FCC SAR Test Report

Applicant	:	**Labpano Technology (Changzhou) Co., Ltd.**
Address	:	**Building 4D, No.160 Xihu West Road, Wujin National Hi-tech Industrial Zone, Changzhou, Jiangsu, China.**
Product Name	:	**PanoX V3**
Report Date	:	**Sept. 29, 2024**

Shenzhen Anbotek Compliance Laboratory Limited

Contents

Address: Sogood Industrial Zone Laboratory & 1/F. of Building D, Sogood Science and Technology Park, Sanwei Community, Hangcheng Subdistrict, Bao'an District, Shenzhen, Guangdong, China.
Tel:(86)0755-26066440 Email: service@anbotek.com
Hotline 400-003-0500
www.anbotek.com

TEST REPORT

Applicant	:	Labpano Technology (Changzhou) Co., Ltd.
Manufacturer	:	Labpano Technology (Changzhou) Co., Ltd.
Product Name	:	PanoX V3
Model No.	:	PIP225, PIP225+
Trade Mark	:	PanoX
Rating(s)	:	Input: 3.85V⎓2A
Test Standard(s)	:	**IEC/IEEE 62209-1528:2020; FCC 47 CFR Part 2.1093; ANSI/IEEE C95.1:2005; Reference FCC KDB 447498; KDB 248227; KDB 616217;**

The device described above is tested by Shenzhen Anbotek Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the IEC/IEEE 62209-1528:2020, FCC 47 CFR Part 2.1093, IEEE Std C95.1-2019 requirements.

Date of Receipt	Aug. 22, 2024
Date of Test	Aug. 23, 2024 to Aug. 26, 2024
Prepared By	Ella Liang (Ella Liang)
Approved & Authorized Signer	Edward Pan (Edward Pan)

Version

Version No.	Date	Description
R00	Sept. 29, 2024	Original

1. Statement of Compliance

<Highest SAR Summary>

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2.1093 and IEEE Std C95.1-2019, and had been tested in accordance with the measurement methods and procedures specified in IEC/IEEE 62209-1528:2020. The maximum results of Specific Absorption Rate (SAR) found during testing are as follows.

<Highest SAR Summary>

Frequency Band	Highest Reported 1g-SAR(W/Kg)	SAR Test Limit (W/Kg)
	Body-worn (0mm)	
WLAN2.4G ANT1	0.444	1.6
WLAN2.4G ANT2	0.476	
WLAN5.2G ANT1	0.613	
WLAN5.2G ANT2	0.279	
WLAN5.8G ANT1	0.358	
WLAN5.8G ANT2	0.111	
Simultaneous Reported SAR (W/Kg)	0.920	
Test Result	PASS	

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2.1093 and IEEE Std C95.1-2019, and had been tested in accordance with the measurement methods and procedures specified in IEC/IEEE 62209-1528:2020.

2. General Information

2.1. Client Information

Applicant	:	Labpano Technology (Changzhou) Co., Ltd.
Address	:	Building 4D,No.160 Xihu West Road, Wuj in National Hi-tech Industrial Zone, Changzhou, Jiangsu, China.
Manufacturer	:	Labpano Technology (Changzhou) Co., Ltd.
Address	:	Building 4D,No.160 Xihu West Road, Wuj in National Hi-tech Industrial Zone, Changzhou, Jiangsu, China.
Factory	:	Labpano Technology (Changzhou) Co., Ltd.
Address	:	Building 4D,No.160 Xihu West Road, Wuj in National Hi-tech Industrial Zone, Changzhou, Jiangsu, China.

2.2. Description of Equipment Under Test (EUT)

Product Name	:	PanoX V3
Model No.	:	PIP225, PIP225+ (Note: PIP225 and PIP225+ have the same circuit design, layout, used components and internal wiring, only the model and color are different because of the different sales channels, so we prepare "PIP225" for test only.)
Trade Mark	:	PanoX
Test Power Supply	:	DC 3.85V
Test Sample No.	:	1-2-1(Engineering Sample)
Tx Frequency	:	BT: 2402~2480MHz 2.4G WIFI: 2412-2462MHz 5.2G WIFI: 5180-5240MHz 5.8G WIFI: 5745-5825MHz
Type of Modulation	:	BT BDR+EDR: GFSK, π/4-DQPSK, 8DPSK BT BLE: GFSK 2.4G WIFI: CCK, DQPSK, DBPSK,BPSK, QPSK, 16QAM, 64QAM 5G WIFI: BPSK, QPSK, 16QAM, 64QAM, 256QAM
Category of device	:	Portable device

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

2.3. Device Category and SAR Limits

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.

2.4. Applied Standard

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards:

- FCC 47 CFR Part 2.1093
- IEEE Std C95.1-2019
- IEC/IEEE 62209-1528:2020
- KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- KDB 865664 D02 RF Exposure Reporting v01r02
- KDB 447498 D01 General RF Exposure Guidance v06
- KDB 248227 D01 802 11 Wi-Fi SAR v02r02

2.5. Environment of Test Site

Items	Required	Actual
Temperature (℃)	18-25	22~23
Humidity (%RH)	30-70	55~65

2.6. Test Configuration

The device was controlled by using a base station emulator. Communication between the device and the emulator was established by air link. The distance between the EUT and the antenna of the emulator is larger than 50 cm and the output power radiated from the emulator antenna is at least 30 dB smaller than the output power of EUT. The EUT was set from the emulator to radiate maximum output power during all tests. For WLAN SAR testing, WLAN engineering testing software installed on the EUT can provide continuous transmitting RF signal.

3. Specific Absorption Rate (SAR)

3.1. Introduction

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

3.2. SAR Definition

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:

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

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

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

$$\mathrm{SAR} = C\left(\frac{\delta T}{\delta t}\right)$$

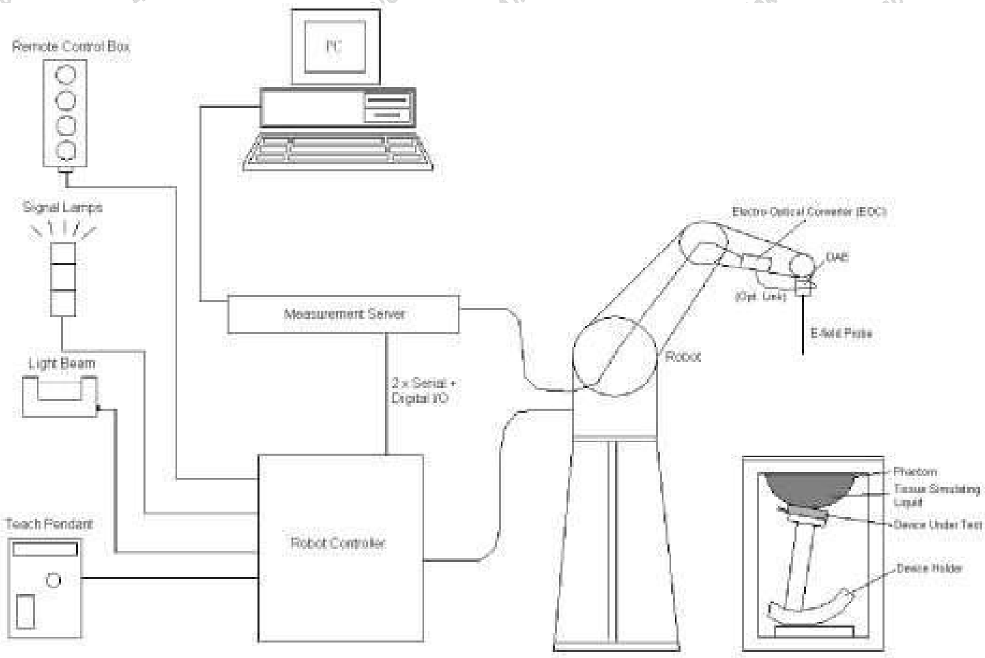
Where: C is the specific head capacity, δT is the temperature rise and δtisthe exposure duration, or related to the electrical field in the tissue by

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

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

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

4. SAR Measurement System



DASY System Configurations

The DASYsystem for performance compliance tests is illustrated above graphically. This system consists of the following items:

- A standard high precision 6-axis robot with controller, a teach pendant and software
- A data acquisition electronic (DAE) attached to the robot arm extension
- A dosimetric probe equipped with an optical surface detector system
- The electro-optical converter (EOC) performs the conversion between optical and electrical signals
- A measurement server performs the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the accuracy of the probe positioning
- A computer operating Windows XP
- DASY software
- Remove control with teach pendant and additional circuitry for robot safety such as warming lamps, etc.
- The SAM twin phantom
- A device holder
- Tissue simulating liquid
- Dipole for evaluating the proper functioning of the system

components are described in details in the following sub-sections.

