Testing Laboratory
1190

FCC SAR TEST REPORT

FCC ID	:	**UZ7MC3300U**
Equipment	:	**Mobile Computer**
Brand Name	:	**Zebra**
Model Name	:	**MC3300U**
Applicant	:	**Zebra Technologies Corporation** **1 Zebra Plaza, Holtsville, NY 11742**
Manufacturer	:	**Zebra Technologies Corporation** **1 Zebra Plaza, Holtsville, NY 11742**
Standard	:	**FCC 47 CFR Part 2 (2.1093)** **ANSI/IEEE C95.1-1992** **IEEE 1528-2013**

The product was received on Sep. 09, 2019 and testing was started from Oct. 07, 2019 and completed on Nov. 21, 2019. 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 variant report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERTIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Cona Huang

Approved by: Cona Huang / Deputy Manager

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History of this test report

Report No.	Version	Description	Issued Date
FA981238	01	Initial issue of report	Dec. 10, 2019

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for Zebra Technologies Corporation, Mobile Computer, MC3300U, are as follows.

Equipment Class	Frequency Band	Highest SAR Summary		Highest Simultaneous Transmission 10g SAR (W/kg)	Highest Simultaneous Transmission 1g SAR (W/kg)
		Extremity	Body-worn		
		10g SAR (W/kg)	1g SAR (W/kg)		
UHF RFID	900MHz	1.81		2.50	1.20
DTS	2.4GHz WLAN		1.02		
NII	5GHz WLAN		1.20		
Date of Testing:		2019/10/7 ~ 2019/11/21			

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 Extremity 10g SAR) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications

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	Mobile Computer
Brand Name	Zebra
Model Name	MC3300U
FCC ID	UZ7MC3300U
Wireless Technology and Frequency Range	WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5720 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz UHF RFID : 902.75 MHz ~ 927.25 MHz NFC : 13.56 MHz
Mode	WLAN: 802.11a/b/g/n/ac HT20/HT40/VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE UHF RFID:ASK NFC:ASK
HW Version	DV
SW Version	RFID Manager Application Version: 2.0.10.1 123 RFID Mobile Application Version: 1.0.0.11 Terminal Version: 02-11-14.00-PG-U07-PRD
FW Version	Module Version: PAAEES00-001-N20 Radio Version: 2.0.32.0 Terminal Version: FUSION_QA_2_1.2.0.006_P
MFD	27JUL19
EUT Stage	Identical Prototype

Remark:
1. The device has two kinds RFID antenna range and sample list as below table, Sku 1/7/13 are a group, sku 2/3/8/9/14/15 are a group, the difference between each group is scanner, keypad and battery. RF exposure is choose Sku 1/2/3 as the main testing, other sku is spot check worst case for SAR compliance, if that sku is not necessary RF exposure testing, because it is based on the verification of scanner, keypad, battery.
2. For WLAN SAR test procedure is choose sku 1/2/3 as the main test, others sku spot check is based on the Sku 1/2/3 worst case to be tested, if that sku is not necessary RF exposure testing, because it is based on the verification of scanner, keypad, battery.
3. When the device is placed into the holster, the RFID can't be triggered by user's finger is holding, therefore body worn is not expected used conditions for RFID transmission, Therefore, for SAR testing is only consideration extremity RF exposure condition for RFID, body worn and extremity RF exposure conditions for WLAN/BT
4. According to user scenarios the body-worn condition only required left and right position when the device is placed into the holster

Accessories Information					
Adapter		Brand Name	Zebra	Part Number	PWR-WUA5V12W0US
		Power Rating	I/P: 100 - 240 V ~ 50-60 Hz 0.5 A ; O/P: 5 Vdc, 2.5 A		
U cable		Brand Name	Zebra	Part Number	CBL-MC33-USBCHG-01
Battery 1	MC32 2X battery (Inventus)	Brand Name	Symbol	Part Number	82-000012-02
		Power Rating	3.7 Vdc, 5200 mAh		
Battery 2	MC33 2X battery (Inventus)	Brand Name	ZEBRA	Part Number	BT-000337-01
		Power Rating	3.7 Vdc, 5200 mAh		
Battery 3	MC33 7000mA 2X (Inventus)	Brand Name	ZEBRA	Part Number	BT-000375-10
		Power Rating	3.6 Vdc, Battery 3		
GUN Holster		Brand Name	ZEBRA	Part Number	SG-MC3021212-01R

sku list	SKU1	SKU2	SKU3
Part Number	MC333R-GI2HG4US	MC339R-GE2HG4US	MC339R-GF2HG4US
RFID Antenna	Middle range	Long range	Long range
Scanner	SE4750SR w/LED	SE4850ER	SE4750MR
Keypad	29	29	29
Region	US	US	US
sku list	**SKU7**	**SKU8**	**SKU9**
Part Number	MC333R-GI3HG4US	MC339R-GE3HG4US	MC339R-GF3HG4US
RFID Antenna	Middle range	Long range	Long range
Scanner	SE4750SR w/LED	SE4850ER	SE4750MR
Keypad	38	38	38
Region	US	US	US
sku list	**SKU13**	**SKU14**	**SKU15**
Part Number	MC333R-GI4HG4US	MC339R-GE4HG4US	MC339R-GF4HG4US
RFID Antenna	Middle range	Long range	Long range
Scanner	SE4750SR w/LED	SE4850ER	SE4750MR
Keypad	47	47	47
Region	US	US	US

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:

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

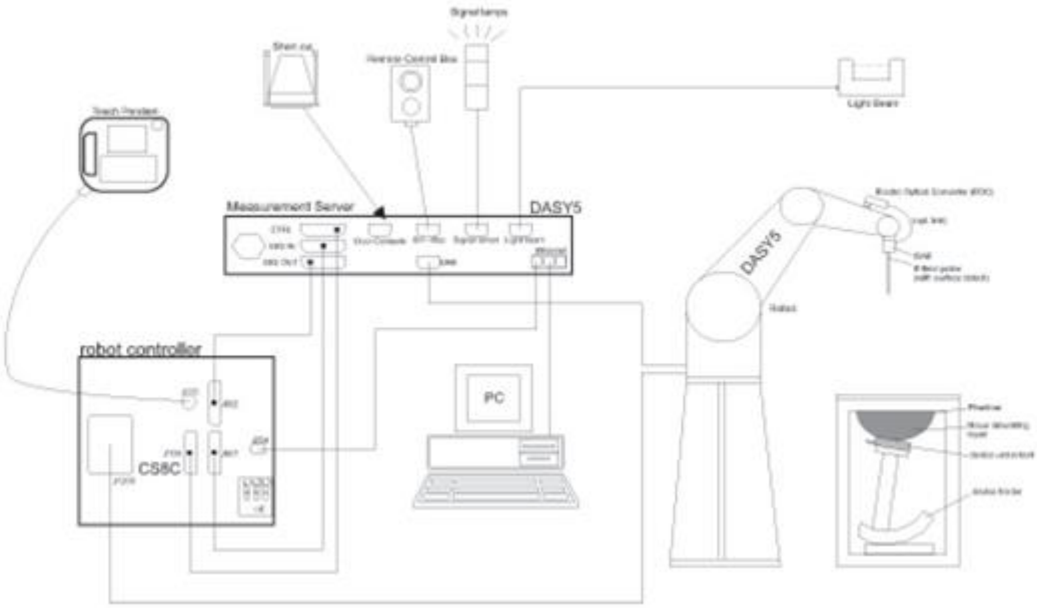
SAR is expressed in units of Watts per kilogram (W/kg)

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

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.

