

TEST REPORT

Applicant: Avantis Education Limited
Address: Unit 2&3 Jessop Court, Waterwells Business Park,
Quedgeley, Gloucester, GL2 2AP UK Gloucester,
United Kingdom
Equipment Type: VR Headset
Model Name: CVR-255-64 (refer to section 2.3)
Brand Name: CLASS VR
FCC ID: 2BNWDCVR-355-128M
Test Standard: FCC 47 CFR Part 2.1093
(refer to section 3.1)
Maximum SAR: Head (1g@0mm): 0.38 W/kg
Sample Arrival Date: Apr. 27, 2025
Test Date: May 14, 2025 - May 15, 2025
Date of Issue: Jun. 16, 2025

ISSUED BY:

Shenzhen BALUN Technology Co., Ltd.

Tested by: Guo Guangwei**Checked by:** Xu Rui**Approved by:** Tolan Tu
(Testing Director)

Revision History

Version	Issue Date	Revisions Content
<u>Rev. 01</u>	<u>Jun. 16, 2025</u>	<u>Initial Issue</u>

TABLE OF CONTENTS

1 GENERAL INFORMATION..... 4

1.1 Test Laboratory 4

1.2 Test Location 4

1.3 Test Environment Condition..... 4

2 PRODUCT INFORMATION 5

2.1 Applicant Information 5

2.2 Manufacturer Information..... 5

2.3 General Description for Equipment under Test (EUT)..... 5

2.4 Ancillary Equipment..... 5

2.5 Technical Information 6

3 SUMMARY OF TEST RESULT 7

3.1 Test Standards 7

3.2 Device Category and SAR Limit 8

3.3 Test Result Summary 9

3.4 Test Uncertainty 11

4 MEASUREMENT SYSTEM 12

4.1 Specific Absorption Rate (SAR) Definition 12

4.2 DASY SAR System 13

5 SYSTEM VERIFICATION 20

5.1 Purpose of System Check 20

5.2 System Check Setup 20

6 TEST POSITION CONFIGURATIONS 21

6.1 Body-worn Position Conditions 21

7 MEASUREMENT PROCEDURE 22

7.1	Measurement Process Diagram	22
7.2	SAR Scan General Requirement	23
7.3	Measurement Procedure	24
7.4	Area & Zoom Scan Procedure	24
7.5	Area & Zoom Scan Procedure	25
8	CONDUCTED RF OUPUT POWER	27
8.1	WIFI.....	27
8.2	Bluetooth	33
9	TEST EXCLUSION CONSIDERATION	34
9.1	10g Extremity Exposure Consideration	36
10	TEST RESULT	37
10.1	WIFI 2.4GHz.....	37
10.2	WIFI 5GHz.....	38
10.3	Bluetooth	39
11	SAR Measurement Variability	40
12	SIMULTANEOUS TRANSMISSION.....	41
12.1	Simultaneous Transmission Mode Consider	41
12.2	Sum SAR of Simultaneous Transmission	42
13	TEST EQUIPMENTS LIST	43
ANNEX A	SIMULATING LIQUID VERIFICATION RESULT	44
ANNEX B	SYSTEM CHECK RESULT	45
ANNEX C	TEST DATA.....	49
ANNEX D	EUT EXTERNAL PHOTOS.....	56
ANNEX E	SAR TEST SETUP PHOTOS	56
ANNEX F	CALIBRATION REPORT	56
ANNEX G	TUNE-UP PROCEDURE.....	56

1 GENERAL INFORMATION

1.1 Test Laboratory

Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Phone Number	+86 755 6685 0100

1.2 Test Location

Name	Shenzhen BALUN Technology Co., Ltd.
Location	☐ Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
	☒ 1/F, Building B, Ganghongji High-tech Intelligent Industrial Park, No. 1008, Songbai Road, Yangguang Community, Xili Sub-district, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Accreditation Certificate	The laboratory is a testing organization accredited by FCC as a accredited testing laboratory. The designation number is CN1196.

1.3 Test Environment Condition

Ambient Temperature	18℃ to 25℃
Ambient Relative Humidity	30% to 70%

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	Avantis Education Limited
Address	Unit 2&3 Jessop Court, Waterwells Business Park, Quedgeley, Gloucester, GL2 2AP UK Gloucester, United Kingdom

2.2 Manufacturer Information

Manufacturer	Channel Electronics (M) SDN.BHD.
Address	Lot 16036, Jln Teknologi 6, Kaw. Perindustrian Tangkak, Johor, Malaysia

2.3 General Description for Equipment under Test (EUT)

EUT Name	VR Headset
Model Name Under Test	CVR-255-64
Series Model Name	CVR-255-32, CVR-255-64-A, CVR-355-128, CVR-355-128-M
Description of Model name differentiation	These models have the same circuit schematic, construction, PCB Layout and critical components. The difference in screen size, memory capacity, battery capacity, and screen assembly. (this information is provided by the customer)
Hardware Version	N/A
Software Version	N/A
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.4 Ancillary Equipment

Ancillary Equipment 1	Battery	
	Brand Name	N/A
	Model No.	GSP9525130
	Limit Charge Voltage	4.35V

2.5 Technical Information

Network and Wireless connectivity	Bluetooth (BR+EDR+BLE) WIFI 802.11a, 802.11b, 802.11g, 802.11n, 802.11ac,
Note: The EUT is a VR glasses, which supports BT, WIFI	

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

Operating Mode	2.4G WIFI, 5G WIFI, Bluetooth	
Frequency Range	802.11b/g /n(HT20/HT40)	2412 ~ 2462 MHz
	802.11a/ /n(HT20/HT40)	5150 ~ 5250 MHz
	/ac(VHT20/VHT40 /VHT80)	5725 ~ 5850 MHz
	Bluetooth	2402 ~ 2480 MHz
Antenna Type	WIFI: PIFA Antenna Bluetooth: PIFA Antenna	
DTM	N/A	
Hotspot Function	Support	
Power Reduction	Support	
Exposure Category	General Population/Uncontrolled exposure	
Product Type	Portable Device	
EUT Type	☒ Production unit	☐ Identical prototype

3 SUMMARY OF TEST RESULT

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 2.1093	Radiofrequency radiation exposure evaluation: portable devices
2	ANSI C95.1-1992	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
3	IEEE Std. 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
4	KDB 447498 D04 v01	447498 D04 Interim General RF Exposure Guidance v01
5	KDB 865664 D01 v01r04	SAR Measurement 100 MHz to 6 GHz
6	KDB 865664 D02 v01r02	RF Exposure Reporting
7	KDB 648474 D04 v01r03	SAR EVALUATION CONSIDERATIONS FOR WIRELESS HANDSETS
8	KDB 248227 D01 v02r02	SAR GUIDANCE FOR IEEE 802.11 (Wi-Fi) TRANSMITTERS

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.

Table of Exposure Limits:

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

3.3.1 Highest SAR Values

Equipment Class	Band	Maximum Scaled SAR (W/kg)		Maximum Report SAR (W/kg)
		Head(0mm)		Head(0mm)
		1g SAR		
		Ant.1	Ant.2	1g SAR
DTS	2.4G WLAN	0.25	0.38	0.38
NII	5.2G WLAN	0.16	0.15	
	5.8G WLAN	0.23	0.20	
DSS	Bluetooth	0.37	/	
Limit (W/kg)		1.6		1.6
Verdict		PASS		

3.3.2 Highest Simultaneous Transmission SAR Values

Equipment Class	Maximum Scaled SAR (W/kg)
	Head 1g (0mm)
DTS	0.62
NII	0.80
DSS	0.80
Limit (W/Kg)	1.60
Verdict	Pass
Note: The highest simultaneous SAR please refer section 12.2	

3.4 Test Uncertainty

According to KDB 865664 D01, When the highest measured 1 g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis is not required in SAR reports submitted for equipment approval.

The maximum 1 g SAR for the EUT in this report is 0.38 W/kg, which is lower than 1.5 W/kg, so the extensive SAR measurement uncertainty analysis is not required in this report.

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

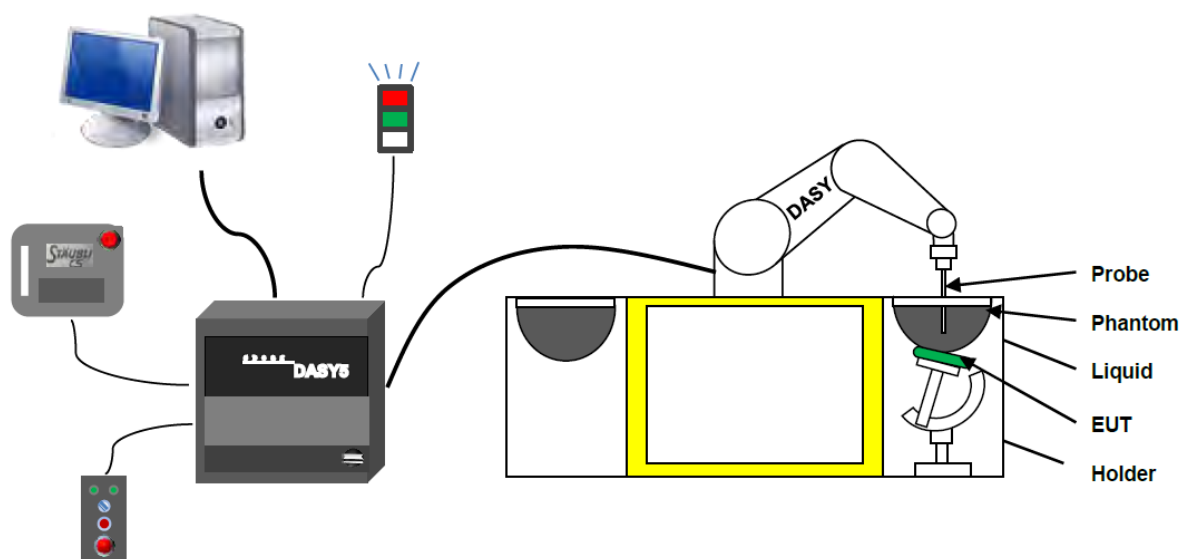
$$SAR = \frac{\sigma E^2}{\rho}$$

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 DASY SAR System

4.2.1 DASY SAR System Diagram



The DASY5 system for performing compliance tests consists of the following items:

1. A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).
2. A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
3. A data acquisition electronic (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
4. A unit to operate the optical surface detector which is connected to the EOC.
5. The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.
6. The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation.
7. DASY5 software and SEMCAD data evaluation software.
8. Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
9. The generic twin phantom enabling the testing of left-hand and right-hand usage.
10. The device holder for handheld mobile phones.
11. Tissue simulating liquid mixed according to the given recipes.
12. System validation dipoles allowing to validate the proper functioning of the system.

4.2.2 Robot

The Dasy SAR system uses the high precision robots. Symmetrical design with triangular core Built-in optical fiber for surface detection system For the 6-axis controller system, Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents). The robot series have many features that are important for our application:



- High precision
(repeatability ± 0.02 mm)
- High reliability
(industrial design)
- Low maintenance costs
(virtually maintenance free due to direct drive gears; no belt drives)
- Jerk-free straight movements
(brush less synchron motors; no stepper motors)
- Low ELF interference
(motor control _elds shielded via the closed metallic construction shields)

4.2.3 E-Field Probe

The probe is specially designed and calibrated for use in liquids with high permittivities for the measurements the Specific Dosimetric E-Field Probe EX3DV4 with following specifications is used.

