

## Channelized Signal Booster (Model 613-8) - Operational Description (revision 3)

### OPERATIONAL DESCRIPTION

The signal booster system transmits into a distributed antenna system (DAS) for downlink output signals and a DONOR antenna for uplink output signals. The DAS usually has a gain of 0 dBi or less, with only 2 antenna elements a splitter and cable loss the gain adds up to roughly -4 dBi (-6.15 dBd). If higher gain antenna are used (higher than 2.72 dBi) the power will be reduced to meet the ERP limitation. The DONOR with 2 antenna elements a splitter and cable loss adds up to roughly -1.28 dBi (-3.43 dBd). If higher gain antenna are used the power will be reduced to meet the ERP limitation.

The Licensee is instructed to reduce booster gain as required in order to ensure their system meets the 37 dBm ERP limitation.



Signal boosters extend radio coverage into areas where abrupt propagation losses prevent reliable communication. The system receives an RF signal, raises its power level, and couples it to an antenna so that it can be re-radiated. The TXRX model 613-8 channelized signal booster is designed to operate in either the 700 or 800 MHz range. The system is based on a modular design that is bi-directional with one uplink and one downlink branch in the module. Each of the branches within the module is capable of handling 14 or 30 carriers in the respective uplink and downlink direction. The filter passbands within a branch are tunable to their required pass frequency via software interface. The emission designators and modulations the system is designed to accommodate are listed in **Table 1**. Signal flow through the system is illustrated with the signal flow block diagram.

Emission Designator	Type of Transmission	Modulation
F1D	Data	RD-LAP [9.6,19.2] (4-L FSK) Dataradio 50 KHz (16FSK) P25 Phase 1 (C4FM) Control/Data
F1E	Voice	4-L FSK (Voice) P25 Phase 1 (C4FM) Tyco-M/A-Com EDACS (GFSK) Securenet (Encrypted Quantized Voice)
F3E	Voice Analog	
FXE	Voice	MotoTrbo, Kenwood, ICOM DMR
FXD	Data	ETSI DMR 2-slot TDMA
G1E	Voice	F4FM (Phase 2 P25 TDMA, Tetrapol)
G1D	Data	F4FM (Phase 2 P25 TDMA, Tetrapol)
D7W		DIMRS - iDEN TETRA, P25 Phase 2 ( $\pi/4$ [W]CQPSK)
D7D		Motorola HPD
D1E		CQPSK
D1W		LSM (Motorola Linear Simulcast)
F9W		Tyco-M/A-Com OpenSky (F4FGSK)
D1E	Voice	WCQPSK (Simulcast)

**Table 1:** Emission Designators, Type of Transmission, and Modulations for the Channelized Signal Booster.

### Uplink and Downlink Input Signals

Uplink input signals (793 - 805 and 806 - 824 for units sold for use in the United States, 794 - 806 and 806 - 824 for units sold for use in Canada) are picked up by the DAS antenna and applied to the triplexer. The uplink input signals pass through the triplexer and are fed into a directional coupler where they are distributed to the uplink input port of both the 700 and 800 MHz channel modules.

Downlink input signals (763 - 775 and 851 - 869 for units sold for use in the United States, 764 - 776 and 851 - 869 for units sold for use in Canada) are picked up by the Donor antenna and applied to the triplexer. The downlink input signals pass through the triplexer and exit at either the 700 or 800 MHz output port. The 700 and 800 MHz downlink inputs signals are then applied to the downlink inputs of the respective 700 and 800 MHz channel modules.

### Channel Module

The uplink input signals and the downlink input signals are applied to a down-converter board when they enter the channel module. Within the channel module input signals are down converted, digitized, and DSP filtering is performed. There are two styles of Channel modules available, a 14 channel version and a 30 channel version. After DSP filtering the analog signal is recreated and up converted with an up-converter board to the original frequency before being output from the channel module at the downlink and uplink output ports.

Up converter boards are available in two different styles including low level and high level. If the signal booster is a high-power model then a low level up converter boards are used in the channel module. If the booster is a low power model then high level up converter boards are used. Signal booster models that have the fiber-optic option installed in them have enhanced down-converter boards that are capable of dealing with the low level signals from the optical conversion.

### Uplink and Downlink Output Signals

Uplink and Downlink output signals leave the channel module at the UL OUT and DL OUT connectors respectively. The 700 and 800 MHz uplink output signals are combined with a directional coupler then passed on to a power amplifier stage. The output of the power amplifier is passed through a triplexer then radiated from the donor antenna. Downlink output signals leave the channel module and are applied to a power amplifier stage. The

output of the power amplifier is passed through a triplexer then radiated from the service antenna.