



## BelAir Wireless Radio Modules

BelAir Networks offers a comprehensive portfolio of wireless radio modules that provide access and backhaul support for the BelAir200 and BelAir100 family of wireless mesh products. Currently BelAir offers five different radio module platforms: Access Radio Module (ARM3), Backhaul Radio Module (BRM4), Public Safety Radio Modules (PSM1 and PSM2), Intelligent Transportation Services (ITS) Modules (TRM) and WiMAX Radio Modules (WRM1 and WRM3), that support a full compliment of frequency bands and adhere to the Wi-Fi (IEEE 802.11 a/b/g) and WiMAX (IEEE 802.16) industry standards.

BelAir Networks wireless radio modules can be configured to operate in a multiple point-to-point, point-to-multipoint, or multipoint-to-multipoint environment, whether you're deploying standalone wireless nodes or creating a municipal wireless mesh network.

As a pioneer of wireless mesh networking products, BelAir Networks prides itself on designing and developing their own high-performance radio modules. The ARM3, BRM4, ERM1 and 2, PSM1, TRM, and WRM radio modules are based on several BelAir patents that deliver industry-leading features and performance.

### Access Radio Module

The Access Radio Module (ARM3) provides access device support for the full BelAir portfolio of wireless mesh nodes. The ARM3 is the latest in a line of access modules that began shipping in 2004 and supports the IEEE 802.11b/g (Wi-Fi) standard. The ARM3 operates in the unlicensed 2.4 – 2.4835 GHz frequency band and delivers up to 54 Mbps of bandwidth to any IEEE 802.11 b/g compliant device



- Designed and developed by BelAir Networks
- Access and backhaul modules
- Wi-Fi, WiMAX, 4.9 Public Safety and 5.9 GHz ITS support
- North America and international frequencies

including access points, laptops, and Wi-Fi phones. The ARM3 supports point-to-multipoint and multipoint-to-multipoint topologies, making it an ideal solution for creating shared mesh clusters for supporting voice, video and data applications.

### Design Scenarios

The ARM3 offers a flexible architecture that can support a variety of functions. For smaller networks that have low data requirements, the ARM3 can be configured to provide both shared access and backhaul support, operating on the 2.4 GHz unlicensed frequency band to deliver up to 54 Mbps. For higher performance, data intensive networks, the ARM3 can be configured in the BelAir200 or the BelAir100 to provide dedicated access support for IEEE 802.11 b/g devices.

### Backhaul Radio Module

The Backhaul Radio Module (BRM4) provides backhaul support for the BelAir200 and BelAir100 wireless mesh node products. The BRM4 is the latest in a line of backhaul modules that began shipping in 2004 and supports the IEEE 802.11a (Wi-Fi) standard. The BRM4 supports various bands in the 5 GHz – 5.85 GHz unlicensed frequency and delivers up to 54 Mbps of bandwidth. The BRM4 is specifically designed to provide backhaul transportation for wireless mesh networks back to the provider core network. It offers a versatile platform that supports multiple point-to-point, point-to-multipoint and multipoint-to-multipoint topologies, making it an ideal solution for large scale municipal or campus networks.

#### Design Scenarios

The BRM4 provides design options for larger, data intensive networks. A basic BelAir100 node configuration can use one ARM3 to provide dedicated access support and one BRM4 to provide dedicated backhaul support. This is ideal for networks that have high data and low voice traffic.

For networks that require more backhaul bandwidth, up to two BRM4 modules can be configured in a BelAir100 node to provide dedicated backhaul access that can operate on different frequency bands, or on the same frequency band but on different channels.

For high performance, multi-media networks where maximum bandwidth and low latency are a necessity, up to three BRM4 modules can be configured in a BelAir200 node. Each BRM4 can be configured to operate in the same frequency band but on different channels, thus delivering true switched dedicated bandwidth to each channel. Additionally, the BRM4 modules can be configured to operate on different bands to support both licensed and unlicensed bands in the same wireless mesh node.

