SAR Compliance Test Report

Date of Report:	26/05/2025	**Client's Contact person:**	Michihito Miyazaki
Number of pages:	29	**Responsible Test engineer:**	Ilari Kinnunen
Testing laboratory:	**Verkotan Oy** Elektroniikkatie 17 90590 Oulu Finland	**Client:**	**Panasonic Entertainment & Communication Co., Ltd** 4-1-62 Minoshima, Hakata-ku 812-8531 Fukuoka Japan
Tested device:	**Wireless Alert Badge**		
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 D01 General RF Exposure Guidance v06

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:

26.05.2025

Laboratory Manager

Miia Nurkkala

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1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Device under Test (DUT):

Product:	Wireless Alert Badge
Manufacturer:	Panasonic
Model:	K-SAB25
DECT ID:	0018E07DC0, 0018E07DBE
FCC ID Number:	ACJ9TAK-SAB25
ISED ID Number:	23335-KSAB25
DUT Number:	20063, 20062
Battery Type used in testing:	Li-Ion Battery
State of the Sample:	Production sample

Testing information:

Testing performed:	19.5.2025
Notes:	-
Document history & changes:	Initial version
Document ID:	FCC_SAR report_K-SAB25_ID7487_26052025.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 Body-worn 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
DECT	**0.014**	**PASS**

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

1.2.2 Maximum Drift

Maximum Drift During Measurements	2.16dB*

*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 %

2. DESCRIPTION OF THE DEVICE UNDER TEST (DUT)

The DUT is a Wireless Alert badge that can be worn on a body by using a strap.

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]
	DECT	1920 – 1930

3. OUTPUT POWER

3.1 Maximum specified conducted output power

From the customer;

Technology	Max Output Power [dBm]	Tolerance [dB]
DECT	10	±1

3.2 Tested conducted power

Measured conducted output power at transmitting antenna connector.

Technology	Output Power [dBm]		
	1921.536 MHz	1924.992 MHz	1928.448 MHz
DECT	10.69	10.63	10.53

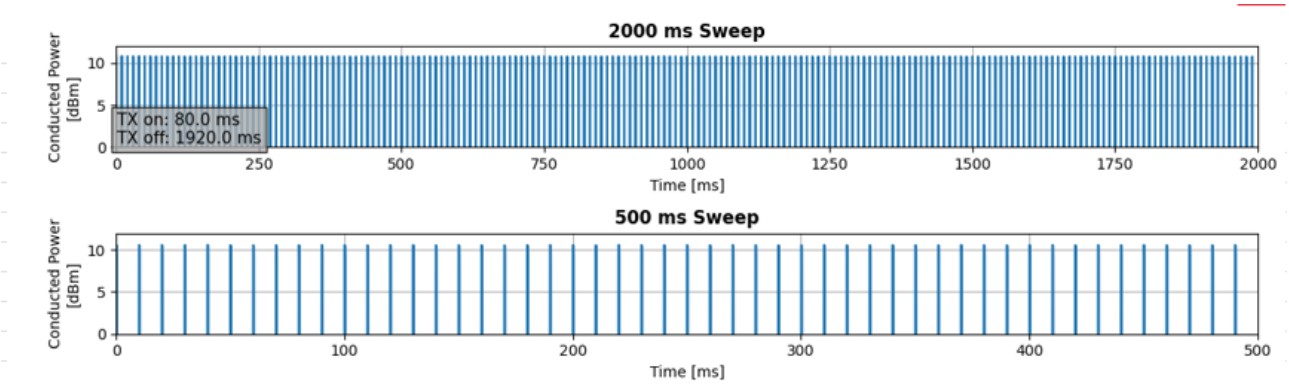


Figure 1. Measured duty cycle of 4% plot.

