



SAR Test Report

For

Applicant Name: Shenzhen Jumper Technology Co.,Ltd
Room B601, C601, JMD Industrial Park, No. 39 Qingfeng Blvd.,
Address: Baolong Community, Baolong Street, Longgang District,
Shenzhen, China
EUT Name: Laptop
Model Number: EZbook S7 Hi
Series Model Number: JNF12

Issued By

Company Name: BTF Testing Lab (Shenzhen) Co., Ltd.
F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park,
Address: Tantou Community, Songgang Street, Bao'an District, Shenzhen,
China

Report Number: BTF240729R00201
47 CFR Part 2.1093 IEC/IEEE 62209-1528: 2020
Test Standards: IEEE C95.1-2019 KDB 447498 D01 KDB 865664 D01
KDB 865664 D02 KDB 248227 D01 KDB 616217 D04
KDB 648474 D04 KDB 690783 D01
FCC ID: 2AQAA-EZBOOKS7HI
Test Conclusion: Pass
Test Date: 2024-08-13 to 2024-08-14
Date of Issue: 2024-08-15

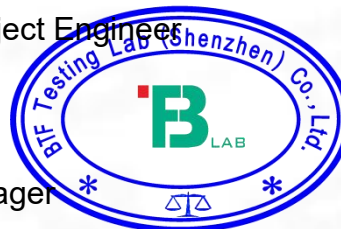
Prepared By: Zoey Zhang
Zoey Zhang / Test Engineer

Prepared By: Amenda Zhong
Amenda Zhong / Project Engineer

Date: 2024-08-15

Approved By: Ryan.CJ
Ryan.CJ / EMC Manager

Date: 2024-08-15



Note: All the test results in this report only related to the testing samples. Which can be duplicated completely for the legal use with approval of applicant; it shall not be reproduced except in full without the written approval of BTF Testing Lab (Shenzhen) Co., Ltd., All the objections should be raised within thirty days from the date of issue. To validate the report, you can contact us.

Revision History		
Version	Issue Date	Revisions Content
R_V0	2024-08-15	Original
Note:		Once the revision has been made, then previous versions reports are invalid.

Table of Contents

1. Introduction	4
1.1 Identification of Testing Laboratory	4
1.2 Identification of the Responsible Testing Location	4
1.3 Laboratory Condition	4
1.4 Announcement	4
2. Product Information	5
2.1 Application Information	5
2.2 Manufacturer Information	5
2.3 Factory Information	5
2.4 General Description of Equipment under Test (EUT)	5
2.5 Equipment under Test Ancillary Equipment	5
2.6 Technical Information	5
3. Summary of Test Results	6
3.1 Test Standards	6
3.2 Device Category and SAR Limit	7
3.3 Test Result Summary	7
3.4 Test Uncertainty	8
4. Measurement System	10
4.1 Specific Absorption Rate (SAR) Definition	10
4.2 MVG SAR System	10
5. System Verification	15
5.1 Purpose of System Check	15
5.2 System Check Setup	15
6. TEST POSITION CONFIGURATIONS	16
6.1 Head Exposure Conditions	16
6.2 Body-worn Position Conditions	21
6.3 Hotspot Mode Exposure Position Conditions	22
6.4 Product Specific 10g Exposure Consideration	22
7. Measurement Procedure	23
7.1 Measurement Process Diagram	23
7.2 SAR Scan General Requirement	24
7.3 Measurement Procedure	25
7.4 Area & Zoom Scan Procedure	25
8. Conducted RF Output Power	26
8.1 Wi-Fi	26
8.2 Bluetooth	29
9. Test Exclusion Consideration	30
9.1 SAR Test Exclusion Consideration Table	30
10. Test Result	31
11. SAR Measurement Variability	32
12. Simultaneous Transmission	33
12.1 Simultaneous Transmission Mode Considerations	33
13. Test Equipment List	34
ANNEX A Simulating Liquid Verification Result	35
ANNEX B System Check Result	35
ANNEX C SAR Dipole Calibrations	35
ANNEX D Test Data	43
ANNEX E SAR Test Setup Photos	49
ANNEX F EUT External and Internal Photos	50
ANNEX G Calibration Information	50

1. Introduction

1.1 Identification of Testing Laboratory

Company Name:	BTF Testing Lab (Shenzhen) Co., Ltd.
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
Phone Number:	+86-0755-23146130
Fax Number:	+86-0755-23146130

1.2 Identification of the Responsible Testing Location

Test Location:	BTF Testing Lab (Shenzhen) Co., Ltd.
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
Description:	All measurement facilities used to collect the measurement data are located at F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
FCC Registration Number	518915
Designation Number	CN1330

1.3 Laboratory Condition

Ambient Temperature:	21°C to 25°C
Ambient Relative Humidity:	48% to 59%
Ambient Pressure:	100 kPa to 102 kPa

1.4 Announcement

- (1) The test report reference to the report template version v0.
- (2) The test report is invalid if not marked with the signatures of the persons responsible for preparing, reviewing and approving the test report.
- (3) The test report is invalid if there is any evidence and/or falsification.
- (4) This document may not be altered or revised in any way unless done so by BTF and all revisions are duly noted in the revisions section.
- (5) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.
- (6) The laboratory is only responsible for the data released by the laboratory, except for the part provided by the applicant.

2. Product Information

2.1 Application Information

Company Name:	Shenzhen Jumper Technology Co., Ltd.
Address:	Room B601, C601, JMD Industrial Park, No. 39 Qingfeng Blvd., Baolong Community, Baolong Street, Longgang District, Shenzhen, China

2.2 Manufacturer Information

Company Name:	Shenzhen Jumper Technology Co., Ltd.
Address:	Room B601, C601, JMD Industrial Park, No. 39 Qingfeng Blvd., Baolong Community, Baolong Street, Longgang District, Shenzhen, China

2.3 Factory Information

Company Name:	Shenzhen Jumper Technology Co., Ltd.
Address:	Room B601, C601, JMD Industrial Park, No. 39 Qingfeng Blvd., Baolong Community, Baolong Street, Longgang District, Shenzhen, China

2.4 General Description of Equipment under Test (EUT)

EUT Name	Laptop
Under Test Model Name	EZbook S7 Hi
Series Model Name	JNF12
Description of Model name differentiation	Only the model name is different, others are the same.

2.5 Equipment under Test Ancillary Equipment

Ancillary Equipment 1	Rechargeable Battery	
	Capacity	5000mAh
	Rated Voltage	7.6V

2.6 Technical Information

Network and Wireless connectivity	2.4G WIFI 802.11b, 802.11g, 802.11n(HT20/40) 5G WIFI 802.11a, 802.11n(HT20/40), 802.11ac(VHT20/40/80) Bluetooth (EDR+BLE)
-----------------------------------	---

The requirement for the following technical information of the EUT was tested in this report:

Operating Mode	WLAN, Bluetooth	
Frequency Range	802.11b/g/n(HT20)	2412 ~ 2462 MHz
	802.11n(HT40)	2422 ~ 2452 MHz
	802.11a	5150 ~ 5250 MHz
	/802.11n(HT20/40)	
	/802.11ac(VHT20/40/80)	5725 ~ 5850 MHz
	Bluetooth	2402 ~ 2480 MHz
Antenna Type	WLAN: PIFA Antenna BT: PIFA Antenna	
Hotspot Function	Not Support	
Power Reduction	Not Support	
Exposure Category	General Population/Uncontrolled exposure	
EUT Stage	Portable Device	
Product	Type	
	☐ Production unit	☒ Identical prototype

3. Summary of Test Results

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 2.1093	Radiofrequency radiation exposure evaluation: portable devices
2	IEC/IEEE 62209-1528: 2020	Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Part 1528: Human models, instrumentation, and procedures (Frequency range of 4 MHz to 10 GHz)
3	IEEE C95.1-2019	IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz
4	KDB 447498 D01	General RF Exposure Guidance v06
5	KDB 865664 D01	SAR measurement 100MHz to 6GHz v01r04
6	KDB 865664 D02	RF Exposure Reporting v01r02
7	KDB 248227 D01	802.11 Wi-Fi SAR v02r02
8	KDB 616217 D04	SAR for laptop and tablets v01r02
9	KDB 648474 D04	Handset SAR v01r03
10	KDB 690783 D01	SAR Listings on Grant v01r03

3.2 Device Category and SAR Limit

This device belongs to portable device category because its radiating structure is allowed to be used within 20 centimeters of the body of the user. Limit for General Population/Uncontrolled exposure should be applied for this device, it is 1.6 W/kg as averaged over any 1 gram of tissue.

Body Position	SAR Value (W/Kg)	
	General Population/ Uncontrolled Exposure	Occupational/ Controlled Exposure
Whole-Body SAR (averaged over the entire body)	0.08	0.4
Partial-Body SAR (averaged over any 1 gram of tissue)	1.60	8.0
SAR for hands, wrists, feet and ankles (averaged over any 10 grams of tissue)	4.0	20.0

NOTE:

General Population/Uncontrolled Exposure: Locations where there is the exposure of individuals who have no knowledge or control of their exposure. General population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

Occupational/Controlled Exposure: Locations where there is exposure that may be incurred by persons who are aware of the potential for exposure. In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

3.3 Test Result Summary

The maximum results of Specific Absorption Rate (SAR) found during test as bellows:

<Highest Reported standalone SAR Summary>

Exposure Position	Frequency Band	Reported SAR (W/kg)	Equipment Class	Highest Reported SAR (W/kg)
Body-supported 1-g SAR (0 mm Gap)	WLAN 2.4 GHz	0.593	DTS	0.593
	WLAN 5.2 GHz	0.552	NII	
	WLAN 5.8 GHz	0.401		

This device is in compliance with Specific Absorption Rate(SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC47 CFR part 2(2.1093) and ANSI/IEEE C95.1-2019, and had been tested in accordance with the measurement methods and procedures specified in IEC/IEEE 62209-1528: 2020.

<Highest Reported Simultaneous SAR>

Exposure Position	Simultaneous Configuration	Highest Reported Simultaneous Transmission SAR (W/kg)	Limit (W/kg)	Verdict
Body-supported 1-g SAR (0 mm Gap)	Ant.1 2.4G WIFI + Ant.2 2.4G WIFI (MIMO)	1.166	1.6	Pass

3.4 Test Uncertainty

3.4.1 Measurement uncertainty evaluation for SAR test

Measurement uncertainty evaluation for SAR test (300MHz to 6GHz)

Uncertainty Component	Tol (+- %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+- %)	10 g Ui (+-%)	Vi veff
Measurement System								
Probe calibration	5.8	N	1	1	1	5.80	5.80	∞
Axial Isotropy	3.5	R	√3	√0.5	√0.5	1.43	1.43	∞
Hemispherical Isotropy	5.9	R	√3	√0.5	√0.5	2.41	2.41	∞
Boundary effect	1.0	R	√3	1	1	0.58	0.58	∞
Linearity	4.7	R	√3	1	1	2.71	2.71	∞
System detection limits	1.0	R	√3	1	1	0.58	0.58	∞
Modulation response	3.0	R	√3	1	1	1.73	1.73	∞
Readout Electronics	0.5	N	1	1	1	0.50	0.50	∞
Response Time	0	R	√3	1	1	0.00	0.00	∞
Integration Time	1.4	R	√3	1	1	0.81	0.81	∞
RF ambient Conditions - Noise	3.0	R	√3	1	1	1.73	1.73	∞
RF ambient Conditions - Reflections	3.0	R	√3	1	1	1.73	1.73	∞
Probe positioner Mechanical Tolerance	1.4	R	√3	1	1	0.81	0.81	∞
Probe positioning with respect to Phantom Shell	1.4	R	√3	1	1	0.81	0.81	∞
Extrapolation, interpolation and integration Algorithms for Max. SAR Evaluation	2.3	R	√3	1	1	1.33	1.33	∞
Test sample Related								
Test sample positioning	2.6	N	1	1	1	2.60	2.60	11
Device Holder Uncertainty	3.0	N	1	1	1	3.00	3.00	7
Output power Variation - SAR drift measurement	5.0	R	√3	1	1	2.89	2.89	∞
SAR scaling	2.0	R	√3	1	1	1.15	1.15	∞
Phantom and Tissue Parameters								
Phantom Shell Uncertainty - Shape, Thickness and Permittivity	4	R	√3	1	1	2.31	2.31	∞
Uncertainty in SAR correction for deviation in permittivity and conductivity	2.0	N	1	1	0.84	2.00	1.68	∞
Liquid conductivity measurement	4.0	N	1	0.78	0.71	3.12	2.84	5
Liquid permittivity measurement	5.0	N	1	0.23	0.26	1.15	1.30	5
Liquid Conductivity - Temperature Uncertainty	2.5	R	√3	0.78	0.71	1.13	1.02	∞
Liquid permittivity - Temperature Uncertainty	2.5	R	√3	0.23	0.26	0.33	0.38	∞
Combined Standard Uncertainty		RSS				10.47	10.34	
Expanded Uncertainty (95% Confidence interval)		k				20.95	20.69	

* This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3.4.2 Measurement uncertainty evaluation for system check

Uncertainty Component	Tol (+-%)	Prob. Dist.	Div.	Ci (1g)	Ci (10 g)	1g Ui (+-%)	10 g Ui (+-%)	Vi veff
Measurement System								
Probe calibration	5.8	N	1	1	1	5.80	5.80	∞
Axial Isotropy	3.5	R	$\sqrt{3}$	1	1	2.02	2.02	∞
Hemispherical Isotropy	5.9	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Boundary effect	1	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	4.7	R	$\sqrt{3}$	1	1	2.71	2.71	∞
System detection limits	1	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Modulation response	0	N	$\sqrt{3}$	0	0	0.00	0.00	∞
Readout Electronics	0.5	N	1	1	1	0.50	0.50	∞
Response Time	0	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Integration Time	1.4	R	$\sqrt{3}$	0	0	0.00	0.00	∞
RF ambient Conditions - Noise	3	R	$\sqrt{3}$	1	1	1.73	1.73	∞
RF ambient Conditions - Reflections	3	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe positioner Mechanical Tolerance	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Probe positioning with respect to Phantom Shell	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Extrapolation, interpolation and integration Algorithms for Max. SAR Evaluation	2.3	R	$\sqrt{3}$	1	1	1.33	1.33	∞
Dipole								
Deviation of experimental source from numerical source	5	N	1	1	1	5.00	5.00	∞
Input Power and SAR drift measurement	0.5	R	$\sqrt{3}$	1	1	0.29	0.29	∞
Dipole Axis to Liquid Dist.	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	∞
Phantom and Tissue Parameters								
Phantom Shell Uncertainty - Shape, Thickness and Permittivity	4	R	$\sqrt{3}$	1	1	2.31	2.31	∞
Uncertainty in SAR correction for deviation in permittivity and conductivity	2.0	N	1	1	0.84	2.00	1.68	∞
Liquid conductivity measurement	4	N	1	0.78	0.71	3.12	2.84	5
Liquid permittivity measurement	5.0	N	1	0.23	0.26	1.15	1.30	5
Liquid Conductivity - Temperature Uncertainty	2.5	R	$\sqrt{3}$	0.78	0.71	1.13	1.02	∞
Liquid permittivity - Temperature Uncertainty	2.5	R	$\sqrt{3}$	0.23	0.26	0.33	0.38	∞
Combined Standard Uncertainty		RSS				10.16	10.03	
Expanded Uncertainty (95% Confidence interval)		k				20.32	20.06	

4. Measurement System

4.1 Specific Absorption Rate (SAR) Definition

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 (ρ). The equation description is as below:

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

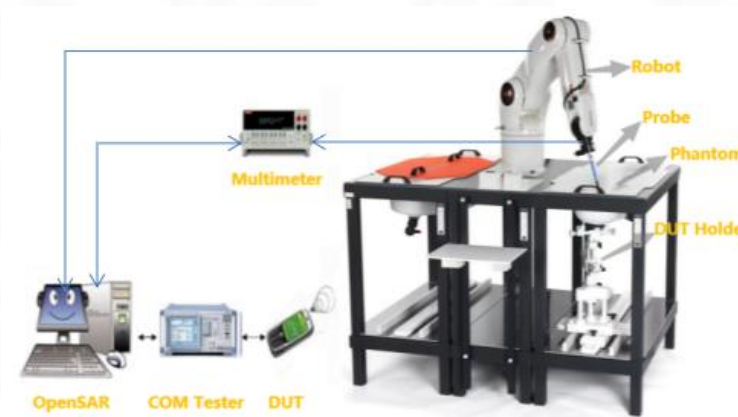
SAR is expressed in units of Watts per kilogram (W/kg) SAR measurement can be related to the electrical field in the tissue by

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

Where: σ is the conductivity of the tissue,
 ρ is the mass density of the tissue and E is the RMS electrical field strength.

