

TEST REPORT

Verified Code: 285288

Report No.:	E20201010106801-7	Application No.:	E20201010106801
Client:	Shen Zhen MTC Co., LTD		
Address:	MTC Industry Park, 1st Lilang Road, Xialilang community, Nanwan street, Longgang district, Shenzhen, China		
Sample Description:	Google Android TV BOX		
Model:	UI-7060A		
Test Specification:	FCC 47 CFR Part 2.1091		
Receipt Date:	2020-10-16		
Test Date:	2020-10-19 to 2020-11-16		
Issue Date:	2020-12-08		
Test Result:	Pass		
Prepared By: Test Engineer <i>Xie Jiang</i>	Reviewed By: Technical Manager <i>Wu Haoming</i>	Approved By: Manager <i>Wu Haoming</i> 	
Other Aspects:			
Note: Note			
Abbreviations: ok / P = passed; fail / F = failed; n.a. / N = not applicable;			
The test result in this test report refers exclusively to the presented test sample. This report shall not be reproduced except in full, without the written approval of GRGT.			



DIRECTIONS OF TEST

- 1. This station carries out test task according to the national regulation of verifications which can be traced to National Primary Standards and BIPM.**
- 2. The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test result without the written permission of the test laboratory.**
- 3. If there is any objection concerning the test, the client should inform the laboratory within 15 days from the date of receiving the test report.**

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1. EVALUATION METHOD

Exposure category: General population/uncontrolled environment

EUT Type: Production Unit

Device Type: Mobile Device

Refer Standard: KDB 447498 D01 General RF Exposure Guidance v06

FCC Part 2 §2.1091

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. 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 anisotropic radiator

R=distance to the center of radiation of the antenna

From the EUT RF output power, the minimum mobile separation distance, $d=0.2m$, as well as the maximum gain of the used as following information, the RF power density can be obtained.

Frequency Band	Antenna type	Internal Identification	Maximum antenna gain
2.4GHz	Internal antenna	Antenna 1	2.64dBi
		Antenna 2	1.95dBi
5GHz	Internal antenna	Antenna 1	5.57dBi
		Antenna 2	5.65dBi

4. ESTIMATION RESULT

4.1 CONDUCTED POWER RESULTS

2.4GHz

Mode	Channel	Frequency(MHz)	Conducted Output Power (dBm)
DH5	00	2402	5.42
	39	2441	4.78
	78	2480	3.05
2DH5	00	2402	6.62
	39	2441	6.07
	78	2480	4.36
3DH5	00	2402	7.01
	39	2441	6.42
	78	2480	4.74
BLE/DH5	00	2402	0.42
	39	2441	-0.24
	78	2480	-2.08

Antenna	Mode	Frequency(MHz)	Peak Conducted Output Power (dBm)
Antenna 1	IEEE 802.11b	2412	14.42
		2437	13.95
		2462	13.42
	IEEE 802.11g	2412	15.12
		2437	15.26
		2462	14.37
	IEEE 802.11n HT20	2412	14.97
		2437	14.27
		2462	14.10
	IEEE 802.11n HT40	2422	15.26
		2437	14.81
		2452	14.66

Antenna	Mode	Frequency(MHz)	Peak Conducted Output Power (dBm)
Antenna 2	IEEE 802.11b	2412	13.27
		2437	13.15
		2462	13.07
	IEEE 802.11g	2412	14.69
		2437	14.42
		2462	15.72
	IEEE 802.11n HT20	2412	14.20
		2437	14.15
		2462	14.11
	IEEE 802.11n HT40	2422	13.87
		2437	14.31
		2452	14.59

5GHz WIFI

Test Mode	Band	Frequency (MHz)	AVG Conducted Output Power (dBm)	
			antenna 1	antenna 2
802.11a	U-NII-1	5180	14.12	13.75
		5200	13.85	13.72
		5240	13.25	13.65
	U-NII-2A	5260	14.04	13.55
		5300	13.65	13.37
		5320	13.83	13.65
	U-NII-2C	5500	13.62	14.21
		5580	13.65	13.68
		5700	14.02	13.47
	U-NII-3	5745	13.48	13.26
		5785	13.72	13.44
		5825	13.87	13.58
802.11n HT20	U-NII-1	5180	11.89	11.99
		5200	11.87	12.23
		5240	12.17	11.75
	U-NII-2A	5260	11.89	12.19
		5300	11.91	11.88
		5320	11.97	11.69
	U-NII-2C	5500	12.57	11.99
		5580	12.29	11.65
		5700	12.62	11.97
	U-NII-3	5745	12.84	12.41
		5785	12.94	12.54
		5825	12.71	12.68
IEEE 802.11ac VHT20	U-NII-1	5180	11.84	11.95
		5200	11.69	12.18
		5240	11.71	11.70
	U-NII-2A	5260	11.83	11.89

