Maximum Permissible Exposure Report

1. Product Information

FCC ID:	2APRGRE01
Product name	WiFi Range Extender
Test Model	RE1800
Additional Model No.	RE1200, RE1500
Model Declaration	PCB board, structure and internal of these model(s) are the same, So no additional models were tested
Power supply	Input: 100-240V~, 50/60Hz, 0.3A
Operation frequency	2412MHz ~ 2462MHz 5180-5240MHz 5745MHz-5825MHz
Antenna Type	Antenna 0: External Antenna Antenna 1: External Antenna
Antenna Gain	1.0dBi(Max)
Hardware version	V1.0
Software version	V1.12.3
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)
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	2400MHz ~ 2500MHz 5180-5240MHz 5745MHz-5825MHz	1.0dBi	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	18.26	18.41
	6	2437	17.94	18.07
	11	2462	17.99	18
11G	1	2412	18.15	18.3
	6	2437	17.9	17.9
	11	2462	17.75	17.82
11N20 SISO	1	2412	18.11	18.03
	6	2437	17.69	17.77
	11	2462	17.52	17.64
11N40 SISO	3	2422	18.72	17.82
	6	2437	18.57	17.81
	9	2452	18.66	17.74
11AX20 SISO	1	2412	18.04	19.21
	6	2437	18.76	18.84
	11	2462	18.75	18.84
11AX40 SISO	3	2422	18.79	18.7
	6	2437	18.57	18.76
	9	2452	18.6	18.64

[2.4GWIFI Max Conducted Power] Ant 0+Ant 1

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)
11N20 MIMO	1	2412	21.08
	6	2437	20.74
	11	2462	20.59
11N40 MIMO	3	2422	21.30
	6	2437	21.22
	9	2452	21.23
11AX20 MIMO	1	2412	21.67
	6	2437	21.81
	11	2462	21.81
11AX40 MIMO	3	2422	21.76
	6	2437	21.68
	9	2452	21.63

[5.2GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Ant 0 Max Conducted Power(dBm)	Ant 1 Max Conducted Power(dBm)
11A	36	5180	17.23	17.45
	40	5200	17.56	17.73
	48	5240	16.89	17.29
11N20 SISO	36	5180	17.24	17.27
	40	5200	17.55	17.26
	48	5240	16.99	16.90
11N40 SISO	38	5190	17.33	15.53
	46	5230	16.82	16.06
11AC20 SISO	36	5180	17.19	17.09
	40	5200	17.55	17.07
	48	5240	17.06	17.11
11AC40 SISO	38	5190	16.35	16.62
	46	5230	15.73	16.42
11AC80 SISO	42	5210	15.26	16.27
11AX20 SISO	36	5180	17.55	17.69
	40	5200	17.75	17.74
	48	5240	17.23	17.01
11AX40 SISO	38	5190	17.33	16.39
	46	5230	15.74	16.80
11AX80 SISO	42	5210	16.01	15.78

[5.2GWIFI Max Conducted Power] Ant 0+Ant 1

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)
11N20 MIMO	36	5180	20.27
	40	5200	20.42
	48	5240	19.96
11N40 MIMO	38	5190	19.53
	46	5230	19.47
11AC20 MIMO	36	5180	20.15
	40	5200	20.33
	48	5240	20.10
11AC40 MIMO	38	5190	19.50
	46	5230	19.10
11AC80 MIMO	42	5210	18.80
11AX20 MIMO	36	5180	20.63
	40	5200	20.76
	48	5240	20.13
11AX40 MIMO	38	5190	19.90
	46	5230	19.31
11AX80 MIMO	42	5210	18.91

[5.8WIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Ant 0 Max Conducted Power(dBm)	Ant 1 Max Conducted Power(dBm)
11A	149	5745	20.58	20.54
	157	5785	20.27	19.87
	165	5825	20.37	19.88
11N20 SISO	149	5745	20.86	20.55
	157	5785	20.12	19.69
	165	5825	20.24	19.78
11N40 SISO	151	5755	19.96	20.85
	159	5795	19.06	20.01
11AC20 SISO	149	5745	20.83	20.49
	157	5785	19.66	19.68
	165	5825	19.45	19.88
11AC40 SISO	151	5755	19.88	20.85
	159	5795	19.09	19.05
11AC80 SISO	155	5775	19.18	20.42
11AX20 SISO	149	5745	20.47	20.61
	157	5785	19.69	19.81
	165	5825	20.31	19.88
11AX40 SISO	151	5755	19.98	20.97
	159	5795	19.1	20.24
11AX80 SISO	155	5775	19.27	17.08

