN:5D004

Communication System: UID 0, CW (0); Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz; Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 1900 MHz; σ = 1.473 S/m; ε_r = 50.638; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.12, 8.12, 8.12); Calibrated: 20.3.2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 31.0, -4.0
- Electronics: DAE4 Sn710; Calibrated: 3.12.2018
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

System Check 1900MHz/Pin=250 mW/Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 96.87 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 16.5 W/kg
SAR(1 g) = 9.54 W/kg; SAR(10 g) = 5.07 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 13.1 W/kg
System Check 1900MHz/Pin=250 mW/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 14.3 W/kg



Test Laboratory: Verkotan Oy

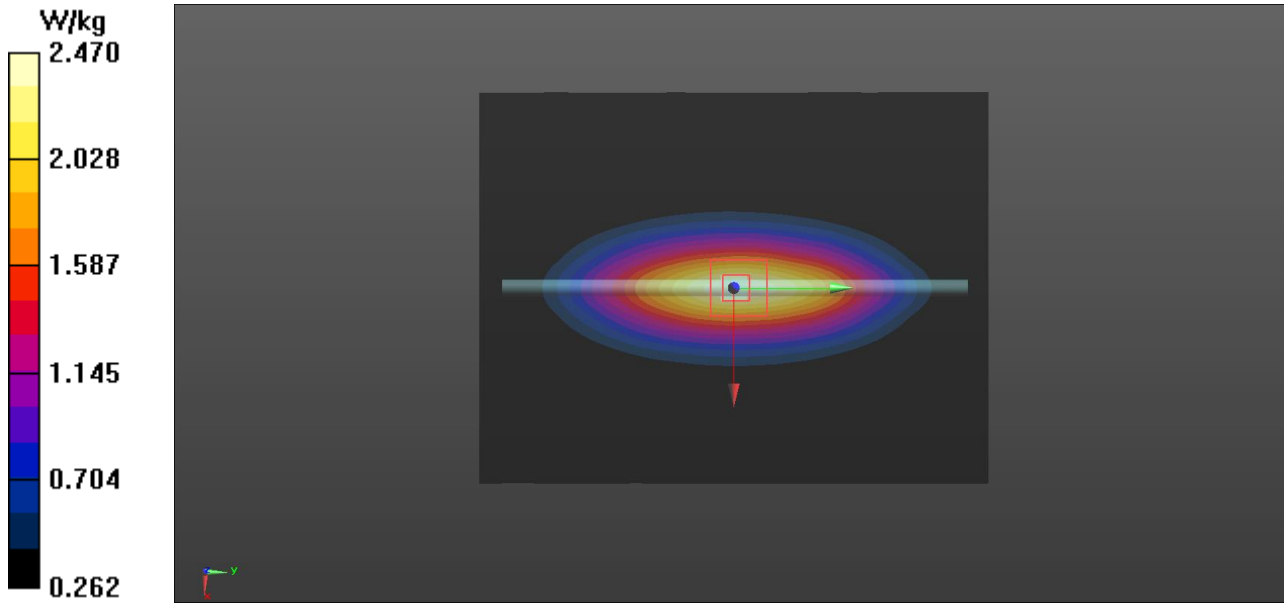
DUT: Dipole 750 MHz D750V3; Type: D750V3; Serial: D750V3 - SN:454

Communication System: UID 0, CW (0); Communication System Band: D750 (750.0 MHz); Frequency: 750 MHz; Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 750 MHz; σ = 0.934 S/m; ε_r = 53.298; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(10.2, 10.2, 10.2); Calibrated: 20.3.2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 6.0, 31.0
- Electronics: DAE4 Sn710; Calibrated: 3.12.2018
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/System Check/Area Scan 2 (101x131x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.44 W/kg
Configuration/System Check/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 48.11 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 2.86 W/kg
SAR(1 g) = 2 W/kg; SAR(10 g) = 1.34 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 2.47 W/kg



Plot 6

Date/Time: 13.3.2019 10:08:31

Test Laboratory: Verkotan Oy

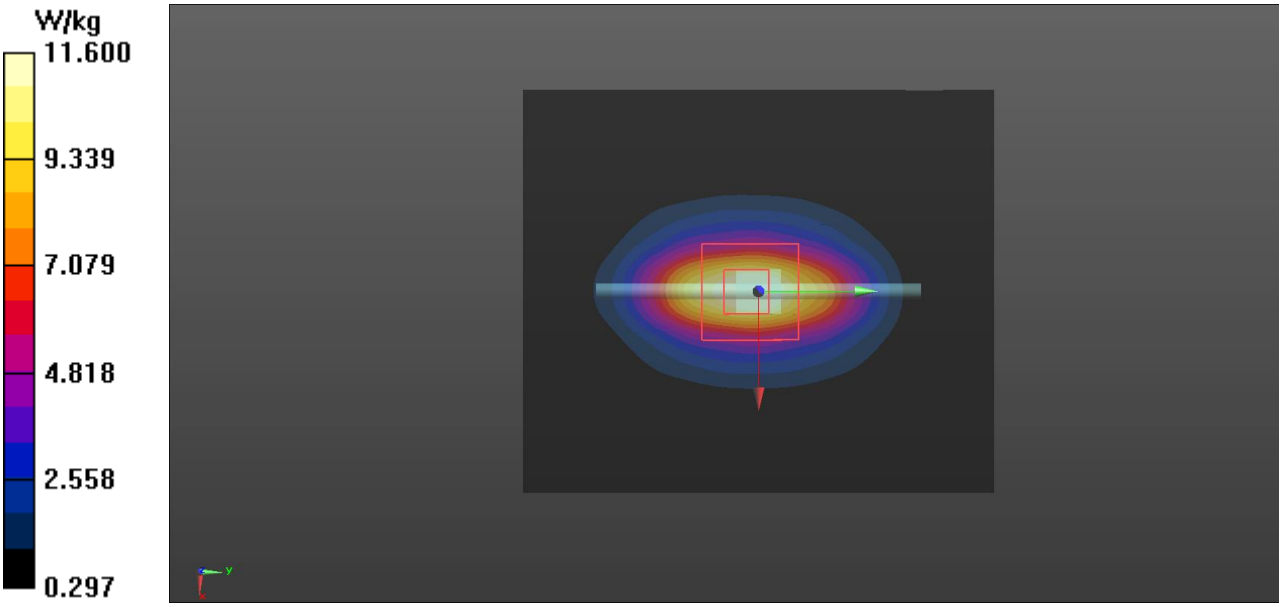
DUT: Dipole 1800 MHz D1800V2; Type: D1800V2; Serial: D1800V2 - SN:2D075

Communication System: UID 0, CW (0); Communication System Band: D1800 (1800.0 MHz); Frequency: 1800 MHz; Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 1800 MHz; σ = 1.408 S/m; ε_r = 50.819; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.25, 8.25, 8.25); Calibrated: 20.3.2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = -4.0, 31.0
- Electronics: DAE4 Sn710; Calibrated: 3.12.2018
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

System Check/Area Scan 2 (61x71x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 12.6 W/kg
System Check/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 82.42 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 14.5 W/kg
SAR(1 g) = 8.72 W/kg; SAR(10 g) = 4.68 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 11.6 W/kg