4.1. E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG).The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

➢ **E-Field Probe Specification**

<EX3DV4 Probe>

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	 **Photo of EX3DV4**
Frequency	10 MHz to 6 GHz; Linearity: ± 0.2 dB	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)	
Dynamic Range	10 μW/g to 100 W/kg; Linearity: ± 0.2 dB (noise: typically< 1 μW/g)	
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	

➢ **E-Field Probe Calibration**

Each probe needs to be calibrated according to a dosimetric assessment procedure with accuracy better than ± 10%. The spherical isotropy shall be evaluated and within ± 0.25dB. The sensitivity parameters (NormX, NormY, and NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested. The calibration data can be referred to appendix C of this report.

4.2. Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and 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.

The input impedance of the DAE is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80dB.

Address: Sogood Industrial Zone Laboratory & 1/F. of Building D, Sogood Science and Technology Park, Sanwei Community, Hangcheng Subdistrict, Bao'an District, Shenzhen, Guangdong, China.
Tel:(86)0755-26066440 Email: service@anbotek.com
Hotline 400-003-0500
www.anbotek.com

Photo of DAE

4.3. Robot

The SPEAG DASY system uses the high precision robots (DASY5: TX60XL) type from Stäubli SA (France). For the 6-axis controllersystem, the robot controller version (DASY5: CS8c) from Stäubli is used. The Stäublirobot series have many features that are important for our application:

- High precision (repeatability ±0.035 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)

Photo of DASY5

4.4. Measurement Server

The measurement server is based on a PC/104 CPU board with CPU (DASY5: 400 MHz, Intel Celeron), chipdisk (DASY5: 128 MB), RAM (DASY5: 128 MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all the real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operations.

Photo of Server for DASY5

4.5. Phantom

<SAM Twin Phantom>

Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm	 **Photo of SAM Phantom**
Filling Volume	Approx. 25 liters	
Dimensions	Length: 1000 mm; Width: 500 mm; Height: adjustable feet	
Measurement Areas	Left Hand, Right Hand, Flat Phantom	

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. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

<ELI4 Phantom>

Shell Thickness	2 ± 0.2 mm (sagging: <1%)	 **Photo of ELI4 Phantom**
Filling Volume	Approx. 30 liters	
Dimensions	Major ellipse axis: 600 mm Minor axis:400 mm	

The ELI4 phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids.

4.6. Device Holder

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5 mm distance, a positioning uncertainty of ±0.5mm would produce a SAR uncertainty of ± 20%. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.

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

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity ε = 3 and loss tangent δ = 0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

Device Holder

4.7. Data Storage and Evaluation

➢ Data Storage

The DASY software stores the assessed data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all the necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files. The post-processing software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of erroneous parameter settings. For example, if a measurement has been performed with an incorrect crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be reevaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type (e.g., [V/m], [A/m], [W/kg]). Some of these units are not available in certain situations or give meaningless results, e.g., a SAR-output in a non-lose media, will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

➢ Data Evaluation

The DASY post-processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	- Sensitivity	$Norm_i$, a_{i0}, a_{i1}, a_{i2}
	- Conversion factor	$ConvF_i$
	- Diode compression point	dcp_i
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multi-meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power.

The formula for each channel can be given as:

$$\mathbf{V_i} = \mathbf{U_i} + \mathbf{U_i^2} \cdot \frac{\mathbf{cf}}{\mathbf{dcp_i}}$$

with V_i= compensated signal of channel i, (i = x, y, z)
U_i = input signal of channel i, (i = x, y, z)
cf = crest factor of exciting field (DASY parameter)
dcp_i = diode compression point (DASY parameter)

From the compensated input signals, the primary field data for each channel can be evaluated:

E-field Probes: $\mathbf{E_i} = \sqrt{\frac{\mathbf{V_i}}{\mathbf{Norm_i \cdot ConvF}}}$

H-field Probes: $\mathbf{H_i} = \sqrt{\mathbf{V_i}} \cdot \frac{\mathbf{a_{i0} + a_{i1} f + a_{i2} f^2}}{\mathbf{f}}$

with V_i = compensated signal of channel i,(i= x, y, z)
$Norm_i$= sensor sensitivity of channel i, (i= x, y, z), μV/(V/m)^2 for E-field Probes
ConvF= sensitivity enhancement in solution
a_{ij}= sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
E_i= electric field strength of channel iin V/m
H_i= magnetic field strength of channel iin A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$\mathbf{E_{tot}} = \sqrt{\mathbf{E_x^2} + \mathbf{E_y^2} + \mathbf{E_z^2}}$$

The primary field data are used to calculate the derived field units.

$$\mathbf{SAR} = \mathbf{E_{tot}^2} \cdot \frac{\boldsymbol{\sigma}}{\boldsymbol{\rho} \cdot \mathbf{1000}}$$

with SAR = local specific absorption rate in W/kg
E_{tot}= total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm^3

Note that the density is set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid.

5. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	2450MHz System Validation Kit	D2450V2	910	Jun. 11,2024	Jun. 10,2027
SPEAG	5GHz System Validation Kit	D5GHzV2	1160	Oct. 02, 2021	Oct. 01, 2024
SPEAG	Data Acquisition Electronics	DAE4	387	Sept.06,2023	Sept.05,2024
SPEAG	Dosimetric E-Field Probe	EX3DV4	7396	May 06,2024	May 05,2025
Agilent	ENA Series Network Analyzer	E5071C	MY46317418	Oct.26, 2023	Oct.25, 2024
SPEAG	DAK	DAK-3.5	1226	NCR	NCR
SPEAG	SAM Twin Phantom	QD000P40CD	1802	NCR	NCR
SPEAG	ELI Phantom	QDOVA004AA	2058	NCR	NCR
AR	Amplifier	ZHL-42W	QA1118004	NCR	NCR
Agilent	Power Meter	N1914A	MY50001102	Oct.26, 2023	Oct.25, 2024
Agilent	Power Sensor	E9323A	US40410647	Jan. 23, 2024	Jan. 22, 2025
Agilent	Power Sensor	E9323A	MY53100007	Jan. 23, 2024	Jan. 22, 2025
CDKMV	Attenuator	6610	6610-1	Oct.20, 2023	Oct.19, 2024
CDKMV	Attenuator	6606	6606-1	Oct.20, 2023	Oct.19, 2024
Agilent	Spectrum Analyzer	N9020A	MY51170037	Oct.26, 2023	Oct.25, 2024
Agilent	Signal Generation	N5182A	MY48180656	Oct.26, 2023	Oct.25, 2024
Worken	Directional Coupler	0110A05601O-10	COM5BNW1A2	Oct.26, 2023	Oct.25, 2024

Note:

1. The calibration certificate of DASY can be referred to appendix C of this report.
2. The dipole calibration interval can be extended to 3 years with justification. The dipoles are also not physically damaged, or repaired during the interval.
3. The Insertion Loss calibration of Dual Directional Coupler and Attenuator were characterized via the network analyzer and compensated during system check.
4. The dielectric probe kit was calibrated via the network analyzer, with the specified procedure (calibrated in pure water) and calibration kit (standard) short circuit, before the dielectric measurement. The specific procedure and calibration kit are provided by Agilent.
5. In system check we need to monitor the level on the power meter, and adjust the power amplifier level to have precise power level to the dipole; the measured SAR will be normalized to 1W input power according to the ratio of 1W to the input power to the dipole. For system check, the calibration of the power amplifier is deemed not critically required for correct measurement; the power meter is critical and we do have calibration for it.

6. Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. 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, which is shown in Fig. 6.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown as followed:

Photo of Liquid Height for Head SAR

The following table gives the recipes for tissue simulating liquid.

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (εr)
For Head								
2450	55.0	0	0	0.3	0	44.7	1.80	39.2
5200	65.5	0	17.2	0	17.3	0	4.66	36.0
5800	65.4	0	17.3	0	17.3	0	5.27	35.3

The following table shows the measuring results for simulating liquid.

Measured Frequency (MHz)	Target Tissue		Measured Tissue				Liquid Temp.	Test Data
	ε_r	σ	ε_r	Dev. (%)	σ	Dev. (%)		
2450	39.2	1.80	39.08	-0.31	1.85	2.78	22.7	08/23/2024
5200	49.00	5.27	48.23	-1.60	5.20	-1.35	22.6	08/26/2024
5800	48.20	6.00	48.45	0.52	5.85	-2.56	22.4	08/26/2024

7. System Verification Procedures

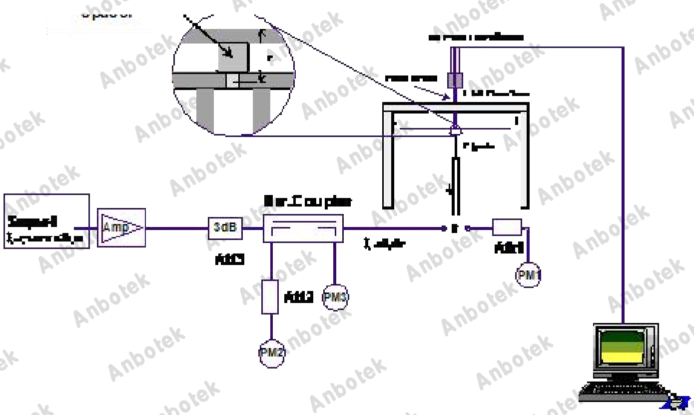
Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to fix it underneath the flat phantom and a corresponding distance holder.

- **Purpose of System Performance 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.

- **System 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:



System Setup for System Evaluation

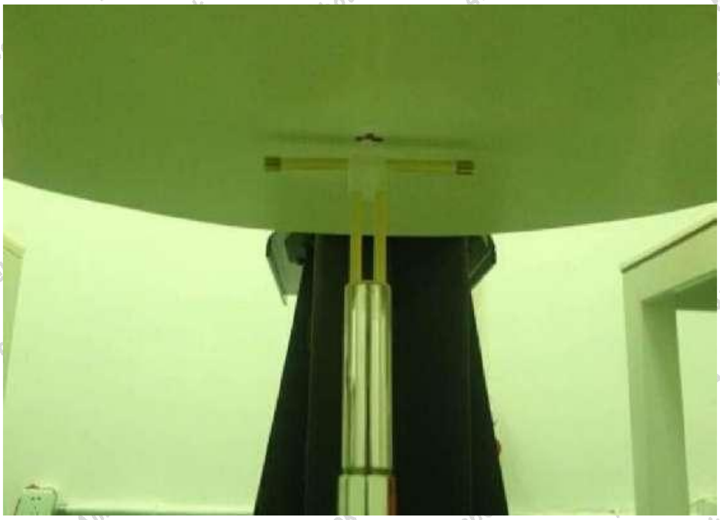


Photo of Dipole Setup

➢ **Validation Results**

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

Date	Frequency (MHz)	Power fed onto reference dipole (mW)	Targeted SAR (W/kg)	Measured SAR (W/kg)	Normalized SAR (W/kg)	Deviation (%)
08/23/2024	2450	250	52.4	12.95	51.8	-1.15
08/26/2024	5200	100	77.8	7.63	76.30	-1.93
08/26/2024	5800	100	78.3	7.95	79.50	1.53

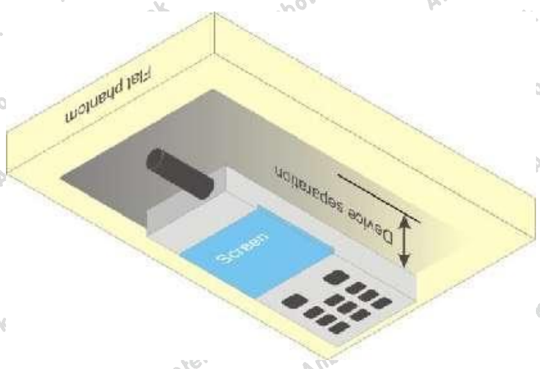
Target and Measurement SAR after Normalized

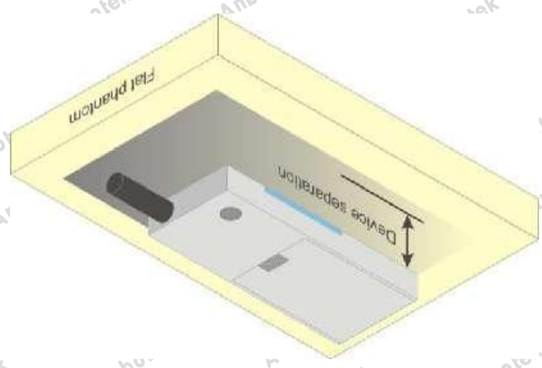
8. EUT Testing Position

8.1. Body Position

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration. Per KDB 648474 D04, 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 FCC KDB 447498 D01 v06, 2015 should be 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 applicable. When the reported SAR for body-worn accessory, measured without a headset connected to the handset is < 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a handset attached to the handset.

Accessories for body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are test with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-chip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.





Body Worn Position

9. Measurement Procedures

The measurement procedures are as follows:

(a) Use base station simulator (if applicable) or engineering software to transmit RF power continuously (continuous Tx) in the middle channel.
(b) Keep EUT to radiate maximum output power or 100% duty factor (if applicable)
(c) Measure output power through RF cable and power meter.
(d) Place the EUT in the positions as setup photos demonstrates.
(e) Set scan area, grid size and other setting on the DASY software.
(f) Measure SAR transmitting at the middle channel for all applicable exposure positions.
(g) Identify the exposure position and device configuration resulting the highest SAR
(h) Measure SAR at the lowest and highest channels attheworst exposure position and device configuration if applicable.

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

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

9.1. Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

(a) Extraction of the measured data (grid and values) from the Zoom Scan
(b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
(c) Generation of a high-resolution mesh within the measured volume
(d) Interpolation of all measured values form the measurement grid to the high-resolution grid
(e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
(f) Calculation of the averaged SAR within masses of 1g and 10g

9.2. Power Reference Measurement

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

9.3. Area Scan Procedures

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum found in the scanned area, within a range of the global maximum. The range (in dB0 is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan), if only one zoom scan follows the area scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of zoom scans has to be increased accordingly.

