SAR TEST REPORT

Report No.:	20240917G17987X-W2
Product Name:	Beacon
Model Name:	ZZ-H-2-001
Trade Name:	ZERO ZERO ROBOTICS
FCC ID:	2AIDW-ZZ-H-2-001
Applicant:	Shenzhen Zero Zero Infinity Technology Co., Ltd.
Address:	4th Floor,Qianhai E-metro Tower,Shenzhen-Hong Kong Cooperation Zone, Shenzhen,China
Test Date:	2024/09/19~2024/09/22
Issued by:	CCIC Southern Testing Co., Ltd.
Lab Location:	Electronic Testing Building, No.43, Shahe Road, Xili Street, Nanshan District, Shenzhen, Guangdong, China
	Tel: 86-755-26627338 **E-Mail:** manager@ccic-set.com

Test Report

Applicant:	Shenzhen Zero Zero Infinity Technology Co., Ltd.
Applicant Address:	4th Floor,Qianhai E-metro Tower,Shenzhen-Hong Kong Cooperation Zone, Shenzhen,China
Manufacturer:	Shenzhen Zero Zero Infinity Technology Co., Ltd.
Manufacturer Address:	4th Floor,Qianhai E-metro Tower,Shenzhen-Hong Kong Cooperation Zone, Shenzhen,China
Test Standards:	**FCC 47 CFR Part 2(2.1093):** Radiofrequency Radiation Exposure Evaluation: Portable Devices **ANSI C95.1–1992:** Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.(IEEE Std C95.1-1991) **IEEE 1528–2013:** IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
Test Result:	Pass

Tested by: Carl Wei 2024-09-24

Carl Wei, Test Engineer

Reviewed by: Sun Jiaohui 2024-09-24

Sun Jiaohui, Senior Engineer

Approved by: Chris You 2024-09-24

Chris You, Manager

Contents

1. Administrative Data

1.1 Testing Laboratory

Test Site:	CCIC Southern Testing Co., Ltd.
Address:	Electronic Testing Building, No.43, Shahe Road, Xili Street, Nanshan District, Shenzhen, Guangdong, China
A2LA Lab Code:	CCIC-SET is a third party testing organization accredited by A2LA according to ISO/IEC 17025:2017. The accreditation certificate number is 5721.01
FCC Registration:	CCIC Southern Testing Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Designation Number: CN1283, valid time is until June.30, 2025.
ISED Registration:	CCIC Southern Testing Co., Ltd. EMC Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 11185A-1 on Aug. 04, 2016, valid time is until June.30, 2025.
Test Environment Condition:	Temperature (℃): 18℃ ~25℃ Relative Humidity (%): 35%~75% RH Atmospheric Pressure (kPa): 86KPa-106KPa

2. Equipment Under Test (EUT)

Identification of the Equipment under Test

Device type :	portable device	
Exposure category:	uncontrolled environment / general population	
Product Name:	Beacon	
Trade Name:	ZERO ZERO ROBOTICS	
Model Name:	ZZ-H-2-001	
Operating Band(s):	WIFI2.4G, WIFI5G, Bluetooth,	
Test Band(s):	WIFI2.4G, WIFI5G, Bluetooth,	
Test modulation:	WIFI 2.4G(DSSS, OFDM), WIFI 5G(OFDM), Bluetooth(GFSK)	
Tested frequency range(s)	transmitter frequency range	receiver frequency range
WIFI:	2412-2462 MHz	
	5150-5250 MHz	
	5725-5850 MHz	
Bluetooth:	2402-2480 MHz	
Hardware version :	RC100_MB_V20	
Software version :	0.0.3_20240923	
Antenna type :	Internal antenna	
Battery options :	Rated Capacity:940 mAh Rated Voltage: 3.85 V	
MAX. SAR Value:	Body: 0.726 W/Kg(1g SAR-5mm,Limit:1.6W/Kg)	

Note:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

3. SAR Summary

Highest Standalone SAR Summary

Exposure Position	Frequency Band	Scaled 1g-SAR(W/kg)	Highest Scaled 1g-SAR(W/kg)
Body (5mm Gap)	WIFI 2.4G ANT 1	0.620	0.726
	WIFI 2.4G ANT 2	0.726	
	WIFI 2.4G MIMO ANT 1+2	0.435	
	WIFI 5G U-NII 1 ANT 1	0.525	
	WIFI 5G U-NII 1 ANT 2	0.612	
	WIFI 5G U-NII 1 MIMO ANT 1+2	0.346	
	WIFI 5G U-NII 3 ANT 1	0.380	
	WIFI 5G U-NII 3 ANT 2	0.441	
	WIFI 5G U-NII 3 MIMO ANT 1+2	0.264	
	Bluetooth ANT 1	0.127	

Highest Simultaneous SAR Summary

Exposure Position	Frequency Band	Highest Simultaneous 1g-SAR(W/kg)
Body (5mmGap)	WIFI 2.4G ANT 2&5.2G ANT 2	1.338

4. Specific Absorption Rate (SAR)

4.1 Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (). The equation description is as below:

$$\mathrm{SAR} = \frac{d}{dt}\left(\frac{dW}{dm}\right) = \frac{d}{dt}\left(\frac{dW}{\rho dv}\right)$$

SAR is expressed in units of Watts per kilogram (W/kg)

SAR measurement can be either related to the temperature elevation in tissue by

$$\mathrm{SAR} = C\frac{\delta T}{\delta t}$$

where C is the specific head capacity, δT is the temperature rise and δt the exposure duration, or related to the electrical field in the tissue by

$$\mathrm{SAR} = \frac{\sigma |E|^2}{\rho}$$

where σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the rms electrical field strength.

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

4.2 Applicable Standards and Limits

4.2.1 Applicable Standards

FCC 47 CFR Part 2(2.1093)	Radiofrequency Radiation Exposure Evaluation: Portable Devices
ANSI C95.1–1992	Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.
IEEE 1528–2013	IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
KDB 248227 D01	v02r02 802.11 Wi-Fi SAR
KDB 447498 D01	v06 General RF Exposure Guidance
KDB 616217 D04	v01r02 SAR for laptop and tablets
KDB 648474 D04	v01r03 Handset SAR
KDB 865664 D01	v01r04 SAR Measurement 100MHz to 6GHz
KDB 865664 D02	v01r02 SAR Exposure Reporting
KDB 941225 D01	v03r01 3G SAR Procedures
KDB 941225 D05	v02r05 SAR for LTE Devices
KDB 941225 D05A	v01r02 LTE Rel.10 KDB Inquiry Sheet
KDB 941225 D06	v02r01 Hotspot Mode

4.2.2 RF exposure Limits

Human Exposure	**Uncontrolled Environment General Population**
Spatial Peak SAR* (Brain/Body)	1.60 mW/g
Spatial Average SAR** (Whole Body)	0.08 mW/g
Spatial Peak SAR*** (Limbs)	4.00 mW/g

The limit applied in this test report is shown in bold letters.

