**Shenzhen CTA Testing Technology Co., Ltd.**

Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China

# TEST REPORT

| | | |
|---|---|---|
| **Report Reference No.....:** | **CTA24050900901** | |
| **FCC ID .....:** | **2AYVYFMYKQ04A3** | |
| Compiled by ( position+printed name+signature)..: | File administrators Zoey Cao | Zoey Cao |
| Supervised by ( position+printed name+signature)..: | Project Engineer Amy Wen | Amy Wen |
| Approved by ( position+printed name+signature)..: | RF Manager Eric Wang | Eric Wang |
| Date of issue.....: | May 21, 2024 | |
| **Testing Laboratory Name.....:** | **Shenzhen CTA Testing Technology Co., Ltd.** | |
| Address.....: | Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China | |
| **Applicant's name.....:** | **Shenzhen FIMI Robot Technology Co.,Ltd.** | |
| Address.....: | 2nd Floor,East Block,Tianliao Builbing,1133 Xueyuan Avenue, Taoyuan Street, Nanshan District,Shenzhen City, Guangdong Province, China | |
| **Test specification.....:** | | |
| Standard.....: | **IEC 62209-2:2010; IEEE 1528:2013; FCC 47 CFR Part 2.1093; ANSI/IEEE C95.1:2005; Reference FCC KDB 447498; KDB 248227; KDB 865664** | |

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| | |
|---|---|
| **Test item description.....:** | **Remote Controller** |
| Trade Mark.....: | / |
| Manufacturer.....: | Shenzhen FIMI Robot Technology Co.,Ltd. |
| Model/Type reference.....: | FMYKQ04A3 |
| Listed Models .....: | / |
| Rating.....: | DC 3.70V From battery and DC 5.0V From external circuit |
| Result.....: | **PASS** |

# TEST REPORT

| | | |
|---|---|---|
| Equipment under Test | : | Remote Controller |
| Model /Type | : | FMYKQ04A3 |
| Listed Models | : | / |
| **Applicant** | : | **Shenzhen FIMI Robot Technology Co.,Ltd.** |
| Address | : | 2nd Floor,East Block,Tianliao Builbing,1133 Xueyuan Avenue, Taoyuan Street, Nanshan District,Shenzhen City, Guangdong Province,China |
| **Manufacturer** | : | **Shenzhen FIMI Robot Technology Co.,Ltd.** |
| Address | : | 2nd Floor,East Block,Tianliao Builbing,1133 Xueyuan Avenue, Taoyuan Street, Nanshan District,Shenzhen City, Guangdong Province, China |

| | |
|---|---|
| **Test Result**: | **PASS** |

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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# Version

| Version No. | Date | Description |
|---|---|---|
| R00 | May 21, 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 4.0W/kg for 10g Extremity SAR specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-2005 and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013.

The maximum results of Specific Absorption Rate (SAR) found during testing are as follows.

| Frequency Band | Highest Reported 10g-SAR(W/Kg) | Simultaneous Reported SAR (W/Kg) |
|---|---|---|
| WLAN2.4G | 1.166 | 2.172 |
| WLAN5.8G | 1.006 | |
| SAR Test Limit (W/Kg) | 4.0 | |
| Test Result | PASS | |

# 2 General Information

## 2.1 General Remarks

| | | |
|---|---|---|
| Date of receipt of test sample | : | May 09, 2024 |
| | | |
| Testing commenced on | : | May 17, 2024 |
| | | |
| Testing concluded on | : | May 20, 2024 |

## 2.2 Description of Equipment Under Test (EUT)

The **Shenzhen FIMI Robot Technology Co.,Ltd.**'s Model: FMYKQ04A3 or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

| | |
|---|---|
| Product Name: | Remote Controller |
| Model/Type reference: | FMYKQ04A3 |
| Power supply: | DC 3.70V From battery and DC 5.0V From external circuit |
| Testing sample ID: | CTA240509009-1# (Engineer sample)<br>CTA240509009-2# (Normal sample) |
| Hardware version: | V1.0 |
| Software version: | V1.0 |
| Tx Frequency: | SRD:<br>2.4G WIFI: 2412~2462MHz<br>5G WIFI: 5745~5825MHz |
| Type of Modulation: | 2.4G WIFI: BPSK,QPSK,16QAM,64QAM<br>5G WIFI: OFDM |
| Category of device: | Portable device |
| **Remark:**<br>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 hand-held device category because its radiating structure is allowed to be used within 20 centimeters of the hands of the user. Limit for General Population/Uncontrolled exposure should be applied for this device, it is 4.0 W/kg as averaged over any 10 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 (2.1093:2013)
- ANSI/IEEE C95.1:2005

- IEEE Std 1528:2013
- 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 Test Facility

**FCC-Registration No.: 517856 Designation Number: CN1318**

Shenzhen CTA Testing Technology Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

**A2LA-Lab Cert. No.: 6534.01**

Shenzhen CTA Testing Technology Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

**ISED#: 27890 CAB identifier: CN0127**

Shenzhen CTA Testing Technology Co., Ltd. has been listed by Innovation, Science and Economic Development Canada to perform electromagnetic emission measurement.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010.

