

## FCC §15.247 (I) & §1.1310 & §2.1091 - MAXIMUM PERMISSIBLE EXPOSURE (MPE)

### Applicable Standard

According to subpart 15.247 (i) and subpart 1.1310, 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

| Limits for General Population/Uncontrolled Exposure |                               |                               |                                     |                          |
|-----------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| Frequency Range (MHz)                               | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density (mW/cm <sup>2</sup> ) | Averaging Time (minutes) |
| 0.3-1.34                                            | 614                           | 1.63                          | *(100)                              | 30                       |
| 1.34-30                                             | 824/f                         | 2.19/f                        | *(180/f <sup>2</sup> )              | 30                       |
| 30-300                                              | 27.5                          | 0.073                         | 0.2                                 | 30                       |
| 300-1500                                            | /                             | /                             | f/1500                              | 30                       |
| 1500-100,000                                        | /                             | /                             | 1.0                                 | 30                       |

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

### Calculated Formulary:

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$  = power density (in appropriate units, e.g. mW/cm<sup>2</sup>);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

**Calculated Data:****Model: L1563****2.4G Wi-Fi&BLE&BT:**

| Mode         | Frequency Range (MHz) | Maximum Antenna Gain |           | Tune-up Conducted Power |        | Evaluation Distance (cm) | Power Density (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) |
|--------------|-----------------------|----------------------|-----------|-------------------------|--------|--------------------------|-------------------------------------|---------------------------------|
|              |                       | (dBi)                | (numeric) | (dBm)                   | (mW)   |                          |                                     |                                 |
| 802.11b      | 2412-2462             | 2.19                 | 1.66      | 25.00                   | 251.19 | 20                       | <b>0.0829</b>                       | <b>1.0</b>                      |
| 802.11g      |                       | 2.19                 | 1.66      | 24.00                   | 100.00 | 20                       | 0.0330                              | 1.0                             |
| 802.11n-HT20 |                       | 2.19                 | 1.66      | 20.00                   | 79.43  | 20                       | 0.0262                              | 1.0                             |
| 802.11n-HT40 | 2422-2452             | 2.19                 | 1.66      | 19.00                   | 316.23 | 20                       | 0.1044                              | 1.0                             |
| BLE(1Mbps)   | 2402-2480             | 2.19                 | 1.66      | -0.50                   | 0.89   | 20                       | 0.0003                              | 1.0                             |
| BLE(2Mbps)   | 2402-2480             | 2.19                 | 1.66      | -0.50                   | 0.89   | 20                       | 0.0003                              | 1.0                             |
| BT           | 2402-2480             | 2.19                 | 1.66      | 10.00                   | 10.00  | 20                       | 0.0033                              | 1.0                             |

**GSM:**

| Mode       | Frequency Range (MHz) | Maximum Antenna Gain |           | Tune-up Conducted Power |        | Evaluation Distance (cm) | Power Density (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) |
|------------|-----------------------|----------------------|-----------|-------------------------|--------|--------------------------|-------------------------------------|---------------------------------|
|            |                       | (dBi)                | (numeric) | (dBm)                   | (mW)   |                          |                                     |                                 |
| GPRS 850   | 824-849               | 1.46                 | 1.40      | 27.50                   | 562.34 | 20                       | <b>0.1566</b>                       | <b>0.55</b>                     |
| EGPRS 850  | 824-849               | 1.46                 | 1.40      | 19.74                   | 94.19  | 20                       | 0.0262                              | 0.55                            |
| GPRS 1900  | 1850-1910             | 2.23                 | 1.67      | 23.50                   | 223.87 | 20                       | 0.0744                              | 1.00                            |
| EGPRS 1900 | 1850-1910             | 2.23                 | 1.67      | 20.24                   | 105.68 | 20                       | 0.0351                              | 1.00                            |

**Note 1:**

GPRS 850: Tune-up maximum output power with 1 slot is 33.50 dBm, 2 slots is 33.00 dBm, 3 slots is 31.50 dBm, 4 slots is 30.50 dBm, so the tune-up time based Ave. power compared to slotted Ave. power is 27.50dBm.

EGPRS 850: Tune-up maximum output power with 1 slot is 27.00 dBm, 2 slots is 25.50 dBm, 3 slots is 24.00 dBm, 4 slots is 22.50 dBm, so the tune-up time based Ave. power compared to slotted Ave. power is 19.74dBm.

GPRS 1900: Tune-up maximum output power with 1 slot is 29.50 dBm, 2 slots is 28.50 dBm, 3 slots is 27.50 dBm, 4 slots is 26.50 dBm, so the tune-up time based Ave. power compared to slotted Ave. power is 23.50 dBm.

