SAR EVALUATION REPORT

FCC 47 CFR § 2.1093
IEEE Std. 1528-2013

For
907X-SPECIAL EDITION

FCC ID: 2AEFA-CFVII1910
Model Name: CFVII-1

Report Number: 4789290187.2-SAR-2
Issue Date: December 16, 2019

Prepared for
Victor Hasselblad Aktiebolag
Utvecklingsgatan 2 SE-417 56 Gothenburg Sweden

Prepared by
UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch
Building 10, Innovation Technology Park, No. 1, Li Bin Road, Song Shan Lake Hi-Tech Development Zone Dongguan, People's Republic of China

Tel: +86 769 22038881
Fax: +86 769 33244054
Website: www.ul.com

The results reported herein have been performed in accordance with the laboratory's terms of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory. The results in this report apply to the test sample(s) mentioned above at the time of the testing period only and are not to be used to indicate applicability to other similar products. This report does not imply that the product(s) has met the criteria for certification.

Revision History

Rev.	Date	Revisions	Revised By
V1.0	December 16, 2019	Initial Issue	\

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

Table of Contents

1. Attestation of Test Results 5

2. Test Specification, Methods and Procedures 6

3. Facilities and Accreditation 7

4. SAR Measurement System & Test Equipment 8

4.1. SAR Measurement System 8

4.2. SAR Scan Procedures 9

4.3. Test Equipment 11

5. Measurement Uncertainty 13

6. Device Under Test (DUT) Information 14

6.1. DUT Description 14

6.2. Wireless Technology 14

7. SAR Test Configuration 15

8. Conducted Output Power Measurement and tune-up tolerance 16

8.1. 2.4G Wi-Fi 16

8.1.1 SISO ANT 0 16

8.1.2 SISO ANT 1 16

8.1.3 MIMO 16

8.2 5GHz Wi-Fi 17

8.2.1 SISO ANT 0 17

8.2.2 SISO ANT 1 17

8.2.3 MIMO 18

8.3 BT 19

9 RF Exposure Conditions 20

10 Dielectric Property Measurements & System Check 22

10.1 Dielectric Property Measurements 22

10.2 System Check 24

11 Measured and Reported (Scaled) SAR Results 26

11.1 SAR Test Results of 2.4G Wi-Fi 28

11.2 SAR Test Results of 5G Wi-Fi 30

12 Simultaneous Transmission SAR Analysis 33

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

Appendixes 34

4789290187.2-SAR-2_App A Photo 34

4789290187.2-SAR-2_App B System Check Plots 34

4789290187.2-SAR-2_App C Highest Test Plots 34

4789290187.2-SAR-2_App D Cal. Certificates 34

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

1. Attestation of Test Results

Applicant Name	Victor Hasselblad Aktiebolag	
Address	Utvecklingsgatan 2 SE-417 56 Gothenburg Sweden	
Manufacturer	Victor Hasselblad Aktiebolag	
Address	Utvecklingsgatan 2 SE-417 56 Gothenburg Sweden	
EUT Name	907X-SPECIAL EDITION	
Model Name	CFVII-1	
Sample Status	Normal	
Brand	/	
Sample Received Date	November 30, 2019	
Date of Tested	November 31 ~ December 12, 2019	
Applicable Standards	FCC 47 CFR § 2.1093 IEEE Std. 1528-2013 Published RF exposure KDB procedures	
SAR Limits (W/Kg)		
Exposure Category	Peak spatial-average(1g of tissue)	Extremities (hands, wrists, ankles, etc.) (10g of tissue)
General population / Uncontrolled exposure	1.6	4
The Highest Reported SAR (W/kg)		
RF Exposure Conditions	**Equipment Class**	
	DTS	**U-NII**
Body (1-g)	0.271	0.311
Test Results	Pass	
Prepared By: Jacky Jiang Engineer Project Associate	Reviewed By: Shawn Wen Laboratory Leader	Approved By: Stephen Guo Laboratory Manager

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

2. Test Specification, Methods and Procedures

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

- 248227 D01 802.11 Wi-Fi SAR
- 447498 D01 General RF Exposure Guidance
- 690783 D01 SAR Listings on Grants
- 865664 D01 SAR measurement 100 MHz to 6 GHz
- 865664 D02 RF Exposure Reporting
- 941225 D07 UMPC Mini Tablet

