

SAR

TEST REPORT

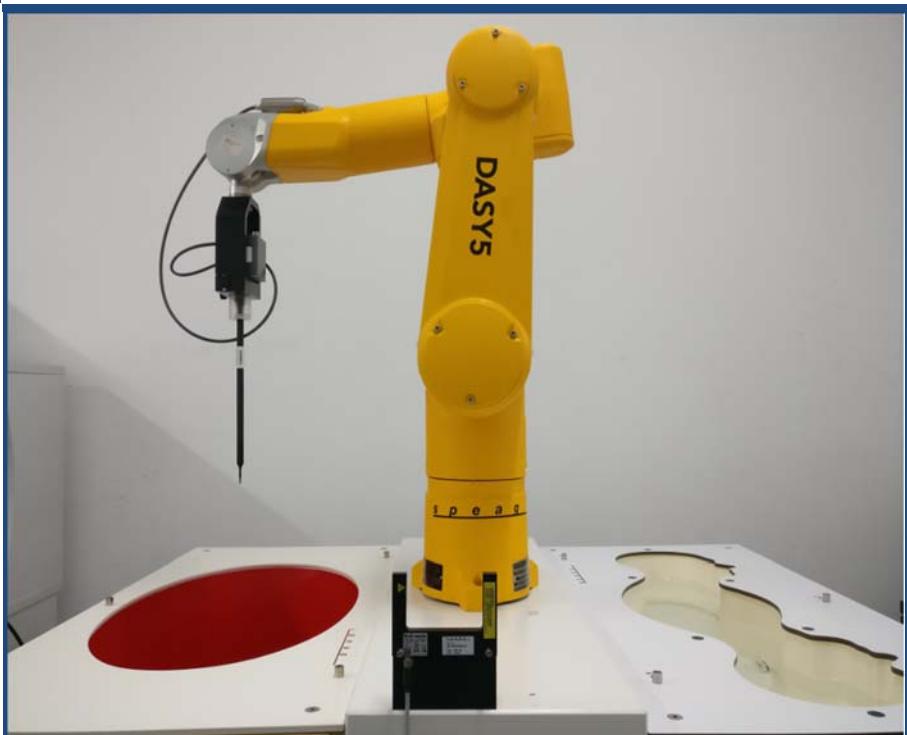
ISSUED BY
Shenzhen BALUN Technology Co., Ltd.



FOR
BrailleSense 6 MINI

ISSUED TO
SELVAS Healthcare, Inc.

155, Sinseong-ro, Yuseong-gu, Daejeon, Rep. of KOREA



Tested by: Liyao Zong
Liyao Zong

Date Jan. 07, 2022

Approved by: Wei Yanquan
Wei Yanquan
(Chief Engineer)

Date Jan. 07, 2022

Report No.: BL-SZ21B0722-701
EUT Name: BrailleSense 6 MINI
Model Name: H620B
Brand Name: HIMS
FCC ID: 2AL4DH620B
Test Standard: 47 CFR Part 2.1093 (refer section 3.1)
Maximum SAR: Body (1 g): 0.791 W/kg
Test Conclusion: Pass
Test Date: Dec. 20, 2021 ~ Dec. 24, 2021
Date of Issue: Jan. 07, 2022

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Revision History

Version	Issue Date	Revisions Content
<u>Rev. 01</u>	<u>Jan. 07, 2022</u>	<u>Initial Issue</u>

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1 GENERAL INFORMATION

1.1 Identification of the Testing Laboratory

Company Name	Shenzhen BALUN Technology Co.,Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Phone Number	+86 755 6685 0100
Fax Number	+86 755 6182 4271

1.2 Identification of the Responsible Testing Location

Test Location	Shenzhen BALUN Technology Co.,Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, 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.
Description	All measurement facilities used to collect the measurement data are located at Block B, FL 1, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China 518055

1.3 Test Environment Condition

Ambient Temperature	21.5°C to 22.5°C
Ambient Relative Humidity	34% to 45%
Ambient Pressure	100KPa to 102KPa

1.4 Announce

- (1) The test report reference to the report template version v2.2.
- (2) The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
- (3) The test report is invalid if there is any evidence and/or falsification.
- (4) The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.
- (5) This document may not be altered or revised in any way unless done so by BALUN and all revisions are duly noted in the revisions section.
- (6) 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.
- (7) 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 Applicant Information

Applicant	SELVAS Healthcare, Inc.
Address	155, Sinseong-ro, Yuseong-gu, Daejeon, Rep. of KOREA

2.2 Manufacturer Information

Manufacturer	SELVAS Healthcare, Inc.
Address	155, Sinseong-ro, Yuseong-gu, Daejeon, Rep. of KOREA

2.3 Factory Information

Factory	SELVAS Healthcare, Inc.
Address	155, Sinseong-ro, Yuseong-gu, Daejeon, Rep. of KOREA

2.4 General Description for Equipment under Test (EUT)

EUT Name	BrailleSense 6 MINI
Model Name Under Test	H620B
Series Model Name	N/A
Description of Model name differentiation	N/A
Hardware Version	HCT-ZN620MB-A2
Software Version	H620B_system_45796
Dimensions (Approx.)	185*103*23mm
Weight (Approx.)	0.439kg (with battery)

2.5 Ancillary Equipment

Ancillary Equipment 1	Battery	
	Brand Name	N/A
	Model No.	H520B-BATT
	Serial No.	N/A
	Capacity	3400 mAh
	Rated Voltage	3.6 V
	Limited Charge Voltage	4.2 V
Ancillary Equipment 2	Earphone	
	Model No.	N/A
	Length (Approx.)	1.2 m

2.6 Technical Information

Network and Wireless connectivity	Bluetooth (BR+EDR+BLE) WIFI 802.11a, 802.11b, 802.11g, 802.11n and 802.11ac U-NII-1/3 GPS, FM Receiver
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The requirement for the following technical information of the EUT was tested in this report:

Operating Mode	2.4G WLAN, 5G WLAN, Bluetooth	
Frequency Range	802.11b/g/n(HT20/HT40)	2412 ~ 2462 MHz
	802.11a/n(HT20/HT40)	5150 ~ 5250 MHz
	802.11	5725 ~ 5850 MHz
	ac(VHT20/VHT40/VHT80)	5150 ~ 5250 MHz
	Bluetooth	5725 ~ 5850 MHz
Antenna Type	WLAN: FPC Antenna Bluetooth: FPC Antenna	
Hotspot Function	N/A	
Exposure Category	General Population/Uncontrolled exposure	
EUT Stage	Portable Device	
Product	Type	
	<input checked="" type="checkbox"/> Production unit	<input type="checkbox"/> 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	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
4	FCC KDB 447498 D01 v06	Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
5	FCC KDB 865664 D01 v01r04	SAR Measurement 100 MHz to 6 GHz
6	FCC KDB 865664 D02 v01r02	RF Exposure Reporting
7	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 (1 g Value)

Band	Antenna	Maximum Scaled SAR (W/kg)	Maximum Report SAR (W/kg)
		Body	Body
2.4G WLAN	Chain0	0.543	0.791
2.4G WLAN	Chain1	0.140	
5.2G WLAN	Chain0	0.188	
5.2G WLAN	Chain1	0.791	
5.8G WLAN	Chain0	0.203	
5.8G WLAN	Chain1	0.786	
Bluetooth	Chain0	0.387	
Limit (W/kg)		1.60	
Verdict		Pass	

3.3.2 Highest Simultaneous SAR

Position	Simultaneous Configuration	Simultaneous SAR (W/kg)	Limit (W/kg)	Verdict
Body	5G WLAN(Chain0) + 5G WLAN(Chain1) + Bluetooth	1.381	1.6	Pass

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 0.791 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:

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

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

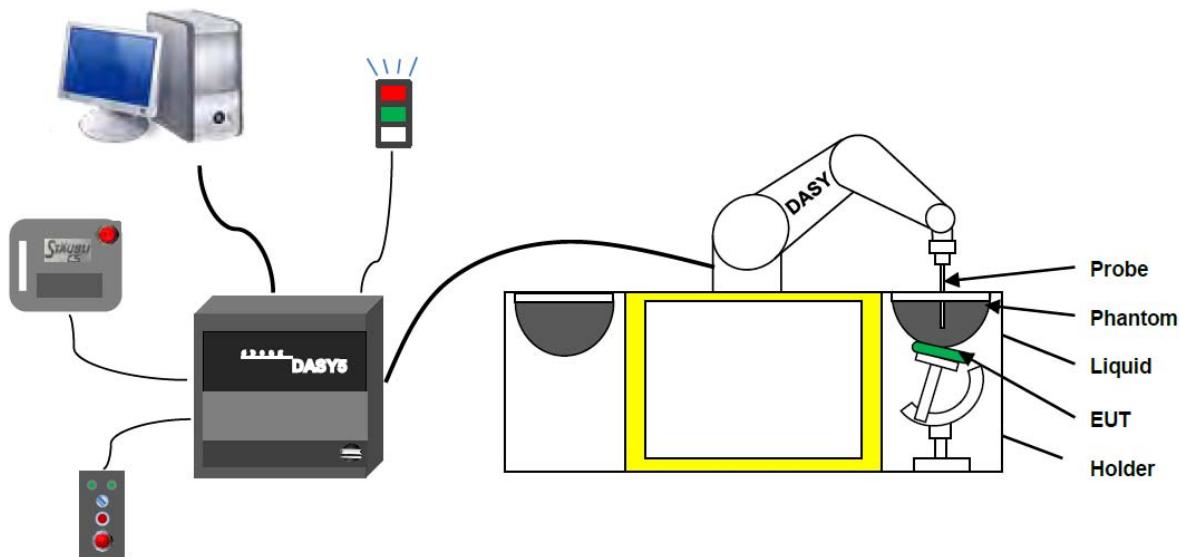
$$\mathbf{SAR} = \frac{\sigma E^2}{\rho}$$

