SAR EVALUATION REPORT

FCC 47 CFR § 2.1093
IEEE Std. 1528-2013

For
Tablet

FCC ID: 2AAGE5081WNC
Model: M081

Report Number: 1102260408-SAR-1

Issued Date: October 10, 2022

Prepared for
Chengdu Vantron Technology Co., Ltd.
No.5 GaoPeng Road, Hi-Tech Zone, Chengdu, SiChuan, ChengDu, China

Prepared by
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Revision History

Rev.	Issue Date	Revisions	Revised By
V0	10/12/2022	Initial Issue	\

Note:

1.This test report is only published to and used by the applicant, and it is not for evidence purpose in China.

2. The measurement result for the sample received is <Pass> according to < IEEE Std. 1528>when <Accuracy Method> decision rule is applied.

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1. Attestation of Test Results

Applicant Name	Chengdu Vantron Technology Co., Ltd.	
Address	No.5 GaoPeng Road, Hi-Tech Zone, Chengdu, SiChuan, ChengDu, China	
Manufacturer	Chengdu Vantron Technology Co., Ltd.	
Address	No.5 GaoPeng Road, Hi-Tech Zone, Chengdu, SiChuan, ChengDu, China	
EUT Name	Tablet	
Model	M081	
Sample Received Date	October 9, 2022	
Sample Status	Normal	
Date of Tested	October 10, 2022 ~ October 11, 2022	
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**
Body (1-g)	0.616	1.194
Simultaneous Transmission (1-g)	\	
Test Results	Pass	
Prepared By: Burt Hu Burt Hu Laboratory Engineer	Reviewed By: Denny Huang Denny Huang Senior Project Engineer	Approved By: Stephen Guo 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

