SAR Compliance Test Report

Date of Report:	22/01/2026	**Client's Contact person:**	Nikoletta Juhasz
Number of pages:	44	**Responsible Test engineer:**	Kalle Orava
Testing laboratory:	**Verkotan Oy** Elektroniikkatie 17 90590 Oulu Finland	**Client:**	**Spaceharmony-system Ltd** Budapest Bem u. 6 1027 Budapest Hungary
Tested device:	**5G Protection Card**		
Related reports:	-		
Testing has been carried out in accordance with:	**EN 50566:2017 A1:2023** Product standard to demonstrate the compliance of wireless communication devices with the basic restrictions and exposure limit values related to human exposure to electromagnetic fields in the frequency range from 30 MHz to 6 GHz: hand-held and body mounted devices in close proximity to the human body **IEC 62209-2:2010, EN 62209-2:2010** Human exposure to radio frequency fields from hand-held and body mounted wireless communication devices - Human models, instrumentation, and procedures - Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz) **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 – Part 1528: Human models, instrumentation, and procedures (Frequency range of 4 MHz to 10 GHz)		
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 test results relate only to devices specified in this document		

Date and signatures:

22.01.2026

Laboratory Manager

Miia Nurkkala

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1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Device Under Test (DUT):

Product:	5G Protection Card
Manufacturer:	Spaceharmony-system Ltd
Serial Number:	SHS_25100948
DUT Number:	03995
State of the Sample:	Production sample

Testing information:

Testing performed:	29.12.2025 – 06.01.2026
Notes:	Test cases selected based on customer request.
Document ID:	SAR report_5G card ID7828_21012026.docx
Document history & changes:	Initial version
Temperature °C:	22±2 / Controlled
Humidity RH%:	30±20 / Controlled
Measurement performed by:	Kalle Orava

1.1.1 Maximum Drift

Maximum Drift During Measurements	-1.06 dB*

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

1.1.2 Measurement Uncertainty

DASY5 System, IEC 62209-2 (30 MHz – 6 GHz)

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

2. DESCRIPTION OF THE DEVICE UNDER TEST (DUT)

The tested device is a small card manufactured by Spaceharmony-system Ltd. 5G phone Samsung A34 was used for testing the product.

Figure 1. Overview of the DUT

Exposure Environment	General population, uncontrolled

2.1 Tested Frequency Bands and Operational Modes

	Modes of Operation	**Transmitter Frequency Range [MHz]**
TX Frequency bands	5G n1	1920 – 1980
	5G n3	1710 – 1785
	5G n8	880 – 915
	5G n28	703 – 748
	5G n78	3300 – 3800

3. 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.

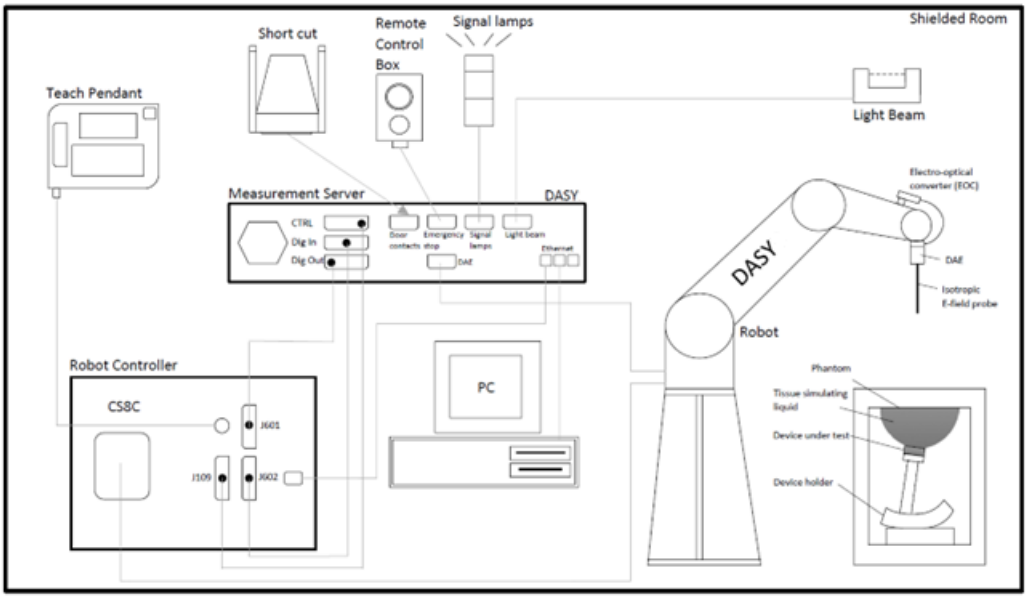


Figure 2 Schematic Laboratory Picture

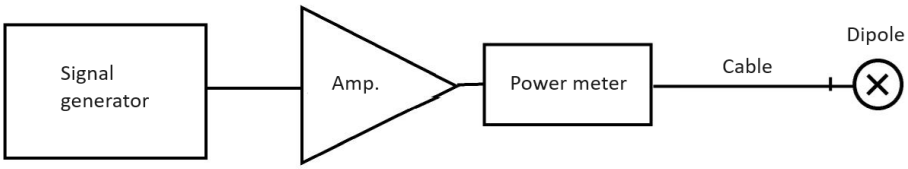


Figure 3. Signal source setup for system check

3.1 Test Equipment List

Test Equipment	Model	Serial Number	Calibration Date	Interval [years]
Amplifier, 800-4200MHz, 50W	5163F	1022	NA	NA
DAE4, converter	DAE4	1332	02/2025	1
DASY5 Software	52.10.4.1527	-	NA	NA
Isotropic DOS probe	EX3DV4	7447	02/2025	1
Isotropic DOS probe	EX3DV4	7827	06/2025	1
Radio Communication Test Station	MT8000A	6262134960	09/2025	1
Signal Analyzer	MS2830A	6201180758	11/2021	NA
System validation dipole	D1900V2	511	03/2023	3
System validation dipole	D835V2	448	03/2023	3
System validation dipole	SID3500	41/21 DIP 3G500-620	09/2024	3

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

3.1.1 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

3.2 Phantoms

SAM Phantom:

The phantom used in SAR tests was the flat phantom section of the twin-headed "SAM Phantom", manufactured by SPEAG. The phantom conforms to the requirements of IEC 62209-1 and IEC 62209-2. The shell thickness of the bottom plate is 2mm ±0.2mm and 6mm ±0.2mm at ear point.

