# QFlex-400 WGS

## ARSTRAT WGS Certified Satellite Modem

A High Performance Modem Based on the
Popular QFlex-400 Series

TELEDYNE
PARADISE DATACOM
Everywhere**you**look™

## Overview

The QFlex-400 WGS satellite Modem is our current rack mount ARSTRAT WGS certified satellite Modem, based on our comprehensive QFlex-400 series Modem. The unit is certified for use with the high-capacity wideband global SATCOM (WGS) system used by the United States and other allied militaries worldwide. The QFlex-400 WGS certified Modem is specifically focused for military and government applications providing broadcast services, data transfer, images and videos to troops in theater.

The QFlex-400 WGS ARSTRAT certified Modem supports DVB-S2 and DVB-S2X, the most powerful and robust modulation and coding available for the space segment, supporting modulations from QPSK to 16APSK. In addition, the Modem is IP centric, supporting Ethernet / IP data in the highly efficient Trunking mode, where maximum performance is achieved in terms of bit rate and packets per second, with zero jitter.

Our Flagship QFlex-400 WGS software defined Satellite Modem is our highest data rate Modem to date. The unit supports data rates to 249Mbps, has an extended L-band frequency range, better RF performance, higher processing capability allowing for future upgrades and yet, is smaller and lighter than it's predecessors and has the lowest power consumption to date.

It is ideal as a versatile point-to-point network modem or a remote modem in a point-to-multipoint network. It is fully compatible with our Q-NET™ satellite network solution and also with our standard QFlex-400 and Q-Lite series Modems.

## Features

- Dual IF/L-band; data rates to 249Mbps
- Low power consumption, typically 30W
- DVB-S2/S2X
- Optimized 20% spectral roll-off
- LinkGuard™ signal-under-carrier interference detection
- Built-in spectrum & constellation monitors
- Q-NET™ Navigator network control app
- Interoperates fully with Q-Lite WGS product range, including Q-Lite Rugged WGS and Q-Lite Half Width WGS
- Software Defined Network support: vendor-independent network device control using standard commands (supports OpenFlow)



## Markets and Applications

- Government secure networks
- Secure commercial networks operating on the WGS constellations
- Military secure networks
- Communications on the move
- IP Trunking
- Hub modem for Q-Lite WGS VSAT terminals

## WGS Certification

- ARSTRAT WGS certification number 20-003

# Why QFlex-400 WGS?

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

## STATE OF THE ART

- DVB-S2X up to 16APSK provides the highest bandwidth efficiency
- Highly efficient Trunking mode, which provides the highest bit rate and packet per second performance with zero jitter

## SECURE

- SCPC is both secure, and with Paradise Modems, easy to provision
- AAA Radius support and access control lists.

## COMPATIBLE

- Compatible with Q-Lite WGS products
- Supports a simple, intuitive web browser in-common with all Paradise WGS Modem products
- Supports IF and L-band in one unit.
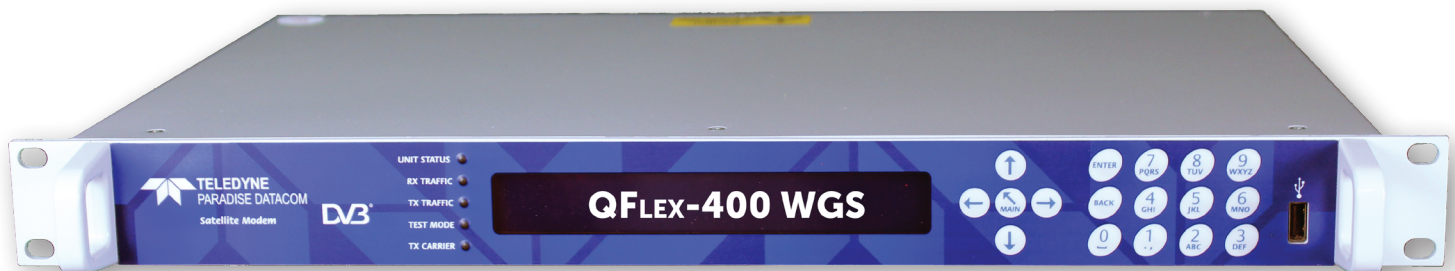
## CONVENIENT

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

## PRACTICAL

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

## EFFICIENT

- DVB-S2X is the most robust and efficient Modulation and coding for the space segment
- Support for Paradise Datacom's highly efficient IP Centric, Trunking mode.

