TELEDYNE PARADISE DATACOM
A Teledyne Technologies Company

QubeFlex Satellite Modem

Installation and Operating Handbook

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Teledyne Paradise Datacom
106 Waterhouse Lane, Chelmsford, Essex CM1 2QU, England.
Tel: +44(0)1376 515636
https://www.teledynedefenseelectronics.com/paradisedatacom

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Chapter 1 Welcome

Figure 1-1 QubeFlex Satellite Modem

The **QubeFlex** satellite modem (Figure 1-1) embodies a new concept in satellite modem technology: a short chassis, flexible software-defined modem, which allows an easy future upgrade path. The Modem provides a flexible hardware platform with support for IF (50 - 180MHz) and L-band (950 – 2450MHz) operation in one unit. Its powerful processor is ideal for handling IP traffic. However, the **QubeFlex** modem can be fitted with EIA-530 (for X.21, RS422, V.35 and RS232 operation) or high speed LVDS terrestrial interfaces and will operate at data rates up to 50Mbps (for IP operation).

The design aim for Paradise's Q Series modems, of which the **QubeFlex** is one, was to create the industry's most versatile and bandwidth-efficient satellite modem. Core features available are:

- **CCSDS & Intelsat Forward Error Correction,** Forward error correction ensures data is protected against transmission loss
- **Spectral roll-off factors down to 5%**, saving up to 15% bandwidth compared with 20% roll-off.
- **Extended Roll-offs**, Extends base modem carrier roll-offs to include up to 60% roll-off (selectable in 1% increments)
- **Extended Doppler,** Extends base modem Doppler limits from ±255kHz, ±2.1kHz/s to ±700kHz, ±9kHz/s
- **9-tap Rx equaliser**, providing compensation for linear distortion in the channel, such as from group delay. The equaliser is automatically switched on in all modes of operation above 10Msps.

New levels of usability are provided by a leading set of built-in diagnostic tools including spectrum and constellation monitors that facilitate the detection of any link degradation. In addition, **LinkGuard™** (U.S. patent 8351495) monitors underneath the received carrier for any interference, while on traffic.

This handbook will guide you through the process of installing and using your **QubeFlex** satellite modem.

Chapter 2 About This Handbook

2.1 Conventions

This warning symbol is intended to alert the user to the presence of a hazard that may cause death or serious injury.

This information symbol is intended to alert the user to the presence of important operating instructions critical to correct system function.

2.2 Trademarks

All trademarks used in this handbook are acknowledged to be the property of their respective owners.

2.3 Disclaimer

Although every effort is made to ensure the accuracy and completeness of the information in this handbook, this cannot be guaranteed, and the information contained herein does not constitute a product warranty. A separate product warranty statement is available. Teledyne Paradise Datacom maintains a program of continuous product improvement and reserves the right to change specifications without prior notice.

Chapter 3 Safety and Compliance Information

PLEASE READ THE FOLLOWING INFORMATION BEFORE INSTALLATION AND USE.

3.1 Safety Compliance

To ensure operator safety, this satellite modem conforms to the provisions of EMC Low Voltage Directive 2006/95/EC and complies with the following standard:

- EN 62368-1:2014 Edition 2 'Safety of Information Technology Equipment, Including Electrical Business Equipment'.

Prior to installation and at all points during operation the following points must be observed.

- ***This satellite modem must be operated with its cover on at all times in order to provide protection from potentially lethal internal voltages. Never operate the unit with the cover removed.***
- ***This satellite modem must be directly connected to a protective earth ground at all times, using the chassis ground stud situated on the rear of the unit.***
- ***The power system to which this satellite modem is connected must provide separate ground, neutral and line conductors. The power system must have a direct ground connection.***
- ***This satellite modem has double pole/neutral fusing. To ensure operator safety, fuses should always be replaced with identical type and rating.***
- ***To allow rapid disconnection from the mains in an emergency, the equipment should be installed near the mains socket outlet, which should be easily accessible.***

3.2 Environmental Compliance

All Teledyne Paradise Datacom satellite modem products are compliant with the following EC environmental directives:

- The Reduction of Hazardous Substances (RoHS) Directive 2011/65/EU.
- The Waste Electrical and Electronic Equipment (WEEE) Directive 2012/19/EU

The equipment should not be directly connected to the Public Telecommunications Network.

Operation of the equipment in an environment other than that stated will invalidate the safety standards.

The equipment must not be operated in an environment in which it is exposed to:

- ***Unpressurised altitudes greater than 3000 metres.***
- ***Extreme temperatures outside the stated operating range.***
- ***Excessive dust.***
- ***Moisture or humid atmosphere above 95% relative humidity.***
- ***Excessive vibration.***
- ***Flammable gases.***
- ***Corrosive or explosive atmosphere.***

3.3 Electromagnetic Compatibility (EMC) Compliance

This satellite modem conforms to the provisions of EMC Directive 2004/108/EC and complies with the following EC and FCC standards:

- Emissions: EN 55032:2015 Class A – 'Information Technology Equipment – Radio Disturbance Characteristics – Limits and Methods of Measurement'.

- Immunity: EN 55035:2017 (incorporating EN61000-3-2:2014 class A) – 'Information Technology Equipment – Immunity Characteristics – Limits and Methods of Measurement'.

- Federal Communications Commission (FCC) Federal Code of Regulation Part 15, Subpart B.

All D-type connectors must have grounding fingers on the plug shell to guarantee continuous shielding. The back-shells must comply with the requirements of VDE 0871 and FCC 20708, providing at least 40dB of attenuation from 30MHz to 1GHz. A good quality cable with a continuous outer shield, correctly grounded, must be used.

Connections to transmit and receive IF interfaces must be made with double-screened coaxial cable (for example, RG223/U).
The modem Ethernet ports should not be connected directly to outdoor Ethernet cables that may be subject to transient overvoltages due to atmospheric discharges and faults in the power distribution network. Instead, the modem should be connected via an Ethernet switch or router to provide isolation from overvoltages as recommended within EN 61000-3-2:2014 class A.

Chapter 4 Installation

4.1 Unpacking

Prior to unpacking, inspect the exterior of the shipping container for any sign of damage during transit. If damage is evident, contact the carrier with a view to submitting a damage report.

Carefully unpack all items, taking care not to discard any packing materials. If the unit needs to be returned to Teledyne Paradise Datacom then you should use the original packing carton as it is designed to provide the necessary level of protection during shipment.

Once unpacked, visually inspect the contents to ensure all parts are present and that there is no visible damage. Other than the unit itself, the shipping container should contain a power cord and a Quick Start Guide.

4.2 Line Supply

This satellite modem is classified by the EN 62368-1 safety standard as a 'Pluggable Equipment Class A'. The mains operating range is 90V to 264V. A 48V DC input option is available. Power consumption ranges from 40W to a maximum of 300W (when a BUC PSU is fitted).

A power cord suitable for use in the country of operation is provided.

The installation of the satellite modem and the connection to the power supply must be made in compliance with local and national wiring regulations for a Category II 'impulse over-voltage' installation. The satellite modem should be positioned to allow a convenient means of disconnection from the line supply.

4.3 Rack Mounting

If the unit is being installed in a rack, then adequate ventilation and cooling should be provided. There must be adequate clearance around the side and rear mounted fans and the ventilation holes on both sides of the unit.

For rack mounting, there are screw positions on the unit's front panel for attaching it to the rack, which prevent the unit from moving. These must always be used in conjunction with full-length L-brackets fitted on both sides of the unit (or a tray underneath the unit) to support its weight.

A 1U gap between units in the rack is not necessary but if extra space is available then any gap will help to minimise the temperature inside each unit, which may contribute to improving long-term reliability (due to the relationship between temperature and reliability of electronic components).

4.4 Getting Started

Connect the appropriate cables to the transmit and receive connectors at the rear of the unit, along with the cable(s) for the M&C and traffic interface.

Power up the unit and wait for it to complete its initialization when it will display summary status information.

QubeFlex configuration must be carried out using the Web User Interface (WUI), as not all settings are available from the front-panel menu (Local User Interface/LUI).

The default M&C IP address is 10.0.70.1/16. This can be accessed from a PC configured with an IP address in the same subnet, or the Modem's M&C IP address can be changed from the LUI. From the front-panel menu, select *Main->Edit->IP->Addresses* in order to set the IP configuration prior to operation.

Configuring the unit from a web browser as described in Section 6.2.

When setting up a number of units that have similar configurations, the configuration settings of one unit can be saved, extracted and then transferred to each of the other units in turn, using either the web user interface or the USB socket on the modem. This procedure is explained in Application Note AN_044 'Working With Q-Series Modem Configuration Files', available from Modem Technical Support.

Getting started is covered in more detail in the **QubeFlex** modem Quick Start Guide (provided with the unit).

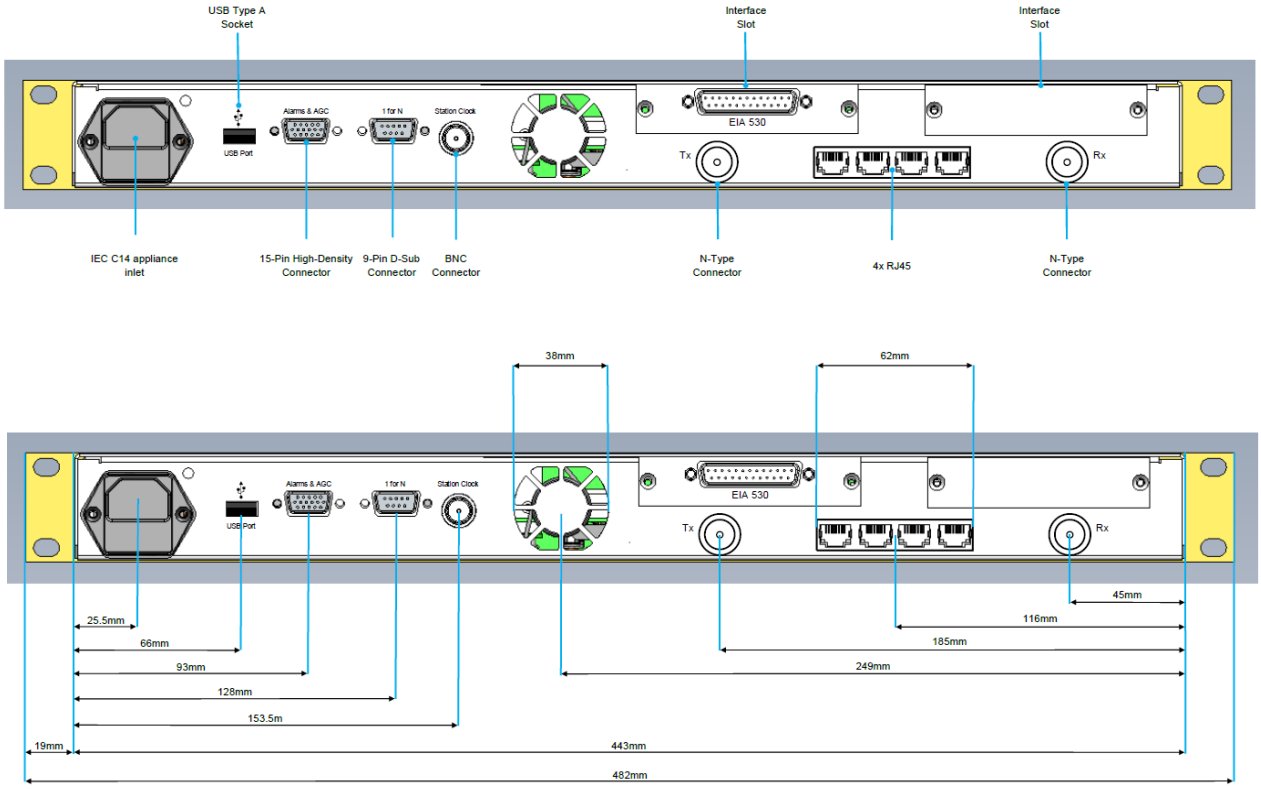


Figure 4-1 QubeFlex Approximate Dimensions and Cable Interconnect

Chapter 5 Introduction

5.1 Overview

The **QubeFlex™** ground-segment modem has been designed for the low-earth orbit CubeSat and smallsat markets. It provides CCSDS and Intelsat-compliant Viterbi/Reed-Solomon operation. Compatible onboard transmitter/transceivers for the satellite are provided by our partners (please contact us for details).

The **QubeFlex™** offers the same front-panel and web user interfaces as other Q-Series modems but with minor modifications to the standard menus as described in this section.

5.2 Standard-Fit Hardware

5.2.1 IF and L-band Operation

The following are provided as standard:

- IF operation, via N-type connectors for Transmit and Receive. 50 to 90MHz and 100 to 180MHz with a resolution of 100Hz.
- L-band operation, via the same transmit and receive L-band N-type connectors (supporting 50Ω operation at 950 to 2450MHz). Resolution of 1Hz.
- A high-stability L-band 10MHz reference signal for output to a Block Up Converter (BUC) or Low-Noise Block (LNB) in order to phase-lock the BUC or LNB's local oscillator to a highly stable frequency reference.

5.2.2 Ethernet Operation

Four Gigabit Ethernet RJ45 connectors are fitted as standard. These can be used concurrently for modem Monitor and Control (M&C) and satellite traffic. These provide a combined 150,000 packets-per-second processing capability and data rates over satellite of up to 50Mbps.

Ethernet speed, duplex and cable termination (crossover versus straight-through) are auto-negotiated. Speed and duplex can also be set to fixed values if desired.

5.2.3 Utilities Card

An add on card that supports the following:

- 9-way D type for 1:1 and 1:N redundancy (compatible with Q-NET PDQS Redundancy Switch) Note: By default the 1:N connector functions as serial M&C and has to be enabled within the factory menus for 1:N working.
- 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, uploading / downloading configurations etc.
- Additional fan
- A Frequency Shift Keying (FSK) capability for performing FSK communications to and from a compatible BUC or IF transceiver. This allows remote monitoring and

control of the BUC or transceiver via a modulated FSK signal on the Inter-Facility Link (IFL) cable

5.3 Hardware Options

5.3.1 Terrestrial Interface Hardware

Table 5-1Table 5-1 lists the different terrestrial interface options that are available.
With the exception of IP, which is provided as standard, they require an interface card to be fitted. Up to two different interface cards can be fitted in addition to the IP interface provided as standard.

IP	IP traffic can use any of the three RJ45 Ethernet traffic ports. The maximum data rate is 50Mbps (subject to prevailaing data rate and symbol rate limits).
RS422	Requires EIA-530 interface card to be fitted. The maximum data rate for RS422 is 10Mbps (subject to prevailaing data rate and symbol rate limits).
RS232	Requires EIA-530 interface card to be fitted. The maximum data rate for RS232 is 100kbps.
V.35	Requires EIA-530 interface card to be fitted. The maximum data rate for V.35 is 10Mbps (subject to prevailaing data rate and symbol rate limits).
LVDS	Requires LVDS interface card to be fitted. The maximum data rate for LVDS is 50Mbps (subject to prevailaing data rate and symbol rate limits).

Table 5-1 Terrestrial Interface Cards

5.3.1.1 EIA-530 Option Card

The EIA-530 option card (part number P3720) provides selectable RS422, X.21, V.35 and RS232 operation up to 10Mbps via a 25-way D-type female connector.

5.3.1.2 LVDS Option Card

The Low Voltage Differential Signal (LVDS) option card (part number P3001) provides LVDS at data rates of up to 50Mbps via a 25-way D-type female connector.

5.3.2 BUC Power Supply Options

The **QubeFlex** satellite modem may optionally be fitted with a BUC Power Supply Unit (PSU) for powering an associated Block Up Converter (BUC). Refer to **Table 5-1**for the available Paradise BUC power supply options.

Part Number	BUC PSU	Type
P3553	200W 24V output	A.C. in/D.C. out
P3554	200W 48V output	A.C. in/D.C. out
P3555	+/-48V input, 200W 24V output	D.C. in/D.C. out
P3556	+/-48V input, 200W 48V output	D.C. in/D.C. out

Table 5-2 BUC Power Supply Options

5.4 Software Options

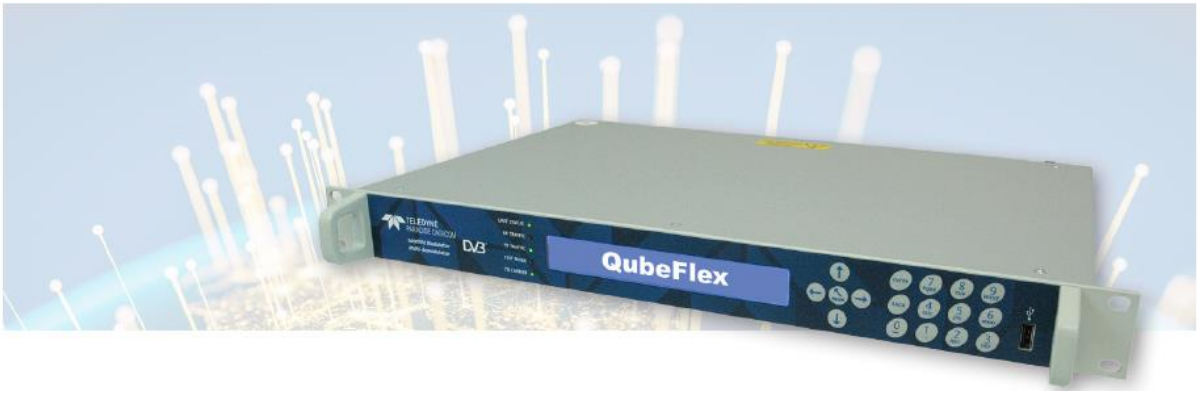
Several software options, known as Software Activated Features (SAF), are available as shown in Table 5-3. These can be purchased on a pay-as-you-go basis and retrospectively activated in deployed units as required. The SAF concept (including time-limited free access to most features) is explained in **Section 7.3**.

In the table, the *SAF Code* column lists the acronyms by which features are referred to on the modem's local user interface.

Feature	SAF Code	Description
Transmit	TX	Enables the Tx service.
Receive	RX	Enables the Rx service.
Terrestrial data rate 0 to 2048kbps	DR0	Enables data rates in the given range.
Terrestrial data rate 0 to 5Mbps	D1L	Enables data rates in the given range.
Terrestrial data rate 0 to 10Mbps	D1H	Enables data rates in the given range.
Terrestrial data rate 0 to 25Mbps	DR2	Enables data rates in the given range.
Terrestrial data rate 0 to 50Mbps	DR3	Enables data rates in the given range. Note: this may be shown 60Mbps however, the limit is 50Mbps.
Optimised spectral roll-off	ROFF	Enables 5%, 10% and 15% spectral roll-off options. (Standard on QubeFlex)
Extended Roll-offs	LRO	Extends base modem carrier roll-offs to include up to 60% roll-off (selectable in 1% increments)
Extended Doppler	DOP	Extends base modem Doppler limits from ±255kHz, ±2.1kHz/s to ±700kHz, ±9kHz/s
Data convert to IP	IPO	Enables data output encapsulated in UDP/IP packets.

Table 5-3 Software Activated Features

5.5 Front Panel



The front panel comprises:

- Light Emitting Diodes (LEDs) that provide basic modem status.
- A Liquid Crystal Display (LCD) that acts as the local user interface.
- A keypad for menu navigation and alphanumeric entry.
- USB port for software upgrades, copying configuration memories, etc.

5.5.1 Status Indicators

The five front-panel LEDs display warning and fault information as shown in **Figure 5-1** and as described in **Table 5-4**.

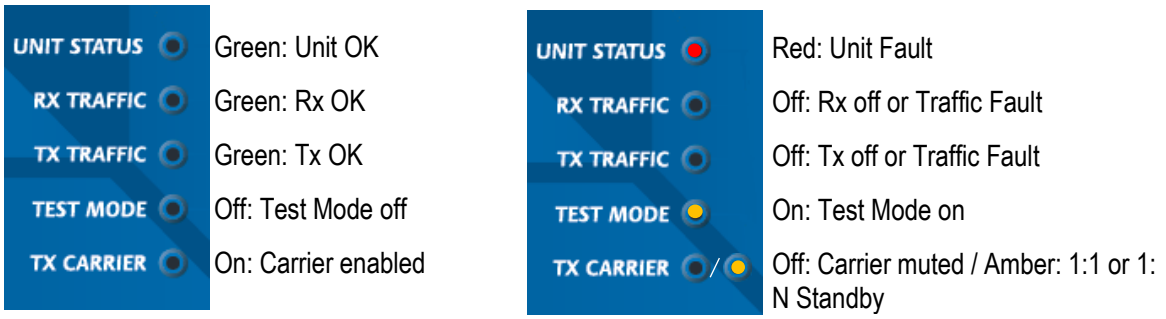


Figure 5-1 Front-panel Status Indicators

Note: A flashing green Unit Status LED indicates that a temporary SAF is about to expire.

	Green	Off	Amber	Red
Unit Status	Unit Ok (Flashing green: SAF timeout alarm)	*Not used*	*Not used*	Unit fault
Rx Traffic	Rx Ok	Rx fault or Rx disabled	*Not used*	*Not used*
Tx Traffic	Tx Ok	Tx fault or Tx disabled	*Not used*	*Not used*
Test Mode	*Not used*	Normal mode	Test mode	*Not used*
Tx Carrier	Carrier enabled	Carrier muted	1:1 / 1:N standby	*Not used*

Table 5-4 Front-panel LED Status

5.5.2 LCD Display

The backlit LCD is a graphical display formatted to give three lines of 40 text characters and is highly legible even in strong ambient light. The contrast is adjustable, and the backlight can be dimmed or brightened as required.

5.5.2.1 Keypad

The keypad (see **Figure 5-2**) is incorporated into a sealed tactile membrane and allows full alphanumeric entry and navigation using arrow keys.

Figure 5-2 Front-panel Keypad

5.6 QubeFlex Rear Panel

The rear panel, shown in Figure 5-3, provides a full set of terrestrial and satellite data interfaces. Connector pinouts are defined in Chapter 10 .

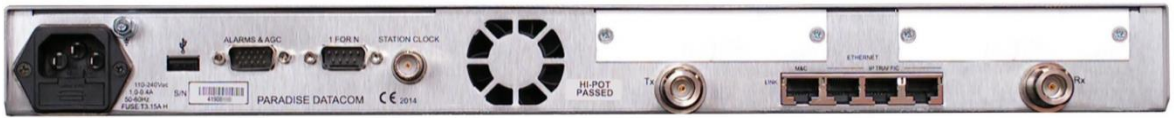


Figure 5-3 The Modem Rear Panel

From left to right, the rear panel consists of:

- **IEC Mains Power Connector/Voltage Selector/Fuse**

The modem is designed to operate from a mains AC supply of 90V to 264V (1A @100V, 0.5A @ 240V, 47 to 63Hz). The IEC connector incorporates two fuses, independently fusing both live and neutral lines. Access to the fuses is provided by a slide-out tray. Both fuses are standard 20mm type, rated T3.15A, of the slow-blow (time-delay) type.

- **Chassis Ground Stud**

There is an M4 stud for connecting a safety earth conductor directly to the chassis of the unit.

- **USB port**

This is a USB host, so slave devices can be connected. Available for software upgrades and transferring configuration memories. USB versions 1 and 2 are supported.

- **Alarms and AGC Connector**

This is a 15-pin D-type male connector that provides access to four 'form-C' relay contacts that indicate alarm conditions. An AGC output is provided that is suitable for peaking antenna position.

The alarm relays have the following definitions:

Unit Fault: A fault exists on the unit indicating an equipment failure.

Tx Traffic Prompt: A Tx traffic fault exists.

Rx Traffic Prompt: An Rx traffic fault exists.

Deferred Alarm: One of the following conditions exists:

• The receive Eb/No is lower than the user-defined threshold.
• Buffer slips are more frequent than the user-defined threshold.
• A backward alarm is being received from either the satellite or terrestrial ports.

- **1:N Redundancy Connector**

The modem has a built-in 1:N redundancy controller, facilitated via a 9-pin D-type male connector. The redundancy controller allows working directly with another Modem in a 1:1 pair or with a 1: N PDQS Redundancy Switch. A 1:1 redundancy system requires two modems, a 1:1 control cable between the two redundancy connectors, a 'Y' cable for splitting the traffic path and passive splitters and combiners for the IF ports. An overview of 1:1 operation is provided in Section 7.2
Note: By default, the 1:N connector functions as serial M&C and must be enabled on the factory menus for 1:N operation.

- **Station Clock**

The Station Clock connector is not used on QubeFlex.

- **Fans**

There is one rear and one side mounted high performance fan fitted to the chassis, these draw air in through the ventilation holes. These holes and the side vents must not be blocked.

- **Tx N Type Connector**

This provides both an IF and L-Band output towards the satellite and is provided using a 50Ω N type connector.

The **IF** covers 50 to 90Mhz and 100 to 180MHz bands with a resolution of 100Hz. Transmit output power is variable between 0 to –25dBm in 0.1dB steps.

L-Band covers 950 to 2450MHz with a resolution of 1Hz. Transmit output power levels conform to the following table, variable in 0.1dB steps.

+5 to –40dBm between 950 to 1950MHz
0 to –40dBm between 1950 to 2150MHz
0 to –30dBm between 2150 to 2450MHz

- **Optional Terrestrial Interface Positions**

Two terrestrial interface positions support EIA-530 and/or LVDS interface cards.

- **Ethernet Connectors**

Four Gigabit Ethernet RJ45 connectors are provided for modem Monitor and Control (M&C) and satellite traffic. Ethernet speed, duplex and cable termination (crossover versus straight-through) are auto-negotiated. Line speed and duplex can also be set to fixed values. The Ethernet ports can be bridged together under software control. If the software option to remove the M&C port from the bridge is invoked, then port 1 of the four-port switch is reserved for M&C only (and the other ports for IP satellite traffic). When the M&C port is bridged to the other ports, M&C and traffic can be passed using any port.

M&C control can be via the Simple Network Management Protocol (SNMP), an embedded web server that sends web pages to a web browser, a Telnet-style terminal emulation application or via TCP packets that encapsulate Paradise Universal Protocol (PUP) commands.

SNMP is disabled by default and must be enabled before it can be used. When enabled, the modem will always respond to SNMP commands regardless of whether it has been placed in a mode that restricts user control to the front panel only.

When using the M&C interface, an M&C IP address (including subnet mask and default gateway) must be set. An IP traffic address is not required when operating in Ethernet bridging modes. IP addresses are described in Section 7.6.2.

When the M&C Ethernet port is out of the bridge then satellite IP traffic and M&C traffic are processed separately and therefore the M&C and traffic Ethernet connectors are no longer interchangeable. Care should be taken in selecting this mode for a remote modem since if the cables have been incorrectly fitted then it could result in M&C communications with the remote modem being lost.

- **Rx N Type Connector**

This provides both an IF and L-Band input from satellite and is provided using a 50Ω N type connector.

The **IF** band covers 50 to 90Mhz and 100 to 180MHz. The IF carrier signal level at the input of the modem must be in the following range:

Minimum signal level: -130 +10 log (symbol rate) dBm

Maximum signal level: -68 + 10 log (symbol rate) dBm

The maximum wanted-to-composite power level that is supported with no implementation loss is defined by the equation:

Maximum wanted-to-composite power level: -102 + 10 log (symbol rate) dBm

The maximum composite power level is +10dBm

The **L-band** covers 950 to 2450MHz band. The carrier level at the input of the modem must be in the following range:

Minimum signal level: -140 +10 log (symbol rate) dBm

Maximum signal level: -68 + 10 log (symbol rate) dBm

The maximum wanted-to-composite power level that is supported with no implementation loss is defined by the equation:

Maximum wanted-to-composite power level: -102 + 10 log (symbol rate) dBm

The maximum composite power level is +10dBm.

Chapter 6 User Interfaces

6.1 User Control

The modem has a web browser user interface and an optional front panel keypad and LCD display.

For remote web browsing, there are two fixed usernames, namely, *admin* and *user*. The *admin* user can view and change the modem configuration, while *user* can only view the modem settings. Only *admin* can change the passwords associated with these two usernames.

There is no restriction on the number of users (as either *admin* or *user*) that can be logged in at the same time. Remote *admin* users who log in while the modem is under local front-panel control will be restricted to view-only permissions.

6.1.1 Local Mode

Local mode allows control of the modem from the front-panel interface only. Web users are still able to log in and view the modem settings in this mode.

6.1.2 Local+ Remote Mode

In *Local+Remote mode*, the modem can be controlled through the front-panel or via a remote *admin* user at the same time. When the modem is switched out of *Local+Remote mode* to *Local mode* then all remote *admin* users will be automatically logged out.

While *Local+Remote mode* is very convenient, it is essential for there to be clear operational procedures in place to avoid conflicts arising in relation to modem control.

6.2 Web User Interface

The modem includes an embedded web server that allows full monitoring and configuration of the modem via a web browser (on port 80).

Secure connections via HTTPS (on port 443) are also supported. Non-secure connections via HTTP (port 80) can optionally be disabled.

Google Chrome, Mozilla Firefox, Microsoft Edge and Internet Explorer web browsers are supported.

6.2.1 Login Screen

To connect to the modem from a web browser, ensure an Ethernet cable is connected into the Remote M&C RJ45 socket on the rear of the modem. From the modem front panel enter (under *Edit->Unit->M&C->IP Address*) an IP address and subnet mask that are compatible with your network. Then enter the modem's IP address into the web browser address bar.

The browser will then request (as shown in Figure 6-1) a username and password. The default *admin* and view-only *user* passwords are both set to *paradise*. It is recommended that passwords are changed from their default values. When entered, the login details are sent in an encrypted form back to the modem.

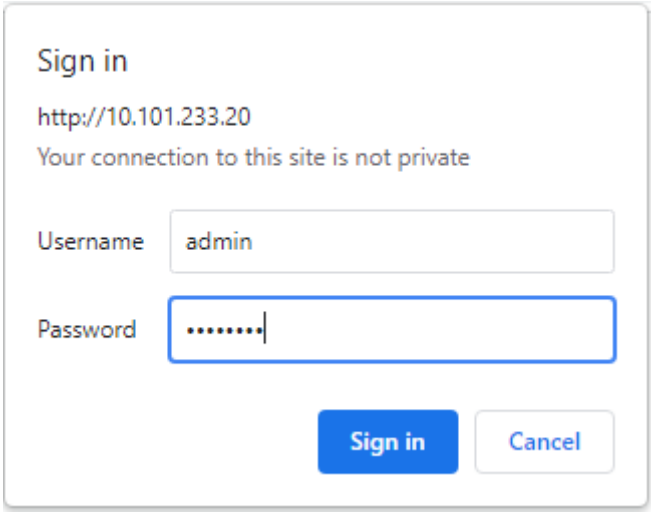


Figure 6-1 Web User Interface Login Screen

On successfully logging in, the user will be presented briefly with the screen shown in **Figure 6-2**.

Figure 6-2 Web Server Welcome Screen

This screen will include the text 'The web user interface is in view-only mode' when the modem is in *Local* control mode, in which modem control is restricted to front-panel operation only. The Status screen shown in **Figure 6-3** will then be presented.

6.2.2 Status Screen

The Status screen is shown in **Figure 6-3**.

Note that 1:N backup modems will show additional status information as defined in the document '*Installation and Operating Handbook for Quantum, Evolution and Q Series Satellite Redundancy Switches'*, which is available for download from https://www.teledynedefenseelectronics.com/paradisedatacom

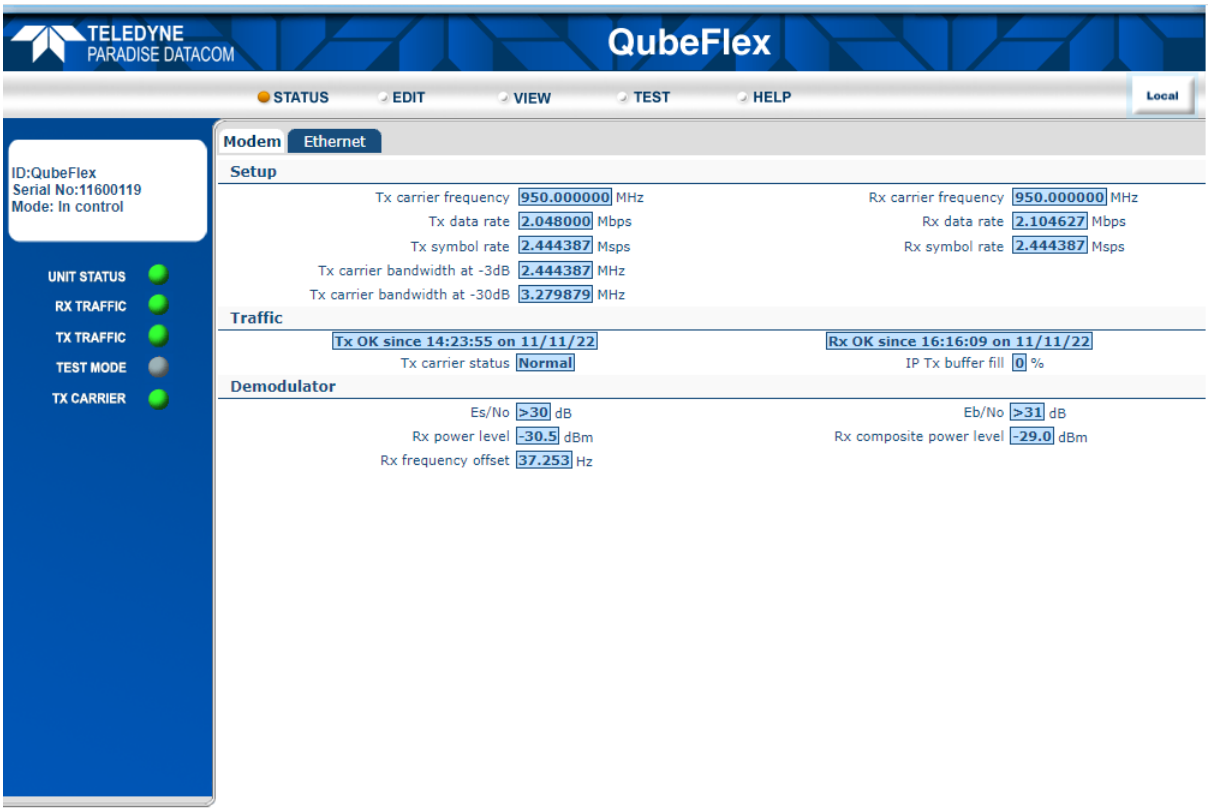


Figure 6-3 Status Screen

The line of buttons across the top of the display (i.e. STATUS, EDIT, VIEW, TEST and HELP) give access to the major modem functions, while the tabs below the buttons give access to individual menus. Tabs are nested and several levels of tab may be displayed at once, allowing the user to see where they currently are in relation to the overall menu system. The main part of the screen will change with the tab menu that is selected. The panel on the left-hand side of the web page contains summary status information and is always displayed. This area is also used to display Help information when the cursor is moved over individual menu options. The simulated Light-Emitting Diodes (LEDs) shown in the left-hand panel mimic the front-panel LED indicators of the modem.

