

## Appendix B. Maximum Permissible Exposure

## 1. Maximum Permissible Exposure

### 1.1. Applicable Standard

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 levels 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 0.2 m normally can be maintained between the user and the device.

(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 Time  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                                                                 |
| 1500-100,000          |                                   |                                   | 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 Time  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                                                                |
| 1500-100,000          |                                   |                                   | 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** = Average 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 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.

### 1.3. Calculated Result and Limit

<Model No.: IBR600LPE / IBR600LPE-PWD>

For WiFi function:

Max Conducted Power for IEEE 802.11n MCS0 20MHz: 16.29 dBm

| Antenna Gain (dBi) | Antenna Gain (numeric) | Average Output Power (dBm) | Average Output Power (mW) | Power Density (S) (mW/cm <sup>2</sup> ) | Limit of Power Density (S) (mW/cm <sup>2</sup> ) | Test Result |
|--------------------|------------------------|----------------------------|---------------------------|-----------------------------------------|--------------------------------------------------|-------------|
| 5                  | 3.1623                 | 16.2938                    | 42.5970                   | 0.026812                                | 1                                                | Complies    |

For WWAN Module (FCC ID: N7NMC7355):

| Frequency (MHz) | Maximum Conducted Power (dBm) | Maximum Conducted Power (W) | Maximum Antenna Gain (dBi) | Duty Cycle | Average EIRP (dBm) | Average EIRP (mW) | Power Density (S) (mW/cm <sup>2</sup> ) | Limit of Power Density (S) (mW/cm <sup>2</sup> ) | Test Result |
|-----------------|-------------------------------|-----------------------------|----------------------------|------------|--------------------|-------------------|-----------------------------------------|--------------------------------------------------|-------------|
| 824-849         | 33                            | 2                           | 6.5                        | 0.250      | 33.48              | 2228.127          | 0.443                                   | 0.549                                            | Complies    |
| 824-849         | 28                            | 0.63                        | 6.5                        | 0.250      | 28.48              | 704.596           | 0.140                                   | 0.549                                            | Complies    |
| 824-849         | 26.2                          | 0.42                        | 6.5                        | 0.375      | 28.44              | 698.283           | 0.139                                   | 0.549                                            | Complies    |
| 824-849         | 25.0                          | 0.32                        | 6.5                        | 0.500      | 28.49              | 706.269           | 0.141                                   | 0.549                                            | Complies    |
| 1850-1910       | 30.0                          | 1.00                        | 3.0                        | 0.250      | 26.98              | 498.816           | 0.099                                   | 1.000                                            | Complies    |
| 1850-1910       | 27.0                          | 0.50                        | 3.0                        | 0.250      | 23.98              | 250.000           | 0.050                                   | 1.000                                            | Complies    |
| 1850-1910       | 25.2                          | 0.33                        | 3.0                        | 0.375      | 23.94              | 247.760           | 0.049                                   | 1.000                                            | Complies    |
| 1850-1910       | 24.0                          | 0.25                        | 3.0                        | 0.500      | 23.99              | 250.594           | 0.050                                   | 1.000                                            | Complies    |
| 824-849         | 25.0                          | 0.3                         | 6.5                        | 1.000      | 31.50              | 1412.538          | 0.281                                   | 0.549                                            | Complies    |
| 1850-1910       | 25.0                          | 0.3                         | 3.0                        | 1.000      | 28.00              | 630.957           | 0.126                                   | 1.000                                            | Complies    |
| 817-824         | 25.0                          | 3                           | 6.5                        | 1.000      | 31.50              | 1412.538          | 0.281                                   | 0.544                                            | Complies    |
| 824-849         | 24.0                          | 0.251                       | 6.5                        | 1.000      | 30.50              | 1122.018          | 0.223                                   | 0.549                                            | Complies    |
| 1710-1755       | 24.0                          | 0.251                       | 6.0                        | 1.000      | 30.00              | 1000.000          | 0.199                                   | 1.000                                            | Complies    |
| 1850-1910       | 24.0                          | 0.251                       | 3.0                        | 1.000      | 27.00              | 501.187           | 0.100                                   | 1.000                                            | Complies    |
| 704-716         | 24.0                          | 0.3                         | 9.0                        | 1.000      | 33.00              | 1995.262          | 0.397                                   | 0.469                                            | Complies    |
| 777-787         | 24.0                          | 0.3                         | 9.0                        | 1.000      | 33.00              | 1995.262          | 0.397                                   | 0.518                                            | Complies    |
| 824-849         | 24.0                          | 0.3                         | 6.5                        | 1.000      | 30.50              | 122.018           | 0.223                                   | 0.549                                            | Complies    |
| 1710-1755       | 24.0                          | 0.3                         | 6.0                        | 1.000      | 30.00              | 1000.000          | 0.199                                   | 1.000                                            | Complies    |
| 1850-1910       | 24.0                          | 0.3                         | 3.0                        | 1.000      | 27.00              | 501.187           | 0.100                                   | 1.000                                            | Complies    |
| 1850-1915       | 24.0                          | 0.3                         | 3.0                        | 1.000      | 27.00              | 501.187           | 0.100                                   | 1.000                                            | Complies    |

**CONCLUSION:**

Both of the WiFi function and WWAN function can transmit simultaneously, the formula of calculated the MPE is:

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

**CPD = Calculation power density**

**LPD = Limit of power density**

Therefore, the worst-case situation is  $0.026812 / 1 + 0.443 / 0.549 = 0.833734$ , which is less than "1". This confirmed that the device comply with FCC 1.1310 MPE limit.