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., glycoether)
Calibration	ISO/IEC 17025 calibration service available
Frequency	10 MHz to 3 GHz; Linearity: ± 0.2 dB (30 MHz to 3 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: 200MOhm
- The Inputs: Symmetrical and Floating
- Common 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 hand
- Right hand
- Flat phantom

Photo of Phantom SN1859



Serial Number	Material	Length	Height
SN 1859 SAM2	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 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			/		5.54	47.86
5800	78.50	21.40			0.1		6.0	48.20

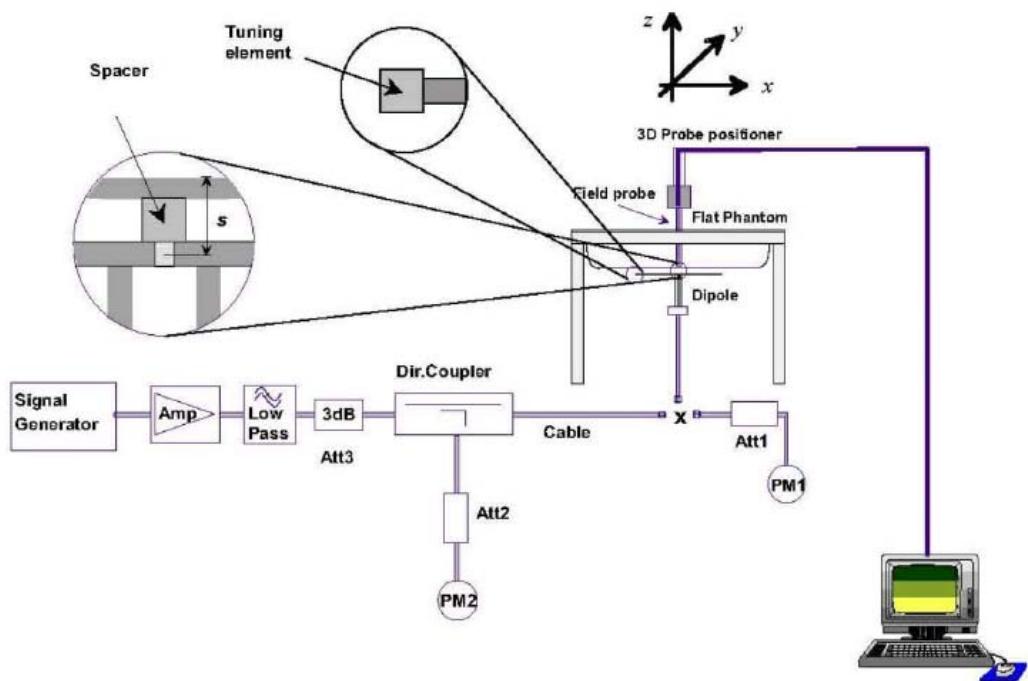
5 SYSTEM VERIFICATION

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. 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

6.1 Tablet Exposure Condition

This DUT was tested in four different positions. They are back side, bottom edge, right edge and top edge in these positions, the surface of DUT is touching with phantom 0mm.

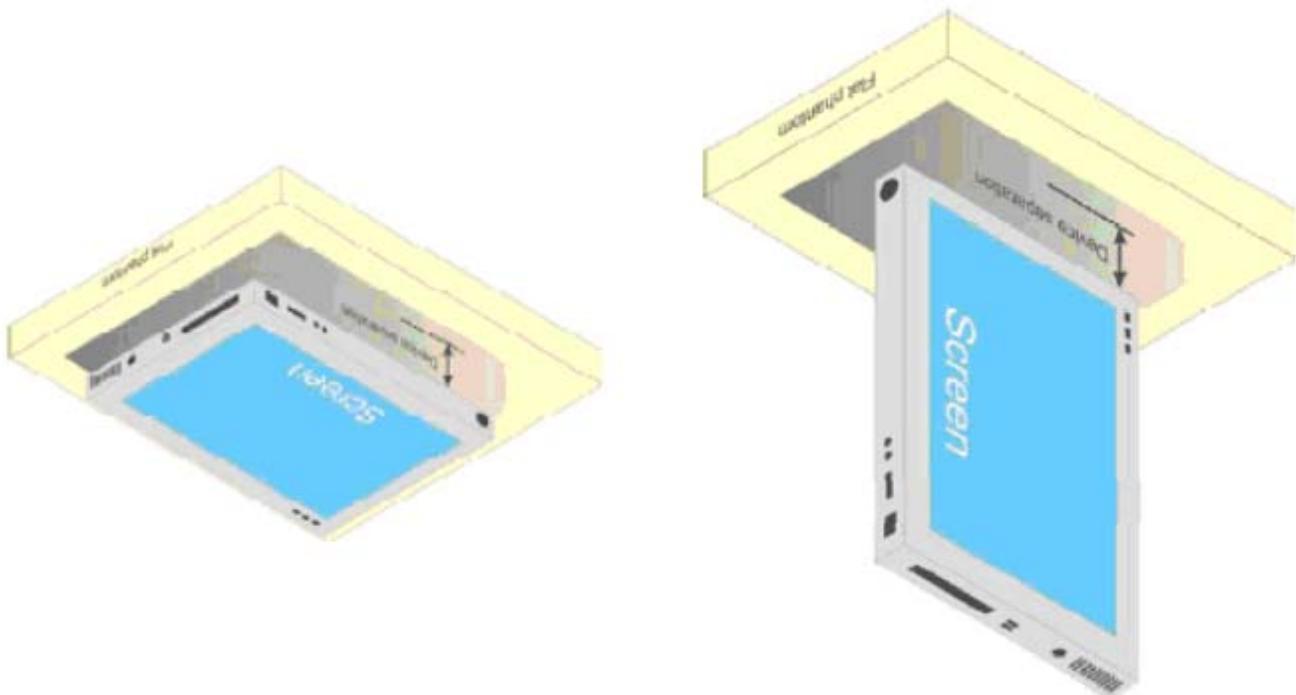
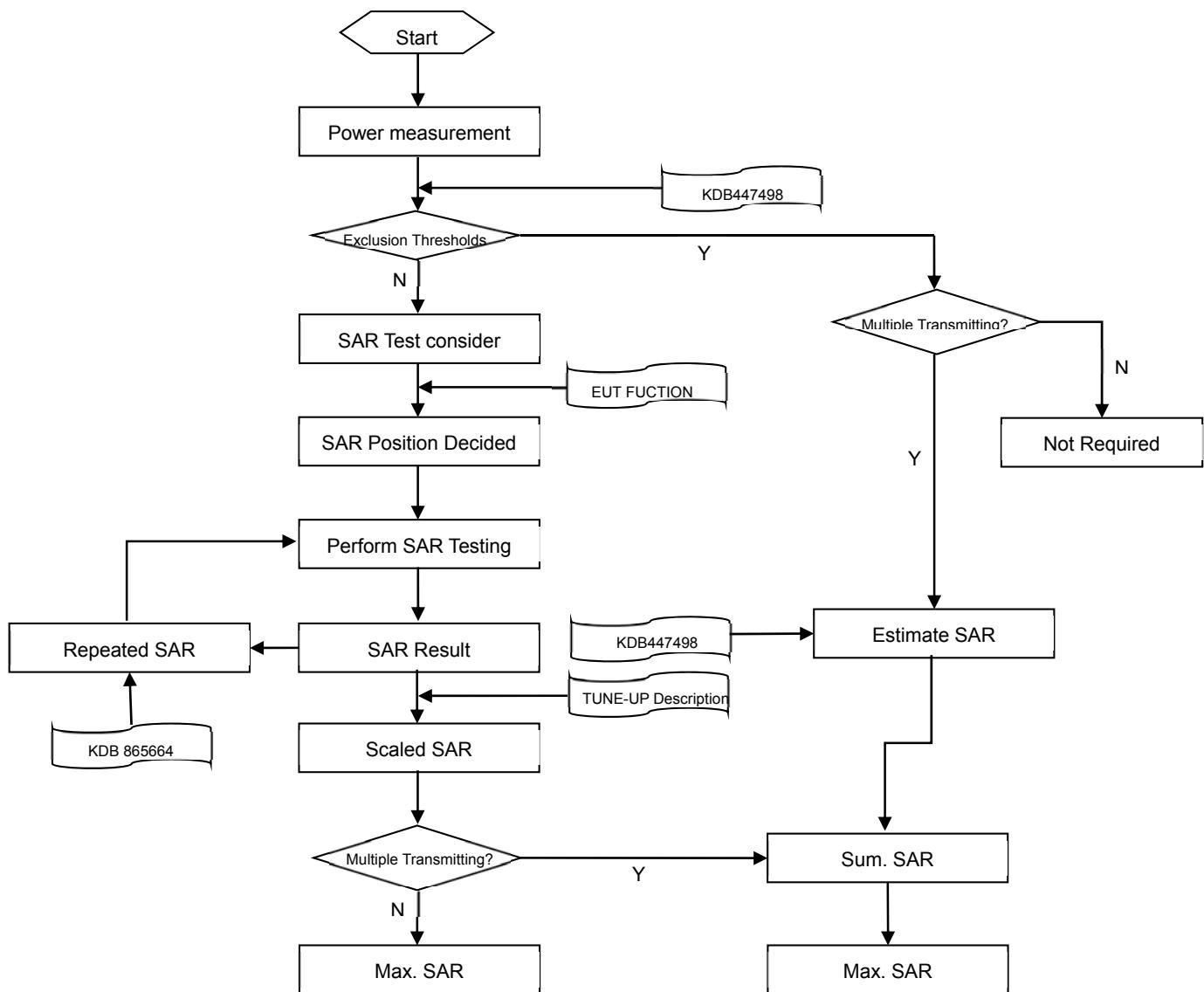


Fig Illustration for Lap-touching Position

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		$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
		≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3–4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
Maximum area scan spatial resolution: Δx Area , Δy Area		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	≤ 4 mm	3–4 GHz: ≤ 3 mm
			4–5 GHz: ≤ 2.5 mm
			5–6 GHz: ≤ 2 mm
Minimum zoom scan volume		≤ 1.5 · Δz Zoom (n-1)	
Note:	x, y, z	≥30 mm	3–4 GHz: ≥ 28 mm
			4–5 GHz: ≥ 25 mm
			5–6 GHz: ≥ 22 mm

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 WIFI

8.1.1 2.4G WIFI (Chain0)

Band (GHz)	Mode	Channel	Freq. (MHz)	Conducted Power (dBm)	Tune-up Power Limit (dBm)	SAR Test Require.	
2.4 (2.4~2.4835)	802.11b	1	2412	10.77	11.00	Yes	
		6	2437	10.75	11.00	Yes	
		11	2462	10.56	11.00	Yes	
	802.11g	1	2412	10.59	11.00	No	
		6	2437	10.79	11.00	No	
		11	2462	10.38	11.00	No	
	802.11n(HT20)	1	2412	10.37	11.00	No	
		6	2437	10.75	11.00	No	
		11	2462	10.72	11.00	No	
	802.11n(HT40)	3	2422	10.63	11.00	No	
		6	2437	10.48	11.00	No	
		9	2452	10.38	11.00	No	
Note: According KDB 248227 D01 SAR is not required for the following 2.4 GHz OFDM conditions. 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.							
Adjusted SAR = Report SAR * (max power (OFDM)/ max power (DSSS)) = 0.543 * (12.59 mw)/(12.59 mw) =0.543 W/kg, so the 2.4GHz OFDM SAR test is not required.							

