SAR Compliance Test Report

Date of Report:	2/09/2025	**Client's Contact person:**	Debbie Heath
Number of pages:	31	**Responsible Test engineer:**	Kalle Orava
Testing laboratory:	**Verkotan Oy** Elektroniikkatie 17 90590 Oulu Finland	**Client:**	**Ocean Signal Limited** Unit 1, Ocivan Way Margate Kent CT9 4NN United Kingdom
Tested device:	**S200**		
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
865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
447498 D04 Interim General RF Exposure Guidance v01

IEC/IEEE 62209-1528, 2020
Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices

RSS-102, Issue 6, 2023
Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

Documentation: The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory

Test Results: **The EUT complies with the requirements in respect of all parameters subject to the test.**
The test results relate only to devices specified in this document

Date and signatures:

02.09.2025

Laboratory Manager

Miia Nurkkala

TABLE OF CONTENTS

1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Device under Test (DUT):

Product:	Maritime Survivor Locating Device
Manufacturer:	Ocean Signal Ltd.
Model:	S200
Serial Number:	TA000017 (SAR sample), TA000018 (Conducted sample)
FCC ID Number:	XYES200
ISED ID Number:	9296A-S200
DUT Number:	03846 (SAR sample), 03845 (Conducted sample)
Battery Type used in testing:	Lithium Battery 6V
State of the Sample:	Production sample

Testing information:

Testing performed:	11.08.2025
Notes:	-
Document history & changes:	Initial version
Document ID:	FCC ISED_SAR report_S200 ID7642_02092025.docx
Temperature °C	22±2 / Controlled
Humidity RH%	30±20 / Controlled
Measurement performed by:	Kalle Orava
FCC Test Firm Designation Number:	FI0005
ISED Company Number:	22218

1.2 Maximum Results

The maximum reported* SAR values for Body-worn condition are shown in a table below. The device conforms to the requirements of the standards when the maximum reported SAR value is less than or equal to the limit. The SAR limit specified in FCC 47 CFR part 2 (2.1093) and Health Canada's RF exposure guideline, Safety Code 6 for Head/Body SAR_{1g} is 1.6 W/kg.

1.2.1 Standalone SAR

System	Highest Reported* SAR_{1g}[W/kg] in Body-Worn Exposure Condition, 0mm separation distance	Result
AIS	**0.03**	**PASS**

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

1.2.2 Maximum Drift

Maximum Drift During Measurements	-1.31 dB*

*Larger than 5% drifts included to scaling factors

1.2.3 Measurement Uncertainty

DASY5 System, SAR 1g: 4 MHz – 300 MHz:

Expanded Uncertainty (k=2) 95 %	±22.8 %

2. DESCRIPTION OF THE DEVICE UNDER TEST (DUT)

DUT is a Maritime Survivor Locating Device supporting AIS technology.

Figure 1. Overview of the DUT

Device Category	Portable
Exposure Environment	General population uncontrolled

2.1 Supported Frequency Bands and Operational Modes

TX Frequency bands	Modes of Operation	Transmitter Frequency Range [MHz]
	AIS	161.975 – 162.025

3. OUTPUT POWER

3.1 Maximum specified conducted output power

From the customer, including tune-up tolerances;

Technology	Max Output Power [dBm]
AIS A	32
AIS B	32

3.2 Tested conducted power

Measured conducted output power at transmitting antenna connector;

