SAR Compliance Test Report

Date of Report	3/08/2020	**Client's Contact person:**	Will Turner
Number of pages:	62	**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		
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:

For the contents:

03.08.2020

Miia Nurkkala

Digitaalinen allekirjoittaja: Miia Nurkkala
Päiväys: 2020.08.03 16:14:12 +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
Manufacturer:	GCE Group
Serial Number:	(01)08592346679832 ZC101006
FCC ID Number:	2AOL9-RS500C4G1 QOQ13
Model:	RS-00500C
DUT Number:	22263
Battery Type used in testing:	14.4V Lithium Ion Battery; Nom 6.6Ah 97Wh
Portable/ Mobile device	Portable
State of the Sample	Production sample

Testing information:

Testing Performed:	06.07.2020 – 15.07.2020
Notes:	-
Document ID:	FCC SAR report_Zeno_ID3640_30072020
Temperature °C	22±2 / Controlled
Humidity RH%	20±20 / Controlled
Measurement performed by:	Kirsi Kyllönen, Jesper Varis

1.2 Maximum Results

The maximum reported* SAR value for Body-worn 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 Body is SAR_{1g} 1.6 W/kg.

System	Equipment Class	Highest Reported* SAR_{1g}(W/kg) in Body-Worn Condition, 4mm separation	Result
GPRS 850	**PCT**	**0.712**	**PASS**
GPRS 1900	**PCT**	**0.454**	**PASS**
WCDMA 2	**PCT**	**0.040**	**PASS**
WCDMA 4	**PCT**	**0.035**	**PASS**
WCDMA 5	**PCT**	**0.034**	**PASS**
LTE 2	**PCT**	**0.015**	**PASS**
LTE 4	**PCT**	**0.011**	**PASS**
LTE 5	**PCT**	**0.04**	**PASS**
LTE 12	**PCT**	**0.04**	**PASS**
LTE 17	**PCT**	**0.04**	**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 4mm 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, 4mm separation	Result
Bluetooth + GPRS 850	**0.742**	**PASS**

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

1.2.1 Maximum Drift

Maximum Drift During Measurements	0.33dB*

*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 5.0	2400-2483.5

2.2 SAR Test exclusions

2.2.1 Separations

SAR test exclusions based on antenna location were made to according to KDB 447498 D01.

While in use the DUT is placed into a carry-bag. The DUT's carry-bag shown in figure 1, provides following separation distances from the user to the surface of the device:
Top – 6mm
Bottom – 4mm
Front – 6mm
Right – 4mm
Back – 4mm
Left – 4mm

Figure 1 The carry-bag for Zen-O

Cellular antenna separations to each edge of the device are following:
Top – 12mm
Bottom – 172mm
Front – 150mm
Right – 200mm
Back – 11mm
Left – 13mm

Figure 2 The drawing of the location of the antenna

Bluetooth antenna separations to each edge of the device are following:
Top – 35mm
Bottom – 265mm
Front – 95mm
Right – 82mm
Back – 65mm
Left – 113mm

The distances used for exemption evaluation is the distance from antenna to the edge of the device plus the separation distance provided by the carry-bag:

Cellular antenna;
Top – 18mm
Bottom – 176mm
Front – 156mm
Right – 204mm
Back – 15mm
Left – 17mm

BLE antenna;
All sides≥41mm

2.2.2 BLE SAR test exclusion

According to appendix A of 447498D01 the SAR test exclusion power threshold for 2450MHz is 77mW at ≤41mm separation distance. The maximum output power of the Bluetooth transmitter is 6.3mW thus it is below the test exclusion threshold.

2.2.2.1 Cellular Technologies SAR test exclusion

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.

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)·(f(MHz)/150)]} mW, for 100 MHz to 1500 MHz, separation distances >50mm

{[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

The duty cycles that DUT is utilizing are taken in account for time averaged output power. The maximum duty cycles for technologies are: 100% for GPRS, 4.34% for WCDMA and 1.628% for LTE.

Table 1 The SAR test exemption table

Separation distances <=50mm							
Test Position	**Operation mode**	**Frequency [GHz] (high channel)**	**Max time avg power (including tune-up tolerance) [dBm]**	**Max time avg power [mW]**	**Antenna to edge distance [mm]**	**Result (4.3.1 a)**	**SAR test required (<=3.0)**
Back	GPRS 850 2tx	0.8488	25.5	355	15	21.8	**yes**
Back	GPRS 1900 2tx	1.9098	22.5	178	15	16.4	**yes**
Back	WCDMA II	1.9076	11.37	13.7	15	1.3	**no**
Back	WCDMA IV	1.7526	11.37	13.7	15	1.2	**no**
Back	WCDMA V	0.8466	11.37	13.7	15	0.8	**no**
Back	LTE 2	1.91	7.07	5.2	15	0.5	**no**

Back	LTE 4	1.755	7.07	5.2	15	0.5	no
Back	LTE 5	0.849	7.07	5.2	15	0.3	no
Back	LTE 12	0.716	7.07	5.2	15	0.3	no
Back	LTE 17	0.716	7.07	5.2	15	0.2	no
Top	GPRS 850 2tx	0.8488	25.5	355	18	18.2	yes
Top	GPRS 1900 2tx	1.9098	22.5	178	18	13.7	yes
Top	WCDMA II	1.9076	11.37	13.7	18	1.1	no
Top	WCDMA IV	1.7526	11.37	13.7	18	1	no
Top	WCDMA V	0.8466	11.37	13.7	18	0.7	no
Top	LTE 2	1.91	7.07	5.2	18	0.4	no
Top	LTE 4	1.755	7.07	5.2	18	0.4	no
Top	LTE 5	0.849	7.07	5.2	18	0.3	no
Top	LTE 12	0.716	7.07	5.2	18	0.2	no
Top	LTE 17	0.716	7.07	5.2	18	0.2	no
Left	GPRS 850 2tx	0.8488	25.5	355	17	8.4	yes
Left	GPRS 1900 2tx	1.9098	22.5	178	17	6.3	yes
Left	WCDMA II	1.9076	11.37	13.7	17	0.5	no
Left	WCDMA IV	1.7526	11.37	13.7	17	0.5	no
Left	WCDMA V	0.8466	11.37	13.7	17	0.3	no
Left	LTE 2	1.91	7.07	5.2	17	0.2	no
Left	LTE 4	1.755	7.07	5.2	17	0.2	no
Left	LTE 5	0.849	7.07	5.2	17	0.1	no
Left	LTE 12	0.716	7.07	5.2	17	0.1	no
Left	LTE 17	0.716	7.07	5.2	17	0.1	no

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]**	**Threshold (4.3.1 b) [mW]**	**SAR test required (power > threshold)**
Right	GPRS 850 2tx	0.8488	25.5	355	204	1029	no
Right	GPRS 1900 2tx	1.9098	22.5	178	204	1649	no
Right	WCDMA II	1.9076	11.37	13.7	204	1649	no
Right	WCDMA IV	1.7526	11.37	13.7	204	1649	no
Right	WCDMA V	0.8466	11.37	5.2	204	1027	no
Right	LTE 2	1.91	7.07	5.2	204	1649	no
Right	LTE 4	1.755	7.07	5.2	204	1649	no
Right	LTE 5	0.849	7.07	5.2	204	1030	no
Right	LTE 12	0.716	7.07	5.2	204	893	no

Right	LTE 17	0.716	7.07	5.2	204	893	**no**
Bottom	GPRS 850	0.8488	25.5	355	176	871	**no**
Bottom	GPRS 1900	1.9098	22.5	178	176	1369	**no**
Bottom	WCDMA II	1.9076	11.37	13.7	176	1369	**no**
Bottom	WCDMA IV	1.7526	11.37	13.7	176	1369	**no**
Bottom	WCDMA V	0.8466	11.37	13.7	176	869	**no**
Bottom	LTE 2	1.91	7.07	5.2	176	1369	**no**
Bottom	LTE 4	1.755	7.07	5.2	176	1369	**no**
Bottom	LTE 5	0.849	7.07	5.2	176	871	**no**
Bottom	LTE 12	0.716	7.07	5.2	176	759	**no**
Bottom	LTE 17	0.716	7.07	5.2	176	759	**no**
Front	GPRS 850 2tx	0.8488	25.5	355	156	758	**no**
Front	GPRS 1900 2tx	1.9098	22.5	178	156	1169	**no**
Front	WCDMA II	1.9076	11.37	13.7	156	1169	**no**
Front	WCDMA IV	1.7526	11.37	13.7	156	1169	**no**
Front	WCDMA V	0.8466	11.37	13.7	156	756	**no**
Front	LTE 2	1.91	7.07	5.2	156	1169	**no**
Front	LTE 4	1.755	7.07	5.2	156	1169	**no**
Front	LTE 5	0.849	7.07	5.2	156	758	**no**
Front	LTE 12	0.716	7.07	5.2	156	664	**no**
Front	LTE 17	0.716	7.07	5.2	156	664	**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, 2Tx-slot)	31.5
GPRS 1900 (GMSK, 2Tx-slot)	28.5

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 5.0	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 190 836.6 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)	33.0	32.96	33.4	30.3	30.23	30.81
GPRS (GMSK, 2Tx-slot)	30.47	30.42	30.94	27.47	27.4	28.18
GPRS (GMSK, 3Tx-slot)	28.62	28.5	29.0	25.66	25.6	26.3
GPRS (GMSK, 4Tx-slot)	27.38	27.32	27.78	24.42	24.38	25.05
EDGE (8PSK, 1Tx-slot)	26.9	26.83	26.78	26.04	25.92	25.96
EDGE (8PSK, 2Tx-slot)	24.46	24.41	24.28	23.55	23.52	23.51
EDGE (8PSK, 3Tx-slot)	22.67	22.54	22.51	21.78	21.75	21.68
EDGE (8PSK, 4Tx-slot)	21.49	21.46	21.35	20.62	20.56	20.51

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	24	23.96	24.4	21.3	21.23	21.81
GPRS 2-slot	**24.47**	**24.42**	**24.94**	**21.47**	**21.4**	**22.18**
GPRS 3-slot	24.36	24.24	24.74	21.4	21.34	22.04
GPRS 4-slot	24.38	24.32	24.78	21.42	21.38	22.05
EDGE 1-slot	17.9	17.83	17.78	17.04	16.92	16.96
EDGE 2-slot	18.46	18.41	18.28	17.55	17.52	17.51
EDGE 3-slot	18.41	18.28	18.25	17.52	17.49	17.42
EDGE 4-slot	18.49	18.46	18.35	17.62	17.56	17.51

