# FCC SAR TEST REPORT

| | | |
|---|---|---|
| **APPLICANT** | **:** | **Meta Platforms Technologies, LLC.** |
| **EQUIPMENT** | **:** | **Handheld controller** |
| **BRAND NAME** | **:** | **META PLATFORMS TECHNOLOGIES, LLC** |
| **MODEL NAME** | **:** | **VM4** |
| **FCC ID** | **:** | **2AGOZ-J93** |
| **STANDARD** | **:** | **FCC 47 CFR Part 2 (2.1093)** |

**We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the test procedures given in 47 CFR Part 2.1093 and FCC KDB and has been in compliance with the applicable technical standards.**

**The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.**

Si Zhang

**Approved by: Si Zhang**

ACCREDITED
Cert #5145.02

***Sporton International Inc. (Kunshan)***
***No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300***
***People's Republic of China***

# Table of Contents

# History of this test report

| Report No. | Version | Description | Issued Date |
|---|---|---|---|
| FA192411-06 | Rev. 01 | Initial issue of report | Aug. 17, 2022 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

# 1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **Meta Platforms Technologies, LLC., Handheld controller, VM4,** are as follows.

| Highest Standalone 10g SAR Summary | | | | |
|---|---|---|---|---|
| Equipment Class | Frequency Band | | Extremity (Separation 0mm) 10g SAR (W/kg) | Highest Simultaneous Transmission 10g SAR (W/kg) |
| DTS | WLAN | 2.4GHz WLAN | <0.10 | 0.14 |
| NII | WLAN | 5GHz WLAN | **0.32** | 0.43 |
| DTS | nRF | nRF | 0.11 | 0.43 |
| Date of Testing: | | 2022/5/1 ~ 2022/5/4 | | |

| Declaration of Conformity: |
|---|
| The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers. |
| Comments and Explanations: |
| The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification. |

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (4.0 W/kg for Extremity 10g SAR) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications

## 2. Administration Data

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

<table>
<tr><th colspan="4">Testing Laboratory</th></tr>
<tr><td>Test Firm</td><td colspan="3">Sporton International Inc. (Kunshan)</td></tr>
<tr><td>Test Site Location</td><td colspan="3">No. 1098, Pengxi North Road, Kunshan Economic Development Zone<br>Jiangsu Province 215300 People's Republic of China<br>TEL : +86-512-57900158<br>FAX : +86-512-57900958</td></tr>
<tr><td rowspan="2">Test Site No.</td><td>Sporton Site No.</td><td>FCC Designation No.</td><td>FCC Test Firm Registration No.</td></tr>
<tr><td>SAR07-KS</td><td>CN1257</td><td>314309</td></tr>
</table>

<table>
<tr><th colspan="2">Applicant</th></tr>
<tr><td>Company Name</td><td>Meta Platforms Technologies, LLC.</td></tr>
<tr><td>Address</td><td>1 Hacker Way, Menlo Park, CA 94025, USA</td></tr>
</table>

## 3. Guidance Applied

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)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2013
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB 865664 D02 SAR Reporting v01r02
- FCC KDB 447498 D01 General RF Exposure Guidance v06
- FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r02

# 4. Equipment Under Test (EUT) Information

## 4.1 General Information

| Product Feature & Specification | |
|---|---|
| **Equipment Name** | Handheld controller |
| **Brand Name** | META PLATFORMS TECHNOLOGIES, LLC |
| **Model Name** | VM4 |
| **FCC ID** | 2AGOZ-J93 |
| **S/N** | Sample 1: 230YV31D3N002B<br>Sample 2: 230YV33D3G000P |
| **Wireless Technology and Frequency Range** | WLAN 2.4GHz Band: 2457 MHz ~ 2462 MHz<br>WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz<br>WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz<br>WLAN 5.5GHz Band: 5500 MHz ~ 5720 MHz<br>WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz<br>nRF: 2402 MHz ~ 2478 MHz for Bypass Mode<br>nRF: 2402 MHz ~ 2426 MHz for Filter Mode |
| **Mode** | WLAN 2.4GHz 802.11b/g/n/ac HT20/VHT20<br>WLAN 5GHz 802.11a/n HT20/HT40<br>WLAN 5GHz 802.11ac VHT20/VHT40/VHT80<br>nRF GFSK |
| **SW Version** | QCAHLSWMTPLZ-1.473021.1 |
| **EUT Stage** | Identical Prototype |

**Remark:**
1. This device has no voice function.
2. 802.11n-HT40 is not supported in 2.4GHz WLAN.
3. There are three samples. The sample 1 is Antenna with no glue, the sample 2 is Antenna with UV glue, Stylus magnet tip, and second source memory supplier and the sample 3 is Antenna with no glue, alternate source antenna vendor (same design, another vendor), LED Flex S-bend design, integrated shield can. According to the differences, we choose sample 1 to perform full test, and the sample 2 are verified the difference with the sample 1. For sample 1 and sample 3, only LED Flex S-bend design and integrated shield can is different, the differences do not affect the test, so sample 3 are not tested.

# 5. RF Exposure Limits

## 5.1 Uncontrolled Environment

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

## 5.2 Controlled Environment

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

**Limits for Occupational/Controlled Exposure (W/kg)**

| Whole-Body | Partial-Body | Hands, Wrists, Feet and Ankles |
|---|---|---|
| 0.4 | 8.0 | 20.0 |

**Limits for General Population/Uncontrolled Exposure (W/kg)**

| Whole-Body | Partial-Body | Hands, Wrists, Feet and Ankles |
|---|---|---|
| 0.08 | 1.6 | 4.0 |

Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

# 6. Specific Absorption Rate (SAR)

## 6.1 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.

## 6.2 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:

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

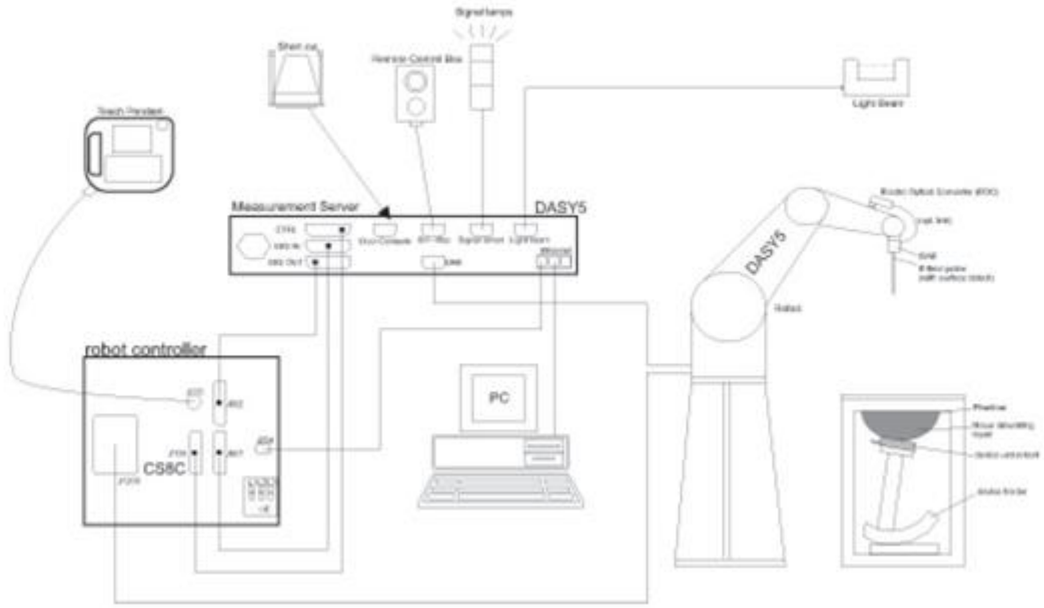
SAR is expressed in units of Watts per kilogram (W/kg)

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

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

# 7. System Description and Setup

**The DASY system used for performing compliance tests consists of the following items:**




- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP or Win7 and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

## 7.1 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.

**<EX3DV4 Probe>**

| | | |
|---|---|---|
| **Construction** | Symmetric design with triangular core<br>Built-in shielding against static charges<br>PEEK enclosure material (resistant to organic solvents, e.g., DGBE) |  |
| **Frequency** | 10 MHz – >6 GHz<br>Linearity: ±0.2 dB (30 MHz – 6 GHz) | |
| **Directivity** | ±0.3 dB in TSL (rotation around probe axis)<br>±0.5 dB in TSL (rotation normal to probe axis) | |
| **Dynamic Range** | 10 µW/g – >100 mW/g<br>Linearity: ±0.2 dB (noise: typically <1 µW/g) | |
| **Dimensions** | Overall length: 337 mm (tip: 20 mm)<br>Tip diameter: 2.5 mm (body: 12 mm)<br>Typical distance from probe tip to dipole centers: 1 mm | |

## 7.2 Data Acquisition Electronics (DAE)

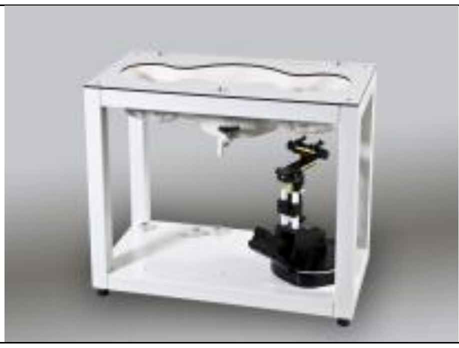
The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an 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 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

**Photo of DAE**

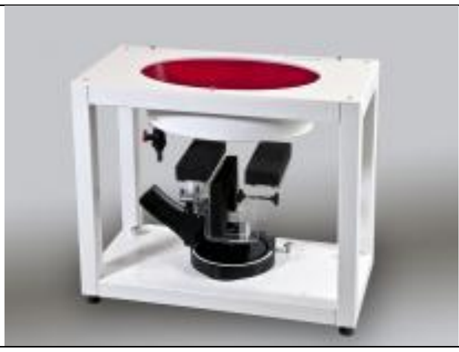
## *7.3 Phantom*

**<SAM Twin Phantom>**

| | | |
|---|---|---|
| **Shell Thickness** | 2 ± 0.2 mm;<br>Center ear point: 6 ± 0.2 mm |  |
| **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.

**<ELI Phantom>**

| | | |
|---|---|---|
| **Shell Thickness** | 2 ± 0.2 mm (sagging: <1%) |  |
| **Filling Volume** | Approx. 30 liters | |
| **Dimensions** | Major ellipse axis: 600 mm<br>Minor axis: 400 mm | |

The ELI 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.

## 7.4 Device Holder

### <Mounting Device for Hand-Held Transmitter>

In combination with the Twin SAM V5.0/V5.0c or ELI phantoms, the Mounting Device for Hand-Held Transmitters enables rotation of the mounted transmitter device to specified spherical coordinates. At the heads, the rotation axis is at the ear opening. Transmitter devices can be easily and accurately positioned according to IEC 62209-1, IEEE 1528, FCC, or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat). And upgrade kit to Mounting Device to enable easy mounting of wider devices like big smart-phones, e-books, small tablets, etc. It holds devices with width up to 140 mm.

Mounting Device for Hand-Held Transmitters

Mounting Device Adaptor for Wide-Phones

### <Mounting Device for Laptops and other Body-Worn Transmitters>

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the mounting device in place of the phone positioned. The extension is fully compatible with the SAM Twin and ELI phantoms.

Mounting Device for Laptops

# 8. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

(a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
(b) Read the WWAN RF power level from the base station simulator.
(c) For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band
(d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power

<SAR measurement>

(a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
(b) Place the EUT in the positions as Appendix D demonstrates.
(c) Set scan area, grid size and other setting on the DASY software.
(d) Measure SAR results for the highest power channel on each testing position.
(e) Find out the largest SAR result on these testing positions of each band
(f) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg

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

## 8.1 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

## 8.2 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.

## 8.3 Area Scan

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 D01v01r04 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: $\Delta x_{Area}$, $\Delta y_{Area}$ | ≤ 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. | |

## 8.4 Zoom Scan

Zoom scans are used assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram 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 D01v01r04 SAR measurement 100 MHz to 6 GHz.