4.2 MVG SAR System

4.2.1 SAR system diagram



4.2.2 Robot



A standard high precision 6-axis robot (Denso) with teaches pendant with Scanning System

- It must be able to scan all the volume of the phantom to evaluate the tridimensional distribution of SAR.
- Must be able to set the probe orthogonal of the surface of the phantom ($\pm 30^\circ$).
- Detects stresses on the probe and stop itself if necessary to keep the integrity of the probe.

4.2.3 E-Field Probe

For the measurements, the Specific Dosimetric SSE2 E-Field Probe with following specifications is used:

- Dynamic range: 0.01-100 W/kg
- Tip diameter: 2mm for SSE2
- Distance between probe tip and sensor centre: 1mm for SSE2
- Distance between sensor centre and the inner phantom surface: 2mm for $f \geq 4\text{GHz}$.
- Probe linearity: $<0.25\text{dB}$.
- Axial Isotropy: $<0.25\text{dB}$.
- Spherical Isotropy: $<0.50\text{dB}$.
- Calibration range: 150 to 6000 MHz for head & body simulating liquid
- Angle between probe axis (evaluation axis) and surface normal line: less than 20° .



4.2.4 Phantoms

SAM Phantom

For the measurements the Specific Anthropomorphic Mannequin (SAM) defined by the IEEE SCC-34/SC2 group is used. The probe scanning of the E-Field is done in the 2 halves of the normalized head. The normalized shape of the phantom corresponds to the dimensions of 90% of an adult head size. It enables the dosimetric evaluation of left and right-hand phone usage and includes an additional flat phantom part for the simplified body performance check. The phantom set-up includes a cover, which prevents the evaporation of the liquid.



SAM Phantom

The thickness of the phantom amounts to $2\text{ mm} \pm 0.2\text{ mm}$. The materials for the phantom do not affect the radiation of the device under test (DUT) : $\epsilon_r' < 5$
The head is filled with tissue simulating liquid. The hand do not have to be modeled.

TWIN SAM phantom

	Mechanical	Electrical	
Overall thickness	$2 \pm 0.2\text{ mm}$ (except ear area)	Relative permittivity	3.4
Dimensions	1000 mm(L) x 500 mm(W) x 200 mm(H)	Loss tangent	0.02
Maximum volume	27 L		
Material	Fiberglass based		

ELLIPTICAL Phantom

The phantom is for Body performance check filled with tissue-equivalent liquid to a depth of at least 150 mm, whose shell material is resistant to damage or reaction with tissue-equivalent liquid chemicals.



ELLI Phantom

The shape of the phantom is an ellipse with length $600\text{ mm} \pm 5\text{ mm}$ and width $400\text{ mm} \pm 5\text{ mm}$.
The phantom shell is made of low-loss and low-permittivity material, having loss tangent $\tan \delta \leq 0.05$ and relative permittivity:
 $\epsilon_r' \leq 5$ for $f \leq 3\text{ GHz}$
 $3 \leq \epsilon_r' \leq 5$ for $f > 3\text{ GHz}$
The thickness of the bottom-wall of the flat phantom is 2.0 mm with a tolerance of $\pm 0.2\text{ mm}$.

Technical & mechanical characteristics

Shell thickness	$2\text{ mm} \pm 0.2\text{ mm}$
Filling volume	25 L
Dimensions	600 mm x 400 mm x 200 mm
Permittivity	4.4
Loss tangent	0.017

4.2.5 Device Holder



System Material	Permittivity	Loss tangent
Delrin	3.7	0.005

(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°.)

System Material	Permittivity	Loss tangent
PMMA	2.9	0.028

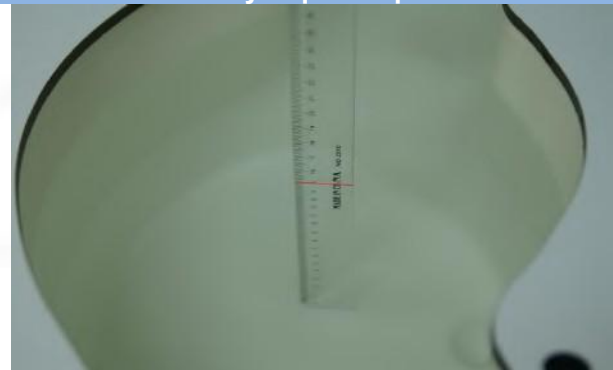
4.2.6 Simulating Liquid

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 height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5%.

Head Liquid Depth



Body Liquid Depth



The following table gives the recipes for tissue simulating liquid and the theoretical Conductivity/Permittivity.

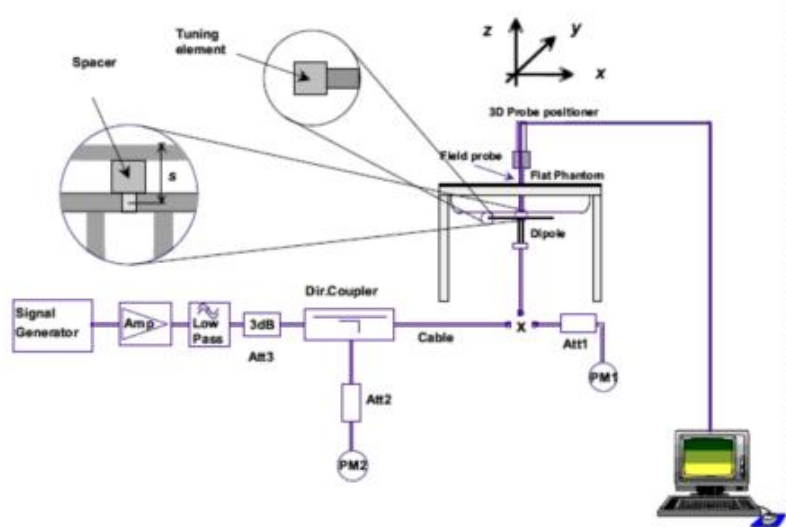
Head (Reference IEEE1528)								
Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity σ (S/m)	Permittivity ϵ
750	41.1	57.0	0.2	1.4	0.2	0	0.89	41.9
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
900	40.3	57.9	0.2	1.4	0.2	0	0.97	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.4	40.0
2450	55.0	0	0	0.1	0	44.9	1.80	39.2
2600	54.9	0	0	0.1	0	45.0	1.96	39.0
Frequency (MHz)	Water (%)	Hexyl Carbitol (%)			Triton X-100 (%)		Conductivity σ (S/m)	Permittivity ϵ
5200	62.52	17.24			17.24		4.66	36.0
5800	62.52	17.24			17.24		5.27	35.3
Body (From instrument manufacturer)								
Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity σ (S/m)	Permittivity ϵ
750	51.7	47.2	0	0.9	0.1	0	0.96	55.5
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
900	50.8	48.2	0	0.9	0.1	0	1.05	55.0
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0.1	0	31.3	1.95	52.7
2600	68.2	0	0	0.1	0	31.7	2.16	52.5
Frequency(MHz)	Water	DGBE (%)			Salt (%)		Conductivity σ (S/m)	Permittivity ϵ
5200	78.60	21.40			/		5.30	49.00
5800	78.50	21.40			0.1		6.00	48.20

5. System Verification

5.1 Purpose of System Check

The system performance check verifies that the system operates within its specifications. System and operator errors can be detected and corrected. It is recommended that the system performance check be performed prior to any usage of the system in order to guarantee reproducible results. The system performance check uses normal SAR measurements in a simplified setup with a well characterized source. The setup was selected to give a high sensitivity to all parameters that might fail or vary over time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.

5.2 System Check Setup



6. TEST POSITION CONFIGURATIONS

According to KDB 648474 D04 Handset, handsets are tested for SAR compliance in head, body-worn accessory and other use configurations described in the following subsections.

6.1 Head Exposure Conditions

Head exposure is limited to next to the ear voice mode operations. Head SAR compliance is tested according to the test positions defined in IEC IEEE 62209-1528:2020 using the SAM phantom illustrated as below.

6.1.1 Definition of the cheek position

The cheek position is established using steps a) to j) as follows.

- (a) Configure the DUT for voice operation, if necessary. For example, for a DUT with a flip.a)swivel, or slide cover piece, open the cover if this is consistent with voice operation. If the DUT can also be used with the cover closed, both configurations shall be tested.
- (b) Define two imaginary lines on the DUT, the vertical centreline and the horizontal line relative to the DUT in vertical orientation as shown in Figure 15.
- (c) The vertical centreline passes through two points on the front side of the DUT: the midpoint of the width w of the DUT at the level of the acoustic output (Point A in Figure 15), and the midpoint of the width w_p at the bottom of the DUT (Point B). The horizontal line is perpendicular to the vertical centerline, and passes through the centre of the acoustic output (Figure 15). The two lines intersect at Point A. Note that for many DUTs, Point A coincides with the centre of the acoustic output. However, the acoustic output could be located elsewhere on the horizontal line. Also note that the vertical centreline is not necessarily parallel to the front face of the DUT, especially for clamshell DUTs, DUTs with flip cover pieces, and other irregularly shaped DUTs.
- (d) Position the DUT close to the surface of the phantom such that Point A is on the (virtual extension of the line passing through points RE (right-ear ear reference point) and LE left-ear ear reference point) on the phantom (see Figure 16a) and Figure 16b)). The plane determined by the vertical centreline and the horizontal line of the DUT shall be parallel to the sagittal plane of the phantom.
- (e) Translate the DUT towards the phantom along the line passing through RE and LE until the DUT touches the ear (see Figure 16c)).
- (f) Rotate the DUT around the (virtual) LE-RE Line until the DUT vertical centreline is in the reference plane (see Figure 16d)).
- (g) Rotate the DUT around its vertical centreline until the plane established by the DUT vertical centreline and horizontal line is parallel to the N-F line (see Annex G), and then translate the DUT towards the phantom along the LE-RE line until DUT Point A touches the ear at the ERP (ear reference point) (see Figure 16e)).
- (h) While keeping Point A on the line passing through RE and LE and maintaining the DUT in contact with the pinna, rotate the DUT about the N-F line until any point on the DUT is in contact with a phantom point below the pinna (cheek) (see Figure 16f)). The physical angles of rotation shall be documented.
- (i) While keeping DUT Point A in contact with the ERP rotate the DUT around a line perpendicular to the plane established by the DUT vertical centreline and horizontal line and passing through DUT Point A, until the DUT vertical centreline is in the reference plane (see Figure 16g)).

- (j) Verify that the cheek position is correct as follows:
- 1) the N-F line is in the plane established by the DUT vertical centreline and horizontal line;
 - 2) DUT Point A touches the pinna at the ERP
 - 3) the DUT vertical centreline is in the reference plane.

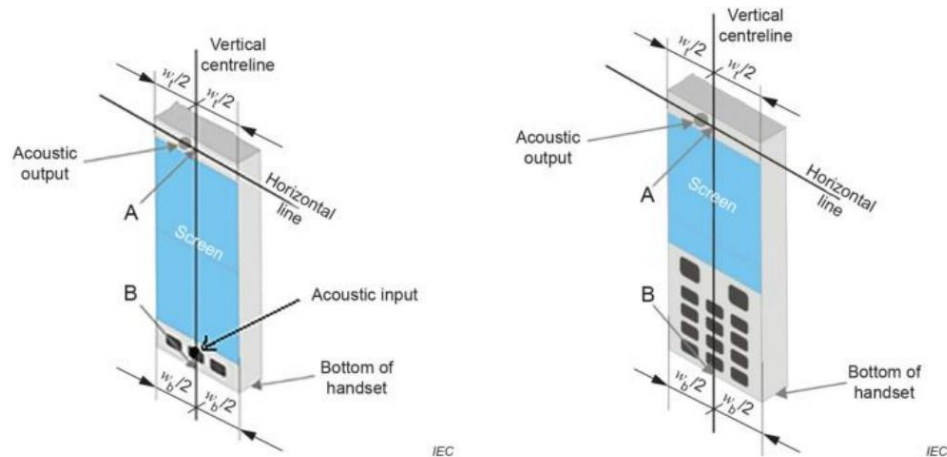
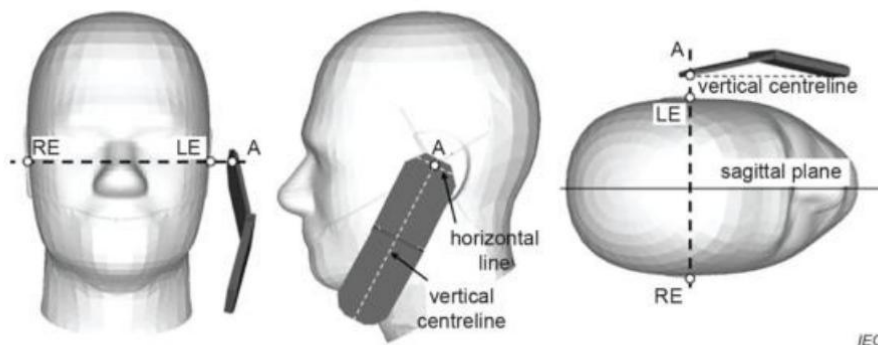


