



## A.1 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 **M4-ChOLC** 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.

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.

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

When several **M4-ChOLC** modules are combined to process multiple channels within a desired band, the RF signals going into the BDA 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.

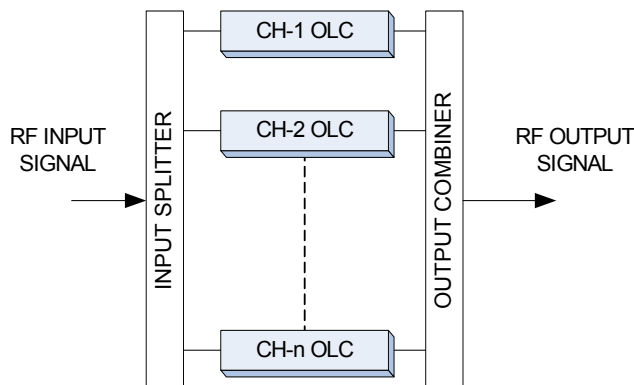
The **M4-ChOLC** modules reduce high power carriers that can saturate the BDAs and create Intermodulation (IM) Products in the system. On the other hand, the **M4-ChOLC** modules boost up weak carriers that would be otherwise lost in a broadband BDA system. See next Figure 2.

The **M4-ChOLC** modules turn a 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).

**M4-ChOLC** modules can be programmed for processing any communications channel in the two-way mobile radio UHF or 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 **M4-ChOLC** 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 **M4-ChOLCs** programmed on F1, F3, F0 and F5 frequencies. The signals on F2, F4 and F6 are filtered out, since there are no **M4-ChOLCs** tuned to them.



