SAR Compliance Test Report

Date of Report	22/09/2022	**Client's Contact person:**	Mark Newton
Number of pages:	33	**Responsible Test engineer:**	Kalle Orava
Testing laboratory:	**Verkotan Oy** Elektroniikkatie 17 90590 Oulu Finland	**Client:**	**Ocean Signal Ltd.** Unit 4, Ocivan Way CT9 4NN Margate United Kingdom

Tested device	EPIRB3 Pro
Related reports:	-
Testing has been carried out in accordance with:	**47CFR §2.1093** Radiofrequency Radiation Exposure Evaluation: Portable Devices **FCC KDB Publications 447498 D04 Interim General RF Exposure Guidance v01.**
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:

22.09.2022

For the contents:

Miia Nurkkala

Digitaalinen allekirjoittaja: Miia Nurkkala
Päiväys: 2022.09.22 15:52:13 +03'00'

Laboratory Manager

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1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Device under Test (DUT):

Product:	Emergency Position Indicating Radio Beacon
Manufacturer:	Ocean Signal
Model:	EPIRB3 Pro
Serial Number:	TA000013 (SAR sample), TA000019 (conducted sample)
FCC ID Number:	XYE EPIRB3
DUT Number:	21544 (SAR sample), 21542 (conducted sample)
Battery Type used in testing:	Lithium/Iron Disulfide
State of the Sample	Production sample

Testing information:

Testing Performed:	06.09.2022 – 19.09.2022
Notes:	-
Document ID:	FCC SAR report_EPIRBV3_ID5732_22092022
Document history & changes:	-
Temperature °C	22±2 / Controlled
Humidity RH%	30±20 / Controlled
Measurement performed by:	Kalle Orava
FCC Test Firm Designation Number	FI00005

1.2 Maximum Results

The maximum reported* SAR values for body-worn-configuration for transmitting system are shown in 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-worn SAR1g is 1.6W/kg.

System	Highest Reported* SAR_{1g}(W/kg) in body-worn Condition, 0mm separation	Result
121.5 MHz	**0.33**	**PASS**
162 MHz	**0.064**	**PASS**
406 MHz	**0.37**	**PASS**

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

1.2.1 Maximum Drift

Maximum Drift During Measurements	0.98dB*

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

1.2.2 Measurement Uncertainty

Expanded Uncertainty (k=2) 95 %	±24.9%

2. DESCRIPTION OF THE DEVICE UNDER TEST (DUT)

The DUT is an emergency locator beacon, which transmit emergency signals during distress situations.

Device operates at the following duty cycles:

121.5 MHz = 97%

162 MHz = 0.35%

406 MHz = 1%

Device Category	Portable
Exposure Environment	Uncontrolled

2.1 Supported Frequency Bands and Operational Modes

TX Frequency bands	Transmitter Frequency Range (MHz)
	121.5
	162
	406

3. OUTPUT POWER

3.1 Maximum Output Power

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

TX Frequency [MHz]	Max Output Power [dBm]
121.5	18.3
162	32.3
406	36.3

3.2 Tested conducted power

Measured conducted output power at transmitting antenna connector [dBm].

TX Frequency [MHz]	Max Output Power [dBm]
121.5	17.79
162	31.22
406	35.23

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.

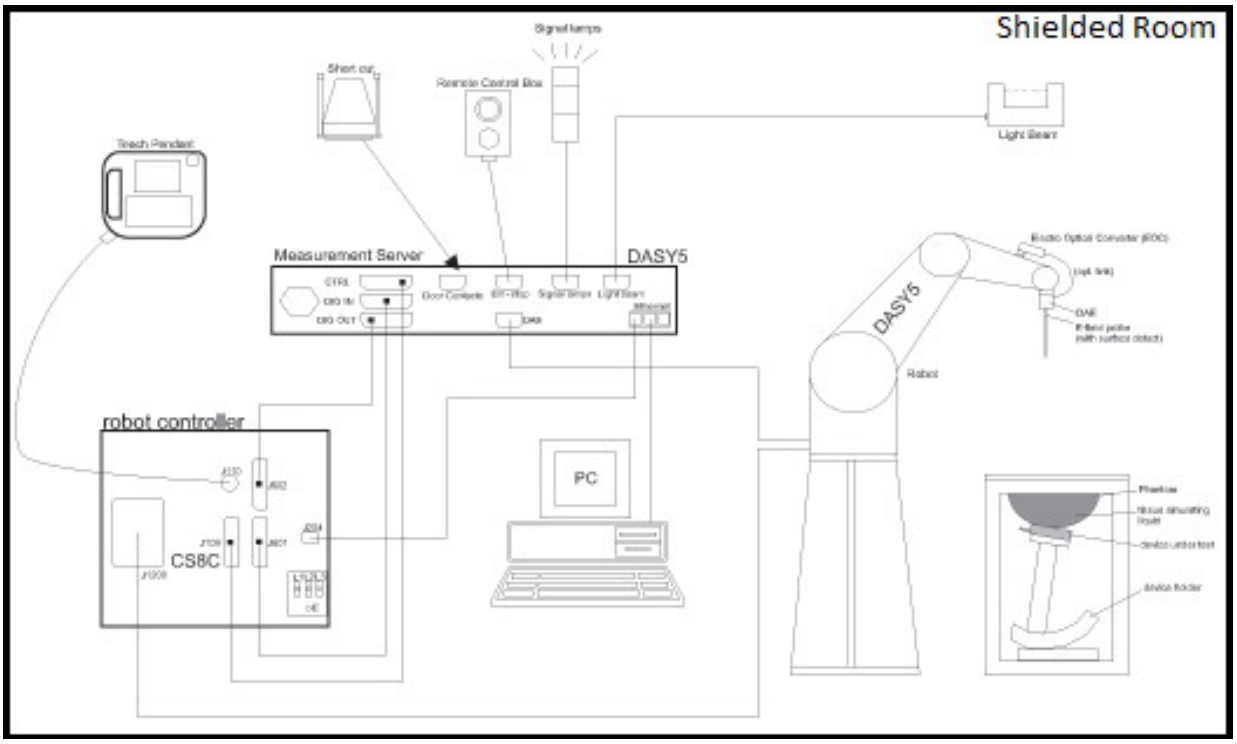


Figure 1 Schematic Laboratory Picture

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	705	02.2022
Probe	EX3DV4	3852	10.2022
Dipole	CLA128	3006	07.2022
Dipole	DIP 0G450	434	02.2022
DASY5 Software	52.8.8.1258	-	NA
Signal Generator	Agilent E4438C	MY42082527	NA
Power Sensor	NRP-Z11	100265	12.2021