Construction	Symmetrical design with triangular core Built-in optical fiber for surface detection system Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., glycolether)
Calibration	ISO/IEC 17025 calibration service available
Frequency	10 MHz to 6 GHz; Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	± 0.2 dB in HSL (rotation around probe axis) ; ± 0.4 dB in HSL (rotation normal to probe axis)
Dynamic range	5 μ W/g to > 100 mW/g; Linearity: ± 0.2 dB
Dimensions	Overall length: 337 mm (Tip: 9 mm) Tip diameter: 2.5 mm (Body: 10 mm) Distance from probe tip to dipole centers: 1.0 mm
Application	General dosimetry up to 3 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms (EX3DV4)



E-Field Probe Calibration Process

Probe calibration is realized, in compliance with CENELEC EN 62209-1/-2 and IEEE 1528 std, with CALISAR, Antennessa proprietary calibration system. The calibration is performed with the EN 62209-1/2 annexe technique using reference guide at the five frequencies.

4.2.4 Data Acquisition Electronics

The data acquisition electronics (DAE) consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converte and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock.



- Input Impedance: 200M Ω m
- The Inputs: Symmetrical and Floating
- Commom Mode Rejection: Above 80dB

4.2.5 Phantoms

For the measurements the Specific Anthropomorphic Mannequin (SAM) defined by the IEEE SCC-34/SC2 group is used. The phantom is a polyurethane shell integrated in a wooden table. The thickness of the phantom amounts to 2mm +/- 0.2mm. It enables the dosimetric evaluation of left and right phone usage and includes an additional flat phantom part for the simplified performance check. The phantom set-up includes a cover, which prevents the evaporation of the liquid.



- Left head
- Right head
- Flat phantom

Photo of Phantom SN1576



Serial Number	Material	Length	Height
SN 1576 SAM1	Vinylester, glass fiber reinforced	1000	500

4.2.6 Device Holder

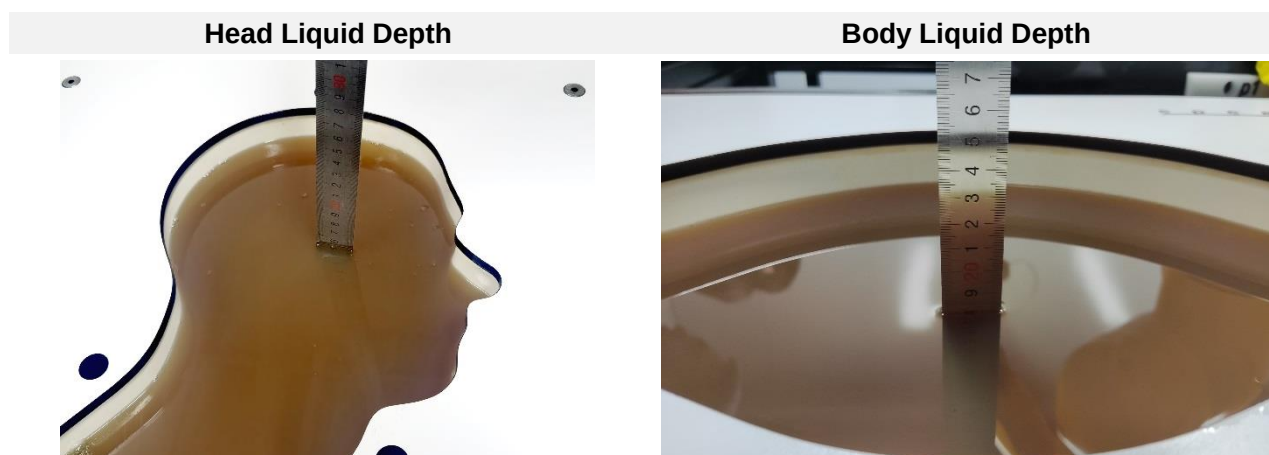
The DASY5 device holder has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65° . The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. This device holder is used for standard mobile phones or PDA's only. If necessary an additional support of polystyrene material is used. Larger DUT's (e.g. notebooks) cannot be tested using this device holder. Instead a support of bigger polystyrene cubes and thin polystyrene plates is used to position the DUT in all relevant positions to find and measure spots with maximum SAR values. Therefore those devices are normally only tested at the flat part of the SAM.



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

4.2.7 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%.



The following table gives the recipes for tissue simulating liquid.

TSL	Manufacturer / Model	Freq Range (MHz)	Main Ingredients
Head WideBand	SPEAG HBBL600-10000V6	600-10000	Ethanediol, Sodium petroleum sulfonate, Hexylene Glycol / 2-Methyl-pentane-2.4-diol, Alkoxylated alcohol

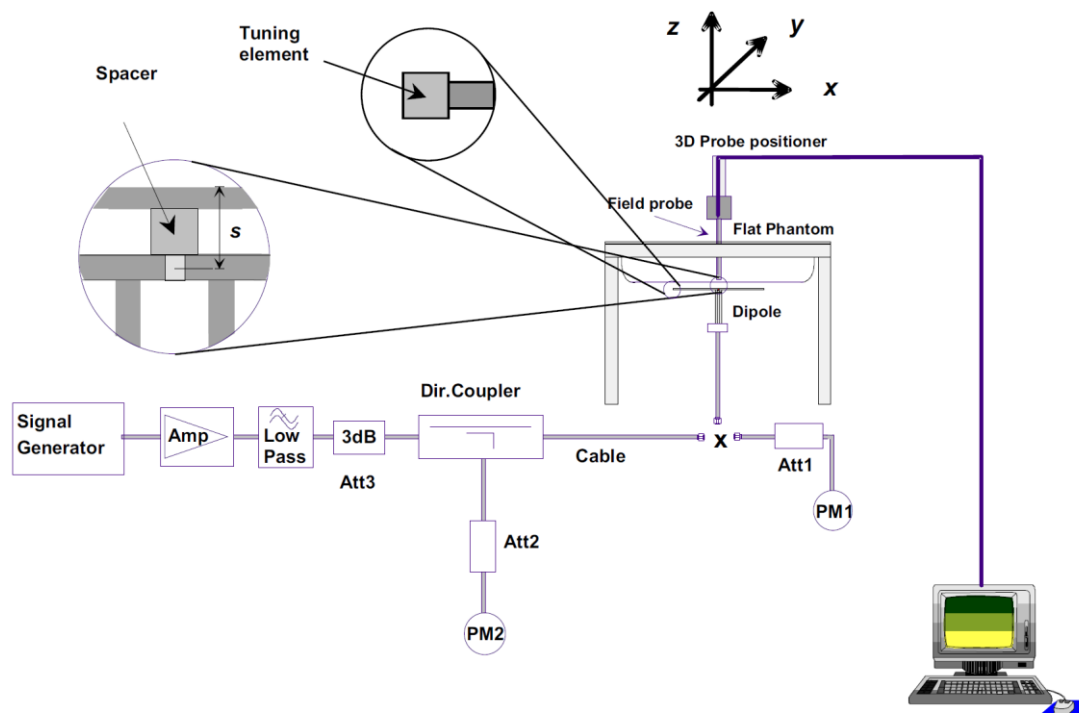
5 SYSTEM VERIFICATION

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. This 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

In the simplified setup for system evaluation, the EUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave that comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The equipment setup is shown below:



6 TEST POSITION CONFIGURATIONS

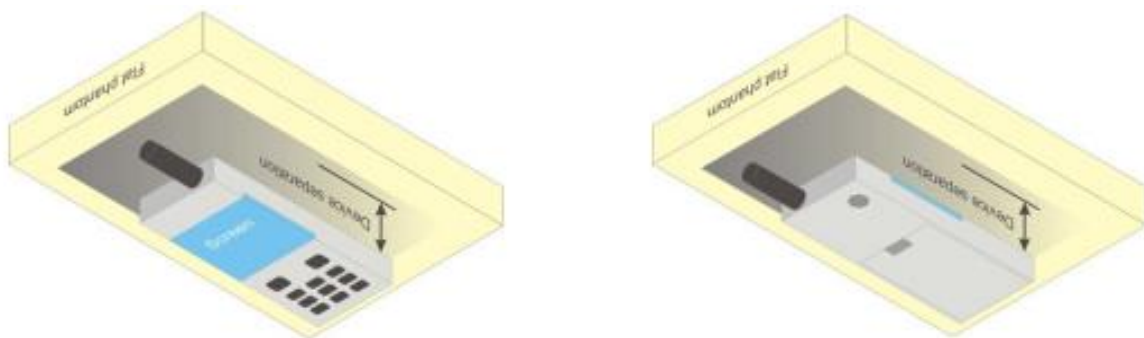
According to KDB 648474 D04 Handset, handsets are tested for SAR compliance in head, body-worn accessory and other use configurations described in the following subsections.

6.1 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.

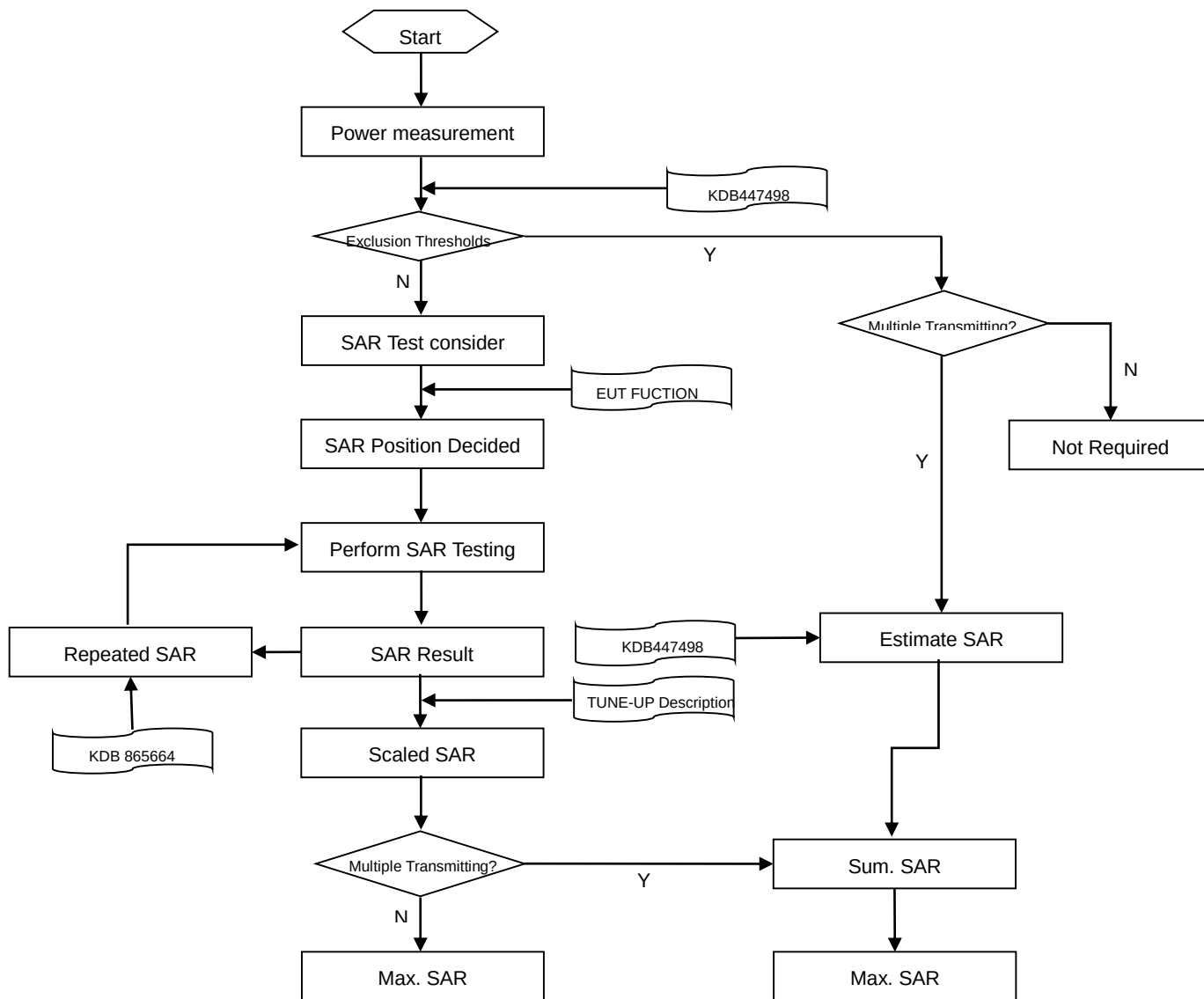
Body-worn accessories that do not contain metallic or conductive components may be tested according to worst-case exposure configurations, typically according to the smallest test separation distance required for the group of body-worn accessories with similar operating and exposure characteristics.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



7 MEASUREMENT PROCEDURE

7.1 Measurement Process Diagram



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 IEEE Std 1528-2013.

