# Exhibit 11: Maximum Permissible Exposure (MPE) calculations for UHF Single Antenna reader VHY3222

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# 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 $\lvert E \rvert^2$, $\lvert H \rvert^2$ 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 $\lvert E \rvert^2$, $\lvert H \rvert^2$ 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

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

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

where
S = power density in mW/cm$^2$,
G = gain relative to an isotropic radiator (dBi),
P = power delivered to the antenna (mW),
r = distance (cm),

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## High Performance Fixed Reader:

Refer to Eq. 1 and the limits in Table 1

f = 902-928 MHz. Let assume MPE case for f = 902 MHz

G*P = 2W ERP => 3200mW EIRP

| | Occupational/Controlled Exposure (mW/cm²) for 6min | General population/Uncontrolled Exposure (mW/cm²) for 30min |
|---|---|---|
| **Limit according to Table 1** | 902/300 = 3.006 | 902/1500 = 0.601 |
| **Distance (cm) to meet MPE according to Eq.1** | $r = \sqrt{\dfrac{3200}{3.006 \times 4\pi}}$<br>$r = 9.20\,cm$ | $r = \sqrt{\dfrac{3200}{0.601 \times 4\pi}}$<br>$r = 20.58\,cm$ |
| **Note** | • Safety notification in manuals and product label on safe distance is 30cm. | |

Now let's assume MPE case for f = 928 MHz

G*P = 2W ERP => 3200mW EIRP

| | Occupational/Controlled Exposure (mW/cm²) for 6min | General population/Uncontrolled Exposure (mW/cm²) for 30min |
|---|---|---|
| **Limit according to Table 1** | 928/300 = 3.093 | 928/1500 = 0.618 |
| **Distance (cm) to meet MPE according to Eq.1** | $r = \sqrt{\dfrac{3200}{3.093 \times 4\pi}}$<br>$r = 9.07\,cm$ | $r = \sqrt{\dfrac{3200}{0.618 \times 4\pi}}$<br>$r = 20.30\,cm$ |
| **Note** | • Safety notification in manuals and product label on safe distance is 30cm. | |

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