FCC SAR Test Report

Product	:	Vision MARK-1
Trade mark	:	N/A
Model/Type reference	:	Vision MARK-1
Add. Model No.	:	N/A
Report Number	:	210125062SAR-1
Date of Issue	:	May 7, 2021
FCC ID	:	2AYS7-MARK1
IC	:	27077-MARK1
Test Standards	:	FCC 47 CFR Part 2 §2.1093 ANSI/IEEE C95.1-1992 IEEE Std 1528-2013
Test result	:	PASS

Prepared for:

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Prepared by:

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Approved by:	Kevin Liang Assistant Manager	Date:	May 7, 2021

Version

Version No.	Date	Description
V1.0	May 7, 2021	Original

Contents

1 General Information

1.1 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for the EUT are as follows:

Equipment Class	Mode	Highest Reported Body SAR_{1g} (W/kg)
DTS	2.4G WLAN	0.126
NII	5G WLAN	0.774
DTS	Bluetooth	N/A

1.2 EUT Description

1.2.1 General Description

Product Name	Vision MARK-1
Trade mark	N/A
Model No.(EUT)	Vision MARK-1
Add. Model No.:	N/A
FCC ID	2AYS7-MARK1
Tx Frequency Bands (Unit: MHz)	WLAN:2412 ~ 2462, 5180 ~ 5240, 5260 ~ 5320, 5500 ~ 5700,5745 ~ 5825 Bluetooth: 2402 ~ 2480
Device Class	B
Antenna Type	PCB Trace Antenna
EUT Stage	Production Unit

1.2.2 Wireless Technologies

2.4G WLAN	802.11b 802.11g 802.11n (HT20)
5G WLAN	802.11a 802.11n (HT20/HT40) 802.11ac (VHT20/VHT40/VHT80)
Bluetooth	LE

1.2.3 List of Accessory

Battery	Model No.	PR-CU-R295-V1
	Battery Type	Lithium-ion Polymer Battery
	Rated Voltage	3.7 Vdc
Adapter	Model No.	GTM96180-1807-2.0
	Input	100-240 V~50/60 Hz 0.6 A
	Output	5.0 V ⎓ 3.6 A 18W

1.3 Maximum Conducted Power

The maximum conducted average power (Unit: dBm) including tune-up tolerance is shown as below.

Mode	2.4G WLAN
802.11b	8.00
802.11g	9.00
802.11n HT20	8.00

Mode	Modulation	2.4G Bluetooth
LE	GFSK	2.00

Band	Mode	5G WLAN
5.2G WLAN	802.11a	9.00
	802.11n HT20	9.00
	802.11n HT40	9.50
	802.11ac VHT20	8.50
	802.11ac VHT40	9.50
	802.11ac VHT80	8.00
5.3G WLAN	802.11a	9.00
	802.11n HT20	9.00
	802.11n HT40	9.00
	802.11ac VHT20	8.50
	802.11ac VHT40	9.00
	802.11ac VHT80	7.50
5.6G WLAN	802.11a	7.00
	802.11n HT20	7.00
	802.11n HT40	7.00
	802.11ac VHT20	6.00
	802.11ac VHT40	6.50
	802.11ac VHT80	5.50
5.8G WLAN	802.11a	7.00
	802.11n HT20	7.00
	802.11n HT40	7.50
	802.11ac VHT20	6.50
	802.11ac VHT40	7.50
	802.11ac VHT80	6.00

1.4 Other Information

Sample Received Date:	January 26, 2021
Sample tested Date:	March 30, 2021 to March 31, 2021

1.5 Testing Location

Shenzhen UnionTrust Quality and Technology Co., Ltd.
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Telephone: +86-755-28230888 Fax: +86-755-28230886
Mail: info@uttlab.com Website: Http://www.uttlab.com

1.6 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L9069

The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC/EN 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

FCC Accredited Lab.
Designation Number: CN1194
Test Firm Registration Number: 259480

A2LA-Lab Certificate No.: 4312.01

Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

ISED Wireless Device Testing Laboratories

CAB identifier: CN0032

1.7 Guidance Standard

The tests documented in this report were performed in accordance with FCC 47 CFRPart 2§2.1093, IEEE Std1528-2013, ANSI/IEEE C95.1-1992, the following FCC Published RF exposure KDB procedures:

KDB 865664 D01 v01r04

KDB 865664 D02 v01r02

KDB 248227 D01 v02r02

KDB 447498 D01 v06

The equipment have been tested by **Shenzhen UnionTrust Quality and Technology Co., Ltd.**, and found compliance with the requirement of the above standards.

2 SpecificAbsorptionRate (SAR)

2.1 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, by appropriate techniques, to produce specific absorptionrates (SARs) as averaged over the whole-body,any 1 g or any 10 g of tissue (defined as a tissue volume in the shape of a cube). All SAR values are to be averaged over any six-minute period. When portable device was used within 20 cm of the user's body, SAR evaluation of the device will be required. The SAR limit in chapter 2.3.