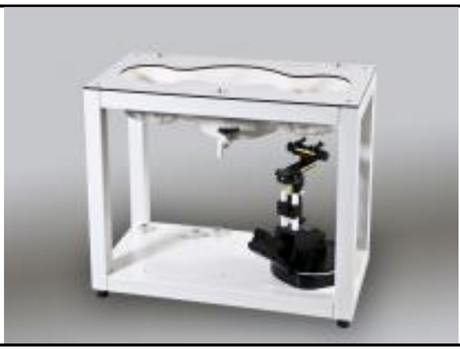
The input impedance of the DAE is 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

Fig 5.1 Photo of DAE

6.3 Phantom

<SAM Twin Phantom>

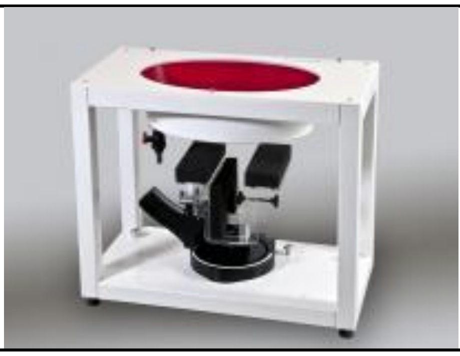
Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	Length: 1000 mm; Width: 500 mm; Height: adjustable feet
Measurement Areas	Left Hand, Right Hand, Flat Phantom



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.

<table>
<tr><th></th><th>≤ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td>Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td>Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">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.</td></tr>
</table>

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.

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

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	900MHz System Validation Kit	D900V2	1d165	Mar. 08, 2019	Mar. 07, 2020
SPEAG	2450MHz System Validation Kit	D2450V2	929	Mar. 06, 2019	Mar. 05, 2020
SPEAG	5GHz System Validation Kit	D5GHzV2	1128	Mar. 05, 2019	Mar. 04, 2020
SPEAG	Data Acquisition Electronics	DAE3	495	May. 21, 2019	May. 20, 2020
SPEAG	Data Acquisition Electronics	DAE4	778	May. 21, 2019	May. 20, 2020
SPEAG	Data Acquisition Electronics	DAE4	854	May. 21, 2019	May. 20, 2020
SPEAG	Data Acquisition Electronics	DAE4	1399	Nov. 16, 2018	Nov. 15, 2019
SPEAG	Dosimetric E-Field Probe	ES3DV3	3170	Nov. 02, 2018	Nov. 01, 2019
SPEAG	Dosimetric E-Field Probe	EX3DV4	3728	Jan. 15, 2019	Jan. 14, 2020
SPEAG	Dosimetric E-Field Probe	EX3DV4	3931	Sep. 26, 2019	Sep. 25, 2020
SPEAG	Dosimetric E-Field Probe	EX3DV4	7306	Jul. 22, 2019	Jul. 21, 2020
RCPTWN	Thermometer	HTC-1	TM685-1	Nov. 12, 2018	Nov. 11, 2019
RCPTWN	Thermometer	HTC-1	TM560-2	Nov. 12, 2018	Nov. 11, 2019
RCPTWN	Thermometer	HTC-1	TM685-1	Nov. 12, 2019	Nov. 11, 2020
RCPTWN	Thermometer	HTC-1	TM560-2	Nov. 12, 2019	Nov. 11, 2020
SPEAG	Device Holder	N/A	N/A	N/A	N/A
Anritsu	Signal Generator	MG3710A	6201502524	Dec. 11, 2018	Dec. 10, 2019
Agilent	ENA Network Analyzer	E5071C	MY46104758	Sep. 06, 2019	Sep. 05, 2020
SPEAG	Dielectric Probe Kit	DAK-3.5	1146	Jul. 16, 2019	Jul. 15, 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	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.

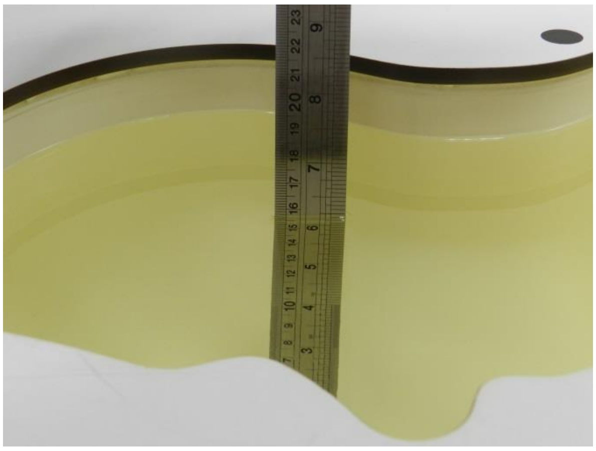


Fig 10.1Photo of Liquid Height for Head SAR

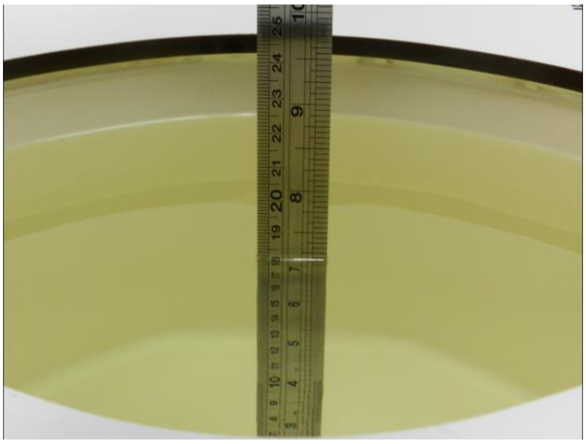


Fig 10.2 Photo of Liquid Height for Body SAR

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)
For Head								
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
For Body								
750	51.7	47.2	0	0.9	0.1	0	0.96	55.5
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
900	50.8	48.2	0	0.9	0.1	0	1.05	55.0
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7
2600	68.1	0	0	0.1	0	31.8	2.16	52.5

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
900	22.3	0.971	41.158	0.97	41.50	0.10	-0.82	±5	2019/10/7
2450	22.5	1.799	39.901	1.80	39.20	-0.06	1.79	±5	2019/11/21
5250	22.4	4.775	35.065	4.71	35.95	1.38	-2.46	±5	2019/10/28
5600	22.4	5.140	34.624	5.07	35.50	1.38	-2.47	±5	2019/10/28
5600	22.2	5.014	36.546	5.07	35.50	-1.10	2.95	±5	2019/11/17
5750	22.4	5.296	34.496	5.22	35.35	1.46	-2.42	±5	2019/10/28
5750	22.2	5.177	36.274	5.22	35.35	-0.82	2.61	±5	2019/11/17
5750	22.5	5.177	36.274	5.22	35.35	-0.82	2.61	±5	2019/11/17

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 (%)
2019/11/21	2450	250	D2450V2-929	EX3DV4 - SN3728	DAE4 Sn854	12.80	52.10	51.2	-1.73
2019/10/28	5250	100	D5GHzV2-1128-5250	EX3DV4 - SN3931	DAE4 Sn778	7.95	76.20	79.5	4.33
2019/10/28	5600	100	D5GHzV2-1128-5600	EX3DV4 - SN3931	DAE4 Sn778	8.50	79.90	85	6.38
2019/11/17	5600	100	D5GHzV2-1128-5600	EX3DV4 - SN7306	DAE3 Sn495	8.33	79.90	83.3	4.26
2019/10/28	5750	100	D5GHzV2-1128-5750	EX3DV4 - SN3931	DAE4 Sn778	7.93	77.80	79.3	1.93
2019/11/17	5750	100	D5GHzV2-1128-5750	EX3DV4 - SN7306	DAE3 Sn495	7.84	77.80	78.4	0.77
2019/11/17	5750	100	D5GHzV2-1128-5750	EX3DV4 - SN3728	DAE4 Sn854	8.20	77.80	82	5.40

