

SAR TEST REPORT

**FCC 47 CFR § 2.1093
IEEE Std 1528-2013**

for
802.11a/b/g/n/ac + BT 4.1 M.2 2230 Type Card

Model Name.: QCNFA364A

Prepared for:
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Issue Date: October 11, 2023**

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Revision History

| Rev. | Issue Date | Revisions | Effect Page | Revised By |
|------|-------------------|---------------------------------|-------------|--------------|
| 00 | November 14, 2022 | Initial Issue | ALL | Allison Chen |
| 01 | October 11, 2023 | See the following Note Rev.(01) | P.23 | Allison Chen |

Note:**Rev.(01)**

1. Modify conducted power for WIFI 2.4G in section 8.1.

Table of Contents

| | | |
|-----------|---|-----------|
| 1 | ATTESTATION OF TEST RESULTS | 4 |
| 2 | TEST SPECIFICATION, METHODS AND PROCEDURES | 5 |
| 3 | DEVICE UNDER TEST (DUT) INFORMATION..... | 6 |
| 3.1 | DUT DESCRIPTION | 6 |
| 3.2 | WIRELESS TECHNOLOGIES | 7 |
| 4 | SAR MEASUREMENT SYSTEM..... | 8 |
| 4.1 | SYSTEM COMPONENTS..... | 9 |
| 4.2 | SAR SCAN PROCEDURES..... | 12 |
| 5 | MEASUREMENT UNCERTAINTY | 14 |
| 6 | RF EXPOSURE CONDITIONS (TEST CONFIGURATIONS)..... | 15 |
| 6.1 | STANDALONE SAR TEST EXCLUSION CONSIDERATIONS | 15 |
| 6.2 | REQUIRED TEST CONFIGURATIONS | 17 |
| 7 | DIELECTRIC PROPERTY MEASUREMENTS & SYSTEM CHECK..... | 18 |
| 7.1 | DIELECTRIC PROPERTY MEASUREMENTS..... | 18 |
| 7.2 | SYSTEM CHECK | 21 |
| 8 | CONDUCTED OUTPUT POWER MEASUREMENTS..... | 23 |
| 8.1 | WI-FI 2.4GHZ (DTS BAND) | 23 |
| 8.2 | WI-FI 5GHZ (U-NII BANDS)..... | 24 |
| 8.3 | BLUETOOTH..... | 27 |
| 9 | MEASURED AND REPORTED (SCALED) SAR RESULTS..... | 29 |
| 9.1 | WI-FI (DTS BAND) | 29 |
| 9.2 | WI-FI (U-NII BAND) | 29 |
| 10 | SAR MEASUREMENT VARIABILITY | 30 |
| 11 | SIMULTANEOUS TRANSMISSION SAR ANALYSIS | 31 |
| 11.1 | SUM OF THE SAR FOR WI-FI & BT | 33 |
| 12 | EQUIPMENT LIST & CALIBRATION STATUS | 34 |
| 13 | FACILITIES | 35 |
| 14 | APPENDICES..... | 35 |

1 Attestation of Test Results

| | | | |
|---|--|-------|-----|
| Applicant Name | ENLI INCORPORATION | | |
| Model Name | QCNFA364A | | |
| Applicable Standards | FCC 47 CFR § 2.1093 Published RF exposure KDB procedures IEEE Std 1528-2013 | | |
| | SAR Limits (W/Kg) | | |
| Exposure Category | Peak spatial-average (1g of tissue) | | |
| General population | 1.6 | | |
| RF Exposure Conditions | Equipment Class - Highest Reported SAR (W/kg) | | |
| | DTS | NII | DSS |
| Body | 0.703 | 0.931 | 0 |
| Simultaneous TX | 1.388 | | |
| Receive EUT Date: | September 1, 2022 | | |
| Date Tested | September 14, 2022 to September 21, 2022 | | |
| Test Results | Pass | | |
| Compliance Certification Services Inc. , tested the above equipment in accordance with the requirements set forth in the above standards. Determination of compliance is based on the results of the compliance measurement,not taking into account measurement instrumentation uncertainty.All indications of Pass/Fail in this report are opinions expressed by Compliance Certification Services Inc, based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report. | | | |
| Approved & Released By: | Tested by: | | |
|  |  | | |
| Sky Zhou Asst. Section Manager Compliance Certification Services Inc. | Jack Yang Engineer Compliance Certification Services Inc. | | |

2 Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IEEE STD 1528- 2013, the following FCC Published RF exposure [KDB](#) procedures:

- 248227 D01 802.11 Wi-Fi SAR v02r02
- 447498 D01 General RF Exposure Guidance v06
- 616217 D04 SAR for laptop and tablets v01r02
- 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04
- 865664 D02 RF Exposure Reporting v01r02

In addition to the above, the following information was used:

- [TCB workshop](#) October, 2016; Page 7, RF Exposure Procedures (Bluetooth Duty Factor)

3 Device Under Test (DUT) Information

3.1 DUT Description

| | |
|----------------------|--|
| Applicant Name | ENLI INCORPORATION |
| Applicant Address | 4F., No. 42, Aly. 5, Ln. 12, Sec. 3, Bade Rd., Songshan Dist., TAIPEI, Taiwan |
| Manufacturer Name | ENLI INCORPORATION |
| Manufacturer Address | 4F., No. 42, Aly. 5, Ln. 12, Sec. 3, Bade Rd., Songshan Dist., TAIPEI, Taiwan |
| Product | 802.11a/b/g/n/ac + BT 4.1 M.2 2230 Type Card |
| Trade Name | N/A |
| Model No. | QCNFA364A |
| Model Discrepancy | N/A |
| Device Dimension | Overall (Length x Width): 299 mm x 197 mm Overall Diagonal: 358 mm Display Diagonal: 305 mm |
| Back Cover | <input checked="" type="checkbox"/> Normal Battery Cover <input type="checkbox"/> Normal Battery Cover with NFC <input type="checkbox"/> Wireless Charger Battery Cover <input type="checkbox"/> Wireless Charger Battery Cover with NFC <input type="checkbox"/> The Back Cover is not removable. |
| Battery Options | <input checked="" type="checkbox"/> Standard – Lithium-ion battery, Rating 11.1Vdc, 2860mAH <input type="checkbox"/> Extended (large capacity) <input type="checkbox"/> The rechargeable battery is not user accessible. |
| Hardware Version | DMA-BA25 A102-2 |
| Software Version | Microsoft Windows 10 2019 LTSC |
| Host Model Name | MIT-W102 |
| Sample Stage | PVT |

