

FCC ID : 2AOKI-WF8221U1

1. RF EXPOSURE EVALUATION

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) Radiation as specified in §1.1307(b).

Limits for Maximum Permissible Exposure (MPE).

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density(mW/cm²)	Average Time
(A) Limits for Occupational/Control Exposures				
300-1500	--	--	F/300	6
1500-100000	--	--	5	6
(B) Limits for General Population/Uncontrol Exposures				
300-1500	--	--	F/1500	6
1500-100000	--	--	1	30

Friis transmission formula: $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2)$

Where

P_d = Power density in mW/cm².

P_{out} =output power to antenna in mW.

G = Numeric gain of the antenna relative to isotropic antenna.

π =3.1416.

R = distance between observation point and center of the radiator in 20cm.

P_d the limit of MPE, 1mW/cm². If we know the maximum gain of the nd total. power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

2. EUT TECHNICAL DESCRIPTION

Product Name:	WIFI 6E Module
Model Number:	WF8221-U1
Power Supply:	DC 5V
Temperature Range:	-10℃~70℃

Bluetooth Version:	V5.2
Data Rate:	1Mbps for GFSK modulation 2Mbps for pi/4-DQPSK modulation 3Mbps for 8DPSK modulation
Modulation:	GFSK, pi/4-DQPSK, 8DPSK
Operating Frequency Range:	2402-2480MHz
Number of Channels:	79 channels

BLE Version:	V5.2
Device Type:	Bluetooth with BLE mode
Data Rate :	1Mbps and 2Mbps
Modulation:	GFSK
Operating Frequency Range:	2402-2480MHz
Number of Channels:	40 Channels

IEEE 802.11 WLAN Mode Supported:	802.11b 802.11g 802.11n(20MHz channel bandwidth) 802.11n(40MHz channel bandwidth) 802.11ax(20MHz channel bandwidth) 802.11ax(40MHz channel bandwidth)
Modulation:	DSSS, OFDM, OFDMA
Operating Frequency Range:	2412-2462MHz for 802.11b/g/n(HT20)/ax(HT20) 2422-2452MHz for 802.11b/g/n(HT40)/ax(HT40)
Number of Channels:	11 channels for 802.11b/g/n(HT20)/ax(HT20) 7 Channels for 802.11n(HT40)/ax(HT40)

WIFI Type:	UNII-1: 5150MHz-5250MHz Band UNII-2A: 5250MHz-5350MHz Band UNII-2C: 5470MHz-5725MHz Band UNII-3: 5725MHz-5850MHz Band
-------------------	--

WLAN Supported:	IEEE 802.11a IEEE 802.11n(20MHz channel bandwidth) IEEE 802.11n(40MHz channel bandwidth) IEEE 802.11ac(20MHz channel bandwidth) IEEE 802.11ac(40MHz channel bandwidth) IEEE 802.11ac(80MHz channel bandwidth) IEEE 802.11ax(20MHz channel bandwidth) IEEE 802.11ax(40MHz channel bandwidth) IEEE 802.11ax(80MHz channel bandwidth)
Frequency Range:	5150MHz-5250MHz Band: 5180-5240MHz for 802.11a 5180-5240MHz for 802.11n(20) 5190-5230MHz for 802.11n(40) 5180-5240MHz for 802.11ac(20) 5190-5230MHz for 802.11ac(40) 5210MHz for 802.11ac(80) 5180-5240MHz for 802.11ax(20) 5190-5230MHz for 802.11ax(40) 5210MHz for 802.11ax(80) 5250MHz-5350MHz Band: 5260-5320MHz for 802.11a 5260-5320MHz for 802.11n(20) 5270-5310MHz for 802.11n(40) 5260-5320MHz for 802.11ac(20) 5270-5310MHz for 802.11ac(40) 5290MHz for 802.11ac(80) 5260-5320MHz for 802.11ax(20) 5270-5310MHz for 802.11ax(40) 5290MHz for 802.11ax(80) 5470MHz-5725MHz Band: 5500-5700MHz for 802.11a 5500-5700MHz for 802.11n(20) 5510-5670MHz for 802.11n(40) 5500-5700MHz for 802.11ac(20) 5510-5670MHz for 802.11ac(40) 5530-5610MHz for 802.11ac(80) 5500-5700MHz for 802.11ax(20) 5510-5670MHz for 802.11ax(40) 5530-5610MHz for 802.11ax(80) 5725MHz-5850MHz Band: 5745-5825MHz for 802.11a 5745-5825MHz for 802.11n(20) 5755-5795MHz for 802.11n(40) 5745-5825MHz for 802.11ac(20) 5755-5795MHz for 802.11ac(40) 5775MHz for 802.11ac(80) 5745-5825MHz for 802.11ax(20) 5755-5795MHz for 802.11ax(40) 5775MHz for 802.11ax(80)
Modulation:	OFDM, OFDMA
TPC Function:	Not Support
Beamforming:	Not Support

DFS Function:	Slave
Smart System:	MIMO

WiFi Type:	UNII-5 Band: 5925 ~ 6425 MHz UNII-6 Band: 6425 ~ 6525 MHz UNII-7 Band: 6525 ~ 6875 MHz UNII-8 Band: 6875 ~ 7125 MHz
WLAN Supported:	802.11ax(20)/ax(40)/ax(80)
Modulation:	OFDMA
Channel Number:	For 5925 ~ 6425MHz band: Channel 1 - 93 For 6425 ~ 6525MHz Band: Channel 97 - 119 For 6525 ~ 6875MHz Band: Channel 117 - 187 For 6875 ~ 7125MHz band: Channel 189 - 233
Smart System	MIMO

3. Measurement Result

Mode	Frequency (MHz)	Max Power (dBm)	Antenna gain (dBi)	Antenna Gain Numeric	R (cm)	Evaluation result (mW/cm2)	Power density Limits (mW/cm2)
BT	2402	11.01	-0.87	0.82	20	0.002	1.0000
2.4G WIFI	2412	24.27	4.21	2.64	20	0.140	1.0000
5G WIFI	5180	14.55	7.95	6.24	20	0.035	1.0000
WIFI 6E	5925	11.55	5.86	3.85	20	0.011	1.0000

NOTE:

(1) All the modes are tested, only the worst data are described in the table.

(2) 2.4G WIFI: Ant1: 1.45dBi, Ant2: 0.94dBi, Directional gain = 4.21dBi

(3) 5G WIFI: Ant1: 4.54dBi, Ant2: 5.32dBi, Directional gain = 7.95dBi

(4) WIFI 6E: Ant1: 3.07dBi, Ant2: 2.62dBi , Directional gain = 5.86 dBi

Conclusion of simultaneous transmitter:

They can transmit simultaneously, the formula of calculated the MPE is:

$CPD1/LPD1 + CPD2/LPD2 + \dots \text{etc.} < 1$

CPD = Calculation power density

LPD = Limit of power density

Therefore the worst-case situation is $0.002/1 + 0.140/1 + 0.035/1 + 0.011/1 = 0.188$, which is less than 1, this confirmed that the device comply with FCC 1.1310 MPE limit.

----- The End -----