## WELL EQUIPPED

### Transmitter
**Fast:**
- Up to 249Mbps and 69.9Msps
- Output power: IF 0 to -25dBm; Standard L-Band +5 to -40dBm

### Interface Ports
**Convenient:**
- 4 port GB Ethernet switch for IP Traffic and M&C
- Support for VLAN M&C

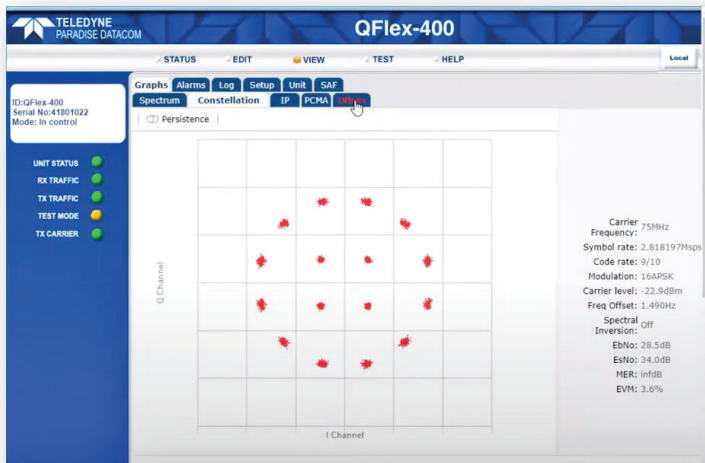### RF Stages
**Future Proof:**
- Transmit and Receive speeds field upgradeable, only pay for the capacity you need now
- Extended L-Band coverage from 950 to 2,450 MHz
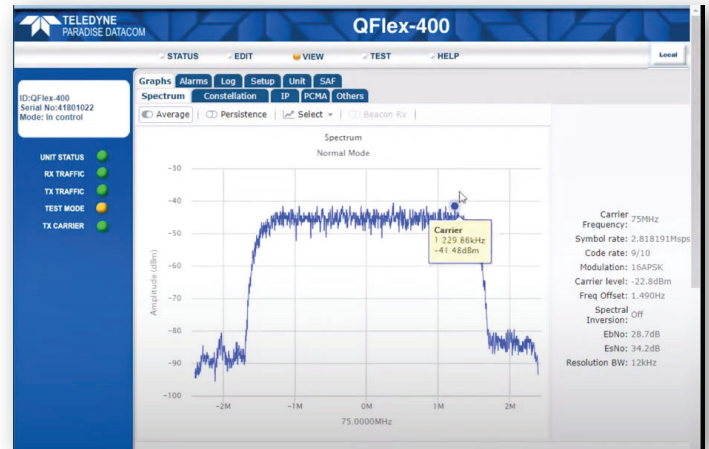- Wideband IF 50 - 180MHz

### Receiver
**Fast:**
- Up to 249Mbps and 69.9Msps

## Powerful On-Board Test Equipment





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

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

## LinkGuard™ Interference Detection

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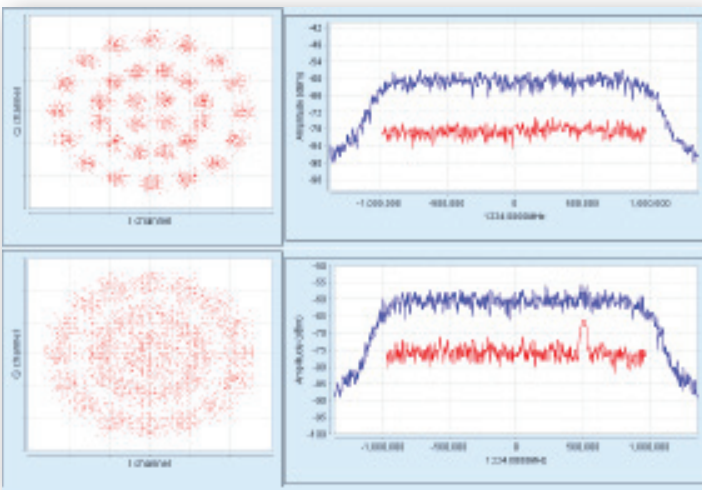


## Advanced Bandwidth-Efficient Features

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

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

Supports the highly efficient transparent Ethernet Trunking mode.

