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Report Template Version: V04  
Report Template Revision Date: 2018-07-06

# RF Exposure Evaluation Report

**Report No. :** CQASZ20210400543E-03  
**Applicant:** UNIONMAN TECHNOLOGY CO., LTD  
**Address of Applicant:** No.5 Huitai Road, Huinan High-Tech Industrial Park, Huizhou City, Guangdong, China.  
**Equipment Under Test (EUT):**  
**Product:** WiFi6 CPE  
**Model No.:** UNR032H, UNR033H  
**Test Model No.:** UNR033H  
**Brand Name:** N/A  
**FCC ID:** 2ATGV-UNR032H  
**Standards:** 47 CFR Part 1.1307  
47 CFR Part 1.1310  
KDB447498D01 General RF Exposure Guidance v06  
**Date of Receipt:** 2021-04-25  
**Date of Test:** 2021-04-25 to 2021-5-24  
**Date of Issue:** 2021-5-24  
**Test Result :** **PASS\***

**\*In the configuration tested, the EUT complied with the standards specified above**

**Tested By:** Lewis Zhou

**(Lewis Zhou)**

**Reviewed By:** Juh Li

**(Sheek Luo)**

**Approved By:** Sheek, Luo

**(Sheek Luo)**



## 1 Version

### Revision History Of Report

Report No.	Version	Description	Issue Date
CQASZ20210400543E-03	Rev.01	Initial report	2021-5-24

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### 3 General Information

#### 3.1 Client Information

Applicant:	UNIONMAN TECHNOLOGY CO., LTD
Address of Applicant:	No.5 Huitai Road, Huinan High-Tech Industrial Park, Huizhou City, Guangdong, China.
Manufacturer:	UNIONMAN TECHNOLOGY CO., LTD
Address of Manufacturer:	No.5 Huitai Road, Huinan High-Tech Industrial Park, Huizhou City, Guangdong, China.
Factory:	UNIONMAN TECHNOLOGY CO., LTD
Address of Factory:	No.5 Huitai Road, Huinan High-Tech Industrial Park, Huizhou City, Guangdong, China.

#### 3.2 General Description of EUT

Product Name:	WiFi6 CPE
Model No.:	UNR032H, UNR033H
Test Model No.:	UNR033H
Trade Mark:	N/A
Hardware Version:	WiFi6 CPE
Software Version:	UNR032H, UNR033H
Sample Type:	<input type="checkbox"/> Mobile <input type="checkbox"/> Portable <input checked="" type="checkbox"/> Fix Location
Power Supply:	Adapter: MODEL: EUTA-24120-2000 INPUT: 100-240V~50/60Hz 0.6A OUTPUT: 12V 2A

#### 3.3 General Description of 2.4G WIFI

Operation Frequency:	IEEE 802.11b/g/n(HT20): 2412MHz to 2462MHz IEEE 802.11n(HT40): 2422MHz to 2452MHz
Channel Numbers:	IEEE 802.11b/g, IEEE 802.11n HT20: 11 Channels IEEE 802.11n HT40: 7 Channels
Channel Separation:	5MHz
Type of Modulation:	IEEE for 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE for 802.11g : OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE for 802.11n(HT20/40): OFDM (64QAM, 16QAM,QPSK,BPSK)
Test Software of EUT:	RF Test (manufacturer declare)
Antenna Type:	internal antenna with ipex connector
Antenna Gain:	ANT1:2dBi
	ANT2:2dBi
	ANT1+2: 5.01dBi

### 3.4 General Description of 5G WIFI

Operation Frequency:	IEEE 802.11a/n/ac(20M): 5150MHz ~5250 MHz IEEE802.11n/ac(40M): 5150MHz ~5250 MHz IEEE802.11ac(80M): 5150MHz ~5250 MHz IEEE 802.11a/n/ac(20M): 5725MHz ~5850 MHz IEEE802.11n/ac(40M): 5725MHz ~5850 MHz IEEE802.11ac(80M): 5725MHz ~5850 MHz IEEE802.11ax(80M): 5150MHz ~5250MHz
Channel Numbers:	IEEE 802.11a/n/ac(20M): 5150MHz ~5250MHz/ 4 channel IEEE 802.11n/ac(40M): 5150MHz ~5250MHz/ 2 channel IEEE 802.11ac(80M): 5150MHz ~5250MHz/ 1 channel IEEE 802.11a/n/ac(20M): 5725MHz ~5850MHz/ 5 channel IEEE 802.11n/ac(40M): 5725MHz ~5850MHz/ 2 channel IEEE 802.11ac(80M): 5725MHz ~5850MHz/ 1 channel IEEE802.11ax(80M): 5150MHz ~5250MHz/ 1 channel
Channel Separation:	IEEE 802.11a/n-HT20/ac-VHT20: 20 MHz IEEE 802.11n-HT40/ac-VHT40: 40 MHz IEEE 802.11ac-VHT80/: 80 MHz IEEE802.11ax(80M): 80 MHz
Type of Modulation:	IEEE 802.11a: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11ac: OFDM(256QAM, 64QAM, 16QAM, QPSK, BPSK) IEEE802.11ax: OFDM(1024QAM, 256QAM, 64QAM, 16QAM, QPSK, BPSK)
Test Software of EUT:	RF Test (manufacturer declare)
Antenna Type:	internal antenna with ipex connector
Antenna Gain:	ANT1:2dBi
	ANT2:3dBi
	ANT1+2: 6.01dBi

Note:

Model No.: UNR032H, UNR033H

Only the model UNR033H was tested, since the electrical circuit design, layout, components used and internal wiring were identical for the above models, with difference being color of appearance and model name.

