The **Q-MultiFlex™** offers a cost-effective solution for point-to-multipoint IP satellite systems. The **Q-MultiFlex™** supports a highly-efficient DVB-S2X shared outbound along with up to 16 FastLink™ low-latency LDPC returns. It is unique in the industry in allowing a rack of hub equipment, including all standard test and network equipment, to be replaced at a fraction of the price by a single box.

All network modems (and other equipment) can be monitored and controlled via **Q-NET™ Navigator** (included as standard).

The optional **Q-NET™ Bandwidth Manager** supports multi-satellite carrier planning, analytics and report generation.

**Advanced Bandwidth-Efficient Features**

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

**DVB-S2X** improves spectral efficiency by between 20% and 60% compared to DVB-S2 and includes spectral roll-offs as low as 5%.

Adaptive Coding and Modulation (ACM), one of many onboard bandwidth-saving IP features, converts any unused link margin into additional throughput.

**FEATURES**

- Star, mesh & hybrid point-to-multipoint IP
- Modulator with up to 16 demodulators
- Scalable to any network size
- Supports low-cost **Q-Lite™** & **Q-Flex™** remote modems
- Dual IF/L-band operation
- DVB-S2X shared outbound
- FastLink™ low-latency LDPC returns
- Data rates to 200Mbps outbound & inbound
- **XStream IP™** advanced IP optimization suite including TCP acceleration, header & payload compression, traffic shaping, encryption & ACM
- Optimized spectral roll-offs, down to 5%
- **LinkGuard™** signal-under-carrier interference detection
- Built-in spectrum and constellation monitors
- DVB Carrier ID. Fully compliant with DVB-CID standard
- **Q-NET™ Navigator** network M&C app
- Optional **Q-NET™ Bandwidth Manager**

**Markets and Applications**

- IP trunking and backhaul
- Corporate networking
- Cellular backhaul
- Disaster recovery
- Maritime, oil & gas communications
- Broadcast
### Demodulator Specification

A demodulator add-on card supports 8 demodulators. One or two demodulator cards can be fitted, supporting up to 16 demodulators. Demodulators are enabled in software in blocks of 4.

<table>
<thead>
<tr>
<th>Demodulator Options</th>
<th>4, 8, 12 or 16 (total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Bandwidth</td>
<td>All inbound carriers must be within a bandwidth of 72MHz</td>
</tr>
<tr>
<td>Operating Mode</td>
<td>FastLink™ Low-latency LDPC decoder operated in Closed Network mode</td>
</tr>
<tr>
<td>Data Rate</td>
<td>Each inbound: 18kbps to 100Mbps Total for all combined: Up to 200Mbps 1bps resolution</td>
</tr>
<tr>
<td>Symbol Rate</td>
<td>Each inbound: 18kbps to 40Mbps Total for all combined: Up to 70Mbps 1bps resolution</td>
</tr>
<tr>
<td>Input Range (dBm)</td>
<td>IF minimum: -115 + 10 log (symbol rate) L-band minimum: -190 + 10 log (symbol rate) IF/L-band maximum: -80 + 10 log (symbol rate)</td>
</tr>
</tbody>
</table>

### Modulator Specification

<table>
<thead>
<tr>
<th>Operating Modes</th>
<th>DVB-S2X (EN 302 307-2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Rate</td>
<td>DVB-S2X: 50kbps to 200Mbps DVB-S2: 50kbps to 200Mbps FastLink™: 1kbps to 100Mbps</td>
</tr>
<tr>
<td>Symbol Rate</td>
<td>DVB-S2X: 100kbps to 50Mbps DVB-S2: 100kbps to 50Mbps FastLink™: 1kbps to 40Mbps</td>
</tr>
<tr>
<td>Output Power</td>
<td>IF: 0 to 26dBm L-band: 0 to 40dBm</td>
</tr>
<tr>
<td>Stability/Accuracy</td>
<td>Stability: ±1.0dB, 0ºC to 50ºC Accuracy: ±0.375dBm</td>
</tr>
<tr>
<td>Transmit Filter</td>
<td>DVB-S2/S2X: 5%, 10%, 15%, 20%, 25%, 35% FastLink™: 5%, 10%, 15%, 20%, 25%, 35%</td>
</tr>
<tr>
<td>Roll-off</td>
<td>Phase Accuracy: ±30dBc minimum</td>
</tr>
<tr>
<td>Harmonics &amp; Spurious</td>
<td>Better than –60dBc/ 4kHz in-band (at 0dBm to -30dBm output)</td>
</tr>
<tr>
<td>Output Phase Noise</td>
<td>As EN 302 307, IESS-308 &amp; IESS-316</td>
</tr>
<tr>
<td>Transmit On/Off Ratio</td>
<td>Transmit On/Off: -65dB minimum</td>
</tr>
<tr>
<td>BUC PSU Option</td>
<td>24V or 48V DC via IFL cable, 200W</td>
</tr>
<tr>
<td>BUC 10MHz Reference</td>
<td>Via IFL cable; 10MHz ± 0.01 ppm; 2dBm ± 1dBm</td>
</tr>
<tr>
<td>FSK Control</td>
<td>Allows monitor &amp; control of a compatible L-band BUC from the modem via the Tx IFL cable</td>
</tr>
</tbody>
</table>