EGPRS 1900: Tune-up maximum output power with 1 slot is 26.50 dBm, 2 slots is 25.50 dBm, 3 slots is 24.50 dBm, 4 slots is 22.50 dBm, so the tune-up time based Ave. power compared to slotted Ave. power is 20.24 dBm.

| Number of Time slot                                  | 1     | 2     | 3        | 4     |
|------------------------------------------------------|-------|-------|----------|-------|
| Duty Cycle                                           | 1:8   | 1:4   | 1:2.66   | 1:2   |
| Time based Ave. power compared to slotted Ave. power | -9 dB | -6 dB | -4.26 dB | -3 dB |

**5G Wi-Fi/WCDMA/LTE:**

| Mode               | Frequency Range (MHz) | Antenna Gain |           | Tune-up Conducted Power |        | Evaluation Distance (cm) | Power Density (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) |
|--------------------|-----------------------|--------------|-----------|-------------------------|--------|--------------------------|-------------------------------------|---------------------------------|
|                    |                       | (dBi)        | (numeric) | (dBm)                   | (mW)   |                          |                                     |                                 |
| 802.11a            | 5150~5250             | 0.05         | 1.01      | 18.50                   | 70.79  | 20                       | 0.0142                              | 1.0                             |
|                    | 5725~5850             | 0.05         | 1.01      | 19.00                   | 79.43  | 20                       | 0.0160                              | 1.0                             |
| 802.11ac20         | 5150~5250             | 0.05         | 1.01      | 21.00                   | 125.89 | 20                       | 0.0253                              | 1.0                             |
|                    | 5725~5850             | 0.05         | 1.01      | 22.00                   | 158.49 | 20                       | 0.0318                              | 1.0                             |
| 802.11n20          | 5150~5250             | 0.05         | 1.01      | 21.50                   | 141.25 | 20                       | 0.0284                              | 1.0                             |
|                    | 5725~5850             | 0.05         | 1.01      | 22.00                   | 158.49 | 20                       | 0.0318                              | 1.0                             |
| 802.11ac40         | 5150~5250             | 0.05         | 1.01      | 15.50                   | 35.48  | 20                       | 0.0071                              | 1.0                             |
|                    | 5725~5850             | 0.05         | 1.01      | 21.00                   | 125.89 | 20                       | 0.0253                              | 1.0                             |
| 802.11n40          | 5150~5250             | 0.05         | 1.01      | 15.50                   | 35.48  | 20                       | 0.0071                              | 1.0                             |
|                    | 5725~5850             | 0.05         | 1.01      | 22.00                   | 158.49 | 20                       | 0.0318                              | 1.0                             |
| 802.11ac80         | 5150~5250             | 0.05         | 1.01      | 11.00                   | 12.59  | 20                       | 0.0025                              | 1.0                             |
|                    | 5725~5850             | 0.05         | 1.01      | 21.50                   | 141.25 | 20                       | 0.0284                              | 1.0                             |
| WCDMA Band II      | 1850-1910             | 2.23         | 1.67      | 22.50                   | 177.83 | 20                       | 0.0591                              | 1.0                             |
| WCDMA Band V       | 824-849               | 1.46         | 1.40      | 22.50                   | 177.83 | 20                       | 0.0495                              | 0.55                            |
| LTE Band 2         | 1850-1910             | 2.23         | 1.67      | 23.50                   | 223.87 | 20                       | 0.0744                              | 1.0                             |
| LTE Band 4         | 1710-1755             | 2.23         | 1.67      | 23.00                   | 199.53 | 20                       | 0.0663                              | 1.0                             |
| LTE Band 5         | 824-849               | 1.46         | 1.40      | 23.00                   | 199.53 | 20                       | 0.0556                              | 0.55                            |
| LTE Band 7         | 2500-2570             | 2.03         | 1.60      | 22.50                   | 177.83 | 20                       | 0.0566                              | 1.0                             |
| LTE Band 38        | 2570-2620             | 2.03         | 1.60      | 22.50                   | 177.83 | 20                       | 0.0566                              | 1.0                             |
| LTE Band 40 Lower  | 2305-2315             | 2.03         | 1.60      | 22.50                   | 177.83 | 20                       | 0.0566                              | 1.0                             |
| LTE Band 40 Upperr | 2350-2360             | 2.03         | 1.60      | 22.50                   | 177.83 | 20                       | 0.0566                              | 1.0                             |
| LTE Band 41        | 2555-2655             | 2.03         | 1.60      | 22.50                   | 177.83 | 20                       | 0.0566                              | 1.0                             |

