

### OVERVIEW

The **QFlex-60™** software-defined satellite modem, a variant of our flagship **Q-Flex™**, is our most affordable, best value modem.

Great value does not mean compromising performance. Compared to the standard **Q-Flex™**, it supports an extended L-band frequency range, better RF performance, more headroom for future upgrades and lower power consumption.

It is ideal as a versatile point-to-point modem. It is a drop-in replacement for the **Q-Flex™** and **Q-Lite™** and is fully compatible with our older modems (including the Evolution and Quantum).

### Advanced Bandwidth-Efficient Features

The **QFlex-60™** modem supports the most powerful bandwidth-saving technology available.

**DVB-S2X** is 20% to 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.

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

### FEATURES

- ▶ L-band operation; data rates to 60Mbps
- ▶ **XStream IP™** advanced IP optimization suite, including TCP & HTTP acceleration, header & payload compression, dynamic routing, traffic shaping, jitter reduction, encryption & ACM
- ▶ DVB-S2/S2X, **FastLink™** LDPC & legacy
- ▶ Terrestrial interfaces: IP & Paradise legacy
- ▶ 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)
- ▶ Low power consumption, typically 25W
- ▶ **Q-NET™ Navigator** network control app
- ▶ Interoperates fully with **Q-Flex™** & **Q-Lite™** and older Paradise modems
- ▶ Software Defined Network support: vendor-independent network device control using standard commands (supports OpenFlow)

### Markets and Applications

- ▶ IP trunking and IP/cellular backhaul
- ▶ Corporate & government networks
- ▶ Maritime, oil & gas communications
- ▶ Broadcast distribution & contribution
- ▶ Universal service obligation networks
- ▶ Disaster recovery

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Main Specifications	
Frequency	<b>L-band:</b> 950 to 2450MHz (resolution 1Hz) N-type connectors for Tx & Rx
Data Rate	<b>Standard:</b> 2,048kbps <b>Options:</b> 5Mbps, 10Mbps, 25Mbps and 60Mbps
Data Rate Limits	<b>DVB-S2/S2X:</b> 50kbps to 60Mbps <b>FastLink™ LDPC:</b> 18kbps to 60Mbps <b>TPC:</b> 2.4kbps to 60Mbps 1bps resolution
Symbol Rate Limits	<b>DVB-S2/S2X:</b> 100ksps to 50Msps <b>FastLink™ LDPC:</b> 18ksps to 40Msps <b>TPC:</b> 2.4ksps to 40Msps
Operating Modes	<b>DVB-S2/S2X</b> (EN 302 307-1 & EN 302 307-2) <b>Closed Network (+ ESC)</b> (IESS-315) <b>IBS/IDR</b> (IESS-308/309/310/314)
Impedance	50Ω
Return Loss	>15dB
Redundancy	1:1 through 1:16 redundancy

Traffic Interfaces	
<b>Standard:</b>	<b>4-port Gigabit Ethernet switch</b> (RJ45 connectors; Used for IP traffic and M&C)
<b>Legacy Options (two interface slots):</b>	<b>EIA-530</b> (RS422, X.21, V.35 and RS232 on 25-pin D-type female) <b>G.703</b> E1/T1, E2/T2, E3/T3 (balanced RJ45; unbalanced 75Ω BNC female) <b>Quad E1 G.703</b> (balanced RJ45) <b>Quad ASI</b> (75Ω BNC female) <b>IDR</b> (to IESS 308; 50-way female D type connector)

Modulator	
Output Power	+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	<b>Stability:</b> ±1.0dB, 0°C to 50°C <b>Accuracy:</b> ±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 -55dBc/ 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; 1x10-8, 2x10-7 year aging; 2dBm ± 2dBm
FSK Control	Allows monitor & control of a compatible BUC from the modem via the Tx IFL cable (requires Utilities Card)

Demodulator	
Input Range (dBm)	<b>Minimum:</b> -140 + 10 log (symbol rate) <b>Maximum:</b> -68 + 10 log (symbol rate)
Maximum Composite	+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; 1x10-8, 2x10-7 year aging; 2dBm ± 2dBm
LNB Voltage	Programmable 13V, 15V, 18V, 20V or 24V DC to LNB via IFL cable; maximum 0.75A

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. <b>Supported for all carriers (including TPC, FastLink, DVB-S/S2/S2X).</b> The CID waveform contains a unique Carrier ID and other identity information. A carrier monitoring system is required to decode CID waveforms	