2.2 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:

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

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

SAR measurement can be related to the electrical field in the tissue by

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

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

2.3 SAR Limits

(A) Limits for Occupational/Controlled Exposure (W/kg)

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

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

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

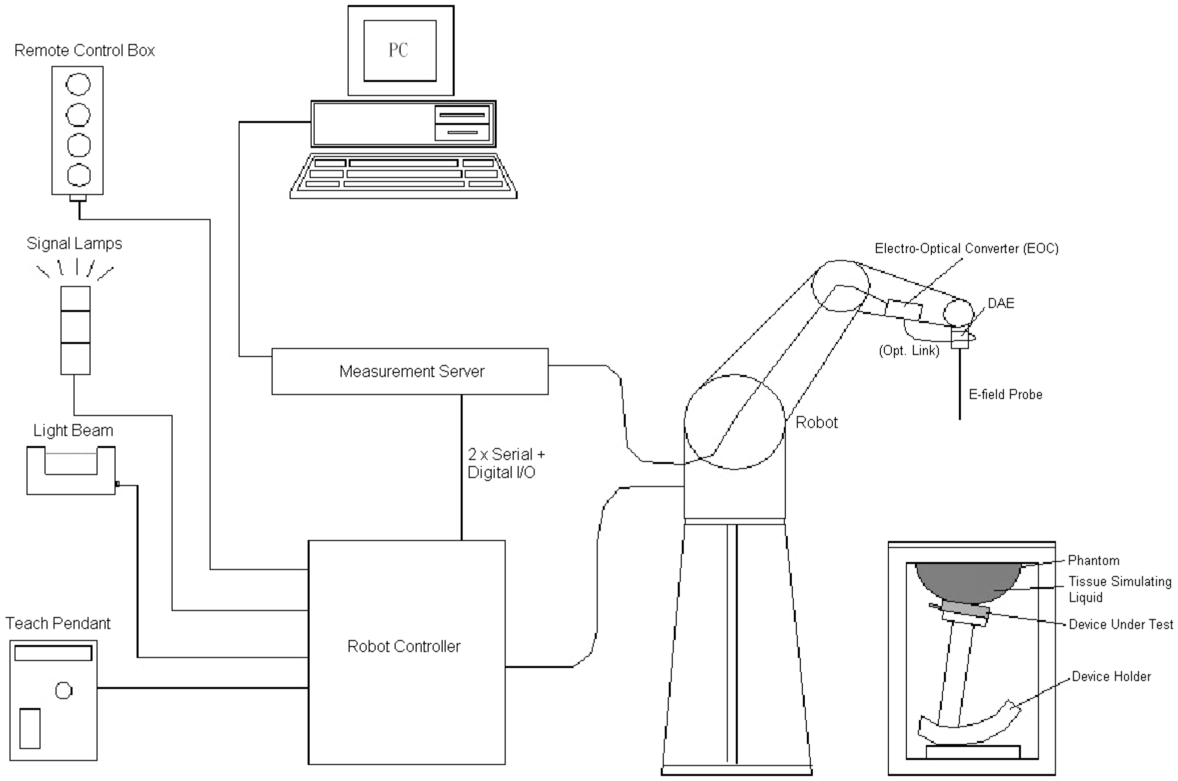
Note:

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, feetand ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape ofa cube.
2. At frequencies above 6.0 GHz, SAR limits are not applicable and MPE limits for power density should be applied at 5 cm or more from the transmitting device.
3. The SAR limit is specified in FCC 47 CFRPart 2§2.1093, ANSI/IEEE C95.1-1992.

3 SAR Measurement System

3.1 SPEAG DASY System

DASY system consists of high precision robot, probe alignment sensor, phantom, robot controller, controlled measurement server and near-field probe. The robot includes six axes that can move to the precision position of the DASY5 software defined. The DASYsoftware can define the area that is detected by the probe. The robot is connected to controlled box. Controlled measurement server is connected to the controlled robot box. The DAE includes amplifier, signal multiplexing, AD converter, offset measurement and surface detection. It is connected to the Electro-optical coupler (ECO). The ECO performs the conversion form the optical into digital electric signal of the DAE and transfers data to the PC.



DASY Measurement System

3.1.1 Robot

The DASYsystem uses the high precision robots from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY4: CS7MB) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability ±0.02 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)

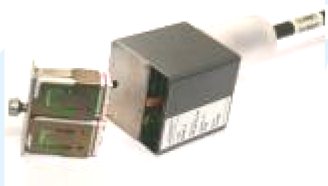
3.1.2 Probe

The SAR measurement is conducted with the dosimetric probe.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.

Model	EX3DV4	
Construction	Symmetrical design with triangular core. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE).	
Frequency	10 MHz to 6 GHz Linearity: ± 0.2 dB	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)	
Dynamic Range	10 µW/g to 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	

Model	ES3DV3	
Construction	Symmetrical 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 to 4 GHz Linearity: ± 0.2 dB	
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in tissue material (rotation normal to probe axis)	
Dynamic Range	5 µW/g to 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: 2.0 mm	

3.1.3 Data Acquisition Electronics (DAE)

Model	DAE3, DAE4	
Construction	Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY embedded system (fully remote controlled). Two step probe touch detector for mechanical surface detection and emergency robot stop.	
Measurement Range	-100 to +300 mV (16 bit resolution and two range settings: 4mV, 400mV)	
Input Offset Voltage	< 5µV (with auto zero)	
Input Bias Current	< 50 fA	
Dimensions	60 x 60 x 68 mm	

3.1.4 Phantom

Model	Twin SAM
Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.
Material	Vinylester, glass fiber reinforced (VE-GF)
Shell Thickness	2 ± 0.2 mm (6 ± 0.2 mm at ear point)
Dimensions	Length: 1000 mm Width: 500 mm Height: adjustable feet
Filling Volume	approx. 25 liters