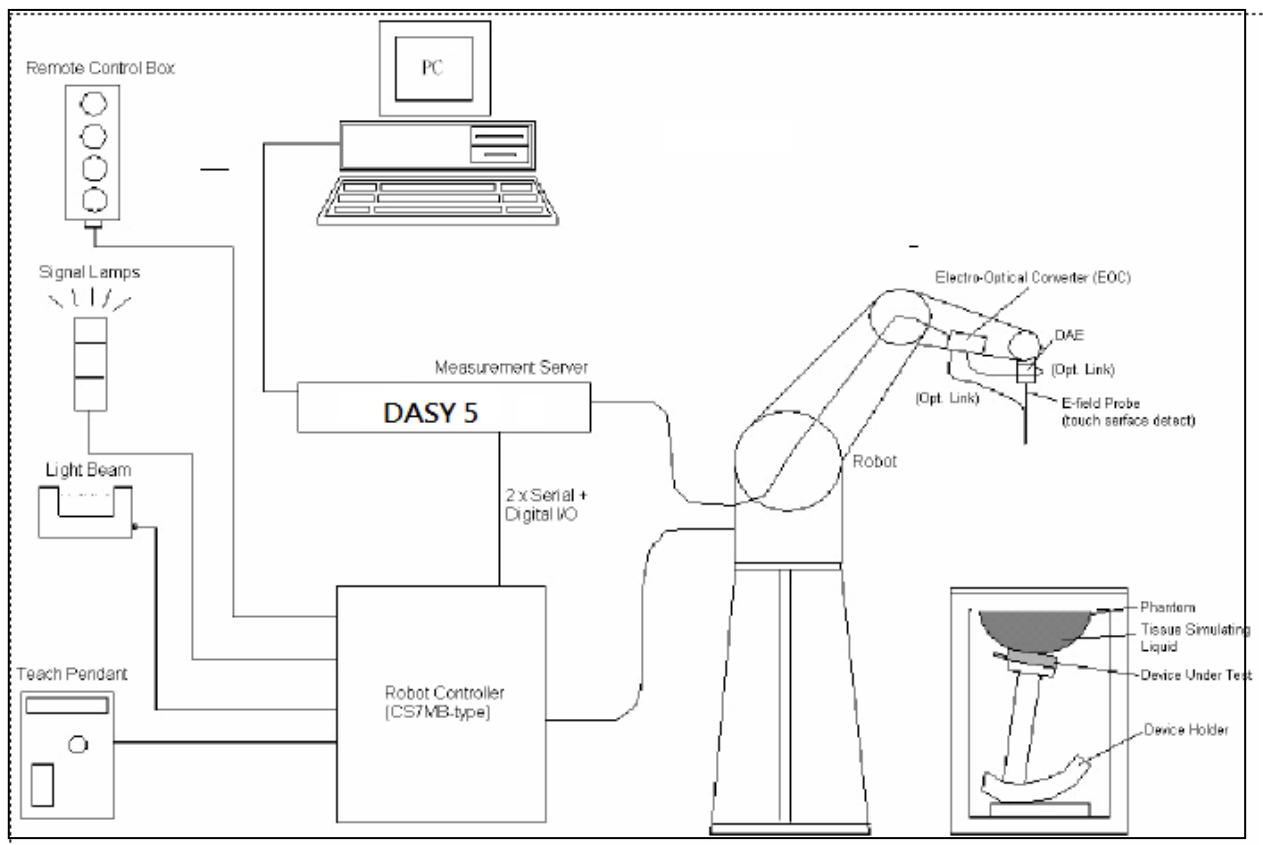
3.2 Wireless Technologies

| Wireless technologies | Frequency bands | Peak Antenna Gain (dBi) | Operating mode | Duty Cycle used for SAR testing |
|-----------------------|--|------------------------------------|------------------|---------------------------------|
| Wi-Fi (Main) | 2.4 GHz | 2.94 | 802.11b | 99.2% (802.11b) |
| | | | 802.11g | 95.25% (802.11g) |
| | | | 802.11n (HT20) | 95.01% (802.11n 20MHz BW) |
| | | | 802.11n (HT40) | 89.94% (802.11n 40MHz BW) |
| | 5.2 GHz 5.3 GHz 5.5 GHz 5.8 GHz | 2.96 2.93 2.69 2.88 | 802.11a | 95.64% (802.11a) |
| | | | 802.11n (HT20) | 95.34% (802.11n/ac 20MHz BW) |
| | | | 802.11n (HT40) | 90.98% (802.11n/ac 40MHz BW) |
| | | | 802.11ac (VHT20) | 83.15% (802.11ac 80MHz BW) |
| | | | 802.11ac (VHT40) | |
| | | | 802.11ac (VHT80) | |
| Antenna Specification | Brand Name | JOINSOON ELECTRONICS MFG. CO., LTD | | |
| | Type | PIFA | | |
| | Parts Number | 1510-0137-0022 | | |
| Wi-Fi (Aux) | 2.4 GHz | 2.91 | 802.11b | 99.2% (802.11b) |
| | | | 802.11g | 95.25% (802.11g) |
| | | | 802.11n (HT20) | 95.01% (802.11n 20MHz BW) |
| | | | 802.11n (HT40) | 89.94% (802.11n 40MHz BW) |
| | 5.2 GHz 5.3 GHz 5.5 GHz 5.8 GHz | 2.82 2.82 2.25 2.84 | 802.11a | 95.64% (802.11a) |
| | | | 802.11n (HT20) | 95.34% (802.11n/ac 20MHz BW) |
| | | | 802.11n (HT40) | 90.98% (802.11n/ac 40MHz BW) |
| | | | 802.11ac (VHT20) | 83.15% (802.11ac 80MHz BW) |
| | | | 802.11ac (VHT40) | |
| | | | 802.11ac (VHT80) | |
| Bluetooth | 2.4 GHz | 2.91 | BR,EDR,LE | 77.13% |
| Antenna Specification | Brand Name | JOINSOON ELECTRONICS MFG. CO., LTD | | |
| | Type | PIFA | | |
| | Parts Number | 1510-0137-0023 | | |
| NFC | 13.56MHz | PIFA | | N/A1 |

Notes:

1. Measured Duty Cycle is not required due to SAR test exemption.
2. The sample selected for test was prototype that representative to production product and was provided by manufacturer
3. Variant information between/among model numbers / trademarks is provided by the applicant, test results of this report are applicable to the sample EUT received of main test model name.
4. Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received

4 SAR Measurement System



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

- A standard high precision 6-axis robot (Staubli RX family) with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
- 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 between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected 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.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 7 or Windows XP.
- DASY software version: NEO52 D10.3 S14.6.13.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand and right-hand usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing validating the proper functioning of the system.

4.1 System Components

DASY5 Measurement Server



The DASY5 measurement server is based on a PC/104 CPU board with a 166MHz low-power Pentium, 32MB chip disk and 64MB RAM. The necessary circuits for communication with either the DAE4 electronic box as well as the 16-bit AD-converter system for optical detection and digital I/O interface are contained on the DASY5 I/O-board, which is directly connected to the PC/104 bus of the CPU board. The measurement server performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation.



The PC-operating system cannot interfere with these time critical processes. All connections are supervised by a watchdog, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements. Furthermore, the measurement server is equipped with two expansion slots which are reserved for future applications. Please note that the expansion slots do not have a standardized pinout and therefore only the expansion cards provided by SPEAG can be inserted. Expansion cards from any other supplier could seriously damage the measurement server. Calibration: No calibration required.

Data Acquisition Electronics (DAE)



The data acquisition electronics (DAE4) 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 mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection. The input impedance of the DAE4 box is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

EX3DV4 Isotropic E-Field Probe for Dosimetric Measurements

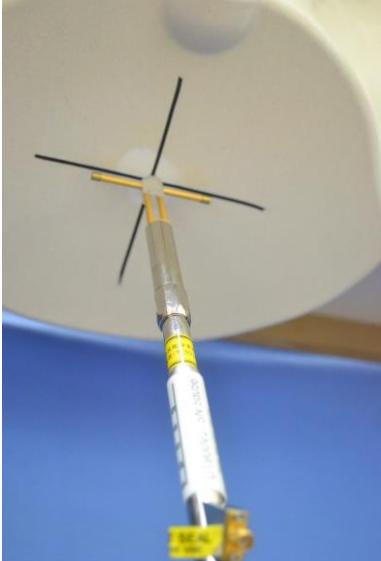
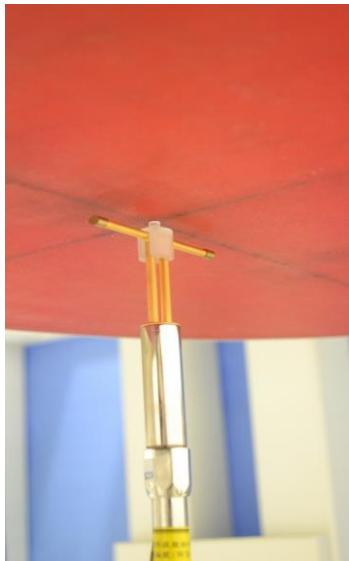
| | |
|---|---|
|  | Construction: Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE) Calibration: Basic Broad Band Calibration in air: 10-3000 MHz. Conversion Factors (CF) for HSL 900 and HSL 1800 CF-Calibration for other liquids and frequencies upon request. Frequency: 10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz) Directivity: ± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in HSL (rotation normal to probe axis) Dynamic Range: 10 μ W/g to > 100 mW/g; Linearity: ± 0.2 dB (noise: typically < 1 μ W/g) Dimensions: Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Distance from probe tip to dipole centers: 1 mm Application: High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%. |
|---|---|

SAM Phantom

| | |
|---|--|
|  | Construction: The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE1528: 2013. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot. Shell Thickness: 2 ± 0.2 mm Filling Volume: Approx. 25 liters Dimensions: Height: 810mm; Length: 1000mm; Width: 500mm |
|---|--|

ELI Phantom

| | |
|---|---|
|  | Construction: Phantom 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 the latest draft of the standard IEEE1528: 2013 and all known tissue simulating liquids. ELI4 has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is supported by software version DASY5 and higher and is compatible with all SPEAG dosimetric probes and dipoles Shell Thickness: 2.0 ± 0.2 mm (sagging: <1%) Filling Volume: Approx. 25 liters Dimensions: Major ellipse axis: 600 mm Minor axis: 400 mm 500mm |
|---|---|

| Device Holder for SAM Twin Phantom | |
|---|---|
|  | Construction: In combination with the Twin SAM Phantom V4.0 or Twin SAM, the Mounting Device (made from POM) enables the rotation of the mounted transmitter in spherical coordinates, whereby the rotation point is the ear opening. The devices can be easily and accurately positioned according to IEC, IEEE, CENELEC, FCC or other specifications. The device holder can be locked at different phantom locations (left head, right head, and flat phantom). |
| System Validation Kits for SAM Phantom | |
|  | Construction: Symmetrical dipole with 1/4 balun. Enables measurement of feedpoint impedance with NWA. Matched for use near flat phantoms filled with brain simulating solutions. Includes distance holder and tripod adaptor. Frequency: 2450, 5300, 5600, 5800 MHz Return loss: > 20 dB at specified validation position Power capability: > 100 W (f < 1GHz); > 40 W (f > 1GHz) Dimensions: D2450V2: dipole length: 51.5 mm; overall height: 290 mm D5GHzV2: dipole length: 20.6 mm; overall height: 300 mm |
| System Validation Kits for ELI phantom | |
|  | Construction: Symmetrical dipole with 1/4 balun. Enables measurement of feedpoint impedance with NWA. Matched for use near flat phantoms filled with brain simulating solutions. Includes distance holder and tripod adaptor. Frequency: 2450, 5300, 5600, 5800 MHz Return loss: > 20 dB at specified validation position Power capability: > 100 W (f < 1GHz); > 40 W (f > 1GHz) Dimensions: D2450V2: dipole length: 51.5 mm; overall height: 290 mm D5GHzV2: dipole length: 20.6 mm; overall height: 300 mm |

4.2 SAR Scan Procedures

Step 1: Power Reference Measurement

The reference and drift jobs are useful jobs for monitoring the power drift of the device under test in the batch process. Both jobs measure the field at a specified reference position, at a selectable distance from the phantom surface. The reference position can be either the selected section's grid reference point or a user point in this section. The reference job projects the selected point onto the phantom surface, orients the probe perpendicularly to the surface, and approaches the surface using the selected detection method.

