



Company & Products Overview





Advanced Communication Solutions

Comtech EF Data Corporation, a subsidiary of Comtech Telecommunications Corporation (NASDAQ: CMTL), is the recognized global leader in satellite bandwidth efficiency and link optimization. Our advanced communication solutions encompass Advanced VSAT Solutions, Modems, RAN & WAN Optimization, Managed Bandwidth, RF Products, and more. The solutions enable commercial and government users to reduce OPEX/CAPEX and to increase throughput for fixed and mobile/transportable satellite-based applications.

Products are designed and manufactured at our Tempe, Arizona USA plant. Our well-maintained facilities are configured to support current and planned production requirements. We employ formal quality management programs and training, including the International Standard Organization's ("ISO-9000") and Aerospace Standard ("AS9100") quality procedure registration programs.

We are recognized as a technology innovator, and have a reputation for product quality and reliability. Examples of our technologies that optimize satellite communications are:

- DoubleTalk® Carrier-in-Carrier® Bandwidth Compression
- VersaFEC® Forward Error Correction
- Adaptive Coding & Modulation
- DVB-S2
- Low Density Parity Check Coding (LDPC) & 8-QAM Modulation
- 2nd Generation Turbo Product Coding
- Integrated Router
- Radio Access Network (RAN) Optimization
- WAN Optimization
- Dynamic Single Carrier per Channel
- Daisy Chain Redundancy Switching

Our products are installed in 160+ countries. We provide "around the clock" customer support and have authorized service centers globally. We are prepared to help you optimize bandwidth, reduce OPEX/CAPEX associated with satcom, and lower the total cost of ownership.

Advanced VSAT Solutions

This portfolio provides high-performance satellite-based communication solutions for mobile backhaul, IP trunking, maritime, offshore and corporate/enterprise networks. The Advanced VSAT Solutions incorporate products and advanced technologies developed by Comtech EF Data, Comtech AHA and Memotec. These bundled solutions provide unmatched performance, market-leading bandwidth efficiencies and network optimization – all at an attractive price.





Our Advanced VSAT Solutions feature products for both hub and remote sites. Below is a sampling of the products:

	Hub	Remote
CDM-800 Gateway Router	◆	
CDD-880 Multi-Receiver Router	◆	
CXU-810 RAN Optimizer	◆	
CDM-840 Remote Router		◆
ODM-840 Remote Router (outdoor version)		◆
Stampede FX-4000 WAN Optimization & Application Acceleration	◆	
Stampede FX-1000 WAN Optimization & Application Acceleration		◆
Memotec CX-U1240/1280 RAN Optimization	◆	
Memotec CX-U1010/1220 RAN Optimization		◆
ACM/VCM Controller	◆	
Network Management System	◆	
Vipersat dSCPC Controller	◆	



Key functionality of the Advanced VSAT Solutions:

- **Advanced Quality of Service (QoS)** – 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.
- **Header & Payload Compression** – Header compression can reduce header overhead by as much as 65% for VoIP. Lossless payload compression can reduce bandwidth requirement by 40-60% for typical traffic.
- **Advanced Forward Error Correction** – The combination of DVB-S2 for the outbound & VersaFEC for the return provides maximum spectral efficiency with minimal latency.
- **Adaptive Coding & Modulation (ACM)** – Converts available link margin into increased throughput.
- **Variable Coding & Modulation (VCM)** – Allows sites with different antenna and footprint characteristics to share a common outbound efficiently.
- **RAN Optimization** – Significantly reduces satellite bandwidth required for mobile backhaul; the level of RAN optimization is selectable to achieve desired link quality & bandwidth savings.
- **WAN Optimization** – Provides TCP connection management, TCP optimization, image reduction and smoothing, caching, bandwidth pooling, and other capabilities for enhanced user experience and significant bandwidth savings.
- **Dynamic Bandwidth Management** – With Vipersat dSCPC functionality, bandwidth is dynamically shared among different users.
- **Network Management System** – Provides centralized configuration, monitoring and control for the network.



We offer two industry-leading brands – Comtech EF Data and Radyne – and the widest range of bandwidth-efficient Modems in the satellite industry. Our award-winning Modems use technologically advanced components, innovative designs and application software for superior performance and features. Whether used to support satellite-based mobile backhaul, to enable broadcast transmissions, to power mission-critical military communications, or to connect remote offices, our innovative technologies offer the performance, flexibility, security and control you require. We offer indoor Modems, outdoor/ruggedized Modems and card-based Modems for a variety of integration choices.