			≤3GHz	>3GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5±1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location			30°±1°	20°±1°
Maximum area scan spatial resolution: Δx Area , Δy Area			≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3–4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
			When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: Δx Zoom , Δy Zoom			≤ 2 GHz: ≤ 8 mm 2 –3 GHz: ≤ 5 mm*	3–4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: Δz Zoom (n)		≤ 5 mm	3–4 GHz: ≤ 4 mm
				4–5 GHz: ≤ 3 mm
				5–6 GHz: ≤ 2 mm
	graded grid	Δz Zoom (1): between 1st two points closest to phantom surface	≤ 4 mm	3–4 GHz: ≤ 3 mm
				4–5 GHz: ≤ 2.5 mm
		Δz Zoom (n>1): between subsequent points	≤ 1.5·Δz Zoom (n-1)	
Minimum zoom scan volume	x, y, z		≥30 mm	3–4 GHz: ≥ 28 mm
				4–5 GHz: ≥ 25 mm
				5–6 GHz: ≥ 22 mm

Note:

1. δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
2. * When zoom scan is required and the reported SAR from the area scan based 1 g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

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.

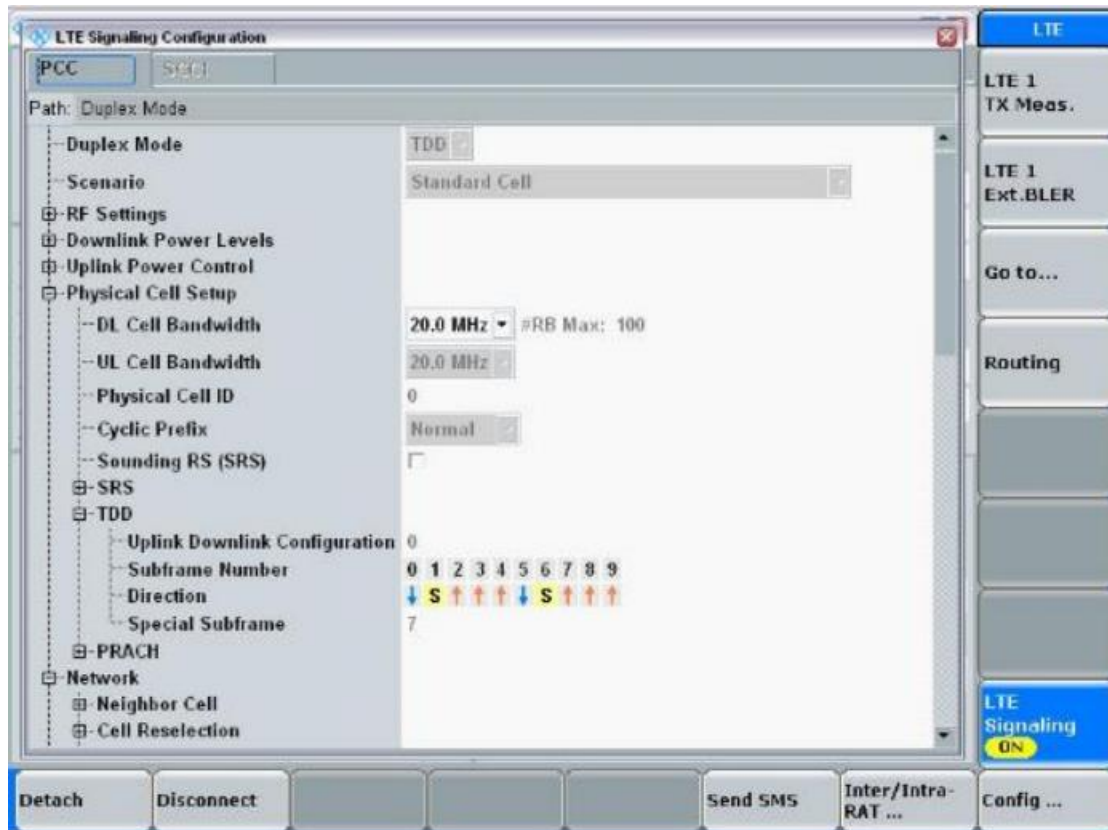
7.4 Area & Zoom Scan Procedure

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.

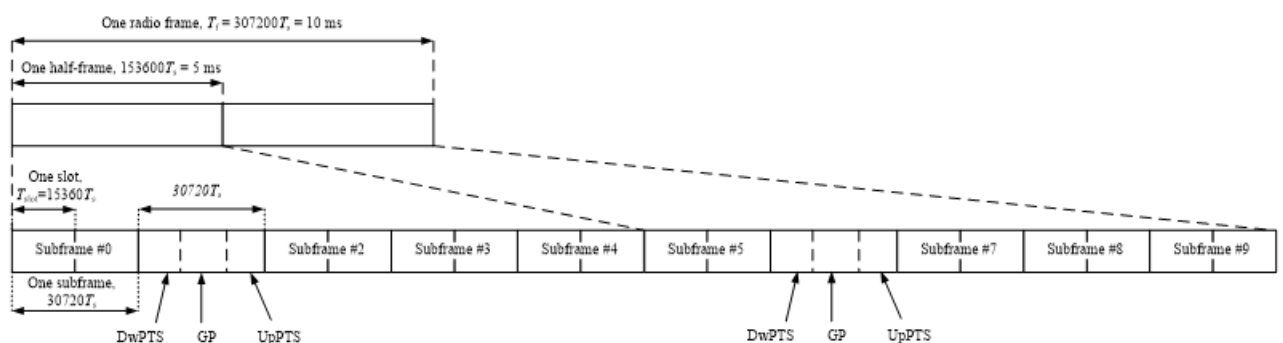
When the 1 g SAR of the highest peak is within 2 dB of the SAR limit, additional zoom scans are required for other peaks within 2 dB of the highest peak that have not been included in any zoom scan to ensure there is no increase in SAR.

7.5 Area & Zoom Scan Procedure

During TDD-LTE SAR testing, the EUT was commanded to transmit on maximum output power and maximum transmitting bandwidth. The uplink and downlink slot configuration as below in one radio frame.



According to 3GPP Per 3GPP TS 36.211. Each radio frame of length ($T_f = 307200 \cdot T_s = 10\text{ms}$) of two half-frames of length ($153600 \cdot T_s = 5\text{ms}$). Each half-frame consists of five sub-frames of length ($30720 \cdot T_s = 1\text{ms}$)



And the special sub-frame with the three fields DwPTS, GP and UpPTS.

The length of DwPTS and UpPTS is given by below table subject to the total length of DwPTS, GP and UpPTS being equal to $30720 \cdot T_s = 1\text{ms}$.

Configuration of special sub-frame (lengths of DwPTS/GP/UpPTS)

Special sub-frame configuration	Normal cyclic prefix in downlink			Extended cyclic prefix in downlink		
	DwPTS	UpPTS		DwPTS	UpPTS	
		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink		Normal cyclic prefix in uplink	Extended cyclic prefix in uplink
0	$6592 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$	$7680 \cdot T_s$	$2192 \cdot T_s$	$2560 \cdot T_s$
1	$19760 \cdot T_s$			$20480 \cdot T_s$		
2	$21592 \cdot T_s$			$23040 \cdot T_s$		
3	$24144 \cdot T_s$			$25600 \cdot T_s$		
4	$26336 \cdot T_s$	$4384 \cdot T_s$	$5120 \cdot T_s$	$7680 \cdot T_s$	$2560 \cdot T_s$	$5120 \cdot T_s$
5	$6592 \cdot T_s$			$20480 \cdot T_s$		
6	$19760 \cdot T_s$			$23040 \cdot T_s$		
7	$21592 \cdot T_s$			$12800 \cdot T_s$	-	-
8	$24144 \cdot T_s$			-		
9	$13168 \cdot T_s$			-		

For special sub-frame uplink time we used the largest cyclic prefix for duty cycle calculate;

Maximum uplink time of one special sub-frame=(largest cyclic prefix)/(one sub-frame of length)* time of one sub-frame= $5120 \cdot T_s / 30720 \cdot T_s \cdot 1\text{ms} = 0.167\text{ms}$

One radio frame with 6 uplink sub-frames and two special sub-frame,

there for the maximum Uplink time in one radio frame is: **$6 \cdot 1\text{ ms} + 2 \cdot 0.167\text{ ms} = 6.334\text{ms}$**

So, the duty cycle for TDD-LTE is: **$6.334\text{ms} / 10\text{ms} = 1: 1.58$**

8 CONDUCTED RF OUPUT POWER

8.1 WIFI

8.1.1 2.4G WIFI-Ant.1

Band (GHz)	Mode	Channel	Freq. (MHz)	Conducted Power (dBm)	Tune-up Limit (dBm)	SAR Test Require.
2.4	802.11b	CH 1	2412	10.61	11.00	Yes
		CH 6	2437	10.55	11.00	No
		CH 11	2462	10.60	11.00	No
	802.11g	CH 1	2412	10.48	11.00	No
		CH 6	2437	10.37	11.00	No
		CH 11	2462	10.45	11.00	No
	802.11n(HT20)	CH 1	2412	10.60	11.00	No
		CH 6	2437	10.35	11.00	No
		CH 11	2462	10.45	11.00	No
	802.11n(HT40)	CH 3	2422	10.46	11.00	No
		CH 6	2437	10.56	11.00	No
		CH 9	2452	10.40	11.00	No

Note: When multiple channel bandwidth configurations in a frequency band have the same maximum tune-up output power, the test configuration is determined by applying the following steps sequentially.

1) The largest channel bandwidth configuration is selected between the multiple configurations in a frequency band with the same maximum tune-up output power.

2) When multiple transmission modes (802.11b/g/n) have the same maximum tune-up output power, largest channel bandwidth, lowest order modulation and lowest data rate, the lowest order 802.11 mode is selected; i.e., 802.11b is chosen over 802.11g, and 802.11g chosen over 802.11n.

3) According KDB 247228, when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified

maximum output power and the adjusted SAR is ≤ 1.2 W/kg, OFDM SAR test is not required.

Adjusted SAR = $0.245 * (12.59\text{mW}/12.59\text{mW}) = 0.245$ W/Kg, so 2.4G OFDM SAR test is not required.