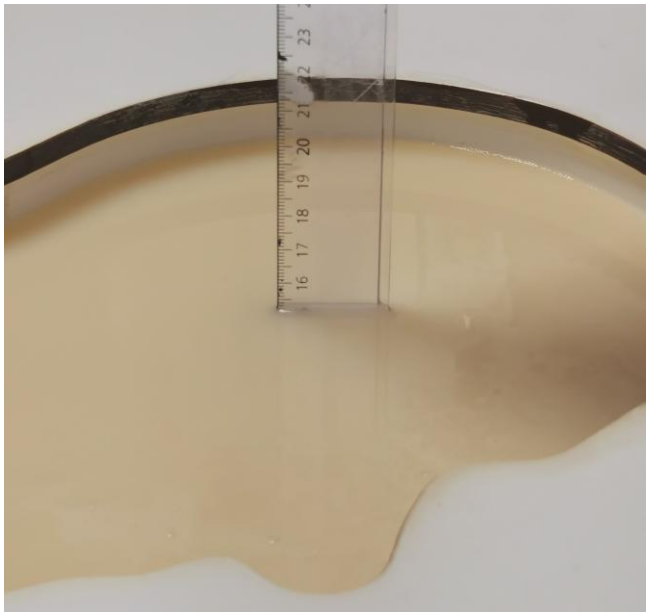


Figure 4 Tissue simulant depth

3.3 Tissue Simulants

Recommended values for the dielectric parameters of the tissue simulants are given in IEC 62209-1. 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. SAR testing was carried out within 24 hours of measuring the dielectric parameters. 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

3.4 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
1900	D1900V2-511	EX3DV4 - SN: 7447	CW	DAE 4 / 1332	38.56	1.43	03/2025
835	D835V2 - 455	EX3DV4 - SN: 7447	CW	DAE 4 / 1332	41.24	0.92	03/2025
3500	41/21 DIP 3G500-620	EX3DV4 - SN: 7827	SMC	DAE4 / 1332	38.36	2.94	01/2026

3.5 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 #
29.12.2025	WB Head	21.8	835	250	2.43	9.36	9.72	3.9	1
31.12.2025	WB Head	21.8	1900	250	8.98	38.02	35.92	-5.5	2
05.01.2026	WB Head	22.0	3500	250	16.4	64.64	65.6	1.5	3

3.5.1 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 [%]
29.12.2025	WB Head	21.8	725.5	41.8	0.86	42.03	0.89	-0.6	-2.7
29.12.2025	WB Head	21.8	835	41.18	0.9	41.5	0.9	-0.8	0.4
29.12.2025	WB Head	21.8	897.5	40.88	0.93	41.5	0.97	-1.5	-4.3
31.12.2025	WB Head	21.8	1747.5	38.53	1.29	40.08	1.37	-3.9	-6.0
31.12.2025	WB Head	21.8	1900	38.3	1.36	40.0	1.4	-4.2	-2.6
31.12.2025	WB Head	21.8	1950	38.17	1.39	40.0	1.4	-4.6	-0.8
05.01.2026	WB Head	21	3500	38.36	2.94	37.9	2.91	1.2	1.1
05.01.2026	WB Head	21	3549.99	38.28	2.98	37.85	2.96	1.1	0.8

4. TEST PROCEDURE

The Phone was measured with and without small card against the back of the phone. Measurements were done on 5 different cellular bands against the body position.

The phone was set to transmit using maximum power with a communication tester.

The reported SAR does not include the scaling of conducted power measurements. It only includes the power drift scaling, if drift is < -5%.

4.1 Device Holder

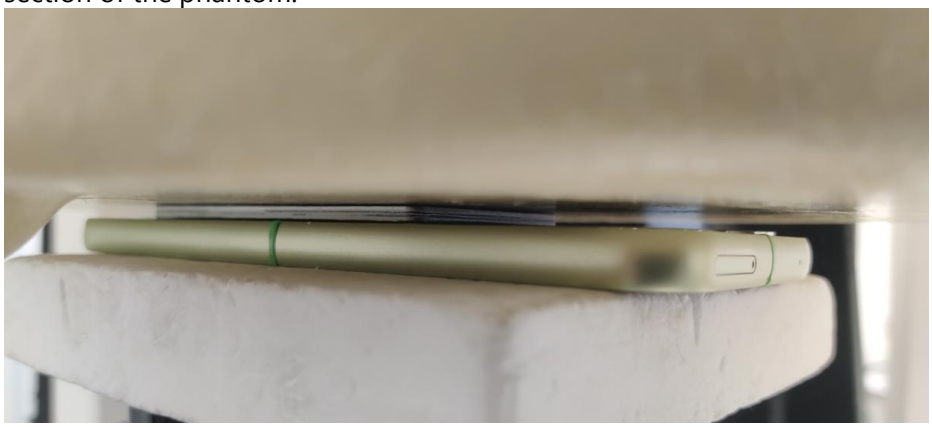
The device was placed in the device holder (illustrated below) that is supplied by SPEAG as an integral part of the Dasy system.

Device holder supplied by SPEAG

4.2 Test Positions

4.2.1 Body-worn Exposure Condition, phone with card

The device was placed in the SPEAG holder with rohacell structure and placed below the flat section of the phantom:



4.2.2 Body-worn Exposure Condition, phone only

The device was placed in the SPEAG holder with rohacell structure and placed below the flat section of the phantom:

4.3 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.

4.4 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.

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

6. TEST RESULTS

6.1 SAR Results for Body-worn Exposure Condition

6.1.1 Phone only

Band	Channel	SCS [kHz]	Waveform	RB Size	RB Offset	Frequency [MHz]	Modulation / BW [MHz]	Test position	Measured SAR_{10g} [W/kg]	Power Drift* [dB]	Duty Cycle [%]	Scaling Factor	Reported SAR_{10g} [W/kg]	Plot #
n1	390000	15	DFT-S-OFDM	1	26	1950	QPSK/20	Body, back	1.260	-0.26	100	1.06	1.338	
n3	349500	15	DFT-S-OFDM	1	26	1747.5	QPSK/20	Body, back	1.370	-0.2	100	1.00	1.370	4
n8	179500	15	DFT-S-OFDM	1	26	897.5	QPSK/20	Body, back	1.090	-0.11	100	1.00	1.090	
n28	145100	15	DFT-S-OFDM	1	26	725.5	QPSK/20	Body, back	0.701	-0.12	100	1.00	0.701	
n78	636666	30	DFT-S-OFDM	1	137	3549.99	QPSK/100	Body, back	1.050	-0.23	100	1.05	1.107	

*Larger than 5% drifts included to scaling factors

6.1.2 Phone with card

Band	Channel	SCS [kHz]	Waveform	RB Size	RB Offset	Frequency [MHz]	Modulation / BW [MHz]	Test position	Measured SAR_{10g} [W/kg]	Power Drift* [dB]	Duty Cycle [%]	Scaling Factor	Reported SAR_{10g} [W/kg]	Plot #
n1	390000	15	DFT-S-OFDM	1	26	1950	QPSK/20	Body, back	0.483	-0.27	100	1.06	0.514	
n3	349500	15	DFT-S-OFDM	1	26	1747.5	QPSK/20	Body, back	0.672	-0.21	100	1.00	0.672	5
n8	179500	15	DFT-S-OFDM	1	26	897.5	QPSK/20	Body, back	0.799	-0.16	100	1.00	0.799	
n28	145100	15	DFT-S-OFDM	1	26	725.5	QPSK/20	Body, back	0.395	-0.13	100	1.00	0.395	
n78	636666	30	DFT-S-OFDM	1	137	3549.99	QPSK/100	Body, back	0.423	-0.07	100	1.00	0.423	

