Overview
The CDM-625A-ENI Advanced Satellite Modem builds on our legacy of providing the most efficient and reliable satellite modems. With support for VersaFEC® Forward Error Correction (FEC), the revolutionary DoubleTalk® Carrier-in-Carrier and additional rolloffs, the CDM-625A-ENI provides significant savings under all conditions. This combination of advanced technologies enables multi-dimensional optimization, allowing satellite communications users to:

- Minimize operating expenses (OPEX)
- Maximize throughput without using additional transponder resources
- Maximize availability (margin) without using additional transponder resources
- Minimize capital expenses (CAPEX) by allowing a smaller BUC/HPA and/or antenna
- Or, a combination to meet specific business needs

Features
- DoubleTalk Carrier-in-Carrier bandwidth compression
- Carrier-in-Carrier Automatic Power Control
- VersaFEC-2 High Performance LDPC with Adaptive Coding and Modulation (ACM), Short Block and Long Block
- VersaFEC FEC with Adaptive Coding and Modulation (ACM)
- 5%, 10%, 15%, 20%, 25% and 35% Filter Rolloff
- Integrated 4-port managed Ethernet switch with VLAN and QoS
- Jumbo frame support
- Dual Band Capability: 70/140 MHz and extended L-Band (950 ~ 2250 MHz) in same unit
- Data Rate: 18 kbps to 25 Mbps
- Symbol Rate: 18 kfps to 12.5 Mfps
- Modulation: BPSK, QPSK/QQPSK, 8PSK/8-QAM/8-ARY, 16-QAM/16-ARY, 32-ARY
- FEC: Viterbi, Sequential, Concatenated Reed Solomon, TCM, Turbo Product Code (TPC) (IESS-315 Compliant), LDPC Code, VersaFEC (low-latency LDPC) and VersaFEC-2 (high performance LDPC)
- Widest Range of data interfaces: EIA-422/530, V.35, G.703 T1, G.703 E1, G.703 T2, G.703 E2, Quad G.703 E1, ASI, LVDS, HSSI, 4-port 10/100Base-T Ethernet

Doubletalk Carrier-in-Carrier
DoubleTalk Carrier-in-Carrier, based on patented “Adaptive Cancellation” technology, allows transmit and receive carriers of a duplex link to share the same transponder bandwidth. DoubleTalk Carrier-in-Carrier is complementary to all advances in modem technology, including advanced FEC and modulation techniques. As these technologies approach theoretical limits of power and bandwidth efficiencies, DoubleTalk Carrier-in-Carrier utilizing advanced signal processing techniques provides a new dimension in bandwidth efficiency.
Figure 1 shows the typical full-duplex satellite link, where the two carriers are adjacent to each other.

Figure 2 shows the typical DoubleTalk Carrier-in-Carrier operation, where the two carriers are overlapping, thus sharing the same spectrum.

When observed on a spectrum analyzer, only the Composite is visible. Carrier 1 and Carrier 2 are shown in Figure 2 for reference only.

As DoubleTalk Carrier-in-Carrier allows equivalent spectral efficiency using a lower order modulation and/or code rate, it can reduce the power required to close the link thereby reducing CAPEX by allowing a smaller BUC/Amplifier and/or antenna. Alternatively, DoubleTalk Carrier-in-Carrier can be used to achieve very high spectral efficiencies E.g., DoubleTalk Carrier-in-Carrier when used with 16-ARY modulation approaches the bandwidth efficiency of 256-ARY (8 bps/Hz).

When combined with VersaFEC-2 or VersaFEC and optimized transmit filter rolloff, it can provide unprecedented savings in transponder bandwidth and power utilization. This allows for its successful deployment in bandwidth-limited and power-limited scenarios, as well as reduction in earth station BUC/HPA power requirements.

Carrier-in-Carrier® is a Registered Trademark of Comtech EF Data
DoubleTalk® is a Registered Trademark of Raytheon Applied Signal Technology
VersaFEC® is a Registered Trademark of Comtech EF Data

Carrier-in-Carrier Automatic Power Control (CnC-APC)
The patent-pending Carrier-in-Carrier Automatic Power Control (CnC-APC) mechanism enables modems on both sides of a CnC link to automatically measure and compensate for rain fade while maintaining the Total Composite Power. In addition to automatically compensating for rain fade, CnC-APC also enables the modems to share link margin, i.e. a modem in clear sky conditions can effectively transfer excess link margin to a distant end modem experiencing fade, thereby further enhancing overall availability.

