SAR Compliance Test Report

Date of Report:	27/03/2025	**Client's Contact person:**	Alberto Gamberini
Number of pages:	35	**Responsible Test engineer:**	Ilari Kinnunen
Testing laboratory:	**Verkotan Oy** Elektroniikkatie 17 90590 Oulu Finland	**Client:**	**DATALOGIC S.R.L.** Via San Vitalino, 13 40012 Lippo di Calderara di Reno Italy
Tested device:	**Powerscan PBT9600 type DKDCRB RFUS**		
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:

27.03.2025

Miia Nurkkala

Laboratory Manager

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1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Device under Test (DUT):

Product:	Barcode Reader
Manufacturer:	Datalogic S.r.l.
Model:	Powerscan PBT9600
Type:	DKDCRB RFUS
Serial Number:	Conducted sample: E25A23148 SAR sample: E25A23196
FCC ID Number:	Contains FCC ID: U4FBT-MRY-A1
ISED ID Number:	Contains IC ID: 3862D-BTMRYA1
DUT Number:	Conducted sample: 20150 SAR sample: 20123
Battery Type used in testing:	Rechargeable Li-Ion Battery 3.6V
State of the Sample:	Production sample

Testing information:

Testing performed:	27.02.2025 – 10.03.2025
Notes:	-
Document history & changes:	Initial version
Document ID:	FCC ISED_SAR report_Powerscan PBT9600_ID7442_27032025.docx
Temperature °C	22±2 / Controlled
Humidity RH%	30±20 / Controlled
Measurement performed by:	Ilari Kinnunen
FCC Test Firm Designation Number:	FI0005
ISED Company Number:	22218

1.2 Maximum Results

The maximum reported* SAR values for Extremity-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 Extremity SAR_{10g} is 4.0 W/kg.

1.2.1 Standalone SAR

1.2.1.1 FCC

System	Highest Reported* SAR_{10g}[W/kg] in Extremity Exposure Condition, 0mm separation distance	Result
RFID	**0.53**	**PASS**
Bluetooth	**0.07**	**PASS**

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

1.2.1.2 ISED

System	Highest Reported* SAR_{10g}[W/kg] in Extremity Exposure Condition, 0mm separation distance	Result
RFID	**0.53**	**PASS**
Bluetooth	**0.62**	**PASS**

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

1.2.2 Simultaneous Transmission SAR

1.2.2.1 FCC

Highest Simultaneous Transmission SAR	SAR_{10g}[W/kg] in Extremity Exposure Condition	Result
RFID + Bluetooth	**0.60**	**PASS**

1.2.2.2 ISED

Highest Simultaneous Transmission SAR	SAR_{10g}[W/kg] in Extremity Exposure Condition	Result
RFID + Bluetooth	**1.15**	**PASS**

1.2.3 Maximum Drift

Maximum Drift During Measurements	-0.73 dB*

*Larger than 5% drifts included to scaling factors

1.2.4 Measurement Uncertainty

DASY5 System, SAR 10g: 300 MHz – 3 GHz:

Expanded Uncertainty (k=2) 95 %	±22.5 %

2. DESCRIPTION OF THE DEVICE UNDER TEST (DUT)

The DUT is a handheld industrial scanner supporting RFID and Bluetooth.

Photos of the DUT are presented in Annex A.

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]**
	RFID	902.75 – 927.25
	Bluetooth	2402 – 2480

2.2 Test Exemptions

2.2.1 FCC

300 MHz – 6 GHz, SAR-Based Exemption:

FCC SAR test exemption power threshold is calculated according to 447498 D04 Interim General RF Exposure Guidance, equation B.2 and B.1:

$$Pth\ (mW) = \begin{cases} ERP_{20\,cm}\,(d\ /\ 20cm)^{x} & d \le 20cm \\ ERP_{20\,cm} & 20cm < d \le 40cm \end{cases} \quad \text{(Equation 1)}$$

where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\,cm}\sqrt{f}}\right) \quad \text{(Equation 2)}$$

and frequency f is in GHz, d is the separation distance (cm), and ERP20cm is per Equation (B.1) below.