*Larger than 5% drifts included to scaling factors

6.2 Result comparison

6.2.1 Body-worn Exposure Condition

Band	Channel	SCS [kHz]	Waveform	RB Size	RB Offset	Frequency [MHz]	Modulation / BW [MHz]	Test position	Phone only	Phone with card	Change in SAR [%]
									Reported SAR_{10g} [W/kg]	Reported SAR_{10g} [W/kg]	
n1	390000	15	DFT-S-OFDM	1	26	1950	QPSK/20	Body, back	1.338	0.514	-61.6
n3	349500	15	DFT-S-OFDM	1	26	1747.5	QPSK/20	Body, back	1.370	0.672	-50.9
n8	179500	15	DFT-S-OFDM	1	26	897.5	QPSK/20	Body, back	1.090	0.799	-26.7
n28	145100	15	DFT-S-OFDM	1	26	725.5	QPSK/20	Body, back	0.701	0.395	-43.7
n78	636666	30	DFT-S-OFDM	1	137	3549.99	QPSK/100	Body, back	1.107	0.423	-61.8

APPENDIX A: PHOTOS OF THE DUT

Size of the card is: 85 x 54 x 4 mm

Figure 5. Reference phone with and without the card

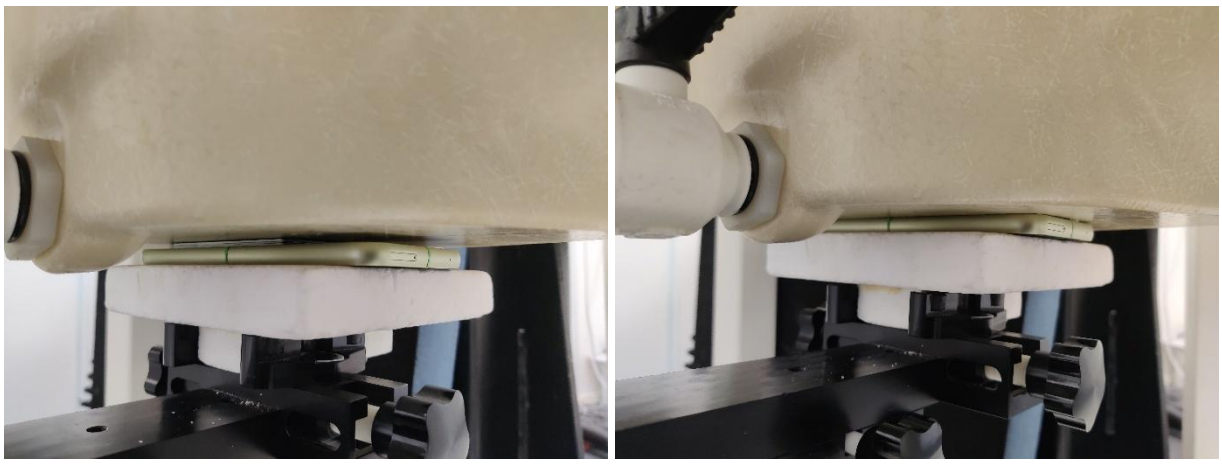


Figure 6. Body, back, with and without the card

APPENDIX B: SYSTEM CHECK SCAN

Plot 1

Date/Time: 29.12.25 10:26:44

Test Laboratory: Verkotan Oy

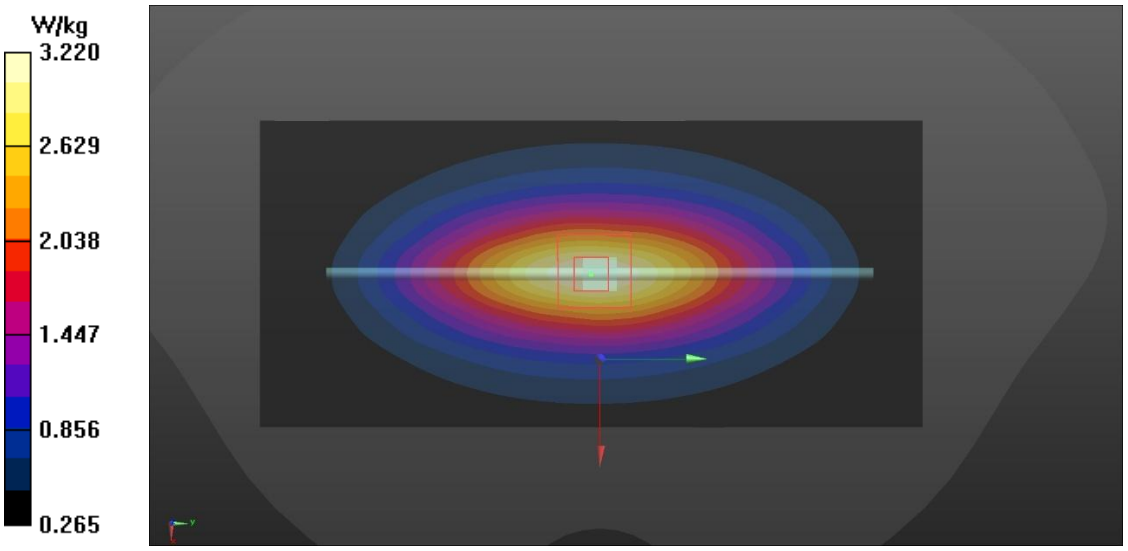
DUT: D835V2 - SN448

Communication System: UID 0, CW (0); Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 835 MHz; σ = 0.904 S/m; ε_r = 41.18; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.84, 8.51, 8.94) @ 835 MHz; Calibrated: 7.2.25
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn1332; Calibrated: 5.2.25
  - Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CC;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System check/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 65.05 V/m; Power Drift = -0.27 dB
Peak SAR (extrapolated) = 3.56 W/kg
SAR(1 g) = 2.43 W/kg; SAR(10 g) = 1.58 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 18.6 mm
Ratio of SAR at M2 to SAR at M1 = 67.8%
Maximum value of SAR (measured) = 3.22 W/kg
Configuration/System check/Area Scan (61x131x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 3.21 W/kg



