

## FCC 47 CFR MPE REPORT

Xiamen Prima Technology Inc.

WIFI MODULE

Model Number: WFM-001

FCC ID: 2ADID-WFM001

|                          |                                                                     |
|--------------------------|---------------------------------------------------------------------|
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|                          |                                                                     |
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|                 |                       |
|-----------------|-----------------------|
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## Maximum Permissible Exposure

### 1. Applicable Standards

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2m normally can be maintained between the user and the device.

#### 1.1. Limits for Maximum Permissible Exposure (MPE)

##### (a) Limits for Occupational/Controlled Exposure

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/cm <sup>2</sup> ) | Averaging Times   E   <sup>2</sup> ,   H   <sup>2</sup> or S (minutes) |
|-----------------------|-----------------------------------|-----------------------------------|-----------------------------------------|------------------------------------------------------------------------|
| 0.3-3.0               | 614                               | 1.63                              | (100)*                                  | 6                                                                      |
| 3.0-30                | 1842/f                            | 4.89/f                            | (900/f)*                                | 6                                                                      |
| 30-300                | 61.4                              | 0.163                             | 1.0                                     | 6                                                                      |
| 300-1500              |                                   |                                   | F/300                                   | 6                                                                      |
| 1500-10000            |                                   |                                   | 5                                       | 6                                                                      |

##### (b) Limits for General Population / Uncontrolled Exposure

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/cm <sup>2</sup> ) | Averaging Times   E   <sup>2</sup> ,   H   <sup>2</sup> or S (minutes) |
|-----------------------|-----------------------------------|-----------------------------------|-----------------------------------------|------------------------------------------------------------------------|
| 0.3-1.34              | 614                               | 1.63                              | (100)*                                  | 30                                                                     |
| 1.34-30               | 824/f                             | 2.19/f                            | (180/f)*                                | 30                                                                     |
| 30-300                | 27.5                              | 0.073                             | 0.2                                     | 30                                                                     |
| 300-1500              |                                   |                                   | F/1500                                  | 30                                                                     |
| 1500-10000            |                                   |                                   | 1.0                                     | 30                                                                     |

Note: f=frequency in MHz; \*Plane-wave equivalent power density

## 1.2. MPE Calculation Method

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \quad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric Field (V/m)

P = Peak RF output Power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained

## 2. Conducted Power Result

### Antenna 1

| Mode                              | Frequency<br>(MHz) | Peak output power<br>(dBm) | Peak output<br>power (mW) | Target power<br>(dBm) | Antenna gain |          |
|-----------------------------------|--------------------|----------------------------|---------------------------|-----------------------|--------------|----------|
|                                   |                    |                            |                           |                       | (dBi)        | (Linear) |
| GFSK                              | 2402               | 5.99                       | 3.9719                    | $5 \pm 1$             | 2            | 1.58489  |
|                                   | 2441               | 5.42                       | 3.4834                    | $5 \pm 1$             | 2            | 1.58489  |
|                                   | 2480               | 4.78                       | 3.0061                    | $4 \pm 1$             | 2            | 1.58489  |
| 8-DPSK                            | 2402               | 7.69                       | 5.8749                    | $7 \pm 1$             | 2            | 1.58489  |
|                                   | 2441               | 7.05                       | 5.0699                    | $7 \pm 1$             | 2            | 1.58489  |
|                                   | 2480               | 6.52                       | 4.4875                    | $6 \pm 1$             | 2            | 1.58489  |
| BLE<br>GFSK                       | 2402               | 9.77                       | 9.4842                    | $9 \pm 1$             | 2            | 1.58489  |
|                                   | 2440               | 8.89                       | 7.7446                    | $8 \pm 1$             | 2            | 1.58489  |
|                                   | 2480               | 8.21                       | 6.6222                    | $8 \pm 1$             | 2            | 1.58489  |
| IEEE<br>802.11b                   | 2412               | 14.58                      | 28.7078                   | $16 \pm 1$            | 2            | 1.58489  |
|                                   | 2437               | 14.42                      | 27.6694                   | $15 \pm 1$            | 2            | 1.58489  |
|                                   | 2462               | 14.53                      | 28.3792                   | $16 \pm 1$            | 2            | 1.58489  |
| IEEE<br>802.11g                   | 2412               | 17.68                      | 58.6138                   | $19 \pm 1$            | 2            | 1.58489  |
|                                   | 2437               | 17.53                      | 56.6239                   | $19 \pm 1$            | 2            | 1.58489  |
|                                   | 2462               | 17.66                      | 58.3445                   | $19 \pm 1$            | 2            | 1.58489  |
| IEEE<br>802.11n<br>HT20<br>(2.4G) | 2412               | 16.36                      | 43.2514                   | $20 \pm 1$            | 2            | 1.58489  |
|                                   | 2437               | 16.49                      | 44.5656                   | $20 \pm 1$            | 2            | 1.58489  |
|                                   | 2462               | 16.30                      | 42.6580                   | $20 \pm 1$            | 2            | 1.58489  |
| IEEE<br>802.11n<br>HT40<br>(2.4G) | 2422               | 15.53                      | 35.7273                   | $19 \pm 1$            | 2            | 1.58489  |
|                                   | 2437               | 15.56                      | 35.9749                   | $19 \pm 1$            | 2            | 1.58489  |
|                                   | 2452               | 15.44                      | 34.9945                   | $19 \pm 1$            | 2            | 1.58489  |
| IEEE<br>802.11a                   | 5180               | 11.65                      | 14.6218                   | $11 \pm 1$            | 2            | 1.58489  |
|                                   | 5200               | 11.49                      | 14.0929                   | $11 \pm 1$            | 2            | 1.58489  |
|                                   | 5240               | 11.56                      | 14.3219                   | $11 \pm 1$            | 2            | 1.58489  |
|                                   | 5745               | 11.32                      | 13.5519                   | $11 \pm 1$            | 2            | 1.58489  |
|                                   | 5785               | 12.02                      | 15.9221                   | $12 \pm 1$            | 2            | 1.58489  |
|                                   | 5825               | 11.96                      | 15.7036                   | $11 \pm 1$            | 2            | 1.58489  |

