

CDM-600 & CDM-600L Open Network Satellite Modems



INTRODUCTION

The CDM-600 and CDM-600L are open network satellite modems, which are fully compliant with IESS-308, -309, -310, -314, and -315 from 64 kbps through T2 and E2. They are available in the following three data rate ranges:

- Low-Rate variable: 2.4 kbps to 5.0 Mbps
- Mid-Rate variable: 2.4 kbps to 10.0 Mbps
- High-Rate variable: 2.4 kbps to 20.0 Mbps

In addition, both modems operate in closed network from 2.4 kbps to 20 Mbps. The modems include T1, E1, T2, and E2 G.703 interfaces, in addition to EIA-422, V.35, EIA-232, and serial LVDS. HSSI is provided by adding the CIC-20 interface converter.

The architecture is firmware and FPGA-based, and the internal Flash memory allows easy updating via the serial port. The modem offers exceptional flexibility and performance in a 1RU enclosure.

FEATURES

- CDM-600: 50 to 90 or 100 to 180 MHz IF range
CDM-600L: 950 to 1950 MHz IF range
- Fast acquisition demodulator (± 32 kHz acquisition range, 64 kbps, Rate 1/2 QPSK: 1 sec average)
- BPSK, QPSK, OQPSK, 8-PSK, 16-QAM modulation types
- Data rate range from 2.4 kbps to 20 Mbps
- Forward Error Correction choices include Turbo Product Coding (IESS-315 compliant), Viterbi, Sequential, Reed-Solomon, LDPC, and TCM
- Intermediate Data Rate (IDR)
- Intelsat Business Services
- D&I++
- ESC++
- Automatic Uplink Power Control (AUPC)
- Embedded Distant-end Monitor and Control (EDMAC)
- Asymmetric Loop Timing
- CDM-600: 50 or 75 Ω , front panel selectable
CDM-600L: Transmit 50 Ω , Receive 50 or 75 Ω , female Type N connector
- Open network compatible and backwards compatible with the CDM-500/CDM-550, and CDM-550T
- Interoperable with SDM-300A, SDM-300L3 (CDM-600L only)
- 1:1 and 1:10 redundancy switch available

FEATURE ENHANCEMENTS

Enhancing the modem's performance 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.

TURBO PRODUCT CODING

The modems offer all traditional FEC methods and incorporate an optional Turbo Product Codec (TPC). TPC is a FEC technique that delivers significant performance improvement when compared to Viterbi with concatenated Reed-Solomon. TPC simultaneously offers increased coding gain, lower decoding delay, and significant bandwidth savings.

Two TPC codecs are offered as hardware options:

- The Low-Rate TPC codec operates up to 5 Mbps with limited code rates.
- The High-Rate TPC codec operates up to 20 Mbps, and offers a full range of code rates (5/16 through 7/8, and 0.95) with all modulation types from BPSK to 16-QAM

EDMAC OPERATION

A special feature of the modems are their ability to monitor and control the distant end of a satellite link using a Comtech EF Data proprietary overhead channel. This framed mode is called EDMAC (Embedded Distant-end Monitor and Control). User data is framed and extra bits are added to pass control, status, and Automatic Uplink Power Control information. This process is completely transparent to the user. An RF transceiver (C-Band and Ku-Band) or Block Up Converter at the distant end of a satellite link may be controlled and monitored from the front panel of the modem using a low data rate FSK signal on the Rx IF cable via the EDMAC channel.

REMOTE CONTROL

The operator may configure and monitor the modem from the front panel, or through the remote M&C port. Ten complete configurations may be stored in the modem. An event log stores alarm and status information in non-volatile RAM, while the Link Statistics log stores link performance (E_b/N_0 and AUPC performance) for QoS reporting purposes. SatMac, a Windows-based monitor and control program, is available for configuring the local and distant end modems, transceivers, and redundancy switches.

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LOW DENSITY PARITY CHECK (LDPC) CODING AND 8-QAM MODULATION

A third codec is available as a hardware option. The TPC/LDPC Codec combines all TPC functions of the High Rate TPC option, plus the following new features:

- Improved performance of LDPC codes at 1/2, 2/3, and 3/4 rates to further improve coding gain and bandwidth efficiency.
- 8-QAM modulation that offers the same bandwidth efficiency of 8-PSK but with improved BER performance and tracking in noisy environments.