Plot 2

Date/Time: 31.12.25 09:59:31

Test Laboratory: Verkotan Oy

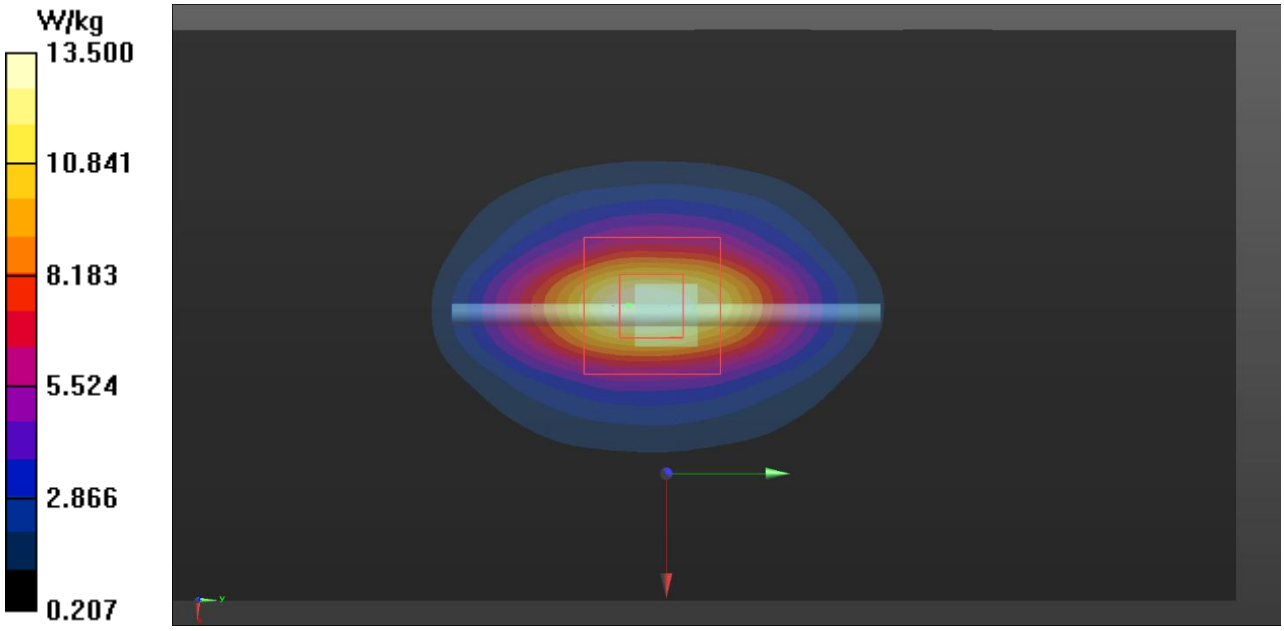
DUT: D1900V2 - SN511

Communication System: UID 0, CW (0); Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 1900 MHz; σ = 1.364 S/m; ε_r = 38.302; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(7.89, 7.59, 7.97) @ 1900 MHz; Calibrated: 7.2.25
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn1332; Calibrated: 5.2.25
  - Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CC;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System check/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 104.6 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 15.8 W/kg
SAR(1 g) = 8.98 W/kg; SAR(10 g) = 4.71 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 10 mm
Ratio of SAR at M2 to SAR at M1 = 56.1%
Maximum value of SAR (measured) = 13.5 W/kg
Configuration/System check/Area Scan (61x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 13.8 W/kg



Plot 3

Date/Time: 5.1.26 08:47:21

Test Laboratory: Verkotan Oy

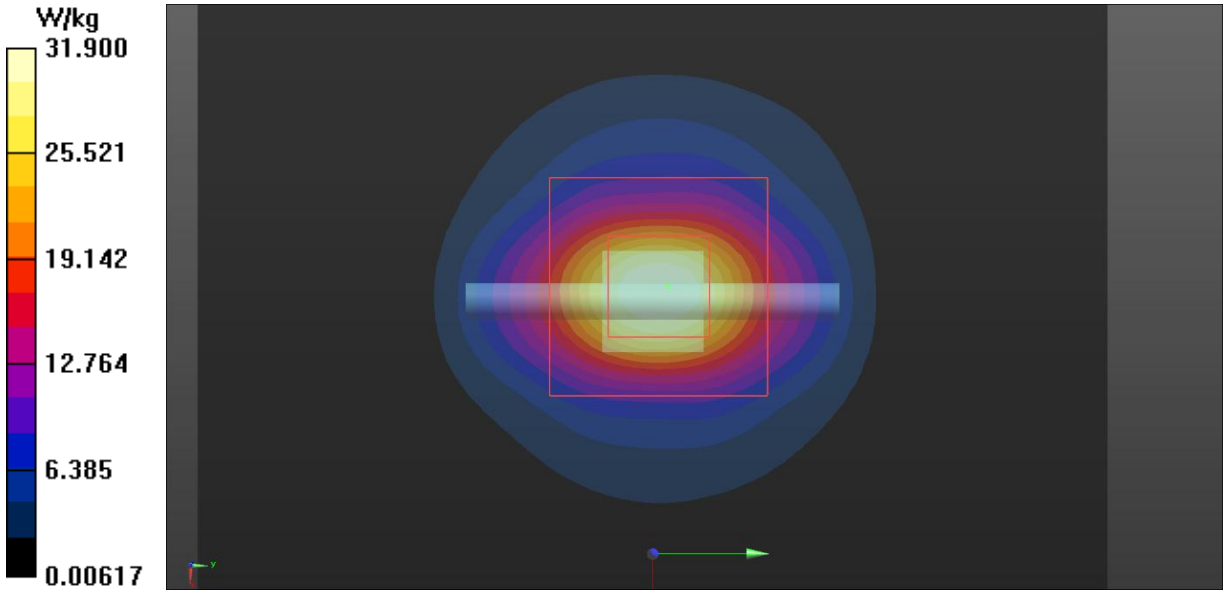
DUT: Dipole 3500 MHz D3500V2

Communication System: UID 0, CW (0); Communication System Band: D3500 (3500.0 MHz); Frequency: 3500 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 3500 MHz; σ = 2.943 S/m; ε_r = 38.358; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7827; ConvF(6.57, 6.45, 6.31) @ 3500 MHz; Calibrated: 20.6.25
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn1332; Calibrated: 5.2.25
  - Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CC;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System check/Zoom Scan (11x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 112.3 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 42.5 W/kg
SAR(1 g) = 16.4 W/kg; SAR(10 g) = 6.28 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 8.6 mm
Ratio of SAR at M2 to SAR at M1 = 36.6%
Maximum value of SAR (measured) = 31.9 W/kg
Configuration/System check/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 32.8 W/kg