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 (%)
2019/10/7	900	250	D900V2-1d165	ES3DV3 - SN3170	DAE4 Sn1399	1.63	7.03	6.52	-7.25

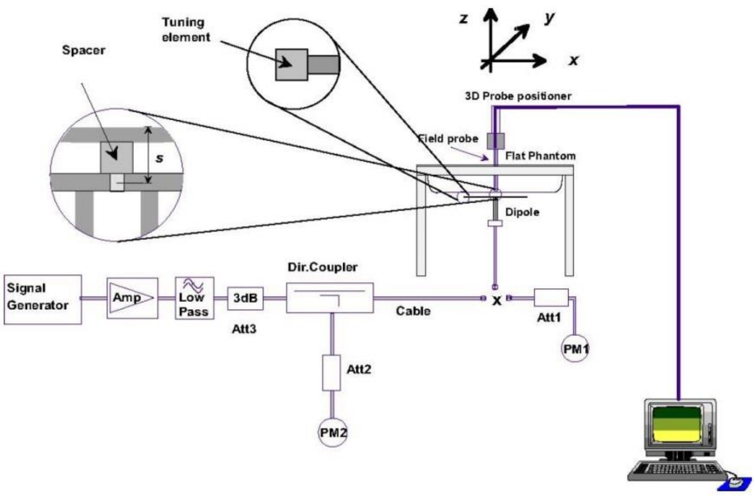


Fig 8.3.1 System Performance Check Setup

Fig 8.3.2 Setup Photo

10. RF Exposure Positions

10.1 Body Worn Accessory

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration (see Figure 9.4). Per KDB648474 D04v01r03, body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB 447498 D01v06 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for body-worn accessory, measured without a headset connected to the handset is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a handset attached to the handset.

Accessories for body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are test with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-chip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

10.2 Extremity Exposure

For smart phones with a display diagonal dimension > 15.0 cm or an overall diagonal dimension > 16.0 cm that provide similar mobile web access and multimedia support found in mini-tablets or UMPC mini-tablets that support voice calls next to the ear, According to KDB648474 D04v01r03, the following phablet procedures should be applied to evaluate SAR compliance for each applicable wireless modes and frequency band. Devices marketed as phablets, regardless of form factors and operating characteristics must be tested as a phablet to determine SAR compliance

1. The normally required head and body-worn accessory SAR test procedures for handsets, including hotspot mode, must be applied.

2. The UMPC mini-tablet procedures must also be applied to test the SAR of all surfaces and edges with an antenna located at ≤ 25 mm from that surface or edge, in direct contact with a flat phantom, for 10-g extremity SAR according to the body-equivalent tissue dielectric parameters in KDB 865664 to address interactive hand use exposure conditions.6 The UMPC mini-tablet 1-g SAR at 5 mm is not required. When hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg.

11. Conducted RF Output Power (Unit: dBm)

<RFID Conducted Power>

RFID Antenna (Long range)				
SKU 2 / 3 / 8 / 14				
UHF RFID Band	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
900MHz	902.75	27.81	28.00	100
	914.75	27.83	28.00	
	927.25	27.84	28.00	

RFID Antenna (Middle range)				
SKU 1 / 7 / 13				
UHF RFID Band	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
900MHz	902.75	27.86	28.00	100
	914.75	27.88	28.00	
	927.25	27.90	28.00	

<WLAN Conducted Power>

General Note:

1. For each antenna, transmit power in SISO operation is larger than (or equal to) the power in MIMO operation, RF exposure compliance of MIMO mode can be deduced from the compliance simultaneous transmission of antennas operating in SISO mode.
2. Per KDB 248227 D01v02r02, the simultaneous SAR provisions in KDB publication 447498 should be applied to determine simultaneous transmission SAR test exclusion for WiFi MIMO. If the sum of 1g single transmission chain SAR measurements is < 1.6W/kg and SAR peak to location ratio ≤ 0.04, no additional SAR measurements for MIMO.
3. 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.
4. 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).
5. 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.
6. 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.

<Non-beamforming mode>

<2.4GHz WLAN ANT 1>

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
2.4GHz WLAN	802.11b 1Mbps	1	2412	22.40	22.50	100
		6	2437	22.40	22.50	
		11	2462	22.10	22.50	
	802.11g 6Mbps	1	2412	18.00	18.00	95.37
		6	2437	22.40	22.50	
		11	2462	16.20	16.50	
	802.11n-HT20 MCS0	1	2412	17.20	17.50	95.32
		6	2437	22.30	22.50	
		11	2462	14.30	14.50	
	802.11n-HT40 MCS0	3	2422	13.40	13.50	90.77
		6	2437	14.80	15.00	
		9	2452	12.50	12.50	
	802.11ac-VHT20 MCS0	1	2412	17.30	17.50	95.33
		6	2437	22.40	22.50	
		11	2462	14.40	14.50	
	802.11ac-VHT40 MCS0	3	2422	13.50	13.50	90.95
		6	2437	14.90	15.00	
		9	2452	12.60	13.00	

<2.4GHz WLAN ANT 2>

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
2.4GHz WLAN	802.11b 1Mbps	1	2412	22.30	22.50	100
		6	2437	22.30	22.50	
		11	2462	22.20	22.50	
	802.11g 6Mbps	1	2412	17.80	18.00	95.37
		6	2437	22.30	22.50	
		11	2462	16.60	17.00	
	802.11n-HT20 MCS0	1	2412	17.50	18.00	95.30
		6	2437	22.10	22.50	
		11	2462	14.50	15.00	
	802.11n-HT40 MCS0	3	2422	13.80	14.00	90.29
		6	2437	15.20	15.50	
		9	2452	12.40	12.50	
	802.11ac-VHT20 MCS0	1	2412	17.60	18.00	95.56
		6	2437	22.20	22.50	
		11	2462	14.60	15.00	
	802.11ac-VHT40 MCS0	3	2422	13.90	14.00	90.96
		6	2437	15.30	15.50	
		9	2452	12.50	13.00	

<2.4GHz WLAN ANT 1+2>

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
2.4GHz WLAN	802.11b 1Mbps	1	2412	22.01	23.50	100
		6	2437	22.61	23.00	
		11	2462	23.26	23.50	
	802.11g 6Mbps	1	2412	18.61	19.00	95.81
		6	2437	21.81	23.50	
		11	2462	16.61	17.00	
	802.11n-HT20 MCS0	1	2412	18.31	19.00	95.30
		6	2437	21.91	23.50	
		11	2462	16.91	17.50	
	802.11n-HT40 MCS0	3	2422	14.96	15.50	91.87
		6	2437	16.91	17.50	
		9	2452	13.41	14.00	
	802.11ac-VHT20 MCS0	1	2412	18.41	19.00	95.47
		6	2437	22.01	23.50	
		11	2462	17.01	17.50	
	802.11ac-VHT40 MCS0	3	2422	15.06	15.50	91.09
		6	2437	17.01	17.50	
		9	2452	13.51	14.00	

<5GHz WLAN ANT1>

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.2GHz WLAN	802.11a 6Mbps	36	5180	15.90	16.00	95.73
		40	5200	15.80	16.00	
		44	5220	15.80	16.00	
		48	5240	15.80	16.00	
	802.11n-HT20 MCS0	36	5180	15.80	16.00	95.07
		40	5200	15.80	16.00	
		44	5220	15.60	16.00	
		48	5240	15.60	16.00	
	802.11n-HT40 MCS0	38	5190	15.80	16.00	91.15
		46	5230	15.70	16.00	
	802.11ac-VHT20 MCS0	36	5180	15.90	16.00	95.54
		40	5200	15.90	16.00	
		44	5220	15.70	16.00	
		48	5240	15.70	16.00	
	802.11ac-VHT40 MCS0	38	5190	15.90	16.00	91.51
		46	5230	15.80	16.00	
	802.11ac-VHT80 MCS0	42	5210	15.50	16.00	85.29

