# 700/800 MHz LTE/Public Safety Dual Band “Class B” Broadband BDA Technical Specification /Comparison to “Class A” Channelized BDA

The functional performance and coverage is comparable between a “Class A” Channelized and “Class B” Broadband BDA in a suburban and urban application. A “Class A” may be more suitable where there is heavy RF interference, such as in a major urban downtown area.

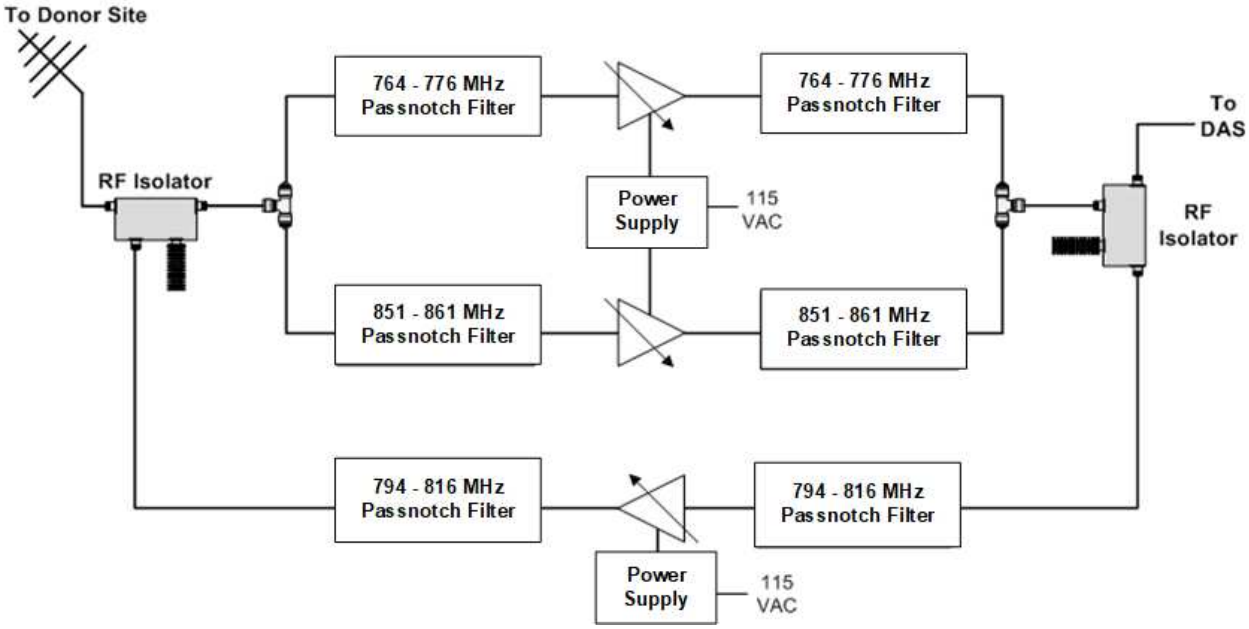
**EMR 700/800 MHz DUAL BAND “CLASS B” BDA Technical Specification**

The following information outlines the critical specifications which define the most important technical performance aspects of the 700/800 MHz Dual Band “Class B” BDA. These details will allow you to choose the correct product for your applications.

| **Model Number:** | **860632/BC(AT,72)** |
|---|---|
| NFPA72 Alarm & Monitoring: | Yes |
| 24 Hour Battery Back-up: | Yes |
| Typical Gain: | 75 dB |
| Power Control: | Yes |
| Adaptable to Fiber: | Upgrade |

## 700/800 MHz BDA System Schematic

Combined BDA Systems Solution



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## 1. BDA Output Systems Gain

Systems Gain includes all the systems loss components not just the output of the amplifier. The loss components include:

- Input and output Filter Losses
- Intercabling Loss
- Jumper Loss
- Connector Loss

## 2. BDA Gain Option

Gain can be increased to between 75 - 80 dB with the addition of an amplifier stage. Higher gain comes with its own set of problems and should only be utilized as a solution when proper engineering deems such high gain necessary.

