FCC SAR TEST REPORT

FCC ID	:	**2AS7A-B3KF1**
Equipment	:	**Head Mounted Display**
Model Name	:	**KW49CM**
Applicant	:	**Imaginante, LLC** **103 Foulk Road, Suite 202, Wilmington, DE 19803**
Standard	:	**FCC 47 CFR Part 2 (2.1093)** **ANSI/IEEE C95.1-1992** **IEEE 1528-2013**

The product was received on Dec. 25, 2019 and testing was started from Dec. 26, 2019 and completed on May 01, 2020. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Approved by: Cona Huang / Deputy Manager

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History of this test report

Report No.	Version	Description	Issued Date
FA9D1825-01	01	Initial issue of report	Aug. 14, 2020

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for Imaginante, LLC, Head Mounted Display, KW49CM, are as follows.

Equipment Class	Frequency Band	Highest SAR Summary		Highest Simultaneous Transmission 1g SAR (W/kg)	Highest Simultaneous Transmission 10g SAR (W/kg)
		Head (Separation 0mm)	Extremity (Separation 0mm)		
		1g SAR (W/kg)	10g SAR (W/kg)		
DTS	2.4GHz WLAN	1.14	2.00		
NII	5GHz WLAN	1.19	1.35	1.34	2.02
DSS	Bluetooth	0.10	0.21		
Date of Testing:		2019/12/26 ~ 2020/5/1			

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 1190) and the FCC designation No. TW1190 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC test. This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg for Partial-Body 1g SAR, 4.0 W/kg for Product Specific 10g SAR) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications

Reviewed by: Jason Wang
Report Producer: Wan Liu

2. Guidance Applied

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards:

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2013
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB 865664 D02 SAR Reporting v01r02
- FCC KDB 447498 D01 General RF Exposure Guidance v06
- FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r02

3. Equipment Under Test (EUT) Information

3.1 General Information

Product Feature & Specification	
Equipment Name	Head Mounted Display
Model Name	KW49CM
FCC ID	2AS7A-B3KF1
Wireless Technology and Frequency Range	WLAN 2.4GHz Band: 2400 MHz ~ 2483.5 MHz WLAN 5.2GHz Band: 5150 MHz ~ 5250 MHz WLAN 5.3GHz Band: 5250 MHz ~ 5350 MHz WLAN 5.6GHz Band: 5470 MHz ~ 5725 MHz WLAN 5.8GHz Band: 5725 MHz ~ 5825 MHz Bluetooth: 2400 MHz ~ 2483.5 MHz SRD: 2402 MHz ~ 2478 MHz
Mode	WLAN: 802.11a/b/g/n/ac/ax HT20/HT40/VHT20/VHT40/VHT80/HE20/HE40/HE80 Bluetooth BR/EDR/LE SRD: GFSK
EUT Stage	Identical Prototype
General Note: 1. This device has three kinds sample, RF exposure evaluation chose Sample J & K as the main test, and Sample M was spot checked the worst case of Sample J or K.	

4. RF Exposure Limits

4.1 Uncontrolled Environment

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

4.2 Controlled Environment

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

Limits for Occupational/Controlled Exposure (W/kg)

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

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

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

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

5. Specific Absorption Rate (SAR)

5.1 Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

5.2 SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is as below:

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

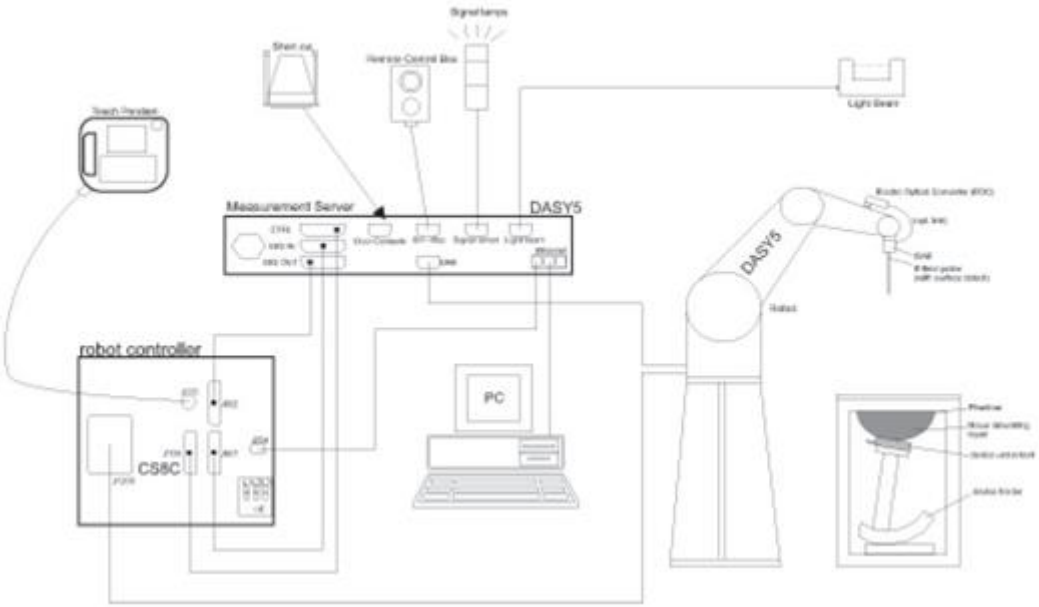
SAR is expressed in units of Watts per kilogram (W/kg)

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

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

6. System Description and Setup

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



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

6.1 E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG).The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

<ES3DV3 Probe>

Construction	Symmetric design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz – 4 GHz; Linearity: ±0.2 dB (30 MHz – 4 GHz)	
Directivity	±0.2 dB in TSL (rotation around probe axis) ±0.3 dB in TSL (rotation normal to probe axis)	
Dynamic Range	5 µW/g – >100 mW/g; Linearity: ±0.2 dB	
Dimensions	Overall length: 337 mm (tip: 20 mm) Tip diameter: 3.9 mm (body: 12 mm) Distance from probe tip to dipole centers: 3.0 mm	

<EX3DV4 Probe>

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

6.2 Data Acquisition Electronics (DAE)

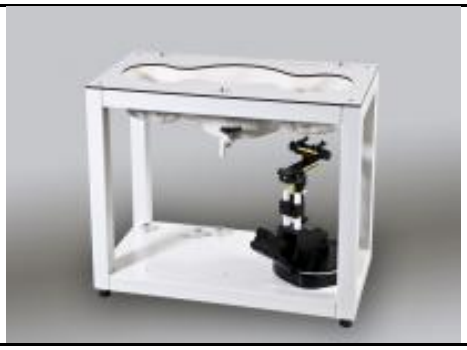
The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

Fig 5.1 Photo of DAE

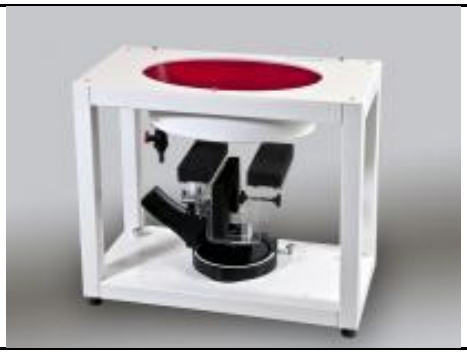
6.3 Phantom

<SAM Twin Phantom>

Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm	
Filling Volume	Approx. 25 liters	
Dimensions	Length: 1000 mm; Width: 500 mm; Height: adjustable feet	
Measurement Areas	Left Hand, Right Hand, Flat Phantom	

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

<ELI Phantom>

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

The ELI phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids.

6.4 Device Holder

<Mounting Device for Hand-Held Transmitter>

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

Mounting Device for Hand-Held Transmitters

Mounting Device Adaptor for Wide-Phones

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

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

Mounting Device for Laptops

7. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

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

<SAR measurement>

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

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

(a) Power reference measurement
(b) Area scan
(c) Zoom scan
(d) Power drift measurement

7.1 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

(a) Extraction of the measured data (grid and values) from the Zoom Scan
(b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
(c) Generation of a high-resolution mesh within the measured volume
(d) Interpolation of all measured values form the measurement grid to the high-resolution grid
(e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
(f) Calculation of the averaged SAR within masses of 1g and 10g

7.2 Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

7.3 Area Scan

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum found in the scanned area, within a range of the global maximum. The range (in dB0 is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan), if only one zoom scan follows the area scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of zoom scans has to be increased accordingly.

Area scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: 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.	

7.4 Zoom Scan

Zoom scans are used assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube shoes base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the zoom scan evaluates the averaged SAR for 1 gram and 10 gram and displays these values next to the job's label.

Zoom scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

			≤ 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	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
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 *reported* SAR from the *area scan based 1-g SAR estimation* 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.

7.5 Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

7.6 Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drifts more than 5%, the SAR will be retested.

8. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	2450MHz System Validation Kit	D2450V2	929	Nov. 21, 2019	Nov. 20, 2020
SPEAG	5GHz System Validation Kit	D5GHzV2	1128	Dec. 16, 2019	Dec. 15, 2020
SPEAG	Data Acquisition Electronics	DAE4	376	Dec. 06, 2019	Dec. 05, 2020
SPEAG	Data Acquisition Electronics	DAE4	1311	Aug. 27, 2019	Aug. 26, 2020
SPEAG	Dosimetric E-Field Probe	EX3DV4	3925	Sep. 20, 2019	Sep. 19, 2020
RCPTWN	Thermometer	HTC-1	TM685-1	Nov. 12, 2019	Nov. 11, 2020
RCPTWN	Thermometer	HTC-1	TM560-2	Nov. 12, 2019	Nov. 11, 2020
R&S	BT Base Station	CBT32	100519	Jun. 04, 2019	Jun. 03, 2020
SPEAG	Device Holder	N/A	N/A	N/A	N/A
Anritsu	Signal Generator	MG3710A	6201502524	Nov. 20, 2019	Nov. 19, 2020
Agilent	ENA Network Analyzer	E5071C	MY46104758	Sep. 06, 2019	Sep. 05, 2020
SPEAG	Dielectric Probe Kit	DAK-3.5	1126	Sep. 18, 2019	Sep. 17, 2020
LINE SEIKI	Digital Thermometer	DTM3000-spezial	3169	Sep. 10, 2019	Sep. 09, 2020
Anritsu	Power Meter	ML2495A	1036004	Aug. 08, 2019	Aug. 07, 2020
Anritsu	Power Sensor	MA2411B	1027253	Aug. 08, 2019	Aug. 07, 2020
Anritsu	Power Meter	ML2495A	1419002	May. 29, 2019	May. 28, 2020
Anritsu	Power Sensor	MA2411B	1339124	May. 29, 2019	May. 28, 2020
Agilent	Spectrum Analyzer	E4408B	MY44211028	Aug. 27, 2019	Aug. 26, 2020
Anritsu	Spectrum Analyzer	MS2830A	6201396378	Jun. 27, 2019	Jun. 26, 2020
Mini-Circuits	Power Amplifier	ZVE-8G+	6418	Oct. 16, 2019	Oct. 15, 2020
Mini-Circuits	Power Amplifier	ZVE-8G+	6382	Aug. 12, 2019	Aug. 11, 2020
Mini-Circuits	Power Amplifier	ZHL-42W+	321501827	Aug. 12, 2019	Aug. 11, 2020
Mini-Circuits	Power Amplifier	ZHL-42W+	715701915	May. 10, 2019	May. 09, 2020
ATM	Dual Directional Coupler	C122H-10	P610410z-02	Note 1	
Woken	Attenuator 1	WK0602-XX	N/A	Note 1	
PE	Attenuator 2	PE7005-10	N/A	Note 1	
PE	Attenuator 3	PE7005- 3	N/A	Note 1	

General Note:

1. Prior to system verification and validation, the path loss from the signal generator to the system check source and the power meter, which includes the amplifier, cable, attenuator and directional coupler, was measured by the network analyzer. The reading of the power meter was offset by the path loss difference between the path to the power meter and the path to the system check source to monitor the actual power level fed to the system check source.

9. System Verification

9.1 Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 10.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 10.2.

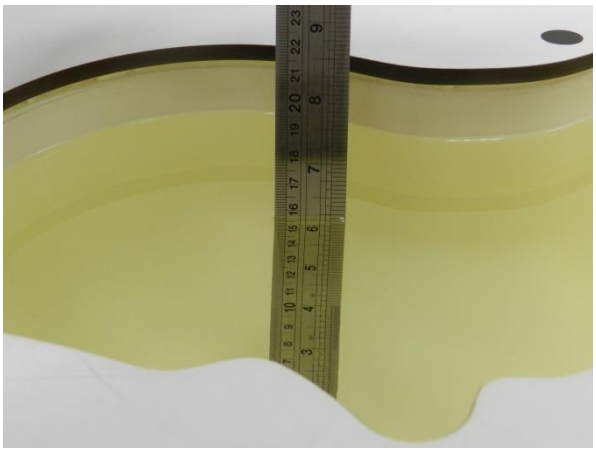


Fig 10.1Photo of Liquid Height for Head SAR

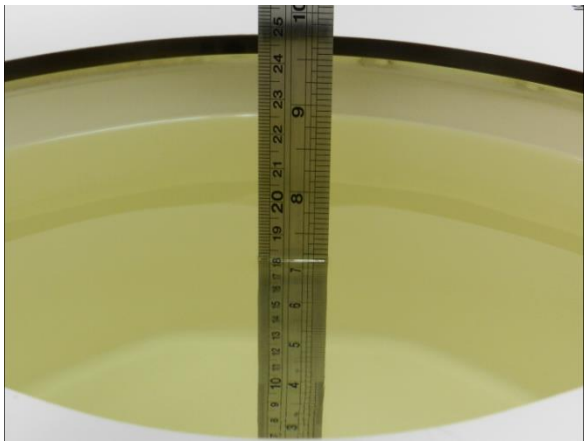


Fig 10.2 Photo of Liquid Height for Body SAR

9.2 Tissue Verification

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

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (εr)
750	41.1	57.0	0.2	1.4	0.2	0	0.89	41.9
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
900	40.3	57.9	0.2	1.4	0.2	0	0.97	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
2600	54.8	0	0	0.1	0	45.1	1.96	39.0

Simulating Liquid for 5GHz, Manufactured by SPEAG

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

<Tissue Dielectric Parameter Check Results>

Frequency (MHz)	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
2450	22.8	1.851	39.293	1.80	39.20	2.83	0.24	±5	2019/12/26
2450	22.3	1.825	38.245	1.80	39.20	1.39	-2.44	±5	2019/12/31
2450	22.5	1.792	38.550	1.80	39.20	-0.44	-1.66	±5	2020/1/2
5250	22.6	4.843	37.159	4.71	35.95	2.82	3.36	±5	2020/4/29
5600	22.3	5.251	36.768	5.07	35.50	3.57	3.57	±5	2020/5/1
5750	22.1	5.047	35.157	5.22	35.35	-3.31	-0.55	±5	2019/12/27
5750	22.3	5.059	35.077	5.22	35.35	-3.08	-0.77	±5	2019/12/31
5750	22.5	5.043	36.259	5.22	35.35	-3.39	2.57	±5	2020/1/2
5750	22.7	5.070	35.699	5.22	35.35	-2.87	0.99	±5	2020/1/7
5750	22.3	5.422	36.585	5.22	35.35	3.87	3.49	±5	2020/5/1

9.3 System Performance Check Results

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

Date	Frequency (MHz)	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)
2019/12/26	2450	250	D2450V2-929	EX3DV4 - SN3925	DAE4 Sn1311	13.10	53.10	52.4	-1.32
2019/12/31	2450	250	D2450V2-929	EX3DV4 - SN3925	DAE4 Sn1311	12.90	53.10	51.6	-2.82
2020/1/2	2450	250	D2450V2-929	EX3DV4 - SN3925	DAE4 Sn1311	12.60	53.10	50.4	-5.08
2020/4/29	5250	100	D5GHzV2-1128-5250	EX3DV4 - SN3925	DAE4 Sn376	7.98	80.00	79.8	-0.25
2020/5/1	5600	100	D5GHzV2-1128-5600	EX3DV4 - SN3925	DAE4 Sn376	8.63	82.40	86.3	4.73
2019/12/27	5750	100	D5GHzV2-1128-5750	EX3DV4 - SN3925	DAE4 Sn1311	7.67	79.10	76.7	-3.03
2019/12/31	5750	100	D5GHzV2-1128-5750	EX3DV4 - SN3925	DAE4 Sn1311	7.55	79.10	75.5	-4.55
2020/1/2	5750	100	D5GHzV2-1128-5750	EX3DV4 - SN3925	DAE4 Sn1311	8.66	79.10	86.6	9.48
2020/1/7	5750	100	D5GHzV2-1128-5750	EX3DV4 - SN3925	DAE4 Sn1311	7.70	79.10	77	-2.65
2020/5/1	5750	100	D5GHzV2-1128-5750	EX3DV4 - SN3925	DAE4 Sn376	7.76	79.10	77.6	-1.90

Date	Frequency (MHz)	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 10g SAR (W/kg)	Targeted 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Deviation (%)
2019/12/26	2450	250	D2450V2-929	EX3DV4 - SN3925	DAE4 Sn1311	6.13	24.70	24.52	-0.73
2019/12/31	2450	250	D2450V2-929	EX3DV4 - SN3925	DAE4 Sn1311	5.96	24.70	23.84	-3.48
2020/1/2	2450	250	D2450V2-929	EX3DV4 - SN3925	DAE4 Sn1311	5.91	24.70	23.64	-4.29
2020/4/29	5250	100	D5GHzV2-1128-5250	EX3DV4 - SN3925	DAE4 Sn376	2.30	22.90	23	0.44
2020/5/1	5600	100	D5GHzV2-1128-5600	EX3DV4 - SN3925	DAE4 Sn376	2.41	23.60	24.1	2.12
2019/12/27	5750	100	D5GHzV2-1128-5750	EX3DV4 - SN3925	DAE4 Sn1311	2.16	22.60	21.6	-4.42
2019/12/31	5750	100	D5GHzV2-1128-5750	EX3DV4 - SN3925	DAE4 Sn1311	2.16	22.60	21.6	-4.42
2020/1/2	5750	100	D5GHzV2-1128-5750	EX3DV4 - SN3925	DAE4 Sn1311	2.42	22.60	24.2	7.08
2020/1/7	5750	100	D5GHzV2-1128-5750	EX3DV4 - SN3925	DAE4 Sn1311	2.17	22.60	21.7	-3.98
2020/5/1	5750	100	D5GHzV2-1128-5750	EX3DV4 - SN3925	DAE4 Sn376	2.21	22.60	22.1	-2.21

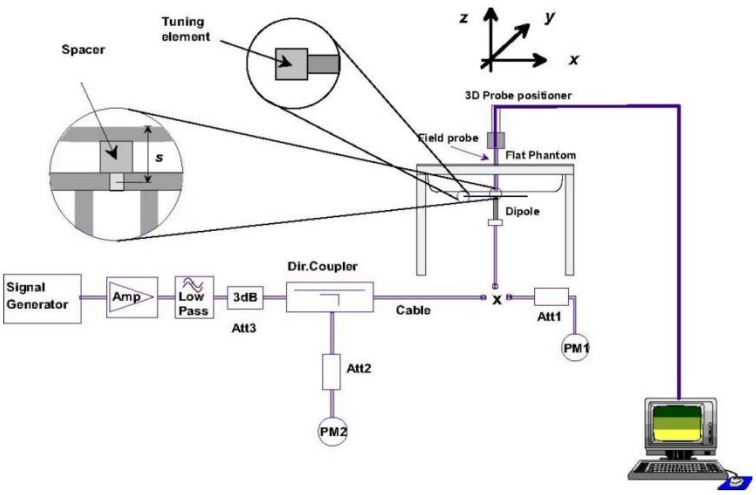


Fig 8.3.1 System Performance Check Setup

Fig 8.3.2 Setup Photo

10. WiFi/Bluetooth Output Power (Unit: dBm)

General Note:

