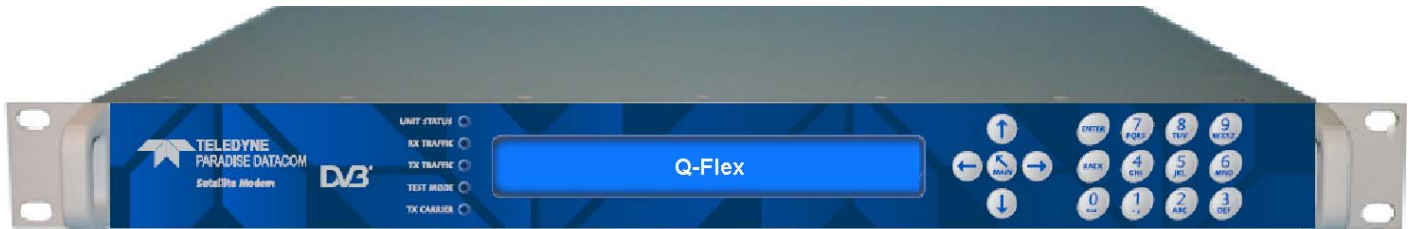


Dual IF/L-Band Broadcast Satellite Modulator/Modem



OVERVIEW

The **Q-FlexV™** broadcast satellite modulator/modem replaces our award-winning Vision Series broadcast modems. The **Q-FlexV™** is ideal for Ultra HDTV, DTH, DSNG, ISP backhaul, fiber restoration and video contribution and distribution services. It supports IP and ASI interfaces, and the **DVB-S2X** and DVB-S/DSNG standards.

The **Q-FlexV™** is a *flexible software-defined modem* that does what you want, now and in the future. The **Q-FlexV™** modem's *flexible hardware platform* makes it ideal for handling high-rate video and IP traffic.

Advanced Bandwidth-Efficient Features

The **Q-FlexV™** 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).

The new **DVB-S2X** standard provides enhanced bandwidth efficiency with low spectral roll-off factors and additional choices of modulation and FEC rates. **ClearLinQ™** adaptive transmit pre-distortion compensates for linear and non-linear distortion in the communications channel. **DVB-S2X ACM** converts any unused link margin into additional throughput and provides 100% link availability.

FEATURES

- ▶ Dual IF/L-band operation
- ▶ Data rates to 155Mbps
- ▶ DVB-S2/S2X & DVB-S/DSNG
- ▶ IP & ASI terrestrial interfaces
- ▶ Constant Coding & Modulation (CCM), Variable Coding & Modulation (VCM) & Adaptive Coding & Modulation (ACM)
- ▶ Optimized spectral roll-offs down to 5%
- ▶ **ClearLinQ™** adaptive Tx pre-distorter
- ▶ **Paired Carrier™** carrier overlay
- ▶ **XStream IP™** is an integrated suite of advanced IP optimization & traffic management features including TCP acceleration, header & payload compression, dynamic routing, traffic shaping & encryption
- ▶ DVB Carrier ID. Fully compliant with DVB-CID standard
- ▶ **LinkGuard™** signal-under-carrier interference detection & constellation monitor
- ▶ Secure AAA RADIUS login using your standard company network login credentials

Applications

- ▶ Satellite news gathering
- ▶ Video contribution/distribution
- ▶ Ultra HDTV/HEVC/SDTV
- ▶ DTH
- ▶ ISP backhaul
- ▶ Fiber restoration
- ▶ Video conferencing & distance learning

Dual IF/L-Band Broadcast Modulator/Modem

Main Specifications	
Frequency	IF: 50 to 90MHz & 100 to 180MHz (resolution 100Hz) (BNC connector) L-band: 950 to 2050MHz (resolution 100Hz) (N-type connector) L-band option: Extends L-band operation to 2150MHz
Data Rate	Operation to 155.52Mbps provided as standard
Data Rate Limits	DVB-S2X: 100kbps to 155.52Mbps DVB-S/DSNG: 100kbps to 100Mbps 1bps resolution
Symbol Rate Limits	DVB-S2X: 100ksps to 50Msps DVB-S/DSNG: 100ksps to 40Msps
Operating Modes	DVB-S2X (EN 302 307-1 & EN 302 307-2) DVB-S/DSNG (EN 300 421 & EN 301 210)
Scrambling	DVB-S2/DVB-S2X: As per EN 302 307 DVB-S/DSNG: As per EN 300 421 & EN 301 210
Impedance	IF: 50Ω/75Ω L-band: 50Ω
Return Loss	IF: 18dB typical L-band: 14dB typical
Redundancy	1:1 or up to 1:16 redundancy

