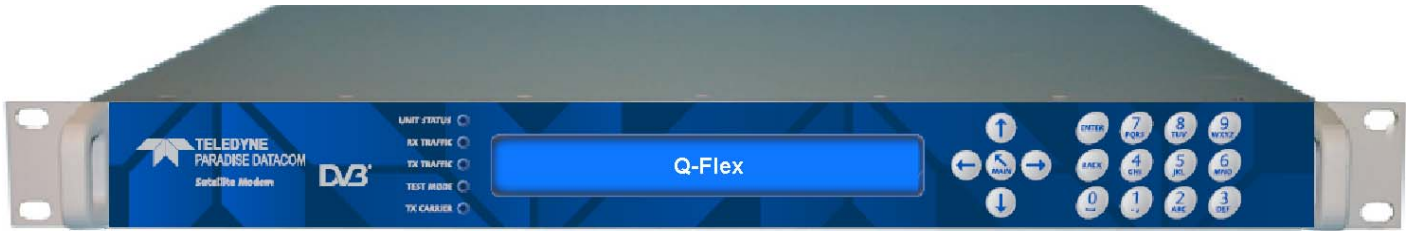
TELEDYNE
PARADISE DATACOM
A Teledyne Technologies Company

Q-Flex™
Dual IF/L-Band Satellite Modem

DVB S2X



OVERVIEW

The **Q-Flex™** modem embodies a new concept in satellite modem technology - a ***flexible software-defined modem*** that does what you want, now and in the future.

The **Q-Flex™** modem's ***flexible hardware platform*** provides IF and L-band operation in one unit. While its powerful processor makes it ideal for handling IP traffic, the **Q-Flex™** modem can be fitted with virtually any type of terrestrial interface and will operate at data rates up to 160Mbps.

Flexible pricing is achieved by enabling only the features you need at any time. ***Future-proofing*** is assured by convenient software upgrades via Ethernet or a memory stick.

Advanced Bandwidth-Efficient Features

The **Q-Flex™** modem supports the most powerful bandwidth-saving technology available.

Paired Carrier™ overlays transmit and receive carriers reducing satellite bandwidth by 50% (using ViaSat's patented PCMA technology).

Both DVB-S2, renowned for its robustness and bandwidth efficiency, and its successor, **DVB-S2X** are supported.

FastLink™ low-latency LDPC is optimised for latency-sensitive applications while giving coding gain that is close to the theoretical limits.

Bandwidth-saving IP features include acceleration and header and payload compression.

FEATURES

- Dual IF/L-band operation
- Data rates to 160Mbps
- **XStream IP™** is an integrated suite of advanced IP optimization & traffic management features including TCP acceleration, header & payload compression, dynamic routing, traffic shaping, encryption & ACM
- DVB-S2X, **FastLink™** LDPC & TPC
- Terrestrial interfaces include Ethernet & optical Ethernet, EIA-530, G.703, ASI, OC-3 & STM-1
- Optimized spectral roll-offs, including 5%
- **Paired Carrier™** carrier overlay
- **LinkGuard™** signal-under-carrier interference detection
- Built-in spectrum & constellation monitors
- **New!** DVB-S2X!
- **New!** DVB Carrier ID! Fully compliant with DVB-CID standard!
- **New!** Secure AAA RADIUS login using your normal company network login credentials!

Markets and Applications

- IP trunking and IP backhaul
- Corporate networking
- Mobile/G.703 backhaul
- Disaster recovery
- Maritime communications
- Satellite news gathering
- High-speed trains