8.1.2 2.4G WIFI-Ant.2

Band (GHz)	Mode	Channel	Freq. (MHz)	Conducted Power (dBm)	Tune-up Limit (dBm)	SAR Test Require.
2.4	802.11b	CH 1	2412	9.78	10.50	No
		CH 6	2437	10.12	10.50	Yes
		CH 11	2462	10.03	10.50	No
	802.11g	CH 1	2412	9.95	10.50	No
		CH 6	2437	9.91	10.50	No
		CH 11	2462	9.94	10.50	No
	802.11n(HT20)	CH 1	2412	9.99	10.50	No
		CH 6	2437	9.90	10.50	No
		CH 11	2462	10.02	10.50	No
	802.11n(HT40)	CH 3	2422	10.08	10.50	No
		CH 6	2437	10.06	10.50	No
		CH 9	2452	10.01	10.50	No

Note: When multiple channel bandwidth configurations in a frequency band have the same maximum tune-up output power, the test configuration is determined by applying the following steps sequentially.

1) The largest channel bandwidth configuration is selected between the multiple configurations in a frequency band with the same maximum tune-up output power.

2) When multiple transmission modes (802.11b/g/n) have the same maximum tune-up output power, largest channel bandwidth, lowest order modulation and lowest data rate, the lowest order 802.11 mode is selected; i.e., 802.11b is chosen over 802.11g, and 802.11g chosen over 802.11n.

3) According KDB 247228, when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, OFDM SAR test is not required.

Adjusted SAR = $0.375 * (11.22\text{mW}/11.22\text{mW}) = 0.375$ W/Kg, so 2.4G OFDM SAR test is not required.

8.1.3 2.4G WIFI-MIMO

Band (GHz)	Mode	Channel	Freq. (MHz)	Conducted Power (dBm)	Tune-up Limit (dBm)	SAR Test Require.
2.4	802.11b	CH 1	2412	/	/	No
		CH 6	2437	/	/	No
		CH 11	2462	/	/	No
	802.11g	CH 1	2412	9.89	10.50	No
		CH 6	2437	9.94	10.50	No
		CH 11	2462	10.01	10.50	No
	802.11n(HT20)	CH 1	2412	10.05	10.50	No
		CH 6	2437	10.03	10.50	No
		CH 11	2462	9.95	10.50	No
	802.11n(HT40)	CH 3	2422	9.91	10.50	No
		CH 6	2437	10.05	10.50	No
		CH 9	2452	9.95	10.50	No

Note: When multiple channel bandwidth configurations in a frequency band have the same maximum tune-up output power, the test configuration is determined by applying the following steps sequentially.

- 1) The largest channel bandwidth configuration is selected between the multiple configurations in a frequency band with the same maximum tune-up output power.
- 2) When multiple transmission modes (802.11b/g/n) have the same maximum tune-up output power, largest channel bandwidth, lowest order modulation and lowest data rate, the lowest order 802.11 mode is selected; i.e., 802.11b is chosen over 802.11g, and 802.11g chosen over 802.11n.

8.1.4 5G WIFI-Ant.1

Band (GHz)	Mode	Channel	Freq. (MHz)	Conducted Power (dBm)	Tune-up Limit (dBm)	SAR Test Require.
5.2	802.11a	36	5180	6.06	6.50	Yes
		40	5200	6.05	6.50	No
		48	5240	5.98	6.50	No
	802.11ac(VHT20)	36	5180	5.99	6.50	No
		40	5200	6.03	6.50	No
		48	5240	5.93	6.50	No
	802.11ac(VHT40)	38	5190	4.43	5.00	No
		46	5230	4.42	5.00	No
	802.11ac(VHT80)	42	5210	5.58	6.00	No
5.8	802.11a	149	5745	6.72	7.00	Yes
		157	5785	6.20	7.00	No
		165	5825	6.62	7.00	No
	802.11ac(VHT20)	149	5745	5.88	6.50	No
		157	5785	5.99	6.50	No
		165	5825	5.96	6.50	No
	802.11ac(VHT40)	151	5755	6.06	6.50	No
		159	5795	5.53	6.00	No
	802.11ac(VHT80)	155	5775	4.91	5.50	No
Note: When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, each band is tested independently for SAR.						

8.1.5 5G WIFI- Ant.2

Band (GHz)	Mode	Channel	Freq. (MHz)	Conducted Power (dBm)	Tune-up Limit (dBm)	SAR Test Require.
5.2	802.11a	36	5180	5.06	5.50	No
		40	5200	4.97	5.50	No
		48	5240	4.97	5.50	No
	802.11ac(VHT20)	36	5180	5.92	6.00	Yes
		40	5200	4.72	5.50	No
		48	5240	5.15	5.50	No
	802.11ac(VHT40)	38	5190	4.45	5.00	No
		46	5230	4.92	5.50	No
	802.11ac(VHT80)	42	5210	4.90	5.50	No
5.8	802.11a	149	5745	5.41	5.50	Yes
		157	5785	4.71	5.50	No
		165	5825	5.33	5.50	No
	802.11ac(VHT20)	149	5745	4.07	4.50	No
		157	5785	3.87	4.50	No
		165	5825	4.02	4.50	No
	802.11ac(VHT40)	151	5755	4.01	4.50	No
		159	5795	3.91	4.50	No
	802.11ac(VHT80)	155	5775	3.05	3.50	No
Note: When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, each band is tested independently for SAR.						

8.1.6 5G WIFI-MIMO

Band (GHz)	Mode	Channel	Freq. (MHz)	Conducted Power (dBm)	Tune-up Limit (dBm)	SAR Test Require.
5.2	802.11a	36	5180	8.38	9.00	No
		40	5200	8.54	9.00	No
		48	5240	8.53	9.00	No
	802.11ac(VHT20)	36	5180	7.97	8.50	No
		40	5200	7.94	8.50	No
		48	5240	8.55	9.00	No
	802.11ac(VHT40)	38	5190	8.37	9.00	No
		46	5230	8.41	9.00	No
	802.11ac(VHT80)	42	5210	8.55	9.00	No
5.8	802.11a	149	5745	8.06	8.50	No
		157	5785	7.96	8.50	No
		165	5825	7.89	8.50	No
	802.11ac(VHT20)	149	5745	8.53	9.00	No
		157	5785	8.00	8.50	No
		165	5825	6.94	7.50	No
	802.11ac(VHT40)	151	5755	8.08	8.50	No
		159	5795	7.94	8.50	No
	802.11ac(VHT80)	155	5775	8.09	8.50	No
Note: When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, each band is tested independently for SAR.						

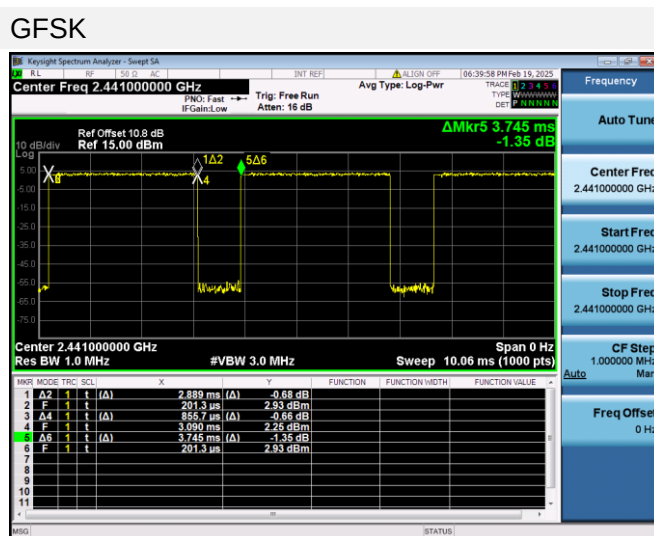
8.2 Bluetooth

Mode	GFSK			$\pi/4$ -DQPSK		
Channel	0	39	78	0	39	78
Frequency (MHz)	2402	2441	2480	2402	2441	2480
EIRP (dBm)	11.48	11.50	11.67	9.30	8.77	9.28
Tune-Up Limit (dBm)	12.00	12.00	12.00	9.50	9.50	9.50
SAR Test Require	No	No	Yes	No	No	No
Mode	8-DPSK			/		
Channel	0	39	78	/	/	/
Frequency (MHz)	2402	2441	2480	/	/	/
EIRP (dBm)	8.22	8.85	9.00	/	/	/
Tune-Up Limit (dBm)	9.50	9.50	9.50	/	/	/
SAR Test Require	No	No	No	/	/	/
Mode	BLE-1Mbps					
Channel	0	19	39			
Frequency (MHz)	2402	2440	2480			
EIRP (dBm)	6.68	7.05	7.56			
Tune-Up Limit (dBm)	8.00	8.00	8.00			
SAR Test Require	No	No	No			

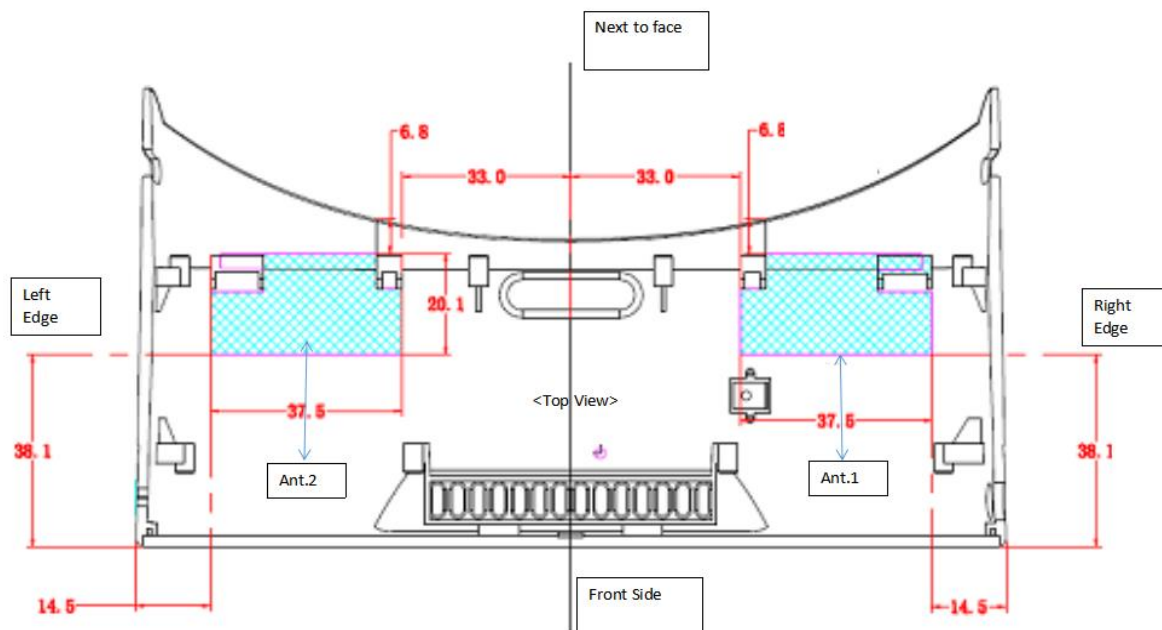
Note 1: Since bluetooth BR mode is the maximum output power mode, SAR measurements were performed with test software using DH5 modulation, and SAR measurement is not required for the EDR and LE. When the secondary mode is $\leq \frac{1}{4}$ dB higher than the primary mode.

Note: The Bluetooth duty cycle is 77.15 % as following figure, according to 2016 Oct. TCB workshop for Bluetooth SAR scaling need further consideration and the maximum duty cycle is 100%, therefore the actual duty cycle will be scaled up to 100% for Bluetooth reported SAR calculation.

