

MARK-IV Channelized (Class-A Narrowband) Signal Booster

MARK-IV CHANNELIZED (Class-A Narrowband) Signal booster with Automatic Output Level Control

MODEL:

M4-ChOLC-options (see table below)

DESCRIPTION:

The **CTI MARK-IV CHANNELIZED REBROADCAST SYSTEM** is designed for multi-carrier two-way rebroadcast systems, where significantly high dynamic range is required.



The **MARK-IV** is a Narrowband Class A (Channelized or Channel Selective) Signal Booster with a 100 dB Automatic Output Level Control, fully compliant with the FCC requirements to transmit signals outdoors back to the donor sites or basestations.

Features & Applications:

- **MARK-IV** modules can be used as a front-end **Channelized Signal Conditioner System** (Channel Selective, class-A narrowband signal boosters per FCC definition) to effectively and efficiently convert broadband BDAs into Channelized Class-A boosters compliant with FCC 90.219(d) rule.
- **MARK-IV Higher Input Dynamic Range** reduces the impact of strong interfering input carriers (those that create 3rd order IM products landing right on another system desired channel). Two interfering carriers could be up to -35 dBm at the module's input without causing harmful interference on the desired channel.
- **MARK-IV** performs **Higher Input (Rx) Intermodulation Rejection**, -35 dBm maximum input for two undesired carriers causing 3rd order IM interference.
- **MARK-IV 100 dB Automatic Output Level Control** equalizes the output signal at a fixed level regardless of the input level = **improves the system dynamic range** to feed RF-over-Fiber optic links or remote boosters with constant levels to overcome the link losses and the RF/Optic converter's very high noise figures.
- **MARK-IV Frequency Tracking** follows exactly the input signal's frequency and modulation (analog or digital), with minimum delay.
- **MARK-IV** modules' Operating frequency is **Field-programmable** by a simple software interface.
- **MARK-IV Manual Input (Rx) Threshold and Output Power Level** controls provide easy field adjustments and Status Indicators (visual LED and Discrete Signals).
- **MARK-IV** modules feature **Small Foot-print & Simple Installation**,
- **MARK-IV** modules require **only +15 VDC**.

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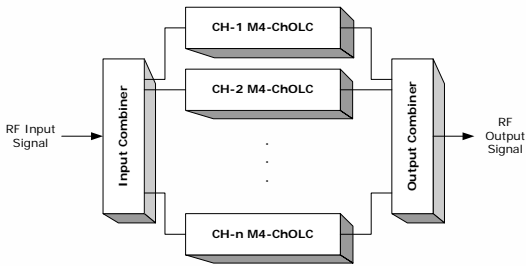


Figure 1: Channelized Rebroadcast System

Per FCC 90.219(d) only narrowband (class A) signal boosters can be used for that application, the broadband BDAs are not allowed to transmit outdoors. See June/05 FCC letter.

Per FCC 90.7: "A signal booster may be either narrowband (Class A), in which case the booster amplifies only those discrete frequencies intended to be retransmitted, or broadband (Class B), in which case all signals within the passband of the signal booster filter are amplified." The class A or B designator is not related to the kind of amplifier bias.

When several **MARK-IV** modules are combined to process multiple channels within a desired band, the RF signals going out of the signal booster are set at a constant level by the 100 dB Automatic Output Level Control, regardless of their input level, which significantly improves the system dynamic range.

It can also be used as a front-end filter system to retrofit Broadband BiDirectional Amplifiers (BDAs).

OPTIONS SUMMARY:

Model number= M4-ChOLC-Option

Option	Option's brief description
800UL	Used for the 806-824 MHz Band
800DL	Used for the 851-869 MHz Band
UHF	Used for the 460-490 MHz Band

A.1 NARROWBAND CLASS-A COMPLIANCE SOLUTION

The **MARK-IV** modules turn a Class-B Broadband BDA into a Narrowband Class A "channelized BDA" that can be used to transmit signals

outdoors, without the limitations set forth by the FCC in Part 90.219(d).