[5.8WIFI Max Conducted Power]Ant 0+Ant 1

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)
11N20 MIMO	149	5745	23.71
	157	5785	23.01
	165	5825	23.07
11N40 MIMO	151	5755	23.28
	159	5795	22.40
11AC20 MIMO	149	5745	23.35
	157	5785	23.31
	165	5825	22.75
11AC40 MIMO	151	5755	23.21
	159	5795	22.41
11AC80 MIMO	155	5775	22.55
11AX20 MIMO	149	5745	23.67
	157	5785	22.39
	165	5825	23.38
11AX40 MIMO	151	5755	23.32
	159	5795	22.48
11AX80 MIMO	155	5775	22.60

7. Measurement Results

2.4GWIFI

11B (Peak) (Ant1)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	18.0	18.0	18.0
Tolerance ±(dB)	1.0	1.0	1.0
11G (Peak) (Ant1)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	18.0	17.0	17.0
Tolerance ±(dB)	1.0	1.0	1.0
11N20 MIMO (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	21.0	20.0	20.0
Tolerance ±(dB)	1.0	1.0	1.0
11N40 MIMO (Peak)			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	21.0	21.0	21.0
Tolerance ±(dB)	1.0	1.0	1.0
11AX20 MIMO (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	21.0	21.0	21.0
Tolerance ±(dB)	1.0	1.0	1.0
11AX40 MIMO (Peak)			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	21.0	21.0	21.0
Tolerance ±(dB)	1.0	1.0	1.0

5.2GWIFI

11A (Peak) (Ant1)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	17.0	17.0	17.0
Tolerance ±(dB)	1.0	1.0	1.0
11N20 MIMO (Peak)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	20.0	20.0	19.0
Tolerance ±(dB)	1.0	1.0	1.0
11N40 MIMO (Peak)			
Channel	Channel 38		Channel 46
Target (dBm)	19.0		19.0
Tolerance ±(dB)	1.0		1.0
11AC20 MIMO (Peak)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	20.0	20.0	20.0
Tolerance ±(dB)	1.0	1.0	1.0
11AC40 MIMO (Peak)			
Channel	Channe38		Channel 46
Target (dBm)	19.0		19.0
Tolerance ±(dB)	1.0		1.0
11AC80 MIMO (Peak)			
Channel	Channel 42		
Target (dBm)	18.0		
Tolerance ±(dB)	1.0		
11AX20 MIMO (Peak)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	20.0	20.0	20.0
Tolerance ±(dB)	1.0	1.0	1.0
11AX40 MIMO (Peak)			
Channel	Channe38		Channel 46
Target (dBm)	19.0		19.0
Tolerance ±(dB)	1.0		1.0
11AX80 MIMO (Peak)			
Channel	Channel 42		
Target (dBm)	18.0		
Tolerance ±(dB)	1.0		

5.8GWIFI

11A (Peak)(Ant0)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	20.0	20.0	20.0
Tolerance ±(dB)	1.0	1.0	1.0
11N20 MIMO (Peak)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	23.0	23.0	23.0
Tolerance ±(dB)	1.0	1.0	1.0
11N40 MIMO (Peak)			
Channel	Channel 151		Channel 159
Target (dBm)	23.0		22.0
Tolerance ±(dB)	1.0		1.0
11AC20 MIMO (Peak)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	23.0	23.0	22.0
Tolerance ±(dB)	1.0	1.0	1.0
11AC40 MIMO (Peak)			
Channel	Channe151		Channel 159
Target (dBm)	23.0		22.0
Tolerance ±(dB)	1.0		1.0
11AC80 MIMO (Peak)			
Channel	Channel 155		
Target (dBm)	22.0		
Tolerance ±(dB)	1.0		
11AX20 MIMO (Peak)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	23.0	22.0	23.0
Tolerance ±(dB)	1.0	1.0	1.0
11AX40 MIMO (Peak)			
Channel	Channe151		Channel 159
Target (dBm)	23.0		22.0
Tolerance ±(dB)	1.0		1.0
11AX80 MIMO (Peak)			
Channel	Channel 155		
Target (dBm)	22.0		
Tolerance ±(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 =20cm, 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/cm2)	MPE Limits (mW/cm2)
		dBm	mW				
IEEE 802.11b	2.462	19.0	79.4328	1.0	1.2589	0.0199	1.0000
IEEE 802.11g	2.412	19.0	79.4328	1.0	1.2589	0.0199	1.0000
IEEE 802.11n HT20	2.412	22.0	158.4893	1.0	1.2589	0.0397	1.0000
IEEE 802.11n HT40	2.452	22.0	158.4893	1.0	1.2589	0.0397	1.0000
IEEE 802.11ax HT20	2.462	22.0	158.4893	1.0	1.2589	0.0397	1.0000
IEEE 802.11ax HT40	2.452	22.0	158.4893	1.0	1.2589	0.0397	1.0000

