Engineering Analysis MPE for 4.9 GHz Public Safety Band Transceiver

FCC ID: RAR20004001
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 RAR20004001 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 below.
- Module RAR20004001 may be co-located with other modules in BelAir Networks products as shown in the co-location compliance tables below. 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 in the table below. 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 radios and antenna the RAR20004001 can be used with:

Case I: ARM3 + PSM1 & 9 dBi antenna BA100 product

Co-location Compliance for Integrated 802.11b/g & 802.11a Public Service Radios								
Safety Distance:	**20 cm**	(7.9 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			RAR20004001				
35.5	0.706	1	30.83	0.241	1	0.947	1	Complies

Case II: BRM3 & 23 dBi antenna + PSM1 & 21 dBi antenna BA100 product

Co-location Compliance for Integrated 802.11a BRM3v3 & 802.11a PSM1 Public Service Radios								
Safety Distance:	**60 cm**	(23.6 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			RAR20004001				
43	0.441	1	42.81	0.422	1	0.863	1	Complies

Case III: BRM3 & 15dBi + ARM3 + PSM1 & 21 dBi BA200 product

Co-location Compliance for Integrated 802.11b/g & 802.11a Radios & 802.11a Public Service Radios											
Safety Distance:	**50 cm**	(19.7 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			RAR20004001			RAR20001003				
35.5	0.113	1	42.81	0.608	1	35	0.101	2	0.922	1	Complies

Case IV: BRM3 & 23dBi + ARM3 + PSM1 & 21 dBi BA200 product

Co-location Compliance for Integrated 802.11b/g & 802.11a Radios & 802.11a Public Service Radios											
Safety Distance:	**72 cm**	(28.3 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			RAR20004001			RAR20001003				
35.5	0.054	1	42.81	0.293	1	43	0.306	2	0.960	1	Complies

Case V: PSM1 & 21 dBi antenna

Co-location Compliance for Integrated 802.11a BRM3v3 & 802.11a PSM1 Public Service Radios								
Safety Distance:	**40 cm**	(15.7 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
	0			RAR20004001				
0	0.000	0	42.81	0.950	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	Minimum Safety Distance	Radios Other combinations	Minimum Safety Distance
BelAir50C BelAir50S Radios	1 x RAR20004001 (PSM1) w. 21 dBi antenna	40 cm (16 inches)	NONE	-------
BelAir100 BelAir100S BelAir100C Radios	1 x RAR20001003 and 23 dbi antenna 1 x RAR20004001 (PSM1) w. 21 dBi antenna	60 cm (24 inches)	1 x RAR20004001(PSM1) w. 9 dBi antenna and 1 x RAR20000003 (ARM3)	20 cm (8 inches)
BelAir200	1 x RAR20001003 and 23 dbi antenna and 1 x RAR20004001(PSM1) w. 21 dBi antenna and 1 x RAR20000003 (ARM3)	72 cm (28.3 inches)	1 x RAR20004001(PSM1) w. 21 dBi antenna1 x RAR20001003 (BRM3) with 15 dBi ant.and 1 RAR20000003 (ARM3)	50 cm (20 inches)