

Maximum Permissible Exposure Evaluation

FCC ID: 2AWNK-AX18

1. Client Information

Applicant	:	Shenzhen Apeman Innovations Technology Co.,Ltd
Address	:	1808, Heng Lu E Times Building, No. 159, North Pingji Road, Hehua Community, Pinghu Street, Longgang District, Shenzhen, Guangdong, China
Manufacturer	:	Shenzhen Apeman Innovations Technology Co.,Ltd
Address	:	1808, Heng Lu E Times Building, No. 159, North Pingji Road, Hehua Community, Pinghu Street, Longgang District, Shenzhen, Guangdong, China

2. General Description of EUT

EUT Name	:	AX1800 Dual Band Wi-Fi 6 Smart Router
Models No.	:	AX18, AX1801, AX1802, AX1803, AX1804, AX1805, AX18A, AX18B, AX18C, AX18D, AX18E
Model Difference	:	All these models are identical in the same PCB, layout and electrical circuit, The only difference is model name.
Sample	:	20210415-09-1#& 20210415-09-2#
Brand Name	:	----
Product Description	:	Operation Frequency: 802.11b/g/n(HT20): 2412MHz~2462MHz 802.11n(HT40): 2422MHz~2452MHz U-NII-1: 5180MHz~5240MHz, U-NII-3: 5745MHz~5825MHz 802.11a: OFDM (BPSK,QPSK,16-QAM,64QAM) 802.11b: DSSS (DQPSK, DBPSK, CCK) 802.11g: OFDM (BPSK, QPSK,16QAM, 64QAM) 802.11n: OFDM (BPSK, QPSK,16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK,16QAM,64QAM, 256QAM) 802.11ax: OFDMA(BPSK, QPSK,16QAM, 64QAM, 256QAM, 1024QAM)
Power Rating	:	Adapter(TPQ-233A120100UW01): Input: 100-240V~, 50/60Hz, 0.4A Output: DC 12V 1A
Software Version	:	A
Hardware Version	:	N/A
Remark	:	the MPE report used the Sample(20210415-09-2#).

MPE Calculations

1. Antenna Gain:

Antenna	Brand	Model Name	Type	2.4G Antenna Gain(dBi)
ANT. 1	N/A	N/A	Dipole	5
ANT. 2	N/A	N/A	Dipole	5
Note: For MIMO mode: Directional Gain=ANT. Gain+10*log(N _{ANT}) =8.01dBi 2.4G working with 802.11b/g/n/ax has MIMO mode.				

Antenna	Brand	Model Name	Type	5G Antenna Gain (dBi)
ANT. 3	N/A	N/A	Dipole	U-NII-1: 5
				U-NII-3: 5
ANT. 4	N/A	N/A	Dipole	U-NII-1: 5
				U-NII-3: 5
Note: For MIMO mode: Directional Gain=ANT. Gain+10*log(N _{ANT})=8.01dBi 5G working with 802.11a/n/ac/ax has MIMO mode.				

2. EUT Operation Condition:

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

3. Exposure Evaluation:

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 the 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

4. Simultaneous transmission MPE Considerations

According to KDB447498 :All transmitters and antennas in the host must be either evaluated for MPE compliance, by measurement or computational modeling, or qualify for the standalone MPE test exclusion in section 7.1.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 .

This means that:

$$\sum \text{ of MPE ratios } \leq 1.0$$

5. Standalone MPE Evaluation:

[2.4GHz WLAN]

