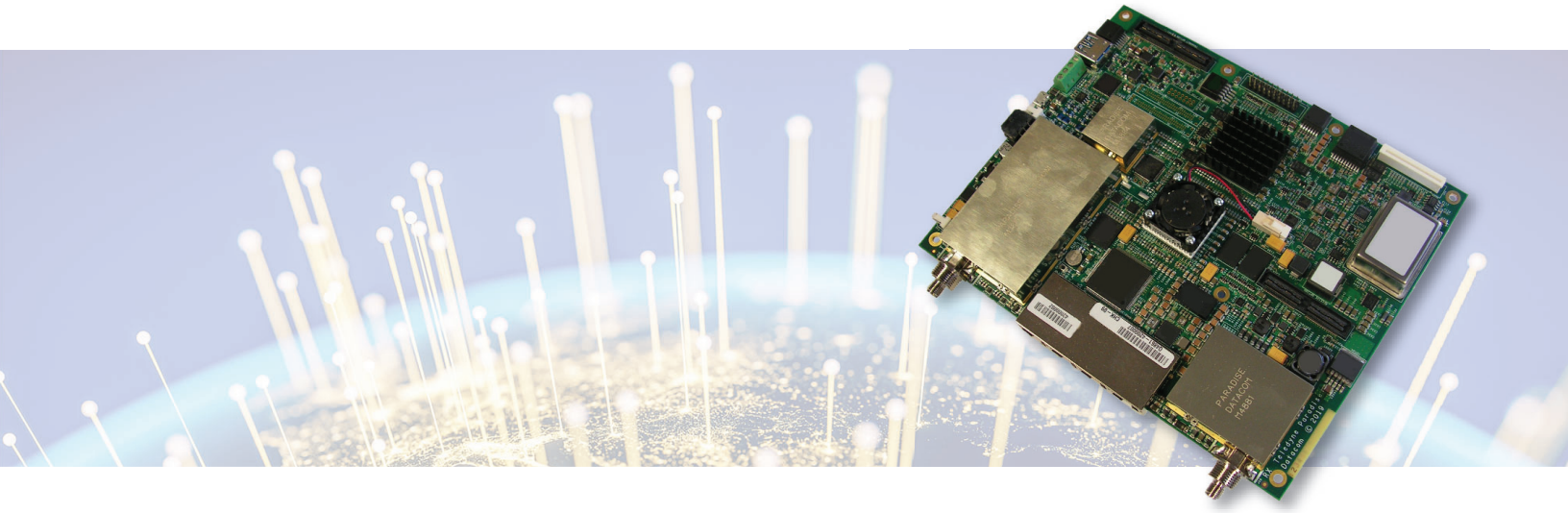
AXIOM-X **Encryption**

Small Form Factor Satellite Modem Card



A New, Smaller, and Compatible Member of the Paradise Modem Family **with AES-256 Encryption**

CDIP
www.cdip.ru
info@cdip.ru
+7 (495) 956-20-22

TELEDYNE
PARADISE DATACOM
Everywhereyoulook™

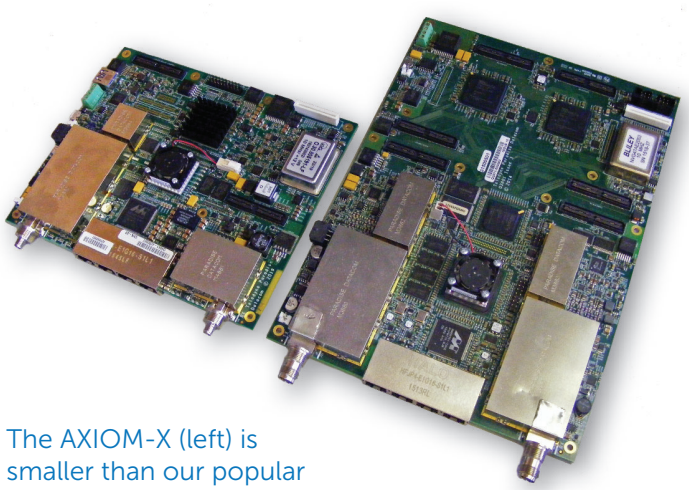
Overview

If you have mission critical data, require continuous availability and the utmost security, then you're in our world. The new AXIOM-X is our smallest, most powerful SCPC satellite modem.

