

FCC ID : 2APR4-X6

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 antenna and total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

2. EUT TECHNICAL DESCRIPTION

Characteristics	Description
Product	Mercku 5G CPE X6
Model Number	X1NA0
Power Supply	AC 120V/60Hz by adapter Adapter: Model: P120W2000U Input: 100-240V~50/60Hz, 0.6A Output: 12V, 2A, 24W
Temperature Range	0°C ~ 40°C

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 with DBPSK/DQPSK/CCK for 802.11b OFDM with BPSK/QPSK/16QAM/64QAM for 802.11g/n/ax
Operating Frequency Range	2412-2462MHz for 802.11b/g/n(HT20)/ax(HT20) 2422-2452MHz for 802.11n(HT40)/ax(HT40)
Number of Channels	11 channels for 802.11b/g/n(HT20)/ax(HT20) 7 Channels for 802.11n(HT40)/ax(HT40)
Smart system	MIMO
Antenna Type	Integrated Antenna
Antenna Gain	Ant1: 2.84dBi, Ant2: 2.84dBi

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 802.11ac(160MHz channel bandwidth) IEEE 802.11ax(20MHz channel bandwidth) IEEE 802.11ax(40MHz channel bandwidth) IEEE 802.11ax(80MHz channel bandwidth) IEEE 802.11ax(160MHz channel bandwidth)
Modulation	OFDM with BPSK/QPSK/16QAM/64QAM for 802.11a/n OFDM with BPSK/QPSK/16QAM/64QAM/256QAM for 802.11ac/ax

Frequency Range	5150MHz-5250MHz Band
	5180-5240MHz for 802.11a 5180-5240MHz for 802.11n(HT20) 5190-5230MHz for 802.11n(HT40) 5180-5240MHz for 802.11ac(HT20) 5190-5230MHz for 802.11ac(HT40) 5210MHz for 802.11ac(HT80) 5180-5240MHz for 802.11ax(HT20) 5190-5230MHz for 802.11ax(HT40) 5210MHz for 802.11ax(HT80)
	5250MHz-5350MHz Band
	5260-5320MHz for 802.11a 5260-5320MHz for 802.11n(HT20) 5270-5310MHz for 802.11n(HT40) 5260-5320MHz for 802.11ac(HT20) 5270-5310MHz for 802.11ac(HT40) 5290MHz for 802.11ac(HT80) 5250MHz for 802.11ac(HT160) 5260-5320MHz for 802.11ax(HT20) 5270-5310MHz for 802.11ax(HT40) 5290MHz for 802.11ax(HT80) 5250MHz for 802.11ax(HT160)
	5470MHz-5725MHz Band
	5500-5700MHz for 802.11a 5500-5700MHz for 802.11n(HT20) 5510-5670MHz for 802.11n(HT40) 5500-5700MHz for 802.11ac(HT20) 5510-5670MHz for 802.11ac(HT40) 5530-5610MHz for 802.11ac(HT80) 5570MHz for 802.11ac(HT160) 5500-5700MHz for 802.11ax(HT20) 5510-5670MHz for 802.11ax(HT40) 5530-5610MHz for 802.11ax(HT80) 5570MHz for 802.11ax(HT160)
	5725MHz-5850MHz Band
	5745-5825MHz for 802.11a 5745-5825MHz for 802.11n(HT20) 5755-5795MHz for 802.11n(HT40) 5745-5825MHz for 802.11ac(HT20) 5755-5795MHz for 802.11ac(HT40) 5775MHz for 802.11ac(HT80) 5745-5825MHz for 802.11ax(HT20) 5755-5795MHz for 802.11ax(HT40) 5775MHz for 802.11ax(HT80)
TPC Function	Applicable
Smart system	MIMO
Beamforming	Not Applicable
Antenna Type	Integrated Antenna
Antenna Gain	Ant1: 5.31dBi, Ant2: 5.31dBi

4G Band:	LTE B2/B4/B5/B7/B12/B13/B30/B41/B48/B66/B71
Modulation:	QPSK, 16QAM, 64QAM, 256QAM
Operating Frequency Range(s):	LTE Band 2: Tx: 1850-1910MHz, Rx: 1930-1990MHz LTE Band 4: Tx:1710-1755MHz, Rx: 2110-2155MHz LTE Band 5: Tx: 824-849MHz, Rx: 875-885MHz LTE Band 7: Tx: 2500-2570MHz, Rx: 2620-2690MHz LTE Band 12: Tx: 699-716MHz, Rx: 729-746MHz LTE Band 13: Tx: 777-787MHz, Rx: 746-756MHz LTE Band 30: Tx: 2307-2313MHz, Rx: 2352-2358MHz LTE Band 41: Tx/Rx: 2496-2690MHz LTE Band 48: Tx/Rx: 3552-3698MHz LTE Band 66: Tx/Rx: 1710-1780MHz LTE Band 71: Tx/Rx: 663~698MHz
Antenna Type:	Integrated Antenna
Antenna Gain:	LTE Band B2: Ant1: 4.98dBi, Ant2: 4.98dBi LTE Band B4: Ant1: 4.98dBi, Ant2: 4.98dBi LTE Band B5: Ant1: 4.66dBi, Ant2: 4.66dBi LTE Band B7: Ant1: 5.46dBi, Ant2: 5.46dBi LTE Band B12: Ant1: 4.66dBi, Ant2: 4.66dBi LTE Band B13: Ant1: 4.66dBi, Ant2: 4.66dBi LTE Band B30: Ant1: 5.46dBi, Ant2: 5.46dBi LTE Band B41: Ant1: 5.46dBi, Ant2: 5.46dBi LTE Band B48: Ant1: 5.33dBi, Ant2: 5.33dBi LTE Band B66: Ant1: 4.98dBi, Ant2: 4.98dBi LTE Band B71: Ant1: 4.66dBi, Ant2: 4.66dBi