<table>
<tr><td colspan="3"></td><td>$\leq$ 3 GHz</td><td>$>$ 3 GHz</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: $\Delta x_{Zoom}$, $\Delta y_{Zoom}$</td><td>$\leq$ 2 GHz: $\leq$ 8 mm<br>2 – 3 GHz: $\leq$ 5 mm*</td><td>3 – 4 GHz: $\leq$ 5 mm*<br>4 – 6 GHz: $\leq$ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>$\leq$ 5 mm</td><td>3 – 4 GHz: $\leq$ 4 mm<br>4 – 5 GHz: $\leq$ 3 mm<br>5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between $1^{st}$ two points closest to phantom surface</td><td>$\leq$ 4 mm</td><td>3 – 4 GHz: $\leq$ 3 mm<br>4 – 5 GHz: $\leq$ 2.5 mm<br>5 – 6 GHz: $\leq$ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>$\geq$ 30 mm</td><td>3 – 4 GHz: $\geq$ 28 mm<br>4 – 5 GHz: $\geq$ 25 mm<br>5 – 6 GHz: $\geq$ 22 mm</td></tr>
<tr><td colspan="5">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.<br>* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is $\leq$ 1.4 W/kg, $\leq$ 8 mm, $\leq$ 7 mm and $\leq$ 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.</td></tr>
</table>

## 8.5 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.

## 8.6 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 drifts more than 5%, the SAR will be retested.

# 9. Test Equipment List

| Manufacturer | Name of Equipment | Type/Model | Serial Number | Calibration | |
|---|---|---|---|---|---|
| | | | | Last Cal. | Due Date |
| SPEAG | 2450MHz System Validation Kit | D2450V2 | 924 | 2020/9/2 | 2023/9/1 |
| SPEAG | 5000MHz System Validation Kit | D5GHzV2 | 1113 | 2019/9/24 | 2022/9/22 |
| SPEAG | Data Acquisition Electronics | DAE4 | 1279 | 2021/9/21 | 2022/9/20 |
| SPEAG | Dosimetric E-Field Probe | EX3DV4 | 7706 | 2022/1/20 | 2023/1/19 |
| SPEAG | SAM Twin Phantom | SAM Twin | TP-2024 | NCR | NCR |
| Testo | Thermo-Hygrometer | 608-H1 | 1241332102 | 2022/1/6 | 2023/1/5 |
| SPEAG | Phone Positioner | N/A | N/A | NCR | NCR |
| Keysight | Preamplifier | 83017A | MY57280111 | 2021/7/12 | 2022/7/11 |
| Agilent | ENA Series Network Analyzer | E5071C | MY46106933 | 2021/7/31 | 2022/7/30 |
| SPEAG | Dielectric Probe Kit | DAK-3.5 | 1138 | 2021/6/9 | 2022/6/8 |
| Anritsu | Vector Signal Generator | MG3710A | 6201682672 | 2022/1/6 | 2023/1/5 |
| Rohde & Schwarz | Power Meter | NRVD | 102081 | 2021/8/12 | 2022/8/11 |
| Rohde & Schwarz | Power Sensor | NRV-Z5 | 100538 | 2021/8/12 | 2022/8/11 |
| Rohde & Schwarz | Power Sensor | NRV-Z5 | 100539 | 2021/8/12 | 2022/8/11 |
| EXA | Spectrum Analyzer | FSV7 | 101631 | 2021/10/14 | 2022/10/13 |
| FLUKE | DIGITAC THERMOMETER | 51II | 97240029 | 2021/8/13 | 2022/8/12 |
| BONN | POWER AMPLIFIER | BLMA 0830-3 | 087193A | Note 1 | |
| BONN | POWER AMPLIFIER | BLMA 2060-2 | 087193B | Note 1 | |
| Agilent | Dual Directional Coupler | 778D | 20500 | Note 1 | |
| Agilent | Dual Directional Coupler | 11691D | MY48151020 | Note 1 | |
| ARRA | Power Divider | A3200-2 | N/A | Note 1 | |
| MCL | Attenuation1 | BW-S10W5+ | N/A | Note 1 | |
| MCL | Attenuation2 | BW-S10W5+ | N/A | Note 1 | |
| MCL | Attenuation3 | BW-S10W5+ | N/A | Note 1 | |

**Note:**

1. Prior to system verification and validation, the path loss from the signal generator to the system check source and the power meter, which includes the amplifier, cable, attenuator and directional coupler, was measured by the network analyzer. The reading of the power meter was offset by the path loss difference between the path to the power meter and the path to the system check source to monitor the actual power level fed to the system check source.
2. Referring to KDB 865664 D01v01r04, 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 justification data of dipole can be found in appendix C. The return loss is < -20dB, within 20% of prior calibration, the impedance is within 5 ohm of prior calibration.

# 10. System Verification

## 10.1 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. 10.1. 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 in Fig. 10.2.

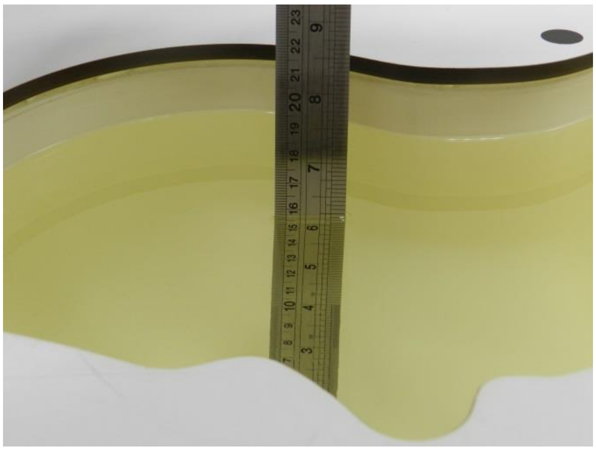


**Fig 10.1 Photo of Liquid Height for Head SAR**

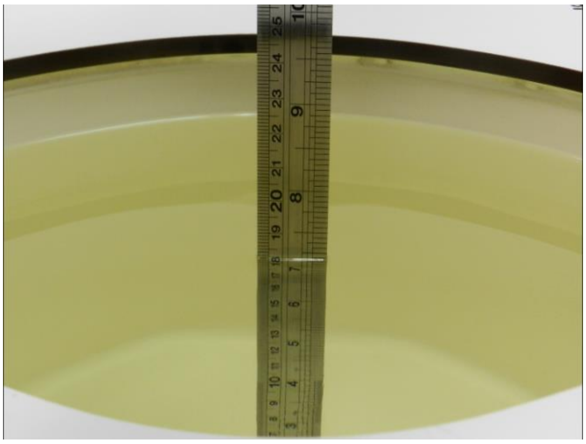


**Fig 10.2 Photo of Liquid Height for Body SAR**

## 10.2 Tissue Verification

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

| Frequency (MHz) | Water (%) | Sugar (%) | Cellulose (%) | Salt (%) | Preventol (%) | DGBE (%) | Conductivity (σ) | Permittivity (εr) |
|---|---|---|---|---|---|---|---|---|
| For Head | | | | | | | | |
| 2450 | 55.0 | 0 | 0 | 0 | 0 | 45.0 | 1.80 | 39.2 |