$$ERP20cm\ (mW) = \begin{cases} 2040f & 0.3 \le f < 1.5GHz \\ 3060 & 1.5GHz \le f \le 6GHz \end{cases} \quad \text{(Equation 3)}$$

Transmission mode	Frequency [GHz]	Separation distance* [cm]	P_{th}** [mW]
Bluetooth	2.480	0.5	6.8

*Calculations have been made by using a minimum separation distance 0.5 cm instead of 0.4 cm.
**P_{th} is multiplied by 2.5 for 10g Extremity condition

2.2.1.1 SAR-Based Test Exclusion, Maximum Defined Output Power and ERP

According to Appendix B at 447498 D04 Interim General RF Exposure Guidance, the equation (B.2.) defines the thresholds for available maximum time-averaged power or maximum time-averaged ERP, whichever is greater. Since the maximum output power is greater than the ERP of the DUT for Bluetooth 2.4GHz, it is used for SAR test exclusion.

Transmission mode	Output power [dBm]	Output power [mW]	Power Gain of Antenna, G [dBi]	ERP Output power [dBm]	ERP Output power [mW]	P_{th} [mW]
Bluetooth	**6.179**	**4.15**	0.5	4.53	2.84	6.8

The maximum output power of Bluetooth is below the test exemption threshold.

2.2.2 ISED

SAR Text Exemptions

SAR test exemption output power limits based on frequency and separation distance are from RSS-102, Issue 6, 2023:

Table 11: Power limits for exemption from routine SAR evaluation based on the separation distance

Frequency (MHz)	≤ 5 mm (mW)	10 mm (mW)	15 mm (mW)	20 mm (mW)	25 mm (mW)	30 mm (mW)	35 mm (mW)	40 mm (mW)	45 mm (mW)	> 50 mm (mW)
≤ 300	45	116	139	163	189	216	246	280	319	362
450	32	71	87	104	124	147	175	208	248	296
835	21	32	41	54	72	96	129	172	228	298
1900	6	10	18	33	57	92	138	194	257	323
2450	3	7	16	32	56	89	128	170	209	245
3500	2	6	15	29	50	72	94	114	134	158
5800	1	5	13	23	32	41	54	74	102	128

Table 1 The SAR Test Exemption Table

Transmission mode	Frequency [MHz]	Minimum separation distance [mm]	Maximum Output Power [dBm]	Maximum Output Power [mW]	Power Gain of Antenna, G [dBi]	EIRP [dBm]	EIRP [mW]	Exemption Limit* [mW]
Bluetooth	2480	≤5	6.179	4.15	0.5	**6.679**	**4.65**	7.5

*Exemption limit is multiplied by 2.5 for 10g Extremity condition

The maximum EIRP of Bluetooth is below the test exemption threshold.

2.3 Simultaneous transmission

RFID and Bluetooth can be operated simultaneously.

3. OUTPUT POWER

3.1 Maximum specified conducted output power

From the customer, including tune-up tolerances;

Technology	Max Output Power [dBm]
RFID	20

3.2 Tested conducted power

Measured conducted output power at transmitting antenna connector;

Technology	Output Power [dBm]		
	902.75 MHz	914.75 MHz	927.25 MHz
RFID	17.97	17.86	17.71

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.