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.3GHz WLAN	802.11a 6Mbps	52	5260	15.90	16.00	95.73
		56	5280	15.80	16.00	
		60	5300	15.80	16.00	
		64	5320	15.80	16.00	
	802.11n-HT20 MCS0	52	5260	15.80	16.00	95.07
		56	5280	15.70	16.00	
		60	5300	15.60	16.00	
		64	5320	15.60	16.00	
	802.11n-HT40 MCS0	54	5270	15.80	16.00	91.15
		62	5310	15.70	16.00	
	802.11ac-VHT20 MCS0	52	5260	15.90	16.00	95.54
		56	5280	15.80	16.00	
		60	5300	15.70	16.00	
		64	5320	15.70	16.00	
	802.11ac-VHT40 MCS0	54	5270	15.90	16.00	91.51
		62	5310	15.80	16.00	
	802.11ac-VHT80 MCS0	58	5290	15.60	16.00	85.29

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.5GHz WLAN	802.11a 6Mbps	100	5500	16.30	16.50	95.73
		116	5580	16.40	16.50	
		124	5620	16.30	16.50	
		132	5660	16.30	16.50	
		140	5700	16.10	16.50	
		144	5720	16.10	16.50	
	802.11n-HT20 MCS0	100	5500	16.00	16.50	95.07
		116	5580	16.10	16.50	
		124	5620	16.20	16.50	
		132	5660	16.10	16.50	
		140	5700	16.30	16.50	
		144	5720	16.20	16.50	
	802.11n-HT40 MCS0	102	5510	16.20	16.50	91.15
		110	5550	16.30	16.50	
		126	5630	16.30	16.50	
		134	5670	16.10	16.50	
		142	5710	16.10	16.50	
	802.11ac-VHT20 MCS0	100	5500	16.10	16.50	95.54
		116	5580	16.20	16.50	
		124	5620	16.30	16.50	
		132	5660	16.30	16.50	
		140	5700	16.40	16.50	
		144	5720	16.30	16.50	
	802.11ac-VHT40 MCS0	102	5510	16.30	16.50	91.51
		110	5550	16.40	16.50	
		126	5630	16.40	16.50	
		134	5670	16.20	16.50	
		142	5710	16.20	16.50	
	802.11ac-VHT80 MCS0	106	5530	16.30	16.50	85.29
		122	5610	16.30	16.50	
		138	5690	16.40	16.50	

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.8GHz WLAN	802.11a 6Mbps	149	5745	17.90	18.00	95.73
		157	5785	17.80	18.00	
		165	5825	17.80	18.00	
	802.11n-HT20 MCS0	149	5745	17.60	18.00	95.07
		157	5785	17.60	18.00	
		165	5825	17.70	18.00	
	802.11n-HT40 MCS0	151	5755	17.70	18.00	91.15
		159	5795	17.80	18.00	
	802.11ac-VHT20 MCS0	149	5745	17.70	18.00	95.54
		157	5785	17.70	18.00	
		165	5825	17.80	18.00	
	802.11ac-VHT40 MCS0	151	5755	17.80	18.00	91.51
		159	5795	17.90	18.00	
	802.11ac-VHT80 MCS0	155	5775	17.70	18.00	85.29

<5GHz WLAN ANT2>

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.2GHz WLAN	802.11a 6Mbps	36	5180	15.90	16.00	95.82
		40	5200	15.80	16.00	
		44	5220	15.80	16.00	
		48	5240	15.80	16.00	
	802.11n-HT20 MCS0	36	5180	15.80	16.00	95.15
		40	5200	15.80	16.00	
		44	5220	15.60	16.00	
		48	5240	15.60	16.00	
	802.11n-HT40 MCS0	38	5190	15.80	16.00	91.47
		46	5230	15.70	16.00	
	802.11ac-VHT20 MCS0	36	5180	15.90	16.00	95.85
		40	5200	15.90	16.00	
		44	5220	15.70	16.00	
		48	5240	15.70	16.00	
	802.11ac-VHT40 MCS0	38	5190	15.90	16.00	91.19
		46	5230	15.80	16.00	
	802.11ac-VHT80 MCS0	42	5210	15.60	16.00	85.61

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.3GHz WLAN	802.11a 6Mbps	52	5260	15.90	16.00	95.82
		56	5280	15.80	16.00	
		60	5300	15.80	16.00	
		64	5320	15.80	16.00	
	802.11n-HT20 MCS0	52	5260	15.70	16.00	95.15
		56	5280	15.70	16.00	
		60	5300	15.60	16.00	
		64	5320	15.60	16.00	
	802.11n-HT40 MCS0	54	5270	15.80	16.00	91.47
		62	5310	15.70	16.00	
	802.11ac-VHT20 MCS0	52	5260	15.80	16.00	95.85
		56	5280	15.80	16.00	
		60	5300	15.70	16.00	
		64	5320	15.70	16.00	
	802.11ac-VHT40 MCS0	54	5270	15.90	16.00	91.19
		62	5310	15.80	16.00	
	802.11ac-VHT80 MCS0	58	5290	15.70	16.00	85.61

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.5GHz WLAN	802.11a 6Mbps	100	5500	16.40	16.50	95.82
		116	5580	16.40	16.50	
		124	5620	16.40	16.50	
		132	5660	16.30	16.50	
		140	5700	16.10	16.50	
		144	5720	16.20	16.50	
	802.11n-HT20 MCS0	100	5500	16.20	16.50	95.15
		116	5580	16.30	16.50	
		124	5620	16.20	16.50	
		132	5660	16.10	16.50	
		140	5700	16.30	16.50	
		144	5720	16.30	16.50	
	802.11n-HT40 MCS0	102	5510	16.40	16.50	91.47
		110	5550	16.30	16.50	
		126	5630	16.30	16.50	
		134	5670	16.30	16.50	
		142	5710	16.10	16.50	
	802.11ac-VHT20 MCS0	100	5500	16.30	16.50	95.85
		116	5580	16.40	16.50	
		124	5620	16.30	16.50	
		132	5660	16.40	16.50	
		140	5700	16.40	16.50	
		144	5720	16.40	16.50	
	802.11ac-VHT40 MCS0	102	5510	16.50	16.50	91.19
		110	5550	16.40	16.50	
		126	5630	16.40	16.50	
		134	5670	16.40	16.50	
		142	5710	16.20	16.50	
	802.11ac-VHT80 MCS0	106	5530	16.40	16.50	85.61
		122	5610	16.50	16.50	
		138	5690	16.40	16.50	

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.8GHz WLAN	802.11a 6Mbps	149	5745	17.60	18.00	95.82
		157	5785	17.80	18.00	
		165	5825	17.70	18.00	
	802.11n-HT20 MCS0	149	5745	17.70	18.00	95.15
		157	5785	17.70	18.00	
		165	5825	17.80	18.00	
	802.11n-HT40 MCS0	151	5755	17.50	18.00	91.47
		159	5795	17.70	18.00	
	802.11ac-VHT20 MCS0	149	5745	17.80	18.00	95.85
		157	5785	17.80	18.00	
		165	5825	17.90	18.00	
	802.11ac-VHT40 MCS0	151	5755	17.60	18.00	91.19
		159	5795	17.80	18.00	
	802.11ac-VHT80 MCS0	155	5775	17.90	18.00	85.61