8.1.2 2.4G WIFI (Chain1)

Band (GHz)	Mode	Channel	Freq. (MHz)	Conducted Power (dBm)	Tune-up Power Limit (dBm)	SAR Test Require.
2.4 (2.4~2.4835)	802.11b	1	2412	10.55	11.00	Yes
		6	2437	10.54	11.00	Yes
		11	2462	10.71	11.00	Yes
	802.11g	1	2412	10.43	11.00	No
		6	2437	10.51	11.00	No
		11	2462	10.32	11.00	No
	802.11n(HT20)	1	2412	10.52	11.00	No
		6	2437	10.57	11.00	No
		11	2462	10.68	11.00	No
	802.11n(HT40)	3	2422	10.65	11.00	No
		6	2437	10.71	11.00	No
		9	2452	10.55	11.00	No

Note: According KDB 248227 D01 SAR is not required for the following 2.4 GHz OFDM conditions. 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 $\leq 1.2 \text{ W/kg}$.
Adjusted SAR = Report SAR * (max power (OFDM)/ max power (DSSS)) = $0.140 * (12.59 \text{ mw})/(12.59 \text{ mw}) = 0.140 \text{ W/kg}$, so the 2.4GHz OFDM SAR test is not required.

8.1.3 2.4G WIFI (MIMO)

Band (GHz)	Mode	Channel	Freq. (MHz)	Conducted Power (dBm)	Tune-up Power Limit (dBm)	SAR Test Require.
2.4 (2.4~2.4835)	802.11g	1	2412	10.62	11.00	No
		6	2437	10.57	11.00	No
		11	2462	10.58	11.00	No
	802.11n(HT20)	1	2412	10.60	11.00	No
		6	2437	10.39	11.00	No
		11	2462	10.63	11.00	No
	802.11n(HT40)	3	2422	10.63	11.00	No
		6	2437	10.45	11.00	No
		9	2452	10.56	11.00	No

Note: For WiFi SAR testing was performed on single antenna RF power in SISO mode that is larger to the single antenna RF power in MIMO mode, and for RF exposure assessment of MIMO mode simultaneous transmission used more conservative "Max. (ant. 0) + Max. (ant. 1)" method to determine SAR compliance. When the sum of 1-g SISO transmission SAR measurement is $<1.6\text{W/kg}$, 2.4G MIMO SAR test is not required.

8.1.4 5G WIFI (Chain0)

Band (GHz)	Mode	Channel	Freq. (MHz)	Conducted Power (dBm)	Tune-up Power Limit (dBm)	SAR Test Require.
5.2 (5.15~5.25)	802.11a	36	5180	9.39	10.00	No
		44	5220	9.45	10.00	No
		48	5240	9.72	10.00	No
	802.11n(HT20)	36	5180	9.40	10.00	No
		44	5220	9.54	10.00	No
		48	5240	9.60	10.00	No
	802.11n(HT40)	38	5190	9.37	10.00	No
		46	5230	9.63	10.00	No
	802.11ac(VHT20)	36	5180	9.38	10.00	No
		44	5220	9.46	10.00	No
		48	5240	9.70	10.00	No
	802.11ac(VHT40)	38	5190	9.41	10.00	No
		46	5230	9.63	10.00	No
	802.11ac(VHT80)	42	5210	9.37	10.00	Yes
5.8 (5.725~5.850)	802.11a	149	5745	9.36	10.00	No
		157	5785	9.41	10.00	No
		165	5825	9.75	10.00	No
	802.11n(HT20)	149	5745	9.68	10.00	No
		157	5785	9.75	10.00	No
		165	5825	9.57	10.00	No
	802.11n(HT40)	151	5755	9.41	10.00	No
		159	5795	9.36	10.00	No
	802.11ac(VHT20)	149	5745	9.54	10.00	No
		157	5785	9.77	10.00	No
		165	5825	9.52	10.00	No
	802.11ac(VHT40)	151	5755	9.56	10.00	No
		159	5795	9.35	10.00	No
	802.11ac(VHT80)	155	5775	9.37	10.00	Yes

8.1.5 5G WIFI (Chain1)

Band (GHz)	Mode	Channel	Freq. (MHz)	Conducted Power (dBm)	Tune-up Power Limit (dBm)	SAR Test Require.
5.2 (5.15~5.25)	802.11a	36	5180	9.78	10.00	No
		44	5220	9.45	10.00	No
		48	5240	9.69	10.00	No
	802.11n(HT20)	36	5180	9.66	10.00	No
		44	5220	9.52	10.00	No
		48	5240	9.59	10.00	No
	802.11n(HT40)	38	5190	9.68	10.00	No
		46	5230	9.55	10.00	No
	802.11ac(VHT20)	36	5180	9.62	10.00	No
		44	5220	9.52	10.00	No
		48	5240	9.52	10.00	No
	802.11ac(VHT40)	38	5190	9.65	10.00	No
		46	5230	9.54	10.00	No
	802.11ac(VHT80)	42	5210	9.35	10.00	Yes
5.8 (5.725~5.850)	802.11a	149	5745	9.74	10.00	No
		157	5785	9.72	10.00	No
		165	5825	9.36	10.00	No
	802.11n(HT20)	149	5745	9.69	10.00	No
		157	5785	9.61	10.00	No
		165	5825	9.30	10.00	No
	802.11n(HT40)	151	5755	9.43	10.00	No
		159	5795	9.62	10.00	No
	802.11ac(VHT20)	149	5745	9.78	10.00	No
		157	5785	9.52	10.00	No
		165	5825	9.35	10.00	No
	802.11ac(VHT40)	151	5755	9.39	10.00	No
		159	5795	9.64	10.00	No
	802.11ac(VHT80)	155	5775	9.34	10.00	Yes

8.1.6 5G WIFI (MIMO)

Band (GHz)	Mode	Channel	Freq. (MHz)	Conducted Power (dBm)	Tune-up Power Limit (dBm)	SAR Test Require.
5.2 (5.15~5.25)	802.11a	36	5180	9.63	10.00	No
		44	5220	9.57	10.00	No
		48	5240	9.76	10.00	No
	802.11n(HT20)	36	5180	9.51	10.00	No
		44	5220	9.61	10.00	No
		48	5240	9.68	10.00	No
	802.11n(HT40)	38	5190	9.51	10.00	No
		46	5230	9.61	10.00	No
	802.11ac(VHT20)	36	5180	9.44	10.00	No
		44	5220	9.52	10.00	No
		48	5240	9.73	10.00	No
	802.11ac(VHT40)	38	5190	9.56	10.00	No
		46	5230	9.61	10.00	No
	802.11ac(VHT80)	42	5210	9.34	10.00	No
5.8 (5.725~5.850)	802.11a	149	5745	9.73	10.00	No
		157	5785	9.68	10.00	No
		165	5825	9.50	10.00	No
	802.11n(HT20)	149	5745	9.54	10.00	No
		157	5785	9.56	10.00	No
		165	5825	9.35	10.00	No
	802.11n(HT40)	151	5755	9.42	10.00	No
		159	5795	9.51	10.00	No
	802.11ac(VHT20)	149	5745	9.53	10.00	No
		157	5785	9.48	10.00	No
		165	5825	9.58	10.00	No
	802.11ac(VHT40)	151	5755	9.53	10.00	No
		159	5795	9.39	10.00	No
	802.11ac(VHT80)	155	5775	9.38	10.00	No