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	22.88	23.03	22.89	0	22.04	22.19	22.16	1
	1	2	22.81	23.07	22.84	0	22.01	22.2	22.11	1
	1	5	22.84	23.01	22.79	0	21.95	22.17	22.13	1
	3	0	22.88	23.06	22.88	0	21.93	22.11	21.97	1
	3	1	22.88	22.99	22.89	0	22.0	22.09	22.01	1
	3	3	22.9	23.02	22.87	0	21.91	22.07	22.02	1
	6	0	21.83	22.05	21.88	1	20.81	21.04	20.92	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	22.89	23.08	22.97	0	22.09	22.28	22.04	1
	1	7	22.89	23.02	22.92	0	22.06	22.13	22.05	1
	1	14	22.81	22.98	22.85	0	21.91	22.1	21.94	1
	8	0	21.92	22.1	22.02	1	20.9	21.07	20.95	2
	8	3	21.94	22.11	22.03	1	20.88	21.04	20.89	2
	8	7	21.87	22.04	21.95	1	20.85	21.02	20.84	2
	15	0	21.89	22.08	21.96	1	20.83	21.02	20.87	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	22.9	23.1	23.02	0	22.1	22.32	22.16	1
	1	12	22.94	23.06	22.94	0	22.08	22.25	22.23	1
	1	24	22.78	22.96	22.83	0	21.99	22.11	22.04	1
	12	0	21.95	22.14	22.08	1	20.91	21.06	21.01	2
	12	6	21.89	22.06	22.0	1	20.87	21.04	20.93	2
	12	13	21.87	22.03	21.95	1	20.84	21.02	20.95	2
	25	0	21.87	22.07	22.0	1	20.86	21.09	21.03	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	23.15	23.33	23.23	0	22.38	22.7	22.49	1
	1	24	22.92	23.08	23.02	0	22.21	22.27	22.2	1
	1	49	22.88	23.0	22.87	0	22.09	22.36	22.14	1
	25	0	22.08	22.24	22.18	1	21.06	21.29	21.18	2
	25	12	21.96	22.11	22.05	1	20.93	21.11	21.05	2
	25	25	21.93	22.06	22.01	1	20.91	21.09	21.01	2
	50	0	22.04	22.13	22.08	1	21.0	21.16	21.06	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	23.47	23.63	23.48	0	22.58	22.71	22.84	1
	1	37	23.08	23.18	23.05	0	22.25	22.25	22.22	1
	1	74	23.06	23.12	22.89	0	22.14	22.13	22.33	1
	36	0	22.33	22.45	22.36	1	21.16	21.27	21.36	2
	36	19	22.11	22.22	22.15	1	20.98	21.08	21.11	2
	36	39	22.11	22.2	22.07	1	20.91	21.03	21.07	2
	75	0	22.25	22.34	22.23	1	21.08	21.19	21.24	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	23.28	**23.56**	23.42	0	22.43	22.77	22.61	1
	1	50	22.88	23.1	22.99	0	22.04	22.21	22.11	1
	1	99	22.67	22.85	22.69	0	21.93	22.01	21.82	1
	50	0	22.26	22.43	22.4	1	21.2	21.35	21.36	2
	50	25	22.01	22.14	22.08	1	20.95	21.08	21.03	2
	50	50	21.94	22.1	22.05	1	20.9	21.05	20.95	2
	100	0	22.12	22.31	22.18	1	21.04	21.19	21.14	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	23.4	23.32	23.25	0	22.57	22.46	22.26	1
	1	2	23.37	23.26	23.22	0	22.51	22.42	22.21	1
	1	5	23.36	23.25	23.25	0	22.47	22.37	22.21	1
	3	0	23.42	23.3	23.29	0	22.43	22.29	22.23	1
	3	1	23.4	23.35	23.32	0	22.47	22.26	22.26	1
	3	3	23.43	23.29	23.29	0	22.42	22.23	22.25	1
	6	0	22.38	22.24	22.17	1	21.34	21.19	21.11	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	23.38	23.29	23.24	0	22.47	22.38	22.22	1
	1	7	23.34	23.21	23.24	0	22.46	22.33	22.34	1
	1	14	23.29	23.14	23.13	0	22.37	22.25	22.19	1
	8	0	22.37	22.24	22.19	1	21.27	21.17	21.11	2
	8	3	22.36	22.18	22.15	1	21.26	21.14	21.12	2
	8	7	22.31	22.17	22.12	1	21.25	21.11	21.08	2
	15	0	22.31	22.18	22.15	1	21.28	21.09	21.05	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	23.37	23.3	23.22	0	22.5	22.36	22.34	1
	1	12	23.32	23.22	23.18	0	22.43	22.26	22.35	1
	1	24	23.24	23.06	23.08	0	22.29	22.2	22.13	1
	12	0	22.37	22.27	22.18	1	21.31	21.19	21.15	2
	12	6	22.31	22.21	22.13	1	21.24	21.09	21.1	2
	12	13	22.27	22.14	22.1	1	21.24	21.07	21.06	2
	25	0	22.27	22.18	22.1	1	21.28	21.15	21.06	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	23.59	23.53	23.41	0	22.73	22.62	22.54	1
	1	24	23.31	23.21	23.15	0	22.43	22.35	22.27	1
	1	49	23.25	23.07	23.09	0	22.35	22.2	22.22	1
	25	0	22.45	22.34	22.24	1	21.42	21.28	21.24	2
	25	12	22.31	22.16	22.15	1	21.26	21.16	21.1	2
	25	25	22.24	22.1	22.09	1	21.22	21.05	21.04	2
	50	0	22.37	22.2	22.18	1	21.3	21.17	21.12	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	23.74	23.75	23.57	0	23.01	22.92	22.7	1
	1	37	23.45	23.28	23.21	0	22.56	22.24	22.27	1
	1	74	23.16	23.06	23.08	0	22.36	22.25	22.24	1
	36	0	22.56	22.48	22.38	1	21.53	21.44	21.34	2
	36	19	22.37	22.24	22.18	1	21.32	21.16	21.13	2
	36	39	22.27	22.14	22.11	1	21.21	21.09	21.06	2
	75	0	22.43	22.32	22.25	1	21.38	21.24	21.22	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	**23.72**	23.71	23.57	0	22.83	22.8	22.62	1
	1	50	23.26	23.14	23.02	0	22.34	22.21	22.07	1
	1	99	22.89	22.75	22.83	0	22.0	21.87	21.88	1
	50	0	22.59	22.5	22.39	1	21.52	21.43	21.31	2
	50	25	22.3	22.16	22.08	1	21.24	21.12	20.99	2
	50	50	22.16	22.06	22.02	1	21.11	20.97	20.94	2
	100	0	22.39	22.3	22.24	1	21.33	21.2	21.17	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	23.27	23.07	23.16	0	22.23	22.11	22.14	1
	1	2	23.22	23.05	23.1	0	22.21	22.16	22.16	1
	1	5	23.27	23.08	23.07	0	22.25	22.07	22.24	1
	3	0	23.27	23.07	23.11	0	22.25	22.05	22.1	1
	3	1	23.25	23.1	23.15	0	22.25	22.02	22.09	1
	3	3	23.24	23.09	23.09	0	22.22	21.99	22.2	1
	6	0	22.21	22.08	22.13	1	21.23	21.02	21.12	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	23.2	23.01	23.1	0	22.17	22.07	22.09	1
	1	7	23.23	23.0	23.06	0	22.25	22.09	22.23	1
	1	14	23.12	22.97	22.95	0	22.22	22.05	22.12	1
	8	0	22.18	21.99	22.03	1	21.22	21.0	21.12	2
	8	3	22.17	21.98	22.0	1	21.19	21.03	21.12	2
	8	7	22.13	21.95	22.01	1	21.19	21.01	21.08	2
	15	0	22.16	21.97	22.03	1	21.17	20.93	21.02	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	23.15	22.97	22.63	0	22.17	22.08	22.01	1
	1	12	23.14	22.99	23.04	0	22.17	22.09	22.14	1
	1	24	23.04	22.91	22.91	0	22.1	21.97	22.06	1
	12	0	22.14	21.98	21.69	1	21.17	20.98	21.06	2
	12	6	22.11	21.96	22.02	1	21.07	20.95	21.05	2
	12	13	22.08	21.92	22.0	1	21.06	20.98	20.57	2
	25	0	22.07	21.94	21.98	1	21.12	20.98	18.87	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	**23.23**	23.02	20.78	0	22.26	22.08	21.98	1
	1	24	23.04	22.98	21.35	0	22.15	22.07	22.1	1
	1	49	22.92	22.89	22.42	0	21.99	21.94	21.59	1
	25	0	22.1	21.96	20.83	1	21.18	20.98	20.97	2
	25	12	22.03	21.97	18.44	1	21.09	20.94	21.04	2
	25	25	21.97	21.89	22.0	1	21.07	20.93	21.05	2
	50	0	22.08	21.95	16.36	1	21.07	20.92	21.04	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	23.19	23.09	22.98	0	22.29	22.23	22.17	1
	1	2	23.18	23.1	22.93	0	22.34	22.3	22.16	1
	1	5	23.2	23.07	22.93	0	22.31	22.32	22.13	1
	3	0	23.18	23.13	22.94	0	22.26	22.19	22.03	1
	3	1	23.19	23.12	22.93	0	22.28	22.2	22.05	1
	3	3	23.2	23.12	22.92	0	22.35	22.2	22.06	1
	6	0	22.23	22.17	21.99	1	21.28	21.2	21.03	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	23.11	23.04	22.87	0	22.27	22.16	22.08	1
	1	7	23.13	23.0	22.88	0	22.4	22.16	22.03	1
	1	14	23.1	22.96	22.84	0	22.36	22.12	22.0	1
	8	0	22.19	22.1	21.99	1	21.28	21.2	21.06	2
	8	3	22.19	22.09	21.95	1	21.27	21.13	21.01	2
	8	7	22.2	22.08	21.96	1	21.33	21.16	21.05	2
	15	0	22.2	22.07	21.95	1	21.25	21.14	20.98	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	23.07	23.07	22.86	0	22.27	22.19	22.09	1
	1	12	23.11	23.03	22.84	0	22.29	22.2	22.08	1
	1	24	23.08	22.9	22.85	0	22.24	22.12	21.99	1
	12	0	22.17	22.13	21.98	1	21.27	21.19	21.01	2
	12	6	22.17	22.09	21.95	1	21.25	21.13	21.01	2
	12	13	22.15	22.06	21.91	1	21.23	21.11	20.99	2
	25	0	22.14	22.07	21.95	1	21.21	21.16	21.01	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	23.12	23.11	23.12	0	22.36	22.41	22.3	1
	1	24	**23.13**	23.07	22.93	0	22.37	22.31	22.19	1
	1	49	22.99	22.85	22.9	0	22.22	22.17	22.04	1
	25	0	22.22	22.14	22.13	1	21.28	21.21	21.18	2
	25	12	22.17	22.1	21.99	1	21.18	21.16	21.08	2
	25	25	22.13	22.01	21.97	1	21.17	21.13	21.06	2
	50	0	22.18	22.08	22.07	1	21.2	21.17	21.1	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.

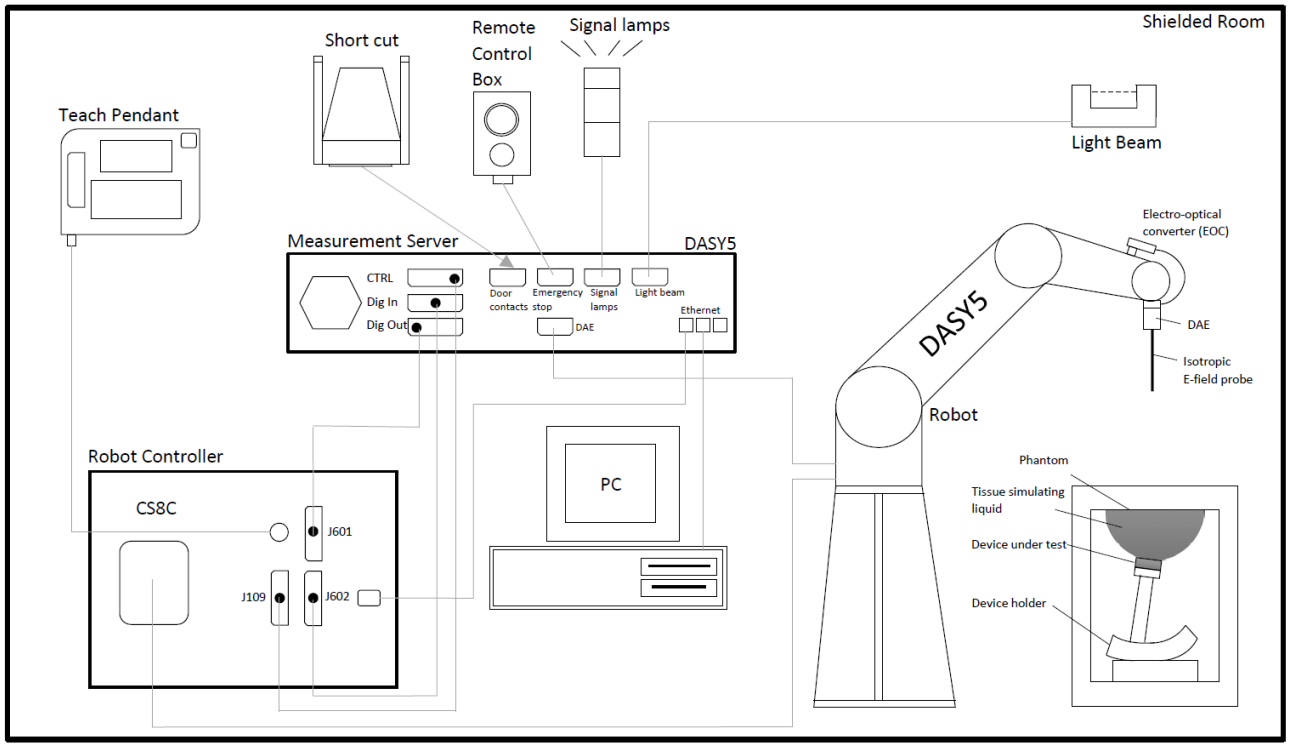


Figure 3 Schematic Laboratory Picture

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	705	04.2020
Probe	EX3DV4	7447	03.2020
Dipole	D835V2	448	03.2020
Dipole	D1800V2	249	03.2020
Dipole	D1900V2	511	03.2020
DASY5 Software	52.8.8.1258	-	NA
Communication tester	Anritsu MT8820C	6200883099	08.2019
Signal generator	Agilent E4438C	MY42082527	NA
Amplifier	Ophir 5163F	1022	NA
Power Reflection Meter	NRT	835065/049	02.2020
Directional Power Sensor	NRT-Z44	835374/021	02.2020

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.