The **MARK-IV** modules reduce high power carriers that can saturate the BDAs and create Intermodulation (IM) Products in the system. On the other hand, the **MARK-IV** modules boost up weak carriers that would be otherwise lost in a broadband BDA system. See next Figure 2.

MARK-IV modules can be programmed for processing any communications channel in the two-way mobile radio VHF, UHF, 700 and 800 MHz SMR bands, while maintaining system flexibility. Multiple modules are combined into a single output signal with Low-Level passive combining, which improves BDA efficiency and cost effectiveness by reducing combiner costs.

The **MARK-IV** modules are a very cost-effective upgrade to existing BDA systems that both improves their performance and makes them compliant with FCC 90.219(d).

Figure 2 shows, as example, the operation of an integrated system with only four **MARK-IVs** programmed on F1, F3, F0 and F5 frequencies. The signals on F2, F4 and F6 are filtered out, since there are no **MARK-IVs** tuned to them.

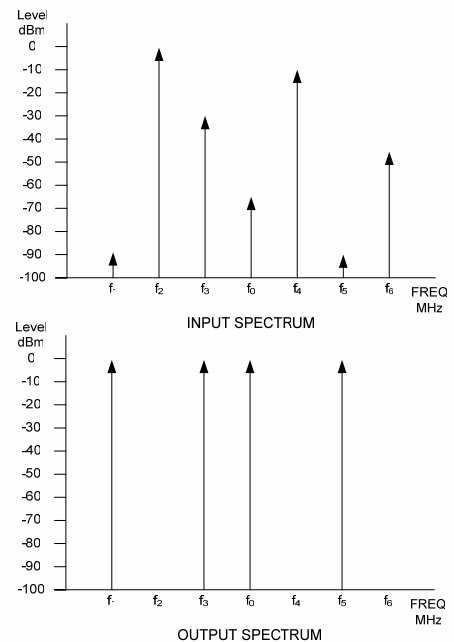


Figure 2: 4-channels Integrated System Input and Output Spectrum

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A.2 HIGHER DYNAMIC RANGE

The **MARK-IV** delivers an outstanding Dynamic Range, which combined with its Input Sensitivity of -110 dBm allows the module to tolerate strong undesired input carriers of up to -35 dBm with no interference on the desired channel. Figure 3 illustrates this case's input spectrum.

This is particularly important for critical applications where the frequency plan contains channels that would create 3rd and 5th order Intermodulation Products landing in-band right on other desired system channel(s), since two or more very strong signals at F_1 and F_2 frequencies impacting other booster's front-end would cause interference on the desired F_0 channel.

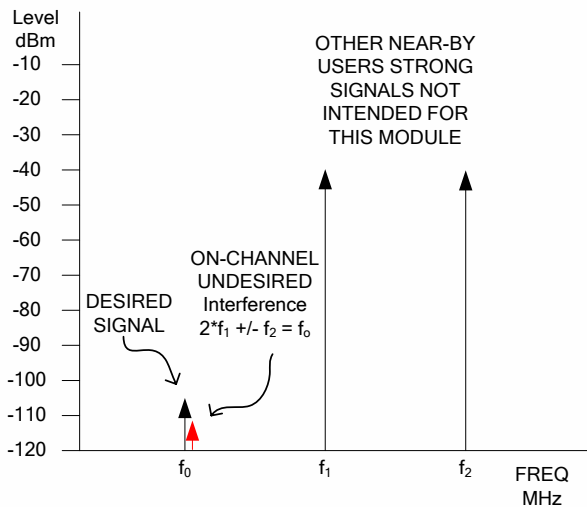


Figure 3: 3rd ORDER on-channel IM interference

$$2 * F_1 \pm F_2 = F_0$$

A.3 CHANNEL SELECTIVITY

The **MARK-IV** is a channel selective signal processor that filters and conditions only the desired channel output power level. Other channels are filtered out, rejected and not affected. The Output Signal is equalized to a steady and fixed level, regardless of the input signal level variations.

The following Figure illustrates the **MARK-IV** operation on f_0 frequency.