		5300	11.85	11.87
		5320	11.93	11.60
	U-NII-2C	5500	12.29	11.95
		5580	12.06	11.61
		5700	12.19	11.96
	U-NII-3	5745	12.78	12.38
		5785	12.63	12.45
		5825	12.68	12.51
802.11n HT40	U-NII-1	5190	12.23	11.45
		5230	11.27	12.74
	U-NII-2A	5270	12.43	12.09
		5310	9.79	8.71
	U-NII-2C	5510	10.13	9.03
		5550	10.95	9.45
		5670	13.07	12.47
	U-NII-3	5755	12.66	12.71
		5795	12.27	12.78

802.11ac VHT40	U-NII-1	5190	12.09	11.33
		5230	11.06	12.37
	U-NII-2A	5270	12.09	11.83
		5310	9.65	8.54
	U-NII-2C	5510	9.71	8.48
		5550	10.43	9.13
		5670	12.17	12.29
	U-NII-3	5755	12.24	12.44
		5795	12.06	12.53
802.11ac VHT80	U-NII-1	5210	8.22	8.46
	U-NII-2A	5290	7.13	7.59
	U-NII-2C	5530	9.55	10.33
		5610	10.11	9.78
	U-NII-3	5775	12.64	12.55

4.2 MANUFACTURING TOLERANCE**2.4GHz**

Frequency (MHz)	DH5	2DH5	3DH5	BLE/DH5
	2402	2402	2402	2402
Target (dBm)	5.0	6.0	7.0	0.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0	1.0

Frequency (MHz)	Antenna 1			
	IEEE 802.11b	IEEE 802.11g	IEEE 802.11n HT20	IEEE 802.11n HT40
	2412	2437	2412	2412
Target (dBm)	14.0	15.0	14.00	15.00
Tolerance $\pm$ (dB)	1.0	1.0	1.0	1.0

Frequency (MHz)	Antenna 2			
	IEEE 802.11b	IEEE 802.11g	IEEE 802.11n HT20	IEEE 802.11n HT40
	2412	2462	2412	2452
Target (dBm)	13.0	15.0	14.0	14.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0	1.0

Frequency (MHz)	Antenna 1			
	802.11a	802.11n HT20	802.11ac VHT20	802.11n HT40
	5260	5700	5745	5670
Target (dBm)	14.0	12.0	12.0	13.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0	1.0

Frequency (MHz)	Antenna 2			
	802.11a	802.11n HT20	802.11ac VHT20	802.11n HT40
	5500	5200	5825	5795
Target (dBm)	14.0	12.0	12.0	12.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0	1.0

Frequency (MHz)	Antenna 1		Antenna 2	
	802.11ac VHT40	802.11ac VHT80	802.11ac VHT40	802.11ac VHT80
	5755	5775	5795	5795
Target (dBm)	12.0	12.0	12.0	12.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0	1.0

4.3 MEASUREMENT RESULTS

4.3.1 STANDALONE MPE

2.4G

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	(dBm)	(mW)					
DH5	6.0	3.9811	2.64	1.8365	100%	0.0015	1.0000
2DH5	7.0	5.0119	2.64	1.8365	100%	0.0018	1.0000
3DH5	8.0	6.3096	2.64	1.8365	100%	0.0023	1.0000
BLE/DH5	1.0	1.2589	2.64	1.8365	100%	0.0005	1.0000

Antenna 1

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	(dBm)	(mW)					
IEEE 802.11 b	15.0	31.6228	2.64	1.8365	100%	0.0116	1.0000
IEEE 802.11 g	16.0	39.8107	2.64	1.8365	100%	0.0146	1.0000
IEEE 802.11 n HT20	15.0	31.6228	2.64	1.8365	100%	0.0116	1.0000
IEEE 802.11 n HT40	16.0	39.8107	2.64	1.8365	100%	0.0146	1.0000