Traffic Interfaces
Base modem (standard): Gigabit Ethernet (single RJ45) for IP traffic
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) Quad ASI (75Ω BNC female)

Modulator	
Output Power	IF: 0 to -25dBm (0.1dB steps) L-band: 0 to -40dBm (0.1dB steps)
Output Power Stability/Accuracy	Stability: ±0.5dB, 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 & EN 301 210, nominally 3dB better
Harmonics	Better than -55dBc/4kHz in band (at 0dBm to -30dBm output)
Spurious	Better than -55dBc/4kHz in band (at 0dBm to -30dBm output)
Transmit On/Off Ratio	55dB minimum
BUC PSU Option	24V or 48V DC via IFL cable, 200W
BUC 10MHz Reference	Via IFL cable; 10MHz ± 0.001 ppm; 3dBm ± 3dB
FSK Control	Allows monitor & control of a compatible L-band BUC from the modem via the Tx IFL cable

Test Facilities and Alarm Outputs	
Test modes	Transmit CW (pure carrier) 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

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	Up to 10Msps: ±1kHz to ±32kHz (1kHz steps) Above 10Msps: ±10kHz to ±250kHz (10kHz 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%
AGC Output	Buffered direct AGC output for antenna peaking
LNB 10MHz Reference	Via IFL cable; 10MHz ± 0.001 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	QPSK 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10, 13/45, 9/20, 11/20, 11/45, 4/15, 14/45, 7/15, 8/15, 32/45 8PSK 3/5, 2/3, 3/4, 5/6, 8/9, 9/10, 23/26, 25/36, 13/18, 7/15, 8/15, 26/45, 32/45 16APSK 2/3, 3/4, 4/5, 5/6, 8/9, 9/10, 26/45, 3/5, 28/45, 23/36, 25/36, 13/18, 7/9, 77/90, 7/15, 8/15, 32/45 32APSK 3/4, 4/5, 5/6, 8/9, 9/10, 32/45, 11/15, 7/9, 2/3 64APSK 11/15, 7/9, 4/5, 5/6
<i>Includes support for DVB-S2</i>	<i>Rates supported by DVB-S2X that are not part of DVB-S2 are shown in italics</i>
DVB-S2X Low-latency Mode	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
<i>Paradise proprietary extension to DVB-S2X</i>	
DVB-S/DSNG	DVB-S: QPSK 1/2, 2/3, 3/4, 5/6 DVB-DSNG: 8PSK 2/3, 5/6, 8/9; 16QAM 3/4, 7/8

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 output power and minimises required back-off. Up to 2dB performance gain

DVB-S2X Rx Adaptive Equaliser
Corrects for group delay, typically introduced on the edges of the transponder, which causes inter-symbol interference. The 9-tap Rx equaliser, provided as standard, is automatically switched on above 10Msps and will compensate for any group delay

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. The DVB Carrier ID option is available as a software upgrade for all Q-Series modems

Ethernet: Standard Features	
Bridging and Static Routing	Trunking mode: Hardware Layer 2 bridging supporting 155Mbps 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 and 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
IP Diagnostic Graphs	Shows Tx, Rx throughput (bps, pps); dropped, errored packet counts
TCP/IP Packet Generator/Analyser	Generates & analyses TCP & UDP packet streams, allowing modem-to-modem IP testing without any other test equipment
Ethernet MTU Size	Standard: 10k bytes Optical Ethernet: 16k bytes

Ethernet: XStream IP™ Option	
<i>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</i>	
Traffic Shaping	Provides guaranteed throughput for priority traffic, using Committed and Burst Information Rates. Stream differentiation is by IP address, IEEE 802.1p priority, Diffserv DSCP, PID, VLAN ID or 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	<i>Supported on Q-FlexE™ model only. See separate Q-FlexE™ datasheet</i>

Ethernet: XStream IP™ DVB-S2	
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 & de-encapsulates using MPE (EN 301 192), ULE (RFC 4326) or Paradise PXE

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 155Mbps traffic rate
Power asymmetry	-10dB to +10dB
Symbol rate asymmetry	Up to 12:1
Eb/No degradation	Typically < 0.5dB (0.7dB for 16QAM/16APSK with 10dB power asymmetry; 1dB or more for 32APSK and higher)
Mobile Operation	Uses GPS data to continually recalculate position relative to satellite, allowing uninterrupted operation in mobile environments anywhere in satellite footprint

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	

* Note: QEF is defined as a BER of 5E-12 (this is equivalent to a PER of approximately 5E-9).