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

3. Facilities and Accreditation

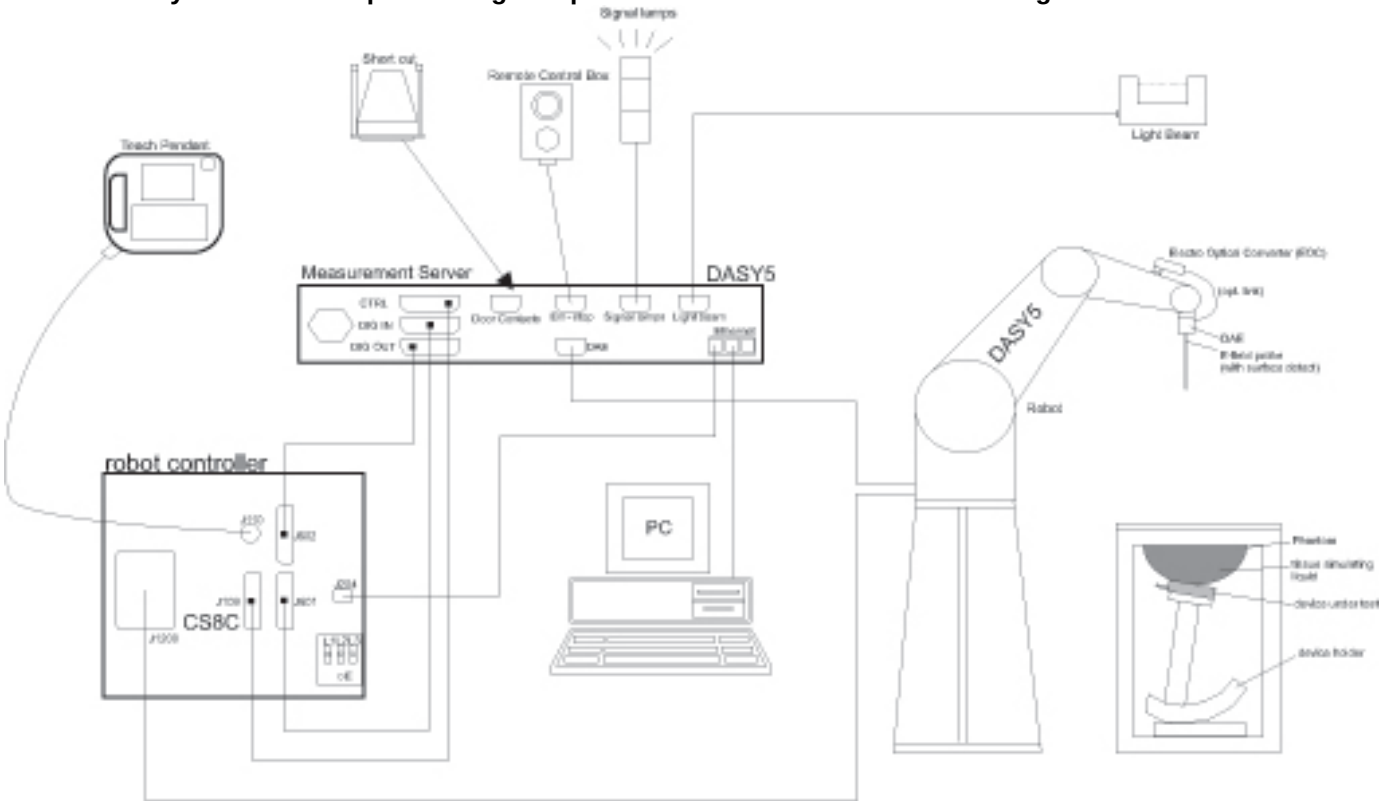
Test Location	UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch.
Address	Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China
Accreditation Certificate	**A2LA (Certificate No.: 4102.01)** UL Verification Services (Guangzhou) Co.,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

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

4. SAR Measurement System & Test Equipment

4.1. SAR Measurement System

The DASY5 system used for performing compliance tests consists of the following items:



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

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

4.2. SAR Scan Procedures

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. The minimum distance of probe sensors to surface is 2.1 mm. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE Standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan). If only one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of Zoom Scans has to be increased accordingly.

Area Scan Parameters extracted from KDB 865664 D01 v01r04 SAR Measurement 100 MHz to 6 GHz

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

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

Step 3: Zoom Scan

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

Zoom Scan Parameters extracted from KDB 865664 D01 v01r04 SAR Measurement 100 MHz to 6 GHz

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.

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

Step 4: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

Step 5: Z-Scan (FCC only)

The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation the extrapolated distance should not be greater than the step size in Z-direction.

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

4.3. Test Equipment

The measuring equipment used to perform the tests documented in this report has been calibrated in accordance with the manufacturers' recommendations, and is traceable to recognized national standards.

