



SAR EVALUATION REPORT

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

**For
Square Terminal**

**FCC ID: 2AF3K-SPD2
Model Name: SPD2-01**

**Report Number: 4789331395-SAR-14
Issue Date: July 16, 2020**

**Prepared for
Square, Inc.**

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Revision History

| Rev. | Date | Revisions | Revised By |
|------|---------------|---|-------------|
| V1.0 | June 01, 2020 | Initial Issue | \ |
| V2.0 | July 06, 2020 | Updated based TCB's comments | Jacky Jiang |
| V3.0 | July 16, 2020 | Page19, updated the calculation of exclusion Page28-32, added the SAR results Updated the Estimated SAR and Simultaneous transmission calculation. | Jacky Jiang |

Note:

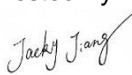


1. The Measurement result for the sample received is<Pass> according to < IEEE Std. 1528-2013> when <Accuracy Method> decision rule is applied.
2. This test report is only published to and used by the applicant, and it is not for evidence purpose in China.

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1. Attestation of Test Results

| | | | |
|--|---|--|------------|
| Applicant Name | Square, Inc. | | |
| Address | 1455 Market St, Suite 600, San Francisco, California, United States 94103 | | |
| Manufacturer | Square, Inc. | | |
| Address | 1455 Market St, Suite 600, San Francisco, California, United States 94103 | | |
| EUT Name | Square Terminal | | |
| Model Name | SPD2-01 | | |
| Sample Status | Normal | | |
| Sample ID | 2809002 | | |
| Brand | / | | |
| Sample Received Date | Jan 13, 2020 | | |
| Date of Tested | Jan 13~ May 21, 2020 | | |
| Applicable Standards | FCC 47 CFR § 2.1093 IEEE Std. 1528-2013 KDB publication | | |
| SAR Limits (W/Kg) | | | |
| Exposure Category | Peak spatial-average(1g of tissue) | Extremities (hands, wrists, ankles, etc.) (10g of tissue) | |
| General population / Uncontrolled exposure | 1.6 | 4 | |
| The Highest Reported SAR (W/kg) | | | |
| RF Exposure Conditions | Equipment Class | | |
| | DTS | U-NII | DSS |
| Body (1-g) | / | 0.781 | / |
| Extremity (10-g) | 1.461 | 2.382 | / |
| Simultaneous Transmission (1-g) | 2.548 | | |
| Test Results | Pass | | |
| Tested By:  Jacky Jiang Engineer Project Associate | Reviewed By:  Shawn Wen Laboratory Leader | Approved By:  Stephen Guo Laboratory Manager | |

2. Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with IEEE Std. 1528-2013, the following FCC Published RF exposure KDB procedures:

- 248227 D01 802.11 Wi-Fi SAR
- 447498 D01 General RF Exposure Guidance
- 690783 D01 SAR Listings on Grants
- 865664 D01 SAR measurement 100 MHz to 6 GHz
- 865664 D02 RF Exposure Reporting
- 616217 D04 SAR for laptop and tablets

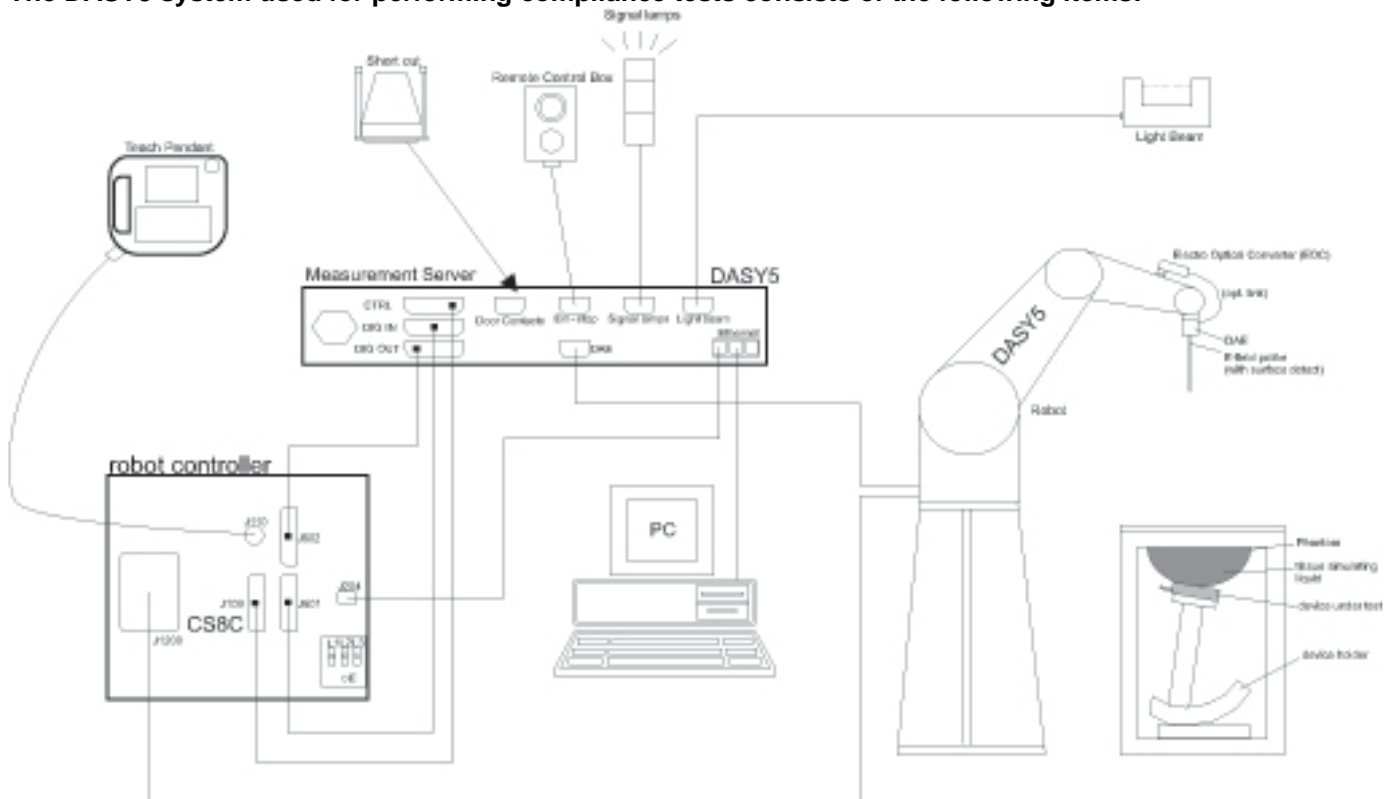
3. Facilities and Accreditation

| | |
|---------------------------|--|
| Test Location | UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. |
| Address | Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China |
| Accreditation Certificate | <p>A2LA (Certificate No.: 4102.01) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch has been assessed and proved to be in compliance with A2LA.</p> <p>FCC (FCC Recognized No.: CN1187) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules</p> <p>IC(Company No.: 21320) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch has been registered and fully described in a report filed with Industry Canada. The Company Number is 21320.</p> <p>VCCI (Registration No.: G-20019, R-20004, C-20012 and T-20011) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch has been assessed and proved to be in compliance with VCCI, the Membership No. is 3793.</p> <p>Facility Name: Chamber D, the VCCI registration No. is G-20019 and R-20004 Shielding Room B , the VCCI registration No. is C-20012 and T-20011</p> |
| Description | All measurement facilities use to collect the measurement data are located at Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China |

4. SAR Measurement System & Test Equipment

4.1. SAR Measurement System

The DASY5 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 Win7 and the DASY52 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.