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

Eli Phantom:

The phantom used in SAR tests was an ELI phantom, manufactured by SPEAG. ELI phantom is used for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the 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 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] Head tissue simulant	Conductivity σ [S/m] Head tissue simulant	Validation Done
							Head tissue simulant
128	CLA 128 - SN: 3006	EX3DV4 - SN: 3852	CW	CW	DAE 4 / 705	49.9	0.75
450	DIP 0G450 – SN: 434	EX3DV4 - SN: 3852	CW	CW	DAE 4 / 705	44.76	0.94

4.5 System Check

Date	Tissue Type	Tissue Temp. [°C]	Frequency [MHz]	Input Power [mW]	Measured SAR_{1g} [W/kg]	1 W Target SAR_{1g} [W/kg]	1 W Normalized SAR_{1g} [W/kg]	Deviation [%]	Plot #
06.9.2022	WB Head	21.5	128	250	0.93	3.48	3.71	6.67	1
08.9.2022	WB Head	23.5	450	250	1.2	4.79	4.8	0.21	2
12.08.2022	WB Head	21.9	450	250	1.22	4.79	4.88	1.88	3

4.5.1 Tissue Simulant Verification

				Target		Measured		Deviation	
Date	Tissue Type	Tissue Temp [°C]	Frequency [MHz]	Dielectric Constant [ε] Target	Conductivity σ [S/m] Target	Dielectric Constant [ε]	Conductivity σ [S/m]	ε (%)	σ (%)
06.9.2022	WB Head	21.7	121	52.95	0.76	50.6	0.77	-4.4	1.5
06.9.2022	WB Head	21.7	128	52.8	0.76	50.42	0.77	-4.5	1.8
06.9.2022	WB Head	21.7	162	51.74	0.77	49.58	0.79	-4.2	2.4
07.9.2022	WB Head	22.5	406	44.03	0.87	45.69	0.9	3.8	3.0
07.9.2022	WB Head	22.5	450	43.5	0.87	44.94	0.94	3.3	7.7
12.9.2022	WB Head	22.3	406	44.03	0.87	44.52	0.9	1.1	3.7
12.9.2022	WB Head	22.3	450	43.5	0.87	43.95	0.93	1.0	6.8

5. TEST PROCEDURE

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

Device was measured using control software, and the frequencies 162MHz and 406MHz were measured with higher duty cycle of 2.4% and 26% respectively. Reported SAR values of 406MHz are scaled to its normal operating duty cycle of 1%.

121.5MHz was measured with duty cycle of 52%, which was then scaled to 97%, which is the normal duty cycle for this frequency.

5.1 Test Positions

5.1.1 Body-worn Configuration, 0mm separation distance

For all of the positions, device was lifted towards the phantom until the distance between the phantom and the device was 0mm.
Area scans were measured from antennas both sides, bottom, and four sides of the DUT, to ensure that worst-case position was captured.

From the worst-case positions which had the highest SAR values (both sides of the antenna), full zoom scan was then measured.
This procedure was done for all of the supported frequencies.
Photos of the test positions are presented in APPENDIX A.

5.2 Scan Procedures

First, area scans were used for determination of the field distribution. Next, a zoom scan was performed around the highest E-field value to determine the averaged SAR value. 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 was averaged over a cube of tissue using interpolation and extrapolation.

The interpolation, extrapolation and maximum search routines within Dasy52 are all based on the modified Quadratic Shepard's method (Robert J. Renka," Multivariate Interpolation of Large Sets of Scattered Data", University of North Texas ACM Transactions on Mathematical Software, vol. 14, no. 2, June 1988, pp. 139-148).
The interpolation scheme combines a least-square fitted function method with a weighted average method. A trivariate 3-D / bivariate 2-D quadratic function is computed for each measurement point and fitted to neighboring points by a least-square method. For the zoom scan, inverse distance weighting is incorporated to fit distant points more accurately. The interpolating function is finally calculated as a weighted average of the quadratics.

In the zoom scan, the interpolation function is used to extrapolate the Peak SAR from the deepest measurement points to the inner surface of the phantom.

6. MEASUREMENT UNCERTAINTY

Uncertainty Budget
According to IEC 62209-2/2010
(30 MHz - 6 GHz range)

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	±6.55 %	N	1	1	1	±6.55 %	±6.55 %	∞
Axial Isotropy	±4.7 %	R	$\sqrt{3}$	0.7	0.7	±1.9 %	±1.9 %	∞
Hemispherical Isotropy	±9.6 %	R	$\sqrt{3}$	0.7	0.7	±3.9 %	±3.9 %	∞
Linearity	±4.7 %	R	$\sqrt{3}$	1	1	±2.7 %	±2.7 %	∞
Modulation Response[m]	±2.4 %	R	$\sqrt{3}$	1	1	±1.4 %	±1.4 %	∞
System Detection Limits	±1.0 %	R	$\sqrt{3}$	1	1	±0.6 %	±0.6 %	∞
Boundary Effects	±2.0 %	R	$\sqrt{3}$	1	1	±1.2 %	±1.2 %	∞
Readout Electronics	±0.3 %	N	1	1	1	±0.3 %	±0.3 %	∞
Response Time	±0.8 %	R	$\sqrt{3}$	1	1	±0.5 %	±0.5 %	∞
Integration Time	±2.6 %	R	$\sqrt{3}$	1	1	±1.5 %	±1.5 %	∞
RF Ambient Noise	±3.0 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
RF Ambient Reflections	±3.0 %	R	$\sqrt{3}$	1	1	±1.7 %	±1.7 %	∞
Probe Positioner	±0.8 %	R	$\sqrt{3}$	1	1	±0.5 %	±0.5 %	∞
Probe Positioning	±6.7 %	R	$\sqrt{3}$	1	1	±3.9 %	±3.9 %	∞
Post-processing	±4.0 %	R	$\sqrt{3}$	1	1	±2.3 %	±2.3 %	∞
Test Sample Related								
Device Holder	±3.6 %	N	1	1	1	±3.6 %	±3.6 %	5
Test sample Positioning	±2.9 %	N	1	1	1	±2.9 %	±2.9 %	145
Power Scaling[p]	±0 %	R	$\sqrt{3}$	1	1	±0.0 %	±0.0 %	∞
Power Drift	±5.0 %	R	$\sqrt{3}$	1	1	±2.9 %	±2.9 %	∞
Phantom and Setup								
Phantom Uncertainty	±7.6 %	R	$\sqrt{3}$	1	1	±4.4 %	±4.4 %	∞
SAR correction	±1.9 %	R	$\sqrt{3}$	1	0.84	±1.1 %	±0.9 %	∞
Liquid Conductivity (mea.)[DAK]	±2.5 %	R	$\sqrt{3}$	0.78	0.71	±1.1 %	±1.0 %	∞
Liquid Permittivity (mea.)[DAK]	±2.5 %	R	$\sqrt{3}$	0.26	0.26	±0.3 %	±0.4 %	∞
Temp. unc. - Conductivity[BB]	±3.4 %	R	$\sqrt{3}$	0.78	0.71	±1.5 %	±1.4 %	∞
Temp. unc. - Permittivity[BB]	±0.4 %	R	$\sqrt{3}$	0.23	0.26	±0.1 %	±0.1 %	∞
Combined Std. Uncertainty						±12.5 %	±12.4 %	748
Expanded STD Uncertainty						±24.9 %	±24.9 %	