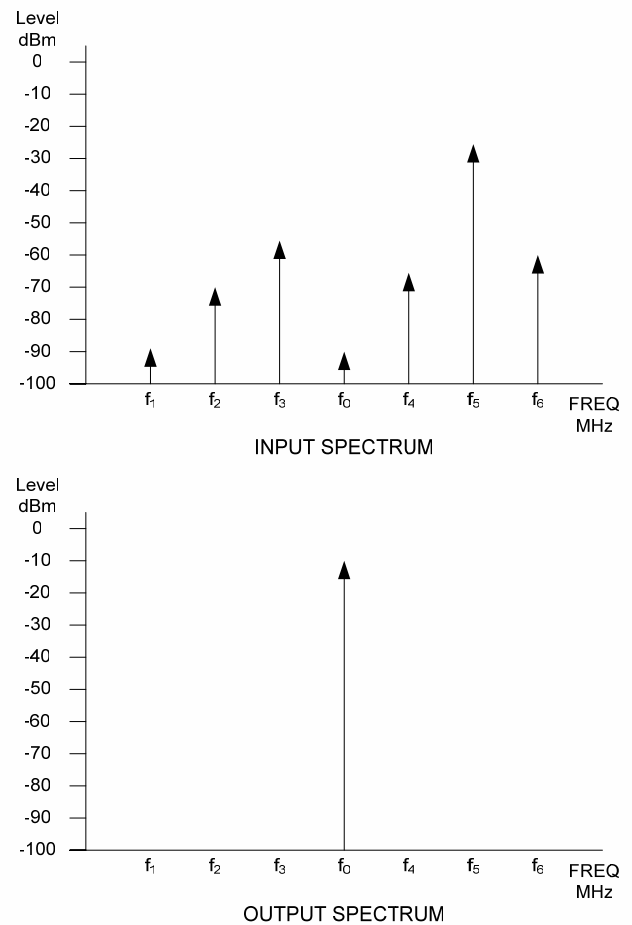


Figure 4: Single *MARK-IV* Input and Output Spectrum

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A.4 MARK-IV MODULE SPECIFICATIONS

MARK-IV Channelized (Class-A Narrowband) Signal Booster module with Automatic Output Level Control – model M4-ChOLC	
• Channel Specs	
Frequency range:	
a. M4-ChOLC-800UL FCC ID: TCJM4-ChOLC-800UL	a: 806 – 824 MHz
b. M4-ChOLC-800DL FCC ID: TCJM4-ChOLC-800DL	b: 851 – 869 MHz
c. M4-ChOLC-UHF FCC ID: TCJM4-ChOLC-UHF	c: 460 – 490 MHz
other bands available	
Frequency Programming Steps	12.5 kHz
Channel Spacing	25 kHz
• RF Input	
Input impedance (typ)	50 ohms
Sensitivity for greater than 20 dB output SINAD (DAQ 3.4)	-110 dBm
Maximum input power (composite) for no-damage	-10 dBm
• RF Output	
Output impedance (typ)	50 ohms
Output power (maximum)	
a. M4-ChOLC-800UL FCC ID: TCJM4-ChOLC-800UL	0 dBm
b. M4-ChOLC-800DL FCC ID: TCJM4-ChOLC-800DL	-2 dBm
c. M4-ChOLC-UHF FCC ID: TCJM4-ChOLC-UHF	-5 dBm
Output level adjustment range	10 dB
Maximum output level variation with input level variations within range	+/- 2 dB
Distortion	≤ 3%
Spurious & harmonics outputs	60 dBc
Duty cycle	Continuous
• Field Adjustments and Status Indicators	
Operating Frequency (serial port interface)	
Input (Rx) Threshold level	
Output Power level	
RF output OK signal (“fail-safe” indication)	
DC current draw OK signal (“fail-safe” indication)	
Receive Signal Strength Indicator – RSSI (DC voltage)	
• Power Requirements	
Power Supply	+15 VDC
Power Consumption	10 W max.
• Environmental	
Operating Temperature range	0° to 50° C
• Mechanical	
Module footprint (typical)	273x234x27.2 mm
RF coaxial connectors are “SMA” type, female.	