Note that the web browser pages served by the modem will be automatically reconfigured to hide irrelevant information and options, in accordance with the available features and the current user selections. Actual web pages may therefore look significantly different to those shown in this handbook.

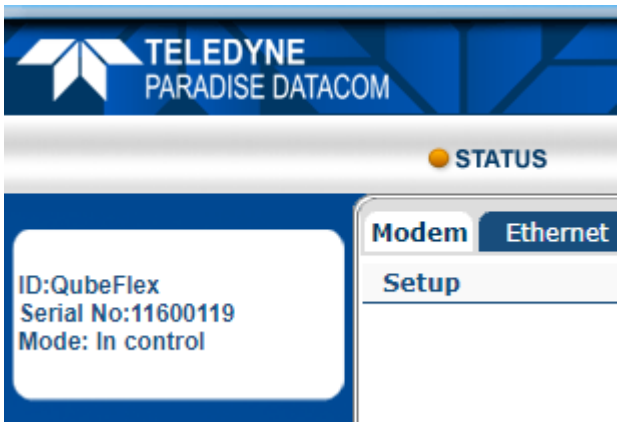


Figure 6-4 Modem Summary Status

Summary status information for the modem is shown at the top left-hand side of the screen as shown in **Figure 6-4**. This presents the following:

- 'ID': The user-entered modem-identification text string.
- 'Serial No.': The modem serial number.
- 'Mode': This will show either 'In control', when the web user has full control over the modem or, 'View only' when the web user is restricted to viewing modem information but cannot change the modem's configuration.

The *Status* screen contains the current modem status split over several screens as described in the following sections.

6.2.2.1 Status Setup

The *Setup* section of the *Status* screen is continually updated with the following information:

- *Transmit and receive carrier frequencies.*
- *Transmit and receive terrestrial data rates.*
- *Transmit and receive symbol rates.*

In addition, the following are shown:

- *Transmit carrier bandwidth at the -3dB point.*
- *Transmit carrier bandwidth at the -30dB point*.

These are useful for performing bandwidth comparisons between different modem configurations, including the use of different spectral roll-off factors. The carrier does not contain any useful information below the -3dB point. There are various definitions of occupied and allocated bandwidth and therefore the -30dB point is used in order to provide an unambiguous reference point. When determining the bandwidth of the carrier, various cut-off points are used by satellite operators, with -30dB being the worst case. Satellite operators will also add a guard band that further increases the overall bandwidth requirements.

6.2.2.1.1 Status Traffic

The *Traffic* section of the *Status* page is continually updated with the following information:

- *Transmit path status*. When there is no transmit path fault then the message 'Tx OK since a particular time and date when the Modem commenced transmission. When a transmit path fault exists then a fault message is displayed instead that indicates the nature of the fault.
- *Receive path status*. When there is no receive path fault then the message 'Rx OK since time and date is displayed. When a receive path fault exists then a fault message is displayed instead that indicates the nature of the fault.
- *Transmit carrier status*. This displays one of the following:
    - '*Normal*': the carrier is on.
    - '*Mute-Ext*': the carrier is muted due to an alarm detected by the modem hardware.
    - '*Mute-Ter*': the carrier is muted due to either the terrestrial Tx RTS pin being active (this is an input signal that can be used to mute the carrier under external control as required) or some other problem being experienced with the terrestrial interface.
    - '*Mute-1:1*': the carrier is muted due to being the Standby modem in a 1:1 redundancy system.
    - '*Mute-Brk*': the carrier is muted following a power outage.
    - '*Mute-Flt*': the carrier is muted due to an alarm detected by the modem software.
    - '*Mute-Cfg*': the carrier is muted due to the modem being in the process of reconfiguring.
    - '*Mute-Off*': the carrier has been muted by the user.
- *IP Tx buffer fill status*. This is displayed when the IP terrestrial interface is selected and shows, as a percentage, how full the modem's transmit buffer towards satellite is.

6.2.2.2 Status Demodulator

The *Demodulator* section of the *Status* screen is continually updated with the following information:

- *Receive Es/No* (the ratio of energy per symbol to noise spectral density).
- *Receive Eb/No* (the ratio of energy per information bit to noise spectral density).
- *Receive power level* (i.e. the level of the wanted signal).
- *Receive composite power level* (i.e. all of the power in the receive channel, consisting of both wanted and unwanted signals).
- *Receive frequency offset.* This is the measured offset from the expected carrier center frequency. It indicates any frequency shift that is introduced by the satellite and frequency conversion equipment.
- *Receive Doppler buffer usage*. This indicates how full the receive Doppler buffer is. This is displayed only when a receive Doppler buffer is being used to compensate for movements in the satellite (i.e. when the Rx clock source is set to something other than *Satellite)*.
- *Number of Doppler buffer overflows and underflows.* These represent the number of times the receive buffer has slipped as a result of overflows and underflows. These counts are reset to zero when the demodulator goes out of lock. They can also be cleared using the front-panel menus.

6.2.2.3 Status BUC

Under the *Status BUC* tab, Block Up Converter (BUC) status is continually updated with the following information when a BUC is being controlled from the modem:

- *BUC output.* This is the output power in dBm at the waveguide flange, or *Off* when the BUC is not transmitting.
- *BUC temperature*. This shows the temperature in degrees Celcius reported by the BUC.
- *BUC class*. This shows the BUC power class in Watts.
- *BUC current*. When a BUC PSU is fitted then this shows the BUC current level in Amperes.

All of the above, other than BUC current, require a communications link to exist between the modem and the BUC.
Note: BUC status (Output power, temp, class) are only available when connected to Teledyne Paradise Datacom BUC.

6.2.3 Edit Screen

The *Edit* screen contains the following tab menu options:

- *Tx-Rx.* These menus allow setup of the modem transmit and receive paths, including the terrestrial interface, and BUC/LNB control.
- *Unit.* These menus contain all the general modem configuration settings, including M&C interface selection (RS232/RS485), alarms, and Software Activated Features (SAF) settings, SW upgrade, miscellaneous (time, reset & NTP).
- *IP.* This menu allows setup of the **IP M&C and traffic interfaces**, including Bridging, Routing and Trunking modes. Note:- Bridge mode should be used on QubeFlex.
- *Memories.* These menus support the storing, recall, deletion, upload and download of modem configurations.

6.2.4 Edit->Tx-Rx->Service Screen

The *Edit->Tx-Rx->Service* screen is shown in **Figure 6-5**.

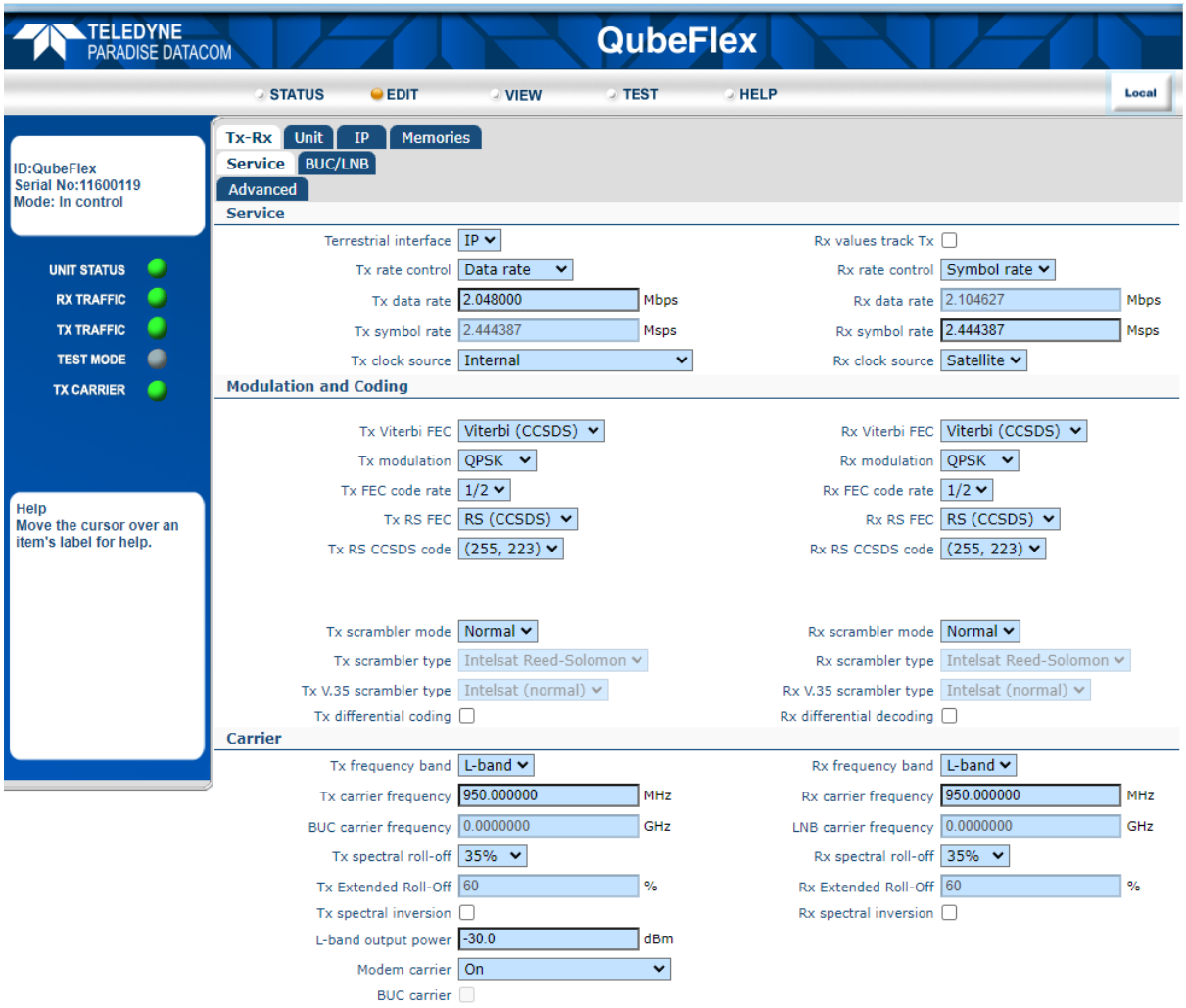


Figure 6-5 Edit->Tx-Rx->Service Screen

When a value is changed in an edit or dropdown box, the background for the box will change to red while the modem is actioning the change, as shown in the example below.

Example of Modem Actioning a User-Requested Change

The box will change back to its standard background color when the modem has implemented the change. Note that each change must be fully completed before the next change can be made.

6.2.4.1 Terrestrial Interface

Table 6-1 lists the different terrestrial interface options that are available (note that some of these are not listed on the datasheet but are nevertheless available). The base Modem has 1 Ethernet port for M&C and 3 Ethernet traffic ports as standard. Two other interface card slots are available:

IP	This enables the Ethernet traffic interface.
RS422	This enables the RS422 traffic interface and requires an EIA-530 interface card to be fitted.
RS232	This enables the RS232 traffic interface and requires an EIA-530 interface card to be fitted.
V.35	This enables the V.35 traffic interface and requires an EIA-530 interface card to be fitted.
LVDS	This enables the LVDS traffic interface.

Table 6-1 Terrestrial Interface

6.2.4.2 Rx Values Track Tx

This is an On/Off control that allows the receive path to be automatically configured to be the same as the transmit path, thereby simplifying set up. There are a number of exceptions including carrier frequency, spectral inversion, timeslots and clock settings.

6.2.4.3 Tx/Rx Rate Control

Data rate	This allows the user to enter a data rate, from which a symbol rate is calculated.
Symbol rate	This allows the user to enter a symbol rate, from which a data rate is calculated.

Table 6-2 Tx/Rx Rate Control

6.2.4.4 Tx/Rx Data Rate

Range: *Default:*	0.05Mbps to 50Mbps; step size: 0.000001Mbps 2.048 Mbps

Description:	The terrestrial data rate is the maximum number of data bits per second that the modem will process in relation to the selected terrestrial interface. The relationship between the terrestrial data rate and the size of the satellite channel is complex. The modem will calculate and display the channel symbol rate for the current configuration. For IP, the terrestrial data rate must allow for all overhead due to IP headers and Ethernet frames. As an alternative to setting the terrestrial data rate, the modem also allows the satellite-link symbol rate to be set and will use this to determine the terrestrial data rate. The minimum and maximum data rate limits are determined by a number of factors such as the terrestrial interface type, type of service, FEC type and FEC rate. The modem will generally prevent invalid data rates from being set and in the event that a limit is exceeded then a configuration warning will be generated.

Table 6-3 Tx/Rx Data Rate

6.2.4.5 Tx/Rx Symbol Rate

Range:	0.1Msps to 40.0Msps; step size: 0.000001Msps
Description:	As an alternative to setting the terrestrial data rate, it is possible to set the symbol rate for the satellite link, which will then determine the data rate. In the absence of the user setting the symbol rate, it will be determined by other settings such as the terrestrial data rate, modulation and FEC rate.

Table 6-4 Tx/Rx Symbol Rate

6.2.4.6 Tx Clock Source

Tx Clock In	The external clock supplied on the interface *Clock In* line will be used. Should this clock fail then the modem will switch to an internal backup clock.
Internal	The Tx clock is generated from an internal frequency reference. This is also output on the *Int Tx Clock Out* line for use by external equipment.
Receive reference	The Tx clock is generated from the Rx clock. This is only of any practical use when the Rx clock is set to *Satellite*.

Table 6-5 Tx Clock Source

6.2.4.7 Rx Clock Source

Satellite	This is the clock from the satellite. This is converted to the rate required at the terrestrial port.
Tx Clock In	This causes the Tx clock to be used to clock Rx data to the terrestrial port. This is a plesiochronous mode and requires the receive buffer to be set to a value sufficient to accommodate both the difference in the clocks at each end of the link and any Doppler shift, while also providing the required interval between buffer slips.
Internal	This uses an internal reference clock to be used to clock data to the terrestrial port. This requires the receive buffer to be set as per the *Tx Clock In* option.

Table 6-6 Rx Clock Source

6.2.4.8 Tx/Rx Viterbi FEC

Off	This turns the Viterbi FEC off.
Viterbi (CCSDS)	This selects a CCSDS-compatible version of the Viterbi FEC.
Viterbi (Intelsat)	This selects an Intelsat-compatible version of the Viterbi FEC.

Table 6-7 Tx/Rx Viterbi FEC settings

6.2.4.9 Tx/Rx modulation

QubeFlex supports BPSK, QPSK and OQPSK modulation schemes.

6.2.4.10 Tx/Rx FEC code rate

The available FEC code rates depend on the FEC type and modulation that are selected. The supported combinations are listed in **Table 6-8**.

Viterbi (Intelsat)	BPSK: 1/2, 3/4, 7/8 QPSK and OQPSK: 1/2, 3/4, 7/8
Viterbi (CCSDS)	BPSK: 1/2, 2/3, 3/4, 5/6, 7/8 QPSK and OQPSK: 1/2, 2/3, 3/4, 5/6, 7/8

Table 6-8 Tx/Rx Modulation and FEC Code Rates

6.2.4.11 Tx/Rx RS FEC mode

Off	This turns the Reed-Solomon FEC off.
RS (Intelsat)	This selects an Intelsat-compatible version of the Reed-Solomon FEC.
RS (CCSDS)	This selects a CCSDS-compatible version of the Reed-Solomon FEC.
ASM Only	This selects ASM only mode (Attached Sync Marker)

Table 6-9 Tx/Rx RS FEC Modes

Reed-Solomon Coding

The Reed-Solomon FEC can be used to correct errors remaining from the Viterbi FEC. The code is specified by three values, namely, n, k, and t. These have a fixed relationship of n - k = 2t, making t half the difference between n and k. An example code is specified as (n, k, t) = (126, 112, 7).

Reed-Solomon error correction works on codewords (blocks) of bytes, where n is the length of the block of which there are k bytes of original data and 2t bytes of error correction information. The Reed-Solomon codec can correct any bytes in error up to a value of t bytes. In the above example with t=7, up to seven bytes within 126 may be corrected no matter how many individual bits per byte are in error. Once the error correction threshold is passed then the codec considers it uncorrectable and passes the entire block uncorrected.

Interleaving depth controls the number of Reed-Solomon codewords that are interleaved. Interleaving mixes up the blocks such that a burst of channel errors is distributed over a number of codewords, rather than affecting a lot of bytes from a single block, thus improving the resilience to error bursts.

6.2.4.12 Tx/Rx RS CCSDS Code

(255, 223)	This selects the Reed-Solomon (255, 223) CCSDS code. This is the default.
(255, 239)	This selects the Reed-Solomon (255, 239) CCSDS code.

Table 6-10 Tx/Rx RS CCSDS Code Rates

6.2.4.13 Tx/RX Scrambler mode

Off, Normal or Other

6.2.4.14 Tx/Rx Scrambler type

V.35 or Intelsat Reed-Solomon

6.2.4.15 Tx/Rx V.35 scrambler type

CCITT, Intelsat (normal), Fairchild or Linkabit

6.2.4.16 Tx/Rx Differential coding/decoding

Tick box on or off.
Disable this setting if using NRZ-L encoded signals (or enable it for NRZ-M encoded signals).

6.2.4.17 Tx/Rx Frequency Band

The modem supports independent selection of IF and L-band operation in transmit and receive.

IF Band	This selects the 70MHz and 140MHz IF bands, allowing operation from 50MHz to 90MHz and 100MHz to 180MHz. Step size: 1Hz
L-band	This selects L-band, allowing operation from 950MHz to 2450MHz. Step size: 1Hz

Table 6-11 Tx/Rx Frequency Band

6.2.4.18 Tx/Rx Carrier Frequency

There are various frequency control options, depending on whether a BUC or LNB is fitted that is being controlled via the modem. The frequency control options are presented in **Table 6-12** through **Table 6-14**.

Range:	50 - 90MHz and 100 - 180MHz Step size: 1Hz
Description:	This is the IF used in transmitting to, or receiving from, satellite.
Range:	950.0MHz to 2450.0MHz; step size: 1Hz
Description:	This is the L-band frequency used in transmitting to, or receiving from, satellite. If the *BUC LO frequency* has been set on the *Edit->Tx-Rx->BUC/LNB* menu then the L-band transmit frequency will no longer be available and will be automatically controlled by the modem to achieve the requested BUC transmit frequency.

Table 6-12 Tx/Rx Carrier Frequency (L-band)

Range:	0.0GHz to 99.999GHz; step size: 100Hz
Description:	This is the BUC frequency used to transmit to satellite. The range is dependent on the configured BUC LO frequency.

Table 6-13 BUC Carrier Frequency

Range:	0.0GHz to 99.999GHz; step size: 100Hz
Description:	This is the LNB frequency used to receive from satellite. The range is dependent on the configured LNB LO frequency. If the *LNB LO frequency* has been set on the *Edit->Tx-Rx->BUC/LNB* menu then the L-band receive frequency will no longer be available and will be automatically controlled by the modem to achieve the requested LNB receive frequency.

Table 6-14 LNB Carrier Frequency

6.2.4.19 Tx/Rx Spectral Roll-off

The spectral roll-off determines the slope of the carrier at its edges. The supported roll-off factors are listed in **Table 6-15**.

Range:	5%, 10%, 15%, 20%, 25%, 35%, Other
Description:	All standard spectral roll-off factors are available for all FECs. The 'Other' setting is only applicable if the modem has the Extended Roll-off feature enabled.

Table 6-15 Tx/Rx Spectral Roll-off

6.2.4.20 Tx/Rx Extended roll-off

Min 35% to Max 60%

Range:	Min 35% to Max 60%, step 1%
Description:	If the 'Extended Roll-offs' feature has been purchased and the Tx/Rx spectral roll-off is set to 'Other', then this setting allows a user-defined roll-off to be specified.

6.2.4.21 Tx/Rx Spectral Inversion

Spectral inversion is an On/Off control that controls whether the carrier I and Q components are swapped or not, allowing the modem to compensate for any other equipment in the transmit or receive chain that has introduced a spectral inversion.

Paradise recommends keeping the signals in the space segment non-inverted. If the uplink equipment contains a spectral inversion, then transmit spectral inversion should be enabled in the modem to correct for it. Similarly, if the downlink equipment contains a spectral inversion (e.g. due to an inverting LNB) then receive spectral inversion should be enabled in the modem to correct for it.

6.2.4.22 Tx Output Power

Range:	IF: 0 to –25dBm; step size: 0.1dB L-band: +5 to –40dBm (950 to 1950MHz) 0 to –40dBm (1950 to 2150MHz) 0 to –30dBm (2150 to 2450MHz) step size: 0.1dB
Description:	This is the transmitted output power when using IF or L-band.

Table 6-16 Tx Output Power

6.2.4.23 Modem/BUC Carrier

These allow the modem and BUC carriers to be switched on/off independently of each other. BUC carrier control requires a control channel (i.e. FSK or RS485) to exist between the modem and the BUC.

6.2.5 Edit->Tx-Rx->Service->Advanced Screen

The *Edit->Tx-Rx->Service->Advanced* screen is shown in **Figure 6-6**.

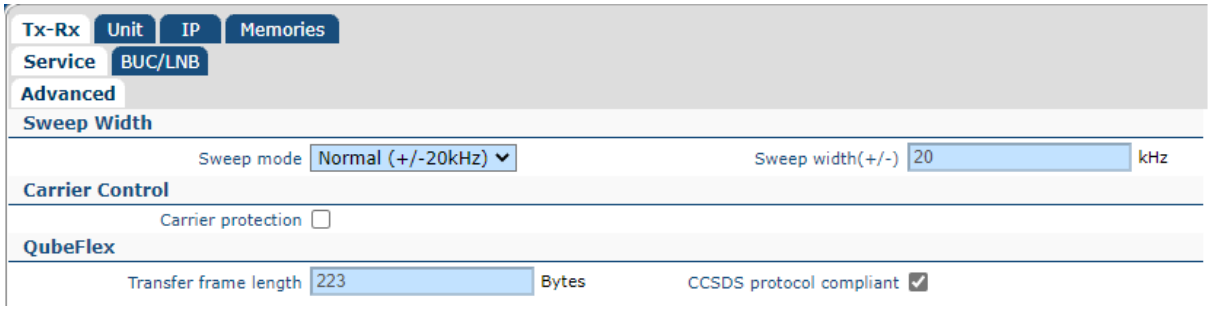


Figure 6-6 Edit->Tx-Rx->Service->Advanced Screen

6.2.5.1 Sweep Mode

Normal	In this mode the sweep width is controlled automatically by the modem. The default sweep width used by the modem is +/-20kHz.
Other	This mode allows the user to set the sweep width in order to compensate for carrier frequency uncertainty introduced in either the ground equipment or in the space segment (due to, for example, frequency conversion errors). At very low data rates, reducing the sweep width may speed up carrier acquisition.

Table 6-17 Sweep Mode

6.2.5.2 Sweep Width

Range (+/-):	Standard: 1kHz to 250kHz; step size: 1kHz With Extended Doppler option: 1kHz to 700kHz; step size: 1kHz
Description:	Controls the Rx signal sweep width when the *Sweep mode* is set to *Other*. This is a +/- setting, i.e. the total width is twice the value that is entered. The default sweep width used by the modem is +/-20kHz.

Table 6-18 Sweep Width

6.2.5.3 Carrier protection

Carrier protection on or off. Reduces the slew rate of Tx carrier level when it is enabled.

6.2.5.4 Transfer Frame Length

Range:	1 byte to 4095 bytes; step size: 1 byte; default: 223 bytes
Description:	For CCSDS Viterbi (and CCSDS uncoded operation), the maximum frame length is 2048. For CCSDS Reed-Solomon, valid transfer frame lengths are a function of the codeblock length, error correcting capability and interleaver depth. The transfer frame length does not include the CCSDS ASM marker. When converting to IP, each IP packet contains a complete CCSDS transfer frame (without ASM marker). For Intelsat operation involving conversion to IP output at the demodulator, the user data will be arbitrarily segmented into IP packets where the payload size is set to equal the transfer frame length.

Table 6-19 Transfer Frame Length

6.2.6 Edit->Tx-Rx->BUC/LNB Screen

The *Edit->Unit->BUC/LNB* screen is shown in **Figure 6-7**.

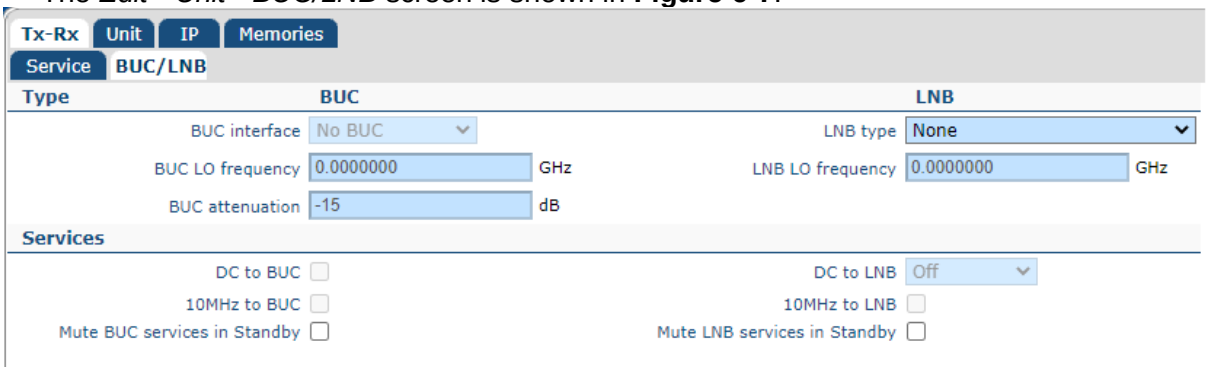


Figure 6-7 Edit->Tx-Rx->BUC/LNB Screen

6.2.6.1 BUC Interface

BUC FSK	This indicates that a BUC is fitted that has FSK communications to the modem.
BUC no comms	This indicates that a BUC is fitted but has no communications to the modem.
No BUC	This indicates that no BUC is fitted.

Table 6-20 BUC Interface

6.2.6.2 BUC LO Frequency

Range:	-99.999GHz to 99.999GHz; step size: 0.0000001GHz
Description:	This is the local oscillator frequency of the BUC.

Table 6-21 BUC LO Frequency

6.2.6.3 BUC Attenuation

Range:	0dB to -15.0dB; step size: 1dB
Description:	This varies the front-end attenuation applied by the BUC. This is used when there is a low level of signal loss between the modem and BUC in order to prevent the modem output from saturating the BUC. **Note:** This control is only available with a Paradise BUC.

Table 6-22 BUC Attenuation

6.2.6.4 DC to BUC

Warning: It is strongly recommended that all 10MHz and DC services are switched off to the BUC and LNB before connecting or disconnecting the modem L-band RF cables in order to avoid the potential for damage.

This is an On/Off control used to enable and disable the DC power supply from the modem to the BUC.

6.2.6.5 10MHz to BUC

Warning: It is strongly recommended that all 10MHz and DC services are switched off to the BUC and LNB before connecting or disconnecting the modem L-band RF cables in order to avoid the potential for damage.

This is an On/Off control used to enable and disable the 10MHz reference from the modem to the BUC.

6.2.6.6 Mute BUC Services in Standby

This is an On/Off control used to enable and disable the transfer of BUC DC and 10MHz services from a failed modem to a backup modem in a 1:1 or 1:N redundancy system. Setting the checkbox causes the services to switch over from the online modem to the backup modem on a failure. Note that FSK communications will always be switched over.

6.2.6.7 LNB Type

None	This indicates that no LNB is fitted.
Other	This indicates that an LNB is fitted but is not one of the Paradise LNBs listed below.
C 3.635 – 4.200 GHz	This presets the LNB LO frequency to 5150MHz.
Ku 10.95 – 11.45 GHz	This presets the LNB LO frequency to 10000MHz
Ku 11.2 – 11.7 GHz	This presets the LNB LO frequency to 10250MHz
Ku 11.7 – 12.2 GHz	This presets the LNB LO frequency to 10750MHz
Ku 12.25 – 12.75 GHz	This presets the LNB LO frequency to 11300MHz

Table 6-23 LNB Type

6.2.6.8 LNB LO Frequency

Range:	-99.999GHz to 99.999GHz; step size: 0.0000001GHz
Description:	This is the local oscillator frequency of the LNB.

Table 6-24 LNB LO Frequency

6.2.6.9 DC to LNB

Warning: It is strongly recommended that all 10MHz and DC services are switched off to the BUC and LNB before connecting or disconnecting the modem L-band RF cables to avoid the potential for damage.

Off	This indicates that DC to the LNB is disabled.
13V, 15V, 18V, 20V & 24V	This allows the selection of the required LNB DC voltage.

Table 6-25 DC to LNB

6.2.6.10 10MHz to LNB

Warning: It is strongly recommended that all 10MHz and DC services are switched off to the BUC and LNB before connecting or disconnecting the modem L-band RF cables to avoid the potential for damage.

This is an On/Off control used to enable and disable the 10MHz reference from the modem to the LNB.

6.2.6.11 Mute LNB Services in Standby

This is an On/Off control used to enable and disable the transfer of LNB DC and 10MHz services from a failed modem to a backup modem in a 1:1 or 1:N redundancy system. Setting the checkbox causes the services to switch over from the online modem to the backup modem on a failure.

6.2.7 Edit->Unit Screen

The *Edit->Unit* screen contains the following tab menu options:

- *M&C.* This controls remote M&C settings including serial control settings and user passwords.
- *Alarms.* This controls alarm thresholds and actions.
- *SAF.* This allows the entry of Software Activated Feature (SAF) codes that enable modem feature activation in the field.
- *Upgrade.* This allows the modem software to be upgraded.
- *Miscellaneous.* This allows the date and time to be set on the modem, as well as allowing a modem to be reset without having to power it down.

6.2.8 Edit->Unit->M&C Screen

The *Edit->Unit->M&C* screen is shown in **Figure 6-8**.

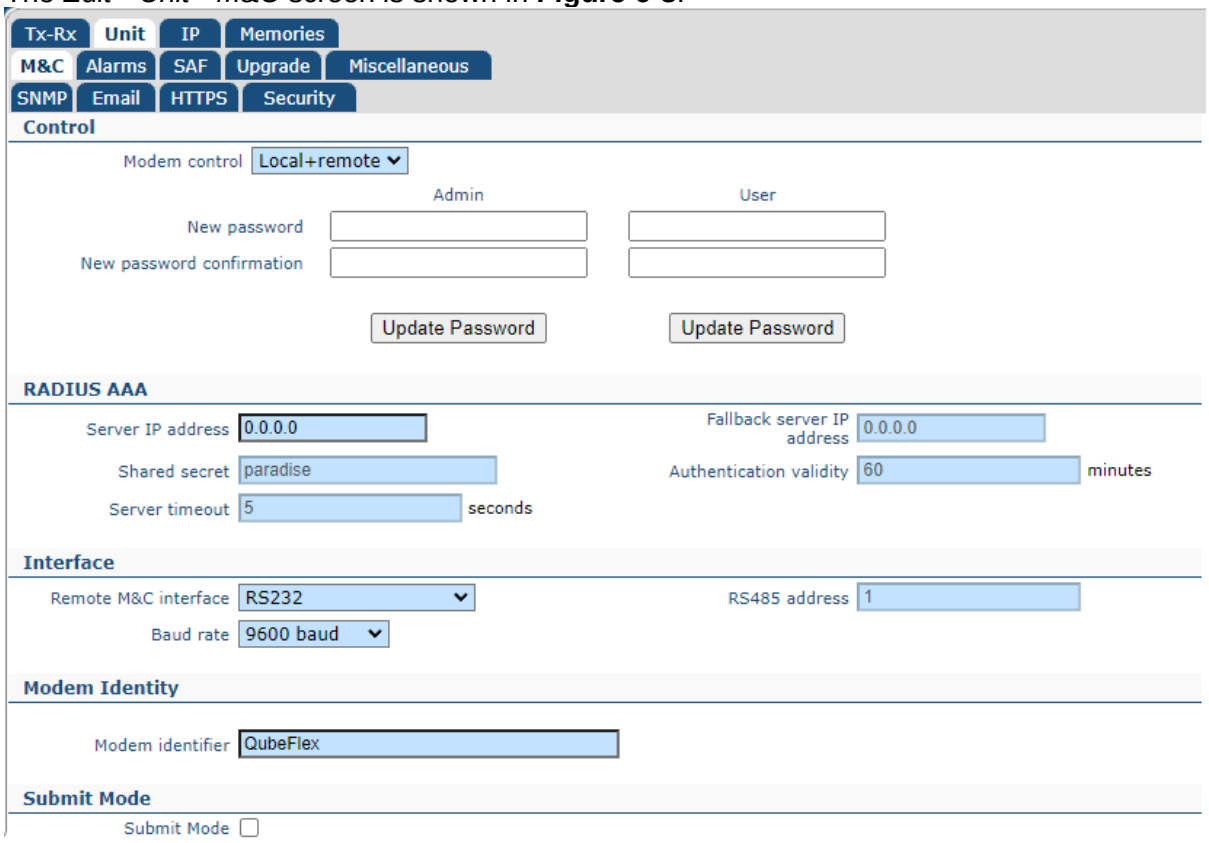


Figure 6-8 Edit->Unit->M&C Screen

The *Edit->Unit->M&C* screen is split into several sections as described in the following sections.