Technology	Output power [dBm]
AIS A	31.28
AIS B	31.3

4. TEST EQUIPMENT

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

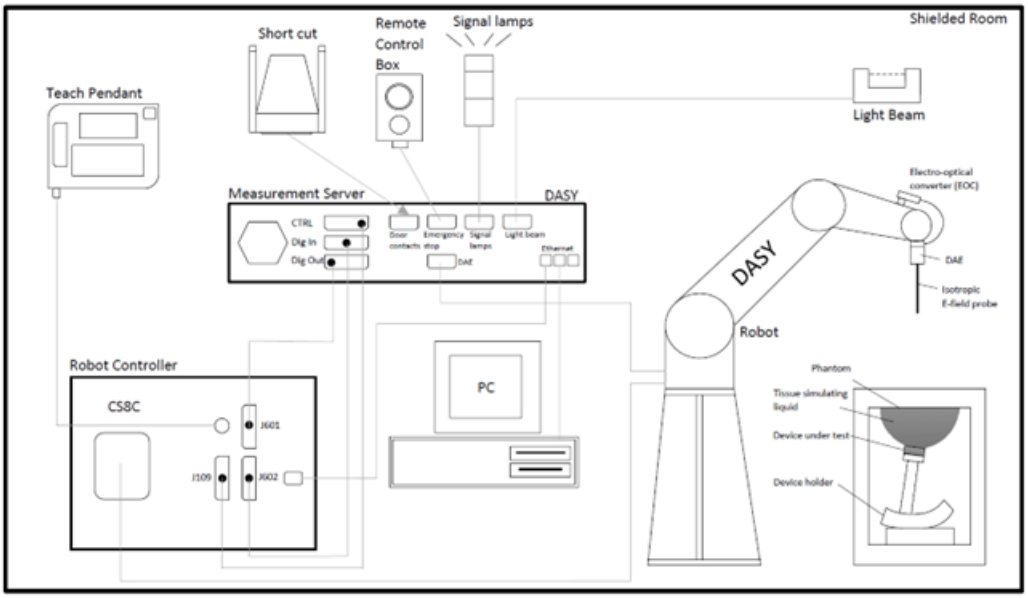


Figure 2 Schematic Laboratory Picture

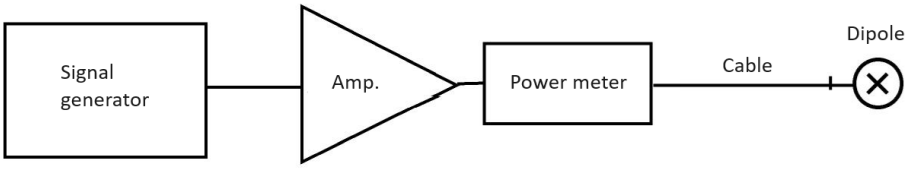


Figure 3. Signal source setup for system check

4.1 Test Equipment List

Test Equipment	Model	Serial Number	Calibration Date	Interval [years]
Amplifier, 0.5-1000MHz	TVA-R5-13A+	2202002	NA	NA
DAE4, converter	DAE4	710	10/2024	1
DASY5 Software	52.8.8.1258	-	NA	NA
Directional Power sensor	NRT-Z44	107780	02/2025	2
Isotropic DOS probe	EX3DV4	3852	10/2024	1
Network Analyzer	E5071C	MY46102812	05/2025	1
Power reflection meter	NRT	835065/049	02/2024	3
Signal Analyzer	MS2830A	6201180758	NA	NA
System validation dipole	CLA150	4027	07/2025	3

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

4.1.1 Isotropic E-field Probe Type EX3DV4

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	Calibration certificate in Appendix D
Frequency	4 MHz to 10 GHz (dosimetry) Linearity: ± 0.2 dB (30 MHz to 10 GHz)
Directivity (typical)	±0.1 dB in TSL (rotation around probe axis) ±0.3 dB in TSL (rotation normal to probe axis)
Dynamic Range	10 µW/g – >100 mW/g Linearity: ±0.2 dB (noise: typically <1 µW/g)
Dimensions	Overall length: 337 mm (tip: 20 mm) Tip diameter: 2.5 mm (body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm
Application	General dosimetry up to 6 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms

4.2 Phantoms

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 4 MHz to 10 GHz. The phantom conforms to the requirements of IEC/IEEE 62209-1528 and FCC published RF Exposure KDB Procedures. The shell thickness of the bottom plate is 2±0.2mm.

4.3 Tissue Simulants

Recommended values for the dielectric parameters of the tissue simulants are given in IEC/IEEE 62209-1528 and FCC published RF Exposure KDB Procedures. The dielectric parameters of the used tissue simulants were within ±10% of the recommended values at frequencies under 3GHz and ±5% at frequencies above 3GHz. A liquid compensation algorithm was used in DASY with which measured peak average SAR values were corrected for the deviation of used liquid. Depth of the tissue simulant was at least 15.0 cm from the inner surface of the flat phantom.

Tissue simulant liquid Ingredients
Deionized Water, tween, salt

4.4 System Validation Status

Frequency [MHz]	Dipole Type / SN	Probe Type / SN	Calibrated Signal Type	DAE Unit / SN	Dielectric Constant [ε']	Conductivity σ [S/m]	Date
150	CLA 150 - SN: 4027	EX3DV4 - SN: 3852	SMC	DAE 4 / 710	49.31	0.79	01/2025

4.5 System Check

Date	Tissue Type	Tissue Temp. [°C]	Frequency [MHz]	Input Power [mW]	Measured SAR1g [W/kg]	1W Target SAR1g [W/kg]	1W Normalized SAR1g [W/kg]	Deviation [%]	Plot #
11.08.2025	WB Head	21.7	150	250	0.946	3.66	3.78	3.39	1

4.5.1 Tissue Simulant Verification

				Measured		Target		Deviation	
Date	Tissue Type	Tissue Temp [°C]	Frequency [MHz]	Dielectric Constant [ε]	Conductivity σ [S/m]	Dielectric Constant [ε] Target	Conductivity σ [S/m] Target	ε [%]	σ [%]
11.08.2025	WB Head	21.7	150	48.07	0.71	52.3	0.76	-8.1	-6.7
11.08.2025	WB Head	21.7	161.975	47.83	0.71	51.74	0.77	-7.6	-7.1
11.08.2025	WB Head	21.7	162.025	47.83	0.71	51.74	0.77	-7.6	-7.1

5. TEST PROCEDURE

Test configurations for SAR testing were selected based on conducted power measurements. Low and high frequency channels for the configuration with the highest SAR value was tested as per ISED notice 2016-DRS001.

A control software for AIS was used to set the DUT to transmit at maximum power. During testing DUT operated at higher duty cycle than in normal use, thus measured and reported SAR values are conservative. Please see table below:

Frequency [MHz]	Description	Conducted Power [dBm]	Test mode Duty Cycle [%]	Normal Duty Cycle [%]
161.975	AIS A	32	2.42	0.178
162.025	AIS B	32	2.42	0.178

5.1 Test Positions

5.1.1 Body-worn Configuration, 0mm separation distance

Body SAR was tested from all of the six sides of the device. The device was placed on top of a Rohacell and lifted towards the phantom until the distance between the phantom and the device was 0mm.