4. TEST EQUIPMENT

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

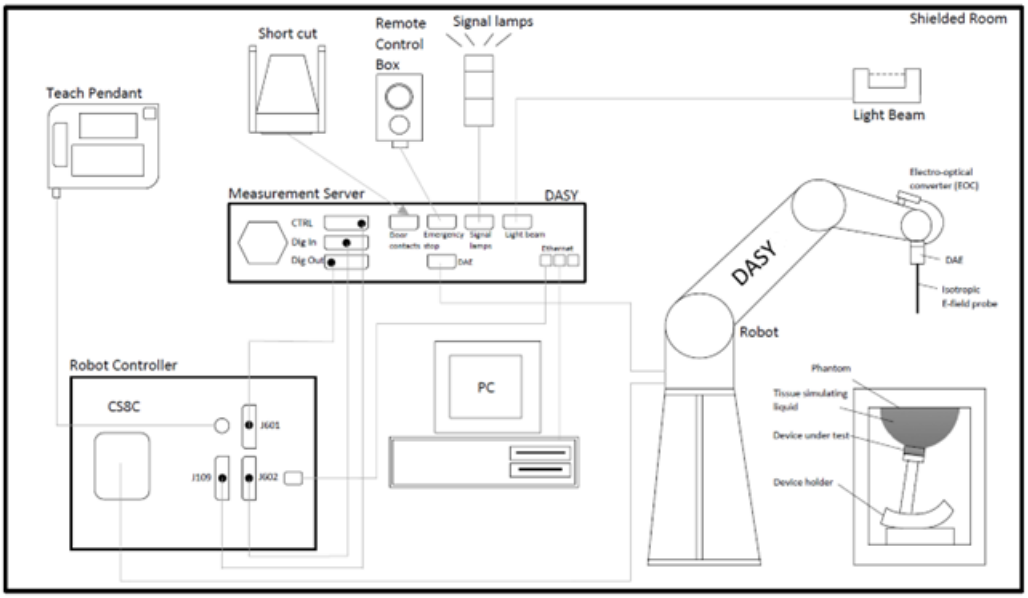


Figure 2 Schematic Laboratory Picture

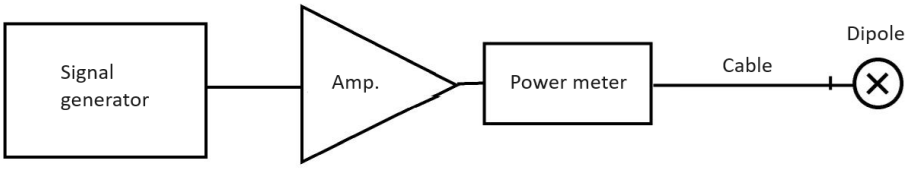


Figure 3. Signal source setup for system check

4.1 Test Equipment List

Test Equipment	Model	Serial Number	Calibration Date	Interval [years]
Amplifier, 800MHz-4200MHz, 10W	10S1G4A	320421	NA	NA
DAE4, converter	DAE4	1332	02/2025	1
DASY5 Software	52.8.8.1258	-	NA	NA
Directional Power sensor	NRT-Z44	107780	02/2025	2
Isotropic DOS probe	EX3DV4	7447	02/2025	1
Network Analyzer	E5071C	MY46102812	05/2024	1
Power reflection meter	NRT	835065/049	02/2024	3
System validation dipole	D1900V2	511	03/2023	3
Vector Signal Generator	MG3710E	6262028675	NA	1
Power Sensor	NRP8S	1419.0006K02-108509-Zh	03/2024	2

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]	
D1900V2-SN:511	1900	-23.0	44.5	-3.8	-23.34	48.5	-6.6

4.1.1 Isotropic E-field Probe Type EX3DV4

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

4.2 Phantoms

Eli Phantom:

The phantom used in SAR tests was an ELI phantom, manufactured by SPEAG. ELI phantom is used for compliance testing of handheld and body-mounted wireless devices in the frequency range of 4 MHz to 10 GHz. The phantom conforms to the requirements of IEC/IEEE 62209-1528 and FCC published RF Exposure KDB Procedures. The shell thickness of the bottom plate is 2±0.2mm.