Simulating Liquid for 5GHz, Manufactured by SPEAG

| Ingredients | (% by weight) |
|---|---|
| Water | 64~78% |
| Mineral oil | 11~18% |
| Emulsifiers | 9~15% |
| Additives and Salt | 2~3% |

### <Tissue Dielectric Parameter Check Results>

| Frequency (MHz) | Tissue Type | Liquid Temp. (℃) | Conductivity (σ) | Permittivity ($\varepsilon_r$) | Conductivity Target (σ) | Permittivity Target ($\varepsilon_r$) | Delta (σ) (%) | Delta ($\varepsilon_r$) (%) | Limit (%) | Date |
|---|---|---|---|---|---|---|---|---|---|---|
| 2450 | Head | 22.6 | 1.809 | 38.576 | 1.80 | 39.20 | 0.50 | -1.59 | ±5 | 2022/5/1 |
| 5250 | Head | 22.9 | 4.557 | 36.100 | 4.71 | 35.90 | -3.25 | 0.56 | ±5 | 2022/5/2 |
| 5600 | Head | 22.9 | 4.982 | 35.817 | 5.07 | 35.50 | -1.74 | 0.89 | ±5 | 2022/5/3 |
| 5750 | Head | 22.9 | 5.113 | 35.387 | 5.22 | 35.40 | -2.05 | -0.04 | ±5 | 2022/5/4 |

## 10.3 System Performance Check Results

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

| Date | Frequency (MHz) | Tissue Type | Input Power (mW) | Dipole S/N | Probe S/N | DAE S/N | Measured 10g SAR (W/kg) | Targeted 10g SAR (W/kg) | Normalized 10g SAR (W/kg) | Deviation (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2022/5/1 | 2450 | Head | 50 | 924 | 7706 | 1279 | 1.170 | 24.00 | 23.4 | -2.50 |
| 2022/5/2 | 5250 | Head | 50 | 1113 | 7706 | 1279 | 1.110 | 23.10 | 22.2 | -3.90 |
| 2022/5/3 | 5600 | Head | 50 | 1113 | 7706 | 1279 | 1.170 | 23.80 | 23.4 | -1.68 |
| 2022/5/4 | 5750 | Head | 50 | 1113 | 7706 | 1279 | 1.090 | 22.80 | 21.8 | -4.39 |

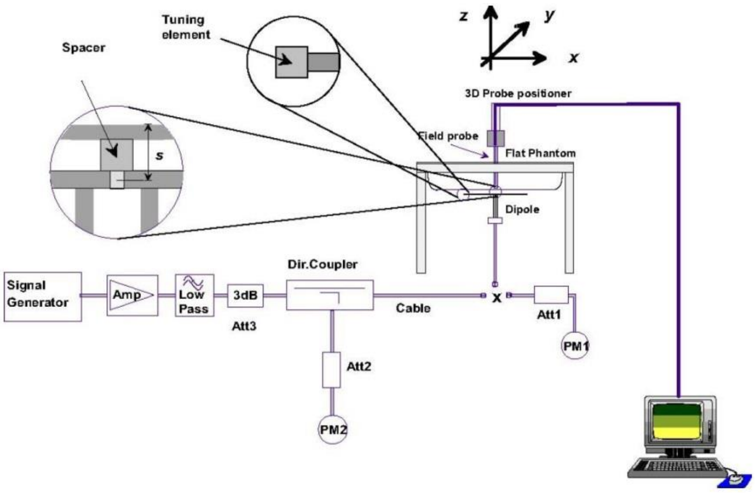



Fig 8.3.1 System Performance Check Setup

Fig 8.3.2 Setup Photo

# 11. RF Exposure Positions

(a) To position the device parallel to the phantom surface with all surfaces of the device.

(b) To adjust the device parallel to the flat phantom.

(c) To adjust the distance between the device surface and the flat phantom to 0mm.

**<EUT Setup Photos>**

Please refer to the test setup photos.

# 12. Conducted RF Output Power (Unit: dBm)

**<WLAN Conducted Power>**

**General Note:**

1. Per KDB 248227 D01v02r02, SAR test reduction is determined according to 802.11 transmission mode configurations and certain exposure conditions with multiple test positions. In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. For OFDM, in both 2.4 and 5 GHz bands, an initial test configuration must be determined for each standalone and aggregated frequency band, according to the transmission mode configuration with the highest maximum output power specified for production units to perform SAR measurements. If the same highest maximum output power applies to different combinations of channel bandwidths, modulations and data rates, additional procedures are applied to determine which test configurations require SAR measurement. When applicable, an initial test position may be applied to reduce the number of SAR measurements required for next to the ear, UMPC mini-tablet or hotspot mode configurations with multiple test positions.
2. For 2.4 GHz 802.11b DSSS, either the initial test position procedure for multiple exposure test positions or the DSSS procedure for fixed exposure position is applied; these are mutually exclusive. For 2.4 GHz and 5 GHz OFDM configurations, the initial test configuration is applied to measure SAR using either the initial test position procedure for multiple exposure test position configurations or the initial test configuration procedures for fixed exposure test conditions. Based on the reported SAR of the measured configurations and maximum output power of the transmission mode configurations that are not included in the initial test configuration, the subsequent test configuration and initial test position procedures are applied to determine if SAR measurements are required for the remaining OFDM transmission configurations. In general, the number of test channels that require SAR measurement is minimized based on maximum output power measured for the test sample(s).
3. For OFDM transmission configurations in the 2.4 GHz and 5 GHz bands, When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel for each frequency band.
4. DSSS and OFDM configurations are considered separately according to the required SAR procedures. SAR is measured in the initial test position using the 802.11 transmission mode configuration required by the DSSS procedure or initial test configuration and subsequent test configuration(s) according to the OFDM procedures.18 The initial test position procedure is described in the following:
   a. When the reported SAR of the initial test position is ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and 802.11 transmission mode combinations within the frequency band or aggregated band.
   b. When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
   c. For all positions/configurations, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