Notes:

* The Spatial Peak value of the SAR averaged over any 1 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time

** The Spatial Average value of the SAR averaged over the whole body.

*** The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

4.3 Phantoms

The phantom used for all tests i.e. for both system checks and device testing, was the twin-headed "SAM Phantom", manufactured by SATIMO. The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region, where shell thickness increases to 6mm).

System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.

SAM Twin Phantom

4.4 Device Holder

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

The device holder is designed to cope with the different positions given in the standard. It has two scales for device rotation (with respect to the body axis) and device inclination (with respect to the line between the ear reference points). The rotation centers for both scales is the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.

Device holder

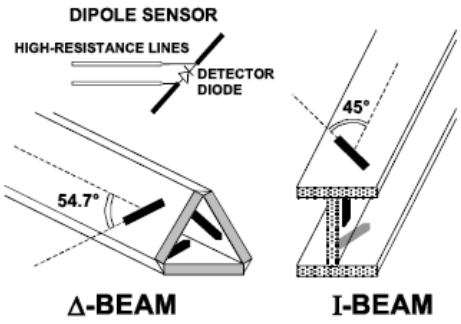
4.5 Probe Specification

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available.
Frequency	700 MHz to 3 GHz; Linearity: ±0.5 dB (700 MHz to 3 GHz)
Directivity	±0.25 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	1.5 μW/g to 100 mW/g; Linearity: ±0.5 dB
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 5 mm Distance from probe tip to dipole centers: <2.7 mm
Application	General dosimetry up to 3 GHz Dosimetry in strong gradient fields Compliance tests of mobile phones
Compatibility	COMOSAR

Isotropic E-Field Probe

The isotropic E-Field probe has been fully calibrated and assessed for isotropicity, and boundary effect within a controlled environment. Depending on the frequency for which the probe is calibrated the method utilized for calibration will change.

The E-Field probe utilizes a triangular sensor arrangement as detailed in the diagram below:



5. Tissue check and recommend Dielectric Parameters

5.1 Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness Power drifts in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations described in Reference [12] and extrapolated according to the head parameters specified in P1528.

Frequency (MHz)	Tissue	
	Real part of the complex relative permittivity, ε_r	Conductivity, σ(S/m)
30	55	0.75
150	52.3	0.76
300	45.3	0.87
450	43.5	0.87
750	41.9	0.89
835	41.5	0.9
900	41.5	0.97
1450	40.5	1.2
1800	40	1.4
1900	40	1.4
1950	40	1.4
2000	40	1.4
2100	39.8	1.49
2450	39.2	1.8
2600	39	1.96
3000	38.5	2.4
3500	37.9	2.91
4000	37.4	3.43
4500	36.8	3.94
5000	36.2	4.45
5200	36	4.66
5400	35.8	4.86
5600	35.5	5.07
5800	35.3	5.27
6000	35.1	5.48

5.2 Simulate liquid

Liquid check results:

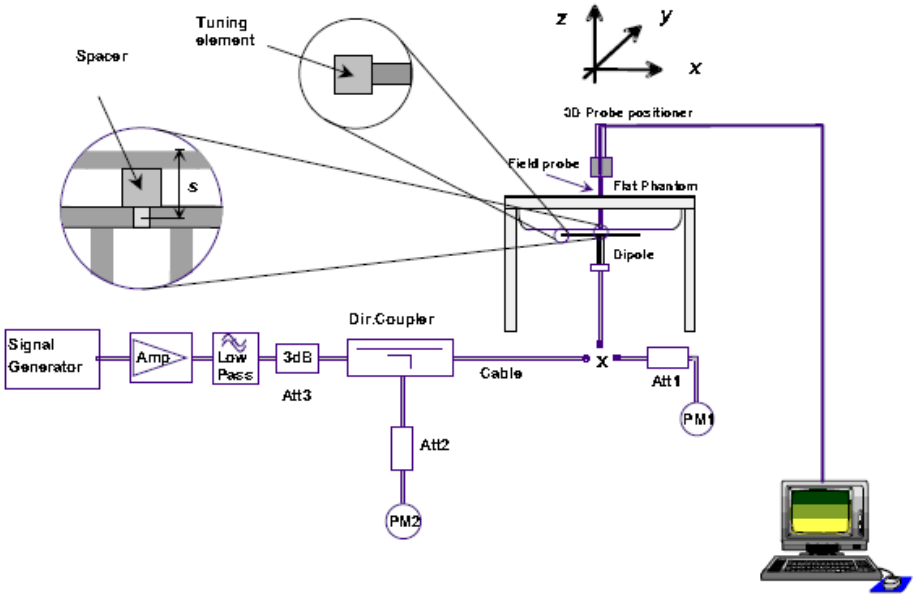
Table 3: Dielectric Performance of Tissue Simulating Liquid

/	Frequency	Permittivity ε	Conductivity σ (S/m)	Liquid Temp. (℃)	Test Date
Target value	2450MHz	39.2±5% (37.24~41.16)	1.80±5% (1.71~1.89)	21.8	2024/09/22
Validation value		38.96	1.77		
Target value	5200MHz	36.0±5% (34.20~37.80)	4.66±5% (4.427~4.893)	22.3	2024/09/20
Validation value		36.87	4.64		
Target value	5800MHz	35.3±5% (33.535~37.065)	5.27±5% (5.0065~5.5335)	22.0	2024/09/19
Validation value		36.14	5.25		

SAR System validation

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of ±10%. The validation results are tabulated below. And also the corresponding SAR plot is attached as well in the SAR plots files.

The following procedure, recommended for performing validation tests using box phantoms is based on the procedures described in the IEEE standard P1528. Setup according to the setup diagram below:



With the SG and Amp and with directional coupler in place, set up the source signal at the relevant frequency and use a power meter to measure the power at the end of the SMA cable that you intend to connect to the balanced dipole. Adjust the SG to make this, say, 0.01W (10 dBm). If this level is too high to read directly with the power meter sensor, insert a calibrated attenuator (e.g. 10 or 20 dB) and make a suitable correction to the power meter reading.

Note 1: In this method, the directional coupler is used for monitoring rather than setting the exact feed power level. If, however, the directional coupler is used for power measurement, you should check the frequency range and power rating of the coupler and measure the coupling factor (referred to output) at the test frequency using a VNA.