Duty Cycle



9 TEST EXCLUSION CONSIDERATION





Antenna	Support Bands
Ant.1	BT, WIFI 2.4, WIFI 5G
Ant.2	WIFI 2.4, WIFI 5G
Note: Because the actual distance between the antenna and the eyes exceeds 5mm, 5mm is selected for testing the front, left, right, top, and bottom Side	

9.1 10g Extremity 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.

Conclusion:

The EUT hotspot mode 1-g reported SAR is 0.38 W/kg, which is less than 1.2 W/kg, 10 g extremity SAR is not required.

10 TEST RESULT

Note: Refer to ANNEX C for the detailed test data for each test configuration.

10.1WIFI 2.4GHz

SISO Ant.1														
Mode	Power Reduction	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (dB)	1 g Meas SAR(W/kg)	Meas. Power (dBm)	Max. tune-up power(dBm)	Scaling Factor	Duty cycle (%)	Duty Factor	1g Scaled SAR (W/kg)	Meas. No.
Head														
802.11 b	Off	Front Side	5	1	2412	-0.18	0.023	10.61	11.00	1.094	100.00	1.000	0.025	/
	Off	Next to face	0	1	2412	-0.14	0.011	10.61	11.00	1.094	100.00	1.000	0.012	/
	Off	Left Side	5	1	2412	0.06	0.011	10.61	11.00	1.094	100.00	1.000	0.012	/
	Off	Right Side	5	1	2412	0.18	0.045	10.61	11.00	1.094	100.00	1.000	0.049	/
	Off	Top Side	5	1	2412	0.03	0.224	10.61	11.00	1.094	100.00	1.000	0.245	2#
	Off	Bottom Side	5	1	2412	-0.11	0.006	10.61	11.00	1.094	100.00	1.000	0.007	/

SISO Ant.2														
Mode	Power Reduction	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (dB)	1 g Meas SAR(W/kg)	Meas. Power (dBm)	Max. tune-up power(dBm)	Scaling Factor	Duty cycle (%)	Duty Factor	1g Scaled SAR (W/kg)	Meas. No.
Head														
802.11 b	Off	Front Side	5	6	2437	-0.14	0.022	10.12	10.50	1.091	100.00	1.000	0.024	/
	Off	Next to face	0	6	2437	-0.01	0.013	10.12	10.50	1.091	100.00	1.000	0.014	/
	Off	Left Side	5	6	2437	-0.12	0.063	10.12	10.50	1.091	100.00	1.000	0.069	/
	Off	Right Side	5	6	2437	-0.05	0.004	10.12	10.50	1.091	100.00	1.000	0.004	/
	Off	Top Side	5	6	2437	0.09	0.344	10.12	10.50	1.091	100.00	1.000	0.375	3#
	Off	Bottom Side	5	6	2437	0.03	0.002	10.12	10.50	1.091	100.00	1.000	0.002	/

10.2WIFI 5GHz

SISO Ant.1															
Fre. Band	Mode	Power Reduction	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (dB)	1 g Meas SAR (W/kg)	Meas. Power (dBm)	Max. tune-up power(dBm)	Scaling Factor	Duty cycle (%)	Duty Factor	1g Scaled SAR (W/kg)	Meas. No.
Head															
5.2	802.11a	Off	Front Side	5	36	5180	0.13	0.031	6.06	6.50	1.107	100.00	1.000	0.034	/
		Off	Next to face	0	36	5180	-0.06	0.013	6.06	6.50	1.107	100.00	1.000	0.014	/
		Off	Left Side	5	36	5180	0.14	0.003	6.06	6.50	1.107	100.00	1.000	0.003	/
		Off	Right Side	5	36	5180	0.18	0.080	6.06	6.50	1.107	100.00	1.000	0.089	/
		Off	Top Side	5	36	5180	0.09	0.147	6.06	6.50	1.107	100.00	1.000	0.163	4#
		Off	Bottom Side	5	36	5180	0.02	0.037	6.06	6.50	1.107	100.00	1.000	0.041	/
5.8	802.11a	Off	Front Side	5	149	5745	-0.08	0.069	6.72	7.00	1.067	100.00	1.000	0.074	/
		Off	Next to face	0	149	5745	-0.08	0.012	6.72	7.00	1.067	100.00	1.000	0.013	/
		Off	Left Side	5	149	5745	-0.18	0.006	6.72	7.00	1.067	100.00	1.000	0.006	/
		Off	Right Side	5	149	5745	-0.05	0.115	6.72	7.00	1.067	100.00	1.000	0.123	/
		Off	Top Side	5	149	5745	0.09	0.216	6.72	7.00	1.067	100.00	1.000	0.230	6#
		Off	Bottom Side	5	149	5745	-0.19	0.003	6.72	7.00	1.067	100.00	1.000	0.003	/

SISO Ant.2															
Fre. Band	Mode	Power Reduction	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (dB)	1 g Meas SAR (W/kg)	Meas. Power (dBm)	Max. tune-up power(dBm)	Scaling Factor	Duty cycle (%)	Duty Factor	1g Scaled SAR (W/kg)	Meas. No.
Head															
5.2	802.11ac(VHT 20)	Off	Front Side	5	36	5180	0.04	0.025	5.92	6.00	1.019	100.00	1.000	0.025	/
		Off	Next to face	0	36	5180	0.10	0.006	5.92	6.00	1.019	100.00	1.000	0.006	/
		Off	Left Side	5	36	5180	0.16	0.042	5.92	6.00	1.019	100.00	1.000	0.043	/
		Off	Right Side	5	36	5180	-0.09	0.002	5.92	6.00	1.019	100.00	1.000	0.002	/
		Off	Top Side	5	36	5180	0.03	0.149	5.92	6.00	1.019	100.00	1.000	0.152	5#
		Off	Bottom Side	5	36	5180	-0.12	0.011	5.92	6.00	1.019	100.00	1.000	0.011	/
5.8	802.11a	Off	Front Side	5	149	5745	0.14	0.060	5.41	5.50	1.021	100.00	1.000	0.061	/
		Off	Next to face	0	149	5745	-0.07	0.006	5.41	5.50	1.021	100.00	1.000	0.006	/
		Off	Left Side	5	149	5745	-0.05	0.113	5.41	5.50	1.021	100.00	1.000	0.115	/
		Off	Right Side	5	149	5745	0.16	0.003	5.41	5.50	1.021	100.00	1.000	0.003	/
		Off	Top Side	5	149	5745	0.17	0.197	5.41	5.50	1.021	100.00	1.000	0.201	7#
		Off	Bottom Side	5	149	5745	-0.17	0.002	5.41	5.50	1.021	100.00	1.000	0.002	/

10.3Bluetooth

Mode	Power Reduction	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (dB)	1 g Meas SAR(W/kg)	Meas. Power (dBm)	Max. tune-up power(dBm)	Scaling Factor	Duty cycle(%)	Duty Factor	1g Scaled SAR (W/kg)	Meas. No.
Head														
DH5	Off	Front Side	5	78	2480	-0.18	0.011	11.67	12.00	1.079	77.01	1.299	0.015	/
	Off	Next to face	0	78	2480	0.15	0.003	11.67	12.00	1.079	77.01	1.299	0.004	/
	Off	Left Side	5	78	2480	0.07	0.006	11.67	12.00	1.079	77.01	1.299	0.008	/
	Off	Right Side	5	78	2480	-0.02	0.221	11.67	12.00	1.079	77.01	1.299	0.310	/
	Off	Top Side	5	78	2480	0.07	0.264	11.67	12.00	1.079	77.01	1.299	0.370	1#
	Off	Bottom Side	5	78	2480	0.07	0.000	11.67	12.00	1.079	77.01	1.299	0.000	/

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.
5. For 1g SAR, the highest measured 1g SAR is $0.344 < 0.80$ 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 Consider

No.	Simultaneous Tx Combination	Head
1	2.4GWIFI(Ant.1)+2.4GWIFI(Ant.2)	Yes
2	Bluetooth+2.4GWIFI(Ant.2)	Yes
3	Bluetooth+5GWIFI(Ant.1)+5GWIFI(Ant.2)	Yes

Note:

1. WiFi 2.4G and Bluetooth share the same antenna, and can't transmit simultaneously.
2. The maximum SAR summation is calculated based on the same configuration and test position.
3. The simultaneous transmission combinations of the more antennas contain combinations of less antennas, so only the worst simultaneous transmission combinations is shown in this report.

12.2Sum SAR of Simultaneous Transmission

12.2.1 Head Simultaneous Transmission SAR Evaluation for WLAN Antenna with Bluetooth

State	Position	Stand alone SAR					SUM SAR		
		1	2	3	4	5			
		Bluetooth	WLAN 2.4GHz (Ant.1)	WLAN 2.4GHz (Ant.2)	MAX. WLAN 5GHz (Ant.1)	MAX. WLAN 5GHz (Ant.2)	Sum SAR (1+3)	Sum SAR (2+3)	Sum SAR (1+4+5)
Head	Front Side 0mm	0.015	0.025	0.024	0.074	0.061	0.039	0.049	0.150
Head	Next to face 0mm	0.004	0.012	0.014	0.014	0.006	0.018	0.026	0.024
Head	Left Side 0mm	0.008	0.012	0.069	0.006	0.115	0.077	0.081	0.129
Head	Right Side 0mm	0.309	0.049	0.004	0.123	0.003	0.313	0.053	0.435
Head	Top Side 5mm	0.369	0.245	0.375	0.230	0.201	0.744	0.620	0.800
Head	Bottom Side 0mm	0.001	0.007	0.002	0.041	0.011	0.003	0.009	0.053
Note:									
1: The highest Summed 1g SAR is 0.800W/Kg <1.6 W/kg, so Simultaneous Transmission SAR test is not required.									

13 TEST EQUIPMENTS LIST

Description	Manufacturer	Model	Serial No./Version	Cal. Date	Cal. Due
PC	Dell	N/A	N/A	N/A	N/A
Test Software	Speag	DASY5	52.8.8.1222	N/A	N/A
2450MHz Validation Dipole	Speag	D2450V2	SN: 952	2024/05/07	2027/05/06
5GHz Validation Dipole	Speag	D5GHzV2	SN: 1200	2024/05/09	2027/05/08
Data Acquisition Electronics	Speag	DAE4	SN: 1710	2025/01/20	2026/01/19
E-Field Probe	Speag	EX3DV4	SN: 7510	2024/06/25	2025/06/24
Signal Generator	Keysight	N5173B	MY62150163	2024/08/12	2025/08/11
Power Meter	R&S	NRVD-B2	835843/014	2024/08/08	2025/08/07
Power Sensor	R&S	NRV-Z4	100381	2024/08/08	2025/08/07
Power Sensor	R&S	NRV-Z2	100211	2024/08/08	2025/08/07
Network Analyzer	Agilent	E5071C	MY46103472	2024/09/11	2025/09/10
Thermometer	Elitech	RC-4HC	EF7216002985	2024/10/31	2025/10/30
Thermometer	Elitech	RC-4HC	EF720B004811	2024/10/31	2025/10/30
Power Amplifier	Mini-Circuits	ZVA-183W-S+	932502132	N/A	N/A
Dielectric Probe Kit	Speag	DAK3.5	SN: 1312	N/A	N/A
Phantom	Speag	SAM	SN: 1576	N/A	N/A
Attenuator	COM-MW	ZA-S1-31	1305003187	N/A	N/A
Directional coupler	AA-MCS	AAMCS-UDC	000272	N/A	N/A
Note: For dipole antennas, BALUN 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.