## Included Network Management

Q-NET Navigator supports monitor and control of all Paradise modems from a single application.

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

## The Paradise Family of Secure SCPC Modems

| Paradise SCPC Modems | | Point-to-Point | Point-to-MultiPoint, Star, Mesh, Hybrid | | Form Factor | Features of Note |
|---|---|---|---|---|---|---|
| | | | Hub or Remote Site | Remote Site | | |
| Standard | QFlex-400 | ✔ | | | 1U 19" Rack | PCMA+ enhanced carrier overlay available |
| | QMultiFlex-400 | ✔ | ✔ | | | Optional Embedded Hub Canceller |
| | QFlex-400 P2MP | | | ✔ | | Configured remote |
| | QubeFlex | ✔ | | | | Small Sat/LEO - Support for CCSDS |
| Small Form Factor | Q-Lite Rugged | ✔ | | | | IP65 weatherproof outdoor satellite modem |
| | Q-Lite Half Width | ✔ | | | | Mountable as two side by side within 1U rack space |
| | Q-Lite Card | ✔ | | | Card | For OEM integration. |
| | AXIOM-X (New) | ✔ | | | Card | Our smallest modem. |

All modem models except QubeFlex are also available as **encrypted models**, capable of TCP/IP packet payload encryption using symmetric AES with 256-bit keys. Note that these models are export controlled.
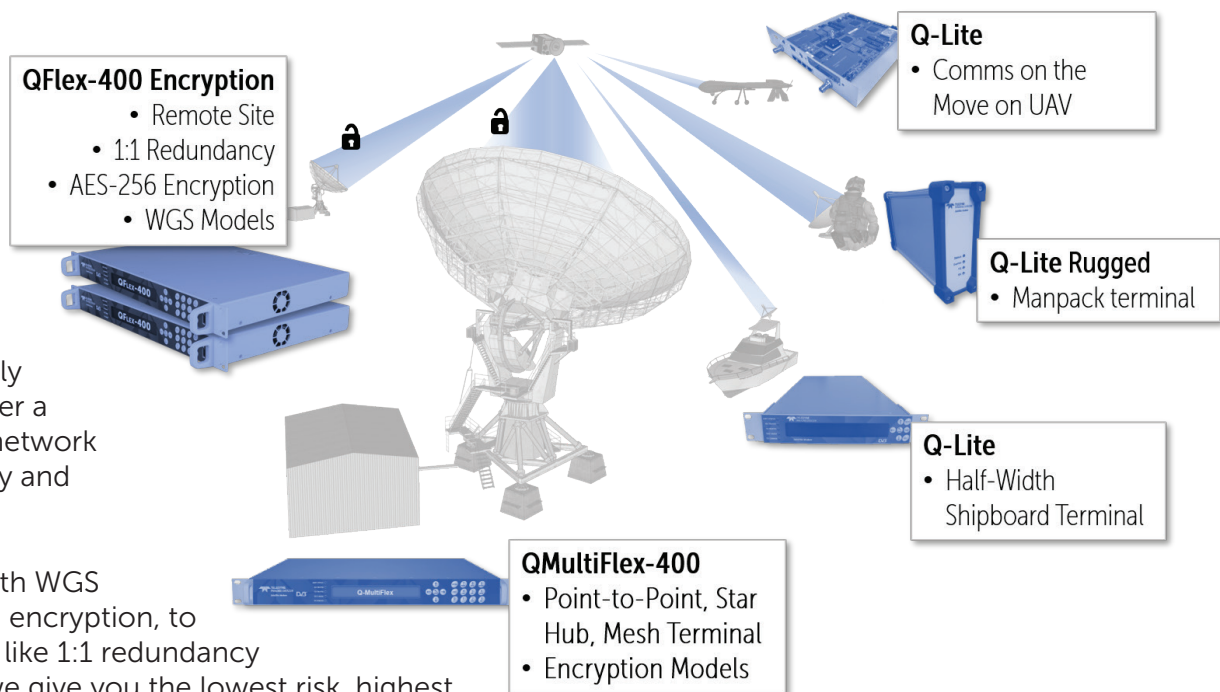
The QFlex-400, Q-Lite, Q-Lite Half Width and Q-Lite Rugged models are also available as WGS-certified models.