| Mode                            | Frequency<br>(MHz) | Peak output power<br>(dBm) | Peak output<br>power (mW) | Target power<br>(dBm) | Antenna gain |          |
|---------------------------------|--------------------|----------------------------|---------------------------|-----------------------|--------------|----------|
|                                 |                    |                            |                           |                       | (dBi)        | (Linear) |
| IEEE<br>802.11n<br>HT20<br>(5G) | 5180               | 11.64                      | 14.5881                   | $11 \pm 1$            | 2            | 1.58489  |
|                                 | 5200               | 11.63                      | 14.5546                   | $11 \pm 1$            | 2            | 1.58489  |
|                                 | 5240               | 11.74                      | 14.9279                   | $11 \pm 1$            | 2            | 1.58489  |
|                                 | 5745               | 10.37                      | 10.8893                   | $10 \pm 1$            | 2            | 1.58489  |
|                                 | 5785               | 11.04                      | 12.7057                   | $11 \pm 1$            | 2            | 1.58489  |
|                                 | 5825               | 11.55                      | 14.2889                   | $11 \pm 1$            | 2            | 1.58489  |
| IEEE<br>802.11ac<br>VHT20       | 5180               | 12.05                      | 16.0325                   | $12 \pm 1$            | 2            | 1.58489  |
|                                 | 5200               | 11.83                      | 15.2405                   | $11 \pm 1$            | 2            | 1.58489  |
|                                 | 5240               | 11.76                      | 14.9968                   | $11 \pm 1$            | 2            | 1.58489  |
|                                 | 5745               | 10.69                      | 11.7220                   | $10 \pm 1$            | 2            | 1.58489  |
|                                 | 5785               | 11.36                      | 13.6773                   | $11 \pm 1$            | 2            | 1.58489  |
|                                 | 5825               | 11.53                      | 14.2233                   | $11 \pm 1$            | 2            | 1.58489  |
| IEEE<br>802.11n<br>HT40<br>(5G) | 5190               | 11.40                      | 13.8038                   | $11 \pm 1$            | 2            | 1.58489  |
|                                 | 5230               | 11.31                      | 13.5207                   | $11 \pm 1$            | 2            | 1.58489  |
|                                 | 5755               | 10.19                      | 10.4472                   | $10 \pm 1$            | 2            | 1.58489  |
|                                 | 5795               | 10.78                      | 11.9674                   | $10 \pm 1$            | 2            | 1.58489  |
| IEEE<br>802.11ac<br>VHT40       | 5190               | 11.39                      | 13.7721                   | $11 \pm 1$            | 2            | 1.58489  |
|                                 | 5230               | 11.31                      | 13.5207                   | $11 \pm 1$            | 2            | 1.58489  |
|                                 | 5755               | 10.16                      | 10.3753                   | $10 \pm 1$            | 2            | 1.58489  |
|                                 | 5795               | 10.53                      | 11.2980                   | $10 \pm 1$            | 2            | 1.58489  |
| IEEE<br>802.11ac<br>VHT80       | 5210               | 11.06                      | 12.7644                   | $11 \pm 1$            | 2            | 1.58489  |
|                                 | 5775               | 10.15                      | 10.3514                   | $10 \pm 1$            | 2            | 1.58489  |

