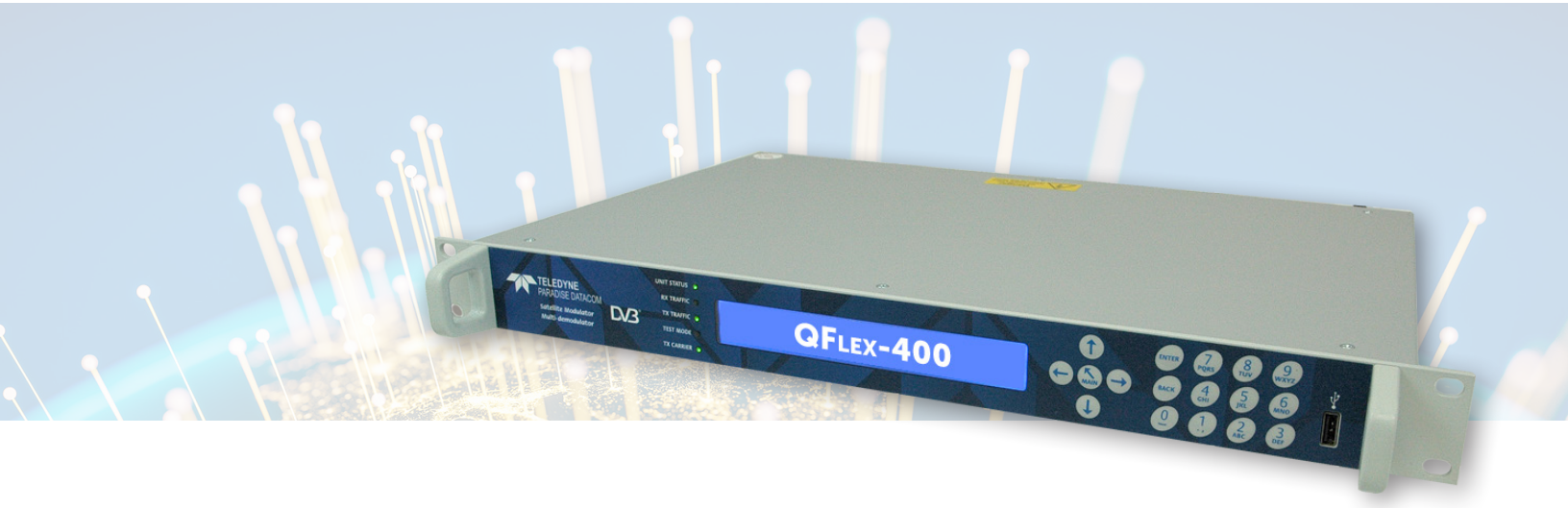
QFlex-400™

Dual IF/L-Band Satellite Modem



A Foundational Member of the Paradise Modem Family

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

TELEDYNE
PARADISE DATACOM
Everywhereyoulook™

Overview

Our Flagship QFlex-400 software defined Satellite Modem is our highest data rate Modem to date. The unit supports data rates to 345Mbps, has an extended L-band frequency range, better RF performance, improved carrier cancellation with paired carrier+, higher processing capability allowing for future upgrades and yet, is smaller and lighter than it's predecessors and has the lowest power consumption to date.

It is ideal as a versatile point-to-point network modem or a remote modem in a point-to-multipoint network. It is fully compatible with our Q-NET™ satellite network solution and is a drop-in replacement for the Q-Flex™ and Q-Lite™ satellite Modems.

Markets and Applications

- IP trunking & IP/cellular backhaul
- Fiber backup restoral services
- Corporate & government networks
- Maritime, oil & gas communications
- Broadcast (H.264/H.265, HD, Ultra HD, etc.)
- Universal service obligation networks
- Disaster recovery
- Hub modem for Q-Lite VSAT terminals