6.2.8.1 Modem Control and Passwords

Table 6-34 shows the *Modem control* options, for user control of the modem.

Local	In *Local* mode only the front panel can be used to control the modem.
Local+remote	In *Local+remote* mode, the modem accepts commands from any user interface at any time.

Table 6-26 Modem Control

Passwords for the administrator (login name *admin*) and user (login name *user*) can be changed (the default password for both is *paradise*). Administrators can both view and control the modem whereas other users can only view modem web pages. Multiple users can be logged on at the same time. When the administrator password is changed then the modem's web user interface will issue an immediate new login request, which needs to be completed using the new password.

6.2.8.2 RADIUS Server IP Address and Fallback Address

The modem supports a RADIUS client that communicates with the server in order to authenticate each user and to provide the authorised level of access (administrator or view-only). This allows users to log in using their personal organization login credentials. All login and configuration change activities are recorded in the modem's log, giving greater visibility and accountability.

Server IP address	This sets the IP address for a network server that supports the RADIUS AAA server to be used for authenticating users' login credentials.
Fallback server IP address	This sets the IP address for a fallback RADIUS network server, to be used in the event that the primary server cannot be contacted. The timeout period is specified by the *Server timeout* value.

Table 6-27 RADIUS Server IP Address and Fallback Address

6.2.8.3 RADIUS Shared Secret

The *Shared secret* is a user-assigned alphanumeric string, which is used as an authentication key (essentially a password) between the RADIUS client in the modem and the RADIUS server on the network.

Note for RADIUS Network Administrators

The modem RADIUS authentication feature will work out-of-the-box, subject to the modem having access to a RADIUS server on the user's network. By default, all authorised users will receive administrator privileges. If you want some users to get administrator access and some view-only access, then customisation of the RADIUS server configuration is required as explained below.

The standard RADIUS Access-Accept response from the RADIUS server can have an optional field added to it in order to distinguish between

administrator and view-only user login authorisation. This involves the addition of a vendor-specific attribute using an SMI network management private enterprise code of 64534 (to denote Teledyne Paradise Datacom), which is one of a range reserved for private use. A vendor-specific attribute named 'Access-Level' is used, where a value of 0 equates to 'Modem Administrator' and a value of 1 equates to 'Modem User' (view-only). If the modem receives an Access-Accept response with no Access-Level attribute, or with an Access-Level value that is not supported, then the modem will default to administrator access being granted. The full specification of this attribute of the Access-Accept response is as follows:

a. Type: (one byte) value 0x1A - indicates a vendor-specific attribute.
b. Length: (one byte) value 0x09 – indicates the entire vendor-specific attribute field is nine bytes in length.
c. Vendor ID: (four bytes) 0x0000FC16 – indicates Paradise private-use.
d. Vendor type: (one byte) value 0x01 – indicates the vendor-specific attribute is 'Access-Level'.
e. Vendor length: (one byte) value 0x03 – indicates the remainder of the vendor-specific attribute field following the Vendor ID is three bytes in length.
f. Vendor data: (one byte) value 0='Modem Administrator'; value 1='Modem User' – indicates the authorised login access level.

6.2.8.4 RADIUS Authentication Validity

Range:	5 to 60 minutes; step size: 1 minute
Description:	Controls the period between automatic re-authentication of the connection to the RADIUS server. This is done in the background and no user intervention is necessary unless the connection to the RADIUS server has failed, when the user may be prompted to log in again using the fallback RADIUS server (or standard modem log in if no RADIUS server is available).

Table 6-28 RADIUS Authentication Validity

6.2.8.5 RADIUS Server Timeout

Range:	1 to 60 seconds; step size: 1 second
Description:	Controls the timeout when connecting to the RADIUS server. Two attempts will be made before reverting to use the fallback RADIUS server. If the fallback server connection attempts also fail, then the user will be presented with the standard (non-RADIUS) login prompt.

Table 6-29 RADIUS Server Timeout

6.2.8.6 Remote M&C Interface

Table 6-36 shows the *Remote M&C interface* options, with respect to the serial M&C interface of the modem. **Tables 6-40** and **6-41** describe the options for assigning an RS485 address to the serial M&C interface and settings its baud rate, respectively.

RS232	This sets the serial M&C interface to RS232. This allows the modem to be controlled using Paradise Universal Protocol (PUP) commands as specified in the document '*Remote M&C Specification for Q-Series modems*. If the serial M&C interface is internally or externally looped to the modem's ESC interface, then the commands can be forwarded to the far end of the link in order to control either the remote modem or other equipment.
RS485	This sets the serial M&C interface to RS485. This allows the modem to be controlled using Paradise Universal Protocol (PUP) commands as specified in the document '*Remote M&C Specification for Q-Series modems*. If the serial M&C interface is internally or externally looped to the modem's ESC interface, then the commands can be forwarded to the far end of the link in order to control either the remote modem or other equipment.

Table 6-30 Modem Control

Range:	1 to 255; step size: 1
Description:	This is the RS485 address that is assigned to the modem's serial M&C interface.

Table 6-31 Serial M&C Interface RS485 Address

Range:	110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 76800, 115200
Description:	This sets the baud rate associated with the modem's serial M&C interface.

Table 6-32 Serial M&C Interface Baud Rate

6.2.8.7 Modem Identity

The *Modem identifier* is a user-assigned text string that is typically used to uniquely identify the modem, satellite service or location. It appears at the top of the front panel LCD when the MAIN key is pressed and is displayed as the *ID* field on the left-hand-side of every web page.

6.2.8.8 Submit Mode

Submit mode is used when reconfiguring modems (particularly remote modems) in order to simplify the process of synchronising configuration changes at both ends of the link in order not to break the link while changing multiple control parameters. When submit mode is active, a Submit button appears on the web user interface as shown in **Figure 6-9**.

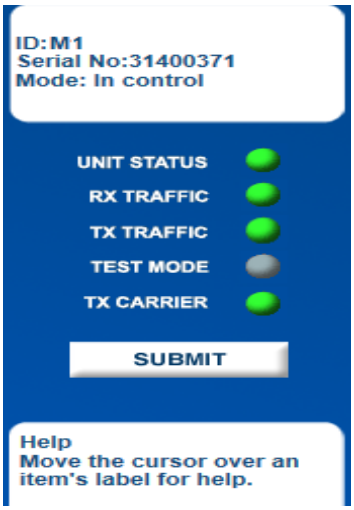


Figure 6-9 Modem Status Summary Screen with Submit Mode Button

In submit mode, none of the configuration changes made to the modem will be activated until the Submit button is pressed. This is true even if the control parameters that are being changed are spread over multiple web pages. Once all of the changes have been made, the Submit button should be pressed and this will activate all of the accumulated control changes. This minimises service downtime when making configuration changes.
When active, Submit mode only operates on the web UI that invoked it. Operators must ensure that no other users make changes by any method, whilst there are unsubmitted commands. Otherwise, the pending commands will be submitted unexpectedly.

6.2.9 Edit->Unit->M&C->SNMP Screen

The *Edit->Unit->M&C->SNMP* screen is shown in **Figure 6-10**.

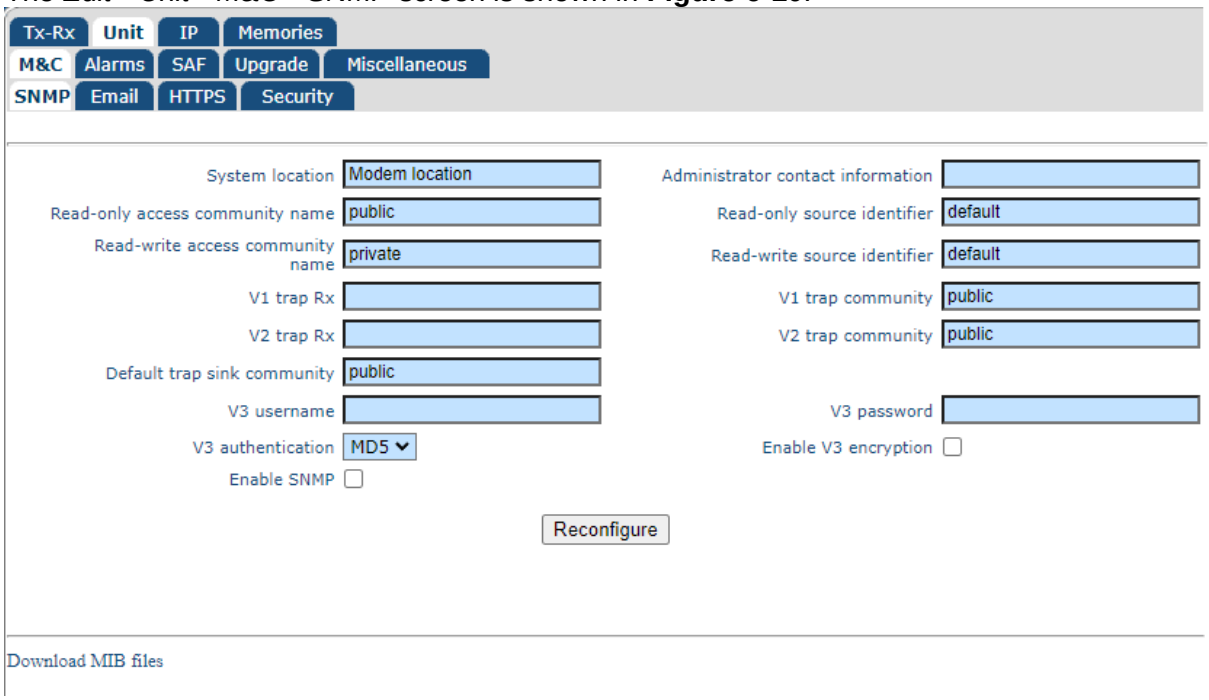


Figure 6-10 Edit->Unit->M&C->SNMP Screen

Simple Network Management Protocol (SNMP) can be configured for use with SNMP v1, v2c and v3.

The modem's SNMP configuration settings have the standard meanings defined by the relevant SNMP standards and are therefore not described in detail. The community names represent passwords that must be present in each SNMP read or write requests in order for the commands to be executed. The source identifier fields are used to define the source IP addresses that read/write requests will be accepted from. The trap receiver fields are used to define the IP address of a trap server to which trap notifications will be sent when modem alarms arise (and when they disappear).

SNMP can be controlled by the *SNMP enable setting.* SNMP is switched off by default. The modem does not need to be configured to tell it which version of SNMP is being used and will respond correctly to all SNMP commands regardless of the version.

The modem's SNMP Management Information Bases (MIBs) can be downloaded directly from the modem using the *Download MIB files* hyperlink at the bottom of the screen.

6.2.10 Edit->Unit->M&C->Email Screen

The *Edit->Unit->M&C->Email* screen is shown in **Figure 6-11**.

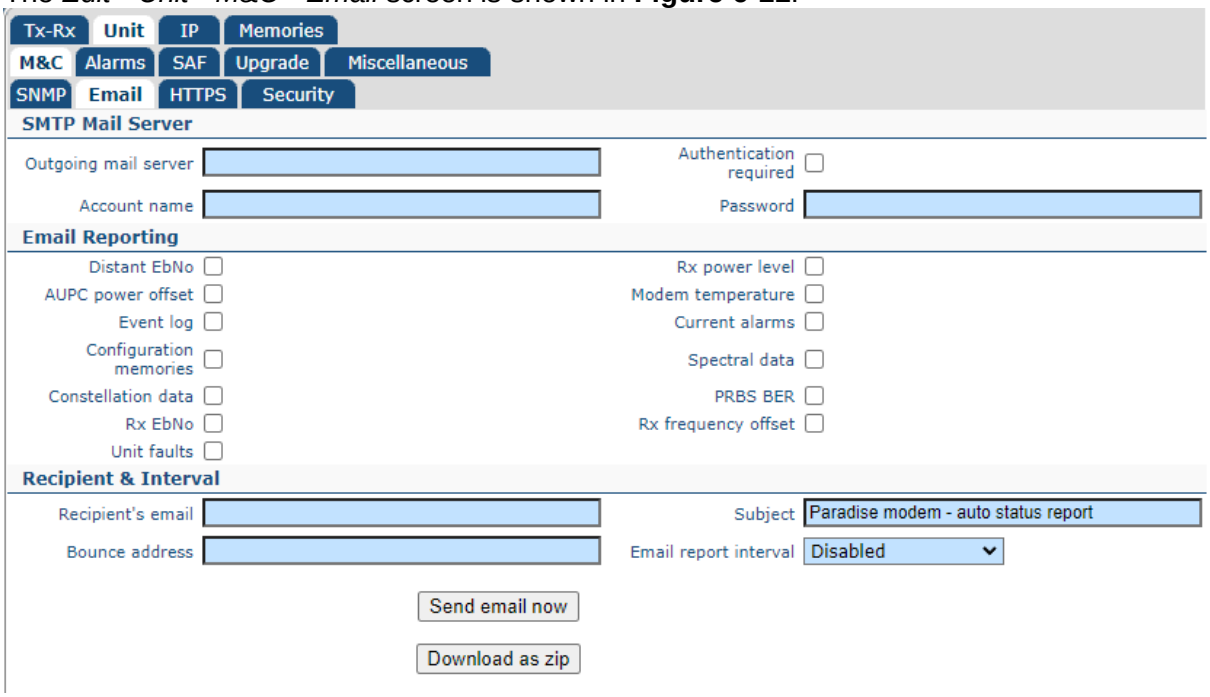


Figure 6-11 Edit->Unit->M&C->Email Screen

From power-up, the modem automatically records modem and satellite link performance information for both online and offline use. This information can be sent by email from the modem to any email address, providing a connection from the modem to a Simple Mail Transfer Protocol (SMTP) mail server is available. This feature is particularly useful when providing Quality of Service reports to satellite-services end users and when investigating unexplained disruptions to the satellite service. It is also possible to fetch performance data over the satellite from a remote modem and then send this by email from the local modem.

The modem has a built-in SMTP mail client. By ticking the required checkboxes, the following information can be sent from the modem, either on demand or at preset intervals:

- Up to a month's worth of logged Rx Eb/No values
- Up to a month's worth of logged AUPC remote Eb/No values
- Up to a month's worth of logged Rx power level values
- Up to a month's worth of logged user BER values
- Up to a month's worth of logged AUPC Tx power level values
- Up to a month's worth of logged modem temperature values
- The contents of the modem's event log (i.e. all notable events that have occurred)
- Current system alarms (i.e. all Unit, Tx and Rx faults and warnings)
- All configuration memories
- Instantaneous spectrum data
- Instantaneous constellation data
- Instantaneous PRBS BER test results

The information is sent in Comma Separated Value (CSV) format, which allows the data to be copied into any spreadsheet from where it can be viewed in a number of formats (e.g. as a graph or a table) and from which reports can be generated.

The relevant data is appended to the email as separate attachments.

The modem needs to know where to send all emails in order for them to be forwarded to individual email accounts. This is the outgoing SMTP mail server name (e.g. smtp.yourmailserver.com). An account name and password may be necessary. The recipient's email address, subject (email title) and email reporting interval should be set as required.

The *Reply to* address field is optional and is the address used to deliver failure notifications in the event that an email cannot be delivered to the recipient's email address.

The following example demonstrates how to graph modem constellation data in a spreadsheet:

- Configure the SMTP mail server and recipient email details.
- Select the *Constellation data* check box and click the *Send email now* button.
- Wait for the email to be received at the recipient's account and open it.
- To import the constellation data into a spreadsheet program (Microsoft Excel is used in this example) double click on the email attachment *constellation.csv* to open it (this should automatically start the spreadsheet application - if not, then save the attachment and open it directly from within the spreadsheet application).
- Within Excel, highlight the A and B columns.
- Select the Chart Wizard from the toolbar (or alternatively select the *Insert* menu followed by *Chart*).
- Select *XY (Scatter)* as the chart type.
- Select the *Scatter* (topmost) sub-chart type.
- Select *Next* and then accept the defaults for *Data Range* and *Series*.
- Add a chart title and X and Y titles as desired.
- Select *Finish* and then resize the resulting graph as desired.

An example of the output is shown in **Figure 6-12**.

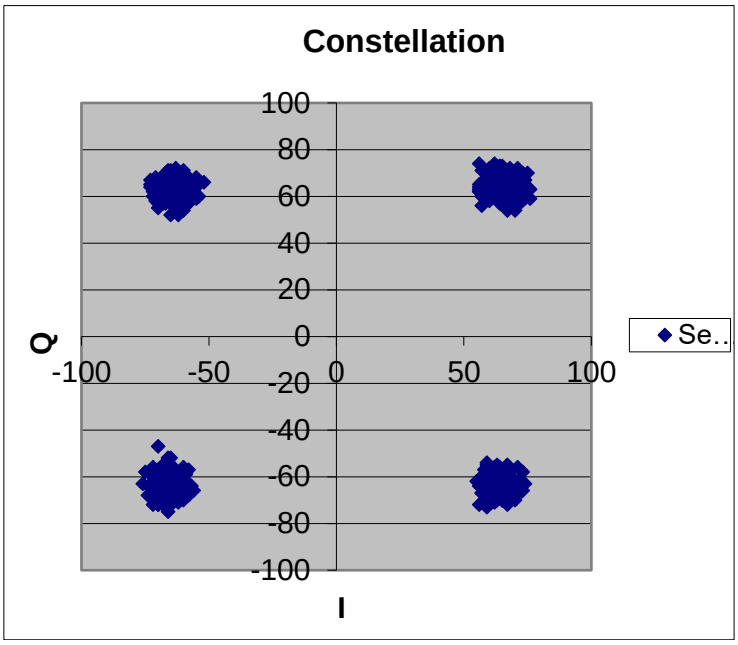


Figure 6-12 Example Constellation Graph (Microsoft Excel)

6.2.11 Edit->Unit->M&C->HTTPS Screen

The *Edit->Unit->M&C->HTTPS* screen is shown in **Figure 6-13**.

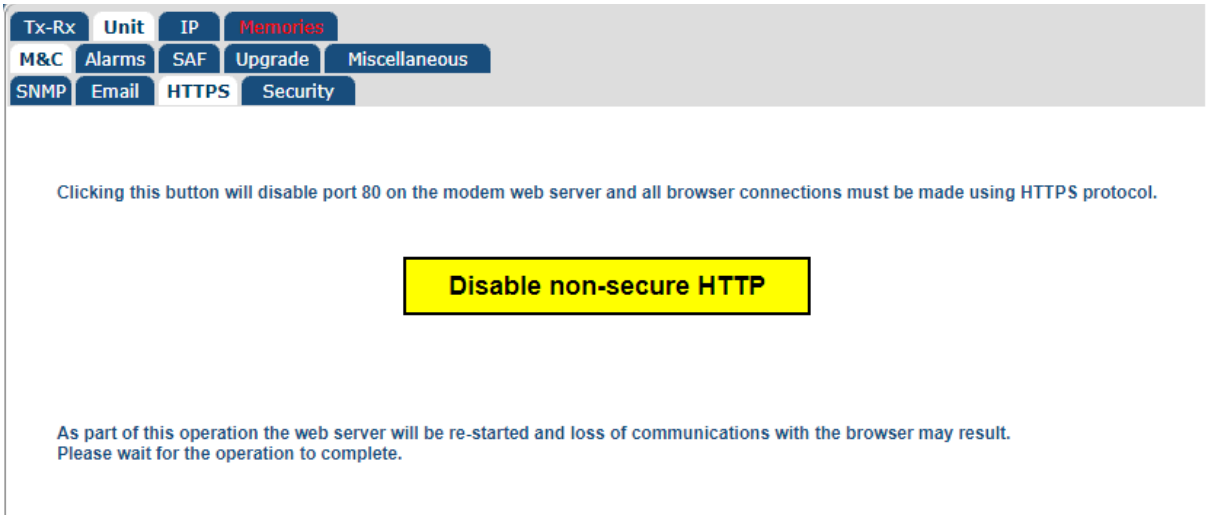


Figure 6-13 Edit->Unit->M&C->HTTPS Screen

Secure HTTPS connections to the modem's web server (on port 443) are always enabled. However, it is possible to disable (and re-enable) standard HTTP requests (on port 80) using this screen.

6.2.12 Edit->Unit->M&C->Security Screen

The *Edit->Unit->M&C->Security* screen is shown in **Figure 6-14**.

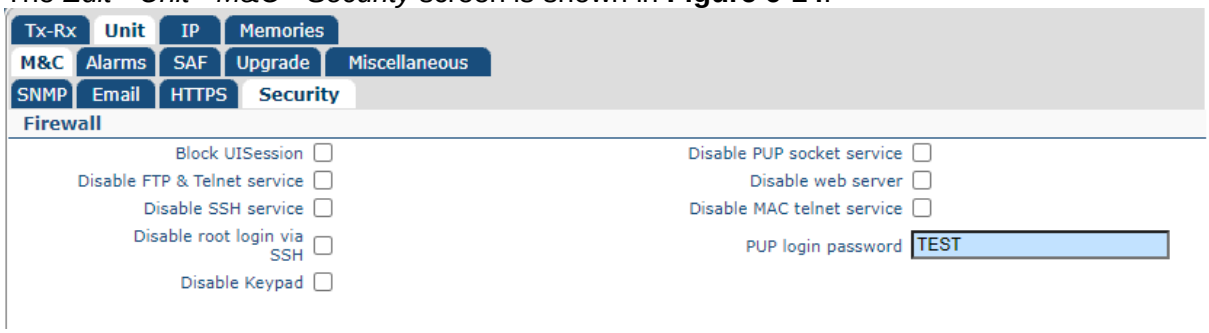


Figure 6-14 Edit->Unit->Alarms Screen

The settings on this page allow various M&C access methods to be disabled or blocked in order to improve security. Services should only be blocked or disabled if they are not being used for legitimate access.
NB if all settings are used, it will not be possible to access the modem except by using the serial interface on the rear panel.
It is recommended to change PUP user password away from its default value.
Regardless of these settings, the modem should only be connected to a private secure M&C LAN, not the public Internet.

6.2.13 Edit->Unit->Alarms Screen

The *Edit->Unit->Alarms* screen is shown in **Figure 6-15**.

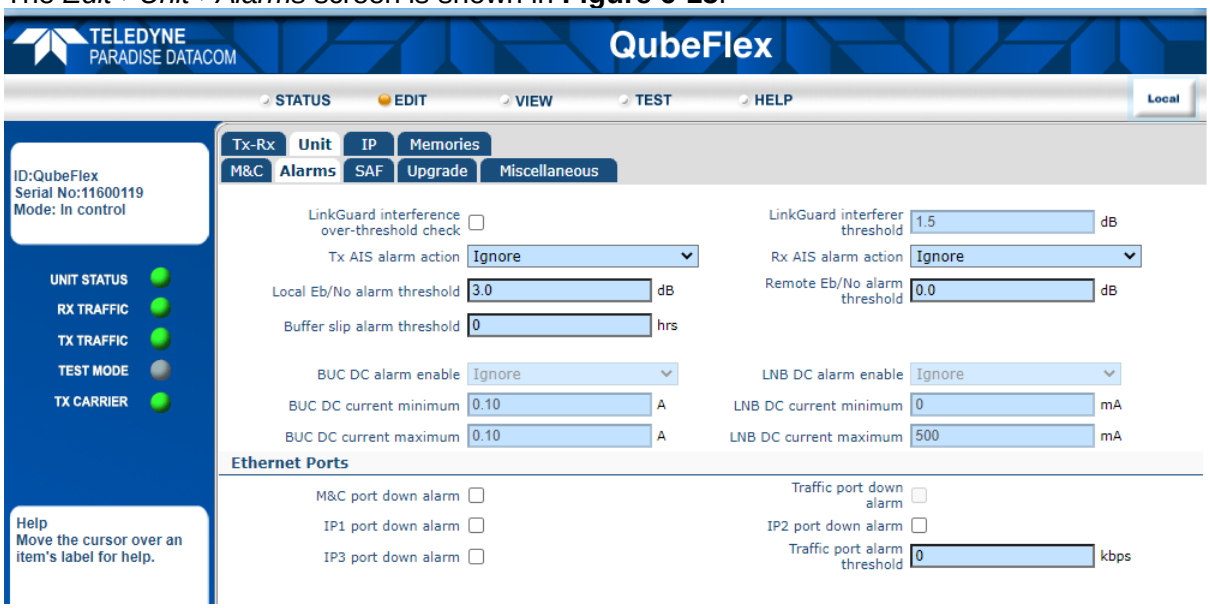


Figure 6-15 Edit->Unit->Alarms Screen

6.2.13.1 LinkGuard™ Interference detection

LinkGuard™ is a Paradise patented technology (US patent 8351495) for detecting in-band interference underneath satellite carriers while remaining on traffic.

An automated alarm can be generated whenever the power spectral density of the interference goes above a user-set threshold, thereby automatically alerting the operator whenever meaningful levels of interference are detected. This threshold check is enabled

and disabled via the *LinkGuard interference over-threshold check* control. The threshold level setting itself is described in **Table 6-33**.

Range:	0dB to 9.9dB; step size: 0.1dB
Description:	Sets a power spectral density threshold used to monitor for any signal under the received carrier. If the detected level of interference exceeds the threshold then an Rx traffic warning alarm is raised. See Section 7.5 for more information on **LinkGuard™**.

Table 6-33 LinkGuard™ Interferer Threshold

6.2.13.2 Tx/Rx AIS Alarm Action

Not relevant for QubeFlex.
These control the action taken with respect to Alarm Indication Signal (AIS) detection, commonly used in G.703 circuits. It is a sequence of 'all ones' that replaces the normal data stream when a failure is detected, in order to alert downstream equipment of the failure.
AIS can be ignored or set to raise an alarm, regenerate AIS and send a backward alarm where possible as described in **Table 6-34**.

Ignore	Ignore any AIS indication.
Prompt	When AIS is detected, raise an alarm, regenerate the AIS indication and send a backward alarm to the upstream equipment.

Table 6-34 Tx/Rx AIS Alarm Action

6.2.13.3 Local/Remote Eb/No Alarm Threshold

Range:	0dB to 99.0dB; step size: 0.1dB
Description:	These set the Eb/No thresholds below which a deferred alarm will be generated for the local (i.e. received carrier) and remote (i.e. transmitted carrier) Eb/No values respectively. Remote Eb/No indications are not available on QubeFlex.

Table 6-35 Local/Remote Eb/No Alarm Threshold

6.2.13.4 Buffer Slip Alarm Threshold

Not relevant for QubeFlex.

Range:	0 hours to 9999 hours; step size: 1 hour
Description:	Sets the threshold period for consecutive buffer slips above which a deferred alarm is generated. A setting of 0 (zero) disables this alarm.

Table 6-36 Buffer Slip Alarm Threshold

6.2.13.5 BUC DC Current Alarm

Even when there is no communications path between the BUC and modem, it is still possible for the modem to monitor the BUC for under/over current and over temperature conditions that cause the BUC to shut down. **Table 6-46** describes how to set the BUC

minimum and maximum DC current levels outside of which a DC current alarm will be raised if *DC alarm enable* is set.

Range:	0.1A to 6.0A; step size: 0.01A
Description:	Sets the trip threshold at which a fault is declared when the current drawn by the Tx ODU is outside the limit. Both a minimum and a maximum current threshold can be set.

Table 6-37 DC Current Minimum/Maximum

6.2.13.6 Ethernet Port Down Alarms

The *Ethernet port down alarm* checkboxes can be used to enable or disable individual alarms associated with each Ethernet port on the modem. These can be used to indicate that a cable has been removed or developed a fault, or that the communicating piece of equipment attached to a particular port has developed a fault.

In addition, the Traffic port alarm threshold allows the user to set a threshold below which an alarm is raised. This function is disabled when the value is set to 0 kbps.

6.2.14 Edit->Unit->SAF Screen

The *Edit->Unit->SAF* screen is shown in **Figure 6-16**. The concept of Software Activated Features (SAF) is explained in Section 7.3

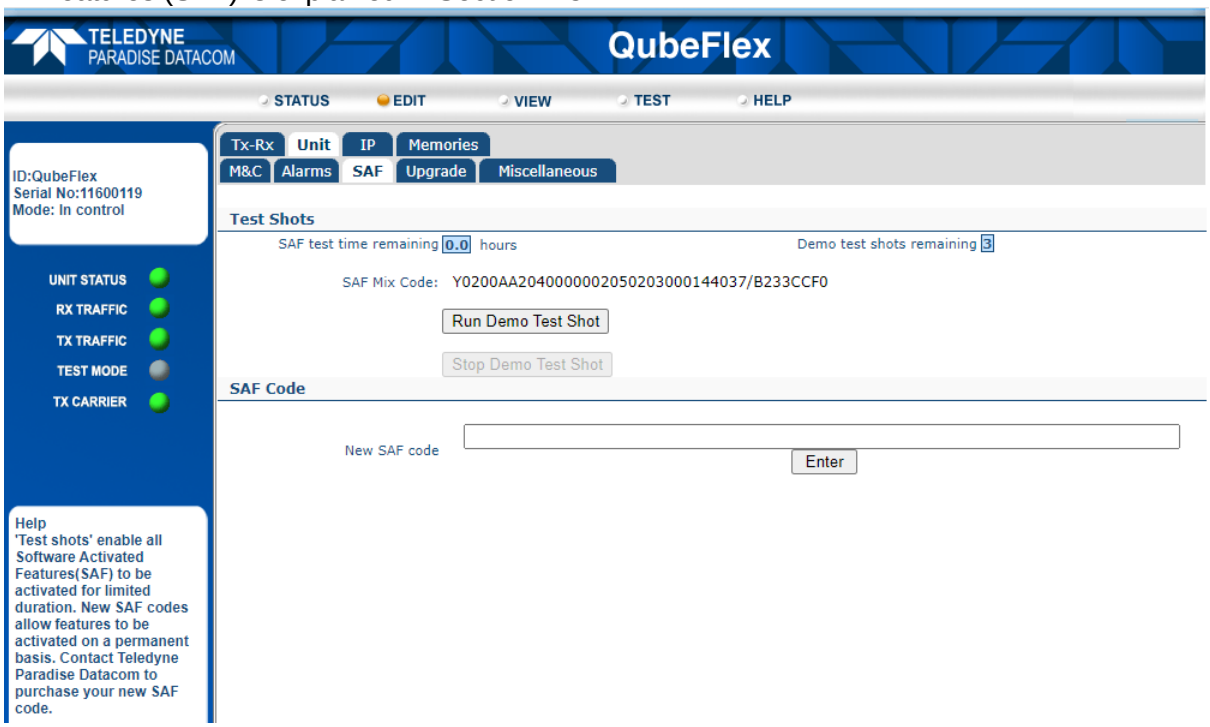


Figure 6-16 Edit->Unit->SAF Screen

This screen displays:

- The remaining time period before any temporarily enabled SAF features time out.
- The number of unused test shots remaining. A test shot enables all of the modem features for a 10-day period (subject to suitable hardware being fitted and with some exceptions).
- The SAF Mix Code, which is a number that represents all of the features that have been permanently enabled on the modem.

The *Run Demo Test Shot* button is used to start a 10-day activation of the modem's SAF features.

The *Stop Demo Test Shot* button is used to terminate the temporary activation of the modem's SAF features. Any remaining time of the test period is lost.

The *New SAF code* edit box is used to enter a code provided by Paradise that unlocks additional modem features. When unlocked, the features immediately become available. The act of unlocking SAF features will not itself interfere with any services being provided by the modem. Entering a code of '0' will enable a test shot.

6.2.15 Edit->Unit->Upgrade Screen

The *Edit->Unit->Upgrade* screen is shown in **Figure 6-17**. This allows the modem's software to be upgraded (and downgraded). This can also be done via the front-panel menus and a USB memory stick.

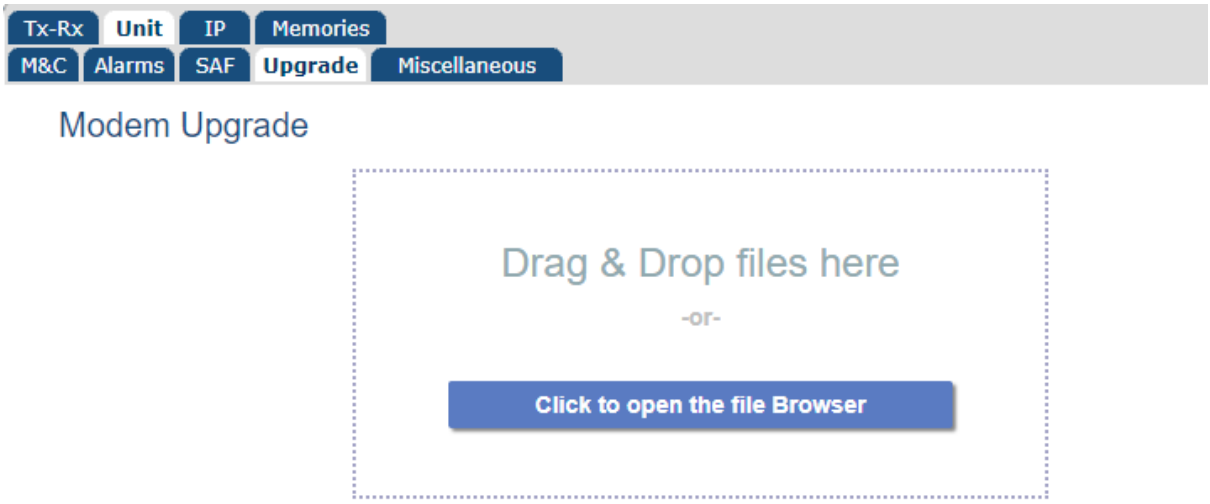


Figure 6-17 Edit->Unit->Upgrade Screen

The latest software can be found under Downloads on the Paradise company web site at: https://www.teledynedefenseelectronics.com/paradisedatacom. The software should be downloaded from the web site to a temporary location that can be accessed by the browser and modem.