## 4 RF Exposure Evaluation

### 4.1 MPE Exposure Compliance Requirement

#### 4.1.1 Limits

According to FCC Part1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in part1.1307(b)

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
<b>(A) Limits for Occupational/Controlled Exposures</b>				
0.3–3.0 .....	614	1.63	*(100)	6
3.0–30 .....	1842/f	4.89/f	*(900/f <sup>2</sup> )	6
30–300 .....	61.4	0.163	1.0	6
300–1500 .....	.....	.....	f/300	6
1500–100,000 .....	.....	.....	5	6
<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
0.3–1.34 .....	614	1.63	*(100)	30
1.34–30 .....	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30–300 .....	27.5	0.073	0.2	30
300–1500 .....	.....	.....	f/1500	30
1500–100,000 .....	.....	.....	1.0	30

F= Frequency in MHz

Friis Formula

Friis transmission formula:  $P_d = (P_{out} * G) / (4 * \pi * R^2)$

Where

$P_d$  = power density in mW/cm<sup>2</sup>

$P_{out}$  = output power to antenna in mW

G = gain of antenna in linear scale

$\pi$  = 3.1416

R = distance between observation point and center of the radiator in cm

$P_d$  is the limit of MPE, 1 mW/cm<sup>2</sup>. If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

#### 4.1.2 Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

#### 4.1.3 EUT RF Exposure Evaluation standalone operations

##### 1) For 2.4G WIFI

Antenna Gain: ANT1: 2.0dBi , ANT2: 2.0dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.58 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

##### Measurement Data

802.11b mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
Lowest(2412MHz)	Ant1	12.80	12.0±1.0	13	19.953
Lowest(2412MHz)	Ant2	12.72	12.0±1.0	13	19.953
Middle(2437MHz)	Ant1	12.42	11.5±1.0	12.5	17.783
Middle(2437MHz)	Ant2	12.85	12.0±1.0	13	19.953
Highest(2462MHz)	Ant1	12.50	11.5±1.0	12.5	17.783
Highest(2462MHz)	Ant2	12.16	11.0±1.0	12	15.849
802.11g mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
Lowest(2412MHz)	Ant1	10.23	9±1.0	10	10.000
Lowest(2412MHz)	Ant2	9.80	9±1.0	10	10.000
Middle(2437MHz)	Ant1	10.51	9.5±1.0	10.5	11.220
Middle(2437MHz)	Ant2	9.10	8±1.0	9	7.943
Highest(2462MHz)	Ant1	10.14	9±1.0	10	10.000
Highest(2462MHz)	Ant2	9.40	8.5±1.0	9.5	8.913
802.11n(HT20) MIMO mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
Lowest(2412MHz)	Ant1+2	13.05	12±1.0	13	19.953
Middle(2437MHz)	Ant1+2	12.96	12±1.0	13	19.953
Highest(2462MHz)	Ant1+2	12.65	12±1.0	13	19.953
802.11n(HT40) MIMO mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
Lowest(2422MHz)	Ant1+2	10.94	10±1.0	11	12.589
Middle(2437MHz)	Ant1+2	10.14	9±1.0	10	10
Highest(2452MHz)	Ant1+2	10.24	9±1.0	10	10

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm <sup>2</sup> )	Limit	Result
19.953	2	0.0063	1.0	PASS

Note: 1) Refer to report No. CQASZ20210400543E-01 for EUT test Max Conducted average Output Power value.

2)  $P_d = (P_{out} * G) / (4 * \pi * R^2) = (19.953 * 1.58) / (4 * 3.1416 * 20^2) = 0.0063$



**2) For 5G WIFI**

Antenna Gain: ANT1: 2.0dBi , ANT2: 3.0dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.58 and 2 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