Mode	Channel	Frequency	Peak Conducted Output Power (dBm)		Tolerance $\pm$ (dB)	Turn-up Power Tolerance (dB)	
			Ant.1	Ant.2		Ant.1	Ant.2
IEEE 802.11b	1	2412	21.43	20.82	1.0	21 $\pm$ 1	21 $\pm$ 1
	6	2437	20.78	21.35	1.0	21 $\pm$ 1	21 $\pm$ 1
	11	2462	21.39	21.11	1.0	21 $\pm$ 1	21 $\pm$ 1
IEEE 802.11g	1	2412	20.19	20.26	1.0	21 $\pm$ 1	21 $\pm$ 1
	6	2437	19.91	20.78	1.0	20 $\pm$ 1	21 $\pm$ 1
	11	2462	20.65	20.55	1.0	21 $\pm$ 1	21 $\pm$ 1
IEEE 802.11n HT20	1	2412	18.27	18.20	1.0	18 $\pm$ 1	18 $\pm$ 1
	6	2437	17.84	18.76	1.0	18 $\pm$ 1	18 $\pm$ 1
	11	2462	18.63	18.54	1.0	18 $\pm$ 1	18 $\pm$ 1
IEEE 802.11n HT40	3	2422	17.14	17.02	1.0	17 $\pm$ 1	17 $\pm$ 1
	6	2437	16.61	17.45	1.0	17 $\pm$ 1	17 $\pm$ 1
	9	2452	16.45	17.40	1.0	17 $\pm$ 1	17 $\pm$ 1
IEEE 802.11ax HE20	1	2412	17.92	17.70	1.0	18 $\pm$ 1	18 $\pm$ 1
	6	2437	17.52	18.24	1.0	18 $\pm$ 1	18 $\pm$ 1
	11	2462	18.33	18.00	1.0	18 $\pm$ 1	18 $\pm$ 1
IEEE 802.11ax HE40	3	2422	17.85	17.36	1.0	18 $\pm$ 1	18 $\pm$ 1
	6	2437	17.36	17.99	1.0	18 $\pm$ 1	18 $\pm$ 1
	9	2452	17.22	17.92	1.0	18 $\pm$ 1	18 $\pm$ 1

[5GHz WLAN U-NII-1]

Mode	Channel	Frequency	Peak Conducted Output Power (dBm)		Tolerance $\pm$ (dB)	Turn-up Power Tolerance (dB)	
			Ant.3	Ant.4		Ant.3	Ant.4
IEEE 802.11a	36	5180	14.07	12.63	1.0	14 $\pm$ 1	13 $\pm$ 1
	40	5200	14.03	12.46	1.0	14 $\pm$ 1	13 $\pm$ 1
	48	5240	13.27	12.50	1.0	14 $\pm$ 1	13 $\pm$ 1
IEEE 802.11n HT20	36	5180	12.80	11.56	1.0	12 $\pm$ 1	12 $\pm$ 1
	40	5200	13.14	11.34	1.0	13 $\pm$ 1	12 $\pm$ 1
	48	5240	11.78	11.31	1.0	12 $\pm$ 1	12 $\pm$ 1
IEEE 802.11ac VHT20	36	5180	14.12	12.69	1.0	14 $\pm$ 1	13 $\pm$ 1
	40	5200	14.70	12.56	1.0	14 $\pm$ 1	13 $\pm$ 1
	48	5240	13.22	12.52	1.0	13 $\pm$ 1	13 $\pm$ 1
IEEE 802.11ax HE20	36	5180	14.41	13.01	1.0	14 $\pm$ 1	13 $\pm$ 1
	40	5200	15.16	12.86	1.0	15 $\pm$ 1	13 $\pm$ 1
	48	5240	13.64	12.80	1.0	14 $\pm$ 1	13 $\pm$ 1
IEEE 802.11n HT40	38	5190	12.99	11.49	1.0	12 $\pm$ 1	11 $\pm$ 1
	46	5230	11.89	11.39	1.0	12 $\pm$ 1	11 $\pm$ 1
IEEE 802.11ac VHT40	38	5190	13.16	11.83	1.0	13 $\pm$ 1	11 $\pm$ 1
	46	5230	12.07	11.65	1.0	12 $\pm$ 1	11 $\pm$ 1
IEEE 802.11ax HE40	38	5190	13.44	12.04	1.0	13 $\pm$ 1	12 $\pm$ 1
	46	5230	12.49	11.89	1.0	13 $\pm$ 1	12 $\pm$ 1
IEEE 802.11ac VHT80	42	5210	16.85	15.45	1.0	17 $\pm$ 1	15 $\pm$ 1
IEEE 802.11ax HE80	42	5210	17.66	15.77	1.0	17 $\pm$ 1	15 $\pm$ 1

[5GHz WLAN U-NII-3]