4.2. SAR Scan Procedures

Step 1: 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. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

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 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 KDB 865664 D01 v01r04 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 | $30^\circ \pm 1^\circ$ | $20^\circ \pm 1^\circ$ |
| Maximum area scan spatial resolution: Δx_{Area} , Δy_{Area} | ≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm | 3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm |
| | When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be \leq 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 v01r04 SAR Measurement 100 MHz to 6 GHz

| | | ≤ 3 GHz | > 3 GHz |
|--|------------------------------------|--|---|
| Maximum zoom scan spatial resolution: $\Delta x_{Zoom}, \Delta y_{Zoom}$ | | ≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm* | 3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm* |
| Maximum zoom scan spatial resolution, normal to phantom surface | uniform grid: $\Delta z_{Zoom}(n)$ | ≤ 5 mm | 3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm |
| | graded grid | $\Delta z_{Zoom}(1)$: between 1 st two points closest to phantom surface | ≤ 4 mm 3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm |
| | | $\Delta z_{Zoom}(n>1)$: between subsequent points | ≤ 1.5 · $\Delta z_{Zoom}(n-1)$ |
| Minimum zoom scan volume | x, y, z | ≥ 30 mm | 3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm |
| Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details. * When zoom scan is required and the <i>reported</i> SAR from the area scan based <i>I-g SAR estimation</i> procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz. | | | |

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 greater than the step size in Z-direction.

4.3. Test Equipment

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.

| Name of equipment | Manufacturer | Type/Model | Serial No. | Cal. Due Date |
|-------------------------------|----------------------|------------------------|------------|---------------|
| ENA Network Analyzer | Keysight | E5080A | MY55100583 | 2020.12.05 |
| Dielectric Assessment Kit | SPEAG | SM DAK 040 SA | 1155 | NCR |
| DC power supply | Keysight | E36103A | MY55350020 | 2020.12.04 |
| Signal Generator | Rohde & Schwarz | SME06 | 837633\001 | 2020.12.04 |
| BI-Directional Coupler | WERLATONE | C8060-102 | 3423 | 2020.12.04 |
| Peak and Average Power Sensor | Keysight | E9323A | MY55440013 | 2020.12.05 |
| Peak and Average Power Sensor | Keysight | E9323A | MY55420006 | 2020.12.05 |
| Dual Channel PK Power Meter | Keysight | N1912A | MY55416024 | 2020.12.05 |
| Amplifier | CORAD TECHNOLOGY LTD | AMF-4D-00400600-50-30P | 1983561 | NCR |
| Dosimetric E-Field Probe | SPEAG | EX3DV4 | 7383 | 2021.01.02 |
| Data Acquisition Electronic | SPEAG | DAE3 | 427 | 2021.03.30 |
| Dipole Kit 2450 MHz | SPEAG | D2450V2 | 977 | 2021.12.04 |
| Dipole Kit 5 GHz | SPEAG | D5GHzV2 | 1231 | 2021.12.07 |
| Software | SPEAG | DASY52 | N/A | NCR |
| Twin Phantom | SPEAG | SAM V5.0 | 1805 | NCR |
| ELI Phantom | SPEAG | ELI V5.0 | 1235 | NCR |
| Thermometer | / | GX-138 | 150709653 | 2020.12.09 |
| Hygrometer | VICTOR | ITHX-SD-5 | 18470005 | 2020.12.10 |

Note:

- 1) As per KDB865664D01 requirements for dipole calibration, the test laboratory has adopted three-year extended calibration interval. Each measured dipole is expected to evaluate with the following criteria at least on annual interval in Appendix C.
 - a) There is no physical damage on the dipole;
 - b) System check with specific dipole is within 10% of calibrated value;
 - c) The most recent return-loss result, measured at least annually, deviates by no more than 20% from the previous measurement.
 - d) The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within 5Ω from the previous measurement.
- 2) Dielectric assessment kit is calibrated against air, distilled water and a shorting block performed before measuring liquid parameters.
- 3) NCR is short for "No Calibration Requirement".

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, the extensive SAR measurement uncertainty analysis described in IEEE Std. 1528-2013 is not required in SAR reports submitted for equipment approval. The equivalent ratio (1.5/1.6) is applied to extremity and occupational exposure conditions.

6. Device Under Test (DUT) Information

6.1. DUT Description

| | |
|---|--|
| The DUT is a point of sales (POS) devices with IEEE 802.11a/b/g/n/ac, and BT radio. | |
|---|--|

| | |
|---------------|--|
| DUT Dimension | Overall (Length x Width x Height): 143 mm x 85 mm x 65mm |
|---------------|--|

6.2. Wireless Technology and Antenna information

| Wireless technology | Frequency band |
|---------------------|----------------|
| Wi-Fi | 2.4 GHz |
| | 5 GHz |
| BT | 2.4 GHz |

6.3. Test signal, Output power and Test Frequencies

The output power of the device was set to transmit at maximum power for all tests.

7. SAR Test Configuration

The DUT is a point of sale (POS) device, Etremity 10-g SAR was evaluated for intended used condition. A body-worn accessory may be used by end user which a 25mm separation was declared by Applicant. So additional SAR for the bottom surface at 25mm separation from flat phantom was evaluated for Body-worn accessory exposure conditions.

8. Conducted Output Power Measurement and tune-up tolerance

General note:

- As per KDB 447498 sec.4.1.d) at the maximum rated output power and within the tune-up tolerance range specified for the product, but not more than 2 dB lower than the maximum tune-up tolerance limit.

8.1. Power measurement result of 2.4GHz Wi-Fi.

| Mode | Channel | Frequency (MHz) | Data Rate | ANT 1 | | ANT 2 | | SAR Test | Duty Cycle (%) | |
|-----------|---------|-----------------|-----------|---------------------|---------------------|---------------------|---------------------|----------|----------------|----------|
| | | | | Average Power (dBm) | Tune-up Limit (dBm) | Average Power (dBm) | Tune-up Limit (dBm) | | | |
| 802.11b | 1 | 2412 | 1Mbps | 15.3 | 16.0 | 15.4 | 16.0 | Required | 98.88 | |
| | 6 | 2437 | | 15.1 | 16.0 | 15.2 | 16.0 | | | |
| | 11 | 2462 | | 15.0 | 16.0 | 15.0 | 16.0 | | | |
| 802.11g | 1 | 2412 | 6Mbps | NMR | 16.0 | NMR | 16.0 | Excluded | \ | |
| | 6 | 2437 | | | 16.0 | | 16.0 | | | |
| | 11 | 2462 | | | 16.0 | | 16.0 | | | |
| 802.11n20 | 1 | 2412 | HT0 | | 15.0 | | 15.0 | 15.0 | | Excluded |
| | 6 | 2437 | | | 15.0 | | 15.0 | | | |
| | 11 | 2462 | | | 15.0 | | 15.0 | | | |
| 802.11n40 | 3 | 2422 | HT0 | | 12.0 | | 12.0 | 12.0 | | Excluded |
| | 6 | 2437 | | | 13.5 | | 13.5 | | | |
| | 9 | 2452 | | | 13.5 | | 13.5 | | | |

Note:

- NMR is short for "No measurement requirement".
- The Duty Cycle comes from 4789331395-8_FCC ID&ISED_ 2.4G WIFI Report.