Note 2: Remember that the use of a 3dB attenuator (as shown in Figure 8.1 of P1528) means that you need an RF amplifier of 2 times greater power for the same feed power. The other issue is the cable length. You might get up to 1dB of loss per meter of cable, so the cable length after the coupler needs to be quite short.

Note 3: For the validation testing done using CW signals, most power meters are suitable. However, if you are measuring the output of a modulated signal from either a signal generator or a handset, you must ensure that the power meter correctly reads the modulated signals.

The measured 1-gram averaged SAR values of the device against the phantom are provided in Tables 5 and Table 6. The body phantom were full of the body tissue simulating liquid. The EUT was supplied with full-charged battery for each measurement.

The distance between the back of the EUT and the bottom of the flat phantom is 10 mm (taking into account of the IEEE 1528 and the place of the antenna).

Table 4: system validation (1g)
System Check Results

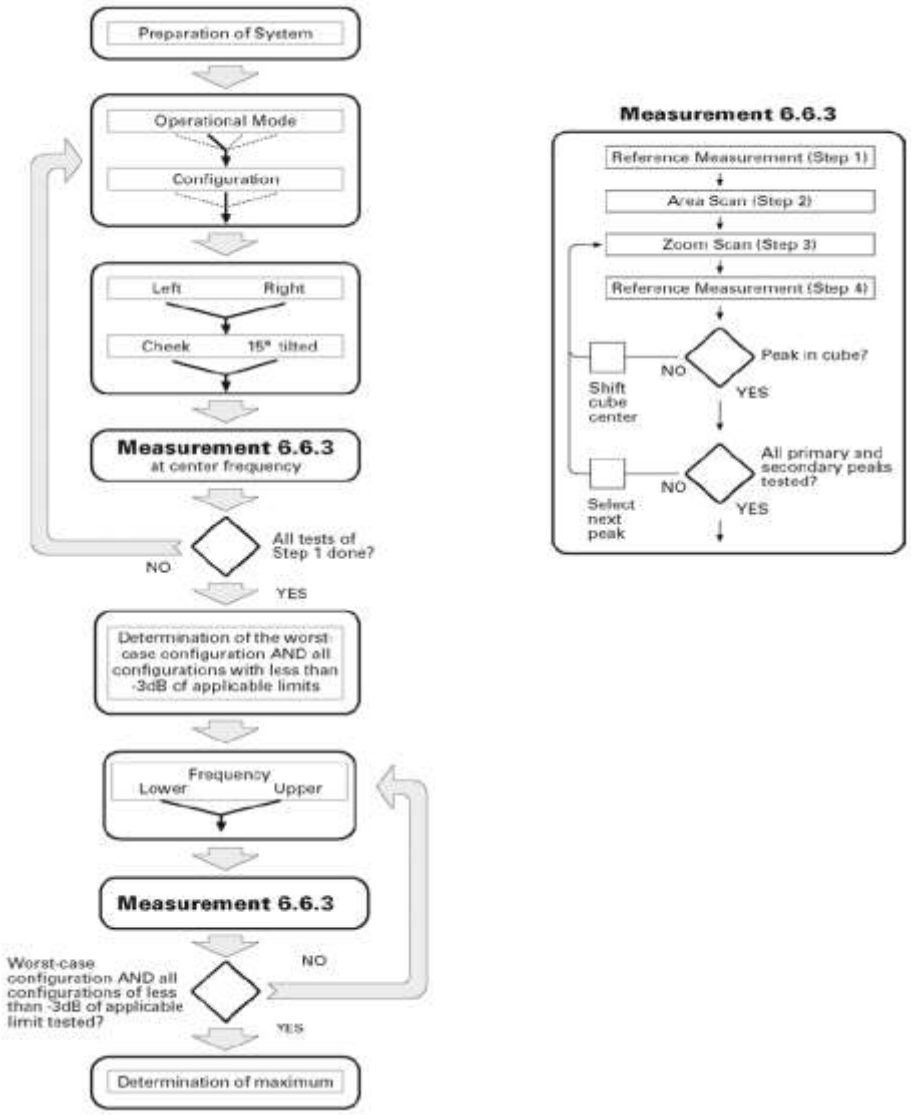
Frequency	Duty cycle	Target value（1-g）(W/Kg)	10mW Test value（1-g）(W/Kg)	Test SAR Normalized to 1W(w/Kg)	Test Date
2450MHz	1:1	51.74 W/kg ±10% (46.566~56.914)	0.5371	53.71	2024/09/22
5200MHz	1:1	152.95 W/kg ±10% (137.655~168.245)	1.6258	162.58	2024/09/20
5800MHz	1:1	174.67 W/kg ±10% (157.203~192.137)	1.7975	179.75	2024/09/19

Note:

1. Target value was referring to the measured value in the calibration certificate of reference dipole.
2. All SAR values are normalized to 1W forward power.

6. SAR measurement procedure

The SAR test against the head phantom was carried out as follow:



Establish a call with the maximum output power with a base station simulator, the connection between the EUT and the base station simulator is established via air interface.

After an area scan has been done at a fixed distance of 2mm from the surface of the phantom on the source side, a 3D scan is set up around the location of the maximum spot SAR. First, a point within the scan area is visited by the probe and a SAR reading taken at the start of testing. At the end of testing, the probe is returned to the same point and a second reading is taken. Comparison between these start and end readings enables the power drift during measurement to be assessed.

Above is the scanning procedure flow chart and table from the IEEEp1528 standard. This is the procedure for which all compliant testing should be carried out to ensure that all variations of the device position and transmission behavior are tested.

7. Conducted RF Output Power

7.1 WIFI Conducted output Power

WIFI 2.4G Output power ANT 1

2.4G WIFI Channel/Freq.(MHz)	Output Power (dBm)		
	802.11b	802.11g	802.11n20
1/2412.0	15.53	14.40	11.57
6/2437.0	15.36	14.38	11.75
11/2462.0	15.16	14.37	11.72

2.4G WIFI Channel/Freq.(MHz)	Output Power (dBm)
	802.11n40
3/2422.0	12.28
6/2437.0	12.04
9/2452.0	11.83

WIFI 2.4G Output power ANT 2

2.4G WIFI Channel/Freq.(MHz)	Output Power (dBm)		
	802.11b	802.11g	802.11n20
1/2412.0	15.01	14.73	11.73
6/2437.0	15.59	14.87	11.63
11/2462.0	15.34	14.58	11.36

2.4G WIFI Channel/Freq.(MHz)	Output Power (dBm)
	802.11n40
3/2422.0	11.79
6/2437.0	11.89
9/2452.0	11.84

