# CDM-Qx Multi-Channel Modem with DoubleTalk™ Carrier-in-Carrier™


## INTRODUCTION

The CDM-Qx is the first 70/140 MHz modular multi-channel satellite modem packaged in a single rack unit chassis. The unit offers exceptional flexibility, redundancy, integration, and performance with four configurable slots. The unique architecture allows cost-effective deployment of multiple modulators, demodulators or modems.

CDM-Qx also supports the DoubleTalk Carrier-in-Carrier option, allowing it to transmit and receive in the same transponder segment.

This flexible modem was designed with satellite operators, service providers and enterprise users in mind. It addresses common challenges encountered when utilizing satellite communications, including:

- Requirement for increasing throughput of point-to-point links without utilizing additional transponder resources
- Need to expand networks with multiple modulators and/or demodulators (asymmetrical links)
- Limited rack space

## FEATURE ENHANCEMENTS

Enhancing the performance of the CDM-Qx is easy. Additional features are added quickly on site, using FAST access codes purchased from Comtech EF Data. To enable these features, simply enter the code at the front panel. Other features are added with a simple module swap.

## DOUBLETALK CARRIER-in-CARRIER

Designed for bandwidth compression, Carrier-in-Carrier is based on Applied Signal Technology's DoubleTalk™, which uses "Adaptive Cancellation," a patent pending technology that allows full duplex satellite links to transmit concurrently in the same segment of transponder bandwidth.

Available as an option to the CDM-Qx, this added dimension can result in a significant improvement in satellite transponder utilization. When combined with our advanced forward error correction and modulation techniques, DoubleTalk Carrier-in-Carrier can deliver unprecedented operating expense savings

## FEATURES

- Optional DoubleTalk Carrier-in-Carrier allowing Tx and Rx in the same transponder segment
- 50 to 90 and 100 to 180 MHz frequency range
- 128 kbps to 20 Mbps plus limited capability down to 32 kbps
- BPSK, QPSK, 8-PSK, 16-QAM operation
- Flexible configuration
  - 1 or 2 modems
  - Up to 4 modulators
  - Up to 4 demodulators
  - Any combination, four slots available
- Optional: Built In Redundancy
  - 1:1 modem
  - Up to 1:3 modulator
  - Up to 1:3 demodulator
- RS-422, V.35, Sync RS-232, G.703 (E1/T1) Interfaces
- RS-232, RS-485 and TCP/IP for M&C remote control
- Viterbi 1/2, 3/4, and 7/8 (QPSK)
- Concatenated Reed Solomon, 2/3 8-PSK, 3/4 16QAM
- Optional: Turbo Product Coding, IESS-315 Compliant
- Asymmetric Loop Timing
- Common frequency reference for all modules
- Optional: High Stability Reference
- Optional: Redundant Power Supply
- Individual modulator output power control
- Interoperable with many Comtech EF Data satellite modems: CDM-550T, 570, 570L, 600, 600L, SDM-8000, 300A, and 300L3

## TURBO PRODUCT CODING

The CDM-Qx offers optional 2nd generation Turbo Product Codec (TPC). TPC simultaneously delivers increased coding gain, lower decoding delay, and significant bandwidth savings. The TPC provides:

- BPSK 21/44 and 5/16
- QPSK / OQPSK 21/44, 3/4, 7/8 and 17/18
- 8-PSK 2/3, 3/4, 7/8, and 17/18
- 16-QAM 3/4 and 7/8

## REMOTE CONTROL

The operator may configure and monitor the modem from the front panel, or through the remote M&C port. M&C is via RS-232, RS-485 (2/4 wire) or TCP/IP.

## DOUBLETALK CARRIER-IN-CARRIER EXAMPLE

Normal carrier positioning is shown in Figure 1, reflecting two carriers positioned side-by-side. Each carrier occupies a unique frequency band and (for practical purposes) they do not overlap or interfere with each other.

DoubleTalk Carrier-in-Carrier[1] allows the two carriers to occupy the same spectral space, as shown in Figure 2. Initially, Carrier 1 and Carrier 2 are displayed to show the carriers in the same space when only one carrier is enabled. Carrier 1 is slightly higher in level than Carrier 2. When both carriers are transmitted simultaneously, the combined energy of both carriers is shown in the composite trace above the two individual carriers.

Operation with asymmetric data rates is permitted as long as the symbol rates of the two carriers are maintained within a factor of 3.