## The Q-Net Family

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

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

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

**QFlex-400 Encryption**
• Remote Site
• 1:1 Redundancy
• AES-256 Encryption
• WGS Models

**Q-Lite**
• Comms on the Move on UAV

**Q-Lite** Rugged
• Manpack terminal

**Q-Lite**
• Half-Width Shipboard Terminal

**QMultiFlex-400**
• Point-to-Point, Star Hub, Mesh Terminal
• Encryption Models

## Main Specifications

| | |
|---|---|
| Topology | Point to Point or Star Modem within a Point to Multipoint Network |
| Frequency | **L-band:** 950 to 2,450MHz (resolution 1Hz) **IF:** 50 to 180MHz (resolution 100Hz) N-type connectors for Tx & Rx |
| Data Rates | **Standard:** 2,048kbps **Options:** 5, 10, 25, 60, 100, 200 & 249Mbps |
| Data Rate Limits | **DVB-S2/S2X:** 50kbps to 249Mbps |
| Symbol Rate Limits | **DVB-S2/S2X:** 100ksps to 69.9Msps |
| Operating Modes | **DVB-S2/S2X** (EN 302 307-1 & EN 302 307-2) |
| Impedance | 50Ω |
| Return Loss | Typically >18dB for **IF** and >16dB for **L-band** to 2GHz |
| Redundancy | 1:1 through 1:16 redundancy |

## Modulator

| | |
|---|---|
| Output Power | **IF:** 0 to −25dBm (0.1dB steps) **L-band:** +5 to −40dBm (950 to 1950MHz) 0 to −40dBm (1950 to 2150MHz) 0 to −30dBm (2150 to 2450MHz) (0.1dB steps) |
| Output Power Stability/ Accuracy | Stability: $\pm$1.0dB, 0°C to 50°C Accuracy: $\pm$0.375dBm |
| Transmit Filter Roll-off | 20% (other spectral roll off's are available including 5% roll off, which is 15% more bandwidth efficient than 20% roll off. (*Not WGS certified*)) |
| Phase Accuracy | $\pm$2° maximum |
| Amplitude Accuracy | $\pm$0.2dB maximum |
| Carrier Suppression | -30dBc minimum |
| Output Phase Noise | As EN 302 307, EN 300 421 |
| Harmonics & Spurious | Better than −60dBc/ 4kHz in-band |
| Transmit On/ Off Ratio | -65dB minimum |
| BUC PSU Option | 24V or 48V DC via IFL cable, 200W |
| BUC 10MHz Reference | Via IFL cable; 10MHz $\pm$ 0.01 ppm; 2dBm $\pm$ 2dBm |
| FSK Control | Allows monitor & control of a compatible L-band BUC from the modem via the Tx IFL cable |

## Demodulator

| | |
|---|---|
| Input Range (dBm) | IF minimum: -130 + 10 log (symbol rate) L-band minimum: -140 + 10 log (symbol rate) IF/L-band maximum: -68 + 10 log (symbol rate) |
| Maximum Input Power | +10dBm |
| Wanted-to-Composite | -102 + 10 log (symbol rate) |
| Frequency Sweep Width | $\pm$1kHz to $\pm$255kHz (1kHz steps) |
| Acquisition Time | Dependent on FEC, data rate and sweep width |
| Receive Spectral Roll-off | 20% (other spectral roll off's are available including 5% roll off, which is 15% more bandwidth efficient than 20% roll off. (*Not WGS certified*)) |
| LNB 10MHz Reference | Via IFL cable; 10MHz $\pm$ 0.01ppm; 2dBm $\pm$ 2dBm |
| LNB Voltage | Programmable 13V, 15V, 18V, 20V or 24V DC to LNB via IFL cable; maximum 0.5A |