8.2. Power measurement result of 5GHz Wi-Fi.

| Band | Mode | Channel | Frequency (MHz) | Data Rate | ANT 1 | | ANT 2 | | SAR Test |
|------------|------------|---------|-----------------|-----------|---------------------|---------------------|---------------------|---------------------|----------|
| | | | | | Average power (dBm) | Tune-up Limit (dBm) | Average power (dBm) | Tune-up Limit (dBm) | |
| U-NII-1 | 802.11a | 36 | 5180 | 6Mbps | NMR | 14.0 | NMR | 14.0 | Excluded |
| | | 40 | 5200 | | | 14.0 | | 14.0 | |
| | | 44 | 5220 | | | 14.0 | | 14.0 | |
| | | 48 | 5240 | | | 14.0 | | 14.0 | |
| | 802.11n20 | 36 | 5180 | HT0 | | 9.0 | | 9.0 | |
| | | 40 | 5200 | | | 9.0 | | 9.0 | |
| | | 44 | 5220 | | | 9.0 | | 9.0 | |
| | | 48 | 5240 | | | 9.0 | | 9.0 | |
| | 802.11n40 | 38 | 5190 | VHT0 | | 11.0 | | 11.0 | |
| | | 46 | 5230 | | | 11.0 | | 11.0 | |
| | 802.11ac20 | 36 | 5180 | VHT0 | | 9.0 | | 9.0 | |
| | | 40 | 5200 | | | 9.0 | | 9.0 | |
| | | 44 | 5220 | | | 9.0 | | 9.0 | |
| | | 48 | 5240 | | | 9.0 | | 9.0 | |
| | 802.11ac40 | 38 | 5190 | VHT0 | | 11.0 | | 11.0 | |
| | | 46 | 5230 | | | 11.0 | | 11.0 | |
| 802.11ac80 | 42 | 5210 | VHT0 | 10.5 | 13.5 | | | | |
| U-NII-2A | 802.11a | 52 | 5260 | 6Mbps | 13.36 | 14.5 | 13.59 | 14.5 | Required |
| | | 56 | 5280 | | 14.04 | 14.5 | 13.82 | 14.5 | |
| | | 60 | 5300 | | 13.77 | 14.5 | 13.78 | 14.5 | |
| | | 64 | 5320 | | 13.85 | 14.5 | 14.11 | 14.5 | |
| | 802.11n20 | 52 | 5260 | HT0 | NMR | 14.0 | NMR | 14.0 | Excluded |
| | | 56 | 5280 | | | 14.0 | | 14.0 | |
| | | 60 | 5300 | | | 14.0 | | 14.0 | |
| | | 64 | 5320 | | | 14.0 | | 14.0 | |
| | 802.11n40 | 54 | 5270 | VHT0 | | 13.1 | | 13.1 | |
| | | 62 | 5310 | | | 11.0 | | 11.0 | |
| | 802.11ac20 | 52 | 5260 | VHT0 | | 14.0 | | 14.0 | |
| | | 56 | 5280 | | | 14.0 | | 14.0 | |
| | | 60 | 5300 | | | 14.0 | | 14.0 | |
| | | 64 | 5320 | | | 14.0 | | 14.0 | |
| | 802.11ac40 | 54 | 5270 | VHT0 | | 13.1 | | 13.1 | |
| | | 62 | 5310 | | | 11.0 | | 11.0 | |
| | 802.11ac80 | 58 | 5290 | VHT0 | | 8.5 | | 8.5 | |

| Band | Mode | Channel | Frequency (MHz) | Data Rate | ANT 1 | | ANT 2 | | SAR Test |
|----------|------------|---------|-----------------|-----------|---------------------|---------------------|---------------------|---------------------|----------|
| | | | | | Average power (dBm) | Tune-up Limit (dBm) | Average power (dBm) | Tune-up Limit (dBm) | |
| U-NII-2C | 802.11a | 100 | 5500 | 6Mbps | 15.35 | 16.2 | 15.48 | 16.2 | Required |
| | | 104 | 5520 | | 15.51 | 16.2 | 15.85 | 16.2 | |
| | | 108 | 5540 | | 15.43 | 16.2 | 15.94 | 16.2 | |
| | | 112 | 5560 | | 15.88 | 16.2 | 15.69 | 16.2 | |
| | | 116 | 5580 | | 15.94 | 16.2 | 16.02 | 16.2 | |
| | | 120 | 5600 | | 15.72 | 16.2 | 15.39 | 16.2 | |
| | | 124 | 5620 | | 15.93 | 16.2 | 15.81 | 16.2 | |
| | | 128 | 5640 | | 15.86 | 16.2 | 15.90 | 16.2 | |
| | | 132 | 5660 | | 15.73 | 16.2 | 15.98 | 16.2 | |
| | | 136 | 5680 | | 15.77 | 16.2 | 15.01 | 16.2 | |
| | | 140 | 5700 | | 16.10 | 16.2 | 16.02 | 16.2 | |
| | 802.11n20 | 100 | 5500 | HT0 | NMR | 14.5 | NMR | 14.5 | Excluded |
| | | 104 | 5520 | | | 14.5 | | 14.5 | |
| | | 108 | 5540 | | | 14.5 | | 14.5 | |
| | | 112 | 5560 | | | 14.5 | | 14.5 | |
| | | 116 | 5580 | | | 14.5 | | 14.5 | |
| | | 120 | 5600 | | | 14.5 | | 14.5 | |
| | | 124 | 5620 | | | 14.5 | | 14.5 | |
| | | 128 | 5640 | | | 14.5 | | 14.5 | |
| | | 132 | 5660 | | | 14.5 | | 14.5 | |
| | | 136 | 5680 | | | 14.5 | | 14.5 | |
| | | 140 | 5700 | | | 14.5 | | 14.5 | |
| | 802.11n40 | 102 | 5510 | VHT0 | NMR | 12.5 | NMR | 12.5 | Excluded |
| | | 110 | 5550 | | | 16.0 | | 16.0 | |
| | | 118 | 5590 | | | 16.0 | | 16.0 | |
| | | 126 | 5630 | | | 16.0 | | 16.0 | |
| | | 134 | 5670 | | | 16.0 | | 16.0 | |
| | 802.11ac20 | 100 | 5500 | VHT0 | NMR | 14.5 | NMR | 14.5 | Excluded |
| | | 104 | 5520 | | | 14.5 | | 14.5 | |
| | | 108 | 5540 | | | 14.5 | | 14.5 | |
| | | 112 | 5560 | | | 14.5 | | 14.5 | |
| | | 116 | 5580 | | | 14.5 | | 14.5 | |
| | | 120 | 5600 | | | 14.5 | | 14.5 | |
| | | 124 | 5620 | | | 14.5 | | 14.5 | |
| | | 128 | 5640 | | | 14.5 | | 14.5 | |
| | | 132 | 5660 | | | 14.5 | | 14.5 | |
| | | 136 | 5680 | | | 14.5 | | 14.5 | |
| | 802.11ac40 | 102 | 5510 | VHT0 | NMR | 12.5 | NMR | 12.5 | Excluded |
| | | 110 | 5550 | | | 16.1 | | 16.1 | |
| | | 118 | 5590 | | | 16.1 | | 16.1 | |
| | | 126 | 5630 | | | 16.1 | | 16.1 | |
| | 802.11ac80 | 106 | 5530 | VHT0 | NMR | 11.5 | NMR | 11.5 | Excluded |
| 122 | | 5610 | 16.1 | | | 16.1 | | | |

| | | | | | | | | | |
|--|--|-----|------|--|--|------|--|------|--|
| | | 138 | 5690 | | | 16.1 | | 16.1 | |
|--|--|-----|------|--|--|------|--|------|--|

