

SAR Compliance Test Report

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Testing laboratory:	Verkotan Oy Elektroniikkatie 17 90590 Oulu Finland	Client:	VusionGroup SA 55 Place Nelson Mandela 92024 Nanterre Cedex France
Tested device:	UGate Lite R		
Related reports:	Test Report: 2026-AT-TC-EE-ET-EX-0-000002-FG-022		
Testing has been carried out in accordance with:	47CFR §2.1093 Radiofrequency Radiation Exposure Evaluation: Portable Devices FCC published RF exposure KDB procedures 447498 D02 SAR Procedures for Dongle Xmtr v02r01 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:	24.09.2026 Laboratory Manager <i>Miia Nurkkala</i>		

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1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Device under Test (DUT):

Product:	UGate Lite R
Manufacturer:	VusionGroup SA
Model:	APUG-LR01-A
Serial Number:	07A6B001203-Q210186463, 07A6B001203-Q202806662
Hardware Version:	RFACP007A00B
FCC ID Number:	2ACQM-APUG-LR01-A
ISED ID Number:	12154A-APUGLR01A
DUT Number:	4089, 4090, 4091 antenna
Battery Type used in testing:	NA
State of the Sample:	Production sample

Testing information:

Testing performed:	31.8.2026
Notes:	-
Document ID:	FCC ISED_SAR report_Vusion UGate Lite R_ID8037_24092026.docx
Document history & changes:	Initial version
Temperature °C:	22±2 / Controlled
Humidity RH%:	30±20 / Controlled
Measurement performed by:	Kirsi Kyllönen
FCC Test Firm Designation Number:	FI0005
ISED Company Number:	22218

1.2 Maximum Results

The maximum reported* SAR values for Body-worn exposure 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) 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
BLE	0.29	PASS

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

1.2.2 Maximum Drift

Maximum Drift During Measurements	-0.1dB
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*Larger than 5% drifts included to scaling factors

1.2.3 Measurement Uncertainty

DASY5 System, SAR 1g: 300 MHz – 3 GHz:

Expanded Uncertainty (k=2) 95 %	±22.6 %
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2. DESCRIPTION OF THE DEVICE UNDER TEST (DUT)

The device under test is electronic shelf labelling system APUG-LR01-A supporting Bluetooth and VusionOS proprietary high-frequency (HF) protocol, with simultaneous transmission not supported. UGate functions as an access point for communication with Electronic Shelf Labels. Device is a dongle with external hinged dipole SMA antenna. Device is powered through USB port. This SAR report covers BLE exposure only. The HF mode is exempt from SAR testing, and the corresponding RF exposure calculations are provided in Test Report: 2026-AT-TC-EE-ET-EX-0-000002-FG-022.



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]
	BLE	2402 – 2480
	HF	2404.1 – 2479.3

3. OUTPUT POWER

3.1 Maximum specified conducted output power

From the customer, including tune-up tolerances;

Bluetooth	Max Output Power [dBm]
Bluetooth LE	8

3.2 Tested conducted power

Measured conducted output power at transmitting antenna connector;

Standard	Output power [dBm]		
	CH 0 2402 MHz	CH 19 2440 MHz	CH 37 2480 MHz
Bluetooth LE	6.82	6.48	6.68

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.

