

## MEASUREMENT/TECHNICAL REPORT



**Intermec Technologies Corporation**  
**2100 UAP RFID Reader**

**REPORT NO: 20040504-1**

**DATE: May 4, 2004**  
**Appendix B**

RF EXPOSURE, MPE CALCULATION

Page 2 Kathrien Antenna Calculation

Page 3 Cushcraft Antenna Calculation

Page 4 Intermec Card Programming Station Calculation

**MAXIMUM PERMISSIVE EXPOSURE, MPE CALCULATOR**  
**2100 UAP RFID 900 MHz Reader**  
**with 6.0 dBi antenna, Intermec PN 805-622-002**  
**Kathrien 25-1000 Antenna**

MPE Calculator				dBi	6.00
				dBi to dBd	2.17
TX Frequency (MHz)	900	Watts	0.3	Antenna Gain dBd	3.83
Cable Losses dB	0.7	dBm	24.771213	Antenna minus cable = dBi	5.30
Calculated ERP (mW)		616.767179		radiated (ERP) dBm	27.901
Calculated EIRP (mW)		1016.532468		radiated (EIRP) dBm	30.071

**Occupational Limit**  
**3.00 mW/cm<sup>2</sup>**

**General Public Limit**  
**0.60 mW/cm<sup>2</sup>**

$$\frac{\text{EIRP}}{4 \uparrow d^2} = \text{mW/cm}^2$$

d = cm    EIRP=mW

TX Frequency (MHz)	
wavelength	
meters	cm
0.333333333	33.333

FCC radiofrequency radiation exposure limits 1.1310			
Freq. MHz	occ.limit		public limit
300-1,500	f/300		f/1500
1,500-10,000	5		1

MPE uses EIRP for calculations. EIRP is based on TX power added to the antenna gain in dBi.  
dBi = dB gain compared to an isotropic radiator

\*

EIRP (milliwatts)	Distance (cm)	Distance (Meters)	Distance (inches)	mW/cm <sup>2</sup>
1016.532	100.00	1.0000	39.37	0.00809
1016.532	75.00	0.7500	29.53	0.01438
1016.532	50.00	0.5000	19.69	0.03236
1016.532	40.00	0.4000	15.75	0.05056
1016.532	35.00	0.3500	13.78	0.06604
1016.532	30.00	0.3000	11.81	0.08988
1016.532	25.00	0.2500	9.84	0.12943
1016.532	20.00	0.2000	7.87	0.20223
1016.532	19.50	0.1950	7.68	0.21274
1016.532	19.00	0.1900	7.48	0.22408
1016.532	18.50	0.1850	7.28	0.23636
1016.532	18.00	0.1800	7.09	0.24967
1016.532	17.50	0.1750	6.89	0.26414
1016.532	17.00	0.1700	6.69	0.27991
1016.532	16.50	0.1650	6.50	0.29713
1016.532	16.00	0.1600	6.30	0.31599
1016.532	15.50	0.1550	6.10	0.33670
1016.532	15.00	0.1500	5.91	0.35952

**MAXIMUM PERMISSIVE EXPOSURE, MPE CALCULATOR**  
**2100 UAP RFID 900 MHz Reader**  
**with 4.0 dBi antenna, Intermec PN A270002-05**  
**Cushcraft Model S9028PC12NF**

MPE Calculator				dBi	4.00
				dBi to dBd	2.17
TX Frequency (MHz)	900	Watts	0.3	Antenna Gain dBd	1.83
Cable Losses dB	0.7	dBm	24.771213	Antenna minus cable = dBi	3.30
	Calculated ERP (mW)	389.153781		radiated (ERP) dBm	25.901
	Calculated EIRP (mW)	641.388627		radiated (EIRP) dBm	28.071

**Occupational Limit**  
**3.00 mW/cm<sup>2</sup>**

**General Public Limit**  
**0.60 mW/cm<sup>2</sup>**

$$\frac{\text{EIRP}}{4 \uparrow d^2} = \text{mW/cm}^2$$

d = cm    EIRP=mW

TX Frequency (MHz)	
wavelength	
meters	cm
0.333333333	33.333

FCC radiofrequency radiation exposure limits 1.1310			
Freq. MHz	occ.limit		public limit
300-1,500	f/300		f/1500
1,500-10,000	5		1