Utilities Card	
Add-on card size: 168mm x 104mm 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. BNC connector for Station Clock input Second fan for environments where extra cooling is required FSK signalling	

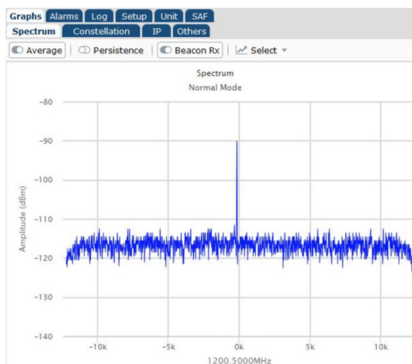
Paired Carrier+™ Option	
Paired Carrier+™ (25kHz to 54MHz occupied bandwidth)	Transmit and receive carriers are overlaid in the same space segment. Echo cancellation techniques are used to cancel the unwanted transmit carrier, leaving the wanted receive carrier
Paired Carrier™ data rate options	256kbps, 512kbps, 1024kbps, 2.5Mbps, 5Mbps, 10Mbps, 15Mbps, 20Mbps, 25Mbps, 30Mbps, 40Mbps, 50Mbps and 60Mbps traffic rate
Carrier Asymmetry	<b>Power:</b> -10dB to +10dB <b>Symbol rate:</b> Up to 10:1
Eb/No Degradation	Typically less than 0.1dB
Delay Range	0 to 330ms
Auto Acquire	Auto-acquires the satellite without the need for position information

Test Facilities and Alarm Outputs	
Built-in Test Tools	As part of built-in web server: Beacon receiver function; Rx constellation monitor; Rx spectrum analyser; <b>LinkGuard™</b> Signal-Under-Carrier interference detection; beacon receiver function that provides automatic detection of satellite beacon transmissions (requires Utilities Card); 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 (requires Utilities Card)

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
Compliances	FCC, CE and RoHS compliant
Safety Standards	EN60950-1:2006
Emissions & Immunity	<b>Emissions:</b> EN55032:2015 <b>Immunity:</b> EN55024:2010
Operating Temperature	<b>Standard:</b> 0 to 50°C (storage: -40°C to 70°C)
Humidity	95% relative humidity, non-condensing

## Beacon Receiver Function

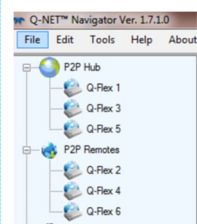
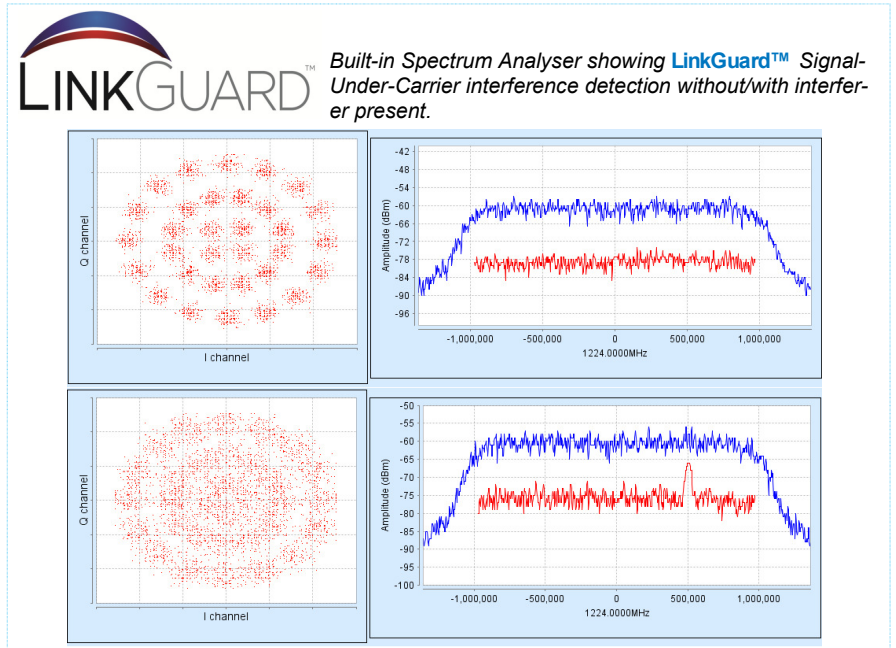
QFlex-60™ detects satellite beacon transmissions down to very low signal levels. This helps with automatic antenna pointing and removes the need for a separate beacon receiver.