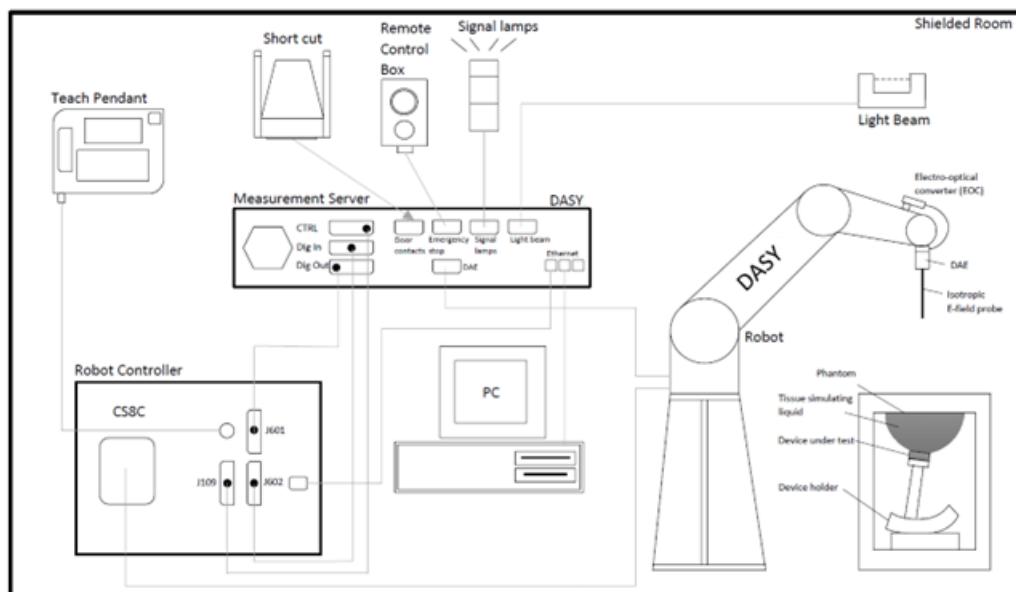


Figure 2 Schematic Laboratory Picture

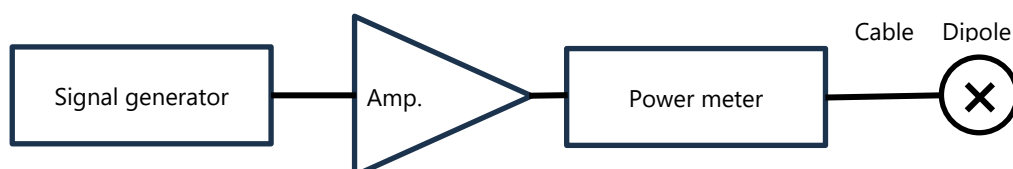


Figure 3. Signal source setup for system check

4.1 Test Equipment List

Test Equipment	Manufacturer	Model	Serial Number	Calibration Date	Interval [years]
Amplifier, 800MHz-4200MHz, 10W	Amplifier Research	10S1G4A	320421	NA	NA
DAE4, converter	Speag	DAE4	705	04/2026	1
Inline Peak Power Sensor	Anritsu	MA24105A	2102058	11/2025	1
Isotropic DOS probe	Speag	EX3DV4	3852	10/2025	1
Network Analyzer	Keysight	E5071C	MY46102812	05/2026	1
Power Sensor	Rohde & Schwarz	NRP8S	1419.0006K02-108509-Zh	03/2026	2
System validation dipole	Speag	D2450V2	729	05/2025	3
Vector Signal Generator	Rohde & Schwarz	SMP02	836402/004	NA	NA
DASY5 Software	Speag	52.10.4.1527	-	NA	NA

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

Dipole calibration period supporting data:

Dipole and Serial Number	Frequency [MHz]	Target			Measured 08/2026		
		Return Loss [dB]	Impedance [Ω]		Return Loss [dB]	Impedance [Ω]	
			R	jX		R	jX
D2450V2 - SN: 729	2450	-23.9	44.3	-1.1	-30.2	48.1	2.4

4.1.1 Isotropic E-field Probe Type EX3DV4

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

4.2 Phantoms

4.2.1 Modular Flat Phantom (MFP)

The Triple Modular Phantom consists of three identical modules that can be installed and removed separately without emptying the liquid. It is used for compliance testing of small wireless devices in body-worn configurations. The phantom conforms to the requirements of IEC/IEEE 62209-1528 and FCC published RF Exposure KDB Procedures. The shell thickness of the bottom plate is 2 ± 0.2 mm. The dimensions are 308x192x182 mm and filling volume is 9.2 liters giving a filling height of 155 mm.

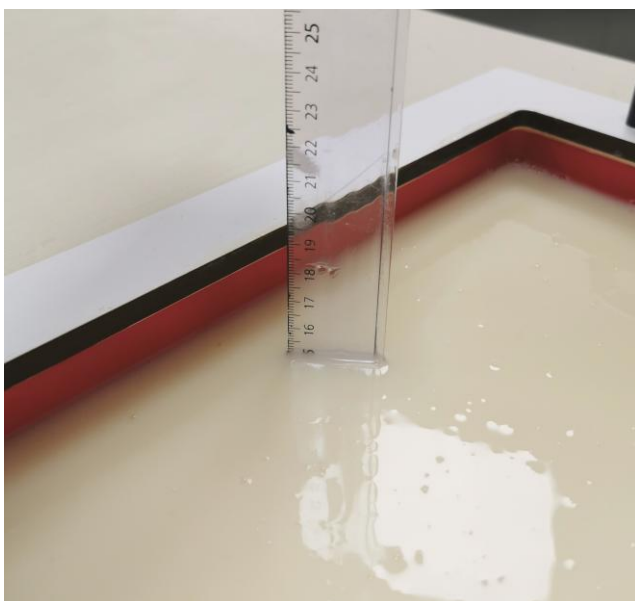


Figure 4 Tissue simulant depth

4.3 Tissue Simulants

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

Tissue simulant liquid Ingredients
Deionized Water, tween, salt

4.4 System Validation Status

Frequency [MHz]	Dipole Type / SN	Probe Type / SN	Calibrated Signal Type	DAE Unit / SN	Dielectric Constant [ϵ']	Conductivity σ [S/m]	Date
2450	D2450V2 - 729	EX3DV4 - SN: 3852	CW	DAE 4 / 710	38.25	1.74	11/2025

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 SAR1g [%]	Plot #
31.08.2026	WB Head	22	2450	250	12.0	52.08	48.0	-7.8	1

Date	Tissue Type	Tissue Temp. [°C]	Frequency [MHz]	Input Power [mW]	Measured SAR10g [W/kg]	1W Target SAR10g [W/kg]	1W Normalized SAR10g [W/kg]	Deviation SAR10g [%]	Plot #
31.08.2026	WB Head	22	2450	250	5.67	24.35	22.68	-6.9	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 [%]
31.08.2026	WB Head	22	2402	38.61	1.61	39.28	1.76	-1.7	-8.3
31.08.2026	WB Head	22	2440	38.57	1.64	39.22	1.79	-1.6	-8.7
31.08.2026	WB Head	22	2450	38.56	1.64	39.2	1.8	-1.6	-8.9
31.08.2026	WB Head	22	2480	38.51	1.66	39.16	1.83	-1.7	-9.6

5. TEST PROCEDURE

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

A control software for BLE was used to set the DUT to transmit at maximum power.