5.2GWIFI

Band/Mode	f (GHz)	RF output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm2)	MPE Limits (mW/cm2)
		dBm	mW				
11A	5.240	18.0	63.0957	1.0	1.2589	0.0158	1.0000
11N20 MIMO	5.200	21.0	125.8925	1.0	1.2589	0.0315	1.0000
11N40 MIMO	5.230	20.0	100.0000	1.0	1.2589	0.0251	1.0000
11AC20 MIMO	5.240	21.0	125.8925	1.0	1.2589	0.0315	1.0000
11AC40 MIMO	5.230	20.0	100.0000	1.0	1.2589	0.0251	1.0000
11AC80 MIMO	5.210	19.0	79.4328	1.0	1.2589	0.0199	1.0000
11AX20 MIMO	5.240	21.0	125.8925	1.0	1.2589	0.0315	1.0000
11AX40 MIMO	5.230	20.0	100.0000	1.0	1.2589	0.0251	1.0000
11AX80 MIMO	5.210	19.0	79.4328	1.0	1.2589	0.0199	1.0000

5.8GWIFI

Band/Mode	f (GHz)	RF output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm2)	MPE Limits (mW/cm2)
		dBm	mW				
11A	5.825	21.0	125.8925	1.0	1.2589	0.0315	1.0000
11N20 MIMO	5.825	24.0	251.1886	1.0	1.2589	0.0629	1.0000
11N40 MIMO	5.795	24.0	251.1886	1.0	1.2589	0.0629	1.0000
11AC20 MIMO	5.825	24.0	251.1886	1.0	1.2589	0.0629	1.0000
11AC40 MIMO	5.755	24.0	251.1886	1.0	1.2589	0.0629	1.0000
11AC80 MIMO	5.775	23.0	199.5262	1.0	1.2589	0.0500	1.0000
11AX20 MIMO	5.825	24.0	251.1886	1.0	1.2589	0.0629	1.0000
11AX40 MIMO	5.755	24.0	251.1886	1.0	1.2589	0.0629	1.0000
11AX80 MIMO	5.775	23.0	199.5262	1.0	1.2589	0.0500	1.0000

8.2 Simultaneous Transmission MPE

The sample support one 2.4GWLAN&5.2G WLAN&5.8G WLAN, another one 2.4GWLAN&5.2G WLAN&5.8G WLAN and another one BT transmit antenna, so need consider simultaneous transmission;
Simultaneous transmission MPE
According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;
∑∑of MPE ratios ≤ 1.0

Mode	MPE1 (mW/cm2)	MPE2 (mW/cm2)	∑MPE ratios	Limit	Results
2.4G WIFI+5.2G WIFI	0.0397	0.0315	0.0712	1.0	PASS
2.4G WIFI+5.8G WIFI	0.0397	0.0629	0.1026	1.0	PASS
5.2G WIFI+5.8G WIFI	0.0315	0.0629	0.0944	1.0	PASS
2.4G WIFI+2.4G WIFI	0.0397	0.0397	0.0794	1.0	PASS
5.2G WIFI+5.2G WIFI	0.0315	0.0315	0.0630	1.0	PASS
5.8G WIFI+5.8G WIFI	0.0629	0.0629	0.1258	1.0	PASS

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 = $PG/4\pi R^2$

9. Conclusion

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

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