7. TEST RESULTS

7.1.1 SAR Results for body-worn Condition with 0 mm separation distance:

121.5MHz:

Frequency [MHz]	Maximum Power [dBm]	Conducted Power [dBm]	Test position	Measured SAR1g* [W/kg]	Power Drift [dB]	Scaling Factor	Normal Duty Cycle [%]	Reported SAR1g [W/kg]	Plot #
121.5	18.3	17.79	Front	0.028	0.12	1.13	97	0.058	
121.5	18.3	17.79	Left	0.039	-0.10	1.13	97	0.082	
121.5	18.3	17.79	Right	0.038	0.06	1.13	97	0.079	
121.5	18.3	17.79	Back	0.026	-0.08	1.13	97	0.055	
121.5	18.3	17.79	Bottom	0.043	0.19	1.13	97	0.091	
121.5	18.3	17.79	Antenna front	0.12	0.02	1.13	97	0.24	
121.5	18.3	17.79	Antenna back	0.16	0.00	1.13	97	0.33	4

*Measured with 52% duty cycle

162MHz:

Frequency [MHz]	Maximum Power [dBm]	Conducted Power [dBm]	Test position	Measured SAR1g* [W/kg]	Power Drift [dB]	Scaling Factor	Reported SAR1g [W/kg]	Plot #
162	32.3	31.22	Front	0.012	-0.10	1.28	0.016	
162	32.3	31.22	Left	0.011	0.01	1.28	0.014	
162	32.3	31.22	Right	0.017	0.14	1.28	0.022	
162	32.3	31.22	Back	0.012	-0.17	1.28	0.015	
162	32.3	31.22	Bottom	0.015	0.33	1.39	0.021	
162	32.3	31.22	Antenna front	0.039	0.01	1.28	0.049	
162	32.3	31.22	Antenna back	0.050	0.16	1.28	0.064	5

*Measured with 2.35% duty cycle

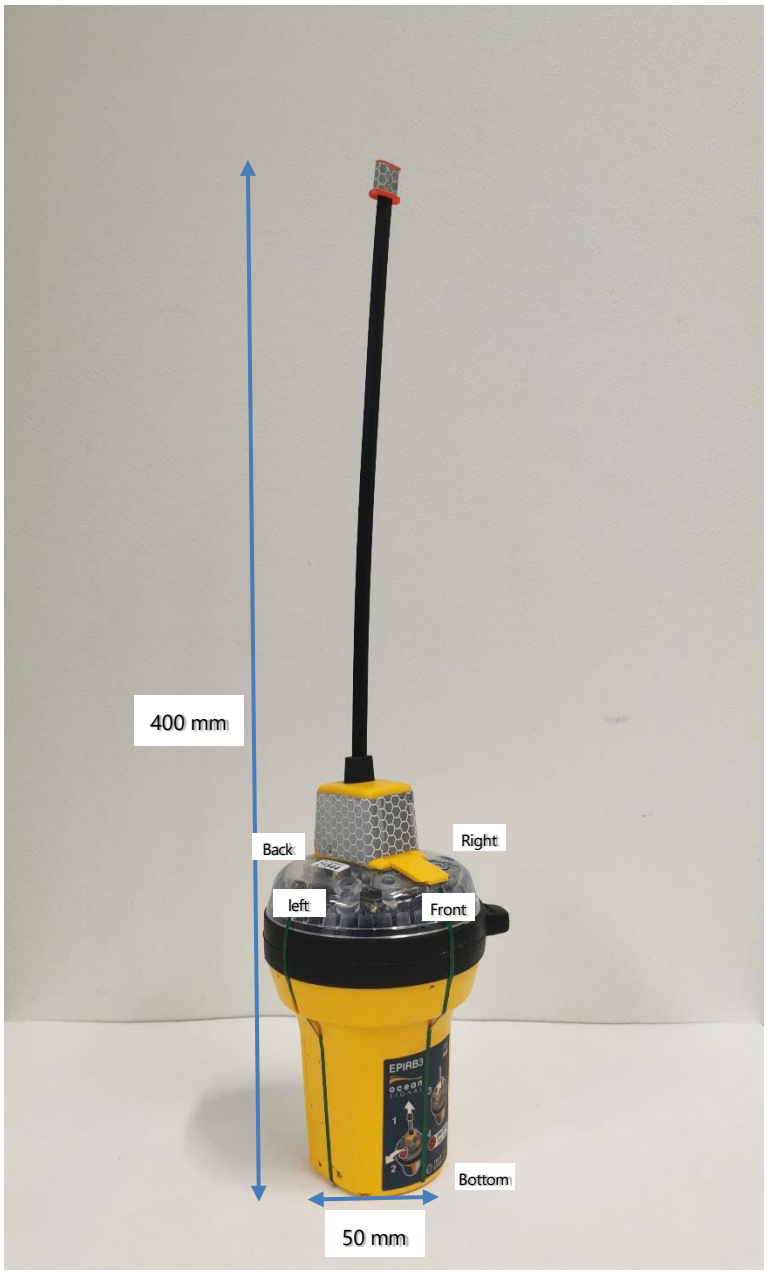
406MHz:

Frequency [MHz]	Maximum Power [dBm]	Conducted Power [dBm]	Test position	Measured SAR1g* [W/kg]	Power Drift [dB]	Scaling Factor	Normal Duty Cycle [%]	Reported SAR1g [W/kg]	Plot #
406	36.3	35.2	Front	0.20	-0.05	1.28	1	0.010	
406	36.3	35.2	Left	0.35	-0.75	1.52	1	0.020	
406	36.3	35.2	Right	0.26	-0.31	1.38	1	0.014	
406	36.3	35.2	Back	0.29	0.98	1.61	1	0.018	
406	36.3	35.2	Bottom	0.49	0.01	1.28	1	0.024	
406	36.3	35.2	Antenna front	6.76	-0.15	1.28	1	0.33	
406	36.3	35.2	Antenna back	6.16	-0.88	1.57	1	0.37	6

*Measured with 26% duty cycle

APPENDIX A: PHOTOS OF THE DUT

Length of the DUT is 400mm with a diameter of 50mm.