Figure 15 - Vertical and horizontal reference lines and reference points A and B on two example device types: a full touch-screen smart phone (left) and a DUT with a keypad (right)

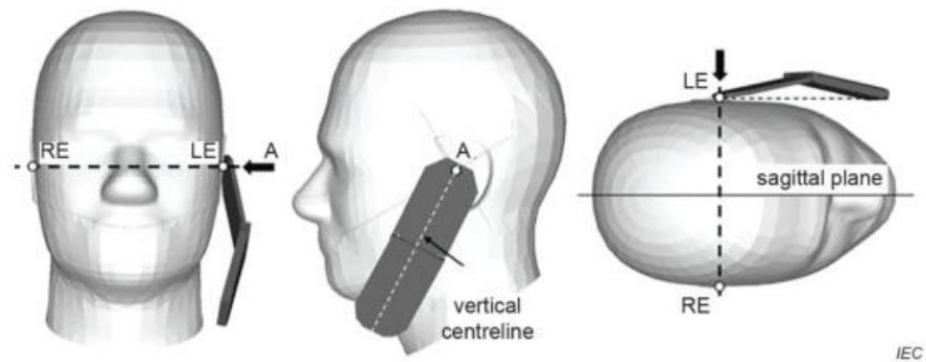


NOTE The reference points for the right-ear ear reference point (RE), left-ear ear reference point (LE), and mouth (M), which establish the reference plane for DUT positioning, are indicated. This device position shall be maintained for the sagittal phantom test set-up shown in Figure G.4.

a) Phone position 1 – cheek position

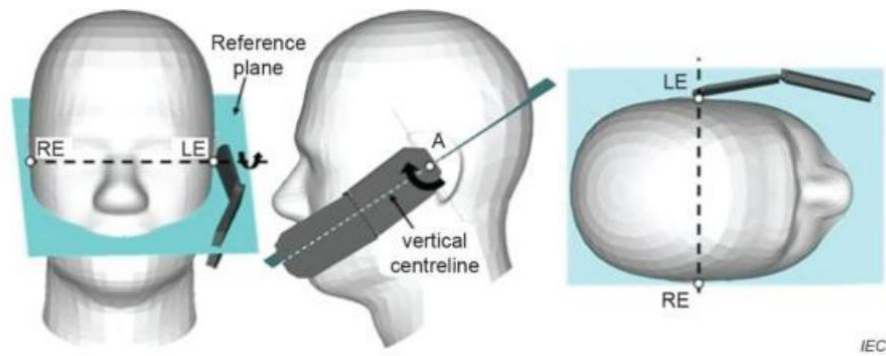


b) One possible DUT position against the head after applying 7.2.4.2.2 c)



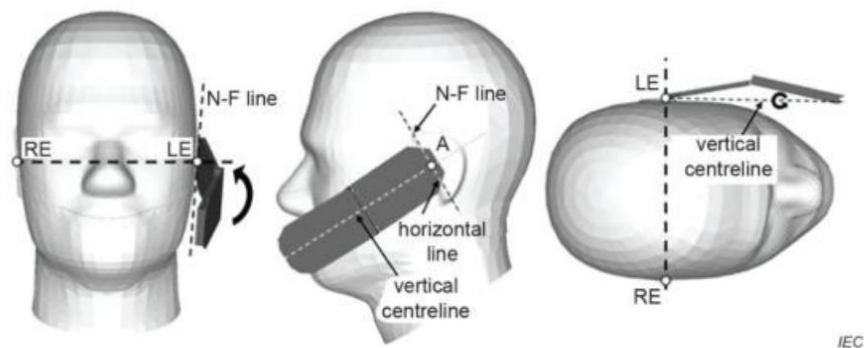
NOTE The black arrows show the direction of translation of the DUT for 7.2.4.2.2 d).

c) DUT position after applying 7.2.4.2.2 d)



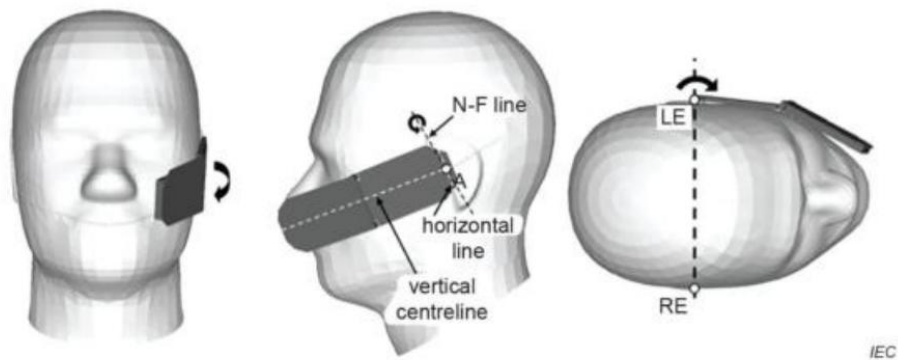
NOTE The curved black arrows show the direction of rotation of the DUT for 7.2.4.2.2 e).

d) DUT position after applying 7.2.4.2.2 e)



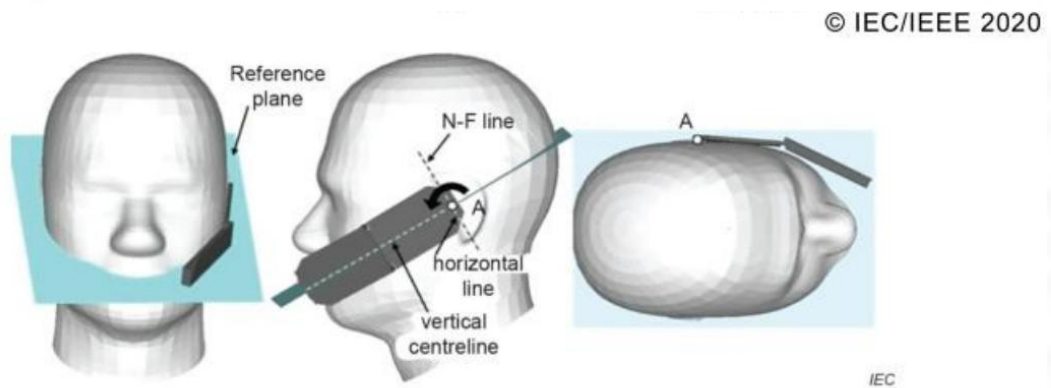
NOTE The curved black arrows show the direction of rotation of the DUT for 7.2.4.2.2 f).

e) DUT position after applying 7.2.4.2.2 f)



NOTE The curved black arrows show the direction of rotation of the DUT for 7.2.4.2.2 g)

f) DUT position after applying 7.2.4.2.2 g)



NOTE The curved black arrows show the direction of rotation of the DUT for 7.2.4.2.2 h).

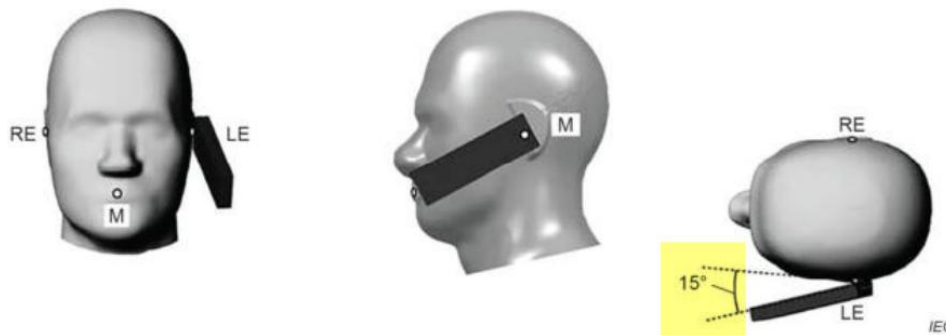
g) DUT position after applying 7.2.4.2.2 h)

Figure 16 – Cheek position of the DUT on the left side of SAM where the device position shall be maintained for the phantom test set-up

6.1.2 Definition of the tilt position

The tilt position is established using steps a) through d) as follows.

- Repeat steps a) through j) of 7.2.4.2.2 to place the DUT in the cheek position (see Figure 16).
- While maintaining the orientation of the DUT, move the DUT away from the pinna along the line passing through RE and LE far enough to allow a rotation of the DUT away from the cheek by 15° .
- Rotate the DUT around the horizontal line by 15° (see Figure 17).
- While maintaining the orientation of the DUT, move the DUT towards the phantom on a line passing through RE and LE until any part of the DUT touches the ear. The tilt position is obtained when the contact is on the pinna. If the contact is at any location other than the pinna, e.g. an extended antenna in contact with the back of the head phantom, the angle of the DUT shall be reduced. In this case, the tilt position is obtained if any part of the DUT is in contact with the pinna and a second point on the DUT is in contact with the phantom, e.g. the antenna in contact with the back of the head.



Key

- M Mouth reference point
- LE Left-ear ear reference point
- RE Right-ear ear reference point

This device position shall be maintained for the phantom test set-up.

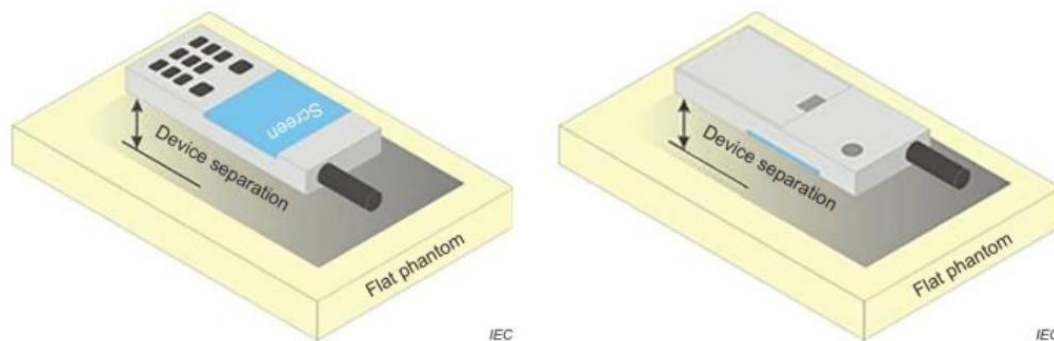
Figure 17 – Tilt position of the DUT on the left side of SAM

6.2 Body-worn Position Conditions

Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in KDB 447498 are used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode. When the reported SAR for a body-worn accessory.

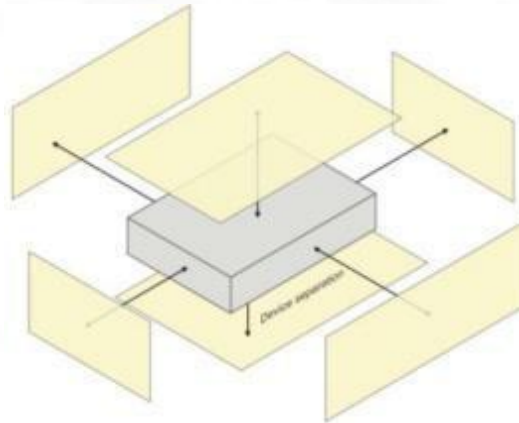
Body-worn accessories that do not contain metallic or conductive components may be tested according to worst-case exposure configurations, typically according to the smallest test separation distance required for the group of body-worn accessories with similar operating and exposure characteristics. All body-worn accessories containing metallic components are tested in conjunction with the host device.

Body-worn accessory SAR compliance is based on a single minimum test separation distance for all wireless and operating modes applicable to each body-worn accessory used by the host, and according to the relevant voice and/or data mode transmissions and operations. If a body-worn accessory supports voice only operations in its normal and expected use conditions, testing of data mode for body-worn compliance is not required. A conservative minimum test separation distance for supporting off-the-shelf body-worn accessories that may be acquired by users of consumer handsets is used to test for body-worn accessory SAR compliance. This distance is determined by the handset manufacturer, according to the requirements of Supplement C 01-01. Devices that are designed to operate on the body of users using lanyards and straps, or without requiring additional body-worn accessories, will be tested using a conservative minimum test separation distance ≤ 5 mm to support compliance.



6.3 Hotspot Mode Exposure Position Conditions

For handsets that support hotspot mode operations, with wireless router capabilities and various web browsing functions, the relevant hand and body exposure conditions are tested according to the hotspot SAR procedures in KDB 941225. A test separation distance of 10 mm is required between the phantom and all surfaces and edges with a transmitting antenna located within 25 mm from that surface or edge. When the form factor of a handset is smaller than 9 cm x 5 cm, a test separation distance of 5 mm (instead of 10 mm) is required for testing hotspot mode. When the separation distance required for body-worn accessory testing is larger than or equal to that tested for hotspot mode, in the same wireless mode and for the same surface of the phone, the hotspot mode SAR data may be used to support body-worn accessory SAR compliance for that particular configuration (surface).