## Full Power

### <2.4GHz WLAN>

| | Mode | Channel | Frequency (MHz) | Average power (dBm) | Tune-Up Limit | Duty Cycle % |
|---|---|---|---|---|---|---|
| 2.4GHz WLAN | 802.11b 1Mbps | 10 | 2457 | 8.71 | 10.50 | 99.00 |
| | | 11 | 2462 | 8.59 | 10.50 | |
| | 802.11g 6Mbps | 10 | 2457 | 8.72 | 10.50 | 98.25 |
| | | 11 | 2462 | 8.70 | 10.50 | |
| | 802.11n-HT20 MCS0 | 10 | 2457 | 8.69 | 10.50 | 98.12 |
| | | 11 | 2462 | 8.62 | 10.50 | |
| | 802.11ac-VHT20 MCS0 | 10 | 2457 | 8.66 | 10.50 | 98.13 |
| | | 11 | 2462 | 8.56 | 10.50 | |

### <5GHz WLAN>

| | Mode | Channel | Frequency (MHz) | Average power (dBm) | Tune-Up Limit | Duty Cycle % |
|---|---|---|---|---|---|---|
| 5.2GHz WLAN | 802.11a 6Mbps | 36 | 5180 | 9.36 | 10.00 | 98.25 |
| | | 40 | 5200 | 9.33 | 10.00 | |
| | | 44 | 5220 | 9.35 | 10.00 | |
| | | 48 | 5240 | 9.29 | 10.00 | |
| | 802.11n-HT20 MCS0 | 36 | 5180 | 9.26 | 10.00 | 98.12 |
| | | 40 | 5200 | 9.19 | 10.00 | |
| | | 44 | 5220 | 9.22 | 10.00 | |
| | | 48 | 5240 | 9.07 | 10.00 | |
| | 802.11n-HT40 MCS0 | 38 | 5190 | 9.36 | 10.00 | 96.24 |
| | | 46 | 5230 | 9.34 | 10.00 | |
| | 802.11ac-VHT20 MCS0 | 36 | 5180 | 9.19 | 10.00 | 98.13 |
| | | 40 | 5200 | 9.16 | 10.00 | |
| | | 44 | 5220 | 9.18 | 10.00 | |
| | | 48 | 5240 | 9.04 | 10.00 | |
| | 802.11ac-VHT40 MCS0 | 38 | 5190 | 9.33 | 10.00 | 96.27 |
| | | 46 | 5230 | 9.31 | 10.00 | |
| | 802.11ac-VHT80 MCS0 | 42 | 5210 | 9.28 | 10.00 | 92.13 |

| | Mode | Channel | Frequency (MHz) | Average power (dBm) | Tune-Up Limit | Duty Cycle % |
|---|---|---|---|---|---|---|
| 5.3GHz WLAN | 802.11a 6Mbps | 52 | 5260 | 9.19 | 10.00 | 98.25 |
| | | 56 | 5280 | 9.10 | 10.00 | |
| | | 60 | 5300 | 9.27 | 10.00 | |
| | | 64 | 5320 | 8.99 | 10.00 | |
| | 802.11n-HT20 MCS0 | 52 | 5260 | 9.03 | 10.00 | 98.12 |
| | | 56 | 5280 | 9.06 | 10.00 | |
| | | 60 | 5300 | 9.05 | 10.00 | |
| | | 64 | 5320 | 8.96 | 10.00 | |
| | 802.11n-HT40 MCS0 | 54 | 5270 | 9.28 | 10.00 | 96.24 |
| | | 62 | 5310 | 9.21 | 10.00 | |
| | 802.11ac-VHT20 MCS0 | 52 | 5260 | 9.00 | 10.00 | 98.13 |
| | | 56 | 5280 | 9.02 | 10.00 | |
| | | 60 | 5300 | 9.03 | 10.00 | |
| | | 64 | 5320 | 8.91 | 10.00 | |
| | 802.11ac-VHT40 MCS0 | 54 | 5270 | 9.25 | 10.00 | 96.27 |
| | | 62 | 5310 | 9.15 | 10.00 | |
| | 802.11ac-VHT80 MCS0 | 58 | 5290 | 9.11 | 10.00 | 92.13 |

| | Mode | Channel | Frequency (MHz) | Average power (dBm) | Tune-Up Limit | Duty Cycle % |
|---|---|---|---|---|---|---|
| 5.5GHz WLAN | 802.11a 6Mbps | 100 | 5500 | 8.56 | 10.00 | 98.25 |
| | | 116 | 5580 | 8.39 | 10.00 | |
| | | 124 | 5620 | 8.66 | 10.00 | |
| | | 132 | 5660 | 8.77 | 10.00 | |
| | | 140 | 5700 | 8.81 | 10.00 | |
| | | 144 | 5720 | 8.80 | 10.00 | |
| | 802.11n-HT20 MCS0 | 100 | 5500 | 8.44 | 10.00 | 98.12 |
| | | 116 | 5580 | 8.38 | 10.00 | |
| | | 124 | 5620 | 8.44 | 10.00 | |
| | | 132 | 5660 | 8.52 | 10.00 | |
| | | 140 | 5700 | 8.62 | 10.00 | |
| | | 144 | 5720 | 8.66 | 10.00 | |
| | 802.11n-HT40 MCS0 | 102 | 5510 | 8.62 | 10.00 | 96.24 |
| | | 110 | 5550 | 8.45 | 10.00 | |
| | | 126 | 5630 | 8.52 | 10.00 | |
| | | 134 | 5670 | 8.83 | 10.00 | |
| | | 142 | 5710 | 8.76 | 10.00 | |
| | 802.11ac-VHT20 MCS0 | 100 | 5500 | 8.41 | 10.00 | 98.13 |
| | | 116 | 5580 | 8.34 | 10.00 | |
| | | 124 | 5620 | 8.41 | 10.00 | |
| | | 132 | 5660 | 8.49 | 10.00 | |
| | | 140 | 5700 | 8.61 | 10.00 | |
| | | 144 | 5720 | 8.64 | 10.00 | |
| | 802.11ac-VHT40 MCS0 | 102 | 5510 | 8.58 | 10.00 | 96.27 |
| | | 110 | 5550 | 8.37 | 10.00 | |
| | | 126 | 5630 | 8.51 | 10.00 | |
| | | 134 | 5670 | 8.76 | 10.00 | |
| | | 142 | 5710 | 8.71 | 10.00 | |
| | 802.11ac-VHT80 MCS0 | 106 | 5530 | 8.40 | 10.00 | 92.13 |
| | | 122 | 5610 | 8.28 | 10.00 | |
| | | 138 | 5690 | 8.61 | 10.00 | |

