

FCC SAR EVALUATION REPORT

**In accordance with the requirements of
FCC 47 CFR Part 2(2.1093) and
IEEE Std 1528-2013**

Product Name : AX5400M Tri-Band High Gain Wireless USB Adapter

Trademark : N/A

Model Name : BL-WTN5400E

Family Model : N/A

Report No. : N25102203904E

FCC ID : 2AL6KBL-WTN5400E

Prepared for

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TEST RESULT CERTIFICATION

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Manufacturer's Name.....: Shenzhen Bilian Electronic Co.,Ltd.

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Product description

Product name.....: AX5400M Tri-Band High Gain Wireless USB Adapter

Trademark: N/A

Model Name: BL-WTN5400E

Family Model.....: N/A

FCC 47 CFR Part 2(2.1093)

Standards.....: IEEE Std 1528-2013

Published RF exposure KDB procedures

This device described above has been tested by Shenzhen NTEK. In accordance with the measurement methods and procedures specified in IEEE Std 1528-2013 and KDB 865664 D01. Testing has shown that this device is capable of compliance with localized specific absorption rate (SAR) specified in FCC 47 CFR Part 2(2.1093). The test results in this report apply only to the tested sample of the stated device/equipment. Other similar device/equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

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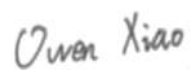
Test Sample Number S2510220141-1#

Date of Test

Date (s) of performance of tests... Oct. 28, 2025~ Oct. 30, 2025

Date of Issue Nov.17, 2025

Test Result **Pass**

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※ ※ Revision History ※ ※

REV.	DESCRIPTION	ISSUED DATE	REMARK
Rev.1.0	Initial Test Report Release	Nov.17, 2025	Owen Xiao

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1. General Information

1.1. RF exposure limits

(A).Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

(B).Limits for General Population/Uncontrolled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

NOTE: **Whole-Body SAR** is averaged over the entire body, **partial-body SAR** is averaged over any 1 gram of tissue defined as a tissue volume in the shape of a cube. **SAR for hands, wrists, feet and ankles** is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

Occupational/Controlled Environments:

Are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure, (i.e. as a result of employment or occupation).

General Population/Uncontrolled Environments:

Are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

NOTE: This product is used for inlaying inside the cabinet and operating by hand

1.2. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for BL-WTN5400E are as follows.

Band	Max Reported SAR Value(W/kg)
	1-g Body(Separation distance of 0mm)
WLAN 2.4G	1.212
WLAN 5.2G	1.359
WLAN 5.8G	1.476
Max Simultaneous Tx	1.399

Note: Only the MIMO mode can transmit simultaneously.

1.3. EUT Description

Device Information			
Product Name	AX5400M Tri-Band High Gain Wireless USB Adapter		
Trade Name	N/A		
Model Name	BL-WTN5400E		
Family Model	N/A		
Model Difference	N/A		
FCC ID	2AL6KBL-WTN5400E		
Device Phase	Identical Prototype		
Exposure Category	General population / Uncontrolled environment		
Antenna Type	External Antenna		
Battery Information	N/A		
Hardware version	V1.0		
Software version	5001.19.113.4		
Device Operating Configurations			
Supporting Mode(s)	WLAN 2.4G/5G		
Test Modulation	WLAN(DSSS/OFDM/OFDMA)		
Operating Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	WLAN 2.4G	2412-2462	
	WLAN 5.2G	5180-5240	
	WLAN 5.8G	5745-5825	

1.4. Test specification(s)

FCC 47 CFR Part 2(2.1093)
IEEE Std 1528-2013
KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04;
KDB 865664 D02 RF Exposure Reporting v01r02;
KDB 447498 D01 General RF Exposure Guidance v06;
KDB 447498 D02 SAR Procedures for Dongle v02r01;
KDB 248227 D01 802.11 Wi-Fi SAR v02r02;

1.5. Ambient Condition

Ambient temperature	20°C – 24°C
Relative Humidity	30% – 70%

1.6. Facilities And Accreditations

1.6.1. Facilities

All measurement facilities used to collect the measurement data are located at Building 1, No. 24 Xinfu East Road, Xiangshan Community, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, China

The sites are constructed in conformance with the requirements of IEC/IEEE 1528:2013

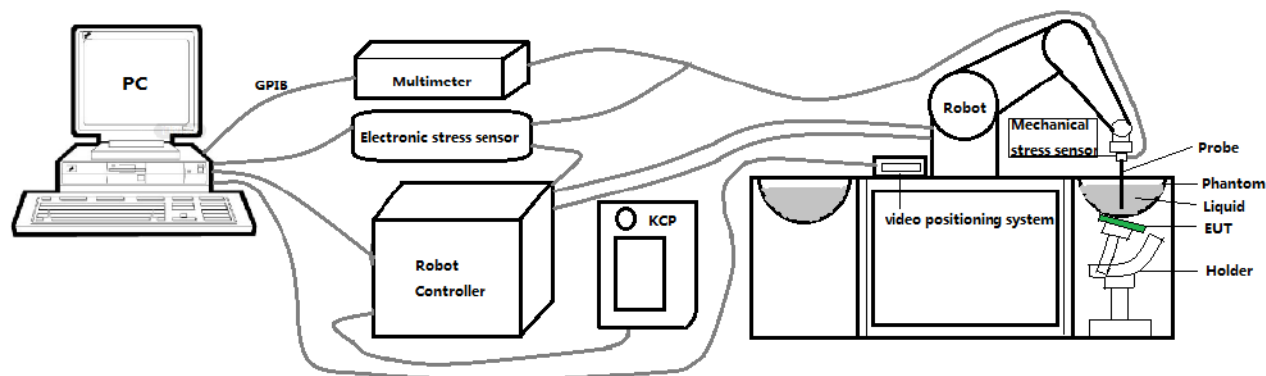
1.6.2. Laboratory Accreditations And Listings

Site Description

CNAS Lab. : The Certificate Registration Number is L5516
A2LA Lab. : The Certificate Registration Number is 4298.01
FCC Accredited : Test Firm Registration Number: 463705
Designation Number: CN1184
ISED Registration : Company Number: 9270A
CAB identifier: CN0074

2. SAR Measurement System

2.1. SATIMO SAR Measurement Set-up Diagram



These measurements were performed with the automated near-field scanning system OPENSAR from SATIMO. The system is based on a high precision robot (working range: 901 mm), which positions the probes with a positional repeatability of better than ± 0.03 mm. The SAR measurements were conducted with dosimetric probe (manufactured by SATIMO), designed in the classical triangular configuration and optimized for dosimetric evaluation.

The first step of the field measurement is the evaluation of the voltages induced on the probe by the device under test. Probe diode detectors are nonlinear. Below the diode compression point, the output voltage is proportional to the square of the applied E-field; above the diode compression point, it is linear to the applied E-field. The compression point depends on the diode, and a calibration procedure is necessary for each sensor of the probe.

The Keithley multimeter reads the voltage of each sensor and send these three values to the PC. The corresponding E field value is calculated using the probe calibration factors, which are stored in the working directory. This evaluation includes linearization of the diode characteristics. The field calculation is done separately for each sensor. Each component of the E field is displayed on the "Dipole Area Scan Interface" and the total E field is displayed on the "3D Interface"

2.2. Robot

The SATIMO SAR system uses the high precision robots from KUKA. For the 6-axis controller system, the robot controller version (KUKA) from KUKA is used. The KUKA robot series have many features that are important for our application:



- High precision (repeatability ± 0.03 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)

2.3. E-Field Probe

This E-field detection probe is composed of three orthogonal dipoles linked to special Schottky diodes with low detection thresholds. The probe allows the measurement of electric fields in liquids such as the one defined in the IEEE and CENELEC standards.

For the measurements the Specific Dosimetric E-Field Probe 0725-EPGO-448 with following specifications is used



- Dynamic range: 0.01-100 W/kg
- Tip Diameter : 2.5 mm
- Distance between probe tip and sensor center: 1 mm
- Distance between sensor center and the inner phantom surface: 2 mm (repeatability better than ± 1 mm).
- Probe linearity: ± 0.06 dB
- Axial isotropy: ± 0.01 dB
- Hemispherical Isotropy: ± 0.01 dB
- Calibration range: 650MHz to 5900MHz for head & body simulating liquid.
- Lower detection limit: 8mW/kg

Angle between probe axis (evaluation axis) and surface normal line: less than 30° .

2.3.1. E-Field Probe Calibration

Each probe needs to be calibrated according to a dosimetric assessment procedure with accuracy better than $\pm 10\%$. The spherical isotropy shall be evaluated and within ± 0.25 dB. The sensitivity parameters (Norm X, Norm Y, and Norm Z), the diode compression parameter (DCP) and the conversion factor (Conv F) of the probe are tested. The calibration data can be referred to appendix D of this report.

2.4. SAM phantoms

Photo of SAM phantom SN 16/15 SAM119

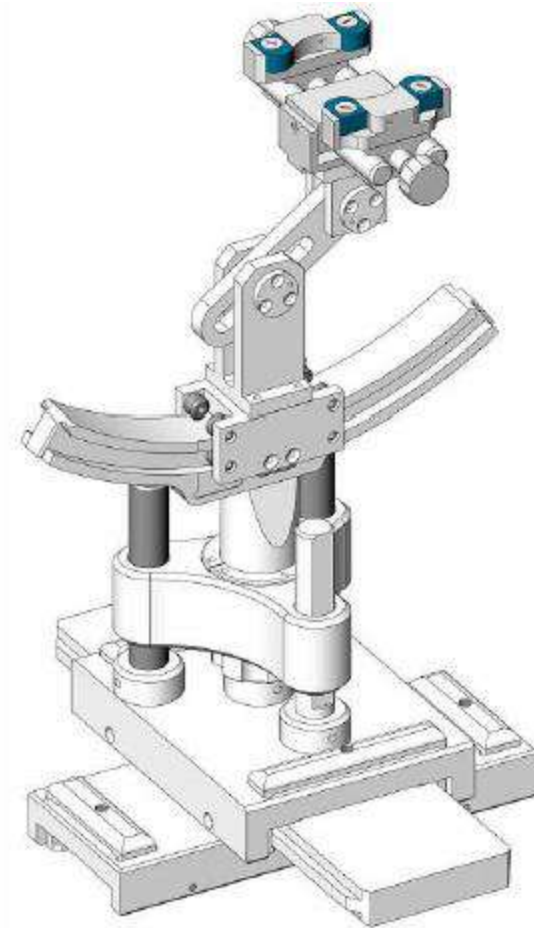


The SAM phantom is used to measure the SAR relative to people exposed to electro-magnetic field radiated by mobile phones.

The test, based on ultrasonic system, allows measuring the thickness with an accuracy of 10 μm .

2.5. Device Holder

The positioning system allows obtaining cheek and tilting position with a very good accuracy. In compliance with CENELEC, the tilt angle uncertainty is lower than 1 degree.



Serial Number	Holder Material	Permittivity	Loss Tangent
SN 16/15 MSH100	Delrin	3.7	0.005

2.6. Test Equipment List

This table gives a complete overview of the SAR measurement equipment.

Devices used during the test described are marked ☒

	Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
					Last Cal.	Due Date
☒	MVG	E FIELD PROBE	SSE2	0725-EPGO-448	Apr. 15, 2025	Apr. 14, 2026
☐	MVG	750 MHz Dipole	SID750	SN 03/15 DIP 0G750-355	Feb. 21, 2024	Feb. 20, 2027
☐	MVG	835 MHz Dipole	SID835	SN 03/15 DIP 0G835-347	Feb. 21, 2024	Feb. 20, 2027
☐	MVG	900 MHz Dipole	SID900	SN 03/15 DIP 0G900-348	Feb. 21, 2024	Feb. 20, 2027
☐	MVG	1800 MHz Dipole	SID1800	SN 03/15 DIP 1G800-349	Feb. 21, 2024	Feb. 20, 2027
☐	MVG	1900 MHz Dipole	SID1900	SN 03/15 DIP 1G900-350	Feb. 21, 2024	Feb. 20, 2027
☐	MVG	2000 MHz Dipole	SID2000	SN 03/15 DIP 2G000-351	Feb. 21, 2024	Feb. 20, 2027
☐	MVG	2300 MHz Dipole	SID2300	SN 03/16 DIP 2G300-358	Feb. 22, 2024	Feb. 21, 2027
☒	MVG	2450 MHz Dipole	SID2450	SN 03/15 DIP 2G450-352	Feb. 21, 2024	Feb. 20, 2027
☐	MVG	2600 MHz Dipole	SID2600	SN 03/15 DIP 2G600-356	Feb. 21, 2024	Feb. 20, 2027
☒	MVG	5000 MHz Dipole	SWG5500	SN 13/14 WGA 33	Feb. 21, 2024	Feb. 20, 2027
☒	MVG	Liquid measurement Kit	SCLMP	SN 21/15 OCPG 72	NCR	NCR
☒	MVG	Power Amplifier	N/A	AMPLISAR_28/14_003	NCR	NCR
☒	KEITHLEY	Millivoltmeter	2000	4072790	May. 12, 2025	May. 11, 2026
☐	R&S	Universal radio communication tester	CMU200	105747	Apr. 17, 2025	Apr. 16, 2026
☒	R&S	Wideband radio	CMW500	103917	May. 12, 2025	May. 11, 2026

		communication tester				
☐	Anritsu	4G LTE comprehensive tester	MT8821C	6262192315	Apr.16 2025	Apr.15 2026
☐	Anritsu	5G NR comprehensive tester	MT8000A	6262186364	Apr.16 2025	Apr.15 2026
☒	Keysight	Network Analyzer	E5071C	LPS-461	Jun. 3, 2025	Jun. 2, 2026
☒	Agilent	Calibration Kit	85033E	N/A	May. 31, 2024	May. 30, 2027
☒	Agilent	MXG Vector Signal Generator	N5182A	MY47070317	Apr. 17, 2025	Apr. 16, 2026
☒	Agilent	Power sensor	E9301A	LES-413-C	May. 6, 2025	May. 5, 2026
☒	Agilent	Power sensor	E9301A	US39212148	Apr. 17, 2025	Apr. 16, 2026
☒	MCLI/USA	Directional Coupler	CB11-20	0D2L51502	Apr. 26, 2024	Apr. 25, 2027
☒	N/A	Thermometer	N/A	LES-085	Mar. 27, 2023	Mar. 26, 2026
☒	MVG	SAM Phantom	SSM2	SN 16/15 SAM119	NCR	NCR
☒	MVG	Device Holder	SMPPD	SN 16/15 MSH100	NCR	NCR

Measurement Software

Manufacturer	Software Name	Software Version
SATIMO	OpenSAR	V5.3.15.11

3. SAR Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

- (a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
- (b) Read the WWAN RF power level from the base station simulator.
- (c) For WLAN/Bluetooth power measurement, use engineering software to configure EUT WLAN/Bluetooth continuously transmission, at maximum RF power in each supported wireless interface and frequency band.
- (d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/Bluetooth output power.

<SAR measurement>

- (a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/Bluetooth continuously transmission, at maximum RF power, in the highest power channel.
- (b) Place the EUT in the positions as Appendix A demonstrates.
- (c) Set scan area, grid size and other setting on the OPENSAR software.
- (d) Measure SAR results for the highest power channel on each testing position.
- (e) Find out the largest SAR result on these testing positions of each band.
- (f) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg.

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

- (a) Power reference measurement
- (b) Area scan
- (c) Zoom scan
- (d) Power drift measurement

3.1. Power Reference

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

3.2. Area scan & Zoom scan

The area scan is a 2D scan to find the hot spot location on the DUT. The zoom scan is a 3D scan above the hot spot to calculate the 1g and 10g SAR value.

Measurement of the SAR distribution with a grid of 8 to 16 mm * 8 to 16 mm and a constant distance to the inner surface of the phantom. Since the sensors cannot directly measure at the inner phantom surface, the values between the sensors and the inner phantom surface are extrapolated. With these values the area of the maximum SAR is calculated by an interpolation scheme. Around this point, a cube of 30 * 30 * 30 mm or 32 * 32 * 32 mm is assessed by measuring 5 or 8 * 5 or 8 * 4 or 5 mm. With these data, the peak spatial-average SAR value can be calculated.

From the scanned SAR distribution, identify the position of the maximum SAR value, in addition identify the positions of any local maxima with SAR values within 2 dB of the maximum value that will not be within the zoom scan of other peaks; additional peaks shall be measured only when the primary peak is within 2 dB of the SAR compliance limit (e.g., 1 W/kg for 1,6 W/kg 1 g limit, or 1,26 W/kg for 2 W/kg, 10 g limit).

Area scan & Zoom scan scan parameters extracted from FCC KDB 865664 D01 SAR measurement 100 MHz to 6 GHz.

			$\leq 3\text{ GHz}$	$> 3\text{ GHz}$
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			$5 \pm 1\text{ mm}$	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5\text{ mm}$
Maximum probe angle from probe axis to phantom surface normal at the measurement location			$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
Maximum area scan spatial resolution: $\Delta x_{\text{Area}}, \Delta y_{\text{Area}}$			$\leq 2\text{ GHz}: \leq 15\text{ mm}$ $2 - 3\text{ GHz}: \leq 12\text{ mm}$	$3 - 4\text{ GHz}: \leq 12\text{ mm}$ $4 - 6\text{ GHz}: \leq 10\text{ mm}$
			When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: $\Delta x_{\text{Zoom}}, \Delta y_{\text{Zoom}}$			$\leq 2\text{ GHz}: \leq 8\text{ mm}$ $2 - 3\text{ GHz}: \leq 5\text{ mm}^*$	$3 - 4\text{ GHz}: \leq 5\text{ mm}^*$ $4 - 6\text{ GHz}: \leq 4\text{ mm}^*$
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{\text{Zoom}}(n)$		$\leq 5\text{ mm}$	$3 - 4\text{ GHz}: \leq 4\text{ mm}$ $4 - 5\text{ GHz}: \leq 3\text{ mm}$ $5 - 6\text{ GHz}: \leq 2\text{ mm}$
	graded grid	$\Delta z_{\text{Zoom}}(1)$: between 1 st two points closest to phantom surface	$\leq 4\text{ mm}$	$3 - 4\text{ GHz}: \leq 3\text{ mm}$ $4 - 5\text{ GHz}: \leq 2.5\text{ mm}$ $5 - 6\text{ GHz}: \leq 2\text{ mm}$
		$\Delta z_{\text{Zoom}}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{\text{Zoom}}(n-1)$	
Minimum zoom scan volume	x, y, z		$\geq 30\text{ mm}$	$3 - 4\text{ GHz}: \geq 28\text{ mm}$ $4 - 5\text{ GHz}: \geq 25\text{ mm}$ $5 - 6\text{ GHz}: \geq 22\text{ mm}$
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.				
* When zoom scan is required and the <i>reported</i> SAR from the <i>area scan based 1-g SAR estimation</i> procedures of KDB 447498 is $\leq 1.4\text{ W/kg}$, $\leq 8\text{ mm}$, $\leq 7\text{ mm}$ and $\leq 5\text{ mm}$ zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.				

3.3. Description of interpolation/extrapolation scheme

The local SAR inside the phantom is measured using small dipole sensing elements inside a probe body. The probe tip must not be in contact with the phantom surface in order to minimise measurements errors, but the highest local SAR will occur at the surface of the phantom.

An extrapolation is using to determinate this highest local SAR values. The extrapolation is based on a fourth-order least-square polynomial fit of measured data. The local SAR value is then extrapolated from the liquid surface with a 1 mm step.

The measurements have to be performed over a limited time (due to the duration of the battery) so the step of measurement is high. It could vary between 5 and 8 mm. To obtain an accurate assessment of

the maximum SAR averaged over 10 grams and 1 gram requires a very fine resolution in the three dimensional scanned data array.

3.4. Volumetric Scan

The volumetric scan consists to a full 3D scan over a specific area. This 3D scan is useful form multi Tx SAR measurement. Indeed, it is possible with OpenSAR to add, point by point, several volumetric scan to calculate the SAR value of the combined measurement as it is define in the standard IEEE1528 and IEC62209.

3.5. Power Drift

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In OpenSAR measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in V/m. If the power drifts more than $\pm 5\%$, the SAR will be retested.

4. System Verification Procedure

4.1. Tissue Verification

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Ingredients (% of weight)	Head Tissue									
Frequency Band (MHz)	750	835	900	1800	1900	2000	2450	2600	5200	5800
Water	34.40	34.40	34.40	55.36	55.36	57.87	57.87	57.87	65.53	65.53
NaCl	0.79	0.79	0.79	0.35	0.35	0.16	0.16	0.16	0.00	0.00
1,2-Propanediol	64.81	64.81	64.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Triton X-100	0.00	0.00	0.00	30.45	30.45	19.97	19.97	19.97	24.24	24.24
DGBE	0.00	0.00	0.00	13.84	13.84	22.00	22.00	22.00	10.23	10.23
Ingredients (% of weight)	Body Tissue									
Frequency Band (MHz)	750	835	900	1800	1900	2000	2450	2600	5200	5800
Water	50.30	50.30	50.30	69.91	69.91	71.88	71.88	71.88	79.54	79.54
NaCl	0.60	0.60	0.60	0.13	0.13	0.16	0.16	0.16	0.00	0.00
1,2-Propanediol	49.10	49.10	49.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Triton X-100	0.00	0.00	0.00	9.99	9.99	19.97	19.97	19.97	11.24	11.24
DGBE	0.00	0.00	0.00	19.97	19.97	7.99	7.99	7.99	9.22	9.22

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15 cm. For head SAR testing, the liquid depth from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm.

Photo of Liquid depth for Head Position

Photo of Liquid depth for Body Position



4.1.1. Tissue Dielectric Parameter Check Results

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine if the dielectric parameters are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within $\pm 5\%$ of the target values.

Tissue Type	Measured Frequency (MHz)	Target Tissue		Measured Tissue		Delta(%)		Liquid Temp.	Test Date
		ϵ_r	σ (S/m)	ϵ_r	σ (S/m)	ϵ_r	σ (S/m)		
Head 2450	2450	39.20	1.80	38.14	1.86	-2.70	3.33	21.6 °C	Oct. 28, 2025
Head 5200	5200	36.00	4.66	36.82	4.60	2.28	-1.29	21.7 °C	Oct. 29, 2025
Head 5800	5800	35.30	5.27	35.45	5.25	0.42	-0.38	21.0 °C	Oct. 30, 2025

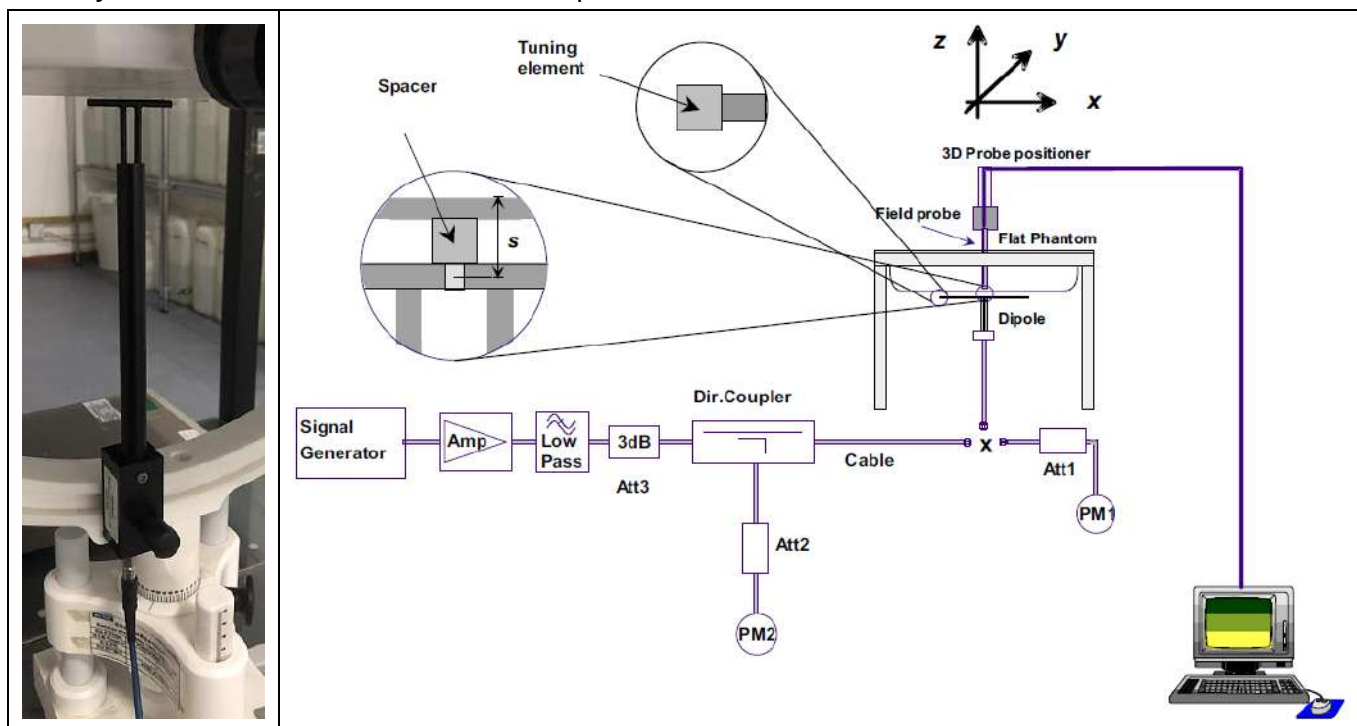
NOTE: 1. The dielectric parameters of the tissue-equivalent liquid should be measured under similar ambient conditions and within 2 °C of the conditions expected during the SAR evaluation to satisfy protocol requirements.

2. Tested by : Max Zhou, Jack Peng

4.2. System Verification Procedure

The system verification is performed for verifying the accuracy of the complete measurement system and performance of the software. The dipole is connected to the signal source consisting of signal generator and amplifier via a directional coupler, N-connector cable and adaption to SMA. It is fed with a power of 100mW (below 5GHz) or 100mW (above 5GHz). To adjust this power a power meter is used. The power sensor is connected to the cable before the system verification to measure the power at this point and do adjustments at the signal generator. At the outputs of the directional coupler both return loss as well as forward power are controlled during the system verification to make sure that emitted power at the dipole is kept constant. This can also be checked by the power drift measurement after the test (result on plot).

The system verification is shown as below picture:



4.2.1. System Verification Results

Comparing to the original SAR value provided by SATIMO, the verification data should be within its specification of $\pm 10\%$. Below table shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance verification can meet the variation criterion and the plots can be referred to Appendix B of this report.

System Verification	Target SAR (1W)		Measured SAR			Measured SAR		Delta (%)		Liquid Temp.	Test Date
						(Normalized to 1W)					
	1-g (W/Kg)	10-g (W/Kg)	Input Power (mW)	1-g (W/Kg)	10-g (W/Kg)	1-g (W/Kg)	10-g (W/Kg)	1-g (%)	10-g (%)		
2450MHz	50.05	23.80	100.00	5.15	2.24	51.48	22.41	2.86	-5.84	21.6 °C	Oct. 28, 2025
5200MHz	162.59	56.21	10.00	1.66	0.57	165.80	57.40	1.97	2.12	21.7 °C	Oct. 29, 2025
5800MHz	182.20	61.32	10.00	1.65	0.60	165.10	59.90	-9.39	-2.32	21.0 °C	Oct. 30, 2025

Tested by : Max Zhou, Jack Peng

5. SAR Measurement variability and uncertainty

5.1. SAR measurement variability

Per KDB865664 D01 SAR measurement 100 MHz to 6 GHz, SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. The additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

- 1) Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.
- 2) When the original highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
- 3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg ($\sim 10\%$ from the 1-g SAR limit).
- 4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20 .

5.2. SAR measurement uncertainty

Per KDB865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. The equivalent ratio (1.5/1.6) is applied to extremity and occupational exposure conditions.

6. RF Exposure Positions

6.1. Generic device

The SAR evaluation shall be performed for surface of the DUT that are accessible during intended use, as indicated in Figure 6.1. Adjust the distance between the device surface and the flat phantom to 0mm.