	Name of equipment	Manufacturer	Type/Model	Serial No.	Cal. Due Date
☒	ENA Network Analyzer	Keysight	E5080A	MY55100583	December 05, 2020
☒	Dielectric Assessment Kit	SPEAG	SM DAK 040 SA	1155	NCR
☒	DC power supply	Keysight	E36103A	MY55350020	December 04, 2020
☒	Signal Generator	Rohde & Schwarz	SME06	837633\001	December 04, 2020
☒	BI-Directional Coupler	WERLATONE	C8060-102	3423	December 04, 2020
☒	Peak and Average Power Sensor	Keysight	E9323A	MY55440013	December 05, 2020
☒	Peak and Average Power Sensor	Keysight	E9323A	MY55420006	December 05, 2020
☒	Dual Channel PK Power Meter	Keysight	N1912A	MY55416024	December 05, 2020
☒	Amplifier	CORAD TECHNOLOGY LTD	AMF-4D-00400600-50-30P	1983561	NCR
☐	Base Station Simulator	Rohde & Schwarz	CMW500	155523	December 05, 2020
☒	Dosimetric E-Field Probe	SPEAG	EX3DV4	7383	December 19, 2019
☒	Data Acquisition Electronic*(Note 4)	SPEAG	DAE3	427	December 11, 2019
☐	Dipole Kit 750 MHz	SPEAG	D750V3	1153	December 6, 2021
☐	Dipole Kit 835 MHz	SPEAG	D835V2	4d206	December 5, 2021
☐	Dipole Kit 900 MHz	SPEAG	D900V2	1d190	December 5, 2021
☐	Dipole Kit 1800 MHz	SPEAG	D1800V2	2d212	December 6, 2021
☐	Dipole Kit 1900 MHz	SPEAG	D1900V2	5d212	December 7, 2021
☐	Dipole Kit 2300 MHz	SPEAG	D2300V2	1065	December 4, 2021
☒	Dipole Kit 2450 MHz	SPEAG	D2450V2	977	December 4, 2021
☐	Dipole Kit 2600 MHz	SPEAG	D2600V2	1117	December 7, 2021
☒	Dipole Kit 5 GHz	SPEAG	D5GHzV2	1231	December 14, 2021
☐	Software	SPEAG	DASY52	N/A	NCR
☒	Twin Phantom	SPEAG	SAM V5.0	1805	NCR
☒	ELI Phantom	SPEAG	ELI V5.0	1235	NCR
☒	Thermometer	Control Company	4242	150709653	December 05, 2020
☒	Hygrometer	\	GX-138	\	December 05, 2020

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

Note:

1) As per KDB865664D01 requirements for dipole calibration, the test laboratory has adopted three-year extended calibration interval. Each measured dipole is expected to evaluate with the following criteria at least on annual interval in Appendix C.
   a) There is no physical damage on the dipole;
   b) System check with specific dipole is within 10% of calibrated value;
   c) The most recent return-loss result, measured at least annually, deviates by no more than 20% from the previous measurement.
   d) The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within 5Ω from the previous measurement.
2) Dielectric assessment kit is calibrated against air, distilled water and a shorting block performed before measuring liquid parameters.
3) NCR is short for “No Calibration Requirement”.
4) The test date is Dec.07~08, 2019, so Data Acquisition Electronic was within validity period of calibration when tests were performed.

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

5. Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg 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.

Therefore, the measurement uncertainty is not required.

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

6. Device Under Test (DUT) Information

6.1. DUT Description

The DUT is a 907X-SPECIAL EDITION with IEEE 802.11a/b/g/n/ac, and BT radio.	
Device Dimension	Overall (Length x Width x Height): 90.45 mm x 92.51 mm x 68.26 mm
Battery Options	DC 7.27V
Accessory	Charging stand, Type-C USB Cable, lens

6.2. Wireless Technology

Wireless technology	Frequency band	Operating mode	Duty cycle(%)
Wi-Fi	2.4 GHz	802.11 b 802.11 g 802.11 n(20M)	99.1(802.11 b) 95.0(802.11 g) 94.7(802.11 n20)
Wi-Fi	5.8 GHz	802.11 a 802.11 n(20M) 802.11 n(40M) 802.11 ac(20M) 802.11 ac(40M) 802.11 ac(80M)	96.3(802.11 a) 94.4(802.11 n20) 89.9(802.11 n40) 87.7(802.11 ac20) 82.7(802.11 ac40) 69.1(802.11 ac80)
BT	2.4 GHz	BLE	64.9

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

7. SAR Test Configuration

The DUT is a hand held device, it may be very close to the human body and limb when used, so 1-g Body SAR and 10-g extremity SAR evaluation are considered. Per KDB941225 D07, The devices must be tested for 1-g SAR on all surfaces and side edges with a transmitting antenna located at ≤ 25 mm from that surface or edge, at 5 mm separation from a flat phantom, for the data modes, wireless technologies and frequency bands supported by the device to determine SAR compliance. When 1-g SAR is tested at 5 mm, 10-g SAR is not required.

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

8. Conducted Output Power Measurement and tune-up tolerance

8.1. 2.4G Wi-Fi

8.1.1 SISO ANT 0

Mode	Channel	Frequency (MHz)	Data Rate	Average Power (dBm)	The Maximum Tune-up (dBm)	SAR Test	Duty Cycle (%)
802.11b	1	2412	1Mbps	11.80	13.0	Required	99.1
	6	2437		11.67	13.0		
	11	2462		12.02	13.0		
802.11g	1	2412	6Mbps	Not Required	14.0	Excluded	/
	6	2437			14.0		
	11	2462			14.0		
802.11n-HT20	1	2412	MCS0	Not Required	14.0	Excluded	/
	6	2437			14.0		
	11	2462			14.0		