Model	ELI
Construction	Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.
Material	Vinylester, glass fiber reinforced (VE-GF)
Shell Thickness	2.0 ± 0.2 mm (bottom plate)
Dimensions	Major axis: 600 mm Minor axis: 400 mm
Filling Volume	approx. 30 liters

3.1.5 Device Holder

Model	Mounting Device	
Construction	In combination with the Twin SAM Phantom or ELI4, the Mounting Device enables the rotation of the mounted transmitter device in spherical coordinates. Rotation point is the ear opening point. Transmitter devices can be easily and accurately positioned according to IEC, IEEE, FCC or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat).	
Material	POM	

Model	Laptop Extensions Kit	
Construction	Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices according to IEC 62209-2 (e.g., laptops, cameras, etc.). It is lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioner.	
Material	POM, Acrylic glass, Foam	

3.1.6 System Validation Dipoles

Model	D-Serial	
Construction	Symmetrical dipole with l/4 balun. Enables measurement of feedpoint impedance with NWA. Matched for use near flat phantoms filled with tissue simulating solutions.	
Frequency	750 MHz to 5800 MHz	
Return Loss	> 20 dB	
Power Capability	> 100 W (f < 1GHz),> 40 W (f > 1GHz)	

3.2 SAR Scan Procedure

3.2.1 SAR Reference Measurement (drift)

Prior to the SAR test, local SAR shall be measured at a stationary reference point where the SAR exceedsthe lower detection limit of the measurement system.

3.2.2 Area Scan

Measurement procedures for evaluating the SAR of wireless device start with a coarse measurement gridto determine the approximate location of the local peak SAR values. This is known as the area-scanprocedure. All antennas and radiating structures that may contribute to the measured SAR or influence the SARdistribution must be included in the area scan. The area scan measurement resolution mustenable the extrapolation algorithms of the SAR system to correctly identify the peak SAR location(s) forsubsequent zoom scan measurements to correctly determine the 1-g SAR. Area scans are performed at aconstant distance from the phantom surface, determined by the measurement frequencies. When ameasured peak is closer than ½ the zoom scan volume dimension (x, y) from the edge of the area scanregion, unless the entire peak and gram-averaging volume are both captured within the zoom scan volume, the area scan must be repeated by shifting and expanding the area scan region to ensure all peaksare away from the area scan boundary. The area scan resolutions specified in the table below must be applied to the SARmeasurements.

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

3.2.3 Zoom Scan

To evaluate the peak spatial-average SAR values with respect to 1 g or 10 g cubes, fine resolution volumescans, called zoom scans, are performed at the peak SAR locations identified during the area scan. If the cube volume within thezoom scan chosen to calculate the peak spatial-average SAR touches any boundary of the zoom-scanvolume, the zoom scan shall be repeated with the center of the zoom-scan volume shifted to the newmaximum SAR location. For any secondary peaks found in the area scan that are within 2 dB of themaximum peak and are not within this zoom scan, the zoom scan shall be performed for such peaks,unless the peak spatial-average SAR at the location of the maximum peak is more than 2 dB below theapplicable SAR limit (i.e., 1 W/kg for a 1.6 W/kg 1 g limit, or 1.26 W/kg for a 2 W/kg 10 g limit).The zoom scan resolutions specified in the table below must be applied to the SARmeasurements.

<table>
<tr><td colspan="3"></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom Scan spatialresolution, normal tophantom surface</td><td colspan="2">uniform grid: $\Delta Z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta Z_{Zoom}(1)$: between 1^{ST} two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta Z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">≤ 1.5·$\Delta Z_{Zoom}(n-1)$ mm</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 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 IEEE Std 1528-2013 for details.
* When zoom scan is required and the reported SAR from the area scan based 1-g SAR estimation procedures ofKDB Publication 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied,respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

3.2.4 SAR Drift Measurement

The local SAR (or conducted power) shall be measured at exactly the same location as in 3.2.1 section. Theabsolute value of the measurement drift (the difference between the SAR measured in 3.2.1 and 3.2.4 section) shall be recorded. The SAR drift shall be kept within ± 5%.

3.3 Test Equipment

Equipment	Manufacturer	Model	SN	Cal. Date	Cal. Interval
Dosimetric E-Field Probe	SPEAG	EX3DV4	7506	May 29, 2020	1 year
Data Acquisition Electronics	SPEAG	DAE4	1557	May 27, 2020	1 year
Dosimetric E-Field Probe	SPEAG	ES3DV3	3090	May 09, 2020	1 Year
Data Acquisition Electronics	SPEAG	DAE4	662	May 06, 2020	1 Year
System Validation Dipole	SPEAG	D2450V2	883	Sep. 20, 2019	3 Year
System Validation Dipole	SPEAG	D5GHzV2	1280	May. 26, 2020	3 year
ENA Series Network Analyzer	Agilent	8753ES	US39170317	Nov. 10, 2020	1 Year
Dielectric Assessment Kit	SPEAG	DAK-3.5	1056	N/A	N/A
USB/GPIB Interface	Agilent	82357B	N10149	N/A	N/A
Signal Generator	R&S	SMB100A	103718	May. 14, 2020	1 Year
POWER METER	R&S	E4417A	MY45100705	May 14, 2020	1 Year
Thermometer	Lisheng	HTC-1	/	Nov. 12, 2020	1 Year
Coupler	REBES	TC-05180-10S	161221001	N/A	N/A
Amplifier	Mini-Circuit	ZHL42	QA1252001	N/A	N/A
DC Source	Agilent	66319B	MY43000795	N/A	N/A

3.4 Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

3.5 Tissue Dielectric Parameter Measurement & System Verification

3.5.1 Tissue Simulating Liquids

The temperature of the tissue-equivalent medium used during measurement must also be within 18 °C to 25 °C and within ± 2 °C of the temperature when the tissue parameters are characterized. The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 - 4 days of use; or earlier if the dielectric parameters can become out of tolerance.