Photos of the test positions are presented in appendix A

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

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

6. MEASUREMENT UNCERTAINTY

Uncertainty Budget
According to IEC/IEEE 62209-1528
(Frequency band: 4MHz–300MHz range)

Symbol	Error Description	Uncert. value	Prob. Dist.	Div.	(cᵢ) (1g)	(cᵢ) (10g)	Std. Unc. (1g)	Std. Unc. (10g)
Measurement System Errors								
CF	Probe Calibration	±13.3%	N	√2	1	1	±6.65%	±6.65%
CF_{drift}	Probe Calibration Drift	±1.7%	R	√3	1	1	±1.0%	±1.0%
LIN	Probe Linearity	±4.7%	R	√3	1	1	±2.7%	±2.7%
BBS	Broadband Signal	±0.6%	R	√3	1	1	±0.3%	±0.3%
ISO	Probe Isotropy	±7.6%	R	3	1	1	±4.4%	±4.4%
DAE	Other Probe+Electronic	±0.8%	N	1	1	1	±0.8%	±0.8%
AMB	RF Ambient	±1.8%	N	1	1	1	±1.8%	±1.8%
Δ_{sys}	Probe Positioning	±0.006mm	N	1	0.04	0.04	±0.10%	±0.10%
DAT	Data Processing	±1.2%	N	1	1	1	±1.2%	±1.2%
Phantom and Device Errors								
LIQ(σ)	Conductivity (meas.)^{DAK}	±2.5%	N	√1	0.78	0.71	±2.0%	±1.8%
$LIQ(T_\sigma)$	Conductivity (temp.)^{BB}	±5.4%	R	√3	0.78	0.71	±2.4%	±2.2%
EPS	Phantom Permittivity	±14.0%	R	3	0	0	±0%	±0%
DIS	Distance DUT – TSL	±2.0%	N	1	2	2	±4.0%	±4.0%
D_{xyz}	Device Positioning	±1.0%	N	1	1	1	±1.0%	±1.0%
H	Device Holder	±3.6%	N	√1	1	1	±3.6%	±3.6%
MOD	DUT Modulation^{m}	±2.4%	R	√3	1	1	±1.4%	±1.4%
TAS	Time-average SAR	±1.7%	R	3	1	1	±1.0%	±1.0%
RF_{drift}	DUT drift	±2.5%	N	1	1	1	±2.5%	±2.5%
VAL	Val Antenna Unc.^{val}	±0.0%	N	1	1	1	±0%	±0%
RF_{in}	Unc. Input Power^{val}	±0.0%	N	1	1	1	±0%	±0%
Correction to the SAR results								
C(ε, σ)	Deviation to Target	±1.9%	N	√1	1	0.84	±1.9%	±1.6%
C(R)	SAR scaling^{p}	±0.0%	R	3	1	1	±0.0%	±0.0%
u(ΔSAR)	Combined Uncertainty						±11.4%	±11.3%
U	**Expanded Uncertainty**						±22.8%	±22.5%

7. TEST RESULTS

7.1 SAR Results for Body Exposure Condition with 0mm separation

Band	Frequency [MHz]	Maximum Power [dBm]	Conducted Power [dBm]	Test position	Measured SAR_{1g} [W/kg]	Power Drift* [dB]	Duty Cycle [%]	Scaling Factor	Reported SAR_{1g} [W/kg]	Plot #
AIS B	162.025	32	31.3	Left, 0mm	0.004	-0.22	2.4	1.24	0.01	
AIS B	162.025	32	31.3	Right, 0mm	4.14E-05	-0.06	2.4	1.17	4.86E-05	
AIS B	162.025	32	31.3	Front, 0mm	0.01	-1.31	2.4	1.59	0.01	
AIS B	162.025	32	31.3	Back, 0mm	0.003	-0.43	2.4	1.30	0.004	
AIS B	162.025	32	31.3	Top, 0mm	4.94E-05	0	2.4	1.17	5.80E-05	
AIS B	162.025	32	31.3	Bottom, 0mm	0.02	0.61	2.4	1.35	0.03	2
AIS A	161.975	32	31.28	Bottom, 0mm	0.02	0.07	2.4	1.18	0.02	

*Larger than 5% drifts included to scaling factors

7.2 IEC/IEEE 62209-1528:2020, Zoom Scan Evaluation

According to IEC/IEEE 62209-1528:2020, subclause 7.4.2 d.4), the zoom scan complies if the peak spatial-average SAR is below 0.1 W/kg, or if the following criteria is met:

1. The smallest horizontal distance from the local SAR peaks to all points 3 dB below the SAR peak is larger than the horizontal grid step.

2. Ratio of SAR at the second measured point (M2) to the SAR at the closest measured point (M1) at the x-y location of the measured maximum is at least 30%.

Zoom scan compliance according to IEC/IEEE 62209-1528:2020 is automatically verified by DASY software and all zoom scans in this test report do pass the criteria. The horizontal distance and Ratio between measurement points M2 and M1 of the highest SAR results are available in Appendix C.