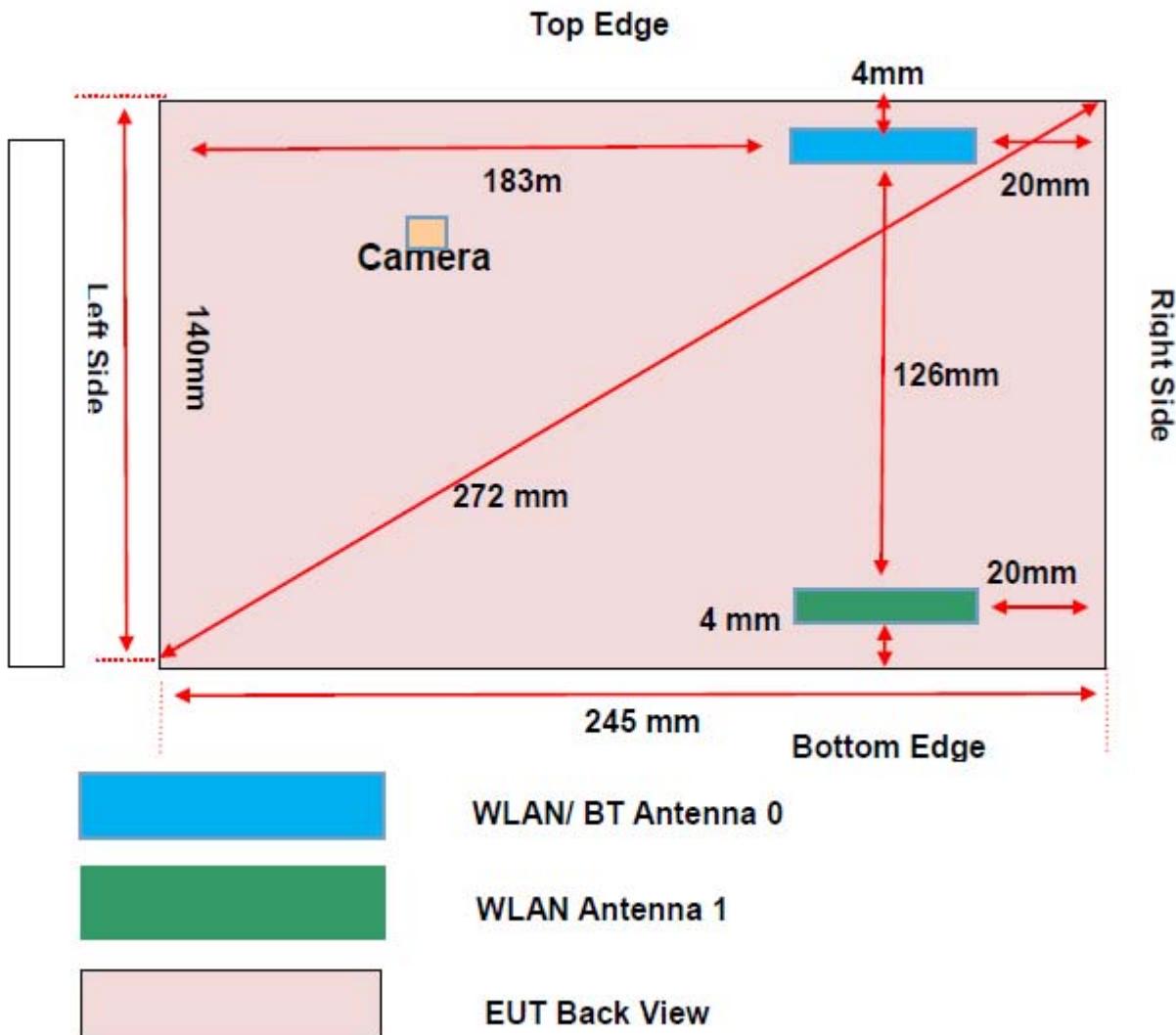
Note: For WiFi SAR testing was performed on single antenna RF power in SISO mode that is larger to the single antenna RF power in MIMO mode, and for RF exposure assessment of MIMO mode simultaneous transmission used more conservative "Max. (ant. 0) + Max. (ant. 1)" method to determine SAR compliance. When the sum of 1-g SISO transmission SAR measurement is <1.6W/kg, 5G MIMO SAR test is not required.

8.2 Bluetooth (Chain0)

Mode	GFSK			$\pi/4$ -DQPSK		
Channel	0	39	78	0	39	78
Frequency (MHz)	2402	2441	2480	2402	2441	2480
Conducted Power (dBm)	7.04	6.93	5.52	6.93	6.78	5.46
Tune-Up Limit (dBm)	8.50	8.00	7.50	7.50	8.00	7.00
Mode	8-DPSK			BLE		
Channel	0	39	78	0	19	39
Frequency (MHz)	2402	2441	2480	2402	2440	2480
Conducted Power (dBm)	7.45	7.24	5.83	2.27	2.97	3.02
Tune-Up Limit (dBm)	8.00	8.00	7.50	4.00	4.00	4.00

9 TEST EXCLUSION CONSIDERATION

9.1 Tablet Mode antenna location sketch



9.2 SAR Test Consideration Table

According with FCC KDB 447498 D01, Appendix A, <SAR Test Exclusion Thresholds for 100 MHz - 6 GHz and ≤ 50 mm> Table, this Device SAR test configurations consider as following :

9.2.1 Tablet mode SAR Test Exclusion Consideration

Chain0

Band	Mode	Max. Conducted Power		Test Position Configurations					
				Back Side	Left Edge	Right Edge	Top Edge	Bottom Edge	
		dBm	mW						
Distance to User (mm)			<5.0	183	20	<5.0	130		
WLAN 2.4 G	SAR Test Required								
	Exclusion Threshold			4.1	1426.0	1.0	4.1	896.0	
	802.11b	11.00	12.59	Yes	No	Yes	Yes	No	
	802.11g	11.00	12.59	No	No	No	No	No	
	802.11n(HT20)	11.00	12.59	No	No	No	No	No	
	802.11n(HT40)	11.00	12.59	No	No	No	No	No	
WLAN 5.2 G	Exclusion Threshold			4.8	1392.0	1.2	4.8	862.0	
	802.11a	10.00	10.00	No	No	No	No	No	
	802.11n(HT20)	10.00	10.00	No	No	No	No	No	
	802.11n(HT40)	10.00	10.00	No	No	No	No	No	
	802.11ac(VHT20)	10.00	10.00	No	No	No	No	No	
	802.11ac(VHT40)	10.00	10.00	No	No	No	No	No	
	802.11ac(VHT80)	10.00	10.00	Yes	No	Yes	Yes	No	
WLAN 5.8 G	Exclusion Threshold			4.8	1392.0	1.2	4.8	862.0	
	802.11a	10.00	10.00	No	No	No	No	No	
	802.11n(HT20)	10.00	10.00	No	No	No	No	No	
	802.11n(HT40)	10.00	10.00	No	No	No	No	No	
	802.11ac(VHT20)	10.00	10.00	No	No	No	No	No	
	802.11ac(VHT40)	10.00	10.00	No	No	No	No	No	
	802.11ac(VHT80)	10.00	10.00	Yes	No	Yes	Yes	No	
Bluetooth	Exclusion Threshold			2.2	1425.0	0.6	2.2	895.0	
	BR/EDR	8.50	7.08	Yes	No	Yes	Yes	No	
	BLE	4.00	2.51	No	No	No	No	No	

Chain1

Band	Mode	Max. Conducted Power		Test Position Configurations				
				Back Side	Left Edge	Right Edge	Top Edge	Bottom Edge
		dBm	mW					
Distance to User (mm)			<5.0	183	20	130	<5.0	
WLAN 2.4 G	SAR Test Required							
	Exclusion Threshold			4.1	1426.0	1.0	896.0	4.1
	802.11b	11.00	12.59	Yes	No	Yes	No	Yes
	802.11g	11.00	12.59	No	No	No	No	No
	802.11n(HT20)	11.00	12.59	No	No	No	No	No
	802.11n(HT40)	11.00	12.59	No	No	No	No	No
	Exclusion Threshold			4.8	1392.0	1.2	4.8	4.8
WLAN 5.2 G	802.11a	10.00	10.00	No	No	No	No	No
	802.11n(HT20)	10.00	10.00	No	No	No	No	No
	802.11n(HT40)	10.00	10.00	No	No	No	No	No
	802.11ac(VHT20)	10.00	10.00	No	No	No	No	No
	802.11ac(VHT40)	10.00	10.00	No	No	No	No	No
	802.11ac(VHT80)	10.00	10.00	Yes	No	Yes	No	Yes
	Exclusion Threshold			4.8	1392.0	1.2	4.8	4.8
WLAN 5.8 G	802.11a	10.00	10.00	No	No	No	No	No
	802.11n(HT20)	10.00	10.00	No	No	No	No	No
	802.11n(HT40)	10.00	10.00	No	No	No	No	No
	802.11ac(VHT20)	10.00	10.00	No	No	No	No	No
	802.11ac(VHT40)	10.00	10.00	No	No	No	No	No
	802.11ac(VHT80)	10.00	10.00	Yes	No	Yes	No	Yes

Note:

1. Maximum power is the source-based time-average power and represents the maximum RF output power including tune-up tolerance among production units
2. Per KDB 447498 D01, for larger devices, the test separation distance of adjacent edge configuration is determined by the closest separation between the antenna and the user.
3. Per KDB 447498 D01, standalone SAR test exclusion threshold is applied; If the distance of the antenna to the user is < 5mm, 5mm is used to determine SAR exclusion threshold
4. Per KDB 447498 D01, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances \leq 50 mm are determined by:
$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR}$$
 - a. $f(\text{GHz})$ is the RF channel transmit frequency in GHz
 - b. Power and distance are rounded to the nearest mW and mm before calculation
 - c. The result is rounded to one decimal place for comparison
 - d. For < 50 mm distance, we just calculate mW of the exclusion threshold value (3.0) to do compare.
5. Per KDB 447498 D01, at 100 MHz to 6 GHz and for test separation distances $>$ 50 mm, the SAR test exclusion threshold is determined according to the following
 - a. $[\text{Threshold at 50 mm in step 1} + (\text{test separation distance} - 50 \text{ mm}) \cdot (f(\text{MHz})/150)] \text{ mW}$, at 100 MHz to 1500 MHz
 - b. $[\text{Threshold at 50 mm in step 1} + (\text{test separation distance} - 50 \text{ mm}) \cdot 10] \text{ mW}$ at > 1500 MHz and ≤ 6 GHz
6. Per KDB 248227 D01, choose the highest output power channel to test SAR and determine further SAR exclusion.8. For each frequency band, testing at higher data rates and higher order modulations is not required when the maximum average output power for each of these configurations is less than 1/4dB higher than those measured at the lowest data rate
7. Per KDB 248227 D01 SAR is not required for the following 2.4 GHz OFDM conditions.
 - a. When KDB Publication 447498 D01 SAR test exclusion applies to the OFDM configuration.
 - b. 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 $\leq 1.2 \text{ W/kg}$.
8. Per KDB 248227 D01 SAR is not required for the following U-NII-1 and U-NII-2A bands conditions.
 - a. 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 $\leq 1.2 \text{ W/kg}$, 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.
 - b. When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is $\leq 1.2 \text{ W/kg}$, SAR is not required for the band with lower maximum output power in that test configuration; otherwise, each band is tested independently for SAR.