### Q-NET™ Navigator

Q-NET™ Navigator supports the M&C of all Paradise modems (old and new) 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.
**Q-MultiFlex™**

### ‘Hub-in-a-Box’ IP Modulator / Multi-demodulator

#### Ethernet: Standard Features

- **Bridging and Static Routing**
  - Trunking mode: Hardware Layer 2 bridge supporting 200Mbps 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 access/trunking

- **DHCP**
  - DHCP client for automatic allocation of MAC & 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 (inc. 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 performance monitoring, giving full network 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

- **OpenAMIP**
  - Support for the Open Antenna Modem Interface Protocol (OpenAMIP) protocol, facilitating the exchange of data with compliant antenna control units (ACUs). Supports antenna deployment/pointing/tracking

- **Packet Generator/Analyser**
  - Generates & analyses TCP & UDP packet streams, allowing modem-to-modem IP testing without any PCs

- **Ethernet MTU Size**
  - 10k bytes

#### XStream IP™ Tier 1 (Tx only)

_XStream IP™ is an IP optimization suite designed for maximum reliability and bandwidth efficiency. The following features are provided as a standard part of the Modulator Option. Note that GSE is a separate option_

- **Traffic Shaping**
  - Provides guaranteed throughput for priority traffic: supports Committed and Burst Information rates. Stream classification uses one or more of: VLAN ID, IP address, IEEE 802.1p priority & DiffServ DSCP

- **IP-over-DVB Encapsulation**
  - Supports the transmission of IP packets with/without Ethernet frames over DVB-S2/DVB-S2X, encapsulates & decapsulates using our highly-efficient 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 & DVB-S2X

#### XStream IP™ Tier 2 (Tx only) Option

_The Tier 2 option extends the transmit capabilities provided by the XStream IP™ Tier 1 option._

- **DVB-S2/SX ACM**
  - Dynamically varies modcod with varying link conditions in order to maximise throughput for each remote site at all times by converting unused link margin into additional throughput; 100% link availability

- **DVB-S2/SX VCM**
  - Supports the transmission of up to 16 IP streams. Each stream has its own associated modcod for optimal per-site throughput

#### XStream IP™ Tier 3 (Tx and Rx) Option

_The following features apply to both transmit and receive and can be used independently of XStream IP™ Tier 1 and XStream IP™ Tier 2 options. The Tier 3 option supports all modulators for a single price._

- **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%

- **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

- **AES-256 Encryption**
  - Provides bi-directional encryption. Remotes can share a common encryption key or each can use a unique key, ensuring different customer data is kept secure. Supported on Q-MultiFlex™ model only. The Q-MultiFlex™ is identical to the standard Q-MultiFlex™ in every other respect

#### Test Facilities and 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; time graphs for key performance indicators (IP throughput, Eb/No, etc.)

- **BER Tester**
  - Demodulator-based bit error rate tester, allowing the link from each remote to be tested for data transparency. 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, deferred, Tx and aggregated Rx alarms

#### Network Control

- **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™ Bandwidth Manager**
  - Provides multi-satellite/transponder carrier planning and high-level system control, monitoring, recording and quality-of-service reporting

- **Modem Compatibility**
  - Compatible with the use of Q-Flex™ and Q-Lite™ satellite modems
Q-MultiFlex™ ‘Hub-in-a-Box’ IP Modulator / Multi-demodulator

