

Enclosed Area Coverage

- **Complete RF coverage solution for in building and underground systems**
- **Fully channel selective**
- **Supports VHF, UHF, 800/900 MHz bands**
- **Compact design makes multi-channel system designs viable**
- **Local and remote monitoring of all system elements available**

CHANEXCOM

Today, providing enclosed area coverage is probably one of the most critical aspects of performance in any wireless communication system. It is also one of the most challenging from a system design point of view, and as such, is very often neglected.

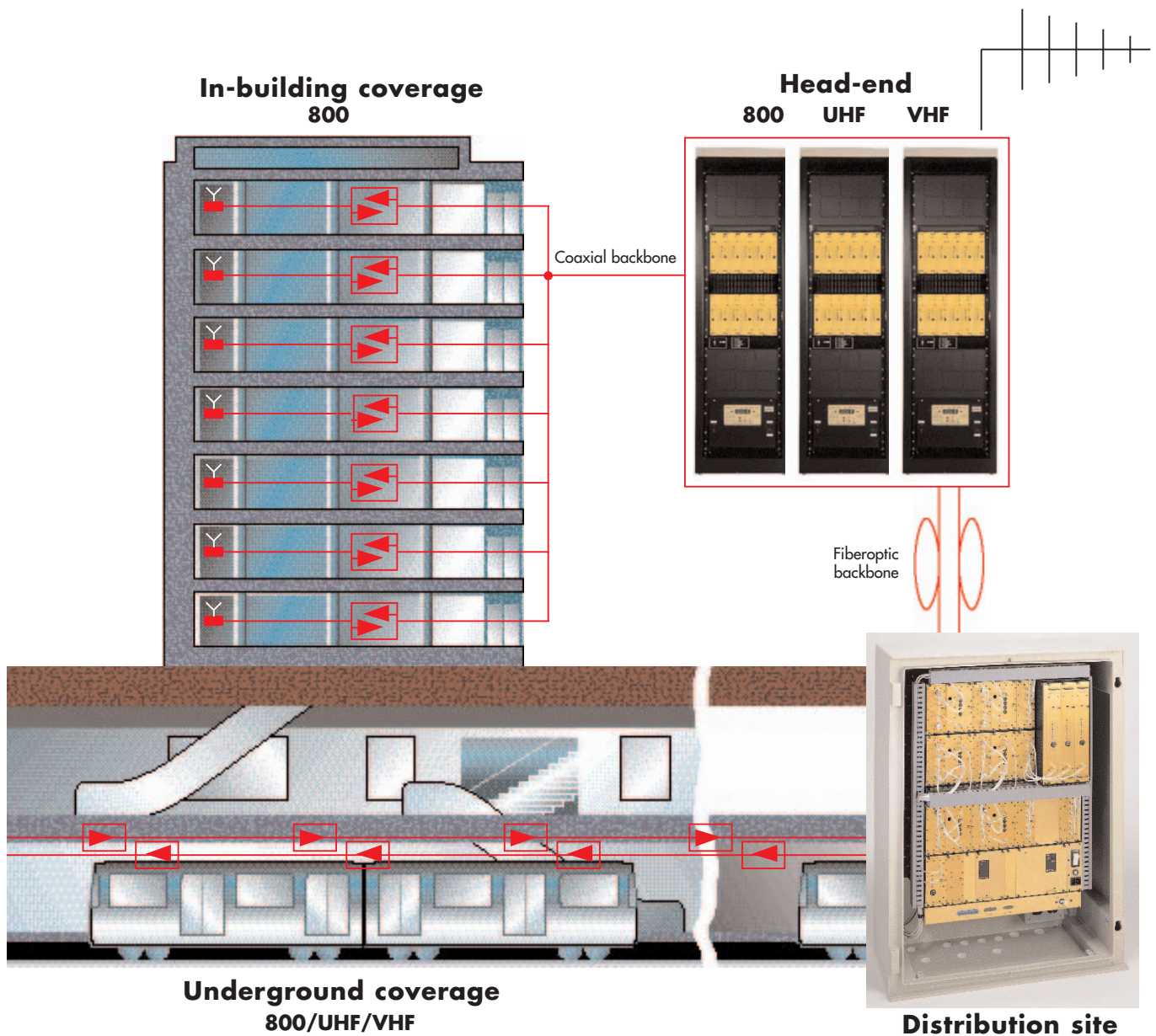
In most systems, enclosed area coverage exists as a result of penetration of external signals. Usually this provides marginal coverage, which is accepted by many users as a fact of life. However, there are systems where either the external signals do not exist or the quality of communications cannot be compromised. Typical examples would be subways, road tunnels, underground shopping malls and parking garages. The complexity of the design task grows exponentially when the system must provide multi-channel/multi-band coverage for a variety of different users. CHANEXCOM is a comprehensive system solution, providing scalable, reliable coverage extension to enclosed areas.

Signal acquisition is one of the most important factors in determining the overall performance of an enclosed area coverage system. Usually this can be accomplished most simply and economically "off-air". CHANEXCOM utilizes a head-end site consisting of channel selective repeaters to accomplish this function, with the added benefit that no site specific interface has to be provided. In some cases, such as subway systems, the head-end site may have to be located a considerable distance from the area to be covered in order to acquire usable

signals. The signals from the head-end can then be transported to their destination for further distribution, either by a coax cable, or where longer distances are involved, an analog fiberoptic backbone.