**Figure 1: Channelized Rebroadcast System**

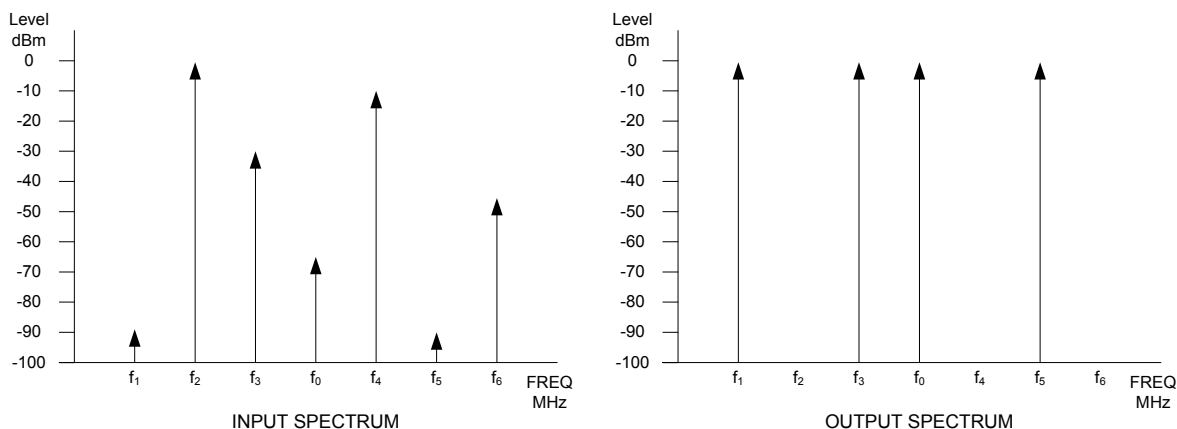


Figure 2: 4-channels Integrated System Input and Output Spectrum

## A.2 FEATURES & APPLICATIONS

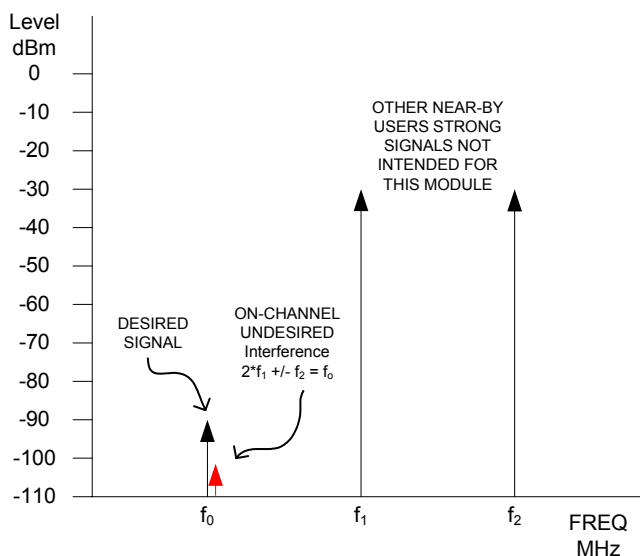
- **M4-ChOLC** modules are a front-end **Channelized Signal Conditioner System** (Channel Selective, class A narrowband signal boosters per FCC definition) that effectively and efficiently converts broadband BDAs into Channelized Class A boosters compliant with FCC 90.219(d) rule.
- **M4-ChOLC** modules, **Higher Input Dynamic Range**, reduce the impact of strong interfering input carriers (those that create 3<sup>rd</sup> order IM products landing right on another system desired channel). Two interfering carriers could be up to -30 dBm at the module's input without causing harmful interference in the desired channel.
- **M4-ChOLC** modules, **Higher Input (Rx) Intermodulation Rejection**, -30 dBm maximum input for two undesired carriers causing 3<sup>rd</sup> order IM interference.
- **M4-ChOLC** modules, **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.
- **M4-ChOLC** modules **Frequency and Phase Tracking** follow exactly the input signal's frequency and modulation (analog or digital), with minimum delay.
- **M4-ChOLC** modules are **Field-programmable Operating Frequency** = PLL-based Synthesizer.
- **M4-ChOLC** module **Manual Input (Rx) Threshold and Output Power Level** controls provide easy field adjustments and Status Indicators (visual LED and Discrete Signals).
- **M4-ChOLC** modules, **Small Foot-print & Simple Installation**,
- **M4-ChOLC** stand-alone modules require **only +15 VDC**.



### A.3 INPUT (Rx) INTERMODULATION REJECTION

The **M4-ChOLC** delivers an outstanding Input (Rx) Intermodulation Rejection, which combined with its Input Sensitivity of -100 dBm allows the module to tolerate strong undesired input carriers of up to -30 dBm with no interference on the desired channel, as per TIA standards. Figure 3 illustrates this case's input spectrum.

This is particularly important for critical applications where the frequency plan contains channels that would create 3<sup>rd</sup> and 5<sup>th</sup> 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 the M4-ChOLC's front-end would cause interference on the desired  $F_0$  channel.



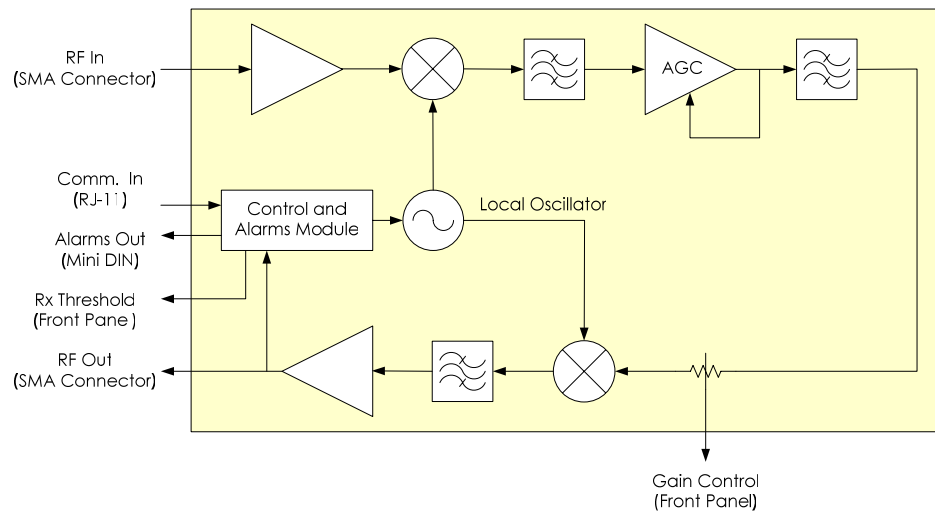
**Figure 3: Input (Rx) Intermodulation Rejection 3<sup>rd</sup> ORDER on-channel IM interference  $2 \cdot F_1 \pm F_2 = F_0$**

### A.4 THE CHANNEL PROCESSOR

The architecture of the **M4-ChOLC** is based on down&up heterodyne frequency converters, featuring narrowband Intermediate Frequency (IF) filters and Automatic Gain Control signal conditioner.