Test all USB orientations [see figure below: (A) Horizontal-Up, (B) Horizontal-Down, (C) Vertical-Front, and (D) Vertical-Back] with a device-to-phantom separation distance of 5 mm or less, according to KDB Publication 447498 D01 requirements. These test orientations are intended for the exposure conditions found in typical laptop/notebook/netbook or tablet computers with either horizontal or vertical USB connector configurations at various locations in the keyboard section of the computer. Current generation portable host computers should be used to establish the required SAR measurement separation distance. The same test separation distance must be used to test all frequency bands and modes in each USB orientation. The typical Horizontal-Up USB connection (A), found in the majority of host computers, must be tested using an appropriate host computer. A host computer with either Vertical-Front (C) or Vertical-Back (D) USB connection should be used to test one of the vertical USB orientations. If a suitable host computer is not available for testing the Horizontal-Down (B) or the remaining Vertical USB orientation, a high quality USB cable, 12 inches or less, may be used for testing these other orientations. It must be documented that the USB cable does not influence the radiating characteristics and output power of the transmitter.

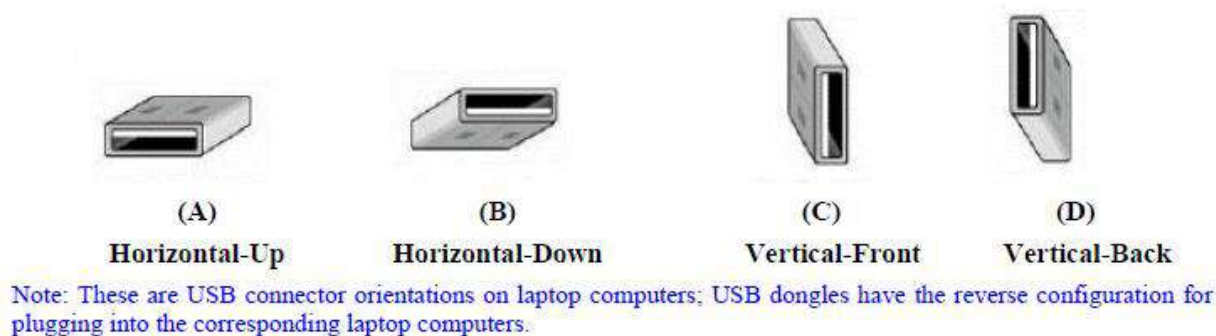


Figure 1 – USB Connector Orientations Implemented on Laptop Computers

DONGLES WITH SWIVEL OR ROTATING CONNECTORS

A swivel or rotating USB connector may enable the dongle to connect in different orientations to host computers. When the antenna is built-in within the housing of a dongle, a swivel or rotating connector may allow the antenna to assume different positions. The combination of these possible configurations must be considered to determine the SAR test requirements. When the antenna is located near the tip of a dongle, it may operate at closer proximity to users in certain connector orientations where dongle tip testing may be required.

The 5 mm test separation distance used for testing simple dongles has been established based on the overall host platform (laptop/notebook/netbook) and device variations, and varying user operating configurations and exposure conditions expected for a peripheral device. The same test distance should generally apply to dongles with swivel or rotating connectors. The procedures described for simple dongles should be used to position the four surfaces of the dongle at 5 mm from the phantom to evaluate SAR. At least one of the horizontal and one of the vertical positions should be tested using an applicable host computer. If the antenna is within 1 cm from the tip of the dongle (the end without the USB connector), the tip of the dongle should also be tested at 5 mm perpendicular to the phantom. For antennas located within 2.5 cm from the USB connector and if the dongle can be positioned at 45° to 90° from the horizontal position [(A) or (B)], testing in one or more of these configurations may need to be considered. A KDB inquiry should be submitted to determine the applicable test configurations.

DONGLES WITH EXTERNAL, SWIVEL OR ROTATING ANTENNAS

For dongles with external antennas or antennas that may swivel or rotate, a KDB inquiry should be submitted to the FCC Laboratory to determine the applicable test configurations. The inquiry should identify if the antenna may transmit in its stowed position, and if a swivel or rotating USB connector is also used. Depending on the antenna configurations used in the individual dongle design and its operating configurations, different test separation distances may apply and must be determined on a case-by-case basis.

7. RF Output Power

7.1. WLAN Output Power

Mode	Channel	Frequency (MHz)	Tune-up (dBm)	Output Power (dBm)	Tune-up (dBm)	Output Power (dBm)	Tune-up (dBm)	Output Power (dBm)
			Ant1		Ant2		MIMO	
802.11b	1	2412	13.00	12.68	14.50	14.30	/	/
	6	2437	13.00	12.41	14.50	14.33	/	/
	11	2462	13.00	12.32	14.50	14.21	/	/
802.11g	1	2412	13.00	12.51	14.50	14.40	/	/
	6	2437	13.00	12.58	14.50	14.18	/	/
	11	2462	13.00	11.96	14.50	14.29	/	/
802.11n HT20	1	2412	11.00	10.38	12.50	11.58	14.00	13.30
	6	2437	11.00	10.56	12.50	12.14	14.00	13.50
	11	2462	11.00	10.08	12.50	11.36	14.00	12.79
802.11n HT40	3	2422	11.00	10.49	12.50	11.50	13.50	13.05
	6	2437	11.00	10.74	12.50	12.04	13.50	13.30
	9	2452	11.00	10.24	12.50	11.34	13.50	12.85
802.11ax HE20	1	2412	11.00	10.76	12.50	11.6	14.00	13.16
	6	2437	11.00	10.73	12.50	12.21	14.00	13.56
	11	2462	11.00	10.88	12.50	11.40	14.00	12.86
802.11ax HE40	3	2422	11.00	10.73	12.50	11.55	14.00	13.10
	6	2437	11.00	10.9	12.50	12.18	14.00	13.56
	9	2452	11.00	10.33	12.50	11.48	14.00	12.92

NOTE: Power measurement results of WLAN 2.4G.

Mode	Channel	Frequency (MHz)	Tune-up (dBm)	Output Power (dBm)	Tune-up (dBm)	Output Power (dBm)	Tune-up (dBm)	Output Power (dBm)
			Ant1		Ant2		MIMO	
802.11a	36	5180	13.00	12.46	14.00	13.72	/	
	40	5200	13.00	12.95	14.00	13.76	/	
	48	5240	13.00	12.41	14.00	13.42	/	
802.11n HT20	36	5180	13.00	12.81	14.00	13.69	16.00	15.51
	40	5200	13.00	12.5	14.00	13.72	16.00	15.50
	48	5240	13.00	12.39	14.00	13.4	16.00	15.08
802.11n HT40	38	5190	13.00	12.63	14.00	13.61	15.50	15.39

	46	5230	13.00	12.28	14.00	13.4	15.50	14.98
802.11ac VHT20	36	5180	13.00	12.51	14.00	13.52	15.50	15.40
	40	5200	13.00	12.66	14.00	13.69	15.50	15.44
	48	5240	13.00	12.24	14.00	13.48	15.50	15.18
802.11ac VHT40	38	5190	12.50	12.44	14.00	13.5	15.50	15.45
	46	5230	12.50	12.14	14.00	13.42	15.50	15.08
802.11ac VHT80	42	5210	12.50	12.19	14.00	13.57	15.50	15.19
802.11acVHT160	50	5250	14.00	13.81	13.50	13.07	15.00	14.96
802.11ax HE20	36	5180	12.50	12.4	14.00	13.65	16.00	15.44
	40	5200	12.50	12.45	14.00	13.78	16.00	15.56
	48	5240	12.50	12.15	14.00	13.47	16.00	15.17
802.11ax HE40	38	5190	13.00	12.58	14.00	13.73	16.00	15.59
	46	5230	13.00	12.37	14.00	13.44	16.00	15.17
802.11ax HE80	42	5210	13.5	12.39	14	13.63	15	15.32
802.11ax HE160	50	5250	13.5	13.47	13	12.88	15	14.98

NOTE: Power measurement results of WLAN 5.2G.

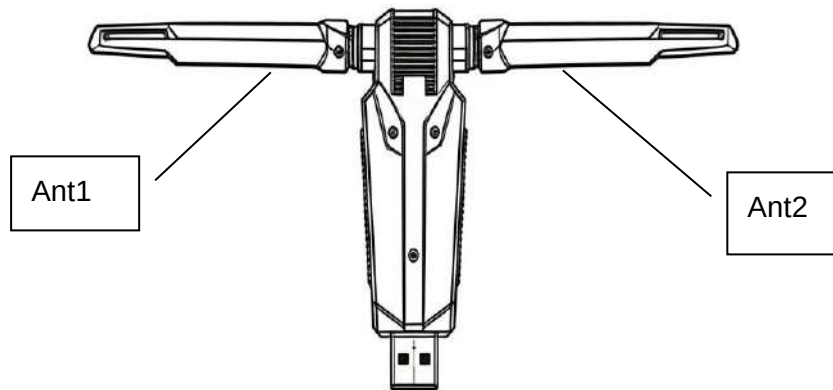
Mode	Channel	Frequency (MHz)	Tune-up (dBm)	Output Power (dBm)	Tune-up (dBm)	Output Power (dBm)	Tune-up (dBm)	Output Power (dBm)
			Ant1		Ant2		MIMO	
802.11a	149	5745	15.00	14.33	15.00	14.57	/	/
	157	5785	15.00	14.71	15.00	14.79	/	/
	165	5825	15.00	14.58	15.00	15	/	/
802.11n HT20	149	5745	15.00	14.53	15.50	14.64	18.00	17.24
	157	5785	15.00	14.53	15.50	14.76	18.00	17.33
	165	5825	15.00	14.84	15.50	15.08	18.00	17.57
802.11n HT40	151	5755	14.50	14.45	15.00	14.72	17.50	17.33
	159	5795	14.50	14.49	15.00	14.88	17.50	17.45
802.11ac VHT20	149	5745	15.00	14.42	15.50	14.61	17.50	17.32
	157	5785	15.00	14.69	15.50	14.78	17.50	17.43
	165	5825	15.00	14.63	15.50	15.03	17.50	17.48
802.11ac VHT40	151	5755	15.00	14.44	15.00	14.62	17.50	17.38
	159	5795	15.00	14.58	15.00	14.92	17.50	17.44
802.11ac VHT80	155	5775	14.50	14.47	15.00	14.63	17.50	17.34
802.11ax HE20	149	5745	15.00	14.48	15.50	14.66	18.00	17.35
	157	5785	15.00	14.67	15.50	14.78	18.00	17.43

	165	5825	15.00	14.61	15.50	15.02	18.00	17.61
802.11ax HE40	151	5755	15.00	14.58	15.00	14.69	18.00	17.37
	159	5795	15.00	14.87	15.00	14.93	18.00	17.54
802.11ax HE80	155	5775	15.00	14.74	15.00	14.65	17.50	17.41

NOTE: Power measurement results of WLAN 5.8G.

8. Antenna Location

The location of the antenna inside the EUT is shown as below picture:



9. SAR Results

9.1. SAR measurement results

General Notes:

- 1) Per KDB447498 D01, all measurement SAR results are scaled to the maximum tune-up tolerance limit to demonstrate compliant.
- 2) Per KDB447498 D01, testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is: ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz. When the maximum output power variation across the required test channels is $> \frac{1}{2}$ dB, instead of the middle channel, the highest output power channel must be used.
- 3) Per KDB865664 D01, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥ 0.8 W/Kg; if the deviation among the repeated measurement is $\leq 20\%$, and the measured SAR < 1.45 W/Kg, only one repeated measurement is required.
- 4) Per KDB865664 D02, SAR plot is only required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination; Plots are also required when the measured SAR is > 1.5 W/kg, or > 7.0 W/kg for occupational exposure. The published RF exposure KDB procedures may require additional plots; for example, to support SAR to peak location separation ratio test exclusion and/or volume scan post-processing(Refer to appendix C for details).

9.1.1. SAR measurement Result of WLAN 2.4G

Ant1

Test Position of Body-Worn with Antenna Horizontal 180° 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Horizontal-Up	6/2437	802.11b	0.893	0.345	2.82	12.41	13.00	1.023	2025/10/28	
Horizontal-Down	6/2437	802.11b	1.005	0.400	-0.25	12.41	13.00	1.151	2025/10/28	
Vertical-Front	6/2437	802.11b	0.578	0.230	-0.30	12.41	13.00	0.662	2025/10/28	
Vertical-Back	6/2437	802.11b	0.561	0.221	3.14	12.41	13.00	0.643	2025/10/28	
Tip Side	6/2437	802.11b	0.021	0.008	3.31	12.41	13.00	0.024	2025/10/28	
Horizontal-Up	1/2412	802.11b	1.126	0.476	3.61	12.68	13.00	1.212	2025/10/28	14#
Horizontal-Up	11/2462	802.11b	1.006	0.399	0.83	12.32	13.00	1.177	2025/10/28	
Horizontal-Up Repeated	6/2437	802.11b	1.097	0.459	-1.62	12.68	13.00	1.181	2025/10/28	

NOTE: 1. Body SAR test results of WLAN 2.4G

2. Tested by : Max Zhou

Ant1

Test Position of Body-Worn with Antenna Vertical 90° 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Horizontal-Up	6/2437	802.11b	0.013	0.011	3.20	12.41	13.00	0.015	2025/10/28	
Horizontal-Down	6/2437	802.11b	0.514	0.210	-3.59	12.41	13.00	0.589	2025/10/28	
Vertical-Front	6/2437	802.11b	0.700	0.286	-2.05	12.41	13.00	0.802	2025/10/28	
Vertical-Back	6/2437	802.11b	0.081	0.032	-2.78	12.41	13.00	0.093	2025/10/28	
Tip Side	6/2437	802.11b	0.608	0.251	2.14	12.41	13.00	0.696	2025/10/28	
Vertical-Front	1/2412	802.11b	0.924	0.358	1.98	12.68	13.00	0.995	2025/10/28	15#
Vertical-Front	11/2462	802.11b	0.479	0.202	3.14	12.32	13.00	0.560	2025/10/28	
Vertical-Front Repeated	6/2437	802.11b	0.917	0.346	0.87	12.68	13.00	0.987	2025/10/28	

NOTE: 1. Body SAR test results of WLAN 2.4G

2. Tested by : Max Zhou

Ant2

Test Position of Body-Worn with Antenna Horizontal 180° 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Horizontal-Up	6/2437	802.11b	0.462	0.197	3.40	14.33	14.50	0.480	2025/10/28	
Horizontal-Down	6/2437	802.11b	0.586	0.250	-1.12	14.33	14.50	0.609	2025/10/28	16#
Vertical-Front	6/2437	802.11b	0.077	0.032	-0.45	14.33	14.50	0.080	2025/10/28	
Vertical-Back	6/2437	802.11b	0.570	0.241	1.76	14.33	14.50	0.593	2025/10/28	
Tip Side	6/2437	802.11b	0.010	0.008	-0.26	14.33	14.50	0.010	2025/10/28	

Ant2

Test Position of Body-Worn with Antenna Vertical 90° 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Horizontal-Up	6/2437	802.11b	0.022	0.008	-1.37	14.33	14.50	0.023	2025/10/28	
Horizontal-Down	6/2437	802.11b	0.308	0.119	-2.25	14.33	14.50	0.320	2025/10/28	
Vertical-Front	6/2437	802.11b	0.072	0.028	-0.13	14.33	14.50	0.075	2025/10/28	
Vertical-Back	6/2437	802.11b	1.058	0.423	0.96	14.33	14.50	1.100	2025/10/28	
Tip Side	6/2437	802.11b	1.026	0.402	0.46	14.33	14.50	1.067	2025/10/28	
Vertical-Back	1/2412	802.11b	1.149	0.503	2.99	14.30	14.50	1.203	2025/10/28	17#

Vertical-Back	11/2462	802.11b	0.906	0.338	-0.11	14.33	14.50	0.942	2025/10/28	
Vertical-Back Side Repeated	1/2412	802.11b	1.121	0.495	1.74	14.30	14.50	1.174	2025/10/28	

MIMO

Test Position of Body-Worn with Antenna Horizontal 180° 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Horizontal-Up	6/2437	802.11b	0.486	0.187	-0.47	13.50	14.00	0.545	2025/10/28	
Horizontal-Down	6/2437	802.11b	0.665	0.305	-1.29	13.50	14.00	0.746	2025/10/28	18#
Vertical-Front	6/2437	802.11b	0.398	0.144	2.41	13.50	14.00	0.447	2025/10/28	
Vertical-Back	6/2437	802.11b	0.303	0.115	-0.82	13.50	14.00	0.340	2025/10/28	
Tip Side	6/2437	802.11b	0.013	0.011	2.48	13.50	14.00	0.015	2025/10/28	

MIMO

Test Position of Body-Worn with Antenna Vertical 90° 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Horizontal-Up	6/2437	802.11b	0.016	0.014	-2.94	13.50	14.00	0.018	2025/10/28	
Horizontal-Down	6/2437	802.11b	0.250	0.095	0.99	13.50	14.00	0.281	2025/10/28	
Vertical-Front	6/2437	802.11b	0.329	0.125	1.00	13.50	14.00	0.369	2025/10/28	
Vertical-Back	6/2437	802.11b	0.480	0.188	2.39	13.50	14.00	0.539	2025/10/28	
Tip Side	6/2437	802.11b	0.655	0.265	0.91	13.50	14.00	0.735	2025/10/28	13#

9.1.2. SAR measurement Result of WLAN 5.2G

Ant1

Test Position of Body-Worn with Horizontal 180° 0mm	Test channel /Freq	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Horizontal-Up	50/5250	802.11ac VHT160	0.444	0.103	1.52	13.81	14.00	0.464	2025/10/29	
Horizontal-Down	50/5250	802.11ac VHT160	0.385	0.086	3.92	13.81	14.00	0.402	2025/10/29	
Vertical-Front	50/5250	802.11ac VHT160	1.211	0.281	0.69	13.81	14.00	1.265	2025/10/29	2#
Vertical-Back	50/5250	802.11ac VHT160	0.017	0.015	0.80	13.81	14.00	0.018	2025/10/29	
Tip Side	50/5250	802.11ac VHT160	0.016	0.014	-1.88	13.81	14.00	0.017	2025/10/29	
Vertical-Front Repeated	50/5250	802.11ac VHT160	1.118	0.252	-1.30	0.00	0.00	1.118	2025/10/29	

NOTE: 1. Body SAR test results of WLAN 5.2G

2. Tested by : Max Zhou

Ant1

Test Position of Body-Worn with Antenna Vertical 90° 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Horizontal-Up	6/2437	802.11ac VHT160	0.014	0.012	0.83	13.81	14.00	0.015	2025/10/29	
Horizontal-Down	6/2437	802.11ac VHT160	0.019	0.017	2.57	13.81	14.00	0.020	2025/10/29	
Vertical-Front	6/2437	802.11ac VHT160	1.088	0.252	-1.30	13.81	14.00	1.137	2025/10/29	1#
Vertical-Back	6/2437	802.11ac VHT160	0.015	0.013	-2.54	13.81	14.00	0.016	2025/10/29	
Tip Side	6/2437	802.11ac VHT160	0.336	0.084	-2.55	13.81	14.00	0.351	2025/10/29	
Vertical-Front Repeated	6/2437	802.11ac VHT160	1.054	0.234	-3.05	0.00	0.00	1.054	2025/10/29	

NOTE: 1. Body SAR test results of WLAN 5.2G

2. Tested by : Max Zhou

Ant2

Test Position of Body-Worn with Antenna Horizontal 180° 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Horizontal-Up	40/5200	802.11a	0.484	0.116	-2.98	13.76	14.00	0.511	2025/10/29	
Horizontal-Down	40/5200	802.11a	0.558	0.129	2.51	13.76	14.00	0.590	2025/10/29	
Vertical-Front	40/5200	802.11a	0.037	0.015	2.71	13.76	14.00	0.039	2025/10/29	
Vertical-Back	40/5200	802.11a	1.214	0.296	3.57	13.76	14.00	1.283	2025/10/29	6#
Tip Side	40/5200	802.11a	0.031	0.014	0.16	13.76	14.00	0.033	2025/10/29	
Vertical-Back	36/5180	802.11a	1.172	0.275	3.57	13.72	14.00	1.250	2025/10/29	
Vertical-Back	48/5240	802.11a	0.988	0.249	2.70	13.42	14.00	1.129	2025/10/29	
Vertical-Back Repeated	40/5200	802.11a	1.195	0.284	1.54	13.76	14.00	1.263	2025/10/29	

Ant2

Test Position of Body-Worn with Antenna Vertical 90° 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Horizontal-Up	40/5200	802.11a	0.025	0.011	-3.13	13.76	14.00	0.026	2025/10/29	
Horizontal-Down	40/5200	802.11a	0.032	0.015	-3.17	13.76	14.00	0.034	2025/10/29	
Vertical-Front	40/5200	802.11a	0.019	0.017	-0.10	13.76	14.00	0.020	2025/10/29	
Vertical-Back	40/5200	802.11a	1.268	0.309	-2.08	13.76	14.00	1.340	2025/10/29	5#
Tip Side	40/5200	802.11a	0.325	0.078	-1.26	13.76	14.00	0.343	2025/10/29	
Vertical-Back	36/5180	802.11a	1.213	0.298	0.20	13.72	14.00	1.294	2025/10/29	
Vertical-Back	48/5240	802.11a	0.994	0.257	-4.69	13.42	14.00	1.136	2025/10/29	
Vertical-Back Repeated	36/5180	802.11a	1.231	0.289	-1.96	13.72	14.00	1.313	2025/10/29	

MIMO

Test Position of Body-Worn with Antenna Horizontal 180° 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Horizontal-Up	40/5200	802.11n	0.635	0.147	2.33	15.50	16.00	0.712	2025/10/29	

		HT20								
Horizontal-Down	40/5200	802.11n HT20	0.364	0.085	0.34	15.50	16.00	0.408	2025/10/29	
Vertical-Front	40/5200	802.11n HT20	1.155	0.265	0.38	15.50	16.00	1.296	2025/10/29	4#
Vertical-Back	40/5200	802.11n HT20	0.903	0.208	-0.81	15.50	16.00	1.013	2025/10/29	
Tip Side	40/5200	802.11n HT20	0.039	0.009	0.68	15.50	16.00	0.044	2025/10/29	
Vertical-Front	36/5180	802.11n HT20	1.108	0.254	3.51	15.51	16.00	1.240	2025/10/29	
Vertical-Front	48/5240	802.11n HT20	0.958	0.174	-2.96	15.08	16.00	1.184	2025/10/29	
Vertical-Front Repeated	40/5200	802.11n HT20	1.136	0.261	0.71	15.50	16.00	1.275	2025/10/29	

MIMO

Test Position of Body-Worn with Antenna Vertical 90° 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Horizontal-Up	40/5200	802.11n HT20	0.026	0.006	1.80	15.50	16.00	0.029	2025/10/29	
Horizontal-Down	40/5200	802.11n HT20	0.038	0.009	-0.86	15.50	16.00	0.043	2025/10/29	
Vertical-Front	40/5200	802.11n HT20	1.211	0.281	0.69	15.50	16.00	1.359	2025/10/29	3#
Vertical-Back	40/5200	802.11n HT20	0.998	0.232	0.33	15.50	16.00	1.120	2025/10/29	
Tip Side	40/5200	802.11n HT20	0.375	0.084	2.20	15.08	16.00	0.463	2025/10/29	
Vertical-Front	36/5180	802.11n HT20	1.186	0.267	3.98	15.51	16.00	1.328	2025/10/29	
Vertical-Front	48/5240	802.11n HT20	0.996	0.185	-1.47	15.08	16.00	1.231	2025/10/29	
Vertical-Front Repeated	40/5200	802.11n HT20	1.195	0.274	1.84	15.50	16.00	1.341	2025/10/29	

9.1.3. SAR measurement Result of WLAN 5.8G

Ant1

Test Position of Body-Worn with Horizontal 180° 0mm	Test channel /Freq	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Horizontal-Up	157/5785	802.11a	0.376	0.097	-0.86	14.71	15.00	0.402	2025/10/30	
Horizontal-Down	157/5785	802.11a	0.340	0.089	2.62	14.71	15.00	0.363	2025/10/30	
Vertical-Front	157/5785	802.11a	0.939	0.250	0.23	14.71	15.00	1.004	2025/10/30	
Vertical-Back	157/5785	802.11a	0.015	0.013	-2.62	14.71	15.00	0.016	2025/10/30	
Tip Side	157/5785	802.11a	0.015	0.013	1.53	14.71	15.00	0.016	2025/10/30	
Vertical-Front	149/5745	802.11a	1.253	0.318	0.67	14.33	15.00	1.462	2025/10/30	8#

NOTE: 1. Body SAR test results of WLAN 5.8G

2. Tested by : Max Zhou

Ant1

Test Position of Body-Worn with Antenna Vertical 90° 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Horizontal-Up	157/5785	802.11a	0.015	0.013	2.76	14.71	15.00	0.016	2025/10/30	
Horizontal-Down	157/5785	802.11a	0.019	0.017	1.05	14.71	15.00	0.020	2025/10/30	
Vertical-Front	157/5785	802.11a	0.956	0.254	-0.91	14.71	15.00	1.022	2025/10/30	
Vertical-Back	157/5785	802.11a	0.015	0.013	-2.21	14.71	15.00	0.016	2025/10/30	
Tip Side	157/5785	802.11a	0.343	0.090	0.24	14.71	15.00	0.367	2025/10/30	
Vertical-Front	149/5745	802.11a	1.265	0.322	0.47	14.33	15.00	1.476	2025/10/30	10#
Vertical-Front	165/5825	802.11a	0.858	0.221	0.26	14.58	15.00	0.945	2025/10/30	
Vertical-Front Side Repeated	149/5745	802.11a	1.251	0.314	-2.61	14.33	15.00	1.460	2025/10/30	

NOTE: 1. Body SAR test results of WLAN 5.8G

2. Tested by : Max Zhou

Ant2

Test Position of Body-Worn with Antenna Horizontal 180° 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Horizontal-Up	157/5785	802.11n HT20	0.429	0.106	-0.22	14.76	15.00	0.453	2025/10/30	
Horizontal-Down	157/5785	802.11n HT20	0.500	0.129	-3.19	14.76	15.00	0.528	2025/10/30	
Vertical-Front	157/5785	802.11n HT20	0.033	0.008	0.71	14.76	15.00	0.035	2025/10/30	
Vertical-Back	157/5785	802.11n HT20	1.068	0.278	1.03	14.76	15.00	1.129	2025/10/30	
Tip Side	157/5785	802.11n HT20	0.027	0.007	0.08	14.76	15.00	0.029	2025/10/30	
Vertical-Back	149/5745	802.11n HT20	1.210	0.325	-0.24	14.64	15.00	1.315	2025/10/30	11#
Vertical-Back	165/5825	802.11n HT20	0.958	0.188	-0.65	15.08	15.00	0.941	2025/10/30	
Vertical-Back Repeated	149/5745	802.11n HT20	1.170	0.314	-0.45	14.64	15.00	1.271	2025/10/30	

Ant2

Test Position of Body-Worn with Antenna Vertical 90° 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Horizontal-Up	157/5785	802.11n HT20	0.020	0.018	1.78	14.76	15.00	0.021	2025/10/30	
Horizontal-Down	157/5785	802.11n HT20	0.026	0.006	-0.41	14.76	15.00	0.027	2025/10/30	
Vertical-Front	157/5785	802.11n HT20	0.015	0.013	0.95	14.76	15.00	0.016	2025/10/30	
Vertical-Back	157/5785	802.11n HT20	1.002	0.252	-3.40	14.76	15.00	1.059	2025/10/30	
Tip Side	157/5785	802.11n HT20	0.263	0.063	-2.99	14.76	15.00	0.278	2025/10/30	

Vertical-Back	149/5745	802.11n HT20	1.191	0.308	-1.45	14.64	15.00	1.294	2025/10/30	12#
Vertical-Back	165/5825	802.11n HT20	0.911	0.179	-0.25	15.08	15.00	0.894	2025/10/30	
Vertical-Back Repeated	149/5745	802.11n HT20	1.136	0.281	-1.96	14.64	15.00	1.234	2025/10/30	

MIMO

Test Position of Body-Worn with Antenna Horizontal 180° 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Horizontal-Up	157/5785	802.11n HT20	0.505	0.133	1.05	17.33	18.00	0.589	2025/10/30	
Horizontal-Down	157/5785	802.11n HT20	0.286	0.073	-0.60	17.33	18.00	0.334	2025/10/30	
Vertical-Front	157/5785	802.11n HT20	0.972	0.262	4.41	17.33	18.00	1.134	2025/10/30	
Vertical-Back	157/5785	802.11n HT20	0.693	0.187	3.91	17.33	18.00	0.809	2025/10/30	
Tip Side	157/5785	802.11n HT20	0.029	0.008	2.60	17.33	18.00	0.034	2025/10/30	
Vertical-Fron	149/5745	802.11n HT20	1.156	0.310	-1.13	17.24	18.00	1.377	2025/10/30	7#
Vertical-Fron	165/5825	802.11n HT20	0.833	0.240	0.35	17.57	18.00	0.920	2025/10/30	
Vertical-Fron Repeated	149/5745	802.11n HT20	1.139	0.302	-2.84	17.24	18.00	1.357	2025/10/30	

MIMO

Test Position of Body-Worn with Antenna Vertical 90° 0mm	Test channel /Freq.	Mode	SAR Value (W/kg)		Power Drift(%)	Conducted Power (dBm)	Tune-up Power (dBm)	Scaled SAR 1-g (W/Kg)	Date	Plot
			1-g	10-g						
Horizontal-Up	157/5785	802.11n HT20	0.019	0.017	2.56	17.33	18.00	0.022	2025/10/30	
Horizontal-Down	157/5785	802.11n HT20	0.029	0.008	2.51	17.33	18.00	0.034	2025/10/30	
Vertical-Front	157/5785	802.11n	0.924	0.250	1.37	17.33	18.00	1.078	2025/10/30	

		HT20								
Vertical-Back	157/5785	802.11n HT20	0.741	0.190	3.11	17.33	18.00	0.865	2025/10/30	
Tip Side	157/5785	802.11n HT20	0.291	0.078	-2.95	17.33	18.00	0.340	2025/10/30	
Vertical-Front	149/5745	802.11n HT20	1.174	0.317	-1.15	17.24	18.00	1.399	2025/10/30	9#
Vertical-Front	165/5825	802.11n HT20	0.825	0.228	-2.73	17.57	18.00	0.911	2025/10/30	
Vertical-Front Repeated	149/5745	802.11n HT20	1.139	0.304	-2.41	17.24	18.00	1.357	2025/10/30	

NOTE: 1. Body SAR test results of WLAN 2.4G

2. Tested by : Max Zhou

9.2. Simultaneous Transmission Analysis

Per KDB 447498 D01, simultaneous transmission SAR is compliant if,

- 1) Scalar SAR summation $< 1.6 \text{ W/kg}$.
- 2) $\text{SPLSR} = (\text{SAR}_1 + \text{SAR}_2)^{1.5} / (\text{min. separation distance, mm})$, and the peak separation distance is determined from the square root of $[(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2]$, where (x_1, y_1, z_1) and (x_2, y_2, z_2) are the coordinates of the extrapolated peak SAR locations in the zoom scan. If $\text{SPLSR} \leq 0.04$, simultaneously transmission SAR measurement is not necessary.

