

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/cm ²) | 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: $P_d = (P_{out} * G) / (4 * \pi * R^2)$

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, 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 |

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| 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 |

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| 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 |

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| 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 |

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

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| 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:

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

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 -----