Features

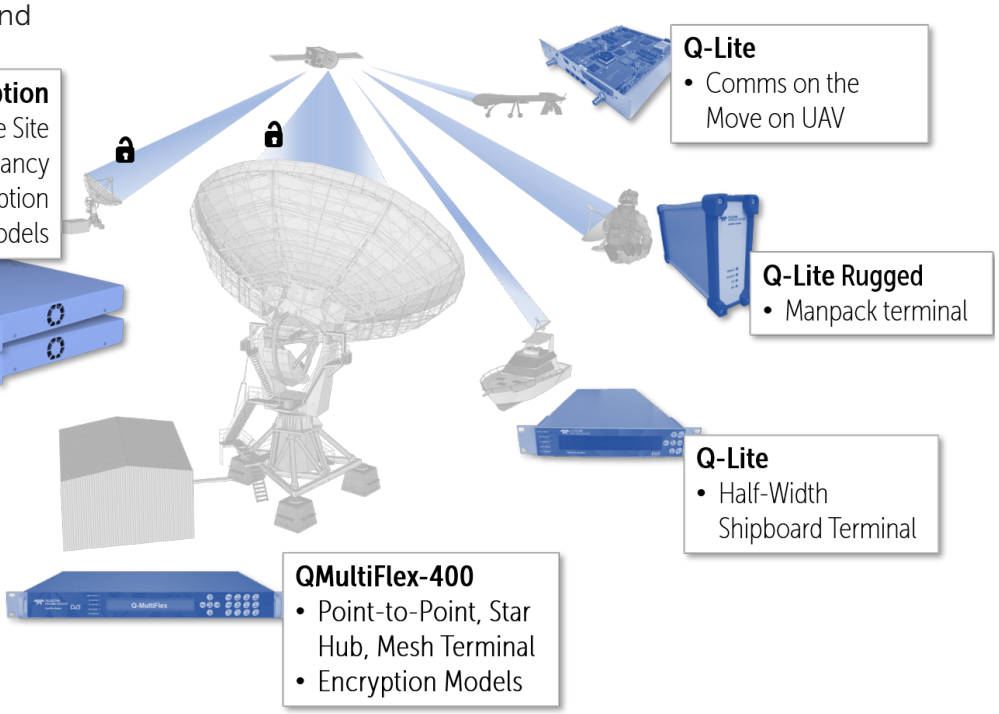
- Dual IF/L-band; data rates to 345Mbps
- Low power consumption, typically 30W
- XStream IP™ advanced IP optimization suite, including TCP Acceleration, header & payload compression, dynamic routing, traffic shaping, jitter reduction & ACM
- DVB-S2/S2X & FastLink™ LDPC
- Optimized spectral roll-offs, including 5%
- Paired Carrier+™ enhanced carrier overlay
- LinkGuard™ signal-under-carrier interference detection
- Built-in spectrum & constellation monitors
- DVB Carrier ID (to DVB-CID standard)
- Q-NET™ Navigator network control app
- Interoperates fully with Q-Flex™ & Q-Lite™
- Software Defined Network support: vendor-independent network device control using standard commands (supports OpenFlow)

The Q-Net Family

Q-Net is a fabric that allows each of the Q-Series modems to seamlessly inter-operate giving you the ability to upgrade your network and re-use assets at will.

The different models have been thoughtfully designed to cover a wide variety of network situations flexibly and securely.

From models with WGS certification and encryption, to built-in features like 1:1 redundancy and test tools, we give you the lowest risk, highest return secure network available.



Why QFlex-400?

Our Flagship Software Defined Modem is Paradise Datacom's most innovative and flexible Satellite Modem to date

STATE OF THE ART

- DVB-S2X up to 64APSK provides the highest bandwidth efficiency
- FastLink Low latency LDPC provides advanced optimisation modes for latency sensitive applications.

SECURE

- SCPC is both secure, and with Paradise Modems, easy to provision
- For enhanced security, AES-256 encryption is optionally built in
- AAA Radius support and access control lists.

COMPATIBLE

- Reuse your existing code
- Drop in replacement for the Q-Flex and Q-Lite Modems
- No need for extensive retraining of Maintenance staff
- Supports legacy interfaces and FEC schemes
- Supports IF and L-band in one unit.

CONVENIENT

- Optional BUC power Supply reduces need for external equipment
- Built in Spectrum Analyser and Constellation monitor

PRACTICAL

- 1U rack mount chassis
- Simple front panel control with backlit LCD
- Intuitive web browser and Q-Net compatible
- Built in test tools, no need for expensive test equipment

EFFICIENT

- Paired Carrier+ saving up to 50% Bandwidth
- 5% spectral roll off saving 15% bandwidth over the standard 20%
- Advanced optimisation features, including TCP acceleration, Header and Payload compression.

WELL EQUIPPED

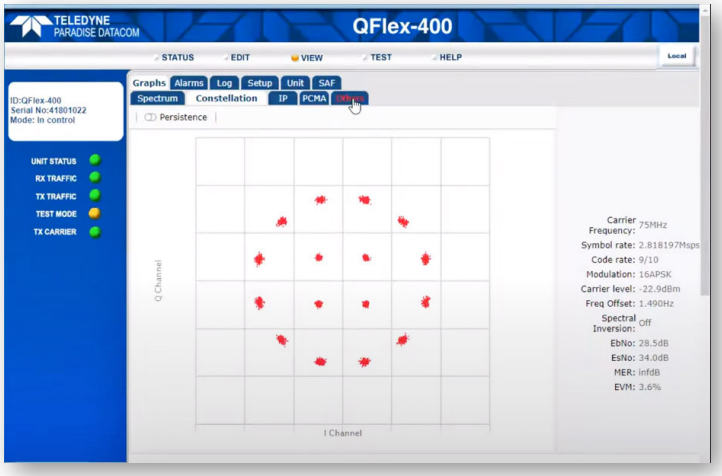
Transmitter
Fast:
- Up to 345Mbps/ 70Msps
- Output power: IF 0 to -25dBm; Standard L-Band +5 to -40dBm

Interface Ports
Convenient:
- For IP traffic and legacy interfaces
- Allowing seamless migration from serial to IP
- 4 GB Ethernet ports, Layer 2 Bridge, Layer 3 router.