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Main Specifications

Frequency	**IF:** 50 to 90MHz & 100 to 180MHz (resolution 100Hz) (BNC connector) **L-band:** 950 to 2150MHz (resolution 100Hz) (N-type connector)
Data Rate	**Standard:** 2,048kbps **Options:** 5Mbps, 10Mbps, 25Mbps, 60Mbps, 100Mbps and 160Mbps
Data Rate Limits	**DVB-S2X (including DVB-S2):** 100kbps to 160Mbps **'Low-cost DVB-S2' option:** 350kbps to 132Mbps **FastLink™ LDPC:** 18kbps to 100Mbps **TPC:** 4.8kbps to 60Mbps 1bps resolution
Symbol Rate Limits	**DVB-S2X (including DVB-S2):** 100ksps to 50Msps **'Low-cost DVB-S2' option:** 350ksps to 37.5Msps **FastLink™ LDPC:** 18ksps to 40Msps **TPC:** 9ksps to 40Msps
Operating Modes	**DVB-S2X** (EN 302 307-2) option **DVB-S2** (EN 302 307-1) option **Closed Network (+ ESC)** (IESS-315) **IBS/IDR** (IESS-308/309/310/314) options
Scrambling	**DVB-S2/DVB-S2X:** As EN 302 307 **IBS:** As IESS-309 **Closed Network + ESC:** Synchronised to ESC overhead
Impedance	**IF:** 50Ω/75Ω **L-band:** 50Ω
Return Loss	**IF:** >18dB **L-band:** >15dB
Redundancy	1:1 through 1:16 redundancy

Traffic Interfaces

Standard:
Gigabit Ethernet (single RJ45) for IP traffic
Options:
4-port Gigabit Ethernet switch (extends base modem Ethernet traffic port with another 3 Ethernet ports, creating 4-port switch)
Optical Gigabit Ethernet/STM-1/OC-3 (Small Form-Factor pluggable module supporting all common optical standards)
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)

Modulator

Output Power	**IF:** 0 to –25dBm (0.1dB steps) **L-band:** 0 to –40dBm (0.1dB steps)
Output Power Stability/Accuracy	**Stability:** ±1.0dB, 0ºC to 50ºC **Accuracy:** ±0.375dBm
Transmit Filter Roll-off	5%, 10%, 15%, 20%, 25%, 35%
Phase Accuracy	±2º 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
Harmonics & Spurious	Better than –60dBc/ 4kHz in-band (at 0dBm to –30dBm output)
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; 3dBm ± 3dB
FSK Control	Allows monitor & control of a compatible L-band BUC from the modem via the Tx IFL cable

Demodulator

Input Range	**IF minimum:** -115 + 10 log (symbol rate) **L-band minimum:** -130 + 10 log (symbol rate) **IF/L-band maximum:** -80 + 10 log (symbol rate)
Maximum Composite	+10dBm
Wanted-to-composite	**IF:** -94 + 10 log (symbol rate) **L-band:** -102 + 10 log (symbol rate)
Frequency Sweep Width	±1kHz to ±250kHz (1kHz steps)
Acquisition Time	Dependent on FEC, data rate and sweep width (at 10Mbps, less than 100ms at 6dB Es/No QPSK)
Clock Tracking Range	±100ppm minimum
Receive Filter Roll-off	5%, 10%, 15%, 20%, 25%, 35%
LNB 10MHz Reference	Via IFL cable; 10MHz ± 0.01 ppm; 0dBm ± 3dB
LNB Voltage	Selectable 13V, 15V, 18V or 24V DC to LNB via IFL cable; maximum 0.5A

Forward Error Correction

DVB-S2X *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-S2X Low-latency Mode *Paradise proprietary extension to DVB-S2X*	**Very Short Frame:** (Frame size of 5,400 bits, reducing latency to 33% of standard DVB-S2 Short frame) **QPSK/8PSK/16APSK/32APSK** 2/5, 7/15, 8/15, 3/5, 2/3, 11/15, 4/5, 13/15, 14/15 **Ultra Short Frame:** (Frame size of 3,240 bits, reducing latency to 20% of standard DVB-S2 Short frame) **QPSK/8PSK/16APSK/32APSK** 1/3, 4/9, 5/9, 2/3, 7/9, 8/9
DVB-S2	**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
TPC	**BPSK** 5/16, 21/44, 3/4, 7/8 **(O)QPSK** 5/16, 21/44, 3/4, 7/8, 0.93 **8PSK** 3/4, 7/8, 0.93 **8QAM** 3/4, 7/8, 0.93 **16QAM** 3/4, 7/8, 0.93
Others	**DVB-S:** QPSK 1/2, 2/3, 3/4, 5/6, 7/8 **DVB-DSNG:** 8PSK 2/3, 5/6, 8/9; 16QAM 3/4, 7/8 **Viterbi:** BPSK/(O)QPSK 1/2, 3/4, 7/8 **TCM:** 8PSK 2/3 **Sequential:** BPSK/(O)QPSK 1/2, 3/4, 7/8 **Reed-Solomon** outer codec available with Viterbi, TCM & Sequential