## 2.6 Environment of Test Site

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

## 2.7 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:

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

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

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

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

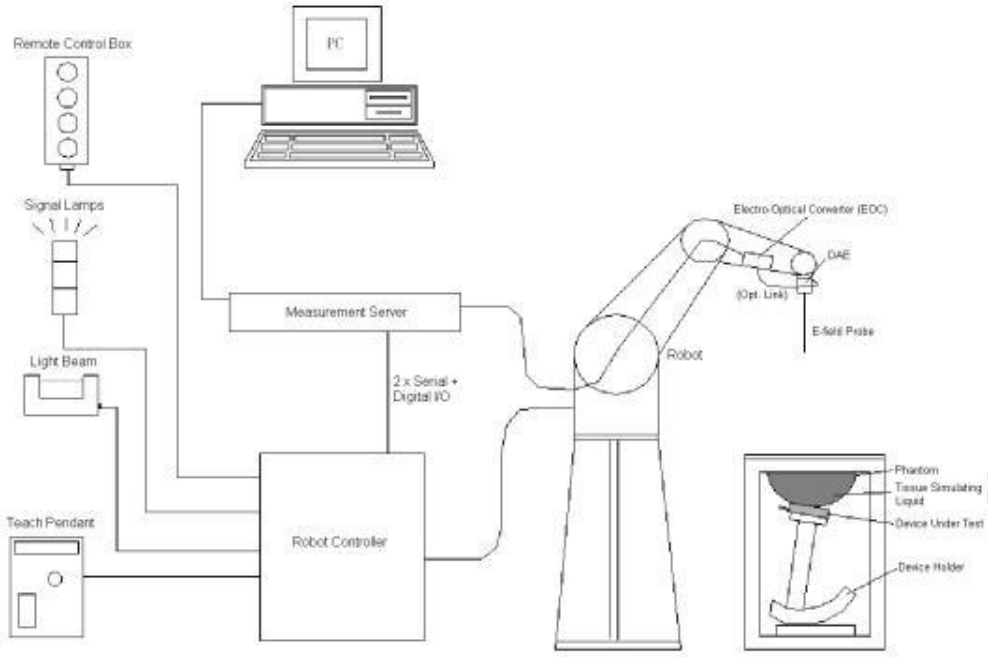
Where: C is the specific head capacity, δT is the temperature rise and δtisthe exposure duration, or related to the electrical field in the tissue by

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

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<br>Built-in shielding against static charges<br>PEEK enclosure material (resistant to organic solvents, e.g., DGBE) | <br>**Photo of EX3DV4** |
| **Frequency** | 10 MHz to 6 GHz; Linearity: ± 0.2 dB | |
| **Directivity** | ± 0.3 dB in HSL (rotation around probe axis)<br>± 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)<br>Tip diameter: 2.5 mm (Body: 12 mm)<br>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.

**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**

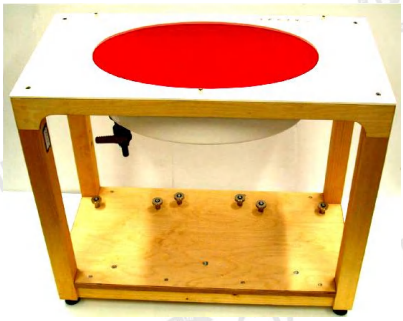
## 4.5 Phantom

**<SAM Twin Phantom>**

| | | |
|---|---|---|
| **Shell Thickness** | 2 ± 0.2 mm;<br>Center ear point: 6 ± 0.2 mm | <br>**Photo of SAM Phantom** |
| **Filling Volume** | Approx. 25 liters | |
| **Dimensions** | Length: 1000 mm; Width: 500 mm;<br>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%) |  <br>**Photo of ELI4 Phantom** |
| **Filling Volume** | Approx. 30 liters | |
| **Dimensions** | Major ellipse axis: 600 mm<br>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：

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

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： $\mathbf{E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}}$

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

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)：

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

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 | 745 | Aug. 28,2023 | Aug. 27,2026 |
| SPEAG | 5GHz System Validation Kit | D5GHzV2 | 1031 | Feb.16, 2023 | Feb.15, 2026 |
| Rohde & Schwarz | UNIVERSAL RADIO COMMUNICATION TESTER | CMW500 | 1201.0002K50-104209-JC | Nov.05, 2023 | Nov.04, 2024 |
| SPEAG | Data Acquisition Electronics | DAE3 | 428 | Aug.30,2023 | Aug.29,2024 |
| SPEAG | Dosimetric E-Field Probe | EX3DV4 | 7380 | June 21,2023 | June 20,2024 |
| Agilent | ENA Series Network Analyzer | E5071C | MY46317418 | Oct.25, 2023 | Oct.24, 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.25, 2023 | Oct.24, 2024 |
| Agilent | Power Sensor | N8481H | MY51240001 | Oct.25, 2023 | Oct.24, 2024 |
| R&S | Spectrum Analyzer | N9020A | MY51170037 | Oct.25, 2023 | Oct.24, 2024 |
| Agilent | Signal Generation | N5182A | MY48180656 | Oct.25, 2023 | Oct.24, 2024 |
| Worken | Directional Coupler | 0110A05601O-10 | COM5BNW1A2 | Oct.25, 2023 | Oct.24, 2024 |

**Note:**

1. The calibration certificate of DASY can be referred to appendix D 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**

**Photo of Liquid Height for Body 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** | | | | | | | | |
| 835 | 40.3 | 57.9 | 0.2 | 1.4 | 0.2 | 0 | 0.90 | 41.5 |
| 1800,1900,2000 | 55.2 | 0 | 0 | 0.3 | 0 | 44.5 | 1.40 | 40.0 |
| 2450 | 55.0 | 0 | 0 | 0 | 0 | 45.0 | 1.80 | 39.2 |
| 2600 | 54.8 | 0 | 0 | 0.1 | 0 | 45.1 | 1.96 | 39.0 |
| **For Body** | | | | | | | | |
| 835 | 50.8 | 48.2 | 0 | 0.9 | 0.1 | 0 | 0.97 | 55.2 |
| 1800,1900,2000 | 70.2 | 0 | 0 | 0.4 | 0 | 29.4 | 1.52 | 53.3 |
| 2450 | 68.6 | 0 | 0 | 0 | 0 | 31.4 | 1.95 | 52.7 |
| 2600 | 65.5 | 0 | 0 | 0 | 0 | 31.5 | 2.16 | 52.5 |

The following table shows the measuring results for simulating liquid.

| Measured Frequency (MHz) | Target Tissue | | Measured Tissue | | | | Liquid Temp. | Test Data |
|---|---|---|---|---|---|---|---|---|
| | $\varepsilon_r$ | σ | $\varepsilon_r$ | Dev. (%) | σ | Dev. (%) | | |
| 2450 | 39.2 | 1.80 | 39.451 | 0.64% | 1.763 | -2.04% | 22.3 | 05/17/2024 |
| 5750 | 35.4 | 5.22 | 35.959 | 1.58% | 5.314 | 1.80% | 22.6 | 05/20/2024 |

