



CTK Co., Ltd.
The Prime Leader of Global Regulatory Compliance

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APPENDIX B – MPE CALCULATION

* * MPE Calculations * *

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the user. The MPE calculation for this exposure is shown below.

$EIRP = P + G$ $EIRP = 14.50 \text{ dBm}$	Where, P = Power input to the antenna (mW) G = Power gain of the antenna (dBi)
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The numeric gain(G) of the antenna with a gain specified in dB is determined by:

$$G = \text{Log}^{-1} (\text{dB antenna gain} / 10)$$

$$G = \text{Log}^{-1} (4 / 10)$$

$$G = 2.51$$

Power density at the specific separation:

$S = PG / (4R^2 \pi)$ $S = (11.22 * 2.51) / (4 * 20^2 * \pi)$ $S = 0.0056 \text{ mW/cm}^2$	Where, S = Maximum power density (mW/cm^2) P = Power input to the antenna (mW) G = Numeric power gain of the antenna R = Distance to the center of the radiation of the antenna (20cm = limit for MPE)
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The Maximum permissible exposure (MPE) for the general population is 1 mW/cm^2 .
The power density at 20cm does not exceed the 1 mW/cm^2 limit.

Estimated safe separation:

$R = \sqrt{(PG / 4 \pi)}$ $R = \sqrt{(11.22 * 2.51 / 4 \pi)}$ $R = 1.50 \text{ cm}$	Where, P = Power input to the antenna (mW) G = Numeric power gain of the antenna R = Distance to the center of the radiation of the antenna (20cm = limit for MPE)
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* * CO-LOCATED MPE CALCULATIONS * *

For multiple co-located transmitters operating simultaneously the total power density can be calculated by summing the Power * Gain product (in linear units) of each transmitter.

LIMITS

From FCC §1.1310 Table 1 (B), the maximum value of $S = 1.0 \text{ mW/cm}^2$

RESULTS

Mode	Band	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)	Power Density (mW/cm^2)	Results
RFID	914.5 MHz	29.52	6.39			
WLAN	2.4 GHz	10.50	4.00			
Combined				20	0.781	Complies

$$S = (P_1 \cdot G_1 + P_2 \cdot G_2) / (4R^2\pi)$$

$$= (3899.42 + 28.18) / (4 * 20^2 * \pi) = 0.781$$

※ Note.

S = Power Density in mW/cm^2

Px = Power of transmitter x in mW

Gx = Numeric gain of antenna x

R = distance in cm