Forward Error Correction

**Q-MultiFlex™**

Includes support for DVB-S2

Normal Frame: QPSK 1/4, 1/3, 2/3, 3/4, 4/5, 5/6, 7/8, 9/10
16APSK 3/4, 3/5, 4/5, 5/6, 6/7, 7/8, 8/9, 9/10
256APSK 1/2, 1/3, 2/3, 3/4, 4/5, 5/6, 6/7, 7/8, 8/9, 9/10
8APSK 1/2, 1/3, 2/3, 3/4, 4/5, 5/6, 6/7, 7/8
16APSK-L 1/2, 1/3, 2/3, 3/4, 4/5, 5/6, 6/7, 7/8
32APSK 1/2, 1/3, 2/3, 3/4, 4/5, 5/6, 6/7, 7/8
4QAM 1/2, 1/3, 2/3, 3/4, 4/5, 5/6, 6/7, 7/8

Includes support for DVB-S2X

Normal Frame: QPSK 1/4, 1/3, 2/3, 3/4, 4/5, 5/6, 7/8, 9/10
16APSK 3/4, 3/5, 4/5, 5/6, 6/7, 7/8, 8/9, 9/10
256APSK 1/2, 1/3, 2/3, 3/4, 4/5, 5/6, 6/7, 7/8, 8/9, 9/10
8APSK 1/2, 1/3, 2/3, 3/4, 4/5, 5/6, 6/7, 7/8
16APSK-L 1/2, 1/3, 2/3, 3/4, 4/5, 5/6, 6/7, 7/8
32APSK 1/2, 1/3, 2/3, 3/4, 4/5, 5/6, 6/7, 7/8
4QAM 1/2, 1/3, 2/3, 3/4, 4/5, 5/6, 6/7, 7/8

FastLink™ Low-Latency LDPC

EPD Rate: 4QAM 0.499 16APSK 0.522 8PSK 0.639 32APSK 0.788 64QAM 0.828
QPSK 0.499 8PSK 0.522 16APSK 0.532 32APSK 0.639 64QAM 0.788
16APSK 0.522 8PSK 0.532 16APSK 0.639 32APSK 0.788 64QAM 0.828
QPSK 0.499 8PSK 0.522 16APSK 0.532 32APSK 0.639 64QAM 0.788

Q-MultiFlex™: The industry’s first ‘Hub in a Box’.

Historically, networks required many different boxes including modulators, demods, IP optimisers, routers, packet encapsulators, BER testers, spectrum analysers, oscilloscopes, interference detectors and traffic analysers.

Now you can replace all of these with a single box! That’s a lot of money you won’t have to spend and that’s leaving out the cost of spares, training and maintenance for all those individual boxes. And you can multiply the saving times over as you scale the network!

‘Before’ and ‘After’
**Q-MultiFlex™**

### 'Hub-in-a-Box' IP Modulator / Multi-demodulator

#### Base Unit

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
</table>
| ✓      | Chassis supporting:  
|        | • IF Tx/Rx BNC connectors and L-band Tx/Rx N-type connectors  
|        | • 1 Gigabit Ethernet port for M&C  
|        | 4-port Gigabit Ethernet Switch for traffic (1 port on base unit combined with 3 ports on Ethernet extension card)  
|        | • High-stability 10MHz reference (for BUC/LNB); FSK Ethernet bridge, static routing and all features described under Ethernet Standard Features  
|        | Web browser monitoring tools: Spectrum display, constellation monitor, TCP/IP throughput metrics Internal Bit Error Rate Tester (BERT): For non-DVB-S2/DVB-S2x operation only |

#### Modulator Options

<table>
<thead>
<tr>
<th>Description</th>
<th>DVB-S2/S2X CCm Tx: Modulator transmit function to 100Mbps/50Mbps (default); DVB-S2 QPSK, 8PSK, 16APSK &amp; 32APSK Tx operation per EN 302 307-1. DVB-S2x QPSK, 8PSK, 16APSK, 32APSK &amp; 64APSK Tx operation per EN 302 307-2. Includes 5%, 10%, 15%, 20%, 25% &amp; 35% spectral roll-offs. Includes XStream™ IP Tier 1 (Tx only), which comprises traffic shaping and IP-over-DVB encapsulation. FastLink™ Low-latency LDPC: Modulator transmit function to 100Mbps/40Mbps; includes BPSK, QPSK, OQPSK, 8PSK, 8QAM, 16APSK, 16QAM, 32APSK &amp; 64QAM; includes 5%, 10%, 15%, 20%, 25% &amp; 35% spectral roll-offs.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>200Mbps data rate: Extends 100Mbps Tx operation to 200Mbps (DVB-S2 &amp; DVB-S2x only)</td>
</tr>
</tbody>
</table>

#### Demodulator Options

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>All demodulators include support for FastLink™ Low-latency LDPC Closed Network operation: BPSK, (O)QPSK, 8PSK, 8QAM, 16APSK, 16QAM, 32APSK, 64QAM; 5%, 10%, 15%, 20%, 25% &amp; 35% spectral roll-off factors; default maximum composite receive data rate total of 100Mbps/70Mbps</td>
<td></td>
</tr>
</tbody>
</table>