It is necessary only to browse to the location of the upgrade file and open the file before starting the upgrade. During the upgrade process the modem will drop any service that it is providing.

Feedback on the progress of the upgrade, which typically takes around two minutes, is provided on the screen on shown in **Figure 6-18**. The modem will restart automatically

when the upgrade is complete and will resume operation using the same configuration as prior to the upgrade.

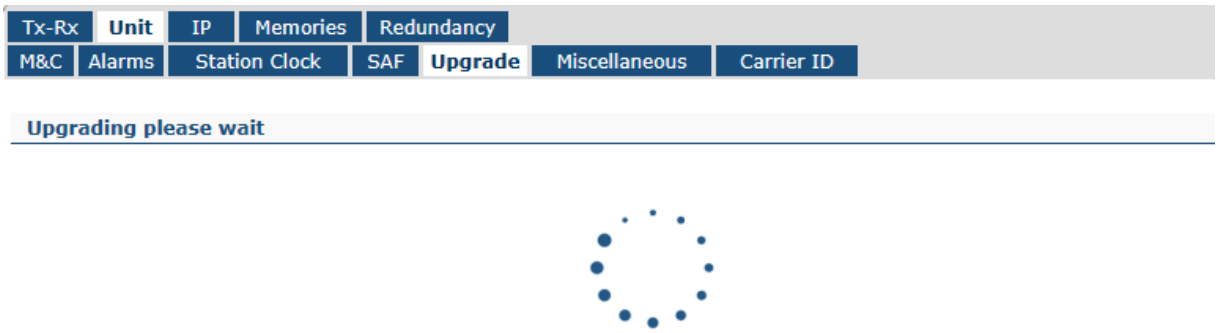


Figure 6-18 Edit->Unit->Upgrade Screen Progress Indication

A remote modem can be upgraded over the satellite link by browsing to the remote modem's IP address and following the same upgrade process. Note that the speed of the upgrade is dependent on the bandwidth available over satellite. An approximate time can be worked out by comparing the size of the upgrade file with the bandwidth available.

In the event that an upgrade is unsuccessful then the modem will revert to a backup version of software. This will normally be the same version as the software that the modem shipped from the factory with. However, it is possible to set the fallback software to any version (please consult Technical Support for further details).

To revert to the backup version of software in the modem, hold down the MAIN key at power-up, then when the menu appears press 5 (this is a hidden menu option). This boots the modem from a backup copy of the software stored when the modem was manufactured. Once the modem has been recovered then the standard upgrade process can be repeated.

Upgrade from USB memory stick

- It is important that only the expected files are present in the USB memory stick file system.
- Format the USB memory stick as FAT32 to ensure the USB stick is blank and ready to use. 'Quick format' can be used.
- Create a directory on the USB memory stick called 'upgrade' (this is case-sensitive).
- Extract/unzip the contents of the new modem software .zip file to this directory.
- If the .zip file also contains a file called 'preupgrade.sh', do not include (delete) that file in the USB stick \upgrade folder, otherwise the upgrade will fail.
- There should only be three files in the \upgrade folder, as shown in **Figure 6-19**. The dates and sizes will depend on the software version used.

Figure 6-19 USB Memory Stick Upgrade Files in Upgrade Folder

- Plug the memory stick into a USB port on the modem.
- On the front panel keypad select **2:Edit**, **4:Unit**, **5:Upgrade**.

- An 'Upgrading!! Do not switch off' message will then be displayed on the front-panel display.
- The modem will reboot automatically and resume normal operation when the upgrade is complete.

If the modem does not recognise the USB memory stick

To be recognised by the modem, the memory stick must have been formatted as 'FAT32'. In Windows, this can be done by right clicking on the USB drive and selecting 'Format' and then selecting 'FAT32'. Note that this will delete the existing contents of the memory stick.

Recovery from a failed upgrade

There are three methods of recovering from a failed upgrade.

Recovery to factory-installed backup software version

To revert to the default backup version of software installed in the modem during the production process, hold down the **MAIN** key at power-up, then when the menu appears press **5** (this is a hidden menu option).

This boots the modem from a backup copy of the software stored when the modem was manufactured. During the boot process the contents of the front-panel display will be incorrect and should be ignored. Once the modem has been recovered then the standard upgrade process can be repeated.

Recovery via the Rescue menu option

It is possible to boot the modem to a basic web server that allows the software upgrade process to be repeated. The basic web server will display a web page that allows you to navigate to the software upgrade file and when this is selected then the software will be upgraded as normal and the modem will reboot automatically at the end of the process.

To initiate the rescue process, hold down the **MAIN** key at power-up, then when the menu appears press **2: Rescue**. The basic web server uses an IP address of 10.0.70.1/16 and uses the IP traffic port on the modem (not the M&C Ethernet port).

Recovery via USB memory stick

- Unzip the contents of the software upgrade zip file 'QubeFlex-x.x.xx.zip' to the root folder for the memory stick (e.g. 'D:\').
- Contact Paradise Customer support for the appropriate `recimage` file and save to the memory stick's root folder:
- There should now be just four files in the memory stick's root folder as shown in **Figure 6-20**. (File sizes and dates will vary.)

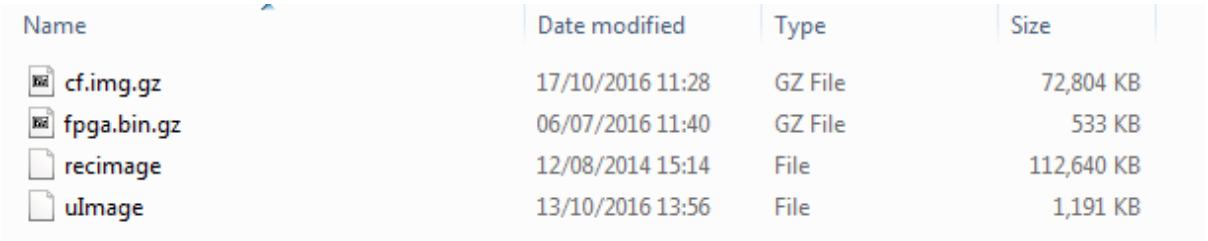


Figure 6-20 USB Memory Stick Root Folder

- Power up the modem and keep the **MAIN** key pressed down for a few seconds until a menu appears.
- Select **3: USB** from the menu.
- The modem will recover and complete the upgrade process from the memory stick within a few minutes. During the boot process the contents of the front-panel display will be incorrect and should be ignored.
- The USB memory stick can be unplugged when the modem has finished booting.

6.2.16 Edit->Unit->Miscellaneous->Time Screen

The *Edit->Unit->Miscellaneous->Time* screen is shown in **Figure 6-21**. This allows the modem's real time clock to be set. The modem incudes a battery and maintains the time when powered down.

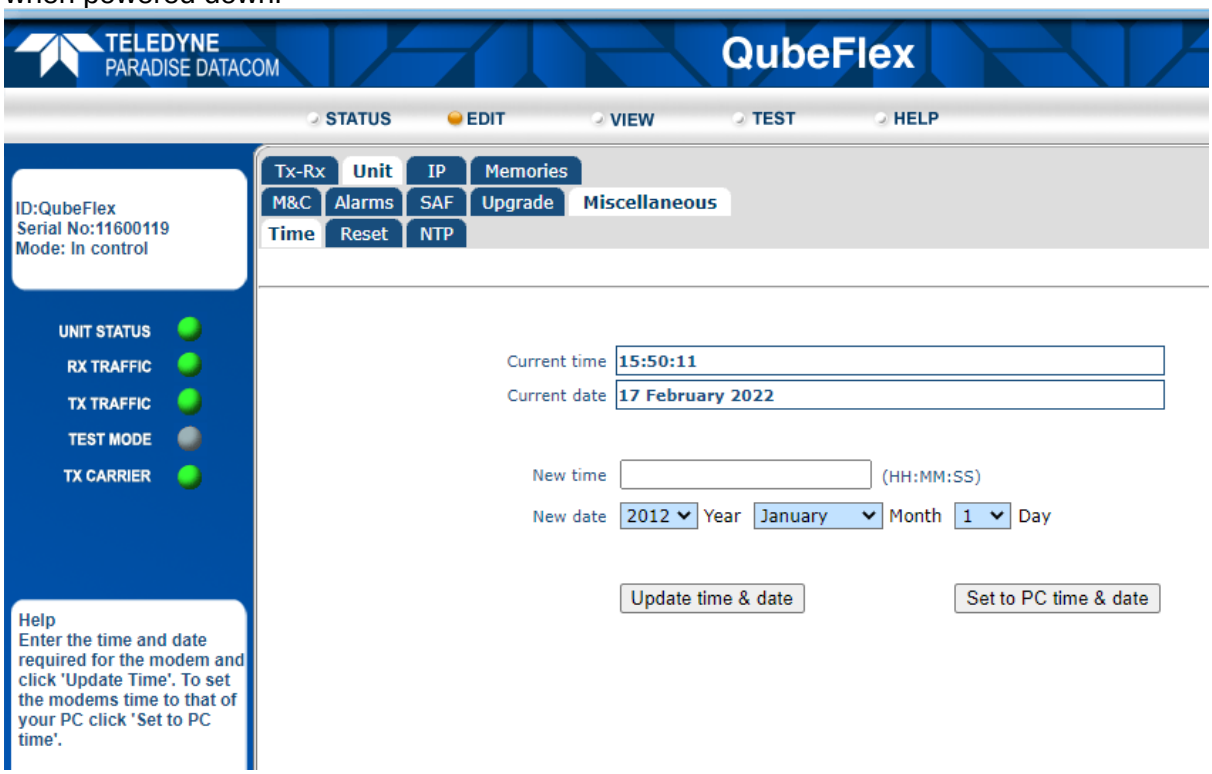


Figure 6-21 Edit->Unit->Miscellaneous->Time Screen

6.2.17 Edit->Unit->Miscellaneous->Reset Screen

The *Edit->Unit->Miscellaneous->Reset* screen is shown in Figure 6-22. This allows the modem to be reset, following confirmation.

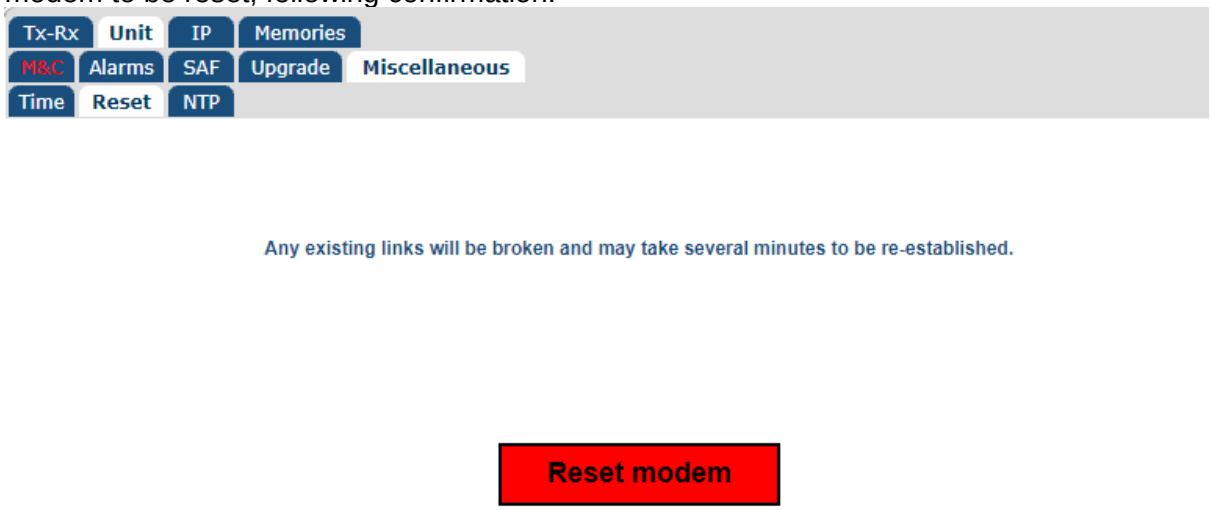


Figure 6-22 Edit->Unit->Miscellaneous->Reset Screen

6.2.18 Edit->Unit->Miscellaneous->NTP Screen

The *Edit->Unit->Miscellaneous->NTP* screen is shown in **Figure 6-23**. This supports using the Network Time Protocol (NTP) to synchronise the modem to the attached computer system. This requires the input of an NTP server IP address (that provides a master source of Coordinated Universal Time (UTC)).

The modem will request the current time from the NTP server on a regular basis.
A time offset can be applied to the modem to account for any regional deviation from UTC.

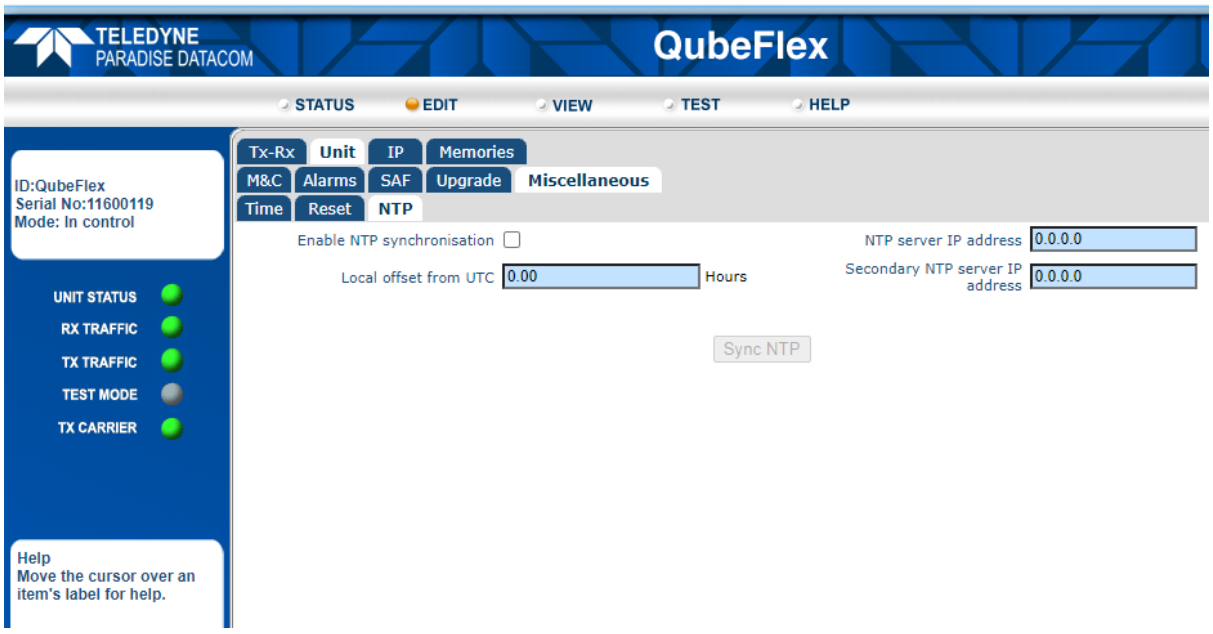


Figure 6-23 Edit->Unit->Miscellaneous->NTP Screen

6.2.19 Edit->IP Screen

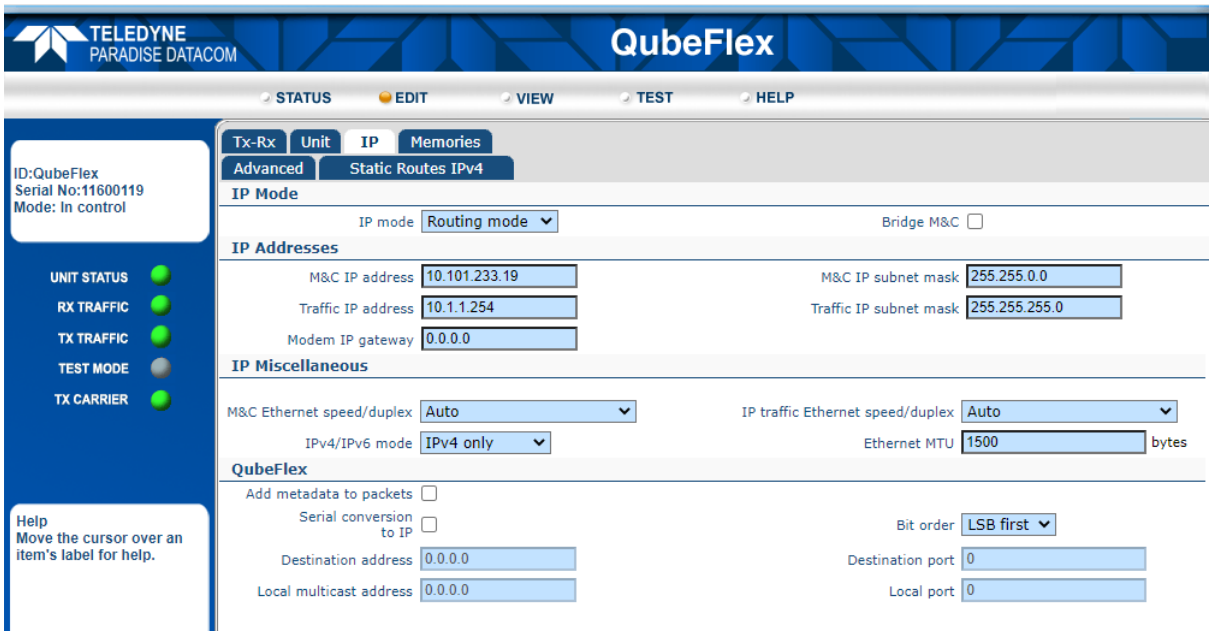


Figure 6-24 Edit->IP Screen

6.2.19.1 IP Mode

Table 6-38 shows the *IP mode* options.

Bridge mode	In this mode the modem acts as an Ethernet bridge, preserving the original Ethernet frames (including additional fields such as VLAN and MPLS headers) over satellite. **If using IP terrestrial interface, QubeFlex must always use Bridge mode.**
Routing mode	In this mode IP packets are forwarded based on the contents of the modem's routing table, which can be configured manually with static routes or controlled dynamically by enabling dynamic routing. Dynamic routing populates the routing table based on information forwarded by other routers in the network. The modem operates as a two-port router in this mode (with separate terrestrial and satellite IP addresses). **Do not use Routing mode on QubeFlex**.
Trunking mode	Trunking mode implements a Layer 2 bridge in hardware. This results in a much higher packet handling capability (up to 200,000 packets per second). Because the processor is bypassed in this mode, jitter is also minimised. ACM (and AUPC) can be used in Trunking mode but other IP features such as TCP acceleration cannot be used because they require the packets to be passed through the processor. **Do not use Trunking mode on QubeFlex.**

Table 6-38 IP Mode

6.2.19.2 Bridge M&C

This is an On/Off control that determines whether the M&C RJ45 Ethernet port is bridged with the traffic ports, or whether they have separate IP addresses allocated to them.

When the M&C Ethernet port is out of the bridge then satellite IP traffic and M&C traffic are processed separately and therefore the modem Ethernet connectors are no longer interchangeable. Care should be taken in selecting this mode for a modem since if the cables have been incorrectly fitted then it could result in loss of M&C communications.

When the Remote M&C Ethernet port is bridged to the satellite IP Traffic port then the modem Ethernet ports act as an Ethernet switch.

6.2.19.3 M&C IP Address, Subnet Mask & Modem IP Gateway

M&C IP Address Default:	10.0.70.1
Description:	This sets the IP address for remote control. When the M&C and traffic Ethernet ports are bridged together then this address is used for both M&C purposes and satellite traffic. An IP address of 0.0.0.0 causes the modem to request its IP address from a Dynamic Host Control Protocol (DHCP) server on the network, removing the need to allocate static IP addresses to each modem. The allocated IP address can be seen on the *View->Unit* screen. A request to the DHCP server is made every minute until a reply is received. When IPv6 support is selected on the menus then additional address entry options are provided. When changing the IP address, devices communicating with the modem may take several minutes to recognize the new address unless the Address Resolution Protocol (ARP) table on the device is flushed.
M&C IP subnet mask Default:	255.255.0.0
Description:	Sets the IP subnet mask associated with the M&C IP address.
Modem IP Gateway Default:	0.0.0.0
Description:	Sets the IP address of a default gateway. The gateway represents the 'next hop' destination, which is normally the address of a router, for packets destined for somewhere other than the local network. An address of 0.0.0.0 means that the gateway is not set.

Table 6-39 M&C IP Address, Subnet Mask & Modem IP Gateway

6.2.19.4 Traffic/Satellite IP Addresses and Subnet Masks

Traffic IP address	This sets the IP address for the modem's IP Traffic port. (DHCP is not supported for this address and therefore an address must be manually entered.) If Bridge M&C is disabled, the Traffic IP address and M&C IP address must belong to different subnets. If Bridge M&C is enabled, set Traffic IP address to 0.0.0.0

Default:	When IPv6 support is selected on the menus, additional address entry options are provided. 0.0.0.0
Traffic IP subnet mask *Default:*	This sets the subnet mask for the modem's IP Traffic port. 255.255.0.0
Satellite IP address *Default:*	This sets the IP address for the modem's satellite IP port. This is only used when in routing mode as the modem acts as a two-port router. Not used on QubeFlex. 0.0.0.0
Satellite IP subnet mask *Default:*	This sets the subnet mask for the modem's satellite IP port. Not used on QubeFlex. 255.255.255.252

Table 6-40 Traffic/Satellite IP Address & Subnet Mask

6.2.19.5 Ethernet Speed/Duplex

Table 6-41 lists the different Ethernet speed and duplex settings for the modem's Ethernet interfaces. Changes will be effective immediately but when an auto-negotiated mode is selected, any Ethernet connection will be briefly disconnected while the change takes effect. The *Auto* setting is recommended for normal use but because Ethernet auto-negotiation varies between different manufacturers it may be necessary to fix the speed and duplex in some circumstances. The type of cable (crossover or straight) is always automatically sensed by the modem, which will work with both.

Auto	In this mode the modem will auto-negotiate the Ethernet speed and duplex settings.
10M half duplex	In this mode the modem will auto-negotiate the Ethernet speed and duplex settings but as part of the negotiation will 'advertise' 10Mbps half duplex as the only option available.
10M full duplex	The modem will auto-negotiate the Ethernet speed and duplex settings but as part of the negotiation will 'advertise' 10Mbps full duplex as the only option available.
100M half duplex	The modem will auto-negotiate the Ethernet speed and duplex settings but as part of the negotiation will 'advertise' 100Mbps half duplex as the only option available.
100M full duplex	The modem will auto-negotiate the Ethernet speed and duplex settings but as part of the negotiation will 'advertise' 100Mbps full duplex as the only option available.
1000M half duplex	The modem will auto-negotiate the Ethernet speed and duplex settings but as part of the negotiation will 'advertise' 1000Mbps half duplex as the only option available.

1000M full duplex	The modem will auto-negotiate the Ethernet speed and duplex settings but as part of the negotiation will 'advertise' 1000Mbps full duplex as the only option available.
10M half duplex (fixed)	The modem's Ethernet interfaces will be fixed to 10Mbps half duplex operation.
10M full duplex (fixed)	The modem's Ethernet interfaces will be fixed to 10Mbps full duplex operation.
100M half duplex (fixed)	The modem's Ethernet interfaces will be fixed to 100Mbps half duplex operation.
100M full duplex (fixed)	The modem's Ethernet interfaces will be fixed to 100Mbps full duplex operation.
1000M half duplex (fixed)	The modem's Ethernet interfaces will be fixed to 1000Mbps half duplex operation.
1000M full duplex (fixed)	The modem's Ethernet interfaces will be fixed to 1000Mbps full duplex operation.

Table 6-41 Ethernet Speed/Duplex

6.2.19.6 IPv4/IPv6 Mode

IPv4 only	This enables the entry and display of IP addresses in IPv4 format only. The modem will bridge IPv4 and IPv6 packets when in IPv4 mode but will route only IPv4 packets.
IPv4 and IPv6	This enables the entry and display of IP addresses in either IPv4 format or IPv6 format. The modem will handle both IPv4 and IPv6 packets in this mode.

Table 6-42 IPv4/IPv6 Mode

6.2.19.7 Ethernet MTU

Range: *Default:*	1,500 bytes to 10,240 bytes; step size: 1 byte 1500
Description:	This controls the Ethernet Maximum Transmission Unit (MTU) size, which defines the largest Ethernet frame that can be handled by the modem without fragmentation into smaller frames.

Table 6-43 Ethernet MTU

6.2.19.8 Add Metadata to Packets

'Add metadata to packets' is an On/Off control that controls whether additional demodulator performance information is added to IP packets output by the demodulator. When this setting is enabled, additional metadata information is prepended to the UDP payload in each packet.

There is a total of 36 bytes of metadata as detailed in **Table 6-44**.

Field	Contents	Size (bytes)	Format/Unit	Resolution
1	Metadata version	1	Unsigned whole number (starting from '0')	1
2	Timestamp	7	Elapsed microseconds since 1 January 1970	1µs
3	Rx power level	4	dBm x 10 (The Rx power level to one decimal place is multiplied by 10 to make it a whole number, e.g. -35.1dBm will be sent as the value -351)	Signed, 0.1dB. (The value must be divided by 10 to give the actual Rx power level to one decimal place)
4	Rx modulation type	8	Null-terminated ASCII string	N/A
5	Rx frequency	4	Hertz	1Hz
6	Rx data rate	4	Bits per second	1bps
7	Rx Eb/No	4	dB x 10 (The Rx Eb/No to one decimal place is multiplied by 10 to make it a whole number.	Signed, 0.1dB. (The value must be divided by 10 to give the actual Rx Eb/No to one decimal place)
8	Rx RS error count	4	N/A	1

Table 6-44 Metadata Format

6.2.19.9 Serial Conversion to IP

'Serial conversion to IP' is an On/Off control that controls whether the stream of demodulated data is output as IP packets rather than being output via a serial interface.

The default operation for conversion to IP of CCSDS data is that each CCSDS user Transfer Frame will be placed in its own IP packet (with or without additional timestamp and metadata). For Intelsat operation, the user data is arbitrarily segmented such that the payload size equals the Transfer Frame length set by the user. IP packets are sent to the destination address and port number provided by the user.

6.2.19.10 Destination Address and Destination Port

Destination address	When converting the user data stream to IP, it is necessary to know what destination address to forward the IP packets to. This can be any unicast or multicast address and is typically the address of a computer that is running a packet capture software application for storage and further processing of the data.
Destination port	The destination UDP port number is used in conjunction with the destination address above in order to identify the specific application on the destination computer that will process the packets output from the demodulator.

Table 6-45 Destination Address & Destination Port

Edit->Memories Screen

The *Edit->Memories* screens shown in this section allow the user to store and recall modem configurations (referred to as configuration memories). These can also be uploaded and downloaded to and from a PC or equivalent to allow configurations to be shared between different modems.

The following operations can be performed on configuration memories:

- *Store.* This allows the current M&C configuration to be stored to a named configuration memory for later use. Up to 20 configuration memories can be created (more may be stored if memory allows). The memories are non-volatile and will persist between successive power-ups of the modem. Configuration memories can be assigned any desired name using the alphanumeric keypad. However, spaces are not supported, and the Modem will not accept these.
- *Recall.* This allows a previously stored configuration to be selected and used in place of the current configuration.
- *Delete.* This allows configuration memories to be deleted.
- *Download.* This is used to download one or more configuration memories from the modem to a PC or equivalent.
- *Upload.* This is used to upload one or more configuration memories to the modem.

A default configuration memory called *LOAD_DEFAULTS* always exists. Recalling it will reset the modem to its factory defaults. When LOAD_DEFAULTS is recalled from the web user interface then the modem's current M&C IP address, netmask, gateway, takeaway control, Modem ID and passwords are all retained whereas when selected from the front panel these go back to their factory defaults. This is done in order not to lose remote control of the modem from the web user interface when using it. *LOAD_DEFAULTS* cannot be erased or overwritten.

Configuration memory names are restricted to alphanumeric characters and underscores only.

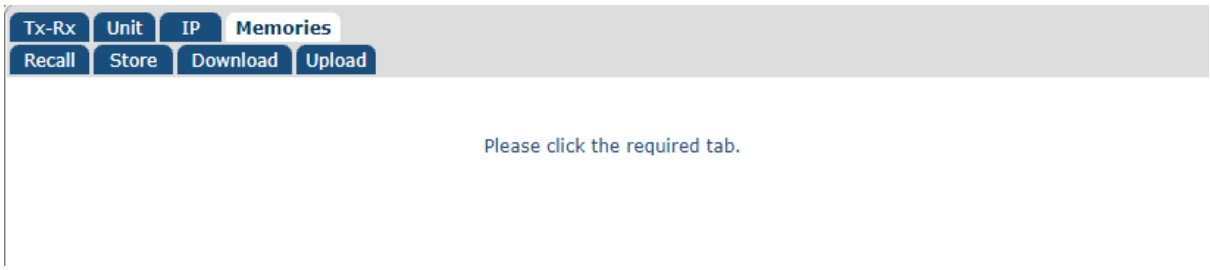


Figure 6-25 Edit->Memories Screen

6.2.19.11 Edit->Memories->Recall Screen

The *Edit->Memories->Recall* screen (shown in **Figure 6-26**) displays all of the configuration memories that are stored on the modem. A specific configuration memory can be made active by selecting the associated *Recall* button. The *Delete* button can be used to delete a configuration memory.

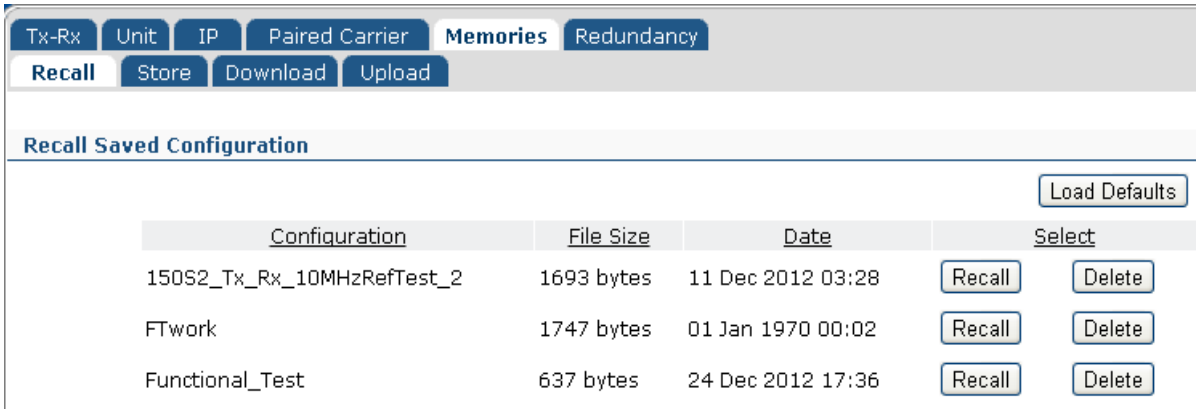


Figure 6-26 Edit->Memories->Recall Screen

6.2.19.12 Edit->Memories->Recall->Advanced Reversionary Control Screen

The *Edit->Memories->Recall->Advanced* screen (shown in **Figure 6-27**) supports a method for recovering a remote modem from a failure during a change to the modem's configuration. In essence, this works in a similar way to the Cisco Reload command, where a known, trusted, configuration is loaded after a defined timeout period in the event that the reload operation is not cancelled by the operator in a timely manner after completing the necessary configuration changes.

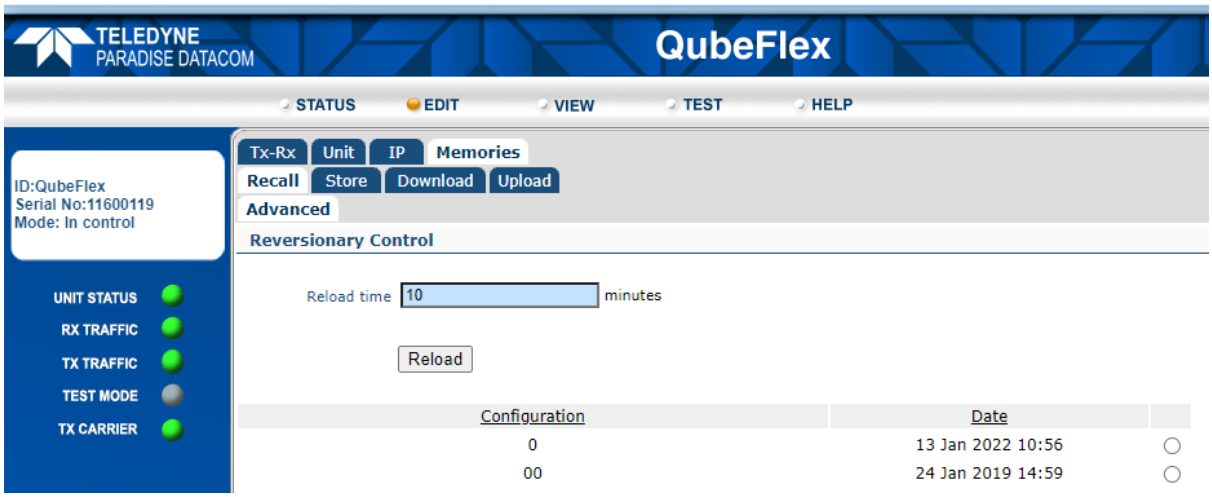


Figure 6-27 Edit->Memories->Advanced Reversionary Control Screen

The procedure for protecting and recovering a remote modem from failure during a configuration change is as follows.