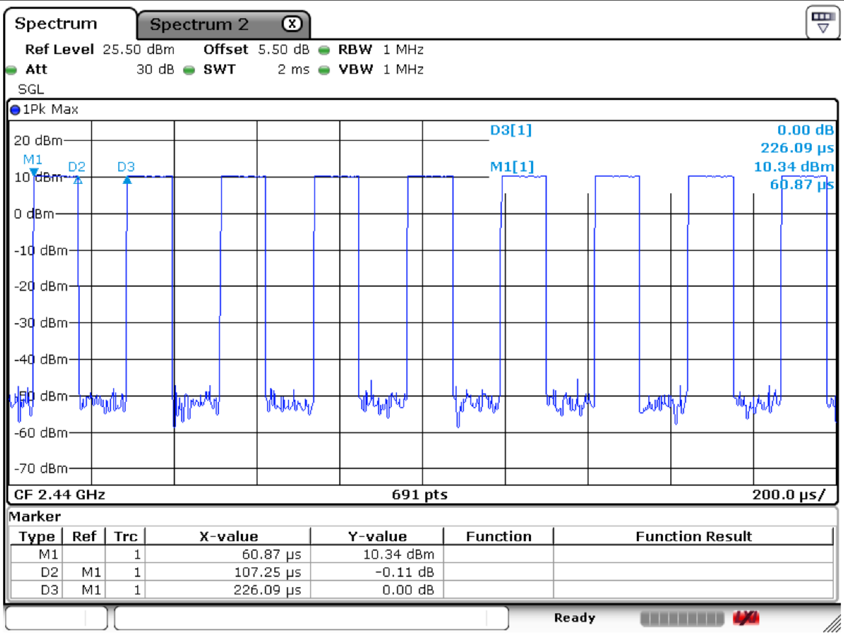
| | Mode | Channel | Frequency (MHz) | Average power (dBm) | Tune-Up Limit | Duty Cycle % |
|---|---|---|---|---|---|---|
| 5.8GHz WLAN | 802.11a 6Mbps | 149 | 5745 | 8.61 | 10.00 | 98.25 |
| | | 157 | 5785 | 8.29 | 10.00 | |
| | | 165 | 5825 | 8.04 | 10.00 | |
| | 802.11n-HT20 MCS0 | 149 | 5745 | 8.47 | 10.00 | 98.12 |
| | | 157 | 5785 | 8.13 | 10.00 | |
| | | 165 | 5825 | 7.93 | 9.50 | |
| | 802.11n-HT40 MCS0 | 151 | 5755 | 8.60 | 10.00 | 96.24 |
| | | 159 | 5795 | 8.26 | 10.00 | |
| | 802.11ac-VHT20 MCS0 | 149 | 5745 | 8.42 | 10.00 | 98.13 |
| | | 157 | 5785 | 8.10 | 10.00 | |
| | | 165 | 5825 | 7.86 | 9.50 | |
| | 802.11ac-VHT40 MCS0 | 151 | 5755 | 8.56 | 10.00 | 96.27 |
| | | 159 | 5795 | 8.24 | 10.00 | |
| | 802.11ac-VHT80 MCS0 | 155 | 5775 | 8.23 | 10.00 | 92.13 |

## <2.4GHz nRF>

**General Note:**

1. The nRF duty cycle are 47.44% as following figure, for nRF SAR scaling need further consideration and the maximum duty cycle is 50%(Declared by Manufacturer), therefore the actual duty cycle will be scaled up to 50% for nRF reported SAR calculation.

**nRF time-domain plot**




| Mode | Channel | Frequency (MHz) | Average power (dBm) |
|---|---|---|---|
| nRF Bypass | CH 00 | 2402 | 9.80 |
| | CH 19 | 2440 | 9.72 |
| | CH 38 | 2478 | 10.11 |
| Tune-up Limit | | | 11.00 |

| Mode | Channel | Frequency (MHz) | Average power (dBm) |
|---|---|---|---|
| nRF Filter | CH 00 | 2402 | 9.18 |
| | CH 07 | 2416 | 8.95 |
| | CH 12 | 2426 | 8.82 |
| Tune-up Limit | | | 10.00 |

# 13. Antenna Location

The detailed antenna location information can refer to SAR Test Setup Photos.

# 14. SAR Test Results

**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 nRF testing of nRF signal with 50% duty cycle (Declared by Manufacturer), the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle) *50%"
   d. For WLAN/nRF: 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. Per KDB 865664 D01v01r04, if the extremity repeated SAR is necessary, 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.
4. Position 5 is evaluated with the side of the device positioned in direct contact against a SAM Twin phantom filled with head tissue-equivalent medium for the SAR test.
5. nRF supports Bypass Mode and Filter Mode, since the supported frequency spans for Filter Mode are completely covered by the Bypass Mode, and Bypass Mode power level higher than Filter Mode power level, therefore, only chose Bypass Mode to perform full SAR testing and Bypass Mode SAR can represent Filter Mode SAR conservatively.

**WLAN Note:**

1. 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.
2. Per KDB 248227 D01v02r02, U-NII-1 SAR testing is not required when the U-NII-2A band highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band.
3. When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
4. For all positions / configurations, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions / configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.
5. During SAR testing the WLAN transmission was verified using a spectrum analyzer.

