



CTK Co., Ltd.  
The Power Leader of Global Regulatory Compliance

## CTK Co., Ltd.

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# RF EXPOSURE EVALUATION

**Applicant** : TELETRON INC.

**Applicant Address** : TELETRON B/D, 1459-2, Kwanyang-Dong , Dongan-Gu, Anyang-Si Gyeonggi-Do, KOREA 13947

**Kind of Product** : WiFi BLE Module

**Equipment model name** : WL3MR1501

**FCC ID** : 2BFHG-WL3MR1501

## Standard Requirement

The following RF exposure procedures are applicable :

- FCC Rules  
Part 1.1310 Radiofrequency radiation exposure limits

Table 1 below sets forth limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields.

Table 1—Limits for Maximum Permissible Exposure (MPE)

| Frequency range (MHz)                                          | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density (mW/cm <sup>2</sup> ) | Averaging time (minutes) |
|----------------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| <b>(A) Limits for Occupational/Controlled Exposure</b>         |                               |                               |                                     |                          |
| 0.3-3.0                                                        | 614                           | 1.63                          | *100                                | 6                        |
| 3.0-30                                                         | 1842/f                        | 4.89/f                        | *900/f <sup>2</sup>                 | 6                        |
| 30-300                                                         | 61.4                          | 0.163                         | 1.0                                 | 6                        |
| 300-1,500                                                      |                               |                               | f/300                               | 6                        |
| 1,500-100,000                                                  |                               |                               | 5                                   | 6                        |
| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                               |                               |                                     |                          |
| 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                       |
| 300-1,500                                                      |                               |                               | f/1500                              | 30                       |
| 1,500-100,000                                                  |                               |                               | <b>1.0</b>                          | 30                       |

*f* = frequency in MHz

\* = Plane-wave equivalent power density

- ISED Rules  
RSS-102 Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

Table 7 : RF field strength and power density limits for devices used by the general public (uncontrolled environment)

| Frequency Range (MHz)                      | Electric Field (V <sub>RMS</sub> /m) | Magnetic Field (A <sub>RMS</sub> /m) | Power Density (W/m <sup>2</sup> )      | Reference Period (minutes) |
|--------------------------------------------|--------------------------------------|--------------------------------------|----------------------------------------|----------------------------|
| 10-20                                      | 27.46                                | 0.0728                               | 2                                      | 6                          |
| 20-48                                      | 58.07/ $f^{0.25}$                    | 0.1540/ $f^{0.25}$                   | 8.944/ $f^{0.5}$                       | 6                          |
| 48-300                                     | 22.06                                | 0.05852                              | 1.291                                  | 6                          |
| 300-6000                                   | 3.142 $f^{0.3417}$                   | 0.008335 $f^{0.3417}$                | <b>0.02619 <math>f^{0.6834}</math></b> | 6                          |
| 6000-15000                                 | 61.4                                 | 0.163                                | 10                                     | 6                          |
| 15000-150000                               | 61.4                                 | 0.163                                | 10                                     | 616000/ $f^{1.2}$          |
| 150000-300000                              | 0.158 $f^{0.5}$                      | 4.21 x 10 <sup>-4</sup> $f^{0.5}$    | 6.67 x 10 <sup>-5</sup> $f$            | 616000/ $f^{1.2}$          |
| <b>Note:</b> <i>f</i> is frequency in MHz. |                                      |                                      |                                        |                            |

## MPE Calculations

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the user. The MPE calculation for this exposure is shown below.

The peak radiated output power (EIRP) is calculated as follows:

|              |                                                                                      |
|--------------|--------------------------------------------------------------------------------------|
| EIRP = P + G | Where,<br>P = Power input to the antenna (mW)<br>G = Power gain of the antenna (dBi) |
|--------------|--------------------------------------------------------------------------------------|

The numeric gain(G) of the antenna with a gain specified in dB is determined by:

$$G = \text{Log}^{-1} (\text{dB antenna gain} / 10)$$

## Power density at the specific separation:

|                      |                                                                                                                                                                                                                                   |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $S = PG / (4R^2\pi)$ | Where,<br>S = Maximum power density (mW/cm <sup>2</sup> )<br>P = Power input to the antenna (mW)<br>G = Numeric power gain of the antenna<br>R = Distance to the center of the radiation of the antenna<br>(20cm = limit for MPE) |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Estimated safe separation:

|                          |                                                                                                                                                                                |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $R = \sqrt{(PG / 4\pi)}$ | Where,<br>P = Power input to the antenna (mW)<br>G = Numeric power gain of the antenna<br>R = Distance to the center of the radiation of the antenna<br>(20cm = limit for MPE) |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



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### RF Exposure Results

#### [FCC]

| Mode            | Measured<br>Max Output<br>Power<br>(dBm) | G<br>(dBi) | Power<br>tolerance<br>(dB) | P<br>(dBm) | P<br>(mW) | Power<br>Density<br>(mW/cm <sup>2</sup> ) | Limit<br>(mW/cm <sup>2</sup> ) | R<br>(cm) |
|-----------------|------------------------------------------|------------|----------------------------|------------|-----------|-------------------------------------------|--------------------------------|-----------|
| BLE             | 9.57                                     | 2.09       | +2                         | 11.57      | 14.35     | <b>0.0038</b>                             | 1.000                          | 20        |
| WLAN<br>2.4 GHz | 19.91                                    | 2.09       | +2                         | 21.91      | 155.24    | <b>0.0407</b>                             |                                |           |
| WLAN<br>5 GHz   | 19.64                                    | 3.81       | +2                         | 21.64      | 145.88    | <b>0.0698</b>                             |                                |           |

#### Simultaneous transmitter

| Mode         | MPE ratios*   | Limit |
|--------------|---------------|-------|
| BLE          | 0.0038        | -     |
| WLAN 2.4 GHz | 0.0407        |       |
| WLAN 5 GHz   | <b>0.0698</b> |       |

\*MPE ratios = MPE/MPE limit at each frequency



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### [ISED]

| Mode            | Measured<br>Max Output<br>Power<br>(dBm) | G<br>(dBi) | Power<br>tolerance<br>(dB) | P<br>(dBm) | P<br>(mW) | Power<br>Density<br>(W/m <sup>2</sup> ) | Limit<br>(W/cm <sup>2</sup> ) | R<br>(cm) |
|-----------------|------------------------------------------|------------|----------------------------|------------|-----------|-----------------------------------------|-------------------------------|-----------|
| BLE             | 9.57                                     | 2.09       | +2                         | 11.57      | 14.35     | <b>0.0038</b>                           | 5.351                         | 20        |
| WLAN<br>2.4 GHz | 19.91                                    | 2.09       | +2                         | 21.91      | 155.24    | <b>0.0407</b>                           | 5.366                         |           |
| WLAN<br>5 GHz   | 19.64                                    | 3.81       | +2                         | 21.64      | 145.88    | <b>0.0698</b>                           | 9.047                         |           |

### Simultaneous transmitter

| Mode         | MPE ratios*   | Limit |
|--------------|---------------|-------|
| BLE          | 0.0038        | -     |
| WLAN 2.4 GHz | 0.0407        |       |
| WLAN 5 GHz   | <b>0.0698</b> |       |

\*MPE ratios = MPE/MPE limit at each frequency