MPE Calculations

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 25cm, consistent with this classification.

FCC part 1.1310, Table 1 limits the power density for uncontrolled exposure. The power density, S (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:

$$S = P_t/(4 \pi d^2)$$

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	2106.8 [2]	0.42	13.0

- [1]Equivalent isotropic output power is the total eirp summed across all active transmitters. There are 16 transmitters available, 3 that can use the 2.4 GHz band and all 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 tables on the following page for the total eirp calculations.
- [2]This calculation is based on the highest eirp configuration with all transceivers operational, refer to tables on the next page).

As shown in the calculations above, the power density 13.0 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 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 and so the main beams from the individual antennas will not all overlap.

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

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.

2400 – 2483.5MHz Band

The system can only use a maximum of three channels in the 2.4 GHz band to avoid allocating overlapping channels. The combinations available for three transceivers are as follows

Channel 1, channel 5 and channel 9 or 10 or 11;
Channel 1, channel 6 and channel 10 or 11;
Channel 1, channel 7 and channel 11;
Channel 2, channel 6 and channel 10 or 11;
Channel 2, channel 7 and channel 11;
Channel 3, channel 7 and channel 11.

The maximum average output power on all channels in the band is 16.7dBm for both b and g modulations.

5150 - 5350 MHz Band

There are 4 non-overlapping channels in this band.

Channel	Mode	Pout (dBm avg)	Pout (mW avg)
36	OFDM	9.3	0.008511
40	OFDM	15.4	0.034674
44	OFDM	16	0.039811
48	OFDM	16	0.039811

Note, total power in this band is limited to 16.6dBm by the system's firmware, which adjusts power on each transceiver depending on the number of transceivers operating in the band.

5250 - 5350 MHz Band

There are 4 non-overlapping channels in this band.

Channel	Mode	Pout (dBm avg)	Pout (mW avg)
52	OFDM	15.7	0.037154
56	OFDM	16	0.039811
60	OFDM	16	0.039811
64	OFDM	10.7	0.011749

5725 - 5850 MHz Band

There are 5 non-overlapping channels in this band.

Channel	Mode	Pout (dBm avg)	Pout (mW avg)
149	OFDM	17	0.050119
153	OFDM	17.1	0.051286
157	OFDM	17.1	0.051286
161	OFDM	17.1	0.051286
165	OFDM	17	0.050119

System EIRP

For the 16-port device, the worst case is with all 16 transceivers operating. To avoid overlapping channels and simultaneous use of any channel, each band must be fully occupied (3 channels in the 2.4 GHz band, 4 in the 5150 MHz band, 4 in the 5250 MHz band, 5 in the 5725 MHz band). The distribution of channels among the transceivers can be separated into multiple different ways with internal or external antennas. The specifications for the antennas are:

Internal antenna: 2.4GHz band = 3dBi; 5GHz band = 6dBi
External antenna, 2.4 GHz Cushcraft 3dBd (5.2dBi) Omni-directional Antenna S2403BH
External antenna, 5 GHz band, Cushcraft 3dBd (5.2dBi) Omni-directional Antenna S5703BH

As there are only three transceivers that can use external antennas, the highest eirp would be with the three external antennas for the 2.4 GHz band where the external antennas (5.2dBi) have a higher gain than the internal antennas (3dBi). In the 5 GHz bands the internal antennas have higher gains (6dBi) than the external omni-directional antenna (5.2dBi).

The table below shows the allocation of channels that gives the highest eirp from the system:

TRX	Ant	Operating Band (MHz)	Pout (mW)	Gain (dBi)	EIRP (mW)
1	ext	2400 - 2483.5	46.8	5.2	154.97
2	ext	2400 - 2483.5	46.8	5.2	154.97
3	ext	2400 - 2483.5	46.8	5.2	154.97
4	int only	5150 - 5350	45.7	6	154.97
5	int only				
6	int only				
7	int only				
8	int only	5250 - 5350	37.2	6	148.10
9	int only	5250 - 5350	37.2	6	148.10
10	int only	5250 - 5350	37.2	6	148.10
11	int only	5250 - 5350	11.4	6	45.38
12	int only	5725 - 5850	50.1	6	199.45
13	int only	5725 - 5850	50.1	6	199.45
14	int only	5725 - 5850	50.1	6	199.45
15	int only	5725 - 5850	50.1	6	199.45
16	int only	5725 - 5850	50.1	6	199.45
				Total eirp:	2106.81