| Band | Mode | Channel | Frequency (MHz) | Data Rate | ANT 1 | | ANT 2 | | SAR Test |
|---------|------------|---------|-----------------|-----------|---------------------|---------------------|---------------------|---------------------|----------|
| | | | | | Average power (dBm) | Tune-up Limit (dBm) | Average power (dBm) | Tune-up Limit (dBm) | |
| U-NII-3 | 802.11a | 149 | 5745 | 6Mbps | 15.21 | 16.0 | 15.14 | 16.0 | Required |
| | | 153 | 5765 | | 15.19 | 16.0 | 15.09 | 16.0 | |
| | | 157 | 5785 | | 15.34 | 16.0 | 15.35 | 16.0 | |
| | | 161 | 5805 | | 15.20 | 16.0 | 15.11 | 16.0 | |
| | | 165 | 5825 | | 15.82 | 16.0 | 15.51 | 16.0 | |
| | 802.11n20 | 149 | 5745 | HT0 | NMR | 15.5 | NMR | 15.5 | Excluded |
| | | 153 | 5765 | | | 15.5 | | 15.5 | |
| | | 157 | 5785 | | | 15.5 | | 15.5 | |
| | | 161 | 5805 | | | 15.5 | | 15.5 | |
| | | 165 | 5825 | | | 15.5 | | 15.5 | |
| | 802.11n40 | 151 | 5755 | VHT0 | | 15.5 | | 15.5 | |
| | | 159 | 5795 | | | 15.5 | | 15.5 | |
| | 802.11ac20 | 149 | 5745 | VHT0 | | 15.5 | | 15.5 | |
| | | 153 | 5765 | | | 15.5 | | 15.5 | |
| | | 157 | 5785 | | | 15.5 | | 15.5 | |
| | | 161 | 5805 | | | 15.5 | | 15.5 | |
| | 802.11ac40 | 151 | 5755 | | | 15.5 | | 15.5 | |
| | | 159 | 5795 | | | 15.5 | | 15.5 | |
| | 802.11ac80 | 155 | 5775 | | | 15.5 | | 15.5 | |

Note:

- 1) NMR is short for "No measurement requirement".
- 2) The Duty Cycle of 802.11a mode is 95% from 4789331395-9_FCC ID&ISED_ 5G WIFI Report.

8.3. Power measurement result BT

| Band | Mode | Antenna | Average Conducted Power (dBm) | | | Tune-up |
|------|------|---------|-------------------------------|------|------|---------|
| | | | 0CH | 39CH | 78CH | |
| 2.4G | DH5 | A | 7.28 | 8.27 | 7.67 | 8.5 |
| | 2DH5 | A | NMR | NMR | NMR | 8.0 |
| | 3DH5 | A | NMR | NMR | NMR | 8.0 |

| Band | Mode | Antenna | Average Conducted Power (dBm) | | | Tune-up |
|------|------|---------|-------------------------------|------|------|---------|
| | | | 0CH | 19CH | 39CH | |
| 2.4G | BLE | A | NMR | NMR | NMR | -1.0 |

Note:

- 1) NMR is short for "No measurement requirement".

9. RF Exposure Conditions

The antenna location diagram inside the device can be found in App A.

Per FCC KDB 447498D01:

1. The 1-g SAR and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR and ≤ 7.5 for product specific 10-g SAR, where:

- $f(\text{GHz})$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

2. The SAR exclusion threshold for distances > 50 mm is defined by the following equation, as illustrated in KDB 447498 D01 Appendix B:

a) at 100 MHz to 1500 MHz

[Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm) · (f(MHz)/150)] mW

b) at > 1500 MHz and ≤ 6 GHz

[Power allowed at numeric Threshold at 50 mm in step 1) + (test separation distance - 50 mm) · 10] mW

3. The test separation distances required for a device to demonstrate SAR or MPE compliance must be sufficiently conservative to support the operational separation distances required by the device and its antennas and radiating structures. For devices such as tablets and transmitters embedded in keyboard sections of laptop computers that are typically used in close proximity to users, the test separation distance is determined by the smallest distance between the outer surface of the device and the user. For larger devices, as the antenna operational separation distance increases to where the SAR characteristics of the device and its antennas are not directly influenced by the user, such as antennas along the top and upper side edges of laptop computer displays or opposite and adjacent edges of tablets, the test separation distance is normally determined by the closest separation between the antenna and the user.

For ANT to edges separation distance larger than 50mm Extremity 10-g SAR.

| Position | ANT | Mode | Frequency (MHz) | Power (dBm) | Power (mW) | Power allowed at 50mm | Separation Distance (mm) | Calculation Result (mW) | SAR Test |
|-------------|------|-----------|-----------------|-------------|------------|-----------------------|--------------------------|-------------------------|----------|
| Bottom edge | ANT1 | ANT1 BT | 2480 | 8.5 | 7.08 | 238.13 | 104.20 | 780.13 | Excluded |
| | | WiFi 2.4G | 2462 | 16.0 | 39.81 | 238.99 | 104.20 | 780.99 | Excluded |
| | | WiFi 5G | 5825 | 16.20 | 41.69 | 155.38 | 104.20 | 697.38 | Excluded |
| | ANT2 | ANT1 BT | 2480 | 8.5 | 7.08 | 238.13 | 110.60 | 844.13 | Excluded |
| | | WiFi 2.4G | 2462 | 16.0 | 39.81 | 238.99 | 110.60 | 844.99 | Excluded |
| | | WiFi 5G | 5825 | 16.20 | 41.69 | 155.38 | 110.60 | 761.38 | Excluded |
| Left edge | ANT2 | ANT1 BT | 2480 | 8.5 | 7.08 | 238.13 | 78.90 | 527.13 | Excluded |
| | | WiFi 2.4G | 2462 | 16.0 | 39.81 | 238.99 | 78.90 | 527.99 | Excluded |
| | | WiFi 5G | 5825 | 16.20 | 41.69 | 155.38 | 78.90 | 444.38 | Excluded |

For ANT1 to edges separation distance less than 50mm

| Position | Mode | Frequency (MHz) | Power (dBm) | Power (mW) | Separation Distance (mm) | Calculation Result | Threshold | SAR Test |
|--|-----------|-----------------|-------------|------------|--------------------------|--------------------|-----------|----------|
| Left Edge, Right Edge, Top Edge and Bottom surface | BT | 2480 | 8.5 | 7.08 | 5.00 | 2.2 | 7.5 | Excluded |
| | WiFi 2.4G | 2462 | 16.0 | 39.81 | 5.00 | 12.5 | 7.5 | Required |
| | WiFi 5G | 5320 | 14.5 | 28.18 | 5.00 | 13.0 | 7.5 | Required |
| | | 5720 | 16.2 | 41.69 | 5.00 | 19.9 | 7.5 | Required |
| | | 5825 | 16.0 | 39.81 | 5.00 | 19.2 | 7.5 | Required |
| Bottom surface For body-worn accessory | BT | 2480 | 8.5 | 7.08 | 25.00 | 0.4 | 3.0 | Excluded |
| | WiFi 2.4G | 2462 | 16.0 | 39.81 | 25.00 | 2.5 | 3.0 | Excluded |
| | WiFi 5G | 5320 | 14.5 | 28.18 | 25.00 | 2.6 | 3.0 | Excluded |
| | | 5720 | 16.2 | 41.69 | 25.00 | 4.0 | 3.0 | Required |
| | | 5825 | 16.0 | 39.81 | 25.00 | 3.8 | 3.0 | Required |

For ANT2 to edges separation distance less than 50mm

| Position | Mode | Frequency (MHz) | Power (dBm) | Power (mW) | Separation Distance (mm) | Calculation Result | Threshold | SAR Test |
|--|-----------|-----------------|-------------|------------|--------------------------|--------------------|-----------|----------|
| Right Edge/ Top Edge/ Bottom surface | WiFi 2.4G | 2462 | 16.0 | 39.81 | 5.00 | 12.5 | 7.5 | Required |
| | WiFi 5G | 5320 | 14.5 | 28.18 | 5.00 | 13.0 | 7.5 | Required |
| | | 5720 | 16.2 | 41.69 | 5.00 | 19.9 | 7.5 | Required |
| | | 5825 | 16.0 | 39.81 | 5.00 | 19.2 | 7.5 | Required |
| Bottom surface For body-worn accessory | WiFi 2.4G | 2462 | 16.0 | 39.81 | 25.00 | 2.5 | 3.0 | Excluded |
| | WiFi 5G | 5320 | 14.5 | 28.18 | 25.00 | 2.6 | 3.0 | Excluded |
| | | 5720 | 16.2 | 41.69 | 25.00 | 4.0 | 3.0 | Required |
| | | 5825 | 16.0 | 39.81 | 25.00 | 3.8 | 3.0 | Required |

10. Dielectric Property Measurements & System Check

10.1. 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.