1. Prepare in advance a configuration memory that represents a known 'safe' or default configuration for the remote modem. This is the configuration that will be recalled should a manual reconfiguration of the remote modem result in a loss of communications with the modem. Ensure that this configuration memory is stored on the remote modem.
2. Immediately prior to making any manual change to the remote modem, navigate to its *Edit->Memories->Recall->Advanced* screen and select the radio button corresponding to the configuration memory to be reloaded in the event of a failure during the configuration process.
3. Set a reload time. This is the period of time in minutes that the operator has to make all the necessary configuration changes to the remote modem. It represents a timeout period after which the modem will automatically reload the selected configuration memory unless the operator intervenes to cancel the timeout.
4. Click on the *Reload* button to start the timeout period, at which point the screen will change to that shown in **Figure 6-28**, which shows the remaining timeout period along with the name of the configuration memory that will be reloaded. In addition, the *Reload* button changes to a *Cancel* button.
5. Make any necessary changes to the remote modem's configuration.
6. After completing the configuration changes, navigate back to the *Edit->Memories->Recall->Advanced* screen and cancel the timeout by clicking on the *Cancel* button. The screen will now revert to its original format shown in **Figure 6-27**.

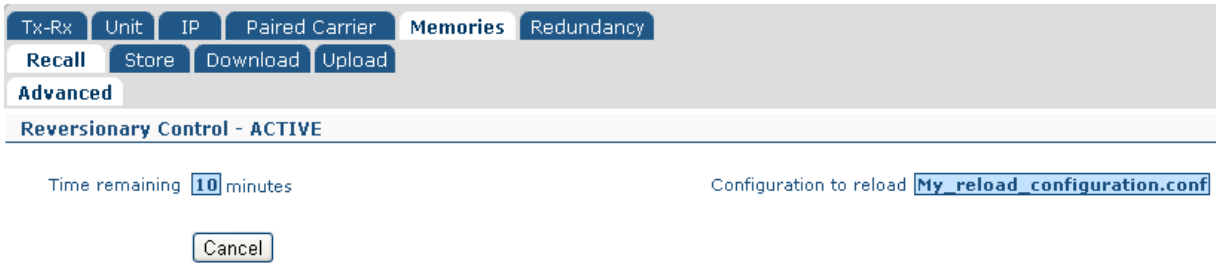


Figure 6-28 Reversionary Control Screen (Active state)

6.2.19.13 Edit->Memories->Store Screen

The *Edit->Memories->Store* screen (shown in **Figure 6-29**) allows the current modem configuration to be stored to a configuration memory under a given name. It also displays all of the configurations that are already stored on the modem. The *Delete* button can be used to delete a specific configuration memory.

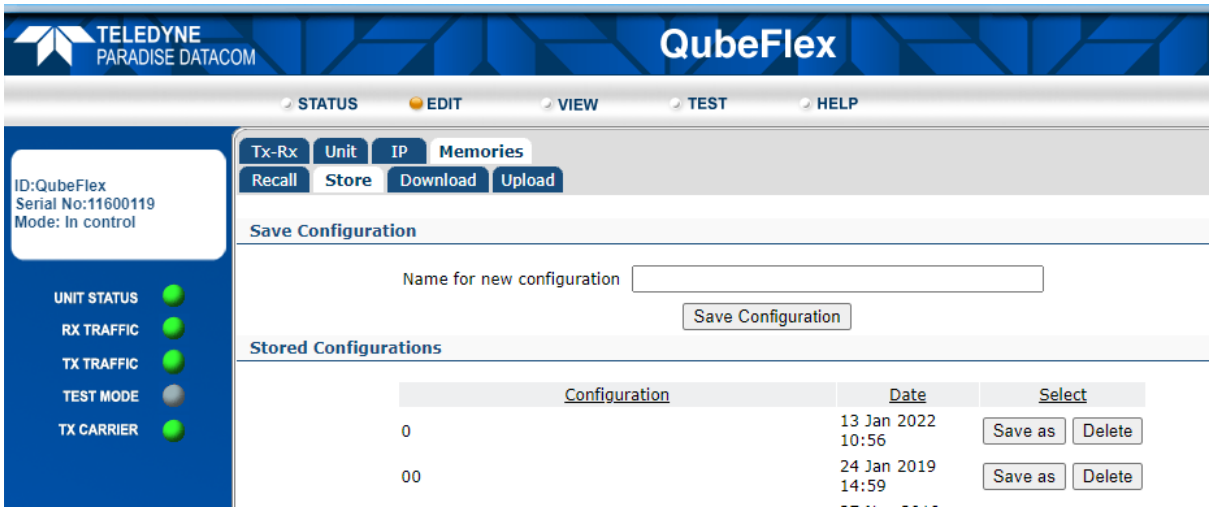


Figure 6-29 Edit->Memories->Store Screen

6.2.19.14 Edit->Memories->Download Screen

The *Edit->Memories->Download* screen (shown in **Figure 6-30**) displays all of the configuration memories that are stored on the modem and can be used to download one or all of the configurations from the modem to the user's browser device (such as a PC).

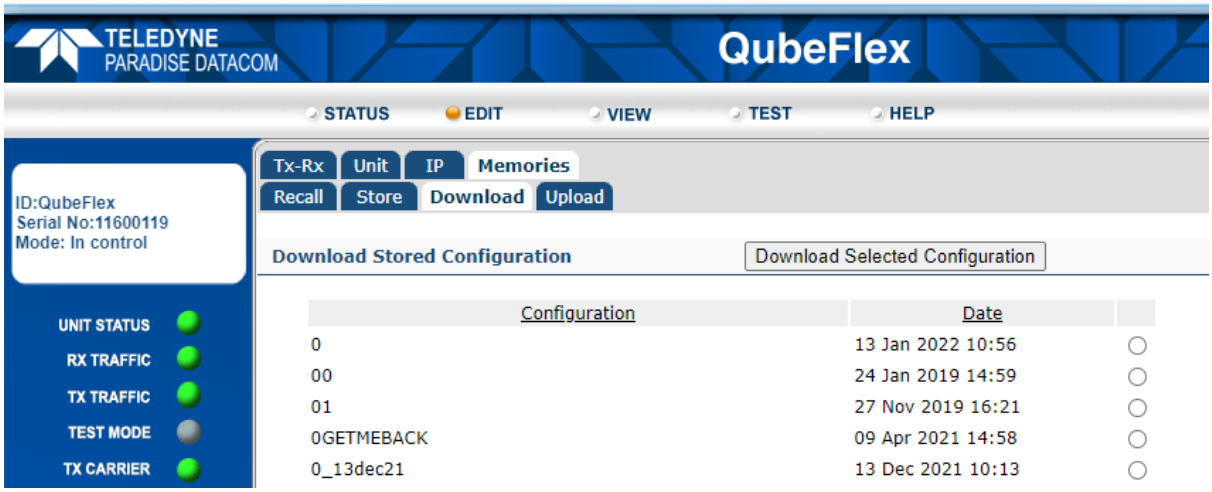


Figure 6-30 Edit->Memories->Download Screen

6.2.19.15 Edit->Memories->Upload Screen

The *Edit->Memories->Upload* screen (shown in **Figure 6-31**) allows the user to browse to a location on their browser device where they have a configuration memory that they want to upload to the modem. After selecting the file, selecting the *Upload Saved Configuration* button causes the configuration to be transferred to the modem.

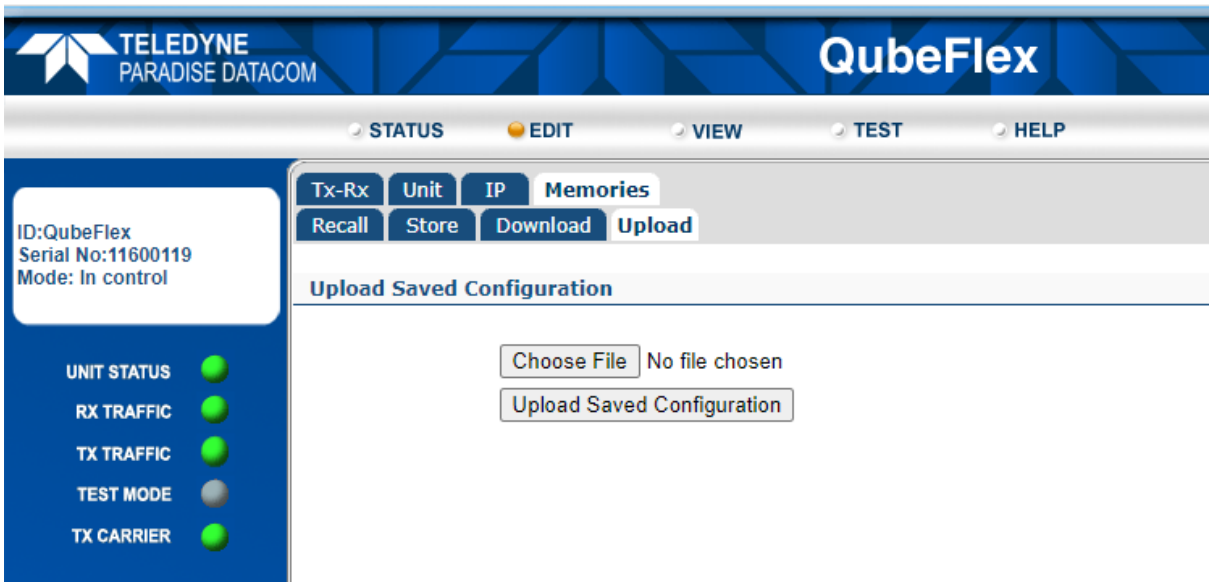


Figure 6-31 Edit->Memories->Upload Screen

6.2.20 View Screen

The *View* screen (shown in **Figure 6-32**) allows the following to be viewed:

- *Graphs*. These include spectrum, constellation, throughput, and time-based performance graphs. None of these interfere with the service being provided by the modem.
- *Alarms*. System alarms and warnings can be viewed.
- *Log*. The system log can be viewed and optionally emptied. The log contains information on all alarms and other notable events. The log contains space for thousands of entries. The oldest entries are deleted when space is required for new entries.
- *Setup*. This provides a succinct summary of the operational setup of the modem.
- *Unit*. This provides manufacturing information (including the software version number and the hardware fitted), power supply voltage levels, modem temperature indication, loopback status and the IP address of the M&C port (for when this has been set using DHCP).
- *SAF*. This displays all of the SAF features for the modem, indicating whether they are enabled or disabled. It also shows how many test shots remain along with the remaining test time. Information on temporary SAF (such as any temporary licenses) is also available.

Figure 6-32 View Screen

Viewing Graphs

From software version V3.0.90 onwards, the modem web graphs no longer require the Java Runtime Environment (JRE) to be installed on the browser device. The replacement form of web graphs does not require any special software to be downloaded to the browser device. If Java is causing web browser security violations, then is recommended that the modem software is upgraded to a non-Java version. Alternatively, please contact Paradise Technical Support for details of Java workarounds that allow Java to continue to be used.

6.2.20.1 Rx Spectrum Monitor

The Rx Spectrum Monitor shown in **Figure 6-33** is a powerful real-time spectrum analyser within the modem that is used to view the received signal spectrum.

The spectrum monitor can also be used in a satellite beacon receiver mode as described in Section 7.8.

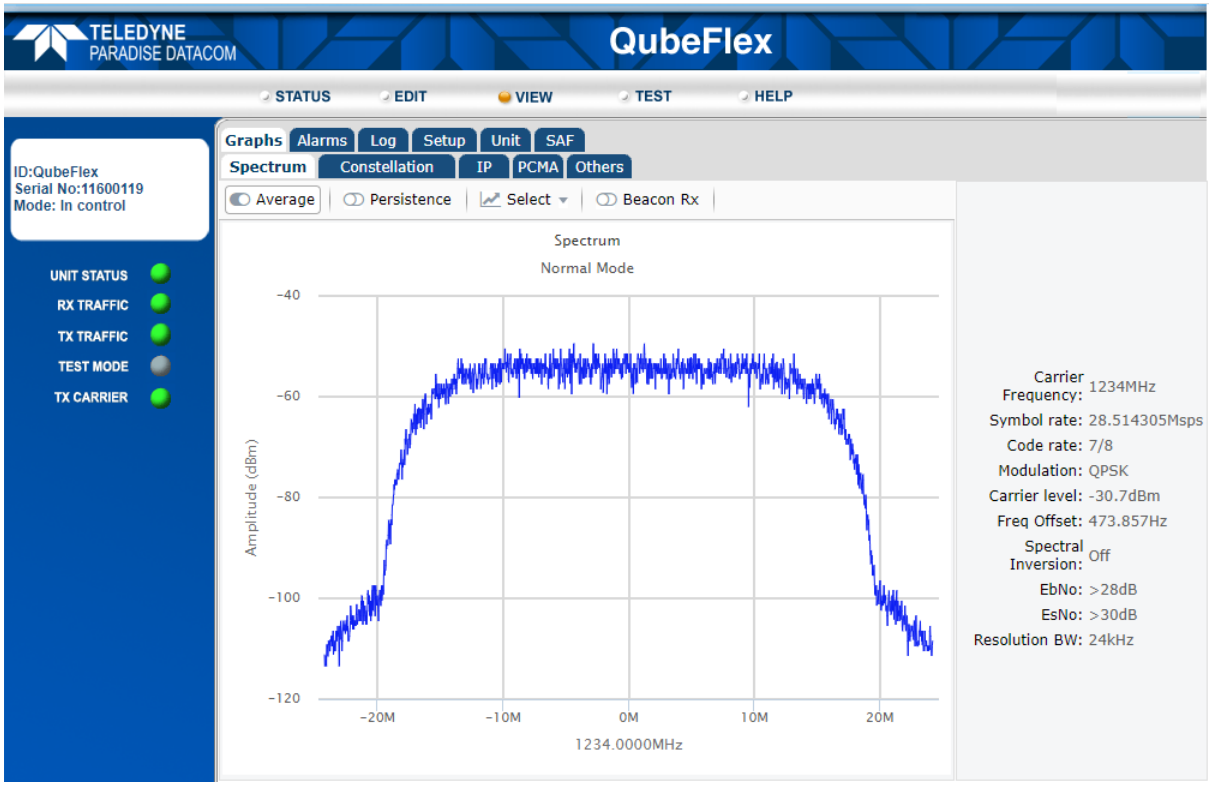


Figure 6-33 Rx Spectrum Monitor

The Rx Spectrum Monitor can be used to check for correct modem operation.

The *Span* can be set to *Normal*, which limits the frequency span to that of the carrier, or *Super Wide*, which displays a frequency span of +/-25MHz centered on the carrier's center frequency. *Super Wide* is useful for checking for adjacent interfering carriers. A zoom control can be activated by moving the mouse over an area of the graph while the mouse button is simultaneously held down. A 'Reset zoom' button appears and can be used to revert to the normal display resolution.

The mouse right click operation can be used to save the spectrum to a file.

Persistence leaves the spectrum to build up over time and is useful for identifying transient signals such as intermittent interference. The *Persistence* button acts as an on/off toggle.

Average increases the number of samples that are used in forming the displayed spectrum. The *Average* button acts as an on/off toggle.

A *Beacon Receiver* facility exists, please refer to Section 7.8 for further details.

LinkGuard™ is patented technology that monitors underneath the received carrier for any interference, while on traffic. It is viewed using the Rx Spectrum Monitor screen shown in **Figure 6-34** (using the Select button to select i). **LinkGuard™** is explained in Section 7.5.

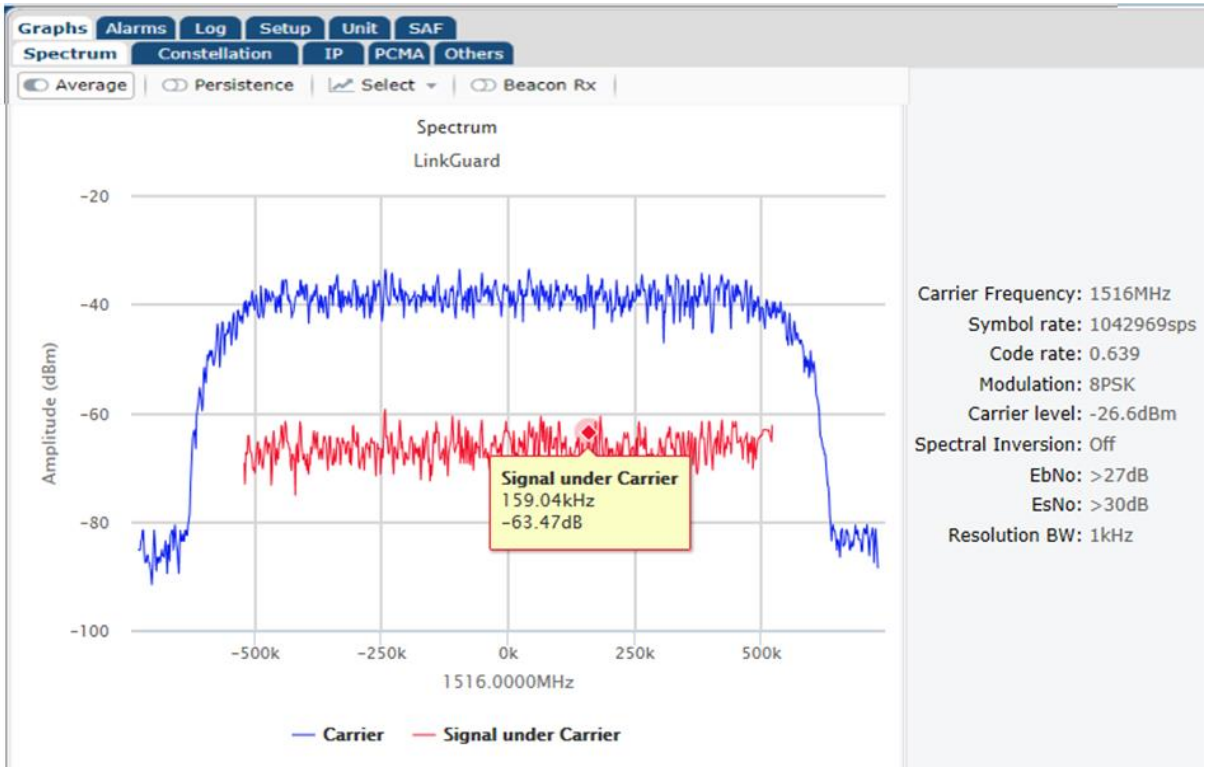


Figure 6-34 LinkGuard™ Signal-Under-Carrier Spectrum Monitor

6.2.20.2 Rx Constellation Monitor

The Rx Constellation Monitor feature shown in **Figure 6-35** allows the modem to be used to view the received signal constellation.

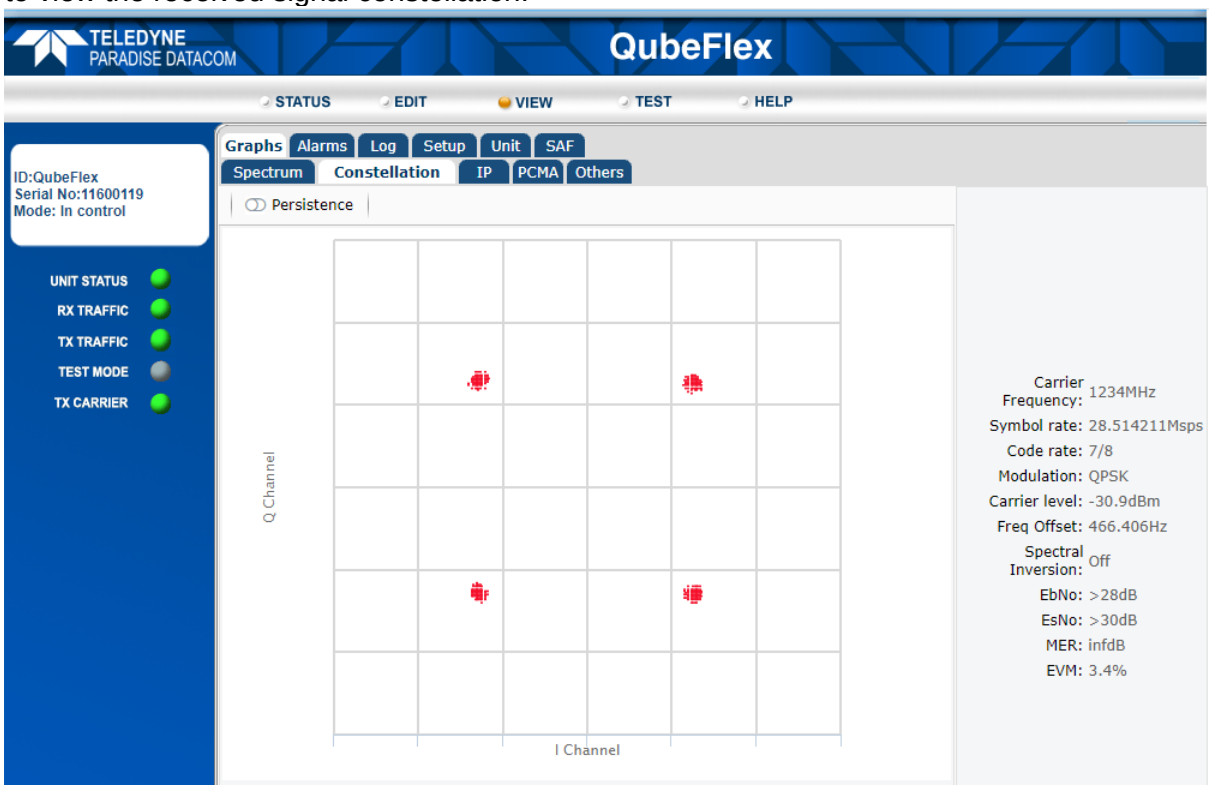


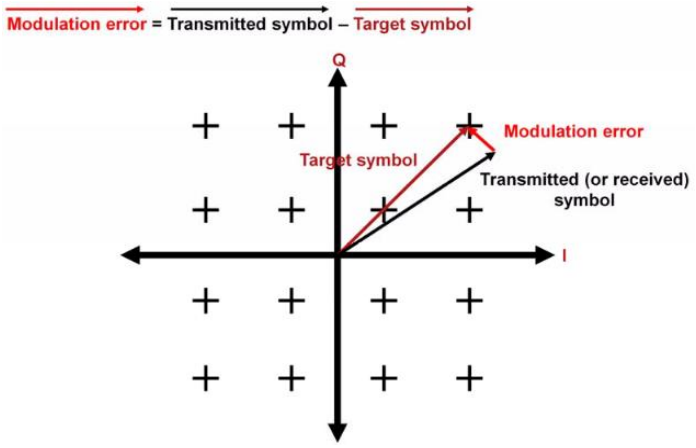
Figure 6-35 Rx Constellation Monitor

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. Excessive phase noise can cause cycle skips, seen as unwanted rotations within the constellation.

Note that MER and EVM figures are available on the panel on the right-hand side. These concepts are explained in the following information panel.

Modulation Error Ratio (MER) and Error Vector Magnitude (EVM)

MER and EVM (as displayed on the Rx Constellation Monitor) measure how imperfect the received signal is in relation to an ideal signal as in the following example.



They are defined as follows:

- ***MER (dB) =***
  $$\frac{\text{Power of ideal signal}}{\text{Power of error signal}}$$
- ***EVM (%) =***
  $$\frac{\text{Power of error signal}}{\text{Power of ideal signal}}$$

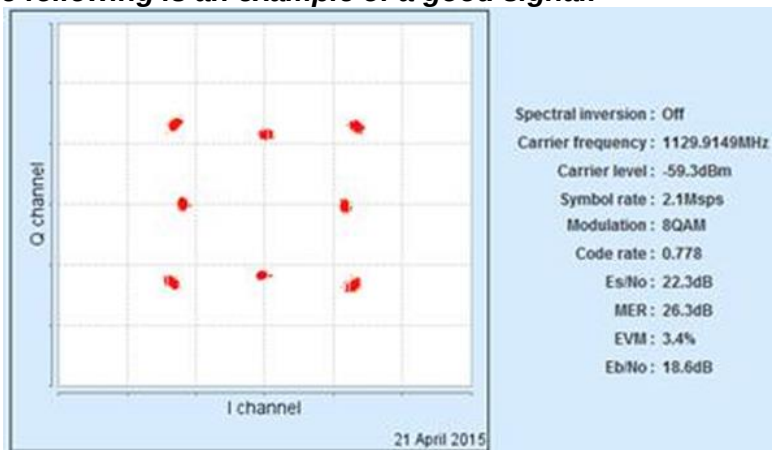
A high MER and low EVM indicate a good signal, whereas a low MER and a high EVM indicate a poor-quality signal.

Why are MER and EVM important? Unless you run a BER test then you do not know what the actual BER for the link is. A 'good' Es/No can be misleading since there could be degradation from interference. Modern FECs have steep BER curves, so the difference between quasi-error free (QEF) operation and losing the link can be very small. MER and EVM give an indication of how close to the 'cliff edge' the link is and may allow remedial action to be taken before the link is lost.

It is good practice when deploying a link to measure these two values when the link is running well. Then reduce the power level of the carrier(s) and establish the equivalent values just above the point at which the carrier unlocks. This will give a good indication of the range

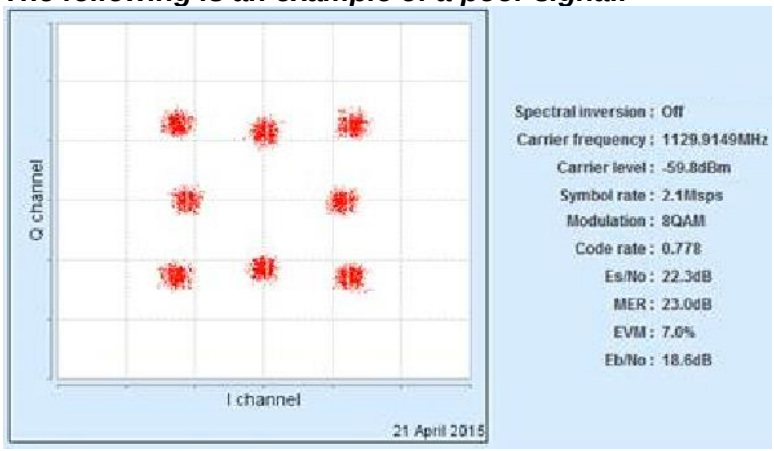
of potential values and can be used to establish an early warning when the link starts to degrade.

The following is an example of a good signal:



where MER=26.3dB and EVM=3.4%.

The following is an example of a poor signal:



where MER=23.0dB and EVM=7.0%.

6.2.20.3 IP Graphs

Figure 6-36 shows an example of an IP throughput graph. IP graphs support the display of throughput (including errored and dropped packets) for transmit and receive in bits per second and packets per second for the terrestrial and satellite ports. The throughput can be viewed in real time and over one day and 30-day time periods.

It is also possible to view the throughput associated with each individual traffic stream as classified by the traffic shaping feature.

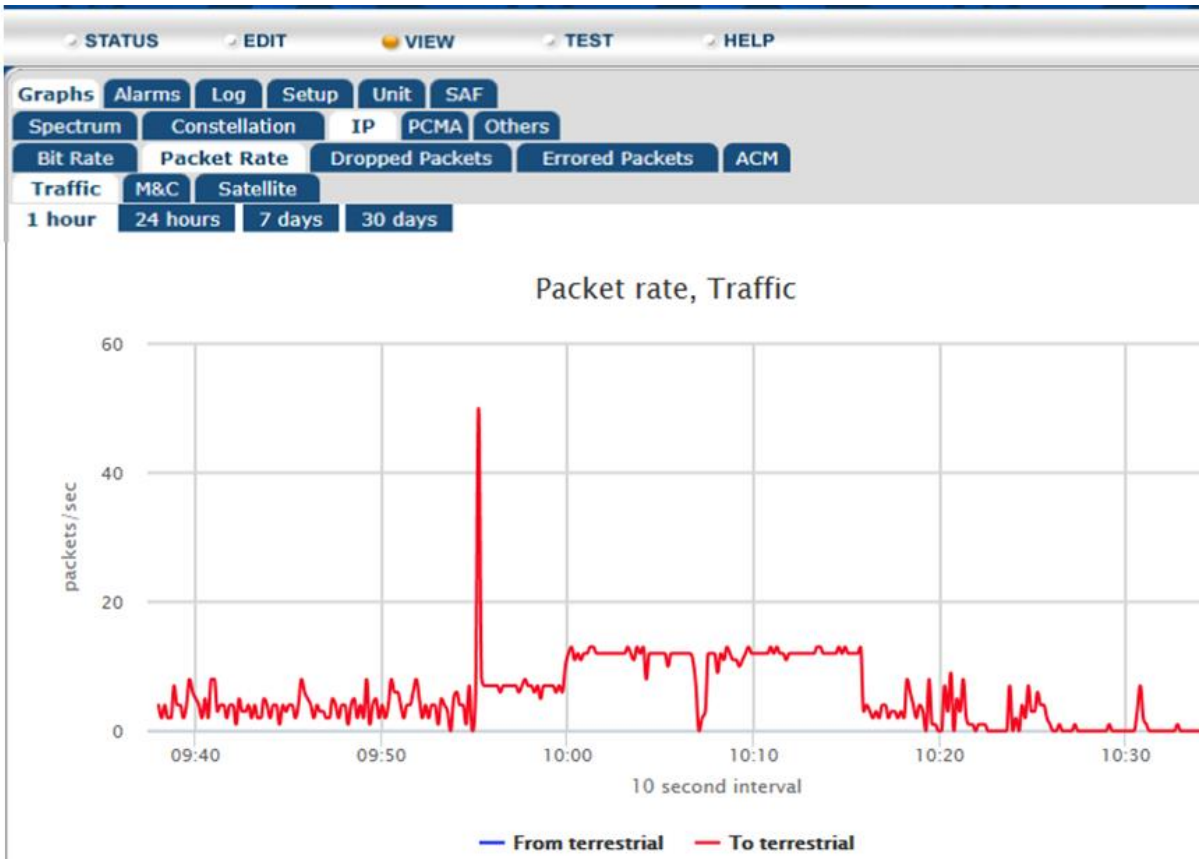


Figure 6-36 IP Throughput Graph

ACM is a DVB-S2X only feature, not applicable to QubeFlex. ACM graph therefore cannot be displayed.

6.2.20.4 Other Time-based Graphs

A number of time-based graphs can be displayed. Graphical values are stored for 31 calendar days or until the modem is powered down. The recording of all values occurs automatically at all times once the modem is powered on and is not dependent on whether the graphs are being viewed or not.

The web interface supports display of the following time-based graphs:

- Modem internal temperature.
- The modem received signal Eb/No.
- The modem received signal Es/No.
- The modem received power level.
- Receive frequency offset from center frequency.
- **LinkGuard™** interference power spectral density.
- The Eb/No of the distant modem being controlled via AUPC.
- The transmit power level while under AUPC control.
- ACM data rate.

An example graph is shown in **Figure 6-37**.

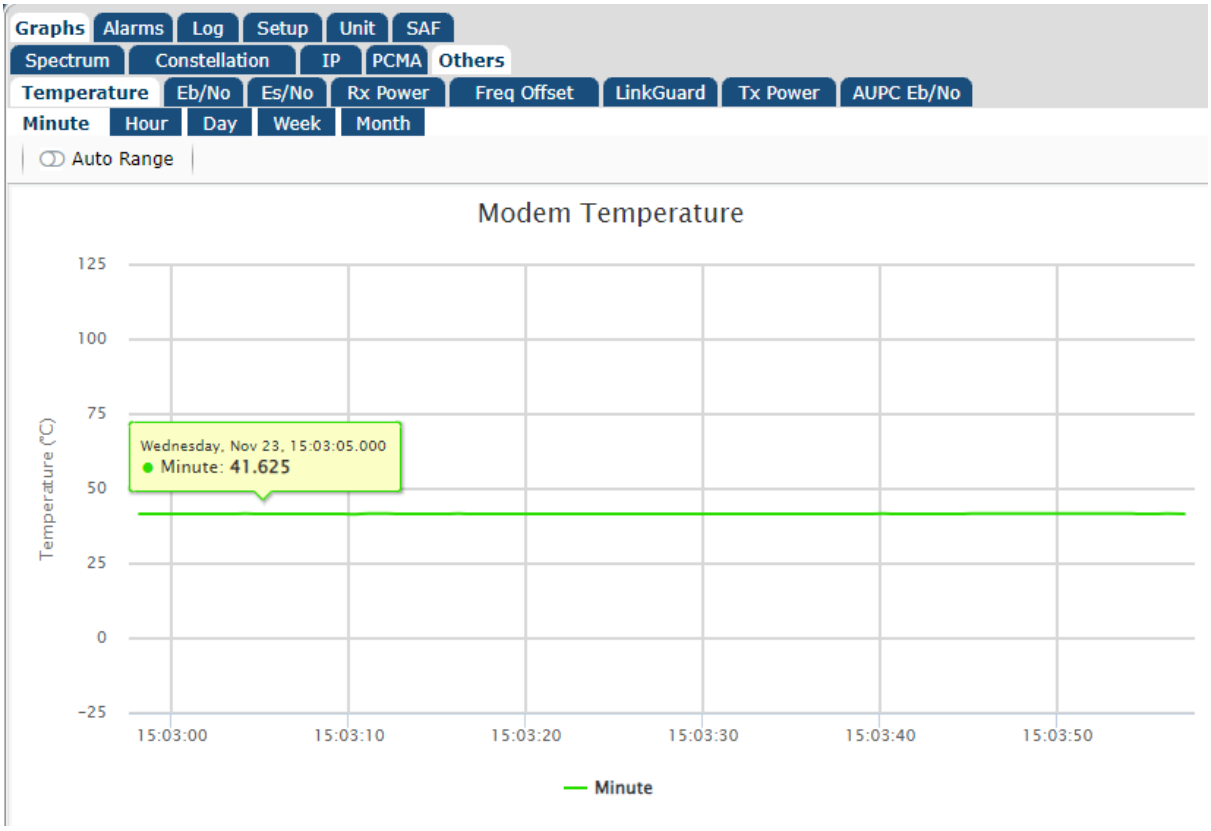


Figure 6-37 Temperature Graph

6.2.20.5 Alarms

System alarms can be viewed using the *View->Alarms* screen shown in **Figure 6-38**. Alarms are latched and their status will be shown as *Off* if they are no longer active. The *Accept* button can be used to delete all of the alarms after which the web page will automatically update and show details of any alarms that are still active.