Designed to be rugged and energy efficient the AXIOM-X is ideal for portable and comms-on-the move applications.

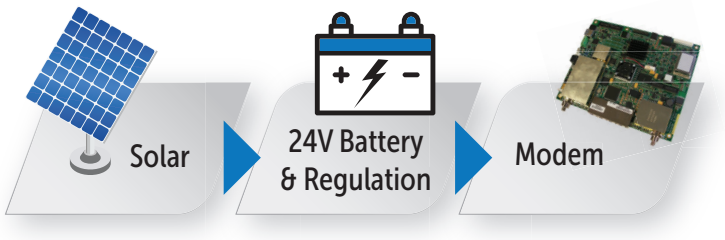
Features include:

- **Small:** 184mm (7.25") x 152 (6") x 18mm (3/4")
- **Lightweight:** 288g (0.6lb)
- **Extended temperature range:** -40 to +85°C
- **High capacity:** IP-centric, DVB-S2X, options up to 345Mb/s Tx, 230Mb/s Rx
- **Secure:** SCPC is more secure than TDMA, and provides guaranteed bandwidth for critical applications. Adding to this, the AXIOM-X Encrypted offers TCP/IP packet payload encryption using symmetric AES with 256-bit keys
- **Compatible with Q-Lite:** Mounting and RF connector centers are similar, uses the same control commands
- **Enhanced Doppler:** Superior performance for LEO and MEO communications with an allowable frequency shift of up to ±330kHz and rate of change up to ±100kHz/s



The AXIOM-X (left) is smaller than our popular Q-Lite modem (right)

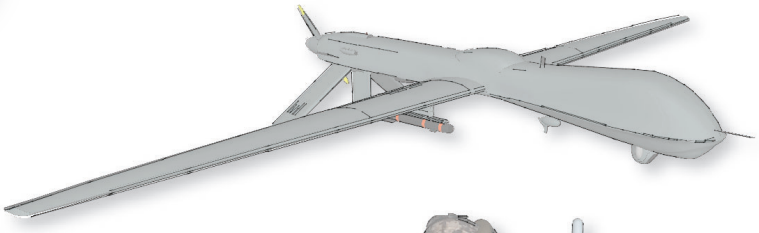
Optimized for Low Power



AXIOM-X is ideal for low power applications like solar-powered systems.

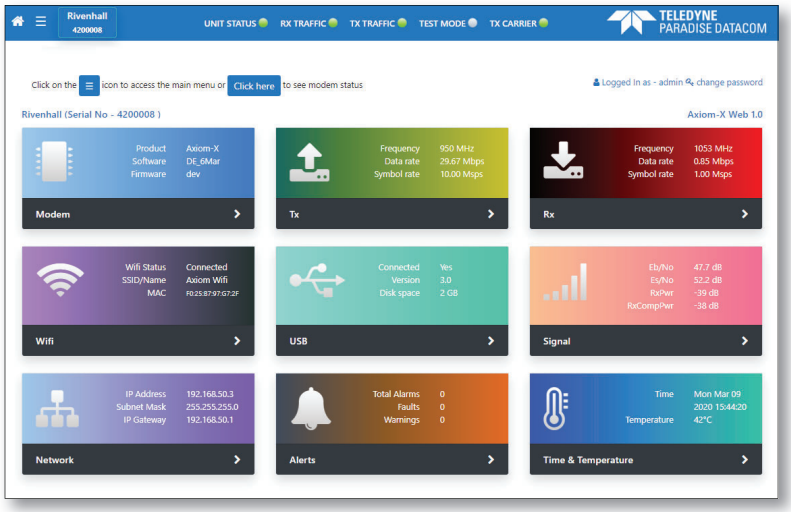
Markets & Applications

- Comms-on-the-move including vehicles, aircraft and UAVs
- Man-packs
- Portable communication systems
- Compact, low-power VSAT terminals
- Satellite news gathering
- Disaster recovery