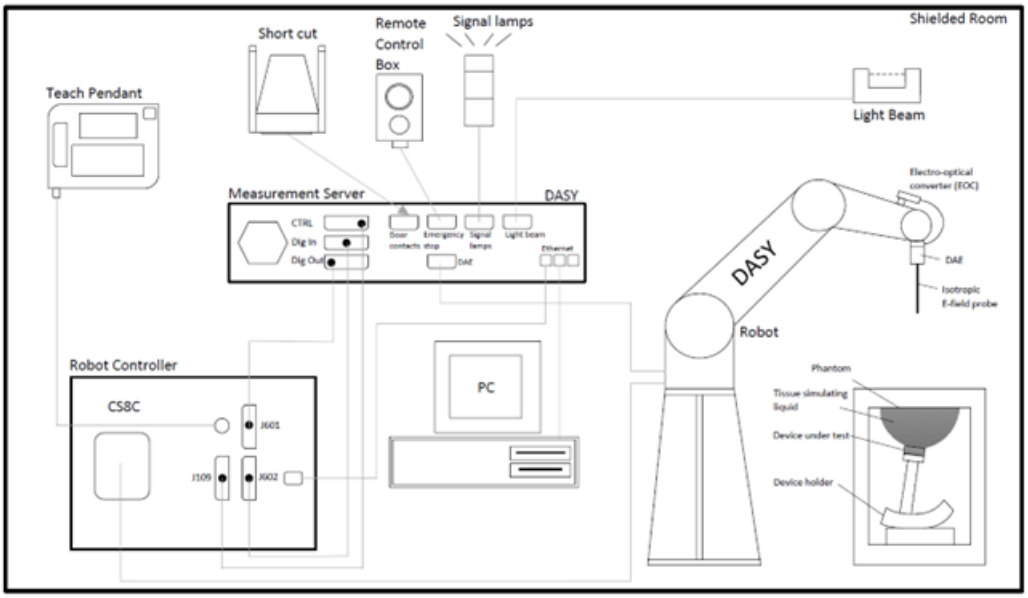


Figure 1 Schematic Laboratory Picture

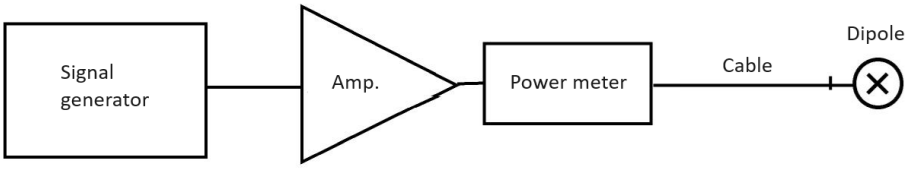


Figure 2. Signal source setup for system check

4.1 Test Equipment List

Test Equipment	Model	Serial Number	Calibration Date	Interval [years]
Amplifier, 800MHz-4200MHz, 10W	10S1G4A	320421	NA	NA
DAE4, converter	DAE4	705	04/2024	1
DASY5 Software	52.8.8.1258	-	NA	NA
Inline Peak Power Sensor	MA24105A	2102058	11/2024	1
Isotropic DOS probe	EX3DV4	3892	04/2024	1
Network Analyzer	E5071B	MY42301191	02/2025	1
Power Sensor	NRP8S	1419.0006K02-108508-HC	09/2023	2
Power Sensor	NRP8S	1419.0006K02-108509-Zh	03/2024	2
System validation dipole	D835V2	448	03/2023	3
Vector Signal Generator	MG3710E	6262028675	NA	1

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:

		Measured on 09/2024			Calibrated		
Dipole and Serial Number	Frequency [MHz]	Return Loss [dB]	Impedance [Ω]		Return Loss [dB]	Impedance [Ω]	
D835V2-SN:448	835	-23.0	43.6	-1.9	-21.53	42.3	-0.1

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

Modular flat phantom:

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±0.2mm. The dimensions are 308x192x182mm and filling volume is 9.2 liters giving a filling height of 155mm.

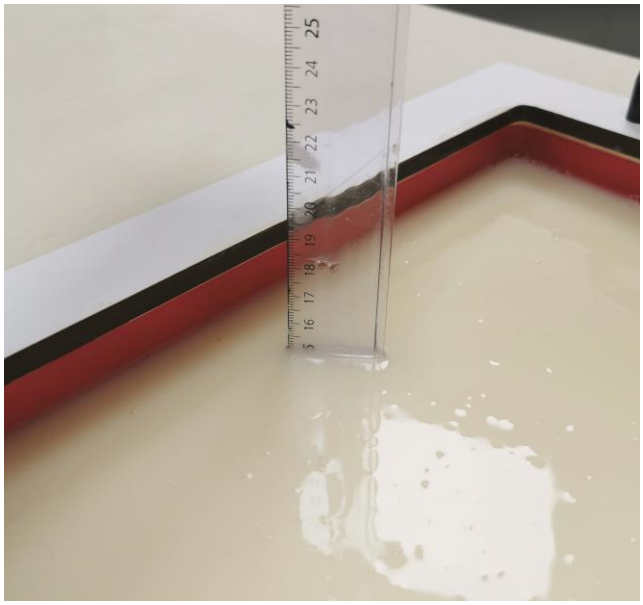


Figure 3 Tissue simulant depth

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 ±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
835	D835V2 - 455	EX3DV4 - SN: 3892	CW	DAE 4 / 705	42.01	0.94	05/2024