6.4 Product Specific 10g Exposure Consideration

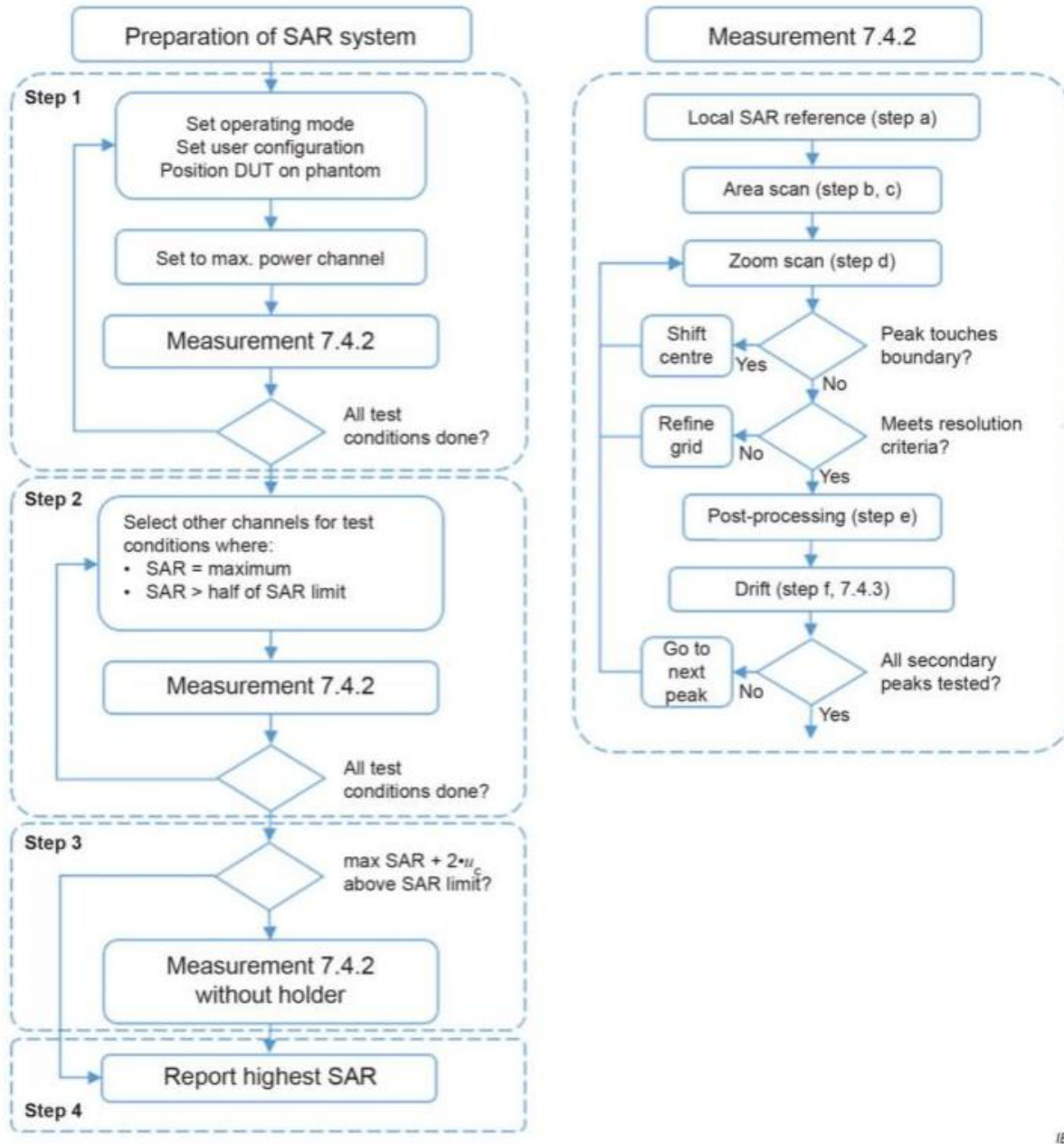
According with FCC KDB 648474 D04, for smart phones with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm that provide similar mobile web access and multimedia support found in mini-tablets or UMPC mini-tablets that support voice calls next to the ear, unless it is confirmed otherwise through KDB inquiries, the following phablet procedures should be applied to evaluate SAR compliance for each applicable wireless modes and frequency band. Devices marketed as phablets, regardless of form factors and operating characteristics must be tested as a phablet to determine SAR compliance;

The UMPC mini-tablet procedures must also be applied to test the SAR of all surfaces and edges with an antenna located at ≤ 25 mm from that surface or edge, in direct contact with a flat phantom, for 10-g extremity SAR according to the body-equivalent tissue dielectric parameters in KDB 865664 to address interactive hand use exposure conditions. The UMPC mini-tablet 1-g SAR at 5 mm is not required. When hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg.

7. Measurement Procedure

7.1 Measurement Process Diagram

Body SAR



IEC

7.2 SAR Scan General Requirement

Probe boundary effect error compensation is required for measurements with the probe tip closer than half a probe tip diameter to the phantom surface. Both the probe tip diameter and sensor offset distance must satisfy measurement protocols; to ensure probe boundary effect errors are minimized and the higher fields closest to the phantom surface can be correctly measured and extrapolated to the phantom surface for computing 1 g SAR. Tolerances of the post-processing algorithms must be verified by the test laboratory for the scan resolutions used in the SAR measurements, according to the reference distribution functions specified in IEC/IEEE 62209-1528: 2020.

Table 3 – Area scan parameters

Parameter	DUT transmit frequency being tested	
	$f \leq 3 \text{ GHz}$	$3 \text{ GHz} < f \leq 10 \text{ GHz}$
Maximum distance between the measured points (geometric centre of the sensors) and the inner phantom surface (z_{M1} in Figure 20 in mm)	5 ± 1	$\delta \ln(2)/2 \pm 0,5^a$
Maximum spacing between adjacent measured points in mm (see O.8.3.1) ^b	20, or half of the corresponding zoom scan length, whichever is smaller	$60/f$, or half of the corresponding zoom scan length, whichever is smaller
Maximum angle between the probe axis and the phantom surface normal (α in Figure 20) ^c	5° (flat phantom only) 30° (other phantoms)	5° (flat phantom only) 20° (other phantoms)
Tolerance in the probe angle	1°	1°
^a δ is the penetration depth for a plane-wave incident normally on a planar half-space.		
^b See Clause O.8 on how Δx and Δy may be selected for individual area scan requirements.		
^c The probe angle relative to the phantom surface normal is restricted due to the degradation in the measurement accuracy in fields with steep spatial gradients. The measurement accuracy decreases with increasing probe angle and increasing frequency. This is the reason for the tighter probe angle restriction at frequencies above 3 GHz.		

Table 4 – Zoom scan parameters

Parameter	DUT transmit frequency being tested	
	$f \leq 3 \text{ GHz}$	$3 \text{ GHz} < f \leq 10 \text{ GHz}$
Maximum distance between the closest measured points and the phantom surface (z_{M1} in Figure 20 and Table 3, in mm)	5	$\delta \ln(2)/2^a$
Maximum angle between the probe axis and the phantom surface normal (α in Figure 20)	5° (flat phantom only) 30° (other phantoms)	5° (flat phantom only) 20° (other phantoms)
Maximum spacing between measured points in the x- and y-directions (Δx and Δy , in mm)	8	$24/f^b$
For uniform grids: Maximum spacing between measured points in the direction normal to the phantom shell (Δz_1 in Figure 20, in mm)	5	$10/(f-1)$
For graded grids: Maximum spacing between the two closest measured points in the direction normal to the phantom shell (Δz_1 in Figure 20, in mm)	4	$12/f$
For graded grids: Maximum incremental increase in the spacing between measured points in the direction normal to the phantom shell ($R_z = \Delta z_2/\Delta z_1$ in Figure 20)	1,5	1,5
Minimum edge length of the zoom scan volume in the x- and y-directions (L_z in O.8.3.2, in mm)	30	22
Minimum edge length of the zoom scan volume in the direction normal to the phantom shell (L_n in O.8.3.2 in mm)	30	22
Tolerance in the probe angle	1°	1°
^a δ is the penetration depth for a plane-wave incident normally on a planar half-space.		
^b This is the maximum spacing allowed, which might not work for all circumstances.		

7.3 Measurement Procedure

The following steps are used for each test position

- a. Establish a call with the maximum output power with a base station simulator. The connection between the mobile and the base station simulator is established via air interface
- b. Measurement of the local E-field value at a fixed location. This value serves as a reference value for calculating a possible power drift.
- c. Measurement of the SAR distribution with a grid of 8 to 16mm * 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.
- d. 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.

7.4 Area & Zoom Scan Procedure

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g. Area scan and zoom scan resolution setting follows KDB 865664 D01v01r04 quoted below.

When the 1 g SAR of the highest peak is within 2 dB of the SAR limit, additional zoom scans are required for other peaks within 2 dB of the highest peak that have not been included in any zoom scan to ensure there is no increase in SAR.

8. Conducted RF Output Power

8.1 Wi-Fi

Ant 1						
Band (GHz)	Mode	Channel	Freq. (MHz)	Average Power (dBm)	Maximum Tune-up(dBm)	SAR Test Require.
2.4 (2.4~2.4835)	802.11b	1	2412	13.12	13.50	No
		6	2437	13.45	13.50	No
		11	2462	13.89	14.00	Yes
	802.11g	1	2412	17.42	17.50	No
		6	2437	17.36	17.50	No
		11	2462	17.82	18.00	No
	802.11n(HT20)	1	2412	15.25	15.50	No
		6	2437	15.01	15.50	No
		11	2462	15.98	16.00	No
	802.11n(HT40)	3	2422	14.77	15.00	No
		6	2437	15.36	15.50	No
		9	2452	15.28	15.50	No
Ant 2						
Band (GHz)	Mode	Channel	Freq. (MHz)	Average Power (dBm)	Maximum Tune-up(dBm)	SAR Test Require.
2.4 (2.4~2.4835)	802.11b	1	2412	14.22	14.50	No
		6	2437	15.11	15.50	No
		11	2462	15.23	15.50	Yes
	802.11g	1	2412	17.89	18.00	No
		6	2437	17.99	18.00	No
		11	2462	18.22	18.50	No
	802.11n(HT20)	1	2412	16.36	16.50	No
		6	2437	17.21	17.50	No
		11	2462	17.53	18.00	No
	802.11n(HT40)	3	2422	15.57	16.00	No
		6	2437	16.15	16.50	No
		9	2452	16.33	16.50	No
MIMO						
Band (GHz)	Mode	Channel	Freq. (MHz)	Average Power (dBm)	Maximum Tune-up(dBm)	SAR Test Require.
2.4 (2.4~2.4835)	802.11n(HT20)	1	2412	18.85	19.00	No
		6	2437	19.26	19.50	No
		11	2462	19.83	20.00	Yes
	802.11n(HT40)	3	2422	18.20	18.50	No
		6	2437	18.78	19.00	No
		9	2452	18.85	19.00	No

Note: SAR is not required for the following 2.4 GHz OFDM conditions as the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2W/kg.

Ant. 1						
Band (GHz)	Mode	Channel	Freq. (MHz)	Average Power (dBm)	Maximum Tune-up(dBm)	SAR Test Require.
U-NII-1 (5.150~5.250)	802.11a	36	5180	13.92	14.00	No
		40	5200	14.00	14.00	No
		48	5240	14.13	14.50	Yes
	802.11n(HT20)	36	5180	11.05	11.50	No
		40	5200	11.27	11.50	No
		48	5240	11.03	11.50	No
	802.11ac(VHT20)	36	5180	10.94	11.00	No
		40	5200	10.96	11.00	No
		48	5240	10.75	11.00	No
	802.11n(HT40)	38	5190	11.77	12.00	No
		46	5230	12.02	12.50	No
	802.11ac(VHT40)	38	5190	11.76	12.00	No
		46	5230	11.90	12.00	No
	802.11ac(VHT80)	42	5210	11.83	12.00	No
	Ant. 2					
Band (GHz)	Mode	Channel	Freq. (MHz)	Average Power (dBm)	Maximum Tune-up(dBm)	SAR Test Require.
U-NII-1 (5.150~5.250)	802.11a	36	5180	12.99	13.00	No
		40	5200	15.90	16.00	Yes
		48	5240	15.71	16.00	No
	802.11n(HT20)	36	5180	14.42	14.50	No
		40	5200	14.28	14.50	No
		48	5240	14.24	14.50	No
	802.11ac(VHT20)	36	5180	14.43	14.50	No
		40	5200	14.16	14.50	No
		48	5240	14.23	14.50	No
	802.11n(HT40)	38	5190	14.22	14.50	No
		46	5230	14.24	14.50	No
	802.11ac(VHT40)	38	5190	14.17	14.50	No
		46	5230	14.32	14.50	No
	802.11ac(VHT80)	42	5210	14.10	14.50	No
	MIMO					
Band (GHz)	Mode	Channel	Freq. (MHz)	Average Power (dBm)	Maximum Tune-up(dBm)	SAR Test Require.
U-NII-1 (5.150~5.250)	802.11n(HT20)	36	5180	16.06	16.50	No
		40	5200	16.04	16.50	No
		48	5240	15.94	16.00	No
	802.11ac(VHT20)	36	5180	16.04	16.50	No
		40	5200	15.86	16.00	No
		48	5240	15.84	16.00	No
	802.11n(HT40)	38	5190	16.18	16.50	No
		46	5230	16.28	16.50	No
	802.11ac(VHT40)	38	5190	16.14	16.50	No
		46	5230	16.29	16.50	Yes
	802.11ac(VHT80)	42	5210	16.12	16.50	No

Ant. 1						
Band (GHz)	Mode	Channel	Freq. (MHz)	Average Power (dBm)	Maximum Tune-up(dBm)	SAR Test Require.
U-NII-3 (5.725~5.850)	802.11a	149	5745	7.90	8.00	No
		157	5785	7.97	8.00	Yes
		165	5825	7.12	7.50	No
	802.11n(HT20)	149	5745	7.94	8.00	No
		157	5785	7.59	8.00	No
		165	5825	7.91	8.00	No
	802.11ac(VHT20)	149	5745	7.65	8.00	No
		157	5785	7.61	8.00	No
		165	5825	7.77	8.00	No
	802.11n(HT40)	151	5755	7.02	7.50	No
		159	5795	7.76	8.00	No
	802.11ac(VHT40)	151	5755	7.96	8.00	No
		159	5795	7.78	8.00	No
	802.11ac(VHT80)	155	5775	7.30	7.50	No
Ant. 2						
Band (GHz)	Mode	Channel	Freq. (MHz)	Average Power (dBm)	Maximum Tune-up(dBm)	SAR Test Require.
U-NII-3 (5.725~5.850)	802.11a	149	5745	6.95	7.00	No
		157	5785	8.02	8.50	Yes
		165	5825	7.93	8.00	No
	802.11n(HT20)	149	5745	6.89	7.00	No
		157	5785	7.84	8.00	No
		165	5825	7.61	8.00	No
	802.11ac(VHT20)	149	5745	6.93	7.00	No
		157	5785	7.76	8.00	No
		165	5825	7.69	8.00	No
	802.11n(HT40)	151	5755	6.88	7.00	No
		159	5795	7.76	8.00	No
	802.11ac(VHT40)	151	5755	6.84	7.00	No
		159	5795	7.73	8.00	No
	802.11ac(VHT80)	155	5775	7.15	7.50	No
MIMO						
Band (GHz)	Mode	Channel	Freq. (MHz)	Average Power (dBm)	Maximum Tune-up(dBm)	SAR Test Require.
U-NII-3 (5.725~5.850)	802.11n(HT20)	149	5745	10.46	10.50	No
		157	5785	10.73	11.00	No
		165	5825	10.77	11.00	Yes
	802.11ac(VHT20)	149	5745	10.32	10.50	No
		157	5785	10.70	11.00	No
		165	5825	10.74	11.00	No
	802.11n(HT40)	151	5755	9.96	10.00	No
		159	5795	10.77	11.00	No
	802.11ac(VHT40)	151	5755	10.45	10.50	No
		159	5795	10.77	11.00	No
	802.11ac(VHT80)	155	5775	10.24	10.50	No

8.2 Bluetooth

EDR	Mode	Maximum Tune-up(dBm)	Average Conducted Output Power (dBm)		
			0	39	78
			2402MHz	2441MHz	2480MHz
	GFSK	8.00	6.62	7.12	7.99
	$\pi/4$ QPSK	6.00	5.35	5.78	5.63
	8DPSK	5.50	5.12	5.42	5.32
BLE	Mode	Maximum Tune-up(dBm)	Average Conducted Output Power (dBm)		
			0	20	39
			2402MHz	2440MHz	2480MHz
	1Mbps	3.50	3.33	3.14	3.22