<5GHz WLAN ANT1+2>

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.2GHz WLAN	802.11a 6Mbps	36	5180	18.76	19.00	95.46
		40	5200	18.76	19.00	
		44	5220	18.61	19.00	
		48	5240	18.56	19.00	
	802.11n-HT20 MCS0	36	5180	18.56	19.00	95.07
		40	5200	18.76	19.00	
		44	5220	18.81	19.00	
		48	5240	18.76	19.00	
	802.11n-HT40 MCS0	38	5190	18.86	19.00	91.12
		46	5230	18.81	19.00	
	802.11ac-VHT20 MCS0	36	5180	18.66	19.00	95.19
		40	5200	18.86	19.00	
		44	5220	18.91	19.00	
		48	5240	18.86	19.00	
	802.11ac-VHT40 MCS0	38	5190	18.96	19.00	91.19
		46	5230	18.91	19.00	
	802.11ac-VHT80 MCS0	42	5210	15.87	16.00	85.24

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.3GHz WLAN	802.11a 6Mbps	52	5260	18.66	19.00	95.46
		56	5280	18.66	19.00	
		60	5300	18.91	19.00	
		64	5320	18.86	19.00	
	802.11n-HT20 MCS0	52	5260	18.81	19.00	95.07
		56	5280	18.71	19.00	
		60	5300	18.71	19.00	
		64	5320	18.66	19.00	
	802.11n-HT40 MCS0	54	5270	18.81	19.00	91.12
		62	5310	18.71	19.00	
	802.11ac-VHT20 MCS0	52	5260	18.91	19.00	95.19
		56	5280	18.81	19.00	
		60	5300	18.81	19.00	
		64	5320	18.76	19.00	
	802.11ac-VHT40 MCS0	54	5270	18.91	19.00	91.19
		62	5310	18.81	19.00	
	802.11ac-VHT80 MCS0	58	5290	14.81	15.00	85.24

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.5GHz WLAN	802.11a 6Mbps	100	5500	19.11	19.50	95.46
		116	5580	19.11	19.50	
		124	5620	19.21	19.50	
		132	5660	19.21	19.50	
		140	5700	19.26	19.50	
		144	5720	19.26	19.50	
	802.11n-HT20 MCS0	100	5500	19.31	19.50	95.07
		116	5580	19.36	19.50	
		124	5620	19.31	19.50	
		132	5660	19.36	19.50	
		140	5700	19.31	19.50	
		144	5720	19.31	19.50	
	802.11n-HT40 MCS0	102	5510	19.36	19.50	91.12
		110	5550	19.11	19.50	
		126	5630	19.11	19.50	
		134	5670	19.11	19.50	
		142	5710	19.21	19.50	
	802.11ac-VHT20 MCS0	100	5500	19.41	19.50	95.19
		116	5580	19.46	19.50	
		124	5620	19.41	19.50	
		132	5660	19.46	19.50	
		140	5700	19.41	19.50	
		144	5720	19.41	19.50	
	802.11ac-VHT40 MCS0	102	5510	19.46	19.50	91.19
		110	5550	19.21	19.50	
		126	5630	19.21	19.50	
		134	5670	19.21	19.50	
		142	5710	19.31	19.50	
	802.11ac-VHT80 MCS0	106	5530	19.41	19.50	85.24
		122	5610	19.36	19.50	
		138	5690	19.16	19.50	

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.8GHz WLAN	802.11a 6Mbps	149	5745	20.66	21.00	95.46
		157	5785	20.71	21.00	
		165	5825	20.71	21.00	
	802.11n-HT20 MCS0	149	5745	20.66	21.00	95.07
		157	5785	20.56	21.00	
		165	5825	20.56	21.00	
	802.11n-HT40 MCS0	151	5755	20.56	21.00	91.12
		159	5795	20.66	21.00	
	802.11ac-VHT20 MCS0	149	5745	20.76	21.00	95.19
		157	5785	20.66	21.00	
		165	5825	20.66	21.00	
	802.11ac-VHT40 MCS0	151	5755	20.66	21.00	91.19
		159	5795	20.76	21.00	
	802.11ac-VHT80 MCS0	155	5775	20.76	21.00	85.24

<Beamforming mode>

<2.4GHz WLAN ANT 1+2>

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
2.4GHz WLAN	802.11ac-VHT20 MCS0	1	2412	20.36	20.50	100
		6	2437	21.35	21.50	
		11	2462	14.45	14.50	
	802.11ac-VHT40 MCS0	3	2422	18.61	19.00	100
		6	2437	20.04	20.50	
		9	2452	15.32	15.50	

<5GHz WLAN ANT1+2>

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.2GHz WLAN	802.11ac-VHT20 MCS0	36	5180	17.82	18.00	100
		40	5200	17.83	18.00	
		44	5220	18.00	18.00	
		48	5240	18.02	18.50	
	802.11ac-VHT40 MCS0	38	5190	17.98	18.00	100
		46	5230	18.11	18.50	
	802.11ac-VHT80 MCS0	42	5210	18.38	18.50	100

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.3GHz WLAN	802.11ac-VHT20 MCS0	52	5260	18.02	18.50	100
		56	5280	17.99	18.00	
		60	5300	17.99	18.00	
		64	5320	18.18	18.50	
	802.11ac-VHT40 MCS0	54	5270	18.22	18.50	100
		62	5310	18.11	18.50	
	802.11ac-VHT80 MCS0	58	5290	18.30	18.50	100

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.5GHz WLAN	802.11ac-VHT20 MCS0	100	5500	18.52	19.00	100
		116	5580	18.46	18.50	
		124	5620	18.35	18.50	
		132	5660	18.38	18.50	
		144	5720	18.40	18.50	
	802.11ac-VHT40 MCS0	102	5510	18.71	19.00	100
		110	5550	18.55	19.00	
		126	5630	18.51	19.00	
		134	5670	18.52	19.00	
		142	5710	18.68	19.00	
	802.11ac-VHT80 MCS0	106	5530	18.88	19.00	100
		122	5610	18.87	19.00	
		138	5690	19.07	19.50	

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
5.8GHz WLAN	802.11ac-VHT20 MCS0	149	5745	19.72	20.00	100
		157	5785	19.80	20.00	
		165	5825	19.92	20.00	
	802.11ac-VHT40 MCS0	151	5755	20.25	20.50	100
		159	5795	20.18	20.50	
	802.11ac-VHT80 MCS0	155	5775	20.48	20.50	100

<2.4GHz Bluetooth>

Mode	Channel	Frequency (MHz)	Average power (dBm)		
			1Mbps	2Mbps	3Mbps
BR / EDR	CH 00	2402	0.52	-2.88	-2.90
	CH 39	2441	1.58	-1.65	-1.72
	CH 78	2480	1.96	-1.20	-1.25
Tune-up Limit			2.00	-1.00	-1.00

Mode	Channel	Frequency (MHz)	Average power (dBm)	
			1Mbps	2Mbps
LE	CH 00	2402	0.10	0.10
	CH 19	2440	1.30	1.30
	CH 39	2480	1.60	1.60
Tune-up Limit			2.00	2.00

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

<Exclusions Applied for Body-worn>

Bluetooth Max Power (dBm)	Separation Distance (mm)	Frequency (GHz)	exclusion thresholds
2	< 5	2.48	0.50

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 Body-worn test exclusion threshold is 0.5 which is <= 3, SAR testing is not required.