10 TEST RESULT

10.1 WIFI 2.4GHz

Antenna	Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (dB)	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.
Body														
Chain0	802.11b	Back Side	0	1	2412	0.01	0.512	99.45	1.006	10.77	11.00	1.054	0.543	1#
		Bottom Edge	0	1	2412	0.05	0.063	99.45	1.006	10.77	11.00	1.054	0.067	/
		Right Edge	0	1	2412	0.12	0.234	99.45	1.006	10.77	11.00	1.054	0.248	/
Chain1	802.11b	Back Side	0	11	2462	0.03	0.063	99.45	1.006	10.71	11.00	1.069	0.068	/
		Top Edge	0	11	2462	-0.18	0.046	99.45	1.006	10.71	11.00	1.069	0.049	/
		Right Edge	0	11	2462	0.07	0.130	99.45	1.006	10.71	11.00	1.069	0.140	2#

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

10.2 WIFI 5GHz

Fre. Band	Antenn a	Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (dB)	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.
Body															
5.2G	Chain0	802.11 ac80	Back Side	0	42	5210	-0.12	0.091	87.50	1.143	9.37	10.00	1.156	0.120	/
			Top Edge	0	42	5210	0.09	0.142	87.50	1.143	9.37	10.00	1.156	0.188	3#
			Right Edge	0	42	5210	0.13	0.066	87.50	1.143	9.37	10.00	1.156	0.087	/
5.2G	Chain1	802.11 ac80	Back Side	0	42	5210	0.01	0.596	87.50	1.143	9.35	10.00	1.161	0.791	4#
			Bottom Edge	0	42	5210	0.15	0.031	87.50	1.143	9.35	10.00	1.161	0.041	/
			Right Edge	0	42	5210	0.03	0.106	87.50	1.143	9.35	10.00	1.161	0.141	/
5.8G	Chain0	802.11 ac80	Back Side	0	155	5775	0.14	0.089	87.50	1.143	9.37	10.00	1.156	0.118	/
			Top Edge	0	155	5775	0.17	0.150	87.50	1.143	9.37	10.00	1.156	0.198	/
			Right Edge	0	155	5775	0.13	0.154	87.50	1.143	9.37	10.00	1.156	0.203	5#
5.8G	Chain1	802.11 ac80	Back Side	0	155	5775	0.12	0.591	87.50	1.143	9.34	10.00	1.164	0.786	6#
			Bottom Edge	0	155	5775	-0.10	0.057	87.50	1.143	9.34	10.00	1.164	0.076	/
			Right Edge	0	155	5775	-0.15	0.277	87.50	1.143	9.34	10.00	1.164	0.369	/

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

10.3 Bluetooth

Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (dB)	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.
Body													
DH5	Back Side	0	0	2402	0.04	0.212	7.04	8.50	1.399	76.61	1.305	0.387	7#
	Top Edge	0	0	2402	0.01	0.022	7.04	8.50	1.399	76.61	1.305	0.040	/
	Right Edge	0	0	2402	-0.18	0.119	7.04	8.50	1.399	76.61	1.305	0.217	/

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

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 $0.596 < 0.80$ 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).

According KDB 447498 D01v06, simultaneous transmission:

- a) SPLSR = $(\text{SAR1} + \text{SAR2})^{1.5} / R_i$ (min. separation distance, mm), and the peak separation distance is determined from the square root of $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$, where (x_1, y_1, z_1) and (x_2, y_2, z_2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
SAR1 is the highest reported or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition.
SAR2 is the highest reported or estimated SAR for the second of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition as the first.
- b) If $\text{SPLSR} \leq 0.04$, simultaneously transmission SAR measurement is not necessary.
- c) Simultaneously transmission SAR measurement, and the reported multi-band SAR $< 1.6\text{W/kg}$.

12.1 Simultaneous Transmission Mode Considerations

NO.	Mode	Body
1	2.4G WLAN(Chain0)	+ 2.4G WLAN(Chain1)
2	2.4G WLAN(Chain1)	+ Bluetooth(Chain0)
3	5G WLAN(Chain0)	+ 5G WLAN(Chain1)
4	5G WLAN(Chain1)	+ Bluetooth(Chain0)
5	5G WLAN(Chain0)	+ 5G WLAN(Chain1) + Bluetooth(Chain0)

Note: The EUT supports the Chain0 with TX/RX diversity function for WLAN and Bluetooth, the Chain1 with TX/RX diversity function for WLAN.

12.2 Sum SAR of Simultaneous Transmission

12.2.1 Highest Bluetooth and WLAN Sum Body SAR of Simultaneous Transmission

Simultaneous Mode	Mode	Max. 1g SAR (W/kg)	1g Sum SAR (W/kg)	SPLSR (Yes/No)	SPLSR Num.
Body (Separation 0 mm)					
2.4G WLAN(Chain0) + 2.4G WLAN(Chain1)	2.4G WLAN(Chain0)	0.543	0.683	No	/
	2.4G WLAN(Chain1)	0.140			
2.4G WLAN(Chain1) + Bluetooth(Chain0)	2.4G WLAN(Chain1)	0.140	0.527	No	/
	Bluetooth(Chain0)	0.387			
5G WLAN(Chain0) + 5G WLAN(Chain1)	5G WLAN(Chain0)	0.203	0.994	No	/
	5G WLAN(Chain1)	0.791			
5G WLAN(Chain1) + Bluetooth(Chain0)	5G WLAN(Chain1)	0.791	1.178	No	/
	Bluetooth(Chain0)	0.387			
5G WLAN(Chain0) + 5G WLAN(Chain1) + Bluetooth(Chain0)	5G WLAN(Chain0)	0.203	1.381	No	/
	5G WLAN(Chain1)	0.791			
	Bluetooth(Chain0)	0.387			

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	2021/05/19	2024/05/18
5GHz Validation Dipole	Speag	D5GHzV2	SN: 1200	2021/05/18	2024/05/17
E-Field Probe	Speag	EX3DV4	SN: 7663	2021/07/23	2022/07/22
Data Acquisition Electronics	Speag	DAE4	SN: 878	2021/07/15	2022/07/14
Signal Generator	R&S	SMB100A	182396	2021/12/20	2022/12/19
Power Meter	R&S	NRVD-B2	7250BJ-0112/2011	2021/09/08	2022/09/07
Power Sensor	R&S	NRV-Z4	100381	2021/09/08	2022/09/07
Power Sensor	R&S	NRV-Z2	100211	2021/09/08	2022/09/07
Network Analyzer	Agilent	E5071B	MY42404001	2021/04/01	2022/03/31
Thermometer	Elitech	RC-4HC	EF720B004820	2021/12/01	2022/11/30
Power Amplifier	SATIMO	6552B	22374	N/A	N/A
Dielectric Probe Kit	SATIMO	SCLMP	SN 25/13 OCPG56	N/A	N/A
Phantom	Speag	SAM	SN: 1859	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 is within 20% of calibrated measurement.
4. Impedance (real or imaginary parts) is 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 (%)
2021.12.20	Head	2450	21.9	1.80	39.52	1.80	39.20	0.00	0.82
2021.12.22	Head	5250	21.3	4.49	37.00	4.71	35.93	-4.67	2.98
2021.12.24	Head	5750	21.2	5.22	35.23	5.22	35.36	0.00	-0.37
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 % (for 1 g).

Head liquid 1g

Date	Liquid Type	Freq. (MHz)	Power (mW)	Measured SAR (W/kg)	Normalized SAR (W/kg)	Dipole SAR (W/kg)	Tolerance (%)
2021.12.20	Head	2450	100	5.320	53.20	53.00	0.38
2021.12.22	Head	5250	100	8.040	80.40	77.80	3.34
2021.12.24	Head	5750	100	7.850	78.50	77.20	1.68
Note: The tolerance limit of System validation $\pm 10\%$.							

System Performance Check Data (2450MHz)

Date: 2021.12.20

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

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.8$ S/m; $\epsilon_r = 39.521$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature: 22.5 Liquid Temperature: 21.9

DASY5 Configuration:

- Probe: EX3DV4 - SN7663; ConvF(8.19, 8.19, 8.19); Calibrated: 2021.07.23;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn878; Calibrated: 2021.07.19
- Phantom: SAM with CRP v5.0 on left 1859; Type: QD000P40CC; Serial: TP:1859
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

CW 2450/Area Scan (101x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 5.83 W/kg