Intermodulation is a well known problem in multi-channel systems, where many signals are being amplified. Any non-linearity in the distribution amplifiers causes the wanted signals to produce intermodulation products which are then further amplified by the system. These intermodulation signals may interfere with wanted channels and in some cases may completely obliterate them. Even if they do not interfere with the wanted signals, they affect the amplifier's power handling capabilities, reducing disposable power for the wanted signals. Intermodulation effects are especially apparent in the downlink path of the system, where maximum power per channel is usually the number one performance objective. This problem becomes more critical as the number of channels in the system increases. CHANEXCOM tackles this problem on two fronts. Firstly, the head-end channel selective repeaters, called Channel






Typical Multi-channel CHANEXCOM Configuration



Modules (CM), let only wanted frequencies into the system, minimizing potential sources of intermodulation products, and secondly, line amplifiers (LA3B) are designed with high IP3 capabilities that minimize intermodulation distortion.

Distribution of the signal is a key issue in the design of an enclosed area coverage system. Shielding losses from walls, floors, cars, trains etc. quickly combine to minimize propagation in the enclosed area. Therefore the designer cannot count on achieving proper coverage by applying a high power signal in one location. The power has to be distributed to the different areas where coverage has to be provided. Other factors such as maintaining sufficient head-end to internal antenna isolation may also limit the maximum power levels that can be radiated at different locations. CHANEXCOM uses a variety of approaches for signal distribution techniques within the enclosed area. These depend very much on site specifics, but generally utilize a combination of distributed coax cable or fiberoptic linked antennas, and radiating cable to provide the most economical and effective solution.

CHANEXCOM System Components

	DEVICE	MAIN FUNCTIONS	MAIN FEATURES
	Channel Module CMD 800 CMD UHF CMD VHF	On channel repeater in 800/900 MHz, UHF and VHF bands provides "off-air" interface	<ul style="list-style-type: none"> • Channel selective • Fixed gain or level • Application specific filtering • Software driven • Easy to setup and monitor • Remotely or locally programmable
	Line Amplifier LA 3B	Tri-band line amplifier compensates for signal distribution losses assuring constant gain	<ul style="list-style-type: none"> • Separately adjustable, fixed gain in each band • Adjustable slope equalization across each band • Compact, rugged design
	Line Amplifier LA 3BAGC	Tri-band line amplifier with AGC option, compensates for signal distribution losses assuring constant signal levels	<ul style="list-style-type: none"> • Separately adjustable, fixed output level in each band • Adjustable slope equalization across each band • Compact, rugged design • Software driven
	Interface Module STN-IF	Interface module provides RF signal routing and switching, bias-tee to DC supply line amplifiers from the cable	<ul style="list-style-type: none"> • Fully overvoltage/overcurrent protected • Compact, rugged design
	Controller Module UC500RF	Controller module provides monitoring and control of complex line amplifier sites	<ul style="list-style-type: none"> • RF modem equipped • Remotely accessible • Compact, rugged design

Noise figure rating of the line amplifiers is often the limiting factor that determines the overall performance of the uplink portion of the system. Cascaded amplifier noise can become a real problem in systems where high propagation losses and low portable transmitter power are encountered. CHANEXCOM minimizes this problem by providing low noise line amplifier equipment.

Fault tolerance is a major concern in many mission critical systems such as subways or tunnels. CHANEXCOM systems architecture provides for fault tolerance by allowing for redundant configurations and features such as alternate signal routing. This allows signal rerouting to be performed in case of cable breaks or equipment malfunctions.

Scalability is possibly the most important feature of CHANEXCOM. All the components required to build many different system configurations are available, from very simple, single channel, to very complex, multi-channel, fault tolerant and remotely controlled systems. CHANEXCOM's compact Channel Modules and LA3B tri-band line amplifiers make building multi-channel, multi-band systems logistically viable and cost effective.

Monitoring and control of the system is another unique feature of CHANEXCOM. If required the system can be fully monitored by a network of controllers communicating over the RF distribution system. The network is centrally polled by a main computer and the status presented by a graphical user interface. All the important settings and configurations of the CHANEXCOM system components can be changed from the main computer remotely, and alarm conditions can be monitored. This can be a very important factor in minimizing the commissioning and ongoing maintenance costs of a large geographically distributed system.

Monitoring and Control Functions		
DEVICE	MONITORING AND CONTROL	ALARMS
Channel Module CMD 800 CMD UHF CMD VHF	<ul style="list-style-type: none"> • Frequency • Gain • Sensitivity • Output power • RSSI level 	<ul style="list-style-type: none"> • Power • VSWR • Temperature • Synthesizer out of lock • Memory error
Line Amplifier LA 3BAGC	<ul style="list-style-type: none"> • Pilot frequency in each band • Gain in each band • Slope equalization • Pilot level in each band • Power in each band • Direction 	<ul style="list-style-type: none"> • Power • Pilot level • Temperature • Synthesizer out of lock • Memory error