APPENDIX C: MEASUREMENT SCAN

Plot 7
Date/Time: 8.3.2019 9:59:34

Test Laboratory: Verkotan Oy

DUT: Zen-O Lite Clarity

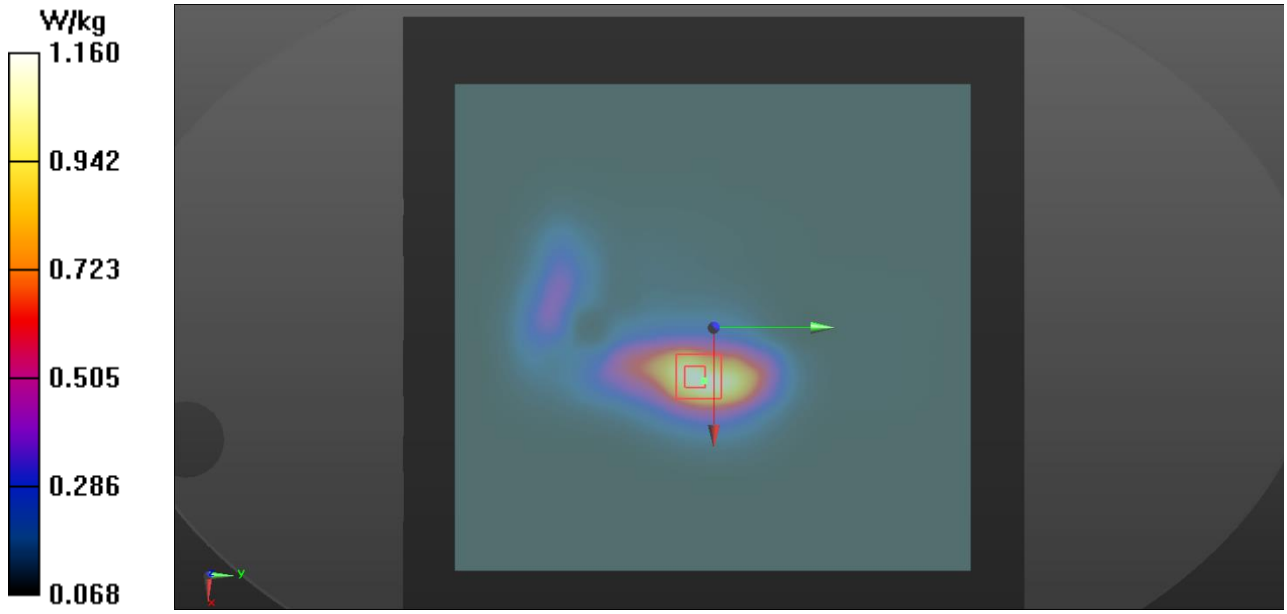
Communication System: UID 0, GPRS850 (0); Communication System Band: GPRS850; Frequency: 836.6 MHz;Communication System PAR: 3.263 dB;
Medium parameters used: f = 837 MHz; σ = 0.979 S/m; ε_r = 53.506; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(9.89, 9.89, 9.89); Calibrated: 20.3.2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 31.0, -4.0
- Electronics: DAE4 Sn710; Calibrated: 3.12.2018
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/GPRS 850 MID Back 8mm separation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 18.67 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 1.38 W/kg
SAR(1 g) = 0.922 W/kg; SAR(10 g) = 0.584 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 1.16 W/kg

Configuration/GPRS 850 MID Back 8mm separation/Area Scan (201x201x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.20 W/kg



Date/Time: 8.3.2019 15:10:56

Test Laboratory: Verkotan Oy

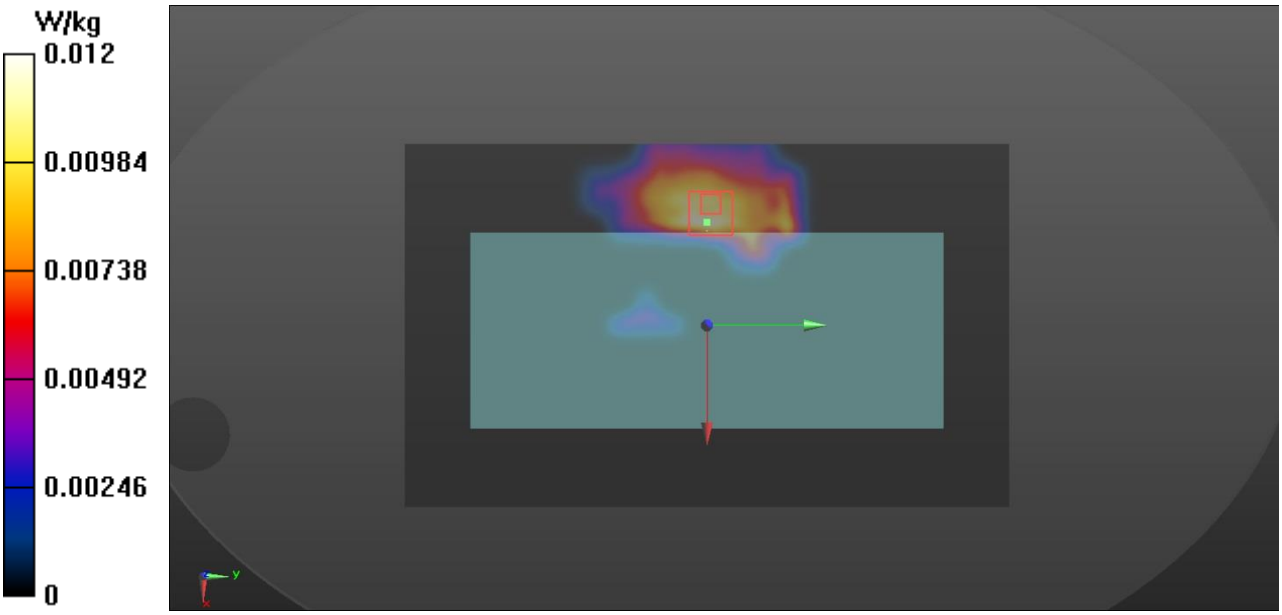
DUT: Zen-O Lite Clarity

Communication System: UID 0, GPRS850 (0); Communication System Band: GPRS850; Frequency: 836.6 MHz;Communication System PAR: 3.263 dB;
Medium parameters used: f = 837 MHz; σ = 0.979 S/m; ε_r = 53.506; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(9.89, 9.89, 9.89); Calibrated: 20.3.2018;
- Sensor-Surface: 2mm (Mechanical Surface, z = -4.0, 31.0
- Electronics: DAE4 Sn710; Calibrated: 3.12.2018
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA; Serial: 29-March-2017
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/GPRS 850 BOTTOM 5mm separation/Area Scan (121x201x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.0123 W/kg
Configuration/GPRS 850 BOTTOM 5mm separation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 2.357 V/m; Power Drift = -0.22 dB
Peak SAR (extrapolated) = 0.0130 W/kg
SAR(1 g) = 0.00948 W/kg; SAR(10 g) = 0.00594 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.0118 W/kg