<Exclusions Applied for Extremity>

Bluetooth Max Power (dBm)	Separation Distance (mm)	Frequency (GHz)	exclusion thresholds
2	43	2.48	0.06

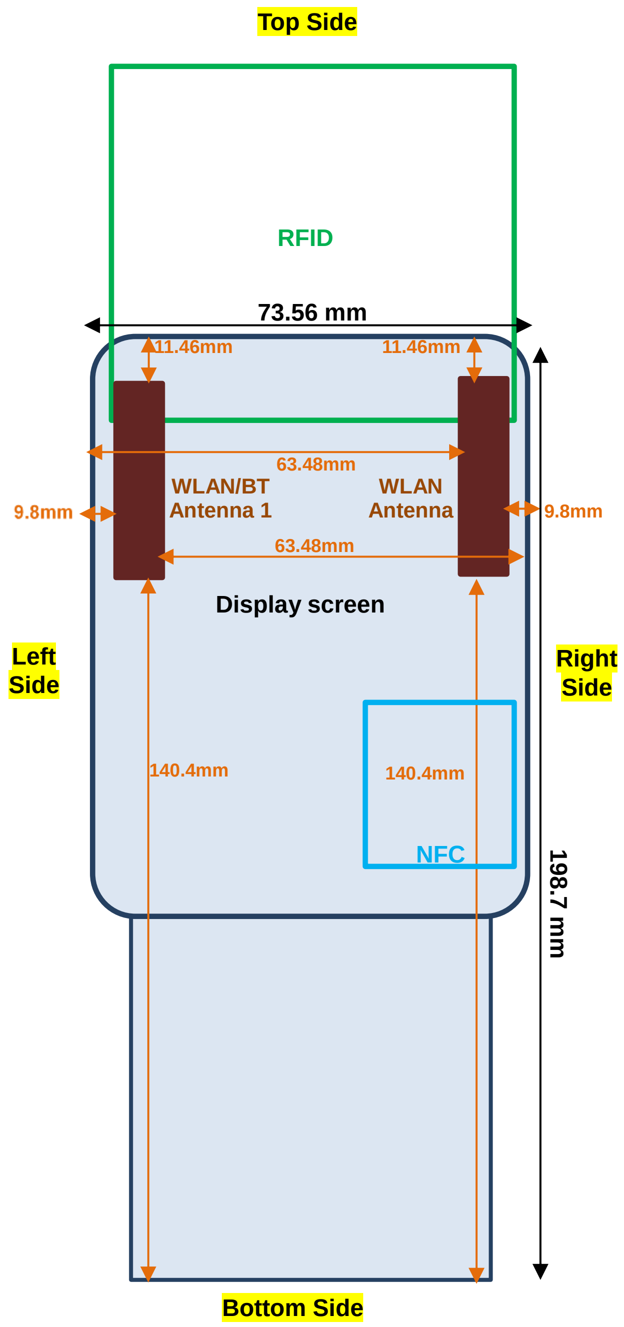
2.4GHz Max Power (dBm)	Separation Distance (mm)	Frequency (GHz)	exclusion thresholds
22.5	43	2.462	6.49

5GHz Max Power (dBm)	Separation Distance (mm)	Frequency (GHz)	exclusion thresholds
18	43	5.825	3.54

Note:

Per KDB 447498 D01v06, when user is holding the device which the WLAN/BT antennas to user finger distance is 43mm, the separation distance is 43 mm applied to determine SAR test exclusion. The test exclusion threshold if <= 7.5, extremity SAR testing is not required.

12. Antenna Location



Front View

13. 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 RFID: Reported SAR(W/kg)= Measured SAR(W/kg)*Tune-up Scaling Factor
   d. For WLAN: 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.
4. When the device is placed into the holster, the RFID can't be triggered by user's finger is holding, therefore body worn is not expected used conditions for RFID transmission, Therefore, for SAR testing is only consideration extremity RF exposure condition for RFID.
5. Since the transmission of RFID has directivity at front face, for RF exposure if test front face is compliant, that mean back side will almost assuredly be compliant due to the antenna design. For the Middle range RFID antenna, test with the antenna 55 mm away from the flat phantom and for the long range RFID antenna, test with the antenna 35 mm away from the flat phantom, A non-standard setup was used for SAR testing based on guidance from the FCC.

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. For WLAN SAR testing was performed on single antenna RF power in SISO mode is larger or equal to the single antenna RF power in MIMO mode, and for RF exposure assessment of MIMO mode simultaneous transmission exclusion analysis was performed with SAR test results of each antenna in SISO mode.
6. Per KDB 248227 D01v02r02, the simultaneous SAR provisions in KDB publication 447498 should be applied to determine simultaneous transmission SAR test exclusion for WiFi MIMO. If the sum of 1g single transmission chain SAR measurements is < 1.6W/kg and SAR peak to location ratio ≤ 0.04, no additional SAR measurements for MIMO.
7. During SAR testing the WLAN transmission was verified using a spectrum analyzer.

13.1 Body Worn Accessory SAR

<WLAN SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Headset	SKU	Battery	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	Right Side	0mm	Ant 1	Holster	SKU 1	Battery 2	6	2437	22.40	22.50	1.023	100	1.000	-0.03	0.918	0.939
	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	Ant 1	Holster	SKU 1	Battery 2	1	2412	22.40	22.50	1.023	100	1.000	-0.14	0.754	0.772
	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	Ant 1	Holster	SKU 1	Battery 2	11	2462	22.10	22.50	1.096	100	1.000	-0.18	0.922	1.011
01	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	Ant 1	Holster	SKU 2	Battery 2	6	2437	22.40	22.50	1.023	100	1.000	-0.03	0.997	1.020
	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	Ant 1	Holster	SKU 2	Battery 2	1	2412	22.40	22.50	1.023	100	1.000	-0.03	0.519	0.531
	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	Ant 1	Holster	SKU 2	Battery 2	11	2462	22.10	22.50	1.096	100	1.000	-0.06	0.646	0.708
	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	Ant 1	Holster	SKU 3	Battery 2	6	2437	22.40	22.50	1.023	100	1.000	-0.18	0.673	0.689
	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	Ant 1	Holster	SKU 8	Battery 2	6	2437	22.40	22.50	1.023	100	1.000	0.03	0.956	0.978
	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	Ant 1	Holster	SKU 8	Battery 2	1	2412	22.40	22.50	1.023	100	1.000	0.09	0.501	0.513
	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	Ant 1	Holster	SKU 8	Battery 2	11	2462	22.10	22.50	1.096	100	1.000	0.13	0.622	0.682
	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	Ant 1	Holster	SKU 14	Battery 2	6	2437	22.40	22.50	1.023	100	1.000	0.11	0.524	0.536
	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	Ant 1	Holster	SKU 2	Battery 1	6	2437	22.40	22.50	1.023	100	1.000	0.12	0.872	0.892
	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	Ant 1	Holster	SKU 2	Battery 3	6	2437	22.40	22.50	1.023	100	1.000	-0.03	0.889	0.910
	WLAN2.4GHz	802.11b 1Mbps	Left Side	0mm	Ant 2	Holster	SKU 1	Battery 2	6	2437	22.30	22.50	1.047	100	1.000	0.13	0.454	0.475
	WLAN2.4GHz	802.11b 1Mbps	Left Side	0mm	Ant 2	Holster	SKU 2	Battery 2	6	2437	22.30	22.50	1.047	100	1.000	0.09	0.464	0.486
	WLAN2.4GHz	802.11b 1Mbps	Left Side	0mm	Ant 2	Holster	SKU 3	Battery 2	6	2437	22.30	22.50	1.047	100	1.000	0.11	0.288	0.302
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Ant 1	Holster	SKU 1	Battery 2	58	5290	15.60	16.00	1.096	85.29	1.172	-0.09	0.497	0.639
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Ant 1	Holster	SKU 2	Battery 2	58	5290	15.60	16.00	1.096	85.29	1.172	0.04	0.735	0.945
02	WLAN5GHz	802.11n-HT40 MCS0	Right Side	0mm	Ant 1	Holster	SKU 2	Battery 2	54	5270	15.80	16.00	1.047	91.15	1.097	0.16	1.020	1.172
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Ant 1	Holster	SKU 3	Battery 2	58	5290	15.60	16.00	1.096	85.29	1.172	0.15	0.483	0.621
	WLAN5GHz	802.11n-HT40 MCS0	Right Side	0mm	Ant 1	Holster	SKU 8	Battery 2	54	5270	15.60	16.00	1.096	91.15	1.097	-0.11	0.636	0.765
	WLAN5GHz	802.11n-HT40 MCS0	Right Side	0mm	Ant 1	Holster	SKU 14	Battery 2	54	5270	15.60	16.00	1.096	91.15	1.097	-0.02	0.663	0.797
	WLAN5GHz	802.11n-HT40 MCS0	Right Side	0mm	Ant 1	Holster	SKU 2	Battery 1	54	5270	15.80	16.00	1.047	91.15	1.097	0.13	1.010	1.160
	WLAN5GHz	802.11n-HT40 MCS0	Right Side	0mm	Ant 1	Holster	SKU 2	Battery 3	54	5270	15.80	16.00	1.047	91.15	1.097	0.04	1.000	1.149
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Ant 2	Holster	SKU 1	Battery 2	58	5290	15.70	16.00	1.072	85.61	1.168	0.06	0.583	0.730
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Ant 2	Holster	SKU 2	Battery 2	58	5290	15.70	16.00	1.072	85.61	1.168	0.05	0.326	0.408
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Ant 2	Holster	SKU 3	Battery 2	58	5290	15.70	16.00	1.072	85.61	1.168	0.07	0.339	0.424

