

## 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 2450 MHz	3.5	6.4	2.9	A
WLAN 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, Max conducted page 25
B	1-0596/20-01-08-A    CTC advanced GmbH report	Antenna gain page 22, 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	1.26%		
	Calculated percentage of Limit:			

**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	<b>Maximum EIRP</b>	4.4	58.9	mW
	<b>Exclusion Limit from above:</b>	0.60	4.42	W
	<b>Calculated percentage of Limit:</b>	0.73%	1.33%	
<b>Collocation:</b>				
	Scenario 1: Zigbee + WLAN	2.06%		
	Calculated percentage of Limit:			

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