Ethernet: Standard Features	
Bridging and Static Routing	<b>Trunking mode:</b> Hardware Layer 2 switch supporting 60Mbps bi-directional traffic at up to 250,000 packets per second; zero jitter <b>Layer 2 bridge &amp; Layer 3 router:</b> Software processing capability of up to 50,000 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 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
IEEE 1588 V2 Precision Time Protocol (PTP)	PTP hardware implementation with nanosecond-resolution timestamping provides sub-microsecond accurate clock synchronisation; modem implements a PTP boundary clock, operating in both master & slave modes
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	10k bytes

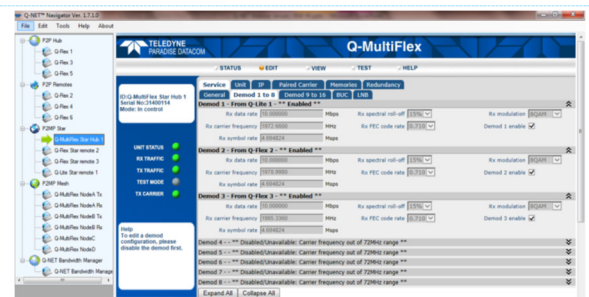
Ethernet: XStream IP™ Option	
<i>XStream IP™ is an integrated set of IP optimization and traffic management features designed for maximum reliability and bandwidth efficiency. The maximum throughput depends on features enabled &amp; traffic format</i>	
Traffic Shaping	Provides guaranteed throughput for 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
HTTP Acceleration	Speeds up download of web pages to web browsers; includes DNS caching
AES-256 Encryption	<i>Supported on Q-FlexE™ model only. See separate Q-FlexE™ datasheet</i>

Ethernet: XStream IP™ DVB-S2X	
<i>Provided as standard as part of DVB-S2/S2X</i>	
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/S2X; encapsulates & decapsulates using GSE (see below), MPE (EN 301 192), ULE (RFC 4326) or Paradise XStream Encapsulation
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	
<i>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</i>	
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



**Network Control: Q-NET™ Navigator**

**Q-NET™ Navigator** supports monitor and control of all Paradise modems and third-party network devices 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. **Q-NET™ Navigator** is included as standard, free of charge.



**Forward Error Correction**

DVB-S2X (EN 302 307-2)	<p><b>Normal Frame:</b>  <b>QPSK</b> 13/45, 9/20, 11/20  <b>8PSK</b> 23/36, 25/36, 13/18  <b>8APSK-L</b> 5/9, 26/45  <b>16APSK</b> 26/45, 3/5, 28/45, 23/36, 25/36, 13/18, 7/9, 77/90  <b>16APSK-L</b> 5/9, 8/15, 1/2, 3/5, 2/3  <b>32APSK</b> 32/45, 11/15, 7/9  <b>32APSK-L</b> 2/3  <b>64APSK</b> 11/15, 7/9, 4/5, 5/6  <b>64APSK-L</b> 32/45</p> <p><b>Short Frame:</b>  <b>QPSK</b> 11/45, 4/15, 14/45, 7/15, 8/15, 32/45  <b>8PSK</b> 7/15, 8/15, 26/45, 32/45  <b>16APSK</b> 7/15, 8/15, 26/45, 3/5, 32/45  <b>32APSK</b> 2/3, 32/45</p>
DVB-S2 (EN 302 307-1)	<p><b>QPSK</b> 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10  <b>8PSK</b> 3/5, 2/3, 3/4, 5/6, 8/9, 9/10  <b>16APSK</b> 2/3, 3/4, 4/5, 5/6, 8/9, 9/10  <b>32APSK</b> 3/4, 4/5, 5/6, 8/9, 9/10</p>
FastLink™ Low-Latency LDPC	<p><b>BPSK</b> 0.499  <b>(O)QPSK</b> 0.532, 0.639, 0.710, 0.798  <b>8PSK/8QAM</b> 0.639, 0.710, 0.778  <b>16APSK/16QAM</b> 0.726, 0.778, 0.828, 0.851  <b>32APSK</b> 0.778, 0.828, 0.886, 0.938  <b>64QAM</b> 0.828, 0.886, 0.938, 0.960</p>
TPC	<p><b>BPSK</b> 5/16, 21/44, 3/4, 7/8  <b>(O)QPSK</b> 5/16, 21/44, 3/4, 7/8, 0.93  <b>8PSK</b> 3/4, 7/8, 0.93  <b>8QAM</b> 3/4, 7/8, 0.93  <b>16QAM</b> 3/4, 7/8, 0.93</p>