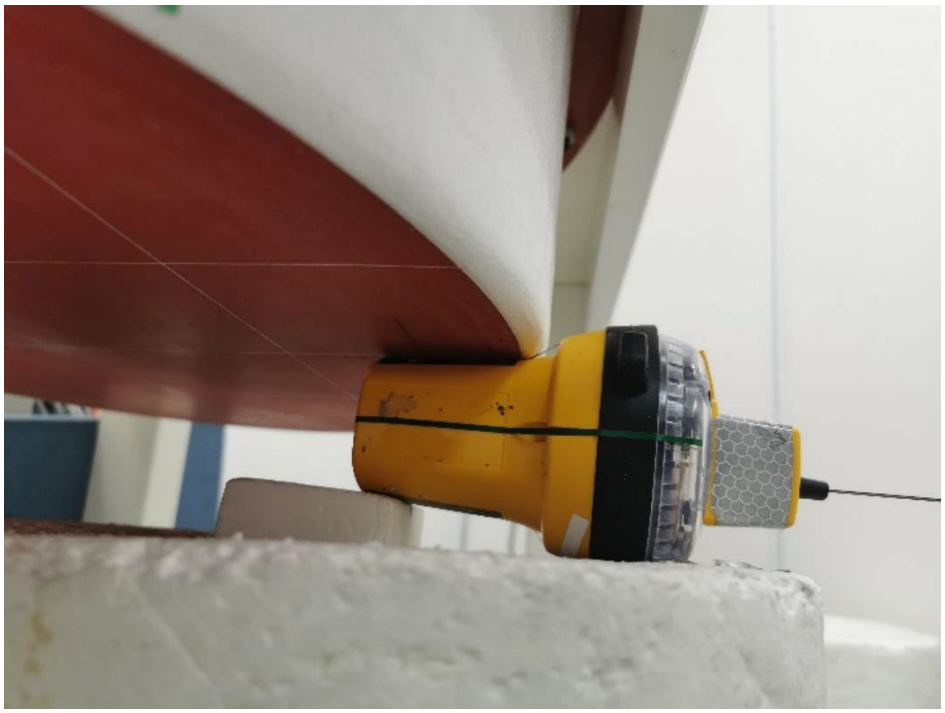


Figure 2. Front of the DUT facing phantom, 0mm

Figure 3. Back of the DUT facing phantom, 0mm

Figure 4. Right side of the DUT facing phantom, 0mm

Figure 5. Left side of the DUT facing phantom, 0mm

Figure 6. Bottom side of the device, 0mm

Figure 7. Front side of the antenna, 0mm

Figure 8. Back side of the antenna, 0mm

APPENDIX B: SYSTEM CHECK SCAN

Plot 1

Date/Time: 06/09/2022 14:39:00

Test Laboratory: Verkotan Oy

DUT: CLA-128 - SN3006; Type: CLA-128; Serial: SN3006

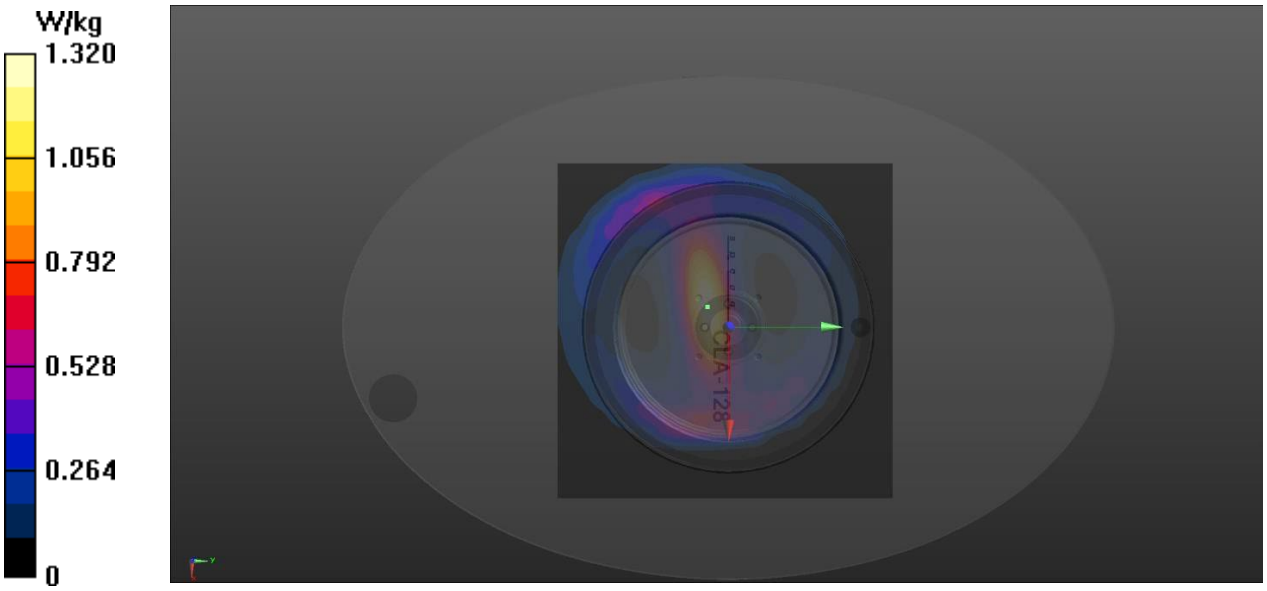
Communication System: UID 0, CW (0); Communication System Band: CLA128 (128.0 MHz); Frequency: 128 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 128 MHz; σ = 0.772 S/m; ε_r = 50.425; ρ = 1000 kg/m^3 , Medium parameters used: σ = 0 S/m, ε_r = 1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(11.62, 11.62, 11.62) @ 128 MHz; Calibrated: 21/10/2021
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn705; Calibrated: 26/04/2021
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System check, 128MHz/Area Scan (171x171x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.32 W/kg

