RF EXPOSURE

5.1 RF Safety Requirements to 2.1091 for Mobile Transmitters

The unit under evaluation has various external antennas. Cirronet Corporation calculated the MPE emission values for a WIT2410 with each of the antennas. The maximum power density occurs when using the 24 dBi dish for fixed applications and with the 15 dBi Yagi for mobile applications. They used the formula shown in OET Bulletin 65 and calculated the minimum distance between antenna and unsuspecting user as 50.2 cm for fixed applications and 20 cm for mobile applications.

Cirronet Corporation will sell the WIT2410 with one of the following antennas.

MANUFACTURER	TYPE OF ANTENNA	MODEL	GAIN dB	TYPE OR CONNECTOR
Fixed Antennas				
Andrews	Parabolic Dish	26T-2400A	24 dBi	Reverse N to MMCX via adapter cable
Hyperlink Technologies, Inc.	Parabolic Dish	2424GC	24 dBi	Reverse N to MMCX via adapter cable
Andrews	Parabolic Dish	18T-2400 A	18 dBi	Reverse N to MMCX via adapter cable
Mobile Antennas				
ACE	Dipole	ACE-2400NF	2 dBi	Reverse SMA to MMCX via adapter cable
Cushcraft	Yagi	PC2415-RTNF	15 dBi	Reverse TNC to MMCX via adapter cable
Mobile Mark	Omni-Directional	OD6-2400-RNTC	6 dBi	Reverse TNC to MMCX via adapter cable
Mobile Mark	Corner Reflector	SCR14-2400PTA-RTNC	14 dBi	Reverse TNC to MMCX via adapter cable
Mobile Mark	Corner Reflector	SCR9-2400-RN	9 dBi	Reverse N to MMCX via adapter cable
Mobile Mark	Vehicle Mount Stub	RM3-2400-RTNC	2.5 dBi	Reverse TNC to MMCX via adapter cable
Mobile Mark	Omni	OD9-2400MUF24005	9 dBi	Reverse TNC to MMCX via adapter cable
MaxRad	Whip	MUF24005.RTNC	5 dBi	Reverse TNC to MMCX via adapter cable
MaxRad	Whip Magnetic Mount (Mobile Vehicle Whip)	MUF24005.RTNC	5 dBi	Reverse TNC to MMCX via adapter cable
Digital Wireless Corporation	Patch	PA2400	Appx. 3 dBi	Reverse TNC to MMCX via adapter cable
Cirronet Corporation	Patch	GA Tech	12 dBi	Non-standard MMCX
Cirronet Corporation	Patch	PA2410	6dBi	Non-standard MMCX

5.1 RF Safety Requirements to 2.1091 for Mobile Transmitters – Cont.

Power Output

The EUT's maximum expected output power as shown in Section 2.6 was

Frequency of Fundamental (GHz)	Measurement (dBm)*	Measurement (W)*	FCC Limit* (Watt)
2400.15	17.10	51.29	1.0
2435.63	17.83	60.67	1.0
2469.81	18.39	69.02	1.0

* Measurement includes 0.1 dB for cable loss

Worst Case Antennas

The maximum EIRP expected for fixed installations is with the +24 dBi gain Andrews parabolic dish antenna. This would yield a maximum EIRP of 18.4 dBm + 24 dBi = +42.4 dBm.

The maximum EIRP expected for mobile installations is with the +15dBi gain Yagi antenna. This would yield and maximum EIRP of 18.4 dBm + 15 dBi = +33.4 dBm.

5.1 RF Safety Requirements to 2.1091 for Mobile Transmitters – Cont.

Source Based Time Averaging

Additionally, source based time averaging may be applied as the worse case transmit duty cycle is given as follows:

Worst Case Transmit Duty Cycle for WIT2410

This factor was calculated by first determining the worst case scenario for system operation - worst case being defined as the scenario when the WIT2410 would be transmitting the longest period during a dwell.

This worst case operating scenario is as follows:

1) point-to-point operation
(only two units communicating with one another)

2) data flow is almost completely unidirectional
(that is, one radio is relaying a large amount of data to the other radio with only synchronization data being passed back the other direction)

3) The amount of data being fed to the sending radio is exactly portioned out to fit the maximum packet size allowable (280 bytes). The radio cannot send more than 280 bytes on a single channel – additional data must be sent on the next hop.

For this example, a remote unit is transferring a large data file to a base unit. The maximum transmit time by Remote on a single channel would be:

= 280 bytes * 8 bits/byte * (1/460.8 Kbps) = 4.86 ms

The minimum hop duration for this scenario would be 6.94 ms. This transmit pattern would continue on each channel and is considered repetitive. Therefore, for purposes of MPE, the transmission duty cycle correction factor is then calculated as:

Duty cycle = (on time)/(total time) = 4.86/6.94 = 70.0 %

This yields for a duty cycle correction of 10 log (0.70) = -1.5 dB. Therefore the maximum EIRP for fixed installations may be expected to be

+42.4 dBm – 1.5 dB = +40.9 dBm
Antilog(40.9 dBm/10) = 12,302.69 mW

The maximum EIRP for mobile installations may be expected to be

+33.4 dBm – 1.5 dB = +31.9 dBm
Antilog(31.9 dBm/10) = 1548.8 mW

5.1 RF Safety Requirements to 2.1091 for Mobile Transmitters – Cont.

MPE Calculations

The limits for this unit (uncontrolled exposure) are 1.0 mW/cm^2. Taking the RF Denisty Field Equation:

Fixed Installations

S = (EIRP in mW)/($4\pi R^2$) and solving for Distance R

S = $12302.69/4\pi 20^2$

S = 12302.69/5026.55

S = 2.5 mW/cm^2

Solving the above equation yields

R = SQRT ((EIRP in mW)/(S4π))

R (cm) = SQRT (12302.69(mw)/(1.0(mW/cm^2)*4*π)) = 31.3 cm for fixed installations

And

Mobile Installations

S = $1,548.80/4\pi\ 20^2$

S = 1,548.8/5026.55

S = 0.308mw/cm^2

All manual instructions will specify 20 cm for mobile installations and 2 meters for fixed installations.