Info

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MPR 4.1 – Model 802890 MPE - FCC

References: FCC ID: JQU802890
47 CFR 1.1307 & 1.1310
OET Bulletin 65, Edition 97
802890 User Manual

The model 802890 is compliant to the MPE routine evaluation limit and MPE mitigation exempt, as shown by calculation herein.

The MPR 4.1 Reader Model 802890 is a single multi-protocol radio with four multiplexed Antenna ports. Only one port is transmitting at a time.

The unit is professionally installed in accordance with maximum permitted ERP for a site. As defined by user manual, the maximum power at the antenna is restricted when operating. The instructions for the installer for setting up the lane are:

> The power output of a Reader at ambient ($P_{out(amb)}$) shall be constrained using internal or external Tx attenuation so that the following is satisfied:
>
> $P_{out(amb)} <= 43.77$ dBd - G_{fund};
>
> Where G_{fund} is the net gain from antenna connector on the Reader to the antenna radiated signal. The antenna gain is expressed in **dBd**. $P_{out(amb)}$ is expressed in **dBm**

These instructions define the limits on power setting into the antenna system (antenna plus cables) so that over temperature the ERP will not exceed 44.77dBmd.

The installer must also declare the operational ERP/EIRP of the system in which this module is used for the FCC or ISED Canada Site Licence.

The maximum permitted ERP of the unit is:

ERP = 44.77 dBmd = 30 W

The maximum EIRP of the unit is:

EIRP = ERP (dBmd) +2.15 dB = 44.77 + 2.15 = 46.92 dBmi

EIRP = 49204 mW = 49.2 W

In addition, the distance used for calculations is 100 cm, as this is the minimum distance an operator will be from the EUT during normal operation as required in the User Manual, and it is a controlled environment. The following statements are included in the User Manual:

> **Note:** IEC 60950-1 and/or EN60950-1, First Edition, Information Technology Equipment – Safety – Part 1: General Requirements require that this equipment must be located in a RESTRICTED ACCESS LOCATION (RAL). Only authorized personnel can have access to the equipment.

"Keep at least 100 cm away from the radiating face of the antenna when the RF module is connected and operating." This statement is found on page 15 of the User Manual.

The antenna height stated in the User Manual is 16 ft, and since these are placed over roadways in toll facilities, no general public can get within a few meters of them. Therefore they are in a controlled environment and no operator will be less than 100 cm from the antenna.

Due to the minimum separation distance MPE is applicable.

Routine Evaluation Exemption Threshold,

As per 1.1307(b)(3)(i)(c) routine evaluation is not required if :

the ERP (watts) is no more than the calculated value prescribed for that frequency.

ERP Threshold = $0.0128\ R^2\ F$

R in meters, F in MHz

Evaluation Exemption limit at 902 MHz = 11.5 W

Therefore routine evaluation against MPE limits is required and is provided below.

Routine Evaluation of MPE against MPE limit

The unit RF Field strength (MPE) is evaluated in accordance with Equation from page 20 of OET Bulletin 65, Edition 97-01.

Equations for Predicting RF Fields

Calculations can be made to predict RF field strength and power density levels around typical RF sources. For example, in the case of a single radiating antenna, a prediction for power density in the far-field of the antenna can be made by use of the general Equations (3) or (4) below [for conversion to electric or magnetic field strength see Equation (1) in Section 1]. These equations are generally accurate in the far-field of an antenna but will over-predict power density in the near field, where they could be used for making a "worst case" or conservative prediction.

$$S = \frac{PG}{4\pi R^2} \qquad (3)$$

where: S = power density (in appropriate units, e.g. mW/cm^2)
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
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

or:

$$S = \frac{EIRP}{4\pi R^2} \qquad (4)$$

where: EIRP = equivalent (or effective) isotropically radiated power

Using equation (4) above, the maximum power density from the unit S is given by :

EIRP (mW) = 49204 mW
R = 100 cm
S = 0.3916 mW/cm^2

The MPE limits for the unit frequency range are defined in 1.310(e)(1) table 1 as :

Power Density Limit (mW/cm^2) :
controlled environment <= $F/300$, with F in MHz, for <6 minute duration
uncontrolled environment <= $F/1500$, with F in MHz, for <30 minute duration

Maximum unit frequency = 921.5 MHz
Power Density Limit, controlled environment = 3.072 mW/cm^2 therefore this is PASS
Power Density Limit, uncontrolled environment = 0.614 mW/cm^2 therefore this is PASS

With this, both the uncontrolled and controlled exposure limits are met at a distance of 100cm

The units are therefore compliant to the Routine Evaluation MPE limits and fall under category one mitigation, in accordance with 1.1307(b)(4)(ii).