## 3. BDA Oscillation Protection

Oscillation between the UL and DL amplifiers will occur without proper engineering of the completed DAS and head-end designs to protect them.

## 4. Isolation Requirement

BDA device placement, antenna location, and intrinsic BDA output signal must be considered to ensure there is a minimum of 15 dB more isolation than the BDA's system gain to prevent oscillation between the UL and DL Power Amplifiers.

## 5. 700/800 MHz Integration

The 700/800 MHz BDA System is integrated to support a single common donor antenna and a single coaxial DAS connection (donor signal is from same transmitter site). Variations on this scheme are available that support multiple donor sites or a Fiber Optic DAS.

## 6. "Class B" Booster Operation

A "Class B" Broadband BDA design doesn't require reprogramming if channels are changed or upgraded *as long as additional channels are added within the operational pass bandwidth.* The authority having jurisdiction (AHJ) avoids any ongoing requirement for detailed reprogramming and maintenance of records if frequencies are changed due to systems capacity or interference needs.



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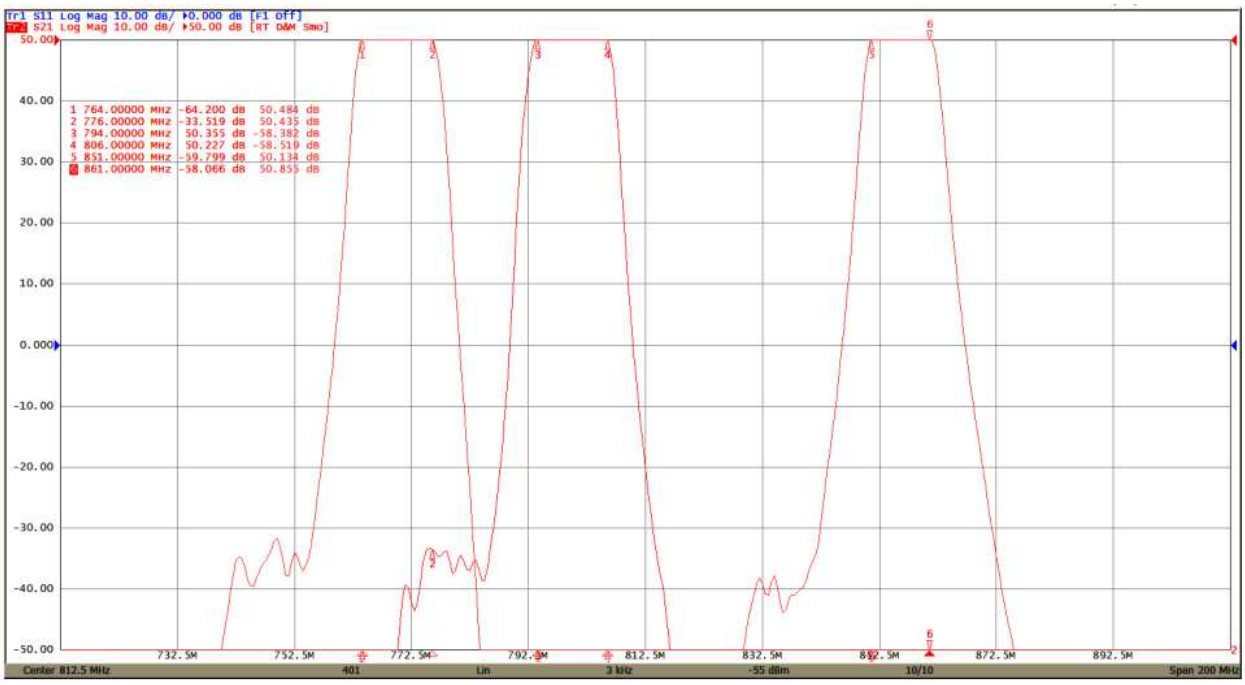
## 7. Filtering