Channel	Frequency (GHz)	Max. Tune-up Power (dBm)	Max. Power (mW)	Test distance (mm)	Exclusion thresholds for 1-g SAR (mW)	RF exposure evaluation required
78	2.480	8.00	6.31	0	10	No

Note

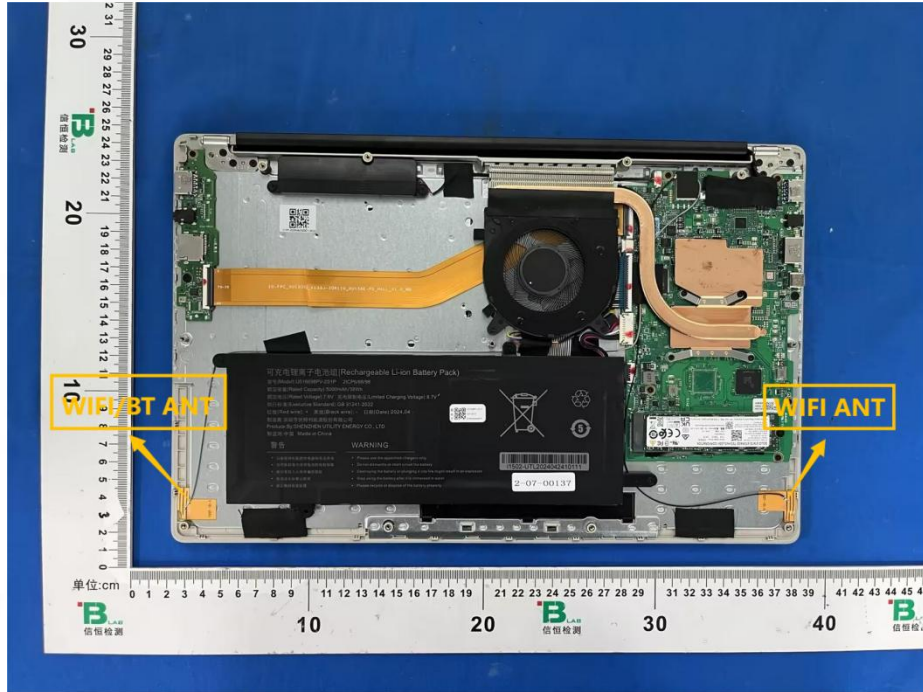
- Per KDB 447498 D01 General RF Exposure Guidance v06, the 1-g SAR test exclusion thresholds for 300 MHz to 6 GHz at *test separation distances* ≤ 40 cm are determined by:

MHz	5	10	15	20	25	mm
150	39	77	116	155	194	SAR Test Exclusion Threshold (mW)
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1500	12	24	37	49	61	
1900	11	22	33	44	54	
2450	10	19	29	38	48	
3600	8	16	24	32	40	
5200	7	13	20	26	33	
5400	6	13	19	26	32	
5800	6	12	19	25	31	

- *When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine estimated SAR.
- Per KDB 248227 D01 v02r02, choose the highest output power channel to test SAR and determine further SAR exclusion.
 - The output power of all data rate were prescan, just the worst case (the lowest data rate) of all mode were shown in report.

9. Test Exclusion Consideration

Antenna information:



Positions for SAR test						
Antenna	Front Side	Back Side	Left Edge	Right Edge	Top Edge	Bottom Edge
WLAN/BT Ant.1	No	Yes	No	No	No	No
WLAN Ant.2	No	Yes	No	No	No	No

Note:
Per KDB 616217 Laptop host platform test requirements: When antennas are incorporated in the keyboard section of a laptop computer, SAR is required for the bottom surface of the keyboard. Provided tablet use conditions are not supported by the laptop computer, SAR tests for bystander exposure from the edges of the keyboard and display screen of laptop computers are generally not required.

9.1 SAR Test Exclusion Consideration Table

Per KDB 447498 requires when the standalone SAR test exclusion of section 4.3.1 is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to the following format to determine simultaneous transmission SAR test exclusion:

$$(\text{max.power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm}) \cdot [\sqrt{f(\text{GHz})} / x]$$

W/kg for test separation distances ≤ 50 mm;

where $x = 7.5$ for 1-g SAR, and $x = 18.75$ for 10-g SAR.

0.4 W/Kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is > 50 mm

Channel	Frequency (GHz)	Max. Tune-up Power (dBm)	Max. Power (mW)	Test distance (mm)	Estimated SAR (W/Kg)
78	2.480	8.00	6.31	0	0.265

10. Test Result

WLAN-2.4g(gap 0mm)													
Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (%)	1g Meas. SAR (W/kg)	Duty cycle (%)	Duty cycle Factor	Meas. Power (dBm)	Max. tune-up power (dBm)	Scaling Factor	1g Scaled SAR (W/kg)	Meas. No.
2.4g Wifi 802.11b ANT1	Back	0	11	2462	1.680	0.428	100.00	1.000	13.89	14.00	1.026	0.439	/
2.4g Wifi 802.11b ANT2	Back	0	11	2462	2.490	0.453	100.00	1.000	15.23	15.50	1.064	0.482	/
2.4g Wifi 802.11n(HT20) MIMO-ANT1 side	Back	0	11	2462	-4.510	0.570	100.00	1.000	19.83	20.00	1.040	0.593	1#
2.4g Wifi 802.11n(HT20) MIMO-ANT2 side	Back	0	11	2462	-1.660	0.551	100.00	1.000	19.83	20.00	1.040	0.573	/
WLAN-5.2g(Body gap 0mm)													
Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (%)	1g Meas. SAR (W/kg)	Duty cycle (%)	Duty cycle Factor	Meas. Power (dBm)	Max. tune-up power (dBm)	Scaling Factor	1g Scaled SAR (W/kg)	Meas. No.
5.2g Wifi 802.11a ANT1	Back	0	48	5240	-2.670	0.507	100.00	1.000	14.13	14.50	1.089	0.552	2#
5.2g Wifi 802.11a ANT2	Back	0	40	5200	4.150	0.481	100.00	1.000	15.90	16.00	1.023	0.492	/
5.2g Wifi 802.11ac(VHT40) MIMO-ANT1 side	Back	0	46	5230	-0.690	0.385	100.00	1.000	16.29	16.50	1.050	0.404	/
5.2g Wifi 802.11ac(VHT40) MIMO-ANT2 side	Back	0	46	5230	1.740	0.362	100.00	1.000	16.29	16.50	1.050	0.380	/
WLAN-5.8g(gap 0mm)													
Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (%)	1g Meas. SAR (W/kg)	Duty cycle (%)	Duty cycle Factor	Meas. Power (dBm)	Max. tune-up power (dBm)	Scaling Factor	1g Scaled SAR (W/kg)	Meas. No.
5.8g Wifi 802.11a ANT1	Back	0	157	5785	2.320	0.332	100.00	1.000	7.97	8.00	1.007	0.334	/
5.8g Wifi 802.11a ANT2	Back	0	157	5785	1.310	0.359	100.00	1.000	8.02	8.50	1.117	0.401	3#
5.8g Wifi 802.11n(HT20) MIMO-ANT1 side	Back	0	165	5825	-4.330	0.291	100.00	1.000	10.77	11.00	1.054	0.307	/
5.8g Wifi 802.11n(HT20) MIMO-ANT2 side	Back	0	165	5825	-0.340	0.264	100.00	1.000	10.77	11.00	1.054	0.278	/
Note: 1. The maximum SAR Value of each test band is marked bold. 2. SAR plot is provided only for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination. 3. Per KDB 447498 D01 v06, for each exposure position, if the highest output power channel Reported SAR $\leq 0.8\text{W/kg}$, other channels SAR testing is not necessary. 4. Per KDB 447498 D01 v06, body-supported use is evaluated with the device positioned at 0mm from a flat phantom filled with body tissue-equivalent medium. 5. Per KDB 447498 D01 v06, the report SAR is measured SAR value adjusted for maximum tune-up tolerance. Scaling Factor= $10^{[(\text{tune-up limit power(dBm)} - \text{Ave.power power (dBm)})/10]}$, where tune-up limit is the maximum rated power among all production units. Reported SAR(W/kg)=Measured SAR (W/kg)*Scaling Factor.													

11. SAR Measurement Variability

According to KDB 865664 D01, SAR measurement variability was assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. Alternatively, if the highest measured SAR for both head and body tissue-equivalent media are ≤ 1.45 W/kg and the ratio of these highest SAR values, i.e., largest divided by smallest value, is ≤ 1.10 , the highest SAR configuration for either head or body tissue-equivalent medium may be used to perform the repeated measurement. These 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.

SAR repeated measurement procedure:

1. When the highest measured SAR is < 0.80 W/kg, repeated measurement is not required.
2. When the highest measured SAR is ≥ 0.80 W/kg, repeat that measurement once.
3. 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, perform a second repeated measurement.
4. If the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20 , and the original, first or second repeated measurement is ≥ 1.5 W/kg, perform a third repeated measurement.

Note: For 1g SAR, the highest measured 1g SAR is $0.570 < 0.80$ W/kg, repeated measurement is not required.

12. Simultaneous Transmission

Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneous transmitting antenna. When the sum of SAR 1g of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit (SAR 1g 1.6 W/kg), the simultaneous transmission SAR is not required. When the sum of SAR 1g is greater than the SAR limit (SAR 1g 1.6 W/kg), SAR test exclusion is determined by the SAR to Peak Location Ratio (SPLSR).

12.1 Simultaneous Transmission Mode Considerations

Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneous transmitting antenna. The device has 2 Tx antennas, one only for wifi, and the other for Wifi&Bluetooth.

Mode	Ant.1 Wifi 1g reported SAR (W/kg)	Ant.2 Wifi 1g reported SAR (W/kg)	Ant.1 Wifi + Ant.2 Wifi 1g simultaneous SAR (W/kg)
2.4g Wifi (SISO)	0.439	0.482	0.921
5.2g Wifi (SISO)	0.552	0.492	1.044
5.8g Wifi (SISO)	0.334	0.401	0.735
2.4g Wifi (MIMO)	0.593	0.573	1.166
5.2g Wifi (MIMO)	0.404	0.380	0.784
5.8g Wifi (MIMO)	0.307	0.278	0.585

13. Test Equipment List

Description	Manufacturer	Model	Serial No./Version	Cal. Date	Cal. Due
E-Field Probe	MVG	SSE2	04/22 EPG0365	2024/02/06	2025/02/05
6 1/2 Digital Multimeter	Keithley	DMM6500	4527164	2023/11/16	2024/11/15
Wideband Radio Communication Tester	ROHDE & SCHWARZ	CMW500	161997	2023/11/16	2024/11/15
MXG Vector Signal Generator	Agilent	N5182A	MY46240163	2023/11/16	2024/11/15
E-Series Avg. Power Sensor	KEYSIGHT	E9300A	MY55050017	2024/03/20	2025/03/19
EPM Series Power Meter	KEYSIGHT	E4418B	MY41293435	2024/03/20	2025/03/19
10dB Attenuator	MIDWEST MICROWAVE	263-10dB	/	2024/03/20	2025/03/19
Coupler	MERRIMAC	CWM-10R-10.8G	LOT-83391	2024/03/20	2025/03/19
2450MHz Validation Dipole	MVG	SID2450	07/22 DIP 2G450-662	2023/02/06	2025/02/05
5200MHz-5800MHz Validation Dipole	MVG	SID5000	07/22 DIP5G000-670	2023/02/06	2025/02/05
LIMESAR Dielectric Probe	MVG	SCLMP	06/22 OCPG88	2024/02/02	2025/02/01
ENA Series Network Analyzer	Agilent	E5071B	MY42301221	2023/11/16	2024/11/15
Thermometer	Riters	DT-232	21A11	2024/03/20	2025/03/19
Antenna network emulator	MVG	ANTA 74	07/22 ANTA 74	/	/
SAM Phantom	MVG	SAM	07/22 SAM149	/	/
Mobile Phone Positioning System	MVG	MSH 118	07/22 MSH 118	/	/
Mechanical Calibration Kit	PNA	/	/	2023/11/16	2024/11/15
Open SAR test software	MVG	/	V5.3.5	/	/

Note: For dipole antennas, BTF has adopted 3 years as calibration intervals, and on annual basis, every measurement dipole has been evaluated and is in compliance with the following criteria:

1. There is no physical damage on the dipole;
2. System validation with specific dipole is within 10% of calibrated value;
3. Return-loss in within 20% of calibrated measurement.
4. Impedance (real or imaginary parts) in within 5 Ohms of calibrated measurement.

ANNEX A Simulating Liquid Verification Result

The dielectric parameters of the liquids were verified prior to the SAR evaluation using an SCLMP Dielectric Probe Kit.

Dielectric performance of tissue simulating liquid									
Frequency (MHz)	ϵ_r		σ (s/m)		Delta (ϵ_r)	Delta (σ)	Limit	Temp (°C)	Date
	Target	Measured	Target	Measured					
2450	39.20	39.08	1.80	1.81	0.31%	-0.56%	±5%	20.0	13/8/2024
5200	36.00	35.88	4.66	4.70	0.33%	-0.86%	±5%	20.0	14/8/2024
5800	35.30	35.18	5.27	5.31	0.34%	-0.76%	±5%	20.0	14/8/2024

NOTE: 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.

ANNEX B System Check Result

Comparing to the original SAR value provided by MVG, the validation data should be within its specification of 10 %(for 10 g).

Frequency (MHz)	Input Power (mW)	10g SAR (W/Kg)	1g SAR (W/Kg)	10g SAR 1W input power normalized (W/Kg)	1g SAR 1W input power normalized (W/Kg)	10g SAR Standard target (1W) (W/Kg)	1g SAR Standard target (1W) (W/Kg)	10g SAR Deviation	1g SAR Deviation
2450	16	0.793	0.352	49.56	22.00	54.4	23.86	-8.89%	-7.80%
5200	13	0.288	1.019	22.15	78.38	21.29	73.88	4.05%	6.09%
5800	13	0.277	0.981	21.31	75.46	21.5	74.21	-0.90%	1.68%

ANNEX C SAR Dipole Calibrations

Justification for Extended SAR Dipole Calibrations

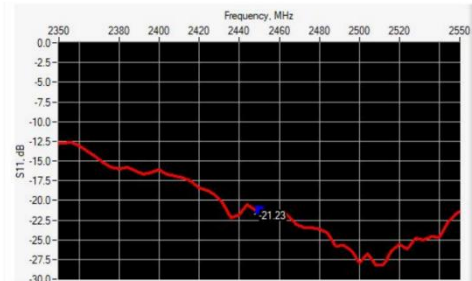
Referring to KDB 865664D01V01r04, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration)and in impedance (within 5 ohm of prior calibration). the annual calibration is not necessary and the calibrationinterval can be extended.While calibration intervals not exceed 3 years.