Date/Time: 12.3.2019 10:39:30

Test Laboratory: Verkotan Oy

DUT: Zen-O Lite Clarity

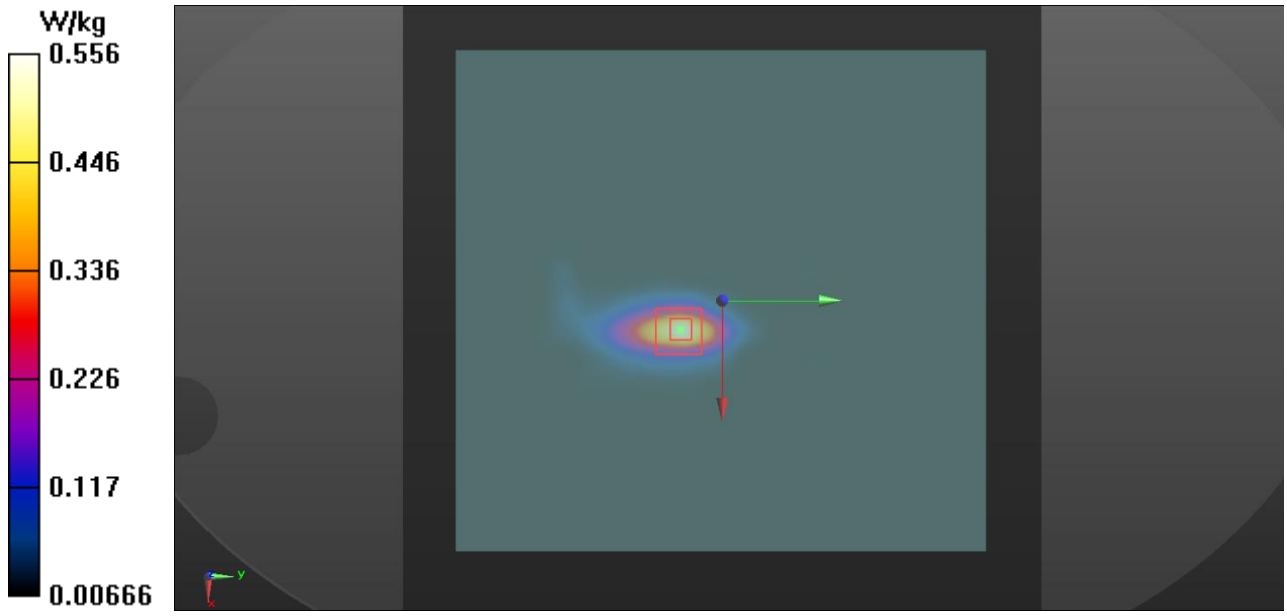
Communication System: UID 0, GPRS1900 1 slot (0); Communication System Band: GPRS1900; Frequency: 1880 MHz;Communication System PAR: 9.191 dB;
Medium parameters used: f = 1880 MHz; σ = 1.458 S/m; ε_r = 50.646; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.12, 8.12, 8.12); Calibrated: 20.3.2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 31.0, -4.0
- Electronics: DAE4 Sn710; Calibrated: 3.12.2018
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

GPRS 1900, 12.3.2019/GPRS 1900 MID Back 8mm separation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 9.632 V/m; Power Drift = -0.34 dB
Peak SAR (extrapolated) = 0.688 W/kg
SAR(1 g) = 0.401 W/kg; SAR(10 g) = 0.204 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.556 W/kg

GPRS 1900, 12.3.2019/GPRS 1900 MID Back 8mm separation/Area Scan (201x201x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.574 W/kg



Date/Time: 12.3.2019 14:30:15

Test Laboratory: Verkotan Oy

DUT: Zen-O Lite Clarity

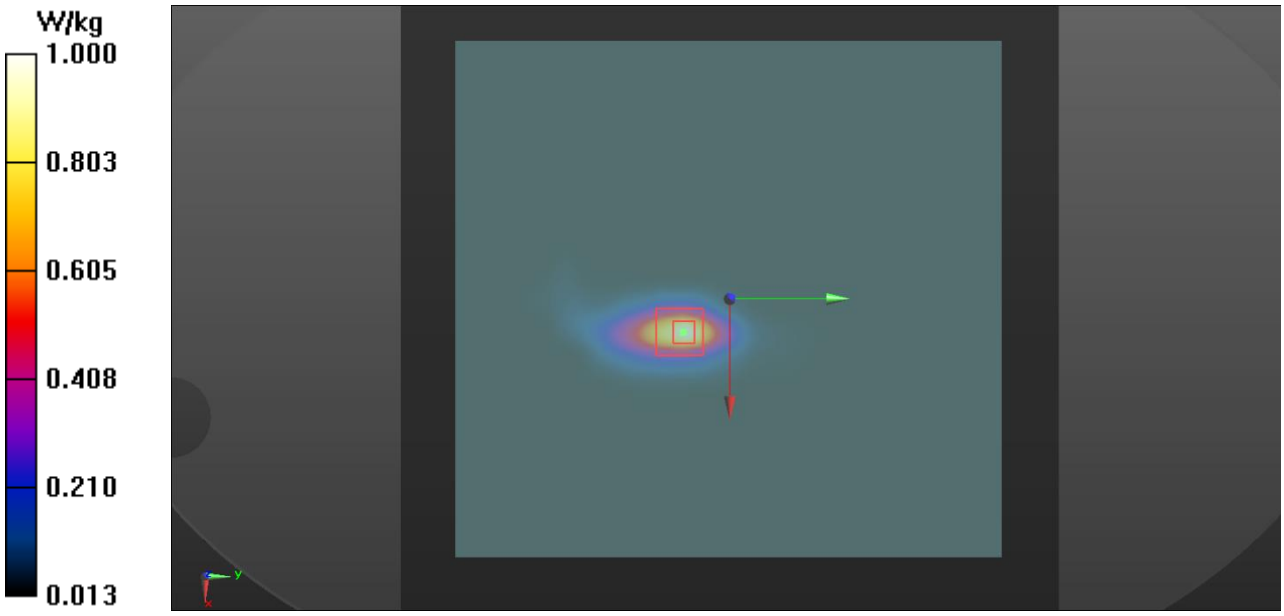
Communication System: UID 0, WCDMA (0); Communication System Band: Band 2; Frequency: 1880 MHz;Communication System PAR: 0 dB; PMF: 1.12202e-005
Medium parameters used: f = 1880 MHz; σ = 1.458 S/m; ε_r = 50.646; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.12, 8.12, 8.12); Calibrated: 20.3.2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 31.0, -4.0
- Electronics: DAE4 Sn710; Calibrated: 3.12.2018
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

WCDMA 2, 12.3.2019/WCDMA 2 MID Back 8mm separation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 11.05 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 1.23 W/kg
SAR(1 g) = 0.723 W/kg; SAR(10 g) = 0.369 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 1.00 W/kg

WCDMA 2, 12.3.2019/WCDMA 2 MID Back 8mm separation/Area Scan (201x201x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.05 W/kg



Date/Time: 8.3.2019 12:08:35

Test Laboratory: Verkotan Oy

DUT: Zen-O Lite Clarity

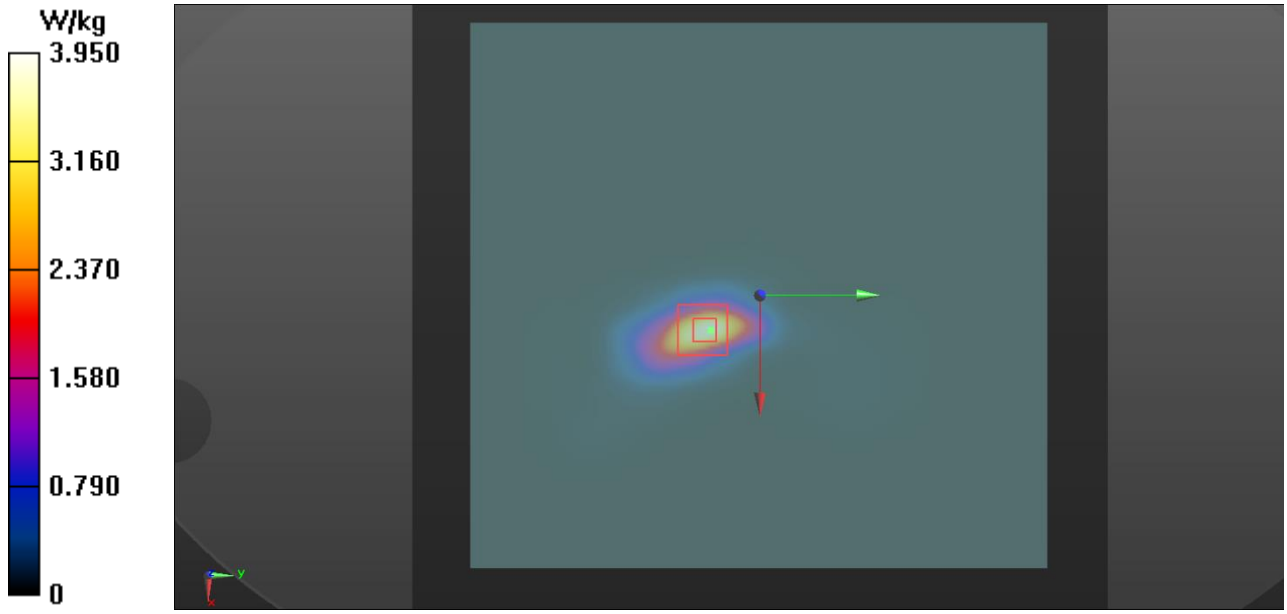
Communication System: UID 0, WCDMA (0); Communication System Band: Band 4; Frequency: 1732.6 MHz;Communication System PAR: 0 dB; PMF: 1.12202e-005
Medium parameters used: f = 1733 MHz; σ = 1.372 S/m; ε_r = 49.176; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3892; ConvF(8.21, 8.21, 8.21); Calibrated: 20.4.2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = -4.0, 31.0
- Electronics: DAE4 Sn756; Calibrated: 8.3.2018
- Phantom: SAR2_Phantom1_ELI back; Type: QD OVA 002 AA;
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