APPENDIX A: PHOTOS OF THE DUT

Size of the DUT is: 230 x 55 x 90 mm

Figure 4. Overview of the DUT

Figure 5. Left side of the DUT, 0mm

Figure 6. Right side of the DUT, 0mm

Figure 7. Front side of the DUT, 0mm

Figure 8. Back side of the DUT, 0mm

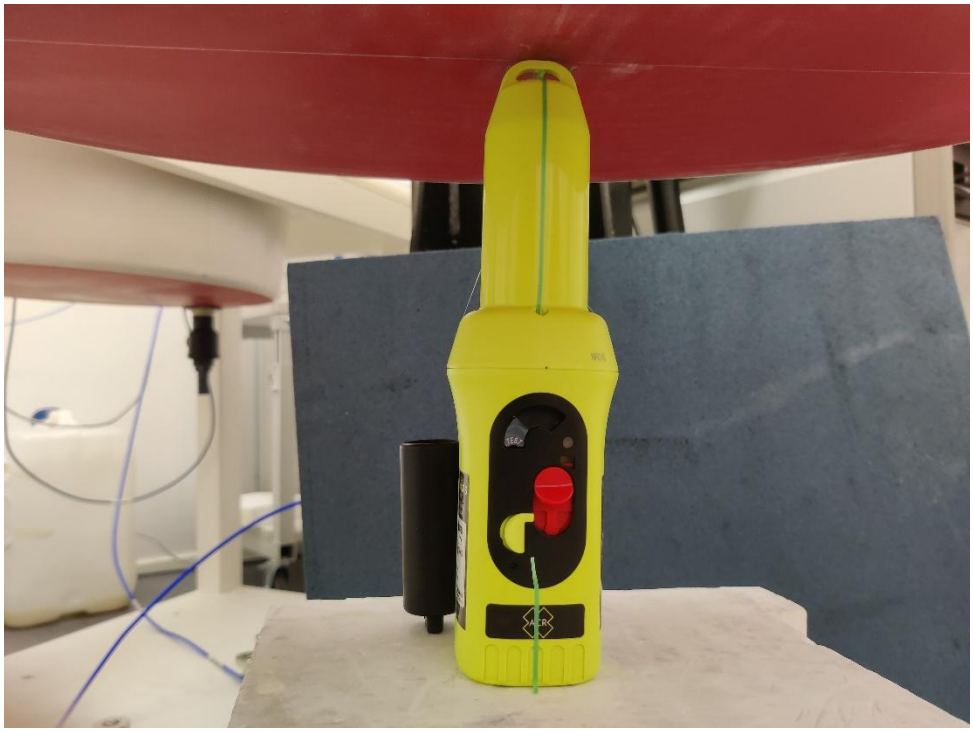


Figure 9. Top side of the DUT, 0mm

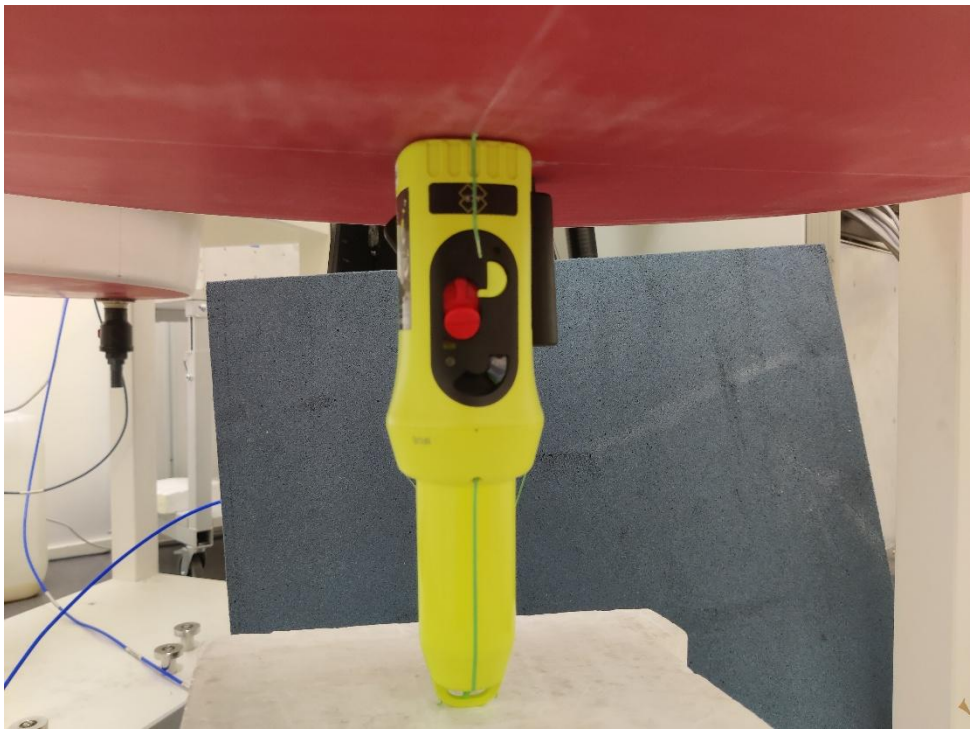


Figure 10. Bottom side of the DUT, 0mm

APPENDIX B: SYSTEM CHECK SCAN

Plot 1

Date/Time: 11.8.25 09:11:34

Test Laboratory: Verkotan Oy

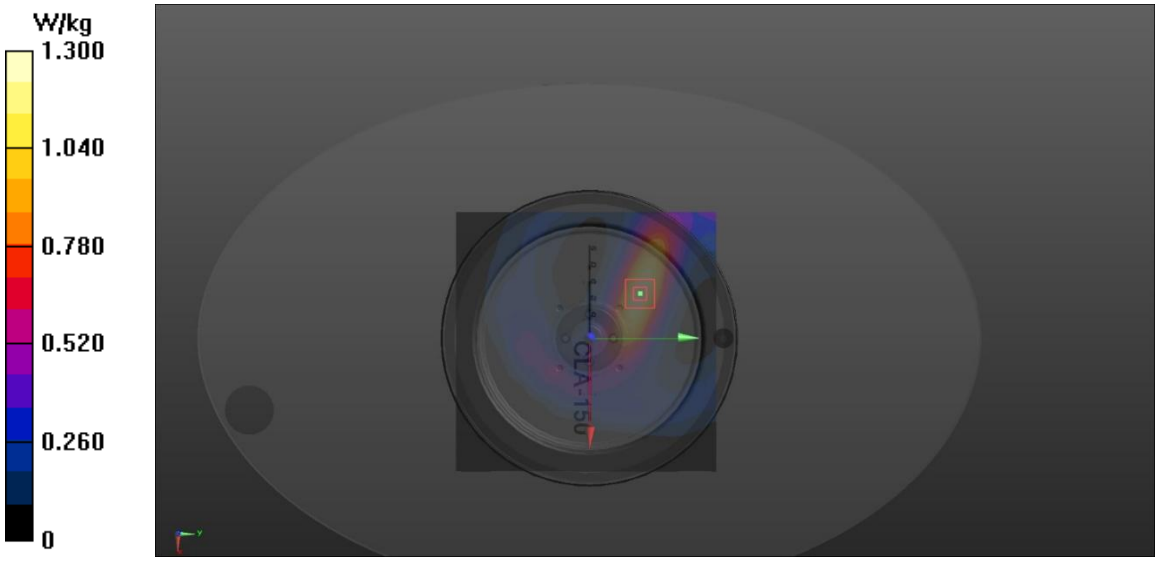
DUT: CLA-150 - SN4027

Communication System: UID 0, CW (0); Communication System Band: D150 (150.0 MHz); Frequency: 150 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 150 MHz; σ = 0.709 S/m; ε_r = 48.074; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(10.32, 10.92, 11.29) @ 150 MHz; Calibrated: 9.10.24
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn710; Calibrated: 8.10.24
