Overview
The CDMER-625A is the Environmentally Resistant (ER) version of the CDM-625A. It offers added protection in more aggressive operating environments that have a higher concentration of dust, sand and salt. The ER version uses an application of Urethane Conformal Coating (CC) and critical interface protective covers for enhanced protection against dust, sand and salt. Special protective Conformal Coating and protective covers have been designed to ensure that the CDMER-625A meets MIL-STD-810G requirements including Method 510 Procedure I (Blowing Dust), Method 510 Procedure II (Blowing Sand) and Method 509 (Salt Fog). Both the CC and protective connector covers are non-nutrient fungal growth materials. The ER version also provides an extended operating temperature range of 0 to 60°C. The ER version is not designed to be used in an un-controlled environment or outdoor application. The ER version carries the same two year standard warranty as other Comtech EF Data products.

CDMER-625A 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® bandwidth compression, additional rolloffs and advanced packet processing, the CDM-625A 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
- Environmentally Resistant (ER)
- 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
- Packet Processor with header compression, payload compression, advanced Quality of Service (QoS) and Managed Switch Mode with VLAN support
- 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 ksps to 12.5 Msps
- Modulation: BPSK, QPSK/OQPSK, 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
- IEEE 1588v2 Precision Time Protocol
- Sub Mux to multiplex IP/Ethernet traffic with serial or G.703 traffic
- Drop & insert for T1/E1
- Enhanced D/I++ for single T1/E1 & quad E1
- Management: 10/100Base-T Ethernet with SNMP, Distant End SNMP Proxy, HTTP, Telnet and EIA-232/EIA-485
- RADIUS Client
- Carrier ID using MetaCarrier® Technology
- Embedded Distant-end Monitor and Control (EDMAC)
- Automatic Uplink Power Control (AUPC)
- Engineering Service Channel (ESC/ESC++)
- Standard high-stability internal reference (± 6 x 10⁻⁷)
- 5-tap Adaptive Equalizer
- L-Band TX: 10 MHz reference for BUC, FSK communications and optional BUC power supply
- L-Band RX: 10 MHz reference and LNB power supply
- L-Band: Advanced FSK for LPD M&C
- 1:1 and 1:10 redundancy switches available
- Backwards compatible with CDM-625

Typical Users
- Mobile Network Operators
- Telecom Operators
- Satellite Service Providers
- Government & Military
- Enterprise
- Offshore

Common Applications
- Mobile Backhaul
- G.703 Trunking
- IP Trunking
- Offshore & Maritime Communications
- Enterprise
- Communications on-the-Move
- Satellite News Gathering
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 modern 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.

DoubleTalk® 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

CDMER-625A 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 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 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 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 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.

Packet Processor
The optional high-performance Packet Processor enables efficient IP networking and transport over satellite with low overhead encapsulation, header compression, payload compression and advance Quality of Service to the CDM-625A. The QoS combined with header and payload compression ensures the highest quality of service with minimal jitter and latency for real-time traffic, priority treatment of mission critical applications and maximum bandwidth efficiency.

Packet processor supports Routed mode as well as Managed Switch Mode of operation. In managed switch mode, it operates as a layer 2 switch with VLAN support, enabling seamless integration with existing infrastructure while providing full optimization including low overhead Streamline Encapsulation, header compression and payload compression and advanced QoS.

Header Compression
The Packet Processor incorporates industry-leading header compression for Ethernet and IP traffic. In managed switch mode, header compression can reduce the 54 byte Ethernet/IP/UDP/RTP header to as little as 1 byte. For TCP/IP, the 54 byte header (including Ethernet) is reduced to as little as 3 bytes. For applications such as VoIP, header compression can provide bandwidth savings exceeding 65%. E.g. the 8 kbps G.729 voice codec requires 31.2 kbps once encapsulated into an Ethernet frame with IP/UDP/RTP. With header compression, the same voice call needs about 9 kbps – a saving of almost 70%. And, bandwidth requirements for typical Web/HTTP traffic can be reduced by 10% or more with TCP/IP header compression.