Head 600-6000 MHz tissue simulant liquid Ingredients
Deionized water, oil, salt, emulsifiers

4.4 System Validation Status

Frequency [MHz]	Dipole Type / SN	Probe Type / SN	Calibrated Signal Type	DAE Unit / SN	Dielectric Constant	Conductivity σ [S/m]	Validation Done
							Head tissue simulant
835	D835V2 - SN: 473	EX3DV4 - SN: 7447	CW/GMSK	DAE 4 / 756	40.96	0.89	04.2020
1800	D1800V2 - SN: 2D075	EX3DV4 - SN: 7447	CW/GMSK	DAE 4 / 756	39.8	1.39	04.2020
1900	D1900V2-SN:5D004	EX3DV4 - SN: 7447	CW/FDD	DAE 4 / 756	39.61	1.45	04.2020

4.5 System Check

Date	Tissue Type	Tissue Temp. [°C]	Frequency [MHz]	Input Power [mW]	Measured SAR_{1g} [W/kg]	1 W Target SAR_{1g} [W/kg]	1 W Normalized SAR_{1g} [W/kg]	Deviation 1g [%]	Plot #
7.7.2020	WB HEAD	22±2	1900	250	10	37.1	40	7.8	1
8.7.2020	WB HEAD	22±2	1900	250	10.2	37.1	40.8	9.9	2
9.7.2020	WB HEAD	22±2	1800	250	9.1	39.21	36.4	-7.2	3
9.7.2020	WB HEAD	22±2	1900	250	10	37.1	40	7.8	4
13.7.2020	WB HEAD	22±2	1800	250	9.29	39.21	37.16	-5.2	5
13.7.2020	WB HEAD	22±2	835	250	2.45	9.38	9.8	4.48	6
14.7.2020	WB HEAD	22±2	835	250	2.44	9.38	9.76	4.05	7

4.5.1 Tissue Simulant Verification

				Target		Measured		Deviation	
Date	Tissue Type	Tissue Temp [°C]	Frequency [MHz]	Dielectric Constant [ε]	Conductivity σ [S/m]	Dielectric Constant [ε]	Conductivity σ [S/m]	ε (%)	σ (%)
07.07.2020	WB Head	22	1850	40	1.4	38.36	1.41	-4.1	0.5
07.07.2020	WB Head	22	1852	40	1.4	38.36	1.41	-4.1	0.6
07.07.2020	WB Head	22	1880	40	1.4	38.32	1.43	-4.2	1.8
07.07.2020	WB Head	22	1900	40	1.4	38.29	1.44	-4.3	2.7
07.07.2020	WB Head	22	1908	40	1.4	38.28	1.44	-4.3	3.0
07.07.2020	WB Head	22	1910	40	1.4	38.28	1.44	-4.3	3.1
08.07.2020	WB Head	22	1850	40	1.4	37.87	1.42	-5.3	1.3
08.07.2020	WB Head	22	1852	40	1.4	37.87	1.42	-5.3	1.4
08.07.2020	WB Head	22	1860	40	1.4	37.86	1.42	-5.4	1.7
08.07.2020	WB Head	22	1880	40	1.4	37.83	1.44	-5.4	2.5
08.07.2020	WB Head	22	1900	40	1.4	37.79	1.45	-5.5	3.3
08.07.2020	WB Head	22	1908	40	1.4	37.78	1.45	-5.6	3.7
08.07.2020	WB Head	22	1910	40	1.4	37.77	1.45	-5.6	3.8
09.07.2020	WB Head	22	1713	40.14	1.35	38.63	1.33	-3.7	-1.7
09.07.2020	WB Head	22	1720	40.13	1.35	38.63	1.33	-3.7	-1.7
09.07.2020	WB Head	22	1732.5	40.11	1.36	38.6	1.34	-3.7	-1.7
09.07.2020	WB Head	22	1733	40.11	1.36	38.6	1.34	-3.7	-1.7
09.07.2020	WB Head	22	1745	40.09	1.37	38.59	1.35	-3.7	-1.7
09.07.2020	WB Head	22	1753	40.07	1.37	38.57	1.35	-3.7	-1.7
09.07.2020	WB Head	22	1800	40	1.4	38.5	1.37	-3.8	-1.8
09.07.2020	WB Head	22	1852	40	1.4	38.42	1.4	-3.9	0.3
09.07.2020	WB Head	22	1880	40	1.4	38.38	1.42	-4.1	1.5
09.07.2020	WB Head	22	1900	40	1.4	38.35	1.43	-4.1	2.4
09.07.2020	WB Head	22	1908	40	1.4	38.34	1.44	-4.2	2.7
13.07.2020	WB Head	22	824	41.59	0.91	40.33	0.91	-3.0	0.9
13.07.2020	WB Head	22	826	41.59	0.91	40.33	0.92	-3.0	0.9
13.07.2020	WB Head	22	835	41.55	0.91	40.3	0.92	-3.0	0.9
13.07.2020	WB Head	22	836	41.55	0.91	40.3	0.92	-3.0	0.9

13.07.2020	WB Head	22	837	41.55	0.91	40.29	0.92	-3.0	0.9
13.07.2020	WB Head	22	847	41.51	0.92	40.25	0.92	-3.0	0.9
13.07.2020	WB Head	22	849	41.5	0.92	40.25	0.92	-3.0	0.9
13.07.2020	WB Head	22	1713	40.14	1.35	38.54	1.32	-4.0	-2.0
13.07.2020	WB Head	22	1720	40.13	1.35	38.52	1.33	-4.0	-2.0
13.07.2020	WB Head	22	1732.6	40.11	1.36	38.49	1.33	-4.0	-2.0
13.07.2020	WB Head	22	1733	40.11	1.36	38.49	1.33	-4.0	-2.0
13.07.2020	WB Head	22	1753	40.07	1.37	38.46	1.35	-4.0	-2.0
13.07.2020	WB Head	22	1800	40	1.4	38.4	1.37	-4.0	-1.9
14.07.2020	WB Head	22	824	41.59	0.91	39.93	0.93	-4.0	2.5
14.07.2020	WB Head	22	826	41.59	0.91	39.93	0.93	-4.0	2.5
14.07.2020	WB Head	22	835	41.55	0.91	39.91	0.93	-4.0	2.5
14.07.2020	WB Head	22	836	41.55	0.91	39.9	0.93	-4.0	2.5
14.07.2020	WB Head	22	837	41.55	0.91	39.9	0.93	-4.0	2.5
14.07.2020	WB Head	22	847	41.51	0.92	39.86	0.94	-4.0	2.5
14.07.2020	WB Head	22	849	41.5	0.92	39.86	0.94	-4.0	2.5

5. TEST PROCEDURE

Testing was carried out in accordance with FCC KDB Publications 447498 D01.

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 on 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 inside while worn on a body.

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

back – 4 mm
front – 6 mm
top – 6 mm
bottom – 4mm
left – 4mm
right – 4mm

Figure 4 ZEN-O inside the carry bag, placed on the cart

For measuring the top position for the device, the battery cover/handle in the middle was removed in order to get the conservative test separation for testing.

The handle removed during testing

5.2 Test exemptions

The test exemption calculations are presented in table 1. For conservative evaluation of SAR, some bands exempted from SAR testing were measured.

5.3 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.

5.4 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	2	31.5	30.42	-0.14	Front, 6mm	1:4	0.0183	1.28	100	0.023	
GPRS850	190	2	31.5	30.42	-0.01	Back, 4mm	1:4	0.555	1.28	100	0.712	**8**
GPRS850	190	2	31.5	30.42	0.04	Left, 4mm	1:4	0.51	1.28	100	0.654	
GPRS850	190	2	31.5	30.42	0.04	Right, 4mm	1:4	0.0214	1.28	100	0.027	
GPRS850	190	2	31.5	30.42	-0.03	Top, 6mm	1:4	0.08	1.28	100	0.103	
GPRS850	190	2	31.5	30.42	-0.16	Bottom, 4mm	1:4	0.00622	1.28	100	0.008	
GPRS850	128	2	31.5	30.47	0.04	Back, 4mm	1:4	0.555	1.27	100	0.704	
GPRS850	251	2	31.5	30.94	-0.01	Back, 4mm	1:4	0.537	1.14	100	0.611	

*Larger than 5% drifts included to scaling factors

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	2	28.5	27.4	0.13	Back, 4mm	1:4	0.327	1.29	100	0.421	
GPRS1900	661	2	28.5	27.4	0.19	Left, 4mm	1:4	0.0531	1.29	100	0.068	
GPRS1900	661	2	28.5	27.4	0.33*	Top, 6mm	1:4	0.0263	1.39	100	0.037	
GPRS1900	512	2	28.5	27.47	-0.03	Back, 4mm	1:4	0.358	1.27	100	0.454	**9**
GPRS1900	810	2	28.5	28.18	0.01	Back, 4mm	1:4	0.384	1.08	100	0.413	

*Larger than 5% drifts included to scaling factors

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	22.89	0.07	Back, 4mm	1:1	0.552	1.63	4.34	0.039	
WCDMA 2	9400	RMC 12.2K	25	22.89	0.08	Top, 6mm	1:1	0.0512	1.63	4.34	0.004	
WCDMA 2	9400	RMC 12.2K	25	22.89	0.19	Left, 4mm	1:1	0.0992	1.63	4.34	0.007	
WCDMA 2	9262	RMC 12.2K	25	22.88	-0.24*	Back, 4mm	1:1	0.568	1.63	4.34	0.040	**10**
WCDMA 2	9538	RMC 12.2K	25	23.25	-0.07	Back, 4mm	1:1	0.572	1.50	4.34	0.037	

*Larger than 5% drifts included to scaling factors

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	23.36	-0.11	Back, 4mm	1:1	0.475	1.46	4.34	0.030	
WCDMA 4	1413	RMC 12.2K	25	23.36	0.09	Top, 6mm	1:1	0.0146	1.46	4.34	0.001	
WCDMA 4	1413	RMC 12.2K	25	23.36	-0.04	Left, 4mm	1:1	0.0982	1.46	4.34	0.006	
WCDMA 4	1312	RMC 12.2K	25	23.4	-0.09	Back, 4mm	1:1	0.363	1.45	4.34	0.023	
WCDMA 4	1513	RMC 12.2K	25	23.33	-0.17	Back, 4mm	1:1	0.546	1.47	4.34	0.035	**11**

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	23.29	0.05	Back, 4mm	1:1	0.511	1.48	4.34	0.033	
WCDMA 5	4183	RMC 12.2K	25	23.29	-0.04	Top, 6mm	1:1	0.0784	1.48	4.34	0.005	
WCDMA 5	4183	RMC 12.2K	25	23.29	0	Left, 4mm	1:1	0.408	1.48	4.34	0.026	
WCDMA 5	4132	RMC 12.2K	25	23.29	-0.02	Back, 4mm	1:1	0.536	1.48	4.34	0.034	**12**
WCDMA 5	4233	RMC 12.2K	25	23.16	0.02	Back, 4mm	1:1	0.454	1.53	4.34	0.030	

*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	18900	20	1	0	25	23.56	-0.1	Back, 4mm	1:1	0.526	1.39	1.628	0.012	
LTE 2	18900	20	50	0	25	22.43	0.07	Back, 4mm	1:1	0.421	1.81	1.628	0.012	
LTE 2	18900	20	1	0	25	23.56	0.22*	Top, 6mm	1:1	0.0431	1.47	1.628	0.001	
LTE 2	18900	20	50	0	25	22.43	0.18	Top, 6mm	1:1	0.0293	1.81	1.628	0.001	
LTE 2	18900	20	1	0	25	22.43	-0.06	Left, 4mm	1:1	0.0954	1.81	1.628	0.003	
LTE 2	18900	20	50	0	25	22.43	0	Left, 4mm	1:1	0.0733	1.81	1.628	0.002	
LTE 2	18700	20	1	0	25	23.28	0.26*	Back, 4mm	1:1	0.565	1.58	1.628	0.015	**13**
LTE 2	18700	20	50	0	25	22.26	0.04	Back, 4mm	1:1	0.43	1.88	1.628	0.013	
LTE 2	19100	20	1	0	25	23.42	0.06	Back, 4mm	1:1	0.454	1.44	1.628	0.011	
LTE 2	19100	20	50	0	25	22.4	0.06	Back, 4mm	1:1	0.412	1.82	1.628	0.012	

*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 4	20050	20	1	0	25	23.72	-0.06	Back, 4mm	1:1	0.321	1.34	1.628	0.007	
LTE 4	20050	20	50	0	25	22.59	-0.12	Back, 4mm	1:1	0.281	1.74	1.628	0.008	
LTE 4	20050	20	1	0	25	23.72	0.2	Top, 6mm	1:1	0.0108	1.34	1.628	0.000	
LTE 4	20050	20	50	0	25	22.59	0.14	Top, 6mm	1:1	0.00869	1.74	1.628	0.000	
LTE 4	20050	20	1	0	25	23.72	0.3	Left, 4mm	1:1	0.0634	1.44	1.628	0.001	
LTE 4	20050	20	50	0	25	22.59	0.04	Left, 4mm	1:1	0.0537	1.74	1.628	0.002	
LTE 4	20175	20	1	0	25	23.71	-0.12	Back, 4mm	1:1	0.374	1.35	1.628	0.008	
LTE 4	20175	20	50	0	25	22.5	0.01	Back, 4mm	1:1	0.317	1.78	1.628	0.009	
LTE 4	20300	20	1	0	25	23.57	-0.16	Back, 4mm	1:1	0.44	1.39	1.628	0.010	
LTE 4	20300	20	50	0	25	22.39	-0.13	Back, 4mm	1:1	0.361	1.82	1.628	0.011	**14**

*Larger than 5% drifts included to scaling factors

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.

The minimum separation distance between the user and/or bystander and the antenna is shortest in the top position: the distance between the antenna and the outer shell of the device is 35mm and the thickness of the carry bag is 6mm resulting total separation of 41mm.

Bluetooth SAR_{1g}= (6.3mW/41mm)*(2.4835GHz)$^{1/2}$/7.5=0.03 W/kg

7.3 Calculated SAR Results, LTE 5, LTE12 and LTE17

Standalone SAR is calculated for LTE 5, LTE12 and LTE17 bands for simultaneous transmission evaluation. Time-averaged power levels are used in the 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.

The separation distance between the user and/or bystander and the antenna is shortest in the top position: the distance between the antenna and the outer shell of the device is 11mm and the thickness of the carry bag is 4mm resulting total separation of 15mm.