Step 2: 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 locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE1528 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 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: Δx_{Zoom} , Δy_{Zoom} | ≤ 2 GHz: ≤ 15 mm $2 - 3$ GHz: ≤ 12 mm | 3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm |
| When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device. | | |

Step 3: Zoom Scan

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures points (refer to table below) within a cube whose 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 g and 10 g and displays these values next to the job's label.

- Zoom Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

| | | ≤ 3 GHz | > 3 GHz |
|--|---|---|--|
| Maximum zoom scan spatial resolution: $\Delta x_{\text{Zoom}}, \Delta y_{\text{Zoom}}$ | | $\leq 2 \text{ GHz: } \leq 8 \text{ mm}$ $2 - 3 \text{ GHz: } \leq 5 \text{ mm}$ | $3 - 4 \text{ GHz: } \leq 5 \text{ mm}$ $4 - 6 \text{ GHz: } \leq 4 \text{ mm}$ |
| Maximum zoom scan spatial resolution, normal to phantom surface | Uniform grid: $\Delta z_{\text{Zoom}}(n)$ | $\leq 5 \text{ mm}$ | $3 - 4 \text{ GHz: } \leq 4 \text{ mm}$ $4 - 5 \text{ GHz: } \leq 3 \text{ mm}$ $5 - 6 \text{ GHz: } \leq 2 \text{ mm}$ |
| | graded grid $\Delta z_{\text{Zoom}}(1):$ between 1 st two points closest to phantom surface $\Delta z_{\text{Zoom}}(n>1):$ between subsequent points | $\leq 4 \text{ mm}$ | $3 - 4 \text{ GHz: } \leq 3 \text{ mm}$ $4 - 5 \text{ GHz: } \leq 2.5 \text{ mm}$ $5 - 6 \text{ GHz: } \leq 2 \text{ mm}$ |
| Maximum zoom scan volume | x, y, z | $\geq 30 \text{ mm}$ | $3 - 4 \text{ GHz: } \geq 28 \text{ mm}$ $4 - 5 \text{ GHz: } \geq 25 \text{ mm}$ $5 - 6 \text{ GHz: } \geq 22 \text{ mm}$ |

Step 4: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1

Step 5: Z-Scan (FCC only)

The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation the extrapolated distance should not be larger than the step size in Z-direction

5 Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, 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 $\leq 30\%$, for a confidence interval of $k = 2$. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE1528: 2013 is not required in SAR reports submitted for equipment approval.

Therefore, the measurement uncertainty is not required.

6 RF Exposure Conditions (Test Configurations)

Refer to Appendixes 1 for the specific details of the antenna-to-antenna and antenna-to-edge(s) distances.

6.1 Standalone SAR Test Exclusion Considerations

Since the *Dedicated Host Approach* is applied, the standalone SAR test exclusion procedure in KDB 447498 is applied in conjunction with KDB 616217 § 4.3 to determine the minimum test separation distance:

- When the separation distance from the antenna to an adjacent edge is ≤ 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.
- When the separation distance from the antenna to an adjacent edge is > 5 mm, the actual antenna-to-edge separation distance is applied to determine SAR test exclusion.

SAR Test Exclusion Calculations for WLAN

Antennas < 50mm to adjacent edges

| Tx Interface | Frequency (MHz) | Output Power | | Separation Distances (mm) | | | | | Calculated Threshold Value | | | | |
|---------------------|-----------------|--------------|----|---------------------------|--------|--------|--------|--------|----------------------------|-------------------|---------|------------------|-------------------|
| | | dBm | mW | Rear | Edge 1 | Edge 2 | Edge 3 | Edge 4 | Rear | Edge 1 | Edge 2 | Edge 3 | Edge 4 |
| Main Antenna | | | | | | | | | | | | | |
| Wi-Fi 2.4 GHz | 2462 | 18.50 | 71 | 5.6 | 157.24 | 257.99 | 13.24 | 25.99 | 18.6 -MEASURE- | > 50 mm | > 50 mm | 8.6 -MEASURE- | 4.3 -MEASURE- |
| Wi-Fi 5.2 GHz | 5240 | 13.50 | 22 | 5.6 | 157.24 | 257.99 | 13.24 | 25.99 | 8.4 -MEASURE- | > 50 mm | > 50 mm | 3.9 -MEASURE- | 1.9 -EXEMPT- |
| Wi-Fi 5.3 GHz | 5320 | 13.50 | 22 | 5.6 | 157.24 | 257.99 | 13.24 | 25.99 | 8.5 -MEASURE- | > 50 mm | > 50 mm | 3.9 -MEASURE- | 2 -EXEMPT- |
| Wi-Fi 5.5 GHz | 5700 | 11.00 | 13 | 5.6 | 157.24 | 257.99 | 13.24 | 25.99 | 5.2 -MEASURE- | > 50 mm | > 50 mm | 2.4 -EXEMPT- | 1.2 -EXEMPT- |
| Wi-Fi 5.8 GHz | 5825 | 12.00 | 16 | 5.6 | 157.24 | 257.99 | 13.24 | 25.99 | 6.4 -MEASURE- | > 50 mm | > 50 mm | 3 -EXEMPT- | 1.5 -EXEMPT- |
| Aux Antenna | | | | | | | | | | | | | |
| Wi-Fi 2.4 GHz | 2462 | 19.50 | 89 | 16.7 | 10.69 | 282.67 | 164.29 | 6.62 | 8.2 -MEASURE- | 12.7 -MEASURE- | > 50 mm | > 50 mm | 19.9 -MEASURE- |
| Wi-Fi 5.2 GHz | 5240 | 16.00 | 40 | 16.7 | 10.69 | 282.67 | 164.29 | 6.62 | 5.4 -MEASURE- | 8.3 -MEASURE- | > 50 mm | > 50 mm | 13.1 -MEASURE- |
| Wi-Fi 5.3 GHz | 5320 | 16.00 | 40 | 16.7 | 10.69 | 282.67 | 164.29 | 6.62 | 5.4 -MEASURE- | 8.4 -MEASURE- | > 50 mm | > 50 mm | 13.2 -MEASURE- |
| Wi-Fi 5.5 GHz | 5700 | 16.00 | 40 | 16.7 | 10.69 | 282.67 | 164.29 | 6.62 | 5.6 -MEASURE- | 8.7 -MEASURE- | > 50 mm | > 50 mm | 13.6 -MEASURE- |
| Wi-Fi 5.8 GHz | 5825 | 15.00 | 32 | 16.7 | 10.69 | 282.67 | 164.29 | 6.62 | 4.5 -MEASURE- | 7 -MEASURE- | > 50 mm | > 50 mm | 11 -MEASURE- |
| Bluetooth | 2480 | 4.00 | 3 | 16.7 | 10.69 | 282.67 | 164.29 | 6.62 | 0.3 -EXEMPT- | 0.4 -EXEMPT- | > 50 mm | > 50 mm | 0.7 -EXEMPT- |

Note(s):

According to KDB 447498, if the calculated threshold value is > 3 then SAR testing is required.

