

RF Exposure evaluation

FCC ID	2BMEZ-M-97D
Product Name	WiFi Extender
Model/Type reference	M-97D
Listed Model(s)	M-97A, M-97B, M-97C, M-97E, M-97F, M-97G, M-97H, M-A17, M-A18, M-A19, M-A20, M-A21, M-A25, M-A26, M-A27, M-A28, M-A29, M-A30, M-A31, M-A32, M-A33, M-A35, M-A36, M-A37, M-A38, M-A39, M-95G, M-AC15, M-AC16, M-95R, M-95H, M-95K, M-95Y, M-95W
Exposure category	General population/uncontrolled environment
EUT Type	Production Unit
Device Type	Mobile Device

1. Reference

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: Radio frequency radiation exposure limits.

FCC CFR 47 part2 2.1091: Radio frequency radiation exposure evaluation: mobile devices

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

3. MPE Calculation Method

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

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

4. Antenna Information

FLW8189FSA7-A WiFi module can only use antennas certificated as follows provided by manufacturer;

Antenna No.	Type of antenna:	Gain of the antenna (Max.)	Frequency range:
WIFI	FPC Antenna	1.86 dBi for 2.4GWIFI 1.34dBi for 5.8GWIFI	2400-6000MHz

5. Conducted Output Power

2.4G WIFI:

Mode	Channel	ANT0 Peak Output Power (dBm)	ANT0 Peak Output Power (mW)	ANT1 Peak Output Power (dBm)	ANT1 Peak Output Power (mW)
IEEE 802.11b	1	15.79	37.93	15.10	32.36
	6	15.66	36.81	15.02	31.77
	11	15.89	38.82	15.09	32.28
IEEE 802.11g	1	15.43	34.91	14.73	29.72
	6	15.42	34.83	14.75	29.85
	11	15.51	35.56	14.95	31.26
IEEE 802.11n_20	1	15.35	34.28	14.67	29.31
	6	15.36	34.36	14.66	29.24
	11	15.39	34.59	14.83	30.41
IEEE 802.11n_40	3	15.46	35.16	14.64	29.11
	6	15.51	35.56	15.93	39.17
	9	15.82	38.19	14.21	26.36

5GWIFI(U-NII-3):

Mode	Channel	ANT0 Output Power (dBm)	ANT0 Output Power (mW)	ANT1 Output Power (dBm)	ANT1 Output Power (mW)
IEEE 802.11a	149	15.847	38.43	14.73	29.72
	157	14.122	25.83	13.728	23.59
	165	14.259	26.66	13.622	23.03
IEEE 802.11n_20	149	15.501	35.49	14.342	27.18
	157	14.729	29.71	13.423	21.99
	165	14.692	29.46	13.381	21.78
IEEE 802.11n_40	151	14.975	31.44	13.649	23.17
	159	14.495	28.15	13.393	21.84
IEEE 802.11ac_20	149	15.536	35.78	14.074	25.55
	157	14.772	30.01	13.627	23.05
	165	14.661	29.25	14.306	26.95
IEEE 802.11ac_40	151	14.981	31.48	13.097	20.40
	159	14.537	28.42	13.243	21.10
IEEE 802.11ac_80	155	13.198	20.88	11.962	15.71

Manufacturing Tolerance

2.4GWIFI:

WIFI ANT0:

IEEE 802.11b			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	15	15	15
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11g			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	15	15	15
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n_20			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	15	15	15
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n_40			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	15	15	15
Tolerance $\pm$ (dB)	1.0	1.0	1.0

WIFI ANT1:

IEEE 802.11b			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	15	15	15
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11g			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	14	14	14
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n_20			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	14	14	14
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n_40			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	14	15	14
Tolerance $\pm$ (dB)	1.0	1.0	1.0

5GWIFI(U-NII-3):

WIFI ANT0:

IEEE 802.11a			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	15	14	14
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n_20			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	15	14	14
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n_40			
Channel	Channel 151	Channel 159	
Target (dBm)	14	14	
Tolerance $\pm$ (dB)	1.0	1.0	
IEEE 802.11ac_20			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	15	14	14
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11ac_40			
Channel	Channel 151	Channel 159	
Target (dBm)	14	14	
Tolerance $\pm$ (dB)	1.0	1.0	
IEEE 802.11ac_80			
Channel	Channel 155		
Target (dBm)	13		
Tolerance $\pm$ (dB)	1.0		

WIFI ANT1:

IEEE 802.11a			
Channel	Channel 149	Channel 157	Channel 165

Target (dBm)	14	13	13
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n_20			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	14	13	13
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n_40			
Channel	Channel 151	Channel 159	
Target (dBm)	13	13	
Tolerance $\pm$ (dB)	1.0	1.0	
IEEE 802.11ac_20			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	14	13	14
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11ac_40			
Channel	Channel 151	Channel 159	
Target (dBm)	13	13	
Tolerance $\pm$ (dB)	1.0	1.0	
IEEE 802.11ac_80			
Channel	Channel 155		
Target (dBm)	11		
Tolerance $\pm$ (dB)	1.0		

2.4GWIFI MIMO(WIFI ANT0+WIFI ANT1)

IEEE 802.11n_20			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	16	16	16
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n_40			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	16	17	17
Tolerance $\pm$ (dB)	1.0	1.0	1.0

5GWIFI(U-NII-3):

MIMO(WIFI ANT0+WIFI ANT1)

IEEE 802.11n_20			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	17	17	17
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n_40			
Channel	Channel 151	Channel 159	
Target (dBm)	17	16	
Tolerance $\pm$ (dB)	1.0	1.0	
IEEE 802.11ac_20			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	17	17	17
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11ac_40			
Channel	Channel 151	Channel 159	
Target (dBm)	17	16	
Tolerance $\pm$ (dB)	1.0	1.0	
IEEE 802.11ac_80			
Channel	Channel 155		
Target (dBm)	15		
Tolerance $\pm$ (dB)	1.0		

6. Standalone MPE Result

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, $r = 20\text{cm}$, the RF power density can be obtained.

2.4GWIFI

BAND/Mode		Tune Up (dBm)	Antenna Gain(dBi)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)	Result
802.11b	ANT0	16	1.86	0.01215	1.0000	PASS
	ANT1	16	1.86	0.01215	1.0000	PASS
802.11g	ANT0	16	1.86	0.01215	1.0000	PASS
	ANT1	15	1.86	0.00965	1.0000	PASS
802.11n (HT20)	ANT0+ ANT1	16	1.86	0.01215	1.0000	PASS
802.11n (HT40)	ANT0+ ANT1	17	1.86	0.01530	1.0000	PASS

5GWIFI(U-NII-3)

BAND/Mode		Tune Up (dBm)	Antenna Gain(dBi)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)	Result
802.11a	ANT0	16	1.34	0.01078	1.0	PASS
	ANT1	15	1.34	0.00857	1.0	PASS
802.11n (HT20)	ANT0+ ANT1	18	1.34	0.01709	1.0	PASS
802.11n (HT40)	ANT0+ ANT1	18	1.34	0.01709	1.0	PASS
802.11ac (HT20)	ANT0+ ANT1	18	1.34	0.01709	1.0	PASS
802.11ac (HT40)	ANT0+ ANT1	18	1.34	0.01709	1.0	PASS
802.11ac (HT80)	ANT0+ ANT1	16	1.34	0.01078	1.0	PASS

Remark:

1. Output power (Peak) including turn-up tolerance;
2. MPE evaluate distance is 20cm from user manual provide by manufacturer.

7. Conclusion

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

-----End of the report-----