  - Phantom: SAR1_Phantom1_ELI_right; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System check 150MHz/Area Scan (131x131x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.30 W/kg
Configuration/System check 150MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 20.54 V/m; Power Drift = -0.30 dB
Peak SAR (extrapolated) = 1.58 W/kg
SAR(1 g) = 0.946 W/kg; SAR(10 g) = 0.618 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 15.7 mm
Ratio of SAR at M2 to SAR at M1 = 58.7%
Maximum value of SAR (measured) = 1.30 W/kg



APPENDIX C: MEASUREMENT SCANS

Plot 2

Date/Time: 11.8.25 14:37:32

Test Laboratory: Verkotan Oy

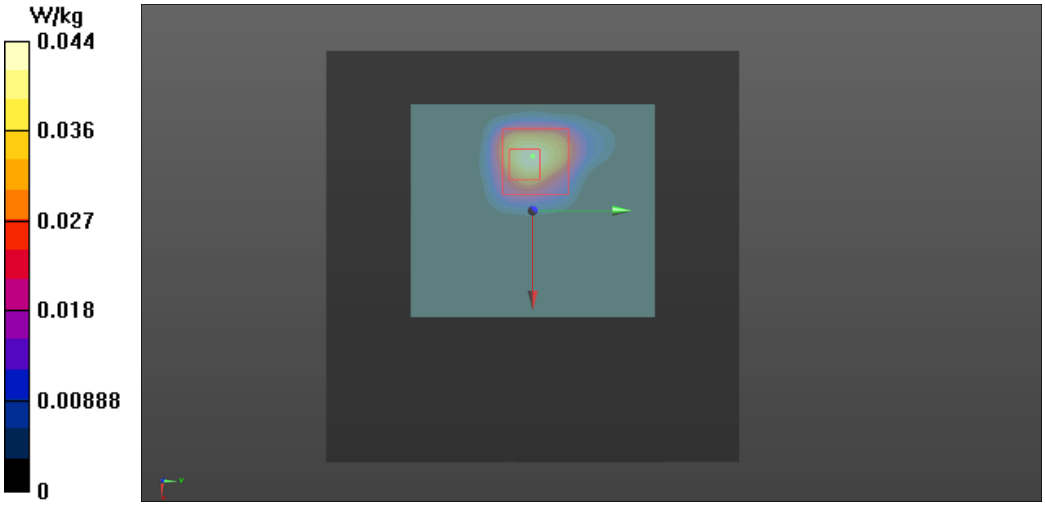
DUT: S200

Communication System: UID 0, AIS 2 (0); Communication System Band: 162 MHz; Frequency: 162.025 MHz;
Communication System PAR: 16.2 dB;
Medium parameters used (interpolated): f = 162.025 MHz; σ = 0.714 S/m; ε_r = 47.833; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