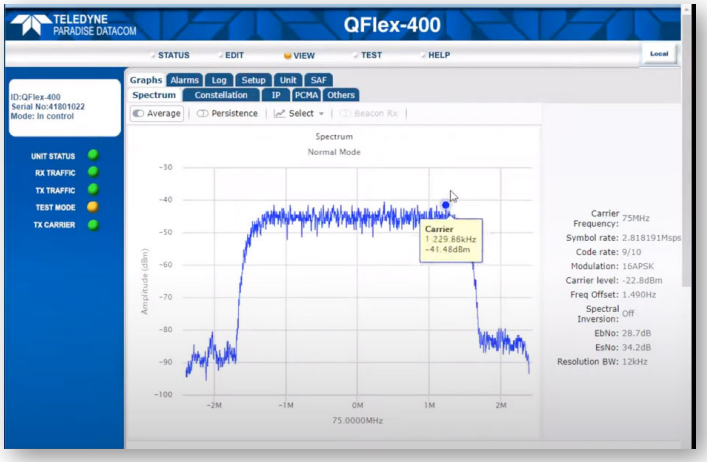
RF Stages
Future Proof:
- Transmit and Receive speeds field upgradeable, only pay for the capacity you need now
- Extended L-Band coverage from 950 to 2,450 MHz
- Wideband IF 50 - 180MHz

Receiver
Fast:
- Up to 345Mbps/ 70Msps

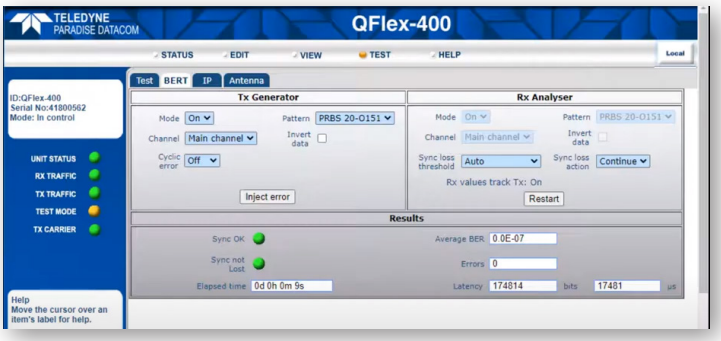
Powerful Onboard Test Equipment



Constellation view: The Rx Constellation Monitor can be used to check for correct modem operation including checking for signal distortion and phase noise. The persistence mode is useful for showing any long-term effects due to phase noise and interference.



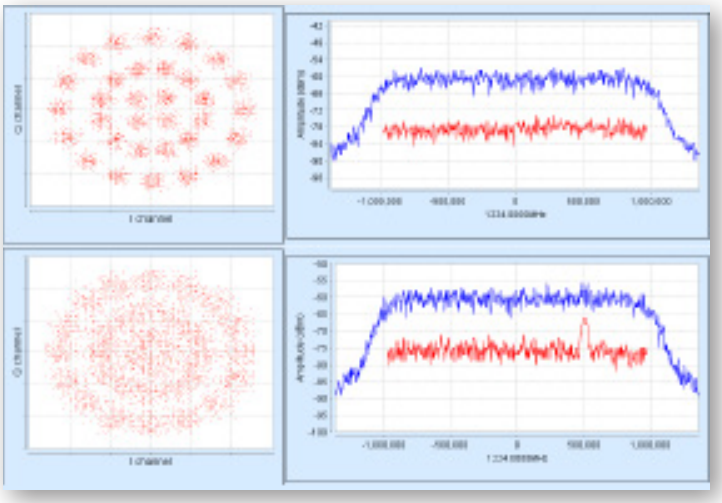
Spectral view: The Rx Spectrum Monitor is a powerful real-time spectrum analyser within the modem that is used to view the received signal spectrum. The monitor can not only display the wanted carrier but a Super Wide view allows checking for adjacent interfering carriers.



Inbuilt Bit Error Rate Test Set (BERT): The internal PRBS BER Tester allows pseudo-random bit patterns to be injected into the main traffic or overhead channel and the BER results to be monitored. Use of the ESC and AUX channels allows continuous real time traffic performance monitoring whilst the modem carries traffic. As well as average BER, number of bit errors and sync status, latency can also be measured.

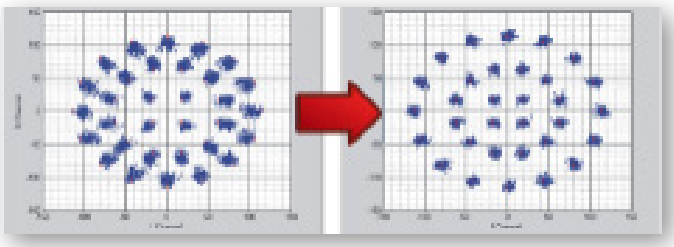
LinkGuard™ Interference Detection

Built-in Spectrum Analyser showing LinkGuard™ Signal-Under-Carrier interference detection without/with interferer present.