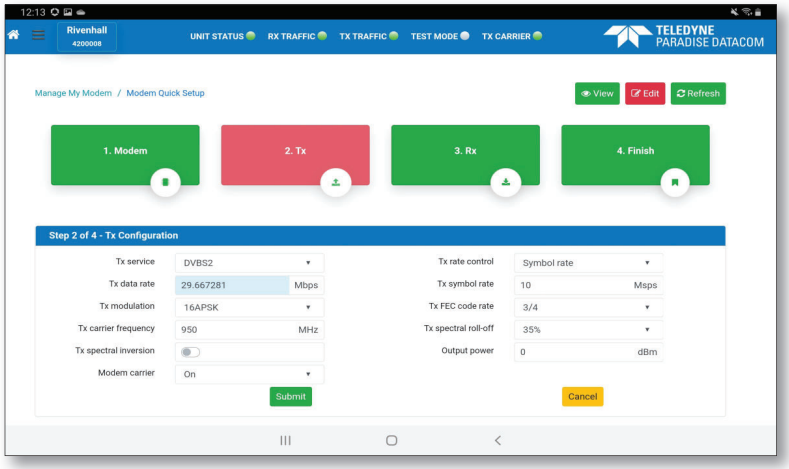


New Web User Interface

The AXIOM-X M&C is via an intuitive Ethernet based web browser ideally suited to use on a tablet, Mobile or laptop PC and allows the user to install, configure and monitor the Modem with ease. In addition, WiFi capability further enhances the ease of use and provides greater flexibility for remote control and installation using portable devices.



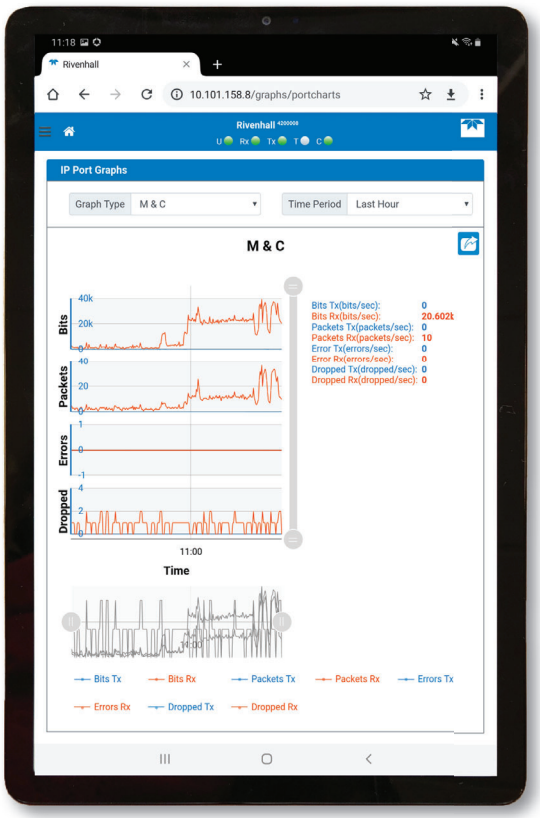
Clear, Intuitive Home views allows easy, one click navigation direct to the required fields



Easy flow configuration allowing quick set-up of key parameters (upper)

Network tree overview (lower)

Tablet view allowing easy on the move Browsing



Built for the Most Stringent Portable Applications

SECURE

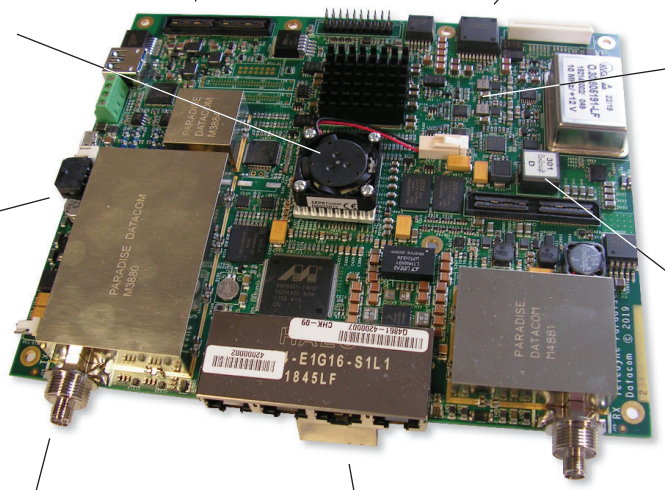
- SCPC is both secure, and with Paradise Modems, easy to provision
- For enhanced security, AES-256 encryption is built in