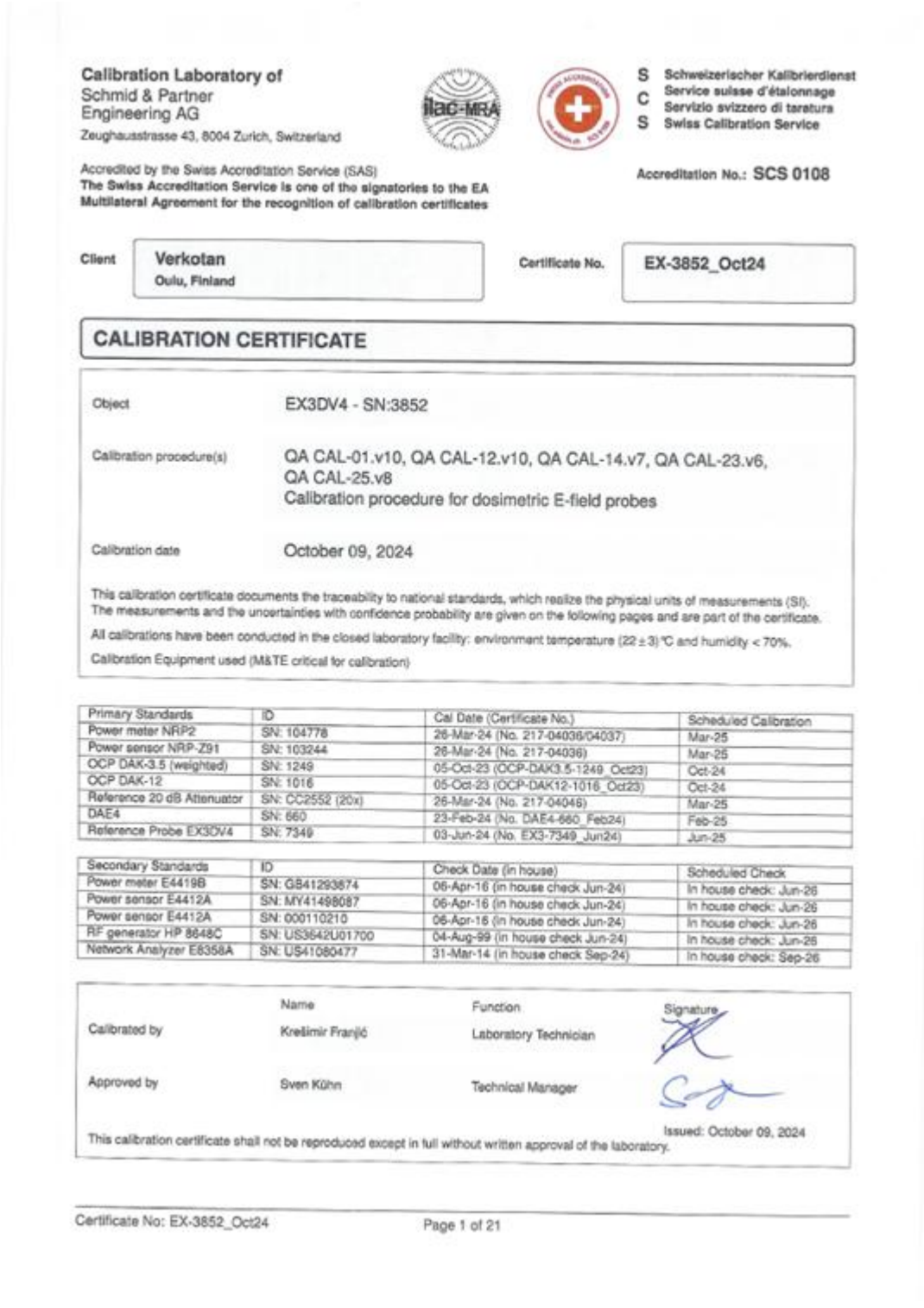
DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(10.32, 10.92, 11.29) @ 162.025 MHz; Calibrated: 9.10.24
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn710; Calibrated: 8.10.24
  - Phantom: SAR1_Phantom1_ELI_right; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/S200, AIS (B), 162.025MHz, Bottom, 0mm/Area Scan (91x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.0444 W/kg
Configuration/S200, AIS (B), 162.025MHz, Bottom, 0mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.765 V/m; Power Drift = 0.61 dB
Peak SAR (extrapolated) = 0.0690 W/kg
SAR(1 g) = 0.020 W/kg; SAR(10 g) = 0.00738 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid
Ratio of SAR at M2 to SAR at M1 = 20.7%
Maximum value of SAR (measured) = 0.0471 W/kg



APPENDIX D: RELEVANT PAGES FROM PROBE & DAE CALIBRATION REPORTS



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

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

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

Accreditation No.: SCS 0108

Client: Verkotan, Oulu, Finland
Certificate No.: EX-3852_Oct24

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3852
Calibration procedure(s)	QA CAL-01.v10, QA CAL-12.v10, QA CAL-14.v7, QA CAL-23.v6, QA CAL-25.v8 Calibration procedure for dosimetric E-field probes
Calibration date	October 09, 2024

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP2	SN: 104778	26-Mar-24 (No. 217-04036/04037)	Mar-25
Power sensor NRP-Z91	SN: 103244	26-Mar-24 (No. 217-04036)	Mar-25
OCP DAK-3.5 (weighted)	SN: 1249	05-Oct-23 (OCP-DAK3.5-1249_Oct23)	Oct-24
OCP DAK-12	SN: 1016	05-Oct-23 (OCP-DAK12-1016_Oct23)	Oct-24
Reference 20 dB Attenuator	SN: CC2552 (20x)	26-Mar-24 (No. 217-04046)	Mar-25
DAE4	SN: 660	23-Feb-24 (No. DAE4-660_Feb24)	Feb-25
Reference Probe EX3DV4	SN: 7349	03-Jun-24 (No. EX3-7349_Jun24)	Jun-25

Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-24)	In house check: Jun-26
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-24)	In house check: Jun-26
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-24)	In house check: Jun-26
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-24)	In house check: Jun-26
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Sep-24)	In house check: Sep-26

	Name	Function	Signature
Calibrated by	Krešimir Franjić	Laboratory Technician	
Approved by	Sven Kühn	Technical Manager	

Issued: October 09, 2024

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

Certificate No: EX-3852_Oct24 Page 1 of 21

Parameters of Probe: EX3DV4 - SN:3852

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc ($k = 2$)
Norm ($\mu V/(V/m)^2$) [A]	0.43	0.41	0.47	±10.1%
DCP (mV) [B]	101.0	99.9	99.2	±4.7%