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

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 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.	

9.4. Zoom Scan Procedures

Zoom scans are used assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube shoes base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the zoom scan evaluates the averaged SAR for 1 gram and 10 gram and displays these values next to the job's label.

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

			≤ 3 GHz	> 3 GHz
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: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	$\le 1.5 \cdot \Delta z_{Zoom}(n-1)$	
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: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.

* When zoom scan is required and the *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 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

9.5. Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregateSAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

9.6. Power Drift Monitoring

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

10. Conducted Power

<WLAN 2.4GHz Conducted Power>

ANT1:

Mode	Channel	Frequency (MHz)	Conducted Average Output Power(dBm)	Tune-up power(dBm)
802.11b	1	2412	13.548	14.00
	6	2437	13.070	13.50
	11	2462	13.262	13.50
802.11g	1	2412	14.934	15.00
	6	2437	14.249	14.50
	11	2462	14.377	14.50
802.11n20	1	2412	14.601	15.00
	6	2437	14.084	14.50
	11	2462	14.401	14.50
802.11n40	3	2422	**15.245**	15.50
	6	2437	14.757	15.00
	9	2452	14.173	15.50

ANT2:

Mode	Channel	Frequency (MHz)	Conducted Average Output Power(dBm)	Tune-up power(dBm)
802.11b	1	2412	13.802	14.00
	6	2437	14.266	14.50
	11	2462	14.396	14.50
802.11g	1	2412	14.956	15.00
	6	2437	15.562	16.00
	11	2462	15.682	16.00
802.11n20	1	2412	14.720	15.00
	6	2437	15.300	15.50
	11	2462	15.430	15.50
802.11n40	3	2422	15.834	16.50
	6	2437	16.128	16.50
	9	2452	**16.430**	16.50

MIMO:

Test Mode	Channel	Frequency (MHz)	Conducted Average Output Power(dBm)			Maximum Tune-Up(dBm)	Test Rate Data
			Antenna 1	Antenna 2	Total		
802.11 n20	1	2412	14.601	14.720	17.671	18.00	MCS0
	6	2437	14.084	15.300	17.745	18.00	MCS0
	11	2462	14.401	15.430	17.956	18.00	MCS0
802.11 n40	3	2422	15.245	15.834	18.560	19.00	MCS0
	6	2437	14.757	16.128	18.507	19.00	MCS0
	9	2452	14.173	16.430	18.457	19.00	MCS0

Note:

1. Per KDB 447498 D01, the 1-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:

[(*max. power of channel, including tune-up tolerance, mW*) / (*min. test separation distance, mm*)] · [√f(GHz)] ≤ 3.0 for 1-g SAR, where

f(GHz) is the RF channel transmit frequency in GHz

Power and distance are rounded to the nearest mW and mm before calculation

The result is rounded to one decimal place for comparison

2. Base on the result of note1, RF exposure evaluation of 2.4G WIFI mode is required.
3. Per KDB 248227 D01, choose the highest output power channel to test SAR and determine further SAR exclusion.
4. Per KDB 248227 D01, In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. SAR is not required for the following 2.4 GHz OFDM conditions:
   1) When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
   2) 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.

<WLAN 5GHz Conducted Power>

Band 1

ANT1:

Mode	Channel Frequency (MHz)	Average Power output (dBm)	Tune-up power(dBm)
802.11a	5180	16.141	16.50
	5200	15.515	16.50
	5240	16.059	16.50
802.11n 20	5180	16.686	17.00
	5200	16.403	17.00
	5240	16.801	17.00
802.11n 40	5190	17.228	17.50
	5230	17.302	17.50
802.11ac 20	5180	16.738	17.00
	5200	16.405	17.00
	5240	16.798	17.00
802.11ac 40	5190	17.249	17.50
	5230	**17.380**	17.50
802.11ac 80	5210	17.199	17.50

ANT2:

Mode	Channel Frequency (MHz)	Average Power output (dBm)	Tune-up power(dBm)
802.11a	5180	12.679	13.00
	5200	12.468	13.00
	5240	12.967	13.00
802.11n 20	5180	13.359	14.00
	5200	13.206	14.00
	5240	13.504	14.00
802.11n 40	5190	13.883	14.00
	5230	13.849	14.00
802.11ac 20	5180	13.481	14.00
	5200	13.206	14.00
	5240	13.550	14.00
802.11ac 40	5190	13.947	14.00
	5230	13.870	14.00
802.11ac 80	5210	**14.179**	14.50

MIMO:

Test Mode	Frequency (MHz)	Conducted Average Output Power(dBm)			Maximum Tune-Up(dBm)	Test Rate Data
		Antenna 1	Antenna 2	Total		
802.11n20	5180	16.686	13.359	18.344	18.50	MCS0
	5200	16.403	13.206	18.103	18.50	MCS0
	5240	16.801	13.504	18.468	18.50	MCS0
802.11n40	5190	17.228	13.883	18.880	19.00	MCS0
	5230	17.302	13.849	18.920	19.00	MCS0
802.11ac20	5180	16.738	13.481	18.418	18.50	MCS0
	5200	16.405	13.206	18.104	18.50	MCS0
	5240	16.798	13.550	18.481	18.50	MCS0
802.11ac40	5190	17.249	13.947	18.915	19.00	MCS0
	5230	17.380	13.870	18.981	19.00	MCS0
802.11ac80	5210	17.199	14.179	18.957	19.00	MCS0

Address: Sogood Industrial Zone Laboratory & 1/F. of Building D, Sogood Science and Technology Park, Sanwei Community, Hangcheng Subdistrict, Bao'an District, Shenzhen, Guangdong, China.
Tel:(86)0755-26066440 Email: service@anbotek.com
Hotline 400-003-0500
www.anbotek.com

Band 4

ANT1:

Mode	Channel Frequency (MHz)	Average Power output (dBm)	**Tune-up power(dBm)**
802.11a	5745	12.203	13.50
	5785	13.245	13.50
	5825	12.298	13.50
802.11n 20	5745	12.918	14.50
	5785	14.019	14.50
	5825	13.007	14.50
802.11n 40	5755	13.490	13.50
	5795	13.934	14.00
802.11ac 20	5745	12.821	14.50
	5785	**14.063**	14.50
	5825	13.020	14.50
802.11ac 40	5755	13.471	14.00
	5795	13.933	14.00
802.11ac 80	5775	14.054	14.50

ANT2:

Mode	Channel Frequency (MHz)	Average Power output (dBm)	**Tune-up power(dBm)**
802.11a	5745	9.822	11.00
	5785	10.556	11.00
	5825	10.06	11.00
802.11n 20	5745	9.399	10.50
	5785	10.326	10.50
	5825	9.739	10.50
802.11n 40	5755	10.448	10.50
	5795	10.298	10.50
802.11ac 20	5745	9.424	10.50
	5785	10.375	10.50
	5825	9.763	10.50
802.11ac 40	5755	10.476	10.50
	5795	10.297	10.50
802.11ac 80	5775	**10.944**	11.00

MIMO:

Test Mode	Frequency (MHz)	Conducted Average Output Power(dBm)			Maximum Tune-Up(dBm)	Test Rate Data
		Antenna 1	Antenna 2	Total		
802.11n20	5745	12.918	9.399	14.516	16.00	MCS0
	5785	14.019	10.326	15.564	16.00	MCS0
	5825	13.007	9.739	14.684	16.00	MCS0
802.11n40	5755	13.490	10.448	15.240	15.50	MCS0
	5795	13.934	10.298	15.496	15.50	MCS0
802.11ac20	5745	12.821	9.424	14.457	16.00	MCS0
	5785	14.063	10.375	15.610	16.00	MCS0
	5825	13.020	9.763	14.700	16.00	MCS0
802.11ac40	5755	13.471	10.476	15.237	16.00	MCS0
	5795	13.933	10.297	15.495	16.00	MCS0
802.11ac80	5775	14.054	10.944	15.782	16.00	MCS0

Note:

1. Per KDB 447498 D01, the 1-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR, where
f(GHz) is the RF channel transmit frequency in GHz
Power and distance are rounded to the nearest mW and mm before calculation
The result is rounded to one decimal place for comparison
2. Base on the result of note1, RF exposure evaluation of 5.2G/5.8G WIFI mode is required.
3. Per KDB 248227 D01, choose the highest output power channel to test SAR and determine further SAR exclusion.
4. Per KDB 248227 D01, In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. SAR is not required for the following 2.4 GHz OFDM conditions:
1) When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
2) 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.