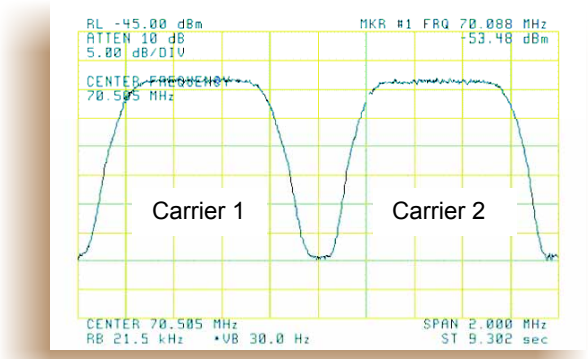
## MODEM INTERFACES

**CDM-Qx Shown With**:

| | |
|---|---|
| Slot 1 | Modulator Card with G.703 Balanced Interface |
| Slot 2 | Modulator Card with G.703 Balanced Interface |
| Slot 3 | Modulator Card with EIA-530 Interface |
| Slot 4 | Modulator Card with EIA-530 Interface |
| IF | 75Ω |

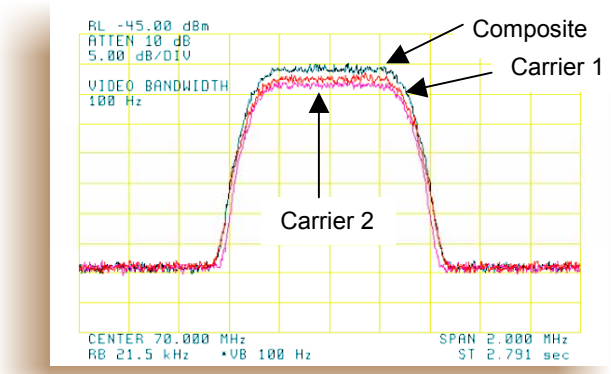
**Notes:**

1. Also shown, placed above the modem are the modulator and demodulator cards with G.703 Unbalanced (BNC) interface.
2. Select one per modem (i.e. modulator and demodulator card combination) OR one per modulator card and demodulator card, if using independently.
3. Redundant units do not need an interface.




***Without DoubleTalk Carrier-in-Carrier***

**Figure 1**




***With DoubleTalk Carrier-in-Carrier***

**Figure 2**

[1]A white paper, *DoubleTalk™ Carrier-in-Carrier™ Bandwidth Compression Providing Significant Improvements in Satellite Transponder Bandwidth*, is available on the Comtech EF Data web site in the Download section under **White Papers**.

## SYSTEM SPECIFICATIONS

| | |
|---|---|
| Input/Output Impedance | 75Ω (Optional 50Ω) |
| IF Connectors | BNC female |
| Data Rate (See Manual) | 128 kbps to 20 Mbps (plus limited capability down to 32 kbps), in 1 bps steps within symbol rate range, data interface dependant |
| Symbol Rate | 128 ksps to 10 Msps (plus limited capability down to 32 kbps) |
| Scrambling | IV.35, or synchronous |
| FEC | Viterbi 1/2, 3/4, 7/8 (QPSK only)<br>Concatenated Reed-Solomon 2/3 8-PSK, 3/4 16 QAM |
| FEC Options | Hardware option only |
| Turbo Product Coding (TPC) - 2nd Generation | BPSK Rate 21/44 and 5/16<br>QPSK Rate 21/44, 3/4, 7/8, and 17/18<br>8-PSK Rate 2/3, 3/4, 7/8, 17/18<br>16QAM Rate 3/4 and 7/8 |
| M&C Interface | RS-232, RS-485 (2- or 4-wire), 10/100 Base-T |
| Form C Relays | Tx, Rx traffic alarms and Unit faults |
| Reference | Internal ± 1.0 ppm (standard) or ± 0.1 ppm (optional), or external 1, 2, 5 or 10 MHz, BNC Connector |

## DATA INTERFACE

| | |
|---|---|
| Data Interfaces | RS-422 32 kbps to 12 Mbps<br>V.35 32 kbps to 12 Mbps<br>HSSI 32 kbps to 20 Mbps<br>G.703 T1 and E1, Balanced or Unbalanced |
| Receive Buffer | 512, 1024, 2048, 4096, 8182 or 16384 bits |
| Receive Clock Options | Rx Satellite, Selected Tx Terrestrial, EXT REF, INT REF |
| Clock Tracking | ± 100 ppm minimum |

## MODULATOR

| | |
|---|---|
| Frequency Range | 50 to 90 and 100 to 180 MHz, in 100 Hz steps |
| Frequency Stability | ± 1.0 ppm (standard) or ± 0.1 ppm (optional),<br>0 to 50ºC (32 to 122ºF) |
| Harmonics and Spurious | <-55 dBc/4 kHz (Typically <-60 dBc/4 kHz) |
| Transmit On/Off Ratio | 55 dB minimum |
| Phase Noise | < 0.75 degrees RMS double-sided, 100 Hz to 1 MHz |
| Output Power | -5 to -25 dBm, 0.1 dB steps, per Individual modulator |
| Accuracy | ± 2 dB over frequency and temperature |
| External Carrier Off | By TTL low signal |