Antenna 2

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	(dBm)	(mW)					
IEEE 802.11 b	14.0	25.1189	1.95	1.5668	100%	0.0078	1.0000
IEEE 802.11 g	16.0	39.8107	1.95	1.5668	100%	0.0124	1.0000
IEEE 802.11 n HT20	15.0	31.6228	1.95	1.5668	100%	0.0099	1.0000
IEEE 802.11 n HT40	15.0	31.6228	1.95	1.5668	100%	0.0099	1.0000

5GWLAN

Antenna 1

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	(dBm)	(mW)					
IEEE 802.11 a	15.0	31.6228	5.57	3.6058	100%	0.0227	1.0000
IEEE 802.11 n HT20	13.0	19.9526	5.57	3.6058	100%	0.0143	1.0000
IEEE 802.11 n HT40	13.0	19.9526	5.57	3.6058	100%	0.0143	1.0000
IEEE 802.11ac VHT20	13.0	19.9526	5.57	3.6058	100%	0.0143	1.0000
IEEE 802.11ac VHT40	13.0	19.9526	5.57	3.6058	100%	0.0143	1.0000
IEEE 802.11 ac VHT80	13.0	19.9526	5.57	3.6058	100%	0.0143	1.0000

Antenna 2

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	(dBm)	(mW)					
IEEE 802.11 a	15.0	31.6228	5.65	3.6728	100%	0.0231	1.0000
IEEE 802.11 n HT20	13.0	19.9526	5.65	3.6728	100%	0.0146	1.0000
IEEE 802.11 n HT40	14.0	25.1189	5.65	3.6728	100%	0.0184	1.0000
IEEE 802.11ac VHT20	13.0	19.9526	5.65	3.6728	100%	0.0146	1.0000
IEEE 802.11ac VHT40	13.0	19.9526	5.65	3.6728	100%	0.0146	1.0000
IEEE 802.11 ac VHT80	13.0	19.9526	5.65	3.6728	100%	0.0146	1.0000

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

According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;

$\sum$ of MPE ratios ≤ 1.0

The sample support 2T2R MIMO antennas, 2.4GHz and 5GHz share same antenna.

Antenna 1 and Antenna 2 for 2.4G WLAN and 5G WLAN

Band	Mode	MPE Ratio Antenna 1	MPE Ratio Antenna 2	$\sum$ MPE ratios	Limit	Results
2.4G	DH5	0.0015	/	/	1.000	Pass
	2DH5	0.0018	/	/	1.000	Pass
	3DH5	0.0023	/	/	1.000	Pass
	BLE/DH5	0.0005	/	/	1.000	Pass
	IEEE 802.11b	0.0116	0.0078	/	1.000	Pass
	IEEE 802.11g	0.0146	0.0124	/	1.000	Pass
	IEEE 802.11n HT20	0.0116	0.0099	0.0215	1.000	Pass
	IEEE 802.11n HT40	0.0146	0.0099	0.0245	1.000	Pass

Band	Mode	MPE Ratio Antenna 1	MPE Ratio Antenna 2	$\sum$ MPE ratios	Limit	Results
5G	IEEE 802.11a	0.0227	0.0231	/	1.000	Pass
	IEEE 802.11n HT20	0.0143	0.0143	0.0327	1.000	Pass
	IEEE 802.11n HT40	0.0143	0.0184	0.0327	1.000	Pass
	IEEE 802.11ac VHT20	0.0143	0.0143	0.0289	1.000	Pass
	IEEE 802.11ac VHT40	0.0143	0.0146	0.0289	1.000	Pass
	IEEE 802.11ac 80	0.0143	0.0146	0.0289	1.000	Pass

Remark:

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

We first evaluate WLAN simultaneous transmission and later evaluate BT and WLAN simultaneous transmission;

Maximum Simultaneous transmission MPE Ratio for WLAN and BT

Maximum MPE ratio 2.4G	Maximum MPE ratio 5G	Σ MPE ratios	Limit	Results
0.0245	0.0327	0.0572	1.000	Pass

Note: The estimation distance is 20cm

5. CONCLUSION

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

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