Configuration/System check, 128MHz/Volume Scan (7x7x7): Measurement grid: dx=5mm, dy=5mm, dz=5mm
SAR(1 g) = 0.928 W/kg; SAR(10 g) = 0.605 W/kg (SAR corrected for target medium)
Reference Value = 27.45 V/m; Power Drift = -0.22 dB
Maximum value of Total (measured) = 41.37 V/m



Plot 20

Date/Time: 08/09/2022 14:14:24

Test Laboratory: Verkotan Oy

DUT: Dipole 450 MHz D450V2; Type: D450V2; Serial: D450V2 - SN:434

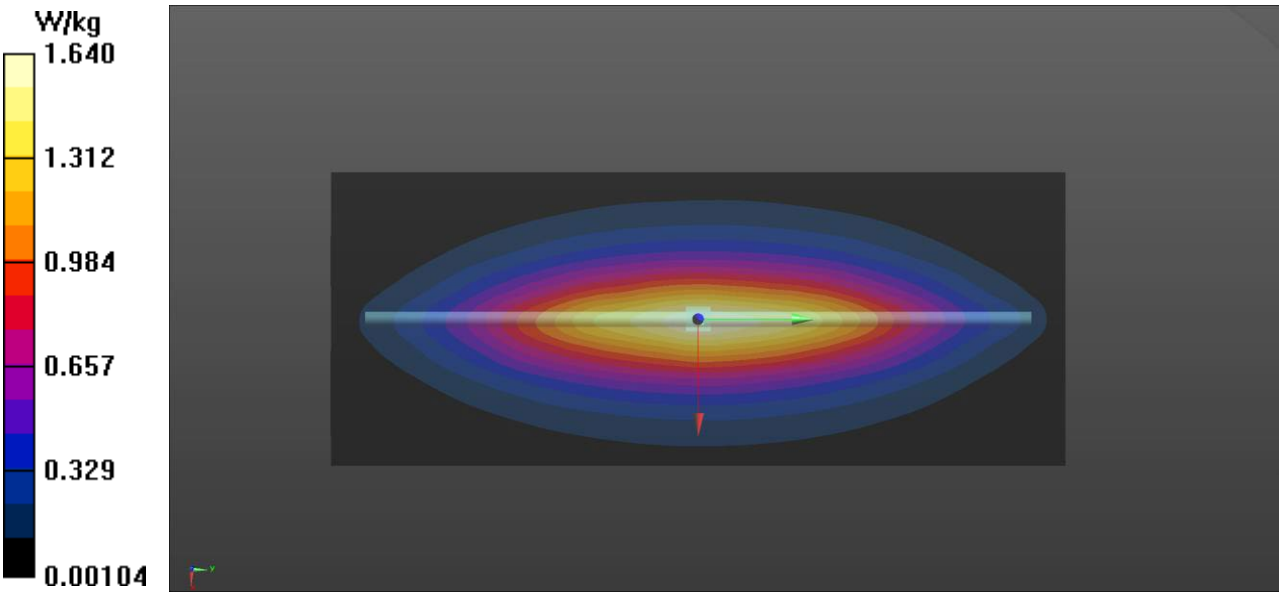
Communication System: UID 0, CW (0); Communication System Band: D450 (450.0 MHz); Frequency: 450 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 450 MHz; σ = 0.937 S/m; ε_r = 44.942; ρ = 1000 kg/m^3 , Medium parameters used: σ = 0 S/m, ε_r = 1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(10.16, 10.16, 10.16) @ 450 MHz; Calibrated: 21/10/2021
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn705; Calibrated: 26/04/2021
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System check, 450MHz/Area Scan (81x201x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.64 W/kg

Configuration/System check, 450MHz/Volume Scan (7x7x7): Measurement grid: dx=5mm, dy=5mm, dz=5mm
SAR(1 g) = 1.2 W/kg; SAR(10 g) = 0.792 W/kg (SAR corrected for target medium)
Reference Value = 38.97 V/m; Power Drift = -0.53 dB
Maximum value of Total (measured) = 43.11 V/m



Plot 21

Date/Time: 12/09/2022 09:26:38

Test Laboratory: Verkotan Oy

DUT: Dipole 450 MHz D450V2; Type: D450V2; Serial: D450V2 - SN:434

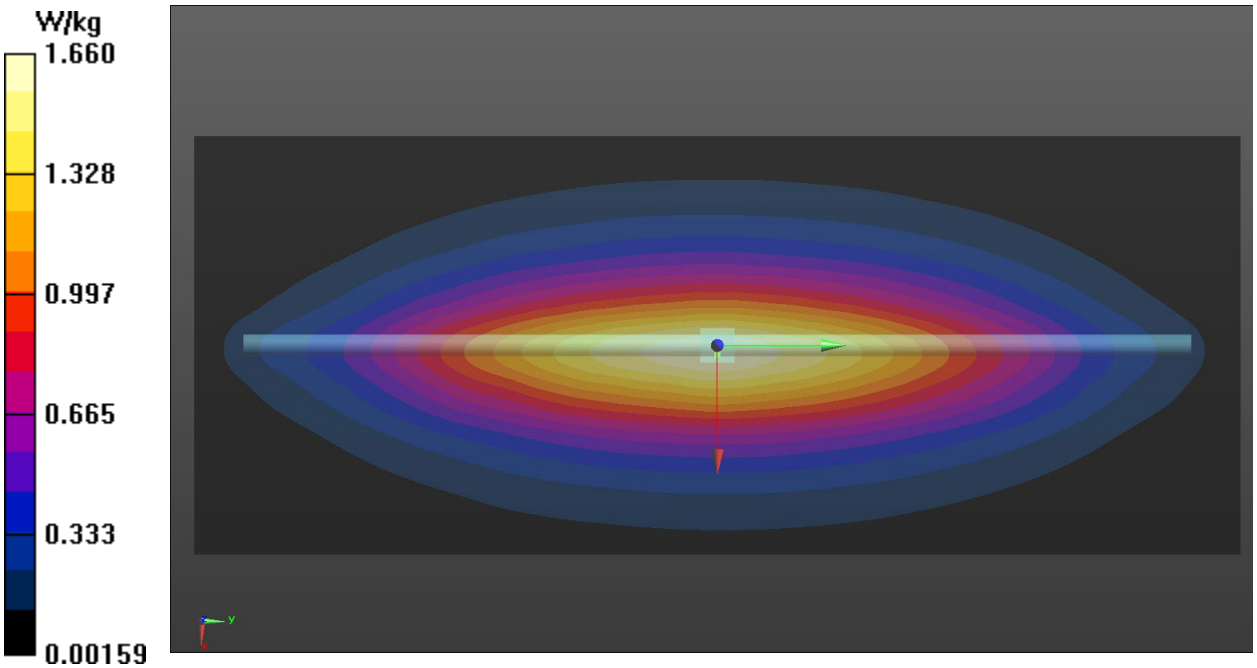
Communication System: UID 0, CW (0); Communication System Band: D450 (450.0 MHz); Frequency: 450 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 450 MHz; σ = 0.929 S/m; ε_r = 43.948; ρ = 1000 kg/m^3 , Medium parameters used: σ = 0 S/m, ε_r = 1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(10.16, 10.16, 10.16) @ 450 MHz; Calibrated: 21/10/2021
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn705; Calibrated: 26/04/2021
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System check, 450MHz/Area Scan (81x201x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.66 W/kg