5.1 Device Holder

The device was placed in the device holder (illustrated below) that is supplied by SPEAG as an integral part of the Dasy system.



Figure 5. Device holder supplied by SPEAG

5.2 Test Positions

5.2.1 Body-worn Configuration, 0mm separation distance

Test positions were in accordance to FCC KDB Publication 447498 D02 and TCB Workshop November 2019 RF Exposure Procedures.

Body SAR was tested from the front, back, left and right side of the device with antenna straight and from the front side antenna connected at 90 degrees, perpendicular to the phantom. The device was placed in the SPEAG holder and lifted towards the phantom until the distance between the phantom and the device was 0mm.

Photos of the test positions are presented in appendix A

5.3 Scan Procedures

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

5.4 SAR Averaging Methods

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

The interpolation, extrapolation and maximum search routines within Dasy are all based on the modified Quadratic Shepard's method (Robert J. Renka, "Multivariate Interpolation of Large Sets of Scattered Data", University of North Texas ACM Transactions on Mathematical Software, vol. 14, no. 2, June 1988, pp. 139-148).

The interpolation scheme combines a least-square fitted function method with a weighted average method. A trivariate 3-D / bivariate 2-D quadratic function is computed for each measurement point and fitted to neighboring points by a least-square method. For the zoom scan, inverse distance weighting is incorporated to fit distant points more accurately. The interpolating function is finally calculated as a weighted average of the quadratics.

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

6. MEASUREMENT UNCERTAINTY

Uncertainty Budget According to IEC/IEEE 62209-1528 (Frequency band: 300MHz–3GHz range)								
Symbol	Error Description	Uncert. value	Prob. Dist.	Div.	(c_1) (1g)	(c_2) (10g)	Std. Unc. (1g)	Std. Unc. (10g)
Measurement System Errors								
CF	Probe Calibration	±13.3%	N	2	1	1	±6.7%	±6.7%
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	±2.8%	R	√3	1	1	±1.6%	±1.6%
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	0.14	0.14	±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 _σ)	Conductivity (temp.) ^{BB}	±3.3%	R	√3	0.78	0.71	±1.5%	±1.4%
EPS	Phantom Permittivity	±14.0%	R	√3	0	0	±0%	±0%
DIS	Distance DUT – TSL	±2.0%	N	1	2	2	±4.0%	±4.0%
D _{xyz}	Device Positioning	±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%	±0.0%
RF _{in}	Unc. Input Power ^{val}	±0.0%	N	1	1	1	±0.0%	±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						±11.3%	±11.2%
U	Expanded Uncertainty						±22.6%	±22.5%

7. TEST RESULTS

7.1 SAR Results for Body-worn Exposure Condition, 0 mm separation distance

Bluetooth:

Mode	Packet Type	Data Rate [Mbps]	Channel	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 #
BLE	DH5	1	0	2402	8	6.82	Front/ antenna straight	0.221	-0.1	70	1.31	0.29	2
BLE	DH5	1	0	2402	8	6.82	Back/ antenna straight	0.184	-0.02	70	1.31	0.24	
BLE	DH5	1	0	2402	8	6.82	Left/ antenna straight	0.01	0.09	70	1.31	0.01	
BLE	DH5	1	0	2402	8	6.82	Right/ antenna straight	0.019	-0.07	70	1.31	0.02	
BLE	DH5	1	0	2402	8	6.82	Front/ antenna 90deg bend	0***	0**	70	1.31	0***	
BLE	DH5	1	19	2440	8	6.48	Front/ antenna straight	0.176	-0.07	70	1.42	0.25	
BLE	DH5	1	37	2480	8	6.68	Front/ antenna straight	0.167	-0.06	70	1.36	0.23	

*Larger than 5% drifts included to scaling factors

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

***Due to low e-field generated by DUT, the measurements are not applicable

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: 52 x 78 x 15mm and the antenna diameter 10mm and height 115mm.