Payload Compression
The Packet Processor incorporates industry-leading GZIP based payload compression for IP/Ethernet traffic. Implemented in hardware for maximum throughput and efficiency, payload compression can typically reduce the required satellite bandwidth by 30-40%.

Streamline Encapsulation (SLE)
The Packet Processor incorporates Comtech EF Data’s patent-pending low overhead Streamline Encapsulation (SLE). SLE can reduce the encapsulation overhead by as much as 65% compared to industry standard HDLC.

Advanced Quality of Service (QoS)
The Packet Processor incorporates multi-level QoS to ensure the highest quality service with minimal jitter and latency for real-time traffic, priority treatment of mission critical applications and maximum bandwidth efficiency. Supported modes are:

- DiffServ – Industry-standard method of providing QoS enabling seamless co-existence in networks that implement DiffServ
- Max/Priority – Provides traffic prioritization with the ability to limit maximum traffic per priority class
- Min/Max – Provides a Committed Information Rate (CIR) to each user defined class of traffic with the ability to allow a higher burstable rate depending on availability

A powerful classifier supports packet classification by Protocol, VLAN ID / range, ToS Byte, Source IP (or subnet), Destination IP (or subnet), Source Port (or Range), Destination Port (or Range) and DSCP (for DiffServ).

Quad E1 Interface (QDI) with Enhanced D&I++
The CDM-625A 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 & AUPC
The CDM-625A supports EDMAC, EDMAC-2, EDMAC-3 and AUPC. 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. AUPC automatically adjusts modem transmit power based on feedback from the distant end modem to maintain the desired Eb/No. AUPC 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, HTTP and Telnet, the modem can be easily integrated into an IP-based management system.

The CDM-625A can also act as SNMP proxy for the distant end CDM-625A. This allows distant end CDM-625A management using SNMP without requiring an end-to-end IP link.
RADIUS Client
The CDM-625A 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).

IEEE 1588v2 Precision Time Protocol (PTP)
PTP has emerged as the key technology for frequency, time and phase synchronization over a packet network. The CDM-625A incorporates hardware support for PTP, thereby significantly improving synchronization accuracy for satellite backhaul.

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 dependant) |
| Symbol Rate | 18 kbps to 12.5 Mbps |
| Operating Frequency | 50 – 180 MHz (standard) and 950 – 2250 MHz (option) |
| Power Accuracy | ±0.480°rms double sided, 100 Hz to 1 MHz (Minimum 16 dB better overall than the Intelsat IESS-308/309 requirements) |
| Transmit Offset | dBh 831 MHz |
| Scrambling | IFR Mode, no RS, - per ITU V.35 (Intelsat variant) |
| VersaFE Codew (Option) | BPSK Rate 0.450 |
| VersaFE 2 Codew (Option) | BPSK Rate 0.450 |
| Externall Reference | BNC connector |
| Data Interfaces | E1: 2.048 Mbps, Port for Quad-E1 (Balanced 120 Ohm) |
| Output Phase Noise | dBh 831 MHz |
| Output Power | ±0.6 dB over frequency, data rate, modulation type and temperature range of 15 to 35° C |
| Power Accuracy | ±0.6 dB over frequency, data rate, modulation type and temperature range of 15 to 35° C |
| Harmonics and Spurious | Better than -60 dBc/4 kHz |
| Alpha (Roll-off) | 5%, 10%, 15%, 20%, 25%, 35% |
| Power Accuracy | ±0.6 dB over frequency, data rate, modulation type and temperature range of 15 to 35° C |
| Modulator | ±0.6 dB over frequency, data rate, modulation type and temperature range of 15 to 35° C |
| Harmonics and Spurious | Better than -60 dBc/4 kHz |
| Alpha (Roll-off) | 5%, 10%, 15%, 20%, 25%, 35% |
| Power Accuracy | ±0.6 dB over frequency, data rate, modulation type and temperature range of 15 to 35° C |
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| VersaFE Codew (Option) | BPSK Rate 0.450 |
| VersaFE 2 Codew (Option) | BPSK Rate 0.450 |
| Externall Reference | BNC connector |
| Data Interfaces | E1: 2.048 Mbps, Port for Quad-E1 (Balanced 120 Ohm) |
| Output Phase Noise | dBh 831 MHz |
| Output Power | ±0.6 dB over frequency, data rate, modulation type and temperature range of 15 to 35° C |
| Power Accuracy | ±0.6 dB over frequency, data rate, modulation type and temperature range of 15 to 35° C |
| Harmonics and Spurious | Better than -60 dBc/4 kHz |
| Alpha (Roll-off) | 5%, 10%, 15%, 20%, 25%, 35% |
| Power Accuracy | ±0.6 dB over frequency, data rate, modulation type and temperature range of 15 to 35° C |