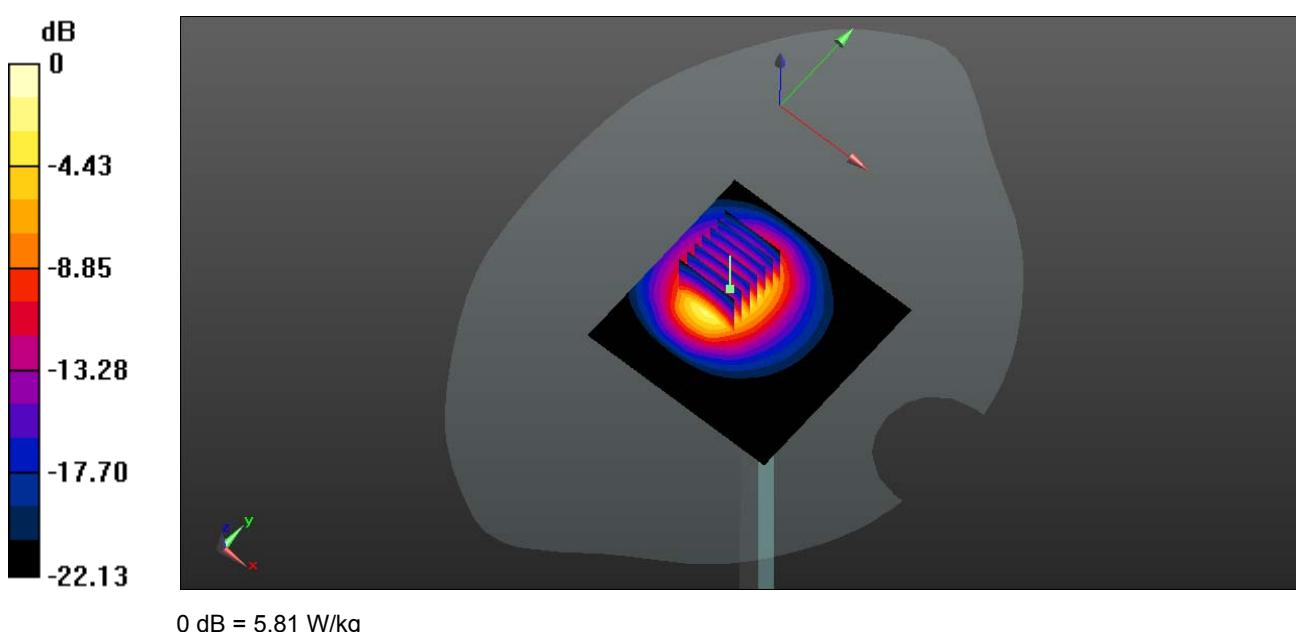
CW 2450/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.53 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 10.8 W/kg

SAR(1 g) = 5.32 W/kg; SAR(10 g) = 2.41 W/kg

Maximum value of SAR (measured) = 5.81 W/kg



System Performance Check Data (5250MHz)

Date: 2021.12.22

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

Medium parameters used: $f = 5250$ MHz; $\sigma = 4.493$ S/m; $\epsilon_r = 36.993$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature: 22.7 Liquid Temperature: 21.3

DASY5 Configuration:

- Probe: EX3DV4 - SN7663; ConvF(5.72, 5.72, 5.72); Calibrated: 2021.07.23;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn878; Calibrated: 2021.07.19
- Phantom: SAM with CRP v5.0 on left 1859; Type: QD000P40CC; Serial: TP:1859
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.10 (7331)

CW 5250/Area Scan (81x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 14.3 W/kg

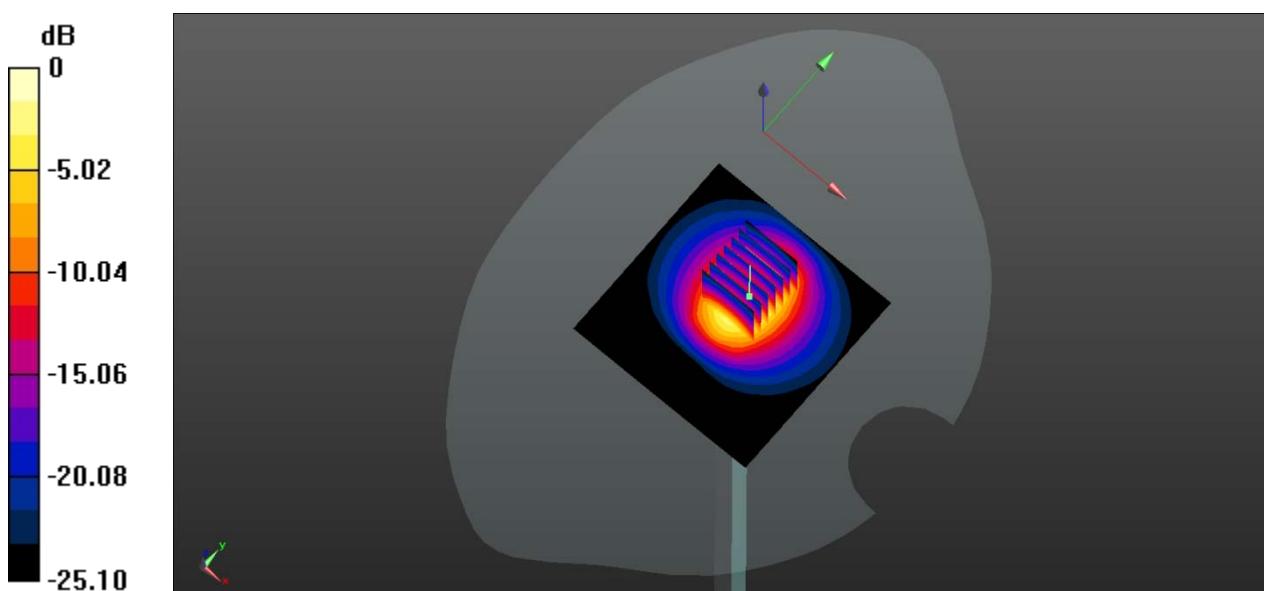
CW 5250/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 24.92 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 33.3 W/kg

SAR(1 g) = 8.04 W/kg; SAR(10 g) = 2.25 W/kg

Maximum value of SAR (measured) = 19.1 W/kg



System Performance Check Data (5750MHz)

Date: 2021.12.24

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

Medium parameters used: $f = 5750$ MHz; $\sigma = 5.222$ S/m; $\epsilon_r = 35.229$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature: 22.2 Liquid Temperature: 21.2

DASY5 Configuration:

- Probe: EX3DV4 - SN7663; ConvF(5.15, 5.15, 5.15); Calibrated: 2021.07.23;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn878; Calibrated: 2021.07.19
- Phantom: SAM with CRP v5.0 on left 1859; Type: QD000P40CC; Serial: TP:1859
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.10 (7331)

CW5750/Area Scan (81x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 8.92W/kg

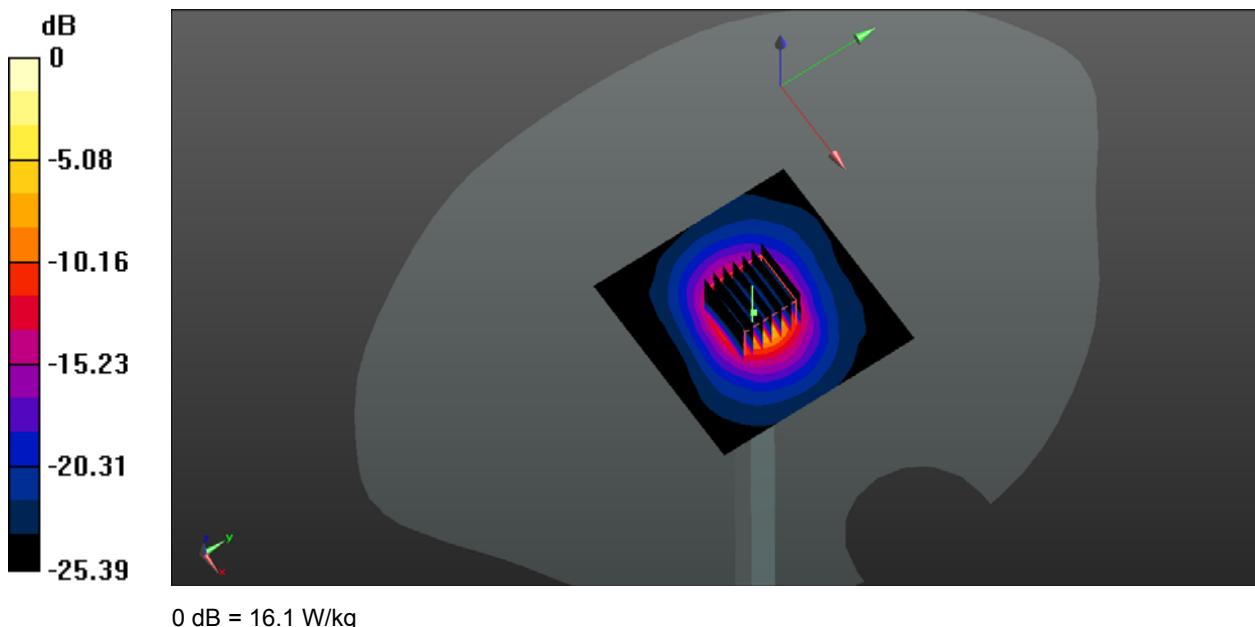
CW5750/Zoom Scan (7x7x21)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 40.19 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 36.7 W/kg

SAR(1 g) = 7.85 W/kg; SAR(10 g) = 2.17 W/kg

Maximum value of SAR (measured) = 16.1 W/kg



ANNEX C TEST DATA

1-Body Plane with Back Side 0mm on Low Channel in IEEE802.11b mode With Ant.0

Date: 2021/12/20

Communication System Band: WLAN(b)MHz; Frequency: 2412 MHz; Duty Cycle: 1:1.006

Medium parameters used: $f = 2412$ MHz; $\sigma = 1.766$ S/m; $\epsilon_r = 39.694$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature: 22.5 Liquid Temperature: 21.9

DASY5 Configuration:

- Probe: EX3DV4 - SN7663; ConvF(8.19, 8.19, 8.19); Calibrated: 2021.07.23;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn878; Calibrated: 2021.07.19
- Phantom: SAM with CRP v5.0 on left 1859; Type: QD000P40CC; Serial: TP:1859
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch1/Area Scan (101x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.641 W/kg