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 and Immunity	Emissions: EN55022:2006 Class B Immunity: EN55024:1998 (+ A1:2001 + A2:2003)
Operating Temperature	Standard: 0 to 50°C (storage: -40°C to 70°C) Extended: 0 to 55°C when fitted with Ruggedisation option
Humidity	95% relative humidity, non-condensing
Ruggedisation	Option recommended for operation in harsh environments. Replaces existing fans with more capable fans that support greater airflow. Adds heatsinks to critical components to improve dissipation of heat. Improves cable fixing inside the modem to reduce modem susceptibility to vibration. Overall effect is to reduce the internal operating temperature of the modem, causing less stress to the electronics and thereby increasing reliability and extending the mean time between failures

Adaptive Coding and Modulation

Adaptive Coding and Modulation (ACM) uses feedback from the receiver to the transmitter to respond to changes in channel conditions to optimise throughput. By varying the error correction to match atmospheric conditions, link margin is converted into additional bandwidth.

The symbol rate and power to satellite are kept constant, changing the transmitted terrestrial data rate up or down in relation to the receive Es/No value. Changes in modcod are transparent at the receiver.

The Q-Flex ACM, previously supported for DVB-S2, has now been extended to work with DVB-S2X also. Deployments of ACM have reported throughput increases of up to 100%.

DVB-S2X

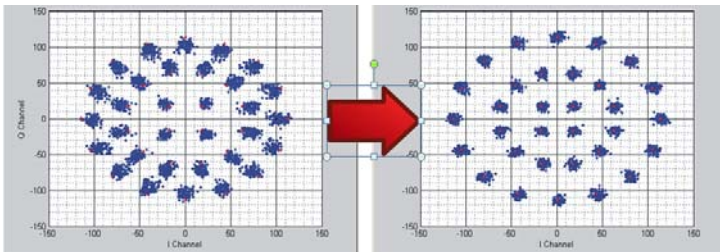
The Q-FlexV™ DVB-S2X supports a full implementation of DVB-S2 (up to and including 32APSK) with far superior BER performance across all modulation and FEC rates compared to many existing DVB-S2 implementations.

DVB-S2X incorporates the following in addition:

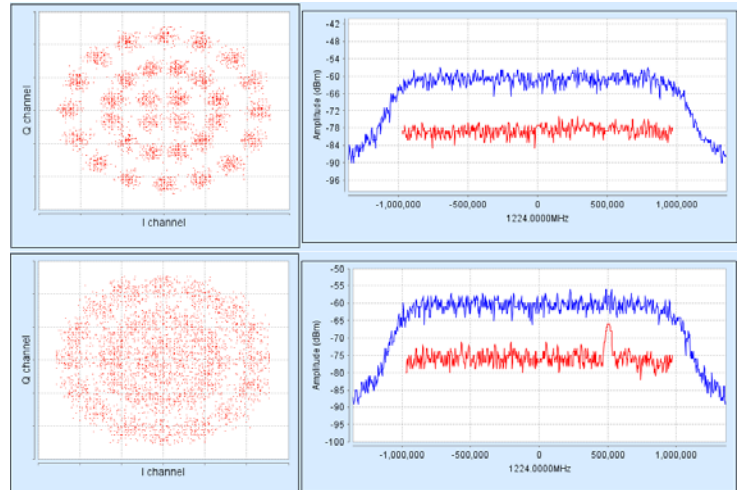
- Additional modulations and FEC rates including 64APSK
- Low spectral roll-off factors of 5%, 10% and 15%
- Symbol rates of up to 50Mps

For DVB-S2X BER performance figures, see separate DVB-S2X datasheet.