# 7 System Verification Procedures

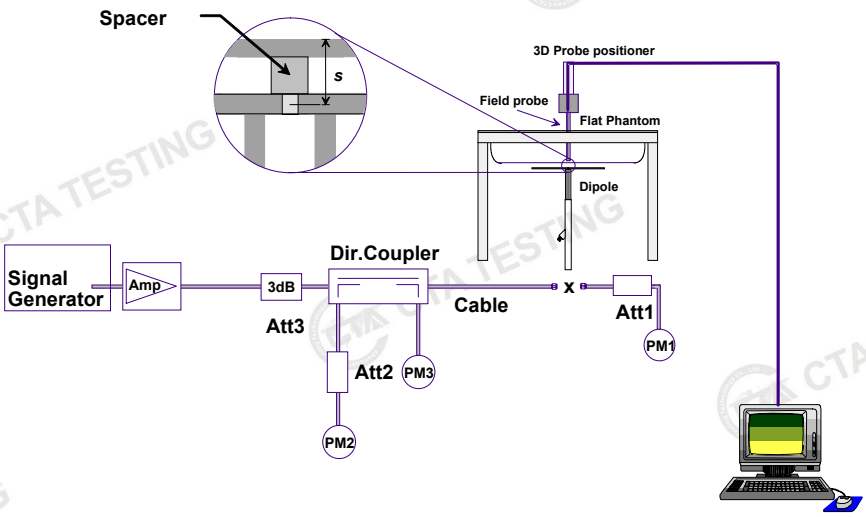
Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to fix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

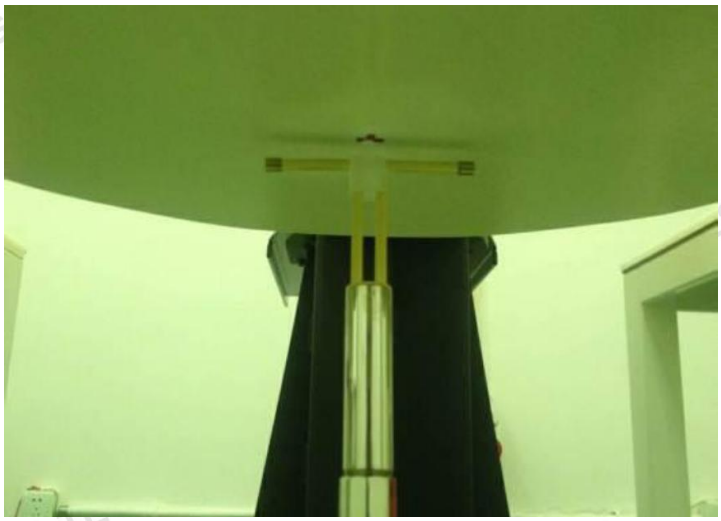


**Photo of Dipole Setup**

- **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 B of this report.

| Date | Frequency (MHz) | Power fed onto reference dipole (mW) | Targeted SAR 10g (W/kg) | Measured SAR 10g (W/kg) | Normalized SAR (W/kg) | Deviation (%) |
|---|---|---|---|---|---|---|
| 05/17/2024 | 2450 | 250 | 24.5 | 6.06 | 24.22 | -1.14% |
| 05/20/2024 | 5750 | 100 | 21.9 | 2.11 | 21.10 | -3.65% |

# 8 EUT Testing Position

## 8.1 Devices with hinged or swivel antenna(s)

This EUT tests shall be performed if applicable in both the horizontal and vertical positions relative to the phantom, and with the antenna oriented away from the body of the DUT (Figure1) and/or with the antenna extended and retracted such as to obtain the highest exposure condition.

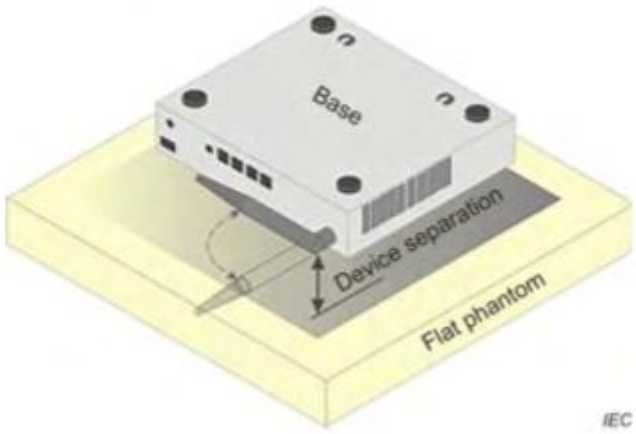



Figure 8.1 – Device with swivel antenna

**Test Distance for SAR Evaluation**

For Hand-held mode (10g Extremity SAR) the EUT is set directly against the phantom and the test distance is 0mm.

# 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 at the worst 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 | $\frac{1}{2}\cdot\delta\cdot\ln(2) \pm 0.5$ mm |
| Maximum probe angle from probe axis to phantom surface normal at the measurement location | 30° ± 1° | 20° ± 1° |
| Maximum area scan spatial resolution: $\Delta x_{Area}$, $\Delta y_{Area}$ | ≤ 2 GHz: ≤ 15 mm<br>2 – 3 GHz: ≤ 12 mm | 3 – 4 GHz: ≤ 12 mm<br>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 distance from closest measurement point (geometric center of probe sensors) to phantom surface | | | 5 mm ± 1 mm | ½·$\delta$·ln(2) mm ± 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: $\Delta x_{Area}$, $\Delta y_{Area}$ | | | ≤ 2 GHz: ≤ 15 mm<br>2 – 3 GHz: ≤ 12 mm | 3 – 4 GHz: ≤ 12 mm<br>4 – 6 GHz: ≤ 10 mm |
| | | | When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device. | |
| Maximum zoom scan spatial resolution: $\Delta x_{Zoom}$, $\Delta y_{Zoom}$ | | | ≤ 2 GHz: ≤ 8 mm<br>2 – 3 GHz: ≤ 5 mm* | 3 – 4 GHz: ≤ 5 mm*<br>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<br>4 – 5 GHz: ≤ 3 mm<br>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<br>4 – 5 GHz: ≤ 2.5 mm<br>5 – 6 GHz: ≤ 2 mm |
| | | $\Delta z_{Zoom}(n>1)$: between subsequent points | ≤ 1.5·$\Delta z_{Zoom}(n-1)$ mm | |
| Minimum zoom scan volume | x, y, z | | ≥ 30 mm | 3 – 4 GHz: ≥ 28 mm<br>4 – 5 GHz: ≥ 25 mm<br>5 – 6 GHz: ≥ 22 mm |

Note: $\delta$ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details.