APPENDIX C: MEASUREMENT SCANS

Plot 4

Date/Time: 31.12.25 11:23:19

Test Laboratory: Verkotan Oy

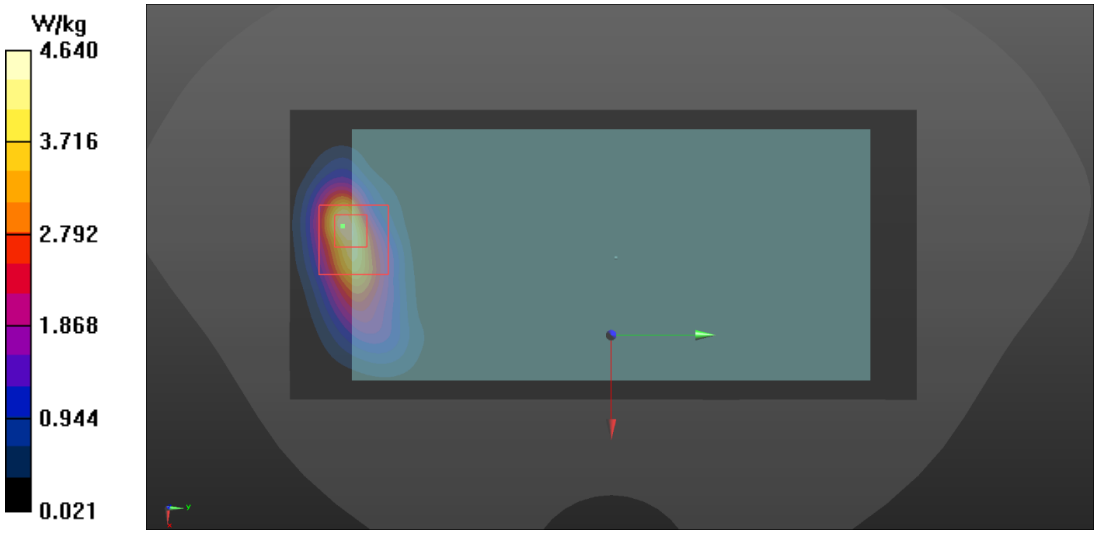
DUT: Samsung A34

Communication System: UID 0, NR (0); Communication System Band: n3; Frequency: 1747.5 MHz;
Communication System PAR: 0 dB;
Medium parameters used (interpolated): f = 1747.5 MHz; σ = 1.288 S/m; ε_r = 38.531; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.1, 7.8, 8.19) @ 1747.5 MHz; Calibrated: 7.2.25
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn1332; Calibrated: 5.2.25
  - Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CC;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Body/Samsung Galaxy A34, no card, n3 CH349500, QPSK, 20MHz, RBs 1, Offset 26, Back, 0mm 2/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.267 V/m; Power Drift = -0.20 dB
Peak SAR (extrapolated) = 6.34 W/kg
SAR(1 g) = 2.9 W/kg; SAR(10 g) = 1.37 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 4.5 mm
Ratio of SAR at M2 to SAR at M1 = 41.2%
Maximum value of SAR (measured) = 4.64 W/kg
Body/Samsung Galaxy A34, no card, n3 CH349500, QPSK, 20MHz, RBs 1, Offset 26, Back, 0mm 2/Area Scan (61x131x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 3.79 W/kg



Plot 5

Date/Time: 31.12.25 11:53:12

Test Laboratory: Verkotan Oy

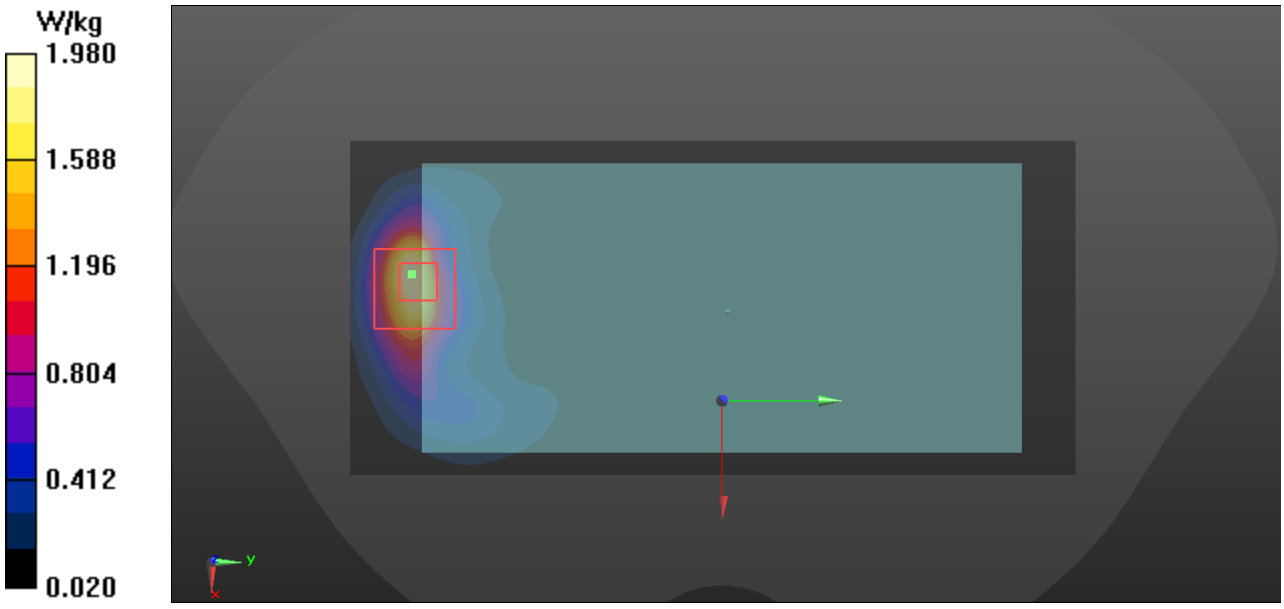
DUT: Samsung A34 with 5G Protection Card

Communication System: UID 0, NR (0); Communication System Band: n3; Frequency: 1747.5 MHz;
Communication System PAR: 0 dB;
Medium parameters used (interpolated): f = 1747.5 MHz; σ = 1.288 S/m; ε_r = 38.531; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN7447; ConvF(8.1, 7.8, 8.19) @ 1747.5 MHz; Calibrated: 7.2.25
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn1332; Calibrated: 5.2.25
  - Phantom: Twin-SAM V4.0 (20deg probe tilt); Type: QD 000 P40 CC;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Body/Samsung Galaxy A34, with card, n3 CH349500, QPSK, 20MHz, RBs 1, Offset 26, Back, 0mm from the card /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 12.02 V/m; Power Drift = -0.21 dB
Peak SAR (extrapolated) = 2.41 W/kg
SAR(1 g) = 1.35 W/kg; SAR(10 g) = 0.672 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 = 58.2%.
Maximum value of SAR (measured) = 1.98 W/kg
Body/Samsung Galaxy A34, with card, n3 CH349500, QPSK, 20MHz, RBs 1, Offset 26, Back, 0mm from the card /Area Scan (61x131x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.83 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-7447_Feb25

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:7447

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: February 07, 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	28-Mar-24 (No. 217-04038)	Mar-25
Short [S6019] + Attenuator [S6020]	SN: L1119	26-Mar-24 (No. 217-04048)	Mar-25
OCP DAK-12	SN: 1016	24-Sept-24 (No. OCP-DAK12-1016_Sep24)	Sep-25
OCP DAK-3.5	SN: 1249	23-Sept-24 (No. OCP-DAK3.5-1249_Sep24)	Sep-25
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 Calibration Box	SN: L1404	30-Sept-24 (No. Report_ACAP2020E-Cave_20240930s)	Sep-25

	Name	Function	Signature
Calibrated by	Paulo Pina	Laboratory Technician	
Approved by	Sven Kühn	Technical Manager	

Issued: February 07, 2025

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

Certificate No: EX-7447_Feb25 Page 1 of 9

Parameters of Probe: EX3DV4 - SN:7447

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc ($k = 2$)
Norm ($\mu V/(V/m)^2$) [A]	0.42	0.43	0.43	±10.1%
DCP (mV) [B]	95.9	91.9	99.5	±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	138.6	±1.7%	±4.7%
		Y	0.00	0.00	1.00		141.7		
		Z	0.00	0.00	1.00		135.0		

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:7447

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle	38.6°
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:7447

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle	38.6°
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.