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| VersaFE 2 Codew (Option) | BPSK Rate 0.450 |
| Externall Reference | BNC connector |
| Data Interfaces | E1: 2.048 Mbps, Port for Quad-E1 (Balanced 120 Ohm) |
| Output Phase Noise | dBh 831 MHz |
| Output Power | ±0.6 dB over frequency, data rate, modulation type and temperature range of 15 to 35° C |
| Power Accuracy | ±0.6 dB over frequency, data rate, modulation type and temperature range of 15 to 35° C |
| Harmonics and Spurious | Better than -60 dBc/4 kHz |
| Alpha (Roll-off) | 5%, 10%, 15%, 20%, 25%, 35% |
| Power Accuracy | ±0.6 dB over frequency, data rate, modulation type and temperature range of 15 to 35° C |
**Satellite Restrictions**
- Maximum Symbol Rate Ratio (Interferer to Desired)
- Power Spectral Density Ratio
- Maximum Symbol Rate
- Eb/No Degradation
- Satellite Restrictions

**Available Options**
- Hardware
- Accessories
- Environmental and Physical

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**Output Impedance & Return Loss**
- 50-180 MHz: 50 Ω/75 Ω, 16 dB minimum return loss (18 dB typical), BNC connector
- 950-2250 MHz: 50 Ω, 19 dB minimum return loss (21 dB typical), Type-N connector

**Clocking Options**
- Internal, ±0.06 ppm (SCT)
- External, locking over ±100 ppm range (TT)
- Loop timing (RX satellite clock) – supports asymmetric operation

**BUC Reference (10 MHz)**
- Via TX IF center conductor, 10.0 MHz ±0.06 ppm (with internal reference), selectable on/off, 0.06 dBm ±3 dB

**BUC Power Supply (HW Option)**
- 24 VDC, 4.17 Amps max., 90 W @ 50° C
- 80 + 10 log (symbol rate) dBm

**Demodulator**
- Input Power Range, Desired Carrier
- Max Composite Operating Level
- Absolute Maximum
- Adaptive Equalizer
- Acquisition Range
- Below 64 ksymbols/sec
- Between 64 and 389 ksymbols/sec
- Above 389 ksymbols/sec

**DoubleTalk Carrier-in-Carrier**
- Delay Range
- Power Spectral Density Ratio
- Maximum Symbol Rate Ratio
- Eb/No Degradation
- Satellite Restrictions

**Return Loss**
50-180 MHz: 50 Ω/75 Ω, 16 dB minimum return loss (18 dB typical), BNC connector
950-2250 MHz: 50 Ω, 19 dB minimum return loss (21 dB typical), Type-N connector

**Monitors**
- By TTL low signal or external contact closure

**BUC Reference (10 MHz)**
Via TX IF center conductor, 10.0 MHz ±0.06 ppm (with internal reference), selectable on/off, 0.06 dBm ±3 dB