* When zoom scan is required and the *reported* SAR from the *area scan based 1-g SAR estimation* procedures of KDB Publication 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 aggregate SAR, 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 TEST CONDITIONS AND RESULTS

## 10.1 Conducted Power

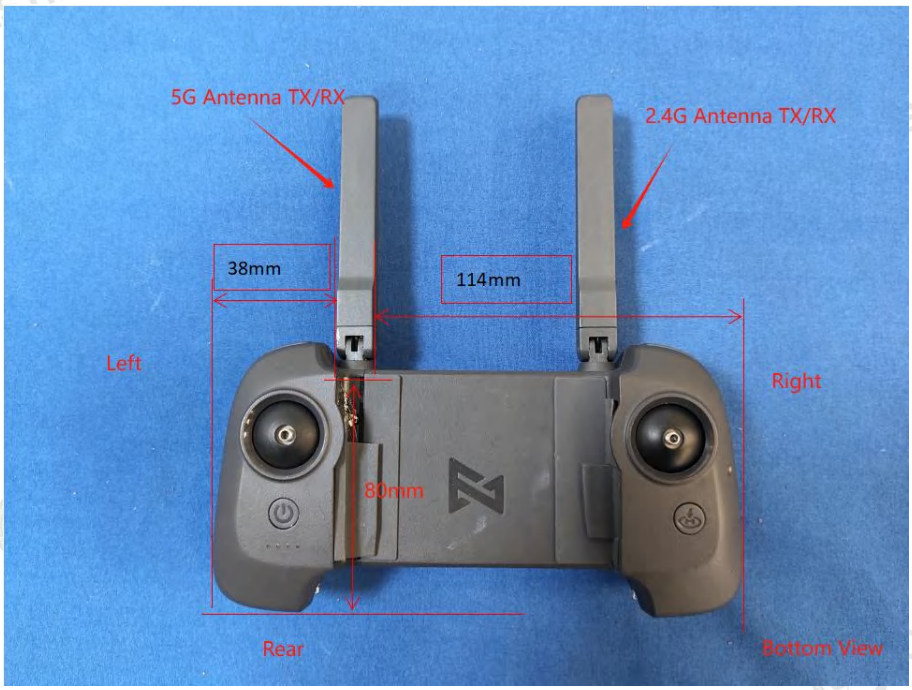
**<WLAN 2.4GHz Conducted Power>**

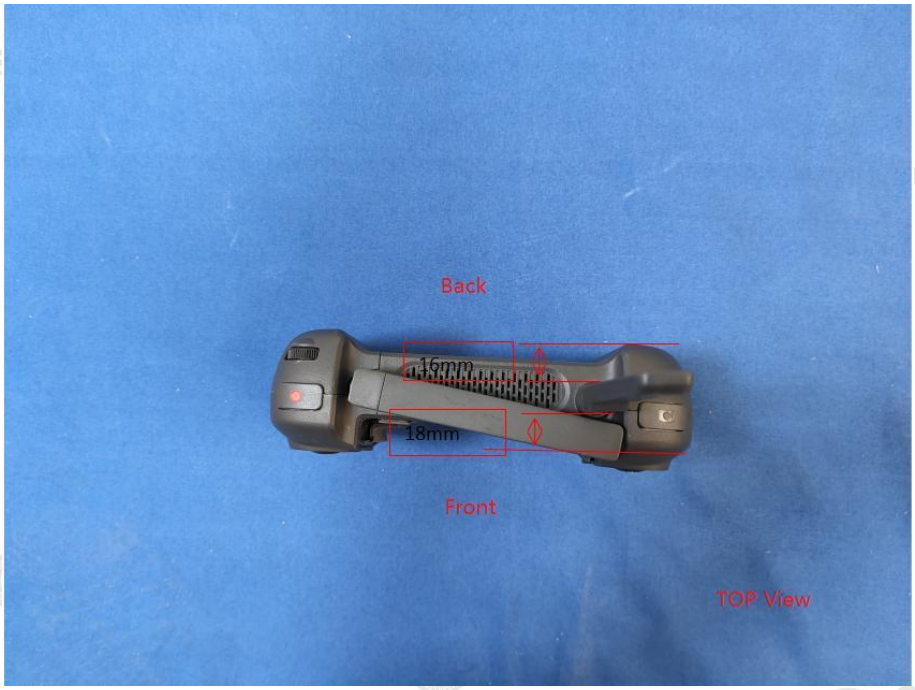
| Mode | Channel | Frequency (MHz) | Conducted Average Output Power(dBm) | Tune-up limit (dBm) |
|---|---|---|---|---|
| 802.11b | 1 | 2412 | 15.95 | 17.00 |
| | 6 | 2437 | **16.83** | 17.00 |
| | 11 | 2462 | 16.06 | 17.00 |
| 802.11g | 1 | 2412 | 13.53 | 14.00 |
| | 6 | 2437 | 13.86 | 14.00 |
| | 11 | 2462 | 13.72 | 14.00 |
| 802.11n(HT20) | 1 | 2412 | 13.02 | 14.00 |
| | 6 | 2437 | 13.34 | 14.00 |
| | 11 | 2462 | 13.80 | 14.00 |
| 802.11n(HT40) | 3 | 2422 | 13.46 | 14.00 |
| | 6 | 2437 | 13.42 | 14.00 |
| | 9 | 2452 | 13.93 | 14.00 |