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B $dB\sqrt{\mu V}$	C	D dB	VR mV	Max dev.	Max Unc[E] $k = 2$
0	CW	X	0.00	0.00	1.00	0.00	147.9	±1.6%	±4.7%
		Y	0.00	0.00	1.00		132.9		
		Z	0.00	0.00	1.00		123.5		
10352	Pulse Waveform (200Hz, 10%)	X	7.01	77.44	15.89	10.00	60.0	±2.6%	±9.6%
		Y	84.00	108.00	25.00		60.0		
		Z	20.00	91.75	21.15		60.0		
10353	Pulse Waveform (200Hz, 20%)	X	20.00	89.55	18.32	6.99	80.0	±1.6%	±9.6%
		Y	20.00	94.01	21.07		80.0		
		Z	20.00	93.49	20.73		80.0		
10354	Pulse Waveform (200Hz, 40%)	X	20.00	92.30	18.19	3.98	95.0	±1.1%	±9.6%
		Y	20.00	100.09	22.73		95.0		
		Z	20.00	97.33	21.12		95.0		
10355	Pulse Waveform (200Hz, 60%)	X	20.00	97.28	19.34	2.22	120.0	±1.2%	±9.6%
		Y	20.00	107.75	25.05		120.0		
		Z	20.00	102.55	22.27		120.0		
10387	QPSK Waveform, 1 MHz	X	1.56	64.87	14.23	1.00	150.0	±1.7%	±9.6%
		Y	1.66	65.14	14.58		150.0		
		Z	1.67	65.22	14.54		150.0		
10388	QPSK Waveform, 10 MHz	X	2.05	66.40	14.89	0.00	150.0	±1.0%	±9.6%
		Y	2.17	67.05	15.24		150.0		
		Z	2.19	67.16	15.23		150.0		
10396	64-QAM Waveform, 100 kHz	X	2.67	68.82	17.85	3.01	150.0	±0.8%	±9.6%
		Y	2.81	69.85	18.47		150.0		
		Z	2.84	69.16	18.01		150.0		
10399	64-QAM Waveform, 40 MHz	X	3.41	66.46	15.38	0.00	150.0	±0.7%	±9.6%
		Y	3.50	66.77	15.57		150.0		
		Z	3.54	66.91	15.61		150.0		
10414	WLAN CCDF, 64-QAM, 40 MHz	X	4.60	65.38	15.33	0.00	150.0	±1.6%	±9.6%
		Y	4.91	65.53	15.44		150.0		
		Z	4.75	64.96	15.14		150.0		

Note: For details on UID parameters see Appendix

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

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

Parameters of Probe: EX3DV4 - SN:3852

Sensor Model Parameters

	C1 fF	C2 fF	α V^{-1}	T1 ms V^{-2}	T2 ms V^{-1}	T3 ms	T4 V^{-2}	T5 V^{-1}	T6
x	43.2	319.95	34.95	7.28	0.35	5.00	1.42	0.17	1.01
y	48.1	357.73	35.17	13.96	0.00	5.06	1.61	0.13	1.01
z	48.4	361.54	35.51	10.13	0.32	5.04	0.86	0.33	1.01

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle	-57.0°
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

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

Parameters of Probe: EX3DV4 - SN:3852

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz)[C]	Relative Permittivity[F]	Conductivity[F] (S/m)	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unc[H] ($k = 2$)
6	55.0	0.75	13.95	14.75	15.25	0.00	1.25	±13.3%
13	55.0	0.75	13.09	13.84	14.31	0.00	1.25	±13.3%
30	55.0	0.75	11.96	12.65	13.08	0.00	1.25	±13.3%
64	54.2	0.75	10.86	11.48	11.87	0.00	1.25	±13.3%
128	52.8	0.76	10.32	10.92	11.29	0.00	1.25	±13.3%
220	49.0	0.81	10.08	10.66	11.02	0.00	1.25	±13.3%
450	43.5	0.87	10.12	10.12	10.12	0.16	1.30	±13.3%
1300	40.8	1.14	8.06	7.99	8.21	0.37	1.27	±11.0%
1450	40.5	1.20	7.96	7.89	8.10	0.37	1.27	±11.0%
1640	40.2	1.31	7.82	7.75	7.96	0.37	1.27	±11.0%
2450	39.2	1.80	6.99	6.93	7.12	0.37	1.27	±11.0%
3300	38.2	2.71	6.47	6.41	6.59	0.36	1.27	±13.1%
3500	37.9	2.91	6.44	6.38	6.55	0.36	1.27	±13.1%
3700	37.7	3.12	6.37	6.31	6.49	0.36	1.27	±13.1%
3900	37.5	3.32	6.28	6.22	6.39	0.36	1.27	±13.1%
4100	37.2	3.53	6.15	6.10	6.26	0.36	1.27	±13.1%
4600	36.7	4.04	5.80	5.75	5.91	0.36	1.27	±13.1%
5250	35.9	4.71	5.05	5.00	5.14	0.32	1.27	±13.1%
5600	35.5	5.07	4.90	4.85	4.98	0.28	1.27	±13.1%
5750	35.4	5.22	4.78	4.73	4.86	0.27	1.27	±13.1%

[C] Frequency validity above 300 MHz of ±100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ±50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ±10, ±25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4–9 MHz, and ConvF assessed at 13 MHz is 9–19 MHz. Above 5 GHz frequency validity can be extended to ±110 MHz.

[F] The probes are calibrated using tissue simulating liquids (TSL) that deviate for ε and σ by less than ±5% from the target values (typically better than ±3%) and are valid for TSL with deviations of up to ±10% if SAR correction is applied.