LTE transmission is having maximum duty cycle 1.628%

The maximum output power for LTE is 25dBm, 316mW thus the time-averaged power is 316mW*1.628% =5.14mW

Calculated SAR for LTE5 is:

SAR_{1g}= (5.14mW /15mm)*(is transmitting at 0.849GHz)$^{1/2}$/7.5=0.04 W/kg

Calculated SAR for LTE12 is:

SAR_{1g}= (5.14mW /15mm)*(0.716GHz)$^{1/2}$/7.5=0.04 W/kg

Calculated SAR for LTE17 is:

SAR_{1g}= (5.14mW /15mm)*(0.716GHz)$^{1/2}$/7.5=0.04 W/kg

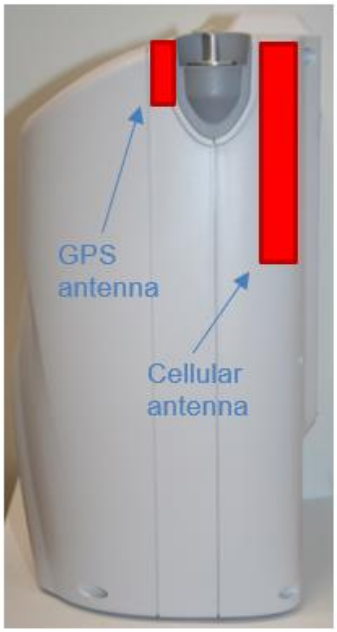
7.4 Simultaneous Transmission Analysis

Simultaneous transmission analysis for maximum cellular SAR and maximum Bluetooth SAR is in a table below. Direct summation of SAR results is performed. Because the peak spatial-average SAR values summed are at different spatial locations the procedure is overestimation of the combined SAR.

	Exposure Condition	Maximum Body SAR_{1g} [W/kg]
Cellular	GPRS 850	0.712
	GPRS 1900	0.454
	WCDMA 2	0.040
	WCDMA 4	0.035
	WCDMA 5	0.034
	LTE 2	0.015
	LTE 4	0.011
	LTE 5	0.04
	LTE 12	0.04
	LTE 17	0.04
Maximum Cellular SAR		0.712
Bluetooth		0.03
SAR Summation:		0.742

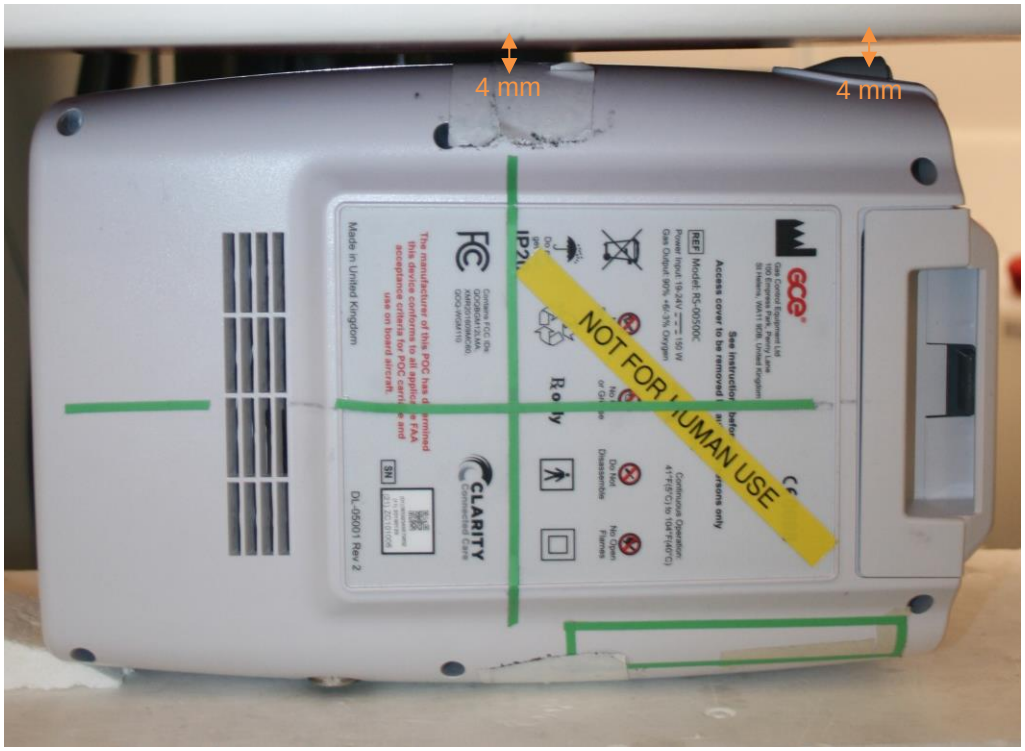
APPENDIX A: PHOTOS OF THE DUT

Dimension of the DUT are: 313 x 212 x 168 mm



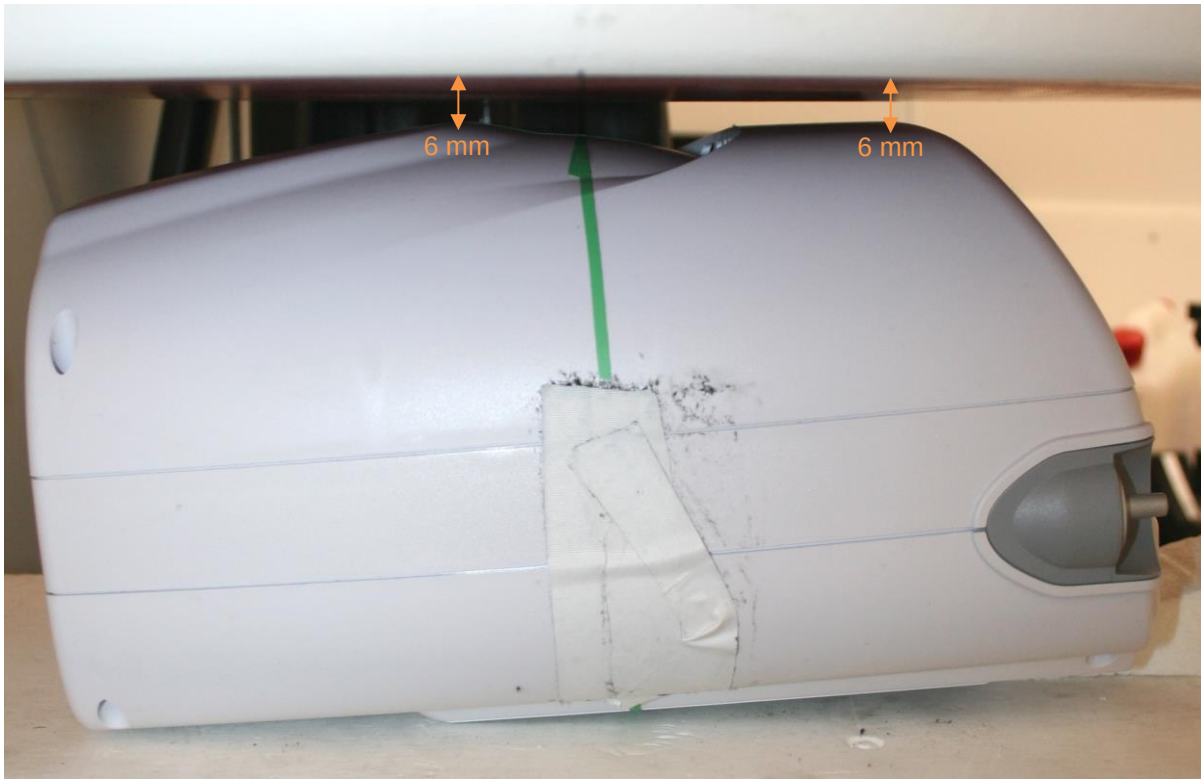
The location of the antenna

Left side of the device against the phantom, 4mm separation



Right side of the device against the phantom, 4mm separation

Back side of the device against the phantom, 4mm separation



Front side of the device against the phantom, 6mm separation

Top of the device against the phantom, 6mm separation

Bottom of the device against the phantom, 4mm separation

APPENDIX B: SYSTEM CHECK SCAN

Plot 1

Date/Time: 7.7.2020 14:23:38

Test Laboratory: Verkotan Oy

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

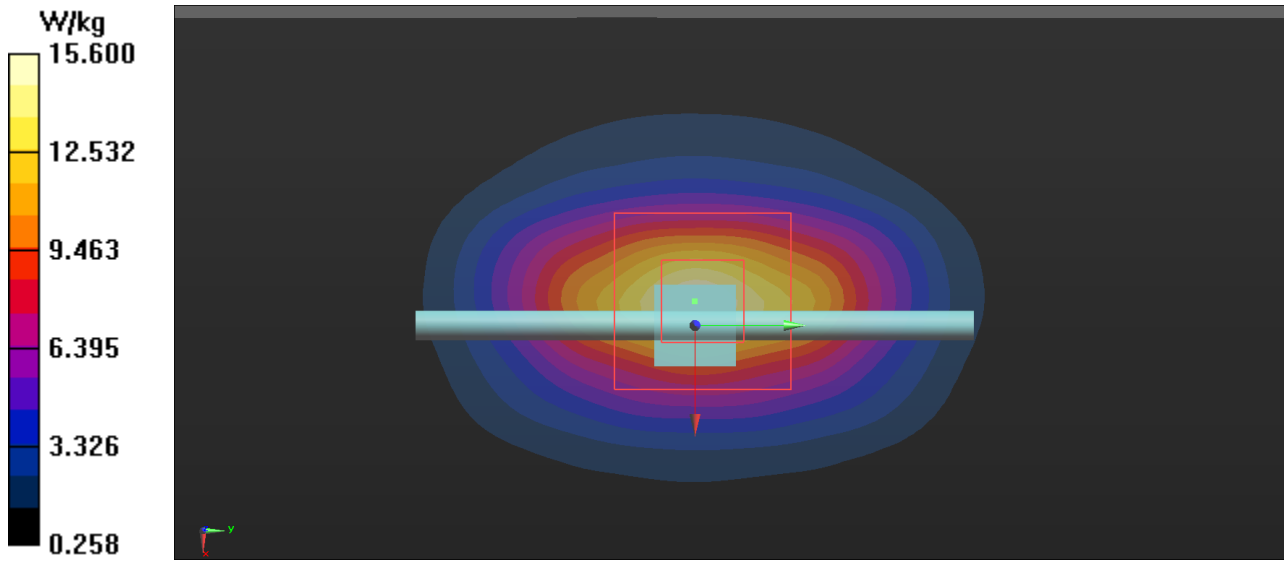
Communication System: UID 0, CW (0); Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz;Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 1900 MHz; σ = 1.437 S/m; ε_r = 38.293; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.29, 8.29, 8.29); Calibrated: 25.3.2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
- Electronics: DAE4 Sn705; Calibrated: 24.4.2020
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/system check/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 103.0 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 18.7 W/kg
SAR(1 g) = 10 W/kg; SAR(10 g) = 5.17 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 15.6 W/kg

Configuration/system check/Area Scan (51x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 16.5 W/kg



Plot 2

Date/Time: 8.7.2020 16:19:26

Test Laboratory: Verkotan Oy

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

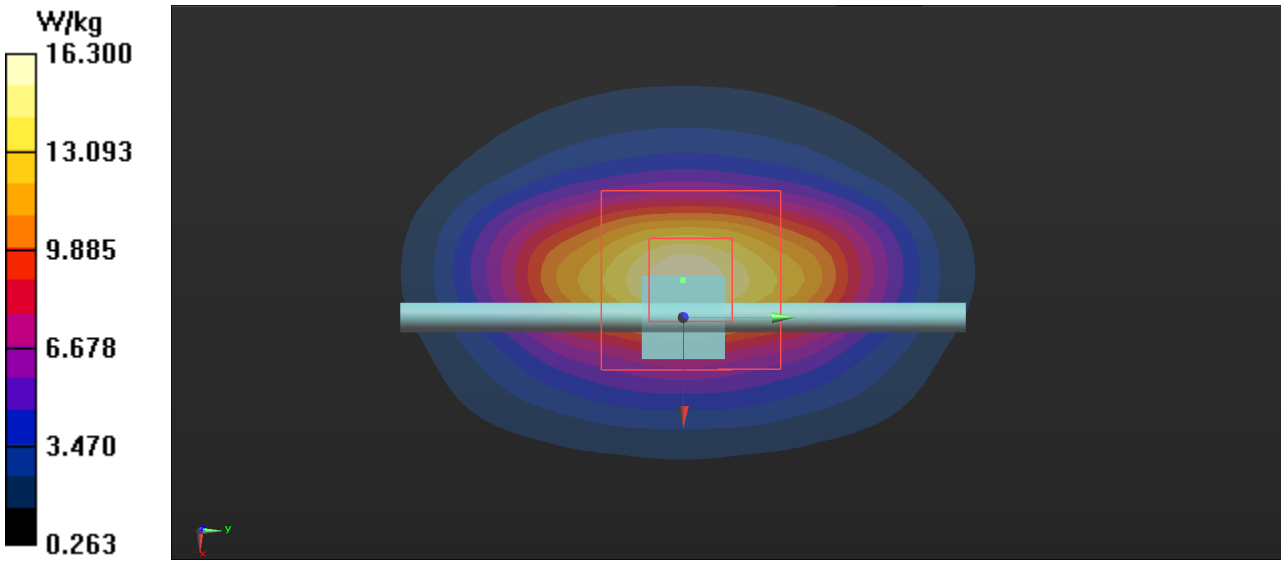
Communication System: UID 0, CW (0); Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz;Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 1900 MHz; σ = 1.447 S/m; ε_r = 37.79; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.29, 8.29, 8.29); Calibrated: 25.3.2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
- Electronics: DAE4 Sn705; Calibrated: 24.4.2020
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/system check/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 98.81 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 19.6 W/kg
SAR(1 g) = 10.2 W/kg; SAR(10 g) = 5.25 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 16.3 W/kg

Configuration/system check/Area Scan (51x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 17.1 W/kg