DROP AND INSERT (D&I++)

Full Drop and Insert functionality is available as an option. The modems offer two variants of Drop and Insert (D&I). The first is an Intelsat Open Network-compliant mode, using the IBS framing (6.7%). The second is CEFD's Proprietary Enhanced mode, called D&I++. This "n" x 64 kbps mode offers any value of "n" up to 24, and permits the simultaneous use of EDMAC, AUPC (see below) and an ESC circuit at 1/576th of the user data rate. This is achieved with the addition of only 2.2% overhead.

ESC++

A high rate overhead channel is now standard in the new enhanced version of the modems. This provides a separate RS-232 channel allowing up to 4.8 kbaud at 64 kbps and up to 38.4 kbaud at 512 kbps. AUPC also operates in this mode.

SYSTEM SPECIFICATIONS

Frequency Range	CDM-600: 50 to 90 or 100 to 180 MHz, CDM-600L: 950 to 1950 MHz, 100 Hz frequency resolution
Input/Output Impedance	CDM-600: 50 or 75Ω (front panel selectable) CDM-600L: Transmit 50Ω, Receive 50 or 75Ω, Female Type N connector
Data Interfaces	EIA-422/-530, V.35, Sync EIA-232, G.703 balanced or unbalanced, Low Voltage Differential Signal (LVDS), HSSI (<i>using CIC-20 HSSI/LVDS interface converter</i>)
Data Rate Range (1 bps programmable, and fully independent Tx and Rx rates)	
Rate Range	
1/2 BPSK	2.4 kbps to 5.0 Mbps
1/2 QPSK/OQPSK	4.8 kbps to 10.0 Mbps
3/4 QPSK/OQPSK	7.2 kbps to 15.0 Mbps
7/8 QPSK/OQPSK	8.4 kbps to 17.5 Mbps
2/3 8-PSK	4.8 kbps to 20.0 Mbps
Uncoded	4.8 kbps to 20.0 Mbps

Turbo Product Coding Rates:

Rate	Range Hi	gh-Rate
21/44 BPSK	4.8 kbps to 3.2 Mbps	4.77 Mbps
5/16 BPSK	4.8 kbps to 2.048 Mbps	3.12 Mbps
1/2 QPSK/OQPSK	4.8 kbps to 9.54 Mbps	Turbo Card
3/4 QPSK/OQPSK	7.2 kbps to 5.0 Mbps	15 Mbps
3/4 8-PSK	10.8 kbps to 5.0 Mbps	20 Mbps
3/4 16-QAM	14.4 kbps to 5.0 Mbps	20 Mbps
7/8 QPSK/OQPSK	8.4 kbps to 17.5 Mbps	Turbo Card
7/8 8-PSK	12.6 kbps to 20.0 Mbps	Turbo Card
7/8 16-QAM	16.8 kbps to 20.0 Mbps	Turbo Card
0.95 QPSK/OQPSK	9.1 kbps to 18.888 Mbps	Turbo Card
0.95 8-PSK	13.6 kbps to 20 Mbps	Turbo Card

Low Density Parity Check (LDPC) Rates:

1/2 BPSK	4.8 kbps to 5.0 Mbps
1/2 QPSK/OQPSK	4.8 kbps to 10.0 Mbps
2/3 QPSK/OQPSK	6.4 kbps to 13.3 Mbps
2/3 8-PSK, 8-QAM	9.6 kbps to 19.0 Mbps
3/4 QPSK/OQPSK	7.2 kbps to 15.0 Mbps
3/4 8-PSK, 8-QAM	10.8 kbps to 20.0 Mbps
3/4 16-QAM	14.4 kbps to 20.0 Mbps
Scrambling	Mode dependent - ITU V.35 (Intelsat IESS-308), or externally synchronized (Intelsat IESS-309/-310/-314 or proprietary)