Ethernet: Standard Features

Bridging and Static Routing	**Trunking mode:** Hardware Layer 2 bridge supporting 160Mbps bi-directional traffic at up to 500,000 packets per second; zero jitter **Layer 2 bridge & Layer 3 router:** Software processing capability of up to 150,000 packets per second
IPv4/IPv6	Dual IPV4/IPV6 TCP/IP supporting IPv4/IPv6 bridging and routing
VLAN Support	IEEE 802.1q VLAN support
	IEEE 802.1p Quality of Service (packet prioritisation) using strict priority or fair weighting queuing
DHCP, SNMP	DHCP for automatic allocation of M&C IP address. SNMP v1, v2c & v3
Web Server	Modem web server M&C interface via Gigabit Ethernet RJ45
IP Diagnostic Graphs	Shows Tx, Rx throughput (bps, pps); dropped, errored packet counts
Packet Generator/ Analyser	Generates & analyses TCP & UDP packet streams, allowing modem-to-modem IP testing without any PCs
Ethernet MTU Size	**Standard:** 10k bytes **Optical Ethernet:** 16k bytes

Ethernet: XStream IP™ Option

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 & 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 10,000 concurrent accelerated TCP connections (plus at least 40,000 unaccelerated TCP connections) up to 100Mbps
AAA RADIUS Secure User Login	Authentication, Authorisation & Accounting. Greater access control & accountability. Replaces standard modem login with user's personal company network login credentials
AES-256 Encryption	*Supported on **Q-FlexE™** model only. See separate Q-FlexE™ datasheet*

Ethernet: XStream IP™ DVB-S2

Provided as standard as part of DVB-S2 & DVB-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
VCM	Supports transmission/reception of two ASI streams or, one ASI stream with one IP stream, each with its own modcod for optimal throughput
IP-over-DVB Encapsulation	Supports the transmission of IP packets with/without Ethernet frames over DVB-S2; encapsulates & decapsulates using MPE (EN 301 192), ULE (RFC 4326) or Paradise PXE

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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
Paired Carrier™ data rate options *(30kHz to 54MHz occupied bandwidth)*	256kbps, 512kbps, 1024kbps, 2.5Mbps, 5Mbps, 10Mbps, 15Mbps, 20Mbps, 25Mbps, 30Mbps, 40Mbps, 50Mbps, 60Mbps, 80Mbps, 100Mbps and 160Mbps traffic rate
Power Asymmetry	-10dB to +10dB
Symbol Rate Asymmetry	Up to 12:1
Eb/No Degradation	Typically 0.1dB to 0.5dB; up to 0.7dB for 16QAM/16APSK; up to 1dB for 32APSK
Mobile Operation	Uses GPS data to continually recalculate position relative to satellite, allowing uninterrupted operation in mobile environments anywhere in satellite footprint

ClearLinQ™ Tx Adaptive 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-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. The CID waveform contains a unique Carrier ID and other identity information. A carrier monitoring system is required to decode CID waveforms

TPC Performance

Eb/No (dB) at BER 5E-8

	Rate 1/2	Rate 3/4	Rate 7/8	Rate 0.93	
BPSK, (O)QPSK	3.0	4.2	4.2	6.5	
8PSK		6.3	6.8	9.6	
8QAM		6.7	6.8	10.1	
16QAM		7.6	7.9	10.4	

DVB-S/DSNG Performance

Eb/No (dB) at QEF

	Rate 1/2	Rate 2/3	Rate 3/4	Rate 5/6	Rate 7/8	Rate 8/9
QPSK	3.9	4.6	4.0	4.6	5.3	
8PSK		6.9		8.9		9.4
16QAM			9.0		10.7	

FastLink™ Performance

Eb/No (dB) at BER 5E-8 (Note: * denotes BER of 5E-12)