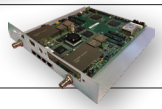


ClearLinQ™

'Before and after' constellations showing ClearLinQ™ Adaptive Tx Pre-distorter compensating for severe non-linear signal distortion to a 32APSK carrier.



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
	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.

The QFlex-400, Q-Lite, Q-Lite Half Width and Q-Lite Rugged models are also available as **WGS-certified** models.

Advanced Bandwidth-Efficient Features

The QFlex-400™ modem supports the most powerful bandwidth-saving technology available.

DVB-S2X, is between 20% and 60% more bandwidth efficient than its predecessor, DVB-S2.

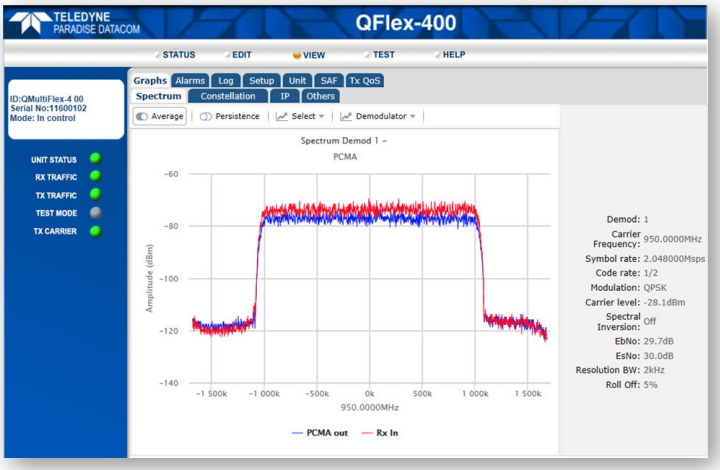
Paired Carrier+™ is our enhanced carrier overlap technology that allows transmit and receive carriers to occupy the same space segment.

XStream IP™ bandwidth-saving IP features include ACM, acceleration and header and payload compression.

Paired Carrier+: used to reduce the occupied satellite bandwidth by up to 50% by overlaying the transmit and receive carriers in the same space segment. Adaptive self-interference cancellation is used to remove the unit's transmitted signal from the composite received signal, leaving just the desired signal.

Included Network Management

Q-NET Navigator supports monitor and control of all Paradise modems from a single application. Includes easy-to-use navigation, support for multiple operator roles / access levels, continuous status / alarm polling and full access to all modem features. The web based Q-NET Navigator is included as standard, free of charge.



Main Specifications

Topology	Point to Point or Star Modem within a Point to Multipoint Network
Frequency	**L-band:** 950 to 2,450MHz (resolution 1Hz) **IF:** 50 to 180MHz (resolution 100Hz) N-type connectors for Tx & Rx
Data Rates	**Standard:** 2,048kbps **Options:** 5, 10, 25, 60, 100, 200 & 345Mbps
Data Rate Limits	**DVB-S2/S2X:** 55kbps to 345Mbps **FastLink™ LDPC:** 18kbps to 100Mbps (1bps resolution) **TPC:** 2.4kbps to 60Mbps (1bps resolution)
Symbol Rate Limits	**DVB-S2/S2X:** 150ksps to 70Msps **FastLink™ LDPC:** 18ksps to 40Msps **TPC:** 2.4ksps to 40Msps
Operating Modes	**DVB-S2/S2X** (EN 302 307-1 & EN 302 307-2) **Closed Network** (+ ESC) (IESS-315) **IBS/IDR** (IESS-308/309/310/314) options
Impedance	50Ω
Return Loss	**L-band:** 950MHz to 2GHz >16dB 2GHz to 2.45GHz >12dB **IF:** > 18dB
Redundancy	1:1 through 1:16 redundancy

Modulator

Output Power	**IF:** 0 to –25dBm (0.1dB steps) **L-band:** +5 to –40dBm (950 to 1950MHz) 0 to –40dBm (1950 to 2150MHz) 0 to –30dBm (2150 to 2450MHz) (0.1dB steps)
Output Power Stability/ Accuracy	Stability: ±1.0dB, 0°C to 50°C Accuracy: ±0.375dBm
Transmit Filter Roll-off	5%, 10%, 15%, 20%, 25%, 35%
Phase Accuracy	±2° maximum
Amplitude Accuracy	±0.2dB maximum
Carrier Suppression	-30dBc minimum
Output Phase Noise	As EN 302 307, EN 300 421, IESS-308 & EN 301 210; minimum 16dB better than IESS-308/309
Harmonics & Spurious	Better than –60dBc/ 4kHz in-band
Transmit On/ Off Ratio	-65dB minimum
BUC PSU Option	24V or 48V DC via IFL cable, 200W
BUC 10MHz Reference	Via IFL cable; 10MHz ± 0.01 ppm; 2dBm ± 2dBm
FSK Control	Allows monitor & control of a compatible L-band BUC from the modem via the Tx IFL cable