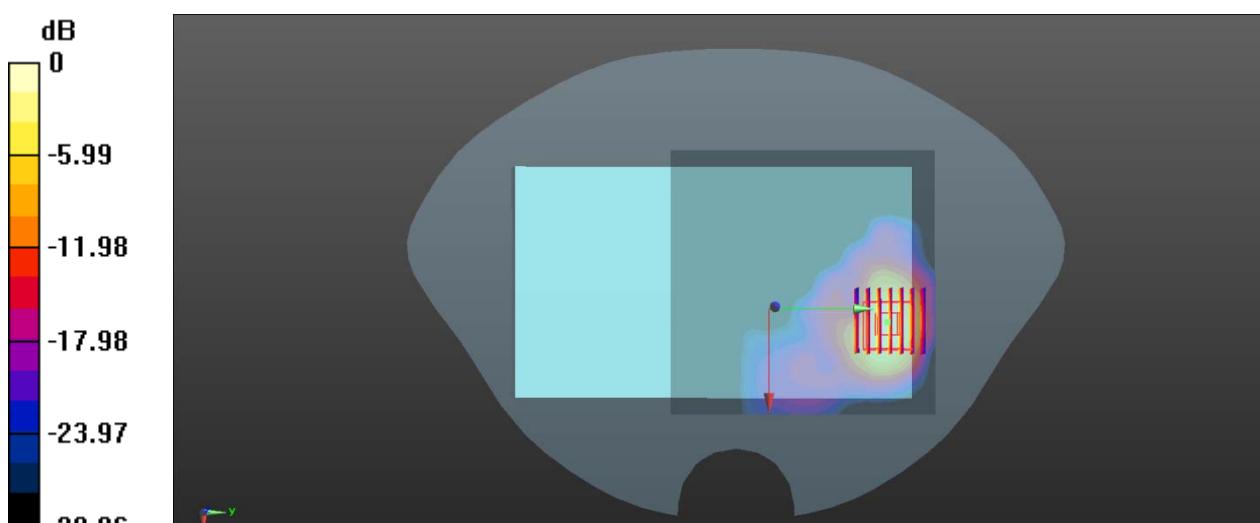
Ch1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 0 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 1.15 W/kg

SAR(1 g) = 0.512 W/kg; SAR(10 g) = 0.191 W/kg

Maximum value of SAR (measured) = 0.588 W/kg



2-Body Plane with Right Edge 0mm on High Channel in IEEE802.11b mode With Ant.1

Date: 2021/12/20

Communication System Band: WLAN(b)MHz; Frequency: 2462 MHz; Duty Cycle: 1:1.006

Medium parameters used: $f = 2462$ MHz; $\sigma = 1.81$ S/m; $\epsilon_r = 39.444$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature: 22.5 Liquid Temperature: 21.9

DASY5 Configuration:

- Probe: EX3DV4 - SN7663; ConvF(8.19, 8.19, 8.19); Calibrated: 2021.07.23;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn878; Calibrated: 2021.07.19
- Phantom: SAM with CRP v5.0 on left 1859; Type: QD000P40CC; Serial: TP:1859
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch11/Area Scan (61x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.173 W/kg

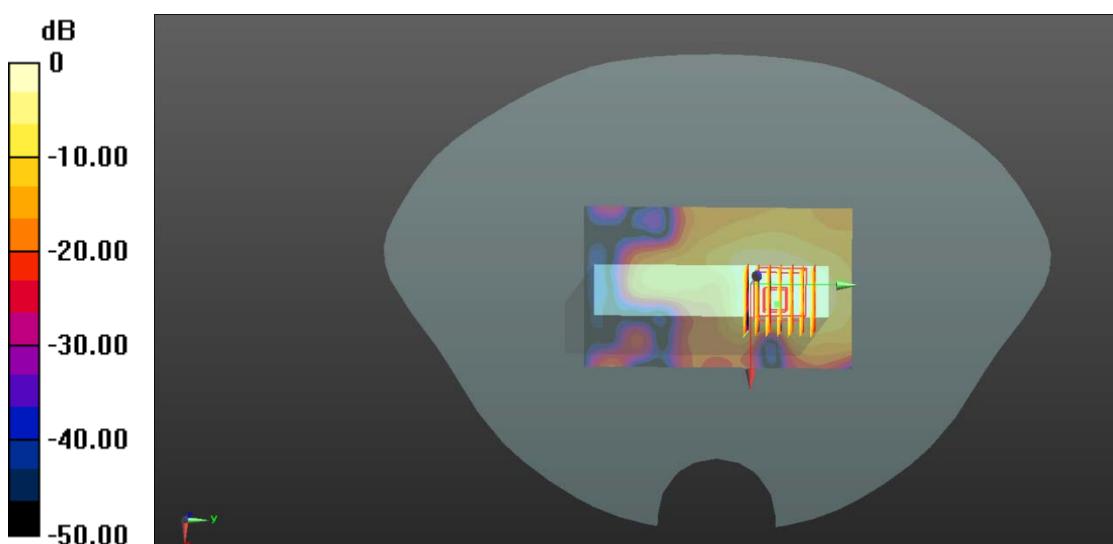
Ch11/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 1.287 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 0.319 W/kg

SAR(1 g) = 0.130 W/kg; SAR(10 g) = 0.054 W/kg

Maximum value of SAR (measured) = 0.126 W/kg



0 dB = 0.126 W/kg

3-Body Plane with Top Edge 0mm on 42 Channel in IEEE802.11ac80 mode With Ant.0

Date: 2021/12/22

Communication System Band: WLAN(ac80)MHz; Frequency: 5210 MHz; Duty Cycle: 1:1.143

Medium parameters used: $f = 5210$ MHz; $\sigma = 4.512$ S/m; $\epsilon_r = 36.882$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature: 22.7 Liquid Temperature: 21.3

DASY5 Configuration:

- Probe: EX3DV4 - SN7663; ConvF(5.72, 5.72, 5.72); Calibrated: 2021.07.23;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn878; Calibrated: 2021.07.19
- Phantom: SAM with CRP v5.0 on left 1859; Type: QD000P40CC; Serial: TP:1859
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch42/Area Scan (81x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.255 W/kg

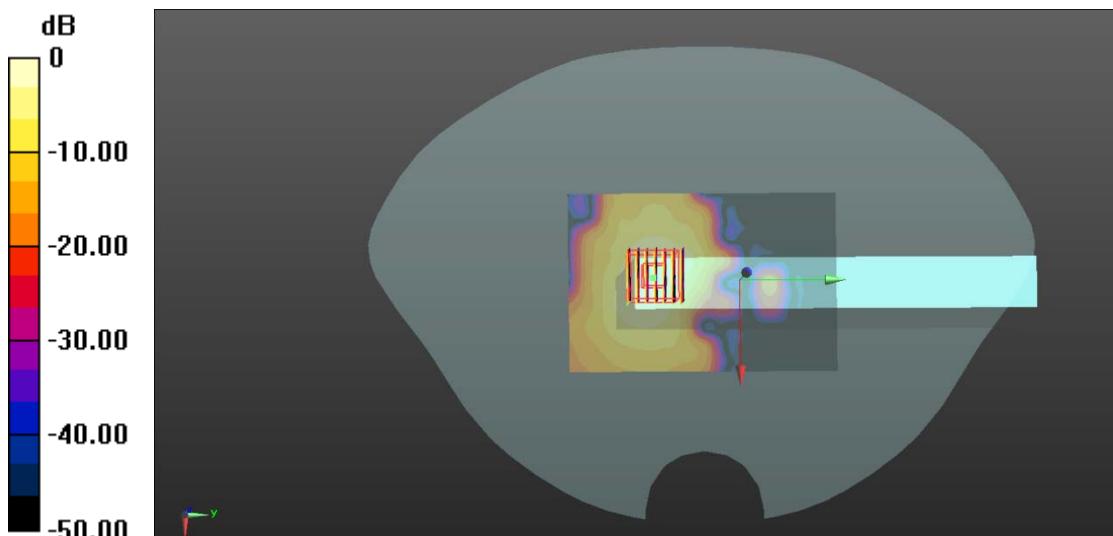
Ch42/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 0.8370 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 0.524 W/kg

SAR(1 g) = 0.142 W/kg; SAR(10 g) = 0.047 W/kg

Maximum value of SAR (measured) = 0.271 W/kg



4-Body Plane with Back Side 0mm on 42 Channel in IEEE802.11ac80 mode With Ant.1

Date: 2021/12/22

Communication System Band: WLAN(ac80)MHz; Frequency: 5210 MHz; Duty Cycle: 1:1.143

Medium parameters used: $f = 5210$ MHz; $\sigma = 4.512$ S/m; $\epsilon_r = 36.882$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature: 22.7 Liquid Temperature: 21.3

DASY5 Configuration:

- Probe: EX3DV4 - SN7663; ConvF(5.72, 5.72, 5.72); Calibrated: 2021.07.23;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn878; Calibrated: 2021.07.19
- Phantom: SAM with CRP v5.0 on left 1859; Type: QD000P40CC; Serial: TP:1859
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch42/Area Scan (121x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.791 W/kg

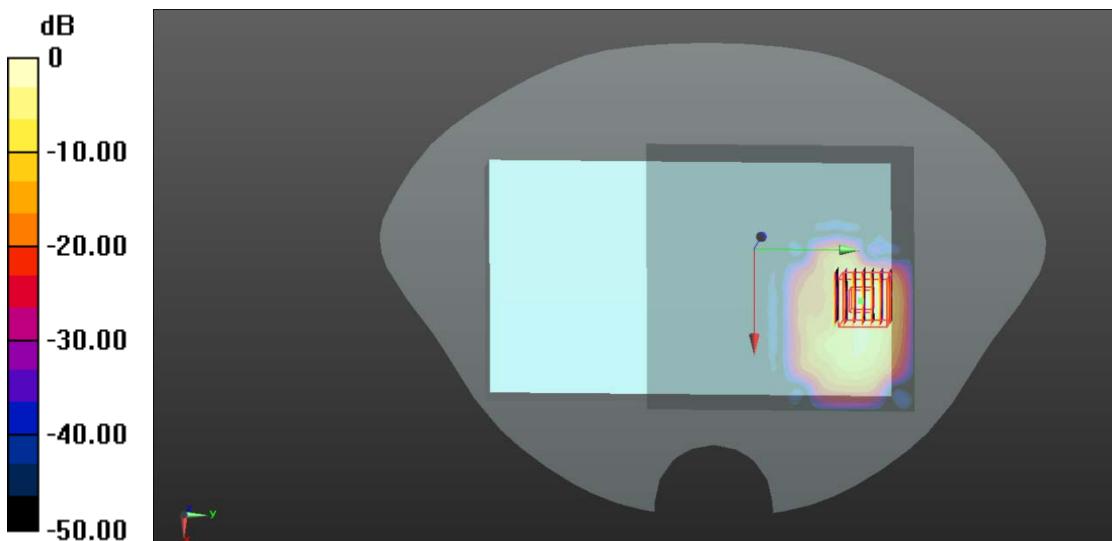
Ch42/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 0 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 1.98 W/kg

