

Maximum Permissible Exposure Report

1. Product Information

FCC ID:	2AX4F-30590
Product name	TriFi Dual Band WiFi Booster
Test Model	30590
Power supply	Input: AC 100-240V, 50/60Hz, 0.3A Max
Operation frequency	2412MHz-2462MHz 5180MHz-5240MHz 5745MHz-5825MHz
Antenna Type	External Antenna
Antenna Gain	3dBi(Max.)
Hardware version	WS-WN575B2-A-V1.2
Software version	WN575B2-R75B2.V4300.200229
Channel Number	11 Channels for 20MHz bandwidth(2412~2462MHz) 7 Channels for 40MHz bandwidth(2422~2452MHz) 4 channels for 20MHz bandwidth(5180MHz-5240MHz) 2 channels for 40MHz bandwidth(5190MHz~5230MHz) 1 channels for 80MHz bandwidth(5210MHz) 5 channels for 20MHz bandwidth(5745MHz-5825MHz) 2 channels for 40MHz bandwidth(5755MHz~5795MHz) 1 channels for 80MHz bandwidth(5775MHz)
Channel Spacing	5MHz
Exposure category	General population/uncontrolled environment
EUT Type	Production Unit
Device Type	mobile devices

2. 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 modelled 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.

3. Limit

3.1 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 1 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 2.1091](#): Radiofrequency radiation exposure evaluation: mobile devices

3.2 Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
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

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	30
3.0 – 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

*=Plane-wave equivalent power density

4. MPE 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. Antenna Information

ES-D4 can only use antennas certificated as follows provided by manufacturer;

Antenna type and antenna number	Operate frequency band	Maximum antenna gain	Notes
External Antenna	2412MHz-2462MHz 5180MHz-5240MHz 5745MHz-5825MHz	3 dBi	WiFi Antenna

6. Conducted Power

[2.4GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	ANT 0 Max Conducted Power(dBm)	ANT 1 Max Conducted Power(dBm)
11B	1	2412	15.17	15.6
	6	2437	15.43	15.29
	11	2462	15.03	15.34
11G	1	2412	16.86	15.17
	6	2437	15.69	15.55
	11	2462	15.39	15.19
11N20SISO	1	2412	15.4	15.15
	6	2437	15.02	15.44
	11	2462	15.02	15.09
11N40SISO	3	2422	17.84	15.58
	6	2437	15.41	15.34
	9	2452	15.21	15.18

[2.4GWIFI Max Conducted Power] ANT 0+ANT1

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)
11N20SISO	1	2412	18.29
	6	2437	18.25
	11	2462	18.07
11N40SISO	3	2422	19.87
	6	2437	18.39
	9	2452	18.21

[5.2GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)
11A	36	5180	16.76
	40	5200	16.27
	48	5240	16.12
11N20 SISO	36	5180	16.58
	40	5200	16.45
	48	5240	16.25
11N40 SISO	38	5190	16.66
	46	5230	16.58
11AC20 SISO	36	5180	16.61
	40	5200	16.57
	48	5240	16.35
11AC40 SISO	38	5190	16.34
	46	5230	16.12
11AC80 SISO	42	5210	16.59

[5.8WIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)
11A	149	5745	16.49
	157	5785	16.71
	165	5825	16.55
11N20 SISO	149	5745	16.78
	157	5785	16.94
	165	5825	16.78
11N40 SISO	151	5755	16.81
	159	5795	16.49
11AC20 SISO	149	5745	16.61
	157	5785	16.57
	165	5825	16.35
11AC40 SISO	151	5755	16.34
	159	5795	16.12
11AC80 SISO	155	5775	16.76

7. Measurement Results

[2.4GWIFI]			
11B (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	15.0	15.0	15.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11G (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	16.0	15.0	15.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N20MIMO (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	18.0	18.0	18.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N40MIMO (Peak)			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	19.0	18.0	18.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

[5.2GWIFI]