Plot 3

Date/Time: 9.7.2020 17:17:30

Test Laboratory: Verkotan Oy

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

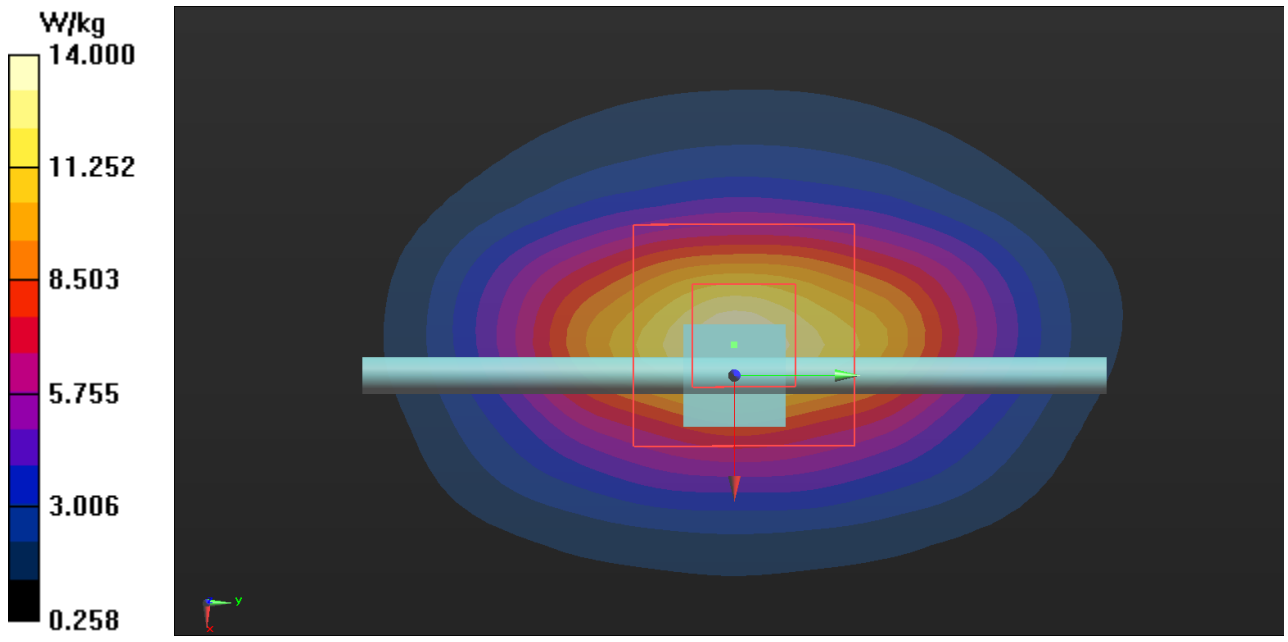
Communication System: UID 0, CW (0); Communication System Band: D1800 (1800.0 MHz); Frequency: 1800 MHz;Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 1800 MHz; σ = 1.375 S/m; ε_r = 38.498; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.65, 8.65, 8.65); Calibrated: 25.3.2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
- Electronics: DAE4 Sn705; Calibrated: 24.4.2020
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/system check/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 103.1 V/m; Power Drift = -0.29 dB
Peak SAR (extrapolated) = 16.7 W/kg
SAR(1 g) = 9.1 W/kg; SAR(10 g) = 4.77 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 14.0 W/kg

Configuration/system check/Area Scan (51x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 15.2 W/kg



Plot 4

Date/Time: 9.7.2020 17:43:41

Test Laboratory: Verkotan Oy

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

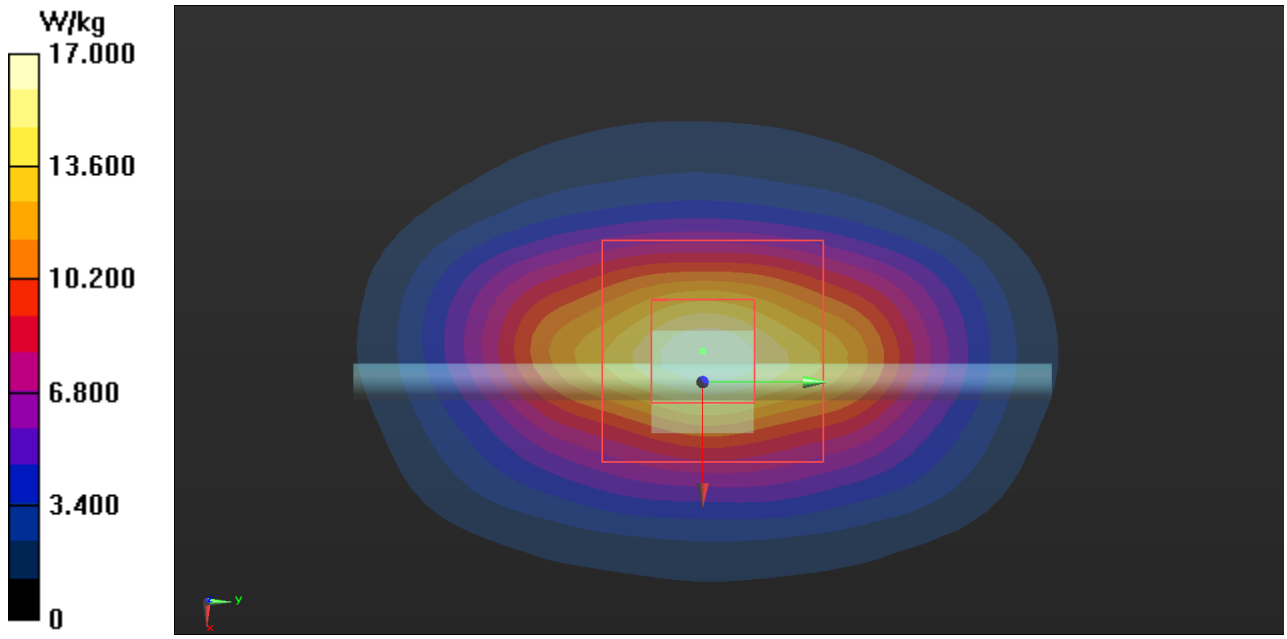
Communication System: UID 0, CW (0); Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz;Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 1900 MHz; σ = 1.433 S/m; ε_r = 38.349; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.29, 8.29, 8.29); Calibrated: 25.3.2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
- Electronics: DAE4 Sn705; Calibrated: 24.4.2020
- 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 (51x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 17.0 W/kg

Configuration/system check/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 110.8 V/m; Power Drift = -0.48 dB
Peak SAR (extrapolated) = 18.8 W/kg
SAR(1 g) = 10 W/kg; SAR(10 g) = 5.21 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 15.7 W/kg



Plot 5

Date/Time: 13.7.2020 8:11:14

Test Laboratory: Verkotan Oy

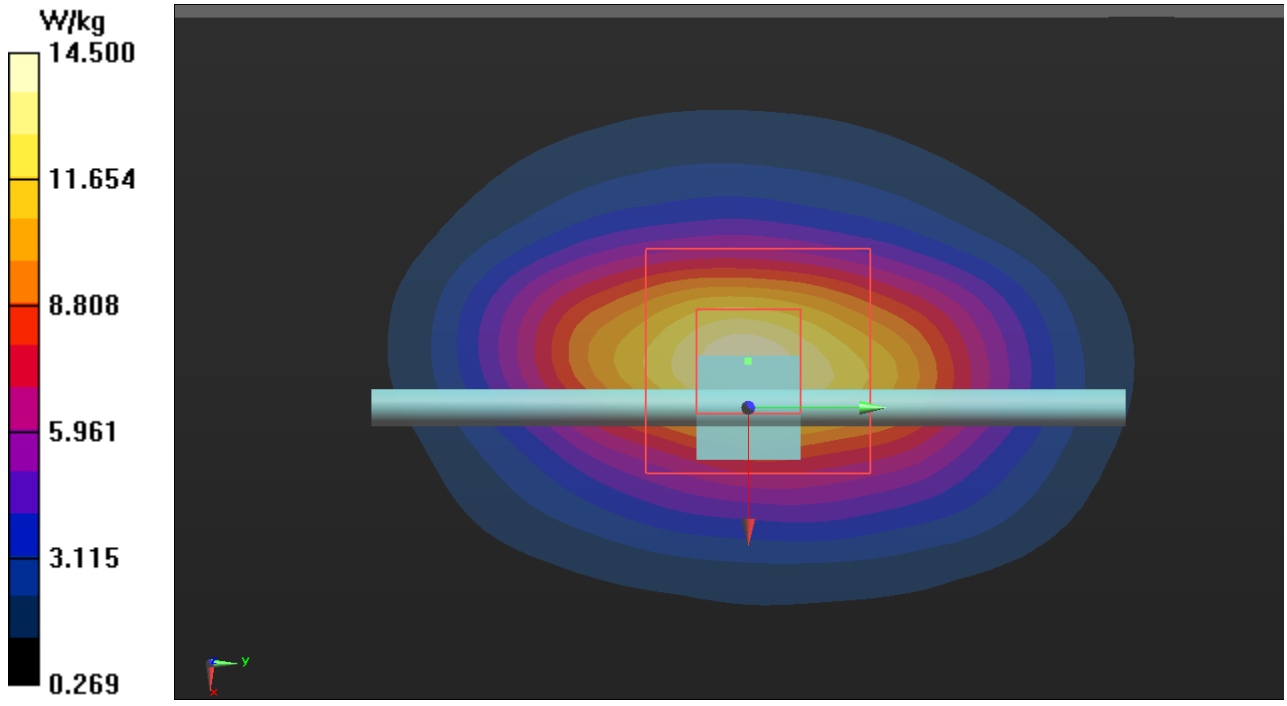
DUT: Dipole 1800 MHz D1800V2; Type: D1800V2; Serial: D1800V2 - SN:249

Communication System: UID 0, CW (0); Communication System Band: D1800 (1800.0 MHz); Frequency: 1800 MHz;Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 1800 MHz; σ = 1.373 S/m; ε_r = 38.399; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.65, 8.65, 8.65); Calibrated: 25.3.2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
- Electronics: DAE4 Sn705; Calibrated: 24.4.2020
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/system check/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 99.49 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 17.2 W/kg
SAR(1 g) = 9.29 W/kg; SAR(10 g) = 4.86 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 14.5 W/kg
Configuration/system check/Area Scan (51x111x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 15.0 W/kg



Plot 6

Date/Time: 13.7.2020 14:52:38

Test Laboratory: Verkotan Oy

DUT: Dipole 835 MHz D835V2; Type: D835V2; Serial: D835V2 - SN:448

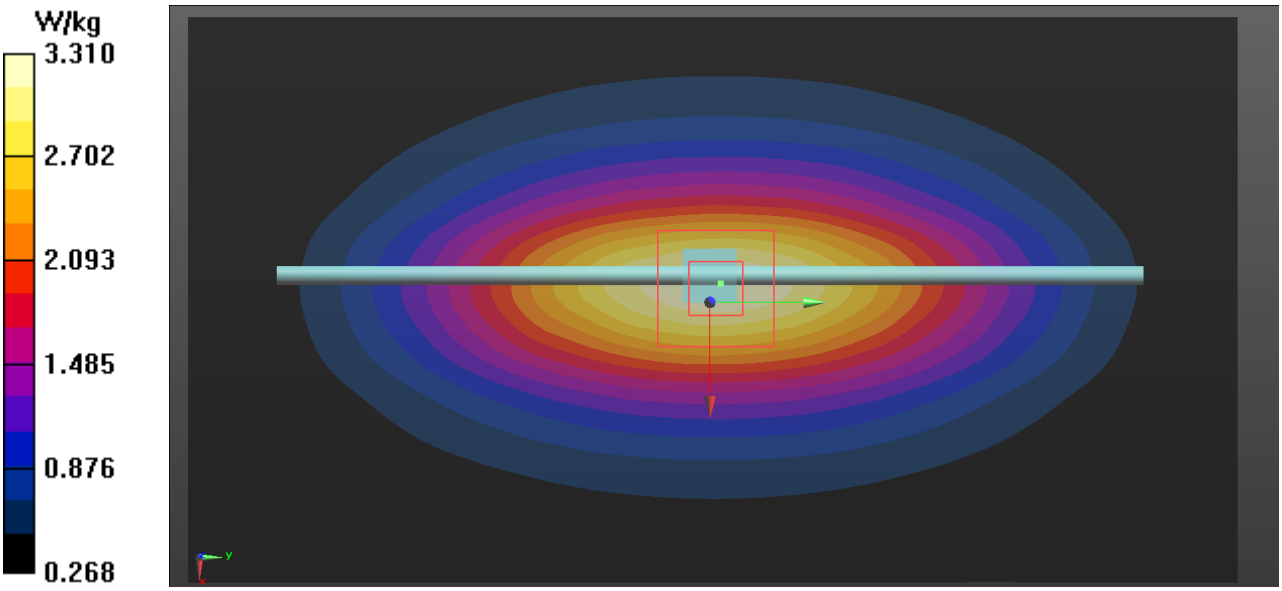
Communication System: UID 0, CW (0); Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz;Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 835 MHz; σ = 0.919 S/m; ε_r = 40.303; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(9.97, 9.97, 9.97); Calibrated: 25.3.2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
- Electronics: DAE4 Sn705; Calibrated: 24.4.2020
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/system check/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 62.53 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 3.74 W/kg
SAR(1 g) = 2.45 W/kg; SAR(10 g) = 1.59 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 3.31 W/kg

Configuration/system check/Area Scan (71x131x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 3.27 W/kg