Demodulator

Input Range (dBm)	IF minimum: -130 + 10 log (symbol rate) L-band minimum: -140 + 10 log (symbol rate) IF/L-band maximum: -68 + 10 log (symbol rate)
Maximum Input Power	+10dBm
Wanted-to-Composite	-102 + 10 log (symbol rate)
Frequency Sweep Width	±1kHz to ±255kHz (1kHz steps)
Acquisition Time	Dependent on FEC, data rate and sweep width
Receive Spectral Roll-off	5%, 10%, 15%, 20%, 25%, 35%
LNB 10MHz Reference	Via IFL cable; 10MHz ± 0.01ppm; 2dBm ± 2dBm
LNB Voltage	Programmable 13V, 15V, 18V, 20V or 24V DC to LNB via IFL cable; maximum 0.5A

Test Facilities & Alarm Outputs

Built-in Test Tools	As part of built-in web server: Rx constellation monitor; Rx spectrum analyser; **LinkGuard™** Signal-Under -Carrier interference detection; beacon receiver function that provides automatic detection of satellite beacon transmissions time graphs for key performance indicators (IP throughput, Eb/No, etc.)
BER Tester	Bit error rate tester operates over main traffic or ESC channel, allowing BER monitoring while on traffic. Not available in DVB-S2/S2X modes. Supports various test patterns compatible with common BER testers
Other Test Modes	Transmit CW Transmit alternate 1-0 pattern Simulated satellite delay for TCP/IP packets
Alarm Relays	4 independent Form C relays for unit, Tx, Rx and deferred alarms

Mechanical/Environmental

Size	1U chassis, 285mm deep excluding front panel handles and rear panel connectors and fans
Weight	3kg
Power Supply	90 to 264VAC, 1A @100V, 0.5A @240V, 47 to 63Hz Fused IEC connector (live and neutral fused); 24V and 48V DC options
Compliance	FCC, CE and RoHS compliant
Safety Standards	EN62368-1:2014,Edition 2
Emissions & Immunity	Emissions: EN 55032:2015 Class A Immunity: EN 55032:2017
Temperature	Standard: 0 to 50°C; Storage: -20°C to 70°C
Humidity	95% relative humidity, non-condensing

Features

ClearLinQ™ Adaptive Tx Predistorter ⊙	Corrects for linear & non-linear distortion in the RF chain (i.e. amplifier and transponder). Applicable to all FECs and modulations. Maximises amplifier linear output power; minimises required back-off. Up to 2dB performance gain
DVB-S2/S2X Rx Adaptive Equaliser	Corrects for slope on the carrier and group delay (typically found at transponder edges, causing inter-symbol interference). The 9-tap Rx equaliser is provided as standard; automatically switched on above 10Msps
DVB Carrier ID Option (ETSI TS 103 129) ⊙	Supports the identification of interfering carriers. Allows identification of individual modem carriers by superimposing a low-power CID waveform onto the carrier with negligible degradation. Supported for all carriers. The CID waveform contains a unique Carrier ID and other identity information. A carrier monitoring system is required to decode CID waveforms
Traffic Interfaces ⊙	**Standard:** **4-port Gigabit Ethernet switch** (RJ45 connectors; used for IP traffic and M&C) **Options:** **EIA-530** (RS422, X.21, V.35 and RS232 on 25-pin D-type female) **G.703** E1/T1, E2/T2, E3/T3 (balanced on RJ45; unbalanced 75Ω BNC female) **Quad E1 G.703** (balanced RJ45) **Quad ASI** (75Ω BNC female) **Serial LVDS** (25-pin D-type female) **HSSI** (50-pin HD SCSI-2 connector) **IDR** (to IESS 308; 50-way female D type connector)
Utility Interfaces	**9-way D type** for 1:1 and 1:N redundancy (compatible with Q-NET PDQS Redundancy Switch); **15-way D type** for alarms (4 independent Form C relays for unit, Tx, Rx and deferred alarms), Tx Inhibit signal and scalable DC voltage output for antenna pointing; **USB connector** for software upgrades, etc.; **Second fan; FSK signalling**