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Headset	SKU	Battery	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	802.11ac-VHT80 MCS0	Right Side	0mm	Ant 1	Holster	SKU 1	Battery 2	138	5690	16.40	16.50	1.023	85.29	1.172	-0.1	0.951	1.141
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Ant 1	Holster	SKU 1	Battery 2	106	5530	16.30	16.50	1.047	85.29	1.172	0.16	0.588	0.722
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Ant 1	Holster	SKU 1	Battery 2	122	5610	16.30	16.50	1.047	85.29	1.172	0.13	0.639	0.784
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Ant 1	Holster	SKU 2	Battery 2	138	5690	16.40	16.50	1.023	85.29	1.172	-0.03	0.972	1.166
03	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Ant 1	Holster	SKU 2	Battery 2	106	5530	16.30	16.50	1.047	85.29	1.172	0.03	0.976	1.198
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Ant 1	Holster	SKU 2	Battery 2	122	5610	16.30	16.50	1.047	85.29	1.172	-0.05	0.975	1.197
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Ant 1	Holster	SKU 3	Battery 2	138	5690	16.40	16.50	1.023	85.29	1.172	-0.14	0.813	0.975
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Ant 1	Holster	SKU 3	Battery 2	106	5530	16.30	16.50	1.047	85.29	1.172	0.08	0.657	0.806
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Ant 1	Holster	SKU 3	Battery 2	122	5610	16.30	16.50	1.047	85.29	1.172	0.15	0.969	1.189
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Ant 1	Holster	SKU 8	Battery 2	106	5530	16.30	16.50	1.047	85.29	1.172	0.1	0.706	0.866
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Ant 1	Holster	SKU 14	Battery 2	106	5530	16.30	16.50	1.047	85.29	1.172	0.05	0.925	1.135
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Ant 1	Holster	SKU 2	Battery 1	106	5530	16.30	16.50	1.047	85.29	1.172	0.12	0.842	1.033
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Ant 1	Holster	SKU 2	Battery 3	106	5530	16.30	16.50	1.047	85.29	1.172	0.11	0.781	0.958
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Ant 2	Holster	SKU 1	Battery 2	122	5610	16.50	16.50	1.000	85.61	1.168	0.13	0.749	0.875
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Ant 2	Holster	SKU 1	Battery 2	106	5530	16.40	16.50	1.023	85.61	1.168	0.06	0.647	0.773
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Ant 2	Holster	SKU 1	Battery 2	138	5690	16.40	16.50	1.023	85.61	1.168	-0.1	0.693	0.828
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Ant 2	Holster	SKU 2	Battery 2	122	5610	16.50	16.50	1.000	85.61	1.168	0.15	0.685	0.800
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Ant 2	Holster	SKU 2	Battery 2	106	5530	16.40	16.50	1.023	85.61	1.168	0.17	0.493	0.589
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Ant 2	Holster	SKU 2	Battery 2	138	5690	16.40	16.50	1.023	85.61	1.168	0.13	0.812	0.971
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Ant 2	Holster	SKU 3	Battery 2	122	5610	16.50	16.50	1.000	85.61	1.168	-0.09	0.861	1.006
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Ant 2	Holster	SKU 3	Battery 2	106	5530	16.40	16.50	1.023	85.61	1.168	0.19	0.586	0.700
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Ant 2	Holster	SKU 3	Battery 2	138	5690	16.40	16.50	1.023	85.61	1.168	0.04	0.893	1.067
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Ant 1	Holster	SKU 1	Battery 2	155	5775	17.70	18.00	1.072	85.29	1.172	-0.18	0.879	1.104
	WLAN5GHz	802.11n-HT40 MCS0	Right Side	0mm	Ant 1	Holster	SKU 1	Battery 2	159	5795	17.80	18.00	1.047	91.15	1.097	0.05	0.672	0.772
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Ant 1	Holster	SKU 2	Battery 2	155	5775	17.70	18.00	1.072	85.29	1.172	-0.16	0.766	0.962
	WLAN5GHz	802.11n-HT40 MCS0	Right Side	0mm	Ant 1	Holster	SKU 2	Battery 2	159	5795	17.80	18.00	1.047	91.15	1.097	-0.1	0.519	0.596
	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Ant 1	Holster	SKU 3	Battery 2	155	5775	17.70	18.00	1.072	85.29	1.172	-0.09	0.835	1.049
	WLAN5GHz	802.11n-HT40 MCS0	Right Side	0mm	Ant 1	Holster	SKU 3	Battery 2	159	5795	17.80	18.00	1.047	91.15	1.097	-0.06	0.652	0.749
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Ant 2	Holster	SKU 1	Battery 2	155	5775	17.90	18.00	1.023	85.61	1.168	-0.14	0.829	0.991
	WLAN5GHz	802.11n-HT40 MCS0	Left Side	0mm	Ant 2	Holster	SKU 1	Battery 2	159	5795	17.70	18.00	1.072	91.47	1.093	-0.1	0.938	1.099
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Ant 2	Holster	SKU 2	Battery 2	155	5775	17.90	18.00	1.023	85.61	1.168	-0.02	0.944	1.128
	WLAN5GHz	802.11n-HT40 MCS0	Left Side	0mm	Ant 2	Holster	SKU 2	Battery 2	159	5795	17.70	18.00	1.072	91.47	1.093	-0.06	0.746	0.874
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Ant 2	Holster	SKU 3	Battery 2	155	5775	17.90	18.00	1.023	85.61	1.168	-0.09	0.901	1.077
	WLAN5GHz	802.11n-HT40 MCS0	Left Side	0mm	Ant 2	Holster	SKU 3	Battery 2	159	5795	17.70	18.00	1.072	91.47	1.093	0.08	0.661	0.774
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Ant 2	Holster	SKU 8	Battery 2	155	5775	17.90	18.00	1.023	85.61	1.168	-0.09	0.673	0.804
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Ant 2	Holster	SKU 14	Battery 2	155	5775	17.90	18.00	1.023	85.61	1.168	-0.02	0.903	1.079
04	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Ant 2	Holster	SKU 2	Battery 1	155	5775	17.90	18.00	1.023	85.61	1.168	-0.04	0.993	1.187
	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Ant 2	Holster	SKU 2	Battery 3	155	5775	17.90	18.00	1.023	85.61	1.168	-0.14	0.990	1.183