## 14.1 Extremity SAR

| Plot No. | Band | Mode | Test Position | Gap (mm) | Ch. | Freq. (MHz) | Sample | Average Power (dBm) | Tune-Up Limit (dBm) | Tune-up Scaling Factor | Duty Cycle % | Duty Cycle Scaling Factor | Power Drift (dB) | Measured 10g SAR (W/kg) | Reported 10g SAR (W/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | WLAN2.4GHz | 802.11b 1Mbps | Right Hand Position 1-A | 0mm | 10 | 2457 | 1 | 8.71 | 10.50 | 1.510 | 99.00 | 1.010 | 0.01 | 0.006 | 0.009 |
| | WLAN2.4GHz | 802.11b 1Mbps | Right Hand Position 1-B | 0mm | 10 | 2457 | 1 | 8.71 | 10.50 | 1.510 | 99.00 | 1.010 | 0.01 | 0.016 | 0.024 |
| | WLAN2.4GHz | 802.11b 1Mbps | Right Hand Position 2 | 0mm | 10 | 2457 | 1 | 8.71 | 10.50 | 1.510 | 99.00 | 1.010 | -0.09 | 0.017 | 0.026 |
| | WLAN2.4GHz | 802.11b 1Mbps | Right Hand Position 3 | 0mm | 10 | 2457 | 1 | 8.71 | 10.50 | 1.510 | 99.00 | 1.010 | 0.01 | 0.015 | 0.023 |
| | WLAN2.4GHz | 802.11b 1Mbps | Right Hand Position 4 | 0mm | 10 | 2457 | 1 | 8.71 | 10.50 | 1.510 | 99.00 | 1.010 | 0.09 | 0.007 | 0.011 |
| | WLAN2.4GHz | 802.11b 1Mbps | Right Hand Position 5 | 0mm | 10 | 2457 | 1 | 8.71 | 10.50 | 1.510 | 99.00 | 1.010 | 0.01 | 0.019 | 0.029 |
| 01 | WLAN2.4GHz | 802.11b 1Mbps | Right Hand Position 5 | 0mm | 11 | 2462 | 1 | 8.59 | 10.50 | 1.552 | 99.00 | 1.010 | 0.01 | 0.020 | **0.032** |
| | WLAN2.4GHz | 802.11b 1Mbps | Right Hand Position 5 | 0mm | 11 | 2462 | 2 | 8.59 | 10.50 | 1.552 | 99.00 | 1.010 | -0.04 | 0.018 | 0.028 |
| | WLAN5.3GHz | 802.11ac-VHT80 MCS0 | Right Hand Position 1-A | 0mm | 58 | 5290 | 1 | 9.11 | 10.00 | 1.227 | 92.13 | 1.085 | 0.06 | 0.013 | 0.018 |
| | WLAN5.3GHz | 802.11ac-VHT80 MCS0 | Right Hand Position 1-B | 0mm | 58 | 5290 | 1 | 9.11 | 10.00 | 1.227 | 92.13 | 1.085 | 0.03 | 0.018 | 0.024 |
| | WLAN5.3GHz | 802.11ac-VHT80 MCS0 | Right Hand Position 2 | 0mm | 58 | 5290 | 1 | 9.11 | 10.00 | 1.227 | 92.13 | 1.085 | 0.03 | 0.014 | 0.018 |
| | WLAN5.3GHz | 802.11ac-VHT80 MCS0 | Right Hand Position 3 | 0mm | 58 | 5290 | 1 | 9.11 | 10.00 | 1.227 | 92.13 | 1.085 | 0.02 | 0.018 | 0.024 |
| | WLAN5.3GHz | 802.11ac-VHT80 MCS0 | Right Hand Position 4 | 0mm | 58 | 5290 | 1 | 9.11 | 10.00 | 1.227 | 92.13 | 1.085 | 0.03 | 0.026 | 0.034 |
| 02 | WLAN5.3GHz | 802.11ac-VHT80 MCS0 | Right Hand Position 5 | 0mm | 58 | 5290 | 1 | 9.11 | 10.00 | 1.227 | 92.13 | 1.085 | 0.09 | 0.201 | **0.268** |
| | WLAN5.3GHz | 802.11ac-VHT80 MCS0 | Right Hand Position 5 | 0mm | 58 | 5290 | 2 | 9.11 | 10.00 | 1.227 | 92.13 | 1.085 | 0.04 | 0.174 | 0.232 |
| | WLAN5.5GHz | 802.11ac-VHT80 MCS0 | Right Hand Position 1-A | 0mm | 138 | 5690 | 1 | 8.61 | 10.00 | 1.377 | 92.13 | 1.085 | 0.02 | 0.008 | 0.013 |
| | WLAN5.5GHz | 802.11ac-VHT80 MCS0 | Right Hand Position 1-B | 0mm | 138 | 5690 | 1 | 8.61 | 10.00 | 1.377 | 92.13 | 1.085 | 0.07 | 0.007 | 0.010 |
| | WLAN5.5GHz | 802.11ac-VHT80 MCS0 | Right Hand Position 2 | 0mm | 138 | 5690 | 1 | 8.61 | 10.00 | 1.377 | 92.13 | 1.085 | 0.19 | 0.019 | 0.029 |
| | WLAN5.5GHz | 802.11ac-VHT80 MCS0 | Right Hand Position 3 | 0mm | 138 | 5690 | 1 | 8.61 | 10.00 | 1.377 | 92.13 | 1.085 | 0.01 | 0.006 | 0.009 |
| | WLAN5.5GHz | 802.11ac-VHT80 MCS0 | Right Hand Position 4 | 0mm | 138 | 5690 | 1 | 8.61 | 10.00 | 1.377 | 92.13 | 1.085 | 0.08 | 0.005 | 0.007 |
| | WLAN5.5GHz | 802.11ac-VHT80 MCS0 | Right Hand Position 5 | 0mm | 138 | 5690 | 1 | 8.61 | 10.00 | 1.377 | 92.13 | 1.085 | 0.09 | 0.166 | 0.248 |
| | WLAN5.5GHz | 802.11ac-VHT80 MCS0 | Right Hand Position 5 | 0mm | 106 | 5530 | 1 | 8.40 | 10.00 | 1.445 | 92.13 | 1.085 | 0.09 | 0.128 | 0.201 |
| 03 | WLAN5.5GHz | 802.11ac-VHT80 MCS0 | Right Hand Position 5 | 0mm | 122 | 5610 | 1 | 8.28 | 10.00 | 1.486 | 92.13 | 1.085 | 0.04 | 0.170 | **0.274** |
| | WLAN5.5GHz | 802.11ac-VHT80 MCS0 | Right Hand Position 5 | 0mm | 122 | 5610 | 2 | 8.28 | 10.00 | 1.486 | 92.13 | 1.085 | 0.06 | 0.123 | 0.198 |
| | WLAN5.8GHz | 802.11ac-VHT80 MCS0 | Right Hand Position 1-A | 0mm | 155 | 5775 | 1 | 8.23 | 10.00 | 1.503 | 92.13 | 1.085 | 0.02 | 0.015 | 0.024 |
| | WLAN5.8GHz | 802.11ac-VHT80 MCS0 | Right Hand Position 1-B | 0mm | 155 | 5775 | 1 | 8.23 | 10.00 | 1.503 | 92.13 | 1.085 | -0.05 | 0.007 | 0.012 |
| | WLAN5.8GHz | 802.11ac-VHT80 MCS0 | Right Hand Position 2 | 0mm | 155 | 5775 | 1 | 8.23 | 10.00 | 1.503 | 92.13 | 1.085 | 0.07 | 0.098 | 0.160 |
| | WLAN5.8GHz | 802.11ac-VHT80 MCS0 | Right Hand Position 3 | 0mm | 155 | 5775 | 1 | 8.23 | 10.00 | 1.503 | 92.13 | 1.085 | 0.06 | 0.005 | 0.008 |
| | WLAN5.8GHz | 802.11ac-VHT80 MCS0 | Right Hand Position 4 | 0mm | 155 | 5775 | 1 | 8.23 | 10.00 | 1.503 | 92.13 | 1.085 | 0.02 | 0.037 | 0.060 |
| 04 | WLAN5.8GHz | 802.11ac-VHT80 MCS0 | Right Hand Position 5 | 0mm | 155 | 5775 | 1 | 8.23 | 10.00 | 1.503 | 92.13 | 1.085 | 0.07 | 0.194 | **0.316** |
| | WLAN5.8GHz | 802.11ac-VHT80 MCS0 | Right Hand Position 5 | 0mm | 155 | 5775 | 2 | 8.23 | 10.00 | 1.503 | 92.13 | 1.085 | 0.06 | 0.159 | 0.259 |
| | nRF | - | Right Hand Position 1-A | 0mm | 38 | 2478 | 1 | 10.11 | 11.00 | 1.227 | 47.44 | 1.054 | 0.03 | 0.051 | 0.065 |
| | nRF | - | Right Hand Position 1-B | 0mm | 38 | 2478 | 1 | 10.11 | 11.00 | 1.227 | 47.44 | 1.054 | 0.03 | 0.045 | 0.058 |
| | nRF | - | Right Hand Position 2 | 0mm | 38 | 2478 | 1 | 10.11 | 11.00 | 1.227 | 47.44 | 1.054 | 0.06 | 0.010 | 0.013 |
| | nRF | - | Right Hand Position 3 | 0mm | 38 | 2478 | 1 | 10.11 | 11.00 | 1.227 | 47.44 | 1.054 | 0.01 | 0.023 | 0.030 |
| | nRF | - | Right Hand Position 4 | 0mm | 38 | 2478 | 1 | 10.11 | 11.00 | 1.227 | 47.44 | 1.054 | -0.07 | 0.068 | 0.062 |
| | nRF | - | Right Hand Position 5 | 0mm | 38 | 2478 | 1 | 10.11 | 11.00 | 1.227 | 47.44 | 1.054 | 0.01 | 0.068 | 0.088 |
| 05 | nRF | - | Right Hand Position 5 | 0mm | 0 | 2402 | 1 | 9.80 | 11.00 | 1.318 | 47.44 | 1.054 | 0.03 | 0.079 | **0.109** |
| | nRF | - | Right Hand Position 5 | 0mm | 19 | 2440 | 1 | 9.72 | 11.00 | 1.343 | 47.44 | 1.054 | 0.02 | 0.047 | 0.067 |
| | nRF | - | Right Hand Position 5 | 0mm | 0 | 2402 | 2 | 9.80 | 11.00 | 1.318 | 47.44 | 1.054 | 0.09 | 0.068 | 0.094 |