Selecting the proper filtering that provides sufficient performance assures acceptable operation as seen in the following illustration:




| Channel Frequency (MHz) | Insertion Loss | Driver Amplifier | | | | Master Amplifier | | | | System Gain | Noise Figure | Power Supply | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Model | Gain | NF | 30IP | Model | Gain | NF | 30IP | | | Voltage | Bias Voltage |
| DL: 764.0000-776.0000 | 6 | 204516/2C | 23 | 2 | +42 | 264636C | 60 | 4 | +47 | 80+ | 12 | 117 | 13.6 |
| DL: 851.0000-861.0000 | 5.2 | 204516/2C | 23 | 2 | +42 | 264636C | 60 | 4 | +47 | 80+ | 12 | 117 | 13.6 |
| UL: 794.0000-806.0000 | 5.3 | 204516/2C | 23 | 2 | +42 | 264636C | 60 | 4 | +47 | 80+ | 12 | 117 | 13.6 |

## 8. "Class A" and "Class B" System Performance

The BDA System should furnish necessary frequency filters with sufficient selectivity/isolation to prevent oscillation between the amplifiers while desired signals are passed and amplified. Additionally, filter "Group Delay" must be considered. Both "Class A" and "Class B" BDA's are filtered.

- "Class A" BDA's will have either a DSP or mixers plus crystal filters.
- The potential for oscillation exists between the UL and DL amplifier in both "Class A" and "Class B" BDA's without passive filters.
- Additional filtering and intermediate frequency DSP conversion will increase Group Delay in a "Class A" BDA. This may impact system coverage and audio sound quality in a TDMA based system such as P25, DMR, MOTORBO.
- Group Delay in "Class B" BDA's is typically less than 1 microsec and will not impact either analog or digitally modulated carriers.

Group delay must be considered in any design. Passive filtering is essential in both a "Class A"



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Channelized and a “Class B” Broadband System. It may have to be added as a separate sub-system to achieve required isolation.

## 9. BDA System Monitoring

NFPA compliant monitoring requires monitoring via the Fire Alarm Panel (FAP) and not via the internet. Monitoring through the Fire Alarm Panel (FAP) requires dry contacts out from the BDA. The BDA may be able to be monitored remotely over an on-line live internet connection via SNMP traps within the BDA monitor.

## 10. NFPA72 Compliance Detail

The Relay Output Port (J11) is a DB25 Male connector typically located on the bottom right panel of the BDA. A label of the pin-outs is also located inside of the door of the BDA. A DB25 Female connector (with hood hardware) is supplied with the unit for the install technician to connect to the Alarm Panel.

*Note: Pin Numbers are written on the DB25 Connectors*

There are 7 alarm relays available that will supply contact closure (Supervisory Signal) to the fire alarm panel. The following systems elements must be monitored to be compliant with NFPA or IFC and authority having jurisdiction (AHJ) regulations:

1. AC Power Failure
2. Signal Booster Failure
3. Battery Charger Failure
4. Low-battery Capacity
5. Power Supply Failure
6. Antenna Malfunction
7. Signal Booster Trouble

## 11. ANNEX O to NFPA 1

The following is an excerpt about the need for Isolation:

> **O.3.1 General:** The document requires that the BDA operates without causing interference to other parts of the public-safety radio system and that technologies be employed that are compatible with the public-safety radio system. Annex O envisions a permitting process whereby the system design must be submitted to the authority having jurisdiction (AHJ) for approval before it can be installed.

## 12. BDA System Battery Back-Up

The Battery Back-up must be housed in a separate NEMA4 Enclosure. Batteries must be suitable to support operation for either 12 or 24 hours as dictated by the authority having jurisdiction (AHJ).