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

[H] The stated uncertainty is the total calibration uncertainty ($k = 2$) of Norm ConvF. This is equivalent to the uncertainty component with the symbol CF in Table 9 of IEC/IEEE 62209-1528:2020.

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

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

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

Accreditation No.: SCS 0108

Client Verkotan
Oulu - Finland

Certificate No: DAE4-710_Oct24

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BM - SN: 710
Calibration procedure(s)	QA CAL-06.v30 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	October 08, 2024

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	27-Aug-24 (No:40547)	Aug-25
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	23-Jan-24 (in house check)	In house check: Jan-25
Calibrator Box V2.1	SE UMS 006 AA 1002	23-Jan-24 (in house check)	In house check: Jan-25

	Name	Function	Signature
Calibrated by:	Adrian Gehring	Laboratory Technician	
Approved by:	Sven Kühn	Technical Manager	

Issued: October 8, 2024

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

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range:	1LSB =	6.1µV ,	full range =	-100...+300 mV
Low Range:	1LSB =	61nV ,	full range =	-1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	403.516 ± 0.02% (k=2)	403.660 ± 0.02% (k=2)	403.819 ± 0.02% (k=2)
Low Range	3.95411 ± 1.50% (k=2)	3.95889 ± 1.50% (k=2)	3.98306 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	348.0 ° ± 1 °

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	199994.95	-1.48	-0.00
Channel X	+ Input	20001.60	-1.14	-0.01
Channel X	- Input	-20001.44	0.80	-0.00
Channel Y	+ Input	199996.63	0.27	0.00
Channel Y	+ Input	20004.20	1.57	0.01
Channel Y	- Input	-19997.46	4.93	-0.02
Channel Z	+ Input	199995.21	-1.18	-0.00
Channel Z	+ Input	19999.61	-3.06	-0.02
Channel Z	- Input	-20000.68	1.78	-0.01

Low Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	2001.81	0.73	0.04
Channel X	+ Input	200.91	-0.47	-0.24
Channel X	- Input	-198.47	-0.04	0.02
Channel Y	+ Input	1999.80	-1.28	-0.06
Channel Y	+ Input	200.97	-0.28	-0.14
Channel Y	- Input	-199.16	-0.68	0.34
Channel Z	+ Input	2000.64	-0.39	-0.02
Channel Z	+ Input	200.94	-0.28	-0.14
Channel Z	- Input	-199.33	-0.75	0.38

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (µV)	Low Range Average Reading (µV)
Channel X	200	20.56	19.51
	- 200	-18.62	-20.05
Channel Y	200	3.23	2.88
	- 200	-3.07	-3.85
Channel Z	200	5.80	6.45
	- 200	-6.94	-7.09

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (µV)	Channel Y (µV)	Channel Z (µV)
Channel X	200	-	-2.42	-1.61
Channel Y	200	6.38	-	-0.48
Channel Z	200	5.09	3.97	-

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	16577	14801
Channel Y	15687	15615
Channel Z	16047	13825

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	-0.91	-2.77	0.85	0.66
Channel Y	-0.37	-1.85	1.16	0.63
Channel Z	0.25	-1.49	2.68	0.65

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9

APPENDIX E: RELEVANT PAGES FROM DIPOLE CALIBRATION REPORTS

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

ilac-MRA

S C S Schweizerischer Kalibrierdienst
Service suisse d'étalonnage
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
Oulu, Finland

Certificate No. CLA150-4027_Jul25

CALIBRATION CERTIFICATE

Object CLA150 - SN: 4027

Calibration procedure(s) QA CAL-15.v11
Calibration Procedure for SAR Validation Sources below 700 MHz

Calibration date: July 08, 2025

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 NRP2	SN: 104778	26-Mar-25 (No. 217-04289)	Mar-26
Power sensor NRP-Z91	SN: 103245	26-Mar-25 (No. 217-04289)	Mar-26
Reference 20 dB Attenuator	SN: CC2552 (20x)	26-Mar-25 (No. 217-04284)	Mar-26
3.5mm mismatch combination	SN: L1152	24-Mar-25 (No. 217-04293)	Mar-26
Reference Probe EX3DV4	SN: 3877	06-Jan-25 (No. EX3-3877_Jan25)	Jan-26
DAE4	SN: 654	18-Oct-24 (No. DAE4-654_Oct24)	Oct-25

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter NRP2	SN: 107193	08-Nov-21 (in house check Jun-24)	In house check: Jun-26
Power sensor NRP-Z91	SN: 100922	15-Dec-09 (in house check Jun-24)	In house check: Jun-26
Power sensor NRP-Z91	SN: 100418	01-Jan-04 (in house check Jun-24)	In house check: Jun-26
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-24)	In house check: Jun-26
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Sep-24)	In house check: Sep-26

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Sven Kühn	Technical Manager	

Issued: July 9, 2025

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	150 MHz ± 1 MHz	

HSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal HSL parameters	22.0 °C	52.3	0.76 mho/m
Measured HSL parameters	(22.0 ± 0.2) °C	50.1 ± 6 %	0.76 mho/m ± 6 %
HSL temperature change during test	< 0.5 °C	----	----

SAR result with HSL

SAR averaged over 1 cm³ (1 g) of HSL	Condition	
SAR measured	1 W input power	3.69 W/kg
SAR for nominal HSL parameters	normalized to 1W	**3.66 W/kg ± 18.4 % (k=2)**

SAR averaged over 10 cm³ (10 g) of HSL	condition	
SAR measured	1 W input power	2.51 W/kg
SAR for nominal HSL parameters	normalized to 1W	**2.49 W/kg ± 18.0 % (k=2)**

