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

Limits for General Population / Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (E) (V/m)**	**Magnetic Field Strength (H) (A/m)**	**Power Density (S) (mW/ cm²)**	**Averaging Time |E|²,|H|² or S (minutes)**
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30
Note 1: f = frequency in MHz ; *Plane-wave equivalent power density Note 2: For the applicable limit, see FCC 1.1310				

- General Population / Uncontrolled exposure is 0.2 mW/cm^2

As this radio can operate over the range of 30-300 MHz the lowest frequency of operation which will give the worst case result, would be 150.9 MHz.

The power density at 150.9 MHz comes out to be 0.20 mW/cm^2.

For Uncontrolled Environment

Power Density = 0.20 $mW/cm^2 = E^2/3770$

$E = \sqrt{0.20*3770}$

E = 27.5 V/m

The rated maximum transmitter power = 5 watts (+37 dBm).

A worst case duty cycle (DC) of 100% (1.0) has been applied to the calculations.

The client has suggested that a standard 3 dBi antenna type would be used by customers with the transmitter.

Calculations of the safe distance for these types of antenna are detailed as below.

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

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

The calculation is as follows:

$D = \sqrt{\ } (30 * P * G*DC) / E$

The calculation for the safe distance would be as follows:

$D = \sqrt{\ } (30 * P * G*DC) / E$
$D = \sqrt{\ } (30 * 5*2*1.0) / 27.5$
D = 0.62 metres or 62 cm

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