Head Liquid

Date	Liquid Type	Fre. (MHz)	Temp. (°C)	Meas. Conductivity (σ) (S/m)	Meas. Permittivity (ϵ)	Target Conductivity (σ) (S/m)	Target Permittivity (ϵ)	Conductivity Tolerance (%)	Permittivity Tolerance (%)
2024.05.14	Head	2450	21.5	1.81	38.44	1.80	39.20	0.56	-1.94
2024.05.15	Head	5250	21.3	4.82	35.44	4.71	35.93	2.34	-1.36
2025.05.15	Head	5750	21.3	5.20	35.86	5.22	35.36	-0.38	1.41

Note: The tolerance limit of Conductivity and Permittivity is $\pm 5\%$.

ANNEX B SYSTEM CHECK RESULT

Comparing to the original SAR value provided by SPEAG, the validation data should be within its specification of 10 %.

Head liquid 1g

Date	Liquid Type	Freq. (MHz)	Power (mW)	Measured SAR (W/kg)	Normalized SAR (W/kg)	Dipole SAR (W/kg)	Tolerance (%)
2024.05.14	Head	2450	100	5.34	53.40	52.60	1.52
2024.05.15	Head	5250	100	7.88	78.80	77.70	1.42
2025.05.15	Head	5750	100	7.73	77.30	77.60	-0.39
Note: The tolerance limit of System validation $\pm 10\%$.							

System Performance Check Data (2450MHz)

Date: 2025.05.14

Communication System Band: D2450 (2450.0 MHz); Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.805$ S/m; $\epsilon_r = 38.44$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature: 22.4°C Liquid Temperature: 21.5°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7510; ConvF(7.75, 7.75, 7.75); Calibrated: 2024.06.25;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1710; Calibrated: 2025.01.20
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1576
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

CW2450/Area Scan (101x101x1): Interpolated grid: $dx=1.000$ mm, $dy=1.000$ mm

Maximum value of SAR (interpolated) = 6.35 W/kg

CW2450/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 58.02 V/m; Power Drift = 0.03 dB

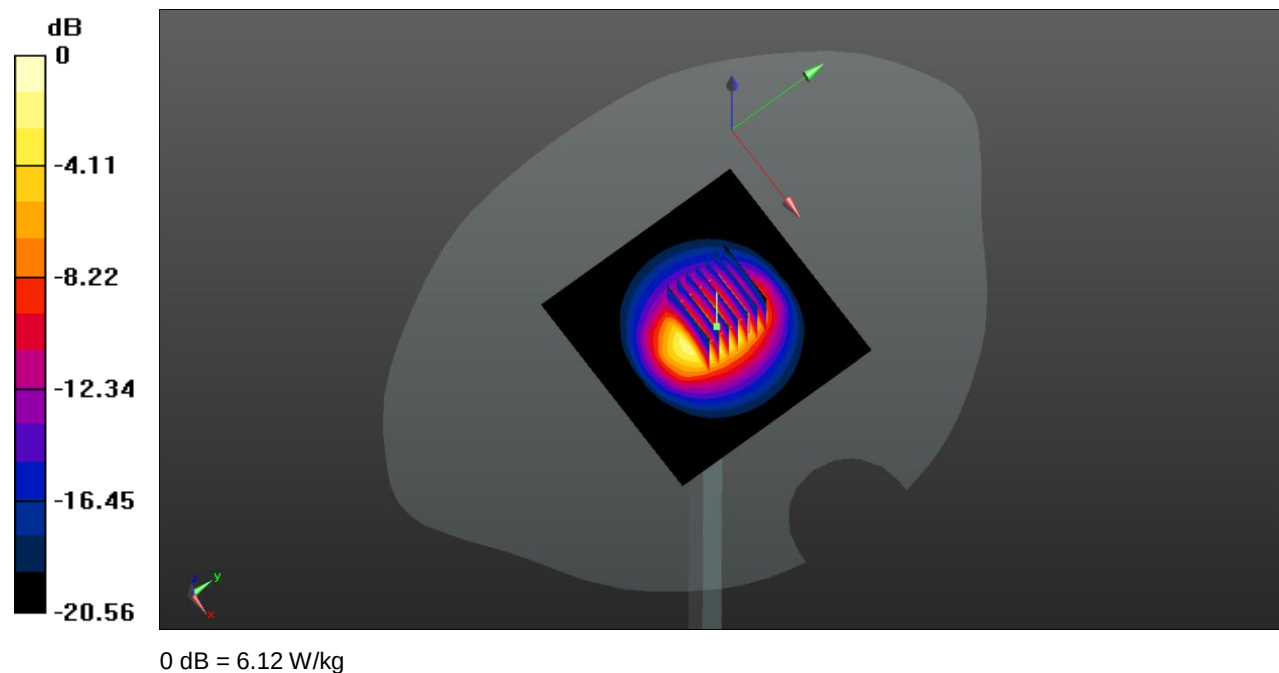
Peak SAR (extrapolated) = 11.4 W/kg

SAR(1 g) = 5.34 W/kg; SAR(10 g) = 2.57 W/kg

Smallest distance from peaks to all points 3 dB below = 9.2 mm

Ratio of SAR at M2 to SAR at M1 = 57.1%

Maximum value of SAR (measured) = 6.12 W/kg



System Performance Check Data (5250MHz)

Date: 2025.05.15

Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5250 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 5250$ MHz; $\sigma = 4.823$ S/m; $\epsilon_r = 35.442$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature: 22.3°C Liquid Temperature: 21.3°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7510; ConvF(5.74, 5.74, 5.74); Calibrated: 2024.06.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1710; Calibrated: 2025.01.20
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1576
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

CW5250/Area Scan (101x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 8.52 W/kg

CW5250/Zoom Scan (7x7x21)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 37.64 V/m; Power Drift = 0.02 dB

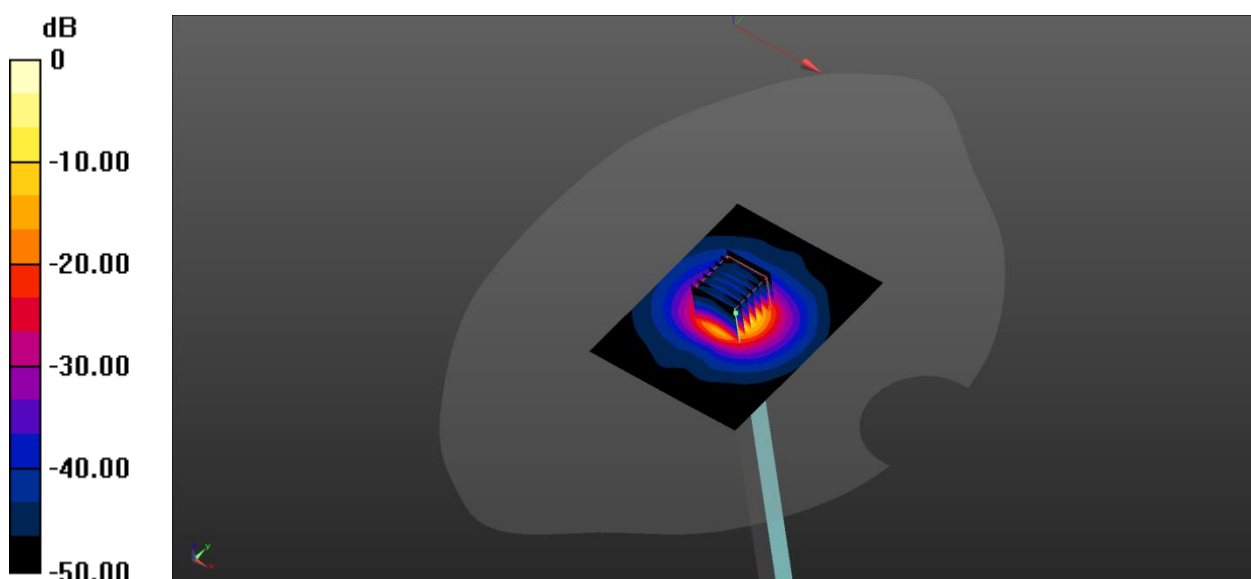
Peak SAR (extrapolated) = 33.2 W/kg

SAR(1 g) = 7.88 W/kg; SAR(10 g) = 2.24 W/kg

Smallest distance from peaks to all points 3 dB below = 10.2 mm

Ratio of SAR at M2 to SAR at M1 = 60.8%

Maximum value of SAR (measured) = 19.6 W/kg



0 dB = 19.6 W/kg

System Performance Check Data (5750MHz)

Date: 2025.05.15

Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5750 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 5750$ MHz; $\sigma = 5.201$ S/m; $\epsilon_r = 35.858$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature: 22.3°C Liquid Temperature: 21.3°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7510; ConvF(5.04, 5.04, 5.04); Calibrated: 2024.06.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1710; Calibrated: 2025.01.20
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1576
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

CW5750/Area Scan (81x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 8.93 W/kg

CW5750/Zoom Scan (7x7x15)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 40.28 V/m; Power Drift = -0.08 dB

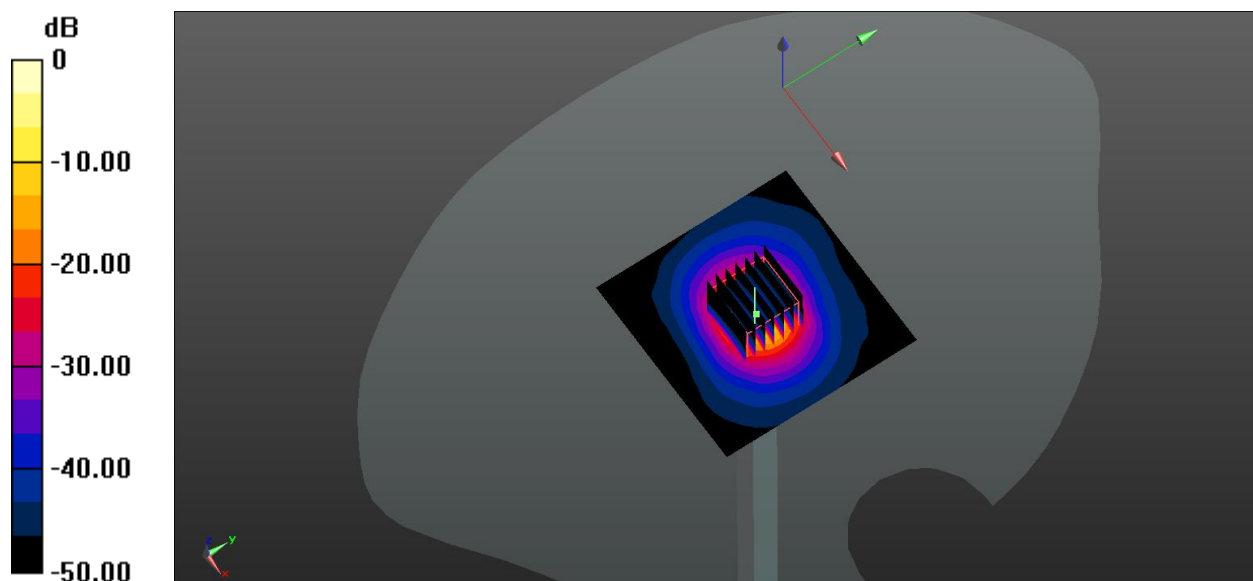
Peak SAR (extrapolated) = 36.6 W/kg

SAR(1 g) = 7.73 W/kg; SAR(10 g) = 2.18 W/kg

Smallest distance from peaks to all points 3 dB below = 9.1 mm

Ratio of SAR at M2 to SAR at M1 = 58.3%

Maximum value of SAR (measured) = 15.5 W/kg



0 dB = 15.5 W/kg

ANNEX C TEST DATA

Meas.1 Body Plane with Top Edge 5mm on 78 Channel in Bluetooth mode with Ant.1

Date: 2025.05.14

Communication System Band: Bluetooth; Frequency: 2480 MHz; Duty Cycle: 1:1.299

Medium parameters used (interpolated): $f = 2480$ MHz; $\sigma = 1.855$ S/m; $\epsilon_r = 38.057$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature: 22.4°C Liquid Temperature: 21.5°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7510; ConvF(7.75, 7.75, 7.75); Calibrated: 2024.06.25;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1710; Calibrated: 2025.01.20
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1576
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch78/Area Scan (81x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.303 W/kg