Mode	Channel	Frequency	Peak Conducted Output Power (dBm)		Tolerance $\pm$ (dB)	Turn-up Power Tolerance (dB)	
			Ant.3	Ant.4		Ant.3	Ant.4
IEEE 802.11a	149	5745	14.34	14.71	1.0	14 $\pm$ 1	14 $\pm$ 1
	157	5785	14.79	14.69	1.0	14 $\pm$ 1	14 $\pm$ 1
	165	5825	13.46	12.86	1.0	14 $\pm$ 1	13 $\pm$ 1
IEEE 802.11n HT20	149	5745	14.87	14.75	1.0	14 $\pm$ 1	14 $\pm$ 1
	157	5785	14.71	14.63	1.0	14 $\pm$ 1	14 $\pm$ 1
	165	5825	13.43	12.86	1.0	13 $\pm$ 1	13 $\pm$ 1
IEEE 802.11ac VHT20	149	5745	15.11	15.01	1.0	15 $\pm$ 1	15 $\pm$ 1
	157	5785	14.93	14.87	1.0	15 $\pm$ 1	15 $\pm$ 1
	165	5825	13.74	13.10	1.0	14 $\pm$ 1	13 $\pm$ 1
IEEE 802.11ax HE20	149	5745	15.53	15.38	1.0	15 $\pm$ 1	15 $\pm$ 1
	157	5785	15.42	15.31	1.0	15 $\pm$ 1	15 $\pm$ 1
	165	5825	14.15	13.56	1.0	14 $\pm$ 1	14 $\pm$ 1
IEEE 802.11n HT40	151	5755	18.85	18.80	1.0	19 $\pm$ 1	19 $\pm$ 1
	159	5795	18.74	18.61	1.0	19 $\pm$ 1	19 $\pm$ 1
IEEE 802.11ac VHT40	151	5755	19.08	18.92	1.0	19 $\pm$ 1	18 $\pm$ 1
	159	5795	18.84	18.57	1.0	19 $\pm$ 1	19 $\pm$ 1
IEEE 802.11ax HE40	151	5755	17.63	17.32	1.0	17 $\pm$ 1	17 $\pm$ 1
	159	5795	17.18	17.01	1.0	17 $\pm$ 1	17 $\pm$ 1
IEEE 802.11ac VHT80	155	5775	21.00	20.83	1.0	21 $\pm$ 1	21 $\pm$ 1
IEEE 802.11ax HE80	155	5775	21.45	21.40	1.0	21 $\pm$ 1	21 $\pm$ 1

2.4GHz WLAN ANT. 1

Modulation Type	Output power (Turn-up Procedure)		Antenna Gain (dBi)	Antenna Gain (Numeric)	Distance (cm) [R]	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW					
IEEE 802.11b	22	158.49	5	3.1623	20	0.0997	1.0000
IEEE 802.11g	22	158.49	5	3.1623	20	0.0997	1.0000
IEEE 802.11n HT20	19	79.43	5	3.1623	20	0.0500	1.0000
IEEE 802.11n HT40	18	63.10	5	3.1623	20	0.0397	1.0000
IEEE 802.11ax HE20	19	79.43	5	3.1623	20	0.0500	1.0000
IEEE 802.11ax HE40	19	79.43	5	3.1623	20	0.0500	1.0000

2.4GHz WLAN ANT. 2

Modulation Type	Output power (Turn-up Procedure)		Antenna Gain (dBi)	Antenna Gain (Numeric)	Distance (cm) [R]	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW					
IEEE 802.11b	22	158.49	5	3.1623	20	0.0997	1.0000
IEEE 802.11g	22	158.49	5	3.1623	20	0.0997	1.0000
IEEE 802.11n HT20	19	79.43	5	3.1623	20	0.0500	1.0000
IEEE 802.11n HT40	18	63.10	5	3.1623	20	0.0397	1.0000
IEEE 802.11ax HE20	19	79.43	5	3.1623	20	0.0500	1.0000
IEEE 802.11ax HE40	19	79.43	5	3.1623	20	0.0500	1.0000

5GHz WLAN U-NII-1 ANT. 3

Modulation Type	Output power (Turn-up Procedure)		Antenna Gain (dBi)	Antenna Gain (Numeric)	Distance (cm) [R]	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW					
IEEE 802.11a	15	31.62	5	3.1623	20	0.0199	1.0000
IEEE 802.11n HT20	14	25.12	5	3.1623	20	0.0158	1.0000
IEEE 802.11ac VHT20	15	31.62	5	3.1623	20	0.0199	1.0000
IEEE 802.11ax HE20	16	39.81	5	3.1623	20	0.0250	1.0000
IEEE 802.11n HT40	13	19.95	5	3.1623	20	0.0126	1.0000
IEEE 802.11ac VHT40	14	25.12	5	3.1623	20	0.0158	1.0000
IEEE 802.11ax HE40	14	25.12	5	3.1623	20	0.0158	1.0000
IEEE 802.11ac VHT80	18	63.10	5	3.1623	20	0.0397	1.0000
IEEE 802.11ax HE80	18	63.10	5	3.1623	20	0.0397	1.0000