COMPATIBLE

- Reuse your existing code
- No need for extensive retraining of maintenance staff
- Inclusion of SMA connectors with the same spacing as Q-Lite aids compatibility

STATE OF THE ART

- DVB-S2X up to 256APSK provides the highest bandwidth efficiency
- Advanced compression and acceleration features optional
- Ideal for use with constellations



RUGGED

Single card, wide operating temperature range of -40 to +85°C with optional advanced temperature testing results for each card shipped

CONVENIENT

Optional BUC Power Supply reduces need for external equipment

COMPACT & EFFICIENT

Small size and weight

WELL EQUIPPED

Transmitter

Fast: Up to 345 Mbps, 70Msps
Output power 0 to -40dBm

4 Gigabit Ethernet Ports

Convenient – no need for an external switch, saving space, power, wiring; Layer 2 Bridging, Layer 3 Routing

Receiver

Fast: Up to 230Mbps, 70Msps

RF Stages

- Future Proof: Transmit and receive speeds upgradeable in the field – only pay for the capacity you need now
- L-band coverage from 950 to 2,150 MHz

Main Specifications

Topology	Point to Point or Star Modem within a Point to Multipoint Network
Standard	**DVB-S2:** (EN 302 307-1) **DVB-S2X:** (EN 302 307-2) (Supports all DVB-S2 & DVB-S2X MODCOD's including Linear MODCOD's)
Frequency	**L-band:** 950 to 2150MHz (resolution 1Hz)
Data Rates	**Standard:** 2,048kbps **Options:** 5Mbps, 10Mbps, 25Mbps, 100Mbps, 230Mbps (Rx) & 345Mbps (Tx only)
Data Rate Limits	**DVB-S2/S2X:** 100kbps to 345Mbps Tx & 100kbps to 230Mbps Rx
Tx Symbol Rate Limits	**DVB-S2/S2X:** 100ksps to 70Msps
RX Symbol Rate Limits	**DVB-S2/S2X:** 100ksps to 70Msps (64Msps@ 16APSK, 52Msps @ 32APSK, 43Msps @ 64APSK, 36Msps @ 128APSK, 32Msps @ 256APSK)

Router Specifications

Network Support	Layer 2 Bridging, Layer 3 Routing, Jumbo Frames to 10k bytes, 160k pps Trunking Mode: Supporting 230Mbps bi-directional traffic at up to 350k pps, each way
Management	HTTP/S Web Server, SNMP v1, v2c & v3, AAA RADIUS Secure User Login & Access Control Lists, SSH, Q-NET™ Navigator
Protocols	IPv4/IPv6, IEEE 802.1q /p VLAN support, Software Defined Network Support, NAT, DHCP, Network Time Protocol (NTP), sFlow Performance Metrics, Active Queue Management (AQM), MPEG over IP, OpenAMIP Protocol Support, Inter VLAN Routing Support with Virtual Routing & Forwarding
Advanced IP Features	Robust Header Compression (RFC 3095), Payload Compression, Dynamic Routing (RIP V1, V2; OSPF V2, V3; BGP V4), TCP Acceleration, **AES-256 Encryption**
DVB Features	ACM/VCM, DVB Encapsulation, GSE Encapsulation