**Legacy Forward Error Correction**

DVB-S/DSNG (Provided as standard with Quad ASI card)	<p><b>DVB-S:</b> QPSK 1/2, 2/3, 3/4, 5/6, 7/8  <b>DVB-DSNG:</b> 8PSK 2/3, 5/6, 8/9; 16QAM 3/4, 7/8          (ETSI EN 300421/ 301210 compliant)</p>
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**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	

**DVB-S2 Performance**  
QEF (PER 10e-7)

Normal frames, Pilots off		
	Spectral Efficiency	Eb/No (dB) & Es/No (dB)
QPSK 1/4	0.490243	1.1 (-2.0)
QPSK 1/3	0.656448	0.7 (-1.1)
QPSK 2/5	0.789412	0.7 (-0.3)
QPSK 1/2	0.988858	1.1 (1.1)
QPSK 3/5	1.188304	1.7 (2.4)
QPSK 2/3	1.322253	2.0 (3.2)
QPSK 3/4	1.487473	2.4 (4.1)
QPSK 4/5	1.587196	2.6 (4.6)
QPSK 5/6	1.654663	3.0 (5.2)
QPSK 8/9	1.766451	3.7 (6.2)
QPSK 9/10	1.788612	3.9 (6.4)
8PSK 3/5	1.779991	3.5 (6.0)
8PSK 2/3	1.980636	4.0 (7.0)
8PSK 3/4	2.228124	4.6 (8.1)
8PSK 5/6	2.478562	5.6 (9.5)
8PSK 8/9	2.646012	6.6 (10.8)
8PSK 9/10	2.679207	6.9 (11.2)
16APSK 2/3	2.637201	5.2 (9.4)
16APSK 3/4	2.966728	5.8 (10.5)
16APSK 4/5	3.165623	6.2 (11.2)
16APSK 5/6	3.300184	6.6 (11.8)
16APSK 8/9	3.523143	7.5 (13.0)
16APSK 9/10	3.567342	7.8 (13.3)
32APSK 3/4	3.703295	7.3 (13.0)
32APSK 4/5	3.951571	7.8 (13.8)
32APSK 5/6	4.119540	8.4 (14.5)
32APSK 8/9	4.397854	9.4 (15.8)
32APSK 9/10	4.453027	9.6 (16.1)

**DVB-S2X Performance**  
QEF (PER 10e-7)

Normal frames, Pilots off		
	Spectral Efficiency	Eb/No (dB) & Es/No (dB)
QPSK 13/45	0.567805	0.5 (-2.0)
QPSK 9/20	0.889135	0.9 (0.4)
QPSK 11/20	1.088581	1.1 (1.5)
8APSK-L 5/9	1.647211	3.1 (5.3)
8APSK-L 26/45	1.713601	3.2 (5.5)
8PSK 23/36	1.896173	3.6 (6.4)
8PSK 25/36	2.062148	4.1 (7.2)
8PSK 13/18	2.145136	4.3 (7.6)
16APSK-L 1/2	1.972253	3.4 (6.3)
16APSK-L 8/15	2.104850	3.5 (6.7)
16APSK-L 5/9	2.193247	3.6 (7.0)
16APSK-L 3/5	2.370043	3.9 (7.6)
16APSK-L 2/3	2.635236	4.4 (8.6)
16APSK 26/45	2.281645	4.2 (7.8)
16APSK 3/5	2.370043	4.4 (8.1)
16APSK 28/45	2.458441	4.2 (8.1)
16APSK 23/36	2.524739	4.6 (8.6)
16APSK 25/36	2.745734	5.2 (9.6)
16APSK 13/18	2.856231	5.4 (10.0)
16APSK 7/9	3.077225	6.0 (10.9)
16APSK 77/90	3.386618	7.0 (12.3)
32APSK-L 2/3	3.289502	6.5 (11.7)
32APSK 3/5	3.510192	6.5 (12.0)
32APSK 11/15	3.620536	6.7 (12.3)
32APSK 7/9	3.841226	7.5 (13.3)
64APSK-L 32/45	4.206428	8.4 (14.6)
64APSK 11/15	4.338659	8.9 (15.3)
64APSK 7/9	4.603122	9.3 (15.9)
64APSK 4/5	4.735354	9.5 (16.3)
64APSK 5/6	4.933701	10.3 (17.2)