**BUC Power Supply (HW Option)**
24 VDC, 4.17 Amps max., 90 W @ 50° C
48 VDC, 3.125 Amps max., 150 W @ 50° C (180 W @ 30° C)

**Demodulator**
Input Power Range, Desired Carrier
50-180 MHz: -105 + 10 log (symbol rate) to -70 + 10 log (symbol rate) dBm
950-2250 MHz: -130 + 10 log (symbol rate) to -80 + 10 log (symbol rate) dBm

Max Composite Operating Level
50-180 MHz:
94 – 10 log (symbol rate, desired carrier) dBc, ±10 dBm max., with the additional requirement that within ±10 MHz of the desired carrier the composite power is ≤ ±30 dBc
950-2250 MHz:
102 – 10 log (symbol rate, desired carrier) dBc, ±10 dBm max., with the additional requirement that within ±10 MHz of the desired carrier the composite power is ≤ ±30 dBc

Absolute Maximum
+20 dBm

Adaptive Equalizer
5-tap design, selectable on/off

Acquisition Range
Programmable in kHz increments

Below 64 ksymbols/sec
±1 kHz to ±(Rs/2) kHz, where Rs = symbol rate in ksymbols/sec

Between 64 and 389 ksymbols/sec
±1 kHz to ±32 kHz

Above 389 ksymbols/sec
±1 kHz to ±(Rs) kHz, up to a maximum of ±200 kHz

Acquisition Time
Highly dependent on data rate, FEC rate, and demodulator acquisition range.
E.g. 120 ms average at 64 kbps, R1/2 QPSK, ±10 kHz acquisition sweep range, 6 db Eb/No

Plesiochronous/Doppler Buffer
Selectable from 64 to 262,144 bits, in 16-bit steps

Receive Clock
RX satellite, TX terrestrial, external reference

Clock Tracking
±100 ppm minimum

LNB Reference (10 MHz)
Via RX IF center conductor, 10.0 MHz ±0.06 ppm (with internal reference), selectable on/off, -3.0 dBm ±3 dB

LNB Voltage
Selectable on/off, 13 VDC, 18 VDC per DiSEq 4.2 and 24 VDC at 500 mA maximum

Monitor Functions
E_{c}/N_{0} estimate, corrected BER, frequency offset, buffer fill state, receive signal level

Delay Range
0 to 300 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/QPSK/8-QAM, 0.3 dB
BPSK, 0.5 dB
8-ARY, 0.4 dB
16-QAM, 0.6 dB
16-ARY, 0.6 dB
32-ARY, 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)

**FAST**
- L-Band IF (in addition to 70/140 MHz)
- Modem data rate – 10 Mbps, 15 Mbps, 20 Mbps or 25 Mbps
- 8PSK and 8-QAM modulation (8-QAM requires TPC/LDPC or VersaFEC Codec)
- 16-QAM modulation

**VersaFEC-2 Codec module**
- VersaFEC Codec symbol rate (ACM) – 300 kbps, 12 Mbps or 4.1 Mbps

**VersaFEC-2 Codec data rate**
- 10 Mbps, 15 Mbps, 20 Mbps or 25 Mbps

**Open network**
- IBS with high rate IBS ESC, IDR and audio

**VersaFEC Codec symbol rate**
- ACM – 1.2 Mbps, 2 Mbps, 4 Mbps

**VersaFEC-2 Codec symbol rate**
- ACM – 1.2 Mbps, 2 Mbps, 4 Mbps

**Accessories**
- CRS-170A
- CRS-180
- CRS-300
- CRS-280
- CRS-280L
- CRS-500

**Environmental and Physical**
- Temperature
  - Operating: 0 to 60°C (32 to 140°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)
  - 1.75” x 19.0” x 17.65”
- Weight
  - 10.8 lbs (4.9 kg) maximum, with all option modules and 48 VDC BUC power supply installed

**Comtech EF Data**
- Available Options
- Hardware
- Accessories
- Environmental and Physical

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