Figure 6 The device under test

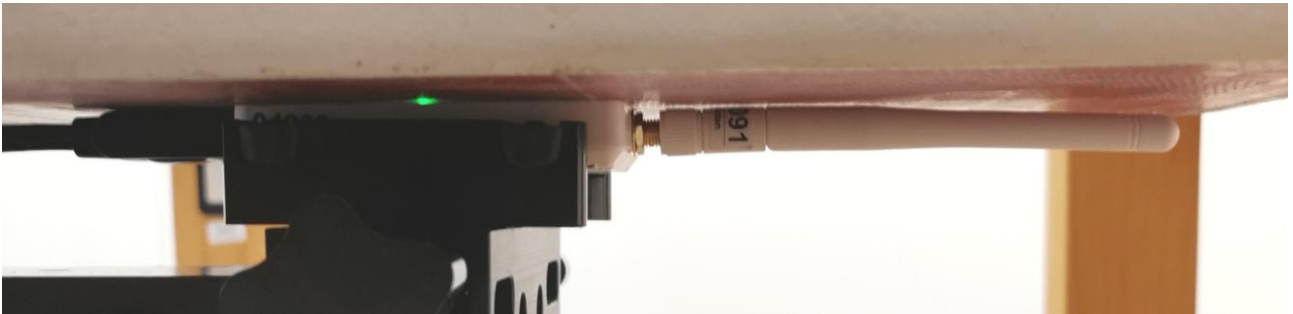


Figure 7 The front side of the device against the phantom, antenna straight

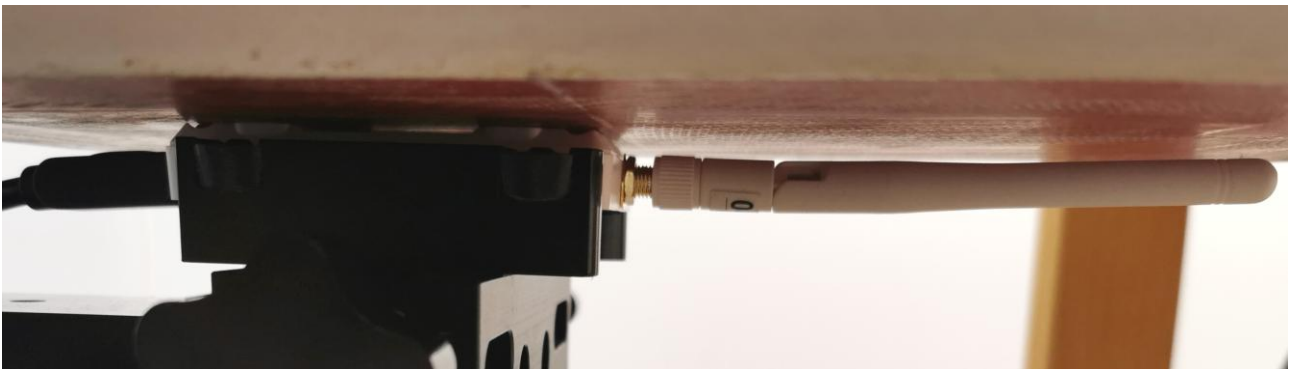


Figure 8 The back side of the device against the phantom, antenna straight



Figure 9 The left side of the device against the phantom, antenna straight

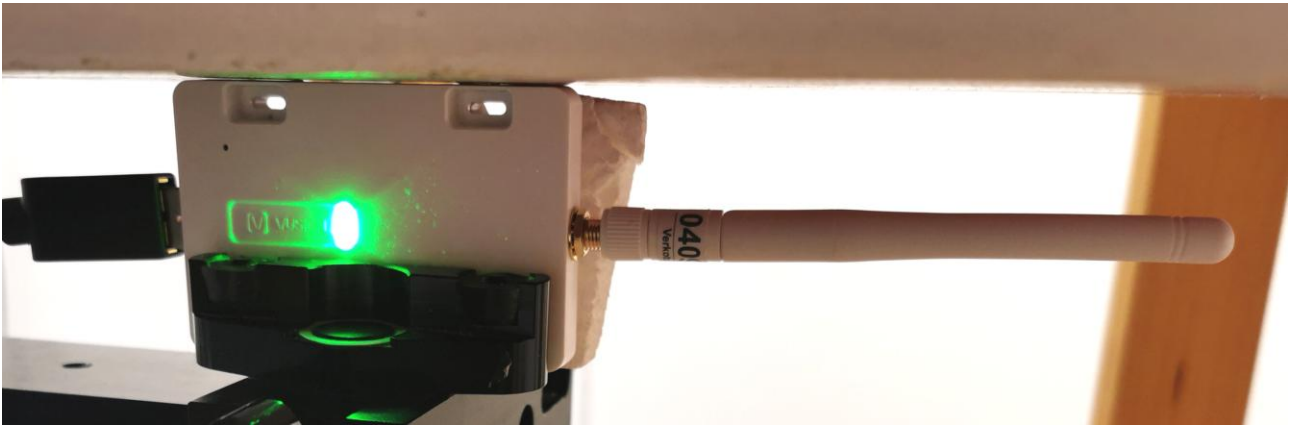


Figure 10 The Right side of the device against the phantom, antenna straight

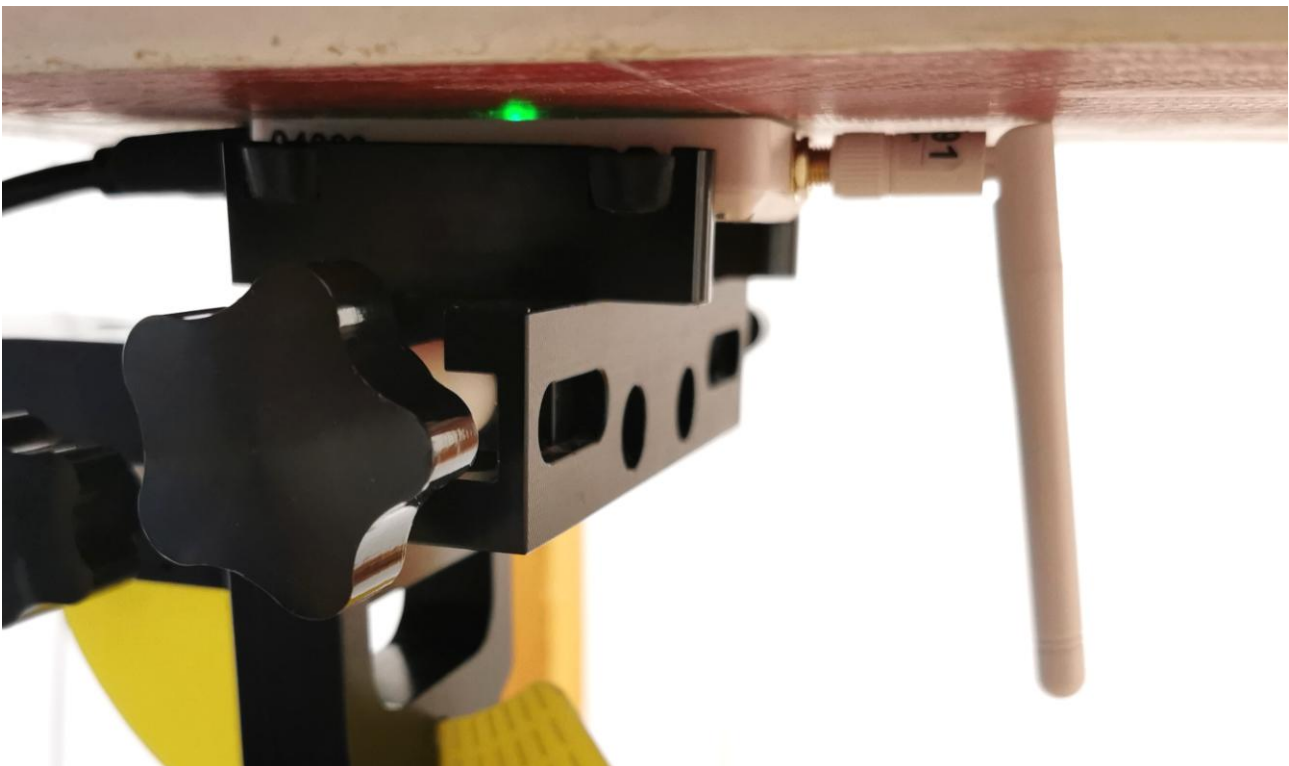


Figure 11 The front side of the device against the phantom, antenna connected at 90 degrees, perpendicular to the phantom

APPENDIX B: SYSTEM CHECK SCAN

Plot 1

Date/Time: 31/08/2026 11:20:17

Test Laboratory: Verkotan Oy

DUT: Dipole 2450 MHz D2450V2

Communication System: UID 0, CW (0); Communication System Band: D2450 (2450.0 MHz); Frequency: 2450 MHz;