The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm with ≤ ± 0.5 cm variation for SAR measurements ≤ 3 GHz and ≥ 10.0 cm with ≤ ± 0.5 cm variation for measurements > 3 GHz. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5% are listed in Table-3.1.

Photo of Liquid Height

Table-3.1 Tissue Dielectric Parameters for Head and Body

Target Frequency	Head		Body	
(MHz)	εr	σ (S/m)	εr	σ (S/m)
750	41.9	0.89	55.5	0.96
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
1450	40.5	1.20	54.0	1.30
1640	40.3	1.29	53.8	1.40
1750	40.1	1.37	53.4	1.49
1800	40.0	1.40	53.3	1.52
1900	40.0	1.40	53.3	1.52
2000	40.0	1.40	53.3	1.52
2300	39.5	1.67	52.9	1.81
2450	39.2	1.80	52.7	1.95
2600	39.0	1.96	52.5	2.16
3500	37.9	2.91	51.3	3.31
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5800	35.3	5.27	48.2	6.00
(εr = relative permittivity, σ = conductivity and ρ = 1000 kg/m3)				

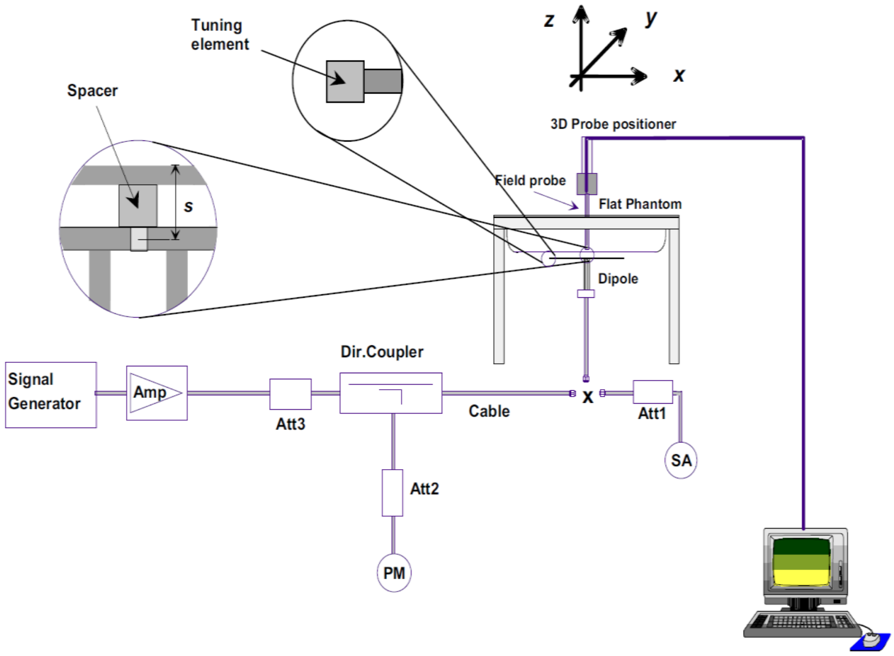
The following table gives the recipes for tissue simulating liquids.

Table-3.2 Recipes of Tissue Simulating Liquid

Tissue Type	Bactericide	DGBE	HEC	NaCl	Sucrose	Triton X-100	Water	Diethylene Glycol Mono-hexylether
H750	0.2	-	0.2	1.4	57.0	-	41.1	-
H835	0.1	-	1.0	1.4	57.0	-	40.5	-
H900	0.1	-	1.0	1.5	56.5	-	40.9	-
H1450	-	45.5	-	0.7	-	-	53.8	-
H1640	-	45.8	-	0.5	-	-	53.7	-
H1750	-	44.5	-	0.3	-	-	55.2	-
H1800	-	44.9	-	0.2	-	-	54.9	-
H1900	-	44.9	-	0.2	-	-	54.9	-
H2000	-	50	-	-	-	-	50	-
H2300	-	44.9	-	0.1	-	-	55.0	-
H2450	-	45.0	-	0.1	-	-	54.9	-
H2600	-	45.1	-	0.1	-	-	54.8	-
H3500	-	8.0	-	0.2	-	20.0	71.8	-
H5G	-	-	-	-	-	17.2	65.52	17.3
B750	0.2	-	0.2	0.8	48.8	-	50.0	-
B835	0.2	-	0.2	0.9	48.5	-	50.2	-
B900	0.2	-	0.2	0.9	48.2	-	50.5	-
B1450	-	34.0	-	0.3	-	-	65.7	-
B1640	-	32.5	-	0.3	-	-	67.2	-
B1750	-	29.4	-	0.4	-	-	70.2	-
B1800	-	29.5	-	0.4	-	-	70.1	-
B1900	-	29.5	-	0.3	-	-	70.2	-
B2000	-	30.0	-	0.2	-	-	69.8	-
B2300	-	31.0	-	0.1	-	-	68.9	-
B2450	-	31.4	-	0.1	-	-	68.5	-
B2600	-	31.8	-	0.1	-	-	68.1	-
B3500	-	28.8	-	0.1	-	-	71.1	-
B5G	-	-	-	-	-	10.7	78.6	10.7