5G NR Band:	n2, n5, n7, n12, n14, n25, n30, n41, n48, n66, n71, n77, n78
NR NSA Band :	n2, n5, n7, n12, n14, n25, n30, n41, n48, n66, n71, n77, n78
Modulation:	QPSK, 16QAM, 64QAM, 256QAM
Operating Frequency Range(s):	NR Band n2: Tx: 1850~1910MHz/ Rx: 1930~1990MHz NR Band n5: Tx: 824~849MHz/ Rx: 875~885MHz NR Band n7: Tx: 2500~2570MHz/ Rx: 2620~2690MHz NR Band n12: Tx: 699~716MHz/ Rx: 729~746MHz NR Band n14: Tx: 788~798MHz/ Rx: 758~768MHz NR Band n25: Tx: 1850~1915MHz/ Rx: 1930~1995MHz NR Band n30: Tx: 2305~2315MHz/ Rx: 2350~2360MHz NR Band n41: Tx/Rx: 2496~2690MHz NR Band n48: Tx/Rx: 3552~3698MHz NR Band n66: Tx/Rx: 1710~1780MHz NR Band n71: Tx/Rx: 663~698MHz NR Band n77: Tx/Rx: 3450~3980MHz NR Band n78: Tx/Rx: 3300~3800MHz
Antenna Type:	Integrated Antenna
Antenna Gain:	NR Band n2: Ant1: 4.98dBi, Ant2: 4.98dBi NR Band n5: Ant1: 4.66dBi, Ant2: 4.66dBi NR Band n7: Ant1: 5.46dBi, Ant2: 5.46dBi NR Band n12: Ant1: 4.66dBi, Ant2: 4.66dBi NR Band n14: Ant1: 4.66dBi, Ant2: 4.66dBi NR Band n25: Ant1: 4.98dBi, Ant2: 4.98dBi NR Band n30: Ant1: 5.46dBi, Ant2: 5.46dBi NR Band n41: Ant1: 5.46dBi, Ant2: 5.46dBi NR Band n48: Ant1: 5.33dBi, Ant2: 5.33dBi NR Band n66: Ant1: 4.98dBi, Ant2: 4.98dBi NR Band n71: Ant1: 4.66dBi, Ant2: 4.66dBi NR Band n77: Ant1: 5.33dBi, Ant2: 5.33dBi NR Band n78: Ant1: 5.33dBi, Ant2: 5.33dBi
Power Supply	AC 120V/60Hz by adapter Adapter : Model: P120W2000U Input: 100-240V~50/60Hz, 0.6A Output: 12V, 2A, 24W
Temperature Extreme Range:	0°C ~ 40°C

3. Measurement Result

Mode	PG (mW)	Tune-up Tolerances (dBm)	Antenna Gain (dBi)	Antenna Gain Numeric	R (cm)	Evaluation result (mW/cm ²)	Power density Limits (mW/cm ²)
2.4G WIFI	81	20	2.84	1.92	20	0.0383	1.0000
5G WIFI	134	22	5.31	3.40	20	0.1071	1.0000
LTE B2	252.9	25	4.98	3.15	20	0.1980	1.0000
LTE B4	208.9	25	4.98	3.15	20	0.1980	1.0000
LTE B5	191	25	4.66	2.92	20	0.1840	0.5510
LTE B7	223.9	25	5.46	3.52	20	0.2212	1.0000
LTE B12	177.8	25	4.66	2.92	20	0.1840	0.4693
LTE B13	175.4	25	4.66	2.92	20	0.1840	0.5197
LTE B30	170.6	25	5.46	3.52	20	0.2212	1.0000
LTE B41	437.5	25	5.46	3.52	20	0.2212	1.0000
LTE B48	147.9	25	5.33	3.41	20	0.2146	1.0000
LTE B66	208.9	25	4.98	3.15	20	0.1980	1.0000
LTE B71	175.8	25	4.66	2.92	20	0.1840	0.4437
NR n2	252.9	25	4.98	3.15	20	0.1980	1.0000
NR n5	191	25	4.66	2.92	20	0.1840	0.5510
NR n7	223.9	25	5.46	3.52	20	0.2212	1.0000
NR n12	177.8	25	4.66	2.92	20	0.1840	0.4693
NR n14	178.2	25	4.66	2.92	20	0.1840	0.5287
NR n25	221.3	25	4.98	3.15	20	0.1980	1.0000
NR n30	170.6	25	5.46	3.52	20	0.2212	1.0000
NR n41	437.5	25	5.46	3.52	20	0.2212	1.0000
NR n48	169.8	25	5.33	3.41	20	0.2146	1.0000
NR n66	208.9	25	4.98	3.15	20	0.1980	1.0000
NR n71	175.8	25	4.66	2.92	20	0.1840	0.4437
NR n77	528.4	28	5.33	3.41	20	0.4283	1.0000
NR n78	539.5	28	5.33	3.41	20	0.4283	1.0000

Note: All the modes are tested, only the worst data are described in the table.

Conclusion of simultaneous transmitter:

Both of the module 1 and module 2 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 $0.1071/1 + 0.4283/1 = 0.5354$, which is less than 1, this confirmed that the device comply with FCC 1.1310 MPE limit.

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