WIFI 2.4G MIMO Output power ANT 1+2

2.4G WIFI Channel/Freq.(MHz)	Output Power (dBm)
	802.11n20
1/2412.0	14.66
6/2437.0	14.70
11/2462.0	14.55
2.4G WIFI Channel/Freq.(MHz)	Output Power (dBm)
	802.11n40
3/2422.0	15.05
6/2437.0	14.98
9/2452.0	14.85

WIFI 5G U-NII-1 Output power ANT 1

Channel/Freq.(MHz)	Output Power (dBm)		
	802.11 a	802.11 n20	802.11 ac20
36/5180.0	14.56	10.25	10.45
40/5200.0	14.49	10.20	10.26
48/5240.0	14.42	10.08	10.20

Channel/Freq.(MHz)	Output Power (dBm)	
	802.11 n40	802.11 ac40
38/5190.0	10.90	10.95
46/5230.0	10.63	10.75

Channel/Freq.(MHz)	Output Power (dBm)
	802.11 ac80
42/5210.0	10.88

WIFI 5G U-NII-1 Output power ANT 2

Channel/Freq.(MHz)	Output Power (dBm)		
	802.11 a	802.11 n20	802.11 ac20
36/5180.0	16.10	9.77	9.71
40/5200.0	16.39	9.57	9.65
48/5240.0	15.88	9.49	9.54

Channel/Freq.(MHz)	Output Power (dBm)	
	802.11 n40	802.11 ac40
38/5190.0	10.23	10.23
46/5230.0	10.13	10.12

Channel/Freq.(MHz)	Output Power (dBm)
	802.11 ac80
42/5210.0	10.14

WIFI 5G U-NII-1 MIMO Output power ANT 1+2

Channel/Freq.(MHz)	Output Power (dBm)	
	802.11 n20	802.11 ac20
36/5180.0	13.03	13.11
40/5200.0	12.91	12.98
48/5240.0	12.81	12.89

Channel/Freq.(MHz)	Output Power (dBm)	
	802.11 n40	802.11 ac40
38/5190.0	13.59	13.62
46/5230.0	13.40	13.46

Channel/Freq.(MHz)	Output Power (dBm)
	802.11 ac80
42/5210.0	13.54

WIFI 5G U-NII-3 Output power ANT 1

Channel/Freq.(MHz)	Output Power (dBm)		
	802.11 a	802.11 n20	802.11 ac20
149/5745.0	14.67	10.52	10.35
157/5785.0	14.14	10.41	10.41
165/5825.0	14.33	10.37	10.12

Channel/Freq.(MHz)	Output Power (dBm)	
	802.11 n40	802.11 ac40
151/5755.0	11.13	11.09
159/5795.0	10.85	11.02

Channel/Freq.(MHz)	Output Power (dBm)
	802.11 ac80
155/5775.0	10.91

Channel/Freq.(MHz)	Output Power (dBm)
	802.11 a(5MHz)
5745.5	14.50
5785.5	13.65
5825.5	14.24

Channel/Freq.(MHz)	Output Power (dBm)
	802.11 a(10MHz)
5745.0	14.35
5785.0	14.34
5825.0	14.28

WIFI 5G U-NII-3 Output power ANT 2

Channel/Freq.(MHz)	Output Power (dBm)		
	802.11 a	802.11 n20	802.11 ac20
149/5745.0	14.72	10.09	10.02
157/5785.0	14.49	9.85	9.88
165/5825.0	14.27	9.72	9.72

Channel/Freq.(MHz)	Output Power (dBm)	
	802.11 n40	802.11 ac40
151/5755.0	10.58	10.65
159/5795.0	10.50	10.50

Channel/Freq.(MHz)	Output Power (dBm)
	802.11 ac80
155/5775.0	10.53

Channel/Freq.(MHz)	Output Power (dBm)
	802.11 a(5MHz)
5745.5	14.64
5785.5	14.06
5825.5	14.28

Channel/Freq.(MHz)	Output Power (dBm)
	802.11 a(10MHz)
5745.0	14.66
5785.0	14.13
5825.0	14.49

WIFI 5G U-NII-3 MIMO Output power ANT 1+2

Channel/Freq.(MHz)	Output Power (dBm)	
	802.11 n20	802.11 ac20
149/5745.0	13.32	13.20
157/5785.0	13.15	13.16
165/5825.0	13.07	12.93

Channel/Freq.(MHz)	Output Power (dBm)	
	802.11 n40	802.11 ac40
151/5755.0	13.87	13.89
159/5795.0	13.69	13.78

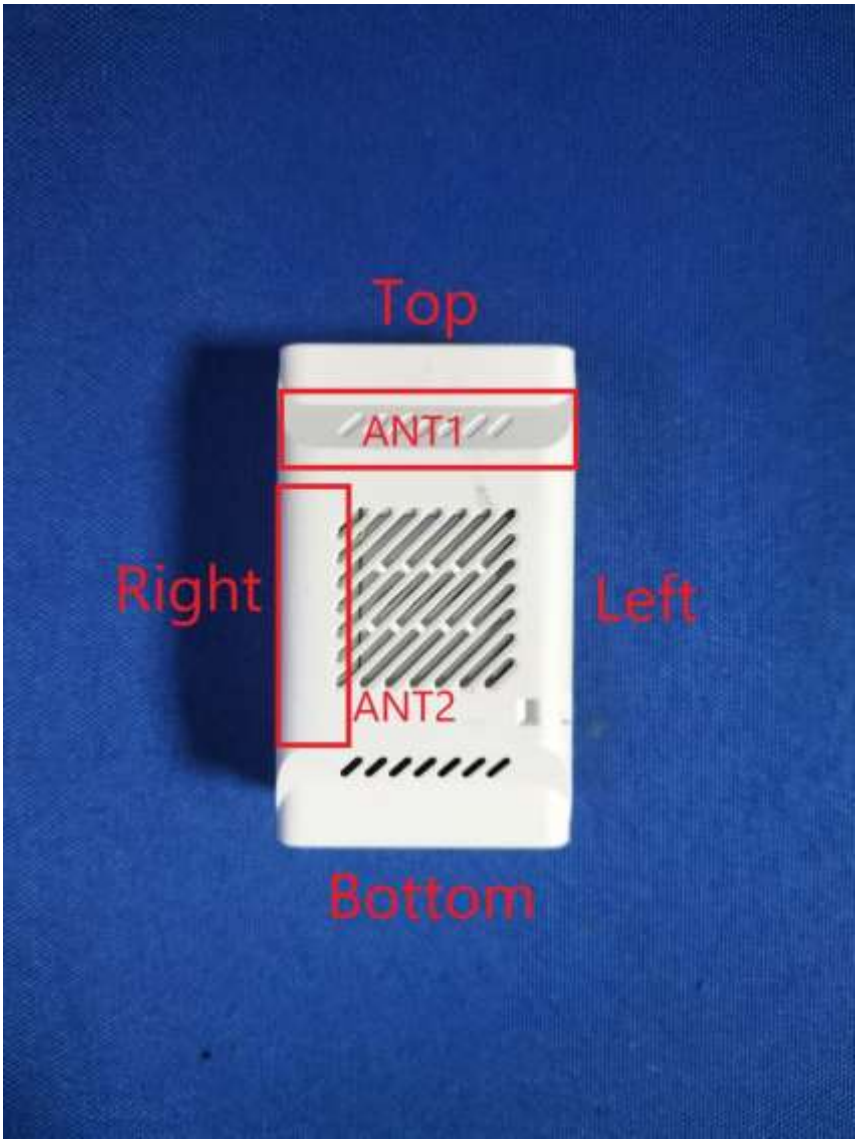
Channel/Freq.(MHz)	Output Power (dBm)
	802.11 ac80
155/5775.0	13.73