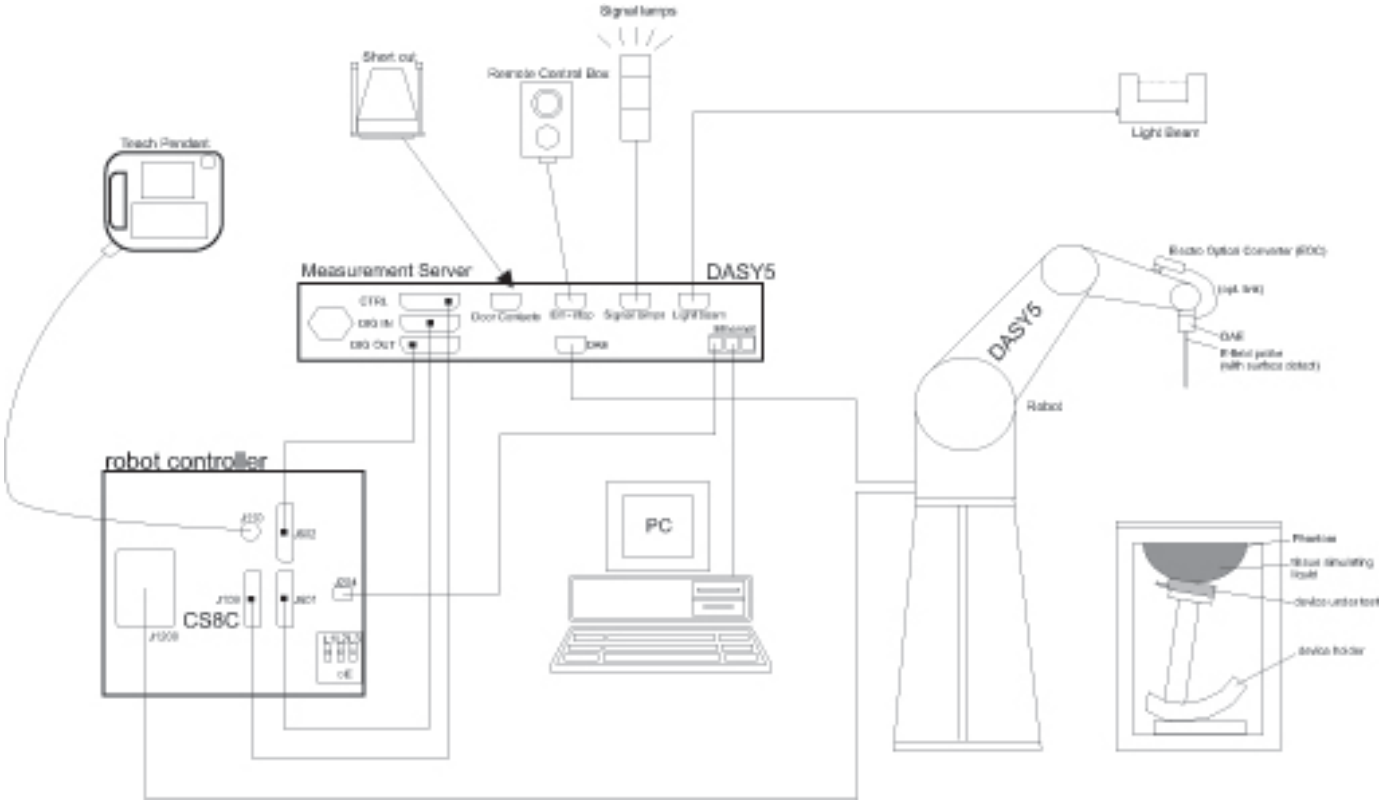
3. Facilities and Accreditation

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	**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. **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 **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. **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. 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
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 mm ± 1 mm	½·δ·ln(2) mm ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}	≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*

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: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ 1.5·$\Delta z_{Zoom}(n-1)$ mm	
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 IEEE Std 1528-2013 for details.

* When zoom scan is required and the *reported* SAR from the *area scan based 1-g SAR estimation* procedures of KDB Publication 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.

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	2022.10.29
Dielectric Probe kit	SPEAG	SM DAK 040 SA	1155	NCR
DC power supply	Keysight	E36103A	MY55350020	2022.10.29
Signal Generator	Rohde & Schwarz	SME06	837633\001	2022.10.29
BI-Directional Coupler	WERLATONE	C8060-102	3423	2022.10.29
Peak and Average Power Sensor	Keysight	E9323A	MY55440013	2022.10.29
Peak and Average Power Sensor	Keysight	E9323A	MY55420006	2022.10.29
Dual Channel PK Power Meter	Keysight	N1912A	MY55416024	2022.10.29
Amplifier	CORAD TECHNOLOGY LTD	AMF-4D-00400600-50-30P	1983561	NCR
Dosimetric E-Field Probe	SPEAG	EX3DV4	7383	2023.1.11
Data Acquisition Electronic	SPEAG	DAE3	427	2023.4.11
Dipole Kit 2450 MHz	SPEAG	D2450V2	977	2022.12.16
Dipole Kit 5 GHz	SPEAG	D5GHzV2	1231	2022.12.15
Software	SPEAG	DASY52	N/A	NCR
Twin Phantom	SPEAG	SAM V8.0	2001	NCR
Thermometer	/	GX-138	150709653	2022.10.29
Thermometer	VICTOR	ITHX-SD-5	18470005	2022.10.29

Note:

1) Per KDB865664D01 v01r04 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) Network analyzer probe calibration against air, distilled water and a shorting block performed before measuring liquid parameters.

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 tablet with IEEE 802.11a/b/g/n/ac, Bluetooth and NFC.	
Dimension	Overall (Length x Width x Height): 235 mm x 165 mm x 23 mm

6.2. Wireless Technology

Wireless technology	Frequency band
Wi-Fi	2.4 GHz
Wi-Fi	5 GHz
BT	2.4 GHz
NFC	13.56 MHz