SAR(1 g) = 0.596 W/kg; SAR(10 g) = 0.098 W/kg

Maximum value of SAR (measured) = 0.963 W/kg



5-Body Plane with Right Edge 0mm on 155 Channel in IEEE802.11ac80 mode With Ant.0

Date: 2021/12/24

Communication System Band: WLAN(ac80)MHz; Frequency: 5775 MHz; Duty Cycle: 1:1.143

Medium parameters used: $f = 5775$ MHz; $\sigma = 5.27$ S/m; $\epsilon_r = 34.892$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature: 22.2 Liquid Temperature: 21.2

DASY5 Configuration:

- Probe: EX3DV4 - SN7663; ConvF(5.15, 5.15, 5.15); Calibrated: 2021.07.23;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn878; Calibrated: 2021.07.19
- Phantom: SAM with CRP v5.0 on left 1859; Type: QD000P40CC; Serial: TP:1859
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch155/Area Scan (81x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.346 W/kg

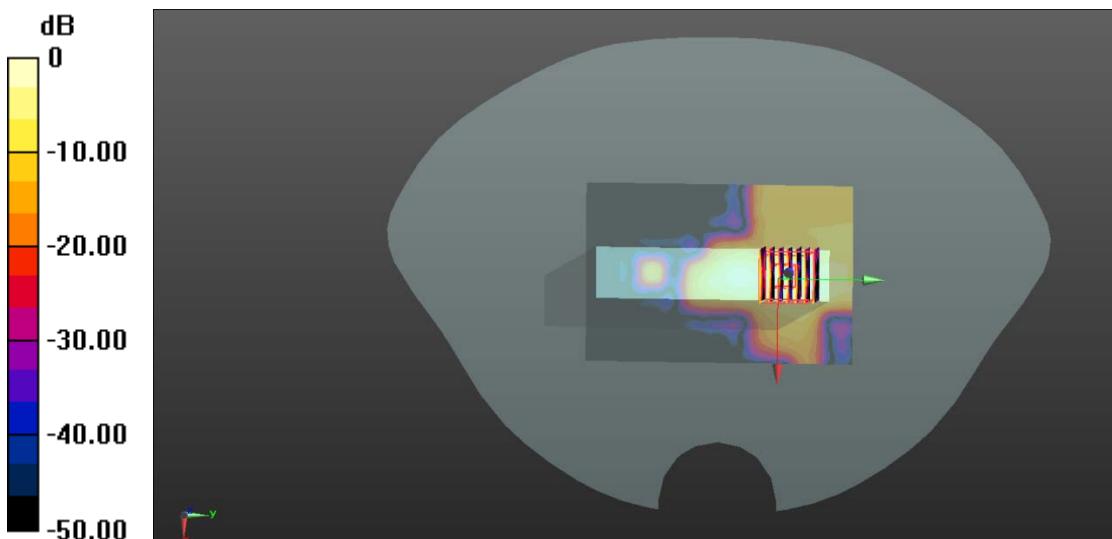
Ch155/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 3.297 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 0.779 W/kg

SAR(1 g) = 0.154 W/kg; SAR(10 g) = 0.038 W/kg

Maximum value of SAR (measured) = 0.336 W/kg



0 dB = 0.336 W/kg

6-Body Plane with Back Side 0mm on 155 Channel in IEEE802.11ac80 mode With Ant.1

Date: 2021/12/24

Communication System Band: WLAN(ac80)MHz; Frequency: 5775 MHz; Duty Cycle: 1:1.143

Medium parameters used: $f = 5775$ MHz; $\sigma = 5.213$ S/m; $\epsilon_r = 33.952$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature: 22.2 Liquid Temperature: 21.2

DASY5 Configuration:

- Probe: EX3DV4 - SN7663; ConvF(5.15, 5.15, 5.15); Calibrated: 2021.07.23;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn878; Calibrated: 2021.07.19
- Phantom: SAM with CRP v5.0 on left 1859; Type: QD000P40CC; Serial: TP:1859
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch155/Area Scan (121x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.26 W/kg

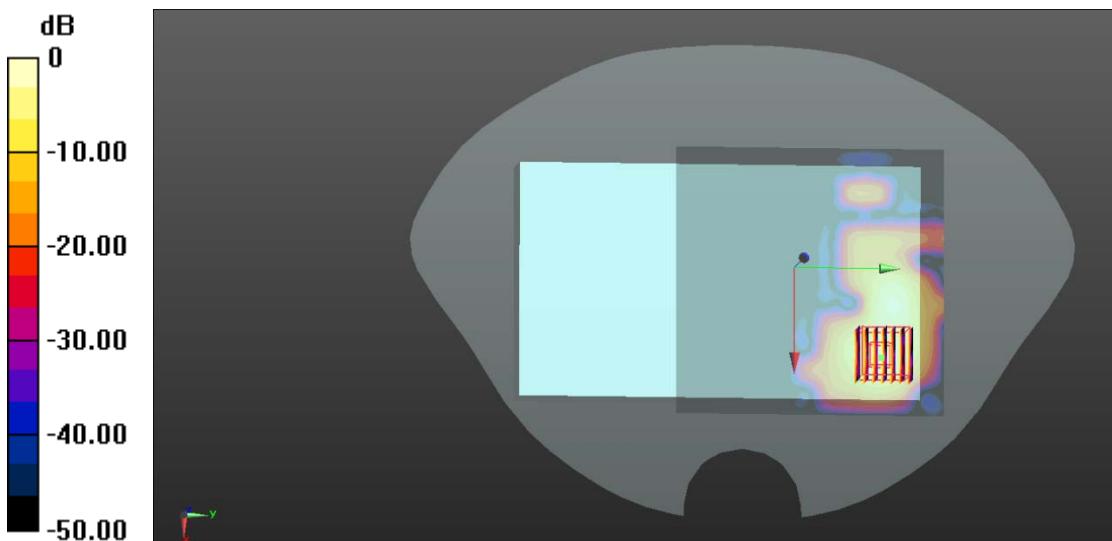
Ch155/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 0 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 2.77 W/kg

SAR(1 g) = 0.591 W/kg; SAR(10 g) = 0.167 W/kg

Maximum value of SAR (measured) = 1.31 W/kg



7-Body Plane with Back Side 0mm on Low Channel in Bluetooth mode With Ant.0

Date: 2021/12/20

Communication System Band: **Bluetooth**; Frequency: 2402 MHz; Duty Cycle: 1:1.305Medium parameters used: $f = 2402$ MHz; $\sigma = 1.744$ S/m; $\epsilon_r = 39.86$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Ambient Temperature: 22.5 Liquid Temperature: 21.9

DASY5 Configuration:

- Probe: EX3DV4 - SN7663; ConvF(8.19, 8.19, 8.19); Calibrated: 2021.07.23;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn878; Calibrated: 2021.07.19
- Phantom: SAM with CRP v5.0 on left 1859; Type: QD000P40CC; Serial: TP:1859
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Ch0/Area Scan (101x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.237 W/kg

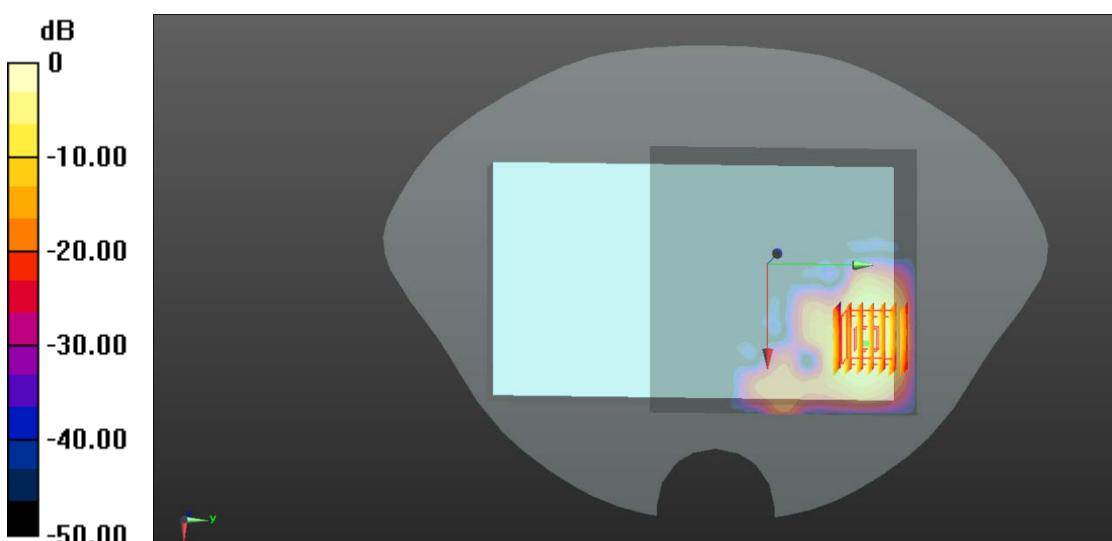
Ch0/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 0 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.422 W/kg

SAR(1 g) = 0.212 W/kg; SAR(10 g) = 0.069 W/kg

Maximum value of SAR (measured) = 0.208 W/kg



ANNEX D EUT EXTERNAL PHOTOS

Please refer the document "BL-SZ21B0722-AW.pdf".

ANNEX E SAR TEST SETUP PHOTOS

Please refer the document "BL-SZ21B0722-AS.pdf".

ANNEX F CALIBRATION REPORT

Please refer the document "CALIBRATION REPORT.pdf".

--END OF REPORT--