Tissue Dielectric Parameters

FCC KDB 865664 D01 v01r04 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

Dielectric Property Measurements Results:

| Liquid | Freq. | Liquid Parameters | | | | Deviation(%) | | Limit (%) | Temp. (°C) | Test Date |
|-----------|-------|-------------------|----------|--------------|----------|--------------|----------|-----------|------------|--------------|
| | | Measured | | Target | | ϵ_r | σ | | | |
| | | ϵ_r | σ | ϵ_r | σ | | | | | |
| Head 2450 | 2360 | 40.00 | 1.69 | 39.36 | 1.72 | 1.63 | -1.86 | ±5 | 22.3 | May 09, 2020 |
| | 2450 | 39.90 | 1.80 | 39.20 | 1.80 | 1.79 | -0.06 | | | |
| | 2540 | 39.44 | 1.90 | 39.09 | 1.90 | 0.90 | 0.21 | | | |
| Head 5250 | 5160 | 36.23 | 4.60 | 36.03 | 4.61 | 0.56 | -0.28 | ±5 | 22.5 | May 10, 2020 |
| | 5250 | 36.09 | 4.73 | 35.93 | 4.71 | 0.45 | 0.42 | | | |
| | 5340 | 35.90 | 4.78 | 35.83 | 4.80 | 0.20 | 0.37 | | | |
| Head 5600 | 5500 | 35.95 | 4.99 | 35.64 | 4.96 | 0.87 | 1.45 | ±5 | 21.8 | May 18, 2020 |
| | 5600 | 35.63 | 5.03 | 35.53 | 5.07 | 0.28 | 0.41 | | | |
| | 5700 | 35.65 | 5.09 | 35.41 | 5.17 | 0.68 | -0.83 | | | |
| Head 5700 | 5660 | 36.70 | 5.26 | 35.46 | 5.13 | 3.50 | 2.53 | ±5 | 22.7 | May 18, 2020 |
| | 5750 | 36.33 | 5.44 | 35.36 | 5.22 | 2.74 | 4.18 | | | |
| | 5840 | 35.87 | 5.43 | 35.27 | 5.30 | 1.70 | 2.49 | | | |

10.2. 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 10mm (above 1GHz) and 15mm (below 1GHz) from dipole center to the simulating liquid surface.
- For area scan, standard grid spacing for head measurements is 15 mm in x- and y- dimension (≤ 2 GHz), 12 mm in x- and y-dimension (2-4 GHz) and 10mm in x- and y- dimension (4-6GHz).
- For zoom scan, $\Delta x_{\text{zoom}}, \Delta y_{\text{zoom}} \leq 2$ GHz - ≤ 8 mm, 2-4GHz - ≤ 5 mm and 4-6 GHz - ≤ 4 mm; $\Delta z_{\text{zoom}} \leq 3$ GHz - ≤ 5 mm, 3-4 GHz - ≤ 4 mm and 4-6GHz - ≤ 2 mm.
- Distance between probe sensors and phantom surface was set to 3 mm except for 5 GHz band. For 5GHz band, Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was set to 100 mW or 250 mW depend on the certificate of the dipoles.
- 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 10% of the manufacturer calibrated dipole SAR target.

| T.S. Liquid | | Measured Results | | Target (Ref. value) | Delta (%) | Limit (%) | Temp. (°C) | Test Date |
|-------------|------|---------------------|---------------------------|------------------------|--------------|--------------|---------------|--------------|
| | | Zoom Scan (W/Kg) | Normalize to 1W (W/Kg) | | | | | |
| Head 2450 | 1-g | 12.7 | 50.80 | 53.70 | -5.40 | ±10 | 22.3 | May 09, 2020 |
| | 10-g | 5.79 | 23.16 | 25.00 | -7.36 | | | |
| Head 5250 | 1-g | 8.57 | 85.7 | 78.60 | 9.03 | ±10 | 22.5 | May 10, 2020 |
| | 10-g | 2.44 | 24.4 | 22.50 | 8.44 | | | |
| Head 5600 | 1-g | 8.41 | 84.1 | 81.20 | 3.57 | ±10 | 21.8 | May 18, 2020 |
| | 10-g | 2.38 | 23.8 | 23.40 | 1.71 | | | |
| Head 5750 | 1-g | 8.300 | 83.00 | 80.00 | 3.75 | ±10 | 21.8 | May 18, 2020 |
| | 10-g | 2.410 | 24.10 | 22.80 | 5.70 | | | |

11. Measured and Reported (Scaled) SAR Results

As per KDB 447498 sec.4.1.e), When SAR or MPE is measured at or scaled to the maximum tune-up tolerance limit, the results are referred to as reported.

Scaled SAR calculation formula:

Scaled SAR = Tune-up in mW / Conducted power in mW * Duty cycle (if available) * SAR value

SAR Test Reduction criteria are as follows:

KDB 447498 D01 General RF Exposure Guidance:

A) Per KDB447498 D01 v06, all SAR measurement results are scaled to the maximum tune-up tolerance limit to demonstrate SAR compliance.

B) 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.

Per KDB865664 D01 v01r04:

For each frequency band, repeated SAR measurement is required only when the measured SAR is ≥ 0.8 W/Kg; if the deviation among the repeated measurement is $\leq 20\%$, and the measured SAR < 1.45 W/Kg, only one repeated measurement is required.

Per KDB 248227 D01 v02r02:

For Wi-Fi SAR testing, a communication link is set up with the testing software for Wi-Fi mode test. During the test, at the each test frequency channel, the EUT is operated at the RF continuous emission mode. The RF signal utilized in SAR measurement has 100% duty cycle and its crest factor is 1. The test procedures in KDB 248227 D01 v02r02 are applied. (Refer to KDB 248227D01 v02r02 for more details)

Initial Test Position Procedure

For exposure condition with multiple test position, such as handsets operating next to the ear, devices with hotspot mode or UMPC mini-tablet, procedures for initial test position can be applied. Using the transmission mode determined by the DSSS procedure or initial test configuration, area scans are measured for all position in an exposure condition. The test position with the highest extrapolated (peak) SAR is used as the initial test position. When reported SAR for the initial test position is ≤ 0.4 W/kg, no additional testing for the remaining test position is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR position until the reported SAR result is ≤ 0.8 W/kg or all test position are measured. For all positions/configurations tested using the initial test position and subsequent test positions, 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.

Initial Test Configuration Procedure

An initial test configuration is determined for OFDM transmission modes according to the channel bandwidth, modulation and data rate combination(s) with the highest maximum output power specified for production units in each standalone and aggregated frequency band. SAR is measured using the highest measured maximum output power channel. For configurations with the same specified or measured maximum output power, additional transmission mode and test channel selection procedures are required (see section 5.3.2 of KDB 248227D01

v02r02). SAR test reduction of subsequent highest output test channels is based on the reported SAR of the initial test configuration.