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

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S Swiss Calibration Service

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

Accreditation No.: SCS 0108

Client Verkotan
Oulu, Finland

Certificate No. EX-7827_Jun25

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:7827
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	June 20, 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	26-Mar-25 (No. 217-04290)	Mar-26
N-type mismatch combination	SN: L1119	26-Mar-25 (No. 217-04292)	Mar-26
OCP DAK-12	SN: 1016	24-Sept-24 (No. OCP-DAK12-1016_Sep24)	Sep-25
OCP DAK-3.5	SN: 1249	23-Sept-24 (No. OCP-DAK3.5-1249_Sep24)	Sep-25
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	30-Sept-24 (No. Report_ACAP2020E-Cave_20240930s)	Sep-25
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: June 20, 2025

Parameters of Probe: EX3DV4 - SN:7827

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc ($k = 2$)
Norm ($\mu V/(V/m)^2$) [A]	0.69	0.59	0.64	±10.1%
DCP (mV) [B]	105.4	107.0	108.7	±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	126.4	±1.4%	±4.7%
		Y	0.00	0.00	1.00		140.4		
		Z	0.00	0.00	1.00		124.5		
10352	Pulse Waveform (200Hz, 10%)	X	1.51	60.47	6.28	10.00	60.0	±2.9%	±9.6%
		Y	1.76	61.55	6.85		60.0		
		Z	1.73	61.58	6.91		60.0		
10353	Pulse Waveform (200Hz, 20%)	X	0.78	60.00	4.82	6.99	80.0	±2.4%	±9.6%
		Y	0.79	60.00	4.88		80.0		
		Z	0.83	60.00	5.11		80.0		
10354	Pulse Waveform (200Hz, 40%)	X	0.01	126.31	2.19	3.98	95.0	±2.8%	±9.6%
		Y	0.27	151.09	1.01		95.0		
		Z	0.14	131.13	0.04		95.0		
10355	Pulse Waveform (200Hz, 60%)	X	0.13	158.18	0.39	2.22	120.0	±1.7%	±9.6%
		Y	7.18	106.14	3.82		120.0		
		Z	9.50	157.84	15.85		120.0		
10387	QPSK Waveform, 1 MHz	X	0.44	61.99	11.60	1.00	150.0	±2.8%	±9.6%
		Y	0.54	65.84	14.25		150.0		
		Z	0.40	61.30	11.19		150.0		
10388	QPSK Waveform, 10 MHz	X	1.19	65.13	13.17	0.00	150.0	±0.8%	±9.6%
		Y	1.39	67.98	14.60		150.0		
		Z	1.12	64.66	12.81		150.0		
10396	64-QAM Waveform, 100 kHz	X	1.52	62.95	15.22	3.01	150.0	±1.2%	±9.6%
		Y	1.69	64.88	16.16		150.0		
		Z	1.64	64.01	15.46		150.0		
10399	64-QAM Waveform, 40 MHz	X	2.70	66.03	14.89	0.00	150.0	±1.4%	±9.6%
		Y	2.82	67.20	15.56		150.0		
		Z	2.63	65.86	14.74		150.0		
10414	WLAN CCDF, 64-QAM, 40 MHz	X	3.76	66.55	15.40	0.00	150.0	±2.4%	±9.6%
		Y	3.69	66.73	15.50		150.0		
		Z	3.67	66.35	15.21		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 Pages 5 and 6).
[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:7827

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	8.0	58.17	33.46	1.13	0.00	4.90	0.00	0.01	1.00
y	7.3	52.27	32.88	1.36	0.00	4.90	0.37	0.00	1.00
z	7.6	54.51	32.57	4.47	0.00	4.92	0.54	0.00	1.00

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle	-79.6°
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:7827

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] ($k = 2$)
2450	39.2	1.80	7.37	7.24	7.09	0.35	1.27	±11.0%
2600	39.0	1.96	7.53	7.40	7.24	0.35	1.27	±11.0%
3300	38.2	2.71	6.30	6.19	6.06	0.36	1.27	±13.1%
3500	37.9	2.91	6.57	6.45	6.31	0.37	1.27	±13.1%
3700	37.7	3.12	6.58	6.46	6.32	0.37	1.27	±13.1%
3900	37.5	3.32	6.33	6.22	6.09	0.37	1.27	±13.1%
4100	37.2	3.53	6.39	6.28	6.14	0.37	1.27	±13.1%
5250	35.9	4.71	5.71	5.61	5.49	0.33	1.27	±13.1%
5600	35.5	5.07	5.25	5.16	5.05	0.29	1.27	±13.1%
5750	35.4	5.22	5.34	5.24	5.13	0.28	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.

Parameters of Probe: EX3DV4 - SN:7827

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] ($k = 2$)
6500	34.5	6.07	5.33	5.23	5.12	0.20	1.27	±18.6%

[C] Frequency validity is −600/+700 MHz at 6.5 GHz, ±700 MHz at or above 7 GHz, and ±150 MHz at 9.85 GHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] The probes are calibrated using tissue simulating liquids (TSL) that deviate for ε and σ by less than ±10% from the target values (typically better than ±6%) and are valid for TSL with deviations of up to ±10%.
[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; below ±2% for frequencies between 3–6 GHz; and below ±4% for frequencies between 6–10 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

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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: DAE4-1332_Feb25

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BM - SN: 1332
Calibration procedure(s)	QA CAL-06.v30 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	February 05, 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
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-25 (in house check)	In house check: Jan-26
Calibrator Box V2.1	SE UMS 006 AA 1002	23-Jan-25 (in house check)	In house check: Jan-26

	Name	Function	Signature
Calibrated by:	Dominique Steffen	Laboratory Technician	
Approved by:	Sven Kühn	Technical Manager	

Issued: February 5, 2025

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

Certificate No: DAE4-1332_Feb25 Page 1 of 5

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	404.388 ± 0.02% (k=2)	403.789 ± 0.02% (k=2)	403.986 ± 0.02% (k=2)
Low Range	4.00058 ± 1.50% (k=2)	3.97378 ± 1.50% (k=2)	3.96150 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	64.5 ° ± 1 °