Communication System PAR: 0 dB;

Medium parameters used (interpolated): $f = 2450$ MHz; $\sigma = 1.641$ S/m; $\epsilon_r = 38.561$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASYS (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(7.03, 7.08, 7.41) @ 2450 MHz; Calibrated: 17/10/2025
 - Sensor-Surface: 1.4mm (Mechanical Surface Detection), $z = -4.0, 31.0$
 - Electronics: DAE4 Sn705; Calibrated: 13/04/2026
 - Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx;
 - DASYS2 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System check 2450MHz/Area Scan (61x61x1): Interpolated grid: $dx=1.000$ mm, $dy=1.000$ mm

Maximum value of SAR (interpolated) = 18.7 W/kg

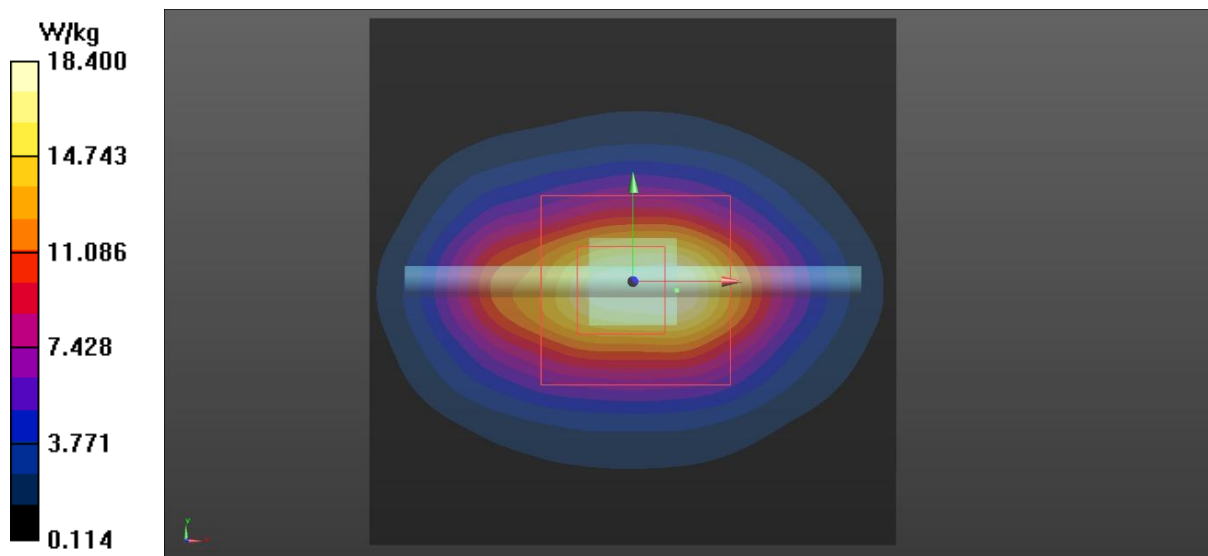
Configuration/System check 2450MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 90.22 V/m; Power Drift = -0.10 dB