7. Conducted Output Power Measurement and tune-up tolerance

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

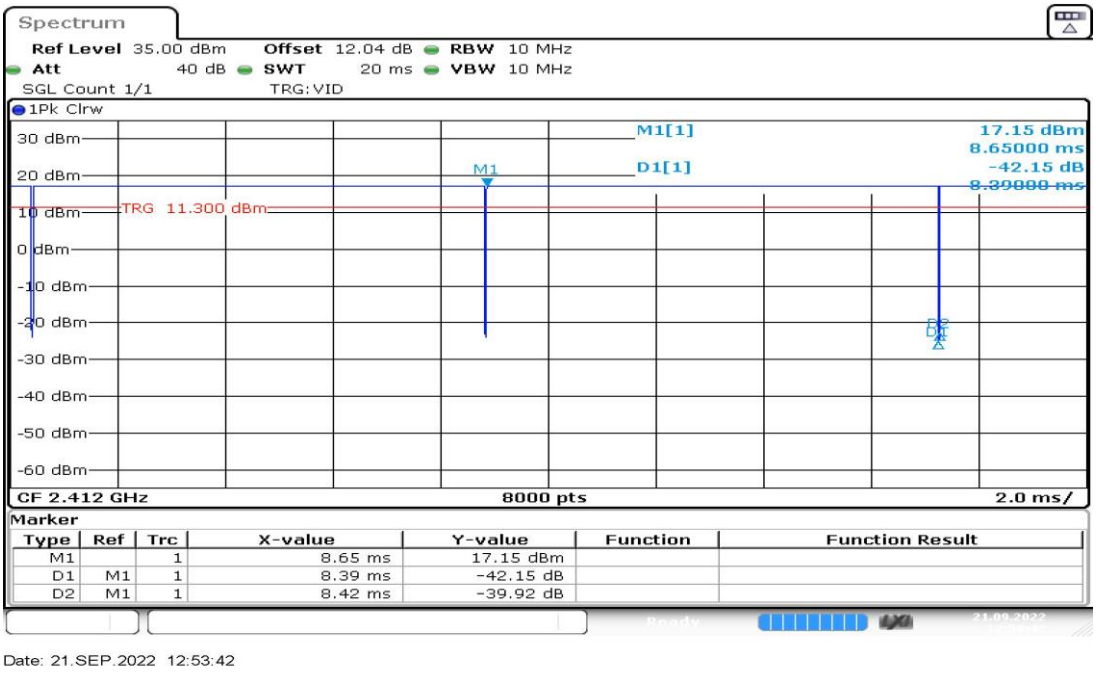
Mode	Channel	Frequency (MHz)	Data Rate	Average Power (dBm)	Tune-up Limit (dBm)	Duty Cycle (%)
802.11b	1	2412	1Mbps	14.90	15.5	99.64
	6	2437		14.02	15.5	
	11	2462		15.45	15.5	
802.11g	1	2412	6Mbps	Not required	15.5	Not required
	6	2437			15.5	
	11	2462			15.5	
802.11n20	1	2412	MCS0	Not required	13.5	Not required
	6	2437			13.5	
	11	2462			13.5	

Note:

1. 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.

Duty cycle:

Test Mode	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
11B	2412	8.39	8.42	99.64



