TECHNICAL NOTES ON BI-DIRECTIONAL AMPLIFIERS

Extending signal coverage inside buildings and tunnels was a tough problem until the BDA was created.

The Celwave BDA family is noted for unique design concepts and features. It is offered in a variety of transmitter power levels, as well as receiver sensitivities and selectivity choices in the 800-900 MHz region for 800 conventional, Trunked SMR, U.S. Cellular A and B bands, ETACS and GSM.

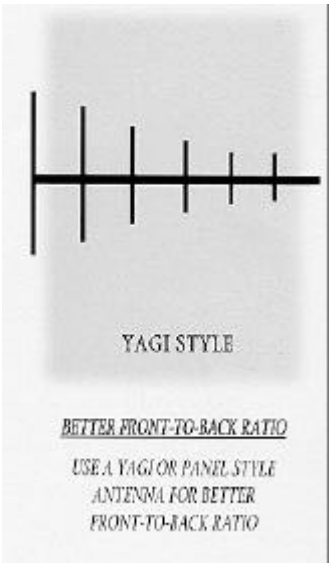
The Celwave BDA consists of two complete repeater systems housed in a single enclosure and connected in parallel through two duplexers feeding two antennas. One repeater path serves to receive and amplify ambient signals from the outside for radiation into the service area. The other repeater path does the opposite, re-transmitting signals from the portables and mobiles operating within the service area back to the outside. Thus, repeater # 1's receiver and repeater #2's transmitter are connected through a duplexer to the outside antenna; repeater # 1's transmitter and repeater #2's receiver are connected through a duplexer to an inside antenna serving the dead zone.

Both repeaters are open and broadbanded, although the duplexers provide band pass characteristics for each. The term "Open" signifies that no modulation processing is performed. Broadbanded means any signal appearing in one receiver's passband is amplified and re-transmitted on the same RF frequency with the same modulation characteristics. Note: optional filters are available to pass cellular A band or B band signals exclusively, so one cellular operator can provide enhanced coverage in an area without boosting the competition's signal also.

No frequency translation or demodulation occurs. The Celwave BDA is digital ready as it exists. There is, however, an Automatic Gain Control between the receivers and transmitters to reduce the gain. This limits intermodulation to a fixed level during overload. In addition, Celwave BDAs have a manual gain control plus an overload recognition circuit that senses when the AGC range is exceeded and turns off the unit for about 5 seconds. This feature helps prevent interference generation.

CELWAVE BDA DESIGN PRINCIPLES APPLIED

Though two duplexers are provided because the two repeaters operate in identical frequency spectra, the potential for feedback between the two ports exists. Accordingly, an important applications requirement is substantial physical separation between the two antennas. Applications that include multi-story buildings, underground parking garages, and rail tunnels are a "natural" for this product.



Typical installation: A five-story building with a central elevator shaft. Sometimes reflective glass or heavy internal construction prevents signals from reaching the lower floors or interior offices. An optimum BDA layout consists of mounting the BDA cabinet near the core, ideally within the elevator shaft or telco/electrical utility closet with vertical conduits. AC power must be available from a minimum 15 Amp circuit.

The ambient signal capture antenna should be directional and roof mounted, with a clear shot to the repeater or paging tower, using a Yagi or panel-style antenna for better front-to-back ratio. Connect this antenna to the BDA using heavy, hardline coaxial cable (minimum 7/8 inch) to minimize loss. Route the cable to the BDA cabinet using the elevator shaft or other conduit as available. Check fire and building codes before specifying cable.

The supplemental signal antenna may be directional or omnidirectional, depending on requirements. Providing coverage from the corner of a parking garage, for example, calls for a directional style. Achieving 360 degree coverage from an elevator shaft or utility closet calls for an omnidirectional antenna. In the omnidirectional case, choose a low gain antenna (zero or 3 dB) to take advantage of the broad vertical beamwidth and to assure maximum coverage to the floors above and below the antenna.

To further enhance the internal supplemental signal to and from the BDA, radiating coaxial cable can be employed. There is a tradeoff to be considered with radiating cable: signal is intentionally lost before it reaches the antenna, so there is less signal to radiate. However, the overall vertical signal fill pattern can be better.