5GHz WLAN U-NII-1 ANT. 4

Modulation Type	Output power (Turn-up Procedure)		Antenna Gain (dBi)	Antenna Gain (Numeric)	Distance (cm) [R]	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW					
IEEE 802.11a	14	25.12	5	3.1623	20	0.0158	1.0000
IEEE 802.11n HT20	13	19.95	5	3.1623	20	0.0126	1.0000
IEEE 802.11ac VHT20	14	25.12	5	3.1623	20	0.0158	1.0000
IEEE 802.11ax HE20	14	25.12	5	3.1623	20	0.0158	1.0000
IEEE 802.11n HT40	12	15.85	5	3.1623	20	0.0100	1.0000
IEEE 802.11ac VHT40	12	15.85	5	3.1623	20	0.0100	1.0000
IEEE 802.11ax HE40	13	19.95	5	3.1623	20	0.0126	1.0000
IEEE 802.11ac VHT80	16	39.81	5	3.1623	20	0.0250	1.0000
IEEE 802.11ax HE80	16	39.81	5	3.1623	20	0.0250	1.0000

5GHz WLAN U-NII-3 ANT. 3

Modulation Type	Output power (Turn-up Procedure)		Antenna Gain (dBi)	Antenna Gain (Numeric)	Distance (cm) [R]	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW					
IEEE 802.11a	15	31.623	5	3.1623	20	0.0199	1.0000
IEEE 802.11n HT20	15	31.623	5	3.1623	20	0.0199	1.0000
IEEE 802.11ac VHT20	16	39.811	5	3.1623	20	0.0250	1.0000
IEEE 802.11ax HE20	16	39.81	5	3.1623	20	0.0250	1.0000
IEEE 802.11n HT40	20	100.00	5	3.1623	20	0.0629	1.0000
IEEE 802.11ac VHT40	20	100.00	5	3.1623	20	0.0629	1.0000
IEEE 802.11ax HE40	18	63.10	5	3.1623	20	0.0397	1.0000
IEEE 802.11ac VHT80	22	125.89	5	3.1623	20	0.0997	1.0000
IEEE 802.11ax HE80	22	125.89	5	3.1623	20	0.0997	1.0000

5GHz WLAN U-NII-3 ANT. 4

Modulation Type	Output power (Turn-up Procedure)		Antenna Gain (dBi)	Antenna Gain (Numeric)	Distance (cm) [R]	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW					
IEEE 802.11a	15	31.623	5	3.1623	20	0.0199	1.0000
IEEE 802.11n HT20	15	31.623	5	3.1623	20	0.0199	1.0000
IEEE 802.11ac VHT20	16	39.811	5	3.1623	20	0.0250	1.0000
IEEE 802.11ax HE20	16	39.81	5	3.1623	20	0.0250	1.0000
IEEE 802.11n HT40	20	100.00	5	3.1623	20	0.0629	1.0000
IEEE 802.11ac VHT40	20	100.00	5	3.1623	20	0.0629	1.0000
IEEE 802.11ax HE40	18	63.10	5	3.1623	20	0.0397	1.0000
IEEE 802.11ac VHT80	22	125.89	5	3.1623	20	0.0997	1.0000
IEEE 802.11ax HE80	22	125.89	5	3.1623	20	0.0997	1.0000

Remark:

1. Output power (Average) including turn-up tolerance;
2. Output power was adjust to duty cycle at 100% if measured duty cycle less than 98%;
3. MPE evaluate distance is 20cm from user manual provide by manufacturer.

