Exposure of humans to RF fields

As per FCC KDB 447498 D01 and Section 2.1091 radio frequency transmitters are required to be operated in a manner that ensures the public is not exposed to RF energy levels.

Calculations have been made using the General Public/Uncontrolled Exposure limits that are defined in Section 1.1310.

Minimum safe distances have been calculated below.

Power density, $mW/cm^2 = E^2/3770$

- General Population / Uncontrolled exposure is (f/1500) mW/cm^2

As this radio will operate in various Part 101 bands between 928 - 960 MHz all calculations have been made at 928 MHz which is the lowest frequency of operation in the USA that will give the worst case result.

For an Uncontrolled Environment

Power Density = 1.0 $mW/cm^2 = E^2/3770$

$E = \sqrt{1.0*3770}$

E = 61.4 V/m

The rated power of 10 Watts (+40 dBm) has been used in the safe distance calculations to give the worst case results.

A worst case scenario duty cycle of 100% has been used for the calculations.

The client has stated that the device can be connected to the antenna models listed below.

Antenna Models:

Manufacturer	Model Number	Gain in dB with cable loss	Numeric gain
ELPRO	UDP400-C	0.6	1.15
ELPRO	BU-3/400	1.2	1.35
ELPRO	BU-6/400	4.2	2.65
ELPRO	YU3/400	2.2	1.65
ELPRO	YU6/400	5.2	3.35
ELPRO	YU9/400	2.4	1.75
ELPRO	YU16/400	7.4	5.50

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The minimum distance from the antenna at which the MPE is met is calculated from the following:

Field strength in V/m	(FS)
Transmit power in watts	(P)
Transmit antenna gain	(G)
Transmitter duty cycle	(DC)
Separation distance in metres	(D)

The calculation is as follows:

FS = (√ (30 * P * G * DC)) / D

Gain in dB With cable loss	Numeric gain	Minimum safe distance (d) (cm)
0.6	1.15	30.0
1.2	1.35	32.7
4.2	2.65	45.9
2.2	1.65	36.2
5.2	3.35	51.6
2.4	1.75	37.3
7.4	5.50	66.1

Sample calculation is given below

D = (√ (30 * P * G * DC)) / FS

D = (√ (30 * 10 * 1.15 * 1)) / 61.4

D = 0.30 m or 30 cm

Result: Complies if the safe distances defined for this environment are applied.

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