**Antenna 2**

| Mode                              | Frequency<br>(MHz) | Peak output power<br>(dBm) | Peak output<br>power (mW) | Target power<br>(dBm) | Antenna gain |          |
|-----------------------------------|--------------------|----------------------------|---------------------------|-----------------------|--------------|----------|
|                                   |                    |                            |                           |                       | (dBi)        | (Linear) |
| IEEE<br>802.11b                   | 2412               | 16.18                      | 41.4954                   | $16 \pm 1$            | 2            | 1.58489  |
|                                   | 2437               | 15.97                      | 39.5367                   | $15 \pm 1$            | 2            | 1.58489  |
|                                   | 2462               | 16.22                      | 41.8794                   | $16 \pm 1$            | 2            | 1.58489  |
| IEEE<br>802.11g                   | 2412               | 19.28                      | 84.7227                   | $19 \pm 1$            | 2            | 1.58489  |
|                                   | 2437               | 19.30                      | 85.1138                   | $19 \pm 1$            | 2            | 1.58489  |
|                                   | 2462               | 19.52                      | 89.5365                   | $19 \pm 1$            | 2            | 1.58489  |
| IEEE<br>802.11n<br>HT20<br>(2.4G) | 2412               | 18.17                      | 65.6145                   | $18 \pm 1$            | 2            | 1.58489  |
|                                   | 2437               | 18.15                      | 65.3131                   | $18 \pm 1$            | 2            | 1.58489  |
|                                   | 2462               | 18.22                      | 66.3743                   | $18 \pm 1$            | 2            | 1.58489  |
| IEEE<br>802.11n<br>HT40<br>(2.4G) | 2422               | 17.12                      | 51.5229                   | $17 \pm 1$            | 2            | 1.58489  |
|                                   | 2437               | 17.07                      | 50.9331                   | $17 \pm 1$            | 2            | 1.58489  |
|                                   | 2452               | 17.11                      | 51.4044                   | $17 \pm 1$            | 2            | 1.58489  |
| IEEE<br>802.11a                   | 5180               | 7.87                       | 6.1235                    | $7 \pm 1$             | 2            | 1.58489  |
|                                   | 5200               | 7.93                       | 6.2087                    | $7 \pm 1$             | 2            | 1.58489  |
|                                   | 5240               | 8.32                       | 6.7920                    | $8 \pm 1$             | 2            | 1.58489  |
|                                   | 5745               | 10.86                      | 12.1899                   | $10 \pm 1$            | 2            | 1.58489  |
|                                   | 5785               | 10.78                      | 11.9674                   | $10 \pm 1$            | 2            | 1.58489  |
|                                   | 5825               | 10.94                      | 12.4165                   | $10 \pm 1$            | 2            | 1.58489  |
| IEEE<br>802.11n<br>HT20<br>(5G)   | 5180               | 8.38                       | 6.8865                    | $8 \pm 1$             | 2            | 1.58489  |
|                                   | 5200               | 8.46                       | 7.0146                    | $8 \pm 1$             | 2            | 1.58489  |
|                                   | 5240               | 8.49                       | 7.0632                    | $8 \pm 1$             | 2            | 1.58489  |
|                                   | 5745               | 10.88                      | 12.2462                   | $10 \pm 1$            | 2            | 1.58489  |
|                                   | 5785               | 10.70                      | 11.7490                   | $10 \pm 1$            | 2            | 1.58489  |
|                                   | 5825               | 10.05                      | 10.1158                   | $10 \pm 1$            | 2            | 1.58489  |
| IEEE<br>802.11ac<br>VHT20         | 5180               | 8.02                       | 6.3387                    | $8 \pm 1$             | 2            | 1.58489  |
|                                   | 5200               | 8.07                       | 6.4121                    | $8 \pm 1$             | 2            | 1.58489  |
|                                   | 5240               | 8.21                       | 6.6222                    | $8 \pm 1$             | 2            | 1.58489  |
|                                   | 5745               | 10.64                      | 11.5878                   | $10 \pm 1$            | 2            | 1.58489  |
|                                   | 5785               | 10.59                      | 11.4551                   | $10 \pm 1$            | 2            | 1.58489  |
|                                   | 5825               | 10.73                      | 11.8304                   | $10 \pm 1$            | 2            | 1.58489  |