Exposure Position	Simultaneous Tx SAR(W/Kg)
2.4G MIMO	0.746
5G MIMO	1.399

Note: Only the MIMO mode can transmit simultaneously.

10. Appendix A. Photo documentation

Refer to appendix Test Setup photo---SAR

11. Appendix B. System Check Plots

Table of contents
MEASUREMENT 1 System Performance Check - 2450MHz
MEASUREMENT 2 System Performance Check - 5200MHz
MEASUREMENT 3 System Performance Check - 5800MHz

1# System check at 2450 MHz

Date of measurement: 28/10/2025

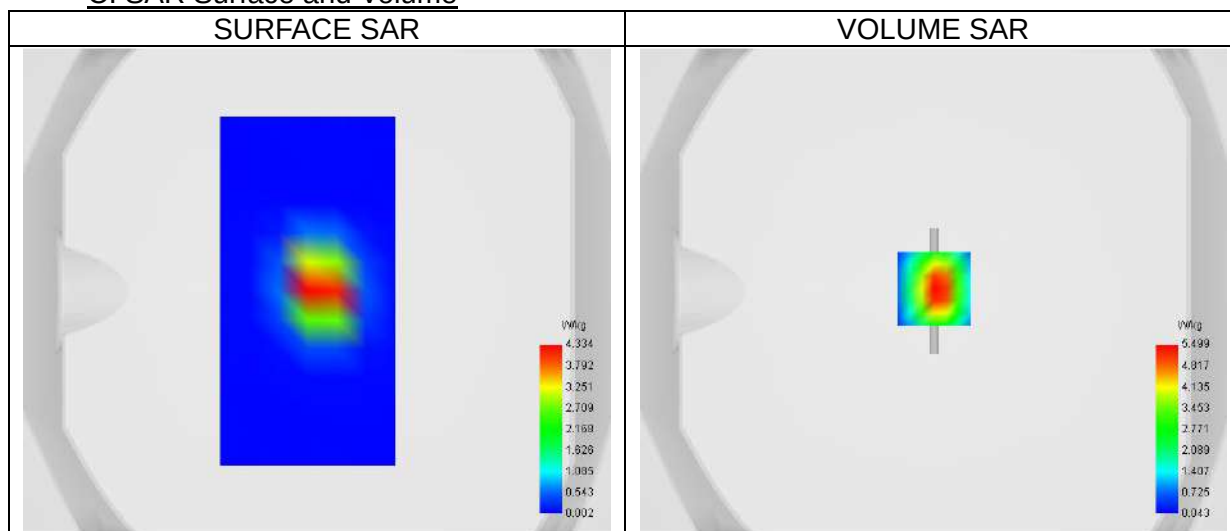
A. Experimental conditions.

Probe	0725-EPGO-448
ConvF	1.63
Area Scan	dx=12mm dy=12mm, Complete
Zoom Scan	7x7x7,dx=5mm dy=5mm dz=5.0mm,Complete
Phantom	Validation plane
Device Position	Dipole
Band	CW2450
Signal	CW
Channels/Frequency	Middle

B. Permittivity

Middle TX Frequency (MHz)	2450.00
Relative permittivity (real part)	38.14
Relative permittivity (imaginary part)	13.64
Conductivity (S/m)	1.86

C. SAR Surface and Volume



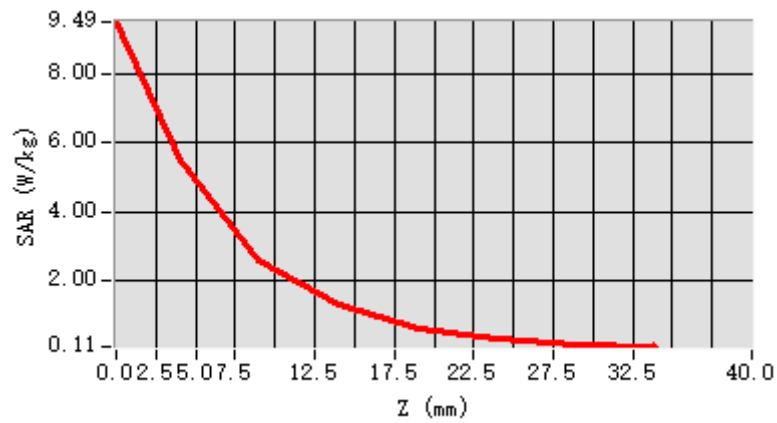
Maximum location: X=0.00, Y=1.00 ; SAR Peak: 9.55 W/kg

D. SAR 1g & 10g

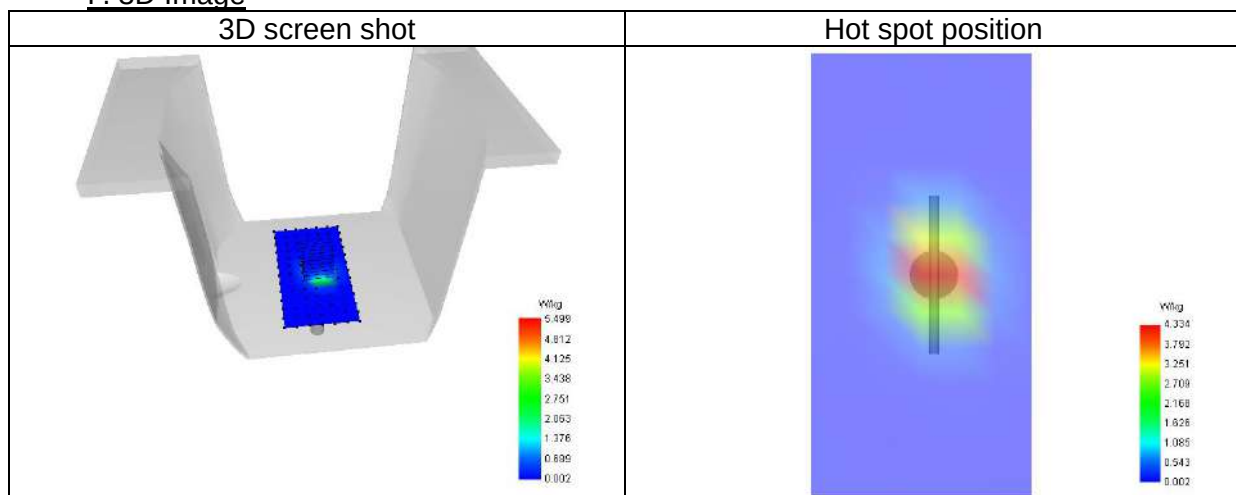
SAR 10g (W/Kg)	2.241
SAR 1g (W/Kg)	5.148
Variation (%)	-0.31
Horizontal validation criteria: minimum distance (mm)	10.00
Vertical validation criteria: SAR ratio M2/M1 (%)	47.34

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	9.494	5.499	2.603	1.319	0.649	0.330	0.181



F. 3D Image



2# System check at 5200 MHz
Date of measurement: 29/10/2025

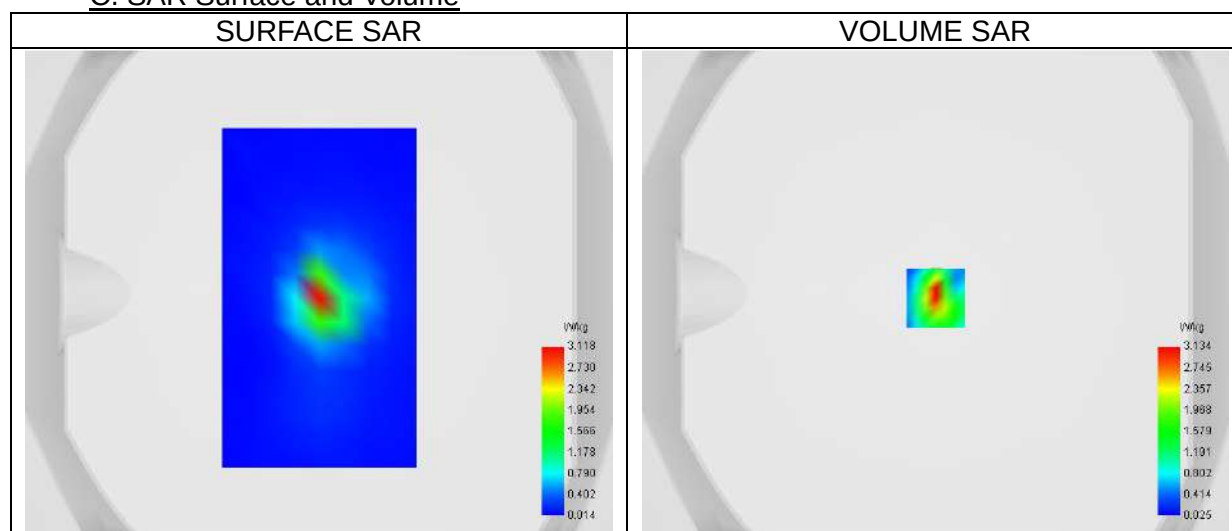
A. Experimental conditions.

Probe	0725-EPGO-448
ConvF	1.37
Area Scan	dx=10mm dy=10mm, Complete
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2.0mm,Complete
Phantom	Validation plane
Device Position	Dipole
Band	CW5200
Signal	CW
Channels/Frequency	Middle

B. Permittivity

Middle TX Frequency (MHz)	5200.00
Relative permittivity (real part)	36.82
Relative permittivity (imaginary part)	15.92
Conductivity (S/m)	4.60

C. SAR Surface and Volume



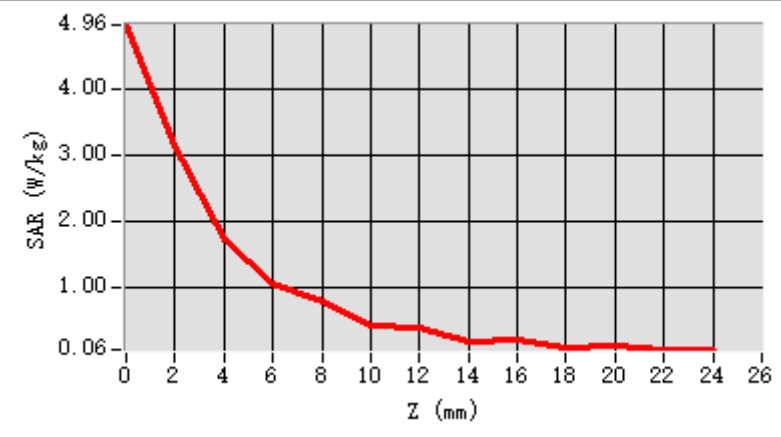
Maximum location: X=0.00, Y=-2.00 ; SAR Peak: 5.37 W/kg

D. SAR 1g & 10g

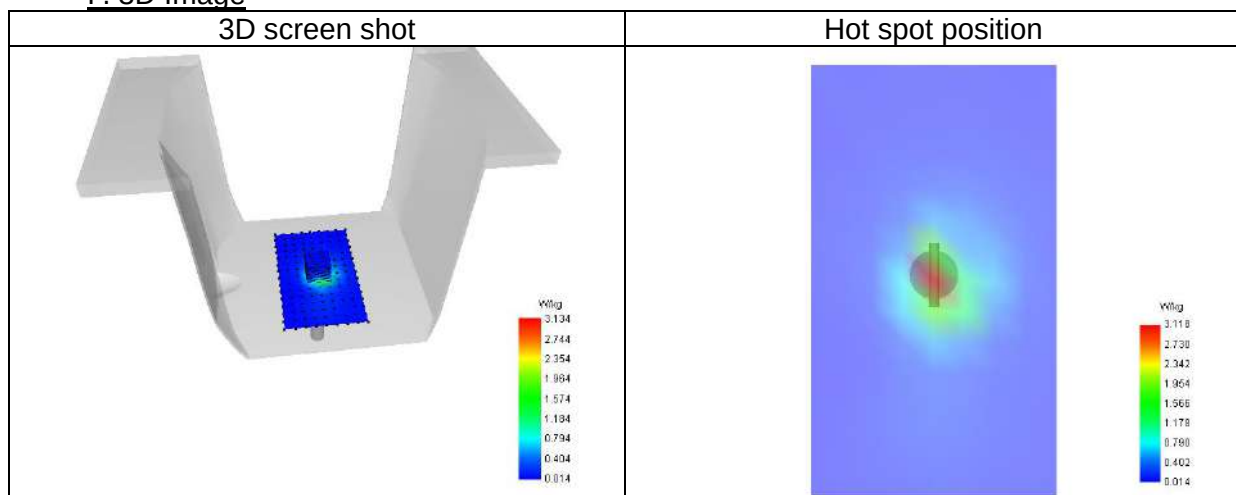
SAR 10g (W/Kg)	0.574
SAR 1g (W/Kg)	1.658
Variation (%)	-0.64
Horizontal validation criteria: minimum distance (mm)	5.66
Vertical validation criteria: SAR ratio M2/M1 (%)	59.84

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.0	12.0	14.0	16.0	18.0	20.0	22.0
						0	0	0	0	0	0	0
SAR (W/Kg)	4.95	3.13	1.72	1.06	0.79	0.41	0.38	0.19	0.20	0.10	0.11	0.06
	8	4	2	4	6	9	1	5	1	1	1	0



F. 3D Image



3# System check at 5800 MHz

Date of measurement: 30/10/2025

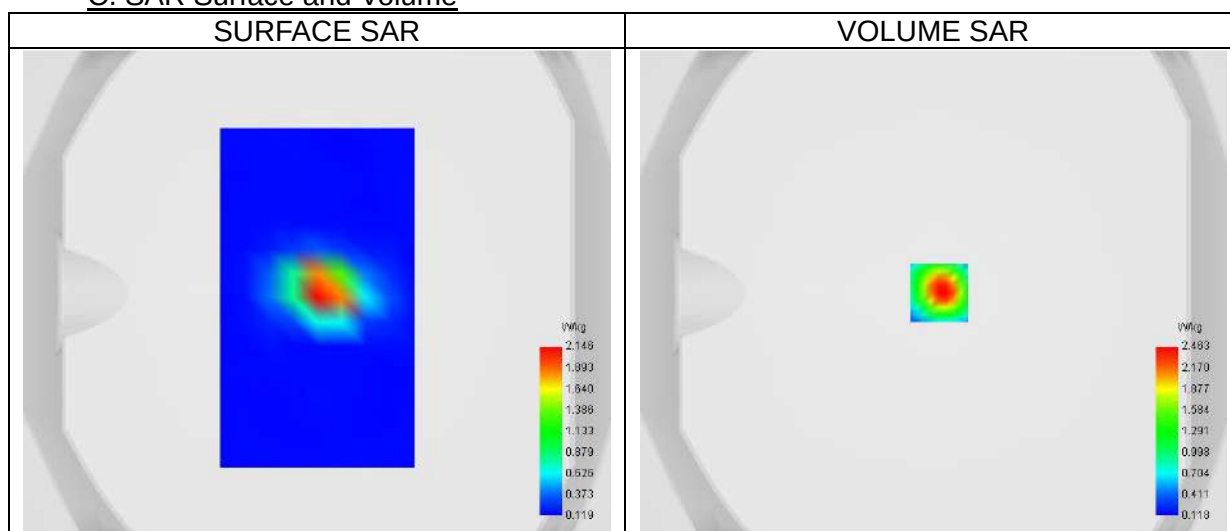
A. Experimental conditions.

Probe	0725-EPGO-448
ConvF	1.35
Area Scan	dx=10mm dy=10mm, Complete
Zoom Scan	9x9x16,dx=3mm dy=3mm dz=1.5mm,Complete
Phantom	Validation plane
Device Position	Dipole
Band	CW5800
Channels/Frequency	Middle
Signal	CW

B. Permittivity

Middle TX Frequency (MHz)	5800.000
Relative permittivity (real part)	35.45
Relative permittivity (imaginary part)	16.28
Conductivity (S/m)	5.25

C. SAR Surface and Volume



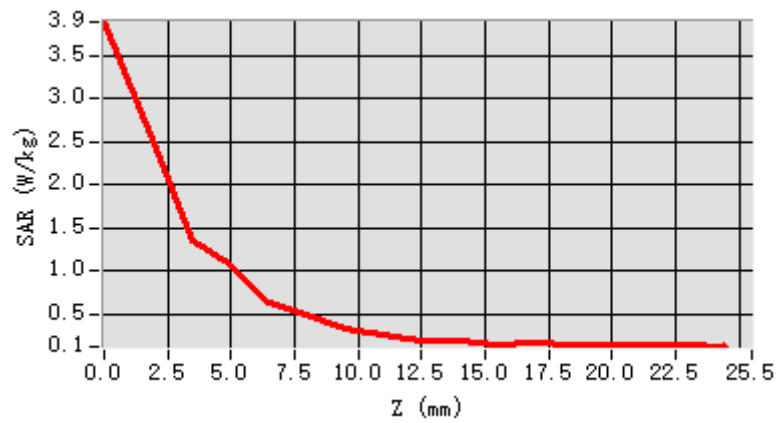
Maximum location: X=2.00, Y=0.00 ; SAR Peak: 4.21 W/kg

D. SAR 1g & 10g

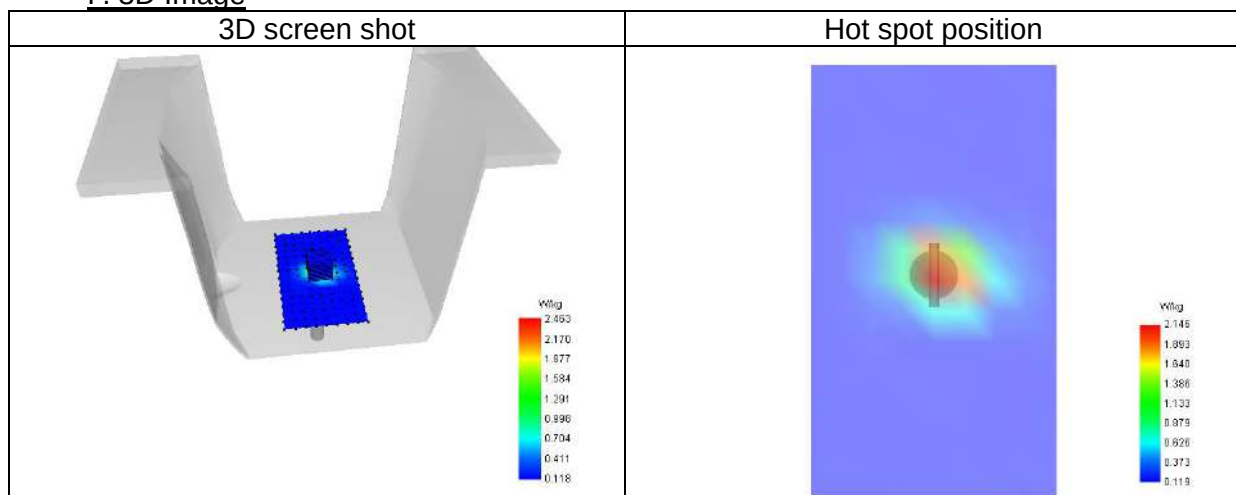
SAR 10g (W/Kg)	0.599
SAR 1g (W/Kg)	1.651
Variation (%)	-0.50
Horizontal validation criteria: minimum distance (mm)	9.49
Vertical validation criteria: SAR ratio M2/M1 (%)	64.02

E. Z Axis Scan

Z (mm)	0.0	2.0	3.5	5.0	6.5	8.0	9.5	11.	12.	14.	15.	17.	18.	20.	21.	23.
	0	0	0	0	0	0	0	00	50	00	50	00	50	00	50	00
SAR (W/Kg)	3.8	2.4	1.3	1.0	0.6	0.5	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	85	63	59	74	42	13	29	73	10	96	58	68	62	49	43	46



F. 3D Image



12. Appendix C. SAR Measurement Plots

- 1# SAR Measurement at U-NII-1 (Body, Validation Plane)**
- 2# SAR Measurement at U-NII-1 (Body, Validation Plane)**
- 3# SAR Measurement at U-NII-1 (Body, Validation Plane)**
- 4# SAR Measurement at U-NII-1 (Body, Validation Plane)**
- 5# SAR Measurement at U-NII-1 (Body, Validation Plane)**
- 6# SAR Measurement at U-NII-1 (Body, Validation Plane)**
- 7# SAR Measurement at U-NII-3 (Body, Validation Plane)**
- 8# SAR Measurement at U-NII-3 (Body, Validation Plane)**
- 9# SAR Measurement at U-NII-3 (Body, Validation Plane)**
- 10# SAR Measurement at U-NII-3 (Body, Validation Plane)**
- 11# SAR Measurement at U-NII-3 (Body, Validation Plane)**
- 12# SAR Measurement at U-NII-3 (Body, Validation Plane)**
- 13# SAR Measurement at ISM (Body, Validation Plane)**
- 14# SAR Measurement at ISM (Body, Validation Plane)**
- 15# SAR Measurement at ISM (Body, Validation Plane)**
- 16# SAR Measurement at ISM (Body, Validation Plane)**
- 17# SAR Measurement at ISM (Body, Validation Plane)**
- 18# SAR Measurement at ISM (Body, Validation Plane)**

MEASUREMENT 1

1# SAR Measurement at U-NII-1 (Body, Validation Plane)

Date of measurement: 29/10/2025

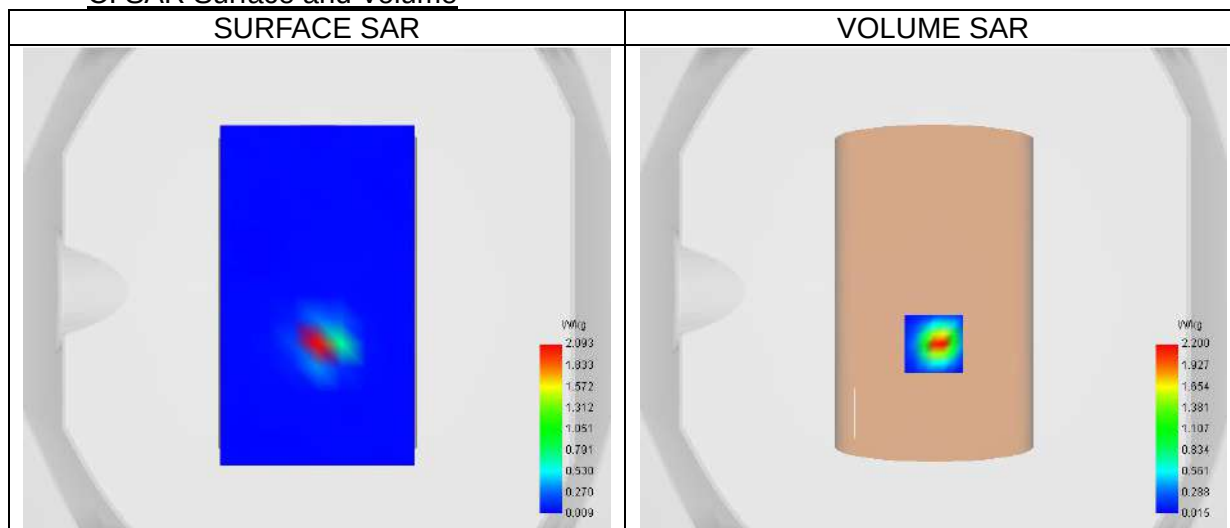
A. Experimental conditions.