WCDMA 4, Back, WCDMA 4, mid, Back 8mm separation/Area Scan (201x201x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 3.95 W/kg

WCDMA 4, Back, WCDMA 4, mid, Back 8mm separation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 26.16 V/m; Power Drift = -0.14 dB
Peak SAR (extrapolated) = 4.61 W/kg
SAR(1 g) = 2.84 W/kg; SAR(10 g) = 1.5 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 3.71 W/kg



Date/Time: 11.3.2019 12:02:27

Test Laboratory: Verkotan Oy

DUT: Zen-O Lite Clarity

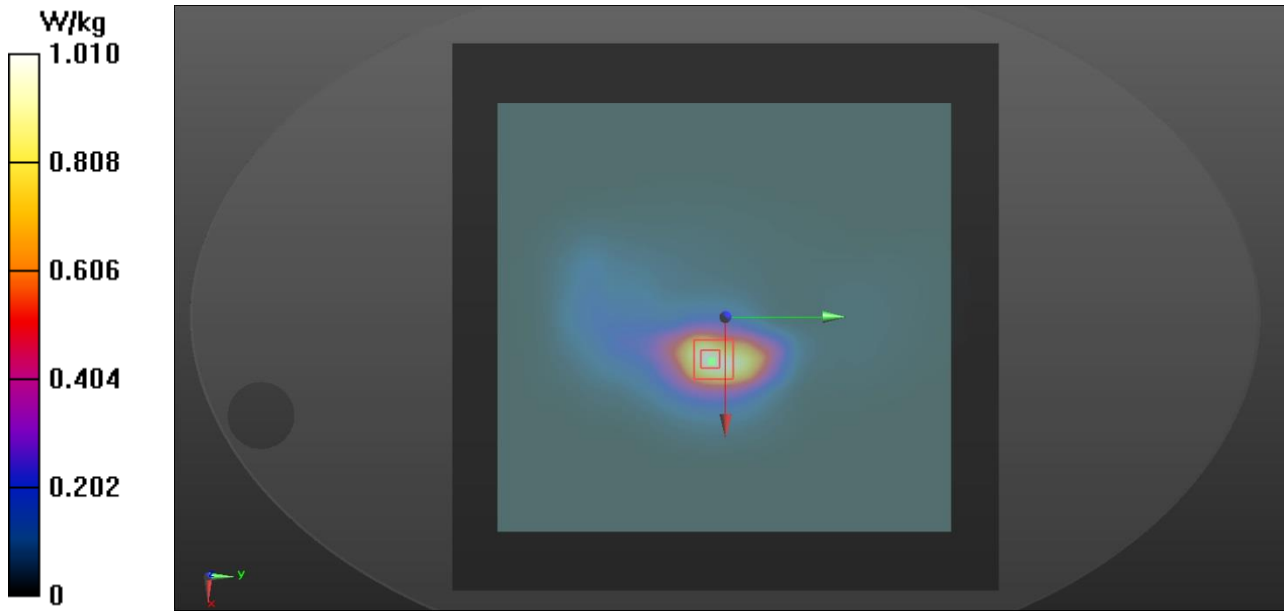
Communication System: UID 0, WCDMA (0); Communication System Band: Band 5; Frequency: 836.6 MHz;Communication System PAR: 0 dB; PMF: 1.12202e-005
Medium parameters used: f = 837 MHz; σ = 0.957 S/m; ε_r = 53.112; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(9.89, 9.89, 9.89); Calibrated: 20.3.2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = -4.0, 31.0
- Electronics: DAE4 Sn710; Calibrated: 3.12.2018
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration 2/DUT22694 WCDMA 850 MID Back 8mm separation/Area Scan (201x201x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.01 W/kg

Configuration 2/DUT22694 WCDMA 850 MID Back 8mm separation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 18.42 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 1.18 W/kg
SAR(1 g) = 0.787 W/kg; SAR(10 g) = 0.491 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 1.01 W/kg



Date/Time: 12.3.2019 16:01:58

Test Laboratory: Verkotan Oy

DUT: Zen-O Lite Clarity

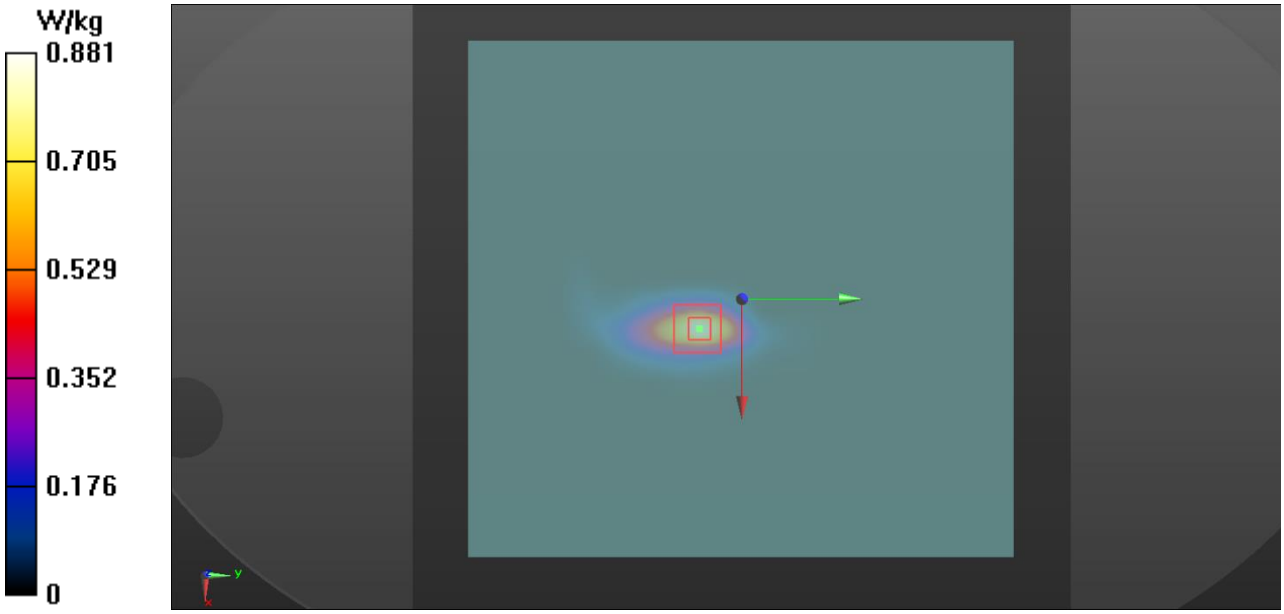
Communication System: UID 0, Generic LTE (0); Communication System Band: Band 2, E-UTRA/FDD (1850.0 - 1910.0 MHz); Frequency: 1900 MHz;Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 1900 MHz; σ = 1.473 S/m; ε_r = 50.638; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.12, 8.12, 8.12); Calibrated: 20.3.2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = -4.0, 31.0
- Electronics: DAE4 Sn710; Calibrated: 3.12.2018
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