4.5 System Check

Date	Tissue Type	Tissue Temp. [°C]	Frequency [MHz]	Input Power [mW]	Measured SAR_{1g} [W/kg]	1 W Target SAR_{1g} [W/kg]	1 W Normalized SAR_{1g} [W/kg]	Deviation [%]	Plot #
10.03.2025	WB Head	22	835	250	2.35	9.36	9.4	0.4	1

4.6 Tissue Simulant Verification

				Measured		Target		Deviation	
Date	Tissue Type	Tissue Temp [°C]	Frequency [MHz]	Dielectric Constant [ε] Target	Conductivity σ [S/m] Target	Dielectric Constant [ε]	Conductivity σ [S/m]	ε [%]	σ [%]
10.03.2025	WB Head	22	835	41.5	0.90	41.3	0.88	-0.6	-2.5
10.03.2025	WB Head	22	902.8	41.5	0.97	40.9	0.90	-1.3	-7.2
10.03.2025	WB Head	22	914.8	41.5	0.98	40.9	0.91	-1.4	-7.2
10.03.2025	WB Head	22	927.3	41.5	0.98	40.8	0.91	-1.5	-7.3

5. TEST PROCEDURE

The testing was carried out in accordance with FCC KDB Publications 447498 D04 Interim General RF Exposure Guidance v01 and RSS-102, Issue 6.

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.

The DUT was set to transmit at maximum power and duty cycle using test software.

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.

Device holder supplied by SPEAG

5.2 Test Positions

5.2.1 Extremity Configuration, 0mm separation distance

Extremity SAR was tested from the back, front, left, right and top side of the device. 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 average 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_i) (1g)	(c_i) (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 Extremity Condition with 0mm separation

Band	Frequency [MHz]	Maximum Power [dBm]	Conducted Power [dBm]	Test position	Measured SAR_{10g} [W/kg]	Power Drift* [dB]	Duty Cycle	Scaling Factor	Reported SAR_{10g} [W/kg]	Plot #
RFID	902.75	20	17.97	Front 0mm	0.262	-0.49	1:1	1.79	0.47	
RFID	902.75	20	17.97	Back 0mm	0.00591	-0.73	1:1	1.89	0.01	
RFID	902.75	20	17.97	Left 0mm	0.0505	-0.41	1:1	1.75	0.09	
RFID	902.75	20	17.97	Right 0mm	0.0575	-0.36	1:1	1.73	0.10	
RFID	902.75	20	17.97	Top 0mm	0.128	0.39	1:1	1.75	0.22	
RFID	902.75	20	17.86	Front 0mm	0.323	-0.02	1:1	1.64	0.53	2
RFID	902.75	20	17.71	Front 0mm	0.212	-0.13	1:1	1.69	0.36	

*Larger than 5% drifts included to scaling factors

7.1 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.

7.2 Calculated Bluetooth SAR

7.2.1 FCC

For simultaneous transmission evaluation the estimated standalone SAR values are calculated according to the following equation described below.

Since KDB 447498 D04 Interim General RF Exposure Guidance v01 does not have estimated SAR formula for SAR10g, the use of formula below was specified by FCC via KDB inquiry.

Estimated SAR = [(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] · [√f(GHz) / x] W/kg

where:

x = 18.75 for 10g SAR.

Estimated SAR = (4.15 / 5) · (√2.480 / 18.75) = 0.07 W/kg

Mode of Operation	Estimated SAR_{10g}[mW/g]
Bluetooth	0.07

7.2.2 ISED

The estimated SAR value for Bluetooth is evaluated according to the following equation stated in RSS-102, Issue 6, Section "7.1.8. SAR estimation for exempted transmitters":

$$SARestimated = \frac{Pmax}{Pmax,exemption} * 0.25 * SARlimit\ W/kg$$

where:

- $Pmax$ is the maximum power level including tune-up tolerance for the exempted transmitter
- $Pmax,exemption$ is the maximum power level of exemption at the same frequency and distance for the exempted transmitter
- $SARlimit$ is the applicable SAR limit (e.g. 1.6 W/kg for 1 g or 4 W/kg for 10 g)

According to RSS-102, Issue 6, 2023, the SAR test exemption power limit for Bluetooth is 7.5mW at ≤5mm separation distance for extremity exposure.