Forward Error Correction (FEC) & Modulation

Our Modems support traditional and advanced methods of forward error correction to improve performance of error-prone channels. Examples of our FECs are:

- VersaFEC® – Patented system of high performance, short-block, low-latency LDPC codes; provides excellent coding gain with lowest possible latency
- DVB-S2 – Provides near Shannon Limit performance over a wide operating range
- Low Density Parity Check Coding – Enables near Shannon Limit performance and additional coding gain
- 2nd Generation Turbo Product Coding – Offers much lower delay than legacy FECs

We have both ASIC and FPGA modulator and demodulator designs with a range of modulation techniques, including BPSK, QPSK, OQPSK, 8-PSK, 16-APSK, 32-APSK, 8-QAM, 16-QAM and 64-QAM.

The combination of advanced FEC and higher order modulation provides increased coding gain, resulting in significant bandwidth and power savings.

DoubleTalk Carrier-in-Carrier

Our award-winning DoubleTalk Carrier-in-Carrier is based on Applied Signal Technology's patented "Adaptive Cancellation" technology that allows transmit and receive carriers of a duplex link to share the same transponder space. When combined with our advanced FEC and modulation, DoubleTalk Carrier-in-Carrier delivers unprecedented savings in transponder bandwidth and power utilization. Therefore, this revolutionary technology can be successfully deployed in both bandwidth-limited and power-limited scenarios. In addition, this technology reduces earth station BUC/HPA power requirements allowing the use of a smaller BUC/HPA and/or antenna.

Adaptive Coding and Modulation (ACM)

Rain fade, inclined orbit satellite operation, antenna pointing errors, noise and interference can all degrade satellite link conditions. These conditions determine the overall link margin of a system. When utilizing ACM operation in our Modems, link margin can be converted into increased throughput of satellite links. The greater the link margin, the more your links can benefit from ACM.



Integrated Router

Modems with our integrated router functionality allow seamless network convergence for data, voice and video traffic. Available options include header compression, payload compression, ultra low overhead streamline encapsulation and Quality of Service (QoS). When utilizing the advanced IP functionality, real-time traffic and other low priority traffic can seamlessly coexist on the same link without impacting the voice quality or delivery of mission critical data. The functions provide high bandwidth efficiency, information security and simplified network design and configuration.

RAN Optimization

Modems featuring RAN optimization can significantly reduce the wide area network (satellite) bandwidth required to carry an E1 bearer used for mobile backhaul. RAN optimization allows users to control the desired level of optimization and link quality.

Redundancy

To support your mission-critical applications, we offer 1:1 and 1:N redundancy solutions. Options include external switch compatibility and on-board, built-in redundancy with either fully automatic or manual switching operations.

Government Networks

We offer Modems ideally suited for military and government applications, engineered to meet a range of requirements, including:

- MIL-STD-188-165A
- AES-256 TRANSEC / FIPS-140-2 Level 2 NIST
- DISA certified for operation on Wideband Global Satcom (WGS) and Defense Satellite Communications System (DSCS) satellite networks

Flexibility

Our modems enable deployment in remote and hub environments; we offer L-Band, 70/140 MHz and combination L-Band & 70/140 MHz systems. We offer both indoor and outdoor Modems with data rate ranges from 2.4 kbps to 238 Mbps. We provide the options you need for operation with single or multiple transponders, and configurations to accommodate Low Noise Block Converters and Block Up Converters. Our product line includes open and closed network Modems, and support for a variety of management and control methods. A wide range of data interfaces are available to support low- and high-speed data transmission.



To enhance the functionality of our Modems, we offer a variety of accessories, including 1:1 and M:N redundancy switches, interface converters, IP-enabled monitor & control interfaces, and more.





RAN & WAN Optimization

Stampede FX Series

Data center simplification and the growing migration to web-enabled applications are driving the need for a new class of multi-function optimization devices. The Stampede FX Series combines both one-sided application delivery and two-sided WAN optimization into a single platform with the added flexibility of unparalleled remote side software WAN optimization options. The FX Series delivers unprecedented application performance, optimization, transparency, availability and management for existing networks.



turboIP®-G2



FX Series



turboIP®-G2 Performance Enhancement Proxies

Acceleration for military and government applications – The *turboIP-G2* is designed with effective WAN optimization features, targeted specifically for the unique challenges of satellite communication. Most notably, acceleration and caching are used to improve network responsiveness, keeping the user experience optimized. In addition, advanced compression techniques are used to minimize data traversing the satellite link, allowing the reduction of monthly WAN bills or avoiding the purchase of additional bandwidth.