Report No.: TMWK2208003444KS

SAR Test Exclusion Calculations for WLAN

Antennas > 50mm to adjacent edges

| Tx Interface | Frequency (MHz) | Output Power | | Separation Distances (mm) | | | | | Calculated Threshold Value | | | | |
|---------------------|-----------------|--------------|----|---------------------------|--------|--------|--------|--------|----------------------------|-----------------------|-----------------------|-----------------------|---------|
| | | dBm | mW | Rear | Edge 1 | Edge 2 | Edge 3 | Edge 4 | Rear | Edge 1 | Edge 2 | Edge 3 | Edge 4 |
| Main Antenna | | | | | | | | | | | | | |
| Wi-Fi 2.4 GHz | 2462 | 18.50 | 71 | 5.6 | 157.24 | 257.99 | 13.24 | 25.99 | < 50 mm | 1168 mW -EXEMPT- | 2175.5 mW -EXEMPT- | < 50 mm | < 50 mm |
| Wi-Fi 5.2 GHz | 5240 | 13.50 | 22 | 5.6 | 157.24 | 257.99 | 13.24 | 25.99 | < 50 mm | 1137.9 mW -EXEMPT- | 2145.4 mW -EXEMPT- | < 50 mm | < 50 mm |
| Wi-Fi 5.3 GHz | 5320 | 13.50 | 22 | 5.6 | 157.24 | 257.99 | 13.24 | 25.99 | < 50 mm | 1137.4 mW -EXEMPT- | 2144.9 mW -EXEMPT- | < 50 mm | < 50 mm |
| Wi-Fi 5.5 GHz | 5700 | 11.00 | 13 | 5.6 | 157.24 | 257.99 | 13.24 | 25.99 | < 50 mm | 1135.2 mW -EXEMPT- | 2142.7 mW -EXEMPT- | < 50 mm | < 50 mm |
| Wi-Fi 5.8 GHz | 5825 | 12.00 | 16 | 5.6 | 157.24 | 257.99 | 13.24 | 25.99 | < 50 mm | 1134.6 mW -EXEMPT- | 2142.1 mW -EXEMPT- | < 50 mm | < 50 mm |
| Aux Antenna | | | | | | | | | | | | | |
| Wi-Fi 2.4 GHz | 2462 | 19.50 | 89 | 16.7 | 10.69 | 282.67 | 164.29 | 6.62 | < 50 mm | < 50 mm | 2422.3 mW -EXEMPT- | 1238.5 mW -EXEMPT- | < 50 mm |
| Wi-Fi 5.2 GHz | 5240 | 16.00 | 40 | 16.7 | 10.69 | 282.67 | 164.29 | 6.62 | < 50 mm | < 50 mm | 2392.2 mW -EXEMPT- | 1208.4 mW -EXEMPT- | < 50 mm |
| Wi-Fi 5.3 GHz | 5320 | 16.00 | 40 | 16.7 | 10.69 | 282.67 | 164.29 | 6.62 | < 50 mm | < 50 mm | 2391.7 mW -EXEMPT- | 1207.9 mW -EXEMPT- | < 50 mm |
| Wi-Fi 5.5 GHz | 5700 | 16.00 | 40 | 16.7 | 10.69 | 282.67 | 164.29 | 6.62 | < 50 mm | < 50 mm | 2389.5 mW -EXEMPT- | 1205.7 mW -EXEMPT- | < 50 mm |
| Wi-Fi 5.8 GHz | 5825 | 15.00 | 32 | 16.7 | 10.69 | 282.67 | 164.29 | 6.62 | < 50 mm | < 50 mm | 2388.9 mW -EXEMPT- | 1205.1 mW -EXEMPT- | < 50 mm |
| Bluetooth | 2480 | 4.00 | 3 | 16.7 | 10.69 | 282.67 | 164.29 | 6.62 | < 50 mm | < 50 mm | 2422 mW -EXEMPT- | 1238.2 mW -EXEMPT- | < 50 mm |

Note(s):

According to KDB 447498, if the calculated Power threshold is less than the output power then SAR testing is required.

6.2 Required Test Configurations

The table below identifies the standalone test configurations required for this device according to the findings in Section 6.1:

| Test Configurations | Rear | Edge 1 | Edge 2 | Edge 3 | Edge 4 |
|---------------------|------|--------|--------|--------|--------|
| Main Antenna | | | | | |
| Wi-Fi 2.4 GHz | Yes | No | No | Yes | Yes |
| Wi-Fi 5.2 GHz | Yes | No | No | Yes | No |
| Wi-Fi 5.3 GHz | Yes | No | No | Yes | No |
| Wi-Fi 5.5 GHz | Yes | No | No | No | No |
| Wi-Fi 5.8 GHz | Yes | No | No | No | No |

| Test Configurations | Rear | Edge 1 | Edge 2 | Edge 3 | Edge 4 |
|---------------------|------|--------|--------|--------|--------|
| Aux Antenna | | | | | |
| Wi-Fi 2.4 GHz | Yes | Yes | No | No | Yes |
| Wi-Fi 5.2 GHz | Yes | Yes | No | No | Yes |
| Wi-Fi 5.3 GHz | Yes | Yes | No | No | Yes |
| Wi-Fi 5.5 GHz | Yes | Yes | No | No | Yes |
| Wi-Fi 5.8 GHz | Yes | Yes | No | No | Yes |
| Bluetooth | No | No | No | No | No |

Note(s):

Yes = Testing is required.

No = Testing is not required.

7 Dielectric Property Measurements & System Check

7.1 Dielectric Property Measurements

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within $\pm 2^\circ\text{C}$ of the temperature when the tissue parameters are characterized.

The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.

Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

The dielectric constant (ϵ_r) and conductivity (σ) of typical tissue-equivalent media recipes are expected to be within $\pm 5\%$ of the required target values; but for SAR measurement systems that have implemented the SAR error compensation algorithms documented in IEEE Std 1528-2013, to automatically compensate the measured SAR results for deviations between the measured and required tissue dielectric parameters, the tolerance for ϵ_r and σ may be relaxed to $\pm 10\%$. This is limited to frequencies ≤ 3 GHz.

Tissue Dielectric Parameters

FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz

| Target Frequency (MHz) | Head | | Body | |
|------------------------|--------------|----------------|--------------|----------------|
| | ϵ_r | σ (S/m) | ϵ_r | σ (S/m) |
| 150 | 52.3 | 0.76 | 61.9 | 0.80 |
| 300 | 45.3 | 0.87 | 58.2 | 0.92 |
| 450 | 43.5 | 0.87 | 56.7 | 0.94 |
| 835 | 41.5 | 0.90 | 55.2 | 0.97 |
| 900 | 41.5 | 0.97 | 55.0 | 1.05 |
| 915 | 41.5 | 0.98 | 55.0 | 1.06 |
| 1450 | 40.5 | 1.20 | 54.0 | 1.30 |
| 1610 | 40.3 | 1.29 | 53.8 | 1.40 |
| 1800 – 2000 | 40.0 | 1.40 | 53.3 | 1.52 |
| 2450 | 39.2 | 1.80 | 52.7 | 1.95 |
| 3000 | 38.5 | 2.40 | 52.0 | 2.73 |
| 5000 | 36.2 | 4.45 | 49.3 | 5.07 |
| 5100 | 36.1 | 4.55 | 49.1 | 5.18 |
| 5200 | 36.0 | 4.66 | 49.0 | 5.30 |
| 5300 | 35.9 | 4.76 | 48.9 | 5.42 |
| 5400 | 35.8 | 4.86 | 48.7 | 5.53 |
| 5500 | 35.6 | 4.96 | 48.6 | 5.65 |
| 5600 | 35.5 | 5.07 | 48.5 | 5.77 |
| 5700 | 35.4 | 5.17 | 48.3 | 5.88 |
| 5800 | 35.3 | 5.27 | 48.2 | 6.00 |

IEEE Std 1528-2013

Refer to Table 3 within the IEEE Std 1528-2013

Typical Composition of Ingredients for Liquid Tissue Phantoms

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.

| Ingredients (% by weight) | Frequency (MHz) | | | | | | | | | |
|------------------------------|-----------------|-------|-------|------|-------|-------|-------|------|------|------|
| | 450 | | 835 | | 915 | | 1900 | | 2450 | |
| Tissue Type | Head | Body | Head | Body | Head | Body | Head | Body | Head | Body |
| Water | 38.56 | 51.16 | 41.45 | 52.4 | 41.05 | 56.0 | 54.9 | 40.4 | 62.7 | 73.2 |
| Salt (NaCl) | 3.95 | 1.49 | 1.45 | 1.4 | 1.35 | 0.76 | 0.18 | 0.5 | 0.5 | 0.04 |
| Sugar | 56.32 | 46.78 | 56.0 | 45.0 | 56.5 | 41.76 | 0.0 | 58.0 | 0.0 | 0.0 |
| HEC | 0.98 | 0.52 | 1.0 | 1.0 | 1.0 | 1.21 | 0.0 | 1.0 | 0.0 | 0.0 |
| Bactericide | 0.19 | 0.05 | 0.1 | 0.1 | 0.1 | 0.27 | 0.0 | 0.1 | 0.0 | 0.0 |
| Triton X-100 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 36.8 | 0.0 |
| DGBE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 44.92 | 0.0 | 0.0 | 26.7 |
| Dielectric Constant | 43.42 | 58.0 | 42.54 | 56.1 | 42.0 | 56.8 | 39.9 | 54.0 | 39.8 | 52.5 |
| Conductivity (S/m) | 0.85 | 0.83 | 0.91 | 0.95 | 1.0 | 1.07 | 1.42 | 1.45 | 1.88 | 1.78 |

alt: 99+% Pure Sodium Chloride

Sugar: 98+% Pure Sucrose

Water: De-ionized, 16 MΩ⁺ resistivity

HEC: Hydroxy thyl Cellulose

DGBE: 99+% Di(ethylene glycol) butyl ether, [2-(2-butoxyethoxy)ethanol]

Triton X-100 (ultra-pure): Polyethylene glycol mono [4-(1, 1, 3, 3-tetramethylbutyl)phenyl]ether

Simulating Liquids for 5 GHz, Manufactured by SPEAG

| Ingredients | (% by weight) |
|--------------------|---------------|
| Water | 78 |
| Mineral oil | 11 |
| Emulsifiers | 9 |
| Additives and Salt | 2 |