3.5.2 System Check Description

The system check procedure provides a simple, fast, and reliable test method that can be performed daily orbefore every SAR measurement. The objective here is to ascertain that the measurement system hasacceptable accuracy and repeatability. This test requires a flat phantom and a radiating source. The system verification setup is shown as below.



System Verification Setup

3.5.3 Tissue Verification

The measuring results for tissue simulating liquid are shown as below.

Test Date	Tissue Type	Frequency (MHz)	Liquid Temp. (℃)	Measured Conductivity (σ)	Measured Permittivity (ε_r)	Target Conductivity (σ)	Target Permittivity (ε_r)	Conductivity Deviation (%)	Permittivity Deviation (%)
Mar. 31, 2021	Head	2450	22.1	1.870	38.900	1.80	39.20	3.89	-0.77
Mar. 30, 2021	Head	5250	22.0	4.690	35.330	4.70	35.90	-0.21	-1.59
Mar. 30, 2021	Head	5600	22.0	5.040	34.827	5.10	35.50	-1.18	-1.90
Mar. 30, 2021	Head	5750	22.0	5.248	34.541	5.20	35.40	0.92	-2.43

Note:

The dielectric properties of the tissue simulating liquid must be measured within 24 hours before the SAR testing and within ± 5% of the target values. The variation of theliquid temperature must be within ±2 °C during the test.

3.5.4 System Verification

The measuring result for system verification is tabulated as below.

Test Date	Tissue Type	Frequency (MHz)	1W Target SAR-1g (W/kg)	Measured SAR-1g (W/kg)	Normalized to 1W SAR-1g (W/kg)	Deviation (%)	Dipole S/N	Probe S/N	DAE S/N
Mar. 31, 2021	Head	2450	52.60	0.558	55.80	6.08	883	3090	662
Mar. 30, 2021	Head	5250	81.80	8.21	82.10	0.37	1280	7506	1557
Mar. 30, 2021	Head	5600	86.00	8.46	84.60	-1.63	1280	7506	1557
Mar. 30, 2021	Head	5750	82.00	8.45	84.50	3.05	1280	7506	1557

Note:

Comparing to the reference SAR value, the validation data should be within its specification of 10%. The result indicates the system check can meet the variation criterion and the plots can be referred to Appendix A of this report.

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4 SARMeasurement Evaluation

4.1 EUT Configuration and Setting

4.1.1 WLAN Configuration and Testing

In general, various vendor specific external test software and chipset based internal test modes are typically used for SAR measurement. These chipset based test mode utilities are generally hardware and manufacturer dependent, and often include substantial flexibility to reconfigure or reprogram a device. A Wi-Fi device must be configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools for SAR measurement. The test frequencies established using test mode must correspond to the actual channel frequencies. When 802.11 frame gaps are accounted for in the transmission, a maximum transmission duty factor of 92 - 96% is typically achievable in most test mode configurations. A minimum transmission duty factor of 85% is required to avoid certain hardware and device implementation issues related to wide range SAR scaling. In addition, a periodic transmission duty factor is required for current generation SAR systems to measure SAR correctly. The reported SAR must be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit.

According to KDB 248227 D01, this device has installed WLAN engineering testing software which can provide continuous transmitting RF signal. During WLAN SAR testing, this device was operated to transmit continuously at the maximum transmission duty with specified transmission mode, operating frequency, lowest data rate, and maximum output power.

Initial Test Configuration

An initial test configuration is determined for OFDM transmission modes in 2.4 GHz and 5 GHz bands according to the channel bandwidth, modulation and data rate combination(s) with the highest maximum output power specified for production units in each standalone and aggregated frequency band. When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band.

Subsequent Test Configuration

SAR measurement requirements for the remaining 802.11 transmission mode configurations that have not been tested in the initial test configuration are determined separately for each standalone and aggregated frequency band, in each exposure condition, according to the maximum output power specified for production units. Additional power measurements may be required to determine if SAR measurements are required for subsequent highest output power channels in a subsequent test configuration. When the highest reported SAR for the initial test configuration according to the initial test position or fixed exposure position requirements, is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for that subsequent test configuration.

SAR Test Configuration and Channel Selection

When multiple channel bandwidth configurations in a frequency band have the same specified maximum output power, the initial test configuration is using largest channel bandwidth, lowest order modulation, lowest data rate, and lowest order 802.11 mode (i.e., 802.11a is chosen over 802.11n then 802.11ac or 802.11g is chosen over

802.11n).After an initial test configuration is determined, if multiple test channels have the same measured maximum output power, the channel chosen for SAR measurement is determined according to the following.

1) The channel closest to mid-band frequency is selected for SAR measurement.

2) For channels with equal separation from mid-band frequency; for example, high and low channels or two mid-band channels, the higher frequency (number) channel is selected for SAR measurement.