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

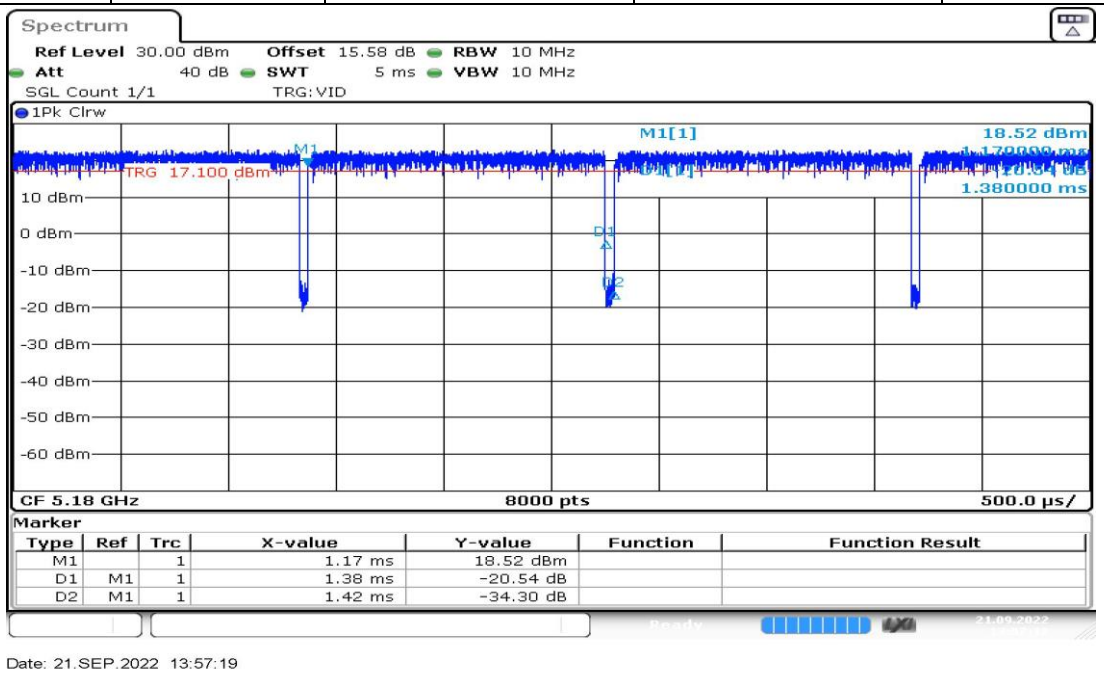
Band	Mode	Channel	**Frequency (MHz)**	Data Rate	Average power (dBm)	Tune-up Limit (dBm)	SAR Test
U-NII-1	802.11a	36	5180	6Mbps	16.98	17.0	Required
		40	5200		16.71	17.0	
		44	5220		16.37	17.0	
		48	5240		16.44	17.0	
	802.11n-HT20	36	5180	MCS0	Not required	16.5	Not required
		40	5200			16.5	
		44	5220			16.5	
		48	5240			16.5	
	802.11n-HT40	38	5190	MCS0		14.0	
		46	5230			14.0	
	802.11ac-VHT20	36	5180	MCS0		16.5	
		40	5200			16.5	
		44	5220			16.5	
		48	5240			16.5	
	802.11ac-VHT40	38	5190	MCS0		14.0	
		46	5230			14.0	
	802.11ac-VHT80	42	5210	MCS0		13.0	
U-NII-3	802.11a	149	5745	6Mbps	15.27	15.5	Required
		153	5765		15.28	15.5	
		157	5785		15.15	15.5	
		161	5805		15.33	15.5	
		165	5825		15.48	15.5	
	802.11n-HT20	149	5745	MCS0	Not required	15.0	Not required
		153	5765			15.0	
		157	5785			15.0	
		161	5805			15.0	
		165	5825			15.0	
	802.11n-HT40	151	5755	MCS0		14.5	
		159	5795			14.5	
	802.11ac-VHT20	149	5745	MCS0		15.0	
		153	5765			15.0	
		157	5785			15.0	
		161	5805			15.0	
		165	5825			15.0	
	802.11ac-VHT40	151	5755	MCS0		14.5	
		159	5795			14.5	
	802.11ac-VHT80	155	5775	MCS0		12.5	

Note:

1. 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.

Duty cycle:

Test Mode	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
11A	5180	1.38	1.42	97.18



7.3. Power measurement result BT

Test Mode	Channel	Average Conducted Power (dBm)	Tune-up(dBm)	Duty Cycle (%)
DH5	0	Not required	4.5	Not required
	39	Not required	6.0	
	78	Not required	6.0	
3DH5	0	Not required	1.7	Not required
	39	Not required	1.7	
	78	Not required	1.7	
BLE_1M	0	Not required	1.0	Not required
	19	Not required	1.5	
	39	Not required	1.5	
BLE_2M	0	Not required	-1.1	Not required
	19	Not required	-1.1	
	39	Not required	-1.1	

Note:

1. 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.
2. As per KDB 447498, maximum tune-up of BT mode is satisfied for Stand-alone SAR evaluation exemption.

   Exemption analysis:

Frequency (MHz)	Power (dBm)	Power (mW)	Separation Distance (mm)	Calculation Result	Threshold
2480	6.00	3.98	5.00	1.3	3.0

8. Test Configuration

8.1. Wi-Fi Test Configuration

For Wi-Fi SAR testing, a communication link is set up with the testing software for Wi-Fi mode test. During the test, at each test frequency channel, the EUT is operated at the RF continuous emission mode. The test procedures in KDB 248227D01 are applied.