Dielectric Property Measurements Results:

| Date | Tissue Type | Frequency (MHz) | Relative Permittivity (ϵ_r) | | | Conductivity (σ) | | |
|-----------|-------------|-----------------|--|--------|-----------|---------------------------|--------|-----------|
| | | | Measured | Target | Delta (%) | Measured | Target | Delta (%) |
| 2022/9/14 | Head | 2400 | 39.99 | 39.30 | 1.76 | 1.70 | 1.76 | -3.41 |
| | | 2450 | 39.76 | 39.20 | 1.43 | 1.76 | 1.80 | -2.39 |
| | | 2480 | 39.64 | 39.16 | 1.23 | 1.80 | 1.83 | -2.02 |
| 2022/9/14 | Head | 5250 | 34.62 | 35.95 | -3.70 | 4.61 | 4.71 | -2.08 |
| | | 5300 | 34.48 | 35.90 | -3.96 | 4.65 | 4.76 | -2.37 |
| | | 5350 | 34.47 | 35.85 | -3.85 | 4.77 | 4.81 | -0.87 |
| 2022/9/15 | Head | 5500 | 35.11 | 35.65 | -1.51 | 4.99 | 4.97 | 0.50 |
| | | 5600 | 34.82 | 35.50 | -1.92 | 5.07 | 5.07 | 0.04 |
| | | 5720 | 34.53 | 35.38 | -2.40 | 5.30 | 5.19 | 2.02 |
| 2022/9/16 | Head | 5500 | 36.00 | 35.65 | 0.98 | 4.98 | 4.97 | 0.32 |
| | | 5600 | 35.83 | 35.50 | 0.93 | 5.06 | 5.07 | -0.22 |
| | | 5720 | 35.58 | 35.38 | 0.57 | 5.29 | 5.19 | 1.91 |
| 2022/9/16 | Head | 5720 | 35.58 | 35.38 | 0.57 | 5.29 | 5.19 | 1.91 |
| | | 5750 | 35.61 | 35.35 | 0.74 | 5.27 | 5.22 | 0.86 |
| | | 5850 | 35.39 | 35.25 | 0.40 | 5.29 | 5.32 | -0.58 |

7.2 System Check

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

System Performance Check Measurement Conditions

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ± 0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm for measurements > 3 GHz.
- The DASY system with an E-Field Probe was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 15 mm (below 1 GHz) and 10 mm (above 1 GHz) from dipole center to the simulating liquid surface.
- The coarse grid with a grid spacing of 15 mm was aligned with the dipole.
For 5 GHz band - The coarse grid with a grid spacing of 10 mm was aligned with the dipole.
- Special 7x7x7 (below 3 GHz) and/or 8x8x7 (above 3 GHz) fine cube
- Distance between probe sensors and phantom surface was set to 2 mm.
- The dipole input power (forward power) was 250 mW (below 2GHz) and 100 mW
- The results are normalized to 1 W input power.

System Check Results

The 1-g and 10-g SAR measured with a reference dipole, using the required tissue-equivalent medium at the test frequency, must be within $\pm 10\%$ of the manufacturer calibrated dipole SAR target. Refer to Appendix 2 for the SAR System Check Plots.

| Date | Tissue Type | Dipole S/N | Input Power (mW) | Measured 1g SAR (W/kg) | Targeted 1g SAR (W/kg) | Normalized 1g SAR (W/kg) | Delta 1g ± 10 (%) | Measured 10g SAR (W/kg) | Targeted 10g SAR (W/kg) | Normalized 10g SAR (W/kg) | Delta 10g ± 10 (%) | Plot No. |
|-----------|-------------|-------------------|------------------|------------------------|------------------------|--------------------------|-----------------------|-------------------------|-------------------------|---------------------------|------------------------|----------|
| 2022/9/14 | Head | D2450V2-727 | 250 | 12.60 | 52.80 | 50.4 | -4.55 | 5.82 | 25.00 | 23.28 | -6.88 | 1 |
| 2022/9/14 | Head | D6GHzV2-1023-5250 | 100 | 8.24 | 81.00 | 82.4 | 1.73 | 2.37 | 23.10 | 23.7 | 2.60 | 2 |
| 2022/9/15 | Head | D6GHzV2-1023-5600 | 100 | 7.97 | 84.40 | 79.7 | -5.57 | 2.26 | 23.80 | 22.6 | -5.04 | 3 |
| 2022/9/16 | Head | D6GHzV2-1023-5600 | 100 | 8.14 | 84.40 | 81.4 | -3.55 | 2.32 | 23.80 | 23.2 | -2.52 | 4 |
| 2022/9/16 | Head | D6GHzV2-1023-5750 | 100 | 8.33 | 81.00 | 83.3 | 2.84 | 2.38 | 22.90 | 23.8 | 3.93 | 5 |

8 Conducted Output Power Measurements

8.1 Wi-Fi 2.4GHz (DTS Band)

The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures.

SAR Test reduction was applied from KDB 248227 guidance, Sec. 2.1, b), 1) 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 802.11g/n/ac/ax mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band. Additional output power measurements were not deemed necessary.

SAR testing is not required for OFDM mode(s) 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.

Measured Results

| Band | Mode | Data Rate | Ch # | Freq. (MHz) | Meas. Avg Pwr (dBm) | | Tune-up Limit (dBm) | | SAR Test (Y/Yes/No) | |
|--------------|----------------|-----------|------|-------------|---------------------|--------------|---------------------|--------------|---------------------|--------------|
| | | | | | Chain 0 Aux | Chain 1 Main | Chain 0 Aux | Chain 1 Main | Chain 0 Aux | Chain 1 Main |
| 2.4GHz (DTS) | 802.11b | 1 Mbps | 1 | 2412 | 18.72 | 17.76 | 19.5 | 18.5 | Yes | Yes |
| | | | 6 | 2437 | 18.13 | 17.42 | | | | |
| | | | 11 | 2462 | 18.75 | 18.03 | | | | |
| | | | 12 | 2467 | Not Required | | 18.0 | 18.0 | No | No |
| | | | 13 | 2472 | | | 11.0 | 11.0 | | |
| | 802.11g | 6 Mbps | 1 | 2412 | Not Required | | 19.0 | 18.0 | No | No |
| | | | 6 | 2437 | | | 12.0 | 12.0 | | |
| | | | 11 | 2462 | | | 2.5 | 2.5 | | |
| | | | 12 | 2467 | | | 12.0 | 12.0 | | |
| | | | 13 | 2472 | | | 2.5 | 2.5 | | |
| | 802.11n (HT20) | MCS0 | 1 | 2412 | Not Required | | 19.0 | 18.0 | No | No |
| | | | 6 | 2437 | | | 12.0 | 12.0 | | |
| | | | 11 | 2462 | | | 2.5 | 2.5 | | |
| | | | 12 | 2467 | | | 12.0 | 12.0 | | |
| | | | 13 | 2472 | | | 2.5 | 2.5 | | |
| | 802.11n (HT40) | MCS0 | 3 | 2422 | Not Required | | 18.5 | 17.5 | No | No |
| | | | 6 | 2437 | | | 12.0 | 12.0 | | |
| | | | 9 | 2452 | | | 2.5 | 2.5 | | |
| | | | 10 | 2457 | | | 12.0 | 12.0 | | |
| | | | 11 | 2462 | | | 2.5 | 2.5 | | |

Report No.: TMWK2208003444KS

8.2 Wi-Fi 5GHz (U-NII Bands)

The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures.

When the same transmission mode configurations have the same maximum output power on the same channel for the 802.11 a/g/n/ac modes, the channel in the lower order/sequence 802.11 mode (i.e. a, g, n then ac) is selected.

SAR Test reduction was applied from KDB 248227 guidance, Sec. 2.1, b), 1) 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 in the initial test configuration, for each frequency band. Additional output power measurements were not deemed necessary.