Test Reduction for U-NII-1 (5.2 GHz) and U-NII-2A (5.3 GHz) Bands

For devices that operate in both U-NII bands using the same transmitter and antenna(s), SAR test reduction is determined according to the following.

1) When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition).

2) When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for the band with lower maximum output power in that test configuration.

4.2 EUT Testing Position

4.2.1 Body Exposure Conditions

RF Exposure Conditions	TestPosition	SeparationDistance	SAR test exclusion
Body	Rear Face	0 cm	Note4
	Left Side		
	Right Side		
	Top Side		
	Bottom Side		

Note:

1. Exposures from antennas through the front surface of thedisplay section of a tablet are generally limited to the user's hands. Exposures to hands for typical consumertransmitters used in tablets are not expected to exceed the extremity SAR limit; therefore, SAR evaluation for thefront surface of tablet display screens are generally not necessary.
2. When voice mode is supported on a tablet and it is limited to speakermode or headset operations only, additional SAR testing for this type of voice use is not required.
3. Next to the ear operation is generally not expected for tablets with overall diagonal dimension > 20 cm. However, when next to the ear voice mode is supported, regardless of the overall dimension, phablets must be tested according to the requirements described in KDB Publication 648474 D04.
4. For SAR test exclusion, please refer to section 4.4.

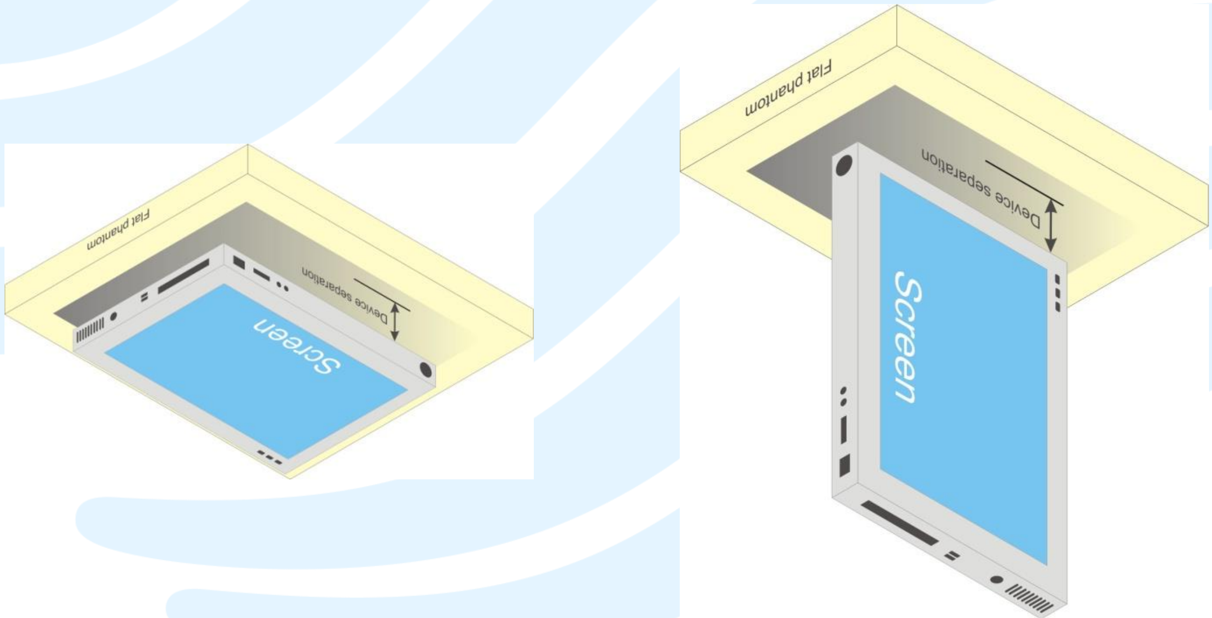

Fig-4.1 Test Positions for Tablet

4.3 Measured Conducted Power Result

4.3.1 Conducted Power of WLAN

Mode		Channel	Frequency (MHz)	Average Power (dBm)
2.4G	802.11b	1	2412	6.64
		6	2437	7.74
		11	2462	6.53
	802.11g	1	2412	7.51
		6	2437	**8.32**
		11	2462	7.39
	802.11n (HT20)	1	2412	7.03
		6	2437	7.97
		11	2462	6.97

Mode		Channel	Frequency (MHz)	Average Power (dBm)
802.11a	5.2G	36	5180	8.77
		40	5200	8.66
		44	5220	8.52
		48	5240	8.46
	5.3G	52	5260	8.65
		56	5280	8.33
		60	5300	8.23
		64	5320	8.39
	5.6G	100	5500	6.17
		104	5520	5.95
		108	5540	5.87
		112	5560	5.62
		116	5580	5.58
		132	5660	5.52
		136	5680	5.83
		140	5700	5.92
	5.8G	149	5745	6.02
		153	5765	6.21
		157	5785	6.36
		161	5805	6.41
		165	5825	6.21

Mode		Channel	Frequency (MHz)	Average Power (dBm)
802.11n (HT20)	5.2G	36	5180	8.11
		40	5200	8.07
		44	5220	8.15
		48	5240	8.06
	5.3G	52	5260	8.21
		56	5280	8.05
		60	5300	8.00
		64	5320	8.16
	5.6G	100	5500	5.75
		104	5520	5.61
		108	5540	5.43
		112	5560	5.31
		116	5580	5.15
		132	5660	5.09
		136	5680	5.37
		140	5700	5.49
	5.8G	149	5745	5.63
		153	5765	5.82
		157	5785	5.98
		161	5805	6.05
		165	5825	5.87