7.1 Bluetooth Conducted Power

Bluetooth Output power ANT 1

Channel	Frequency (MHz)	BLE Output Power(dBm)	
		1M(GFSK)	2M(GFSK)
CH 0	2402	6.12	5.92
CH 19	2440	6.81	6.56
CH 39	2480	5.77	5.57

8. Antenna Location:



Antenna	Test Band
ANT 1	WIFI2.4G, WIFI5G, Bluetooth
ANT 2	WIFI2.4G, WIFI5G

Note:
1. Here only reflects the antenna for the emission of the EUT test frequency band.

9. Scaling Factor calculation

Operation Mode	Channel /Frequency	Output Power(dBm)	Tune up Power in tolerance(dBm)	Max. Tune up(dBm)	Scaling Factor
WIFI 2.4G 802.11b ANT 1	1/2412.0	15.53	15.0 ±1.0	16.00	1.114
	6/2437.0	15.36	15.0 ±1.0	16.00	1.159
	11/2462.0	15.16	14.5 ±1.0	15.50	1.081
WIFI 2.4G 802.11b ANT 2	1/2412.0	15.01	14.5 ±1.0	15.50	1.119
	6/2437.0	15.59	15.0 ±1.0	16.00	1.099
	11/2462.0	15.34	15.0 ±1.0	16.00	1.164
WIFI 2.4G MIMO 802.11n40 ANT 1+2	3/2422.0	15.05	14.5 ±1.0	15.50	1.109
	6/2437.0	14.98	14.5 ±1.0	15.50	1.127
	9/2452.0	14.85	14.5 ±1.0	15.50	1.161
WIFI U-NII-1 802.11a ANT 1	36/5180.0	14.56	14.0 ±1.0	15.00	1.107
	40/5200.0	14.49	14.0 ±1.0	15.00	1.125
	48/5240.0	14.42	14.0 ±1.0	15.00	1.143
WIFI U-NII-1 802.11a ANT 2	36/5180.0	16.10	15.5 ±1.0	16.50	1.096
	40/5200.0	16.39	16.0 ±1.0	17.00	1.151
	48/5240.0	15.88	15.5 ±1.0	16.50	1.153
WIFI U-NII-1 MIMO 802.11ac40 ANT 1+2	38/5190.0	13.62	13.0 ±1.0	14.00	1.091
	46/5230.0	13.46	13.0 ±1.0	14.00	1.132
WIFI U-NII-3 802.11a ANT 1	149/5745.0	14.67	14.0 ±1.0	15.00	1.079
	157/5785.0	14.14	13.5 ±1.0	14.50	1.086
	165/5825.0	14.33	14.0 ±1.0	15.00	1.167
WIFI U-NII-3 802.11a ANT 2	149/5745.0	14.72	14.0 ±1.0	15.00	1.067
	157/5785.0	14.49	14.0 ±1.0	15.00	1.125
	165/5825.0	14.27	14.0 ±1.0	15.00	1.183
WIFI U-NII-3 MIMO 802.11ac40 ANT 1+2	151/5755.0	13.89	13.5 ±1.0	14.50	1.151
	159/5795.0	13.78	13.5 ±1.0	14.50	1.180
Bluetooth BLE_1M ANT 1	0/2402.0	6.12	5.5 ±1.0	6.50	1.091
	19/2440.0	6.81	6.5 ±1.0	7.50	1.172
	39/2480.0	5.77	5.5 ±1.0	6.50	1.183

10. Test Results

Results overview of WIFI 2.4G

Body-worn(5mm)	Channel /Frequency	Mode	SAR Value (W/kg)1-g	Power drift(%)	Scaled Factor	Scaled SAR (W/Kg)1-g	Limit (W/kg)	SAR Plot.
ANT 1								
Front Upward	6/2437.0	802.11b	0.286	0.69	1.159	0.331	1.6	/
Back Upward	6/2437.0	802.11b	0.535	2.23	1.159	0.620	1.6	/
Left	6/2437.0	802.11b	0.257	1.51	1.159	0.298	1.6	/
Right	6/2437.0	802.11b	0.169	-0.74	1.159	0.196	1.6	/
Top	6/2437.0	802.11b	0.511	-0.41	1.159	0.592	1.6	/
Bottom	6/2437.0	802.11b	0.037	2.85	1.159	0.043	1.6	/
Back Upward	1/2412.0	802.11b	0.515	-1.03	1.114	0.574	1.6	/
Back Upward	11/2462.0	802.11b	0.486	0.69	1.081	0.525	1.6	/
ANT 2								
Front Upward	6/2437.0	802.11b	0.237	-2.11	1.099	0.260	1.6	/
Back Upward	6/2437.0	802.11b	0.448	-0.18	1.099	0.492	1.6	
Left	6/2437.0	802.11b	0.059	0.11	1.099	0.065	1.6	/
Right	6/2437.0	802.11b	0.647	-0.49	1.099	0.711	1.6	/
Top	6/2437.0	802.11b	0.460	0.93	1.099	0.506	1.6	
Bottom	6/2437.0	802.11b	0.196	2.82	1.099	0.215	1.6	/
Right	1/2412.0	802.11b	**0.649**	0.32	1.119	**0.726**	1.6	1
Right	11/2462.0	802.11b	0.621	-0.70	1.164	0.723	1.6	/
MIMO ANT 1+2								
Front Upward	6/2437.0	802.11n40	0.105	0.45	1.127	0.118	1.6	/
Back Upward	6/2437.0	802.11n40	0.182	-1.23	1.127	0.205	1.6	/
Left	6/2437.0	802.11n40	0.093	0.60	1.127	0.105	1.6	/
Right	6/2437.0	802.11n40	0.372	-0.71	1.127	0.419	1.6	/
Top	6/2437.0	802.11n40	0.344	0.90	1.127	0.388	1.6	/
Bottom	6/2437.0	802.11n40	0.116	-2.08	1.127	0.131	1.6	/
Right	3/2422.0	802.11n40	0.348	1.50	1.109	0.386	1.6	/
Right	9/2452.0	802.11n40	0.375	0.93	1.161	0.435	1.6	/