**Note:**

1. For the above tune up power were declared by the manufacturer.
2. Wi-Fi and BT/BLE cannot transmit simultaneously.
3. For 802.11b, 802.11g, 802.11a, the tune-up power is base on SISO mode  
For 802.11ac20/n20/n40/ac40/ac80, the tune-up power is base on MIMO mode
4. Wi-Fi & GPRS/WCDMA/LTE or BT/BLE & GPRS/WCDMA/LTE can transmit simultaneously; the worst condition is 2.4G Wi-Fi & GPRS 850 as below:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.0829/1.00 + 0.1566/0.55 = 0.3676 < 1.0$$

**Conclusion:** The device meets MPE at distance 20cm.

**Model: L1573****2.4G Wi-Fi&BLE&BT:**

| Mode         | Frequency Range (MHz) | Maximum Antenna Gain |           | Tune-up Conducted Power |        | Evaluation Distance (cm) | Power Density (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) |
|--------------|-----------------------|----------------------|-----------|-------------------------|--------|--------------------------|-------------------------------------|---------------------------------|
|              |                       | (dBi)                | (numeric) | (dBm)                   | (mW)   |                          |                                     |                                 |
| 802.11b      | 2412-2462             | 0.66                 | 1.16      | 25.00                   | 316.23 | 20                       | <b>0.0730</b>                       | <b>1.0</b>                      |
| 802.11g      |                       | 0.66                 | 1.16      | 24.00                   | 251.19 | 20                       | 0.0580                              | 1.0                             |
| 802.11n-HT20 |                       | 0.66                 | 1.16      | 20.00                   | 100.00 | 20                       | 0.0231                              | 1.0                             |
| 802.11n-HT40 | 2422-2452             | 0.66                 | 1.16      | 19.00                   | 79.43  | 20                       | 0.0183                              | 1.0                             |
| BLE(1Mbps)   | 2402-2480             | 0.19                 | 1.04      | -0.50                   | 0.89   | 20                       | 0.0002                              | 1.0                             |
| BLE(2Mbps)   | 2402-2480             | 0.19                 | 1.04      | -0.50                   | 0.89   | 20                       | 0.0002                              | 1.0                             |
| BT           | 2402-2480             | 0.19                 | 1.04      | 10.00                   | 10.00  | 20                       | 0.0021                              | 1.0                             |

**GSM:**

| Mode       | Frequency Range (MHz) | Maximum Antenna Gain |           | Tune-up Conducted Power |        | Evaluation Distance (cm) | Power Density (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) |
|------------|-----------------------|----------------------|-----------|-------------------------|--------|--------------------------|-------------------------------------|---------------------------------|
|            |                       | (dBi)                | (numeric) | (dBm)                   | (mW)   |                          |                                     |                                 |
| GPRS 850   | 824-849               | 1.24                 | 1.33      | 27.50                   | 562.34 | 20                       | <b>0.1488</b>                       | <b>0.55</b>                     |
| EGPRS 850  | 824-849               | 1.24                 | 1.33      | 19.74                   | 94.19  | 20                       | 0.0249                              | 0.55                            |
| GPRS 1900  | 1850-1910             | 1.22                 | 1.32      | 23.50                   | 223.87 | 20                       | 0.0588                              | 1.00                            |
| EGPRS 1900 | 1850-1910             | 1.22                 | 1.32      | 20.24                   | 105.68 | 20                       | 0.0277                              | 1.00                            |

**Note 1:**

GPRS 850: Tune-up maximum output power with 1 slot is 33.50 dBm, 2 slots is 33.00 dBm, 3 slots is 31.50 dBm, 4 slots is 30.50 dBm, so the tune-up time based Ave. power compared to slotted Ave. power is 27.50dBm.

EGPRS 850: Tune-up maximum output power with 1 slot is 27.00 dBm, 2 slots is 25.50 dBm, 3 slots is 24.00 dBm, 4 slots is 22.50 dBm, so the tune-up time based Ave. power compared to slotted Ave. power is 19.74dBm.

GPRS 1900: Tune-up maximum output power with 1 slot is 29.50 dBm, 2 slots is 28.50 dBm, 3 slots is 27.50 dBm, 4 slots is 26.50 dBm, so the tune-up time based Ave. power compared to slotted Ave. power is 23.50 dBm.