LTE 2, MID Back 8mm separation/Area Scan (201x201x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.881 W/kg

LTE 2, MID Back 8mm separation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 12.11 V/m; Power Drift = -0.17 dB
Peak SAR (extrapolated) = 1.05 W/kg
SAR(1 g) = 0.613 W/kg; SAR(10 g) = 0.314 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.849 W/kg



Plot 14

Date/Time: 13.3.2019 16:38:47

Test Laboratory: Verkotan Oy

DUT: Zon-o-lite;

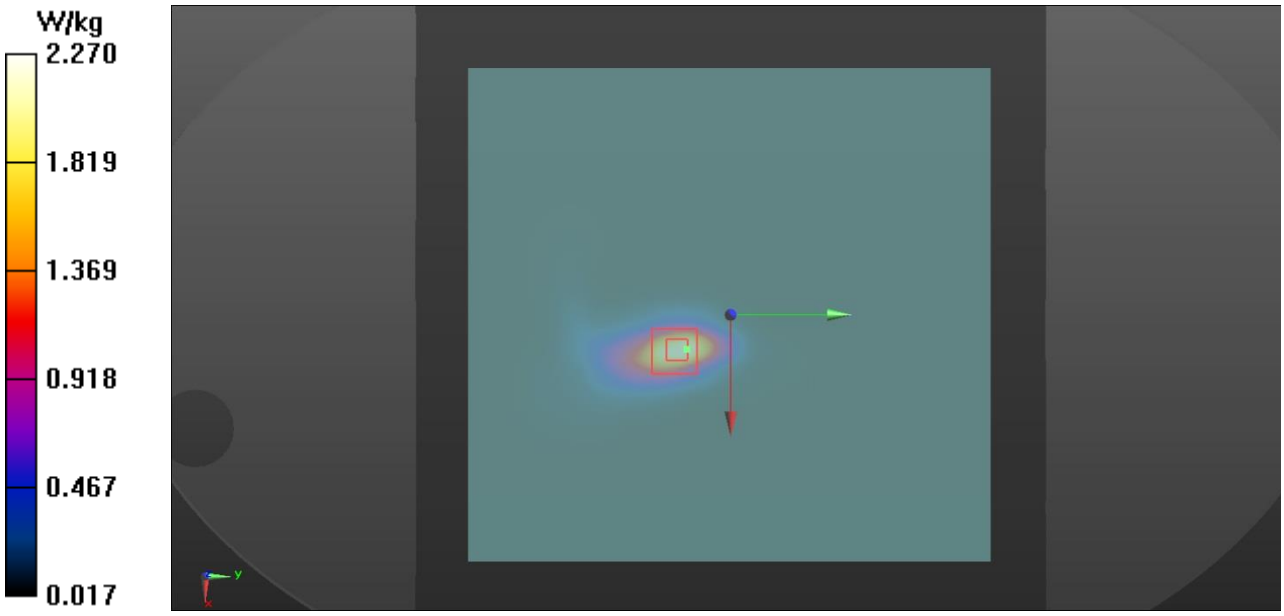
Communication System: UID 0, Generic LTE (0); Communication System Band: Band 4, E-UTRA/FDD (1710.0 - 1755.0 MHz); Frequency: 1732.5 MHz;Communication System PAR: 0 dB; PMF: 1
Medium parameters used (interpolated): f = 1732.5 MHz; σ = 1.373 S/m; ε_r = 50.977; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.25, 8.25, 8.25); Calibrated: 20.3.2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 31.0, -4.0
- Electronics: DAE4 Sn710; Calibrated: 3.12.2018
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

LTE 4, back, mid, Back 8mm separation/Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 16.28 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 2.84 W/kg
SAR(1 g) = 1.78 W/kg; SAR(10 g) = 0.954 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 2.27 W/kg

LTE 4, back, mid, Back 8mm separation/Area Scan (201x201x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.44 W/kg



Date/Time: 11.3.2019 19:20:03

Test Laboratory: Verkotan Oy

DUT: Zen-O Lite Clarity

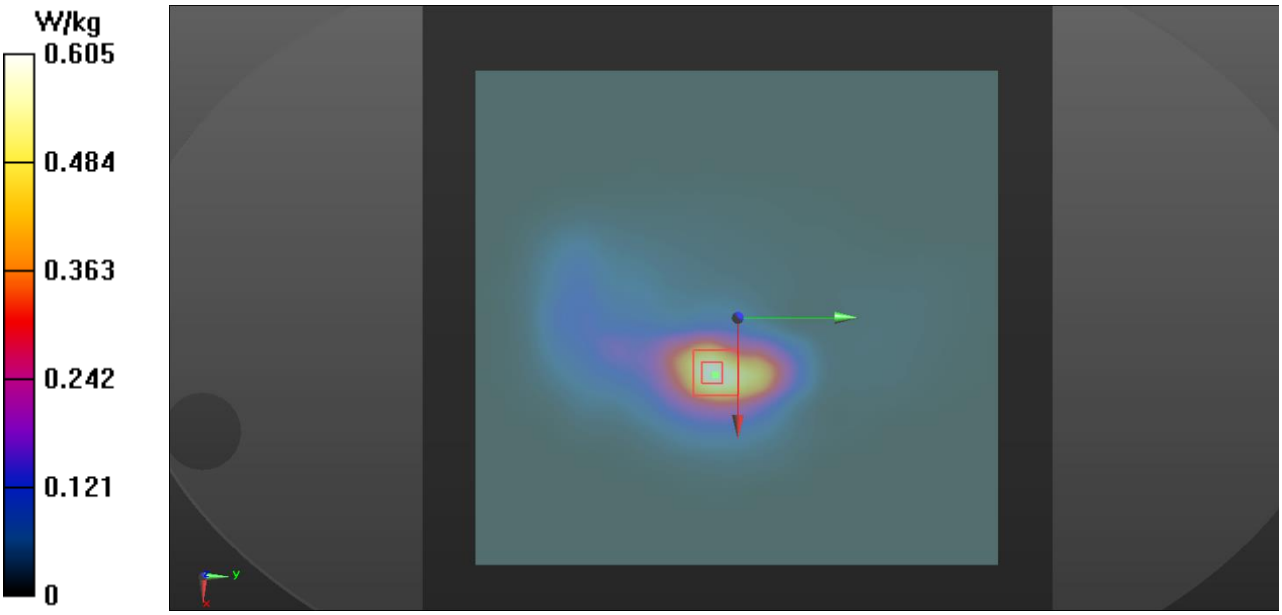
Communication System: UID 0, Generic LTE (0); Communication System Band: Band 5, E-UTRA/FDD (824.0 - 849.0 MHz); Frequency: 829 MHz;Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 829 MHz; σ = 0.957 S/m; ε_r = 53.123; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(9.89, 9.89, 9.89); Calibrated: 20.3.2018;
- Sensor-Surface: 2mm (Mechanical Surface, Sensor-Surface: 2mm (Mechanical Surface Detection), z = -4.0, 31.0
- Electronics: DAE4 Sn710; Calibrated: 3.12.2018
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

LTE 5 Back/DUT22694 50%RB/Area Scan (201x201x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.605 W/kg

LTE 5 Back/DUT22694 50%RB/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 14.26 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.701 W/kg
SAR(1 g) = 0.466 W/kg; SAR(10 g) = 0.288 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.589 W/kg