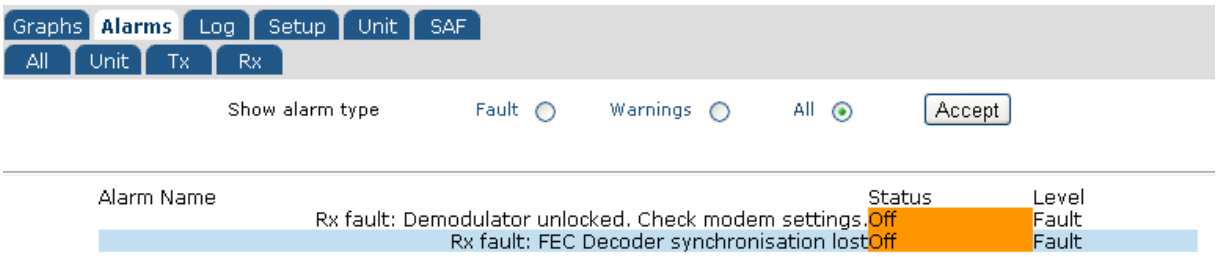


Figure 6-38 System Alarms Screen

6.2.20.6 System Log

The system log can be viewed using the *View->Log* screen shown in **Figure 6-39**. The *Clear* button can be used to delete all of the entries in the log. The *Download Log file* button can be used to download a text file of the log contents to the browser device.

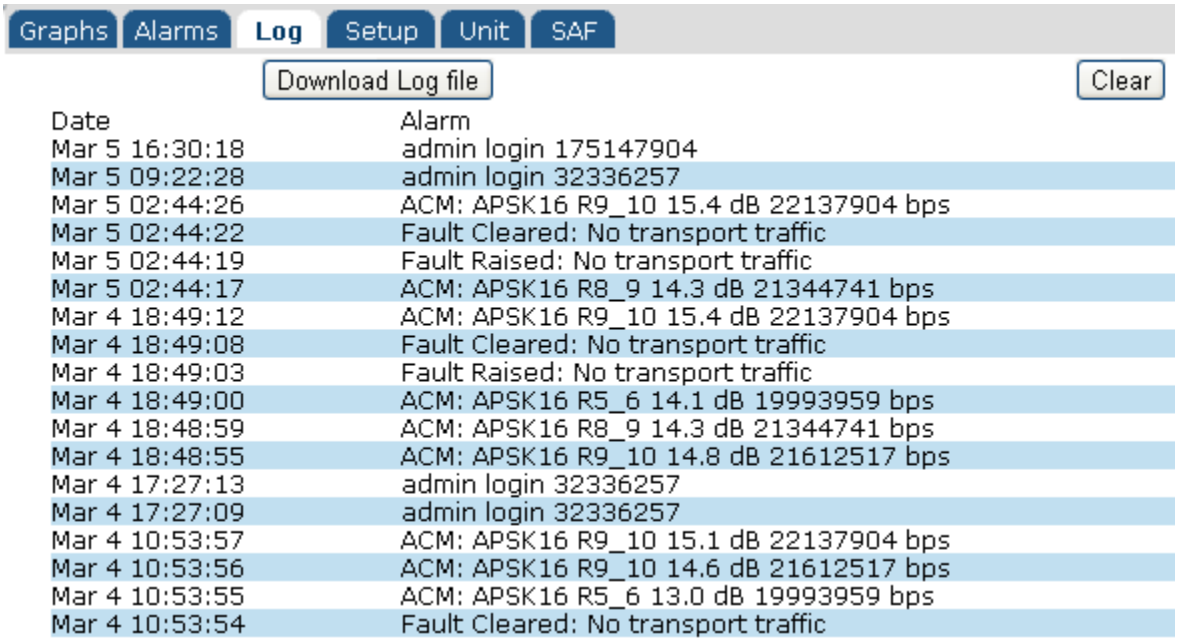


Figure 6-39 System Log Screen

6.2.20.7 View->Setup Screen

The *View->Setup* screen shown in **Figure 6-40** displays the current values of the most important configuration settings.

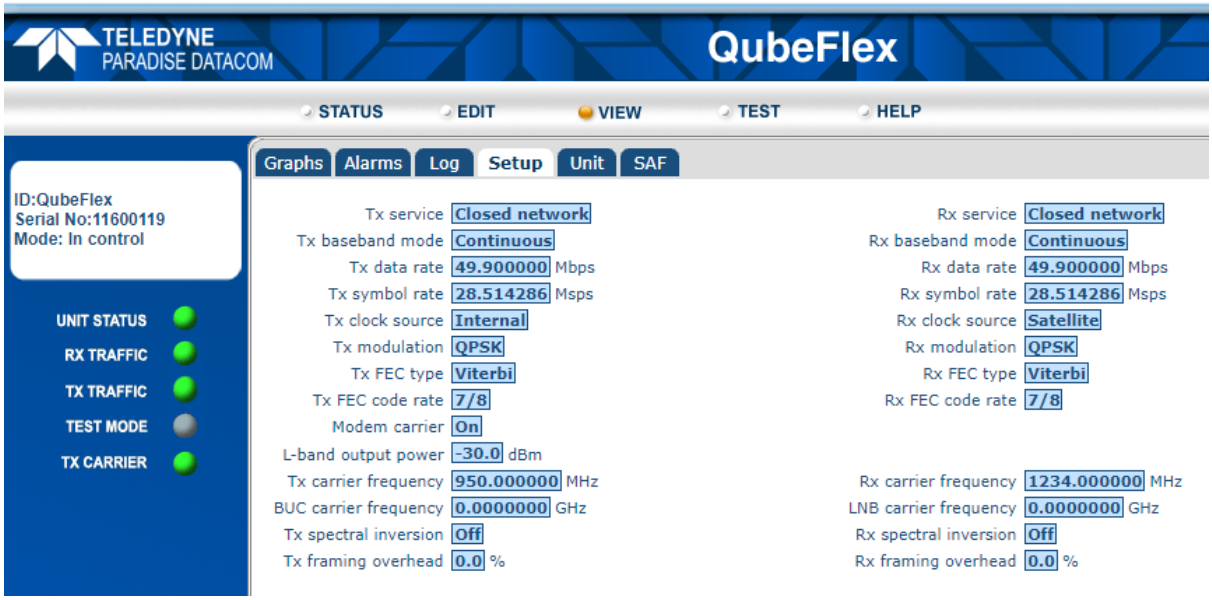


Figure 6-40 View->Setup Screen

6.2.20.8 View->Unit Screen

The *View->Unit* screen shown in **Figure 6-41** displays manufacturing information (including the software version number and the hardware fitted), power supply voltage levels, modem temperature indication, loopback status and the IP address of the M&C port (for when this has been set using DHCP).

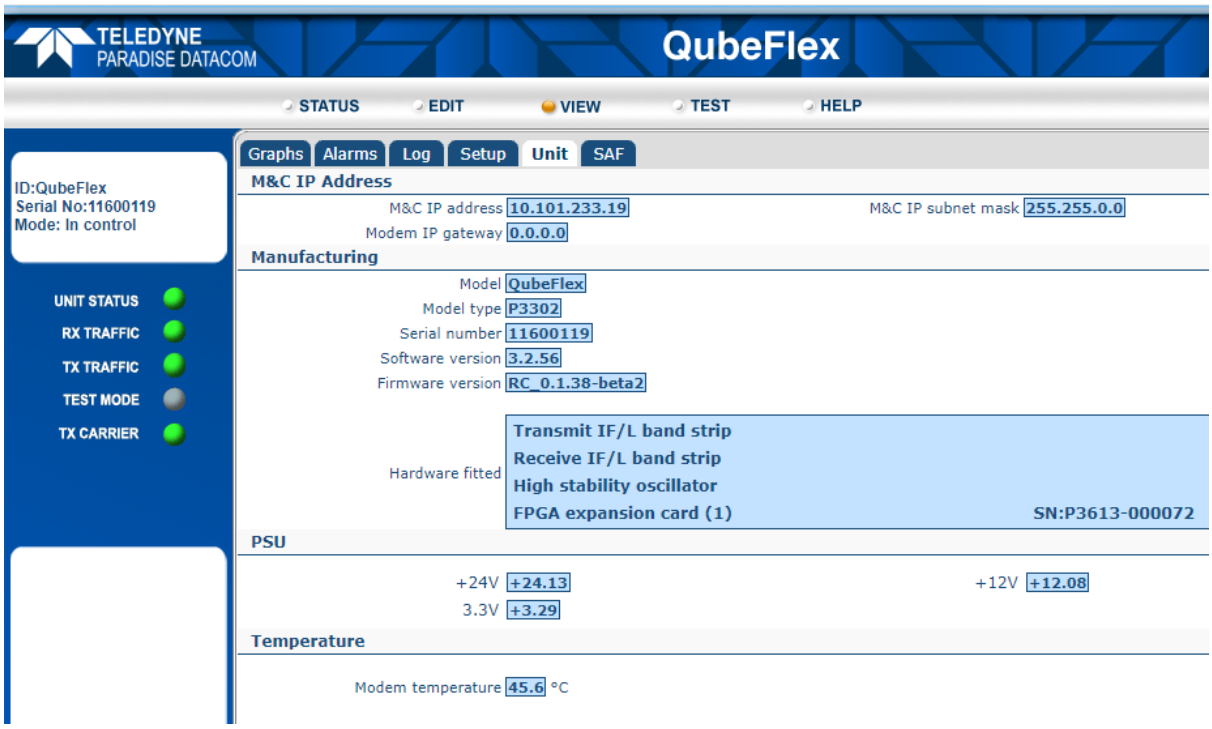


Figure 6-41 View->Unit Screen

6.2.20.9 View->SAF Screen

The *View->SAF* screen shown in **Figure 6-42** displays the status of each modem Software Activated Feature (SAF) indicating whether they are on, off or temporarily enabled. It also shows how many test shots remain along with the remaining test time. Information on temporary SAF (such as any temporary licenses) is also available. The SAF concept is explained in Section 7.3.
A QubeFlex purchased for operation up to 50Mbps may show 'Data rate 60Mbps' on this screen, however, the useable data rate will be 50Mbps or lower, depending on the modulation and FEC settings.

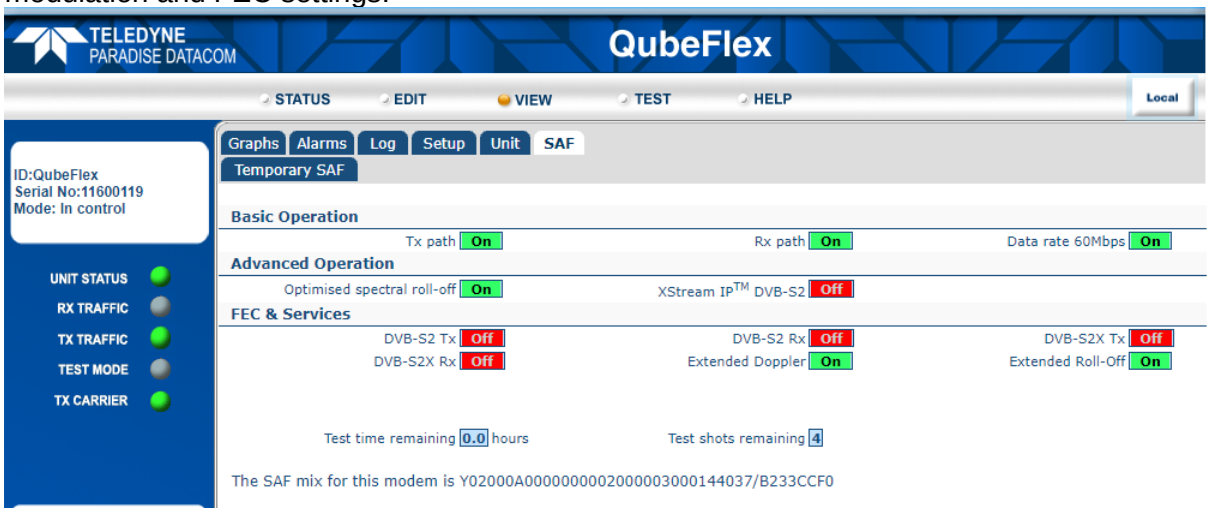


Figure 6-42 View->SAF Screen

6.3 Front-panel Interface

The use of a front-panel keypad and LCD display is available, as follows:

6.3.1 Keypad Operation

6.3.1.1 Cursor

An inverse-video cursor is used to navigate around the LCD display.

6.3.1.2 Navigation Keys

The menu options are arranged into a hierarchy of menus. Navigation is performed using the arrow and *ENTER* keys or by entry of the number associated with each menu option.

Arrow Keys

The *Up* arrow key moves the cursor up one line except when entering a numeric value, when it increments the digit highlighted by the cursor.

The *Up* arrow key is also used to enter a hyphen when a range of values is required (such as for timeslots).

The *Down* arrow key moves the cursor down one line except when entering a numeric value, when it decrements the digit highlighted by the cursor.

The *Down* arrow key is also used to enter a comma when entering a number of values together (such as when entering a list of timeslots).

The *Left* arrow key moves the cursor to the left, both on menus and when entering alphanumeric values. The *Left* arrow key has a special function when viewing the system log, where it is used to move backwards in the log by 100 entries.

The *Right* arrow key moves the cursor to the right, both on menus and when entering alphanumeric values. The *Right* arrow key has a special function when viewing the system log, where it is used to move forwards in the log by 100 entries.

When entering alphanumeric values, pressing the 0 key and the *Right* arrow key together deletes the character at the cursor.

***MAIN* Key**

The *MAIN* key returns the user to the *MAIN* menu from anywhere in the menu hierarchy.

***ENTER* Key**

On a menu, the *ENTER* key is used to navigate to the submenu highlighted by the cursor. When entering or selecting a new value, the *ENTER* key is used to accept the new value and a further press of the *ENTER* key is (generally) required to move to the next screen

Note that when a new value is accepted, it is applied to the modem hardware immediately.

***BACK* Key**

On a menu, the *BACK* key is used to navigate to the previous screen. When entering or selecting a new value, the *BACK* key is used to cancel any change to the current value and move backwards to the previous screen.

6.3.1.3 Alphanumeric Keys

The alphanumeric keys provide numeric entry. Where it is valid to enter alphabetic characters, repeated pressing of a numeric key will cause the key to cycle through its associated lower-case and then upper-case alphabetic characters.

6.3.1.4 Special Function Keys

Help

Help information can be displayed for any M&C control by holding down the 0 key and pressing the *Left* arrow key together while the screen containing the M&C control is displayed. This brings up scrollable text that explains the M&C control's function. Pressing the 0 key and *Left* arrow key together for a second time removes the Help text and reverts the display back to its previous contents.

Keyboard Lock

The keypad can be locked against inadvertent use by holding down the 0 key and pressing the *MAIN* key together at the same time. Pressing the two keys again at the same time unlocks the keypad.
The keypad can also be locked using the 'Disable keypad' setting on the Web UI Edit/Unit/M&C/Security menu. Locking from the Security menu cannot be unlocked from the front panel.

LCD Contrast

The contrast of the LCD display can be adjusted by holding down the 0 key and pressing the *Up* (or *Down*) arrow key together at the same time. The *Up* arrow key increases the contrast and the *Down* arrow key decreases the contrast.

LCD Backlight

The LCD backlight can be switched off or on by holding down the 0 key and pressing the *ENTER* key together at the same time.

Log/Alarm Clear

The system log and system alarms can be cleared by pressing the 0 key when on the front-panel *View->Log* and *View->Alarms* screens.

Buffer Overflow / Underflow clear

The buffer Overflow and Underflow slip counters can be cleared by pressing the 0 key when on the front-panel *Status->Demodulator* screen.

6.3.2 LCD Screen Layout

The front panel user interface uses a menu system to present choices to the user. These in turn allow either the selection of a value from a list of options or require the setting of a new value. Examples of these types of screen are shown below.

```
Tx spectral roll-off:  [Other]
 1:20%    2:25%    3:35%    4:15%
 5:10%    6:5%     7:Other
```

Screen Type 1: Menu Selection from Pre-defined List

```
IF carrier freq: 50 to 90, 100 to 180MHz
    [070.0000] Step 100Hz
New:  070.0000
```

Screen Type 2: Entry of New Value

Features that are not available appear on the display are preceded by a '#'. There are several reasons why a feature may not be available:

- ***The feature is a Software Activated Feature (SAF) and the appropriate SAF code has not been enabled. Please contact Teledyne Paradise Datacom Sales, who can issue a SAF key to unlock the feature.***
- ***The feature is available, but its use is precluded by the current operational modem settings.***

6.4 Front Panel Menu Structure

The menu hierarchy for the front panel is described in the following sections.

6.4.1 Main Menu

```
          [London-New York]
    1:Status          2:Edit
    3:View            4:Test
```

The *Main* menu can be accessed from any display by pressing the *MAIN* key. It is from this menu that all functions are selected.

It contains the following sub-menus:

Status Displays modem operational status summary information.

Edit Allows modification of all modem configurable properties.

View Displays detailed operational status and read-only configurable property values.

Test Controls the selection of test modes.

A user-set Modem Identifier is shown on the top line of the screen and is typically used to specify the physical location of the modem or identify the modem satellite link. This can be set via the *Edit->Unit->M&C->Identity* menu.

Chapter 7 Modem Concepts

7.1 System Clocking

The following sections are most relevant where serial terrestrial data interfaces are used. When the terrestrial interface is IP, the Tx clock source should be set to 'Internal' and the Rx clock source should be 'Satellite'.

7.1.1 Transmit Clocking

There are three transmit clocking modes that are used in the modem.

7.1.1.1 Internal Clock

When *Internal* is selected, the modem, which is always configured to be a Data Communications Equipment (DCE), supplies the clock. This is provided by the modem to the Data Terminal Equipment (DTE) via the External Transmit Clock (ETC) signal line for using in clocking the data through to the modem. It is important that the terrestrial data coming into the modem uses the ETC clock looped back through the DTE equipment.

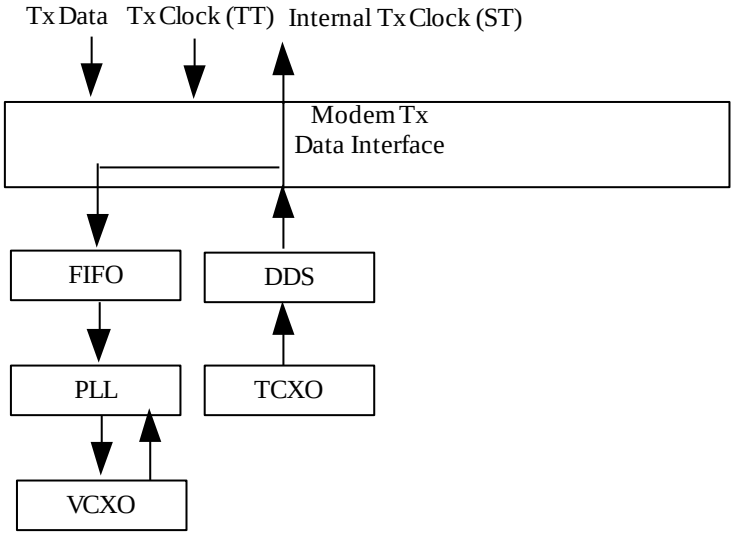


Figure 7-1 Internal Tx Clock Mode

7.1.1.2 Tx Clock In

When *Tx Clock In* is selected, the DTE equipment is responsible for providing the clock. The modem provides a signal on Send Timing (ST) in this mode and requires a clock signal to be provided on Terminal Timing (TT). The ST signal is provided in order to allow the DTE to be operated with a modem supplied clock, in a similar way to when *Internal Clock* is

selected but the TT and Send Data (SD) phase-relationship will be correctly aligned. If the external clock is missing for any reason, then the modem will substitute an internal clock. Note that the G.703 interface should always use external clocking.

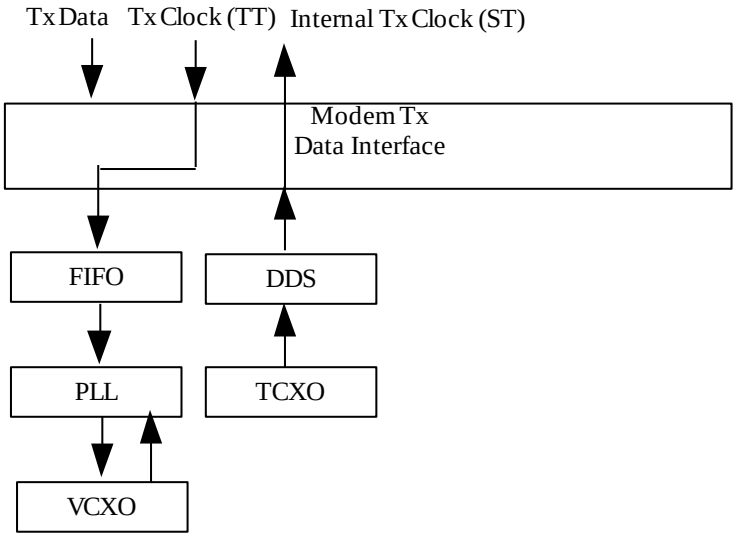


Figure 7-2 External Tx Clock Mode

7.1.1.3 Receive Reference

When *Receive Reference* is selected, it allows the modem to provide an ST clock to the DTE that is locked to the receive satellite signal. The timing is actually phase locked to the Rx data rate but at the frequency of the Tx data rate. This is to allow asymmetric operation. The DTE then synchronises the data going into the modem (SD) to this clock. If the external clock is missing for any reason, then the modem will substitute an internal clock.

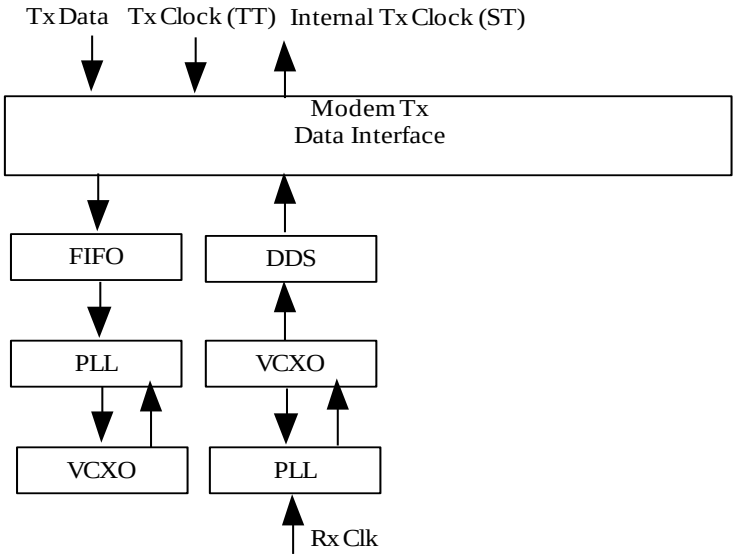


Figure 7-3 Receive Reference Tx Clock Mode

7.1.2 Receive Clocking

There are three receive clocking modes that are used in the modem.

7.1.2.1 Satellite

When *Satellite* is selected, the modem disables the Rx Doppler buffer and derives a clock from the incoming satellite signal. This means that the signal will be subject to Doppler/plesiochronous offsets.

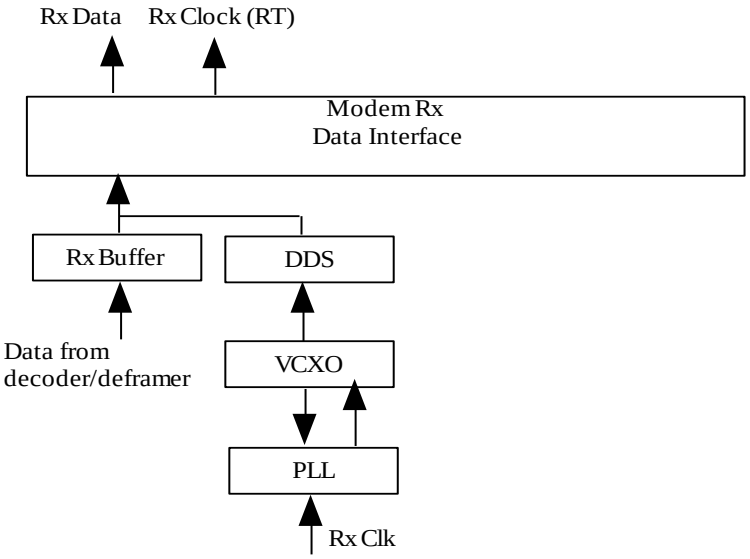


Figure 7-4 Satellite Rx Clock Mode

7.1.2.2 Tx Clock In

When *Tx Clock In* is selected, the Rx clock and data are phase locked to the Tx data rate frequency but at the Rx data rate. The clock and data appear on Receive Timing (RT) and Receive Data (RD) respectively. The Rx Doppler buffer is enabled and the output clock for the buffer is derived from either ST or TT.

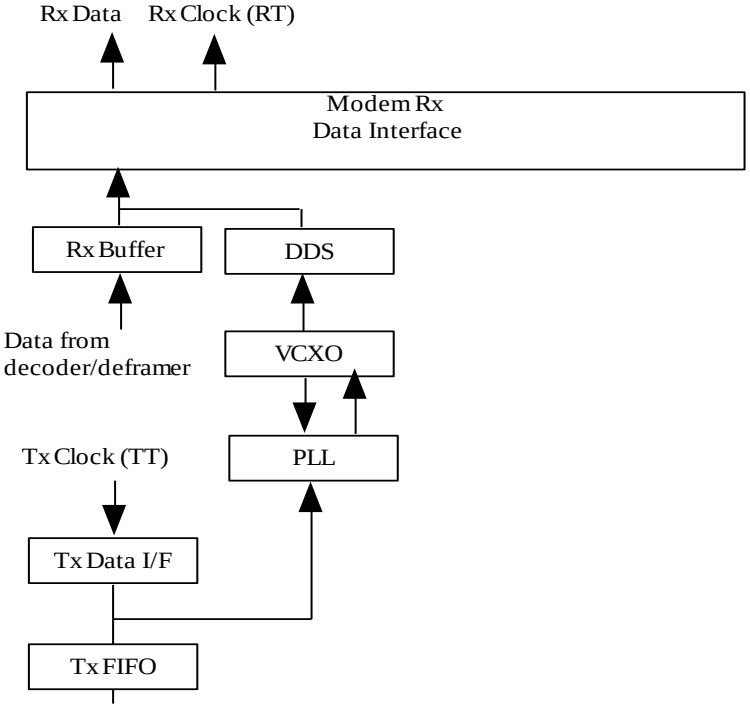


Figure 7-5 Tx Clock In Rx Clock Mode

7.1.2.3 Internal Clock

When *Internal* is selected, the modem's Rx timing is phase locked to the modem's internal clock but is run at the Rx data rate frequency. The Rx Doppler buffer is enabled. The clock and data appear on Receive Timing (RT) and Receive Data (RD) respectively.

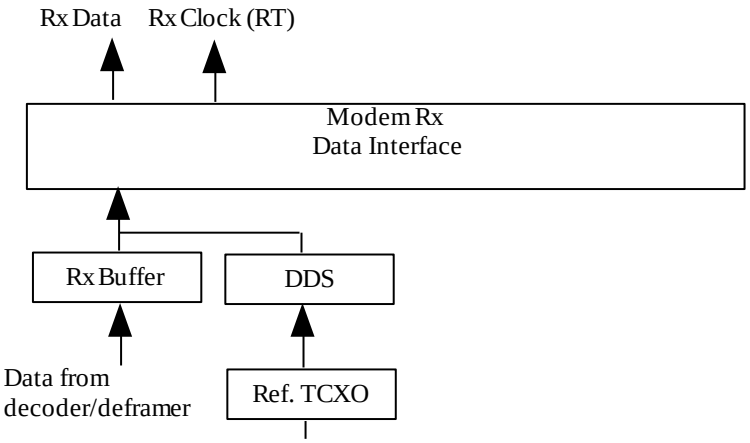


Figure 7-6 Internal Rx Clock Mode

7.2 1:1 Redundancy Operation

7.2.1 Overview

Two modems can operate as a 1:1 redundant pair using a single interconnecting lead, two power splitters/combiners and cable forms to parallel up the terrestrial interfaces of both units. Both modems operate normally with respect to incoming data and IF signals, but only one modem enables its satellite and terrestrial outputs at any point in time.

Figure 7-7 illustrates how a 1:1 redundant pair is configured.

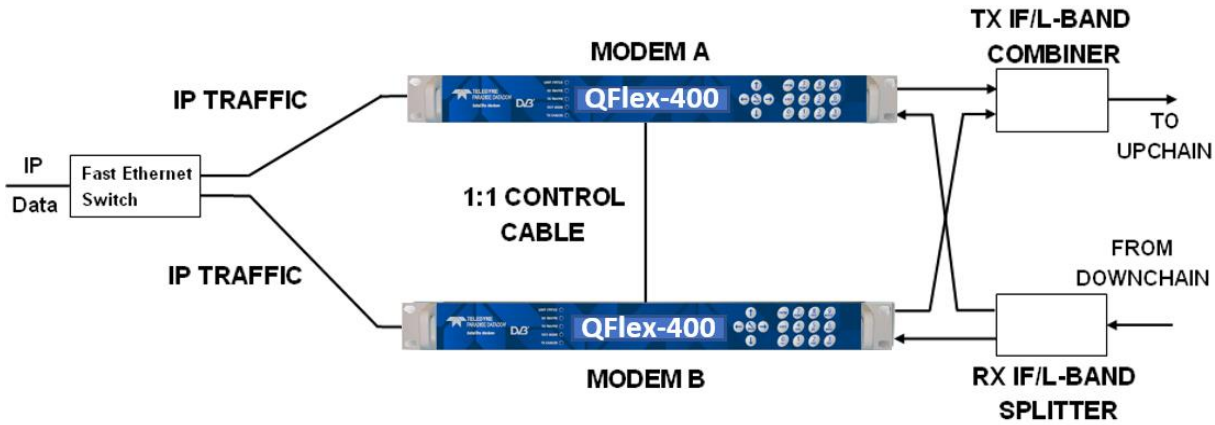


Figure 7-7 Modem 1:1 Redundancy System

It is possible to replace the offline modem in a 1:1 pair without interrupting traffic.

7.2.2 Switching Operation

If a particular modem is required to be the online modem, then this should be powered up first. Alternatively, a manual switchover should be invoked once the modems have powered up. This is achieved by selecting the *Switch to standby* control on the *Edit->Redundancy->1:1* menu, which momentarily simulates a failure in the operational unit.

The Standby modem monitors its own status and the status of the online modem continually and will switch over to become the online modem automatically in the event that a fault occurs with respect to the online modem. The types of faults that will cause a switchover are configurable. Both unit and traffic faults can cause a switchover. Traffic faults that are external to the equipment that affect both units simultaneously do not result in any switchover. L-band services can be configured to switch with the modem or to remain with the online modem after it has failed.

In order to minimize unnecessary switchovers, a modem that experiences a failure will remain offline even if it returns to its normal working state. If it does return to a normal state, then it will act as the Standby unit.

7.2.3 Setup Procedure

A 1:1 redundant modem pair is set up as follows:

1. Ensure that both modems are running the same software version and are configured identically. See Section 7.2.4 for details of how to configure IP addresses in modem redundancy configurations.
2. Connect a Paradise Datacom supplied cable between the 9-way 1:1 connector on the two modems.
3. Connect the terrestrial data interfaces for the two modems in parallel.
4. Configure the two units alike. Suitable adapter cables are available from Teledyne Paradise Datacom.
5. If the Ethernet traffic port is used on the modem, then the two traffic ports may be connected to a hub or other multi-port LAN device using RJ45 crossover cables.
6. Connect the two transmit IF ports to the input ports of a suitable splitter/combiner of the correct impedance (50 ohm or 75 ohm) and the appropriate frequency range. The combined output is fed to the up-conversion equipment. Note that only one output is active at a time. Because of the signal loss associated with splitters/combiners, the power level at the output of each modem needs to be increased by approximately 3.5dB.
7. Connect the two receive IF ports to the two output ports of a suitable power splitter/combiner of the correct impedance (50 ohm or 75 ohm) and the appropriate frequency range. Both demodulators will receive an identical signal from the down-conversion equipment via the splitter/combiner. Because of the wide dynamic range of the modem AGC circuitry there should be no need to modify signal levels.
8. Check correct operation by performing a manual switch between the units (via the *Unit-Advanced-Operation* menu). The pair will not switch over unless the Standby unit is fully operational. (Note that the pair can be tested in loopback mode, but this requires the IF signals to be split and combined and looped back to the other unit. Looping the output of one unit back to itself will not work, since the Standby unit output is muted, and it will therefore not detect any carrier.)