Mode		Channel	Frequency (MHz)	Average Power (dBm)
802.11n (HT40)	5.2G	38	5190	**9.08**
		46	5230	8.74
	5.3G	54	5270	**8.66**
		62	5310	8.62
	5.6G	102	5510	**6.51**
		110	5550	6.11
		134	5670	6.12
	5.8G	151	5755	6.72
		159	5795	**7.09**

Mode		Channel	Frequency (MHz)	Average Power (dBm)
802.11ac (VHT20)	5.2G	36	5180	8.03
		40	5200	8.01
		44	5220	8.14
		48	5240	8.02
	5.3G	52	5260	8.16
		56	5280	8.02
		60	5300	7.95
		64	5320	8.11
	5.6G	100	5500	5.69
		104	5520	5.53
		108	5540	5.38
		112	5560	5.24
		116	5580	5.10
		132	5660	5.04
		136	5680	5.33
		140	5700	5.45
	5.8G	149	5745	5.58
		153	5765	5.76
		157	5785	5.94
		161	5805	6.02
		165	5825	5.81

Mode		Channel	Frequency (MHz)	Average Power (dBm)
802.11ac (VHT40)	5.2G	38	5190	9.01
		46	5230	8.63
	5.3G	54	5270	8.58
		62	5310	8.55
	5.6G	102	5510	6.50
		110	5550	6.06
		134	5670	6.08
	5.8G	151	5755	6.67
		159	5795	7.03

Mode		Channel	Frequency (MHz)	Average Power (dBm)
802.11ac (VHT80)	5.2G	42	5210	7.61
	5.3G	58	5290	7.27
	5.6G	106	5530	5.31
		138	5690	5.30
	5.8G	155	5775	5.73

4.3.2 Conducted Power of BT

Mode		Channel	Frequency (MHz)	Average Power (dBm)
LE	GFSK	0	2402	1.71
		19	2440	1.76
		39	2480	1.27

4.4 SAR Test Exclusion Evaluations

4.4.1 Standalone SAR Test Exclusion Considerations

According to KDB 447498 D01, the SAR test exclusion condition is based on source-based time-averaged maximumconducted output power, adjusted for tune-up tolerance, and theminimum test separation distance required for the exposure conditions. The 1-g and 10-g *SAR test exclusion thresholds* are determined by the following:

a) For 100 MHz to 6 GHz and *test separation distances* ≤ 50 mm:

$$\frac{Max.Tune\ up\ Power_{(mW)}}{Min.Test\ Separation\ Distance_{(mm)}} \times \sqrt{f_{(GHz)}} \leq 3.0 \text{ for SAR-1g}, \leq 7.5 \text{ for SAR-10g}$$

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

b) For 100 MHz to 1500 MHz and *test separation distances*> 50 mm:

{[Threshold for 50 mm in step a)]+ [(test separation distance – 50 mm) · ($f_{(MHz)}$/150)]} mW

c) For >1500 MHz and ≤ 6 GHz and *test separation distances*> 50 mm:

{[Threshold for 50 mm in step a)]+ [(test separation distance – 50 mm) ·10]} mW

When the calculated result in step a) is <= 3.0 for SAR-1g exposure condition, or <= 7.5 for SAR-10g exposure condition, the SAR testing exclusion is applied.
When the device output power is less than the calculated result (power threshold, mW) shown in in step b) and c), the SAR testing exclusion is applied.

Mode	Max. Tune-up Power (dBm)	Max. Tune-up Power (mW)	Front Face			Bottom Side		
			Ant. to Surface (mm)	Calculated Result	Require SAR Testing?	Ant. to Surface (mm)	Calculated Result	Require SAR Testing?
BT	2.0	1.58	5	0.5	No	5	0.5	No

4.4.2 Estimated SAR Calculation

According to KDB 447498 D01, when an antenna qualifies for the standalone SAR test exclusion and also transmits simultaneously with other antennas, the standalone SAR value must be estimated according to the following to determine the simultaneous transmission SAR test exclusion criteria:

a) For *test separation distances*≤ 50 mm:

$$Estimated\ SAR = \frac{Max.Tune\ up\ Power_{(mW)}}{Min.Test\ Separation\ Distance_{(mm)}} \times \frac{\sqrt{f(\text{GHz})}}{x}$$

Where x = 7.5 for 1-g SAR and x = 18.75 for 10-g SAR.

b) For *test separation distances*>50 mm, 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR.

