

## **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:

Co-location		dBi antenna		BA100 product					_		
				& 802.11a Public \$	Service Rac	lios					
Safety Dista	nce:	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			
35.5	RAR20000003 0.706	1	30.83	RAR20004001 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 Dista	nce:	60	cm	( 23.6 inches )							
Worst-case Total EIRP [dBm]	Max Power Density [mW/cm^2]	Maximum Number of Radios	Worst-case		Maximum Number of Radios	Total Density for co-located radios [mW/cm^2]	Limit: General Population / Uncontrolled Exposure [mW/cm^2]	Result			
	RAR20001003			RAR20004001					1		
43	0.441	1	42.81	0.422	1	0.863	1	Complies			
Case III: BRM3 & 15dBi + ARM3 + PSM1 & 21 dBi Co-location Compliance for Integrated 802.11b/g & 802.11a Radios & 802.11a Public Service Radios Safety Distance: 50 cm (19.7 inches)											
		r Integrated	802.11b/g 8	& 802.11a Radios			adios				
	Max Power Density [mW/cm^2]	r Integrated	802.11b/g 8 cm Worst-case	& 802.11a Radios ( 19.7 inches )  Max Power Density [mW/cm^2]		Public Service R  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
Safety Dista  Worst-case Total EIRP [dBm]	Max Power Density [mW/cm^2] RAR2000003	Maximum Number of Radios	802.11b/g 8 cm  Worst-case Total EIRP [dBm]	& 802.11a Radios ( 19.7 inches )  Max Power Density [mW/cm^2] RAR20004001	& 802.11a	Public Service R  Worst-case Total EIRP [dBm]	Max Power Density [mW/cm^2] RAR20001003	Number of Radios	for co- located radios [mW/cm^2]	Population / Uncontrolled Exposure [mW/cm^2]	Result
Safety Dista  Worst-case Total EIRP	Max Power Density [mW/cm^2]	Maximum Number of	802.11b/g 8 cm  Worst-case Total EIRP	& 802.11a Radios ( 19.7 inches )  Max Power Density [mW/cm^2]	& 802.11a l	Public Service R  Worst-case Total EIRP [dBm]	Max Power Density [mW/cm^2]	Number of	for co- located radios	Population / Uncontrolled Exposure	
Worst-case Total EIRP [dBm] 35.5  Case IV:	Max Power Density [mW/cm*2] RAR2000003 0.113 BRM3 & 23dBi	Maximum Number of Radios	Worst-case Total EIRP [dBm] 42.81	Max Power Density [mW/cm^2] RAR20004001 0.608	& 802.11a Maximum Number of Radios  1  BA200 produc	Worst-case Total EIRP [dBm]  35	Max Power Density [mW/cm*2] RAR20001003 0.101	Number of Radios	for co- located radios [mW/cm^2]	Population / Uncontrolled Exposure [mW/cm^2]	Result
Worst-case Total EIRP [dBm] 35.5  Case IV:	Max Power Density [mW/cm*2] RAR2000003 0.113 BRM3 & 23dBi	Maximum Number of Radios	Worst-case Total EIRP [dBm] 42.81	Max Power Density [mW/cm^2] RAR20004001 0.608	& 802.11a Maximum Number of Radios  1  BA200 produc	Worst-case Total EIRP [dBm]  35	Max Power Density [mW/cm*2] RAR20001003 0.101	Number of Radios	for co- located radios [mW/cm^2]	Population / Uncontrolled Exposure [mW/cm^2]	Result
Worst-case Total EIRP [dBm] 35.5  Case IV:	Max Power Density [mW/cm*2] RAR2000003 0.113 BRM3 & 23dBi Compliance fo	Maximum Number of Radios  1 + ARM3 + Integrated	Worst-case Total EIRP [dBm] 42.81	Max Power Density [mW/cm^2] RAR20004001 0.608	& 802.11a Maximum Number of Radios  1  BA200 produc	Worst-case Total EIRP [dBm]  35	Max Power Density [mW/cm*2] RAR20001003 0.101	Number of Radios	for co- located radios [mW/cm^2]	Population / Uncontrolled Exposure [mW/cm^2]	Result
Worst-case Total EIRP [dBm] 35.5  Case IV: Co-location	Max Power Density [mW/cm^2] RAR2000003 0.113  BRM3 & 23dBi Compliance fo nce:  Max Power Density [mW/cm^2]	Maximum Number of Radios  1 + ARM3 + Integrated	Worst-case Total EIRP [dBm] 42.81 PSM1 & 21 802.11b/g & cm	Max Power Density [mW/cm^2] RAR20004001 0.608 dBi & 802.11a Radios ( 28.3 inches )	& 802.11a Maximum Number of Radios  1  BA200 produc	Worst-case Total EIRP [dBm]  35  tt  Worst-case Total EIRP [dBm]	Max Power Density [mW/cm^2] ARA20001003 0.101  Addios  Max Power Density [mW/cm^2]	Number of Radios	for co- located radios [mW/cm^2]	Population / Uncontrolled Exposure [mW/cm^2]	Result Complies
Safety Dista  Worst-case Total EIRP [dBm] 35.5  Case IV: Co-location Safety Dista  Worst-case Total EIRP	Max Power Density [mW/cm^2] RAR20000003 0.113 BRM3 & 23dBi Compliance fo	Maximum Number of Radios  1 + ARM3 + Integrated 72  Maximum Number of	802.11b/g a cm  Worst-case Total EIRP [dBm] 42.81  PSM1 & 21 802.11b/g a cm  Worst-case Total EIRP	Max Power Density [mW/cm^2] RAR20004001 0.608 dBi & 802.11a Radios (28.3 inches)	Maximum Number of Radios  1  BA200 produc & 802.11a i	Worst-case Total EIRP [dBm]  35  tt  Worst-case Total EIRP [dBm]	Max Power Density [mW/cm^2] RAR20001003 0.101  Radios  Max Power Density	Number of Radios  2  Maximum Number of	for co- located radios [mW/cm^2] 0.922	Population / Uncontrolled Exposure [mW/cm^2]  1  Limit: General Population / Uncontrolled Exposure	Result

Case V: PSM1 & 21 dBi antenna							
Co-location Compliance fo	r Integrated 802.11a BR	M3v3 & 802.11a PSM1 Public Service					
Safety Distance:	40 cm	( 15.7 inches )					
	Maximum	Maximum Total Dens					

Case V. Tomi a 21 abi ancima								
Co-location	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	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(PS M1) 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)