Peak SAR (extrapolated) = 21.8 W/kg **SAR(1 g) = 12 W/kg; SAR(10 g) = 5.67 W/kg** (SAR corrected for target medium)

Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 53.8% Maximum value of SAR (measured) = 18.4 W/kg



APPENDIX C: MEASUREMENT SCANS

Plot 2

Date/Time: 31/08/2026 13:44:49

Test Laboratory: Verkotan Oy

DUT: Vusion

Communication System: UID 0, Bluetooth (0); Communication System Band: Bluetooth; Frequency: 2402 MHz;

Communication System PAR: 1.549 dB;

Medium parameters used (interpolated): $f = 2402$ MHz; $\sigma = 1.612$ S/m; $\epsilon_r = 38.61$; $\rho = 1000$ kg/m³

Phantom section: Center Section

Measurement Standard: DASYS (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3852; ConvF(7.03, 7.08, 7.41) @ 2402 MHz; Calibrated: 17/10/2025
 - 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: 13/04/2026
 - Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx;
 - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/Front antenna straight, black antenna/Area Scan (181x71x1): Interpolated grid: $dx=1.200$ mm, $dy=1.200$ mm Maximum value of SAR (interpolated) = 0.351 W/kg

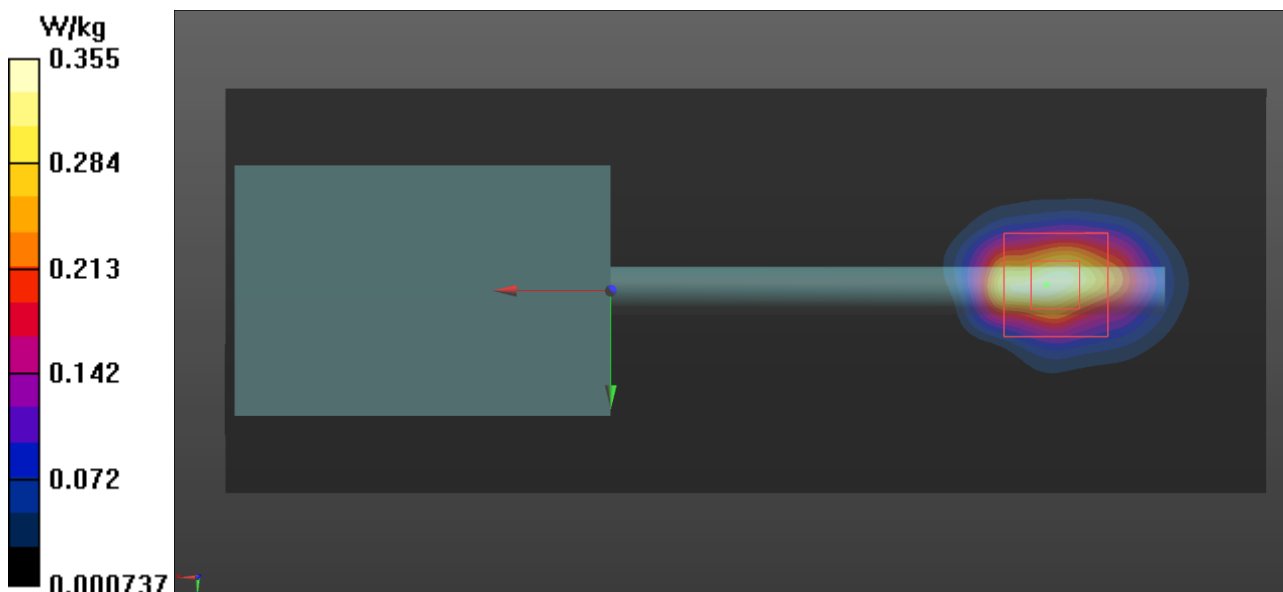
Configuration/Front antenna straight, black antenna/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm Reference Value = 9.216 V/m; Power Drift = -0.10 dB

Peak SAR (extrapolated) = 0.431 W/kg

SAR(1 g) = 0.221 W/kg; SAR(10 g) = 0.099 W/kg (SAR corrected for target medium)

Smallest distance from peaks to all points 3 dB below = 7.6 mm

Ratio of SAR at M2 to SAR at M1 = 49.8% Maximum value of SAR (measured) = 0.355 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_Oct25**

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, QA CAL-48.v2
Calibration procedure for dosimetric E-field probes**

Calibration date **October 17, 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	Calibration Date (Certificate No.)	Sched. Cal.
Power Sensor R&S NRP-33T	SN: 100967	30-Apr-25 (No. 1020-300791789)	Apr-26
N-type mismatch combination	SN: L1119	26-Mar-25 (No. 217-04292)	Mar-26
OCP DAK-12	SN: 1016	16-Sept-25 (No. OCP-DAK12-1016_Sep25)	Sep-26
OCP DAK-3.5	SN: 1248	16-Sept-25 (No. OCP-DAK3.5-1248_Sep25)	Sep-26
Reference Probe EX3DV4	SN: 7349	10-Jan-25 (No. EX3-7349_Jan25)	Jan-26
DAE4	SN: 1301	07-Nov-24 (No. DAE4-1301_Nov24)	Nov-25