Estimated Bluetooth SAR = (4.65 / 7.5) · 0.25 · 4.0 = 0.62 W/kg

7.3 Simultaneous Transmission Analysis

Simultaneous transmission analysis for the maximum RFID and the maximum Bluetooth SAR is in the table below. Direct summation of SAR results was performed.

7.3.1 FCC

Extremity SAR:

	Exposure Condition	Extremity SAR_{10g} [W/kg]				
	Test Position	**Front**	**Back**	**Left**	**Right**	**Top**
RFID		0.53	0.01	0.09	0.10	0.22
Bluetooth		0.07				
Direct Summation:		**0.6**	**0.08**	**0.16**	**0.17**	**0.29**

7.3.2 ISED

Extremity SAR:

	Exposure Condition	Extremity SAR_{10g} [W/kg]				
	Test Position	**Front**	**Back**	**Left**	**Right**	**Top**
RFID		0.53	0.01	0.09	0.10	0.22
Bluetooth		0.62				
Direct Summation:		**1.15**	**0.63**	**0.71**	**0.72**	**0.84**

APPENDIX A: PHOTOS OF THE DUT

Annex A is provided as a separate document.

APPENDIX B: SYSTEM CHECK SCAN

Plot 1

Date/Time: 10/03/2025 10:17:16

Test Laboratory: Verkotan Oy

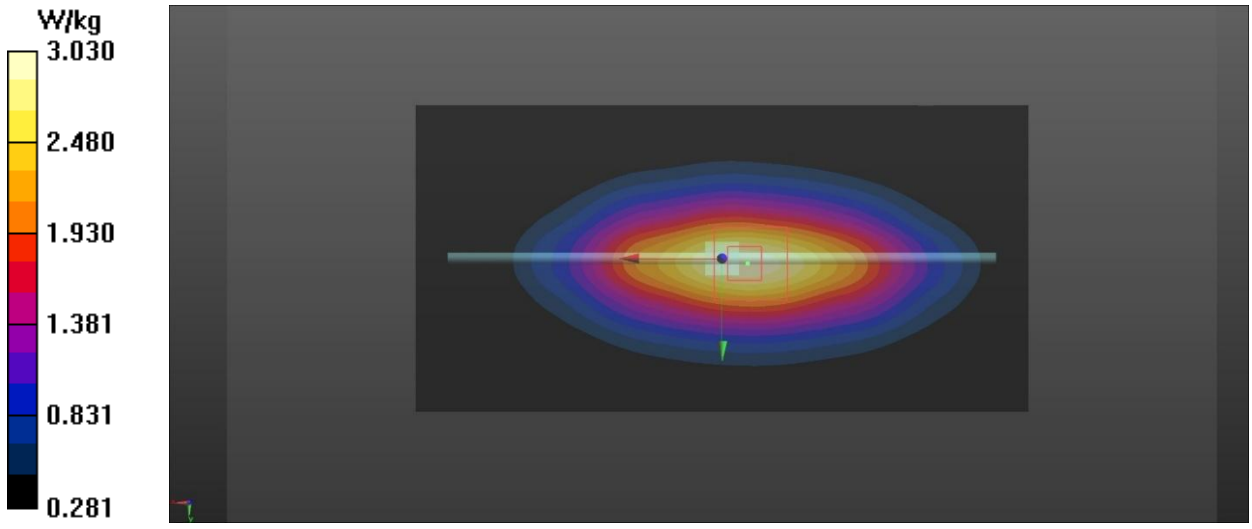
DUT: D835V2 - SN455

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 = 0.877 S/m; ε_r = 41.26; ρ = 1000 kg/m^3
Phantom section: Center Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3892; ConvF(9.05, 9.23, 9.06) @ 835 MHz; Calibrated: 15/04/2024
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -4.0, 31.0
  - Electronics: DAE4 Sn705; Calibrated: 09/04/2024
  - Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