8.1.1. 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 ≤ 0.4W/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 ≤ 0.8W/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.

8.1.2. 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). 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.

8.1.3. 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.

8.1.4. 2.4GHz Wi-Fi SAR Test Procedures

Separate SAR procedures are applied to DSSS and OFDM configurations in the 2.4 GHz band to simplify DSSS test requirements. For 802.11b DSSS SAR measurements, DSSS SAR procedure applies to fixed exposure test position and initial test position procedure applies to multiple exposure test positions.

A) 802.11b DSSS SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either a fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

1) When the reported SAR of the highest measured maximum output power channel (section 3.1 of KDB 248227D01) for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
2) When the reported SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

B) 2.4GHz 802.11g/n OFDM SAR Test Exclusion Requirements

When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, the measurement and test reduction procedures for OFDM are applied (section 5.3 of KDB 248227D01). SAR is not required for the following 2.4 GHz OFDM conditions.

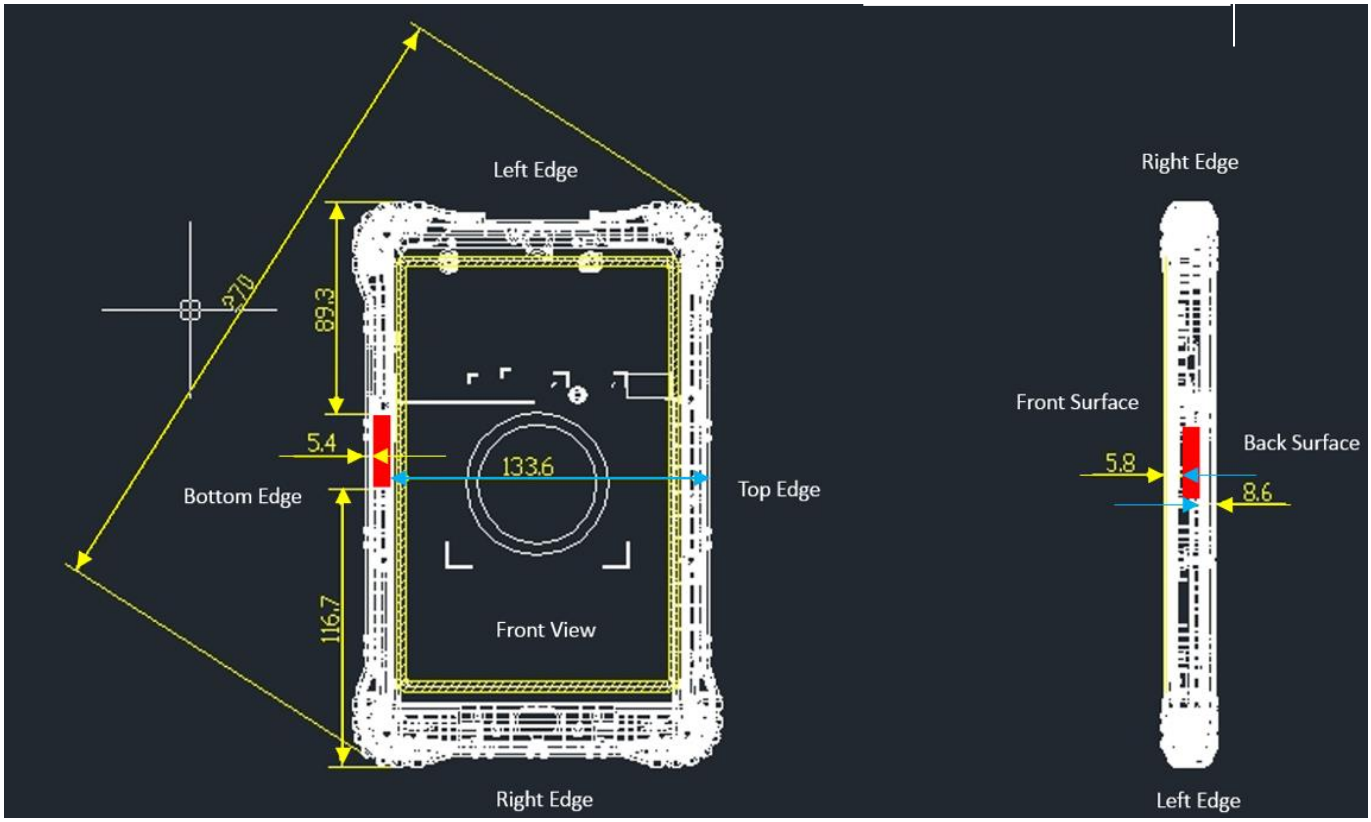
1) When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
2) When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