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	200034.87	1.05	0.00
Channel X	+ Input	20003.48	-0.15	-0.00
Channel X	- Input	-20007.26	1.80	-0.01
Channel Y	+ Input	200036.46	2.50	0.00
Channel Y	+ Input	20003.72	-0.02	-0.00
Channel Y	- Input	-20012.41	-3.41	0.02
Channel Z	+ Input	200037.10	3.38	0.00
Channel Z	+ Input	20003.35	-0.39	-0.00
Channel Z	- Input	-20011.39	-2.23	0.01

Low Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	1999.21	0.33	0.02
Channel X	+ Input	198.42	-0.23	-0.12
Channel X	- Input	-201.16	-0.21	0.11
Channel Y	+ Input	1998.86	0.11	0.01
Channel Y	+ Input	197.94	-0.63	-0.32
Channel Y	- Input	-202.39	-1.25	0.62
Channel Z	+ Input	1998.61	-0.05	-0.00
Channel Z	+ Input	197.95	-0.70	-0.35
Channel Z	- Input	-202.11	-0.89	0.44

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	-16.43	-18.36
	- 200	19.28	17.84
Channel Y	200	-22.58	-22.93
	- 200	21.27	21.07
Channel Z	200	-9.80	-9.99
	- 200	9.39	9.03

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	-	-0.80	-3.50
Channel Y	200	6.54	-	1.86
Channel Z	200	9.07	3.62	-

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	15927	15639
Channel Y	16077	15695
Channel Z	16001	15779

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	0.70	-0.33	1.44	0.32
Channel Y	-0.39	-1.47	0.48	0.37
Channel Z	-0.10	-1.21	1.34	0.44

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

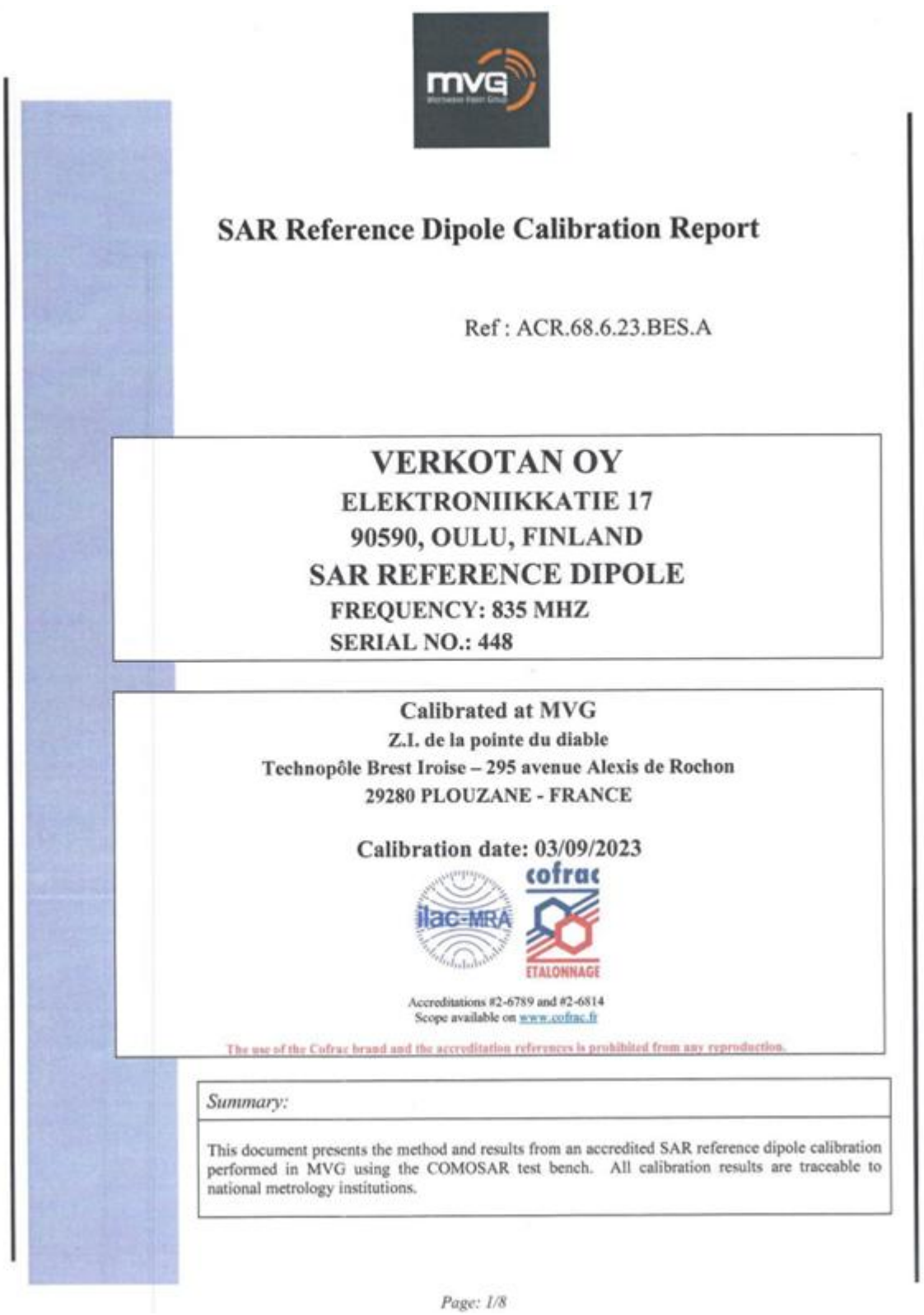
8. Low Battery Alarm Voltage (Typical values for information)

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



SAR Reference Dipole Calibration Report

Ref : ACR.68.6.23.BES.A

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

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

Calibration date: 03/09/2023

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.

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SAR REFERENCE DIPOLE CALIBRATION REPORT Ref: ACR.68.6.23.BES.A

	Name	Function	Date	Signature
Prepared by :	Cyrille ONNEE	Measurement Responsible	3/9/2023	
Checked & approved by:	Jérôme Luc	Technical Manager	3/9/2023	
Authorized by:	Yann Toutain	Laboratory Director	3/9/2023	

Yann Toutain ID Signature numérique de Yann Toutain ID Date : 2023.03.09 15:03:27 +01'00'

	Customer Name
Distribution :	Verkotan Oy

Issue	Name	Date	Modifications
A	Cyrille ONNEE	3/9/2023	Initial release

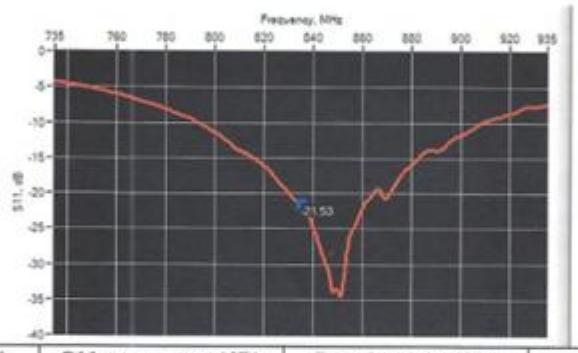
6 CALIBRATION RESULTS

6.1 MECHANICAL DIMENSIONS

L mm		h mm		d mm	
Measured	Required	Measured	Required	Measured	Required
-	161.00 +/- 2%	-	89.80 +/- 2%	-	3.60 +/- 2%

6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
835	-21.53	-20	42.3Ω - 0.1jΩ

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.