Report No.: TMWK2208003444KS

Measured Results

| Band | Mode | Data Rate | Ch # | Freq. (MHz) | Meas. Avg Pwr (dBm) | | Tune-up Limit (dBm) | | SAR Test (Yes/No) | |
|-------------------|------------------|-----------|------|-------------|---------------------|--------------|---------------------|--------------|-------------------|--------------|
| | | | | | Chain 0 Aux | Chain 1 Main | Chain 0 Aux | Chain 1 Main | Chain 0 Aux | Chain 1 Main |
| 5.2GHz (U-NII 1) | 802.11a | 6 Mbps | 36 | 5180 | 15.23 | 12.37 | 16.0 | 13.5 | No | No |
| | | | 40 | 5200 | 15.28 | 12.42 | | | | |
| | | | 44 | 5220 | 15.36 | 12.68 | | | | |
| | | | 48 | 5240 | 15.24 | 12.96 | | | | |
| | 802.11n (HT20) | MCS0 | 36 | 5180 | Not Required | | 15.5 | 13.0 | No | No |
| | | | 40 | 5200 | | | | | | |
| | | | 44 | 5220 | | | | | | |
| | | | 48 | 5240 | | | | | | |
| | 802.11ac (VHT20) | MCS0 | 36 | 5180 | Not Required | | 15.5 | 13.0 | No | No |
| | | | 40 | 5200 | | | | | | |
| | | | 44 | 5220 | | | | | | |
| | | | 48 | 5240 | | | | | | |
| | 802.11n (HT40) | MCS0 | 38 | 5190 | Not Required | | 15.5 | 13.0 | No | No |
| | | | 46 | 5230 | | | | | | |
| | 802.11ac (VHT40) | MCS0 | 38 | 5190 | Not Required | | 15.5 | 13.0 | No | No |
| | | | 46 | 5230 | | | | | | |
| | 802.11ac (VHT80) | MCS0 | 42 | 5210 | Not Required | | 15.5 | 13.0 | No | No |
| 5.3GHz (U-NII 2A) | 802.11a | 6 Mbps | 52 | 5260 | 15.16 | 12.84 | 16.0 | 13.5 | Yes | Yes |
| | | | 56 | 5280 | 15.12 | 12.58 | | | | |
| | | | 60 | 5300 | 15.09 | 12.31 | | | | |
| | | | 64 | 5320 | 15.07 | 12.42 | | | | |
| | 802.11n (HT20) | MCS0 | 52 | 5260 | Not Required | | 15.5 | 13.0 | No | No |
| | | | 56 | 5280 | | | | | | |
| | | | 60 | 5300 | | | | | | |
| | | | 64 | 5320 | | | | | | |
| | 802.11ac (VHT20) | MCS0 | 52 | 5260 | Not Required | | 15.5 | 13.0 | No | No |
| | | | 56 | 5280 | | | | | | |
| | | | 60 | 5300 | | | | | | |
| | | | 64 | 5320 | | | | | | |
| | 802.11n (HT40) | MCS0 | 54 | 5270 | Not Required | | 15.5 | 13.0 | No | No |
| | | | 62 | 5310 | | | | | | |
| | 802.11ac (VHT40) | MCS0 | 54 | 5270 | Not Required | | 15.5 | 13.0 | No | No |
| | | | 62 | 5310 | | | | | | |
| | 802.11ac (VHT80) | MCS0 | 58 | 5290 | Not Required | | 15.5 | 13.0 | No | No |

Measured Results (continued)

| Band | Mode | Data Rate | Ch # | Freq. (MHz) | Meas. Avg Pwr (dBm) | | Tune-up Limit (dBm) | | SAR Test (Yes/No) | |
|-------------------|------------------|-----------|------|-------------|---------------------|--------------|---------------------|--------------|-------------------|--------------|
| | | | | | Chain 0 Aux | Chain 1 Main | Chain 0 Aux | Chain 1 Main | Chain 0 Aux | Chain 1 Main |
| 5.5GHz (U-NII 2C) | 802.11a | 6 Mbps | 100 | 5500 | 15.29 | 9.76 | 16.0 | 11.0 | Yes | Yes |
| | | | 116 | 5580 | 14.83 | 9.89 | | | | |
| | | | 124 | 5620 | 14.87 | 10.21 | | | | |
| | | | 132 | 5660 | 15.18 | 10.49 | | | | |
| | | | 140 | 5700 | 15.37 | 10.56 | | | | |
| | | | 144 | 5720 | 15.48 | 10.41 | | | | |
| | 802.11n (HT20) | MCS0 | 100 | 5500 | Not Required | | 15.5 | 10.5 | No | No |
| | | | 116 | 5580 | | | | | | |
| | | | 124 | 5620 | | | | | | |
| | | | 132 | 5660 | | | | | | |
| | | | 140 | 5700 | | | | | | |
| | | | 144 | 5720 | | | | | | |
| | 802.11ac (VHT20) | MCS0 | 100 | 5500 | Not Required | | 15.5 | 10.5 | No | No |
| | | | 116 | 5580 | | | | | | |
| | | | 124 | 5620 | | | | | | |
| | | | 132 | 5660 | | | | | | |
| | | | 140 | 5700 | | | | | | |
| | | | 144 | 5720 | | | | | | |
| | 802.11n (HT40) | MCS0 | 102 | 5510 | Not Required | | 15.5 | 10.5 | No | No |
| | | | 110 | 5550 | | | | | | |
| | | | 118 | 5590 | | | | | | |
| | | | 126 | 5630 | | | | | | |
| | | | 134 | 5670 | | | | | | |
| | | | 142 | 5710 | | | | | | |
| | 802.11ac (VHT40) | MCS0 | 102 | 5510 | Not Required | | 15.5 | 10.5 | No | No |
| | | | 110 | 5550 | | | | | | |
| | | | 118 | 5590 | | | | | | |
| | | | 126 | 5630 | | | | | | |
| | | | 134 | 5670 | | | | | | |
| | | | 142 | 5710 | | | | | | |
| | 802.11ac (VHT80) | MCS0 | 106 | 5530 | Not Required | | 15.5 | 10.5 | No | No |
| | | | 122 | 5610 | | | | | | |
| | | | 138 | 5690 | | | | | | |
| 5.8GHz (U-NII 3) | 802.11a | 6 Mbps | 149 | 5745 | 14.28 | 11.21 | 15.0 | 12.0 | Yes | Yes |
| | | | 157 | 5785 | 14.24 | 10.86 | | | | |
| | | | 165 | 5825 | 14.15 | 10.74 | | | | |
| | 802.11n (HT20) | MCS0 | 149 | 5745 | Not Required | | 14.5 | 11.5 | No | No |
| | | | 157 | 5785 | | | | | | |
| | | | 165 | 5825 | | | | | | |
| | 802.11ac (VHT20) | MCS0 | 149 | 5745 | Not Required | | 14.5 | 11.5 | No | No |
| | | | 157 | 5785 | | | | | | |
| | | | 165 | 5825 | | | | | | |
| | 802.11n (HT40) | MCS0 | 151 | 5755 | Not Required | | 14.5 | 11.5 | No | No |
| | | | 159 | 5795 | | | | | | |
| | 802.11ac (VHT40) | MCS0 | 151 | 5755 | Not Required | | 14.5 | 11.5 | No | No |
| | | | 159 | 5795 | | | | | | |
| | 802.11ac (VHT80) | MCS0 | 155 | 5775 | Not Required | | 14.5 | 11.5 | No | No |

Report No.: TMWK2208003444KS

8.3 Bluetooth.

Average Power Measured Results

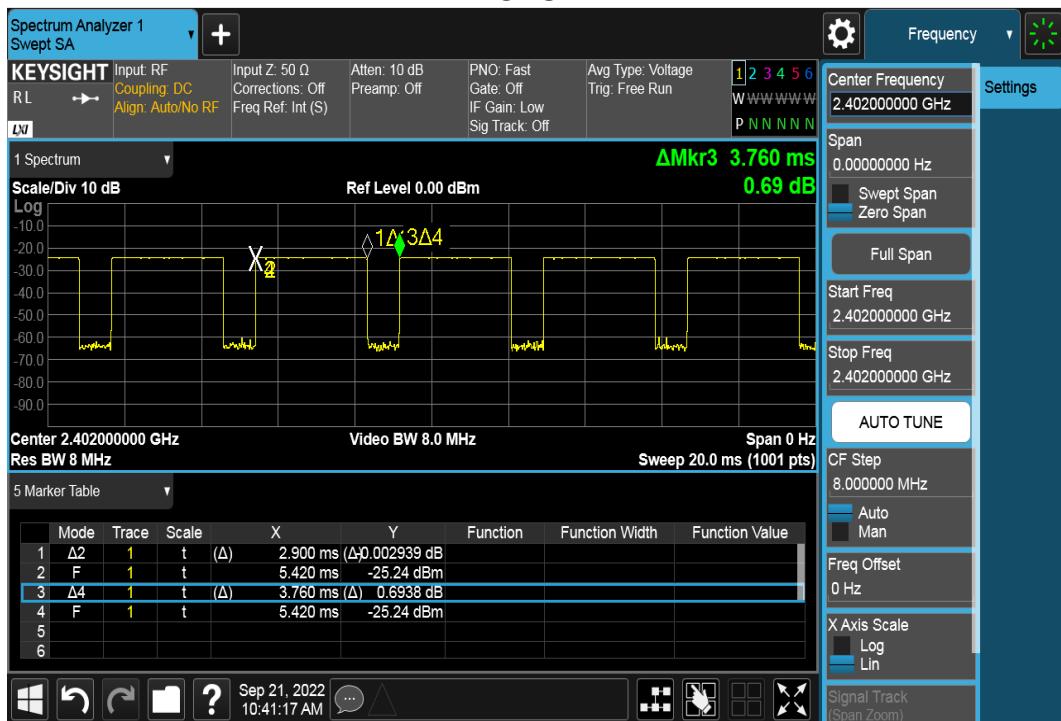
| Band (GHz) | Mode | Data Rate | Ch # | Freq. (MHz) | Meas. Avg Pwr (dBm) | Meas. Avg Pwr (mW) | Tune-up Limit (dBm) | SAR Test (Yes/No) |
|------------|--------------------|-----------|------|-------------|---------------------|--------------------|---------------------|-------------------|
| 2.4 | GFSK | 1 Mbps | 0 | 2402 | 2.36 | 1.72 | 4.0 | No |
| | | | 39 | 2441 | 3.02 | 2.00 | | |
| | | | 78 | 2480 | 3.57 | 2.28 | | |
| | EDR, $\pi/4$ DQPSK | 2 Mbps | 0 | 2402 | 1.13 | 1.30 | 2.5 | No |
| | | | 39 | 2441 | 1.82 | 1.52 | | |
| | | | 78 | 2480 | 2.14 | 1.64 | | |
| | EDR, 8-DPSK | 3 Mbps | 0 | 2402 | 0.43 | 1.10 | 2.0 | No |
| | | | 39 | 2441 | 0.91 | 1.23 | | |
| | | | 78 | 2480 | 1.27 | 1.34 | | |
| | LE, GFSK | 1 Mbps | 0 | 2402 | 0.21 | 1.05 | 1.5 | No |
| | | | 19 | 2440 | 0.57 | 1.14 | | |
| | | | 39 | 2480 | 0.92 | 1.24 | | |