Results overview of WIFI 5G U-NII 1

Body-worn(5mm)	Channel /Frequency	Mode	SAR Value (W/kg)1-g	Power drift(%)	Scaled Factor	Scaled SAR (W/Kg)1-g	Limit (W/kg)	SAR Plot.
ANT 1								
Front Upward	40/5200.0	802.11a	0.239	0.92	1.125	0.269	1.6	/
Back Upward	40/5200.0	802.11a	0.446	2.60	1.125	0.502	1.6	/
Left	40/5200.0	802.11a	0.195	-0.43	1.125	0.219	1.6	/
Right	40/5200.0	802.11a	0.130	2.40	1.125	0.146	1.6	/
Top	40/5200.0	802.11a	0.400	1.18	1.125	0.450	1.6	/
Bottom	40/5200.0	802.11a	0.085	-0.16	1.125	0.096	1.6	/
Back Upward	36/5180.0	802.11a	0.432	0.69	1.107	0.478	1.6	/
Back Upward	48/5240.0	802.11a	0.459	0.83	1.143	0.525	1.6	/
ANT 2								
Front Upward	40/5200.0	802.11a	0.193	0.90	1.151	0.222	1.6	/
Back Upward	40/5200.0	802.11a	0.332	-1.44	1.151	0.382	1.6	/
Left	40/5200.0	802.11a	0.066	0.25	1.151	0.076	1.6	/
Right	40/5200.0	802.11a	0.518	-1.20	1.151	0.596	1.6	/
Top	40/5200.0	802.11a	0.310	1.63	1.151	0.357	1.6	/
Bottom	40/5200.0	802.11a	0.144	0.50	1.151	0.166	1.6	/
Right	36/5180.0	802.11a	**0.545**	2.10	1.096	0.597	1.6	2
Right	48/5240.0	802.11a	0.531	-0.62	1.153	**0.612**	1.6	/
MIMO ANT 1+2								
Front Upward	38/5190.0	802.11n40	0.095	-1.58	1.091	0.104	1.6	/
Back Upward	38/5190.0	802.11n40	0.153	-0.19	1.091	0.167	1.6	/
Left	38/5190.0	802.11n40	0.078	-0.51	1.091	0.085	1.6	/
Right	38/5190.0	802.11n40	0.317	0.75	1.091	0.346	1.6	/
Top	38/5190.0	802.11n40	0.288	0.20	1.091	0.314	1.6	/
Bottom	38/5190.0	802.11n40	0.098	2.69	1.091	0.107	1.6	/
Right	48/5230.0	802.11n40	0.306	0.82	1.132	0.346	1.6	/

Results overview of WIFI 5G U-NII 3

Body-worn(5mm)	Channel /Frequency	Mode	SAR Value (W/kg)1-g	Power drift(%)	Scaled Factor	Scaled SAR (W/Kg)1-g	Limit (W/kg)	SAR Plot.
ANT 1								
Front Upward	157/5785.0	802.11a	0.204	-1.68	1.086	0.222	1.6	/
Back Upward	157/5785.0	802.11a	0.350	0.41	1.086	0.380	1.6	/
Left	157/5785.0	802.11a	0.154	-2.51	1.086	0.167	1.6	/
Right	157/5785.0	802.11a	0.102	0.23	1.086	0.111	1.6	/
Top	149/5745.0	802.11a	0.314	-0.78	1.086	0.341	1.6	/
Bottom	157/5785.0	802.11a	0.024	0.15	1.086	0.026	1.6	/
Right	149/5745.0	802.11a	0.330	0.69	1.079	0.356	1.6	/
Right	165/5825.0	802.11a	0.308	0.83	1.167	0.359	1.6	/
ANT 2								
Front Upward	157/5785.0	802.11a	0.139	1.83	1.125	0.156	1.6	/
Back Upward	157/5785.0	802.11a	0.246	-1.29	1.125	0.277	1.6	/
Left	157/5785.0	802.11a	0.038	0.50	1.125	0.043	1.6	/
Right	157/5785.0	802.11a	**0.392**	-0.74	1.125	**0.441**	1.6	3
Top	149/5745.0	802.11a	0.226	2.64	1.125	0.254	1.6	/
Bottom	157/5785.0	802.11a	0.108	-1.02	1.125	0.122	1.6	/
Right	149/5745.0	802.11a	0.368	-2.04	1.067	0.393	1.6	/
Right	165/5825.0	802.11a	0.354	0.38	1.183	0.419	1.6	/
MIMO ANT 1+2								
Front Upward	151/5755.0	802.11n40	0.060	1.53	1.151	0.069	1.6	/
Back Upward	151/5755.0	802.11n40	0.096	-0.51	1.151	0.110	1.6	/
Left	151/5755.0	802.11n40	0.048	0.35	1.151	0.055	1.6	/
Right	151/5755.0	802.11n40	0.200	-1.10	1.151	0.230	1.6	/
Top	151/5755.0	802.11n40	0.176	2.14	1.151	0.203	1.6	/
Bottom	151/5755.0	802.11n40	0.062	-0.24	1.151	0.071	1.6	/
Right	159/5795.0	802.11n40	0.224	0.80	1.180	0.264	1.6	/

Results overview of Bluetooth

Body-worn(5mm)	Channel /Frequency	Mode	SAR Value (W/kg)1-g	Power drift(%)	Scaled Factor	Scaled SAR (W/Kg)1-g	Limit (W/kg)	SAR Plot.
ANT 1								
Front Upward	19/2440.0	BLE_1M	0.064	-2.33	1.172	0.075	1.6	/
Back Upward	19/2440.0	BLE_1M	**0.108**	-0.98	1.172	**0.127**	1.6	4
Left	19/2440.0	BLE_1M	0.039	1.78	1.172	0.046	1.6	/
Right	19/2440.0	BLE_1M	0.036	-2.90	1.172	0.042	1.6	/
Top	19/2440.0	BLE_1M	0.075	0.19	1.172	0.088	1.6	/
Bottom	19/2440.0	BLE_1M	0.014	-0.55	1.172	0.016	1.6	/
Back Upward	0/2402.0	BLE_1M	0.092	0.62	1.091	0.100	1.6	/
Back Upward	39/2480.0	BLE_1M	0.101	-2.06	1.183	0.119	1.6	/

Note:

1. The maximum SAR value of each test band is marked bold.
2. When the 1-g SAR for the mid-band channel or the channel with the highest output power satisfy the following conditions, testing of the other channels in the band is not required. (Per KDB 447498 D01 General RF Exposure Guidance v06)
   - ≤ 0.8 W/kg, when the transmission band is ≤ 100 MHz
   - ≤ 0.6 W/kg, when the transmission band is between 100 MHz and 200 MHz
   - ≤ 0.4 W/kg, when the transmission band is ≥ 200 MHz
3. *: Due the antenna location and antenna performance results the SAR value lower than the lowest system limit, then we show “<0.001 W/Kg” in the report.