## Test Facilities & Alarm Outputs

| | |
|---|---|
| Built-in Test Tools | As part of built-in web server: Rx constellation monitor; Rx spectrum analyser; **LinkGuard™** Signal-Under -Carrier interference detection; beacon receiver function that provides automatic detection of satellite beacon transmissions time graphs for key performance indicators (IP throughput, Eb/No, etc.) |
| Other Test Modes | Transmit CW Transmit alternate 1-0 pattern |
| Alarm Relays | 4 independent Form C relays for unit, Tx, Rx and deferred alarms |

## Mechanical/Environmental

| | |
|---|---|
| Size | 1U chassis, 285mm deep excluding front panel handles and rear panel connectors and fans |
| Weight | 3kg |
| Power Supply | 90 to 264VAC, 1A @100V, 0.5A @240V, 47 to 63Hz Fused IEC connector (live and neutral fused); 24V and 48V DC options |
| Compliance | FCC, CE and RoHS compliant |
| Safety Standards | EN62368-1:2014,Edition 2 |
| Emissions & Immunity | Emissions: EN55022:2010 Class B Immunity: EN55024:2010 |
| Temperature | Standard: 0 to 50°C; Storage: -20°C to 70°C |
| Humidity | 95% relative humidity, non-condensing |

## WGS Certification

| | |
|---|---|
| Number | ARSTRAT WGS certification number 20-003 |

## Features

| | |
|---|---|
| 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 |
| Traffic Interfaces | **Standard:** **4-port Gigabit Ethernet switch** (RJ45 connectors; used for IP traffic and M&C) |
| Utility Interfaces | **9-way D type** for 1:1 and 1:N redundancy (compatible with Q-NET PDQS Redundancy Switch); **15-way D type** for alarms (4 independent Form C relays for unit, Tx, Rx and deferred alarms), Tx Inhibit signal and scalable DC voltage output for antenna pointing; **USB connector** for software upgrades, etc.; **Second fan; FSK signalling** |

## Network Control

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

## Ethernet: Standard Features

| | |
|---|---|
| Trunking Mode | Hardware Layer 2 switch supporting 249Mbps bi-directional traffic at up to 200,000 packets per second; zero jitter |
| IPv4/IPv6 | Dual IPv4/IPv6 TCP/IP support |
| VLAN Support | Passes VLAN tagged traffic transparently in Trunking mode |
| DHCP | DHCP client for automatic allocation of M&C IP address |
| SNMP | SNMP v1, v2c & v3 |
| Access Control Lists | Separate IP and MAC address black/white user access control lists (for M&C port only) |
| Network Time Protocol (NTP) | NTP client synchronises modem time & date to NTP server; provides millisecond accuracy |
| Web Server | Modem web server M&C interface (including built-in tools listed under Test Facilities) |
| AAA RADIUS Secure User Login | Authentication, Authorisation & Accounting. Greater access control & accountability. Replaces standard modem login with user's personal network login credentials |
| IP Metrics | Tx, Rx throughput (bps, pps) graphs; dropped, errored packet counts |
| OpenAMIP Protocol Support | Controls modem interaction with compliant antenna control units to support antenna deployment/pointing/tracking |
| Ethernet MTU Size | Standard: 10k bytes |