4.3 Tissue Simulants

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

Tissue simulant liquid Ingredients
Deionized Water, tween, salt

4.4 System Validation Status

Frequency [MHz]	Dipole Type / SN	Probe Type / SN	Calibrated Signal Type	DAE Unit / SN	Dielectric Constant [ε']	Conductivity σ [S/m]	Date
1900	D1900V2-511	EX3DV4 - SN: 7447	CW	DAE 4 / 1332	38.56	1.43	03/2025

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 #
19.5.2025	WB Head	22.5	1900	250	9.45	38.02	37.8	-0.6 %	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 [%]
19.05.2025	WB Head	22.4	1900	38.1	1.4	40.0	1.4	-4.8	0.3
19.05.2025	WB Head	22.4	1921.54	38.06	1.42	40.0	1.4	-4.8	1.3
19.05.2025	WB Head	22.4	1924.99	38.06	1.42	40.0	1.4	-4.8	1.5
19.05.2025	WB Head	22.4	1928.45	38.06	1.42	40.0	1.4	-4.8	1.6

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 DECT 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.

Device holder supplied by SPEAG

5.2 Test Positions

5.2.1 Body-worn Configuration, 0mm separation distance

Body SAR was tested from all sides of the device. The device was placed in the SPEAG holder with a piece of Rohacell and lifted towards the phantom until the distance between the phantom and the device was 0mm.

Photos of the test positions are presented in appendix A

5.3 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_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%
$LIQ(T_\sigma)$	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 Exposure Condition with 0mm separation

Technology	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 #
DECT	1921.54	11	10.69	Front	0.0061	-2.16	4%	1.77	0.011	
DECT	1921.54	11	10.69	Back	0.0088	-1.66	4%	1.57	0.014	2
DECT	1921.54	11	10.69	Right	0.0026	-0.88	4%	1.32	0.003	
DECT	1921.54	11	10.69	Left	0.0005	-1.62	4%	1.56	0.001	
DECT	1921.54	11	10.69	Top	0.0009	0	4%	1.07	0.001	
DECT	1921.54	11	10.69	Bottom	0.0011	-1.8	4%	1.63	0.002	
DECT	1924.99	11	10.63	Bottom	0.0088	0.82	4%	1.32	0.012	
DECT	1928.45	11	10.53	Bottom	0.0087	-0.64	4%	1.29	0.011	

*Larger than 5% drifts included to scaling factors

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

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

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

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

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

APPENDIX A: PHOTOS OF THE DUT

Annex A is provided in a separate document.

APPENDIX B: SYSTEM CHECK SCAN

Test Laboratory: Verkotan Oy Plot 1

DUT: D1900V2 - SN511

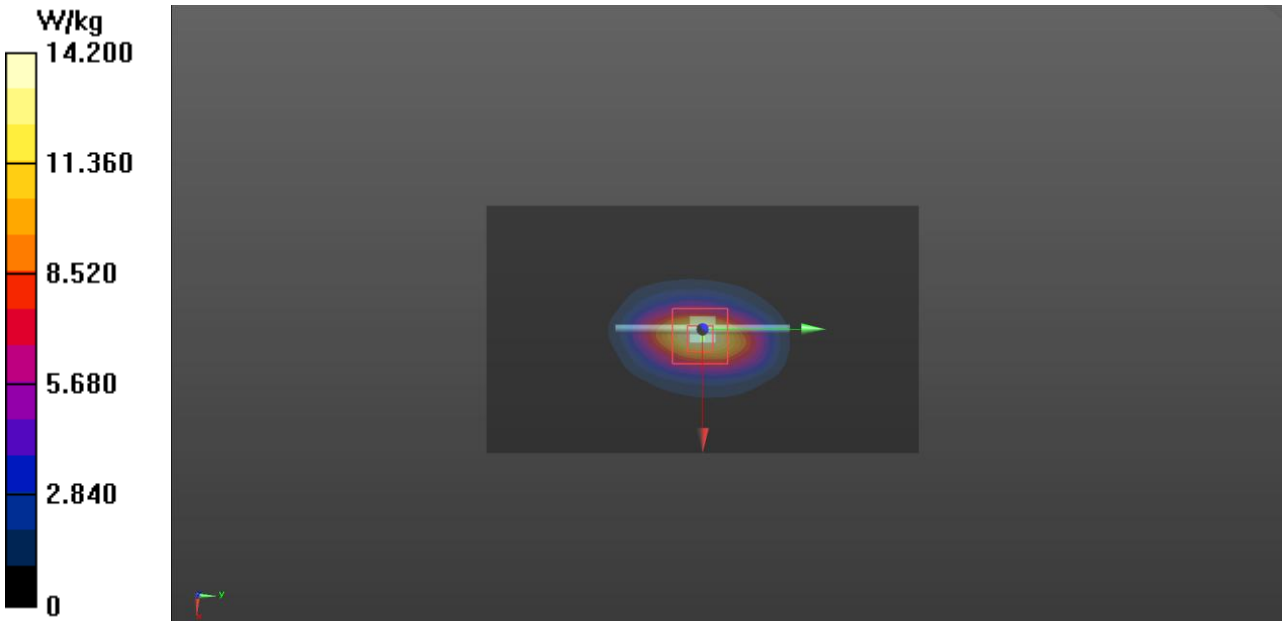
Communication System: UID 0, CW (0); Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz;
Communication System PAR: 0 dB;
Medium parameters used: f = 1900 MHz; σ = 1.404 S/m; ε_r = 38.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC)