8.1.2 SISO ANT 1

Mode	Channel	Frequency (MHz)	Data Rate	Average Power (dBm)	The Maximum Tune-up (dBm)	SAR Test	Duty Cycle (%)
802.11b	1	2412	1Mbps	11.89	13.0	Required	99.1
	6	2437		12.39	13.0		
	11	2462		12.22	13.0		
802.11g	1	2412	6Mbps	Not Required	14.0	Excluded	/
	6	2437			14.0		
	11	2462			14.0		
802.11n-HT20	1	2412	MCS0	Not Required	14.0	Excluded	/
	6	2437			14.0		
	11	2462			14.0		

8.1.3 MIMO

Mode	Channel	Frequency (MHz)	Data Rate	Average Power (dBm)	The Maximum Tune-up (dBm)	SAR Test	Duty Cycle (%)
802.11b	1	2412	1Mbps	11.89	16.0	Required	99.1
	6	2437		12.39	16.0		
	11	2462		12.22	16.0		
802.11g	1	2412	6Mbps	Not Required	17.0	Excluded	/
	6	2437			17.0		
	11	2462			17.0		
802.11n-HT20	1	2412	MCS0	Not Required	17.0	Excluded	/
	6	2437			17.0		
	11	2462			17.0		

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

Note:
1) SAR is not required for 802.11g/n modes when the adjusted SAR for 802.11b is <1.2 W/kg.
2) For "Not Required", SAR Test reduction was applied from KDB 248227 guidance, Sec.2.1, b), 1) 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. Additional output power measurements were not deemed necessary.

8.2 5.8GHz Wi-Fi

8.2.1 SISO ANT 0

Band	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	The Maximum Tune-up (dBm)	SAR Test	Duty Cycle (%)
U-NII-3	802.11a	149	5745	6Mbps	Not required	15.0	Excluded	/
		153	5765			15.0		
		157	5785			15.0		
		161	5805			15.0		
		165	5825			15.0		
	802.11n-HT20	149	5745	MCS0	Not required	15.0	Excluded	/
		153	5765			15.0		
		157	5785			15.0		
		161	5805			15.0		
		165	5825			15.0		
	802.11n-HT40	151	5755	MCS0	14.42	15.0	Required	89.9
		159	5795		13.82	15.0		
	802.11ac-VHT20	149	5745	MCS0	Not required	14.0	Excluded	/
		153	5765			14.0		
		157	5785			14.0		
		161	5805			14.0		
		165	5825			14.0		
	802.11ac-VHT40	151	5755	MCS0	Not required	14.0	Excluded	/
		159	5795			14.0		
	802.11ac-VHT80	155	5775	MCS0	Not required	13.0	Excluded	/

8.2.2 SISO ANT 1

Band	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	The Maximum Tune-up (dBm)	SAR Test	Duty Cycle (%)
U-NII-3	802.11a	149	5745	6Mbps	15.29	16.0	Required	96.3
		153	5765		14.85	16.0		
		157	5785		14.73	16.0		
		161	5805		14.93	16.0		
		165	5825		15.16	16.0		
	802.11n-HT20	149	5745	MCS0	Not required	16.0	Excluded	/
		153	5765			16.0		

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

		157	5785			16.0		
		161	5805			16.0		
		165	5825			16.0		
	802.11n-HT40	151	5755	MCS0	Not required	15.0	Excluded	/
		159	5795			15.0		
	802.11ac-VHT20	149	5745	MCS0	Not required	15.0	Excluded	/
		153	5765			15.0		
		157	5785			15.0		
		161	5805			15.0		
		165	5825			15.0		
	802.11ac-VHT40	151	5755	MCS0	Not required	13.0	Excluded	/
		159	5795			13.0		
	802.11ac-VHT80	155	5775	MCS0	Not required	14.0	Excluded	/

8.2.3 MIMO

Band	Mode	Channel	Frequency (MHz)	Data Rate	Average power (dBm)	The Maximum Tune-up (dBm)	SAR Test	Duty Cycle (%)
U-NII-3	802.11a	149	5745	6Mbps	Not required	18.0	Excluded	/
		153	5765			18.0		
		157	5785			18.0		
		161	5805			18.0		
		165	5825			18.0		
	802.11n-HT20	149	5745	MCS0	Not required	18.0	Excluded	/
		153	5765			18.0		
		157	5785			18.0		
		161	5805			18.0		
		165	5825			18.0		
	802.11n-HT40	151	5755	MCS0	17.26	18.0	Required	89.9
		159	5795		16.83	18.0		
	802.11ac-VHT20	149	5745	MCS0	Not required	18.0	Excluded	/
		153	5765			18.0		
		157	5785			18.0		
		161	5805			18.0		
		165	5825			18.0		
	802.11ac-VHT40	151	5755	MCS0	Not required	17.0	Excluded	/
		159	5795			17.0		
	802.11ac-VHT80	155	5775	MCS0	Not required	16.0	Excluded	/

Note:
3) SAR is not required for 802.11g/n modes when the adjusted SAR for 802.11b is <1.2 W/kg.
4) For "Not Required", SAR Test reduction was applied from KDB 248227 guidance, Sec.2.1, b), 1) 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. Additional output power measurements were not deemed necessary.