Band	Frequency (GHz)	Max.Tune-up Power (dBm)	Test Position	Separation Distance (mm)	Estimated SAR (W/kg)
BT(LE)	2.44	2.0	Body	5	0.066

4.5 SAR Testing Results

4.5.1 SAR Test Reduction Considerations

KDB 447498 D01 General RF Exposure Guidance

Testing of other required channels within the operating mode of a frequency band is not required when the *reported* SAR for the mid-band or highest output power channel is:

a) ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
b) ≤ 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
c) ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

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a) For handsets operating next to ear,hotspot mode or mini-tablet configurations, the initial test position procedures were applied. The testposition with the highest extrapolated peak SAR will be used as the initial test position. When the reported SAR of initial test position is <= 0.4 W/kg, SAR testing for remaining testpositions is not required. Otherwise, SAR is evaluated at the subsequent highest peak SARpositions until the reported SAR result is <= 0.8 W/kg or all test positions are measured.
b) For WLAN 2.4 GHz, the highest measured maximum outputpower channel for DSSS was selected for SARmeasurement. When the reported SAR is <= 0.8 W/kg, no further SAR testing is required. Otherwise, SAR is evaluated at the next highest measured output power channel.When any reported SAR is >1.2 W/kg, SAR is required for the third channel.For OFDM modes (802.11g/n),SAR is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and it is <= 1.2 W/kg.
c) For WLAN 5GHz, the initial test configuration was selectedaccording to the transmission mode with the highest maximum output power. When the reported SAR of initial test configuration is > 0.8 W/kg, SARis required for the subsequent highest measured output power channel until the reported SAR result is <=1.2 W/kg or all required channels are measured. For othertransmission modes,SAR is not required when the highest reported SAR for initial test configuration is adjusted by the ratio of subsequent test configuration to initial test configuration specified maximum output power and it is <= 1.2 W/kg.
d) For WLAN MIMO mode, the power-based standalone SAR test exclusion or the sum of SAR provision in KDB 447498 to determine simultaneous transmission SAR test exclusion should be applied. Otherwise, SAR for MIMO mode will be measured with all applicable antennas transmitting simultaneously at the specified maximum output power of MIMO operation.

4.5.2 SAR Results for Body Exposure Condition

Plot No.	Band	Mode	Test Position	Separation Distance (cm)	Ch.	Maximum Tune-up (dBm)	Conducted Power (dBm)	Power Drift (dB)	Measured SAR-1g (W/kg)	Scaling Factor	Scaled SAR-1g (W/kg)
1	2.4GHz	802.11b	Front Face	0	6	8.00	7.74	0.13	0.086	1.06	0.091
		802.11b	Rear Face	0	6	8.00	7.74	-0.06	0.001	1.06	0.001
		802.11b	Left Side	0	6	8.00	7.74	0.09	0.003	1.06	0.003
		802.11b	Right Side	0	6	8.00	7.74	0.02	0.001	1.06	0.001
		802.11b	Bottom Side	0	6	8.00	7.74	-0.14	0.024	1.06	0.025
		802.11g	Front Face	0	6	9.00	8.32	-0.10	0.108	1.17	**0.126**
		802.11g	Rear Face	0	6	9.00	8.32	0.03	0.001	1.17	0.001
		802.11g	Left Side	0	6	9.00	8.32	0.11	0.004	1.17	0.005
		802.11g	Right Side	0	6	9.00	8.32	0.08	0.002	1.17	0.002
		802.11g	Bottom Side	0	6	9.00	8.32	-0.03	0.030	1.17	0.035
2	UNII-1,	802.11n (HT40)	Front Face	0	38	9.50	9.08	-0.17	0.704	1.10	**0.774**
		802.11n (HT40)	Rear Face	0	38	9.50	9.08	0.00	0.007	1.10	0.008
		802.11n (HT40)	Left Side	0	38	9.50	9.08	0.00	0.001	1.10	0.001
		802.11n (HT40)	Right Side	0	38	9.50	9.08	0.00	0.000	1.10	0.000
		802.11n (HT40)	Bottom Side	0	38	9.50	9.08	-0.01	0.060	1.10	0.066
3	UNII-2C	802.11n (HT40)	Front Face	0	102	7.00	6.51	0.00	0.542	1.12	**0.607**
		802.11n (HT40)	Rear Face	0	102	7.00	6.51	0.00	0.005	1.12	0.006
		802.11n (HT40)	Left Side	0	102	7.00	6.51	0.00	0.013	1.12	0.015
		802.11n (HT40)	Right Side	0	102	7.00	6.51	0.00	0.001	1.12	0.001
		802.11n (HT40)	Bottom Side	0	102	7.00	6.51	-0.03	0.120	1.12	0.134
4	UNII-3	802.11n (HT40)	Front Face	0	159	7.50	7.09	-0.06	0.284	1.10	**0.312**
		802.11n (HT40)	Rear Face	0	159	7.50	7.09	0.00	0.003	1.10	0.003
		802.11n (HT40)	Left Side	0	159	7.50	7.09	0.00	0.001	1.10	0.001
		802.11n (HT40)	Right Side	0	159	7.50	7.09	0.00	0.001	1.10	0.001
		802.11n (HT40)	Bottom Side	0	159	7.50	7.09	-0.03	0.127	1.10	0.140

Note :the max power for UNII-1 is 9.50 dBm and UNII-2A is 9.00 dBm, according to (9.00/9.50)*0.774=0.733, so UNII-2A is not needed.

Appendix A. SAR Plots of System Verification

The plots for system verification with largest deviation for each SAR system combination are shown as follows.

Appendix B. SAR Plots of SAR Measurement

The SAR plots for highest measured SAR in each exposure configuration, wireless mode and frequency band combination, and measured SAR > 1.5 W/kg are shown as follows.

Appendix C. Calibration Certificate for Probe and Dipole

The calibration certificates are shown as follows.

Appendix D. Photographs of EUT and Setup

*** End of Report ***

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