835 MHz system check/Area Scan (121x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 3.00 W/kg
835 MHz system check/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.97 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 3.36 W/kg
SAR(1 g) = 2.35 W/kg; SAR(10 g) = 1.53 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 17.5 mm
Ratio of SAR at M2 to SAR at M1 = 68.4%
Maximum value of SAR (measured) = 3.03 W/kg



APPENDIX C: MEASUREMENT SCANS

Plot 2

Date/Time: 10/03/2025 13:25:13

Test Laboratory: Verkotan Oy

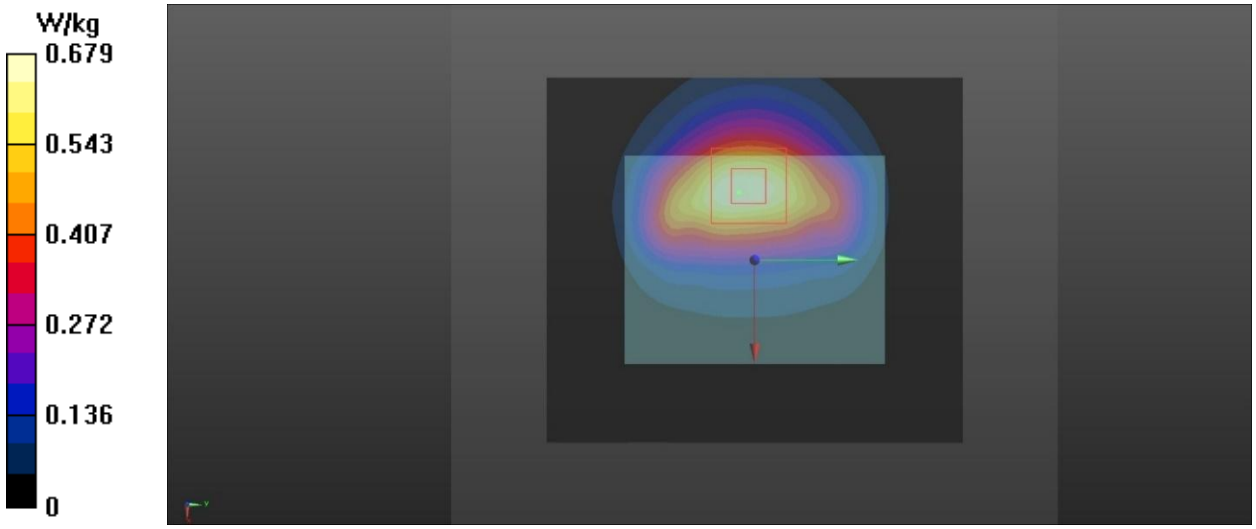
DUT: PBT9600

Communication System: UID 0, RFID (0); Communication System Band: 900; Frequency: 914.75 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 915 MHz; σ = 0.906 S/m; ε_r = 40.894; ρ = 1000 kg/m^3
Phantom section: Center Section
Measurement Standard: DASY5 (IEEE/IEC)

DASY Configuration:

- Probe: EX3DV4 - SN3892; ConvF(9.05, 9.23, 9.06) @ 914.75 MHz; Calibrated: 15/04/2024
  - Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 31.0, -4.0
  - Electronics: DAE4 Sn705; Calibrated: 09/04/2024
  - Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

RFID, 914.75 MHz, Front, 0mm 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 15.64 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.720 W/kg
SAR(1 g) = 0.511 W/kg; SAR(10 g) = 0.323 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 15 mm
Ratio of SAR at M2 to SAR at M1 = 66.3%
Maximum value of SAR (measured) = 0.635 W/kg
RFID, 914.75 MHz, Front, 0mm 2/Area Scan (71x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.679 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-3892_Apr24**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3892
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	April 15, 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-Nov-23 (No. EX3-7349_Nov23)	Nov-24

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

	Name	Function	Signature
Calibrated by	Joanna Lleshaj	Laboratory Technician	
Approved by	Sven Kühn	Technical Manager	