### 4.9 GHz Public Safety Radio Modules

The 4.9 Public Safety Radio Modules (PSM1 and PSM2) supports the IEEE 802.11a standard and operates in the licensed 4.940 – 4.990 GHz frequency band for public safety applications. The PSM1, based on the BRM4 radio, but operating in the 4.9 GHz band, provides

both access and backhaul support with the ability to configure multiple point-to-point, point-to-multipoint or multipoint-to-multipoint connections. The PSM1 is supported in the BelAir200 and BelAir100 wireless mesh nodes. The PSM2 is a half-slot 4.9 GHz radio that is supported in the BelAir100T wireless mesh node.

#### Design Scenarios

An ideal deployment for the PSM1 or PSM2 is to configure as an access radio along with an ARM3 in the BelAir200, to provide both unlicensed 2.4 GHz and licensed 4.9 GHz client access support. This scenario allows municipalities to segment public access users from public safety users in a wireless mesh network.

### 5.9 GHz ITS Module

The 5.9 GHz ITS Module (TRM) supports the 802.11a standard and operates in the licensed 5.850 – 5.925 GHz band designated for Intelligent Transportation Service applications. The TRM can be used for either access or backhaul and can be configured in multiple point-to-point, point-to-multipoint or multipoint-to-multipoint connections. The TRM can be supported on any BelAir wireless mesh nodes.

#### Design Scenarios

The modular nature of the BelAir Networks architecture enables multi-frequency support on a single mesh node. The TRM can be deployed in combination with other BelAir radio modules including ARM, BRM, WRM, PSM or other TRM's.

### WiMAX Radio Module

The WiMAX Radio Modules (WRM1 and WRM3) are BelAir Networks first radio module to operate in the licensed 2.3 GHz and 2.5 GHz frequency bands supporting the IEEE 802.16d (WiMAX) industry standard. The WRM provides WiMAX backhaul support for the BelAir200 and BelAir100 wireless mesh nodes with the capacity to deliver up to 40 Mbps of dedicated bandwidth. This is the first in a family of WiMAX Radio Modules that will provide both backhaul and access support for IEEE 802.16 (WiMAX) compliant devices. The WRM supports point-to-point topologies and is ideal for creating dedicated connections to other BelAir wireless mesh nodes in a network.

**Design Scenarios**

An ideal deployment for the WRM is to configure it with BelAir200 nodes and/or BelAir100 nodes to provide last mile access for cellular backhaul applications. The WRM1 operates in the licensed 2.3 GHz band, and the WRM3 operates in the licensed 2.5 GHz frequency band. The added capacity that WiMAX (IEEE 802.16d) delivers to the network is ideal for critical applications such as voice traffic.

WRM modules when configured in the BelAir200 or BelAir100 wireless mesh nodes.

**Topology Options**

**Multiple point-to-point** – Used to create a switched wireless mesh topology that connects multiple channels to multiple points for greater capacity and performance. A multiple point-to-point wireless mesh node has dedicated channels that connect to other wireless nodes in the network. This topology is supported on the BRM4 and the

**Point-to-multipoint** – Used to create a hub-and-spoke or star topology whereby a wireless mesh node connects to multiple other wireless nodes in the network, referred to in wired networks as the “home-run” design. This topology is supported on the BRM4 module when configured in the BelAir200 or BelAir100 wireless mesh nodes.

**Multipoint-to-multipoint** – Used to create a shared wireless mesh topology that operates on a single channel where network capacity is shared by all the nodes on the network. This topology is ideal for networks that need to support data applications as well as low capacity voice and is supported on the ARM3 and BRM4 when configured in the BelAir200 or BelAir100 wireless mesh nodes.

**Wireless mesh node platform support**

Radio Module	BelAir200	BelAir100	BelAir100C	BelAir100S	BelAir100T	BelAir100M
ARM3	✓	✓	✓	✓	✓	✓
BRM4	✓	✓	✓	✓	✓	✓
ERM1		✓	✓	✓	✓	✓
ERM2	✓	✓				✓
PSM1	✓	✓	✓	✓	✓	✓
PSM2	-	-	-	-	✓	✓
TRM	✓	✓	✓	✓	✓	✓
WRM (WiMAX)	✓	✓	-	✓	✓	✓