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 = -4.0, 31.0
  - Electronics: DAE4 Sn1332; Calibrated: 5.2.25
  - Phantom: SAR1_Phantom1_ELI_left; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/System Check 1900MHz/Area Scan (141x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 14.2 W/kg
Configuration/System Check 1900MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 105.2 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 16.7 W/kg
SAR(1 g) = 9.45 W/kg; SAR(10 g) = 4.99 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below = 9.5 mm
Ratio of SAR at M2 to SAR at M1 = 57.8%

Maximum value of SAR (measured) = 14.4 W/kg



APPENDIX C: MEASUREMENT SCANS

Plot 2

Date/Time: 19.5.25 10:24:42

Test Laboratory: Verkotan Oy

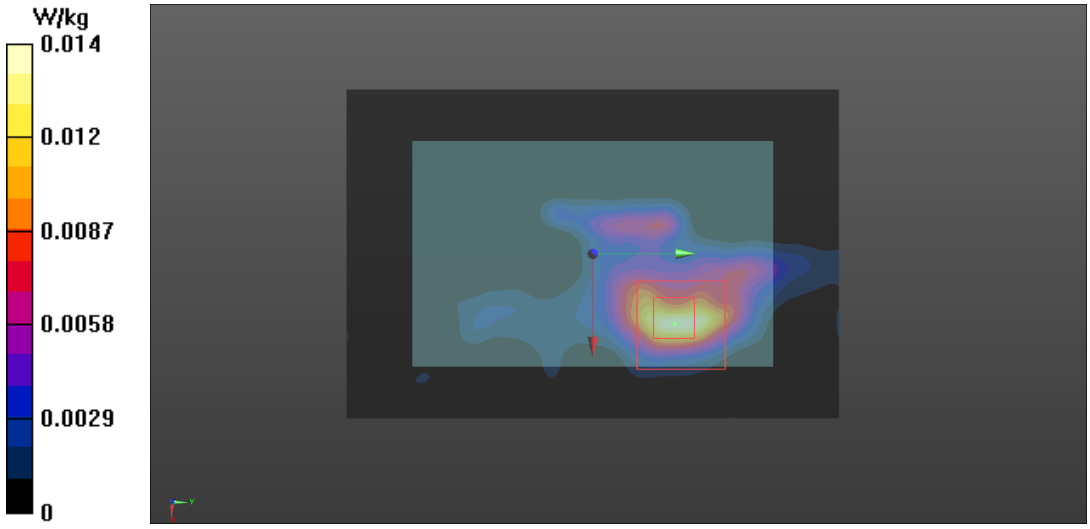
DUT: Wireless Alert Badge

Communication System: UID 0, DECT (0); Communication System Band: FCC; Frequency: 1921.54 MHz;
Communication System PAR: 13.508 dB;
Medium parameters used: f = 1922 MHz; σ = 1.418 S/m; ε_r = 38.065; 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) @ 1921.54 MHz; Calibrated: 7.2.25
  - 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 Sn1332; Calibrated: 5.2.25
  - Phantom: SAR1_Phantom1_ELI_left; Type: QD OVA 002 AA;
  - DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Configuration/DECT 1921.54MHz, back 0mm 2/Area Scan (81x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.0145 W/kg
Configuration/DECT 1921.54MHz, back 0mm 2/Zoom Scan (9x8x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.604 V/m; Power Drift = -1.66 dB
Peak SAR (extrapolated) = 0.0370 W/kg
SAR(1 g) = 0.00879 W/kg; SAR(10 g) = 0.00342 W/kg (SAR corrected for target medium)
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid
Ratio of SAR at M2 to SAR at M1 = 41.7%
Maximum value of SAR (measured) = 0.0174 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 [S6019i] + Attenuator [S6020i]	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

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.

EX3DV4 - SN:7447

February 07, 2025

Parameters of Probe: EX3DV4 - SN:7447

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz)[C]	Relative Permittivity[F]	Conductivity[F] (S/m)	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unc[H] ($k = 2$)
13	55.0	0.75	17.29	12.19	17.95	0.00	1.25	±13.3%
750	41.9	0.89	9.40	9.05	9.50	0.35	1.27	±11.0%
900	41.5	0.97	8.84	8.51	8.94	0.35	1.27	±11.0%
1750	40.1	1.37	8.10	7.80	8.19	0.33	1.27	±11.0%
1950	40.0	1.40	7.89	7.59	7.97	0.33	1.27	±11.0%
2100	39.8	1.49	7.78	7.49	7.87	0.33	1.27	±11.0%
2300	39.5	1.67	7.66	7.37	7.74	0.33	1.27	±11.0%
2450	39.2	1.80	7.56	7.28	7.65	0.33	1.27	±11.0%
2600	39.0	1.96	7.41	7.14	7.50	0.32	1.27	±11.0%
5250	35.9	4.71	5.52	5.32	5.58	0.29	1.27	±13.1%
5600	35.5	5.07	4.84	4.66	4.90	0.27	1.27	±13.1%
5750	35.4	5.22	4.94	4.76	5.00	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: DAE4-1332_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.