Configuration/System check, 450MHz/Volume Scan (7x7x7): Measurement grid: dx=5mm, dy=5mm, dz=5mm
SAR(1 g) = 1.22 W/kg; SAR(10 g) = 0.806 W/kg (SAR corrected for target medium)
Reference Value = 37.09 V/m; Power Drift = -0.06 dB
Maximum value of Total (measured) = 43.64 V/m



APPENDIX C: MEASUREMENT SCAN

Plot 4

Date/Time: 07/09/2022 09:40:20

Test Laboratory: Verkotan Oy

DUT: Ocean Signal_EPIRB3 Pro;

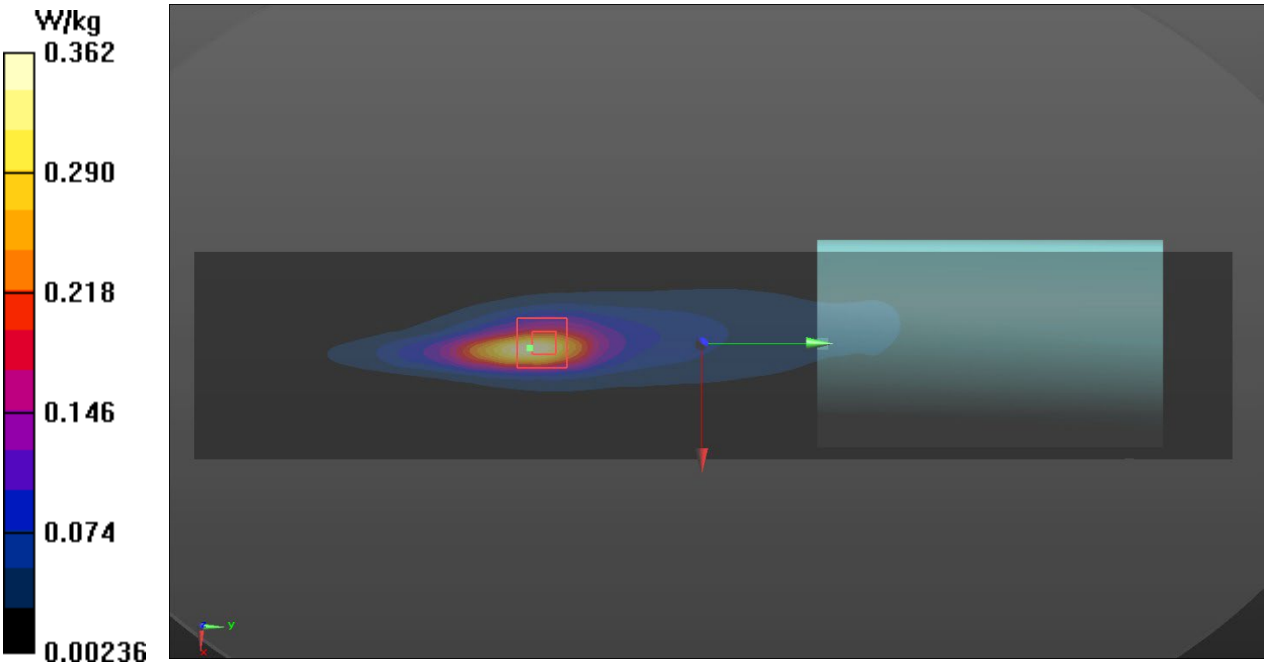
Communication System: UID 0, 121.5MHz (0); Communication System Band: 121.5MHz; Frequency: 121.5 MHz;
Communication System PAR: 0.177 dB;
Medium parameters used (interpolated): f = 121.5 MHz; σ = 0.769 S/m; ε_r = 50.593; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(11.62, 11.62, 11.62) @ 121.5 MHz; Calibrated: 21/10/2021
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn705; Calibrated: 26/04/2021
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

121MHz/EPIRB3 Pro, 121MHz, Antenna back, 0mm/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 9.390 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.839 W/kg
SAR(1 g) = 0.159 W/kg; SAR(10 g) = 0.061 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 5 mm
Ratio of SAR at M2 to SAR at M1 = 20.4%
Maximum value of SAR (measured) = 0.362 W/kg

121MHz/EPIRB3 Pro, 121MHz, Antenna back, 0mm/Area Scan (61x301x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.241 W/kg



Plot 5

Date/Time: 07/09/2022 12:52:34

Test Laboratory: Verkotan Oy

DUT: Ocean Signal_EPIRB3 Pro;

