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Introduction

The Roombox Videoconferencing unit is a set-top device that contains a 2.4GHz Bluetooth transmitter, 2.4 GHz WiFi transmitter and a disabled 5 GHz WiFi Transmitter.

The FCC requires that the calculated MPE (Maximum Permissible Exposure) be equal to or less than a given limit dependent on frequency at a distance of 20 cm from the device to the body of the user. For simultaneous transmitters the summation MPE for worse case should be calculated.

In this application the worst case scenario occurs when the 802.11n 2x2 MIMO WLAN service is activated. For completeness the 802.11g SISO WLAN service is also analysed as is the Bluetooth Classic operation.

To demonstrate worse case MPE conditions the greater of the typical conducted power (data sheet) or the highest measured conducted power are used in the calculations. Which particular figure is used is identified in the results tables.

The MPE calculation for individual transmitters is calculated as recommended in ANSI C95.1. The limits for simultaneous output of multiple transmitters is calculated as per KDB 447498.

Summation MPE calculation for the 802.11n 2x2 MIMO 2.4 GHz WLAN Service

Mode	**WLAN 802.11n 2x2 MIMO**	
	ANT 1	**ANT2**
Frequency (MHz)	2400	2400
Measured conducted output power (dBm)	14.92	14.92
Gain (dBi)	2.67	4.66
Duty Cycle	1	1
EIRP (mW) (RF exposure)	57.4	90.8
Distance (cm)	20	20
Power density (mW/cm^2)	0.011	0.018
Limit	1.00	1.00
% of limit	1.14%	1.81%

Table 1: Calculated Summation Power Density for 802.11n MIMO 2x2 WLAN Service utilising 2.4 GHz transmission only

The summation percentage of limit figure is 1.14% + 1.81% = 2.95%

MPE calculation for the 802.11bg SISO WLAN Service

Mode	**WLAN 802.11b SISO**
	ANT1
Frequency (MHz)	2400
Typical conducted output power (dBm)	16.0
Gain (dBi)	2.67
Duty Cycle	1
EIRP (mW) (RF exposure)	73.6
Distance (cm)	20
Power density (mW/cm^2)	0.0146
Limit	1.00
% of limit	1.46%

Table 2: Calculated Power Density for 802.11bg SISO WLAN Service

The percentage of limit figure is 1.46%

MPE calculation for the Bluetooth Classic Service

Mode	**Bluetooth Classic**
	ANT1
Frequency (MHz)	2400
Measured conducted output power (dBm)	9.99
Gain (dBi)	2.67
Duty Cycle	1
EIRP (mW) (RF exposure)	18.5
Distance (cm)	20
Power density (mW/cm^2)	0.00367
Limit	1.00
% of limit	0.37%

Table 3: Calculated Power Density for Bluetooth Classic Service

The percentage of limit figure is 0.37%

Conclusion

Assuming the worst case situation of WLAN 802.11n 2x2 MIMO transmitting at maximum rated module power then the summation MPE is 2.95% of the 100% limit. Consequently, Roombox is exempt from Routine RF exposure evaluation.

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