**<WLAN 5.8GHz Conducted Power>**

| Type | Channel | Frequency (MHz) | Conducted Average Output Power(dBm) | Tune-up Power (dBm) |
|---|---|---|---|---|
| 802.11a | 149 | 5745 | 15.36 | 16.00 |
| | 157 | 5785 | 15.44 | 16.00 |
| | 165 | 5825 | 14.86 | 15.00 |
| 802.11n(HT20) | 149 | 5745 | 15.64 | 16.00 |
| | 157 | 5785 | 15.58 | 16.00 |
| | 165 | 5825 | 14.96 | 15.00 |
| 802.11n(HT40) | 151 | 5755 | **15.66** | 16.00 |
| | 159 | 5795 | 14.77 | 15.00 |
| 802.11ac(VHT20) | 149 | 5745 | 15.34 | 16.00 |
| | 157 | 5785 | 15.44 | 16.00 |
| | 165 | 5825 | 14.83 | 15.00 |
| 802.11ac(VHT40) | 151 | 5755 | 14.45 | 15.00 |
| | 159 | 5795 | 14.38 | 15.00 |
| 802.11ac(VHT80) | 155 | 5775 | 12.65 | 13.00 |

## 10.2 Transmit Antennas




| Distance of The Antenna to the EUT surface and edge | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Antennas** | **Antenna direction** | **Front** | **Back** | **Top Side** | **Bottom Side** | **Left Side** | **Right Side** |
| **5G** | Extend 180° | 18mm | 16mm | 0mm | 80mm | 38mm | 114mm |
| | Fold 90° | 0mm | 16mm | 0mm | 80mm | 38mm | 114mm |
| **2.4G** | Extend 180° | 18mm | 16mm | 0mm | 80mm | 114mm | 38mm |
| | Fold 90° | 0mm | 16mm | 0mm | 80mm | 114mm | 38mm |

## 10.3 Test Exclusion and Estimated SAR

### SAR Test Exclusion Considerations

Per KDB 447498 D01v06, 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.

Per KDB 447498 D01v06, 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) [Threshold at 50mm)+(test separation distance-50mm)*(f(MHz)/150)]mW, at 100MHz to 1500MHz

b) [Threshold at 50mm)+(test separation distance-50mm)*10]mW at > 1500MHz and ≤ 6GHz

### Estimated SAR

Per KDB447498 requires when the standalone SAR test exclusion of section 4.3.1 is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to the following to determine simultaneous transmission SAR test exclusion;

● (max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] • [ √ f(GHz)/x] W/kg for test separation distances ≤ 50 mm;

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

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

The below table, exemption limits for routine evaluation based on frequency and separation distance was according to SAR-based Exemption – §1.1307(b)(3)(i)(B).

| | Standalone SAR Test Exclusion and Estimated SAR_ Extend 180° | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Wireless Interface | Frequency (MHz) | Configuration | Max. Power With tune-up | | Distance (mm) | Calculation Result | SAR Exclusion Thresholds | Standalone SAR Exclusion | Estimated SAR (W/Kg) |
| | | | dBm | mW | | | | | |
| 2.4GHz WLAN | 2450 | Front | 17.0 | 50.119 | 18 | 4.4 | 7.5 | Yes | 0.232 |
| | | Back | 17.0 | 50.119 | 16 | 4.9 | 7.5 | Yes | 0.261 |
| | | Left Side | 17.0 | 50.119 | 114 | 50.119 | 879.6 | Yes | 1.000 |
| | | Right Side | 17.0 | 50.119 | 38 | 2.1 | 7.5 | Yes | 0.110 |
| | | Top Side | 17.0 | 50.119 | 0 | 15.7 | 7.5 | No | N/A |
| | | Bottom Side | 17.0 | 50.119 | 80 | 50.119 | 539.6 | Yes | 1.000 |
| 5.8 GHz WLAN | 5785 | Front | 16.0 | 39.811 | 18 | 5.3 | 7.5 | Yes | 0.284 |
| | | Back | 16.0 | 39.811 | 16 | 6 | 7.5 | Yes | 0.319 |
| | | Left Side | 16.0 | 39.811 | 38 | 2.5 | 7.5 | Yes | 0.134 |
| | | Right Side | 16.0 | 39.811 | 114 | 39.811 | 795.9 | Yes | 1.000 |
| | | Top Side | 16.0 | 39.811 | 0 | 19.2 | 7.5 | No | N/A |
| | | Bottom Side | 16.0 | 39.811 | 80 | 39.811 | 455.9 | Yes | 1.000 |

| | Standalone SAR Test Exclusion and Estimated SAR_ Fold 90° | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Wireless Interface | Frequency (MHz) | Configuration | Max. Power With tune-up | | Distance (mm) | Calculation Result | SAR Exclusion Thresholds | Standalone SAR Exclusion | Estimated SAR (W/Kg) |
| | | | dBm | mW | | | | | |
| 2.4GHz WLAN | 2450 | Front | 17.0 | 50.119 | 0 | 15.7 | 7.5 | No | N/A |
| | | Back | 17.0 | 50.119 | 16 | 4.9 | 7.5 | Yes | 0.261 |
| | | Left Side | 17.0 | 50.119 | 114 | 50.119 | 879.6 | Yes | 1.000 |
| | | Right Side | 17.0 | 50.119 | 38 | 2.1 | 7.5 | Yes | 0.110 |
| | | Top Side | 17.0 | 50.119 | 0 | 15.7 | 7.5 | No | N/A |
| | | Bottom Side | 17.0 | 50.119 | 80 | 50.119 | 539.6 | Yes | 1.000 |
| 5.8 GHz WLAN | 5785 | Front | 16.0 | 39.811 | 0 | 19.2 | 7.5 | No | N/A |
| | | Back | 16.0 | 39.811 | 16 | 6 | 7.5 | Yes | 0.319 |
| | | Left Side | 16.0 | 39.811 | 38 | 2.5 | 7.5 | Yes | 0.134 |
| | | Right Side | 16.0 | 39.811 | 114 | 39.811 | 795.9 | Yes | 1.000 |
| | | Top Side | 16.0 | 39.811 | 0 | 19.2 | 7.5 | No | N/A |
| | | Bottom Side | 16.0 | 39.811 | 80 | 39.811 | 455.9 | Yes | 1.000 |

*Remark:*

1. Maximum average power including tune-up tolerance;
2. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion
3. when the distance is < 50 mm exclusion threshold is "Ratio", when the distance is > 50 mm exclusion threshold is "mW".