Modulator Specifications

Modulator	**DVB-S2:** QPSK, 8PSK & 16APSK **DVB-S2X:** QPSK, 8PSK, 8APSK-L 16APSK, 16APSK-L, 32APSK, 32APSK-L, 64APSK & 64APSK-L **Options for Advanced Modulation:** 128APSK, 256APSK and 256APSK-L
Output Power	0 to –40dBm (950 to 2,150MHz)
Transmit Filter Roll-off	**DVB-S2:** 20%, 25%, 35% **DVB-S2X:** 5%, 10%, 15%, 20%, 25%, 35%
Harmonics & Spurious	Better than –55dBc/ 4kHz in-band (at 0dBm to –30dBm output)
BUC PSU SAF Option	Allows either 24V DC, or separate 48V input to be used to power a BUC via the IFL (4A Max)
BUC 10MHz Reference	Via IFL cable; 10MHz ± 0.01 ppm; 2dBm ± 2dBm
QoS	Provides guaranteed throughput for priority traffic; supports Committed and Burst Information Rates. Stream classification by VLAN ID, IP address, IEEE 802.1p priority, Diffserv DSCP, & MPLS EXP

Demodulator Specifications

Demodulator	**DVB-S2:** QPSK, 8PSK & 16APSK **DVB-S2X:** QPSK, 8PSK, 8APSK-L 16APSK, 16APSK-L, 32APSK, 32APSK-L, 64APSK & 64APSK-L **Options for Advanced Modulation:** 128APSK, 256APSK and 256APSK-L
Enhanced Doppler	**Frequency shift:** up to ±330kHz; r**ate of change** up to ±100kHz/s (symbol rate dependent)
Receive Filter Roll-off	**DVB-S2:** 20%, 25%, 35% **DVB-S2X:** 5%, 10%, 15%, 20%, 25%, 35%
Input Range	**Minimum:** -140 + 10 log (symbol rate) **Maximum:** -78 + 10 log (symbol rate)
LNB Voltage	Selectable 13V, 15V, 18V or 20V DC to LNB via IFL cable; maximum 0.5A

Interface, Mechanical and Environmental Specifications:

Traffic	4-port Gigabit Ethernet switch (RJ45 connectors; Interface used for IP traffic and M&C)
IF Tx and Rx	L-band: 950 to 2,150MHz (resolution 1Hz) SMA connectors
Power Supply	Regulated 24 Volt DC input ± 0.5V (not provided) Power consumption 30W max
Mechanical	Size: 184 x 152 x 18mm[1]; Weight: 288g
Environmental	-40°C to 85°C Operating Temperature; 95% relative humidity, non-condensing, FCC, CE and RoHS compliant, Safety: EN62368-1:2014 Edition 2, Emissions: EN55032:2015 Class B, Immunity: EN55035:2017; Shock & Vibration– MIL-810G currently in progress

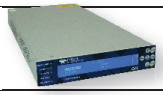
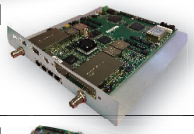
[1] 18mm tall with heatsink fan. Customers may use their own cooling, in which case height is 13mm without fan

Comparing AXIOM-X to Q-Lite

Specification	AXIOM-X Family	Q-Lite
Data Rate	Tx: 345 Mbps Rx: 230 Mbps	345 Mbps
Symbol Rate	Tx: 70 Msps Rx: 70 Msps [2]	70 Msps
Modulation	DVB-S2X up to 256APSK	DVB-S2X up to 256APSK
RF Frequency Range	L: 950 to 2,150 MHz	IF: 50 to 180 MHz L: 950 to 2,450 MHz
RF Tx Power Range	L: 0 to -40 dBm	IF: 0 to -25 dBm L: +5 to -40 dBm (950 to 1,950 MHz) 0 to -40 dBm (1,950 to 2,150 MHz) 0 to -30 dBm (2,150 to 2,450 MHz)
RF Connector	SMA Connectors	TNC IF & L
PCMA Bandwidth	N/A	72 MHz
Terrestrial Interface Slots	N/A	Choice of Two
Ethernet M&C/ Traffic Ports	1 M&C, 3 Traffic	IP: 1 M&C, 3 Traffic
Size, Weight	184 x 152 x 18mm, 0.29kg	255mm x 184mm, 0.35kg
Cooling	OEM Terminal Dependent	Terminal Dependent or 2 Fans: 1 Side, 1 Rear Mounted

[2] 70Msps available with QPSK and 8PSK, 64Msps@ 16APSK, 52Msps @ 32APSK, 43Msps @ 64APSK, 36Msps @ 128APSK, 32Msps @ 256APSK