## DEMODULATOR

| | |
|---|---|
| Frequency Range | 50 to 90 and 100 to 180 MHz, in 100 Hz steps |
| Input Power, Minimum | -15 to –45 dBm, < 2 Msps<br>-15 to –40 dBm, ≥ 2 Msps ≤ 4 Msps<br>-15 to –35 dBm, > 4 Msps |
| Automatic Gain Control | > 30dB |
| Max Composite Level | +35 dBc, up to -5 dBm |
| Acquisition Range | To ± 32 kHz, programmable, in 1 kHz steps |
| Carrier in Carrier | 64 kbps to 20 Mbps Data Rate Range<br>128 kbps to 10 Mbps Symbol Rate Range<br>0 to 330 mS delay<br>Rx Carrier ± 7 dBc relative to outbound carrier<br>Up to 3:1 difference in Output/Input symbol rates |

## BER PERFORMANCE

Met with two adjacent carriers 7 dB higher at 1.3 channel spacing
Guaranteed $E_b/N_0$, in dB
*Consult the CDM-Qx Manual for a comprehensive listing of the performance of all FEC types, Code Rates, Modulation types, and Data Rate ranges.*

| Turbo | BPSK | | QPSK/OQPSK | | | |
|---|---|---|---|---|---|---|
| | 21/44 | 5/16 | 21/44 | 3/4 | 7/8 | 17/18 |
| $10^{-6}$ | 2.9 | 2.4 | 3.5 | 3.8 | 4.3 | 6.8 |
| $10^{-8}$ | 3.3 | 2.8 | 3.6 | 4.4 | 4.5 | 7.4 |
| **Turbo** | **8-PSK** | | | **16-QAM** | | |
| | **3/4** | **7/8** | **17/18** | **3/4** | **7/8** | |
| $10^{-6}$ | 6.2 | 7.0 | 9.3 | 7.4 | 8.1 | |
| $10^{-8}$ | 6.8 | 7.2 | 10.3 | 8.2 | 8.3 | |

| | |
|---|---|
| Degradation | BPSK, QPSK, and 8-PSK: 0.5 dB max. with DoubleTalk Carrier-in-Carrier<br>Equal power in outgoing, incoming, and adjacent channels<br>16-QAM: 1.0 dB max. with same test conditions |
| Monitor Functions | $E_b/N_0$, Frequency Offset, BER, Buffer fill status, Rx signal level, CnC ratio |

## ENVIRONMENTAL AND PHYSICAL

| | |
|---|---|
| Temperature | Operating: 0 to 50ºC (32 to 122ºF)<br>Storage: -25 to 85ºC (-13 to 185ºF) |
| Power Supply | 100 to 240 VAC, 50/60 Hz, Auto sensing |
| Power Consumption | < 90 W typical, (Depends on configuration) |
| Physical Dimensions (1RU) | 1.75H x 19.0W x 19 D inch<br>(4.4H x 48W x 48D cm) approximate |
| Weight | < 20 lbs (7.0 kg) approximate<br>(Depends on configuration) |
| CE Mark | EMC<br>Safety |
| FCC | Compliant |

## AVAILABLE OPTIONS

### Chassis Options

| How Enabled | Option |
|---|---|
| Hardware | IF Connector 75 or 50Ω |
| Hardware | Redundant Power Supply |
| Hardware | Reference 0.1 ppm |
| Hardware | -48 VDC power supply |
| FAST | 1:1, 1:2, or 1:3 Redundancy |
| FAST | Carrier-in-Carrier to 512 kbps |
| FAST | Carrier-in-Carrier to 1 Mbps |
| FAST | Carrier-in-Carrier to 2.5 Mbps |
| FAST | Carrier-in-Carrier to 5 Mbps |
| FAST | Carrier-in-Carrier to 10 Mbps |
| FAST | Carrier-in-Carrier to 20 Mbps |

### Modulator/Demodulator Options

| How Enabled | Option |
|---|---|
| Hardware | 2nd Generation Turbo Product Coding Module |
| Hardware | *25-Pin RS-422, V.35 or Sync RS-232 Interface |
| Hardware | *G.703 E1/T1 Balanced Interface |
| Hardware | *G.703 E1/T1 Unbalanced Interface |
| Hardware | *HSSI Interface |
| FAST | Data Rate to 5 Mbps (Standard) |
| FAST | Data Rate to 10 Mbps |
| FAST | Data Rate to 20 Mbps |
| FAST | 8-PSK |
| FAST | 16-QAM |

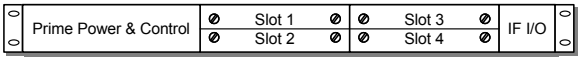
* A data interface is only needed in the demodulator card when the modulator and demodulator are used together as a modem. All input and output data are routed through the data interface in the demodulator.

### Slot Configuration Information

Modulator, Demodulator, or No Module in any slot.

Required modem configuration:

Modem 1: Modulator in Slot 1 Demodulator in Slot 2




2114 West 7th Street, Tempe, Arizona 85281 USA Voice 1 480 333 2200 Fax 1 480 333 2540 Email sales@comtechefdata.com