MPE Calculations – XS-3900-16

The device is not a portable device (i.e. intended to be worn on the body or be hand-held), so it is classified as being either a mobile device or a fixed mounted device. The user's manual specifies a minimum separation distance of at least 20cm, consistent with this classification.

FCC part 1.1310, Table 1 limits the power density for uncontrolled exposure. The power density, P_d (mW/cm^2) calculated from the maximum EIRP, P_t (mW) and the distance, d (m), between the transmitting antenna and the closest person, can be calculated using:

$$P_d = P_t /(4 \ pd^2)$$

Frequency	MPE Limit (mW/cm^2)	Eirp (mW) [1]	Pd at 20cm (mW/cm^2)	Distance where Pd = limit (cm)
2400 to 5850 MHz	1.00	4265.8 [2]	0.8	18.4

- [1]Equivalent isotropic output power is the total eirp summed across all active transmitters. There are 16 transmitters available, 4 that can use the 2.4 GHz band and all 16 are capable of operating in the 5GHz bands. The worst case eirp in the table above is for the worst case configuration, based on the channels used being those with the highest output power. Refer to the table on the following page for the total eirp calculations.
- [2]This calculation assumes that all transceivers are connected to antennas with gains of 6dBi (highest gain antenna available in any band).

As shown in the calculations above, the power density 18.4 cm from the device is below the maximum permitted level for uncontrolled exposure. The instructions in the user's manual require a separation distance of at least 25cm.

Calculation Tables For Determining Total EIRP Across All 16 Transmitters

The calculations for maximum eirp do not take into account the fact that:
- All transmitters do not transmit with a 100% duty cycle
- The majority of antennas used (at least 12 of the 16) are directional antennas with little overlap in the main beams from each antenna

The calculations are, therefore, a conservative estimate for the rf hazard presented by the device.

Band	Mode	Output Power		Antenna gain (Max)	EIRP		Channels Available	Channels Used	Total EIRP	
		Peak	Average		dBm	W			W	dBm
2400 - 2483.5	OFDM	21.3	16.7	6.0	22.7	0.186	11	-		
2401 - 2483.5	CCK	18.0	16.7	6.0	22.7	0.186				
5150 - 5250	OFDM	-	11.0	6.0	17.0	0.050	4	-		
5250 - 5350	OFDM	-	17.6	6.0	23.6	0.231	4	4	0.923	29.7
5470 - 5725	OFDM	-	17.2	6.0	23.2	0.209	11	7	1.463	31.7
5725 - 5850	OFDM	19.7	-	6.0	25.7	0.372	5	5	1.858	32.7
							Totals:	16	4.243	36.3

The system incorporates a lock-out mechanism to prevent a channel being used more than once, therefore the maximum number of transmitters in each band is limited to the lower of number of channels available or number of transceivers capable of operating in the band.

4 transceivers can operate in the 2400-2483.5 MHz band. All 16 transceivers can operate in the 5150 - 5250MHz, 5250-5350MHz, 5470-5725MHz and 5725-5850MHz bands. Operation in any band does not allow any two radios to use the same channel or to use overlapping channels (the only band with overlapping channels is the 2.4GHz band which has a 5 MHz channel spacing and a 6dB signal bandwidth of between 12 MHz (for 802.11b) and 17 MHz (802.11g).

Maximum eirp is calculated using the highest average power for each channel (where given), otherwise it uses the highest peak power.

As there are 16 transceivers available, the transceivers are assigned to the available channels in order of decreasing power as follows:
- The 5725-5850 MHz band has the highest eirp, and 5 channels available so the first five transceivers are allocated to that band;
- The band with the next highest eirp per channel is 5250-5350 MHz, with four channels, so the next four transceivers are placed in that band (9 transceivers so far);
- The band with the next highest eirp per channel is 5470-5725 MHz, with eleven channels, so the next seven transceivers are placed in that band (total of 16 transceivers).

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Band	Mode	Output Power		Antenna gain	EIRP		Channels Available	Channels Used	Total EIRP			
		Peak	Average	(Max)	dBm	W			W	dBm		
2400 - 2483.5	OFDM	21.3	16.7	6.0	22.7	0.186	11	-				1
2401 - 2483.5	CCK	18.0	16.7	6.0	22.7	0.186						
5150 - 5250	OFDM	-	11.0	6.0	17.0	0.050	4	-			0.000	1
5250 - 5350	OFDM	-	17.6	6.0	23.6	0.231	4	4	0.923	29.7	0.923	922.6989
5470 - 5725	OFDM	-	17.2	6.0	23.2	0.209	11	7	1.463	31.7	1.463	1462.507
5725 - 5850	OFDM	19.7	-	6.0	25.7	0.372	5	5	1.858	32.7	2.780	1857.676
							Totals:	16	4.243	36.3		

The system incorporates a lock-out mechanism to prevent a channel being used more than once, therefore the maximum number of transmitters in each band is limited to the lower of number of channels available or number of transceivers capable of operating in the band.

4 transceivers can operate in the 2400-2483.5 MHz band. All 16 transceivers can operate in the 5150 - 5250MHz, 5250-5350MHz, 5470-5725MHz and 5725-5850MHz bands.

Maximum eirp is calculated as follows:
Uses the average power for each channel (where given), otherwise uses the peak power
As there are 16 transceivers available, the transceivers are assigned to the available channels in order of decreasing power (e.g. the 5725-5850 band has the highest eirp so the first five transceivers are allocated to that band, the next 4 to the 5250-5350 band and the next seven to the to the 5470-5725 band)