Probe	0725-EPGO-448
ConvF	1.37
Area Scan	dx=10mm dy=10mm, Complete
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2.0mm,Complete
Phantom	Validation plane
Device Position	Body
Band	U-NII-1
Signal	IEEE 802.11 ac
Channels/Frequency	Middle (50)/ frequency 5250.00 Mhz

B. Permittivity

Middle TX Frequency (MHz)	5250.00
Relative permittivity (real part)	36.69
Relative permittivity (imaginary part)	16.03
Conductivity (S/m)	4.68

C. SAR Surface and Volume



Maximum location: X=0.00, Y=-22.00 ; SAR Peak: 4.06 W/kg

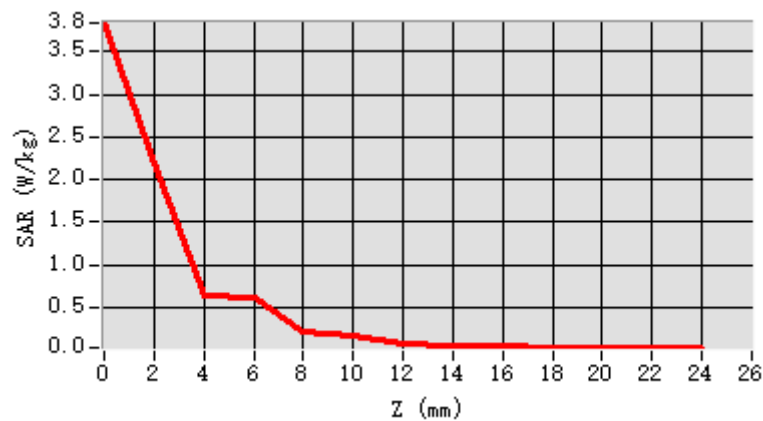
D. SAR 1g & 10g

SAR 10g (W/Kg)	0.252
SAR 1g (W/Kg)	1.088
Variation (%)	-1.30
Horizontal validation criteria: minimum distance (mm)	5.66
Vertical validation criteria: SAR ratio M2/M1 (%)	53.45

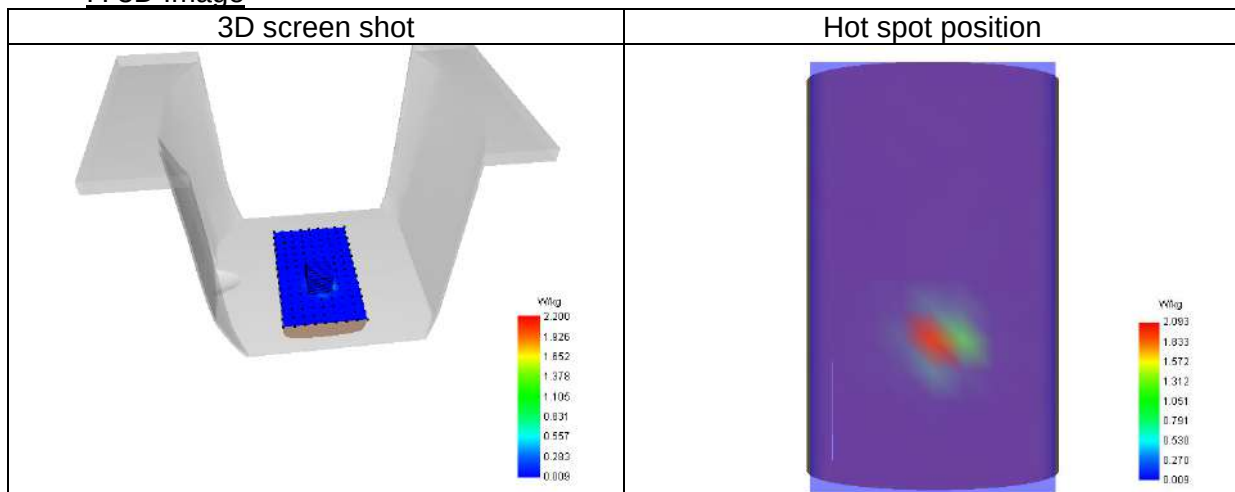
E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.0	12.0	14.0	16.0	18.0	20.0	22.0
						0	0	0	0	0	0	0

SAR (W/Kg)	3.84	2.20	0.63	0.60	0.20	0.16	0.08	0.05	0.04	0.03	0.02	0.02
	1	0	0	7	7	9	0	8	5	1	4	7



F. 3D Image



2# SAR Measurement at U-NII-1 (Body, Validation Plane)

Date of measurement: 29/10/2025

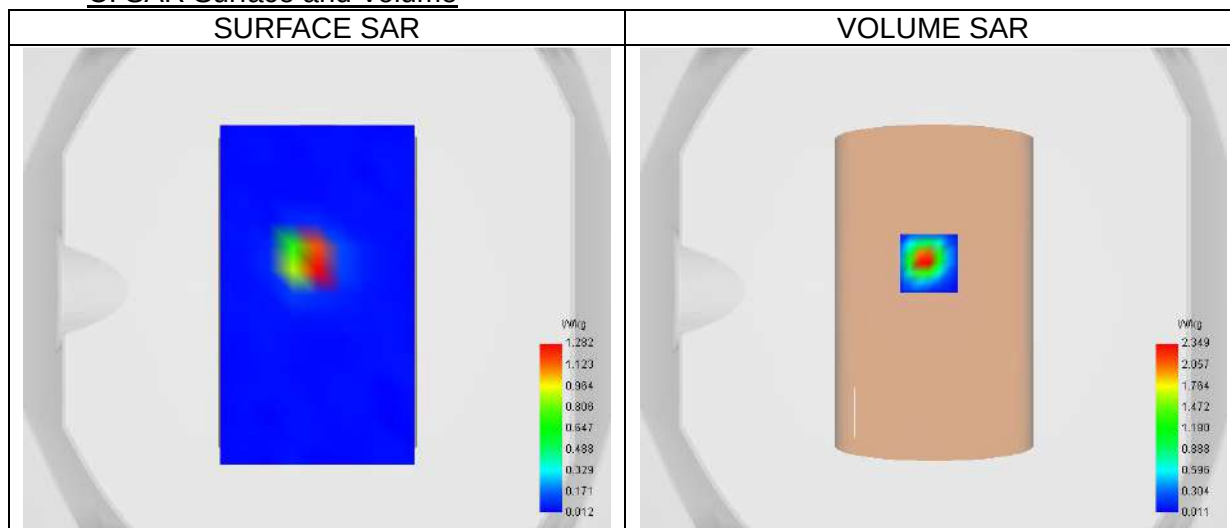
A. Experimental conditions.

Probe	0725-EPGO-448
ConvF	1.37
Area Scan	dx=10mm dy=10mm, Complete
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2.0mm,Complete
Phantom	Validation plane
Device Position	Body
Band	U-NII-1
Signal	IEEE 802.11 ac
Channels/Frequency	Middle (50)/ frequency 5250.00 Mhz

B. Permittivity

Middle TX Frequency (MHz)	5250.00
Relative permittivity (real part)	36.69
Relative permittivity (imaginary part)	16.03
Conductivity (S/m)	4.68

C. SAR Surface and Volume



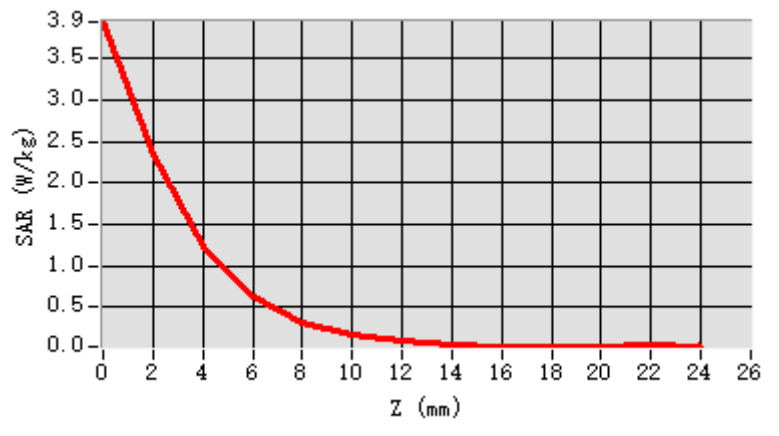
Maximum location: X=-2.00, Y=11.00 ; SAR Peak: 4.59 W/kg

D. SAR 1g & 10g

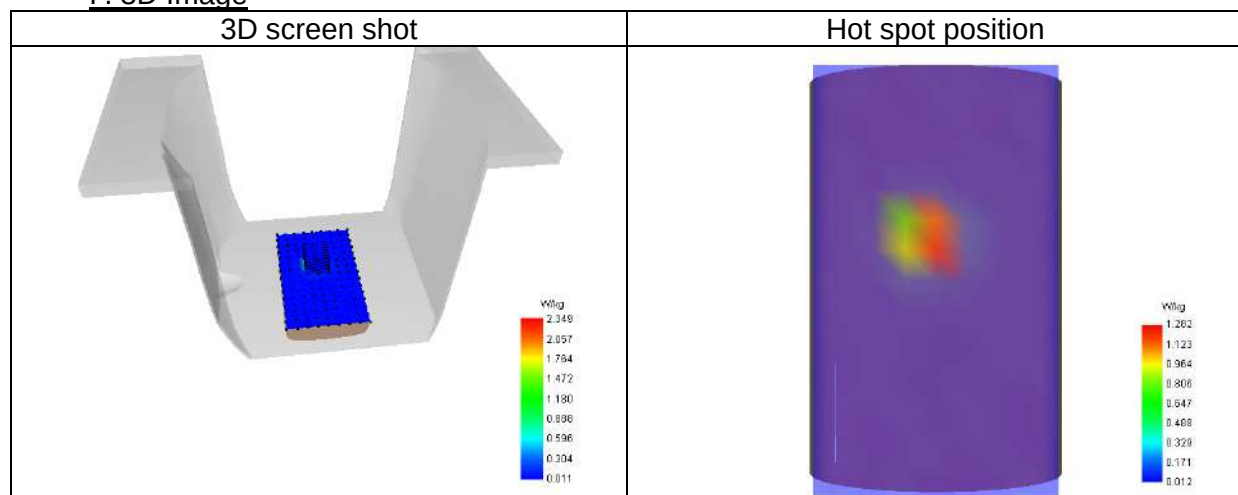
SAR 10g (W/Kg)	0.281
SAR 1g (W/Kg)	1.211
Variation (%)	0.69
Horizontal validation criteria: minimum distance (mm)	5.66
Vertical validation criteria: SAR ratio M2/M1 (%)	52.14

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.0	12.0	14.0	16.0	18.0	20.0	22.0
						0	0	0	0	0	0	0
SAR (W/Kg)	3.93	2.34	1.22	0.63	0.31	0.16	0.10	0.05	0.03	0.03	0.02	0.04
	6	9	5	0	7	9	0	2	9	5	9	1



F. 3D Image



3# SAR Measurement at U-NII-1 (Body, Validation Plane)

Date of measurement: 29/10/2025

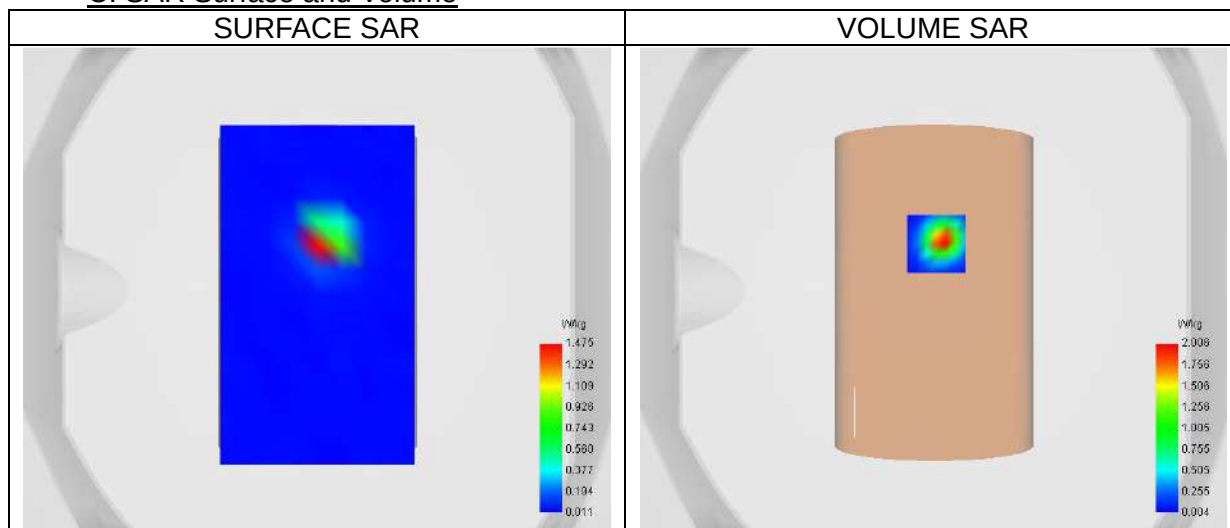
A. Experimental conditions.

Probe	0725-EPGO-448
ConvF	1.37
Area Scan	dx=10mm dy=10mm, Complete
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2.0mm,Complete
Phantom	Validation plane
Device Position	Body
Band	U-NII-1
Signal	IEEE 802.11 n
Channels/Frequency	Middle (40)/ frequency 5200.00 Mhz

B. Permittivity

Middle TX Frequency (MHz)	5200.00
Relative permittivity (real part)	36.82
Relative permittivity (imaginary part)	15.92
Conductivity (S/m)	4.60

C. SAR Surface and Volume



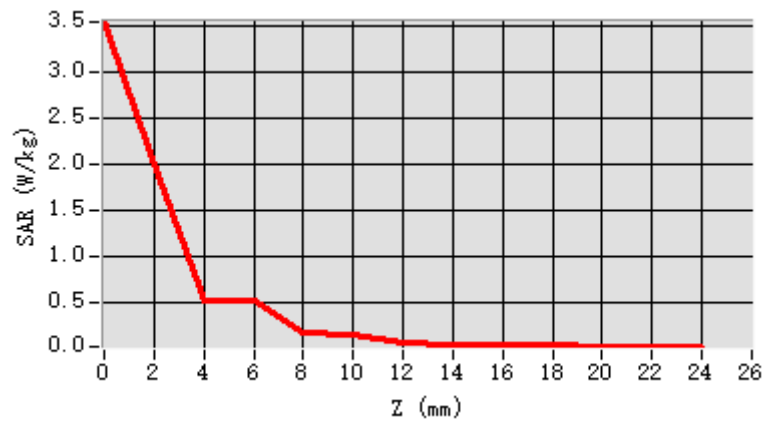
Maximum location: X=1.00, Y=19.00 ; SAR Peak: 3.85 W/kg

D. SAR 1g & 10g

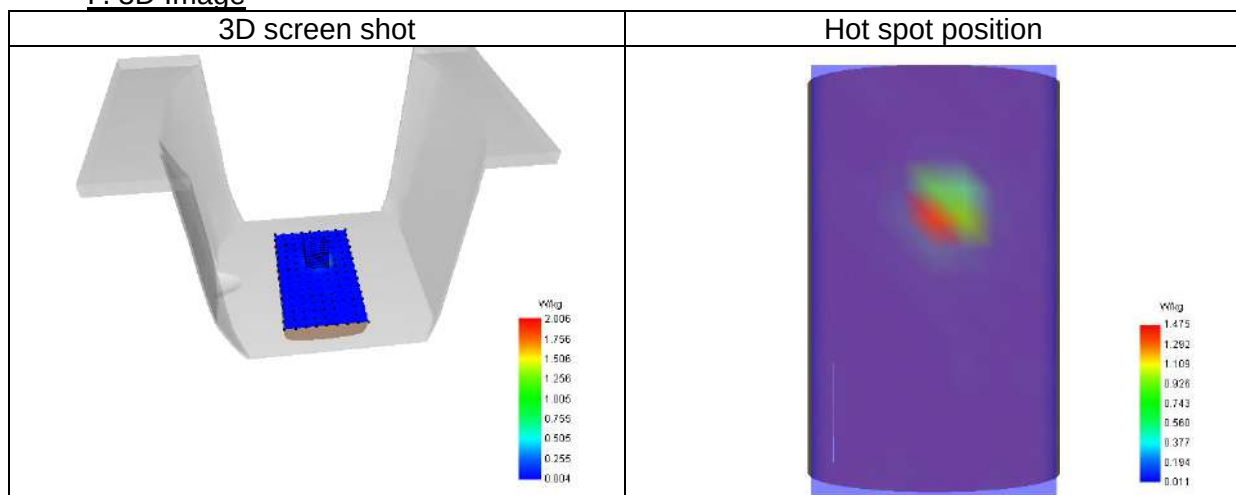
SAR 10g (W/Kg)	0.236
SAR 1g (W/Kg)	1.010
Variation (%)	-3.05
Horizontal validation criteria: minimum distance (mm)	5.66
Vertical validation criteria: SAR ratio M2/M1 (%)	51.04

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.0	12.0	14.0	16.0	18.0	20.0	22.0
						0	0	0	0	0	0	0
SAR (W/Kg)	3.54	2.00	0.51	0.51	0.17	0.15	0.06	0.04	0.03	0.03	0.02	0.01
	9	6	9	8	2	4	7	8	0	0	1	7



F. 3D Image



4# SAR Measurement at U-NII-1 (Body, Validation Plane)

Date of measurement: 29/10/2025

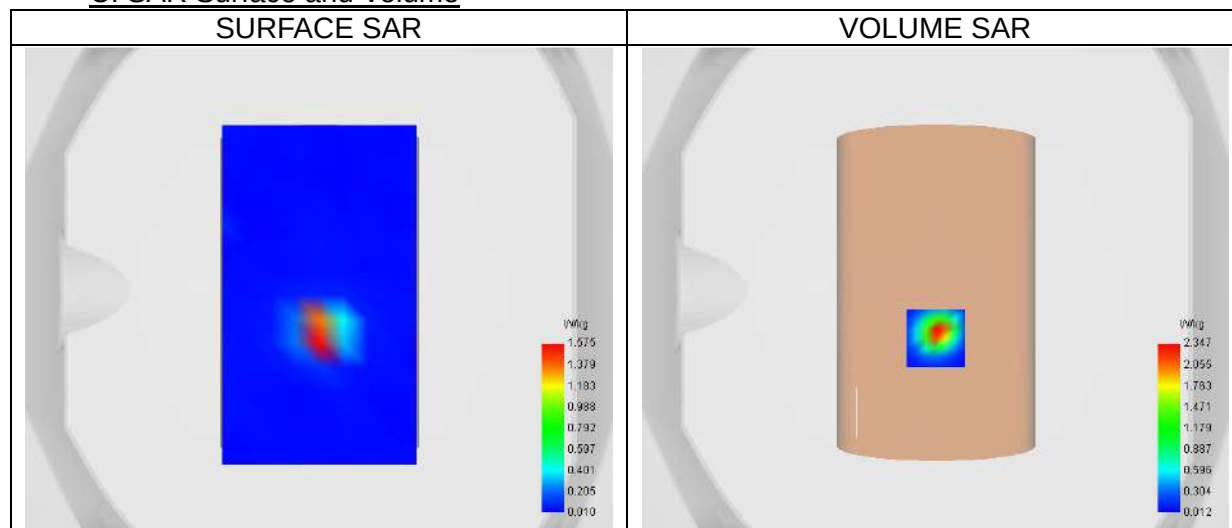
A. Experimental conditions.

Probe	0725-EPGO-448
ConvF	1.37
Area Scan	dx=10mm dy=10mm, Complete
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2.0mm,Complete
Phantom	Validation plane
Device Position	Body
Band	U-NII-1
Signal	IEEE 802.11 n
Channels/Frequency	Middle (40)/ frequency 5200.00 Mhz

B. Permittivity

Middle TX Frequency (MHz)	5200.00
Relative permittivity (real part)	36.82
Relative permittivity (imaginary part)	15.92
Conductivity (S/m)	4.60

C. SAR Surface and Volume



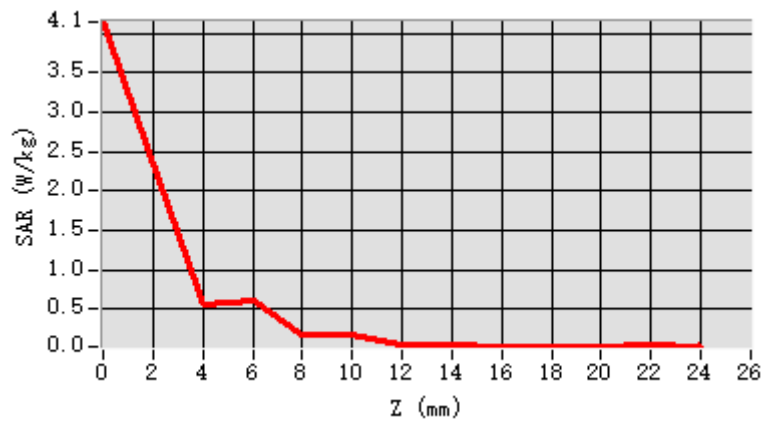
Maximum location: X=0.00, Y=-20.00 ; SAR Peak: 4.37 W/kg

D. SAR 1g & 10g

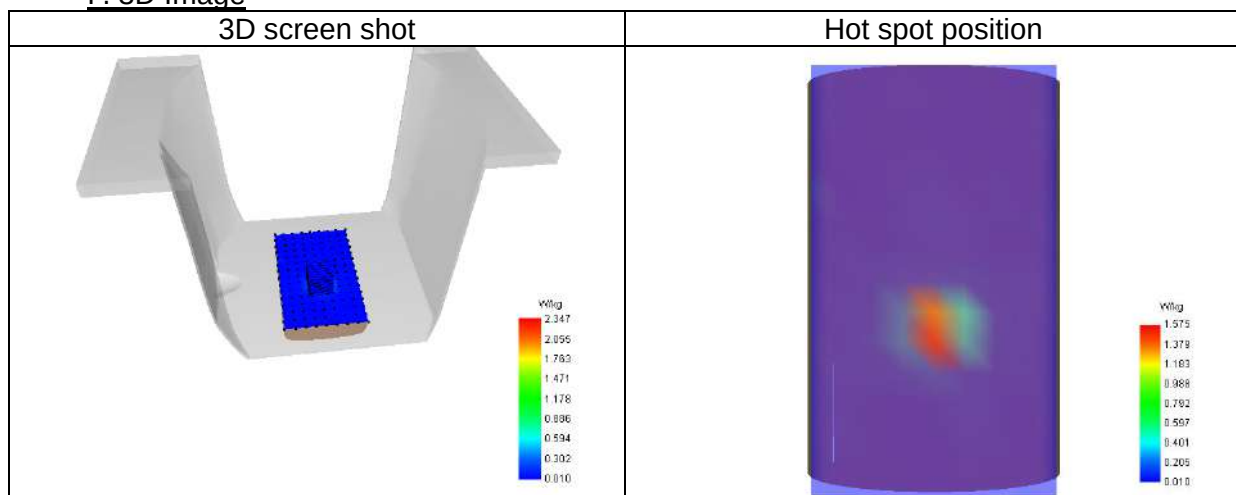
SAR 10g (W/Kg)	0.265
SAR 1g (W/Kg)	1.155
Variation (%)	0.38
Horizontal validation criteria: minimum distance (mm)	5.66
Vertical validation criteria: SAR ratio M2/M1 (%)	51.43

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.0	12.0	14.0	16.0	18.0	20.0	22.0
						0	0	0	0	0	0	0
SAR (W/Kg)	4.14	2.34	0.56	0.62	0.18	0.17	0.06	0.05	0.03	0.02	0.02	0.04
	1	7	5	0	4	9	2	8	4	8	7	5



F. 3D Image



5# SAR Measurement at U-NII-1 (Body, Validation Plane)

Date of measurement: 29/10/2025

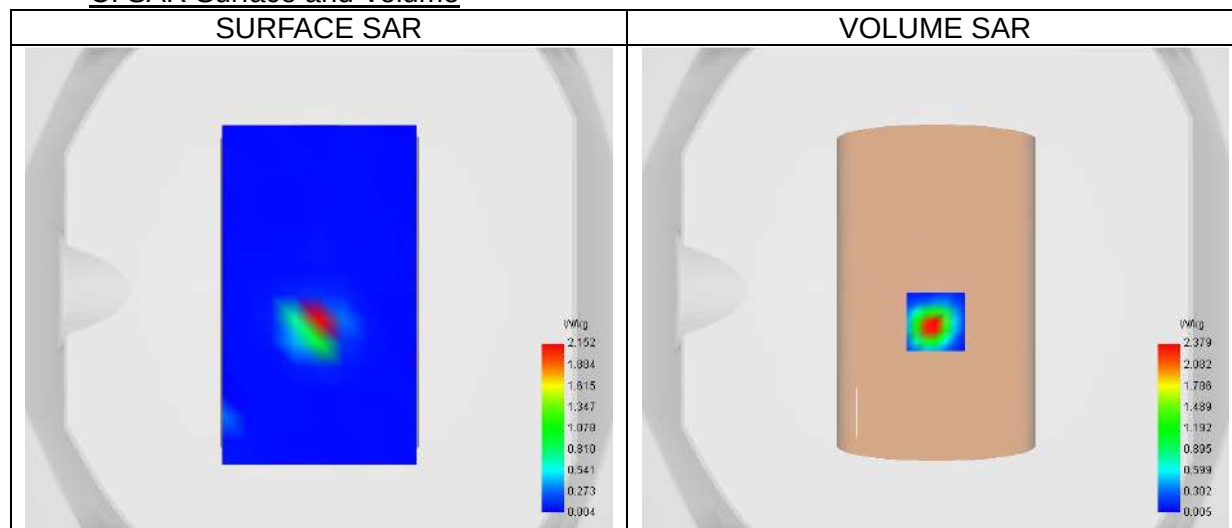
A. Experimental conditions.

Probe	0725-EPGO-448
ConvF	1.37
Area Scan	dx=10mm dy=10mm, Complete
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2.0mm,Complete
Phantom	Validation plane
Device Position	Body
Band	U-NII-1
Signal	IEEE 802.11 a
Channels/Frequency	Middle (40)/ frequency 5200.00 Mhz

B. Permittivity

Middle TX Frequency (MHz)	5200.00
Relative permittivity (real part)	36.82
Relative permittivity (imaginary part)	15.92
Conductivity (S/m)	4.60

C. SAR Surface and Volume



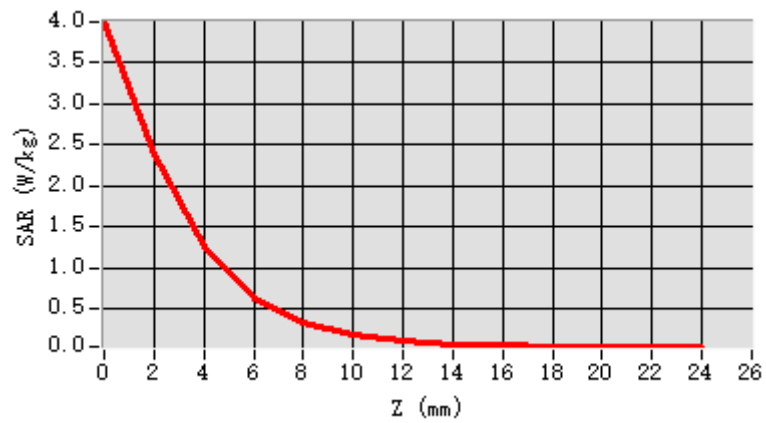
Maximum location: X=0.00, Y=-13.00 ; SAR Peak: 4.66 W/kg

D. SAR 1g & 10g

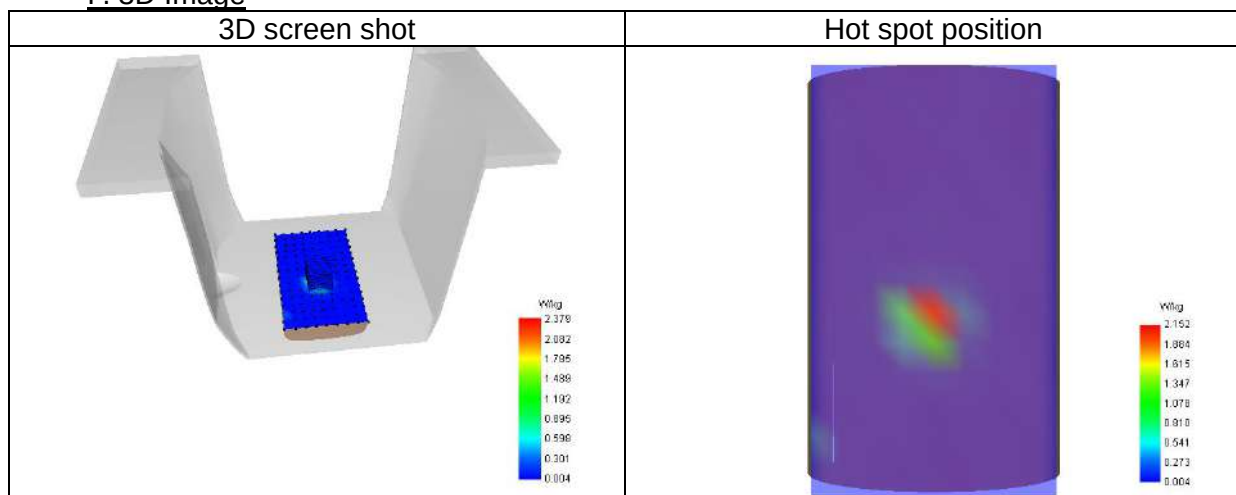
SAR 10g (W/Kg)	0.309
SAR 1g (W/Kg)	1.268
Variation (%)	-2.08
Horizontal validation criteria: minimum distance (mm)	5.66
Vertical validation criteria: SAR ratio M2/M1 (%)	52.66

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.0	12.0	14.0	16.0	18.0	20.0	22.0
						0	0	0	0	0	0	0
SAR (W/Kg)	4.00	2.37	1.25	0.63	0.33	0.17	0.10	0.07	0.05	0.03	0.03	0.03
	0	9	3	2	5	6	6	3	4	8	8	9



F. 3D Image



6# SAR Measurement at U-NII-1 (Body, Validation Plane)

Date of measurement: 29/10/2025

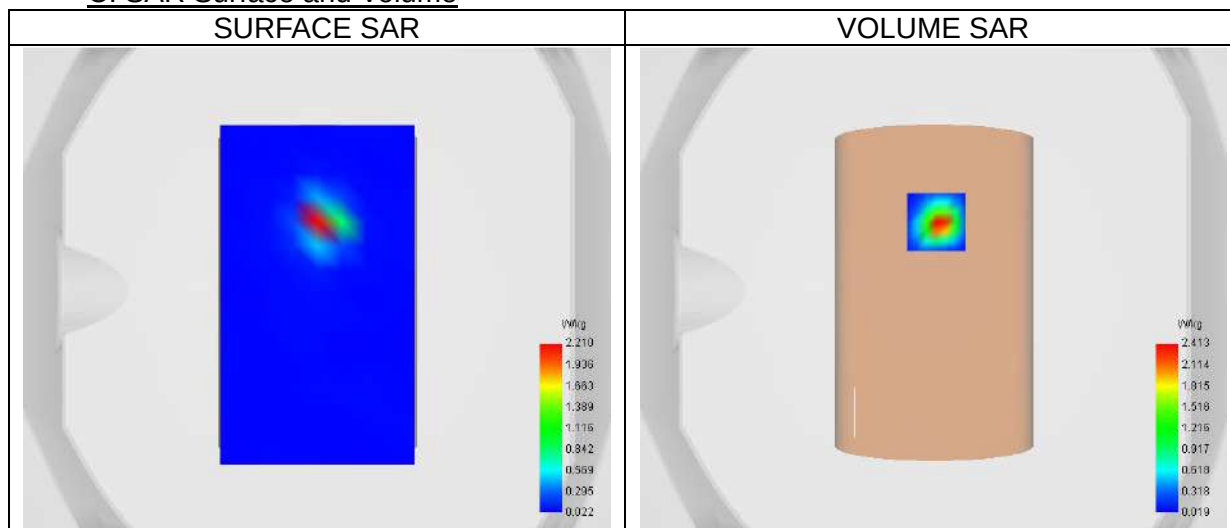
A. Experimental conditions.