1. Per KDB 248227 D01v02r02, SAR test reduction is determined according to 802.11 transmission mode configurations and certain exposure conditions with multiple test positions. In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. For OFDM, in both 2.4 and 5 GHz bands, an initial test configuration must be determined for each standalone and aggregated frequency band, according to the transmission mode configuration with the highest maximum output power specified for production units to perform SAR measurements. If the same highest maximum output power applies to different combinations of channel bandwidths, modulations and data rates, additional procedures are applied to determine which test configurations require SAR measurement. When applicable, an initial test position may be applied to reduce the number of SAR measurements required for next to the ear, UMPC mini-tablet or hotspot mode configurations with multiple test positions.
2. For 2.4 GHz 802.11b DSSS, either the initial test position procedure for multiple exposure test positions or the DSSS procedure for fixed exposure position is applied; these are mutually exclusive. For 2.4 GHz and 5 GHz OFDM configurations, the initial test configuration is applied to measure SAR using either the initial test position procedure for multiple exposure test position configurations or the initial test configuration procedures for fixed exposure test conditions. Based on the reported SAR of the measured configurations and maximum output power of the transmission mode configurations that are not included in the initial test configuration, the subsequent test configuration and initial test position procedures are applied to determine if SAR measurements are required for the remaining OFDM transmission configurations. In general, the number of test channels that require SAR measurement is minimized based on maximum output power measured for the test sample(s).
3. For OFDM transmission configurations in the 2.4 GHz and 5 GHz bands, When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel for each frequency band.
4. DSSS and OFDM configurations are considered separately according to the required SAR procedures. SAR is measured in the initial test position using the 802.11 transmission mode configuration required by the DSSS procedure or initial test configuration and subsequent test configuration(s) according to the OFDM procedures.18 The initial test position procedure is described in the following:
   a. When the reported SAR of the initial test position is ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and 802.11 transmission mode combinations within the frequency band or aggregated band.
   b. When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
   c. For all positions/configurations, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.
5. Per 201904 TCBC workshops, General principles of FCC KDB Publication 248227 D01 can be applied to determine the SAR Initial Test Configurations and test reduction for 802.11ax SAR testing. For the table below the 802.11ax maximum power is SU (non-OFDMA).
6. In applying the test guidance, the IEEE 802.11 mode with the maximum output power (out of all modes) should be considered for testing
7. For modes with the same maximum output power, the guidance from section 5.3.2 a) of FCC KDB Publication 248227 D01 should be applied, with 802.11ax being considered as the highest 802.11 mode for the appropriate frequency bands
8. When SAR testing for 802.11ax is required
   a. If the maximum output power is highest for OFDMA scenarios, choose the tone size with the maximum number of tones and the highest maximum output power
   b. Otherwise, consider the fully allocated channel for SAR testing
   c. When SAR testing is required on RU sizes less than the fully allocated channel, use the RU number closest to the middle of the channel, choosing the higher RU number when two RUs are equidistant to the middle of the channel

<2.4GHz WLAN ANT 1+2>

	Mode	Channel	Frequency (MHz)	MIMO Ant 1 Average Power (dBm)	MIMO Ant 1 Tune-Up Limit	MIMO Ant 2 Average Power (dBm)	MIMO Ant 2 Tune-Up Limit	MIMO Ant 1+2 Average Power (dBm)	MIMO Ant 1+2 Tune-Up Limit	Duty Cycle %
2.4GHz WLAN	802.11b 1Mbps	1	2412	18.00	18.00	17.90	18.00	20.96	21.00	85.30
		6	2437	17.90	18.00	17.80	18.00	20.86	21.00	
		11	2462	17.90	18.00	17.70	18.00	20.81	21.00	
		12	2467	17.90	18.00	17.70	18.00	20.81	21.00	
		13	2472	18.00	18.00	17.70	18.00	20.86	21.00	
	802.11g 6Mbps	1	2412	16.00	16.50	16.10	16.50	19.06	19.50	96.80
		6	2437	17.80	18.00	17.70	18.00	20.76	21.00	
		11	2462	16.30	16.50	16.30	16.50	19.31	19.50	
		12	2467	17.80	18.00	17.60	18.00	20.71	21.00	
		13	2472	17.90	18.00	17.60	18.00	20.76	21.00	
	802.11n-HT20 MCS0	1	2412	17.80	18.00	17.70	18.00	20.76	21.00	96.20
		6	2437	17.70	18.00	17.60	18.00	20.66	21.00	
		11	2462	13.40	13.50	13.50	13.50	16.46	16.50	
		12	2467	17.70	18.00	17.50	18.00	20.61	21.00	
		13	2472	17.80	18.00	17.50	18.00	20.66	21.00	
	802.11n-HT40 MCS0	3	2422	15.50	16.00	15.50	16.00	18.51	19.00	95.90
		6	2437	17.60	18.00	17.50	18.00	20.56	21.00	
		9	2452	16.00	16.50	16.20	16.50	19.11	19.50	
		10	2457	5.70	6.00	5.80	6.00	8.76	9.00	
		11	2462	17.70	18.00	17.60	18.00	20.66	21.00	
	802.11ax-HE20 MCS0	1	2412	17.90	18.00	17.70	18.00	20.81	21.00	97.90
		6	2437	17.80	18.00	17.80	18.00	20.81	21.00	
		11	2462	16.40	16.50	16.30	16.50	19.36	19.50	
		12	2467	17.80	18.00	17.70	18.00	20.76	21.00	
		13	2472	17.80	18.00	17.70	18.00	20.76	21.00	
	802.11ax-HE40 MCS0	3	2422	17.80	18.00	17.70	18.00	20.76	21.00	97.70
		6	2437	17.50	18.00	17.60	18.00	20.56	21.00	
		9	2452	17.60	18.00	17.70	18.00	20.66	21.00	
		10	2457	17.70	18.00	17.80	18.00	20.76	21.00	
		11	2462	17.70	18.00	17.70	18.00	20.71	21.00	

<5GHz WLAN ANT1+2>

	Mode	Channel	Frequency (MHz)	MIMO Ant 1 Average Power (dBm)	MIMO Ant 1 Tune-Up Limit	MIMO Ant 2 Average Power (dBm)	MIMO Ant 2 Tune-Up Limit	MIMO Ant 1+2 Average Power (dBm)	MIMO Ant 1+2 Tune-Up Limit	Duty Cycle %
5.2GHz WLAN	802.11a 6Mbps	36	5180	14.70	16.00	15.50	16.00	18.13	19.00	98.30
		40	5200	14.70	16.00	15.40	16.00	18.07	19.00	
		44	5220	14.70	16.00	15.40	16.00	18.07	19.00	
		48	5240	14.80	16.00	15.40	16.00	18.12	19.00	
	802.11n-HT20 MCS0	36	5180	14.60	16.00	15.40	16.00	18.03	19.00	95.80
		40	5200	15.10	16.00	15.60	16.00	18.37	19.00	
		44	5220	15.10	16.00	15.70	16.00	18.42	19.00	
		48	5240	15.40	16.00	15.70	16.00	18.56	19.00	
	802.11n-HT40 MCS0	38	5190	13.30	14.50	14.30	14.50	16.84	17.50	95.40
		46	5230	15.50	16.00	15.80	16.00	18.66	19.00	
	802.11ac-VHT20 MCS0	36	5180	14.50	16.00	15.40	16.00	17.98	19.00	95.50
		40	5200	15.10	16.00	15.60	16.00	18.37	19.00	
		44	5220	15.00	16.00	15.60	16.00	18.32	19.00	
		48	5240	15.20	16.00	15.60	16.00	18.41	19.00	
	802.11ac-VHT40 MCS0	38	5190	13.20	14.50	14.30	14.50	16.80	17.50	95.20
		46	5230	15.40	16.00	15.80	16.00	18.61	19.00	
	802.11ac-VHT80 MCS0	42	5210	13.60	14.50	14.30	14.50	16.97	17.50	98.00
	802.11ax-HE20 MCS0	36	5180	14.60	16.00	15.40	16.00	18.03	19.00	97.70
		40	5200	14.50	16.00	15.40	16.00	17.98	19.00	
		44	5220	14.70	16.00	15.30	16.00	18.02	19.00	
		48	5240	14.90	16.00	15.40	16.00	18.17	19.00	
	802.11ax-HE40 MCS0	38	5190	13.30	14.50	14.30	14.50	16.84	17.50	92.20
		46	5230	15.10	16.00	15.60	16.00	18.37	19.00	
	802.11ax-HE80 MCS0	42	5210	13.50	14.50	14.20	14.50	16.87	17.50	99.60