Date/Time: 14.7.2020 14:11:09

Test Laboratory: Verkotan Oy

DUT: Dipole 835 MHz D835V2; Type: D835V2; Serial: D835V2 - SN:448

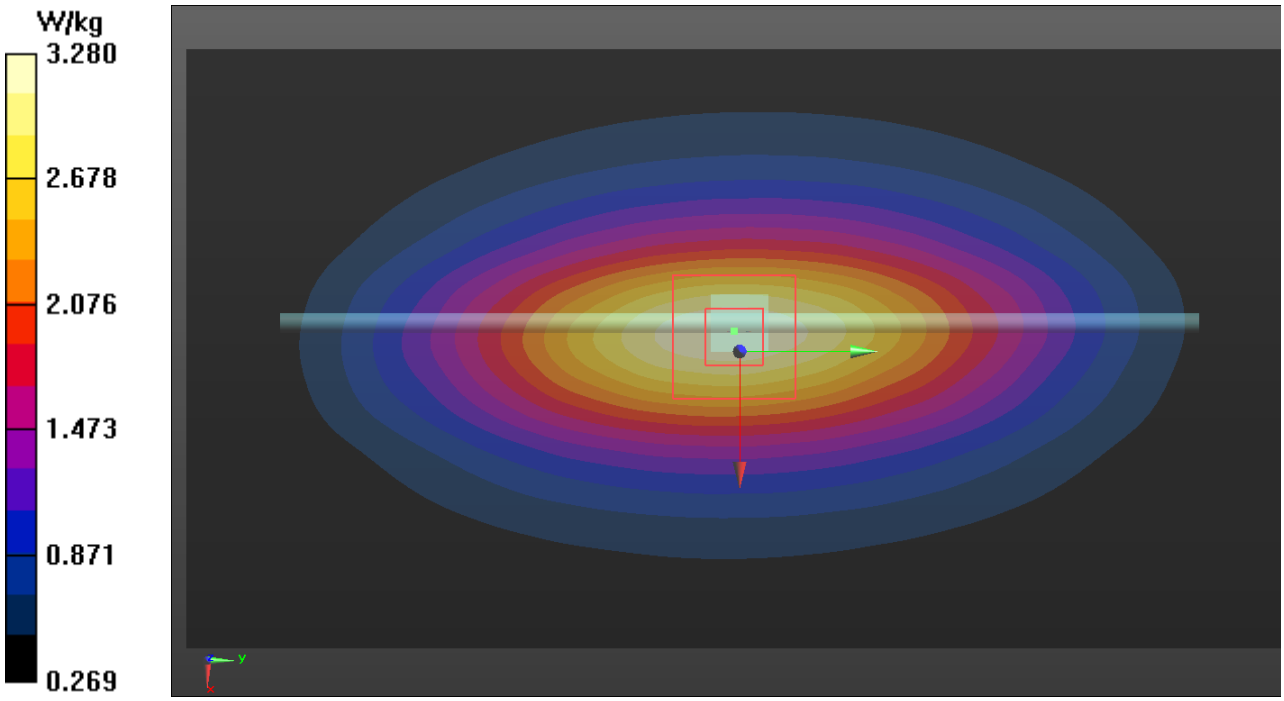
Communication System: UID 0, CW (0); Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz;Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 835 MHz; σ = 0.933 S/m; ε_r = 39.906; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(9.97, 9.97, 9.97); Calibrated: 25.3.2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
- Electronics: DAE4 Sn705; Calibrated: 24.4.2020
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/system check/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 62.59 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 3.71 W/kg
SAR(1 g) = 2.44 W/kg; SAR(10 g) = 1.59 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 3.28 W/kg

Configuration/system check/Area Scan (71x131x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 3.29 W/kg



APPENDIX C: MEASUREMENT SCAN

Plot 8

Date/Time: 14.7.2020 16:01:25

Test Laboratory: Verkotan Oy

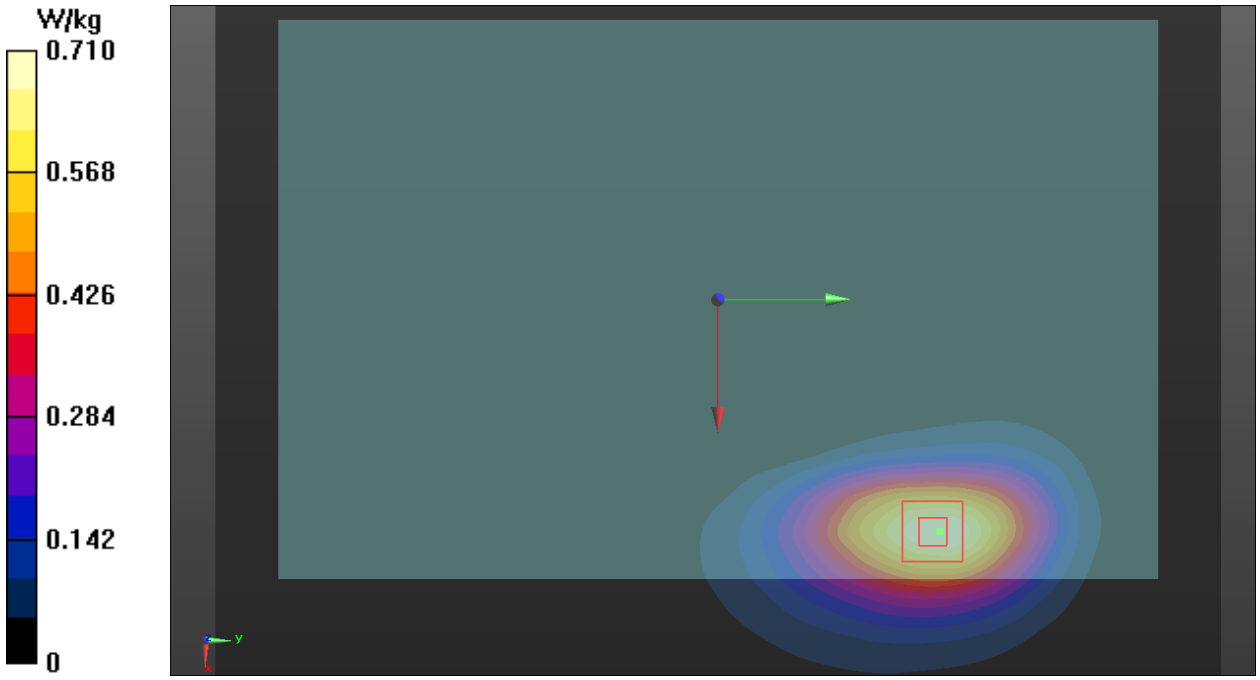
DUT: Zen-O

Communication System: UID 0, GPRS 2 slots (0); Communication System Band: GPRS 2 slots 850; Frequency: 836.6 MHz;Communication System PAR: 6.335 dB;
Medium parameters used: f = 837 MHz; σ = 0.934 S/m; ε_r = 39.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(9.97, 9.97, 9.97); Calibrated: 25.3.2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
- Electronics: DAE4 Sn705; Calibrated: 24.4.2020
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/GSM850 tx2 Back 4mm separation/Area Scan (181x241x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.710 W/kg
Configuration/GSM850 tx2 Back 4mm separation/Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 23.25 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.802 W/kg
SAR(1 g) = 0.555 W/kg; SAR(10 g) = 0.376 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.716 W/kg



Plot 9

Date/Time: 9.7.2020 15:41:36

Test Laboratory: Verkotan Oy

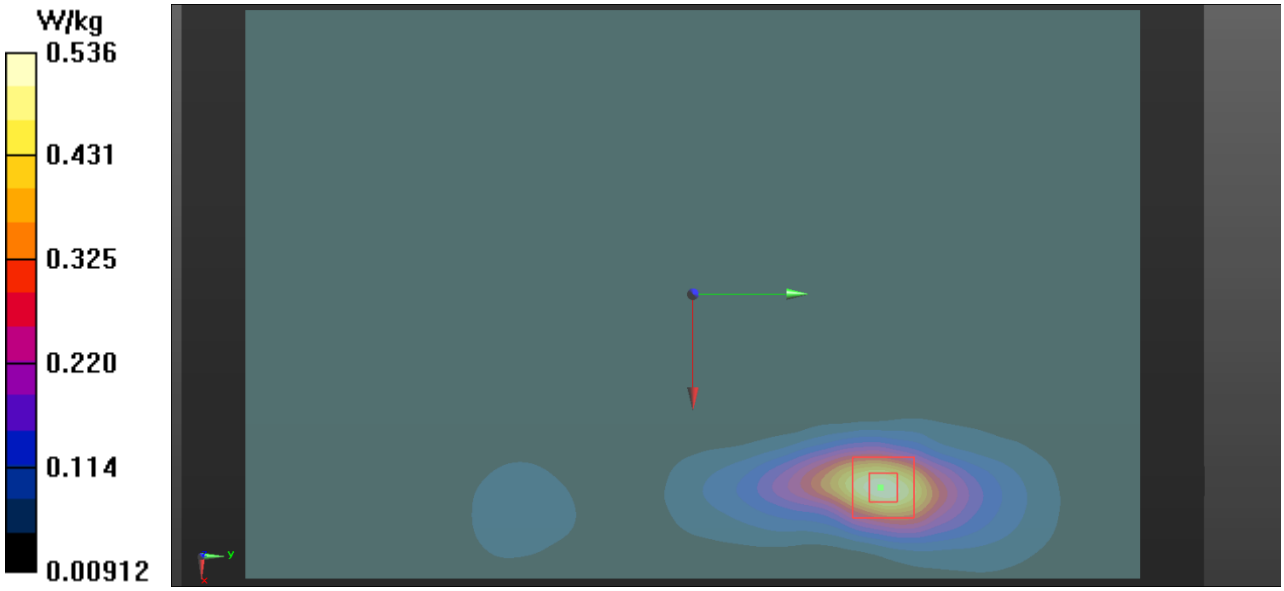
DUT: Zen-O

Communication System: UID 0, GPRS 2 slots (0); Communication System Band: GPRS 1900; Frequency: 1850.2 MHz;Communication System PAR: 6.335 dB;
Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.419 S/m; ε_r = 37.869; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.29, 8.29, 8.29); Calibrated: 25.3.2020;
- 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 Sn705; Calibrated: 24.4.2020
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/low GPRS1900 tx2 Back 4mm separation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 15.81 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.636 W/kg
SAR(1 g) = 0.358 W/kg; SAR(10 g) = 0.195 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.536 W/kg
Configuration/low GPRS1900 tx2 Back 4mm separation/Area Scan (181x241x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.530 W/kg



Date/Time: 10.7.2020 9:32:57

Test Laboratory: Verkotan Oy

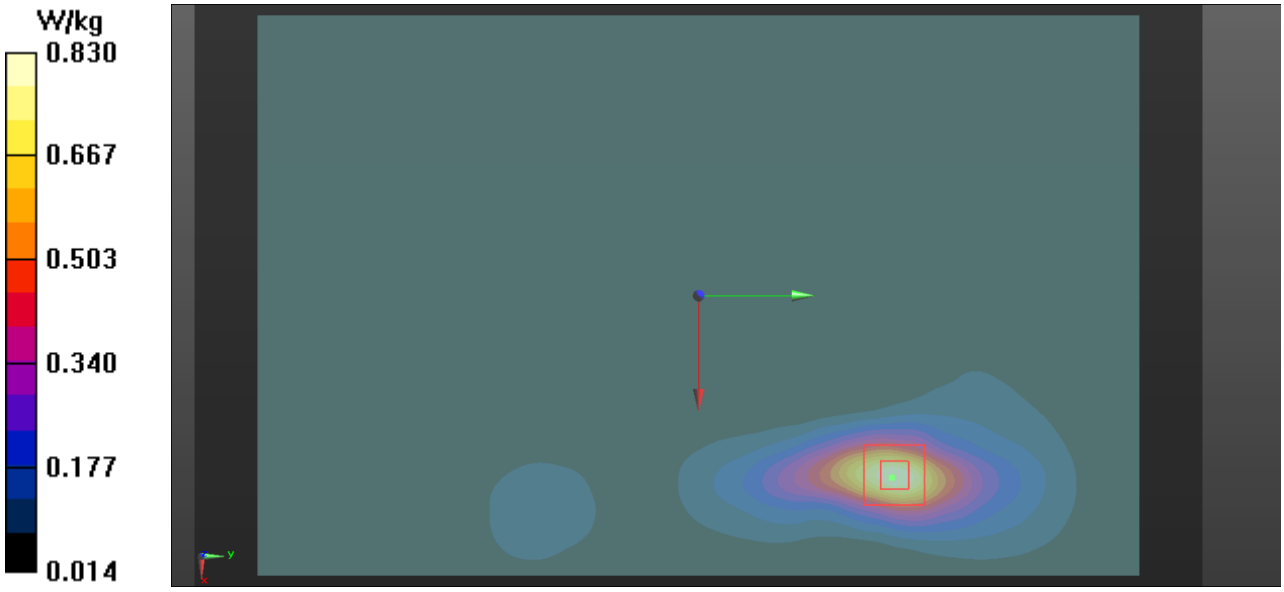
DUT: Zen-O

Communication System: UID 0, WCDMA (0); Communication System Band: Band 2; Frequency: 1852.5 MHz;Communication System PAR: 0 dB; PMF: 1.12202e-005
Medium parameters used (interpolated): f = 1852.5 MHz; σ = 1.405 S/m; ε_r = 38.423; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.29, 8.29, 8.29); Calibrated: 25.3.2020;
- 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 Sn705; Calibrated: 24.4.2020
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/low WCDMA 2 Back 4mm separation 2/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 9.061 V/m; Power Drift = -0.24 dB
Peak SAR (extrapolated) = 0.988 W/kg
SAR(1 g) = 0.568 W/kg; SAR(10 g) = 0.313 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.830 W/kg
Configuration/low WCDMA 2 Back 4mm separation 2/Area Scan (181x241x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.855 W/kg