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## 13. Design Assistance

EMR can do a complete DAS design for you. We can email you a BDA Design Template to assist you in collecting the required data. The following information is required to complete a DAS design:

- Repeater TX frequencies to be supported.
- Repeater RX frequencies to be supported.
- Repeater ERP.
- Distance between building to be covered and the repeaters.
- Signal level on the building's roof.
- Local building code requirements, such as:
    1. Battery Back-up – 12 and 24 hour options available.
    2. Alarm and Monitoring, SNMP – NFPA72.
- Minimum signal strength levels and/or minimum DAQ levels within the building coverage area. This will mean acceptance testing and documentation of system performance is required for the application.
- PDF of the building(s) to be covered. This pdf drawing needs to be to scale and distances specified on the drawings (this will allow us to derive a reasonably accurate scale from the resized PDF). *Please don't send an architectural log, it will lengthen our response time.*
- Location within the building where the BDA head-end is to be installed.
- Location of vertical chases noted to ease cable installation to multistory buildings.
- Location of hard ceilings noted to avoid making cable installation more difficult. We will look to run cable in hallways which typically are soft ceilings.
- Antennas attached to the cable will need to be below metal ducting and piping.
- "Critical" coverage areas noted.
- Note areas where coverage is not desired. This can help lower cost and in other cases EM radiation can cause "issues" (wafer fabrication areas, hospital radiology, etc.).

## 14. In-Building "Class B" Part 90 Signal Booster Registration

EMR Corporation manufactures "Class B" Signal Boosters which must be registered with the FCC when operated within the United States. The FCC has developed the Part 90 Class B Signal Booster Registration & Discovery as a tool to assist the public in identifying Part 90 Class B signal boosters in their area. It also allows licensees to determine if a registered Part 90 Class B signal booster is causing interference to their other signals.

## 15. Qualifications for Technicians & Installers

Local building code may dictate what level of FCC qualifications or certification by the manufacturer is



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required by the installer. The Electronics Technicians Association (ETA) provides training (much is self-guided) and certifications from associate to full DAS certification on In-Building Systems.

## 16. Section J103.23 of the NFPA Minimum Qualifications of Personnel

A valid FCC General Radio Operators License is no longer required for Land-Mobile. It is only required for High Power/Maritime (see FCC 13-4). It has been replaced by third party testing as part of the CET Exam which is offered by ETA, and a Certification of in-building systems training issued by a nationally recognized organization or school or *a certificate issued by the manufacturer of the equipment being installed.*

Further stated is that "the agency (aka- authority having jurisdiction) may waive these requirements upon successful demonstration of adequate skills and experience satisfactory to the fire code official". These are done to purge those that are not competent to do these installs/optimizations but do add cost and complexity to be paid/absorbed by the contractor.

## 17. BDA Applications

**Buildings:**

Any large building is a candidate especially those having floors which are below grade. BDA's have been installed in office buildings, schools, college campuses, casinos, jails, court houses, police stations, hospitals, water treatment facilities, manufacturing facilities, shopping malls, parking structures, nuclear and coal power plants, hotels, apartments, condos, and golf courses.

Buildings require a three-dimensional signal distribution system to provide coverage of multiple floors including open spaces, stairwells, corridors, and elevators. The high gain BDA provides the interface between the remotely located repeaters and the interior of the building. The Distributed Antenna System (DAS) deployed within the building to support the BDA will consist of multiple branches routed through low loss coaxial cable and/or radiating cable and/or fiber optic cable via splitters or line taps which will in turn feed signal to a number of omni-directional antennas.

**Tunnels:**

RF signals do not always propagate well in narrow tunnels which are often comprised of high RF loss walls resulting in poor performance from a DAS supported with a number of omni-directional antennas. Instead, a DAS featuring radiating cable transmission line is often a better choice to better support uniform RF coverage inside such tunnels. Tunnels include mine shafts, railway and vehicular tunnels, underground passageways, maintenance and utility shafts, metros, and subways.

For any questions and/or clarifications please contact our sales team.