EGPRS 1900: Tune-up maximum output power with 1 slot is 26.50 dBm, 2 slots is 25.50 dBm, 3 slots is 24.50 dBm, 4 slots is 22.50 dBm, so the tune-up time based Ave. power compared to slotted Ave. power is 20.24 dBm.

| Number of Time slot                                  | 1     | 2     | 3        | 4     |
|------------------------------------------------------|-------|-------|----------|-------|
| Duty Cycle                                           | 1:8   | 1:4   | 1:2.66   | 1:2   |
| Time based Ave. power compared to slotted Ave. power | -9 dB | -6 dB | -4.26 dB | -3 dB |

**5G Wi-Fi/WCDMA/LTE:**

| Mode               | Frequency Range (MHz) | Antenna Gain |           | Tune-up Conducted Power |        | Evaluation Distance (cm) | Power Density (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) |
|--------------------|-----------------------|--------------|-----------|-------------------------|--------|--------------------------|-------------------------------------|---------------------------------|
|                    |                       | (dBi)        | (numeric) | (dBm)                   | (mW)   |                          |                                     |                                 |
| 802.11a            | 5150~5250             | 1.57         | 1.44      | 18.50                   | 70.79  | 20                       | 0.0203                              | 1.0                             |
|                    | 5725~5850             | -0.79        | 0.83      | 19.00                   | 79.43  | 20                       | 0.0131                              | 1.0                             |
| 802.11ac20         | 5150~5250             | 1.57         | 1.44      | 21.00                   | 125.89 | 20                       | 0.0361                              | 1.0                             |
|                    | 5725~5850             | -0.79        | 0.83      | 22.00                   | 158.49 | 20                       | 0.0262                              | 1.0                             |
| 802.11n20          | 5150~5250             | 1.57         | 1.44      | 21.50                   | 141.25 | 20                       | 0.0405                              | 1.0                             |
|                    | 5725~5850             | -0.79        | 0.83      | 22.00                   | 158.49 | 20                       | 0.0262                              | 1.0                             |
| 802.11ac40         | 5150~5250             | 1.57         | 1.44      | 15.50                   | 35.48  | 20                       | 0.0102                              | 1.0                             |
|                    | 5725~5850             | -0.79        | 0.83      | 21.00                   | 125.89 | 20                       | 0.0208                              | 1.0                             |
| 802.11n40          | 5150~5250             | 1.57         | 1.44      | 15.50                   | 35.48  | 20                       | 0.0102                              | 1.0                             |
|                    | 5725~5850             | -0.79        | 0.83      | 22.00                   | 158.49 | 20                       | 0.0262                              | 1.0                             |
| 802.11ac80         | 5150~5250             | 1.57         | 1.44      | 11.00                   | 12.59  | 20                       | 0.0036                              | 1.0                             |
|                    | 5725~5850             | -0.79        | 0.83      | 21.50                   | 141.25 | 20                       | 0.0233                              | 1.0                             |
| WCDMA Band II      | 1850-1910             | 1.22         | 1.32      | 22.50                   | 177.83 | 20                       | 0.0467                              | 1.0                             |
| WCDMA Band V       | 824-849               | 1.24         | 1.33      | 22.50                   | 177.83 | 20                       | 0.0470                              | 0.55                            |
| LTE Band 2         | 1850-1910             | 1.22         | 1.32      | 23.50                   | 223.87 | 20                       | 0.0588                              | 1.0                             |
| LTE Band 4         | 1710-1755             | 2.19         | 1.66      | 23.00                   | 199.53 | 20                       | 0.0659                              | 1.0                             |
| LTE Band 5         | 824-849               | 1.24         | 1.33      | 23.00                   | 199.53 | 20                       | 0.0528                              | 0.55                            |
| LTE Band 7         | 2500-2570             | 2.17         | 1.65      | 22.50                   | 177.83 | 20                       | 0.0584                              | 1.0                             |
| LTE Band 38        | 2570-2620             | 1.47         | 1.40      | 22.50                   | 177.83 | 20                       | 0.0495                              | 1.0                             |
| LTE Band 40 Lower  | 2305-2315             | 2.06         | 1.61      | 22.50                   | 177.83 | 20                       | 0.0570                              | 1.0                             |
| LTE Band 40 Upperr | 2350-2360             | 2.49         | 1.77      | 22.50                   | 177.83 | 20                       | 0.0626                              | 1.0                             |
| LTE Band 41        | 2555-2655             | 1.47         | 1.40      | 22.50                   | 177.83 | 20                       | 0.0495                              | 1.0                             |

**Note:**

1. For the above tune up power were declared by the manufacturer.
2. Wi-Fi and BT/BLE cannot transmit simultaneously.
3. For 802.11b, 802.11g, 802.11a, the tune-up power is base on SISO mode  
For 802.11ac20/n20/n40/ac40/ac80, the tune-up power is base on MIMO mode
4. Wi-Fi & GPRS/WCDMA/LTE or BT/BLE & GPRS/WCDMA/LTE can transmit simultaneously; the worst condition is 2.4G Wi-Fi & GPRS 850 as below:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.0730/1.00 + 0.1488/0.55 = 0.3436 < 1.0$$

**Conclusion:** The device meets MPE at distance 20cm.