	Mode	Channel	Frequency (MHz)	MIMO Ant 1 Average Power (dBm)	MIMO Ant 1 Tune-Up Limit	MIMO Ant 2 Average Power (dBm)	MIMO Ant 2 Tune-Up Limit	MIMO Ant 1+2 Average Power (dBm)	MIMO Ant 1+2 Tune-Up Limit	Duty Cycle %
5.3GHz WLAN	802.11a 6Mbps	52	5260	14.80	16.00	15.40	16.00	18.12	19.00	98.30
		56	5280	14.80	16.00	15.40	16.00	18.12	19.00	
		60	5300	14.80	16.00	15.50	16.00	18.17	19.00	
		64	5320	14.90	16.00	15.40	16.00	18.17	19.00	
	802.11n-HT20 MCS0	52	5260	15.40	16.00	15.60	16.00	18.51	19.00	95.80
		56	5280	15.40	16.00	15.70	16.00	18.56	19.00	
		60	5300	15.50	16.00	15.70	16.00	18.61	19.00	
		64	5320	15.50	16.00	15.70	16.00	18.61	19.00	
	802.11n-HT40 MCS0	54	5270	15.50	16.00	15.70	16.00	18.61	19.00	95.40
		62	5310	12.50	13.00	12.80	13.00	15.66	16.00	
	802.11ac-VHT20 MCS0	52	5260	15.40	16.00	15.50	16.00	18.46	19.00	95.50
		56	5280	15.40	16.00	15.60	16.00	18.51	19.00	
		60	5300	15.50	16.00	15.60	16.00	18.56	19.00	
		64	5320	15.20	16.00	15.30	16.00	18.26	19.00	
	802.11ac-VHT40 MCS0	54	5270	15.40	16.00	15.60	16.00	18.51	19.00	95.20
		62	5310	12.50	13.00	12.70	13.00	15.61	16.00	
	802.11ac-VHT80 MCS0	58	5290	12.60	13.00	12.70	13.00	15.66	16.00	98.00
	802.11ax-HE20 MCS0	52	5260	15.40	16.00	15.60	16.00	18.51	19.00	97.70
		56	5280	15.60	16.00	15.60	16.00	18.61	19.00	
		60	5300	15.60	16.00	15.70	16.00	18.66	19.00	
		64	5320	15.70	16.00	15.80	16.00	18.76	19.00	
	802.11ax-HE40 MCS0	54	5270	15.70	16.00	15.80	16.00	18.76	19.00	92.20
		62	5310	12.60	13.00	13.00	13.00	15.81	16.00	
	802.11ax-HE80 MCS0	58	5290	12.50	13.00	12.60	13.00	15.56	16.00	99.60

	Mode	Channel	Frequency (MHz)	MIMO Ant 1 Average Power (dBm)	MIMO Ant 1 Tune-Up Limit	MIMO Ant 2 Average Power (dBm)	MIMO Ant 2 Tune-Up Limit	MIMO Ant 1+2 Average Power (dBm)	MIMO Ant 1+2 Tune-Up Limit	Duty Cycle %
5.5GHz WLAN	802.11a 6Mbps	100	5500	14.50	15.50	15.30	15.50	17.93	18.50	98.30
		116	5580	14.50	15.50	14.90	15.50	17.71	18.50	
		124	5620	14.60	15.50	14.40	15.50	17.66	18.50	
		132	5660	14.50	15.50	14.70	15.50	17.61	18.50	
		144	5720	14.50	15.50	15.40	15.50	17.98	18.50	
	802.11n-HT20 MCS0	100	5500	14.60	15.00	14.80	15.00	17.71	18.00	95.80
		116	5580	14.90	15.00	14.90	15.00	17.91	18.00	
		124	5620	15.00	15.00	14.90	15.00	17.96	18.00	
		132	5660	14.50	15.00	14.40	15.00	17.46	18.00	
		144	5720	15.00	16.00	15.60	16.00	18.32	19.00	
	802.11n-HT40 MCS0	102	5510	14.20	15.00	14.30	15.00	17.26	18.00	95.40
		110	5550	16.60	17.00	16.50	17.00	19.56	20.00	
		126	5630	16.60	17.00	16.50	17.00	19.56	20.00	
		134	5670	16.60	17.00	16.60	17.00	19.61	20.00	
		142	5710	16.40	17.00	16.80	17.00	19.61	20.00	
	802.11ac-VHT20 MCS0	100	5500	14.60	15.00	14.70	15.00	17.66	18.00	95.50
		116	5580	14.80	15.00	14.80	15.00	17.81	18.00	
		124	5620	15.00	15.00	14.80	15.00	17.91	18.00	
		132	5660	14.40	15.00	14.40	15.00	17.41	18.00	
		144	5720	14.90	16.00	15.60	16.00	18.27	19.00	
	802.11ac-VHT40 MCS0	102	5510	14.20	15.00	14.20	15.00	17.21	18.00	95.20
		110	5550	16.70	17.00	16.30	17.00	19.51	20.00	
		126	5630	16.70	17.00	16.30	17.00	19.51	20.00	
		134	5670	16.60	17.00	16.50	17.00	19.56	20.00	
		142	5710	16.50	17.00	16.60	17.00	19.56	20.00	
	802.11ac-VHT80 MCS0	106	5530	13.70	14.00	13.60	14.00	16.66	17.00	98.00
		122	5610	16.40	17.00	16.60	17.00	19.51	20.00	
		138	5690	16.70	17.00	16.60	17.00	19.66	20.00	
	802.11ax-HE20 MCS0	100	5500	15.20	15.50	15.40	15.50	18.31	18.50	97.70
		116	5580	15.50	16.00	15.50	16.00	18.51	19.00	
		124	5620	13.00	13.00	12.30	13.00	15.67	16.00	
		132	5660	12.60	13.00	12.70	13.00	15.66	16.00	
		144	5720	15.60	16.50	16.20	16.50	18.92	19.50	
	802.11ax-HE40 MCS0	102	5510	14.80	15.00	14.90	15.00	17.86	18.00	92.20
		110	5550	16.60	17.00	16.20	17.00	19.41	20.00	
		126	5630	16.50	17.00	16.50	17.00	19.51	20.00	
		134	5670	16.60	17.00	16.50	17.00	19.56	20.00	
		142	5710	16.50	17.00	16.70	17.00	19.61	20.00	
	802.11ax-HE80 MCS0	106	5530	13.50	14.00	13.50	14.00	16.51	17.00	99.60
		122	5610	16.30	17.00	16.80	17.00	19.57	20.00	
		138	5690	16.50	17.00	16.50	17.00	19.51	20.00	

	Mode	Channel	Frequency (MHz)	MIMO Ant 1 Average Power (dBm)	MIMO Ant 1 Tune-Up Limit	MIMO Ant 2 Average Power (dBm)	MIMO Ant 2 Tune-Up Limit	MIMO Ant 1+2 Average Power (dBm)	MIMO Ant 1+2 Tune-Up Limit	Duty Cycle %
5.8GHz WLAN	802.11a 6Mbps	149	5745	16.40	17.00	17.00	17.00	19.72	20.00	98.30
		157	5785	16.90	17.00	17.00	17.00	19.96	20.00	
		165	5825	17.00	17.00	16.40	17.00	19.72	20.00	
	802.11n-HT20 MCS0	149	5745	16.40	17.00	16.90	17.00	19.67	20.00	95.80
		157	5785	16.70	17.00	16.90	17.00	19.81	20.00	
		165	5825	17.00	17.00	16.30	17.00	19.67	20.00	
	802.11n-HT40 MCS0	151	5755	16.60	17.00	17.00	17.00	19.81	20.00	95.40
		159	5795	16.80	17.00	16.70	17.00	19.76	20.00	
	802.11ac-VHT20 MCS0	149	5745	16.30	17.00	16.90	17.00	19.62	20.00	95.50
		157	5785	16.50	17.00	16.80	17.00	19.66	20.00	
		165	5825	17.00	17.00	16.20	17.00	19.63	20.00	
	802.11ac-VHT40 MCS0	151	5755	16.50	17.00	17.00	17.00	19.77	20.00	95.20
		159	5795	16.80	17.00	16.60	17.00	19.71	20.00	
	802.11ac-VHT80 MCS0	155	5775	16.60	17.00	17.00	17.00	19.81	20.00	98.00
	802.11ax-HE20 MCS0	149	5745	16.40	17.00	16.90	17.00	19.67	20.00	97.70
		157	5785	16.70	17.00	16.90	17.00	19.81	20.00	
		165	5825	17.00	17.00	16.40	17.00	19.72	20.00	
	802.11ax-HE40 MCS0	151	5755	16.60	17.00	17.00	17.00	19.81	20.00	92.20
		159	5795	16.60	17.00	17.00	17.00	19.81	20.00	
	802.11ax-HE80 MCS0	155	5775	14.00	15.00	14.60	15.00	17.32	18.00	99.60