## WGS Supported Modulation and Code Rates

| Waveform | Minimum Data Rate (kbps) | Maximum Data Rate (kbps) | Minimum Symbol Rate (ksps) | Maximum Symbol Rate (ksps) |
|---|---|---|---|---|
| QPSK DVB-S2 1/4 NF | 50 | 34,268.00 | 101.99 | 69,900 |
| QPSK DVB-S2 1/3 NF | 65.645 | 45,885.73 | 100 | 69,900 |
| QPSK DVB-S2 2/3 NF | 132.225 | 92,425.49 | 100 | 69,900 |
| QPSK DVB-S2 5/6 NF | 165.466 | 115,660.94 | 100 | 69,900 |
| QPSK DVB-S2 8/9 NF | 176.645 | 123,474.94 | 100 | 69,900 |
| QPSK DVB-S2 9/10 NF | 178.861 | 125,023.97 | 100 | 69,900 |
| QPSK DVB-S2X 13/45 NF | 56.781 | 39,689.60 | 100 | 69,900 |
| QPSK DVB-S2X 11/20 NF | 108.858 | 76,091.82 | 100 | 69,900 |
| | | | | |
| QPSK DVB-S2 2/5 SF | 76.093 | 53,188.86 | 100 | 69,900 |
| QPSK DVB-S2 1/2 SF | 84.884 | 59,333.92 | 100 | 69,900 |
| QPSK DVB-S2 3/4 SF | 142.027 | 99,276.78 | 100 | 69,900 |
| QPSK DVB-S2X 11/45 SF | 50 | 31,681.17 | 110.318 | 69,900 |
| QPSK DVB-S2X 14/45 SF | 58.51 | 40,898.76 | 100 | 69,900 |
| QPSK DVB-S2X 7/15 SF | 89.28 | 62,406.45 | 100 | 69,900 |
| QPSK DVB-S2X 32/45 SF | 137.631 | 96,204.25 | 100 | 69,900 |
| | | | | |
| 8PSK DVB-S2 2/3 NF | 198.064 | 138,446.47 | 100 | 69,900 |
| 8PSK DVB-S2 3/4 NF | 222.812 | 155,745.84 | 100 | 69,900 |
| 8PSK DVB-S2 9/10 NF | 267.921 | 187,276.57 | 100 | 69,900 |
| 8PSK DVB-S2X 23/36 NF | 189.617 | 132,542.52 | 100 | 69,900 |
| 8PSK DVB-S2X 13/18 NF | 214.514 | 149,945.01 | 100 | 69,900 |
| | | | | |
| 8PSK DVB-S2 3/5 SF | 172.532 | 120,599.78 | 100 | 69,900 |
| 8PSK DVB-S2 8/9 SF | 257.778 | 180,186.67 | 100 | 69,900 |
| 8PSK DVB-S2X 7/15 SF | 133.188 | 93,098.14 | 100 | 69,900 |
| 8PSK DVB-S2X 26/45 SF | 165.974 | 116,016.18 | 100 | 69,900 |
| 8PSK DVB-S2X 32/45 SF | 205.319 | 143,517.81 | 100 | 69,900 |
| | | | | |
| 16APSK DVB-S2 2/3 NF | 263.72 | 184,340.33 | 100 | 69,900 |
| 16APSK DVB-S2 5/6 NF | 330.018 | 230,682.87 | 100 | 69,900 |
| 16APSK DVB-S2 8/9 NF | 352.314 | 246,267.70 | 100 | 69,900 |
| 16APSK DVB-S2 9/10 NF | 356.734 | 249,357.20 | 100 | 69,900 |
| 16APSK DVB-S2X 26/45 NF | 228.165 | 159,487.00 | 100 | 69,900 |
| 16APSK DVB-S2X 3/5 NF | 237.004 | 165,666.00 | 100 | 69,900 |
| 16APSK DVB-S2X 23/36 NF | 252.474 | 176,479.26 | 100 | 69,900 |
| 16APSK DVB-S2X 25/36 NF | 274.573 | 191,926.78 | 100 | 69,900 |
| 16APSK DVB-S2X 7/9 NF | 307.723 | 215,098.05 | 100 | 69,900 |
| 16APSK DVB-S2X 77/90 NF | 338.662 | 236,724.57 | 100 | 69,900 |
| | | | | |
| 16APSK DVB-S2 3/4 SF | 280.966 | 196,395.36 | 100 | 69,900 |
| 16APSK DVB-S2X 7/15 SF | 176.618 | 123,456.23 | 100 | 69,900 |
| 16APSK DVB-S2X 8/15 SF | 202.705 | 141,691.01 | 100 | 69,900 |
| 16APSK DVB-S2X 3/5 SF | 228.792 | 159,925.80 | 100 | 69,900 |
| 16APSK DVB-S2X 32/45 SF | 272.271 | 190,317.10 | 100 | 69,900 |