Probe	0725-EPGO-448
ConvF	1.37
Area Scan	dx=10mm dy=10mm, Complete
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2.0mm,Complete
Phantom	Validation plane
Device Position	Body
Band	U-NII-1
Signal	IEEE 802.11 a
Channels/Frequency	Middle (40)/ frequency 5200.00 Mhz

B. Permittivity

Middle TX Frequency (MHz)	5200.00
Relative permittivity (real part)	36.82
Relative permittivity (imaginary part)	15.92
Conductivity (S/m)	4.60

C. SAR Surface and Volume



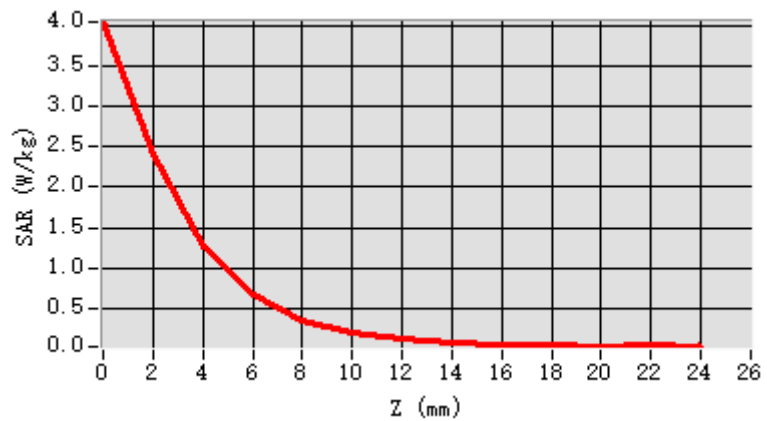
Maximum location: X=1.00, Y=28.00 ; SAR Peak: 4.51 W/kg

D. SAR 1g & 10g

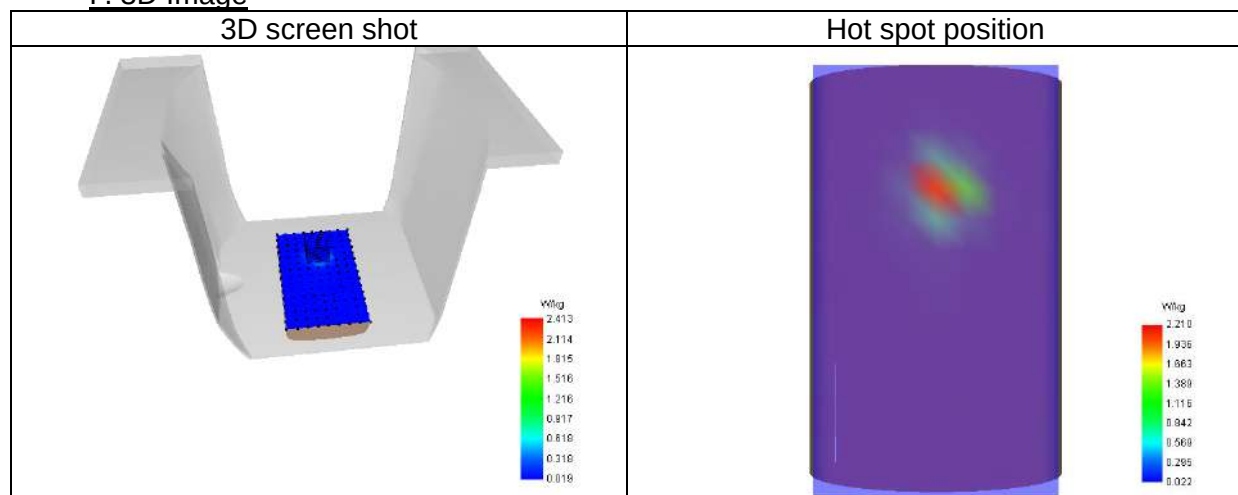
SAR 10g (W/Kg)	0.296
SAR 1g (W/Kg)	1.214
Variation (%)	3.57
Horizontal validation criteria: minimum distance (mm)	5.66
Vertical validation criteria: SAR ratio M2/M1 (%)	52.42

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.0	12.0	14.0	16.0	18.0	20.0	22.0
						0	0	0	0	0	0	0
SAR (W/Kg)	4.03	2.41	1.26	0.66	0.33	0.20	0.11	0.07	0.06	0.04	0.03	0.04
	9	3	5	4	7	1	6	4	3	0	8	0



F. 3D Image



7# SAR Measurement at U-NII-3 (Body, Validation Plane)

Date of measurement: 30/10/2025

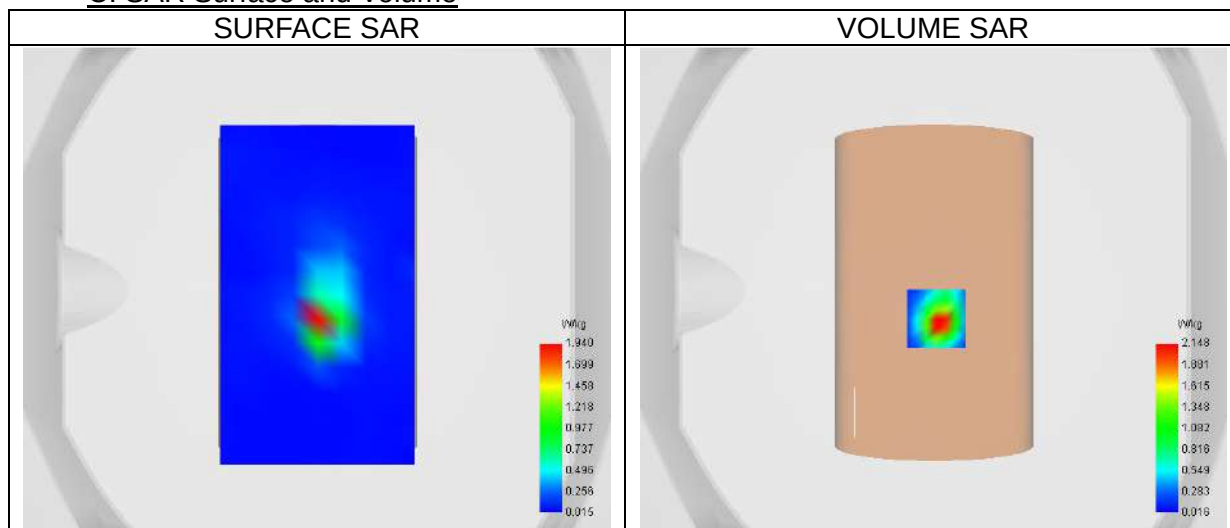
A. Experimental conditions.

Probe	0725-EPGO-448
ConvF	1.35
Area Scan	dx=10mm dy=10mm, Complete
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2.0mm,Complete
Phantom	Validation plane
Device Position	Body
Band	U-NII-3
Signal	IEEE 802.11 n
Channels/Frequency	Lower (149)/ frequency 5745.00 Mhz

B. Permittivity

Middle TX Frequency (MHz)	5745.00
Relative permittivity (real part)	35.58
Relative permittivity (imaginary part)	16.32
Conductivity (S/m)	5.21

C. SAR Surface and Volume



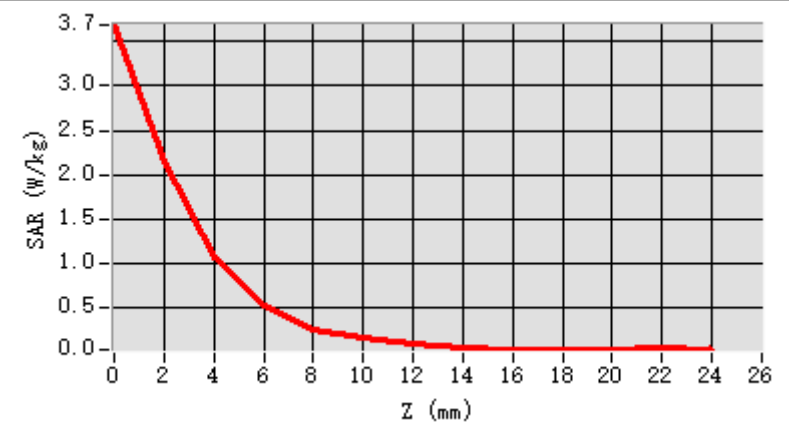
Maximum location: X=1.00, Y=-12.00 ; SAR Peak: 4.27 W/kg

D. SAR 1g & 10g

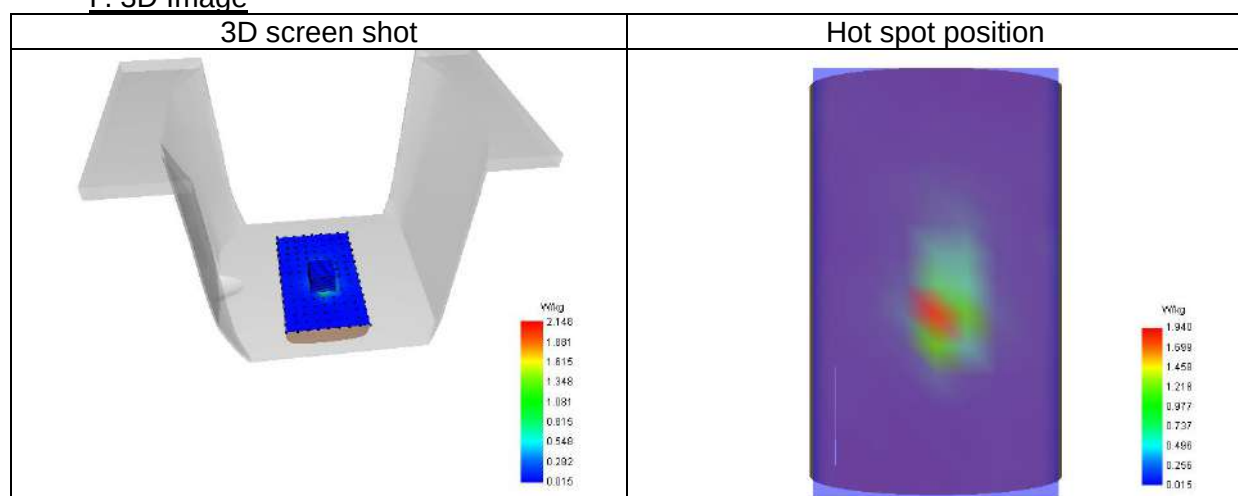
SAR 10g (W/Kg)	0.310
SAR 1g (W/Kg)	1.156
Variation (%)	-1.13
Horizontal validation criteria: minimum distance (mm)	5.66
Vertical validation criteria: SAR ratio M2/M1 (%)	49.84

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.0	12.0	14.0	16.0	18.0	20.0	22.0
						0	0	0	0	0	0	0
SAR (W/Kg)	3.68	2.14	1.07	0.51	0.24	0.15	0.08	0.05	0.03	0.02	0.02	0.03
	8	8	0	5	8	1	5	0	1	3	6	9



F. 3D Image



8# SAR Measurement at U-NII-3 (Body, Validation Plane)

Date of measurement: 30/10/2025

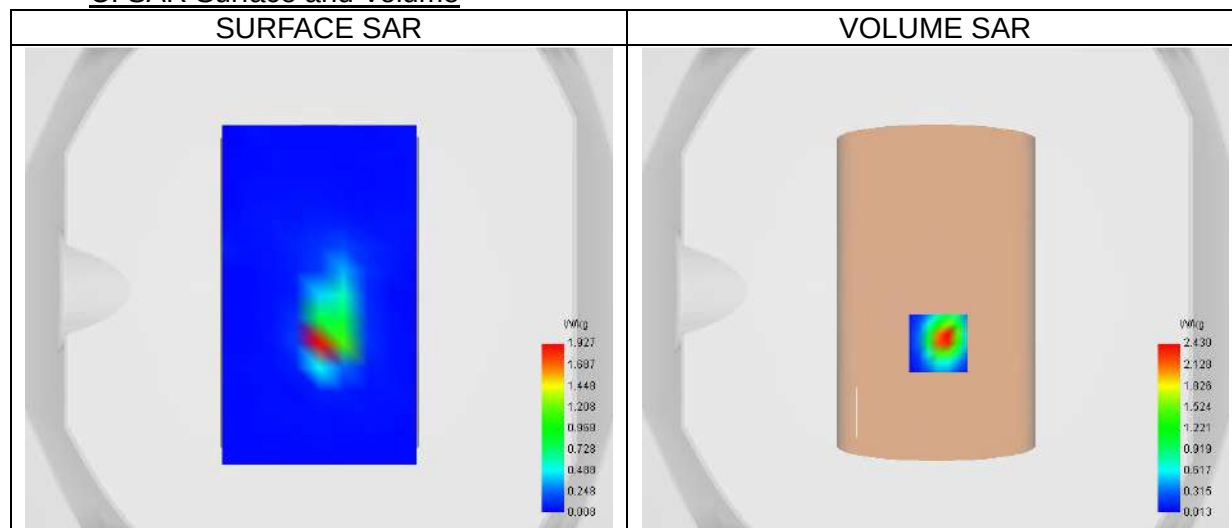
A. Experimental conditions.

Probe	0725-EPGO-448
ConvF	1.35
Area Scan	dx=10mm dy=10mm, Complete
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2.0mm,Complete
Phantom	Validation plane
Device Position	Body
Band	U-NII-3
Signal	IEEE 802.11 a
Channels/Frequency	Lower (149)/ frequency 5745.00 Mhz

B. Permittivity

Middle TX Frequency (MHz)	5745.00
Relative permittivity (real part)	35.58
Relative permittivity (imaginary part)	16.32
Conductivity (S/m)	5.21

C. SAR Surface and Volume



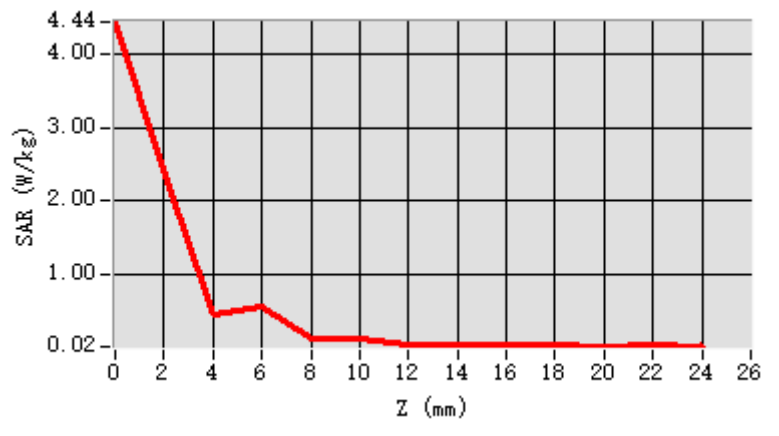
Maximum location: X=1.00, Y=-22.00 ; SAR Peak: 4.83 W/kg

D. SAR 1g & 10g

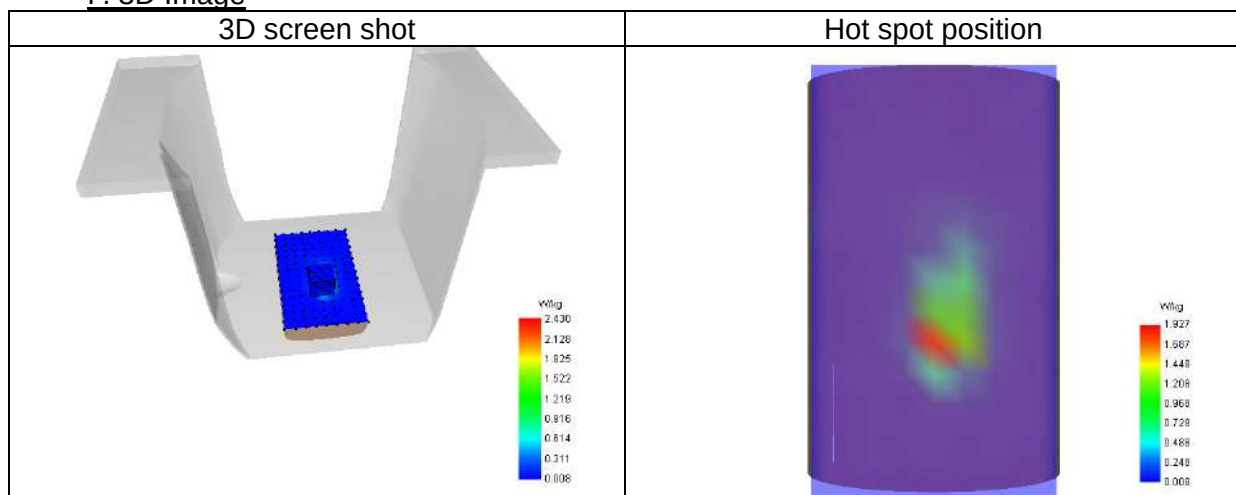
SAR 10g (W/Kg)	0.318
SAR 1g (W/Kg)	1.253
Variation (%)	0.67
Horizontal validation criteria: minimum distance (mm)	5.66
Vertical validation criteria: SAR ratio M2/M1 (%)	47.15

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.0	12.0	14.0	16.0	18.0	20.0	22.0
						0	0	0	0	0	0	0
SAR (W/Kg)	4.43	2.43	0.44	0.55	0.13	0.13	0.04	0.05	0.03	0.04	0.01	0.03
	6	0	0	0	6	1	5	0	2	1	5	6



F. 3D Image



9# SAR Measurement at U-NII-3 (Body, Validation Plane)

Date of measurement: 30/10/2025

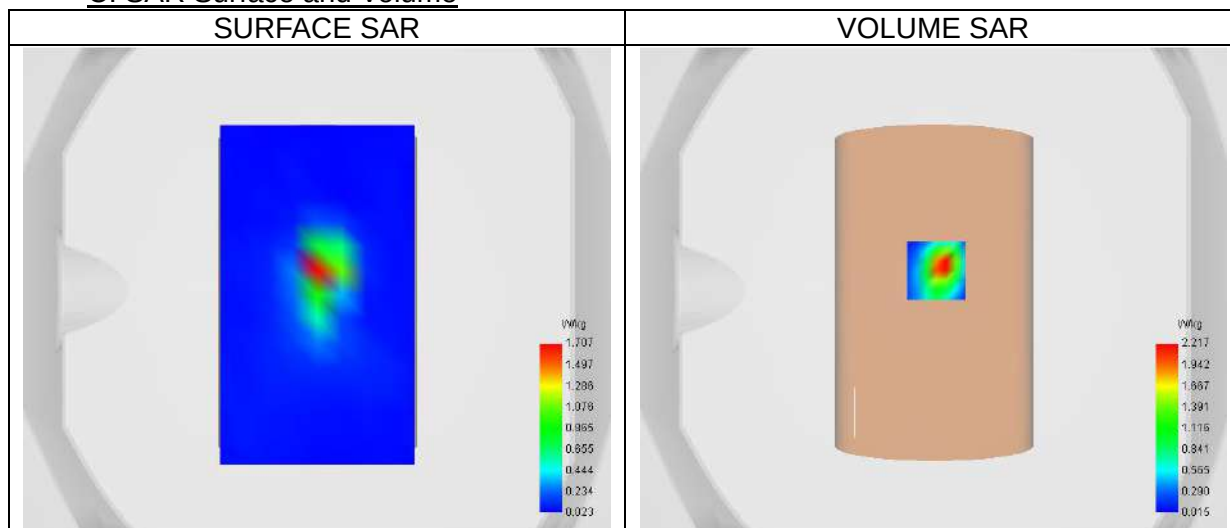
A. Experimental conditions.

Probe	0725-EPGO-448
ConvF	1.35
Area Scan	dx=10mm dy=10mm, Complete
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2.0mm,Complete
Phantom	Validation plane
Device Position	Body
Band	U-NII-3
Signal	IEEE 802.11 n
Channels/Frequency	Lower (149)/ frequency 5745.00 Mhz

B. Permittivity

Middle TX Frequency (MHz)	5745.00
Relative permittivity (real part)	35.58
Relative permittivity (imaginary part)	16.32
Conductivity (S/m)	5.21

C. SAR Surface and Volume



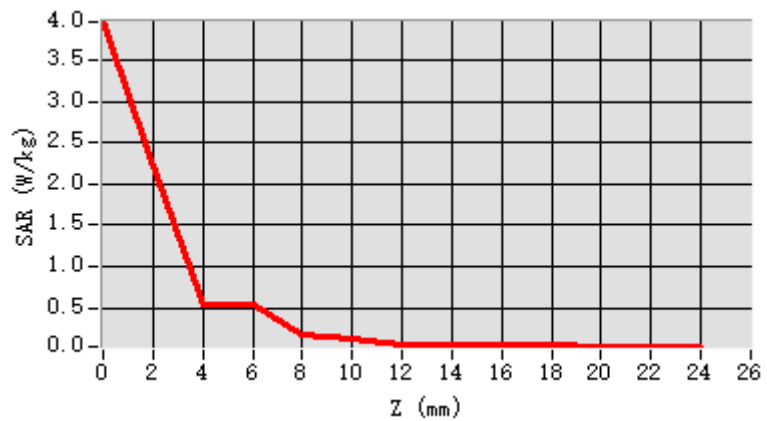
Maximum location: X=1.00, Y=8.00 ; SAR Peak: 4.27 W/kg

D. SAR 1g & 10g

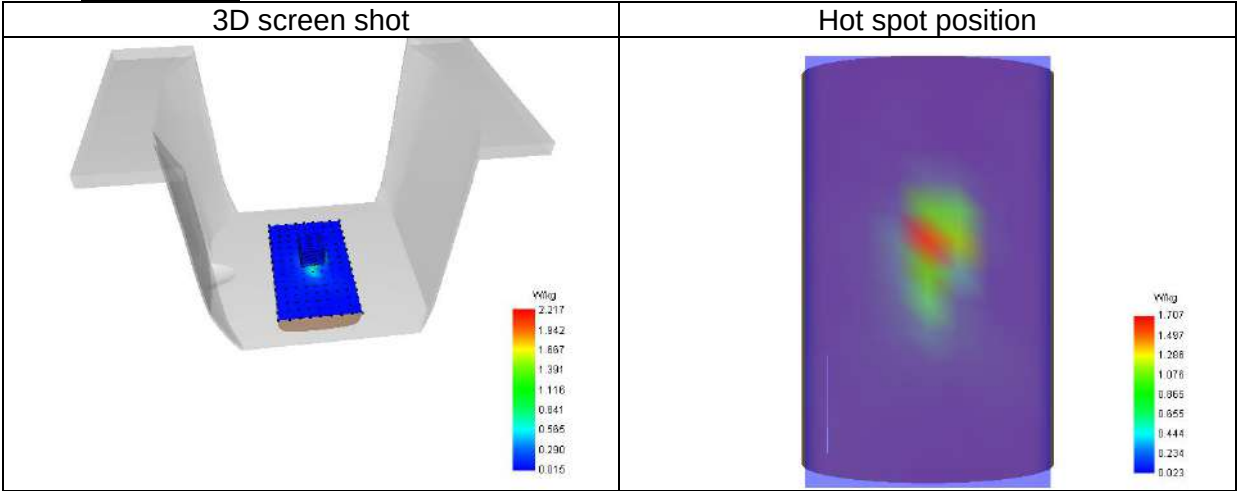
SAR 10g (W/Kg)	0.317
SAR 1g (W/Kg)	1.174
Variation (%)	-1.15
Horizontal validation criteria: minimum distance (mm)	5.66
Vertical validation criteria: SAR ratio M2/M1 (%)	49.44

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.0	12.0	14.0	16.0	18.0	20.0	22.0
						0	0	0	0	0	0	0
SAR (W/Kg)	3.96	2.21	0.53	0.55	0.16	0.13	0.06	0.06	0.04	0.04	0.03	0.03
	4	7	2	0	5	3	2	0	7	8	3	8



F. 3D Image



10# SAR Measurement at U-NII-3 (Body, Validation Plane)

Date of measurement: 30/10/2025

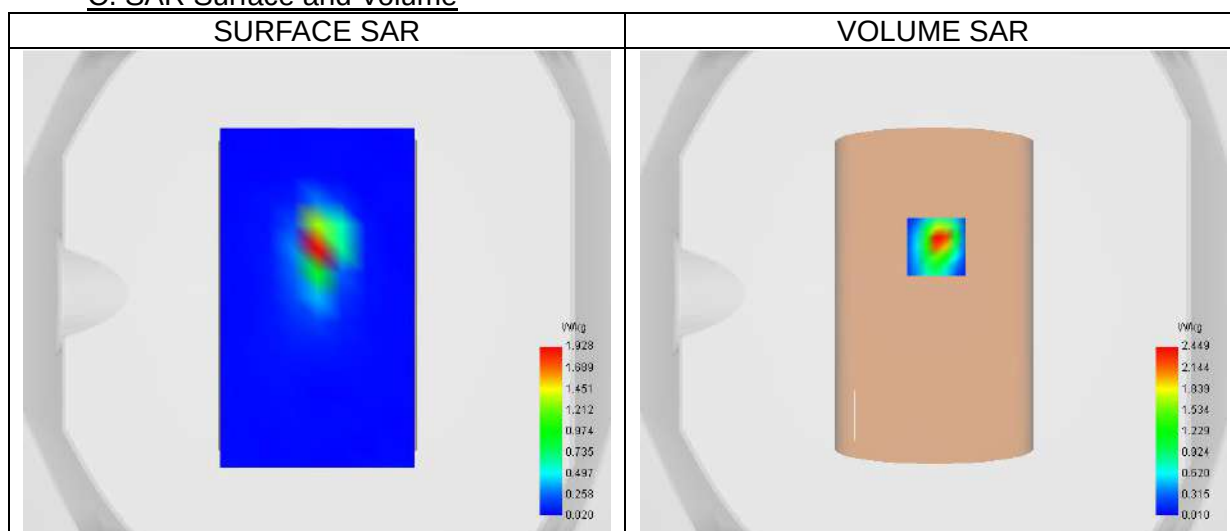
A. Experimental conditions.

