**Overview**

The CDM-425 Advanced Satellite Modem continues to build on our legacy of providing the most efficient and reliable satellite modems. It offers the most popular and powerful features of the CDM-625A, with a smaller footprint and less power. Its Forward Error Correction options comprise 18 VersaFEC® ModCods and 74 VersaFEC-2 ModCods, permitting the user to optimize for latency and coding gain for any link budget. It includes DoubleTalk® Carrier-in-Carrier bandwidth compression, additional TX rolloffs and sophisticated packet processing capabilities. 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 – similar performance to DVB-S2X with significantly lower latency.
- VersaFEC FEC with Adaptive Coding and Modulation (ACM), both standard and Ultra-Low Latency (ULL)
- 5%, 10%, 15%, 20%, 25% and 35% Transmit Filter Rolloff
- Optional 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 kbps to 12.5 Mps
- Modulation: BPSK, QPSK, 8-QAM/8-ARY, 16-QAM/16-ARY, 32-ARY
- FEC: VersaFEC (low-latency LDPC) and VersaFEC-2 (high performance LDPC)

**Typical Users**

- Mobile Network Operators
- Telecom Operators
- Satellite Service Providers
- Enterprise
- Offshore

**Common Applications**

- Mobile Backhaul
- Offshore & Maritime Communications
- Enterprise

- Wide Range of data interfaces: EIA-422/530, V.35, G.703 T1/E1, Quad G.703 E1, 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
- ETSI compliant Carrier ID using MetaCarrier® Technology
- Embedded Distant-end Monitor and Control (EDMAC)
- Automatic Uplink Power Control (AUPC), and combined AUPC and ACM
- Standard high-stability internal reference (± 6 x 10-8)
- 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 LPOD M&C
- 1:1 and 1:10 redundancy switches available
- Backwards compatible with CDM-625 (VersaFEC modes) and CDM-625A (VersaFEC and VersaFEC-2 modes)
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-425 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 comparable with DVB-S2X 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 circular or 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-425 offers VersaFEC, a system of high-performance short-block 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.

Dual Band Capability
CDM-425 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-425 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-425. 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-425 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-425 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. Simultaneous AUPC and ACM is offered for IP modes.

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-425 can also act as SNMP proxy for the distant end CDM-425. This allows distant end CDM-425 management using SNMP without requiring an end-to-end IP link.
RADIUS Client
The CDM-425 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-425 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 | 950 – 2250 MHz (standard)  
50 – 180 MHz (option)  
100 Hz resolution, independent TX and RX operation |
| Major Operating Modes (See User Manual for Details) | VersaFEC and VersaFEC-2 Codec with Adaptive Coding and Modulation (ACM) or Constant Coding & Modulation (CCM)  
EDMAC Framed with/without AUPC  
Drop & insert (D&I) /Enhanced D&I++ (option)  
Quad E1 drop & insert (QDI) (option)  
DoubleTalk Carrier-in-Carrier (option) |
| FEC & Modulation VersaFEC Codec | BPSK Rate 0.488  
QPSK Rate 0.533, 0.631, 0.706, 0.803  
8-QAM Rate 0.576 (ECCM), 0.642, 0.711, 0.780  
16-QAM Rate 0.644 (ECCM), 0.731, 0.780, 0.829, 0.853  
BPSK 0.493 (ULL)  
QPSK 0.493, 0.654, 0.734 (ULL) |
| VersaFEC-2 Codec | BPSK Rate 0.489  
QPSK Rate 0.489, 0.537, 0.586, 0.611, 0.635, 0.660, 0.684, 0.733  
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, 0.757, 0.782  
32-ARY Rate 0.660, 0.684, 0.708, 0.733, 0.757, 0.782, 0.801, 0.831, 0.856, 0.879 |
| Scrambling | ITU V.35 (Intelsat variant) / IESS-315 |
| Management Form C Relays | 10/100Base-T Ethernet with SNMP, HTTP and Telnet support  
EIA-232, EIA-485 (2- or 4-wire) |
| External Reference Input OR Output | BNC connector  
Input: 1.2, 5, or 10 MHz, -6 dBm to +10 dBm, 50 Ω ± 15% (nominal)  
Output: 10 MHz, 2.7 V peak-to-peak  
± 0.4 V, low impedance output |

