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Report Template Version: V04

Report Template Revision Date: 2018-07-06

RF Exposure Evaluation Report

Report No. : CQASZ20191101241E-03

Applicant: Winstars Technology Limited

Address of Applicant: Block 4, Taisong Industrial Park, Dalang Street, Longhua Town, Bao'an District, Shenzhen, China

Equipment Under Test (EUT):

Product: Wireless Repeater

Model No.: WS-WN575A2, WL-WN575A2, WS-WN575A3, WL-WN575A3, WS-WN575A4, WL-WN575A4, WS-WN575A5, WL-WN575A5, WS-WN575B5, WL-WN575B5, WS-WN578R2, WL-WN578R2, WS-WN578HR2, WL-WN578HR2, WS-WN578S2, WL-WN578S2, WS-WN579G3, WL-WN579G3, WS-WN579X3, WL-WN579X3, AERIAL X, AERIAL MAX, AERIAL S2, AERIAL S2H, AERIAL S2Q, AERIAL S2M

Test Model No.: WL-WN575A3

Brand Name: N/A

FCC ID: NZ3-WN0001

Standards: 47 CFR Part 1.1307
47 CFR Part 1.1310
KDB447498D01 General RF Exposure Guidance v06

Date of Receipt: 2019-11-29

Date of Test: 2019-11-29 to 2019-12-31

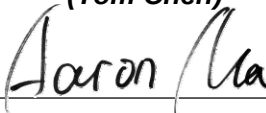
Date of Issue: 2019-12-31

Test Result : PASS*

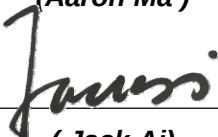
*In the configuration tested, the EUT complied with the standards specified above

Tested By: 

(Tom Chen)

Reviewed By: 

(Aaron Ma)

Approved By: 

(Jack Ai)



1 Version

Revision History Of Report

Report No.	Version	Description	Issue Date
CQASZ20191101241E-03	Rev.01	Initial report	2019-12-31

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3 General Information

3.1 Client Information

Applicant:	Winstars Technology Limited
Address of Applicant:	Block 4, Taisong Industrial Park, Dalang Street, Longhua Town, Bao'an District, Shenzhen, China
Manufacturer:	Winstars Technology Limited
Address of Manufacturer:	Block 4, Taisong Industrial Park, Dalang Street, Longhua Town, Bao'an District, Shenzhen, China

3.2 General Description of EUT

Product Name:	Wireless Repeater
Model No.:	WS-WN575A2, WL-WN575A2, WS-WN575A3, WL-WN575A3, WS-WN575A4, WL-WN575A4, WS-WN575A5, WL-WN575A5, WS-WN575B5, WL-WN575B5, WS-WN578R2, WL-WN578R2, WS-WN578HR2, WL-WN578HR2, WS-WN578S2, WL-WN578S2, WS-WN579G3, WL-WN579G3, WS-WN579X3, WL-WN579X3, AERIAL X, AERIAL MAX, AERIAL S2, AERIAL S2H, AERIAL S2Q, AERIAL S2M
Test Model No.:	WL-WN575A3
Trade Mark:	N/A
Hardware Version:	WS-WN575A3-A V1.3
Software Version:	RPT75A3.V4300.180801
Sample Type:	☐ Mobile ☐ Portable ☒ Fix Location
Power Supply:	100-240V 50/60Hz

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:	MT7603 QA V0.0.0.71 (manufacturer declare)
Antenna Type:	Omni Directional Antenna
Antenna Gain:	ANT1:3dBi ANT2:3dBi

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
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
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
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)
Test Software of EUT:	MT7662 QA V1.0.3.2 (manufacturer declare)
Antenna Type:	Omni Directional Antenna
Antenna Gain:	ANT1:3dBi
	ANT2:3dBi

Note:

Model No.: WS-WN575A2,WL-WN575A2,WS-WN575A3,WL-WN575A3,WS-WN575A4,WL-WN575A4,
WS-WN575A5,WL-WN575A5,WS-WN575B5,WL-WN575B5,WS-WN578R2,WL-WN578R2,
WS-WN578HR2,WL-WN578HR2,WS-WN578S2,WL-WN578S2,WS-WN579G3,WL-WN579G3,
WS-WN579X3,WL-WN579X3,AERIAL X,AERIAL MAX,AERIAL S2,AERIAL S2H,AERIAL S2Q,
AERIAL S2M

Only the model WL-WN575A3 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 RF 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 ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f ²)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f ²)	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/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