Probe	0725-EPGO-448
ConvF	1.35
Area Scan	dx=10mm dy=10mm, Complete
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2.0mm,Complete
Phantom	Validation plane
Device Position	Body
Band	U-NII-3
Signal	IEEE 802.11 a
Channels/Frequency	Lower (149)/ frequency 5745.00 Mhz

B. Permittivity

Middle TX Frequency (MHz)	5745.00
Relative permittivity (real part)	35.58
Relative permittivity (imaginary part)	16.32
Conductivity (S/m)	5.21

C. SAR Surface and Volume



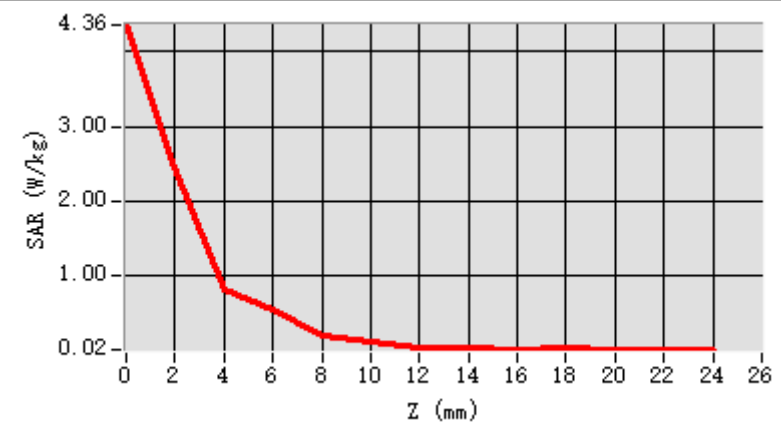
Maximum location: X=1.00, Y=19.00 ; SAR Peak: 4.80 W/kg

D. SAR 1g & 10g

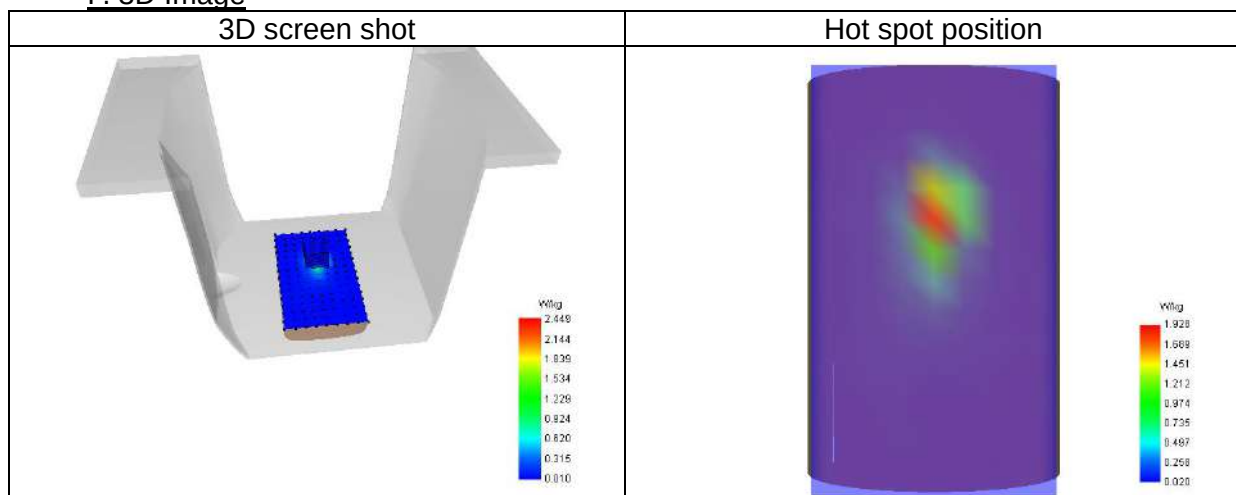
SAR 10g (W/Kg)	0.322
SAR 1g (W/Kg)	1.265
Variation (%)	0.47
Horizontal validation criteria: minimum distance (mm)	5.66
Vertical validation criteria: SAR ratio M2/M1 (%)	47.35

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.0	12.0	14.0	16.0	18.0	20.0	22.0
						0	0	0	0	0	0	0
SAR (W/Kg)	4.35	2.44	0.81	0.54	0.20	0.13	0.05	0.03	0.03	0.03	0.03	0.02
	8	9	0	4	4	0	3	6	1	4	3	0



F. 3D Image



11# SAR Measurement at U-NII-3 (Body, Validation Plane)

Date of measurement: 30/10/2025

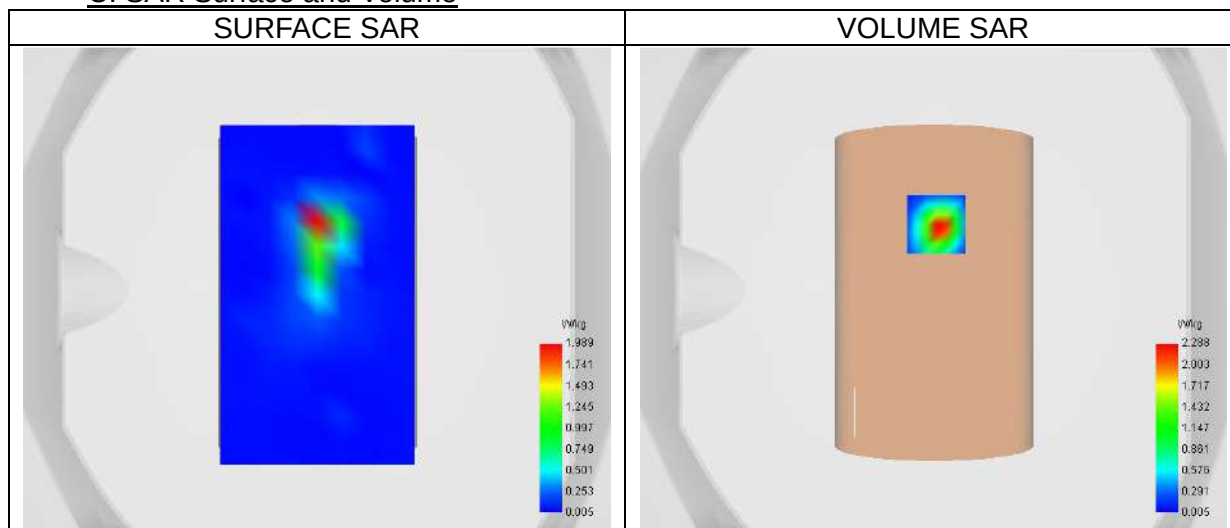
A. Experimental conditions.

Probe	0725-EPGO-448
ConvF	1.35
Area Scan	dx=10mm dy=10mm, Complete
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2.0mm,Complete
Phantom	Validation plane
Device Position	Body
Band	U-NII-3
Signal	IEEE 802.11 n
Channels/Frequency	Lower (149)/ frequency 5745.00 Mhz

B. Permittivity

Middle TX Frequency (MHz)	5745.00
Relative permittivity (real part)	35.58
Relative permittivity (imaginary part)	16.32
Conductivity (S/m)	5.21

C. SAR Surface and Volume



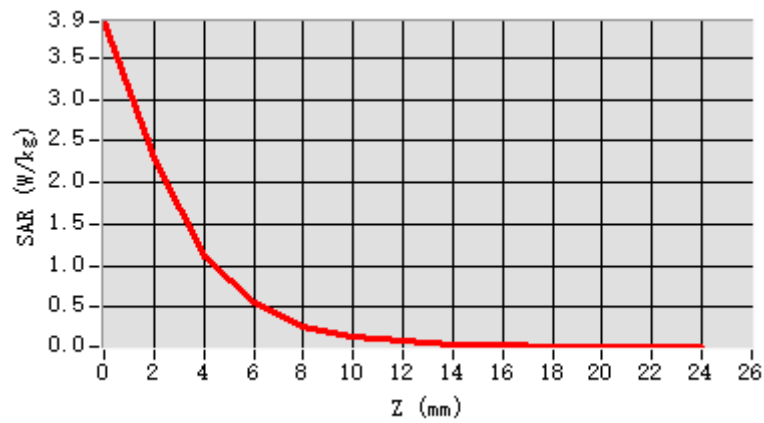
Maximum location: X=1.00, Y=27.00 ; SAR Peak: 4.48 W/kg

D. SAR 1g & 10g

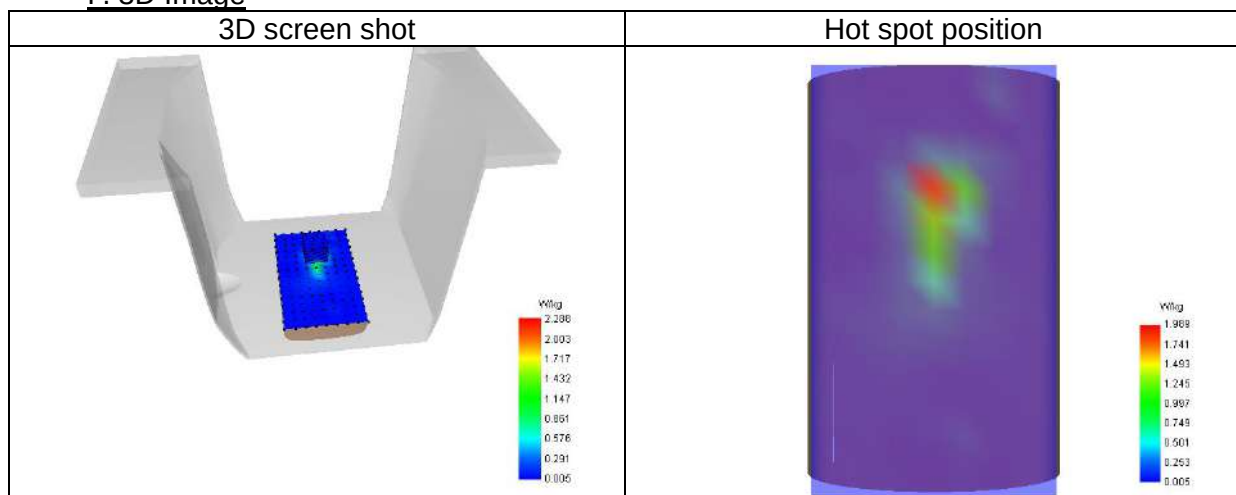
SAR 10g (W/Kg)	0.325
SAR 1g (W/Kg)	1.210
Variation (%)	-0.24
Horizontal validation criteria: minimum distance (mm)	5.66
Vertical validation criteria: SAR ratio M2/M1 (%)	48.21

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.0	12.0	14.0	16.0	18.0	20.0	22.0
						0	0	0	0	0	0	0
SAR (W/Kg)	3.93	2.28	1.10	0.55	0.26	0.14	0.08	0.04	0.03	0.02	0.02	0.03
	6	8	3	1	4	0	4	0	9	3	9	1



F. 3D Image



12# SAR Measurement at U-NII-3 (Body, Validation Plane)

Date of measurement: 30/10/2025

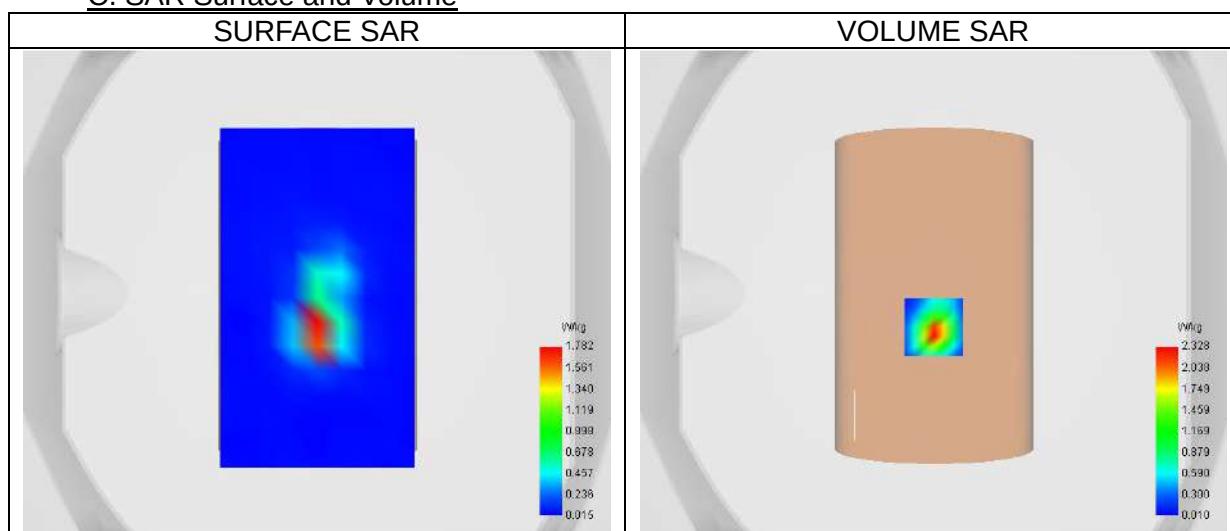
A. Experimental conditions.

Probe	0725-EPGO-448
ConvF	1.35
Area Scan	dx=10mm dy=10mm, Complete
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2.0mm,Complete
Phantom	Validation plane
Device Position	Body
Band	U-NII-3
Signal	IEEE 802.11 n
Channels/Frequency	Lower (149)/ frequency 5745.00 Mhz

B. Permittivity

Middle TX Frequency (MHz)	5745.00
Relative permittivity (real part)	35.58
Relative permittivity (imaginary part)	16.32
Conductivity (S/m)	5.21

C. SAR Surface and Volume



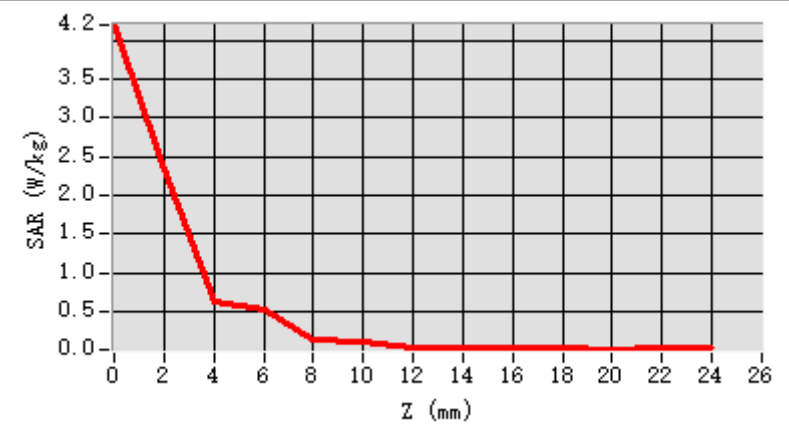
Maximum location: X=0.00, Y=-14.00 ; SAR Peak: 4.49 W/kg

D. SAR 1g & 10g

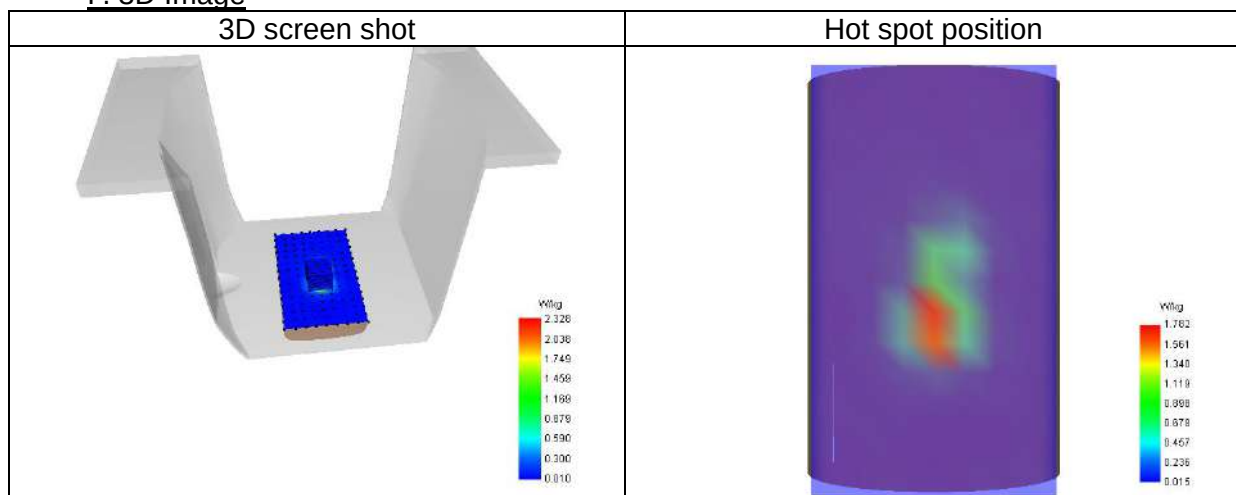
SAR 10g (W/Kg)	0.308
SAR 1g (W/Kg)	1.191
Variation (%)	-1.45
Horizontal validation criteria: minimum distance (mm)	8.00
Vertical validation criteria: SAR ratio M2/M1 (%)	46.81

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.0	12.0	14.0	16.0	18.0	20.0	22.0
						0	0	0	0	0	0	0
SAR (W/Kg)	4.19	2.32	0.63	0.52	0.15	0.12	0.04	0.03	0.02	0.03	0.01	0.03
	7	8	0	3	2	8	9	8	9	7	4	0



F. 3D Image



13# SAR Measurement at ISM (Body, Validation Plane)

Date of measurement: 28/10/2025

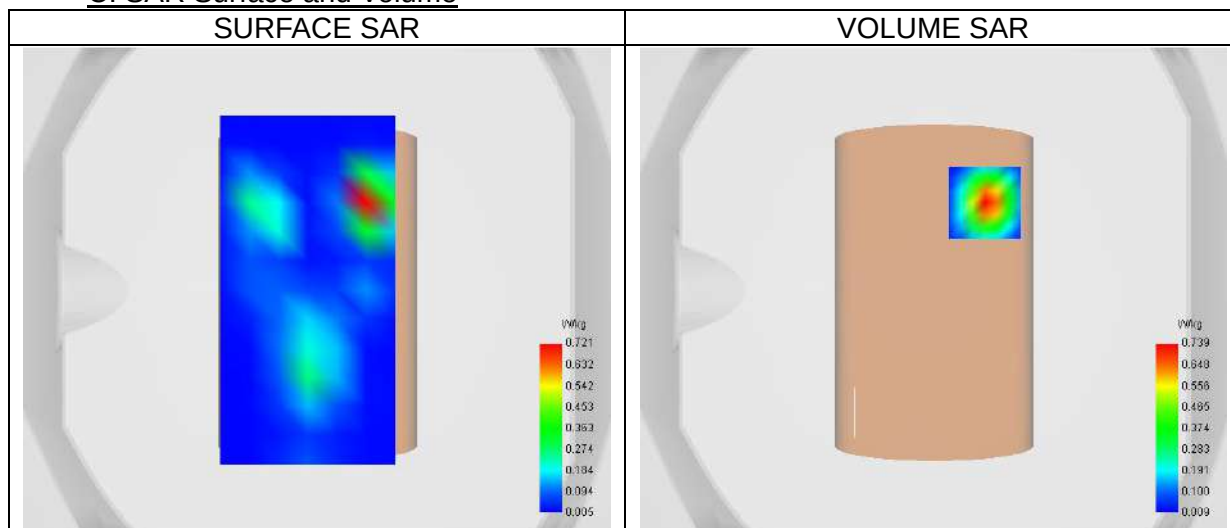
A. Experimental conditions.

Probe	0725-EPGO-448
ConvF	1.63
Area Scan	dx=12mm dy=12mm, Complete
Zoom Scan	7x7x7,dx=5mm dy=5mm dz=5.0mm,Complete
Phantom	Validation plane
Device Position	Body
Band	ISM
Signal	IEEE 802.11 n
Channels/Frequency	Middle (6)/ frequency 2437.00 Mhz

B. Permittivity

Middle TX Frequency (MHz)	2437.00
Relative permittivity (real part)	38.19
Relative permittivity (imaginary part)	13.56
Conductivity (S/m)	1.84

C. SAR Surface and Volume



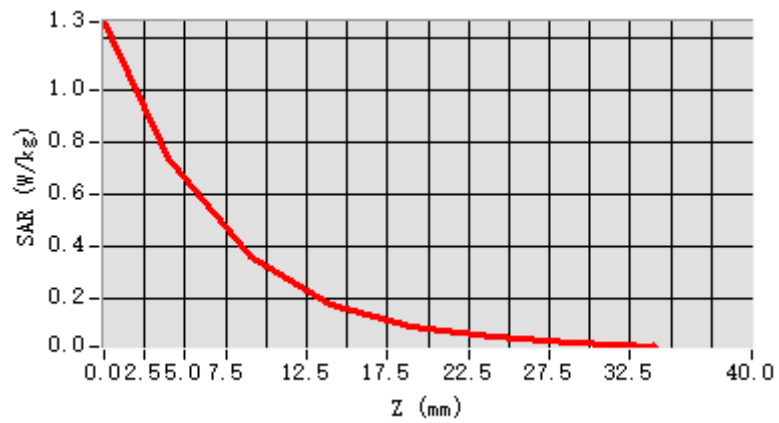
Maximum location: X=21.00, Y=36.00 ; SAR Peak: 1.25 W/kg

D. SAR 1g & 10g

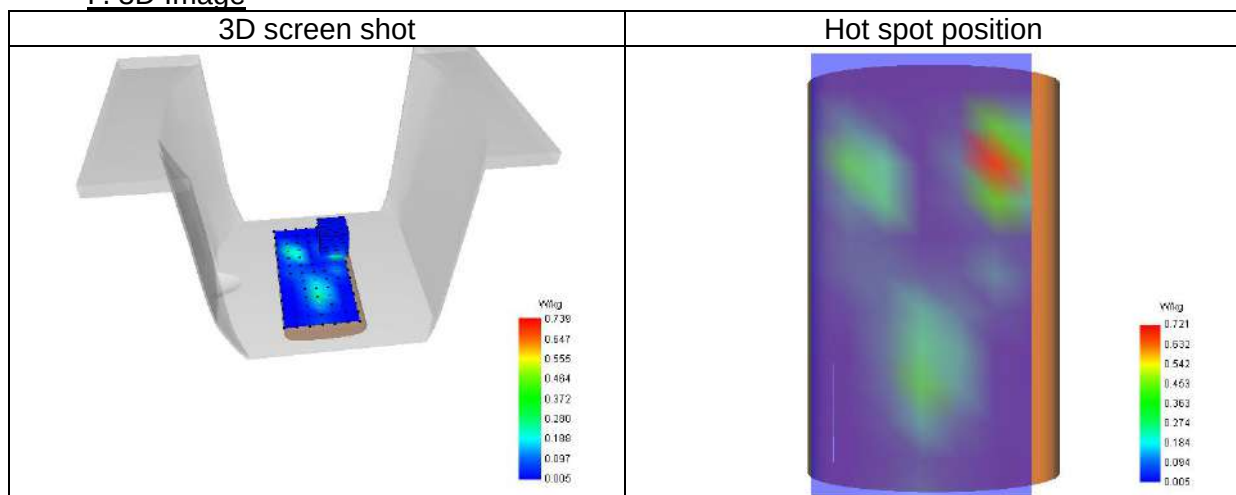
SAR 10g (W/Kg)	0.265
SAR 1g (W/Kg)	0.655
Variation (%)	0.91
Horizontal validation criteria: minimum distance (mm)	10.00
Vertical validation criteria: SAR ratio M2/M1 (%)	48.78

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.260	0.739	0.360	0.182	0.097	0.052	0.030



F. 3D Image



14# SAR Measurement at ISM (Body, Validation Plane)

Date of measurement: 28/10/2025

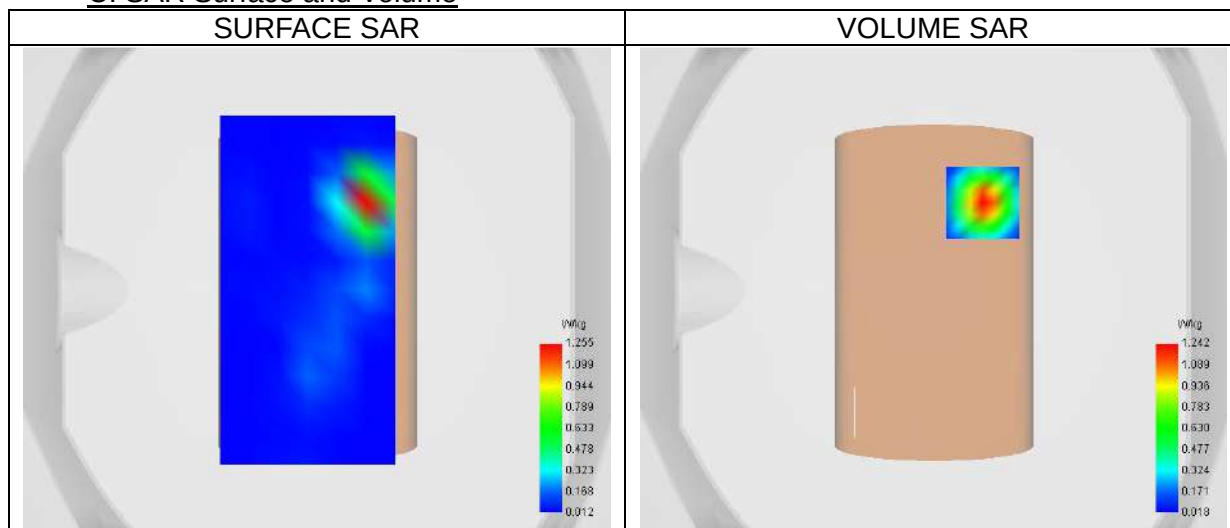
A. Experimental conditions.