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

8.3 BT

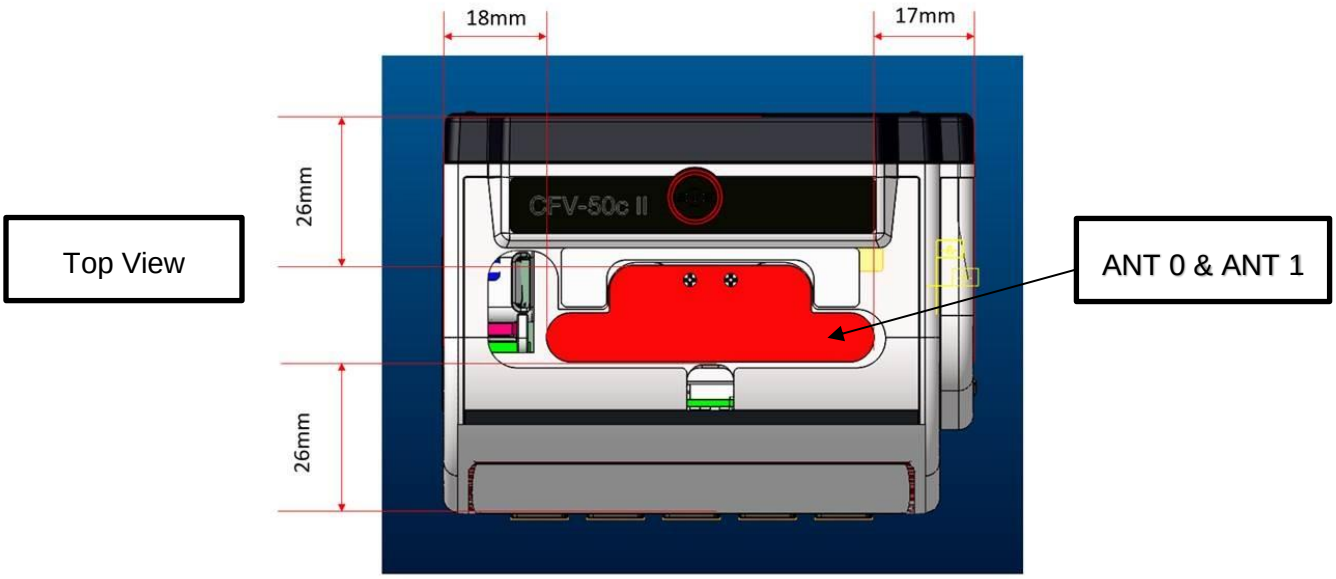
BT	Average Conducted Power (dBm)			The Maximum Tune-up (dBm)
	0CH	19CH	39CH	
BLE	0	0	0	0.0

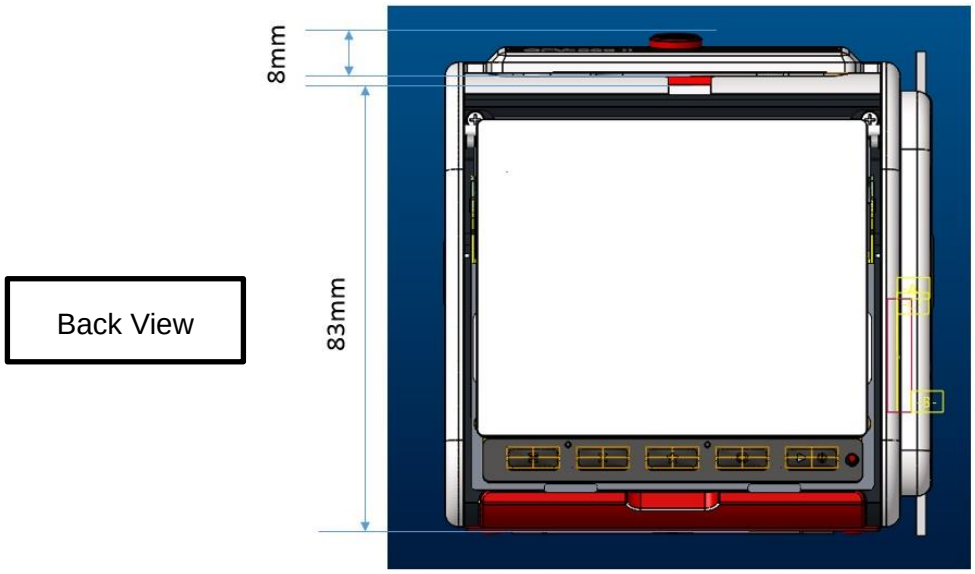
Note:
5) As per KDB 447498 sec.4.1.d) at the maximum rated output power and within the tune-up tolerance range specified for the product, but not more than 2 dB lower than the maximum tune-up tolerance limit.