The Paradise Family of Secure SCPC Modems

Paradise SCPC Modems		Point-to-Point	Point-to-MultiPoint, Star, Mesh, Hybrid		Form Factor	Features of Note
			Hub or Remote Site	Remote Site		
Standard	QFlex-400	✓			1U 19" Rack	PCMA+ enhanced carrier overlay available
	QMultiFlex-400	✓	✓			Optional Embedded Hub Canceller
	QFlex-400 P2MP			✓		Configured remote
CubeSat-Focused	QubeFlex	✓				Small Sat/LEO - Support for CCSDS
Small Form Factor	Q-Lite Rugged	✓				IP65 weatherproof outdoor satellite modem
	Q-Lite Half Width	✓				Mountable as two side by side within 1U rack space
	Q-Lite Card	✓			Card 	For OEM integration.
	AXIOM-X (New)	✓			Card 	Our smallest modem.

All modem models except QubeFlex are also available as encrypted models, capable of TCP/IP packet payload encryption using symmetric AES with 256-bit keys. Note that these models are export controlled.

Ordering: AXIOM-X Encryption

Standard Features		Description
	☑	**100kbps to 2.048Mbps DVB-S2 CCM/ACM** (EN 302 307-1) **Modem**, Supporting QPSK, 8PSK & 16APSK, 20%, 25% & 35% Roll off, with **4-port Gigabit Ethernet switch for M&C and traffic**; **L-band** operation 950 to 2,150MHz; high-G 10MHz reference (with G sensitivity rating of 1 x10^{-9}/g) **AUPC:** Automatic Uplink Power Control **Traffic Shaping:** Supports CIR/BIR/priority settings for IP streams classified by IP address, Diffserv class, IEEE 802.1p priority tag, MPLS EXP field, and VLAN ID **Dynamic Routing:** RIP, OSPF and BGP
	☑	**AES-256 Encryption:** TCP/IP packet payload encryption using symmetric AES with 256-bit keys

Optional Features		
Extend Tx Data Rate	○	**5Mbps data rate:** Extends base operation to 5Mbps
	○	**10Mbps data rate:** Extends 5Mbps operation to 10Mbps
	○	**25Mbps data rate:** Extends 10Mbps operation to 25Mbps
	○	**100Mbps data rate:** Extends 25Mbps operation to 100Mbps
	○	**345Mbps data rate:** Extends 100Mbps operation to 345Mbps
Extend Rx Data Rate	○	**5Mbps data rate:** Extends base operation to 5Mbps
	○	**10Mbps data rate:** Extends 5Mbps operation to 10Mbps
	○	**25Mbps data rate:** Extends 10Mbps operation to 25Mbps
	○	**100Mbps data rate:** Extends 25Mbps operation to 100Mbps
	○	**230Mbps data rate:** Extends 100Mbps operation to 230Mbps
Add Advanced IP Features	○	**Header Compression:** IP/UDP/TCP/RTP packet header compression (RFC 3095) plus Ethernet header compression **Payload Compression:** TCP/UDP packet payload compression using the Deflate algorithm (RFC 1951)
	○	**TCP Acceleration:** Up to 10,000 concurrent accelerated TCP connections to 100Mbps subject to prevailing data rate limits
DVB-S2X Tx/Rx	○	DVB-S2X CCM, ACM, VCM: QPSK, 8PSK, 8APSK, 16APSK, 32APSK & 64APSK Tx/Rx operation per EN 302 307-2. Includes 5%, 10%, 15%, 20%, 25% & 35% spectral roll-offs. Includes DVB features; ACM, VCM and DVB encapsulation. To 345/230Mbps subject to prevailing modem data rate limits.
Advanced Modulation	○	DVB-S2X Advanced Modulations: 128APSK, 256APSK, 256APSK-L
BUC PSU SAF	○	Enables the BUC PSU software feature to provide DC via the IFL to power a BUC. 4A Max at 24V supplied via the Modem PSU or 48V can be separately connected to the IFL via the AXIOM-X
Advanced Temperature Testing	○	-40 to +85°C temperature cycling, full test results & certificate provided on shipment.

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