Probe	0725-EPGO-448
ConvF	1.63
Area Scan	dx=12mm dy=12mm, Complete
Zoom Scan	7x7x7,dx=5mm dy=5mm dz=5.0mm,Complete
Phantom	Validation plane
Device Position	Body
Band	ISM
Signal	IEEE 802.11 b
Channels/Frequency	Lower (1)/ frequency 2412.00 Mhz

B. Permittivity

Middle TX Frequency (MHz)	2412.00
Relative permittivity (real part)	38.23
Relative permittivity (imaginary part)	13.59
Conductivity (S/m)	1.82

C. SAR Surface and Volume



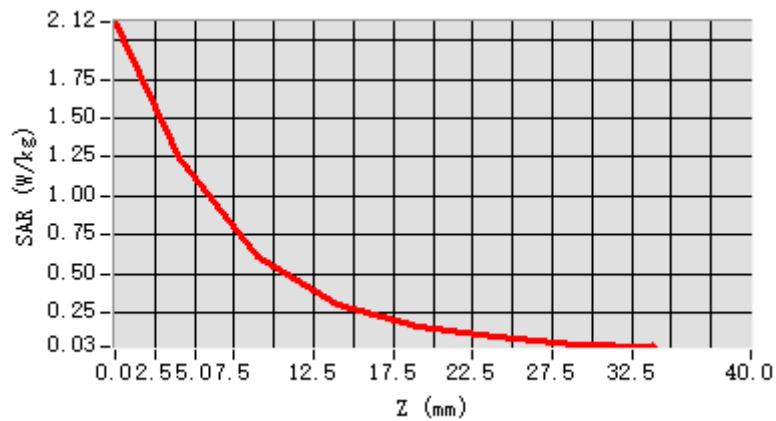
Maximum location: X=20.00, Y=36.00 ; SAR Peak: 2.10 W/kg

D. SAR 1g & 10g

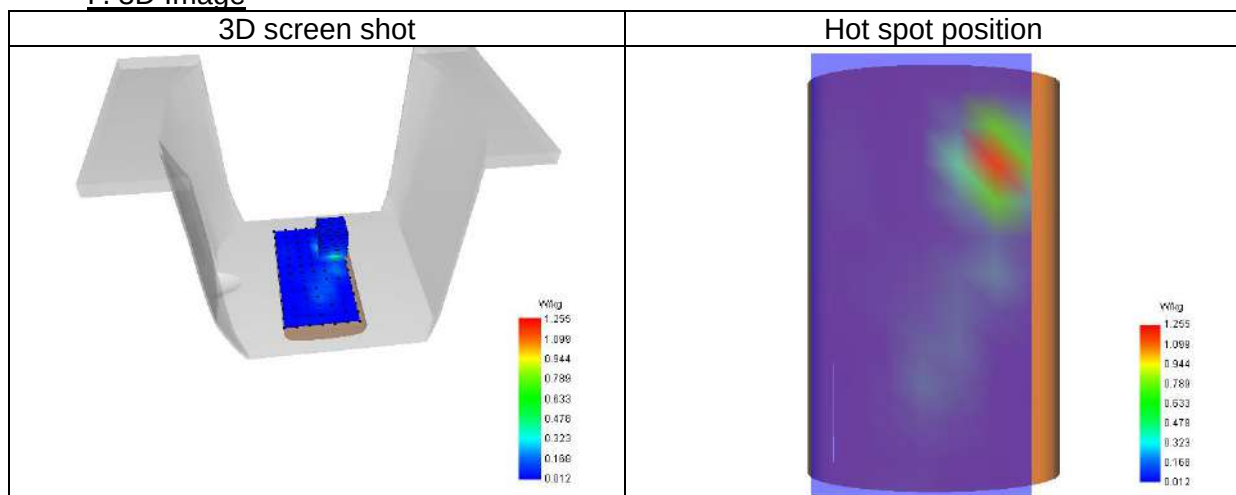
SAR 10g (W/Kg)	0.476
SAR 1g (W/Kg)	1.126
Variation (%)	3.61
Horizontal validation criteria: minimum distance (mm)	10.00
Vertical validation criteria: SAR ratio M2/M1 (%)	48.82

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	2.117	1.242	0.606	0.307	0.161	0.092	0.050



F. 3D Image



15# SAR Measurement at ISM (Body, Validation Plane)

Date of measurement: 28/10/2025

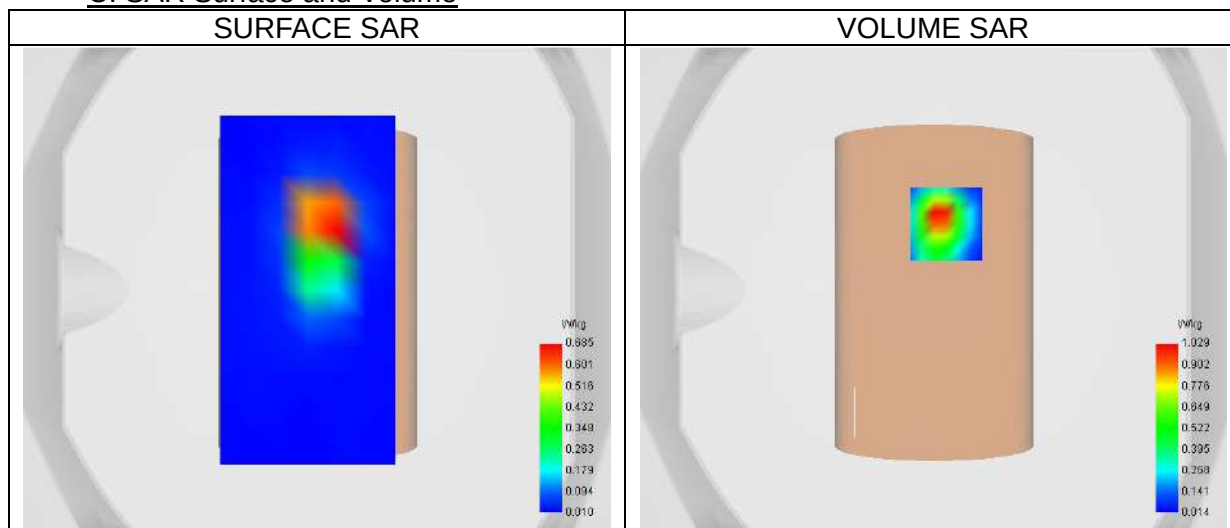
A. Experimental conditions.

Probe	0725-EPGO-448
ConvF	1.63
Area Scan	dx=12mm dy=12mm, Complete
Zoom Scan	7x7x7,dx=5mm dy=5mm dz=5.0mm,Complete
Phantom	Validation plane
Device Position	Body
Band	ISM
Signal	IEEE 802.11 b
Channels/Frequency	Lower (1)/ frequency 2412.00 Mhz

B. Permittivity

Middle TX Frequency (MHz)	2412.00
Relative permittivity (real part)	38.23
Relative permittivity (imaginary part)	13.59
Conductivity (S/m)	1.82

C. SAR Surface and Volume



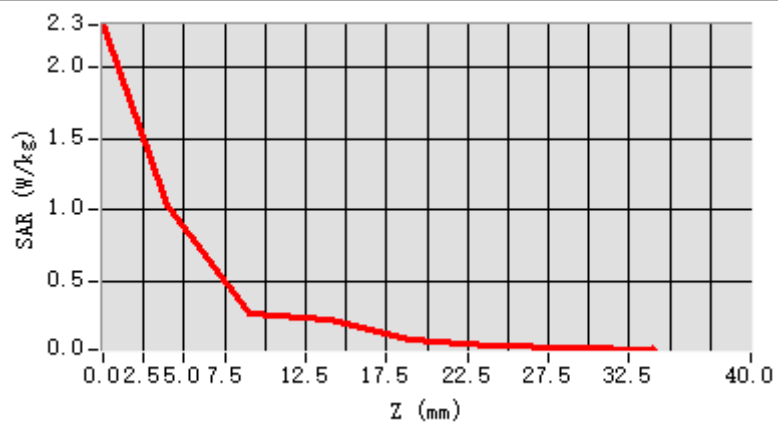
Maximum location: X=5.00, Y=27.00 ; SAR Peak: 1.87 W/kg

D. SAR 1g & 10g

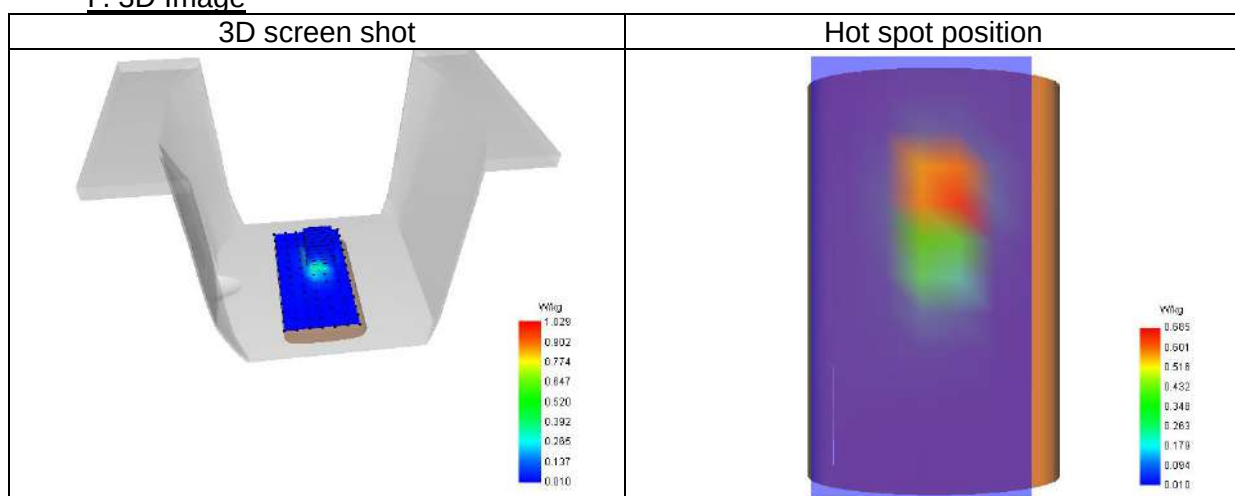
SAR 10g (W/Kg)	0.358
SAR 1g (W/Kg)	0.924
Variation (%)	1.98
Horizontal validation criteria: minimum distance (mm)	7.07
Vertical validation criteria: SAR ratio M2/M1 (%)	46.88

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	2.293	1.029	0.268	0.229	0.095	0.056	0.035



F. 3D Image



16# SAR Measurement at ISM (Body, Validation Plane)

Date of measurement: 28/10/2025

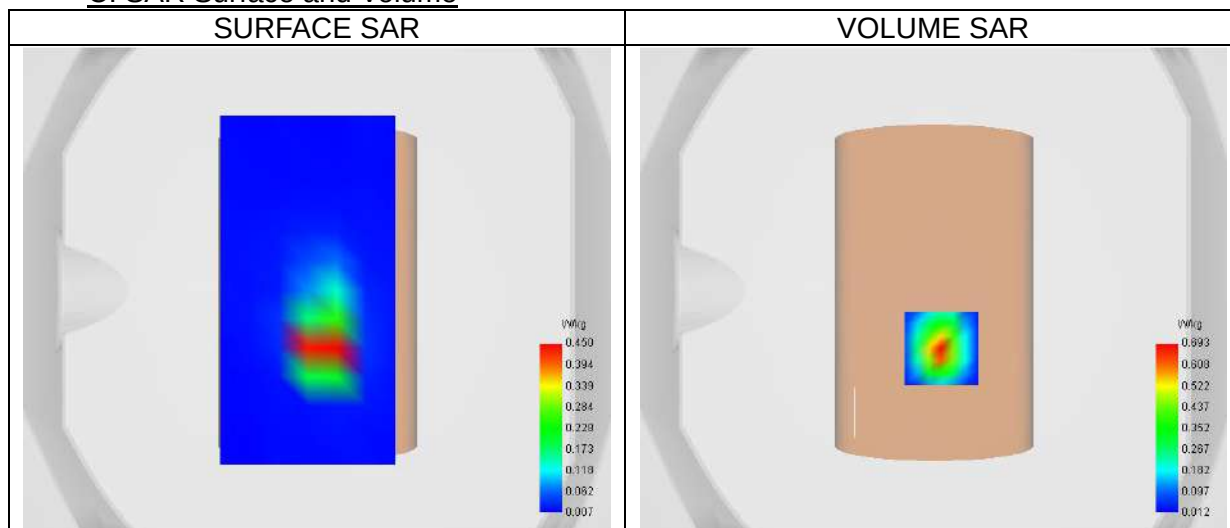
A. Experimental conditions.

Probe	0725-EPGO-448
ConvF	1.63
Area Scan	dx=12mm dy=12mm, Complete
Zoom Scan	7x7x7,dx=5mm dy=5mm dz=5.0mm,Complete
Phantom	Validation plane
Device Position	Body
Band	ISM
Signal	IEEE 802.11 b
Channels/Frequency	Middle (6)/ frequency 2437.00 Mhz

B. Permittivity

Middle TX Frequency (MHz)	2437.00
Relative permittivity (real part)	38.19
Relative permittivity (imaginary part)	13.56
Conductivity (S/m)	1.84

C. SAR Surface and Volume



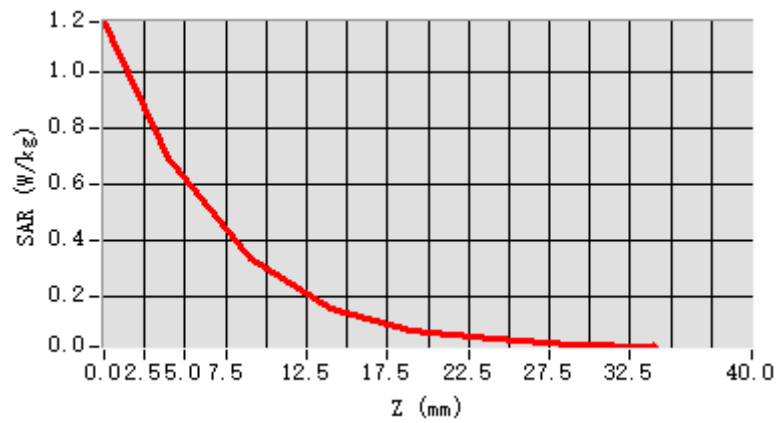
Maximum location: X=3.00, Y=-24.00 ; SAR Peak: 1.18 W/kg

D. SAR 1g & 10g

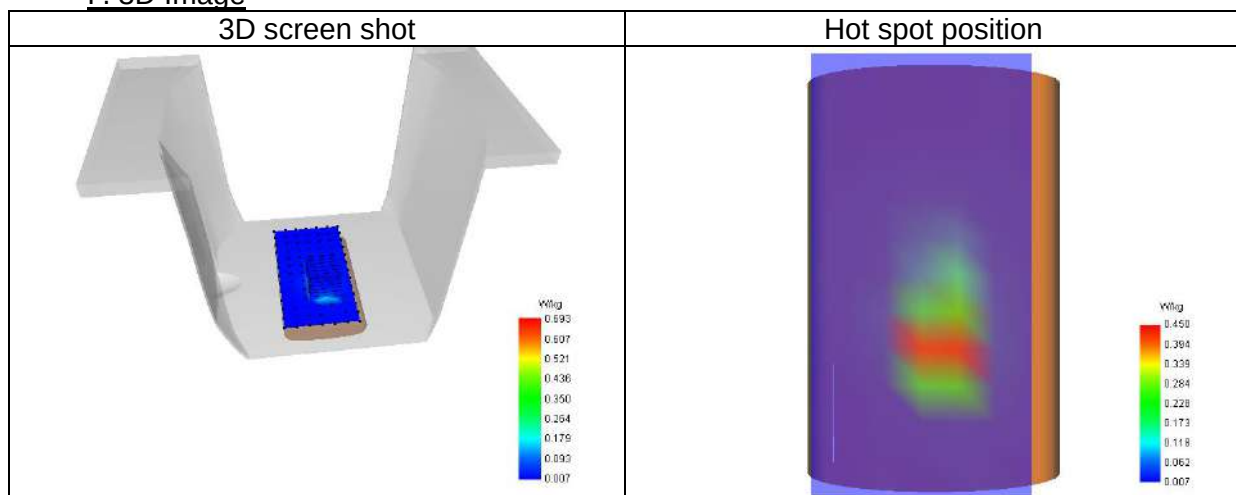
SAR 10g (W/Kg)	0.226
SAR 1g (W/Kg)	0.586
Variation (%)	1.01
Horizontal validation criteria: minimum distance (mm)	10.00
Vertical validation criteria: SAR ratio M2/M1 (%)	48.11

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.181	0.693	0.333	0.156	0.077	0.047	0.028



F. 3D Image



17# SAR Measurement at ISM (Body, Validation Plane)

Date of measurement: 28/10/2025

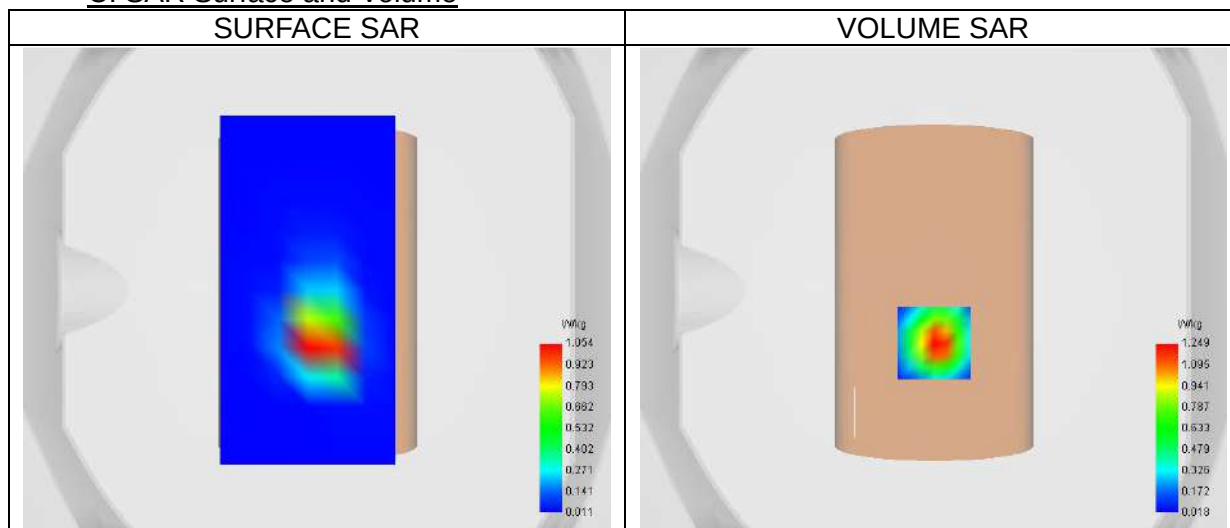
A. Experimental conditions.

Probe	0725-EPGO-448
ConvF	1.63
Area Scan	dx=12mm dy=12mm, Complete
Zoom Scan	7x7x7,dx=5mm dy=5mm dz=5.0mm,Complete
Phantom	Validation plane
Device Position	Body
Band	ISM
Signal	IEEE 802.11 b
Channels/Frequency	Lower (1)/ frequency 2412.00 Mhz

B. Permittivity

Middle TX Frequency (MHz)	2412.00
Relative permittivity (real part)	38.23
Relative permittivity (imaginary part)	13.59
Conductivity (S/m)	1.82

C. SAR Surface and Volume



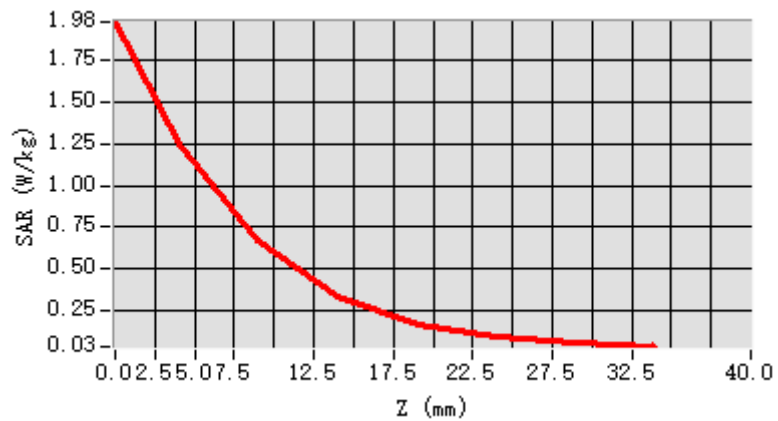
Maximum location: X=0.00, Y=-22.00 ; SAR Peak: 2.02 W/kg

D. SAR 1g & 10g

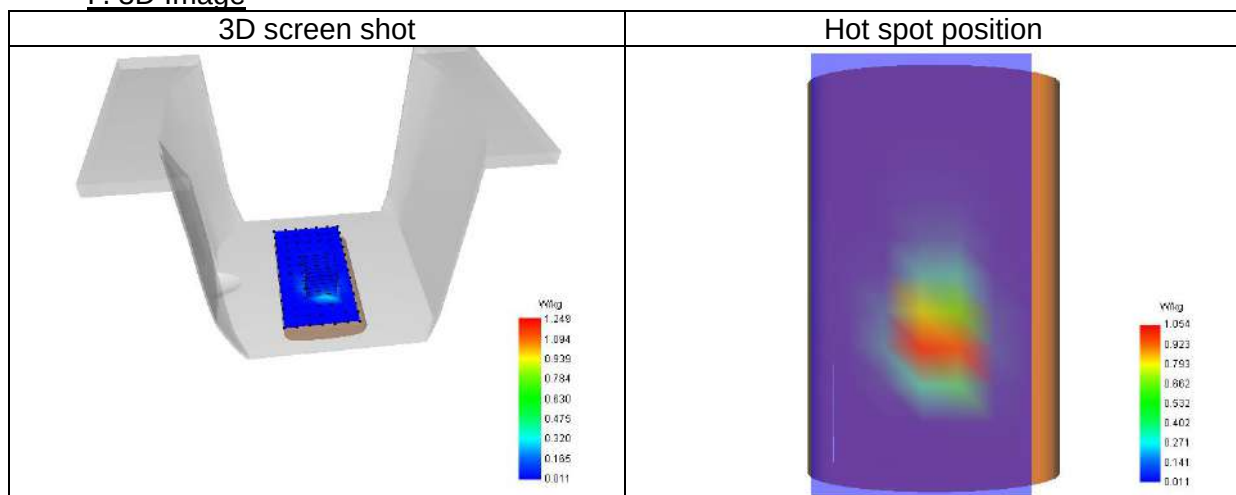
SAR 10g (W/Kg)	0.503
SAR 1g (W/Kg)	1.149
Variation (%)	2.99
Horizontal validation criteria: minimum distance (mm)	10.00
Vertical validation criteria: SAR ratio M2/M1 (%)	53.33

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.979	1.249	0.666	0.336	0.169	0.093	0.052



F. 3D Image



18# SAR Measurement at ISM (Body, Validation Plane)

Date of measurement: 28/10/2025

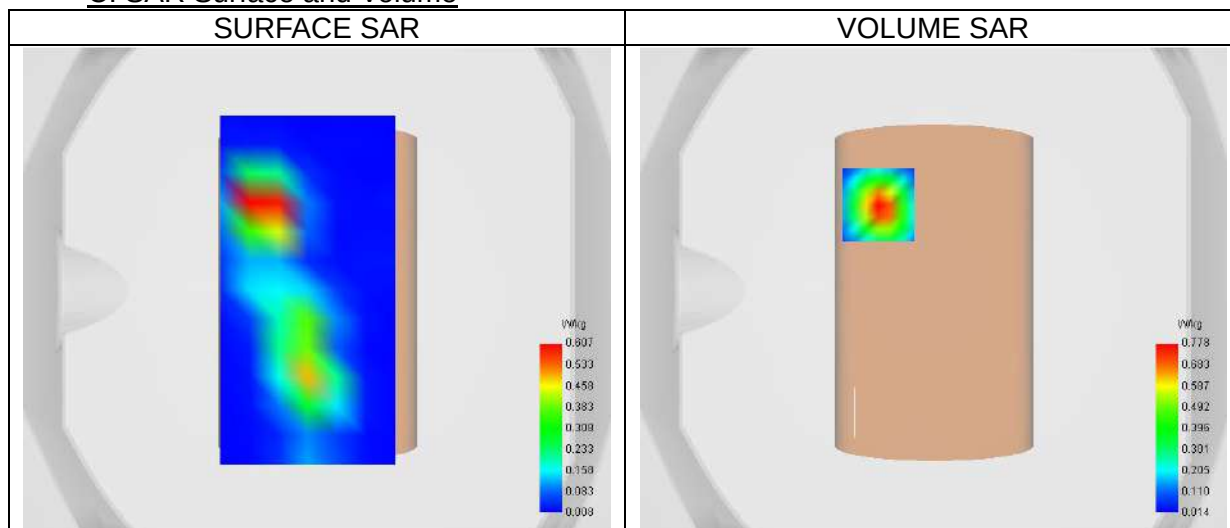
A. Experimental conditions.

Probe	0725-EPGO-448
ConvF	1.63
Area Scan	dx=12mm dy=12mm, Complete
Zoom Scan	7x7x7,dx=5mm dy=5mm dz=5.0mm,Complete
Phantom	Validation plane
Device Position	Body
Band	ISM
Signal	IEEE 802.11 n
Channels/Frequency	Middle (6)/ frequency 2437.00 Mhz

B. Permittivity

Middle TX Frequency (MHz)	2437.00
Relative permittivity (real part)	38.19
Relative permittivity (imaginary part)	13.56
Conductivity (S/m)	1.84

C. SAR Surface and Volume



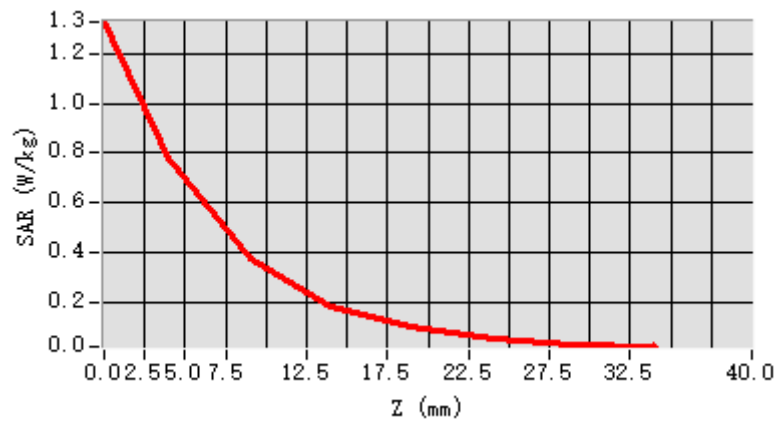
Maximum location: X=-23.00, Y=35.00 ; SAR Peak: 1.32 W/kg

D. SAR 1g & 10g

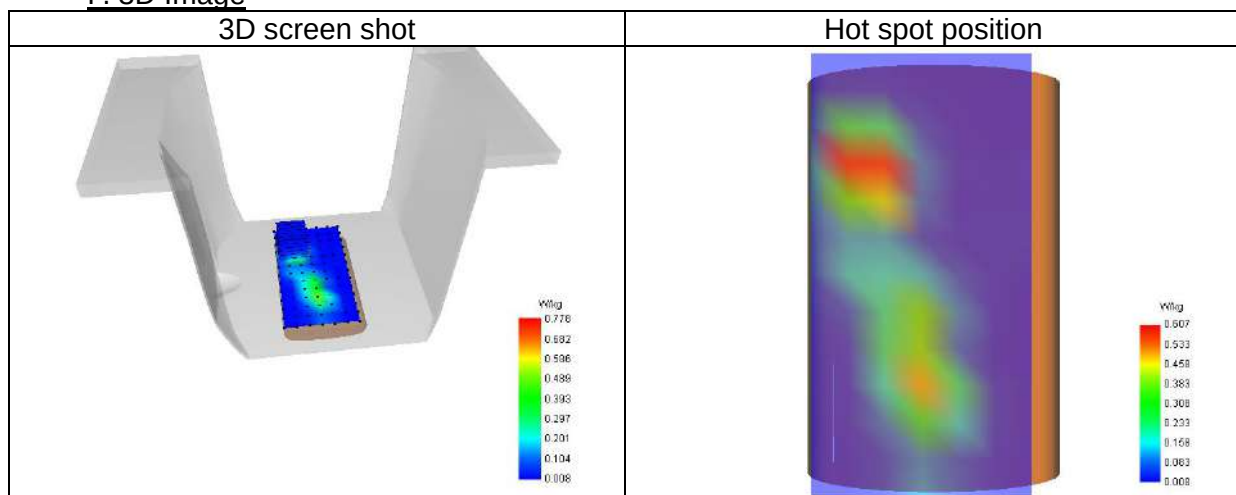
SAR 10g (W/Kg)	0.305
SAR 1g (W/Kg)	0.665
Variation (%)	-1.29
Horizontal validation criteria: minimum distance (mm)	10.00
Vertical validation criteria: SAR ratio M2/M1 (%)	48.71

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	1.326	0.778	0.379	0.188	0.100	0.054	0.033



F. 3D Image



13. Appendix D. Calibration Certificate

Table of contents
E Field Probe - 0725-EPGO-448
2450 MHz Dipole - SN 03/15 DIP 2G450-352
5000-6000 MHz Dipole - SN 13/14 WGA 33
<Justification of the extended calibration>

DocuSign Envelope ID: 8D8CB647-C2B4-4414-A550-C6E3F74EB7AD



COMOSAR E-Field Probe Calibration Report

Ref : ACR.108.1.25.BES.A

SHENZHEN NTEK TESTING TECHNOLOGY CO., LTD.