<2.4GHz Bluetooth>

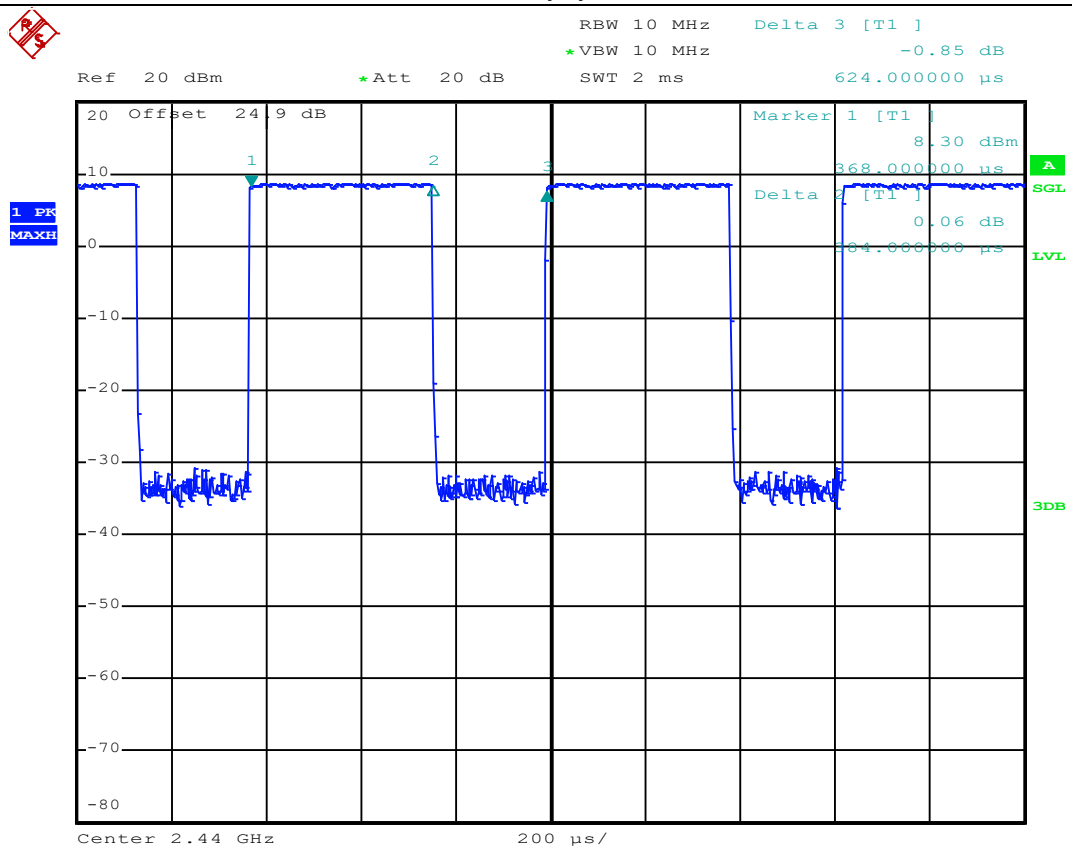
Mode	Channel	Frequency (MHz)	Average power (dBm)		
			1Mbps	2Mbps	3Mbps
BR / EDR	CH 00	2402	2.68	1.04	1.03
	CH 39	2441	2.68	1.03	1.07
	CH 78	2480	1.77	0.10	0.15
Tune-up Limit			3.00	1.50	1.50

Mode	Channel	Frequency (MHz)	Average power (dBm)	
			1Mbps	2Mbps
LE	CH 00	2402	9.00	9.20
	CH 19	2440	9.00	9.20
	CH 39	2480	8.10	8.40
Tune-up Limit			9.50	9.50

General Note:

1. For 2.4GHz Bluetooth SAR testing was selected 1Mbps due to its highest average power and duty cycle is 61.54% considered in SAR testing, and the duty cycle would be scaled to theoretical 83.3% in reported SAR calculation.

BT Duty cycle



<2.4GHz SRD>

Mode Band	Max Average power(dBm)
2.4GHz SRD	0.5

Note:

1. Per KDB 447498 D01v06, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:
   [(*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)] ·[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR
   - f(GHz) is the RF channel transmit frequency in GHz
   - Power and distance are rounded to the nearest mW and mm before calculation
   - The result is rounded to one decimal place for comparison

SRD Max Power (dBm)	Separation Distance (mm)	Frequency (GHz)	exclusion thresholds
0.5	< 5	2.48	0.35

Note:

Per KDB 447498 D01v06, when the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion. The test exclusion threshold is 0.35 which is <= 3, SAR testing is not required.

11. SAR Test Results

General Note:

1. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
   c. For WLAN/Bluetooth: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
2. Per KDB 447498 D01v06, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 1-g or 10-g SAR for the mid-band or highest output power channel is:
   - ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
   - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
   - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
3. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.

WLAN Note:

1. Per KDB 248227 D01v02r02, for 2.4GHz 802.11g/n SAR testing is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.
2. Per KDB 248227 D01v02r02, U-NII-1 SAR testing is not required when the U-NII-2A band highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band.
3. When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
4. For all positions / configurations, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions / configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.
5. During SAR testing the WLAN transmission was verified using a spectrum analyzer.

11.1 Head SAR

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Sample	Antenna		Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN2.4GHz	802.11b 1Mbps	Inner Surface	0mm	Sample J	Right Ant	Ant 1+2 (1)	1	2412	18.00	18.00	1.000	85.30	1.172	0.07	0.655	0.768
01	WLAN2.4GHz	802.11b 1Mbps	Inner Surface	0mm	Sample J	Left Ant	Ant 1+2 (2)	1	2412	17.90	18.00	1.023	85.30	1.172	-0.08	0.950	1.139
	WLAN2.4GHz	802.11b 1Mbps	Inner Surface	0mm	Sample J	Left Ant	Ant 1+2 (2)	6	2437	17.80	18.00	1.047	85.30	1.172	-0.17	0.684	0.839
	WLAN2.4GHz	802.11b 1Mbps	Inner Surface	0mm	Sample J	Left Ant	Ant 1+2 (2)	11	2462	17.70	18.00	1.072	85.30	1.172	0.04	0.821	1.031
	WLAN2.4GHz	802.11b 1Mbps	Inner Surface	0mm	Sample J	Left Ant	Ant 1+2 (2)	12	2467	17.70	18.00	1.072	85.30	1.172	-0.11	0.736	0.924
	WLAN2.4GHz	802.11b 1Mbps	Inner Surface	0mm	Sample J	Left Ant	Ant 1+2 (2)	13	2472	17.70	18.00	1.072	85.30	1.172	0.09	0.757	0.951
	WLAN2.4GHz	802.11b 1Mbps	Inner Surface	0mm	Sample K	Right Ant	Ant 1+2 (1)	1	2412	18.00	18.00	1.000	85.30	1.172	-0.13	0.705	0.826
	WLAN2.4GHz	802.11b 1Mbps	Inner Surface	0mm	Sample K	Right Ant	Ant 1+2 (1)	6	2437	17.90	18.00	1.023	85.30	1.172	0.12	0.560	0.672
	WLAN2.4GHz	802.11b 1Mbps	Inner Surface	0mm	Sample K	Right Ant	Ant 1+2 (1)	11	2462	17.90	18.00	1.023	85.30	1.172	0.09	0.685	0.822
	WLAN2.4GHz	802.11b 1Mbps	Inner Surface	0mm	Sample K	Right Ant	Ant 1+2 (1)	12	2467	17.90	18.00	1.023	85.30	1.172	-0.05	0.686	0.823
	WLAN2.4GHz	802.11b 1Mbps	Inner Surface	0mm	Sample K	Right Ant	Ant 1+2 (1)	13	2472	18.00	18.00	1.000	85.30	1.172	0.17	0.700	0.820
	WLAN2.4GHz	802.11b 1Mbps	Inner Surface	0mm	Sample K	Left Ant	Ant 1+2 (2)	1	2412	17.90	18.00	1.023	85.30	1.172	-0.14	0.678	0.813
	WLAN2.4GHz	802.11b 1Mbps	Inner Surface	0mm	Sample K	Left Ant	Ant 1+2 (2)	6	2437	17.80	18.00	1.047	85.30	1.172	-0.1	0.642	0.788
	WLAN2.4GHz	802.11b 1Mbps	Inner Surface	0mm	Sample K	Left Ant	Ant 1+2 (2)	11	2462	17.70	18.00	1.072	85.30	1.172	-0.12	0.801	1.006
	WLAN2.4GHz	802.11b 1Mbps	Inner Surface	0mm	Sample K	Left Ant	Ant 1+2 (2)	12	2467	17.70	18.00	1.072	85.30	1.172	-0.19	0.750	0.942
	WLAN2.4GHz	802.11b 1Mbps	Inner Surface	0mm	Sample K	Left Ant	Ant 1+2 (2)	13	2472	17.70	18.00	1.072	85.30	1.172	-0.15	0.711	0.893
	WLAN2.4GHz	802.11b 1Mbps	Inner Surface	0mm	Sample M	Right Ant	Ant 1+2 (1)	1	2412	18.00	18.00	1.000	85.30	1.172	0.06	0.680	0.797
	WLAN2.4GHz	802.11b 1Mbps	Inner Surface	0mm	Sample M	Left Ant	Ant 1+2 (2)	1	2412	17.90	18.00	1.023	85.3	1.172	-0.14	0.661	0.793