Issued: April 15, 2024

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

Certificate No: EX-3892_Apr24 Page 1 of 9

Parameters of Probe: EX3DV4 - SN:3892

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc ($k = 2$)
Norm ($\mu V/(V/m)^2$) [A]	0.47	0.39	0.49	±10.1%
DCP (mV) [B]	102.6	104.9	102.5	±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	118.3	±1.9%	±4.7%
		Y	0.00	0.00	1.00		139.8		
		Z	0.00	0.00	1.00		123.5		

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:3892

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle	34.0°
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:3892

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 ($k = 2$)
300	45.3	0.87	11.28	11.28	11.28	0.09	1.00	±13.3%
450	43.5	0.87	10.66	10.66	10.66	0.16	1.30	±13.3%
600	42.7	0.88	10.14	10.14	10.14	0.10	1.25	±13.3%
750	41.9	0.89	9.10	9.76	9.42	0.38	1.27	±11.0%
900	41.5	0.97	9.05	9.23	9.06	0.37	1.27	±11.0%
1750	40.1	1.37	8.02	8.45	7.93	0.26	1.27	±11.0%
1950	40.0	1.40	7.72	8.09	7.63	0.29	1.27	±11.0%
2450	39.2	1.80	7.14	7.45	7.00	0.30	1.27	±11.0%
2600	39.0	1.96	6.97	7.29	6.83	0.29	1.27	±11.0%
4400	36.9	3.84	6.07	6.33	5.93	0.37	1.27	±13.1%
4800	36.4	4.25	5.75	6.00	5.64	0.37	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.

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

ilac-MRA

S Schweizerischer Kalibrierdienst
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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_Apr24

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 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
Keithley Multimeter Type 2001	SN: 0810278	29-Aug-23 (No:37421)	Aug-24
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: April 9, 2024

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	403.350 ± 0.02% (k=2)	404.806 ± 0.02% (k=2)	403.932 ± 0.02% (k=2)
Low Range	3.94768 ± 1.50% (k=2)	3.96406 ± 1.50% (k=2)	3.96264 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	65.5 ° ± 1 °

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	200011.01	3.25	0.00
Channel X	+ Input	20017.24	1.39	0.01
Channel X	- Input	-19983.57	4.76	-0.02
Channel Y	+ Input	200004.92	-3.13	-0.00
Channel Y	+ Input	20014.30	-1.56	-0.01
Channel Y	- Input	-19985.06	3.28	-0.02
Channel Z	+ Input	200009.28	1.60	0.00
Channel Z	+ Input	20015.65	-0.12	-0.00
Channel Z	- Input	-19986.74	1.59	-0.01

Low Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	2016.73	1.90	0.09
Channel X	+ Input	216.79	1.56	0.72
Channel X	- Input	-183.73	0.98	-0.53
Channel Y	+ Input	2015.83	1.11	0.06
Channel Y	+ Input	215.51	0.41	0.19
Channel Y	- Input	-184.74	0.02	-0.01
Channel Z	+ Input	2015.11	0.35	0.02
Channel Z	+ Input	214.46	-0.66	-0.31
Channel Z	- Input	-184.75	0.15	-0.08

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	1.70	-0.35
	- 200	2.83	0.72
Channel Y	200	10.28	9.75
	- 200	-10.10	-10.41
Channel Z	200	11.50	11.59
	- 200	-12.22	-13.08

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	-	-2.18	-2.49
Channel Y	200	9.26	-	-1.82
Channel Z	200	5.03	7.42	-

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	15867	13632
Channel Y	15716	16466
Channel Z	15611	17267

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	0.93	-0.38	2.39	0.54
Channel Y	0.72	-0.76	1.96	0.50
Channel Z	-0.14	-1.14	1.49	0.48