BUILDING E, FENDA SCIENCE PARK, SANWEI
COMMUNITY, XIXIANG STREET,
BAO'AN DISTRICT, SHENZHEN GUANGDONG, CHINA
MVG COMOSAR DOSIMETRIC E-FIELD PROBE
SERIAL NO.: 0725-EPGO-448

Calibrated at MVG

Z.I. de la pointe du diable

Technopôle Brest Iroise – 295 avenue Alexis de Rochon
29280 PLOUZANE - FRANCE

Calibration date: 04/15/2025



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

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Summary:

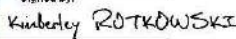
This document presents the method and results from an accredited COMOSAR Dosimetric E-Field Probe calibration performed at MVG, using the CALIPROBE test bench, for use with a MVG COMOSAR system only. The test results covered by accreditation are traceable to the International System of Units (SI).

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.108.125.BES.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by:</i>	Pedro Ruiz	Technical Manager	4/18/2025	
<i>Checked & approved by:</i>	Pedro Ruiz	Technical Manager	4/18/2025	
<i>Authorized by:</i>	Kim Rutkowski	Quality Manager	4/23/2025	Signed by:  25068547AD17431...

	<i>Customer Name</i>
<i>Distribution:</i>	SHENZHEN NTEK TESTING TECHNOLOGY CO., LTD.

<i>Issue</i>	<i>Name</i>	<i>Date</i>	<i>Modifications</i>
A	Pedro Ruiz	4/18/2025	Initial release

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.108.125.BES.A

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.108.125.BES.A

1 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR DOSIMETRIC E FIELD PROBE
Manufacturer	MVG
Model	SSE2
Serial Number	0725-EPGO-448
Product Condition (new / used)	New
Frequency Range of Probe	0.15 GHz-7.5GHz
Resistance of Three Dipoles at Connector	Dipole 1: R1=0.191 MΩ Dipole 2: R2=0.212 MΩ Dipole 3: R3=0.208 MΩ

2 PRODUCT DESCRIPTION

2.1 GENERAL INFORMATION

MVG's COMOSAR E field Probes are built in accordance to the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards.



Figure 1 – MVG COMOSAR Dosimetric E field Probe

Probe Length	330 mm
Length of Individual Dipoles	2 mm
Maximum external diameter	8 mm
Probe Tip External Diameter	2.5 mm
Distance between dipoles / probe extremity	1 mm

3 MEASUREMENT METHOD

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards provide recommended practices for the probe calibrations, including the performance characteristics of interest and methods by which to assess their effect. All calibrations / measurements performed meet the fore-mentioned standards.

3.1 SENSITIVITY

The sensitivity factors of the three dipoles were determined using a two step calibration method (air and tissue simulating liquid) using waveguides as outlined in the standards for frequency range 600-7500MHz and using the calorimeter cell method (transfer method) as outlined in the standards for frequency 150-450 MHz.

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3.2 LINEARITY

The evaluation of the linearity was done in free space using the waveguide, performing a power sweep to cover the SAR range 0.01W/kg to 100W/kg.

3.3 ISOTROPY

The axial isotropy was evaluated by exposing the probe to a reference wave from a standard dipole with the dipole mounted under the flat phantom in the test configuration suggested for system validations and checks. The probe was rotated along its main axis from 0 to 360 degrees in 15-degree steps. The hemispherical isotropy is determined by inserting the probe in a thin plastic box filled with tissue-equivalent liquid, with the plastic box illuminated with the fields from a half wave dipole. The dipole is rotated about its axis (0°–180°) in 15° increments. At each step the probe is rotated about its axis (0°–360°).

3.4 BOUNDARY EFFECT

The boundary effect is defined as the deviation between the SAR measured data and the expected exponential decay in the liquid when the probe is oriented normal to the interface. To evaluate this effect, the liquid filled flat phantom is exposed to fields from either a reference dipole or waveguide. With the probe normal to the phantom surface, the peak spatial average SAR is measured and compared to the analytical value at the surface.

The boundary effect uncertainty can be estimated according to the following uncertainty approximation formula based on linear and exponential extrapolations between the surface and $d_{be} + d_{step}$ along lines that are approximately normal to the surface:

$$SAR_{uncertainty}[\%] = \Delta SAR_{be} \frac{(d_{be} + d_{step})^2}{2d_{step}} \frac{(\delta - d_{be}/\delta)^2}{\delta/2} \quad \text{for } (d_{be} + d_{step}) < 10 \text{ mm}$$

where

$SAR_{uncertainty}$	is the uncertainty in percent of the probe boundary effect
d_{be}	is the distance between the surface and the closest <i>zoom-scan</i> measurement point, in millimetre
Δ_{step}	is the separation distance between the first and second measurement points that are closest to the phantom surface, in millimetre, assuming the boundary effect at the second location is negligible
δ	is the minimum penetration depth in millimetres of the head tissue-equivalent liquids defined in this standard, i.e., $\delta \approx 14 \text{ mm}$ at 3 GHz;
ΔSAR_{be}	in percent of SAR is the deviation between the measured SAR value, at the distance d_{be} from the boundary, and the analytical SAR value.

The measured worst case boundary effect SARuncertainty[%] for scanning distances larger than 4mm is 1.0% Limit ,2%).

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.108.125.BES.A

3.5 PROBE MODULATION RESPONSE

MVG's probe were evaluated experimentally with various modulated signal and the deviation from CW response were found neglectable in the used power range of the probe. So the correction to taking into account the linearization parameters for different modulation is null, therefore the CW factor given in this report can be used whatever the measured modulation

4 MEASUREMENT UNCERTAINTY

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty associated with a SAR probe calibration using the waveguide or calorimetric cell technique depending on the frequency.

The estimated expanded uncertainty (k=2) in calibration for SAR (W/kg) is +/-11% for the frequency range 150-450MHz.

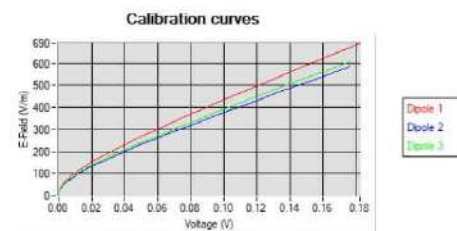
The estimated expanded uncertainty (k=2) in calibration for SAR (W/kg) is +/-14% for the frequency range 600-7500MHz.

5 CALIBRATION RESULTS

Ambient condition	
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

5.1 CALIBRATION IN AIR

The following curve represents the measurement in waveguide of the voltage picked up by the probe toward the E-field generated inside the waveguide.



From this curve, the sensitivity in air is calculated using the below formula.

$$E^2 = \sum_{i=1}^3 \frac{V_i (1 + V_i / DCP_i)}{Norm_i}$$

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where

V_i =voltage readings on the 3 channels of the probe

DCPi=diode compression point given below for the 3 channels of the probe

Normi=dipole sensitivity given below for the 3 channels of the probe

Normx dipole 1 ($\mu\text{V}/(\text{V}/\text{m})^2$)	Normy dipole 2 ($\mu\text{V}/(\text{V}/\text{m})^2$)	Normz dipole 3 ($\mu\text{V}/(\text{V}/\text{m})^2$)
1.03	1.37	1.26

DCP dipole 1 (mV)	DCP dipole 2 (mV)	DCP dipole 3 (mV)
109	107	108

5.2 CALIBRATION IN LIQUID

The calorimeter cell or the waveguide is used to determine the calibration in liquid using the formula below.

$$\text{ConvF} = \frac{E_{\text{liquid}}^2}{E_{\text{air}}^2}$$

The E-field in the liquid is determined from the SAR measurement according to the below formula.

$$E_{\text{liquid}}^2 = \frac{\rho \text{ SAR}}{\sigma}$$

where

σ =the conductivity of the liquid

ρ =the volumetric density of the liquid

SAR=the SAR measured from the formula that depends on the setup used. The SAR formulas are given below

For the calorimeter cell (150-450 MHz), the formula is:

$$\text{SAR} = c \frac{dT}{dt}$$

where

c =the specific heat for the liquid

dT/dt =the temperature rises over the time

For the waveguide setup (600-75000 MHz), the formula is:

$$\text{SAR} = \frac{4P_W}{ab\delta} e^{-\frac{2z}{\delta}}$$

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

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where

a=the larger cross-sectional of the waveguide

b=the smaller cross-sectional of the waveguide

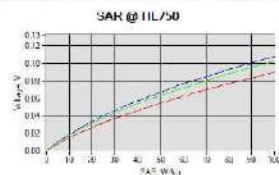
δ =the skin depth for the liquid in the waveguide

Pw=the power delivered to the liquid

The below table summarize the ConvF for the calibrated liquid. The curves give examples for the measured SAR depending on the voltage in some liquid.

Liquid	Frequency (MHz)	ConvF
HL750	750	1.39
HL850	850	1.32
HL900	900	1.33
HL1800	1800	1.50
HL1900	1900	1.58
HL2000	2000	1.63
HL2300	2300	1.64
HL2450	2450	1.63
HL2600	2600	1.52
HL3300	3300	1.36
HL3500	3500	1.39
HL3700	3700	1.35
HL3900	3900	1.41
HL4200	4200	1.58
HL4600	4600	1.61
HL4900	4900	1.38
HL5200	5200	1.37
HL5400	5400	1.37
HL5600	5600	1.36
HL5800	5800	1.35

(*) Frequency validity is +650MHz below 600MHz, +700MHz from 600MHz to 6GHz and +700MHz above 6GHz



Slope 1
Slope 2
Slope 3



Slope 1
Slope 2
Slope 3

6 VERIFICATION RESULTS

The figures below represent the measured linearity and axial isotropy for this probe. The probe specification is +/-0.2 dB for linearity and +/-0.15 dB for axial isotropy.

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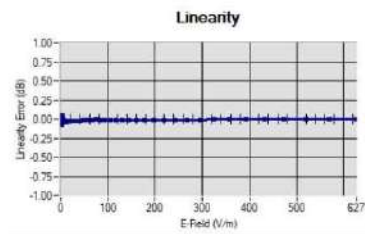
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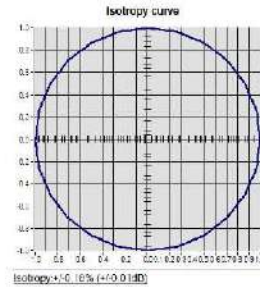


COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR108.125.BES.A



Linearity $\pm 1.54\%$ ($\pm 0.07\text{dB}$)



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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.108.125.BES.A

7 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
CALIPROBE Test Bench	Version 2	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2026
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	07/2022	07/2027
Multimeter	Keithley 2000	4013982	02/2023	02/2026
Signal Generator	Rohde & Schwarz SMB	183277	05/2022	05/2026
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2021	06/2026
USB Sensor	Keysight U2000A	SN: MY62340002	10/2024	10/2027
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Fluoroptic Thermometer	LumaSense Luxtron 812	94264	09/2022	09/2025
Coaxial cell	MVG	SN 32/16 COAXCELL_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG2_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_0G800_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG4_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_0G900_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG6_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G500_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG8_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G800B_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_1G800H_1	Validated. No cal required.	Validated. No cal required.

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COMOSAR E-FIELD PROBE CALIBRATION REPORT

Ref: ACR.108.125.BES.A

Waveguide	MVG	SN 32/16 WG10_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_3G500_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG12_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_5G000_1	Validated. No cal required.	Validated. No cal required.
Waveguide	MVG	SN 32/16 WG14_1	Validated. No cal required.	Validated. No cal required.
Liquid transition	MVG	SN 32/16 WGLIQ_7G000_1	Validated. No cal required.	Validated. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44235403	02/2024	02/2027

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SAR Reference Dipole Calibration Report

Ref : ACR.53.29.24.BES.A

**SHENZHEN NTEK TESTING TECHNOLOGY
CO., LTD.**

**BUILDING E, FENDA SCIENCE PARK, SANWEI
COMMUNITY, XIXIANG STREET,
BAO'AN DISTRICT, SHENZHEN GUANGDONG, CHINA**

MVG COMOSAR REFERENCE DIPOLE

FREQUENCY: 2450 MHZ

SERIAL NO.: SN 03/15DIP2G450-352

Calibrated at MVG

Z.I. de la pointe du diable

Technopôle Brest Iroise – 295 avenue Alexis de Rochon

29280 PLOUZANE - FRANCE

Calibration date: 02/21/2024



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.



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.29.24.BES.A

	Name	Function	Date	Signature
Prepared by :	Pedro Ruiz	Measurement Responsible	2/22/2024	
Checked & approved by:	Jérôme Luc	Technical Manager	2/22/2024	
Authorized by:	Yann Toutain	Laboratory Director	2/27/2024	

Yann
Toutain ID

Signature
numérique de
Yann Toutain ID
Date : 2024.02.27
08:57:39 +01'00'

	Customer Name
Distribution :	SHENZHEN NTEK TESTING TECHNOLOGY CO., LTD.

Issue	Name	Date	Modifications
A	Pedro Ruiz	2/22/2024	Initial release



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.29.24.BES.A

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR-53.29.24.BES-A

1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 2450 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID2450
Serial Number	SN 03/15DIP2G450-352
Product Condition (new / used)	Used

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

MVG's COMOSAR Validation Dipoles are built in accordance to the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards. The product is designed for use with the COMOSAR test bench only.



Figure 1 – MVG COMOSAR Validation Dipole



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.29.24.BES.A

4 MEASUREMENT METHOD

4.1 MECHANICAL REQUIREMENTS

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards specify the mechanical components and dimensions of the validation dipoles, with the dimension's frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness. A direct method is used with a ISO17025 calibrated caliper.

4.2 S11 PARAMETER REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a S11 of -20 dB or better. The S11 measurement shall be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. A direct method is used with a network analyser and its calibration kit, both with a valid ISO17025 calibration.

4.3 SAR REQUIREMENTS

The IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore-mentioned standards.

5 MEASUREMENT UNCERTAINTY

5.1 MECHANICAL DIMENSIONS

For the measurement in the range 0-300mm, the estimated expanded uncertainty (k=2) in calibration for the dimension measurement in mm is +/-0.20 mm with respect to measurement conditions.

For the measurement in the range 300-450mm, the estimated expanded uncertainty (k=2) in calibration for the dimension measurement in mm is +/-0.44 mm with respect to measurement conditions.

5.2 S11 PARAMETER

The estimated expanded uncertainty (k=2) in calibration for the S11 parameter in linear is +/-0.08 with respect to measurement conditions.

5.3 SAR

The guidelines outlined in the IEC/IEEE 62209-1528 and FCC KDB865664 D01 standards were followed to generate the measurement uncertainty for validation measurements.

The estimated expanded uncertainty (k=2) in calibration for the 1g and 10g SAR measurement in W/kg is +/-19% with respect to measurement conditions.

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.29.24.BES.A

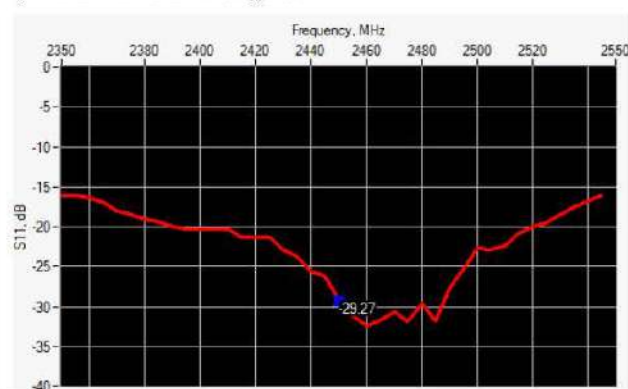
6 CALIBRATION RESULTS

6.1 MECHANICAL DIMENSIONS

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

6.2 S11 PARAMETER

6.2.1 S11 parameter in Head Liquid



Frequency (MHz)	S11 parameter (dB)	Requirement (dB)	Impedance
2450	-29.27	-20	$53.6\Omega + 0.1j\Omega$

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.

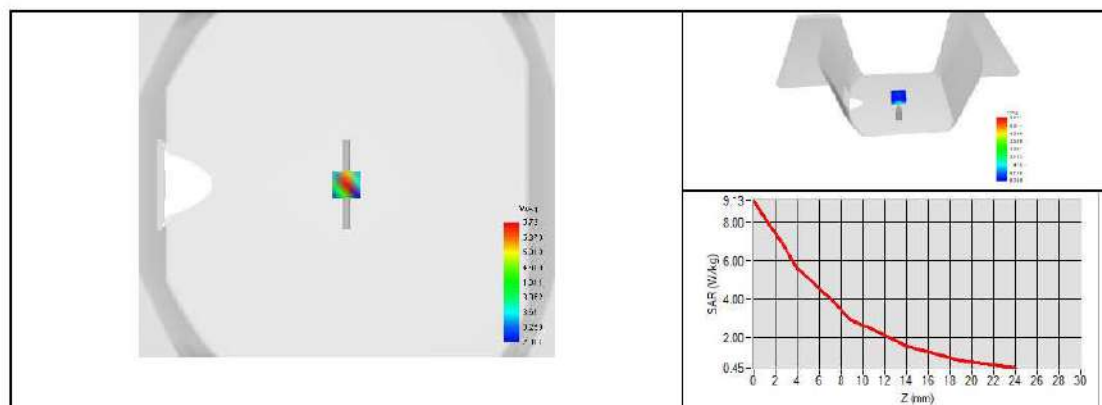


SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.29.24.BES.A

Software	OPENSAR V5
Phantom	SN 13/09 SAM68
Probe	3523-EPGO-429
Liquid	Head Liquid Values: ϵ_{ps} : 42.1 σ : 1.83
Distance between dipole center and liquid	10.0 mm
Area scan resolution	$dx=8mm/dy=8mm$
Zoon Scan Resolution	$dx=5mm/dy=5mm/dz=5mm$
Frequency	2450 MHz
Input power	20 dBm
Liquid Temperature	20 +/- 1 °C
Lab Temperature	20 +/- 1 °C
Lab Humidity	30-70 %

Frequency	1g SAR (W/kg)			10g SAR (W/kg)		
	Measured	Measured normalized to 1W	Target normalized to 1W	Measured	Measured normalized to 1W	Target normalized to 1W
2450 MHz	5.00	50.05	52.40	2.38	23.80	24.00





SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref.: ACR.53.29.24.BES.A

7 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN 13/09 SAM68	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rohde & Schwarz ZVM	100203	08/2021	08/2024
Network Analyzer – Calibration kit	Rohde & Schwarz ZV-Z235	101223	07/2022	07/2025
Calipers	Mitutoyo	SN 0009732	11/2022	11/2025
Reference Probe	MVG	3523-EPGO-429	11/2023	11/2024
Multimeter	Keithley 2000	4013982	02/2023	02/2026
Signal Generator	Rohde & Schwarz SMB	106589	03/2022	03/2025
Amplifier	MVG	MODU-023-C-0002	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	NI-USB 5680	170100013	06/2021	06/2024
Power Meter	Keysight U2000A	SN: MY62340002	10/2022	10/2025
Directional Coupler	Krytar 158020	131467	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature / Humidity Sensor	Testo 184 H1	44225320	06/2021	06/2024



SAR Reference Waveguide Calibration Report

Ref : ACR.53.31.24.BES.A

**SHENZHEN NTEK TESTING TECHNOLOGY
CO., LTD.**

**BUILDING E, FENDA SCIENCE PARK, SANWEI
COMMUNITY, XIXIANG STREET, BAO'AN
DISTRICT, SHENZHEN GUANGDONG, CHINA MVG
COMOSAR REFERENCE WAVEGUIDE**

**FREQUENCY: 5000-6000 MHZ
SERIAL NO.: SN 13/14 WGA 33**

Calibrated at MVG

Z.I. de la pointe du diable

**Technopôle Brest Iroise – 295 avenue Alexis de Rochon
29280 PLOUZANE - FRANCE**

Calibration date: 02/21/2024



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

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Summary:

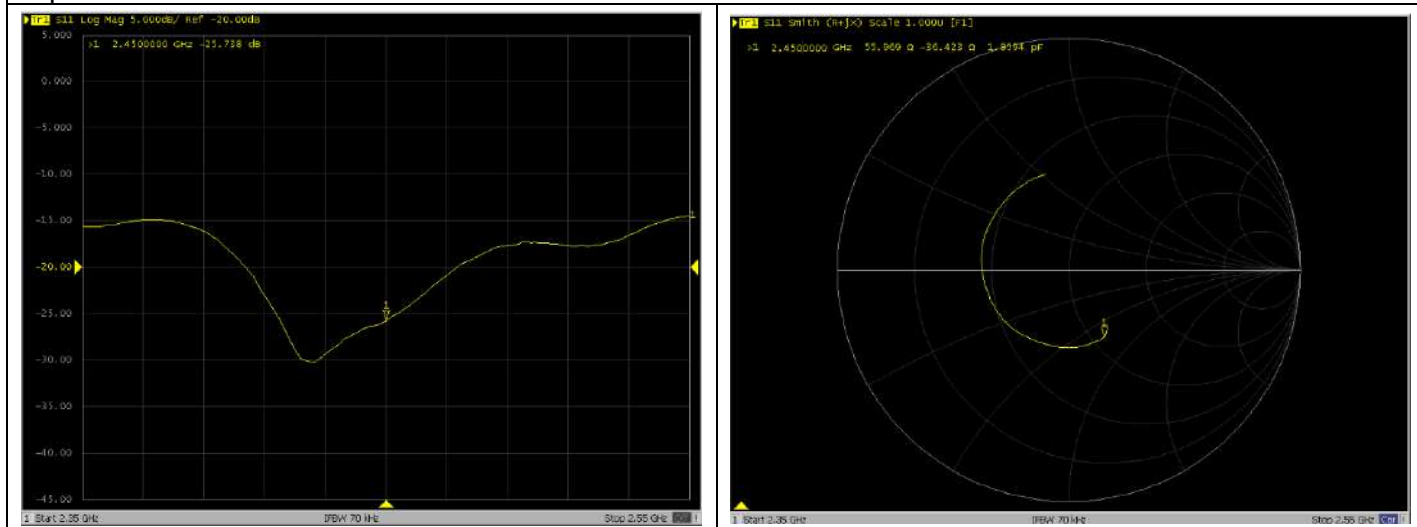
This document presents the method and results from an accredited SAR reference waveguide calibration performed at MVG, using the COMOSAR test bench. The test results covered by accreditation are traceable to the International System of Units (SI).

<Head 2450MHz>

Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)	Date of Measurement
-29.27	-	53.6	-	Feb. 21, 2024
-25.738	12.07	55.969	2.369	Feb. 13, 2025

The return loss is <-20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data

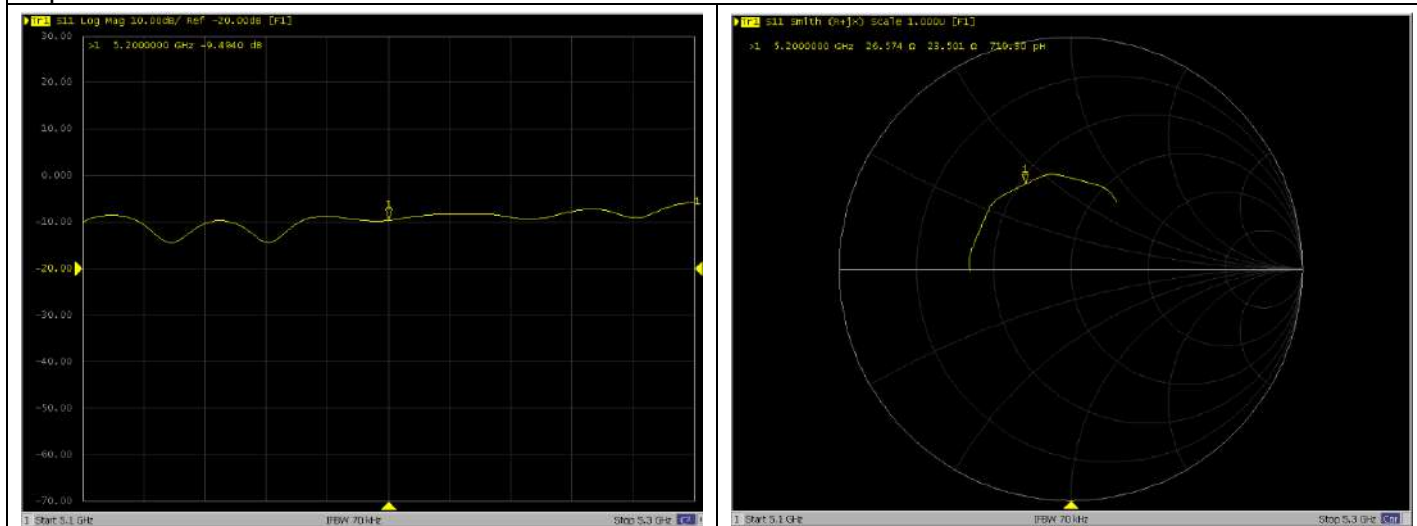


<Head 5200MHz>

Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)	Date of Measurement
-9.64	-	25.8	-	Feb. 21, 2024
-9.494	1.51	26.574	0.774	Feb. 13, 2025

The return loss is <-8dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data

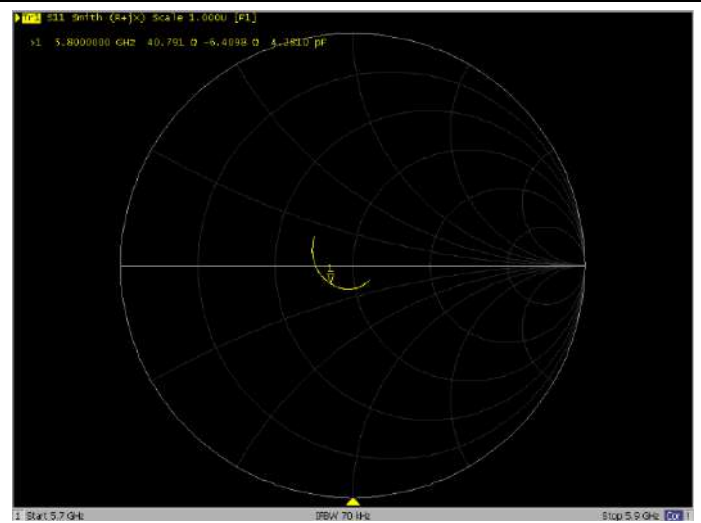
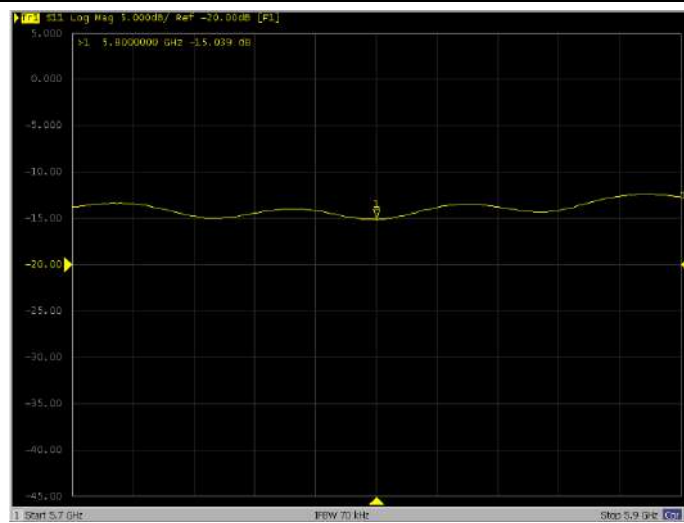


<Head 5800MHz>

Return Loss (dB)	Delta (%)	Impedance	Delta(ohm)	Date of Measurement
-14.91	-	38.53	-	Feb. 21, 2024
-15.039	0.865	40.791	2.261	Feb. 13, 2025

The return loss is <-8dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data



END