VersaFEC-2 High Performance LDPC Forward Error Correction
CDM-625A-ENI offers a new high performance LDPC FEC specifically design to optimize performance at low and mid-tier symbol rates. VersaFEC-2 long-block provides 38 ModCods (BPSK to 32-ARY) with performance generally better than DVB-S2 at significantly lower latency and short-block provides 36 ModCods (BPSK to 32-ARY) with higher coding gain than first generation VersaFEC and similar latency. All higher order constellations are quasi-circular for optimal peak-to-average performance. Both CCM and ACM operation is support for long block and short block.

VersaFEC Forward Error Correction
CDM-625A-ENI offers VersaFEC, a patent-pending system of high-performance LDPC codes designed to provide maximum coding gain while minimizing latency. VersaFEC is designed to support ACM and CCM mode of operation

The Ultra Low Latency (ULL) codes provide even lower latency compared to standard VersaFEC codes.

Adaptive Coding & Modulation (ACM)
Satellite users have traditionally relied on worst case link margin to overcome rain fade which leads to significant inefficiencies. ACM can provide significant increase in throughput as well as availability. ACM converts the fade margin into increased capacity making it possible to more than double the throughput for Ku-band operation. Even under deep fade, ACM may be able to maintain the link at the lower MODCOD thereby increasing availability. It is tightly integrated with packet processor QoS which allows higher priority, mission critical traffic to be maintained even during fade.

Low Density Parity Check Codes (LDPC) & Turbo Product Codes (TPC)
CDM-625A-ENI offers an integrated LDPC and 2nd Generation TPC codec. LDPC is an advanced Forward Error Correction technique capable of providing performance much closer to Shannon limit. The current LDPC implementation can provide 0.7 to 1.2 dB additional coding gain compared to an equivalent TPC code.

In order to take full advantage of the increased coding gain provided by LDPC, Comtech EF Data has developed a patented 8-QAM modulation that allows for acquisition and tracking at much lower Eb/No compared to 8PSK.
Dual Band Capability
CDM-625A-ENI supports 70/140 MHz and extended L-Band (950 – 2250 MHz) capability in the same unit with independently selectable transmit and receive IF. This simplifies sparing and stocking in networks requiring 70/140 MHz and L-Band units.

4-Port Managed Ethernet Switch with VLAN & QoS
CDM-625A-ENI incorporates a 4-port 10/100Base-T managed Ethernet switch with VLAN capability and priority-based Quality of Service. Access (Native) Mode and Trunk Mode are supported. Traffic can be prioritized using port-based priority or VLAN priority. The modem supports jumbo frames with maximum Ethernet frame size of 2048 bytes.

Quad E1 Interface (QDI) with Enhanced D&I++
The CDM-625A-ENI supports a Quad E1 interface that can aggregate up to four full or fractional E1s into a single carrier, with very low overhead. This provides significant CAPEX savings by reducing the number of modems and could possibly reduce the BUC/HPA size by eliminating the multi-carrier backoff. A proprietary, closed network drop & insert (D&I++) allows for dropping or inserting any combination of 1 to 31 time slots on each E1. D&I++ is supported for E1-CCS only.

IP Sub Multiplexer
The IP sub mux allows multiplexing IP/Ethernet traffic with serial or G.703 traffic into a single carrier. This is particularly useful for cellular backhaul when both E1 and IP backhaul is required. This reduces the number of modems and could possibly reduce the BUC/HPA size by eliminating the multi-carrier backoff. The IP sub mux ratio ranges from 9:1 (IP data rate is 9 times that of the serial or G.703 data rate) to as low as 1:59. IP sub mux can also be used to provision an overhead IP channel for management when using non IP/Ethernet traffic interfaces.

EDMAC & AUIC
The CDM-625A-ENI supports EDMAC, EDMAC-2, EDMAC-3 and AUIC. EDMAC/EDMAC-2/EDMAC-3 can be used to monitor and control the distant end of a satellite link using a proprietary overhead channel. EDMAC-3 is also used for SNMP management of the distant end modem. AUIC automatically adjusts modem transmit power based on feedback from the distant end modem to maintain the desired Eb/No. AUIC and EDMAC are supported for point-to-point duplex links.