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

P_d is the limit of MPE, 1 mW/cm². 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: 3.0dBi , ANT2: 3.0dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.0 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	12.08	12.0±1.0	13.0	19.953
Lowest(2412MHz)	Ant2	12.26	12.0±1.0	13.0	19.953
Middle(2437MHz)	Ant1	12.56	12.0±1.0	13.0	19.953
Middle(2437MHz)	Ant2	12.87	12.0±1.0	13.0	19.953
Highest(2462MHz)	Ant1	12.51	12.0±1.0	13.0	19.953
Highest(2462MHz)	Ant2	12.9	12.0±1.0	13.0	19.953
802.11g mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
Lowest(2412MHz)	Ant1	12.51	12±1.0	13.0	19.953
Lowest(2412MHz)	Ant2	12.8	12±1.0	13.0	19.953
Middle(2437MHz)	Ant1	12.96	12±1.0	13.0	19.953
Middle(2437MHz)	Ant2	12.46	12±1.0	13.0	19.953
Highest(2462MHz)	Ant1	12.9	12±1.0	13.0	19.953
Highest(2462MHz)	Ant2	12.69	12±1.0	13.0	19.953
802.11n(HT20) SISO mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
Lowest(2412MHz)	Ant1	12.39	12±1.0	13.0	19.953
Lowest(2412MHz)	Ant2	12.55	12±1.0	13.0	19.953
Middle(2437MHz)	Ant1	12.93	12±1.0	13.0	19.953
Middle(2437MHz)	Ant2	12.33	12±1.0	13.0	19.953
Highest(2462MHz)	Ant1	12.54	12±1.0	13.0	19.953
Highest(2462MHz)	Ant2	12.53	12±1.0	13.0	19.953
802.11n(HT40) SISO mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)

Lowest(2422MHz)	Ant1	12.66	13±1.0	14.0	25.119
Lowest(2422MHz)	Ant2	12.16	13±1.0	14.0	25.119
Middle(2437MHz)	Ant1	13.59	13±1.0	14.0	25.119
Middle(2437MHz)	Ant2	12.88	13±1.0	14.0	25.119
Highest(2452MHz)	Ant1	12.24	13±1.0	14.0	25.119
Highest(2452MHz)	Ant2	12.85	13±1.0	14.0	25.119
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	14.96	15±1.0	16.0	39.811
Middle(2437MHz)	Ant1+2	15.44	15±1.0	16.0	39.811
Highest(2462MHz)	Ant1+2	15.60	15±1.0	16.0	39.811
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	15.04	15±1.0	16.0	39.811
Middle(2437MHz)	Ant1+2	15.16	15±1.0	16.0	39.811
Highest(2452MHz)	Ant1+2	15.38	15±1.0	16.0	39.811

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
39.811	3	0.0158	1.0	PASS

Note: 1) Refer to report No. CQASZ20191101241E-01 for EUT test Max Conducted average Output Power value.

$$2) P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2) = (39.811 \cdot 2.0) / (4 \cdot 3.1416 \cdot 20^2) = 0.0158$$

2) For 5G WIFI

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

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 2.0 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	12.73	12±1.0	13.0	19.953
5180	Ant2	12.09	12±1.0	13.0	19.953
5200	Ant1	12.02	12±1.0	13.0	19.953
5200	Ant2	11.6	12±1.0	13.0	19.953
5240	Ant1	11.92	12±1.0	13.0	19.953
5240	Ant2	11.71	12±1.0	13.0	19.953
5745	Ant1	12.68	12±1.0	13.0	19.953
5745	Ant2	12.75	12±1.0	13.0	19.953
5785	Ant1	11.18	12±1.0	13.0	19.953
5785	Ant2	12.26	12±1.0	13.0	19.953
5825	Ant1	12.35	12±1.0	13.0	19.953
5825	Ant2	12.65	12±1.0	13.0	19.953
802.11n(HT20) SISO mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
5180	Ant1	12.03	12±1.0	13.0	19.953
5180	Ant2	12.49	12±1.0	13.0	19.953
5200	Ant1	12.5	12±1.0	13.0	19.953
5200	Ant2	12.51	12±1.0	13.0	19.953
5240	Ant1	12.67	12±1.0	13.0	19.953
5240	Ant2	12.04	12±1.0	13.0	19.953
5745	Ant1	12.47	12±1.0	13.0	19.953
5745	Ant2	12.53	12±1.0	13.0	19.953
5785	Ant1	12.18	12±1.0	13.0	19.953
5785	Ant2	12.45	12±1.0	13.0	19.953
5825	Ant1	12.46	12±1.0	13.0	19.953
5825	Ant2	12.5	12±1.0	13.0	19.953