<Bluetooth Conducted Power>

Mode	Channel	Frequency (MHz)	Conducted Peak Power (dBm)	Conducted Average Power (dBm)	Tune-up power(dBm)
BT BDR (GFSK)	00	2402	0.037	-2.483	0.00
	39	2441	-3.031	-5.521	0.00
	78	2480	-0.041	-2.561	0.00
BT EDR (Π/4DQPSK)	00	2402	-0.641	-3.121	0.00
	39	2441	-4.248	-6.768	0.00
	78	2480	-1.06	-3.540	0.00
BT EDR (8DPSK)	00	2402	-0.274	-2.784	0.00
	39	2441	-3.972	-6.462	0.00
	78	2480	-0.538	-3.048	0.00
BT BLE_1M (GFSK)	00	2402	3.955	2.445	2.50
	19	2440	1.834	0.344	0.50
	39	2480	4.015	2.525	3.00
BT BLE_2M (GFSK)	00	2402	3.989	2.479	2.50
	19	2440	1.863	0.383	0.50
	39	2480	4.146	**2.696**	3.00

Note:

Per KDB 447498 D01, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR

f(GHz) is the RF channel transmit frequency in GHz

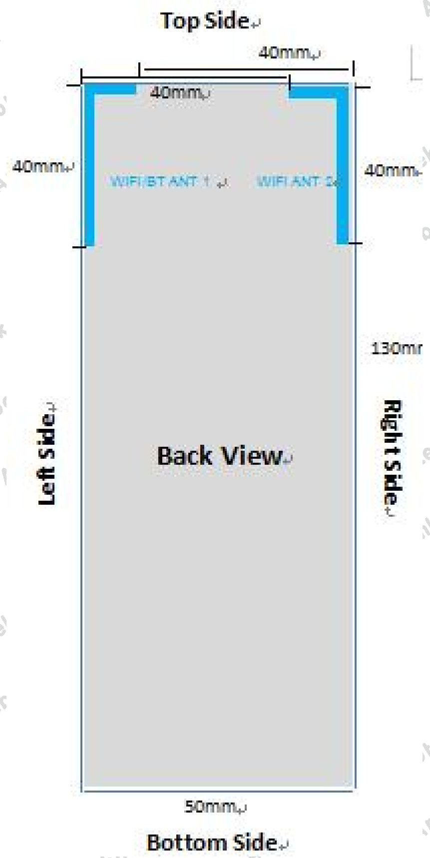
Power and distance are rounded to the nearest mW and mm before calculation

The result is rounded to one decimal place for comparison

Bluetooth Max Power (dBm)	Separation Distance (mm)	Frequency (GHz)	exclusion thresholds
2.696	5	2.480	0.586

Per KDB 447498 D01, when the minimum test separation distance is <10 mm, a distance of 10 mm is applied to determine SAR test exclusion. The test exclusion threshold is 0.586 which is < 3, SAR testing is not required.

11. Antenna Location



Distance of The Antenna to the EUT surface and edge						
Antennas	**Front**	**Back**	**Top Side**	**Bottom Side**	**Left Side**	**Right Side**
WIFI/BT ANT1	<25mm	<25mm	<25mm	>25mm	<25mm	>25mm
WIFI ANT2	<25mm	<25mm	<25mm	>25mm	>25mm	<25mm

Positions for SAR tests; Body mode						
Antennas	**Front**	**Back**	**Top Side**	**Bottom Side**	**Left Side**	**Right Side**
WIFI/BT ANT1	Yes	Yes	Yes	No	Yes	No
WIFI ANT2	Yes	Yes	Yes	No	No	Yes

General Note: According with FCC KDB 447498 D01, appendix A, <SAR test exclusion thresholds for 100MHz~6GHz and≤50mm＞table, this device SAR test configurations considerations are shown in the table above.

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.

12. SAR Test Results Summary

General Note:
1.Per KDB 447498 D01v05r01, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.

Scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.

Reported SAR(W/kg)= Measured SAR(W/kg) Scaling Factor*

2.Per KDB 447498 D01v05r01, for each exposure position, if the highest output channel reported SAR≤0.8W/kg, other channels SAR testing are not necessary
3.Per KDB 941225 D05, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
4.Per KDB 941225 D05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
5.Per KDB 941225 D05, For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.
6.Per KDB 941225 D05, 16QAM output power for each RB allocation configuration is > not ½ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225 D05, 16QAM SAR testing is not required.
7.Per KDB 941225 D05, Smaller bandwidth output power for each RB allocation configuration is > not ½ dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤ 1.45 W/kg; Per KDB 941225 D05, smaller bandwidth SAR testing is not required.
8.Per KDB865664 D01, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/Kg; if the deviation among the repeated measurement is ≤20%,and the measured SAR <1.45W/Kg, only one repeated measurement is required.
9.When the user enables the personal Wireless router functions for the handsets, actual operationsinclude simultaneous transmission of both the Wi-Fi transmitting frequency and thus cannot beevaluated for SAR under actual use conditions. The “Portable Hotspot” feature on the handset was NOT activated, to ensure the SAR measurements were evaluated for a single transmissionfrequency RF signal.

12.1. Body-worn SAR Results

<WIFI>

ANT1:

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
	WIFI2.4GHz	802.11n40	Left	0	3	2422	15.245	15.50	1.060	0.11	0.382	0.405
	WIFI2.4GHz	802.11n40	Right	0	3	2422	15.245	15.50	1.060	N/A	N/A	N/A
	WIFI2.4GHz	802.11n40	Top	0	3	2422	15.245	15.50	1.060	0.02	0.363	0.385
	WIFI2.4GHz	802.11n40	Bottom	0	3	2422	15.245	15.50	1.060	N/A	N/A	N/A
	WIFI2.4GHz	802.11n40	Front	0	3	2422	15.245	15.50	1.060	0.03	0.403	0.427
#1	WIFI2.4GHz	802.11n40	Back	0	3	2422	15.245	15.50	1.060	0.07	0.419	**0.444**
	WIFI5.2GHz	802.11ac40	Left	0	46	5230	17.38	17.50	1.028	0.02	0.503	0.517
	WIFI5.2GHz	802.11ac40	Right	0	46	5230	17.38	17.50	1.028	N/A	N/A	N/A
	WIFI5.2GHz	802.11ac40	Top	0	46	5230	17.38	17.50	1.028	0.03	0.481	0.494
	WIFI5.2GHz	802.11ac40	Bottom	0	46	5230	17.38	17.50	1.028	N/A	N/A	N/A
	WIFI5.2GHz	802.11ac40	Front	0	46	5230	17.38	17.50	1.028	0.03	0.588	0.604
#2	WIFI5.2GHz	802.11ac40	Back	0	46	5230	17.38	17.50	1.028	0.12	0.596	**0.613**
	WIFI5.8GHz	802.11ac20	Left	0	157	5785	14.063	14.50	1.106	0.05	0.291	0.322
	WIFI5.8GHz	802.11ac20	Right	0	157	5785	14.063	14.50	1.106	N/A	N/A	N/A
	WIFI5.8GHz	802.11ac20	Top	0	157	5785	14.063	14.50	1.106	0.02	0.272	0.301
	WIFI5.8GHz	802.11ac20	Bottom	0	157	5785	14.063	14.50	1.106	N/A	N/A	N/A
	WIFI5.8GHz	802.11ac20	Front	0	157	5785	14.063	14.50	1.106	0.07	0.313	0.346
#3	WIFI5.8GHz	802.11ac20	Back	0	157	5785	14.063	14.50	1.106	0.10	0.324	**0.358**