13.2 Extremity SAR

<RFID SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	SKU	Battery	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)
05	UHF RFID	ASK	Front	35mm	SKU 2	Battery 2	927.25	27.84	28.00	1.038	100	1.000	-0.03	1.740	1.805
	UHF RFID	ASK	Bottom Side	0mm	SKU 2	Battery 2	927.25	27.84	28.00	1.038	100	1.000	-0.1	0.688	0.714
	UHF RFID	ASK	Front	35mm	SKU 3	Battery 2	927.25	27.84	28.00	1.038	100	1.000	-0.13	1.580	1.639
	UHF RFID	ASK	Front	35mm	SKU 8	Battery 2	927.25	27.84	28.00	1.038	100	1.000	-0.17	1.500	1.556
	UHF RFID	ASK	Front	35mm	SKU 14	Battery 2	927.25	27.84	28.00	1.038	100	1.000	-0.08	1.450	1.504
	UHF RFID	ASK	Front	35mm	SKU 2	Battery 2	902.75	27.81	28.00	1.045	100	1.000	0.06	0.989	1.033
	UHF RFID	ASK	Front	35mm	SKU 2	Battery 2	914.75	27.83	28.00	1.040	100	1.000	-0.05	1.440	1.497
	UHF RFID	ASK	Front	35mm	SKU 2	Battery 1	927.25	27.84	28.00	1.038	100	1.000	-0.01	1.650	1.712
	UHF RFID	ASK	Front	35mm	SKU 2	Battery 3	927.25	27.84	28.00	1.038	100	1.000	-0.01	1.560	1.619
	UHF RFID	ASK	Front	55mm	SKU 1	Battery 2	927.25	27.90	28.00	1.023	100	1.000	-0.01	0.261	0.267
	UHF RFID	ASK	Bottom Side	0mm	SKU 1	Battery 2	927.25	27.90	28.00	1.023	100	1.000	-0.05	0.542	0.555
	UHF RFID	ASK	Bottom Side	0mm	SKU 7	Battery 2	927.25	27.90	28.00	1.023	100	1.000	-0.08	0.535	0.547
	UHF RFID	ASK	Bottom Side	0mm	SKU13	Battery 2	927.25	27.90	28.00	1.023	100	1.000	0.06	0.517	0.529
	UHF RFID	ASK	Bottom Side	0mm	SKU 1	Battery 2	902.75	27.86	28.00	1.033	100	1.000	0.01	0.715	0.738
	UHF RFID	ASK	Bottom Side	0mm	SKU 1	Battery 2	914.75	27.88	28.00	1.028	100	1.000	0.1	0.800	0.822
	UHF RFID	ASK	Bottom Side	0mm	SKU 1	Battery 1	914.75	27.88	28.00	1.028	100	1.000	0.11	0.792	0.814
	UHF RFID	ASK	Bottom Side	0mm	SKU 1	Battery 3	914.75	27.88	28.00	1.028	100	1.000	0.11	0.799	0.821

13.3 Repeated SAR Measurement

No.	Band	Mode	Test Position	Gap (mm)	Antenna	Headset	SKU	Battery	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	Right Side	0mm	Ant 1	Holster	SKU 2	Battery 2	6	2437	22.40	22.50	1.023	100	1.000	-0.03	0.997	-	1.020
2nd	WLAN2.4GHz	802.11b 1Mbps	Right Side	0mm	Ant 1	Holster	SKU 2	Battery 2	6	2437	22.40	22.50	1.023	100	1.000	-0.13	0.950	1.05	0.972
1st	WLAN5GHz	802.11n-HT40 MCS0	Right Side	0mm	Ant 1	Holster	SKU 2	Battery 2	54	5270	15.80	16.00	1.047	91.15	1.097	0.16	1.020	-	1.172
2nd	WLAN5GHz	802.11n-HT40 MCS0	Right Side	0mm	Ant 1	Holster	SKU 2	Battery 2	54	5270	15.80	16.00	1.047	91.15	1.097	0.16	0.999	1.02	1.148
1st	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Ant 1	Holster	SKU 2	Battery 2	106	5530	16.30	16.50	1.047	85.29	1.172	0.03	0.976	-	1.198
2nd	WLAN5GHz	802.11ac-VHT80 MCS0	Right Side	0mm	Ant 1	Holster	SKU 2	Battery 2	106	5530	16.30	16.50	1.047	85.29	1.172	-0.02	0.935	1.04	1.147
1st	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Ant 2	Holster	SKU 2	Battery 1	155	5775	17.90	18.00	1.023	85.61	1.168	-0.04	0.993	-	1.187
2nd	WLAN5GHz	802.11ac-VHT80 MCS0	Left Side	0mm	Ant 2	Holster	SKU 2	Battery 1	155	5775	17.90	18.00	1.023	85.61	1.168	-0.1	0.928	1.07	1.109

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.

14. Simultaneous Transmission Analysis

NO.	Simultaneous Transmission Configurations	Body-Worn	Extremity
1.	WLAN ANT 1 + WLAN ANT 2	Yes	Yes
2.	RFID + WLAN ANT 1 + WLAN ANT 2	Yes	Yes

General Note:

1. WLAN and Bluetooth share the same antenna1, 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, exclusion 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.
   iv) Exclusion estimated SAR is determined by 43mm separation, for extremity estimated calculation.

RF Transmitter	Max Power	Separation Distance	Exposure Position	Estimated 1g SAR (W/kg)
BT Ant 1	2dBm	5 mm	Body-worn	0.066 W/kg

RF Transmitter	Max Power	Separation Distance	Exposure Position	Estimated 10g SAR (W/kg)
BT Ant 1	2 dBm	43 mm	Extremity	0.003 W/kg
2.4GHz WLAN Ant 1	22.5 dBm	43 mm	Extremity	0.346 W/kg
2.4GHz WLAN Ant 2	22.5 dBm	43 mm	Extremity	0.346 W/kg
5GHz WLAN Ant 1	18 dBm	43 mm	Extremity	0.189 W/kg
5GHz WLAN Ant 2	18 dBm	43 mm	Extremity	0.189 W/kg

14.1 Body-Worn Accessory Exposure Conditions

Exposure Position	1	2	3	4	5	1+2 Summed 1g SAR (W/kg)	3+4 Summed 1g SAR (W/kg)	2+5 Summed 1g SAR (W/kg)	4+5 Summed 1g SAR (W/kg)
	2.4GHz WLAN Ant 1	2.4GHz WLAN Ant 2	5GHz WLAN Ant 1	5GHz WLAN Ant 2	Bluetooth Ant 1				
	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	Estimated 1g SAR (W/kg)				
Left side		0.486		1.187		**0.486**	**1.187**	**0.486**	**1.187**
Right side	1.020		1.198		0.066	**1.020**	**1.198**	**0.066**	**0.066**

14.2 Extremity Exposure Conditions

Exposure Position	0	1	2	3	4	5	0+1+2 Summed 10g SAR (W/kg)	0+3+4 Summed 10g SAR (W/kg)	0+2+5 Summed 10g SAR (W/kg)	0+4+5 Summed 10g SAR (W/kg)
	WWAN	2.4GHz WLAN Ant 1	2.4GHz WLAN Ant 2	5GHz WLAN Ant 1	5GHz WLAN Ant 2	Bluetooth				
	10g SAR (W/kg)	Estimated 10g SAR (W/kg)	Estimated 10g SAR (W/kg)	Estimated 10g SAR (W/kg)	Estimated 10g SAR (W/kg)	Estimated 10g SAR (W/kg)				
Front	1.805	0.346	0.346	0.189	0.189	0.003	**2.497**	**2.183**	**2.154**	**1.997**
Bottom side	0.822	0.346	0.346	0.189	0.189	0.003	**1.514**	**1.200**	**1.171**	**1.014**

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15. 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.

16. 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.