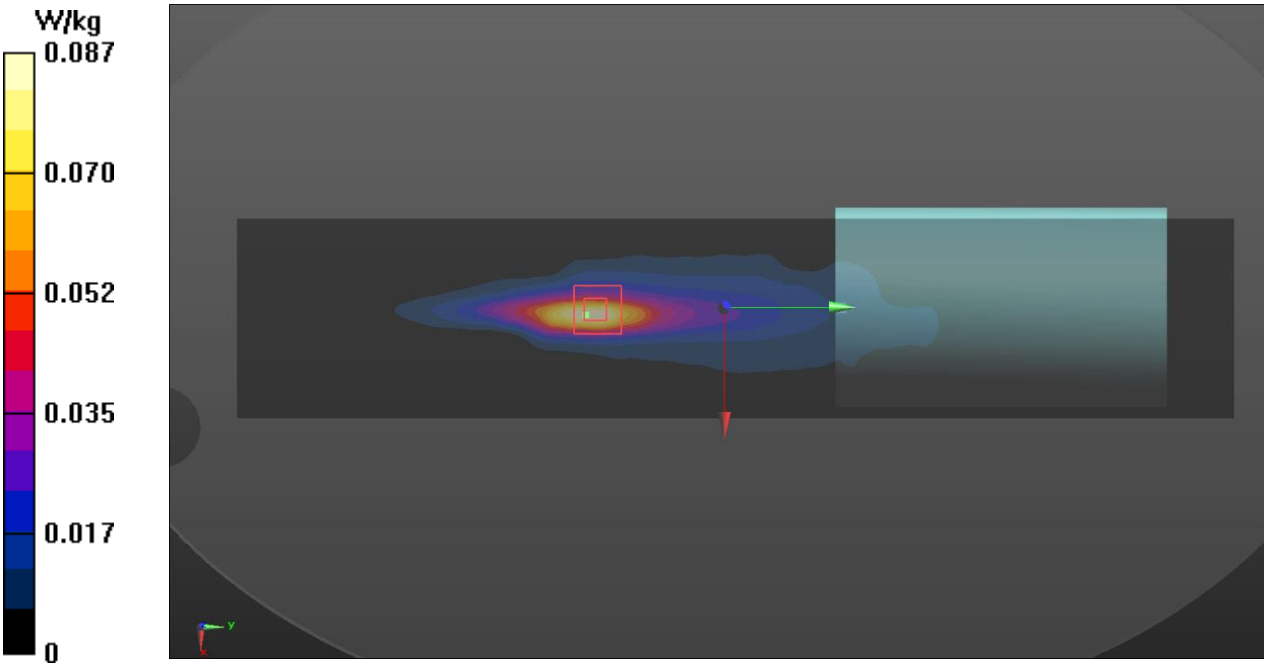
Communication System: UID 0, AIS (0); Communication System Band: 162; Frequency: 162 MHz;
Communication System PAR: 15.75 dB;
Medium parameters used: f = 162 MHz; σ = 0.787 S/m; ε_r = 49.579; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(11.62, 11.62, 11.62) @ 162 MHz; Calibrated: 21/10/2021
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn705; Calibrated: 26/04/2021
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

162MHz/EPIRB3 Pro, 162MHz, Antenna back, 0mm/Area Scan (61x301x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.0874 W/kg

162MHz/EPIRB3 Pro, 162MHz, Antenna back, 0mm/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.570 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 0.228 W/kg
SAR(1 g) = 0.050 W/kg; SAR(10 g) = 0.020 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 5 mm
Ratio of SAR at M2 to SAR at M1 = 22.6%
Maximum value of SAR (measured) = 0.108 W/kg



Plot 6

Date/Time: 12/09/2022 10:22:47

Test Laboratory: Verkotan Oy

DUT: Ocean Signal_EPIRB3 Pro;

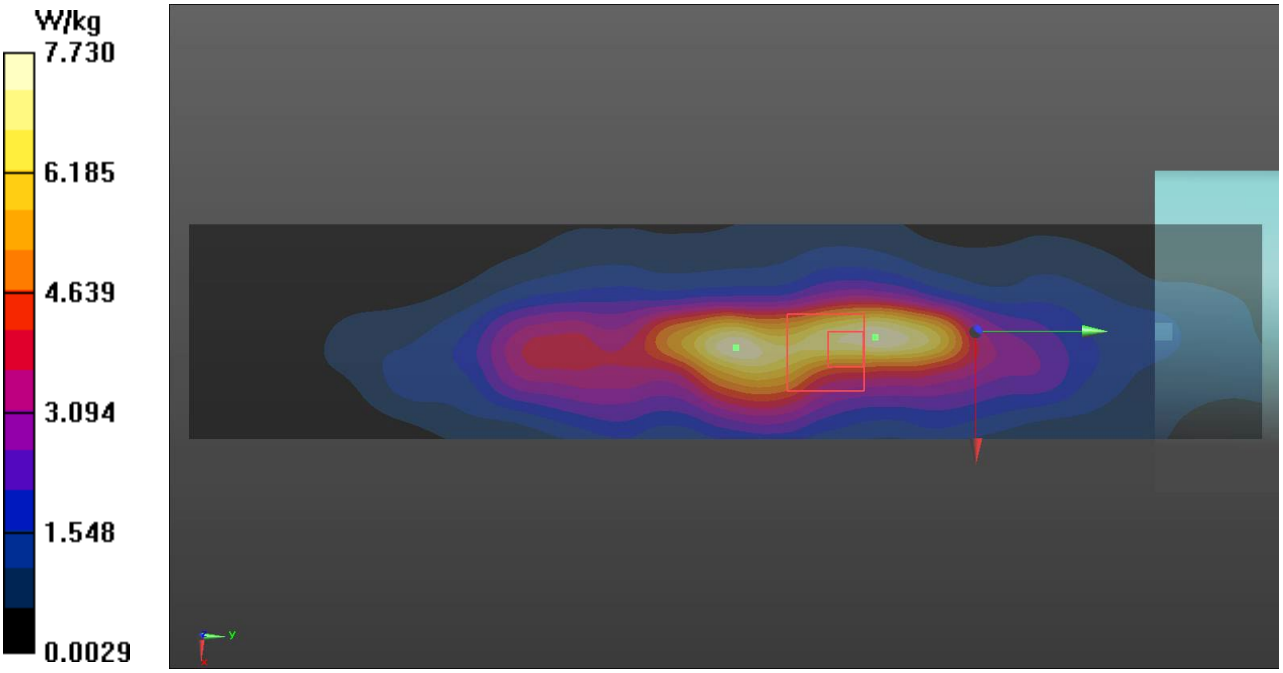
Communication System: UID 0, 406MHz (0); Communication System Band: 406MHz; Frequency: 406 MHz;
Communication System PAR: 0.177 dB;
Medium parameters used: f = 406 MHz; σ = 0.902 S/m; ε_r = 44.519; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(10.16, 10.16, 10.16) @ 406 MHz; Calibrated: 21/10/2021
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn705; Calibrated: 26/04/2021
  - Phantom: SAR1_Phantom1_ELI; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

406MHz/EPIRB3 Pro, 406MHz, Antenna back, 0mm /Area Scan (41x201x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 7.73 W/kg

406MHz/EPIRB3 Pro, 406MHz, Antenna back, 0mm/Zoom Scan (8x10x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 62.96 V/m; Power Drift = -0.88 dB
Peak SAR (extrapolated) = 18.8 W/kg
SAR(1 g) = 6.16 W/kg; SAR(10 g) = 3.07 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 6 mm
Ratio of SAR at M2 to SAR at M1 = 45.6%
Maximum value of SAR (measured) = 11.7 W/kg