C) SAR Test Requirements for OFDM configurations

When SAR measurement is required for 802.11 g/n OFDM configurations, each standalone and frequency aggregated band is considered separately for SAR test reduction. In applying the initial test configuration and subsequent test configuration procedures, the 802.11 transmission configuration with the highest specified maximum output power and the channel within a test configuration with the highest measured maximum output power should be clearly distinguished to apply the procedures.

9. RF Exposure Conditions

Refer to the diagram of the device below for the specific details of the antenna to surface and edge distance.



Note:

1. The figure in red indicates the antenna.

Per FCC KDB 616217 D04
The overall diagonal dimension of the display section of a tablet is > 20cm, the bottom surface and edges of the tablet should be selected for SAR evaluation at a 0mm separation distance, Exposures from antennas through the front surface of the display section of a full-size tablet, away from the edges, are generally limited to the user's hands. Exposures to hands for typical consumer transmitters used in tablets are not expected to exceed the extremity SAR limit; therefore, SAR evaluation for the front surface of tablet display screens are generally not necessary, except for tablets that are designed to require continuous operations with the hand(s) next to the antenna(s)

Per FCC KDB 447498 D01:
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:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for product specific 10-g SAR, where:

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

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 >50mm 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.

9.1. SAR exclusion analysis

For 2.4GHz Wi-Fi 1-g SAR (antenna to surface or edge separation distance less than 50mm)

Position	Frequency (MHz)	Power (dBm)	Power (mW)	Separation Distance (mm)	Calculation Result	Threshold	SAR Test
Back surface	2450	15.5	35.48	8.60	6.5	3.0	Required
Left edge	2450	15.5	35.48	\	\	\	\
Right edge	2450	15.5	35.48	\	\	\	\
Top edge	2450	15.5	35.48	\	\	\	\
Bottom edge	2450	15.5	35.48	5.40	10.3	3.0	Required

For 2.4GHz Wi-Fi 1-g SAR (antenna to surface or edge separation distance greater than 50mm)

Position	Frequency (MHz)	Power (dBm)	Power (mW)	Power allowed at 50mm	Separation Distance (mm)	Calculation Result (mW)	SAR Test
Back surface	2450	15.5	35.48	\	\	\	\
Left edge	2450	15.5	35.48	95.83	89.3	488.83	Excluded
Right edge	2450	15.5	35.48	95.83	116.70	762.83	Excluded
Top edge	2450	15.5	35.48	95.83	133.60	931.83	Excluded
Bottom edge	2450	15.5	35.48	\	\	\	\

Note:

1. Because the power in mW is less than the calculation result, so SAR evaluation for corresponding position is not required.

For 5GHz Wi-Fi U-NII-1 1-g SAR (antenna to surface or edge separation distance less than 50mm)

Position	Frequency (MHz)	Power (dBm)	Power (mW)	Separation Distance (mm)	Calculation Result	Threshold	SAR Test
Back surface	5250	17	50.12	8.60	13.4	3.0	Required
Left edge	5250	17	50.12	\	\	\	\
Right edge	5250	17	50.12	\	\	\	\
Top edge	5250	17	50.12	\	\	\	\
Bottom edge	5250	17	50.12	5.40	21.3	3.0	Required

For 5GHz Wi-Fi U-NII-1 1-g SAR (antenna to surface or edge separation distance greater than 50mm)

Position	Frequency (MHz)	Power (dBm)	Power (mW)	Power allowed at 50mm	Separation Distance (mm)	Calculation Result (mW)	SAR Test
Back surface	5250	17	50.12	\	\	\	\
Left edge	5250	17	50.12	163.66	89.3	556.66	Excluded
Right edge	5250	17	50.12	163.66	116.70	830.66	Excluded
Top edge	5250	17	50.12	163.66	133.60	999.66	Excluded
Bottom edge	5250	17	50.12	\	\	\	\

Note:

1. Because the power in mW is less than the calculation result, so SAR evaluation for corresponding position is not required.