11. Simultaneous Transmissions Analysis

Localized Specific Absorption Rate (SAR) of this portable wireless device has been measured in all cases requested by the relevant standards cited in Clause 6 of this report. Maximum localized SAR is below exposure limits specified in the relevant standards.

No.	Simultaneous Tx Combination	Body
1	WLAN 2.4GHz SISO+WLAN 5GHz/MIMO	Support
2	WLAN 5GHz SISO/MIMO+ Bluetooth SISO	Support

Note:

1. The reported SAR summation is calculated based on the same configuration and test position.

Applicable Multiple Scenario Evaluation

WIFI SAR:

Position 1gSAR(W/kg)		2.4GWIFI ANT 1	2.4GWIFI ANT 2	2.4GWIFI ANT 1 +ANT 2 MIMO	5.2GWIFI ANT 1	5.2GWIFI ANT 2
		1	2	3	4	5
Body-worn 5mm distance	Front	0.331	0.260	0.118	0.269	0.222
	Back	0.620	0.492	0.205	0.525	0.382
	Left	0.298	0.065	0.105	0.219	0.076
	Right	0.196	0.726	0.435	0.146	0.612
	Top	0.592	0.506	0.388	0.450	0.357
	Bottom	0.043	0.215	0.131	0.096	0.166

Position 1gSAR(W/kg)		5.2GWIFI ANT 1 +ANT 2 MIMO	5.8GWIFI ANT 1	5.8GWIFI ANT 2	5.8GWIFI ANT 1 +ANT 2 MIMO	Bluetooth ANT 1
		6	7	8	9	10
Body-worn 5mm distance	Front	0.104	0.222	0.156	0.069	0.075
	Back	0.167	0.380	0.277	0.110	0.127
	Left	0.085	0.167	0.043	0.055	0.046
	Right	0.346	0.111	0.441	0.264	0.042
	Top	0.314	0.359	0.254	0.203	0.088
	Bottom	0.107	0.026	0.122	0.071	0.016

WIFI and Bluetooth simultaneous transmission mode

Position 1gSAR(W/kg)		WIFI and Bluetooth Simultaneous SAR							
		1	2	3	4	5	6	7	8
Body-worn 5mm distance	Front	0.331	0.260	0.118	0.269	0.222	0.104	0.222	0.156
	Back	0.620	0.492	0.205	0.525	0.382	0.167	0.380	0.277
	Left	0.298	0.065	0.105	0.219	0.076	0.085	0.167	0.043
	Right	0.196	0.726	0.435	0.146	0.612	0.346	0.111	0.441
	Top	0.592	0.506	0.388	0.450	0.357	0.314	0.359	0.254
	Bottom	0.043	0.215	0.131	0.096	0.166	0.107	0.026	0.122
Position 1gSAR(W/kg)		WIFI and Bluetooth Simultaneous SAR							
		9	10	1+4	1+5	1+6	1+7	1+8	1+9
Body-worn 5mm distance	Front	0.069	0.075	0.600	0.553	0.435	0.553	0.487	0.400
	Back	0.110	0.127	1.145	1.002	0.787	1.000	0.897	0.730
	Left	0.055	0.046	0.517	0.374	0.383	0.465	0.341	0.353
	Right	0.264	0.042	0.342	0.808	0.542	0.307	0.637	0.460
	Top	0.203	0.088	1.042	0.949	0.906	0.951	0.846	0.795
	Bottom	0.071	0.016	0.139	0.209	0.150	0.069	0.165	0.114
Position 1gSAR(W/kg)		WIFI and Bluetooth Simultaneous SAR							
		2+4	2+5	2+6	2+7	2+8	2+9	4+10	5+10
Body-worn 5mm distance	Front	0.529	0.482	0.364	0.482	0.416	0.329	0.344	0.297
	Back	1.017	0.874	0.659	0.872	0.769	0.602	0.652	0.509
	Left	0.284	0.141	0.150	0.232	0.108	0.120	0.265	0.122
	Right	0.872	1.338	1.072	0.837	1.167	0.990	0.188	0.654
	Top	0.956	0.863	0.820	0.865	0.760	0.709	0.538	0.445
	Bottom	0.311	0.381	0.322	0.241	0.337	0.286	0.112	0.182

Position 1gSAR(W/kg)		WIFI and Bluetooth Simultaneous SAR				Max WIFI and Bluetooth Simultaneous SAR
		6+10	7+10	8+10	9+10	
Body-worn 5mm distance	Front	0.179	0.297	0.231	0.144	0.600
	Back	0.294	0.507	0.404	0.237	1.145
	Left	0.131	0.213	0.089	0.101	0.517
	Right	0.388	0.153	0.483	0.306	1.338
	Top	0.402	0.447	0.342	0.291	1.042
	Bottom	0.123	0.042	0.138	0.087	0.381

Note:

1. The maximum combination of Body is less than 1.6W/kg and does not require testing for simultaneous transmission of SAR.