802.11n(HT40) SISO mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
5190	Ant1	12.03	12.5±1.0	13.5	22.387
5190	Ant2	12.49	12.5±1.0	13.5	22.387
5230	Ant1	12.5	12.5±1.0	13.5	22.387
5230	Ant2	12.51	12.5±1.0	13.5	22.387
5755	Ant1	12.67	12.5±1.0	13.5	22.387
5755	Ant2	12.04	12.5±1.0	13.5	22.387
5795	Ant1	12.47	12.5±1.0	13.5	22.387
5795	Ant2	12.53	12.5±1.0	13.5	22.387
802.11ac(VHT20) SISO mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
5180	Ant1	11.83	12±1.0	13.0	19.953
5180	Ant2	12.27	12±1.0	13.0	19.953
5200	Ant1	12.15	12±1.0	13.0	19.953
5200	Ant2	11.82	12±1.0	13.0	19.953
5240	Ant1	12.56	12±1.0	13.0	19.953
5240	Ant2	12.07	12±1.0	13.0	19.953
5745	Ant1	12.55	12±1.0	13.0	19.953
5745	Ant2	11.89	12±1.0	13.0	19.953
5785	Ant1	11.89	12±1.0	13.0	19.953
5785	Ant2	12.29	12±1.0	13.0	19.953
5825	Ant1	12.89	12±1.0	13.0	19.953
5825	Ant2	11.92	12±1.0	13.0	19.953
802.11ac(VHT40) SISO mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
5190	Ant1	12.48	12±1.0	13.0	19.953
5190	Ant2	12.54	12±1.0	13.0	19.953
5230	Ant1	12.24	12±1.0	13.0	19.953
5230	Ant2	12.61	12±1.0	13.0	19.953
5755	Ant1	12.7	12±1.0	13.0	19.953
5755	Ant2	11.92	12±1.0	13.0	19.953

5795	Ant1	12.57	12±1.0	13.0	19.953
5795	Ant2	12.32	12±1.0	13.0	19.953
802.11ac(VHT80) SISO mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
5210	Ant1	12.01	12.5±1.0	13.5	22.387
5210	Ant2	12.87	12.5±1.0	13.5	22.387
5775	Ant1	12.92	12.5±1.0	13.5	22.387
5775	Ant2	12.84	12.5±1.0	13.5	22.387
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	14.95	15±1.0	16.0	39.811
5200	Ant1+2	15.36	15±1.0	16.0	39.811
5240	Ant1+2	14.99	15±1.0	16.0	39.811
5745	Ant1+2	15.01	15±1.0	16.0	39.811
5785	Ant1+2	15.22	15±1.0	16.0	39.811
5825	Ant1+2	15.16	15±1.0	16.0	39.811
802.11n(HT40) MIMO mode					
Test channel	Antenna	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
5190	Ant1+2	15.34	15±1.0	16.0	39.811
5230	Ant1+2	14.89	15±1.0	16.0	39.811
5755	Ant1+2	15.18	15±1.0	16.0	39.811
5795	Ant1+2	15.17	15±1.0	16.0	39.811
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	14.75	14.5±1.0	15.5	35.481
5200	Ant1+2	14.76	14.5±1.0	15.5	35.481
5240	Ant1+2	14.69	14.5±1.0	15.5	35.481
5745	Ant1+2	14.98	14.5±1.0	15.5	35.481
5785	Ant1+2	14.91	14.5±1.0	15.5	35.481
5825	Ant1+2	14.94	14.5±1.0	15.5	35.481

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	15.20	15±1.0	16.0	39.811
5230	Ant1+2	15.61	15±1.0	16.0	39.811
5755	Ant1+2	15.59	15±1.0	16.0	39.811
5795	Ant1+2	15.15	15±1.0	16.0	39.811
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	15.63	15±1.0	16.0	39.811
5775	Ant1+2	15.50	15±1.0	16.0	39.811

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
39.811	3	0.0158	1.0	PASS

Note: 1) Refer to report No. CQASZ20191101241E-02 for EUT test Max Conducted average Output Power value.

$$2) P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2) = (39.811 \cdot 2.0) / (4 \cdot 3.1416 \cdot 20^2) = 0.0158$$

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	$0.0158/1 + 0.0158/1$	$=0.0316 < 1$