## Ordering: QFlex-400 WGS

| Standard Features | | Description |
|---|---|---|
| Base Modem | ✓ | 2.4kbps to 2.048Mbps Tx/Rx DVB modem with 4-port Gigabit Ethernet switch for M&C and traffic. Front-panel keypad and display<br>IF operation 50 to 180MHz. L-band operation 950 to 2450MHz; high-stability 10MHz reference<br>All features described under Ethernet Standard Features. All features described under Test Facilities<br>AUPC: Automatic Uplink Power Control<br>AC mains input |
| DVB-S2X<br>To 249Mbps subject to prevailing modem data rate limits | ✓ | **DVB-S2/S2X CCM Tx:** DVB-S2 QPSK, 8PSK & 16APSK Tx operation per EN 302 307-1. DVB-S2X QPSK, 8PSK, 8APSK, 16APSK, Tx operation per EN 302 307-2. Includes 20% spectral roll-off. |
| | | **DVB-S2/S2X CCM Rx**: Add-on card supporting DVB-S2 QPSK, 8PSK & 16APSK Rx operation per EN 302 307-1. DVB-S2X QPSK, 8PSK, 8APSK, 16APSK Rx operation per EN 302 307-2. Includes 20% spectral roll-off |

### Optional Features

| | | |
|---|---|---|
| Tx Only | ◯ | Transmit functions only |
| Rx Only | ◯ | Receive functions only |
| Extend Tx Data Rate | ◯ | **5Mbps data rate:** Extends base operation to 5Mbps |
| | ◯ | **10Mbps data rate:** Extends 5Mbps operation to 10Mbps |
| | ◯ | **25Mbps data rate:** Extends 10Mbps operation to 25Mbps |
| | ◯ | **60Mbps data rate:** Extends 25Mbps operation to 60Mbps |
| | ◯ | **100Mbps data rate:** Extends 25Mbps operation to 100Mbps |
| | ◯ | **200Mbps data rate:** Extends 100Mbps operation to 200Mbps |
| | ◯ | **249Mbps data rate:** Extends 200Mbps operation to 249Mbps |
| DC Input | ◯ | **48V DC:** K3025 48V DC primary power input (in place of 100 to 240V AC input) |
| BUC PSU | ◯ | **AC In & 24V Out:** P3553 AC input, 24V 200W DC to Tx BUC |
| | ◯ | **AC In & 48V Out:** P3554 AC input, 48V 200W DC to Tx BUC |
| | ◯ | **48V In & 24V Out:** P3555 48V DC input; +24V 200W DC to Tx BUC |
| | ◯ | **48V In & 48V Out:** P3556 48V DC input; +48V 200W DC to Tx BUC |

# Global Sales Offices

**U.S., Canada, Latin America, Asia Pacific**

Teledyne Paradise Datacom
11361 Sunrise Park Drive
Rancho Cordova, CA  95742
Tel: +1 (916) 638-3344
sales@paradisedata.com

**Eastern Regional Sales Office
(Eastern U.S. & Latin America)**

RF Inquiries: John O'Grady, (732) 280-1688
Modem Inquiries: Mike Towner, (470) 509-9941
sales@paradisedata.com

(CORRESPONDENCE ONLY)
Teledyne Paradise Datacom

930 New Hope Road #11-129
Lawrenceville, GA 30045

**Western Regional Sales Office
(Western U.S. & Canada)**

Cell: +1 (480) 444-9676
sales@paradisedata.com

**U.K. Office Covering the UK & Europe**

Teledyne Paradise Datacom
2-3 The Matchyns, London Road, Rivenhall End
Witham CM8 3HA United Kingdom

Tel: +44(0)1376 515636
Fax: +44(0)1376 533764
sales@paradisedata.com