Plot No.	Band	Mode	Test Position	Gap (mm)	Sample	Antenna		Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN5GHz	802.11n-HT40 MCS0	Inner Surface	0mm	Sample J	Right Ant	Ant 1+2 (1)	54	5270	15.50	16.00	1.122	95.40	1.048	-0.12	0.710	0.835
	WLAN5GHz	802.11a 6Mbps	Inner Surface	0mm	Sample J	Right Ant	Ant 1+2 (1)	60	5300	14.80	16.00	1.318	98.30	1.017	-0.1	0.740	0.992
	WLAN5GHz	802.11n-HT40 MCS0	Inner Surface	0mm	Sample J	Left Ant	Ant 1+2 (2)	54	5270	15.70	16.00	1.072	95.40	1.048	-0.12	0.450	0.505
	WLAN5GHz	802.11n-HT40 MCS0	Inner Surface	0mm	Sample K	Right Ant	Ant 1+2 (1)	54	5270	15.50	16.00	1.122	95.40	1.048	0.07	0.760	0.894
	WLAN5GHz	802.11a 6Mbps	Inner Surface	0mm	Sample K	Right Ant	Ant 1+2 (1)	60	5300	15.50	16.00	1.122	98.30	1.017	-0.08	0.783	0.893
	WLAN5GHz	802.11n-HT40 MCS0	Inner Surface	0mm	Sample K	Left Ant	Ant 1+2 (2)	54	5270	15.70	16.00	1.072	95.40	1.048	-0.05	0.652	0.732
02	WLAN5GHz	802.11a 6Mbps	Inner Surface	0mm	Sample M	Right Ant	Ant 1+2 (1)	60	5300	14.80	16.00	1.318	98.30	1.017	0.06	0.889	1.192
	WLAN5GHz	802.11n-HT40 MCS0	Inner Surface	0mm	Sample M	Right Ant	Ant 1+2 (1)	54	5270	15.50	16.00	1.122	95.40	1.048	0.02	0.844	0.992
	WLAN5GHz	802.11n-HT40 MCS0	Inner Surface	0mm	Sample M	Left Ant	Ant 1+2 (2)	54	5270	15.70	16.00	1.072	95.40	1.048	-0.11	0.552	0.620
	WLAN5GHz	802.11ac-VHT80 MCS0	Inner Surface	0mm	Sample J	Right Ant	Ant 1+2 (1)	138	5690	16.70	17.00	1.072	98.00	1.020	-0.01	0.228	0.249
	WLAN5GHz	802.11ac-VHT80 MCS0	Inner Surface	0mm	Sample J	Left Ant	Ant 1+2 (2)	138	5690	16.60	17.00	1.096	98.00	1.020	-0.14	0.284	0.318
	WLAN5GHz	802.11ac-VHT80 MCS0	Inner Surface	0mm	Sample J	Left Ant	Ant 1+2 (2)	106	5530	13.60	14.00	1.096	98.00	1.020	-0.14	0.233	0.261
	WLAN5GHz	802.11ac-VHT80 MCS0	Inner Surface	0mm	Sample J	Left Ant	Ant 1+2 (2)	122	5610	16.60	17.00	1.096	98.00	1.020	-0.12	0.432	0.483
	WLAN5GHz	802.11ac-VHT80 MCS0	Inner Surface	0mm	Sample K	Right Ant	Ant 1+2 (1)	138	5690	16.70	17.00	1.072	98.00	1.020	-0.13	0.144	0.157
	WLAN5GHz	802.11ac-VHT80 MCS0	Inner Surface	0mm	Sample K	Left Ant	Ant 1+2 (2)	138	5690	16.60	17.00	1.096	98.00	1.020	-0.1	0.230	0.257
	WLAN5GHz	802.11ac-VHT80 MCS0	Inner Surface	0mm	Sample K	Left Ant	Ant 1+2 (2)	106	5530	13.60	14.00	1.096	98.00	1.020	-0.02	0.106	0.119
	WLAN5GHz	802.11ac-VHT80 MCS0	Inner Surface	0mm	Sample K	Left Ant	Ant 1+2 (2)	122	5610	16.60	17.00	1.096	98.00	1.020	-0.11	0.309	0.346
	WLAN5GHz	802.11ac-VHT80 MCS0	Inner Surface	0mm	Sample M	Right Ant	Ant 1+2 (1)	138	5690	16.70	17.00	1.072	98.00	1.020	-0.15	0.295	0.322
03	WLAN5GHz	802.11ac-VHT80 MCS0	Inner Surface	0mm	Sample M	Left Ant	Ant 1+2 (2)	122	5610	16.60	17.00	1.096	98.00	1.020	-0.02	0.687	0.768
	WLAN5GHz	802.11ac-VHT80 MCS0	Inner Surface	0mm	Sample M	Left Ant	Ant 1+2 (2)	138	5690	16.60	17.00	1.096	98.00	1.020	0.06	0.651	0.728
	WLAN5GHz	802.11ac-VHT80 MCS0	Inner Surface	0mm	Sample M	Left Ant	Ant 1+2 (2)	106	5530	13.60	14.00	1.096	98.00	1.020	-0.09	0.341	0.381
	WLAN5GHz	802.11ac-VHT80 MCS0	Inner Surface	0mm	Sample J	Right Ant	Ant 1+2 (1)	155	5775	16.60	17.00	1.096	98.00	1.020	-0.11	0.177	0.198
	WLAN5GHz	802.11ac-VHT80 MCS0	Inner Surface	0mm	Sample J	Left Ant	Ant 1+2 (2)	155	5775	17.00	17.00	1.000	98.00	1.020	-0.16	0.218	0.222
	WLAN5GHz	802.11ac-VHT80 MCS0	Inner Surface	0mm	Sample K	Right Ant	Ant 1+2 (1)	155	5775	16.60	17.00	1.096	98.00	1.020	-0.09	0.472	0.528
	WLAN5GHz	802.11ac-VHT80 MCS0	Inner Surface	0mm	Sample K	Left Ant	Ant 1+2 (2)	155	5775	17.00	17.00	1.000	98.00	1.020	-0.09	0.516	0.526
	WLAN5GHz	802.11ac-VHT80 MCS0	Inner Surface	0mm	Sample M	Right Ant	Ant 1+2 (1)	155	5775	16.60	17.00	1.096	98.00	1.020	0	0.409	0.457
04	WLAN5GHz	802.11ac-VHT80 MCS0	Inner Surface	0mm	Sample M	Left Ant	Ant 1+2 (2)	155	5775	17.00	17.00	1.000	98.00	1.020	-0.15	0.730	0.745

<Bluetooth SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Sample	Antenna		Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	Bluetooth	LE-1Mbps	Inner Surface	0mm	Sample J	Left Ant	Ant 2	19	2440	9.00	9.50	1.122	61.54	1.354	-0.11	0.035	0.053
	Bluetooth	LE-1Mbps	Inner Surface	0mm	Sample J	Left Ant	Ant 2	0	2402	9.00	9.50	1.122	61.54	1.354	-0.09	0.035	0.053
	Bluetooth	LE-1Mbps	Inner Surface	0mm	Sample J	Left Ant	Ant 2	39	2480	8.10	9.50	1.380	61.54	1.354	-0.19	0.027	0.050
	Bluetooth	LE-1Mbps	Inner Surface	0mm	Sample K	Left Ant	Ant 2	19	2440	9.00	9.50	1.122	61.54	1.354	-0.14	0.060	0.091
05	Bluetooth	LE-1Mbps	Inner Surface	0mm	Sample K	Left Ant	Ant 2	0	2402	9.00	9.50	1.122	61.54	1.354	-0.17	0.065	0.099
	Bluetooth	LE-1Mbps	Inner Surface	0mm	Sample K	Left Ant	Ant 2	39	2480	8.10	9.50	1.380	61.54	1.354	-0.12	0.044	0.082
	Bluetooth	LE-1Mbps	Inner Surface	0mm	Sample M	Left Ant	Ant 2	0	2402	9.00	9.50	1.122	61.54	1.354	-0.16	0.051	0.077

11.2 Extremity SAR

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Sample	Antenna		Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	Sample J	Right Ant	Ant 1+2 (1)	1	2412	18.00	18.00	1.000	85.30	1.172	-0.12	0.277	0.325
	WLAN2.4GHz	802.11b 1Mbps	Left Side	0mm	Sample J	Left Ant	Ant 1+2 (2)	1	2412	17.90	18.00	1.023	85.30	1.172	-0.18	0.230	0.276
	WLAN2.4GHz	802.11b 1Mbps	Top Side	0mm	Sample J	Left Ant	Ant 1+2 (2)	1	2412	17.90	18.00	1.023	85.30	1.172	-0.09	0.127	0.152
	WLAN2.4GHz	802.11b 1Mbps	Bottom Side	0mm	Sample J	Right Ant	Ant 1+2 (1)	1	2412	18.00	18.00	1.000	85.30	1.172	-0.14	0.097	0.114
	WLAN2.4GHz	802.11b 1Mbps	Right Slant	0mm	Sample J	Right Ant	Ant 1+2 (1)	1	2412	18.00	18.00	1.000	85.30	1.172	-0.07	1.530	1.793
	WLAN2.4GHz	802.11b 1Mbps	Right Slant	0mm	Sample J	Right Ant	Ant 1+2 (1)	6	2437	17.90	18.00	1.023	85.30	1.172	-0.11	1.380	1.655
	WLAN2.4GHz	802.11b 1Mbps	Right Slant	0mm	Sample J	Right Ant	Ant 1+2 (1)	11	2462	17.90	18.00	1.023	85.30	1.172	0.16	1.550	1.859
	WLAN2.4GHz	802.11b 1Mbps	Right Slant	0mm	Sample J	Right Ant	Ant 1+2 (1)	12	2467	17.90	18.00	1.023	85.30	1.172	-0.16	1.430	1.715
	WLAN2.4GHz	802.11b 1Mbps	Right Slant	0mm	Sample J	Right Ant	Ant 1+2 (1)	13	2472	18.00	18.00	1.000	85.30	1.172	-0.19	1.350	1.582
	WLAN2.4GHz	802.11b 1Mbps	Left Slant	0mm	Sample J	Left Ant	Ant 1+2 (2)	1	2412	17.90	18.00	1.023	85.30	1.172	-0.17	1.050	1.259
	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	Sample K	Right Ant	Ant 1+2 (1)	1	2412	18.00	18.00	1.000	85.30	1.172	-0.15	0.259	0.304
	WLAN2.4GHz	802.11b 1Mbps	Left Side	0mm	Sample K	Left Ant	Ant 1+2 (2)	1	2412	17.90	18.00	1.023	85.30	1.172	0.15	0.188	0.225
	WLAN2.4GHz	802.11b 1Mbps	Top Side	0mm	Sample K	Left Ant	Ant 1+2 (2)	1	2412	17.90	18.00	1.023	85.30	1.172	-0.03	0.143	0.171
	WLAN2.4GHz	802.11b 1Mbps	Bottom Side	0mm	Sample K	Right Ant	Ant 1+2 (1)	1	2412	18.00	18.00	1.000	85.30	1.172	-0.01	0.115	0.135
06	WLAN2.4GHz	802.11b 1Mbps	Right Slant	0mm	Sample K	Right Ant	Ant 1+2 (1)	1	2412	18.00	18.00	1.000	85.30	1.172	0.06	1.710	2.004
	WLAN2.4GHz	802.11b 1Mbps	Right Slant	0mm	Sample K	Right Ant	Ant 1+2 (1)	6	2437	17.90	18.00	1.023	85.30	1.172	0.12	1.450	1.739
	WLAN2.4GHz	802.11b 1Mbps	Right Slant	0mm	Sample K	Right Ant	Ant 1+2 (1)	11	2462	17.90	18.00	1.023	85.30	1.172	0	1.570	1.883
	WLAN2.4GHz	802.11b 1Mbps	Right Slant	0mm	Sample K	Right Ant	Ant 1+2 (1)	12	2467	17.90	18.00	1.023	85.30	1.172	0.14	1.490	1.787
	WLAN2.4GHz	802.11b 1Mbps	Right Slant	0mm	Sample K	Right Ant	Ant 1+2 (1)	13	2472	18.00	18.00	1.000	85.30	1.172	0.14	1.400	1.641
	WLAN2.4GHz	802.11b 1Mbps	Left Slant	0mm	Sample K	Left Ant	Ant 1+2 (2)	1	2412	17.90	18.00	1.023	85.30	1.172	-0.19	1.160	1.391
	WLAN2.4GHz	802.11b 1Mbps	Right Slant	0mm	Sample M	Right Ant	Ant 1+2 (1)	1	2412	18.00	18.00	1.000	85.30	1.172	0.11	1.600	1.875
	WLAN2.4GHz	802.11b 1Mbps	Left Slant	0mm	Sample M	Left Ant	Ant 1+2 (2)	1	2412	17.90	18.00	1.023	85.30	1.172	0.04	1.110	1.331