Ch78/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 0.9810 V/m; Power Drift = 0.07 dB

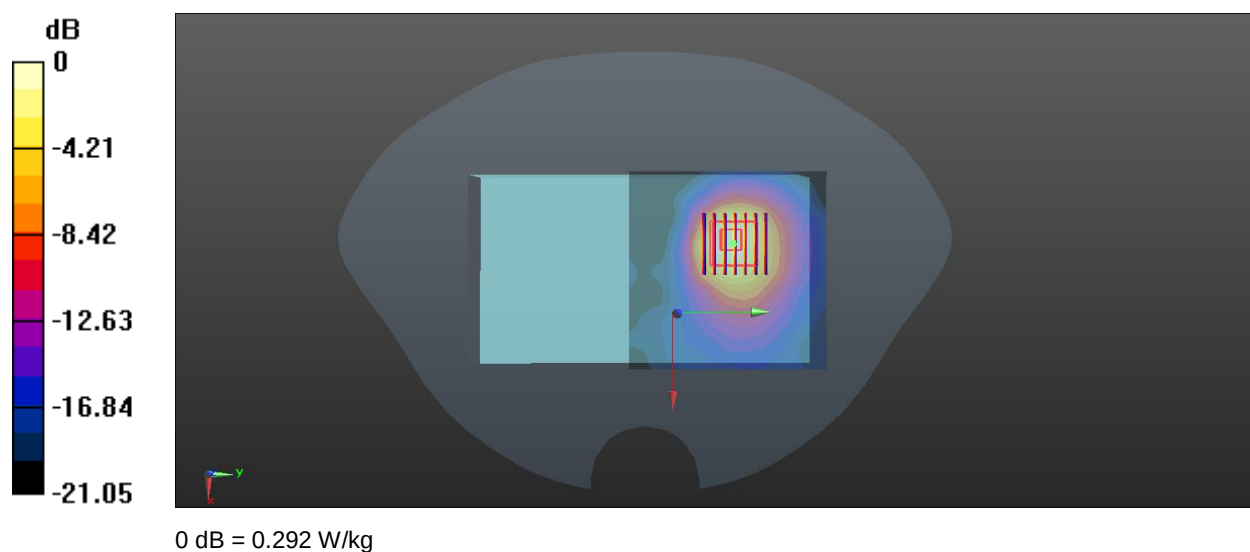
Peak SAR (extrapolated) = 0.515 W/kg

SAR(1 g) = 0.264 W/kg; SAR(10 g) = 0.125 W/kg

Smallest distance from peaks to all points 3 dB below = 8.9 mm

Ratio of SAR at M2 to SAR at M1 = 54.5%

Maximum value of SAR (measured) = 0.292 W/kg



Meas.2 Body Plane with Top Edge 5mm on 1 Channel in IEEE802.11b mode with Ant.1

Date: 2025.05.14

Communication System Band: WLAN(b); Frequency: 2412 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 2412$ MHz; $\sigma = 1.753$ S/m; $\epsilon_r = 40.384$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature: 22.4°C Liquid Temperature: 21.5°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7510; ConvF(7.75, 7.75, 7.75); Calibrated: 2024.06.25;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1710; Calibrated: 2025.01.20
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1576
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch1/Area Scan (81x81x1): Interpolated grid: $dx=1.200$ mm, $dy=1.200$ mm

Maximum value of SAR (interpolated) = 0.282 W/kg

Ch1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 1.669 V/m; Power Drift = 0.03 dB

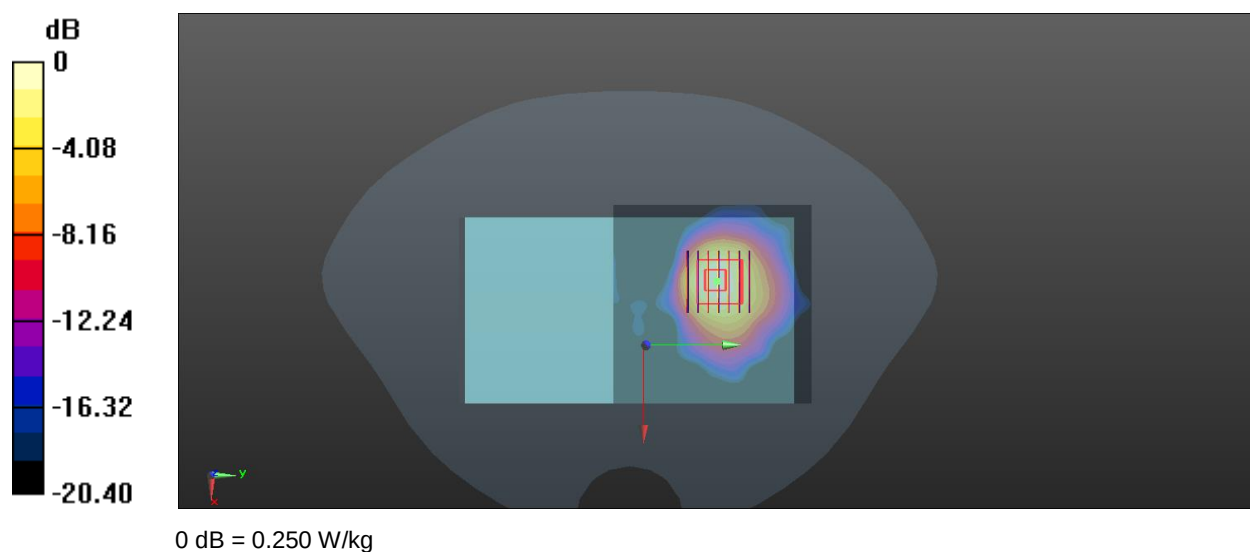
Peak SAR (extrapolated) = 0.432 W/kg

SAR(1 g) = 0.224 W/kg; SAR(10 g) = 0.108 W/kg

Smallest distance from peaks to all points 3 dB below = 9.9 mm

Ratio of SAR at M2 to SAR at M1 = 53.9%

Maximum value of SAR (measured) = 0.250 W/kg



Meas.3 Body Plane with Top Edge 5mm on 11 Channel in IEEE802.11b mode with Ant.2

Date: 2025.05.14

Communication System Band: WLAN(b); Frequency: 2462 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 2462$ MHz; $\sigma = 1.835$ S/m; $\epsilon_r = 38.161$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature:22.4℃ Liquid Temperature:21.5℃

DASY5 Configuration:

- Probe: EX3DV4 - SN7510; ConvF(7.75, 7.75, 7.75); Calibrated: 2024.06.25;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1710; Calibrated: 2025.01.20
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1576
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch11/Area Scan (81x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.409 W/kg

Ch11/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 0 V/m; Power Drift = 0.09 dB

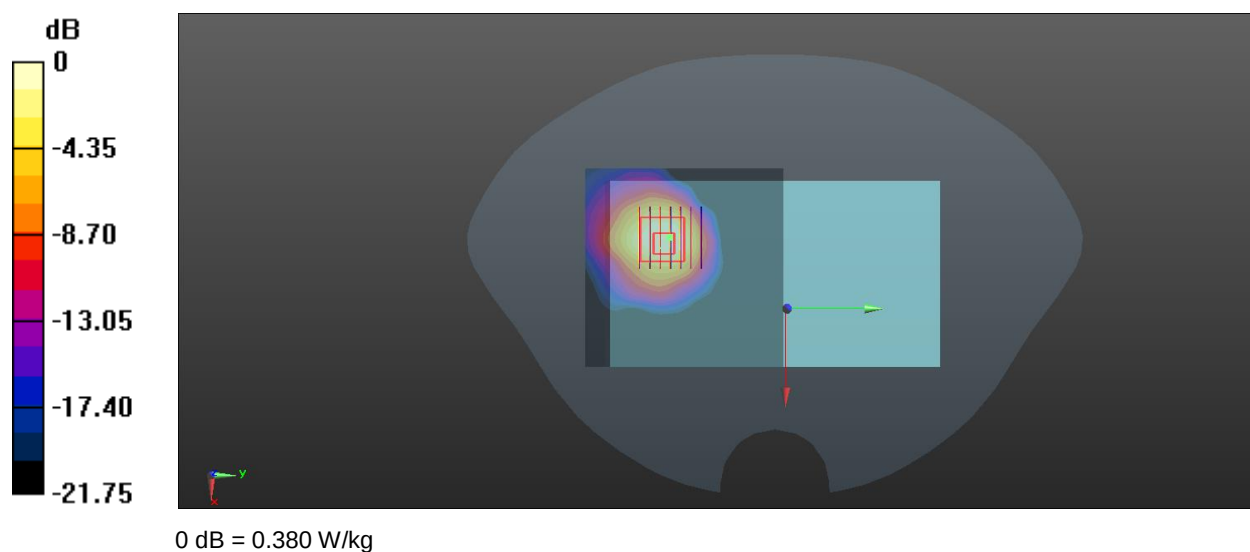
Peak SAR (extrapolated) = 0.676 W/kg

SAR(1 g) = 0.344 W/kg; SAR(10 g) = 0.166 W/kg

Smallest distance from peaks to all points 3 dB below = 8.5 mm

Ratio of SAR at M2 to SAR at M1 = 51.5%

Maximum value of SAR (measured) = 0.380 W/kg



Meas.4 Body Plane with Top Edge 5mm on 36 Channel in IEEE802.11a mode with Ant.1

Date: 2025.05.15

Communication System Band: WLAN(a); Frequency: 5180 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5180$ MHz; $\sigma = 4.542$ S/m; $\epsilon_r = 36.831$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature: 22.3°C Liquid Temperature: 21.3°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7510; ConvF(5.74, 5.74, 5.74); Calibrated: 2024.06.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1710; Calibrated: 2025.01.20
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1576
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch36/Area Scan (101x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.286 W/kg

Ch36/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 0 V/m; Power Drift = 0.09 dB