7.2.4 IP Addressing and Operation in Redundancy Configurations

7.2.4.1 1:1 IP Operation

The following rules should be observed when using 1:1 redundancy for IP.

1. In 1:1 mode, the M&C IP addresses need to be different for each modem.
2. In 1:1 mode, the IP traffic addresses also need to be different for each modem. In bridging modes, the IP traffic address is not used but it is required for routing mode.
3. The M&C Ethernet port must not be bridged to the IP traffic port (this is controlled via the *Bridge M&C* control on the *Edit->IP* screen).
4. The M&C IP address and the traffic IP address should be on different subnets. The modem defines one default gateway. If the second subnet also requires a gateway, then a static route should be added that defines a gateway for that subnet.

On the 1:1 Standby modem, the carrier is muted, as is the satellite receive port (in order to ensure that no received data is passed out of the terrestrial port). The M&C port and the terrestrial IP traffic port are not muted.

If a switchover occurs when in bridging mode, the Standby modem will automatically learn to bridge the traffic as necessary once it comes online.

If dynamic routing is being used when a switchover occurs, then the route through the newly online modem will be learned automatically.

If static routing is being used, then the M&C system will need to detect that a switchover has occurred and update the routes accordingly for the new IP address associated with the online modem. Some network devices support route failover, which automates this process. In this case the M&C system router that supports route failover should be configured to include another route in the routing table with a higher ‘metric’ or ‘distance’ for the route that uses the Standby modem’s IP traffic address. The switchover to using the Standby modem will then be automatic when it detects the path through the primary modem is no longer available.

7.2.4.2 1:N IP Operation

The following rules should be observed when using 1:N redundancy for IP.

1. In 1:N mode, the M&C IP addresses need to be different for each modem.
2. In 1:N mode, the IP traffic address of the highest priority Modem will be copied to the backup Modem. The IP traffic port on the backup modem is physically isolated from the network via a relay contact, which ensures that having identical IP addresses does not cause any problems.
3. The M&C Ethernet port must not be bridged to the IP traffic port (this is controlled via the *Bridge M&C* control on the *Edit->IP* screen).
4. The M&C IP address and the traffic IP address should be on different subnets. The modem defines one default gateway. If the second subnet also requires a gateway, then a static route should be added that defines a gateway for that subnet.

On the 1:N Standby modem, the carrier is muted. The IP traffic port remains active but is physically isolated from the network. The M&C port is not muted, allowing the M&C system to control the Standby modem at all times.

The switchover operation in relation to bridging and routing is similar to that for 1:1 operation.

Note: by default, the 1:N connector functions as serial M&C and has to be enabled to support 1:N operation.

7.3 Software Activated Features

While some modem functions are available as plug-in option cards, the majority of additional functions are made available through Software Activated Feature (SAF) support. As the name implies, these are modem features that can be enabled by entering a feature code via any of the modem's user interfaces. Feature codes are encrypted codes issued by Teledyne Paradise Datacom, uniquely associated with individual modems.

To allow evaluation of modem features, all of the SAF features of the modem that it is capable of supporting can be activated for a 10-day period by entering a feature code of 0. This is referred to as Demonstration Mode. Demonstration Mode can be activated up to three times after which any further attempts to use it will be rejected. Note that it is not necessary to wait for Demonstration Mode to time out before reactivating it: it can be activated twice to give a 20-day demonstration period and three times to give 30 days. The user will be alerted shortly before the demonstration period times out. As well as allowing feature evaluation, Demonstration Mode can be used to test compatibility with other equipment and allows rapid substitution of equipment in a crisis.

To enable one or more features permanently (referred to as Permanent Mode), a modem-specific feature code needs to be obtained from Teledyne Paradise Datacom. The code is tied to the modem serial number (available via the user interfaces and on the back panel).

The features that have been temporarily enabled on a modem can be viewed along with the time remaining before they become disabled, as can the features that have been permanently enabled and those that can potentially be enabled.

The SAF function keeps the initial cost of a modem to the minimum and allows simple field upgrading at a later date, as required.

7.4 Software Upgrading

It is possible to update the software and firmware within the modem via USB memory stick or the Remote M&C Ethernet connection web user interface (upgrades via the serial M&C port are not supported). The software upgrade process is described in Section 6.2.15.

7.5 LinkGuard™ Interference Detection

LinkGuard™ is a Paradise patented technology for detecting in-band interference underneath satellite carriers while remaining on traffic. A visual indication of any unwanted interference is provided through a signal-under-carrier spectrum web graph showing the wanted carrier along with any unwanted interference. The graph includes a 'persistence' mode to show even intermittent interference.

Figure 7-8 shows a 32APSK carrier (in blue) initially with no interference (shown in red) and then with interference caused by another modulated carrier. Note that the interference

is sufficient to reduce the Es/No of the carrier by around 4dB but is not obvious by looking only at the received carrier spectrum. The modem I/Q constellation graph is also shown.

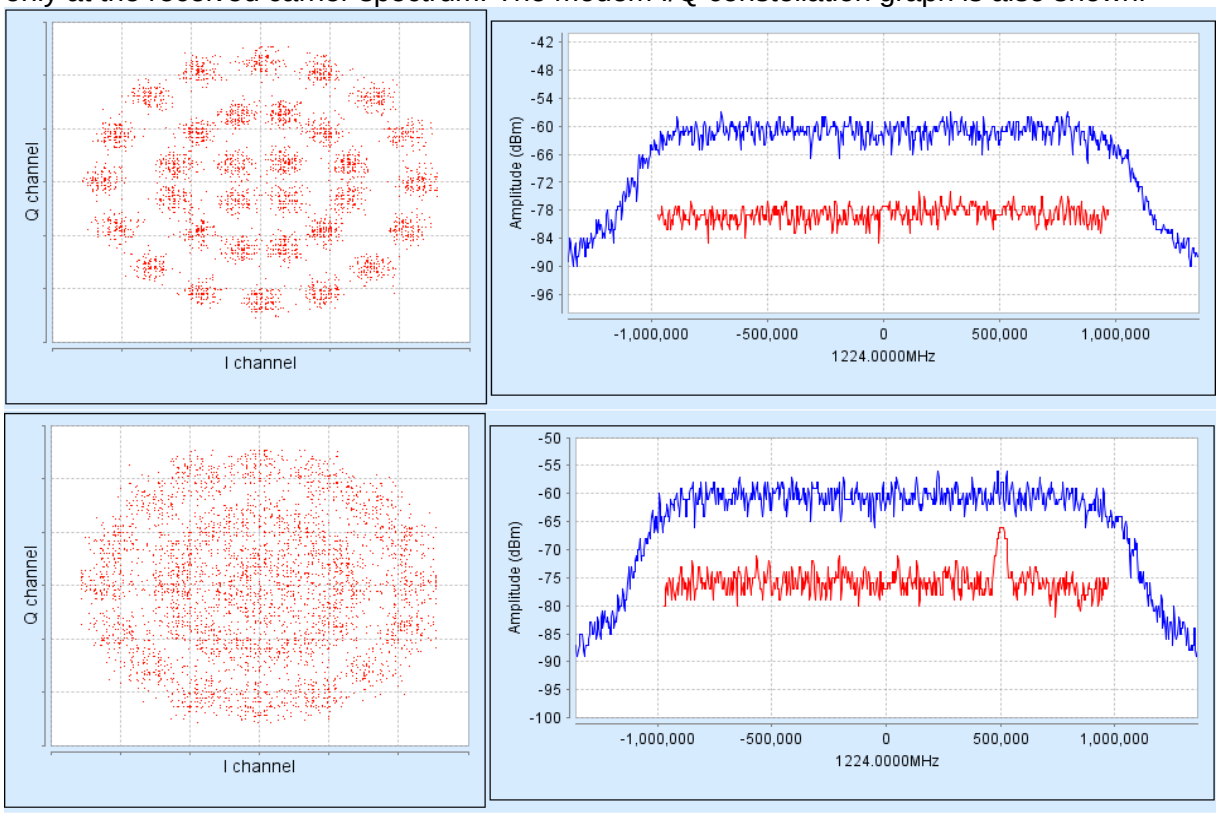


Figure 7-8 Example LinkGuard™ Web Screenshots without/with Interference

LinkGuard™ provides a menu option for setting a power spectral density threshold, above which the modem will automatically alarm to indicate that a significant source of interference has been detected. The LinkGuard™ Rx traffic warning alarm is displayed locally on the modem and can be accessed remotely via the modem's web server, SNMP traps and physical contact relays. Automated 24x7 interference detection is therefore provided without the need for an operator to be present.

LinkGuard™ detects various forms of interference including tonal interferers (such as CW), radars, Wi-MAX, jammers and other modulated carriers including adjacent interfering carriers. If there is more than one source of interference, then it will detect and display all of them.

When *Paired Carrier* is being used (where two carriers are deliberately superimposed on top of each other) then LinkGuard™ is capable of detecting and displaying any interference under both of the carriers.

For existing links, even ones that do not use Paradise modems, a LinkGuard™-capable modem can be set up to receive the same Rx signal in order to simply monitor the link for interference (so long as it can lock to the carrier). This is a useful and convenient way of quickly confirming suspected cases of interference while keeping the service running.

Note that even when the level of interference is severe enough to prevent the demodulator from locking, the spectrum graph will continue to show the interference along with the wanted signal (although it will not be able to differentiate between them at this point and will show a single composite spectrum).

LinkGuard™ does not necessarily replace other interference detection equipment but it does provide a useful new first line of defense. It works with all carriers including DVB-S2/X from Software version 3.1.43.

7.6 IP Functionality

7.6.1 Base Modem IP

As shown in **Figure 7-9**, the modem has four RJ45 auto-sensing Gigabit Ethernet ports for M&C and satellite IP traffic.

Figure 7-9 Modem Ethernet Ports

The Ethernet connections by default form part of an Ethernet bridge and share an IP address. Essentially, the bridge makes the modem disappear from the network in relation to passing IP traffic over a satellite. Consequently, for simple point-to-point communications, little or no user set up is required to pass IP traffic over satellite. If the Ethernet ports are configured to be part of the bridge then a single Ethernet connection to the modem can be used for both IP traffic and modem M&C control (using either of the RJ45 connectors). If the M&C port is configured to be outside the bridge then one Ethernet port is dedicated to M&C traffic and the others to customer IP traffic (as labeled on the connectors).

To communicate with the modem itself for M&C purposes, an IP address and subnet mask must be set. Note that setting an IP address to 0.0.0.0 causes the modem to request an IP address from a Dynamic Host Control Protocol (DHCP) server on the network. Static routes are supported allowing routing decisions to be made based on a set of explicit routing rules that can be entered via the web user interface. Dynamic routing is also supported.

The use of a default gateway IP address is supported. When a gateway is specified then it provides a next-hop IP address for all destinations that are not on the local subnet. This is usually the address of a router that has been set up to forward packets to the correct network.

The bridge maintains information on how to forward frames based on replies that are received from each device in the network.
The M&C port can be taken out of the bridge (via the '*Bridge M&C port*' menu option) in which case M&C and traffic ports have their own IP addresses.

7.6.2 IP Addressing

On QubeFlex modems, when the M&C port is not bridged to the traffic ports, the Traffic IP address must be defined. The assigned IP traffic port and M&C port IP addresses *must* be in different IP subnets.

7.6.2.1 Gateways

There is a single gateway address for the modem. This can be applied to either the M&C or IP traffic ports, depending on the subnet that the gateway IP address belongs to. If further gateways are required, then these can be applied as static routes.

7.6.3 Throughput Performance

Actual throughput performance depends on a number of factors including one way/two way traffic, packet size, data rates and the mixture of IP features switched on. There are endless combinations and therefore it is strongly recommended that empirical testing is undertaken prior to deployment to ensure that the required level of service can be provided.

The modem can process up to 150,000 packets per second. (In Trunking mode this increases to 200,000 packets to second.) It is good practice to put a switch (or router) between the modem and local network in order to minimize the number of packets the modem has to process, as incidental network traffic (not intended for satellite) has the potential to push the modem over its packet processing limit.

TCP acceleration, Header compression and Payload compression are not applicable to QubeFlex.

7.6.4 M&C VLAN

M&C VLAN must not be used on QubeFlex. Leave all M&C VLAN setings at their defaults.

7.7 Antenna Control

Two methods of antenna control are provided by the modem:

- A scalable (0 to 10V) AGC output is available via the Alarms & AGC serial connector (the pinout for which is defined in Chapter 10). The AGC output can be set to represent the demodulator AGC level, the Rx composite power level, the Rx wanted signal level or the receive Eb/No level (the last two of which are only available when the demodulator is locked). Other signals on this connector can be used to infer the demodulator lock status and to mute the modem Tx carrier.
- The OpenAMIP protocol is supported.

Both options are described in more detail below.

Antenna Serial Control

Serial antenna control is supported under *Test->Antenna* (**Figure 7-10**).

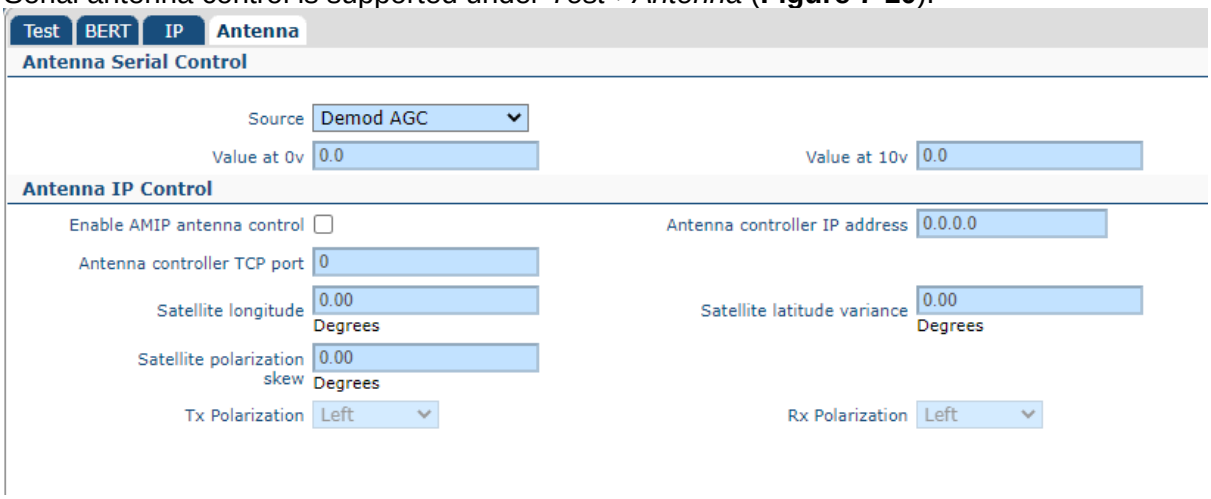


Figure 7-10 Antenna Serial & IP Control

The AGC output on the Alarms & AGC connector can be set to be driven by various signals (demodulator AGC, Rx composite power, Rx wanted signal level and Rx Eb/No) as shown in **Figure 7-11**.

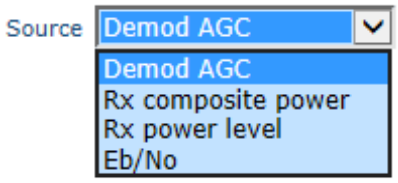


Figure 7-11 Antenna Serial Control Output Source Signal Selection

The AGC output range is 0 to 10V. A scaling factor can be applied to the output. This controls the slope of the output in order to give the desired range of output values for supplying to the antenna controller. For example, if the AGC output is set to represent Eb/No, then a user may decide to set 0V to represent 0dB and 10V to represent 6dB Eb/No (by entering 0 and 6 respectively to represent the 0 and 10V levels). In this case, any Eb/No value over 6dB would be represented by a 10V output also.

In addition to the AGC output on pin 8, there is a Tx Mute control and the Rx Lock status can be obtained on the Alarms & AGC connector as follows:

- Pin 3 provides an indication for Rx traffic faults, the highest priority fault of which is a demodulator unlock (so the alarm output approximately amounts to a demodulator lock/unlock status). Since this is a relay output, the relay common on pin 2 needs to be connected to GND (pin 15). A pull-up resistor (if there isn't one already in the ACU) needs to be attached to pin 3 as it is normally open (representing the non-fail state).
- Pin 7 is a Tx Mute input from the ACU. It will inhibit transmission when active.
- GPS is supported by the modem in general but not for beam switching therefore a GPS input is not required in relation to antenna control.

Antenna IP Control

The OpenAMIP protocol is supported for use with antenna control units. This feature is supported in the Antenna IP Control section of the *Test->Antenna* menu (**Figure 7-12**).

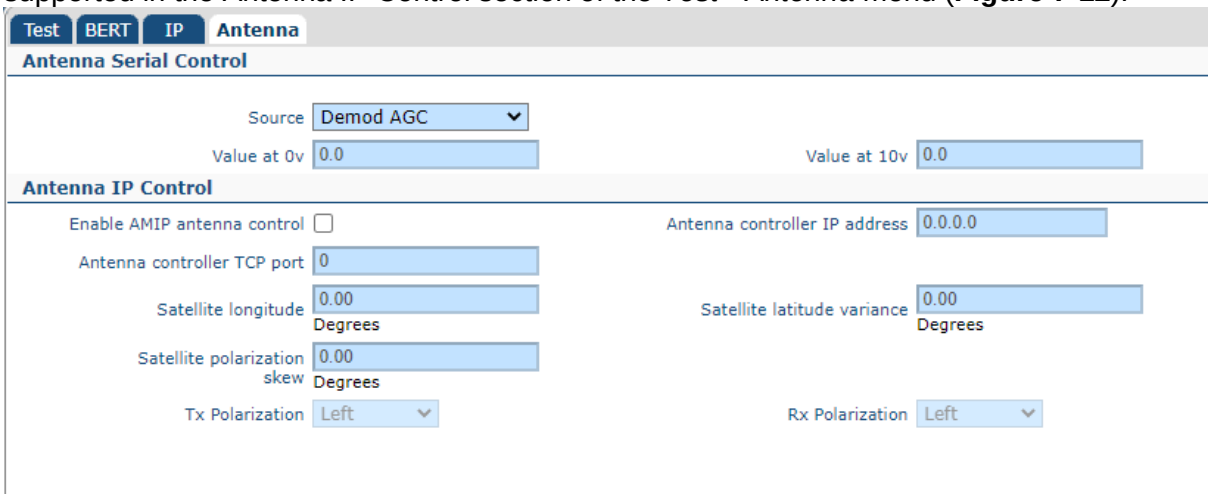


Figure 7-12 Antenna IP Control

Tx Mute control and Rx Lock status are provided via the AMIP protocol. The AMIP control needs to be enabled and the antenna controller IP address and TCP port number need to be entered.
Satellite longitude: Enter the required satellite coordinates for the antenna system to locate the desired satellite.
Satellite latitude variance: Enter Satellite Latitude Variance (if working with an Inclined Orbit satellite).
Satellite polarization skew: During Cross-Pol isolation tests, enter the known skew value of the satellite, then as instructed by the NOC, increase, or decrease the satellite skew parameter.
Polarization: Enter the Tx and Rx polarization: Left, Right, Horizontal or Vertical.

7.8 Beacon Receiver

The Qubeflex modem supports a beacon receiver mode of operation as standard.
The beacon receiver support in the modem can help with automatic antenna pointing when attempting to lock onto a satellite. This modem feature negates the need for a separate beacon receiver.

The beacon receiver detection capability (**Figure 7-13**) has been added to the existing built-in web spectrum monitor tool and allows a satellite beacon transmission to be detected down to very low signal levels.

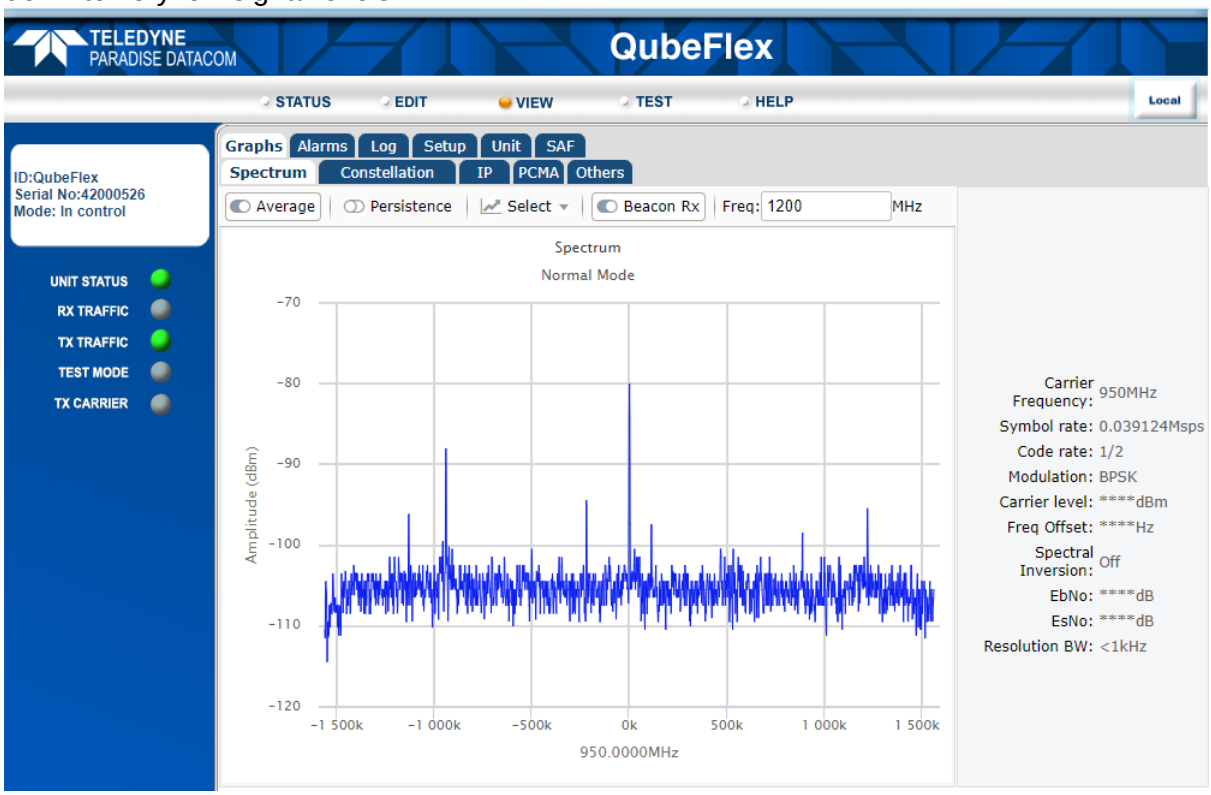


Figure 7-13 Spectrum Monitor in Beacon Receiver Mode

When the beacon receiver mode is selected, the demodulator is reprogrammed and can lock onto a CW signal being transmitted by a satellite beacon. This will be shown on the spectrum plot and the Rx signal level will be reported. The composite Rx power level (from all the transponders on the satellite) is also available and can be used in conjunction with the received beacon signal level at an early point in the detection process to confirm the antenna is pointed in the correct direction. Once the signal has been peaked it is possible to determine the beacon carrier-to-noise measurement by analysing the spectrum graph data and looking for maximum and minimum signal levels.
This feature is useful when deploying a satellite terminal, allowing the user to correctly identify the satellite that antenna is pointed towards.

While active, the beacon detection interferes with the normal demodulation process of the modem but since beacon detection is normally a deployment activity prior to establishing a working service, this restriction should not be an issue.

Chapter 8 Remote Control Protocol

The modem supports the following remote control interfaces:

- A built-in remote web user interface that provides web pages from the modem (using a web server) to a web browser. This is accessed by entering the IP address of the modem into a web browser address bar (the web server being on port 80).
- A serial interface (selectable between RS232 and RS485) that can be used to send and receive Paradise Universal Protocol (PUP) messages. This interface can be driven either through a generic user-entry application such as HyperTerminal (in the case of RS232) or through an application that uses a driver developed specifically to implement the PUP protocol. In the case of RS485, a message wrapper (defined in the document *'Remote M&C Specification for Q Series Satellite Modems*) is used to encapsulate PUP commands and responses, which are incorporated into the message payload.
- An Ethernet interface that can be used to send and receive PUP messages or Simple Network Management Protocol (SNMP) messages. This interface can be used in several ways.

  Firstly, a generic user-entry application such as Telnet can be used to automatically send or manually enter PUP commands.

  Secondly, PUP messages can be encapsulated directly into TCP packets using the message format defined in the document *'Remote M&C Specification for Q Series Satellite Modems'*. These must be sent to a specific TCP port that the modem listens on for PUP commands. Typically, this will result in much faster communications than when using Telnet. This method is referred to as 'direct encapsulation' elsewhere in this document to differentiate it from the Telnet type of communications.

  Thirdly, SNMP V1, V2c or V3 can be used to communicate between an SNMP network manager and the SNMP agent on the modem.

The remote control protocol for the modem is specified in the document '*Remote M&C Specification for Q Series Satellite Modems*'.

M&C message example

The following example shows how to:

1) *get* the transmit power from a modem. (The response has a value of -25. Note that numeric text denotes the message contents as hexadecimal characters.)

```
          g e t    T I F T x I F P w r *
02 15 01 09 67 65 74 20 54 49 46 54 78 49 46 50 77 72 2A 0B 03

          - 2 5 *
02 0A 01 09 2D 32 35 2A C8 03
```

2) Login to the modem to be able to make changes. (The response has a value of *.)

```
          l o g i n   p a r a d i s e *
02 15 01 09 6C 6F 67 69 6E 20 70 61 72 61 64 69 73 65 2A B6 03
```

*****
02 08 01 09 20 2A 54 03

3) *Set* the transmit power to a new value. (-20). (The response has a value of *.)

s e t T I F T x I F P w r - 2 0 *
02 19 01 09 73 65 74 20 54 49 46 54 78 49 46 50 77 72 20 2D 32 30 2A C6 03

*****
02 08 01 09 20 2A 54 03

4) *get* the transmit power to prove that the change has been accepted. (The response indicates a value of -20.)

g e t T I F T x I F P w r *
02 15 01 09 67 65 74 20 54 49 46 54 78 49 46 50 77 72 2A 0B 03

- 2 0 *
02 0A 01 09 2D 32 30 2A C3 03

Chapter 9 Data Interfaces

The modem provides Ethernet IP interfaces as standard plus options for LVDS and EIA-530 (RS422, V.35, and RS232). There are two terrestrial interface positions on the modem other than the standard IP interface.

Handshake Lines

Many interfaces provide optional control lines (such as RTS/CTS etc.). It is generally better to use these if they are available.

Q3001 LVDS Interface

The LVDS interface is used as follows.

Min Req	Signal Description	LVDS Name	Circuit Number	25 pin		Electrical Levels
				A	B	
DATA CIRCUIT TOWARDS MODEM (TX)						
✓	**Clock In**	TT	113	24	11	LVDS
✓	**Data In**	SD	103	2	14	LVDS
	Sig' Valid In	RS	105	4	19	LVDS
	Sig Accpt'd Out	CS	106	5	13	LVDS
	Int' Tx Clock Out	ST	114	15	12	LVDS
DATA CIRCUIT FROM MODEM (RX)						
✓	**Clock Out**	RT	115	17	9	LVDS
✓	**Data Out**	RD	104	3	16	LVDS
	Sig' Valid Out	RR	109	8	10	LVDS
COMMON LINES						
✓	**Signal Ground**	SG	102	7		Ground
✓	**Shield/Protective ground**	PG	101	1		Screen
	Device (DTE) Ready In	TR	108	20	23	LVDS
	Device (DCE) Ready Out	DM	107	6	22	LVDS
	Local Loop In	LL	141	18		LVDS
	Remote Loop In	RL	140	21		LVDS

The modem can operate at high data rates using the LVDS interface, but the maximum useable data rate is limited by connecting cable length. The maximum data rate is 10Mbps over a 10m cable (over good quality twisted pair screened cable), but this rate is reduced as

the connecting cables extend beyond 10m. As an estimate, assume the maximum rate halves as the distance doubles (i.e. 5Mbps to 20m, 2.5Mbps to 40m etc.). Similarly, the maximum data rate increases as the connecting cable length is reduced (i.e. 20Mbps to 5m, 40Mbps to 2.5m).

The input clock/data phase is selected automatically, reporting a `Data Marginal` warning whenever it has to switch phase. If the modem reports Data Marginal frequently then this is not a modem fault but an indication that you have a clocking problem external to the modem (i.e. changing clock/data phase, a problem which would otherwise have caused untraceable data errors). With the Tx Clocking Set to *Tx Clock In* the `Data In` signal is checked against the `Clock In` signal. With the Tx Clocking Set to *Internal* or *Rx* the `Data In` signal is checked against the `Int` Tx Clk Out` signal.

By selecting *Advanced* it is possible to configure the modem to raise an alarm if either the `Sig` Valid In` line (RS) or `Device (DTE) Ready In` line (TR) switch to the inactive state. It is also possible to configure the Tx carrier to be switched on and off by the `Sig` Valid In` line (RS) by selecting *Edit->Tx->Carrier* and selecting *RTS enabled*.

EIA-530 Interface in RS422 Mode

The EIA-530 interface is used in RS422 mode as follows.

Min Req	Signal Description	RS422 Name	Circuit Number	25 pin		Electrical Levels
				A	B	
DATA CIRCUIT TOWARDS MODEM (TX)						
✓	**Clock In**	TT	113	24	11	RS422
✓	**Data In**	SD	103	2	14	RS422
	Sig' Valid In	RS	105	4	19	RS422
	Sig Accpt'd Out	CS	106	5	13	RS422
	Int' Tx Clock Out	ST	114	15	12	RS422
DATA CIRCUIT FROM MODEM (RX)						
✓	**Clock Out**	RT	115	17	9	RS422
✓	**Data Out**	RD	104	3	16	RS422
	Sig' Valid Out	RR	109	8	10	RS422
COMMON LINES						
✓	**Signal Ground**	SG	102	7		Ground
✓	**Shield/Protective ground**	PG	101	1		Screen
	Device (DTE) Ready In	TR	108	20	23	RS422
	Device (DCE) Ready Out	DM	107	6	22	RS422
	Local Loop In	LL	141	18		RS232
	Remote Loop In	RL	140	21		RS232

The maximum data rate is 10Mbps (over good quality twisted pair screened cable), but this rate is reduced as the connecting cables extend beyond 10m. As an estimate, assume the maximum rate halves as the distance doubles (i.e. 5Mbps to 20m, 2.5Mbps to 40m etc.).

The input clock/data phase is selected automatically, reporting a `Data Marginal` warning whenever it has to switch phase. If the modem reports Data Marginal frequently then this is not a modem fault but an indication that you have a clocking problem external to the modem (i.e. changing clock/data phase, a problem which would otherwise cause untraceable data errors). With the Tx Clocking Set to *Tx Clock In* the `Data In` signal is checked against the `Clock In` signal. With the Tx Clocking Set to *Internal* or *Rx* the `Data In` signal is checked against the `Int= Tx Clk Out` signal.

EIA-530 Interface in V.35 Mode

The EIA-530 interface is used inV.35 mode as follows.

Min Req	Signal Description	V.35 Name	Circuit Number	25 pin		Electrical Levels	Old Style Winchester
				A	B		
DATA CIRCUIT TOWARDS MODEM (TX)							
✓	**Clock In**	SCTE	113	24	11	V.35	U & W
✓	**Data In**	SD	103	2	14	V.35	P & S
	Sig' Valid In	RTS	105	4		RS232	C
	Sig Accpt'd Out	CTS	106	5		RS232	D
	Int' Tx Clock Out	SCT	114	15	12	V.35	Y & aa
DATA CIRCUIT FROM MODEM (RX)							
✓	**Clock Out**	SCR	115	17	9	V.35	V & X
✓	**Data Out**	RD	104	3	16	V.35	R & T
	Sig' Valid Out	RLSD	109	8		RS232	F
COMMON LINES							
✓	**Signal Ground**	SG	102	7		Ground	B
✓	**Shield/Protective ground**	FG	101	1		Screen	A
	Device (DTE) Ready In	DTR	108	20		RS232	H
	Device (DCE) Ready Out	DSR	107	6		RS232	E
	Local Loop In	LL	141	18		RS232	-
	Remote Loop In	RL	140	21		RS232	-

The maximum data rate is 10Mbps (over good quality twisted pair screened cable), but this rate is reduced as the connecting cables extend beyond 10m. As an estimate, assume the maximum rate halves as the distance doubles (i.e. 5Mbps to 20m, 2.5Mbps to 40m etc.).

The input clock/data phase is selected automatically, reporting a `Data Marginal` warning whenever it has to switch phase. If the modem reports Data Marginal frequently then this is not a modem fault but an indication that you have a clocking problem external to the modem (i.e. changing clock/data phase, a problem which would otherwise have caused untraceable data errors). With the Tx Clocking Set to *Tx Clock In* the `Data In` signal is checked against the `Clock In` signal. With the Tx Clocking Set to *Internal* or *Rx* the `Data In` signal is checked against the `Int= Tx Clk Out` signal.

If you require the older 34-pin `Winchester` connector then an adaptor lead is required - please contact the factory for details.

EIA-530 Interface in RS232 Mode

The EIA-530 interface is used in RS2322 mode as follows. The interface type can be selected as *Synchronous* or *Asynchronous*.