For next to the ear, hotspot mode and UMC mini-tablet exposure configurations where multiple test positions are required, the initial test position procedure is applied to minimize the number of test positions required for SAR measurement using the initial test configuration transmission mode. For fixed exposure conditions that do not have multiple SAR test positions, SAR is measured in the transmission mode determined by the initial test configuration. When the reported SAR of the initial test configuration is > 0.8 W/kg, SAR measurement is required for the subsequent next highest measured output power channel(s) in the initial test configuration until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

Sub Test Configuration Procedure

SAR measurement requirements for the remaining 802.11 transmission mode configurations that have not been tested in the initial test configuration are determined separately for each standalone and aggregated frequency band, in each exposure condition, according to the maximum output power specified for production units.

When the highest reported SAR for the initial test configuration, according to the initial test position or fixed exposure position requirements, is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for that subsequent test configuration.

Note:

- 1) The same procedure is applied to extremity SAR evaluation, and the corresponding limitation is 2.5 times of 1-g SAR.

11.1. SAR Test Results of 2.4G Wi-Fi

Test results for Extremity 10-g SAR

| Test Position | Test Mode | Channel/ Frequency | Power (dBm) | | Measured SAR | | Duty Cycle (%) | Scaled (W/Kg) | Limit (W/Kg) |
|----------------|-----------|-----------------------|-------------|-------|--------------|-------------|----------------|---------------|--------------|
| | | | Tune-up | Meas. | 1-g (W/Kg) | 10-g (W/Kg) | | | |
| ANT1 | | | | | | | | | |
| Left Edge | 802.11b | 1/2412 | 16.00 | 15.30 | 0.105 | 0.055 | 98.88 | 0.066 | 4.0 |
| Right Edge | 802.11b | 1/2412 | 16.00 | 15.30 | 0.024 | 0.014 | 98.88 | 0.017 | 4.0 |
| Top Edge | 802.11b | 1/2412 | 16.00 | 15.30 | 0.197 | 0.116 | 98.88 | 0.138 | 4.0 |
| Bottom surface | 802.11b | 1/2412 | 16.00 | 15.30 | 3.29 | 1.230 | 98.88 | 1.461 | 4.0 |
| ANT2 | | | | | | | | | |
| Right Side | 802.11b | 1/2412 | 16.00 | 15.40 | 2.390 | 1.000 | 98.88 | 1.161 | 4.0 |
| Top Edge | 802.11b | 1/2412 | 16.00 | 15.40 | 0.239 | 0.110 | 98.88 | 0.128 | 4.0 |
| Bottom surface | 802.11b | 1/2412 | 16.00 | 15.40 | 0.004 | 0.001 | 98.88 | 0.001 | 4.0 |

OFDM mode SAR evaluation exclusion analysis for Extremity 10-g SAR

| Mode | Tune-up (dBm) | Tune-up (mW) | Highest Reported SAR (W/Kg) | Adjusted SAR (W/Kg) | SAR Test |
|------------|---------------|--------------|-----------------------------|---------------------|----------|
| 802.11b | 16.0 | 39.81 | 1.461 | \ | \ |
| 802.11g | 16.0 | 39.81 | \ | 1.461 | Excluded |
| 802.11n20 | 15.0 | 31.62 | \ | 1.161 | Excluded |
| 802.11n 40 | 13.5 | 22.39 | \ | 0.822 | Excluded |

Note:

- 1) The highest reported 10-g SAR for DSSS adjusted by the ratio of OFDM 802.11g/n to DSSS specified maximum output power and the adjusted SAR is ≤ 3.0 W/kg, so Extremity 10-g SAR evaluation for 802.11g/n are not required.

11.2. SAR Test Results of 5G Wi-Fi

Test results for 0mm Extremity 10-g SAR

| Test Position | Test Mode | Channel/ Frequency | Power (dBm) | | Measured SAR Value | | Power Drift | Duty Cycle (%) | Scaled (W/Kg) |
|-----------------------------------|-----------|-----------------------|-------------|-------|--------------------|-------------|-------------|----------------|---------------|
| | | | Tune-up | Meas. | 1-g | 10-g (W/Kg) | | | |
| 5.3GHz band | | | | | | | | | |
| SISO ANT1 | | | | | | | | | |
| Left Edge | 802.11a | 64/5320 | 14.5 | 13.85 | 0.199 | 0.040 | -0.16 | 95.0 | 0.046 |
| Right Edge | 802.11a | 64/5320 | 14.5 | 13.85 | 0.029 | 0.005 | 0.13 | 95.0 | 0.006 |
| Top Edge | 802.11a | 64/5320 | 14.5 | 13.85 | 0.169 | 0.045 | 0.0 | 95.0 | 0.055 |
| Bottom surface | 802.11a | 64/5320 | 14.5 | 13.85 | 7.450 | 1.590 | 0.18 | 95.0 | 1.944 |
| SISO ANT2 | | | | | | | | | |
| Right Side | 802.11a | 52/5260 | 14.5 | 14.11 | 2.670 | 0.813 | 0.02 | 95.0 | 0.936 |
| Top Edge | 802.11a | 52/5260 | 14.5 | 14.11 | 1.055 | 0.392 | 0.15 | 95.0 | 0.451 |
| Bottom surface | 802.11a | 52/5260 | 14.5 | 14.11 | 0.407 | 0.144 | -0.03 | 95.0 | 0.166 |
| 5.5GHz band | | | | | | | | | |
| SISO ANT1 | | | | | | | | | |
| Left Edge | 802.11a | 140/5700 | 16.2 | 16.1 | 0.238 | 0.044 | 0.18 | 95.0 | 0.048 |
| Right Edge | 802.11a | 140/5700 | 16.2 | 16.1 | 0.051 | 0.011 | 0.11 | 95.0 | 0.011 |
| Top Edge | 802.11a | 140/5700 | 16.2 | 16.1 | 0.229 | 0.061 | 0.15 | 95.0 | 0.065 |
| Bottom surface | 802.11a | 140/5700 | 16.2 | 16.1 | 9.420 | 1.925 | 0.16 | 95.0 | 2.074 |
| SISO ANT2 | | | | | | | | | |
| Right Side | 802.11a | 116/5580 | 16.2 | 16.02 | 5.690 | 1.602 | 0.02 | 95.0 | 1.758 |
| Top Edge | 802.11a | 116/5580 | 16.2 | 16.02 | 1.240 | 0.490 | 0.07 | 95.0 | 0.551 |
| Bottom surface | 802.11a | 116/5580 | 16.2 | 16.02 | 0.259 | 0.110 | -0.03 | 95.0 | 0.124 |
| 5.8GHz band | | | | | | | | | |
| SISO ANT1 | | | | | | | | | |
| Left Edge | 802.11a | 165/5825 | 16.0 | 15.82 | 0.217 | 0.046 | 0.08 | 95.0 | 0.050 |
| Right Edge | 802.11a | 165/5825 | 16.0 | 15.82 | 0.203 | 0.033 | 0.06 | 95.0 | 0.036 |
| Top Edge | 802.11a | 165/5825 | 16.0 | 15.82 | 0.442 | 0.101 | 0.01 | 95.0 | 0.111 |
| Bottom surface | 802.11a | 165/5825 | 16.0 | 15.82 | 9.698 | 2.285 | -0.03 | 95.0 | 2.382 |
| Bottom surface | 802.11a | 157/5785 | 16.0 | 15.34 | 8.748 | 2.011 | 0.03 | 95.00 | 2.341 |
| SISO ANT2 | | | | | | | | | |
| Right Side | 802.11a | 165/5825 | 16.0 | 15.51 | 3.600 | 1.100 | 0.09 | 95.0 | 1.296 |
| Top Edge | 802.11a | 165/5825 | 16.0 | 15.51 | 1.070 | 0.411 | 0.0 | 95.0 | 0.484 |
| Bottom surface | 802.11a | 165/5825 | 16.0 | 15.51 | 0.210 | 0.070 | -0.03 | 95.0 | 0.082 |
| Retest at the worst configuration | | | | | | | | | |
| Bottom surface | 802.11a | 165/5825 | 16.0 | 15.82 | 9.425 | 2.216 | -0.08 | 95.0 | 2.310 |

Note:

SAR is measured in the transmission mode determined by the initial test configuration.