FEC Options

Viterbi	Rate 1/2 BPSK, QPSK/OQPSK Rate 3/4 and 7/8 QPSK/OQPSK and 16-QAM w/RS
Pragmatic TCM	8-PSK 2/3
Low-Rate TPC	21/44, 5/16 BPSK, and 3/4 8PSK, 3/4 16-QAM
High-Rate TPC	21/44, 5/16 BPSK, 1/2, 3/4, 7/8, 0.95 QPSK/OQPSK, 3/4, 7/8, 0.95 8-PSK, and 3/4, 7/8 16-QAM
LDPC	1/2 BPSK, 2/3, 3/4 QPSK/OQPSK, 2/3, 3/4 8-PSK, 2/3, 3/4 8-QAM, and 3/4 16-QAM
Reed-Solomon	Intelsat compliant and proprietary modes available
Uncoded	BPSK, QPSK/OQPSK
M&C Interface	EIA-232, EIA-485 (2- or 4-wire)
Form C Relays	Tx, Rx traffic alarms and Unit faults Backward alarms for IDR and IBS

DATA INTERFACES

Electrical Interface	G.703 (T1, E1, T2, E2), RS-422, V.35, LVDS or Synchronous RS-232 (refer to manual for further information)
Frame Formats Supported	D4 or ESF for T1, CCS for E1 (Also CAS E1 for Open Network)
Available nx64 kbps Data Rates	1 to 6, 8, 10, 12, 15, 16, 20, 24 or 30 for Open Network, 1 to 24 for D&I++ Enhanced Proprietary

ESC SPECIFICATIONS

IDR (Total Overhead 96 kbps)

Voice Orderwire	2 ADPCM (input: 4-wire VF), or 64 kbps data 8 kbps (EIA-422 interface)
Data Orderwire	Form C contacts, hardware or software mapped
Backward Alarms	

IBS (Total Overhead 1/15 x data rate)

ASYNCR Data Orderwire	1/2000 x data rate
Backward Alarm	Form C contacts

ESC++ (Refer to manual) ASYNCR RS-232 at 1.2 to 38.4 kbaud

MODULATOR

Output Spectrum/Filtering Meets IESS-308/309 power spectral mask

Frequency Stability Standard: ± 1.5 ppm, 0° to 50°C (32° to 122°F)
Option: ± 0.02 ppm, 0° to 50°C (32° to 122°F)

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 CDM-600: 0 to -20 dBm, 0.1 dB steps, CDM-600L: 0 to -40 dBm, 0.1 dB steps

Accuracy CDM-600: ± 0.5 dB over frequency and temperature
CDM-600L: ± 1.5 dB over frequency and temperature

External Tx Carrier Off By TTL LOW signal

Tx Terrestrial Internal (SCT), EXT TT, Loop

Clock Options Timing from Satellite and EXT CLOCK

BUC FSK Communications CDM-600L Only: Via Tx center conductor with FSK BUCs

ODU/BUC Voltage (Optional) CDM-600L Only: 24 VDC, 4 amps, 100W
48 VDC, 3.75 amps, 180W

BUC 10 MHz CDM-600L Only: On/Off

DEMODULATOR

Input Power Range CDM600: -30 to -60 dBm
CDM600L: -130 dBm + 10Log (Symbol Rate) minimum

AGC (CDM-600L Only) 50 dB above minimum

Max Composite Level +35 dBc, up to -5 dBm

Acquisition Range ± 1 to ± 32 kHz, programmable in 1 kHz steps

Acquisition Time Dependent on data rate, FEC and acquisition range
Example: 1 sec average at 64 kbps Rate $\frac{1}{2}$

LNB Voltage CDM-600L only: 12, 18 or 24 VDC, up to 500mA

LNB 10 MHz CDM-600L Only: On/Off

Example BER Performance Met with two adjacent carriers 7 dB higher
Guaranteed E_b/N_0 , in dB (Typical values in parentheses)

Viterbi (B, Q, and OQPSK)

	<u>1/2</u>	<u>3/4</u>	<u>7/8</u>	
10 ⁻⁵	5.4 (4.9)	6.8 (6.3)	7.7 (7.2)	
10 ⁻⁷	6.7 (6.2)	8.2 (7.7)	9.0 (8.6)	
Sequential	(Consult manual for details)			

Viterbi Concatenated Reed-Solomon 220/200 or 200/180 (B, Q, and OQPSK)

	<u>1/2</u>	<u>3/4</u>	<u>7/8</u>	
10 ⁻⁵	4.3 (4.0)	5.6 (4.7)	6.5 (6.0)	
10 ⁻⁷	4.5 (4.2)	6.0 (5.2)	6.9 (6.5)	
8-PSK TCM/RS (IESS-310)	(Consult manual for details)			

