

FCC RF EXPOSURE EVALUATION REPORT

FCC ID:VW3DIW387

Project No. : 1802C215A

Equipment : Android BoxDIW387 UHD

Model : DIW387 UHD TDS

Applicant : SAGEMCOM BROADBAND SAS

Address : 250 Route de l'Empereur, RUEIL MALMAISON CEDEX,
France

Exposure category : General population/uncontrolled environment

EUT Type: : Production Unit (Engineer Sample)

Device Type : Mobile Device

1. Evaluation Method

Systems operating under the provisions of FCC 47 CFR section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.

In accordance with KDB447498D01 for Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0 . The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

2. Limits for General Population/Uncontrolled Exposure

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

3. Refer Evaluation Method

ANSI C95.1–1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

FCC KDB publication 447498 D01 General RF Exposure Guidance v06: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

FCC CFR 47 part1 1.1310: Radiofrequency radiation exposure limits.

FCC CFR 47 part2 2.1093: Radiofrequency radiation exposure evaluation: portable devices

4. Calculation Method

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG / 4\pi R^2$$

Where:

S=power density

P=power input to antenna

G=power gain of the antenna in the direction of interest relative to an isotropic radiator

R=distance to the center of radiation of the antenna

5. Conducted Power Results

5.1 Test Setup



5.2 Test Equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Power Meter	ANRITSU	ML2495A	1128009	Mar.11, 2019
2	Pulse Power Sensor	ANRITSU	MA2411B	1027500	Mar.11, 2019

Remark: all calibration period of equipment list is one year.

5.3 Test Procedure

- The EUT was directly connected to the power meter and antenna output port as show in the block diagram Test Setup.
- Setup EUT work at duty cycle more than 98%;
- Read power sensor values in Peak detector;

5.4 Test Results and Manufacturing Tolerance

Mode	Maximum Peak power declared by Manufacturer
	Antenna 0
GFSK	≤ 3.50
8DPSK	≤ 3.00
GFSK – BT LE	≤ 4.00

Mode	Frequency Band	Maximum Average power declared by Manufacturer			
		Antenna 1	Antenna 2	Antenna 3	Antenna 4
IEEE 802.11a	Band 1	≤ 20.00	≤20.00	≤20.00	≤20.00
	Band 2A	≤ 20.00	≤20.00	≤20.00	≤20.00
	Band 2C	≤ 20.00	≤20.00	≤20.00	≤20.00
	Band 3	≤ 24.00	≤ 24.00	≤ 24.00	≤ 24.00
IEEE 802.11n HT20	Band 1	≤ 14.00	≤ 13.00	≤ 13.50	≤ 13.00
	Band 2A	≤ 13.00	≤ 12.00	≤ 12.50	≤ 12.00
	Band 2C	≤ 12.50	≤ 12.00	≤ 12.50	≤ 12.00
	Band 3	≤ 22.50	≤ 22.50	≤ 23.00	≤ 22.50
IEEE 802.11n HT40	Band 1	≤ 16.50	≤ 16.00	≤ 16.50	≤ 16.50
	Band 2A	≤ 17.00	≤ 16.00	≤17.00	≤ 16.50
	Band 2C	≤ 16.50	≤ 16.00	≤ 16.50	≤ 16.50
	Band 3	≤22.00	≤ 22.50	≤ 22.50	≤ 22.00
IEEE 802.11ac VHT20	Band 1	≤ 14.00	≤13.00	≤ 13.50	≤ 13.00
	Band 2A	≤13.00	≤ 12.00	≤ 13.00	≤ 12.50
	Band 2C	≤ 13.00	≤12.00	≤ 12.50	≤ 12.50
	Band 3	≤ 22.50	≤ 22.50	≤ 22.50	≤ 22.00
IEEE 802.11ac VHT40	Band 1	≤ 16.50	≤ 15.50	≤ 16.50	≤ 15.50
	Band 2A	≤17.00	≤ 16.00	≤ 16.50	≤16.00
	Band 2C	≤16.00	≤ 16.50	≤ 16.50	≤ 16.00
	Band 3	≤ 22.00	≤ 22.50	≤ 22.50	≤ 22.00
IEEE 802.11ac VHT80	Band 1	≤ 16.50	≤ 16.00	≤ 16.50	≤ 16.00
	Band 2A	≤ 16.50	≤ 16.00	≤ 17.00	≤16.50
	Band 2C	≤ 16.50	≤ 15.50	≤ 16.50	≤ 16.00
	Band 3	≤ 22.50	≤ 22.50	≤ 22.50	≤ 22.00

6. Antenna Information

BT/LE

Antenna	Manufacturer	Model Name	Antenna Type	Connector	Maximum Peak Gain (dBi)
Antenna 0	N/A	N/A	PCB	N/A	3.59

5G

Antenna	Manufacturer	Model Name	Antenna Type	Connector	Maximum Peak Gain (dBi)
Antenna 1	N/A	N/A	PIFA	N/A	6.54
Antenna 2	N/A	N/A	PIFA	N/A	3.54
Antenna 3	N/A	N/A	PIFA	N/A	5.31
Antenna 4	N/A	N/A	PIFA	N/A	3.37