**Radio module frequency support**

Radio Module	Frequency	Spectrum Category	Industry Standard	Max Modulation
ARM3	2.4 to 2.4835 GHz ISM	Unlicensed	Wi-Fi (IEEE 802.11b/g)	54 Mbps
BRM4	5.725 to 5.825 GHz UNII-3	Unlicensed (Long range)	Wi-Fi (IEEE 802.11a)	54 Mbps
BRM4	5.825 to 5.850 GHz ISM	Unlicensed	Wi-Fi (IEEE 802.11a)	54 Mbps
ERM1	5.47 to 5.875 GHz and 4.940 to 4.990 GHz	Unlicensed Licensed	Wi-Fi (IEEE 802.11a)	54 Mbps
ERM2	5.47 to 5.875 GHz	Unlicensed	Wi-Fi (IEEE 802.11a)	54 Mbps
PSM1/PSM2	4.940 to 4.990 GHz	Licensed	Public Safety	54 Mbps
TRM	5.850 to 5.925 GHz	Licensed	Wi-Fi (IEEE 802.11a)	54 Mbps
WRM1	2.30 to 2.36 GHz WCS	Licensed	WiMAX (IEEE 802.16d)	40 Mbps
WRM3	2.495 to 2.690 GHz BRS	Licensed	WiMAX (IEEE 802.16d)	40 Mbps

## Additional technical specifications

Radio Module	Frequency	Transmit Power	Receive Sensitivity	Channel Size
ARM3	2.4 to 2.4835 GHz	up to 27.6 dBm	-100 dBm (DSSS) -94 dBm (OFDM)	20 MHz
PSM1	4.940 to 4.990 GHz	up to 20 dBm	-90 dBm @ 6 Mbps	20 MHz
PSM2	4.940 to 4.990 GHz	up to 17 dBm	-90 dBm @ 6 Mbps	5, 10 and 20 MHz
BRM4	5.725 to 5.825 GHz	up to 20 dBm	-90 dBm @ 6 Mbps -71 dBm @ 54 Mbps	20 MHz
BRM4	5.825 to 5.875 GHz	up to 20 dBm	-90 dBm @ 6 Mbps -71 dBm @ 54 Mbps	20 MHz
WRM1	2.300 to 2.360 GHz	up to 20 dBm	-96 dBm @ 5 MHz	2.5/5 MHz
WRM3	2.495 to 2.690 GHz	up to 20 dBm	-93 dBm @ 10 MHz	5/10 MHz
ERM1	4.940 to 4.990 GHz and 5.47 to 5.875 GHz	up to 30 dBm	-90 dBm @ 6 Mbps -71 dBm @ 54 Mbps	5/10/20/ MHz
ERM2	5.47 to 5.875 GHz	up to 20 dBm	-90 dBm @ 6 Mbps -71 dBm @ 54 Mbps	5/10/20 MHz
TRM	5.850 to 5.925 GHz	up to 20 dBm	-90 dBm @ 6 Mbps -71 dBm @ 54 Mbps	5/10/20 MHz

### Antenna options

- Access
  - Internal directional: 8.5, 11.5 dBi
  - External directional: 8.5 dBi
  - External omni-directional: 4, 6, 8, 10, 12 dBi
- Backhaul
  - Internal directional: 6, 9, 10.25, 10.5, 12, 13.5, 15 dBi
  - External directional: 10.5, 12, 15 dBi

### Approvals

BelAir Networks wireless mesh products configured with ARM3, BRM3, BRM3 – 4.9 and WRM radio modules, meet the following approval standards:

- Radio: FCC part 15 and part 27, EN 300 328, EN 300 440, EN 301 893 and Industry Canada RSS 210 Issue 5
- EMC: FCC 47 CFR part 15, subpart B Class B and EN 301 489-1/-17 Class B
- Safety: ANSI/UL std no.60950-1, CSA-C22.2 std no. 60950-1, CB-60950-1
- Laser safety: Class 1 laser product complies with 21CFR 1040 and IEC60825
- RF safety: FCC OET Bulletin 65, Health Canada Safety code 6
- Outdoor use: IP56/NEMA4/NEMA4X for wet and dusty conditions
- CE! mark
- Mexico: NOM
- Korea: MIC2003-15
- Russia: GOST-R
- India: ETA-74/2005, ETA-78/2005
- Taiwan: LP00002, ETC094LP0425, ETC094LPD0426, ETC094LPD0426a



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