Min Req	Signal Description	RS232 Name	Circuit Number	25 pin		Electrical Levels
				A	B	
DATA CIRCUIT TOWARDS MODEM (TX)						
✓	**Clock In**	DA	113	24		RS232
✓	**Data In**	BA	103	2		RS232
	Sig' Valid In	CA	105	4		RS232
	Sig Accpt'd Out	CB	106	5		RS232
	Int' Tx Clock Out	DB	114	15		RS232
DATA CIRCUIT FROM MODEM (RX)						
✓	**Clock Out**	DD	115	17		RS232
✓	**Data Out**	BB	104	3		RS232
	Sig' Valid Out	CF	109	8		RS232
COMMON LINES						
✓	**Signal Ground**	AB	102	7		Ground
✓	**Shield/Protective ground**	SHIELD	101	1		Screen
	Device (DTE) Ready In	CD	108	20		RS232
	Device (DCE) Ready Out	CC	107	6		RS232
	Local Loop In	LL	141	18		RS232
	Remote Loop In	RL	140	21		RS232

The maximum synchronous data rate is 100kbps (over good quality screened cable), but this rate is reduced as the connecting cables extend beyond 10m. As an estimate, assume the maximum rate halves as the distance doubles (i.e. 50kbps to 20m, 25kbps to 40m etc). Note that this is a synchronous RS232 interface - if you need an asynchronous interface then please contact the factory.

For the Synchronous RS232 interface, the input clock/data phase is selected automatically, reporting a `Data Marginal` warning whenever it has to switch phase. If the modem reports Data Marginal frequently then this is not a modem fault but an indication that you have a clocking problem external to the modem (i.e. changing clock/data phase, a problem which would otherwise have caused untraceable data errors). With the Tx Clocking Set to *Tx Clock In* the `Data In` signal is checked against the `Clock In` signal. With the Tx Clocking Set to *Internal* or *Rx* the `Data In` signal is checked against the `Int= Tx Clk Out` signal. By selecting *Advanced* it is possible to configure the modem to raise an alarm if either the `Sig= Valid In` line (CA) or `Device (DTE) Ready In` line (CD) switch to the inactive state. It is also possible to configure the Tx carrier to be switched on and off by the `Sig= Valid In` line (CA) by selecting *Change*, *Tx*, *Modulator*, *Carrier*, *RTS-Controlled*.

For Asynchronous RS232 interface the Tx / Rx AIS detectors and the data marginal detectors are automatically disabled to prevent any unwanted alarms. The internal Tx clock output is also automatically used to provide a reference clock to the incoming Async data. For best operation, Paradise recommends using the Async RS232 interface at least 10 times oversampled. For example, an Async baud rate of 56.7kbaud requires a Modem bit rate of 512kbit.

EIA-530 Interface in X.21 Mode

The EIA530 interface can provide both X.21 DCE and X.21 DTE operation. For X.21 operation the interface must be set to RS422 mode, and the Tx & Rx Clocking modes must be set correctly. With the use of the appropriate adaptor lead (to convert to the X.21 standard 15 pin D connector), a full X.21 DCE or DTE interface is available.

X.21 DCE Operation

This has only a clock *from* the modem to the terrestrial equipment. Configure a cable with a 15 pin `D` female at one end (X.21 DCE) and a 25 pin `D` male at the other end as follows:

Min Req	X.21 DCE (15 pin D female)			Signal Description	RS422 Name	Circuit Number	25 pin		Electrical Levels
	Name	A	B				A	B	
DATA CIRCUIT TOWARDS MODEM (TX)									
✓	T	2	9	**Data In**	SD	103	2	14	RS422
	C	3	10	Sig' Valid In	RS	105	4	19	RS422
DATA CIRCUIT FROM MODEM (RX)									
✓	S	6	13	**Clock Out**	RT	115	17	9	RS422
✓	R	4	11	**Data Out**	RD	104	3	16	RS422
	I	5	12	Sig' Valid Out	RR	109	8	10	RS422
COMMON LINES									
✓	Sig gnd	8		**Signal Ground**	SG	102	7		Ground
✓	Prot gnd	1		**Shield/ Prot' ground**	PG	101	1		Screen

Clocking

For the interface to function as X.21, the clocking must be set as follows. The *Rx Clock Menu* is used to set the source of the single clock from the modem as *Satellite*, *Internal*, or *Station Clock*. *Tx Clk In* does not exist in X.21 and cannot be used. The Tx clock should be set to *Rx* as the Tx data is clocked by the same clock as the Rx data.

The maximum data rate is 10Mbps (over good quality twisted pair screened cable), but this rate is reduced as the connecting cables extend beyond 10m. As an estimate, assume the maximum rate halves as the distance doubles (i.e. 5Mbps to 20m, 2.5Mbps to 40m etc.).

The input clock/data phase is selected automatically, reporting a `Data Marginal` warning whenever it has to switch phase. If the modem reports Data Marginal frequently then this is not a modem fault but an indication that you have a clocking problem external to the modem (i.e. changing clock/data phase, a problem which would otherwise have caused untraceable data errors). Check the phase of the *Data In* with respect to the *Clock Out* line.

It is possible to configure the Tx carrier to be switched on and off by the `Sig= Valid In` line by selecting Edit->*Tx->Carrier* and selecting *RTS enabled*.

X.21 DTE Operation

This has only a clock *to* the modem from the terrestrial equipment. Configure a cable with a 15 pin `D` male at one end (X.21 DTE) and a 25 pin `D` male at the other end as follows:

Min Req	X.21 DTE (15 pin D male)			Signal Description	RS422 Name	Circuit Number	25 pin		Electrical Levels
	Name	A	B				A	B	
DATA CIRCUIT TOWARDS MODEM (TX)									
Y	S	6	13	**Clock In**	TT	113	24	11	RS422
Y	R	4	11	**Data In**	SD	103	2	14	RS422
	I	5	12	Sig' Valid In	RS	105	4	19	RS422
DATA CIRCUIT FROM MODEM (RX)									
Y	T	2	9	**Data Out**	RD	104	3	16	RS422
	C	3	10	Sig' Valid Out	RR	109	8	10	RS422
COMMON LINES									
Y	Sig gnd	8		**Signal Ground**	SG	102	7		Ground
Y	Prot gnd	1		**Shield / Prot' ground**	PG	101	1		Screen

Clocking

For the interface to function as X.21, the clocking must be set as follows. The *Tx Clocks* menu should be used to take the single clock from the terrestrial by selecting *Tx Clock In.* The *Rx Clocks* menu should also be set to return Rx data in time with the single Tx Clock by also selecting *Tx Clock In*. No other combinations will work.

The maximum data rate is 10Mbps (over good quality twisted pair screened cable), but this rate is reduced as the connecting cables extend beyond 10m. As an estimate, assume the maximum rate halves as the distance doubles (i.e. 5Mbps to 20m, 2.5Mbps to 40m etc.).

The input clock/data phase is selected automatically, reporting a `Data Marginal` warning whenever it has to switch phase. If the modem reports Data Marginal frequently then this is not a modem fault but an indication that you have a clocking problem external to the modem (i.e. changing clock/data phase, a problem which would otherwise have caused untraceable data errors). Check the phase of the *Data In* with respect to the Clock In line.

It is possible to configure the Tx carrier to be switched on and off by the `Sig= Valid In` line by selecting *Edit->Tx->Carrier* and selecting *RTS enabled*.

IP Interface

The IP is a standard interface supplied with the modem.

The modem supports three RJ45 Ethernet ports for IP traffic and one RJ45 port for remote control

The Ethernet supports 10/100/1000Mbps data rates and uses CAT 5 Ethernet cable. Both straight and crossover cables are supported.

Chapter 10 Connector Pinouts

ALARMS and AGC

15-pin, Male, D-type, High density

Pin	
1	Alarm 4 N/O (Deferred Alarm)
2	Alarm Common
3	Alarm 3 N/O (Rx Traffic Fault)
4	Alarm 1 N/O (Unit Fault)
5	Alarm 2 N/O (Tx Traffic Fault)
6	DAC out
7	Tx. Inhibit
8	Rx. Data
9	Alarm 4 N/C
10	Alarm 3 N/C
11	Alarm 1 N/C
12	Alarm Common
13	Alarm 2 N/C
14	Tx, Data
15	Ground

To externally inhibit the Transmit carrier, either apply a TTL/CMOS 'low' signal to pin 7, or short pin 7 to ground (for example with an external relay closure).

All relay contacts are rated 30V DC 2A, or 125VAC 0.4A.

Note: N/O means 'normally open' *in the non-fail state of the modem* (relays energised) when power is removed the relays fall back to the non-normal (i.e. non-energised) alarm state.

Line In/Out & Fail In/Out
The 1:1 redundancy cable is wired as follows:

Modem 1	Modem 2	Signal Name
Pin 1	Pin 1	Circuit ground (screen)
Pin 2	Pin 3	On-Line signal 2-1
Pin 3	Pin 2	On-Line signal 1-2
Pin 6	Pin 7	Fail signal 2-1
Pin 7	Pin 6	Fail signal 1-2

The cable must be of the shielded variety and should be kept as short as practical.

A standard 1:1 lead (part number P1391) is available from Teledyne Paradise Datacom. The lead is 10cm long and is designed for use when two modems are mounted vertically adjacent to each other in the rack.

In addition, the 1 For N port houses the **RS232 and RS485 interfaces**, where the selection must be made from the front panel or WUI. This has the following pinout:

Serial In/Out (Uses 9-pin, Male D-type 1 For N port).

Provides an RS232 or RS485 serial port:

RS232:	Modem	Signal Name
	Pin 1	Circuit ground (screen)
	Pin 4	Serial In A
	Pin 8	Serial Out A

RS485:	Modem	Signal Name
	Pin 1	Circuit ground (screen)
	Pin 4	Serial In A+
	Pin 5	Serial In B-
	Pin 8	Serial Out A+
	Pin 9	Serial Out B-

STATION CLOCK

75 Ohm BNC (Not used on QubeFlex)

Transmit Connector: 50 Ohm N-Type

Receive Connector: 50 Ohm N-Type

ETHERNET 10M/100M/1Gigabit
4 x RJ45

Chapter 11 Fault Messages

The following table lists all the modem faults along with a description of what the fault means. It also describes relevant checks the operator might make to try to eliminate the fault condition. Note that the text shown in the table will be displayed in full on the web user interface and in the system log but may appear in an abbreviated format on the front panel LCD display due to space considerations.

The acronyms used to define the actions taken on each fault occurring are as follows:

Actions: Relays

U: Prompt unit fault relay.
T: Prompt traffic fault relay.
D: Deferred alarm relay.

Actions: To Terrestrial

TA: AIS in selected timeslot if the Insert MUX is active or AIS over all data if not in Insert mode. If Insert mode is active and the user control thin route spoofing is on, then AIS is forced over the whole PCM bearer, not just the selected timeslots to spoof full bearer connectivity when passed over a Thin Route satellite circuit.
TB: Frame Backward alarm.
TC: AIS forced in the G.732 CAS 'abcd' signalling nibble.
TD: Force a fixed value in the G.732 CAS 'abcd' signalling nibble.
TE: Multiframe Backward alarm in IBS/SMS TS16/TS48 over satellite.

Actions: To Satellite

SA: AIS framed and scrambled and subject to RS coding if active.
SB: Frame Backward alarm.
SC: AIS in CAS signalling carried in IBS/SMS TS16/TS48 over satellite.

Actions: Other

CM: Carrier mute.
TF: Tx flow control CTS (Clear To Send) line is switched off.
RF: Rx flow control RR (Receive Ready) line is switched off.

11.1 Transmit Faults

Fault Text	Notes	Relays	To Ter	To Sat	Other
Tx fault: External Tx clock selected, but no clock from interface.	The modem is set to use an external clock, but no clock is being provided. The clock generation will use the internal clock as a backup to maintain the carrier and signal integrity. Check the data connector is attached and check for activity on the clock input lines.	T	TB	SA,SC	
Tx fault: Data Ready Input active.	The DRI line has been de-asserted by the data source feeding the modem, indicating a unit fault with data source.	T			
Tx fault: Signal Valid Input active.	The SVI line has been de-asserted by the data source feeding the modem, indicating it wished to disable transmission. If the carrier is set to RTS Enabled the carrier will be muted.	T			
Fault Text	**Notes**	**Relays**	**To Ter**	**To Sat**	**Other**
Tx fault: Data input is all ones (AIS), indicating upstream equipment fault.	The data supplied to the modem is all ones (AIS). This is normally used to indicate an upstream equipment fault. It is not a modem fault. This alarm can be switched off if required using the *Edit->Unit->Advanced->Alarms->Actions* menu.	T	TB	SA,SC,	
Tx fault: BUC PSU outside limits.	The current drawn by the BUC has exceeded the permissible upper & lower limits.				CM
Tx fault: Tx terrestrial DPLL unlocked.	Consult technical support if this alarm cannot be cleared.				CM
Tx fault: Tx channel DPLL unlocked.	Consult technical support if this alarm cannot be cleared.				

Table 11-1 Transmit Faults

Transmit Warnings

Fault Text	Notes	Relays	To Ter	To Sat	Other
Tx warning: Cannot hold/reach power set at BUC	The required BUC output power cannot be achieved. This alarm is only displayed when the modem is in terminal mode & the modem attempts to set the BUC output power by adjusting its output level & a attenuator in the BUC. This can be caused by too much attenuation in the cross-site cabling or inability to control the attenuator in the BUC (such as use of a non-Paradise BUC with no input attenuator)	D			
Tx warning: Tx data rate outside interface range.	Configuration error, data rate for terrestrial interface exceeded.				
Tx warning: Carrier out of range.	The carrier frequency selected for the Tx carrier has exceeded the permissible range for the configured symbol rate.				CM
Tx warning: Tx symbol rate outside range.	The modems current configuration exceeds the permissible symbol rate, check the configuration.				CM
Tx warning: Data clock inverted, data changing state on wrong edge.	The phase of the input clock and data is checked to ensure the data is stable when it is actually latched into the modem. This message means that the data is changing at this critical time, and it will cause data errors. Check the A & B clock lines are not reversed.	D			

Table 11-2 Transmit Warnings

11.3 Receive Faults

Fault Text	Notes	Relays	To Ter	To Sat	Other
Rx fault: RS de-interleaver unable to sync to decoded data. Check RS settings.	The demodulator can lock to the carrier and the inner FEC decoder to the demodulated data. However, the Reed-Solomon de-interleaver cannot synchronise with the decoded data. Check the RS de-interleaving depth and the values of `n` and `k`.	R	TA,TC	SB	RF
Rx fault: Demodulator unlocked. Check modem settings.	The demodulator cannot find a carrier to lock to at the specified frequency. Check the frequency, data rate and FEC settings. Check the demodulator by enabling IF loopback test mode.	R	TA,TC	SB	RF
Rx fault: Final BER > 1E-3.	Final BER has exceed 1x10-3	R	TA,TC	SB	
Rx fault: FEC Decoder synchronization lost.	Synchronisation has been lost in the FEC decoder. Check inner FEC configuration.	R	TA,TC	SB	RF
Rx fault: Rx channel DPLL unlocked.	Consult technical support if this alarm cannot be cleared.	D			
Rx fault: Rx terrestrial DPLL unlocked.	Consult technical support if this alarm cannot be cleared.	D			
Rx fault: Terrestrial muted due to sync loss.	This is as a result of setting the modem to mute terrestrial data on a loss of sync (where the data is unmuted when the Eb/no threshold is exceeded). This is used to counter an excessive number of log entries due to sun outages (scintillations) causing the demod to continuously go into and out of lock.				
Rx fault: RS de-interleaver unable to sync to decoded data. Check RS settings.	Check RS settings, particularly the interleaver depth.				

Table 11-3 Receive Faults

11.4 Receive Warnings

Fault Text	Notes	Relays	To Ter	To Sat	Other
Rx Mode Adaptor error (x)	This may occur if there is some kind of baseband data corruption or errors. For example, if operating too close to QEF for the MODCOD being used, if there is signal degradation or interference. Check the Carrier to noise is sufficient for the MODCOD being used. The (x) suffix provides further information for the Paradise engineering team.				
Rx warning: Rx data rate outside interface range.	Configuration error, data rate for terrestrial interface exceeded.				
Rx warning: The remote Eb/No has fallen below the user threshold.		D			
Rx warning: The receive Eb/No is worse than the user threshold set for the deferred alarm.		D			
Rx warning: Rx symbol rate outside range.	The modems current configuration exceeds the permissible symbol rate, check the configuration.				
Rx warning: Selected Rx output clock has failed.	The clock selected as the Receive data output clock has failed. The modem has switched to using a backup clock generated by the Rx PLL to preserve the receive traffic. This fault can only occur if the source is the same frequency as the Rx data rate (otherwise the clock is not used directly but is instead rate converted by the Rx PLL and would result in a different failure). Check which signal the PLL uses as a backup clock.	D			
Rx warning: Demodulator FIFO overflowed.	This should not occur in normal operating circumstances. Consult factory.				
Rx warning: The final BER is worse than the user threshold set for the deferred alarm.	This indicates that the received signal has degraded resulting in a potentially unacceptable number of errors.	D			

Rx warning: Wanted Rx input power out of range.	Indicates that the wanted signal is very low or very high.				
Rx warning: Composite Rx input power out of range.	Indicates very high level of composite power.				
Rx warning: Composite to wanted power level ratio >37dBc.	Indicates very high level of composite-to-wanted power.				
Rx warning: LinkGuard interference over threshold.	A source of interference has been detected underneath the receive carrier that exceeds the alarm threshold set by the user. This may be degrading the received signal and should be investigated and reported to the satellite operator.				

Table 11-4 Receive Warnings

11.5 Unit Faults

Fault Text	Notes	Relays	To Ter	To Sat	Other
Unit fault: One or more PSU rails are out of range.	The unit has a linear supply and will fail if the mains input is below the specified minimum level. Check the mains voltage and the internal PCB-mounted low-voltage fuses.	U	TA,TC		RF, TF, CM
An internal fault has occurred. Please consult factory.	This indicates that the software has been unable to initialise the hardware. Power the modem down and back up to see whether this clears the problem.	U	TA,TC		TF, RF, CM
Unit fault: Rx backup clock has failed	The clock used when the selected Rx clock fails has also failed. Contact technical support for advice.	U	TA,TC		RF
Unit fault: Communications with the BUC have failed. Check connections.	Unable to communicate with the BUC, check BUC type & services are correctly configured.	U			TF
Unit fault: BUC PLL failure.	The PLL in the BUC is reporting out of lock. Check reference clock.	U			TF
Unit fault: BUC over-temperature failure.	The BUC is indicating an over-temperature fault.	U			TF
Unit fault: Modulator DPLL has lost lock.	Consult technical support if this alarm cannot be cleared	U			
Unit fault: Tx Synth has lost lock.	Consult technical support if this alarm cannot be cleared	U			TF, CM
Unit fault: Rx Synth has lost lock.	Consult technical support if this alarm cannot be cleared	U	TA,TC		RF
Unit fault (occurs initially as unit warning): Operating temperature exceeded.	This refers to the internal unit temperature, Check the modem vent slots are clear and the rear fan has not failed. This alarm is a warning beyond 60 deg C and becomes a fault at 70 deg C	U,D	TA,TC		TF,RF, CM

Table 11-5 Unit Faults

11.6 Unit Warnings

Fault Text	Notes	Relays	To Ter	To Sat	Other
Unit warning: fan failure	One or more of the cooling fans have failed.				
Unit warning: PSU fail	One or more PSU rails are out of range.				
Unit warning: Carrier muted due to power outage. Acknowledge power-up to enable.	The Tx carrier is set to mute after a power failure. The power has failed and returned. The fault needs to be acknowledged in order to allow the carrier to be unmuted.	D			CM
Unit warning: Rental SAF features %s will expire in less than 48 hours.	Indicates that one or more SAF features (such as Paired Carrier) that have been purchased on a temporary license are about to expire. A new purchase order should be raised if the features are still required.				
Unit warning: Operating temperature exceeded.	This refers to the internal unit temperature, Check the modem vent slots are clear and the rear fan has not failed. This alarm is a warning beyond 60 deg C and becomes a fault at 70 deg C	U,D	TA,TC		TF,RF, CM

Table 11-6 Unit Warnings

11.7 Start-up Problems

Fault Text	Notes	Relays	To Ter	To Sat	Other
Unit fails to boot, due to an invalid configuration, but passes the initial built in test, proceeding to the initialising screen.	Remove the mains input lead, wait for a short period of time and then re-power the unit. As soon as the initialising screen is reached enter 1, 3, 7, and 9 using the keypad. The scrolling full stops seen after the initialising message should change to asterisks (****) and the Modem will boot. The invalid configuration will be stored to memory, entitled, deleted_date.				
Software upgrade fails or unit fails to boot.	Hold down the [main] button whilst applying power, choose the front panel menu option: [rescue], connect a PC to the top Ethernet port (IP traffic) and browse to the default IP address of the modem, 10.0.70.1, login as normal then upload the new software using the upgrade button.				

Table 11-7 Start-up Problems

Chapter 12 Specification Summary

Parameter	Modem
Modulation Scheme	BPSK, QPSK, OQPSK
L-band Frequency Range	950 to 2450 MHz
Frequency Resolution	1Hz
IF Frequency Range	50 – 90MHz and 100 – 180MHz
Frequency Resolution	1Hz
Traffic Interface - Electrical	4-port Gigabit Ethernet switch on RJ45 connectors with link and traffic indicators
Traffic Interface - Options	RS422 including X.21 DCE and DTE emulation, V.35 and RS232 on EIA530 connector 25 pin female D-type (Option) – EIA530 maximum 10Mbps, RS232 max 100kbps LVDS 25 pin female D-type (Option)
User Traffic Data Rate	2.4kbps to 2Mbps Extends base operation to 5Mbps Extends 5Mbps to 10Mbps Extends 10Mbps to 25Mbps Extends 25Mbps to 50Mbps Extensions are cumulative
User Traffic Data Rate Resolution	1bps
Note The combination of FEC rate, modulation scheme and satellite overhead limit the traffic data rate range in all modes.	
User Data Rate Range: Closed Network	2.4kbps (2.4ksps) to 2.048mbps (2.45Msps)
User Data Rate Range: Closed Network Plus ESC	As Closed Network except limits inclusive of overhead of approximately 1.4 times the ESC baud rate. Supports ESC rate from 110bps to 115kbps
Forward Error Correction	**CCSDS-Compliant Viterbi & Reed Solomon** BPSK, QPSK & OQPSK 1/2,2/3,3/4,5/6.7/8 **Intelsat-Compliant Viterbi & Reed Solomon** BPSK, QPSK & OQPSK 1/2,3/4,7/8
Scrambling – Closed Network Plus ESC	32kbps or above: synchronised to ESC overhead. Less than 32kbps: as per closed network. V.35 Scrambler has CCITT, Intelsat, Fairchild and Linkabit modes up to 55Mbps (with high Data Rate options)
L-band connector Type	N Type
L-band Impedance	50Ω
L-band Return Loss	14dB Minimum
Internal Frequency Reference - Ageing	<1ppm/yr.
External Reference	Clocking Only: 1-10MHz in 1kHz steps. Clocking and RF Frequency: 10MHz, 2dBm±1dB

12.1 Common Main Specifications

Parameter	Modem
Modulation Scheme	BPSK, QPSK, OQPSK
L-band Frequency Range	950 to 2450 MHz
Frequency Resolution	1Hz
IF Frequency Range	50 – 90MHz and 100 – 180MHz
Frequency Resolution	1Hz
Traffic Interface - Electrical	4-port Gigabit Ethernet switch on RJ45 connectors with link and traffic indicators
Traffic Interface - Options	RS422 including X.21 DCE and DTE emulation, V.35 and RS232 on EIA530 connector 25 pin female D-type (Option) – EIA530 maximum 10Mbps, RS232 max 100kbps LVDS 25 pin female D-type (Option)
IF/L-band connector Type	N Type
IF/L-band Impedance	50Ω
L-band Return Loss	14dB Minimum
Internal Frequency Reference - Ageing	<1ppm/yr.

12.2 Tx Modulator Specifications

Parameter	Modem
L-band Output Power Level	+5 to –40dBm (950 to 1950MHz) 0 to –40dBm (1950 to 2150MHz) 0 to –30dBm (2150 to 2450MHz) (0.1dB steps)
IF Output Power	0 to –25dBm (0.1dB steps)
Output Level Stability	±1.0dB, 0ºC to 50ºC
Transmit Filtering	Root-raised cosine filter provides choice of spectral roll-off factors of 5%, 10%, 15%, 20%, 25% and 35-60% in 1% steps. Contact Paradise Technical Support for the document 'Saving Satellite Bandwidth by Optimising Spectral Roll-off' (document number AN_035)
Occupied Bandwidth	See referenced document AN_035 above
Recommended Channel Spacing	See referenced document AN_035 above
Phase Accuracy	±2º maximum
Amplitude Accuracy	±0.2dB maximum
Carrier Suppression	-30dBc minimum
Output Phase Noise	As IESS-308, nominally 3dB better
L-band Output Frequency Stability	±0.05 ppm per year
L-band Harmonics	Better than –60dBc/ 4kHz in band, no worse than –45dBc out of band to 5GHz
L-band Spurious	Better than –60dBc/ 4kHz in band, no worse than –40dBc out of band 10MHz to 5GHz
Transmit On/Off Ratio	65dB minimum
External Transmit Inhibit	By external contact closure or by TTL signal applied to Utilities Card Alarms & AGC connector

12.3 Rx Demodulator Specifications

Parameter	Modem
Input Range	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 Composite signal	+10dBm
Wanted-to-composite Level	-102+10 log (symbol rate)
Frequency Acquisition Range	Selectable from ±1kHz to ±250kHz (1kHz steps) or ±1kHz to ±700kHz (1kHz steps) with Extended Doppler option.
Acquisition Threshold	<5dB Es/No QPSK
Acquisition Time	Dependent on FEC, data rate and sweep width.
Clock Tracking Range	±100ppm minimum
Receive Filtering	Root-raised cosine filter provides choice of spectral roll-off factors of 5%, 10%, 15%, 20%, 25% and 35-60% in 1% steps with Extended roll-off option.
Performance Monitoring	Measured Eb/No (range 0-15dB, ±0.2dB). Measured Frequency Offset (100Hz resolution). Wanted signal level strength indicator centered on the middle of the Rx. Input range.
AGC Output	Buffered direct AGC output for antenna tracking etc.

12.4 Clocking and Buffering Specifications

Parameter	Modem	
Clock Integrity	Frequency Locked Loops give phase-hit immune operation even with poor clock sources such as routers etc.	
Tx Clocking	Internal	±0.5ppb per day
	External	Tracking range ±100ppm/min
	Rx Clock	Slaves Tx timing from Rx clock. (Includes full asymmetric operation)
Rx Clocking	Buffer Disable	Clock from Satellite
	Tx Input clock	Plesiochronous. (Includes full asymmetric operation)
	Internal	±0.5ppb per day
	External timing clock (DTE interface only)	
Buffer Size	Selectable in 1ms increments from 0ms to 99ms at data rates up to 42Mbps and from 0ms to 80ms at data rates from 42Mbps up to 55Mbps. Automatically adjusted to slip an integer number of terrestrial multi-frame lengths for framed rates Buffer storage: Maximum buffer size – 256kbytes	

12.5 Traffic Log Specifications

Parameter	Modem
Capacity	Over 6000 entries
Entry Format	Fault message with time and date stamp. Separate entry when fault clears/changes.

12.6 Internet Traffic

Parameter	Modem
Standard	The modem supports processing of 150,000 packets per second when in a standard bridge mode with no other IP features switched on. Performance when IP features are switched on is subject to data rate, packet size and the specific combination of features. Please contact Technical Support for help with assessing suitability for specific applications.

12.7 BUC / LNB facilities

Parameter	Modem
BUC Power Supply Options	Any BUC up to 200W can be connected. The unit will route the power out through the Tx RF connector to the BUC.
LNB Power	Multiple voltages between 13 and 20V plus 24V 0.5A DC to LNB via Rx IFL (standard)
FSK Control	Qubeflex: Standard P3729 card fitted
10MHz Reference	Uses a high-stability $7.5x10^{-8}$/yr. Reference Oscillator. 10MHz may be provided via the Tx RF connector to the BUC and via the Rx RF connector to the LNB

12.8 Common Specifications

Parameter	Modem
Loopbacks	Interface Loop (Local and Remote) Internal IF loopback (local, automatically matching Rx IF frequency to Tx) RF Loopback (Supports external cabled loopback)
Test Modes	Transmit CW (Pure Carrier) Transmit Alternate 1-0 Pattern
Alarm Relays	Four Independent Change-Over Contacts: Unit Fault, Rx Traffic Fault Tx Traffic Fault, Deferred Alarm (backward alarm, BER or Eb/No below user set threshold)
Embedded Software	Revised embedded software may be downloaded into NAND FLASH memory via Ethernet port or USB.
Configuration Memories	Configurations can be stored and recalled from the front panel or remote M&C. Memories can be labeled with text string to aid identification. (Without spaces within the text string.)
User Interface	Clear and intuitive web browser operator interface with plain English dialogue. Graphic display, backlit, high contrast, wide angle LCD and 17-key tactile keyboard.
Remote Monitor and Control	For multi-drop applications, RS485 interface. For direct to PC applications, RS232 interface (front panel selectable). Ethernet (10/100 BaseT) via RJ45, embedded Web server, SNMP agent V1, V2c, V3.
Redundancy Features	1:1 redundancy controller built in. “Y” cables passively split data maintaining impedances. IF inputs/outputs are passively split/combined outside the units. Off-line unit tri-states data outputs and mutes Tx carrier. 1:N (up to 16) supported for many interface types.
Monitor	0-10V analogue output (Signal level, Eb/No, or Rx offset frequency) on Alarms & AGC connector
Mechanical	1U chassis, 285mm deep excluding front panel handles and rear panel connectors and fans
Weight	3 Kg
Power Supply	90 to 264V AC 47 to 63 Hz 24V and 48V DC options available.
Safety	EN 62368-1:2014 Edition 2
Emission and Immunity	Emissions: EN 55032:2015 class A Immunity: EN 55032:2017
Environmental	Operating Temperature Range: QubeFlex: 0ºC to 55ºC

Chapter 13 Glossary

8PSK	Eight Phase Shift Keying
16QAM	Sixteen Quadrature Amplitude Modulation
ACM	Adaptive Coding and Modulation
AGC	Automatic Gain Control
ASM	Attached Sync Marker
AUPC	Automatic Up-link Power Control
BER	Bit Error Rate
BERT	Bit Error Rate Tester
BPSK	Binary Phase Shift Keying
BUC	Block Up Converter
CCSDS	Consultative Committee for Space Data Systems
CRC	Cyclic Redundancy Check
CW	Continuous Wave
ESC	Engineering Services Channel
FEC	Forward Error Correction
LCD	Liquid Crystal Display
IBS	Intelsat Business Service
IESS	Intelsat Earth Station Standard
IDR	Intermediate Data Rate
LUI	Local User Interface
M&C	Monitor and Control
MIB	(SNMP) Management Information Base
Mux	Multiplexer
OQPSK	Offset Quaternary Phase Shift Keying
PCB	Printed Circuit Board
PUP	Paradise Universal Protocol
PLL	Phase Locked Loop
PRBS	Pseudo-Random Bit Sequence
QPSK	Quaternary Phase Shift Keying
RF	Radio Frequency
RS	Reed-Solomon
Rx	Receive or Receiver
SAF	Software Activated Feature
SNMP	Simple Network Management System
TCM	Trellis Coded Modulation
TPC	Turbo Product Coding
Tx	Transmit or Transmitter
WUI	Web User Interface

Chapter 14 Technical Support

Technical Support can help with:

- Queries regarding equipment operation.
- The return of equipment for upgrade or repair.
- Customer training.
- Application notes and white papers.

Contact details in Europe and North America are as follows:

Teledyne Paradise Datacom,
A division of Teledyne UK Ltd.
106 Waterhouse Lane,
Chelmsford, Essex CM1 2QU
Tel: +44 1245 847520 (main line)

Worldwide support via email is available by filling in the Technical Support Contact Form on the Support web page at:
https://www.teledynedefenseelectronics.com/paradisedatacom/paradise_support/Pages/Product%20Support_RMAs.aspx

This will forward your support issues to your local Technical Support team for your geographic area.

Repair/Return Procedure

Please refer to the equipment warranty statement for full details of returning equipment for repair or upgrade. In summary:

1. Ensure the equipment really does have a fault.

2. Write a *detailed fault report*, including what appears to be wrong, the circumstances under which it occurs and what other equipment is involved.

3. Provide an official Purchase Order to cover the cost of any repairs or sign disclaimer on the Fault Report page.

4. Contact the UK Paradise Datacom office for a Return Material Authorisation (RMA) number and information on import/export procedures. The RMA number must be quoted on all documentation and on the outside of the packaging.

5. Generate the required import paperwork explicitly following the import/export procedures stated when the RMA number was given.

6. E-mail the paperwork to us directly and return the goods to Teledyne Paradise Datacom at the UK address above.

TELEDYNE PARADISE DATACOM

Global Sales Offices

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

Teledyne Paradise Datacom
11361 Sunrise Park Drive
Rancho Cordova, CA 95742
Tel: +1 (814) 954-6163
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

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

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

U.K. Office
Europe, Middle East, Africa

Teledyne Paradise Datacom
106 Waterhouse Lane,
Chelmsford, Essex, England, CM1 2QU

Tel: +44(0)1245 847520
Tel: +44(0)1376 515636
sales@paradisedata.com

Asia Pacific Office

Teledyne Paradise Datacom
Thailand Office

333, 20 C1 Fl., Lao Peng Nguan Tower 1,
Vibhavadi-Rangsit Rd.,
Chomphol, Chatuchak,
Bangkok 10900
Thailand

Tel: +66 2-272-2996
Fax: +66 2-272-2997
sales@paradisedata.com

Beijing, China Office
Teledyne Paradise Datacom Representative Office

Room 204, No.1 Building,
No.9 Jiuxianqiao East Road,
Chaoyang District,
Beijing, China 100016

Tel: +86 13601251528
sales@paradisedata.com