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

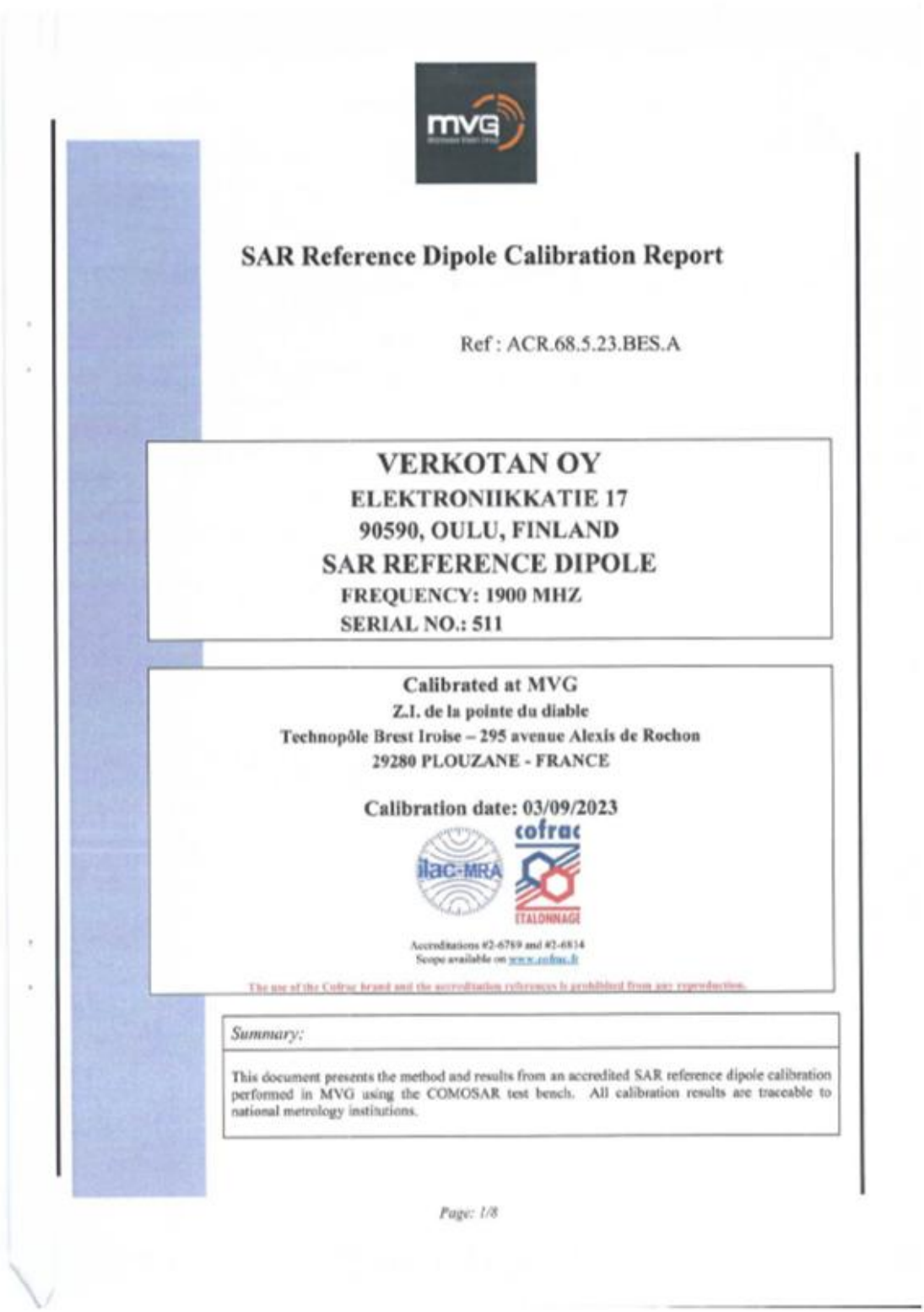
8. Low Battery Alarm Voltage (Typical values for information)

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.68.5.23.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

ilac-MRA cofrac ETALONNAGE

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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mvg