Date/Time: 13.3.2019 11:53:31

Test Laboratory: Verkotan Oy

DUT: Zen-O Lite Clarity

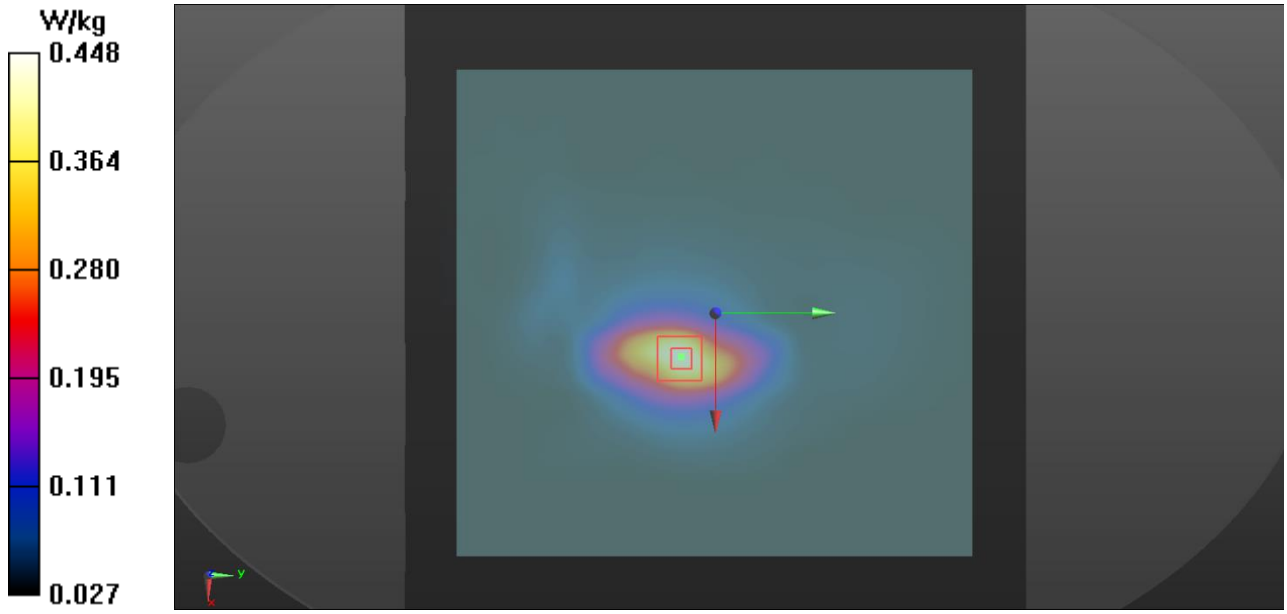
Communication System: UID 0, Generic LTE (0); Communication System Band: Band 12, E-UTRA/FDD (698.0 - 716.0 MHz); Frequency: 704 MHz;Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 704 MHz; σ = 0.917 S/m; ε_r = 53.523; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

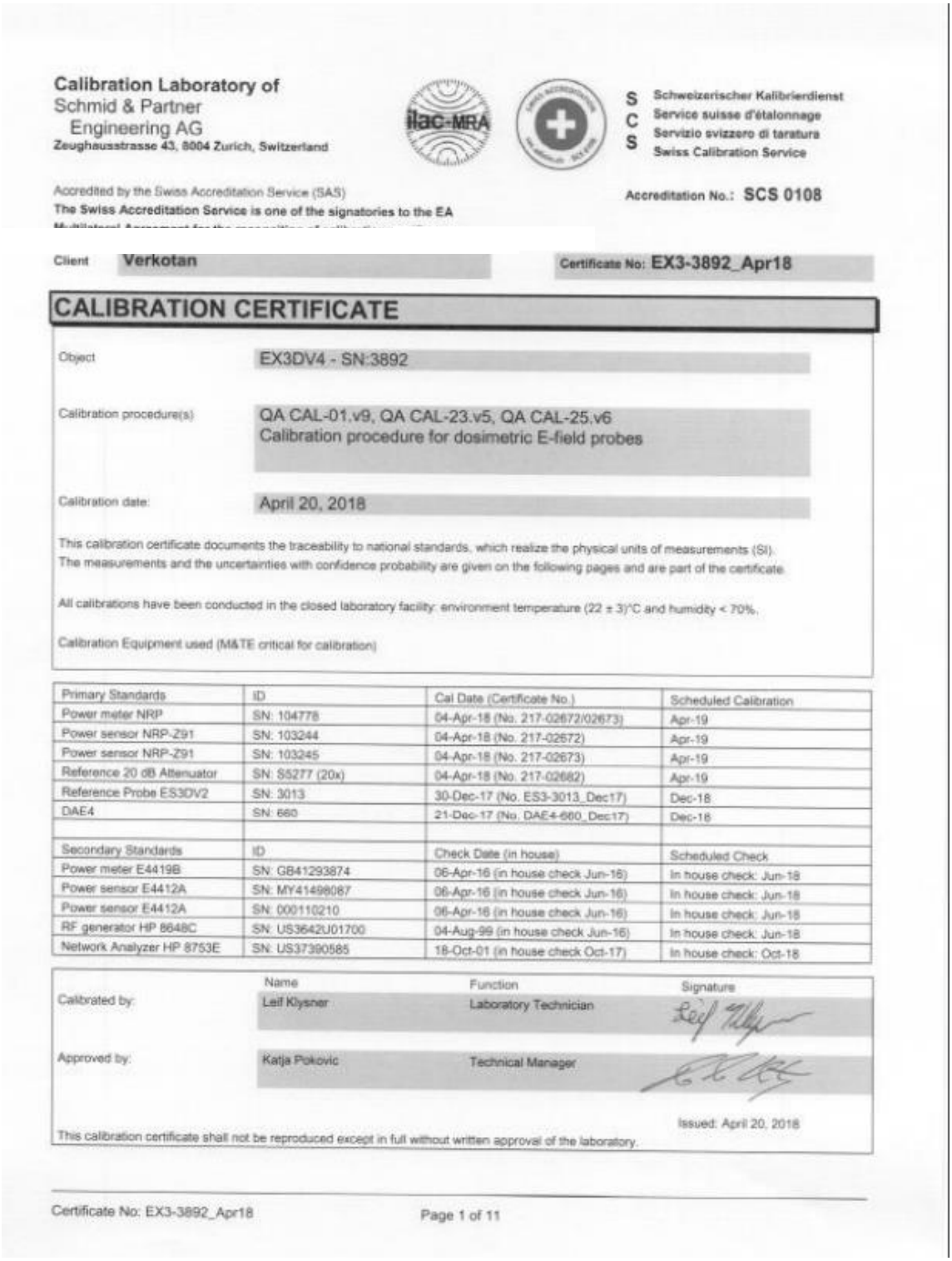
- Probe: EX3DV4 - SN7447; ConvF(10.2, 10.2, 10.2); Calibrated: 20.3.2018;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 31.0, -4.0
- Electronics: DAE4 Sn710; Calibrated: 3.12.2018
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA; Serial: 29-March-2017
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

LTE 12, back, low, Back /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 12.16 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.527 W/kg
SAR(1 g) = 0.357 W/kg; SAR(10 g) = 0.224 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.448 W/kg

LTE 12, back, 1low, Back /Area Scan (201x201x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.445 W/kg



APPENDIX D: RELEVANT PAGES FROM PROBE CALIBRATION



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

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Servizio svizzero di taratura
Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA

Accreditation No.: SCS 0108

Client Verkotan Certificate No: EX3-3892_Apr18

CALIBRATION CERTIFICATE

Object EX3DV4 - SN:3892

Calibration procedure(s) QA CAL-01.v9, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: April 20, 2018

