



Maximum Permissible Exposure Evaluation

for

CELPLAN TECHNOLOGIES, INC.

FR-100

For Part 15 Certification

FCC ID: TFF-FR-100

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Maximum Permissible Exposure Test Report

for

FCC ID: TFF-FR-100

1 1.0 Introduction

This report has been prepared on behalf of CELPLAN TECHNOLOGIES, INC. Transmitter to show compliance with the RF exposure requirements as defined in FCC §1.1307.

1.1 1.1 Requirements

Three different categories of transmitters are defined by the FCC in OET Bulletin 65. These categories are fixed installation, mobile, and portable and are defined as follows:

- **Fixed Installations:** fixed location means that the device, including its antenna, is physically secured at a permanent location and is not able to be easily moved to another location. Additionally, distance to humans from the antenna is maintained to at least 2 meters.
- **Mobile Devices:** a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to be generally used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structures and the body of the user or nearby persons. Transmitters designed to be used by consumers or workers that can be easily re-located, such as a wireless modem operating in a laptop computer, are considered mobile devices if they meet the 20 centimeter separation requirement. The FCC rules for evaluating mobile devices for RF compliance are found in 47 CFR §2.1091.
- **Portable Devices:** a portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user. Portable device requirements are found in Section 2.1093 of the FCC's Rules (47 CFR§2.1093).

For this test report the CELPLAN TECHNOLOGIES, INC. FR-100 is evaluated as a Modular Approval to be employed in fixed and mobile installations.

The FCC also categorizes the use of the device as based upon the user's awareness and ability to exercise control over his or her exposure. The two categories defined are Occupational/ Controlled Exposure and General Population/Uncontrolled Exposure. These two categories are defined as follows:

- **Occupational/Controlled Exposure:** In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means. Awareness of the potential for RF exposure in a workplace or similar environment can be provided through specific training as part of a RF safety program. If appropriate, warning signs and labels can also be used to establish such awareness by providing prominent information on the risk of potential exposure and instructions on methods to minimize such exposure risks.
- **General Population/Uncontrolled Exposure:** The general population / uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity. Warning labels placed on low-power consumer devices such as cellular telephones are not considered sufficient to allow the device to be considered under the occupational/controlled category, and the general population/uncontrolled exposure limits apply to these devices.

Since there are no warnings or training associated with this unit and it can be used by anyone, the CELPLAN TECHNOLOGIES, INC. is evaluated to the General Population/Uncontrolled Exposure limits.

1.2 Radio Frequency Radiation Exposure Evaluation

The highest RF output power of the unit was measured is recorded. According to §1.1310 of the FCC rules, the power density limit for General Population/Uncontrolled Exposure is $1\text{mW}/\text{cm}^2$. The MPE shall be calculated at 20cm to show compliance with the power density limit. The following formula was used to calculate the Power Density:

$$S = \frac{PG}{4\pi R^2}$$

Where:

S = Power Density

P = Output Power at the Antenna Terminals

G = Gain of Transmit Antenna (linear gain-isotropic)

R = Distance from Transmitting Antenna

1.2.1 Maximum Output Power Measured

Maximum Output Power		dBm
DTS:	2400 - 2483.5 MHz	28.2
	5725 - 5850 MHz	26.0
UNII:	5150-5250 MHz	17.0
	5725-5825 MHz	25.1

1.2.2 Antennas Employed In Fixed Installations

Following are data on the antennas to be used in the system:

Type		2.4 GHz	5.2 GHz	5.3 GHz	5.8 GHz
Omni	Mfgr	Hyperlink	Hyperlink	Hyperlink	Hyperlink
	Model	HG2415U/PRO	HG5310U	HG5310U	HG5812U/PRO
	Gain (dBi)	15	10	10	12
Panel (patch)	Mfgr	Hyperlink	Hyperlink	Hyperlink	Hyperlink
	Model	HG2418P	HG4953P	HG4953P	HG5158P
	Gain (dBi)	18	8	8	8
Directional	Mfgr	Hyperlink	MAXRAD	MAXRAD	MAXRAD
	Model	XA2424G	WISP4959018MBV	WISP4959018MBV	WISP4959018MBV
	Gain (dBi)	24	18	18	18

1.2.3 MPE Calculations

The following tables show the MPE calculations for individual frequencies of operation at the maximum measured power for each frequency.

2400-2483.5 MHz: Fixed Installations

The conducted power (max) at 2.4GHz is 28.2 dBm; the maximum gain antenna to be used is 24dBi. However, the power must be reduced by an amount of $(24\text{dBi}-6\text{dBi})/3 = 6 \text{ dB}$ when using the 24dBi antenna. MPE at 2.4 GHz is calculated using these values in the following table.

Single Transmitter

Frequency 2437 MHz

Limit 1.000 mW/cm²

Distance (cm), R = 20 cm

Power (dBm), P = 22.2 dBm

TX Ant Gain (dB), G = 24 dB

MPE 8.29 mW/cm² **Separation>20 cm**

Minimum Distance: 57.6 cm

2400-2483.5 MHz: Portable Installations

The conducted power (max) at 2.4GHz is 28.2 dBm; the maximum gain antenna to be used is 8dBi. MPE at 2.4 GHz is calculated using these values in the following table.

Single Transmitter

Frequency 2437 MHz

Limit 1.000 mW/cm²

Distance (cm), R = 20 cm

Power (dBm), P = 28.2 dBm

TX Ant Gain (dB), G = 8 dB

MPE 0.83 mW/cm² **Separation<20 cm**

Minimum Distance: 18.2 cm

5725 - 5850 MHz: Fixed Installations

Single Transmitter

Frequency 5805 MHz

Limit 1.000 mW/cm²

Distance (cm), R = 20 cm

Power (dBm), P = 26 dBm

TX Ant Gain (dB), G = 18 dB

MPE 5.00 mW/cm² **Separation>20 cm**

Minimum Distance: 44.7 cm

5725 - 5850 MHz: Portable Installations

Single Transmitter

Frequency 5805 MHz

Limit 1.000 mW/cm²

Distance (cm), R = 20 cm

Power (dBm), P = 26 dBm

TX Ant Gain (dB), G = 10 dB

MPE 0.79 mW/cm² **Separation < 20 cm**

Minimum Distance: 17.8 cm

5150-5250 MHz: Fixed and Portable Installations

Frequency 5200 MHz

Limit 1.000 mW/cm²

Distance (cm), R = 20 cm

Power (dBm), P = 17 dBm

TX Ant Gain (dB), G = 18 dB

MPE 0.63 mW/cm² **Separation < 20 cm**

Minimum Distance: 15.9 cm