MPE uses EIRP for calculations. EIRP is based on TX power added to the antenna gain in dBi.  
dBi = dB gain compared to an isotropic radiator

EIRP (milliwatts)	Distance (cm)	Distance (Meters)	Distance (inches)	mW/cm <sup>2</sup>
641.3886	100.00	1.0000	39.37	0.00510
641.3886	75.00	0.7500	29.53	0.00907
641.3886	50.00	0.5000	19.69	0.02042
641.3886	40.00	0.4000	15.75	0.03190
641.3886	35.00	0.3500	13.78	0.04167
641.3886	30.00	0.3000	11.81	0.05671
641.3886	25.00	0.2500	9.84	0.08166
641.3886	20.00	0.2000	7.87	0.12760
641.3886	19.50	0.1950	7.68	0.13423
641.3886	19.00	0.1900	7.48	0.14139
641.3886	18.50	0.1850	7.28	0.14913
641.3886	18.00	0.1800	7.09	0.15753
641.3886	17.50	0.1750	6.89	0.16666
641.3886	17.00	0.1700	6.69	0.17661
641.3886	16.50	0.1650	6.50	0.18748
641.3886	16.00	0.1600	6.30	0.19938
641.3886	15.50	0.1550	6.10	0.21245
641.3886	15.00	0.1500	5.91	0.22684

\*

**MAXIMUM PERMISSIVE EXPOSURE, MPE CALCULATOR**  
**2100 UAP RFID 900 MHz Reader**  
**with -5.0 dBi antenna, Intermec PN ITA915017**  
**Intermec Card Programming Station Antenna**

MPE Calculator				dBi	-5.00
				dBi to dBd	2.17
TX Frequency (MHz)	900	Watts	0.3	Antenna Gain dBd	-7.17
Cable Losses dB	0.7	dBm	24.771213	Antenna minus cable = dBi	-5.70
	Calculated ERP (mW)	48.991558		radiated (ERP) dBm	16.901
	Calculated EIRP (mW)	80.746044		radiated (EIRP) dBm	19.071

**Occupational Limit**  
**3.00 mW/cm<sup>2</sup>**

**General Public Limit**  
**0.60 mW/cm<sup>2</sup>**

$$\frac{\text{EIRP}}{4 \uparrow d^2} = \text{mW/cm}^2$$

TX Frequency (MHz)	
wavelength	
meters	cm
0.333333333	33.333

d = cm      EIRP=mW

FCC radiofrequency radiation exposure limits 1.1310			
Freq. MHz	occ.limit		public limit
300-1,500	f/300		f/1500
1,500-10,000	5		1

MPE uses EIRP for calculations. EIRP is based on TX power added to the antenna gain in dBi.  
dBi = dB gain compared to an isotropic radiator

EIRP (milliwatts)	Distance (cm)	Distance (Meters)	Distance (inches)	mW/cm <sup>2</sup>
80.74604	100.00	1.0000	39.37	0.00064
80.74604	75.00	0.7500	29.53	0.00114
80.74604	50.00	0.5000	19.69	0.00257
80.74604	40.00	0.4000	15.75	0.00402
80.74604	35.00	0.3500	13.78	0.00525
80.74604	30.00	0.3000	11.81	0.00714
80.74604	25.00	0.2500	9.84	0.01028
80.74604	20.00	0.2000	7.87	0.01606
80.74604	19.50	0.1950	7.68	0.01690
80.74604	19.00	0.1900	7.48	0.01780
80.74604	18.50	0.1850	7.28	0.01877
80.74604	18.00	0.1800	7.09	0.01983
80.74604	17.50	0.1750	6.89	0.02098
80.74604	17.00	0.1700	6.69	0.02223
80.74604	16.50	0.1650	6.50	0.02360
80.74604	16.00	0.1600	6.30	0.02510
80.74604	15.50	0.1550	6.10	0.02675
80.74604	15.00	0.1500	5.91	0.02856

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