Memotec NetPerformer

The NetPerformer Satellite Routers combine the functionality of a data router, a multiplexer and a voice gateway in a single device, enabling users to create converged networks and transport any type of traffic over any type of satellite or terrestrial links.

Designed to provide maximum network performance in low-bandwidth environments, the NetPerformer reduces network infrastructure costs and simplifies WAN connectivity. The NetPerformer's compression technology, prioritization and multiplexing capabilities and the ability to route all traffic over a high efficient cell-relay based protocol, make it the product of choice for converged voice and data applications over satellite networks. The NetPerformer's Quality of Service supports IP Precedence TOS bit and 802.1p/q to provide end-to-end QoS. Users can define up to eight classes of service with 16 different levels of prioritization to ensure that mission-critical applications always receive sufficient bandwidth.



CX-U Series



NetPerformer

Memotec CX-U Series

The CX-U Series brings together a flexible access device and mobile backhaul traffic optimization, offering a variety of backhaul interfaces and transmission options. The CX-U offers Abis/Ater optimization, 2G/3G aggregation, DCME voice trunking optimization, TDM Pseudowire, all over IP, Frame Relay or MLPPP protocol support.

Our CX-U products support digital fractional T1/E1, high-speed serial and Ethernet network interfaces with a choice of protocols (Frame Relay, IP/MLPPP) and multiple network backup options. Designed with the utmost reliability in mind, it can support an extended temperature range. Line Bypass and optional 100 ms 1+1 hot standby redundancy without service interruption are also available for ultimate availability in challenging, remote locations.

The CX-U products can be used in stand-alone mode of operation at hubs or aggregation points, or in conjunction with the CX-U devices located at remote cell sites.



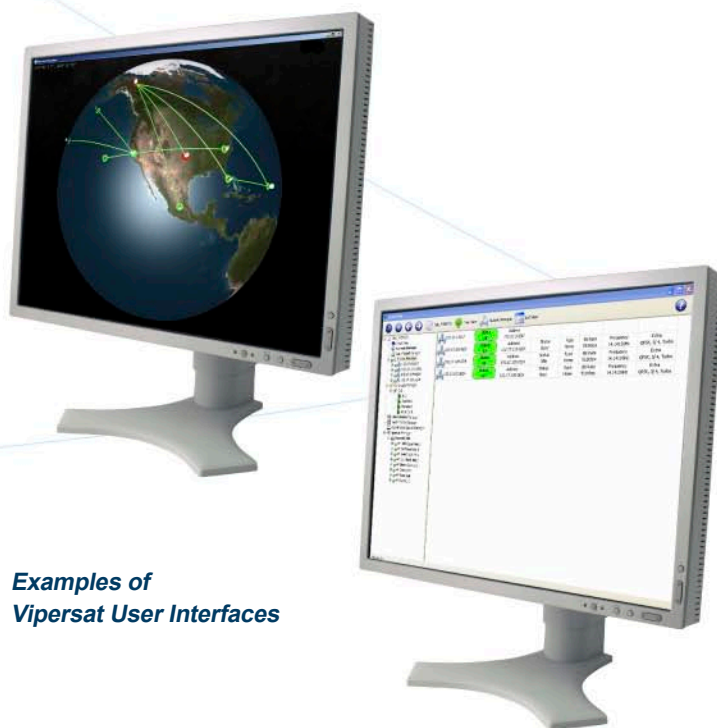
Managed Bandwidth

Vipersat Network Products

The Vipersat Network Products are a suite of software applications that optimize SCPC bandwidth utilization and provide powerful network management features when using our Modems.

The primary applications of Vipersat Network Products are:

- **Vipersat Management System (VMS)** –
Automates carrier switching & bandwidth management
- **Virtual Network Operator Support (VNO)** –
Enables the Vipersat operator to create a web application with custom views of the entire network
- **Roaming Oceanic Satellite Server (ROSS)** –
Facilitates on-the-move satcom for oceanic vessels
- **Vipersat File Streamer (VFS)** –
Provides efficient & reliable file transfers



*Examples of
Vipersat User Interfaces*

The combined solution of Vipersat Network Products and our bandwidth-efficient Modems offers unique features that minimize operating expenses and maximize transponder utilization. The solution is flexible, scalable and able to adjust to changing networks.





SkyWire

The revolutionary SkyWire™ MDX420 system combines the throughput and robustness of a single channel per carrier (SCPC) system with the bandwidth savings of a time division multiple access (TDMA) system. Our SkyWire MDX420 leverages the benefits of each to provide the ultimate in satellite network performance.