Management & SNMP Proxy
The modem can be managed via the front panel, the remote M&C port (EIA-232/EIA-485), or the 10/100Base-T Ethernet port. With support for SNMP V2 and V3, HTTP and Telnet, the modem can be easily integrated into an IP-based management system. The CDM-625A-ENI can also act as SNMP proxy for the distant end CDM-625A-ENI. This allows distant end CDM-625A-ENI management using SNMP without requiring an end-to-end IP link.

RADIUS Client
The CDM-625A-ENI supports the Remote Authentication Dial In User Service (RADIUS) client enabling centralized user authentication for management access to the modem by web browser and telnet. RADIUS client supports Password Authentication Protocol (PAP) and Challenge-Handshake Authentication Protocol (CHAP).

Advanced FSK for LPOD Monitoring & Control
The Advanced FSK allows for monitoring and control of LPOD through modem front panel menus, serial remote control and Telnet.

Specifications

| Data Rate | 18 kbps to 25 Mbps, in 1 bps steps (modulation, FEC & data interface dependent) |
| Symbol Rate | 18 kbps to 12.5 Mbps |
| Operating Frequency | 50 – 180 MHz (standard) and 950 – 2250 MHz (option) |
| Major Operating Modes | Open network, per IESS-308 / 309 / 310 / 314 transparent, closed network per IESS-315 LDPC / TPC Codec (option) |
| VersaFEC Codec (Option) with ACM or Constant Coding & Modulation (CCM) | EMDAC Framed with/without AUIC RS Outer Codec |
| High rate ESC / Enhanced ESC (ESC++) | Drop & insert (D&I) / Enhanced D&I++ (option) |
| Quad E1 drop & insert (QDI) (option) | DoubleTalk Carrier-in-Carrier (option) |
| FEC & Modulation | Uncoded BPSK/QPSK |
| Viterbi: k=7, per IESS-308/309 | Rate 1/2 BPSK/QPSK/QOQSK |
| Rate 3/4 QPSK/QOQSK | Rate 7/8 QPSK/QOQSK |
| Viterbi with Reed Solomon | Rate 3/4 16-QAM |
| Rate 7/8 16-QAM | Sequential See CDM-625A-ENI user manual for details |
| Reed Solomon | Open network and closed network modes |

TCM (Per IESS-310)

| Integrated LDPC and TPC (2nd Gen) Codec (Optional Plug-in Module) | 8PSK/TCM Rate 2/3 |
| VersaFEC Codec (Option) with ACM or Constant Coding & Modulation (CCM) | LDPC Code Rates |
| EMDAC Framed with/without AUIC RS Outer Codec | Rate 1/2 BPSK/QPSK/QOQSK |
| Rate 2/3 QPSK/QOQSK/8PSK/8-QAM | Rate 3/4 QPSK/QOQSK/8PSK/8-QAM/16-QAM |
| Rate 5/6 BPSK | Rate 5/6 QPSK/QOQSK/8PSK/8-QAM/16-QAM |
| Rate 7/8 QPSK/QOQSK/8PSK/8-QAM/16-QAM | Rate 9/10 QPSK/QOQSK/8PSK/8-QAM |
| Rate 9.5 QPSK/QOQSK/8PSK/8-QAM | Rate 10.5 QPSK/QOQSK/8PSK/8-QAM |

VersaFEC Codec (Option)

| BPSK Rate 0.488 | BPSK Rate 0.533, 0.631, 0.706, 0.803 |
| Rate 8-QAM 0.576 (ECCM), 0.642, 0.711, 0.780 | Rate 16-QAM 0.644 (ECCM), 0.731, 0.780, 0.829, 0.853 |
| Rate 20-QAM 0.753, 0.782 | Rate 8-ARY Rate 0.521, 0.537, 0.562, 0.586, 0.611, 0.635, 0.660, 0.684, 0.708, 0.733 |
| Rate 24-QAM 0.785 | 16-ARY Rate 0.586, 0.611, 0.635, 0.660, 0.684, 0.708, 0.733, 0.797, 0.872 |

VersaFEC-2 Codec (Option)

| BPSK Rate 0.489 | BPSK Rate 0.489, 0.537, 0.586, 0.611, 0.635, 0.660, 0.684, 0.708, 0.733 |
| Rate 8-ARY Rate 0.521, 0.537, 0.562, 0.586, 0.611, 0.635, 0.660, 0.684, 0.708, 0.733 | 16-ARY Rate 0.586, 0.611, 0.635, 0.660, 0.684, 0.708, 0.733, 0.797, 0.872 |
### Data Interfaces