Turbo Product Codec (Q/OQPSK)

	<u>1/2</u>	<u>3/4</u>	<u>7/8</u>	<u>0.95</u>	
10 ⁻⁶	2.9 (2.6)	3.8 (3.4)	4.3 (4.0)	6.4 (6.0)	
10 ⁻⁸	3.3 (2.8)	4.4 (4.0)	4.5 (4.2)	6.9 (6.5)	

(Please consult the manual for a performance listing of all FEC types, Code Rates, and Modulation types.)

Receive Buffer 64 to 262144 bits, in 16 bit increments

Receive Clock Options Rx Satellite, Tx Terrestrial, External Reference, Insert

Clock Tracking ± 100 ppm minimum

External Clock Input BNC connector, 2.4 kHz to 20 MHz

External Reference Input (Optional) SMA female, 1, 2, 5, 10 or 20 MHz

Monitor Functions E_b/N_0 , Frequency Offset, BER, Buffer fill status, Rx receive signal level

DROP AND INSERT

Electrical Interface G.703, RS-422 or V.35 (T1 or E1)

Frame Formats Supported D4 or ESF for T1, CCS for E1 (Also CAS E1 for Open Network)

Available n x 64 kbps Data Rates 1 to 6, 8, 10, 12, 15, 16, 20, 24 or 30 for Open Network
1 to 24 for D&I++ Enhanced Proprietary

ACCESSORIES

CRS-150 CRS-150 1:1 Modem Redundancy Switch (With CRS-170A L-Band IF Switch - CDM-600L)

CRS-300 CRS-300 1:N Modem Redundancy Switch

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AVAILABLE OPTIONS

How Enabled	Option
N/A	Variable data rate to 5 Mbps (standard)
FAST	Variable data rate to 10 Mbps
FAST	Variable data rate to 20 Mbps
FAST	8-PSK modulation (and 8-QAM if TPC/LDPC Codec is installed – CDM-600)
FAST	CDM-600: LDPC to 10 Mbps
FAST	CDM-600: LDPC to 20 Mbps
FAST 16-QAM	modulation
FAST IBS	Operation
FAST	IBS with High Rate IBS ESC Operation
FAST IDR	Operation
FAST	Drop & Insert Operation (Open Network and D&I++)
FAST	2 Audio IBS Operation
Hardware Turbo	Codec – Low Rate 5 Mbps (21/44, 5/16, 3/4)
Hardware Turbo	Codec – High Rate 20 Mbps (21/44, 5/16, 1/2, 3/4, 7/8, 0.95)
Hardware	CDM-600: High-stability Internal Reference (2 x 10 ⁻⁸) with external input capability CDM-600L: internal Reference 1.0 ppm (standard, not with BUCs) or 2.0 ppm (optional)
Hardware	CIC-20 HSSI Interface Converter
Hardware	TPC/LDPC Codec (Base to 5 Mbps - CDM-600)
Hardware	Rx Type F or Type N connector (CDM-600L)
Hardware	CDM-600L: ODU PS 24 VDC, 100 W, AC or DC input
Hardware	CDM-600L: ODU PS 48 VDC, 180 W, AC or DC input

ENVIRONMENTAL AND PHYSICAL

Temperature	Operating: 0 to 50°C (32 to 122°F) Storage: -25 to 85°C (-13 to 185°F)
Power Supply	100 to 240 VAC, 50/60 Hz 38 to 60 VDC (optional DC)
Power Consumption (see manual)	55 W max AC, w/o BUC power supply 290 W max AC, with BUC power supply
Dimensions	
CDM-600 (1RU)	1.72H X 19W X 13.1D inches (4.4H X 48.2W X 33.3D cm)
CDM-600L (1RU)	1.72H X 19W X 18.0D inches (4.4H X 48.2W X 45.7D cm)
Weight	
CDM-600	10 lbs (4.5 kg) max
CDM-600L	10 lbs (4.5 kg) max, w/o BUC power supply 11.6 lbs (5.3 kg) max, with BUC power supply



CDM-600 Satellite Modem Back Panel



CDM-600L Satellite Modem Back Panel

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