Secondary Standards	ID	Check Date (in house)	Sched. Check
ACAP 2020 Setup 1	SN: L1404	01-Oct-25 (No. IHCK_ACAP2020-1_Oct25)	Oct-26
OCP DAK-12	SN: 1029	27-Feb-25 (No. OCP-DAK12-1029_Feb25)	Feb-26
OCP DAK-3.5	SN: 1336	09-Dec-24 (No. OCP-DAK3.5-1336_Dec24)	Dec-25

	Name	Function	Signature
Calibrated by	Paulo Pina	Laboratory Technician	
Approved by	Sven Kühn	Technical Manager	
Issued: October 17, 2025			
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Certificate No: EX-3852_Oct25

Page 1 of 9

EX3DV4 - SN:3852

October 17, 2025

Parameters of Probe: EX3DV4 - SN:3852

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k = 2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.42	0.40	0.46	$\pm 10.1\%$
DCP (mV) ^B	100.4	99.5	99.6	$\pm 4.7\%$

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Max dev.	Max Unc ^E k = 2
0	CW	X	0.00	0.00	1.00	0.00	142.8	$\pm 2.0\%$	$\pm 4.7\%$
		Y	0.00	0.00	1.00		134.4		
		Z	0.00	0.00	1.00		149.7		

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

^A The uncertainties of Norm X,Y,Z do not affect the E^2 -field uncertainty inside TSL (see Page 5).

^B Linearization parameter uncertainty for maximum specified field strength.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

EX3DV4 - SN:3852

October 17, 2025

Parameters of Probe: EX3DV4 - SN:3852

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle	-59.3°
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	12 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

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

EX3DV4 - SN:3852

October 17, 2025

Parameters of Probe: EX3DV4 - SN:3852

Calibration Parameter Determined in HSL

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	14.58	14.97	15.61	0.00	1.25	±13.3%
13	55.0	0.75	13.76	14.13	14.73	0.00	1.25	±13.3%
30	55.0	0.75	12.60	12.94	13.49	0.00	1.25	±13.3%
64	54.2	0.75	11.42	11.73	12.22	0.00	1.25	±13.3%
128	52.8	0.76	10.81	11.10	11.57	0.00	1.25	±13.3%
220	49.0	0.81	10.41	10.70	11.15	0.00	1.25	±13.3%
2450	39.2	1.80	7.03	7.08	7.41	0.31	1.27	±11.0%
5250	35.9	4.71	5.31	5.35	5.60	0.28	1.27	±13.1%
5600	35.5	5.07	4.93	4.97	5.20	0.26	1.27	±13.1%
5750	35.4	5.22	4.89	4.93	5.16	0.25	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: **DAE4-705_Apr26**

CALIBRATION CERTIFICATE

Object DAE4 - SD 000 D04 BM - SN: 705

Calibration procedure(s) QA CAL-06.v30
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: April 13, 2026

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

All calibrations have been conducted in the closed laboratory facility; environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0610278	15-Aug-25 (No:43673)	Aug-26
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	23-Jan-26 (in house check)	In house check: Jan-27
Calibrator Box V2.1	SE UMS 006 AA 1002	23-Jan-26 (in house check)	In house check: Jan-27

Calibrated by: Name: Adrian Gehring, Function: Laboratory Technician, Signature:

Approved by: Name: Sven Kühn, Function: Technical Manager, Signature:

Issued: April 13, 2026

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Certificate No: DAE4-705_Apr26

Page 1 of 5

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 μ V, full range = -100...+300 mV

Low Range: 1LSB = 61 nV, full range = -1.....+3 mV

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

Calibration Factors	X	Y	Z
High Range	403.331 $\pm$ 0.02% (k=2)	404.796 $\pm$ 0.02% (k=2)	403.919 $\pm$ 0.02% (k=2)
Low Range	3.94523 $\pm$ 1.50% (k=2)	3.96375 $\pm$ 1.50% (k=2)	3.95440 $\pm$ 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	65.5 $^{\circ}$ $\pm$ 1 $^{\circ}$
---	------------------------------------

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	199996.75	-0.63	-0.00
Channel X + Input	20003.47	0.51	0.00
Channel X - Input	-19998.38	3.72	-0.02
Channel Y + Input	199996.39	-1.20	-0.00
Channel Y + Input	20001.51	-1.53	-0.01
Channel Y - Input	-20001.15	1.05	-0.01
Channel Z + Input	199995.70	-1.78	-0.00
Channel Z + Input	20002.17	-0.76	-0.00
Channel Z - Input	-19999.37	2.91	-0.01

Low Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	2001.25	-0.33	-0.02
Channel X + Input	201.90	0.19	0.10
Channel X - Input	-198.69	-0.64	0.32
Channel Y + Input	2001.13	-0.22	-0.01
Channel Y + Input	201.45	-0.03	-0.02
Channel Y - Input	-199.02	-0.79	0.40
Channel Z + Input	2001.68	0.23	0.01
Channel Z + Input	201.15	-0.35	-0.17
Channel Z - Input	-198.35	-0.27	0.14