**Measurement Data**

802.11a mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
5180	Ant1	14.41	13.5±1.0	14.5	28.184
5180	Ant2	14.41	13.5±1.0	14.5	28.184
5200	Ant1	13.9	13±1.0	14	25.119
5200	Ant2	13.91	13±1.0	14	25.119
5240	Ant1	13.51	12.5±1.0	13.5	22.387
5240	Ant2	13.74	13±1.0	14	25.119
5745	Ant1	16.07	15±1.0	16	39.811
5745	Ant2	13.83	13±1.0	14	25.119
5785	Ant1	15.57	14.5±1.0	15.5	35.481
5785	Ant2	12.81	12±1.0	13	19.953
5825	Ant1	15.21	14±1.0	15	31.623
5825	Ant2	12.56	11.5±1.0	12.5	17.783
802.11n(HT20) SISO mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
5180	Ant1	5.48	4.5±1.0	5.5	3.548
5180	Ant2	14.05	13±1.0	14	25.119
5200	Ant1	6.32	5.5±1.0	6.5	4.467
5200	Ant2	13.86	13±1.0	14	25.119
5240	Ant1	10.13	9±1.0	10	10
5240	Ant2	13.83	13±1.0	14	25.119
5745	Ant1	11.02	10±1.0	11	12.589
5745	Ant2	14.25	13±1.0	14	25.119
5785	Ant1	10.63	10±1.0	11	12.589
5785	Ant2	13.09	12±1.0	13	19.953
5825	Ant1	10.49	9.5±1.0	10.5	11.220
5825	Ant2	13.18	12±1.0	13	19.953

802.11ac(VHT20) SISO mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
5180	Ant1	2.71	2±1.0	3	1.995
5180	Ant2	13.11	12±1.0	13	19.953
5200	Ant1	2.23	1±1.0	2	1.585
5200	Ant2	13.1	12±1.0	13	19.953
5240	Ant1	2.81	2±1.0	3	1.995
5240	Ant2	12.9	12±1.0	13	19.953
5745	Ant1	5.57	5±1.0	6	3.981
5745	Ant2	13.18	12±1.0	13	19.953
5785	Ant1	4.82	4±1.0	5	3.162
5785	Ant2	12.17	11±1.0	12	15.849
5825	Ant1	4.62	4±1.0	5	3.162
5825	Ant2	12.1	11±1.0	12	15.849
802.11ac(VHT40) SISO mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
5190	Ant1	3.24	2±1.0	3	1.995
5190	Ant2	13.74	13±1.0	14	25.119
5230	Ant1	2.9	2±1.0	3	1.995
5230	Ant2	13.38	12.5±1.0	13.5	22.387
5755	Ant1	6.73	6±1.0	7	5.012
5755	Ant2	13.76	13±1.0	14	25.119
5795	Ant1	6.48	5.5±1.0	6.5	4.467
5795	Ant2	13.47	12.5±1.0	13.5	22.387
802.11ac(VHT80) SISO mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
5210	Ant1	4.79	4±1.0	5	3.162
5210	Ant2	15.13	14±1.0	15	31.623
5775	Ant1	7.37	6.5±1.0	7.5	5.623
5775	Ant2	14.84	14±1.0	15	31.623

802.11n(HT20) MIMO mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
5180	Ant1+2	14.28	13±1.0	14	25.119
5200	Ant1+2	13.97	13±1.0	14	25.119
5240	Ant1+2	13.8	13±1.0	14	25.119
5745	Ant1+2	13.97	13±1.0	14	25.119
5785	Ant1+2	13.1	12±1.0	13	19.953
5825	Ant1+2	14.28	13±1.0	14	25.119
802.11ac(VHT20) MIMO mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
5180	Ant1+2	13.42	12.5±1.0	13.5	22.387
5200	Ant1+2	13.18	12±1.0	13	19.953
5240	Ant1+2	12.89	12±1.0	13	19.953
5745	Ant1+2	13.16	12±1.0	13	19.953
5785	Ant1+2	12.13	11±1.0	12	15.849
5825	Ant1+2	11.91	11±1.0	12	15.849
802.11ac(VHT40) MIMO mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
5190	Ant1+2	13.86	13±1.0	14	25.119
5230	Ant1+2	13.15	12±1.0	13	19.953
5755	Ant1+2	13.7	13±1.0	14	25.119
5795	Ant1+2	13.54	12.5±1.0	13.5	22.387
802.11ac(VHT80) MIMO mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
5210	Ant1+2	14.66	13.5±1.0	14.5	28.184
5775	Ant1+2	14.66	15±1.0	14.5	28.184

IEEE802.11ax(80M) mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
5210	Ant1+2	19.89	19±1.0	20	100

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm <sup>2</sup> )	Limit	Result
100	3	0.0597	1.0	PASS

Note: 1) Refer to report No. CQASZ20210400543E-02 for EUT test Max Conducted average Output Power value.

2)  $P_d = (P_{out} * G) / (4 * \pi * R^2) = (100 * 6.01) / (4 * 3.1416 * 20^2) = 0.0597$

#### 4.1.4 EUT RF Exposure Evaluation simultaneous transmission operations

According to 865664D02 2.2 d) 1):

The sum of the ratios of the spatially averaged results to the applicable frequency dependent MPE limits :

Simultaneous transmission mode	The sum of the ratios	Result
2.4G WIFI + 5G WIFI	$0.0063/1 + 0.0597/1$	$=0.0660 < 1$