## 10.4 SAR Test Results Summary

### General Note:

1 Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.

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

b) For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"

c) For WLAN/Bluetooth: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor

2 Per KDB 447498 D01v06, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

- ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
- ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
- ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

3 Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg, The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.

## SAR Results

### SAR Values [WIFI2.4G]

| Plot No. | Mode | Test Position | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Scaling Factor | Power Drift (dB) | Measured $SAR_{10g}$ (W/kg) | Scaled $SAR_{10g}$ (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Measured / Reported SAR numbers- antenna Extend 180° 0mm** | | | | | | | | | | |
| | 802.11b | Top Side | 06 | 2437 | 16.83 | 17.0 | 1.040 | 0.11 | 1.054 | 1.096 |
| **Measured / Reported SAR numbers- antenna Fold 90° 0mm** | | | | | | | | | | |
| | 802.11b | Front Side | 06 | 2437 | 16.83 | 17.0 | 1.040 | -0.07 | 1.107 | 1.151 |
| #1 | 802.11b | Top Side | 06 | 2437 | 16.83 | 17.0 | 1.040 | -0.07 | **1.121** | **1.166** |

Note: Per KDB 248227 D01v02r02, for 2.4GHz 802.11g/n SAR testing is not required 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. these thresholds should be multiplied by 2.5 when 10-g extremity SAR is considered.

### SAR Values [WIFI5.8G]

| Plot No. | Mode | Test Position | Ch. | Freq. (MHz) | Average Power (dBm) | Tune-Up Limit (dBm) | Scaling Factor | Power Drift (dB) | Measured $SAR_{10g}$ (W/kg) | Scaled $SAR_{10g}$ (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Measured / Reported SAR numbers- antenna Extend 180° 0mm** | | | | | | | | | | |
| | 802.11n(HT40) | Top Side | 151 | 5755 | 15.66 | 16.0 | 1.081 | 0.07 | 0.897 | 0.970 |
| **Measured / Reported SAR numbers- antenna Fold 90° 0mm** | | | | | | | | | | |
| | 802.11n(HT40) | Front Side | 151 | 5755 | 15.66 | 16.0 | 1.081 | -0.10 | 0.918 | 0.993 |
| #2 | 802.11n(HT40) | Top Side | 151 | 5755 | 15.66 | 16.0 | 1.081 | -0.05 | **0.930** | **1.006** |

## 10.5 SAR Measurement Variability

SAR measurement variability must be 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. The following procedures are applied to determine if repeated measurements are required. The same procedures should

be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.

1 Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.

2 When the original highest measured SAR is ⩾ 0.80 W/kg, repeat that measurement once.

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 ⩾1.45 W/kg (~ 10% from the 1-g SAR limit).

4 Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

**SAR Measurement Variability**

| Band | Mode | Test Position | Ch. | Spacing (mm) | Original SAR (W/kg) | First Repeated SAR (W/kg) | The Ratio | Second Repeated SAR (W/kg) |
|---|---|---|---|---|---|---|---|---|
| / | / | / | / | / | / | / | / | / |

## 10.6 Simultaneous Transmission Analysis

Application Simultaneous Transmission information:

| No. | Simultaneous Transmission Configurations | Hand |
|---|---|---|
| 1 | 2.4GHz WLAN + 5GHz WLAN | Yes |

### 10.8.2 Evaluation of Simultaneous SAR

**Simultaneous transmission SAR_antenna Extend 180°**

| Exposure Position | 1<br>MAX. WLAN 2.4G Reported SAR<br>10g SAR (W/kg) | 2<br>MAX. WLAN5G Reported SAR<br>10g SAR (W/kg) | 1+2 Summed 10g SAR (W/kg) | SPLSR |
|---|---|---|---|---|
| Front | 0.232 | 0.284 | 0.516 | N/A |
| Back | 0.261 | 0.319 | 0.580 | N/A |
| Left Side | 1.000 | 0.134 | 1.134 | N/A |
| Right Side | 0.110 | 1.000 | 1.110 | N/A |
| Top Side | 1.096 | 0.970 | 2.066 | N/A |
| Bottom Side | 1.000 | 1.000 | 2.000 | N/A |

MAX. $\Sigma SAR_{10g}$ =**2.066**W/kg<4.0 W/kg, so the Simultaneous transmission SAR with volume scan are not required.

**Simultaneous transmission SAR_antenna Fold 90°**

| Exposure Position | 1<br>MAX. WLAN 2.4G Reported SAR<br>10g SAR (W/kg) | 2<br>MAX. WLAN5G Reported SAR<br>10g SAR (W/kg) | 1+2 Summed 10g SAR (W/kg) | SPLSR |
|---|---|---|---|---|
| Front | 1.151 | 0.993 | 2.144 | N/A |
| Back | 0.261 | 0.319 | 0.580 | N/A |
| Left Side | 1.000 | 0.134 | 1.134 | N/A |
| Right Side | 0.110 | 1.000 | 1.110 | N/A |
| Top Side | 1.166 | 1.006 | 2.172 | N/A |
| Bottom Side | 1.000 | 1.000 | 2.000 | N/A |

MAX. $\Sigma SAR_{10g}$ =**2.172**W/kg<4.0 W/kg, so the Simultaneous transmission SAR with volume scan are not required.