For 5GHz Wi-Fi U-NII-3 1-g SAR (antenna to surface or edge separation distance less than 50mm)

Position	Frequency (MHz)	Power (dBm)	Power (mW)	Separation Distance (mm)	Calculation Result	Threshold	SAR Test
Back surface	5825	15.5	35.48	8.60	10.0	3.0	Required
Left edge	5825	15.5	35.48	\	\	\	\
Right edge	5825	15.5	35.48	\	\	\	\
Top edge	5825	15.5	35.48	\	\	\	\
Bottom edge	5825	15.5	35.48	5.40	15.9	3.0	Required

For 5GHz Wi-Fi U-NII-3 1-g SAR (antenna to surface or edge separation distance greater than 50mm)

Position	Frequency (MHz)	Power (dBm)	Power (mW)	Power allowed at 50mm	Separation Distance (mm)	Calculation Result (mW)	SAR Test
Back surface	5825	15.5	35.48	\	\	\	\
Left edge	5825	15.5	35.48	155.38	89.3	548.38	Excluded
Right edge	5825	15.5	35.48	155.38	116.70	822.38	Excluded
Top edge	5825	15.5	35.48	155.38	133.60	991.38	Excluded
Bottom edge	5825	15.5	35.48	\	\	\	\

Note:

1. Because the power in mW is less than the calculation result, so SAR evaluation for corresponding position is not 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 ± 2°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 1528-2013Dielectric 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	2400	38.650	1.768	39.29	1.76	-1.63	0.45	±5	23.5	October 9, 2022
	2450	38.650	1.826	39.20	1.80	-1.40	1.44			
	2480	38.430	1.843	39.16	1.83	-1.86	0.71			
Head 5250	5160	34.730	4.455	36.03	4.61	-3.61	-3.36	±5	22.8	October 10, 2022
	5250	34.630	4.560	35.93	4.71	-3.62	-3.18			
	5340	34.500	4.644	35.83	4.80	-3.71	-3.25			
Head 5750	5660	35.400	4.939	35.46	5.13	-0.17	-3.72	±5	22.8	October 10, 2022
	5750	35.320	5.006	35.36	5.22	-0.11	-4.10			
	5840	35.170	5.112	35.27	5.30	-0.28	-3.55			

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(≤2GHz), 12 mm in x- and y-dimension(2-4 GHz) and 10mm in x- and y- dimension(4-6GHz).
- For zoom scan, Δx_{zoom}, Δy_{zoom}≤ 2GHz - ≤8mm, 2-4GHz - ≤5 mm and 4-6 GHz-≤4mm; Δz_{zoom} ≤3GHz - ≤5 mm, 3-4 GHz- ≤4mm and 4-6GHz-≤2mm.
- 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. (℃)	Test Date
		Zoom Scan (W/Kg)	Normalize to 1W (W/Kg)					
Head 2450	1-g	13.500	54.00	53.20	1.50	±10	23.5	October 9, 2022
	10-g	6.210	24.84	24.20	2.64			
Head 5250	1-g	8.100	81.00	77.90	3.98	±10	22.8	October 10, 2022
	10-g	2.350	23.50	22.60	3.98			
Head 5750	1-g	7.580	75.80	78.30	-3.19	±10	22.8	October 10, 2022
	10-g	2.190	21.90	22.40	-2.23			

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 * 100 / (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 ≥0.8W/Kg; if the deviation among the repeated measurement is ≤ 20%, and the measured SAR <1.45W/Kg, only one repeated measurement is required.

KDB 248227 D01 v02r02 for Wi-Fi Devices:
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 ≤ 0.4W/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 ≤ 0.8W/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:
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 2.4GHz Wi-Fi.