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

9 RF Exposure Conditions

Refer to the diagram inside the device which attached below for the specific details of the antennas to outer surface distances. The ANT 0 and ANT 1 overlap on the top surface.





Per FCC KDB 941225D07: UMPC mini-tablet devices must be tested for 1-g SAR on all surfaces and side edges with a transmitting antenna located at ≤ 25 mm from that surface or edge.

Position	Separation Distance (mm)	Threshold Distance (mm)	SAR Test
Top surface	5.0	25mm	Required
Bottom surface	83.0		Excluded
Left side for ANT 0&1	17.0		Required
Right side for ANT 0&1	18.0		Required
Front side for ANT 0&1	26.0		Excluded
Back side ANT 0&1	26.0		Excluded

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

Per FCC KDB 447498D01:
1. The 1-g SAR and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for product specific 10-g SAR, where:

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

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

2. The SAR exclusion threshold for distances >50mm is defined by the following equation, as illustrated in KDB 447498 D01 Appendix B:
a) at 100 MHz to 1500 MHz
[Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm)·(f(MHz)/150)] mW
b) at > 1500 MHz and ≤ 6 GHz
[Power allowed at numeric Threshold at 50 mm in step 1) + (test separation distance - 50 mm)·10] mW

Frequency (MHz)	Power (dBm)	Power (mW)	Separation Distance (mm)	Calculated Result	Threshold	SAR Test
2480	0.0	1.0	5.00	0.315	≤ 3.0	Excluded

Note:
1) Because the calculated result is less than the threshold, so SAR evaluation for BT 1-g SAR is not required.

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

10 Dielectric Property Measurements & System Check

10.1 Dielectric Property Measurements

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized.
The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 – 4 days of use; or earlier if the dielectric parameters can become out of tolerance; for example, when the parameters are marginal at the beginning of the measurement series.
Tissue dielectric parameters were measured at the low, middle and high frequency of each operating frequency range of the test device.

Tissue Dielectric Parameters

FCC KDB 865664 D01 v01r04 SAR Measurement 100 MHz to 6 GHz

Target Frequency (MHz)	Head		Body	
	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5000	36.2	4.45	49.3	5.07
5100	36.1	4.55	49.1	5.18
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5400	35.8	4.86	48.7	5.53
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5700	35.4	5.17	48.3	5.88
5800	35.3	5.27	48.2	6.00

IEEE Std 1528-2013
Refer to Table 3 within the IEEE Std 1528-2013

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

Dielectric Property Measurements Results:

Liquid	Freq.	Liquid Parameters				Deviation(%)		Limit (%)	Temp. (℃)	Test Date
		Measured		Target						
		ε_r	σ	ε_r	σ	ε_r	σ			
Head 2450	2360	40.00	1.701	39.36	1.72	1.63	-1.10	±5	23.1	December 8, 2019
	2450	39.90	1.813	39.20	1.80	1.79	0.72			
	2540	39.44	1.918	39.09	1.90	0.90	0.95			
Head 5750	5660	36.18	5.102	35.46	5.13	2.03	-0.55	±5	22.7	December 7, 2019
	5750	35.80	5.277	35.36	5.22	1.24	1.09			
	5840	35.34	5.269	35.27	5.30	0.20	-0.58			

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

10.2 System Check

SAR system verification is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are re-measured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

System Performance Check Measurement Conditions:

- The measurements were performed in the flat section of the TWIN SAM or ELI phantom, shell thickness: 2.0 ±0.2 mm (bottom plate) filled with Body or Head simulating liquid of the following parameters.
- The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm for measurements > 3 GHz.
- The DASY system with an E-Field Probe was used for the measurements.
- The dipole was mounted on the small tripod so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm (above 1GHZ) and 15mm (below 1GHz) from dipole center to the simulating liquid surface.
- For area scan, standard grid spacing for head measurements is 15 mm in x- and y- dimension(≤2GHz), 12 mm in x- and y-dimension(2-4 GHz) and 10mm in x- and y- dimension(4-6GHz).
- For zoom scan, Δx_{zoom}, Δy_{zoom}≤ 2GHz - ≤8mm, 2-4GHz - ≤5 mm and 4-6 GHz-≤4mm; Δz_{zoom} ≤3GHz - ≤5 mm, 3-4 GHz- ≤4mm and 4-6GHz-≤2mm.
- Distance between probe sensors and phantom surface was set to 3 mm except for 5 GHz band. For 5GHz band, Distance between probe sensors and phantom surface was set to 2.5 mm
- The dipole input power (forward power) was set to 100 mW or 250 mW depend on the certificate of the dipoles.
- The results are normalized to 1 W input power.

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

System Check Results

The 1-g and 10-g SAR measured with a reference dipole, using the required tissue-equivalent medium at the test frequency, must be within 10% of the manufacturer calibrated dipole SAR target.