# 15. Simultaneous Transmission Analysis

| NO. | Simultaneous Transmission Configurations | Handheld controller |
|---|---|---|
| | | Extremity |
| 1. | nRF Filter + WLAN2.4GHz | Yes |
| 2. | nRF Bypass + WLAN5GHz | Yes |

**General Note:**

1. The EUT has no voice function means data only.
2. EUT will choose either 2.4GHz WLAN or 5GHz WLAN according to the network signal condition; therefore, 2.4GHz WLAN and 5GHz WLAN will not operate simultaneously at any moment.
3. Above table listed transmitting simultaneous state is supported only for this device.
4. According to the EUT characteristic, WLAN 5GHz and nRF Bypass can transmit simultaneously.
5. According to the EUT characteristic, WLAN 2.4GHz and nRF Filter can transmit simultaneously.
6. Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,
   i) 10g Scalar SAR summation < 4.0W/kg.
   ii) SPLSR = (SAR1 + SAR2)^1.5 / (min. separation distance, mm), and the peak separation distance is determined from the square root of [(x1-x2)2 + (y1-y2)2 + (z1-z2)2], where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
   iii) If SPLSR ≤ 0.10 for 10g SAR, simultaneously transmission SAR measurement is not necessary.
   iv) Simultaneously transmission SAR measurement, and the reported multi-band 10g SAR < 4.0W/kg.

## 15.1 Extremity Exposure Conditions

| Exposure Position | 1 | 2 | 3 | 1+3 | 2+3 |
|---|---|---|---|---|---|
| | WLAN2.4GHz | WLAN5GHz | nRF | Summed | Summed |
| | 10g SAR (W/kg) | 10g SAR (W/kg) | 10g SAR (W/kg) | 10g SAR (W/kg) | 10g SAR (W/kg) |
| Right Hand Position 1-A | 0.009 | 0.024 | 0.065 | 0.074 | 0.089 |
| Right Hand Position 1-B | 0.024 | 0.024 | 0.058 | 0.082 | 0.082 |
| Right Hand Position 2 | 0.026 | 0.160 | 0.013 | 0.039 | 0.173 |
| Right Hand Position 3 | 0.023 | 0.024 | 0.030 | 0.053 | 0.054 |
| Right Hand Position 4 | 0.011 | 0.060 | 0.062 | 0.073 | 0.122 |
| Right Hand Position 5 | 0.032 | 0.316 | 0.109 | **0.141** | **0.425** |

**Test Engineer :** Martin Li, Varus Wang, Light Wang

# 16. Uncertainty Assessment

Per KDB 865664 D01 SAR measurement 100MHz to 6GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be ≤ 30%, for a confidence interval of k = 2. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. For this device, the highest measured 1-g SAR is less 1.5W/kg. Therefore, the measurement uncertainty table is not required in this report.

# 17. References

[1] FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”

[2] ANSI/IEEE Std. C95.1-1992, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, September 1992

[3] IEEE Std. 1528-2013, “IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, Sep 2013

[4] SPEAG DASY System Handbook

[5] FCC KDB 865664 D01 v01r04, "SAR Measurement Requirements for 100 MHz to 6 GHz", Aug 2015.

[6] FCC KDB 865664 D02 v01r02, “RF Exposure Compliance Reporting and Documentation Considerations” Oct 2015.

[7] FCC KDB 447498 D01 v06, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, Oct 2015

[8] FCC KDB 248227 D01 v02r02, “SAR Guidance for IEEE 802.11 (WiFi) Transmitters”, Oct 2015.

------THE END------