# 11 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 | $\frac{}{\sqrt{3}}$ | 1 | 1 | 2.9 | 2.9 | ∞ |
| **Phantom and set-up** | | | | | | | | | |
| 19 | Phantom uncertainty | 4.0 | R | $\frac{}{\sqrt{3}}$ | 1 | 1 | 2.3 | 2.3 | ∞ |
| 20 | Liquid conductivity (target) | 5.0 | R | $\frac{}{\sqrt{3}}$ | 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 | $\frac{}{\sqrt{3}}$ | 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 | $U_c = \sqrt{\sum^{n} C_i^2 U_i^2}$ | | | 11.4% | 11.3% | 236 |
| **Expanded uncertainty(P=95%)** | | $U = k U_c$ ,k=2 | | | | | **22.8%** | **22.6%** | |

# Appendix A. EUT Photos and Test Setup Photos

Top side _ Antenna Extend 180°(0mm)

Front_ Antenna Fold 90°(0mm)

Top side_ Antenna Fold 90°(0mm)

# Appendix B. Plots of SAR System Check

## 2450MHz System Check

Date: 05/17/2024

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 745**

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 2450 MHz; σ = 1.763 S/m; εr = 39.451; ρ = 1000 kg/m3

Phantom section: Flat Section

**DASY Configuration:**

- Probe: EX3DV4 - SN7380; ConvF(7.50, 7.50, 7.50,) ; Calibrated: 6/21/2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn428; Calibrated: 08/30/2023
- Phantom: Twin-SAM V8.0 ; Type: QD 000 P41 AA; Serial: 1974
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

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

Maximum value of SAR (interpolated) = 14.9 W/kg

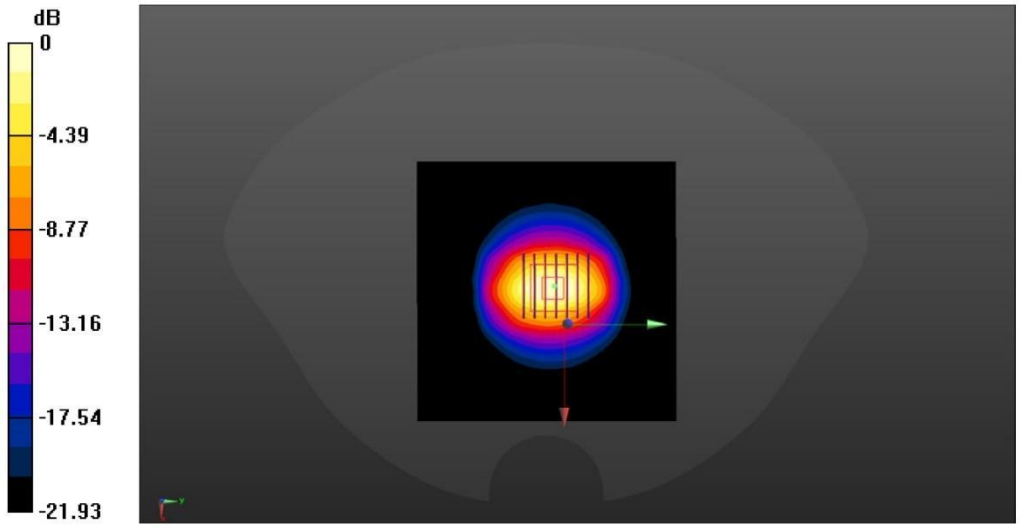
**Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 85.69 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 27.4 W/kg

**SAR(1 g) = 13.14 W/kg; SAR(10 g) = 6.06 W/kg**

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




0 dB = 15.5 W/kg

System Performance Check 2450MHz 250mW

## 5750MHz System Check

Date: 05/20/2024

**DUT: Dipole 5GHz; Type: D5GHzV2; Serial: 1102**

Communication System: CW; Frequency: 5750 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 5750 MHz; σ = 5.314 S/m; εr = 35.959; ρ = 1000 kg/m3

Phantom section: Flat Section

**DASY5 Configuration:**

- Probe: EX3DV4 - SN7380; ConvF(4.86, 4.86, 4.86) ; Calibrated: 6/21/2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn428; Calibrated: 08/30/2023
- Phantom: Twin-SAM V8.0 ; Type: QD 000 P41 AA; Serial: 1974
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

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

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

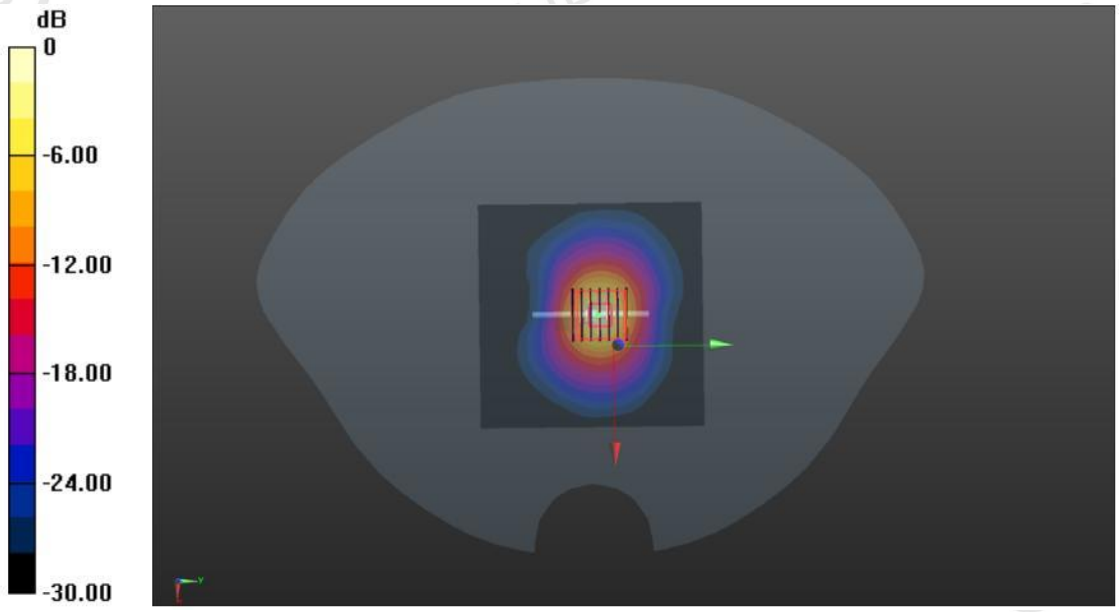
**Zoom Scan (7x7x13):** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 43.3 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 18.8 W/kg