T.S. Liquid		Measured Results		Target (Ref. value)	Delta (%)	Limit (%)	Temp. (℃)	Test Date
		Zoom Scan (W/Kg)	Normalize to 1W (W/Kg)					
Head 2450	1-g	12.87	51.60	53.70	-3.91	±10	22.4	December 8, 2019
	10-g	5.93	23.48	25.00	-6.08			
Head 5750	1-g	8.21	81.30	80.00	1.63	±10	21.3	December 7, 2019
	10-g	2.39	23.00	22.80	0.88			

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

11 Measured and Reported (Scaled) SAR Results

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

SAR Test Reduction criteria are as follows:

KDB 447498 D01 General RF Exposure Guidance:
A）Per KDB447498 D01 v06, all SAR measurement results are scaled to the maximum tune-up tolerance limit to demonstrate SAR compliance.
B）Testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

- ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz.
- ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz.
- ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz.

Per KDB865664 D01 v01r04:

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

Per KDB 248227 D01 v02r02:

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

Initial Test Position Procedure

For exposure condition with multiple test position, such as handsets operating next to the ear, devices with hotspot mode or UMPC mini-tablet, procedures for initial test position can be applied. Using the transmission mode determined by the DSSS procedure or initial test configuration, area scans are measured for all position in an exposure condition. The test position with the highest extrapolated (peak) SAR is used as the initial test position. When reported SAR for the initial test position is ≤ 0.4W/kg, no additional testing for the remaining test position is required. Otherwise, SAR is evaluated at the subsequent highest peak SAR position until the reported SAR result is ≤ 0.8W/kg or all test position are measured. For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions /configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

Initial Test Configuration Procedure

An initial test configuration is determined for OFDM transmission modes according to the channel bandwidth, modulation and data rate combination(s) with the highest maximum output power specified for production units in each standalone and aggregated frequency band. SAR is measured using the highest measured maximum output power channel. For configurations with the same specified or measured maximum output power, additional transmission mode and test channel selection procedures are required (see section 5.3.2 of KDB 248227D01 v02r02). SAR test reduction of subsequent highest output test channels is based on the reported SAR of the initial test configuration.
For next to the ear, hotspot mode and UMC mini-tablet exposure configurations where multiple test positions are required, the initial test position procedure is applied to minimize the number of test positions required for SAR

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

measurement using the initial test configuration transmission mode. For fixed exposure conditions that do not have multiple SAR test positions, SAR is measured in the transmission mode determined by the initial test configuration. When the reported SAR of the initial test configuration is > 0.8 W/kg, SAR measurement is required for the subsequent next highest measured output power channel(s) in the initial test configuration until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

Sub Test Configuration Procedure

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

2.4 GHz SAR Procedures

Separate SAR procedures are applied to DSSS and OFDM configurations in the 2.4 GHz band to simplify DSSS test requirements. For 802.11b DSSS SAR measurements, DSSS SAR procedure applies to fixed exposure test position and initial test position procedure applies to multiple exposure test positions. When SAR measurement is required for an OFDM configuration, the initial test configuration, subsequent test configuration and initial test position procedures are applied. SAR is not required for the following 2.4 GHz OFDM conditions.

a) When KDB Publication 447498 D01 SAR test exclusion applies to the OFDM configuration.

b) 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.

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

11.1 SAR Test Results of 2.4G Wi-Fi

Test Position	Test Mode	Channel/ Frequency	Power (dBm)		Measured SAR Value	Power Drift	Duty Cycle (%)	Scaled (W/Kg)
			Tune-up	Meas.	1-g (W/Kg)			
SISO ANT0 5mm Body SAR								
Top Side	802.11b	11/2462	13.0	12.02	0.169	0.05	99.10	0.214
Left Side	802.11b	11/2462	13.0	12.02	0.003	-0.09	99.10	0.004
Right Side	802.11b	11/2462	13.0	12.02	0.002	-0.13	99.10	0.003
SISO ANT1 5mm Body SAR								
Top Side	802.11b	6/2437	13.0	12.39	0.044	0.06	99.10	0.051
Left Side	802.11b	6/2437	13.0	12.39	0.003	0.11	99.10	0.003
Right Side	802.11b	6/2437	13.0	12.39	0.001	0.12	99.10	0.001
MIMO 5mm Body SAR								
Top Side	802.11b	11/2462	16.0	15.13	0.220	-0.15	99.10	0.271
Left Side	802.11b	11/2462	16.0	15.13	0.004	0.08	99.10	0.005
Right Side	802.11b	11/2462	16.0	15.13	0.002	-0.04	99.10	0.002
Test Results with Lens at worst case								
Top Side	802.11b	11/2462	16.0	15.13	0.217	-0.15	99.10	0.268

OFDM mode SAR evaluation exclusion analysis for 1-g SAR for ANT 0

Mode	Tune-up (dBm)	Tune-up (mW)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR Test
802.11b	13	19.95	0.214	\	\
802.11g	14	25.12	\	0.269	Excluded
802.11n (20M)	14	25.12	\	0.269	Excluded

Note:

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

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

OFDM mode SAR evaluation exclusion analysis for 1-g SAR for ANT 1

Mode	Tune-up (dBm)	Tune-up (mW)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR Test
802.11b	13	19.95	0.051	\	\
802.11g	14	25.12	\	0.064	Excluded
802.11n (20M)	14	25.12	\	0.064	Excluded

Note:

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

OFDM mode SAR evaluation exclusion analysis for 1-g SAR for MIMO

Mode	Tune-up (dBm)	Tune-up (mW)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR Test
802.11b	16	39.81	0.271	\	\
802.11g	17	50.12	\	0.341	Excluded
802.11n (20M)	17	50.12	\	0.341	Excluded

Note:

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

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

11.2 SAR Test Results of 5G Wi-Fi

Test Position	Test Mode	Channel/ Frequency	Power (dBm)		Measured SAR Value	Power Drift	Duty Cycle (%)	Scaled (W/Kg)
			Tune-up	Meas.	1-g (W/Kg)			
SISO ANT0 5mm Body SAR								
Top Side	802.11N HT40	151/5755	15.0	14.42	0.170	0.81	89.90	0.216
Left Side	802.11N HT40	151/5755	15.0	14.42	0.014	0.03	89.90	0.017
Right Side	802.11N HT40	151/5755	15.0	14.42	0.014	-0.13	89.90	0.018
SISO ANT1 5mm Body SAR								
Top Side	802.11a	149/5745	16.0	15.29	0.254	0.12	96.30	0.311
Left Side	802.11a	149/5745	16.0	15.29	0.007	0.03	96.30	0.008
Right Side	802.11a	149/5745	16.0	15.29	0.017	-0.13	96.30	0.021
MIMO 5mm Body SAR								
Top Side	802.11N HT40	151/5755	18.0	17.26	0.213	0.12	89.90	0.281
Left Side	802.11N HT40	151/5755	18.0	17.26	0.014	0.03	89.90	0.018
Right Side	802.11N HT40	151/5755	18.0	17.26	0.015	-0.13	89.90	0.020
Test Results with Lens at worst case								
Top Side	802.11a	149/5745	16.0	15.29	0.239	0.07	96.30	0.292

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

Subsequent test configuration SAR evaluation exclusion analysis for 1-g SAR for ANT 0

Mode	Tune-up (dBm)	Tune-up (mW)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR Test
802.11n 40M	15	31.62	0.216	\	\
802.11a	15	31.62	\	0.216	Excluded
802.11n 20M	15	31.62	\	0.216	Excluded
802.11ac 20M	15	31.62	\	0.216	Excluded
802.11ac 40M	14	25.12	\	0.172	Excluded
802.11ac 80M	14	25.12	\	0.172	Excluded

Note:

1) The 802.11n 40M mode is selected as Initial Test Configuration for SAR test according to the specified maximum output power. As the highest reported SAR for the initial test configuration is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR test for the other 802.11 modes are not required.

Subsequent test configuration SAR evaluation exclusion analysis for 1-g SAR for ANT 1

Mode	Tune-up (dBm)	Tune-up (mW)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR Test
802.11a	16	39.81	0.311	\	\
802.11n 20M	16	39.81	\	0.311	Excluded
802.11n 40M	15	31.62	\	0.247	Excluded
802.11ac 20M	15	31.62	\	0.247	Excluded
802.11ac 40M	14	25.12	\	0.196	Excluded
802.11ac 80M	14	25.12	\	0.196	Excluded

Note:

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

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

Subsequent test configuration SAR evaluation exclusion analysis for 1-g SAR for MIMO

Mode	Tune-up (dBm)	Tune-up (mW)	Highest Reported SAR (W/Kg)	Adjusted SAR (W/Kg)	SAR Test
802.11n 40M	18	63.10	0.281	\	\
802.11a	18	63.10	\	0.281	Excluded
802.11n 20M	18	63.10	\	0.281	Excluded
802.11ac 20M	18	63.10	\	0.281	Excluded
802.11ac 40M	17	50.12	\	0.223	Excluded
802.11ac 80M	16	39.81	\	0.177	Excluded

Note:

1) The 802.11n 40M mode is selected as Initial Test Configuration for SAR test according to the specified maximum output power. As the highest reported SAR for the initial test configuration is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR test for the other 802.11 modes are not required.

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

12 Simultaneous Transmission SAR Analysis

Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneous transmitting antenna.

The ANT 0 supports 2.4GHz and 5GHz Wi-Fi and BT, the ANT 1 supports 2.4GHz, 5GHz Wi-Fi, they can't work at the same time, so simultaneous transmission doesn't exist.

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.

Appendixes

Refer to separated files for the following appendixes.

4789290187.2-SAR-2_App A Photo

4789290187.2-SAR-2_App B System Check Plots

4789290187.2-SAR-2_App C Highest Test Plots

4789290187.2-SAR-2_App D Cal. Certificates

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

This report shall not be reproduced except in full, without the written approval of UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch.