RF Exposure evaluation

FCC ID	2BNUT-AW869C
Product Name	5.8GHz/5.1GHz/2.4GHz WLAN/Bluetooth module
Model/Type reference	AW869C
Listed Model(s)	N/A
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/cm²)	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/f2)*	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/cm²)	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/f2)*	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

$S=PG/4\pi R^2$

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:
B70L	External Antenna	1.78dBi	2400-5850MHz

5. Manufacturing Tolerance

BT:

DH5			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	8	9	8
Tolerance ±(dB)	1.0	1.0	1.0
2DH5			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	8	8	7
Tolerance ±(dB)	1.0	1.0	1.0
3DH5			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	8	8	8
Tolerance ±(dB)	1.0	1.0	1.0

BLE:

BLE 1M			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	8	9	8
Tolerance ±(dB)	1.0	1.0	1.0
BLE 2M			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	8	8	9
Tolerance ±(dB)	1.0	1.0	1.0

2.4GWIFI:

IEEE 802.11b			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	18	17	17
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11g			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	18	18	18
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n_20			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	17	18	18
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n_40			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	18	19	18
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11ax_20			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	18	19	18
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11ax_40			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	18	19	19
Tolerance ±(dB)	1.0	1.0	1.0

5GWIFI

IEEE 802.11a			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	12	9	9
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n_20			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	7	7	7
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n_40			
Channel	Channel 38		Channel 46
Target (dBm)	7		4
Tolerance ±(dB)	1.0		1.0
IEEE 802.11ac_20			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	5	4	15
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11ac_40			
Channel	Channel 38		Channel 46
Target (dBm)	2		2
Tolerance ±(dB)	1.0		1.0

IEEE 802.11a						
Channel	Channel 52	Channel 60	Channel 64	Channel 100	Channel 116	Channel 140
Target (dBm)	5	5	5	10	10	10
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11n_20						
Channel	Channel 52	Channel 60	Channel 64	Channel 100	Channel 116	Channel 140
Target (dBm)	2	0	0	4	2	2
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0

IEEE 802.11n_40				
Channel	Channel 54	Channel 62	Channel 110	Channel 134
Target (dBm)	4	-1	2	0
Tolerance ±(dB)	1.0	1.0	1.0	1.0

IEEE 802.11ac_20						
Channel	Channel 52	Channel 60	Channel 64	Channel 100	Channel 116	Channel 140
Target (dBm)	5	5	15	7	10	16
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0

IEEE 802.11ac_40				
Channel	Channel 54	Channel 62	Channel 110	Channel 134
Target (dBm)	1	-1	-2	0
Tolerance ±(dB)	1.0	1.0	1.0	1.0

IEEE 802.11ac_80				
Channel	42	58	106	122
Target (dBm)	-2	1	-3	6
Tolerance ±(dB)	1.0	1.0	1.0	1.0

IEEE 802.11ax_20						
Channel	Channel 52	Channel 60	Channel 64	Channel 100	Channel 116	Channel 140
Target (dBm)	5	4	4	2	5	6
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0

IEEE 802.11ax_40					
Channel	Channel 54	Channel 62	Channel 102	Channel 110	Channel 134
Target (dBm)	1	-3	1	0	2
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0

IEEE 802.11ax_80			
Channel	58	106	122
Target (dBm)	1	-3	6
Tolerance ±(dB)	1.0	1.0	1.0

IEEE 802.11a			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	9	9	9
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n_20			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	0	0	0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n_40			
Channel	Channel 151	Channel 159	
Target (dBm)	12	5	
Tolerance ±(dB)	1.0	1.0	
IEEE 802.11ac_20			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	8	8	4
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11ac_40			

Channel	Channel 151	Channel 159
Target (dBm)	6	5
Tolerance ±(dB)	1.0	1.0
IEEE 802.11ac_80		
Channel	Channel 155	
Target (dBm)	2	
Tolerance ±(dB)	1.0	
IEEE 802.11ax_20		
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	8	9	0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11ax_40		
Channel	Channel 151	Channel 159
Target (dBm)	6	-4
Tolerance ±(dB)	1.0	1.0
IEEE 802.11ax_80		
Channel	Channel 155	
Target (dBm)	2	
Tolerance ±(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 =20cm, as well as the gain of the used antenna is 1.78dBi, the RF power density can be obtained.

Mode	Output power		Antenna Gain (dBi)	Antenna Gain(linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
EDR	10	10	1.78	1.51	0.00300	1.0000
BLE	10	10	1.78	1.51	0.00238	1.0000
2.4GWIFI	20	100	1.78	1.51	0.01891	1.0000
5GWIFI	17	50.12	0.84	1.21	0.00961	1.0000

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------