11A (Peak)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	16.0	16.0	16.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N20 SISO (Peak)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	16.0	16.0	16.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N40 SISO (Peak)			
Channel	Channel 38	Channel 46	
Target (dBm)	16.0	16.0	
Tolerance $\pm$ (dB)	1.0	1.0	
11AC20 SISO (Peak)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	16.0	16.0	16.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11AC40 SISO (Peak)			
Channel	Channel 38	Channel 46	
Target (dBm)	16.0	16.0	
Tolerance $\pm$ (dB)	1.0	1.0	
11AC80 SISO (Peak)			
Channel	Channel 42		
Target (dBm)	16.0		
Tolerance $\pm$ (dB)	1.0		

[5.8GWIFI]

11A (Peak)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	16.0	16.0	16.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N20 SISO (Peak)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	16.0	16.0	16.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N40 SISO (Peak)			
Channel	Channel 151	Channel 159	
Target (dBm)	16.0	16.0	
Tolerance $\pm$ (dB)	1.0	1.0	
11AC20 SISO (Peak)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	16.0	16.0	16.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11AC40 SISO (Peak)			
Channel	Channel 151	Channel 159	
Target (dBm)	16.0	16.0	
Tolerance $\pm$ (dB)	1.0	1.0	
11AC80 SISO (Peak)			
Channel	Channel 155		
Target (dBm)	16.0		
Tolerance $\pm$ (dB)	1.0		

8. Evaluation Results

8.1 Standalone MPE Evaluation

As declared by the Applicant, the EUT is a wireless device used in a fix application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance, $r=20\text{cm}$, as well as the gain of the used antenna refer to antenna information, the RF power density can be obtained.

2.4GWIFI

Band/Mode	f (GHz)	RF output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
		dBm	mW				
IEEE 802.11b	2.437	16	39.81	3.0	1.995	0.016	1.0000
IEEE 802.11g	2.412	17	50.12	3.0	1.995	0.020	1.0000
IEEE 802.11n HT20	2.412	19	79.43	3.0	1.995	0.032	1.0000
IEEE 802.11n HT40	2.422	20	100	3.0	1.995	0.040	1.0000

5.2GWIFI

Band/Mode	f (GHz)	RF output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
		dBm	mW				
11A	5.180	17	50.12	3.0	1.995	0.02	1.0000
11N20 SISO	5.180	17	50.12	3.0	1.995	0.02	1.0000
11N40 SISO	5.190	17	50.12	3.0	1.995	0.02	1.0000
11AC20 SISO	5.180	17	50.12	3.0	1.995	0.02	1.0000
11AC40 SISO	5.190	17	50.12	3.0	1.995	0.02	1.0000
11AC80 SISO	5.210	17	50.12	3.0	1.995	0.02	1.0000

5.8GWIFI

Band/Mode	f (GHz)	RF output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
		dBm	mW				
11A	5.785	17.0	50.12	3.0	1.995	0.02	1.0000
11N20 SISO	5.785	17.0	50.12	3.0	1.995	0.02	1.0000
11N40 SISO	5.755	17.0	50.12	3.0	1.995	0.02	1.0000
11AC20 SISO	5.745	17.0	50.12	3.0	1.995	0.02	1.0000
11AC40 SISO	5.755	17.0	50.12	3.0	1.995	0.02	1.0000
11AC80 SISO	5.775	17.0	50.12	3.0	1.995	0.02	1.0000

Remark:

1. Output power including turn-up tolerance;
2. Output power is burst average power;
3. MPE evaluate distance is 20cm from user manual provide by manufacturer;
4. $MPE\ values = PG/4\pi R^2$

8.2 Simultaneous Transmission MPE

The sample supports two antennas for 2.4G WIFI and one antenna for 5G WIFI, so need consider simultaneous transmission;

Simultaneous transmission MPE

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

Σ of MPE ratios ≤ 1.0

Mode	MPE1 (mW/cm ²)	MPE2 (mW/cm ²)	Σ MPE ratios	Limit	Results
2.4G WIFI+5.2G WIFI	0.040	0.02	0.06	1.0000	PASS
2.4G WIFI+5.8G WIFI	0.040	0.02	0.06	1.0000	PASS

Remark:

The worst case results were recorded.

The 2.4G WIFI and 5G WIFI can transmit at the same time.

9. 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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