ANT2:

Plot No.	Band	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
	WIFI2.4GHz	802.11n40	Left	0	9	2452	16.43	16.50	1.016	N/A	N/A	N/A
	WIFI2.4GHz	802.11n40	Right	0	9	2452	16.43	16.50	1.016	0.09	0.439	0.446
	WIFI2.4GHz	802.11n40	Top	0	9	2452	16.43	16.50	1.016	-0.05	0.417	0.424
	WIFI2.4GHz	802.11n40	Bottom	0	9	2452	16.43	16.50	1.016	N/A	N/A	N/A
	WIFI2.4GHz	802.11n40	Front	0	9	2452	16.43	16.50	1.016	0.10	0.457	0.464
#4	WIFI2.4GHz	802.11n40	Back	0	9	2452	16.43	16.50	1.016	0.06	0.468	**0.476**
	WIFI5.2GHz	802.11ac80	Left	0	42	5210	14.179	14.50	1.077	N/A	N/A	N/A
	WIFI5.2GHz	802.11ac80	Right	0	42	5210	14.179	14.50	1.077	0.06	0.225	0.242
	WIFI5.2GHz	802.11ac80	Top	0	42	5210	14.179	14.50	1.077	N/A	0.208	0.224
	WIFI5.2GHz	802.11ac80	Bottom	0	42	5210	14.179	14.50	1.077	N/A	N/A	N/A
	WIFI5.2GHz	802.11ac80	Front	0	42	5210	14.179	14.50	1.077	0.09	0.248	0.267
#5	WIFI5.2GHz	802.11ac80	Back	0	42	5210	14.179	14.50	1.077	0.07	0.259	**0.279**
	WIFI5.8GHz	802.11ac80	Left	0	155	5775	10.944	11.00	1.013	N/A	N/A	N/A
	WIFI5.8GHz	802.11ac80	Right	0	155	5775	10.944	11.00	1.013	0.07	0.082	0.083
	WIFI5.8GHz	802.11ac80	Top	0	155	5775	10.944	11.00	1.013	N/A	0.067	0.068
	WIFI5.8GHz	802.11ac80	Bottom	0	155	5775	10.944	11.00	1.013	N/A	N/A	N/A
	WIFI5.8GHz	802.11ac80	Front	0	155	5775	10.944	11.00	1.013	0.11	0.096	0.097
#6	WIFI5.8GHz	802.11ac80	Back	0	155	5775	10.944	11.00	1.013	0.14	0.110	**0.111**

Note:
1. Per KDB 865664 D01V01,for each frequency band ,repeated SAR measurement is required only when the measured SAR is≥0.8W/Kg.
2. Per KDB 865664 D01V01,if the ratio of largest to smallest SAR for the original and first repeated measurement is≤1.2and the measured SAR＜1.45W/Kg, only one repeated measurement is required.
3. Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is＞1.20 or when the original or repeated measurement is ≥ 1.45W/Kg
4. The ratio is the difference in percentage between original and repeated measured SAR.

13. Simultaneous Transmission Analysis

Simultaneous TX SAR Considerations

No.	Applicable Simultaneous Transmission
1.	WIFI 2.4G ANT1 +WIFI 2.4G ANT2
2.	WIFI 5.2G ANT1 +WIFI 5.2G ANT2
3.	WIFI 5.8G ANT1 +WIFI 5.8G ANT2
4.	Bluetooth +WIFI 2.4G ANT2
5.	Bluetooth +WIFI 5.2G ANT2
6.	Bluetooth +WIFI 5.8G ANT2

Evaluation of Simultaneous SAR

1. WiFi ANT1 and Bluetooth share the same antenna, and cannot transmit simultaneously.

Simultaneous Transmission Procedures

2. This device contains transmitters that may operate simultaneously. Therefore simultaneous transmission analysis is required. Per FCC KDB 447498 D01, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is ≤ 1.6 W/kg.
3. For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01 based on the formula below
   a) [(max. Power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] * [√f(GHz)/x]W/kg for test separation distances ≦50mm; whetn x=7.5 for 1-g SAR, and x=18.75 for 10-g SAR.
   b) When the minimum separation distance is <5mm, the distance is used 5mm to determine SAR test exclusion
   c) 0.4 W/kg for 1-g SAR and 1.0W/kg for 10-g SAR, when the test separation distances is >50mm.

Bluetooth Max power	Exposure position	Body-worn
	Test separation	0mm
3.00dBm	Estimated SAR (W/kg)	0.083

Simultaneous- Body

WIFI 2.4G ANT1 +WIFI 2.4G ANT2:

Test Position	WiFi ANT 1 SAR_{1-g} (W/Kg)	WiFi ANT 2 SAR_{1-g} (W/Kg)	MAX. ΣSAR_{1-g} (W/Kg)	SAR_{1-g} Limit (W/Kg)	Simut. Meas. Required
Left	0.405	N/A	0.405	1.6	N/A
Right	N/A	0.446	0.446	1.6	N/A
Top	0.385	0.424	0.809	1.6	N/A
Bottom	N/A	N/A	N/A	1.6	N/A
Front	0.427	0.464	0.891	1.6	N/A
Back	**0.444**	**0.476**	**0.920**	1.6	N/A

WIFI 5.2G ANT1 +WIFI 5.2G ANT2:

Test Position	WiFi ANT 1 SAR_{1-g} (W/Kg)	WiFi ANT 2 SAR_{1-g} (W/Kg)	MAX. ΣSAR_{1-g} (W/Kg)	SAR_{1-g} Limit (W/Kg)	Simut. Meas. Required
Left	0.517	N/A	0.517	1.6	N/A
Right	N/A	0.242	0.242	1.6	N/A
Top	0.494	0.224	0.718	1.6	N/A
Bottom	N/A	N/A	N/A	1.6	N/A
Front	0.604	0.267	0.871	1.6	N/A
Back	**0.613**	**0.279**	**0.892**	1.6	N/A

WIFI 5.8G ANT1 +WIFI 5.8G ANT2:

Test Position	WiFi ANT 1 SAR_{1-g} (W/Kg)	WiFi ANT 2 SAR_{1-g} (W/Kg)	MAX. ΣSAR_{1-g} (W/Kg)	SAR_{1-g} Limit (W/Kg)	Simut. Meas. Required
Left	0.322	N/A	0.322	1.6	N/A
Right	N/A	0.083	0.083	1.6	N/A
Top	0.301	0.068	0.369	1.6	N/A
Bottom	N/A	N/A	N/A	1.6	N/A
Front	0.346	0.097	0.443	1.6	N/A
Back	**0.358**	**0.111**	**0.469**	1.6	N/A

Bluetooth +WIFI 2.4G ANT2:

Test Position	Bluetooth SAR_{1-g} (W/Kg)	WiFi ANT 2 SAR_{1-g} (W/Kg)	MAX. ΣSAR_{1-g} (W/Kg)	SAR_{1-g} Limit (W/Kg)	Simut. Meas. Required
Left	0.083	N/A	0.083	1.6	N/A
Right	N/A	0.446	0.446	1.6	N/A
Top	0.083	0.424	0.507	1.6	N/A
Bottom	N/A	N/A	N/A	1.6	N/A
Front	0.083	0.464	0.547	1.6	N/A
Back	0.083	**0.476**	**0.559**	1.6	N/A

Bluetooth +WIFI 5.2G ANT2:

Test Position	Bluetooth SAR_{1-g} (W/Kg)	WiFi ANT 2 SAR_{1-g} (W/Kg)	MAX. ΣSAR_{1-g} (W/Kg)	SAR_{1-g} Limit (W/Kg)	Simut. Meas. Required
Left	0.083	N/A	0.083	1.6	N/A
Right	N/A	0.242	0.242	1.6	N/A
Top	0.083	0.224	0.307	1.6	N/A
Bottom	N/A	N/A	N/A	1.6	N/A
Front	0.083	0.267	0.350	1.6	N/A
Back	0.083	**0.279**	**0.362**	1.6	N/A

Bluetooth +WIFI 5.8G ANT2:

Test Position	Bluetooth SAR_{1-g} (W/Kg)	WiFi ANT 2 SAR_{1-g} (W/Kg)	MAX. ΣSAR_{1-g} (W/Kg)	SAR_{1-g} Limit (W/Kg)	Simut. Meas. Required
Left	0.083	N/A	0.083	1.6	N/A
Right	N/A	0.083	0.083	1.6	N/A
Top	0.083	0.068	0.151	1.6	N/A
Bottom	N/A	N/A	N/A	1.6	N/A
Front	0.083	0.097	0.180	1.6	N/A
Back	0.083	**0.111**	**0.194**	1.6	N/A

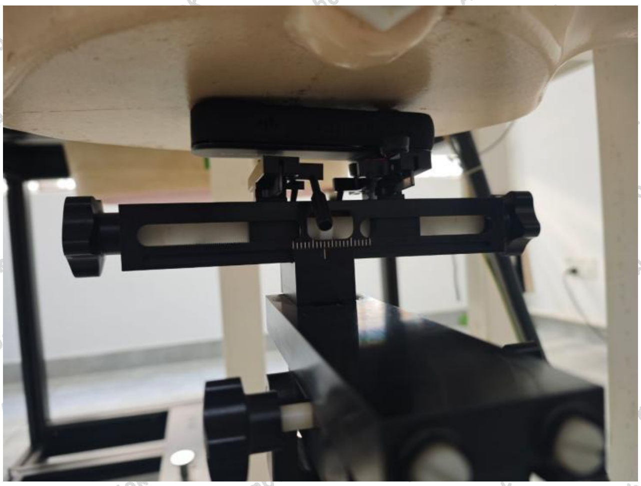
14. Measurement Uncertainty

NO	Source	Uncert. ai（%）	Prob. Dist.	Div. k	ci (1g)	ci (10g)	Stand.Uncert. ui (1g)	Stand.Uncert. ui (10g)	*Veff*
1	Repeat	0. 4	N	1	1	1	0. 4	0. 4	9
				Instrument					
2	Probe calibration	7	N	2	1	1	3.5	3.5	∞
3	Axial isotropy	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
4	Hemispherical isotropy	9.4	R	$\sqrt{3}$	0.7	0.7	3.9	3.9	∞
5	Boundary effect	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
6	Linearity	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
7	Detection limits	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
8	Readout electronics	0.3	N	1	1	1	0.3	0.3	∞
9	Response time	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
10	Integration time	2.6	R	$\sqrt{3}$	1	1	1.5	1.5	∞
11	Ambient noise	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
12	Ambient reflections	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
13	Probe positioner mech. restrictions	0.4	R	$\sqrt{3}$	1	1	0.2	0.2	∞
14	Probe positioning with respect to phantom shell	2.9	R	$\sqrt{3}$	1	1	1.7	1.7	∞
15	Max.SAR evaluation	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞

Test sample related									
16	Device positioning	3.8	N	1	1	1	3.8	3.8	99
17	Device holder	5.1	N	1	1	1	5.1	5.1	5
18	Drift of output power	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up									
19	Phantom uncertainty	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
20	Liquid conductivity (target)	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
21	Liquid conductivity (meas)	2.5	N	1	0.64	0.43	1.6	1.2	∞
22	Liquid Permittivity (target)	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.5	∞
23	Liquid Permittivity (meas)	2.5	N	1	0.6	0.49	1.5	1.2	∞
Combined standard			RSS	$u_c = \sqrt{\sum c_i^2 u_i^2}$			11.4%	11.3%	236
Expanded uncertainty(P=95%)			$U = k u_c$,k=2				**22.8%**	**22.6%**	

Address: Sogood Industrial Zone Laboratory & 1/F. of Building D, Sogood Science and Technology Park, Sanwei Community, Hangcheng Subdistrict, Bao'an District, Shenzhen, Guangdong, China.
Tel:(86)0755-26066440 Email: service@anbotek.com
Hotline 400-003-0500
www.anbotek.com

Appendix A. EUT Photos and Test Setup Photos

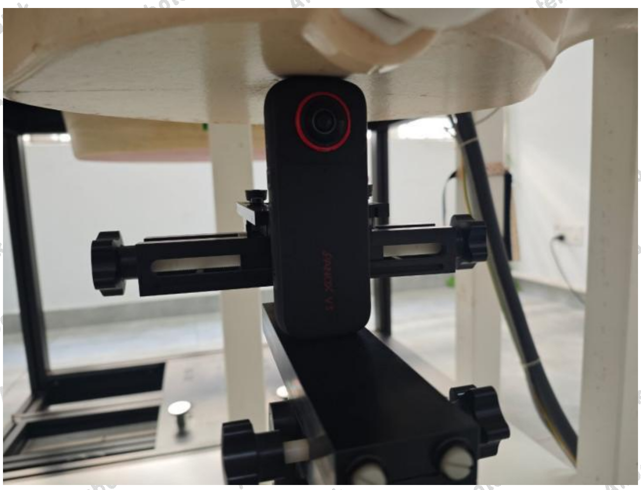


Body Front(0mm)

Body Back(0mm)

Body Left(0mm)

Body Right(0mm)



Body Top(0mm)

Appendix B. Plots of SAR System Check

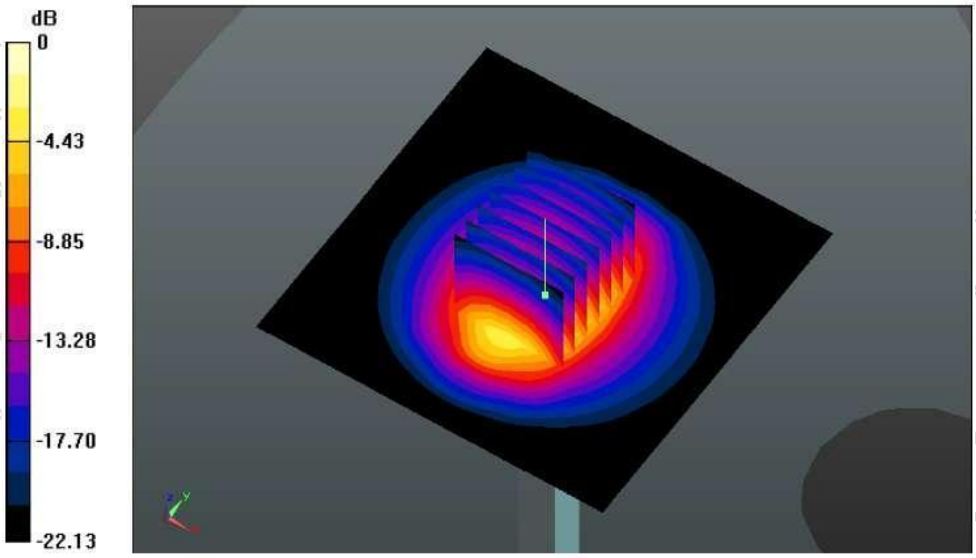
2450MHz Head System Check Date:08/23/2024