| Mode                            | Frequency<br>(MHz) | Peak output power<br>(dBm) | Peak output<br>power (mW) | Target power<br>(dBm) | Antenna gain |          |
|---------------------------------|--------------------|----------------------------|---------------------------|-----------------------|--------------|----------|
|                                 |                    |                            |                           |                       | (dBi)        | (Linear) |
| IEEE<br>802.11n<br>HT40<br>(5G) | 5190               | 8.02                       | 6.3387                    | $8 \pm 1$             | 2            | 1.58489  |
|                                 | 5230               | 7.78                       | 5.9979                    | $7 \pm 1$             | 2            | 1.58489  |
|                                 | 5755               | 10.22                      | 10.5196                   | $10 \pm 1$            | 2            | 1.58489  |
|                                 | 5795               | 10.43                      | 11.0408                   | $10 \pm 1$            | 2            | 1.58489  |
| IEEE<br>802.11ac<br>VHT40       | 5190               | 7.88                       | 6.1376                    | $7 \pm 1$             | 2            | 1.58489  |
|                                 | 5230               | 7.68                       | 5.8614                    | $7 \pm 1$             | 2            | 1.58489  |
|                                 | 5755               | 10.24                      | 10.5682                   | $10 \pm 1$            | 2            | 1.58489  |
|                                 | 5795               | 10.40                      | 10.9648                   | $10 \pm 1$            | 2            | 1.58489  |
| IEEE<br>802.11ac<br>VHT80       | 5210               | 7.41                       | 5.5081                    | $7 \pm 1$             | 2            | 1.58489  |
|                                 | 5775               | 9.88                       | 9.7275                    | $9 \pm 1$             | 2            | 1.58489  |

### 3. Calculated Result and Limit

#### Antenna 1

| Mode                | Target power (dBm) | Antenna gain |          | Power Density (S) (mW/cm <sup>2</sup> ) | Limited of Power Density (S) (mW/cm <sup>2</sup> ) | Test Result |
|---------------------|--------------------|--------------|----------|-----------------------------------------|----------------------------------------------------|-------------|
|                     |                    | (dBi)        | (Linear) |                                         |                                                    |             |
| 2.4G Band           |                    |              |          |                                         |                                                    |             |
| GFSK                | 6                  | 2            | 1.58489  | 0.00126                                 | 1                                                  | Compiles    |
| 8-DPSK              | 8                  | 2            | 1.58489  | 0.00199                                 | 1                                                  | Compiles    |
| BLE GFSK            | 10                 | 2            | 1.58489  | 0.00315                                 | 1                                                  | Compiles    |
| IEEE 802.11b        | 17                 | 2            | 1.58489  | 0.01580                                 | 1                                                  | Compiles    |
| IEEE 802.11g        | 20                 | 2            | 1.58489  | 0.03153                                 | 1                                                  | Compiles    |
| IEEE 802.11n HT20   | 21                 | 2            | 1.58489  | 0.03969                                 | 1                                                  | Compiles    |
| IEEE 802.11n HT40   | 20                 | 2            | 1.58489  | 0.03153                                 | 1                                                  | Compiles    |
| 5G Band             |                    |              |          |                                         |                                                    |             |
| IEEE 802.11a        | 13                 | 2            | 1.58489  | 0.00629                                 | 1                                                  | Compiles    |
| IEEE 802.11n HT20   | 12                 | 2            | 1.58489  | 0.00500                                 | 1                                                  | Compiles    |
| IEEE 802.11ac VHT20 | 13                 | 2            | 1.58489  | 0.00629                                 | 1                                                  | Compiles    |
| IEEE 802.11n HT40   | 12                 | 2            | 1.58489  | 0.00500                                 | 1                                                  | Compiles    |
| IEEE 802.11ac VHT40 | 12                 | 2            | 1.58489  | 0.00500                                 | 1                                                  | Compiles    |
| IEEE 802.11ac VHT80 | 11                 | 2            | 1.58489  | 0.00397                                 | 1                                                  | Compiles    |