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-18 (No. 217-02672/02673)	Apr-19
Power sensor NRP-Z91	SN: 103244	04-Apr-18 (No. 217-02672)	Apr-19
Power sensor NRP-Z91	SN: 103245	04-Apr-18 (No. 217-02673)	Apr-19
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-18 (No. 217-02682)	Apr-19
Reference Probe ES3DV2	SN: 3013	30-Dec-17 (No. ES3-3013_Dec17)	Dec-18
DAE4	SN: 660	21-Dec-17 (No. DAE4-660_Dec17)	Dec-18
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-16)	In house check: Jun-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-17)	In house check: Oct-18

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: April 20, 2018

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

Certificate No: EX3-3892_Apr18 Page 1 of 11

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)
750	41.9	0.89	10.51	10.51	10.51	0.49	0.80	± 12.0 %
900	41.5	0.97	9.85	9.85	9.85	0.49	0.82	± 12.0 %
1750	40.1	1.37	8.59	8.59	8.59	0.35	0.80	± 12.0 %
1900	40.0	1.40	8.33	8.33	8.33	0.31	0.80	± 12.0 %
2450	39.2	1.80	7.46	7.46	7.46	0.30	0.85	± 12.0 %
2600	39.0	1.96	7.35	7.35	7.35	0.25	1.04	± 12.0 %

[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. 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.

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

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	55.5	0.96	10.03	10.03	10.03	0.52	0.80	± 12.0 %
900	55.0	1.05	10.08	10.08	10.08	0.45	0.85	± 12.0 %
1750	53.4	1.49	8.21	8.21	8.21	0.38	0.85	± 12.0 %
1900	53.3	1.52	7.93	7.93	7.93	0.35	0.83	± 12.0 %
2450	52.7	1.95	7.52	7.52	7.52	0.33	0.93	± 12.0 %

[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. 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
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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: EX3-7447_Mar18

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:7447

Calibration procedure(s): QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: March 20, 2018

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-17 (No. 217-02521/02522)	Apr-18
Power sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02525)	Apr-18
Reference 20 dB Attenuator	SN: S5277 (20x)	07-Apr-17 (No. 217-02526)	Apr-18
Reference Probe ES3DV2	SN: 3013	30-Dec-17 (No. ES3-3013_Dec17)	Dec-18
DAE4	SN: 660	21-Dec-17 (No. DAE4-660_Dec17)	Dec-18
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-16)	In house check: Jun-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-17)	In house check: Oct-18

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

Issued: March 22, 2018

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

Certificate No: EX3-7447_Mar18 Page 1 of 11

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

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	41.9	0.89	10.35	10.35	10.35	0.50	0.80	± 12.0 %
900	41.5	0.97	9.63	9.63	9.63	0.43	0.89	± 12.0 %
1750	40.1	1.37	8.68	8.68	8.68	0.35	0.85	± 12.0 %
1950	40.0	1.40	8.76	8.76	8.76	0.32	0.85	± 12.0 %
2150	39.7	1.53	8.65	8.65	8.65	0.29	0.85	± 12.0 %
2300	39.5	1.67	8.21	8.21	8.21	0.31	0.88	± 12.0 %
2450	39.2	1.80	7.77	7.77	7.77	0.34	0.85	± 12.0 %
2600	39.0	1.96	7.46	7.46	7.46	0.39	0.85	± 12.0 %
5250	35.9	4.71	5.17	5.17	5.17	0.35	1.80	± 13.1 %
5600	35.5	5.07	4.46	4.46	4.46	0.40	1.80	± 13.1 %
5750	35.4	5.22	4.68	4.68	4.68	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. 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.

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

Calibration Parameter Determined in Body Tissue Simulating Media

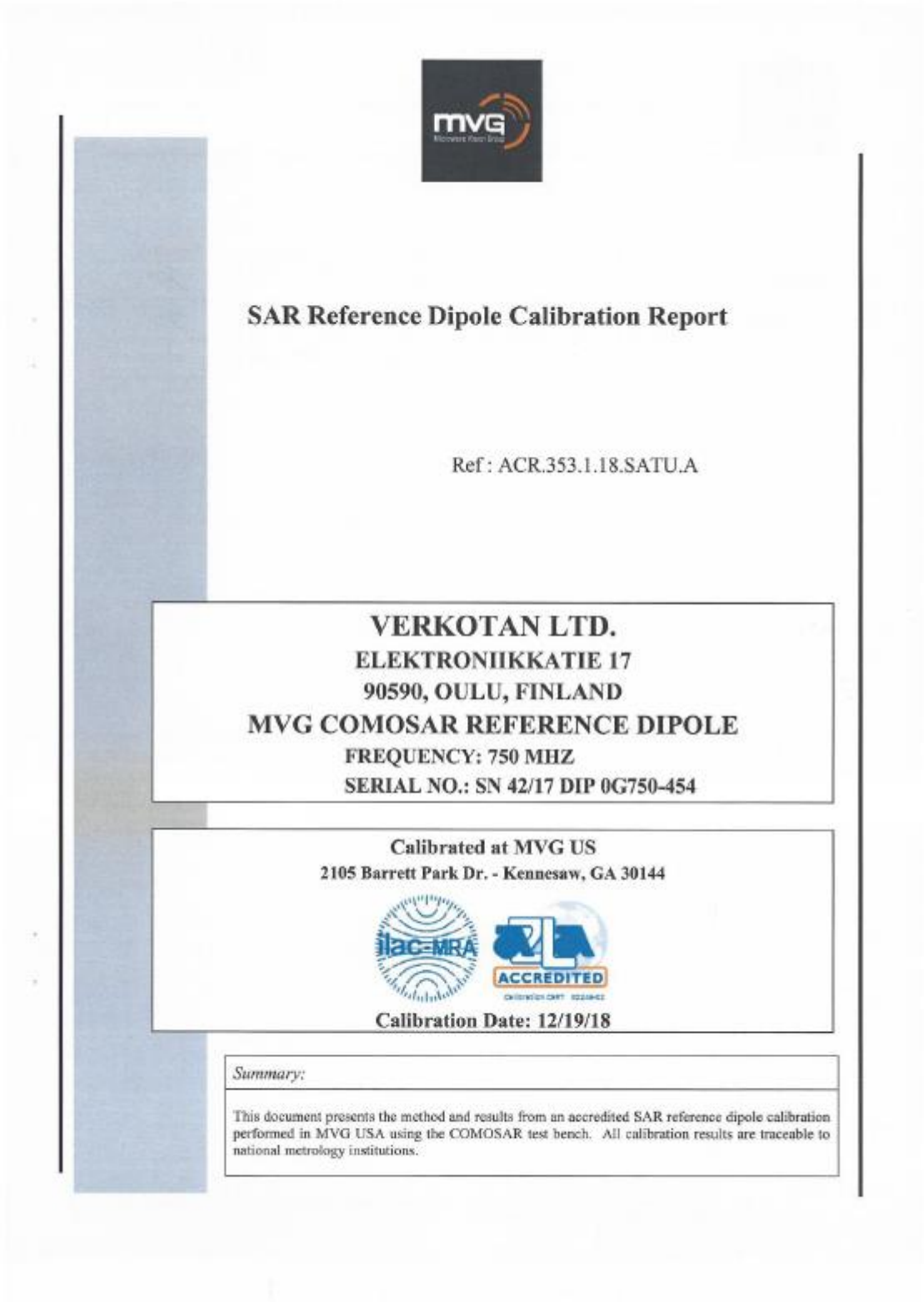
f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
750	55.5	0.96	10.20	10.20	10.20	0.56	0.80	± 12.0 %
900	55.0	1.05	9.89	9.89	9.89	0.41	0.96	± 12.0 %
1750	53.4	1.49	8.25	8.25	8.25	0.36	0.87	± 12.0 %
1950	53.3	1.52	8.12	8.12	8.12	0.35	0.85	± 12.0 %
2450	52.7	1.95	7.68	7.68	7.68	0.39	0.90	± 12.0 %
2600	52.5	2.16	7.48	7.48	7.48	0.25	1.05	± 12.0 %
5250	48.9	5.36	4.36	4.36	4.36	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.74	3.74	3.74	0.50	1.90	± 13.1 %
5750	48.3	5.94	4.05	4.05	4.05	0.50	1.90	± 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. Above 5 GHz frequency validity can be extended to ± 110 MHz.