<table>
<thead>
<tr>
<th>Interface</th>
<th>Specification</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIA-422/530 DCE, Up to 14 Mbps</td>
<td>25-pin D-sub (female)</td>
<td>For connection to EIA-422/530 DCE</td>
</tr>
<tr>
<td>V.35 DCE, Up to 14 Mbps</td>
<td>25-pin D-sub (female)</td>
<td>For connection to V.35 DCE</td>
</tr>
<tr>
<td>LVDS Serial, Up to 25 Mbps</td>
<td>25-pin D-sub (female)</td>
<td>For connection to LVDS Serial</td>
</tr>
<tr>
<td>HSSI Serial, Up to 25 Mbps</td>
<td>25-pin D-sub (female)</td>
<td>For connection to HSSI Serial</td>
</tr>
<tr>
<td>G.703 T1, 1.544 Mbps (Balanced 100 Ω)</td>
<td>9-pin D-sub (female)</td>
<td>Balances the signal at 1.544 Mbps for balanced transmission</td>
</tr>
<tr>
<td>G.703 T2, 6.312 Mbps (Unbalanced 75 Ω or balanced 110 Ω)</td>
<td>9-pin D-sub (female)</td>
<td>Unbalances the signal at 6.312 Mbps for unbalanced transmission</td>
</tr>
<tr>
<td>G.703 E1, 2.048 Mbps (Unbalanced 75 Ω or balanced 120 Ω)</td>
<td>9-pin D-sub (female)</td>
<td>Unbalances the signal at 2.048 Mbps for unbalanced transmission</td>
</tr>
<tr>
<td>G.703 E2, 8.448 Mbps (Unbalanced 75 Ω)</td>
<td>9-pin D-sub (female)</td>
<td>Unbalances the signal at 8.448 Mbps for unbalanced transmission</td>
</tr>
<tr>
<td>ASI, Up to 25 Mbps</td>
<td>44-pin High-density D-sub (male)</td>
<td>For connection to ASI, Up to 25 Mbps</td>
</tr>
<tr>
<td>Additional 2.048 Mbps E1 Ports for Quadri E1 (Balanced 120 Ω)</td>
<td>9-pin D-sub (female)</td>
<td>For connection to Additional 2.048 Hz E1 Ports</td>
</tr>
<tr>
<td>Overhead Data</td>
<td>15-pin D-sub (male)</td>
<td>For connection to Overhead Data</td>
</tr>
<tr>
<td>Modem Alarms</td>
<td>4-pin RJ-45</td>
<td>For connection to Modem Alarms</td>
</tr>
<tr>
<td>4-port 10/100Base-T Managed Ethernet Switch (Optional Packet Processor Available)</td>
<td>4 x RJ-45</td>
<td>For connection to 4-port 10/100Base-T Managed Ethernet Switch (Optional Packet Processor Available)</td>
</tr>
</tbody>
</table>

### Clocking Options

- Internal, ±0.06 ppm (SCT): Internal clocking with ±0.06 ppm accuracy.
- External, locking over ±100 ppm range (TT): External clocking with ±100 ppm accuracy and loop timing.
- Loop timing (RX satellite clock): Supports asymmetric operation.

### External TX Carrier Off

- Supplied through TX IF center conductor and selectable on/off via M&C control.

### Demodulator

- Input Power Range, Desired Carrier: 50-180 MHz, -105 to 10 log (symbol rate) dBm to -70 to 10 log (symbol rate) dBm.
- Max Composite Operating Level: 50-180 MHz.

### Scrambling

- IDR Mode, no RS, - per ITU V.35 (Intelsat variant): External frame synchronization.
- IBS mode, no RS, - per IESS-309: External frame synchronization.
- Turbo mode, external frame synchronized - proprietary.