**Antenna 2**

| Mode                | Target power (dBm) | Antenna gain |          | Power Density (S) (mW/cm <sup>2</sup> ) | Limited of Power Density (S) (mW/cm <sup>2</sup> ) | Test Result |
|---------------------|--------------------|--------------|----------|-----------------------------------------|----------------------------------------------------|-------------|
|                     |                    | (dBi)        | (Linear) |                                         |                                                    |             |
| 2.4G Band           |                    |              |          |                                         |                                                    |             |
| IEEE 802.11b        | 17                 | 2            | 1.58489  | 0.01580                                 | 1                                                  | Compiles    |
| IEEE 802.11g        | 20                 | 2            | 1.58489  | 0.03153                                 | 1                                                  | Compiles    |
| IEEE 802.11n HT20   | 19                 | 2            | 1.58489  | 0.02505                                 | 1                                                  | Compiles    |
| IEEE 802.11n HT40   | 18                 | 2            | 1.58489  | 0.01989                                 | 1                                                  | Compiles    |
| 5G Band             |                    |              |          |                                         |                                                    |             |
| IEEE 802.11a        | 11                 | 2            | 1.58489  | 0.00397                                 | 1                                                  | Compiles    |
| IEEE 802.11n HT20   | 11                 | 2            | 1.58489  | 0.00397                                 | 1                                                  | Compiles    |
| IEEE 802.11ac VHT20 | 11                 | 2            | 1.58489  | 0.00397                                 | 1                                                  | Compiles    |
| IEEE 802.11n HT40   | 11                 | 2            | 1.58489  | 0.00397                                 | 1                                                  | Compiles    |
| IEEE 802.11ac VHT40 | 11                 | 2            | 1.58489  | 0.00397                                 | 1                                                  | Compiles    |
| IEEE 802.11ac VHT80 | 10                 | 2            | 1.58489  | 0.00315                                 | 1                                                  | Compiles    |

**Antenna 1+2**

| Mode                | Directional<br>AntennaGain<br>(Numeric) | Peak<br>Output<br>Power<br>(mW) | Power Density<br>(S)<br>(mW/cm <sup>2</sup> )<br>Total | Limited of<br>Power Density<br>(S)<br>(mW/cm <sup>2</sup> ) | Test Result |
|---------------------|-----------------------------------------|---------------------------------|--------------------------------------------------------|-------------------------------------------------------------|-------------|
| 2.4G Band           |                                         |                                 |                                                        |                                                             |             |
| IEEE 802.11n HT20   | 3.170<br>(5.01dBi)                      | 109.90                          | 0.03465                                                | 1                                                           | Compiles    |
| IEEE 802.11n HT40   | 3.170<br>(5.01dBi)                      | 87.30                           | 0.02753                                                | 1                                                           | Compiles    |
| 5G Band             |                                         |                                 |                                                        |                                                             |             |
| IEEE 802.11n HT20   | 3.170<br>(5.01dBi)                      | 27.03                           | 0.00852                                                | 1                                                           | Compiles    |
| IEEE 802.11ac VHT20 | 3.170<br>(5.01dBi)                      | 26.07                           | 0.00822                                                | 1                                                           | Compiles    |
| IEEE 802.11n HT40   | 3.170<br>(5.01dBi)                      | 23.01                           | 0.00726                                                | 1                                                           | Compiles    |
| IEEE 802.11ac VHT40 | 3.170<br>(5.01dBi)                      | 22.26                           | 0.00702                                                | 1                                                           | Compiles    |
| IEEE 802.11ac VHT80 | 3.170<br>(5.01dBi)                      | 20.08                           | 0.00633                                                | 1                                                           | Compiles    |

Note: 2.4 and 5GHz bands are share an antenna, Cann't both the 2.4 and 5 GHz bands operate simultaneously.

**End of Test Report**