Data Interfaces
EIA-422-250 DCE, Up to 14 Mbps  
V.35 DCE, Up to 14 Mbps  
G.703 T1, 1.544 Mbps (Balanced 100 Ω)  
G.703 E1, 2.048 Mbps (Unbalanced 75 Ω or balanced 120 Ω)  
Additional 2.048 Mbps E1 Ports for Quad-E1 (Balanced 120 Ω)  
Modem Alarms | 25-pin D-sub (female)  
9-pin D-sub (female)  
9-pin D-sub (female)  
9-pin D-sub (female)  
15-pin D-sub (male)  
4 x RJ-45 |

Modulator
| Frequency Stability | ± 0.06 ppm (± 6 x 10⁻⁶), 0° to 50°C (32° to 122°F) with internal reference |
| Transmit Filtering | Transmit Alpha = 35%, per IESS-308 |
| Additional Alphas (Roll-off) | 5%, 10%, 15%, 20% and 25% |
| Harmonics and Spurious | Better than -60 dBc/4 kHz (typically < –65 dBc/4kHz)  
Measured from 1 to 500 MHz (50-180 MHz band)  
Measured F3 ± 50 MHz (950-2250 MHz band) |
| Transmit On/Off Ratio | ± 0 dBc minimum |
| Output Phase Noise | < 0.48° rms double sided, 100 Hz to 1 MHz  
(Minimum 16 dB better overall than the Intelsat IESS-308/309 requirements)  
dBHz Frequency Offset  
-63.0 100 Hz  
-73.0 1 kHz  
-83.0 10 kHz  
-93.0 100 kHz |
| Output Power | 50-180 MHz:  
0 to -25 dBm, 0.1 dB steps |
| Power Accuracy | 50-180 MHz:  
± 0.5 dB over frequency, data rate, modulation type and temperature range of 15 to 35° C  
± 0.8 dB over frequency, data rate, modulation type and temperature range of 0 to 50° C |
| Output Impedance & Return Loss | 50-180 MHz:  
50 Ω/75 Ω, 16 dB minimum return loss (18 dB typical), BNC connector |
| Clocking Options | Input, ± 0.06 ppm (SCT)  
External, locking over a ± 100 ppm range (TT)  
Loop timing (RX satellite clock) – supports asymmetric operation  
External clock |
| External TX Carrier Off | 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, 0.0 dBm ± 3 dB |
| BUC Power Supply (HV 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) |
| Supplied through TX IF center conductor and selectable on/off via M&C control |
### Demodulator

**Input Power Range, Desired Carrier**

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>Power Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>50-180 MHz</td>
<td>-105 + 10 log (symbol rate) dBm</td>
</tr>
<tr>
<td>950-2250 MHz</td>
<td>-130 + 10 log (symbol rate) dBm</td>
</tr>
</tbody>
</table>

**Max Composite Operating Level**

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>Power Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>50-180 MHz and 950-2250 MHz</td>
<td>≤ 30 dBc</td>
</tr>
</tbody>
</table>

**Absolute Maximum**

+20 dBm

**Acquisition Range** Programmable in 1 kHz increments

**Below 64 ksymbols/sec**

<table>
<thead>
<tr>
<th>Symbol Rate</th>
<th>Eb/No (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 224 kbps</td>
<td>2.5 dB</td>
</tr>
<tr>
<td>2.5 Mbps</td>
<td>3.0 dB</td>
</tr>
<tr>
<td>5 Mbps</td>
<td>3.5 dB</td>
</tr>
<tr>
<td>10 Mbps</td>
<td>4.0 dB</td>
</tr>
<tr>
<td>15 Mbps</td>
<td>4.5 dB</td>
</tr>
<tr>
<td>20 Mbps</td>
<td>5.0 dB</td>
</tr>
<tr>
<td>25 Mbps</td>
<td>5.5 dB</td>
</tr>
<tr>
<td>32 Mbps</td>
<td>6.0 dB</td>
</tr>
</tbody>
</table>

**Between 64 and 389 ksymbols/sec**

<table>
<thead>
<tr>
<th>Symbol Rate</th>
<th>Eb/No (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 1 kHz</td>
<td>3.0 dB ± 3 dB</td>
</tr>
<tr>
<td>1 kHz – ≤ 2.2 kHz</td>
<td>0.5 dB/3:1 (TX:RX or RX:TX)</td>
</tr>
<tr>
<td>&gt; 2.2 kHz</td>
<td>3.0 dB/3:1 (TX:RX or RX:TX)</td>
</tr>
</tbody>
</table>

**Above 389 ksymbols/sec**

<table>
<thead>
<tr>
<th>Symbol Rate</th>
<th>Eb/No (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 2.2 kHz</td>
<td>2.5 dB</td>
</tr>
<tr>
<td>&gt; 2.2 kHz</td>
<td>3 dB/3:1</td>
</tr>
</tbody>
</table>