		Low BER	Balanced	Low Latency
BPSK	0.499	2.1	2.9	3.4
(O)QPSK	0.532	2.1	2.6	2.9
(O)QPSK	0.639	2.4	2.8	3.2
(O)QPSK	0.710	2.7	3.2	3.7
(O)QPSK	0.798	3.1	3.9	4.2
8PSK	0.639	5.4*	5.9*	6.3*
8PSK	0.710	5.6*	5.5	5.8
8PSK	0.778	5.6	6.1	6.4
8QAM	0.639	4.4	4.8	5.0
8QAM	0.710	5.0	5.3	5.5
8QAM	0.778	5.5	5.9	6.1
16APSK	0.726	7.6*	7.5*	7.5
16APSK	0.778	7.8*	7.1	7.5
16APSK	0.828	7.4	8.1	8.4
16APSK	0.851	7.9	8.3	8.8
16QAM	0.726	7.2*	6.6	6.8
16QAM	0.778	6.7	7.1	7.4
16QAM	0.828	7.2	7.7	8.0
16QAM	0.851	7.5	8.0	8.4
32APSK	0.778	9.8*	9.6	10.0
32APSK	0.828	9.8	10.6	10.9
32APSK	0.886	10.8	11.4	11.9
32APSK	0.938	12.6	13.2	13.9

Test Facilities and Alarm Outputs

BER Tester	Bit error rate tester operates over main traffic or ESC channel, allowing BER monitoring while on traffic. Not available in DVB-S2 mode
	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

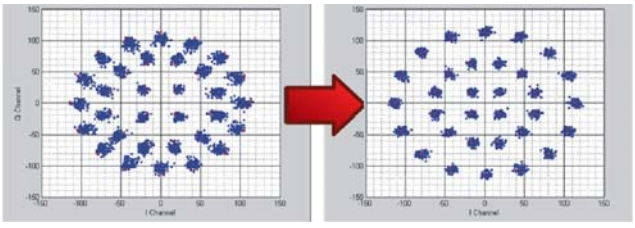
Mechanical/Environmental

Size	1U chassis, 410mm deep excluding front panel handles and rear panel connectors and fans
Weight	3.5kg
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
Compliances	FCC, CE and RoHS compliant
Safety Standards	EN60950-1:2006
Emissions & Immunity	**Emissions:** EN55022:2010 Class B **Immunity:** EN55024:2010
Operating Temperature	**Standard:** 0 to 50ºC (storage: -40ºC to 70ºC) **Extended:** 0 to 55ºC when fitted with **Ruggedisation** option
Humidity	95% relative humidity, non-condensing

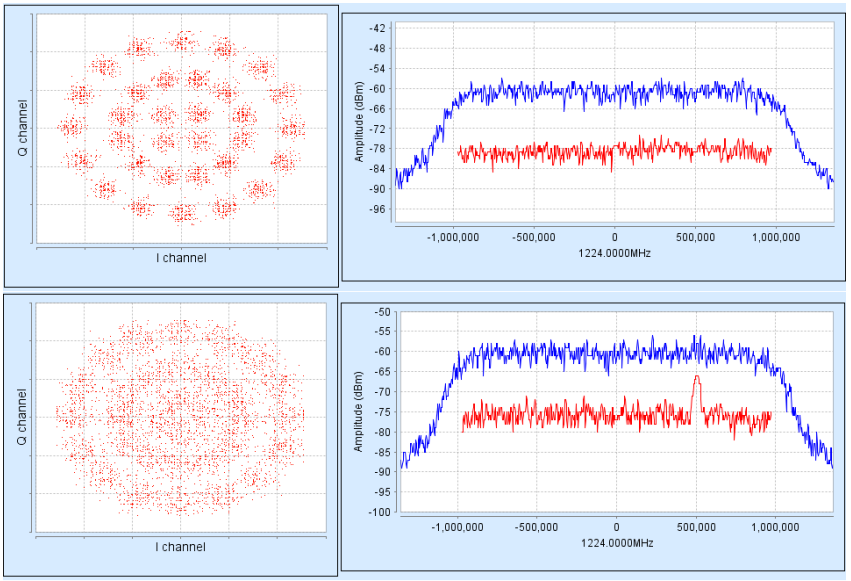
DVB-S2 Performance

Eb/No (dB) for Normal (64k) frames at DVB-S2 QEF (Es/No in brackets)
(for DVB-S2X performance, see separate datasheet)