6. Summary simultaneous transmission information

Modulation Type	Work Frequency Band	Transmit Antenna		Antenna 1/3 Antenna 2/4 Synchronization transmit
		Antenna 1/3	Antenna 2/4	
IEEE 802.11a	U-NII-1/U-NII-3	Yes	Yes	Yes
IEEE 802.11b	2.4GHz	Yes	Yes	Yes
IEEE 802.11g	2.4GHz	Yes	Yes	Yes
IEEE 802.11n HT20	2.4GHz	Yes	Yes	Yes
IEEE 802.11n HT20	U-NII-1/ U-NII-3	Yes	Yes	Yes
IEEE 802.11n HT40	2.4GHz	Yes	Yes	Yes
IEEE 802.11n HT40	U-NII-1/ U-NII-3	Yes	Yes	Yes
IEEE 802.11ac VHT20	U-NII-1/ U-NII-3	Yes	Yes	Yes
IEEE 802.11ac VHT40	U-NII-1/ U-NII-3	Yes	Yes	Yes
IEEE 802.11ac VHT80	U-NII-1/ U-NII-3	Yes	Yes	Yes
IEEE 802.11ax HE20	2.4GHz	Yes	Yes	Yes
IEEE 802.11ax HE40	2.4GHz	Yes	Yes	Yes
IEEE 802.11ax HE20	U-NII-1/ U-NII-3	Yes	Yes	Yes
IEEE 802.11ax HE40	U-NII-1/ U-NII-3	Yes	Yes	Yes
IEEE 802.11ax HE80	U-NII-1/ U-NII-3	Yes	Yes	Yes

Note: 2.4G used antenna 1 and antenna 2, 5G used antenna 3 and antenna 4

7. Summary simultaneous transmission results

Antenna 1 and Antenna 2 for 2.4GWLAN

Modulation Type	MPE _{Antenna 1} (mW/cm ²)	MPE _{Antenna 2} (mW/cm ²)	ΣMPE ratios	Limit	Results
IEEE 802.11b	0.0199	0.0158	0.0357	1.0	PASS
IEEE 802.11g	0.0158	0.0126	0.0284	1.0	PASS
IEEE 802.11n HT20	0.0199	0.0158	0.0357	1.0	PASS
IEEE 802.11n HT40	0.0250	0.0158	0.0408	1.0	PASS
IEEE 802.11ax HE20	0.0126	0.0100	0.0226	1.0	PASS
IEEE 802.11ax HE40	0.0158	0.0100	0.0258	1.0	PASS

Antenna 3 and Antenna 4 for 5GWLAN U-NII-1

Modulation Type	MPE _{Antenna 3} (mW/cm ²)	MPE _{Antenna 4} (mW/cm ²)	ΣMPE ratios	Limit	Results
IEEE 802.11a	0.0158	0.0158	0.0316	1.0	PASS
IEEE 802.11n HT20	0.0126	0.0126	0.0252	1.0	PASS
IEEE 802.11ac VHT20	0.0199	0.0158	0.0357	1.0	PASS
IEEE 802.11ax HE20	0.0199	0.0158	0.0357	1.0	PASS
IEEE 802.11n HT40	0.0126	0.0100	0.0226	1.0	PASS
IEEE 802.11ac VHT40	0.0126	0.0100	0.0226	1.0	PASS
IEEE 802.11ax HE40	0.0126	0.0100	0.0226	1.0	PASS
IEEE 802.11ac VHT80	0.0126	0.0100	0.0226	1.0	PASS
IEEE 802.11ax HE80	0.0126	0.0079	0.0205	1.0	PASS

Antenna 3 and Antenna 4 for 5GWLAN U-NII-3

Modulation Type	MPE Antenna 3 (mW/cm ²)	MPE Antenna 4 (mW/cm ²)	ΣMPE ratios	Limit	Results
IEEE 802.11a	0.0199	0.0199	0.0398	1.0	PASS
IEEE 802.11n HT20	0.0199	0.0199	0.0398	1.0	PASS
IEEE 802.11ac VHT20	0.0250	0.0250	0.0500	1.0	PASS
IEEE 802.11ax HE20	0.0250	0.0250	0.0500	1.0	PASS
IEEE 802.11n HT40	0.0629	0.0629	0.1258	1.0	PASS
IEEE 802.11ac VHT40	0.0629	0.0629	0.1258	1.0	PASS
IEEE 802.11ax HE40	0.0397	0.0397	0.0794	1.0	PASS
IEEE 802.11ac VHT80	0.0997	0.0997	0.1994	1.0	PASS
IEEE 802.11ax HE80	0.0997	0.0997	0.1994	1.0	PASS

2.4G and 5G Maximum Simultaneous transmission MPE Ratios is $0.1994+0.1994=0.3988 \leq 1.0$.

8. Conclusion:

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

-----END OF REPORT-----