**Eb/No Degradation**

<table>
<thead>
<tr>
<th>Format</th>
<th>Power Spectral Density Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPSK/QPSK/8PSK/8-QAM</td>
<td>≤ 3 dB</td>
</tr>
<tr>
<td>16-QAM/16-ARY</td>
<td>≤ 7 dB</td>
</tr>
</tbody>
</table>

**Maximum Symbol Rate Ratio**

<table>
<thead>
<tr>
<th>Symbol Rate</th>
<th>Eb/No (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 1 kbps</td>
<td>+10 dB</td>
</tr>
<tr>
<td>1 kbps – 999 kbps</td>
<td>+10 dB</td>
</tr>
<tr>
<td>&gt; 999 kbps</td>
<td>+10 dB</td>
</tr>
</tbody>
</table>

**Power Spectral Density Ratio**

<table>
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<td>≤ 7 dB</td>
</tr>
</tbody>
</table>

**Delay Range**

0 to 330 ms

**LNB Reference (10 MHz)**

<table>
<thead>
<tr>
<th>Format</th>
<th>Power Spectral Density Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Via RX IF center conductor</td>
<td>≤ 30 dB</td>
</tr>
<tr>
<td>Selectable on/off</td>
<td>≤ 30 dB</td>
</tr>
</tbody>
</table>

**LNB Voltage**

Selectable on/off, 13 VDC, 18 VDC per DiSEq 4.2 at 500 mA maximum

**Monitor Functions**

E/N0 estimate, corrected BER, frequency offset, buffer fill state, receive signal level

**DoubleTalk Carrier-in-Carrier**

**Delay Range**

0 to 330 ms

**Power Spectral Density Ratio**

<table>
<thead>
<tr>
<th>Format</th>
<th>Power Spectral Density Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPSK/QPSK/8PSK/8-QAM</td>
<td>≤ 3 dB</td>
</tr>
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<td>16-QAM/16-ARY</td>
<td>≤ 7 dB</td>
</tr>
</tbody>
</table>

**Maximum Symbol Rate Ratio**

<table>
<thead>
<tr>
<th>Symbol Rate</th>
<th>Eb/No (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 1 kbps</td>
<td>+10 dB</td>
</tr>
<tr>
<td>1 kbps – 999 kbps</td>
<td>+10 dB</td>
</tr>
<tr>
<td>&gt; 999 kbps</td>
<td>+10 dB</td>
</tr>
</tbody>
</table>

**Eb/No Degradation**

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<td>BPSK/QPSK/8PSK/8-QAM</td>
<td>≤ 3 dB</td>
</tr>
<tr>
<td>16-QAM/16-ARY</td>
<td>≤ 7 dB</td>
</tr>
</tbody>
</table>

**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, 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
- Hardware Packet Processor

**FAST**

- 70/140 MHz (in addition to L-Band IF)
- 8-QAM/8-ARY modulation
- 16-QAM/16-ARY modulation
- 32-ARY modulation
- 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
- D&I/D&I+ for single Port T1/E1
- D&I+ For Quad E1 Port 2, 3 and 4
- Quality of Service (requires Packet Processor)
- Header Compression (requires Packet Processor)
- Payload Compression (requires Packet processor)
- Advanced Network Timing (IEEE 1588v2 PTP)
- Carrier ID
- VersaFEC Codec data rate (CCM) – 2.5 Mbps, 5 Mbps, 16 Mbps
- VersaFEC Codec symbol rate (ACM) – 1.2 Msps, 4.1 Msps
- VersaFEC-2 Codec data rate (CCM) – 10 Mbps, 15 Mbps, 20 Mbps or 25 Mbps
- VersaFEC-2 Codec symbol rate (ACM) – 2.0 Msps, 4.1 Msps, 8.0 Msps or 12.5 Msps

### 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)

**CRS-500**

1:N Modern Redundancy System (For use with Packet Processor Only)

**CRS-282XXX**

1:10 IF Redundancy Switch (For use with CRS-500)

### 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

-48 VDC (HW option)

**Dimensions (1RU) (height x width x depth)**

1.75” x 19.0” x 14”

(4.4 x 48 x 35.5 cm) approximately

**Weight**

8.8 lbs (3.9 kg) maximum, with Packet Processor module and 48 VDC BUC power supply installed

**CE Mark**

EN 301 489-1 (ERM)

EN55022 (Emissions)

EN55024 (Immunity)

EN 61000-3-2

EN 61000-3-3

EN60950 (Safety)

**FCC**

FCC Part 15, Subpart B