Frequency (MHz)	Return loss(dB)		Impedance(Ω)				error range (%)		Results	Date of Measure ment
	measurement	target	measurement		target		Return loss(±20%)	Impedance(±5 Ω)	(P/F)	
			real part	imaginary part	real part	imaginary part				
CW2450	-24.37	-21.23	48.3	5.7	49.40	+8.6	14.79%	4.0	P	2/5/2024
CW5200	-21.14	-20.29	58.4	-4.5	58.76	-4.43	4.19%	0.43	P	2/5/2024
CW5800	-28.88	-28.48	50.8	0.1	50.12	-3.76	1.40%	4.34	P	2/5/2024

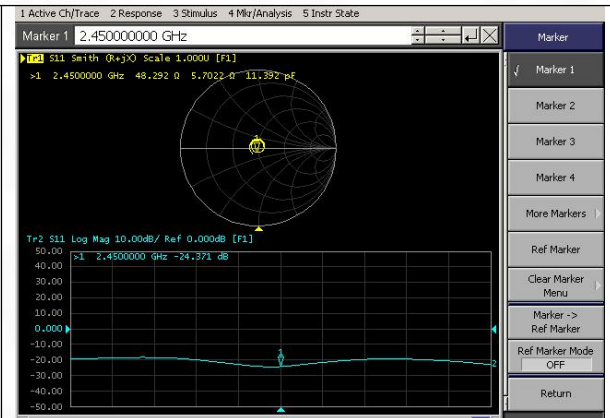
Dipole calibration report data

Self-examination data

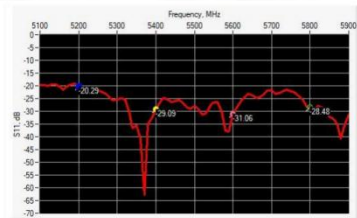
2450MHz Dipole



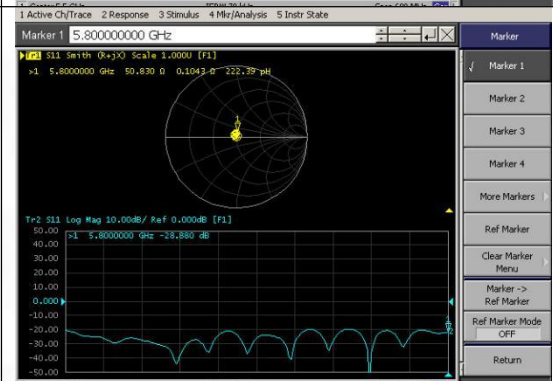
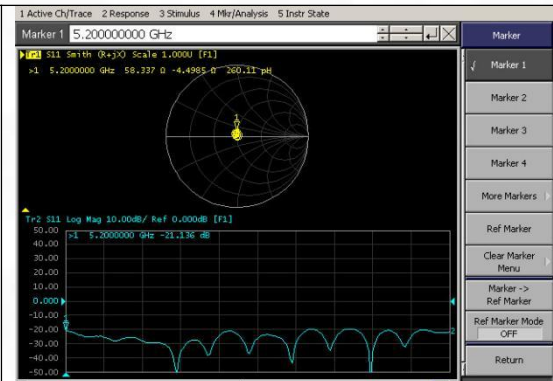
Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
2450	-21.23	-20	49.4 Ω + 8.6 j Ω



5000MHz Dipole



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
5200	-20.29	-20	58.76 Ω - 4.43 j Ω
5400	-29.09	-20	53.46 Ω + 0.61 j Ω
5600	-31.06	-20	52.76 Ω - 0.45 j Ω
5800	-28.48	-20	50.12 Ω - 3.76 j Ω



System Performance Check Data (2450 MHz)

System check at 2450 MHz

Date of measurement: 13/8/2024

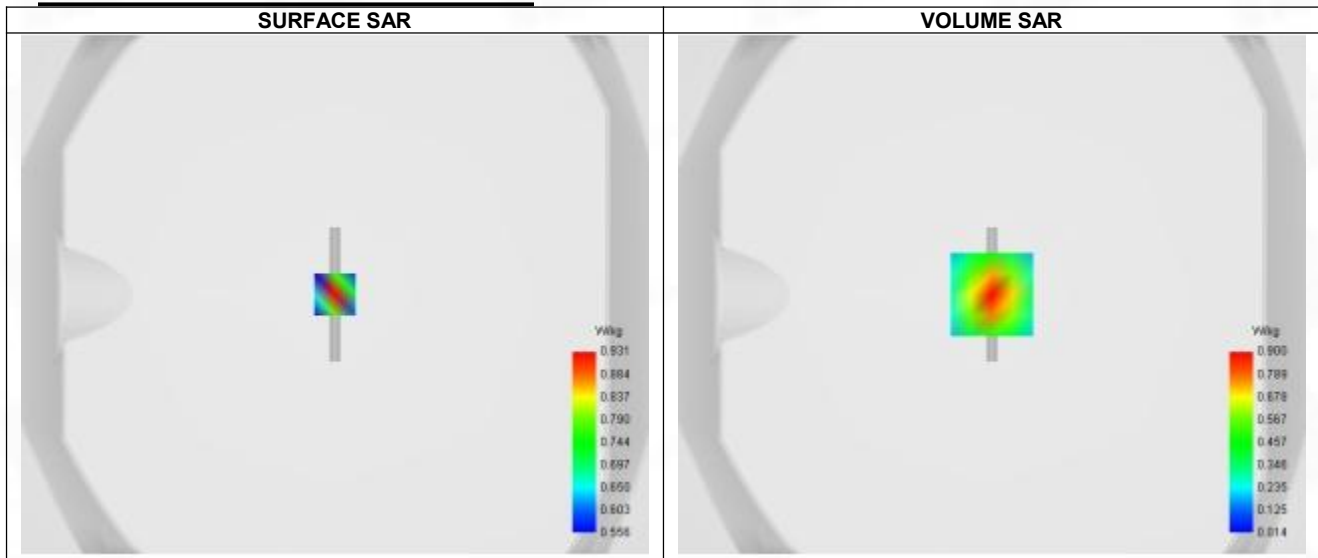
A. Experimental conditions.

Probe	SN 04/22 EPG0365
ConvF	2.36
Area Scan	dx=8mm dy=8mm, Adaptive 1 max
Zoom Scan	5x5x7, dx=5mm dy=5mm dz=5mm, Complete
Phantom	Validation plane
Device Position	Dipole
Band	CW2450
Channels	Middle
Signal	CW

B. Permittivity

Frequency (MHz)	2450.000
Relative permittivity (real part)	39.080
Relative permittivity (imaginary part)	13.340
Conductivity (S/m)	1.810

C. SAR Surface and Volume



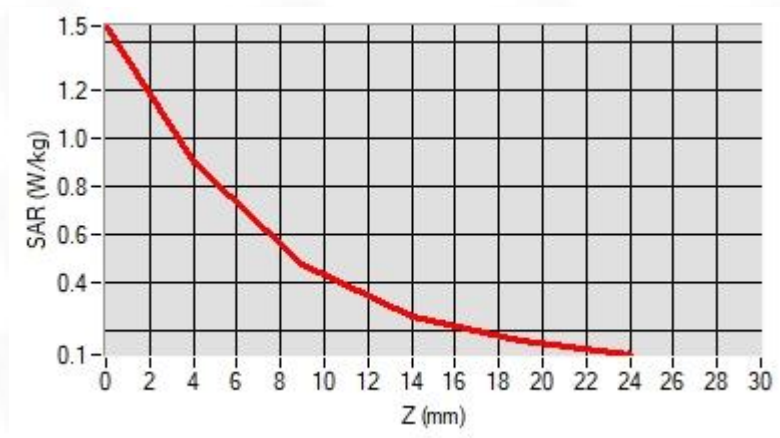
Maximum location: X=0.00, Y=0.00 ; SAR Peak: 1.47 W/kg

D. SAR 1g & 10g

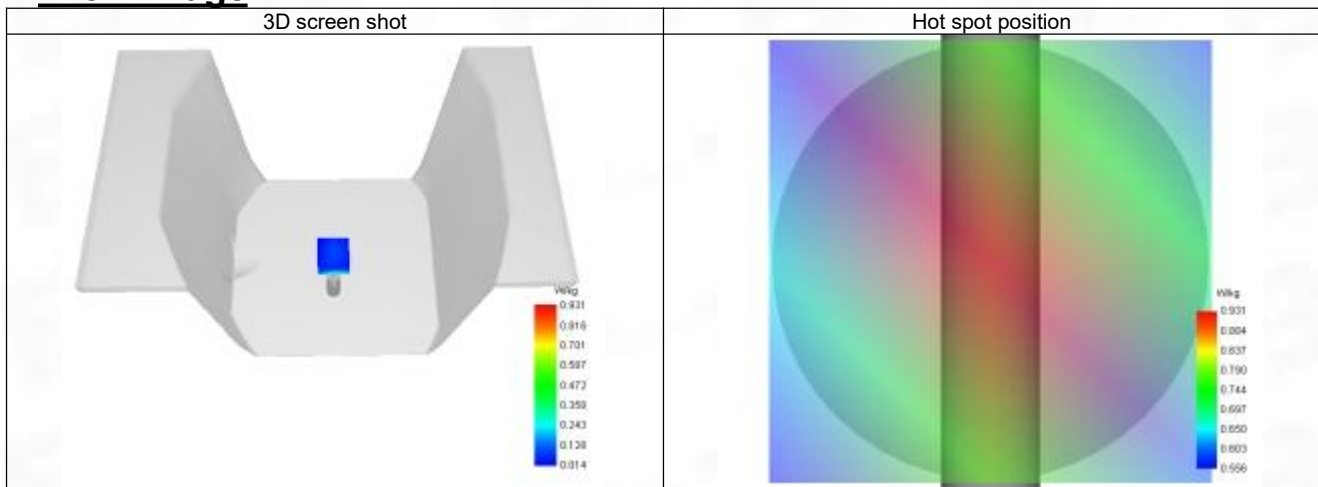
SAR 10g (W/Kg)	0.352
SAR 1g (W/Kg)	0.793
Variation (%)	-2.570
Horizontal validation criteria: minimum distance (mm)	9.514
Vertical validation criteria: SAR ratio M2/M1 (%)	53.00%

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.466	0.900	0.477	0.261	0.158



F. 3D Image



System Performance Check Data (5200 MHz)

System check at 5200 MHz

Date of measurement: 13/8/2024

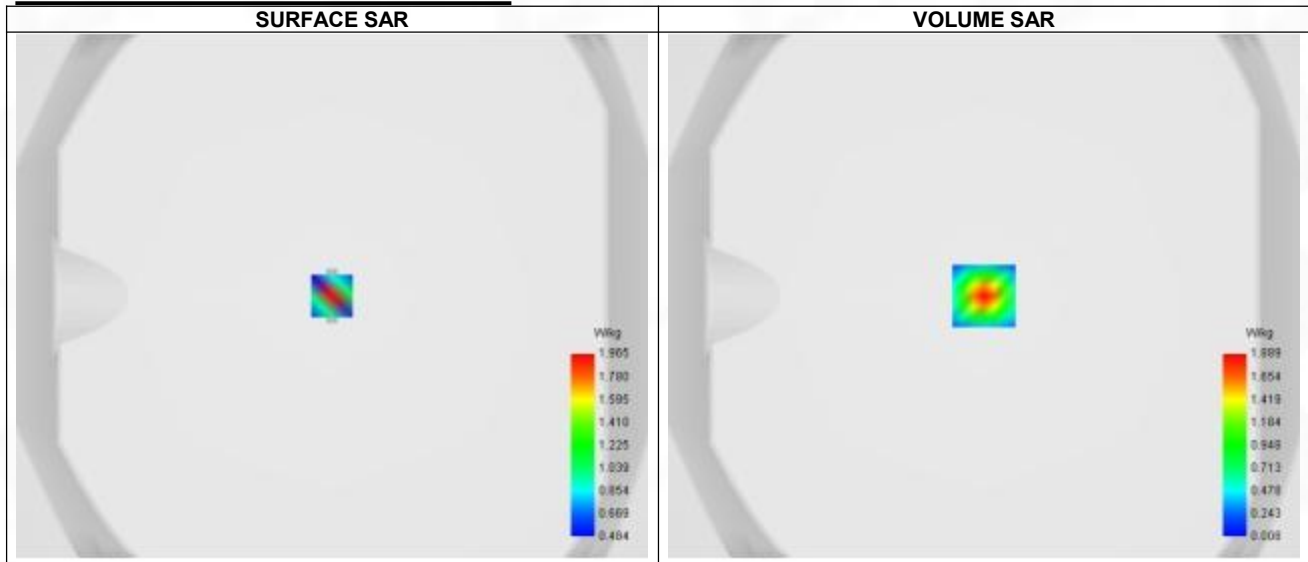
A. Experimental conditions.