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

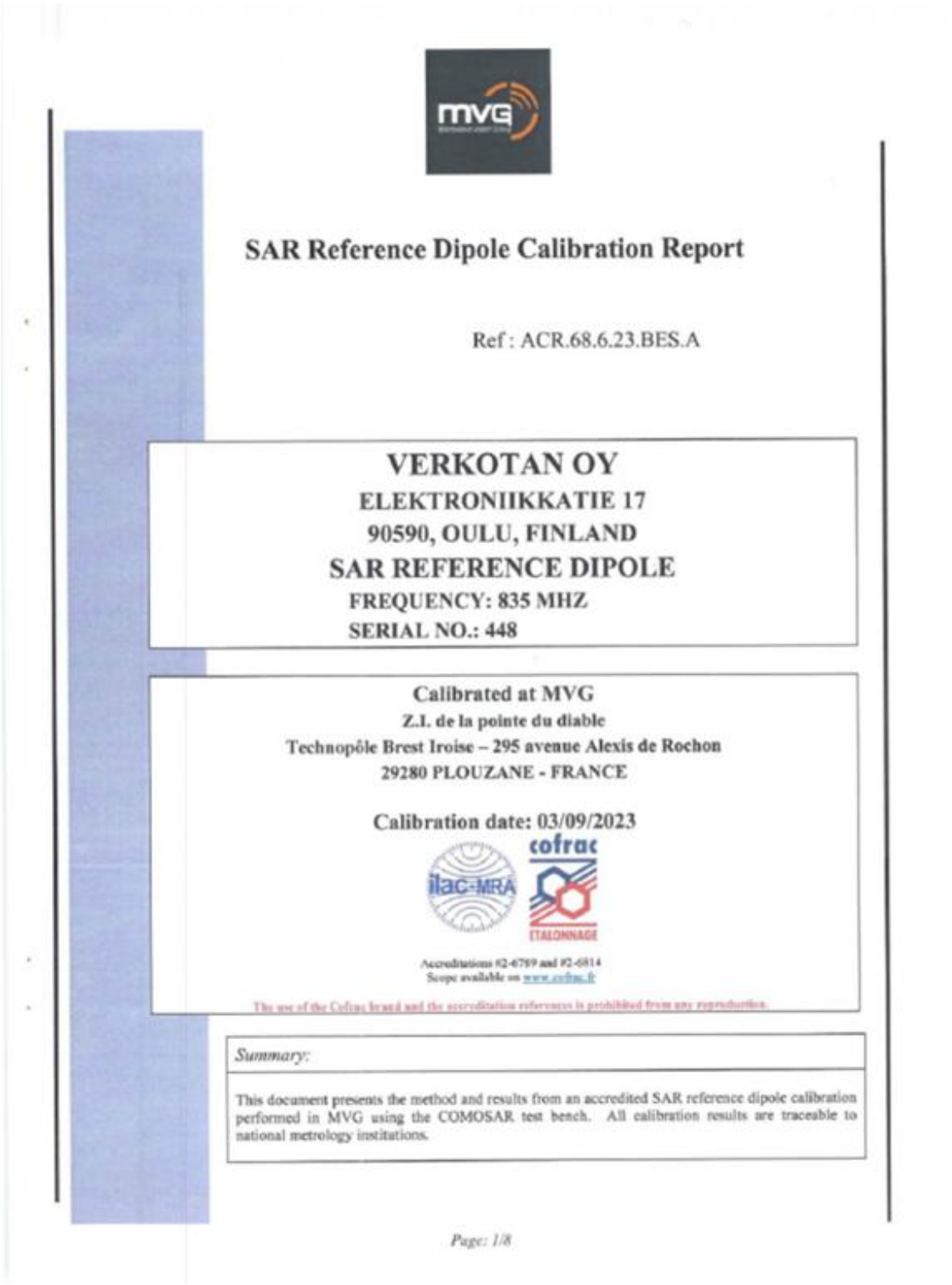
8. Low Battery Alarm Voltage (Typical values for information)

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



mvg

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

ilac-MRA cofrac ETALONNAGE

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

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Summary:

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

Page: 1/8

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

Page: 2/8

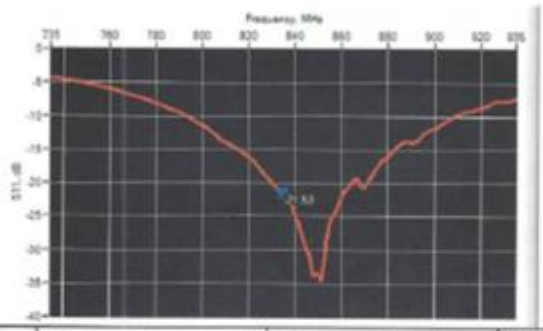
6 CALIBRATION RESULTS

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.66.6.23.IES.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