- **8 Demodulator Hardware** option: adds a single demodulator add-on card supporting demodulators numbered 1 to 8 (hardware option); none are enabled in software by default
- **4 demodulators**: enables demodulators 1 to 4 inclusive (software option) (requires 8 Demodulator Hardware option)
- **8 demodulators**: enables demodulators 5 to 8 inclusive (software option) (requires 4 Demodulator option)
- **16 Demodulator Hardware** option: adds second demodulator add-on card supporting demodulators number 9 to 16 (hardware option); none are enabled in software by default
- **12 demodulators**: enables demodulators 9 to 12 inclusive (software option) (requires 16 Demodulator Hardware option)
- **16 demodulators**: enables demodulators 13 to 16 inclusive (software option) (requires 12 Demodulator option)

#### Data Rate Options

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>200Mbps data rate: Extends 100Mbps Rx operation to 200Mbps (composite data rate total for all demodulators)</td>
<td></td>
</tr>
</tbody>
</table>

#### XStream IP™ Options

| Description | XStream IP™ Tier 1 (Tx only): provided as standard with any Modulator Option: includes:  
|-------------|--------------------------------------------------------|
|            | • Traffic Shaping: CIR/BlR/priority settings for IP streams classified by VLAN ID, IP address, IEEE 802.1p priority and DiffServ DSCP  
|            | • IP-over-DVB Encapsulation: transmission of IP packets and Ethernet frames over DVB-S2/S2x using Paradise XStream Encapsulation (PX) |
|            | XStream IP™ Tier 2 (Tx only): requires Modulator Option: includes:  
|            | • DVB-S2/S2x point-to-multipoint VCM (up to 16 streams in shared outbound, each controlled by its own modcod)  
|            | • DVB-S2/S2x point-to-multipoint ACM (dynamic adjustment of all outbound modcods to maximize data rate) |
|            | XStream IP™ Tier 3 (Tx & Rx): applies to Tx and Rx; does not require XStream IP™ Tier 1 or Tier 2 options; supports all enabled demodulators; includes:  
|            | • Header Compression: IP/UDP/TCP/RTP packet header compression (RFC 3095) plus Ethernet header compression  
|            | • Payload Compression: TCP/UDP packet payload compression using the Deflate algorithm (RFC 1951)  
|            | • TCP Acceleration: Supports up to 10,000 concurrent accelerated TCP connections at up to 100Mbps  
|            | • 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-MultiFlex™ model only. The Q-MultiFlex™ is identical to the standard Q-MultiFlex™ in every other respect |

#### XStream IP™ DVB-S2 GSE Encapsulation

| Description | Highly efficient encapsulation of IP packets or Ethernet frames; compatible with EN 302 307-2 standard, for use with DVB-S2 and DVB-S2x |

#### Ruggedisation

| Ruggedisation | Ruggedises the equipment for harsh environments (fans with higher airflow, heatsinks on key components, etc.) supporting extended temperature operation from 0 to 55°C |

#### DVB-CID

| Description | DVB Carrier ID: Tx carrier identification per ETSI 103 129 |

#### DC Input

| Description | 24V DC: K3023 24V DC primary power input (in place of 100 to 240V AC input)  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>48V DC: K3018 48V DC primary power input (in place of 100 to 240V AC input)</td>
</tr>
</tbody>
</table>

#### BUC PSU

| Description | AC In & 24V Out: P3543 AC input, 24V 200W DC to Tx BUC  
|-------------|--------------------------------------------------------|
|             | AC In & 48V Out: P3544 AC input, 48V 200W DC to Tx BUC  
|             | 48V In & 24V Out: P3545 Floating 48V DC input; +24V 200W DC to Tx BUC  
|             | 48V In & 48V Out: P3546 Floating 48V DC input; +48V 200W DC to Tx BUC  
|             | +48V In & 48V Out: P3547 +48V DC input; +48V 200W DC to Tx BUC |

---

Teledyne Paradise Datacom reserves the right to change specifications of products described in this document at any time without notice and without obligation to notify any person of such changes. Refer to the website or contact Sales or Customer Support for the latest product information. The information contained herein is classified EAR99 under the U.S. Export Administration Regulations. The modem itself is classified ECCN 5A991.b.4 and is subject to U.S. Department of Commerce export control. Export re-export or diversion contrary to U.S. law is prohibited.