Duty Factor Measured Results

| Mode | Type | T on (ms) | Period (ms) | Duty Cycle | Crest Factor (1/duty cycle) |
|------|------|-----------|-------------|------------|-----------------------------|
| GFSK | DH5 | 2.9 | 3.76 | 77.13% | 1.13 |

Duty Cycle plots

GFSK



9 Measured and Reported (Scaled) SAR Results

9.1 Wi-Fi (DTS Band)

| RF Exposure Conditions | Mode | Antenna | Dist. (mm) | Test Position | Ch #. | Freq. (MHz) | Duty Cycle | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|------------------------|---------|-------------|------------|---------------|-------|-------------|------------|---------------|-------|----------------|--------------|----------|
| | | | | | | | | Tune-up Limit | Meas. | Meas. | Scaled | |
| Body | 802.11b | SISO Main 1 | 0 | Rear | 11 | 2462 | 99.2% | 18.5 | 18.03 | 0.602 | 0.676 | 1 |
| | | | | Edge 3 | 11 | 2462 | 99.2% | 18.5 | 18.03 | 0.092 | 0.103 | |
| | | | | Edge 4 | 11 | 2462 | 99.2% | 18.5 | 18.03 | 0.023 | 0.026 | |
| Body | 802.11b | SISO Aux 0 | 0 | Rear | 11 | 2462 | 99.2% | 19.5 | 18.75 | 0.201 | 0.241 | |
| | | | | Edge 1 | 11 | 2462 | 99.2% | 19.5 | 18.75 | 0.106 | 0.127 | |
| | | | | Edge 4 | 11 | 2462 | 99.2% | 19.5 | 18.75 | 0.587 | 0.703 | 2 |

9.2 Wi-Fi (U-NII Band)

| RF Exposure Conditions | Frequency Band | Mode | Antenna | Dist. (mm) | Test Position | Ch #. | Freq. (MHz) | Duty Cycle | Power (dBm) | | 1-g SAR (W/kg) | | Plot No. |
|------------------------|----------------|---------|-------------|------------|---------------|-------|-------------|------------|---------------|-------|----------------|--------------|----------|
| | | | | | | | | | Tune-up Limit | Meas. | Meas. | Scaled | |
| Body | 5.3 (U-NII 2A) | 802.11a | SISO Main 1 | 0 | Rear | 52 | 5260 | 95.64% | 13.5 | 12.84 | 0.568 | 0.691 | 3 |
| | | | | | Edge 3 | 52 | 5260 | 95.64% | 13.5 | 12.84 | 0.153 | 0.186 | |
| Body | 5.3 (U-NII 2A) | 802.11a | SISO Aux 0 | 0 | Rear | 52 | 5260 | 95.64% | 16.0 | 15.16 | 0.181 | 0.230 | |
| | | | | | Edge 1 | 52 | 5260 | 95.64% | 16.0 | 15.16 | 0.437 | 0.554 | 4 |
| | | | | | Edge 4 | 52 | 5260 | 95.64% | 16.0 | 15.16 | 0.152 | 0.193 | |
| Body | 5.5 (U-NII 2C) | 802.11a | SISO Main 1 | 0 | Rear | 140 | 5700 | 95.64% | 11.0 | 10.56 | 0.364 | 0.421 | 5 |
| Body | 5.5 (U-NII 2C) | 802.11a | SISO Aux 0 | 0 | Rear | 144 | 5720 | 95.64% | 16.0 | 15.48 | 0.290 | 0.342 | |
| | | | | | Edge 1 | 100 | 5500 | 95.64% | 16.0 | 15.29 | 0.634 | 0.781 | |
| | | | | | Edge 1 | 116 | 5580 | 95.64% | 16.0 | 14.83 | 0.660 | 0.903 | |
| | | | | | Edge 1 | 124 | 5620 | 95.64% | 16.0 | 14.87 | 0.655 | 0.888 | |
| | | | | | Edge 1 | 132 | 5660 | 95.64% | 16.0 | 15.18 | 0.737 | 0.931 | 6 |
| | | | | | Edge 1 | 140 | 5700 | 95.64% | 16.0 | 15.37 | 0.729 | 0.881 | |
| | | | | | Edge 1 | 144 | 5720 | 95.64% | 16.0 | 15.48 | 0.741 | 0.873 | |
| | | | | | Edge 4 | 144 | 5720 | 95.64% | 16.0 | 15.48 | 0.257 | 0.303 | |
| Body | 5.8 (U-NII 3) | 802.11a | SISO Main 1 | 0 | Rear | 149 | 5745 | 95.64% | 12.0 | 11.21 | 0.574 | 0.720 | 7 |
| Body | 5.8 (U-NII 3) | 802.11a | SISO Aux 0 | 0 | Rear | 149 | 5745 | 95.64% | 15.0 | 14.28 | 0.213 | 0.263 | |
| | | | | | Edge 1 | 149 | 5745 | 95.64% | 15.0 | 14.28 | 0.644 | 0.795 | 8 |
| | | | | | Edge 4 | 149 | 5745 | 95.64% | 15.0 | 14.28 | 0.190 | 0.234 | |

10 SAR Measurement Variability

In accordance with published RF Exposure KDB 865664 D01 SAR measurement 100 MHz to 6 GHz. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

- 1) Repeated measurement is not required when the original highest measured SAR is <0.8 or 2 W/kg (1-g or 10-g respectively); steps 2) through 4) do not apply.
- 2) When the original highest measured SAR is \geq 0.8 or 2 W/kg (1-g or 10-g respectively), 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 \geq 1.45 or 3.6 W/kg (~ 10% from the 1-g or 10-g respective SAR limit).
- 4) Perform a third repeated measurement only if the original, first, or second repeated measurement is \geq 1.5 or 3.75 W/kg (1-g or 10-g respectively) and the ratio of largest to smallest SAR for the original, first and second repeated measurements is $>$ 1.20.

N/A

11 Simultaneous Transmission SAR Analysis

KDB 447498 D01 General RF Exposure Guidance provides two procedures for determining simultaneous transmission SAR test exclusion: Sum of SAR and SAR to Peak Location Ratio (SPLSR)

Sum of SAR

To qualify for simultaneous transmission SAR test exclusion based upon Sum of SAR the sum of the reported standalone SARs for all simultaneously transmitting antennas shall be below the applicable standalone SAR limit. If the sum of the SARs is above the applicable limit then simultaneous transmission SAR test exclusion may still apply if the requirements of the SAR to Peak Location Ratio (SPLSR) evaluation are met.

SAR to Peak Location Ratio (SPLSR)

KDB 447498 D01 General RF Exposure Guidance explains how to calculate the SAR to Peak Location Ratio (SPLSR) between pairs of simultaneously transmitting antennas:

$$\text{SPLSR} = (\text{SAR}_1 + \text{SAR}_2)^{1.5} / \text{R}_i$$

Where:

SAR₁ is the highest measured or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition

SAR₂ is the highest measured or estimated SAR for the second of a pair of simultaneous transmitting antennas, in the same test operating mode and exposure condition as the first

R_i is the separation distance between the pair of simultaneous transmitting antennas. When the SAR is measured, for both antennas in the pair, it is determined by the actual x, y and z coordinates in the 1-g SAR for each SAR peak location, based on the extrapolated and interpolated result in the zoom scan measurement, using the formula of $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$

In order for a pair of simultaneous transmitting antennas with the sum of 1-g SAR > 1.6 W/kg to qualify for exemption from Simultaneous Transmission SAR measurements, it has to satisfy the condition of:

$$(\text{SAR}_1 + \text{SAR}_2)^{1.5} / \text{R}_i \leq 0.04$$

When an individual antenna transmits at on two bands simultaneously, the sum of the highest reported SAR for the frequency bands should be used to determine SAR1 or SAR2. When SPLSR is necessary, the smallest distance between the peak SAR locations for the antenna pair with respect to the peaks from each antenna should be used.