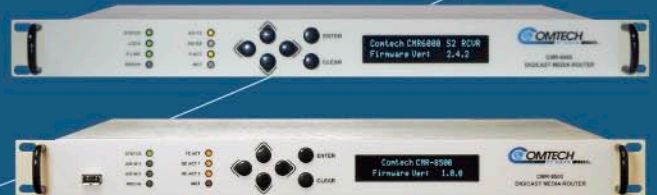
The SkyWire MDX420 is the first TDMA broadband satellite system to eliminate the need for high stability references or an expensive central hub with complicated system software. With its revolutionary single hop bandwidth-on-demand capability, the SkyWire MDX420 minimizes system response time to changes in traffic flow. The small, efficient burst sizes and ultra low overhead allow the SkyWire MDX420 to provide unprecedented bandwidth efficiency and increased network throughput.

The SkyWire MDX420 system is easy to configure and the auto-everything 10/100/1000 terrestrial data ports provide instant connectivity for any IP application.

Whether you need a TRUE full mesh or a hybrid network solution, the system provides the most cost-effective, easy to use, bandwidth efficient TDMA solution available. The system is packaged in a single, secure, one rack unit box.



Encapsulators & Receivers



Enabling broadcast of IP / Ethernet traffic, MPEG audio and video, our Encapsulators and Receivers use the highly efficient and open network Digital Video Broadcasting standards DVB-S & DVB-S2. The products optimize end-to-end solutions for stand-alone and overlay broadband IP networks in the entertainment and corporate enterprise markets. A range of interfaces, redundancy options and IP-based management are provided to accommodate diverse network configurations.

The combined solution of Encapsulators, Receivers and our bandwidth-efficient Modems can enable operating expenses to be minimized for service providers delivering IP-based broadcast connectivity.



RF Products

Comtech EF Data is a recognized leader in RF products. Our extensive product line provides frequency conversion and amplifier solutions for both environments – indoor and outdoor.

The products are cost-effective, providing field-proven performance and reliability required to support your satellite communications needs. Deployed globally by commercial and government users, our products support a variety of fixed and mobile / transportable applications.

Indoor Products

70/140 MHz Frequency Conversion

We offer systems for frequency conversion between the traditional IF frequencies of 70/140 MHz and L-Band, as well as translation from these IF frequencies and C-, X-, Ku- and Hotbird RF Bands. These reliable, cost-effective and high-performance products feature low phase noise, high gain, gain compensation, patented daisy chain switching and redundancy.

L-Band Frequency Conversion

The rack mountable converter systems feature frequency conversion between L-Band IF & 70/140 MHz IF, as well as L-Band to C-/X-/Ku-Band RF, low phase noise, flexible configurations and optional redundancy.

The Amplifiers with integrated L-Band BUCs feature optional redundancy, low loss combining technique and temperature compensation.

Amplifiers

Available in C-, X- or Ku-Band versions and a wide range of output power levels, our indoor Solid-State Power Amplifiers (SSPAs) are reliable, field-proven and designed for use in satellite uplink systems.



Outdoor Products

L-Band Frequency Conversion

Rugged, weatherproof ground equipment designed to withstand harsh environments, we offer C-, Ku- and X-Band configurations with:

- No redundancy – Amplifiers, BUCs & Terminals
- Transmit only redundancy – Amplifiers & Combiner Switches
- Transmit / receive redundancy – Multi-Band Transceivers, Amplifiers & Combiner Switches

70/140 MHz Frequency Conversion

Our C-, X- and Ku-Band Transceivers provide performance, flexibility, ease of installation and field-proven reliability in harsh environments. We cover a power range of 5 to 500 Watts, and beyond.

Amplifiers

Our feature-rich outdoor models include key differentiators:

- High-Power Outdoor Power Amplifiers – Features field replaceable power supplies, redundancy, and 1:1 and 1:2 phase combined configurations
- Low Noise Amplifiers – Compact and rugged units that offer industry-leading RF performance; available in both stand-alone and redundant packages



More Information

For additional information on our advanced communication solutions, visit our web site: www.comtechefdata.com. You will find detailed product specifications, white papers, manuals, industry-specific solutions, sales contacts, and more.



2114 West 7th Street
Tempe, AZ 85281 USA
Voice +1.480.333.2200
Email sales@comtechefdata.com

www.comtechefdata.com

May 2011



© Copyright 2011 Comtech EF Data Corporation

Comtech EF Data reserves the right to change specifications of products described in this document at any time without notice and without obligation to notify any person of such changes. Information in this document may differ from that published in other Comtech EF Data documents. Refer to the web site or contact Customer & Technical Support for the latest released product information.