7. Evaluation Results

7.1 Standalone

Antenna 0

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (W/m ²)	MPE Limits (W/m ²)
	(dBm)	(W)					
GFSK	3.50	0.0022	3.59	2.2856	100%	0.0010	1.0000
8DPSK	3.00	0.0020	3.59	2.2856	100%	0.0009	1.0000
GFSK – BT LE	4.00	0.0025	3.59	2.2856	100%	0.0011	1.0000

Antenna 1

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (W/m ²)	MPE Limits (W/m ²)
	(dBm)	(W)					
IEEE 802.11a	24.00	0.2512	6.54	4.5082	100%	0.2254	1.0000
IEEE 802.11n HT20	22.50	0.1778	6.54	4.5082	100%	0.1600	1.0000
IEEE 802.11n HT40	22.00	0.1585	6.54	4.5082	100%	0.1422	1.0000
IEEE 802.11ac VHT20	22.50	0.1778	6.54	4.5082	100%	0.1600	1.0000
IEEE 802.11ac VHT40	22.00	0.1585	6.54	4.5082	100%	0.1422	1.0000
IEEE 802.11ac VHT80	22.50	0.1778	6.54	4.5082	100%	0.1600	1.0000

Antenna 2

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (W/m ²)	MPE Limits (W/m ²)
	(dBm)	(W)					
IEEE 802.11a	24.00	0.2512	3.54	2.2594	100%	0.1130	1.0000
IEEE 802.11n HT20	22.50	0.1778	3.54	2.2594	100%	0.0800	1.0000
IEEE 802.11n HT40	22.50	0.1778	3.54	2.2594	100%	0.0800	1.0000
IEEE 802.11ac VHT20	22.50	0.1778	3.54	2.2594	100%	0.0800	1.0000
IEEE 802.11ac VHT40	22.50	0.1778	3.54	2.2594	100%	0.0800	1.0000
IEEE 802.11ac VHT80	22.50	0.1778	3.54	2.2594	100%	0.0800	1.0000

Antenna 3

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (W/m ²)	MPE Limits (W/m ²)
	(dBm)	(W)					
IEEE 802.11a	24.00	0.0251	5.31	3.3963	100%	0.1698	1.0000
IEEE 802.11n HT20	23.00	0.0056	5.31	3.3963	100%	0.1349	1.0000
IEEE 802.11n HT40	22.50	0.0079	5.31	3.3963	100%	0.1202	1.0000
IEEE 802.11ac VHT20	22.50	0.0079	5.31	3.3963	100%	0.1202	1.0000
IEEE 802.11ac VHT40	22.50	0.0079	5.31	3.3963	100%	0.1119	1.0000
IEEE 802.11ac VHT80	22.50	0.0079	5.31	3.3963	100%	0.1119	1.0000

Antenna 4

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (W/m ²)	MPE Limits (W/m ²)
	(dBm)	(W)					
IEEE 802.11a	24.00	0.2512	3.37	2.1727	100%	0.1086	1.0000
IEEE 802.11n HT20	22.50	0.1779	3.37	2.1727	100%	0.0769	1.0000
IEEE 802.11n HT40	22.00	0.1585	3.37	2.1727	100%	0.0685	1.0000
IEEE 802.11ac VHT20	22.00	0.1585	3.37	2.1727	100%	0.0685	1.0000
IEEE 802.11ac VHT40	22.00	0.1585	3.37	2.1727	100%	0.0685	1.0000
IEEE 802.11ac VHT80	22.00	0.1585	3.37	2.1727	100%	0.0685	1.0000

Remark:

1. Maximum power including tune-up tolerance;
2. EIRP including tune-up tolerance;
3. MPE use distance is 20cm from manufacturer declaration of user manual.

7.2

Simultaneous Transmission for SAR Exclusion

The sample support one WLAN modular and one BT modular, WLAN and BT share difference antenna, need consider simultaneous transmission;

Antenna 1, Antenna 2, Antenna 3 and Antenna 4 for 5G WLAN

Band	Mode	MPE Ratio	MPE Ratio	MPE Ratio	MPE Ratio	Σ MPE ratios	Limit	Results
		Antenna 1	Antenna 2	Antenna 3	Antenna 4			
5G	IEEE 802.11a	0.2254	0.1130	0.1698	0.1086	N/A	1.0	PASS
	IEEE 802.11n HT20	0.1600	0.0800	0.1349	0.0769	< 0.5	1.0	PASS
	IEEE 802.11n HT40	0.1422	0.0800	0.1202	0.0685	< 0.4	1.0	PASS
	IEEE 802.11ac VHT20	0.1600	0.0800	0.1202	0.0685	< 0.4	1.0	PASS
	IEEE 802.11ac VHT40	0.1422	0.0800	0.1119	0.0685	< 0.4	1.0	PASS
	IEEE 802.11ac VHT80	0.1600	0.0800	0.1119	0.0685	< 0.4	1.0	PASS

Maximum MPE Ratios for BT and WLAN simultaneous transmission

Maximum MPE Ratio _{BT}	Maximum MPE Ratio _{WLAN}	Σ MPE ratios	Limit	Results
< 0.1	< 0.5	< 0.6	1.0	PASS

Remark:

1. Maximum power including tune-up tolerance;
2. EIRP including tune-up tolerance;
3. MPE use distance is 20cm from manufacturer declaration of user manual.

8. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1093 for the uncontrolled RF Exposure and SAR Exclusion Threshold per KDB 447498 v06.