

Exhibit 11: Maximum Permissible Exposure (MPE) calculations for High Performance UHF Readers

Maximum Permissible Exposure calculations

Table 1. *FCC Limits for Maximum Permissible Exposure (MPE)*

(A) Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f ²)*	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	f/300	6
1500-100,000	--	--	5	6

(B) 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/cm ²)	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 ²)*	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	f/1500	30
1500-100,000	--	--	1.0	30

f = frequency in MHz

*Plane-wave equivalent power density

Source: http://www.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet65/oet65b.pdf

The basic relationship among power, gain, and field strength is

$$S = \frac{G * P}{4\pi r^2} \quad (1)$$

where

S = power density in mW/cm²,

G = gain relative to an isotropic radiator (dBi),

P = power delivered to the antenna (mW),

r = distance (cm),

High Performance Fixed Reader:

Refer to Eq. 1 and the limits in Table 1

$f = 902\text{-}928\text{ MHz}$. Let assume MPE case for $f = 902\text{ MHz}$

$G \cdot P = 4\text{ W EIRP} \Rightarrow 4000\text{ mW EIRP}$

	Occupational/Controlled Exposure (mW/cm ²) for 6min	General population/Uncontrolled Exposure (mW/cm ²) for 30min
Limit according to Table 1	$902/300 = 3.006$	$902/1500 = 0.601$
Distance (cm) to meet MPE according to Eq.1	$r = \sqrt{\frac{4000}{3.006 \times 4\pi}}$ $r = 10.29\text{ cm}$	$r = \sqrt{\frac{4000}{0.601 \times 4\pi}}$ $r = 23.01\text{ cm}$
Note	<ul style="list-style-type: none"> Safety notification in manuals and product label on safe distance is 30cm. 	

Now let's assume MPE case for $f = 928\text{ MHz}$

$G \cdot P = 4\text{ W EIRP} \Rightarrow 4000\text{ mW EIRP}$

	Occupational/Controlled Exposure (mW/cm ²) for 6min	General population/Uncontrolled Exposure (mW/cm ²) for 30min
Limit according to Table 1	$928/300 = 3.093$	$928/1500 = 0.618$
Distance (cm) to meet MPE according to Eq.1	$r = \sqrt{\frac{4000}{3.093 \times 4\pi}}$ $r = 10.14\text{ cm}$	$r = \sqrt{\frac{4000}{0.618 \times 4\pi}}$ $r = 22.70\text{ cm}$
Note	<ul style="list-style-type: none"> Safety notification in manuals and product label on safe distance is 30cm. 	