APPENDIX D: RELEVANT PAGES FROM PROBE CALIBRATION

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

ilac-MRA

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

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

Accreditation No.: SCS 0108

Client Verkotan **Certificate No: EX3-3852_Oct21**

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3852

Calibration procedure(s): QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v6, QA CAL-23.v5, QA CAL-25.v7
Calibration procedure for dosimetric E-field probes

Calibration date: October 21, 2021

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	09-Apr-21 (No. 217-03291/03292)	Apr-22
Power sensor NRP-Z91	SN: 103244	09-Apr-21 (No. 217-03291)	Apr-22
Power sensor NRP-Z91	SN: 103245	09-Apr-21 (No. 217-03292)	Apr-22
Reference 20 dB Attenuator	SN: CC2552 (20x)	09-Apr-21 (No. 217-03343)	Apr-22
DAE4	SN: 660	23-Dec-20 (No. DAE4-660_Dec20)	Dec-21
Reference Probe ES3DV2	SN: 3013	30-Dec-20 (No. ES3-3013_Dec20)	Dec-21
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-20)	In house check: Jun-22
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-22

	Name	Function	Signature
Calibrated by:	Jeffrey Katzman	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: October 23, 2021

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3852

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-52.7
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3852

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)
30	55.0	0.75	13.53	13.53	13.53	0.00	1.00	± 13.3 %
64	54.2	0.75	12.08	12.08	12.08	0.00	1.00	± 13.3 %
128	52.8	0.76	11.62	11.62	11.62	0.00	1.00	± 13.3 %
220	49.0	0.81	11.12	11.12	11.12	0.00	1.00	± 13.3 %
450	43.5	0.87	10.16	10.16	10.16	0.16	1.30	± 13.3 %
1300	40.8	1.14	8.79	8.79	8.79	0.27	0.80	± 12.0 %
1450	40.5	1.20	8.68	8.68	8.68	0.33	0.80	± 12.0 %
1640	40.2	1.31	8.48	8.48	8.48	0.26	0.86	± 12.0 %
3500	37.9	2.91	6.90	6.90	6.90	0.30	1.35	± 13.1 %
3700	37.7	3.12	6.70	6.70	6.70	0.30	1.35	± 13.1 %
3900	37.5	3.32	6.44	6.44	6.44	0.40	1.60	± 13.1 %
4100	37.2	3.53	6.25	6.25	6.25	0.40	1.60	± 13.1 %
5250	35.9	4.71	4.90	4.90	4.90	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.61	4.61	4.61	0.40	1.80	± 13.1 %
5750	35.4	5.22	4.69	4.69	4.69	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

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

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

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

Accreditation No.: **SCS 0108**

Client: **Verkotan**

Certificate No: **CLA128-3006_Jul22**

CALIBRATION CERTIFICATE

Object: CLA128 - SN: 3006

Calibration procedure(s): QA CAL-15.v9
Calibration Procedure for SAR Validation Sources below 700 MHz

Calibration date: July 18, 2022

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-22 (No. 217-03525/03524)	Apr-23
Power sensor NRP-Z91	SN: 103244	04-Apr-22 (No. 217-03524)	Apr-23
Power sensor NRP-Z91	SN: 103245	04-Apr-22 (No. 217-03525)	Apr-23
Reference 20 dB Attenuator	SN: CC2552 (20x)	04-Apr-22 (No. 217-03527)	Apr-23
Type-N mismatch combination	SN: 310982 / 06327	04-Apr-22 (No. 217-03528)	Apr-23
Reference Probe EX3DV4	SN: 3877	31-Dec-21 (No. EX3-3877_Dec21)	Dec-22
DAE4	SN: 654	26-Jan-22 (No. DAE4-654_Jan22)	Jan-23

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-22)	In house check: Jun-24
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-22)	In house check: Jun-24
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-22)	In house check: Jun-24
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-22)	In house check: Jun-24
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-22

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

Issued: July 20, 2022

Measurement Conditions

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

DASY Version	DASY5	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	ELI4 Flat Phantom	Shell thickness: 2 ± 0.2 mm
EUT Positioning	Touch Position	
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	128 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	52.8	0.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	51.0 ± 6 %	0.74 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	1 W input power	3.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**3.41 W/kg ± 18.4 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	1 W input power	2.24 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**2.27 W/kg ± 18.0 % (k=2)**

SAR Reference Dipole Calibration Report

Ref : ACR.53.5.22.BES.A

VERKOTAN LTD.
ELEKTRONIIKKATIE 17
90590, OULU, FINLAND
MVG COMOSAR REFERENCE DIPOLE
FREQUENCY: 450 MHZ
SERIAL NO.: SN 37/16 DIP 0G450-434

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

Calibration date: 02/22/2022

Summary:

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

Page: 1/11

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ε,')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±10 %		0.87 ±10 %	
450	43.5 ±10 %	42.8	0.87 ±10 %	0.91
750	41.9 ±10 %		0.89 ±10 %	
835	41.5 ±10 %		0.90 ±10 %	
900	41.5 ±10 %		0.97 ±10 %	
1450	40.5 ±10 %		1.20 ±10 %	
1500	40.4 ±10 %		1.23 ±10 %	
1640	40.2 ±10 %		1.31 ±10 %	
1750	40.1 ±10 %		1.37 ±10 %	
1800	40.0 ±10 %		1.40 ±10 %	
1900	40.0 ±10 %		1.40 ±10 %	
1950	40.0 ±10 %		1.40 ±10 %	
2000	40.0 ±10 %		1.40 ±10 %	
2100	39.8 ±10 %		1.49 ±10 %	
2300	39.5 ±10 %		1.67 ±10 %	
2450	39.2 ±10 %		1.80 ±10 %	
2600	39.0 ±10 %		1.96 ±10 %	
3000	38.5 ±10 %		2.40 ±10 %	
3300	38.2 ±10 %		2.71 ±10 %	
3500	37.9 ±10 %		2.91 ±10 %	
3700	37.7 ±10 %		3.12 ±10 %	
3900	37.5 ±10 %		3.32 ±10 %	
4200	37.1 ±10 %		3.63 ±10 %	
4600	36.7 ±10 %		4.04 ±10 %	
4900	36.3 ±10 %		4.35 ±10 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

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

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPGO333
Liquid	Head Liquid Values: eps' : 42.8 sigma : 0.91
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	450 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58	4.67 (0.47)	3.06	3.08 (0.31)
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4		20.1	
1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3300	-		-	
3500	67.1		25	
3700	67.4		24.2	
3900	-		-	
4200	-		-	
4600	-		-	
4900	-		-	