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

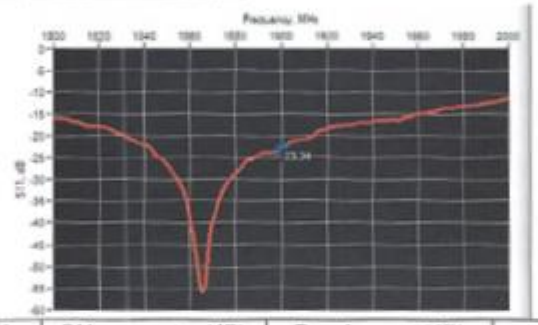
6 CALIBRATION RESULTS

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

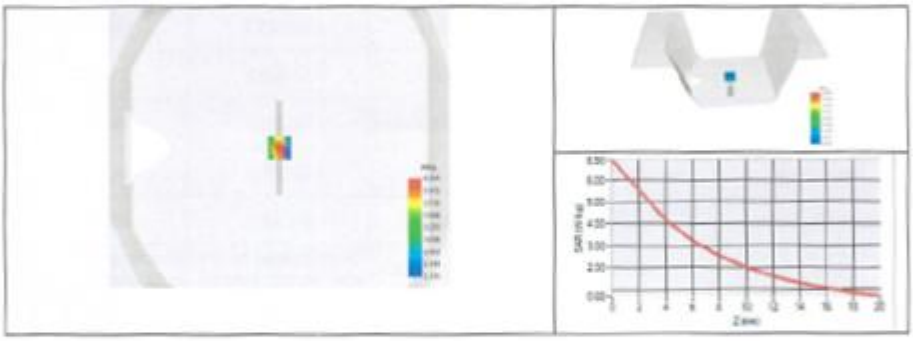
The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured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