6.3.1 SAR with Head Liquid

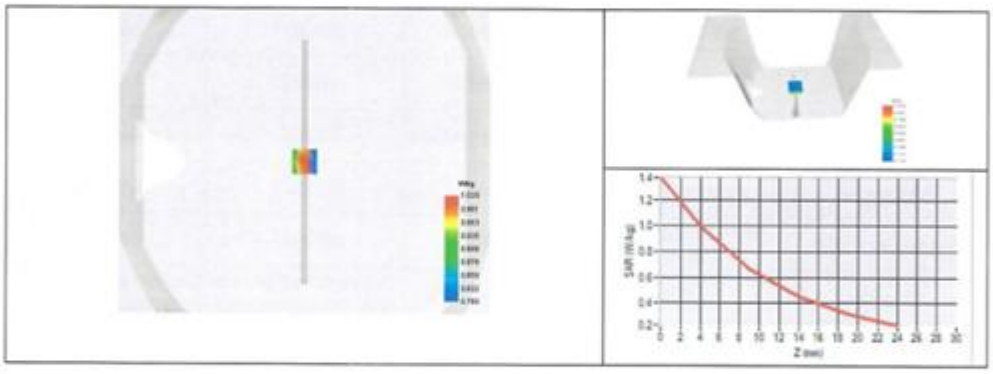
The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured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

SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.68.6.23.BES.A

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPGO333
Liquid	Head Liquid Values: eps' : 44.1 sigma : 0.89
Distance between dipole center and liquid	15.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	835 MHz
Input power	20 dBm
Liquid Temperature	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
835 MHz	0.94	9.36	9.56	0.61	6.05	6.22



SAR Reference Dipole Calibration Report

Ref : ACR.68.5.23.BES.A

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

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

Calibration date: 03/09/2023

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

Summary:

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

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SAR REFERENCE DIPOLE CALIBRATION REPORT Ref: ACR.68.5.23.BES.A

	Name	Function	Date	Signature
Prepared by :	Cyrille ONNEE	Measurement Responsible	3/9/2023	
Checked & approved by:	Jérôme Luc	Technical Manager	3/9/2023	
Authorized by:	Yann Toutain	Laboratory Director	3/9/2023	

Yann Toutain ID Signature numérique de Yann Toutain ID Date : 2023.03.09 15:01:12 +01'00'

	Customer Name
Distribution :	Verkotan Oy

Issue	Name	Date	Modifications
A	Cyrille ONNEE	3/9/2023	Initial release

Page: 2/8

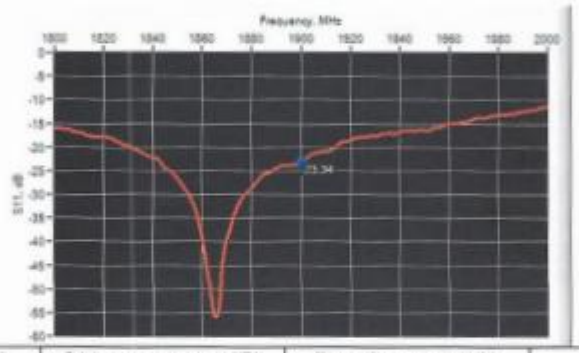
6 CALIBRATION RESULTS

6.1 MECHANICAL DIMENSIONS

L mm		h mm		d mm	
Measured	Required	Measured	Required	Measured	Required
-	68.00 +/- 2%	-	39.50 +/- 2%	-	3.60 +/- 2%

6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
1900	-23.34	-20	48.5Ω - 6.6jΩ

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.

6.3.1 SAR with Head Liquid

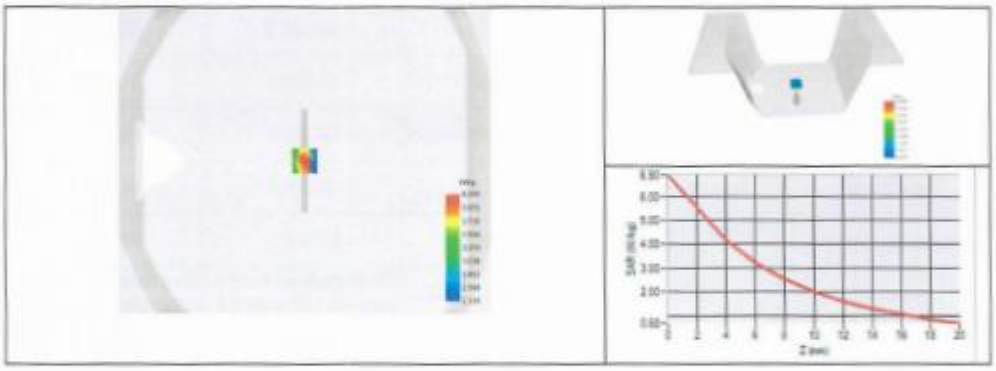
The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured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

SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.68.5.23.BES.A

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 41/18 EPGO333
Liquid	Head Liquid Values: eps' : 40.4 sigma : 1.40
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	1900 MHz
Input power	20 dBm
Liquid Temperature	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
1900 MHz	3.80	38.02	39.70	1.94	19.41	20.50



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SAR Reference Dipole Calibration Report

Ref : ACR.288.9.24.BES.A

VERKOTAN LTD.
ELEKTRONIIKKATIE 17
90590, OULU, FINLAND
MVG COMOSAR REFERENCE DIPOLE
FREQUENCY: 3500 MHZ
SERIAL NO.: 4121-DIP3G500-620

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

Calibration date: 09/26/24

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

Summary:

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

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	Name	Function	Date	Signature
Prepared by :	Jérôme Le Gall	Measurement Responsible	10/14/2024	
Checked & approved by:	Pedro Ruiz	Technical Manager	10/14/2024	
Authorized by:	Pedro Ruiz	Laboratory Director	10/14/2024	Assinado por: Pedro RUIZ 29093B31C46F428...

	Customer Name
Distribution:	Verkotan Ltd.

Issue	Name	Date	Modifications
A	Jérôme Le Gall	10/14/2024	Initial release

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	SN 36/23 EPGO429
Liquid	Head Liquid Values: eps' : 39.5 sigma : 2.62
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=4mm/dy=4mm/dz=2mm
Frequency	3500 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
3500 MHz	6.46	64.64	67.10	2.58	25.80	25.00