### Demodulator

- Frequency Stability: ±0.06 ppm (±6 x 10-8), 0° to 50°C (32° to 122°F) with internal reference.
- Transmit Filtering: Per IESS-308.
- Alpha (Roll-off): 5%, 10%, 15%, 20%, 25%, 35%.
- Harmonics and Spurious: Better than -60 dBc/4 kHz (typically <56 dBc/4 kHz); Measured from 1 to 500 MHz (50-180 MHz band).
- Transmit On/Off Ratio: -60 dBc minimum.
- Output Phase Noise: <0.48° rms double sided, 100 Hz to 1 MHz.
- Plesiochronous/Doppler Buffer: Selectable from 64 to 262,144 bits, in 16-bit steps (Additional limitations for G.704 frame boundaries).
- Receive Clock: RX satellite, TX terrestrial, external reference.
- Clock Tracking: ±0.1 ppm minimum.
DoubleTalk Carrier-in-Carrier

Delay Range
0 to 330 ms

Power Spectral Density Ratio
BPSK/QPSK/8PSK/8-QAM: -7 dB to +11 dB
16-QAM: -7 dB to +7 dB

Maximum Symbol Rate Ratio
3:1 (TX:RX or RX:TX)

Eb/No Degradation
0 dB Power Spectral Density Ratio
BPSK/QPSK: 0.3 dB
8-QAM: 0.4 dB
8PSK: 0.5 dB
8-QAM: 0.4 dB
16-QAM: 0.6 dB
16-QAM: 0.6 dB
32-QAM: 0.6 dB
+10 dB power spectral density ratio
Additional 0.3 dB

Satellite Restrictions
Satellite in “loop-back” mode (i.e., the transmit station can receive itself)
“Non-processing” satellite (i.e., does not demodulate or remodulate the signal)

Available Options

Hardware - 100 – 240 VAC, 120 W AC primary power supply
-48 VDC, 125 W primary power supply
-24 VDC, 120 W primary power supply
24 VDC, 90 W @ 50°C BUC power supply, AC, 24 VDC or 48 VDC primary power supply
48 VDC, 150 W @ 50°C (180 W @ 30°C) BUC power supply, AC or 48 VDC primary power supply
VersaFEC-2 Codec module
Integrated TPC (2nd generation) and LDPC Codec module

FAST - Activate DoubleTalk Carrier-in-Carrier Feature
DoubleTalk Carrier-in-Carrier Data rate (full) – 512 kbps, 1.1 Mbps, 2.5 Mbps, 5 Mbps, 10 Mbps, 15 Mbps, 20 Mbps or 25 Mbps
DoubleTalk Carrier-in-Carrier Data rate (fractional) – 2.5 Mbps, 5 Mbps, 10 Mbps, 15 Mbps, 20 Mbps or 25 Mbps
VersaFEC Codec data rate (CCM) – 1.1 Mbps, 2.5 Mbps, 5 Mbps or 16 Mbps
VersaFEC Codec symbol rate (ACM) – 300 kbps, 1.2 Mbps or 4.1 Mbps
Open network – IBS with high rate IBS ESC, IDR and audio
D&I / D&I++ for single Port T1/E1
D&I++ For Quad E1 Port 2, 3 and 4
VersaFEC-2 Codec data rate (CCM) – 5 Mbps, 10 Mbps, 15 Mbps, 20 Mbps or 25 Mbps
VersaFEC-2 Codec symbol rate (ACM) – 1.2 Mbps, 2.0 Mbps, 4.1 Mbps, 8.0 Mbps or 12.5 Mbps

Accessories

CRS-170A 1:1 Modern Redundancy Switch (L-Band)
CRS-180 1:1 Modern Redundancy Switch (70/140 MHz)
CRS-300 1:10 Modern Redundancy Switch (Not available with Packet Processor)
CRS-280 1:10 IF Redundancy Switch (70/140 MHz)
CRS-280L 1:10 IF Redundancy Switch (L-Band)

Environmental and Physical

Temperature
Operating: 0 to 50°C (32 to 122°F)
Storage: -40 to 85°C (-40 to 185°F)

Humidity
95% maximum, non-condensing

Power Supply
100 – 240 VAC, +6%/-10%, 50/60 Hz, auto sensing
-24 VDC (HW option)
-48 VDC (HW option)

Dimensions (1RU)
(height x width x depth)
1.75’’ x 19.0’’ x 17.65’’

(4.4 x 48 x 44.8 cm) approximate

Weight
10.8 lbs (4.9 kg) maximum, with all option modules and 48 VDC BUC power supply installed

CE Mark
EN 301 489-1 (ERM)
EN 55022 (Emissions)
EN 55024 (Immunity)
EN 61000-3-2
EN 61000-3-3
EN 60950 (Safety)

FCC
FCC Part 15, Subpart B