**DVB-S2 Performance**  
QEF (PER 10e-7)

Short frames, Pilots off		
	Spectral Efficiency	Eb/No (dB) & Es/No (dB)
QPSK 1/4	0.365324	2.2 (-2.2)
QPSK 1/3	0.629060	1.3 (-0.7)
QPSK 2/5	0.760928	1.1 (-0.1)
QPSK 1/2	0.848840	1.6 (0.9)
QPSK 3/5	1.156532	2.1 (2.7)
QPSK 2/3	1.288400	2.3 (3.4)
QPSK 3/4	1.420269	2.9 (4.4)
QPSK 4/5	1.508181	3.1 (4.9)
QPSK 5/6	1.596093	3.5 (5.5)
QPSK 8/9	1.727961	4.0 (6.4)
8PSK 3/5	1.725319	4.0 (6.4)
8PSK 2/3	1.922040	4.5 (7.3)
8PSK 3/4	2.118761	5.1 (8.4)
8PSK 5/6	2.381056	6.0 (9.8)
8PSK 8/9	2.577777	7.0 (11.1)
16APSK 2/3	2.548792	5.6 (9.7)
16APSK 3/4	2.809662	6.2 (10.7)
16APSK 4/5	2.983575	6.7 (11.4)
16APSK 5/6	3.157488	7.1 (12.1)
16APSK 8/9	3.418357	8.1 (13.4)
32APSK 3/4	3.493093	8.1 (13.5)
32APSK 4/5	3.709309	8.7 (14.4)
32APSK 5/6	3.925526	9.0 (14.9)
32APSK 8/9	4.249850	10.2 (16.5)

**DVB-S2X Performance**  
QEF (PER 10e-7)

Short frames, Pilots off		
	Spectral Efficiency	Eb/No (dB) & Es/No (dB)
QPSK 11/45	0.453236	1.4 (-2.0)
QPSK 4/15	0.497192	1.3 (-1.7)
QPSK 14/45	0.585104	1.1 (-1.2)
QPSK 7/15	0.892796	1.4 (0.9)
QPSK 8/15	1.024664	1.7 (1.8)
QPSK 32/45	1.376313	2.6 (4.0)
8PSK 7/15	1.331876	3.1 (4.3)
8PSK 8/15	1.528597	3.4 (5.2)
8PSK 26/45	1.659745	3.8 (6.0)
8PSK 32/45	2.053188	4.8 (7.9)
16APSK 7/15	1.766184	4.0 (6.5)
16APSK 8/15	2.027053	4.4 (7.5)
16APSK 26/45	2.200966	4.8 (8.2)
16APSK 3/5	2.287923	5.0 (8.6)
16APSK 32/45	2.722705	5.8 (10.2)
32APSK 2/3	3.168769	6.8 (11.8)
32APSK 32/45	3.384985	7.3 (12.6)

**FastLink™ Performance at BER 5E-8**

(Note: \* denotes BER of 5E-12)