The output signal reproduces the exact input's frequency and modulation (analog or digital), as received at the module's input.

The next diagram in Figure 4 shows the simplified **M4-ChOLC** architecture.

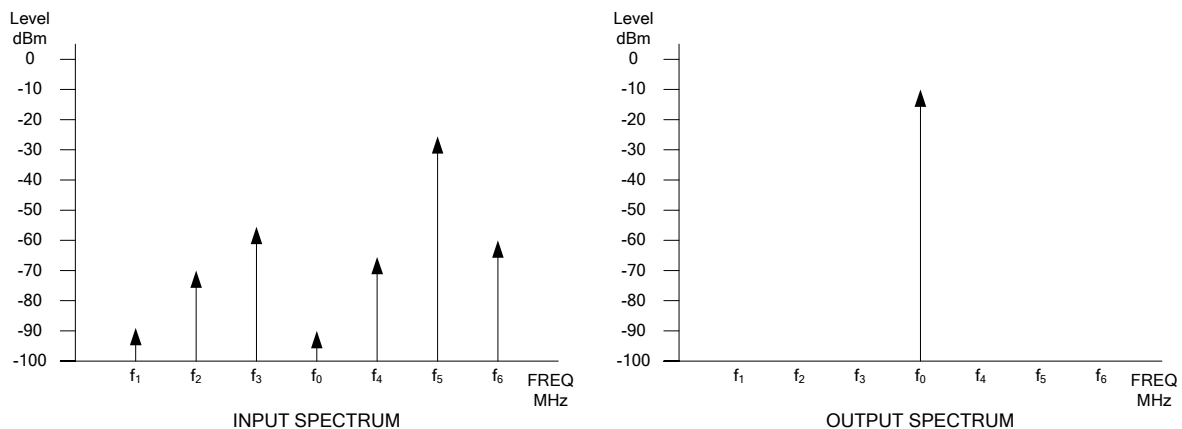


**Figure 4:** M4-ChOLC Block Diagram

## A.5 CHANNEL SELECTIVITY

The **M4-ChOLC** 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 **M4-ChOLC** operation on  $f_0$  frequency.



**Figure 5:** Single ChOLC Input and Output Spectrum



## A.6 MARK-IV MODULE SPECIFICATIONS

<b>MARK-IV Channelized (Class A Narrowband) Signal Booster module with Automatic Output Level Control – model M4-ChOLC</b>	
<b>• Channel Specs</b>	
Frequency range: a. M4-ChOLC-800UL FCC ID: TCJM4-ChOLC-800UL b. M4-ChOLC-800DL FCC ID: TCJM4-ChOLC-800DL c. M4-ChOLC-UHF FCC ID: TCJM4-ChOLC-UHF	a: 806 – 824 MHz b: 851 to 869 MHz c: 460 to 490 MHz
Frequency Programming Steps	12.5 kHz
Channel Spacing	25 kHz
<b>• RF Input</b>	
Input impedance (typ)	50 ohms
Sensitivity for greater than 20 dB output SINAD (DAQ 3.4)	-90 dBm
Maximum input power (composite) for no-damage	-10 dBm
<b>• RF Output</b>	
Output impedance (typ)	50 ohms
Output power (maximum) a. M4-ChOLC-800UL FCC ID: TCJM4-ChOLC-800UL b. M4-ChOLC-800DL FCC ID: TCJM4-ChOLC-800DL c. M4-ChOLC-UHF FCC ID: TCJM4-ChOLC-UHF	0 dBm -2 dBm -5 dBm
Output level adjustment range	10 dB
Maximum output level variation with input level variations within range	+/- 2 dB
Distortion	≤ 4%
Spurious & harmonics outputs	< -13 dBm
Duty cycle	Continuous
<b>• Field Adjustments and Status Indicators</b>	
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)	
<b>• Power Requirements</b>	
Power Supply	+15 VDC
Power Consumption	10 W max.
<b>• Environmental</b>	
Operating Temperature range	0° to 50° C
<b>• Mechanical</b>	
Module footprint (typical)	273x234x27.2 mm
RF coaxial connectors are "SMA" type, female.	