[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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

APPENDIX E: RELEVANT PAGES FROM DIPOLE CALIBRATION REPORTS



mvg

SAR Reference Dipole Calibration Report

Ref : ACR.353.1.18.SATU.A

VERKOTAN LTD.
ELEKTRONIIKKATIE 17
90590, OULU, FINLAND
MVG COMOSAR REFERENCE DIPOLE
FREQUENCY: 750 MHZ
SERIAL NO.: SN 42/17 DIP 0G750-454

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

ilac-MRA ACCREDITED

Calibration Date: 12/19/18

Summary:

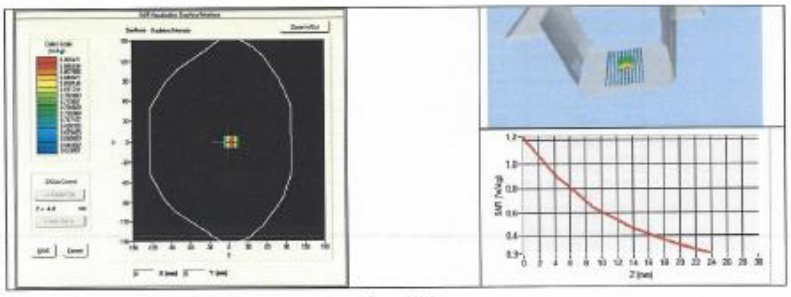
This document presents the method and results from an accredited SAR reference dipole calibration performed in MVG USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.

2300	52.9 ±5 %		1.81 ±5 %	
2450	52.7 ±5 %		1.95 ±5 %	
2600	52.5 ±5 %		2.16 ±5 %	
3000	52.0 ±5 %		2.73 ±5 %	
3500	51.3 ±5 %		3.31 ±5 %	
3700	51.0 ±5 %		3.55 ±5 %	
5200	49.0 ±10 %		5.30 ±10 %	
5300	48.9 ±10 %		5.42 ±10 %	
5400	48.7 ±10 %		5.53 ±10 %	
5500	48.6 ±10 %		5.65 ±10 %	
5600	48.5 ±10 %		5.77 ±10 %	
5800	48.2 ±10 %		6.00 ±10 %	

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: eps' : 56.8 sigma : 1.00
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	750 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
750	8.73 (0.87)	5.83 (0.58)



SAR Reference Dipole Calibration Report

Ref : ACR.165.29.17.SATU.A

VERKOTAN LTD.
ELEKTRONIIKKATIE 17
90590, OULU, FINLAND
SAR REFERENCE DIPOLE
FREQUENCY: 835 MHZ
SERIAL NO.: D835V2-455

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

ilac-MRA A2LA ACCREDITED

Calibration Date: 06/14/17

Summary:

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

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

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

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

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 40.0 sigma : 0.90
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	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56	9.46 (0.95)	6.22	6.08 (0.61)
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	

SAR Reference Dipole Calibration Report

Ref : ACR.165.30.17.SATU.A

VERKOTAN LTD.
ELEKTRONIIKKATIE 17
90590, OULU, FINLAND
SAR REFERENCE DIPOLE
FREQUENCY: 1800 MHZ
SERIAL NO.: D1800V2-2D075

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

ilac-MRA A2LA ACCREDITED Calibration CERT #2246-02

Calibration Date: 06/14/17

Summary:

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

835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.	PASS	41.7 ±1 %.	PASS	3.6 ±1 %.	PASS
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7±1 %.		26.4 ±1 %.		3.6 ±1 %.	

7 VALIDATION MEASUREMENT

The IEEE Std. 1528, FCC KDBs and CEI/IEC 62209 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.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ε_r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	43.5 ±5 %		0.87 ±5 %	
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %		0.90 ±5 %	
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	
1800	40.0 ±5 %	PASS	1.40 ±5 %	PASS
1900	40.0 ±5 %		1.40 ±5 %	

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

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

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

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 41.7 sigma : 1.46
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	1800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4	38.01 (3.80)	20.1	20.02 (2.00)
1900	39.7		20.5	
1950	40.5		20.9	

SAR Reference Dipole Calibration Report

Ref : ACR.165.31.17.SATU.A

VERKOTAN LTD.
ELEKTRONIIKKATIE 17
90590, OULU, FINLAND
SAR REFERENCE DIPOLE
FREQUENCY: 1900 MHZ
SERIAL NO.: D1900V2-5D004

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

ACCREDITED

Calibration Date: 06/14/17

Summary:

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

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

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

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

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 38.5 sigma : 1.45
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	1900 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7	39.74 (3.97)	20.5	20.44 (2.04)
1950	40.5		20.9	

APPENDIX F: TRANSMISSION DUTY CYCLE CALCULATIONS FROM THE CUSTOMER

ZenO Lite Clarity Transmitter Duty Cycle Calculations

Revision	Release Date	ECO No	Created by	Approved	Notes
1	19/03/2019	E1082	W Turner		First Draft

Device Functionality:

Zeno Lite Clarity has 2 transmitter systems: PLS62W capable of worldwide LTE/UMTS/GPRS and BGM123A for Bluetooth Low Energy 4.2. The power levels of Bluetooth Low Energy are such that no duty cycle calculation is necessary to meet the required limits.

FCC Section 15.255 (b):

Total Transmitted Data Calculations:

The Zeno Lite Clarity has several purposes for data transmission via the PLS62W cellular modem and the total data volume and connection speed dictates the transmission times. The largest amount of data sent in a 6 minute transmission period would be a device firmware upgrade, limited by available device memory to less than 512kB of actual data. This data may be partially encrypted increasing that, along with overheads and padding, to a total worst case of no more than 750kB. A device upgrade is a rare occurrence of perhaps once per month. Normal operation only consumes up to 50kB per day in a single upload.

GPRS

Although a single GPRS timeslot has a theoretical maximum data rate of 21.4kbps and as the Zeno Lite Clarity modem can support up to Class 12 it could have 4 active transmit timeslots, giving 85.6kbps. But at worst signal and highest transmit power it will more likely be only 8.0kbps. Over a 6 minute period that gives 2880kbits or 360kB total download capability. Using the maximum data volumes above of 750kB and 50kB in 6 minutes gives:
GPRS worst case device upgrade duty ratio of 100%.
GPRS normal operation maximum duty cycle of 13.9%.

WCDMA / UMTS

At longer ranges, i.e. maximum transmit power, WCDMA/UMTS is capable of 384kbps. This allows up to 17280kB in 6 minutes. As above same 750kB and 50kB maximum of data volumes in 6 minutes gives:
WCDMA / UMTS worst case device upgrade duty ratio of 4.34%.
WCDMA / UMTS normal operation maximum duty cycle of 0.3%.

LTE Cat 1

LTE category 1 is capped at 10Mbps but at longer ranges, i.e. maximum transmit power, we are assuming it is only 10% of that data rate thus 1Mbps, i.e. 46080kB in 6 minutes. As above same 750kB and 50kB maximum of data volumes in 6 minutes gives:
LTE Cat 1 worst case device upgrade duty ratio of 1.628%.
LTE Cat 1 normal operation maximum duty cycle of 0.1%.