	Rate 1/4	Rate 1/3	Rate 2/5	Rate 1/2	Rate 3/5	Rate 2/3	Rate 3/4	Rate 4/5	Rate 5/6	Rate 8/9	Rate 9/10
QPSK	1.5 (-1.6)	1.1 (-0.7)	1.3 (0.3)	1.5 (1.5)	2.1 (2.8)	2.2 (3.4)	2.6 (4.3)	3.0 (5.0)	3.1 (5.3)	3.8 (6.3)	4.1 (6.6)
8PSK					3.3 (5.8)	4.0 (7.0)	4.7 (8.2)		5.7 (9.6)	6.7 (10.9)	7.0 (11.3)
16APSK						5.1 (9.3)	5.8 (10.5)	6.6 (11.6)	7.0 (12.2)	7.9 (13.4)	8.2 (13.7)
32APSK							8.2 (13.9)	8.8 (14.8)	9.2 (15.3)	10.1 (16.5)	10.4 (16.9)



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



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

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	Option	Description — Fully configurable - pay only for what you need!
Base Modem	✓	**4.8kbps to 2.048Mbps Closed Network (+ ESC) modem with two Gigabit Ethernet RJ45s for M&C and traffic** respectively; Ethernet bridge, static routing; IPv4/IPv6; IEEE 802.1p QoS; IEEE 802.1q VLAN; 10k bytes MTU **IF operation 50 to 90MHz & 100 to 180MHz** **L-band operation 950 to 2150MHz**; high-stability 10MHz reference; FSK **TPC:** BPSK, QPSK, OQPSK, 8PSK, 8QAM and 16QAM; to 60Mbps subject to prevailing modem data rate **LinkGuard™:** Signal-under-carrier interference detection web spectrum graph showing received spectrum and any interference underneath the received carrier while on traffic; automated alarm when interference rises above user-set threshold; supported for FastLink™, TPC and DVB-S2X for all modulations **AUPC:** Automatic Uplink Power Control **Web browser monitoring tools:** Spectrum display, constellation monitor, TCP/IP throughput **Internal Bit Error Rate Tester (BERT):** For non-DVB-S2/DVB-S2X operation only **TCP/IP Packet Generator/Analyser:** Generates and analyses TCP & UDP packet streams, allowing modem-to-modem IP testing without any other equipment
Tx-only		Transmit functions only
Rx-only		Receive functions only
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 60Mbps operation to 100Mbps (FastLink™, DVB-S2 & DVB-S2X only)
		160Mbps data rate: Extends 100Mbps operation to 160Mbps (DVB-S2 & DVB-S2X only)
XStream IP™		**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 10,000 concurrent accelerated TCP connections to 100Mbps subject to prevailing data rate
		AAA RADIUS Secure User Login: Authentication, Authorisation & Accounting. Greater access control & accountability. Replaces standard modem login with user's personal company network login credentials
		AES-256 Encryption: *Please note that AES-256 Encryption (TCP/IP packet payload encryption using AES with 256-bit keys) is supported on the* ***Q-FlexE*** *model only. The Q-FlexE is identical to the standard Q-Flex in every other respect*
XStream IP™ DVB-S2 *Provided as standard as part of DVB-S2 & DVB-S2X options*		**IP-over-DVB Encapsulation:** Encapsulation of IP packets and Ethernet frames over DVB-S2 using Paradise XStream Protocol (PXE), MPE or ULE
		ACM: DVB-S2/DVB-S2X ACM
		VCM: Allows either two ASI streams, or one ASI stream and one IP stream, to be multiplexed onto a single carrier; requires Quad ASI hardware option
DVB-S2X *To 160Mbps subject to prevailing modem data rate limits*		**DVB-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-S2, which comprises ACM, VCM and IP-over-DVB encapsulation
		DVB-S2X CCM Rx: Add-on card (P3609) 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-S2, which comprises ACM, VCM and IP-over-DVB decapsulation
DVB-S2 ***Low-cost*** *DVB-S2 option; to 132Mbps subject to modem data rate limits*		**DVB-S2 CCM Tx:** DVB-S2 QPSK, 8PSK & 16APSK Tx operation per EN 302 307-1. Includes 15%, 20%, 25% & 35% spectral roll-offs. Includes XStream IP™ DVB-S2, which comprises ACM, VCM and IP-over-DVB encapsulation
		DVB-S2 CCM Rx: Add-on card (P3604) supporting DVB-S2 QPSK, 8PSK & 16APSK Rx operation per EN 302 307-1. Includes 15%, 20%, 25% & 35% spectral roll-offs. Includes XStream IP™ DVB-S2, which comprises ACM, VCM and IP-over-DVB decapsulation. *Please note that this add-on card is physically different to the DVB-S2X add-on card*
DVB-S2X Low-latency Mode *Proprietary extension to DVB-S2X*		**Very Short Frame:** Frame size of 5,400 bits, reducing latency to 33% of standard DVB-S2 Short frame; supports QPSK/8PSK/16APSK/32APSK 2/5, 7/15, 8/15, 3/5, 2/3, 11/15, 4/5, 13/15, 14/15 **Ultra Short Frame:** Frame size of 3,240 bits, reducing latency to 20% of standard DVB-S2 Short frame; supports QPSK/8PSK/16APSK/32APSK 1/3, 4/9, 5/9, 2/3, 7/9, 8/9
ClearLinQ™		**Tx Adaptive Predistorter:** Corrects for linear & non-linear distortion in the RF chain (amplifier & transponder). Applicable to all FECs and modulations including DVB-S2X, FastLink™ & TPC
FastLink™ Low-latency LDPC		Add-on card (P3605); includes BPSK, QPSK, OQPSK, 8PSK, 8QAM, 16APSK, 16QAM, 32APSK & 64QAM; to 100Mbps subject to prevailing modem data rate limits; includes 20%, 25% & 35% spectral roll-offs as standard