Paired Carrier+™ Option ⊙

Paired Carrier+™	Transmit and receive carriers are overlaid in the same space segment. Echo cancellation techniques are used to cancel the unwanted transmit carrier, leaving the wanted receive carrier. Supports an occupied bandwidth between 25kHz and 70MHz depending on licence
Data Rate Options	256kbps, 512kbps, 1024kbps, 2.5Mbps, 5Mbps, 10Mbps, 15Mbps, 20Mbps, 25Mbps, 30Mbps, 40Mbps, 50Mbps, 60Mbps, 80Mbps, 100Mbps, 200Mbps and 345Mbps traffic rate
Carrier Asymmetry	**Symbol rate:** Up to 10:1
Max Sym Rate	70MBaud (carrier roll-off 10% max)
Min Sym Rate	25kBaud
Delay Range	0 to 350ms
Cancellation Range	-10 to +10dB local to remote carrier
Cancellation ratio	28dB typical
Es/No degradation (symmetric carriers)	<0.1dB for Es/No ≤ 7dB. <0.2dB for 7dB < Es/No ≤ 11dB. <0.4dB for 11dB < Es/No ≤ 14dB. <0.5dB for 14dB < Es/No ≤ 16dB. <1.0dB for 16dB < Es/No ≤ 18dB. <1.5dB for 18dB < Es/No ≤ 20dB. <2.0dB for 20dB < Es/No ≤ 22dB.
Monitoring	Delay, frequency offset, power offset, lock status, channel amplitude slope and group delay (consult sales)
Mobile Operation	Uses GPS data to continually recalculate position relative to satellite, allowing uninterrupted operation in mobile environments anywhere in satellite footprint

Forward Error Correction

DVB-S2X EN 302 307-2 ⊙ Includes support for DVB-S2	**Normal Frame:** **QPSK** 13/45, 9/20, 11/20 **8PSK** 23/36, 25/36, 13/18 **8APSK-L** 5/9, 26/45 **16APSK** 26/45, 3/5, 28/45,23/36, 25/36, 13/18, 7/9, 77/90 **16APSK-L** 5/9, 8/15, 1/2, 3/5, 2/3 **32APSK** 32/45, 11/15, 7/9 32APSK-L 2/3 **64APSK** 11/15, 7/9, 4/5, 5/6 64APSK-L 32/45 **Short Frame:** **QPSK** 11/45, 4/15, 14/45, 7/15, 8/15, 32/45 **8PSK** 7/15, 8/15, 26/45, 32/45 **16APSK** 7/15, 8/15, 26/45, 3/5, 32/45 **32APSK** 2/3, 32/45
DVB-S2 EN 302 307-1	**QPSK** 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 **8PSK** 3/5, 2/3, 3/4, 5/6, 8/9, 9/10 **16APSK** 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 **32APSK** 3/4, 4/5, 5/6, 8/9, 9/10
FastLink™ Low-Latency LDPC ⊙	**BPSK** 0.499 **(O)QPSK** 0.532, 0.639, 0.710, 0.798 **8PSK/8QAM** 0.639, 0.710, 0.778 **16APSK/16QAM** 0.726, 0.778, 0.828, 0.851 **32APSK** 0.778, 0.828, 0.886, 0.938 **64QAM** 0.828, 0.886, 0.938, 0.960

⊙ Optional Functionality

Ethernet: Standard Features

Bridging and Static Routing	**Trunking mode:** Hardware Layer 2 switch supporting 345Mbps bi-directional traffic at up to 200,000 packets per second; zero jitter **Layer 2 bridge & Layer 3 router:** Software processing capability nominally 150k packets per second. However, this is derated when internal optimisation features are enabled
IPv4/IPv6	Dual IPv4/IPv6 TCP/IP supporting IPv4/IPv6 bridging and routing
VLAN Support	IEEE 802.1q VLAN support IEEE 802.1p packet prioritisation using strict priority or fair weighting queuing
Software Defined Network Support	OpenFlow and other WA-SDN protocols provide support for network virtualisation; see Q-NET Satellite Network Solution whitepaper for more details
DHCP	DHCP client for automatic allocation of M&C IP address; DHCP server allocates IP addresses to network devices
NAT	NAT firewall; allows all network devices to share a single IP address when viewed from other end of satellite link
SNMP	SNMP v1, v2c & v3
Access Control Lists	Separate IP and MAC address black/white user access control lists
Network Time Protocol (NTP)	NTP client synchronises modem time & date to NTP server; provides millisecond accuracy
Web Server	Modem web server M&C interface (including built-in tools listed under Test Facilities)
AAA RADIUS Secure User Login	Authentication, Authorisation & Accounting. Greater access control & accountability. Replaces standard modem login with user's personal network login credentials
IP Metrics	Tx, Rx throughput (bps, pps) graphs; dropped, errored packet counts
sFlow Performance Metrics	sFlow is the industry standard for network monitoring, giving full modem performance visibility to sFlow compatible network management devices
Active Queue Management (AQM)	Implements CoDel (controlled delay) which overcomes buffer bloat by maintaining a constant delay through the modem for all IP packets
MPEG over IP	Supports the efficient transfer of SMPTE 2002-2 MPEG2 transport streams over satellite
OpenAMIP Protocol Support	Controls modem interaction with compliant antenna control units to support antenna deployment/pointing/tracking
Virtual Routing & Forwarding	VRF supports multiple modem routing tables, allowing inter-VLAN routing
Packet Generator/Analyser	Generates & analyses TCP & UDP packet streams, allowing modem-to-modem IP testing without any PCs
Ethernet MTU Size	Standard: 10k bytes

