Intermec

A UNOVA Company

June 20. 2002

Intermec Technologies Corporation
Systems and Solutions
550 Second Street S.E.
Cedar Rapids, IA 52401

Subject: FCC ID: EHA-RM91501X04
Antenna details for Intermec radio model ITRM915.

Intermec PN A270001-02

Gain 6-dBi in final worst case configuration.

The Sinclair SRL-441U antenna is a 5.5-dBd (7.67-dBi) gain antenna. Intermec will use 13 feet of RG 58 cable to introduce 2.0-dB loss in the antenna path. The net gain of this antenna system will be 5.7-dBi gain.

Intermec PN A270002-05

Gain 4-dBi in final worst case configuration.

The Cushcraft S9028PC12NF antenna is a 7.5-dBic-gain antenna. Applying a -3 dB linear isolation calculation the antenna has a horizontal or vertical gain of 4.5 dBi. Intermec will use 6 feet of RG 58 cable to introduce 0.7-dB loss in the antenna path. The net gain of this antenna system will be 3.8-dBi gain.

Both antennas above will offer cables longer than specified above to accommodate installation variations. Those cables will be of the same type listed above. All antennas will use connectors that meet the unique connector regulations and will NOT have any offering that includes field terminations.

Dave Fry
Regulatory Engineer

Intermec
Technologies Corporation
EMC Test Laboratory
Cedar Rapids, IA

David L. Fry
Regulatory Engineer
Date: May 7, 2002

MAXIMUM PERMISSIVE EXPOSURE, MPE CALCULATOR
900 RFID with 6.0 dBi antenna, Intermec PN A270001-02
Sinclair Model SRL-441U

MPE Calculator					dBi	7.67
				dBd + 2.17 = dBi	dBi to dBd	2.17
TX Frequency (MHz)	900	Watts	1	Antenna Gain dBd		5.5
Cable Losses dB	2	dBm	30.000000	Antenna minus cable = dBi		5.67

Calculated ERP (mW)	2238.721139	radiated (ERP) dBm	33.500
Calculated EIRP (mW)	3689.775986	radiated (EIRP) dBm	35.670

Ocupational Limit
3.00 mW/cm ^{2}

General Public Limit
0.60 mW/cm ^{2}

$$\frac{EIRP}{4 \pi d^2} = mw/cm^2$$

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 (watts)	Distance (cm)	Distance (Meters)	Distance (inches)		mW/cm ^{2}
3689.776	100.00	1.0000	39.37		0.02936
3689.776	75.00	0.7500	29.53		0.05220
3689.776	50.00	0.5000	19.69		0.11745
3689.776	40.00	0.4000	15.75		0.18351
3689.776	35.00	0.3500	13.78		0.23969
3689.776	30.00	0.3000	11.81		0.32625
3689.776	25.00	0.2500	9.84		0.46980
3689.776	24.75	0.2475	9.74		0.47934
3689.776	24.50	0.2450	9.65		0.48917
3689.776	24.25	0.2425	9.55		0.49931
3689.776	24.00	0.2400	9.45		0.50976
3689.776	23.75	0.2375	9.35		0.52055
3689.776	23.50	0.2350	9.25		0.53169
3689.776	23.25	0.2325	9.15		0.54318
3689.776	23.00	0.2300	9.06		0.55505
3689.776	22.75	0.2275	8.96		0.56732
3689.776	22.50	0.2250	8.86		0.58000
3689.776	22.25	0.2225	8.76		0.59310
3689.776	22.00	0.2200	8.66		0.60666
3689.776	21.75	0.2175	8.56		0.62069
3689.776	21.50	0.2150	8.46		0.63520
3689.776	21.25	0.2125	8.37		0.65024

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

MPE Calculator					dBi	4.50
				dBd + 2.17 = dBi	dBi to dBd	2.17
TX Frequency (MHz)	900	Watts	1	Antenna Gain dBd		2.33
Cable Losses dB	0.7	dBm	30.000000	Antenna minus cable = dBi		3.80
Calculated ERP (mW)		1455.459081		radiated (ERP) dBm		31.630
Calculated EIRP (mW)		2398.832919		radiated (EIRP) dBm		33.800

Ocupational Limit
3.00 mW/cm ^{2}

General Public Limit
0.60 mW/cm ^{2}

$$\frac{EIRP}{4\pi d^2} = mw/cm^2$$

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 (watts)	Distance (cm)	Distance (Meters)	Distance (inches)		mW/cm ^{2}
2398.833	100.00	1.0000	39.37		0.01909
2398.833	75.00	0.7500	29.53		0.03394
2398.833	50.00	0.5000	19.69		0.07636
2398.833	40.00	0.4000	15.75		0.11931
2398.833	35.00	0.3500	13.78		0.15583
2398.833	30.00	0.3000	11.81		0.21210
2398.833	25.00	0.2500	9.84		0.30543
2398.833	20.00	0.2000	7.87		0.47723
2398.833	19.50	0.1950	7.68		0.50202
2398.833	19.00	0.1900	7.48		0.52879
2398.833	18.50	0.1850	7.28		0.55776
2398.833	18.00	0.1800	7.09		0.58918
2398.833	17.50	0.1750	6.89		0.62332
2398.833	17.00	0.1700	6.69		0.66053
2398.833	16.50	0.1650	6.50		0.70117
2398.833	16.00	0.1600	6.30		0.74568
2398.833	15.50	0.1550	6.10		0.79456
2398.833	15.00	0.1500	5.91		0.84841