**SAR(1 g) = 7.49 W/kg; SAR(10 g) = 2.11 W/kg**

Maximum value of SAR (measured) = 19.0 W/kg




0 dB = 19.0 W/kg

System Performance Check 5750MHz 100mW

# Appendix C. Plots of SAR Test Data

**#1**

Date: 05/17/2024

**WIFI2.4G_Top side_ANT Fold 90°_0mm_802.11b _Ch06**

Communication System: UID 0, Generic WLAN (0); Frequency: 2437 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 2437 MHz; σ = 1.847 S/m; εr = 38.415; ρ = 1000 kg/m3

Phantom section: Flat Section

**DASY5 Configuration:**

- Probe: EX3DV4 - SN7380; ConvF(7.50, 7.50, 7.50,) ; Calibrated: 6/21/2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn428; Calibrated: 08/30/2023
- Phantom: Twin-SAM V8.0 ; Type: QD 000 P41 AA; Serial: 1974
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**Area Scan (81x101x1):** Measurement grid: dx=1.200mm, dy=1.200mm

Maximum value of SAR (interpolated) = 2.77 W/Kg

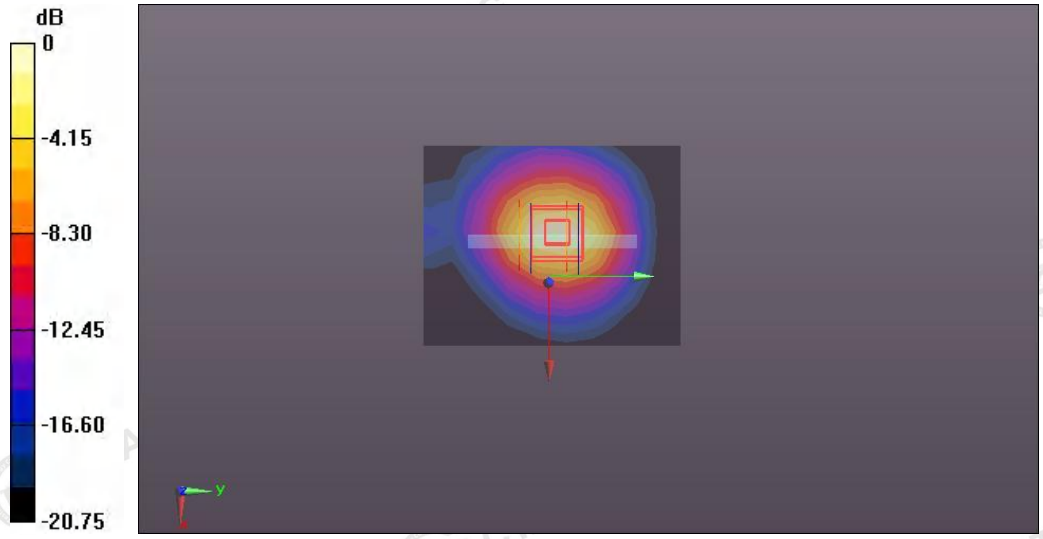
**Zoom Scan (7x7x5)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 36.10 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 4.45 W/kg

**SAR(1 g) = 1.92 W/kg; SAR(10 g) = 1.121 W/kg**

Maximum value of SAR (measured) = 3.05 W/kg



**#2**

Date: 05/20/2024

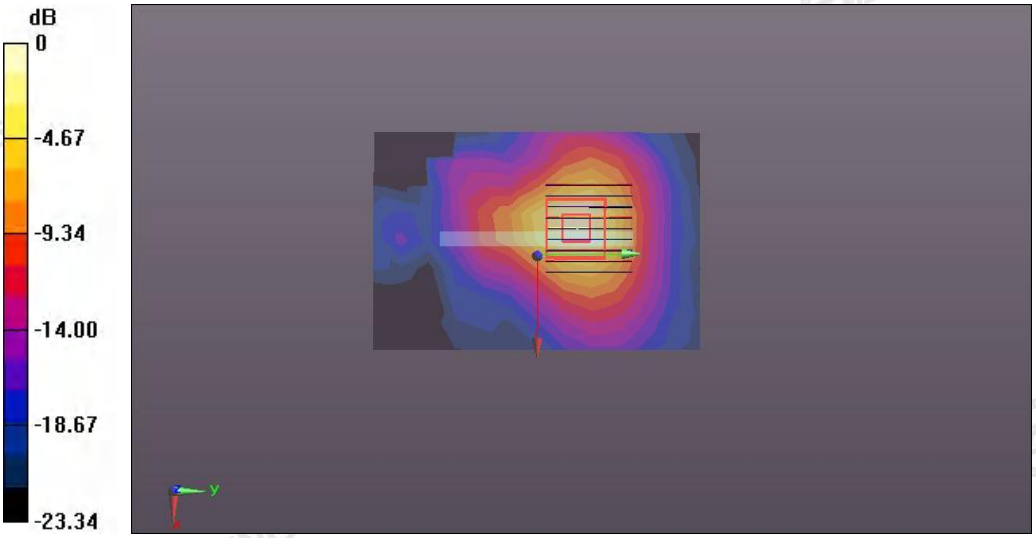
**WLAN 5.8GHz_Top side_ANT Fold 90°_0mm_802.11n(HT40)_CH151**

Communication System: UID 0, Generic WLAN (0); Frequency: 5755 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5755 MHz; σ = 5.354 S/m; εr = 34.614; ρ = 1000 kg/m3
Phantom section: Flat Section

**DASY5 Configuration:**

- Probe: EX3DV4 - SN7380; ConvF(4.96, 4.96, 4.96) ; Calibrated: 6/21/2023
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn428; Calibrated: 08/30/2023
- Phantom: Twin-SAM V8.0 ; Type: QD 000 P41 AA; Serial: 1974
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

**Area Scan (90x130x1):** Measurement grid: dx=1.000mm, dy=1.000mm
Maximum value of SAR (interpolated) = 2.42 W/Kg

**Zoom Scan (9x9x7):** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 25.42 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 4.50 W/kg

**SAR(1 g) = 1.22 W/kg; SAR(10 g) = 0.930 W/kg**
Maximum value of SAR (measured) = 2.97 W/kg