Configuration options continue on next page.

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	Option	Description — Fully configurable - pay only for what you need!
Paired Carrier™ *Subject to prevailing modem data rate limits.* *Occupied bandwidth: minimum 30kHz; maximum 54MHz* *Note that* Paired Carrier™ *is also available as a low-cost 90-day per annum license for redundancy system standby modems - please contact Sales for details*		**Paired Carrier™ add-on card** P3607 (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 **160Mbps**
Terrestrial Interfaces (Please choose up to four hardware options)		**4-port Gigabit Ethernet Switch:** Extends base modem Ethernet traffic port with 3 Ethernet ports, creating 4-port switch
		Optical Gigabit Ethernet/STM-1/OC-3: Small Form-factor Pluggable module; supports single-mode & multi-mode fibre & all wavelengths; supports all standard fibre connector types such as SC & LC (subject to provision of suitable mating socket for SFP cage)
		G.703: Provides unbalanced G.703 on 2xBNC 75Ω sockets & balanced G.703 on RJ45; includes G.703 clock extension, 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; IBS satellite framing enabled as standard; MultiMux enabled as standard, allows 2 E1s + 2Mbps IP + 2Mbps EIA-530, or 3 E1s + IP or EIA-530 (but not both), or 2 E1s + 4Mbps IP, or E1 + 2 x EIA-530, or up to 30Mbps IP + EIA-530, or IP + E3 (subject to relevant interfaces being fitted)
		Quad ASI: 4xBNC 75Ω sockets; includes DVB-S/DSNG FEC (which can be used with all terrestrial interfaces)
		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 FastLink™, TPC & legacy FECs including DVB-S
Ruggedisation		Ruggedises the modem for harsh environments (fans with higher airflow, heatsinks on key components, etc.)
DVB-CID		**DVB Carrier ID:** Tx carrier identification per ETSI 103 129
Packet Synchronisation		Supports IEEE 1588 Precision Time Protocol Version 2 and Simple Network Time Protocol
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 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
LinkGuard™ Carrier Relocation		Automatic carrier relocation to a user-defined fallback frequency in the event of persistent, significant levels of interference
24V DC Input		**K3023** 24V DC primary power input (in place of 100 to 240V AC input)
48V DC Input		**K3018** 48V DC primary power input (in place of 100 to 240V AC input)
24V 200W BUC PSU		**P3543** AC input, 24V 200W DC to Tx BUC
48V 200W BUC PSU		**P3544** AC input, 48V 200W DC to Tx BUC
48V In & 24V BUC PSU		**P3545** Floating 48V DC input; +24V 200W DC to Tx BUC
48V In & 48V BUC PSU		**P3546** Floating 48V DC input; +48V 200W DC to Tx BUC
+48V In & 48V BUC PSU		**P3547** +48V DC input; +48V 200W DC to Tx BUC