Test Positon (Body 0mm)	Test Mode	Channel/ Frequency	Power (dBm)		SAR Value	Power Drift	Duty Factor (%)	Scaled (W/Kg)
			Tune-up	Meas.	1-g (Zoom Scan)			
Back Surface	802.11 b	11/2462	15.5	15.45	0.569	0.16	99.64	0.578
Bottom Edge	802.11 b	11/2462	15.5	15.45	0.607	0.14	99.64	0.616

OFDM mode SAR evaluation exclusion analysis

Mode	Tune-up (dBm)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR Test
802.11b	15.5	0.616	\	\
802.11g	15.5	\	0.616	Excluded
802.11n (20M)	13.5	\	0.389	Excluded

Note:

1. The highest reported SAR for DSSS adjusted by the ratio of OFDM 802.11g/n to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, so SAR evaluation for 802.11g/n is not required.

11.2. SAR Test Results of 5GHz Wi-Fi U-NII-1.

Test Positon (Body 0mm)	Test Mode	Channel/ Frequency	Power (dBm)		SAR Value	Power Drift	Duty Factor (%)	Scaled (W/Kg)
			Tune-up	Meas.	1-g (Zoom Scan)			
Back Surface	802.11 a	36/5180	17.00	16.98	0.986	0.18	97.18	1.019
Back Surface	802.11 a	40/5200	17.00	16.71	0.963	0.00	97.18	1.059
Back Surface	802.11 a	48/5240	17.00	16.44	1.020	-0.12	97.18	1.194
Bottom Edge	802.11 a	36/5180	17.00	16.98	0.691	0.12	97.18	0.714
Back Surface-Repeated	802.11 a	48/5240	17.00	16.44	1.010	0.00	97.18	1.182

Subsequent test configuration SAR evaluation exclusion analysis

Mode	Tune-up (dBm)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR Test
802.11a	17.0	1.194	\	\
802.11n 20M	16.5	\	1.064	Excluded
802.11n 40M	14.0	\	0.598	Excluded
802.11ac 20M	16.5	\	1.064	Excluded
802.11ac 40M	14.0	\	0.598	Excluded
802.11ac 80M	13.0	\	0.475	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 SAR of the other rest mode is ≤ 1.2 W/kg, SAR test for the accordingly modes are not required.

11.3. SAR Test Results of 5GHz Wi-Fi U-NII-3.

Test Positon (Body 0mm)	Test Mode	Channel/ Frequency	Power (dBm)		SAR Value	Power Drift	Duty Factor (%)	Scaled (W/Kg)
			Tune-up	Meas.	1-g (Zoom Scan)			
Back Surface	802.11 a	165/5825	15.5	15.48	0.981	-0.16	97.18	1.014
Back Surface	802.11 a	157/5785	15.5	15.15	1.020	0.17	97.18	1.138
Back Surface	802.11 a	149/5745	15.5	15.27	0.938	-0.11	97.18	1.018
Back Surface	802.11 a	153/5765	15.5	15.28	1.000	-0.07	97.18	1.082
Back Surface	802.11 a	161/5805	15.5	15.33	1.030	-0.13	97.18	1.102
Bottom Edge	802.11 a	165/5825	15.5	15.48	0.719	0.02	97.18	0.743
Back Surface-Repeated	802.11 a	157/5785	15.5	15.15	1.050	-0.06	97.18	1.171

Subsequent test configuration SAR evaluation exclusion analysis

Mode	Tune-up (dBm)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR Test
802.11a	15.5	1.171	\	\
802.11n 20M	15	\	1.044	Excluded
802.11n 40M	14.5	\	0.930	Excluded
802.11ac 20M	15	\	0.144	Excluded
802.11ac 40M	14.5	\	0.930	Excluded
802.11ac 80M	12.5	\	0.578	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 SAR of the other rest mode is ≤ 1.2 W/kg, SAR test for the accordingly modes is not required.

12. Simultaneous Transmission SAR Analysis

Simultaneous transmission is not supported.

Appendixes

Refer to separated files for the following appendixes.

1102260408-SAR-1_App A Photo

1102260408-SAR-1_App B System Check Plots

1102260408-SAR-1_App C Highest Test Plots

1102260408-SAR-1_App D Cal. Certificates

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