Ethernet: XStream IP™ Option

Description	XStream IP™ is an integrated set of IP optimization and traffic management features designed for maximum reliability and bandwidth efficiency. The maximum throughput depends on features enabled & traffic format
Traffic Shaping	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, PID & MPLS EXP
Header Compression	Robust Header Compression (RFC 3095). Reduces Ethernet/IP/UDP/TCP/RTP header sizes typically by 90%. 1-way packet processing limit: 60,000 pps; 2-way limit: 45,000 pps. Includes Ethernet header compression (compresses 14-byte Ethernet frame to typically one byte)
Payload Compression	Uses Deflate algorithm (RFC 1951) to compress TCP & UDP packets; typical payload compression of 50%
Dynamic Routing	RIP V1, V2; OSPF V2, V3; BGP V4
TCP Acceleration	Typical throughput level of 90% of link capacity. Supports 4,400 concurrent accelerated TCP connections (plus at least 40,000 unaccelerated TCP connec-tions) up to 100Mbps
AES-256 Encryption	Supported on the QFlex-400E model only.

Ethernet: XStream IP™ DVB-S2X

Note	Provided as standard as part of DVB-S2/S2X
ACM	Dynamically varies modcod with varying link conditions, maximises throughput at all times by converting unused link margin into additional throughput; 100% link availability
IP-over-DVB Encapsulation	Supports the transmission of IP packets with/without Ethernet frames over DVB-S2/S2X; encapsulates & decap-sulates using GSE (see below), MPE (EN 301 192), ULE (RFC 4326) or Paradise XStream Encapsulation (PXE)
GSE Encapsulation	Highly efficient encapsulation of IP packets or Ethernet frames; compatible with EN 302 307-2 standard, for use with DVB-S2 and DVB-S2X

Network Control

Description	Web browser user interface support is provided as standard. SNMP and command line interfaces support the development of third-party user interfaces. In addition, the following network control application options are available
Q-NET™ Navigator	Allows all modems and third-party network devices to be fully controlled through a single application. It provides an easy-to-navigate site map, summary status reporting, etc. Provided as standard, free of charge

Ordering: QFlex-400™

Standard Features		Description
Base Modem	☑	2.4kbps to 2.048Mbps Tx/Rx Closed Network (+ ESC) modem with 4-port Gigabit Ethernet switch for M&C and traffic. Front-panel keypad and display IF operation 50 to 180MHz. L-band operation 950 to 2450MHz; high-stability 10MHz reference TPC: BPSK, QPSK, OQPSK, 8PSK, 8QAM and 16QAM; to 60Mbps subject to prevailing modem data rate. All features described under Ethernet Standard Features. All features described under Test Facilities AUPC: Automatic Uplink Power Control AC mains input
Optional Features		
Tx Only	☐	Transmit functions only
Rx Only	☐	Receive functions only
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
	☐	**60Mbps data rate:** Extends 25Mbps operation to 60Mbps
	☐	**100Mbps data rate:** Extends 25Mbps operation to 100Mbps
	☐	**200Mbps data rate:** Extends 100Mbps operation to 200Mbps (DVB-S2 & DVB-S2X only)
	☐	**345Mbps data rate:** Extends 200Mbps operation to 345Mbps (DVB-S2 & DVB-S2X only)
XStream IP™	☐	**Xstream IP Bundle,** includes all of the features listed below:
		Traffic Shaping: Supports CIR/BIR/priority settings for IP streams classified by VLAN ID, IP address, Diffserv class, IEEE 802.1p priority, MPLS EXP field & MPEG2 transport stream PID
		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)
		Dynamic Routing: RIP, OSPF and BGP
		TCP Acceleration: Up to 4,400 concurrent accelerated TCP connections to 100Mbps subject to prevailing data rate
DVB-S2X To 345Mbps subject to prevailing modem data rate limits	☐	**DVB-S2/S2X CCM Tx:** DVB-S2 QPSK, 8PSK, 16APSK & 32APSK Tx operation per EN 302 307-1. DVB-S2X QPSK, 8PSK, 8APSK, 16APSK, 32APSK & 64APSK Tx operation per EN 302 307-2. Includes 5%, 10%, 15%, 20%, 25% & 35% spectral roll-offs. Includes XStream IP™ DVB-S2X, which comprises ACM, VCM and IP-over-DVB encapsulation
	☐	**DVB-S2/S2X CCM Rx**: Add-on card supporting DVB-S2 QPSK, 8PSK, 16APSK & 32APSK Rx operation per EN 302 307-1. DVB-S2X QPSK, 8PSK, 8APSK, 16APSK, 32APSK & 64APSK Rx operation per EN 302 307-2. Includes 5%, 10%, 15%, 20%, 25% & 35% spectral roll-offs. Includes XStream IP™ DVB-S2X, which comprises ACM, VCM and IP-over-DVB decapsulation
FastLink™ Low-latency LDPC	☐	Add-on card; includes BPSK, QPSK, OQPSK, 8PSK, 8QAM, 16APSK, 16QAM, 32APSK & 64QAM; to 100Mbps subject to prevailing modem data rate limits; includes 5%, 10%, 15%, 20%, 25% & 35% spectral roll-offs as standard