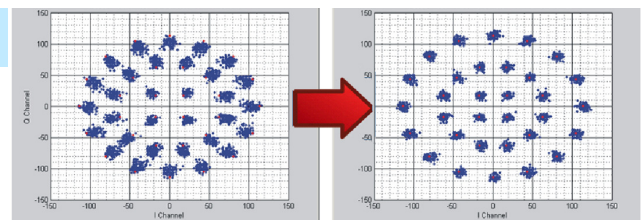
	FEC Rate	Spectral Efficiency	Low BER Eb/No & Es/No	Balanced Eb/No & Es/No	Low Latency Eb/No & Es/No
BPSK	0.499	0.499	2.1 (-0.9)	2.9 (-0.1)	3.4 (0.4)
(O)QPSK	0.532	1.064	2.1 (2.4)	2.6 (2.9)	2.9 (3.2)
(O)QPSK	0.639	1.278	2.4 (3.5)	2.8 (3.8)	3.2 (4.3)
(O)QPSK	0.710	1.42	2.7 (4.2)	3.2 (4.7)	3.7 (5.2)
(O)QPSK	0.798	1.596	3.1 (5.1)	3.9 (6.0)	4.2 (6.2)
8PSK	0.639	1.917	5.4* (8.2)	5.9* (8.7)	6.3* (9.1)
8PSK	0.710	2.13	5.6* (8.9)	5.5 (8.8)	5.8 (9.1)
8PSK	0.778	2.334	5.6 (9.3)	6.1 (9.7)	6.4 (10.1)
8QAM	0.639	1.917	4.4 (7.2)	4.8 (7.6)	5.0 (7.8)
8QAM	0.710	2.13	5.0 (8.3)	5.3 (8.6)	5.5 (8.8)
8QAM	0.778	2.334	5.5 (9.2)	5.9 (9.6)	6.1 (9.8)
16APSK	0.726	2.904	7.6* (12.2)	7.5* (12.1)	7.5 (12.1)
16APSK	0.778	3.112	7.8* (12.7)	7.1 (12.0)	7.5 (12.4)
16APSK	0.828	3.312	7.4 (12.6)	8.1 (13.3)	8.4 (13.6)
16APSK	0.851	3.404	7.9 (13.2)	8.3 (13.6)	8.8 (14.1)
16QAM	0.726	2.904	7.2* (11.8)	6.6 (11.2)	6.8 (11.4)
16QAM	0.778	3.112	6.7 (11.6)	7.1 (12.0)	7.4 (12.3)
16QAM	0.828	3.312	7.2 (12.4)	7.7 (12.9)	8.0 (13.2)
16QAM	0.851	3.404	7.5 (12.8)	8.0 (13.3)	8.4 (13.7)
32APSK	0.778	3.89	9.8* (15.7)	9.6 (15.5)	10.0 (15.9)
32APSK	0.828	4.14	9.8 (16.0)	10.6 (16.8)	10.9 (17.1)
32APSK	0.886	4.43	10.8 (17.3)	11.4 (17.9)	11.9 (18.4)
32APSK	0.938	4.69	12.6 (19.3)	13.2 (19.9)	13.9 (20.6)

**PER v BER**

Note: A PER of 10e-7 is equivalent to a BER of 6.6 x 10e-11.

**ClearLinQ™**

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



	Option	Description	Fully configurable - pay only for what you need!
<b>Base Modem</b>  <i>Note: front-panel keypad and display is not available for this model</i>	✓	<b>2.4kbps to 2.048Mbps Tx/Rx modem with 4-port Gigabit Ethernet switch for M&amp;C and traffic</b> <b>L-band operation 950 to 2450MHz;</b> 10MHz reference <b>TPC:</b> BPSK, QPSK, OQPSK, 8PSK, 8QAM and 16QAM; to 60Mbps subject to prevailing modem data rate <b>All features described under Ethernet Standard Features</b> <b>All features described under Test Facilities</b> (except those requiring Utilities Card) <b>AUPC:</b> Automatic Uplink Power Control <b>AC mains input</b>	
<b>Tx-only</b>		Transmit functions only	
<b>Rx-only</b>		Receive functions only	
<b>Data Rate</b>		<b>5Mbps data rate:</b> Extends base operation to 5Mbps	
		<b>10Mbps data rate:</b> Extends 5Mbps operation to 10Mbps	
		<b>25Mbps data rate:</b> Extends 10Mbps operation to 25Mbps	
		<b>60Mbps data rate:</b> Extends 25Mbps operation to 60Mbps	
<b>XStream IP™</b>		<b>Traffic Shaping:</b> 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	
		<b>Header Compression:</b> IP/UDP/TCP/RTP packet header compression (RFC 3095) plus Ethernet header compression	
		<b>Payload Compression:</b> TCP/UDP packet payload compression using the Deflate algorithm (RFC 1951)	
		<b>Dynamic Routing:</b> RIP, OSPF and BGP	
		<b>TCP Acceleration:</b> Up to 10,000 concurrent accelerated TCP connections to 60Mbps subject to prevailing data rate	
		<b>HTTP Acceleration:</b> Speeds up download of web pages to web browsers; includes DNS caching; <i>requires TCP acceleration to be on and the modem to be in routing mode</i>	
<b>XStream IP™</b> <b>DVB-S2X</b> <i>Provided as standard as part of DVB-S2/S2X option</i>		<b>IP-over-DVB Encapsulation:</b> Encapsulation of IP packets and Ethernet frames over DVB-S2/S2X using GSE, Paradise XStream Protocol (PXE), MPE or ULE	
		<b>ACM:</b> DVB-S2/S2X ACM (dynamic adjustment of outbound modcod to maximize data rate)	
		<b>VCM:</b> 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	
<b>DVB-S2X</b> <i>To 60Mbps subject to prevailing modem data rate limits</i>		<b>DVB-S2/S2X CCM Tx:</b> 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	
		<b>DVB-S2/S2X CCM Rx:</b> 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	
<b>FastLink™</b> Low-latency LDPC		Add-on card; includes BPSK, QPSK, OQPSK, 8PSK, 8QAM, 16APSK, 16QAM, 32APSK & 64QAM; to 60Mbps subject to prevailing modem data rate limits; includes 5%, 10%, 15%, 20%, 25% & 35% spectral roll-offs as standard	