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# 860632/BC(AT,72)

## 700 / 800 Class B Dual Band Directional Amplifier System

**Electrical Specifications**

| | |
|---|---|
| Uplink Frequency Band: | 793 – 816 MHz |
| 700 MHz Downlink Frequency: | 763 – 775 MHz |
| 800 MHz Downlink Frequency: | 851 – 861 MHz |
| System Gain: | 70 min, 80 dB typ |
| Amplifier O/P Power: | +37 dBm max |
| PA Power Control setpoint: | +37 dBm |
| Amplifier Noise Figure: | 3.0 dB |
| System Noise Figure: | 7.0 dB max |
| IP3: | +49 dBm |
| Nominal Impedance: | 50 ohms |
| VSWR: | 1.35:1 max |
| Propagation Delay: | 0.2 µsec max |
| Amplifier Bias Voltage: | 13.6 VDC |
| Amplifier Current draw, total: | 6.5 A max |
| System Voltage: | 115 - 240 VAC |
| Connectors: | N Female |

**Mechanical Specifications**

| | |
|---|---|
| Finish: | Red |
| Enclosure Type: | NEMA 4 |
| Size (WxDxH): | 30 x 24 x 20 in (762 x 610 x 508 mm) |
| Weight: | 87 lbs (39.5 kg) |
| DAS solutions supported: | Coaxial, Radiating |

**Environmental Specifications**

| | |
|---|---|
| Operating Temperature Range: | -30°C to +60°C |
| Operating Humidity Range: | 0-90% non-condensing |

**Alarm and Monitoring**

| | |
|---|---|
| Relay Output Port: | DB25 |
| Number of alarm Relays: | 7 |
| Supervisory Signal to FAP: | AC Power Failure<br>Signal Booster Failure<br>Battery Charger Failure<br>Low-Battery Capacity<br>Power Supply Failure<br>Antenna Malfunction<br>Signal Booster Trouble |

*Specifications are subject to change without prior notification*

EMR bi-directional repeaters provide two way (uplink and downlink) filtering and amplification of both 700 and 800 MHz Public Safety signals within buildings, tunnels or areas that are shaded from adequate RF signal coverage. In addition to the BDA repeater, other devices needed for a distribution system include transmission line, power splitters, hybrid & directional couplers, and indoor antennas. The use of radiating cable is a viable choice for coverage in tunnels and long corridors. All EMR BDA's and UDA's can be upgraded with fiber optic transceivers when choosing to implement a fiber optic DAS.

The effect of composite power when the BDA is operating at it maximum output level. In this table the input to the BDA of the carrier(s) are all -42 dBm and the BDA gain is set to 75 dB; the maximum composite output power is +33 dBm.

| # of Input Carriers | Output Pwr/Chan | Composite O/P Pwr | Effective Gain |
|---|---|---|---|
| 1 | 33.00 dBm | 2000 mW | 75.00 dB |
| 2 | 29.96 dBm | 993 mW | 71.96 dB |
| 3 | 28.21 dBm | 664 mW | 70.21 dB |
| 4 | 27.98 dBm | 630 mW | 68.00 dB |
| 5 | 26.00 dBm | 399 mW | 67.20 dB |
| 6 | 25.20 dBm | 332 mW | 66.00 dB |
| 7 | 24.55 dBm | 286 mW | 97.00 dB |
| 8 | 23.95 dBm | 249 mW | 65.95 dB |
| 9 | 23.50 dBm | 224 mW | 65.00 dB |
| 10 | 23.00 dBm | 200 mW | 62.00 dB |

**Optional System Upgrades**

- UPS w/ Battery Backup 12 hours
- UPS w/ Battery Backup 24 hours

* System output power is a function of the number of carriers incident on the system, the signal level of these carriers to the signal enhancement system, and the insertion loss of the filters within the bidirectional system.

"WARNING. This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST register Class B signal booster (as defined in 47 CFR 90.219) online at www.fcc.gov/signal-boosters/registration. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation." [75 FR 21564, Apr. 12, 2013]



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