Date/Time: 10.7.2020 13:12:19

Test Laboratory: Verkotan Oy

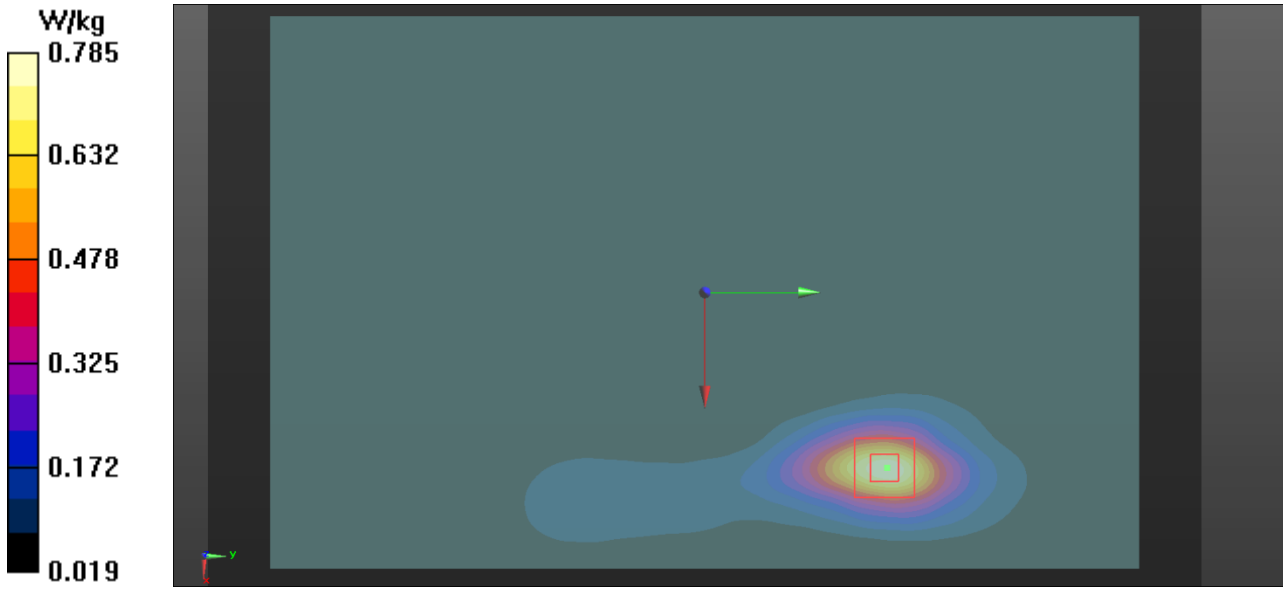
DUT: Zen-O

Communication System: UID 0, WCDMA (0); Communication System Band: Band 4; Frequency: 1752.6 MHz;Communication System PAR: 0 dB; PMF: 1.12202e-005
Medium parameters used: f = 1753 MHz; σ = 1.349 S/m; ε_r = 38.574; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.65, 8.65, 8.65); Calibrated: 25.3.2020;
- 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 Sn705; Calibrated: 24.4.2020
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/high WCDMA 4 Back 4mm separation /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 10.21 V/m; Power Drift = -0.17 dB
Peak SAR (extrapolated) = 0.921 W/kg
SAR(1 g) = 0.546 W/kg; SAR(10 g) = 0.307 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.785 W/kg
Configuration/high WCDMA 4 Back 4mm separation /Area Scan (181x241x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.803 W/kg



Test Laboratory: Verkotan Oy

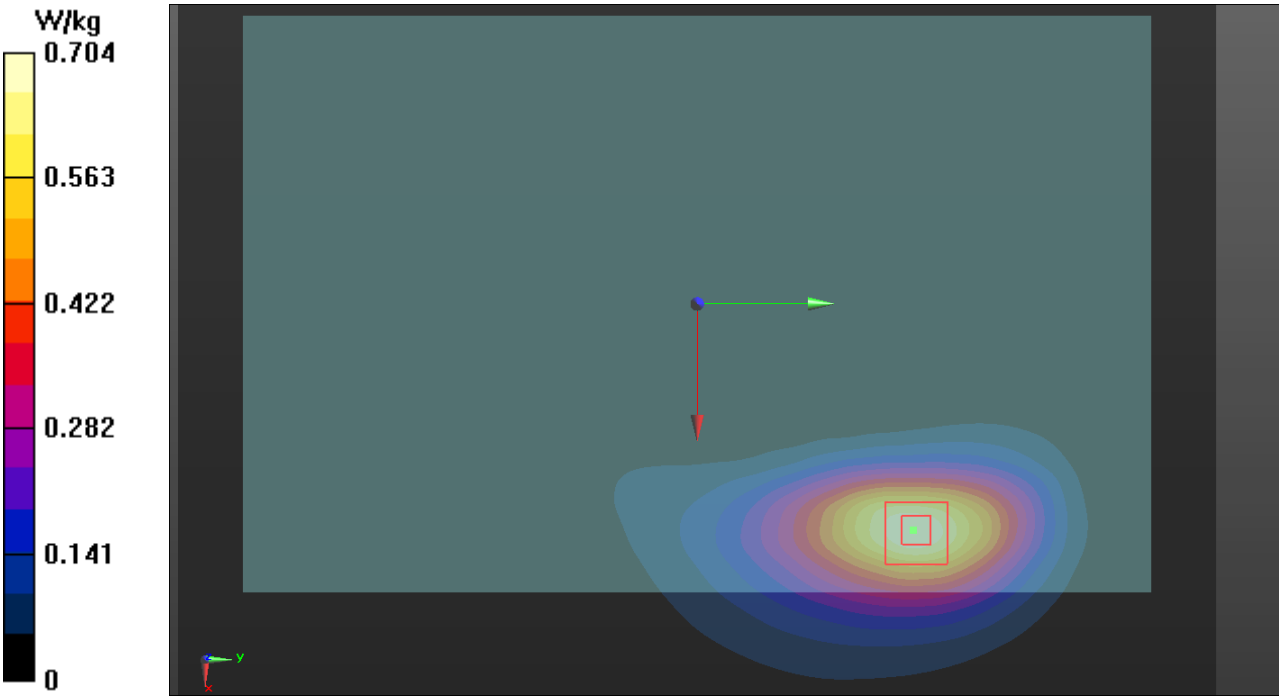
DUT: Zen-O

Communication System: UID 0, WCDMA (0); Communication System Band: Band 5; Frequency: 826.4 MHz;Communication System PAR: 0 dB; PMF: 1.12202e-005
Medium parameters used (interpolated): f = 826.4 MHz; σ = 0.93 S/m; ε_r = 39.929; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(9.97, 9.97, 9.97); Calibrated: 25.3.2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection (Locations From Previous Scan Used)), Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
- Electronics: DAE4 Sn705; Calibrated: 24.4.2020
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/WCDMA 5 Low Back 4mm separation/Area Scan (181x241x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.704 W/kg
Configuration/WCDMA 5 Low Back 4mm separation/Zoom Scan (6x6x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 22.39 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.785 W/kg
SAR(1 g) = 0.536 W/kg; SAR(10 g) = 0.360 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.697 W/kg



Plot 13

Date/Time: 9.7.2020 11:21:41

Test Laboratory: Verkotan Oy

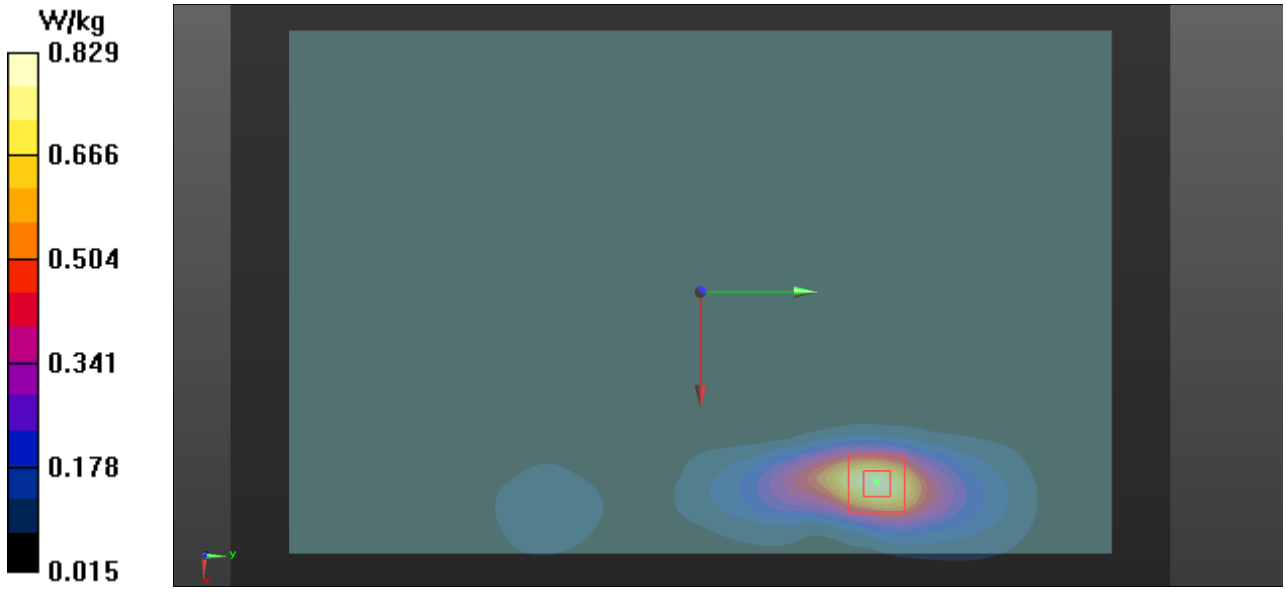
DUT: Zen-O

Communication System: UID 0, Generic LTE (0); Communication System Band: Band 2, E-UTRA/FDD (1850.0 - 1910.0 MHz); Frequency: 1860 MHz;Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 1860 MHz; σ = 1.423 S/m; ε_r = 37.859; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.29, 8.29, 8.29); Calibrated: 25.3.2020;
- 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 Sn705; Calibrated: 24.4.2020
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/low LTE 2 Back 4mm separation BW 20 RB Size 1 Offset 0/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 13.98 V/m; Power Drift = 0.26 dB
Peak SAR (extrapolated) = 0.987 W/kg
SAR(1 g) = 0.565 W/kg; SAR(10 g) = 0.311 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.829 W/kg
Configuration/low LTE 2 Back 4mm separation BW 20 RB Size 1 Offset 0/Area Scan (181x241x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.827 W/kg



Plot 14

Date/Time: 10.7.2020 17:52:42

Test Laboratory: Verkotan Oy

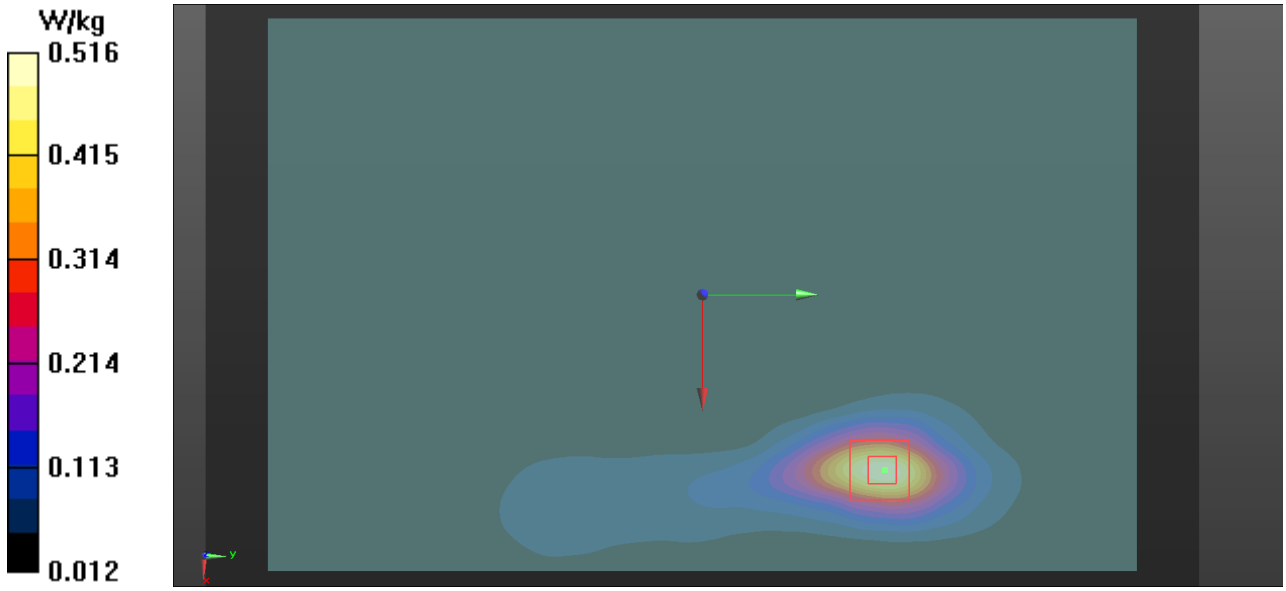
DUT: Zen-O

Communication System: UID 0, Generic LTE (0); Communication System Band: Band 4, E-UTRA/FDD (1710.0 - 1755.0 MHz); Frequency: 1745 MHz;Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 1745 MHz; σ = 1.345 S/m; ε_r = 38.585; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.65, 8.65, 8.65); Calibrated: 25.3.2020;
- 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 Sn705; Calibrated: 24.4.2020
- Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7373)