The antennas in all antenna pairs that do not qualify for simultaneous transmission SAR test exclusion must be tested for SAR compliance, according to the enlarged zoom scan and volume scan post-processing procedures in KDB Publication 865664 D01

Report No.: TMWK2208003444KS

Simultaneous Transmission Condition

| RF Exposure Condition | Item | Capable Transmit Configurations | | | |
|-----------------------|------|---------------------------------|---|-------------|---|
| Standalone | 1 | DTS (Main) | + | DTS (Aux) | + |
| | 2 | U-NII (Main) | + | U-NII (Aux) | + |

Notes:

1. Wi-Fi 2.4GHz & Wi-Fi 5GHz cannot transmit simultaneously.
2. Wi-Fi SISO mode SAR result can also represent for MIMO mode SAR and is used for MIMO mode simultaneous transmission analysis because antennas are not overlapping and the MIMO mode maximum power is equal or less than SISO mode.

Report No.: TMWK2208003444KS

Estimated SAR for Simultaneous Transmission SAR Analysis

Considerations for SAR estimation

- When standalone SAR test exclusion applies, standalone SAR must also be estimated to determine simultaneous transmission SAR test exclusion.
- Dedicated Host Approach criteria for SAR test exclusion is likewise applied to SAR estimation, with certain distinctions between test exclusion and SAR estimation:
 - When the separation distance from the antenna to an adjacent edge is ≤ 5 mm, a distance of 5 mm is applied for SAR estimation; this is the same between test exclusion and SAR estimation calculations.
 - When the separation distance from the antenna to an adjacent edge is > 5 mm but ≤ 50 mm, the actual antenna-to-edge separation distance is applied for SAR estimation.
 - When the minimum test separation distance is > 50 mm, the estimated SAR value is 0.4 W/kg
- Please refer to Estimated SAR Tables to see which test positions are inherently compliant as they consist of only estimated SAR values for all applicable transmitters and consequently will always have sum of SAR values < 1.2 W/kg. Simultaneous transmission SAR analysis was therefore not performed for these test positions.

Estimated SAR for WLAN

| Tx Interface | Frequency (MHz) | Output Power | | Separation Distances (mm) | | | | | Estimated 1-g SAR Value (W/kg) | | | | |
|---------------------|-----------------|--------------|----|---------------------------|--------|--------|--------|--------|--------------------------------|-----------|--------|-----------|-----------|
| | | dBm | mW | Rear | Edge 1 | Edge 2 | Edge 3 | Edge 4 | Rear | Edge 1 | Edge 2 | Edge 3 | Edge 4 |
| Main Antenna | | | | | | | | | | | | | |
| Wi-Fi 2.4 GHz | 2462 | 18.50 | 71 | 5.6 | 157.24 | 257.99 | 13.24 | 25.99 | -MEASURE- | 0.400 | 0.400 | -MEASURE- | -MEASURE- |
| Wi-Fi 5.2 GHz | 5240 | 13.50 | 22 | 5.6 | 157.24 | 257.99 | 13.24 | 25.99 | -MEASURE- | 0.400 | 0.400 | -MEASURE- | 0.258 |
| Wi-Fi 5.3 GHz | 5320 | 13.50 | 22 | 5.6 | 157.24 | 257.99 | 13.24 | 25.99 | -MEASURE- | 0.400 | 0.400 | -MEASURE- | 0.260 |
| Wi-Fi 5.5 GHz | 5700 | 11.00 | 13 | 5.6 | 157.24 | 257.99 | 13.24 | 25.99 | -MEASURE- | 0.400 | 0.400 | 0.318 | 0.159 |
| Wi-Fi 5.8 GHz | 5825 | 12.00 | 16 | 5.6 | 157.24 | 257.99 | 13.24 | 25.99 | -MEASURE- | 0.400 | 0.400 | 0.396 | 0.198 |
| Aux Antenna | | | | | | | | | | | | | |
| Wi-Fi 2.4 GHz | 2462 | 19.50 | 89 | 16.7 | 10.69 | 282.67 | 164.29 | 6.62 | -MEASURE- | -MEASURE- | 0.400 | 0.400 | -MEASURE- |
| Wi-Fi 5.2 GHz | 5240 | 16.00 | 40 | 16.7 | 10.69 | 282.67 | 164.29 | 6.62 | -MEASURE- | -MEASURE- | 0.400 | 0.400 | -MEASURE- |
| Wi-Fi 5.3 GHz | 5320 | 16.00 | 40 | 16.7 | 10.69 | 282.67 | 164.29 | 6.62 | -MEASURE- | -MEASURE- | 0.400 | 0.400 | -MEASURE- |
| Wi-Fi 5.5 GHz | 5700 | 16.00 | 40 | 16.7 | 10.69 | 282.67 | 164.29 | 6.62 | -MEASURE- | -MEASURE- | 0.400 | 0.400 | -MEASURE- |
| Wi-Fi 5.8 GHz | 5825 | 15.00 | 32 | 16.7 | 10.69 | 282.67 | 164.29 | 6.62 | -MEASURE- | -MEASURE- | 0.400 | 0.400 | -MEASURE- |
| Bluetooth | 2480 | 4.00 | 3 | 16.7 | 10.69 | 282.67 | 164.29 | 6.62 | 0.037 | 0.057 | 0.400 | 0.400 | 0.090 |

11.1 Sum of the SAR for Wi-Fi & BT

| Test Position | Standalone SAR (W/kg) | | | | | Σ 1-g SAR (W/kg) | |
|---------------|-----------------------|--------------|--------------|--------------|-------|-------------------------|------------|
| | DTS | | U-NII | | BT | DTS + BT | U-NII + BT |
| | Chain 0 ① | Chain 1 ② | Chain 0 ③ | Chain 1 ④ | ⑤ | ① + ② + ⑤ | ③ + ④ + ⑤ |
| Rear | 0.241 | 0.676 | 0.342 | 0.720 | 0.037 | 0.954 | 1.099 |
| Edge 1 | 0.127 | 0.400 | 0.931 | 0.400 | 0.057 | 0.584 | 1.388 |
| Edge 3 | 0.400 | 0.103 | 0.400 | 0.186 | 0.400 | 0.903 | 0.986 |
| Edge 4 | 0.703 | 0.026 | 0.303 | 0.260 | 0.090 | 0.819 | 0.653 |

Conclusion:

Simultaneous transmission SAR measurement (Volume Scan) is not required because either the sum of the 1-g SAR is < 1.6 W/kg or the SPLSR is < 0.04 for all circumstances that require SPLSR calculation.

12 Equipment List & Calibration Status

The measuring equipment used to perform the tests documented in this report has been calibrated in accordance with the manufacturers' recommendations, and is traceable to recognized national standards.

| Dielectric Property Measurements | | | | |
|---|--------------|---------------|------------|---------------|
| Name of Equipment | Manufacturer | Type/Model | Serial No. | Cal. Due Date |
| Network Analyzer | SPEAG | DAKS_VNA R140 | 0140417 | 2023/1/24 |
| Dielectric Assessment Kit | SPEAG | DAKS-3.5 | 1001 | 2023/1/26 |
| Thermometer | TES | TES-1306 | 210801061 | 2022/10/21 |

| System Check | | | | |
|------------------------------|--------------|------------|------------|---------------|
| Name of Equipment | Manufacturer | Type/Model | Serial No. | Cal. Due Date |
| Signal Generator | Agilent | N5181A | MY50141235 | 2023/7/22 |
| Power Meter | Anritsu | ML2496A | 2136002 | 2022/12/5 |
| Power Sensor | Anritsu | MA2411B | 1911386 | 2022/10/24 |
| Power Meter | Agilent | E4417A | MY52240003 | 2022/10/25 |
| Power Sensor | Agilent | E9301H | MY52200004 | 2022/10/23 |
| Dual Directional Coupler | Agilent | 772D | MY46151242 | 2023/8/29 |
| Amplifier | EMCI | ZVE-8G | S1900977 | N/A |
| Data Acquisition Electronics | SPEAG | DAE4 | 877 | 2023/4/27 |
| Dosimetric E-Field Probe | SPEAG | EX3DV4 | 7642 | 2023/3/2 |
| System Validation Dipole | SPEAG | D2450V2 | 727 | 2023/4/24 |
| System Validation Dipole | SPEAG | D5GHzV2 | 1023 | 2023/1/26 |
| Humidity/Temp meter | TECPTEL | DTM-303A | TP130075 | 2023/1/13 |
| Thermometer | TES | TES-1306 | 210801061 | 2022/10/21 |

| Software Version |
|---------------------------|
| DASY NEO52 D10.3 S14.6.13 |
| SEMCAD-X-PostPro |

13 Facilities

All measurement facilities used to collect the measurement data are located at

- No.11, Wugong 6th Rd., Wugu Dist., New Taipei City, Taiwan.
- No. 12, Ln. 116, Wugong 3rd Rd., Wugu Dist., New Taipei City, Taiwan.

14 Appendixes

| Exhibit | Content |
|---------|--|
| 1 | SAR Setup Photos |
| 2 | SAR System Check Plots |
| 3 | Highest SAR Test Plots |
| 4 | SAR DAE and Probe Calibration Certificates |
| 5 | SAR Dipole Calibration Certificates |

END OF REPORT