Ordering: QFlex-400™ Continued

Paired Carrier+™ Subject to prevailing modem data rate limits. Occupied bandwidth: minimum 25kHz; maximum 72MHz Paired Carrier+™ is also available as a low-cost 90 -day license for light users (the license counts down only when Paired Carrier+™ is being actively used) - please contact us for details	○	**Paired Carrier+™ add-on card** (requires one or more options below)
	○	Paired Carrier+™ up to **256kbps** (requires Paired Carrier+™ add-on card)
	○	Extends Paired Carrier+™ up to **512kbps**
	○	Extends Paired Carrier+™ up to **1.024Mbps**
	○	Extends Paired Carrier+™ up to **2.5Mbps**
	○	Extends Paired Carrier+™ up to **5Mbps**
	○	Extends Paired Carrier+™ up to **10Mbps**
	○	Extends Paired Carrier+™ up to **15Mbps**
	○	Extends Paired Carrier+™ up to **20Mbps**
	○	Extends Paired Carrier+™ up to **25Mbps**
	○	Extends Paired Carrier+™ up to **30Mbps**
	○	Extends Paired Carrier+™ up to **40Mbps**
	○	Extends Paired Carrier+™ up to **50Mbps**
	○	Extends Paired Carrier+™ up to **60Mbps**
	○	Extends Paired Carrier+™ up to **80Mbps**
	○	Extends Paired Carrier+™ up to **100Mbps**
	○	Extends Paired Carrier+™ up to **200Mbps**
	○	Extends Paired Carrier+™ up to **345Mbps**
Terrestrial Interfaces (Please choose up to two hardware options)	○	**G.703:** Provides unbalanced G.703 on 2xBNC 75Ω sockets & balanced G.703 on RJ45; includes G.703 clock exten-sion, which provides a high-stability reference clock over satellite (alternative to GPS); includes Drop & Insert; supports E1, T1, E2, T2, E3 & T3
	○	**EIA-530:** D25 DCE supporting RS422/X.21/V.35/RS232
	○	**Quad E1:** Balanced G.703 on 4xRJ45; all 4 ports support Drop & Insert and are enabled as standard; supports Closed Network (+ ESC) satellite framing (< 0.5% overhead); MultiMux enabled as standard: dynamically replaces one or two E1 ports with IP and/or EIA-530, allowing combinations such as: 2 E1s + up to 32Mbps IP + up to 8Mbps EIA-530, or 3 E1s + up to 32Mbps IP, or 3 E1s + up to 8Mbps EIA-530, or up to 8Mbps EIA-530 plus up to 32Mbps IP
	○	**Quad ASI:** 4xBNC 75Ω sockets; includes DVB-S/DSNG FEC (for use with ASI, or MPEG over IP, or general IP)
	○	**Serial LVDS:** On 25-way D-type connector
	○	**HSSI:** On HD50 50-way SCSI-2 connector
	○	**IDR:** To IESS-308; 50-way female D-type connector; includes Advanced AUX (variable rate synchronous Aux channel; includes option to replace IDR audio channels with serial data); includes Audio option (for IBS carriers this allows 2 x audio in 64kbps or 2 x audio+64kbps data in 128kbps - requires IBS option)
Optimised Spectral Roll-Off	○	Extends the standard 35%, 25% and 20% roll-off factors to include 5%, 10% and 15% roll-offs for TPC and legacy FEC's
ClearLinQ™	○	**Adaptive Tx Predistorter:** Corrects for linear & non-linear distortion in the RF chain (amplifier & transponder). Appli-cable to all FECs and modulations
DVB-CID	○	**DVB Carrier ID:** Tx carrier identification per ETSI 103 129
IBS	○	Satellite framing to IESS 309 with low-rate Intelsat ESC (to IESS 403) and high-rate IBS ESC
Legacy FEC	○	**Sequential FEC** (limited to maximum of 2.048Mbps); TCM 8PSK 2/3 to IESS 310; Viterbi BPSK/QPSK/OQPSK FEC rates 1/2, 3/4 & 7/8; Intelsat Reed-Solomon outer codec
DC Input	○	**48V DC:** K3025 48V DC primary power input (in place of 100 to 240V AC input)
BUC PSU	○	**AC In & 24V Out:** P3553 AC input, 24V 200W DC to Tx BUC
	○	**AC In & 48V Out:** P3554 AC input, 48V 200W DC to Tx BUC
	○	**48V In & 24V Out:** P3555 48V DC input; +24V 200W DC to Tx BUC
	○	**48V In & 48V Out:** P3556 48V DC input; +48V 200W DC to Tx BUC