Configuration/high LTE 4 Back 4 mm separation BW20 RB Size 50 Offset 0/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 8.307 V/m; Power Drift = -0.13 dB
Peak SAR (extrapolated) = 0.606 W/kg
SAR(1 g) = 0.361 W/kg; SAR(10 g) = 0.203 W/kg (SAR corrected for target medium)
Maximum value of SAR (measured) = 0.516 W/kg
Configuration/high LTE 4 Back 4 mm separation BW20 RB Size 50 Offset 0/Area Scan (181x241x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.530 W/kg



APPENDIX D: RELEVANT PAGES FROM PROBE CALIBRATION

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)

Accreditation No.: SCS 0108

Multilateral Agreement for the recognition of calibration certificates

Client Verkotan

Certificate No: EX3-7447_Mar20

CALIBRATION CERTIFICATE

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

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

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

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

Issued: March 27, 2020

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

Certificate No: EX3-7447_Mar20 Page 1 of 9

EX3DV4 – SN:7447 March 25, 2020

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

Basic Calibration Parameters

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

Calibration Results for Modulation Response

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

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

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

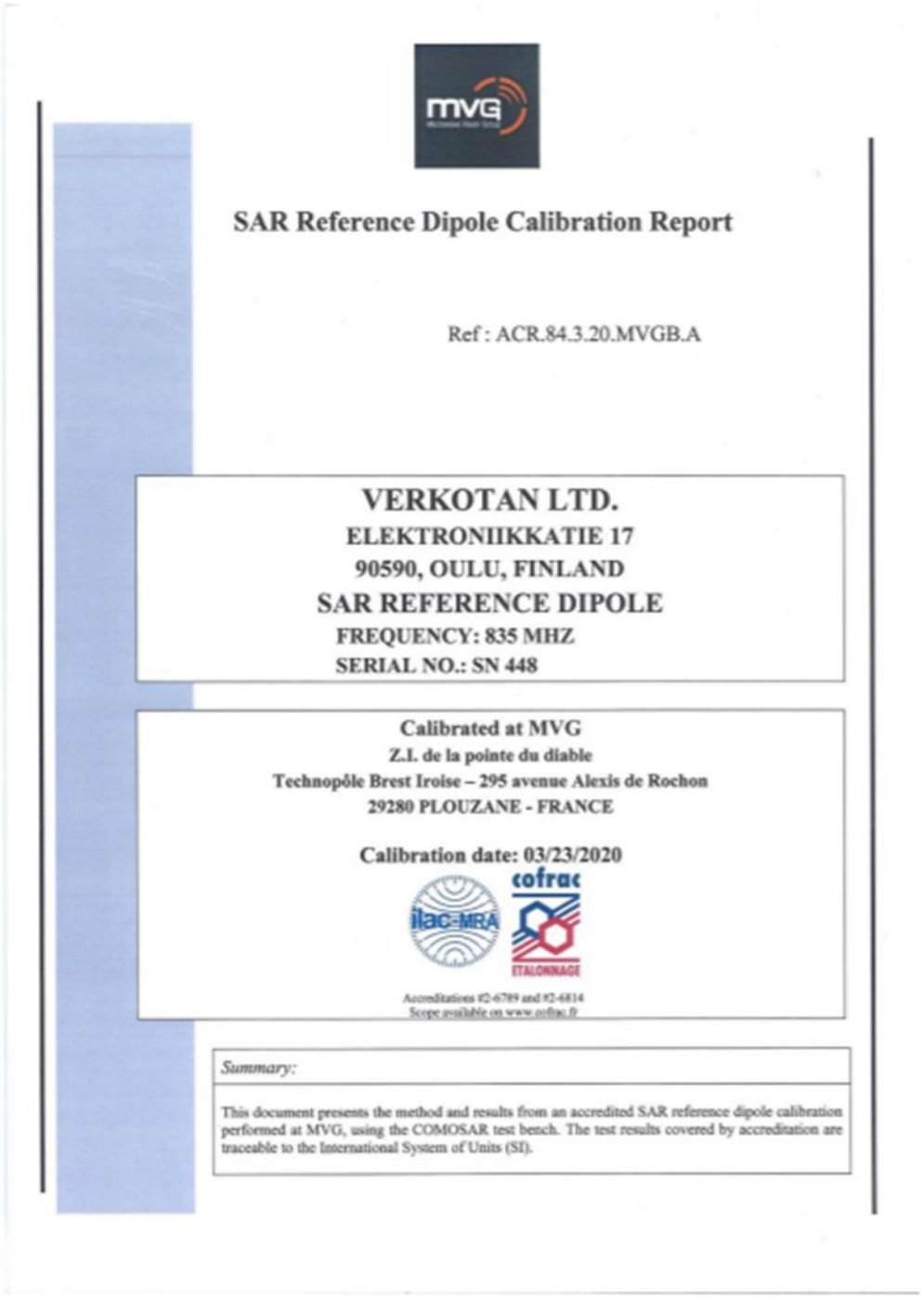
DASY/EASY - Parameters of Probe: EX3DV4 - SN:7447

Calibration Parameter Determined in Head Tissue Simulating Media

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

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

APPENDIX E: RELEVANT PAGES FROM DIPOLE CALIBRATION REPORTS



SAR Reference Dipole Calibration Report

Ref : ACR.84.3.20.MVGB.A

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

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

Calibration date: 03/23/2020

ilac-MRA cofrac ETALONNAGE

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

Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed at MVG, using the COMOSAR test bench. The test results covered by accreditation are traceable to the International System of Units (SI).

SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.84.3.20.MVGB.A

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Technical Manager	3/24/2020	
Checked by :	Jérôme LUC	Technical Manager	3/24/2020	
Approved by :	Yann Toutain	Laboratory Director	3/24/2020	

	Customer Name
Distribution :	Verkotan Ltd.

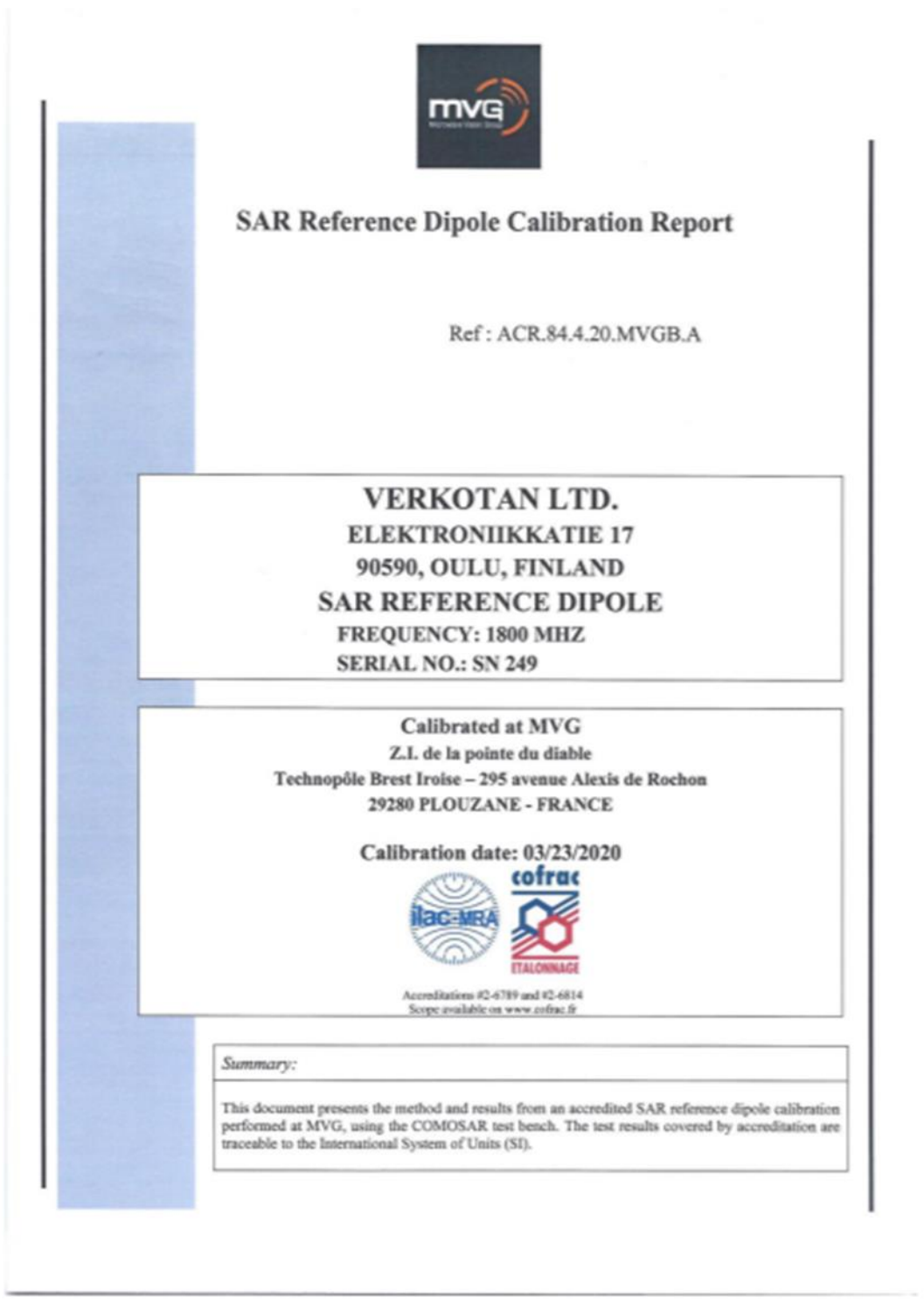
Issue	Name	Date	Modifications
A	Jérôme LUC	3/24/2020	Initial release

2300	39.5 ±10 %		1.67 ±10 %	
2450	39.2 ±10 %		1.80 ±10 %	
2600	39.0 ±10 %		1.96 ±10 %	
3000	38.5 ±10 %		2.40 ±10 %	
3500	37.9 ±10 %		2.91 ±10 %	

7.3 MEASUREMENT RESULT

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.

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	9.38 (0.94)	6.22	5.94 (0.59)
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	



SAR Reference Dipole Calibration Report

Ref : ACR.84.4.20.MVGB.A

VERKOTAN LTD.
ELEKTRONIIKKATIE 17
90590, OULU, FINLAND
SAR REFERENCE DIPOLE
FREQUENCY: 1800 MHZ
SERIAL NO.: SN 249

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

Calibration date: 03/23/2020

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

Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed at MVG, using the COMOSAR test bench. The test results covered by accreditation are traceable to the International System of Units (SI).

mvg

SAR REFERENCE DIPOLE CALIBRATION REPORT Ref: ACR.84.4.20.MVGB.A

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Technical Manager	3/24/2020	
Checked by :	Jérôme LUC	Technical Manager	3/24/2020	
Approved by :	Yann Toutain	Laboratory Director	3/24/2020	

	Customer Name
Distribution :	Verkotan Ltd.

Issue	Name	Date	Modifications
A	Jérôme LUC	3/24/2020	Initial release

2300	39.5 ±10 %		1.67 ±10 %	
2450	39.2 ±10 %		1.80 ±10 %	
2600	39.0 ±10 %		1.96 ±10 %	
3000	38.5 ±10 %		2.40 ±10 %	
3500	37.9 ±10 %		2.91 ±10 %	

7.3 MEASUREMENT RESULT

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.

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	39.21 (3.92)	20.1	20.96 (2.10)
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	

SAR Reference Dipole Calibration Report

Ref : ACR.84.5.20.MVGB.A

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

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

Calibration date: 03/23/2020

ilac-MRA cofrac ETALONNAGE

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

Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed at MVG, using the COMOSAR test bench. The test results covered by accreditation are traceable to the International System of Units (SI).

SAR REFERENCE DIPOLE CALIBRATION REPORT Ref: ACR.84.5.20.MVGB.A

	Name	Function	Date	Signature
Prepared by :	Jérôme LUC	Technical Manager	3/24/2020	
Checked by :	Jérôme LUC	Technical Manager	3/24/2020	
Approved by :	Yann Toutain	Laboratory Director	3/24/2020	

	Customer Name
Distribution :	Verkotan Ltd.

Issue	Name	Date	Modifications
A	Jérôme LUC	3/24/2020	Initial release

2300	39.5 ±10 %		1.67 ±10 %	
2450	39.2 ±10 %		1.80 ±10 %	
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3000	38.5 ±10 %		2.40 ±10 %	
3500	37.9 ±10 %		2.91 ±10 %	

7.3 MEASUREMENT RESULT

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.

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
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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	35.4		19.3	
1800	38.4		20.1	
1900	39.7	37.10 (3.71)	20.5	19.14 (1.91)
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	

APPENDIX F: TRANSMISSION DUTY CYCLE CALCULATIONS FROM THE CUSTOMER

ZenO Clarity Transmitter Duty Cycle Calculations

Revision	Release Date	ECO No	Created by	Approved	Notes
1	29/07/2020	E1153	W Turner		First Draft

Device Functionality:

Zeno Clarity has 2 transmitter systems: PLS62W capable of worldwide LTE/UMTS/GPRS and BGM13S for Bluetooth Low Energy 5.0. 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 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 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%.