Plot No.	Band	Mode	Test Position	Gap (mm)	Sample	Antenna		Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
	WLAN5GHz	802.11n-HT40 MCS0	Right Side	0mm	Sample J	Right Ant	Ant 1+2 (1)	54	5270	15.50	16.00	1.122	95.40	1.048	0.03	0.069	0.081
	WLAN5GHz	802.11n-HT40 MCS0	Left Side	0mm	Sample J	Left Ant	Ant 1+2 (2)	54	5270	15.70	16.00	1.072	95.40	1.048	-0.08	0.075	0.084
	WLAN5GHz	802.11n-HT40 MCS0	Top Side	0mm	Sample J	Left Ant	Ant 1+2 (2)	54	5270	15.70	16.00	1.072	95.40	1.048	-0.15	0.075	0.084
	WLAN5GHz	802.11n-HT40 MCS0	Bottom Side	0mm	Sample J	Right Ant	Ant 1+2 (1)	54	5270	15.50	16.00	1.122	95.40	1.048	-0.07	0.077	0.091
	WLAN5GHz	802.11n-HT40 MCS0	Right Slant	0mm	Sample J	Right Ant	Ant 1+2 (1)	54	5270	15.50	16.00	1.122	95.40	1.048	0.14	0.436	0.513
	WLAN5GHz	802.11n-HT40 MCS0	Left Slant	0mm	Sample J	Left Ant	Ant 1+2 (2)	54	5270	15.70	16.00	1.072	95.40	1.048	-0.18	0.328	0.368
	WLAN5GHz	802.11n-HT40 MCS0	Right Side	0mm	Sample K	Right Ant	Ant 1+2 (1)	54	5270	15.50	16.00	1.122	95.40	1.048	-0.03	0.126	0.148
	WLAN5GHz	802.11n-HT40 MCS0	Left Side	0mm	Sample K	Left Ant	Ant 1+2 (2)	54	5270	15.70	16.00	1.072	95.40	1.048	0.16	0.075	0.084
	WLAN5GHz	802.11n-HT40 MCS0	Top Side	0mm	Sample K	Left Ant	Ant 1+2 (2)	54	5270	15.70	16.00	1.072	95.40	1.048	-0.18	0.107	0.120
	WLAN5GHz	802.11n-HT40 MCS0	Bottom Side	0mm	Sample K	Right Ant	Ant 1+2 (1)	54	5270	15.50	16.00	1.122	95.40	1.048	-0.17	0.079	0.093
	WLAN5GHz	802.11n-HT40 MCS0	Right Slant	0mm	Sample K	Right Ant	Ant 1+2 (1)	54	5270	15.50	16.00	1.122	95.40	1.048	-0.01	0.759	0.892
	WLAN5GHz	802.11n-HT40 MCS0	Left Slant	0mm	Sample K	Left Ant	Ant 1+2 (2)	54	5270	15.70	16.00	1.072	95.40	1.048	-0.19	0.522	0.586
07	WLAN5GHz	802.11n-HT40 MCS0	Right Slant	0mm	Sample M	Right Ant	Ant 1+2 (1)	54	5270	15.50	16.00	1.122	95.40	1.048	-0.16	0.847	0.996
	WLAN5GHz	802.11n-HT40 MCS0	Left Slant	0mm	Sample M	Left Ant	Ant 1+2 (2)	54	5270	15.70	16.00	1.072	95.40	1.048	-0.1	0.510	0.573

Plot No.	Band	Mode	Test Position	Gap (mm)	Sample	Antenna		Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Sample J	Right Ant	Ant 1+2 (1)	138	5690	16.70	17.00	1.072	98.00	1.020	-0.03	0.042	0.046
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Sample J	Left Ant	Ant 1+2 (2)	138	5690	16.60	17.00	1.096	98.00	1.020	0.18	0.030	0.034
	WLAN5GHz	802.11ac-VHT80 MCS0	Top Side	0mm	Sample J	Left Ant	Ant 1+2 (2)	138	5690	16.60	17.00	1.096	98.00	1.020	-0.17	0.060	0.067
	WLAN5GHz	802.11ac-VHT80 MCS0	Bottom Side	0mm	Sample J	Right Ant	Ant 1+2 (1)	138	5690	16.70	17.00	1.072	98.00	1.020	0.15	0.021	0.023
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Slant	0mm	Sample J	Right Ant	Ant 1+2 (1)	138	5690	16.70	17.00	1.072	98.00	1.020	-0.15	0.913	0.998
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Slant	0mm	Sample J	Right Ant	Ant 1+2 (1)	106	5530	13.70	14.00	1.072	98.00	1.020	-0.12	0.449	0.491
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Slant	0mm	Sample J	Right Ant	Ant 1+2 (1)	122	5610	16.40	17.00	1.148	98.00	1.020	0.15	1.020	1.195
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Slant	0mm	Sample J	Left Ant	Ant 1+2 (2)	138	5690	16.60	17.00	1.096	98.00	1.020	0.11	0.405	0.453
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Sample K	Right Ant	Ant 1+2 (1)	138	5690	16.70	17.00	1.072	98.00	1.020	-0.13	0.045	0.049
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Sample K	Left Ant	Ant 1+2 (2)	138	5690	16.60	17.00	1.096	98.00	1.020	0.12	0.036	0.040
	WLAN5GHz	802.11ac-VHT80 MCS0	Top Side	0mm	Sample K	Left Ant	Ant 1+2 (2)	138	5690	16.60	17.00	1.096	98.00	1.020	-0.14	0.077	0.086
	WLAN5GHz	802.11ac-VHT80 MCS0	Bottom Side	0mm	Sample K	Right Ant	Ant 1+2 (1)	138	5690	16.70	17.00	1.072	98.00	1.020	-0.18	0.010	0.011
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Slant	0mm	Sample K	Right Ant	Ant 1+2 (1)	138	5690	16.70	17.00	1.072	98.00	1.020	0.1	0.802	0.877
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Slant	0mm	Sample K	Left Ant	Ant 1+2 (2)	138	5690	16.60	17.00	1.096	98.00	1.020	-0.16	0.890	0.995
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Slant	0mm	Sample K	Left Ant	Ant 1+2 (2)	106	5530	13.60	14.00	1.096	98.00	1.020	-0.17	0.412	0.461
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Slant	0mm	Sample K	Left Ant	Ant 1+2 (2)	122	5610	16.60	17.00	1.096	98.00	1.020	0.18	0.414	0.463
08	WLAN5GHz	802.11ac-VHT80 MCS0	Right Slant	0mm	Sample M	Right Ant	Ant 1+2 (1)	122	5610	16.40	17.00	1.148	98.00	1.020	-0.16	1.150	1.347
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Slant	0mm	Sample M	Right Ant	Ant 1+2 (1)	138	5690	16.70	17.00	1.072	98.00	1.020	0.14	0.969	1.059
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Slant	0mm	Sample M	Right Ant	Ant 1+2 (1)	106	5530	13.70	14.00	1.072	98.00	1.020	-0.09	0.471	0.515
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Slant	0mm	Sample M	Left Ant	Ant 1+2 (2)	138	5690	16.60	17.00	1.096	98.00	1.020	-0.11	0.868	0.971
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Sample J	Right Ant	Ant 1+2 (1)	155	5775	16.60	17.00	1.096	98.00	1.020	0	0.095	0.106
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Sample J	Left Ant	Ant 1+2 (2)	155	5775	17.00	17.00	1.000	98.00	1.020	0	0.090	0.092
	WLAN5GHz	802.11ac-VHT80 MCS0	Top Side	0mm	Sample J	Left Ant	Ant 1+2 (2)	155	5775	17.00	17.00	1.000	98.00	1.020	-0.09	0.165	0.168
	WLAN5GHz	802.11ac-VHT80 MCS0	Bottom Side	0mm	Sample J	Right Ant	Ant 1+2 (1)	155	5775	16.60	17.00	1.096	98.00	1.020	0.05	0.038	0.042
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Slant	0mm	Sample J	Right Ant	Ant 1+2 (1)	155	5775	16.60	17.00	1.096	98.00	1.020	0.16	0.488	0.546
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Slant	0mm	Sample J	Left Ant	Ant 1+2 (2)	155	5775	17.00	17.00	1.000	98.00	1.020	0.01	0.641	0.654
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Sample K	Right Ant	Ant 1+2 (1)	155	5775	16.60	17.00	1.096	98.00	1.020	-0.16	0.163	0.182
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Sample K	Left Ant	Ant 1+2 (2)	155	5775	17.00	17.00	1.000	98.00	1.020	0.03	0.078	0.080
	WLAN5GHz	802.11ac-VHT80 MCS0	Top Side	0mm	Sample K	Left Ant	Ant 1+2 (2)	155	5775	17.00	17.00	1.000	98.00	1.020	-0.14	0.128	0.131
	WLAN5GHz	802.11ac-VHT80 MCS0	Bottom Side	0mm	Sample K	Right Ant	Ant 1+2 (1)	155	5775	16.60	17.00	1.096	98.00	1.020	0.03	0.052	0.058
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Slant	0mm	Sample K	Right Ant	Ant 1+2 (1)	155	5775	16.60	17.00	1.096	98.00	1.020	0.03	1.050	1.174
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Slant	0mm	Sample K	Left Ant	Ant 1+2 (2)	155	5775	17.00	17.00	1.000	98.00	1.020	-0.14	0.749	0.764
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Slant	0mm	Sample M	Right Ant	Ant 1+2 (1)	155	5775	16.60	17.00	1.096	98.00	1.020	-0.19	1.020	1.141
09	WLAN5GHz	802.11ac-VHT80 MCS0	Left Slant	0mm	Sample M	Left Ant	Ant 1+2 (2)	155	5775	17.00	17.00	1.000	98.00	1.020	-0.18	1.290	1.316

