SECTION 8

RF EXPOSURE INFORMATION

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 HN1510 with each of the antennas. The maximum power density occurs when using the 24 dBi dish for fixed applications and with the 12 dBi omnidirectional for mobile applications. They used the formula shown in OET Bulletin 65 and calculated the minimum distance between antenna and unsuspecting user as 26.0 cm for fixed applications and 6.5 cm for mobile applications.

Cirronet Corporation will sell the HN1510 with one of the following antennas:

Previously Approved Antennas as Listed in Original Submittal

MANUFACTURER	TYPE OF ANTENNA	MODEL	GAIN dB
ACE	Dipole	ACE-2400NF	2 dBi
Cushcraft	Yagi	PC2415-RTNF	15 dBi
Mobile Mark	Omni-Directional	OD6-2400-RTNC	6 dBi
Mobile Mark	Omni-Directional	OD12-2400PTA-RTNC	12 dBi
Mobile Mark	Corner Reflector	SCR14-2400PTA-RTNC	14 dBi
Mobile Mark	Patch	P7-2400RTNC	7 dBi
Cirronet Corporation.	Patch	PA2410	Appx. 3 dBi

New Additional Antennas Covered by Permissive Change Application

MANUFACTURER	TYPE OF ANTENNA	MODEL	GAIN dB
Mobile Mark	Vehicle Mount	RM3-2400-RTNC	2.5 dBi
Mobile Mark	Corner Reflector	SCR9-2400-RN	9 dBi
MaxRad	Whip	MUF24005-RTNC	5 dBi
Andrews	Parabolic Dish	26T-2400 A	24 dBi
Andrews	Parabolic Dish	18T-2400 A	18 dBi

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

Power Output

The EUT's maximum expected output power as shown in the original grant of certification (FCC ID: HSW-2410M) was

Frequency of Fundamental (MHz)	Measurement (dBm)*	Measurement (Watt)*	FCC Limit* (Watt)
2401.9	16.2	0.041	1.0
2440.0	16.8	0.047	1.0
2483.5	16.8	0.047	1.0

* Measurement includes 0.3 dB for cable loss

The maximum EIRP expected for fixed installations is with the +24 dBi gain parabolic dish antenna. This would yield and maximum EIRP of 16.8 dBm + 24 dBi = +40.8 dBm.

The maximum EIRP expected for mobile installations is with the +12 dBi gain omnidirectional antenna. This would yield and maximum EIRP of 16.8 dBm + 12 dBi = +28.8 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 HN1510

This factor was calculated by first determining the worst case scenario for system operation - worst case being defined as the scenario when the HN1510 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

+40.8 dBm – 1.5 dB = +39.3 dBm
Antilog(39.3 dBm/10) = 8511.4 mW

The maximum EIRP for mobile installations may be expected to be

+28.8 dBm – 1.5 dB = +27.3 dBm
Antilog(27.3 dBm/10) = 537.0 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:

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

R = SQRT ((EIRP in mW)/($S4\pi$))

Solving the above equation yields

R (cm) = SQRT (8511.4(mw)/(1.0(mW/cm^2)*4*π)) = 26.0 cm for fixed installations

R (cm) = SQRT (537.0(mw)/(1.0(mW/cm^2)*4*π)) = 6.5 cm for mobile installations

Since the EUT is designed for mobile and fixed applications (where the expected separation distance between antenna and humans is greater than 20 cm or 2 m respectively), all manual instructions have specified 20 cm or 2 meters as appropriate for the types of antenna being used the minimum exposure distance.