When the reported 10-g SAR of the initial test configuration is > 2.0 W/kg, SAR measurement is required for the subsequent next highest measured output power channel(s) in the initial test configuration until the reported 10-gSAR is \leq 3.0 W/kg or all required channels are tested.

Subsequent test configuration SAR evaluation exclusion analysis for 10-g extremity SAR at U-NII-1 band

| Mode | Tune-up (dBm) | Tune-up (mW) | Highest Reported SAR (W/Kg) | Adjusted SAR (W/Kg) | SAR Test |
|--------------|---------------|--------------|-----------------------------|---------------------|----------|
| 802.11a | 14.5 | 28.18 | 1.944 | \ | \ |
| 802.11a | 14.0 | 25.12 | \ | 1.733 | Excluded |
| 802.11n 20M | 9.0 | 7.94 | \ | 0.548 | Excluded |
| 802.11n 40M | 11.0 | 12.59 | \ | 0.868 | Excluded |
| 802.11ac 20M | 9.0 | 7.94 | \ | 0.548 | Excluded |
| 802.11ac 40M | 11.0 | 12.59 | \ | 0.868 | Excluded |
| 802.11ac 80M | 10.5 | 11.22 | \ | 0.774 | Excluded |

Subsequent test configuration SAR evaluation exclusion analysis for 10-g extremity SAR at U-NII-2A band

| Mode | Tune-up (dBm) | Tune-up (mW) | Highest Reported SAR (W/Kg) | Adjusted SAR (W/Kg) | SAR Test |
|--------------|---------------|--------------|-----------------------------|---------------------|----------|
| 802.11a | 14.5 | 28.18 | 1.944 | \ | \ |
| 802.11n 20M | 14 | 25.12 | \ | 1.733 | Excluded |
| 802.11n 40M | 13.1 | 20.42 | \ | 1.408 | Excluded |
| 802.11ac 20M | 14 | 25.12 | \ | 1.733 | Excluded |
| 802.11ac 40M | 13.1 | 20.42 | \ | 1.408 | Excluded |
| 802.11ac 80M | 8.5 | 7.08 | \ | 0.488 | Excluded |

Subsequent test configuration SAR evaluation exclusion analysis for 10-g extremity SAR at U-NII-2C band

| Mode | Tune-up (dBm) | Tune-up (mW) | Highest Reported SAR (W/Kg) | Adjusted SAR (W/Kg) | SAR Test |
|--------------|---------------|--------------|-----------------------------|---------------------|----------|
| 802.11a | 16.2 | 41.69 | 2.074 | \ | \ |
| 802.11n 20M | 14.5 | 28.18 | \ | 1.402 | Excluded |
| 802.11n 40M | 16.0 | 39.81 | \ | 1.981 | Excluded |
| 802.11ac 20M | 14.5 | 28.18 | \ | 1.402 | Excluded |
| 802.11ac 40M | 16.1 | 40.74 | \ | 2.027 | Excluded |
| 802.11ac 80M | 16.1 | 40.74 | \ | 2.027 | Excluded |

Subsequent test configuration SAR evaluation exclusion analysis for 10-g extremity SAR at U-NII-3 band

| Mode | Tune-up (dBm) | Tune-up (mW) | Highest Reported SAR (W/Kg) | Adjusted SAR (W/Kg) | SAR Test |
|--------------|---------------|--------------|-----------------------------|---------------------|----------|
| 802.11a | 16.0 | 39.81 | 2.382 | \ | \ |
| 802.11n 20M | 15.5 | 35.48 | \ | 2.123 | Excluded |
| 802.11n 40M | 15.5 | 35.48 | \ | 2.123 | Excluded |
| 802.11ac 20M | 15.5 | 35.48 | \ | 2.123 | Excluded |
| 802.11ac 40M | 15.5 | 35.48 | \ | 2.123 | Excluded |
| 802.11ac 80M | 15.5 | 35.48 | \ | 2.123 | Excluded |

Note:

- 1) The 802.11a mode is selected as Initial Test Configuration for SAR test according to the specified maximum output power. As the highest reported SAR for the initial test configuration is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted 10-g SAR is ≤ 3.0 W/kg, SAR test for the other 802.11 modes are not required.

Test results for 25mm Body-worn 1-g SAR

| Test Position | Test Mode | Channel/Frequency | Power (dBm) | | Measured SAR Value | | Power Drift | Duty Cycle (%) | Scaled (W/Kg) | Limit (W/Kg) |
|----------------|-----------|-------------------|-------------|-------|--------------------|-------------|-------------|----------------|---------------|--------------|
| | | | Tune-up | Meas. | 1-g | 10-g (W/Kg) | | | | |
| 5.5GHz band | | | | | | | | | | |
| SISO ANT1 | | | | | | | | | | |
| Bottom surface | 802.11a | 140/5700 | 16.1 | 16.1 | 0.472 | 0.194 | 0.12 | 95.0 | 0.497 | 1.60 |
| SISO ANT2 | | | | | | | | | | |
| Bottom surface | 802.11a | 116/5580 | 16.2 | 16.02 | 0.084 | 0.028 | -0.03 | 95.0 | 0.092 | 1.60 |
| 5.8GHz band | | | | | | | | | | |
| SISO ANT1 | | | | | | | | | | |
| Bottom surface | 802.11a | 165/5825 | 16.0 | 15.82 | 0.712 | 0.325 | 0.14 | 95.0 | 0.781 | 1.60 |
| SISO ANT2 | | | | | | | | | | |
| Bottom surface | 802.11a | 165/5825 | 16.0 | 15.51 | 0.0 | 0.0 | 0.0 | 95.0 | 0.0 | 1.60 |

Subsequent test configuration SAR evaluation exclusion analysis for 1-g body-worn SAR at U-NII-2C band

| Mode | Tune-up (dBm) | Tune-up (mW) | Highest Reported SAR (W/Kg) | Adjusted SAR (W/Kg) | SAR Test |
|--------------|---------------|--------------|-----------------------------|---------------------|----------|
| 802.11a | 16.2 | 41.69 | 0.497 | \ | \ |
| 802.11n 20M | 14.5 | 28.18 | \ | 0.336 | Excluded |
| 802.11n 40M | 16.0 | 39.81 | \ | 0.475 | Excluded |
| 802.11ac 20M | 14.5 | 28.18 | \ | 0.336 | Excluded |
| 802.11ac 40M | 16.1 | 40.74 | \ | 0.486 | Excluded |
| 802.11ac 80M | 16.1 | 40.74 | \ | 0.486 | Excluded |

Subsequent test configuration SAR evaluation exclusion analysis for 1-g body-worn SAR at U-NII-3 band

| Mode | Tune-up (dBm) | Tune-up (mW) | Highest Reported SAR (W/Kg) | Adjusted SAR (W/Kg) | SAR Test |
|--------------|---------------|--------------|-----------------------------|---------------------|----------|
| 802.11a | 16.0 | 39.81 | 0.781 | \ | \ |
| 802.11n 20M | 15.5 | 35.48 | \ | 0.696 | Excluded |
| 802.11n 40M | 15.5 | 35.48 | \ | 0.696 | Excluded |
| 802.11ac 20M | 15.5 | 35.48 | \ | 0.696 | Excluded |
| 802.11ac 40M | 15.5 | 35.48 | \ | 0.696 | Excluded |
| 802.11ac 80M | 15.5 | 35.48 | \ | 0.696 | Excluded |

- 1) The 802.11a mode is selected as Initial Test Configuration for SAR test according to the specified maximum output power. As the highest reported SAR for the initial test configuration is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR test for the other 802.11 modes are not required.