Probe	SN 04/22 EPG0365
ConvF	2.24
Area Scan	dx=8mm dy=8mm, Adaptive 1 max
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2mm,Complete
Phantom	Validation plane
Device Position	Dipole
Band	CW5200
Channels	Middle
Signal	CW

B. Permittivity

Frequency (MHz)	5200.000
Relative permittivity (real part)	35.880
Relative permittivity (imaginary part)	16.250
Conductivity (S/m)	4.700

C. SAR Surface and Volume



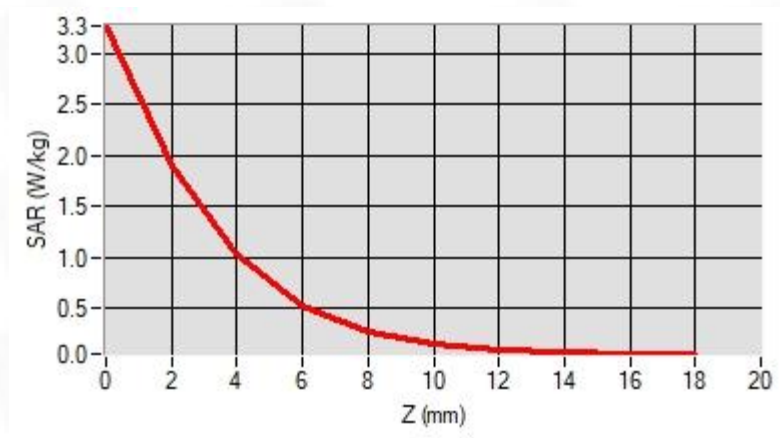
Maximum location: X=0.00, Y=0.00 ; SAR Peak: 3.38 W/kg

D. SAR 1g & 10g

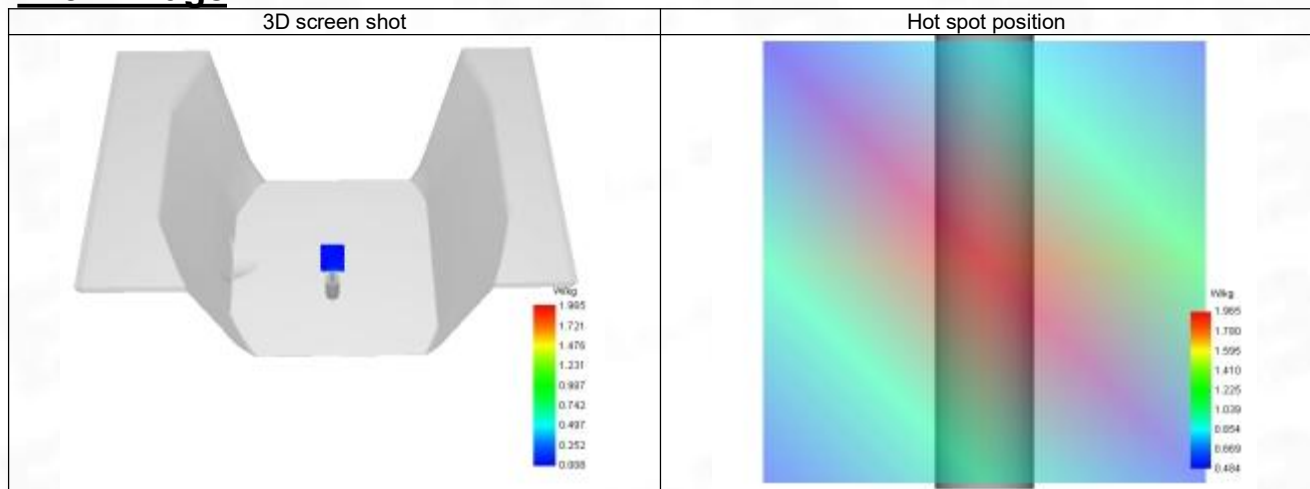
SAR 10g (W/Kg)	0.288
SAR 1g (W/Kg)	1.019
Variation (%)	-3.400
Horizontal validation criteria: minimum distance (mm)	5.987
Vertical validation criteria: SAR ratio M2/M1 (%)	54.05%

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00
SAR (W/Kg)	3.268	1.889	1.021	0.523	0.266	0.142	0.085	0.060	0.052



F. 3D Image



System Performance Check Data (5800 MHz)

System check at 5800 MHz

Date of measurement: 13/8/2024

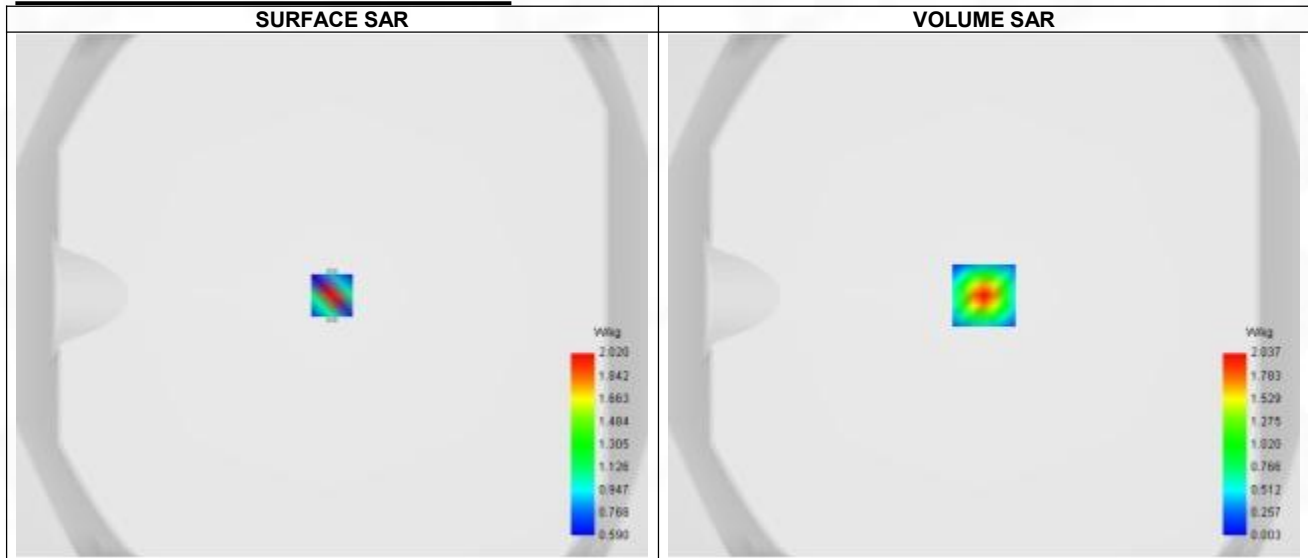
A. Experimental conditions.

Probe	SN 04/22 EPG0365
ConvF	2.04
Area Scan	dx=8mm dy=8mm, Adaptive 1 max
Zoom Scan	7x7x12,dx=4mm dy=4mm dz=2mm,Complete
Phantom	Validation plane
Device Position	Dipole
Band	CW5800
Channels	Middle
Signal	CW

B. Permittivity

Frequency (MHz)	5800.000
Relative permittivity (real part)	35.180
Relative permittivity (imaginary part)	16.480
Conductivity (S/m)	5.310

C. SAR Surface and Volume



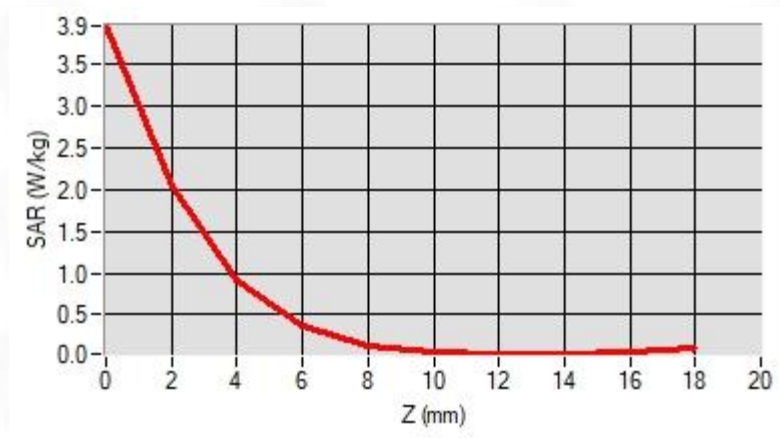
Maximum location: X=0.00, Y=0.00 ; SAR Peak: 4.17 W/kg

D. SAR 1g & 10g

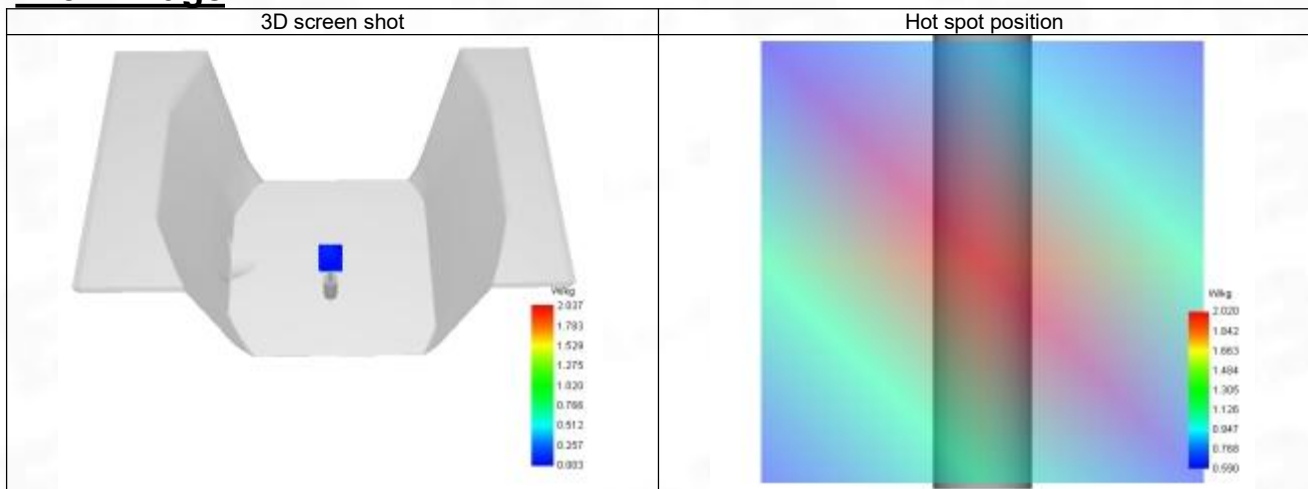
SAR 10g (W/Kg)	0.277
SAR 1g (W/Kg)	0.981
Variation (%)	0.490
Horizontal validation criteria: minimum distance (mm)	6.957
Vertical validation criteria: SAR ratio M2/M1 (%)	44.92%

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00
SAR (W/Kg)	3.948	2.037	0.915	0.361	0.135	0.055	0.033	0.037	0.059



F. 3D Image



ANNEX D Test Data

1-Body with back position in dist. 0mm on Channel 11 in IEEE 802.11n ISM

SAR Measurement at IEEE 802.11n ISM (Body, Validation Plane)

Date of measurement: 13/8/2024

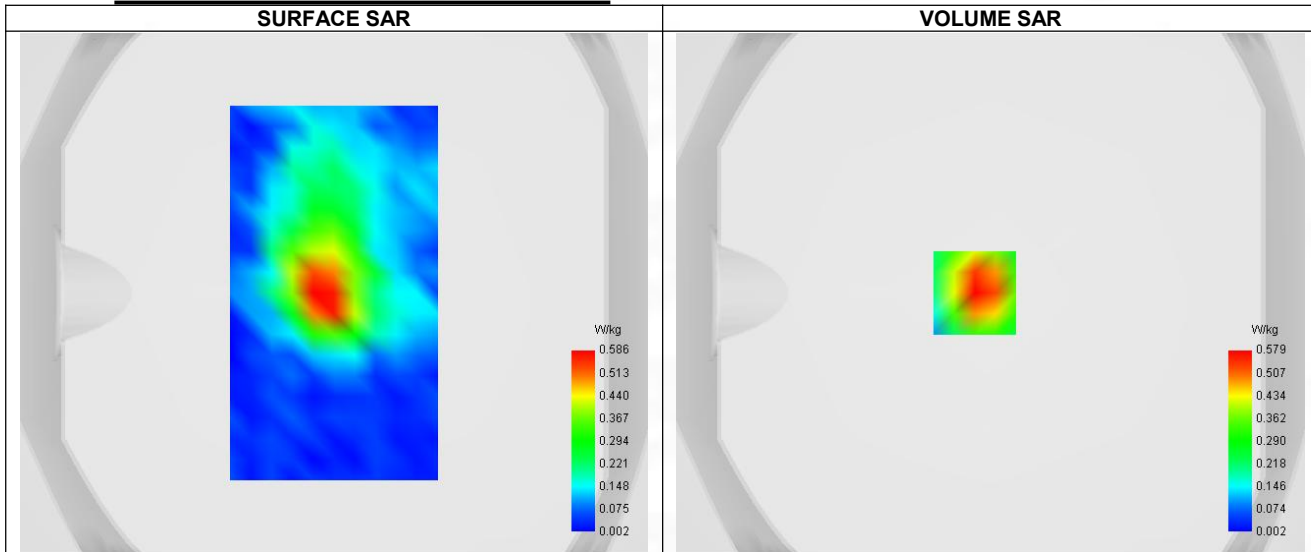
A. Experimental conditions.

Probe	SN 04/22 EPG0365
ConvF	2.12
Area Scan	dx=8mm dy=8mm, Adaptive 1 max
Zoom Scan	5x5x7, dx=8mm dy=8mm dz=5mm, Complete
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11n ISM
Channels	Higher (11)
Signal	IEEE 802.11

B. Permittivity

Frequency (MHz)	2462.000
Relative permittivity (real part)	39.064
Relative permittivity (imaginary part)	13.288
Conductivity (S/m)	1.823

C. SAR Surface and Volume



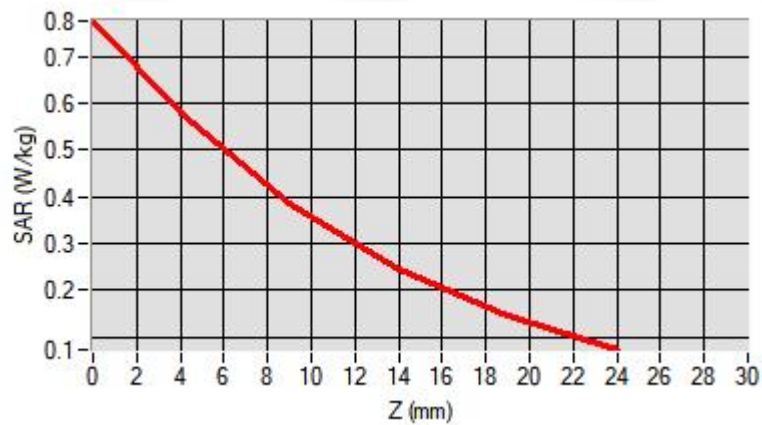
Maximum location: X=-6.00, Y=0.00 ; SAR Peak: 0.83 W/kg

D. SAR 1g & 10g

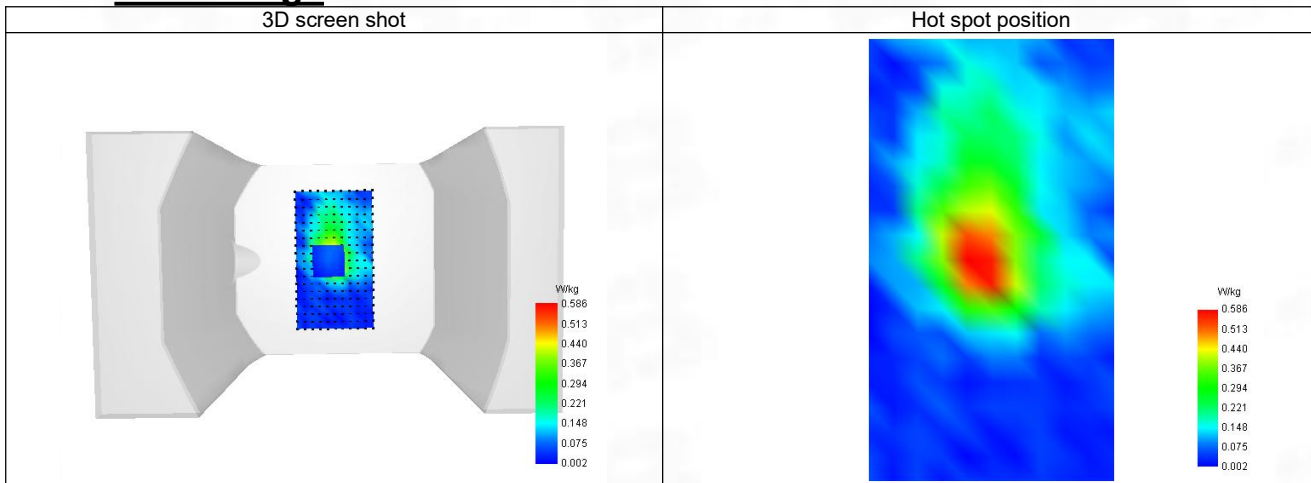
SAR 10g (W/Kg)	0.319
SAR 1g (W/Kg)	0.570
Variation (%)	-4.510
Horizontal validation criteria: minimum distance (mm)	8.925
Vertical validation criteria: SAR ratio M2/M1 (%)	66.84%

E. Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.776	0.579	0.387	0.246	0.145



F. 3D Image



2-Body with back position in dist. 0mm on Channel 48 in IEEE 802.11a U-NII

SAR Measurement at IEEE 802.11a U-NII (Body, Validation Plane)

Date of measurement: 14/8/2024

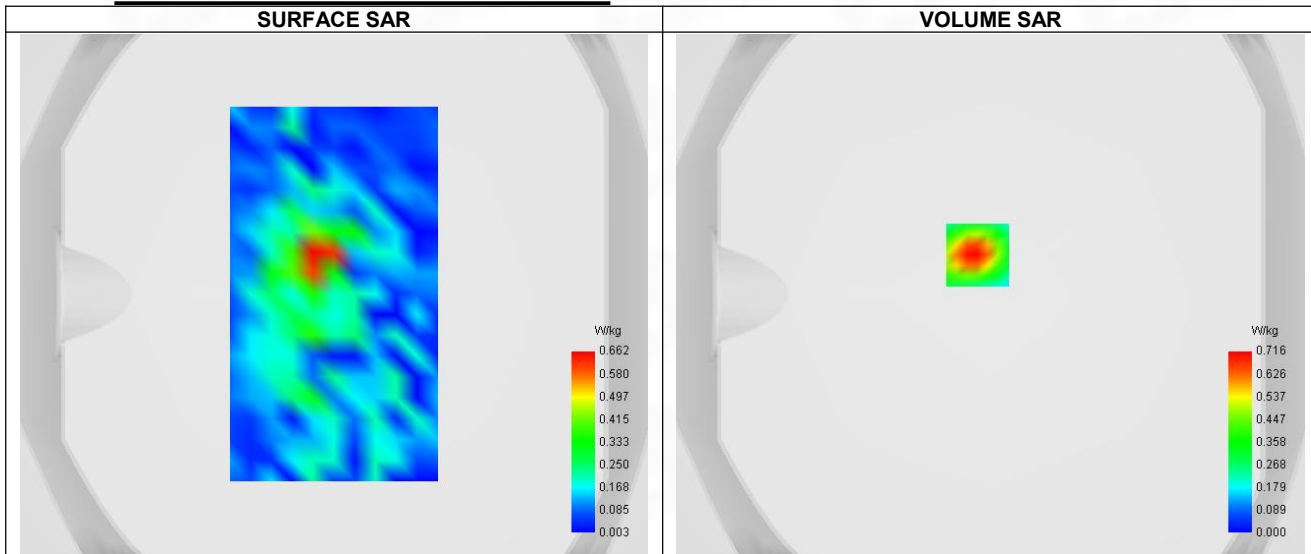
A. Experimental conditions.

Probe	SN 04/22 EPG0365
ConvF	1.79
Area Scan	dx=8mm dy=8mm, Adaptive 1 max
Zoom Scan	7x7x12, dx=4mm dy=4mm dz=2mm, Complete
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11a U-NII
Channels	Higher (48)
Signal	IEEE 802.11

B. Permittivity

Frequency (MHz)	5240.000
Relative permittivity (real part)	35.840
Relative permittivity (imaginary part)	16.264
Conductivity (S/m)	4.740

C. SAR Surface and Volume

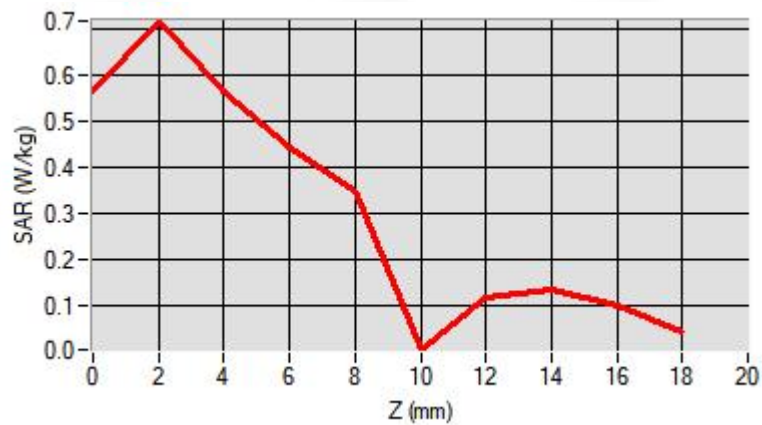


D. SAR 1g & 10g

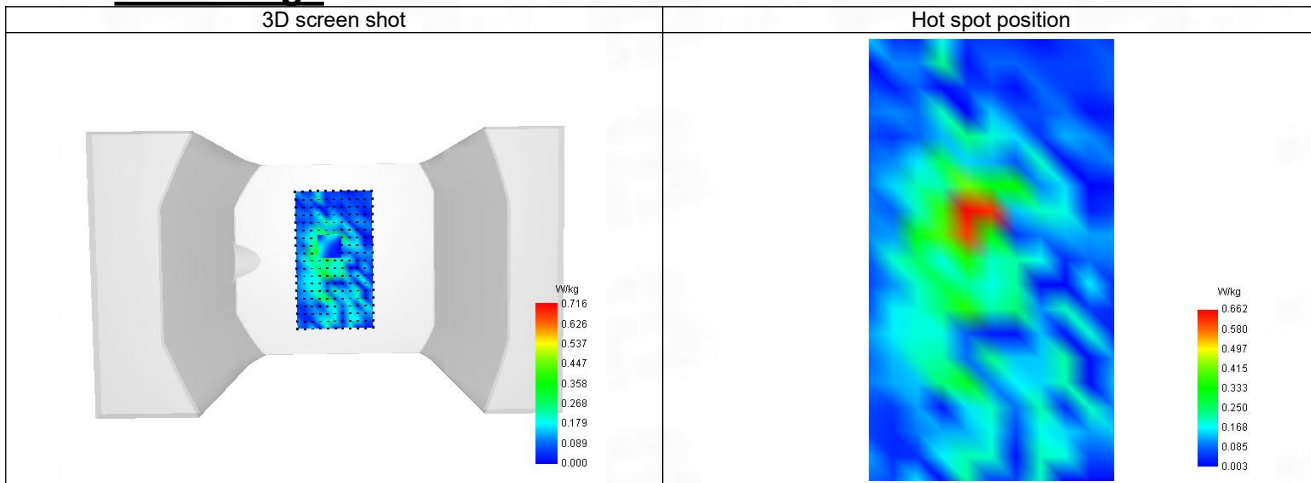
SAR 10g (W/Kg)	0.204
SAR 1g (W/Kg)	0.507
Variation (%)	-2.670
Horizontal validation criteria: minimum distance (mm)	6.287
Vertical validation criteria: SAR ratio M2/M1 (%)	76.12%

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00
SAR (W/Kg)	0.564	0.716	0.545	0.443	0.346	0.003	0.114	0.132	0.100



F. 3D Image



3-Body with back position in dist. 0mm on Channel 157 in IEEE 802.11a U-NII

SAR Measurement at IEEE 802.11a U-NII (Body, Validation Plane)

Date of measurement: 14/8/2024

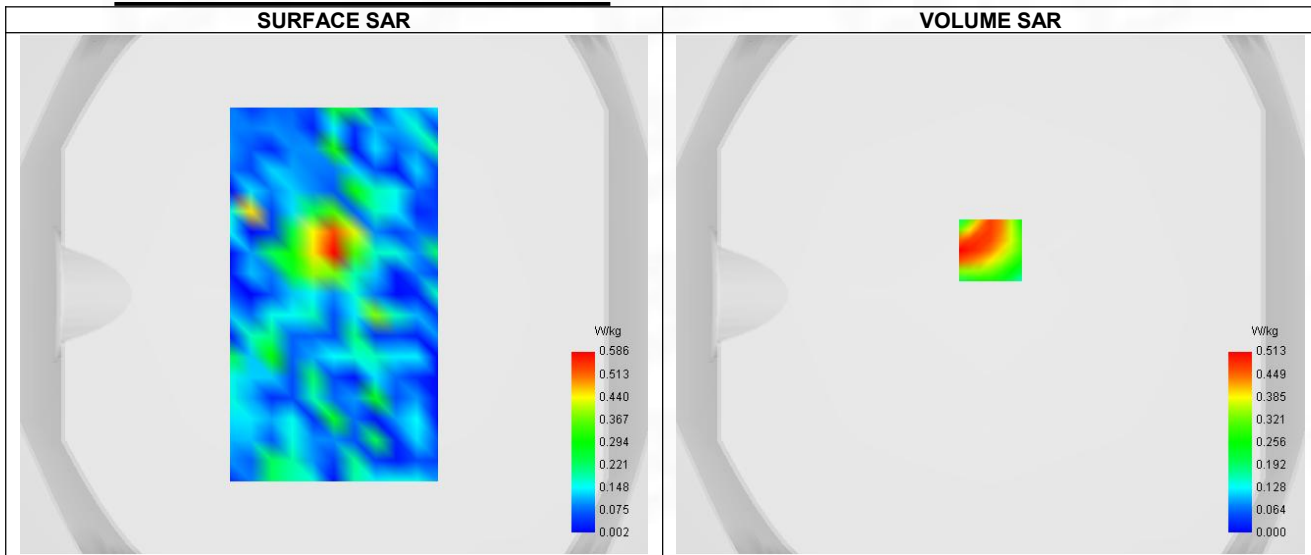
A. Experimental conditions.

Probe	SN 04/22 EPG0365
ConvF	1.60
Area Scan	dx=8mm dy=8mm, Adaptive 1 max
Zoom Scan	7x7x12, dx=4mm dy=4mm dz=2mm, Complete
Phantom	Validation plane
Device Position	Body
Band	IEEE 802.11a U-NII
Channels	Middle (157)
Signal	IEEE 802.11

B. Permittivity

Frequency (MHz)	5785.000
Relative permittivity (real part)	35.195
Relative permittivity (imaginary part)	16.476
Conductivity (S/m)	5.295

C. SAR Surface and Volume

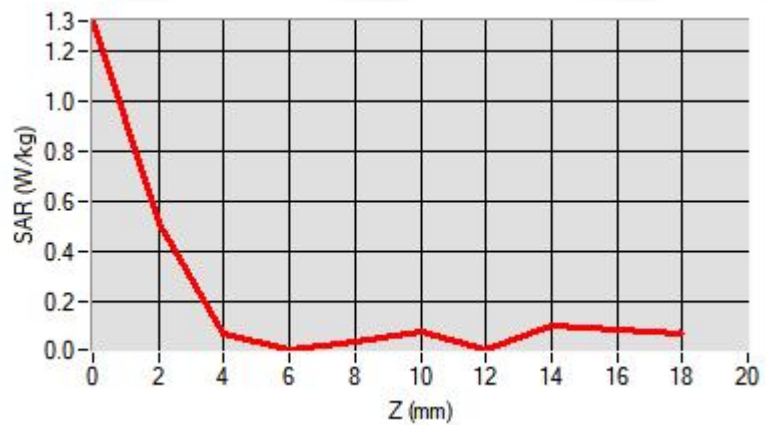


D. SAR 1g & 10g

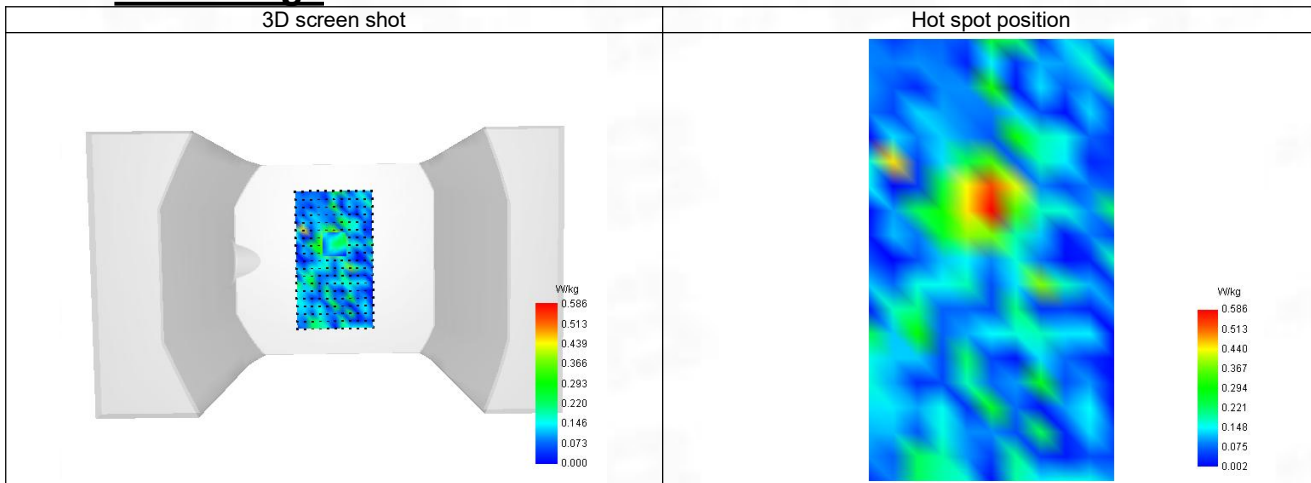
SAR 10g (W/Kg)	0.166
SAR 1g (W/Kg)	0.359
Variation (%)	1.310
Horizontal validation criteria: minimum distance (mm)	7.144
Vertical validation criteria: SAR ratio M2/M1 (%)	52.44%

E. Z Axis Scan

Z (mm)	0.00	2.00	4.00	6.00	8.00	10.00	12.00	14.00	16.00
SAR (W/Kg)	1.321	0.513	0.269	0.156	0.134	0.079	0.038	0.022	0.013



F. 3D Image



ANNEX E SAR Test Setup Photos

Reference Photo: simulation liquid depth 15cm



Reference Photos



Back (dist. 0mm)

ANNEX F EUT External and Internal Photos

Please refer to RF Report.

ANNEX G Calibration Information

Please refer to the document "Calibration.pdf".



BTF Testing Lab (Shenzhen) Co., Ltd.

F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street,
Bao'an District, Shenzhen, China

www.btf-lab.com

--END OF REPORT--