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 910

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2450 MHz; σ = 1.85S/m; εr = 39.08; ρ = 1000 kg/m3
Phantom section: Flat Section

DASY5 Configuration:
Probe: EX3DV4 - SN7396; ConvF(7.57, 7.57, 7.57); Calibrated: May 06, 2024;
Sensor-Surface: 3mm (Mechanical Surface Detection)
Electronics: DAE4 Sn387; Calibrated: Sep.06.2023;
Phantom: SAM 1; Type: SAM;
Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.5 (6469)

Area Scan (61x91x1): Measurement grid: dx=10.00 mm, dy=10.00 mm
Maximum value of SAR (interpolated) = 19.664 W/kg
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 84.571 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 26.125 W/kg
SAR(1 g) = 12.95 W/kg; SAR(10 g) = 5.92 W/kg
Maximum value of SAR (measured) = 19.47W/kg



5200MHz Head System Check Date:08/26/2024

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1160

Communication System: UID 0, CW; Frequency: 5200 MHz; Duty Cycle: 1:1

Medium parameters used: f = 5200 MHz; σ = 5.20 S/m; ε_r = 48.23; ρ = 1000 kg/m^3

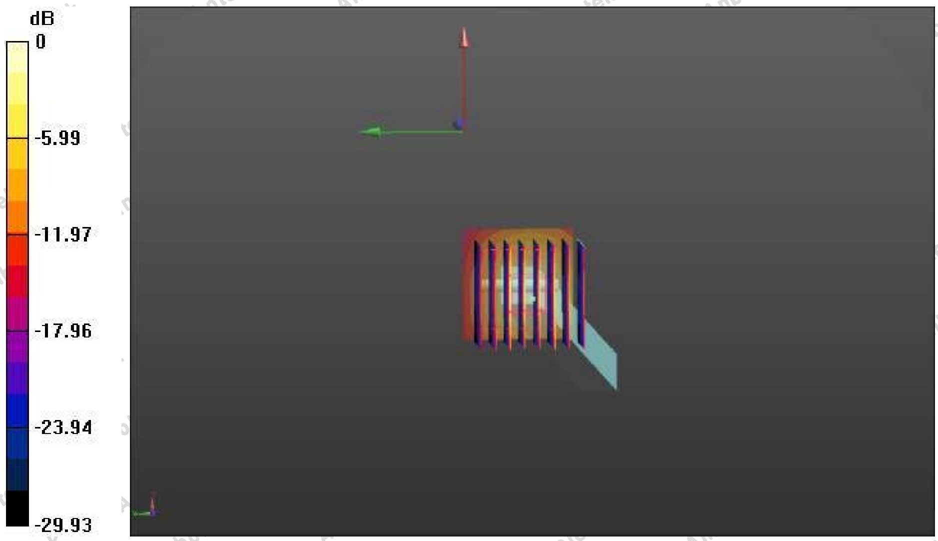
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7396; ConvF(5.33, 5.33, 5.33); Calibrated: May 06, 2024;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn387; Calibrated: Sep. 06, 2023
- Phantom: SAM; Type: QD000P40CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Configuration/Pin=100mW/Area Scan (71x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 20.9 W/kg

Configuration/Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 59.857 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 34.58 W/kg
SAR(1 g) = 7.63 W/kg; SAR(10 g) = 2.21 W/kg
Maximum value of SAR (measured) = 20.8 W/kg



5800MHz Head System Check Date:08/26/2024

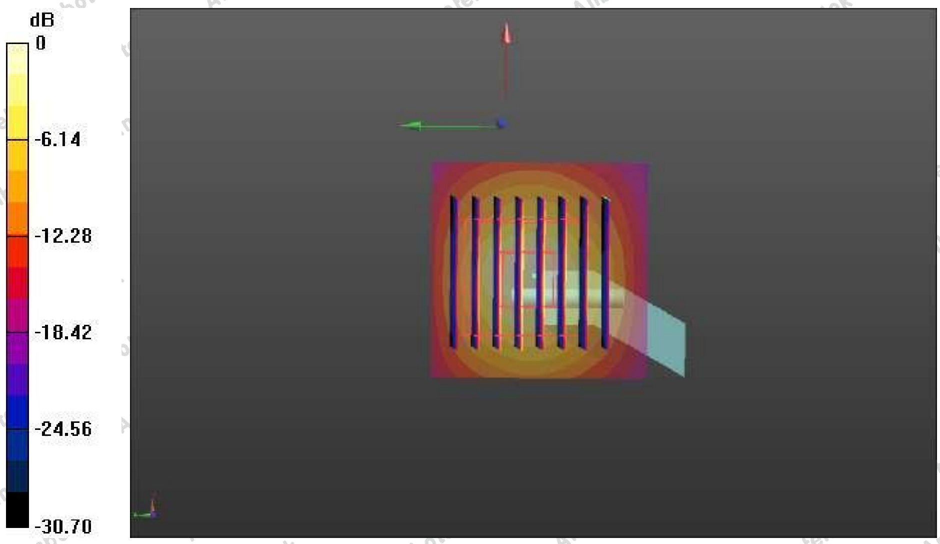
DUT: Dipole 5800 MHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1160
Communication System: UID 0, CW; Frequency: 5800 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5800 MHz; σ = 5.85 S/m; ε_r = 48.45; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7396; ConvF(4.92, 4.92, 4.92); Calibrated: May 06, 2024;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn387; Calibrated: Sep. 06, 2023
- Phantom: SAM; Type: QD000P40CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Configuration/Pin=100mW/Area Scan (71x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 18.8 W/kg

Configuration/Pin=100mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 56.773 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 31.5 W/kg
SAR(1 g) = 7.95 W/kg; SAR(10 g) = 2.23 W/kg
Maximum value of SAR (measured) = 19.8 W/kg



Address: Sogood Industrial Zone Laboratory & 1/F. of Building D, Sogood Science and Technology Park, Sanwei Community, Hangcheng Subdistrict, Bao'an District, Shenzhen, Guangdong, China.
Tel:(86)0755-26066440 Email: service@anbotek.com
Hotline 400-003-0500
www.anbotek.com

Appendix C. Plots of SAR Test Data

#1 Date: 08/23/2024

WIFI 2.4G_802.11n40_Body Back _Ch3

Communication System: UID 0, wifi (fcc) (0); Frequency: 2422 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 2422 MHz; σ = 1.85 S/m; ε_r = 39.08; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY5 Configuration:

•Probe: EX3DV4 - SN7396; ConvF(7.57, 7.57, 7.57); Calibrated: May 06.2024;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE4 Sn387; Calibrated: Sep.06,2023
•Phantom: SAM 1; Type: SAM;
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

BODY/Back /Area Scan (91x161x1): Measurement grid: dx=1.200mm, dy=1.200mm
Maximum value of SAR (measured) = 1.654 W/kg

BODY/Back /Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.573 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.639 W/kg
SAR(1 g) = 0.419W/kg; SAR(10 g) = 0.218 W/kg

Maximum value of SAR (measured) = 0.458 W/kg