12. Simultaneous Transmission SAR Analysis

According to FCC OET KDB447498 D01, when the sum of 1g SAR for all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration.

Depend on the description of coexistence mode on the module certification report, the Wi-Fi and BT can't transmit simultaneously, 2.4G and 5G can't also.

12.1. Estimated SAR

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

- 1) $(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})$.
 $[\sqrt{f(\text{GHz})}/x] \text{ W/kg}$ for test separation distances $\leq 50 \text{ mm}$, where $x = 7.5$ for 1-g SAR and $x = 18.75$ for 10-g SAR.
- 2) 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distance is $> 50 \text{ mm}$.

When the minimum test separation distance is $< 5 \text{ mm}$, a distance of 5 mm is applied.

Estimated SAR of ANT 1

| Position | Mode | Frequency (GHz) | Power (dBm) | Power (mW) | Separation Distance (mm) | Estimated SAR (W/Kg) | |
|------------------------------|------|-----------------|-------------|------------|--------------------------|----------------------|-------|
| | | | | | | 1-g | 10-g |
| Top edge | BT | 2.48 | 8.50 | 7.08 | 5.0 | / | 0.119 |
| Left edge | BT | 2.48 | 8.50 | 7.08 | 5.0 | / | 0.119 |
| Right edge | BT | 2.48 | 8.50 | 7.08 | 5.0 | / | 0.119 |
| Bottom edge | BT | 2.48 | 8.50 | 7.08 | 104.2 | / | 1.0 |
| Bottom surface | BT | 2.48 | 8.50 | 7.08 | 5.0 | / | 0.119 |
| Bottom surface for body-worn | BT | 2.48 | 8.50 | 7.08 | 25 | 0.024 | / |
| | WIFI | 2.462 | 16.0 | 39.81 | 25 | 0.333 | / |
| | | 5.32 | 14.5 | 28.18 | 25 | 0.347 | / |

Estimated SAR of ANT 2

| Position | Mode | Frequency (GHz) | Power (dBm) | Power (mW) | Separation Distance (mm) | Estimated SAR (W/Kg) | |
|------------------------------|------|-----------------|-------------|------------|--------------------------|----------------------|------|
| | | | | | | 1-g | 10-g |
| Bottom edge | WIFI | 2.462 | 16.0 | 39.81 | 110.6 | / | 1.0 |
| | | 5.32 | 14.5 | 28.18 | 110.6 | / | 1.0 |
| | | 5.72 | 16.20 | 41.69 | 110.6 | / | 1.0 |
| | | 5.825 | 16.00 | 39.81 | 110.6 | / | 1.0 |
| Left edge | WIFI | 2.462 | 16.0 | 39.81 | 78.9 | / | 1.0 |
| | | 5.32 | 14.5 | 28.18 | 78.9 | / | 1.0 |
| | | 5.72 | 16.20 | 41.69 | 78.9 | / | 1.0 |
| | | 5.825 | 16.00 | 39.81 | 78.9 | / | 1.0 |
| Bottom surface for body-worn | WIFI | 2.462 | 16.0 | 39.81 | 25.0 | 0.333 | / |
| | | 5.32 | 14.5 | 28.18 | 25.0 | 0.347 | / |

12.2. Simultaneous Transmission calculation WLAN and BT antenna.

All the value stated in the table below are the worst case found for standalone measurement with disregard of the transmission mode or channel where the worst case was found.

| Position | Antenna | Highest Reported SAR(1g)(W/kg) | | |
|------------------------------|---------|---------------------------------|-----------|-----------|
| | | WLAN 2.4GHz | WLAN 5GHz | Bluetooth |
| Bottom surface for body-worn | ANT1 | 0.333 | 0.781 | 0.024 |
| | ANT2 | 0.333 | 0.347 | / |
| Position | Antenna | Highest Reported SAR(10g)(W/kg) | | |
| | | WLAN 2.4GHz | WLAN 5GHz | Bluetooth |
| Top edge | ANT1 | 0.138 | 0.111 | 0.119 |
| | ANT2 | 0.128 | 0.551 | / |
| Bottom edge | ANT1 | 1.0 | 1.0 | 1.0 |
| | ANT2 | 1.0 | 1.0 | / |
| Right edge | ANT1 | 0.017 | 0.036 | 0.119 |
| | ANT2 | 1.161 | 1.758 | / |
| Left edge | ANT1 | 0.066 | 0.050 | 0.119 |
| | ANT2 | 1.0 | 1.0 | / |
| Bottom surface | ANT1 | 1.461 | 2.382 | 0.119 |
| | ANT2 | 0.001 | 0.166 | / |

| Position | Simultaneous Tx Antenna Combination | | Σ SAR 1g (W/kg) | SPLSR |
|------------------------------|-------------------------------------|-------------|------------------|----------|
| | ANT1 | ANT2 | | |
| Bottom surface for body-worn | WLAN 5GHz | WLAN 5GHz | 1.128 | Excluded |
| | WLAN 2.4GHz | WLAN 2.4GHz | 0.666 | Excluded |
| Position | Simultaneous Tx Antenna Combination | | Σ SAR 10g (W/kg) | SPLSR |
| | ANT1 | ANT2 | | |
| Top edge | WLAN 5GHz | WLAN 5GHz | 0.662 | Excluded |
| | WLAN 2.4GHz | WLAN 2.4GHz | 0.266 | Excluded |

| | | | | |
|----------------|-------------|-------------|-------|----------|
| Bottom edge | WLAN 5GHz | WLAN 5GHz | 2.0 | Excluded |
| | WLAN 2.4GHz | WLAN 2.4GHz | 2.0 | Excluded |
| Right edge | WLAN 5GHz | WLAN 5GHz | 1.794 | Excluded |
| | WLAN 2.4GHz | WLAN 2.4GHz | 1.178 | Excluded |
| Left edge | WLAN 5GHz | WLAN 5GHz | 1.066 | Excluded |
| | WLAN 2.4GHz | WLAN 2.4GHz | 1.050 | Excluded |
| Bottom surface | WLAN 5GHz | WLAN 5GHz | 2.548 | Excluded |
| | WLAN 2.4GHz | WLAN 2.4GHz | 1.462 | Excluded |

Note:

- 1) For 2.4G and 5G SAR was evaluated for SISO mode. The SAR distributions in MIMO mode were verified and the hot spots were sufficiently separated such that the two chains can be treated independently. So the highest SAR value across both chains in SISO mode represents the SAR value for MIMO mode.
- 2) For the maximum SUM 1-g SAR ≤ 1.6 W/Kg the SPLSR analysis is not required, when the maximum SUM 10-g SAR ≤ 4.0 W/Kg, the SPLSR analysis is not required also.

Appendixes

Refer to separated files for the following appendixes.

4789331395-SAR-14_App A Photo

4789331395-SAR-14_App B System Check Plots

4789331395-SAR-14_App C Highest Test Plots

4789331395-SAR-14_App D Cal. Certificates

-----End of Report-----