



Engineering Analysis MPE for 5GHz DRU Transceiver

FCC ID: RAR30005002

BelAir Networks

This analysis was performed as part of the FCC certification requirements for spread spectrum devices, according to the requirements of: FCC part 15, and FCC OET Bulletin 65 “Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields”.

- Module RAR30005002 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.
- 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:

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

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 IEEE 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 adds together.



The following tables outlines the MPE analysis for various combinations of radios and antennas the RAR30005001 can be used with:

Case 1: 1 X RAR30002002 (DRU 2.4GHz radio) with 16dBi Antennas and 1 X RAR30005002 (DRU 5GHz radio) with 22dBi Antennas

Co-location Compliance for Integrated DRU 2.4GHz IEEE 802.11b/g/n & DRU 5GHz IEEE 802.11a/n Radios								
Safety Distance:		109 cm			(42.9 inches)			
Worst-case Total EIRP	Max Power Density	Maximum Number of Radios	Worst-case Total EIRP	Max Power Density	Maximum Number of Radios	Total Density for co-located radios	Limit: General Population / Uncontrolled Exposure	Result
[dBm]	[mW/cm ²]		[dBm]	[mW/cm ²]		[mW/cm ²]	[mW/cm ²]	
RAR30002002 (DRU 2.4GHz radio)			RAR30005002 (DRU 5GHz radio)					
42.28	0.113	1	51.14	0.871	1	0.984	1	Complies

Case 2: 1 X RAR30002002 (DRU 2.4GHz radio) with 5dBi Antennas and 1 X RAR30005002 (DRU 5GHz radio) with 7 dBi Antennas

Co-location Compliance for Integrated DRU 2.4GHz IEEE 802.11b/g/n & DRU 5GHz IEEE 802.11a/n Radios								
Safety Distance:		20.5 cm			(8.1 inches)			
Worst-case Total EIRP	Max Power Density	Maximum Number of Radios	Worst-case Total EIRP	Max Power Density	Maximum Number of Radios	Total Density for co-located radios	Limit: General Population / Uncontrolled Exposure	Result
[dBm]	[mW/cm ²]		[dBm]	[mW/cm ²]		[mW/cm ²]	[mW/cm ²]	
RAR30002002 (DRU 2.4GHz radio)			RAR30005002 (DRU 5GHz radio)					
33.27	0.402	1	33.43	0.417	1	0.819	1	Complies

Case 3: 1 X RAR30002002 (DRU 2.4GHz radio) with 8dBi Antennas and 1 X RAR30005002 (DRU 5GHz radio) with 15 dBi Antennas

Co-location Compliance for Integrated DRU 2.4GHz IEEE 802.11b/g/n & DRU 5GHz IEEE 802.11a/n Radios								
Safety Distance:		49 cm			(19.3 inches)			
Worst-case Total EIRP	Max Power Density	Maximum Number of Radios	Worst-case Total EIRP	Max Power Density	Maximum Number of Radios	Total Density for co-located radios	Limit: General Population / Uncontrolled Exposure	Result
[dBm]	[mW/cm ²]		[dBm]	[mW/cm ²]		[mW/cm ²]	[mW/cm ²]	
RAR30002002 (DRU 2.4GHz radio)			RAR30005002 (DRU 5GHz radio)					
35.61	0.121	1	44.14	0.860	1	0.980	1	Complies

Case 4: 1 X RAR30002002 (DRU 2.4GHz radio) with 5dBi Antennas and 1 X RAR30005002 (DRU 5GHz radio) with 15 dBi Antennas

Co-location Compliance for Integrated DRU 2.4GHz IEEE 802.11b/g/n & DRU 5GHz IEEE 802.11a/n Radios								
Safety Distance:		48 cm			(18.9 inches)			
Worst-case Total EIRP	Max Power Density	Maximum Number of Radios	Worst-case Total EIRP	Max Power Density	Maximum Number of Radios	Total Density for co-located radios	Limit: General Population / Uncontrolled Exposure	Result
[dBm]	[mW/cm ²]		[dBm]	[mW/cm ²]		[mW/cm ²]	[mW/cm ²]	
RAR30002002 (DRU 2.4GHz radio)			RAR30005002 (DRU 5GHz radio)					
33.27	0.073	1	44.14	0.896	1	0.969	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.



The following worst case summary table will be incorporated in BelAir Networks installation procedures.

Minimum Safety Distances					
Standard Antennas		Medium Gain Antennas		High Gain Antennas (up to 22 dBi)	
DRU 2.4GHz radio	DRU 5GHz radio	DRU 2.4GHz radio	DRU 5GHz radio	DRU 2.4GHz radio	DRU 5GHz radio
5 dBi	7 dBi	≤ 8dBi	≤ 15dBi	> 8dBi	> 15dBi
Minimum Distance		Minimum Distance		Minimum Distance	
8.1 inches		19.3 inches		42.9 inches	