Option	Description
<b>Fully configurable - pay only for what you need!</b>	
<b>Paired Carrier+™</b>  <i>Subject to prevailing modem data rate limits.</i>  <i>Occupied bandwidth: minimum 25kHz; maximum 54MHz</i>  Paired Carrier+™ is also available as a low-cost 180-day license for light users (the license counts down only when Paired Carrier+™ is being actively used) - please contact Sales for details	<b>Paired Carrier+™ add-on card</b> (requires one or more options below)
	Paired Carrier+™ up to <b>256kbps</b> (requires Paired Carrier+™ add-on card)
	Extends Paired Carrier+™ up to <b>512kbps</b>
	Extends Paired Carrier+™ up to <b>1.024Mbps</b>
	Extends Paired Carrier+™ up to <b>2.5Mbps</b>
	Extends Paired Carrier+™ up to <b>5Mbps</b>
	Extends Paired Carrier+™ up to <b>10Mbps</b>
	Extends Paired Carrier+™ up to <b>15Mbps</b>
	Extends Paired Carrier+™ up to <b>20Mbps</b>
	Extends Paired Carrier+™ up to <b>25Mbps</b>
	Extends Paired Carrier+™ up to <b>30Mbps</b>
	Extends Paired Carrier+™ up to <b>40Mbps</b>
	Extends Paired Carrier+™ up to <b>50Mbps</b>
	Extends Paired Carrier+™ up to <b>60Mbps</b>
<b>Terrestrial Interfaces</b> (Please choose up to two hardware options)	<b>G.703:</b> 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
	<b>EIA-530:</b> D25 DCE supporting RS422/X.21/V.35/RS232
	<b>Quad E1:</b> 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
	<b>Quad ASI:</b> 4xBNC 75Ω sockets; includes DVB-S/DSNG FEC (for use with ASI, or MPEG over IP, or general IP)
	<b>IDR:</b> 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)
<b>Utilities Card</b>	Add-on card with: 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. BNC connector for Station Clock input Second fan for environments where extra cooling is required FSK signalling
<b>ClearLinQ™</b>	<b>Adaptive Tx Predistorter:</b> Corrects for linear & non-linear distortion in the RF chain (amplifier & transponder). Applicable to all FECs and modulations
<b>IBS</b>	Satellite framing to IESS 309 with low-rate Intelsat ESC (to IESS 403) and high-rate IBS ESC
<b>DVB-CID</b>	<b>DVB Carrier ID:</b> Tx carrier identification per ETSI 103 129
<b>Legacy FEC</b>	<b>Sequential FEC</b> (limited to maximum of 2.048Mbps); <b>TCM 8PSK 2/3</b> to IESS 310; <b>Viterbi BPSK/QPSK/OQPSK</b> FEC rates 1/2, 3/4 & 7/8; Intelsat <b>Reed-Solomon</b> outer codec
<b>DC Input</b>	<b>24V &amp; 48V DC: K3025</b> 24V & 48V DC primary power input (in place of 100 to 240V AC input)
<b>BUC PSU</b>	<b>AC In &amp; 24V Out: P3553</b> AC input, 24V 200W DC to Tx BUC
	<b>AC In &amp; 48V Out: P3554</b> AC input, 48V 200W DC to Tx BUC
	<b>48V In &amp; 24V Out: P3555</b> 48V DC input; +24V 200W DC to Tx BUC
	<b>48V In &amp; 48V Out: P3556</b> 48V DC input; +48V 200W DC to Tx BUC

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