Engineering Analysis MPE for 4.9 GHz Public Safety Band Transceiver, Module 2 (PSM2)

FCC ID: RAR20008001
BelAir Networks

This analysis was performed as part of the FCC certification requirements for spread spectrum devices, according to the requirements of: FCC 47cfr1.1310 , and FCC OET Bulletin 65 “Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields”.

- Module RAR20008001 will be mounted in BelAir Networks host units and will be professionally installed (Fixed) to provide a minimum separation distance from all persons as detailed in co-location compliance tables.
- Module RAR20008001 may be co-located with other modules in BelAir Networks products as shown in the co-location compliance tables. Worst-case configurations are shown below.
- This device will only be operated according to the exposure conditions described in this application.
- End users and installers will be provided with antenna installation and transmitter operating conditions for satisfying RF exposure compliance.

The measured worst-case transmit power yielding the worst-case EIRP were used for the MPE calculations. Calculations were performed based on FCC OET Bulletin 65. The calculations are performed based on the following formula provided in OET 65:

$S = EIRP / (4\pi R^2)$.

Co-location compliance for multiple frequency exposure criteria to the power density exposure limit is detailed. This calculation is a worst-case analysis since it assumes all devices are continuously transmitting. The device utilizes the 802.11 WLAN protocol which operates in time-division duplex (TDD) mode, so the transmit duty cycle can never be 100% in normal operation. It is also assumed that all directional antennas are aligned to point in the same direction so that power from all radios add.

The following tables outlines the MPE analysis for various combinations of BelAir Networks radios and antenna. The RAR20008001 can be used with (FCCID : RAR… is included in the table)

Case I: ARM3 + PSM2 & 16 dBi antenna or less BA100T product

Co-location Compliance for Integrated 802.11b/g & 802.11a Public Service Radios									
Safety Distance:		35 cm	(13.8 inches)						
Worst-case Total EIRP [dBm]	Max Power Density [mW/cm^2]	Maximum Number of Radios	Worst-case Total EIRP [dBm]	Max Power Density [mW/cm^2]	Maximum Number of Radios	Total Density for co-located radios [mW/cm^2]	Limit: General Population / Uncontrolled Exposure [mW/cm^2]	Result	
	RAR20000003			RAR20008001					
35.5	0.230	1	40	0.650	1	0.880	1	Complies	

Case II: ARM3 + PSM2 & 25 dBi antenna (Includes 21 dBi) BA100T product

Co-location Compliance for Integrated 802.11a BRM3v3 & 802.11a PSM1 Public Service Radios									
Safety Distance:		85 cm	(33.5 inches)						
Worst-case Total EIRP [dBm]	Max Power Density [mW/cm^2]	Maximum Number of Radios	Worst-case Total EIRP [dBm]	Max Power Density [mW/cm^2]	Maximum Number of Radios	Total Density for co-located radios [mW/cm^2]	Limit: General Population / Uncontrolled Exposure [mW/cm^2]	Result	
	RAR20000003			RAR20008001					
35.5	0.039	1	49	0.875	1	0.914	1	Complies	

Case III: ARM3 + PSM2 & 25 dBi + BRM3 & 15dBi BA100T product

Co-location Compliance for Integrated 802.11b/g & 802.11a Radios & 802.11a Public Service Radios											
Safety Distance:		85 cm	(33.5 inches)								
Worst-case Total EIRP [dBm]	Max Power Density [mW/cm^2]	Maximum Number of Radios	Worst-case Total EIRP [dBm]	Max Power Density [mW/cm^2]	Maximum Number of Radios	Worst-case Total EIRP [dBm]	Max Power Density [mW/cm^2]	Maximum Number of Radios	Total Density for co-located radios [mW/cm^2]	Limit: General Population / Uncontrolled Exposure [mW/cm^2]	Result
	RAR20000003			RAR20008001			RAR20001003				
35.5	0.039	1	49	0.875	1	35	0.035	1	0.949	1	Complies

Case IV: ARM3 + PSM2 & 25 dBi + BRM3 & 23dBi BA200 product

Co-location Compliance for Integrated 802.11b/g & 802.11a Radios & 802.11a Public Service Radios											
Safety Distance:		95 cm	(37.4 inches)								
Worst-case Total EIRP [dBm]	Max Power Density [mW/cm^2]	Maximum Number of Radios	Worst-case Total EIRP [dBm]	Max Power Density [mW/cm^2]	Maximum Number of Radios	Worst-case Total EIRP [dBm]	Max Power Density [mW/cm^2]	Maximum Number of Radios	Total Density for co-located radios [mW/cm^2]	Limit: General Population / Uncontrolled Exposure [mW/cm^2]	Result
	RAR20000003			RAR20008001			RAR20001003				
35.5	0.031	1	49	0.700	1	43	0.176	1	0.908	1	Complies

Case V: PSM2 & 25 dBi + 2 X BRM3 & 23dBi

Co-location Compliance for Integrated 802.11a BRM3v3 & 802.11a PSM1 Public Service Radios								
Safety Distance:		100 cm	(39.4 inches)					
Worst-case Total EIRP [dBm]	Max Power Density [mW/cm^2]	Maximum Number of Radios	Worst-case Total EIRP [dBm]	Max Power Density [mW/cm^2]	Maximum Number of Radios	Total Density for co-located radios [mW/cm^2]	Limit: General Population / Uncontrolled Exposure [mW/cm^2]	Result
	RAR20001003			RAR20008001				
43	0.159	2	49	0.632	1	0.950	1	Complies

The equipment therefore fulfills the requirements on power density for general population/uncontrolled exposure and therefore complies with the requirements of FCC Bulletin 65.

To simplify installation instructions the following summary of distances will be used based on the worst case MPE:

RF Exposure	Radios Combinations	FCCID	Minimum Safety Distance	
	& antennas dBi	Radio Modules	cm	inches
BelAir 100T Radio	Case I: ARM3 + PSM2 & 16 dBi antenna or less	1 X RAR20000003 + 1 X RAR20008001	35	13.8
	Case II: ARM3 + PSM2 & 25 dBi antenna (Includes 21 dBi)	1 X RAR20000003 + 1 X RAR20008001	85	33.5
	Case III :ARM3 + PSM2 & 25 dBi + BRM3 & 15dBi	1 X RAR20000003 + 1 X RAR20008001 + 1 X RAR20001003	85	33.5
	Case IV :ARM3 + PSM2 & 25 dBi + BRM3 & 23dBi	1 X RAR20000003 + 1 X RAR20008001 + 1 X RAR20001003	95	37.4
	Case V :PSM2 & 25 dBi + 2 X BRM3 & 23dBi	1 X RAR20008001 + 2 X RAR20001003	100	39.4