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	1.62	-0.54
	- 200	2.35	0.40
Channel Y	200	9.37	9.45
	- 200	-11.49	-11.57
Channel Z	200	12.84	11.97
	- 200	-12.66	-12.92

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	-	-2.71	-2.15
Channel Y	200	9.97	-	-1.10
Channel Z	200	5.05	7.07	-

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	15859	12709
Channel Y	15718	16580
Channel Z	15642	16589

5. Input Offset Measurement

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

	Average (μ V)	min. Offset (μ V)	max. Offset (μ V)	Std. Deviation (μ V)
Channel X	1.19	0.14	2.30	0.50
Channel Y	0.45	-0.48	1.61	0.41
Channel Z	0.23	-0.78	1.05	0.40

6. Input Offset Current

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

7. Input Resistance (Typical values for information)

	Zeroing (k Ω m)	Measuring (M Ω m)
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

Docusign Envelope ID: 5C52517C-7FBF-49B6-8CC1-F810A827F83F



SAR Reference Dipole Calibration Report

Ref : ACR.139.5.25.BES.A

VERKOTAN LTD.
ELEKTRONIIKKATIE 17
90590, OULU, FINLAND
SAR REFERENCE DIPOLE
FREQUENCY: 2450 MHZ
SERIAL NO.: D2450V2-729

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

Calibration date: 05/16/25



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

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

Summary:

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

Docusign Envelope ID: 5C52517C-7FBF-49B6-8CC1-F810A827F83F



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.5.25.BES.A

	Name	Function	Date	Signature
Prepared by :	Pedro Ruiz	Technical Manager	5/19/2025	
Checked & approved by:	Pedro Ruiz	Technical Manager	5/19/2025	
Authorized by:	Kim Rutkowski	Quality Manager	5/19/2025	signed by: 28689547AD17461...

	Customer Name
Distribution :	Verkotan Ltd.

Issue	Name	Date	Modifications
A	Pedro Ruiz	5/19/2025	Initial release

Page: 2/8

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

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.5.25.BES.A

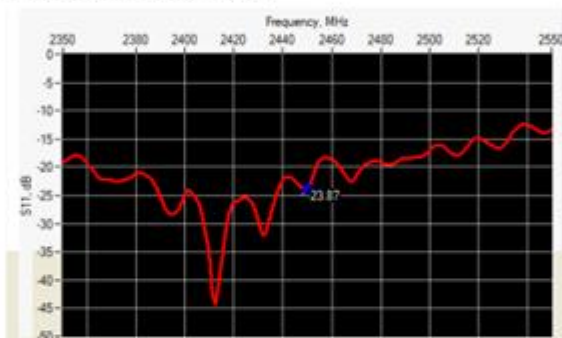
6 CALIBRATION RESULTS

6.1 MECHANICAL DIMENSIONS

L mm		h mm		d mm	
Measured	Required	Measured	Required	Measured	Required
-	51.50 +/- 2%	-	30.40 +/- 2%	-	3.60 +/- 2%

6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
2450	-23.87	-20	44.3Ω - 1.1jΩ

6.3 SAR

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

6.3.1 SAR with Head Liquid

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

Software	OPENSAR V5
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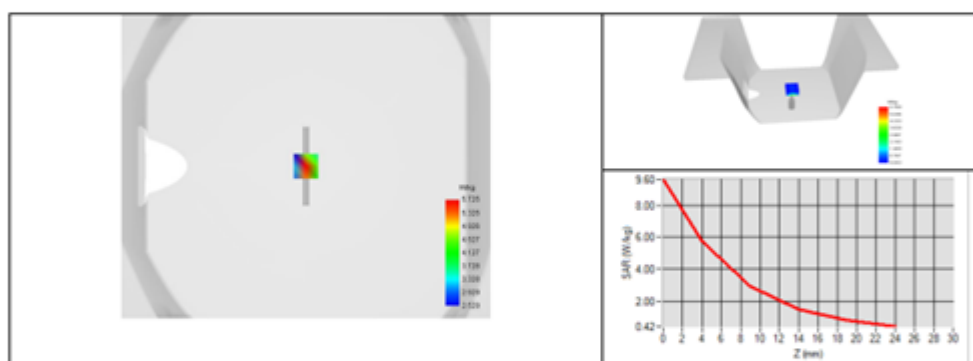


SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.139.5.25.BES.A

Phantom	SN 13/09 SAM68
Probe	4424-EPGO-443
Liquid	Head Liquid Values: ϵ_{ps} : 41.6 σ : 1.88
Distance between dipole center and liquid	10.0 mm
Area scan resolution	$dx=8mm/dy=8mm$
Zoon Scan Resolution	$dx=5mm/dy=5mm/dz=5mm$
Frequency	2450 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency	1g SAR (W/kg)			10g SAR (W/kg)		
	Measured	Measured normalized to 1W	Target normalized to 1W	Measured	Measured normalized to 1W	Target normalized to 1W
2450 MHz	5.21	52.08	52.40	2.44	24.35	24.00



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