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



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



	Option	Description Fully configurable - pay only for what you need!
Base Modem	✓	<p>Data rate to 155.52Mbps; two Ethernet 10/100/1000 BaseT RJ45s for M&C and traffic respectively; Ethernet bridge, static routing; IPv4/IPv6; IEEE 802.1p QoS; IEEE 802.1q VLAN; 10k bytes MTU</p> <p>IF operation 50 to 90MHz and 100 to 180MHz</p> <p>L-band operation 950 to 2050MHz; high-stability 10MHz reference; FSK</p> <p>DVB-S2X CCM Tx: DVB-S2 QPSK, 8PSK, 16APSK & 32APSK Tx operation per EN 302 307-1. DVB-S2X QPSK, 8PSK, 16APSK, 32APSK & 64APSK Tx operation per EN 302 307-2. Includes 5%, 10%, 15%, 20%, 25% & 35% spectral roll-offs</p> <p>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, 16APSK, 32APSK & 64APSK Rx operation per EN 302 307-2. Includes 5%, 10%, 15%, 20%, 25% & 35% spectral roll-offs</p> <p>XStream IP™ DVB-S2: Consisting of: 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 VCN: 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</p> <p>DVB-S2X Low-latency Mode: <i>Proprietary extension to DVB-S2X consisting of:</i> 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</p> <p>ClearLinQ™ Adaptive Tx Predistorter: Corrects for linear & non-linear distortion in the RF chain. Applicable to all FECs and all modulations</p> <p>DVB-S/DSNG: QPSK, 8PSK, 16QAM</p> <p>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 all FECs and all modulations</p> <p>AUPC: Automatic Uplink Power Control</p> <p>Web browser monitoring tools: Spectrum display, constellation monitor, TCP/IP throughput</p> <p>TCP/IP Packet Generator/Analyser: Generates and analyses TCP and UDP packet streams, allowing modem-to-modem IP testing without the need for any other test equipment</p>
Tx-only		Discount for when only transmit functionality is required. The receive functions specified in the base modem will be disabled
Rx-only		Discount for when only receive functionality is required. The transmit functions specified in the base modem will be disabled
DVB-S2-only		Discount for when DVB-S2-only operation is required. Includes DVB-S2 CCM Tx & Rx operation with QPSK, 8PSK & 16APSK per EN 302 307-1. Tx operation also includes 32APSK per EN 302 307-1. Maximum symbol rate of 37.5Msps. Includes 15%, 20%, 25% & 35% spectral roll-offs. <i>Please note that while it is possible to upgrade to DVB-S2X operation at a later date, this will require fitting an add-on card for DVB-S2X Rx operation!</i>
XStream IP™		<p>Traffic Shaping: Supports CIR/BIR/priority settings for IP streams classified by IP address, Diffserv class, IEEE 802.1p priority tag, MPLS EXP field, VLAN ID and MPEG2 transport stream PID</p> <p>Header Compression: IP/UDP/TCP/RTP packet header compression (RFC 3095) plus Ethernet header compression</p> <p>Payload Compression: TCP/UDP packet payload compression using the Deflate algorithm (RFC 1951)</p> <p>Dynamic Routing: RIP, OSPF and BGP</p> <p>TCP Acceleration: Up to 10,000 concurrent accelerated TCP connections to 100Mbps subject to prevailing data rate</p> <p>AAA RADIUS Secure User Login: Authentication, Authorisation & Accounting. Greater access control & accountability. Replaces standard modem login with user's personal company network login credentials</p> <p>AES-256 Encryption: <i>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</i></p>

Configuration options continue on next page.

Option	Description
Fully configurable - pay only for what you need!	
Paired Carrier™ <i>Occupied bandwidth: minimum 30kHz; maximum 54MHz</i> <i>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</i>	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 155.52Mbps	
Terrestrial Interfaces (Please choose up to three 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)
	Quad ASI: 4xBNC 75Ω sockets
Ruggedisation	Ruggedises the modem for harsh environments (fans with higher airflow, heatsinks on key components, etc.)
Wideband	Extends L-band operation upper frequency limit from 2050MHz to 2150MHz
DVB-CID	DVB Carrier ID: Tx carrier identification per ETSI 103 129
Packet Synchronisation	Supports IEEE 1588 Precision Time Protocol Version 2
24V DC Input	K3023 24V DC primary power input (in place of 100 to 240V AC input); DC input attaches via a screw-terminal connector plate
48V DC Input	K3018 48V DC primary power input (in place of 100 to 240V AC input); DC input attaches via a screw-terminal connector plate
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; DC input attaches via a screw-terminal connector plate
48V In & 48V BUC PSU	P3546 Floating 48V DC input; +48V 200W DC to Tx BUC; DC input attaches via a screw-terminal connector plate
+48V In & 48V BUC PSU	P3547 +48V DC input; +48V 200W DC to Tx BUC; DC input attaches via a screw-terminal connector plate

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