12. Measurement Uncertainty

No.	Uncertainty Component	Type	Uncertainty Value (%)	Probability Distribution	k	ci	Standard Uncertainty (%) ui(%)	Degree of freedom Veff or vi
	Measurement System							
1	- Probe Calibration	B	5.8	N	1	1	5.8	∞
2	- Axial isotropy	B	3.5	R	$\sqrt{3}$	0.5	1.43	∞
3	- Hemispherical Isotropy	B	5.9	R	$\sqrt{3}$	0.5	2.41	∞
4	- Boundary Effect	B	1	R	$\sqrt{3}$	1	0.58	∞
5	- Linearity	B	4.7	R	$\sqrt{3}$	1	2.71	∞
6	- System Detection Limits	B	1.0	R	$\sqrt{3}$	1	0.58	∞
7	Modulation response	B	3	N	1	1	3.00	
8	- Readout Electronics	B	0.5	N	1	1	0.50	∞
9	- Response Time	B	1.4	R	$\sqrt{3}$	1	0.81	∞
10	- Integration Time	B	3.0	R	$\sqrt{3}$	1	1.73	∞
11	- RF Ambient Conditions	B	3.0	R	$\sqrt{3}$	1	1.73	∞
12	- Probe Position Mechanical tolerance	B	1.4	R	$\sqrt{3}$	1	0.81	∞
13	- Probe Position with respect to Phantom Shell	B	1.4	R	$\sqrt{3}$	1	0.81	∞
14	- Extrapolation, Interpolation and Integration Algorithms for Max. SAR evaluation	B	2.3	R	$\sqrt{3}$	1	1.33	∞
	Uncertainties of the DUT							
15	- Position of the DUT	A	2.6	N	$\sqrt{3}$	1	2.6	5
16	- Holder of the DUT	A	3	N	$\sqrt{3}$	1	3.0	5
17	- Output Power Variation – SAR drift measurement	B	5.0	R	$\sqrt{3}$	1	2.89	∞

Phantom and Tissue Parameters								
18	- Phantom Uncertainty(shape and thickness tolerances)	B	4	R	$\sqrt{3}$	1	2.31	∞
19	Uncertainty in SAR correction for deviation(in permittivity and conductivity)	B	2	N	1	1	2.00	
20	- Liquid Conductivity Target – tolerance	B	2.5	R	$\sqrt{3}$	0.6	1.95	∞
21	- Liquid Conductivity – measurement Uncertainty)	B	4	N	$\sqrt{3}$	1	0.92	9
22	- Liquid Permittivity Target tolerance	B	2.5	R	$\sqrt{3}$	0.6	1.95	∞
23	- Liquid Permittivity – measurement uncertainty	B	5	N	$\sqrt{3}$	1	1.15	∞
Combined Standard Uncertainty				RSS			10.63	
Expanded uncertainty (Confidence interval of 95 %)				K=2			21.26	

13. System Check Uncertainty

No.	Uncertainty Component	Type	Uncertainty Value (%)	Probability Distribution	k	ci	Standard Uncertainty (%) ui(%)	Degree of freedom Veff or vi
	Measurement System							
1	- Probe Calibration	B	5.8	N	1	1	5.8	∞
2	- Axial isotropy	B	3.5	R	$\sqrt{3}$	0.5	1.43	∞
3	- Hemispherical Isotropy	B	5.9	R	$\sqrt{3}$	0.5	2.41	∞
4	- Boundary Effect	B	1	R	$\sqrt{3}$	1	0.58	∞
5	- Linearity	B	4.7	R	$\sqrt{3}$	1	2.71	∞
6	- System Detection Limits	B	1	R	$\sqrt{3}$	1	0.58	∞
7	Modulation response	B	0	N	1	1	0.00	
8	- Readout Electronics	B	0.5	N	1	1	0.50	∞
9	- Response Time	B	0.00	R	$\sqrt{3}$	1	0.00	∞
10	- Integration Time	B	1.4	R	$\sqrt{3}$	1	0.81	∞
11	- RF Ambient Conditions	B	3.0	R	$\sqrt{3}$	1	1.73	∞
12	- Probe Position Mechanical tolerance	B	1.4	R	$\sqrt{3}$	1	0.81	∞
13	- Probe Position with respect to Phantom Shell	B	1.4	R	$\sqrt{3}$	1	0.81	∞
14	- Extrapolation, Interpolation and Integration Algorithms for Max. SAR evaluation	B	2.3	R	$\sqrt{3}$	1	1.33	∞
	Uncertainties of the DUT							
15	Deviation of experimental source from numberical source	A	4	N	1	1	4.00	5
16	Input Power and SAR drift measurement	A	5	R	$\sqrt{3}$	1	2.89	5
17	Dipole Axis to Liquid Distance	B	2	R	$\sqrt{3}$	1	1.2	∞

Phantom and Tissue Parameters								
18	- Phantom Uncertainty(shape and thickness tolerances)	B	4	R	$\sqrt{3}$	1	2.31	∞
19	Uncertainty in SAR correction for deviation(in permittivity and conductivity)	B	2	N	1	1	2.00	
20	- Liquid Conductivity Target – tolerance	B	2.5	R	$\sqrt{3}$	0.6	1.95	∞
21	- Liquid Conductivity – measurement Uncertainty)	B	4	N	$\sqrt{3}$	1	0.92	9
22	- Liquid Permittivity Target tolerance	B	2.5	R	$\sqrt{3}$	0.6	1.95	∞
23	- Liquid Permittivity – measurement uncertainty	B	5	N	$\sqrt{3}$	1	1.15	∞
Combined Standard Uncertainty				RSS			10.15	
Expanded uncertainty (Confidence interval of 95 %)				K=2			20.29	

14. Equipment List

This table is a complete overview of the SAR measurement equipment. Devices used during the test described are marked ☒.

	EQUIPMENT	Model	Serial number	Calibration Date	Due Date
☒	SAR Probe	SSE2	3723-EPGO-433	2024/04/17	2025/04/16
☒	SAR Probe	SSE2	SN 41/18 EPGO330	2024/01/24	2025/01/23
☒	Dipole	SID2450	SN 09/13 DIP2G450-220	2023/05/24	2026/05/23
☒	Dipole	SWG5500	SN15/15 WGA39	2023/05/25	2026/05/24
☒	Multimeter	Keithley-2000	4014020	2024/01/18	2025/01/17
☒	Vector Network Analyzer(R&S)	ZVB8	100343	2024/01/18	2025/01/17
☒	PC 3.5 Fixed Match Calibration Kit	ZV-Z32	100571	2024/01/18	2025/01/17
☒	Dielectric Probe Kit	SCLMP	SN 09/13 OCPG51	2024/01/18	2025/01/17
☒	Signal Generator	SMU100A	177649	2024/01/18	2025/01/17
☒	Amplifier	Nucletudes	143060	2024/01/18	2025/01/17
☒	Directional Coupler	DC6180A	305827	2024/06/02	2025/06/01
☒	Power Meter	NRP2	103434	2024/01/18	2025/01/17

ANNEX A: Appendix A: SAR System performance Check Plots

(Please See Appendix A)

ANNEX B: Appendix B: SAR Measurement results Plots

(Please See Appendix B)

ANNEX C: Appendix C: Calibration reports

(Please See Appendix C)

ANNEX D: Appendix D: SAR Test Setup

(Please See Appendix D)

—End of the Report—