<Bluetooth SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Sample	Antenna		Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 10g SAR (W/kg)	Reported 10g SAR (W/kg)
	Bluetooth	LE-1Mbps	Right Side	0mm	Sample J	Left Ant	Ant 2	19	2440	9.00	9.50	1.122	61.54	1.354	0	0.001	0.002
	Bluetooth	LE-1Mbps	Left Side	0mm	Sample J	Left Ant	Ant 2	19	2440	9.00	9.50	1.122	61.54	1.354	0	0.013	0.020
	Bluetooth	LE-1Mbps	Top Side	0mm	Sample J	Left Ant	Ant 2	19	2440	9.00	9.50	1.122	61.54	1.354	-0.13	0.007	0.011
	Bluetooth	LE-1Mbps	Bottom Side	0mm	Sample J	Left Ant	Ant 2	19	2440	9.00	9.50	1.122	61.54	1.354	0	0.001	0.002
	Bluetooth	LE-1Mbps	Right Slant	0mm	Sample J	Left Ant	Ant 2	19	2440	9.00	9.50	1.122	61.54	1.354	0	0.001	0.002
	Bluetooth	LE-1Mbps	Left Slant	0mm	Sample J	Left Ant	Ant 2	19	2440	9.00	9.50	1.122	61.54	1.354	-0.17	0.091	0.138
	Bluetooth	LE-1Mbps	Left Slant	0mm	Sample J	Left Ant	Ant 2	0	2402	9.00	9.50	1.122	61.54	1.354	-0.16	0.074	0.112
	Bluetooth	LE-1Mbps	Left Slant	0mm	Sample J	Left Ant	Ant 2	39	2480	8.10	9.50	1.380	61.54	1.354	-0.15	0.065	0.121
	Bluetooth	LE-1Mbps	Right Side	0mm	Sample K	Left Ant	Ant 2	19	2440	9.00	9.50	1.122	61.54	1.354	0	0.001	0.002
	Bluetooth	LE-1Mbps	Left Side	0mm	Sample K	Left Ant	Ant 2	19	2440	9.00	9.50	1.122	61.54	1.354	0.11	0.014	0.021
	Bluetooth	LE-1Mbps	Top Side	0mm	Sample K	Left Ant	Ant 2	19	2440	9.00	9.50	1.122	61.54	1.354	-0.11	0.011	0.017
	Bluetooth	LE-1Mbps	Bottom Side	0mm	Sample K	Left Ant	Ant 2	19	2440	9.00	9.50	1.122	61.54	1.354	0	0.001	0.002
	Bluetooth	LE-1Mbps	Right Slant	0mm	Sample K	Left Ant	Ant 2	19	2440	9.00	9.50	1.122	61.54	1.354	0	0.001	0.002
	Bluetooth	LE-1Mbps	Left Slant	0mm	Sample K	Left Ant	Ant 2	19	2440	9.00	9.50	1.122	61.54	1.354	-0.14	0.109	0.166
	Bluetooth	LE-1Mbps	Left Slant	0mm	Sample K	Left Ant	Ant 2	0	2402	9.00	9.50	1.122	61.54	1.354	-0.16	0.084	0.128
	Bluetooth	LE-1Mbps	Left Slant	0mm	Sample K	Left Ant	Ant 2	39	2480	8.10	9.50	1.380	61.54	1.354	-0.16	0.084	0.157
10	Bluetooth	LE-1Mbps	Left Slant	0mm	Sample M	Left Ant	Ant 2	19	2440	9.00	9.50	1.122	61.54	1.354	-0.04	0.140	0.213
	Bluetooth	LE-1Mbps	Left Slant	0mm	Sample M	Left Ant	Ant 2	0	2402	9.00	9.50	1.122	61.54	1.354	0.09	0.112	0.170
	Bluetooth	LE-1Mbps	Left Slant	0mm	Sample M	Left Ant	Ant 2	39	2480	8.10	9.50	1.380	61.54	1.354	-0.02	0.103	0.193

11.3 Repeated SAR Measurement

No.	Band	Mode	Test Position	Gap (mm)	Sample	Antenna		Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Ratio	Reported 1g SAR (W/kg)
1st	WLAN2.4GHz	802.11b 1Mbps	Inner Surface	0mm	Sample J	Left Ant	Ant 1+2 (2)	1	2412	17.90	18.00	1.023	85.30	1.172	-0.08	0.950	-	1.139
2nd	WLAN2.4GHz	802.11b 1Mbps	Inner Surface	0mm	Sample J	Left Ant	Ant 1+2 (2)	1	2412	17.90	18.00	1.023	85.30	1.172	-0.07	0.905	1.05	1.085
1st	WLAN5GHz	802.11a 6Mbps	Inner Surface	0mm	Sample M	Right Ant	Ant 1+2 (1)	60	5300	14.80	16.00	1.318	98.30	1.017	0.06	0.889	-	1.192
2nd	WLAN5GHz	802.11a 6Mbps	Inner Surface	0mm	Sample M	Right Ant	Ant 1+2 (1)	60	5300	14.80	16.00	1.318	98.30	1.017	0.04	0.874	1.02	1.172

General Note:

1. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.
2. Per KDB 865664 D01v01r04, if the ratio among the repeated measurement is ≤ 1.2 and the measured SAR <1.45W/kg, only one repeated measurement is required.
3. The ratio is the difference in percentage between original and repeated *measured SAR*.
4. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

12. Simultaneous Transmission Analysis

NO.	Simultaneous Transmission Configurations	Head	Extremity
1.	WLAN5GHz + Bluetooth + SRD	Yes	Yes
2.	WLAN2.4GHz + SRD	Yes	Yes

General Note:

1. 2.4GHz WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously.
2. EUT will choose either WLAN 2.4GHz or WLAN 5GHz according to the network signal condition; therefore, 2.4GHz WLAN and 5GHz WLAN will not operate simultaneously at any moment.
3. The Scaled SAR summation is calculated based on the same configuration and test position.
4. Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,
   i) Scalar SAR summation < 1.6W/kg.
   ii) SPLSR = (SAR1 + SAR2)^1.5 / (min. separation distance, mm), and the peak separation distance is determined from the square root of [(x1-x2)2 + (y1-y2)2 + (z1-z2)2], where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
   iii) If SPLSR ≤ 0.04, simultaneously transmission SAR measurement is not necessary.
   iv) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg.
5. For simultaneous transmission analysis, SRD SAR is estimated per KDB 447498 D01v06 based on the formula below.
   i) (*max. power of channel, including tune-up tolerance, mW*)/(*min. test separation distance, mm*)]·[√f(GHz)/*x*] W/kg for *test separation distances* ≤ 50 mm; where *x* = 7.5 for 1-g SAR, and *x* = 18.75 for 10-g SAR.
   ii) When the minimum separation distance is < 5mm, the distance is used 5mm to determine SAR test exclusion.
   iii) 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the *test separation distances* is > 50 mm.

SRD Max Power	Exposure Position	Head
	Test separation	0 mm
0.5dBm	Estimated SAR (W/kg)	0.047 W/kg

SRD Max Power	Exposure Position	Extremity
	Test separation	0 mm
0.5dBm	Estimated SAR (W/kg)	0.019 W/kg

12.1 Head Exposure Conditions

Exposure Position	1 2.4GHz WLAN Ant 1+2 1g SAR (W/kg)	2 5GHz WLAN Ant 1+2 1g SAR (W/kg)	3 Bluetooth Ant 2 1g SAR (W/kg)	4 SRD Ant 2 Estimated 1g SAR (W/kg)	1+4 Summed 1g SAR (W/kg)	2+3+4 Summed 1g SAR (W/kg)
Inner Surface	1.139	1.192	0.099	0.047	**1.186**	**1.338**

12.2 Extremity Exposure Conditions

Exposure Position	1 2.4GHz WLAN Ant 1+2 10g SAR (W/kg)	2 5GHz WLAN Ant 1+2 10g SAR (W/kg)	3 Bluetooth Ant 2 10g SAR (W/kg)	4 SRD Ant 2 Estimated 10g SAR (W/kg)	1+4 Summed 10g SAR (W/kg)	2+3+4 Summed 10g SAR (W/kg)
Right Side	0.325	0.182	0.002	0.019	**0.344**	**0.203**
Left Side	0.276	0.092	0.021	0.019	**0.295**	**0.132**
Top Side	0.171	0.168	0.017	0.019	**0.190**	**0.204**
Bottom Side	0.135	0.093	0.002	0.019	**0.154**	**0.114**
Right Slant	2.004	1.347	0.002	0.019	**2.023**	**1.368**
Left Slant	1.391	1.316	0.213	0.019	**1.410**	**1.548**

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13. Uncertainty Assessment

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

14. References

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

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

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

[4] SPEAG DASY System Handbook

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

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

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

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