



## Maximum Permissible Exposure (MPE) & Exposure evaluation

**Report identification number: 1-0596/20-02-11 MPE (FCC\_ISED)**

| Certification numbers and labeling requirements |             |
|-------------------------------------------------|-------------|
| FCC ID                                          | MFFLSR48    |
| ISED number                                     | 5782A-LSR48 |
| HVIN (Hardware Version Identification Number)   | 02          |
| PMN (Product Marketing Name)                    | LS-R-4.8    |
| FVIN (Firmware Version Identification Number)   | -/-         |
| HMN (Host Marketing Name)                       | -/-         |

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**EUT technologies:**

| Technologies:      | Max. power [dBm] |      | Antenna gain max.: [dBi] | # |
|--------------------|------------------|------|--------------------------|---|
|                    | conducted        | EIRP |                          |   |
| Zigbee<br>2450 MHz | 3.5              | 6.4  | 2.9                      | A |
| WLAN<br>5GHz       | 14.5             | 17.7 | 3.2                      | B |

Details and origins of the measurements shown in the table above:

| # | Results from:                                  | Additional information                         |
|---|------------------------------------------------|------------------------------------------------|
| A | 1-0596/20-01-07-A     CTC advanced GmbH report | Antenna gain page 22,<br>Max conducted page 25 |
| B | 1-0596/20-01-08-A     CTC advanced GmbH report | Antenna gain page 22,<br>Max conducted page 25 |

### Prediction of MPE limit at given distance - FCC

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG / 4\pi R^2$$

where: S = Power density  
 P = Power input to the antenna  
 G = Antenna gain  
 R = Distance to the center of radiation of the antenna  
 PG = Output Power including antenna gain

The table below is excerpted from Table 1B of 47 CFR 1.1310 titled "Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure"

| Frequency Range (MHz) | Power Density (mW/cm <sup>2</sup> ) | Averaging Time (minutes) |
|-----------------------|-------------------------------------|--------------------------|
| 300 -1500             | f/1500                              | 30                       |
| 1500 - 100000         | 1.0                                 | 30                       |

where f = Frequency (MHz)

Prediction: worst case

| Technologies:       |                                        | Zigbee | WLAN   |                    |
|---------------------|----------------------------------------|--------|--------|--------------------|
|                     | Frequency (MHz)                        | 2450   | 5000   |                    |
| PG                  | Declared max power (EIRP)              | 6.4    | 17.7   | dBm                |
| R                   | Distance                               | 20     | 20     | cm                 |
| S                   | MPE limit for uncontrolled exposure    | 1      | 1      | mW/cm <sup>2</sup> |
|                     | <b>Calculated Power density:</b>       | 0.0009 | 0.0117 | mW/cm <sup>2</sup> |
|                     | <b>Calculated percentage of Limit:</b> | 0.09%  | 1.17%  |                    |
| <b>Collocation:</b> |                                        |        |        |                    |
|                     | Scenario 1: Zigbee + WLAN              |        |        |                    |
|                     | Calculated percentage of Limit:        | 1.26%  |        |                    |

**This prediction demonstrates the following:**

The power density levels for FCC at a distance of 20 cm are below the maximum levels allowed by regulations.

### Prediction of MPE limit at given distance - ISED

RSS-102, Issue 5, 2.5.2

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than  $4.49/f^{0.5}$  W (adjusted for tune-up tolerance), where  $f$  is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than  $1.31 \times 10^{-2} f^{0.6834}$  W (adjusted for tune-up tolerance), where  $f$  is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

Prediction: worst case

|                     |                                 | Zigbee | WLAN  |     |
|---------------------|---------------------------------|--------|-------|-----|
|                     | Frequency                       | 2450   | 5000  | MHz |
| R                   | Distance                        | 20     | 20    | cm  |
| P                   | Max power input to the antenna  | 3.5    | 14.5  | dBm |
| G                   | Antenna gain                    | 2.9    | 3.2   | dBi |
| PG                  | Maximum EIRP                    | 6.4    | 17.7  | dBm |
| PG                  | Maximum EIRP                    | 4.4    | 58.9  | mW  |
|                     | Exclusion Limit from above:     | 0.60   | 4.42  | W   |
|                     | Calculated percentage of Limit: | 0.73%  | 1.33% |     |
| <b>Collocation:</b> |                                 |        |       |     |
|                     | Scenario 1: Zigbee + WLAN       |        |       |     |
|                     | Calculated percentage of Limit: | 2.06%  |       |     |

**Conclusion:** RF exposure evaluation is not required.