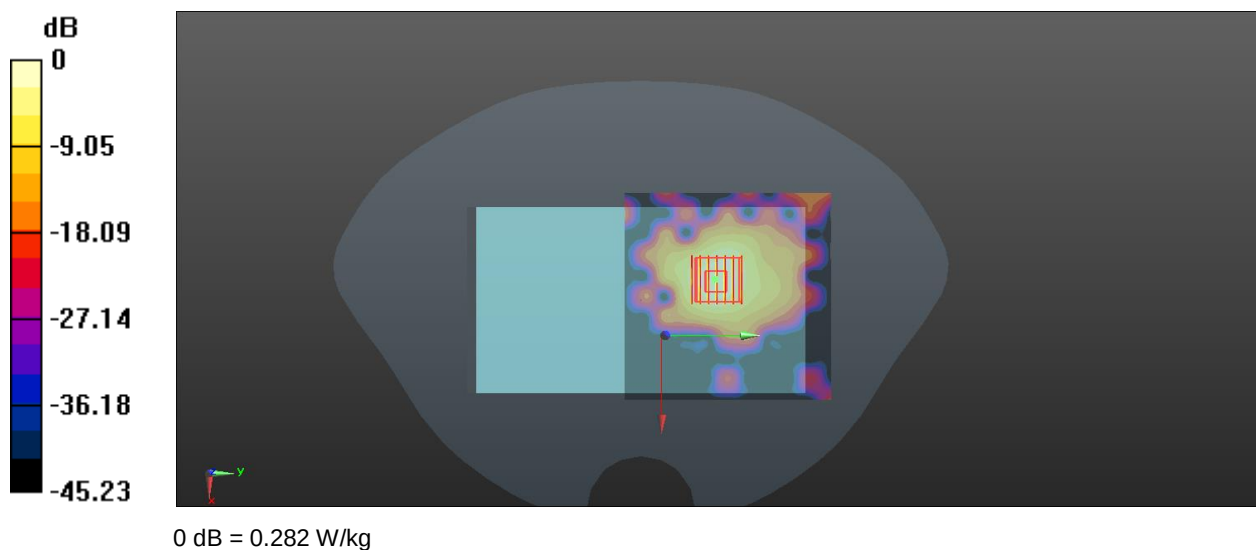
Peak SAR (extrapolated) = 0.550 W/kg

SAR(1 g) = 0.147 W/kg; SAR(10 g) = 0.047 W/kg

Smallest distance from peaks to all points 3 dB below = 8.9 mm

Ratio of SAR at M2 to SAR at M1 = 56%

Maximum value of SAR (measured) = 0.282 W/kg



Meas.5 Body Plane with Top Edge 5mm on 36 Channel in IEEE802.11ac20 mode with Ant.2

Date: 2025.05.15

Communication System Band: WLAN(ac20); Frequency: 5180 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5180$ MHz; $\sigma = 4.542$ S/m; $\epsilon_r = 36.831$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature: 22.3°C Liquid Temperature: 21.3°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7510; ConvF(5.74, 5.74, 5.74); Calibrated: 2024.06.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1710; Calibrated: 2025.01.20
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1576
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch36/Area Scan (101x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.293 W/kg

Ch36/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 0.5580 V/m; Power Drift = 0.03 dB

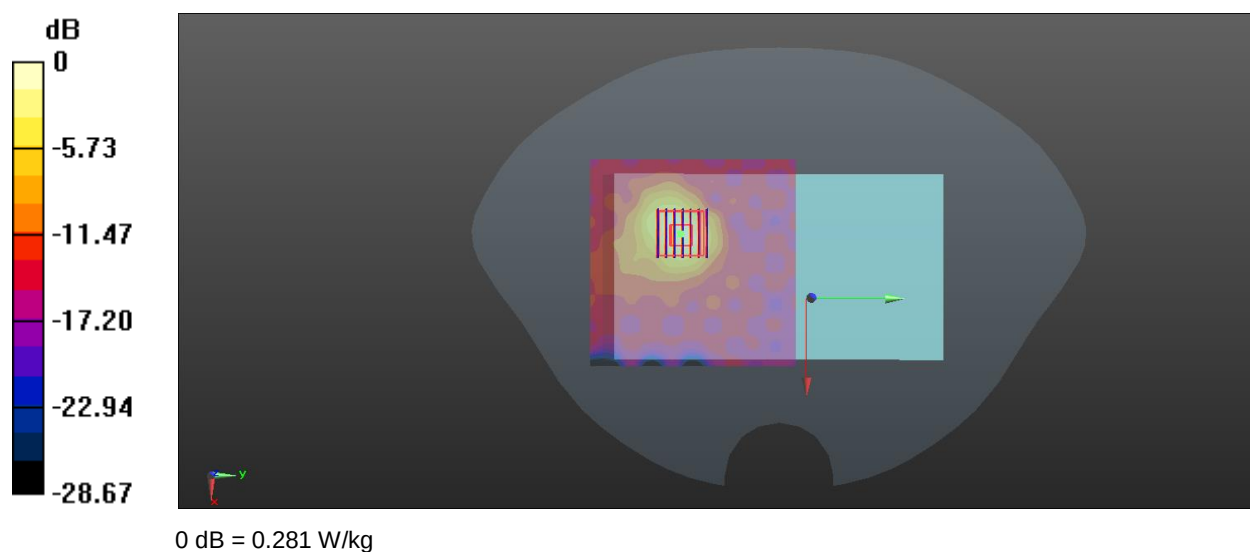
Peak SAR (extrapolated) = 0.586 W/kg

SAR(1 g) = 0.149 W/kg; SAR(10 g) = 0.050 W/kg

Smallest distance from peaks to all points 3 dB below = 8.5 mm

Ratio of SAR at M2 to SAR at M1 = 54.6%

Maximum value of SAR (measured) = 0.281 W/kg



Meas.6 Body Plane with Top Edge 5mm on 149 Channel in IEEE802.11a mode with Ant.1

Date: 2025.05.15

Communication System Band: WLAN(a); Frequency: 5745 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5745$ MHz; $\sigma = 5.122$ S/m; $\epsilon_r = 36.046$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature: 22.3°C Liquid Temperature: 21.3°C

DASY5 Configuration:

- Probe: EX3DV4 - SN7510; ConvF(5.04, 5.04, 5.04); Calibrated: 2024.06.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1710; Calibrated: 2025.01.20
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1576
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch149/Area Scan (101x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.443 W/kg

Ch149/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 0 V/m; Power Drift = 0.09 dB

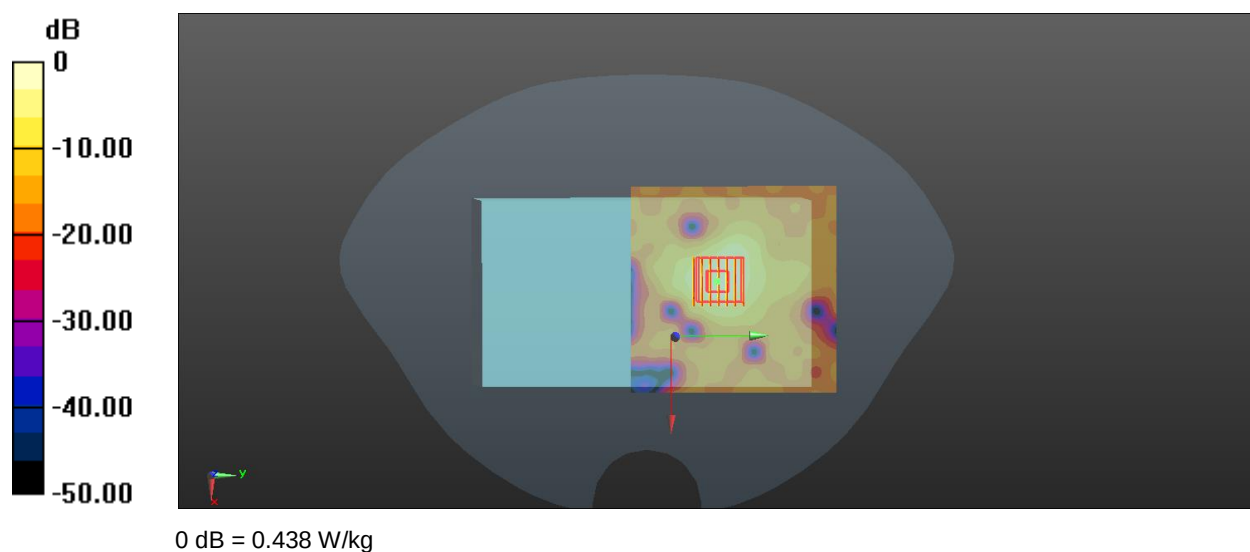
Peak SAR (extrapolated) = 0.964 W/kg

SAR(1 g) = 0.216 W/kg; SAR(10 g) = 0.067 W/kg

Smallest distance from peaks to all points 3 dB below = 8 mm

Ratio of SAR at M2 to SAR at M1 = 50.8%

Maximum value of SAR (measured) = 0.438 W/kg



Meas.7 Body Plane with Top Edge 5mm on 149 Channel in IEEE802.11a mode with Ant.2

Date: 2025.05.15

Communication System Band: WLAN(a); Frequency: 5745 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5745$ MHz; $\sigma = 5.122$ S/m; $\epsilon_r = 36.046$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature:22.3℃ Liquid Temperature:21.3℃

DASY5 Configuration:

- Probe: EX3DV4 - SN7510; ConvF(5.04, 5.04, 5.04); Calibrated: 2024.06.25;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1710; Calibrated: 2025.01.20
- Phantom: SAM1; Type: QD000P40CD; Serial: TP:1576
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch149/Area Scan (101x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.392 W/kg

Ch149/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 0.7170 V/m; Power Drift = 0.17 dB

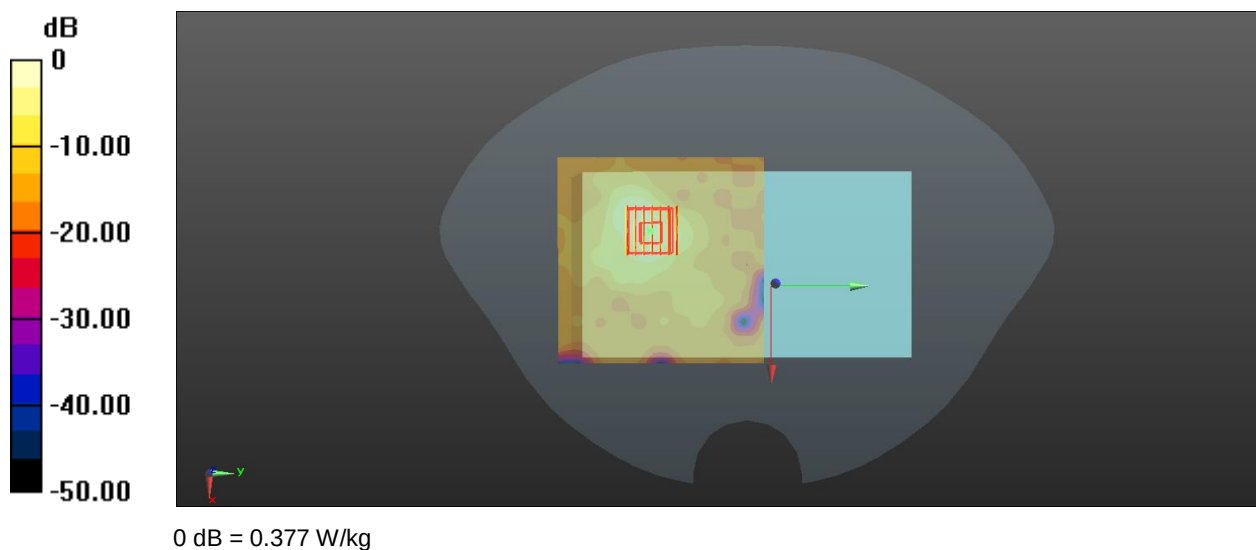
Peak SAR (extrapolated) = 0.887 W/kg

SAR(1 g) = 0.197 W/kg; SAR(10 g) = 0.065 W/kg

Smallest distance from peaks to all points 3 dB below = 8 mm

Ratio of SAR at M2 to SAR at M1 = 49.3%

Maximum value of SAR (measured) = 0.377 W/kg



ANNEX D EUT EXTERNAL PHOTOS

Please refer the document “BL-SZ2541284-AW.pdf”.

ANNEX E SAR TEST SETUP PHOTOS

Please refer the document “BL-SZ2541284-AS.pdf”.

ANNEX F CALIBRATION REPORT

Please refer the document “BL-SZ2541284-AC.pdf”.

ANNEX G TUNE-UP PROCEDURE

Please refer the document “BL-SZ2541284-AT.pdf”.

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